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F.

F, the sixth letter of our alphabet, is the equivalent of *ph*, and probably of the Greek ϕ. It is a labio-dental mute, and is quite strongly aspirated, but is not truly vocalized. F, as we learn from old Latin writers, differed in power from the Greek ϕ, and in ancient times was doubtless a strong, rough aspirate, like the Greek digamma, Ϝ, from which it took its form, if not its power. In Spanish, *h* takes the place of the Latin *f* very frequently, while *f* often represents the Greek ϕ. F is to some extent interchangeable with the dentals *t, d,* and *th*, as well as with the labials *p, v,* and *wh*, but less so in English than in some other languages. F in chemistry is the symbol of fluorine.

F, in music, the fourth degree in the ascending scale of C, major or minor, being the subdominant in that scale. The bass or F clef is placed on the fourth line of the stave, at the distance of a seventh above gamut G; hence, as a note on that line is called F, the other notes, above and below, take their names accordingly. In German music, F Dur is F major; F Moll, F minor; Fis is F sharp; Fis Dur, F sharp major; and Fis Moll, F sharp minor. The letter F, or *f*, is also used for *forte*, loud; and FF, or *ff*, for *fortissimo*, very loud. WILLIAM STAUNTON.

Fa'am, an orchidaceous plant growing in the Mauritius, in Réunion, and in India—the *Angræcum fragrans*, highly prized for its fragrance, and long used there, in the same way as Chinese tea is used, as a beverage. Many residents in the East greatly prefer it to tea. It is aromatic, stimulant, and of very agreeable taste. It is used to some extent in France, and has reputation as an antispasmodic and an expectorant.

Fa'ba [Lat., a "bean"], a genus of leguminous plants to which belongs *Faba vulgaris*, or *Vicia Faba*, L., of unknown, probably Oriental, origin, the common bean of Europe, but not the beans ordinarily raised in the U. S., which are of the genus *Phaseolus*.

Fabaceæ. See LEGUMINOSÆ.

Fa'ber (BASIL), a German Protestant writer and scholar, b. at Sorau 1520, wrote *Thesaurus Eruditionis Scholasticæ* (1571), often reprinted, and d. rector of the academy at Erfurt in 1576.

Faber (FREDERICK WILLIAM), D. D., an English theologian and poet, a nephew of George Stanley Faber, noticed below, was b. at Durham June 28, 1814, graduated at Oxford in 1836, became vicar of Elton in 1843, went over to the Roman Catholic Church in 1845, founded the Oratory of the brotherhood of St. Philip Neri in London in 1849, and in 1854 removed with it to Brompton, where he d. Sept. 26, 1863. He wrote a considerable number of books, both controversial and devotional, in support of the Church of his adoption, but will be longest remembered as the author of some exquisitely beautiful hymns, equally admired by all communions. The first edition of his hymns, few in number, appeared in 1848, and the 5th ed., containing 150 hymns, in 1862. R. D. HITCHCOCK.

Faber (GEORGE STANLEY), D. D., English theologian, b. near Bradford, in Yorkshire, Oct. 25, 1773, graduated at University College, Oxford, in 1803, and was prebendary of the cathedral of Salisbury in 1831, and master of Sherburn Hospital at Durham, 1832; d. there Jan. 27, 1854. Wrote *Horæ Mosaicæ, or View of the Mosaical Records* (1801), *Difficulties of Infidelity* (1824), *Difficulties of Romanism* (1826), *Original Expiatory Sacrifice*, etc.

Faber (JACOBUS STAPULENSIS), the greatest of the "Reformers before the Reformation" in France, was b. at Étaples about the year 1450, and d. in 1536. His translation of the New Testament appeared in 1523, and of the Old Testament in 1528. He published also several commentaries. R. D. HITCHCOCK.

Faber (JOHN), a Dutch mezzotint engraver, who d. at Bristol, England, in May, 1721, was the father of another John Faber, an excellent mezzotint engraver, who produced portraits of the Kit Cat Club and the Hampton Court beauties, and probably d. in 1756 in London.

Faber (TANAQUIL). See LE FEVRE.

Fa'bian, SAINT, was pope 236 A. D., suffering martyrdom under Decius, 250 A. D.

Fa'bius, tp. of Davis co., Ia. Pop. 1494.

Fabius, tp. of St. Joseph co., Mich. Pop. 1277.

Fabius, tp. of Knox co., Mo. Pop. 1587.

Fabius, tp. of Marion co., Mo. Pop. 1908.

Fabius, tp. of Schuyler co., Mo. Pop. 1474.

Fabius, post-v. and tp. of Onondaga co., N. Y. Pop. of v. 378; of tp. 2047.

Fa'bius Max'imus Verruco'sus (QUINTUS), surnamed CUNCTATOR, was consul for the first time 233 B. C., and dictator in 217. Contending against Hannibal the Carthaginian, he adhered so closely to the policy of defensive warfare that his opponent could gain no advantage, and his successes of this sort, long continued, secured for him his surname. His is one of the most illustrious names in Roman history.

Fa'bius Pic'tor (QUINTUS), the earliest Roman historian, was a member of the patrician family of the Fabii, and lived at the time of the Second Punic war (which began B. C. 218), though the dates of his birth and death are unknown. The last distinct notice of him is his being sent as an ambassador to Delphi after the battle of Cannæ, B. C. 216. He wrote a history or annals of Rome (for the name is not given) from the early settlement of the city to his own times, and his work is often quoted by Livy, Dionysius, and Polybius. He has been charged with great carelessness and perversion of the truth, especially in the earlier portions of his work. But both Livy and Dionysius draw freely from him, and frequently commend his fidelity; and Polybius, who is his severest censor, uses his materials in his own account of the Second Punic war (in which Fabius was an actor), though charging him with carelessness and partiality for the Romans. His work was written in Greek, but it is supposed there existed also a Latin translation of it. Among modern writers Fabius has found a defender in the historian Niebuhr in his *Lectures on the History of Rome*. The fragments of Fabius Pictor are collected, and the events of his life given, by KRAUSE, *Hist. Rom. Fragmenta*, Berlin, 1833; by MÜLLER, *Hist. Græc. Fragm.*, vol. iii., pp. 80–92. (See also H. K. WHITTE, Copenhagen, 1832; BAUMGART, Breslau, 1842; NIEBUHR, quoted above; and GERLACH, *Geschichtschreiber der Römer*, Stuttgart, 1855.)
H. DRISLER.

Fabius River, of Missouri, rises by several forks, and flows into the Mississippi River nearly opposite Quincy, Ill. The course of the main stream is but short. The North Fabius, the longest fork, rises in Iowa.

Fa'ble [Lat. *fabula*, from *for, fari*, to "speak;" Fr. *fable;* Ger. *Fabel*], as a peculiar kind of literary composition, means a fictitious story in prose or verse, enacted by animals, without any regard to probability, or even possibility, and illustrative of some moral maxim, which is given in a positive and pointed form after the story, like the title under an engraving. Of all kinds of didactic poetry, the fable is the most pleasant and the most effective. By representing the several features of the human mind—as, for instance, pride, rashness, avarice, shrewdness, etc.—under the picture of individual animals, the fable gives to the imagination a most striking and entertaining portrait of these features, thereby rousing the attention for the story, and inculcating the moral truth which it illustrates in a most impressive manner. Good fables were always highly appreciated, but they are rare. When we look at the whole literature of fables—the Indian by Pilpay, the Arabic by Lokman, the Greek by Æsop (620–564 B. C.?), the Latin by Phædrus, a Greek slave whom Augustus gave his liberty, the French by La Fontaine (1621–95), the English by Gay (1688–1732), and the German by Gellert (1715–69)—we find that quite a number of the stories are common to all the writers, taken from the same source, or transferred from one literature to another: only the scenery, depending on the climate and the age, and the style, depending on the individuality of the writer, are different. The two most original fable-writers are Æsop and La Fontaine. Æsop's fables, however, we do not know in their original form. They were written in prose, and afterwards turned into verse. (See BABRIUS.) But, as far as we can judge, they were very vigorous and pointed, and whenever it is possible to trace the story back to an Oriental source, it is interesting to see how the wild and gorgeous fancies of the Hindoo are reduced by the Greek to clearness and plastic simplicity. La Fontaine is sometimes garrulous, and he does not always hit the nail on the head with the first stroke; but his style is elegant, his sarcasm well bred, his observation acute, and a tone of refined good-humor per-

vades the whole, making his fables an exceedingly pleasant book. CLEMENS PETERSEN.

Fabliaux [Fr., plu. of *fabliau*] is the name given in early French literature to the metrical tales composed in the *langue d'oil*, or northern dialect, by the Trouvères, chiefly in the twelfth and thirteenth centuries. The fabliaux were often satirical, and not unfrequently licentious.

Fabre (ANTOINE FRANÇOIS HIPPOLYTE), French medical writer, b. at Marseilles 1797, edited the *Lancette Française*, and had a medal (1833) from the French Institute for a work on cholera, d. in Dec., 1853.

Fabre (FRANÇOIS XAVIER PASCAL), French painter, was b. at Montpellier Apr., 1766, and wrought at Rome and Florence. His best works are *The Judgment of Paris*, *The Preaching of John the Baptist*, and a portrait of Alfieri. D. at Montpellier Mar. 12, 1837.

Fabre (JEAN RAYMOND AUGUSTE), French poet, b. at Jaujac June 24, 1792, wrote *Calédonie* (1823), *Irene*, tragedy (1825), etc. D. Oct. 23, 1839.

Fabre (MARIE JOSEPH VICTORIN), French poet and orator, b. at Jaujac July 19, 1785, wrote an *Eulogy on Corneille*, prose (1808), which was crowned by the French Institute. The *Death of Henry IV.*, poem (1808), *Ode on Tasso*, *Eulogy on Montaigne* (1812), and *Literary History of France in the Eighteenth Century* (1810), are among his works. D. May 29, 1831.

Fabre de l'Aude (JEAN PIERRE), French statesman, b. at Carcassonne Dec. 8, 1755, was deputy to the Council of Five Hundred in 1795 and 1797, and commissioner of finance. In 1807 was senator and count of the empire, then chevalier of the grand council of administration of the senate, and d. at Paris July 6, 1832.

Fabret'ti (RAFAEL), Italian antiquary, b. at Urbino 1618, was secretary to Pope Alexander VIII., and keeper of archives in the castle of St. Angelo under Innocent XII. Wrote *De Columna Trajani* (1683) and *Inscriptionum Antiquarum Explicatio* (1699). D. at Rome Jan. 7, 1700.

Fabria'ni (SEVERINO), Italian author and philanthropist, b. at Spilimbergo Jan. 7, 1792, aided Baraldi in his *Memoirs on Religious Literature*, and wrote biographies, besides instructing the deaf and dumb. D. Apr. 27, 1849.

Fabria'no, town of Italy, in the province of Ancona, 38 miles S. W. of Ancona, especially known for its paper-mills, established in the sixteenth century. Pop. 5699.

Fabriano, da (GENTILE), an Italian painter of whom little is known; lived between 1360 and 1440, was a contemporary of Fra Angelico. Several of his works are at Urbino and Perugia, but his fame is associated with a picture in the great council-chamber in Venice, which, some say, was thought so remarkable that the republic conferred on him a life pension and the patrician's robe. Specimens of his work are in the churches Santa Maria Maggiore and St. John Lateran in Rome, and the San Felice, Venice. O. B. FROTHINGHAM.

Fabri'ce, von (GEORG FRIEDRICH ALFRED), general of cavalry and secretary of war in the kingdom of Saxony, became widely known as commander of the German army of occupation in France from Mar. 7 to June 19, 1871. Was b. at Quesnoy-sur-Deule May 23, 1818; entered the Saxon service in 1834; became a member of the staff in 1850; was chief of the staff to the Saxon troops in Sleswick-Holstein in 1863 and 1864, and to the crown-prince of Saxony in 1866, during the Bohemian campaign, in which position he distinguished himself greatly, though the latter campaign could boast of no victory. Became secretary of war Oct. 1, 1866, thus assuming the great task of reorganizing the Saxon army after the Prussian pattern, in accordance with the present political position of the kingdom—a task which required both great military ability and great diplomatic talent, as, after the unfortunate war, there reigned in Saxony a great bitterness against Prussia. But he fulfilled the task with perfect success, and displayed the same talents as commander-in-chief of the army of occupation in France in 1871; even during the revolution of the Commune in Paris he understood how to maintain his position without incurring any conflict, and he commanded the respect of the Frenchmen at the same time he earned the hearty regard of the Germans. AUGUST NIEMANN.

Fabric'ius (JOHANN), b. at Altorf, in Saxony, Feb. 11, 1644; studied theology in his native town, at Nuremberg, and from 1663 to 1665 at Helmstedt, in Brunswick, where he became a disciple of Georg Calixtus; travelled in Germany and Italy from 1670 to 1677, during which period he was for some time a minister to the German Lutheran congregation in Venice; and was appointed professor in theology at Altorf in 1677, and at Helmstedt in 1697, which was especially famous as a school of theology, and Johann Fabricius vindicated its fame. His *Amœnitates Theologicæ* (1699) and *Consideratio Variarum Controversiarum* (1704) were received with great applause. King Charles of Spain, afterwards emperor of Germany under the name of Charles VI., proposed marriage to the princess Elizabeth Christine of the house of Brunswick, and wished her to embrace the Roman Catholic faith. Fabricius published a *Gutachten*, showing that it was proper, and even her duty, to renounce her Protestant faith to become queen of Spain and empress of Germany. The elector of Hanover, afterwards George I. of England, disliked this *Gutachten*, and in 1709 Fabricius was removed from his chair at the university. D. Jan. 29, 1729.

Fabricius (JOHANN ALBRECHT), German scholar and writer, b. at Leipsic Nov. 11, 1668, was professor of eloquence and philosophy at Hamburg about 1700. Published more than one hundred learned works, among the most important of which were *Bibliotheca Latina, sive Notitia Scriptorum Veterum Latinorum* (3 vols., Leipsic, 1697; revised and greatly improved by Ernesti, 3 vols., 1773); *Bibliotheca Græca* (14 vols., 1705–28; 4th ed., improved by Harles, 12 vols., 1790–1809); *Bibliographia Antiquaria* (1713; enlarged 1760); *Bibliotheca mediæ et infimæ ætatis* (5 vols., Hamburg, 1734; a 6th added by Schœttgen, 1746); *Codex Apocryphus Nov. Test.* (3 vols., Hamburg, 1719); and *Codex Pseudepigraphus Veteris Test.* (Hamburg, 1713). D. at Hamburg Apr. 30, 1736.

Fabricius (JOHANN CHRISTIAN), b. at Tondern, in the duchy of Sleswick, Jan. 7, 1743; studied natural history at Copenhagen, Leyden, Edinburgh, Freiberg in Saxony, at Upsal under Linnæus (of whom he became an enthusiastic disciple), and was appointed professor of natural science in 1775 at the University of Kiel, where he d. in 1807. Entomology was his favorite study, and his *Systema Entomologica* (Copenhagen, 1775, 4 vols.), *Philosophia Entomologica* (1778), and *Supplementum Entomologicæ* (1797) are his principal works. An utterance of Linnæus led him to establish the structure of the mouth as the principle of division in the entomological system, and he worked out this idea with great energy and enthusiasm. He undertook every year extensive pedestrian trips in different parts of Europe, studying the world of insects in nature and in the museums; and his writings are rich in observations.

Fabricius (THEODOSIUS), Lutheran theologian, b. at Nordhausen in 1560, was professor at Göttingen. His *Harmony of the Four Evangelists* was published in Latin, Greek, Hebrew, and German. D. in 1597.

Fabri'zio (GERONIMO), Italian anatomist and surgeon, b. at Acquapendente 1537; was professor at Padua, wrote treatises on anatomy and surgery, and had for a pupil Dr. Harvey, whose discovery of the circulation of the blood was suggested by some observations of his teacher upon the valves of the veins. D. in May, 1619.

Fabro'ni, or **Fabbroni** (ANGELO), Italian biographer and Latin scholar, b. at Marradi Sept., 1732; published in 1766 the first volume of *Lives of Italians Eminent for Learning who flourished in the Seventeenth and Eighteenth Centuries* (twenty volumes in all), was prior of the church of San Lorenzo, Florence, 1767, is sometimes called the "Plutarch of modern Italy," and d. at Pisa Sept., 1803.

Fabroni, or **Fabbroni** (GIOVANNI VALENTINO MATHIAS), b. at Florence Feb. 13, 1752; studied natural science in his native city and in France and England; was appointed director of the physical cabinet of the grand duke of Tuscany, and went in 1798 to Paris as a member of the committee assembled in that city for the establishment of unity between the French and Tuscan weights and measures. During the annexation of Tuscany with France, Fabroni occupied a very conspicuous position both socially and politically, and many very difficult tasks, both scientific and diplomatic, he performed with great success. He constructed the bridge across the Dora Baltea, and the road across Mont Genèvre leading from the Sardinian province of Susa into the French department of the Hautes-Alpes, at an elevation of 6500 feet. After the restoration of the house of Lorraine in Tuscany, in 1815, Fabroni retired to the chair of natural science at the University of Pisa, where he d. Dec. 17, 1822. His writings are on political economy, natural science, agriculture, education, etc.

Fabry (JEAN BAPTISTE GERMAIN), French writer, b. at Cornus in 1780; edited *Spectateur Français* (12 vols., 1805–12), wrote *Itinéraire de Bonaparte de l'Isle d'Elbe à Saint Hélène* (1817), and d. Jan. 4, 1821.

Fabvier (CHARLES NICOLAS), BARON, b. at Mousson, in the department of Meurthe, France, Dec. 10, 1782; educated at the École Polytechnique and the military school of Metz; entered the first regiment of artillery in 1804; was sent in 1807, as a member of a corps of French officers, to Constantinople and Ispahan for the purpose of reorganizing

the Turkish and Persian armies after the French model; returned in 1809 to Europe; fought in Spain in 1811 as aide-de-camp to Marshal Marmont, and distinguished himself greatly in 1812 at the storming of Moskva. In 1817 he accompanied Marshal Marmont as chief of his staff to Lyons, and when the insurrection was put down, he published a pamphlet, *Lyons in 1807*, charging the whole civil service of the city and department with gross abuses. He was arraigned and fined; left the military service, and devoted himself for several years to commercial business. In 1823 he went to Greece, and fought with great distinction in the war of liberation until 1827. In the revolution of July, 1830, he played quite a conspicuous part; was for some time the military commander of Paris; became lieutenant-general in the army in 1839 and peer of France in 1845; was a member of the legislative assembly in 1849; filled minor diplomatic offices, and d. at Paris Sept. 15, 1855.

Façade [Fr.], one of the sides of a building viewed from without, especially applied to the principal front of a large or architecturally fine building. But there may be also rear and lateral façades, as well as interior façades surrounding a court.

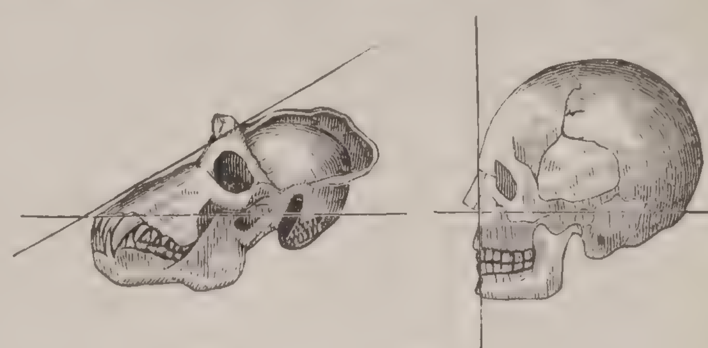
Facciola'ti, or **Facciola'to** (Giacomo), Italian philologist, b. at Torreglia, near Padua, Jan. 4, 1682; was professor of logic in the University of Padua 1722, published an edition of the *Lexicon Septem Linguarum* of Ambrogio Calepino (an Augustine friar of Calepio), (2 vols. folio, Padua, 1731), of the Greek lexicon of Schrevelius (Padua, 1715, etc.), and of the *Lexicon Ciceronianum* of Nizolius (Padua, folio, 1734). He began a Latin lexicon, finished by Forcellini, and d. at Padua Aug. 25, 1769. (See Forcellini.)

Fa'cet [Fr. *facette*, a "little face"], a term used by lapidaries to denote the plane surfaces cut upon precious stones to increase their lustre. The planes which bound a crystal, the flat surfaces of the cornea of an insect's eye, and in fact any minute plane surface may take this name.

Face'tiæ [Lat. pl. of *facetia*, "things facetious"], a collection of humorous sayings, witty stories, *bons mots*, repartees, in prose and verse. From the ancients nothing has come down to us except the *Jests of Hierocles*, the sayings and doings of one "Scholasticus," the typical blunderer of earlier times, the prototype of the modern perpetrator of "bulls;" *e. g.* hearing that a raven would live 200 years, he bought one to test the truthfulness of the statement. Of the earliest specimen in modern times, the *Liber Facetiarum* of Poggio Bracciolini (1st ed. Rome, 1470), Shepherd gives this account: "During the pontificate of Martin V. the officers of the Roman chancery were accustomed to assemble in a kind of common hall. In this apartment, which from the nature of the conversation of its frequenters, who were much more studious of wit than of truth, acquired the name of *Bugiale* [manufactory of lies], they discussed the news of the day, and amused themselves by the communication of entertaining anecdotes. They indulged themselves in the utmost latitude of satiric remark, dealing out their sarcasms with such impartiality that they did not spare even the pontiff himself." These "pointed jests and humorous stories . . . furnished the greater portion of the materials for the *Liber Facetiarum*."

Properly, *ana* and *table-talk* are facetiæ; ana being mainly the personal observations of him whose name forms the title, sometimes, though not always, supplied by himself. The first printed *ana*, *Scaligerana Secunda* (Joseph Scaliger), was the work of Jean and Nicholas de Vassan, published by Isaac Vossius (1666). *Menagiana*, one of the best (Paris, 1715), was furnished and published by the friends of Giles Menage. On the other hand, *Chevræana* (Amsterdam, 1700), *Parrhasiana* (Amsterdam, 1701), and *Huetiana* (Paris, 1722) were the recorded observations of the men whose names the books bear. *Walpoliana* (London, 1804) is the best English ana. *Table-talk* is graver in its tone than ana, giving the views of some thinker on topics with which he is especially conversant, less formally than in essays. Martin Luther's *Colloquia Mensalia* (best ed. Leipsic, 1844; English translation by Capt. Henrie Bell, London, 1652) handles phenomena of nature, matters in Church and State, and social relations. John Selden's *Table-Talk* (London, 1860) abounds in learned, pithy remarks. From Melanchthon to Charles Sumner men have found amusement in these works. Richard Porson was fond of them; many of his own are in *Facetiæ Cantabrigienses* (London, 1825) and in E. H. Barker's *Literary Anecdotes* (London, 1852). America has furnished her share; *e. g.* the *Breitmann Ballads*, by C. G. Leland, the works of Bret Harte, of John Hay, of John G. Saxe; and in our newspaper press, as Mr. Frederic Hudson says, "there is a daily effervescence of *bons mots*, from Canada to Mexico. . . . The United States are a Vesuvius of wit and humor in a constant state of eruption, and the lava is in perpetual motion down the sides of its mountains." (See Journalism.) Jonathan S. Green.

Fa'cial An'gle (the angle formed by the face with a certain other plane), as generally accepted, is the angle subtended by (1) a line coincident with the face, or rather



Facial angle, according to Owen.

the most projecting parts of the face, and (2) a line drawn from the external opening of the ear to the floor of the nostrils. Such was the idea of Camper, who originally (about 1771) employed the facial angle as a diagnostic criterion for the distinction of the races of men and their contradistinction from the lower animals. Others have modified the criterion by taking different lines; thus, the angle subtended by (1) the face, and (2) the plane coincident with the axis of the floor of the skull, was considered by Von Baer to furnish a more trustworthy criterion for the purposes desired; by others, still, the angle intersected by (1) the face, or "the most prominent parts of the forehead and upper jaw," and (2) "a line drawn from the occipital condyle along the floor of the nostrils," is accepted as the facial angle. Such is the view promulgated by Prof. Owen (*On the Anatomy of Vertebrates*, ii. 572). These are all inconsiderable modifications of the same idea, and are the true expressions of the facial angle. With it must not be confounded, as has been done by some persons, measurements of the skull to express the relations of other parts of the skull and the comparative intellectual conditions of animals. The facial angle, as properly understood, is not only of little value in determining the relative intellectual rank of an animal, but is often very deceptive as an index. Its value has been greatly exaggerated, and it is now only used by scientific writers with great reserve and precautions as to its fallacious nature. To some extent, however, it is quite useful as a diagnostic character at least. If we compare the several races of mankind in their *adult* stages, it will be found that there are *average* indexes furnished by the facial angle for each one, and that between the European and negro the differences in this respect are notable; thus, in the former the facial angle (by Camper's method) is about 80°; in the latter, about 70°; if these are contrasted with the old individuals of some of the apes and monkeys, the differences will be found still greater; *e. g.* in the adult baboons the angle is only about 30°; in the common monkeys it ranges from about 45° to 60°; and in those nearest to man it varies considerably in the adult, and bears an indefinite relation to the size attained, the largest having a more acute angle. Thus, in the gibbons it is about 60°, in the larger apes about 30°–40°. The contrast in this respect between man and most other animals has led to a very exaggerated idea of the value of the character as an exponent of intelligence. A very few facts, however, serve to disabuse our minds. It will be readily granted, probably, that adults, on the whole, are more intelligent than the young of the same species, and that therefore there should be some coincidence between the development of the facial angle and that of the individual, if the angle were in fact an exponent of intellectuality. So far is this from being the case, however, that there is an *inverse* development of the angle and the individual, which is illustrated in the case of man, and to a much greater extent in other species. In the young of the different races of mankind the differences of the facial angle are inconsiderable, and the angle in all is more obtuse (instead of being more acute) than in the adult; and especially is the contrast marked between the negro baby and the adult man. In the young of the apes and monkeys the head is well shaped—*i. e.* it resembles that of man rather closely in its contour—and the facial angle is proportionately developed, being generally not much if any less than about 70°. As has been already indicated, the angle is more acute in the old; and this acuteness, on the whole (but by no means in all), increases in proportion to the size of the animal; thus, in the older and larger monkeys it becomes as acute as 45°; in the large African apes nearly 30°, and in the Asiatic ape and baboon the angle is even more acute than 30°. If the facts in several cases are analyzed, it will be found that the same figures do not by any means always express similar factors; *e. g.* although there is little difference between the indexes for the chimpanzee and the orang-outang, the results are

produced by different causes, the upper jaw in the former being produced forward, and in the latter downward to the suture; on the other hand, there is apparently much greater difference between the adult male chimpanzee and gorilla indicated by the facial angle, although the differences otherwise are slight, from the fact that in the chimpanzee the supraorbital ridges are moderate, while in the gorilla they are very strongly developed; the differences in the facial angle in these cases are therefore not the exponents of differences in intelligence or brains, but simply of the development of osseous matter over the orbits. The differences in all the cases between the young and old result from the fact that whereas in the young the teeth are undeveloped and the jaws correspondingly reduced, in the old the teeth become developed and the jaws correspondingly enlarged to accommodate them; and hence they became prognathous —*i. e.* the jaws protrude—in proportion to the size and number of the teeth. Inasmuch as the same being is certainly less intelligent when just born or very young than when old, it follows that any index which points to the reverse must be fallacious; and such is the facial angle in this case. The facial angle, in brief, is merely the exponent of either (1) the development of the jaws (and to a certain extent of the teeth) in some one or other direction, or (2) the development of the forehead at some one point; *e. g.* by frontal sinuses or supraorbital ridges. It is a very uncertain and unreliable exponent of the size of the cranial cavity or brain, and therefore of the intelligence of any given animal. This truth has been recognized by the best naturalists; among others, Prof. Huxley (*Man's Place in Nature*, p. 171) has proposed a substitute in other measurements, remarking that "the lines the intersection of which forms the facial angle are drawn through parts of the skull, the position of each of which is modified by a number of circumstances, and is not the expression of any one definite organic relation of the parts of the skull." The application of the facial angle is also sometimes impossible, or would result in absurdities; *e. g.* in the case of the elephants and whales; and inasmuch as in the birds and lower vertebrates the position of the nostrils varies greatly in related forms, the facial angle determined in accordance with any of the criteria cited would be deceptive in its indications. The practical or diagnostic applicability of the character is also limited.

In the fishes, and to a great extent in the amphibians, no external ear is developed, and there is no certain external index for it or for the other bases taken by Von Baer or Owen; therefore, the use of the facial angle is impracticable. The modifications and diverse relations of the facial and other bones in allied forms are also so great in the fishes as to vitiate any results if they could be obtained. In the reptiles and birds, on account of the extreme modifications of the bill or snout and position of the nostrils in related forms, the index, unless specifically checked or counter-indicated by other characters, would be illusive and lead to false conclusions. In the mammals, likewise, the character would be very often extremely illusive; *e. g.* the sloths, ant-eaters, and various species of armadillos are closely related (within ordinal limits), yet the index of the facial angle for the sloths would be the same as for some of the highest monkeys, while that for the ant-eaters would be the same as for the long-snouted reptiles or long-billed birds. These examples will suffice to show with what extreme caution conclusions should be drawn from the indication of the facial angle; and although there may be a rough general agreement in the highest mammals between the index for the facial angle and the intellectual status, it is even in them very often exceedingly fallacious.

Of course the index of the facial angle will vary with the bases accepted, and the indexes of Von Baer's and Owen's methods differ considerably from that of Camper's; thus, while, according to Camper's method, the facial angle in the European is about 80° and in the African about 70°, according to Owen's in the former it would be about 95° and in the latter about 85°. It is important, therefore, to ascertain the method used in every case. Unless otherwise indicated, it may be assumed generally that Camper's is the one adopted.

The substitutes that have been proposed in place of the facial angle will be more properly indicated in the article on the SKULL (MEASUREMENTS OF THE). A method analogous to the facial angle is, however, noteworthy in this connection. CRANIOFACIAL ANGLE is a name given by Prof. Huxley (see *The Anatomy of the Vertebrated Animals*, p. 420) to the angle subtended by the intersection of (1) the plane of the bony face in its prominent parts, and (2) "a line drawn from the anterior extremity of the *premaxilla* to the anterior extremity of the basicranial axis." In the several races of mankind "it varies with the extent to which the face lies in front of or below the anterior end of the cranium, from less than 90° to 120°. When it is great, the face is *prognathous;* when it is small, the face is *orthognathous.* This is the fundamental condition of *prognathism* or *orthognathism.* A secondary condition is the form of the alveolar portion of the upper jaw, which so far as it is vertical tends toward orthognathism, but so far as it is oblique and produced tends to prognathism."

THEODORE GILL.

Fa'cial Nerve. The facial nerve is the seventh cranial nerve, according to the numerical classification of Sömmering. It originates from a mass of nerve-cells lying deep in the medulla oblongata in its upper median part, passes out of the medulla at its upper lateral tract, just behind the pons Varolii, leaves the cranial cavity by entering the internal auditory foramen in company with the auditory (eighth) nerve, pursues an irregular course through the petrous portion of the temporal bone, and issues from the skull through the stylo-mastoid foramen. The majority of its branches are now given off, and the most important lie in the superficial parts of the face, and are distributed to the facial muscles—the muscles of expression. The deeper branches of the nerve go, after communicating with other nerves, to the muscles of the middle ear and to those of the palate. The facial nerve communicates with the following nerves: the auditory, the intra-cranial sympathetic, the pneumogastric, the glosso-pharyngeal, and with the various branches of the trigeminus. The seventh nerve is strictly a motor nerve, though, away from its origin, it communicates so freely with the trigeminus as to appear sensitive. It is often called *portio dura*, to distinguish it from *portio mollis*, the auditory nerve, considered by some anatomists a portion of the seventh nerve. E. C. SEGUIN.

Fa'cial Neural'gia, a disease characterized by more or less paroxysmal pain in parts of the head and face supplied with sensibility by branches of the trigeminus nerve. Any one branch of the trigeminus nerve may be the seat of pain (in brow-ague the supraorbital branch), or all its branches may be involved. The cause of the neuralgia is a morbid state of the nervous centre giving origin to the nerve (the medulla oblongata); and this morbid state may itself be the result of simple malnutrition (anæmia), of blood-poisoning (malaria), or of inherited predisposition. Various other pathological conditions may give rise to pain in the distribution of the trigeminus, irritation of other sensitive nerves (bad teeth), tumors pressing on the nerve, inflammation of the nerve itself. E. C. SEGUIN.

Fa'cial Paral'ysis, a paralysis of the superficial muscles of the face, due to a loss of the motor property of the nerve supplying them—the seventh or facial nerve. The symptoms are loss of expression on the affected side of the face, a drawing of the mouth and features generally to the opposite (healthy) side, inability to close the eyelids on the palsied side, slight impairment in articulation, owing to palsy of a part of the muscles of the tongue. When both sides of the face are palsied, the face appears like a smooth mask, the mouth (lips) is open, the eyes cannot be closed. The pathological conditions which produce this palsy may be disease of the cerebrum, pons Varolii, or of the medulla oblongata, pressure upon the nerve in the skull or in the canals in the petrous bone, injuries to the nerve in these locations or upon the face, or the sudden impact of cold air upon the face (draught). E. C. SEGUIN.

Fack'ler's Station, tp. of Jackson co., Ala. Pop. 760.

Fac Sim'ile [Lat., "make the like," imperative], an exact copy of a picture, handwriting, or any work of art.

Fac'tor [Lat., a "maker"], in mathematics, is one of the several measures or divisors of a number or quantity. The name is given to each of those quantities which, when all are multiplied together, will produce the *product.*

Factor, a general agent employed in the purchase or sale of merchandise, with power to retain possession of the property in regard to which his authority is exercised, and to control, to a large extent, its management and disposal by proceedings in his own name. By the possession of these peculiar powers a factor is distinguished from a broker, who only conducts negotiations and bargains concerning property of his principal, without having it in his charge, and who properly acts in a representative character by the use of his principal's name. The term "factor," though the one usually employed in law, is not so common in popular usage as "commission merchant" or "consignee." Compensation by the principal is generally a certain percentage on the amount of purchases or sales, called factorage or commission. A *domestic factor* is one who resides in the same country with his principal; a *foreign factor*, one who resides in a different country. A foreign factor, in his relations with third persons, is regarded, to a large extent, as if he were himself principal, and he is therefore under a greater responsibility than one merely domestic. In the application of this distinction

the States of the Union are not, according to the general course of decisions, regarded as foreign to one another. The fundamental duty of a factor is to exercise reasonable care in the performance of the duties with which he is entrusted, and to exhibit such skill and prudence as is required by the nature of the business and a proper consideration for the welfare of his employer. Otherwise, he has no valid claim for his commissions, and for injurious negligence and default may even be subjected to an action by his principal. In the management of the property committed to him he has commonly extensive discretionary power. He may buy and sell, sue and be sued, collect money, give receipts, etc., in the same manner as if he were himself owner of the goods, unless specially restricted by the principal. If any special instructions are given to guide his action, he is bound, as between him and his principal, to follow them strictly, except in some few cases where the necessary protection of his own interests requires that such directions be violated. An instance of the latter kind occurs where the factor has made advances for his principal, and finds it necessary to sell the goods upon the credit of which the advances were made, in order to reimburse himself, upon failure or refusal of the principal to make repayment after proper notice and demand. In such a case the generally established American rule is that the factor has a right to sell to the extent of his advances, even in opposition to the wishes of his principal. The English rule, however, is different. Even where the factor violates special instructions, he may, in certain cases, confer a title upon a purchaser acting in good faith. In the absence of instructions, factors should conform to the usages of the business in which they are engaged, and will be justified in the adoption of any practice which such usages warrant, provided there is no wanton disregard of their employers' interests. They have a lien upon the property entrusted to them for their commissions, advances, and other proper charges, so long as they retain possession. Sometimes, in consideration of an increased commission, a factor guarantees the payment of the price of goods by the purchaser to his principal. He is then said to act under a *del credere* or guaranty commission, and is subject to most of the obligations of a surety. A factor acquires no right to his commissions until all the services for which he was engaged have been rendered. (See AGENT; BROKER.) (See STORY on *Agency;* DUNLAP'S *Paley on Agency;* PARSONS, CHITTY, and other authors on *Contracts.* Statutes have been passed in England and some of the American States regulating the rights and duties of factors in certain respects.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fac'tory [from the Lat. *factor*, a "maker," from *facio, factum*, to "make"]. This word is, in the U. S., applied almost exclusively to a building or collection of buildings devoted to the manufacture of goods on an extensive scale. Until near the close of the last century such a thing as a factory was hardly known in America. Now factories have multiplied till we have them not only for making cloth, to which our first factories were devoted, but for making it up into clothing; for hats and hose and boots and shoes; for doors and blinds and sashes; for household furniture, for carriages, for mechanics' tools and agricultural implements, for clocks and watches, for pins and buttons, and other articles innumerable. A million of our people, probably, are engaged in these various manufactures.

We propose to treat, briefly, in this article of the *factory system* of industry as distinguished from the separate and independent labor of individuals, with reference to its bearing upon the pecuniary, mental, physical, and moral interests of the community.

The *advantages* of the factory system are, 1st, the bringing together of a large number of workers for one purpose, thus securing such a division of labor that each may be employed constantly upon some one part of a complex object. In a carriage-factory, *e. g.*, no individual makes an entire carriage. One set of men work on the bodies, another on the wheels, another on axles, etc. And these are again subdivided, no one making an entire wheel, but one working on the hubs, another the spokes, another the felloes; and even these several parts are still further distributed. The larger the number of hands employed in a particular establishment, the farther the division of labor may be carried; and the smaller the part that each one has to perform, the more skilful and expert he will be likely to become in doing it. In each of the breech-loading rifles now making (July, 1874) at the National Armory in Springfield, Mass., there are sixty different pieces, and more than six hundred distinct operations in making them, and some six hundred men are now employed there. Now, if each workman were required to go through all these operations, far more time would be lost in making the changes from one to another, and getting mind, muscles, and tools adjusted to each new operation, than is now spent in doing all the work. 2d. Machinery is made to perform a large share of most factory operations; and they are not only performed with vastly greater rapidity than they can be by hand, but most of them more accurately also. It is one of the marvellous triumphs of modern machinery that the corresponding parts in a thousand or a million complex mechanisms can be made so exactly alike that each of them will fit in the place of any other. So if a wheel or lever breaks in a factory-made watch, another that will be sure to fit can be ordered and sent by mail at a thousand miles' distance; or when a gun is disabled upon the battle-field, the damaged part may be replaced at once from another that is injured in a different part. Again: the simplification of processes by the use of machinery enables a cheaper class of hands to do a large share of the work, so diminishing further the price of the manufactured goods. The direct effect of the factory system, therefore, financially and as a matter of political economy, must be largely profitable to the community at large.

But there are aspects of the factory system that are not so pleasing—its *disadvantages*. Among these, real or alleged, are, 1st, *intellectual degeneracy* of the operatives. This, it is argued, is the natural consequence of being engaged in an everlasting routine of mechanical operations that require so little mental exercise; at the same time, opportunities for education and for acquiring general information are very limited.

Another danger from factory employment is *injury to health*. The work is often done in crowded and ill-ventilated rooms, frequently in an atmosphere loaded with particles from the materials wrought upon, or in air heated far above a healthful temperature, perhaps saturated with moisture, or sometimes even pervaded by poisonous gases. Then, the work is such as, more than in most other departments of labor, taxes some muscles at the expense of others. The result is, not seldom, positive distortion and deformity in a degree, and when it falls short of that, cannot but be unfavorable to good health. Some of these unwholesome influences touch comparatively few; others affect, in a measure, a large proportion of those employed in factories. And it is evident that the more complete the division of labor, the more will some of these injurious influences be aggravated.

Again: *family ties* and *domestic habits* are likely to suffer, especially through the extensive employment of females in the mills.

Furthermore, it is alleged that so large a capital is requisite to enable one to be a master-manufacturer that most of the workmen despair of attaining such a position, and become spendthrifts, and that they constitute a dangerous political element, their limited opportunities disqualifying them for intelligent citizenship, and their relation to their employers preventing them from casting their votes independently.

Finally, it is thought that factories are *demoralizing*, productive of irreligion and vice.

Such are the principal disadvantages known or suspected to attend on the factory system of industry. And there are those who believe that the densest masses of ignorance, thriftlessness, infidelity, and vice are found almost exclusively in manufacturing towns, and regard the rise of a factory village as the breaking out of a plague-spot in a community. Thus, a British poet, contemplating the manufactories that had sprung up upon a certain stream dear to his youth, exclaimed—

"And call they this improvement?—to have changed,
My native Clyde, thy once romantic shore,
Where Nature's face is banished and estranged,
And heaven reflected in thy wave no more;
* * * * * * * *
And for the daisied greensward, down thy stream
Unsightly brick-lanes smoke and clanking engines gleam.

"Speak not to me of swarms the scene sustains;
One heart, free, tasting Nature's breath and bloom,
Is worth a thousand slaves to Mammon's gains.
But whither goes the wealth, and gladd'ning whom?
See, left but life enough and breathing room
The hunger and the hope of life to feel,
Yon pale mechanic bending o'er his loom,
And childhood's self, as at Ixion's wheel,
From morn till midnight tasked to earn its little meal."

A melancholy picture, indeed! And its gloom is not *all* the mere product of the poet's imagination. But we think its counterpart would be easier to find in Great Britain than in America. And, if we may credit some apparently trustworthy statements recently published, it would not be difficult to paint as dark and as truthful a picture of the condition of the agricultural laborers in some districts there. It is not to be denied that there have been factory villages which, if we took them as fair specimens of what manufacturing communities are, should make us earnestly deprecate their multiplication. But there is reason to think

that facts as they exist, in this country at least, do not justify the very disparaging view which some take.

As to the tendency of manufacturing employments to dwarf the intellect, it may be said, first, that there are some compensations for any lack of ordinary means of culture. The contact of mind with mind where so many are thrown together will do something to sharpen the intellect. Perhaps the fact that the simple operations performed demand so little mental effort may lead, in some cases, to a freer range of thought abroad. And it not unfrequently happens that the compact populations of manufacturing towns have larger opportunities for schools and lectures and such means of mental improvement than those in agricultural towns. Even in Great Britain high authorities doubt the mental inferiority of the manufacturing class.

That factory employments are injurious to *health* seems better established. Yet the quietness of the life, and the shelter from storms and from extremes of heat and cold, may counterbalance some unhealthful conditions; and in most factories of recent construction the necessity of ventilation is recognized, and of securing a proper temperature and purity of atmosphere. This, however, is limited in some cases by the necessities of the work.

As to the alleged unthrift and hopeless poverty of factory-workers, it is not sustained by observation in New England. Many of them do accumulate property enough to make them more than comfortable in advanced years. And if this is not generally true, it is not for want of opportunity. The wages they receive are believed to be equal to those of the corresponding class in most other departments of labor, and, as a general rule, they are as well fed and clothed and housed.

Of the moral and religious condition of factory populations it is not easy to speak with assurance; different persons come to different conclusions. But from the direct testimony of numbers of intelligent men who have excellent opportunities to observe in various places and divers branches of manufacture, we conclude that, when rightly estimated, the moral standing of our larger manufacturing towns, at least, is not below that of others of equal size. They seem to be as well supplied with churches; and, since it is for the interest of employers that their workmen be temperate and virtuous, they are pretty sure to use the great power of control which they have to exclude certainly the grosser forms of immorality from their establishments. It is true that the operatives in some of our largest and oldest manufacturing towns are inferior in intelligence and in general character to what they were forty years ago. But this does not prove a damaging influence of factory employment. They are not only not the same *persons*, but they are drawn from very different sources. A large majority of those employed in our cotton and woollen mills to-day are of foreign origin, and others are from families at a low grade in the social and moral scale; so that, remembering what the raw material of these operatives is, we can believe, as we are assured by men who know, that there is in general a decided lifting up, and not a degeneracy in character after they enter this employment.

Remedies.—While thus we guard against an exaggerated estimate of the evils attending the factory system, unquestionably they are enough, and great enough, to demand the earnest inquiry, What can be done to remove or diminish them? Legislation may lend important aid toward that good end. It *has* done something in Great Britain and in this country. Laws limiting the hours of work, limiting the age at which children shall be permitted to enter the mills, and compelling a certain amount of schooling, have accomplished not a little good. And while there are difficulties attending the regulating of such matters by law, yet probably legislation might be advantageously yet farther invoked. Again: An important means of exciting a healthful ambition, and which would work for good in various ways, is allowing the operatives themselves to become owners of stock in the companies for which they labor. This is practised now by some companies, and might be by many others if they were so disposed.

But the grand remedy for the ills of this branch of industry is the same as for all others—a *general purification of society.* There are wise and good men managing some of our manufacturing establishments who do a great deal for the physical, intellectual, and moral health of their employés by providing good work-rooms, healthful lodging-houses, well-selected and free libraries, and helping to secure suitable religious privileges. And when upright, magnanimous Christian men shall be at the head of all our factory companies, there will be a great diminution of whatever special infelicities now attend them. Such a consummation may be distant, yet we cannot but cherish strong hopes that our multiplying manufactories, instead of being the curse and ruin of the country, are to contribute to its prosperity socially, politically, and morally, as well as financially, and to have their full share of the glory which we fondly anticipate for the nation.

GEORGE T. DOLE.

Fac'tory Point, post-v. of Manchester tp., Bennington co., Vt., on the Harlem Extension R. R. It has manufactures of leather, lumber, wagons, and knit goods, and quarries of marble.

Fac'tory Village, a v. of Milton tp., Saratoga co., N. Y., has two paper-mills.

Factoryville, Staten Island, N. Y. See NEW BRIGHTON.

Fac'toryville, post-v. of Barton tp., Tioga co., N. Y., has a planing-mill and other manufactures. Pop. 318.

Factoryville, post-v. of Clinton tp., Wyoming co., Pa., on the Delaware Lackawanna and Western R. R., 15 miles N. W. of Scranton. The seat of Keystone Academy.

Faculæ. See SUN, by PROF. CHARLES A. YOUNG, Ph. D.

Fac'ulty [Lat. *facultas*], as applied to the body of instructors of an institution of learning, is a term of mediæval origin, and at first designated all the graduates, or those who had received power or authority (*facultas*) to impart instruction. There were said to be four faculties—those of philosophy, medicine, law, and divinity. Even now, the whole body of graduates are occasionally so called, especially in the phrases "medical faculty" and "legal faculty;" but more frequently the officers of instruction and discipline in a college or university are collectively designated as the faculty of that particular college.

Faculty of the Mind. See MIND, by PRES. JAMES McCOSH, S. T. D., LL.D.

Fæ'ces [the plu. of the Lat. *fæx*, the lees of wine or the dross of metals], the substance ejected by animals from the alimentary canal, consists in general of (1) the surplus of the food, over and above what is needed for nutrition for the time being; (2) those elements of the food which are not available for nutrition; and (3) certain excrementitious and effete matters which the liver, the intestine, etc. have removed from the blood (stercorine, cholesterine, etc.). To these, in the Monotremata and all the vertebrates inferior to mammals (as well as in many invertebrates), the renal excretions are added. Fæcal matters are highly important as fertilizers; and this is especially true of guano and the excrement of birds generally, since it contains the urinary excretions combined, as we have seen, with those of the intestine, the whole in a very condensed form.

Fæcula. See STARCH.

Faed (JOHN), artist, b. in 1820 at Burley Mill, Kirkcudbright, Scotland. His father was an engineer and millwright, but the lad showed a taste for painting that made the homely surroundings tributary to it, and at the age of twelve finished a picture so well that his future career was determined. In 1841 he went to Edinburgh for study, and there, in 1850, exhibited pictures which attracted attention from their naturalness and met a ready sale. He painted *Shakspeare and his Friends, The Cotter's Saturday Night, The Soldier's Return, Tam O'Shanter, Haddon Hall of Old, John Anderson my Jo, Parting of Gabriel and Evangeline,* and other pieces of kindred character, clothing historical fact with sentiment. Since 1864, he has lived in London.

O. B. FROTHINGHAM.

Faed (THOMAS), R. A., younger brother of the above, b. at the same place in 1826. He too had a passion for art, and on the death of his father followed his brother to Edinburgh. At the Academy of Design there, under the instruction of Sir W. Allan, he soon distinguished himself. His first exhibited piece was in water-colors, *The Old English Baron.* After that he tried oil-painting, like his brother choosing humble themes—*The Players of Draughts, The Shepherd Boys.* In 1849, Faed became an associate of the Royal Scottish Academy. Two years later the well-known picture, *Walter Scott and his Friends at Abbotsford,* made him famous. In 1852 he removed to London, and sent his work to the Royal Academy. From year to year his reputation increased. *The Mitherless Bairn* (1855) was pronounced the picture of the season. His painting *Baith Father and Mither* (1864) was again exhibited at the World's Fair of 1867, along with two other canvases by the same hand. Was made member of the Royal Academy Dec., 1864.

O. B. FROTHINGHAM.

Faen'za, city of Central Italy, 19 miles S. W. of Ravenna. The manufactures of the peculiar earthenware which received its name from this city (*faïence*) have recently increased considerably. The city has many remarkable old buildings and fine pictures. Pop. 17,486.

Fag'gert's, tp. of Cabarrus co., N. C. Pop. 619.

Fag'ging, a technical term to denote a custom which has become part of the public-school system of England. This custom differs in detail in the several schools, but rests in all on the same principle. This principle is, that the discipline of the school should be left, as far as possible, to the boys themselves, the responsibility for order being thrown on the highest form, known as the sixth form, called also prefects (as at Winchester) or præposters (as at Rugby). Those who are thus responsible for discipline have also the right of "fagging" the boys in the lower forms, those in the forms immediately under the sixth being exempted. Dr. Arnold defines fagging as "the power given by the supreme authorities of the school to the sixth form, to be exercised by them over the lower boys, for the sake of securing a regular government amongst the boys themselves, and avoiding the evils of anarchy; in other words, of the lawless tyranny of brute force." (*Quarterly Journal of Education*, vol. ix.) The origin of this custom of fagging cannot now be ascertained with any certainty, but, so far as there are any authentic records, it would seem to have always existed in the old schools. Thus, it is clear, from Christopher Johnson's poem *De Collegiis* and the *Consuetudinarium Vetus Scholæ Etoniensis*, that it was in active operation at Winchester and Eton in the sixteenth century. It is probable, however, that the custom arose as soon as the schools received any large number of boys as boarders. It is indeed obvious that where large numbers of boys of ages ranging from ten and eleven up to nineteen are thrown together away from their own homes, they must be placed either under the constant surveillance of masters or under some distinct and recognized form of self-government. The latter alternative has always prevailed in the English public schools, and is, in fact, the only one which is in accord with the national character. There is abundant proof, moreover, that the custom of fagging as a part of the system does not stand merely on tradition, but is accepted as beneficial at the present time, in the fact that it has been deliberately introduced in the schools which have been founded within the last thirty years. The number of the great public schools had remained stationary for three hundred years, since Queen Elizabeth's reign, during which Harrow, Rugby, and others not so well known were founded. In the present reign a remarkable revival has occurred, and a number of public schools have been founded, of which the best known are Marlborough, Haileybury, Wellington College, and Cheltenham. Fagging has been introduced in the three former of these. At Cheltenham, where the school is in a large town, and is chiefly composed of day-scholars, or boys living at their own homes, though there is no legal system of "fagging" recognized by the school authorities, the practice exists, but without the usual safeguards against abuse. In all the schools the power of fagging carries with it certain duties. Besides that of keeping order generally, the sixth-form boy is the recognized adviser and protector of those fags with whom he comes in immediate contact. In any case of bullying or bad conduct the appeal of the aggrieved boy is to the sixth-form boy of his room or passage, or to the head of his house, and not to his tutor or house or form master. And the sixth-form boy is bound to accept the responsibility of acting himself, and would completely lose caste were he to refer any but flagrant cases of ill-conduct to the master.

Simultaneously with the public-school revival of the last thirty years, however, great modifications of the fagging system have been introduced. At the beginning of that period "fagging" included a number of menial functions, such as cleaning boots and candlesticks, and the power of the sixth form was practically unlimited as to hours. A boy might be fagged, for instance, during a whole afternoon at cricket, day after day. All this is now changed. At Eton and one or two other schools there is now no cricket-fagging, and in those where it still exists it is very light. Thus, at Haileybury the whole of the fags are taken in regular order for one hour, so that each fag's turn comes only once in three weeks, and even then he is let off if he makes a good catch or otherwise distinguishes himself. A similar custom prevails at Marlborough, where, however, besides the sixth form, the Eleven have the power of fagging at cricket—a solitary example (it is believed) where this power is not dependent on proficiency in study as evidenced by position in the school. Football-fagging is also very light at all the schools except Rugby, only some half dozen fags being told off, to keep the ball in bounds. At Rugby every fag is obliged to play "little side," lasting two hours at most, unless he holds a medical certificate of inability to play. He is also obliged to run (in the paper chases) unless holding such a certificate. Apart from games, general fagging is practically confined to running errands, a sixth-form boy having power to call any fag, at any time, for this purpose. House-fagging, in like manner, consists of little beyond small services of this kind—carrying up the trays on which their master's breakfast and tea things are set, and perhaps toasting a round of bread or a rasher of bacon. "Study-fagging" still exists at Rugby, where each sixth-form boy has two fags specially attached to him, who sweep out his study and put it in order in alternate weeks. At the school-house also "night-fagging" is still in force. Every fag has his choice between study-fagging and night-fagging. The rota of night-fags is kept by the head fag, who tells off four for each week in the term. Their duties are to be ready in the passages between 8.30 and 9.30 to answer the call of any of the sixth form.

At Eton the fifth form have the power of fagging, but (as above stated) it is usually confined exclusively to the sixth form. The numbers of the sixth are not strictly limited, but seldom exceed thirty-five or forty. Harrow has the largest sixth form of any school, divided into the "upper," "lower," and "modern side," and numbering eighty, all of whom have the power of fagging, but only the fifteen highest, or "monitors," have the power of enforcing discipline with the cane, if necessary. Only the fifth form at Harrow, numbering 140, are exempt from fagging. As the school averages in all 550 boys, there are consequently some 330 fags to 80 masters.

The most distinguished masters of public schools, from Dr. Arnold downward, have been singularly unanimous in their approval of the modified system of fagging which now exists. The public opinion both of old public-school men and of the boys themselves is also strongly in favor of it as the best means of maintaining the due subordination of ranks, of keeping down "cheek," and preventing bullying. There is every likelihood, therefore, that it will not only continue in its present form in all the higher public schools, but will also be adopted in the numerous middle-class public schools which are springing up in England upon old and neglected foundations or in consequence of local effort. (See also Arnold's *Life*, by STANLEY, 1st ed., vol. i., p. 105, and *Report of Public-School Commissioners* (1864), and *Appendix of Evidence of Bishop of Exeter, Drs. Butler, Balston, and others;* and specially section of *Report on Monitorial System*, p. 42 *et seq.*) (See BACCHANTEN.) THOMAS HUGHES.

Fa'gius (PAUL BÜCHEIN), German Protestant theologian, b. at Rheizabern in the Palatinate 1504, was pastor at Isny in 1537, and professor of Hebrew at Strasburg in 1544. Was in England in 1549, and was appointed to the chair of theology at Cambridge University, but d. Nov. 12, 1549. His body was exhumed and burned by order of Queen Mary in 1558.

Fagna'ni (JOSEPH), b. at Naples, Italy, Dec. 24, 1819; studied in the royal academy of his native city, and made crayon portraits in early youth; went to Vienna, Paris, and Madrid, and in 1849 came to the U. S. with Sir Henry Bulwer; in 1851 married an American lady and settled in New York; was afterwards distinguished, both in Europe and the U. S., as a painter of portraits, and for his skill received several decorations and other honors. D. in New York May 22, 1873.

Fagun'dus, post-v. of Warren co., Pa., in the Oil Region.

Fagus. See BEECH.

Fahlun. See FALUN.

Fahr'enheit (GABRIEL DANIEL), F. R. S., a physicist, b. in 1690 at Dantzic, Prussia; became a constructor of scientific instruments; resided in France, England, and afterwards in Holland, and was everywhere recognized as one of the leading physicists of his time. In 1720 he first introduced the use of mercury in thermometers. He invented the Fahrenheit scale (see THERMOMETER); also an improved areometer and other valued instruments. He was the author of several learned papers, chiefly regarding heat and specific gravities. D. at Amsterdam in 1740.

Faidherbe (LOUIS LÉON CÉSAR), French general of division and author of several geographical, ethnographical, and linguistical papers, was b. at Lille June 3, 1818, and began his career in the colonies, principally in Algeria, where he served with distinction. Made himself favorably known while governor of Senegal by several valuable scientific papers which were published in the *Annuaire du Sénégal* (1859, 1860, and 1861) and in the *Bulletin de la Société de Géographie*. He also wrote *Chapitre de Géographie sur le Nord-Ouest de l'Afrique* (St. Louis, 1864), and *Collection complète des inscriptions Numidiques* (Paris, 1870). Published from 1860 the *Bulletin du Sénégal* (St. Louis), and rendered the French dominion in Africa great service by his exact knowledge of the country and its population, and by his talent of organiza-

tion. At the outbreak of the war with Germany he commanded the subdivision of Bona, and was called to active participation in the war by the government of National Defence in Dec., 1870. On Dec. 3 received the supreme command of the armée du Nord, organized in and around Lille. He commanded in the undecided or drawn battles of the Hallue, on Dec. 23, 1870 (also called the battle of Quérieux), and of Bayaume on Jan. 2 and 3, 1871. On Jan. 19, 1871, he was defeated by General von Goeben at St. Quentin, but his artillery was weak, and he had almost no cavalry, and thus it is certainly not to be wondered at that his newly-organized and little-practised forces could not hold their ground against the old German soldiers, led by an excellent commander. Acknowledged as a very able commander and organizer in war, Faidherbe entered into politics after the war during the reorganization of the government. Joined the party of Gambetta, and was elected to the National Assembly from three different places; accepted the election from his native place, Lille. But when the government of Thiers triumphed, and the influence of Gambetta decreased, Faidherbe retired from public life. He wrote a book on the war, *Campagne de l'armée du Nord*, dedicated to Gambetta (Paris, 1871). A. NIEMANN.

Faïence [Fr., from *Faenza*, the original place of its manufacture], a name for glazed pottery having an earthenware ground and enamelled with painted designs.

Fai-Fo, seaport of Anam, and a mart of considerable importance. It trades principally with China, and exports sugar and cinnamon. It has a large Booddhic temple, with 2 Chinese temples. Pop. 5000.

Faillon (MICHEL ÉTIENNE), b. at Tarascon, France, in 1799, became a Sulpician in Paris, and in 1854 came to Canada as a visitor to the Sulpician houses of that country. He published numerous valuable biographies of distinguished French Canadian religionists, and undertook an extended history of the French in Canada, of which 3 vols. 4to (1865–66) were completed. D. at Paris Oct. 25, 1870.

Failly, de (CHARLES ACHILLE), French general, was b. at Rozoy-sur-Serre, Aisne, Jan. 21, 1810. After 1828 served partly in France, partly in Algeria. In the Crimean war distinguished himself in the battle of the Alma and the storming of Sebastopol; and at the battle of the Tchernaya led his brigade with valor and success. In the war against Austria, in 1859, commanded, as general of division, the third division of the fourth army corps, and on the day of the battle of Solferino received the grand cross of the Legion of Honor. After this war, and to 1870, was president of the comité consultatif de l'infanterie, and under his authority all improvements in the equipment and exercise of the infantry were discussed and put in practice; he had the merit of introducing the Chassepot gun. In 1867 commanded the expedition whose task was to protect the pope against the attacks of Garibaldi, and his name attained a sad celebrity from the battle of Mentona, in which Garibaldi's irregular host were slaughtered, and from the report of this battle, in which the Chassepot gun was mentioned as having done "wonders." At the beginning of the war with Germany, Failly received the command of the fifth corps, but was very unsuccessful, and was violently attacked by his countrymen; after the war he published a pamphlet in vindication of himself—*Marches et opérations du cinquième corps* (Brussels, 1871)—in which a broken heart speaks from every line. The principal charges brought against Failly are—that at Wörth he did not come to the support of MacMahon, though he stood near enough to do so; and that he marched his corps from Chalons to Sedan so badly and improvidently that it was surprised and defeated at Baumont. On these accounts he lost his command on the very day before the battle of Sedan. In the above-mentioned pamphlet he tries to refute these charges, but on his return from German captivity he received no command. AUGUST NIEMANN.

Fainéants [Fr.], ("Do-Nothings"), a name applied to several Frankish sovereigns, chiefly of the Merovingian dynasty. The title is indicative of their idle and worthless reigns, which indeed were merely nominal. Thierry III. of Austrasia and Burgundy, Clovis III., Childebert III., Dagobert III., Chilperic II., Thierry IV., and Childeric III., all Merovingian kings of France, were *rois fainéants*, as was also Louis V., the last of the Carlovingians. The same appellation is often applied to worthless monarchs of later times and other countries.

Faint'ing (*Syncope*), a more or less complete and sudden loss of sensation and of the power of motion, unaccompanied by convulsions, but usually attended by feebleness of the circulation and respiration. Fainting is attended by anæmia of the brain, its proximate cause; more remotely it may be caused by loss of blood, by profound emotional disturbance, or by heart-disease. Closely akin to it, but more permanent and dangerous, are the collapse which occurs in cholera (caused by loss of the fluid constituents of the blood) and the shock which follows severe injuries. Fainting is to be treated by placing the patient on his back in a horizontal position, or with the head and chest slightly depressed below the level of the rest of the body; by admission of fresh air to the patient; and, in prolonged cases, by applying diffusive stimulants to the nostrils and resorting to artificial respiration. Fainting is seldom mortal, unless in cases of severe disease.

REVISED BY WILLARD PARKER.

Faioum. See FAYUM.

Fair [a word kindred to the Lat. *feria*, a "holiday"]. This name was originally given to stated temporary markets containing many kinds of goods and wares. When population was sparse, and the means of travelling and transportation were extremely limited, it was found most convenient to expose merchandise for sale at the largest gatherings of the people. Hence, European fairs were early identified with religious festivals, and were often designated by the name of the saint in whose honor each festival was held. However, as the difficulties and dangers of intercommunication diminished, and the number of cities and villages increased, factories, shops, and warehouses became more accessible, and the inhabitants generally found it more convenient, as well as more profitable, to buy goods as they needed them, from time to time, than to purchase a year's supply in advance. Thus, fairs for the sale of goods constantly decreased in number and importance with the growth and improvement of each country, until not more than two or three of any note were held in all Europe. The most famous of these—and, it is said, the largest in the world—is held annually during the months of July and August at Nijni-Novgorod in Russia, situated at the confluence of the rivers Volga and Oka, about 265 miles E. of Moscow. The amount of sales at this fair is reported to have reached the enormous sum of 150,000,000 roubles (about $112,000,000). Yet it is not improbable that the proposed Siberian railway will, when completed, open new places of business along its line through Northern Russia and Central Asia, and thus eventually cut off the supplies which are now gathered annually at Nijni-Novgorod. In Arabia, Hindostan, and other Eastern countries such fairs are still held, and will continue to be so until the general introduction of railways and other modern improvements.

In the U. S., temporary markets containing the effects of itinerant merchants are entirely unknown, although the term *fair* is often applied to such collections of fancy articles as are generally sold by ladies for the benefit of religious and charitable associations. This term has, however, a far higher meaning, and now more frequently designates a collection of superior products which are exposed, not for sale, but solely for public inspection, and for careful examination by experts as to their respective qualities. Numerous annual fairs, embracing rare specimens of skill, industry, and inventive genius, and furnishing abundant evidence of progress and improvement, form a feature peculiar to this country. They are identified with a grand movement for bettering the material condition of man, which, by enlisting all classes, and thus securing the hearty co-operation of the mass of the people, has already gathered irresistible force, and must therefore be regarded as the most significant sign of advancement in the nineteenth century.

Several attempts were made at an early day in this country to encourage art and invention by offering prizes for superior specimens of a few kinds of goods, but no permanent system for improvement was established until the year 1810. Elkanah Watson, a merchant of Albany, N. Y., whose original plans regarding inland navigation, uniform currency, and general education entitle him to a prominent place among American philanthropists, was the real author of the present system of fairs and cattle-shows sustained and directed by agricultural societies. Having retired from active business, and removed to his farm near Pittsfield, Mass., he conceived the idea of interesting the farmers of Berkshire county in holding an exhibition of improved breeds of cattle and superior products of the soil, for the purpose of proving what might be accomplished by proper culture; and to compensate and reward exhibitors for the care and labor bestowed on their specimens, prizes were to be awarded for the best. The first fair was quite a success, and for the purpose of enlarging the next he appealed to the citizens of Boston for pecuniary aid, but failed to get a single favorable response. Ex-President John Adams, in his reply, made it quite apparent that the leading men of that day did not appreciate the importance of this new step for encouraging the useful arts. This was pithily expressed in a single sentence: "You will get

no aid from Boston: commerce, literature, theology, medicine, the university, and universal politics are against you." Watson was not thwarted by this rebuff; he redoubled his exertions at home, and for several years annual fairs were held. In 1815 he returned to Albany, and immediately proceeded to organize an agricultural society and to establish fairs and cattle-shows in the neighboring counties. In 1819 the legislature of the State of New York passed an act appropriating $10,000 annually, for six years, for the promotion of agriculture and family manufactures, which was to be divided among the agricultural societies of the several counties in proportion to their population, provided a like sum was raised in each by voluntary subscription. In 1832 the present State Agricultural Society was incorporated, and in 1841 a law was passed similar to that of 1819, appropriating the sum of $8000. Under the present system each county agricultural society is required to report annually to the State society, which embraces the essential parts of the whole in its report to the legislature. This plan of organizing State and county agricultural societies, with power to hold fairs, was adopted before 1858 in the States of Michigan, New Hampshire, Indiana, Wisconsin, Massachusetts, Connecticut, Illinois, Vermont, Tennessee, California, Maine, and Iowa. Many other States have been added to this list since that time. Nothing illustrates the rapid extension of this system, and the popular sentiment in its favor, better than the announcement of a great fair at Omaha, Neb., and another at Colorado Springs within the Rocky Mountain range, in the fall of 1874. These societies are, as a general rule, under the guidance and patronage of the best and most influential farmers, who take a natural pride in the efficient management of their respective fairs. The collected transactions of State agricultural societies, including reports on annual fairs, printed by order of the several legislatures, already form a large and valuable library on the subject of agriculture and the allied arts.

Other fairs of a more varied and comprehensive kind have been held in many of the large cities of this country, prominent among which are those of the American Institute of the city of New York, the Franklin Institute of Philadelphia, the Maryland Institute of Baltimore, the Massachusetts Charitable Mechanics' Association of Boston; also the industrial exhibitions of Chicago, Cincinnati, St. Louis, New Orleans, and San Francisco.

These exhibitions embrace not only agricultural products, but superior specimens of the fine, ornamental, and useful arts, including working models of recent inventions, machinery in motion, improved chemical and mechanical processes, with the material resulting therefrom, and practical illustrations of the best methods of generating and utilizing force. The articles composing these displays are arranged according to various systems of classification: that of the American Institute is the simplest and most comprehensive of any yet devised. It consists of seven departments, each of which is divided into seven groups; and every possible product or device can be readily assigned to a proper place in one of these forty-nine divisions. The remarkable feature of these fairs is the spirit of emulation evinced by exhibitors. This desire to excel, although it may be stimulated by both rewards and rivalry, springs from a longing to accomplish a given end by the best and most economical methods. Their highest ambition is to add something to the stock of useful knowledge. Fortunately, this friendly strife for supremacy in skill and ingenuity has a constant tendency to expand and give greater variety and value to every display. Competition is not solely an incentive to improvement, for by demanding the severest tests it becomes the means of exposing the advantages and defects of every construction, thus ensuring the adoption of the best.

Few persons are aware of the great expense incurred by many exhibitors for the purpose of making an imposing display at these fairs, or of the large sums expended by their respective managers to render them attractive, instructive, and of real benefit to their patrons. Complete returns of the number of persons attending the numerous agricultural and other fairs have never been made, but from careful estimates it may be safely assumed that the average total number of visitors during each year exceeds 5,000,000.

The advancement of man is clearly indicated by invention and discovery. Whatever may be the state of his shifting opinions on social and political questions, his actual progress and elevation mainly depend on increased facilities for supplying his wants of body and mind by means of new devices which will lessen the rigor of manual labor and render knowledge more accessible. The highest evidences of the increasing skill of our artists and artisans, and of the constant growth and prosperity of this country, are to be found in its numerous autumnal fairs, and together they form a reliable index of the annual progress made in developing its material resources.

SAMUEL D. TILLMAN.

Fair'bairn (PATRICK), D. D., a farmer's son, was b. at Greenlaw, Berwickshire, Scotland, in 1805, graduated at the University of Edinburgh, was settled in 1830 in one of the Orkney Islands, at Bridgeton, a suburb of Glasgow, in 1837, and at Saltoun, near his birthplace, in 1840. After being for some years professor at Aberdeen, he was in 1856 made principal and professor of systematic theology and New Testament exegesis in the Free Church Theological College at Glasgow. He d. suddenly Aug. 6, 1874. His principal works are *The Typology of Scripture* (1847; 5th ed. 1870); *Commentary on Ezekiel* (1851; 2d ed. 1855); *Prophecy, its Nature, Functions, and Interpretation* (1856); *Hermeneutical Manual* (1858); *Revelation of Law in Scripture* (1868); and a commentary on *The Pastoral Epistles of Paul* (1873). He visited the U. S. in 1871.

R. D. HITCHCOCK.

Fairbairn (ROBERT BRINCKERHOFF), D. D., a clergyman of the Episcopal Church, was b. in the city of New York May 27, 1818; educated at the Mechanics' School in Chambers street, New York, and at Trinity College, Hartford, where he graduated B. A. 1840, and also at the General Theological Seminary, New York. Immediately after his ordination as deacon July 2, 1843, became the rector of Christ Church, Troy, N. Y. From 1853 to 1862 was the principal of the Catskill Academy, as well as rector of Calvary Church, Cairo, N. Y. In 1862 was appointed the professor of mathematics and natural philosophy in St. Stephen's College, Annandale, N. Y., of which institution he became warden in 1863, and also professor of moral philosophy. He still continues to preside over this college. Is the author of several printed sermons, addresses, and pamphlets on religious and educational subjects.

Fairbairn (Sir THOMAS), BART., C. E., eldest son of Sir William Fairbairn, b. at Manchester 1823. As "Amicus" in the *London Times* and in other ways he has sought the social progress of England, writing upon trade-unionism, art, etc. Was active in arrangements for the great English exhibitions of 1851 and 1862.

Fairbairn (Sir WILLIAM), BART., F. R. S., LL.D., a noted British civil engineer, b. at Kelso, Scotland, in 1789; received his early education at a parish school, with some instruction from his uncle, and was apprenticed to an engine-wright at a British colliery. On the termination of his apprenticeship worked for two years in London, when he visited various places in England, Wales, and Ireland, working for a brief time in each, in order to acquire a practical knowledge of mechanical engineering. In 1817 began business on his own account at Manchester. His first important improvement was the substitution of iron for wood in the shafting of cotton-mills, and the use of lighter shafting where metal was already in use. By this change the cost of machinery was reduced and the speed increased fourfold. His attention was next directed to the use of iron for ships, and he was the first in England to construct an iron ship. This branch of industry he subsequently developed to a great extent, making it his principal business. More than one hundred iron ships were constructed by his firm, varying in size from the smallest to the war-vessel of 2600 tons. By invitation of the British Association (1834–35), in connection with Mr. Hodgkinson, he investigated the causes of certain supposed defects in iron produced by hot-blast furnaces, and submitted a valuable report upon the subject. Also, at the instance of scientific bodies, and for his own information, made a protracted series of experiments to test the strength of various kinds of iron; also on the resistance of hollow tubes or cylinders to outside pressure, which led to valuable practical results. Mr. Fairbairn co-operated with Robert Stephenson in designing and constructing the great tubular bridge across the Menai Strait, and at his instance the plan suggested by Mr. Stephenson was modified to better meet the required conditions, and it was owing to his "determined perseverance" that Mr. Stephenson's conception became realized. Sir Wm. was one of the founders of the British Association for the Advancement of Science, and the author of many valuable professional books and papers, among which may be mentioned *Mills and Mill-work*, *Iron, its History and Manufacture*, *Application of Iron to Building Purposes*, *Iron Shipbuilding* *Useful Information for Engineers*, 1st, 2d, and 3d series. President of the British Association, corresponding member of the National Institute of France, and chevalier of the Legion of Honor. Created a baronet in 1869. D. Aug. 17, 1874.

G. C. SIMMONS.

Fair'bank, post-tp. of Buchanan co., Ia. Pop. 1238.

Fair'banks, tp. of Sullivan co., Ind. Pop. 1234.

Fairbanks (Erastus), LL.D., an American manufacturer, b. at Brimfield, Mass., Oct. 28, 1792, formed a partnership with his brother for the making of scales in 1825 at St. Johnsbury, Vt., and their works there have a world-wide reputation. Was member of the Vermont legislature 1836–38, governor of the State in 1852–53 and 1860–61, and d. at St. Johnsbury, Vt., Nov. 20, 1864. Governor Fairbanks was a man of unusual business abilities, a faithful and disinterested public officer, a citizen of spotless virtue and integrity, and a liberal benefactor of many religious and charitable enterprises, in the success of which he took a deep interest.

Fair Bluff, tp. of Columbus co., N. C. Pop. 1309.

Fair'burn, post-v. of Campbell co., Ga., 18 miles S. W. of Atlanta, on the Atlanta and West Point R. R. P. 305.

Fair'bury, post-v. of Indian Grove tp., Livingston co., Ill., at the crossing of the Toledo Peoria and Warsaw and the Chicago and Paducah R. Rs., 10 miles S. E. of Pontiac, Ill. It has 2 banks, 3 grain-elevators, a fine hall, 6 churches, 1 weekly newspaper, and a general publishing and printing house; also coal-mines, mills, shops, factories, etc. It is in a thickly-settled and fertile region, abounding in coal, limestone, fire-clay, sandstone, and a micaceous quartz which affords a fine fireproof building-material. Clays of nearly all colors abound. Pop. 1493.
O. J. & L. W. Dimmick, Eds. and Pubs. "Independent."

Fairbury, post-v. and tp., capital of Jefferson co., Neb., is situated on the Little Blue River and on the line of the St. Joseph and Denver City R. R. It has a splendid water-power, a fine flouring-mill, a good school-house, 2 churches, a steam saw-mill, 1 weekly newspaper, 1 bank, 2 drug and 5 general stores, 4 lumber yards, etc. Pop. of tp. 370. Geo. Cross, Ed. "Gazette."

Fair'child (James H.), D. D., president Oberlin College, b. 1817 at Stockbridge, Mass., was removed to Ohio when a year old; at seventeen years of age entered Oberlin College as freshman, and has been connected with the college thenceforth to the present time. In 1838 was tutor, in 1842 professor of languages, in 1847 of mathematics, in 1858 of theology, and in 1866 became its president. Has published *Moral Philosophy*, and pamphlets on questions connected with his college, particularly on the education of women, besides contributing to periodicals.

Fairchild (Lucius) was b. at Franklin Mills, Portage co., O., Dec. 27, 1831, served in the war of 1861–65 from the State of Iowa, becoming a brigadier-general of volunteers Aug. 5, 1861; was secretary of State of Wisconsin 1864–65, and governor 1866–67. At present (1874) U. S. consul at Liverpool, England.

Fair'fax, county of Virginia, bounded on the E. chiefly by the Potomac. Area, 430 square miles. The surface is undulating. The soil is in part productive. Grain is the principal crop. Carriages and wagons are among the more important manufactures. The county is intersected by the Washington City Virginia Midland and Great Southern and the Washington and Ohio R. Rs. Cap. Fairfax Court-house. Pop. 12,952.

Fairfax, a v. of New Garden tp., Wayne co., Ind. P. 21.

Fairfax, post-tp. of Linn co., Ia., on the Chicago and North-western R. R., 9 miles S. W. of Cedar Rapids. Pop. 1193.

Fairfax, post-v. of Concord and Jackson tps., Highland co., O. Pop. 84.

Fairfax, post-v. and tp. of Franklin co., Vt., 37 miles N. W. of Montpelier. It has four churches, manufactures of woollens, leather, lumber, and other goods, and is the seat of the New Hampton Theological and Literary Institution (Baptist). Pop. 1956.

Fairfax (post-office name **Culpeper**), post-v., cap. of Culpeper co., Va., in Catalpa tp., on the Washington Virginia Midland and Great Southern R. R., 69 miles S. W. of Washington. It was an important strategic point during the civil war. It has two newspapers. Pop. 1800.

Fairfax Court-house, a post-v., cap. of Fairfax co., Va., 14 miles W. by N. of Alexandria and 4 miles from Fairfax Station. It has 1 weekly newspaper, 2 churches, 4 schools, a carriage and wagon manufactory, 4 stores, 2 hotels, and 1 bakery. Principal business, farming, stock-raising, and dairying. It is elevated about 160 feet above tide-water, is very healthy, and is handsomely situated. Pop. about 300.
Saml. Simpson, Ed. and Prop. of the "News."

Fairfax (Bryan), Lord, was b. about 1730, and d. at Mount Eagle, near Cameron, Va., Aug. 7, 1802. Was an Episcopal clergyman at Alexandria, Va., during the last of his life. Was a loyalist in the war of the American Revolution, but preserved the friendship of Washington.

Fairfax (Donald McN.), U. S. N., b. Aug. 10, 1823, in Virginia, entered the navy as a midshipman Aug. 12, 1837; became a passed midshipman in 1843, a lieutenant in 1851, a commander in 1862, a captain in 1866, a commodore in 1873. Commanded the steamer Cayuga in 1862 on the Mississippi River; in command of the monitor Nantucket participated in the first attack upon Fort Sumter, Apr. 7, 1863, and commended by Rear-Admiral Dupont, in his report of that action, for "the highest professional capacity and courage." In command of the monitor Montauk took part in all the fights with the forts and defences of Charleston harbor which occurred during July and August, 1863, and for his excellent service on these occasions received the thanks of Rear-Admiral Dahlgren in general orders and in official communications to the navy department. Foxhall A. Parker.

Fairfax (Edward), English poet, son of Sir Thomas Fairfax, b. at Denton, Yorkshire, about the end of the sixteenth century, translated Torquato Tasso's "Jerusalem Delivered" into English, verse for verse, and this work is still of standard excellence. A *History of Edward the Black Prince*, in verse, and a *Discourse of Witchcraft*, etc., are also his works. The American edition of his great translation, last ed., 12mo (1855), gives the text of Charles Knight's edition from the old folio edition of 1600.

Fairfax (John Contee), M. D., the eleventh Lord Fairfax, a resident of Bladensburg, Prince George co., Md., b. in 1830, a younger son of Hon. Albert Fairfax, succeeded to the title in 1869 on the death of his brother, the tenth Lord Fairfax. Dr. Fairfax formerly practised medicine at Woodburne, Md., and in 1857 married a daughter of Col. Edward Kirby, U. S. army. His cousin, Mr. Raymond Fairfax, is the heir-presumptive to the title. The Fairfaxes are of the Scottish peerage, and never had a seat in the British House of Lords. The first of the title was Ferdinando, a nephew of the poet; made a peer in 1627, d. in 1648. He was the author of some extant writings.

Fairfax (Thomas), Lord, English general, b. at Denton, Yorkshire, Jan., 1611, was son of Ferdinando, Lord Fairfax, and Mary, daughter of Edmund Sheffield, Lord Mulgrave; served in Holland as a volunteer under Horace, Lord Vere, whose daughter he afterwards married; at the outbreak of civil war in 1642 received from Parliament a commission as general of cavalry, his father being commander-in-chief of the northern forces; defeated the royalists under Col. Bellasis, Apr., 1644, and July 2 of that year was especially distinguished by bravery and activity at the king's defeat at Marston Moor, where he commanded the right wing; in Jan., 1645, became commander-in-chief of the Parliamentary or "new model" army, with Oliver Cromwell as lieutenant-general; gained the battle of Naseby, June 14, 1645, and on the 18th of June took Leicester; on the 22d of July took Bridgewater, on the 10th of Sept., Bristol; in June, 1646, captured Oxford, and Charles I. fled to Scotland. Fairfax was then commissioned by Parliament to carry £200,000 to the Scotch army, who agreed to deliver the king to him for that sum. He met the king near Nottingham Feb. 11, 1647. Soon after this he yielded to the genius of Cromwell, and when, in Mar., 1648, he succeeded to his father's titles, continued to fight for him. Appointed one of the High Court of Justice in 1649, he attended but a single session of the court. In the spring of 1649 he was made commander of all the forces in England and Ireland, but refused to fight the Scots, and resigned his commission in June, 1650. In Sept., 1654, he was a member of Cromwell's first Parliament, and in Dec., 1659, took part with Monk in the defeat of Lambert; Jan. 1, 1660, was a member of the council of state, and in May chairman of the committee delegated by the House of Commons to prevent the return of Charles II. D. of a fever at Nun Appleton, on his estates, Nov. 12, 1671. Fairfax was a warm friend to learning, wrote *Short Memorials of Thomas, Lord Fairfax*, besides theological, poetical, and other MS. compositions.

Fairfax (Thomas), Lord, of the same family as the preceding, was b. in England 1691, but settled in the county of Frederick in Virginia, where he had large estates. Making the acquaintance of George Washington in 1748, the friendship between them was unbroken by the American Revolution, although Fairfax was ever a frank and avowed loyalist. Such were his qualities, indeed, that his property was always equally respected by the Americans and the English. D. at Greenway Court, Frederick co., Va., Dec. 12, 1781, and his immense domain of 5,282,000 acres was then confiscated.

Fair'field, south-westernmost county of Connecticut, having the Housatonic River on the E., Long Island Sound on the S., and the State of New York on the W. Area, 650 square miles. The surface is hilly and well cul-

tivated. Grain, cattle, hay, tobacco, butter, and cheese are staple products. Hardware, brick, building-stone, metallic wares, boots, shoes, hats, clothing, flour, harnesses, sewing-machines, and carriages are among the various manufactured products. The county is intersected by the New York New Haven and Hartford, the Housatonic, and the Danbury and Norwalk R. Rs. Caps. Danbury and Bridgeport. Pop. 95,276.

Fairfield, county of Ohio, in the S. central part of the State. Area, 490 square miles. The S. part is broken, the remainder level, and the soil is very fertile. Grain, cattle, wool, hay, and dairy products are the staples. Flour, carriages, saddlery, and harnesses are among the manufactures. The Columbus and Hocking Valley and the Cincinnati and Muskingum Valley R. Rs. traverse the county. Cap. Lancaster. Pop. 31,138.

Fairfield, county of South Carolina, in the N. central part of the State, between the Wateree River on the E. and the Broad on the W. Area, 680 square miles. The surface is hilly, but very fertile. Cotton and corn are the chief crops. It is intersected by the Charlotte Columbia and Augusta and the Spartanburg and Union R. Rs. Cap. Winnsboro'. Pop. 19,888.

Fairfield, tp. of Pickens co., Ala. Pop. 2132.

Fairfield, a v. of Suisun tp., Solano co., Cal., on the California Pacific R. R. Pop. 329.

Fairfield, post-v., formerly one of the capitals of Fairfield co., Conn., near Long Island Sound, and on the New York New Haven and Hartford R. R., 52 miles N. E. of New York. The village was burned by the British troops under Tryon in 1779. Fairfield was the scene of the last conflict with the Pequot Indians in 1637. It is a port of entry, and one of the most beautiful villages in the State. Fairfield township includes also the villages of Southport, Greenfield Hill, and Black Rock, all beautiful places. Southport is the chief business-centre, and Black Rock has a fine harbor; lat. 41° 8′ 30″ N., lon. 73° 12′ 44″ W. Fairfield has a national and a savings bank, 7 churches, 16 public schools, some manufactures, and considerable foreign and coastwise traffic. The village of Fairfield is half a mile from the sound, and is a place of summer resort. Since 1870 some 3 square miles of the township have been annexed to Bridgeport. Pop. of tp. in 1870, 5645.

Fairfield, tp. of Bureau co., Ill. Pop. 748.

Fairfield, post-v., cap. of Wayne co., Ill., 90 miles E. of St. Louis, is on the Springfield and Illinois South-eastern and Louisville New Albany and St. Louis Air-line R. Rs. It has 1 bank, 2 newspapers, 3 churches, 2 hotels, an extensive woollen-factory, and large flouring and saw-mills. Principal business, farming. Pop. 719.

D. W. Barkley, Ed. "Press."

Fairfield, tp. of De Kalb co., Ind. Pop. 1554.

Fairfield, post-tp. of Franklin co., Ind. Pop. 845.

Fairfield, tp. of Tippecanoe co., Ind. P. 2230.

Fairfield, tp. of Cedar co., Ia. Pop. 754.

Fairfield, tp. of Fayette co., Ia. Pop. 1026.

Fairfield, tp. of Grundy co., Ia. Pop. 720.

Fairfield, tp. of Jackson co., Ia. Pop. 889.

Fairfield, city, capital of Jefferson co., Ia., at the crossing of the Chicago Rock Island and Pacific and the Burlington and Missouri River R. Rs., 50 miles W. of Burlington, on a fertile, well-wooded prairie, and on the Big Cedar River. It is the seat of Fairfield College (Lutheran) and a female seminary, and has a weekly newspaper and one national bank. Pop. 2226; of the tp., exclusive of the city, 1640.

Fairfield, post-v. of Nelson co., Ky. Pop. 167.

Fairfield, post-v. and tp. of Somerset co., Me., on the W. bank of the Kennebec River, 21 miles N. of Augusta, with which it is connected by the Maine Central R. R. It has an excellent water-power. The township contains 6 post-offices, 6 churches, 2 hotels, 32 stores, 1 savings bank, 1 newspaper, an extensive corn and fruit-canning factory, 2 large furniture-factories, 6 wood-shops, 13 saw-mills, 1 tannery, and 1 machine-shop and foundry. P. of tp. 2998.

George H. Colby, Ed. "Fairfield Chronicle."

Fairfield, post-tp. of Lenawee co., Mich., on the Chicago and Canada Southern R. R. Pop. 1725.

Fairfield, tp. of Shiawassee co., Mich. Pop. 632.

Fairfield, tp. of Cumberland co., N. J., on Delaware Bay. Pop. 3011.

Fairfield, a post-v. and tp. of Herkimer co., N. Y. It has an acàdemy, limestone-quarries and 5 cheese-factories, producing 1,000,000 pounds of cheese a year. Pop. of v. 281; of tp. 1653.

Fairfield, post-tp. of Hyde co., N. C., near Mattamuskeet Lake. Pop. 1145.

Fairfield, tp. of Butler co., O. Pop. 2431.

Fairfield, tp. of Columbiana co., O. Pop. 2652.

Fairfield, post-v. of Greene co., O. Pop. 397.

Fairfield, tp. of Highland co., O. Pop. 2565.

Fairfield, tp. of Huron co., O. Pop. 1332.

Fairfield, tp. of Madison co., O. Pop. 1210.

Fairfield, tp. of Tuscarawas co., O. Pop. 781.

Fairfield, tp. of Washington co., O. Pop. 824.

Fairfield, post-v. of Hamiltonban tp., Adams co., Pa., 8½ miles S. W. of Gettysburg. Pop. 258.

Fairfield, tp. of Crawford co., Pa. Pop. 871.

Fairfield, tp. of Lycoming co., Pa. Pop. 479.

Fairfield, tp. of Westmoreland co., Pa. Pop. 1895.

Fairfield, post-v., cap. of Freestone co., Tex., 155 miles N. E. of Austin. It is the seat of two colleges. Pop. 800.

Fairfield, post-tp. of Franklin co., Vt., 41 miles N. W. of Montpelier. It has 4 churches, and manufactures of boots, shoes, leather, lumber, wagons, sleighs, farming-tools, etc. Pop. 2391.

Fairfield, tp. of Henrico co., Va. Pop. 4980.

Fairfield, tp. of Northumberland co., Va. Pop. 1645.

Fairfield, tp. of Sauk co., Wis. Pop. 689.

Fairfield (Genevieve Genevra), American writer, a daughter of S. L. Fairfield, mentioned below, was b. in New York 1832, wrote *Genevra, or the History of a Portrait, The Vice-President's Daughter, The Wife of Two Husbands, The Innkeeper's Daughter*, etc.

Fairfield (John), b. at Saco, Me., Jan. 30, 1797, became a lawyer of Saco, and reporter of the supreme judicial court 1832; published (1835–37) 3 vols. of law-reports; was in Congress 1835–39; governor of Maine 1839–40, 1842–43; U. S. Senator 1843–47. D. at Washington, D. C., Dec. 24, 1847.

Fairfield (Sumner Lincoln), American poet, b. at Warwick, Mass., June 25, 1803, studied at Brown University, Providence, R. I., and sailed for London in Dec., 1825. Returning to the U. S., he married Miss Jane Frazee of Rahway, N. J., and subsequently was principal of Newtown Academy, 30 miles from Philadelphia. He published *Cities of the Plain, Père la Chaise, Westminster Abbey, The Sisters of St. Clara* (1826), *Abaddon, The Last Night of Pompeii* (1832), *Lays of Melpomene* (1824), and *The Heir of the World* (1829). From 1833 to 1838 he published the *North American Magazine.* D. in New Orleans, La., Mar. 6, 1844. (See his *Life* by Mrs. Fairfield, 1846.)

Fair Forest, tp. of Spartanburg co., S. C. Pop. 1129.

Fair Grove, tp. of Dickinson co., Ia. Pop. 172.

Fairgrove, post-tp. of Tuscola co., Mich. Pop. 928.

Fair Haven, former post-v. of New Haven co., Conn., now the seventh ward of the city of New Haven. It is celebrated for its oyster-trade. Pop. 3991. (See New Haven.)

Fair Haven, tp. and post-v. of Carroll co., Ill. P. 1169.

Fair Haven, post-v. and tp. of Bristol co., Mass., on the E. side of New Bedford harbor (which is the estuary of Acushnet River). Fair Haven is the terminus of a branch of the Cape Cod R. R., and is 60 miles S. of Boston. It has 1 national and 1 savings bank, 5 churches, manufactures of cooperage, ships' furniture, metallic wares, tacks, castings, etc., besides oil-refineries and some fishing interests. It is a beautiful town. The harbor is good. The village is connected with New Bedford by a bridge three-fourths of a mile long. Sept. 7, 1788, it was attacked by the British, who were repulsed by the militia under Major Israel Fearing. Pop. 2626.

Fair Haven, tp. of Huron co., Mich. Pop. 528.

Fair Haven, post-tp. of Stearns co., Minn. Pop. 320.

Fair Haven, post-v. of Sterling tp., Cayuga co., N. Y., is the northern terminus of the Southern Central R. R., 31 miles N. from Auburn. It is on Little Sodus Bay, which is one of the best harbors on the S. shore of Lake Ontario. Pop. 532.

Fairhaven, tp. and post-v. of Rutland co., Vt., on the Rensselaer and Saratoga R. R., 8 miles N. E. of Whitehall, N. Y. It has a national bank, eight churches, great water-power, and extensive manufactures of slate and marble goods, the materials for which are quarried here. Pop. 2208.

Fair Havens [Gr. Καλοὶ Λιμένες], a harbor on the S. side of the island of Crete, mentioned by Luke (Acts xxvii.

8), and by no other ancient writer. Saint Paul sailed out of this harbor shortly after the middle of October, and was shipwrecked about the first of November, 60 A. D. It appears to have been the port of Lasæa, the ruins of which were discovered in 1856 by the yachting-party of Hugh Tennent, Esq. (See JAMES SMITH'S *Voyage and Shipwreck of Saint Paul*, 1st ed. 1848; 2d ed. 1856; 3d ed. 1866.)

Fair Head, or **Benmore Head,** a lofty promontory of the coast of Antrim co., Ulster, Ireland, opposite Rathlin Isle. It consists of carboniferous strata overlaid by greenstone columns, and rises 636 feet perpendicular above the sea. Lat. 55° 13′ N., lon. 6° 8′ W.

Fair Hill, a post-tp. of Cecil co., Md. Pop. 2219.

Fair′holme (GEORGE), English writer on the connection of the Bible and science, published a *General View of the Geology of Scripture* in 1838, and *New and Conclusive Physical Demonstrations both of the Fact and Period of the Mosaic Deluge* (1830; 2d ed. 1840).

Fair′holt (FREDERICK WILLIAM), English artist and writer, b. in London 1814, published *Costume in England, a History of Dress to the Close of the Eighteenth Century* (1846), *The Home of Shakspeare Illustrated and Described* (1847), *Remarkable and Scientific Characters* (1849), *Dictionary of Terms in Art* (1854), etc. D. Apr. 3, 1866.

Fair Isle, a solitary isle, 4 by 2½ miles in extent, between Orkney and Shetland. It rises 708 feet above the sea, and is accessible for ships only at one point, on the S. E. In 1588 the duke of Medina Sidonia, admiral of the Spanish Armada, was wrecked here, and most of his crew were murdered. Lat. 59° 33′ N., lon. 1° 38′ W.

Fair′land, post-v. of Shelby co., Ind., at the junction of the Martinsville R. R. with the Indianapolis Cincinnati and Lafayette R. R.

Fair′lee, tp. and post-v. of Orange co., Vt., on the Connecticut and Passumpsic Rivers R. R. and on the Connecticut River, 22 miles N. N. E. of White River Junction. It has manufactures of lumber, etc. Pop. 416.

Fair′mont, post-v. of Fillmore co., Neb., 100 miles W. of the Missouri River, on the line of the Burlington and Missouri River R. R. in Nebraska. It has one newspaper and printing-office. The principal business is trade in dry goods, groceries, provisions, grain, agricultural implements, etc. Pop. about 250.

W. T. STROTHER, PUB. "FILLMORE CO. BULLETIN."

Fairmont, post-v. and tp., capital of Marion co., W. Va., 77 miles W. of Wheeling, at the head of navigation of the Monongahela River and on the Baltimore and Ohio R. R. It has a national bank, two newspapers, a State normal school, several large mills and shops, the usual number of stores, and several large coal-mines. Principal business, mining. Pop. of v. 621; of tp. 1781.

FLEMING & POWELL, EDS. "WEST VIRGINIAN."

Fairmount, tp. of Pike co., Ill. Pop. 1120.

Fairmount, post-v. of Vance tp., Vermilion co., Ill., on the Toledo Wabash and Western R. R., 12 miles W. by S. of Danville.

Fairmount, tp. and post-v. of Grant co., Ind. Pop. of v. 337; of tp. 1573.

Fairmount, tp. and post-v. of Leavenworth co., Kan., on the Leavenworth branch of the Kansas Pacific R. R., 11 miles S. of Leavenworth. Pop. 749.

Fairmount, post-v., county-seat of Martin co., Minn. Pop. of Fairmount tp. 699.

Fairmount, a v. of West Farms, Westchester co., N. Y. (annexed in 1873 to New York City). Pop. 508.

Fairmount, a v. of Goshen tp., Belmont co., O. P. 125.

Fairmount, tp. of Luzerne co., Pa. P. O., FAIRMOUNT SPRINGS. Pop. 1031.

Fairmount Park. See PHILADELPHIA, by H. C. SHEAFER of the "PHILADELPHIA BULLETIN."

Fair Oaks, locality in Henrico co., Va., on the Richmond and York River R. R., 7 miles E. of Richmond.

BATTLE OF. In the movements of Gen. McClellan's army in its advance from Yorktown, after reaching a point near Roper's Church on the Williamsburg and Richmond road, the right wing, consisting of the corps of Gens. Sumner, Porter, and Franklin, took the road *viâ* Cumberland and the White House, striking the Chickahominy at New Bridge, while the left wing, comprising the corps of Heintzelman and Keyes, kept the Richmond road to Bottom's Bridge; the advance-guards reaching these points about May 16, 17, 1862. The Chickahominy here is a stream of no great volume, flowing through a belt of heavily-timbered swamp (averaging from three to four hundred yards wide), sometimes in a single channel, more frequently divided into several, and when but a foot or two above its summer level overflows the whole swamp. The bottom-lands between the swamp and the highlands are little elevated above the swamp, so that a few feet rise of the stream overflows large areas of them. Thus, while the stream was no obstacle for infantry, the swamp and bottom-lands were impracticable for cavalry and artillery. On the 20th of May, Gen. Naglee crossed the Chickahominy with his brigade near Bottom's Bridge, and pushed forward to within two miles of the James River without meeting serious resistance. The rest of the Fourth corps, commanded by Gen. Keyes, crossed on the 23d. On the 25th the corps was advanced about a mile in front of Savage Station, which position was fortified; on the 28th, Casey's division moved forward to a point half a mile in advance of Seven Pines, where a new line of rifle-pits and a redoubt for six guns were commenced, and timber felled in front of the line; Couch's division, in support, advanced and encamped along the Nine-mile road. On the 25th the Third corps had crossed the Chickahominy, and taken a position two miles in advance of Bottom's Bridge; Gen. Heintzelman, its commander, was placed in command of both corps. On the 30th, Heintzelman obtained permission to advance the Third corps to a better supporting position. The position of the left wing just previous to the battle of the 31st was as follows: Casey's division (5000), in advance, extended from the Williamsburg road to the York River R. R.; Couch's (7000) along and in front of the Nine-mile road, its right near Fair Oaks Station, its left near Seven Pines; Kearny's (6500) 1½ miles to the rear, in advance of Savage Station; Hooker's, guarding the approaches to White Oak Swamp. The right wing still remained on the N. side of the river. Gen. Johnston, the Confederate commander, perceiving the possibility of destroying the Fourth corps in its advanced and (as he supposed) isolated position, ordered, on the 30th, a concentrated attack with his whole force (57,000 men) to be made early next morning; a heavy rain, however, which fell during the afternoon and evening of the 30th, so swelled the streams that his plans could not be fully executed, and at 1½ P. M. the division of D. H. Hill advanced alone, striking Naglee's brigade, posted in front of the intrenchments, and to which, after a gallant struggle, it was compelled to retire. A messenger sent to Gen. Heintzelman for reinforcements was delayed, and it was nearly 5 P. M. before Kearny's division arrived. Gen. Hooker was ordered up from White Oak Swamp, arriving after dark. As soon as the firing was heard, Gen. McClellan, still at New Bridge, ordered Sumner to have his corps, encamped on the N. side of the river, some six miles above Bottom's Bridge, in readiness to move. This corps consisted of Sedgwick's and Richardson's divisions, each division having now a bridge over the stream opposite its own position. At 2 P. M. these divisions were ordered to cross without delay, and push forward to support Heintzelman; which movement was at once commenced. In the mean time, Naglee's brigade, with the artillery of Casey's division, under command of Col. G. D. Bailey, and reinforced by a regiment from Peck's brigade, struggled gallantly to maintain the redoubt and rifle-pits against the superior attacking force. The left of this position was, however, turned, and the whole line driven back, with the loss of six guns, beyond the position occupied by Couch. Gen. Couch had previous to this time been ordered to advance two regiments to relieve Casey's right flank. In making this movement he discovered large masses of Confederates crossing the railroad, as well as a heavy column moving towards Fair Oaks Station. This column he engaged with two regiments, but, though reinforced by two additional regiments, was overpowered. The Confederates pushed between him and the main body of his division; falling back with these four regiments and one battery about half a mile, Couch, learning that Sumner had crossed, at once formed line of battle, facing towards Fair Oaks, and prepared to hold the position. Kearny's division had now arrived in front of Seven Pines. Berry's brigade was ordered to deploy to the left, so as to have a flank fire upon the hostile lines; which movement was brilliantly executed, materially retarding the pursuit in that direction. This position was held till after dark, when, being cut off from the main body, he fell back, and succeeded in bringing his men by a circuitous route in good order within the Federal lines. Jameson with two regiments, moving rapidly to the front on the left of the Williamsburg road, succeeded for a time in keeping the abattis clear, but was forced back, gaining camp under cover of night. Gen. Devens, holding the centre of Couch's division, after gallant efforts to regain portions of the lost ground, finally withdrew behind the rifle-pits near Seven Pines. The Confederate attack here had been made by Hill's and Longstreet's divisions, reinforced by Smith's. Meantime (6 P. M.), Gen. Sumner had arrived with Sedgwick's division at the point held by Couch, the road being so muddy that

Sedgwick was able to get but one of his batteries to the front. The First Minnesota was deployed to protect the flank; the rest of the division formed in line of battle, Kirby's battery near the centre, and a regiment was sent to open communication with Gen. Heintzelman. These dispositions were no sooner made than a heavy fire was opened by the Confederates along the line, and several charges were made, which were repulsed with great loss. Gen. Sumner now ordered a charge to be made, which was brilliantly executed, and the Confederates driven from the field in confusion. At this moment Gen. Johnston was severely wounded, and shortly afterward Richardson's division arrived upon the field. Darkness now ended the battle for that day. During the night dispositions were made for its renewal. Couch's division, and as much of Casey's as could be collected together, with Gen. Kearny's, occupied the rifle-pits near Seven Pines; Hooker brought up his division about dark, and bivouacked in rear of the rifle-pits on the other side of the railroad; Sedgwick's division held about the same position as when the fight ceased; and Richardson was ordered to place his division on the left to connect with Kearny. French's brigade was posted along the railroad, and Howard's and Meagher's in second and third lines. During the night three batteries of Sedgwick's division arrived, it being impossible to move the rest; but the corps of Franklin and Porter were not brought forward, these 35,000 fresh troops remaining on the other side of the Chickahominy during the next day. The command of the Confederate army had, upon Johnston being disabled, devolved upon Gen. G. W. Smith. About 5 A. M. (June 1) skirmishers and cavalry appeared in front of Richardson's division, which were soon dispersed. Richardson's line was extended to close the wide interval between him and Kearny; and scarcely had this position been gained when the Confederates appeared in large force from the woods in front, and opened a heavy musketry-fire along the line, approaching rapidly in columns of attack, supported by infantry in line of battle on each side, cutting Gen. French's line, and appearing determined to carry all by one crushing blow. The first line of Richardson's division withstood this fire nearly an hour, Howard being finally ordered to French's assistance; which order being obeyed, the fire of the Confederates ceased, and their whole line fell back from that part of the field. On the opening of the fire in the morning, Hooker advanced on the railroad with two regiments, followed by Sickles' brigade. On coming near the woods, which were held by the Confederates in force, Hooker found Birney's brigade in line of battle. Sending back to hasten Sickles' brigade, he found it had been turned off to the left by Gen. Heintzelman to meet a column advancing in that direction. Calling upon Col. Ward (in command of Birney's brigade) to support him, Hooker at once attacked with two regiments, pushing the Confederates before him; and a final charge being ordered, the Confederates fled in confusion, abandoning their arms. Sickles, who had been ordered to the left, formed in line of battle on both sides of the Williamsburg road, and after a brief interchange of musketry the brigade pushed into the timber and put the Confederates to flight. On the right, vigorous efforts had been made to break through Gen. Richardson's lines, which were frustrated. In about an hour Richardson's whole line advanced, pouring in a heavy fire at close range, and forcing the Confederates back. This was followed by a bayonet charge, led by Gen. French in person, which turned the Confederate retreat to flight. The Confederates were now retreating in confusion along the whole line toward Richmond. The pursuit was continued until the lines held by the Union forces before the attack on May 31st were regained. On the field were found large supplies of arms and stores abandoned by the Confederates in their flight. On the next morning the Confederate pickets were pressed back to within five miles of Richmond, but Gen. McClellan did not pursue farther, and the old lines were resumed. The loss on either side was probably about equal, but the result was against the Union forces, inasmuch as the opportunity of striking a decisive blow was not improved; for there is scarcely a doubt that had McClellan followed up with his whole army, Richmond would have fallen into his hands; and the occasion thus presented did not return. The Union loss in killed, wounded, and missing is officially reported at 5739; the estimated Confederate loss is somewhat greater.

Fairplains′, tp. of Montcalm co., Mich. Pop. 974.

Fairplay′, post-v., capital of Park co., Col., at the head of South Park, on the mountain-route between Denver and Santa Fé, 95 miles from the former place. It is noted as the supply-point for the Mount Lincoln mining district. It has several stores, hotels, and saloons, besides two banks and a weekly newspaper. Its altitude is 9764 feet—nearly two miles above sea-level—and 3500 feet above Mount Washington. Its inhabitants, though never experiencing the "heated term," yet from June to September have the luxury of moderately warm days and cool nights, the monotony being occasionally relieved by a snow-storm in August. Mount Lincoln towers above the plain to a height of over 16,000 feet, and along its sides to within a few yards of the top, often enveloped by clouds, and frequently above them, miners and prospecters are developing or seeking new discoveries. Pop. about 1000.

Fairplay, tp. of Greene co., Ind. Pop. 780.

Fairplay, post-v. of Jamestown tp., Grant co., Wis.

Fair′port, a v. of Sweetland tp., Muscatine co., Ia. Pop. 136.

Fairport, post-v. of Perrinton tp., Monroe co., N. Y., on the New York Central R. R., 11 miles E. of Rochester, and on the Erie Canal. It has a banking institution, manufactures of sal-aëratus, cream-tartar and baking-powder, a flouring and three planing-mills, a furnace, manufactures of barrels, staves, agricultural implements, carriages, confectionery, etc., a fruit-canning establishment, marble-works, five churches, a union school, a weekly newspaper, and a large local trade. Pop. about 2000.

Frost & Newman, Props. "Fairport Herald."

Fair′view, tp. of Independence co., Ark. Pop. 243.

Fairview, tp. of Bond co., Ill. Pop. 1044.

Fairview, post-tp. of Fulton co., Ill. Pop. 1317.

Fairview, tp. of Fayette co., Ind. Pop. 601.

Fairview, post-v. of Greene tp., Randolph co., Ind. Pop. 142.

Fairview, tp. of Allamakee co., Ia. Pop. 630.

Fairview, tp. of Emmett co., Ia. Pop. 56.

Fairview, tp. of Jasper co., Ia. Pop. 2332.

Fairview, tp. and post-v. of Jones co., Ia. Pop. 238; of tp. 3085.

Fairview, tp. of Monona co., Ia. Pop. 281.

Fairview, tp. of Shelby co., Ia. Pop. 647.

Fairview, tp. of Labette co., Kan. Pop. 464.

Fairview, tp. of Caldwell co., Mo. Pop. 910.

Fairview, tp. of Livingston co., Mo. Pop. 1006.

Fairview, tp. of Sarpy co., Neb. Pop. 381.

Fairview, post-v. and tp. of Buncombe co., N. C. Pop. 779.

Fairview, post-v. of Oxford tp., Guernsey co., O. Pop. 377.

Fairview, tp. of Butler co., Pa. Pop. 1078.

Fairview, post-b. and tp. of Erie co., Pa., on Lake Erie and on the Pittsburg and Erie and the Lake Shore R. Rs. Pop. of b. 480; of tp. 1674.

Fairview, tp. of Mercer co., Pa. Pop. 920.

Fairview, tp. of York co., Pa. Pop. 1941.

Fairview, post-tp. of Greenville co., S. C. Pop. 1749.

Fairview, post-v., capital of Hancock co., West Va., 3 miles E. of the Cleveland and Pittsburg R. R. It has 1 newspaper, several large mills and shops, the usual number of stores, 2 hotels, 2 churches, and 3 public schools. Principal business, farming. Pop. about 400.

J. W. Plattenburg, Ed. "Hancock Courier."

Fairview, a v. of Paw Paw tp., Marion co., West Va. Pop. 72.

Fair′ville, post-v. of St. John co., N. B., on the St. John River and the European and North American Railway, $2\frac{1}{2}$ miles from St. John. It is the seat of the New Brunswick Lunatic Asylum. Pop. about 1500.

Fairville, post-v. of Arcadia tp., Wayne co., N. Y., on the Sodus Point and Southern R. R., 4 miles N. of Newark. Pop. 154.

Fair′y Lore is closely allied to mythology, fairy tales being mere remnants of myths which remain lingering in popular superstition for some time after the myths themselves have died out of popular belief. Only those races which have created a mythology possess a fairy lore—as, for instance, the Hindoos, Greeks, Scandinavians, and Finns—while those races which never formed myths—as, for instance, the Jews and the Arabs—never produced any fairy tales either. There are stories enough, both in the Jewish and Arabic literatures, which tell of wonders wrought by spirits and other supernatural beings, but they are *fairies* like Spenser's *Faerie Queen* or Shakspeare's *Midsummer Night's Dream;* that is to say, they are literary treatments of fairy tales, and not fairy lore; they express a certain taste, not a certain state of consciousness in general. The true fairy tale was originally a myth. All mythological creations have a double character. The materials of which

they are produced are either fused into form around moral ideas which place the human mind in a relation of absolute obligation, or they are kept in a floating state, which leaves the mind free in pure contemplation, and allows almost unlimited play to the imagination. Of these two elements, the former, the religious, dies out when a mythology is supplanted by a higher form of religion; but the latter, the poetical, may remain for centuries, and live on among the people as its fairy lore, modified and developed in a most striking manner by influences from the new religion, from the climate and surface of the country, from the occupations and history of the nation, etc. The same story, originally based on some truth, will be differently colored by the miners in the mountain-regions, the sailors along the coasts, and the shepherds on the prairies. Having no moral substance which commands obedience, and addressing people through their imagination only, it will hardly come into collision with the religion; on the contrary, it will shift and change till it falls into harmony as well with the interior spiritual conditions as with the external surroundings. And it is this character of being an unconscious, natural, and living expression of the spirit of a people in its most mysterious activity which gives to the study of fairy lore its peculiar charm and its paramount importance.

Fairy Rings are imperfectly circular or annular patches in grass-land in which the vegetation is either richer or more scanty than that around it. They are common in the British Islands and other parts of Europe, where, according to folk-lore, they are caused by the dancing of fairies. After much investigation, it has been shown that they are caused by the growth of mushrooms (*Agaricus*), which spread from the centre outward, and at first check, but afterwards by their decay accelerate, the growth of the grass.

Fai'son's, post-tp. of Duplin co., N. C., on the Wilmington and Weldon R. R., 63 miles N. of Wilmington. Pop. 1918.

Faith [Lat. *fides; fidere*, to "trust"] is belief, conviction, assurance, or trust, resting on any sort of evidence whose force is affected subjectively—that is, by the mental condition of the recipient. An assurance resting on purely objective grounds relies upon the common state of all minds, not on the special condition of any, and involves knowledge. We *believe* there is a God, but there are temptations to unbelief which have led men to atheism. We *know* that twice two are four, and it is not possible to tempt us to doubt it. One and the same thing may be an object of faith at one stage of evidence, and of knowledge at another. There may be a subjective difficulty which is invincible to the sort and degree of evidence which is ordinarily sufficient for faith, yet is overcome by the evidence which produces knowledge. The mind may pass therefore from unbelief to belief, from belief to knowledge, or from unbelief to knowledge. It may pass from unbelief to belief without addition to evidence, solely by change in itself, but it cannot pass from either to knowledge, except by additions to evidence. The faith of one man may rest on the presumed knowledge of another, and thus be confounded with knowledge itself. The great body of scientific fact is actually the object of knowledge to a few, and is supposed to be a part of the knowledge of the many only because the many have faith in the statements of the few, though they can neither verify them, nor even understand the processes by which they are reached. "We *believe*," says Lewes (*Problems*, i. 21), "that the sensation of violet is produced by the striking of the ethereal waves against the retina more than seven hundred billions of times in a second. . . . These statements are accepted *on trust* by us who know that there are thinkers for whom they are irresistible conclusions." Knowledge involves intellectual *coercion*—faith involves *freedom*. We are not *responsible* for the fact that under the conditions of knowledge we *know*, or in defect of them do not know; we are responsible if under the conditions of a well-grounded faith we disbelieve. In the history of philosophy the names of Hobbes, Huet, Leibnitz (*Faith and Reason*), D'Alembert, Kant, and Daub are connected with special views of faith. (For the philosophy of faith or belief, see JACOBI, F. H.)

In theology the relations of faith to knowledge and the question of precedence have long been agitated. Augustine and his school held that faith precedes understanding; Jacobi confessed that to him the dualism of the two was hopeless; Hegel proposed to relieve the antagonism by absorbing faith into knowledge; Schleiermacher says they are the two foci of one ellipse. In the Bible, faith is by pre-eminence trust, a conjoint movement of the intellectual powers, the affections, and the will. Its object is the supersensuous, God, and God in Christ. It involves knowledge or mental vision, voluntary reception, personal adhesion, and obedience. The Scholastics distinguish between believing that God is, believing God, and believing *in* God. Faith *informis* is merely intellectual; faith *formata* involves love, and is a virtue. Faith was regarded as a general intellectual assent to revealed truth as interpreted by the Church. In contradistinction to this, the Reformers laid stress on faith as a personal assurance of the forgiveness of sins for Christ's sake. This faith involves knowledge, assent, and trust. It justifies not by the merit, or on the ground of the works which follow it, but as the medium, the hand which lays hold of and appropriates Christ and his merit. (See JUSTIFICATION.) C. P. KRAUTH.

Faith, Articles of. See FAITH, CONFESSIONS OF.

Faith, Confessions of, official statements of doctrine—SYMBOLS (which see) in the theological sense. As distinguished from CREEDS (which see), confessions of faith are fuller presentations. We speak of the Apostles' Creed, the Westminster Confession. Confessions are, with reference to time, ancient or modern. In the extent of reception they are (1) œcumenical, catholic, or general, as accepted by the whole Church catholic; (2) particular, as accepted by particular parts of the Church. The term has also been applied to the carefully prepared statement of the faith of individuals. Articles of faith are the separate parts of confessions. A confession is an organic body or *corpus* of faith, its parts are members or *articuli*, such as the articles concerning God, sin, Christ, the Church. (See the articles on the particular systems, as ARMINIANISM, etc., the Confessions, as the AUGSBURG CONFESSION, etc., and the various churches.) C. P. KRAUTH.

Faith, Rule of (*Fidei Regula*), that to which FAITH (which see) appeals as its source and guide. *Why* do I believe this or that? and *what* am I bound to believe? are questions answered by the rule of faith, while the confession of faith, as such, simply states what I do believe. The confession is drawn from the rule. In the Roman Catholic Church the rule of faith is the body of revealed truth embraced in Holy Scripture and tradition ("in libris scriptis et sine scripto traditionibus"—*Council of Trent*, Sess. IV.), in the sense in which the Church holds that truth. In the Protestant churches the canonical Scriptures are regarded as the sole rule of faith.—RULE OF FAITH, ANALOGY OF FAITH, have been applied also from very ancient times to the body of most necessary and saving doctrines, so explicitly and clearly set forth in the Scriptures as to form a general guide in interpreting the more obscure parts. The APOSTLES' CREED (which see) was frequently so styled by the Fathers. The *Regula Fidei* is valid on the assumption that there is absolute unity in all parts of the doctrinal teaching of the Bible. C. P. KRAUTH.

Faith'full (EMILY), MISS, was born at Headley rectory, Surrey, in 1835; educated at Kensington, and at an early age displayed the firmness and independence which have characterized her subsequent life; becoming interested in the condition of women, she devoted her time to extending their sphere of labor, establishing in 1860, in spite of great opposition, a printing establishment in which women were employed. Queen Victoria gave this project her approval, and a printing business was formed styled "The Victoria Press," which is still conducted with steam machinery in Farringdon street. A fine specimen of workmanship, entitled *Victoria Regia*, and dedicated, by special permission, to the queen, secured the approbation of Her Majesty, who appointed Miss Faithfull publisher in ordinary to Her Majesty. In 1863 the *Victoria Magazine*, a monthly publication, was commenced, being devoted to the claims of women to remunerative employment. Miss Faithfull has established a publishing-office, with all the appliances of bookseller, stationer, and bookbinder connected. In 1873 she visited the U. S., and her lectures on her favorite topic were largely attended.

Fai'thorne (WILLIAM), English engraver, b. in London about 1616, was imprisoned as a loyalist, and then banished from England under Cromwell. He went to France and studied engraving. From 1650 to 1680 he was a printseller in London, and d. there in May, 1691. He engraved *Christ at Prayer in the Garden of Olives*, *The Marriage of Cana in Galilee*, etc., and wrote a treatise on the art of engraving.

Fa'kir [from an Arabic word signifying "poor"], a class of religious mendicants in India, found there now in large numbers, and with evidence of their existence very early in Hindoo history. Rules for some of their practices are found in the *Institutes* of Manu, 1000 B. C., while they are distinctly mentioned by the Greek historians at the time of Alexander's conquest, by whom they were termed Gymnosophists—a name, it would seem, indicative much more of their bodily than of their mental state. Some of them are ascetics, who practise surprising mortifications

and bodily tortures, such as swinging on hooks thrust through their flesh, lying on a bed of spikes, walking on sandals through which spikes are driven, hanging suspended during life before a slow fire, fulfilling a vow to continue in one position during life, holding the limbs in a fixed position till they become immovable, carrying a cumbrous load or drawing a heavy chain, crawling on their hands and knees for years, rolling on the earth from one end of the land to the other, etc. By these means they acquire a reputation for sanctity which gives them a great hold upon the superstitions and the fears of their countrymen, though there is little religious sense displayed in all these performances, which are adopted, for the most part, as a mode of obtaining notoriety or a livelihood. The Hindoos have apparently little respect for these men, but they dread their curses, and the powerful rajah will rise up on his elephant and salute one of these "saints" as he passes by.

Formerly, the fakirs often banded together in robber hordes, sometimes numbering thousands, which carried devastation through whatever region they visited. The English government has put a stop to all this, as it has to many of their self-inflicted tortures. These men rarely appear now in absolute nudity, as was formerly often the case, but one meets them in the streets of any Hindoo city, daubed with ashes and paint, a bit of sackcloth depending from their loins, their long, coarse hair hanging in a tangled mat over their face and shoulders or wound in a thick mop around their heads, and presenting a most hideous and revolting spectacle. They number hundreds of thousands, and perhaps two millions in India, at the present day.

J. H. Seelye.

Falaise, a town of France, in the department of Calvados, 22 miles S. S. E. of Caen. It is picturesquely situated on a lofty platform bordering on a rocky precipice (*falaise*), which position made it a very strong fortress in olden times, before the invention of gunpowder. Its old castle, now mostly in ruins, was the seat of the dukes of Normandy and the birthplace of William the Conqueror. Pop. 8561.

Fal'ashas, those Abyssinian Jews inhabiting the mountainous regions of Samen and the plains along Lake Tzana, and numbering about 250,000. Their origin is as uncertain as that of all Abyssinians. (See Abyssinia.) The name *Falashah* signifies "exile" or "wanderer," and hence it is inferred that he is not a native of the soil. According to Falashah tradition, their forefathers, who were of the tribe of Levi, came to Abyssinia in the days of Solomon, but ethnologists hold that they must have come there some time in the seventh century, during the Mohammedan invasion of Egypt, while some of the German missionaries who have been in Abyssinia believe that the Falashas came originally from the kingdom of Yemen (which see) in the tenth century. But, however uncertain their origin, they have become thoroughly Abyssinian, and are distinguished from their fellows only by their religion. Like the native Christians, they are handsomely built, and resemble the nomads of Arabia. They are of medium height, with face oval, nose finely sharpened, mouth well proportioned, lips properly formed and by no means exuberant, sparkling eyes and well-set teeth, and hair somewhat curled or straight. (See Figuier, *Les Races Humaines*, Paris, 1872, 8vo, p. 406.) Until the beginning of the nineteenth century they constituted an independent tribe, and were governed by their own prince; in the tenth and twelfth centuries it appears that they even ruled over the Abyssinians. They were subjected by the Amharas about 1800, and are now under the rule of the princes of Tigré. The Falashas speak both the Amharic and a dialect of the Agaon tongue, and are very industrious, devoting themselves to the various trades, particularly architecture; also largely to agriculture. During the late war between Great Britain and their country, many of their number distinguished themselves as able warriors. Unlike other Semitics, they are averse to commerce, regarding traffic an obstacle to fidelity and rigor in religious observances. The Falashas, although they possess the whole of the Old Testament or Jewish canon (in the Geez language, a sister-tongue of the Hebrew, Arabic, and Aramean dialects and the mother of the Amharic), together with the apocryphal books accepted by the Abyssinian Church, deviate in many instances from Jewish usages. Thus, the fringed "praying-scarf" (*taleth*) and the "phylacteries" are not used in their devotions; and while they retain the usage of offering sacrifices, it is rather as commemorative ceremonies than as real sacrifices. The most common is the offering for the repose of the dead; but no sacrifice is permitted on the sabbath or on the day of atonement. Like other Jews, the Falashah hopes for a return to Jerusalem. Very peculiar are their priests, who live round the enclosures of the temples (which are situated near the edge of the villages, and have more the appearance of the ancient sanctuary than the modern synagogue), observe the laws of purity with rigor, prepare their own food, and keep aloof from the world. They are principally engaged in the education of youth, making the Bible and tradition the basis of their instruction. Polygamy, though tolerated, is nevertheless discouraged. Slaveholding is suffered, but slave-dealing is strictly forbidden. Slaves are kindly treated, instructed in the laws of Moses, and on conversion are manumitted. Attempts on the part of the London Missionary Society and the Scottish Church Mission to convert the Falashas to Christianity induced the Jewish Alliance Universelle in 1867 to send among them M. Halévy of Paris, to secure their education and to counteract the Christianizing influence of the missionaries. (See, besides works on Abyssinia, Hotten, *Abyssinia and its People* (London, 1868), and particularly the articles by Halévy in the *Bulletin* of the French Geographical Society for Mar. and Apr., 1869.) Jas. H. Worman.

Falcid'ian Law, a law under the civil or Roman law system, proposed by a tribune Falcidius during the reign of Augustus, in the year of Rome 714 (a. c. 37), by which it was enacted that testators should not have power to dispose of more than three-fourths of their property by will, and that the remaining one-fourth should descend to the heir. This fourth was termed the "Falcidian portion." No such restriction exists at common law, a testator having an unqualified power to distribute his property entirely among strangers, and leave his family unprovided for if he desires. Among the American States, Louisiana, which has adopted the civil law, has a provision similar to the Falcidian law. In some of the other States restrictive enactments have been made in regard to bequests to charitable corporations or associations. For instance, in New York a testator having a husband, wife, child, or parent living can only leave to such institutions one-half of his property after the payment of his debts. (*Laws* 1860, ch. 360.) George Chase. Revised by T. W. Dwight.

Falck'enstein, von (Eduard Vogel), Prussian general of infantry, was b. in Silesia Jan. 5, 1797. He was the son of a Prussian major, but the father d. early, and the mother, unable to educate the boy herself, asked assistance from her relative the prince-bishop of Breslau. The prince-bishop promised to help, but on the condition that the boy should be a clergyman. But at the rising of the Prussian people against Napoleon in 1813, the boy left the ecclesiastical career, and entered as a volunteer into the West Prussian grenadier battalion of Colonel von Klück. He distinguished himself in the battle of the Katzbach, and at Montmirail, when all the officers had fallen, he led the battalion with imperturbable calmness, though a youth of hardly seventeen years. After the war he studied topography with great zeal, and founded a school for glass-painting in Berlin, under the auspices of Friedrich Wilhelm IV. On Mar. 18, 1848, in the riots in Berlin, he was wounded, but took part in the same year in the campaign in Holstein, and became commander of the foot-guards in 1849, and in 1851 colonel and chief of the staff of Wrangel. He held the same position in 1864 during the second war with Denmark, but after the war he was made commander-in-chief of the seventh army corps. In the war of 1866 he commanded against Hanover, Hesse, Nassau, Baden, Würtemberg, and Bavaria, and displayed considerable strategic talent. After the war he received a dotation, was elected to the North German Diet by the city of Königsberg, and spoke energetically for a triennial military service and a strong military budget. During the war of 1870 he held the chief command of the maritime provinces, and organized the whole defence of the Baltic and of the North Sea.

August Niemann.

Fal'con [Lat. *falco*], a name applied to various accipitrine (raptorial) birds (birds of prey) of the family Falconidæ, and especially to those of the group Falconinæ, including the genus *Falco* and others closely allied to it. In the language of Falconry (which see) the term *noble falcon* designates those birds of whatever species which may be trained for use in hawking; the rest are *ignoble.* Others designate the high-flying falcons which stoop upon the prey as *noble*, while those which fly low, chasing the prey, are *ignoble.* The most important of the long-winged, high-flying falcons are the gyrfalcon, the merlin, the lanner, the peregrine, and the white falcon. Of the ignoble birds we may mention the hobby, the goshawk (or falcon gentle), the sparrowhawk, and certain small species of *Hypotriorchis* and *Ierax*, much used in Asia in hawking. Of these, the more important are noticed in this work under their alphabetical heads. Anciently, the term *falcon* designated only female birds, while the male, always smaller and weaker, was called a *falconet*, or tercel, whatever the species. The peregrine falcons (*Falco peregrinus*

or *communis*) of Europe and North America and the gyrfalcon (*Falco candicans*) are typical species. The true

Gyrfalcon (*F. candicans*).

falcons are of numerous species, both in the Old and the New World. (See FALCONIDÆ.)

Falco'ne (ANIELLO), one of the first and best painters of battle-scenes, a pupil of Spagnoletti and master of Salvator Rosa, b. in Naples in 1600, and d. in 1665. His paintings are in high esteem, and there are many engravings ascribed to him.

Fal'coner (HUGH), M. A., M. D., F. R. S., b. at Forres, Scotland, Sept. 29, 1808; graduated M. A. at Aberdeen 1826; M. D. at Edinburgh 1829; went to India as a surgeon 1830; commenced palæontological explorations in the Siwalik Hills 1831; became superintendent of the botanical garden at Seharanpoor 1832; received the Wollaston medal 1837; became F. R. S. 1845; superintendent of the botanical garden at Calcutta 1847; d. in London Jan. 31, 1865. Published *Selections from the Bostân of Saadi*, 1838; *Fauna Antiqua Sivalensis* (1846, jointly with T. P. Cautley); *Palæontological Memoirs*, 1868.

Falconer (WILLIAM), a poet, b. in Edinburgh about 1730, was a barber's son. His brothers and sisters were deaf and dumb. Falconer was bred a sailor, and is best known by his great poem, *The Shipwreck* (1762); published also a *Marine Dictionary* (1769), and various minor poems. Lost at sea in 1769, while purser of the Aurora frigate.

Falcon'idæ [from *Falco*, one of the genera], a family of the birds of prey (order Raptores) which is by most naturalists made to include all the order except the vultures and the owls. It includes the eagles, true buzzards, kites, falcons, hawks, etc., which are generally arranged in seven or more sub-families. They all have a bill sharp, curved, and compressed, with a partial cere, a broad tail, long, pointed wings, sharp and curved claws, a sunken eye, and a feathered head and neck.

Fal'conry is the art of capturing, rearing, and training falcons for the chase of other birds, and even of small quadrupeds. The name *falconry* was also applied to the aviary or enclosure where the falcons were kept. It appears that the practice of hunting with falcons was introduced into Europe from the East, for Ctesias alludes to the existence of such a custom in India in his time. Marco Polo also, in his *Milione*, speaking of the Tatars, says that their great khan "took with him full ten thousand falconers and good five hundred ger-falcons, with falcons *peregryne* and falcons *sacre* in great abundance; also he had a great number of goshawks for fowling along the waters," etc. Hawking seems to have passed over from the Tatars to the czars of Muscovy, who took great pleasure in this amusement. (See *Prince Serebrianni*, by Alexis Tolstoi, London, 1874.) In Europe this pastime is anterior to the Middle Ages, as, among the later Romans, Martial, Apuleius, and Julius Firmicus make special mention of it. On the descent of the Lombards into Italy, hawking became much more general, and from this it may be inferred that the ancient Germans were acquainted with it. Charlemagne took great delight in it, and he is said to have kept as many falconers as huntsmen. Pope Gregory IX. appears to have kept falcons. (See DU CANGE, *v. Falco.*) Henry the *Fowler* received his surname from his passion for this sport. The emperor Frederic II. not only enjoyed hunting with falcons, but he was a master of the art, and even wrote a treatise upon it, annotated by his son Manfred, with the title *De arte venandi cum avibus*. Another treatise on the same subject is attributed to Edward the Confessor of England. Brunetto Latini, in his *Tesoro* (chs. ix., x., xi., xii.), speaks of falconry; Dante reminds him of it in the *Divina Commedia*.

To English readers the most interesting treatise on this subject is that ascribed to Dame Julyana Berners, forming the first part of the *Boke of St. Albans*, first printed in 1481. Among the many continental writings upon falconry should be mentioned *La Venerie et Fauconnerie de Jacques du Pouilloux*, Paris, 1535, and the Italian work of Federigo Giorgi, who published in Venice in 1578 a volume entitled *Del Modo di conoscere i buoni falconi, astori e sparvieri, di esercitarli e farli perfetti, di governarli e di medicarli*, describing the various qualities of the falcon and the methods of keeping and caring for it. We learn from the *Glossary* of Du Cange that the privilege of keeping falcons was, in the Middle Ages, confined to the nobility. This, however, does not seem to have been the case in all countries, for in the *Boke of St. Albans* it is stated that certain falcons belonged by right to certain ranks; for instance: "an Egle, a Bawtere, a Meloune, . . . thyse thre by theyr nature belonge unto an Emperor. A Gerfawkon, a Tercell of a Gerfawkon, are dewe to a kyng. There is a Fawkon gentyll; and a Tercell gentyll; and thyse be for a prynce. There is a Fawkon of the rocke; and that is for a duke. There is a Fawkon peregryne; and that is for an erle." Then follow various other classes, till we come to "the Merlyon; and that hawke is for a lady;" and finally, "there is a Goshawk; and that is for a yoman. There is a Tercell; and that is for a poore man," etc. From this we must infer that in England, at least, the amusement of hawking was not wholly confined to the nobility. The office of grand falconer at the Byzantine court, in that of England, and in the ducal court of Savoy, was one of the highest dignity. Both the art of falconry and the practice of it, hawking, had their special vocabularies or "kindly speche," the thorough knowledge and accurate use of which were thought highly important as a test of good-breeding and as a means of distinguishing "a gentylman fro a yoman, and from a yoman a vylayne."

A great number of these terms and much other quaint matter on this subject will be found in the *Boke of St. Albans* and the other treatises above quoted. In the fifth chapter of Cibrario's *Della Economia Politica del Medio Evo* is a full description of this sport: "The time of the chase was either early in the morning or towards evening. The sportsmen rode out, with their falcons resting upon their strongly-gloved wrists. When a bird was discovered suited to the nature and the habits of the falcon, the little hood which covered its eyes was drawn off, and the falcon rose in rapid circles high above its destined prey; if the quarry was a small bird, she then suddenly swooped (or *stooped*, as the phrase was) directly upon her victim; but if the latter was a large and powerful bird, formidable in beak and wing, the falcon was cautious and cunning in her advances, turned and wheeled with great dexterity, seizing only the favorable moment to strike. Having secured the prize, she swept in large circles over the head of the falconer, and finally presented him the booty; the falconer put it in the game-bag, and then set before his falcon the food prepared for her. Falcons which soared high and pursued birds of lofty flight were called *altani;* others took a lower but more extended range; some were for the inland country, others for aquatic birds. These last were assisted by dogs. When, for example, a flock of herons is discovered, the falconer approaches them secretly, and suddenly beats a drum before the herons can get sight of the falcon, otherwise they would not dare to rise. Frightened by the drum, they take to flight; then the sportsman lets loose his falcon, and while she prepares to seize the herons in the air, the barking of the dogs prevents the poor birds from hiding again in the water. Eagles and falcons of the largest species may be trained for this chase, and they will even take foxes and hares." With Eastern sovereigns hawking is still in great favor, but it has almost entirely disappeared from Europe. The rare occasions in which the falcon is now employed are rather scenic representations of the old custom than attempts to revive it. The history of this pastime is especially interesting, as being almost the only outdoor amusement in which women of rank, in the Middle

Ages, took an active part, and it has furnished the writer of fiction with many a romantic situation, the poet and the painter with many a happy illustration. (For more complete information we refer to G. E. FREEMAN, *Falconry, its Claims, History, and Practice*, London, 1859, and the authorities there cited.) ANGELO DE GUBERNATIS.

Fal'eme, a river of Senegambia, Western Africa. It is one of the most important tributaries of the Senegal, which it joins in lat. 14° 40′ N., lon. 11° 48′ W.

Fale'rii, powerful city of ancient Etruria, situated N. of Mount Soracte and W. of the Tiber. It is believed to have been one of the twelve cities of the Etruscan confederation. It was often at war with Rome, but in 241 B. C. was conquered and destroyed by that power. A new Roman Falerii was founded near by, whose ruins, 5 miles distant from Nepi, are of great interest. The old Falerii probably stood at Civita Castellana.

Faler'nian Wine [so called from *Falernus Ager*, a region of Campania Felix, where it was grown], the most celebrated of the wines of the ancient Romans, was of three varieties—a light, a sweet, and a dry—as we learn from Pliny. It was very strong and generous, so that it would take fire from a lighted taper. When new it was very harsh and unpleasant. The excellent Massic wines came from the same region, and the two sorts were often confounded. Indeed, the better qualities were called indiscriminately by either name. These regions still produce good wine. From all accounts, the Falernian must have resembled the modern sherry wine.

Falie'ri (MARINO), doge of Venice, b. of an eminent family in 1274; served the republic with applause in war and on important embassies; and in 1354, when seventy-nine years old, was chosen to the dogate, soon after which the Venetian fleet was lost in a great battle with the Genoese. Not long after, at a carnival feast, he was grossly insulted, as he conceived, by a young nobleman, and in revenge determined to destroy the whole body of nobles, who were detested by the people. His conspiracy was detected and suppressed, and the doge, after a full confession, was beheaded Apr. 17, 1355. His story has been a favorite one with the poets and dramatists.

Fal'kington, tp. of Sangamon co., Ill. Pop. 973.

Fal'kirk, parliamentary borough of Scotland, 24 miles W. N. W. of Edinburgh, on the Edinburgh and Glasgow and Scottish Central Railway, near the old Roman wall of Antoninus and the well-known Carron Iron-works. Its three annual trysts are the largest cattle-fairs in Scotland, sales being made to the amount of nearly £1,000,000. In 1298, Sir William Wallace was defeated here by Edward I., and in 1746 the Highlanders under Prince Charles Edward defeated the royal troops. Pop. 9547.

Falk'land, royal borough of Scotland, in the county of Fife, 22 miles N. of Edinburgh. It is situated at the base of the Lomond Hills, which rise so abruptly behind it as to intercept the rays of the sun from it for several weeks during winter. The remains of Falkland Palace are very interesting, both in architectural respects and on account of their connection with the history of James IV. and James V. Pop. 2938.

Falkland (LUCIUS **Cary**), VISCOUNT, an English statesman, warrior, and writer of the eventful reign of Charles I., was b. at Burford, Oxfordshire, in 1610, and was educated at St. John's College, Cambridge, where he was noted for his remarkable attainments in the classics. At the age of nineteen he came into possession of a valuable estate, and a few years after married and settled at Great Tew, Oxfordshire. His house, situated so near Oxford, became at once the centre of all the learned of that noted school. He is said to have been not only a friendly critic to Chillingworth, but to have largely assisted the doctor in his work on the *Religion of the Protestants*. In 1633, upon the death of his father, Lucius succeeded as viscount, and was made by King Charles gentleman of the royal bedchamber. After the outbreak of the rebellion in Scotland, in 1638, Falkland hoped for an appointment in the army, but, disappointed in this, he entered it as a volunteer in 1639. In 1640 he was chosen member of the Short Parliament, and was re-elected to the Long Parliament, where he distinguished himself by his independent and fearless course. He was identified with the "reform party," and hence his sudden change after the execution of Strafford, and his espousal of the royal cause, were hardly explicable to his contemporaries. His political consistency is made plain, however, when we accept him as one of those who sought, in those disturbing times, a middle course between the Puritans and the aggressions of Anglicanism. He was a liberal Churchman, "but, shrinking from revolution in Church or State, would have liberalized both, in a truer and nobler sense than his contemporary revolutionists, ecclesiastical or political." (*Tulloch.*) Opposed to what seemed to him the excesses and illegalities of the popular party, he entered the lists in defence of the king, and became secretary of state. When civil war seemed inevitable he joined the army, and was therefore removed from the Commons, and placed on the list with those to whom no mercy was to be accorded. Falkland behaved admirably at the battle of Edgehill, and had his advice been followed Charles would have been successful in his military and civil career, and the rupture with the people been promptly healed. Unfortunately for his king, Falkland was killed at the battle of Newbury, Sept. 20, 1643. He wrote various treatises, of which is best known the *Discourse of the Infallibility of the Church of Rome* (best ed. London, 1660, 4to). (See, besides, the English historians, FORSTER, *Historical and Biographical Essays* (London, 1858); TULLOCH, *Rational Theology and Christian Philosophy in England in the Seventeenth Century* (London, 1872, vol. i.); LODGE, *Portraits of Illustrious Personages of Great Britain*, vol. iv.)
JAS. H. WORMAN.

Falkland Islands [Fr. *Malouines*], a cluster of islands in the South Atlantic Ocean, between lat. 51° and 53° S. and lon. 57° and 62° W., consisting of nearly 200 islands and presenting an area of about 13,000 square miles. Of the two largest islands, respectively called East and West Falkland, and separated from each other by a narrow sound, the former has an area of 3000 square miles, the latter of 2000 square miles; the rest are small islets. On account of the peculiar climate, the thermometer ranging in the winter between 30° and 50°, and in the summer between 40° and 65°, with frequent rain and high winds, the soil is much better adapted to pasturage than to cultivation. No trees, no fruits, scarcely anything but a few vegetables, are raised in the settlement, but the natural grass is extremely luxuriant, and horses and cattle, originally imported by the Buenos Ayreans and others, have gone on increasing in an astonishing degree. Pigs and rabbits are also abundant, and the coasts teem with fish. The islands were first discovered by Davis in 1592. In 1690 they were visited by Strong, who gave them the name which they now bear. French, Spanish, and English settlements have alternately been formed on them, but the English have ultimately retained possession of them. Port Stanley, a thriving town with an excellent harbor on East Falkland, is an entirely English settlement. Pop. of colony in 1870, 812.

Fal'köping, town in Sweden, Westergöthland, known by the battle of 1389, in which the Danish queen Margrethe conquered the army of the Swedish king Albrecht, and took him prisoner. This victory led to the famous Union of Calmar, 1397.

Falk'ville, tp. of Morgan co., Ala. Pop. 1198.

Fal'lacy [Lat. *fallacia*, from *fallax*, "deceitful;" *fallo*, to "deceive"], in logic, is produced by an incorrect performance of the process of reasoning. Not every wrong notion is a fallacy. If the process of reasoning is performed correctly, and the wrong notion rises either from a biassed and prejudiced assumption of distorted premises or from a weak and groping confidence in insufficient premises, it is in the first case an error—in the last, a mistake. Only when the wrong notion is the result of a fault in the reasoning process itself is it a fallacy, properly speaking.

As the whole process of reasoning can be reduced to the making of inferences, and as the fundamental character of all inferences is the syllogism, the fallacy may be defined as the result of some fault in the formation of the syllogism. And furthermore, as all faults which can be committed in the formation of a syllogism rise either from the two propositions being a repetition of each other, and consequently incapable of producing any legitimate third proposition, or from their being wholly incongruous, lacking the true middle term, which alone could draw the premises together into a conclusion, all fallacies fall into two classes corresponding to these two divisions of faulty syllogisms, and may be characterized either as a reasoning in a circle or as a jumping to the conclusion.

The first kind of logical fallacy, the reasoning in a circle—which, in the terminology of the old logical systems, was called a *petitio principii*—consists in proving one position by assuming another which is identical with it. Of all kinds of logical fallacies, this is the most desperate. When a person is caught by such a fallacy, debate must stop; when an age is caught, civilization must stop. It acts on the mind like a magical ring. A person or an age may move around in it, around and around, with steadily increasing passions, and there is no escape from it unless through a revolutionary concussion of the whole mind. It is of most frequent occurrence in theological matters, and in those questions of politics which it seems

impossible to solve satisfactorily by the mere application of the principle of expediency, without any intermediate agency of moral principles.

The other kind of logical fallacy—which, in accordance with a striking expression from every-day conversation, I have characterized as a "jumping to the conclusion"—is much less dangerous, though much more frequent, and comprises a great number of distinct forms, which the old logic describes as the fallacy of the *æquivocatio, accidens, argumentum ad hominem, post hoc ergo propter hoc, undistributed middle*, etc. The general characteristic of all these different forms is the application of a middle term composed not of truly constituent, but of merely accidental, qualifications of the two ideas which it is put to combine. Thus, in a comedy of Holberg, Erasmus Montanus proves that his mother is a stone in this way:

A stone cannot fly; you cannot fly. *Ergo*, You are a stone.

A more thoroughgoing definition of the terms will, in most cases, be able to destroy this kind of logical fallacy, which, however, has become dangerously frequent in our days in cases in which statistics are applied to the solution of historical or moral questions. Thus Mr. Buckle, in his "History of Civilization in England," reasons as follows: "Necessary laws exclude free will. Statistics show the existence of necessary laws in history. *Ergo*, free will is excluded from history." Any definition of history which in any way can pretend to cover the field which in reality belongs to the idea will break this syllogism to pieces, and show the fallacy of the conclusion.

It must be noticed, however, that even when a fallacy of this kind shows us a fault in the construction of the syllogism, thus making the incorrectness of the performance of the process of reasoning perfectly apparent, it generally originates in a wilful or otherwise unwarranted assumption of premises; and in his book on logic Mill treats fallacies of this kind as errors and mistakes, though he retains the name of fallacy. CLEMENS PETERSEN.

Fall Brook, post-b. of Ward tp., Tioga co., Pa., the southern terminus of the Tioga R. R., 48 miles from Corning, N. Y. It has important mines of semi-bituminous coal. Pop. 1390.

Fall Creek, post-tp. of Adams co., Ill., on the Mississippi River, and on the Quincy Alton and St. Louis R. R., 12 miles S. E. of Quincy. Pop. 990.

Fall Creek, tp. of Hamilton co., Ind. Pop. 1530.

Fall Creek, tp. of Henry co., Ind. Pop. 2005.

Fall Creek, tp. of Madison co., Ind. Pop. 2483.

Fall Creek, tp. of Yadkin co., N. C. Pop. 1192.

Falling Bodies. Among the earliest ideas derived from experience are those of *weight* and of the direction *up and down*. All material bodies tend downward with more or less force, and the measure of this tendency in each is the weight of that body. The tendency itself is imputed to an influence called *gravitation* inherent in matter universally (see GRAVITATION), and is the resultant of the mutual attractions which take place between all the material particles of the body and those of the earth. When this tendency is adequately resisted, the body is said to be supported, and it remains at rest; when the resistance is withdrawn, the body falls. Observation of bodies falling naturally shows that all do not fall equally fast. A metal bullet descends with great rapidity; shreds of paper flutter downward slowly; some very light substances, like the down of feathers or the winged seeds of plants, seem scarcely to descend at all; and some, relatively lighter still, like bubbles and balloons, even rise. But when we observe that if heavy bodies be immersed in water the differences and seeming anomalies of this kind which occur are much more numerous and more remarkable still, we soon learn to attribute the unequal velocities with which bodies fall in the atmosphere to the buoyant power of the air, and the resistance it opposes to bodies moving through it. If, in order to test the truth of this hypothesis, we make the experiment of dropping from the same support, at the same instant, in a tall receiver exhausted of its air, two substances so physically different as a bullet and a bit of thistle-down, we shall find our anticipation confirmed; for the velocity of fall will be the same for both, and the two will reach the bottom together. If we would inquire, therefore, the laws which govern the fall of bodies, we must consider bodies as falling *freely*—that is to say, *in vacuo*. The buoyant power of the air simply diminishes the downward tendency and velocity of descent; it is the resistance to motion which disturbs the law of fall.

This resistance is proportioned to extent of surface; the weight or urging force is proportioned to density. Bodies of large specific gravity, exposing small surface, are very little interfered with in their fall (at least, through the heights to which observation can extend) by atmospheric resistance. But the densest substances, when spread out into thin laminæ, such as gold and silver in leaf, fall as irregularly and as slowly as tissue-paper or down.

The earliest experiments on the fall of bodies were made by Galileo at Pisa, who took advantage of the favorable opportunity offered by the famous leaning tower of that city—which is 180 feet in height, and overhangs its base by about 14 feet—to observe the effects produced upon the time and velocity of fall by changing the form and the material of the body subjected to experiment. He deduced the correct conclusion that in the absence of the air all bodies, without regard to their form or density, would fall with the same velocity; but in his time this truth could not be experimentally demonstrated, since the air-pump was then unknown.

The law governing the motion of a body falling freely may be abstractly inferred by considering the relation of force to motion. Velocity in a given body is proportional to the force impressed. As gravity is a *constant* force (that is, a force which acts all the time), it imparts every instant to the falling body a minute addition, always the same in amount, to the velocity which the body had before. Thus, this velocity goes on increasing, and increases equally in equal times—in technical language it is uniformly accelerated—and the final velocity is always proportional to the time which has elapsed since the fall began. By experiment it is found that a body, in falling from a state of rest, acquires, in one second of time, a velocity which, continued uniformly, would carry it over 32.2 feet in a second. If, then, we put 32.2 ft. $= g$, and represent any other time in seconds (whole or fractional) by t, and also represent the final velocity by v, we shall have $v = gt$.

The expression for space s, fallen through in time t, is not so obvious, because the velocity is not uniform. But since, for uniform velocity, we have $s = vt$, if we suppose the time t to be divided into an indefinite number $(= n)$ of minute parts, during each one of which the velocity remains uniform, while the velocities, in the successive instants denoted by $v_{,}$, $v_{,,}$, $v_{,,,}$, etc., uniformly increase, and the final velocity v_n is equal to v—that is, to the velocity acquired by falling through the whole time, t—then the sum of all the spaces $s_{,} = v_{,}\frac{t}{n}$, $s_{,,} = v_{,,}\frac{t}{n}$, ... $s_n\frac{t}{n}$, will be equal (with only a very minute error) to s, the whole space fallen through in time t. By making n infinitely great, $\frac{t}{n}$ becomes infinitely small, and $s_{,} + s_{,,} + s_{,,,} + \ldots . s_n = s$. But $s_{,} + s_{,,}$, etc. is an arithmetical series, of which the sum is equal to half the sum of the extremes multiplied by the number of terms. Hence,

$$s = \frac{s_{,} + s_n}{2} = \frac{v_{,} + v_n}{2} . \frac{t}{n} . n.$$

Or as, on this supposition, $v_{,}$ is too small to be appreciable, $s = \frac{1}{2} v_n t = \frac{1}{2} vt$. And as $v = gt$, we have, finally, by substitution, $s = \frac{1}{2} gt^2$. If $t = 1$ second, $s = \frac{1}{2} g = 16.1$ feet. That is, the space fallen through in one second from rest is half that through which the acquired velocity would cause it subsequently to move if continued uniform for another second. This proposition may be stated conversely and generally thus: The velocity acquired by a body in falling from rest during the time t is such as, continued uniform, would carry it in an equal time over twice the space through which it has fallen to acquire that velocity. The following table shows the spaces fallen during the number of seconds or fractional parts of seconds specified in it, the distances through which the acquired velocity, continued uniform, would carry the body in a time equal to the time of fall, and the acquired velocity (per second) itself:

t = time of fall, seconds or fractions.	s = space fallen, feet and decimals.	d = distance in time t, with vel. = v.	v = vel. acquired by fall, in feet.
0.001	0.000016	0.000032	0.0322
0.01	0.00161	0.00322	0.322
0.1	0.1610	0.3220	3.220
$\frac{1}{8}$	0.2516	0.5031	4.025
$\frac{1}{4}$	1.0062	2.0135	8.050
$\frac{1}{2}$	4.0250	8.0500	16.100
$\frac{3}{4}$	9.0562	18.1125	24.150
$\frac{7}{8}$	12.3284	24.6568	28.175
1	16.1	32.2	32.2
2	64.4	128.8	64.4
3	144.9	289.8	96.6
4	257.6	515.2	128.8
5	402.5	805.0	161.0
6	579.6	1159.2	193.2
7	788.9	1577.8	225.4
8	1030.4	2060.8	257.6
9	1304.1	2608.2	289.8
10	1610.1	3220.0	322.0
12	2318.4	4636.8	386.4
15	4622.5	9245.0	483.0
18	5216.4	10432.8	579.6
20	6440.0	12880.0	644.0

The value of $g =$ the velocity acquired in one second of fall, is commonly said to represent the accelerating force of gravity; and this varies slightly with the latitude of the place, being greatest at the poles of the earth and least at the equator. The value 32.2 ft. corresponds to about latitude 45°, and for ordinary uses may be taken as true everywhere.

Of the three quantities s, v, and t, if any one be known, the other two may be found from the following formulæ, of which two have been given above and the rest are deducible from them:

$$1.\ s = \tfrac{1}{2} gt^2. \qquad 3.\ t = \frac{v}{g}. \qquad 5.\ v = gt.$$

$$2.\ s = \frac{v^2}{2g}. \qquad 4.\ t = \sqrt{\frac{2s}{g}}. \qquad 6.\ v = \sqrt{2gs}.$$

If a body be projected downward with the velocity v_a, it is obvious that, for the space passed over in the time t, there must be added the space $v_a t$ due to the velocity of projection, to $\frac{1}{2}gt^2$ due to gravity; hence $s = v_a t + \frac{1}{2}gt^2$. But if the body be projected directly upward, the gravity opposes the ascent, and $s = v_a t - \frac{1}{2}gt^2$. Substituting for gt from (5) we have $s = v_a t - \frac{1}{2}vt$. The space s is maximum when the projectile force is exhausted, and the body then falls again as from rest. On reaching the point from which it was projected, it will have re-acquired the velocity v_a, lost in ascending, which will also be the velocity v imparted by gravity. Hence, when the space s described by a body projected vertically upward becomes maximum, $v_a = v$; and $s = v_a t - \frac{1}{2}vt = vt - \frac{1}{2}vt = \frac{1}{2}vt$; that is, the body will ascend to the same height from which it must have fallen to acquire the velocity of projection. A cannon-ball leaves the gun with a velocity of about 1200 feet per second. If fired directly upward, it ought to rise $1200^2 \div 64.4 = 22{,}360$ feet, or nearly $4\frac{1}{4}$ miles, and be absent 74.534 seconds (time of rise and fall), when it should return with the original velocity of 1200 feet. But the resistance of the air at such high velocities is so great that these anticipations will be far from being realized.

The motions of bodies descending inclined planes (without friction) are governed by the same laws as those of bodies falling freely, the urging force being reduced, however, in the ratio of radius to the sine of inclination. If a be the angle of inclination, all the foregoing formulæ will be made applicable to this case, by substituting g sin. a for g wherever this letter occurs. As $v = \sqrt{2gs}$, and as $s = l$, the length of the plane, when the body descends it to the bottom, we have $v = \sqrt{2gl \text{ sin. } a}$. But l sin. $a = h$, the height of the plane, or $v = \sqrt{2gh}$. Hence the velocity acquired by a body in descending an inclined plane is precisely the same as that attained in falling freely through the vertical height of the plane. Also, putting $t_{,}$ for the time of descent of the plane,

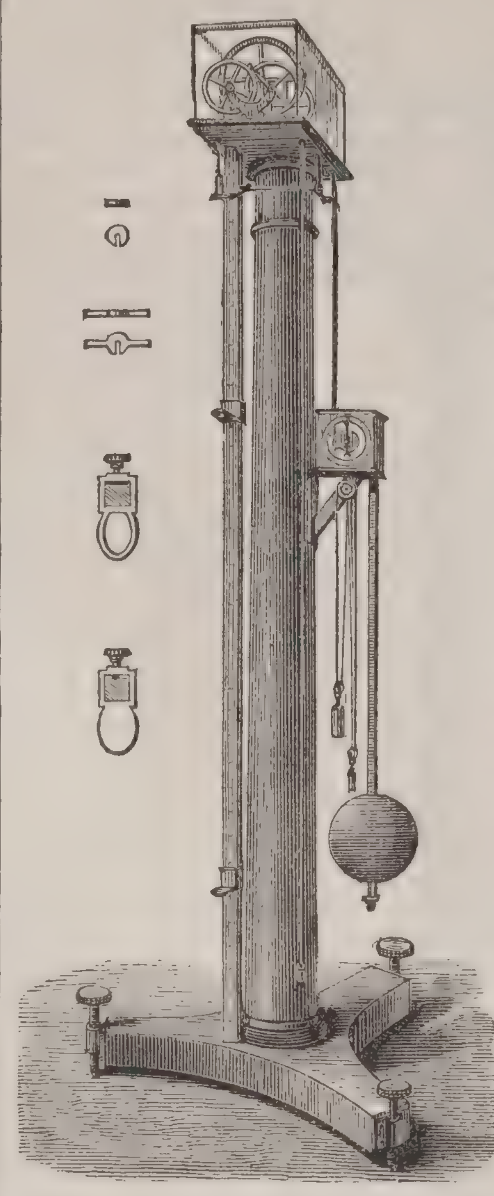
$$\text{Since } t_{,} = \sqrt{\frac{2l}{g \text{ sin. } a}} = \sqrt{\frac{2l \text{ sin. } a}{g \text{ sin.}^2 a}} = \frac{1}{\text{sin. } a}\sqrt{\frac{2h}{g}} = \frac{t}{\text{sin. } a};$$

hence, $t_{,}$ sin. $a = t$; or $t_{,} : t :: 1 : \text{sin. } a :: l : h$.

That is, the time down the plane is to the time of falling through the height of the plane as the length of the plane is to its height; and if any number of planes have the same height, the several times of descent down them will be as their respective lengths. Hence, if a plane be one foot high and forty feet long, a body will be ten seconds in descending it; if of the same height and twenty feet long, five seconds. With four feet height and eighty feet length, the time will be ten seconds; with the same height and forty feet length, five seconds. Owing to the retardation of velocity and the protraction of the time of descent of bodies upon inclined planes, the experimental investigation of the motion of falling bodies is much easier upon such planes than when bodies fall freely, the resistance of the atmosphere being also greatly reduced. Hence, Galileo made use of such planes for the purpose of determining the laws of fall. Since his time more elaborate instrumental means have been devised for accomplishing the same result, of which the most important are the machines of Atwood, Morin, and Bourbouze.

Atwood's machine is briefly described under that name in our first volume, but this is the proper place to explain its uses. The appearance of the machine is shown in Fig. 1. An upright column about eight feet high sustains a small platform on which the essential part of the machine rests. This consists of a light wheel delicately supported upon large friction-wheels, and carrying two equal weights suspended at the extremities of a slender and very flexible silken cord, which runs in a groove upon its circumference. While these two weights continue to be equal the system remains at rest, but if an additional weight, however small, be placed upon either, this one will descend, and in descending will generate a velocity in a given time as many times less than that produced in the same time by gravity in bodies falling freely as the added weight is less than the entire mass moved. It is common, in experimenting with this machine, to employ weights having a definite proportion to this mass. Thus, if the whole mass is sixty-four times as heavy as the added weight which furnishes the motive-power, the velocity generated in one second will be the sixty-fourth part of thirty-two feet (disregarding for the moment the fraction); that is to say, six inches. And as the space fallen through in the first second from rest is only half as great as that which expresses the acquired velocity, the weights of the machine will move only three inches in this first second. In preparing for experiment, one of the weights is loaded and raised nearly to the platform at the top of the column, where it is detained by a movable arm brought beneath it, and is held at rest at the zero of a divided scale, shown in the figure, on which the distances of descent are to be noted.

Fig. 1.



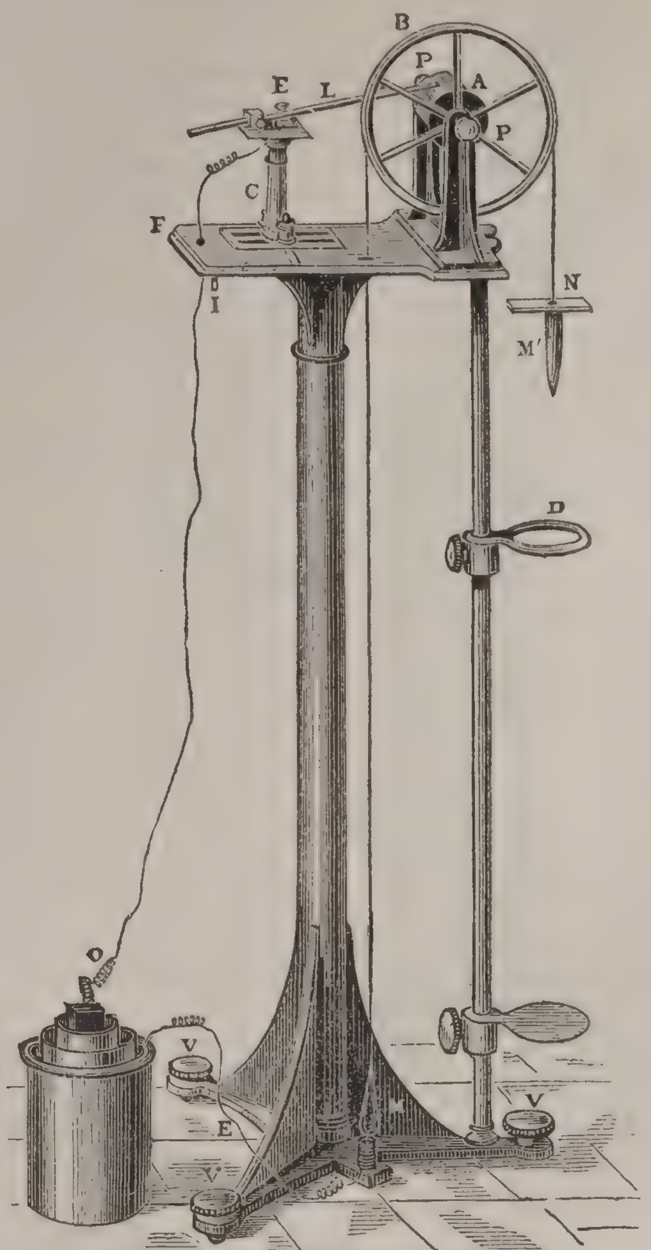
Atwood's Machine.

A clock, supported by a bracket on the side of the column, is connected with the movable arm above mentioned by a mechanism which causes the arm to drop just as the second-hand marks zero. Sliding on the scale is a small movable brass stage, which may be placed at any point at which it is desired to arrest the fall. And there is also a ring sliding on the same scale, on which the load of the descending weight may rest, leaving the weight afterwards to descend unloaded. The forms of the weights used as loads may be seen represented on the left in the figure, where also are given direct views of the stage and ring. The loading weights designed to be arrested by the ring are constructed with arms. The others are simple disks notched to the centre, that they may not interfere with the suspending hook and cord. The clock marks the seconds with a loud tick. The moment at which the load is taken off by the ring, or at which the moving weight strikes the stage, is indicated by the sound of the contact. The law of motion is illustrated by noting the points on the scale at which coincidence takes place between these sounds and the beats of the clock. Thus, if as above supposed, the load is one sixty-fourth of the whole moving mass, and the stage is fixed three inches below zero, the stroke of the weight on the stage will coincide exactly with the first beat of the clock heard after the movement begins. But in order that coincidence may occur at the second beat, the stage must be placed at four times as great a distance down, or at twelve inches. For coincidence at the third beat the distance must be nine times as great, or twenty-seven inches. In like manner four seconds require sixteen times as great a distance; and five seconds, twenty-five times, or seventy-five inches, which is equal to six feet and three inches. This illustrates the law of uniform acceleration theoretically established above —viz. that the space is as the square of the time. If, however, the moving weight be unloaded at the distance *three*, by placing the ring at that point, then its subsequent motion will not be accelerated, but uniform, and its velocity will be $2 \times 3'' = 6''$; so that it will take it twelve additional seconds (or thirteen in all) to reach the stage at the seventy-fifth inch—a point which, under the previously supposed conditions, it reaches in five.

The apparatus of Bourbouze, represented in Fig. 2, offers some advantages, in respect to the accuracy of its indications, over that just described. This has the pulley, weights, ring, and stage of Atwood's. The pulley also sometimes runs on friction-wheels, though none are shown in this figure. But this machine differs from the other in being provided with a light cylinder on the same axis with the

pulley, on which rests the extremity of a delicate tracer, L. This tracer is an elastic spring capable of a slight lateral

Fig. 2.

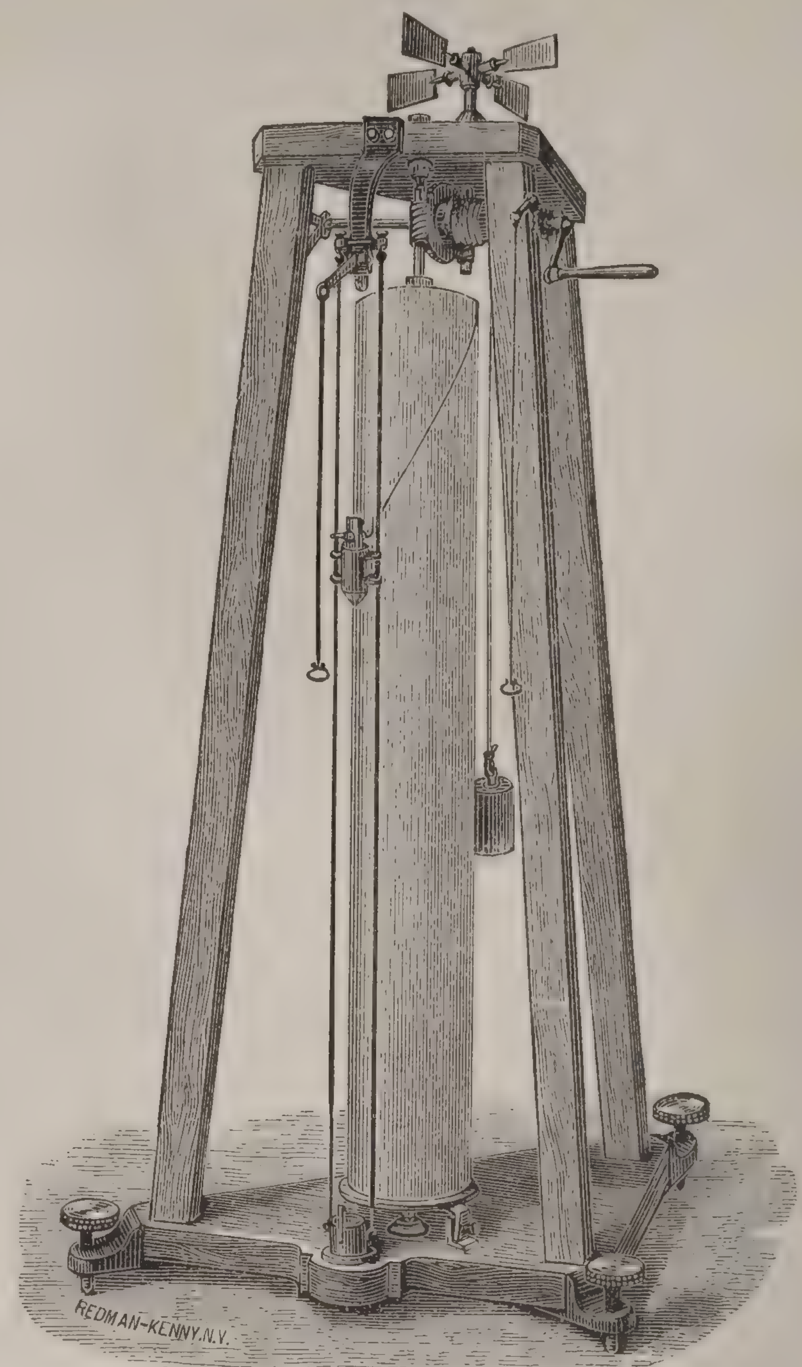


Bourbouze's Modification of Atwood's Machine.

vibratory motion, which is maintained during the experiment by an electro-magnet, E, of which the exciting battery is seen at O; the battery circuit being alternately closed and broken by the vibration itself. The same battery excites an electro-magnet at M, which holds one of the pulley-weights at M′, though loaded with the additional weight N. If the circuit is momentarily broken, the weight M is released and M′ falls. The tracer then describes upon the surface of the cylinder A a sinuous curve, in which the summits of the successive undulations will be equidistant if the motion is uniform, and gradually increasing in distance if it is accelerated. As the vibrations of elastic bodies are isochronous, the undulations are described in equal times, and the distances of the successive summits from the beginning of the trace are proportional to the distances simultaneously passed over by the weight M′. In order to prevent the curves described in the successive revolutions from confusing or obliterating each other, the cylinder is made to run upon a helicoidal axis which gradually displaces it laterally. And since it is necessary that the motion shall be as little interfered with as possible by the friction of the tracer, the surface of the cylinder is covered with paper coated with lampblack from the smoke of burning camphor. It adds to the exactness of the measurements between the successive sinuosities to allow the machine, after having prepared it for the experiment, to run for a few seconds without attaching the battery. The trace will then be a simple line without sinuosities. Afterwards, on restoring the original arrangement, connecting the battery, and experimenting in the usual manner, the undulating line described by the tracer will cross the mean line previously traced, at intervals of time exactly equal, and the intersections thus formed will afford more definite points of reference in measurement than are found in the rounded summits of the undulations.

Morin's machine, which remains to be described, is represented in Fig. 3. The essential part of this machine is a vertical cylinder six or seven feet high, turning easily upon its axis of figure, and driven by clockwork and a descending weight. A wind-vane regulator serves to maintain uniformity of motion. The cylinder is closely covered with white paper, which ought to be ruled with equidistant parallel lines, both horizontally and vertically. A weight, which is perfectly free to fall when released from a detent at the top of the machine, is guided in its fall by a couple of wires stretched vertically, and carries in its descent a pencil, of which the point is kept by a light spring in contact with the paper wrapping the revolving cylinder. The machine, after being started, is allowed to run until the

Fig. 3.



Morin's Apparatus.

rotation becomes sensibly uniform, when the detent is touched and the weight allowed to fall. The velocity of descent being accelerated, while that of the rotation is uniform, a trace will be described by the pencil, which, as the resultant of these two motions, will be necessarily a curve. By measuring the co-ordinates of this curve, which the regular ruling of the paper will make an easy process, it will be found to have the properties of a parabola; and from this the law of acceleration is at once deduced, and is found to be identical with the law determined by theory.

F. A. P. Barnard.

Falling Spring, post-tp. of Greenbrier co., West Va. Pop. 1138.

Falling Stars. See Meteors, by Prof. H. A. Newton, LL.D., M. N. A. S.

Fal′lington, a v. of Falls tp., Bucks co., Pa. P. 211.

Fall′ing Wa′ter, post-tp. of Berkeley co., West Va. Pop. 1218.

Fall of Man, in theology, the lapse of the first man, and through him the lapse of the human race, from the state of integrity into the state of corruption. The doctrine is placed usually as the systematic link between creation and redemption. The narrative in Gen. iii. is treated throughout the Bible as historical. The myths and legends of paganism have many parallels with the Scripture account of the Fall. The tree of knowledge is generally regarded as simply affording the means of testing man, not as having in its fruit any special objective character. The serpent is simply organic and instrumental, the mask of the real tempter, the devil. The sin of the Fall is apostasy from moral fellowship with God, caused by abuse of the freedom of the will, and followed by the loss of the divine image and by liability to temporal and eternal death on the part of Adam and his posterity. Various explanations have been urged as substitutes for the historical sense of the narrative, both in ancient and modern times. The Ophites regarded the serpent as incarnate Wisdom. Many modern German thinkers consider the Fall as a necessary part of man's development in reason and character, "the happiest event in human history." Hase calls it "the image of that which occurs in every man." Nitzsch says, "it is true history, but not actual." (A statement and vindication of the received view will be found in Krauth's

Conservative Reformation, 376–455, and HODGE'S *Systematic Theology*, ii. 123–129.) C. P. KRAUTH.

Fallo'pian Tubes [named from Fallopius, long reputed as their discoverer], or more properly **O'viducts,** in the higher animals, two canals in the free margin of the broad ligaments of the uterus, one on either side, extending from the ovary to the uterus. In woman the tubes are each about four inches long, with a very narrow passage along the inner half of the length, but much larger outward. The inner end opens into the cavity of the uterus, and the trumpet-shaped outward end opens into the abdominal cavity. The outward end is fimbriated with fringe-like processes, and has been called *morsus diaboli*. The oviducts are identical with what are called Müller's ducts in the fœtus. Birds have but one developed oviduct. In most marsupials each tube serves as a separate uterus. In the higher animals the uterus and vagina are regarded as formed by the union of the oviducts. The office of the Fallopian tubes is to convey the ovum from the ovary to the uterus. REVISED BY WILLARD PARKER.

Fallo'pius, or **Fallopio** (GABRIELE), an illustrious anatomist, b. at Modena in 1528, or, according to Tomassini, in 1490. With Vesalius and Eustachius (the latter his rival) Fallopius has the honor of being the chief restorer of anatomical science; he taught at Ferrara and Pisa, and in 1551 became professor of anatomy and surgery at Padua and director of the botanic gardens. His name is given to the Fallopian tubes, which he did not first discover, though he first suggested correctly their use.

Falloux, de (FRÉDÉRIC ALFRED PIERRE), VICOMTE, b. at Angers, France, May 7, 1811, became distinguished as a political leader of the Catholic party, but retired from public life in 1851; became one of the editors of the *Correspondant* in 1855; and is known by his *Histoire de Louis XVI.* (1840), a Legitimist work; *Histoire de Pie V.*, 1844; *Madame Swetchine, sa vie et ses œuvres*, 1859; and another volume of Madame Swetchine's letters, 1866; also some devotional and other works.

Fal'low, a name formerly applied to land which is allowed to rest after cropping for one or more seasons with no tillage, except perhaps one or more ploughings. Such are now called *naked* fallows. The custom is a very ancient one, and is chiefly useful on heavy soils, where it acts probably by way of liberating plant-food from hitherto unavailable compounds. It has, among the best farmers, given way to what is called the green fallow, of which the clover-fallow is one of the best kinds. Some green crop, as clover or buckwheat, is grown and allowed to rot on the surface, or is ploughed under. This crop serves at once to choke the weeds and to fertilize the land, and the growing crop saves the soil from blowing away in the winds, which in naked fallows causes a serious loss.

Fallow Deer [*fallow* means "pale yellow"], the most common deer of Europe, found also in Northern Africa, is the *Dama vulgaris*. Though now very common in England, it was introduced there, but very early, it is supposed by the Roman colonists. In a wild state it only exists in Southern Europe, but in the later Tertiary its range extends farther N. In summer it is beautifully mottled. The male is called a buck, the female a doe, the young a fawn. The doe is without horns. The venison of the fallow deer is regarded as the most savory known. It is smaller than the stag, and has more spreading and palmated horns. It goes in herds, and each herd has its master, an old buck which all the others obey.

Fallow Deer (*Dama vulgaris*).

Fal'lowfield, tp. of Washington co., Pa. Pop. 834.

Fall Riv'er, tp. of La Salle co., Ill. Pop. 523.

Fall River, post-tp. of Greenwood co., Kan. P. 1119.

Fall River, tp. of Wilson co., Kan. Pop. 896.

Fall River, city of Bristol co., Mass., in lat. 41° 42′ 3″ N., lon. 71° 9′ 37½″ W., on the Rhode Island border, on the eastern side of Mount Hope Bay, the north-eastern arm of Narragansett Bay, and along Taunton River, some 20 miles from the sea. It is about 9 miles in length, comprising 27½ square miles; is 48½ miles S. of Boston, Mass., 20 from Providence, R. I., 15 from Taunton, Mass., 13 from New Bedford, Mass., and 18 from Newport, R. I., being central to them all and connected with each by railway. It is at the head of deep-water navigation, and the terminus of a line of steamers from New York. Its industries comprise iron-works that run 105 nail-machines and turn out 120,000 kegs of nails yearly; 2 large calico print-works (the American and the Bay State), one of which has over 900 employés and runs 16 machines, and together they turn out 75,000,000 yards of calico per annum; 1 woollen-factory; 38 cotton-mills, turning out some 300,000,000 yards per annum, mostly print cloths; a large bleachery, and a multitude of mechanical enterprises connected with the cotton manufacture. The capital employed in these industries is over $20,000,000, keeping in motion 1,269,788 spindles and 29,521 looms. The city contains water-works, nearly completed, bringing the water from Watuppa Lake, a beautiful sheet of water 10 miles long in the eastern part of the city; an efficient paid fire department with fire-alarm telegraph; 6 national and 4 savings banks; 2 daily and 3 weekly newspapers; immense granite-quarries; a large coastwise shipping-trade; a children's home; a free public library and reading-room; a high school, 3 large graded grammar and many primary schools; 23 churches; and a public park of 60 acres. Fall River was first settled in 1659, incorporated as a town in 1803, and became a city in 1854. Pop. 26,766.
WILLIAM REED, ED. "DAILY EVENING NEWS."

Fall River, post-v. of Fountain Prairie tp., Columbia co., Wis., on the Milwaukee and St. Paul R. R. Pop. 259.

Falls, county of Texas, in the E. central part. Area, 795 square miles. The surface is fertile, one half prairie and one half timbered land. Cattle, corn, and cotton are the staples. It is traversed by the Houston and Texas Central R. R. and by the Brazos River. Cap. Marlin. P. 9851.

Falls, tp. of Cerro Gordo co., Ia. Pop. 553.

Falls, tp. of Chase co., Kan. Pop. 459.

Falls, tp. of Hocking co., O. It contains Logan, the county-seat. Pop. 3760.

Falls, tp. of Muskingum co., O. Pop. 3361.

Falls, tp. of Bucks co., Pa. Pop. 2298.

Falls, post-tp. of Wyoming co., Pa. Pop. 1096.

Falls, tp. of Fayette co., W. Va. Pop. 1414.

Falls'burg, tp. and post-v. of Licking co., O. P. 865.

Falls'burgh, post-tp. of Sullivan co., N. Y., on the New York and Oswego Midland R. R. The township contains several villages. Leather, lumber, and dairy products are manufactured. Pop. 3206.

Falls Church, post-tp. of Fairfax co., Va., on the Washington and Ohio R. R., 11 miles from Alexandria. Pop. 2461.

Falls City, post-v. and tp., capital of Richardson co., Neb., 9 miles W. of the Missouri River, in the Great Nemaha Valley and on the Atchison and Nebraska R. R. It has a brick court-house, nearly completed, 2 hotels, good schools, 5 churches, 25 stores, excellent flouring-mills, two weekly newspapers, and a broom-factory; also a pork-packing house, nearly completed. Pop. of v. 607; of tp. 1166. W. S. STRETCH, ED. "NEMAHA VALLEY JOURNAL."

Falls City, post-v. of Fayette co., Pa., on the Pittsburg Washington and Baltimore R. R.

Falls of Montmorenci, a celebrated waterfall and village in the counties of Quebec and Montmorenci, province of Quebec, Canada. Here the river Montmorenci falls

from a precipice 250 feet high directly into the St. Lawrence, 7 miles below Quebec. The village at this point has a population of about 850, and has manufactures of lumber. The falls are visited by great numbers of travellers in summer, when the scene is one of great beauty. In winter very large and remarkable cones of ice form here.

Fall′ston, post-v. of Harford co., Md.

Fallston, b. of Beaver co., Pa. Pop. 629.

Falls′town, tp. of Iredell co., N. C. Pop. 879.

Falls Vil′lage, post-v. of Canaan tp., Litchfield co., Conn., on the Housatonic R. R., 67 miles N. of Bridgeport, at the romantic falls of the Housatonic River, has a national and a savings bank, and manufactures of iron.

Fal′mouth, parliamentary and municipal borough of England, in the county of Cornwall, on a branch of the estuary of the Fal, which here forms one of the best harbors in England, 5 by 1 to 2 miles in extent, 12 to 18 fathoms deep, and capable of sheltering 500 vessels at a time. It is a rendezvous for fleets and mail-packets. Pop. 5294.

Falmouth, post-v., county-seat of Pendleton co., Ky. on the Kentucky Central R. R., 39 miles S. by E. of Covington, and on the Licking River. It has a weekly newspaper. Pop. 614.

Falmouth, post-tp. of Cumberland co., Me., 7 miles N. of Portland, on the Grand Trunk and the Maine Central R. Rs. Portland and the neighboring towns were included in the old town of Falmouth. It borders on Casco Bay, has three churches, great water-power, and manufactures of bricks, machinery, carriages, etc. Pop. 1730.

Falmouth, post-tp. of Barnstable co., Mass., at the extreme W. end of Cape Cod, on the shores of Buzzard's Bay and Vineyard Sound. It has a spacious harbor at Wood's Hole, which is safe, never freezes, and is of sufficient depth for the largest ships or steamers. It contains 9 churches, 4 hotels, 7 post-offices, 1 national bank, and 2 manufactories. The Pacific Guano Co. at Wood's Hole has a capital of $1,000,000. Falmouth is rapidly becoming noted as a watering-place, and Falmouth Heights has already attained a wide reputation as a seaside resort. Pop. 2237. ED. OF "FALMOUTH CHRONICLE."

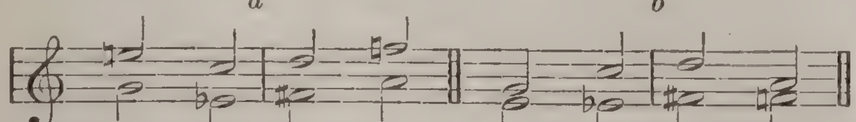
Falmouth, tp. and post-v. of Stafford co., Va., on the Richmond Fredericksburg and Potomac R. R. and on the Rappahannock, opposite Fredericksburg. Pop. 1694.

False [Lat. *fallo, falsum,* to "deceive"]. In music this term is often applied to that which is incorrect, faulty, or in direct violation of rule. To *sing* falsely or with false intonation is to deviate from the true pitch of the notes sung. False *harmony* is that which disregards the laws of counterpoint and correct taste. A false *progression* is a wrong resolution of a discord, two perfect fifths or octaves in succession, or other similar error. A *melody* also may be false, not only in performance, but in its construction, when certain notes proceed otherwise than the harmony of the accompaniment demands. A falsetto voice is an abnormal series of sounds ranging above the pure and natural tones of a man's voice, and produced only by more or less of constraint. WILLIAM STAUNTON.

False Bay is an inlet on the E. side of the mountainous district of South Africa which terminates in the Cape of Good Hope. As it is sheltered from the N. W. monsoon, to which the harbor of Cape Town is exposed, it receives periodically all trading-vessels from Cape Town for temporary protection, and it is the permanent station of the naval force of the colony.

False Cross Rela′tion, in musical composition, a certain progression, by a skip, in which a note in its natural form is followed by the same note altered by a sharp or flat, or *vice versâ,* in another part of the harmony, as in the example, at *a:*

a *b*



The disagreeable effect of this arises from an apparent contradiction between the two parts, the one being major, and the other minor. The error is avoided by placing the change on the *same grade* or the *same part of the harmony,* as at *b.* WILLIAM STAUNTON.

False Impris′onment, an unlawful deprivation of personal liberty. It is not necessary to constitute this offence that there should be an actual incarceration of the person, or that any actual force should be employed in procuring the wrongful restraint. An unwarrantable detention in a private apartment, or even in a public highway, is sufficient, and there need be no other exercise of power than a mere command or direction to submit to arrest, provided it is accompanied with such a display of authority, or such threats of compulsion, or exhibition of means to procure compliance, as naturally lead the person accosted to believe that he is submitting to legal authority, or that he will be forced to yield if he attempts resistance. It is enough that one's voluntary control and direction of his own movements is wrongfully interfered with. False imprisonment usually occurs from the unjustifiable exercise of pretended legal authority, as by arresting without process when process is known to be necessary, or when there is a mistaken assumption that a case is one in which no process is required to sanction an arrest. For instance, a constable or other peace-officer has power to arrest without warrant if he have reasonable ground of suspicion that a felony has been committed and that the person whom he seeks to detain is the offender. In like manner, a private individual needs no legal process to justify him in taking into custody the supposed perpetrator of a felony whose guilt is reasonably presumable. A private person's privilege in this respect, however, is more restricted than that of a constable, for mere suspicion that the offence has been committed is not enough, but it must be shown to have actually occurred, even though the party suspected be in fact innocent. Furthermore, any person, whether he be an officer or not, in whose presence a breach of the peace is committed, may detain the wrongdoer and deliver him to the proper legal authorities for punishment. But whenever the right of arrest without warrant is exercised, a just occasion must be shown to exist by the entire correspondence of the circumstances of the case with those requirements which alone afford a sufficient cause for detention without process, or the person making the arrest will be guilty of false imprisonment. In all other grades of offence legal process is necessary to justify an arrest, and without it any restraint or detention of a person is unlawful. So an arrest is invalid and wrongful, even if made under color of process, if the process be void from some irregularity or defect, or if the arrest be made on an unlawful occasion, as on Sunday or a legal holiday, upon civil process merely. All who are engaged in a wrongful interference with a person's liberty, either as principals or instigators, or those who are indirectly its cause, as by suing out illegal process, knowing it to be unjustifiable, are guilty of an unlawful arrest, and equally punishable.

The remedies for false imprisonment are adapted to secure either a restoration of the person confined to liberty, as by writ of HABEAS CORPUS (which see), or the punishment of the party who is chargeable with the wrongful confinement, as by a civil action for damages or a criminal indictment. The jealous care and watchfulness with which the right of personal liberty is protected at common law, and the numerous safeguards which have been provided to secure its unhampered exercise, are abundantly indicated by this variety of remedies, and by the strict rules which confine the power of arrest without process within narrow limits, only permitting its exercise when offences of a particularly criminal character are to be punished, and when any requirement of delay for the purpose of obtaining a warrant would be attended with danger to the welfare of the community. The high degree of civil liberty which English-speaking peoples have developed and maintained so sedulously is an outgrowth of that sense of personal independence and individuality of which the law of false imprisonment furnishes so ample and noteworthy an exemplification. GEORGE CHASE. REVISED BY T. W. DWIGHT.

False Pretences. See CHEAT, by PROF. T. W. DWIGHT, LL.D.

Falsetto. See FALSE, by WILLIAM STAUNTON, S. T. D.

Fal′ster, Danish island in the Baltic, separated from Seeland, Möen, and Laaland by very narrow straits. It is very low, entirely flat, and somewhat unhealthful, but it is very fruitful and well cultivated. It has an area of 178 square miles, and a population of 32,413. The principal town is Nykjöbing, on the Guldborgsund, between Falster and Laaland.

Fa′lun, or **Fah′lun,** town of Sweden, situated at Lake Runn, 120 miles N. W. of Stockholm. It is famous for its copper-mines, which gave Gustavus Adolphus occasion to call it "the treasury of Sweden," but at that time the mines yielded 3000 tons annually, while at present they yield only 400 tons. Pop. 4618.

Faluns, a name given to a sub-division of the miocene tertiary in the valley of the Loire, France. The Falunian beds of D'Orbigny include the *gres de Fontainebleau*—the upper portion of the eocene—and also the overlying miocene strata.

Famagos′ta, or **Famagusta,** city on the eastern coast of Cyprus. From the twelfth to the eighteenth century, while Cyprus was under the Venetian rule, Famagosta was one of the principal commercial cities of the

Levant, but now its defences, warehouses, palaces, and churches are in ruins, and its harbor is choked up by sand. It is inhabited by 200 or 300 Greeks.

Famil′iars [so called because they belonged to the official family of the inquisitor], officials of the Inquisition, whose office it was to take suspected persons and convey them to a place of confinement. Familiars received large indulgences from various popes. The office was highly honorable in the popular view, and even noblemen and their sons were willing to possess it.

Familiar Spirits [derived by some from *familia*, denoting intimacy; by others from *famulus*, denoting subjection and service], demons supposed to be in attendance upon fortune-tellers, necromancers, and the like. The original Hebrew word (אוֹב; plu. אוֹבוֹת) which is rendered in our English version *familiar spirit* or *spirits* occurs in the Bible at least fifteen times (Lev. xix. 31; xx. 6, 27; Deut. xviii. 11; 1 Sam. xxviii. 3, 7, 8, 9; 2 Kings xxi. 6; xxiii. 24; 1 Chron. x. 13; 2 Chron. xxxiii. 6; Isa. viii. 19; xix. 3; xxix. 4). The primary meaning of אוֹבוֹת, *oboth*, is *leathern bottles*, suggesting the idea of *inflation* by the familiar spirit, with some reference, perhaps, to the tricks of ventriloquism. The Hebrew word has also two secondary senses. In some of the passages referred to above it denotes the persons who "have" or employ familiar spirits; in others, it denotes the spirits themselves. For example, persons are meant in Lev. xix. 31, and spirits in Deut. xviii. 11. Nothing is said in the Bible to justify the inference that such spirits were actually in attendance upon fortune-tellers and necromancers. The Witch of Endor (1 Sam. xxviii.) was generally *supposed* to have a familiar spirit. But the coming of Samuel in answer to her incantations appears to have been more than the Witch herself was expecting. R. D. Hitchcock.

Fam′ilists, or **Family of Love,** an English mystic sect, was founded in Holland by Henry Nicholas, a native of Westphalia, and originally an Anabaptist, and was finally transferred to England near the middle of the sixteenth century. They taught that religion consists wholly in love, independently of any form of truth held and believed. Through love man could become absolutely absorbed in and identified with God in a subjective sense; that God regards not the outward actions, but only the heart; that to the pure all things are pure, even things forbidden. Nicholas, as the apostle of this "service of love," claimed, it is said, superiority over Christ, on the ground that Moses only preached *hope*, Christ *faith*, but he preached *love*. Much misrepresentation of their confession of faith (given in Strype's *Annals*, ii. 57) brought out an *Apology* in 1575, in which they seek to identify themselves with evangelical Christianity. In 1580, Queen Elizabeth instituted an investigation into their practices, and in consequence they were dispersed and their books publicly burned. They continued to flourish, however, for another century, and in 1604 petitioned King James for permission to publicly clear themselves of the charges preferred against them. This request was denied them, because they were known to have been guilty of grossly immoral practices. (Baxter, *Autobiography*, p. 77.) (See a curious book by J. R. (John Rogers) entitled *The Displaying of an Horrible Sect naming themselves the Family of Love*, London, 1579; and Knewstub, *Confutation of Monstrous and Horrible Heresies taught by H. N., etc.*, London, 1579; Mosheim, *Ecclesiastical History*, ch. xvi., § iii., p. xii., § 25; Collier, *Ecclesiastical History of England*, vi. 609; vii. 311; Hardwick, *History of the Reformation*, ch. v.; Carrière, *Philos. Weltanschauung d. Reformationzeit*, Stuttgart, 1847.) Jas. H. Worman.

Fam′ily [Lat. and Span. *familia;* Fr. *famille;* It. *famiglia*]. The word is said to have its origin in the Oscan root *famul*, which signifies a "slave." The idea of subjection is thus identified with it always. In its early use this idea was most prominent. Latin writers often use the word for the collective body of slaves owned by one master. In a wider sense they made it comprehend all, both free persons, slaves, and objects of property, that were subjected to the will of an individual head of a house. By Roman law, children and grandchildren, as well as slaves, were subject to the almost absolute power of the head of the family.

The English word properly represents a household living together under one head, including parents, children, servants, and such other persons as may have a continuous place in the association. It is also extended to embrace the descendants of a common ancestor regarded collectively; and in the widest sense mankind are spoken of as the family of Adam.

By divine ordinance the family is the germ of all human society: "God setteth the solitary in families." It is an arrangement of highest economy and efficiency to provide, by detailed responsibility and care, for the increase, nurture, and best development of the human race. It begins at the best time of life, and under the most favorable circumstances, the training of men in subjection to legitimate authority, in self-sacrifice of individual choice for a common good, in the recognition of the rights of others, in the exercise of kindness and good-will to benefit others, and so in habits most favorable to social harmony and peace and order. The family is in its ideal a little commonwealth under government of rightful authority, sustained by the bond of mutual respect and love between its members. The simplest form of government for the state is the patriarchal—just an extension of family rule and order. Hence, it is true, as Plato says, "Whatever is most excellent in the state must always begin at the fireside." Hence a nation's prosperity and civilization are best secured by influences which first pervade, and then flow from, its families. The family lies at the foundation of social science, and a prime object of that science is to promote the order, the freedom, the purity, and the refinement of social life in the family. A. L. Chapin.

Family, in zoology, indicates a group of animals intermediate between the genus and order; it is based on structural features of a more general character than the genus, while the limits are determined by the range and extent of the differential characters which exist between the typical form and the next allied: a family may therefore be monotypic (*i. e.* limited to a single known species), or exceedingly polymorphic (*i. e.* embracing thousands of species). Examples of family groups are found among mammals in the cat-like animals (Felidæ), the dog-like animals (Canidæ), and the bear-like animals (Ursidæ), in the order of Carnivora; in the horses and asses (Equidæ), the rhinoceroses (Rhinocerotidæ), the tapirs (Tapiridæ), and the hollow-horned ruminants—*i. e.* cattle, sheep, goats, and antelopes (Bovidæ)—in the order of Ungulates, and in man (Hominidæ) in the order of Primates. Inasmuch as a distinctive similarity of form is associated with the structural characters which distinguish most of these and many other families, especially of mammals, the group has been defined, by Prof. Agassiz, as the embodiment of form determined by structure. This definition, however, entirely fails in many, and even perhaps most, cases; for example, in the Unionidæ some forms are higher than long, while others are extremely elongated; and in the Primates there is a greater difference in form between some monkeys of one family than there is between others of different families. Families are therefore distinguished on account of certain differences in structure which may or may not be correlated with corresponding modifications of form. No exact criterion can be given, discrimination being a matter of judgment.

The term *family* was originally introduced by French naturalists as the vernacular equivalent of the Latin *ordo*, and in this sense it is still used by botanists—*e. g.* by Dr. Asa Gray, who combines certain forms in groups, for which he employs the word *order* as the scientific term, and *family* as the popular; thus, *Order 1. Ranunculaceæ* (*crow-foot family*). By Lamarck and Latreille, however, the two terms were restricted in meaning, the word *order* being retained in the sense in which it was employed by Linnæus, while the word *family* was re-established for a section of the order. Later (in 1811), William Kirby (*Trans. Linn. Soc.*, London, xi., p. 88) proposed that all families should have the patronymic termination *-idæ;* and this was gradually adopted, and now it is almost universally employed by zoologists. Although, strictly speaking, the use of this termination may not always be in exact accordance with grammatical purity, its great convenience as a uniform indicator of the taxonomic value of the group outweighs the objections, and has ensured its present currency. Theodore Gill.

Fam′ine [from the Lat. *fames*, "hunger"], a failure of the supply of food for any region, usually caused by drought or other climatic influences, such as excessive and unusually protracted cold in the summer of northern regions, but also liable to be produced by swarms of devouring insects, such as locusts, or by blights and diseases affecting vegetation, like the potato-rot, which produced the terrible famines of Ireland in 1846 and the years which followed. The dreadful famines which have occurred in Egypt, that most fruitful of lands, have been generally due either to deficiency or excess in the annual floods of the Nile. That of Persia (1871–72), the most terrible of modern times, was produced by the great drought of 1870. Long-continued and exhausting wars have led to famines, by breaking up the routine of farm-labor and rendering industry impossible. Great pestilences have in a like manner caused famine, while famine, in turn, has been a most fruitful cause of epidemic disease. Such a disease is the relapsing or

famine fever, or hunger-pest, which, though not remarkably destructive of life at ordinary times, becomes a great scourge in times of general want.

Famines are now much less to be dreaded than in former times. The introduction of steam-navigation, the submarine telegraph, and the other recent commercial improvements will do much to alleviate the horrors of famine; but the experience of Ireland shows the importance of a system of mixed agriculture, so that if the potato-crop or the wheat-crop should fail, some other accessory product may be at hand to take its place. The same lesson was taught in the famine of India, 1872–73, which followed the failure of the rice-crop—a failure due to atmospheric influences.

Fan [from the Ang.-Sax. *fánn*, allied to the Latin *vannus*], an implement used to agitate the air for coolness, seems to have been in use from the remotest times with all people living in hot or warm climates. China, however, is generally called the fatherland of the fan, and there and in Japan it is as indispensable to a gentleman as his boots. It is used in all different ways, even as a newspaper, since on important occasions news, libels, and political caricatures are transmitted on it. During the riots when missionaries were attacked at Pekin in 1873, popular ill-feeling was excited by inflammatory pictures on fans; and the first locomotive-engine seen in Japan was promptly published in the same manner. Also is the common Chinese palm-leaf fan generally supposed to be the oldest form of this implement, as it is still by far the best for simple utility. It is manufactured in immense quantities in China, especially at Canton and Nankin, where also fans of great elegance are produced from bamboo, palm leaf, silk, sandal-wood, tortoise-shell, and ivory. A very singular style of Chinese fan consists of a round paper disk mounted in a split handle on a pivot like a wheel. When not in use it is turned around and folded up, so as to make a straight stick. In Persia, Egypt, Greece, and Rome fans were known at a very early period, and in each country they attained great elegance. The Egyptians knew the peculiar fan made of a bird's wing extended, and so beautifully manufactured by the Chippeway Indians and in England. From a passage in Euripides it appears that Greek fans were round and made of feathers, and when the Greeks obtained the peacock (about 500 B. C.) they began to use its plumes for fans. In Herculaneum there is a fresco representing a youth holding a peacock fan, and in an ancient representation of the twelve months, published by Lambecius, one of the same kind hangs up by the genius of August. The Roman fan for ladies was often made of thin tablets of perfumed wood, and as branches of myrtle, acacia, and palm were the first fans or materials for them, these shapes were preserved in imitations for centuries. A fan with a wooden handle, and a *feuille* provided with a picture of a love-affair or a view of a city, with a corresponding inscription, was much in use in Italy during the Middle Ages. In a work of costumes which appeared at Venice in 1664, containing several hundred dresses, especially the Lombard from the eleventh century, women often hold fans, some of them of very eccentric shapes. The *tuft*-fan of peacock's feathers was set on an ivory handle adorned with gems, and one like this, but with a horse's tail, appears on the sculptures of Persepolis. In a volume of Italian costumes of the Middle Ages in the *Wolfenbüttel Library* (A. L. Millen) fans may be seen made of the feathers of parrots and many other kinds of birds. In Queen Elizabeth's wardrobe twenty-seven fans are enumerated, one of which cost £40, and about 1660 the manufacture of this article was quite extensive in England, as appears from a petition of the fan-makers, who complained that 550,000 fans having lately been brought over, "great numbers of poor people, continually employed in the work, must perish unless a stop be put to the importation." In the twelfth year of the reign of Charles II. a protecting duty of 40*s*. per dozen was imposed on fans, and the importation of all painted fans was prohibited. The folding fan was introduced in France by Catharine de Medicis, and under Louis XIV. the manufacture became a great industry. Those who exercised it formed a corporation, established in 1673, and four years of apprenticeship were required, though the masters who made this regulation wisely set it aside in favor of their own sons or of any man who should marry their daughters or widows. One of the most original patterns of French fans was the so-called Pompadour, consisting of brins without *feuilles*, and forming, when opened, a beautiful oval. During the Revolution fans went out of fashion, but in this century, especially of late, the manufacture has again become very prosperous. Large quantities of costly fans are produced in Paris, made of what is called chicken skin (a very thin yet tough preparation of kid skin), satin, gauze, tulle, crape, or parchment, and provided with beautiful pictures by great artists, such as water-colors by Marie Bonheur, A. Soldé, Edouard Moreau, Tony Faivre, and others, priced at from £50 to £130. Large numbers of these fans are exported to Spain, where the fan is as essential an article as in China or Japan. The native Spanish product, however, is rather coarse and ungainly, and, although Spain has laid a heavy duty on French fans, the Spanish workmen are yet not able to compete with the French. A curious but very elegant exhibition of fans was held at the South Kensington Museum, London, in 1870. The empress of France, who had been instrumental in developing this branch of industry, as of all kinds of luxury in dress, sent to it all her finest fans, thirty-four in number. An illustrated catalogue of this exhibition was published at London. In the U. S. the production of anything beyond the cheapest grades of paper fans is one of our more recent enterprises. The character of the cheap goods, palm leaf, paper, etc., is well known, but the ivory, bone, and composition fans have been among the rarer Oriental luxuries. We have imported very largely a variety of grades of fans of what are known as the wood stick, as well as ivory, pearl stick, and bone fans, from France; our importation of these, mostly in muslin, linen, silk, and satin, decorated or plain, amounting to about 2,000,000 francs ($400,000) per annum. We have also imported large quantities of the finest leather fans from Austria, in kid and imitation or genuine Russia leather. The attempt to compete in our market with the European manufacturers is of recent date, and met at first with serious difficulties. In this, as in most articles of luxury, the popular prejudice was strongly in favor of imported goods. Our people are very slow to be convinced that any description of fancy goods or articles of luxury can be made as well and as tastefully here as abroad. At first the carving, perforating, and polishing of the sticks were done by hand, by slow and laborious processes. But ingenious machines have been invented, working rapidly and with great precision. Also the painting and decoration are now carried to such perfection by American manufacturers that they are able to compete successfully with the finest imported painted fans. According to the census of 1870, there were then six fan manufactories in the U. S., employing 117 hands, $28,000 capital, paying $23,426 wages, using $37,179 of material, and producing 92,000 fans of all sorts. Of these, two were in Massachusetts, employing 59 hands and $17,000 capital, paying $8740 wages, using $21,989 of raw materials, and producing $43,000 worth of fans; two were in New York, employing 16 hands and producing $22,000 worth of fans; and one each in Connecticut and New Jersey, employing together 42 hands and producing $26,500 worth of fans.

CHARLES G. LELAND.

Fana'riotes [from *Fanar*, one of the quarters of Constantinople where they dwell—from φανάριον, the "beacon" there situated], a body of Constantinopolitan Greeks who claim a noble Byzantine descent. Spared by the Turkish conquerors, they artfully insinuated themselves into public affairs, and until 1822 held many important civil, military, and naval positions, in which they displayed, as a rule, selfish and ungenerous qualities. Their power as a class is now completely broken.

Fan'cy [from *phantasy*, the Gr. φαντασία, from φαίνω, to "show"], a term used by philosophers, sometimes as synonymous with IMAGINATION (which see), but the better practice would appear to conform more or less closely to that of Dugald Stewart, who says: "The office of this power is to collect materials for the imagination; and therefore the latter power presupposes the former, while the former does not presuppose the latter. . . . It is the power of fancy which supplies the poet with metaphorical language, and with all the analogies which are the foundation of his allusions; but it is the power of imagination that creates the complex scenes he describes and the fictitious characters he delineates. To fancy we apply the epithets of rich or luxuriant; to imagination, those of beautiful or sublime." Others make the two powers the same, but call it imagination when its exercise conforms more nearly to nature—fancy, when its exercise is more extravagant and unrestrained.

Fancy Creek, tp. of Sangamon co., Ill. Pop. 1195.

Fancy Gap, post-tp. of Carroll co., Va. Pop. 1530.

Fandan'go, a national dance of Spain and Spanish America, usually in 3-4 or 6-8 time. It is thought by some to have been introduced by African slaves into the colonies, and thence carried to Spain. It is danced generally to the guitar and the castanets, and is a favorite dance with the people.

Faneuil (PETER), merchant of Boston, Mass., was b. of a French Huguenot family at New Rochelle, N. Y., in 1700. In 1740, at a public meeting in Boston, he offered to erect a suitable edifice for a public market-house at his

own expense and give it to the town. Faneuil d. at Boston Mar. 3, 1743.

Faneuil Hall, in Boston, Mass., was built by Peter Faneuil in 1742, and given to the town. It was burned in 1761, its walls of brick remaining. It was rebuilt at the expense of the town. It is called the "Cradle of Liberty," from the fact that the "Sons of Liberty" held many meetings there during the early years of the final struggle of the colonies with the mother-country. The British troops, during the occupation of the city, used it as a theatre. In 1805 it was made forty feet wider and one story higher. The hall, which is used for public meetings, is now about eighty feet square, and contains several good paintings. Its vane, in the form of a grasshopper, was copied from that of the Royal Exchange, London. A grasshopper was the crest of Sir Thomas Gresham, the founder of the Royal Exchange.

Fanfa'ni (Pietro), b. at Pistoia in 1817, became well known as a writer on philological subjects, and has also produced some novels and tales for children. In 1859 became director of the Marucellian Library at Florence.

Fanfare [Fr.; Sp. *fanfarria*], a loud flourish of trumpets, or any short, lively military air played upon brass instruments.

Fani'no, or **Fan'nio** (Faventino), one of the earliest martyrs during the reformatory period in Italy, was a native of Faenza, then in the Papal dominions; was won over to the Protestant cause by the reading of the Scriptures (probably Brucciolí's version, 1532) and of Protestant apologies, and became so enthusiastic for the new religion that he gave himself to proselyting efforts, which came to the ear of the ecclesiastics, and he was imprisoned. Being the head of a family, he was persuaded to recant for the sake of his wife and children. Upon his release, however, he became dejected in mind, and found peace only in the resolve to openly battle for liberty of conscience; and he set out on a tour through the Romagna, preaching everywhere the Reformed religion. He was arrested in 1548 at Bagna Cavallo, and conducted in chains to Ferrara. During his imprisonment he was visited by many distinguished Italians, among them the princess Lavinia della Rovere and Olympia Morata, who were edified by his instruction and prayers, and took a deep interest in his fate. But his repeated and emphatic refusals to recant caused his condemnation to the stake by Pope Julius III. Fanino was strangled at dawn, and his body burned at noon in Sept., 1550. (See for interesting details Young, *Life of Paleario*, ii. 111; McCrie, *History of the Reformation in Italy*, pp. 259–261.) Jas. H. Worman.

Fan'net, tp. of Franklin co., Pa. Pop. 2146.

Fan'nettsburg, post-v. of Franklin co., Pa., 17 miles N. W. from Chambersburg.

Fan'nin, county of Georgia, bounded on the N. by North Carolina and Tennessee. Area, about 300 square miles. The surface is broken by mountains. Gold, iron, and marble of excellent quality are found. Corn and dairy products are the agricultural staples. Cap. Morganton. Pop. 5429.

Fannin, county in the N. of Texas, on the Red River. Area, 900 square miles. Cattle, grain, tobacco, hemp, cotton, and fruit are produced. The lands are mostly extremely fertile prairie and bottom lands. Cap. Bonham. Pop. 13,207.

Fannin (James W.), Colonel, Texan, was b. in North Carolina, fought in the war for Texan independence, and was one of 357 prisoners shot at Goliad by order of Santa Anna, the Mexican general, Mar. 27, 1836.

Fan'ning (Alexander C. W.), lieutenant-colonel in the U. S. army, was b. in Massachusetts 1788, graduated at West Point Military Academy 1812, was lieutenant Third Artillery, Mar. 1812, captain Mar. 13, 1813, was made brevet major for gallant conduct in the defence of Fort Erie Aug. 15, 1814, major Fourth Artillery Nov. 3, 1832, brevet colonel for meritorious service in battle near the Wethlacoochie and in defence of Fort Mellon, Fla., Feb. 8, 1837, and lieutenant-colonel Fourth Artillery Sept. 16, 1838. D. at Cincinnati, O., Aug. 18, 1846.

Fanning (Col. David), b. in Wake co., N. C., about 1756; became the leader of a band of Tories or "loyalists," chiefly of Chatham and Randolph counties, who during the later years of the war of the Revolution performed in Central North Carolina many daring exploits, tarnished by wholesale cruelty and the desolation of settlements. In 1781 he took the town of Pittsborough, and soon after Hillsborough, then the State capital, carrying off Gov. Burke and his whole suite. He was one of the three persons excluded by act of the North Carolina legislature from the amnesty proclaimed after the peace; escaped into Florida, traded with the Indians, made his way to New Brunswick, and thence to Digby, N. S., where he d. in 1825. He wrote a curious *Autobiography*, which was copied in 1860 by Porter C. Bliss, and printed in limited number at Richmond, Va., in 1861, as vol. i. of *Historical Records of the Old North State*, with introduction by Col. John H. Wheeler and T. H. Wynne, and instructive notes by ex-Gov. David L. Swain. A 2d ed. of 100 copies was printed by J. Sabin, New York, 1865.

Fanning (Edmund), LL.D., American Tory in the Revolution, was b. on Long Island 1737; graduated at Yale College 1757, settled in Hillsborough, N. C., and became colonel of Orange co.; took part against the people in their struggle for independence of Great Britain, raising and commanding the king's American regiment of foot. After the war he was appointed councillor and lieutenant-governor of Nova Scotia and governor of Prince Edward's Island (1786–1805) by the English. He was successively major-general, lieutenant-general, and general in the British army, and d. in London Feb. 28, 1818.

Fan'ning-machine, or **Fanning-mill,** an agricultural implement for winnowing grain. Anciently, the wind was the agent chiefly employed for separating chaff and dirt from grain; and the *mystica vannus Iacchi*, like the winnowing-fan of the Bible, seems to have been at first a mere shovel for throwing up the grain and exposing it to the action of the wind. The artificial combination of sieves and fans which now makes the farmer independent of the uncertain action of the wind is a Dutch invention, probably of no great antiquity. There have been many improved forms invented, particularly in the U. S.

Fan'nius (Caius) **Stra'bo,** son-in-law of Lælius, is introduced by Cicero as one of the speakers in his works *De Amicitia* and *De Republica*. Served in the third Punic war under Scipio Africanus (B. C. 149–146). Was distinguished as an orator, and was one of the earliest Roman historians who wrote in Latin. His *History* treated of contemporary events, and the eighth book is referred to, though the extent is not known. The few fragments remaining are collected in Krause's *Hist. Rom. Fragm.*, pp. 173–174. (See Gerlach, *Geschichtschreiber der Römer*, pp. 70–71.) This Fannius is often confounded with C. Fannius Strabo, who was consul B. C. 122, and from whose speech on the allies and Latins, directed against Gracchus (praised as good and noble by Cicero), certain fragments are preserved. These are given by Meyer, *Orat. Rom. Fragm.*, pp. 199–200. H. Drisler.

Fa'no, town and seaport in Central Italy, in the province of Urbino e Pesaro, on the shore of the Adriatic, lat. 43° 51' N., lon. 13° 1' E., 30 miles N. W. of Ancona. It is a well-built and beautifully-situated town, containing many splendid paintings by Domenichino and Guido, and the remains of a triumphal arch of white marble erected in honor of Augustus. Pop. 6901.

Fans, a cannibal race found upon the Gaboon River in equatorial Africa. They are coffee-colored, have rather thin lips, and are slight of frame. They eat their own dead, and purchase the dead of other tribes as food, use poisoned arrows and the cross-bow, and are fast becoming the dominant people of that region, where they first appeared since 1847.

Fanshawe, or **Fanshaw** (Sir Richard), D. C. L., English diplomatist and translator, b. at Ware, in Hertfordshire, 1608, studied at Cambridge, and was minister resident at the court of Spain under King Charles I. of England. He was a royalist, and at the battle of Worcester, 1651, was taken prisoner and kept captive for years. Was privy councillor of Ireland 1661, the same year ambassador to Portugal, and negotiator of the marriage between Charles II. and the princess Catharine. In 1664 was ambassador to Spain, and died at Madrid June 16, 1666. His translations were those of Guarino's *Pastor Fido*, *The Lusiad* of Camoens, etc.

Fantail. See Pigeon.

Fanta'sia [Fr. *fantasie;* It., Span., Port., and Lat. *fantasia*], in music, a species of composition nearly identical with the cappriccio, in which imaginative and fluent writers express their thoughts with the highest freedom compatible with an observance of the fundamental laws of harmony. Originally, the fantasia was probably nothing more than simple improvisation—a transient, unstudied, and unwritten effusion of the performer's fancy. But as extempore playing naturally leads to the recording of the ideas, themes, and general course of thought pursued in any successful effort, the transition was easy to the writing, at leisure, of compositions resembling improvisations in peculiarities of movement, form, modulation, expression, and harmony. In many of these compositions

writers give free play to the impulses of a luxurious fancy, regardless of method and design, but still preserving a certain continuity of outline amid much that is wild, rugged, and abrupt. The term "fantasia," however, is now often given to compositions which are perfectly regular in time and harmony, and even more symmetrical in their structure than many pieces not so designated. WILLIAM STAUNTON.

Fan'tee, or **Fan'ti,** is the name of a tribe, and of the country it inhabits, in Western Africa, on the coast of Guinea. The country consists of a small strip of land extending along the Atlantic from the Sakum on the E. to the Kaku on the W., and separated N. from the dominions of the Ashantees by a belt of impenetrable forests crossed only by a few narrow and intricate paths. But this strip of land is very fertile, densely peopled, and rich in gold-dust. The inhabitants belong to the same family and speak nearly the same language as the Ashantees, though they are inferior to them both in skill and vigor. They succeeded, however, in defending their independence. They started an individual civilization. They built large cities, such as Yankumasi, Abrah, Annamabu, etc., and they began trading and manufacturing. But early in this century they came in contact with the English, who built a fort and established a commercial station at Cape Coast Castle. Their labor became subservient to English enterprise and speculation. Their political organization became weakened and almost dissolved under English influence and authority. Their civilization faded away, and they became a prey for the Ashantees, who in their turn were conquered by the English. (See ASHANTEE.)

Fantoccini. See PUPPETS.

Fan-tracery, a species of vaulting peculiar to the English Gothic of the fifteenth century and later times, characterized by divergent ribs, which spring from the cap of the shaft and radiate at equal intervals with a uniform curvature, and terminate in the ribs of the roof. Between the divergent fan-ribs there are cusps and foils, forming a rich tracery, whence the name.

Fan'wood, a v. of Westfield tp., Union co., N. J., on the Central R. R. of New Jersey, 21½ miles W. S. W. of New York. Here is Fanwood Park, and the residences of persons doing business in New York. It is surrounded by beautiful scenery. The post-office name is SCOTCH PLAINS.

Far'ad [from *Faraday*], the unit of quantity in electrometry. It is the quantity of electricity with which an electro-motive force of one *volt* would flow through the resistance of one *megohm* in one second. One farad per second is the British Association's unit of current. A million farads equal one megafarad. One farad contains a million microfarads. Some electricians name the common farad *microfarad,* and call the ordinary megafarad by the name of farad.

Far'aday (MICHAEL), D. C. L., F. R. S., was b. at Stoke Newington, a suburb of London, Sept. 22, 1791. He d. on Hampton Court Green, in a house presented to him for his lifetime by the queen, on Aug. 25, 1867. His education he describes as being "of the most ordinary description, consisting of little more than the rudiments of reading, writing, and arithmetic." His hours out of school were passed at home or in the streets. The love of nature, which was with him so deep, was ancestral instead of individual. In 1804 he went as an errand-boy to a bookbinder named Ribeau, his father's homely dwelling being in Jacob's Well Mews, close by. In 1805 he was taken as an apprentice. One line of his indentures reveals the moral stuff out of which the future philosopher and gentleman was made: "In consideration of his faithful service no premium is given." He read many of the books he bound. He mentions specially Mrs. Marcet's *Conversations on Chemistry* and the articles on electricity in the *Encyclopædia Britannica.* He also made electrical experiments, and went occasionally to evening lectures on natural philosophy given by a Mr. Tatum at 53 Dorset street, Fleet street. The charge was a shilling a lecture, and his elder brother's purse often helped him here. To enable him to draw the apparatus employed by Mr. Tatum he took lessons in perspective. It was his habit to enter in a note-book jottings of such volumes, papers, and magazines as interested him. This he called his "philosophical miscellany." It was intended "to promote both amusement and instruction, and also to corroborate or invalidate those theories which are continually starting into the world of science."

His letters to his friend Benjamin Abbott show him to be occupied during his leisure hours with electrical experiments. The friends work at the same subject and discuss their results. Alertness and tenacity are the traits which mark Faraday. He holds his convictions resolutely and defends them cleverly. But his letters are even less remarkable for the keenness of his logic than for the courtesy of his style. Nature sends into the world beings physically beautiful and physically ugly, subsequent culture making but comparatively small impression upon her firm outlines. So it is in the intellect and morals; in respect to which beauty and nobleness were potential in Faraday at his birth, requiring but the smallest stimulus from favoring circumstance to unfold them into actual life.

After his apprenticeship he worked for a time as a journeyman bookbinder. And now we come to the hinge of circumstance on which his life turned. Davy was giving his last course of lectures at the Royal Institution. Faraday was taken to hear them by a Mr. Dance, to whom and to the event he thus subsequently refers: "Under the encouragement of Mr. Dance I wrote to Sir H. Davy, sending as a proof of my earnestness the notes I had taken of his last four lectures. The reply was immediate, kind, and favorable. After this I continued to work as a bookbinder, with an exception of some days, during which I was writing as an amanuensis for Sir H. Davy."

On Mar. 18, 1813, Davy reported to the managers of the Royal Institution his engagement of Faraday at weekly wages. He travelled subsequently with Davy on the Continent, returning to the institution in 1815. On the Continent he saw many interesting experiments and made the acquaintance of many distinguished men. Even in those days, when he was fresh from the press of the bookbinder, there must have been something remarkably cultivated in his demeanor. During the journey, however, the independence of his character often blazed out into resentment against Lady Davy, who wished to treat him as an underling. Davy himself, though yielding for the sake of quietness to the caprices of his wife, was always considerate and kind. After his return, Faraday became connected with the City Philosophical Society, where he sometimes lectured to the delight of all hearers.

Three years after his appointment in the Royal Institution he made his first published contribution to science: it was an analysis of some caustic lime from Tuscany. Under Davy's advice and encouragement he thus began. Both skill and insight are revealed by a short paper on sounding flames published in 1818. Other smaller contributions followed. Mr. Brande was at that time lecturer on chemistry, and his occupation was described by his hearers as "lecturing on velvet," so skilfully, quietly, and effectively was he assisted by Faraday. In 1820 a chemical paper opened the long series with which Faraday subsequently enriched the *Philosophical Transactions.* On June 12, 1821, he married, and an entry made by himself six and twenty years subsequently shows how he regarded the most important occurrence of his life: "Amongst these records and events I here insert the date of one which, as a source of honor and happiness, far exceeds all the rest. We were *married* on June 12, 1821. M. FARADAY."

Œrsted's discovery in 1820 directed all minds to the interaction of magnetism and electricity. In 1821, Faraday wrote *A History of the Progress of Electro-Magnetism,* and thus prepared, he succeeded on Christmas morning, 1821, in making a magnetic needle rotate round a wire carrying an electric current. To Faraday's intense annoyance, it was whispered that he had plagiarized the experiment from Wollaston, but he completely cleared himself of this charge. Jointly with his friend Mr. Stodart he conducted experiments on the alloys of steel; and I still possess a razor given to me by Faraday, formed from one of his alloys. In 1823 he liquefied chlorine and other gases, and hence originated a difference between him and Davy which everybody must regret, but which, in my opinion, involved not a shade of dishonor on either side. In 1824, Faraday was elected a fellow of the Royal Society. In 1825 and 1826 he published chemical papers in the *Philosophical Transactions.* In one of these he announced the discovery of benzol, which afterward became the basis of our splendid aniline dyes. From 1825 to 1829, in conjunction with Herschel, he tried to improve the manufacture of glass for optical purposes. Practically considered, this investigation was a failure, but the "heavy glass" they produced led afterward to two of Faraday's greatest discoveries. It was at this period that the respectable artilleryman, Anderson, who subsequently became such a prominent figure in Faraday's lectures, was engaged as an assistant.

Disciplined and strengthened by his previous work, Faraday, in 1831, made his great discovery of magneto-electric induction, opening thereby a vast and novel electrical domain. Enigmas which had previously challenged and defeated the efforts of the greatest men ceased to be enigmas. The magnetism of rotation, for example, discovered by Arago and experimented on by Babbage and Herschel, was shown to be due to a special manifestation of Faraday's induced currents. It is needless to say that all our induction coils, our medical machines, and the electric light so far as it has been applied to lighthouses, are the direct

progeny of Faraday's discovery. In the paper here referred to he for the first time calls the "magnetic curves" formed when iron-filings are strewn around a magnet "lines of magnetic force." All his subsequent researches upon magnetism were made with reference to those lines. They enabled him to play like a magician with the magnetic force, guiding him securely through mazes of phenomena which would have been perfectly bewildering without their aid. The spark of the *extra current*, which I believe was noticed for the first time by Prof. Joseph Henry, had been noticed independently by Mr. William Jenkin. Faraday at once brought this observation under the yoke of his discovery, proving that the augmented spark was the product of a secondary current evoked by the reaction of the primary upon its own wire.

The desire to refer diverse natural energies to unity of principle is the strongest of the scientific mind, and soon after the period at which we have now arrived Faraday illustrated this desire by his attempt to prove experimentally the "identity of electricities." He operated upon the electricities of the machine, the pile, the gymnotus, the torpedo, thermo-electricity, and magneto-electricity, examining and comparing their phenomena in various ways, and finally deciding in favor of their identity. He then passes on to electric decomposition, both by the machine and the pile. The amazing difference in point of "quantity" and "intensity" is strikingly brought out; Faraday concluding, though he is almost afraid to publish the conclusion, that the amount of electricity involved in the decomposition of a single grain of water equals that produced by 800,000 discharges of his large Leyden battery. In May, 1833, he published a paper on a *New Law of Electric Conduction*, in which he forcibly shows the influence of the "state of aggregation" on the transmission of the current. Water, for instance, allows the current to pass—ice does not. Why? This leads him to a profound consideration of the subject of electrolysis. Again, in June, 1833, he published a paper on this subject, profoundly thoughtful and profoundly skilful at the same time. While holding fast to his general line of thought, he did not close his eyes to the smaller offshoots from his great inquiries: with such an offshoot, *On the Power of Metals and other Solids to Induce the Combination of Gaseous Bodies*, he closed his labors in 1833.

But these researches, considered in the light of subsequent achievements, take rank as mere preliminary disciplines, leading him to the final establishment of the great doctrine of "definite electro-chemical decomposition." He measures the strength of his currents by their chemical action in his voltameter, comparing the quantity of this action with that of other chemical actions in his circuit. He includes in the same circuit water and fused chloride of tin, and finds that for every atom of hydrogen and oxygen liberated in the one cell, there is an atom of tin liberated in the other. "Both the water and the chloride were broken up in proportions expressed by their respective chemical equivalents. The amount of electricity which wrenched asunder a molecule of water was competent, and neither more nor less than competent, to wrench asunder the constituents of a molecule of the chloride of tin." The fact is typical. With the indications of his voltameter he compared the decompositions of other substances, both singly and in series. He submitted his conclusions to numberless tests; he purposely introduced "secondary actions;" as a true son of science, he endeavored to hamper those very laws which it was the intense desire of his mind to see established. From all these difficulties, however, emerged the truth, "that under every variety of circumstance the decompositions of the voltaic current are as definite in their character as those chemical combinations which gave birth to the atomic theory."

With regard to the origin of power in the voltaic pile scientific opinion had been divided. Volta found the source of power in the contact of heterogeneous metals, and he proved beyond a doubt that electricity arises from such contact. But it would be difficult at the present day to enter into the state of mind which could accept simple contact as the origin of the floods of energy obtainable from the pile. Faraday could not help taking a side here. His experience had showed him that chemical action was the invariable accompaniment of the current; it had led him to conclude that the one was proportional to the other, and therefore forced upon him the conviction that the "contact theory," as maintained by Volta, was a delusion. The origin of power in the pile he referred to its chemical actions. He thus became the strongest pillar of the "chemical theory," which had been previously enunciated by Fabroni and Wollaston. His researches in frictional electricity occupied him from 1836 to 1838. Here he enters with keen insight into the subject of conduction and induction, regarding both from a wholly original point of view. To this hour these questions, to the advantage of Faraday's notions, engage the attention of experimental philosophers. One of his principal results here is the establishment of the specific inductive capacity of insulators—a subject of supreme importance in connection with submarine cables. As a striking illustration of Faraday's insight, it may be mentioned that as early as 1838 he had virtually foreseen and predicted the retardation produced by the inductive action between the wires of submarine cables and the surrounding sea-water.

Toward the close of 1840 he suffered the penalty of all great workers, who first learn the limits of their powers by transgressing them. Faraday broke down, and for two years was prohibited from working. He went to Switzerland in 1841, and slowly improved after his return. He knew that polarized light was a most subtle investigator of molecular condition, and he had tried it frequently in investigating the state of electrified bodies. Though baffled oft, his thoughts on his return from Switzerland returned to the subject. He placed a piece of his heavy glass between the poles of an electro-magnet. Including both magnet and glass between two Nicol's prisms, he sent a beam of light through the system. When the Nicols were parallel the light was transmitted—when they were crossed the light was cut off. On exciting the magnet in the case of the crossed Nicols, the light was instantly transmitted, and one of the Nicols had to be turned through an angle depending on the strength of the magnet and the length of glass traversed to again quench the light. The experiment proved that by the act of magnetization "the plane of polarization" is caused to rotate. Faraday proved the direction of the rotation to be determined by the polarity of the magnet, being reversed when the polarity is reversed. He also proved that the voltaic current exercised a similar power. He pointed out the difference between this effect and the rotation of the plane of polarization by quartz and certain other bodies, and entitled his discovery "the magnetization of light."

This was the first reward of Faraday's long and apparently futile inquiry on the manufacture of optical glass. His second reward was the discovery of diamagnetism, the name given to a force of repulsion exerted by a magnet on the great majority of known bodies. He called it diamagnetism because an elongated diamagnetic body acted upon by a magnet sets *across* the lines of magnetic force, while a paramagnetic body, like iron, sets parallel to the lines of force. He pushed his inquiries in diamagnetism into the heart of the subject, exploring it experimentally in all directions. Faraday's antecedent culture and his notions regarding molecular force are strikingly illustrated by this inquiry and the subsequent one on magno-crystallic action.

To these discoveries succeed his investigations on the magnetism of gases, his elaborate papers on atmospheric magnetism, his speculations on the nature of matter and force, and his researches on "lines of magnetic force, their definite character, and their distribution within a magnet and through space"—inquiries marked by profound insight and illustrated with refined experimental skill. "Taking him for all in all, it will, I think, be conceded that Faraday was the greatest experimental philosopher that the world has ever seen; and I would hazard the opinion that the progress of future research will tend not to diminish but to enhance the labors of this mighty explorer."

It might perhaps be considered culpable on my part if I omitted to state that this extraordinary man, in whom force of intellect and beauty of character were so wonderfully united, drew his spiritual nutriment from his faith as a Christian. In reply to a question of Lady Lovelace (Byron's "Ada"), Faraday thus renders an account of his religious position: "There is no philosophy in my religion. I am of a very small and despised sect of Christians, known, if known at all, as *Sandemanians*, and our hope is founded on faith that is in Christ. But though the natural works of God can never, by any possibility, come in contradiction with the higher things that belong to our future existence, and must, with everything concerning Him, for ever glorify Him, still, I do not think it at all necessary to tie the study of the natural sciences and religion together; and in my intercourse with my fellow-creatures that which is religious and that which is philosophical have ever been two distinct things." JOHN TYNDALL.

Faradiza'tion, in medicine, the application to the animal frame of the Faradic or induction electricity. Faradic electricity (named from Faraday, who thoroughly studied this force) is obtained from a variety of apparatuses called batteries—some magneto-electric, composed of a revolving magnet and coils of wires, others of a "cell" (giving a galvanic current) and coils. In cell-batteries the current of the cell never reaches the patient; each current delivered by the battery is distinct (not continuous with any

other), and is the result of induction—*i. e.* the production of electricity in a conductor by its adjacency to another current. The batteries in common use give primary, secondary, or ternary currents (so named because of their derivation from a first, second, or third coil). The coils added to the first are progressively made of finer and longer wire, and yield currents not essentially different, but stronger. We owe to Dr. Duchenne of Paris the best methods for making use of Faradism in therapeutics. It is used for two purposes: (*a*) to produce muscular contractions (passive exercise); (*b*) to excite the nerves of sensation. The first object may be attained in two ways—first, by placing both electrodes (ends of insulated conductors armed with sponge, of various shapes) upon the moistened skin covering the muscles we wish to cause to contract; or, second, by placing one electrode as above and the other over the nerve-trunk which sends branches to that muscle. To excite the nerves of sensation, a portion of skin should be made dry by means of starch-powder, a wire-brush electrode held upon or drawn lightly over this dry skin, while the other sponge electrode is held (wet) on the integument not far away. The current can be made to reach the internal organs (bladder, uterus, etc.) by means of peculiarly shaped electrodes. The popular use of Faradism by holding both electrodes in the hands is worthless. E. C. SEGUIN.

Farallo′ne Islands, a group of six small lofty and rocky islands of the Pacific, lying 30 miles W. by S. of the Golden Gate, or entrance to San Francisco Bay, Cal. They are owned by a company, which here collects the eggs of the gull and the murre, a sea-bird of the auk family. These eggs are furnished in great numbers for the San Francisco market. The south-easternmost and largest island (lat. 37° 41′ 49″ N., lon. 122° 59′ 5″ W.) has a lighthouse, with a flashing white light of the first order, 360 feet above the sea. The islands breed great numbers of rabbits, and their coasts abound in sea-lions. They are in San Francisco co., Cal.

Farce [Lat. *farcio*, to "stuff," so called from its varied ingredients] is the name of a peculiar kind of comedy in which the characters are without psychological truth and the plot without moral impression. When in a comedy the *dramatis personæ* are not characters representing complete mental organisms, but figures representing only one single feature of the human mind, and when the situations of which the plot consists are formed without any intention of imitating life, but so as to show off this single mental feature in its most extravagant appearance, a high degree of comical effect can be attained; and there is in the principle itself on which the farce rests no reason why its comical effect should not be accompanied with perfect elegance and gracefulness. The farce originated in the southern European countries from rustic festivities, in which masks and every other description of disguise were used. There are traces of it in the so-called Fabulæ Atellanæ, far back in the days of the old Roman republic, and we meet it every now and then during the Dark Ages, until in the sixteenth century it enters the stage, where it led a brilliant life under the name of *commedia dell' arte*, as a kind of improvised drama. Molière introduced it among the arts. Many of his plays are simply farces. But after his time it was utterly neglected, and sank down to be low comedy, comedy for the mob, and it showed no signs of revival until the middle of the nineteenth century. But at our time it seems once more to come to the foreground. The present French farce is often indecent, but its mirthfulness cannot be denied. It needs only some purification to be brilliant art. And here in America the "minstrels" often perform small farces which are exceedingly comical, without indulging in improprieties. CLEMENS PETERSEN.

Far′cy, the more chronic form of glanders, a disease attacking horses, asses, and mules, and from them transmissible to men. This disease is highly contagious, and thus far generally incurable. Farcy differs from glanders in having a slower course, and is characterized by the formation of tumors involving the glands of the lymphatic system alone ("button farcy"), the glands and the adjacent areolar tissue ("bud farcy"), or the lymphatic vessels ("farcy pipe"), and is followed by fever. Where farcy runs a somewhat rapid course it is generally fatal; while if its course proves very slow, a recovery may be looked for, at least in man. Glanders, however, which is the same disease, primarily attacking the nasal mucous membrane instead of the lymphatics, is almost always fatal. The treatment of acute cases is palliative chiefly; that of very chronic ones is expectant, the strength being maintained by nutritious food. In horses the disease is most common in those which are overworked, exposed to the weather, and kept in ill-ventilated stables. Farcied horses should be killed at once, without any attempt at treatment. (See GLANDERS.)

Far′del-bound, a disease of sheep and neat cattle, known in its milder form as "loss of cud." The animal refuses to chew the cud, is stupid, feverish, has a dry nose, and sometimes grunts as if in pain. The disease is an irritation or inflammation of the third stomach (*omasum*, many-plies, or fardel), the folds of which are dry and often inflamed. Sometimes this organ is impacted with food. The treatment is gentle purgation, as with Epsom salts, followed by liquid food, such as mashes sweetened with molasses and flavored with a little ginger. As a preventive, avoid the use of coarse and overripe hay. The animal will generally recover within three weeks.

Fareham, town and sea-bathing place of England, in the S. of Hampshire, on a creek of Portsmouth harbor. Pop. with surroundings, 10,796.

Farel (GUILLAUME), the boldest of the French Reformers and father of Swiss Protestantism, was b. in 1489 in a little hamlet near Gap in Dauphiny. His parents, of noble descent and pious Romanists, subjected him to rigid religious training, and intended him for the army. But William gave himself to study, and when all opposition seemed fruitless he was suffered (about 1500) to set out for Paris, there to study philosophy, Greek, and Hebrew at the university. The shining light of the Paris school was, at that time, the brilliant Lefèvre d'Étaples, around whom were gathered disciples from every country. Young Farel became one of the most devoted of these. This illustrious connection was, moreover, the means of withdrawing Farel from obscurity, and securing him a large circle of acquaintance, and a chair in the College of Cardinal le Moine. Gradually, however, Lefèvre's influence declined and Farel's hold weakened. Lefèvre had espoused the doctrine which became the corner-stone of the Reformed structure—justification by faith—and had dared to declare the Bible the sole guide of the Christian. The Sorbonne condemned these innovations, and Parliament pronounced against them. Farel had accepted the views of his instructor, and was therefore in danger from persecution. In 1521, Lefèvre retreated to Meaux, but Farel remained in the capital, and for a time boldly continued to maintain his cause with professors, priests, students, and citizens wherever he could do so, in the university and in the city. The doctors of the Sorbonne, however, proved the stronger party, and Farel soon found it expedient to join Lefèvre at Meaux. Here, also, persecution found them out, and "the heretics of Meaux" were obliged to quit the town. Farel dared to return to Paris, but, finding himself in great danger, retired to Dauphiny. His three brothers became converts, and many adherents were gathering when the authorities, civil and ecclesiastical, combined against him, and he was obliged to quit the vicinity of Gap. He now visited other parts near the foot of the Alps and labored successfully. His life becoming endangered, he crossed over, early in 1524, into Switzerland, where he was warmly welcomed by the Reformers. He tarried for a while at Bâle, making his home with the learned Œcolampadius, who was charmed "with the learning, piety, and courage of the young Frenchman." Bâle was at this time much exercised by the religious innovations prevalent there, but officially no action had been taken in favor of the Reformed doctrines. Farel published thirteen theses covering the chief points of dispute, and defended them publicly without answer from the Romanists. In consequence, the Reformed doctrines became quite popular, and their success might have been established had not Farel fallen into angry dispute with Erasmus, who heaped such abuse upon the young Frenchman that he left Bâle in May, 1524, and repaired to Schaffhausen, Zurich, and Constance. On his return to Bâle he was ordered to leave the place. He retired to Strasburg, and there enjoyed the companionship of Capito and Bucer until secretly recalled to Bâle to be set apart by Œcolampadius for the ministry at Montbéliard. Farel had from the first been rather turbulent. Made priest, he by intemperance in language and conduct soon made himself an object of much hatred. He was driven from his parish in 1525. His friends were disappointed, yet would they not forsake him, for they knew well that he was as honest as he was fearless. After a brief visit to Œcolampadius, Farel joined Capito and Bucer at Strasburg, where he had another meeting with his beloved teacher, the saintly and now aged Lefèvre. In 1527 he went to Aigle, where he taught school, at first under an assumed name (*Ursinus*), but no sooner had he secured a sufficient hold on the people to warrant his safety than he boldly made known his real mission, and when Berne became Protestant (1528) extended his labors throughout its territory. "Honest and fearless," says Fisher, "Farel fulminated against the tenets and practices of Rome in city and country, in the church and by the wayside, wherever he could find an audience." "To this gospel missionary," writes D'Aubigné, "every place was a

church; every stone, every brick, every platform, was a pulpit. . . . No sooner did this man of small stature rise up in any place, with his pale yet sunburnt complexion, with red and unkempt beard, with sparkling eye and expressive mouth, than the monks' labor was lost: the people collected around; . . . all eyes were fixed on him; with open mouth and attentive ears they hung upon his words." He communicated his zeal to the Switzers, and by 1531 secured the reformation not only of the western cantons, but also "caused the balance to incline in favor of the new doctrines throughout the confederation." Sent to the Waldenses, then in synod in the valley of Angrogna, he returned in 1532 by way of Geneva, which was at this time agitated by great religious strife. Though a stranger, he dared to preach while in the city. In consequence he was driven from the place, and only escaped with his life by the bursting of a gun that was aimed at him. He returned again in the next year, and was again expelled. Still undaunted, he returned a third time, and was successful. The new doctrines were now largely heard and accepted. Farel was full of toil, and his triumph came Aug. 27, 1535, when the city council, by special edict, proclaimed Geneva as an adherent to the Reformation. In 1536 his cause was strengthened by a visit from Calvin, who was persuaded by Farel to take up his residence at Geneva. Farel and Calvin henceforth labored unitedly for the good of the Genevese; Calvin, by common consent, assuming the leadership in ecclesiastical organization. An able assistant these men found in Viret. In consequence of their bitter attack on the sensuality which many of the Genevese had fallen subject to under Savoyard rule, and the strict enforcement of ecclesiastical discipline, the Reformers became unpopular, and (Apr., 1538) were expelled from the city. They went together to Berne, Zurich, and Bâle, where they separated, Farel going to Neufchâtel, whose Reformed society was then in deplorable disorder. Farel soon restored harmony (1542). Went to Metz to organize a society, but was persecuted, and finally obliged to retire to the neighboring town of Montigny, and afterwards to Gorze, where he enjoyed the protection of Count Fürstemberg. Attacks upon his life caused his removal to Strasburg, and ultimately his return to Neufchâtel, where he married, when sixty-nine years old, a young wife, very much to Calvin's disgust. In 1560 he visited his native Dauphiny, and by his bitterness excited the roughs of Gap, who put him in prison, from which he was rescued by his friends. He now returned to Neufchâtel, and d. Sept. 13, 1565. "Of all the Reformers," says D'Aubigné, "Farel and Luther are the two most memorable for the struggles they had to pass through. . . . Farel is the pioneer of the Reformation in Switzerland and in France. He threw himself into the work, and with his axe cleared a passage through a forest of abuses. Calvin followed, as Luther was followed by Melanchthon, resembling him in his office of theologian and 'master-builder.' And yet if Farel reminds us of Luther, we must allow that it is only in one aspect of the latter that we are reminded of him. Luther, besides his superior genius, had, in all that concerned the Church, a moderation and prudence, an acquaintance with past experience, a comprehensive judgment, and even a power of ardor, which were not found in an equal degree in the Reformer of Dauphiny." Farel was certainly a learned man, though he showed more skill as a speaker than writer. He was a missionary rather than an organizer, an iconoclast rather than a theologian. He may be called "the Swiss John Knox," and, like the renowned Scotchman, moved the world by his eloquence, intensity of zeal, and honesty of purpose. His writings are of interest only to the student of the Swiss Reformation. (See KIRCHHOFER, *Life of Farel* (in German, 2 vols., Zurich, 1831–33; in English, London, 1837); GOGUEL, *Vie de Farel* (1841); SCHMIDT, *Études sur Farel* (1834); SCHMIDT, *Farel und Viret* (1860); BLACKBURN, *Farel and the Story of the Swiss Reformation* (Philadelphia, 1865).) J. H. WORMAN.

Fa'rey (JOHN), English civil engineer, b. in London Mar. 20, 1791, obtained a silver medal from the Society of Arts in 1807 for making perspective drawings, and in 1813 a gold medal for a machine for drawing ellipses. He was employed in Russia in 1819, and died in London July 17, 1851. His treatise on the steam-engine was published in 1827.

Far'go, post-v., capital of Cass co., Dak., on the W. bank of the navigable Red River of the North, opposite Morehead, Minn., and on the Northern Pacific R. R., 254 miles W. of Duluth. It has considerable trade, two weekly newspapers, machine-shops, and a U. S. land-office.

A. J. HARWOOD, ED. "FARGO EXPRESS."

Fa'ria Sou'za (MANOEL), Portuguese historian and poet, b. at Pombeiro, or Souto, Mar. 18, 1590, was envoy to Rome 1630–34, and died at Madrid June 3, 1649 or 1647. His histories are in Spanish, and among his works are *Commentary on the Lusiad of Camoens* (2 vols. 1639), *Asia Portuguesa* (3 vols. 1666), *History of Portugal to 1557*, etc., besides various poems.

Far'ibault, county of Minnesota, bordering on Iowa. Area, 720 square miles. The surface is undulating prairie and very fertile. Dairy products, grain, hay, and wool are the staples. It is watered by the Maple and Blue Earth rivers, and is traversed by the Southern Minnesota R. R. Cap. Blue Earth City. Pop. 9940.

Faribault, post-v. and tp., capital of Rice co., Minn., on the Milwaukee and St. Paul R. R., at the junction of Straight and Cannon rivers, 53 miles S. of St. Paul. It contains the State asylum for the deaf, dumb, and blind, an Episcopal divinity college, 5 seminaries, 10 churches, a public reading-room and library, 2 parks, 5 flouring-mills, 2 national banks, 2 weekly newspapers, and a number of manufactories and stores. It is lighted by gas and provided with a steam fire-engine. Pop. of v. 3045; of tp. 4103. A. W. MCKINSTRY, ED. "REPUBLICAN."

Fari'na [Lat., "meal"], a name applied to powdered cereal grains, and even powdered pulse (pease, beans, etc.). In a still wider sense it includes the starchy foods prepared from various roots and stalks, such as arrow-root, sago, tapioca. From the fact that such substances abound in starch, starchy food is often called farinaceous.

The pollen of flowers, after it has been gathered by bees, is also called farina. This is made into bee-bread, to serve as food for the larvæ, and probably enters into the paste which covers the larva-cells of honeycomb.

Farina, post-v. of Laclede tp., Fayette co., Ill., on the Illinois Central R. R., 224 miles S. S. W. of Chicago. P. 232.

Farina'to (PAOLO), Italian painter, b. at Verona 1525, was pupil or imitator of Titian and Giorgione, painted in oil and fresco, excelled in design, and d. in 1606. *The Miracle of the Loaves and Fishes* is one of his best works.

Farinel'li (CARLO), Italian soprano singer (proper name CARLO BROSCHI), b. at Naples Jan. 24, 1705, studied under Porpora, performed with applause in London 1734–35, and in 1737 went to Madrid to sing to and soothe King Philip V., and, succeeding, became his favorite, as also the favorite of Ferdinand VI., Philip's successor. Farinelli d. at Bologna July 15, 1782. He was a eunuch, and perhaps the best singer of the eighteenth century. He displayed brilliant talents for court-intrigue at Madrid, but possessed many amiable and even generous traits.

Fari'ni (CARLO LUIGI), Italian statesman, historian, and orator, b. at Russi, in the Roman States, Oct. 22, 1822, studied medicine and wrote medical treatises. Proscribed for political offences in 1843, he returned after the amnesty proclaimed by Pope Pius IX. in 1846, and was chosen a member of Parliament for Faenza; then exiled again 1848–49, but was minister of the interior in Piedmont in 1850. He took part in negotiations with Napoleon III., and was named dictator of Modena 1859. In 1860 he was commissioner extraordinary to the court of Naples. In the last cabinet of Cavour he was minister of commerce, and was president of the cabinet Dec., 1862, holding the position until Mar. 24, 1863, when he retired on account of ill-health, and died Aug. 1, 1866. *Lo Stato Romano dell' anno 1815 dell' anno 1850* (1850), *Letters to Lord John Russell* (1859), and *Letters to Mr. Gladstone* (1856), are among his works.

Far'ley, post-v. of Dubuque co., Ia., at the junction of the Dubuque and South-western and the Iowa division of the Illinois Central R. R., 23 miles from Dubuque. It has the machine-shops of the former road.

Farley (HARRIET), American writer, b. at Claremont, N. H., edited and contributed to the *Lowell* (Mass.) *Offering*, sustained by factory-girls. *Shells from the Strand of the Sea of Genius* (1847) and *Mind among the Spindles*, issued in London in 1849, are her publications.

Farley (JAMES LEWIS), Irish correspondent and author, was b. at Dublin Sept. 9, 1823, and in 1860 was accountant-general of the State Bank of Turkey at Constantinople. In 1863 he was correspondent of the London *Daily News* during the present Turkish sultan's visit to Egypt. In Mar., 1870, he became Turkish consul at Bristol, England. *Two Years in Syria* (1858), *The Druses and Maronites* (1861), *The Resources of Turkey* (1862), *Banking in Turkey* (1863), and *Turkey* (1866), have been published by Mr. Farley.

Farm. See AGRICULTURE, by HORACE GREELEY, LL.D.

Farm'dale, post-v. of Franklin co., Ky.

Far'mer, post-tp. of Defiance co., O. Pop. 1184.

Farmer (HENRY T.), M. D., physician and poet, was b. in England, emigrated to Charleston, S. C., and after his medical education in New York settled there in the

practice of medicine. He published *Imagination, The Mariner's Dream, and Other Poems*, 1819, and d. in 1840, forty-six years of age.

Farmer (Rev. Hugh), an English dissenting clergyman of great learning and ability, b. near Shrewsbury in 1714, studied under Dr. Doddridge at Northampton, and from about 1746 was pastor of a congregation at Walthamstow, where he d. Feb. 6, 1787. Published *Inquiry into the Nature and Origin of our Lord's Temptation in the Wilderness* (1761), designed to show that the temptation was not objective and real; *A Dissertation on the Miracles* (1771); *Essay on the Demoniacs of the New Testament* (1775; 3d ed. 1818); *Prevalence of the Worship of Human Spirits in Ancient Heathen Nations* (1783). R. D. Hitchcock.

Farmer (John), American genealogist, born at Chelmsford, Mass., June 12, 1789, was a founder and the corresponding secretary of the New Hampshire Historical Society, and published an edition of Belknap's *History of New Hampshire, Genealogical Register of the First Settlers of New England* (1829), *History of Billerica* (1806), *History of Amherst* (1820), *Gazetteer of New Hampshire* (1823), etc. He died at Concord, N. H., Aug. 13, 1838.

Far'mer City, post-v. of De Witt co., Ill., at the crossing of the Gilman Clinton and Springfield and the Indianapolis Bloomington and Western R. Rs. It has 2 weekly newspapers, 3 churches, 3 hotels, steam flouring-mill, 2 banks, and a large lumber business. Pop. 537.

Far'mers, tp. of Fulton co., Ill. Pop. 1058.

Far'mersburg, post-tp. of Clayton co., Ia. Pop. 1236.

Far'mers' Clubs are associations of agriculturists, generally those of some one community or neighborhood, who meet at stated times for the discussion of questions affecting the interests of agriculture, and more especially for considering the methods of practical farming—the relative values and uses of different fertilizers, the adaptation of special crops to particular soils, the choice of breeds of live-stock and of varieties of cultivated plants, and the like. Mr. Solon Robinson and the late Hon. Horace Greeley were among the early and influential advocates of farmers' clubs. They were associated with the Farmers' Club of the American Institute in New York, the discussions of which were for many years printed weekly in the *New York Tribune*, and widely read. Some farmers' clubs have libraries and invested funds, and sustain regular courses of lectures in the winter season, and in general ladies are admitted. The constitution and by-laws are, or should be, simple in plan, and the meetings are social rather than formal. In many places, besides the regular discussion, there is the reading of one or more original papers, usually agricultural; and music adds variety to the exercises. To some extent the old farmers' clubs have recently been converted into, or replaced by, the granges of the Patrons of Husbandry. (See Grange, by L. P. Brockett, A. M., M. D.)

Farmer's Creek, post-tp. of Jackson co., Ia. P. 1502.

Far'mers-Gen'eral, an association of persons in France, under the old monarchy, to whom the privilege of levying certain taxes, as imposts on salt or tobacco, or town-dues in particular districts, was farmed or let out for a given sum paid down. This system of raising the public revenue was employed by the Roman state. (See Publicans.) It was introduced into France in the thirteenth century, when Philip the Fair gave to Lombard Jews and brokers the privilege of collecting the *gabelle*, or tax on salt, to provide means for carrying on war against the English. It continued to be employed under various modifications down to the Revolution of 1789. The system involved such extortions and cruelties to the people, and such frauds on the government, that it excited general odium. Great financial ministers like Sully and Colbert had to grapple with it for the temporary correction of evils, but it could not be dispensed with till the old order of things passed away. In 1720 the farmers of the taxes formed a regular association, called the *ferme générale*. It included originally forty, and afterwards sixty, *fermiers généraux*, who held, for a specified number of years, the exclusive management of the *gabelle*, the tax on tobacco, the *octrois* of Paris, and other excise duties. These men accumulated enormous wealth, and by bribing ministers of state, courtiers, and functionaries of all classes had influence enough to keep up the ruinous system. Turgot and Necker, in the reign of Louis XVI., attempted to change the arrangement, but the nobility, clinging to their privilege of exemption from taxation, effectually resisted their efforts. By the revolutionary constitution of 1791 the system was swept away, and many of the farmers-general were executed. A. L. Chapin.

Far'mers' Mills, manufacturing post-v. of Kent tp., Putnam co., N. Y.

Far'mersville, post-tp. of Lowndes co., Ala. P. 1116.

Farmersville, post-tp. of Tulare co., Cal. Pop. 807.

Farmersville, post-v., capital of Union parish, La., is 1 mile from the head of navigation of the Bayou d'Arbonne, and 200 miles by water N. N. W. of Baton Rouge. It has a weekly newspaper. Pop. 272.

Farmersville, post-v. and tp. of Cattaraugus co., N. Y. Pop. 1114.

Farmersville, post-v. of Jackson tp., Montgomery co., O. Pop. 312.

Farmersville, post-v. of West Earl tp., Lancaster co., Pa., has one monthly periodical. It is 5 miles S. of New Berlin Station.

Far'mer Vil'lage, post-v. of Covert tp., Seneca co., N. Y., has a machine-shop, foundry, and three churches.

Farming. See Agriculture, by Horace Greeley, LL.D.

Farming Class, The, in America. In the U. S. the word *farming* has a meaning quite unlike that given to it in Europe. In England, the farmer is a tenant paying rent, generally to some holder of entailed lands. In France, the census shows that 36,000,000 acres of land are divided into farms, none of them of more than eight acres in extent. (*Mark Lane Express*, Apr. 13, 1874.) In England, the farmer has little influence in directing society, for he has no permanent interest in the land. In France, his ownership is of so small a possession that it is virtually a garden—too small to permit the raising of cattle or sheep, to produce manure; and where chemical manures must be depended upon to sustain the three-course system, consisting of two crops of cereals and a bare fallow, and where the cows that supply milk, butter, and cheese must be made to do the work of tillage, the fact that the cultivator is the owner gives him no political importance.

Here the cultivator of the soil almost always is the owner, and except in the vicinity of great cities less than fifty acres would hardly be called a farm. Thus, the American farmer generally possesses the advantages that follow combined occupancy and ownership of landed estates, not too large to be directed by one man, and yet large enough to employ all the energies and ability of an active and enterprising mind.

The fathers of our government by law for ever swept out of our institutions all that had been for ages crystallizing in the countries from which we sprung into impassable walls between different orders of society, and not only provided against hereditary government, but against the establishment of families upon foundations of wealth in real estate that they cannot alienate. Equal political and social rights create an active condition of society, for each youth feels that there is no place so high as to be beyond the possibilities that are before him.

A century has not elapsed since we commenced our career as a nation under our own institutions. With a population of scarcely 3,000,000, inhabiting a narrow belt along the sea-coast, with no accumulated capital, with a heavy national debt, the future was bravely faced, and the line of settlements was extended into the interior, where fertile lands covered with forests invited the enterprising to leave the granitic soils of the coasts. Along the only river that reached by its navigable waters through the mountain-range next the sea the lands were largely held in great estates, upon which it had been attempted to plant the institutions of the Old World. The manors of the Livingstones and the Van Rensselaers and their compeers, stretching along the Hudson River, are sufficient illustrations of the influence of such estates upon the public interests.

Immediately after independence was established armies were sent beyond the ranges of coast-mountains to terminate the war with the Indians, that by the treaty with England had been left unsettled. The return of the soldiers brought news of a wonderful country in Central and Western New York, which speculators grasped in large part; but they were wise enough to invite purchasers on liberal terms, and in a wonderfully short time the far-famed Genesee county was settled and brought into cultivation. The State of New York constructed a canal connecting the waters of the interior lakes with the Hudson, and the tide of moving pioneers carried agriculture to Ohio, to Michigan, and finally to the great prairies of the West.

The government of the U. S. adopted a wise policy in regard to its lands lying in the North, and sold at low prices, but for pay down except in cases of settlement before survey, when pre-emption privileges were given.

The general law of emigration is, that the most energetic take the lead, leaving the less enterprising to stay behind and enjoy the old home. To this native energy, that first prompted the movement, in due time is added the self-reliance and quick use of all the powers of body and mind

that comes of frontier life. Those who escape death in becoming inured to the change in climate and habits become men of great deeds if occasion calls out their powers. To realize this discipline we have only to consider the hardships that must be encountered by an early settler of such a country as was Central New York three-quarters of a century ago. A man from New England starts on horseback, and following a scarcely passable road, lodging in the wayside cabins of the early settlers, who at distances of a few miles apart furnish entertainment for man and beast, he, after a month or so of travel, finds himself on the long-sought "lot" that he had perhaps purchased unseen. Here, cutting away a few trees, he clears a space for a hut of logs, that the pioneers who have come before him help to raise. Planting, if the season is right, some important seeds, he leaves for home, in due time to return with his family and a few domestic animals. Once settled, the work of removing the trees commences, and many lofty ones fall before the axe and are destroyed. For food, the new-comer must depend upon the nearest settlement and his own skill with the rifle, aided by the fish that the lakes and streams furnish.

The second year gives a crop of corn and potatoes, and perhaps some other food. The work of clearing goes on, and each added year sees new acres producing crops; and soon this pioneer has become, in the language of the place and times, "an old settler," and has food to sell to new-comers, and is possessed of flocks and herds. He is now a man of consequence, called upon to organize new counties, towns, school districts, to lay out roads, to bridge the streams, to construct school-houses and churches—to organize society and to make and enforce the laws. In the mean time, sons and daughters have been born, grown up, and now demand more of education than the little district school can give. There must be an academy established and in active operation. When this high school is doing its work the pioneers feel that they are living in an old country, and ready to send their sons farther on into the wilderness to repeat the work. This is the way in which the timbered lands that reached from the sea-coast to the Prairies have been converted into fruitful farms, owned by the men who cultivate them.

We must not forget that the hardest part of the task devolved upon the women, and that the greatest obstacle in the way of rapid progress were the diseases incident to the cultivation of the new soil. Malaria was everywhere, and fever wasted and destroyed. The women must prepare the food, manufacture cloth, and make garments for the family, nurse the sick, and bear and rear the children. Both men and women by this stern education received an energy and power of execution unknown in more elegant life. Self-reliance, personal independence, and manhood proud of its muscular prowess were the result. From this training has come the American farmer of the grain-growing States.

What influences and results such a body of men, thus nurtured, may produce on the policy of our nation is an interesting matter of inquiry. Society has been so long in the habit of receiving its leadings either from an hereditary aristocracy, or from some class especially educated and trained to execute the governing powers, that it is no easy task to break away from customs so firmly established. But causes are in active operation here that never before influenced society, and they are quite likely to materially change the old order of things. The means of universal education are more abundant than were ever before given any great people. The school-district library brings to every hamlet a collection of standard works that are too costly to be otherwise furnished for the people, and the newspaper is everywhere, and in no society is its influence more pervading than among the cultivators of the soil. By the newspaper every event of the least public importance is speedily known in the hut of the far-off pioneer, and as fully as in the great centres of wealth and commerce. The policy of the government, the decisions of the courts, and all the changes that are going on are discussed everywhere among the farmers, and they form and freely express opinions as to the influence of public measures upon their own special interests and those of every other class.

Thus stands this body of industrious, active, and well-informed men, having many millions in their ranks, vast aggregate wealth in lands, and votes sufficient to dictate the policy of the country—generally not so ambitious of office as desirous of having wise laws honestly administered.

It would have been strange if such men had not required, as supplementary to the general newspaper literature of the country, a press devoted to their own special wants. The general tendencies of our times to accurate and scientific knowledge in regard to the things in which we have the greatest interest have nowhere had more influence than among farmers. The laws of life in animal or vegetable are to the farmer matters of the greatest importance. The chemistry of vegetation—how plants grow, and how to make them grow at the least cost—is a matter of vital interest. Scientific books especially devoted to agricultural matters soon followed the agricultural newspaper, and no class of men entertains higher respect for the really scientific writer than the practical farmers of our country.

The old men insist upon their sons having advantages of education greatly in advance of anything known in their school-boy days. They demand that their sons' time shall not be consumed in the acquisition of a learning that, however well it may be adapted to other pursuits, is of little value on the farm; they demand that the education of their children shall be directed in such a way as will make it of actual practical value in their future work. Out of this feeling has grown the attempt to establish colleges especially devoted to agricultural education. Experience had shown that to send a farmer's son through the usual collegiate course, devoting most of his time to the study of the languages of nations that no longer influence public affairs, was the almost certain way to create a distaste for life in the fields, and generally landed him in the pulpit, the bar, or among the doctors of medicine. The slow processes that had led his father to independence and public consideration were connected with an amount of physical exertion that the softened muscles revolted from. The liberal grant made by the nation to promote agricultural education has in many cases been so perverted as to strengthen institutions established for other ends. In some States new colleges have sprung into being on this endowment that are somewhat improved in their course of study, but thus far the result of this effort has been anything but satisfactory to the farmer. A college in Michigan, founded before the national grant was made, has perhaps come nearer the end aimed at than any other. That State wisely gave the lands that came to it under the national grant to its agricultural college, that had already become well started. There each student is required to perform a considerable amount of manual labor every day, for which he is paid in proportion to its value, and all are required to live on the farm. The course of study is well adapted to the supposed special wants of farmers and to active life generally, and the habit of labor is preserved; and the graduates, thus far, have shown a marked willingness to adopt farming as a business.

It is an unsettled question whether special agricultural education can be successfully had in connection with other courses of study—in fact, whether actual manual labor on the farm is not a condition without which there can be no marked success. The various plans adopted by the several institutions that have received the national grant will ultimately solve these questions in a practical way. And when a large part of this national fund has been wasted on old institutions in vain efforts to give them adaptation to a special end, it may at last come to pass that there will be several real agricultural colleges. When this is the character of a half score or more institutions, situated in unlike climates, and dealing with unlike soils, but all acting in concert, the real wants of our agriculture will be found out, and some of the questions that so much perplex the individual farmer may find a solution, and the labor of food-production may become vastly lessened and the fruits of the earth greatly multiplied.

To further aid in the advancement of the agriculture of the country, Congress has established what is called a department of agriculture, but the practical results of this undertaking have thus far been unimportant.

Agricultural interests have been greatly aided in the several States by appropriations of money made by them to assist the local agricultural societies. The State of New York has taken the most prominent position in this work, and for something more than thirty years has had in successful operation a State society, and county and town societies auxiliary thereto. The policy of the State society has been from the day of its first fair, held at Syracuse (1841), to instruct rather than amuse the immense multitudes who attend these annual meetings. All "side shows" are excluded, and there has never been on the grounds during a fair the least attempt to test the speed of horses, or any other thing to draw the public attention from the objects that the society had in view. These fairs have been held at points far apart, and never two successive years in the same place. From the city of New York to Buffalo, Poughkeepsie, Albany, Utica, Syracuse, Auburn, Rochester, on the central line of travel, and on each side Saratoga, Watertown, and Elmira, have in their turn been visited, and now the society has become firmly established in three central positions—Albany, Elmira, and Rochester. The railroads centering at these places give such advantages of transportation that the society has determined,

for at least twelve years, to test the policy of having more permanent buildings, better accommodations for both exhibitors and spectators, than could formerly be secured. The State has provided at Albany a building to be used jointly by the Agricultural Society and the Museum of Natural History. In this building are the library, lecture-room, and offices for the secretary and for all the business of the society not connected with the field-operations of its annual shows. The secretary is employed all the time, and makes his head-quarters at this centre, and keeps up a correspondence with like institutions in all countries, and has the doors open to all visitors to the rooms devoted to the exhibition of objects of interest to farmers, embracing, among other things, tools used many hundreds of years ago alongside the most improved of modern genius. Thus, this department of agriculture of New York exercises an important influence in the education of, and interchange of information among, the farmers of the whole country. No influences of political parties have ever disturbed its councils, and leading men have given their best efforts to the organization. The volumes of its *Transactions* (32) now published constitute the most valuable collection of agricultural information extant.

The settlement of the timbered country was attended with so much labor that agricultural development did not so rapidly advance as to entirely outstrip the other industries. Manufactures and commerce kept nearly even march with agriculture; and the connection of the great lakes with the sea by the Erie Canal gave a very cheap line of water-communication with the commercial world for the surplus land-products. The result was a healthy growth of all the great industries, without any very great or undue stimulus to any one of them. The pioneers found a market for their surplus food in supplying such as came immediately after them, and mills and factories followed in regular sequence. These remarks are measurably true of the settlement of all the country lying E. of Lake Michigan and between the lakes on the N. and the Ohio River on the S., but not of the prairie countries beyond.

The locomotive steam-engine and the facility of rapidly turning the treeless prairies into productive fields, pastures, and meadows have caused a more rapid development of agriculture beyond Lake Michigan than was possible under the circumstances that were connected with the settlement of the lands E. of that lake, and the production of food has greatly outstripped other important branches of industry. Thus, agriculture there has become comparatively unprofitable for want of a home-market for its surplus productions. The true balance of the great industries must be brought about in order to secure real prosperity. The coal that underlies so large a proportion of the great West, and the minerals that abound, furnish raw material for a vast manufacturing interest that must in time give employment to many millions of consumers of the fruits of the soil. Though the Mississippi, with its navigable branches, and the lakes and rivers and canals of the North and East, give a way to market, and though railroads have been so extended as to reach nearly every hamlet, yet the vast distances that intervene between the wheat-fields of the West and the workshops of the Eastern States and Europe will for ever remain, and real prosperity can only come when producer and consumer are brought much nearer together.

The balance between the several great branches of industry is already being restored. The tendency of our people to city and village life, and the necessities of all parties, will, very soon it is to be hoped, correct the evils under which the grain-growers of the West are suffering so severely, and give them a home-market. The resources of the North-western States, the fertility of the soil, and the small proportion of waste or untillable lands, together with the minerals that underlie them, must soon support in affluence a great number of people. Already 12,000,000 persons are engaged in advancing the great interests of these ten States, and the tide of immigration from the Old World is so established in that direction that prosperous times must be near at hand.

The settlement of the country has been so rapid that it has not been possible to establish any systematic methods of cultivating the soil. When the country took its place among the nations less than one hundred years ago, it was poor in everything but the undeveloped capacities of the land. There was very little accumulated capital, and men cleared away the forests to find a place on which they could raise their food, and from which they could raise the wool and flax to be wrought in their own houses into clothing. Almost necessarily these first-cleared fields were cultivated with very little attempt at keeping up their fertility, until they were exhausted of those stores that Nature had been ages in accumulating. This policy was continued until the crops became so small as to no longer pay for the labor bestowed. Then followed a more rational system, in which herds of cattle and flocks of sheep were combined with grain-raising. Cities and villages had grown up, and manufacturing centres made a brisk demand for all that the tillers of the soil had to sell; and in the Eastern States the increase of consumers was such that very soon food had to be imported from the fast-settling West. The cost of transportation from these Western fields gave the food-producers of the East such advantages that they found it profitable to resort to improved methods of cultivation, to which their lands responded by giving them abundant crops. The city and village markets all around them enabled them to produce the crops that would not bear long and expensive transportation.

In localities especially adapted to certain crops, like hops, tobacco, potatoes, beans, fruits, or to the feeding of animals, these special branches have had, under favoring circumstances, extraordinary attention, while the cereals have perhaps been raised in only sufficient quantities for supplying the family and dependants. This change in the character of the crops raised in the older parts of the country has led superficial observers to think that the total agricultural product has greatly fallen off, and that the owners of the farms are gradually destroying them. Census tables have helped to spread this opinion, and statisticians have been predicting speedy ruin. The answer to all this is the fact that the Eastern cultivators of the soil are enlarging their barns and giving every indication of prosperity, convincing an observing traveller that they are well rewarded for their labor. Taking the State of New York as representing a fair mean between the older States of the East and the newer of the West, we find that while this State does not raise much more than one-quarter of the bread consumed within it, the farming lands have risen in selling value to twice or more the prices they bore in the days when millions of bushels of wheat were annually produced. Leaving out of a survey of this State the old counties, and not considering that vast forest that lies in its north-eastern part, where the climate forbids profitable cultivation, we shall find that prosperity based upon fertility is the almost universal law, as is shown by the fine houses and capacious barns that are everywhere being constructed out of the profits derived from the land.

The question is constantly asked, Does farming pay? It would be a short way of answering this question to say that within a time that would not average more than the lives of two generations all the capital in that part of New York under consideration has been created out of the land by its owners' industry; and if we were to find the cost of the buildings, fences, roads, farm-stock, tools, and machinery, and add to this the reasonable cost of clearing the land from its forests, we should have a sum so vast, representing the earnings of only two generations, that we could form some just opinion upon this oft-repeated question, and our minds would be ready to grasp in some measure the probabilities of the future of the descendants of the people who, in addition to raising and educating families and living in luxury, have accumulated this vast capital in so short a time.

The facilities for acquiring lands have been so great that the sons of farmers, if they intended to follow the avocations of their fathers, have generally themselves become owners soon after arriving at man's estate; thus the labor on farms has commanded very high prices, and the demand has very generally been supplied by persons of foreign birth. Out of this scarcity of men who would work for wages has grown a demand for improved machinery and implements. The old hand-winnowing fan, made of willows and shaped like a clam-shell, used by expert hands to throw grain into a current of brisk wind, has been superseded by a machine that threshes and cleans a bushel of wheat in a minute. The cast-iron plough has been perfected from inventions of our own farmers by our own mechanics, so as to take the highest prize at the World's Fair in England in 1851. This has been followed by the cast-steel plough; and the old wooden plough, having a wrought-iron share and point, that was fifty years since considered to be a good implement, can now only be found in collections of curiosities. With the great improvement of the plough came in rapid succession improvements in harrows, cultivators, and machines for sowing grain and harvesting it. The first successful mowing-machine was the beginning of a revolution in the management of farms. In 1852 the New York Agricultural Society had a trial of farm implements at Geneva, and there and then were brought face to face the various manufacturers of implements used in hay and grain raising. The trial was full and exhaustive, and from it the great advance in perfecting these implements may be dated. The mowers there used far surpassed in quantity and quality of work anything that could be done by hand-labor. But since that

time the improvements have been so decided that no progressive farmer could now be induced to use the premium machines of 1852 if given to him. It has been computed (John J. Thomas, *Farm Implements and Farm Machinery*, p. 8) that the reaping-machines introduced throughout the country up to the beginning of 1861 performed labor, while working in harvest, equal to that of 1,000,000 men with hand-implements. Since that estimate was made the mower and reaper have been greatly improved, so that it is safe to say that in cutting, raking, and housing hay and grain the labor performed by men has been reduced, except in binding grain and loading grain and hay, so as not to exceed one-quarter the amount required before the introduction of modern implements. The authority before quoted says, "The reaper filled the void caused by the demand on the workingmen for the army. An earlier occurrence of the war must have resulted in the general ruin of the grain interests, and prevented the annual shipment of the millions during that gigantic contest."

The threshing-machine, driven by a steam-engine, that by one process threshes the grain, taking from it the chaff and delivering the straw on top, if required, of high stacks, enables the grower to hasten his crop to market, and dispenses with much barn room that would be required to keep the crops while the old ways of threshing and winnowing had to be employed. The wheat-grower ploughs his land with a plough that takes less than half the power once required, and that does the work as perfectly as it can be done by hand-spading. Improved harrows and wheel-cultivators, on which he rides, fit the ground for the seed, which is sown with mathematical accuracy by a drill drawn by horses. The grass-seeds are sown at the same time and by the same machine, and the gypsum or other fertilizer is distributed by the power of horses, and with a precision unattainable by hand-labor. The grain is cut and cast off the harvesting-machine by the power of two horses driven by a boy, and the work is better done than by hand; and this one machine, boy, and horses can go over as many acres as could six ordinary laborers with the tools of the olden times. The bundles must be cared for in the old way, but the steel-toothed wheel-rake, driven by the boy, goes over the field and gathers gleanings that formerly were lost to an amount often sufficient to pay for harvesting the crop. The cost of making and housing the hay-crop is lessened by modern implements more than is that of grain, for the hay is spread by a tedder that is drawn by horses, the driver riding, and which goes over more ground and does the work better than could six men in the old way. The wheel-rake gathers the hay when made and gleans all scatterings. The horse-pitchfork takes it off the wagon and carries it to the back side of the deepest bay in the barn. The advantages growing out of the improved implements are not so decided in some other branches of farming. The expenditure in human labor in feeding and caring for animals, and in making butter and cheese, is not materially lessened, and in the management of sheep very little has been gained except in providing forage for their winter's consumption. The census tables show that there are about one-third less men now employed in proportion to the whole population in producing food than there were twenty years ago. This may be accepted as indicating that the manual labor employed in farming has been lessened 33⅓ per cent.; and this, all branches being considered, is probably very near the truth.

Who is most benefited by this lessening of the labor necessary to produce food and raw material for clothing the people? The price paid for manual labor on the farm, when reduced to gold, is fully double the price paid for like service thirty years ago. So the first benefit of the improvements in machinery inures to the laborer. The employer pays more to his men than is saved by the improved implements. If three men, at $1 each per day, did the work now accomplished by two men, each receiving $2 per day, then the sum paid is $3 against $4, the extra dollar going to the laborer. The prices of farm products are higher than they were thirty years ago, or the employer could not pay the present prices of labor. The liberating of one-third of the agricultural laborers, and setting them free to engage in other occupations, is felt in all branches of business. The laborer now has money to provide his family with comforts unknown in his mode of life thirty years ago. The immediate consequences of this plenty, with people who will work, are better education and more independence and elevation of character. Savings banks have larger deposits, merchants sell more goods, and all branches of business are quickened. Mr. Thomas estimates the value of the implements of American farming at more than $500,000,000. Our mechanics have not only to keep good this supply, but, because of superior materials and workmanship, they export largely to Europe.

The tendency of the improvements in implements has been in favor of large farms, as it is only a large farm that will justify the outlay of capital necessary to have a full supply and to keep up with the latest improvements; and the large farm justifies the construction of comfortable houses for the accommodation of families, which find permanent homes and employment. Systematic and organized labor comes next. Rotation, draining wet lands, removal of all stones and other obstructions to the use of machinery, the careful preservation of manure, the raising of live-stock with grain and the dairy-products,—these things bring the whole into harmony, and the use of green crops, stimulated by special manures when necessary, gives large returns and constantly increasing fertility. The first settlers, partly from necessity, partly from ignorance of their own interests, do indeed impoverish their lands, but they are succeeded by men who follow the rational system, under which the lands are made to produce crops far more remunerative than were raised by those who went before them. In the new States the farming of to-day must generally be classed as of the exhaustive kind. The farming of the older States is fast assuming the most healthy condition.

Aside from the labors that have been described as having been performed by the farmers of our country, and their advance in wealth, they have not failed to give their attention to the improvement of their animals. The horse in the hands of our breeders has had his useful powers developed beyond anything done elsewhere. The more practical American mind has discarded the running horse, and tried to produce one "of all work," good for the plough, the carriage, or the saddle. Substance, endurance, strength, and speed in the useful movements of the walk or trot have been the objects aimed at, and the result has been a better horse "for all work," and for any work except profitless racing, than has before been known. The American farmer has purchased the best neat-cattle of the Old World and brought them here, and by his skill in breeding has given them a reputation so high that at public sales their descendants have sold to men representing breeders of England at prices ranging from four to eight times as much as has been paid at any time in England. The sheep that a short time ago produced the clothing of Europe have been brought from their native hills of Spain to this country, and by the skill of our farmers their fleeces have been fully doubled in quantity to any raised elsewhere, without any deterioration in quality; and there appears to be no point yet reached in this improvement beyond which it may not go.

These victories are proofs that men who combine in themselves the interests of both cultivator and owner of the lands have inducements that must lead to thorough knowledge of the laws of production of both animal and vegetable food, and that must ultimately lead them to the highest social and political position.

The next generation, with its increased capital and more cultivated tastes, will devote more means and attention to making the homes of farmers attractive. Carefully cultivated ornamental trees and shrubberies, flowers, and walks will add to the charms of country life, and increase self-respect and public consideration. George Geddes.

Far'mingdale, a v. and tp. of Kennebec co., Me., 5 miles S. of Augusta, on the W. side of the Kennebec and on the Kennebec and Portland R. R. Ice and stone-ware are produced here. Pop. 859.

Farmingdale, thriving post-v. of Howell tp., Monmouth co., N. J., on the New Jersey Southern and the Freehold and Jamesburg R. Rs., 26 miles S. S. W. of Sandy Hook. It has marl-works and some manufactures.

Farmingdale, post-v. of Oyster Bay tp., Queens co., N. Y., on Long Island and Stewart's (Central) R. Rs., has 2 hotels, stores, weekly newspaper, union school, and large brickyard (Stewart's). J. Breitwiser, Ed. "Head-Light."

Farm'ington, tp. and post-v. of Hartford co., Conn., on Farmington River and on the New Haven and Northampton R. R., 31 miles N. of New Haven. It has a national and a savings bank, a ladies' seminary, and important manufactures. Pop. 2616.

Farmington, tp. and post-v. of Fulton co., Ill., on the Chicago Burlington and Quincy R. R., 11 miles N. of Canton. The village is finely situated. It has a monthly newspaper. Pop. of tp. 2066.

Farmington, tp. of Cedar co., Ia. Pop. 1249.

Farmington, tp. and post-v. of Van Buren co., Ia., on the Des Moines River and the Burlington and Southwestern and the Keokuk and Des Moines R. Rs., has 1 school, 6 churches, 4 hotels, mill, machine-shop, and a weekly newspaper. Pop. of v. 640; of tp. 1439.
L. M. Mooers, Ed. "Gazette."

Farmington, tp. of Republic co., Kan. Pop. 219.

Farmington, post-v. and tp., capital of Franklin co., Me., 80 miles N. E. of Portland, and at the terminus of the Androscoggin R. R. It has a national bank, a savings bank, 1 weekly newspaper, a State normal school, Abbott's Family School for boys, Wendell Institute for boys and girls, "The Willows" school for young ladies, a library, 8 churches, 3 hotels, an iron-foundry, 3 grist and flour mills, several saw, shingle, and clapboard mills, 2 drum-manufactories, a box-factory, a steam sash, door, and blind manufactory, a cheese-factory, about 30 stores, etc. Its schools make it one of the best educational centres in the State. Principal business, mercantile, farming, and dairying. Several valuable slate-quarries were discovered here in the fall of 1873, and the legislature of 1854 granted charters to two companies for opening and manufacturing. The slate is a superior quality for mantels, billiard-tables, etc. Pop. of tp. 3251. A. H. S. Davis, Ed. and Prop. "Farmington Chronicle."

Farmington, post-tp. of Oakland co., Mich. Pop. 1927.

Farmington, post-v. of Dakota co., Minn., 27 miles from St. Paul, on the Milwaukee and St. Paul R. R., also junction of the Hastings and Dakota R. R. It is in an almost exclusively farming country, mainly devoted to wheat-raising. It has 2 hotels, 1 newspaper, 1 flouring-mill, 2 shoe-manufactories, several manufactories of carriages, 1 large wheat-elevator, and the usual number of stores. Pop. about 2000. J. W. Emery, Ed. "Press."

Farmington, tp. of Olmsted co., Minn. Pop. 937.

Farmington, post-v., capital of St. François co., Mo., 2½ miles from the St. Louis and Iron Mountain R. R., on the turnpike leading from Iron Mountain to Ste. Genevieve. It has 2 newspapers, 4 churches, 1 good public-school building, an excellent jail, and other good buildings. Pop. 393. Wash. Hughes, Ed. "New Era."

Farmington, tp. and post-v. of Strafford co., N. H., on the Dover and Winnipiseogee R. R., 10 miles S. E. of Alton Bay. It has 1 national and 1 savings bank, 3 churches, a high school, and manufactures of boots, shoes, and lumber. Pop. 2063.

Farmington, post-tp. of Ontario co., N. Y. Pop. 1896.

Farmington, post-tp. of Davie co., N. C. Pop. 2047.

Farmington, post-tp. of Trumbull co., O. Pop. 1056.

Farmington, tp. of Clarion co., Pa. Pop. 1642.

Farmington, tp. of Tioga co., Pa. Pop. 997.

Farmington, tp. of Warren co., Pa. Pop. 1101.

Farmington, post-v., county-seat of Davis co., Ut., on the Utah Central R. R., 21 miles S. of Ogden and 16 miles N. of Salt Lake City.

Farmington, post-v. of Lincoln tp., Marion co., West Va., on the Baltimore and Ohio R. R., 10 miles W. of Fairmont. Pop. 85.

Farmington, post-tp. of Jefferson co., Wis. Pop. 2416.

Farmington, tp. of La Crosse co., Wis. Pop. 1522.

Farmington, tp. of Polk co., Wis. Pop. 593.

Farmington, tp. of Washington co., Wis. Pop. 1885.

Farmington, tp. of Waupacca co., Wis. Pop. 734.

Farm'land, post-v. of Monroe tp., Randolph co., Ind., on the Cleveland Columbus Cincinnati and Indianapolis R. R., 13 miles E. of Muncie. Pop. 532.

Farm Ridge, post-tp. of La Salle co., Ill. Pop. 1042.

Farm'ville, post-v. and tp., capital of Prince Edward co., Va., on the Appomattox River and the Atlantic Mississippi and Ohio R. R., 70 miles S. W. of Richmond and 7 miles N. of Hampden-Sidney College and the Union Theological Seminary. It has 3 banks, 1 insurance company, 1 weekly newspaper, 1 female college, 6 churches, 33 stores, 2 hotels, and several large tobacco-factories and warehouses. Principal business, tobacco-trade. Pop. of v. 1543; of tp. 2496. C. E. Madison, Ed. "Mercury."

Farne (or **Fern**) **Islands,** a group of seventeen islets and rocks, some of which are visible only at low tide; they are situated 2 to 5 miles off the E. coast of England, opposite Bamborough, Northumberland. On two of the islands lighthouses have been built, as navigation is extremely dangerous in these waters. On another of the isles is a tower raised in honor of Saint Cuthbert, who lived there during the last two years of his life. Lat. of Farne lights, 55° 37′ N., lon. 1° 39′ E.

Farne'se (Alexander), duke of Parma and governor of the Netherlands, b. about 1546, and went with his mother to the Netherlands in 1559. Nov. 18, 1565, married the princess Mary of Portugal. At the naval battle of Lepanto, Sept. 16, 1571, greatly distinguished himself. He assumed the government of the Low Countries in 1578, and gained important victories. In 1588 was appointed commander of the Spanish "Invincible Armada," but was so shut up in Antwerp by the Dutch fleet as not to take any part in its fortunes. In the French civil war in 1590 he invaded the country, and compelled Henry IV. to raise the siege of Paris. Opposing Henry IV. of France and Maurice of Nassau, he was so wounded before Caudebec as to die at Arras 3d of Dec., 1592.

Farn'ham is a town of England, in the W. of Surrey, on the left bank of the Wey. It contains the fine old castle of the bishops of Winchester, first built by Bishop de Blois, but razed by Henry III., then rebuilt by Charles I., and restored to its present state in 1684. Pop. with suburbs, 39,872.

Farnham, post-tp. of Richmond co., Va. Pop. 1354.

Farnham (Eliza Woodson), Mrs., authoress and philanthropist, was b. at Rensselaerville, N. Y., Nov. 17, 1815, went to Illinois in 1835, and in 1836 married Thomas J. Farnham. In 1841 she returned to her native State, visited prisons and lectured to the women convicts until 1844, when she was four years matron of the Sing Sing (N. Y.) State prison. In this period she published *Life in Prairie-Land* and edited Samson's *Criminal Jurisprudence.* In 1848 she was connected with the Boston (Mass.) Institution for the Blind. In California from 1849 to 1856; she then returned to New York, and published *California, Indoors and Out. My Early Days* appeared in 1859, and in that year she organized a society to aid and protect destitute women in emigration to the West. *Woman and Her Era* was published in 1864, and Dec. 15 of that year she d. in New York City. Her maiden name was Burhans.

Farnham (Luther), American Congregational clergyman, b. at Concord, N. H., Feb. 5, 1816, was pastor at Northfield, Mass., and at Marshfield, Mass.; secretary of the Southern Aid Society (1855–61), and then secretary of the General Theological Library at Boston. *Glance at Private Libraries* was published in 1855.

Farnham (Noah L.), an American officer of volunteers, b. at Haddam, Conn., June 6, 1829, removed to New York at an early age, and soon became an active member of the City Guard, being on duty at the Astor Place riot. On the outbreak of the civil war he left for Washington with the Seventh New York, but soon after his arrival accepted the appointment of lieutenant-colonel of Ellsworth's Zouaves, succeeding as colonel on the death of Ellsworth. Though confined to a sick bed at the time of his regiment being ordered to Manassas, he insisted upon leading his regiment, and while gallantly fighting at the head of his men he received a wound which resulted in his death, Aug. 14, 1861. George C. Simmons.

Farnham (Ralph), American Revolutionary soldier, b. at Lebanon, Me., July 7, 1756; d. at Acton, Me., Dec. 26, 1861, the last surviving soldier of the Bunker's Hill fight. In 1780 he was at Acton, its first inhabitant.

Farnham (Thomas Jefferson), a traveller, husband of Eliza W. Farnham, b. in Vermont 1804, in 1839 organized and led a small expedition across the continent to Oregon. In California in the same year he procured the release of a large number of American and English prisoners from the Mexican government. *Travels in Oregon Territory* appeared in 1842, *Travels in California* and *Scenes on the Pacific* in 1845, a *Memoir of the North-west Boundary Line,* with *Mexico, its Geography, People, and Institutions,* in 1846. D. in California, Sept., 1848.

Farns'worth (Benjamin Franklin), D. D., American clergyman and educator, b. at Bridgeton, Me., Dec. 17, 1793, graduated at Dartmouth College 1813; was Baptist pastor at Edenton, N. C.; principal of the Bridgewater (Mass.) Academy from Sept., 1821, to 1823, then of a female high school at Worcester, Mass. He was professor of theology at the New Hampton Theological Institute from May, 1826, to 1833, and in 1836 president of Georgetown College, Ky., subsequently of Louisville (Ky.) University from 1837 to his death, June 4, 1851.

Farnsworth (Elon J.), American brigadier-general of volunteers, b. in Livingston co., Mich., 1835, was killed at the battle of Gettysburg, July 3, 1863. In the summer of 1861 he was battalion quartermaster of the Eighth Illinois Cavalry, then captain. Was in the Peninsular and in Gen. Pope's campaigns, aide to Gen. Pleasanton in May, 1863, and brigadier-general June 29, 1863.

Farnsworth (John F.), American Congressman and soldier, b. in Eaton, Lower Canada, Mar. 27, 1820, is a lawyer and has been representative from Illinois in the 35th, 36th, 38th, 39th, and 40th Congresses. In 1861–63 he served in the civil war, at first commanding the Eighth Illinois Cavalry. In 1863–64 he raised the Seventeenth Illinois Volunteers, having been brevetted brigadier-general in 1862.

Farn'worth, town of England, in the county of Lancaster, manufactures sail-cloth, watches, files, and all kinds of iron tools. Pop. 8720.

Fa'ro, the capital of the province of Algarve, Portugal, is situated at the mouth of the Fermosa, where three small islands form a somewhat confined but otherwise convenient and safe harbor. Faro exports considerable quantities of oranges, figs, anchovies, and cork, and is a bishop's see. Pop. 8361.

Fa'ro, a game at cards, used only in playing for money. It is played in different ways in different countries, but in all the player contends against a bank, represented by a professional faro-banker; and the chances, though apparently only slightly in favor of the bank, are in reality quite strongly so. The game is illegal in many cities and in some of the States.

Farochon (Jean Baptiste Eugène), b. at Paris in 1807, was a pupil of David, attained fame as a sculptor and medallion-cutter, and in 1863 attained a professorship in the Paris School of Fine Arts.

Fa'röe, or **Faerö** [Dan. *Färöerne*], a group of islands, twenty-two in number, of which only seventeen are inhabited, belonging to Denmark, and situated in the North Atlantic, nearly midway between the Shetlands and Iceland, between lat. 61° 20′ and 62° 20′ N., and between lon. 6° and 8° W. Their entire area is about 500 square miles; the population, 9992. The principal island is Stromö, with the cap. Thorshavn. All these islands are basaltic formations, rising conically to a height of 3000 feet, with steep and lofty coasts, abruptly broken by deep inlets, which often afford the safest and most convenient anchorage, but which sometimes cause whirlpools or form currents, thereby making navigation very dangerous. The trap-rock is covered with a thin layer of vegetable soil, which yields a superb pasturage. Of trees there are none, on account of the furious gales which always prevail here; peat and miocene coal, of which a seam of good quality has recently been discovered on Suderöe, are used as fuel. Of the common cereals and vegetables, only barley, turnips, and potatoes can be raised, on account of the high northern latitude; yet the oceanic influences modify the climate so greatly that snow rarely lies long on the ground, and the cattle graze the greater part of the year in the open air. Cattle and sheep are not the only resources, however, of the inhabitants. The waters abound with fish, and the feathers and eggs of the myriads of fowls which swarm around these coasts are often sources of considerable wealth. The inhabitants are of Norwegian origin. In the ninth century the islands were discovered by the Norwegians and peopled by Norwegian settlements, but during the long connection between Denmark and Norway the islands passed into possession of the Danes, and they are now governed by a Danish *amtmand;* they send a representative to the Danish *rigsdag.*

Far'quhar (George), Irish dramatist, b. at Londonderry, 1678, was educated at the University of Dublin, settled in London, and d. there in Apr., 1707. *Love and a Bottle* (1698), *Twin Rivals* (1703), and *The Beaux' Stratagem* (1707), comedies, were among his productions. His works have been recently published in the same volume with those of Wycherley, Congreve, and Vanbrugh, London, 1849, by Moxon.

Farquhar (Norman H.), U. S. N., b. Apr. 11, 1840, in Pennsylvania, graduated at the Naval Academy in 1859, became a lieutenant in 1861, a lieutenant-commander in 1865, a commander in 1872. Served as executive officer of the steamer Mahaska, North Atlantic blockading squadron, in 1862–63, during which period he was frequently under fire afloat, and several times engaged, in co-operation with the army, in expeditions on shore. His character and services are thus honorably mentioned by Commander Foxhall A. Parker in an official report dated Nov. 26, 1862: "I should do injustice to my own feelings and to the service were I to close this report without making special mention of Lieut. Farquhar, upon whom the major portion of the labor attending our little enterprises devolved. Always reliable and always efficient, his high standard of professional character is apparent in everything he undertakes." As executive officer of the Santiago de Cuba, Farquhar participated in both attacks on Fort Fisher, and led the men of that vessel in the assault on the fort of Jan. 15, 1865, when he behaved with his usual coolness and intrepidity.

Foxhall A. Parker.

Farr (William), M. D., F. R. S., D. C. L., English writer and superintendent of the statistical department of the registrar-general's office at Somerset House, b. at Kenley, Shropshire, 1807, was educated at Dorington and Shrewsbury and at the Universities of Paris and London. Practising medicine in London, he edited the *Medical Annual* and the *British Annals of Medicine.* He has written much for medical journals, the "Vital Statistics" in *McCulloch's Statistics of the British Empire,* official reports on the public health, and on the *Causes of Death in England* (1837–70), reported in detail the cholera epidemic of 1849, framed a new *Statistical Nosology,* etc.

Far'ragut (David Glasgow), America's great admiral, was b. at Campbell's Station, East Tenn., July 5, 1801. Descended, on his father's side, from Don Pedro Ferragut, one of the "conquerors" of Majorca, he inherited from him, in all likelihood, that love of adventure and fearlessness of danger which, according to the Aragonese troubadour of the thirteenth century, Mossen Jaime Febrer, were the distinguishing traits in the character of the renowned Don Pedro. On his mother's side he came from the good old Scotch family of McIven.

Entering the navy as a midshipman Dec. 10, 1810, he had the good fortune to serve first under Capt. David Porter, who had procured him his appointment, and who now instilled into his youthful mind those ideas of devotion to duty from which he never swerved during his long and eventful career. "The boy is father to the man," and on the quarter-deck of the Essex, under the watchful eye of her commander, was formed the hero who was to lead his country's fleets to victory up the "River of Death," and by Forts Morgan and Gaines into Mobile Bay.

In 1823, Midshipman Farragut took part in the severe fight between our naval forces under Com. Porter and a large band of pirates strongly intrenched at Cape Cruz, Cuba, which lasted twelve hours, and resulted in the utter defeat of the latter and the suppression of piracy in the West Indies. This was his last battle-service as a young man, and he now entered upon the regular routine duties of his profession, broken only by a year's residence in Tunis with our consul, Mr. Charles Folsom, afterward a distinguished professor of Harvard, who kindly directed his studies and gave him that "thirst for information," says Mrs. Farragut in a letter to the writer, "which, as his eyes were not strong, kept all his household busy reading to him." His knowledge was varied, and in matters relating to his profession profound, and he was one of the best linguists in the navy. Passing in succession through the grades of lieutenant and commander, the war of 1861–65 found him a captain and living in Norfolk, Va., where every inducement was held out to him to unite his fortunes with the seceding States. But, "intimately connected with the South as he was by birth, marriage, and residence, he was a son of the republic rather than a citizen of a State;" and so, leaving Norfolk on Apr. 19, 1861, he took his family to Hastings on the Hudson, and then hastened to offer his services to the government.

The capture of New Orleans being resolved upon, Farragut was chosen to command the fleet destined to effect this purpose, his force consisting of the West Gulf blockading squadron and Porter's mortar flotilla. In Jan., 1862, he hoisted his broad pennant on board the Hartford at Hampton Roads, and sailing thence on Feb. 3d, reached Ship Island on the 20th, where he at once began his preparations for the work before him.

On the 20th of April, after a council of war had been held, Farragut issued a general order to his fleet, in which he gives his views at length as to the proper mode of attack to be adopted by it, and adds: "The flag-officer having heard all the opinions expressed by the different commanders, is of the opinion that whatever is to be done will have to be done quickly. When, therefore, the propitious time has arrived, the signal will be made to weigh and advance to the conflict." In accordance with this order, at 5 minutes before 2 o'clock on the morning of Apr. 24th, two red lights were hoisted at the mizzen-peak of the Hartford, and immediately each vessel commenced heaving up her anchor. At half-past 3 the whole fleet was under way, and standing up the river in two columns, the right column being instructed to engage Fort St. Philip—the left, Fort Jackson. It is not our province here to relate the particulars of the battle that ensued—to describe the fire of hell rained upon the forts from Porter's flotilla; their fierce fire in reply; the sinking of two Confederate vessels by the Varuna, and her foundering, at the moment of victory, almost by their side; the duel between the Mississippi and the ram Manassas; the silencing of Fort St. Philip by the Brooklyn; the Hartford in flames halfway up to her tops, and yet never for a moment relaxing her fire. Suffice it to say, that a great victory was won and New Orleans ours, and that, in recognition of his glorious services, Farragut received the thanks of Congress and was made a rear-admiral. In the summer of 1862 he "ran the Vicksburg batteries up and down the river," and on Mar. 14, 1863, passed through the fearful fire of the forts at Port Hudson, and opened communication with Flag-officer Porter, who commanded on the Upper Mississippi. On May 24th, in con-

junction with the army, he commenced active operations against Port Hudson, and when it fell, on July 9th, he turned over to Porter, who five days previously had been made a rear-admiral, the entire control of the Western waters above New Orleans. He now enjoyed a short respite from his labors, but on Jan. 20th of the following year we find him making a reconnoissance of Forts Morgan and Gaines, and expressing the opinion that "with a single iron-clad and 5000 men he could take Mobile."

At length, on the morning of Aug. 5, 1864, with four iron-clads and fourteen wooden vessels, the rear-admiral filled up the measure of his fame by the victory of Mobile Bay.

The fleet was in two columns, as at New Orleans, the iron-clads being on the right and a little in advance, with the Tecumseh leading, the wooden vessels, lashed together by twos, forming the port column, with the Brooklyn and Octorora leading. Next astern of the Brooklyn was the Hartford, carrying now, as at New Orleans, the flag of the commander-in-chief. In this order the attacking fleet steamed steadily up the main ship-channel, "the Tecumseh firing the first shot at 47 minutes past 6 o'clock. At 6 minutes past 7, Fort Morgan opened, and was replied to by a gun from the Brooklyn, and immediately after the action became general." Suddenly, however, the Tecumseh reeled as from an earthquake-shock, and went down almost instantaneously—sunk by a torpedo—while the Brooklyn, observing "a row of suspicious buoys directly under her bows," stopped and backed, thus arresting the advance of the whole fleet. A moment's hesitation now on the part of the rear-admiral and the battle is lost! But Farragut, high up in the main rigging, overlooking the whole scene of action, is equal to the emergency. "Go ahead at full speed!" he cries to Drayton, the captain of the Hartford; and the order being instantly obeyed, the Hartford dashes onward, and the other ships follow, "the officers and men believing they are going to a noble death with their commander-in-chief." At this supreme moment the gallant seaman raised his heart in supplication to the Almighty. "O Thou Creator of man! who gave him reason," he prayed, "guide me now. Shall I continue on, or must I go back?" "A voice then thundered in my ear," said he afterward in speaking of this battle, "'Go on!' and I felt myself relieved from further responsibility, for I knew that God himself was leading me to victory."

The rest is a tale we all know—how the forts were passed, the gunboats dispersed or captured, and the formidable ram Tennessee forced to strike her colors to the old flag she had so long set at defiance.

The fall of Mobile was now reduced to a mere question of time. Fort Powell was blown up Aug. 6th, and a few days thereafter Forts Gaines and Morgan surrendered. "The navy will do its whole duty," wrote the rear-admiral to Secretary Welles shortly before the great fight, and well had the navy justified his prediction.

In November, Farragut returned to his home, and on Dec. 22d he was made a vice-admiral. But the people demanded that the nation's hero should be further rewarded, and in July, 1866, the grade of admiral was created for him whose name had become a household word throughout the land. But he was not destined long to enjoy his earthly honors. His arduous services had greatly impaired his health, and in the summer of 1870, at Portsmouth, N. H., Aug. 14, after a long and painful illness, he died as he had lived—a Christian gentleman, and mourned by the whole nation. In battle he was as fearless as Nelson, in public virtue and patriotism not excelled by the greatest heroes of antiquity, while in his spotless purity of character he rivalled the illustrious Collingwood. There are many naval names dear to the American heart, but

"A brighter name must dim their light
With more than noontide ray—
The Viking of the river-fight,
The conqueror of the bay!
Shape not for him the marble form,
Let never bronze be cast,
But paint him in the battle-storm,
Lashed to his flag-ship's mast."

FOXHALL A. PARKER.

Far'rar (ELIZA WARE) was b. in Flanders, Europe, in 1791, and was the daughter of Benjamin Rotch of New Bedford, Mass. In 1828 she married Prof. John Farrar of Harvard University. *Congo in Search of his Master* was written and published in England. It was followed by *Children's Robinson Crusoe, The Story of La Fayette, The Life of Howard, Youth's Letter-writer, Young Lady's Friend* (1837), and *Recollections of Seventy Years* (1866). D. at Springfield, Mass., Apr. 22, 1870.

Farrar (FREDERIC WILLIAM), D. D., F. R. S., son of a clergyman, b. in the Fort, Bombay, in 1831; graduated at Cambridge in 1854; became assistant master at Harrow in 1855, and master of Marlborough College in 1871. He is also chaplain in ordinary to the queen. He has published the following works of fiction: *Eric* (10th ed. 1858); *Julian Home* (4th ed. 1859); *St. Winifred's* (4th ed. 1863). His philological works are *The Origin of Language* (1860); *Chapters on Language* (1865); *Greek Grammar Rules* (6th ed. 1865); *Greek Syntax* (3d ed. 1867); and *Families of Speech* (1870). His more important theological works are *Seekers after God* (1869); *The Witness of History to Christ* (1871); *The Silence and Voices of God* (1873); and *The Life of Christ* (in two vols., 1874). He has also been a contributor to Smith's *Dictionary of the Bible* and other similar works. He is master of a singularly fresh and brilliant style. R. D. HITCHCOCK.

Farrar (JOHN), LL.D., American mathematician, b. in Lincoln, Mass., July 1, 1779, graduated at Harvard University, Mass., 1803. In 1805 he was Greek tutor at Harvard; from 1807 to 1831 professor of mathematics and natural philosophy at the same institution. In 1820 he married Lucy M. Buckminster, who d. in 1824; in 1828 he married Eliza Rotch. His *Elements of Algebra*, translated from La Croix, was published in 1818; in succeeding years he published eleven other translations of mathematical works, contributed to the *North American Review*, and d. at Cambridge, Mass., May 8, 1853.

Farrar (JOHN), b. at Alnwick, Northumberland, July 29, 1802, was educated near Leeds, became a minister in Aug., 1822, was governor of Abney House Wesleyan Theological Institution in 1839, and subsequently of Headingley College (1868); has been secretary and president of the Wesleyan Conference, the latter in 1854 and in 1870. A *Biblical and Theological Dictionary, Ecclesiastical Dictionary, Proper Names of Scripture*, and *A Manual of Biblical Geography* are his works.

Farrar (SAMUEL), b. at Lincoln, Mass., 1784, graduated at Harvard in 1797, and in 1800 became a tutor there. He afterwards was a lawyer at Andover, Mass., for thirty years was president of the Andover Bank, and for thirty-eight years treasurer of the Theological Seminary and Phillips Academy, of which institution he was a liberal benefactor. D. at Andover, Mass., May 13, 1864.

Farrar (TIMOTHY), LL.D., American judge, b. at Concord, Mass., July 11, 1747, graduated at Harvard University 1767, was a major in the American Revolution, and after its close a justice of the common pleas in New Hampshire for forty years. Feb. 22, 1802, he was appointed chief-justice. D. at Hollis, N. H., Feb. 21, 1849.

Farrar (TIMOTHY), LL.D., son of the preceding, b. at New Ipswich, N. H., Mar. 17, 1788, graduated at Dartmouth in 1807, was a law-partner of Daniel Webster from 1813 to 1816, from 1824 to 1833 judge of the New Hampshire court of common pleas, and vice-president of the New England Historical and Genealogical Society 1853–58. He has published the *Dartmouth College Case, Review of the Dred Scott Decision*, and articles in the *North American Review* and *New Englander*.

Far'rer (HENRY), a younger brother of THOMAS C. FARRER (which see), a rising artist, working principally in water-colors. B. in London Mar. 23, 1843, and followed his brother to New York in 1863, where he has since continued to reside. CLARENCE COOK.

Farrer (THOMAS CHARLES), an English artist, some time resident in New York, b. in London Dec. 16, 1838. His father was a radical of an extreme type, who, on principle, refused his son all means of education, and, as far as was possible, kept him from all companionship with his fellows. Farrer was seventeen years old before he learned to read or write. He early gravitated, however, to the light, and, encouraged by his mother, developed a love and aptitude for art, still further helped by the profusion of opportunity which London affords by the National Gallery, the British Museum, the Royal Academy, and, though last, not least, the print-shop windows. About 1855, Mr. Ruskin set up a free drawing-school in London, and here Farrer received his first and only definite instruction in drawing. In 1858, his father being dead, Farrer came to America, and after struggling for a considerable time he made the acquaintance of a number of young Americans of about his own age—artists, architects, and literary men, who, like himself, were enthusiastically devoted to the ideas and principles developed in the writings of Mr. Ruskin. This society welcomed Farrer as the ablest, and indeed the only, exponent of the faith that was in them, and they rallied so cordially about him as artist and teacher that his success was soon assured. He was a zealous and able teacher, and the influence he exerted through his classes at the Cooper Institute, his private pupils, his pictures in the Academy exhibitions, was very important. He insisted on close study from nature, on accuracy of drawing, on the importance of detail, and showed a prodigious industry and a skill in execution far

from common. But more important was the moral influence he exerted in counteracting the mercenary, worldly, and mechanic spirit that prevailed in the artist-world here, and which was doing infinite harm to the artists themselves and to the public. Farrer's high personal character, his patient perseverance in poverty and neglect, his refusal to work otherwise than he thought right, were a tonic of which we stood in great need. We owe him more for this than for his pictures. He formed several artists—Henry R. Newman, Charles H. Moore, Margaret I. McDonald—and was not without influence on the Hills, father and son, though to them also, as independent teachers, the development of art in this country owes a great deal. In 1869, Farrer went to England, where he has since remained, and where he will probably continue to live, as he has been very successful there, taken cordially in hand by Mr. Ford Madox Brown, Mr. Ruskin, Mr. Morris, and other leaders in that circle of painters, poets, and teachers. While living in America, Mr. Farrer was devoted to those progressive ideas which we love to call American, and when the war for the Union broke out he entered the ranks as a common soldier, showing then, as always, that his devotion to principle was not mouth-service merely. In 1864, Mr. Farrer married Anne Richards, daughter of the late Rev. James W. McLane. By this lady he has several children.

CLARENCE COOK.

Far'riery [remotely from the Lat. *ferrum*, "iron"]. From its derivation and the early use of the word, farriery means the trade of applying iron to the horse's foot. However, as all horse-surgery was of the coarsest and often of the most brutal kind, performed by the common smith with the tools and implements at hand, it is natural that veterinary surgery as it grew into a profession should have been called *farriery*. Now, however, the treatment of the diseases of our domestic animals is no longer of necessity left to the guesswork of the blacksmith, nor surgical operations to the tongs and searing-iron. Therefore we return to the original definition.

The foot of the horse is wonderfully guarded against injury from without, and equally protected against painful jars and disease which one might suppose would arise from the tremendous blows which the feet sustain when travelling upon hard roads. The hoof is a tough, elastic, horn-like substance, completely boxing in the delicate tissues, cushions, and bones of the foot. In the living animal and in the recent state it is in one piece, but after maceration it may be separated into the crust or wall, the sole, and the frog. The front part of the crust of each hoof is called the toe, the hindmost parts the heels, and the intermediate parts the quarters. The corresponding parts of the shoe have the same names. The *crust* grows from the coronet, at the top of the hoof next the hair, and from the sensitive laminæ which surround the pedal or coffin bone upon its upper sides. It is about half an inch in thickness at the edge, and in many horses so hard and tough that they hardly need shoeing at all except in icy weather or when used upon paved roads. The *sole* is a slightly-arched dome with a large segment removed, in the place of which the frog is found. The horn of the sole differs essentially from that of either the crust or the frog, it being more granular and shelly, wearing off naturally with comparatively little abrasion. At the rearward portions of the sole, divided as they are by the frog, two elevated ridges, of a character of horn more resembling the crust, occur. These are called the *bars*, and are really the ends of the crust reflected inward at the heels. The *frog* is a wedge-shaped body in form like a sharp-pointed V, the point being turned forward. It is of an exceedingly spongy and elastic kind of horn, and is placed as a cushion between the navicular bone and joint and the ground, to relieve concussion and to distribute jars so as to break their force. With every step of the natural foot, unshod as well as when at rest, the frog communicates a pressure directly upon the navicular joint and the tendons which underlie it. In ordinary shoeing the frog never touches the ground, being cut away and left reduced in size, while at the same time the foot is lifted up from the earth by thick-heeled or calked shoes. That a foot so treated becomes diseased is not to be wondered at. The wonder is that acute diseases of the foot are not much more prevalent. The flexibility and elasticity of the hoof, concerning which so much is written, rests chiefly, indeed almost altogether, in the frog, slightly in the sole, and practically very little or not at all in the crust or walls of the foot. Much has been written about the expansion and elasticity of the quarters and heels. It may be disregarded. There is indeed elasticity in the crust, but it is only brought into play perceptibly under extraordinary circumstances.

When an unshod natural hoof is placed upon hard ground, the parts which bear upon it are the edge of the crust all around and the frog. Upon uneven ground the sole is frequently called upon to sustain its share of the weight, and when the horse steps upon frozen clods or stones the sole often bears the whole. In travelling upon ordinary country roads the hoof wears very evenly; upon gravelly roads the toe usually wears fastest, and will first become tender. If the toe and quarters be protected from wear by a narrow shoe, for ordinary service no other shoeing will be necessary. If such a shoe, which is the "half-moon shoe" of Coleman, drawn out thin at the quarters, be seated nearly level with the sole by cutting out the crust of the hoof upon the toe and quarters, it is evident that the horse will have his natural foot, with simply an iron front edge to take the wear. This is the lightest and best shoe a horse can wear when his work is not too severe nor upon too rough ground. Were the same principle to be carried out in a shoe similarly seated (level with the sole), much wider in the web, and extended to the heels, so as to protect the foot thoroughly, the foot would still have its natural bearings, and be guarded against even extraordinary wear and tear. The frog would bear upon the ground, and so would the sole, nearly as much as if the hoof were not shod.

The presence of a shoe prevents the natural wear of the hoof; hence, sooner or later, according to the rapidity of growth of the horn, it must be reset and the horn pared back as nearly as possible to the condition it would have been in if it had not been shod and had worn off evenly and naturally. The earliest shoes worn by horses were probably plates of iron, having a similar shape to our present horseshoes, but covering a much larger portion of the hoof. This necessitated a paring away of both crust and sole when the shoes were reset. The sole is very easily cut by the smith, and so is the frog, while the crust is hard and tough. It is easily rasped off, however, after the sole is cut away, and the smith has plain sailing.

When a horse is brought to a common blacksmith to be shod, the "clinches" at the ends of the nails are first cut off; then the shoe is wrenched off with the tongs, a portion of the crust coming off frequently with it. This is done by an apprentice, who then proceeds to pare out the sole all around, cutting close to the frog. The cutting down of the crust is done by the smith himself, if he is a very careful man, or by an experienced journeyman, but quite as often trusted to an apprentice, who forms roughly, at his discretion, the seat for the shoe. Then the shoe is shaped, heated red hot or nearly so, and a seating burned level by the application of the hot shoe—an operation liable to do serious harm. When the shoe is formed to fit the foot it usually happens that if flat at first the heels are made nearly twice as thick as the toe, if indeed they be not turned down into calks, making the shoe at the heels half an inch to an inch or more in thickness; and thus it is applied. The result is that no part of the hoof touches the ground. The frog, upon which so much depends, is gradually reduced in size, both by the paring of the smith and (especially) by lack of use: it shrivels often to one-third its proper size. The paring out of the sole is usually accompanied by the cutting away of the bars entirely, which the smith says he does "to open the heels." The foot, thus weakened and placed in a most unnatural position, becomes the seat of disease. When the bars are cut away, or the soles pared too thin near the heels, and the frog has no bearing upon the ground, ulcers occur near the heels, which are called *corns*.

The frog should, by its constant pressure at every step, give healthy action to the navicular bone and joint; this wanting, inflammation or fever of these parts, *navicular disease*, results. To this, horses with strong, solid-looking hoofs are especially liable. Flat-footed horses are liable to another trouble from the same cause—namely, *founder*. As already said, the weight of the horse is sustained naturally upon the crust of the hoof and upon the frog. Where the frog can bear none the crust must sustain all. The crust grows in part from the sensitive laminæ enveloping the pedal-bone, and is attached to them by laminæ of horn interlocking—or, rather, interleaved—with them; and it is upon these sensitive laminæ that all the weight is thus placed. They can bear a great deal naturally, but inflammation (*laminitis*) is almost sure to come when there is a provoking cause, and the horse is foundered. *Seedy toe* is a form of laminitis, where the crust separates from the laminæ at the toe. *Pummice foot* is a name given to another form of laminitis, wherein the sole becomes convex instead of concave, and the horn is spongy within and externally brittle, the whole foot being in a highly feverish condition. *Contraction of the heel* comes from the same general cause—namely, want of frog-pressure. *Thrush* is a disease of the frog, made apparent by a very offensive discharge from the cleft, and results primarily from lack of use of the frog, and, except the frog be wounded, probably altogether from this cause. *Quittor* is an ulcer or abscess of the foot, result-

ing from bruise, nail-prick, thrush, or any other cause which may finally, if neglected, affect the coffin or pedal bone. It cannot be treated by the farrier, but presents a problem which only a surgeon can properly solve. Taken in time, a cure is possible. *Sand-crack, quarter-crack,* etc.—The fibres of the horn in the wall of the hoof run from the coronet to the ground direct. In hoofs subject to inflammation the secretion of horn is often of a weak character, and the fibres separate, forming a crack, or, in case of an injury to the coronet, a soft, spongy streak in the horn, causing lameness. The cause of the former is bad shoes and bad shoeing—of the latter, usually, "calking," the horse treading on his own coronet. The cure for both is causing healthy horn to be secreted by rest and counter-irritants, and shoeing so as to give bearing to the frog and sole. *Nail-prick* in shoeing shows itself either at once, in which case little harm usually results, or after the horse has been used a day or so, in which case suppuration may take place. The horse will tell which nail is at fault when the hoof is tapped by the hammer around the clinches. The offending nail must be taken out, the shoe being removed, the hole probed, and if any fetid odor be perceptible and the hoof be hot, the hole must be enlarged, and, in case of any discharge, cut out until blood flows, and the opening syringed out with chlorinated soda, chloride of zinc, or some other active prophylactic. The shoe may be replaced if necessary, provided the animal is not seriously lame, the nails being lightly driven. The foot must be kept cool and rest given. Nails picked up on the road will seldom enter the sole to do injury if it be not pared down, and thus softened and weakened; but they may be found between the frog and the bars, in which situation they seldom do much injury unless neglected. The wound should be cleaned out and syringed with some corrosive as above mentioned. *Overreaching* is when a horse throws his hind foot into the heels or against the sole of the fore foot as it is partially raised to take the step in trotting. It occasions bruises on the heels or in the sole near the toe. The former are treated by external applications—tincture of arnica, etc.; the latter like a prick or any bruise of the sole. A horse well shod will seldom overreach, but long hoofs or big toe-calks on the fore feet will cause the foot to be placed upon the ground an inch or two short of where it should rest, and this is sufficient cause for the trouble. *Interfering, or "cutting."*—A horse allowed to tread fairly on the ground seldom or never cuts himself, if the shoe does not extend outside the crust.

So far as we are aware, the most rational system of horseshoeing ever proposed is that invented by Mr. Goodenough, and called the Goodenough system. It has been for several years, and is now, extensively used by street-railroad companies in New York and Brooklyn and elsewhere, and by omnibus, express, and transfer companies also. The superintendent of one of these stables informed the writer that the simple use of the Goodenough shoe and system, without any other application, had cured corns, quarter-cracks, thrush, etc. throughout his stables, and had developed previously shrunken frogs, spread out contracted heels, and given his horses almost uniformly sound feet. The shoe is applied by cutting out a seating for it, leaving the sole and frog as much exposed as possible, and never applying the knife to either. It is light, has five calks or bearings, a lower surface, similar to the edge of the natural foot, is beveled on both surfaces, the nail-holes are countersunk, and the shoes are applied *cold.*

M. C. Weld.

Far'rington (William George), D. D., an American clergyman, b. Dec. 15, 1832, in the city of New York; graduated from Columbia College in 1853, and from the General Theological Seminary, New York, in 1856. Was ordained deacon on St. Peter's Day and priest on St. Thomas' Day of the same year, and entered upon the rectorship of St. John's church, Huntington, L. I., which he held until July 4, 1858. Assisted in Trinity parish, New York, from Dec. 15, 1858, to Easter, 1862. In the spring of 1863 he organized the parish of Christ Church, Hackensack, N. J., and continued rector of the same for seven years. In 1870 accepted a call to St. Barnabas' church, Newark, and in 1872 took charge of the church of the Holy Innocents, Orange, N. J., where he resides (1874). Published a tractate on *The Historical Church* in 1861, and has edited *The Church Almanac* since 1868. Was elected secretary of the diocese of New Jersey in 1867, and secretary of the General Theological Seminary, New York, in 1869, both of which offices he still holds. The degree of master of arts was conferred upon him by his alma mater in 1856, and the degree of doctor of divinity by the College of William and Mary, Va., July 4, 1873.

Far Rock'away, bathing-place upon Rockaway Beach (Long Island), is in Hempstead tp., Queens co., N. Y., on a branch of the Southside R. R., 21 miles S. E. of Brooklyn.

Fars, or **Farsistan'** [a name etymologically identical with *Persia*], a province of Persia, lying between lat. 28° and 32° N. and lon. 50° and 55° E., presenting an area of 55,000 square miles, with a population of 1,700,000, and bounded by the Persian Gulf and the provinces of Khoozistan, Irak-Ajemee, Yezd, Kerman, and Laristan. Along the gulf the land is low, sandy, or argillaceous, scorched by the sun—a desert; farther back it rises through broad terraces, separated from each other by high and wild mountain-ranges, into a flat, sandy table-land, where the large salt lake Bakhtegan occurs. The terraces belong to the most fertile and beautiful regions on earth. They are well watered by the Bundemeer (Araxes), which flows into Bakhtegan, and by the Nabou and the Tab (Arosis), which fall into the Persian Gulf. They produce tobacco, wine, rice, dates, opium, linen, cotton, silk, and kermes. They are the home of the rose, from which is manufactured the celebrated perfume, attar. They have iron and lead mines and marble and alabaster quarries. The principal towns are Shiraz, Jehroom, Darab, and Bushire. In this province occur the ruins of Persepolis, Pasargadæ, and Shapoor, and the celebrated sculptured rocks called by the Persians *Naksh-i-Rustam.*

Far'thing [from the Ang.-Sax., and signifying a "fourth part"], a British coin, the fourth part of a penny. It was coined by the Saxons, and again by King John (1210), but the quarter of a penny, cut twice across, also passed for a farthing. In Edward VI.'s time the coinage of silver farthings ceased. An act 9 Henry V. mentions a *gold* farthing. Copper farthings were first struck in 1665; tin farthings appeared in 1684 and 1692; half farthings were coined in 1843 and 1852. A farthing is worth about half a cent.

Farthingale. See Crinoline.

Far'well, post-v., capital of Clare co., Mich., 55 miles N. W. of Saginaw, on the Flint and Père Marquette R. R. It has a union school, 2 churches, 1 newspaper, 2 hotels, 1 ladies' library, 1 public park, 1 manufactory of hemlock extract, 1 large saw-mill, and 8 stores. It was organized on temperance principles, and is so conducted. Principal business, farming and lumbering. Pop. about 700.

James S. Holden, Ed. "The Register."

Fasa'no, town in Southern Italy, in the province of Terra di Bari, on the road from Bari to Brindisi. It is celebrated for its olive-plantations. Pop. 11,022.

Fas'ces [Lat., plu. of *fascis*, a "bundle"], a bundle of rods of birch or elm, sometimes having an axe (*securis*) tied up within it. Such fasces were borne by the lictors before the superior magistrates of ancient Rome. The ancient kings, the consuls, the prætors, the dictator, etc. had the fasces carried before them; while the quæstors had this distinction in the provinces only. Generals who had been saluted as imperatores had fasces crowned with laurel, a custom anciently observed with some of the other magistrates. The number of the fasces and lictors varied with the rank of the dignitary, and was different in different ages.

Fas'cia [Lat., a "bandage;" plu. *fasciæ*], in the anatomy of man and most of the vertebrate animals, a laminated tissue of fibrous or aponeurotic character found in nearly all parts of the body. There are two kinds, the superficial and the deep fasciæ. The superficial fascia lies under the skin, is of varying thickness, and is disposed into several layers of fibro-areolar substance, containing particles and layers of fat. Between its layers blood-vessels and nerves run. Its fat serves to keep the body warm. The deep fasciæ are composed of unyielding fibrous substance. They sheathe the several muscles and the entire limbs (aponeuroses of investment), or serve instead of bones for the insertion of certain muscles (aponeuroses of insertion).

Fascina'tion by Serpents. Popular opinion has for a long time attributed to certain serpents a power of so charming weak animals by their eyes and movements of body that they are easily secured as prey. This is not a blind, overpowering force, but one which the doomed animal seems to partly appreciate, but is unwilling to entirely resist. Squirrels, mice, and the weaker birds are the animals which are most often captivated by this power. They are described as running in front of the fascinator by short vibrations of distance or passing round in a circle, gradually shortening the intervals until they are seized by the serpent. Often the animal during the process utters piercing cries, as if aware of its danger, and yet unable to resist. Sometimes a diversion of the animal's attention by a sudden noise, or the interposition of some material obstruction to the vision, breaks the charm and sets the captive free.

Though the whole process is often ridiculed as impossible, yet it seems to bear a striking analogy to the so-called mesmeric influence which one human being sometimes has over

another, or to the more undefined od or odylic force. Or perhaps it is the diseased mental or bodily element manifested in a desire often expressed by persons to throw themselves from a tower or precipice; and even still further, where the mind or body or both are so diseased that there is a morbid impulse to commit an insane act, or destroy its own self or some other person. EDWARD HITCHCOCK.

Fash′ion [remotely from the Lat. *facere*, *factum*, to "make"], in dress, in customs, on every field where it reigns, arises from our desire of beauty, and changes with our ideas of what is beautiful. Dress is by itself a product of physical necessity, determined by a regard, first, to what is useful under a certain climate (*national costume*); then, to what is convenient for a certain occupation (*uniform*); and lastly, to what is beautiful (*style*). Customs are by themselves a product of moral necessity, determined by a regard, first, to what is due to certain authorities (*religious rites*), next, to what is proper at certain occasions (*social etiquette*), and lastly, to what is beautiful (*good manners*). The true cause of any change of fashion in dress or customs is a regard to beauty, purposing to produce a new and more refined harmony, or at least to avoid something harsh and discrepant; and although in details it would be very difficult to demonstrate the relation between a certain piece of dress and the ruling ideal of beauty, still in all the great movements of fashion the connection is apparent. The enormous change which took place between 1789 and 1799 in dress corresponded exactly to a similar change of taste in general from the *rococo* to the classic ideal. Fashion thus being the expression of the ideal of beauty in a certain stage of its development, stubborn disregard makes people as unfit for refined society as stupid acceptance; the uncouth independence of the "original" is generally neither more valuable nor more agreeable than the conceited silliness of the "swell."

Fasquelle (JEAN LOUIS), LL.D., b. in France in 1808, became a resident of the U. S. in 1834; was professor of languages in the University of Michigan 1846–62; author of a series of French text-books. D. in Michigan 1862.

Fast [Ang.-Sax. *fæstan*], to abstain from food from any cause, particularly through religious discipline. When the mind is much excited the claims of the body are less felt; if disturbed by grief, there cannot be much regard for the gratifying of appetite. The Psalmist expresses what is common to man when he says, "My heart is smitten down, so that I forget to eat my bread." Fasting thus becomes an expression of mental engagement. It is natural that a man should observe what is seen to attend the state of mind which he would cultivate. It is also wise that any outward rule intended to enforce special spiritual duty should impose, as an aid, the outward attendant on the spiritual state. Hence it is that men are severe with themselves in proportion as they consider it proper to discipline their souls, and that in all ages and in all countries religion has imposed fasting. The proper state of mind can be indicated only, but the outward signs of such a state can be exacted; and so fasts belong to all religions. All ancient nations with whom history makes us acquainted had their fasts—the Egyptians, the Phœnicians, the Assyrians, the Indians, and after these the Greeks and Romans. Extraordinary religious acts were preceded by fasts. The mysteries demanded this discipline, especially from those about to be admitted to them. In consequence of certain prodigies the Sibylline books directed "a fast in honor of Ceres to be instituted and to be kept every fifth year." (*Livy*, lib. 36, c. 37.) A stated fast imposed by Jupiter is spoken of by Horace (*Satire*, ii. 3). Fastings were sometimes practised before undertaking military enterprises, or whenever there was special cause to seek the favor of the gods or to avert their anger. A notable instance is given in the book of Jonah. When Nineveh was threatened with destruction, to avert the calamity a fast was proclaimed, and the order given, "Let neither man nor beast, herd nor flock, taste anything; let them not feed nor drink water." Among heathen philosophers and religious people fasting was reckoned a duty—markedly so by the Pythagoreans, who lived a life of constant asceticism, abstaining always from flesh and fish, and at times from food altogether. At the present day, fasting as a religious act is confined to no land or faith. The nations of the East and our Western red men are alike exceedingly severe in this respect. The Mohammedans keep as an annual fast their ninth month, Ramadan; during every day of this month, from sunrise to sunset, they eat nothing, drink nothing, and give up the solace of their pipe and every other usual indulgence. Their months being lunar, each in the course of thirty-three years occurs in every season. When the Ramadan happens in summer, the long hot days are exceedingly trying to those who must labor. The Jews from their earliest existence to the present day have observed stated and special fasts, national and private. Under the Law, as first given, there was but one day imposed on the nation—the great day of the Atonement. In the course of time four other days were added in commemoration of sorrowful events in Jewish history. These days, especially the first, have been always, and are now, observed with great rigor: no food, no water, is allowed to pass the lips, not even for the rinsing which, on first rising, must always make clean the mouth before the pronouncing of God's name; even the swallowing of the saliva is carefully avoided. The fast lasts from sunset, when the Jewish day begins, until the shining of the stars the night after. Besides the public fasts, there were and are many observed by individuals in consequence of vows, or because of personal cause for affliction, or by way of discipline. The Pharisees fasted statedly twice in the week—Monday and Thursday. These fasts are not all of equal severity.

Under the New Testament there is no fast-day appointed by the Lord or by his apostles, nor does the practice rest upon direct command from them. It is even clear that Jesus imposed no special abstinence on his disciples, but it is also clear that he assumed that this exercise would not be neglected by any who desire the rewards given by God. He gave directions for fasting, for the shunning of hypocritical show, saying, "When ye fast be not of a sad countenance," etc., and by his example he taught the duty. It may be said that he thus taught and acted as a Jew. But we know that when it was objected that his disciples did not fast as did those of other Jewish teachers, he gave as a reason why they did not that he being with them the signs of sorrow were not expedient; and he added that the time would come when they should fast, referring to a time after the fulfilling of the Law. If the apostles gave no rule on the subject, there is no room to doubt as to their practice. One reference is sufficient. In Acts xiii. it is said that as certain prophets and teachers at Antioch "ministered to the Lord, and fasted, the Holy Ghost said, Separate Barnabas and Saul for the work whereunto I have called them. And when they had fasted and prayed, and laid their hands on them, they sent them away."

It is not so stated in the New Testament, but we cannot but believe that from its first recurrence the day of the crucifixion was observed as a day of humiliation, as it has been through the many centuries since. We know that very soon rules were laid down touching this and other seasons of bodily mortification. Wednesday and Friday in every week were kept as such, and early writers who speak of these days of abstinence refer the observance to apostolic usage. The duty of bodily mortification at times of repentance or humiliation or of special spiritual exercises (for fasting does not of necessity imply sorrow) is recognized, it is believed, in this day by all classes of Christians without exception. There are some bodies of believers who have rejected the seasons so long observed, but yet these, on what they deem proper occasions, appoint days to be kept by all their members. Even the early Puritans of New England had their yearly Fast-day.

In the West, the churches of the Roman obedience, together with the Church of England, impose as stated fasts, first, Lent, the *spring* fast, beginning with Ash Wednesday in the seventh week before Easter, and counting forty days, Sundays being excluded. This long fast is of very early observance, but the time of its commencement and the period of its duration were not always the same, it being an expansion of the observance of the time of the passion of our Lord. As now kept, Lent was fixed by Saint Gregory the Great in the sixth century. Second, the Ember Days, which are Wednesday, Friday, and Saturday preceding the four quarterly seasons of ordination. It has been already shown that in apostolic days fasting preceded ordination. The name is variously accounted for: probably it is a corruption of the Latin name for the seasons—*quatuor tempora*, or *tempora*. Third, the Rogation Days, the three preceding Ascension Day. This fast is not older than the close of the fifth century; it was first instituted in Vienne in France, to accompany a season of special rogations (petitions) that God would withdraw certain temporal chastisements. It was probably fixed because of its being a meet introduction to a great festival. Fourth, every Friday, this day being the weekly commemoration of the crucifixion, even as the first day, the Lord's Day, is a joyful remembrance of his resurrection. Fifth, the vigils on the eves of certain great festivals. At one time these vigils were literally kept as watches, the whole night, or a part, being spent in devotions in the churches. They are not so kept now. Advent, the four weeks before Christmas, bears some analogy to Lent, but its Wednesdays and Fridays are alone kept as fasts. The Protestant Episcopal Church in the U. S. follows the Anglican rule, excepting that vigils are not imposed.

The rule of the Orthodox, the Armenian, and other

churches of the East is nearly like that of the Western, having the same origin, that of the usage before the schism, but in some details they differ—*e. g.* in the Holy Orthodox Church on the 1st of August begins the fast of the Mother of God, which lasts until the feast of her repose—fourteen days. It is to be observed, however, that in the East the strict idea of a fast is preserved to a greater extent than in the West. From earliest times a distinction in food was recognized, and allowance made for those who through bodily weakness could not wholly abstain. To whatever due, it is a fact that in the West the rules of fasting have always been more lenient than in the East. Very few of the days spoken of as fast-days are strictly such; they are days of abstinence, when less food and of a coarser character is taken. In the Holy Orthodox Church 266 days in the year are kept as fasts with scrupulous fidelity.

A practice so universal as that of fasting must be based on some necessity of man. Nevertheless, the objection is sometimes heard that it tends to spiritual pride and formalism. This must be granted, but abuse is no argument against due use. A Christian, who knows that his Lord joined together prayer and fasting, can hardly advance the objection. It is also objected that health is frequently injured by religious fasting. It may be so. But on the other hand, it can admit of no doubt that in an age and country particularly luxurious a stated abstinence from food, a weekly putting aside of self-indulgence, and supporting the body on plainer, less attractive food, would go far towards freeing men from many of the evils that wait on appetite. WILLIAM F. BRAND.

Fast-and-Loose, a game formerly much played at fairs and popular assemblies in England. The exhibitor places a girdle, belt, or garter upon a table in such a way that it seems certain that a skewer thrust through it in a certain direction must hold it fast to the table. Upon this point the rustic visitor is induced to wager his money, when the exhibitor takes the belt by both ends and pulls it away without any difficulty.

Fas'ti, the court-days or festival-days of the ancient Romans. The word is used absolutely to denote these. But as *fastus, -a, -um* is, properly speaking, an adjective, derived, probably, from *fari*, it is necessary to supply *dies*. In accordance with this derivation, *dies fasti* were days on which it was allowed to speak, hence days on which judgment could be pronounced, on which courts could be held—court-days. A *dies nefastus* therefore denoted the opposite, and *dies nefasti* were esteemed unlucky days. To the *dies fasti* belonged the *dies comitiales;* to the *dies nefasti*, the *dies religiosi*, which were considered days of evil omen. The institution of these days is ascribed to Numa Pompilius, and belongs, therefore, to the earliest days of Rome. Their order or succession was long known only to the priests, who thus acquired great political power, until Cn. Flavius made it public about 304 B. C. From this time onward the lists of the *dies fasti et nefasti* received more particular attention, and contained, gradually enlarged and perfected, an accurate description of the whole year according to its months, with exact specification of the *dies fasti, dies comitiales*—festivals and holidays, days appointed for the celebration of public games, etc. Thus, they assumed the form of our calendars or almanacs. As they were still, notwithstanding the care taken in their preparation, unavoidably inaccurate and imperfect, we are told of Cæsar "fastos correxit," etc. As the fasti or calendaria of ancient Rome were engraved on stone and set up in public places, remnants or fragments of such records, more or less complete, have been preserved and united together, in order to produce as perfect a representation as possible of one of these ancient Roman calendars or almanacs. If the ordinary fasti or calendaria are valuable as affording a correct knowledge of the Roman year, much more important are those which Livy calls "fasti consulares," and which, because they were set up on the Capitoline, are also called Capitolini. The Fasti Capitolini contain lists of the annual consuls, of the censors, dictators, magistri equitum, and also of generals who celebrated triumphs (*fasti triumphales*) and a record of the services for which a triumph had been granted. Of such Fasti Capitolini important fragments, discovered in 1547 at Rome, are extant. (For further particulars, see PAULI'S *Real Encyklopädie*, etc.)

Fasti is also the title of a well-known but unfinished poem by Ovid, the subject of which is the Roman festivals —the festival-calendar. It may be regarded as "a poetical year-book or companion to the almanac, having been composed to illustrate the Fasti published by Julius Cæsar," who corrected and entirely reformed the calendar.

HENRY I. SCHMIDT.

Fa'ta Morgan'a [the *Fairy Morgana—i. e.* castles or palaces of], a remarkable and singularly beautiful effect of mirage, occasionally observable in the Sea of Reggio, Straits of Messina, between Sicily and Calabria. It presents a series of magnificent architectural structures and landscape views, embracing columns, arches, towers, castles, palaces, trees, avenues, and wooded plains, with crowds of moving men and animals, all constantly varying and assuming new aspects, and in certain conditions of the atmosphere becoming resplendent with prismatic colors. There can be no doubt that these images are derived from objects on the shore, their singular forms and transformations being the result of extraordinary refractions in the atmosphere (for the explanation of which see MIRAGE). F. A. P. BARNARD.

Fate [Lat. *fatum;* literally, "something spoken," as a decree, and involving the thought that events come out of an inevitable destiny]. Fatalism is the belief in such a destiny. It has various forms. The old Chaldaic or astrological fatalism looked upon the visible heavens as the book of this destiny, and found all things necessarily prefigured in the positions of the stars. The old Stoical fatalism considered the rise and the decay of the world as controlled by an absolute necessity, but while this necessity, with them, was a fate (εἱμαρμένη) which determines, it was also a providence (πρόνοια) which governs all things. The fatalism of the Greek dramatists made all events fixed through the control of Dike and Nemesis, Justice and Retribution. Mohammedan fatalism regards all things, great and small, as so inexorably predetermined from the foundation of the world that no accident is possible, and any attempted defence against danger is futile. Pantheistic fatalism considers the infinite substance which it calls God to be developed in space and time by a procedure so changeless that things extended or things thought are equally necessary; and which not only destroys all freedom of the will, but obliterates all distinction between good and evil. The modern philosophical conception of fate is that of a blind causality undirected and undetermined by any conditions. J. H. SEELYE.

Fates, The [Gr. Μοῖραι, plu. of μοῖρα, "one's part, lot, or destiny;" Lat. *Parcæ*], in the Greek mythology, three goddesses who ruled the fates of men and all things. They are generally named Clotho, who spins the thread of life; Lachesis, who marks off the allotted span; and Atropos—the inflexible—who cuts the thread. Their genealogy, and the whole mythus, are quite variously given in different authors. The Homeric poems speak usually only of one Moira, and the personification is not complete; no particular appearance of the goddess, no attributes, and no parentage are mentioned. Nor is the Homeric Moira an inflexible fate to which the gods themselves must bow; on the contrary, Zeus, as the father of gods and men, weighs out their fate to them. With Hesiod the personification of the Fates is completed, but they are still represented as depending on their father Zeus, and subject to his commands. And it was not until the time of Æschylus that they appeared as the divinities of fate in the strict sense of the word, independent of the Olympic gods, the messengers of the eternal necessity to which even the gods must bow. They are generally associated with the Erinnyes, who inflict the punishment for evil deeds, and they are sometimes called their sisters. By authors still later their genealogy is changed, and they are called children of Erebus and Night (Cicero), of Cronos and Night (Tzetzes), of Ge and Oceanus (Athenagoras), or of Ananke and Necessity (Plato).

Fa'ther Lash'er, or **Luck'y Proach,** the *Aspicotta bubalis*, a marine fish of the European and Arctic American coasts, from six inches long up to a much larger size. It belongs to the Cottidæ or sculpin family, its head is covered with spines, and it has a repulsive aspect. It can live a long time out of water, and though regarded with aversion and seldom used, it affords a palatable article of food.

Fa'ther Point, a small post-v. of Rimouski co., Quebec, Canada, on the S. shore of the St. Lawrence, 207 miles below Quebec. It is important only as a landing-place for passengers and mails from ocean steamers. Father Point lighthouse is in lat. 48° 31′ N., lon. 68° 27′ W. Pop. about 100.

Fa'thers (of the Church), the distinguished earlier laborers in the Christian Church. (See APOSTOLIC FATHERS.) The Roman Catholic Church distinguishes between Church Fathers, Church teachers, and Church writers. The Church teachers are men of acknowledged orthodoxy, authorities for the doctrines of the Church, while the Church writers are of less, or even doubtful, authority. The greatest of the Church teachers are also Church Fathers. Such were Athanasius, Basil the Great, Gregory of Nazianzen, and Chrysostom in the Oriental Church—Jerome, Ambrose, Augustine, and Gregory the Great in the Church of the West. Thomas Aquinas and Bonaventure may be named

as Church teachers who were not fathers, and Tertullian in his second era and Origen as Church writers. The line of Church Fathers is generally regarded by Protestant theologians as terminating with the sixth century; the Roman Catholic writers extend it to the thirteenth. The scientific treatment of the matter contained in the writings of the Fathers is embraced in PATRISTICS (which see), while their lives and topics related to the externals of their works come under the head of PATROLOGY, but this distinction is not always observed. The Fathers are of great value in the history of biblical interpretation, the history of dogmas, creeds, rituals, the constitution of the Church, and indeed in every part of historical theology; nor is there any part of theology in which they may not be made highly useful. In the greatest internal struggles of the Church the importance of the Fathers as witnesses or as authorities has been recognized on both sides, as in the Reformation, and in our own day in the controversies of the Anglican Church. (The principles to be observed in interpreting the Fathers are stated in KRAUTH'S *Conservative Reformation*, 726 *seq.*) Next to the Apostolic Fathers in value are the Apologists, or APOLOGETIC FATHERS (which see); the Alexandrians, Clement and Origen, Athanasius, Gregory of Nyssen, Chrysostom, Augustine, and Jerome. (All the earlier writers on patrology, beginning with Jerome, were edited together by Fabricius, 1718.) The greatest laborers in the issue of editions of the Fathers have been the BENEDICTINES. (See that word and BENEDICTINE EDITIONS OF THE FATHERS.) Next to them have been the Anglican divines. The most recent interest in patristics in Great Britain has been shown in the issue of translations of the Fathers. In the Roman Catholic Church, among the names illustrious in patristics are Bellarmin, Oudin, Du Pin, Le Nourry, Tillemont, and Hefele; in the Protestant churches of the Continent, Scultetus, Walch, Danz, Bunsen, Otto; in Great Britain, Cave, Cureton, Routh, and Pusey. Among the editions of the collected writings of the Fathers, the most complete are De la Bigne's, 17 vols. fol., 1654; the Lyons *Maxima Bibliotheca*, 27 vols. fol., 1677; Cailleau and Guillon, 1829 *seq.*, 148 vols., and still in issue; Migne, 1844 *seq.* The last is, *in bulk*, the greatest of the collections. The very numerous editions of particular Fathers are mentioned under their names. Books of selections, Rösler, Augusti, Orelli, Philo, Œhler; epitomes, introductions, Moehler (1839); monographs on the lives and literature of the Fathers, Ullmann—Gregory of Nazianzen; Neander—Chrysostom (3d ed. 1858); Wiggers—Augustinismus (1821–1831) have been characteristic of our century. C. P. KRAUTH.

Fath'om [from a Teutonic root denoting a "seizure;" Gothic, *fahan*, to "take"], originally the length which a man can measure by extending both his arms. It now denotes a measure equal to two yards, or six lineal feet, and is chiefly employed in nautical affairs. It is the unit of measure in soundings, and is employed in the measurement of cables, etc. The early colonists of the present U. S. reckoned the Indian wampum-chains, then current as money, in fathoms.

Fat'imites, a family of Arabian caliphs who took their name from the fact that they claimed descent from Fatima, the daughter of the prophet Mohammed. They ruled from 909 till 1171, chiefly at Cairo, and at the period of their widest sway ruled all North Africa, with Syria and Palestine. They professed the Shiite doctrines, while the subjects of the Bagdad caliphs were orthodox. After the death of the last Fatimite of this line (Adhid), the great sultan Saladin assumed authority.

Fat Lute, a mixture of pipe-clay and linseed oil, mixed and worked together like putty. It will stand considerable heat. It is used by chemists and pharmacists to cover joints in apparatus, and especially to prevent the escape of corrosive vapors.

Fats. (See OILS.) In the common sense, fats are those unctuous parts of animal and vegetable bodies secreted in the cellular tissues, and separable therefrom by fusion at a moderate temperature. The animal fats do not differ chemically from those of vegetable origin. Both are definite compounds of certain fatty acids, chiefly oleic, stearic, and palmitic acids, with a peculiar base called GLYCERINE (which see), or the sweet principle of fats. The fats are, as a rule, nearly insoluble in water, but dissolve readily in ether, which is their proper solvent. They are also soluble in naphtha, benzine, and the oils from coal; in oil of turpentine and other essential oils; bisulphide of carbon, chloroform, fusel oil, etc. They are scarcely at all soluble in cold ordinary alcohol. In absolute alcohol they dissolve much more readily than in weaker alcohol, and especially with the aid of heat.

The fats stain paper permanently, and are not volatile by heat, a high degree of heat being required to make them boil. They distil over at a high heat, but not without complete, or nearly complete, decomposition, and the evolution of a peculiar pungent, disagreeable odor, irritating the eyes and known as *acroleine*. Those fats which are fluid at ordinary temperatures are called oils. All the fats burn with a bright flame and with little smoke.

Chemically, the fats form part of a very large group of organic bodies (the fatty group), distinguished as containing no nitrogen or its analogues, being hydrocarbons with little or no oxygen.

M. Chevreul, in a series of six memoirs concluded in 1816 (*Ann. de Ch. et Phys.*), first revealed to us the true constitution of the fats—that they are mixtures of several fats of different degrees of fusibility—*e. g.* oleine, stearine, palmitine—the hard fats being chiefly stearine and palmitine, and the soft fats oleine. The hard fats are beef fat, mutton fat, human fat, cholesterine, Chinese tallow, cacao butter, wax, spermaceti, etc.; the soft fats, hog's lard, butter, etc., which are greasy at ordinary temperatures; while the liquid fats, or oils, are fluid at ordinary temperatures.

The researches of Chevreul showed that fats were either saponifiable or non-saponifiable; *e. g.*, if boiled with an alkaline solution, certain fats, so called, were unaffected (as spermaceti, wax, paraffin, etc.), while others were broken up and soaps formed, the fatty acids combining with the alkali, while the glycerine was set free; and that this change was accompanied by a gain of weight in the products as compared with the weight of the factors employed; which could be accounted for only by the assumption that hydrogen and oxygen from the water must contribute to form the product. This led him to the conclusion that the saponifiable fats were analogous in constitution to compound ethers—*i. e.* the fats are compounds of fatty acids with glycerine, *minus* a certain quantity of water, just as ethers are compounds of alcohol with acids, *minus* a certain quantity of water. In later years the researches of Berthelot have demonstrated the accuracy of Chevreul's views by the synthesis of fats from the union of fatty acids with glycerine, and the separation of one, two, and three molecules of water. (See GLYCERIDES, OILS, and SOAP.)

The memoirs of Chevreul on the fatty bodies are among the most remarkable examples of a chemical research which has remained for more than half a century almost without important addition or change from the labors of subsequent investigators. B. SILLIMAN.

Fat'ty Degenera'tion, in pathology, a condition in which the minute structural elements of the tissues of living organisms are gradually replaced by fat-globules. In man this diseased condition has been observed in nearly all the tissues, though some authorities state that the nerves and the red corpuscles of blood are not liable to this change. Fats, though always of organic origin, and often closely associated with living tissues, are never, it is believed, truly organized bodies; and consequently they are not regarded as ever truly vitalized, any more than are the water and the lime which are found in living organisms. In this view, fatty degeneration is a molecular death, a necrobiosis, of the tissues. It has been likened to the change of dead bodies into adipocere.

In the great closed glands of the fœtus, and in the corpus luteum of the ovary, fatty degeneration is a normal process. In the liver, it is merely an excess of the normal fatty element contained in the acini, which, however, encroaches upon the organized elements of those structures, and becomes a true fatty degeneration. It also attacks the muscles, and especially the heart; the bones (in some forms of *mollities*), the brain (yellow softening), the cornea (*arcus senilis*), and the kidney in many cases of so-called Bright's disease. The fatty degeneration of the heart is a rather frequent disease, but very difficult to detect, even by the trained diagnostician. When suspected, a quiet life, a nourishing but not too stimulating diet, with the judicious use of tonics and iron, are to be recommended. For the disease there is no cure known.

REVISED BY WILLARD PARKER.

Fatu'ity [from the Lat. *fatuus*, "insipid, tasteless, foolish"] is a state of mind characterized by absence or great deficiency of the will and the intellect, and by apathy with regard to those things which usually arouse the feelings and impulses. If congenital, it constitutes complete or partial idiocy. When it is associated with, or consequent upon, acute disease, it has no significance except as a symptom of that disease; while if it be long continued, obscure in its origin, and progressive in character, it is almost certain to result in dementia, one of the most hopeless forms of mental disorder.

Fau'ces Ter'ræ [Lat., "jaws of the land"], projecting headlands or promontories, including arms of the sea, as, *e. g.*, bays, creeks, lakes, basins, harbors, rivers, etc., where the tide ebbs and flows. In England the general rule is

that such bodies of water, as far as the point to which the flow of the tide extends, and unless they are within the body of a county, are under the jurisdiction of the courts of admiralty. In these exceptional instances the common-law courts exercise exclusive jurisdiction, except in a few classes of questions to which admiralty powers have been extended by statute. A stream is said to be "within the body of a county" (*infra corpus comitatus*) when a person standing on one shore can see what is done upon the other. In the U. S. the admiralty jurisdiction is not confined to tide waters, and is not excluded from waters "within the body of a county," but extends over the great lakes and over all rivers, etc. capable of navigation for practical commercial purposes. The whole subject is fully developed in the decisions of the Supreme Court of the U. S., as found in the volumes of reports.

George Chase. Revised by T. W. Dwight.

Fau'cett's, tp. of Alamance co., N. C. Pop. 1327.

Fauche (Hippolyte), b. at Auxerre in 1797, inherited a fortune and became a Sanscrit scholar. His translations of the *Râmâyana* (9 vols., 1854–58) and the *Mahâbhârata* (7 vols., unfinished, 1863–67) are among his most important works. He published an original tale and some poems. D. at Juilly, Seine-et-Marne, 1869.

Faucher (Léon), French state minister, political economist, and financial writer, b. in Limoges Sept. 8, 1803, was in youth a designer of embroidery-patterns, and then a teacher; wrote for the *Courrier Français* and the *Revue des Deux Mondes.* In 1846, in the French Chamber of Deputies, acted with the *Gauche;* minister of the interior from Dec., 1848, to May, 1849, and from Apr. to Oct., 1851; was liberal but not republican in politics. *Studies on England* (1845) and *Miscellanies of Political Economy and Finance* (2 vols., 1856) were his productions. D. at Marseilles Dec. 15, 1854, having always declined office under the emperor Louis Napoleon.

Fau'cit (Helen), an English actress of renown, b. in 1816, made her *début* at Covent Garden, London, Jan. 5, 1836, in the character of Julia in the *Hunchback*, in which she achieved great success and at once took high rank as an actress, becoming a leading member of Mr. Macready's companies during the production of his Shaksperian revivals. She was the original representative of the heroines in Bulwer's *Lady of Lyons, Richelieu*, etc., and in many other plays of different authors; married in 1851 to Theodore Martin, but has continued to appear on the stage at intervals. George C. Simmons.

Faugeres (Margaretta V.) was b. at Tomhanick, near Albany, N. Y., in 1771. Her mother, Mrs. Ann E. Bleeker, had considerable fame as a poet. In 1792 she married Dr. Peter Faugeres of New York, whose irregular habits brought his wife to poverty. She afterwards became a successful teacher, and was well known for her poems and prose-writings, which at that time were highly prized. *Belisarius* (1795), a tragedy, was her most ambitious work. D. at New York Jan. 9, 1801.

Faul'horn, a mountain of the Alps, in the canton of Berne, between the valley of the Grindelwald and the Lake of Brienz. It is 8802 feet high.

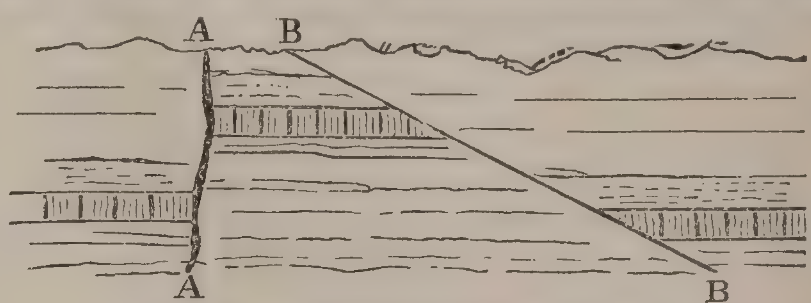
Faulk, county of S. E. Central Dakota. Area, 900 square miles. It is chiefly on the Couteau de Missouri, and is traversed by the watershed or divide between the valleys of the Dakota and the Red River of the North. It was formed after the census of 1870.

Faulk'ner, county of Central Arkansas. Area, 810 square miles. It is bounded W. by the Arkansas River and the north fork of the Cadron Creek. It is undulating, well timbered, well watered, and fertile. It was formed since the U. S. census of 1870. Cap. Conway.

Faulkner (Charles J.), American Congressman, b. in Berkeley co., Va., in 1805, received a collegiate education, and was admitted to the bar in 1829. In 1832–33 was elected to the house of delegates, in 1841 to the senate of Virginia, in 1848 again to the house of delegates, and in 1850 was a member of a convention to revise the constitution of the State; representative in Congress from Virginia 1851–1860, when appointed minister to France by President Buchanan. Returning to the U. S. in 1861, was imprisoned, on suspicion of disloyalty, in Fort Warren, Boston harbor, and exchanged in December of that year for Hon. Alfred Ely. In 1874 was elected to Congress from West Virginia.

Faulkner's Island, a small elevated island lying off the harbor of Guilford, Conn., in Long Island Sound. It is within the limits of New York, and has a lighthouse with a flashing light, and a fog-bell, lat. 41° 12′ 41″ N., lon. 72° 38′ 54″ W.

Fault, in geology, a vertical displacement of rocks accompanying a line of fracture. "The amount of dislocation measured in a *vertical direction* produced by a fault is termed its 'throw,' a fault being said to be an 'upthrow' or a 'downthrow,' or an 'upcast' or a 'downcast,' according to the side from which we view it." (*Jukes.*) The "dislocation" may have been caused by the mass on one side of the fracture having subsided by reason of its weight, or the displacement may be the result of an upward thrust. Faults may be vertical or inclined at various angles. In the accompanying cut two faults are represented, the one



Vertical and Inclined Faults (Jukes).

vertical at A and the other inclined at B, and have clearly been the result of a subsidence of the two lateral masses. Faults may extend indefinitely downward, and the throw may amount to many thousand feet. Horizontally also, faults extend for long distances; one in Virginia, according to H. D. Rogers, has been traced for upwards of 80 miles. The fissure accompanying a fault may be wide and the interval filled up with subsequent deposits, thus in many instances giving rise to mineral veins, or the faces of the fracture may remain in apposition. In the latter case the sliding of the one surface over the other will have smoothed and polished both, thus causing the appearance known as "slickensides." Miners in different districts use the terms "slip," "slide," "heave," "dyke," "thing," "throw," "trouble," "check," etc. to express a fault; and one of the chief difficulties and causes of expense in coal, and indeed in other mining, is caused by the displacements of the veins or beds by faults. Geology, by establishing the facts which determine the sequence of sedimentary strata, has done much to simplify the difficulties caused by faults in coal-mines. E. C. H. Day.

Fau'na [from *faun*, a rural divinity in the Latin mythology] is a term given to the assemblage of animals inhabiting any given locality, either in the present or past ages of the globe. In palæontology, however, it is sometimes used with more latitude, and is given to an assemblage of animals characteristic of a given period. Inasmuch as there are no very abrupt demarcations for any given region, the idea of a *fauna* is based, to a greater or less extent, on the forms combined in a central, or, as it is called, metropolitan district. Various combinations of animals are more or less characteristic of certain countries or portions of the earth's surface, many forms being limited by climatal or physiographical or unknown conditions.

Various names have been applied to these combinations, or to the regions of which these combinations are characteristic, but the most restricted ones are generally designated *regions* or *districts;* and to the more comprehensive into which they are combined, among others, the names *realm, range,* or *fauna* have been given, the last having at one time been applied by Agassiz in this sense. (The consideration of the faunas of the respective regions of the earth is the subject of a particular branch of science, Zoological Geography; and under that head the principles and facts involved will be treated, while the principal features of the geographical distribution of the various groups of animals—the subject of Geographical Zoology—will be presented in the articles on such groups.) Theodore Gill.

Fau'nus, a Roman woodland deity, corresponding to the Grecian Pan, many of whose attributes were assigned to him. He possessed the power of prophecy, and his oracles were in the groves. A festival, named Faunalia, was celebrated in his honor by the country-people. As a frolicsome wood-deity, represented with the horns of a goat and the feet of a satyr, he became multiplied by the poets, and the Fauni or Fauns corresponded to the Greek satyrs. Poetic tradition represented him as an early king of Latium, son of Picus, grandson of Saturn, and father of Latinus.

H. Drisler.

Fau'quier, county of Virginia, in the N. E. part of the State. Area, 680 square miles. It has the Rappahannock on the S. W. and the Blue Ridge on the N. W. The surface is pleasantly diversified and the soil is productive. Grain, cattle, and wool are produced, and flour is manufactured. Soapstone, magnesia, gold, etc. are found, and there are important mineral springs. It is traversed by the Washington City Virginia Midland and Great Southern R. R. Cap. Warrenton. Pop. 19,690.

Fauquier (FRANCIS), lieutenant-governor of Virginia 1758–68, was a popular and able governor, a man of culture, a free-thinker in religion, and a friend of Jefferson. He published some financial writings in England, and d. Mar. 3, 1768.

Fauquier White Sulphur Springs, in Fauquier co., Va., 56 miles W. S. W. of Washington and 10 miles N. W. of Bealton Station on the Great Southern R. R., have strong saline sulphur waters. The buildings were to great extent destroyed during the war. The situation is delightful, and the waters have a wide range of usefulness in chronic diseases.

Faure (JEAN BAPTISTE), a French baritone singer of great reputation, b. at Moulins Jan. 15, 1830, went upon the stage in 1852, and became in 1857 a professor at the Conservatoire.—His wife, CONSTANCE CAROLINA LEFEBVRE, b. at Paris Dec. 21, 1828, has also attained distinction as an operatic singer.

Fauriel (CLAUDE CHARLES), French philologist and historian, b. at St. Etienne Oct. 21, 1772, was nephew of the abbé Sieyès, and d. in Paris July 15, 1844. In 1830 a chair of foreign literature was founded for him in Paris. Among his principal works are a *History of Southern Gaul under the Rule of the German Conquerors* (1836), *History of Provençal Literature* (1846), and *Popular Songs of Modern Greece*, with a French version (1825).

Faust (JOHANN), DR., a German magician who flourished during the first thirty years of the sixteenth century, is generally supposed to have been a native of Knittlingen in Würtemberg, b. about 1480, d. about 1538. His history is obscured by extravagant fiction, and it is impossible to state with certainty the place of his birth or decease. Regarding his existence there is undoubted testimony, and we learn that he spent some time at Wittenberg, at one time enjoying the association of Melanchthon. (See SCHEIBEL, *Kloster*, ii. p. 14.) Conrad Gesner, and even Luther (*Tischreden*, p. 216) also, make mention of him. Dr. Faust seems to have been a learned man who had studied magic and astrology, and, travelling about the country performing various feats, came to be regarded as a dealer in the black art, and one maintaining an intimate relation with evil spirits. The belief in witchcraft was universal in Europe in the Middle Ages, and nowhere did it prevail so universally as in Germany. A bull of Pope Innocent IV. (1243–54) declares that it having come to his ears that in parts of Germany persons forgetting or denying the Christian faith have dealings with the devil, he commands all such individuals to be seized and punished forthwith with loss of property and life; and soon after appeared a work on sorcery and witchcraft—the *Malleus Maleficarum*, or "Witch's Hammer"—which enjoyed the approbation of the theological faculty of Cologne. "Germany indeed seemed to live and breathe in an atmosphere of sorcery. The ground which Faith had lost Superstition made her own." Even the Reformers believed in witchcraft and in the bodily presence of the Spirit of Evil upon the earth. According to tradition, Faust enjoyed in his youth a large fortune, gave himself to a life of extravagance and licentiousness, and soon squandered his vast possessions. He then devoted himself to the study of magic at Cracow, determined to regain his wealth and enjoyments, and after a mastery of the secret sciences made a compact with Satan, according to which the latter was to serve Faust for twenty-four years, when the Evil One should possess the soul of Faust. The contract signed by Faust with his own blood contained the following conditions: "1. He shall renounce God and all celestial hosts; 2, he shall be an enemy of all mankind; 3, he shall not obey priests; 4, he shall not go to church nor partake of the holy sacraments; 5, he shall hate and shun wedlock." Mephistopheles, a devil "who liked to live among men," was given Faust as an attendant, and the two together roamed over the land, Faust enjoying every form of sensual pleasure, and performing magical feats never before performed, until at last the time arrived when the fatal debt was due, and Satan appeared in the most hideous form imaginable between twelve and one o'clock at night, and finished Faust's earthly career, bearing away with him the soul of the unhappy being. Such is the monstrously mythical form in which Faust's life appears in the popular tradition. Its aim evidently is to describe that tendency to sacrifice the future, however precious—nay, salvation itself—to immediate gratification. Embodying all the dire superstitions, the idle terrors, the thirst for the strange and wondrous, the story of Faust entertained the popular mind, while the clergy availed themselves of the moral it taught to recall men from sensuality and vice, and from the foolish attempts to fathom the mysteries of the supernatural.

The story of Faust was first published by the printer Spies of Frankfort-on-the-Main in 1587, under the title *Historia von D. Johann Fausten, den weitbeschreyten Zauberer und Schwarzkünstler*, and already in 1588 another edition was called for; in this year appeared also a rhymed edition and a version in Low German and Danish. In 1590 two English translations came out—one entitled *A Ballad of the Life and Death of Doctor Faustus, the great Conjurer*, and the other, *The History of the Damnable Life and Deserved Death of Dr. John Faustus* (which was probably used by MARLOWE (which see) in 1591 in the preparation of his drama). In 1592 appeared a Dutch, and in 1598 a French version. In 1599, G. R. Widmann published an "improved" edition, entitled *Wahrhaftige Historien von den grewlichen und abschewlichen Sünden und Lastern, auch von vielen wunderbarlichen und seltzamem abentheuren so D. Johannes Faustus hat getrieben* (Hamburg, 3 vols.); still further improved by Pfitzer in 1674 (Nuremberg). Widmann's edition, but without his or Pfitzer's notes, was published at Reutlingen in 1834. A large number of books on necromancy have inserted Faust's cabalistic formulas, charms, talismans, etc. All of these publications, and also all important monographs bearing upon this subject, are found in SCHEIBEL, *Das Kloster, weltlich u. geistlich* (Stuttgart, 1847). German literature abounds in elegies, pantomimes, tragedies, and comedies on Faust. As far back as 1594 appeared a work by Tholeth Schotus, purporting to be from the Spanish and treating of Faust and his disciple Wagner. Its form intended it for the marionettes, and it was promptly taken up. (See *Puppenspiel*, edited by Charles Simrock (Leipsic, 1850); MAGNIN, *Histoire des Marionnettes* (Paris, 1854, 8vo); HAGEN, *Ueber die ältesten Darstellungen der Faustsage* (1844); and SCHEIBEL'S work.) In a dramatic form, Faust was first treated in the German by Lessing in his masterly fragment entitled *Faust und die Sieben Geister*, but the grandest of all on this subject is Goethe's *Faust*, of which Bayard Taylor has recently furnished a masterly English version (Boston, 1870, 2 vols., 4to). Goethe, however, introduced an element foreign to his model—that of the ardent, inextinguishable thirst for knowledge for its own sake alone. (Compare KREYSSIG, *Vorlesungen über Goethe's Faust*, Berlin, 1866, 12mo, p. 3–36.) Goethe's *Faust* has furnished Gounod with the subject of his opera. (See DÜNTZER, *Die Sage von D. Joh. Faust* (Stuttgart, 1846); PETER, *Literatur der Faustsage* (2d ed., Leipsic, 1851); and especially KÜHNE, *Das älteste Faustbuch* (Leipsic, 1868).) JAS. H. WORMAN.

Faust, or **Fust** (JOHANN), a rich goldsmith, a native of Mentz, Germany, who shares with Gutenberg and Schöffer the honor of establishing the art of printing. He was (1450–55) Gutenberg's partner in the new business of printing books, but Faust probably did nothing but furnish capital. In 1455, Faust prosecuted Gutenberg for money advanced, took the business into his own hands, and associated with himself his son-in-law, Peter Schöffer, the inventor of the punch used by type-founders. They carried on the business successfully until 1462, when, at the sack of Mentz, the workmen were scattered and the art of printing was no longer a secret. Faust still went on with his business, and is thought to have died of the plague at Paris in 1466. There are in existence copies of quite a number of books printed by Faust and his partners, some of them beautifully executed.

Fausti'na (THE ELDER) **Annia Galeria,** wife of the emperor Antoninus Pius. Her character was in marked contrast to that of her husband, who nevertheless retained his regard for her, and at her death caused a temple to be erected to her honor, remains of which are still standing.

Faustina (THE YOUNGER) **Annia,** daughter of the preceding, was married by her father to Marcus Aurelius, her cousin, who had been adopted by Antoninus at the suggestion of Hadrian. She d. A. D. 175, near Mt. Taurus in Asia Minor, and though, like her mother, she had proved unworthy of the affection of her virtuous husband, yet at the request of Aurelius divine honors were decreed to her by the senate. As a further testimonial of his regard for her memory, Aurelius established, as Antoninus had done in the case of the elder Faustina, an asylum for female orphans, to which the name "Faustinian" (*Faustinianæ*) was given. H. DRISLER.

Faus'tulus, in the early legends of Rome, the herdsman of Amulius, who found the twin-brothers Romulus and Remus, when they had been exposed by the order of Amulius, and took them to his home and reared them as his own children. (See ROMULUS.) H. DRISLER.

Fauveau, de (FÉLICIE), b. in 1803 at Florence of a family of Breton legitimist exiles, attained distinction as a sculptor under the patronage of the restored Bourbons; took part in the legitimist movements of 1832; was condemned to deportation, but escaped, and has since chiefly lived at Florence, and practised her art with success.—Her

brother, Hippolyte de Fauveau, has considerable fame as a sculptor.

Fauvelet (Jean Baptiste), a French genre and flower painter, b. in Bordeaux in 1822, first began to exhibit in 1845; attained reputation for the gracefulness and fidelity of his paintings, which are numerous, and in style somewhat resemble the works of Meissonier.

Fauvette [Fr.], a name applied to several song-birds in France, and used to some extent in England. The term is nearly equivalent to warbler.

Fava′ra, town of Sicily, celebrated for its rich mines of sulphur. Pop. 12,829.

Favart (Charles Simon), b. at Paris Nov. 13, 1710, published many plays, and was the inventor of the modern vaudeville. D. May 12, 1792.—His wife, Marie Justine Benoîte, *née* du Ronceray (1727–72), was a famous singer, comic actress, and dancer, and wrote some plays.—His son, Charles Nicholas Joseph Justin (1749–1806), and grandson, Antoine Pierre Charles (b. in 1784), had great repute—the first as a comedian, the second as a politician, *littérateur*, and painter.—Marie Favart, the adopted daughter of the last-named, *née* Pierrette Ignace Pingaud, b. Feb. 16, 1833, went upon the stage in 1848, and attained a most brilliant fame as an actress in comedy.

Fa′ver's, tp. of Tuscaloosa co., Ala. Pop. 467.

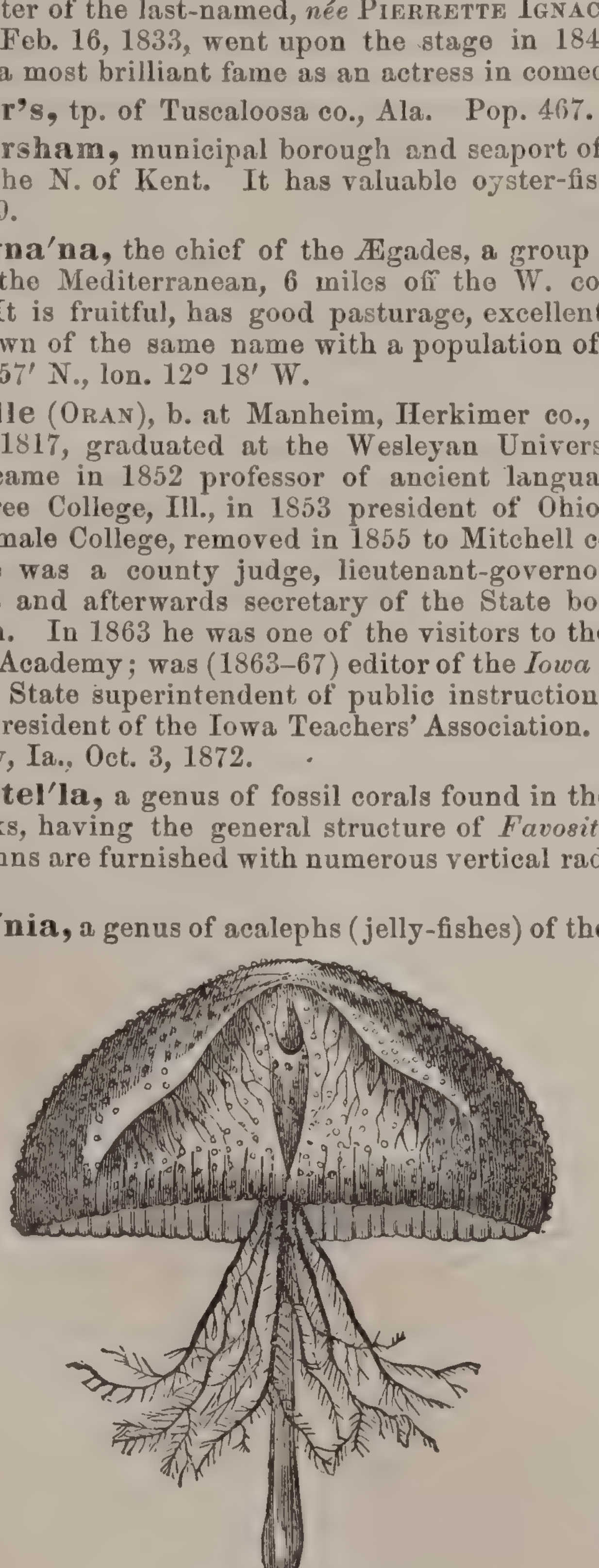
Fa′versham, municipal borough and seaport of England, in the N. of Kent. It has valuable oyster-fisheries. Pop. 7189.

Favigna′na, the chief of the Ægades, a group of islands in the Mediterranean, 6 miles off the W. coast of Sicily. It is fruitful, has good pasturage, excellent wine, and a town of the same name with a population of 3245. Lat. 37° 57′ N., lon. 12° 18′ W.

Fa′ville (Oran), b. at Manheim, Herkimer co., N. Y., Oct. 13, 1817, graduated at the Wesleyan University in 1844, became in 1852 professor of ancient languages at McKendree College, Ill., in 1853 president of Ohio Wesleyan Female College, removed in 1855 to Mitchell co., Ia., where he was a county judge, lieutenant-governor, and president and afterwards secretary of the State board of education. In 1863 he was one of the visitors to the U. S. Military Academy; was (1863–67) editor of the *Iowa School Journal;* State superintendent of public instruction 1864–66, and president of the Iowa Teachers' Association. D. at Waverley, Ia., Oct. 3, 1872.

Favistel′la, a genus of fossil corals found in the Silurian rocks, having the general structure of *Favosites*, but the columns are furnished with numerous vertical radiating septa.

Favo′nia, a genus of acalephs (jelly-fishes) of the order



Favonia Octonema.

Discophora, including some of the most characteristic organisms of that order. The *Favonia octonema* of the South Seas has a somewhat hemispherical body, with a long proboscis and eight branchiferous appendages.

Favo′nius (Marcus), a Roman politician, whose career was marked by strong personal opposition to Pompey and admiration for Cato. In 55 B. C. he was ædile, and probably was prætor in 49; went over to Pompey's party in 48, and after the battle of Pharsalia was reconciled to Cæsar, but after Cæsar's murder was a partisan of Brutus, and was outlawed and put to death 42 B. C.

Favori′nus, a philosopher and rhetorician in Rome under Trajan and Hadrian, b. at Arelate (now Arles) in the south of Gaul. He received his education in Rome, and became distinguished for his knowledge of Greek, in which language he had Dion Chrysostom as instructor. He stood high in the favor of Hadrian, and numbered among his friends Demetrius of Alexandria, Fronto, Plutarch (who dedicated to him his treatise περὶ τοῦ πρώτου Ψυχροῦ), and Herodes Atticus, to whom he bequeathed his library and his house in Rome. Wrote numerous works on a great variety of subjects, all in Greek, and was famed also as an orator, on which account the Athenians raised a brazen statue to his honor, but when he lost the favor of Hadrian they tore it down. Among his numerous writings two are of an historical character, his Παντοδαπὴ Ἱστορία and his Ἀπομνημονεύματα, from both of which a few fragments are preserved. His orations have all perished. (See J. L. Marres, *Dissertatio de Favorini Arelatensis vita, studiis, scriptis, accedunt Fragmenta*, Utrecht, 1853. The fragments are collected also in Müller's *Hist. Græc. Fragm.*, vol. iii. pp. 577–585.) H. Drisler.

Favosi′tes, an extinct genus of corals exceedingly common in the Devonian and carboniferous rocks, of which a large number of species are described. The corallum of *Favosites* is compound, and usually forms hemispherical or conical masses, composed of a large number of prismatic columns divided horizontally by transverse septa or "*tabulæ*," and usually having the vertical walls pierced by one or several rows of pores. The name is derived from *favus*, a "honeycomb," which some of the species very much resemble. J. S. Newberry.

Favre (Jules Claude Gabriel), b. in Lyons, France, Mar. 21, 1809, became a prominent lawyer and liberalist of Paris, and in 1848 held positions in the revolutionary ministry, opposed Louis Napoleon during the presidency of the latter, and more especially after the *coup d'état* of 1851. In 1858 he ably defended Orsini, the would-be assassin, and in the Corps Législatif eloquently and irreconcilably opposed the policy of the emperor on all leading public questions; opposed the measures which ended in the Franco-German war, and after the fall of Sedan advocated the deposition of the imperial dynasty, and became minister of foreign affairs and vice-president in the provisional government. As minister of foreign affairs he took an important part in the negotiations for peace with Bismarck. He was for a time, during the siege of Paris, acting minister of the interior; but withdrew in 1871 from the government during the presidency of Thiers, and devoted himself to law and literature. He is author of *Rome et la République Française* (1871) and *Le Gouvernement du 4 Septembre* (1871–72).

Favula′ria, a sub-genus of *Sigillaria*, which includes some of the most remarkable trees of the coal-flora. The name was given by Sternberg to those species in which the trunks are fluted and the leaf-scars are closely approximated. (See Sigillaria.) J. S. Newberry.

Fa′vus [Lat., "honeycomb"], or **Scald Head** (*i. e.* "scabby head," from *scall*, a "scab"), a disease formerly known as *tinea* and *porrigo*, generally seated on the hairy part of the scalp, but sometimes attacking the roots of the nails and other parts. This disease is now known to be caused by a parasitic vegetation of low forms of fungus. These fungi are known as *Achorion Schœnleinii*, and *Puccinia favi*, but are now believed to be aberrant forms of the species known as the yeast-plant, *Cryptococcus cerevisæ*. Favus is a contagious disease, best prevented by cleanliness, and best cured by carefully removing the hair and applying parasiticide medicines, such as have the power of destroying low organisms. Sulphurous and carbolic acids and weak solutions of corrosive sublimate are the best applications. It is called *favus* because the diseased surface often assumes a honeycombed appearance. It leads to permanent baldness.

Faw′cett (Henry), M. A., b. at Salisbury, England, in 1833; graduated with honors at Trinity Hall, Cambridge, 1856; lost his sight by an accident in 1858; attained a fellowship at Cambridge, and in 1863 became professor of political economy there. Has several times sat in Parliament, where he advocated republican principles. Author of *Manual of Political Economy* (1863, 1869), *The Economic Position of the British Laborer* (1868), *Pauperism* (1871), etc.—His wife, Millicent Garrett, is also a writer on topics kindred to those treated of by her husband, and is the author of some books.

Fawkes (Guy or Guido), English conspirator in the reign of James I., was a Catholic and a native of Yorkshire. In 1605, with Robert Catesby, Thomas Percy, and others, he endeavored to blow up the English House of Parliament, with king, Lords and Commons, having hired a vault under the House of Lords and lodged in it thirty-six barrels of gunpowder, but was arrested on the night of Nov. 5th in the vault, and executed at Westminster Jan. 31, 1606.

Fawn, tp. of Allegheny co., Pa. Pop. 681.

Fawn, tp. of York co., Pa. Pop. 1457.

Fawn Creek, post-tp. of Montgomery co., Kan. P. 505.

Fawn River, post-tp. of St. Joseph co., Mich. P. 680.

Fax'on, post-tp. of Sibley co., Minn. Pop. 587.

Fay (Heman A.), b. at Bennington, Vt., 1778, graduated at West Point Military Academy in 1808, and d. at Bennington Aug. 20, 1865. He wrote *Official Account of the Battles of 1812–15.*

Fay (Jonas), M. D., b. at Hardwick, Mass., Jan. 17, 1737, was surgeon under Col. Ethan Allen at the surrender of Ticonderoga, a member of the convention of 1777 which declared Vermont an independent State, and author of the declaration of the fact and their reasons for it to Congress; secretary of the convention to form the State constitution in July, 1777, and one of the council of safety to administer the government; member of the State council (1778–85); judge of the supreme court (1782); of probate (1782–87); agent of the State in Congress Jan., 1777, Oct., 1779, June, 1781, and Feb., 1782. He published a pamphlet, with Ethan Allen, in 1780, on the New Hampshire and New York controversy. D. at Bennington, Vt., Mar. 6, 1818.

Fay (Theodore Sedgwick), American author and diplomatist, was b. in New York City Feb. 10, 1807, and admitted to the bar in 1828, but not practising, soon began contributing to the *New York Mirror,* which he finally edited. *Dreams and Reveries of a Quiet Man* was published in 1832. This was succeeded by *Minute Book,* a journal of travel in Europe. *Norman Leslie,* his first novel, published in 1835, went to a second edition in the same year. Other works are *Sydney Clifton* (1839), *The Countess Ida* (1840), *Hoboken* (1843), *Robert Rueful* (1844), *Ulric, or The Voices,* poems (1851). His best known fugitive contributions are his papers on Shakspeare. He has also published a *History of Switzerland,* in which country he was U. S. minister-resident from 1853 to 1861. Prior to this appointment he was U. S. secretary of legation at Berlin from 1837 to 1853.

Fayal' [from the Port. *faya,* a "beech tree," but its so-called beech trees are myrtles of the species called *Myrica Faya*], one of the most important of the Azores, a group of islands in the Northern Atlantic belonging to the Portuguese. It contains 37 square miles, with 25,000 inhabitants. It is very fertile, and besides its considerable transit-trade with America it exports a great quantity of oranges and wine. Its principal town, Horta, lies in lat. 38° 30' N. and lon. 28° 41' W.

Faye (Hervé Auguste Étienne Albans), French astronomer, b. in the department of Indre Oct. 5, 1814, was a member of the French Institute, and discovered the comet bearing his name Nov. 22, 1843. He was elected a member of the section of astronomy Jan. 18, 1841, and of the bureau of longitudes Mar. 26, 1862. In 1864 he was appointed a member of the imperial council of public instruction, with the rank of officer of the Legion of Honor; was professor of geodesy at the École Polytechnique from 1848 to 1854; became rector of the Académie Universitaire at Nancy in 1854; and is the author of some valuable papers and several text-books of astronomical science.

Faye's Comet was discovered by M. Faye Nov. 22, 1843. It has been shown by Leverrier that it came into the solar system in 1747, and that the attraction of Jupiter then gave it its present orbit. Its mean distance is 3.8118 times that of the earth; its eccentricity is .5576; its inclination, 11° 22' 7", its period, 7.414 years, and its motion is direct.

Fayette, county in the W. N. W. of Alabama. Area, 670 square miles. The surface is well watered, uneven, and fertile. Cotton and corn are the chief products. Cap. Fayette Court-house. Pop. 7136.

Fayette, county of Georgia, in the N. W. central part of the State. Area, about 215 square miles. Its surface is generally level. Iron and granite are found. Dairy products and grain are the agricultural staples. It is traversed by the Savannah Griffin and North Alabama R. R. Cap. Fayetteville. Pop. 8221.

Fayette, county of Illinois, in the S. W. central part. Area, 720 square miles. Its surface is level prairie and timber-land, and is very fertile. Grain, cattle, wool, hay, tobacco, and dairy products are the staples. Lumber, carriages, and flour are extensively manufactured. The Kaskaskia River and the Illinois Central and the St. Louis Vandalia and Terre Haute R. Rs. traverse the county. Cap. Vandalia. Pop. 19,638.

Fayette, county in the E. S. E. of Indiana. Area, 196 square miles. It is a highly cultivated and densely peopled county. The surface is level and based on limestone. Grain, cattle, and wool are produced, and carriages and wagons extensively manufactured. This county is traversed by the west fork of the Whitewater River, by the Whitewater Canal, and the Fort Wayne Muncie and Cincinnati and the Cincinnati and Indianapolis Junction R. Rs. Cap. Connersville. Pop. 10,476.

Fayette, county in the N. E. of Iowa. Area, 720 square miles. Its surface is undulating, fertile, well timbered, and well watered, and the water-power is quite extensive. Grain, cattle, wool, flour, and lumber are the chief products. It is traversed by the Milwaukee division of the Burlington Cedar Rapids and Minnesota R. R. Cap. West Union. Pop. 16,973.

Fayette, county of E. Central Kentucky, in the "Blue-grass region." Area, about 300 square miles. It is a beautiful and highly fertile limestone county. Grain, live-stock, and wool are staple products. There are manufactures of clothing, carriages, flour, woollen and cotton goods, bagging, and other commodities. It is traversed by the Kentucky Central and other railroads. Cap. Lexington. Pop. 26,656.

Fayette, county of S. W. Central Ohio. Area, 414 square miles. Its soil is generally quite level and very fertile. Cattle, grain, and wool are produced. Bricks are quite extensively manufactured. It is intersected by several creeks and by the Cincinnati and Muskingum Valley R. R. Cap. Washington Court-house. Pop. 17,170.

Fayette, county of Pennsylvania, bordering on West Va. Area, 800 square miles. It is bounded on the W. by the Monongahela, is intersected by the Youghiogheny and its branches, and by the National Road and the Pittsburg Baltimore and Washington R. R. The soil is very fertile. Grain, cattle, wool, and hay are produced. Bituminous coal is very extensively mined and iron ore abounds. Metallic wares, cooperage, leather, carriages, flour, clothing, lumber, and saddlery are among the articles manufactured. Cap. Uniontown. Pop. 43,284.

Fayette, county in the S. W. of Tennessee. Area, 500 square miles. Its soil is very productive. Cattle, corn, and cotton are staple products. It is traversed by the Memphis and Louisville and the Memphis and Charleston R. Rs. Cap. Somerville. Pop. 26,145.

Fayette, county of S. E. Central Texas, intersected by the navigable Colorado River. Area, 1025 square miles. The soil is fertile prairie, timber, and bottom lands. Live-stock, corn, wool, cotton, and lumber are the chief products. Grazing is excellent. The climate is generally healthful. Cap. Lagrange. Pop. 16,863.

Fayette, county of West Virginia, in the S. central part. Area, 770 square miles. The surface is mountainous and heavily timbered. The soil is very fertile. Tobacco, timber, wool, and fruit are staple products. Coal and iron ore abound. The New River and its tributaries furnish extensive water-power. It is traversed by the Chesapeake and Ohio R. R. Cap. Fayetteville. Pop. 6647.

Fayette, tp. of Calhoun co., Ark. Pop. 220.

Fayette, tp. of Livingston co., Ill. Pop. 257.

Fayette, tp. of Vigo co., Ind. Pop. 1912.

Fayette, tp. of Decatur co., Ia. Pop. 318.

Fayette, post-v. of Fayette co., Ia., 8 miles S. of West Union, the county-seat, and on the Davenport and St. Paul R. R.

Fayette, tp. of Linn co., Ia. Pop. 914.

Fayette, post-v. and tp. of Kennebec co., Me., 18 miles N. W. of Augusta, has manufactures of edge-tools and carriages. Pop. 900.

Fayette, tp. of Hillsdale co., Mich. Pop. 2172.

Fayette, post-v., capital of Jefferson co., Miss., 23 miles E. N. E. of Natchez. It has a weekly newspaper. Pop. 120.

Fayette, post-v., capital of Howard co., Mo., 12 miles from the Missouri River, on the Missouri Kansas and Texas R. R. It has 2 weekly newspapers, 1 college, 1 female seminary, 1 colored school, 6 churches (2 of which are colored), and one hotel. The L. and Mo. R. R. R., now being graded, will pass through Fayette. Pop. 815.

C. J. Walden,

Ed. and Prop. "Howard Co. Advertiser."

Fayette, post-tp. of Seneca co., N. Y., extends from Cayuga to Seneca Lake. It is a fertile tract. Lime is manufactured and building-stone is extensively quarried. Pop. 3364.

Fayette, tp. of Lawrence co., O. Pop. 2082.

Fayette, tp. of Juniata co., Pa. Pop. 2051.

Fayette, tp. and post-v. of La Fayette co., Wis., on the Western Union R. R. Pop. 1193.

Fayette City, post-b. of Fayette co., Pa., on the Monongahela River. Pop. 889.

Fayetteville (P. O. name, Fayette Court-house),

post-v., capital of Fayette co., Ala., on the survey at the crossing of the Columbus Fayette and Decatur and Aberdeen and Elyton R. Rs. It has 1 newspaper, an academy, 2 churches, 2 hotels, 1 tannery, several shops, the usual number of stores, etc. Pop. about 640.

ED. OF "WATCHMAN."

Fayetteville, tp. of Talladega co., Ala. Pop. 1337.

Fayetteville, post-v., capital of Washington co., Ark., in the Ozark Mountains, 60 miles from the Atlantic and Pacific R. R. in Missouri, and 55 miles from the Arkansas River. It has 1 bank, 2 newspapers, flour-mill, sash and blind factory, 4 hotels, 4 churches, a number of private schools, free schools for both colors, the usual number of shops, stores, etc. The Arkansas Industrial University is situated here. Pop. 955. SAMUEL BARD, PROP. "NEWS."

Fayetteville, post-v., county-seat of Fayette co., Ga., 25 miles S. of Atlanta.

Fayetteville, a v. of Hazle Hill tp., Johnson co., Mo. Pop. 139.

Fayetteville, post-v. of Onondaga co., N. Y., about 8 miles E. of Syracuse. The manufacture of hydraulic cement, quick-lime, and land-plaster is extensively carried on here. There are 5 churches, 1 excellent union school, a public library, 2 banks, several large flouring-mills, manufactories of pearl barley, 2 paper-mills, a machine-shop, 15 stores, 3 hotels, and 1 weekly newspaper. Pop. 1402.

F. A. DARLING, ED. "THE WEEKLY RECORDER."

Fayetteville, post-v., capital of Cumberland co., N. C., on Cape Fear River and the Western R. R. of North Carolina, 60 miles from Raleigh and 90 from Wilmington. It has 8 churches, 3 banks, about 125 stores and business-places (including 5 jobbing-houses), a building and loan association, 3 fire companies, 3 uniformed and armed volunteer military companies, a gas company, water-works, 3 hotels, 2 livery stables, a public cemetery, 1 female college (not in operation now), a male institute, a dozen or more private and primary schools, and a large and excellent school for colored children; 4 weekly newspapers, 1 large carriage-factory, a wagon-manufactory, 4 mills, 2 extensive coppersmith establishments, and a large grape-vineyard. There are also 4 cotton-factories near the village. It contains 3 public halls, the county court-house, prison, etc., a large opera-house, a town clock, and a market-house. It has a large trade in rosin, turpentine, and cotton, is a great horse and mule market, and has 8 steamboats running to Wilmington. It enjoys a large trade from the surrounding country. Fayetteville suffered largely from invasion and destruction to property at the close of the war. Pop. 4660. M. J. MCSWEEN, ED. "EAGLE."

Fayetteville, post-v. of Perry tp., Brown co., O. Pop. 397.

Fayetteville, post-v. of Franklin co., Pa., 5 miles E. by S. of Chambersburg, and near the Mont Alto R. R.

Fayetteville, post-v. and the capital of Lincoln co., Tenn., 82 miles S. of Nashville, 12 miles N. of the Alabama State line, on Elk River, terminus of the Winchester and Alabama R. R. It has 1 savings and 1 national bank, 2 newspapers, a manufactory of woollen goods, broadcloths, cassimeres, etc., a carriage-manufactory, 3 churches, 2 academies, and 3 other schools, and the usual number of stores and shops. About 4500 bales of cotton and large quantities of corn, wheat, hogs, etc. were shipped during the winter season of 1873–74. Pop. 1206.

N. O. WALLACE, ED. "OBSERVER."

Fayetteville, post-v., county-seat of Windham co., Vt. It is in New Fane tp., 12 miles N. W. of Brattleboro'.

Fayetteville, post-v., county-seat of Fayette co., West Va., in a tp. of the same name. Pop. of tp. 1977.

Fayoom′ [also written **Faioum, Fayoum,** and **Fayum,** from the Coptic *Pi-om*, which means, Wilkinson says, "the cultivated land," or, according to Mariette, "the sea"], a province of Egypt, on the W. side of the Nile, between lat. 29° and 30° N. and lon. 30° and 31° E. Its capital, Medeeneh (pop. about 13,000), is about 65 miles S. W. of Cairo and 30 miles N. W. of Benisooef. The Fayoom is a basin formed by a depression in the Libyan range, its main plateau being on about the level of the Nile, but in its lowest point 100 feet below that level. Its area, anciently somewhat greater, is now about 750 square miles, more than 100 of which are occupied by the natural lake Birket el Keroon. It is still the most fertile province of Egypt, abounding in figs, grapes, apricots, olives, and other fruits. But its ancient renown was much greater. It contained the LABYRINTH (which see), and the artificial lake MOERIS (which see), both built by Amenemka III., the great king of the twelfth dynasty, according to Wilkinson, nearly 2000 B. C., according to Mariette, nearly 3000 B. C. (See HERODOTUS, ii. 148–150; *Aperçu de l'Histoire d'Égypte*, by AUGUSTE MARIETTE-BEY, 2d ed. 1870; and ZINCKE'S *Egypt of the Pharaohs and of the Khedive*, 1871.)

R. D. HITCHCOCK.

Fays′ton, tp. of Washington co., Vt., 10 miles S. W. of Montpelier, has manufactures of lumber and leather. Pop. 694.

Fay′ville, flourishing post-v. of Southborough tp., Worcester co., Mass., on the Boston Clinton and Fitchburg R. R., 28 miles W. of Boston. Boots and shoes are the leading articles of manufacture.

Fazy (JEAN JACQUES), Swiss statesman and journalist, b. at Geneva May 12, 1796, was liberal editor at Paris from 1826 to 1835, then leader of the democratic party at Geneva, which triumphed in 1846, and president of the council of state in his canton. He published several works.

F Clef, in music, a curved mark resembling the reversed letter C placed across the fourth line of the stave, with two dots enclosing the line, thus: 𝄢. Every note on that line is called F, and the others, above and below, derive their names from this. The F clef indicates the stave on which the bass is written, and the notes placed on this stave are an octave and a sixth below those in a similar position on the G (or treble) stave. In ancient music the F clef was occasionally transferred to another line; in which case that line became F, and the other notes were named in conformity with it. WILLIAM STAUNTON.

Fe′alty [Fr. *fealté*, from Lat. *fidelitas*], loyalty or faithfulness to the ruling power; especially used of submission to a feudal superior or the duty owed by a tenant to his lord in mediæval times.

Fear′ing, tp. of Washington co., O. Pop. 1358.

Feast, or **Fes′tival** [Fr. *fête;* Lat. *festum*, a holy day; kindred with *fastus* and *fas*, originally terms of the religious language; and with *feriæ*, days of rest, of sacrifice—"*feria, a feriendis victimis vocata*"], a joyful commemoration of a fact or teaching. Most persons are under the influence of times and seasons, and to them the recurrence of a day associated with any important event will revive the feelings which the day brought to them. Individuals and families keep days of glad remembrance; communities observe with signs of rejoicing the anniversaries of striking events, or they appoint days on which facts connected with their history shall be celebrated, in order that these facts may be kept fresh in memory, and have an influence on the tone of mind of the nation or of those concerned. There has probably never been any community which has not had its festivals, and which has not owed much to the spirit of vigor resulting from them. Such aids were more important to earlier communities, for higher civilization multiplies bonds of union. As their history shows, a marked influence on the segregated states of Greece was produced by their common festivals, the Olympic, Pythian, Isthmian, and Nemean games. To these all of Hellenic race were admitted, and none other, as competitors for the prizes given. The right to contend was highly esteemed. Each state habitually sent representatives, and so did colonies when scarcely any other tie was maintained with the mother-country. It could not be that the associating thus as members of one family on equal footing did not keep alive to some extent a feeling of common interest. Whatever their dissensions among themselves, as against the rest of the world they were of one blood; they made a clear distinction between Greeks and Barbarians, and their national games helped to draw this line of separation and to draw them to each other. The most important of these games were those celebrated in honor of Jupiter Olympius every fourth year at Olympia in Elis. The institution of the festival is lost in the obscurity of the mythic ages. It was revived in the year B. C. 776, and when afterwards the Olympiads were used as a chronological era they were dated from this revival. During the month in which the games were held all hostilities ceased throughout Greece, and a religious sanctity protected the territory of Elis. It need hardly be said that besides these four great festivals, open to all of Hellenic blood, there were many others observed—some peculiar to each state or town, others more general as belonging to the service of gods worshipped by all; for here and in all early nations festivals and their ceremonies were intimately connected with all religion. Among the Romans there were many festivals, private and public; the latter were *stativæ*, fixed, or *conceptivæ*, movable, or *imperitivæ*, occasional; these were divided into days of sacrifice and days of banqueting, days of games and days of rest, or *feriæ*. Some of the feasts of ancient nations were celebrated with very great pomp. Herodotus tells us of one at Bubastos in Egypt that "at this solemnity 700,000 men and women assemble." The sums spent by the later Romans were enormous. A like enthusiasm

for the honor of their deities is shown in the East in our day; the lavish expenditure on some of the Hindoo feasts far surpassing the common Christian estimate of what religion demands.

We have said that the observance of seasons is in obedience to an instinct with most persons. The believer in revelation recognizes also that it was commanded by God. The Son of Sirach asks (Ecclus. xxxiii.), "Why doth one day excel another, whenas all the light of every day in the year is of the sun? By the knowledge of the Lord they were distinguished; and He altered the seasons and the feasts. Some of them hath He made high days and hallowed, and some of them hath He made ordinary days." In Leviticus xxiii. is given a list of the "feasts of the Lord:" α. The Sabbath, which was observed from the beginning, dividing time into weeks of seven days, and which, after the Exodus, was imposed with burdens. Connected with the weekly Sabbath was the rest of the sabbatical year, which returned every seventh year, and the year of Jubilee, which was at the end of seven times seven years. β. The Passover, a commemoration of the night when the angel of the Lord slew all the first-born in Egypt, and passed over the houses marked by the blood of the slain lamb. The passover lamb was offered at even in the fourteenth day of the first ecclesiastical month, and the next day was the first day of the Feast of Unleavened Bread. γ. The Feast of Weeks, called afterwards Pentecost, a feast of first-fruits, also the anniversary of the delivery of the Law. δ. The Feast of Trumpets, said by the rabbins to be in commemoration of the offering of Isaac by Abraham, when a ram was sacrificed in his stead. The cause of the institution is not given in Holy Scriptures. This feast is on the first day of the seventh month, being the beginning of the civil year. Modern Jews mark, as do most nations, by special observances their New Year's Day. Their frequent salutation on this day is, "May you be inscribed for a happy year!" having reference to their belief that on this day God passes sentence on each man—not definitely, for the doom is not fixed until the Day of Atonement, before which time it may be modified by repentance. The first of each month, or new moon, is also kept. ε. The tenth day of the seventh month is the Atonement—a most solemn fast, though now preceded by a banquet. ζ. Five days after, and lasting seven days, is the Feast of Tabernacles, reminding all Israelites that God made their fathers to dwell in booths when he brought them out of the land of Egypt. These are the "holy convocations" of the Mosaic Law. Other feasts were afterwards added, the chief of which are the Purim and the Dedication. The former is in memory of the escape from total annihilation plotted against the Jews by Haman, as recorded in the book of Esther. Haman had cast lots (*purim*) to discover a suitable time for the accomplishment of his purpose; he did so in the first month, and the lot indicated the twelfth month, and thus time was given for the deliverance. This feast (*Purim*) is kept now by Jews with masqueradings, banquetings, and great rejoicing.

The national festivals thus far spoken of were all connected with religious observances. The derivation given of the term *feast* implies the association. It is to be noted that no nation has fewer holidays than our own. This is due, in part, to the fact that the Union is not yet a hundred years old, but also to the fact that the U. S. government has no connection with religion. An attempt has been made to institute a national yearly Thanksgiving, but the President, who has on several occasions recommended the observance, cannot appoint as one authorized to do so. Another reason is that the majority of the citizens of the U. S. have discarded the religious system on which are based the feasts observed in Christian lands during many centuries. The natural promptings which found expression under that system are gratified by the ceremonies connected with secret societies akin to Masonry, and by vereins which result from the tie of race, not of citizenship.

Under the New Testament there are no festivals of Divine appointment, save as the Church rules in God's name—none enforced as were those commanded to Moses. But from the first, Christians observed the Lord's Day and Easter, the weekly and yearly memorials of the fact which confirms the Christian faith. They also observed Pentecost, in commemoration of the descent of the Spirit and the founding of the Church. Additions were gradually made to these feasts, until each prominent event in the life of our Blessed Lord had its special day of observance. Some of these are, as near as may be, anniversaries; others are assumed to be such. Some are fixed, recurring always on the same day of the month; others, dependent upon Easter, are movable. The cycle of the Church's teaching, marked by her appointed days, is, in the eyes of those accustomed to its observance, very beautiful, as tending to ensure due consideration of all Christian doctrine. The year begins with Advent, when we are told of the second coming of the Lord in glory, and are also prepared to celebrate His first coming in humility at Christmas—the Nativity. Eight days after is the Circumcision, which marks His obedience to the law for man and our need of the true circumcision of the Spirit. Then follows the season of Epiphany, which includes His manifestation to the Gentiles and His baptism. Next we are bid to dwell upon the facts which in the Litany we plead before God—His fasting and temptation; His agony and bloody sweat; His cross and passion; His precious death and burial; His glorious resurrection and ascension; and, finally, that which was purchased by His death and which followed His ascension—the coming of the Holy Ghost on the day of Pentecost, or Whitsun Day. The first Sunday after this is Trinity Sunday, from which, in the English Church, the remaining Sundays of the year are named. "Thus every year the whole gospel story is, as it were, enacted before our eyes; and then follow the exhortations to practise, to fulfil in daily life, the duties of the Christian religion." Besides these feasts of the Lord, embracing the whole year, there are many others commemorating His Blessed Mother, His apostles and saints. Every day is a saint's day, many of them being dedicated to more than one saint, and in different churches to different saints. Some of these minor holy days are of doubtful origin, but many of them date back to early persecutions. We have seen in our day repeated the very mode by which many saints' days came to be observed—viz. the yearly assembling of admiring friends at the grave of a holy man on the anniversary of his death or burial for the purpose of religious service. All Christian bodies who keep stated festivals agree in their general observances while differing in respect to the minor feasts. The Church of England, when the Book of Common Prayer was set forth, provided special services (with two exceptions) only for the days of saints connected directly with the history of our Lord, while yet, from whatever reason, other names were retained on her calendar. The Protestant Episcopal Church has omitted all days for which there is no prescribed service.

As the term "holy day," a day of sacred rest, has been changed to "holiday," a mere season of leisure and enjoyment, so the word "feast" has naturally come to express in a lower sense feasting, banqueting. For, as sorrow is marked by a setting aside of luxuries, so joy that is shared with others generally finds expression in indulgence of appetite, in eating and drinking. The plea, "For good fellowship," which has led to so much intemperance, has its warrant in nature, if the habits of all ages result from the teaching of nature. The word *festum*, whence comes our "feast," has been derived from *ἑστιάω*, to "receive on one's own hearth," to "feast;" however true this may be, festivals were always accompanied by sacrificial banquetings. The habits of the Jews on glad days holy to the Lord was to "eat the fat, drink the sweet, and send portions." And in the Christian Church, while spiritual joy is not connected with indulgence of the senses, feasts are contrasted with fasts. The most ascetic rule is modified by the occurrence of a feast-day. And we cannot but note that the partaking in common of bread and wine is made by the Lord the sacrament of closest communion, while his apostle, to mark entire separation, has written, "With such an one, no not to eat." WM. F. BRAND.

Feath'erfoil, Water-feather, or **Water-violet,** the *Hottonia inflata* of the U. S. and *Hottonia palustris* of Europe, curious primulaceous plants which grow submerged in water, and thrust up long scapes into the air to produce the blossoms, which in the European species are very beautiful. Other species are known. The name commemorates Peter Hotton, a Dutch botanist who d. in 1709.

Feath'er-Grass [so called from the long feathery awns or beard attached to the seed], a name applied to several long-awned grasses, especially to those of the genus *Stipa*, several of which grow in the U. S. From the hygroscopic twisting and untwisting of these awns the name "weather-grass" is also used. It is stated that this hygroscopic twist causes the awn to act like the vanes of a windmill, so as to screw the seed down into soft earth, where it takes root.

Feath'er Riv'er, in California, is formed by the union of its N., S., and Middle forks, which rise in Plumas co., in the Sierra Nevada. Its waters reach the Sacramento in Sutter co. It is a beautiful stream, whose lower waters are navigated by steamboats as far as Yuba City.

Feath'ers are a modification of the epidermic system peculiar to birds, of which they form the covering and means of flight. Every feather is composed of a quill or barrel (Fig. 1, *a*), a shaft (*b*, *b*), and a vane or beard (*c*, *c*) consisting of barbs (Fig. 5, *e*) and barbules (*f*, *f*). The quill is horny, semi-transparent, and nearly cylindrical.

Its lower extremity is pierced by an orifice called the lower umbilicus (Fig. 1, *e*), and at its upper extremity, where the shaft begins, is a second orifice, termed the upper umbilicus (*f*). The shaft, always longer than the quill, tapers from its base to its apex, is nearly four-sided, and is more or less curved towards the bird's body. Its inner surface (Fig. 5, *c*) is divided by a fine longitudinal groove, while its outer surface (*b*) is smooth and slightly convex. It is composed of a white elastic substance called the pith (*a*), covered by a horny material similar to that of the quill. The barbs (*e, e*), formed of a like horny substance, are laminæ, branching from each side of the shaft near its outer surface, with an oblique direction towards its apex. Their broad sides are towards each other, and in some feathers these are so shaped that every barb fits exactly into the one next it. The barbules grow from both sides of the upper margin of the barbs, and are sometimes barbed in turn. They are commonly short, close set, and constructed so as to hook the barbs one to another (*f, f*). Those growing from that side of the barb nearest the tip of the feather are curved downward, while those of the opposite side are curved upward; thus, two adjoining rows of barbules interlock. This mechanism is subject to many variations. Sometimes—for instance, as in the plumes of the ostrich—the barbules are long and loose. The feathers of the owl have the barbs covered with silky down; hence the slow and silent flight of that bird. The secondary quills of the waxwing (*Bombycilla*) have the tips of their shafts widened into little horny disks resembling sealing-wax. In the down of all birds the barbs are separate and the barbules long and floating. At the point where the quill and shaft unite, there frequently grows from the feather an appendage called the plumule or secondary plume (Fig. 1, *d*). This is often a small downy tuft, but it varies in different species and in different parts of the same bird's plumage. In the emu it rivals in size and structure the feather from which it springs. In the cassowary there are two plumules to a feather, so that one quill supports three shafts and vanes. The ostrich has no accessory plumes.

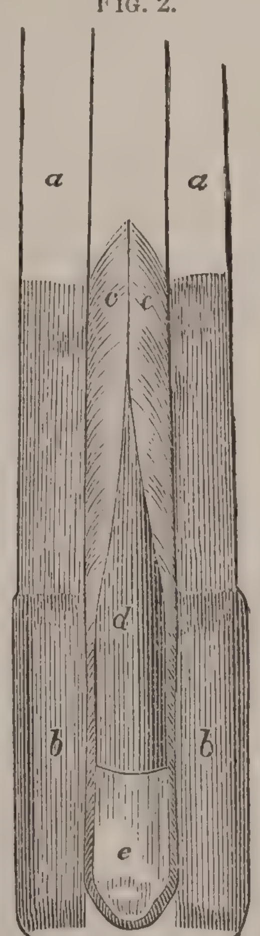
Fig. 1.

Parts of the Feather.

From Owen's *Comparative Anatomy and Physiology of Vertebrates*, vol. ii., London, 1866.

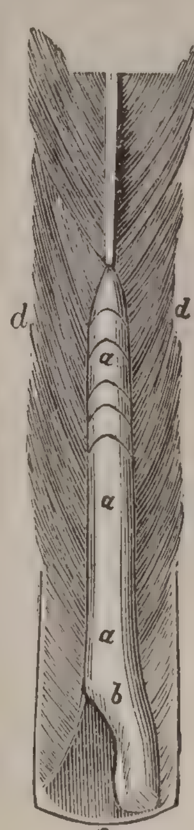
Plumage may be generally divided into quill-feathers and clothing-feathers. These are classified by ornithologists, and have special names according to their position and uses. The wing-quills are called *remiges*, or rowing feathers, and are classified as primaries, secondaries, and tertiaries. Upon the development and shape of the primaries depends the mode of flight pursued by the bird. The tail-quills are called *rectrices*, or steering feathers. Their insertion is hidden above and beneath by feathers termed the upper and under tail-coverts. In some birds these grow very long. The upper tail-coverts of the peacock form the gorgeous "train," which is supported by the short and stiff tail-quills. The under tail-coverts of the marabout stork are developed into beautiful plumes much used as ornaments. A newly-hatched bird is scantily covered by *fasciculi* of down, each growing from a small quill and enclosed in a thin sheath, which soon crumbles away when exposed to the atmosphere. These fasciculi fall off, and are succeeded by feathers, which first appear in clumps upon those parts of the body least liable to friction. To these clumps special names have been given by naturalists. (See *Anatomy of Vertebrates*, Owen, vol. ii. p. 237.) Each feather is produced by the matrix (Fig. 2), a cylindrical cone-shaped organ attached by filaments to a papilla of the skin, and consisting of a capsule (*a, a*), a bulb (*e*), and two intermediate membranes. The capsule is composed of several layers, the outermost of which is of the nature of epiderm. The sides of the capsule corresponding to the outer and inner sides of the enclosed feather are marked each by a white longitudinal line. The capsule infolds a *medulla*, or bulb, of cylindrical shape and soft fibrous texture, which adheres by its base to the parts beneath, and there receives various blood-vessels and a nerve. The two membranes (*b, d*) lie between the medulla and the capsule. From the external membrane (*b*) proceed several close-set parallel laminæ, which branch obliquely and in an upward direction from both sides of the outer white line of the capsule, curve round the cylinder, and meet at the inner white line on its opposite side. In the narrow spaces between these laminæ the matter of the vane (*c, c*) is deposited and formed into barbs and barbules. The outer white line receives and moulds upon the inner side of the capsule the horny back of the shaft; while on the opposite surface of the internal membrane (*d*) are formed the pith of the shaft and the horny covering of its inner surface. The inner white line serves as a barrier between the meeting extremities of the barbs. The shaft and barbs (Fig. 3, *d*) at the apex of the cylinder are the first parts formed. As the medulla increases at its base, these are pushed through the tip of the capsule, the bulb (Fig. 3, *a, a, b*; Fig. 4, *a*) supplying the necessary secretions, which are moulded between the two membranes until the feather is completed. The membrane enclosing the bulb is connected with a series of membranous cones (Fig. 4, *b, c, d, e*) ranged one upon another along the bulb, and joined by a tube running through its centre. The interspaces of these cones are filled with a pulpy matter, which, as the feather develops, becomes absorbed, leaving the dry conical caps. These are the light pith found inside quills. When the grooves in which the shaft and barbs are moulded are filled with horny matter, and the barbed part of the feather is finished, the horny matter spreads about the medulla and forms the quill. The quill having become firm, the internal bulb dries up: its last remnant is the ligament which passes from the pith through the quill and attaches it to the skin.

Fig. 2.



Matrix of a Growing Feather, with the capsule laid open.
From Owen.

Fig. 3.

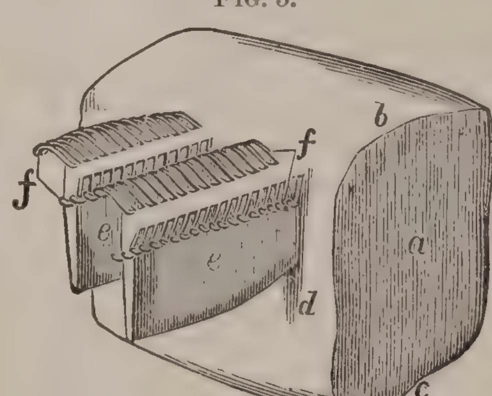


Growing Feather.
From Owen.

Fig. 4.

Structure of the Bulb.
From Owen.

Fig. 5.



Diagrammatic Section of the Shaft and Vane, enlarged.
From Owen.

The growth of feathers is very rapid, any torn out or dropped being generally replaced in a few days. The plumage is wholly or partially renewed once, and in some species twice, every year by a process called *moulting*. The nestling may be said to moult for the first time when its downy covering is exchanged for feathers. In a few months these drop out and are replaced. Some birds require four or five years to attain their perfect plumage; thus, an adult, a half-grown, and a young specimen of the same class are occasionally mistaken for birds of different species. When the male bird's plumage differs from that of the female, as is the case with blackbirds, the young birds of both sexes resemble their mother in their first plumage; but when the adult male and female are of the same color, the young birds have a plumage peculiar to themselves. Thus, swans, both the black and white species, have gray cygnets.

Under the body-feathers, especially on the breast, there is a growth of down. In aquatic birds this down is very thick and elastic, and the warm air which it keeps in increases their buoyancy in the water. Most birds dress their feathers with an oily fluid secreted by a gland at the base of the tail; this oil renders the plumage almost impervious to wet, and is most abundantly secreted by aquatic birds. The care which a bird bestows on its feathers, the connection of these feathers with the skin, from which they continually derive nourishment, and their regular renewal by moulting, account for their fresh gloss and color, and also for the diminution of these qualities after their separation from the bird's body.

Feathers are used chiefly for ornament, for the stuffing of beds and cushions, and for writing-implements. A great variety of feathers are used for ladies' head-dresses and military plumes, the principal kinds being those of the ostrich, brought from the northern shores of Africa, Sahara, Madagascar, Senegal, and the Cape of Good Hope; the bird of paradise, from New Guinea and the Moluccas; the marabout stork, from India and tropical Africa; the ibis, from the Nile Valley and from South America; the rhea, from South America; the grebe, from North America; the peacock, the pheasant, the domestic cock, the seagull, the jay. Of all these, ostrich feathers are most important in commerce. Those growing above the wings are most esteemed; in the male they are generally pure white—in the female they are always tinged with gray. Next in value are the wing and tail feathers. The body-feathers, varying in length from four to fourteen inches, are called down, and are black in the male, gray in the female. In preparing the feathers for use the first process is to sort them, and tie those of equal quality in bundles of twenty-five. These bundles are washed in a lather of soap and tepid water to free them from grease, and afterwards rinsed several times in very hot water. They are next steeped for a quarter of an hour in boiling water holding in solution Spanish white, then rinsed three times, and passed very quickly through a bath of cold water deeply colored with indigo. Finally, they are exposed for a short time to sulphur vapor and carefully dried. Very discolored feathers undergo a preparatory bleaching: their stems having been pointed, they are planted upright in a grass-plot and exposed for a fortnight to the sun and dew; they are then bleached in the ordinary way. The tools of the *plumassier*, or feather-dresser, are—scissors for trimming the barbs; a knife or piece of sharp-edged glass for scraping and paring the under part of the stem, in order to render the feather pliant; a blunt curling-knife, its handle made so as to keep it from turning in the hand; and flattened needles for sewing feathers together, two or more being often joined to form one plume. The breast of the grebe and seagull are used for muffs and trimmings. Very elegant trimmings are also made of swans' down and of ostrich, peacock, and vulture feathers. In former times the plumassiers ranked high among French artisans. Henry IV., of the celebrated white plume, gave them statutes, and a charter which was confirmed in 1612 by Louis XIII., and in 1644 by Louis XIV. The number of master-plumassiers was limited to twenty-five, and they alone were allowed to prepare feathers and enrich them with real or imitation gold and silver. (CELNART, *Art du Plumassier.*)

The Romans used feathers for stuffing beds and cushions. "The geese that come from Germany," says Pliny, "are most esteemed. They are white, of a small size, and are called *gantæ*. The price paid for their feathers is ten denarii the pound. Hence, we have repeated charges brought against the commanders of our auxiliaries, who detach whole cohorts from their posts in pursuit of these birds." Here we have, perhaps, the origin of our common expression, "A wild-goose chase." Pliny further complains: "We have reached such a pitch of effeminacy, that now-a-days not even men can lie down without the aid of goose feathers as pillows." (*Nat. Hist.*, x. 27.) Down was also used. Martial, in his 161st Epigram, says, "When fatigued, you may recline on Amyclæan feathers, which the swan's inner down provides for you."

The date when feather beds were first used in England is unknown. An old chronicle tells us that the duke of Gloucester, uncle to Richard II., was smothered with "a feder-bedde." (STRUTT, *Manners and Customs of the English*, ii. 88.) By a statute of Henry VII. it was forbidden to make beds of mixed down and feathers: "The mixture of such being conceived contagious for man's body to lie on." (*Stat.* xi., ch. 59.) From this period "fether-beddes" are included in most inventories of household furniture.

Goose feathers are brought from Germany, Russia, and Poland. In the fenny part of Lincolnshire, called Holland, flocks of geese are kept for the sake of their feathers, which are plucked four or five times a year. New feathers are dried by the sun's heat or in ovens, and then beaten to clean them. Those that have been used are purified by a short exposure to steam, and are dried in the air. Eider down, so much prized for lining quilts, skirts, etc., is found most commonly on small rocky islands from 45° N. to the highest Arctic regions yet explored.

The oldest authentic mention of writing-quills is in a passage of Isidorus, who died in 636. (*Origines*, lib. vi. 13, p. 132, cited in BECKMANN'S *History of Inventions.*) A short poem on a writing-pen is found in the works of Aldhelmus, who died in 709. The Dutch invented the art of preparing quills so as to free them from a fatty humor which prevented the ink from flowing. They used hot ashes, and for a long time kept the process a secret, but it was discovered and improved. A bath of fine sand is kept at a temperature of 140°; into this the quill end of the feather is put and left a few instants. It is then rubbed with flannel, and becomes white and clear. The yellow tint of age is given by dipping the quills into diluted muriatic acid and then drying them. Each goose-wing produces five good quills, which are classified according to their order in the wing, the first being the best. A portion of the barb is stripped off for packing. A pen-cutter will make about 800 pens in a day. Besides goose-quills, those of the swan, turkey, and crow are used, the last-named chiefly for drawing. Since the introduction of steel pens the use of quills for writing has diminished in a great degree. JANET TUCKEY.

Feath'er Star, a popular name for certain echinodermatous radiate organisms of the genus *Comatula*, which in their younger stages are fixed, like the true crinoids, by a stem, but in adult life they become detached, whence they are sometimes called free crinoids. The feather star has five pinnate rays, with a chalky shell in many movable pieces. The *Comatula rosacea*, the best known species, is graceful and active in its motions, and, though a deep-sea species, can move readily upon the land.

Feath'erstone, tp. of Goodhue co., Minn. Pop. 850.

Featherstone (W. S.), Confederate brigadier-general, b. in Tennessee, emigrated to Mississippi, and represented that State in Congress (1847–51).

Feath'erstonehaugh (GEORGE WILLIAM), F. R. S., traveller and author, published a translation of the *Republic* of Cicero in 1828; in 1834 made a *Geological Report of the Elevated Country between the Missouri and Red Rivers*, *Excursion through the Slave States* (1844), *Geology of Green Bay and Wisconsin* (1836), *Observations on the Ashburton Treaty* (1842), *Canoe Voyage to the Minnesota* (2 vols., 1847), and *Geological Reconnaissance in 1835 to Coteau de Prairie* (1836). He was commissioner for Great Britain to settle the northern boundary of the U. S. under the Ashburton treaty, and afterward British consul for Calvados and Seine, France. D. at Havre, France, Sept. 28, 1866.

Feb'iger (CHRISTIAN), American soldier, b. in Denmark 1747, enlisted Apr. 28, 1775, and served honorably at Bunker's Hill. He was made prisoner at Quebec in Arnold's attack on that citadel; was conspicuous also at the capture of Stony Point and at Yorktown, Va., where he commanded the Second Virginia regiment. He was treasurer of Pennsylvania from 1789 to his death, at Philadelphia, Sept. 20, 1796.

Febiger (JOHN C.), U. S. N., b. Feb. 14, 1821, in Pennsylvania, entered the navy as a midshipman Sept. 14, 1838, became a passed midshipman in 1844, a lieutenant in 1853, a commander in 1862, a captain in 1868. From 1861 to 1863 commanded various vessels of the Western Gulf and Mississippi squadrons, and in 1864–65 commanded the Mattabeset (North Atlantic blockading squadron), in which vessel he participated in the desperate fight between the little squadron of wooden vessels under the command of Captain Melancthon Smith and the ram Albemarle, which took place in Albemarle Sound, N. C., on May 5, 1864, and resulted in the defeat of the ram and the capture of her tender, the Bombshell. For his "gallantry and skill" on this occasion Febiger was warmly commended by Captain Smith and Rear-Admiral Samuel Phillips Lee.

FOXHALL A. PARKER.

Febric'ula [a diminutive of the Lat. *febris*, "fever"], or **Ephemeral Fever,** a short feverish attack lasting from one day to a week, marked by a rapid pulse, a furred tongue, and often by a very considerable increase of heat and by headache. Persons suffering from febricula are said to be "threatened with a fever," and are too often improperly dosed. A warm bath, warm or cold water to drink as best suits the patient, the use of enemata if called for, and other simple treatment is sufficient, for the disease will pass away of itself if allowed to do so. It is often followed by an eruption or a stage of profuse sweating. There would appear to be no constant factor in the causes of febricula, which may be associated with a severe cold, a profound emotional disturbance, or with some excess on the patient's part. It is especially common during epidemics of typhoid and typhus fevers.

REVISED BY WILLARD PARKER.

Feb'rifuge [from the Lat. *febris*, "fever," and *fugo*, to "put to flight"], a medicine capable of banishing or diminishing fever. The term is much less used than formerly, it being now recognized that the specific fevers are as a rule self-limited diseases, with a somewhat definite course to run; consequently, it is not considered desirable or possible to "break up" fevers of this class. Still, much may be done by the use of water, the cinchona alkaloids, and the arterial sedatives, such as veratrum and aconite,

to diminish the severity of fevers. Such medicines as quinia and arsenic may, however, have a really specific febrifugal action in many malarial fevers. Hence, it is to them that the name more strictly belongs.

Febro′nianism [so called from *Justinus Febronius*, the pseudonym of its founder], a name applied to the views taught in the writings of J. N. von Hontheim (1701–90), suffragan bishop of the Roman Catholic diocese of Treves. He taught that the primacy of the pope is of human origin, and opposed with great success the Ultramontane view. He had many followers, but in his old age was so annoyed by the persecutions visited upon himself and his family that he recanted twice, and finally abandoned his bishopric; but Febronianism long survived, and the "Old Catholic" movement of recent years is its development. (See HONTHEIM, VON.)

Feb′ruary [so named from *Februus*, an old Etruscan and Roman divinity, identified in later times with the Pluto of the Greeks], the second month of the Gregorian year, having twenty-eight days, except in leap-years, when it has twenty-nine.

Fécamp [Lat. *Fiscannum*], a manufacturing town and seaport of France, in the department of Seine-Inférieure. Its port, though small, is one of the best on the English Channel, and is much frequented by colliers from Newcastle and Sunderland, and by timber-ships and fishing-vessels from the Baltic. Lat. of Fécamp light, 49° 46′ N., lon. 22′ E. It is a favorite resort for sea-bathing, and has some manufacturing interests. Pop. 12,243.

Fech′ner (GUSTAV THEODOR), b. at Gross-Särchen Apr. 19, 1801, after a brilliant course of study at Sorau and Dresden studied medicine at Leipsic, where he became professor of physics in 1834; has written much and ably upon chemistry, physics, anthropology, medical science, philosophy, and antiquities; besides poetry, criticism, and humorous literature. Among his more important works are *Ueber das höchste Gut*, 1846; *Elemente der Psychophysik*, 1860; *Zur Geschichte der Holbein'schen Madonna*, 1866.

Fech′ter (CHARLES ALBERT), actor, b. in London Oct. 23, 1824. His father was a German, his mother a Frenchwoman, and he was educated in England and France. For some time he devoted himself to sculpture, but having an inclination for the stage, he made his *début* at the Salle Molière in *Le Mari de la Veuve;* after passing some weeks at the Conservatory he joined a company and made the tour of Italy; on his return he resumed his occupation of sculptor. His first success on the French stage was as Duval in *La Dame aux Camélias*. In 1860 he appeared on the English stage as Hamlet, and in 1861 as Othello; and in 1863 he leased the Lyceum Theatre and produced *The Duke's Motto, Bel Demonio*, etc., assuming the principal characters himself. In 1870 he played successful engagements in the principal cities of the U. S., and managed the Globe Theatre in Boston for a season. G. C. SIMMONS.

Fecula. See STARCH.

Fecundation. See EMBRYOLOGY, by PROF. J. C. DALTON, M. D., M. N. A. S.; also FERTILIZATION OF PLANTS.

Fed′eralist, written also **Fœderalist** [from the Lat. *fœdus*, meaning a "league," and akin to *fides*, "faith"].

I. A collection of essays written in favor of the new (present) Constitution of the U. S., and, with the exception of the concluding nine of the eighty-six numbers, originally published in *The Independent Journal*, a semi-weekly newspaper printed in the city of New York, between the 27th of Oct., 1787, and the 2d of Apr., 1788. Its authors were Alexander Hamilton, James Madison, and John Jay, who addressed themselves over the common signature of "Publius," in a series of letters, "To the People of the State of New York," with the avowed purpose of securing the accession of that State to the Constitution as proposed by the Federal convention of Sept. 17, 1787.

The immediate cause, or, so to say, provocation of the work, was the appearance, almost simultaneously with the recommendation of the convention, of two series of able articles so severely criticising the proposed Constitution that its adoption was more than endangered. Mr. Hamilton resolved to counteract these attacks through the same means, the public press—to answer the arguments advanced, and, in reply to a charge that the supporters of the Constitution designed to supplant the Union of the States by their fusion under a centralized (if not monarchical) government, to retort upon its opponents with an implied accusation of favoring the division of the States into separate confederacies. For this purpose he drew up a syllabus of essays, to be written by himself and associates, which should perspicuously exhibit the advantages of the Union, expose the insufficiency of the subsisting Confederation, with the necessity of a more energetic government, and advocate the plan under consideration by showing that it was the least objectionable of any feasible scheme, and that it conformed to republican principles and approved institutions.

It is beyond reasonable doubt that Mr. Jay, then secretary for foreign affairs, discussed the foreign relations of the States in the second, third, fourth, and fifth numbers, and the lodgment with the Senate of the treaty-making power in the sixty-fourth. Concerning the respective shares of Hamilton and Madison in the authorship a dispute early arose between the admirers of those gentlemen. The curious reader may consult the introduction to Mr. Dawson's edition for a summary account of this not unembittered controversy, which was never of much moment save, mayhap, as to No. 49 and those immediately succeeding, relating to the independence of the several departments of the government. It is a noteworthy indication of the importance attached by Mr. Hamilton to the posthumous fame of his connection with the work that he was at pains to leave a significant memorandum concerning it in the office of a friend the day before his fatal duel with Aaron Burr.

In estimating its merits the *Federalist* is to be judged as a collection of fugitive pieces intended to vindicate a specific Constitution, rather than as an elaborate treatise on the science of government. For the end aimed at it was admirably adapted. The basis of the argument wellnigh throughout is utility, or, as has been somewhat harshly said, "interest and fear." From this point of view it would have been difficult to adduce more convincing reasons for the preservation of the Union; many of them, in the light of more recent events, savor of prescience. The method is mainly empirical, rarely speculative. The style is elevated, yet designedly popular. The whole is replete with more or less familiar illustrations, particularly from history. It may be true, as was the opinion of Mr. Stuart Mill, that a more philosophical work upon modern democracy has been founded upon American institutions, but it was also said by a no less eminent foreigner, M. Guizot, that "in the application of the elementary principles of government it is the greatest work known."

If the Constitution is to be interpreted according to the intention of its framers and the understanding of those who ratified it, an acquaintance with the *Federalist* is nearly indispensable. It also affords a valuable view of many of the cardinal differences of the parties which, under various names, have contended in American politics.

The first collected edition appeared in 1788 in two 12mo volumes from the press of J. & A. M'Lean, the proprietors of *The Independent Journal*. It has since been issued, in this country and abroad, in over twenty editions, of which one by Mr. Dawson is the most attractive and complete. The references in this article, however, are made to the numbers of the first and more familiar edition.

II. The name of a political party prominent in the early history of the U. S.

Various circumstances have been assigned as its origin. But, whatever its proximate cause, its real basis must be sought in divergent connections and interests of long and gradual growth. During the struggle for independence the Revolutionary government was supported by a devotion frequently cited by observant foreigners as a marvellous example (*e. g.* CONSTANT, *Cours de politique*, i. p. 101, ed. 1872). Upon the accomplishment of the Revolution and relaxation of the motives to the self-denial which alone had made it possible, the necessity of a more vigorous authority for the unimpassioned purposes of peace became irresistibly apparent. What change would be most expedient was the question to be decided.

Experience of the shortcomings of the existing system had peculiarly impressed its defects upon the leading citizens, who had had the most to do with administering it. A majority of these were imbued with British constitutional traditions, and not unaffected by the exercise of peremptory powers during the war. They distrusted the capacity of the masses to manage their own concerns, and feared in the common people a disrespect for the rights of persons and of property. They believed it necessary to consolidate the country under a general national government powerful enough to permeate the whole. Though by no means harmonious as to the powers to be conferred, they were unanimously in favor of a "strong government." With these the commercial classes generally sided, as did also the greater number of those distinguished by wealth and social position.

On the other hand, the very self-sacrifice so long practised had increased the attachment of the masses for independent local institutions, and quickened their jealousy of an overshadowing authority beyond the reach of "a swift responsibility." They had dearly learned the worth of the Union, but, imputing to the more aristocratic party a design to subvert their liberties, and believing a limited alliance of free States sufficient for their purposes, they desired

to retain the federal league (under the Articles of Confederation), somewhat modified to suit unforeseen needs.

Out of this conflict came the Constitution, "extorted," in the words of John Quincy Adams, "from the grinding necessity of a reluctant nation." By one of those freaks of nomenclature not uncommon in religion and politics, those who favored the consolidation of the States into one nation received the name of "Federalists," while the misnomer of "Anti-Federalists" was bestowed upon their opponents, who least of all deserved it.

With the administration of Gen. Washington the Federalists came into ascendency. Having only accepted the compromise Constitution in default of something more to their liking, they, under the accomplished leadership of Hamilton, set about finding in that instrument a warrant for the government they desired through the doctrines of "implied and constructive" constitutional power, of the exercise of which the establishment of a national bank and the assumption of the State debts may serve as examples. This perversion of the organic law of the land caused the defeat of the Federalists and the accession of their opponents (under the name of Republicans) in the election of Mr. Jefferson, who announced as the new policy "the support of the State governments in all their rights as the most competent administrations for our domestic concerns and the surest bulwark against anti-republican tendencies—the preservation of the general government in its whole constitutional vigor as the sheet-anchor of our peace at home and safety abroad." The power of the Federalists was irretrievably lost by their action in the famous Hartford Convention, which was called to protest against alleged neglect of New England during the last war with Great Britain, but which fastened upon them the imputation of condemning the war itself. The party, as such, expired six years later on the election of Mr. Monroe and the commencement of the "era of good feeling." Long after its public overthrow the seeds sown by this powerful organization continued to bear fruit, particularly in the judiciary, its last stronghold. Despite that its prestige was broken even here by the resistance of Mr. Secretary Madison to a mandamus of the Supreme Court in the case of Marbury, one of the so-called "midnight appointees" of Mr. Adams, the decisions of that tribunal long continued under the influence of Federalist doctrines, of which a striking instance is to be found in the Dred Scott case, wherein the leading opinion was delivered by Mr. Chief-Justice Taney, himself an old Federalist.

III. The generic name of divers political parties in Spain opposed to monarchical government, but favoring very different systems, ranging from a socialism resembling that set up by the Parisian Commune of 1871 to a republic patterned after the U. S. of America. Upon the abdication of King Amadeus (Feb. 11, 1873) the government of the country fell to a national assembly elected during the late reign, and mainly made up of the mild royalists called "radicals." Dissensions amongst the monarchists enabled the republican members, although in the minority, to bring about a declaration of the Republic with a republican ministry, under the supervision of a permanent committee, which should represent the legislature until the convening of a constituent assembly. After the lapse of a couple of months preparations were made, with the assistance of the permanent committee, for seizing the government by a military *coup d'état* in the interest of Marshal Serrano. This was frustrated by the adroit boldness of the civil governor of Madrid, Señor Estevanoy, who, on the day elected for the Serrano movement, disarmed the guards by which it was to have been effected, and enabled President Pi y Margall and his associates to dismiss the permanent committee and take full possession of the government by what is known as the Federalist *coup d'état* of Apr. 23, 1873. The ensuing elections were favorable to the republicans, but, through disagreements amongst themselves, their administration lasted but one year, when they gave place to Serrano, who, after having been practically dictator, at the end of 1874 in turn yielded to the monarchy of Alphonso XII.

The term *Federalist* has also been used at other periods to designate other less prominent partisans, particularly in Spain and Spanish America. CHARLES F. MACLEAN.

Federal Point, tp. of New Hanover co., N. C., named from the point at the entrance to New Inlet and Cape Fear River, which has a lighthouse on iron piles; lat. 33° 57′ 34″ N., lon. 77° 55′ 11″ W. Pop. 410.

Fed′eralsburg, post-v. and tp. of Caroline co., Md., on Nanticoke River and the Dorchester and Delaware R. R., near the centre of the great Peach Peninsula. It has 3 churches, a weekly newspaper, 2 hotels, 3 public schools, is well supplied with stores, and largely engaged in the manufacture of fruit-baskets. It is being rapidly settled by Northerners. Principal occupation of its people, fruit-raising. Pop. of tp. 1506.

GEO. BAKER, ED. "MARYLAND COURIER."

Federa′tion [from the Lat. *fœdus*, a "league"], a union of states under a compact by which the general or common government is supreme in its own sphere. As distinguished from a confederation, with which it is often confounded, a federation is a composite sovereignty under a supreme government formed from attributes of sovereignty relinquished by the constituent states or component parts of the new body politic. It follows, as to domestic economy, that a federal government within its proper sphere can act directly upon the individual citizens of the several states, instead of mediately through the state governments; as to international relations, it follows, further, that the supreme central power alone can hold intercourse with foreign governments, which recognize only independent sovereignties. Contrariwise, the several states forming a confederation retain their autonomy and sovereignty, and can maintain all international relations not conflicting with the conditions of the union, while the individual subject is answerable only to his own state government. In short, a confederation differs little from an ordinary alliance except in the permanency and intimacy of the association. The distinction between the two forms of government is aptly suggested by the German names *Bundesstaat* ("Union-State") and *Staatenbund* ("Union of States"), as also in the phraseology of English writers on constitutional law by the terms "composite state" and "system of confederated states."

An important consequence of the relations of the aggregate body and the constituent states of a federation is the competency of the judiciary of each to examine the acts of the other, in that the states can obviously no longer exercise the powers which they have relinquished to the general government, and that the latter has no powers not expressly conferred upon it.

The principal existing examples of this form of government are the American republics and the federation of the Swiss cantons. In all of these the superintendence of the foreign relations of the states is vested in general congresses, which also have more or less direct and controlling relations to the individual subjects. The U. S. of America furnish the most complete and thorough model of a federation (see CONSTITUTION OF THE U. S.)—a model after which the other American federations have been more or less directly fashioned. The latter are, the "United States of Mexico" (twenty-seven states, a federal district, and a territory), the "United States of Colombia" (Antioquia, Bolivar, Boyacá, Cauca, Cundinamarca, Magdalena, Panama, Santander, Tolima), and the "United States of Rio de la Plata" (fourteen provinces, commonly called the "Argentine Republic").

The Swiss or Helvetian federation is composed of twenty-two political cantons, of which the supreme authority is vested in a federal diet composed of a national council (a deputy for every 1000 inhabitants) and a state council (two delegates from each canton). Seven members are chosen by the two branches of the diet, on a joint ballot, to form the federal council, which exercises the executive authority under a president, who holds office but one year, and is ineligible for the next ensuing term. The diet is responsible for the internal and external security of the federation. It alone can declare war or conclude treaties of peace, commerce, or alliance with foreign powers. The several cantons can, however, conclude conventions respecting matters of revenue and police with subordinate departments of foreign governments, subject to the approval of the federal authority. CHARLES F. MACLEAN.

Fee [Sax. *feh, feoh,* a "stipend or reward;" L. Lat. *feodum, feudum;* Scot. *feu;* Fr. *fief*]. In its original signification under the feudal-law system of tenure the term "fee" or "feud" was employed to denote the allotment of land which a vassal received from his superior lord on condition of the performance of various services in his lord's behalf—especially of military service in time of war. (See FEUDAL SYSTEM.) It was used in contradistinction to *allodium*, which applied to land which a man owned in his own right, without any obligation to render service to another. But in the gradual modification of the law appertaining to the tenure of landed property the word "fee," while still retained, has undergone a change of signification, being used to designate the estate which a land-owner possesses. And by "estate" in this connection is meant not the property itself—though such an application of the term is common in popular parlance—but the interest which one has in the land as regards the nature and duration of his title. A fee, therefore, signifies an estate of inheritance—*i. e.* an interest in land which, on the death of the owner without a will, passes immediately to his heirs. When used without any word of description it has the same general extent of meaning as the phrases "fee-simple" and "fee-simple absolute." These words of designation appended are employed to indicate more spe-

cifically that the estate is to be enjoyed without any qualifications or restrictions limiting or tending to limit the indefinite duration and absoluteness of the tenure, and that it is indefeasible, in contradistinction to the terms "qualified fee," "determinable fee," etc., to be hereafter explained. A fee or fee-simple is the highest estate known to the law. Its mode of creation by deed at common law still exhibits the application of arbitrary rules derived from the feudal system, which derive their justification only from the circumstance that they are the result of the historic growth of the system of tenure, a factitious importance being given to them which seems, to a great degree, unreasonable when they are considered without reference to their origin. Thus, it is absolutely essential that the word "heir" or "heirs" be employed in a deed in connection with the name of the grantee, or the only interest created will be a life estate. The purely arbitrary nature of this requirement has caused its abrogation in a few of the American States by statute. In wills, moreover, and in estates created under the doctrines of Uses (see Uses and Trusts), it has never been obligatory, since in these cases the object of legal interpretation has been to arrive at the true intent of the devisor or grantor, and to effectuate his real purposes without such precise regard to the forms in which they are couched. When a fee is conveyed to a corporation aggregate the word "heirs" is unnecessary, even in a deed, since it is not properly applicable; if the conveyance be to a corporation sole, the word "successors" should be substituted. The most important right which the owner of a fee-simple possesses is that of free and unrestricted enjoyment of the property, and an unlimited power to dispose of it at his own pleasure. Even if any language be inserted in the conveyance through which he received his title restricting his power of alienation, it is void and may be disregarded. This is not true, however, as to restrictions upon the mode of occupation, for there may be prohibitions against erecting buildings of a certain character or the use of the land for certain specified purposes which cannot be transgressed. An owner in fee may transfer his entire estate to another, or he may carve out of it any inferior estate, such as a life estate or an estate for years, retaining in himself a reversion or creating a remainder in a third person, or he may make any other transfer he may think desirable. His interest may be seized and sold for the payment of his debts, either in his own lifetime or after his death, in exclusion of the claims of his heirs.

Estates in fee inferior to a fee-simple are termed "base" or "qualified" or "determinable" fees—*i. e.* estates of inheritance which are granted with qualifications or restrictions which may cause their defeasance. These assume various forms. Thus, there may be a *fee upon limitation,* as an estate given to A until B goes to Boston. In such a case, if B ever goes to Boston the estate is at once defeated; if he never goes, the fee becomes absolute. A fee may be granted upon *condition,* as an estate to A on condition that he builds a market upon the land within three years. If the grantee fails to comply with the stipulation, the grantor or his heirs may re-enter after the condition is broken and recover the estate. Limitations are created by words of time; conditions, by terms in the nature of a proviso. There are also what are styled estates upon *conditional limitation,* as an estate to A until B goes to Boston, when the estate is to pass to C, some third person. No entry is required in such a case by the grantor to defeat the estate, as in the case of a condition, but on the occurrence of the event specified the estate is at once, *ipso facto,* vested in C, the grantee in the alternative. There was, moreover, a fee conditional at common law, which was afterwards modified by statute into a peculiar estate termed a *fee tail.* This was created when an estate was given to a man and the "heirs of his body." In this case the grantee had a fee, but could not make disposition of it so as to defeat the right of the heirs designated. This particular restriction at common law was, in course of time, in England avoided by a resort to ingenious legal fictions, as by fines and recoveries; and in the American States there has been very generally an entire abolition of this form of estate, or so fundamental a change in it that this mode of limitation is made equivalent to a conveyance in fee-simple. (See Entail.) (On this general topic consult Washburn on *Real Property;* Williams on the same subject; Cruise's *Digest;* Kent's *Commentaries,* etc.)

George Chase. Revised by T. W. Dwight.

Fee'jee (Fidji, Fiji, or **Viti) Islands** is a group in the South Pacific Ocean, between lat. 15° 30′ and 20° 30′ S., and lon. 177° and 178° W., numbering about 200 islands, of which about 80 are inhabited. They were discovered in 1643 by the Dutch navigator Tasman, but not fully explored until 1840, when they were visited by the American navigator Wilkes. The two largest islands are Viti Levu, having an area of 90 miles by 50, and an estimated population of 50,000; and Vanua Levu, with about 30,000; the others are small. The Feejee Islands are of volcanic origin; earthquakes are common and hurricanes periodical. The soil, which consists of a deep yellow loam, and is well watered, is exceedingly fertile, and the moist and hot climate, the temperature ranging from 60° to 120°, calls forth a most luxuriant vegetation, consisting of bread-fruit trees, bananas, cocoanuts, sugar-canes, and tea-plants; cotton grows wild. The inhabitants were a most fierce and savage race, middle-sized, strong-limbed, short-necked, with a complexion between copper-color and black. They live in tribes, each tribe being governed by its own chief, who rules absolutely. Lately, however, the efforts of Christian missionaries have been followed with success, and in 1861 the king and chiefs of Viti Levu formally offered the island to Great Britain; which offer, after many hesitations, was accepted in 1874, when the British flag was first hoisted on Feejee soil. The population of the islands is probably 200,000, some of the smaller islands being exceedingly populous. It was formerly true to call the islanders cannibals, but it is not true now. This was the case when the Wesleyan missionaries went there in 1835, but now 100,000, or half the whole native population, regularly attend church on the Sabbath. There are 22,223 church-members. There are 663 native preachers of the gospel. There are 1524 day schools, attended by 57,057 children, and the barbarities, crimes, and vices of their former state have within a few years greatly lessened.

Feel'ing has a double definition. In its narrower meaning it refers simply to the sense of feeling, and denotes the sensation produced by an object on the sensory nerve, as hearing denotes the sensation produced by an object on the auditory nerve, sight the sensation produced by an object on the visual nerve, and so on. In its wider sense it comprises all the impressions we receive through the senses, as they all arise from the same general sensibility, which is merely particularized in the special sensory organs; but it refers to them not as far as they are sensations in the organs of sense, but as far as they are modifications of consciousness. Thus, feeling is nearly synonymous with emotion, and the two expressions are often used synonymously, though emotion is more properly applied to the separate states of the feeling, and feeling to the general capacity for emotions. Emotion refers to the shifting, changing surface of the feeling—feeling, to the steadily recurring sentiments rooting in the depths of our organization.

In this, its wider sense, feeling is one of the three forms under which the mind becomes conscious of itself, thought and will being the two others. The mind is conscious of itself only as far as it feels or thinks or wills, and it is never conscious of itself as performing more than one of these operations at a time, the two others being either dormant or absorbed. But although intellect, volition, and feeling thus form three very different manifestations of the mind, the distinction between them is nevertheless only an abstraction; in actual life no line of separation can be drawn. Thus, feeling involves thought, and thought feeling. An impression on our sensibility remains a sensation in the organ of sense until an idea is sent out to meet it, to introduce it into consciousness, and to transform it into a feeling. All feelings—anger, pity, sorrow, love, joy, etc. —are charged with ideas. They express themselves not only through laughter and tears, but in winged words, and when they are strong they make men eloquent. Feelings which are untouched by intellect we refuse to call feelings; we call them instincts, cravings, appetites, desires, and so on. On the other hand, ideas are nothing but feelings which have been fixed in the memory, and by comparison, analysis, abstraction, and other processes of thinking, wrought into thoughts. A man has so many original ideas as he has living feelings, and no more; the rest are unoriginal, often borrowed, sometimes stolen. Our ideas correspond to our feelings, not only with respect to their number, but also with respect to their quality—nay, even with respect to their most delicate coloring. A man who feels hatred can rise in morals to the idea of justice, but never to that of love. With Seneca, all his ideas were tinged by a cold, vain pride; with Voltaire, by a malicious, cowardly joy; with Hegel, by a broad, benign sympathy; with Stuart Mill, by a machine-like exactness and delicate subtleness. To draw a broad and unwavering line of demarcation between thought and feeling, or, generally, between the three different manifestations of the human mind, and to assign to each of them its own thoroughly encircled sphere, as the old psychology tried to do, is impossible, and leads to grave errors. To discover and describe the delicate transitions or transfusions of thought, feeling, and will, as modern psychology tries to do, is of paramount importance for the right understanding of the human mind, and has proved less difficult than it seemed at first sight.

Clemens Petersen.

Fees'burg, post-v., Clark tp., Brown co., O. Pop. 201.

Fehm'ic (or **Vehm'ic**) **Court** [Ger. *Femgericht;* Old Ger. *Vehm,* "punishment"], of Germany. It is claimed by some that Charlemagne first organized these courts, and by others that they came down from the ante-historic Germans; but whether either of these statements is correct or not, they first appear in history during the anarchical days which followed the expulsion of Henry the Lion from his estates by the Diet of Wurzburg in 1180. This court was composed of "initiated" members (*Wissende*), who were sworn to secrecy by a tremendous oath. The archbishop of Cologne (as lord of Westphalia) and the emperor were at least nominal members. The courts were presided over by a *Freigraf,* or free count. Their tribunals were either open—held by day in the open air—or secret, the latter being held for the trial of the more serious offences. The Fehmic courts came to have a most extensive and dreadful authority. Not only feudal barons, but at least in one instance the emperor himself was cited before this irresponsible tribunal. In the Pact of Westphalia (1371) they were recognized as lawful. In 1438 the emperor Albert II. attempted to suppress them. In 1461, so dreadful was their influence that many nobles, prelates, and cities of Germany and Switzerland combined to resist their power. In 1495, Maximilian I. gave them a new code, which greatly reduced their authority. In 1568 their last open court was held near Celle in Hanover, but in Westphalia, their true home, these courts nominally existed until 1811, holding secret meetings, but were suppressed in the latter year by Jerome Bonaparte. Born of a stern necessity, the Fehmic courts came in time to be a serious evil, and are now chiefly remembered for the excessive cruelty of their punishments.

Feia, a large lake of Brazil, 130 miles N. E. of Rio Janeiro, near the Atlantic, with which it has been connected by a canal. It is shallow, but abounds in fish.

Feild (Rt. Rev. Edward), D. D., b. in England in 1801, was educated at Rugby and at Queen's College, Oxford, where he graduated with honors, and in 1827 became a public examiner. He held the living of English Bicknor, Gloucestershire, and in 1844 was consecrated Anglican bishop of Newfoundland, receiving the appointment from the queen. His diocese includes the Bermudas, and he is *ex officio* a member of the government of the latter colony.

Felanich'e, or **Felanitx,** an old town of the Spanish island of Majorca. It has considerable trade in wine, brandy, and fruit. On a neighboring mountain is the old castle, with its subterranean vaults constructed by the Moors. Pop. 5918.

Felch (Alpheus), b. in Limerick, Me., Sept. 28, 1806; graduated at Bowdoin College 1827, and became a lawyer of Michigan; was in the State legislature 1836–37; bank commissioner 1838–39; auditor-general of Michigan; was a judge of the State supreme court 1842–45; governor of Michigan 1846–47; U. S. Senator 1847–53; was a commissioner of California land claims 1853–56.

Felch'ville, post-v. of Reading tp., Windsor co., Vt. It has manufactures of furniture and other goods. It is 59 miles S. of Montpelier.

Feld'kirch, thriving manufacturing town of Austria, in the Vorarlberg, is the seat of a bishop, suffragan to the bishop of Brixen, and vicar-general of the Vorarlberg. It has an important Jesuit educational institution (Stella Matutina) and a Capuchin cloister, and is the seat of important courts, etc. It is 20 miles S. W. of Bregenz. Its manufactures are varied and important. Pop. 2350.

Feld'spar, or **Felspar,** a term in mineralogy derived from the German *Feldspath* ("field-spar"), or, according to some, from *fels,* a "rock," and applied to a family of minerals embracing many species, which crystallize in several systems. In chemical composition they all agree in being silicates of alumina, with silicates of other bases, either soda, potash, or lime. By some authors the term is restricted to one species, the common potash feldspar, or orthoclase. Popularly, the term is also applied to albite, a soda feldspar, and to labradorite and oligoclase, soda-lime feldspars, etc. Feldspars enter largely into the composition of all granitic and of many metamorphic rocks, and form the chief element of porphyries and volcanic rocks. In their decomposition they are the source of clay. Moonstone and lapis-lazuli are members of this family valued in the arts, and feldspar is also used as a glaze for porcelain. Edward C. H. Day.

Felegyha'za, town of Hungary, on the road between Pesth and Temesvar. It has great cattle-markets, and an extensive trade in corn, wine, and fruit. Pop. 19,390.

Feli'ce, de (Fortunato Bartolommeo), b. at Rome Aug. 24, 1723; studied at Rome and Naples; eloped with a nun to Switzerland, and became a Protestant printer, editor, and teacher of Yverdun; published Italian and other translations of the leading philosophical works of that period; wrote some original works upon natural, national, and civil law; and was the principal editor of an *Encyclopédie* (in 58 vols., 1770–80) based upon the great French *Encyclopédie.* Died at Yverdun Feb. 7, 1789.

Felicis'simus, a deacon of Carthage, ordained by the enemies of the bishop Cyprian while he was absent in time of persecution, between Feb. 250, A. D., and April, 251 A. D. He was a man of wealth, of talents, of energy, and of influence. As soon as he returned to Carthage, Cyprian summoned a council which excommunicated Felicissimus and the presbyters who sympathized with him. Refusing to submit, the party chose one of their own number (Fortunatus) in place of Cyprian as bishop. Felicissimus was deputed to represent their cause at Rome and to sustain charges against Cyprian. This project failed, and the schism soon came to an end. (See *Cyprianic Epistles,* 38 and 55, for the character of Felicissimus, drawn in the darkest colors.)

Another Felicissimus was a friend of Cyprian, and first to suffer in the Decian persecution. It is uncertain whether he is the Saint Felicissimus named in the martyrologies. R. D. Hitchcock.

Felic'itas, Saint, a mother and a martyr put to death, with her seven sons, at Rome under Marcus Aurelius Antoninus (161–180 A. D.). All were arraigned together before the tribunal of Publius the prefect. To the question whether they would sacrifice to idols, they replied by a firm refusal, fearlessly confessing their Christian faith. The officer informed the emperor of their refusal, and by him they were left to the sentence of the judges, who ordered the sons to be put to death by diverse punishments, but the mother to be beheaded.

Another of the same name suffered death for the Christian faith, in company with Saint Perpetua, under Caracalla (211–217 A. D.). The two, who alike remained firm in their refusal to offer sacrifice as they were required, were first exposed to wild beasts, and after having been torn by them, were put to death. R. D. Hitchcock.

Felic'ity, post-v. of Franklin tp., Clermont co., O., 42 miles S. E. from Cincinnati. Pop. 955.

Fel'idæ [from *Felis,* the typical genus of the family], a family of the order Feræ and group Æluroidea, distinguished by the dentition (M. $\frac{1}{1}$, P. M. $\frac{3}{2}$ or $\frac{2}{2}$, C. $\frac{1}{1}$, I. $\frac{3}{3} \times 2$ = 28 or 30), form of body (cat-like), digitigrade feet, and the absence of an alispheroid canal. Most of the forms have retractile claws, but the hunting leopard (*Guepardu*) has non-retractile ones. The family contains the cats, lions, tigers, panthers, leopards, lynxes, etc.

Felix, tp. of Grundy co., Ill. Pop. 616.

Fe'lix, tp. of Grundy co., Ia. Pop. 656.

Fe'lix [Gr. Φῆλιξ] Antonius, a freedman of the emperor Claudius, whence he was also, according to Suidas, called Claudius, and a brother of the powerful freedman Pallas, through whose influence with the emperor and the empress Agrippina, Felix was appointed procurator of Judæa about 53 A. D. He found his province filled with disorders and tumults, caused by the robbers and assassins (*sicarii*) who then abounded, and he exercised great severity in repressing them, but he also was guilty of great rapacity. Married Drusilla (youngest daughter of Herodes Agrippa I.), whom he induced to leave her former husband. It was this Felix to whom Lysias sent the apostle Paul, and before whom he "reasoned of righteousness, temperance, and judgment to come." In A. D. 60 (probably, but the year is uncertain) he was succeeded by Festus, and on his return to Rome the Jews preferred complaints against him, but he was saved from punishment by the influence of his brother Pallas. H. Drisler.

Félix (Célestin Joseph), Jesuit preacher, b. at Neuville-sur-l'Escaut June 28, 1810, began preaching in Paris in 1851 with great success, entered the Society of Jesus in 1837, and has contributed largely to *L'Ami de la Religion,* and is the author of several works, "conferences," sermons, etc.

Felix (Marcus Minucius), commonly called Minucius Felix, an eloquent Roman lawyer and Christian, who probably lived about 230 A. D., but the period when he lived is not at all certain. Wrote the dialogue *Octavius,* designed as a popular defence of Christianity, and remarkable for its choice diction. The edition of Gronovius (Leyden, 1707) is one of the best.

Felix I., Saint, succeeded Pope Dionysius Dec. 29, 269 A. D. In the persecutions under the Roman emperor Aurelian he was condemned to die, but expired in prison Dec. 22, 274.—Felix II., Pope, chosen by the Arians or by the emperor Constantius in 355, during Liberius's

exile, upon whose return he was expelled. D. Nov. 22, 365, and was canonized by the Romish Church.—FELIX III., pope in 483 A. D., was a native of Rome and great-grandfather of Gregory the Great. His condemnation of Acsius, patriarch of Constantinople, accused of heresy in 484, occasioned the first schism between the Eastern and the Western churches. D. Feb. 24 or 25, 492.—FELIX IV., pope in July, 526, appointed by Theodoric, king of the Goths. D. Oct., 530.—FELIX V., POPE or ANTIPOPE, was elected by the Council of Bâle Nov. 5, 1439, and consecrated July 24, 1440, but renounced the pontificate Apr. 9, 1449.—FELIX, bishop of Urgel, in Catalonia, in the eighth century, promulgated the "Adoptian heresy"—*i. e.* that Christ, as man, was merely the adopted son of God. He was deposed and banished about 800, and d. about 818.

Fell, tp. of Luzerne co., Pa. Pop. 343.

Fel'lah, plu. **Fellahin'** [Arab. "peasant"], a term designating the laboring class in Egypt. They are mostly Mohammedans, but a few of them are Copts. Except the slaves, they are the lowest class of the population. Politically and socially, they are in a deplorable condition. They are far more numerous than any other body of the Egyptian people. They are of mixed Coptic, Arabian, and Nubian stock. They are licentious, idle, and obstinate from the effects of many ages of grievous oppression. The name *Fellahin* is also given to the laboring classes of other Mohammedan countries.

Fellat'ahs, Fou'lahs, or **Fella'ni,** an interesting Mohammedan people of the Western Soudan in Africa, remarkable for their enterprise, intelligence, and religious zeal. They are a race, and not a nation—have many tribes, several shades of color and varieties of form, probably from the fact that they have blended with various subject-races. They cultivate Mohammedan learning with much enthusiasm. Their history is quite obscure. Saccatoo is their principal state, but they are the predominant people of many countries in the Soudan.

Fel'lenberg, von (PHILLIPP EMMANUEL), b. in Berne, Switzerland, June 27, 1771, was a descendant on the mother's side of Admiral Van Tromp. In youth he imbibed in some measure the philanthropic views of Pestalozzi, his father's friend. Fellenberg studied at Colmar and Tübingen, and a visit to Paris just after Robespierre's death convinced him that a better public education was necessary to the safety of society. He opposed the French in their occupation of Switzerland, for which cause he was banished, but after his return was employed in important diplomatic, political, and military offices. Failing to secure government aid in his educational plans, he founded in 1799 his famous educational and manual-labor establishment at Hofwyl, near Schönbühl, in the canton of Berne. In this school Fellenberg invested all his large fortune. In 1804, Pestalozzi removed his Burgdorf school to the old monastery of München-Buchsee, adjoining Hofwyl, and admitted Fellenberg to a share in the management of the school; but in 1805, on account of differing views in regard to methods of management, Pestalozzi removed to Yverdun. In 1807, Fellenberg established a scientific department, and in 1808 a normal school and an agricultural institution, where scientific agriculture was taught and practised and farming-implements manufactured. The Hofwyl institution flourished, and before Fellenberg's death there were in it ten distinct departments of instruction. Children of all ages, the rich and poor alike, were received. The wife and nine children of Fellenberg assisted him in his work. He d. at Berne Nov. 21, 1844. A few years after his death his establishment was abandoned, but many similar ones have been founded in various parts of Europe. Of these, the most extensive are the pauper-colonies of Fredericksoord, Wilhelminesoord, Willemsoord, Wateren, Veenhinzen, and Ommerschans in the Netherlands, which contain nearly 11,000 inmates in the aggregate.

Feller (HENRIETTA), b. in Switzerland about 1780 of a wealthy family, came, after her husband's death in 1835, to Canada, where she established the Grande Ligne mission for French Canadians. There she endured much persecution, but finally triumphed by her gentleness, courage, and benevolence, and became widely known and beloved by Roman Catholics as well as Protestants. Madame Feller was a Baptist. She expended her own fortune in her work, and was afterwards supported by the benevolent of various denominations. D. at Grande Ligne, province of Quebec, Canada, Mar. 27, 1868.

Feller, de (FRANÇOIS XAVIER), a Jesuit, b. at Brussels Aug. 18, 1735, held professorships in various Jesuit colleges. His principal works are *Catéchisme philosophique* (1773) and a *Dictionnaire historique* (1781), often revised and reprinted. D. at Ratisbon May 21, 1802.

Fel'lowes (ROBERT), b. in Norfolk, England, in 1770; graduated at St. Mary's Hall, Oxford; entered the Anglican priesthood, which he afterwards abandoned, having embraced new religious views. He was a man of exalted moral character and great benevolence, and was one of the founders of the London University. His peculiar views are set forth in a series of works, culminating in his *Religion of the Universe* (1836). D. in 1847. Was for a time editor of the *London Critical Review.*

Fel'lows (Sir CHARLES), b. at Nottingham, England, in 1799; made four expeditions into Asia Minor; collected the Lycian Marbles, now in the British Museum; was knighted in 1845, and d. Nov. 8, 1860. Author of *Journal of an Excursion into Asia Minor* (1839), a *Journal* (1841) of his second expedition, *Xanthian Marbles* (1843), *Account of an Ionic Trophy Monument* (1848), *Coins of Ancient Lycia* (1855), etc. The rich archæological remains of Lycia were quite unknown until announced by him.

Fellows (JOHN), American general in the war of the Revolution, b. at Pomfret, Conn., 1733, served in the French war, was in the provincial congress in 1775, led a regiment to Boston after the battle of Lexington, commanded a brigade at Long Island, at White Plains, and at Bemis' Heights, N. Y. His commission as brigadier-general dated June 25, 1776. D. at Sheffield, Mass., Aug. 1, 1808.

Fellows (JOHN), b. at Sheffield, Mass., 1760, graduated at Yale College 1783, and d. in New York City Jan. 3, 1844. He wrote upon the authorship of Junius, *Life of General Putnam* (12mo, 1843), *Exposition of the Mysteries or Religious Dogmas and Customs of the Ancient Egyptians, Pythagoreans, and Druids,* and *Inquiry into Freemasonry.*

Fel'lowship, in the universities of Oxford, Cambridge, Durham, and Dublin, a position held by the fellows (*socii*) of a particular college. The fellows were originally poor students (chiefly of divinity) who received the income of the fellowship as a means of support, but when they obtained a sufficient benefice, or became owners of property beyond a certain amount, or by marriage signified their abandonment of the Church, they lost the fellowship. The same causes, with some modifications and exceptions, will vacate a fellowship at present. Now, however, the fellowships are rewards for eminent scholarship, yielding in some cases a very handsome income, besides other valuable perquisites. Recent legislation has much simplified the ancient system of fellowships. The fellows of certain American colleges are simply members of a board of trustees who manage the business-affairs of their college.

Fe'lo de Se [Lat., "a felon of himself"], a self-murderer, one who commits suicide. Under the English law this offence is, as the name indicates, regarded as a peculiar kind of felony. The act causing death may either be deliberate and intentional, with a view to self-destruction, or a felonious attack upon another which results unexpectedly in the death of the assailant, as where one shoots at another, but the gun bursts and kills himself. The person committing the act must be of years of discretion, and possessed of sufficient soundness of mind to be able to appreciate its wrongful nature. It follows, therefore, that even a lunatic may be guilty of this crime if he kill himself in a lucid interval. The consequences of suicide under the English law from very early times, as regards the forfeiture of property, were the same as attended the commission of other kinds of felony, with this important exception, however—that only chattels were forfeited, and not lands of inheritance, and that no corruption of blood resulted. In order to vest the chattels in the Crown the fact of suicide must be determined by a coroner's inquisition. Formerly, in order to show the detestation of law for the crime, the body of the suicide was required to be buried in the highway with a stake driven through it. This barbarous mode of burial was abolished by statute in the reign of George IV. (1824), but the law still affixes the stigma of peculiar enormity to the offence by providing that interment shall take place by night, in privacy, and without the performance of the rites of Christian burial. The offence has never been punishable in the U. S., and of course the peculiar English modes of burial have never been practised.

The questions of greatest importance which arise at the present day in relation to suicide occur in connection with the subject of life insurance. Life policies usually contain a clause exempting the company from liability in case the insured "shall die by his own hands" or "take his own life." When suicide is committed by a person in the full possession of his mental faculties no difficulty can evidently arise as to the company's responsibility; but when the act is claimed to be the consequence of insanity, especially when this is only temporary in its character, or is nothing more than monomania or morbid impulse, considerable diversity of opinion has arisen in the courts as to

the effect of the exemption in the policy. The prevalent view seems to be that if the self-murderer, though his mind was disordered, had still "power to distinguish right from wrong, and the power to adhere to the right and avoid the wrong," the claim under the policy is invalidated. The application of this general principle must, however, give rise to many perplexing questions. If the death of the insured be caused "by his own hand," but is purely accidental, as if he should take poison by mistake or shoot himself by some unfortunate mischance, there is general agreement among the legal authorities that the company remains liable. If the insured, being in the possession of his ordinary reasoning faculties, from anger, pride, jealousy, or a desire to escape from the ills of life, intentionally takes his own life, there can be no recovery. On the other hand, if the death is caused by his voluntary act, and he knows and intends that his death shall be the result, but his reasoning faculties are so far impaired that he does not understand the general nature and consequences of the act, or is impelled thereto by an insane impulse which he has not the power to resist, the insurer is liable. (*Life Insurance Co.* vs. *Terry*, 15 Wallace, U. S. Reports, 580.) This proposition, however, has been criticised in the very recent case of *Van Zandt* vs. *Life Insurance Co.*, 55 N. Y. 178, and the whole subject is still open for discussion. If there be no exemption clause in the policy, and suicide be committed in a fit of temporary insanity, the insurer is liable. Whether the insurer would be responsible in the same way under such a policy if the insured were sane at the time of committing the act, is not yet definitely settled. The presumption is, that this would be regarded as a fraud upon the company which would make the policy null and void. (See MAY on *Insurance*.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fel′ony [derivation uncertain. Some etymologists suppose it to be a compound of the Saxon word *feh*, "fee" or "feud," and the German word *lon*, "price" or "value," and its original meaning therefore to have been "the price or cost of one's fee." Others refer it to the Saxon verb *fælen* or *felen*, to "fail" or "fall," because the criminal's property *fell* to his superior lord or to the Crown]. Under the English common law all grades of criminal offences have, from an early period, been divided into two great classes, felonies and misdemeanors. The principle of classification in accordance with which this distinction was made did not depend upon any definite inherent peculiarity by which the offences in one category were separated from those in the other, but merely upon the difference in the modes of punishment adopted. The commission of offences of greater criminality was attended with a forfeiture of the wrongdoer's lands, goods, or both, and all crimes thus punished were included under the comprehensive designation *felony*. Death was in a large number of instances superadded to forfeiture, but was not a distinguishing characteristic of this grade of offence. The common belief, that in order for a crime to be felonious it must be one for which capital punishment is inflicted, is entirely erroneous. In the English law at the present day there have been some important changes made in the laws concerning forfeiture, but the term "felony" retains its previously established signification, and no offence comes under this designation to which forfeiture is not annexed as a penalty. Goods and chattels are forfeited upon conviction for any felony, but in the case of lands conviction alone is not sufficient, but sentence of attainder must be pronounced. (See ATTAINDER.) By attainder for felony the offender forfeits the profits of all freehold estates during life; if the offence be *murder*, he also forfeits, after his death, all lands held in fee simple to the Crown for a year and a day. (See FORFEITURE.) In the U. S., where the nature and punishment of crimes are generally determined by statutory provisions, there is no universally recognized meaning given to the word "felony." Some States which have still retained it in use give to it a specific definition, employing it to designate crimes involving a certain kind of penalty, but making the penalty of a different character from that by which its meaning was originally determined. Thus, in New York any offence punishable by death or by imprisonment in a State prison is a felony. In a few States the use of the term is entirely discarded, and if it be employed at all in legal proceedings, it is without definiteness and precision of meaning. (See CRIME.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fel′sing (JAKOB), German engraver, born at Darmstadt 1802, wrought in Italy ten years, and then, in 1832, obtained at Darmstadt the title of engraver to the court. *The Marriage of Saint Catharine*, after Correggio, *Holy Family*, after Overbeck, and *Violin-Player*, after Raphael, are among his best works.

Felsö-Bánya, town of Hungary, county of Szathmár, in the neighborhood of rich gold, silver, copper, and lead mines. Pop. 5500.

Felspar. See FELDSPAR.

Fel′stone, a name given by some writers to such rocks as consist largely of feldspar, such as pitch-stone, the trachytes, phonolite, etc.

Felt [kindred to the Gr. πῖλος, "felt"], a stuff composed of wool, fur, or hair, of which the fibres are so entangled and interlaced that they cannot readily be separated. Felt is an article which has long been known. Homer and Hesiod distinctly mention it. It was a common material for caps, hosiery, floor-cloths, tents, and cloaks. It has long been known in the East, and the nomads of the desert largely occupy tents of felt. There is, however, a tradition that Saint Clement discovered felt while on a pilgrimage. Having put a bat of carded wool into each shoe to save his feet from blistering, he found at his journey's end that moisture and friction had converted the wool into felt.

Waste wool is largely employed for felting. It is first deprived of its oil, then carded and placed in a machine, where it is kept wet with hot water and subjected to a process of beating, by which the fibres are made to move upon each other until the interlocking of their serrations and the curling of the fibre itself unite the whole into a compact sheet of felt. The *fulling* of cloth is but a partial felting of wool already woven. Felted wool is used for carpets (often beautifully printed), carpet-covers, coarse hats, carriage-linings, and even for cloaks and other garments. The cheapest woollen rags, etc. are worked into felt for covering steam-boilers. This is an excellent non-conductor, and greatly diminishes the waste of heat. Roofing felt is a coarse kind, usually coated and filled with coal-tar, and sometimes with tar and powdered slate. Felt is also used for sheathing walls, and is useful as a non-conductor of heat. Felt for hats is made of the fur of nutria, raccoons, beavers, conies (rabbits), etc., and is generally mixed with some Saxony or other felting wool. The heap of fur is struck with a bowstring until it falls into an even layer, and it is felted by working it with the hands in a soapy liquid. Machinery is also sometimes used in this process. The U. S. census of 1870 reports the manufacture for that year of 586,000 yards of felt carpeting, made in Connecticut, New York, and Pennsylvania, but there are no separate returns for the manufacture of felt hats or clothing, or of boiler, roofing, and wall felts. Felt stiffened with dextrine, etc. is used for making surgeons' splints.

Felt (Rev. JOSEPH BARLOW), LL.D., American scholar and author, b. at Salem, Mass., Dec. 22, 1789, graduated at Dartmouth College 1813, and d. in Salem Sept. 8, 1869. He was pastor at Sharon and at Hamilton, Mass., from 1821 to 1824, and from 1824 to 1834, respectively. In 1846 he completed the classification and binding of the archives of the State of Massachusetts. He was president of the New England Historical and Genealogical Society 1850–53, besides holding other offices in kindred institutions. *Annals of Salem* (1827), *History of Massachusetts Currency* (1839), *Ecclesiastical History of New England* (2 vols., 1855–62), etc., were among his publications.

Fel′ton, post-v. of S. Murderkill hundred, Kent co., Del., on the Delaware R. R., 10 miles S. of Dover. It is the seat of an institute and classical seminary. Pop. 437.

Fel′ton (CORNELIUS CONWAY), LL.D., American scholar and author, b. at West Newbury, Mass., Nov. 6, 1807, graduated at Harvard University 1827, and taught in Northampton, Mass., and at Genesee, N. Y. In 1829 he was Latin tutor at Harvard University, in 1830 Greek tutor at the same institution. In 1832 he became Eliot professor of Greek there, and July 19, 1860, was inaugurated its president. D. at Chester, Pa., Feb. 26, 1862. President Felton's publications were numerous. *Homer, with English Notes and Flaxman's Illustrations*, appeared in 1833; Menzel's *German Literature* (translation in 3 vols.) in 1840; in 1841 the *Clouds* of Aristophanes. In 1843, with Sears and Edwards, he published *Ancient Literature and Art;* in 1845 assisted Prof. Longfellow in the *Poets and Poetry of Europe;* in 1849 edited the *Panegyricus* of Isocrates, the *Agamemnon* of Æschylus, and translated Guyot's *Earth and Man.* In 1852 he edited the *Birds* of Aristophanes; in 1853–54 he made a European tour; in 1855 revised for publication Smith's *History of Greece*, with an edition of Lord Carlisle's *Diary in Turkish and Greek Waters.* A selection from modern Greek writers was published by him in 1856. Other works of his were a *Life of Gen. Eaton* in Sparks's *American Biography*, occasional addresses, and contributions to the *North American Review*, etc. He contributed to the *New American Cyclopædia*, wrote upon Spiritualism in the *Boston Courier* in 1857–58, was a member of the Massachusetts board of education, regent of the Smithsonian Institution, and member of the American

Academy of Arts and Sciences. *Familiar Letters from Europe* was published in 1865.

Felt's Mills, post-v. of Rutland tp., Jefferson co., N. Y., on the Black River and the Utica and Black River R. R., 8 miles E. by N. of Watertown, has important manufactures of leather. Pop. 235.

Feluc'ca [from the Arabic], a vessel used in the Mediterranean Sea, having a small tonnage, light draught, and great speed with a light wind. These vessels have from ten to eighteen sweeps or large oars, carry lateen sails, and have frequently a rudder at each end, so that they may be used as "double-enders" and may reverse their course without tacking or veering.

Feme Coverte. See MARRIED WOMEN.

Fem'ern, or **Feh'marn,** a very low, perfectly level, marshy, but fertile island in the Baltic, belonging to Prussia, and separated from Holstein by a narrow and shallow sound. It has two towns, Burg and Petersdorf. Pop. 9600.

Femme Osage, post-tp. of St. Charles co., Mo. Pop. 2383.

Fe'mur [Lat. the "thigh"], in the vertebrate skeleton the proximal bone of the posterior extremity, interposed between the innominate bone and the tibia and fibula, the bones of the leg. It has (1) a globular *head,* rotating within the acetabulum or socket of the hip, and joined by a (2) *neck* to the main femur or (3) *shaft;* also (4, 5) a *greater* and a *lesser trochanter,* prominences for attaching the rotating muscles and giving them leverage; (6) a *linea aspera,* or "rough line," running lengthwise for the attachment of muscles; and (7, 8) *outer* and *inner condyles,* at the lower end, affording articulating surfaces for union with the bones of the leg. The femur in man is popularly called the thigh-bone.

Fences, Law of. At common law, land-owners were under no obligation to build and maintain fences between their premises and those of adjacent owners. Trespasses by cattle and other animals were to be prevented, not by means of fences, but by a duty imposed upon each owner of animals to keep them within the precincts of his own estate, and to take precautions against their entering upon a neighbor's premises. If cattle should escape and do injury to another's land, their owner would be liable in an action for damages. The obligation to build fences might, however, be assumed by contract or imposed by prescription, as if a land-owner should keep up fences upon his property for twenty years to the benefit of his neighbor. In such cases, if damage should be done by cattle trespassing in consequence of a defect in the fences, the fence-builder would be responsible, and not, as customarily, the cattle-owner. At the present day the matter of fence-building is generally regulated to some extent by statute, both in England and in this country. The duties imposed upon railroad companies to maintain fences along the line of their routes are particularly minute and exacting. (The statutes of each State should be specially consulted.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fen'cing [formerly called "the *fence,*" a contraction of *defence*]. Combat with the sword is as old as the history of the human race. The Roman soldier was a carefully instructed swordsman, but aided by the shield. Fencing, the art of handling the small-sword with skill in attack and to the greatest advantage, relying upon it as a means of defence, came into use after armor and the shield ceased to be worn. It was in Italy during the religious wars of Charles V., under a condition of society which rendered life particularly insecure, that the small-sword or rapier was adopted and habitually worn by military and state officers, and generally by all men whose position in society or whose occupation permitted it. Then and there its skilful use was found essential, and fencing at that period and long subsequently was considered a necessary art. The Italians, who were expert fencers, were the instructors of the art, first in Spain and afterwards in France, where, during the last century, fencing was brought to the highest perfection.

The small-sword, when once it came into use, was adopted as the fairest weapon for duelling; and though to the custom of wearing it may be charged the disposition to indulge in violence, many desperate encounters in which innocent persons sometimes suffered, and the loss of valuable lives, it must be said that the practice of duelling, which had previously been so conducted that every unfair advantage was taken and allowed, and with a revolting display of ferocious passions, was greatly humanized by the refinement introduced by the rules and art of fencing. Skill with the sword is practically of advantage to those upon whom falls the duty of the national defence, to enable them to use loyally the weapon they alone are required to wear. But as the sword is no longer generally worn, and is not, among English-speaking peoples, used in duelling, adroitness in its use may no longer be feared as likely to create a fondness for contention; and fencing may be and is now resorted to as an enjoyable and healthful recreation and as a certain means of physical development. As an exercise it is void of danger, gives no occasion for rudeness, calls for no over-exertion, yet brings into active and graceful play every muscle of the body, and demands the eager and unremitting attention of every faculty.

A distinguished French authority on the art of fencing declares that a swordsman, on crossing blades with an antagonist and before closing in combat, must take in at a glance the intellectual and physical powers of his adversary, so as to judge of the employment he will likely make of them, and decide by the first few movements of his weapon if he is a man of nerve or one that may be intimidated or confused; observe on the instant if his guard is faulty, and what advantage may be taken of it; discover by feints his natural parry, and by his attitude and aspect whether his *forte* is the attack or defence; if he will probably rush in, trusting all to strength and audacity; and of whose attack signal advantage may be taken if anticipated, or contend warily with the skill of one accustomed to fencing, and must therefore be attacked with caution. This, so true in mortal combat, must be borne in mind by fencers to secure the best advantages from the use of foils as an exercise.

The Foil.—The foil or small-sword consists of two parts, the hilt and blade; and the hilt of three pieces, the pommel, the gripe, and the guard. The part of the blade nearest the guard is the fort. The two-thirds nearest the point are the feeble. The side of the gripe on which the thumb rests should be broad, flat, and convex, the opposite side slightly concave.

To hold the foil or sword in the most advantageous manner, the thumb must be extended along the convex side of the handle, and at least half an inch from the guard. The fore finger is partially extended on the under side, the middle portion opposite the thumb. The remaining fingers embrace lightly the side of the handle. At the moment of making a blow or parry the handle is firmly grasped, but to hold it so constantly would soon fatigue and paralyze the hand.

The *guard* is the attitude a swordsman assumes, best calculated for attack and defence. It is the position men take naturally when they meet in combat. The right foot is twice its length in front of the left, the knees bent equally, the right being vertically over the instep. The body should be erect, and its weight resting a little more on the left than the right leg. The right foot should point directly to the front, and the knees be flared apart. The weapon is at the same time raised to the height of the waist and turned near the left side, bringing the point to the front; the right arm is extended till it is half bent, the elbow about six inches in front of the side and turned in towards the body, the hand at the height of and opposite the right nipple, the nails turned up, the thumb horizontal, the back to the right. The point of the blade should be at the height and in front of the eyes. The left hand is extended to the rear and a few inches higher than the head, the elbow is slightly bent, the hand open, palm to the front. The arm from the shoulder to the end of the fingers forms a curve. The reverse of this position is true for left-handed men. The guard here described is the "middle guard," because in it the weapon occupies a middle position in reference to those it assumes in the defence. When on guard it is essential to be *covered* on the side towards which the adversary's blade points.

If the hand is carried to the right till it is so nearly in front of the right shoulder that the adversary's point, if extended on that side, would not touch, one is covered and the guard of tierce is formed; if to the left till the hand is sufficiently in front of the left breast to divert the point on that side, the guard of quarte is formed. The moment blades are crossed one or the other of these guards is formed, and is called the *engagement.*

Men of small stature should form the guard with the hand nearly as high as the neck; those of medium size, with the hand as high as the breast; tall men, with the hand a little below the breast. Although the guard should be habitually taken according to stature, still it must be varied, for it is dangerous not to make the height of the guard correspond with that of one's adversary.

The *engagement* is the act of crossing weapons and bringing them into contact. When the right of the blades is in contact, the engagement is in tierce; if the left, the engagement is in quarte. When the hand is turned so as to bring the back up and obliquely to the left, and the points lowered and brought in contact on the right, and at the height of the groin, the engagement is in seconde.

These are the only three engagements, and from these

all blows are made; the last is rarely offered, unless from a feeling of superiority and to provoke an attack.

The *opposition* is a slight movement of the sword to bear the point of the antagonist's weapon out of the line of the person while delivering a blow to prevent falling upon it, and to avoid receiving a blow in return when in the act of recovering the position of guard. It must be insisted upon from the first blow a beginner makes till it becomes a confirmed habit.

To *change the engagement*, make a very small quick movement of the point, passing it under and as near as possible to the blade of the antagonist to the opposite side; this movement must be abrupt, and executed with the fingers only, without lowering the hand. *Cover* at the instant the point of the opposing blade is felt.

Feeling the blade consists in supporting and keeping the weapon in contact with the adversary's, without pressing upon it. This requires a delicate sensibility of the hand most essential to acquire. It indicates, in connection with the eye, when the opponent's blade has commenced an attack, and enables the weapon to be so managed in the parries as to deflect a blow without violence.

Fingering the sword is to conduct the point of the sword by the action of the fingers alone, without the aid of the wrist. To do this, the grasp, particularly of the two middle fingers, must be alternately relaxed and tightened. It is only by cultivating this that disengagements can be abruptly and closely made, and the point moved with quickness, dexterity, and precision either in making a feint or avoiding the adversary's disengagement in order to deliver a blow.

The *blow* is the act of directing the point towards the antagonist. It may be delivered in two ways—by means of the *thrust*, or with the thrust combined with the extension of the body called the *development*.

To *thrust*, extend the arm to the front fully and vigorously, raising the hand to the height of the mouth, and lower the point slightly by bending the wrist, but without loosening the grasp. At the same time throw the weight of the body forward on the right leg by straightening quickly and stiffly the left, and bring down the left arm by the side, rigidly extended, the hand about three inches above the left leg, fingers extended and joined, the palm to the left.

The *elevation* is raising the sword-hand when delivering the blow. This movement of the hand increases the probabilities of making a successful blow, while it acts as an important protection from a return blow.

The *development* is executed by, in addition to the action prescribed for the *thrust*, advancing the right foot close to the ground about twice its length, the left foot remaining firm in its position; the body is slightly thrown forward in an easy attitude, the head erect; the right knee vertical over the instep.

To *recover the guard*, raise the toe of the right foot, and exert strongly the muscles of the right leg, throwing up rapidly the left arm to the rear at the same moment, and take the position of guard. The right hand should be brought instantly to its position, never falling *below* it.

The left arm is an important auxiliary in all these movements in maintaining the equilibrium, and in materially assisting in the development and recovery of the guard.

To *advance*, move the right foot quickly forward its own length, raising it but slightly from the ground, and follow it at once with the left, moving it the same distance, and resume the position of guard. In advancing to make a blow at an antagonist who is out of distance, it is necessary to bring up the left foot near the right, keeping the legs well bent.

To *retreat*, move the left foot its length to the rear, and follow it quickly with the right, moving it the same distance, and resume the position of guard. The hand and point must neither rise nor fall in these movements. The point must remain steadily presented in a menacing attitude at the adversary.

Points of Attack.—There are three general points where an antagonist may be attacked when on guard. As the breast is nearest and most vulnerable, it is to be aimed at whenever exposed. But the point cannot, in a desperate encounter, be directed with absolute certainty, and cannot but be damaging wherever it touches. The blow at the face and right side, on the right of the weapon, is the attack on the "right;" at the face and left side, on the left of the weapon, the attack on the "left;" and under the sword-arm, the attack "below." Two of these points are always exposed, as the weapon can guard but one at any one moment.

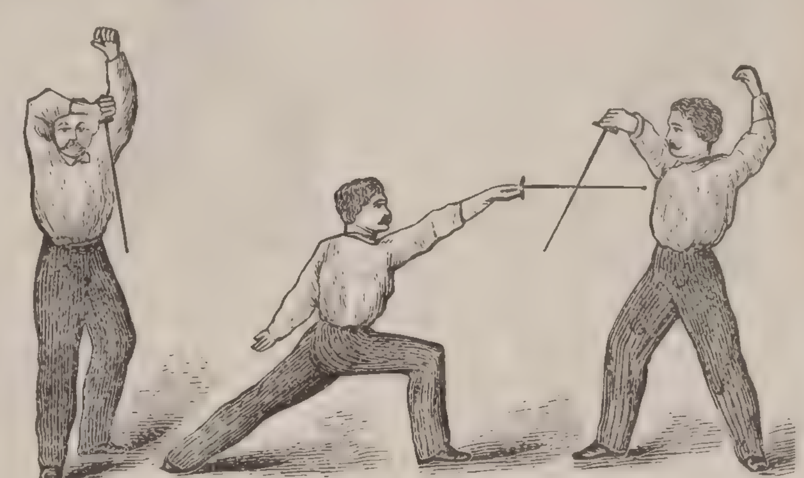
The *direct blow* is the result of the effort which carries the point to the front, in the most direct line, to the point of attack. It is the quickest of all the blows, and of course should be executed whenever the opportunity offers—that is, whenever the antagonist is *uncovered*. For instance, if engaged in tierce, to deliver a direct blow the point would be moved to the front on the same side (the right) as the engagement, should the antagonist momentarily uncover himself.

To *disengage* is to change the direction of the point and deliver a blow at the antagonist where he is not protected by his weapon; the movement of the point must precede the development. But these acts must be as nearly simultaneous as possible.

The *measure* is the distance the point attains when the person is fully developed.

The *appel* is striking the right foot on the ground, and generally twice in rapid succession, by raising it about an inch and striking it back with force. It is resorted to in making a feint to discompose the antagonist, or is done by the fencer to reassure himself in his position after a retreat, and deter his adversary from advancing too rapidly.

A *parry* is the action of turning aside the antagonist's blade from the point at which it is aimed. This is done with the fort of the blade. Ten parries have been decided upon as affording protection to the person from all blows that can be directed at it. They are designated by the (old) French ordinal numbers, and are thus known in all languages—viz. prime, seconde, tierce, quarte, quinte, six, sept, octave, counter-tierce, and counter-quarte. Tierce, quarte, quinte, and six are called simple parries, as the weapon is but slightly moved from the position of guard. Prime, seconde, sept, and octave are called half-counters, as the point describes a half circle in effecting the parry. The remaining two are called counters, as the point is made to describe a complete curve, returning to its original position. To parry correctly, the weapon must take a position which will protect the person, while at the same time the point is retained in front of the antagonist. The advantage of having a number of parries is to add to the security of the defence by embarrassing the antagonist in deciding which will be resorted to.



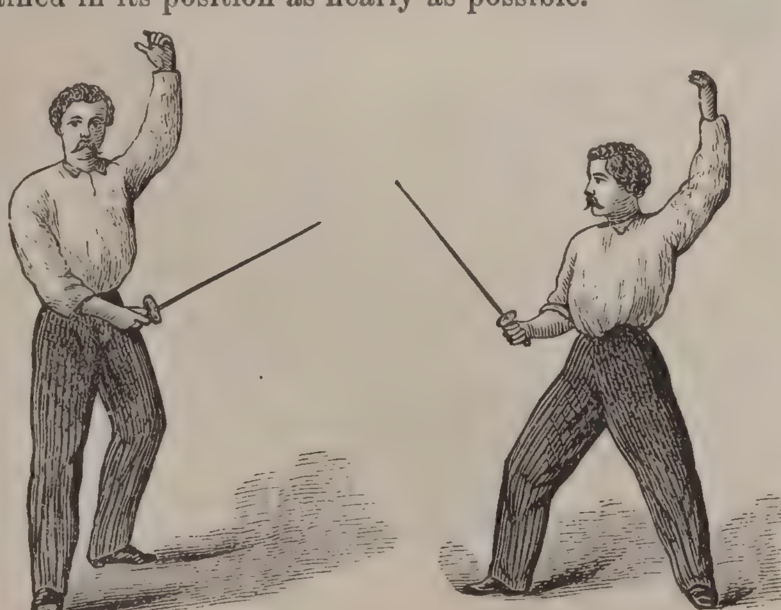
Prime is the position that would be involuntarily taken by one if attacked when in the act of drawing his blade from the scabbard. From the position of guard it is formed by turning the hand until the back is towards the left, keeping the point stationary to the front, then raise the hand diagonally to the left until the fore arm is in front of the forehead, describing with the point, in descending, a curve from right to left, arresting it on a line with the left side at the height of the waist. It is necessary to describe a curve with the point, so that the blade will cut the line of approach of the opposite weapon. Executed properly, it is most effective, as it may be used to turn aside every blow that can be made from the position of guard, which cannot be said of any other parry. It is particularly advantageous to men of small stature.

Seconde naturally follows prime in case that parry is avoided. From guard it is formed by turning the hand in pronation, both lowering it and moving it slightly to the right, describing with the point a curve, the convexity to

the left, arresting the point on a line with the right side and at the height of the groin.

Tierce.—When seconde has been avoided by the antagonist's point, tierce would be resorted to involuntarily; it is nearly the same as the guard of tierce. From the middle guard it is formed by moving the hand to the right till it is opposite the right side, keeping it in supination—that is, with the back down; the point moves as little as possible, the hand is drawn slightly back.

Quarte would naturally follow to parry a high disengagement from tierce. It is formed from the middle guard by moving the hand to the left as far as the left side, inclining the nails slightly to the left. The point is maintained in its position as nearly as possible.



Quinte.—Quinte is naturally resorted to in order to parry

a low disengagement from tierce. It is formed by lowering the hand diagonally, placing it in front of the left side at the height of the groin, the nails to the left; the point is arrested as nearly as possible on a line with the right shoulder of the antagonist.

Six was formerly tierce parry, and constituted among early masters the guard of tierce; it is yet too frequently confounded with the true tierce. It is formed from middle guard by turning the hand in pronation and moving it opposite the right side; the point is in front of the antagonist and at the height of the crown of the head.

Sept.—This parry is also called demi-circle. It is formed from middle guard by bending the wrist and lowering the point, describing with it a slight curve, the convexity to the right; the hand is raised slightly and moved to the left, opposite the left side, and the point is arrested in front of the groin of the antagonist. Sept is used to parry blows delivered at the waist, but it is less effective than quinte.

Octave.—This parry is formed from guard by bending the wrist, retaining the arm in its position, and lowering the point, describing with it a slight curve, the convexity to the left; the hand is moved in front of the right side, and the point is arrested opposite the groin of the antagonist.

Counter-parries are those in which the point moves under and around the antagonist's weapon, returning to the position from which it started. In executing a counter the arm should not move, the wrist alone acts. The point in its motion describes an ellipse. Every parry may have a corresponding counter; but two, however, are found to be of advantage, counter-tierce and counter-quarte. The counters have two advantages: they cut all the lines of attack, and throw off the weapon of the antagonist to the side on which he is prepared to take the opposition, and consequently may leave him uncovered and exposed to a direct return blow.

Counter-tierce.—Being engaged in tierce, when the antagonist disengages at the "left" lower the point with a quick bend of the wrist, passing it under the approaching weapon, and throw it off to the right.

Counter-quarte is executed after the same manner from the engagement of quarte; the blow is thrown off to the left. The point in both these parries must be arrested opposite the antagonist's face.

Double Counters.—The execution of the counters twice in quick succession is called a *double counter*. It is a parry that should be much practised, as it gives great command of the weapon.

Disengagements.—The disengagement from tierce to quarte, or from quarte to tierce, is made by pressing on the gripe with the thumb and middle fingers, changing the point from one side to the other with an abrupt and rapid

motion, at the same time that it is moved in a spiral direction to the front. The point should be directed at the right nipple. The curve which the point makes around the blade should be as small as possible. To disengage "below" from tierce or quarte, the point is lowered by bending the wrist, and moved to the front at the same time just under the blade of the antagonist. The disengagement from tierce at the "left" may be parried with quarte, a simple parry, prime, seconde, and octave, half counter, and with counter-tierce. The disengagement from quarte at the "right" may be parried with tierce and six, with prime and sept, and with counter-quarte. The disengagement "below" from tierce may be parried with quinte, prime, and with seconde and octave; from quarte, with prime and sept.

Feints.—A feint is a quick movement of the point towards an exposed "point of attack," as if a blow was intended, the object being to disquiet the antagonist and induce him to move his blade, and thus expose himself. To execute a feint, the point must be moved smoothly and quickly to the front, nearly to the full extent of the arm, and as close as possible to the antagonist's weapon. The hand should be raised to the height of the mouth; neither the body nor the legs should move. The feint may be accompanied with an appel. In feinting "below," lower the point in a vertical line, and move it to the front just under the antagonist's guard, being careful to raise the hand well. To execute a feint at the "left," supposing the engagement to be in tierce, change the point and advance it nearly to the full length of the arm, describing with it the smallest possible circle around the antagonist's weapon. A feint is followed by a disengagement or by a direct blow. If the opponent moves his weapon to oppose the feint, disengage; if he does not move it, deliver a direct blow, being careful to take in either case the opposition.

Counter-disengagements.—To avoid the counter-tierce and counter-quarte parries, it is necessary to move the point entirely around the adverse blade, describing a very small circle near the shoulder of the foil. This, if followed by delivering a blow, is called a counter-disengagement.

The *riposte* is the blow that immediately follows a successful parry. It may be delivered with the thrust or development, direct or with a disengagement. If delivered direct, it should be with such rapidity as to touch the opponent before he recovers his guard. It may be made also by first menacing a direct thrust, and as soon as the opponent recovers his guard and covers the point of attack menaced, then disengaging.

To *menace* is to advance the point quickly by a partial extension of the arm on the side of the engagement, as if about to make a direct blow. In menacing after a parry the opposition must be maintained. If the adversary moves his blade towards the point menaced, disengage; if he does not, deliver a direct blow.

Ripostes are usually attempted after quarte, quinte, six, and tierce, counter-quarte, and counter-tierce parries. The riposte, after six, from the favorable position of the hand, can be delivered with more certainty and fatal effect and with more rapidity than any other. These ripostes are all executed by the thrust or development, raising the hand and lowering the point, directing it at the face and neck, or by first menacing and then disengaging at whichever point of attack may be uncovered.

Riposte after Prime Parry.—Keep the hand in the position of prime, and by a rapid extension of the arm, and making a strong effort with the thumb and wrist, direct the point "below."

To Riposte after Seconde Parry.—Lower the hand, keeping it in pronation; raise the point and deliver the blow at the flank, or menace "below" and turn the hand as in tierce, and deliver the blow at the "right."

To Riposte after Six.—Raise the hand as high as the head, turning the thumb directly down; lower the point over the guard of your antagonist, and deliver the blow at the "right," or disengage "below."

To Riposte after Sept Parry.—Lower the hand and deliver the blow at the flank; or menace, and as the antagonist covers himself and recovers his guard, disengage.

To Riposte after Octave Parry.—Lower the hand very slightly, raise the point, and deliver the blow at the flank. This is also called *flanconade.*

Disengagements by cutting over the point are made by raising the blade over the point of the antagonist's weapon and as close as possible to it. The cut, as a simple blow, is always preceded by a feint, or an attack upon the weapon, by exerting some force upon it, pressing or striking it aside. For instance, whether on guard in quarte or tierce, turn the hand, the thumb up, and with a sudden energetic pressure move the antagonist's point out of the line of the body; then leave his blade abruptly and extend the point to the front; as soon as your antagonist covers, raise the blade over his point and develop. The cut is most successfully made at the "right," first compelling the antagonist to parry quarte.

Ruse.—Force in fencing accomplishes little, quickness much, but ability and skill to deceive the antagonist, everything.

On Commencing the Attack.—The disengagement, simple feint, and menace have been explained. The other modes of commencing an attack are as follows:

Gliding the weapon is executed by moving it smoothly along, and in slight contact with the adversary's, till the arm is nearly extended, then terminating the movement with the greatest celerity, executing a direct blow. The opportunity for making this blow can only occur when the opponent is not covered, and, as the point approaches him, does not take the opposition. If the opponent protects himself, taking the opposition, a disengagement may be made.

Pressing.—Without quitting the adversary's blade, move the weapon forward quickly, bearing upon his, commencing at the feeble, and develop, or if the opposition is taken, disengage. This blow is employed with advantage against one who extends his blade too much.

Beating.—Raise the point slightly and strike the opponent's weapon at an acute angle, the fort against his "feeble." It is employed against an extended guard to displace the point of an adversary upon whom a feint has no effect, in order to afford an opportunity for a disengagement.

False beating or *tapping* is to strike the adversary's weapon with the "feeble" on the side of the engagement a slight quick tap, by the action of the wrist alone, for the purpose of disquieting him, and causing him to grasp nervously his weapon and make some movement of which advantage may be taken. It is often done several times in rapid succession. The same effect may be produced by rapidly changing the guard.

Removing the Point.—When an adversary has a hard hand and bears upon the weapon, remove the point suddenly, but only a short distance. Finding the support to his blade removed, he will involuntarily seek it, and will almost certainly afford an opportunity for making a direct blow or disengagement; or he may attack, of which, being anticipated, advantage may be taken.

Crossing is employed against an antagonist who, without replying to a feint, extends his blade, presenting it at the breast. It is executed by holding the hand high and turning the blade over that of the adversary, and forming the parry of seconde or sept (demi-circle), thus securing command of his weapon and an opportunity of attacking "below." Crossing, if done with force and skill, will disarm. To disarm, however, in fencing as an exercise, is a discourtesy.

Binding is employed the instant after a successful parry, when the feeble of the adversary's blade is controlled. For instance, if the antagonist disengages from quarte "below," and the blow is parried with sept, then an opportunity occurs to bind his weapon by turning the blade under his, and with a quick motion of the wrist raise it and throw it off to the right. If done at the nick of time, as the antagonist is recovering his guard, an opportunity is given to deliver a blow at the "right," where he will be uncovered, his weapon still retaining its opposition in quarte with which he delivered his blow. Binding after the parry, if octave, may be effected after the same manner. The weapon in this case is thrown off to the left, and a blow may be delivered at the "left." In either case, if the antagonist is quick enough after his weapon has been bound to close the line of the direct blow, a disengagement should follow.

Flanconade.—The blow delivered at the flank of the antagonist when he menaces at the "left" is called flanconade, and is executed as follows: If engaged in quarte, the antagonist menaces or extends his point too far to the front and low, or if he feints at the "left" from the engagement of tierce, execute the parry of octave and deliver a blow at the flank, raising well the hand. This blow is parried with octave or seconde.

Time thrusts are made at an antagonist who, in delivering his blow, is uncovered or who makes a too wide disengagement. Such blows may be best parried by attacking in return, by a quick extension of the arm, taking a strong opposition.

Time blows are those delivered at an antagonist who advances within distance uncovered, or who makes his feints too slow or wide. As the success of such blows depends upon the readiness with which advantage is taken of the momentary indiscretion of an antagonist, they are regarded as the most brilliant in fencing.

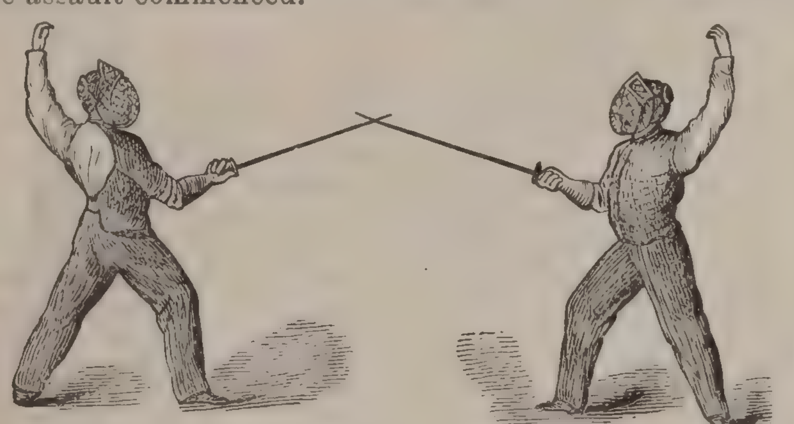
Encircling is effected by raising the hand after parrying six, mastering with the forte the feeble of the adversary's blade, then (as the latter rises and tries to guard against

the riposte) turning or sliding the blade around it without quitting it, and riposting "below" or by a cut over the point at the "left."

Combinations.—A feint followed by a disengagement is called "feint *one, two.*" For instance, if engaged in tierce, feint one, two would be made by showing the point at the "left," and when the opponent covers the "left," disengaging at the "right." If, instead of this disengagement, a feint be made at the "right," and when the opponent covers the blow be delivered "below" or at the "left," the combination would be feint *one, two, three.* Two feints and a disengagement or counter-disengagement, or cut over the point, or a feint and a double counter-disengagement, is as much of a combination as can be attempted in an assault.

Wall practice, or tierce and quarte, is an exercise for the purpose of acquiring a fine development and great precision in making the simple disengagement at the "right" and "left."

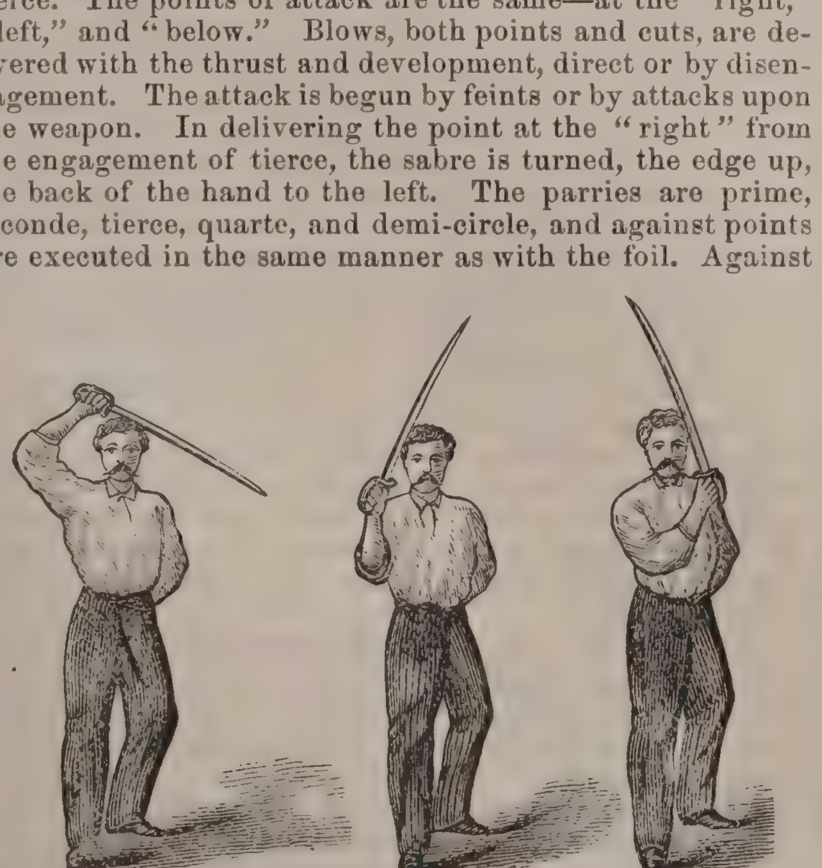
The *salute* is a preparatory exercise in the fencing-hall in which fencers indulge as a compliment to spectators and to each other, and to assure themselves before engaging in an assault. The masks are laid aside. The fencers, on first taking the position of guard, rise, salute with their weapons each other and the spectators on the right and left. On resuming guard in tierce, one disengages first at the "left," then at the "right," the blows being delivered with a loose hand, so that the weapon, on being parried, will be turned and the point thrown to the rear, the parrier at the same time lowering his point out of line. After a few repetitions of these disengagements the first fencer will discontinue, and will so indicate by an appel, both rising. The guard of tierce is then again resumed, and the other fencer will make the same disengagements. On appelling and both rising, the salute with the weapon will terminate the exercise, when masks will be resumed and the assault commenced.



The Assault.

The Sabre.—The attack and defence with the foil is the basis for that of the sabre.

The guards with the sabre are essentially the same as with the foil—in tierce, quarte, and seconde; the left hand, however, is placed on the hip, to avoid cutting the arm. The edges of the sabres are in contact. The ordinary guard is tierce. The points of attack are the same—at the "right," "left," and "below." Blows, both points and cuts, are delivered with the thrust and development, direct or by disengagement. The attack is begun by feints or by attacks upon the weapon. In delivering the point at the "right" from the engagement of tierce, the sabre is turned, the edge up, the back of the hand to the left. The parries are prime, seconde, tierce, quarte, and demi-circle, and against points are executed in the same manner as with the foil. Against



Prime against Cut. Tierce against Cut. Quarte against Cut.

cuts at the head, the hand, in parrying prime, tierce, and quarte, is raised, so that the sabre affords the required protection. Cuts are made with the point of the sabre and by a motion of the wrist alone, raising the sabre as little as possible. With a keen edge slight force will inflict a fatal cut. From the ordinary engagement of tierce the first cut would be made at the face or right of the head, and parried with tierce. Or the cut may be at the left of the head by raising the hand, turning the edge of the sabre to the left as it is launched beyond the antagonist, making the cut in drawing the hand back. The parry against this cut is prime. The cut "below" at the right flank would be parried by seconde. From the engagement of quarte the first cut would be at the face or left of the head, and parried by quarte, or at the right of the head, by raising the hand, turning the edge to the right as it is launched beyond the antagonist, making the cut in drawing the hand back.

The cut "below" at the left flank would be parried by demi-circle. The cut at the leg is best avoided by with-

Slipping the Leg.

drawing the leg, at the same time extending the point. The most effective parries are prime and seconde. The most

Riposte with point after Tierce parry.

Cut after Prime parry.

effective ripostes are with the point after tierce parry, with the cut after prime. J. C. Kelton.

Fen'dall (Josias), governor of Maryland from 1656 to 1660, received appointment from the commissioners of Parliament in 1658, his previous appointment, in 1656, having been made by the Proprietors. Was superseded in 1660 for intrigues and sedition. In 1681 was heavily fined and banished for their continuance.

Fendall (Philip R.), b. at Alexandria, Va., in 1794, graduated in 1815 at Princeton, and became an eminent lawyer of Alexandria and Washington, D. C., where he was district attorney (1841–45 and 1849–53). Was an able writer. D. at Washington Feb. 16, 1868.

Fénelon (François Salignac de la Motte), French archbishop and author, b. at the château de Fénelon, Périgord, Aug. 6, 1651, went to the University of Cahors in 1663, and thence to the College of Plessis. He preached his first sermon in 1666, went thence to the Seminary of Sulpice, and received holy orders about 1675. In 1678 was superior of the order of Nouvelles Catholiques, for the instruction of new converts. In 1686, after the Revocation of the Edict of Nantes, was sent by Louis XIV. to Poitou to convert Protestants. Was preceptor to the duke of Burgundy in 1689, tutor to the duke of Anjou in 1690, and to the duke of Berri in 1693. In the same year he became a

member of the French Academy. Was appointed archbishop of Cambray Feb., 1695, and during that year, as afterwards, became the friend and defender of Madame Guyon. Bossuet denounced him as a heretic in 1697, and in 1699, Fénelon, having in vain appealed to the pope, signed his renunciation of Mme. Guyon's doctrines, and d. at Cambray Jan. 7, 1715. Among Fénelon's earliest works was *Traité du Ministère des Pasteurs*, an argument against Protestantism. While tutor to the duke of Burgundy he wrote *Dialogues of the Dead*, etc. His *Explication des Maximes des Saints*, regarded as an indirect apology for Guyonism, appeared in 1697, *Les Aventures de Télémaque* in 1699. Other works of Fénelon's were *Dialogues on the Eloquence of the Pulpit*, *Demonstration of the Existence of God*, *On the Temporal Power of the Mediæval Popes*, a *Treatise on the Education of Girls*, etc. (The following works may be consulted: RAMSAY, *Vie de Fénelon*, 1725; CARDINAL DE BAUSSET, *Histoire de Fénelon*, 4 vols., 1808; GOSSELIN, *Histoire littéraire de Fénelon*, 1843; CHARLES BUTLER, *Life of Fénelon*, 1810; ALPHONSE DE LAMARTINE, *Fénelon*, Paris, 1854; HENRI LEMAIRE, *Vie de Fénelon*, 1826; J. F. DE LAHARPE, *Éloge de F. Salignac de la Motte Fénelon*, 1771; MAURY, *Éloge de Fénelon*, 1771; ROY, *Histoire de Fénelon*, 1842; WERFER, *Leben des F. Fénelon*, etc., 1852; E. GANDAR, *Fénelon et son Temps*, 1864.)

Fen'elon Falls, post-v. of Fenelon tp., Victoria co., Ontario, Canada, between Cameron and Sturgeon lakes, 16 miles N. of Lindsay, with which it is connected by steamboat. It has large lumber-mills, and a waterfall 20 feet high and 300 feet wide. Pop. about 750.

Fenestel'la, a genus of fossil bryozoans, of which many species have been obtained from the palæozoic rocks. They usually have the form of a calcareous network, of which the meshes are often quadrangular, resembling little windows, whence the name. The threads of the network are poriferous. The corallum of *Fenestella* frequently grows in the form of a broad, ribbon-like frond, spirally wound round and radiating from a central axis. J. S. NEWBERRY.

Fenestella, a Latin historian who flourished under Augustus, and continued to live into the reign of Tiberius, since, according to the statement of Jerome, he d. in the seventieth year of his age, A. D. 21. Nothing further is known positively of his life. Wrote a work entitled *Annales*, of which the twenty-second book is cited by Nonius, and which supplied to Plutarch materials for some of the statements in his *Lives* of distinguished Romans. It probably extended from the period of the kings down to and including the later history of the republic, which portion seems to have been more fully treated than the earlier. (See J. PÖTH, *De Fenestella hist. script. et carm.*, Bonn, 1849. The fragments are collected in HAVERCAMP'S *Sallust*, vol. ii. pp. 385–387; reprinted in Frotscher's ed., Leipsic, 1825–30.) H. DRISLER.

Fe'nian, a name first applied in the early history of Scotland and Ireland to a tribe of warriors noted for their prowess. Finn MacCumhail was their most famous chief. According to Irish annals, he died about 285 A. D. So great was his renown that these Gaelic warriors were henceforth called Feinne, Fiana, or Fenians. Their deeds form the theme of many poems and legendary tales in Celtic literature, and are also commemorated by various names in Scotch and Irish topography. In early Irish histories they are represented as an established militia, whose duty it was "to defend the country against foreign or domestic enemies, to support the right and succession of their kings, and to be ready, upon the shortest notice, for any surprise or emergency of state." With the rise of monasticism the ancient order disappeared, but Finn and his Fenians, and especially his two sons, Fergus and Oisin (the Scottish Ossian), long remained to the Gaelic imagination what Arthur and his knights were to the Cymric.

In 1859 the name was applied to an organization of Irishmen that was formed in America and Great Britain to secure the independence of Ireland. The organization was constituted on republican principles, having its social, district, and State circles, and its congress, in which was vested the supreme legislative authority and the choice of the chief executive officer. The first Fenian congress met in Chicago in 1863; the order, however, did not attract much attention until its second congress, in Cincinnati in 1865. It then became very popular among the Irish; 80,000, it was said, belonging to it in the U. S. In 1866 several attempts were made by the Fenians in this country to invade the British provinces, but all, except two, were frustrated by the U. S. authorities. The two companies of Fenians who succeeded in crossing the Canadian frontier were speedily driven back, and most of those who returned were taken prisoners by the U. S. troops and sent on parole to their homes. During the following year there was a number of Fenian riots in Great Britain, but all were soon quelled, and some of the rioters executed. From that period the Fenian excitement rapidly subsided. Divisions occurred in the organization, the masses lost confidence in their leaders, and many of the wrongs of Ireland which they sought to redress were abolished by legislation.

L. CLARK SEELYE.

Fen'nec, Cer'do, or **Zer'da,** a small fox-like animal of Northern and Central Africa, considered by some as a dog (*Canis Cerda*), by others a fox (*Vulpes Zaärensis*), and by others as quite different from either, and assigned to a genus *Megalotis*, so called from its large ears. Its habits accord generally with those of the true foxes. Its fur is highly prized by the Africans.

Fen'nel [Lat. *fœniculum*, dim. of *fœnum*, "hay," from its finely-divided leaves], a genus (*Fœniculum*) of Old World umbelliferous herbs, closely allied, and by many assigned, to *Anethum*, the dill genus. The *Fœniculum vulgare* (common fennel), *Fœniculum dulce* (sweet fennel), and *Fœniculum officinale* of Europe (the first cultivated in the U. S. also) are raised extensively for their seeds, a very pleasant, warm aromatic much employed in pharmacy. These seeds abound in volatile oil of fennel. The leaves and blanched shoots are used as salad and potherbs in Europe. The *Fœniculum Capense* of South Africa has an edible root. The *Fœniculum Panmorium* of India is much cultivated for its aromatic seeds. Among the popular superstitions there is a belief that he who sows fennel-seed sows sorrow. Fennel-leaves were once emblematic of grief. The giant fennel, in whose stalk Prometheus concealed the fire which he stole from heaven, was the *Ferula Ferulago* of the Mediterranean coasts, whose pith is still used as a port-fire and as tinder. This coarse plant is also umbelliferous. "Small fennel" is the *Nigella sativa* of Europe and Asia, the "love-in-a-mist" of our gardens, a small ranunculaceous herb with quaint flowers and aromatic seeds, sometimes used in cookery and medicine.

Fen'ner, post-tp. of Madison co., N. Y., has marl-beds and manufactures of lime. Pop. 1381.

Fenner (ARTHUR), governor of Rhode Island from 1789 to 1805, was b. at Providence, R. I., in 1745, and d. there Oct. 15, 1805. Before his election as governor he was for a long time clerk of the superior court.

Fenner (JAMES), LL.D., son of the preceding, was b. at Providence, R. I., in 1771, graduated at Brown University in 1789, was U. S. Senator from 1805 to 1807, then governor of Rhode Island from 1807 to 1811, as also from 1824 to 1831, and in 1844–45. D. at Providence Apr. 17, 1846.

Fen'nimore, post-tp. of Grant co., Wis. Pop. 1794.

Fenouillet, de (ÉMILE), journalist in Canada, was b. at Hyères, France, studied law and wrote for the Paris press, edited the *Journal de Quebec* after Oct., 1854, besides teaching history and literature at the Laval normal school and writing for the *Journal de l'Instruction Publique*. D. at Quebec June 30, 1859.

Fen'ter, tp. of Grant co., Ark. Pop. 173.

Fenter, tp. of Hot Springs co., Ark. Pop. 1057.

Fen'ton, tp. of Whitesides co., Ill., on the Chicago Burlington and Quincy R. R. Pop. 758.

Fenton, a v. and tp. of Genesee co., Mich., is situated in an agricultural district about 50 miles N. W. of Detroit, on the Detroit and Milwaukee R. R. It has an extensive flouring-mill, 4 hotels, 2 weekly newspapers, 3 dry-goods houses, an extensive cooperage, an iron-foundry, a woollen-factory, a Baptist seminary, an Episcopal high school, a union school, etc. Pop. of v. 2353; of tp. 3965. (P. O. name, FENTONVILLE.) W. H. H. SMITH, ED. "GAZETTE."

Fenton, tp. of Broome co., N. Y. Pop. 1499.

Fenton (ELIJAH), English poet, b. in Staffordshire in 1683, had M. A. from Cambridge University in 1704. He assisted Pope in the translation of the *Odyssey*, having as his portion the first, fourth, nineteenth, and twentieth books, and, according to the earl of Orrery, to whom he was secretary, double that number of books. His *Mariamne* (1723), tragedy, was successful. He wrote also *Life of Milton* (1727), etc., and d. in Berkshire July, 1730.

Fenton (REUBEN E.), American legislator, was b. at Carroll, Chautauqua co., N. Y., July 11, 1819, educated at Pleasant Hill and Fredonia academies, studied law, and became a merchant. He was supervisor of Carroll in 1843, representative in the U. S. Congress from the thirty-third district of New York from Dec., 1857, to Mar., 1865, governor of New York from 1865 to 1869, and then U. S. Senator from New York, being elected in 1869.

Fen'tonville, Mich. See FENTON.

Fentonville, post-v. of Carroll tp., Chautauqua co., N. Y., on the Dunkirk Allegheny Valley and Pittsburg R. R. Pop. 82.

Fen'tress, county of Tennessee, bordering on Kentucky. Area, 570 square miles. It is a part of the Cumberland Mountain plateau, and has abundance of coal and iron ore, not yet worked. It has a great extent of fine pasture-lands. Grain is the staple agricultural product. Cap. Jamestown. Pop. 4717.

Fen'triss, post-tp. of Guilford co., N. C. Pop. 866.

Fen'ugreek [Lat. *fœnum Græcum*, "Greek hay," because it is used in the Levant and in Asia as a forage-plant], a name given to the *Trigonella Fœnum Græcum* and other species of the genus, leguminous annual herbs of Asia and Europe, resembling clover. The above species is cultivated in France and Germany for its seeds, which are ground into an oily, mucilaginous meal, much used in farriery as a vehicle for drugs. They were once valued in medicine, but are now only employed in poultices, etc.

Fen'wick, a v. of Old Saybrook tp., Middlesex co., Conn., near the mouth of the Connecticut River, is the S. terminus of the Connecticut Valley R. R.

Fenwick (BENEDICT J.), b. in St. Mary's co., Md., Sept. 3, 1782, joined the Jesuits; was president of Georgetown College, D. C. In 1825 became Roman Catholic bishop of Boston, Mass., and displayed remarkable administrative talent in that position. D. at Boston Aug. 11, 1846.

Fenwick (EDWARD), D. D., first Roman Catholic bishop of Cincinnati, was b. in Maryland in 1768; became bishop in 1822, and d. in Wayne co., O., Oct. 6, 1832. Was succeeded by Archbishop Purcell.

Fenwick (GEORGE), English proprietor of a plantation near Saybrook, Conn., came to America in 1636, and was governor of Saybrook until Dec. 5, 1644. Selling out to the Connecticut colony, he returned to England, and was one of the judges at the trial of Charles I. D. in 1657.

Fenwick (Sir JOHN), English Roman Catholic conspirator in the reign of William III., b. near the middle of the seventeenth century, was committed to the Tower for his part in the assassination plot June 11, 1696, and, a bill of attainder against him being passed Jan. 11, 1697, was executed on the 28th of January in the same year. This was the last execution in consequence of attainder in Great Britain.

Fenwick (JOHN), English Quaker and founder of a colony in New Jersey, was b. in England in 1618. His grant of land in West Jersey was obtained in 1673, and he settled at Salem in 1675. In 1678, Governor Andros, disputing his claim to the governorship, confined him in prison two years. He d. poor in 1683, having transferred his claim to William Penn.

Fenwick (JOHN R.), b. at Charleston, S. C., 1780, educated in England, and entered the service of the U. S. as lieutenant of marines Nov., 1799; promoted to be captain in that corps 1809. In Dec., 1811, he accepted the commission in the army of lieutenant-colonel of artillery; as such served with distinction in the war with Great Britain 1812–15, particularly at the assault on Queenstown Heights, Oct. 13, 1812, where he was three times wounded, and made prisoner. Brevetted colonel Mar. 18, 1813, for gallant conduct on the Niagara frontier, was on same date appointed adjutant-general of the army, with the rank of colonel, and disbanded as such June 1, 1815, but retained in the army as lieutenant-colonel of light artillery; commissioned colonel Fourth Artillery May 8, 1822; brevet brigadier-general Mar. 18, 1823. D. at Marseilles, France, Mar. 19, 1842.

G. C. SIMMONS.

Fenwick's Island, on the E. coast of Worcester co., Md., 20 miles S. of Cape Henlopen, has a lighthouse 86 feet high, with a flashing light; lat. 38° 27′ 1″ N., lon. 75° 2′ 59″ W.

Feoff'ment, a mode of conveyance of landed property, formerly in use in the English law, by which land or other corporeal hereditaments were transferred by one person called a *feoffor* to another called a *feoffee*. Feoffment meant originally, under the feudal system, the giving of a feud or fee (see FEE), but in the modification of the system of land tenure which afterwards ensued it was employed to denote the grant of an estate in fee-simple, and was then extended to any transfer of freehold estates in hereditaments purely corporeal. An actual delivery of the land was made by a peculiar ceremony known as *livery of seizin*—*i. e.* a delivery of the possession of the land by taking the feoffee upon or near it and directly investing him with the ownership and occupation. When the parties entered upon the land the livery was said to be *in deed*, and in the presence of witnesses the feoffor handed to the feoffee a clod or turf or a twig or bough as a symbol of actual investiture, at the same time uttering certain words of transfer. When the delivery was made in sight only of the land, the livery was said to be *in law;* and in order to make the transfer effectual the feoffee had to make an actual entry during the feoffor's life. The words of donation which accompanied the livery were at first oral, but at an early period they were reduced to writing in the form of a deed of transfer, though no written instrument was imperatively required until the enactment of the STATUTE OF FRAUDS (which see). Conveyance by feoffment was for a long period in English history the only ordinary method of transfer of land in possession. It has been entirely superseded by more convenient methods. It was only to be tolerated at a time when the means of communication between different sections of country were imperfect, and transfers of property were generally made between residents in the same immediate neighborhood. As a part of the common law it was in use in this country until abolished. It was frequently resorted to as a means of "disseising" a claimant of land, and thus setting in motion the statute of limitations. In this way, after the lapse of a certain number of years (say twenty-one), a party would gain a title by force of his uninterrupted possession and claim of ownership. For an instance of this see *McGregor* vs. *Comstock*, 17 New York Reports, 162. The mode of conveyance now in use is by deed. (See DEED.)

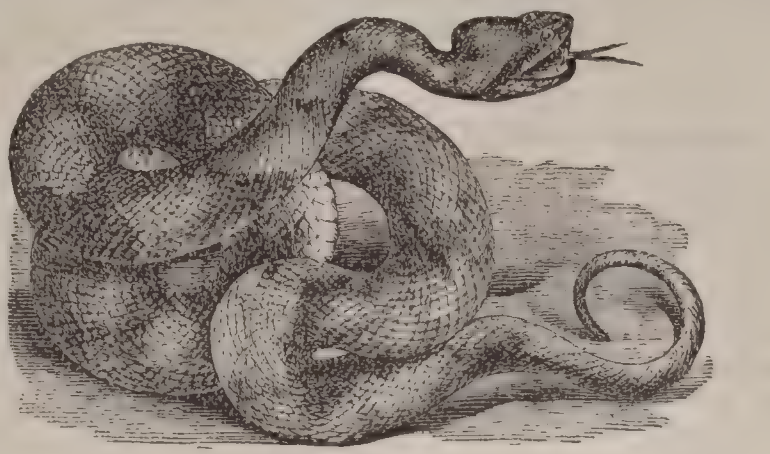
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fe'ræ Natu'ræ [Lat., "of a wild nature"], a legal term used to designate such animals as are naturally of a wild disposition, as bears, foxes, deer, pigeons, wild-geese, etc. The separation of such animals as a class from those which are domestic is of importance in law, on account of the difference in the right of property which an owner is said to have in the two instances. Property in domestic animals is absolute, or indefeasible, while in animals *feræ naturæ* it is only qualified—*i. e.* the right of property only continues to exist as long as the animals are reclaimed from their savage or wild condition, and ceases when they return to it. When animals are of such a kind that if once restored to their freedom they would never return of themselves to their owner, his ownership of them can continue only so long as he keeps them confined. Wild beasts in a menagerie would be of this character. But if animals naturally wild have become so tamed that if suffered to escape or roam at large they have a habit or disposition of returning (*animum revertendi*), a qualified property in them continues so long as this habit is found to have a controlling influence. But if they stray and remain absent, it is lawful for any stranger to take them as his own property. Pigeons, bees, deer are familiar examples of this kind of wild animals. A property in bees is obtained by hiving them. But if they swarm and fly away, the owner retains his property as long as he keeps them in sight while pursuing them, so that he may distinguish them as from his own hive. A qualified property may also exist in certain cases by reason of the inability of the animals to depart from a person's property, as in the case of the young of wild birds who have built their nests in trees. While a qualified property continues, the owner's right is as much under legal protection as is his interest in property of any kind, and any interference with it is punished in the same manner. The owner of such animals will in some instances be liable for their acts. A distinction is to be taken between animals that are and are not naturally inclined to do mischief. In cases of the first class the owner is not in general responsible for injuries done by his animals, unless he is shown to have special knowledge of some vicious propensity. This knowledge is technically called *scienter*, and must be alleged in an action, and proved. This proof would not be necessary if the animals were trespassing on the land of another. The owner in that case is liable for acts done in the course of the trespass. When the animal belongs to the second class, and is naturally inclined to do mischief, no proof of knowledge is requisite, as the owner is presumed to have knowledge of its vicious propensities.

In regard to the right in wild animals killed upon any person's property, certain peculiar rules have been established. If such animals, while upon or flying over a person's land, are killed either by himself or by a trespasser, they become the land-owner's property. If he starts animals upon his own grounds, follows them into another's, and there kills them, the property remains in himself. If a trespasser chases game from one man's land into another's, and there kills it, he has a claim superior to that of the owner of either of the contiguous estates. This last rule has, however, been questioned. A number of statutes in regard to the preservation of game and the protection of wild animals of various kinds have been passed both in England and in the States of the Union, which should be consulted. GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fer de Lance [Fr., "lance-iron"—*i. e.* the head of a lance], the *Craspedocephalus lanceolatus*, a much-dreaded

venomous serpent of the West Indies and South America, especially abundant in St. Lucia and Martinique. This



Fer de Lance.

serpent is extremely prolific, and is from five to eight feet long. It gives no warning of its attack. The bite is very often fatal, and when its present effects are warded off by stimulants it usually ruins the health of the sufferer, who is for years afflicted with boils and ulcers, and often with paralysis and other distressing symptoms.

Fer′dinand, post-tp. of Dubois co., Ind. Pop. 1732.

Ferdinand, tp. of Essex co., Vt., traversed by the Grand Trunk R. R. Pop. 33.

Ferdinand the Just, king of Aragon, was co-regent of Castile and Leon near the close of Dec., 1406, became king June 24, 1412, and d. Apr. 2, 1416. In 1413 he defeated and imprisoned the count of Urgel.

Ferdinand I., ex-emperor of Austria, eldest son of Francis I., emperor of Germany, b. Apr. 19, 1793, married Maria Anna Carolina Pia, daughter of Victor Emmanuel I., king of Sardinia, in 1831. Took the throne Mar. 2, 1835, but was under the direction of Prince Metternich, his prime minister. On Dec. 2, 1848, he abdicated in favor of Francis Joseph, the present emperor, after having repeatedly fled from Vienna during the revolutionary agitations of that year. D. June 29, 1875.

Ferdinand I., king of Bohemia and Hungary and emperor of the Romans, was b. at Alcalá, Spain, Mar. 10, 1503, married Anne Jagellon May 5, 1521, and was made king of Bohemia Feb. 24, 1527, of Hungary, Oct. 28, 1527, and of the Romans, Jan. 15, 1531. Took the title of emperor when his brother, Charles V., abdicated, near the end of Sept., 1556. Recognized as emperor by the electors at Frankfort Mar. 12, 1558, was forbidden to take the title by Pope Paul IV. In 1562 he sent ambassadors to the Council of Trent, and d. at Vienna July 25, 1564.

Ferdinand II., king of Bohemia and Hungary and emperor of the Romans, b. July 9, 1578, was crowned king of Bohemia July 29, 1617. Failed to protect his Protestant subjects against the persecutions of the Roman Catholics, and the Bohemian states deposed him Aug. 19, 1619, and offered the crown to Frederick, elector-palatine. Had been crowned king of Hungary at Presburg July 1, 1618, and was elected Roman emperor Aug. 28, 1619. Frederick, having accepted the Bohemian crown, was defeated by Ferdinand's army, under Maximilian of Bavaria, at Prague, Nov. 8, 1620, and in 1623 the Bavarian duke received the Palatinate. In 1624 the imperial general, Wallenstein, defeated the armies of another Protestant league which had been formed against Ferdinand, with the king of Denmark at its head. Dec., 1625, and Nov., 1627, respectively, Ferdinand resigned the crowns of Hungary and Bohemia to his son, Ferdinand III. In 1630–32, Gustavus Adolphus of Sweden, with France and Venice in a new league against the emperor, invaded Germany, and gained important successes over Ferdinand, although at the battle of Lützen in Nov., 1632, the Swedish monarch was slain. The battle of Leipsic was fought in Sept., 1631, that of the Lech in Apr., 1632. Chancellor Oxenstiern directing the league after the death of Gustavus Adolphus, Ferdinand was more fortunate, made peace with some of the allies, and procured the election of his son Ferdinand as king of the Romans. D. at Vienna Feb. 15, 1637.

Ferdinand III., king of Bohemia and Hungary and emperor of the Romans, was b. July 20, 1608, and became king of Hungary and Bohemia Dec. 8, 1625, and Nov. 25, 1627. In 1631 he married Mary Anne of Spain, who d. in 1646. Gained the battle of Nördlingen in the contest of his father (Ferdinand II.) against the Swedes and their allies, Sept. 6, 1634, was made king of the Romans Dec. 22, 1636, and became emperor in 1637. The Thirty Years' war continuing, the battles of Thionville, of Fribourg, and of Sommershausen were fought in June, 1639, in 1644, and in 1648. In this latter year Ferdinand married Maria Leopoldina, who d. in 1649. In 1648 he also signed the peace of Westphalia, guaranteeing religious liberty to his Protestant subjects. In 1651 he married Eleanor of Mantua, and d. at Vienna Apr. 2, 1657.

Ferdinand I. (THE GREAT), king of Castile and Leon, married Doña Sancha of Leon, and was named king of Castile in 1033, succeeding to the throne in 1035, and being crowned king of Leon June 22, 1038. Invaded Portugal, and acquired Coimbra in 1044 and 1045. In 1046–49 he warred against the Moors. On Sept. 3, 1054, he defeated Garcia III., king of Navarre, near Burgos; in 1063 conquered Mohammed ben Abad, dividing his kingdom between his three sons in 1064. Forced the kings of Saragossa and Toledo to become his tributaries in 1065, and d. at Leon Dec. 27 of that year.

Ferdinand III., THE SAINT, king of Castile and Leon, was son of Alfonso IX., king of Leon, and Berengaria, queen of Castile, succeeding in Castile, on his mother's abdication, Aug. 31, 1217, and in Leon in 1230. In his Moorish wars he conquered the kingdom of Baeza, took Cordova and Seville, and made the kings of Granada and Murcia his tributaries. D. May 30, 1252, and was canonized by Pope Clement X. in 1671.

Ferdinand V., king of Castile and Aragon, THE CATHOLIC, b. at Sos, Spain, Mar. 10, 1452, married Isabella of Castile Oct. 18, 1469. At this time Spain was divided into the kingdoms of Castile, Aragon, Navarre, and Granada, the last held by the Moors. On the death of Isabella's brother, Henry IV., Ferdinand was proclaimed king, with her as queen, at Segova, Dec. 13, 1474. Isabella's title being disputed by the princess Joanna, Henry IV.'s acknowledged daughter, Ferdinand defeated Affonso, king of Portugal, who supported her claims, at Toro in 1476. In 1479, Isabella secured undisputed possession of the kingdom by a peace with France, signed Nov. 9, 1478. In Jan., 1479, Ferdinand succeeded his father, John II., in Aragon; and immediately afterwards in both kingdoms, but especially in Castile, the two sovereigns commenced salutary reforms in the administration of justice, restraining the excesses of the nobility, and checking their power as feudal lords. In 1480, Ferdinand established the Inquisition at Seville, and subsequently permitted its establishment in Aragon. Began his wars with the Moors for the possession of Granada in 1482, the Moors having in 1481 captured the fortress of Zahara in Andalusia, and on Jan. 6, 1492, with Isabella his queen, he entered Granada in triumph. The same year he issued an edict for the expulsion of all Jews from his dominions. This year also Isabella furnished to Christopher Columbus two vessels in his fleet of three, with which he discovered San Salvador. Columbus returned in Mar., 1493, and during that year Ferdinand and Isabella obtained a bull from Pope Alexander VII. confirming their title to all the territories which they should discover in the Western hemisphere. In 1493, Ferdinand reacquired Roussillon and Cerdagne from Charles VIII. of France, and in 1495 opposed Charles in Italy, the Spanish troops being commanded by Gonsalvo de Cordova. In 1497 he promoted the expedition of Amerigo Vespucci. By 1500 the Spanish conquest of Naples was complete; by 1501 every Moor had been expelled from the kingdom or was compelled to be baptized. Isabella d. Nov. 26, 1504, and Ferdinand married Germanie de Foix, niece of Louis XII. of France, Mar. 14 or 18, 1506. On the death of Philip, his son-in-law, he became regent of Castile in Sept., 1506. By the treaty of Cambray (Dec., 1508) he received several Venetian cities, which were incorporated with the kingdom of Naples. In Oct., 1511, he joined the "Holy League" against France, and Jean d'Albret, king of Navarre, having leagued himself with the French monarch, Ferdinand invaded his dominions, drove him from the throne, and in 1512 subjugated that kingdom, thus finally uniting Aragon, Castile, Granada, and Navarre under one sway. Ferdinand d. Jan. 23, 1516.

Ferdinand I., king of Naples, b. in 1425, married Isabella de Clermont in 1434, was legitimized by Pope Eugene IV., and crowned king in June, 1458. In a short time his subjects invited John of Anjou to take the throne, and having done so, John sustained himself for a time, but Ferdinand defeated him at Troia Aug. 18, 1462, and became master of the kingdom in 1463. In 1476 married Joanna of Aragon. In 1486 the barons of Naples revolted. Ferdinand having made peace with them on Aug. 11, treacherously arrested and massacred them at the palace on Aug. 13. For this he was excommunicated by Pope Innocent VIII. June 29, 1489; he made peace with the pope in May, 1492, and d. Jan. 25, 1494.

Ferdinand IV., king of Naples, and **I.** of the Two Sicilies, was b. at Naples Jan. 12, 1751, and succeeded, on the accession of his father, Don Carlos, to the throne of Spain, Oct. 5, 1759. In 1767 he expelled the Jesuits; Apr. 7, 1768, married Maria Carolina of Austria by proxy,

and in person on May 22. In 1777 dismissed his prime minister, Tanucci; in 1792 joined the first coalition against France, but in 1796 purchased peace from the Directory. In Nov., 1798, a secret alliance having been formed with Russia, Austria, and England against France, the Neapolitan army marched to Rome, but was defeated by the French, who made conquest of Naples Jan. 23, 1799. The king and queen fled to Sicily, but during the same year were restored to power by the successes of the allies, and then took a bloody revenge on the republican citizens of Naples. Mar. 28, 1801, by the treaty of Florence, Ferdinand made peace with France, but in Sept., 1805, joined a third coalition against her. In the end of that year he was deprived of Naples by Napoleon I., and retired to Sicily under English protection. In Jan., 1812, he resigned his authority in favor of his son Francis, but on Napoleon's fall he was restored, entering the capital Aug. 14, 1815. In Dec., 1816 or 1817, he took the title of king of the Two Sicilies (Naples and Sicily), but in the latter part of his reign (1820–21) was threatened with a fresh revolt of his subjects, annulled their constitution, and entered Naples, supported by the Austrian army, May 15, 1821. D. Jan. 3, 1825.

Ferdinand I., king of Portugal, b. at Coimbra Feb. 27, 1340, succeeded to the throne Jan. 18, 1367. In 1369 claimed Castile, but was defeated by Henry II. of that kingdom, and compelled to make peace in 1371. The war being renewed, a like issue ensued in 1373. Again warred with Castile, assisted by Edmund, duke of Cambridge, in 1381, and d. Oct. 20, 1383.

Ferdinand VI., king of Spain (THE WISE), b. at Madrid Sept. 23, 1713, or Apr. 10, 1712, married the princess Magdalene Theresa of Portugal in Jan., 1729, and succeeded his father, Philip V., Aug. 10, 1746. Acceded to the treaty of Aix-la-Chapelle June 28, 1748. His queen d. Aug. 27, 1758, and he d. Aug. 10, 1759.

Ferdinand VII., king of Spain, was b. at St. Ildefonso Oct. 13, 1784, and was proclaimed prince of Asturias and heir to the crown in 1790; Oct. 6, 1801, he married Maria Antoinetta Theresa of Naples, who d. May 21, 1806. On the abdication of his father (Mar. 19, 1808) he succeeded to the kingdom, but meeting Napoleon at Bayonne (Apr. 28), was compelled to resign, which he did on May 1, and was sent with his brother and uncle to the château of Valençay. In Mar., 1814, was liberated, and in May annulled the Spanish constitution and dissolved the Cortes; Sept. 29, 1816, married Isabella Maria, infanta of Portugal, who d. Dec. 26, 1818; Oct. 2, 1819, married Maria Josephine of Saxony. The French having invaded Spain under the duke of Angoulême in Apr., 1823, Ferdinand was declared incapable by the Cortes, and a regency was appointed on June 11, but he was restored on Sept. 28, and proclaimed an amnesty, with promise of good government, on Sept. 30. Married the daughter of Maximilian of Saxony in 1824, and she d. in 1829. The same year he married Maria Christina of Naples. Mar. 29, 1830, re-established the Pragmatic Sanction of 1789, and d. Sept. 27, 1833.

Ferdinand II. of the Two Sicilies, known as KING BOMBA, b. Jan. 12, 1810, succeeded his father, Francis I., in 1830; by false promises and liberal measures at first excited great hopes among the friends of liberty, which his subsequent course cruelly disappointed. The history of his reign is a catalogue of conspiracies, rebellions, executions. His reckless bombardment of Messina Sept. 2–7, 1848, won him his shameful title. D. at Naples May 22, 1859.

Fère, La, town of France, in the department of Aisne, on an island in the Oise. It is a fortress of the fourth rank, and has a school of artillery. Pop. 4945.

Ferenti'no, town of Central Italy, 6 miles N. W. of Frosinone. Portions of the old cyclopean wall still exist. Pop. 9096.

Fer'gus, post-v. of Nichol tp., Wellington co., Ontario, Canada, on the Guelph branch of the Great Western Railway, 17 miles N. N. W. of Guelph. It has varied and important manufactures, and one weekly newspaper. Pop. 1666.

Fergus Falls, post.-v. of Otter Tail co., Minn., 225 miles N. W. of Minneapolis, on Otter Tail River, in a lumber region. It has fine water-power, a number of saw and planing mills, two weekly newspapers, and a national bank.

Fer'guson, tp. of Drew co., Ark. Pop. 400.

Ferguson, tp. of Centre co., Pa. Pop. 2111.

Ferguson, tp. of Clearfield co., Pa. Pop. 585.

Ferguson (ADAM), LL.D., b. at Logierait, Perthshire, Scotland, June 20, 1723; studied at St. Andrew's; read divinity in Edinburgh; was ordained in 1745; became Gaelic chaplain in the Forty-second regiment; was professor of natural philosophy at Edinburgh 1759–64, professor of moral philosophy 1764–84; was one of the commissioners sent in 1778 to the U. S. to effect a peace. D. at St. Andrew's Feb. 22, 1816. Author of a *History of Civil Society*, 1767; *History of the Roman Republic*, 1783; *Institutes of Moral Philosophy*, 1769; *Moral and Political Science*, 1792.

Ferguson (ELIZABETH GRÆME), b. in 1739, was the daughter of Dr. Thomas Græme of Philadelphia and Anne, granddaughter of Gov. Keith. She translated Fénelon's *Telemachus* into English heroic verse, and wrote minor poems, letters, etc. The latter were printed; the MSS. of the former are in the Philadelphia Library. The American estate of her husband, Hugh Henry Ferguson, having been confiscated for his adherence to the British government in the Revolutionary war, a part of it was restored to Mrs. Ferguson, from whom he had separated, by the legislature in 1781. D. Feb. 23, 1801, in Montgomery co., Pa.

Ferguson (JAMES), F. R. S., astronomer and mechanician, was b. in Banffshire, Scotland, in 1710. His mechanical genius was developed at a very early age by investigation into the wheel and axle and the construction of a wooden clock and watch which were good timekeepers. He spent several years in Edinburgh, and in 1743 went to London. In 1747 he published a *Dissertation on the Phenomena of the Harvest Moon*, and in 1748 commenced lecturing upon astronomy and mechanics. Elected a fellow of the Royal Society in 1763, he was chosen a member of the American Philosophical Society in 1770, and d. Nov. 16, 1776. *Astronomy Explained* (1756) and *Lectures on Subjects in Mechanics, Hydrostatics, Pneumatics, Optics, etc.* were among his *Works*, which were edited in 5 vols. 8vo by Sir David Brewster. The *Encyclopædia Britannica* is authority for the assertion that "in his whole life he had not received above half a year's instruction at school."

Ferguson (JAMES), PROF., was b. in Perthshire, Scotland, Aug. 31, 1797, arrived in New York Sept., 1800, was assistant civil engineer on the Erie Canal 1817–19; assistant surveyor on the boundary commission under the treaty of Ghent 1819–22; astronomical surveyor on the same commission 1822–27; civil engineer for the State of Pennsylvania 1827–32; first assistant of the U. S. Coast Survey 1833–47; and assistant astronomer of the U. S. Naval Observatory 1847–67. He discovered during this latter service the following asteroids: Euphrosyne in Sept., 1854; Virginia in 1857; Echo in 1860, for which he was awarded the astronomical prize medal by the Academy of Sciences of France in 1854, and again, by the same institution, in 1860. Prof. Ferguson was a valued contributor to Dr. Gould's *Astronomical Journal* and to the *Astronomische Nachrichten;* also to the Episcopal *Church Review*, to the Albany *Argus*, the *Merchants' Magazine* of New York, and to other standard papers. The records of the navy department alone show a career of most useful and distinguished service on the part of Prof. Ferguson, extending over twenty years, and ending only at his death, which seems to have been occasioned by extraordinary devotion to, and exposure in the line of, duty. His character as a man of varied learning and accomplishments was adorned by manly modesty, sincerity, and the principles of practical Christianity. D. Sept. 26, 1867.

Ferguson (PATRICK), MAJOR, English officer, was killed at the battle of King's Mountain, S. C., Oct. 7, 1780. Had served at the battle of Brandywine and on the Hudson in 1779, and so distinguished himself at the siege of Charleston in 1780 that he was made major of the Seventy-first regiment.

Ferguson (ROBERT), English poet and prose-writer, b. at Carlisle 1820, published *The Shadow of the Pyramid*, poem, in 1847, and *The Pipe of Repose, or Recollections of Eastern Travel,* in 1848.

Ferguson (Sir WILLIAM), BART., F. R. S., F. R. S. E., was b. at Prestonpans, East Lothian, Mar. 20, 1808, studied under Drs. Knox and Turner in the Royal College of Surgeons at Edinburgh at the age of eighteen, and became a licentiate of that institution in 1828, a fellow of the corporation in 1829, and began to lecture on the principles and practice of surgery in 1831. In 1836 he was assistant surgeon to the Royal Infirmary, and in 1839 a fellow of the Royal Society of Edinburgh. He settled in London in 1840, having been appointed professor of surgery in King's College and surgeon to King's College Hospital. He is now professor of clinical surgery in King's College, having also been elected president of the Royal College of Surgeons of England July 4, 1870, and having been for some time professor of surgery and human anatomy in that institution. These are but a few of the active and honorary positions to which he has been called. His *Progress of Anatomy and Surgery in the Nineteenth Century* was the substance of two courses of his lectures. His *System of Practical Surgery*

has reached its fifth edition; he is the inventor of numerous surgical instruments, and in 1865 was made a baronet.

Fer'gusonville, post-v. of Davenport tp., Delaware co., N. Y., has considerable manufacturing interests.

Fer'gusson (James), D. C. L., F. R. S., architect, b. at Ayr, Scotland, in 1808, journeyed through the East, and in 1845 published *Illustrations of the Rockcut Temples of India. Picturesque Illustrations of Ancient Architecture in Hindostan* appeared in 1847; *Handbook of Architecture,* in 1855; *Essay on a Proposed New System of Fortification by Earthworks,* in 1849; *The Palaces of Nineveh and Persepolis Restored,* in 1851. He was the architect of the Nineveh Court in the Crystal Palace at Sydenham. On Apr. 17, 1871, he received the royal gold medal at a meeting of the Royal Institute of British Architects.

Fergusson (Right Hon. Sir James), Bart., b. at Edinburgh Mar. 18, 1832, succeeded to the title on his father's death in 1849; was educated at Rugby school, after which he entered the Grenadier Guards, in which he became captain 1854; retired from the army in 1855; represented the county of Ayr in Parliament 1854–57 and 1859–68; under secretary for India 1866–67, and under secretary for the home department July, 1867–Aug., 1868; governor of South Australia 1868–72. In 1873 he became governor of New Zealand.

Fe'riæ [Lat., plu. of *feria;* probably (through *fesiæ*) connected with *festus*], in ancient Rome, were those holidays whereôn business could not lawfully be done and when slaves might rest from their labors. These public festivals were of many kinds and were very numerous. Marcus Antoninus fixed them at 135 in the year, though before his time they had been much more frequent. The way in which they were kept varied extremely, but in general their celebration resembled that of the Christian Sabbath, there being a religious element in their observation.

A feria in the Ordo of the Roman Catholic Church is a week-day having no feast. The feriæ of Ash Wednesday, Holy Week, Whitsun Eve, and the Octaves of Easter and Whitsuntide have the offices of Sundays of the first class. The feriæ of Advent, of Lent, the Ember Days, and the Tuesday of Rogation Week are called greater feriæ.

Ferish'ta (Mohammed Kasim), Persian historian, b. at Astrâbâd 1550 or 1570, wrote a *History of India,* commencing about the close of the tenth century. In the introduction he gives an account of Indian history prior to the invasion of the Mussulmans. His history was translated by A. Dow (2 vols., 1768) and by Gen. Briggs (4 vols. 8vo, 1829). D. about 1612.

Ferland (Jean Baptiste Antoine), L'Abbé, author, was b. at Montreal, Canada, Dec. 25, 1805, and admitted to orders in the Roman Catholic Church in 1823. Was priest and professor in Canada for several years, then superior of the College of Nicollet in 1847, afterwards professor at Laval University June 10, 1855. *Observations on the History of Canada* was published in 1851; then *Notes on the Registers of Notre Dame de Quebec, A Voyage to Labrador, Courses of History of Canada from 1534 to 1633, Journal of a Voyage to the Coast of Gaspé,* and *Life of Bishop Plessis,* the last in 1863. D. at Quebec Jan. 8, 1864.

Ferman'agh, inland county of the province of Ulster, Ireland. It has an area of 714 square miles and a pop. of 92,688. Its surface varies from the richest vales to the wildest uplands. Its rocks are mountain limestone, millstone grit, and old red sandstone, with some coal, iron, and marble. In the low grounds the soil is a deep and rich loam, which grows thin and cold in the uplands. Fermanagh returns two members to Parliament. Cap. Enniskillen.

Fermanagh, tp. of Juniata co., Pa. Pop. 993.

Fermat, de (Pierre), French mathematician, was b. at Toulouse in 1601, and d. there Jan. 12, 1665. French savants claim for him a great part of the honor of the discovery of the differential calculus. He made important discoveries in the theory of numbers, and invented a theory of finding maxima and minima. La Place thought Fermat ought to share with Pascal in the fame of the invention of the calculus of probabilities. His *Works* (*varia opera*) were published by his son in 1679. He was a councillor of the Parliament of Toulouse, and cultivated mathematics as a recreation, and is known as the first to propose two celebrated theorems called by his name.

Fermenta'tion [Fr. *fermentation;* Ger. *Gährung*], a spontaneous change or decomposition which takes place in most vegetable and animal substances when exposed at ordinary temperatures to air and moisture. When the process is accompanied by the liberation of fœtid gases, as in the decomposition of urine, blood, or flesh, it is termed *putrefaction.* When it occurs with free access of air, and without excess of water, it is termed *decay* or *eremacausis,* as when a fallen tree moulders into brown pulverulent humus. The term *fermentation* is limited in common language to the process as conducted for the production of inoffensive and useful products, as when grape-juice and malt-wort are fermented into wine and beer. While these processes differ widely in their products, they are all similar in their general character. The substances most liable to undergo putrefaction are compounds rich in nitrogen, such as albumen, fibrin, caseine, gluten, gelatine, etc. These bodies require only the presence of water, and access of air for a short time, to bring them into a state of putrefactive fermentation, which is very offensive, owing to the liberation of sulphuretted hydrogen, ammonia, and a variety of volatile bodies, whose exact nature has not been definitely determined. These bodies, which ferment spontaneously, are composed of carbon, hydrogen, nitrogen, oxygen, and sulphur. Many non-nitrogenous substances, consisting of carbon, hydrogen, and oxygen only, which are incapable of fermenting or putrefying spontaneously, readily undergo this change when brought in contact with albuminous or gelatinous compounds, either in a fresh state or in a condition of incipient putrefaction. These latter bodies, which are capable of exciting fermentation, are called *ferments,* and bodies which are made to ferment by them are said to be *fermentable.* One of the most active of all ferments is yeast, a plant which develops in liquids undergoing vinous or alcoholic fermentation. Bodies composed wholly of carbon and hydrogen do not appear to be capable of undergoing fermentation under any circumstances. Bodies may be brought into different states of fermentation by the same ferment, according to the particular stage of decomposition which it may have attained. Thus, in the raising of bread by the aid of leaven, vinous fermentation may occur, with the production of alcohol and carbon-dioxide gas (CO_2), which makes the bread light and porous, or lactous fermentation may occur, with the formation of lactic acid, which makes the bread sour and heavy. Temperature influences both the development and the character of fermentation. It cannot occur at a temperature much below 40° F., nor much above 140°.

Fermentation is generally indicated by a sensible internal motion, the development of heat, and the liberation of bubbles of gas; and when it occurs in a clear liquid, always results in turbidity and the formation of a scum and a sediment. During the process complex organic bodies are resolved into simpler organic bodies, as when milk-sugar is changed to lactic acid; or into simpler organic bodies and inorganic compounds, as when glucose is changed to alcohol and carbon-dioxide; or the decomposition may result in the liberation of elementary bodies, as hydrogen and nitrogen. The elements of water are often assimilated during fermentation, and enter into the composition of the new bodies. The process is always complex, and while it often results in the formation of some well-characterized predominating product, as alcohol, acetic acid, lactic acid, butyric acid, etc., there is always produced a variety of bodies in smaller quantities the exact nature of which has not been fully determined, although many of these secondary bodies have been identified. Fermenting substances generally have a tendency to abstract oxygen from the air and other bodies. When fermentation occurs with free access of air, it is accompanied by oxidation (*eremacausis*) on the surface. Putrefying bodies reduce ferrous sulphate to sulphide of iron by withdrawing oxygen.

Fermentation has long been resorted to in raising bread with leaven or yeast, in preparing alcoholic beverages, and in preparing certain vegetables, as sour beans and sauerkraut. It is the process, too, by which all vegetable and animal substances ultimately undergo destruction, and finally return to the inorganic world in the form of carbon-dioxide (CO_2), water (H_2O), ammonia (NH_3), nitrogen (N), etc., to become again the food of plants, and under the influence of the solar rays again to generate complex organic bodies. It is the process by which milk and vegetables sour, meats putrefy, and fats become rancid, and by which timber and textile fabrics decay. It is, moreover, intimately associated with the development of contagious diseases, and its study leads to the discovery of methods for preserving food and timber and for preventing the occurrence and spread of many diseases.

There is an endless variety of processes to which the term fermentation may be applied with more or less propriety; the following are a few of the most important: (1) Vinous, alcoholic, or panary fermentation; (2) acetous; (3) lactous; (4) butyrous; (5) mucous or viscous; (6) putrefactive; (7) saccharous; (8) glucosic; (9) pectous; (10) gallous; (11) amygdalous; (12) sinapous; (13) urinous; and (14) peptous.

I. *Vinous or Alcoholic Fermentation* is the process by which grape-juice is converted into wine and the wort of

malt into beer. A solution of pure sugar in water will remain unaltered for a long time, but finally mould appears upon it, and it becomes sour and dark-colored. If, however, a suitable ferment is added to it, such as yeast, putrid blood, or partially decomposed flour-paste, albumen, caseine, fibrin, or any similar body, it rapidly passes into a state of active fermentation, by which the sugar is converted into alcohol, carbon-dioxide, etc. The sweet juices of plants contain, in addition to sugar, small quantities of albumen, gluten, and legumen, and when they are exposed to the air and maintained at a temperature of about 80° F., they undergo fermentation spontaneously, the process continuing from forty-eight hours to several weeks, according to the temperature, the amount of sugar present, and the nature and quantity of the nitrogenous bodies which act as ferments. The most striking phenomena of this fermentation are—(1) the liquid becomes turbid, (2) bubbles of gas rise to the surface, (3) the temperature rises, (4) the sugar disappears, (5) alcohol makes its appearance, (6) by and by the liquid becomes clear and quiet again, and a light scum and a light-colored deposit are formed. This deposit consists of yeast, which is capable of exciting vinous fermentation in other solutions of sugar. The conditions essential to vinous fermentation are—(1) an aqueous solution of sugar, which may be either glucose, cane-sugar, or milk-sugar. The two latter are, however, invariably changed to glucose before they undergo vinous fermentation. (See *Saccharous Fermentation.*)

$$\underset{\text{Cane-sugar.}}{C_{12}H_{22}O_{11}} + \underset{\text{Water.}}{H_2O} = \underset{\text{Glucose.}}{2C_6H_{12}O_6}.$$

(2) The presence of yeast or of a nitrogenous ferment; (3) access of air, at least at the outset; (4) a certain temperature, the limits of which are 41° and 86° F. The lower the temperature the slower the process, while at the temperature of 86° the vinous fermentation is liable to pass into butyrous fermentation. The chief products of the fermentation are alcohol and carbon-dioxide, which are produced from the glucose by the following decomposition:

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} = \underset{\text{Alcohol.}}{2C_2H_6O} + \underset{\text{Carbon-dioxide.}}{2CO_2}.$$

Were these the only products, 100 parts of glucose would yield 51.11 of alcohol and 48.89 of carbon-dioxide; but only about 95 per cent. of the sugar is accounted for by these products. Most of the missing 5 per cent. is converted into succinic acid (discovered by C. Schmidt in 1847) and glycerine (discovered by Pasteur). In addition to these bodies, there is a host of others in minute quantities, derived partly from the glucose, partly from the ferment, and partly from the other bodies always present in vegetable solutions. The following scheme gives approximately the products from 100 parts of glucose:

Alcohol	48.5 per cent.
Carbon-dioxide	46.5 "
Glycerine	3.6 "
Succinic acid	0.7 "
Acetic acid; Cellulose; Fatty substances; Hydrogen; Nitrogen; Hydrocarbon (methane?); Propylic alcohol*; Butylic alcohol*; Amylic alcohol*; Acetate, butyrate, valerianate, and œnanthate of ethyl, amyl, etc.*	0.7
	100.0 per cent.

The last-mentioned bodies, indicated by a *, constitute, when separated by distillation, what is called the *fusel oil.* Béchamp reports leucin and tyrosin as constant products of vinous fermentation (*Comptes rendus*, lxxiv.), and T. Oser finds an alkaloid, $C_{26}H_{20}N_4$ (*Acad. z. Wien*, 1867, p. 209). The formation of succinic acid and glycerine is explained thus:

$$\underset{\text{Glucose.}}{49C_6H_{12}O_6} + \underset{\text{Water.}}{30H_2O} = \underset{\text{Succinic acid.}}{12C_4H_6O_4} + \underset{\text{Glycerine.}}{72C_3H_8O_3} + \underset{\text{Carbon-dioxide.}}{30CO_2}.$$

H. T. Brown (*J. Chem. Soc.*, 1872, p. 570) suggests

$$C_6H_{12}O_6 + H_4 = 2C_3H_8O_3.$$

As Brown finds that water is always decomposed during vinous fermentation, the following seems probable:

$$4C_6H_{12}O_6 + 2H_2O + H_2 = C_4H_6O_4 + 6C_3H_8O_3 + 2CO_2.$$

Brown also finds that if the water used contains nitrates, a small quantity of nitric oxide (N_2O_2) will be found among the gases evolved. The yeast increases from 0.8 to 1.5 per cent. of the sugar.

The infusion of malt and sugar solutions to which gluten, caseine, albumen, or substances of like nature are added, do not generally undergo a purely vinous fermentation; lactous, butyrous, acetous, and putrefactive fermentation also occurs, and offensive products result. This can be prevented by the addition at the outset of a proper quantity of yeast, which at once determines the vinous fermentation; and if a temperature below 86° F. is maintained, and the air is properly excluded, the products of this kind of fermentation alone result. In the making of wine and the brewing of beer the complete destruction of the sugar is not desirable, and rarely, if ever, occurs, but in the manufacture of spirits the change to alcohol is made as complete as possible. (See WINE and BEER.) When vinous fermentation is resorted to in making bread, the object is not to produce alcohol, but carbon-dioxide, which shall make the bread light. Many substitutes for fermentation are in use by which the carbon-dioxide is produced without the alcohol. (See BREAD.)

Theories of Fermentation.—The discovery of fermentation and the preparation of wine date back beyond historic times. According to the Egyptians, Osiris, and according to the Greeks, Bacchus, taught the art to men. The Israelites attribute the discovery to Noah. The alchemists often employed the terms *fermentation* and *putrefaction*, but in a sense quite different from that in which the words are now used; the gradual solution of an inorganic body was called putrefaction, while fermentation was used as equivalent to our word *digestion*—*i. e.* the digestion of a mineral with an acid. The term *ferment* was applied to every active chemical agent. Valentine supposed the alcohol to pre-exist in the wort, and to be simply set free during fermentation. Libavius believed fermentation and putrefaction to be similar processes, differing merely in their products. Van Helmont (1648) attributed to fermentation the formation of gases during digestion, also the formation of the blood and of the sap. He considered fermentation to be the cause of the formation of living organisms, and of their reproduction and development. Mayow (1669) noticed the importance of air to fermentation. Sylvius de le Boë (1659) claimed that fermentation differed entirely from the action of acids upon alkalies (carbonates). He says the latter results in combination, while fermentation results in decomposition. Lemery (1775) recognized a similar distinction. Becher (1669) considered fermentation as similar to combustion (separation of phlogiston from calx), and as resulting in a splitting up of the fermenting body. Willis (1659) and Stahl (1697) considered fermentation and putrefaction similar processes, and attributed them to the action of a ferment—a body possessed of internal motion, which motion it communicated to the fermentable bodies.

The modern theories of fermentation have been developed as our knowledge of the conditions and products of the process has become more accurate. The production of alcohol attracted attention very many centuries ago. Van Helmont (1648) noticed the gas liberated during vinous fermentation, and called it "gas vinosum," to distinguish it from "gas carbonum," produced by coal. He recognized the fact that during fermentation something disappears or evaporates (sugar), which could otherwise be changed to coal (charcoal). He says *fermentum volatilizat quod alias in carbonem mutatur.* McBride (1764) showed that fermentation and putrefaction yielded the gas called "fixed air" by Black, and Cavendish (1776) showed that sugar yielded 57 per cent. (correctly, 48.89) of the same gas which is obtained from marble. After the discovery of oxygen, hydrogen, and nitrogen, of the composition of water and of the atmosphere, and the elementary composition of vegetable and animal bodies, and the recognition of the true character of combustion, Lavoisier (1789), in his *Traité élémentaire de Chymie*, exhibited the quantitative relations of cane-sugar to its products on fermentation, in the following table:

	Carbon.	Hydrogen.	Oxygen.
95.9 lbs. cane-sugar	= 26.8	7.7	61.4
and yield			
57.7 lbs. alcohol	= 16.7	9.6	38.4
35.3 " carbonic acid	= 9.9	....	25.4
2.5 " acetic acid	= 0.6	0.2	1.7
95.5, total products.			

These numbers are not correct, the actual products being as already stated. He claimed that the products contained all the carbon, hydrogen, and oxygen of the sugar, and that it was not necessary to suppose that water was decomposed during fermentation. He assumed that sugar, an oxide, was split into two products, the gas and the alcohol, which, if they could reunite, would regenerate the sugar. Berthollet (1803) believed that the alcohol had no isolated existence in the wine, but that, excluding the argol and the acids, the wine was a homogeneous body, in which alcohol was produced by heat. Brande (1811) and Gay-Lussac (1813) proved the pre-existence of alcohol in wine. The further investigation of the nitrogenous ferments, and finally the study of the yeast-plant, have given us the following definite theories of fermentation: (1) *acid theory;* (2) *contact theory;* (3) *influence theory;* (4) *chemical theory;* (5) *galvanic theory;* (6) *germ theory.*

1. *The Acid Theory.*—Pliny considered the action of leaven in raising bread to be due to an acid. Fabbroni, in his prize essay on fermentation, published at Florence in 1787, claims that fermentation depends on the action of a vegetable acid on sugar. He afterwards advanced the theory that the ferment is a vegeto-animal body, like gluten, and that the products result both from the sugar and from the ferment—the carbon of the ferment and oxygen of the sugar forming the carbonic acid, while the deoxidized sugar forms alcohol with the hydrogen and nitrogen of the ferment. The acid theory was long since disproved by the fact that fermentation occurs in the presence of calcic as well as of alkaline carbonates, and of metallic oxides.

2. *Contact Theory.*—Berzelius supposed that fermentation is due to the contact or *catalytic* action of the ferment, in the same way that platinum sponge was supposed to effect the union of alcohol and the oxygen of the air, and sulphuric acid was formerly supposed to change alcohol to ethylic ether. As these reactions have already received more rational explanations, the idea of catalysis has been generally abandoned.

3. *Influence, Contagious, Mechanical, or Physical Theory.*—This theory originated with Stahl, and was re-established by Liebig in 1839, and was held by Pelouze, Frémy, Gerhardt, etc. It attributes fermentation to the mechanical action of certain nitrogenous matters (ferments), which are themselves in a state of decomposition, which is imparted to the sugar as soon as it comes in contact with the decomposing ferments under favorable circumstances. The more changeable body, by its own inherent instability, initiates molecular movements in a more permanent compound. The action is compared to several inorganic reactions, as the solution in nitric acid of platinum when alloyed with silver, platinum alone being insoluble; the decomposition of hypochlorous acid, chloride of nitrogen, peroxide of hydrogen; action of pyroracemic acid on argentic carbonate; the kindling of combustible bodies; crystallization from supersaturated solutions by rubbing the side of the vessel with a rod or introducing angular particles. The yeast-plant is supposed by the advocates of this theory to be only an incidental product of some varieties of fermentation, and to be active in inducing fermentation only in that it contains decomposing albuminous substances. The access of air is by them supposed to be necessary only to initiate by oxidation the activity of the ferment.

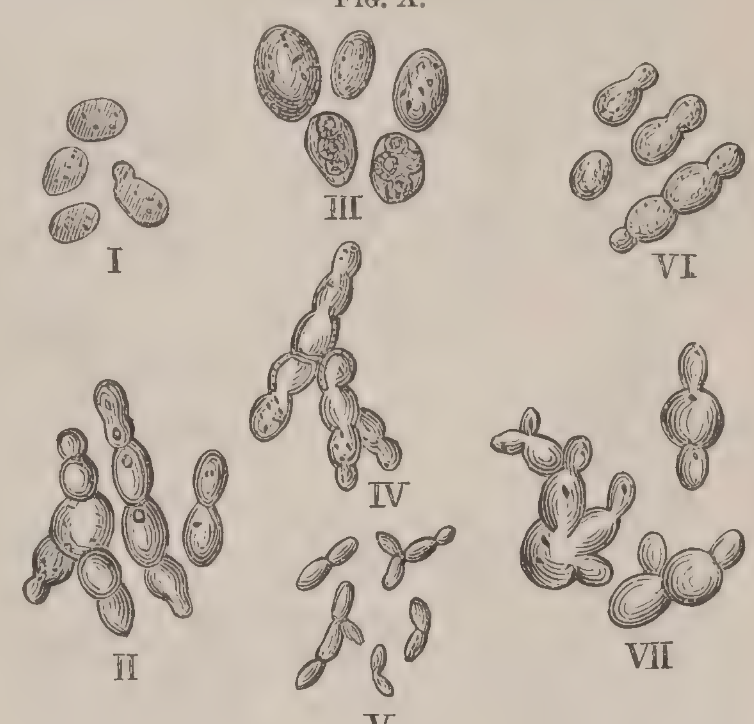
4. *The Chemical Theory* supposes a purely chemical action of the ferment or yeast on the sugar. It was founded by Trommsdorff and Meissner, but has at present few if any adherents.

5. *The Galvanic Theory* assumes that the decomposition is called forth by the dualism of the exciting body in a conducting fluid. Its adherents are Schweigger, Colin, and Kölle.

6. *The Germ, Vital, or Physiological Theory.*—This theory, which is the one which is now generally accepted, attributes the decomposition of the fermentable body to the vital action of living organisms, the vegetable cells of the yeast-fungus. These plants are formed from the nitrogenous substances present in the grape-juice, beer-wort, or other fermenting material, and involve the consumption and consequent destruction of the sugar, and the production of a variety of products of which in vinous fermentation, alcohol, carbon-dioxide, glycerine, and succinic acid are, as already stated, the most abundant. "It is now fully established that (1) the growth and reproduction of the yeast-fungus takes place only in fermentable liquids; (2) that the saccharine liquid will only ferment when the yeast-plant is present in a state of active development." (*Dalton.*) This view is now so well established that any process which is proved to proceed without the development of living organisms must be excluded from the class of decompositions known as fermentation.

The Yeast-Plant.—In 1680, Anthony Leeuwenhoeck, with his newly-invented microscope, discovered the fact that yeast consisted of "little globules collected into groups of three or four together." Fabbroni (1787), as already stated, considered the yeast to be a "vegeto-animal" body, like gluten. Fourcroy entertained the same idea. In 1803, Thénard stated that yeast contains a nitrogenous "animal" substance common to all ferments. Mulder (1844) endeavored to show that a peculiar nitrogenous body, which he called *proteine*, was essentially characteristic of living matter, and was nearly allied in chemical composition to albumen, caseine, fibrin, and gluten. Payen in 1846 recorded the opinion that all vegetable cells contain materials similar in composition to animal organisms; and in the same year Von Mohl, a German botanist, invented for the active compound in living cells the term "protoplasm." The relation of the yeast-cells to fermentation was recognized by Thénard in 1803. He then first enunciated the "germ-theory," by assuming that the yeast assimilates a little of the sugar, while the rest breaks up into alcohol and carbon-dioxide. The same idea was maintained by Erxlebens in 1818, and in 1825 Desmazières examined the yeast of beer and of wine, and called them animals. These investigations attracted little attention, even after Cagniard de la Tour in 1837 rediscovered the yeast-plant, made some most important observations upon it, and "declared that by some effect of their vegetation the equilibrium of the sugar was destroyed." He measured the yeast-cells and found them to be about $\frac{1}{2500}$th of an inch in diameter; and he also noticed that by a process of budding they multiplied during fermentation, and increased six or seven fold. Schwann made similar observations in the same year; Kützig investigated the subject; and Turpin, in 1838, made an elaborate study of beer-yeast. All of these writers considered yeast organisms to be alone capable of initiating fermentation. Mitscherlich adopted this view, and referred fermentation to vegetable organisms, and putrefaction to minute animals. Helmholz, in 1843, made a remarkable experiment: he placed a quantity of yeast on one side of a film of bladder, and a solution of sugar on the other, and although the liquids circulated freely through the membrane, the yeast could not pass, and fermentation took place only on the side of the yeast. Nevertheless, the "influence" theory of Liebig was generally accepted till about fifteen years ago, when Pasteur made the most elaborate and conclusive investigation, which has finally established the germ-theory. He says: "Albuminous bodies are never the ferments, but the aliment of the ferments;" "the true ferments are living organisms."

Fig. A.

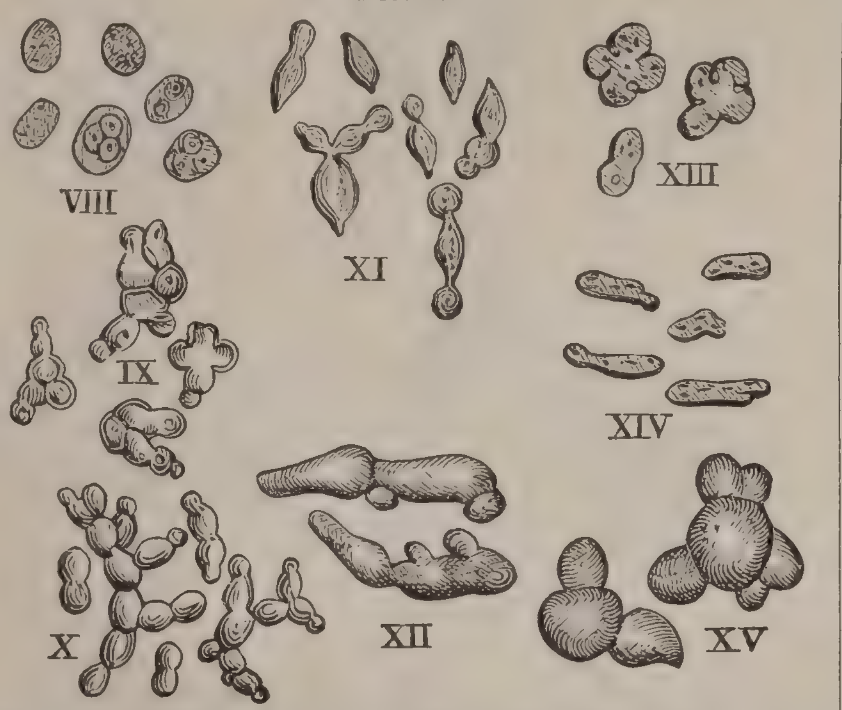


Beer-yeast, Reess: *Saccharomyces cerevisiæ.* I. Top yeast; III. Top yeast, developing ascrospores; II., IV. Top yeast, fully developed; VI. Bottom yeast; VII. Bottom yeast, cultivated at 61° to 65° F. *Saccharomyces exiguus;* V. The yeast of the after-fermentation.

The study of this subject has expanded far beyond its original limits, and has involved the questions of spontaneous generation and the germ-theory of disease, which are now engrossing the attention of the most acute observers on both sides of the Atlantic. This arose from the necessity of accounting for the presence of the living yeast-cells in fermenting and putrefying liquids, which decompose spontaneously without the addition of yeast. Appert, who studied early in this century the preservation of vegetable and animal food, found that by boiling such perishable articles, and sealing them up so as to exclude the air, they could be preserved indefinitely. This was explained by many by supposing that the oxygen of the air, which is necessary to initiate decomposition, was excluded. It was long supposed that a large number of animals were produced spontaneously. Aristotle supposed that shellfish, sponges, maggots, worms, moths, eels, etc. were produced without parents, and the idea that putrefaction is peculiarly favorable to the production of life was entertained by him, repeated by Pliny four centuries later, by Fabricius in 1600, Harvey in 1650, and is now held by the advocates of spontaneous generation. In the year 1668, Francis Redi, an Italian, showed that maggots were the progeny of the flies. His experiments were important, as they demonstrated the fact that insects were produced from eggs. As investigations continued, the idea of spontaneous generation was narrowed down to include only the microscopic organisms, the Infusoria. Needham, in 1748, wrote that he had seen them produced from decaying organic matter. He boiled solutions containing animal matter, corked them hot to exclude air, and found after a few days that they were full of living organisms, whose origin he attributed to

"vegetative force" residing in the solutions. Spallanzani, in 1776, repeated these experiments in glass flasks, with more care, and satisfied himself that the germs of life entered the solutions from the air. Schultze, in 1836, repeated the experiments, renewing the air, but subjecting it on its way to the flasks to the action of sulphuric acid or caustic potassa, to destroy the vitality of any germs it might contain. Schwann, in the following year, repeated these experiments, passing the air into the flasks through tubes heated to 600° F. They showed that the Infusoria were not produced spontaneously, but from spores or germs floating in the air. Schroeder and Dusch in 1854, and Schroeder alone in 1859, repeated these experiments, and found that if the air admitted to the flasks was filtered through cotton plugs, it failed to induce decomposition and develop animal or vegetable organisms. Pasteur even detected germs on the cotton plugs by the microscope, and found that when the plugs were placed in suitable solutions they at once gave rise to numerous animals and fungi. Dr. Lamaire, in 1864, collected germs by condensing the moisture of the air in glass tubes cooled by ice, and Tyndall showed the floating particles in the air by a beam of light. It was thus established that the germs of the yeast-fungus and of Infusoria float in the air, fall into organic solutions, and give rise to fermentation and putrefaction, and, as many think, to infectious diseases. There are still, however, many advocates for the theory of spontaneous generation, who base their belief on the experiments of Wyman, Bastian, Cantoni, and others, who claim to have seen living organisms develop in sealed flasks which had been exposed, after sealing, to temperatures varying from 140° F. to 300° F.

Fig. B.



Wine-yeast, Reess: VIII., IX., X. *Saccharomyces ellipsoideus;* XI. *S. apiculatus;* XII. *S. Pastorianus;* XIII. *S. conglomeratus;* XIV. *S. Reessii;* XV. *Mucor racemosus*, bullet-yeast.

The yeast-fungus consists of little cells composed of cellulose, containing a fluid, in which may be seen granules or germinal cells; it multiplies by budding (gemmation). The name *Torula* or *Torvula cerevisiæ* was first applied to it; it was subsequently called *Mycoderma vini, Cryptococcus, Hormiscium*, etc. Dr. Max Reess, who has made the most elaborate study of the subject (*Botanische Untersuchungen über die Alkoholgährungspilze*, Leipsic, 1870), found that there is a variety of yeast-fungi, and proposed for the genus the name *Saccharomyces*, which has been generally adopted. Beer-yeast is *S. cerevisiæ*, which develops in two different ways, according to the temperature. At about 72° F., as in the brewing of ale, the fermentation is rapid, and the yeast is carried to the surface of the liquid by the bubbles of carbon-dioxide; this is *top yeast.* When the fermentation proceeds at a temperature between 40° and 50° F., in brewing lager beer, it proceeds much slower, and the yeast appears as a sediment—*bottom yeast.* (See Beer.) These two varieties have a tendency to reproduce the kind of fermentation by which they were developed; and if the bottom yeast is placed in wort at a temperature of 72° F., it does not develop into top yeast, although its mode of growth is considerably modified. The after-fermentation of beer is caused by the development of another species, *S. exiguus*, the smallest of all yeast-fungi.

There is a greater number of species noticed in the fermentation of wine; *S. ellipsoideus* is the most common, and often the only form seen. Next in order of frequency occurs *S. apiculatus.* Engel insists that this form belongs to a different genus, and calls it *Carpozyma apiculatus.* During the after-fermentation of wines, especially of sweet wines and of other wines than the grape, *S. Pastorianus* appears. *S. conglomeratus* is often noticed at the beginning of the fermentation. *S. Reessii* occurs in some red wines. One or two familiar mould-fungi, *Mucor Mucedo,* and especially *M. racemosus,* have the property, in the total exclusion of the air, of developing their mycelium in sugar solutions in more or less globular forms, producing true alcoholic fermentation. This gives some confirmation to the suggestion made by certain observers, that the yeast-fungus is developed from the spores of common mould-fungi, like *Penicillium glaucum,* etc. Fitz noticed that when the quantity of alcohol reached $3\frac{1}{2}$ per cent., the development of the *Mucor* ceased.

The chemical composition of yeast has not been very fully determined. It consists chiefly, as do all plants, of cellulose, albuminoids, fat, and metallic salts. It contains no chlorophyll. An elementary analysis gives about the following percentages: carbon, 48.9; hydrogen, 6.8; nitrogen, 10.8; oxygen, 29.9; sulphur, 0.6; ash, 3. Some analyses make the ash in dry yeast as high as 7 or 8 per cent. The ash consists chiefly of potassic phosphate, with small quantities of sodic, calcic, magnesic, and ferric phosphates.

II. *Acetous Fermentation.*—While it is true that alcohol and other organic bodies may be readily oxidized to acetic acid without the aid of fungi, as when platinum-black, containing condensed oxygen, chromic acid, nitric acid, hypochlorous acid, etc., is employed, it is nevertheless true that in the ordinary process of vinegar-making we have a true fermentation, caused by a peculiar fungus, the *Mycoderma aceti,* which acts as a carrier of oxygen. Pure diluted alcohol does not undergo oxidation to acetic acid when exposed to the air. Like all other fungoid plants, the *M. aceti* requires food in the form of nitrogenous bodies and mineral salts, which are always present in wine, beer, and other fermented vegetable juices. The formation of vinegar is always preceded in such cases by the development of the plant, either from small additions from a previous fermentation or from germs from the air. The plant acts as a carrier of oxygen from the air to the alcohol, and the oxidation occurs in two successive stages; alcohol becomes aldehyde by the loss of hydrogen (withdrawal by oxygen), and then passes into acetic acid by a gain of oxygen.

$$\underset{\text{Alcohol.}}{C_2H_6O} + O = \underset{\text{Aldehyde.}}{C_2H_4O} + H_2O.$$
$$\underset{\text{Aldehyde.}}{C_2H_4O} + O = \underset{\text{Acetic acid.}}{C_2H_4O_2}.$$

In the quick vinegar process considerable losses occurred at first from the evaporation of the very volatile aldehyde, which escaped conversion into acetic acid from a deficient supply of air. The conditions most favorable to the formation of acetic acid by fermentation are—(1) a sufficient dilution; the fluid should not contain more than 10 per cent. of alcohol, nor should it be much below 4 or 5 per cent.; (2) the presence of nitrogenous and saline bodies; (3) the presence of the *M. aceti* added from a previous operation; (4) a suitable temperature, not above 36° C. (96.8° F.), nor below 10° C. (50° F.); below 7° C. (44.6° F.) the formation of vinegar no longer takes place. Above 40° C. (104° F.) it takes place very rapidly, but there is a considerable loss of alcohol and acid by evaporation; (5) a plentiful supply of air, with an extended surface of liquid for its ready contact. The progress of the fermentation is indicated by the development of the fungus, a rise of temperature, an increase of the specific gravity, the disappearance of alcohol, and the sour taste of the acetic acid. The plant acts best when it simply spreads over the surface. If it becomes diffused through the liquid, its action proceeds too far, and the acetic acid is in turn oxidized and destroyed. This second fermentation or putrefaction is most liable to occur in vinegar made from malt or stale beer, and is attributed to the presence of large quantities of nitrogenous bodies. Vinegar-makers believed that this putrefaction could be prevented by an addition of sulphuric acid, and in England they were allowed by law to add $\frac{1}{1000}$ by weight. Although it is now known that this practice is unnecessary, it is still continued. In practice acetic acid is made chiefly from wood by distillation, but large quantities of vinegar are still made by acetous fermentation. The materials employed are wine, malt, sour beer, cider, sugar, molasses, and spirits. Dr. Stenhouse has shown that when sea-weeds are subjected to fermentation at 96° F. in the presence of lime, acetate of lime is found in large quantities, from which acetic acid can be readily extracted. (See Vinegar.)

III. *Lactous fermentation* occurs in milk which has been allowed to stand, the milk-sugar changing to lactic acid.

$$\underset{\text{Milk-sugar.}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{Lactic acid.}}{4HC_3H_5O_3}.$$

The milk is at the same time coagulated by the lactic acid formed, which neutralizes the alkali by which the caseine is held in solution. By the addition of carbonate of lime, oxide of zinc, etc. the lactous fermentation is not prevented,

but the lactic acid being neutralized as soon as it is formed, the coagulation of the milk is prevented. Glucose and cane-sugar are also capable of undergoing lactous fermentation.

$$\underset{\text{Glucose.}}{C_6H_{12}O_6} = \underset{\text{Lactic acid.}}{2HC_3H_5O_3}.$$

$$\underset{\text{Cane-sugar.}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{Lactic acid.}}{4HC_3H_5O_3}.$$

Albuminous substances, which at an advanced stage of putrefaction act as alcoholic ferments, often induce lactous fermentation at a certain period of decomposition. The azotized matters of malt, when suffered to putrefy in water for a few days, induce lactous fermentation, while in a more advanced state of putrefaction they cause vinous fermentation. The gluten of wheat flour, which is the active agent in leaven, behaves in the same manner. When wheat flour is made into a paste with water, and left for four or five days in a warm place, it becomes a lactous ferment; if left a few days longer, it acts as an alcoholic ferment. This accounts for the uncertainty which attends the use of leaven for raising bread: when it acts as a vinous ferment the bread is light, porous, and spongy; when it causes lactous fermentation, the bread is heavy and sour. (See BREAD.) Cheese, glue, urine, and many other substances containing more or less nitrogenous matter, induce lactous fermentation under certain conditions. The same property is possessed by many animal membranes in a certain state of decomposition. The most active of these is the inner coat of the stomach of the sucking calf, called rennet. This is the agent employed to coagulate milk in the manufacture of cheese. The stomach, bladder, etc. of the dog possess the same property. Lactous fermentation occurs between 58° and 104° F.; a temperature of from 75° to 90° F. is probably the most favorable. Lactous fermentation is often accompanied by vinous fermentation, the product exhibiting the products of both, with an evolution of carbonic acid (CO_2). Butyrous fermentation often occurs at the same time, with an evolution of hydrogen and carbonic acid and the formation of butyric acid. Mannite, a product of mucous fermentation, is said to occur among the products of lactous fermentation, but it is not clear whether this is also a product of this fermentation or is an evidence of mucous fermentation.

According to Pasteur (*Ann. Chem. Phys.* [3], li. 298; lii. 404) lactous fermentation is caused by the common mould-fungus (*Penicillium glaucum*) which develops in solutions containing milk-sugar, cane-sugar, or glucose, and the necessary nitrogenous matters and mineral salts, just as the vinous fermentation is caused by the yeast-fungus. Pasteur collected this plant as a gray sediment formed during lactous fermentation, and introduced it into a cooled filtered decoction of beer-yeast, with from 15 to 20 pints of water, together with chalk, and sugar equal to from $\frac{1}{20}$th to $\frac{1}{15}$th of the liquid. On keeping this mixture at from 86° to 95° F. for some days, a brisk effervescence of carbonic acid and hydrogen took place, the chalk dissolved in the lactic acid formed, while the liquid became turbid and deposited a sediment. This sediment, a purer form of the fungus, produced lactous fermentation within an hour in a solution of sugar containing chalk. When air is excluded from solutions which otherwise undergo lactous fermentation, or is supplied through heated tubes, fermentation does not occur, because the germs of the *P. glaucum* do not gain admission. The lactous ferment resembles in mass ordinary beer-yeast. It is gray, somewhat glutinous, and appears under the microscope to consist of minute spherules $\frac{1}{15000}$th to $\frac{1}{10000}$th inch in diameter—some isolated, others in groups. It increases at first by the formation of new round cells, but afterwards by the formation of elongated and branched groups, which ultimately cover the surface like a white mould. A small quantity of lactous ferment is capable of decomposing a large quantity of sugar, provided the liquid is kept neutral by chalk, which forms calcium lactate; otherwise its action on the sugar is retarded by the presence of the free acid. If no other ferment is present, the lactous fermentation goes on regularly, and often more quickly than vinous fermentation. According to Blondeau (*J. Pharm.* [3], xii. 257), the liquid becomes viscous previous to lactous fermentation, in consequence of the development of the *P. glaucum*, whose ramifications fill the liquid.

The name *Oïdium lactis* has been given to the fungus found in sour milk. Karsten, in his *Chemismus der Pflanzenzelle*, calls it milk-yeast (*Milchhefe*), and considers it a mere form of development of the beer and wine yeast. De Bary, in his *Ueber Schimmel und Hefe*, insists that the *O. lactis* is a distinct plant, not to be confounded with *P. glaucum*. Reess (*Botanische Untersuchungen über die Alkoholgährungspilze*, p. 2) and Mayer (*Lehrbuch der Gährungs-chemie*, p. 162) insist that the true lactous ferment is a minute *bacterium*, which the latter figures, and that the mould-fungus, called *P. glaucum* and *O. lactis*, is merely an incidental growth. Béchamp claimed to have shown that the germs of the real ferment were contained in the chalk used in lactous fermentation. He called the fungi *Microzyma cretæ*. His conclusions are disproved by the fact that oxide of zinc, chemically prepared, may be substituted for the chalk without modifying the character of the fermentation; and also by the experiment of O. Loew, of heating the chalk red hot previous to introducing it into the liquid. (*American Chemist*, i. 244.)

Lactous fermentation is conducted in the following manner for the production of lactic acid: To 2 gals. milk are added 6 lbs. raw sugar, 8 oz. putrid cheese, and 4 lbs. chalk. The mixture is placed in a loosely-covered jar, and maintained at a temperature of about 86° F. with occasional stirring. After two or three weeks the process is complete, and a semi-solid mass of calcium-lactate is the result, from which lactic acid is readily prepared. By substituting oxide of zinc for the chalk, zinc-lactate is obtained. A certain quantity of mannite is found at the same time. The spontaneously developed fermentation of saccharine juices is sometimes lactous, sometimes vinous, more frequently both together. Lactous fermentation is the process by which articles of food are so often spoiled when they are said to become sour; it is also the process by which the German *Sauerkraut* and *Sauerbohnen* are prepared.

IV. *Butyrous Fermentation* sets in when lactous fermentation is allowed to proceed beyond the point indicated by the formation of calcium-lactate. The calcium-lactate redissolves, carbonic acid and hydrogen are evolved, and calcium-butyrate is found in the solution.

$$\underset{\text{Lactic acid.}}{2HC_3H_5O_3} = \underset{\text{Butyric acid.}}{HC_4H_7O_2} + 2CO_2 + 2H_2.$$

A temperature of 100° F. or more seems to favor this fermentation. By adding to calcium-lactate a certain quantity of cheese, and maintaining an elevated temperature, butyrous fermentation is induced, and the lactate is converted into calcium-butyrate, with some valerianate and acetate. (WILLIAMSON, *Chem. News*, xxii. 236.) Blondeau refers butyrous fermentation to *Penicillium glaucum*, but Pasteur (*Compt. rend.*, lii. 344; liv. 416) refers it to minute bacteria or vibrios. They appear as small cylindrical stems, rounded at the ends, usually straight, and occurring singly or in chains of two, three, or more, $\frac{1}{12000}$th of an inch in thickness, a single stem varying from $\frac{1}{12000}$th to $\frac{1}{1200}$th of an inch in length. They increase by division, and may be sown and cultivated in a suitable medium like beer-yeast. Sugar or lactates, with ammonia salts and phosphates, constitute the necessary food of the plant. (*Bull. Soc. Chim.*, 1862, p. 52.) As soon as the lactate is all converted, the vibrios die. (*American Chemist*, ii. 371.)

V. *Mucous* or *Viscous Fermentation* occurs in solutions of cane-sugar under the influence of nitrogenous bodies, and in contact with the air, under circumstances not fully investigated. Carbonic acid gas and hydrogen are evolved, and the cane-sugar is converted into mannite, a peculiar gum, and a mucilaginous substance. The ferment is composed of spherules about $\frac{1}{20000}$th of an inch in diameter. When these are added to 100 parts of cane-sugar in water, with some albumen, 51.09 parts of mannite and 45.5 parts of gum are obtained, which corresponds to

$$\underset{\text{Cane-sugar.}}{25C_{12}H_{22}O_{11}} + 13H_2O = \underset{\text{Mannite.}}{24C_6H_{14}O_6} + \underset{\text{Gum.}}{12C_{12}H_{20}O_{10}} + 12CO_2.$$

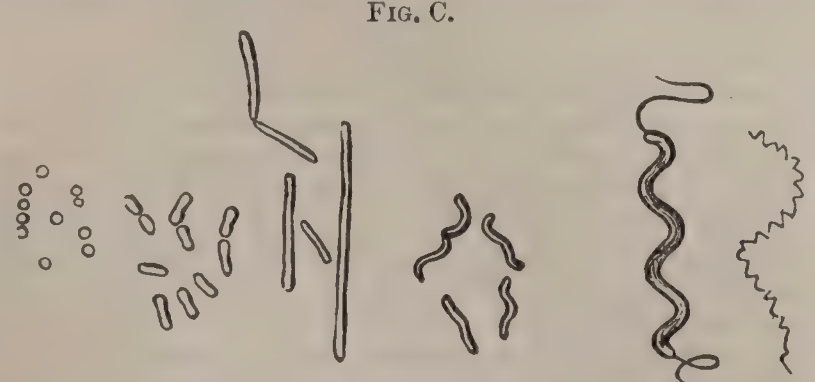
Although often accompanied by vinous and lactous fermentation, mucous fermentation may occur without the formation of either alcohol or acid. It occurs at temperatures ranging from 68° to 104° F. The juice of the sugar-cane, sugar-beet, mangold wurzel, carrot, dandelion, etc. are liable to undergo this form of fermentation spontaneously when exposed to the air. Effervescing lemonade, made from sugar, citric acid, oil of lemon, and carbonic acid, loses its fluidity on long keeping from this kind of fermentation.

When yeast is washed with cold water, then boiled with water, and $\frac{1}{20}$th part of sugar added to the filtrate, the liquid undergoes fermentation for a week or two, evolving hydrogen, carbonic acid, and carbonic oxide, and becoming turbid and tenacious like a decoction of linseed. Water boiled with gluten produces a similar change in solutions of cane-sugar. When the fermentation is completed, the liquid is still sweet, but is so thick that it runs out in threads when the vessel is inverted. The gum produced resembles gum arabic, but is less soluble in water, makes a thicker mucilage, but yields scarcely any mucic acid when treated with nitric acid. (PASTEUR, *Bull. Soc. Chim.*, 1861, p. 30; HOCHSTETTER, *J. pr. Ch.*, xxix. 30; PLAGUE, *J. Pharm.*, xxvi. 248; KIRCHER, *Ann. Pharm.*, xxxi. 337; DESFOSSES, *J. Pharm.*, xv. 602; VAUQUELIN, *Ann. Chim. Phys.*, xx. 93.)

VI. *Putrefaction*, or putrefactive fermentation, is the

process by which azotized animal and vegetable substances undergo decomposition spontaneously, with the production of offensive gases. The essential conditions are the presence of moisture, a temperature between 32° and 140° F., and exposure to the air during or previous to the process. The process is very complicated, resulting in the formation of carbonic acid, sulphuretted hydrogen, phosphuretted hydrogen, marsh-gas, ammonia, nitrogen, hydrogen, acetic, lactic, butyric, and valerianic acids, and many offensive bodies which have not yet been identified. Resins, if present, are but little changed, and fats often resist all decomposition save saponification, remaining as free fatty acids for years. (See ADIPOCERE.) The process varies considerably with the quantity of water present and the extent to which air has access. Two theories have been advanced to account for putrefaction. Liebig claimed that "when the life-power or vital force has ceased to control the organic combinations, the nitrogen in the albuminous bodies, by its affinity for hydrogen, decomposes water, with the formation of ammonia." "The molecule set in motion by this affinity imparts its motion to other molecules with which it is in contact." Many investigators still hold that the true putrefactive ferment is an albuminoid substance not endowed with vitality. (PANUM in *Virchow's Archiv für path. Anat.*, 1874.) The theory generally accepted, however, is that of Schwann, Pasteur, and Cohn, which describes putrefaction as a chemical process induced by bacteria. The bacteria bear the same relation to putrefaction that the yeast-plants bear to alcoholic fermentation; the *Bacterium termo* (Fig. C, 2) being the most common species. If we expose a clear solution of any nitrogenous animal or vegetable matter, such as an infusion of hay, to the air at ordinary temperatures, it will soon become turbid, and exhibit the usual signs of decomposition, evolving offensive gases. The microscope shows the turbidity to be caused by innumerable bacteria, which move in every direction and multiply by division. After a time putrefaction ceases, the liquid becomes clear, and a sediment of bacteria is found to have separated. The smallest portion of this sediment will excite putrefaction in another albuminous liquid, just as yeast causes fermentation. Any process by which the access of bacteria germs to the albuminous solutions can be prevented is found to protect them from putrefaction. Dr. Burdon-Sanderson has shown (*13th Rep. Med. Officer of the Privy Council*) that contamination by germs of bacteria usually occurs from contact with water and moist surfaces, not directly from the air, while the germs of the mould-fungi enter directly from the atmosphere. Substances, protected from bacteria germs, mould, but do not putrefy. A piece of muscle, cut out of a recently killed animal with a knife which had just been heated, was hung under a bell-jar, and after 31 days, although overgrown with mould-fungi, *Penicillium*, etc., it showed no signs of bacteria or putrefaction. In the ordinary process of decay the putrefaction occasioned by bacteria is accompanied by the action of the mould-fungi, the organisms themselves being subsequently destroyed by similar agencies, other bacteria, and fungi, till nothing remains save brown humus (see HUMUS) and the mineral salts, the carbon, hydrogen, nitrogen, sulphur, and oxygen passing into the atmosphere or washed into the soil as carbonic acid, ammonia, water, etc.

FIG. C.



1 2 3 4 5 6

Bacteria.

Bacteria, Vibriones, Microzymas, Microzoaires, Mycoderma, etc. were first recognized by Leeuwenhoeck in 1684. O. F. Müller in the last century recognized and described the most important forms, and Ehrenberg in 1830 established for them the family of Vibrionidæ, which Dujardin in 1841 placed as the first and lowest form of Infusoria. They were first supposed to be animals—at least those which are endowed with motion—but all are now recognized as plants. Ferdinand Cohn first established their vegetable character and structural relations. (*Nova Acta Ac. Car. Leop. nat. cur.*, xxiv. 1, 1853.) He has since added much to our knowledge of their classification and general physiology. (*Beiträge zur Biologie der Pflanzen*, heft. ii. p. 127, 1872.) The bacteria consist of cells composed of cellulose or a body similar to it, containing protoplasmic matter, but no chlorophyll. They are spherical, oblong, cylindrical, curved or twisted, isolated or connected in chains. They are extremely minute, taxing the highest powers of the best immersion lenses. The *Bacterium termo* is $\frac{1}{500}$th mm., or $\frac{1}{12000}$th inch, in length, and $\frac{1}{1000}$th mm., or $\frac{1}{24000}$th inch, in diameter; 41,000,000,000 weigh one grain. They multiply by division or scission, neither buds nor spores having been detected. Cohn, believing that they divide once every hour, finds that one bacterium will by doubling every hour produce in 24 hours $16\frac{1}{2}$ millions bacteria; in 2 days, 281 billions; in 3 days, 47 trillions; and in a week a number expressed by 51 figures. Billroth has recently announced that the spores noticed by Cohn among the bacteria (*Dauersporen*) form micrococci (spherical bacteria) in their interior, which are set free by the bursting of the envelope, and multiply by scission or lengthen into rod bacteria. They are formed in the interior of bacteria, and sink to the bottom of the liquids. The bacteria are killed by an exposure to 140° F. for several hours, to 212° for 10 or 15 minutes, to 215 for 4 or 5 minutes. Near the freezing-point the movements stop, but are resumed again on warming to 40° or 45° F. Billroth finds that the spores described by him retain their vitality after freezing, boiling, and drying. He has some which were kept eight years without losing their power of producing bacteria. To kill them he employs a temperature of 392° F. Bacteria live upon albuminous ammonia or urea and carbonaceous matters, organic acids, sugar, etc., and require mineral salts. They absorb oxygen and exhale carbonic acid.

Cohn subdivided the bacteria into six genera, distributed among four families:

I. Family, Sphærobacteria (spherical bacteria).
  1. Genus, *Micrococcus* (Fig. C, 1).
II. Family, Microbacteria (short rods).
  2. Genus, *Bacterium proper* (Fig. C, 2).
III. Family, Desmobacteria (thread-like).
  3. Genus, *Bacillus* (Fig. C, 3).
  4. Genus, *Vibrio* (Fig. C, 4).
IV. Family, Spirobacteria (corkscrew-like).
  5. Genus, *Spirillum* (short, stiff screws, Fig. C, 5).
  6. Genus, *Spirochæte* (flexible spirals, Fig. C, 6).

(For a description of the species see *Beit. z. Biol. d. Pflanzen*, ii. p. 146.)

Recent investigations have shown that bacteria may be developed in the interior of living animals, that they exist in the body during various diseases, and that healthy animals may be inoculated with the virus. This has led to the germ-theory of disease (see GERM-THEORY), now accepted by many of the most prominent investigators. This theory assumes that such diseases as smallpox, diphtheria, malignant pustule, septicæmia, cholera, typhus and typhoid fever, etc., are caused by bacteria, and that they belong to the same class of processes as fermentation and putrefaction. The discovery that the potato-rot is caused by a fungoid plant, the muscardine of silkworms by a mould-fungus, and the pébrine of the same animal by a minute plant, and the study of the trichinæ and of several skin diseases caused by mould-fungi, have furnished a very solid foundation for this theory. As the *Micrococci*, the smallest of the bacteria, are concerned in these diseases, the difficulty of actually determining their relation to the disease is most serious, and renders direct proof very inaccessible.

VII. *Saccharous Fermentation* is the process by which starch is changed to dextrine and glucose. This change is effected by the diastase of germinating barley and other seeds, saliva, blood-serum, pancreatic juice, etc. The starch first changes to dextrine and glucose, the former in turn changing to glucose.

$$\underset{\text{Starch.}}{2C_6H_{10}O_5} + \underset{\text{Water.}}{H_2O} = \underset{\text{Dextrine.}}{C_6H_{10}O_5} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

$$\underset{\text{Dextrine.}}{C_6H_{10}O_5} + \underset{\text{Water.}}{H_2O} = \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

This is one of the most important processes of nature; by it the store of starch laid up in seeds, tubers, bulbs, and in the bark of some trees, is made available for assimilation and conversion into vegetable tissue. No observations have shown it to be connected in any way with living organisms corresponding to yeast. (See DIASTASE, GLUCOSE, DEXTRINE, BEER, GERMINATION, etc.)

VIII. *Glucosic Fermentation* takes place when cane-sugar is subjected to vinous fermentation.

$$\underset{\text{Cane-sugar.}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{Lævoglucose.}}{C_6H_{12}O_6} + \underset{\text{Dextroglucose.}}{C_6H_{12}O_6}.$$

Although acids produce a similar change, it is produced by yeast, or a watery solution from yeast, in the presence of carbonate of soda. Berthollet attributes it to a nitrogenous ferment analogous to diastase or pancreatin. Béchamp (*Comp. rend.*, lviii. 601, 723; lix. 496) finds a soluble ferment in the mould of sugar solutions, which he calls *zymase*, which converts cane-sugar into glucose. (See SUGAR.)

IX. *Pectous Fermentation.*—Many unripe fruits and fleshy roots contain an insoluble substance called *pectose*, which is converted by a ferment called *pectase* into the soluble gelatinous bodies pectin, parapectin, pectic acid, and metapectic acid. (See PECTIN.)

X. *Gallous Fermentation* (*Tannous Fermentation*).—When powdered nut-galls are exposed to moisture, the tannic acid they contain is changed to gallic acid, with the formation of sugar; hence tannic acid has been classed with the glucosides. (See GLUCOSIDES.)

$$\underset{\text{Tannic acid.}}{C_{27}H_{22}O_{17}} + 4H_2O = \underset{\text{Gallic acid.}}{3C_7H_6O_5} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

(STAS, *Ann. Ch. Pharm.*, xxx. 205; STRECKER, *ibid.*, xc. 328.) This change is said by Van Tieghem (*Compt. rend.*, lxv. 1091) to be due to the growth of the two common mould-fungi *Penicillium glaucum* and *Aspergillus niger*. (See TANNIC ACID.)

XI. *Amygdalous Fermentation* results from the action of the emulsin of bitter almonds upon the amygdalin, by which hydride of benzoyl, hydrocyanic acid, and glucose are produced. (See ALMONDS, OIL OF.)

XII. *Sinapous Fermentation*, the formation of the volatile oil of mustard by the action of myrosin on myronic acid. (See MUSTARD, OIL OF.)

XIII. *Urinous Fermentation* occurs when urine becomes putrid. The urea is changed to carbonate of ammonia by the influence of the mucus and other nitrogenous bodies present.

$$\underset{\text{Urea.}}{CH_4N_2O} + 2H_2O = \underset{\text{Carbonate of ammonia.}}{(NH_4)_2CO_3}.$$

In the presence of yeast the change takes place very rapidly. (C. SCHMIDT, *Ann. Ch. Pharm.*, lxi. 168.) This action has been referred to bacteria. (PASTEUR, *Ann. Chim. Phys.*, 1862, 1864; VAN TIEGHEM, *Compt. rend.*, lviii. 210, 1864.)

XIV. *Peptous Fermentation* is a name given to the action of pepsin of the gastric juice on the albuminoids of the food. The exact nature of the process is not known. (See PEPSIN.)

XV. *Prevention of Fermentation and Putrefaction.*—As moisture and the development of vegetable germs are necessary to induce these processes, they may be prevented by (1) drying thoroughly; (2) cooling to prevent the development of the germs; (3) sealing hermetically in jars or tin cans, and subjecting to a temperature sufficient to destroy the vitality of all the germs present; (4) employing antiseptic substances, such as alcohol, common salt, saltpetre, sugar syrup, tannic acid, creosote, smoke, phenol, salicylic acid, salts of iron, zinc, lead, mercury, and copper, borax, sulphurous acid, sulphites, etc. (See PRESERVATION OF FOOD, PRESERVATION OF TIMBER, and EMBALMING.)

For further information on fermentation, etc. consult, in addition to the works already mentioned, *The Germ-Theory of Disease*, by PRES. F. A. P. BARNARD, *Am. Chemist*, v. 15; *The Origin and Propagation of Disease*, by DR. J. C. DALTON, *Am. Chemist*, iv. 373; *Spontaneous Generation*, by DR. J. C. DALTON, *New York Med. J.*, Feb., 1872; *Four Lectures on Fermentation*, by A. W. WILLIAMSON, *Chem. News*, xxii. 234; xxiii. 9; Paper, by DR. J. WYMAN, *Am. J. Sci.*, xliv. Sept., 1867; *Inaug. Address*, by T. H. HUXLEY, *Chem. News*, xxii. 133; *A Lecture on Yeast*, by T. H. HUXLEY, *Pop. Sci. Monthly*, 1872, i. p. 573; Paper, by BURDON-SANDERSON, *12th Rep. Med. Officer Privy Council*; *The Antiseptic System*, by A. E. SANSOM; *The Germ-Theory of Fermentation*, by A. E. SANSOM, *Chem. News*, xxii. 241, 254; *Disease-Germs*, by L. S. BEALE; *The Beginnings of Life*, by H. C. BASTIAN; *Mémoire sur la fermentation alcoolique*, by PASTEUR, *Ann. Chim. Phys.*, lviii. 1860, 323; *Animalcules infusoires vivant dans gaz oxygène libre et déterminant des fermentations*, by PASTEUR, *Comp. rend.*, 1861; *Mémoire sur les corpuscles organisées, qui existent dans l'atmosphere*, by PASTEUR, *Ann. Chim. Phys.*, 1862, p. 52; *Les ferments alcooliques*, by L. ENGEL, Paris, 1872; Paper *on Yeast*, by L. ENGEL, *Comp. rend.*, 1874, 468; *Fermentation, history*, by KOPP, *Geschichte der Chem.*, iv. 285; *Lehrbuch der Gährungschemie*, by A. MAYER, Heidelberg, 1874; *Die pflanzlichen Parasiten*, by DR. F. A. ZÜRN, Weimar, 1874; *Ungeformte Fermente*, by G. HUFNER, *J. f. pr. Ch.*, 1872, Nos. 8 and 9; *Die Gährung*, by WEINBERG, *Bäyerisches Industrie u. Gewerbeblatt*, Aug., 1870; SCHWANN, *Pogg. Ann.*, xli. 184; HELMHOLZ, *J. f. pr. Ch.*, xxxi. 429; LIEBIG, *Handw. d. Chem.*, iii. 217. C. F. CHANDLER.

Fermented Liquors. See BEER and WINE, by C. F. CHANDLER, PH. D., M. D., LL.D.

Fermeuse, one of the oldest towns of Newfoundland, in Ferryland district, 51 miles by land S. of St. John's, has a good harbor and cod and salmon fisheries, and a Roman Catholic church. It is 7 miles from Ferryland. Pop. 578.

Fer'mo, town of Central Italy, province of Ascoli, 30 miles S. E. of Ancona and 4 miles from the Adriatic. It is fortified, is the see of an archbishop, and has some trade. Pop. 8011.

Fermoy', town of the province of Munster, Ireland, in the county of Cork, on the right bank of the Blackwater, over which a splendid bridge on thirteen arches was built in 1689; is the site of St. Colman's College (Roman Catholic). Pop. 8705.

Fer'mont, small v. of Champlain co., Quebec, Canada, 14 miles N. of Three Rivers, is important only for its iron-mines and forges, producing excellent pig iron and castings. Pop. about 150.

Fern (FANNY). See PARTON.

Fernan'dez de Ta'os, post-v., county-seat of Taos co., N. M.

Fernandi'na, city and port of entry of Nassau co., Fla., on the W. side of Amelia Island, between Nassau and Prince William sounds, and separated from the mainland by a channel called Amelia River, which affords a deep, safe, and spacious anchorage. The harbor-entrance is marked by a lighthouse; lat. 30° 40′ 23″ N., lon. 81° 26′ 20″ W. Vessels drawing 20 feet can enter at high tide. The manufacture and export of lumber and the foreign and coastwise trade in cotton and naval stores are important. The Florida R. R. extends from this point 154 miles to Cedar Keys. Fernandina is the seat of the Protestant Episcopal bishop of Florida, has a ladies' seminary, ten churches, a weekly newspaper, three hotels, cotton-ginning works, and manufactures of cotton-seed oil. The entrance is protected by Fort Clinch, a strong defensive work. Pop. 1722. FRED. W. HOYT, ED. "FERNANDINA OBSERVER."

Fernan'do de Noron'ha, a small but mountainous, woody, and rugged island in the S. Atlantic Ocean, 125 miles from the E. extremity of Brazil, to which the island belongs, and which uses it as a place of banishment. It has several harbors defended by forts. It is surrounded by smaller islets. Lat. 3° 53′ S., lon. 32° 25′ W.

Fernando Po, an island, 44 miles long and 20 miles broad, on the W. coast of Africa, in the Bight of Biafra, 20 miles from the nearest point of the shore, between lat. 3° 12′ and 3° 47′ N., and lon. 8° 26′ and 8° 57′ E. It is a beautiful island, traversed by a lofty range of mountains terminating in a magnificent cone (Clarence Peak) 10,650 feet high. A most luxuriant vegetation, sugar-canes and yams, and dense forests of palms, *Bombax*, etc., cover the island, but the climate is so hot, and, along the coast, so unhealthy, that all attempts made by the English and Spaniards at forming settlements on the island hitherto have been in vain. The native inhabitants, whose number is estimated at from 4000 to 20,000, consist of two tribes, so different from each other that members of one tribe cannot even understand those of the other. And, still more singular, both these tribes are entirely different from the inhabitants of Guinea, from whom they are distinguished by the athletic but perfectly proportionate shape of their limbs, the light yellow color and beautiful angle of their faces. They are pagans, but slavery is unknown.

Fer'nan Nu'ñez, town of the province of Cordova, Spain. It has woollen and linen manufactures. Pop. 5961.

Ferney, a small town of France, in the department of Ain, with only 1100 inhabitants, but famous as the residence of Voltaire during the last twenty years of his life. Ferney was a miserable hamlet when Voltaire arrived; it was a prosperous town when he left. The château in which he lived has undergone many alterations since his death, yet it retains many relics of him, and is annually visited by many thousand tourists.

Ferns [Lat. *filices*; Fr. *fougères*; Ger. *Farnkräuter*], the name of a large family of flowerless plants which forms the largest natural order of the class Acrogens, the other orders of this class being Equisetaceæ, Lycopodiaceæ, Marsiliaceæ, Salvinieæ, and Isoëteæ. Ferns are characterized by having a woody root-stock, which is creeping, or afterwards erect, and even developed into an arboreous trunk, and bears along the sides or at the end green leaves (*fronds*), which are either simple and entire, or variously lobed or decompound, often presenting most elegant feathery patterns. These leaves produce, commonly on the back, but sometimes along the edges, variously grouped collections of capsules (*sporangia*) filled with minute seeds (properly *spores*), each consisting of a single vegetable cell, which is commonly either bean-shaped, ovoid, or tetrahedral. In the production of the spores there is nothing analogous to the action of the pollen upon ovules in flowering plants, nor strictly to the fertilization of the pistillidia in mosses; but when the spore germinates it produces a minute, roundish primary frond (*prothallus*), which bears on its lower surface antheridia and archegonia, the latter containing a vesicle, which, when fertilized by the

ciliated threads of the former, develops in the manner of a bud into a proper frond-bearing fern. A prominent characteristic of ferns, which fails only in the doubtful suborder Ophioglosseæ, is that the fronds are coiled up spirally in the bud, and when half-grown bear a very beautiful resemblance to a crosier, the tip of the frond being at the centre of the coil, and of course the last to straighten. In respect to size, ferns vary from the smallest *Hymenophyllum*, consisting of a few little leaves not half an inch long, growing from a thread-like, creeping stem, up to the gigantic tree-ferns of the tropics, which have an erect trunk sometimes 50 or 60 feet high, bearing at the top a magnificent crown of feather-branched fronds, often 8 to 10, or even 15 to 20, feet long, and gracefully curving outward on every side. The whole number of known ferns cannot be exactly stated, owing to the very different views of specific distinctions taken by the various writers. A most moderate estimate, however, places the number of well-known species at 2500, and with a fair allowance for little-known and undiscovered species all the ferns of the world probably do not exceed 3000 species. With regard to their geographical distribution, it should first be noticed that in regions of extreme cold ferns are scanty in number and small in size; in the warmer temperate regions they are larger and more numerous; and in the torrid zone, especially in its more humid districts, they become very abundant and reach their grandest proportions. Europe and temperate North America are much less abundant in ferns than the temperate parts of Asia, there being in the U. S. and British America only about 128 ferns, in Europe 67, and in temperate Asia 413. In the arctic regions the species of ferns are 26, and, according to Mr. J. G. Baker of Kew, the entire fern-flora of the N. temperate zone consists of 514 species, of which only 34 are common to all three continents. The same author assigns to the S. temperate zone 423 species, and to the torrid zone 1901 species, of which 946 are American, 863 Asiatic and Polynesian, the remainder being natives of Africa and the African islands, the greater proportion being insular rather than continental.

The warm and moist forests and mountain-sides of equatorial America are the richest fern-region of the world, and this richness extends in a less marked degree to the neighboring regions of Mexico, the West Indies, Southern Brazil, and Chili. The S. temperate zone affords, again, a diminished number of species, 423 in all, while beyond the Antarctic Circle no fern has been discovered.

Many systems of classification for the ferns have been proposed, the earliest ones being based principally upon the shape of the frond. Such was the system—if it may be called a system—in which Plumier in 1705 arranged the ferns of the Antilles. Linnæus recognized 12 genera, based on the position and grouping of the sporangia, and in 1790 Sir James Edward Smith published an essay in the memoirs of the Turin Academy in which he increased the number to 22. Bernhardi added several genera in 1800, and about the same time Swartz, in *Schrader's Journal*, reduced the known ferns to order and arranged them in 30 genera, all but two of which are still held to be good genera. In 1806 the same botanist published his *Synopsis Filicum*, and now arranged the genera, by this time 38, in three tribes, the first tribe, "Gyratæ," being the ferns in which the sporangium is provided with an articulate elastic ring, which at length straightens and breaks open the sporangium, thus liberating the spores; the second tribe, "Spurie Gyratæ," comprised the ferns with a rudimentary ring; and the third, "Agyratæ," those with no vestige of ring. In this work 609 species are recognized, and many others, of various authors, are referred to as dubious and not understood. Swartz's work remained for many years the standard treatise on ferns, and though many species and a few genera were from time to time proposed or established, it was not until 1836 that a serious attempt was made to establish an entirely new system. In that year Presl, of the University of Prague, published his *Tentamen*, in which he took the ground that differences in the arrangement of the veins of the frond should be considered of generic importance. Accordingly, he adopted or proposed 112 genera. Mr. John Smith, curator of the Kew Gardens, arrived independently at much the same views, and published them in Hooker's *Journal of Botany* in 1841. Dr. Fée of Strasburg not only followed out the same theory, but took characters also from the number of articulations in the rings of the sporangium and from the form of the spores, and in his various writings has admitted no less than 212 genera. Later writers have rejected as untenable many of these genera, and in two of the more recent systems of fern-genera, that of the late Dr. Mettenius of Leipsic and of the celebrated Sir W. J. Hooker of Kew, the admitted genera are, respectively, 68 and 75. From the studies of these and other systematists there now seem to be satisfactorily established eight well-marked tribes, mainly distinguished by the nature of the sporangium and of the elastic ring in the tribes where that exists. These tribes, with their essential characters and the names of their principal genera, are given below:

TRIBE I.—POLYPODIACEÆ.—Sporangia pedicelled, the pedicel running into a vertical, narrow, incomplete many-jointed ring. Seldom tree-ferns; fronds simple, or variously lobed or decompound. This tribe, by far the largest of all, is divided into about ten groups of genera.

Principal Genera.—1, Acrostichum, Platycerium; 2, Polypodium; 3, Monogramma, Vittaria, Tænitis, Antrophyum; 4, Selliguæa, Hemionitis, Gymnogramma, Meniscium, Brainea, Nothochlæna; 5, Pellæa, Adiantum, Cheilanthes, Pteris, Ceratopteris; 6, Blechnum, Lomaria, Sadleria, Woodwardia; 7, Scolopendrium, Asplenium; 8, Hypolepis, Phegopteris, Aspidium, Oleandra, Nephrolepis, Onoclea, Cystopteris, Woodsia; 9, Lindsæa, Davallia, Dennstædtia; 10, Sphæropteris, Deparia, Dicksonia, Cibotium, Thyrsopteris.

TRIBE II.—CYATHEACEÆ.—Elastic ring completely encircling the sporangium, and usually oblique, not connected with the pedicel. Mainly tree-ferns.

Genera.—Alsophila, Hemitelia, Cyathea, Matonia.

TRIBE III.—HYMENOPHYLLEÆ.—Elastic ring complete, oblique or horizontal. Sporangia sub-globose, sessile on a bristle-like receptacle. Small ferns of a very delicate texture.

Genera.—Hymenophyllum, Trichomanes (Loxsoma?).

TRIBE IV.—GLEICHENIEÆ.—Sporangia large, solitary or few together, globose; elastic ring broad, transverse to the sporangium's point of attachment. Fronds rigid, usually forking and with axillary buds.

Genera.—Platyzoma, Gleichenia.

TRIBE V.—SCHIZÆACEÆ.—Sporangia ovate or sub-globose, sessile, the ring forming a radiated cap at the end opposite the point of attachment.

Genera.—Schizæa, Aneimia, Lygodium, Mohria.

TRIBE VI.—OSMUNDEÆ.—Sporangia globose, short-pedicelled, reticulated, the ring reduced to a few cells forming a short band opposite and transverse to the line by which the sporangium opens into two nearly equal valves.

Genera.—Osmunda, Todea.

TRIBE VII.—MARATTIEÆ.—Sporangia without any ring, arranged in a circle or in a double row, or combined in a many-celled compound sporangium, each cell or sporangium opening by a longitudinal cleft. Root-stock often fleshy or tuberous.

Genera.—Kaulfussia, Angiopteris, Marattia, Danæa.

TRIBE VIII.—OPHIOGLOSSEÆ.—Sporangia large, coriaceous, globose, without ring, opening into two equal valves, disposed in spikes or panicles, or else grouped in clusters alternately on both sides of an elongated axis. Fronds erect in the bud, never rolled into a crozier, as in all other ferns.

Genera.—Ophioglossum, Botrychium, Helminthostachys.

It should be observed that the genera *Ceratopteris* and *Loxsoma*, each of a single species, are made the types of separate tribes by many authors, and that the Ophioglosseæ differ so much from all other ferns that they ought perhaps to be considered a separate natural order, having nearly as close a relationship to lycopods as to ferns proper.

The economical uses of ferns are few. The Hawaiian species of *Cibotium* have the young fronds enveloped in a fine and dense woolly covering, which is gathered by the natives, and under the name of *pulu* is extensively used to stuff pillows and cushions, and for some years past has been exported to America and other countries in great quantities. In New Zealand the root-stocks of *Pteris aquilina* are used for food after a process of washing, scraping, macerating, and baking, and the experiment of preparing and eating it has been tried in England with fair success. The ashes of the same species, the common brake, are made into balls and used for making lye by the English peasantry. The root-stocks of *Aspidium filix-mas* have long been used in medicine as an anthelmintic, and *Aspidium athamanticum* in Southern Africa is there used in the same way. The moonwort (*Botrychium lunaria*) was formerly supposed to have wonderful powers in healing and in magical craft, and the belief that the fortunate possessor of fern-seed could walk invisible was anciently common, and is referred to in the play of *King Henry IV.*

Ferns of some sort existed as long ago as in the later Devonian age, and became very abundant in the Carboniferous, from which time they have continued, though in diminished numbers, to the present day. As the fructification is rarely preserved in fossil ferns, very little besides the shape and size of the frond, and the venation, exists on which to base genera, and so the common genera of most fossil ferns, *Pecopteris*, *Sphenopteris*, *Neuropteris*, etc., are purely arbitrary. But specimens with the fruit do oc-

casionally occur, and some very good genera have been described closely related to those now existing. Thus, *Scolecopteris* and *Anomopteris* are considered to have been related to *Marattia*, and *Seftenbergia* was not far from *Aneimia;* and even some existing genera have been pretty fairly identified among ancient ferns. For the later geological ages this is quite probable, but the greater part of the ferns of the Devonian and Carboniferous were most likely utterly unlike those we now see.

(For a good general essay on ferns the reader is referred to BERKELEY'S *Introduction to Cryptogamic Botany*, and for the study of genera and species to the various writings of HOOKER, METTENIUS, FÉE, BAKER, etc.)

DANIEL C. EATON.

Fero'nia, an Italian goddess concerning whose cultus and myth little is known. She has been variously regarded by commentators as goddess of the earth, of the inferior world, of commerce, and of liberty. She appears to have been especially honored among the Sabines; and the chief seat of her worship was the town of Feronia, at the foot of Mount Soracte.

Fe'rox (URSEIUS), a Roman jurist, the author of legal works now known only through the citations in other writers. He probably lived in the latter part of the first century.

Ferozepoor, or **Ferozapore,** town in the district of Sirhind, British India, on the E. bank of the Sutlej. The extensive ruins surrounding the town indicate that at one time it must have been a place of great importance, but in 1835, when it came into the possession of the English, it was utterly poor and insignificant. It is now rising once more, and aspiring to the rank of a great commercial centre. Pop. about 10,000.

Feroze Shah, Canal of, a great canal of India, serving chiefly for irrigation, was begun in 1356 by Feroze Shah, king of Delhi, but was not finished until some 250 years later. It flows from the W. side of the Jumna more than 100 miles above Delhi, and with its branches is 240 miles long. It rejoins the Jumna at Delhi. The British authorities have cleaned the canal out during the present century, and also constructed a similar canal on the E. side, running from Fyzabad (a little below the origin of the old canal) to Delhi. These canals are of importance to the agriculture of that region. (See FYROUZ SHAH.)

Ferrandi'na, town in the province of Basilicata, in the S. of Italy, on the right bank of the Basento. It produces excellent wine. Pop. 6420.

Ferra'ra, province of Italy, bounded N. by the main branch of the Po, E. by the Adriatic, S. and W. by the provinces of Ravenna, Bologna, and Modena. It has an area of 1144 square miles and a population of 209,767. The ground is low, in many parts below the level of the Po, marshy, and, on account of the vast swamps, unhealthy, but the soil is rich, and produces, besides extensive pastures, grain, flax, and hemp. In the Middle Ages it formed a dukedom belonging to the House of Este. In 1598, Clement VIII. united it to the Papal States. In 1860 it became a part of the kingdom of Italy.

Ferrara, old and celebrated city of Northern Italy, capital of the province of the same name. While this province belonged to the House of Este, Ferrara was the ducal residence and a city of great splendor and importance. It was a commercial centre in Northern Italy; it developed a school of art of its own; Tasso, Ariosto, and Guarino lived here. Under the papal rule it went into decay, and it has now a deserted and melancholy appearance. Still, many of its monuments—as the cathedral, the ducal palace, etc., with their collections of pictures—are of great interest, and several branches of manufacture and trade are carried on with success. It is an archbishop's see. Pop. 72,447.

Ferrara, Council of, was convened by Pope Eugenius IV. in opposition to the Council of Bâle, in 1438. It was soon joined by the Byzantine emperor, John Palæologus, with 700 followers, including the patriarchs of the Greek Church, the emperor hoping, by obtaining a union of the Eastern and Latin churches, to gain the aid of the West against the Turks. The council discussed principally the points of difference between the Eastern and Western churches. In 1439, the plague prevailing at Ferrara, the council was transferred to Florence. (See FLORENCE, COUNCIL OF.)

Ferra'ri (GAUDENZIO), an Italian painter, b. at Valdugia 1484, d. in 1550. Studied in Rome under Raffaelle, whom he assisted in some of his works. His style of painting was impressive and grand. He studied the highest models, and entered into competition with the highest eminences—with no less a master than Titian. His best works are in Milan. O. B. FROTHINGHAM.

Fer'ret, the *Putorius furo*, a carnivorous mammal of the weasel family, so closely allied to the European polecat (*Putorius fœtidus*) that many regard it as merely a delicate albino variety of the latter. It breeds freely with the polecat, has red eyes, a white or yellowish fur, and is so tender that the winters of England are too severe for it unless well housed. It is half domesticated in Europe, but is probably of African origin. It is much employed in hunting rabbits and rats, but often has to be muzzled, otherwise it will suck its victim's blood and leave the body in the burrow. It is fierce and treacherous, sometimes severely biting the hand of its master.

Fer'ric Ox'ide, called also **Sesquioxide** (or **Peroxide**) **of Iron** (Fe_2O_3), a feebly basic oxide of iron, found abundantly in nature as the principal constituent of the valuable ores known as hæmatite. It also abounds in the ochres and in most of the so-called mineral paints. It forms astringent salts with strong acids. With some bases, such as potash and barium, it gives rise to salts called ferrates. Magnetic iron ore (Fe_3O_4) is sometimes called a ferrate of iron, but it is generally held that the ferrates are compounds of FeO_3—an oxide which has not yet been isolated.

Ferricy'anides, a class of chemical compounds formed by the action of oxidizing agents upon ferrocyanides, from which an atom of the metal is extracted. For example, the potassium ferrocyanide (yellow prussiate of potash, $K_4Fe''Cy_6$) is changed by the action of chlorine into potassium ferricyanide (red prussiate of potash, $K_3Fe'''Cy_6$, or $6KCy.F'''_2Cy_6$). The most important of these salts are the potassio-ferrous ferricyanide (soluble prussian blue) and Turnbull's blue (ferrous ferricyanide). Potassium ferricyanide is a delicate test for ferrous salts, and is invaluable in the laboratory. The ferricyanides may be regarded as compounds of ferric cyanide (Fe_2Cy_6) with some other cyanide.

Fer'rier (JAMES FREDERICK), a Scottish moral philosopher, b. in Edinburgh 1808, and son-in-law of Prof. John Wilson, became professor of history at Edinburgh University in 1842, and of moral philosophy and political economy at St. Andrew's in 1845. *Institutes of Metaphysic, the Theory of Knowing and Being*, was his chief work, though he edited the *Works* of his father-in-law in 12 vols. Ferrier d. at St. Andrew's June 11, 1864.

Fer'ries, Law Concerning. A ferry, according to the legal definition of the term, is a franchise or privilege created by governmental grant or by prescription, which authorizes the transportation of passengers and goods across streams and other bodies of water, giving a right to demand compensation by way of toll in return. In England the grant is by the king's license—in the U. S., by statutory enactments in the several States. The right may, however, be derived from the supreme power indirectly through authority delegated to courts, commissioners, or municipalities to create such franchises. Without a grant, no one, not even the owner of both sides of a stream, is authorized in maintaining a public ferry. The conferring of the privilege constitutes a contract between the state and the individual or corporation, and the ferry thus becomes a species of property, and reciprocal duties are imposed upon the contracting parties. If the ferry-proprietor abuse his franchise or fail to provide and maintain suitable accommodations for the public, government may withdraw the grant. On the other hand, he must, if guilty of no default, be protected in his property, and if it be taken from him in the exercise of the public right of eminent domain, suitable compensation must be made. Thus, ferry-premises may be taken for the construction of a bridge, but only on condition that remuneration be given. As, however, ferries are principally established for the benefit of the public, they may be controlled by the legislature, and their value may be diminished or entirely destroyed by the lawful creation of new ferries in their immediate proximity. As this would be but a legitimate exercise of governmental prerogative, no right to demand compensation would exist. If, however, the grant was plainly of an exclusive right, the legislature could not properly establish another ferry which would interfere with the existing one, as such a course would trench upon that provision of the U. S. Constitution which forbids the impairment of the obligation of contracts. If an unauthorized ferry should be established in the neighborhood of a former one, so as materially to diminish public travel by it, this would constitute a nuisance, on account of which an injunction might be sought in equity or a civil action for damages be instituted. (See FRANCHISE.)

Ferry-proprietors are common carriers, invested with the same rights and subject to the same duties as other carriers. They must afford accommodation to the entire public, must exercise the same high degree of care as is

obligatory upon all who engage in the business of transportation, and are responsible for damage to property entrusted to them unless it be attributable to the act of God or the public enemy. This responsibility may be modified, or, according to some authorities, in the absence of fraud or misfeasance, entirely cast off, by lawful agreement with the owner, and in some instances by notice. (See CARRIERS.) Safe means of access to the ferry-boats must be provided, and every reasonable precaution taken to prevent injury. The responsibility of ferrymen commences when passengers or teams are upon the drops or slips of the flat which affords a way of access to the boats. Even though property be under the care of an owner or driver during the transit, the ferry company will be liable for any injury which it sustains, unless the owner himself occasion the disaster by his own wrongful act or default.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fer'ris, post-tp. of Montcalm co., Mich. Pop. 494.

Ferris (ISAAC), D. D., LL.D., was b. in New York Oct. 9, 1798; graduated at Columbia College in 1816, having served for a time during his college course in a military company during the war of 1812; taught in the Albany Academy for one year; studied theology under Dr. J. M. Mason two years, and in the Rutgers Seminary at New Brunswick, N. J., one year; was licensed to preach in 1820; held Reformed Dutch pastorates at New Brunswick, N. J., 1821–24; at Albany, N. Y., 1824–36; in the Market Street church, New York, 1836–53; was commissioner to Holland on behalf of American missionaries in the Netherlands India in 1842; chancellor of the University of New York City 1852–70. Found the university in a depressed state, and largely by his own personal efforts brought it to a condition of prosperity. He was professor of moral science and Christian evidences 1853–70, and acting professor of constitutional and international law 1855–69. Was also prominent in Sunday-school and mission work. Previous to his chancellorship he was for a time principal of the Rutgers Institute for young women. Was author of *Home Made Happy, Characteristics of the Reformed Dutch Church, Memorial of the First Fifty Years of the American Bible Society, Memorial of Dr. Bethune*, etc. D. at Roselle, N. J., June 16, 1873.

Fer'risburg, post-tp. of Addison co., Vt., 3 miles N. of Vergennes, on the Rutland and Burlington R. R. and on the E. side of Lake Champlain. It has manufactures of leather and woollen goods. Pop. 1768.

Fer'ro, the smallest and least fertile of the Canary Islands, situated in lat. 27° 45′ N. and lon. 18° 7′ W., with an area of 100 square miles and a pop. of 4337. As it is the most westerly isle of the archipelago, it was by ancient geographers considered the most westerly point of the world, and they drew through it the first meridian. German geographers still adhere to this manner of reckoning longitudes, while the English have adopted the meridian of Greenwich as the first meridian, but the meridian of Ferro is the conventional line between the hemispheres.

Ferrocy'anides, a class of chemical compounds formed by uniting ferrous cyanide with some other cyanide. Thus, ferrous cyanide ($FeCy_2$), added to four equivalents of potassium cyanide (KCy), gives $K_4Fe''Cy_6 = 4KCy.Fe''Cy_2$ = the ferrocyanide of potassium (yellow prussiate of potash), an extremely valuable chemical reagent; useful also in pharmacy, and especially in dyeing and calico-printing. Refuse animal matters, iron-filings, and commercial potash are melted together, and the mass is poured into hot water, filtered, evaporated, and repeatedly crystallized, yielding a very pure salt; but several other processes have been invented. Ferric ferrocyanide is commercial prussian blue.

Fer'rol, strongly fortified seaport and the chief naval arsenal of Spain, in the province of Galicia. Its harbor, surrounded by splendid dockyards where fifteen ships-of-the-line can be built at a time, is formed by an inlet of the Bay of Betanzos, so narrow as to admit only one ship-of-the-line at a time, and defended by the castles of San Felipe and Palma. Pop. 17,404.

Fer'rotype, a photograph taken on japanned sheet iron by a collodion process. (See PHOTOGRAPH.)

Fer'ry, post-tp. of Oceana co., Mich. Pop. 366.

Ferry (JULES), French advocate, journalist, and politician, b. at Saint Dié, in the Vosges, Apr. 5, 1832, joined the Paris bar in 1851, and became connected with the *Gazette des Tribunaux*. In 1865 he contributed to the *Temps*, obtaining notoriety in 1868 by his attacks on Baron Hausmann's administration of the city of Paris. In 1869 he was returned to the Corps Législatif by the sixth circonscription of Paris, and in Sept., 1870, became a member of the government of the National Defence.

Ferry (ORRIS SANFORD), U. S. Senator, b. in Bethel, Conn., Aug. 15, 1823, graduated at Yale College in 1844, and was admitted to the bar in 1846. In 1847 was lieutenant-colonel of the first division of Connecticut militia; in 1849 judge of probate for the district of Norwalk, Conn.; State senator in 1855 and 1856; in 1856–59 State attorney for the county of Fairfield; in 1859 was chosen representative to Congress from Connecticut. Served as colonel and brigadier-general in the U. S. volunteers in the war of 1860–65, and was then chosen U. S. Senator from Connecticut for 1867–73. In 1872 he was re-elected to the same office for a second term.

Ferry (PAUL), a French Protestant divine, noted in ecclesiastical history for his irenic proclivities, was b. at Metz Feb. 24, 1591. His parents were related to the first of the Huguenot families; his mother was sister to Attorney-General Jolly. Paul was destined for the ministry, and educated at the Huguenot seminary in Montauban, where, while yet a student, he issued a volume of poems of considerable merit. In 1612 took holy orders, and returned to his native place to become pastor of a congregation which he served until his death July 28, 1669. Ferry was distinguished for his eloquence, and ranked second only to Calmet in all Lorraine. But he was more noted still for his generous sentiments and unbounded religious toleration. Was not only the pride of Protestants, but was beloved also by Romanists, and gave himself so largely to efforts not only for a union of all Protestants, but of all Christians, that he was surnamed THE PACIFICATOR. He corresponded for this purpose with the great Scotch irenic John Duræus and with the noted French ecclesiastic Bossuet. (See *Œuvres de Bossuet*, Versailles ed., vol. xxv.) The correspondence with Bossuet was provoked by Ferry's *Catéchisme Général de la Réformation* (Sedan, 1654), which, holding that the corruption of the Church had called for the Reformation, was replied to by Bossuet, and thus opened the way for an exchange of opinions on many topics, until the irenical subject became uppermost. Ferry is charged with having received a pension of 500 crowns from the government, under Richelieu, for agitating the reunion of Romanists and Protestants in France. His receipt for the amount is said to exist in the National Library at Paris. Ferry wrote much, but published little. His most important works are *Scholastici Orthodoxi Specimen* (Geneva, 1616, 8vo, and since), *Le dernier Désespoir de la tradition contre l'écriture* (Sedan, 1618, 8vo; defended against attacks in 1624), *Vindiciæ pro Scholastico orthodoxo adversus Leon. Perinium Jesuit.* (Leyden, 1630, 8vo). (See HAAG, *La France Protestante;* BAYLE, *Histor. Dict.; London Review*, July, 1856, p. 409 *seq.*)

JAMES H. WORMAN.

Ferry (THOMAS W.), b. at Mackinaw, Mich., June 1, 1827; entered early upon a business life; removed to Grand Haven; was sent to the State legislature in 1850, to the State senate in 1856; was long an active member of the State Republican committee; was a vice-president of the Chicago convention of 1860; a member of Congress from Michigan 1864–71; elected U. S. Senator in 1871 for the full term.

Ferry (WILLIAM M.), father of U. S. Senator T. W. Ferry, b. in Granby, Mass., Sept. 8, 1796, and d. at Grand Haven, Mich., Dec. 30, 1867. He graduated at Union College in 1817; was a Presbyterian missionary at Mackinaw from 1821 to 1832, conducting successfully a school for white and Indian children. His health failing, he purchased land in the Grand River Valley, near Lake Michigan, founded a prosperous settlement there, which became the city of Grand Haven, engaged largely in the lumber manufacture, and became wealthy.

W. S. GEORGE.

Fer'ryland, port of entry of Newfoundland, the capital of Ferryland district, has a good harbor, 44 miles S. of St. John's. It was settled by Lord Baltimore in 1623, and called Avalon; was deserted in consequence of disturbances by the French. Ruins of the old batteries remain. It has a court-house and jail and a lighthouse. Pop. 680.

Fer'rysburg, post-v. of Ottawa co., Mich., on Grand River and Spring Lake, and on the Michigan Lake Shore and the Detroit and Milwaukee R. Rs., 1 mile N. of Grand Haven. It has important manufactures.

Ferté-sous-Jouarre, La, town of France, in the department of Seine-et-Marne, on the Marne. About 1200 pairs of burr millstones are annually quarried in its vicinity and shipped to England and America. Pop. 4482.

Fer'tile, post-tp. of Worth co., Ia. Pop. 164.

Fertiliza'tion of Plants, the process by which the contents of two sexual cells are blended to form the starting-point in a new development. In flowering as well as flowerless plants the mechanism of reproduction is so complicated that some knowledge of vegetable physiology is necessary to its comprehension. (See PHYSIOLOGY, VEGETABLE.)

Fer'tilizers [Lat. *fertilis*, "productive," from *fero*, to "produce"]. The name *fertilizer* is applied to substances which enrich the soil with nutriment of plants. Agriculturists distinguish usually between home-made and artificial mineral or commercial fertilizers. The former consist mainly of the various refuse matters, animal and vegetable, incidental to the particular farm operations carried on. The latter include a large number of articles which are obtained elsewhere than from the farm. The use of animal secretions of every description, and of all kinds of vegetable refuse matter in the form of barnyard manure and farm composts, has been known in agriculture from time immemorial, whilst the application of the commercial fertilizers can scarcely be dated farther back than to the close of the past or the beginning of the present century. Lime, salt, saltpetre, oyster-shells, gypsum, and ground bones are among the first more prominently mentioned commercial fertilizing substances. The consumption, however, of these and similar articles remained quite limited until some thirty years ago, when their demand at once began to increase rapidly in consequence of Prof. Justus von Liebig's famous exposition of the relations which exist between the constituents of the soil and the growth of plants.

The extensive use of commercial or artificial fertilizers is one of the most important features in the present management of farms. Their merits are so generally recognized that a rational and thorough system of agriculture is thought impracticable without their assistance, particularly when it is proposed to apply them for the purpose of rendering the stable manure a complete fertilizer for the various crops under cultivation. The successful introduction of these fertilizers furnishes one of the most striking illustrations of the influence and the value which exact modes of inquiry with well-defined questions have over mere experimenting without a previous correct appreciation of the agencies and the principles involved in the operation.

Agriculture, although one of the oldest industries, was, comparatively speaking, until of late in an unusual degree deficient in rational explanations of many of its modes of operation. Stable manure, ashes of plants, and various other means, as fallow and rotation of crops, irrigation, and drainage, etc., had been employed for ages in the interest of a successful fertilization of cultivated lands, yet no satisfactory explanation regarding their respective action was offered until quite recently—a fact which readily accounts for their repeated failures in former ages. The state of the natural and the physical sciences previous to the beginning of the present century rendered in many instances a correct exposition of the processes involved impossible. To enter with any reasonable prospect of success upon the discussion of so intricate questions as the relation of animal secretions to plant-life required not only a familiarity with the composition of the air, the water, and the soil, and the various reactions of these agencies upon each other and on plant-life under the influence of light and heat, but also a thorough knowledge of the various constituents of plants and animals, their respective organizations, and the functions of their assimilative, respiratory, and excretory organs. Without any knowledge of the nature of the previously mentioned important physiological processes peculiar to animal and vegetable life, not even an approximately correct appreciation could be entertained regarding the mutual dependency of plants and animals in the economy of farming. Modern agriculture rests its claim of real progress, as compared with previous centuries, less on the introduction of new means for the maintenance of an increased production of cultivated lands than on a more efficient because more rational use of the best features of well-known modes of cultivation. It ascribes the present advanced position, and its claims of being a scientific art, to the accumulated results of the scientific researches of many of the most illustrious scientists of the past century in every branch of the natural and physical sciences, and recognizes in Lavoisier, Sir Humphry Davy, and Liebig the foremost and most influential minds during its various stages of progress. One of the most important services which the experimental sciences have rendered of late to practical agriculture consists in the elucidation of the fact that it is essential to a successful cultivation of the various crops to restore without delay to the soil those of its constituents which the crops have abstracted.

It is scarcely more than some thirty years since the mineral constituents of plants were looked upon as being merely of incidental occurrence, and without any essential bearing upon their development: these views have been entirely changed in consequence of recent careful analytical investigations. In comparing the ash-constituents of different plants it was noticed soon that certain mineral elements were present in a more or less conspicuous proportion in every plant. The general occurrence of these substances led ultimately to the quite natural assumption that their presence might be necessary for the performance of some physiological process of vegetable life. These important relations were in their general outlines for the first time pointed out in the year 1840 by Justus von Liebig in his memorable work on *Organic Chemistry in its Application to Agriculture and Physiology*. Subsequent additional actual experiments, instituted under well-defined circumstances for testing his views, have not only confirmed their correctness in their main features, but furnished much additional information in regard to the requirements for a successful cultivation of plants. We have learned since that of all the substances which enter into the composition of plants, only potassium, calcium, magnesium, iron, sulphuric acid, phosphoric acid, and carbonic acid, besides some nitrogenous compounds, as ammonia or nitric acid, and water, are indispensable for their growth; whilst the functions of a few other elements quite frequently noticed in plants, as sodium, silicium, chlorine, etc., remain still less explained. As soil and air were thus proved to be equally important contributors of the essential articles of plant-food—the former furnishing the mineral constituents of plants, the latter mainly their organic portion—it became evident that the atmospheric resource of plant-food could only serve its purpose in the same degree as the soil-constituents present would be able to support them in the production of vegetable matter. To store the farm-lands with the largest possible amount of available essential mineral constituents of plants in particular has thus become the most important point of consideration in practical agriculture. The intelligent farmer of to-day recognizes this principle in the selection of his modes of operation. An early experience has taught him that the soil he cultivates, as a general rule, differs more or less in its physical condition and its chemical composition. Chemists have subsequently proved to him that any improvement in the former direction tends to render the natural and original resources of the soil treated sooner and in a larger degree available, and thus hastens on its final sterility in consequence of the production of larger crops. Superior mechanical treatment of the soil before seeding—rotation of crops, fallow, irrigation, and drainage—is for this reason at present resorted to mainly for the purpose of turning the natural resources of the soil to better account, either in consequence of a more uniform distribution of its plant-food or at the expense of time; whilst a continued unimpaired production is secured by returning in the form of some suitable fertilizer the soil-constituents which the removed crops have abstracted. The selection of a fertilizer is for economical reasons always made with reference to the nature and the amount of available plant-food in the soil under cultivation, and to the special requirements of the crops to be raised. Most of our home-made fertilizers are of a compound nature, whilst the commercial or artificial fertilizers supply usually but one or two articles; they are for this reason frequently called "special fertilizers." Stable manure, although the most complex of home-made fertilizers, cannot be considered a complete one as long as farmers sell a part of their produce. The commercial fertilizers furnish excellent means to correct the composition of the stable manure obtained under any system of agricultural industry, and to make it a complete fertilizer for the crops under cultivation. Although the stable manure represents still by far the largest bulk of the fertilizers used in general mixed farm-management, the demand for commercial fertilizers is already so great that their manufacture ranks among the most extensive branches of chemical industry of the present day. Their importance cannot be over-estimated in regard to the maintenance of the fertility of our farm-lands as long as farmers still allow a fair portion of their home fertilizing material to waste, and as long as the sewage question of our centres of social life remains practically unsolved. Bones, mineral phosphates, and superphosphates—the latter frequently mixed with nitrogenous animal matter, as fish, blood, meat, etc., or ammonia compounds—have been for years the main portion of commercial fertilizers. Phosphoric acid, lime, sulphuric acid, and nitrogen have thus for years past been duly represented in the market, while potassa and magnesia were less attended to until of later years. The sources of potassa for fertilizing purposes consisted formerly largely of nitre and wood-ash; the former proved too expensive, and the latter insufficient in quantity, to encourage a more general application for agricultural use. The recent discovery of large mineral deposits at Stassfurt and elsewhere, containing both potassa and magnesia in soluble form, has given a peculiar interest to extensive and systematic agricultural experiments, by which their great value has been abundantly demonstrated. Many of the artificial fertilizers have acquired also an additional value on account of their special character, and thus their special

action on the quality of various important crops for industrial purposes, as tobacco, sugar-beets, etc. The study of the peculiar influence of each article of plant-food in reference to the production of vegetable substances, such as starch, sugar, oil, etc., has more recently engaged the particular attention of agricultural chemists.

CHARLES A. GOESSMANN.

Fe'sa, town of Persia, in the province of Fars, with an estimated population of 18,000. Its silk fabrics are famous.

Fes'cennine Verse (*carmen Fescenninum, versus Fescenninus*), in ancient Italy, a rude and generally extemporaneous kind of poetry, often roughly satirical and licentious, sung at first in rustic communities at harvest-homes and weddings, and afterwards introduced into Rome, where it was long popular. The *fascinum* or *phallus*, the symbol of fertility, is supposed by some to have given it a name, which others derive from Fescennium, a town near Falerii. This verse was originally in form a dialogue.

Fesch (JOSEPH), CARDINAL, a half-brother of the mother of the first Napoleon, b. at Ajaccio Jan. 3, 1763, was a commissioner attached to the French army of Italy (1795–99), archbishop of Lyons (Apr., 1802), ambassador to Rome and cardinal (1803), grand almoner and senator (1805), président of the Council of Paris (1811), then exiled to Lyons for opposing Napoleon (1811–14), and d. at Rome May 13, 1839.

Fes'cue, a name applied to the numerous species of grass of the genus *Festuca*, which abound in most temperate regions of the globe. The sheep's fescue and the field fescue (*Festuca ovina* and *elatior*) are excellent pasture and forage grasses. Peru has the *Festuca quadridentata*, which is reputed poisonous to stock, perhaps from the growth of ergot in place of its seeds. The European fescues are more numerous and important than the American. The celebrated tussock-grass of the Falkland Islands is a fescue—*Festuca flabellata.*

Fes'senden (FRANCIS) was b. at Portland, Me., Mar. 18, 1839, graduated at Bowdoin College 1858, studied law, but was appointed captain 19th U. S. Infantry May 14, 1861; wounded at Shiloh; colonel of the 25th Me. Vols. Oct., 1862, to Jan., 1863; in command of brigade in the battle of Chantilly, Va.; colonel of the 30th Me. Vols. in the battle of Sabine Cross-roads; commanded a brigade in battles of Pleasant Hill and Monett's Bluff, La., and lost a leg; brigadier-general of volunteers May, 1864; brevet major-general of volunteers, and brevet major, lieutenant-colonel, colonel, and brigadier and major-general U. S. army; lieutenant-colonel 28th U. S. Infantry; retired Nov. 1, 1866.

Fessenden (SAMUEL), LL.D., American lawyer, b. at Fryeburg, Me., July 16, 1784, graduated at Dartmouth College in 1806. Admitted to the bar in 1809, he practised at New Gloucester, Me.; was a member of the Massachusetts general court (1814–16), and of the senate (1818–19); major-general of militia (1818–32). Removed to Portland, Me., in 1822, and was its representative in the Maine legislature (1825–26), as also grand master of the grand lodge of Masons in Maine. He was the father of Hon. W. P. Fessenden. D. near Portland, Me., Mar. 13, 1869.

Fessenden (SAMUEL C.), American Congressman, b. in New Gloucester, Me., Mar. 7, 1815, graduated at Bowdoin College 1834, and at the Bangor (Me.) Theological Seminary in 1837. In 1838 became pastor of the Second Congregational church at Thomaston (now Rockland), Me. In 1856 he left that place and established the *Maine Evangelist.* In 1858 studied law, soon became judge of the municipal court of Rockland, and was then elected a representative from Maine to the Thirty-seventh Congress. In 1861 was appointed a member of the board of examiners of the U. S. Patent Office at Washington, D. C.

Fessenden (T. A. D.), American Congressman, b. at Portland, Me., Jan. 23, 1826, graduated at Bowdoin College, Me., 1845, was aide-de-camp to the governor of Maine in 1858, and in 1860 was a member of the Maine legislature; in 1861 was attorney for the county of Androscoggin. In 1862 was chosen representative from Maine to the U. S. Congress for the unexpired term of C. W. Walton. D. at Lewiston, Me., Sept. 28, 1868.

Fessenden (THOMAS GREEN), American poet and agricultural writer, b. at Walpole, N. H., Apr. 22, 1771, graduated at Dartmouth College 1796, and studied law, but the success of a poem, *Jonathan's Courtship*, led him to literature. In 1803 he wrote in London *A Terrible Tractoration*, a satirical poem; in 1804 settled in Boston, publishing there, in 1806, *Democracy Unveiled*, a political poem, etc. Afterwards edited the *Weekly Inspector* at New York City two years. In 1812 practised law at Bellows Falls, Vt., removing to Brattleboro', Vt., in 1815, where he published *The Reporter.* From 1816 to 1822 he edited the *Intelligencer* at Bellows Falls, Vt. From that time until his death, at Boston Nov. 11, 1837, he published *The New England Farmer* at Boston, Mass., and edited *The Horticultural Register. Original Poems, The Ladies' Monitor* (1818), *American Clerk's Companion* (1815), *Laws of Patents for New Inventions*, etc., were also published by Mr. Fessenden.

Fessenden (WILLIAM PITT), LL.D., an American statesman, b. at Boscawen, N. H., Oct. 16, 1806; graduated at Bowdoin College 1823; admitted to the bar 1827; began the practice of his profession at Bridgeton, Me., removing two years later to Portland, Me., where he continued to reside, and with whose interest and progress he was ever identified. Chosen as a Whig to the State legislature in 1832, although the youngest member of that body, he attained distinction as a legislator and debater; refusing further political preferment, he devoted himself (1832–39) to his profession, rising to the highest rank as counsellor and advocate. He was, however, returned to the legislature in 1840, and in 1841–43 represented his district in the Congress of the U. S., where he made a brilliant record as an eloquent and forcible debater. During the year 1843 he received the Whig vote for U. S. Senator, but was defeated; was returned to the State legislature in 1845 and 1846, and again in 1853, when he was elected to the U. S. Senate as a Whig, though the legislature was Democratic; but the Kansas-Nebraska question, which now began to assume importance, obliterated strict party lines, and by a union of the Free-Soil Democrats with the Whigs he was elected. Taking his seat Feb., 1854, he was placed upon the finance committee, and the following month made one of the most eloquent and effective speeches delivered against the Nebraska bill, establishing him at once as a leading member of the Senate. Re-elected in 1859, he was made chairman of the finance committee, and throughout the civil war rendered valuable service, as such, by aiding the secretary of the treasury to maintain the national credit, as well as by his eloquence and counsel in the Senate chamber. In 1864, on the retirement of Mr. Chase from the secretaryship of the treasury, he accepted that portfolio, and discharged the duties of the office during a most critical period of the nation's finances until Mar., 1865, when, owing to his delicate health and the overwhelming duties of the office, he resigned and resumed his seat in the Senate, to which he had been re-elected. On the conclusion of the impeachment-trial of President Johnson, he cast his vote for acquittal, in accordance with his opinions, which he set forth fully in an able and logical speech. For this act he was severely censured by his party, which was strong for conviction, but no taint of suspicion could be attached to the integrity of his vote, and he regained its confidence upon the subsidence of momentary excitement, and retained his place in the Senate as a leading debater and member of the party. As a politician he began his career as an ardent Whig; was member of the convention which nominated Harrison for the Presidency in 1840; of that which nominated Taylor in 1848, though in the latter he advocated the claims of Mr. Webster; but in the convention of 1852 he opposed Webster and favored Scott. He was one of the founders of the Republican party, in which he became a recognized leader. As a lawyer he ranked among the first in his State, and in the Supreme Court of the U. S. made himself a national reputation; as a debater he had few if any superiors in the Senate; and as a man his character was irreproachable. He was for a number of years an invalid, and suffered from a chronic complaint that finally hastened his death, which occurred at Portland, Me., Sept. 8, 1869.

G. C. SIMMONS.

Fess'ler (IGNAZ AURELIUS), b. at Czörendorf, in Hungary, in July, 1756; was at first a Capuchin, but in 1791 became a Protestant; was 1785–87 professor of Oriental languages at Lemberg, and in 1809 received the same chair at St. Petersburg, and afterwards was a prominent Lutheran official in Russia. Besides novels, Masonic treatises, etc., he wrote *Marc-Aurel* (a romance, 1790–92); *Matthias Corvinus* (1793); *Aristides und Themistokles* (1792); *Attila* (1794); a history of Hungary (1812–25); and an autobiography (1826). D. at St. Petersburg Dec. 15, 1839.

Festival. See FEAST, by REV. W. F. BRAND, A. M.

Fes'tus [Gr. Φῆστος], PORCIUS, procurator of Judæa, succeeded Antonius Felix about A. D. 60, while Nero was emperor. On his arrival in his province he found the apostle Paul a prisoner, examined his case, refused to gratify the vindictive feelings of the Jews against him, and would have set him at liberty, but as the apostle had appealed to Cæsar (*i. e.* Nero), he sent him to Rome to lay his case before the emperor. The disturbances caused by the robbers, assassins, and magicians which had prevailed in the time of Felix still continued under the government of Festus, and he was obliged to use vigorous measures to

subdue them. D. about two years after his appointment, and was succeeded by Albinus. H. DRISLER.

Festus (SEXTUS POMPEIUS), a Latin grammarian and lexicographer of uncertain date, but after Martial (A. D. 100), from whom he quotes, and before Charisius and Macrobius (400 A. D.), who quote from him. No particulars of his life have come down to us apart from his connection with the great work of FLACCUS, VERRIUS (which see), *De Significatu Verborum.* Festus prepared an abridgment of this work, which he arranged under the letters of the alphabet into twenty books, following the order and authority of Flaccus, introducing additional matter from his other writings, but rejecting certain points, which he intended to treat of in his *Priscorum Verborum cum exemplis.* This abridgment, entitled *De Significatione Verborum,* caused no doubt the loss of the original work of Flaccus, but it would have been, even in its reduced form, an exceedingly valuable treasure-house of the forms of Latin words and of Roman antiquities and mythology. In the eighth century, however, PAULUS DIACONUS (which see) made a meagre abridgment of Festus's work, adapted to the wants of his own time, and thus no doubt caused the discontinuance, and finally the disappearance, of the latter. One manuscript only of the eleventh century, now preserved at Naples, survived, but in a very imperfect condition, as it began with the letter *M,* and part of the remainder was defaced by fire. The labors of many scholars have been bestowed on the restoration of this important work, from some slight fragments of the original treatise of Flaccus, from the surviving MS. of Festus, and the compend of Paulus. The results are presented in their best and most complete form by K. O. Müller, Leipsic, 1839, who has printed the several works in separate columns. H. DRISLER.

Fe'tials, or **Fe'cials** [Lat. *fetiales;* etymology uncertain], a body of ancient Roman priests who had charge of certain international affairs, acting as heralds in the announcement of war to a foreign state and presiding over the solemnities attending the return of peace. They were probably twenty in number, were anciently citizens of high birth, were chosen for life, and were called *patres patrati.* Their duties were performed with much ceremony. Their rites and regulations constituted a code known as the *Jus fetiale.*

Fe'tich [root in the Lat. *factum,* but derived directly from the Portuguese *feitiço,* meaning a "charm," "witchcraft," "magic"], a name given by the Portuguese discoverers to the objects worshipped by the degraded tribes of Senegal and Congo. A fetich is not an idol, and is not properly a symbol, but is looked upon as the actual and visible dwelling-place of a preternatural power. It may be thus some fixed object of nature, as some lofty mountain, a grove, or a tree; it may be an animal, as a snake, a snail, a crocodile, and often a sheep or a goat; or it may be any object on which the whim or the fancy has fixed, as the beak of a bird, the fin of a fish, the hoof of a quadruped, a stone, a block, a feather, a stick, a nail, or almost anything else that can be named. One thing will do about as well as another for a fetich, provided the worshipper can believe that his god resides therein; and this he is easily led to do in reference to anything which pleases or is useful to him. A fetich is often worn about the person or hung up in the hut as a talisman, and is employed in the most disgusting rites of superstition and witchcraft. Fetichism shows the religious instinct degraded into its lowest forms. J. H. SEELYE.

Fet'id Gums, in pharmacy and medicine, are certain gum-resins which are the concrete natural juices of umbelliferous plants. They have a strong, unpleasant alliaceous odor, whence the name. They are antispasmodics and expectorants. Assafœtida, ammoniac, galbanum, and sagapenum are the best known.

Fétis (FRANÇOIS JOSEPH), Belgian writer on music and biographer, b. at Mons Mar. 25, 1784, studied at the Conservatory of Paris in 1800, was organist and professor of singing at Douai in 1813, director of the conservatory at Brussels in 1833, member of the Academy of Belgium in 1845, musical executor of Meyerbeer, producing his *Africaine* in 1864, officer of the Legion of Honor in 1864, grand officer of the Order of Leopold 1869, dying at Brussels Mar. 27, 1871. Published treatises on music, a *Universal Biography of Musicians* (8 vols., 1834–44; 2d ed. 1868–70), and a *General History of Music from the Earliest Times down to the Present,* 8 vols. Founded and edited the *Revue Musicale.*

Fet'lock, originally, it would appear, a name for a horse's fetter; also called **Fetter-lock,** both words occurring in heraldry as names of the rude figure of a fetter. At present it is the name of the point on a horse's leg behind the pastern-joint. The fetlock is covered by a tuft of long hair.

Fet'terman, post-tp. of Taylor co., W. Va., on the Baltimore and Ohio R. R., 1 mile N. W. of Grafton. P. 958.

Feu'dal Sys'tem. In the Roman empire, as in all compact states where the central power has its due degree of strength, the individual was placed directly under the supreme magistrate, and all authority of subordinate officers was exercised in his name. This dependence of the freeman in the direct way on the head of the state continued in the Germanic kingdoms, after they superseded the Roman power, for a length of time. In the tenth century, however, a new set of institutions are at work, rooting out and breaking up the institutions of the state proper. We give to them the name of *feudalism, feudality,* or *the feudal system.* They developed themselves, without absolutely destroying all earlier institutions, in France, England, Germany, Spain, Italy, and in the neighboring lands of Hungary, Poland, and Denmark. They appear also in other parts of Europe, and out of Europe in the Christian kingdom of Jerusalem. If traced back, they must be brought into connection with the Germanic element which diffused itself by invasion over a large part of Europe, while yet there was, properly speaking, no feudalism among the invaders. The notion common some time since that the invading armies consisted of bands under chieftains to whom the conquering kings gave lands for their services, and who in turn gave lands to their *comitatus* or retainers, is beginning to be exploded. Feudalism was a German growth, but had no such antique and tangible shape. It grew up, by little and little, out of institutions which were ripened in the Carolingian period, no one of which is enough of itself to explain feudalism, and which in combination could not have brought it about but for concurrent historical causes.

Feudalism controlled society and government for several centuries, and began to grow weak at the same time that the countries of Europe began to be nationalized; that is, at about the end of the fourteenth century. It was, however, not the sole, but only the controlling, power of society. The Church, the suzerains, the towns, were at heart its foes, although they put on some of its forms.

The word *feudum* in mediæval Latin, from which *feudal* is derived, did not come into use until about the ninth century, when it began to take the place of *beneficium,* which denoted a property given for use on certain conditions, the ownership of which did not go over with the usufruct. *Feudum* and *allodium* included the two tenures by which property was held in independent right—in fee-simple, as we say—and by which it was held on condition of performing a service to the former owner. *Alod* is from *al,* "all," and *od,* "property," entire or genuine property, freehold estate; and *feud, fief,* is from a root (Gothic, *faihu;* Old High Ger. *firu;* Old Sax. *fëho,* etc.) denoting "cattle," "property;" then "money," "rent," "interest." *Fe-od,* then, would be property for which rent is paid. The German expression is *lehen,* "loan;" thus, *lehen,* or *lehngut,* is originally a property lent, which may be recalled; *lehnrecht* is feudal tenure.

But what was the feudal system? It may be defined as that political form in which there was a chain of persons holding land of one another on condition of performing certain services, beginning with the serfs and lowest freemen, and ascending through *milites* or knights to the arrière-vassals and immediate vassals of the suzerain. Every member in the chain, from the milites upward, was bound to his immediate superior, held land from him, took the oath of allegiance to him, and became his man. The suzerain, then, had, when the system was pure, no direct connection with any but the great vassals, and they, with others, it might be, under them, were lords in their districts. The legal fiction was that the land was originally in the hands of the suzerain (that is, all the land which was not allodial, of which there was much in Germany, but in France very little); that allegiance and certain services fixed by custom were due to him; and that for neglect to perform these services the lands and all rights going with them could be forfeited. With the lands, down to the holders of knights' fees, jurisdiction was connected, as well as legislation within certain limits, military command over the fief-holders of the barony, and, to a considerable extent, the right of coining money, together with that of giving charters. In short, nearly all sovereign powers passed over from the old sovereign—who now must be called a *suzerain,* to show his altered position—to his vassals; so that society was disintegrated, as much as it would be if every county in one of the U. S. had the rights of holding courts of itself and of passing laws. This it is that formed the most marked peculiarity of the system, and obstructed for centuries all uniform development, all national existence, all unity. In this disunited condition there grew up endless diversities of customs; there was for a long time no general law; every feudal connection stood on its own foot, and was sub-

ject to compact between the suzerain and the vassal, a lord and an inferior. For instance, down to the first part of the twelfth century, females, if a baron died and left no son, could not inherit, but then they began to gain this right in Eastern France, England, Castile, Aragon, and the kingdom of Jerusalem. By this change it was brought about that females could inherit the throne, this being viewed in the light of a fief. And thus the law of succession in some monarchies took more or less definitely a new shape. This is one of many instances which will justify us in saying that in European feudalism public or political relations were confounded with private relations—political rights were blended with private rights.

The origin of the system has been traced by some writers to the Roman custom in the empire, from the time of Alexander Severus, of protecting the borders towards Germany by military colonies, in which the soldiers received land and were bound, they and their descendants, to military service. This, which was by no means confined to the Roman empire, but is seen in other parts of the world, was perhaps suggested by a Germanic usage. As Waitz says (*Deutsch. Verfassungsgesch.*, i. 376), "the way in which, among various Germanic tribes, Scandinavian as well as Teutonic, military service was united with possession of land, gives a probability to the opinion that even in the earliest times a certain connection between them subsisted." But this is the least characteristic element of the feudal system. It does not account for subinfeudation, or for the political powers which the fief-holder had, which was the striking characteristic of feudalism.

Neither can the *comitatus*, or relation of the *comites* or companions to the *princeps* or chief, as existing among the Germans of the time of Tacitus, account for feudal institutions. That was a relation of any chieftain to his companions, and not of a German king only to his followers. And that relation conveyed no political authority.

The true account of the matter seems to be this. Under the first race of Merovingian kings the kingdom was modelled much after the plan of the Roman empire. The county was assigned to a man (a *comes* or "count") who was both civil and military ruler, who commanded the forces of the county, administered justice, had no hereditary right to jurisdiction, but who might have grants of land for his lifetime, or on some other condition, from the king.

During the reigns of the later Merovingians, and after the East-Frank or Carolingian dynasty got possession of the throne, there were growing up several institutions in some respects new, in some respects analogous to older Germanic ones. These were vassalage and commendation, the beneficiary system, and immunity or exemption. To give a complete exposition of these elements of new social and political forms, and indeed to exhibit full-grown feudalism in its details, would require far more space than can be here afforded. We will try to give an explanation of what is necessary in the fewest words possible.

1. *Beneficia and the Beneficiary System.*—This was a relation of *property*, and long before the feudal system proper grew up *beneficium* denoted a gift of property, especially of landed property, in usufruct only, with reversibility to the donor or his heirs. The early meaning still appears in our word "benefice," in its sense of an ecclesiastical property, the use of which is given to a clergyman as officiating in a certain parish. The donor or grantor of the *beneficium* might be a king, any lay person, any ecclesiastical corporation; while the grantee might be any man, even the king himself, or a female, or a corporation, as before. *Beneficia* given for a short term of years or revocable at pleasure were called *precaria*—that is, obtained by the prayers or requests of the beneficiary; and the short, uncertain tenure of such holdings illustrates the modern word "precarious." But the distinction between *beneficia* and *precaria* is by no means a perfectly exact one. Such precaria were given, for instance, where a donor of land to a monastery in full ownership received it back in usufruct, with perhaps some of the older Church property besides.

Beneficia are distinguished in the course of time from leased lands transferred for use to dependent persons, such as serfs. Thus, a monastery might have serfs on its lands or free tenants. The lands so cultivated by them were not regarded as *beneficia*, but a man who received from such a foundation tracts of land to be cultivated by his own people, or lands with laborers on them, would be called a "beneficiary."

The terms and conditions on which such benefices were held were very various. Some were for short terms, some were renewable every five years, while others were expressly excepted from this condition. *Beneficia* of the king usually terminated with the life of the grantor or of the grantee, but sometimes they passed on to the grantee's heirs. Under the grandsons of Charlemagne they came to have more and more of an hereditary character, and in the kingdom of the West Franks (or France) a sort of acknowledgment of the hereditary principle was made in 877 A. D. by Charles the Bald at the convention or diet of Quiercy-sur-Oise (*conventus Carisiæus*). Yet diplomas of Charles the Bald show that this rule of inheritance was not absolutely fixed by the celebrated capitulary referred to. And this provision had no necessary authority in other parts of the kingdom of Charlemagne. On the renewal of grants of benefices sometimes money was demanded, reminding one of the subsequent fine or relief, but this was not thought to be becoming. The obligation for holding a benefice might be something like a rent, real or nominal, or no requital of any outward sort might be called for. But a certain kind of tie grew out of the giving and receiving of benefices—something expressed by the Latin word *obsequium* in the formulas of gifts—that is, a readiness to comply with the wishes of the benefactor; if he were the king, a personal feeling of gratitude apart from the sense of duty as a subject. This is expressed in a form of which the following is a translation: "Let him know that he ought to show such (*obsequium*) dutiful compliance towards his senior on the ground of that gift, as other men, on the ground of similar beneficence, are wont to show towards their seniors." Here we see the reception of benefices becoming connected with

2. *Vassality* or *commendation*, which was a merely *personal tie.* The latter of these words has the more extensive meaning, and several relations were described by it besides that which was called "vassality." The essence of these relations lay in formally putting one's self under the protection of another. The king was regarded as the protector of certain helpless classes, such as widows and orphans. They were *in his peace*, as also were the whole people and the Church. So, too, pilgrims and travellers were for the time under his care—under the tutelage or the defence of the king—although *commendation* is not the term specially used in such cases. Again, young men brought to the court to be trained for some service or court office are said to be commended, although no formal taking of them into his protection or guardianship (*mundium*) may have found place. Nor was the king alone in giving his protection. The *major-domus*, or mayor of the palace, sometimes gave his protection with or instead of the king, and Pepin made his son Charles (Charlemagne) joint protector with himself. The property of a diocese might be in the tutelage of a count—that of a convent under a count's or bishop's protection. Free men put themselves under the guardianship of a convent. Thus, originally there were manifold relations, differing, yet having resemblances to one another, which were described by the same words.

A person who made commendation of himself was called *vassus* or *vassallus*, a word probably of Celtic origin, and at first denoting a servant, then in time confined to the relation above spoken of. (See WAITZ, *Deutsch. Verfassungsgesch.*, iv. 205, for examples of the use of the words as applied to inferior proprietors.) Another equivalent term was *gasindus*, of Germanic origin (comp. modern German *gesinde*), and another still was *homo*, of Latin origin, whence *homage* comes. The person who received another into his protection was especially called *senior* (whence *seignior*), and also *dominus*. In later documents the seignior's relation or standing is called *senioratus* (as if seigniorship). The entrance into the relation of a vassal was denoted by the form of folding the hands together and laying them in the hands of the *senior* or protector. This was accompanied by an oath containing a promise of fidelity. The oath and the form in general were used as well when a count or other important person took an inferior under his protection as when the king received a vassal into his service. The oath and obligation were contemporaneous with the general oath of allegiance on the part of the subjects, as required by Charlemagne and other Carolings. And yet the oath to the king's or emperor's subject certainly tended at length to weaken the tie between the head of the state and those members of it who were bound to others than the sovereign or suzerain.

The vassal sometimes remained with his senior, especially if the king was the senior, and served in his court; sometimes he lived remote from the king on lands which had been given to him for his use. If an inmate of his senior's dwelling, he was bound to services, such as military duty, going on messages, presence at his courts (*placita*), following in his train. In a capitulary of A. D. 811 it is said of such vassals of the king that if they have benefices, and vassals on them, they shall not keep these subordinate vassals with them, but "shall allow them to go with the count to whose district they belong." From this it appears that already vassals had vassals; that some vassals had no benefices; and apparently, also, that the old-received jurisdiction and military power of the count in his county (*pagus*) was beginning to be weakened, for it was necessary to give

orders that such vassals should follow the count to his county and upon military expeditions.

At first the tie between a person other than the sovereign and his man was probably weaker than that between the magnates and the king. In the disorders after Charlemagne's death, and in the time of his grandsons, the great people seduced each other's vassals away, so that this had to be expressly prohibited. The vassal also could not leave his senior or lord except for reasons which involved a crime on the senior's part, unless, indeed, the latter freely dismissed him. Such crimes, as mentioned in a capitulary of Aix-la-Chapelle (A. D. 816), are attempts on the senior's part to enslave the vassal, seduction of his wife by the senior, plots against his life, running upon him with a drawn sword, neglecting to protect him if this were in the senior's power. With this may be compared the feudal crime of felony, which is generally committed by the vassal against his lord, but may also be committed by the lord himself against his vassal.

It came to pass in the course of time that vassals held benefices and beneficiaries became vassals—that is, that no person could stand in the one relation without its involving the other. Waitz says (*Deutsch. Verfassungsgesch.*, iv. 216) that "no one could get a benefice without binding himself by commendation more closely to the grantor of the land—more closely than would take place by the fact of having another's land put for use into his hands." Roth, in his *Beneficialwesen*, says more safely that this union of the two relations was usage only for some time, and not universal custom. When the custom was becoming universal a class of landholders was growing up who held estates by a tie of personal obligation to a superior; and this class, owing to the vast tracts of land which the Frank kings could dispose of, embraced a large part of the leading persons, especially in the West Frank kingdom.

3. *Immunity* (*emunity*) or *exemption*, a *political* privilege, was the third constituent element of the feudal system. The first form under which this element appears is immunity from taxes or burdens on the land. When the king gave benefices he transferred that which before belonged to the *fisc*, and which was exempt from taxes. It was a great thing for a person to obtain this exemption. The first exemptions that are known are all granted to convents or to other ecclesiastical foundations, the property of which was entirely derived at first from gifts of lands. Originally, this grant of immunity could only proceed from the king, yet documents issued to such corporations by nobles who were vassals of kings confer it, in the expectation, perhaps, that a confirmation of the step would be obtained from the supreme authority. There seems also to have been a special anxiety on the part of convents that a public officer should not enter within their premises and disturb their sacred quiet. However little or much this cause may have affected, the immunity naturally took the shape under Pepin and the next sovereigns that no public officer should enter the court or lands of the foundation, either to levy peace-money (*freda*), or to demand quarters and lodging, or to take securities, or to hold the people of the foundation to justice, or to set up judicial proceedings there. These dispensations from what was due to the state were not granted all at once, but one at a time; and, on the other hand, there were cases where the public officer might enter the religious precincts. We may well imagine that these privileges would be eagerly coveted, and in regard to nothing in the mediæval times do so many forged documents exist as in regard to these grants of immunities. They were protected by fines very considerable in amount. But as free men commended themselves to the Church corporations to get rid of public service in war, an edict of 825 gives the counts the right to distrain on them, "notwithstanding the immunity." In some cases this privilege was given for hedged or enclosed lands only, not for plough, pasture, or wood lands, at least so far that breaches of it should not have the same penalty outside of the court and buildings as within.

This privilege evidently could amount, if bestowed on all holders of benefices (or fiefs, as we now may call them), to an overthrow of direct public power, and was evidently worth the efforts of the secular proprietors to secure for themselves. When and by what steps they obtained it does not so clearly appear as in the case of convents and other Church foundations. But such a privilege could not be confined to ecclesiastics, and in the unquiet times under the grandsons of Charlemagne, and afterwards, public power became weak, while at an equal pace the power of the landholding grantees became great. The smaller free proprietors could not stand alone in those times, but found it necessary, in order to protect themselves, to join some society where they could find protection, and so gave up their lands to a count or other great person, to receive them back as his men owing allegiance and securing support. The counts would naturally be large landholders within the county, and if their functions, at their death, passed out of the family, the son would naturally want to have the same authority in his estates which his father had in the county or district. These are some of the reasons which brought it about that multitudes of men, ecclesiastical and civil, in process of time got exemptions from public authority—that is, as far as justice, police, military headship were concerned—broke up society into fragments, and denationalized a great part of Europe.

These three causes, then, working together, produced the feudal system. Public property, by the distribution of lands in the way of beneficiary gifts, which were finally held by hereditary right, created great proprietors. Vassalage connected these proprietors by a personal tie with one another, and at length *only* with one another, the high vassals alone having immediate relations to the sovereign. Finally, immunity distributed in process of time the principal powers of the state to the vassals of the suzerain or to their vassals also. In this course of things different parts of Europe moved forward independently. In France, where there was very little allodial property, the maxim of feudalism was "Nulle terre sans seigneur." In Germany there were many small free proprietors who stood their ground, as in Ditmarsch, and many large proprietors whose allods alone, without their fiefs, were very wide territories. When Henry the Lion was deprived of both his Saxon and Bavarian dukedoms, in 1180, for his want of fidelity to Frederick Barbarossa, he had still in his hands the extensive Brunswick territories, which, when divided up, made several important German principalities.

In another particular, which was of no inconsiderable moment, the countries differed. In France, if we mistake not, all the feudal holdings became hereditary at an early day. It was otherwise in Germany and in Italy. In Germany there had been no acknowledgment of the right of the great vassals to transmit their imperial fiefs to their children until the emperor Henry II. silently acknowledged it in every known instance but one (1002–24). But still, the princes retained the right to dispose of the fiefs on the death of arrière-vassals as they pleased, until Conrad II. (1024–39) gave it to be understood—without any positive law, as it would appear—that the same usage must prevail towards them also, and thus raised up a class of friends to the imperial power among the smaller nobility. In Italy things were even worse for the arrière-vassals—the *valvassors* as they were called—until the same emperor by his constitution, given out before Milan, granted to the valvassors the right of inheritance in their fiefs, of trials by their peers, of appeal to the emperor or his deputies the counts palatine, and of security against the conversion of fiefs into leasehold or copyhold properties—a measure by which he made friends of the smaller nobles, and took away arbitrary power from the larger.

Feudalism grew up and spread in the different parts of Europe amid so many different influences, favorable or counteracting, that its minor diversities in the several countries were countless. Thus, in France the North was especially the home of customary law (*coutumes*), while the South retained influences from the Roman times. In England a duke of Normandy, a vassal of the French Capets for his French possessions, is supreme ruler under no superior, brings the land and land-tenures into the forms of feudalism, but endeavors to mitigate the disintegrating tendencies of that system and to uphold the royal power by modifications more or less drawn from the Saxon institutions. In Germany an elected emperor, an intimate connection with the papacy, a necessity during a long time for a vigorous head to protect the land from Eastern neighbors, with various other causes, gave a peculiar turn to many of the institutions. Here we see the old Teutonic ideas standing their ground, while foreign law and institutions are creeping in from Italy. So also if we look at the internal affairs of each part of Europe, we find opposing elements at work and a most vigorous, unquiet life; the kings, at war with their principal feudatories, leaning for support on the towns or the lawyers; the Church feudalized, but in contest with the unruly nobles, and falling back upon the ecclesiastical unity represented by the pope. And, to mention but one thing more, we discover new institutions like the towns arising, capital other than land becoming important, unions of the citizens of various communities against the nobles.

The theory of feudalism, not true in matter of fact, has been already stated to be that all the land belonged originally to the king, and was given over on certain conditions to his principal vassals, and by them to theirs. Long after the fiefs became hereditary their original lapse into the hands of the superior was indicated by the fine or payment called *relief* which the heir paid on entering into possession of his father's or next relative's possession. As the tenure was personal, the holder of a fief could not sell it without his

lord's consent, who had on such occasions the right of prior purchase, called *rachat.* The necessity of defending the kingdom or fief led for a time to the exclusion of females from succession, and, especially in France, to the indivisibility of a fief where a deceased person had left more than one son; but to these rules there were extensive exceptions. Where more than one fief pertained to a family, a subordinate one might be given to a younger son. In Germany subdivision among the male children of the fief-holder was the general rule. It was natural that if an unmarried daughter succeeded to the fief, the superior's consent should be necessary before she could marry the man of her choice. Again, when an heir was a minor there was a propriety that the superior should be his or her guardian—a very gainful thing for the higher vassal or for the suzerain.

As for the termination of the feudal relation, it could cease by extinction of the line; by the vassal's felony towards his lord, which comprehended a number of the grossest and most dishonorable actions in violation of his feudal oath; by the felonious conduct of the superior against his vassal (of which we have spoken already); or by the vassal's voluntary relinquishment of his fief where this was permissible. When a vassal's crime subjected him to loss of his fiefs, a judgment of a court of peers was necessary; the superior could not generally, by his own act, without such consent, declare him to have forfeited his estate. The most remarkable cases of such trial were that by which John of England, on sentence of his French peers, was stripped of the lands he held in France by homage as a vassal of Philip Augustus (A. D. 1203), and that by which Henry the Lion in 1180 lost the dukedom of Saxony, as has been already mentioned.

As feudalism grew up, not only laymen but ecclesiastics and corporations were invested with fiefs, and in fact the great bishops and abbots ranked in some countries among the most important feudatories. The kings were quite willing to have such vassals, for the lay barons gave them trouble by active resistance more frequently, and there was an opportunity, on the death of a feudal ecclesiastic, of influencing the appointment of a successor, as well as of deriving advantages from the introduction of a new ecclesiastical person into the feudal relation. But as the ecclesiastics holding fiefs had two characters—that of feudatories and that of churchmen under the pope—it was natural that just at this point there should be a conflict of secular and religious authority. The most important struggles of the Middle Ages grew out of the two characters of the ecclesiastical princes, the sovereigns being unwilling to give up their feudal rights over Church lands held as fiefs, and the popes claiming the independent relation of the great ecclesiastics toward the sovereign, as well as the inalienability and sacredness of lands once consecrated to religious purposes. As the bishops and abbots could not sit in capital trials according to the canons, and could not without irregularity take part in traffic, they needed lay vicars, who often managed to enrich themselves and grow into power at the expense of the foundations.

The complexity in the feudal system was increased by the fact that not only land, but everything that could be held as property, could take the form of fiefs. So also certain offices at the suzerain's court, as those of the high chamberlain, butler, seneschal, constable, pertained to certain families; and the counts palatine, who were originally assistants of their suzerain in the administration of justice, transmitted their title and the lands connected with their office to their sons.

The principal obligations of the fief-holders or vassals were the following:

1. Service in war (*service d'hoste*). The customary obligation in France, when the superior was involved in war or followed his own superior in war, was a military service of forty days with his men or with a fixed number, after the expiration of which the vassal could go home, although the war was not at an end. If certain specific reasons prevented his appearing at all, a fine (in Old France an *écuage*) could be demanded from him. Such a limited time of service of course broke up many expeditions. Hence, in France—which we select as especially the feudal country—toward the end of the eleventh century fiefs were granted on the condition that the vassal should serve until the end of the war. The vassal under these obligations was especially a liege-man (*homo ligius*—*ligius* being derived from the Latin *ligo*, to "bind," most probably), while the vassal bound to definite service was his lord's man simply, and his relation was called ordinary homage (*hommage ordinaire*). Still another kind of service, called *hommagium planum*, bound the vassal neither to service at his lord's court nor to service in war, but simply to fidelity and neutrality. Others, still, were bound to defend only a castle of their superior, and were maintained at his expense.

2. Another general obligation was that called *justitia*, or that the vassal must appear, when summoned, at his lord's courts, either to act the part of a judge, together with his fellow-vassals or peers (*pares curiæ*), or to submit to trial before them as judges. The rule was trial by peers, and the power of administering justice was vested in all the gradations of the feudal persons down to the knights (*milites*), who themselves, if there were free persons on their estates, were their natural judges. The great lords did their office by deputies for the most part, and in process of time their vassals came into the habit of having their representatives also. Besides other proof, wager of battle or trial by combat was a common method of deciding cases in these courts, being a kind of feudal ordeal.

3. *Aids or Auxilia.*—These were money payments, determined according to feudal usage. They were due in France and in England when the lord was to be redeemed from captivity, when his son (or eldest son) was made a knight, and when his daughter (or eldest daughter) was married. (Comp. *Magna Charta*, § 14.) At one time aids were demanded and given when the lord went on a crusade.

Besides these, the specific duty of fealty implied general respect and obedience, honesty in not altering the condition of the fiefs, and similar duties.

The feudal system not only broke up countries into almost independent parts, encouraged private feuds, and made the leaders of society a law unto themselves in great measure, but it rested on a system of serfage, which appears as well among the Germans before the emigrations as in the later Roman empire. Under it there could be no unity except that of the Church. Its evils were immense, but amid the evils, by the help of Christian ideas, there grew up the sentiments of honor and of fidelity, the spirit of courage and of personal independence, the sense of obligation to protect the weak, a new respect for woman unknown to the classical nations. Among its good principles of a political kind, those of trial by peers and of taxation only by consent of the taxpaying inferior were the most important.

At length the feudal system began to fall; new political ideas and forms, new powers in society, began to take its place; nations arose out of separate fiefs, and suzerains again became kings. What broke up feudalism? The most prominent immediate causes were the substitution of a better law in the place of feudal law, the growth of the cities, and new methods of warfare. These causes added strength to the central power, created an opulent class outside of the feudal nobility, gave birth to new political institutions, helped somewhat the lower classes, and brought in new knowledge, a new civilization. In the first place, as the feudal law was found inapplicable to the new circumstances which the growth of cities and of industry had introduced, the Roman law was called in the twelfth century out of the obscurity where it had long lain in the north of Italy; and the University of Bologna owed its origin or its first prosperity to this study. Hither multitudes resorted for the purpose of learning the new science. From this starting-point it was propagated through Europe. The courts of the suzerains made use of it, and with the more effect owing to the fact that the appeals to their courts, which had in France at least been long disused, were revived. In this way a code which was favorable to the growth of a central power began to prevail over one unsuited to the times, and the kings began anew to be regarded as centres of justice. In the next place, the growth of towns all over Europe in and after the Crusades was a source of changes in the political system. The towns acquired privileges by especial charters granted by their feudal lords, whose resources might in this way be increased. As they grew they became a new power, which, like the suzerain's, was naturally opposed to the feudal power. The kings aided them because both were enemies of the feudal nobility, and they in turn helped the kings. Their self-government, capital, and common interests made the towns, though isolated, aware of their strength; they were able to send deputies to the estates-general, parliaments, or cortes through which nations expressed their national feeling; they could give assistance to the kings in struggles against the feudal element by their men and money. Louis IX., who died in 1270, the best sovereign in the Middle Ages, in his testament exhorted his son to be mindful of the interests of the "good towns," as if there were a natural alliance between them and the sovereign.

Again, the new modes of warfare had advantages over the feudal military system, which was heavy in its movements and unreliable. Its great strength lay in its mail-clad horsemen. The use of cross-bowmen, gunpowder, guns, and cannon, and of a population in the towns or of freemen in the country who could serve as hired soldiers, changed the face of war. The battle of Crécy, gained by Edward III. of England in 1346, was due to two causes—that a yeomanry had grown up in England earlier than in France, and that these intrepid freemen were skilled at

the cross-bow. The battle of Agincourt (1415) was won by bill and bow, the French chivalry literally sticking fast in the mud, to be shot down by English archers. The victories of Granson and Murten or Morat (1476) were won by free Switzerland over the troops of the most feudal of princes, Charles the Bold. What is remarkable here is that the superiority as it respects arms lay on the duke of Burgundy's side, so that guns alone were not the cause of the fall of the feudal military system. But there is no doubt that the use of weapons capable of producing an effect at a distance gave to foot-troops, and to those who were cheaply equipped, a great advantage over the heavy-moving horsemen and the undisciplined infantry of feudalism, and thus helped the sovereigns and others who soonest availed themselves of the new instruments of war.

Underlying and acting with the other causes of the downfall of feudalism were the more general ones which indicated the progress of society. Intelligence was spreading in the middle class, but not so much in the higher. There were men in many towns who had travelled into the East and seen the institutions of the nations in remote parts; there were professional men who were cultivated in law or in medicine at the universities; there were great merchants whose views were enlarged by the intercourse which they kept up with the world; the arts were beginning to refine the dwellers in the towns; church architecture was already in its glory. It was impossible that capital, intelligence, the means of closer intercourse, should not have an effect in modifying political forms which had given power to soldiers and landowners less intelligent and with less available capital. The feudal lords themselves in many places entered the towns and became burghers, thus confessing that the centre of social life was altered.

The feudal period, one of the most remarkable in the history of the world, passed away, leaving a multitude of influences which will never die out of our civilization. We must not despise it; we ought to deal justly with it—to blame and to admire on good grounds. But it is becoming in the rapid progress of society more and more strange to us. Many of our institutions which sprang up in that institutional era need to be explained, as we explain Roman and Greek usages. The study of an age now ancient alone can make the origins of many customs and laws that are still vigorous, intelligible. T. D. Woolsey.

Feuer′bach (Ludwig Andreas), a German philosopher of great notoriety, b. at Landshut, Silesia, July 28, 1804; in 1822 went to Heidelberg to study theology, but removed in 1824 to Berlin, where, under Hegel's auspices, he devoted himself exclusively to the study of philosophy. In 1828 he gave a course of lectures at the University of Erlangen, and in 1844 another at the University of Heidelberg. Meanwhile he developed a great activity in literature, and wrote, besides numerous minor essays in periodicals, *Thoughts on Death and Immortality* (1830), *History of Modern Philosophy from Bacon to Spinoza* (1833), *Criticism of the Philosophy of Leibnitz* (1837), *Pierre Bayle* (1838), *Philosophy and Christianity* (1839), *Das Wesen des Christenthums* (1841), *Principles of the Philosophy of the Future* (1843), and *Das Wesen der Religion* (1845). After 1844 he retired to a small village in Franconia, where he lived, very poor and mostly occupied by practical employments, till his death, Sept. 12, 1872. A national subscription was raised for him shortly before he died.

Ludwig Feuerbach is the representative of the modern atheism in its German form. His polemic is often boisterous and uncouth, but his positive views are entirely free from that coarse or supercilious materialism which characterizes the English and French atheism. He dissolves the idea of God into that of nature; construes religion as the product of a merely psychological process—natural, perhaps necessary, at one stage of human development, ridiculous and injurious at another. His views on this last point contain many deep and striking psychological ideas, and it is not until he approaches Christianity, and begins to construe its doctrines too as resulting from the weakness and confusion of the human spirit, that he becomes crude, and sometimes even puerile. Clemens Petersen.

Feuillant Club, The, of the French Revolution, took its name from the cloister of the Feuillants, where its meetings were held. It was founded in 1790, and known at first as "the Company of 1789." We first hear of a Feuillant club in the summer of 1791, and by November of that year the club was suppressed. Its members were of the moderate party, and were consequently objects of popular violence. La Fayette was the most distinguished of its members.

Feuillants [from *Feuillans*, a village near Toulouse, where their first abbey was situated], a name applied to certain congregations of reformed Cistercian monks and nuns. Jean de la Barrière, abbot of Feuillans, began the reform in 1567. The reform was approved by the pope in 1586 and 1587. Their first house in Paris was instituted in 1588. Their severe rule was mitigated in 1595. The congregation was divided in 1630 into that of Notre Dame de Feuillans and the reformed Bernardines (the latter Italian). Nuns were admitted to receive the rule of the Feuillants in 1588. The nuns (Feuillantines) were first organized as a congregation in 1583 by Marguerite de Polastron. The Feuillants were one of the numerous remote branches of the Benedictine order.

The original abbey at Feuillans (*Folium, Fulium*), in Haute-Garonne, Languedoc, was founded in 1162.

Feuillet (Octave), dramatist, b. at St. Lô (Manche) Aug. 11, 1812; was educated at the College of Louis-le-Grand at Paris, where he distinguished himself; entered upon his literary career in 1844 under the name of Désiré Hazard, and since that time has been a constant contributor to various newspapers and periodicals, and has written many comedies, dramas, and farces, most of which have been received with much favor. Among his remarkable productions are *La Nuit Terrible, La Cérise, La Tentation, Redemption, The Sphinx*, etc., and of his works of fiction *Bellah, Le Roman d'un Jeune Homme Pauvre.* In 1862 he was elected to fill the chair in the French Academy left vacant by the death of Eugène Scribe.

Feuilleton [Fr., a "small leaf"], in recent French journalism, the name of that part of the sheet which contains the literary intelligence, criticism, and other similar matter. The feuilleton often contains tales, either complete or serial. Hence, a light romance written for a journal is often called a feuilleton.

Féval (Paul Henri Corentin), French novelist, b. at Rennes Sept. 27, 1817, was admitted to the bar at his native place, but soon became an author. Among his many novels the following have been translated into English: *The Lover of Paris* (1846), *The Duke's Motto* (1863), *The Woman of Mystery* (1864), and *Thrice Dead* (1869). Was made an officer of the Legion of Honor in 1869.

Fe′ver [Lat. *febris*, allied to *ferveo*, to "glow," to "be hot"]. In distinction from other diseases, which, however grave or extended, are confined to certain organs or systems of the body, fever may be said to be a departure of the *whole body* from its normal condition—a perversion of all the physiological functions. Not enough is known of the nature of the febrile process to make a definition of it possible. Even a description of it is difficult to give, considering the great variety of its forms and the difference of its degrees.

Symptomatology.—This difference will best be understood by selecting for description a febrile attack of average degree and duration. After a sensation of general *malaise*, of bodily as well as mental languor, with more or less headache, with pains in the back and in the limbs, loss of appetite, an accelerated and rather small pulse, and great sensitiveness of the skin to the temperature of the surrounding atmosphere, a *chill* sets in, causing involuntary shaking of all parts of the body, with paleness of the surface and a bluish tinge of the nails and lips. This stage, after having lasted a certain length of time, gives way to a sensation of *heat*, not merely felt by the patient himself, but also by others. The skin becomes turgid and congested, feels hot and dry, the pulse remains quick, but is fuller, the respiration is more hurried and irregular, the general restlessness becomes very great, the thirst intense, the appetite is wholly lost, the tongue is coated with a whitish film, the mucous membrane of the mouth and throat is dry, the urine is scanty, of a deeper color but clear, and of a greater specific gravity; the patient, who during the cold stage could hardly get on clothing enough, wants to free himself from every covering. After this stage of dry heat the skin breaks out in a profuse *sweat*, the dryness of the mouth and the thirst diminish, the respiration becomes deeper, more regular, and less frequent, the pulse, still accelerated, is full and bounding, the patient gets calmer, and often falls into a sleep, out of which he awakes with a pleasant sensation of well-being, although more or less debilitated.

Not all the symptoms just described must necessarily be present to pronounce a certain condition of the system as febrile in character. It is not always that fever is ushered in with a chill. Very often only slight horripilations and insignificant rigors precede the development of intense heat, which may pass off, scarcely moistening the skin by sweat. Instead of the great muscular pain and the torturing sensation of restlessness, there may be not more than a rather voluptuous feeling of laziness, and, in place of a distressing confusion of ideas, a not unpleasant play of the fancy may exist. The appetite is not always wholly lost, nor is the thirst necessarily great. The pulse, never as slow as in health, either from individual peculiarities, or from bodily enfeeblement antedating the fever, or from

long duration of the fever, may show great frequency, and yet not denote a very grave febrile state, provided other symptoms are moderate. The symptoms may vary too, in consequence of the coexistence, intrinsic or accidental, of local diseases, or according to the duration of the febrile process. With all these variations, producing the most different types of fever, it is surprising that the totality of symptoms so strikingly impresses the mind of even non-professional observers that hardly ever a mistake is made in pronouncing a patient "feverish."

But there is one symptom which is never wanting in fever, which can be measured with mathematical exactitude, which always keeps in true relation to the degree of the fever: it is the *increase of the temperature* of the body as determined by the thermometer. It varies from 98.5° F. (normal temperature of the body) to 108° F., or a little more (37.5° to 42° C.). There is no more certain and trustworthy guide to a correct judgment of the dangers threatening health and life from fever than the thermometer, and it is now universally adopted by the medical profession as a means of diagnosis and prognosis in fevers.

It is interesting in this respect to find with what unerring grasp popular instinct has seized on the leading symptom of fever, and made it the name-giver of this most complex morbid action in the different languages, at least of Indo-Germanic origin. Fever in Greek is *πυρετός*, from *πῦρ*, "fire;" in Latin, *febris*, Old Latin, *ferbis*, from *ferveo*, "I grow hot;" in German, *Fieber*, from the Old German, *Fiur*, "fire." All these words, it is believed, are from the Indo-European root, *pû*, to "purify."

The classification of fevers is based partly on scientific, partly on practical, partly on purely arbitrary grounds. The principal and really scientific distinction is between *idiopathic* (primary) and *symptomatic* (secondary) fevers. The first class comprises those varieties in which the fever is the only, or at least the first (primary), morbid action, so that local diseases occurring in the course of the fever must be considered as depending upon it, or as acceding to it, without cogent inner cause. These fevers are also called *essential* fevers, because they make up the essence of the disease. All zymotic fevers, be they contagious or miasmatic, belong to this class. Symptomatic fevers require a local disease as a preceding condition, by which the fever is started. All the fevers belong to this class whose names are derived from the *morbid process* which lies at their root; for example, inflammatory, catarrhal, rheumatic, hectic fevers; also all fevers named after the organs whose diseased condition causes them—brain, lung, gastric, enteric fever. Another principle of distinction is, whether fevers occur in solitary instances (*sporadic*), or whether they attack a larger number of individuals. In this latter respect, if they are circumscribed by certain limits beyond which they cannot be discriminated, they are called *endemic;* if migrating over extended spaces, ignoring varying climatic and other differences, *epidemic*.

The name of some fevers is derived from some predominating symptom—*e. g.* typhus (*τῦφος*, "stupor"), eruptive fevers, broken-bone fever, spotted, scarlet, yellow fever. Sometimes the real or supposed *cause* is made use of to give the name—*e. g.* malarial, septic, hay, jail, ship fever.

The name *bilious* fever is often given to cases of ill-defined type and varied character, very commonly with no special propriety; and the term is happily obsolescent.

A very important principle of distinction is what is called the *type* of the fever. It is characteristic of the febrile process that, while having, like most acute diseases, its stages of rise, height, and decline, yet it does not run through them with an even tenor, but that certain oscillations will be noticeable, the febrile symptoms showing an exacerbation and remission every twenty-four hours, or even in shorter intervals. The exacerbation in the greatest number of cases will set in in the evening and rise until about midnight, when the remission commences, so that in the morning hours all the symptoms are mildest. Yet, the symptoms never wholly disappearing, the fever is called a *continued* or *continuous* one. This peculiarity of the febrile process may be so marked that it nearly ceases in the morning—*remittent;* or the febrile symptoms may disappear altogether, to return on another day at about the same time—*intermittent*. This intermission may occur daily—*quotidian;* or every other day—*tertian;* or every three days—*quartan*. Or the fever may last with certain well-marked symptoms for several days, then disappear, returning after a couple of days' intermission, to react the former scene—*relapsing* fever.

A prominent feature of the fever is the one which refers to a condition of apparent augmentation or depression of the vital process as a whole. This constitutes the *character* of the fever, which is wholly distinct from its type, although carelessly this expression is used rather indiscriminately. If the essential symptoms of fever are average in degree and proportion, none preponderating unduly, the fever is called *erethic*. If the circulation is very much increased in force, the respiration is deep, the skin turgid and very hot, the eyes are glistening, it is a *synochal* fever. If, on the contrary, the stamp of exhaustion or suppression of vital forces is marked on the whole process, we speak of it as an *adynamic* fever. And if the disturbance of the depressed vital functions is coming on insidiously, or is such as to threaten almost at any moment their annihilation, we call it *malignant*.

From what has been said it is plain that the febrile process in the same individual and at the same time may belong to different varieties, according to the principle of classification applied. For example: typhus fever is always an idiopathic, zymotic, contagious, eruptive fever of a continuous type. It may be or not sporadic, malignant, ship, or jail fever.

Pathology.—To understand fully what occurs in fever, conditions would have to be fulfilled which to our present anatomical, physiological, and chemical knowledge are either totally hidden or obscure, or the realization of which is surrounded by such difficulties that they have become only partially solved. Granted a thorough knowledge of the anatomical structure of the organs and the systems of the body in perfect health; of their chemical composition; their relative and total weight; of the quantity and quality of secretions and excretions; and testing the same individual just emerging from a fever in all these respects,—the *ultimate* changes wrought by fever would be apparent.

To understand how these changes have been produced it would be necessary to know the quantity and chemical constitution of solid and liquid food consumed during the fever; the alteration of the circulation; the air inspired and expired; the quantity of force expended by voluntary and involuntary motion; the quantity and chemical composition of all secretions and excretions; and finally, the amount of animal heat generated during the fever. Moreover, to guard against any error vitiating the value of these facts, it would be necessary to eliminate all the influences of local diseases, producing the fever or being produced by it. Moreover, all the above occurrences would have to be gathered, not as a whole, but in parts, in regular intervals, some of them if not hourly at least twice a day, as it is known that periodical fluctuations do take place in the physiological state during the night and day. Of all these matters only a very small part has been studied with such frequency and thoroughness that results have been gained which are beyond doubt.

At present, instead of philosophical speculations and the coining of a more or less ingenious hypothesis, a true scientific method of observation and experiment rules the science of pathology; and if no great advances have been made in clearing up the pathology of fever, it is not altogether because the ways are unknown, but because the means and time to unravel the complex maze of the febrile process are not furnished even to scientific institutions, not to speak of single individuals.

What is known with certainty is this: that the waste of organic material is not merely owing to a diminished supply of food or to an imperfect assimilation, but that of all organic substances the albumen of the body is disproportionately consumed. This is shown by the fact that more than double the quantity of urea is eliminated than is normal. The quantity of urea cannot be increased unless a corresponding decomposition of nitrogenous substances by oxidation takes place. Further, more carbonic acid gas is given off, partly by breathing, partly by insensible loss, than under the same conditions in a state of health. The same is true of water. But neither of these substances is lost in so great a proportion as urea. Consequently, it is not improbable that the body does not become poorer in fat-generating substances. This at first sight somewhat paradoxical assertion finds its corroboration in the fact that at the close of very wasting febrile diseases—for example, typhoid fever—a marked fatty degeneration of the muscles is found. The coloring-matter of the urine is increased in quantity, which demonstrates disintegration of the red blood-corpuscles and of the muscles. The urine, too, contains a much greater proportion of salts of potash—another argument for the waste of red blood-corpuscles and muscles. Not much is known of the changes in the other non-organic acids and salts, nor of the quantitative and qualitative changes in the other secretions. But the known changes which have been alluded to cannot occur except by increased oxidation. And as oxidation is the source of heat, during fever more heat is necessarily produced. This increase of heat in the body is found even during the cold stage; and although the outer parts are colder than they are normally, yet within the cavities of the body the thermometer detects an increase of heat. This increase is somewhat moderated by the body giving off more heat by

conduction, radiation, and evaporation, or by all three combined. Nevertheless, the body retains a surplus, which keeps it hotter while the fever lasts than under the same conditions in the normal state. That wonderful regulation by which the body in the physiological state keeps its inner temperature at 98.5 F°., contracting the blood-vessels of the skin if the surrounding medium is cold, or causing evaporation by sweat if the surrounding medium is hot, although not entirely lost, is materially perverted in fever.

Pathogeny.—Limited and fragmentary as is the knowledge of pathology of fever, even less is known of its origin. One hypothesis has certainly been shown to be untenable—namely this, that an irritation of the peripheral nerves can produce an alteration in the nervous centres, in consequence of which fever is originated. That fever can be produced experimentally by injecting septic substances into the blood—that contagious and infectious fevers are the result of peculiar substances, which get into the circulation either because they float in the air we breathe or because they are contained in what we eat and drink—is beyond doubt. The inference, then, is strong that secondary fevers also are generated in a similar manner, the local diseases producing some substance which if absorbed contaminates the blood in such a way that fever must follow.

In what manner this is done is unknown. Some pathologists of the humoral school would have it that the organic and chemical changes in the blood alone are sufficient so to alter the whole process of nutrition and assimilation that a general disease, called fever, must be the result. According to their views, the nervous system would be degraded to, as it were, a mere registering apparatus for the changes which occur, without originating or influencing them. Another party, although recognizing that the blood is the first bodily constituent on which the fever-exciting cause acts, maintain that no fever could arise if the blood, having undergone certain changes, did not act in a manner on the nervous centres—that the functions of nutrition, assimilation, secretion, and particularly the regulation of animal heat, cannot be kept any longer in physiological harmony by the nerves leading from the nervous centres to the peripheral parts. This latter hypothesis, although it has hardly reached yet the dignity of a theory, seems the more probable one, and is held by far the larger number of pathologists. (The more important varieties of fever are described under their alphabetical heads.)

ERNST KRACKOWIZER.

Fever Bush, the *Lindera Benzoin*, a handsome shrub of the order Lauraceæ, common in the Northern States. Decoctions of its bark and leaves have been used for aromatic and stimulant drinks in low fevers. Its red spicy berries have afforded a poor substitute for allspice. It is also called spice bush and benjamin tree.

Fe'verfew (*i. e.* a "febrifuge"), the *Pyrethrum Parthenium*, a large perennial herb of the order Compositæ, resembling chamomile, and a native of Europe, sparingly naturalized in the U. S. There are some fine cultivated varieties, which are prized in the flower-garden. It was formerly much used as a deobstruent, tonic, and febrifuge. It is not much used, but it has valuable medicinal powers.

Fe'verwort, Wild Ipecac, Horse Gentian, or **Tinker's Weed,** a coarse perennial herb of the U. S., the *Triosteum perfoliatum* of the order Caprifoliaceæ. Its root is used as a cathartic and emetic. It is mild and usually safe. A smaller species, *Triosteum angustifolium*, grows in the Southern States.

Few (IGNATIUS A.), D. D., LL.D., an eminent minister of the Methodist Episcopal Church, South. He was b. in Augusta, Ga., Apr. 11, 1789, and d. in Athens, Ga., Nov. 28, 1845. He was educated at Princeton and New York, and his legal studies were directed by Gen. Flournoy of Augusta. In 1812 he obtained a colonel's commission in the army, which he honorably held till the close of the war, when he returned to his legal practice. He was at this time tinctured with infidelity, but, becoming a Christian, he shortly after (in 1828) entered the ministry of the Methodist Episcopal Church, in which he soon rose to great eminence. He was the founder and first president of Emory College, Oxford, Ga. He was distinguished in the highest councils of the Church, and was an able defender of the South in the General Conference of 1844, when measures were adopted which led to the organization of the Methodist Episcopal Church, South. He suffered for years from hæmorrhages of the lungs, which occasioned his death. He was highly esteemed for his encyclopædic attainments and abundant labors, and as much beloved for his catholicity of spirit and childlike simplicity. T. O. SUMMERS.

Few (WILLIAM), b. in Baltimore co., Md., June 8, 1748, removed in 1758 to Orange co., N. C., and to Georgia in 1776. He was chosen to the State convention to form a constitution, as also to the assembly, and made one of the council. With the rank of colonel he served in the war of the Revolution; in 1778 he became surveyor-general, and also presiding judge of the Richmond co. court. From Jan., 1780, to 1783, he was delegate to the old Congress, and also in 1786; a member of the national constitutional convention in 1787, and of those of the State of Georgia in 1796 and 1798; U. S. Senator from Georgia 1789–93, and then three years on the bench. He removed to New York in 1799, and was afterwards in the State legislature, commissioner of loans, and mayor of the city. D. at Fishkill, N. Y., July 16, 1828.

Fez, province of the empire of Morocco, by which it was conquered in 1548. It is bounded N. by the Mediterranean, E. by Algeria, S. by the mountains of Atlas, and W. by the Atlantic. It is a rich champaign country, productive of wheat, honey, tobacco, olives, and wine. Its population is estimated at 3,200,000.

Fez, Fes, or **Fas,** the capital of Morocco, numbers 100,000 inhabitants, and is situated, according to the statement of the Spanish general Badia (Ali Bey el Abassi), in lat. 34° 6′ 3″ N. and lon. 5° 1′ 11″ W., in a valley on the north-western slope of the Atlas, surrounded by mountains on all sides except towards the S. Two rivers run through the city, changing their names whenever they change their course. Thus, the river which rises about 20 kilomètres S. W. from Fez is first called Ras-el-ma, and then, on entering the city, Ued-Fes; in the city it unites with a larger river coming from the S. E., and after the conjunction it is first called Ued-Fes, and then Ued Tebu, which latter name belonged to the larger river before it entered the city. Fez consists of Old Fez (Fes-el-bali) and New Fez (Fes-el-djedid), and these two parts of the city are two kilomètres distant from each other, connected with one street only, which, however, is densely set with houses. Old Fez lies to the N., and its eastern part rises with the slope; New Fez lies to the S., wholly in the valley. Old Fez numbers sixteen quarters and has seven gates; New Fez, only two quarters and three gates. The above-mentioned rivers unite between the two parts of the city, and run then through Old Fez, dividing it into an eastern and a smaller western part, which are connected with each other by six stone bridges. Both Old Fez and New Fez are surrounded with walls from 30 to 40 feet high, from 6 to 7 feet broad at the base, about 3 feet at the top, and built of a mixture of clay, lime, and cement; only the gates are framed with stone. At each 350 mètres rises a quadrangular tower constructed to hold cannon, and the upper passage of the wall has loopholes adapted for defence. But the walls are in very bad repair; only those of New Fez are a little better preserved, and some of their towers rise to a height of 80 feet. Yet, although two detached forts of stone are added to these fortifications, one to the E. and one to the W., they would afford no real power of resistance except against a native enemy. Fez makes, generally, a gloomy impression, as the streets are very narrow, the public squares very small, and the houses two or three stories high, without presenting any windows to the street. Pavement does not exist, whence an immense dust in the summer and deep mud in the winter. The interiors of the houses, however, are often very handsome, the yards being paved with marble and the walls and ceilings of the rooms covered with light colors. Each house has a spring or fountain to wash away offal and dirt. The palace of the sultan of Morocco comprises the whole south-western part of New Fez. This gigantic palace consists of many large yards provided with arcades and surrounded with buildings. The harem, situated separately in the S. E. corner, affords room for more than 1000 women. The garden is beautiful, and yields the finest European vegetables. Besides this, the sultan has another but smaller palace called Bu-Djelud, situated between Old and New Fez, and built—probably by European renegades—in the style of the Renaissance, blended with Moorish ideas. A couple of miles S. of New Fez he has a summer palace, and here is laid out a camping-ground (Mhalla) for the army, which is always stationed near the person of the sultan, the soldiers encamping in tents. Among the remarkable buildings are also the mosques of Karubin and El Mulei Edris. The former is of immense dimensions, and rests on about 800 columns. It is situated in the middle of Old Fez, and is very rich. Its architecture is without harmony, heavy but durable. A library consisting of manuscripts is connected with the mosque, and even science is taught here. The mosque of El Mulei Edris, named after the founder of the city, lies close by the Karubin, is very old, and of an architecture which evidently imitates the Christian temple. It has no court. The main building consists of one single quadrangular nave without columns, and contains the tomb of Mulei Edris. This mosque is a refuge for fugitive criminals. Fez has eleven mosques of importance, besides a

great number of smaller ones. Although the natives are hospitable in the highest degree, yet the great conflux of foreigners has made inns and hotels necessary. The best ones, which are built to lodge both men and animals, are called *tenaduk;* they are large and substantial buildings, but entirely without furniture. The city has a considerable trade with Marseilles, Gibraltar, Cadiz, and Lisbon. Raw and manufactured silk, cotton, cloth, paper, arms, tea, sugar, and spices are imported from Europe. Tanning, weaving, and pottery are the principal manufactures of the country, and form the exports. Fez is unsurpassed in the manufacture of silk scarfs. The inhabitants are a mixed race of Arabs and Berbers, ugly, very uncleanly, and fanatical in religion. From 8000 to 10,000 Jews live here.

Fez was founded at the end of the eighth century; as to the exact date, authorities disagree. Edris, a relative of Haroun-al-Raschid, was its founder, and he was very fortunate in selecting the location of the city. From several points in the surroundings of Fez it seems evident that there must have been earlier Roman settlements in these localities. The etymology of the name of Fez is uncertain. At the time of the Crusades it was one of the most magnificent cities in the Mohammedan world, but since the middle of the sixteenth century it has declined.

A. Niemann.

Fezzan′ [the ancient *Phasania*], a kingdom of Northern Africa, between lat. 24° and 31° N. and lon. 12° and 17° E., bounded N. by Tripoli, and on the other sides by the Sahara. The northern part of the country is covered with bare hills of black quartz sandstone, without rivers and almost without vegetation. The southern part is level land, often consisting of dry sand. Only one-tenth of the soil is cultivable. The climate is in summer extremely hot, and at all seasons very dry. Wheat and barley are cultivated; dates, figs, and lentils are the principal articles of food. Horses and camels are reared, but cattle, and even sheep, are rare. Lions, tiger-cats, and jackals are abundant; also gazelles and ostriches. The inhabitants, whose number is estimated at about 50,000, are a mixed race of Berbers, Tuaricks, Arabs, and negroes. They are governed by a sultan, who pays a tribute to the viceroy or *valy* of Tripoli. Moorzook is the capital and the rendezvous for the caravans coming from Cairo, Tripoli, and Timbuctoo, which occasion a considerable trade.

Fibre. See Nerve-Fibre, by E. C. Seguin, M. D.

Fi′bre [Lat. *fibra*, a "filament"]. Man has for ages availed himself of the filamentous character of various parts of plants to make clothing, domestic utensils, parts of instruments of the chase, and shelter for himself and his possessions. The animal kingdom has also been laid under contribution from the earliest times, and even the mineral kingdom contributes, in the substance known as asbestos, a fibre—in the general sense of the word—which has various uses in the arts. The history of the employment of these different materials, their uses, and the details of those processes of manufacture by which they are converted into fabrics for the use of man, belong properly to the different articles in this work in which they are severally described. (See Silk, Wool, etc.) But the minute characteristics of the principal vegetable fibres, and the points on which their value for particular purposes depends, are most conveniently studied by grouping them under one subject. Anatomically considered, vegetable fibres may be referred to three different sources: viz. (1) plant-hairs, (2) fibro-vascular bundles, or (3) the separate constituents of the latter. (1) The important plant-hairs employed for textile purposes are the long, single cells which are attached to the seeds of certain species of *Gossypium* (cotton). (2) Fibro-vascular bundles are obtained from the stems of endogenous plants, and consist chiefly of long bast-cells, with an admixture of spiral ducts (*e. g.* Manila hemp). (3) The principal elements of fibro-vascular bundles of exogens—namely, bast-cells and woody tissue—are used separately as fibres for spinning or for papermaking (*e. g.* flax and poplar-wood). These structures are cells of different shapes, sizes, and thickness of wall. Although they are derived from sources so different, they possess in common certain chemical and physical properties which must be considered before an examination of individual fibres is undertaken.

Chemical Characters.—The principal material of vegetable tissues consists of cellulose ($C_6H_{10}O_5$, or some higher multiple, $C_{18}H_{30}O_{15}$). This is generally accompanied by an incrusting substance which greatly reduces the flexibility of the fibre. Fibres are freed from this incrusting matter by the careful use of acids, alkalies, and bleaching agents. Cellulose dissolves in an ammoniacal solution of cupric oxide. (For an account of other changes produced by chemical agents, see Gun-cotton, Parchment-paper.)

Physical Properties.—Fibres vary in color, from the snow-white of china-grass (*Böhmeria nivea*) to the grayish-black of *Tillandsia.* All vegetable fibres are doubly refringent in polarized light. The conductive power of vegetable fibres for heat appears to be greater in the direction of the length of the fibre than perpendicular to it. The hygroscopic power of fibres is shown in the following table by Wiesner (*Rohstoffe,* § 293):

Fibre.	Percentage of water when air-dry.	Greatest amount of water.
Esparto	6.95	13.32
Belgian flax	5.70	13.90
Cotton	6.66	20.99
Fresh jute	6.00	23.30
Manila hemp	12.50	about 40.00

Cotton.—Cotton fibres are the hairs which grow upon the seeds of species of *Gossypium,* plants belonging to the mallow family. Five species, now much mixed up, produce most of the cotton of commerce—*G. arboreum, barbadense, herbaceum, hirsutum, religiosum.* In India and China *G. arboreum* and *religiosum* are extensively cultivated; *G. hirsutum* is common in the West Indies; *G. barbadense* and *herbaceum* are those best known in the U. S. The seeds are numerous in the capsule (boll), which splits from the top into three or five parts as the fruit ripens. Each seed is clothed with delicate cells of variable length. Very short hairs are mixed thickly with the longer cells, which are used as fibres. The longer cells vary in length within certain limits in different species; the following measurements by Wiesner are averages:

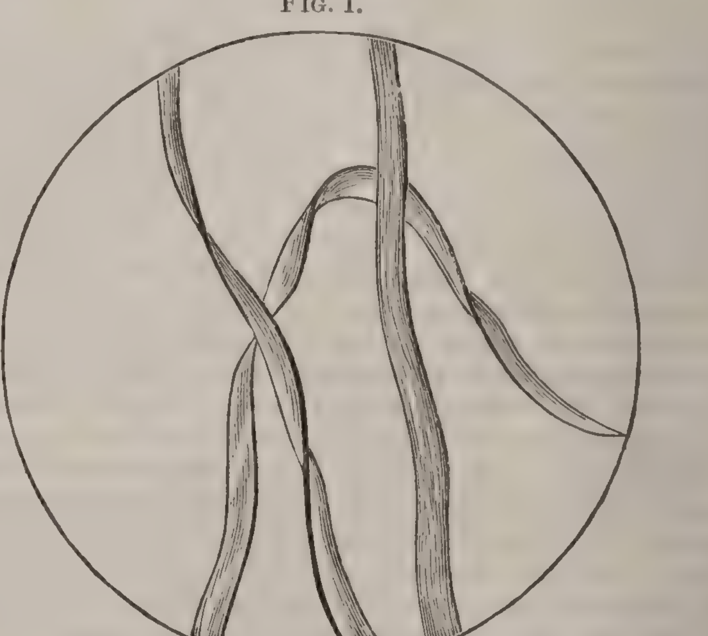
Gossypium barbadense	3.89–4.05 cm.
" *arboreum*	2.50
" *herbaceum*	1.03–1.82 cm.

The cells are slender cylinders, with a slight enlargement a little above the base, after which they taper to the summit. The thin walls collapse and twist as the seed ripens, so that the slender, tapering tubes become spiral bands. The breadth of the flattened cells varies in different species. The measurements (from Wiesner) are given in fractions of a millimètre:

G. barbadense,	0.0192–0.0279,	most common	0.0252
G. arboreum,	0.0200–0.0378,	" "	0.0299
G. herbaceum,	0.0119–0.0220,	" "	0.0189
G. religiosum,	0.0255–0.0400,	" "	0.0333

The spiral is irregular, sometimes turning to the right, and then abruptly turning in the opposite direction; occasionally, there is simply a folding of one edge of the band over the other. These spirals adapt the cells for spinning. Contiguous fibres cling together slightly by interlocking their spirals as they are drawn out, and this slight grasp is strengthened by torsion of the thread at the spindle. Length of fibre is known in the cotton trade as length of "staple."

Fig. 1.



Cell of cotton (170 diam.).

Under a magnifying power of 200 diameters, the flattened cell, if ripe, exhibits plainly the cell-walls and the space between them, which is filled with air. In exceptional cases the walls are thick, and then the air-space is reduced to a slender dark line. The surface of the wall has a cuticular layer, which may appear unevenly striated, somewhat granular, or nearly smooth. When a cotton fibre is placed in an ammoniacal solution of cupric oxide, the cell-wall dissolves, and leaves the cuticular layer somewhat altered in shape. The same phenomenon is observed in the case of other plant-hairs—for instance, vegetable silk—but never in bast-cells. This use of the solvent serves for the positive discrimination of the textile plant-hairs. The cotton fibre is usually white, but may be tinged yellow (*G. religiosum*). The finer short fibres are frequently colored green (*G. hirsutum*). This becomes rose-red on the addition of dilute acid, but the green color is restored by

ammonia. The removal of the cotton fibre from the epidermis of the seed is effected without material injury to the hairs of black-seed cotton by means of the saw-gin. In green-seed cotton the fibres are more closely adherent. The shorter hairs which remain after the ginning are utilized in papermaking. The characters which determine the commercial grade of cotton are length of staple, fineness, and whiteness. In sea-island cotton, always black-seeded (*G. barbadense*), the latter qualities are found combined with great length of staple. The cotton of Louisiana is short-stapled, fine, and white; that from *G. religiosum* (and *G. flavidum*) is short-stapled, fine, and yellow.

Bombax Wool.—The mature seeds of many Bombaceæ are packed in their capsules in a mass of silky hairs which have become detached during ripening. These hairs are single cells of brilliant lustre and a yellowish-brown color. It cannot be spun except when mixed with cotton or other fibres, which it can in no way improve.

Vegetable Silk.—Under this name are grouped the fibres which grow on the seeds of many milkweeds (Asclepiadaceæ and the like). The remarkable fineness and lustre of these fibres have led to many futile attempts to employ them, either alone or with cotton. The fibre is so weak and brittle that it would be useless for weaving even if it could be spun. A species of *Beaumontia* in India yields a vegetable silk of greater strength and almost pure whiteness. It is used in the manufacture of artificial flowers.

Fibro-vascular Bundles of Endogenous Plants. — *New Zealand Flax.*—This fibre is obtained from *Phormium tenax*, now extensively cultivated in New South Wales. The leaves yield 22 per cent. of merchantable fibre. The fibre is yellowish, and composed of bast-cells mixed with ducts and cambium-cells. The bast-cells are 0.008–0.0189 millimètre broad, and 2.7–5.65 millimètres long. These form the raw fibre, which often exceeds a mètre in length. New Zealand flax is fitted for cordage by its strength and resistance to the action of water and the atmosphere. According to Labillardière, the absolute strength of New Zealand flax, hemp, and flax are in the ratio of 60 : 48 : 34.5 ; silk = 100.

Aloë Fibre.—This is obtained from tropical species of *Aloë*. The fibre is white, of brilliant lustre, and of nearly the same thickness throughout its great length of 20–50 centimètres. It is made up chiefly of bast-cells 1.3–3.72 millimètres long, which do not readily separate from the bundle. The fibres are used in the rough state for cordage. The finest aloë fibres are spun and woven for fine muslins.

Manila Hemp.—This fibre, known also in commerce under the names plantain fibre, Siam hemp, Menado hemp, and white rope, is obtained from the clasping leaf-stalks of *Musa textilis* of the Philippine Islands. The fibres of other species of *Musa* have been employed, notably the plantain and banana. The outer parts yield coarse fibres seven mètres long—the inner, finer, about two mètres. The fibre consists chiefly of bast-cells 2.7 millimètres long and .029 millimètre thick. Manila hemp is used for cordage.

Agave Fibre, from *Agave Americana*, now cultivated in many warm climates, is less tough and flexible than Manila hemp. It is extremely light, and is capable of extensive use in rigging, but it has of late been more employed as an addition to bristles in the manufacture of brushes.

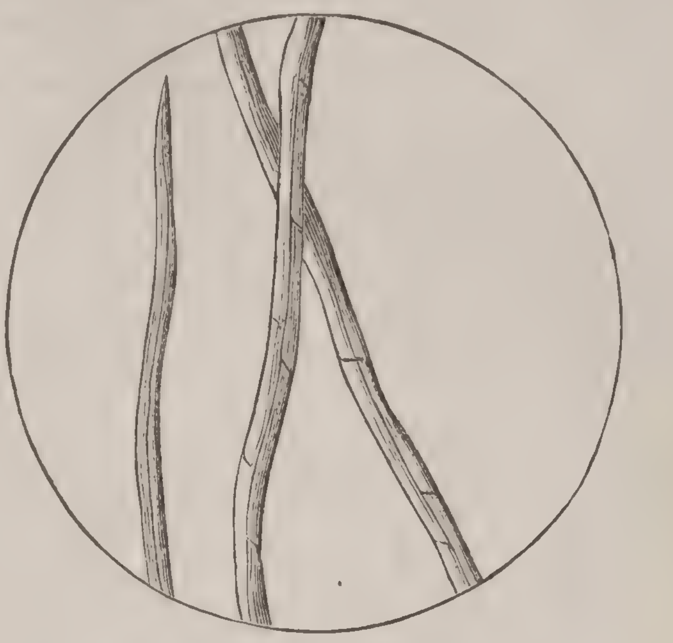
Cocoanut Fibre, from species of *Cocos*, a tropical palm, is known in commerce under the name coir. It consists of the fibro-vascular bundles of the husk of the fruit. It is reddish-brown in color, very strong, and withstands the action of water for a long time. It is regarded by Grothe as the lightest of all fibres which can be used for making cordage. The raw fibre is 15–33 centimètres thick, and consists of many structural elements. The bast-cells are the most important. These are from half a millimètre to one millimètre in length, and 0.016 m. broad. The walls are unequally thickened. Coir is one of the most important vegetable fibres of the tropics. It is now used for twine, cordage, tapestry, brushes, coarse paint-brushes, and even machine-belting.

Pineapple Fibre.—The fibres of the leaves of several species of *Bromelia* are employed for textile purposes. *Bromelia Karatas*, of South America, yields a whitish, glistening fibre which resembles Manila hemp, but is coarser, weaker, and less flexible. The fibres are cylindrical and about a mètre in length, seldom exceeding 1.2 millimètres in thickness. Its constituents are chiefly thin-walled bast-cells, with a few spiral vessels. When carefully prepared the finest fibres can be used for delicate fabrics.

Bast-Fibres from Exogenous Plants.—These are the inner layer of the bark. They are long, flexible cells, with thick walls, aggregated with parenchyma in bundles or bands which are separated by very narrow (or in some cases wide) medullary rays.

Flax.—This is the bast-fibre of species of *Linum*, chiefly *L. usitatissimum*, of which there are several varieties. The separation of the bast-fibres of flax, hemp, etc. from their contiguous tissues involves mechanical and chemical manipulations which are elsewhere described in detail. The stems are first subjected in mass to the action of water, either cold or warm. A kind of fermentation ensues, after which the bast-fibres can be separated from the surrounding tissues by mechanical means. The processes are known as "retting" and "scutching." The best results have been reached by what is known as warm-water rotting, followed by the use of a heckling machine, from which, according to the quality of the flax-plant, 15–20 per cent. of pure flax has been obtained. The length of flax fibres thus separated varies from a fifth of a mètre to a mètre and two-fifths; their width varies from 0.045–0.620 millimètre. The fibres are made up of regular cylindrical cells which taper towards the ends. The calibre of the cells is very minute, and is often reduced so that it appears a mere dark line. The cells are 2–4 centimètres long and from 0.015–0.017 millimètre broad. Here and there minute canals are to be detected in the walls, and by crushing the cell-wall exhibits spiral markings. The microscopic appearance of fresh flax bast-cells differs from that presented by manufactured fibre. The thickening layers of

FIG. 2.

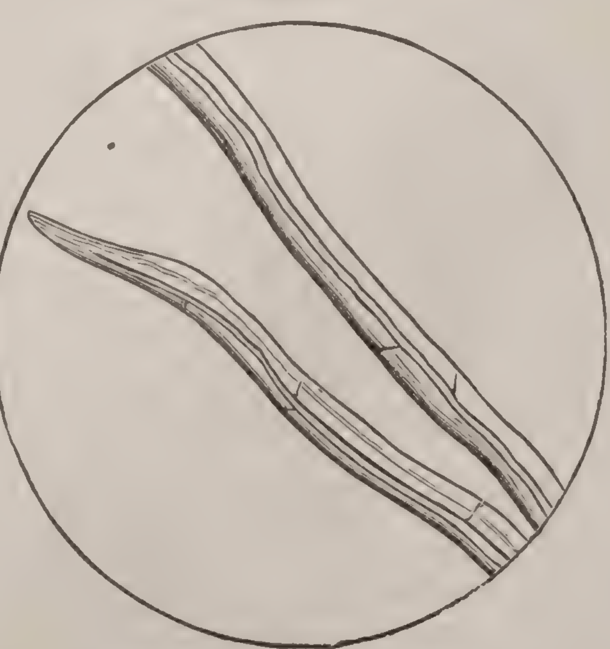


Bast-cell of flax (170 diam.).

the cell-wall are more or less broken, and the cells are covered with dark lines which are nearly parallel to each other, and generally run in the direction of the length of the cell. This appearance is seen under a magnifying power of 200–300 diameters. The best flax fibre is whitish, and this absence of color is secured by the best methods of preparation. Much of the Belgian flax is steel-gray, and that of Egypt is grayish-yellow. Flax has a delicate silky lustre. The total absence of any lustre is an indication that the bast-cells have not been wholly freed from surrounding tissues. Irish, Belgian, and, of late years, Italian flax is regarded finest. The Irish fibre is very fine, soft to the touch, and strong. Many Belgian varieties are nearly as fine as the Irish, and exceed it in length. The longest fibre comes from Egypt. It is coarse and hard to bleach, but very strong. The use of flax in the manufacture of linen thread and linen fabrics can be traced farther back than that of any other textile vegetable fibre. It is spun before bleaching.

Hemp.—This fibre consists of the bast-cells of *Cannabis sativa*, a plant of the nettle family. Hemp fibre is generally longer than flax fibre, sometimes reaching a length

FIG. 3.



Bast-cell of hemp (170 diam.).

of one or two mètres, or even more. Whitish and grayish fibres are best, the greenish come next, and lastly come the yellowish. Hemp fibre, even when finest, contains a mix

ture of parenchyma with the bast-cells. The latter are not so regular as those of flax. The walls are not always equally thick, but they are in general strongly thickened, and exhibit the canals which have been described under *Flax*. The air-space in the cells equals one-third of the whole breadth of the cell. Wiesner has shown that an ammoniacal solution of cupric oxide serves for the discrimination of hemp from flax. Under the influence of this agent the inner layer separates and becomes much crumpled, while the outer portion of the cell-wall becomes swollen and exhibits a fine parallel marking. Flax and cotton become blue by the action of iodine solution and sulphuric acid, but hemp turns somewhat greenish. The finest hemp is Bolognese, but by far the largest amount comes from Russia. It is not so fine as the hemp from Prussia or Austria. The hemp produced near Strasbourg is used for spinning. Hemp is chiefly used for fine and coarse cordage.

Mallow Hemp.—Several plants of the mallow family yield fibres which may be treated of in this place.

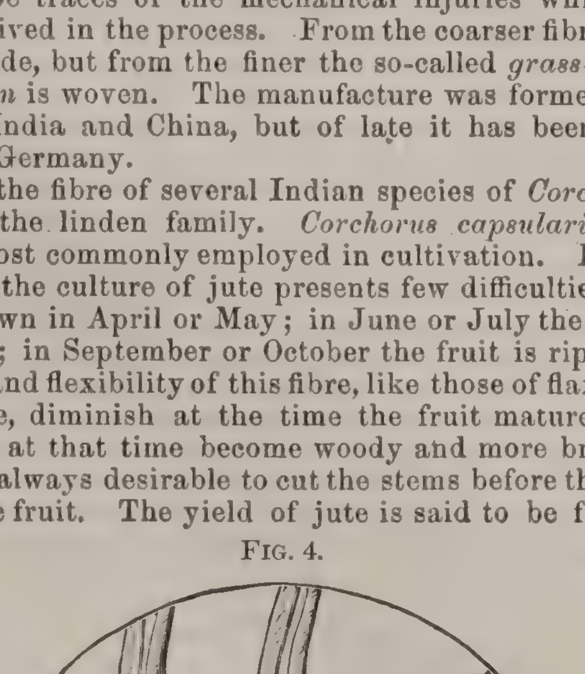
Hibiscus cannabinus of India, now cultivated in the West Indies, where it is called *ambaree*, has fibres of unequal length and differing greatly in their thickness. The bast-cells are 4–6 millimètres long and .020–.041 millimètre thick.

Sida retusa and other species of *Sida* are much used in India as sources of fibres, which are coarse or fine according to the mode of preparation. The bast is without lustre and of remarkable strength. The fibres consist almost wholly of flattened irregular cells, which in other characters much resemble the bast-cells of flax. Sunn hemp is produced from stems of *Crotolaria*, a plant of the pulse family. It is a fine and very strong fibre, only slightly hygroscopic. It is known in India also as Madras hemp. The flattened fibres are striated, and vary in width from 0.02–0.35 millimètre. Tercum fibre and Jetee fibre are from the stems of plants of the milkweed family.

China-Grass and Ramie.—These are from plants of the nettle family—the first from *Böhmeria nivea*, and the second from *B. tenacissima*. China-grass is cultivated in India and Southern China. The bast is very tough, and can be finely divided into minute fibres, which are known as cottonized fibre. It is whiter and more lustrous than ramie fibre, but in other respects does not differ widely from it. *Ramie* is cultivated in China and Japan and in some parts of America. By the "cottonizing" process the fibres are broken up into the bast-cells, which are themselves sometimes broken. It is frequently possible to detect under the microscope traces of the mechanical injuries which they have received in the process. From the coarser fibres cordage is made, but from the finer the so-called *grass-cloth* or *grass-linen* is woven. The manufacture was formerly confined to India and China, but of late it has been undertaken in Germany.

Jute is the fibre of several Indian species of *Corchorus*, a plant of the linden family. *Corchorus capsularis* is the species most commonly employed in cultivation. In warm countries the culture of jute presents few difficulties. The seed is sown in April or May; in June or July the plant is in flower; in September or October the fruit is ripe. The strength and flexibility of this fibre, like those of flax, hemp, and ramie, diminish at the time the fruit matures. The bast-cells at that time become woody and more brittle, so that it is always desirable to cut the stems before the ripening of the fruit. The yield of jute is said to be from two

FIG. 4.



Bast-cell of jute (170 diam.).

to five times as great as that of hemp or flax. The stalk is three to four mètres high. The fibre of jute is very silky, slightly colored, and composed almost wholly of bast-cells, which are cylindrical, somewhat flattened, or prismatic. The cells are 0.8–4.1 mm. long, and 0.016 mm. thick. The most striking peculiarity of its microscopic structure is the total lack of parallelism between the inner and outer surfaces of the wall. At many points the cell-wall is much thickened, while in others it is as thin as in vegetable silk. The same unevenness is seen in a few other fibres, but not in flax or hemp. Jute in its finest state has such a brilliancy of lustre, and takes colors so well, that it has been much used to mix with silk. Much has been employed as a substitute for human hair in the manufacture of chignons, etc. Of late it has found an extensive use in papermaking. Jute was formerly imported from Calcutta, and was used chiefly in the manufacture of bagging. The term gunny bagging (*goni*, a Madras word) was applied not only to this, but to coarse fabrics made out of sunn, *Crotolaria juncea*. Much jute is brought into the market in the form of jute butts, in which state it is taken by the papermakers. A fibre much like jute, and frequently mixed with it, is obtained from *Abelmoschus* (*Hibiscus*) *tetraphyllos*, a plant of the mallow family from India. The bast-cells are 1–1.6 mm. long and about 0.016 thick.

Esparto Fibre.—This is obtained from the stems and leaves of *Macrochloa tenacissima*, a grass of South-western Europe. The fibre has been employed in the manufacture of coarse twine, but is now used wholly for papermaking.

Any of the fibres which have been spoken of can be used in the manufacture of paper, but only a few of them can be economically employed for this purpose at first hand. The fibres first serve in cordage or in woven fabrics, and then are turned over in the form of rags to the papermaker. Fibres for paper must be waste products or very cheap raw material (for instance, wood-tissue) which can be economically worked. *Zizania* (wild rice), *Phragmites* (reed), and the straw of cereals are used in the manufacture of different grades of paper.

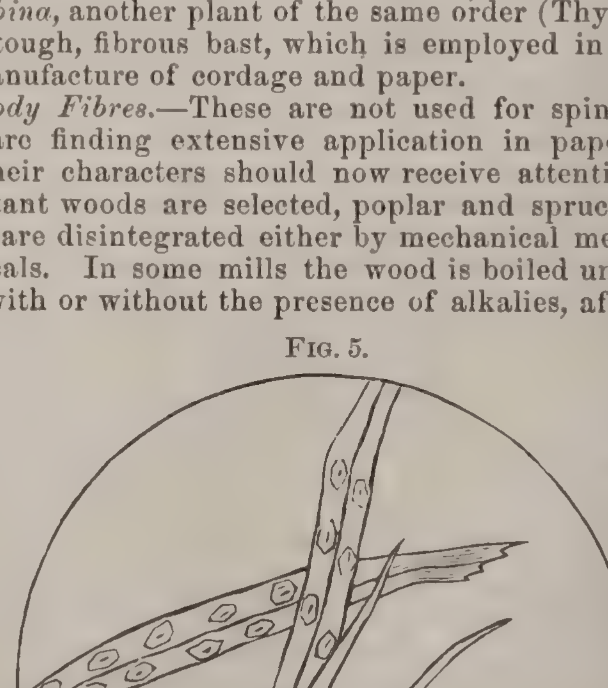
Paper Mulberry.—This plant, which belongs to the fig family, furnishes the fibres of which the tapa cloth of Polynesia and the common paper of Japan are made. The inner bark is beaten to a pulp and spread out in thin layers. Much of the Japanese paper contains some vegetable mucilage by which the texture is rendered firmer, but in general the tissues cohere without the addition of any *size*.

Bast Tissue.—The bast of the linden and some other exogenous plants may be separated from the stem in broad and thick bands, which can be split up into thin ribbons. From these thin bands the coarse Russia matting is made.

Bast of the Linden (*Tilia parvifolia* and *T. grandifolia*).—Stems thirty to forty centimètres high are best for the purpose. From these stems strips six to seven centimètres broad can be taken. Their ultimate bast-cells are very thick-walled, and sometimes much widened in the middle. Cuba bast, used for tying up packages of cigars, is from *Paritium tiliaceum* and *elatum*, plants which may be referred to the genus *Hibiscus*, of the mallow family. *Lagetta lintearia*, the lace-bark tree, yields a delicate but strong white bast which has open meshes like coarse lace. *Daphne cannabina*, another plant of the same order (Thymelaceæ), has a tough, fibrous bast, which is employed in India for the manufacture of cordage and paper.

Woody Fibres.—These are not used for spinning, but they are finding extensive application in papermaking, and their characters should now receive attention. Two important woods are selected, poplar and spruce, both of which are disintegrated either by mechanical means or by chemicals. In some mills the wood is boiled under pressure, with or without the presence of alkalies, after which

FIG. 5.

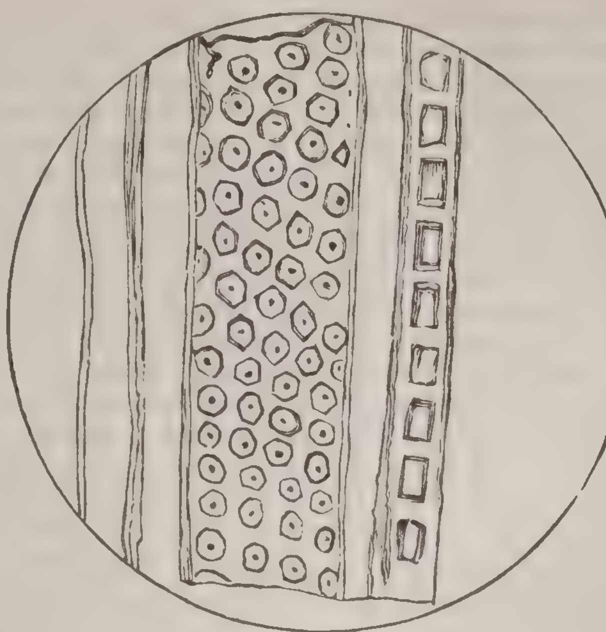


Poplar fibre (170 diam.).

it is easily broken down into its cells.. In the Voelter process the wood is simply ground upon a rough surface, and

the fibres are sufficiently fine for papermaking. The processes will be found described under the title PAPERMAKING.

FIG. 6.



Spruce fibre (170 diam.).

Chemical Tests for Vegetable Fibres.—A. Iodine in solution, followed by sulphuric acid. 1. Blue color: cotton; raw flax; cottonized china-grass and ramie (sometimes reddish to blue); raw hemp, greenish-blue to pure blue. 2. Yellow to brown: raw jute; raw esparto; bromelia; aloë and New Zealand flax.

B. Ammoniacal solution of cupric oxide. 1. Dissolves the cellulose: cotton, the cuticular layer remaining; cottonized china-grass and ramie; raw flax; hemp; sunn. 2. Colors the fibre blue, and causes it to swell up: raw jute; New Zealand flax; aloë; bromelia. 3. Simply colors the fibres: vegetable silk, blue; esparto, green.

C. Sulphate of aniline. Almost without effect on cotton, raw and cottonized china-grass and ramie; raw flax and New Zealand flax. Produces change of color in raw jute (gold yellow), raw hemp (light yellow), esparto (bright yellow), aloë and bromelia (gold yellow).

Microscopical Discrimination of Fibres as used.—Fibres of a single cell: cotton, vegetable silk, bombax wool (plant-hairs), cottonized ramie and china-grass (isolated bast-cells). Groups of cells chiefly bast: raw jute, flax, aloë. Groups of cells chiefly bast, with traces of parenchyma of the bast: raw sida, abelmoschus, and hemp. Groups of bast-cells mixed with ducts: New Zealand flax, manila hemp, esparto, coir. E. M. SCHAEFFER.

Fi′brin [etymology the same as for *fibre*], an organic substance found in the blood and lymph. In the former it is present in the proportion of two or three parts per thousand; in the latter in smaller quantity. Fibrin derives its chief importance from being an ingredient of the blood, making its first appearance in it about the fifteenth day of intra-uterine life, remaining constantly present thereafter. Its quantity varies, however, in different parts of the body. Arterial blood has more than venous, and the large veins near the heart have less than those at a distance; while in the blood of the renal and hepatic veins it is usually absent entirely.

Fibrin is the only component of the body which coagulates spontaneously; and it is by means of this property that it is extracted from the blood for examination and analysis. But it must be borne in mind that in its natural condition in the blood fibrin is always fluid, and its coagulated form, being abnormal, does not therefore exactly represent the original substance itself.

Fibrin may be extracted from freshly-drawn blood by whipping it with a bundle of twigs, to which, as it coagulates, it adheres. After washing, the coagulum presents a white, tough appearance, and upon placing it under the microscope it is found to consist of colorless and elastic filaments of considerable length, crossing each other in every direction, so as to form an irregular network. These filaments, or *fibrillæ*, are exceedingly small, having a diameter not greater than $\frac{1}{30000}$ or $\frac{1}{40000}$ of an inch. Within a few minutes after blood has been taken from the body it commences to lose its fluid condition, gradually becoming more and more solid until its coagulation is complete. It is then said to be clotted. The blood clots in the interior of the body after death; also during life when effused into the tissues, and also in a blood-vessel itself when a ligature is placed around it. This change depends wholly upon the presence of fibrin, for after its withdrawal the blood remains fluid indefinitely. With regard to the exact nature of coagulation there are many theories, but nothing is definitely known.

In inflammatory diseases the blood contains more fibrin and it clots more quickly. In fevers and exhausting diseases its quantity is diminished, and coagulation is retarded. This clotting of the blood is of the utmost importance in the preservation of life. When a blood-vessel is wounded or cut across, the fibrin of the blood which is poured out coagulates upon the edges of the vessel, forming a plug, so that no more blood can escape. If it were not for this spontaneous coagulation, it would be impossible ever to arrest hæmorrhage.

As one of the organic ingredients of the blood, fibrin must also play an important part in nutrition, but exactly what that part is has never been demonstrated.

G. H. WYNKOOP.

Fibroïn, the substance allied to horny tissue, of which silk and sponge are composed.

Fi′brous Tis′sues, a name applied to a group of histological elements which play an important part in the animal economy. They are generally assigned to two groups—the white and the yellow fibrous tissues, the former found in tendons, fasciæ, and other unyielding parts, the latter elastic and found in many organs, notably in the middle coat of the arteries. Fibro-cartilage is a substance intermediate between the fibrous tissues and true cartilage, and is found in a great variety of gradations, approaching more or less closely to one or the other type. Fibrous tissues, though so important to animal life, always play a merely mechanical part. Sparingly supplied with blood-vessels and nerves, they are not highly vitalized and have no active functions. They are composed of an albuminoid substance, which is changed into gelatine by boiling. They are of probable cell-origin, but when injured are repaired, if at all, by the effusion and subsequent fibrillation of blood-plasma. The white fibrous tissue is the principal seat of rheumatic disease. White fibrous tissue exists also in many neoplasms, constituting fibromata or fibroid tumors.

Fib′ula [Lat., a "pin" or "clasp"], in the vertebrate skeleton, the outer of the two bones of the leg between the knee and the ankle, the inner bone being the tibia. In man the fibula is much smaller than the tibia, and does not quite reach the knee-joint. Its upper extremity is the styloid process; its lower, the outer malleolus. It is developed from three centres, and is regarded as the homologue of the radius in the upper extremity.

Ficherelli, or **Ficarelli** (FELICE), b. at San Gemignano, Tuscany, about 1605; studied painting under Empoli, and became the friend and imitator of Cristofano Allori. He was an admirable copyist of Perugino and Andrea del Sarto, and his original works, now become rare and valued, are very delicately executed, excelling especially in the heads, which are very pleasing. His style is simple and natural. D. in 1660.

Fichet (GUILLIAUME), b. at Aunay, near Paris, France, early in the fifteenth century; was in 1467 rector of the University of Paris, teaching at the same time rhetoric, theology, and philosophy. He was employed by Louis XI. in making peace with the duke of Burgundy, and was the patron by whose influence the first printing-press was brought from Germany and set up in the Sorbonne at Paris. Among the first books printed in France were his *Rhetoricorum Libri tres* (probably 1470) and *Epistolæ, in Parisiorum Sorbona* (1471). Fichet afterwards held office at the papal court of Sixtus IV. The date of his death is unknown.

Fich′te (IMMANUEL HERMANN), son of the great Fichte, was b. at Jena July 18, 1797, and educated at Berlin, where he studied philology. He was early attracted to philosophy, however, especially by the ideas of his father, and made a comprehensive study of its history. He also heard Hegel's lectures, but he is said to have felt rather disgusted at them, and in his own philosophical writings the opposition to Hegel is often sharp and pointed. He spent the earlier part of his life as a teacher, but in 1836 he was appointed professor of philosophy at the University of Bonn, and from 1842 to 1875 occupied the same office at the University of Tübingen. His literary activity has been very comprehensive and very prolific. The most important of his works are *System der Ethik* (1850–53), *Anthropologie, neubegrundet auf naturwissenschaftlichen Wege* (1860), and *Psychologie als Lehre vom bewussten Geiste des Menschen* (1864). One of the most interesting of his many essays and speeches is that with which he opened a meeting of philosophers at Gotha in 1847, *On the Philosophy of the Future.* He has also written on politics *Grundzüge zur Entwickelung der künftigen deutschen Reichsverfassung* (1848), and on theology, *Die speculative Theologie* (1846). In opposition to the absolute identity of finite and infinite, subjective and objective, matter and mind, world and God, which characterizes the philosophy of Hegel, I. H. Fichte teaches an absolute dualism between world and God, and all his efforts have been directed to the rational demonstra-

tion of the personality of God and to the establishment of a system of true theism.

Fichte (Johann Gottlieb), the second of the four greatest philosophers of Germany, was born at Rammenau, in Upper Lusatia, May 19, 1762. He was of Swedish descent, and his father was a ribbon-weaver. In his earliest youth he exhibited the moral characteristics that appeared subsequently in the stern outlines of his philosophic system. When he was in his ninth year his excellent memory attracted the attention of the Baron von Miltitz, who interested himself in his education, and placed him successively in the family of a clergyman at Niederau, at the town-school of Meissen, at the Princes' School of Pforta (1774–80). At the latter place he became acquainted with the writings of Goethe, Wieland, and Lessing. The latter writer exercised an overpowering influence on his mode of thinking and his literary style. He studied theology at Jena and Leipsic, and began to grapple with the problems that form the centre of his philosophic system—those of free-will and necessity. At this time he studied the systems of Spinoza and Wolff, and adopted a fatalistic view of life. While acting as family tutor in Zurich (1790) he made the acquaintance of Johanna Rahn, niece of the poet Klopstock, whom he subsequently married. Returning to Leipsic in 1790, he began the study of the Kantian critiques, which had been published, the critique of *Pure Reason* in 1781, of *Practical Reason* in 1788, and that of the *Judgment* in 1790. He now found a new world, and began to live a higher life. He saw free-will to be the highest principle, and his fatalistic theories crumbled away at once. He visited Kant, and presented as his letter of introduction the manuscript of a *Critique of all Revelation*, a work composed in five days. It won him Kant's respect and esteem, and on its anonymous publication was taken for an original work of Kant by the philosophic public. Fichte, being announced as its author, found himself at once in the foremost rank of philosophers. After his marriage in 1793 he published a work in which he attempted to justify the French Revolution, and by this brought upon himself the suspicion of the German governments. Nevertheless, in 1794 he was called to the chair of philosophy in Jena, to succeed Reinhold, and there came into personal contact with Goethe, Schiller, Wieland, Herder, Humboldt, and Jacobi, and carried on an extensive correspondence with Reinhold, Schelling, Tieck, Novalis, and the Schlegels. Fichte here elaborated the great central work of his system, in which he attempted to demonstrate the basis of the Kantian system by an *Analysis of Consciousness*. Kant had borrowed his categories from the traditions of formal logic, and thus, while he combated dogmatism, had grounded his system on a dogmatic basis. Fichte sought to correct this by supplying a strict deduction of the categories from pure consciousness, and thus to place philosophy for ever beyond the reach of skepticism, and make it rival geometry in the certainty of its results. His *Science of Knowledge* (*Wissenschaftslehre*) appeared in 1794. Goethe, who had read it sheet by sheet as it passed through the press, wrote him: "In my opinion, you will confer a priceless benefit on the human race, and make every thinking man your debtor, by giving a scientific foundation to that upon which nature seems long ago to have agreed with herself." It was the first attempt in the history of human thought to unfold dialectically from the Ego the *a priori* conditions of all knowledge. It was at once adopted by the leading thinkers of the Kantian school. In an essay *On the Ground of our Faith in a Divine Government of the World*, which he published in his *Philosophical Journal* in 1798, he used language in speaking of the moral order of the world implying its equivalence to the idea of God, and thus aroused the charge of atheism against him. This, strengthened by the prejudice created by his work on the French Revolution, resulted in his dismissal from his professorship, notwithstanding a vigorous self-defence. To add to his misfortune, Kant at this time saw fit to publish his disclaimer of Fichte's system as a true interpretation of his own. He declared that in his opinion the *Science of Knowledge* was an altogether faulty system, chimerical and ephemeral. Refused protection by neighboring states, but assured of toleration by Frederick William III. of Prussia, he repaired to Berlin, and came into intimate association with Schleiermacher, Frederick Schlegel, Novalis, Tieck, Schelling, and others. Here he published several eloquent popular expositions of his system, the most prominent of which are the *Destination of Man* (1800), *The Sun-clear Report to the Public upon the True Nature of the Latest Philosophy—an Attempt to Force the Reader to an Understanding of it* (1801), *The Way to the Blessed Life* (1806). An outline of the philosophy of history appears in his *Characteristics of the Present Age* (1806). In his *Addresses to the German Nation* he took a bold, patriotic stand against Napoleon (1808). He became rector of the University of Berlin upon its establishment, and exerted a powerful influence upon its constitution. The new career opening to him after the downfall of Napoleon was cut short by his death from typhoid fever on Jan. 27, 1814.

As a philosopher, Fichte's position is that of the immediate successor of Kant and the completer of the critical system. Kant had endeavored to obtain a critical insight into the nature of knowledge. It was for him the product of two factors—the Ego, or subject, and things-in-themselves. He endeavored to determine accurately the value of the subjective coefficient of our knowledge. The intuitions of Time and Space, and the categories of Quantity, Quality, Relation, and Modality, were found to be the results of the spontaneity (or original action) of the Ego; and these results formed the subjective coefficient of knowledge. Kant did not show how these determinations arise in the spontaneous activity of the Ego; he only inferred that they did thus arise from the demonstrated impossibility of their arising from experience. They were logical conditions of all experience whatsoever, and were presupposed by experience, instead of derived from it. The most obvious difficulties of Kant's theory were removed by Fichte's science of knowledge. They were two: 1. Kant held that the subjective factor of knowledge included the general forms or laws (Time, Space, Causality, etc.), while objective things *per se* furnished the contents of sensation, or in other words affected the sensory. But *to affect* is *to cause*, and hence Kant, while he denied all objective existence to the subjective factor of knowledge, was obliged to apply the category of causality to things in themselves, in order to justify their necessity in his theory. Thus, his subjective coefficient belonged also to his objective coefficient of knowledge. Fichte avoided this glaring inconsistency by showing that the activity of the Ego furnishes the groundwork of the objective. In ordinary consciousness we do not perceive this phase of the activity of the Ego, but by disciplined reflection the mind may acquire the power of seeing the mental genesis of the ideas of Time and Space and of the laws of Causality, Substantiality, etc., and the resulting objectivity which we give to the mere subjective feeling which is the basis of all sensation. 2. Kant's illogical attempt to destroy dogmatism by the critique of *Pure Reason*, as well as skepticism by the critique of *Practical Reason*, has been mentioned. He had not deduced the necessary basis of his categories, but had dogmatically assumed them from logic, without proving them, and hence had left his philosophy open to skepticism. Fichte made a searching analysis of Consciousness, and, starting from the self-identity of the Ego = Ego, or A = A, and proceeding to the self-distinction of the Non-ego not = Ego, or — A not = A, he reaches the idea of limitation or division of the totality by mutual exclusion of the self and the not-self. Thus, the first analysis shows the genesis of the categories of Quality,—Reality, Negation, Limitation. Pursuing this subtle psychological analysis, he arrives at the other categories, and establishes the fundamental distinctions between realism and idealism, between theoretical and practical. The most wonderful characteristic of this psychological analysis—which is valid for all time, although Fichte's concrete applications of his philosophy to the worlds of nature and history lack value by reason of his failure to study each department in its detailed developments—consists in his demonstration of the successive additions made by reflection in the endeavor to become self-conscious. For instance, in order to be conscious of feeling, the mind thinks it under the form of time; to be conscious of feeling *and* time, it thinks it under the form of space; to be conscious of the latter, it thinks the object under the form of causality. Thus, it successively recognizes its own phases of formal activity as conditions of objectivity, and adds these, one after the other, to its sensation, and thereby arrives at the perception of an object in space which affects the organ of sensation. This process is present in all perception of external objects, but is rapid and unconscious. As with Kant, so with Fichte, the greatest stress was laid on the free-will and the moral aspect of human nature.

Fichte's complete works were collected and edited in eight volumes by his son in 1845–46. Access to his system through English translations is now quite adequate. The *Life of Fichte* and his popular writings, including *The Nature of the Scholar, The Vocation of the Scholar, The Destination of Man, Characteristics of the Present Age, Way towards the Blessed Life, Outlines of the Doctrine of Knowledge*, were published in London, translated by William Smith (1848–49). *The Destination of Man* was also translated by Mrs. Percy Sinnett (London, 1846), and a portion of it by one of the contributors to *Hedge's German Prose Writers* (New York, 1856). The *Science of Knowledge* (ed. of 1794) and *Science of Rights* were translated by A. E. Kroeger (Philadelphia, 1868–70). In the *Journal of*

Speculative Philosophy (St. Louis) have appeared (*a*) *The Introduction to the Science of Knowledge* (ed. of 1794), (*b*) *Criticism of Philosophical Systems*, (*c*) *Sun-clear Statement*, (*d*) *New Exposition of the Science of Knowledge* (1801), (*e*) *Facts of Consciousness*. (See articles on KANT, SCHELLING, HEGEL, LEIBNITZ, and GERMAN PHILOSOPHY.)

WILLIAM T. HARRIS.

Fich'telgebirge (the "Pine Mountains") is a short but broad range of mountains, covered with firs and pines, on the northern frontier of Bavaria. They are not remarkable for their height, the highest peak, Schneeberg ("Snow Mountain"), rising only 3333 feet, but by reason of their central position they form the nucleus from which all the chief mountain-ranges of Germany diverge, and they separate the affluents of the German Ocean and the Black Sea, the Naab descending from them on the S. to the Danube, the Main on the W. to the Rhine, the Saale on the N., and the Eger on the E. to the Elbe.

Fici'no (MARSILIO), celebrated as the reviver of Platonic philosophy in Italy, was b. in Florence in 1433, and d. at Careggi in 1499. When still a youth he was selected and carefully educated by Cosimo de' Medici with a view to place him at the head of a proposed academy for the cultivation and dissemination of Platonic philosophy. The zeal of Cosimo for Platonism had been kindled by the enthusiasm of a learned Greek—George Gemistus Pletho—who had come from Constantinople with John Palæologus II. to the Council of Florence on the mission which resulted in the union of the churches of the East and West, in 1438. The academy which was founded in 1460 became in after years an asylum for the few learned Greeks who had fled to Italy on the capture of Constantinople by the Turks (1453). About this time the invention of the art of printing contributed the necessary means for the rapid spread of classic study, by multiplying and rendering accessible the originals and translations of the same. Ficino translated into Latin the entire works of Plato (1484) and Plotinus (1492), accompanying them with a more or less complete commentary. Besides these, he made translations of many of the works of Proclus, Jamblichus, Porphyry, Dionysius Areopagita, Hermes Trismegistus, Alcinous, Speusippus, and Xenocrates. His translations are frequently reprinted side by side with the Greek text in modern times, and are found of special value in restoring the original text, as it seems that he had before him manuscripts now lost. His Latin is pure, literal, and perspicuous. His work on the Platonic theology (1482), in eighteen books, treats of the nature of the soul, of spirits, and of God. It is especially devoted to the proofs of immortality and the refutation of the Averroistic doctrine of the World-Soul or Mundane Intelligence, which makes the latter to be immortal and the particular soul to be perishable, being cognizant of universals only through participation in the higher intelligence. The most important feature of the philosophy of Ficino is his claim to harmonize Platonic idealism with Christian doctrine. This made Platonism very popular, and gave rise subsequently to a school of mystics which numbers Pico of Mirandola, Reuchlin, Agrippa of Nettesheim, Patritius, Telesius, Ramus, and others. The supposed connection of Neo-Platonism with Jewish mysticism through the Cabbala, and the discovery of a profound esoteric doctrine beneath the letter of the Bible, stimulated the enthusiasm of its votaries. Freedom in philosophy begins with the conflict of authorities, as Gibbon remarks. The conflict between the schools of Platonism and Aristotelianism at that time prepared the way for the original thinking of the following centuries. Ficino, with Bessarion before him and Pico after him, stands opposed to Pomponatius, the reviver of Alexandrian Peripateticism. The collected works of Ficino (not including the translations of Plato and Plotinus) were published at Bâle in 2 vols. fol., 1561 and 1576; revised with additions, Paris, 1641, 2 vols. fol. W. T. HARRIS.

Fic'tion, in law, in its ordinary meaning, is an assumption that a thing is true which is either not true, or which is as probably false as true. Mr. Best, an author on *Presumptions*, distinguishes it from a presumption, a mere rule of law established for the purpose of reaching a certain conclusion, though it may be arbitrary, which is based on public convenience or on the difficulty of arriving at the exact truth. Thus, the rule that a child under seven years of age cannot commit a felonious crime is a conclusive presumption, rather than a fiction. Some writers—as, *e. g.*, Mr. Maine (see his work on *Ancient Law*)—use the word "fiction" in a broader sense, to signify any assumption which conceals, or affects to conceal, the fact that a rule of law has undergone alteration, its letter remaining unchanged while its operation is being modified. From this point of view fiction is a powerful agency in the improvement of law. By means of it new views more adapted to the age are introduced under color of observance of ancient forms. The agencies causing the progress of jurisprudence are fiction, equity (see EQUITY), and legislation. Among these, fiction has played no unimportant part. In some instances courts have even, by means of it, subverted the will of the legislature. A striking instance of this intentional employment of fiction is found in the early English statute of entailments. The history of this subject is so illustrative that it will be stated with some fulness. It is a well-known rule of the English common law that a conveyance of land "to A and his *heirs*" gives him the complete ownership and power of disposal of the property. If, however, the words "*heirs of the body*" were used, instead of "heirs," the effect would be different. Such language points only to descendants; and as there might be none, the estate was deemed to be a conditional one. If "heirs of the body" should come into existence, the condition on which the estate was given was deemed to be performed, and the title of A for certain purposes became absolute. For example, he could sell, and thus cut off all claim on the part of his descendants, or he could forfeit the property by his treason, or encumber it by his voluntary act. If none of these acts were done, the estate would pass to surviving heirs of the body, and if there were no such persons, would revert to the original grantor.

The English landed proprietors being dissatisfied with this result, through their influence in Parliament caused a statute to be passed in the reign of Edward I. (13 Edw. I. c. 1) which was designed to prevent it, and to vest the ownership in A in the case supposed, and at the same time deny to him the power to sell or to encumber the property. The intention was that he should use it as owner, fell trees, mine, and do other proprietary acts, while at the same time the property should descend according to the line prescribed in the terms of the gift. From this violation of a cardinal rule of ownership mischievous consequences soon developed themselves. Creditors and purchasers were defrauded, lessees were deprived of their leases, for the tenant in possession could make no deed, mortgage, or lease which should outlast his own life, though he appeared to all observers to be the owner. Records of title were unknown, so that fraud was easily practised by one who had all the outward badges of ownership. This state of things was endured for a long period, the nobility being unwilling to repeal a law which tended so strongly to the preservation of their estates.

In the reign of Edward IV., after the lapse of nearly two hundred years, the courts allowed a fictitious legal proceeding to be gone through with, which was declared to have the effect to destroy the entailment, and to enable A in the case supposed to become absolute owner. It was a pure fiction, called a "common recovery," and so understood by all parties to it. It was a fictitious lawsuit with regular and formal parties, and its effect was to destroy the entailment, and vest an absolute title in the first person named in the entailment (A). The rule soon became so perfectly settled that it was impossible for a conveyancer to frame a regular entailment without having it subject to this mode of disincumbering the title, so that a "common recovery" became a mere mode of conveyance. In later times the fiction had become so transparent and so cumbrous that the Parliament substituted in its place a mere deed of conveyance, known as a "disentailing deed" (3 and 4 Wm. IV. c. 74). The case is of interest and value as showing how the fiction, after being allowed for a time, is ultimately recognized as a change or modification of law, and tends to assume the form of a precise provision by means of a statute.

There are many fictions of law now regularly resorted to, and having a powerful influence on the administration of justice. It is a cardinal maxim that a legal fiction must be consistent with equity. This doctrine has not been universally followed, particularly in the so-called doctrine of "relation." The meaning of that doctrine, so far as it refers to time, is, that in some cases, when an act is done on a particular day, it shall be considered for legal purposes as being done on some earlier day. The act is then said to "relate back" to that prior day. One mischievous consequence of this rule was that if a law was passed during a session of Parliament, it "related back" to the first day of the session, although weeks or months might have elapsed. By this vicious retrospection an act which was perfectly lawful when committed might be treated as a crime. This result was done away with by the statute of 33 Geo. III. c. 13, which enacted that the time when an act receives the royal assent shall be the date of its commencement, unless some other provision is made by law. The same rule prevails in this country. The doctrine of "relation" is resorted to in bankruptcy, referring the effect of the decree back to some date earlier than that of the commencement of the proceedings. It is also used in

many other cases, not only as to time, but as to place, person, or thing, and in general is made to work consistently with right and justice. An instance of it may be noticed. Should a person deliver a deed conditionally, or in *escrow*, and subsequently, between the time of the first and the ultimate delivery, become disabled to convey, the law will refer the transaction back to the first delivery, for the purpose of upholding it. In other aspects of the case the conveyance would only take effect from the delivery transpiring after the condition had been performed.

Another instance of a fiction is the legal rule that "the law regards no fraction of a day." By means of this theory a person born on the seventh of the month becomes of full age twenty-one years later on the sixth. The fiction, however, gives way where justice requires that a distinction should be taken between two acts done on the same day. In this case a single moment may be decisive, as where two or more conveyances are left for record on the same day by parties having antagonistic interests.

Attempts have been made by various writers to classify fictions, but without much practical success. They are said to be limited by three principal rules: *First*, the fiction must have the semblance of truth: that which is impossible is not to be feigned. *Second*, it shall not be allowed to work an injury. *Third*, it is only to be resorted to to accomplish the end for which it was introduced. To that extent it cannot be contradicted; beyond that it may be impugned. "The law," says Gould, J., in *Lord Raymond's Reports*, 516, 517, "does not love that rights should be destroyed, but, on the contrary, for the supporting of them invents notions and fictions." When they are urged to an intent and purpose not within their reason and policy, a party injuriously affected by them may show the truth.

T. W. Dwight.

Fi′cus [Lat., a "fig"]. The genus *Ficus* belongs to the Artocarpaceæ, or bread-fruit family, in which it is associated with the bread-fruit of the Pacific, the jack of the Indian Archipelago, the mulberry, the Osage orange of our own country, and the notorious upas tree of Java. The common fig tree (*Ficus carica*) is the most valued representative of this genus; it is a deciduous tree, attaining to a height of from fifteen to thirty feet, and often living to a great age. The fig itself is a multiple fruit formed from monœcious flowers aggregated together in the interior of a hollow fleshy receptacle. Figs are highly prized in the fresh state, but they are more generally esteemed in the dried condition, in which state they form an important article of commerce from the Mediterranean, and especially from Turkey. They are dried in the sun, and, containing a large amount of grape-sugar, this in the process of drying serves to preserve them. Many trees of the family yield a remarkable milky juice, which, inspissated, forms the caoutchouc of commerce. The original India-rubber plant, or *Ficus elastica*, of Java, is one of these. The celebrated banyan tree (*Ficus Indica*) of India yields the well-known resin gum-lac. Several of the *Fici* have poisonous qualities. One of the most remarkable species is the peepul or Bo-tree (which see). E. C. H. Day.

Fid′dletown, post-tp. of Amador co., Cal. Pop. 1219.

Fid′ei Commis′sum [Lat., "committed to (one's) faith"], a species of trust existing under the Roman or civil law which was employed to effect the testamentary disposition of property to certain persons who by law were incapable of receiving it by direct devise or bequest. Exiles, strangers, unmarried persons, those who had no children, and some other classes of persons were under this disability, and whenever a testator desired to evade this law and leave his property to one thus debarred, he selected some person as heir or legatee who was not incapacitated from taking; annexing a request to the gift that he who was thus constituted a recipient of the property should hold what he received in trust for him who was intended as the real object of the testator's bounty. When this form of trust was first adopted there was no means by which the duty imposed upon the immediate donee could be enforced against him. Its fulfilment depended entirely upon his good faith and honor. From this circumstance the trust received the name of *fidei commissum*. In later times, however, to prevent the frauds which were sometimes perpetrated by failure to fulfil such trusts, laws were enacted rendering their execution compulsory. In the time of Justinian a law was adopted by which a trustee could be compelled to disclose under oath the fact that a trust had been committed to him. From *fidei commissa* was derived the doctrine of uses in the English law. (See Uses.) George Chase. Revised by T. W. Dwight.

Fide′næ, an ancient Latin city on the left bank of the Tiber, 5 miles above Rome. Livy erroneously calls it an Etruscan city. In Rome's early days Fidenæ was her powerful rival and enemy, but it declined as Rome increased, and before Cicero's time was an insignificant village, important only for its tufa-quarries.

Fi′des [Lat., "faith"], in the religious system of ancient Rome, was the personification of good faith, represented as a venerable matron crowned with laurel or olive, and carrying corn and fruits. Fides Publica had a temple on the Capitoline, built by Numa.

Fief, an estate or dignity held of a feudal superior upon condition of military service. (See Feudal System, by Pres. T. D. Woolsey, S. T. D., LL.D.)

Field (Cyrus West), a son of Rev. David D. Field, D. D. (1781–1867), was b. at Stockbridge, Mass., Nov. 30, 1819; was educated in Stockbridge, became a clerk in New York when fifteen years old, and became the head of a prosperous mercantile business. He travelled in 1853 in South America for six months, and on his return became interested in ocean-telegraphy. Having been applied to for aid in building a land-telegraph across Newfoundland, to receive the news from a line of fast steamers to ply between St. John's and Ireland, the idea struck him of carrying the wire across the Atlantic. In 1854 he obtained from the legislature of Newfoundland the exclusive right for fifty years of landing telegraph cables from Europe and America on that island. Mr. Field next formed a company known as the "New York, Newfoundland, and London Telegraph Company," with Peter Cooper, Wilson G. Hunt, Marshall O. Roberts, Moses Taylor, and Chandler White, and in two years the lines were finished from New York across Newfoundland. The first cable to extend from Newfoundland to Cape Breton Island having been lost in a storm while it was being laid in 1855, a second cable was laid in 1856. In that year he went to London and organized the "Atlantic Telegraph Company," of which he furnished one-fourth of the capital. The U. S. and British governments furnished ships for the enterprise. Mr. Field accompanied the expedition of 1857, the two of 1858, and those of 1865–66 for the laying of cables. Of these, the first two were failures, and the cable laid by the third worked but a short time. The public lost faith in the enterprise, civil war followed in the U. S., and Mr. Field could not obtain the capital to renew the attempt until 1865. In that year the Great Eastern laid 1200 miles, when the cable parted, and was lost for the time. In 1866 a cable was successfully laid, and the cable of 1865 was picked up in mid-ocean and completed by the Great Eastern. At last, after nearly thirteen years of unceasing toil, Mr. Field was completely successful. He crossed the Atlantic some fifty times in his work. He has been the recipient of many medals and other honors, and was afterwards interested in establishing telegraphic communication between Europe, India, China, and Australia, and with the West Indies and South America. At present (1874) Mr. Field is engaged in the effort to raise the necessary capital to lay a submarine cable from San Francisco to Japan, thus completing the telegraphic circuit of the globe. Since 1867 three trans-Atlantic cables have been successfully laid, and telegraphic communication has been uninterrupted.

Field (David Dudley), D. D., American clergyman, b. at East Guilford, Conn., May 20, 1781, graduated at Yale College 1802; was settled at Haddam, Conn., from Apr. 11, 1804, to 1818, and then at Stockbridge, Mass., from Aug. 25, 1819, to 1837; then at same church as before in Haddam from Apr. 11, 1837, until 1851, when he returned to Stockbridge. He published a *History of Middlesex County, Conn.*, in 1817, a *History of Berkshire County, Mass.*, in 1829, *Sermons*, etc., and d. at Stockbridge, Mass., Apr. 15, 1867.

Field (David Dudley), an American jurist, b. at Haddam, Conn., Feb. 13, 1805, the eldest son of Rev. David D. Field, D. D., the Congregational minister of the town, who removed in 1819 to Stockbridge, Mass.; and in 1821 the son entered Williams College. In 1825 he commenced the study of the law, and was admitted to the bar in 1828, and settled in New York, where he soon made his way into the front rank of his profession. But finding the practice of the law, which was after the English model, extremely complicated, dilatory, and expensive, he began to study how it could be revised and improved, and so entered upon those labors in favor of law reform which were to occupy so large a part of his life. In 1839 he published his first essay on the subject, which he continued to press on the public attention until in 1847 he was appointed by the legislature of New York one of a commission to reform the practice of the State. Upon this work he was engaged for two years, and the result was contained in two codes of procedure, the one civil and the other criminal. The civil code was in great part adopted by the State of New York, and has since been adopted by twenty-three States and Territories. It is the basis of the legal reform established by the new Judicature Act in England and of the practice in several of the English colonies, including India. After the

completion of the codes of procedure he was placed by the State of New York at the head of a new commission to undertake a complete codification of the whole body of the law. This was a work of years, but in due time the commission reported a civil code, a penal code, and a political code. These five codes, which were mainly the work of Mr. Field, covered the whole province of American law, both common and statute, and were designed to supersede the unwritten or common law—the object being to give the people in this compact form the whole of the laws by which they were governed. This body of law has as yet been adopted in full and intact only by the State of California and the Territory of Dakota, but there is every reason to believe that the substance of it, at least, will before many years be the law of the greater portion of the American Union. In this great work Mr. Field was engaged nearly a quarter of a century, carrying it on at the same time with a professional practice among the very largest in the country. Not satisfied with this, he often turned aside from professional engagements to indulge his taste for literary pursuits, writing essays and reviews and sketches of travel, and discussing, both in the press and in public speeches, the political questions of the day. In 1867 he brought before the British Association for Social Science a proposition to frame an international code. This led to the preparation by him of what was really a complete work on international law, though modestly entitled *Draft Outlines of an International Code,* one feature of which was the introduction of the principle of arbitration to settle disputes between nations. This work has attracted great attention in Europe, and been translated into French and Italian.

Field (FREDERICK), English clergyman, b. about 1800, was educated at Trinity College, Cambridge, graduating in 1823. He has edited the Greek text of Saint Chrysostom's *Homilies on St. Matthew* (1839), *Interpretation of the Pauline Epistles* (1845–62), and the Septuagint version of the Old Testament according to the Alexandrian Codex. In 1842 he was presented to the rectory of Reepham, Norfolk, resigned in 1863, and has since edited Origen's *Hexapla.*

Field (HENRY MARTYN), D. D., a son of Rev. David D. Field, D. D., b. at Stockbridge, Mass., Apr. 3, 1822; entered Williams College at the age of twelve; graduated at sixteen; studied theology three years at East Windsor, Conn., and one year at New Haven; at twenty took charge of a church in St. Louis, Mo., where he resided from 1842 to 1847, when he resigned, and spent the following year in Europe; was a witness of the Revolution in Paris in Feb., 1848, of which he wrote a very full account, as also of the Italian Revolutions, which he witnessed soon after. A month in Rome, including the Holy Week, led him to write a pamphlet on *The Good and the Bad in the Roman Catholic Church.* Returning to America, he became acquainted with the descendants of the Irish exiles, Wolfe Tone, Thomas Addis Emmet, and others living in New York, which led him to study that tragical chapter of Irish history in which they took part, and finally to write a book entitled *The Irish Confederates, and the Rebellion of 1798.* In 1851 he was settled in West Springfield, Mass., where he remained four years. During this period he published a number of sermons and reviews. In 1854 he removed to New York to become one of the editors of the *Evangelist,* a religious journal with which he has been connected for twenty years, and of which he is now the sole proprietor. Visiting Europe in 1858, he wrote a volume of travel entitled *Summer Pictures: From Copenhagen to Venice.* In 1867 he went abroad again to the Exposition in Paris. In 1866 he published a *History of the Atlantic Telegraph.*

Field (JOSEPH M.), actor and dramatist in the U. S., was b. in England, and d. in Mobile, Ala., Jan. 30, 1856. He lived in New Orleans, La., in St. Louis, Mo., and at Mobile. *The Drama in Pokerville and Other Stories, by Everpoint* (1847), etc. were among his publications, and he edited for some time the St. Louis *Reveille.*

Field (KATE), b. in St. Louis, Mo., was educated in Massachusetts and in Europe, where she enjoyed the friendship of Walter Savage Landor in his later years at Florence; was European correspondent of the Boston *Courier* and *Transcript* and the New Orleans *Picayune;* was afterwards the well-known correspondent "Straws, Jr.," of the Springfield *Republican;* became in 1867 a frequent contributor to the New York *Tribune,* the Chicago *Tribune,* the Philadelphia *Press,* and the London journals; has written much for the *Atlantic Monthly* and other magazines, and is an able dramatic critic. In 1874 she made her first appearance as Peg Woffington at Booth's Theatre, New York. Author of *Pen Photographs of Dickens's Readings, Ten Days in Spain* (1874), etc., and is a popular lecturer.

Field (Hon. MAUNSELL BRADHURST), an American lawyer, b. in New York Mar. 26, 1822; graduated at Yale College 1841; admitted to the bar 1847, and became associated with Hon. John Jay in the practice of the law. In 1854 he acted as secretary to the American legation in France, under Hon. John Y. Mason, and subsequently became attached to the Spanish legation, under Mr. Soulé. In 1855 was appointed president of the American commissioners to the Universal Exposition at Paris; deputy sub-treasurer of the U. S. in New York 1861, and subsequently assistant secretary of the treasury at Washington, D. C.; which latter office he resigned in 1865, owing to impaired health, and was appointed collector of internal revenue for the sixth district of New York; which office he held four years. In 1869 he resigned his position and resumed the practice of law in New York City; appointed judge of the second district (civil) court 1873. In early life Mr. Field was a Democrat, but on the second election of Mr. Lincoln voted with the Republicans, and has since continued in that party. In 1874 he published a volume of *Personal Recollections* of the distinguished men with whom he had come in contact at home and abroad. D. Jan. 24, 1875.

Field (RICHARD STOCKTON), LL.D., American judge, was b. at Whitehill, N. J., Dec. 31, 1803; graduated at the College of New Jersey in 1821; was professor in the New Jersey Law School 1847–55; for a long time attorney-general of New Jersey; U. S. Senator in 1862–63, in place of J. R. Thompson, deceased, and then judge of the district court of the U. S. for New Jersey, appointed by President Lincoln, until his death at Princeton, N. J., May 25, 1870. Published *The Provincial Courts of New Jersey* (1849), and contributed to the collections of the N. J. Historical Society.

Field (STEPHEN JOHNSON), a judge of the Supreme Court of the U. S., a son of Rev. David D. Field, D. D., was b. at Haddam, Conn., Nov. 4, 1816; graduated at Williams College in 1837; studied law with his brother, David Dudley, in New York, and on his admission to the bar became his partner; went to California in 1849; in Jan., 1850, was elected first alcalde of Marysville; in October of that year was elected to the legislature, and served one session; in 1857 was elected judge of the supreme court of the State, and in 1859 became chief-justice; in 1863 was appointed by President Lincoln an associate justice of the Supreme Court of the U. S.—an office which he now holds. In 1869 he was appointed professor of law in the University of California. In 1873 he was appointed by the governor one of a commission to examine the codes of the State, and to prepare amendments to the same for the consideration of the legislature.

Field′fare, or **Gray Thrush** (*Turdus pilaris*), a passerine bird of Northern Europe and Asia which winters in England and other comparatively warm regions. It is shot in considerable numbers in winter, and is often trapped and tamed, making a very pleasing song-bird. It is extremely prolific, nesting in the far North. It is ten inches long, and is generally seen in small flocks.

Field-Glass, a form of magnifying apparatus which is essentially a telescope of low power. It may have a single tube (like the antiquated spy-glass), or more frequently of late it is binocular, resembling in form the double opera-glass. (See TELESCOPE.)

Field′ing (COPLEY VANDYKE), English landscape-painter, b. about 1788, was eminent in water-color paintings, which he began to exhibit in 1810; was president of the Society of Painters in Water-Colors in 1831. D. at Worthing Mar. 3, 1855.

Fielding (HENRY), an English dramatist and novelist, b. at Sharpham Park, near Glastonbury, Somersetshire, Apr. 22, 1707. The founder of the English family was Geoffrey, count of Hapsburg, who came to England in the thirteenth century and assumed the name of Feilding. Henry Fielding's education commenced at home under the care of Mr. Oliver, the family chaplain, of whom it is said he was the original of Parson Trulliber in *Joseph Andrews.* As soon as sufficiently advanced, he was sent to Eton, where he made much progress, particularly in his classical studies. Being destined by his father for the law, he was, at the age of eighteen, transferred to the University of Leyden, where he maintained his character as a diligent student for about two years, when, owing to the inability of his father to continue his pecuniary supplies, he was compelled to return to London, where, at the age of twenty, he found himself dependent upon his own resources. His first effort, a comedy entitled *Love in Several Masques,* appeared in Feb., 1728, and was favorably received. Between his first appearance as a dramatic author and 1737, Fielding wrote twenty-three pieces for the stage, most of them comedies and farces. Of these only one proved decidedly successful—a burlesque entitled *The Tragedy of Tragedies, or the Life and Death of Tom Thumb the Great,* intended to ridicule the extrav-

agant style of the tragedies of the day. *The Mock Doctor* and *The Miser*, translations of Molière's comedies, were also well received. In 1735 he married Miss Cradock, one of the belles of Salisbury, and possessed of a small fortune of £1500. Fielding had succeeded, on his mother's death, to a small estate at East Stour in Dorsetshire, to which he now retired, and assumed the character of a country squire of the first magnitude, by which his slender means were rapidly dissipated, and in a very short time he was compelled to break up and return to London and seek means for the support of his wife and child. Intending to apply himself to his profession, he was turned aside by an opportunity of producing a satirical drama—*Pasquin, a Dramatic Satire on the Times;* its success was so great that in 1737 he produced another, *The Historical Register for 1736,* which attracted so much attention that the Licensing Act, placing the stage under ministerial control, was passed. Resolving now to devote himself to the law, he entered himself (Nov. 1, 1737) as a student of the Middle Temple. In 1740 he was called to the bar, took chambers, and commenced practice. To the columns of *The Champion,* in which he was interested, he contributed largely. He also compiled a valuable work on Crown law. Circumstances now led Fielding to turn his attention to the sphere in which he was destined to win enduring renown. In Feb., 1742, his first novel was published under the title of *The Adventures of Joseph Andrews and his friend Abraham Adams*—a work suggested by Richardson's *Pamela,* which appeared in 1740 and created an extraordinary sensation. Its success was immediate; it soon became a universal favorite, and was regarded as the best work of fiction produced up to that time in the English language. *The Wedding Day,* a comedy written several years before, was produced in Feb., 1743. The *Miscellanies* appeared in 1743; *A Journey from this World to the Next,* in the second volume, is an admirably contrived satire, though in a fragmentary state; the third volume is entirely taken up with *The History of Jonathan Wild the Great,* the least agreeable of Fielding's works of fiction. In this year Fielding's affectionate wife died—a calamity that so deeply affected him that for a time his reason was endangered. As soon as he was sufficiently recovered he again applied himself to his profession. During the memorable events of 1745 he published a political journal, *The True Patriot,* which expired with the suppression of the rebellion. In 1747 he started another political paper, called *The Jacobite Journal,* which was discontinued towards the end of 1748, when he received the appointment of justice of the peace for Middlesex and Westminster—a sphere of duty in which he speedily earned for himself credit and distinction. The office was not at this time held in high estimation by reason of the trafficking in committals and convictions for the fees which formed the compensation of the magistrates, and for which practice they were termed "trading justices." Fielding refused to adopt these discreditable practices, and labored ardently to check the growth of depravity and crime; and his services in this department of life alone were of such importance as to entitle him to the respect of posterity. In 1749 he published his great work, upon which he had been long engaged, *The History of Tom Jones, a Foundling,* which placed him at the head of English novelists. Its success was most decided, and it still maintains a prominent place among works of fiction. In 1749, Fielding was elected chairman of the sessions, which entailed upon him the additional duty of attending at the bench. In addition to these duties, he published several valuable tracts, among which *An Inquiry into the Increase of Thieves and Robbers* attracted much attention. In 1751 he produced another work of fiction, *Amelia,* in which work the heroine is intended as a portrait of his first wife. This was Fielding's last production in fiction. In 1752 he published a literary journal called *The Covent Garden Journal,* and, the following year, several law reports. But the complication of disorders from which he had long suffered was fast undermining his strength; and a vigorous warfare which he successfully waged against the gangs of desperate ruffians then infesting London so wore upon his shattered frame that he was compelled to retire from the active performance of his duties. A trip to Bath was made without beneficial effect, and by the advice of his physicians he embarked for Lisbon on June 26, 1754. After a stormy voyage, of which he left an account, published in 1755, under the title of *The Journal of a Voyage to Lisbon,* he reached Lisbon in August. But his strength was too far declined to rally, and on Oct. 8 he expired. (See Murphy's *Life and Genius of Fielding;* Sir Walter Scott's "Prefatory Memoir" in Ballantyne's *Novelists' Library; Life of Henry Fielding,* by Frederick Lawrence, 1855.) George C. Simmons.

Fielding (Rev. J. H.) was b. in Coleraine, Ireland, Feb. 28, 1796, and d. at St. Charles, Mo., Oct. 14, 1844. Came to the U. S. in his eighteenth year; in 1819 licensed to preach; in 1826 he was called to the chair of mathematics in Madison College, Pa., where he remained five years—one year as acting president. He then spent two years in the chair of mathematics in Augusta College, Ky. In May, 1835, he accepted the presidency of St. Charles College, Mo., and discharged the duties of that office with signal success. He was noted for extensive and accurate scholarship. Though not eloquent, his sermons were finished productions. At the time of his death he was delegate-elect to the Louisville convention which organized the Methodist Episcopal Church, South. "All immortality and eternal life" were his last words. T. O. Summers.

Field-Marshal. See Marshal.

Field Mice, a name applied to those mice which live out of doors and do not frequent houses; but given especially to mice of the genus *Arvicola,* of which there are more than six species in the U. S., besides many species of allied genera and similar habits. Europe has also several species, and in England these mice are in some years extremely destructive, not only to grain-crops, but to orchard and forest trees, whose bark they gnaw. At times the British government has paid bounties for their destruction.

Field Officer, in the army, is a colonel, lieutenant-colonel, or major of a battalion or regiment, as distinguished from general officers, who are superior to field officers in rank; from line officers, who are inferior; and from staff officers, general or regimental, who may be of rank superior, equivalent, or inferior to that of field officers.

Field of the Cloth of Gold, the magnificent interview between Henry VIII. of England and Francis I. of France, between Ardres and Guisnes, June 7–24, 1520, within the English Pale. The movement was designed to strengthen the union of the two princes against Charles V.

Field'on, a tp. of Watonwan co., Minn. Pop. 254.

Fields (James Thomas), A. M., American author and publisher, b. at Portsmouth, N. H., Dec. 31, 1817, read an anniversary poem before the Boston (Mass.) Mercantile Library Association in his eighteenth year, and in 1848 another poem, *The Post of Honor,* before the same society. He was a member of the publishing firm of Ticknor, Reed & Fields, Ticknor & Fields, and Fields, Osgood & Co. for twenty-five years, up to Jan., 1871. By his own exertions he collected and issued De Quincey's *Works* in 21 vols. In 1849, 1854, and 1858, respectively, he printed volumes of his poems for private distribution. He edited *The Atlantic Monthly* at Boston from 1862 to July, 1870, has repeatedly visited Europe, and has had wide acquaintance with literary men abroad. He has also lectured in the U. S., and published *Yesterdays with Authors*—reminiscences of literary men.

Fields (Rev. Johnson B.), a minister of the Methodist Episcopal Church, South, was a Cherokee Indian, b. in Murray co., Ga., Oct. 18, 1800, converted in 1827, and entered the ministry in the Tennessee conference in 1833. He served as preacher and interpreter in the Cherokee Nation for twelve years, and d. Feb. 12, 1846. T. O. Summers.

Field-works. See Fortifications, by Capt. O. H. Ernst, U. S. Army.

Fi'eri Fa'cias [Lat., "you cause to be made"], a writ of execution (usually termed a *fi. fa.*) to secure the satisfaction of a judgment recovered against a debtor, directing the officer to whom it is addressed *to cause to be made* of the debtor's goods and chattels or real estate the amount therein specified. By this is meant that he is to levy upon the property and sell sufficient to obtain the requisite sum. Personal property is first sold, and afterwards recourse may be had to the debtor's real estate. In executing this writ the sheriff has no authority to break open the outer door of a dwelling-house after request for permission to enter is refused, as may be done on criminal process; but if he has once secured lawful admission into the premises he may break through inner doors, open chests, etc. to secure possession of the goods. When the property is within the debtor's store or barn, even the outer door may be forcibly entered; so, if it be upon the premises of a stranger and entrance is refused, the house may be broken, for a man's house is a protection only for his own property. If, however, the goods are not found upon the stranger's premises, the sheriff is liable as a trespasser. (For further details see Execution.)

George Chase. Revised by T. W. Dwight.

Fies'chi, de', or **Fies'co** (Giovanni Luigi), count of Lavagna, b. 1523 at Genoa of a celebrated Guelfic family of remote Bavarian origin. A wealthy and ambitious demagogue, he entered into a conspiracy to kill Andrea Doria, doge of Genoa, and to overthrow the government, but the scheme failed in both its objects, and Fieschi, striving to seize the public galleys, was drowned Jan. 2, 1547.

Fieschi (Giuseppe Maria), b. in Murato, Corsica, Dec. 3, 1790; entered the French army in 1808; served in Russia in 1812; was imprisoned 1816–26 for theft and forgery; went to Paris in 1830; invented the infernal machine by which the attempt was made, July 28, 1835, to assassinate Louis Philippe, who escaped with a slight wound, though sixteen of his attendants were killed or mortally wounded. Fieschi was executed Feb. 19, 1836.

Fies'ole [anc. *Fæsulæ*], small town of Italy, 3 miles N. E. of Florence. It is one of the oldest Etruscan towns, and was anciently a great and powerful city; contains many interesting remains, and commands a most magnificent view of the Arno valley. It is a bishop's see. Pop. 2404.

Fiesole, da (Fra Giovanni), an Italian painter, commonly called Angelico, and sometimes Il Beato, from the character of his art. Was b. at Vicchio, among the Apennines, in the province of Mugello, in 1387. Of his youth nothing is known. At the age of twenty he entered the religious order of St. Dominic, and then changed his original name (Guido) for that of Giovanni, a name of sanctity in the order. His first years were passed in the convent at Foligno, not far from Perugia and Assisi, famous places both of art and piety. The plague drove him to Cortona about 1413, where he stayed four or five years. Then he returned to Fiesole, his spiritual birthplace and the home of his best years. Here and in Florence his greatest work was done. The last ten years of his life (1445–55) were spent by the pope's desire in Rome, where he d. Feb. 18, 1455. Was buried in the Church of Santa Maria sopra Minerva, where his monument, with its quaint epitaph and the effigy of the painter in his monastic habit, is still to be seen.

Fra Angelico was an artist and a saint from his youth, and the soul of his piety was also the soul of his art. Though a student, evidently, of the masters who lived before him in Perugia, and especially in Florence, the impulse and spirit of his art were his own. Piety suggested both subjects and treatment. His first productions were in miniature, after the style of the illuminations done by monks, but an exquisitely tender feeling for Nature made him a student of her forms and colors, thus blending the natural with the spiritual in his compositions. A saintly dislike of nudity deprived him of the knowledge of anatomy required in figure-drawing; his figures were all draped, and lacked the substance that bone and muscle give, but a singular grace of pose and movement marked them all. The charm of a happy serenity is in all his work. His mind was without sorrow and without ambition. His delight was in happy thoughts. His themes were received by him as inspirations from Heaven, to be treated earnestly and carefully. He began his work with prayer, never altered the first design, discarded artful accessories, accepted no orders from the rich or great, held himself at the service of his superiors, and took no mercenary pay. They who wanted paintings from his hand must apply to the spiritual authorities. The works of Fra Angelico are numerous, most of them small panel-pictures executed for convents. Traces of them are in every place where he lived. Many of his pieces are in Perugia. The churches, chapels, and convents of Florence were enriched by his masterpieces, the best of which are now in the Academy of Fine Arts there. The cloister and cells of San Marco possessed noble examples of his art. At the command of Pope Eugenius IV. he painted two chapels in the Vatican —the chapel of the Holy Sacrament, destroyed afterwards to make room for a staircase, and the chapel of Nicholas V. His paintings were in great demand, for in his prime he was regarded as the most famous artist in Italy. An unfinished work of his in the cathedral at Orvieto has for its subject the *Last Judgment*. The best preserved of Angelico's work is in the convent of San Marco at Florence. Worthy of special attention are a *Coronation of the Virgin* in the Uffizi at Florence, a *Descent from the Cross* in the Academy, and a *Coronation of the Virgin* in the Louvre. The sameness of the subjects, as well as of their treatment, is to be explained by the nature of his genius, which was most free in the region of triumphant and glorified faith. The sufferings of faith, the martyrdoms, tortures, crucifixions, were distasteful to him. He had no power to express agony. His *Last Judgments* are weakest where Michael Angelo was strongest. Fra Angelico founded no school, imitation of him being impossible. His disciples fell away from his purity into love of external form and decoration. He left no peer, and was followed by no successor; his works stand alone. The best *Life* of Fra Angelico is that of E. Cartier, translated from the French, and published in London 1865. The Arundel Society of London has published several excellent copies in chromolithography of his pictures. A good copy in chromo-lithography of his finest picture, *The Coronation of the Virgin* in the Louvre, has been made by Kellerhoven in Paris.

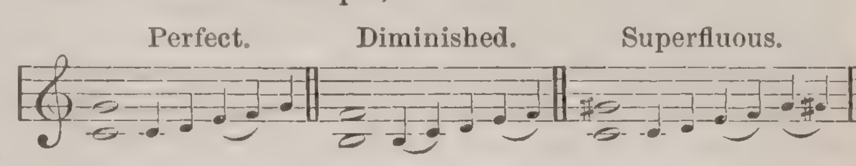
O. B. Frothingham.

Fife [etymologically related to *pipe*], a wooden instrument chiefly used with the snare-drum in martial music. It is made in one piece, without keys, has six finger-holes, and one mouthpiece or hole for blowing upon one side, as in the flute. Its notes are shrill and somewhat harsh. The fife is variously pitched.

Fife, or **Fifeshire,** county of Scotland, forming a peninsula between the Frith of Forth, the Frith of Tay, and the North Sea. Area, 503 square miles. Pop. 160,499. It is one of the most thickly-peopled and best-cultivated counties of Scotland. Principal towns, Cupar, Dunfermline, St. Andrew's, Dysart, and Kirkcaldy.

Fifteenth', in music, the interval of a double octave, comprising a distance of fifteen grades of the scale, from the lower to the upper note; also, the name of a stop in the organ, of which each pipe is tuned two octaves above the regular pitch as represented on the keyboard.

Fifth, in music, an interval comprising five degrees of the scale, or the distance, *e. g.*, from C to G, D to A, etc. Fifths, according to their position on the scale or the influence of accidentals, are various in their compass, embracing from six to eight semitones. They are usually classified as *perfect*, *diminished*, and *superfluous* (or *augmented*). The perfect contains three whole tones and one semitone; the diminished, two whole tones and two semitones; and the superfluous, three whole tones and two semitones. For example,



In counterpoint the progressions of the fifth are regulated by certain laws, partly arising from the harmonious nature and relations of this chord, and partly in view of the ease with which its use and abuse suggest themselves to the minds of young harmonists, who are unaware of the difficulties of its proper treatment. The restrictions, however, imposed by the old masters have been so far relaxed in modern schools of music that certain progressions of fifths are now freely used which a century ago would have been strictly forbidden. William Staunton.

Fifth-Mon'archy Men, a small religious sect in England during Cromwell's protectorate and the first part of the reign of Charles II. They professed to believe that the time was near at hand when, to the four great monarchies of Daniel's prophetic vision, was to succeed the fifth, which was to break in pieces all others and to "stand for ever." Of this Jesus was to be King; and in their eagerness to seize the fitting opportunity to proclaim Him they conspired (Apr. 9, 1657) against Cromwell; and again (Jan. 6, 1661), on the prospect of Charles II. being fully restored to power, they rose in insurrection, and attempted to sustain themselves, under a leader named Venner, by force of arms. The insurrection was promptly suppressed, and Venner and several others were executed. The Independents, Baptists, and Quakers formally disclaimed all sympathy with the insurgents, yet were made to suffer odium and civil hardships in consequence of the movement. Two years later another insignificant rising occurred, in consequence of which six persons are said to have been executed. The sect seems to have had no connection with Anabaptists on the Continent, but to have derived encouragement—however unwarrantably—from the views of some eminent men. Clarendon says of Sir Henry Vane that "he did at some time believe he was the person deputed to reign over the saints upon earth for a thousand years." Yet he certainly had no sympathy with the Fifth-Monarchy men. R. D. Hitchcock.

Fifth Nerve. See Trigeminus, by E. C. Seguin, M. D.

Fig [Fr. *figue;* Lat. *ficus*], the fruit of *Ficus carica*, L., a deciduous tree of the Artocarpeæ or bread-fruit family, fifteen to twenty feet high, with rough and deeply-lobed leaves, a native of Asia from Syria to the Caucasus and Koordistan. In the Scriptures the fig tree is often mentioned, along with the vine, as a symbol of peace and plenty. Although unknown in Greece during the Homeric age, it was common in the time of Plato; it was early introduced into Italy, and thence into Spain and Gaul. Charlemagne ordered its cultivation in Central Europe, and it is now cultivated in most warm temperate climates. That it has succeeded even in England appears from the mention of the historian Matthew Paris, that the year 1257 was so inclement that figs, cherries, and plums totally failed to ripen. Figs can be well ripened, and can be raised for preservation in the dried state, only where the summer and autumn are warm and dry. In the Atlantic U. S. the main

obstacle to their cultivation is the cold of winter, which frequently destroys unprotected trees even in Florida. On the Pacific coast they find a more congenial climate. The fig tree bears two crops in a season—an earlier one from the axils of leaves of the preceding growth; a later and longer-continued one from the axils of the leaves of the season. The fig is popularly said to fruit without flowering. This comes from the nature of this particular fruit. It is a hollow, pear-shaped receptacle, nearly closed or barely pervious at the broad apex, lined throughout the interior with innumerable small flowers, male and female. The so-called seeds are the ripened achenia (*i. e.* seed-like fruits) of the latter; the luscious pulp mainly belongs to the ripened and softened receptacle or hollow flower-stalk. A good idea of the botanical nature of a fig is got by comparing it with *Dorstenia*, of the same natural family; in this the flowers occupy the upper surface of a plate or saucer shaped common receptacle. By imagining this saucer to deepen into a cup, and the cup to pass into the form of a jug by a contraction of the summit, the whole peculiarity of the fig-fruit will be apparent. In ripening, the acrid milky sap characteristic of the family is replaced by saccharine matter, chiefly grape-sugar. Fresh figs, most agreeable to many, are too sweet and cloying for other palates, being destitute of acidulous flavor. In the fresh, and still more in the dried state, figs form an important article of food in the Levant, etc. Smyrna is the principal mart whence dried figs are exported to Northern Europe and America. The annual import into Great Britain alone is valued at over $1,000,000. Dried figs are said by the dealers to be *natural* when not compressed in the packing, but retaining their original shape, or *pulled* when after drying they are made supple by kneading, and then packed by pressure into drums or boxes. *Eleme* figs are merely those of superior quality, so called from a Turkish word meaning "hand-picked."

REVISED BY ASA GRAY.

Figeac, town of France, in the department of Lot, on the Sellé. It is a quaint old city, situated in a deep valley surrounded by rocky, vine-clad heights. Pop. 8381.

Fight′ing-fish, the *Ctenops pugnax*, a little fresh-water fish of Farther India, often brought from Siam as a curiosity. It is akin to the perch family. In its native lands this fish is kept for fighting purposes, and much money is often wagered upon the result of the combat. Two of these fishes placed in the same vessel of water will attack each other with the utmost fury.

Figuei′ra da Foz, town of Portugal, in the province of Beira, at the mouth of the Mondego, has a lively trade in salt, oil, wine, and fruit, and is a favorite bathing-place. Pop. 4432.

Figue′ras, frontier-town of Spain, in the province of Gerona. On a height near the town is the citadel of San Fernando, the strongest fortress of Spain and the key of the Pyrenees. Pop. 10,370.

Figueras (ESTANISLAO), b. in Barcelona Nov. 13, 1819; received an excellent education; became at an early age one of the leaders of the liberal party in Catalonia; was elected to the Cortes in 1851; was a member of the revolutionary committee of Tarragona 1854; engaged in the liberal conspiracy of 1866, for which he was imprisoned in 1867, and took a prominent part in the organization of the republican party after the overthrow of Queen Isabella in 1868. On the abdication of King Amadeo (Feb. 11, 1873) he became provisional president of the republic, holding that post until April, when he retired from public life.

Figuero′a, de (FRANCISCO), b. at Alcalá de Henares, Spain, about 1540; author of highly-admired poems in Italian and Spanish. D. about 1620.

Figuier (GUILLAUME LOUIS), French chemist and scientific writer, b. at Montpellier Feb. 15, 1819; became M. D. 1841, professor in the school of pharmacy at Montpellier 1846; then scientific editor of *La Presse* at Paris. Has written largely in scientific journals, publishing also *Exposition et Histoire des Principales Découvertes Scientifiques Modernes* (3 vols., 1851–53; 5th ed. 1858); *Histoire du Merveilleux dans les Temps Modernes* (4 vols., 1859–60); *Vie des Savants Illustres depuis l'Antiquité jusqu' au XIXe Siècle* (1866), etc., and a large number of popular scientific works translated and extensively read in the U. S. and Great Britain.

Fig′urate Num′bers, series of numbers that may be derived from the expression

$$\frac{n(n+1)(n+2)\dots(n+m)}{1.2.3\dots.(m+1)} \cdots\cdots (1),$$

by giving suitable values to m and n. The value of m determines the nature of the series, and n denotes the place of any term in that series.

Figurate series are divided into orders: If $m=0$, the series is of the *first* order; if $m=1$, the series is of the *second* order; if $m=2$, the series is of the *third* order; and so on. If we make $m=0$, expression (1) reduces to n. Making n equal to 1, 2, 3, etc., we have for the figurate series of the *first* order the natural numbers

1, 2, 3, 4, 5, . . . , etc.

If we make $m=1$, expression (1) reduces to $\frac{n(n+1)}{1.2}$. Making n equal to 1, 2, 3, etc., we have for the figurate series of the *second* order the numbers

1, 3, 6, 10, 15, 21, 28, . . . , etc.

If we make $m=2$, expression (1) reduces to $\frac{n(n+1)(n+2)}{1.2.3}$. Making n equal to 1, 2, 3, etc., we have for the figurate series of the *third* order the numbers

1, 4, 10, 20, 35, . . . , etc.

In like manner, figurate series of higher orders may be deduced. They may also be deduced in succession by means of the following law—viz. if the n^{th} term of a series of any order is added to the $(n+1)^{\text{th}}$ term of the series of the preceding order, the sum will be the $(n+1)^{\text{th}}$ term of the given series. Thus, take the series of the first and second order:

1st *order:* 1, 2, 3, 4, 5, 6, 7 . . .
2d *order:* 1, 3, 6, 10, 15, 21, 28 . . .

If we add the second term in the upper line to the first term in the lower line, we have the second term in the lower line; if we add the third term in the upper line to the second term in the lower line, we have the third term in the lower line; and so on.

Regarding the series of 1s as a figurative series of the 0 order, we may form from it, in the manner just explained, the following table, called

THE ARITHMETICAL TRIANGLE.

0th *order*......	1	1	1	1	1	1	1	.	.
1st *order*......	1	2	3	4	5	6	7	.	.
2d *order*......	1	3	6	10	15	21	.	.	
3d *order*......	1	4	10	20	35	.	.		
4th *order*......	1	5	15	35	.	.			
5th *order*......	1	6	21	.	.				
6th *order*......	1	7	.	.					
7th *order*......	1	.	.						
	.	.	.	.					

This table may be continued to any desirable extent. The numbers in the first line are simple units; those in the second line are the natural numbers; those in the third line are called *triangular* numbers, because they express the numbers of balls that may be arranged in equilateral triangles as in the diagram:

```
                               o
                   o          o o
          o       o o        o o o
o,       o o,    o o o,     o o o o, etc.;
```

those in the fourth line are called *pyramidal* numbers, because they express the numbers of balls that can be piled in the form of regular triangular pyramids; those in the fifth, sixth, and seventh lines have been called *trianguli-triangular*, *trianguli-pyramidal*, and *pyramidi-pyramidal* numbers. Hence the name *figurate numbers*.

It will be seen that the numbers of the table, read diagonally upward, are the numerical coefficients of the development of $x+a$ to a power whose exponent corresponds to the order of the series. This property, besides rendering the table useful in the formation of powers, enables us to use it, in the calculus of probabilities, to find the number of combinations of m things taken in sets of n. Thus, to find the number of combinations of 7 things taken in sets of 1, 2, 3, etc., we enter the table opposite the 7th order and read diagonally upward: the number in the second column is the number of combinations of 7 things in sets of 1; that in the third column is the number of combinations in sets of 2; that in the fourth column is the number of combinations in sets of 3; and so on.

It is this last property that connects the arithmetical triangle so closely with the logical *Abecedarium*. (See JEVONS, *Principles of Science*.) W. G. PECK.

Fig′ured (*canto figurato*), a term much used in ancient ecclesiastical music, meaning refined or ornamented. The original Gregorian chants being exceedingly plain, and limited in their range of melody, were, in the course of time, varied and rendered more free by the addition of new inflections, wider excursions of melody, and other traits

of ornament and expression. Music so improved was said to be *figured*, to distinguish it from the *canto fermo*, or plain chant. A similar application of the term was subsequently made in reference to pieces more elaborately and richly harmonized than those of the "strict" style.

Figured Bass, in music, a bass over or under which the harmony is expressed by ordinary figures, dashes, etc., instead of being written out in notes. These figures are not intended to represent the structure or *melodious movement* of the upper parts, but only the nature and elements of the *harmony* on which those parts depend. Nor do the figures usually determine the exact *positions* of chords as played by the right hand on keyed instruments; as such positions may be taken near the bass, or distant from it, or be in either close or dispersed harmony, at the discretion of the performer. The figures represent intervals counted *upward* from the bass; and generally those intervals which *exceed* an octave are expressed by figures denoting the same letter *within* the octave. Accidental flats, sharps, and naturals are used with the figures when necessary, but a sharp is frequently expressed by a stroke drawn through the figure. Figures standing one *over* the other indicate intervals to be struck simultaneously, but those standing one *after* the other are to be taken successively. The triad (or "common chord"), in its fundamental form, requires no figures, unless when succeeding a different chord on the same bass, or when there may be some ambiguity or obscurity in the progression. In keys having sharps or flats at the signature (at the beginning), those sharps or flats will of course affect the figures as well as the notes.

Dotted notes may be represented by dotted figures. Rests also may be introduced, though a small cipher (o) is preferable.

The words *tasto solo* imply that the bass is unaccompanied by harmony until the recurrence of figures.

The present article affords room only for an explanation of the general term, but its practical working will be easily understood; and for fuller information on this subject the student may consult ALBRECHTSBERGER'S *Generalbass-Schule*, CHERUBINI'S *Treatise on Counterpoint*, and BEETHOVEN'S *Studien im Generalbass*.

WILLIAM STAUNTON.

Figure of the Earth. See EARTH, by PROF. A. GUYOT, LL.D.

Figure, Grammatical and **Rhetorical,** a distinction of great importance in the logical construction of figurative language—a subject on which there is an extraordinary amount of confused thinking. The grammatical figure rests upon a *real* relation of the subject and predicate. "My Milton is in four volumes" involves a figure or form of speech departing from strict literalness; but it is a grammatical figure, for the relation on which it rests is real, objective, and undeniable: it is, according to the letter, the grammar, and hence has been styled the grammatical. Milton is literally the author of the works contained in the volumes. The two great grammatical figures are METONYMY (which see) and SYNECDOCHE (which see). They may be at home in the plainest and most commonplace prose—in the language of a will or of an advertisement. The rhetorical figure rests upon an ideal or an idealized relation between the subject and predicate. The mind makes it, and can unmake it; it can exist to one mind, and be denied by another; it may be conceded by the mind at one time and in one state, and denied at another time. "Milton is an eagle" involves a METAPHOR (which see), which is the chief rhetorical figure. The relation is ideal; it may be denied; or the mind may allow it at one time and deny it at another. Some of the most confused and persistent logomachies have arisen from failing to observe this distinction. C. P. KRAUTH.

Figures, Numerals. See NUMERALS.

Fig'wort (*Scrophularia*), a flowering plant of the order Scrophulariaceæ, common in many parts of North America and Europe. It was formerly prized in medicine for the cure of scrofula and other diseases. Its leaves and knotty root may have active properties, but at present are not much used. Other species of the genus, as *Scrophularia aquatica*, etc. (mostly Old-World plants), have had some repute as medicines.

Fiji. See FEEJEE.

Fil'ament [Lat. *filamentum*, *filum*, a "thread"], in botany, is the support or stalk of the anther of the stamen; "it is to the anther what the petiole is to the blade of the leaf."—*Gray*.

Filangie'ri (GAËTANO), b. at Naples Aug. 18, 1752; entered the army 1766; went to the royal court 1777; became a member of the supreme council of the finances 1787. Is chiefly remembered as author of *Scienza della legislazione* (1780–88, unfinished), a noble treatise on the principles of legislation. D. at Vico-Equense July 21, 1788.—His son CARLO (1783–1867), duke of Taormina, was a brave soldier under Napoleon, governor of Sicily under Ferdinand II., and prime minister under Francis II. of the Two Sicilies.

Fil'bert [etymology doubtful; believed to be *full-beard;* Ger. *Bartnuss*, "beard-nut"], the nut of the HAZEL (which see). The name is not often applied to the American wild hazel-nuts; and in commerce the round varieties of European hazel-nuts are called cob-nuts, the name *filbert* strictly belonging to the elongated sorts, which have also a finer-cut and more beard-like envelope; whence perhaps the name. Filberts are chiefly the product of *Corylus Avellana*, the common hazel of Europe and Asia, which is extensively cultivated. Barcelona nuts are a variety of filbert, kiln-dried for better keeping. *Corylus Colurna*, of Turkey, produces large, oily filberts. Filberts are used as dessert-nuts, and large amounts of oil (nut-oil) are also expressed from the kernels. It is a drying oil, much used by artists and makers of choice varnishes. But few filberts are grown in the U. S. Several species are known.

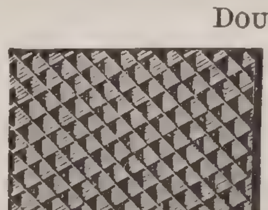
File [Fr. *lime;* Ger. *Feile*]. A file is a tool used in shaping all kinds of materials of construction. It is a bar of steel, the size and shape of which are determined by the use for which it is intended. Its surfaces are covered with sharp cutting edges or teeth, the direction and number of the edges and the magnitude and distribution of the teeth varying with the nature of the material and the degree of smoothness of the surface which the file is required to produce. The cutting edges or teeth are usually made by the edge of a cold chisel. Where the surface has isolated sharp teeth separated by comparatively wide spaces the file is called a *rasp*. The teeth of the rasp are made with a punch having a pyramidal point.

Files are used upon surfaces of all kinds. Rasps are especially fitted for rapid work on surfaces of materials having slight resisting power. They are used by workers in wood and leather, and by the farrier. The effect of rubbing the file upon the surface of the metal, wood, ivory, or other material to be changed in form or dimensions, is to abrade it, cutting from it minute shavings or small particles, and reducing the mass by a very gradual process. Files are therefore only used in shaping small pieces or in "finishing" surfaces which are already of approximately correct figure. The file usually follows the work of the lathe or the planer-tool.

The forms given to files, as well as their shapes and sizes, are almost numberless. Those files which have cutting edges extending unbroken from side to side are called "floats" or "single-cut" files. Those which have two sets of such edges, crossing each other at an angle, are called "double-cut." The effect of such crossing of edges is to produce points or teeth, rather than true cutting edges. The rasp has already been defined.

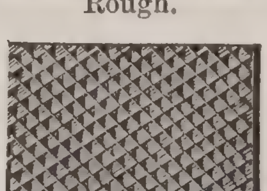
The coarseness or fineness of the file is known by the trade-terms: 1, rough; 2, middle cut; 3, bastard; 4, second cut; 5, smooth; 6, superfine or dead-smooth. The second grade is rarely found in the market. The most common are the "Sheffield cuts," rough, bastard, and smooth. These are shown in the accompanying sketches.

DOUBLE-CUT.

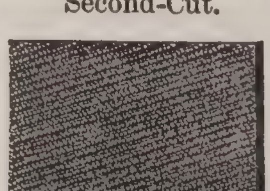


Rough.

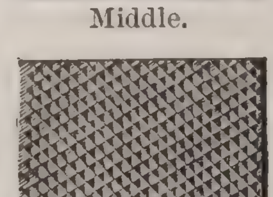
Second-Cut.



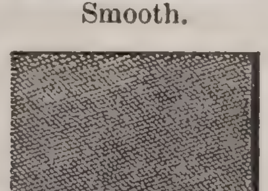
Middle.



Smooth.



Bastard.



Dead-Smooth.

In what are known as the Nicholson or "increment-cut" files, the forms of the teeth and the cutting edges are very similar to those of ordinary files as just described. These are machine-cut files, but they differ from other machine-cut files by being cut with teeth slightly expanding or increasing in size and space from point to heel, thus avoiding

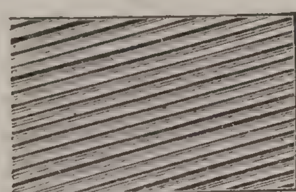
the great regularity of teeth common to ordinary machine-cut files. A writer remarks in regard to this peculiar file:

RASP-CUT. FLOAT-CUT.

Rough.

Rough.

Bastard.



Bastard.

Smooth.

Smooth.

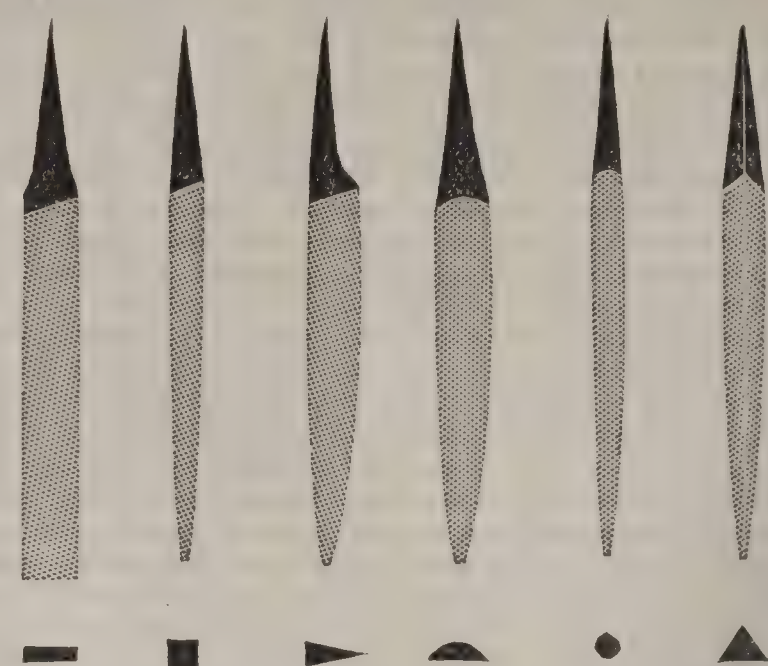
"The difference between this and the perfect regularity of other kinds must be apparent, particularly in double-cut files, as in the one case the file, cut with such extreme regularity, when put to use will in the first inch of its movement produce channels or grooves, and these grooves will continue to be made deeper as the file is shoved along, thus producing that 'grooving' and 'chattering' so often complained of; while with the 'increment-cut file' the grooves made by the movement of the file for the first inch will have their sides cut away as the file is moved toward the 'tang' or handle, and *vice versâ;* and while it is cutting as fast as its points permit, it is also said to cut smoother than the best hand-cut file of the same coarseness. The irregularity spoken of consists not only in the spaces between the teeth, but also in the heights of the teeth themselves." The object in having the teeth of differing heights is to admit of their being held down to the work with less effort on the part of the workman. Files having perfectly regular teeth, as is commonly the case with machine-made files, require a great pressure to compel the teeth to take hold of the work in surface filing.

The regularity of the teeth, so characteristic of most machine-work, is not easily obtained by the hand-worker, who, seated with his blank firmly held on a stone block in front of him, strikes the chisel into the blank and raises the first tooth; the chisel is then lifted out of its groove, placed on the blank and slid up until it comes into contact with the tooth previously raised, when the second blow is struck and another tooth is produced. If the force of these blows were alike in each case, the spaces would be equal; but as it is impossible for the most expert workman to strike the great number of blows required in the entire side of a file with exact uniformity, irregularity in the distribution of the teeth must exist. Possibly, the failure of many of the earlier enterprises may be traced in a measure to the defect in their machinery of producing this extreme regularity in the cut of their files.

When a side or an edge of a file is left uncut, it is said to be "safe."

Watchmakers' files are often exceedingly delicate, measuring less than an inch in length, and having a thickness not greatly exceeding that of a coarse bristle. The larger files used by watchmakers seldom exceed four inches in length. Mechanics working on tools, small apparatus, and light machinery, use files of from six to twelve inches in length, and machinists employed on steam-engines and heavy machinery call for files of from ten to eighteen inches in length, and occasionally, for special purposes, use files of double these sizes. The shape of the cross-section of the file is usually either that of a square, a parallelogram, a circle, an oval, a triangle, or a combination of straight lines and arcs of circles. Fig. 1 represents the "parallel hand" file, called, when small, a "pottance" file, or if very slender a "pillar" file. This file is also called a "verge" or a "pivot" file, and when of large size a "cotter" file. Fig. 2 represents the "square" file, which is often, as is the case with all other forms of section, made with parallel sides. Fig. 3 is the "knife" file. This form is usually small, and is of limited use. It is made for the purpose of cutting or enlarging narrow, triangular notches. Fig. 4 exhibits the "half-round" file, the section of which, as seen, is not a complete semicircle. The thickness of the file is usually from one-half to one-fourth the radius of the circle. Fig. 5 is the "round" file. If of small size it is called, when tapering, a "rat-tail" file, and when parallel a "joint" file or "gulletting saw" file. Fig. 6 is the triangular file, often called by the workman a "three-

FIG. 1. FIG. 2. FIG. 3. FIG. 4. FIG. 5. FIG. 6.

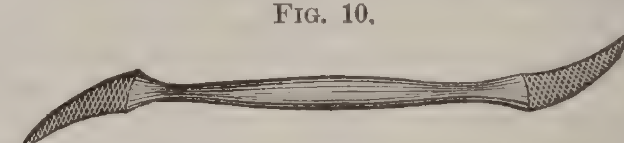


square" file. It is used for sharpening saws, for cutting internal angles, and for cleaning up corners. Fig. 7 resembles Fig. 1, but it is a thinner file. It is known as a "warding" file, and was formerly much used by locksmiths in cutting the wards of the keys of locks. Fig. 8 is the "cross" or "double half-round" file, the two sides usually having different curvatures. The first name is derived from the fact that it was originally designed for trimming out the crosses or arms of small wheels. Fig. 9 is the "slitting," "feather-edge," or "screw-head" file, having two knife edges, and used for the same purpose as the "knife file."

FIG. 7. FIG. 8. FIG. 9.

"Equalling" files are flat and thin. They are always uniform in thickness, and usually in width also. Two opposite surfaces are frequently left "safe." "Rubbers" are large, heavy, coarse files, of usually inferior quality, which are used for rough kinds of work. "Rifflers" or "bent" files are of the shape shown in Fig. 10, and have usually curved surfaces. They are used by sculptors and

FIG. 10.



by makers of ornamental castings. They are double-cut, single-cut, or rasp-cut, and of various degrees of fineness, as required for different kinds of work. They are especially adapted for smoothing up irregular forms, such as are most frequently met with in bronze castings.

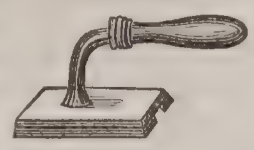
The common kinds of file are frequently bent for convenience in working upon curved surfaces. Bending is readily accomplished by heating to a red heat and shaping over a properly-formed wooden block by striking it light blows with a wooden mallet. When the file has thus been given the desired shape, it is re-tempered and is ready for use. The file is bent to a smaller radius than that of the concavity in which it is to be used.

The tapering end of the file outside the shoulder, and upon which the handle is driven, is called the "tang" or the shank. The tapering form given the tang is not well adapted to give a firm hold to the handle, and it has probably been adopted and retained partly through conservatism and partly because workmen frequently use one handle for several files, and the tapering tang permits the file to be readily inserted into and withdrawn from the handle. To ensure a good "hold," a tang of uniform section, and either cylindrical or prismatic in form, would be far preferable. This has been proposed by Mr. J. E. Sweet. Mr. Sweet is also the inventor of the round "screw-thread" file, in which the cutting edges are formed by making a "ratchet-thread" in the lathe, different pitches of thread thus making different grades of file. The cutting edges of these files are thus formed from the solid stock, and are said to possess remarkable endurance, and, acting like milling tools, do rapid and good work.

The handle of the file is usually driven directly upon

the tang. It sometimes happens, however—as in filing extended flat surfaces, for example—that the file-handle interferes with the use of the file by bearing upon the surface and preventing the cutting portion of the file coming down to its work. In such cases the tang is bent or a "holder" is used, as in Figs. 11 and 12.

FIG. 11.



Files are usually made of the best of material, and great

FIG. 12.

care is taken to select steel that is uniformly and highly converted. "Rubbers" for smiths' use are made from blistered steel, but all other files are made from better grades of steel. Files are forged into shape in a similar manner to all small work in steel, the smith taking care not to work the metal at a higher than a blood-red heat. Peculiar shapes are produced in dies or formers. Special care is taken to select good fuel for the fires in which the blanks are forged. It is usually coke, made from coals free from any trace of sulphur. The blanks are very thoroughly annealed after having been forged. The finer qualities are annealed or "lighted" in iron boxes, in which they are imbedded in sand. Cheaper grades are annealed in ordinary annealing ovens—a less expensive method, but one in which the blanks are less completely protected against the access of air. The annealed blanks are next ground into the exact shape demanded, and the scale formed during the antecedent process is removed, leaving a clean and properly formed surface for the file-cutter to work upon. It was formerly customary to shape the blanks by filing, but the use of the grindstone is now much more usual. After grinding, the blanks are greased and sent to the file-cutter.

File-cutting is usually performed by hand, although many attempts have been made during the past two centuries to produce a machine capable of making files of equally good quality. The tools of the file-cutter consist of peculiarly shaped hammers and chisels, an anvil, and packing pieces of lead or pewter. The hammers weigh from one to five or six pounds, the smaller sizes being used for very small and the heavier for very large files. They have a singular form, such as would be obtained by making the head first in the form of a truncated pyramid—the upper and lower bases having a breadth equal to about one-fifth and one-fourth its altitude respectively—and then bending it to an arc of a radius equal to about twice the altitude. The handle is inserted at a point considerably nearest the smaller end. In striking a blow the hammer is pulled toward the workman as it descends, the mass taking a direction approximating to that of the inclination of the chisel. The chisel is short and light, nearly a triangle in form, with a broad, straight edge. It is held between the finger and thumb of the left hand, much as a pen is held by the right hand in writing. The file-blank is placed upon the anvil, where it is held by a strap passing over each end and tightened by the workman, who places his feet in the "bight" of the strap as a horseman places his feet in his stirrups. As each blow is struck the workman moves the blank slightly to bring the chisel over the proper place for the next cut, the strap being loosened at the instant to allow the movement to take place.

In making small and "smooth" or "dead-smooth" files, the blows and these nearly simultaneous movements succeed each other with surprising rapidity. The smallest files are often cut by women or by boys and girls. The surface of the file being "single cut," a second set of cuts is usually made at a large angle with the first, the two sets making angles of about $+50°$ and $-80°$ respectively with the middle line of the file. Before making the second cut the tops of the teeth already formed are smoothed off by lightly running over them a fine file. The blank is then turned over, and the opposite side and the edges are next cut. When a surface already cut is placed downward, a strip of lead or pewter is placed beneath it, to prevent injury of the teeth by contact with the hard surface of the anvil. By constant practice the workman becomes very expert, and the rapidity and accuracy of his work are quite wonderful, and are probably among the finest illustrations of the degree of perfection in workmanship which may be attained by the hand when guided by a delicate sense of touch.

After cutting, the files are next hardened, although those made for use on wood and other comparatively soft substances are frequently left unhardened, and several kinds which are made of peculiar shapes for some purposes, as for sculptors, are made of good iron and case-hardened. The files to be hardened are first besmeared with a mixture of salt and carbonaceous materials which are considered to be best adapted to preserve the teeth from decarbonization and oxidation, and which at the same time, by fusion upon the surface, may indicate the proper heat at which to temper. This surface-coating of comparatively non-conducting material also checks the first sudden change of temperature on immersion in the tempering liquid, and thus decreases the liability of the file to crack. The difficulty which might be experienced from the change of shape which invariably occurs to a greater or less extent on suddenly cooling the file is avoided by giving the untempered file a slight distortion in the opposite direction, so that the subsequent change of shape may leave it in the desired form. In all cases the general shape of the file is determined previous to the operation of hardening.

When the file has been heated in the fire to a temperature at which the surface-coating fuses, it is taken by the tang and suddenly immersed in a tank of water, the rapidity and particular direction of the immersion being determined by the size and shape of the file. Withdrawing it before it becomes cold, the workman inserts it between the jaws of a clamp or between a pair of iron bars, where he corrects by force any slight defect in form, while pouring water over it to thoroughly cool it. The tang is next softened by immersion in molten lead; the file is then scrubbed thoroughly and washed in lime-water to remove the scales of salt mixture. It is carefully dried and oiled, and is then ready for the market.

A careful system of inspection is adopted by the best makers, by which all imperfect files are detected and thrown out to be sold as "wasters." Those files which pass inspection are packed by dozens in papers. In the U. S. some files are packed in boxes.

The time at which files were first made seems to be quite unknown. The manufacture of files was introduced into America very soon after the settlement of the country. File-cutters settled in Pennsylvania at the end of the seventeenth century. The firm of Broadmeadow & Co. began file-making in Pittsburg in 1829. George Chatterton, a Sheffield file-maker, settled in Providence, R. I., in 1839, and is still known (1874) as a leading manufacturer. There are now a considerable number of file-manufacturers in the U. S.

File-cutting machinery was probably first proposed nearly two centuries ago. A Parisian mechanic, Duverger, presented a file-cutting machine to the French *Académie des Sciences* in 1699, and a description of this apparatus appeared in the *Journal des Savants* in 1702. Thiout in his *Traité de l'Horologie*, published at Paris in 1740, describes another machine. Still later, Raoul, another French mechanic, made files by machinery, and obtained a report upon them from a committee of the *Lycée des Arts* in which it was stated that they were equal to the best English hand-made files. In 1812, Morris B. Belknap of Greenfield, Mass., patented a file-cutting machine, and William T. James, who is said to have worked at Union Village, patented another, which has also not been described. In 1836, Capt. John Ericsson, then in England, patented a file-cutting machine, which is described in Holzapffel's work on *Mechanical Manipulation*, where it is stated that one machine could do the work of ten men. In 1847 an ingenious machine was invented by George Winslow of Boston, and was described in Appleton's *Dictionary of Mechanics*. Still later, a machine was invented by M. Bernot of Paris, and was described in detail by Byrne. This machine was used to some extent with success in France and Belgium, and has since 1860 been introduced into Great Britain and the U. S. In this machine the chisel is driven by a cam as the file-blank moves along beneath it, and the difference in height of teeth which is given by the hand-process in passing from the end to the middle of the file, and the reverse, is thus imitated. Considerable sums of money were expended in the effort to make this process a success in Birmingham, but in vain. A few of these machines are still in operation in the U. S., at Pawtucket, R. I. In 1858 the attempt was made at Ballardvale, Mass., to manufacture files by the use of the machine invented by Milton D. Whipple. Extensive works were erected and a large amount of capital was engaged. The company failed in 1869. Some of the machinery was purchased by other manufacturers, and is still in operation. In 1866 the Weed File Company commenced operations at South Boston, Mass., but failed after working two years. The Nicholson File Company of Providence, R. I., was organized in the spring of 1865, with Mr. W. T. Nicholson, the inventor of the machinery, at its head. This company is claimed to have built machines which do satisfactory work.

This problem has, as is seen from the above sketch, taxed the patience and has employed the ingenuity of some of the ablest mechanics of all countries for many years. Very small clock and watchmakers' files have been made by machinery for many years, but the difficulties met with in the

attempt to make larger files have seemed almost insurmountable. Maigne, in his *Dictionnaire des Inventions*, remarks: "It has seemed impossible to obtain machinery having the delicacy of touch of the practised hand of the file-cutter, which varies its action, the position of the chisel, and the force and direction of each blow according to circumstances." The problem to be solved embodies the following conditions: To make direction and intensity of the blow such as to give a cut of precisely the desired depth, and, on curved surfaces, of spread; to draw back the chisel without injuring the edge just made; to avoid a rebound or "chattering" of the chisel; to move the blank with such regularity as shall ensure uniformity in the distribution of the teeth; and to combine all of these movements with absolute precision as to time of succession, and with such speed as shall enable the machine to compete successfully with hand-labor. The Bernot and the Nicholson machines seem to have been the most successful yet invented.

R. H. THURSTON.

File-fish (Balistidæ), a family of fishes belonging to the sub-order Sclerodermi of the order Plectognathi. The file-fishes have a conical muzzle, terminating in a mouth furnished with teeth in both jaws. In *Balistes* proper there are eight teeth in a single row in each jaw; their bodies are covered with hard rhomboidal scales, having the appearance of the teeth of a file; and they are furnished with spines in relation with the dorsal and other fins. The file-fishes are brilliantly colored, and abound in warm seas; several species occur on the Atlantic coasts of the U. S. The species represent several very distinct types of structure, varying in the development of the spinous dorsal fin, the position of that fin (which in some is very far forward), the character of the scales, etc. The principal types of structure are two, and represented in the Balistinæ, which has two or three dorsal spines peculiarly articulated, and the Monacanthinæ, which have but one such spine. (See BALISTES.) THEODORE GILL.

Fi'ler, tp. of Manistee co., Mich. Pop. 376.

Fil'ibuster [Sp. *filibustero*, from *filibote*, a "flyboat," a fast-sailing vessel, first used, it is thought, on the river Vly in the Netherlands], a name formerly applied by the Spanish Americans to the buccaneers and other pirates. In 1849 and 1851 the name was applied by the Cubans to Narciso Lopez and his followers; and from that time it became a common name in the U. S. for the military adventurers who have fitted up expeditions from this country against the Spanish American states. The most famous of the filibusters have been Lopez, above mentioned, and William Walker, who invaded Sonora, Mexico, in 1853, and afterwards three times attempted to make himself master of Nicaragua (1855–57, again in 1857, and afterwards in 1860.) (See LOPEZ, NARCISO, and WALKER, WILLIAM.)

Filica'ja, da (VINCENZO), a celebrated Italian poet, b. at Florence of a noble family Dec. 30, 1642, and d. Sept. 24, 1707. Even in youth his ardent temperament was controlled by a clear judgment and high principles, and he returned to Florence, after his student-life at Pisa, with the character of an accomplished scholar and an earnest, upright man. Eminent as a jurist, and even consulted as a theologian, he occupied every leisure hour with poetry, and when at the age of thirty-one he married into the great Capponi family and was made senator by the grand duke, he was already known in Italy as a poet of distinguished genius. His reputation became European after the appearance of his noble *Canzone* addressed to John Sobieski on occasion of the raising of the siege of Vienna in 1683, and kings and emperors congratulated and honored him. His sonnets are models of purity of style, of vigor, and of sublimity of thought. Among the most celebrated of these are *La Providenza*, a sonnet of exquisite beauty, and *L'Italia*. The translation of the latter, introduced by Byron into the fourth canto of *Childe Harold*, and beginning with "Italia! oh Italia!" etc., is familiar to every English reader. Filicaja held positions of high trust, and his life was in noble accord with the lofty sentiments of his poems. Tiraboschi says that "he died deeply lamented alike by rich and poor, and beloved by God and man." (TIRABOSCHI, *Storia della letteratura Italiana;* FABBRONI, *Vite Italiane;* CRESCIMBENI, *Vite degli Arcadi.*)

Fil'igree [from the Lat. *filum*, a "thread," and *granum*, a "grain"], a delicate kind of ornamental work made of fine wires of silver and gold entwined with beads. It is often extremely elegant, and is considerably employed for personal decoration. It comes chiefly from Italy and the Levant, and from Malacca and China.

Filio'que [Lat.]. The Council of Nice (325 A. D.) affirmed the consubstantiality of the Son with the Father, and simply declared its belief "in the Holy Spirit." The Council at Constantinople (381 A. D.) affirmed, in effect, the consubstantiality of the Spirit with both the Father and the Son, and taught the procession of the Spirit "from the Father." It was not affirmed that the Spirit proceeds from the Father *only*, but this is certainly the *suggestion* of the Creed, and it became at last the established doctrine of the Greek Church. But at first the Greek Fathers were not agreed. Athanasius (d. 373), Basil (d. 379), and Gregory of Nyssa (d. after 394) were non-committal, neither affirming nor denying the procession of the Spirit "from the Father *and the Son*" (*filioque*). Marcellus of Ancyra (d. 373, 374), Epiphanius (d. 403), and Cyril of Alexandria (d. 444) affirmed it. But it was denied by Theodore of Mopsuestia (d. 429), and by Theodoret of Cyrus (d. 457–458). And this, as we have said, is the view which finally prevailed in the Greek Church.

In the Latin Church, on the other hand, the double procession of the Spirit appears never to have been denied. In Saint Augustine's treatise on the Trinity, which was written between 400 and 416 A. D., it is clearly and emphatically taught that the Spirit proceeds from both the Father and the Son. And so firmly did this become the established doctrine in the West, that at the third synod of Toledo in Spain (589 A. D.) the clause *filioque* was added to the Niceno-Constantinopolitan Confession, and the doctrinal basis was laid for the schism—urged on by other influences—which permanently separated the Churches of the East and the West.

In the East, the orthodox doctrine, confirmed by the influence of John Damascenus (d. between 754–787), rejected from the Creed the *filioque;* while in the West, at a synod convened by the emperor Charlemagne, the introduction of the phrase into the Creed was endorsed especially through the influence of Alcuin, Theodulph of Orléans, and the Frank theologians. Pope Leo III. had already expressed his approval of the doctrine which the term implied, while he hesitated to approve its introduction into the Creed. He regarded it rather as speculative than practical. At length, when, in the ninth century, the controversy arose between Photius, patriarch of Constantinople, and Nicholas I., which led to the rupture between the Churches, the doctrinal difference was made a topic of discussion, and the Western Church was reproached with having departed from the faith. Its position was defended by Æneas of Paris, Ratramn of Corvey, and especially by Anselm, archbishop of Canterbury. In 1274 A. D. an attempt was made at the Council of Lyons to effect a reconciliation, but the effort proved futile. In 1439 A. D., at the Council of Florence, the attempt was renewed, but the formula proposed did not secure acceptance, although theologians of both parties were present, and had full opportunities to confer together. Plans of union between the two Churches have repeatedly been suggested, and hopes have been cherished that the breach might be healed. Possibly it might, if the question at issue had been limited to the phrase *filioque*, but in each instance in which its merits have been discussed, other influences have operated to prevent the reunion. Although other characteristic differences separate the two Churches, their diverse views of the *filioque* have become historically the most conspicuous, if not the most important. The two Churches are equally committed to the maintenance of the doctrine of the Trinity; the difference between them relates merely to the philosophy of the doctrine.

R. D. HITCHCOCK.

Filippi (CAMILLO), b. in Ferrara about 1510, d. 1574, belonged to the Roman school, and imitated Michael Angelo. His *Annunciation* in the church of Santa Maria in Vado in Ferrara is much admired. Most of his other pictures have perished.

Filippini (ANTONIO PIETRO), b. at Vescovato de Casinca, near Bastia, in Corsica, in 1529; took part in the civil wars which raged in the island from 1555 to 1564, and d. towards the close of the sixteenth century. His *Istoria di Corsica*, published in 1594, and again in 1832, tells the history of the island from the mythical ages to 1594, and although it is wanting in critical respects, and not remarkable for its style, it is very interesting on account of the characteristic facts it communicates and the peculiar nationality it depicts. The earlier part of the history, up to 1559, is given by reprinting the works of earlier chroniclers.

Fil'lebrown (T. SCOTT), U. S. N., b. Aug. 13, 1824, in the District of Columbia, entered the navy as a midshipman Oct. 19, 1841; became a passed midshipman in 1847, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866. Was in action several times on the Stono and Tagoda rivers, S. C., while in command of the Montauk and Sonoma, during 1864–65, and was favorably spoken of by Rear-Admiral Dahlgren in his official report of July 11, 1864. FOXHALL A. PARKER.

Fill'more, county of Minnesota, bordering on Iowa, and in the S. E. part of the State. Area, 864 square

miles. Its surface is undulating and very fertile. Grain, cattle, wool, dairy products, and hay are the agricultural staples. It is traversed by the Southern Minnesota R. R. Cap. Preston. Pop. 24,887.

Fillmore, county in the S. S. E. of Nebraska. Area, 576 square miles. The surface is undulating and finely adapted to grazing. It is intersected by the Burlington and Missouri River R. R. Cap. Geneva. Pop. 238.

Fillmore, post-v. of Marion tp., Putnam co., Ind., on the St. Louis Vandalia Terre Haute and Indianapolis R. R., 32 miles S. W. of Indianapolis. Pop. 217.

Fillmore, tp. of Iowa co., Ia. Pop. 1004.

Fillmore, tp. of Allegan co., Mich., on the Michigan Lake Shore R. R., 18 miles N. W. of Allegan, and is traversed by the Chicago and Michigan Lake Shore R. R. P. 1436.

Fillmore, post-tp. of Fillmore co., Minn. Pop. 937.

Fillmore, post-v. of Jackson tp., Andrew co., Mo. Pop. 271.

Fillmore, tp. of Bollinger co., Mo. Pop. 427.

Fillmore, post-v. of Hume tp., Allegany co., N. Y., on the Genesee River and Canal. Pop. 215.

Fillmore (Millard), D. C. L., the thirteenth President of the U. S., was b. of New England parentage in Summer Hill tp. (then a part of Locke), Cayuga co., N. Y., Jan. 7, 1800. Worked in youth upon his father's farm in Sempronius (now Niles) in the above county, and when fifteen years of age was apprenticed as a wool-carder and cloth-dresser. His school-education was scanty, but his leisure hours were occupied with study. Undertook when nineteen years of age the study of law with Judge Wood of Montville, N. Y., teaching school a portion of the time. In 1822 removed to Buffalo, N. Y., was admitted to the bar in 1823, and opened a law-office in East Aurora, N. Y.; commenced practice in the State supreme court in 1827, and in 1830 removed to Buffalo, where he became a partner of S. G. Haven and the late Judge N. K. Hall. Was sent to the New York assembly 1829–32; was in Congress 1833–35 and 1837–41, where he was an active and useful member, favoring Mr. J. Q. Adams's views upon slavery, and in other public questions acting mainly with the Whigs. While chairman of the committee of ways and means he took the leading part in drawing up the tariff of 1842. In 1844 was the Whig candidate for governor of New York. In 1847 was chosen comptroller of the State, and resigned in 1849. In 1848 was chosen Vice-President of the U. S. on the ticket with Gen. Taylor; and on the death of the latter, July 9, 1850, Mr. Fillmore became President. The great events of his administration were the passage of the Compromise Acts of 1850 and the Japan expedition of 1852. Mr. Fillmore was in Europe 1855–56, and in the latter year was the candidate of the American party for the Presidency. He did not again enter public life. D. of paralysis Mar. 8, 1874. Mr. Fillmore was affable and courteous, and of spotless private character. In his later years he took an active interest in the historical and fine-art societies of Buffalo and in the various local charities of that city.

Fillmore City, post-v., county-seat of Millard co., Ut., 150 miles S. of Salt Lake.

Filter. See Water, by C. F. Chandler, Ph. D., LL.D.

Fi′lum A′quæ [Lat., "a thread of water"], a legal term used to denote an imaginary line passing along the middle of a river, and dividing the soil underneath into two equal portions. In navigable streams above the point where the tide ebbs and flows, and in all streams which are not navigable, the *filum aquæ* designates the boundary to which the lands of owners along the river extend. If a grant be made of land adjacent to a river, it includes the soil to the centre of the stream, unless the terms of the grant clearly indicate a contrary intention. If an island forms in the river so as to be divided by the *filum aquæ*, the parts thus separated belong respectively to the opposite proprietors. If there be a gradual deposition of earth upon one bank, and none or little upon the other, the thread of the stream will constantly vary, so as to always be midway between the banks. But if a large portion of land be detached from one side and carried to the other, the thread remains as before, so that the estate of each owner may extend to the same limits as previously. If a single person owns the land on both sides of a stream, of course the entire bed is also his sole property.

The *filum aquæ* in all cases only denotes the ownership of land forming the bed of a river or rising above the surface, but does not indicate any exclusive proprietary right in the water which is thus supposed to be divided. Each riparian owner along the whole course of the stream has a right to have the water flow in its accustomed manner and volume, and no one of the owners is justified in diverting the stream to his own uses, or in so materially diminishing the water-supply which it affords as to occasion unreasonable injury to the others. But any use of the water, as for purposes of irrigation, etc., which does not sensibly impair the rights of such other persons, is allowable.

In the case of public rivers, or those in which there is a flow of tide water, the soil underneath does not belong to adjoining owners, but to the sovereign or state, so that the doctrine of the *filum aquæ* has in general no application. It may, however, denote the boundary-line between two different States or two different counties. In some of the States the doctrine is maintained that though there is no tide, the bed of a stream which is in fact navigable belongs to the State, and not to the riparian owners. (See Rivers, Navigable Streams.)

George Chase. Revised by T. W. Dwight.

Fin, the principal organ of locomotion in fishes and cetaceans. A fin usually consists of a thin membrane supported by bony spines or cartilaginous rays, often very numerous. When these rays or spines are direct appendages of the internal skeleton, they are homologues of the limbs of the higher quadruped—the pectoral fins representing the fore limbs, the ventral the hind limbs, even if (as is the case with the so-called jugular fins of some fishes) the ventrals are before the pectorals. There may be, however, one or more dorsal or anal fins (on the median line of the back or belly respectively), and a caudal fin at the end of the tail. These (called in fishes *vertical* fins) are not appendages of the internal skeleton. The tail of fishes is usually the chief organ of locomotion. The other vertical fins serve as a keel or centre-board, while the proper limbs (the pectorals and ventrals) probably assist in guiding the course. There are a few fishes which are quite destitute of fins. A few others have the pectorals so large as to serve to some extent as organs of aërial flight.

The tail (fluke) of a whale is flattened horizontally, instead of vertically, and the pectorals (arms) are present, while the posterior limbs, which in some cases are represented by the flukes, in others are rudimentary, being represented by a small bone concealed within the body. Some whales have a dorsal tuberosity, whence they are called "finbacks." The flippers of sirenians and of some of the seals approach closely to the character of the cetacean fin.

Fi′nal Cau′ses, causes (see Cause) which are not also effects. All other causes are, on one side, caused; they come forth as well as go forth. Final causes do not come forth. The physical sciences, as such, have nothing to do with final causes. When they exhaust physical causes, they exhaust all with which they have to deal, for physical science is the science of second causes. They assume the simples and forces as existent, and the question, *How* these simples and forces came to exist? is not for them. In this sphere the objection of Bacon and Des Cartes to the investigation of final causes is well founded. It was too often an indolent or ignorant evasion of the real work of science. But, as it is no part of the distinctive work of physical science to determine final causes, it is equally remote from its province to assert that there are not final causes. The whole doctrine of final causes has been denied by materialism. (See Strauss's *Old Faith and New Faith*.) Ulrici shows that the argument of materialism at this point rests upon a confounding of "the *notion* of causality with the *mental law* of causality," and that the law of causality "does not affirm that whatever *exists* must have a cause, but only that all that *happens*, all that *comes into being*, must have a cause." (See Ulrici's *Review of Strauss*, with an introduction by C. P. Krauth, 1874, pp. 86–91, and pp. 56–58.) C. P. Krauth.

Finance′ [It. *finanza;* Fr. *finance*]. The word originated in feudal usages, and primarily signified revenue arising from fines; hence it came to be a comprehensive term for the revenue of a king or state, and taking a wider range it now embraces the medium of exchange, the science of the medium of exchange and liquidation in commerce. Finance has been more briefly defined as the science of money. Although money is universally adopted as the instrument by which value is measured and expressed, it does not include the total of the medium. The science of that medium, of whatever composed, is the science of finances.

The common use of the word is in the plural, *finances*. It is so applied, indiscriminately, to the affairs of individuals, companies, and governments. A merchant who fails to pay his notes at maturity is said to be embarrassed in his finances, or, in usual parlance, to be *short of money*. Under this locution is embraced a great variety of phenomena, of which no conception is conveyed by the literal terms used.

In the singular, *finance*, which is the generic form, the word applies not only to experimental phenomena, but also to the principles of administration in connection with the general economy of the country—the assessment of values,

the apportionment of taxes, the negotiation of loans, the husbandry of resources, the liquidation of debt, the policy of commercial intercourse with foreign countries, and, at large, with all the employments and interests of human life. In a scientific view, finance must be regarded as the main pillar of social organization. It supports the entire superstructure of credit, and its combinations extend through every department of industry and enterprise. Practically, it governs the valuation of property, and thus it comes home to every individual. The details composing this wide system of things constitute the subject of continuous classification and generalization. But while, in late years, the gathering of statistics has been pursued with diligence in all active commercial countries, comparatively little attention has been bestowed on the investigation of the laws and principles by which alone their scientific relation can be determined. Hence, no division of human knowledge is less developed in the present day than that which falls under the general head of *Finance*.

Every government has an officer with the title *minister of finance*, or its equivalent, to whom is entrusted the direction of its treasury affairs. In England he is commonly styled *chancellor of the exchequer;* in the U. S., *secretary of the treasury*. The practical scope of finance is signified by the duties assigned to this officer. The secretary of the treasury is required to "prepare plans for the improvement and management of the revenue and the support of public credit;" to report to each session of Congress, on its assembling, the receipts and disbursements of the fiscal year past, and estimates thereof for the year ensuing; to superintend the collection of the revenues; to grant all the warrants for moneys to be paid in pursuance of appropriations by law; to execute necessary services in the sale of the public lands; and "to make report and give information to either branch of the legislature, in person or in writing, respecting all matters referred to him."

A vivid conception of the scope of duties which devolve on a competent minister of finance may be obtained by reference to two pre-eminent examples. One is that of Colbert, minister of Louis XIV. of France, who, we are told, "labored for sixteen hours a day during twenty-two years in his tariffs, his custom-house regulations, his mercantile negotiations." In his view, "the question of free exchange could not be separated from the general state of the world. . . . He possesses and sums up in his strong head," says one of his biographers, "a living encyclopædia in which are arranged in good order the innumerable regulations of industrial pursuits and the details of so many admirable ordinances which were provided for the management of forests, the entry of sailors, the security of the merchant. He knows to a fraction all the merchandise that enters the kingdom, and all that leaves it.

The other example is that of the British chancellor of the exchequer, who may be said, with almost exact literal truth, to govern the financial destinies of the world. The foreign commerce alone (exports and imports) of Great Britain for the year 1872 amounted to the prodigious sum of $3,346,000,000. The industrial capacity of this "speck on the globe" is estimated by the force of machinery at twenty times its population, or the equivalent of six hundred million man-power. That this astonishing result is due, chiefly, to the organization of its financial system is an incontrovertible proposition. A single fact will suffice to show the diligence and the exhaustive application with which that system is maintained. In order to establish a contested point in the practice of the House of Commons with respect to the appropriation of money, Mr. Gladstone "personally examined the titles of all the statutes passed since the Restoration (embracing a period of over two hundred years), and selecting from the mass those which had reference to finance from year to year, observed for himself, in each particular instance, the component parts of those statutes." J. S. Gibbons.

Fin-back, a name given to the whales of the family Balænopteridæ, on account of their prominent dorsal fin—an appendage which in most other whales is either absent or comparatively small and rudimentary. The fin-back whales have not been much sought for by whalers, on account of their fierce disposition, and from the fact that their oil, though excellent, is not abundant, while their baleen is often scanty and poor; but the "Bahia finner" (*Megaptera Braziliensis*) is much sought for its baleen. Fin-backs are frequently of very large size; and of late they have been much hunted off the coast of Norway for their oil and their flesh and bones, which are converted into fertilizers for the European markets. There are several species, mostly of the genus *Balænoptera*.

Fin'castle, a post-v. of Eagle tp., Brown co., O. Pop. 140.

Fincastle, post-v. and tp., cap. of Botetourt co., Va., at the head of the Great Valley of Virginia, 30 miles S. of the Chesapeake and Ohio R. R., 14 miles N. of the Atlantic Mississippi and Ohio R. R., 12 miles from the present terminus of the James River and Kanawha Canal, and 4 miles N. of the Valley R. R., now under contract. It has a large flouring-mill, a woollen-factory, a savings bank (just chartered), 2 hotels, 4 churches, 1 newspaper, and a number of stores. Principal business, farming and merchandise. Pop. of tp. 3501. M. W. Camper, Ed. "Herald."

Finch [Ger. *Fink*], a name given to various birds, especially to certain European and American birds of the family Fringillidæ, and more particularly to those of the sub-family Fringillinæ. The American finches are mostly of the genera *Carpodacus, Chrysomitris, Pipilo, Cyanospiza, Poocætes, Chondestes, Zonotrichia*, etc. They feed on seeds as well as insects, are generally bright, active birds, and some are good songsters. (See Goldfinch, Bullfinch, Chaffinch, etc.)

Find'horn, a river of Scotland, which after a course of about 90 miles enters the Moray Frith. In 1829, in August, it rose at one place 25 feet, and caused the great floods known as "Moray's Floods."

Find'ing, in law. The finder of lost property upon land who takes it into his possession becomes invested with a special property therein, which is superior to the claims of all persons except that of the true owner. He is under no legal obligation to take into his custody any articles he may thus discover, but if he does, certain important rights and obligations immediately attach to his possession. His primary duty is to preserve the property intact, and in as excellent condition as its nature and state at the time of finding will permit, in anticipation of the owner's appearing to reassert his title. A finder thus becomes a kind of bailee, and, like other bailees, he may defend his possession and interest by bringing action against any third person who injures the property, or asserts dominion over it, or interferes with his immediate ownership. If the absolute owner ever appears, restoration must be made to him, and the finder will be entitled to no reward if none had been previously offered, and can only claim to be remunerated for the actual and necessary expenses incurred in the proper care of the goods. But if a specific reward had been promised, of which the finder had knowledge, he would be authorized in demanding it, and would have a lien upon the property until such charges were satisfied. If at the time of making the discovery the finder knew, or had means of readily ascertaining, to whom the property belonged, it would be his duty to seek out the owner and return whatever he had thus acquired; and if he failed to do this his retention of the goods would be a fraudulent appropriation of them which would constitute larceny. But in cases where knowledge of ownership could not be acquired no larceny could be committed. Retaining the chattels would then not be wrongful, but reasonable and obligatory. If the former owner can never be discovered or never asserts any claim to the property, it vests absolutely in the finder. The place where the finding occurred is immaterial as regards his rights. If an article which was lost in a store was picked up by any stranger, he would have the first claim to it, and if the owner never reappeared might enforce his title even against the storekeeper. This would not be the case, however, if the article was only left by accident, for it would then be regarded as confided to the keeping of the proprietor of the store, who might demand it from any one by whom it was discovered.

The finder of a chose in action, as a check or lottery-ticket, cannot enforce payment of it if the party liable under it has notice that the applicant is not the real owner. If in such a case payment was made, the proper owner would not be debarred from a subsequent recovery. If, however, the finder transferred the instrument for value to a *bona fide* holder, who was ignorant of his defective title, it would, if negotiable, be good in the latter's hands, according to the general principles governing commercial paper.

At common law there were special rules concerning the finding of *estrays*—*i. e.* of cattle whose owner is unknown—but this matter is now generally provided for by statute. (For the rules applying to Treasure Trove, see the article on that subject; in regard to goods found at sea, see Salvage.) George Chase. Revised by T. W. Dwight.

Find'lay, post-v. and tp., cap. of Hancock co., O., is situated in the N. W. part of the State, 46 miles S. of Toledo, on the Lake Erie and Louisville Railway, midway between Fremont and Lima. It has 10 churches, 3 weekly newspapers, 4 banks, 3 machine-shops and foundries, 3 flouring-mills, 3 planing-mills, 1 oil-mill, 1 flax-mill, 1 woollen-factory, 3 carriage-factories, 1 spoke-factory, 1 stave-factory, 2 wagon-shops, and a goodly number of fine business-houses. It is the terminus of a branch of the Cin-

cinnati Sandusky and Cleveland R. R. Pop. of v. 3315; of tp. 4073. L. GLESSNER, ED. OF "HANCOCK COURIER."

Find'lay (JAMES), b. in Franklin co., Pa., about 1775, went to Cincinnati, O., in 1793; was in the legislative council for that Territory in 1798, and became a prominent Democratic leader, filling various civil offices until 1824. As colonel of the Second Ohio volunteers in 1812 served under Gen. Hull at Detroit, Mich. Was in 1826–33 M. C. from Ohio, and d. at Cincinnati Dec. 28, 1835.

Findlay (WILLIAM), b. at Mercersburg, Pa., of Scotch-Irish stock, June 20, 1768; was a prominent Democratic State legislator; State treasurer 1807–17; governor of Pennsylvania 1817–20; U. S. Senator 1821–27; treasurer of the U. S. mint, Philadelphia, 1827–41. D. at Harrisburg, Pa., Nov. 12, 1846.

Find'ley, tp. of Webster co., Mo. Pop. 625.

Findley, tp. of Allegheny co., Pa. Pop. 1170.

Findley, tp. of Mercer co., Pa. Pop. 1710.

Findley (WILLIAM), American politician, b. in the north of Ireland about 1750, came to Pennsylvania while young; served in the war of the Revolution; at its close became a member of the legislature, then of the State constitutional convention, and was M. C. 1791–99 and 1803–17. He published a *Review of the Funding System in 1794*, etc., and d. at Unity, Westmoreland co., Pa., Apr. 5, 1821.

Finds, a name sometimes given, without special propriety, to discoveries of collections of relics associated with mankind during the pre-historic ages; such as weapons or other implements, bones of man or of animals eaten by him, etc. (See KITCHEN-MIDDENS; PALEFITS, and PRE-HISTORIC MAN.)

Fine, post-tp. of St. Lawrence co., N. Y., has iron ore and timber. The village of Andersonville has some manufactures. Pop. 603.

Fine [Lat. *finis*, "an end"], a pecuniary mulct imposed by a court upon a criminal offender as a means of punishment. The precise amount of the fine is commonly left to the discretion of the court, though a maximum and minimum sum appropriate to each particular offence is, in general, designated by statute, and the exercise of judicial discretion must be confined within these limits. There is a provision in the U. S. Constitution that "excessive fines shall not be imposed."

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fine Arts is a general term applied to certain methods of embodying the beautiful in human productions. To the degree in which any work of man is produced according to the laws of taste only, and is intended to awaken æsthetic emotions solely, to that degree is it a work of fine art. But even among the works of poetry, music, painting, sculpture, and architecture—which five branches of art denote the five primary methods of embodying beauty in human productions—many do not serve æsthetic purposes solely. Hymns, oratorios, and church edifices serve also religious purposes; patriotic songs and statues, legislative buildings, and halls of justice, also patriotic or governmental purposes; drawings and paintings of animals, plants, and fossil remains, also scientific purposes, etc. Such works form a transition from the fine arts to the useful arts, or, as they often are called, the mechanical or industrial arts, in whose productions usefulness is the primary quality, beauty only a secondary. A further distinction is often made between those arts which use language as their medium—poetry—and those which do not; and the term fine art is thus confined to music, painting, sculpture, and architecture. A transition between poetry and art is formed by eloquence and acting.

The physical senses, the channels through which all external objects are cognized by the human spirit, furnish the basis for the classification of the fine arts. Taste, through which perceptions can be formed only by destroying the object, is entirely excluded from the realm of beauty. With feeling and smell—being more abstract, consequently more refined senses—beauty begins to dawn, but it has its true home in the spheres of sight and hearing, and these two senses being the chief avenues for the reception of all our external knowledge, the fine arts are divided into two great groups upon the basis of them. Those which appeal to the eye are termed the *formative arts*. Those which appeal to the ear may be termed the *sounding* or the *hearing arts* (though no such generic term has yet gained a foothold in the English language), and include music, oratory, and poetry, with the other forms of belles-lettres or artistic literature. Sometimes several arts are combined in the same work, as architecture, sculpture, and painting in a monumental edifice; poetry, dramatic action, and scenic painting in a theatrical representation; and these, together with instrumental and vocal music, in an operatic representation. The *multiplying arts*, such as engraving, chromo-lithography, and photography, are those by which, through the aid of mechanical and chemical means, many repetitions can be quickly and cheaply produced, which shall contain most or all of the prominent features of a work of art. G. F. COMFORT.

Fine of Lands, a species of conveyance formerly in use in the English law. It was in form a judgment of a court of justice. There was, however, no real litigation. The party against whom the action was apparently brought admitted upon the records of the court that the claim of the apparent plaintiff was just. This admission created a species of *estoppel*, so that he was prevented from afterwards denying a statement thus solemnly made. This would be true, notwithstanding his title before the admission was perfect. In this way a fine might be resorted to as a conveyance. At an early day (18 Ed. I. § 4) it was required by statute that a married woman in making such an admission should declare before the court or an authorized officer, separately and apart from her husband, that she made the admission freely, and without fear or compulsion of her husband. This last feature of "fines" has been much used in the U. S. as applied to an ordinary conveyance by married women, the acknowledgment being made, *e. g.*, before a justice of the peace, commissioner of deeds, or even, in some States, before a notary-public. A fine might on these principles be resorted to to "bar an entail" (see ENTAIL), though another fictitious proceeding, termed a "common recovery," was more effectual. (See RECOVERY, COMMON.) Another important use of a fine was to operate as a short statute of limitations. (See LIMITATIONS, STATUTE OF.) The rule is well expressed in the statute already referred to of 18 Ed. I.: "The fine is so high a bar and of so great force, and of a nature so powerful in itself, that it precludes not only those who are parties to the fine and their heirs, but *all other persons in the world* who are of full age, out of prison, of sound memory, and within the four seas the day of the fine levied, unless they put in their claim within *a year and a day*." In the reign of Henry VII. the time was extended to five years, and the claim must be made within that period, except in the case of persons under disability. In their case five years was allowed after the disability was removed. It was further required that there should be a proclamation of the fine in open court. This method of limitation has been in use in this country with some modifications. An instance of it, when it became the support of an important title, is found in the case of *MacGregor* v. *Comstock*, 17 New York Reports, 162 (decided 1858). T. W. DWIGHT.

Fine's Creek, post-tp. of Haywood co., N. C. P. 1048.

Fin'gal's Cave, a remarkable cavern on the island of Staffa, off the W. coast of Scotland, hollowed out in a mass of volcanic rocks. Two ranges of basaltic rocks are supported upon a lava-like mass beneath, and the unequal hardness of the materials, combined with the perfection of the columnar structure, has permitted the carving out, by the waves of the sea, of one of the most picturesque pieces of natural architecture in the world. The discovery of tertiary plants, associated with the corresponding volcanic rocks on the neighboring island of Mull, enables us to fix the time of the eruption of these basalts as belonging to the miocene period. A similar age has been assigned to the beds of basalt on the coast of Antrim, Ireland, which were, in fact, probably but a part of the same great outpouring of lava. (See GIANT'S CAUSEWAY.) EDWARD C. H. DAY.

Finger. See HAND, STRUCTURE OF THE, by PROF. EDWARD HITCHCOCK, A. M., M. D.

Fing'ering, in music, (1) the mode or system devised for the proper use of the fingers in playing on certain instruments, as the organ, pianoforte, violin, etc.; (2) the application or practical use of such system. In elementary instruction-books and exercises for the organ or pianoforte the notes are "fingered"—*i. e.* accompanied by the marks x, 1, 2, 3, 4 (the x indicating the thumb), or by the figure 1 for the thumb, and 2, 3, 4, 5 for the fingers.

Fin'ial [from the Lat. *finis*, an "end"], in architecture, a decoration designed to surmount a spire, gable, or other projecting point within or without a building. Finials are of wood, metal, or stone, and often are carved with great delicacy and good taste or with grotesque and fanciful designs. The ornamentation is sometimes of a heraldic character.

Finiguer'ra (TOMMASO or MASO), Italian niello-worker and goldsmith, b. at Florence 1424, d. in 1475, is reckoned the inventor of the art of taking engravings from metallic plates on paper.

Fi'ning, or **Clarifica'tion,** the process of clearing turbid liquors, generally used in connection with wines and malt liquors, though the process is resorted to for clearing a great variety of solutions, such as syrups, jellies, coffee, argol, etc. In the manufacture of wine and

beer the yeast, which either rises to the surface as a scum or forms a deposit at the bottom, generally carries with it all suspended impurities, and leaves the liquid limpid. When this is not the case, "finings" must be employed.

Filtering.—For fining small quantities of many liquors the process of filtration is the simplest. A funnel lined with porous filter-paper is the most convenient apparatus, though filters are made of a great variety of porous substances, such as cotton, flannel, earthenware, sand, charcoal, etc. Filtration is not always effective, as the impurities which render the liquid turbid are often so fine that they pass through the filter. This is generally the case with wines and malt liquors. Another objection to filtration is the difficulty of conducting it without exposing the liquor to the air, which in the case of light wines and malt liquors would be fatal.

Isinglass, or gelatine, is most frequently employed for beer and ale. "Brewers' finings" are made by softening the gelatine in four times its weight of cold water or sour beer. As the gelatine swells, more water or sour beer is added. The thick jelly thus obtained is dissolved in eight times its volume of the liquor to be fined, when it presents the consistence of a syrup; 1 pound of isinglass makes about 12 gallons of finings. This is added in about the proportion of 1 to 2 pints to a barrel of ale or to a hogshead of cider or wine. The gelatine is coagulated, or rendered insoluble, by the astringent tannic acid of the liquor, and as the insoluble compound gradually settles to the bottom of the barrel, it inviscates and carries with it all the suspended impurities, and leaves the liquor clear. In some cases this removal of the astringent principle is objectionable, as it modifies the flavor and diminishes the keeping qualities of the liquor. In the case of red wines, this is so important a consideration that albumen is employed instead of gelatine. Coffee is often clarified by the addition of a piece of the skin of salted codfish, which furnishes gelatine which is coagulated by the tannic acid present. Carrageen moss is sometimes used for clarifying beer, as are also the dried stomachs of the cod, called *sounds*. *Lime* in the water used is supposed to aid materially in the clarification of beer by combining with the acids of the malt, forming insoluble salts, which carry down the suspended matters. The spring water used in the breweries at Burton-on-Trent contains a considerable quantity of sulphate of lime, which is thought to aid in clearing the ales.

Albumen is coagulated either by heat or by alcohol. It is used in large quantities by sugar-refiners, who clarify or "defecate" their solutions of raw sugar with bullock's blood. The blood is added while the solution is below 140° F., and then, on raising the temperature to a boil by means of steam, the albumen of the blood is coagulated, and the coagulum, forming flocks, collects and envelops the suspended impurities, and partly rises to the surface as a scum, to be skimmed off, and partly settles to the bottom, to be separated by the "bag filters."

In making calf's foot jelly fresh egg-shells are often thrown in, that the adhering albumen may be subsequently coagulated by heat and clear the liquid, from which the shells and coagulum are separated by a bag filter of flannel. When albumen is added to wines, it is coagulated by the alcohol, and operates as when coagulated by heat. Heat alone clarifies many vegetable and animal juices by coagulating the albumen which they naturally contain.

Vegetable acids clarify many expressed juices, and the juice of sour cherries will completely separate the pectin of currant and raspberry juice, so as to fit them for syrups.

Alum is sometimes used. It is specially serviceable in clarifying waters which are rendered turbid by fine mud, a pinch of alum thrown into a barrel of water being sufficient to render it clear and limpid after a few hours' standing. The alumina is probably precipitated by the carbonate of lime, which is always present in river as well as in spring water.

Acetate of lead has been used for clarifying liquors, its precipitation being effected by a subsequent addition of half its weight of sulphate of potassa. It is a very dangerous agent on account of its poisonous character.

Plaster of Paris, clay, sand, and *marl* are often effective in clarifying turbid solutions, such as cider, etc.

Soluble salts, as a solution of sal-ammoniac, often cause the separation of finely-divided precipitates, which remain long in suspension in pure water. They also greatly facilitate the filtering and washing of precipitates, which otherwise pass through the filter. C. F. CHANDLER.

Finistère, or **Finisterre** [Lat. *Finis Terræ*, "Land's End"], is a department of France, comprising the western part of the former duchy of Bretagne. It has an area of 2648 square miles, and a population of 642,963. Its coasts along the English Channel and the Atlantic are formed of rugged and broken granite rocks, but in the interior the soil is generally fertile and well cultivated. Its silver and lead mines are very valuable.

Finisterre, Cape ("Land's End"), is a promontory at the north-western extremity of Spain; lat. 42° 54′ N., lon. 9° 21′ W.

Fink (FREDERICK), American painter, b. at Little Falls, N. Y., Dec. 18, 1817, became known at the age of eighteen by his portrait of W. S. Parker; went to Europe, and d. in 1849. Among his *genre* pictures are *An Artist's Studio, Shipwrecked Mariner, Young Thieves, Negro Woodsawyer*, etc.

Fin'land [Fin. *Suomesimaa*, the "land of lakes"] is a grand duchy of Russia, lying between lat. 59° and 70° N. and lon. 21° and 33° E., and bounded by Russia, Norway, Sweden, and the Gulfs of Bothnia and Finland. It includes a portion of Russian Lapland. Its area is about 135,000 square miles, one-third of which is occupied by lakes and marshes. The ground may generally be described as a table-land from 400 to 600 feet high, with occasional elevations, depressions, and ranges of hills covered with dense forests of fir and pine, which, in connection with the beautiful lakes, give the country a picturesque and romantic though somewhat sombre aspect. The coast is low, except the southern part, which presents a line of rugged cliffs skirted with innumerable rocky islands. While Finland was united to Sweden it exported yearly a great quantity of rye and barley; indeed, it was called the "granary of Sweden." But since its annexation to Russia it seems to have given up agriculture and taken to cattle-breeding, for which the country in many places is eminently adapted. The most valuable exports are, however, the products of its forests, as timber, pitch, potash, tar, and rosin. It yields also some copper, iron, lime, and slate. Reindeer, wolves, elks, beavers, various kinds of game, and, among fishes, salmon, trout, and herring, abound. The climate is rigorous. A severe winter of seven or eight months passes through a short spring, immediately into a hot, dry summer. Yet the time in winter when the sun never rises, and in summer when he never sets, has its very peculiar charms. The population, which numbers, according to the census of Dec. 31, 1871, 1,766,880, consists of Finns, interspersed with Laplanders, Swedes, and Russians. The Finns are a branch of the Ugrian race, kindred to the Laplanders and the Magyars of Hungary, but different both from the Swedes and the Russians. They are tall, strongly built, and well proportioned, but the shape of their faces is nearer the square than the oval, and their features do not indicate any high degree of intellectuality. They are an honest, industrious, and energetic people, however, and their peculiar language and literature have of late attracted much attention. In olden times they formed an independent empire, but in the twelfth century they were conquered and converted to Christianity by the Swedes. During the union with Sweden the Swedish language and civilization took deep root among the Finns, and when in 1809 Russia conquered and secured the country, she was met with great opposition and aversion by the people. She has governed the country with great prudence, however, granted the Finns many privileges, and her attempts at eliminating the Swedish elements by supporting and developing the original Finnish foundation have been somewhat successful. All the native population are able to read and write; and in 1872 the work of Russianizing Finland was commenced by rendering education in Russia compulsory in the public schools. The most important towns are Helsingfors, Åbo, Sweaborg, and Viborg. The emperor of Russia is grand duke of Finland. The state church is Lutheran. The government is nearly independent of the rest of the Russian empire, and is administered in accordance with the Finnish constitution of 1772. (See FINNS and FINNISH LANGUAGE AND LITERATURE.) (GERSHAU, *Versuch einer Geschichte Finlands*, 1821; *Bibliographia hodierna Fenice*, 1846; FRIIS, *Beskrivelse over de norske Finlapper*, 1841; TAPELIUS, *Finland fremställdt i Teckning*, 1860.) CLEMENS PETERSEN.

Fin'land, Gulf of, the great eastern arm of the Baltic, situated between lat. 59° and 61° N. and lon. 22° and 30° E. Its water is only very slightly salt, having come from the great lakes Onega, Ladoga, Peipus, and Saima through the river Neva. At its E. end is St. Petersburg, and along its coasts are Narva, Reval, Frederikshamn, Helsingfors, and Viborg.

Fin'lay (GEORGE), LL.D., the learned historian of *Greece under Foreign Domination*, was born in Scotland about the beginning of the present century. In 1823, before the death of Lord Byron, he joined the Greeks in their struggle for independence, and has remained in the country ever since, making his home in Athens. His ardent Hellenic hopes have been disappointed. He speaks with regret of having "abandoned the active duties of life, and the noble task of laboring to improve the land, for the sterile occupation of recording its misfortunes." His works are in seven vol-

umes, as follows: I. *Greece under the Romans*, 146 B. C. to 716 A. D. (1843; 2d ed. 1856); II. *History of the Byzantine Empire*, 716–1057 A. D. (1852; 2d ed. 1856); III. *History of the Byzantine and Greek Empires*, down to 1453 A. D. (1854); IV. *History of Greece from its Conquest by the Crusaders to its Conquest by the Turks*, 1204–1566 A. D., and of *the Empire of Trebizond*, 1204–1461 (1851); V. *History of Greece under Othoman and Venetian Domination*, 1453–1821 A. D. (1856); VI., VII. *History of the Greek Revolution* (1861). He has also written much for the London *Times*, proving himself a real friend of Greece, but often offending Greek pride by his strictures upon public men and measures. D. Jan. 26, 1875. R. D. HITCHCOCK.

Fin′ley, tp. of Scott co., Ind. Pop. 1102.

Finley, tp. of Christian co., Mo. Pop. 1276.

Finley, tp. of Douglas co., Mo. Pop. 332.

Finley, tp. of McDowell co., N. C. Pop. 580.

Finley (JAMES BRADLEY), an American Methodist preacher, b. in North Carolina July 1, 1781, removed to Ohio in 1801; joined the Methodist ministry in 1809; took charge of the Wyandotte Indian mission in Upper Sandusky in 1814, where he spent six years. For forty-five years was one of the most successful Methodist itinerants of the North-west, and was eight times a delegate in the General Conference of his denomination. Published numerous works, among which are an *Autobiography*, *Wyandotte Mission*, *Sketches of Western Methodism*, etc. D. in Cincinnati Sept. 8, 1856. ABEL STEVENS.

Finley (JOHN P.), American Methodist clergyman and educator, b. in South Carolina in June, 1783, taught in various academies in Ohio from 1810 to 1822, and in the latter year was chosen professor of languages in Augusta College, Ky. About this time he joined the ministry. D. in May, 1825.

Finley (MARTHA), ("MARTHA FARQUHARSON"), American writer, b. in Chillicothe, O., has published Sunday-school books, *Casella, or Children of the Valleys*, *Old-Fashioned Boy*, *Lilian*, and *Wanted, a Pedigree*. She resides in Philadelphia, Pa.

Finley (ROBERT), D. D., American Presbyterian clergyman, b. at Princeton, N. J., 1772; graduated at the College of New Jersey 1787, was tutor or trustee there from 1793 to 1817, and June 16, 1795, was ordained pastor of the church at Baskingridge, N. J. Originated the colonization of emancipated blacks from the U. S. in Africa, helping to form and organize the American Colonization Society. Became in July, 1817, president of Franklin College, Athens, Ga., and d. there Oct. 3, 1817. Published sermons, etc. on colonization.

Finley (ROBERT W.), American Methodist clergyman, b. in Bucks co., Pa., June 9, 1750, studied for seven years at Princeton, N. J., and in 1774 entered the Presbyterian ministry. In 1788 emigrated to Kentucky, and opened a theological school. In 1811 became an itinerant in the Methodist Church, and labored as such until eighty years of age. D. at Germantown, O., Dec. 8, 1840.

Finley (SAMUEL), D. D., Presbyterian clergyman and president of the College of New Jersey, b. at Armagh, Ireland, 1715, arrived in Philadelphia, Pa., Sept. 28, 1734, was licensed to preach Aug. 5, 1740, and was ordained at New Brunswick, N. J., Oct. 13, 1742. Beginning his ministry in the revivals of the time, he preached at New Haven, Conn., in violation of a law forbidding itinerants to preach in the parishes of settled ministers without their consent, and in Sept., 1743, was seized and carried beyond the colonial limits as a vagrant. From July 14, 1744, to 1761, was pastor and teacher of an academy which he established at Nottingham, Md. In July, 1761, was chosen president of the College of New Jersey at Princeton, N. J. Published sermons, and edited those of his predecessor, Pres. Davies. D. July 17, 1766.

Fin′mark, province of Norway, comprises the northernmost part of continental Europe, and lies between lat. 68° 30′ and 71° N. and lon. 17° and 31° E. Its area is 24,000 square miles; its population, 20,329. Finmark is a high table-land, sometimes rising 3000 feet above the level of the sea, indented by numerous deep, narrow, winding fiords, and skirted with innumerable islands. As agriculture becomes impossible at an elevation of 100 feet, at which height only a few wild berries will ripen, and as it is possible only along the fiords to raise a little barley and potatoes, the two only sources of wealth which the inhabitants possess are the reindeer and the codfish; 3000 boats and 15,000 men are employed at the fisheries, and the average annual produce is 16,000,000 fish, 24,500 barrels of cod-liver oil, and 6000 barrels of roe. The reindeer, of which a Finn may own several thousands, roam in large herds over the table-land, fattening in the summer on the fine grass, and starving in the winter on a small, colorless lichen which lives under the snow. The Norwegian and most of the Finnish (Lappish) population have fixed abodes, but a few Lapps are nomades. The principal town is Hammerfest, the northernmost city of the world.

Finn (HENRY J.), comedian, b. at Sydney, Cape Breton, about 1788, performed in London, England, Montreal, Canada, New York City, Savannah, Ga., Boston, Mass., and Portland, Me., and was lost with the burned steamboat Lexington, on which he was a passenger, Jan. 13, 1840. Finn was an exceedingly popular actor of broad comedy, and a representative of a decidedly American school of art. He was also a successful humorous writer.

Fin′ney (CHARLES G.), American clergyman and college president, b. at Warren, Conn., Aug. 29, 1792, and studied law in Jefferson co., N. Y., but was ordained as a minister in 1822. Has been specially noted as a revivalist. In 1835, Mr. Finney became a professor at Oberlin College, O., and its president in 1852, holding that office until 1866. In 1837 began his pastorate of the college church. In 1848–51 preached in England with eloquence and effect. His publications have been *Guide to the Saviour*, *Lectures to Professing Christians*, *Lectures on Revivals of Religion*, with notes and memoir, *Sermons on Important Subjects* (1839), *Skeleton of a Course of Theological Lectures* (1841), *Lectures on Systematic Theology* (1851). D. Aug. 16, 1875.

Fin′nish Language and Literature. The Finnish language is a branch of the Turanian family, also called the Scythic, Mongolian, or Uralo-Altaic, which comprises the languages of the Magyars, Turks, Samoyeds, Tunguses, Tartars, and Mongols, and whose chief branch is the Mantchoo. Of these languages it is nearest allied to that of the Magyars, both in form and substance, a large number of its roots always consisting of two syllables, with the accent on the first, nearly identical with the monosyllabic roots of the Hungarian language. It is spoken in the north-western part of European Russia, in Finland, and the adjacent districts by over 2,000,000 people, and in three different dialects—the E. Finnish or Karelian, which is the oldest, most primitive, and least developed; the S. Finnish, spoken in the districts around Åbo and Helsingfors, from which the written language of the Finnish literature has been developed; and the W. Finnish, which extends along the Bothnian Gulf into Sweden and Norway. Kindred dialects are spoken by the Lapps along the Arctic Ocean, by the Wotes, S. of the Gulf of Finland, and by the Tschudis, in the governments of Olonetz and Novgorod.

With respect to the character of its substance, the Finnish language is decidedly vocalic, and its system of vocalization is very elaborate, so that Rask called it the most sonorous and harmonious of all tongues. The consonants *b*, *c*, *d*, *f*, and *g* occur only in foreign words. Two consonants never occur at the beginning and very seldom at the end of a syllable; foreign words are most curiously altered in order to submit them to this rule. Hiatus, on the contrary, is very frequent. Besides the five fundamental vowels, *a*, *e*, *i*, *o*, and *u*, and the three modified vowels, *ä*, *ö*, and *ü* (*y*), the Finnish language employs twelve diphthongs, and the arrangement of this large number of vocalic sounds is governed by very minute rules. Thus, the vowels *a*, *o*, *u* can never occur in the same word with their modifications, *ä*, *ö*, *y*, and the vowel of the suffix has to be changed according to this rule, in order to correspond to the vowel of the theme. With respect to its formal character, the Finnish language is agglutinative, like all languages of the Turanian family, and it expresses the grammatical relations between the different parts of the speech by suffixes only, never by prefixes. The noun is the principal class of words. It is used without any article, and has no gender, but it is declined, both in singular and plural, through fifteen different cases, expressive of those relations which in the Indo-Germanic languages are often denoted by prepositions. The verb has only two tenses, the present and the past; the future tense is formed periphrastically. But its conjugation is very complicated, and it has a great capacity of expressing even the finest shades and modifications of the original signification by slight augmentations to the theme. The infinitive mode has five different forms, expressing five different modifications of the idea, which can be diversified still further by declensions through different cases. (The best dictionaries are that by ROTHSTEN, *Latin-Finnish*, Helsingfors, 1864, and that by EUROPÆUS and AHLMAN, *Swedish-Finnish*, Helsingfors, 1865. Grammars have been given by REUVALT, 1840, EUROPÆUS, 1849, and KOSKINEN, 1865.)

From the twelfth century, when the Swedish king Erik the Saint made his first crusade to Finland, in order to convert the pagan Finns to Christianity and stop their piracy, and up to the beginning of this century, when Sweden ceded all its possessions E. of the Bothnian Gulf to Russia by the treaty of Frederikshamn (1809) Finland

was a Swedish province, and during this long period the Swedish language was the official language of the country and the bearer of civilization to the people. The Finnish language was slowly but steadily retreating. It was forgotten by the educated classes, and for literary purposes it was hardly used at all. There existed a translation of the Bible, commenced in 1548 by Michael Agricola, bishop of Åbo, but not finished until 1642. There also existed some religious and moral tracts; but even in these few literary monuments the language was not pure. As soon, however, as Finland became a Russian possession, its political situation at the same time becoming more independent, a great change took place with respect to the position of the original language of the population. The Russian government saw that the most efficacious, perhaps the only, means by which to wean the Finns from their long and very cordial adherence to the Swedes would be a revival of the Finnish language. It consequently encouraged and supported all exertions in this direction, and the endeavors at resuscitation succeeded beyond expectation. To-day the Finnish language is the official language of the country. It is heard in the church, the court, the school, the theatre, and the educated circles of society. It is used in poetry and science, and cultivated in all branches of literature with care, with enthusiasm, and with talent. About twenty periodicals are issued in it, among which are several newspapers of good standing and a couple of magazines of merit.

The reason of this extraordinary success was not that there existed among the Finns any secret rancor against Swedish civilization; on the contrary, the feeling of sympathy and fellowship was as general as it was deep. But at the bottom of the Finnish language lay hidden a great treasure, and when it was lifted, and all Europe admired it, the Finns naturally became proud of themselves. Among the peasants of Eastern Finland and Karelia there still lived a great number of old popular songs, called *Runot* (sing. *Runo*), which evidently originated from the pagan times. They describe the strifes between the people of Kaleva, the Finns, and the people of Pohjola, the Lapps, and sing the courtship of Kaleva's sons, Wäinämöinen, Illmarinen, and Lemminkäinen, to the daughters of the princess of Pohjola—their heroic exploits and their wonderful adventures. These songs had never been written down; they were handed over by oral tradition from one generation to the other, and when sung by the "Runolainen," strolling singers, to the kartele, a sort of harp with five strings, they were listened to by the people with great rapture. In 1835, Lönnrot published a collection of these songs which he called *Kalevala*, "the land of Kaleva," and which was immediately recognized by the Finns as their great national epos. With the support of the Finnish literary society in Helsingfors he gave a new and complete edition in 1849, containing 50 runot, consisting of 22,800 verses. *Kalevala* was translated into Swedish by Castrén in 1844 and Collin in 1865; into French by Leonzon le Duc in 1845; into German by Schiefner in 1852; and everywhere it charmed with the perfect epic objectivity of its descriptions, and with the splendid views it revealed of a new mythology, a new popular character, a new sense of beauty. The verses of *Kalevala* consist of four trochees. The foot is formed according to the quantity, not according to the accent of the syllables. The verses are bound together not by rhymes, though such occur now and then, but by alliteration. The general character of the poem is somewhat monotonous and melancholy, even plaintive. A striking peculiarity of the poetical style is the periphrastical repetition of the same idea through several verses.

In 1840, Lönnrot published *Kanteletar*, a collection of ballads and lyrical pieces, and in 1842 *Suomen kansan sanalaskuja*, a collection of 7077 popular proverbs. From 1854 to 1862, Ecro Salmelainen published a collection of Finnish popular tales in prose. CLEMENS PETERSEN.

Finsbury, or **Fen Town.** See LONDON.

Finsteraar'horn, the highest peak of the Bernese Alps, Switzerland, 14,026 feet in elevation.

Fin'sterwalde, town of Prussia, in the province of Brandenburg, manufactures cloth, flannel, cotton, and linen fabrics, and trades in wool. Pop. 6621.

Fiord [Scandinavian], a narrow inlet of the sea or a bay penetrating deeply into the land and bounded by high and precipitous sides. Such inlets are found breaking up, deeply indenting, and giving wild and picturesque outlines to many coasts contiguous to mountainous regions; they are, in fact, continuations of the valleys that intersect the mountain-ranges. The coasts of Norway, of Iceland, and Greenland, of Chili, and around Cape Horn, and again of North-western America and of parts of New Zealand, afford examples of fiords. The water in fiords is often of great depth, and extends for many miles into the heart of a mountain-range, though in some instances the valley is partly filled up towards its head by alluvial or diluvial deposits. As fiords are often chasms excavated by glaciers, they generally indicate the former existence of glacial conditions in the regions in which they occur, and in some cases they are still partly the beds of ice-streams; they also prove the submergence of the coast on which they are found, as they were formed by sub-aërial conditions.

EDWARD C. H. DAY.

Fiorel'li (GIUSEPPE), b. about 1823 in the province of Naples, won early fame as a director of the Pompeian explorations, but was displaced on account of his liberalism. After Victor Emmanuel came into possession of Southern Italy, Fiorelli was made (1860) chief director of the operations at Pompeii. Is editor of the *Giornale dei Scavi;* has published maps and reports of his work, etc.

Fir, the English name for all coniferous trees of the genus *Abies* (and in England, indeed, even the native pine is called Scotch *fir*, but incorrectly); but there is a prevailing tendency to restrict the name to the group represented by the silver fir of Europe (*Abies pectinata*), the balsam firs of Atlantic North America (*A. balsamea* and *A. Fraseri*), and the noble *A. grandis*, *A. amabilis*, and *A. nobilis* of Oregon and California; *i. e.* to those species which bear lateral and erect cones, the scales of which at maturity fall away with the seeds. Most of these yield fir balsam. (See BALSAM, CANADA.) The numerous species of the other main division properly takes the name of *spruce*. These are known by their cones hanging from the tips of branches and their scales remaining permanently attached to the axis. There is a peculiar group of spruces or spruce-firs represented in the Northern Atlantic U. S. by the hemlock spruce (*Abies Canadensis*), and in and W. of the Rocky Mountains by the noble Douglas spruce (*A. Douglasii*). Fir timber generally is light, soft, and white; that of some species is excellent for masts and spars, but not otherwise of high value. That of the spruce is more valuable than that of the proper firs, excepting, however, the European silver fir. This genus furnishes some of our best and most available evergreen trees for ornamental planting. As to the Northern and Middle U. S., to which they are mainly adapted, the commonest and one of the best spruce firs is the Norway (*Abies excelsa*), much excelling our native black spruce (*A. nigra*), but it is excelled for all northern regions by our beautiful white spruce (*A. alba*) and by the Menzies spruce (*A. Menziesii*) of the Rocky Mountains. As to the true firs, our balsam firs are very short-lived; the European silver fir is apt to die down from the winter, at least when young; and it remains to be seen whether any of our magnificent Western species are sufficiently hardy to be generally planted with success. ASA GRAY.

Firbolgs', an ancient and half-mythical tribe who, according to the Irish historians, once inhabited that island and other parts of Europe. To this people belonged the first dynasty of Irish kings.

Firdou'si, or **Firdusi,** surnamed ABOOL KÂSIM MANSOOR, Persian poet, b. near Toos, Khorassan, about 940 A. D. The surname is thought to have been given because his father was a gardener. His great poem, *Shah-Namah* or *Shah-Nameh* ("Book of Kings"), has about 56,000 distichs. D. 1020 or 1022 A. D. Of *Shah-Namah* Sir William Jones says: "If it should ever be generally understood in its original language, it will contest the merit of invention with Homer himself." (Consult the preface to JULIUS VON MOHL's translation and commentary on the work; SIR W. GORE OUSELEY's *Biographical Notices of the Persian Poets;* and ATKINSON's biographical notice prefixed to the *Abridgment of the Shah-Nameh*, London, 1832.)

Fire. See FLAME, by PROF. E. W. HILGARD, Ph. D., M. N. A. S.

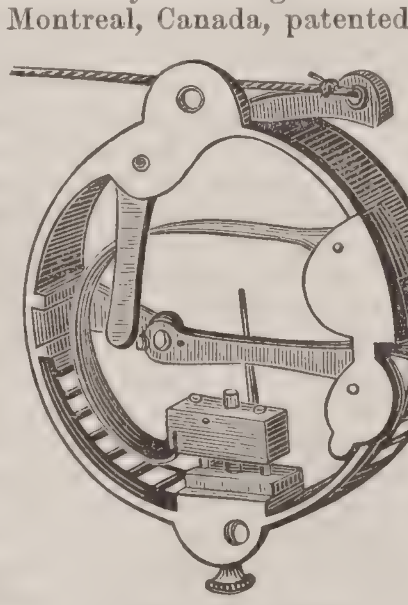
Fire-Alarms are used for giving notice of the occurrence of a fire, and are classified as fire-alarm telegraphs, automatic electric fire-detectors, and mechanical fire-detectors. In the first named a system of signal-boxes is distributed over a given district, and connects by electric circuits with a central station, and thence with a series of alarm-bells on a second circuit. By giving a signal at one of the boxes the place of the fire is telegraphed to the central station, and from the latter to the signal-bells at the local stations, to direct the engines to the place where needed. The first practical trial of a fire-alarm telegraph system was made in 1851 in Berlin and New York, but the plan was much modified in succeeding years, and as thus changed was fully adopted in some of the cities of the Eastern States before being put into regular use in New York in 1871. Although simple in principle, the details of the system are somewhat complex, and for a full description the reader is referred to the U. S. patent of Farmer and Channing, dated May 19, 1857. It is well known that

different substances or mechanical devices change their volume or position with change of temperature; and if we imagine one of these substituted in lieu of human fingers to break or close, by such changes, an electric circuit connected with alarm mechanism, we have an idea of the essential principle of a self-acting electric fire-detector. Mechanical detectors depend for their action upon agencies altogether mechanical; such, for example, as the burning of a string to set the annunciating appliances in motion.

The fire-alarms of most interest are those of the automatic electric variety, of which in recent years a number have been devised. The insurance companies of New York City have reduced their rates 5 per cent. on buildings fitted with such apparatus. In each of these alarms a thermometric device, acting, when heated, by change of form or position, is used to break or close a circuit; but the arrangement of the circuit wires, the thermometric devices, and the accessory mechanism in the different plans are widely different.

The earliest record of an electric fire-alarm appears to be the English patent of N. Rutter (1847), in which the mercurial column of a thermometer closes the circuit when the temperature is high enough to be dangerous. A galvanometer, alarm-bell apparatus, and electro-magnetic coil are included in the circuit. Thermometers properly fitted with wires are placed in important parts of the building, so that any unusual increase of temperature becomes instantly known. On the completion of the circuit, a soft iron bar, detached from a permanent magnet, falls upon the detent of a spring or other alarum, putting it into action, and at the same time deflects the galvanometer needle, so as to show the place of the danger. Rutter also proposed the modified use of his invention as a "burglar alarm" and for the detection of undue pressure of steam in boilers, etc. In 1852 one John Hunter suggested applying fusible or combustible conductors to render electric telegraphs self-communicating in case of fires. In the same year Price patented a thermometric circuit-actuating device, the principle of which has been, and still is, in practical use. Lloyd describes an indicator for completing the circuit by means of a curved compound metallic strip made of steel and hammered zinc, connected with one battery pole; the other battery pole is fixed to the opposite part of the instrument. On elevation of temperature the strip straightens itself and completes the circuit. Lloyd describes an alarum in which a detent lever, actuated from the circuit, releases a toothed wheel, which is then rotated by a cord and weight, whereupon a suitable escapement causes a hammer to strike a bell. In 1857, Greenhow patented a valuable modification, in which, instead of setting the alarm in action by completing the circuit, the same effect is produced by breaking it.

In 1865, Charles Dion of Montreal, Canada, patented in France fire-alarms embracing contrivances both electric and mechanical, in which the thermo-actuating device consisted of an inverted cone, with a small orifice at the top, fixed to one end of a balanced lever. On the occurrence of a fire, the heated air rising through the perforated cone tilts the lever and puts the apparatus into operation. In the electric apparatus the tilting of the lever trips a detent, which sets free a wheel actuated by a spring or weight. The periphery of this wheel carries a series of teeth which, acting upon a key similar to that of the Morse telegraph, transmits the alarm to a fire-station at a distance. A local alarm is at the same time produced, apprising the inmates of their danger. In 1871, W. B. Watkins of Jersey City, N. J., patented elaborate schemes for fire-alarms, which are set forth in his patents of Jan. 31 of that year. He uses a metallic "thermostat," so termed, as the thermo-actuated agent for closing a local circuit to operate a local magnet, the armature of which is arranged to release the detent of the signal-box mechanism of a fire-alarm telegraph.



Dion's Fire-Alarm.

The patents of John H. Guest of Brooklyn, N. Y., 1873, display features of importance, some of which are also claimed by Mr. William Gates of New Haven, Conn., who, at the present writing, has pending an application for a patent on certain points claimed by Guest. The gist of Mr. Guest's improvement lies in the use of thermometric devices that under ordinary conditions themselves form a portion of the circuit, so that elevation of temperature will break the circuit and transmit the alarm; the same also occurring when the circuit is broken by accident. This is an improvement on Greenhow's apparatus. In his patent of Nov. 11, 1873, Mr. Guest claims, among other things, the combination in a closed circuit of distinct alarm signal-boxes, automatic fire-alarms, indicators for each fire-alarm, and a mechanism to alarm the central station and the house where the automatic fire-alarms are placed, and to show the point whence the alarm originates. But one line-wire is required for any number of rooms in a building, and the signal-boxes of the ordinary alarm telegraph are retained.

In automatic electric alarms a thermometric device for breaking or closing the circuit is essential. The mercurial thermometer of Rutter does not appear to have met with favor, although on a small scale it has been applied to apparatus for artificial incubation, and found to operate satisfactorily. The quicksilver used in some electric clocks for closing the circuit becomes partially oxidated, and gives but an imperfect connection. This could hardly, however, occur in the thermometer. As regards sensitiveness, the funnel and balance lever of Dion is claimed to excel any other device. Mr. Guest proposes a glass bulb filled with quicksilver, having a horn at each end, around which an elbow-spring is wound, one of the ends of which acts as a stop for the detent of the circuit-changing mechanism. With elevation of temperature the expansion of the mercury bursts the bulb, the two ends of the spring fly farther apart, the detent is released, and the mechanism is put in operation.

Instead of the compound bar of Dion, Mr. Gates has proposed a thermometric balance lever, said to be of such extreme sensitiveness that it may be tilted by the warmth of the breath.

Although mechanical fire-alarms, strictly so termed, cannot compete for cities, villages, or even for large buildings, with those employing an electric circuit, they may perhaps be found useful in isolated dwellings, or under circumstances where batteries would be troublesome or the regulation of the mechanism difficult. They are even now receiving as much attention from inventors as telegraphic alarms.

Joseph Smith patented in England in 1802 a fire-alarm set in motion by the burning of a string. In another device for the same purpose all the apartments of a building were connected with a single one by means of tubes. It was expected that the occurrence of a fire in any apartment would send a current of air through the corresponding tube, and thus make it manifest. Still another device employed the rupture of a brass wire softened by mercury brought into contact with it by expansion to start a train of wheels, and thus ring a bell. In what is known as Tunnicliffe's invention a small cylinder of gunpowder is furnished with a fuse igniting at 200° F., the device being hung to the ceiling of the room and the explosion sounding the alarm. In more recent times (1872), F. F. Herman combines with an alarm a gun-cotton cord connecting with the wick of a lamp, to light the latter when the alarm is started. This, presumably, may be used with either mechanical or electric apparatus. In 1873, Wm. A. Barnes patented an alleged improvement in alarm-cartridges, acting on the same plan as Tunnicliffe's, but not so liable to fly into dangerous fragments when exploded. Also in 1873, Henry L. Brown patented a contrivance which the patent-office brief describes as follows: "The detent lever of a wound-up alarm-bell mechanism is connected with the arm of an inflated bellows or air-chamber, which is in air-tight communication with a tube of fusible metal running through the rooms to be protected. On the melting of the closed tube by a fire at any point, the escape of air collapses the air-chamber and the alarm is sounded." This *modus operandi* is reversed in the contrivance patented in the same year by Charles H. Lehnis, consisting of one or more U-shaped tubes containing mercury, one arm being in connection with a closed and exhausted fusible tube extending to the locality to be guarded. In Dion's mechanical application of his funnel thermometric device the balanced lever was made hollow, and a sphere of some heavy substance was placed therein above or near the point. On the tilting of the lever by the upward movement of the funnel the ball rolled out against the detent of a bell-sounding device, and thence into the mouth of an inclined tube that conducted it to a receiver in the office of the hotel, for which class of buildings the apparatus was more especially designed, the balls being marked with the numbers of the rooms. It was also proposed to use the conducting tubes for the passage of balls marked with the names of articles likely to be called for by the occupants, so that orders could be received from the rooms without first ascending to them. In Dion's application of the principle of the compound bar in the construction of a mechanical fire-alarm the straightening of the curved bar (composed of an outer strip of iron and

an inner strip of brass) tilts a weight, which unlocks a horizontal lever, that in its turn releases a secondary lever. To the outermost end of this is attached a cord extending to the alarm-bell mechanism, which is so constructed and arranged as to sound when the cord is slackened. Provision is made for the adjustment of the parts to trip the weight at any desired temperature, the device being set to the proper pitch by a pointer and scale on the front of the instrument.

The importance of automatic fire-alarm apparatus is far from being adequately appreciated. Contrivances operating on similar principles are capable of being successfully applied to many other purposes. JAMES A. WHITNEY.

Fire-Armor. Appliances known by this name are equally fitted for use in burning buildings to facilitate escape or the management of fire-extinguishing apparatus; in mines filled with choke or fire-damp; or in the pursuit of occupations that, like stoking, puddling, loading guano, etc., involve exposure to undue heat or noxious gases. It is about half a century since fire-armors were proposed for practical use, but it is only recently that they have been made sufficiently light, simple, and cheap to commend them to public favor. They are of two kinds, in one of which the wearer breathes from a supply of compressed air carried in a suitable reservoir fastened upon the person; the other, in which the air is filtered through a moistened porous material interposed between the respiratory organs and the atmosphere. The efficacy of each has been proved beyond dispute. The invention of M. Galibert, on the former plan, has been extensively introduced in the French navy; the American invention of Crofutt, on the last-named system, is being adopted in several cities of the U. S.

The idea of fire-armor was naturally derived from that of submarine armor, and the first apparatus of the kind was adapted for either use. The U. S. patent of W. H. James, granted in 1828, describes a diving-dress which the inventor stated could be employed "in mines and other places filled with deleterious gases, wherein it may be used with perfect safety and very great advantage." In this a circular air-receiver was placed around the waist of the wearer under the arms and extending down to the hips, this receiver being held in place by straps. It was formed of a coil of metal pipe, and provided with a valve through which passed air under pressure, either from a pump or from a stationary reservoir kept filled for the purpose. A water-tight helmet was fitted over the head. The helmet connected with the air-receiver by a pipe, which thus admitted air to the nostrils, the pipe having a suitable valve to control the flow of air. Within the helmet was a mouth-piece, held by the teeth and lips of the wearer, and extended by a short tube to the outside of the helmet, but fitted with a valve opening outward. It was through this that the expired air was driven. To avoid too great pressure of air within the helmet, the latter was provided with a safety-valve, and to permit vision a strong glass plate was fixed in its front. (This glazing of the helmet, it may be mentioned, was derived from Dr. Halley's submarine armor, tested about the year 1715, and which, moreover, in some other respects suggested, if it did not show, some of the other essentials of more modern fire and submarine armor.) James also fitted to the lower part of the helmet "a water-proof garment," which was brought down over the breast and shoulders, and held snugly around the lower part of the body by elastic straps. It was calculated that an apparatus within a manageable compass could be made to hold air enough to last one hour, but to do this a pressure of fifteen atmospheres, or about 225 pounds to the square inch, was required. This, together with the somewhat cumbrous character of the apparatus, seems to have led to its abandonment. The simpler apparatus of M. Galibert (see p. 344 of Dr. Barnard's *Rep. Paris Ex.*, 1867) has an air-receiver of India-rubber cloth, from which the air passes by a tube to the mouth of the wearer, the expired air passing out through a valvular device attached to the nostrils. Within a few years past a somewhat similar appliance has been put on sale in England, the air being in this case contained in a sheet-metal cylinder strapped to the back like a fire-extinguisher.

Crofutt's Eye and Lung Protector.

That class of fire-armors in which the air is filtered on the way to the lungs appears to have been primarily derived from the old and well-known "aspirator" used by surgeons in making dissections, etc., and comprising a wire-cloth shell filled with powdered charcoal, and held over the mouth and nose by a strap buckled around the head. After the James's device just described a British miner named Roberts designed a "hood and mouth-piece," which attracted considerable attention, and, as a writer of that time avers, "its efficacy was repeatedly proved in the presence of numerous scientific individuals, amidst the most dense smoke arising from the combustion of wool, wet hay, straw, shavings, and large quantities of sulphur, in temperatures varying from 90° to 240° F." This certainly showed the utility of filtration in such appliances, but the apparatus was somewhat complex, and required considerable dexterity and time in its application to the person, as will be seen from the following description: A leather cap or hood was arranged to entirely enclose the head, the lower part being drawn tight around the neck by a strap and buckle; the said lower part being padded with cotton and covered with wash-leather to cushion snugly upon the throat. The hood was furnished with strong glass eye-pieces, and below this with what was termed "a proboscis," affording space within for the nose and mouth of the wearer, and provided externally with a tube about two feet and a half in length, with a five-inch funnel at the end filled or stuffed with sponge, which, when the device was to be used, was well moistened with water. The expired air appears to have been forced outward through the sponge. An opening, closed by a removable cork stopper, was provided in the front of the hood, so that on occasion the wearer could breathe the outer air direct, as might be permitted during intervals in the excess of smoke, heat, or foul gases in the place where used.

The latest invention, brought out by George A. Crofutt of New York City in 1873–74, differs in many respects from the fire-armors previously devised, although the principle of filtering the air on its way to the lungs is retained. It is termed an "eye and lung protector," and is really a mask of novel construction held over the face by an elastic band passing about the head. A duplex shell, formed of thin steel covered with India-rubber, fits over the eyes of the person using the device; the external edges of the rubber being flexible, and so shaped as to fit tight around the eyes to exclude dust, smoke, etc. from the eyes; while the eyeholes provided in the shell have flexible lips, with a groove between, which receive plates of transparent mica, a tight joint being formed between the mica and the rubber. Provision is thus made for the protection of the eyes, independent of the respiratory organs. To protect the latter the duplex shell is provided with a curtain of porous cloth, which, being gathered in at the bottom by means of a string around the neck of the wearer, forms a semi-elastic bag over the lower portion of the face. In this is placed a wet sponge of suitable size and shape, held by the bag against the mouth and nostrils. The wearer breathes through the moist sponge, which eliminates from the air passing through it the dust, noxious gases, foul odors, etc. with which it may be impregnated, and also cools the air during such passage. The entire device weighs but a few ounces, and may be fitted in place for use in less time than is usually taken by a lady to tie her bonnet-strings. Some of the experiments made with this appliance are worthy of note, as illustrating the efficacy of the filtration of air, which might be carried into effect with exceedingly advantageous results on a larger scale, under quite different conditions and for many other purposes. In San Francisco, July 28, 1874, a small room was filled with smoke of "pulo" and tobacco until daylight could not be seen through the glass doors; four men provided with the "protector" remained in this atmosphere during more than half an hour without inconvenience. On Aug. 6, 1874, at a trial at Toronto, Canada, persons remained for twenty-three minutes in an atmosphere of smoke from damp straw and tobacco-stalks, in which the chief of the city fire brigade found it impossible to remain more than one minute without the protector. In October of the same year, in Boston, Mass., the inventor wore the device for nearly half an hour, without inconvenience, in a small apartment containing all the fumes generated by the burning of two pounds of brimstone. These facts, taken in connection with the trials, now more than forty years old, with Roberts's "hood and mouth-piece," suggest the feasibility of purifying the air on an extensive scale where, under present practice, its impurity is taken for granted as irremediable. It may be mentioned, in conclusion, that Crofutt's invention has been adopted in the remoter West with great alacrity; for example, by the fire departments of Virginia City, Gold Hill, Los Angeles, and Placerville, and by the Crown Point, Belcher, Yellow Jacket, and Ophir silver-mines on the Comstock Lode, Nev. J. A. WHITNEY.

Firearms, arms loading with powder and ball; all arms which expel their charge by the combustion of powder, whether cannon, such as guns, howitzers, mortars, or small-arms, such as muskets, rifles, pistols, fowling-pieces. (See ARTILLERY; SMALL-ARMS.)

Fire-Brick, a name given to brick made from very refractory clay, and used for the lining of furnaces, stoves, grates, etc. As they are largely consumed in iron-making, the manufacture is an important branch of industry which has been carefully perfected by experience, and is now largely carried on at certain localities where the somewhat rare materials used for the purpose are most easily attainable. Fire-brick are usually made from FIRE-CLAY (which see), but other materials are used in their manufacture; as, for example, the "Dinas brick," the fire-brick most esteemed in Wales, is made of pulverized quartzose rock cemented with a little lime. In America the best fire-brick are made from the "Amboy clay" (a cretaceous clay found in New Jersey) and from the fire-clays of the coal-measures of Pennsylvania, Ohio, Illinois, and Missouri. In the manufacture of fire-brick both plastic and non-plastic clays are employed. In the use of a plastic clay like that of New Jersey, this is first burned in a kiln, losing its plasticity by the process, and becoming what is known as "cement." This is then coarsely ground, mixed with from one-sixth to one-tenth of plastic clay, moulded and burned. The Mt. Savage fire-brick are made at Mt. Savage, Md., from two varieties of carboniferous fire-clay; one of which is non-plastic, in its natural state has the properties of the "cement" before mentioned, and is treated in the same way. The Mt. Savage brick are of great excellence—being equally esteemed with the Amboy brick—and are extensively used throughout the U. S. At Mineral Point, Tuscarawas co., O., a non-plastic clay is found similar in appearance and properties to that used at Mt. Savage. It is here manufactured in the same way, and the brick made from it are scarcely inferior to those before mentioned. In all factories of fire-brick the refuse of the kilns is ground over and cemented with a little fresh plastic clay, and in this way brick are manufactured which have great power to resist fire. From their mode of manufacture the most refractory fire-brick are necessarily tender, and have little power to resist mechanical strain or violence. They are therefore employed only for the central portions of furnaces, where they are exposed to the greatest heat. Higher up in the blast furnace and near the doors of puddling furnaces brick of greater strength and less resistance to fire are used. These are made in large part of plastic clay, to which more or less sand is added. In the various parts of the different kinds of furnaces used in smelting operations brick of different shapes and qualities are required. Hence, at all factories may be seen bricks of various forms and sizes, and those in which the materials are differently mixed. As all iron furnaces frequently require to be relined with fire-brick, the impression generally prevails that they are rapidly destroyed by the action of the heat. This, however, is not true, as the best fire-brick are infusible by ordinary means. The rapid destruction of fire-brick which takes place in a furnace is for the most part due to the union of the iron with the silica of the brick, forming a fusible slag; in this way the brick are eaten or dissolved away. In the selection of clay for fire-brick it is important that it should contain as little iron, lime, soda, potash, etc. as possible, as these readily combine with the silica, forming a fusible silicate. The price of the best fire-brick in the U. S. varies from $35 to $60 per 1000 at the kiln, and these are made at comparatively few localities. Cheaper brick, and those of somewhat inferior quality, and yet adapted to most purposes for which fire-brick are used, are or may be manufactured at a thousand different localities; wherever, indeed, a reasonably good fire-clay can be obtained. (See BRICK, by GEN. Q. A. GILLMORE.) J. S. NEWBERRY.

Fire-Clay, the name specifically applied to the beds of clay which underlie most of the coal-seams in the carboniferous strata. They are so called because as a class they are very resistant to the action of fire. These clay-beds are fine sediments which accumulated at the bottom of shallow pools of water, subsequently filled up by growing vegetation. The roots of aquatic plants penetrating this clay have generally abstracted its potash, soda, lime, iron, etc., and have removed such a percentage of silica as to leave it with a larger relative quantity of alumina than it had before being subjected to their action. Thus, they have taken from it its more fusible ingredients, and have imparted to it the peculiar property it possesses of remaining unchanged at a high heat. Clays very like our fire-clays are now found underlying many beds of peat, and we may in such circumstances see the formation of fire-clays going on.

In the U. S. we have two varieties of fire-clay—the one non-plastic, and specially adapted to the manufacture of fire-brick; and the other plastic, and used also for fire-brick, and for pottery, glass-pots, etc. In the first class are the clays of Mt. Savage, Md., Mineral Point and New Lisbon, O., and from these large quantities of superior fire-brick are made. The second class includes most of the fire-clays of the coal-measures. These differ much among themselves as regards purity and excellence, but they are very largely employed for the manufacture of stoneware and second-quality fire-brick. Analyses are given below of some of the best and best-known fire-clays, Nos. 2 and 3 being non-plastic—4 and 5 plastic clays.

ANALYSES OF FIRE-CLAYS.

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Water	17.34	12.74	11.70	5.34	5.45
Silica	45.25	50.45	49.20	59.95	70.70
Alumina	28.77	35.90	37.80	33.85	21.70
Oxide of iron	7.72	1.50			
Lime	0.47	0.13	0.40	2.05	0.40
Magnesia	......	0.20	0.10	0.55	0.37
Potash					

No. 1 is from Stourbridge, England; 2, Mt. Savage, Md.; 3, Mineral Point, O.; 4, Port Washington, O.; 5, Springfield, O. J. S. NEWBERRY.

Fire-Damp, Methane, Marsh-Gas, or **Light Carburetted Hydrogen,** is a dangerous gas often disengaged in great abundance "in coal-mines from the fresh-cut surface of the coal, and from remarkable apertures or 'blowers,' which emit for a great length of time a copious stream or jet of gas, probably existing in a state of compression pent up in the coal." With seven or eight times its volume of atmospheric air this gas becomes highly explosive, and fearful accidents are constantly occurring in coal-mines, owing to the incautious introduction of a naked flame into such mixtures accumulated in the workings. It was to meet the dangers of this gas that Sir H. Davy devised his safety-lamp.—*Fownes.* E. C. H. DAY.

Fire-Eater, a term the invention of which is ascribed to Col. Howell Rose of Coosa co., Ala., who in the Southern Rights Convention at Montgomery co., Ala., in 1851, applied this epithet to the avowed Disunionists of that body. The term was afterwards applied in political parlance to extremists among the Southern Rights men, whether Disunionists or not.

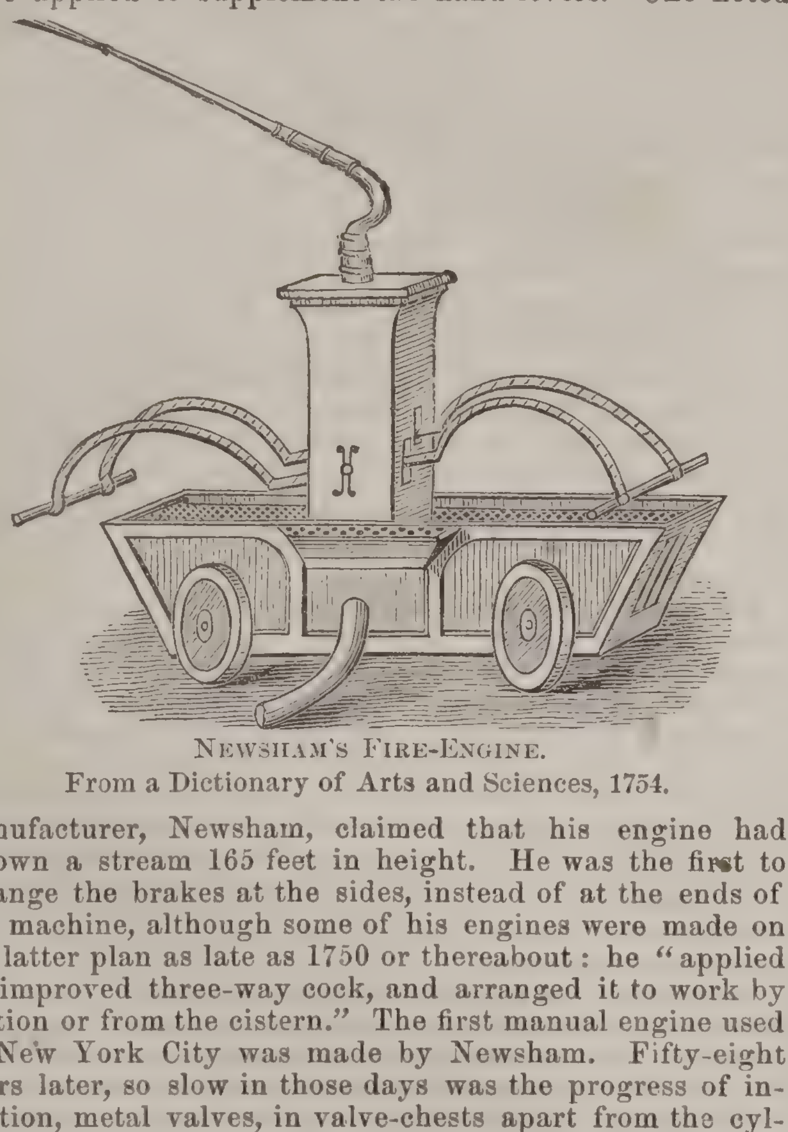
Fire-En'gines, apparatus used for projecting water upon or into burning buildings. Their utility depends upon the fact that fire may be extinguished either by reducing the temperature of the combustible below the point at which ignition occurs, or by preventing access of air to the flame. The application of water induces both of these conditions; the vaporization of the liquid rendering latent a large amount of heat, and the volume of steam shutting away the surrounding atmosphere. Until within the past half century the construction of fire-engines has been extremely rude, but the same principle (that of the force-pump) is found in all.

Hand-syringes, termed *siphos*, were, after buckets, the first devices used for casting water upon fires; and although a fire-engine, comprising two pumps furnished with valves, having an outlet in common and worked by levers or brakes like a modern garden-engine, was invented in Egypt in the second century before Christ, the "squirt" or syringe seems to have been in use for the same purpose during many hundred years. In England, however, even this primitive apparatus appears to have been for ages forgotten, for in 1558 reliance was had "upon leathern buckets, ladders, and crooks;" nor does it appear that the hand-squirt was revived until near the close of the sixteenth century. The Great Fire of London in 1666 was followed by a law dividing the city into four districts, each of which, in addition to other appliances, was to be furnished with "two brazen hand-squirts." Small "engines" are also mentioned, and it is probable that such were previously, to some slight extent, in use in London, several apparatus of this character having been previously described in printed publications. These were commonly provided with handles at the sides, whereby they were carried and directed by porters, while others worked the piston of the forcing-pump. Five of the old hand-squirts formerly used by the firemen of London are still to be seen in the vestry-room of St. Dionis Backchurch, Fenchurch street, in that city.

The first portable engine appears to have been invented in Germany, and is stated by Decaus to have been successfully used in that country previous to 1615. His illustration shows a single-acting pump furnished with a jointed outlet pipe for directing the jet, and mounted upon a double-ended sledge. There are known to have been used in Augsburg in 1618 huge syringes mounted upon wheels.

An English writer, one John Batts, in a *Treatise on Art and Nature*, published in 1634–45, describes "divers squirts and petty engines drawn upon wheels," which he asserts have "been found very commodious and profitable in cities and large towns." He shows seven different engines, each including a tub mounted on wheels and furnished with a force-pump. Fire-engines were introduced into Paris in the year 1699 by a projector named Duperrier, who held a patent from the Crown. They do not appear to have differed materially from the English except in the addition of an air-vessel. This latter is believed to have been used in Hero's Egyptian engine previously referred to, although its invention has been very commonly attributed to Leupold in 1620. In 1657 one John Hautch of Nuremberg made an apparatus which, worked by twenty-eight men, threw an inch stream 80 feet high; it was placed upon runners and drawn by two horses. In 1676 the knowledge of leathern hose for fire-engines was brought to England from Holland; in it the seams were sewed. It was not until 1808 that Messrs. Sellers & Pennock of Philadelphia (U. S.) substituted a line of rivets for the stitching, the former an improvement which Jacob Perkins carried to England ten years later.

Little improvement in fire-engines was made until about the year 1734, when there was considerable rivalry in their manufacture in England, and the fire-engine became an important and efficient machine. According to one plan, the engine threw two jets at once; in another, treadles were applied to supplement the hand-levers. One noted



NEWSHAM'S FIRE-ENGINE.
From a Dictionary of Arts and Sciences, 1754.

manufacturer, Newsham, claimed that his engine had thrown a stream 165 feet in height. He was the first to arrange the brakes at the sides, instead of at the ends of the machine, although some of his engines were made on the latter plan as late as 1750 or thereabout: he "applied an improved three-way cock, and arranged it to work by suction or from the cistern." The first manual engine used in New York City was made by Newsham. Fifty-eight years later, so slow in those days was the progress of invention, metal valves, in valve-chests apart from the cylinders and air-chamber, were substituted for the leather valves previously located within the cylinders, etc. Ten years before this, however, Joseph Bramah patented a rotary pump for use upon fire-engines, and afterwards one in which a semi-rotary movement alternately in opposite directions was adopted. Some of these engines are still in use in London.

Floating fire-engines worked by manual power were first employed on the Thames. The exact date is not known, but they were certainly in use in 1793. At first they were constructed with rotary pumps, but the rapid wear of these caused them to be discarded for plunger pumps. In one arrangement the same mechanism that worked the pumping apparatus was also capable of connection with the paddle-wheels to propel the vessel. An English engine on this system was built for the Russian government as recently as 1841. In the year 1834 an English writer stated that the "*ne plus ultra* of fire-extinguishing machinery would be a steam floating fire-engine of about thirty horse-power." Manual power, however, was employed in working floating fire-engines for several years later. The first one operated by steam was that designed for the use of the East India Docks in 1850, in which a pump was fitted upon a propeller and geared with the engine; it threw 600 gallons of water per minute 20 feet above the roofs of the highest buildings on the docks. A floating steam fire-engine was built by the London fire-engine department in 1852, and others at a later date. Such apparatus have been of great utility in extinguishing fires along the water-fronts of cities and on shipboard in harbors. The John Fuller, a floating steam fire-engine furnished with rotary pumps that when not engaged in throwing the stream through the hose serve as jet-propellers to propel the vessel, has been doing good service on the East and North rivers, New York, during some years past.

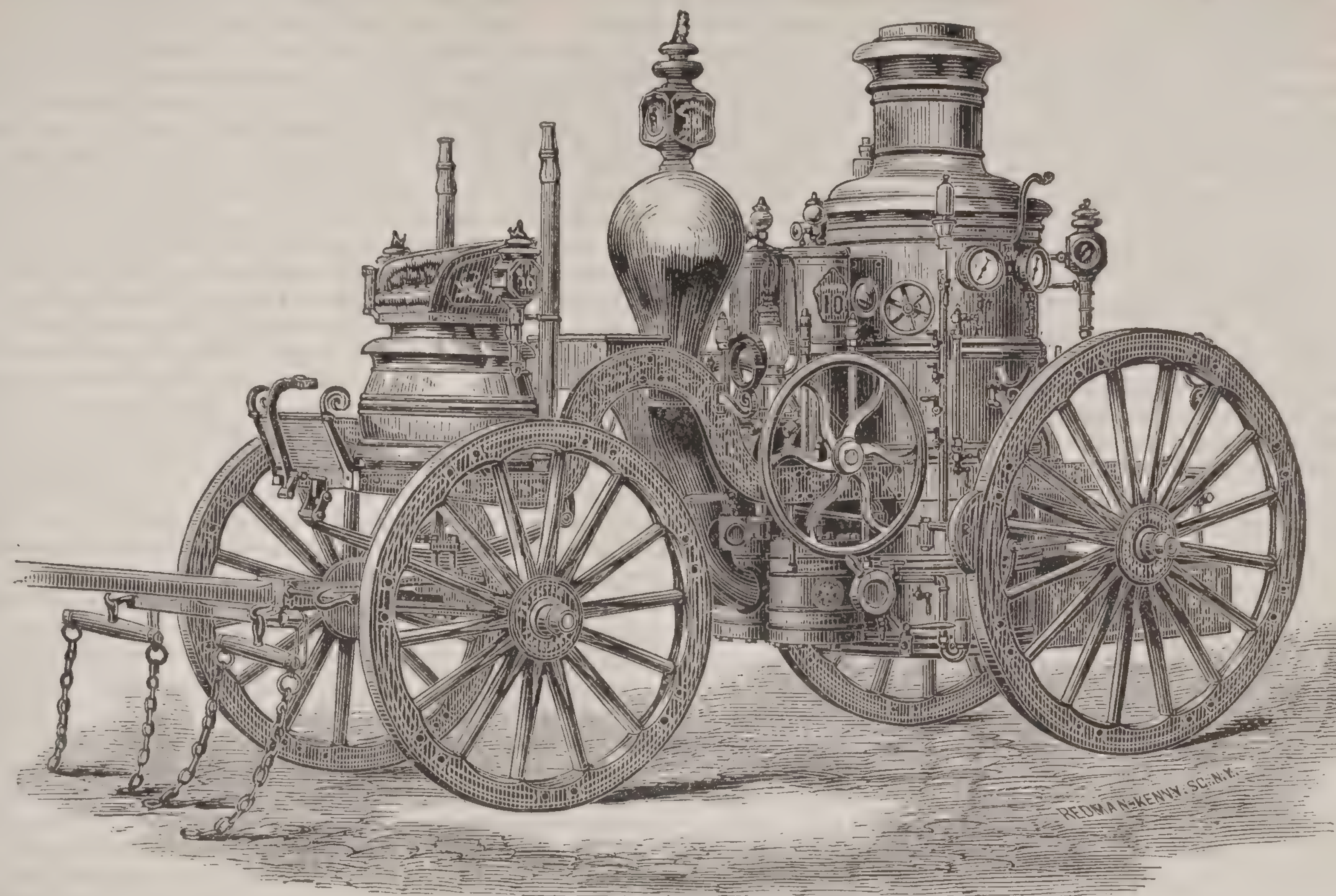
The earliest *steam* fire-engine for use on land was made in London by Braithwaite and Ericsson in 1829; five of these engines were built—some of which were sent to France, Russia, and Prussia—but after 1832 they met with no favor in England during twenty years. They had plunger pumps worked direct from the piston-rods of the steam-cylinders. From a mechanical stand-point they were successful, and were used in subduing several large fires, but were popularly objected to as throwing *too much* water. In 1840 an English steam fire-engine was introduced in New York, and the system gradually made its way to extended favor in this country. In England, from 1852 forward, steam fire-engines were the subject of much experiment, but it was not until 1860 that the London establishment used a land steam-engine in extinguishing a fire in one of the back streets of Doctors' Commons.

The comparatively early adoption of steam fire-engines in the U. S. about the year 1840, and their continuous use thereafter, led to their rapid improvement in the details of construction; and concerning the steam fire-engine trials at Sydenham, England, it has been remarked by an English writer that "as to the workmanship of American engines, there has been nothing seen in England at all approaching it, and it was the universal theme of commendation by all practical men." The engines now in use in New York and Brooklyn are made both with rotary and cylinder pumps, and show various arrangements of pumps, air-chambers, valves, etc., designed to secure a maximum of lightness, manageability, and great projecting force, some having been made almost wholly of steel. Self-propelling steam fire-engines have been constructed both in Europe and America, but have been found, all things considered, very much less efficient than those drawn by horses in the usual way: they are much less economical and less readily available, as they must be kept "with steam up" continually, in order to avoid delay when suddenly called upon for use. As to the superiority of the steam over the manual fire-engine, careful English experiments have shown that, taking as a standard a given height and volume of water thrown, the expense of the latter is £9 sterling, and of the former 2*s.* 6*d.* But this is not the only, or indeed the main, consideration, for hand-engines are of little use when the height of the burning building is greater than 60 feet, whereas a well-constructed steam fire-engine will play with effect upon the roof of a building 150 feet high.

According to the most recent authority, Paris places the most reliance upon manual engines worked by eight men, and which throw a ⅝-inch jet to a height of 100 feet. Hanover has a steam fire-engine in the city of that name, but hand-engines are commonly used, and the people of each district are bound by law to assist the firemen in working them. In Holland, Amsterdam and Rotterdam have regularly organized fire brigades and steam fire-engines. In Prussia, Berlin was the first European city to adopt the steam fire-engine, but very little is known of its fire department. In Russia the working of fire-engines, which are commonly small and operated by four or five men, is a punishment for military misdemeanors. In Switzerland each village has its volunteer fire brigade; these are said to be remarkably prompt and efficient, keys to the engine-houses being kept by three or four persons in the vicinity of each, to permit quick action in emergencies. Turkey has had fire brigades during several centuries, but the fire-extinguishing apparatus is only a slight improvement on the squirt. In China pumps mounted on stretchers suspended from poles, and carried by four men, constitute rude engines, which are worked amid much noise and confusion on the part of the populace.

In the U. S. the use of fire-engines dates back to 1731, when it was resolved by the common council of New York to import two of Newsham's engines, which were received the following year. Five years later the common council ordered that £10 be advanced to one Turk to enable him to finish the first fire-engine built in the country. Steam fire-engines are now universally used in all of the larger cities, and the number of paid firemen aggregates many thousand; twenty thousand marched in procession at the firemen's celebration in Philadelphia in 1865. The New York City fire department has now thirty-five engine companies, of twenty-four men each, and an aggregate of thirty-five steamers. It may be remarked, in conclusion, that American steam fire-engines possess a demonstrated superiority over those of foreign make, due to the high

speed at which they are worked, which in its turn is dependent upon the fact that in many important respects they are proportioned in close imitation of railway locomotive-engines. James A. Whitney.



Amoskeag Steam Fire-Engine.
First and Second Class Double Plunger Engine. Crane-neck Frame.

Fire-Escapes. The common fire-escape is simply a system of fixed iron ladders attached to a building to permit descent from the upper windows; ordinarily, a platform or balcony is provided to each story, and the ladders are extended from one to another, either in a vertical or inclined position. Such devices are unsightly, and are limited to tenement-houses and the like. It is usual for many persons to provide a long rope attached at one end to a bar, which latter may, on emergency, be fixed across a window with the rope pendent, to permit sliding down the same. A similar idea has been embraced in several recent inventions, a reel with a rope wound on it being provided within the base of a chair, stool, table, or similar article of furniture, so as to be capable on occasion of the use aforesaid, but ordinarily kept out of the way. As it is difficult in descending the rope to grasp it securely enough to prevent a too rapid descent, several plans have been brought forward, in which a mechanical clutch is provided to grip the rope, and enable the person escaping to regulate the rapidity of the descent. In some cases a thin metallic strip, giving greater strength and capable of being coiled in less space when not needed for use, has been substituted for the rope. Such appliances have operated successfully in experiments where the experimenter was cool and clear-headed, but have seldom been of much use in the confusion of actual danger. As the value of land increases in cities, the buildings are made higher, and this materially increases the difficulty of escape in case of fire. It also enhances the obstacles in the way of constructing an entirely practicable fire-escape. The want of such an apparatus is felt in every large city in the civilized world, but, although scores of fire-escapes have been projected, reliance is still had by firemen upon sectional ladders manipulated at a great disadvantage by hand. These were in use previous to A. D. 385, as also were flexible ladders with hooks at the ends, which were thrown to catch upon walls and window-sills. Telescopic tubes raised perpendicularly from a base-frame by means of a screw, and carrying a basket large enough to hold several persons, also lazy-tongs, or jointed superposed bars lifting a platform, were also known at that date. Both of these principles of operation are embraced in numerous fire-escape apparatus projected in recent times.

Apart from fixed ladders attached to the building, and the sectional ladders of the hook-and-ladder companies, fire-escapes may be classified as follows: 1st, those whereby the inmates of a burning building may slide down a rope grasped by the hands or by a gripping device; to which class belong the simple rope devices hereinbefore referred to; 2d, those embracing extensible ladders carried upon a suitable carriage and provided with winches for elevating; 3d, those in which a chute is employed, through which persons may slide to the ground; 4th, those in which a platform is raised and lowered by a system of lazy-tongs; and 5th, those in which a platform or basket is suspended from a rope or chain worked by a winch from the ground. Of the first class, one of the most efficient was brought forward nearly half a century since, and was known as the "sling" fire-escape. It comprised a rope passed over a sheave temporarily hooked to the window-sill, the rope being furnished at one end with a sling or loop serving the purpose of a seat, and also with a belt passing around the waist; the opposite portion of the rope being grasped by the hand, and slowly payed out until the person was let gently to the ground. Within a few years past the same plan has been re-invented, with the addition of a hollow iron window-sill provided to contain the apparatus when not in operation. In the second class a number of ladders lie flat upon a vehicle during transport from place to place, and when required for use are lifted to a nearly vertical position, and then moved out longitudinally, one from the other, until their utmost limit is reached. Numerous modifications of this system have been made in the arrangement of gearing to elevate the ladders. It was stated, on apparently good authority, in 1859, that the city of New York had paid $25,000 for the right to use a certain improved apparatus of this kind, but it was never adopted in practice. The third class attracted much notice in England about forty years ago. The apparatus comprised a strong sail-cloth tube distended by a hoop at the upper end, which was attached to a window; the diameter of the tube being such that a person sliding down could regulate his speed by pressing his elbows outward against the sides. The tube should be stretched from the window to the street at an angle of 45°. That it provides for the safe descent of persons from a great height without danger has been often demonstrated by experimental trials; among others, by one in the neighborhood of the city hall in New York as recently as 1869. But the canvas is liable to ignite from the contiguity of the flame, and the apparatus, unless kept ready in the building itself, is difficult to put in place. A recent apparatus, embracing the same principle of operation, is constructed with a telescopic tube to be elevated from the sidewalk, and formed at its lower end with a curved outlet to gradually check the rapidity of the descent. The fourth or lazy-tong system is open to the apparent objection of being somewhat complicated, but its practical operation dates from the fourth century, when the plan was employed for raising soldiers to the tops of walls. The "lazy-tongs" have been actuated by various combinations of screws, gearing, etc., and provision has been made for keeping the elevated apparatus in the perfectly perpendicular position essential to its successful operation, by providing jack-screws to the main frame, which is thus capable of adjustment to a horizontal position by lifting the wheels clear of the ground, from the

working of the screws separately to the required extent. A tolerably efficient device of the fifth class was proposed, and to a slight extent adopted, in England in the beginning of the present century. It consisted of a strong pole of from 36 to 40 feet in length surmounted by an iron cross-bar designed to rest against the side of the building and to keep the pole from turning. About three feet from its upper extremity the pole carried a pulley over which was a rope having at one end a basket, the rope being worked from the pavement to raise and lower the basket. The rope, pulley, and basket have been frequently combined with a ladder, the last taking the place of the pole previously described. Many years ago the town of Leith in Scotland temporarily adopted a fire-escape in which a telescopic pillar elevated by pulleys raised a telescopic ladder furnished with a platform, to which latter a hose-nozzle was attached. This was a combined fire-escape and fire-extinguishing apparatus; it would be well if its double object were embodied in all fire-escapes.

The numerous fire-escapes that have been projected and experimentally tried have hitherto done little to prevent loss of life, but it is to be supposed that in course of time some one or more will be sufficiently perfected to meet all the conditions of success; and there can be no doubt that something more than fire-ladders should be available by firemen, both for facilitating the escape of occupants from burning buildings and for playing water upon the flames. But perfect security can never be obtained until in the construction of buildings the contingencies of fires and the necessity of escape therefrom are kept especially in view. If a fireproof well two feet square extending from the attic to the ground floor, and opening to the street, was provided in each dwelling, and furnished with mechanism for lifting or lowering persons, many of the losses of life with which the public have been made familiar during the past few years would have been avoided. JAMES A. WHITNEY.

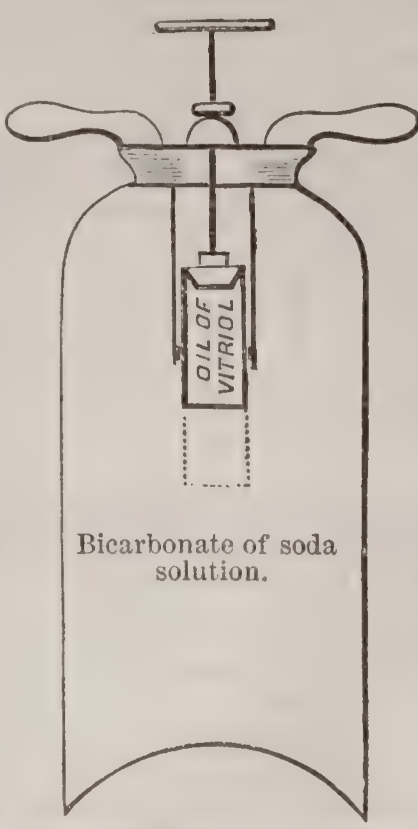
Fire-Extinguishers. This term designates a large class of fire-extinguishing apparatus in which water is surcharged with some other body antagonistic to flame. Ordinarily, the water is charged with carbonic acid, but other substances, some of a saline character, have been used. A fire-extinguisher, commonly so termed, is of small size, having a capacity of about one-fourth of a barrel; of cylindrical form; provided with a strap by which it can be secured upon the back of a fireman or other person; and having a short hose and nozzle attached, whereby a small but forcible jet may be thrown in any direction. In some varieties there are provided within the cylinder, filled with water, two vessels or receptacles, one containing a bicarbonate, the other a strong acid; as, for example, oil of vitriol. When the apparatus is to be used the contents of the two receptacles are thrown into the water, and the chemical reaction sets free the carbonic acid, which, being confined and consequently under pressure, is absorbed by or dissolved in the water. In some, however, as we shall have occasion to explain, the water is charged by other agencies. On opening a suitable valve in the hose or outlet the pressure of the confined gas forces out the liquid in a strong jet, which carries with it a very considerable portion of the carbonic acid gas contained therein. This non-combustible gas, being thus brought in intimate contact with the flame, excludes the atmospheric air, and in a very high degree assists the action of the water in its extinguishment. The same effect is of course produced when the water in the extinguisher has a sufficient portion of either acid or bicarbonate dissolved in it, and a single receptacle is used to hold either acid or bicarbonate, as the case may be, apart from the liquid until the device is required for use. As fire-extinguishers occupy but little space, are extremely portable, and can be made available at a moment's warning, they have been introduced by thousands during the past few years, and for subduing small fires, and thereby preventing larger ones, their utility is unquestioned; and recently many improvements and modifications have been made in them, most of these, however, relating merely to details of construction. The essential principle of operation (the use of water charged with, and forced out in a jet by the pressure of, carbonic acid gas) has been applied on a larger scale in the so-called chemical fire-engines. The first portable fire-extinguisher was made and successfully used in London in the year 1816. It embraced a cylindrical vessel fitted to be carried on the back in the same manner as the apparatus of the present day. The vessel was partially filled with a solution of pearl-ash, and air was forced into the remaining space to any required pressure by a force-pump. This done, the inlet valve was closed, and in opening the outlet the jet was projected with a force proportioned to the pressure of the compressed air. At a much more recent date it has been proposed, in France, to charge the water with ammonia.

The attention of the public was first forcibly drawn to the possibility of extinguishing fires by means other than the simple application of water about the year 1851, at which time the Phillips fire-annihilator, so called, was introduced. In this a slightly conical shell was fitted internally with an annular brick or tile composed of 20 parts powdered charcoal, 60 parts saltpetre, and 5 of gypsum, the whole boiled in water and subsequently dried at 100°. In the central cavity of this brick was placed a bottle containing a mixture of chlorate of potash and sugar, the bottle surmounted by a globule of sulphuric acid. The shell was perforated in numerous places, and placed within another, also perforated, to permit the outflow of the gases. The whole was placed within a double cylindrical receiver containing water in its lower part, and having two covers, the outermost also perforated. The cover carried a spike, which, being forced down, broke the bottle to permit the sulphuric acid to fall on the chlorate and sugar, and ignite the same; the ignition spreading to the surrounding composition, caused the evolution of gases therefrom, which, accumulating under a certain degree of pressure, forced the water in the bottom of the receiver up between the walls, where it became converted into vapor, and mingling with the evolved gases passed out in a dense cloud to envelop and smother the contiguous flame.

The Phillips fire-annihilator was wholly different in its *modus operandi* from the extinguishers now in use. But before these latter were perfected numerous other ingenious plans were put forth of more or less theoretical value, but none of them meeting with much favor in practice. Among these was one patented in 1867, in which the expansion of mercury caused it to reach a wire, the integrity of which was destroyed by the contact. The fracture of the wire set in motion certain previously arranged mechanism, which mingled chemicals to generate carbonic acid gas, which, filling the apartment, was expected to extinguish the fire. In the same year it was proposed to provide for extinguishing fires in the holds of ships or in closed apartments by providing them with strong closed vessels containing ammonia, carbonic acid, or sulphurous acid, compressed nearly or quite to the point of liquefaction; the vessels to be opened from the outside of the hold or room by any suitable mechanical devices.

Baragwanath's fire-extinguisher was the first to employ water charged with carbonic acid generated by chemical action within the vessel (the reaction being identical with that whereby soda-water, so called, is charged); but for some reason the invention lay idle until brought into use by subsequent inventors. The changes made by these, although important in bringing the apparatus to its present high efficiency, are, as before remarked, mainly in matters of detail, and any elaborate description of even the more important would occupy more space than can be here afforded. But those modifications of the essential principle of the apparatus which materially extend its usefulness beyond its original sphere may be briefly sketched. Among these was the employment in 1867 of a sealed glass vessel to hold the acid, which is fractured on occasion by suitable mechanical devices; also the use (in 1870) of one or more perforated plates, partitions, or diaphragms arranged within a portable fire-extinguisher and below the acid vessel, to distribute the acid through the alkaline solution previously provided therein, to facilitate the chemical action, and to prevent the accumulation of the acid at the bottom of the vessel. Previous to this, in 1868, an apparatus was made that when used was "inverted, having the effect of mixing dry acid on a foraminous internal shelf with the water already charged with the opposite material, thus producing and charging the water with carbonic acid gas, which, upon the opening of the cock, forcibly discharged the water from the vessel." An apparatus which combined in a measure the characteristics of the old "annihilator" and the more recent "extinguisher" was patented in 1868. A charge of peculiar composition was placed in the upper part of the closed chamber containing the liquid, and being ignited produced a gas which, accumulating until a high pressure was reached, remained to exert a constant pressure upon the water. This invention is in reality merely a method of charging the water without the use of the chemicals hereinbefore specified. Of course, the apparatus is kept continually under pressure, and in this respect acts mechanically, upon the same principle as that of the first fire-extinguisher ever made, the compressed gas in the one case being simply an equivalent for the compressed air in the other. The Babcock extinguisher is filled with a solution of bicarbonate of soda, and has in its upper part a vessel of acid suspended by lateral pivots to a stirrup depending from the top of the apparatus. The stopper of this vessel is worked by a rod through the top of the extinguisher. By withdrawing the stopper the vessel tilts over, and mingles the acid with the solution thereby discharging the carbonic acid from the latter.

The use of salts in solution, which by evaporation of the water will be left encrusting the burning material, thereby excluding air, or by decomposition by the heat giving off incombustible gases, has been indicated in several cases. Among the substances used for this purpose are common salt and the sulphite and hyposulphite of soda. The idea of casting prepared bodies into the flames, to give off extinguishing gases when subjected to the heat, has also been attempted. In one of these devices a compound of coal-dust, saltpetre, sulphur, and chalk was provided in a portable cylinder, the ends of which were covered only with paper rendered highly combustible by saturation with nitre.



Babcock's Fire-Extinguisher.

The transition from a fire-extinguisher small enough to be carried on the back to one sufficiently large to require wheels was easy and natural, and under the name of chemical fire-engines these latter have been put in practice with a certain measure of success. Among the alleged improvements is one (1869) in which there is arranged upon a truck or carriage "two or more cylinders or reservoirs, connected by pipes which are controlled by stopcocks, and which connect with an issue-pipe or nozzle common to all the pipes, so that in extinguishing a fire one reservoir may be resupplied while another is being exhausted, and thus a continuous supply and stream be kept up and thrown upon the fire." Another apparatus, produced a year or two anterior to the above, was constructed with a chamber, in the upper part of which was placed the gas-generating material, determinate portions of this latter being brought automatically from the chamber and mingled with the stream of water ejected by a forcing pump. In another a stream of carbonic acid gas from a separate receptacle was caused to mingle with the jet issuing from an ordinary fire-engine. Such apparatus, however, are of comparatively limited utility, the steam fire-engine alone being sufficient to cope under all conditions with fires that have passed that incipient stage in which they may be readily subdued by the small extinguishers carried by the operator.

Numerous methods have been proposed for ensuring the automatic action of fire-extinguishing apparatus through the inevitable increase of temperature. Pipes extending from a central reservoir charged with water or extinguishing gases, and provided with fusible plugs, have been suggested, and under some conditions could be made available. Even the explosion of gunpowder, and much more feasibly the severing of a combustible cord, have also been projected as suitable means for ensuring the automatic turning on of the extinguishing element to the place where needed.

JAMES A. WHITNEY.

Firefly, the name of many nocturnally luminous coleopterous insects of the families Lampyridæ and Elateridæ, the former including the glow-worms. According to some writers, some of the Fulgoridæ, which are hemipterous insects, are luminous also, but the weight of the evidence is quite to the contrary. The luminous organs of fireflies and glow-worms are composed of yellow masses of cells filled with granular matter and traversed by many tracheæ. It is now generally held that the light is produced by the slow combustion of granular and perhaps fatty matter, oxygen being abundantly supplied by the tracheæ. It is not thought at present that phosphorus is present in any noteworthy amount in the luminous matter. Spectroscopic examination of the light of insects of both families gives a very beautiful continuous spectrum without lines. The fireflies of Central and South America are chiefly Elateridæ of the genus *Pyrophorus*. They generally give a very intense light, which comes from two spots on the prothorax. The U. S. have some Elateridæ with luminous larvæ (*Melanectes*). Our common "lightning-bugs" are of numerous species, all Lampyridæ, and mostly of the genera *Photinus* and *Photuris*. *Photuris Pennsylvanica* is the most common. Both sexes are winged. *Photinus* is distinguished from the old genus *Lampyris* by the females being winged. (See GLOWWORM.)

Fire-hole Basin. See NATIONAL PARK.

Fire-hole River, or the main fork of Madison River, is a stream flowing from Madison Lake, a small sheet of water of some 60 acres area. It flows N. W. through the Fire-hole Basin, one of the most remarkable geyser regions of the National Park. It is in Wyoming Territory. The Fire-hole is, in fact, the upper part of Madison River.

Fire Insurance. See INSURANCE.

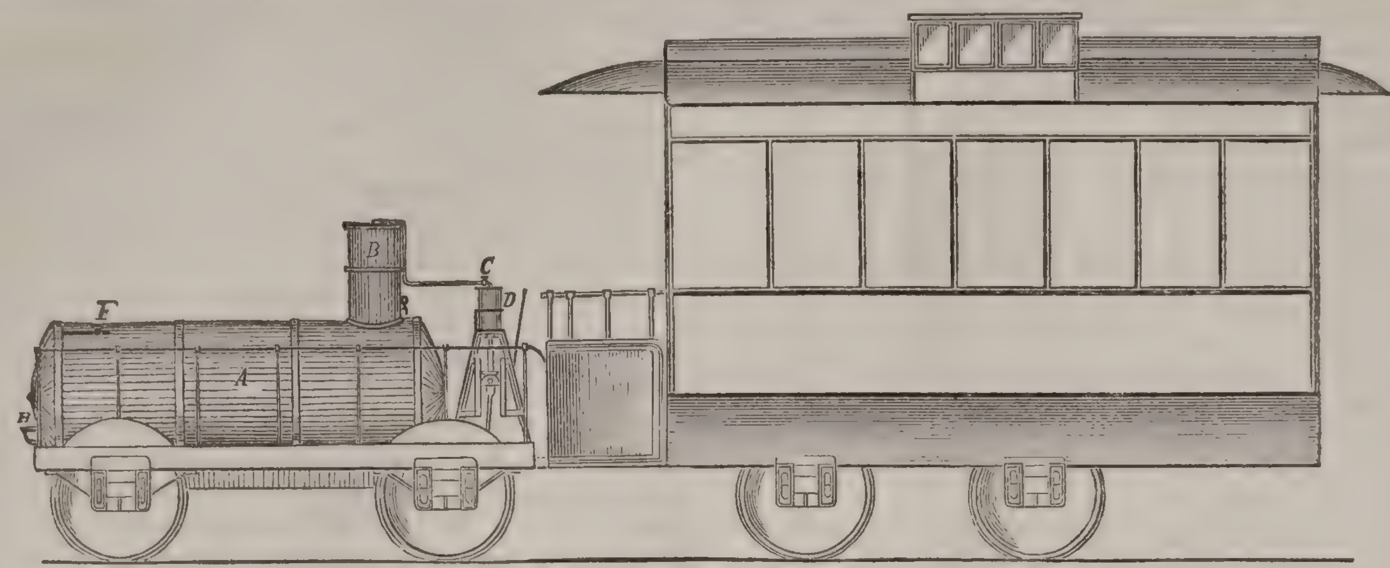
Fire Island, a small island in the Great South Bay, S. of Long Island, is a place of summer resort. It is reached by rail to Islip and by steamer. It is in Brookhaven tp., Suffolk co., N. Y.

Fire Island Beach, a low, sandy spit of land broken by a few inlets, separates the Great South Bay of Long Island from the Atlantic. It is some 30 miles in length, and belongs to the township of Brookhaven, Suffolk co., N. Y. At its W. extremity is Fire Island Inlet and a lighthouse of brick 166 feet high, with a flashing light of the first order; lat. 40° 37′ 54″ N., lon. 73° 12′ 48″ W.

Fireless Engine, a successor to the ammoniacal gas-engine. Dr. Émile Lamm, a native of France, but for many years a citizen of New Orleans, La., was the inventor and patentee (July 19, 1870) of an engine in which the power was derived from the vapor of ammonia. The ammonia, on escaping from the engine which it propelled, was recondensed (absorbed) by water, over which it was passed. This ammoniated reservoir of water, on being heated to the temperature of about 135° F., gave up the ammonia in the form of vapor. The same vapor was again returned to the engine, and was again scaped, to be absorbed by its bath of water. The detail of the construction of the engine and water-bath need not be given, since the engine has been superseded by the incidental discovery, by Dr. Lamm, of a convenient method of using detached steam for the like purpose. Suffice it to say, that the ammonia engine was successfully used in propelling street-cars in the city of New Orleans on the Canal street railroad, at the rate of about 8 miles per hour, and with decided economy as compared with horse-power. This was used in the year 1871. A stock company was formed, and the invention, under ample patent guaranty, was placed upon the market. While perfecting the methods of applying the ammonia propelling power, and studying heat in its latent and active forms, Dr. Lamm was impressed with the facility with which the vapor of water may be condensed, even at high temperature, in water under high pressure; and following up the experiments, he was led to the invention of the fireless engine, patented Apr. 9, 1872, and now in complete use in New Orleans, but first perfected by Dr. Lamm himself, and applied to the selfsame engine used for driving the ammonia cars.

The whole invention and method of its use are so simple and obvious, when once stated or conceived, as to lead to surprise that men familiar with every principle involved should so long have blundered directly around the invention, without seeing the application. It has been long and familiarly known that water, which is converted into steam at 212° F. in the open air, may be raised to a very high degree of heat under steam pressure without being evaporated. A boiler half filled with water and heated to 212° will soon fill with steam, a cock permitting the air to escape until vapor condenses in the scape, and then closed. Above this temperature, continually increased, no more steam will be generated, excepting what is due to compression. There is no limit to the temperature you may apply without changing the status of the water contained, short of the red heat which weakens the boiler and ultimately bursts it. It follows as a corollary, that steam injected into this water while under pressure will be condensed, giving out to the water its 967 degrees or units of latent heat, and swelling the volume of water by the amount injected as steam, and condensed therein. It was further obvious to Dr. Lamm that any steam let off through a valve from the steam-chamber above the water would be replaced by the evaporation of a corresponding amount of water, the total pressure and heat being reduced in proportion; and without any new heat applied this supply of steam would be kept up till the heat should be reduced to about 212°, and the pressure to about one atmosphere, or 14.07 pounds. The reasoning was verified by experiment, and the use of steam thus cumulated and detached was resolved upon. One street-car was fitted up and furnished with cylindrical receivers in the form of boilers, and inserted beneath the floor, under the longitudinal seats of the car. These were furnished with a perforated tube lying near the bottom of the receiver and projecting through its end, where it was readily connected with a steam-pipe leading from a stationary boiler and furnace at the dépôt. Through this pipe steam was injected into the half-filled receiver till it reached a temperature of some 363° and a pressure of about 150 pounds. The steam-valve in the tube was closed and the pipe detached. Two small engines working an endless chain geared to a drum

on one of the axles of the truck were placed upon the forward platform of the car, and properly connected by pipe and valve with the steam-chamber of the receiver. The usual facilities for slacking, accelerating, stopping, starting, and backing were supplied as in ordinary engines. The effect was immediate and complete. After running this dummy for some time on the Carrollton road it was removed, and a number of like "dwarf-locomotives" were ordered by the Carrollton R. R. company. These were on greatly improved patterns.



Fireless Engine, with Car.

The receiver in this locomotive is placed upon a four-wheeled truck, not unlike those on which the passenger street-cars are mounted. A single tank or receiver, 6 feet 6 inches long and 3 feet in diameter, is covered with a non-conducting substance about two inches thick, and lined outside with wood and sheet iron. The steam drum or dome rises about $2\frac{1}{2}$ feet, not unlike the locomotive chimney. Inside of the insulated receiver, at the bottom, is the perforated tube through which the steam is injected into the water, which fills about seven-eighths the capacity of the tank. On the rear end of the receiver's platform is located a pair of small $4\frac{1}{2}'' \times 8''$ engines, standing upright, worked by steam from the dome and pipes. These are geared by cranks to the pinion-wheels, that operate by cog-gearing the driving wheels of the dummies. The scape-pipe rises some six feet and discharges in the air. The steam is injected till the gauge reads 125 pounds to 135 pounds, at option. The temperature corresponding to the latter is 355° F. These cars run from the dépôt at Carrollton, where the receivers are charged from stationary boilers, down to Napoleon Avenue (halfway to Canal street, the city centre), and return in half an hour, $5\frac{1}{2}$ miles, thus working off the pressure to about 60 pounds. They are then recharged in about two minutes, and are ready to start again. So perfectly manageable are they, towing usually only one car, but capable of two more, that no serious accidents of any kind have delayed or missed a connection in running the ten locomotives for (now) six months. No engineer is needed on the cars; the ordinary laborer who can drive a mule is entirely competent for their management.

These fireless locomotives have been tried on the streets of Philadelphia, Brooklyn, Chicago, and New Orleans, and the statistics of their working show a saving in cost, safety, and simplicity that must at an early day remove all horse-power from street-cars. Gen. G. T. Beauregard, president of the Carrollton R. R. Co., and a distinguished engineer of great practical experience, expresses himself well satisfied with the results thus far obtained with the ten fireless engines he has had in operation on his road since Sept., 1873, and says that the economy over the horse-system will necessarily be materially increased as the number of these dummies is augmented.

It is due to the memory of Dr. Lamm to state that his accidental death by drowning in 1873 deprived his invention (destined to work such a revolution in street and perhaps other locomotion) of the benefits of his gifted mind in completing its improvements. The New Orleans Academy of Sciences, of which he had been an active fellow for many years, paid a proper tribute to his memory.

C. G. Forshey.

Fireproof Buildings. Absolute security from fire is alone obtained by constructing buildings of material that is not only in itself incombustible, but which will not be decomposed by an extreme degree of external heat, and by the utter absence as storage of quickly combustible merchandise. The necessity of these conditions is shown by the rapidity with which structures only partially of wood are consumed, and also by the wholesale destruction in the recent fires of Chicago and Boston of great iron, marble, and granite buildings, and by the experience of London warehousemen, from the tumbling down of solid walls because of the expansion of iron beams in so-called fireproof buildings filled with saltpetre, oils, and other highly inflammable substances. As a material for building, hard-burned brick has been found to have the greatest fire-resisting properties; the evil results of the expansion of iron girders have been measurably overcome by supporting them on roller bearings, which relieve the walls of their thrust; and the danger of the common mansard roof has been in a material degree reduced by the substitution of iron for wood as a support for the slate. Nevertheless, as concerns warehouses, the security is only relative, for no safeguard can be provided to prevent the weakening and falling in of iron beams raised to any temperature approaching that of a cherry red, and with inflammable contents there are no buildings that are really proof against fire. Of late years the danger has been materially increased by the storage of petroleum oils, the vapors of which combine with atmospheric air to form explosive compounds; but this may be somewhat provided against by securing a free circulation of air throughout the building, to carry off the vapors before the explosive point is reached. It was an axiom of architects nearly a century ago that good party-walls between buildings form the best preventives of the spread of fires from house to house, and that similar means will prevent it passing from one room to another in the same building. But a defect in many brick walls exists in the mortar, which frequently crumbles from heat. The quality of the mortar used is of even more importance than that of the brick. The covering of walls with a fire-resisting cement has been suggested, but this would be open to the same drawbacks as stone and cast iron—viz. splitting and cracking when heated and subjected to the contact of cold water. To secure as far as possible immunity from the worst results of fire, the building should be constructed with special reference to the class of merchandise it is designed to hold. The storage of petroleum, rosin, turpentine, etc. would be best in underground receptacles covered only by a light structure, the rule holding good in this, as with oilcloth factories and the like, that it is better that the whole should be rapidly swept away than that the standing walls should hold the flames like a blast furnace.

In warehouses the nearest approach to perfect fireproofing is found in the employment of brick walls, and concrete floors and ceilings supported by girders having their weight uniformly distributed upon the walls. In New York, floors of corrugated iron and cement have long been in use, but the objection to iron is so great that some architects have recommended wood strongly pugged with cement as preferable. It is notable that wooden beams having only their sides exposed to flame are seldom burned in to a greater depth than one inch; and when the surface is protected by cement, even this is much diminished. But the end-section of wood exposed to fire burns away with great rapidity. The construction of perfectly fireproof stairs is a greater problem than that presented by walls or ceilings; and for these well-pugged wooden beams have been recommended as preferable to iron as supports for the brickwork, which should always be used instead of stone. The utility of brick as a fire-resistant received a remarkable demonstration during a large fire in Tooley street, London, some years since. In this instance, says an eye-witness, "an immense range of cellars was filled with oil, which ignited. For weeks this oil was burning, a rolling sea of flame. The cellars were vaulted with brick. They had this glowing mass below and the heated *débris* above, and yet, upon a careful examination after the oil was removed, scarcely a trace of injury could be detected." When brick arches cannot be used, the same writer recommends "strong wooden timbers thickly pugged, and supported on strong wooden posts, in preference to iron girders or iron columns." But it must be remembered that in this use of wood everything depends upon the character of the pug-

ging, and the cement used in this country is inferior to that which has shown the utility of the system abroad—a fact having a positive bearing on the construction here of fireproof dwellings after the French manner, hereinafter referred to. The isolation of the several stories from each other is also a matter of importance, but is seldom provided for; the most perfect example of its practice in this country is the building of Harper & Bros., New York. In this there are no openings through the floors, and it has neither internal stairs nor hoistways, the stairways being provided in an isolated tower connecting with the building by iron bridges, and the hoistway being outside of the enclosure.

The number of fires of late years occurring from the use of wood as a material for mansard roofs has led to the introduction of several new methods of applying iron as a support for the slate; and such should always be employed. It may be remarked that, as concerns fireproof floors, some of the older fireproof structures, so called, in New York, were floored with boiler-plate riveted into large sheets and bolted to the beams or girders. A more recent plan, that experimentally resisted severe tests, embraced a thick layer of clay bedded upon a metal support. The idea of filling the spaces between floors and ceilings and between inner walls with a fireproof composition capable of evolving water and incombustible gases when subjected to heat, has a certain degree of plausibility, but would be too expensive to meet with favor, and would be subject to dampness. Gunpowder magazines have been surrounded with walls filled in with alum and sawdust as a safeguard against the conduction of heat to the explosive contents.

As a means of increasing the proof of buildings against fire, a plan first proposed by Sir Samuel Bentham in 1793 is now somewhat widely adopted in London. An example is shown in the workshops at Nine Elms of the London and South-western Railway, in which "cast-iron pipes with small holes in the direction required are laid along the roofs on the inside, and so arranged that each shop or portion supplied with these pipes can be put in connection with the water-supply, and in turning a cock the pressure of the water (from a suitable head) drives it through the tubes and out through the various holes, deluging the whole area." Westminster Abbey has recently been provided in one of its towers with a tank holding 6000 gallons, and connected with a system of pipes and hose, whereby the roof may be flooded at will; the apparatus cost upwards of £2000. It would not be difficult to provide for the automatic turning on of the water by the action of the fire itself; as, for example, by the use of fusible plugs. The mere filling of hollow beams, columns, etc. with water is but a poor precaution, the water being quickly dissipated if any outlet is afforded, and if hermetically enclosed providing exploding steam generators when subjected to great heat. A fireproof monolith has been projected by the inventor of the *béton Coignet*, the water-passages, as well as flues and ventilating shafts, being formed within the plastic mass of cement during the process of construction.

For dwellings in which economy dictates a comparatively slight structure, and to a greater or less extent the use of wood, the Paris system is preferable, provided a plaster or cement equal to the French is used for pugging. This plan is, in brief, as follows: The central idea is to secure the strength of wood on end, and to utilize the resistance of plaster to the direct action of fire. In France oak timber is commonly used, and being comparatively dense adds somewhat to the efficacy of the system, the closer woods being less liable to quick ignition than our hemlock, spruce, and pine. The framing is made in any ordinary manner, but battened with oak battens nailed several inches apart. Rubble, burnt clay, stone chips, or brickbats freshly broken are laid into the space between the two series of vertical battens, and plaster of Paris is then applied to each side, filling up the interstices and leaving smooth cement surfaces. The wood is thus firmly imbedded in stone and plaster, and put practically beyond the reach of fire. The floor-timbers are laid in the usual manner, with battens nailed on their lower sides covering about half the area. Underneath is provided a temporary platform reaching nearly to the battens. Plaster of Paris is then worked in below and around the battens, the platform being allowed to remain until the plaster has set. In this manner the ceiling of the room below is formed. Above, upon the timbers, are laid transverse billets or battens of wood, that receive an upper layer of plaster, which constitutes the floor, either with or without a flooring of boards; which latter in this case forms a mere fixture of the room, and is incapable of communicating fire to parts from which it is separated by thicknesses of concrete or plaster. The inner or partition walls are made in the same manner as the outer ones just described, even when these latter are replaced by bricks. The stairways are of wood, but are placed between walls of brick or in some cases of stone, in others of wood filled in and pugged, and are filled in with solid rubble and plaster, which practically secures immunity in case of fire. JAMES A. WHITNEY.

Fireproof Construction in Italy. Destructive fires sometimes occur in Italy in magazines and other buildings where great quantities of combustible materials are stored, as also in wooden structures in the rare cases in which such are built; but in stone or brick private houses and other buildings the fire is almost always confined within the walls of the house where it originated.

The *old* and substantial dwellings of most Italian towns are built on the following general plan: The *outer* walls are of rubble masonry, and very thick. They are not lined with furring or otherwise, but the plastering is applied directly to the inner surface. In many of the better class of Italian houses a lining, or a thin detached wall—sometimes more than 20 feet high, of brick laid *edgewise*, and only 2 inches thick—is built a couple of inches within the inner surface of the outer wall, to receive the plaster. This inner wall is stiffened and bound with the outer wall by an occasional single brick, and is of course continuously bound with it around the openings. A better method of stiffening and binding would be with short strips of hoop iron, which might also be used advantageously at the corners and exposed places. Such linings are very nearly as dry and as warm as wooden framing. All the *partition* walls, even of small chambers and closets, are of stone or brick, and the door and window casings are of stone. The *staircases* are all wholly of stone (cheap constructions often with *treads* of tiles laid on a segment of a stone arch).

It is obvious that in this mode of construction there is absolutely no combustible connection between story and story, and consequently a fire can communicate from one story to another only by the breaking down of the floor. The following description and measurements, taken from a house of the fourteenth century now in good condition in Florence, will serve as a type of this mode of construction. The *floors* are either vaulted with brick, the crown of the vault, including the tile flooring, resting on it, not exceeding 4″ or 5″ in thickness, even in a room 30 feet square, or they are of timber, boards, tiles, and mortar laid thin. Across the room, at distances of 8 or even 10 feet in the clear, are laid pine or fir timbers of 10″ by 16″, and reaching from wall to wall. On the sides of these timbers, from 4″ to 6″ below the upper surface, are spiked moulded planks, and on these planks are laid joists of 3″ by 4″, or, in the large rooms we speak of, 4″ by 6″ scantling, the upper surface of the joists being flush with that of the timbers. The joists are from 10″ to 12″ apart, and between the ends of each pair strips of board are nailed to the timbers to keep the joists in place; but there is no mortising in the framework of the floor. On the joists is laid a flooring of $1\frac{1}{4}$″ plank, about a foot wide, with a narrow strip of thin stuff nailed along the joists on the under side. On this flooring tiles are laid in mortar, and over the tiles, usually, but not always, a thin coating of stucco. The under side of the flooring is left exposed. Sometimes lathing of strips of wood, rush wickerwork, or wire netting is used to receive plastering, being secured to the under surface of the joists; and very often painted cloth, stretched on a frame secured to the under surface of the joists, is used as a ceiling. It is evidently next to impossible that such a flooring should take fire, or even be set on fire.

So far, the Italian method of building might be employed in the U. S. at a little advance on the cost of our common tinder-box method of construction, and with little or no inconvenience or disadvantage. In ordinary houses the principal partitions of stone or brick are carried up to the roof, and where they occur answer the purpose of principal rafters. In the house above described the wooden principal rafters are of fir-wood, 10″ by 16″ square, and reach from the wall-plate to the ridge-pole, which is a stick 6″ by 10″ square. The principal rafters are from 10 to 14 feet apart. On the principal rafters are laid cross-timbers or joists 6″ by 10″ square, about 4 feet apart; and on these the rafters proper, of 2″ by $3\frac{1}{2}$″, or in some places 3″ by 3″ or 3″ by 4″ scantling, about 11 inches apart in the clear. Spikes or nails are occasionally used to hold the frame of the roof together, but there is no mortising. On these rafters there is no boarding, but instead are laid 1-inch flat tiles 6″ by 13″, and on these pantiles in mortar. Slates might be employed upon a roof of this construction. Such a roof will certainly not take fire from sparks or any ordinary exposure, and it would indeed be a hard matter to set it on fire. The cornice and mouldings ought to be of pressed brick, but even if of wood the roof would not be very much exposed.

In 1874 the Tiratojo, a large thirteenth-century structure in Florence, was burned. Its floors and some of its partitions were of wood. In some of its apartments large quan-

tities of straw, lumber, and other inflammable material were stored, yet though the upper story was an open *loggia*, over which the roof was upheld by pillars, and, though all combustible matter in the structure was burned, the fire did not spread to any of the adjacent buildings, nor did the falling roof crush in the vaults of the lower story. It should be noted that although the fire departments of Italian cities cannot compare for efficiency with those of New York, it is extremely rare in Italy for a fire to pass from a burning building to a contiguous structure, owing to superior modes of construction. It may be observed, too, that the people of Europe are generally much more careful in the use of fire than those of the U. S.

In Central (and even in Northern) Europe tiles are almost exclusively used for roofing, except in rural districts. They are extremely thin (often less than half an inch thick); very hard burnt, or indeed almost vitrified; and they also have a glazing which almost entirely prevents the lodging of snow; and to prevent the driving in of rain under the tiles, as well as to reduce the probability of the piling of snow on the roof, it is common to give the roof a very steep pitch. GEORGE P. MARSH.

Fireproofing. On Mar. 17, 1735, one Obadiah Wyld obtained an English patent for "making or preparing paper, linen, canvas, and such like substances which will neither flame nor retain fire, by mixing alum, borax, vitriol, or copperas dissolved," and dipping the fabrics "into a strong infusion of the said materials in water or thin size made hot." Although nearly a century and a half have passed, no other method of fireproofing has avoided its use of mineral salts; and impregnation with alum, borax, or copperas, as the case may be, is at the present time the best treatment for fireproofing and preserving wood, which thus treated has been strongly urged as the proper material for railway cars subjected to risk of fire from overturned stoves and lamps in cases of collision, etc. Copperas especially seems to be equally efficacious against the quick oxidation of combustion and the slow oxidation of decay; the bodies of miners buried by accident in English mines have been recovered intact after forty years' immersion in the water holding copperas in solution, and the woollen garments of a warrior buried during the Stone Age, the most ancient fabrics known, were preserved in the grave down to a few years since by a like agency. The use for fireproofing of sulphate of ammonia was proposed by De Breza in 1838; that of soluble glass by Bethell in the same year; that of hydrochlorate of ammonia by Froggant in 1851, but this last does not appear to have received serious attention. The use of tungstate of soda and phosphate of ammonia was at a later date found by Dr. Versemann, after a series of the most careful experiments, to be the best adapted for common use with cloths, etc., either of these rendering the lightest muslins uninflammable. The tungstate of soda, however, has this advantage over the other, that it may be used with starch, and does not interfere with ironing. A mixture of this salt with starch is sold in London under the name of fireproof starch.

Alum, borax, sulphate of iron, soluble glass, sulphate of ammonia, phosphate of ammonia, and tungstate of soda are the substances most advocated hitherto for fireproofing by impregnation. In their application the process must be varied with the material treated. Cloth fabrics should be immersed or soaked; wood should have the solution forced through its pores; and with paper the solution should be worked into the pulp during manufacture. The first four are better suited for timber than for fabrics. Soluble glass may be used for surface-impregnation of the same material, but experience has shown it to be a treacherous substance, liable to effloresce; and theoretically, at least, its free alkali tends to the deterioration of any organic substances with which it may be brought into contact. Sulphate of ammonia does not appear to have ever been thoroughly tested; and although a fabric treated with it would perhaps be difficult of ignition, the salt would probably be dissipated by anything approaching a high heat. The phosphate of the same base is efficacious as a fireproof, but leaves the fabric harsh to the touch. The tungstate of soda, therefore, should be used in preference to the others for light articles of apparel, curtains, upholstery, etc.

As combustion depends upon access of air, light woodwork may be measurably protected by fire-resisting paints. These are especially applicable to the shingled roofs of farm-houses, cottages, etc. One of the oldest is composed of 3 parts wood-ashes ground with 1 part of boiled linseed oil, and applied with a brush when fresh. Another is made by mingling lime and ashes with skimmed milk, the casein of the latter serving as the binding substance for the mineral particles. A German recipe for fireproof coating is three successive applications of a hot solution of 3 parts alum and 1 part copperas, and after this of a solution of copperas brought to the consistence of paint by the admixture of pipe-clay. JAMES A. WHITNEY.

Fireproof Safes. The idea of rendering the contents of an iron strong-box secure against fire by lining it with a fire-resisting medium originated with James Conner, a type-founder of New York City, between the years 1829 and 1832. This safe was filled in with plaster of Paris, and was used in the office of the inventor during some years. He, however, does not appear to have fully appreciated the importance of his invention, for the safe was allowed to pass into disuse, and seems to have been nearly or quite forgotten, even by the inventor, until in the year 1843 it was reinvented by one Fitzgerald. The latter, in defending his patent, was met by proof of Conner's previous invention, but the U. S. courts decided that as the former had abandoned his invention without giving a knowledge of it to the public, the latter must in equity and sound public policy be adjudged the legal patentee. From this date the manufacture of fireproof safes received a lasting impetus. Numerous new compounds were devised for filling, the advocates of each claiming for it a marked superiority over all others as a fire-resistant. But, although Conner was the first to make a fireproof safe, William Marr of London was the first to patent and make public a method of construction. This he did in 1834. Marr's invention differed materially from Conner's; the former filling the spaces between the inner and outer shells or casings of the safe with sheets of mica pasted upon paper, and crowding the space between with burnt clay and powdered charcoal, or in lieu of these with powdered marble. The next alleged improvement was that of Charles Chubb, also of London, in 1838, who used a series of concentric linings of iron plates, the intermediate spaces filled with baked wood-ashes, or "such other slow-conducting materials as will retard the transmission of heat." A third improvement was that of Thomas Milner of Liverpool, which in 1840 was set forth by him as consisting in forming "boxes, safes, or other depositories of an outer case of iron, enclosing one, two, or more inner cases, with spaces between them containing an absorbent material, in which are distributed vessels, pipes, or tubes filled with an alkaline solution or any other matter evolving steam or moisture, or otherwise discharging themselves, on the exposure of the box or other depository to heat or fire, into the surrounding absorbent matter; which, thus pervaded with moisture and rendered difficult of destruction, protects the inner cases or boxes and their contents." In 1843 three gentlemen named Tann brought out the method of making safes fireproof by filling the spaces with ground alum, finely sifted, and gypsum, also finely pulverized. The alum and gypsum were intimately mingled, heated to liquefaction, and after cooling to a hard and brittle condition comminuted to a coarse powder for use. This mixture, when subjected to an extreme heat, would give off water from the plaster; but the lack of chemical knowledge on the part of the projectors is plainly indicated by the calcination of the alum before putting the filling in place. In 1855, George Price of Wolverhampton coated the surfaces of metal exposed to the filling with a composition to prevent corrosion from the contact of the same. He used powdered alum and sawdust as a filling. During the previous use of alum it had been discovered that various other salts containing water of crystallization would serve the same purpose in the filling.

The construction of fireproof safes has of late years formed a very important branch of manufacture, and many improvements have been made which in the aggregate have much increased their utility. But the essential features remain the same, so that these fireproof receptacles may still be classified as 1st, those having a filling of some simply non-conducting material, like clay or concrete; 2, those fitted with plaster capable of giving off water by calcination, though only in moderate quantities; 3, those in which alum or other salt yielding a large percentage of water by decomposition is mingled with the plaster; and 4, the steam-safes, in which vessels either of glass or metal and filled with water are arranged between the inner and outer walls to give off steam when subjected to a high heat. The first-named class is of doubtful utility; the second of measurable value under many conditions; the third and fourth are the best as yet devised, although their efficiency in any case depends wholly upon the judgment and care displayed in their manufacture.

Very many inventions relating to fireproof safes have been developed in the U. S. during the past few years, among others as follows: In 1860, the attachment of the plaster filling to plates suspended between the walls, so that in shrinking its diminished size will not permit its falling from its place; also, the use for filling of pure alumina; also, for the same purpose, of sulphate of iron mixed with plaster of Paris. In 1863, the construction of a safe with two air

and steam-tight casings, one within the other, and with the intermediate space filled in with material capable of generating steam under high heat, the latter melting fusible plugs in the outer casing to permit the exit of the steam; also, the use of filling made of plaster of Paris set with a solution of starch; also, a filling formed of a compound of calcined and powdered gypsum and alum in pieces imbedded in the plaster in such relative proportions that the water of crystallization in the alum evolved by heat shall set the plaster (this last is the filling of one of the most noted and efficient safes in the market); also, the furnishing of the filling with cavities to prevent the rupture of the parts from the expansion of moisture by freezing. In 1864, a filling of alum in small lumps rolled in plaster and then bedded in dry clay. In 1865, a filling of epsom salts, either alone or combined with sulphate of lime or plaster of Paris (this also is the filling used in a celebrated and efficient fireproof safe). In 1866, a novel arrangement of vessels containing water between the inner and outer walls to form a steam-safe (this feature is essential to a well-known safe, as that of imbedding water-receptacles in the plaster filling is of another hereinafter mentioned). In 1867, providing about the wooden inner casing a layer of felt surrounded consecutively by a metallic lining, a layer of cement, a water-chamber, a second layer of cement, and the external metallic casing. In 1868 nearly a score of patents for fireproof safes were granted; among others, upon wood imbedded in the plaster filling to enhance its non-conducting power, the introduction of non-conducting material between the plates of the door and door-casings, the use of fine (common) salt as a filling, water-vessels stopped with glue or mucilage inserted in the cement filling, the construction of the set filling with cells for the reception of a vaporizing substance; also several novel forms of steam-safes, in one of which a space external to the water-filling was provided to receive the steam from the filling, and thus provide a non-conducting jacket to the whole. In 1869, the use, external to an alum or similar filling, of cans containing steam or vapor producing substance placed between such filling and the outer casing of the safe; also, the construction of safes with a water-supply from an elevated head. Later modifications of each type of fireproof receptacle have been made, but none appear to merit particular notice in this connection. It must always be remembered that no safe is absolutely fireproof, although several manufacturers make them capable of withstanding an exceedingly high temperature. Wherever possible, a safe should be imbedded in brickwork, which experience has shown to be one of the most effective of all protections against the injurious transmission of heat.

JAMES A. WHITNEY.

Fire-ship, a vessel, often old and unseaworthy, which is laden with combustibles, fired, and sent into the midst of an enemy's ships for the purpose of setting them on fire. This ancient device has been frequently tried in modern warfare; and though sometimes of much service, as in the war of Greek independence, it can never be of much effect when employed against a well-managed steam-marine. This service is moreover fraught with great danger to the aggressive party.

Fireworks. See PYROTECHNY.

Fire-Worshippers. See GUEBRES and PARSEEISM.

Firk'owitsch (ABRAHAM), a Jewish archæologist, was b. at Lutzk, in the Crimea, in 1786. He was the son of Caraite parents, and was reared in the faith of his forefathers. (See CARAITES.) Of a ready mind and eager for learning, he was afforded all the advantages which the Jews of the Crimea had at their command. These were but scanty; most of his knowledge consisted, therefore, of a thorough mastery of the Hebrew of the Old Testament canon and of tradition, acquired mainly at Eupatoria, where he had enjoyed the use of a manuscript library belonging to the Caraite congregation. He became a rabbi, and distinguished himself in his connections at Cherson and Koslov. His study of the MSS. at Eupatoria had instilled in him a love for ancient Jewish authors, particularly Caraites, and a desire to see the study of Hebrew literature and of Caraism revived among his nation. His opportunity to urge the matter successfully came in 1825, when the Caraites of Eupatoria established a printing-press. Firkowitsch finally became the principal guide of the Crimean Caraites not only in the reproduction of ancient MSS., but also in the selection of modern works worth printing. Unsatisfied by the meagre supply in the Crimea, Firkowitsch visited the scattered Caraite communities in Turkey, Syria, Palestine, Persia, and the Caucasus, not shunning any danger or privation, determined to unearth the treasures of the past. He penetrated into the very depths of Asiatic wildernesses, searching wherever he might hope to find a fragment of Caraite antiquity. "He gathered rolls of the Law and other MSS. that for ages were not imagined to exist, having ceased to be legible even to their possessors. Entire books or mutilated MSS. were brought out of hiding-places previously unexplored—some of high antiquity and in excellent preservation; others faded and rotting in tattered fragments. . . . His keen eye discovered and deciphered inscriptions in broken or abraded marbles that the showers or frosts of ages had nearly obliterated." (RULE, *Hist. Karaite Jews*, p. 198.) He dug under cellars, tore up the rotten rafters of old buildings, anywhere, everywhere, in search of his precious MSS. He brought together and deposited in the Imperial Library at St. Petersburg no less than 1500 MSS.—"a collection," says the *Academy* (London, July 25, 1874, p. 105), "which rivals, if it does not surpass, the fine collection of Hebrao-Arabic codices at Oxford." In the decipherment of these MSS., Rabbi Samuel Pinsker assisted and frequently guided Firkowitsch. They are not yet as widely known as they deserve to be. Mr. Neubauer, the Jewish savant of Oxford, and others have drawn attention to the great value of the Firkowitsch fragments of ancient MSS. of the Old Testament, both for the various readings of the Hebrew text and for the Masora. Firkowitsch d. in 1874. (See CARAITES.)

J. H. WORMAN.

Fir'man [Pers. *fermân*, a "command"], in Oriental countries the certificate or written mandate of a sovereign or government. It is especially applied to the passports issued to travellers in Turkish countries.

Fir'micus Mater'nus (JULIUS), a writer on mathematics and astrology, was b. in Sicily, and flourished in the time of Constantine. He followed at first the profession of an advocate. He wrote in Latin a work entitled *Matheseos libri VIII.* (A. D. 354), which treated of astrological subjects, such as nativities, the influence of the stars on human life, etc., more than of mathematics. The work is still extant, and was printed by Aldus (1499). The author was evidently, from several passages of his work, a heathen. If the treatise *De errore profanarum religionum*, which is ascribed to Julius Firmicus Maternus, be by the same author, he must in his later years have become a Christian. But it is more probable that this work is by another writer of the same name, who flourished at the same period, as his book is dedicated to Constantius and Constans, the sons of Constantine. It is a vigorous defence of the Christian religion against the errors of paganism, which he exhorts the emperors to destroy. The best edition is by Münter (Copenhagen, 1826); also, with Minucius Felix, by Oehler (Leipsic, 1847). (See HERTZ, *Dissert. de Julio Firmico Materno*, Copenhagen, 1817.)

H. DRISLER.

Fir'min (GILES), English clergyman and physician in America, b. in Suffolk, England, 1615, came to New England with Rev. John Wilson in 1632. Returning to England, he came again to New England in 1637, and Jan., 1639, was settled at Ipswich, Mass., where he also practised medicine. Went to Europe again in 1644, was settled at Colchester, England, in 1646, and in 1651 at Shalford, whence he was ejected in 1662. His last settlement was at Ridgewell, Essex, England, where he d. in Apr., 1697. *The Real Christian* (1670) was often reprinted in England and America; also wrote theological treatises.

First-born [Heb. בְּכוֹר, בְּכוֹרָה; Gr. πρωτότοκος, LXX. and N. T.; Lat. *primogenitus*, Vulgate]. The first-born son among the Hebrews was the first child of the father and the mother; hence he is spoken of in regard to the father as "the beginning of his strength" (Gen. xlix. 3; Deut. xxi. 17), and in regard to the mother as "the opening of the womb" (Ex. xiii. 2). Before the establishment of the Hebrew theocracy the rights of primogeniture were recognized, but they were sometimes transferred from the eldest to a younger son, as from Esau to Jacob (Gen. xxv. 29–34; xxvii. 18–40), and from Reuben to Joseph (1 Chron. v. 1–3). After the Mosaic economy was established such a transfer was forbidden (Deut. xxi. 15–17). The birthright consisted in a double portion of the inheritance; that is, the eldest son received twice as much of the patrimony as any one of the younger sons (Deut. xxi. 15–17; 1 Chron. v. 1, 2). When Elijah was about to be translated, Elisha said to him, "I pray thee let a double portion of thy spirit be upon me" (2 Kings ii. 9). He meant that, like a first-born son, he might inherit a double portion of Elijah's prophetic prerogatives; not that he should be twice as great a prophet as his master, but, like him, be at the head of "the sons of the prophets"—their superior in office; and so he became. It is nowhere said in the Bible that the birthright embraced the family priesthood and government. As to the family priesthood, nothing specific is recorded. It is likely that the eldest son officiated in place of the father when he was absent, or after his death while the family remained together. To commemorate the destruction of the first-born of the Egyptians, God required that

the first-born males of the Hebrews should be consecrated to him; also the firstlings of their cattle and the first-fruits of their ground. After the Exodus their first-born sons, numbering 22,273, were substituted by 22,000 Levites, and the 273 surplus were redeemed at five shekels a head (Num. iii.). The tribe of Levi thus became the priestly tribe for the nation. But how this affected the family priesthood does not appear. So the right of government naturally inhered in the eldest son in the absence of the father, or in the case of his death while the family remained together. This pre-eminence attached to the eldest son in the royal family, as he succeeded to the throne (2 Chron. xxi. 3), though in special cases this rule was reversed; as, *e. g.*, Solomon, who for theocratic reasons was substituted for his eldest brother (1 Kings i.). The first-born son seems to have had authority over the rest of the family from the earliest times; but this appears to be distinguished from the peculiar birthright prerogative, for Esau says of Jacob, "Is he not rightly named Jacob [a supplanter]? for he hath supplanted me these two times: he took away my birthright, and behold now he hath taken away my blessing" (Gen. xxvii. 37). In the blessing, Isaac said, "Let people serve thee, and nations bow down to thee: be lord over thy brethren, and let thy mother's sons bow down to thee" (Gen. xxvii. 29). So it is said that the birthright was taken from Reuben and given to Joseph: "For Judah prevailed above his brethren, and of him came the chief ruler, but the birthright was Joseph's" (2 Chron. v. 1, 2; cf. Gen. xlix. 8–10; Mic. v. 2; Matt. ii. 6). As the first-born was considered more vigorous than younger children, having been begotten and brought forth before the parents had lost their strength, and first developing into manhood, he was naturally invested with superior prerogatives in the family. This has been the case among almost all people. Hence the destruction of the first-born of Egypt was considered so great a calamity, and hence so much importance was attached to the first-born of man and beast that by the Levitical law they were consecrated to Jehovah. The male first-born of men, being represented by the priestly tribe, were redeemed. When the child was a month old the father paid five shekels of the sanctuary to the priest, and so redeemed him. If the child died before he was a month old, the rabbins say the father was excused from the payment. The firstling of an unclean beast was also redeemed, as not fit to be offered in sacrifice. The firstling of an ass, for instance, was to be redeemed by a lamb, otherwise his neck was to be broken. The firstlings of clean animals were not to be redeemed, but offered in sacrifice (Ex. xiii. 11–15; xxii. 29, 30; Num. viii. 16–18; xviii. 15–17).

The term first-born is used metaphorically for the first, or chief, or pre-eminent; thus (Job xviii. 13), "The first-born of death shall devour his strength"—*i. e.* the most deadly disease shall destroy him. "The first-born of the poor" (Isa. xiv. 30) are the poorest and most wretched. God said of David (Ps. lxxxix. 27), "I will make him my first-born, higher than the kings of the earth," where the second clause explains the first. David, as the royal representative of the theocracy, enjoyed a higher prerogative than any heathen monarch. In the New Testament, *prōtotokos* occurs nine times. Thrice it is used literally (Matt. i. 25; Luke ii. 7; Heb. xi. 28). Christ is "first-born among many brethren" (Rom. viii. 29), as he is "the Son of God" in a peculiar sense—pre-eminent among the sons of God, who are made so through him by adoption and regeneration. He is called "first-born of every creature" (Col. i. 15) or of all creation, as he is "Lord of all," being the Creator of all (cf. Col. i. 16; Heb. i. 1–6). He is called "first-born from the dead" (Col. i. 18) and "first-begotten of the dead" (the same word, Rev. i. 5), because he was the first "raised from the dead to die no more," and so is "become the first-fruits of them that slept" (Rom. vi. 9; 1 Cor. xv. 20). He is called "the first-begotten" (same word, Heb. i. 6), as he was destined to occupy the highest position of honor in the universe (cf. Ps. lxxxix. 27; Phil. ii. 9–11). The righteous are spoken of as "a society of first-borns, registered in heaven" (Heb. xii. 23), because they enjoy the freedom of the city of God, the heavenly Jerusalem; it expresses their pre-eminent dignity and distinguished prerogatives. (Cf. Ex. iv. 22; Jer. xxxi. 9.)

"The English doctrine of primogeniture," says Bouvier, "by which, by the common law, the eldest son and his issue take the whole real estate, has been universally abolished in this country. So, with few exceptions, has been the distinction between male and female heirs." (See Bouvier's *Law Dictionary*, under the words "Descent" and "Primogeniture.") T. O. Summers.

First-Fruits [Heb. רֵאשִׁית; Gr. ἀπαρχαί; Lat. *primitiæ*]. The offering of the first-fruits of the season, with more or less of religious ceremony, is a natural expression of pious gratitude in acknowledgment of the Divine bounty, and was practised by the ancient Egyptians, Greeks, and Romans, as well as by the Hebrews. The form in which it is first expressly commanded by Moses (Ex. xxii. 29) implies a custom already existing. We may trace it back, perhaps, to the very beginning of history (Gen. iv. 3, 4). Under the Mosaic ritual these offerings were of two kinds—the one national, the other individual. The national offerings were in connection with two of the great national festivals; the first, a sheaf of barley at the Passover, when the barley-harvest began; the second, two loaves of bread at Pentecost, when the wheat-harvest ended. These national offerings, which had a solemn representative character, were to be made, of course, at Jerusalem, and ceased with the destruction of the Temple. The rules to be observed are laid down in Lev. xxiii. Still more minute directions are given in the Talmud. Individual offerings were not merely in acknowledgment of dependence upon God, but also for the sustenance of the priesthood, and were to be made throughout the country, as well as at Jerusalem. Specific directions, bringing out the religious significance of the act, are contained in Deut. xxvi. 1–11. Some kinds of offerings were expressly devoted to the priests' use (Num. xviii. 12), as the best of the oil, wine, and wheat, in addition to which mention is also made (Deut. xviii. 4) of the fleece of sheep. Of young trees no fruits could be taken till the fourth year, in which they were offered to the Lord, subsequently to which they might be eaten. Of every kind of produce of the earth, as it ripened, a basketful was to be presented by each Israelite, some in their natural, and others, as wine and oil, in their prepared state. The amount of the gifts of the first-fruits was not specified in the Law, and the field was thus left open for Talmudic casuistry to busy itself in deciding what was proper or obligatory. The gift was not to be taken from the portion designed for tithes, nor from the corners left for the poor. One-fortieth (or, according to the school of Shammai, one-thirtieth) was accounted a liberal proportion of the entire produce, while a moderate portion was a fiftieth, and a scanty portion a sixtieth. But whatever was offered must be the produce of the Holy Land. Beyond Palestine it might be converted into money, and thus sent to the Temple. (See Spencer, *De Legibus Hebræorum Ritualibus*, iii. 9.) R. D. Hitchcock.

Fir-wool, a fibre prepared to some extent in Germany from the leaves of *Pinus sylvestris* (Scotch fir), and made into cloth and wadding, which are believed to be useful in the treatment of rheumatism and skin diseases. Fir-wool oil is an oil of turpentine made from these leaves. Fir-wool extract is a residual substance prepared from the leaves, and used to some extent in medicine.

Fisch (Georges), D. D., a noted French Protestant clergyman who figured prominently at the "Evangelical Alliance" held in New York in 1873, was b. in Switzerland July 6, 1814, and was educated in the academy at Lausanne. After entering the ministry he preached for nearly five years to a German-speaking congregation at Vevay, and then emigrated to France and joined the French Evangelical Church. Became in 1846 the successor of the celebrated Adolphe Monod at Lyons. In 1855 removed to Paris, and is now pastor of the church Taitbout, where he is the colleague of his brother-in-law, Edmond de Pressensé, the most learned French Protestant ecclesiastic. Since 1863, Dr. Fisch has held the presidency of the "Union" seeking the coalition of French Protestants, and is a director of the Evangelical Society of France, a powerful auxiliary to the "Union." James H. Worman.

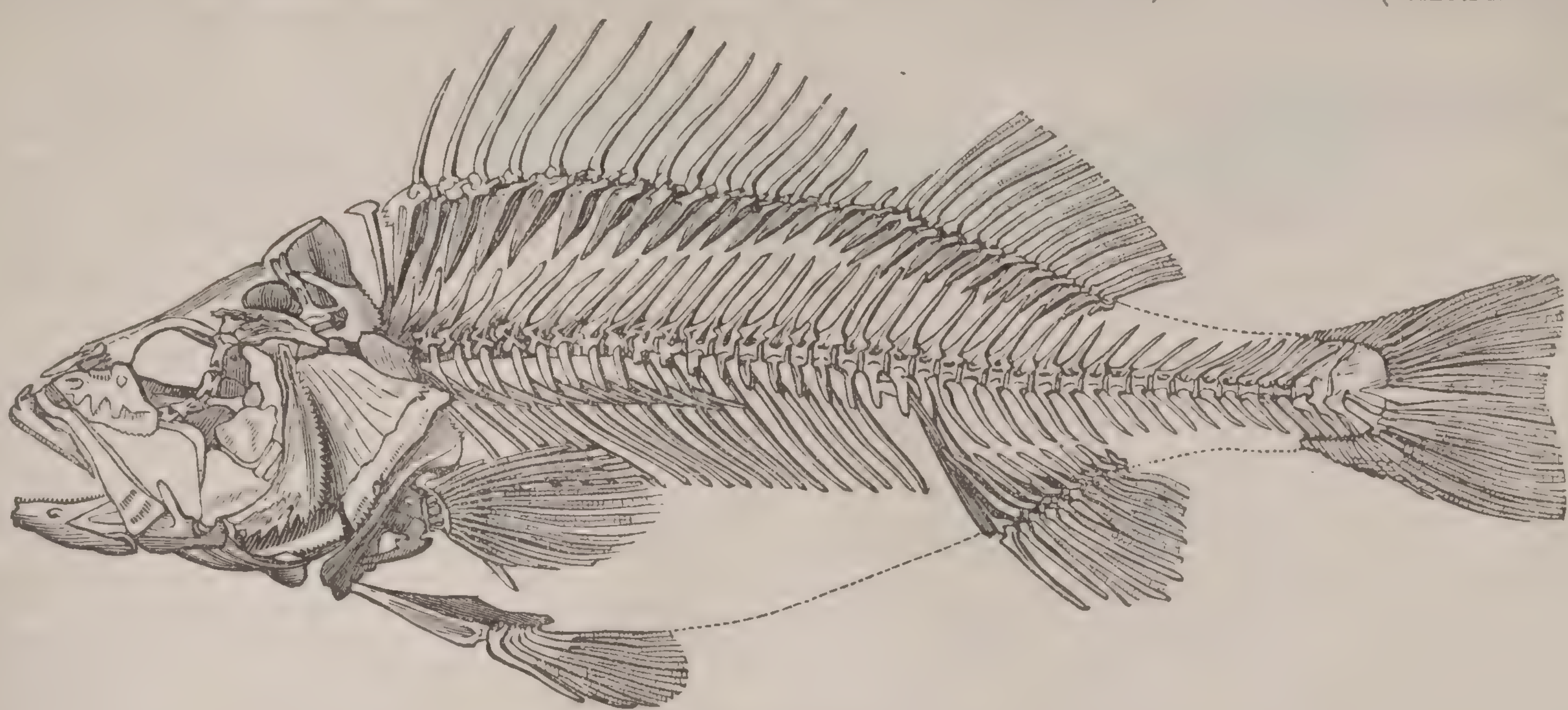
Fisch'art (Johann), surnamed Mentzer, German satirist, b. at Mentz or Strasburg about 1545, wrote in prose and verse, and is highly admired. Published *Glückhafft Schiff* in 1576, and d. in 1614.

Fisch'er (Ernst Kuno Berthold), German philosophical critic and historian, b. at Sandewalde, Silesia, July 23, 1824, studied at Leipsic and Halle, and delivered lectures as a privatdocent at Heidelberg in 1850. Received in 1855 his call as professor of philosophy in the University of Jena. *Diotima, the Idea of the Beautiful* (Pforzheim, 1849), *History of Modern Philosophy* (6 vols., 1852–72), *Apology for My Doctrine* (1854), *Logic and Metaphysics* (1852), *Bacon of Verulam* (1856), and *Die Selbstbekenntnisse Schillers* (1858), are among his works.

Fish [cognate closely with the Ang.-Sax. *fisc*, Ger. *fisch*, Dutch *visch*, Gothic *fisks*, Scandinavian *fisk*, and remotely with the Latin *piscis* and its derivatives]. This name is applied, in a popular sense, to the vertebrated and all other inhabitants of the waters; in a scientific sense, restricted at first to vertebrates dwelling in the waters and inspiring air through its medium by means of branchiæ or gills, and later to a still more limited group. (See Ichthyology.)

General Characters.—Fishes, in the last acceptation of

the term, may be defined as *lyriferous vertebrates, with a skull provided with membrane or dermal bones;* in other words, the shoulder-girdle forms a lyriform or furcula-shaped apparatus, like a bird's wish-bone, the scapular bones and their adjuncts of the two sides being connected below at the median line; an air-bladder (sometimes lung-



Skeleton of the Perch.

like) is, as a rule, developed, and either connects with the œsophagus by a single duct (as in the Ganoids and soft-finned fishes), or is entirely closed (as in the spine-finned fishes); the skull is highly developed, and is provided with membrane bones, or with dermal shields which are homologous with them; the shoulder-girdle is formed, in great part, by large furcula-like bones, which bound the region behind the head, and which, besides meeting at the median line, are generally connected, by means of intervening bones, with the skull; these external scapular bones are also membrane or dermal bones, and are not developed in the Selachians: to the internal surfaces of these bones are attached smaller ones or cartilages (homologous with the shoulder-girdles of sharks), which support the pectoral fins.

The gills and branchial apparatus are contained entirely within the cephalic cavity, in front of the scapular arch, and consist of five arches, the hindmost of which are, however, generally modified into pharyngeal bones; the gills are free at their distal margins. The brain is well developed, and has, generally, approximately equal cerebral and optic lobes and a moderate cerebellum. The heart is also well developed, and in all the forms (except some Dipnoi) is divided into an auricle and a ventricle. The members, anterior or "pectoral," and posterior or "ventral," whenever present, are developed as "fins." In addition to these there are also generally median or unpaired fins sustained by rays (peculiar to lyriferous vertebrates), and of which the dorsal and anal are connected by the intervention of "interspinal" bones with the dorsal and inferior spines (neurapophyses and hæmapophyses) of the vertebral column; these fins are respectively termed "dorsal," "anal," and "caudal." The caudal must by no means be confounded with the "tail" or "flukes" of the whales, which are to a certain extent homologous with the hind limbs.

Such are the characters which are common to all true fishes; that is, the classes Fishes and Ganoids of Agassiz, etc., embracing such forms as the flat-fishes, cod-fishes, perches, mullets, bill-fishes, pikes, herrings, carps, electrical eels, mormyroids, cat-fishes, true eels, ganoids, etc. There is, however, much variation in other respects among these numerous constituents of the class. The skeleton may be bony or cartilaginous; the caudal, ventral, and even pectoral fins present or absent; scales, of very various character, present or absent; the air-bladder, either membranaceous or lung-like, present or absent; and, in fact, every portion of the framework and organization generally is liable to modification of some kind. The character and mode of association of some of these modifications may be best exhibited in connection with the systematic relations of the class.

European Perch.

In the typical fishes, known as TELEOSTS, the skeleton is ossified (whence the name); the optic nerves cross (decussate) each other; the heart has only two opposite valves; the outer elements of the scapular arch (proscapula) are simple, the inner elements mostly ossified, and usually three or two in number; the pectoral member destitute of any representatives of the humerus, and connected with the scapular arch by several (generally four) narrow bones (actinosts).—To this great division belong by far the largest number of species and those most familiar to most persons: they are grouped in a number of orders which have been named PLECTOGNATHS, LOPHOBRANCHIATES, PEDICULATES, HEMIBRANCHIATES, TELOCEPHALS, SCYPHOPHORES, NEMATOGNATHS, APODES, and OPISTHOMES; and to these the reader is referred.

In the remaining fishes, united by most recent naturalists under the name of GANOIDS, the skeleton is variable in its composition; the optic nerves do not cross, but are united by a commissure; the heart has a thickened bulbus arteriosus, provided with several rows of valves (but with those of each row sometimes united into a ridge, as in the Lepidosirenids); the elements of the outer portions of the scapular arch (proscapula) are in some double, in others united; the inner scapular element is cartilaginous and simple; the pectoral member is provided with two basilar elements (bounding the insertion of the pectoral fin on each of its sides), or with a single pedicle corresponding with the humerus.—The fishes combined under this last division, although not now numerous in species, exhibit extreme differences when compared with each other, and have been even considered (and with at least some degree of propriety) as constituting several sub-classes. Commencing with those types which are most nearly related to the typical fishes, the characteristics may be briefly given and contrasted as follows:

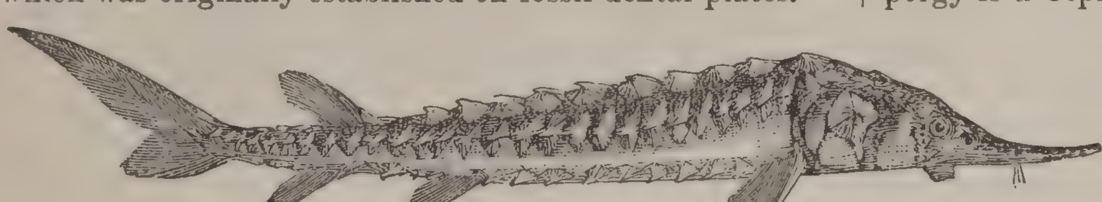
In the first group (HYOGANOIDS) the skeleton is ossified; the skull also exhibits well-ossified bones; supramaxillary and intermaxillary bones are well developed; the nasal apertures are both external; preopercular and interopercular bones are present; the hyoid apparatus is well developed; the ceratohyals sustain a number of branchiostegal rays; the pectoral fin has two external cartilaginous basilar elements entirely separated from each other; and the air-bladder connects with the œsophagus by a duct which enters it from above.—This group contains the orders CYCLOGANOIDS (represented in the U. S. by the bowfins or Amiids) and RHOMBOGANOIDS (represented by the alligator-gars or Lepidosteids).

In the second group (BRACHIOGANOIDS) the skeleton is also in great part ossified, but the centra or bodies of the vertebræ may be either osseous, or (in extinct types) represented by a persistent notochord; the skull is provided with well-ossified but superficial bones; supramaxillary and intermaxillary bones are distinguishable; the nasal apertures are external; preopercular and interopercular bones are both wanting; the hyoid apparatus is defective in the branchiostegal rays; the pectoral member is connected with and interposed at its base between two bones converging and uniting at their base with a cartilage representing a humerus; the air-bladder is highly cellular, and connects by its duct with

the floor of the œsophagus.—The group is represented in the present age of the earth by a single order (CROSSOPTERYGIANS) with two genera (*Polypterus* and *Calamoichthys*), but was in ancient times rich in species.

The Lepidosiren Paradoxa.

In the third group (DIPNOANS) the skeleton is in part ossified and in part cartilaginous, and the bodies of the vertebræ, instead of being ossified, are represented by a simple notochord; the skull is in great degree cartilaginous, but is also encased with superficial and thin membrane bones; no supramaxillary or intermaxillary bones are distinguishable; the posterior nasal apertures are internal, *i. e.* in the mouth; no preopercula or interopercula are developed; the hyoid apparatus is more or less defective, especially in branchiostegal rays; the pectoral member is connected by a pedicle (homologous in part, at least, with the humerus) to the intrascapular (coracoid) cartilage; the air-bladder is replaced by a true lung, which is more or less divided into two, and which is connected with the œsophagus by a duct or rudimentary trachea, which enters it from beneath.—This type is represented at present by three very distinct genera—viz. *Lepidosiren* in South America, *Protopterus* in Africa, and *Ceratodus* (so called) in Australia. Formerly, the members of the group were among the principal representatives of the class, and in the triassic period of Europe the *Ceratodus* of Australia was represented by several typical species of that genus, which was originally established on fossil dental plates.



The Common Sturgeon.

In the last group (CHONDROGANOIDS) the skeleton is almost entirely cartilaginous (and from this circumstance the group has been named); this is the case especially with the vertebral column and its appendages; the skull is also cartilaginous, but is covered by dermal bones; no supramaxillary or intermaxillary bones are differentiated; the nasal apertures are external; both the preopercular and interopercular elements are wanting; the hyoid apparatus, as in the last types, is defective in branchiostegal rays; the pectoral member, as in the Hyoganoids, has external cartilaginous basilar elements entirely distinct; and the air-bladder connects with the œsophagus by a duct which enters from above.—To this group belong the sturgeons (constituting the order CHONDROSTEI) and the "shovelnoses" or "paddle-fishes" of North America and Eastern Asia (constituting the order SELACHOSTOMI).

While the four groups just enumerated are the only great primary types of ganoid fishes that have members in the waters of the present epoch of the earth, in ancient times there were some very strange and peculiar forms which are not referable to any of those divisions, but which appear to stand isolated and afar from all others, and thus necessitate still another primary group. The types alluded to flourished among the first-known fishes, and in the Silurian and Devonian epochs. So strange are some of these in their appearance that remains of them have been referred to the Crustaceans. Such are the forms which have been called Cephalaspidæ. Others ("Placoganoidea") are almost equally aberrant in appearance, and their relations would not be suspected from their external characters; but the dental armature and scapular arches of a species discovered by Prof. Newberry in Ohio have convinced the writer that they were closely allied to the order Sirenoidei, and with them formed the super-order Dipnoi. The vomerine and palatine dental plates were contiguous, and seem to be homologous with the palatine plates of the Sirenoidei.

Limitations of Characters.—The student of the fishes, more than of any other class of vertebrates, must dissipate all prejudices with regard to the value of form in determining the relations of members of the class. Forms as diverse, almost, as any among all the quadruped mammals or among all the birds are found combined in the same natural family among fishes, and on the other hand we have forms that are very similar associated with structural characteristics that are very dissimilar. The student must also dismiss prejudices respecting the constancy of members (fins in fishes) in weighing their systematic relations. The members, for example, may vary in the same family, and ventral fins may be present or absent in closely-related genera; scales are also by no means invariably characteristic of fishes, for they likewise may be present in one genus and absent in another in other respects very closely related. But although the presence or absence, *per se*, of parts may be comparatively immaterial, their structure, when present, is all important. The pectoral and ventral members, for example, are always constructed on the same *general* plan, and contrast markedly with those of the higher vertebrates. The character and mode of development of the scales, too, though not so distinctive as the fins, are *sui generis* in fishes.

Geographical Distribution.—About 9000 species of living fishes are now known, variously distributed and found in greater or less numbers in almost all the waters of the globe, fresh and salt; the greatest numbers of species, however, are found in the tropical waters, and especially in the seas of the Indo-Molluccan Archipelago. The distribution of the types, especially of the marine species, to a considerable degree coincides with thermometrical conditions. In the polar and northern temperate regions, for example, are found representatives of the families of Gadoids or codfishes, Lycodoids, Stichæoids, Liparidoids, Cottoids or sculpins, and others less known; in the tropical regions many forms are distributed throughout the entire zone (and therefore designated as tropicopolitan), this being especially the case with many genera of Labroids (of which our tautog is a northern type), Scaroids or parrot-fishes, Pomacentroids, Gerroids, Serranoids or groupers, Sparoids (of which our porgy is a representative), Carangoids or horse-mackerel, and others; numerous species of these families being found in torrid waters, while very few extend far northward or southward. In the antarctic regions, again, we have another combination of forms; typical cod-fishes and the other types characteristic of high northern latitudes are wanting, but are replaced by several peculiar groups, which seem to fill an analogous place in the economy of nature, having a superficial resemblance in general aspect, although they are not at all (comparatively speaking) related in structure. The Gadoids, for example, are replaced by Notothenioids, the Lycodoids by peculiar genera, the Cottoids by Harpagiferoids, etc. In the contrast between these antarctic and the arctic forms we have evidence of the absence of any paramount causal relation between temperature and structure; and it is necessary to remark here that, in addition to the "tropicopolitan" types, each great region has a number of characteristic and peculiar types.

But the distribution of the inhabitants of the great open seas and those of the inland waters are determined by different conditions, as might *a priori* be supposed. While, for example, the inhabitants of the opposite sides of converging continents are, to a great extent, similar, the freshwater species of those continents are mostly quite dissimilar, and especially so as we progress southward.

There are numerous families of fishes which are represented in the fresh waters, some exclusively so; others with marine species. The geographical limitation and relation in space of these families may be exhibited under combinations in several categories—viz.:

(1) Peculiar to North America: Sciænidæ (Haploidonotinæ), Centrarchidæ, Aphredoderidæ, Amblyopsidæ, Percopsidæ, Hyodontidæ, and Amiidæ.

(2) Peculiar to tropical Asia: Platypteridæ, Helostomidæ, Osphromenidæ, Nandidæ, Luciocephalidæ, Ophiocephalidæ, Notopteridæ, Salangidæ, Homalopteridæ, and Sisoridæ.

(3) Peculiar to Africa: Kneriidæ, Mormyridæ, Gymnarchidæ, and Polypteridæ.

(4) Peculiar to tropical America: Centropomidæ, Polycentridæ, Sternopygidæ, Electrophoridæ, Hypophthalmidæ, Trichomycteridæ, Callichthyidæ, Argiidæ, Loricariidæ, and Aspredinidæ.

(5) Peculiar to Australia: Gadopsidæ, Ceratodontidæ.

(6) Peculiar and common to the cis-tropical hemisphere —that is, Northern America, Europe, and Northern Asia: Gadidæ (Lotinæ), Cottidæ (Uranideæ), Percidæ (Percinæ), Gasterosteidæ (Gasterosteinæ), Esocidæ, Umbridæ, Catastomidæ (America and Eastern Asia), Salmonidæ, Acipenseridæ, and Polyodontidæ (America and Eastern Asia).

(7) Peculiar and common to Europe and Asia: Cobitidæ.

(8) Peculiar and common to South America and Australasia: Percophididæ, Haplochitonidæ, Galaxiidæ, and Osteoglossidæ.

(9) Peculiar and common to tropical and sub-tropical America and Africa: Cichlidæ, Characinidæ, and Lepidosirenidæ.

In addition to these, the family Cyprinidæ is represented in the entire cis-tropical or "arctogæan" hemisphere as well as in tropical Africa and Asia; and there are several monotypic families limited to very small regions, such as the Comepharidæ, the single species of which is only known from Lake Baikal. There are, further, a number of families (in addition to several already mentioned) which are chiefly represented by marine species, but which have also a greater or less number of representatives in fresh water in different regions of the earth: such are the Brotulidæ, Blenniidæ, Gobiidæ, Atherinidæ, Mugilidæ, Cyprinodontidæ, Microstomidæ, Clupeidæ, Dorosomidæ, etc.

Others, again, were represented in former epochs in parts of the world where they are not now found, and especially to be noted among these are two families at present characteristic in their distribution; the first of these is the Cobitidæ, which, in the early tertiary, were inhabitants of Western America, and which thus increased the similarity of the fauna of our (cis-tropical) continent with that of Northern Asia; the second is the Ceratodontidæ, a family whose representatives have been long known from fossil teeth found in palæozoic and mesozoic deposits (and which were referred by Prof. Agassiz to the sharks), and had been supposed to have expired toward the end of the triassic epoch; yet recently (since 1870) two species, closely allied to those found in the triassic beds of Europe, have been discovered *living* in Australia; and thus another ancient type has been preserved in that continent to illustrate the past life of our own hemisphere.

If we now seek to apply the knowledge thus gained to the appreciation of the different fish-faunas of the globe, we are forced to the following conclusions:

Inasmuch as the cis-tropical hemisphere shares in common the same families, and to a considerable extent the same genera, and even some species, it is presumable that the different regions of that hemisphere have derived their inhabitants from a common primitive source, although North America has quite a large proportion of forms peculiar to it. The relations of those peculiar forms, however, are in all cases rather with some found in the northern hemisphere (fresh water or marine) than with any found elsewhere; but, at the same time, towards the south-western limits of our country occur representatives of families which are characteristic of tropical America.

Tropical Asia also nourishes a number of peculiar forms, but the relations of those are either intimate with cis-tropical ones or with marine types.

Africa likewise has Cyprinoids and Anabantids in common with tropical Asia, and Cyprinoids in common with the cis-tropical hemisphere, but it also supports several very peculiar families for whose relations we have to seek in other continents.

In tropical America are to be found the nearest relations of some of those African types, and several almost or quite limited to those two continents; on the other hand, in South America are found several families having no analogues in the parts of the world yet mentioned, but for which we have to turn our eyes to Australasia; and there we find representatives of not only the same families, but even, it has been contended, one of the same species. Under these circumstances we are almost compelled to believe that the first fauna of South America was derived, at a distant epoch, to some extent, from a common source with that of Africa and that of Australia. We have, however, at first sight, contrary indications, but they are not irreconcilable: the most conspicuous and, as it were, obtrusive types of South American fishes are analogues of African forms, members of the families Cichlidæ and Characinidæ, but the species belong to widely different genera. On the other hand, although the types common to South America and Australia are not conspicuous in numbers or importance, they are much more nearly related to corresponding Australian species than the former, and, in common with other facts, somewhat tend to verify Huxley's views respecting an "Austro-Columbian" fauna.

In fine, dividing the earth into regions distinguished by general ichthyological peculiarities, several primary combinations may be recognized—viz. (1) an *Arctogæan*, embracing Europe, Northern Asia, and Northern America; (2) an *Asiatic*, embracing the tropical portions of the continent; (3) an *African*, limited to the region S. and E. of the Desert; (4) an *American*, embracing the America *par excellence* dedicated to Amerigo Vespucci, and including the tropical and trans-tropical portions; and (5) an *Australasian*. Further, of these (*a*) the first two have intimate relations to each other, and (*b*) the last three others among themselves; and some weighty arguments might be adduced to support a division of the faunas of the globe into two primary regions coinciding with the two combinations alluded to—(*a*) PLIOGÆA, and (*b*) EOGÆA.

Chronological History.—No representatives of the class of fishes have been found in the lowest fossiliferous rocks, and it is only when we reach the uppermost Silurian or lower Devonian that we find evidences of their existence in fossil bones or teeth. The most ancient known fishes belonged to types entirely distinct from any that are in existence at the present time. As already mentioned in the remarks on the primary groups of fishes, the Placoganoids, first of known fishes, heralded the advent of the class, and these were the predominant species apparently in the Devonian epoch; from somewhat later formations have been obtained the remains of representatives of orders still existing, but in very small numbers; such were especially the Dipnoans, which were then represented by numerous genera and species; coeval with these were various Selachians or sharks. Almost all of the true fishes existing during the mesozoic epoch have been referred to the great group of Ganoids, but it is probable that some have been erroneously identified, and that they belonged to the sub-class of Teleosts. No universally recognized species of that group, however, have been found in deposits lower than the cretaceous; in that epoch they began to culminate, and in time became the greatly prominent forms; and in the present epoch almost all the species (excluding the Selachians) belong to this great group; and, so far as numbers go, all of the living Ganoids might disappear, and yet the loss would scarcely be apparent in the sum-total of the class. Of about 9000 existing species of fishes or Teleostomes, less than 100 do not belong to the Teleosts, and that number alone represents the various primary groups of the ganoid fishes, and yet, great as is the number of the Teleostomes, and small as is that of the Ganoids, the latter exhibit much greater differences in contrast with each other than do all the Teleosts among themselves. Such is the character of the difference between the animals of the present and the distant past periods of the earth's history; and it is fortunate for the fulness of our knowledge of that history that, although with few lineal heirs left, most of the ancient types are still represented by some examples of their organization. THEODORE GILL.

Fish (HAMILTON), LL.D., b. in New York City Aug. 3, 1808, a son of Nicholas Fish; educated at Columbia College in his native city; graduated in 1828, was admitted to the bar in New York in 1830; was in 1837 chosen to the State legislature; then served in Congress in 1843–45; was lieutenant-governor of New York 1847–49; governor of New York 1849–51; and from 1851 to 1857 was one of its U. S. Senators. Was in 1862 one of the U. S. commissioners to visit soldiers confined in Confederate prisons, and rendered valuable service in negotiating for the exchange of prisoners. In 1869 was appointed secretary of state in the cabinet of President Grant, his term of office commencing in March. Mr. Fish suggested the Joint High Commission between the U. S. and Great Britain which met in 1871 to settle the various difficulties between the two nations, including the famous Alabama claims. In 1872 he became president of the order of the Cincinnati.

Fish (HAMILTON, JR.), b. in Albany, N. Y., Apr. 17, 1849; graduated at Columbia College 1869; was private secretary to his father 1869–70; in 1873 graduated at the Columbia College Law School, and was elected to the New York Assembly; was colonel, and aide-de-camp to Gov. Dix. He is a lawyer in New York City, and resides at Garrison's, Putnam co., N. Y.

Fish (HENRY CLAY), D. D., American Baptist clergyman, b. at Halifax, Vt., Jan. 27, 1820, graduated at Union Theological Seminary, N. Y., in 1845. From 1845 to 1850 was pastor of the Baptist church at Somerville, N. J., and since then of the First Baptist church at Newark, N. J. Has contributed largely to the extension of Baptist churches and to the interests, educational and missionary, of New Jersey. *Primitive Piety Revived, History and Repository of Pulpit Eloquence* (3 vols.), *Select Discourses from the French and German, The Price of Soul-Liberty, and Who Paid it,* are among his works.

Fish (NICHOLAS), b. in New York Aug. 28, 1758, entered the College of New Jersey at Princeton, N. J., at the age of sixteen, but left, and commenced the study of law with John Morin Scott, with whom he served in 1776 as aide-de-camp, and subsequently as major of brigade; Nov. 21 major of the Second New York regiment, and at the close of the war was a lieutenant-colonel. Col. Fish was in both battles of Saratoga, commanded a corps of light infantry at the battle of Monmouth, served in Sullivan's expedition against the Indians in 1779, was with the light infantry

under La Fayette in 1780, and in 1781 was active with his regiment in the operations which resulted in the surrender of Cornwallis at Yorktown, Va. He was adjutant-general of the State in Apr., 1786, and thereafter for many years. He was revenue supervisor under Washington in 1794, and a New York alderman from 1806 to 1817; president of the New York Society of the Cincinnati in 1797. D. at New York June 20, 1833.

Fish (NICHOLAS), A. M., LL.B., b. in New York City Feb. 17, 1846; graduated at Columbia College in 1867, and at Harvard College Law School in 1869; became assistant secretary of U. S. legation at Berlin July 1, 1871, and in July, 1874, was appointed secretary of the same legation.

Fish'burn (WILLIAM), American major-general, b. in 1760, was on the staff of Gen. Anthony Wayne at the capture of Stony Point, N. Y.; was in the convention which framed the State constitution of South Carolina; then a member of the State legislature, and d. at Walterborough, S. C., Nov. 3, 1819.

Fish Creek, tp. of Humboldt co., Nev., in Fish Creek Valley, which has 4000 acres of arable land. Pop. 11.

Fish-Culture. The propagation of fish has for many centuries been practised by various nations to a greater or less extent, but in recent times it has received an immense impulse from the discovery of a method of artificial impregnation of the ova. As is well known, the egg in oviparous animals generally is impregnated within the body of the creature; and this rule was supposed to hold in regard to fishes as with the rest. It was found, however, with fishes that the eggs are impregnated after leaving the parent, and it was also found—and this was what gave the discovery its practical importance—that fish-eggs could be impregnated and hatched artificially by man with vastly better results than were produced when the fish were left to themselves. This discovery has already raised fish-culture from a position of no importance to one of great practical consideration.

The main fact upon which the economical importance of modern fish-culture rests is that by artificial means, fish, one of the great staples of human subsistence, can be indefinitely increased in quantity with a very slight corresponding increase of cost; and this fact in turn rests on the following considerations: (1) The possible yearly increase of fish is very great, the ratio of increase varying from 100 to 1 in a yearling trout to perhaps 1,000,000 to 1 in a full-grown sturgeon. (2) This increase, which is nearly all lost in nature, can be almost entirely saved at a comparatively insignificant expense by artificial impregnation and hatching. (3) The food which the fish get their growth on in the water after they are hatched is not a source of expense to man. It is obvious that under these conditions fish can be multiplied to a vast extent at a trifling cost, and that consequently the culture of so important a staple for food must be one of great value.

The culture of shad in the U. S. furnishes an illustration of this. At an expense of a few hundred dollars shad were artificially hatched and returned to the Connecticut River in 1867 by Seth Green, one of the pioneers of American fish-culture. In three years, the time required for shad to mature, these fish had become more abundant in the river than they were before the white man began to fish them out. (See *Connecticut Fisheries Report*, 1871.) The increase was enormous, and the fish having obtained their food in the ocean, their growth had cost nothing. Thousands of tons of shad were added to the produce of the Connecticut River that year, and we think it is safe to say that the investment of stocking the river artificially in 1868 returned an increase of a thousand-fold.

The experiment was repeated the next year in the same river, and also extended to other rivers; and since then shad artificially impregnated and hatched have been transported in great numbers to the Mississippi, the Sacramento, and various other rivers of the U. S. and their tributaries, which were destitute of shad; and from the U. S. they will be carried to other countries, making the ultimate benefit to the world of the artificial culture of shad almost incalculable, and showing how great the importance of the universal culture of fish must be when the results of the culture of one variety are so stupendous.

The honor of the discovery of the artificial impregnation of the eggs, on which the achievements of modern fish-culture rest, is generally conceded to a lieutenant (afterwards major) of the Prussian army named G. L. Jacobi of Hollenhausen, whose experiments were published in the *Hanover Magazine* in 1763. Four hundred years before that, however, a Roman Catholic monk of the abbey of Réome, named Dom Pinchon, hatched some fish-eggs by an artificial process; but the account is not clear as to whether they were impregnated naturally or artificially. The publication of Jacobi's successful experiments attracted considerable attention for a time, but led to no important practical results, and the art seems to have remained forgotten for nearly a hundred years, when it was rediscovered and again practised by Joseph Rémy, a fisherman of the Vosges Mountains between Alsace and Lorraine; and it is to Joseph Rémy that the discovery of the artificial impregnation of fish-eggs, as far as it has led to permanent results, must be attributed. Rémy's discoveries soon came into public notice, chiefly through the agency of M. Coste, professor of biology in the College of France, and eventually led to the establishment of the extensive fish-breeding works at Hüningen in 1851, formerly the property of the French government, but now in possession of the German emperor. This was the first practical effort at fish-culture on a large scale that was based on the artificial impregnation of the eggs. Since then the practice of the art has spread over Europe and America, and there is now hardly a civilized country which has not one or more fish-breeding establishments, public or private.

The principle of the artificial impregnation is substantially the same with all the varieties of fish that have been experimented with. It consists in mixing the eggs of the female fish with the milt of the male in some convenient receptacle immediately after the eggs and milt leave the fish. The fecundation of the eggs being a merely mechanical process, this artificial mixing impregnates them better than if the fish had mixed the eggs and milt themselves. The subsequent treatment of the eggs after impregnation is quite various with different kinds of fishes; and in order to fully illustrate these differences we will give a brief description of the treatment of the eggs of the salmon (*Salmo salar*), the shad (*Alosa præstabilis*), the glass-eyed pike (*Lucioperca*), and the yellow perch (*Perca flavescens*). These are representative fish, the salmon representing the class of fish depositing their eggs separate like shot, and spawning in cold water; the shad representing the fish which have similar eggs, but spawn in warm water; the glass-eyed pike representing the fishes whose eggs come separate from the fish like shot, but which stick inseparably together upon entering the water; and the yellow perch representing the fish which deposit their eggs united in a gelatinous mass, resembling frog-spawn.

(1) In taking salmon eggs the parent fish are usually confined in some enclosure where they can be conveniently caught, and a female with ripe eggs having been found, the eggs are stripped from the fish into a dry pan or pail. As soon as they are taken the milt of the male is also stripped into the same pan. The eggs and milt are then thoroughly mixed by stirring, and left to stand two or three minutes. Sufficient water is then poured into the pan to stand to the depth of one or two inches over the eggs. They will now stick together for some time, and must be left quiet till they separate of themselves, which is in half an hour, more or less, cold water requiring more time than warmer water. After the eggs are separated they are thoroughly washed from the superfluous milt, and when perfectly clean are placed in the hatching apparatus. This apparatus consists of a box, trough, or any wholesome vessel, through which a steam of pure cold water is conveyed which is free from fungus and sediment, and protected from living enemies. They are then left here till they hatch.

The time that it takes salmon eggs to hatch depends wholly on the temperature of the water. If the water stands at 45°, as at the Cold Spring Trout-Ponds at Charlestown, N. H., it will take 70 days; if at 50°, 50 days; if at 55°, as at the U. S. salmon-breeding station at the head-waters of the Sacramento River, it will take 35 days. After the young salmon are hatched they are usually kept in confinement and artificially reared for a time before being placed in the natural waters intended for their final destination. They are retained in this way sometimes three or six months, and sometimes a year; at the expiration of which time they are turned loose and their artificial life is at an end. The same general treatment of the eggs is usually adopted with brook-trout, salmon-trout, char, graylings, white-fish, and other Salmonidæ.

(2) *Shad* (*Alosa præstabilis*).—In operating with shad the eggs are generally taken from the parent fish as they are drawn up in the seine, this fish being too delicate to be caught and kept alive in confinement. Shad eggs are usually taken in water instead of in a dry pan, the eggs impregnating as well in water as without, while with Salmonidæ eggs, unnatural as it seems, the presence of water is unfavorable to impregnation. The eggs after being taken are treated at first in the same way that salmon eggs are, but after they are washed they are placed in a box with a wire-netting bottom, which is so anchored in the river from which the parent shad are taken that there is a constant circulation around the eggs. The water always being warm in shad rivers at the spawning season, these eggs hatch in

a few days. Unlike the salmon, the young shad are not kept any great length of time in confinement, but are soon turned loose into the river, or if intended for transportation are moved as soon as possible after being hatched.

(3) *Glass-eyed Pike* (*Lucioperca*).—The eggs of the glass-eyed pike are taken on plates of glass or something similar, care being taken to deposit only one layer on each plate. This care is necessitated by the fact that the eggs, being coated with a very adhesive film, will, if piled together, stick so closely that the interior layers, being wholly excluded from the air and water, will suffocate and die. The eggs which have been taken on the glass adhere to it very strongly, and may be placed in any favorable spot under running water where they will be protected against sediment, fungus, and living enemies. As but little is now known about the habits and requirements of the very young fish, it is thought the best way after hatching them is to place them as soon as possible in the waters which they are intended to stock. A favorable temperature for hatching *Lucioperca* eggs is 50° F., and a number of these eggs experimented with by the writer in 1873 were one month hatching in water averaging 47° F.

(4) *Yellow Perch* (*Perca flavescens*).—The eggs of the yellow perch, which come out in gelatinous folds, are the easiest to hatch of all fish-eggs. It is only necessary to impregnate them in the usual way, and to keep them in moderately clean safe water having a slight circulation. A temperature of from 50° to 60° is favorable for them, and they hatch in this temperature in two or three weeks.

The methods by which modern fish-culture is now practised may be reduced to four, as follows:

(1) The fish are operated upon at their own river, and when the eggs are hatched the young fry are replaced in the river for the purpose of increasing the stock. This is the way in which fish-culture has been practised with salmon in the Tay, Galway, and other rivers in Great Britain; in the Connecticut, Hudson, and other rivers in the U. S. with shad, and in trout-brooks in various places with brook-trout.

(2) The young fish when hatched, or in some cases the eggs when sufficiently matured, are transported from the place of their nativity to other waters which it is thought desirable to stock with them. This is the case with the German (formerly French) imperial fish-breeding establishment at Hüningen, with the U. S. government establishments at the head-waters of the Sacramento and on the Penobscot, and in part with the shad-hatching works of various rivers of the U. S.

(3) The fish are bred and raised at private establishments, which are supported by the sale of the spawn, young fry, and mature fish to parties who wish to stock other waters, and also in the case of the full-grown fish for the purpose of the table. This is true of the Troutdale Fishery at Keswick, Cumberland, in England, and of the various trout-breeding establishments of the U. S.

(4) Fish of different varieties, naturally bred, are caught and transported alive to waters which are destitute of these varieties. This is the way in which hundreds of ponds and lakes in New York and New England have been stocked with black bass, salmon-trout, glass-eyed pike, and various other fish. It was in this way also that the attempt was made to stock the waters of California with Eastern varieties of fish by means of the California aquarium car, which was wrecked at the Elkhorn River in Nebraska.

It is mainly by the above methods that fish-culture is practised in modern times. Actual operations in fish-culture at the present time are quite extensive, especially in the U. S. Besides the large fish-breeding works at Hüningen and others similar, both public and private, in the European states, there are in the U. S. several hundred places where trout-breeding is carried on. In most of the Northern and Middle States, and in some others, there are duly-appointed fish commissions, for which annual appropriations are made, and through whose instrumentality great results have been already accomplished in the increasing of shad, black bass, and other varieties of fish, and greater undertakings are still contemplated. The U. S. government also is doing a great deal in the way of distributing shad and salmon over the country, and has a large salmon-breeding station in California and another in Maine. By means of all these agencies trout, salmon, shad, salmon-trout, black bass, and all the other finer varieties of fish have been, or will soon be, introduced into the principal waters of the U. S.

Fish-culture is without doubt destined to be one of the great practical arts of the present civilization. Vast as were the resources of the land before they had been reached by agriculture, they did not surpass the vast unreached resources of the sea; and when aquæculture, even in its earliest infancy, has attained the point of perfection which centuries of study and practice have given agriculture, the sea will yield a harvest of marvellous magnitude; for the fish, large and small, which swarm in the waters of the earth have a life-producing capacity which lies hardly within the reach of figures to compute, and certainly not within the power of the mind to measure. For instance, a single spawning-ground of the herring contains, without doubt, a hundred thousand million eggs. Even this number the mind cannot grasp, yet this is an insignificant fraction of the whole amount of fish-eggs in the sea, a mere dot in the waste of waters, or as the leaves of a single tree compared with the boundless universal flora of the earth. These vast life-producing powers of the sea are now just where the productive powers of the land were before agriculture, with its skill and inventions, made them fruitful. But how wonderfully the art of agriculture has multiplied and remultiplied the productiveness of the land! A no less brilliant future awaits the art of aquæculture. It is only making its first infant efforts now, but we think it is safe to prophesy that it will stand side by side in magnitude and utility with its sister art of agriculture.

The following brief account of what has been done at the Cold Spring Trout-Ponds may serve as a specimen of the average work accomplished at the larger trout-breeding locations of this country. This establishment, at Charlestown, N. H., was the first of the kind in New England, and began business in 1866, when 15,000 trout were hatched. In 1867, 100,000 trout eggs and 40,000 salmon eggs were laid down in the hatching-troughs. In 1868 a black-bass branch was added to the establishment, which yielded 100,000 young fry, and salmon-breeding works were erected in New Brunswick, as another branch of the same place, which yielded 450,000 salmon eggs. In the same year 200,000 trout eggs were hatched at Charlestown. In 1869, 175,000 trout eggs were hatched at the same place. In 1870, 250,000 trout eggs were laid down; one of the largest hotels in Boston was supplied with large trout through the summer, and several consignments of large trout were sent to Fulton Market. In 1871, 300,000 trout eggs were laid down, and an order for eggs was received from Europe. In 1872 the proprietor went to California, and the business of the Cold Spring Trout-Ponds was considerably contracted, and only 100,000 trout eggs were hatched. In 1873, 200,000 trout eggs were hatched, also 50,000 California salmon eggs, and 160,000 Penobscot salmon for the State of Vermont. Large orders were received during the last two or three years from England and California.

(Among the American works on fish-culture are NORRIS, *American Fish-Culture*, 1868; *Trout-Culture*, by SETH GREEN, 1870; *Fish-Culture*, J. H. KLIPPART, 1873; *Domesticated Trout*, 1873; and various State, U. S., and Canadian reports, etc.) LIVINGSTON STONE.

Fish'dam, post-tp. of Union co., S. C. Pop. 1120.

Fish'er, the largest of the martens, is the *Mustela Pennantii*, a carnivorous quadruped of the family Mustelidæ, found in Canada and the U. S., arboreal in its habits, and receiving its name, as it is said, from its fondness for fish; which, however, it probably does not capture, but which it often steals from the traps of fur-collectors, who use fish as a bait for the pine-marten. The fisher is not often trapped, being very skilful in escaping this fate. It is some three feet long, inclusive of the tail. In color it is chiefly black, often with gray or brown tints towards the head. It is a fierce nocturnal animal, living chiefly upon birds and small quadrupeds. Its fur in winter is good, and is used chiefly in Europe. The black tail was once a favorite ornament to the caps of the Polish Jews, and brought a high price; but this fashion has gone by.

Fisher, tp. of Fremont co., Ia. Pop. 748.

Fisher (ALEXANDER METCALF), b. in Franklin, Mass., in 1794, graduated at Yale College, New Haven, Conn., 1813; was tutor there in 1815, and then professor of mathematics and natural philosophy in that college from 1817 until his death, Apr. 22, 1822, by shipwreck on the coast of Ireland. Wrote upon his special topics in *Silliman's Journal*.

Fisher (ALVAN), an American painter of landscapes and portraits, b. in Needham, Mass., Aug. 9, 1792; studied under Penniman, an ornamental painter. His native talent overcame the more serious disadvantages of so cramped an education. In 1824 he took his position as an artist; in 1825 visited Europe and pursued his studies in Paris; returned to Boston, and d. at Dedham, Mass., Feb. 14, 1863. Was a pleasing painter, without remarkable force or brilliancy. His portrait of Dr. Spurzheim, taken immediately after his death and finished from recollection (1832), was admired. O. B. FROTHINGHAM.

Fisher (HON. CHARLES), D. C. L., b. in York co., New Brunswick, graduated at King's College, N. B.; studied law, was admitted to the bar, and elected to the provincial Parliament in 1837. In 1848–57 was a member of the

executive council; in 1852 a commissioner to codify the provincial statutes; from Oct., 1854, to May, 1856, was attorney-general, again in 1856–61, and again Apr., 1866. Always advocated the union of all the provinces of British America, and in 1857 was a member of the conference of the representatives of British North America in London, by which the terms of the union were arranged. Is (1874) a judge of the supreme court of New Brunswick.

Fisher (Ebenezer), D. D., American Universalist clergyman, b. in Charlotte, Me., Feb. 6, 1815. Has been president of the theological department of St. Lawrence University, Canton, N. Y., since Apr. 15, 1858.

Fisher (Elwood), American editor and statistical writer, b. Oct. 1, 1808; though of Quaker descent, for years defended American slavery and advocated the secession of the Southern States. *The Southern Press*, established by him in 1850 at Washington, D. C., had this avowed object. D. at Atlanta, Ga., Oct. 1, 1862.

Fisher (George Jackson), M. D., b. Nov. 27, 1825, in Westchester co., N. Y.; graduated in medicine at the medical department of the New York University Mar. 1, 1849; physician and surgeon of the male and female departments of the New York State prisons at Sing-Sing in 1853–54; president of the village of Sing-Sing 1856; fellow of the New York Academy of Medicine 1857; permanent member of the Medical Society of the State of New York 1857; president of the Medical Society of Westchester co., N. Y., 1857–58; permanent member of the American Medical Association 1858; honorary degree of A. M. from Madison University 1859; corresponding member of New York Lyceum of Natural History 1860; corresponding member of New York Historical Society 1862; vice-president Medical Society of the State of New York 1864; corresponding member of the Gynæcological Society of Boston 1869; resigned (after 20 years' service) surgeon Seventh brigade N. G. S. N. Y. 1873; president of Medical Society State of New York 1874. Author of *Biographical Sketches of Deceased Physicians of Westchester co., N. Y.*, 1861; *On Animal Substances employed as Medicines by the Ancients*, 1862; *Diploteratology, an Essay on Compound Human Monsters*, pp. 200, 33 lithographic plates of 126 figures, 1865–68; *On the Influence of Maternal Mental Emotion in the Production of Monsters*, pp. 55, 1870.

Fisher (George P.), b. in Milford, Kent co., Del., Oct. 13, 1817; graduated at Dickinson College, Pa., in 1838; was admitted to the bar in 1841. In 1843–44 was in the Delaware house of representatives; in 1846 was secretary of state for Delaware; in 1850 was appointed a commissioner by President Taylor to settle claims against Brazil; from 1855 to 1860 was attorney-general of Delaware and a representative in Congress 1861–63. President Lincoln appointed him to a judgeship in the supreme court of the District of Columbia. In 1874 he was appointed district attorney of the District of Columbia.

Fisher (George Park), D. D., was b. in Wrentham, Mass., Aug. 10, 1827; graduated at Brown University in 1847, and studied theology at New Haven (1848–49), at Andover, where he graduated in 1851, and in Germany. Became professor of divinity in Yale College in 1854, and in 1861 was transferred to the chair of ecclesiastical history. The degree of D. D. was conferred on him by his alma mater in 1866. Has published *Essays on the Supernatural Origin of Christianity* (1865), *Life of Benjamin Silliman* (1866), *History of the Reformation* (1873), and numerous articles in the *Bibliotheca Sacra*, *North American Review*, *British Quarterly*, and *New Englander*. Since 1866 has been one of the editors of the *New Englander*. His writings are marked by learning, acuteness, solidity, and breadth of vision. R. D. Hitchcock.

Fisher (John), bishop of Rochester, b. at Beverley, Yorkshire, 1459, took his M. A. at Cambridge University in 1491; in 1501 became chancellor of the university, and in 1504 bishop of Rochester. In 1505 was master of Queen's College, Cambridge, and on Shrove Sunday, 1527, burned Tyndale's Bibles at Paul's Cross; besides this, in opposition to the Lutheran doctrines, he wrote several treatises. In 1530 he opposed the divorce of Henry VIII. from Catharine of Aragon, was imprisoned in the Tower of London in 1534, and, receiving the cardinal's hat from Pope Paul III. May, 1535, was convicted for denying the royal supremacy on June 11, and executed at London June 22, 1535.

Fisher (John Charlton), LL.D., journalist, d. Sept., 1849, on the Sarah Sands steamer from England. Founded and edited the *New York Albion*, went to Quebec in 1823, and conducted *The Official Gazette*, then the *Quebec Mercury*, and in 1841 *The Conservative*, a weekly. Was president of the Quebec Literary and Historical Society.

Fisher (John Dix), M. D., American instructor of the blind, b. in 1799; graduated at Brown University in 1820, assisted in the organization and management of the Perkins' Institution for the Blind at Boston, Mass.; was visiting physician to the Massachusetts General Hospital. He wrote *Description of the Small-pox, Varioloid*, etc. (1834). D. Mar. 3, 1850.

Fisher (Jonathan), American clergyman, b. at New Braintree, Mass., Oct. 17, 1768; graduated at Harvard University 1792, was licensed to preach Oct. 1, 1793, and was minister at Blue Hill, Me., from July 3, 1796, to his death, Sept. 22, 1847. Was a thorough Calvinist, an able linguist, and compiled a Hebrew dictionary.

Fisher (Joshua), M. D., American physician, b. at Dedham, Mass., May, 1749; graduated at Harvard University 1766; was surgeon in a private armed ship in 1775, was captured and escaped to France, but returning to America settled in practice at Beverly, Mass. Bequeathed $20,000 to Harvard University to establish a professorship of natural history, was president of the Massachusetts Medical Society, and published a *Discourse on Narcotics* (1806). D. at Beverly, Mass., Mar. 21, 1833.

Fisher (Redwood), American statistician, b. at Philadelphia, Pa., 1783; was a merchant there, then edited a daily paper in New York, and published several volumes on political economy, dying at Philadelphia May 17, 1856.

Fisher (Thomas), American poet and scientist, b. in Philadelphia, Pa., Jan. 21, 1801; was a merchant and active member of the Academy of Natural Sciences; and published *Dial of the Seasons* (1835), *Song of the Sea-shells* (1850), *Mathematics Simplified and made Attractive* (1853), etc. D. in Philadelphia Feb. 12, 1856.

Fisher (William Mark), American painter, b. at Boston, Mass., Dec. 15, 1841; studied with George Innis, then in 1864 and 1867 at Paris, and has painted many *genre* pictures, as also landscapes and cattle-pieces.

Fish'eries. The right to catch fish on the high seas, on banks in the same, on the coasts, or in the bays and rivers of lands not pertaining to the jurisdiction of any organized state, is open to all; but by international law, as the sea for a marine league is under the jurisdiction of the sovereign of the adjoining land, no one can lawfully fish there without liberty expressly given or conceded by law or treaty. Much less has any one a right to dry and cure fish on the soil belonging to any organized state without permission.

In the treaty of 1783, by which Great Britain acknowledged the independence of the American colonies, their right to take fish on the Bank of Newfoundland was admitted, as well as in the Gulf of St. Lawrence and at all other places of the sea where they had been wont to fish in earlier times. *Liberty* also was conceded to them to take fish without drying or curing them on parts of the coast of Newfoundland used by British fishermen, and "on the coasts, bays, and creeks" of all other British dominions in America; and also to take, cure, and dry fish in any of the unsettled bays, harbors, and creeks of Nova Scotia, Magdalen Islands, and Labrador, so long as they should remain unsettled, but to dry and cure fish after the settlement of such coast, etc. "only with the consent of the inhabitants, proprietors, or possessors of the ground."

The treaty of Ghent (1815), terminating the war of 1812–15, said nothing of the right of fisheries. Our government claimed that the old treaty of 1783 survived the war, and the British government denied such a claim, on the general principle that war dissolves ordinary provisions of treaties. In 1818 a convention made at London conceded to fishermen from the U. S. the right to take fish on the south-western and western coasts of Newfoundland within certain limits, on the shores of the Magdalen Islands, and on those of Labrador from Mount Joly eastward and northward. The liberty of drying and of curing fish was confined to the southern coasts of Newfoundland and the coast of Labrador, as defined in the treaty, so long as they should continue unsettled, but afterwards only with the consent of proprietors, as before. These grants were expressly made perpetual, and therefore suspended only, but not terminated, by war. On the other hand, the U. S. renounced for ever the right to take, cure, or dry fish within three marine miles of any coasts of the British dominions not named in the treaty. Liberty to enter bays or harbors thus excepted from the right of fishing was granted for purposes of shelter, repairing damages, and obtaining wood and water.

In 1854 a new treaty relating to the fisheries on the eastern coasts was negotiated, which went by the name of the Reciprocity Treaty, and considerably enlarged the liberties conceded to fishermen from the U. S. The rights created by the old treaty remained untouched and unenlarged; this treaty granted the additional right of taking fish, except shell-fish, of every kind on the sea-coasts and shores

and in the bays, harbors, and creeks of Canada, New Brunswick, Nova Scotia, Prince Edward's Island, and of the islands thereto adjacent, and the permission of landing to dry their nets and cure fish on all these coasts, as well as on those of the Magdalen Islands; provided it be done without interference with private property. From the permissions given by this treaty those of catching salmon and shad and of fishing in the mouths of rivers were excepted. On the other hand, similar liberties were given to British fishermen to fish along the shores of the U. S. as far S. as the 36th degree of latitude, with similar permission to dry and cure, and with the reservation of fisheries similar to those already mentioned. Other rights, such as the free navigation of Lake Michigan by both parties, and that of using the St. Lawrence within British territory, were provided for.

This treaty, terminable after ten years on twelve months' notice, was actually terminated by the action of the U. S. Mar. 17, 1866, in pursuance of notice given a year before. Consequently, the treaty of 1818 alone regulated the fisheries on British American eastern coasts, and many irritating exercises of power and claims that the Americans had surpassed their rights occurred on the part of the authorities of the British dominions. Five years passed away before the treaty of Washington of 1871 put the fisheries on a new basis. In this treaty most of the particulars which enter into the intercourse of border states were considered, and form a system in which the advantages were intended to be equal. The fisheries were again placed substantially, as far as rights of fishing, curing, and drying were concerned, on the basis of the reciprocity treaty of 1854; only, the southern limit of British rights of fishing, etc. along the coasts of the U. S. was moved northward to the 39th parallel. A new and important feature of the treaty was that of article 21, the admission of fish-oil and fish (except fish of inland waters and fish preserved in oil) into the territories of the U. S. from those of the Dominion of Canada and of Prince Edward's Island, being the produce of their fisheries, and *vice versâ*, free of duty. Another provision of the treaty arose from the claim on the British American side that the concessions were of more value to the U. S. than to themselves. In order to determine this, article 23 provides for the appointment of commissioners to meet at Halifax and determine what gross sum, if any, ought to be paid to the British government as a compensation for the excess of advantages conceded to the U. S. Such commissioners have been appointed, but have not yet met (1874). This part of the treaty of Washington is by article 33 terminable after ten years, and after one year's notice.

T. D. Woolsey.

Fisheries. Under this designation are embraced all that relates to the capture of fishes on a large scale, the mode of curing and preparing them, and the economical and statistical information relating to them. Involving, etymologically, the consideration of fishes in the original or popular significance of that term, it is still used in connection with the pursuit of all the animals of economic importance formerly (and still popularly) confounded under the name of "fishes;" it hence relates not only to the true fishes, but also to the cetacean and even pinniped mammals and invertebrates which are the object of a regular industry; it is, however, unless qualified, to be understood to refer to the fishes and the cetaceans.

The fisheries may be considered with reference to the objects of pursuit, the places and modes of capture, and the numbers and value of the captures. We have only space to consider (1) the subjects of capture, and (2) statistics respecting them so far as the U. S. are concerned.

Leaving out of consideration, for the present, "whale fisheries" and "seal fisheries," the fisheries *par excellence* will be treated of and may be considered under the heads of sea fisheries, in-shore fisheries, and lake fisheries.

Sea Fisheries.—Those whose objects of pursuit are found in the high seas, and which may engage together the industry of several nations on common or neutral grounds, may be designated sea fisheries. The subjects of these are chiefly arctopolitan species—that is, those which are generally distributed in the colder regions of the northern hemisphere—and are severally, in the order of their importance, the cod-fish, the mackerel, and the herring. These are all too well known to be described here, but information respecting them may be found under their several names in the alphabet. It is only necessary to add here information in brief respecting their economical relations and mode of capture.

The cod-fish far outranks all others in its commercial value and in the numbers taken. Besides forming the objects of capture on fitting coasts between the 40th and 60th degrees of latitude, it is found in immense numbers on the great Banks of Newfoundland, a table-land in the sea about 300 miles long by about 180 in width; thither vessels of the English, Americans, and French resort; there the fish is taken in great numbers, on favorable occasions the men being incessantly employed in pulling in the lines, which are scarcely thrown in baited before they are pulled out with fishes attached, so that a single man occasionally takes 300 to 400 a day. From the nature of their habitat, as well as on account of the facility with which they take the hook, the fishery for them is almost entirely restricted to line-fishing, the baits used being various, but by preference capelin, herring, and squids. Some are sold fresh (but form a very small proportion of the total); most, after their heads are cut off, are split and flattened out, salted, and dried on flakes; their tongues are also separately preserved; the liver forms an important contribution to medicine in the form of cod-liver oil for consumptives; the air-bladder yields a valuable glue; and the intestines even are in some countries used as a bait, especially for the sardine fishery. It has been the object of a well-known fishery since at least as early as the fourteenth century.

The mackerel is a species which periodically approaches the coasts in the northern seas in immense schools. One of the visitations is made in the spring of the year by larger fishes, and another in the fall or early winter by smaller ones. On their first approach they are comparatively poor, but soon become fat. They are caught with line, and also with deep nets with meshes just large enough to prevent them from passing through; the night is in many places regarded as being the most favorable time for fishing; the baits used are various, almost any, and even the bare hook, being often eagerly seized upon. For curing they are split along the middle of the belly to the head, and, with their heads retained, salted or pickled.

Both the cod and mackerel (in common with allied species) deposit eggs whose specific gravity is so light that they ascend to the surface and there undergo development.

The herring, like the mackerel, is a deep-water fish which visits the coasts periodically for the purpose of finding spawning-grounds. It associates in immense schools, of which the females are said to exceed the males in the proportion of more than three to one. The principal season for its capture is the spring; it is caught in deep nets whose meshes are just sufficient to restrain from passing through ordinary sized fishes, and thus somewhat smaller than those used for mackerel. They are chiefly cured by being smoked, a process introduced, it is said, by a native of Holland named Buckolz, in the fifteenth century.

The eggs of the herring are deposited on the ground, and there become matured and hatched.

In-shore Fisheries.—The in-shore fisheries by which the various markets of the country are supplied with fresh fish are very extensive, employing many thousand men, and the objects of capture are quite numerous. Between 80 and 100 species may be seen at one season or another every year in the markets of the city of New York, but in this number are included a few lake and river fishes, as well as the off-shore and in-shore species; comparatively a small number of these, however, are of great economical importance, and chief of these are the shad (*Alosa sapidissima*), river herring (*Pomolobus mediocris*), alewife (*Pomolobus pseudoharengus*), porgy (*Stenotomus argyrops*), rock-fish or striped bass (*Roccus lineatus*), and bluefish (*Pomatomus saltatrix*). These fishes are chiefly caught in pound-nets, and a considerable supply is also obtained by the hook and line, as well as by seines and (in the case of the anadromous clupeids) by gill-nets and fykes. There has been for some time, and still is, a growing tendency to the concentration of the industry on the coasts in the hands of small capitalists, who erect and own pounds, sometimes in considerable number, at different points along the shore.

Another industry of recent origin and of rapidly increasing importance is the appropriation of the menhaden or mossbunker for preservation in oil as sardines. Although inferior to the true sardine, it appears to be favorably received by a large community, inasmuch as there are, especially in the State of New Jersey, several large factories devoted to the curing of the fish in this way. Their bones are softened for this purpose by exposure to steam. Until within late years the menhaden had been used almost solely as manure or for conversion into oil and guano. An extensive industry of this kind is also carried on in Norway.

Lake Fisheries.—Extensive fisheries are also carried on in the great lakes between the U. S. and Canada. The objects of capture are of course fresh-water species, and the most important are two Salmonines: (1) the salmon, or Mackinaw trout (*Salmo namaycush*), and (2) the siscowet (*Salmo siscowet*); two Coregonines: (1) the white-fish (*Coregonus albus*) and (2) the lake-herring (*Argyrosomus clupeiformis*); and the lake-sturgeon (*Acipenser rubicundus*).

The salmon or Mackinaw trout reaches an average weight of about 5 pounds, although it frequently attains a weight

of 15 pounds or more, exceptionally reaching even about 100 pounds. Except in the spawning season, it is found in comparatively deep waters of the lakes, a depth of over thirty fathoms being the most favorable for finding them, although some, in winter, are caught in comparatively shallow bays, through holes cut in the ice. They are taken almost exclusively in gill-nets, but are, however, easily taken by the hook, as they are extremely ravenous, and will bite at almost any bait. Their chief food in the depths which they affect is a peculiar species of herring-like white-fish or cisco (*Argyrosomus Hoyii*) peculiar to such depths.

The siscowet is a smaller fish than the preceding, only averaging about 4½ pounds, and one of 8 pounds weight is unusually large. It inhabits, except during the breeding season, the deep waters of Lake Superior, rarely going upward beyond the horizon of forty fathoms below the surface. It is caught with gill-nets. Its food appears to consist in large part of a peculiar Cottid or sculpin (*Triglopsis Thompsonii*) found in the same waters.

The white-fish varies in size with the locality, at some places averaging 1½ pounds, and at other places as much as 4 pounds or even more, and exceptionally it is said to reach the weight of 22 pounds. It frequents the moderately deep waters of the lakes, but also approaches the shoal waters, and is caught in pounds as well as gill-nets and seines. Its food consists of minute crustaceans and mollusks. It will very rarely take bait.

The lake-herring (which has no relation to the sea or river herrings) averages in weight about 9 or 10 ounces, frequents shoal waters, and is caught chiefly in pound-nets. It is very destructive to spawn, and especially that of the white-fish, feeding upon it by preference.

The sturgeon is the largest of the lake fishes, averaging little less than 5 feet in length and about 50 pounds in weight. It frequents the shoal waters of the lakes and their bays, and is generally caught in pound-nets. Its food is chiefly the various kinds of mollusks (but especially the thin-shelled ones) occurring in the stations which it frequents.

On the Pacific coast of the U. S. are numerous peculiar species. Among the most prominent of these are the species called rock-fishes (Scorpænidæ) and the so-called perches, under which name is confounded a number of viviparous fishes (Embiotocidæ). Other esteemed species are the turbot (*Platichthys stellatus*) and several species of flat-fishes, confounded under the name of sole; the so-called sea-bass (*Atractoscion nobilis*), which belongs to the family Sciænidæ, and the so-called sheepshead (*Pimelometopon pulcher*), belonging to the same family as the Eastern tautog or black-fish. There are also several species of smelts, representing the families Atherinidæ and Microstomidæ, and the cod of the San Francisco market (*Ophiodon elongatus*), which is in nowise related to our own codfishes, but belongs to a peculiar family (Chiridæ). The true codfish is not found in the Californian waters.

Statistics.—The statistics of American fisheries have been collected in a very unsatisfactory manner, and represent quite inadequately the facts respecting the different branches of industry and their relations *inter se*. This has been appreciated by none more clearly than by the superintendent of the late census (Gen. Francis Walker) and the present chief of the bureau of statistics (Hon. Edward Young); to the latter gentleman we are under great obligations for manuscript transcripts of tabulated statistics relating to our fisheries from the archives of his bureau; and from these we have selected the most significant for present publication. Reliable statistics respecting our lake fisheries have not yet been published, but with the consent of the U. S. commissioner of fisheries (Prof. S. F. Baird) we have been favored by the deputy commissioner (Mr. J. W. Milner) with statistics collected by him for publication in the forthcoming report of the commissioner; and the selection from them herewith published will give at least some idea of an industry which has grown into importance within a comparatively few years, and concerning which very little is exactly known even to the few specially interested in the subject.

Statistics of Product and Consumption of Fisheries in various countries, in order of values.

Countries.	Value of Product.	Annual Consumption.	Per capita.
Norway	$13,625,415	$1,000,000	$0.60
France	12,807.113	9.845,786	26
United States	8,898,196	8,777,955	25
Great Britain	7,803,870	9,429,431	32
Russia	5,745,000	8,659,568	11
Newfoundland	5,600,000	244,893	2.00
Nova Scotia	3,476.462	374,770	1.12
Holland	3,100,000	3,105,620	83
Italy	3,048,000	5,426,976	24
Spain	3,000,000	5,496,825	35
Japan	2,500,000	2,362,635	07
Austria	1,750,000	2,813,303	08
Siam	1,600,000	1,177,708	10
Canada	1,225,000	1,096,770	41
Denmark	1,109,000	1,027,991	38
German Zollverein	1,000,000	5,500,056	15
Sweden	1,000,000	3,126,449	76
Portugal	800,000	1,695,693	43
New Brunswick	500,000	192,570	76
Belgium	450,000	1,359,099	27
Prince Edward's Island	400,000	100,085	1.24
Greece	250,000	325,000	30
Total	$79,688,264	73,159,183	

Statement of Vessels of the U. S. Enrolled and Licensed in the Cod and Mackerel Fisheries during the fiscal years from June 30, 1854, to June 30, 1874, inclusive.

Fiscal Years 1854 to 1874, inclusive.	Cod Fisheries.	Mackerel Fisheries.	Total.
	Tons.	Tons.	Tons.
1854	111,928	35,041	146,969
1855	111,915	21,625	133,540
1856	102,452	29,887	132,339
1857	111,868	28,328	140,196
1858	119,252	29,594	148,846
1859	129,637	27,070	156,707
1860	136,653	26,111	162,764
1861	137,666	54,795	192,461
1862	123.601	80,596	204,197
1863	117,290	51,019	168,309
1864	103,742	55,499	159,241
1865	65,185	41,209	106,394
1866	51,642	46,589	98,231
1867	44,567	31,498	76,065
1868	83,887	....	83,887
1869	62,704	....	62,704
1870	91,460	....	91,460
1871	92,865	....	92,865
1872	97,547	....	97,547
1873	109,518	....	109,518
1874	78,290	....	78,290

Subsequent to the year 1867 the cod and mackerel fisheries are combined under the head "Cod Fisheries."

Domestic Exports of Fish from U. S. from 1854 to 1874, inclusive.

Years.	Dried or Smoked.		Pickled.			Preserved in oil.	Fresh.	Other cured.
	cwt.	dols.	barrels.	kegs.	dols.	dols.	dols.	dols.
1854	131,316	389,973	25,209	3,673	162,187			
1855	119,926	379,892	16,988	1,505	94.111			
1856	168,971	578,011	30,801	4,065	173,939			
1857	174,765	570,348	35,759	2,313	211,383			
1858	161,269	487,007	30,470	3,375	197,441			
1859	209,350	642,901	34,948	3.307	203,760			
1860	219,628	690,088	33.815	2,433	191,634			
1861	219 324	634,941	48,352	2,662	244.028			
1862	250,819	712,584	65,575	8,538	330,685			
1863	228,234	921,131	74,793	3,750	429.316			
1864	192,505	967,918	73,756	12,190	508,568	29,543		
1865	157,532	1,107,955	55.790	8,670	632,690	....	13,890	
1866	139,693	734,427	33,394	7,288	360,074	....	192,198	
1867	109,114	596,586	22,044	4,372	217,494	....	189,281	
1868	129,074	598,137	24,162	6,967	209,461	....	184,774	
1869	88,415	398,825	24,228	......	213.455	....	65,348	
1870	111,672	579,334	30.935	......	253.211	....	69,131	344,117
1871	119,618	592,598	29,653	......	226,369	....	39,983	440,412
1872	126,613	588,194	30,642	......	209.077	....	67,832	635,533
1873	118.076	569,151	16,747	......	109.201	....	64,577	677.171
1874	129,982	612,589	29,000	......	226.041	....	56,974	1,128,208

Imports of Fish from Canada and other British North American Provinces (free of duty), other than under the Reciprocity Treaty, for the half year to June 30, 1855, and the fiscal years ending June 30, 1856–66.

Years.	Dried or Smoked.		Pickled.		All other (in barrels).		All other (not in barrels).	
	bbls.	dols.	bbls.	dols.	bbls.	dols.	pounds.	dols.
½ year 1855	....	....	1,038	5,582	....	....	256,892	6,211
1856	240,585	1,336,268	....	....	....	....	19,569,744	548,788
1857	226,064	1,162,933	....	....	....	....	13,289,717	470,416
1858	935,096	1,172,916	....	....	....	....	10,448,069	341,855
1859	278,774	1,328,969	....	....	....	....	15,244,423	422,505
1860	301,917	1,389,852	....	....	....	....	8,847,099	313,491
1861	202,876	945,603	....	....	....	....	13,577,887	415,201
1862	183,462	684,358	....	....	....	....	4,728,875	137,337
1863	131,132	483,631	....	....	....	....	4,872,954	144,305
1864	7,533	6,054	152,327	781,090	51,233	50,467	6,141,306	234,126
1865	9,789	18,787	241,412	1,510,257	45,691	71,782	3,914,007	197,932
fr. July 1, 1865, to Mar. 17, 1865, exp. of treaty.	....	28,784	....	1,527,352	....	28,062	....	326,715

Imports of Fish from Canada and British North American Provinces from Mar. 17, 1866, to June 30, 1874.

Years, 1866 to 1874.	Mackerel, $2 per bbl.		Herring, $1 per bbl.		Salmon, $3 per bbl.		All other in bbls., $1.50 per bbl.		All not in bbls. sold by weight, 50 cts. per 100 lbs.		Fresh and cured, not of Am. fish.	Others not elsewhere specified.	Total Duty.
	bbls.	dols.	bbls.	dols.	bbls.	dols.	bbls.	dols.	pounds.	dols.	dols.	dols.	dols.
1866	5,310	48,117	2,070	5,489	488	1,975	16,392	29,697	1,051,190	26,388	....	....	43,997.95
1867	77,503	675,986	97,595	321,404	6,216	125,323	24,629	152,688	6,505,942	197,686	....	....	308,192.57
1868	41,655	354,429	54,301	181,850	6,513	90,090	14,188	64,912	7,788,017	230,204	est. duty	....	216,372.00
1869	......	....	......	....	......	....	......	....	....	....	1,117,757	....	257,084.00
1870	......	....	......	....	......	....	......	....	....	....	1,169,407	....	268,964.00
1871	......	....	......	....	......	....	......	....	....	....	1,201,175	....	276,270.00
1872	77,731	438,410	64,200	225,144	......	....	......	....	....	....	....	355,761	240,493.00
1873	89,698	605,778	53,039	179,377	......	....	......	....	....	....	278,687	‡278,687	
1874	89,693	*802,460	63,931	†229,522	......	....	......	....	....	....	850,537	§48,939	

Statistics of the Number of Pounds of Lake Fishes received by First Handlers for the year 1872.

Place.	Hard fish.	Mixed fish.	Soft fish.	Lake-herring.	Sturgeon.	Salt fish.
Rochester, N. Y.	11,725	78,000				
Buffalo, N. Y......................	1,471,028	....	656,530	....	....	3,008,000
Erie, Pa.	193,446					
Conneaut, O.	187,498					
Ashtabula, O.	27,820					
Cleveland, O.......................	1,016,843	....	54,460	98,207	....	1,750,000
Sandusky, O.......................	1,646,315	394,405	501,046	1,560,249	720,500	
Put-in-Bay, O.....................	85,000	....	12,000	146,600		
Huron, O............................	197,891	....	76,663	913,252		
Toledo, O...........................	1,263,095	....	883,505	1,080,400		
Detroit, Mich......................	2,346,100	....	160,880	21,000	....	1,800,000
Mackinaw, Mich.................	471,468	....	25,000	135,240		
Green Bay, Wis.	....	662,000				
Milwaukee, Wis.	....	....	....	....	....	852,300
Chicago, Ill.........................	4,712,198	18,800	17,784	167,673	25,147	2,519,500
In the hulls of vessels frozen in on Lake Superior..........................	....	....	....	....	....	270,000
Total.	13,630,427	1,153,205	2,387,808	4,122,621	745,647	10,199,800

The two ports handling the largest amounts of fish are Chicago and Buffalo, as shown in the following table:

Place.	Hard fish.	Mixed fish.	Soft fish.	Lake-herring.	Sturgeon.	Salt fish.	Total.	Value.
Buffalo, N. Y.....	2,428,750	....	937,350	....	....	3,008,000	6,374,100	$333,625.08
Chicago, Ill.......	4,712,198	18,800	17,784	167,673	25,147	2,519,500	7,461,104	414,717.50

The fishes in the preceding tables are classified according to the system adopted at Sandusky, Toledo, and Cleveland. Under this system the marketable fishes are divisible into several classes: (1) "hard fish," including the wall-eyed pike or pickerel (*Stizostedion Americanum*), the black-bass (*Micropterus nigricans*), the Oswego bass (*Micropterus salmoides*), the lake-pike (*Esox lucius*), the muskellunge (*Esox nobilior*), the salmon-trout (*Salmo namaycush*), the white-fish (*Coregonus albus*), and the skinned cat-fishes, selling for the highest prices in the market; (2) "soft fish," under which are comprised the sauger (*Stizostedion griseum*), the white-bass (*Roccus chrysops*), the suckers (*Catostomus teres, Catostomus aureolus*, and *Catostomus melanops*), and the carp (*Carpiodes cyprinus*); (3) "mixed fish" includes both kinds; and several species are kept independent of these categories. All quantities exchanged between the places named, after being recorded for their original market, are deducted from the receipts of the subsequent one, and hence arises the difference in the several tables for Buffalo. The figures opposite Sandusky include both the fresh and salt fish; those for Mackinaw, Green Bay, and Milwaukee are incomplete. The sum-total of this record is 32,239,508 pounds of fish, and their value was about $1,600,000. The manufacture of caviare from the roe of the lake sturgeon is an accessory industry of importance recently introduced into the U. S.

With the figures in these tables may be compared those for 1873 of the Canadian province of Ontario. The Canadian cabinet has a minister of fisheries and marine, and the statistics in the Dominion are collected much more systematically and thoroughly than in the U. S.; and those here given will afford some idea of the relative proportions of the several species taken in the lakes. The orthography of the names is that used in the official reports.

Kinds, Quantities, and Prices (in coin) of Fish.

	Barrels.	Pounds.	Number.	Value. Fresh.	Value. Pickled.	Total value.
White-fish...	16,453			$		$
"	......	1,430,514				
"	......	......	43,586			
Trout..........	9,188					
Herring.......	7,348					
Sciscox.........	288					
Maskinonge.	143					
Bass	731					
Pike............	1,248					
Pickerel	1,055					
Coarse fish ...	2,806					
Total.......	39,260	1,430,514	43,586	223,505	69,585	293,090

A barrel of fish is equal to about 200 pounds.

* Of this, free of duty, 89,503 barrels; value, $800,910. † 51,423 barrels; value, $181,521. ‡ Of this, sardines and anchovies preserved in oil or otherwise, dutiable, value, $3527. § Sardines, etc., $126.

Investment in Fishing-stocks on Lake Michigan in 1871.

281 pound-nets, average value, $500	$140,500
102 gill-nets, "heavy rigs," average value, $725	73,950
348 gill-nets, "light rigs," average value, $225	78,300
98 boats, average value, $500	49,000
348 Mackinaw boats, average value, $100	34,800
143 pound-net boats, average value, $50	7,150
100 anchor-boats, average value, $25	2,500
4 steam fishing-boats, average value, $1800	7,200
1 schooner	3,000
500 shanties, average value, $50	25,000
100 ice-houses, average value, $100	10,000
Total of fishing investment	$431,400

The current working capital employed in the fisheries, omitting wages and including packages, inspection, salt, ice, freightage, and repairs, is a large sum of money—probably as much as $150,000. (See WHALE FISHERIES, PEARL FISHERIES, SEAL FISHERIES, SALMON FISHERIES, MENHADEN FISHERIES, and the names of the principal species of fish.) THEODORE GILL.

Fish'erman's Ring (*annulus piscatorius*), a seal-ring worn by the pope, who with it seals certain briefs, which are said to be "given under the fisherman's ring." It bears a figure representing Saint Peter fishing, and is borne by the popes as Saint Peter's successors. It has been employed since the thirteenth century.

Fish'ersburg, post-v. of Stony Creek tp., Madison co., Ind. Pop. 96.

Fish'er's Grant, in the tp. and co. of Pictou, N. S., is the N. terminus of the Nova Scotia Railway. It is on Pictou Harbor, and is connected with Pictou, 2 miles distant, by a ferry. Pop. about 300.

Fisher's Island, an island of Long Island Sound, lying near the Connecticut shore, but belonging to Southold tp., Suffolk co., N. Y., is 7 miles long and 1½ miles broad. Area, 4000 acres.

Fish'ersville, post-v. of Merrimack co., N. H., constituting the first ward of the city of CONCORD (which see), is on the Merrimack River and on the Northern R. R., 7 miles N. of the main part of Concord. It has two churches, an academy, woollen and cotton mills, and considerable local trade. Pop. 1439.

Fish'ery, Law of. The rules of the English common law regulating the subject of fisheries are of a twofold variety, since navigable waters—by which is meant, in legal usage, those in which the tide ebbs and flows—are distinguished, as regards the right to fish, from those which are not navigable. In streams above the reach of the tidal flow the soil to the centre of the river-bed belongs to the riparian proprietors upon the opposite banks (see FILUM AQUÆ), and each of them possesses an exclusive right of fishery in that half of the stream over which his independent ownership exists. If the land upon both sides is vested in the same person, his fishing privilege pertains to the whole width of the river as far as the boundaries of his property along the course of the river may extend. But this exclusive right must be exercised so as not to interfere with the public convenience in passing along the stream in boats or rafts, and no dams or other obstructions can be made which would prevent the free passage of the fish, unless such privilege be given by statute. In navigable or tide waters, on the contrary, the soil is vested in the sovereign, and the right of fishery is common to the entire public. A special or exclusive privilege can only be created by legislative grant or by prescription, which must be clearly proved. This, however, is very unusual. This right of all persons to fish in public waters is called a *common fishery*. When several have a right to fish in a private stream in derogation of the owner of the soil, it is termed a *common of fishery* or *of piscary*. The designation *free fishery* is applied to an exclusive right in a navigable river arising by grant or prescription, without any right in the soil, while the term *several fishery* is employed when, in connection with such an exclusive grant, a property in the soil is also given. These various terms are, however, often employed without precision of meaning.

The doctrines of the English law concerning fisheries have been generally adopted in the U. S. In some few States, however, the common right of the public to take fish has been extended to streams ordinarily considered private, being above the flow of the tide. Thus, in Pennsylvania and North and South Carolina it is declared that the great rivers of those States, even above tide-water limits, are subject to no exclusive privileges, but open to the general public. The regulation of fisheries by statutory provisions is very general, particularly in recent years, when such great attention is given to the breeding of choice varieties of fish and the stocking of lakes and rivers. The modes and times of taking fish are often thus appointed, and penalties imposed for any violation of the restrictions created.

In the absence of any special statutory prohibition, it is supposed the inhabitants of one State may exercise the same right of fishing in the waters of another as the citizens of the latter possess. But the important question has come before a few of the courts for adjudication, whether, if any State imposes upon the citizens of other States restrictions in regard to the power of fishing within its limits which are not imposed upon its own citizens, that clause of the U. S. Constitution is not violated which provides that "the citizens of each State shall be entitled to all the privileges and immunities of citizens in the several States." Some decisions have held that the right of fishing is in the nature of a right of property incident to the right of territory, and that the legislation of any State appropriating it to the use of the citizens of that State, either exclusively or with the grant of peculiar privileges, would therefore not be unconstitutional. But this reasoning has been impugned, and the question needs further adjudication before the law upon it can be considered as completely settled. (Consult *Corfield* v. *Coryell*, 4 Washington Circuit Court Reports, 380; *Bennett* v. *Boggs*, Baldwin's Reports, 60; *The State* v. *Medbury*, 3 Rhode Island Reports, 138; *Dunham* v. *Lamphere*, 3 Gray's Reports, 276.)

The U. S. government at an early period adopted important measures of legislation to promote cod-fishing along the coast, providing for the payment of bounties to those persons who would engage in the business. Thus, a law was passed in 1819 establishing the following bounties, which continued to be paid annually until the year 1866 to the owners of all vessels employed in the cod-fisheries for at least four months in the fishing season: For vessels between five and thirty tons, $3.50 per ton; for those above thirty tons, $4 per ton, except that the allowance to any vessel was not to exceed $360. But in 1866 fishing-bounties were abolished, and the only privilege now granted to the cod-fishermen is that duties shall be remitted on imported salt in bond which they take on board for curing purposes.

In the prosecution of the cod, mackerel, and other fisheries along the coast of Newfoundland and the other British possessions much hostility was created between British and American fishermen on account of the practices of the latter in fishing unlawfully in bays and inlets, and in drying and curing their fish upon British shores. The high seas are free and open to all nations, and people of any nationality may fish therein without restriction, but this right ceases at the mouths of rivers and in bays and harbors along the coast of any country. Foreigners can acquire a privilege to catch fish in places of this kind only by grant of the state or sovereign. At one time the colonial authorities used force to drive away American fishermen from the Newfoundland and Canadian coasts. In order to remedy these difficulties, various treaties have from time to time been negotiated between the U. S. and Great Britain granting certain privileges reciprocally to the inhabitants of either country. The treaty-regulations now (1874) in force are those agreed upon by the Alabama Claims Commission in 1871. (For the provisions of this treaty, see the article FISHERIES, by PRES. T. D. WOOLSEY, S. T. D., LL.D.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fish-glue, a species of isinglass not sufficiently refined for culinary and medicinal purposes, but suitable for making cements, etc. It is prepared from the offal of the fisheries, and sometimes has a strong fishy odor.

Fish-Hawk, the common American name of the *Pandion haliaëtus*, a raptorial bird of the family Falconidæ, inhabiting a large part of North America, and identical with the osprey of the Old World (*Pandion haliaëtus*). It subsists upon fish alone, and takes its prey by plunging from a considerable height into the water. It nests upon a tall tree near the water, and constructs its large nest of sticks and weeds. It is often robbed of its prey by the bald eagle while flying from the scene of capture.

Fish-hook, a curved, barbed, and pointed steel wire used in angling and the fisheries. The most famous seats of the fish-hook manufacture are Limerick in Ireland and Redditch, Worcestershire, England, but fish-hooks of the best quality are made in the U. S., not inferior to those of Limerick except in reputation and cost. The Limerick hook has a barb which is forged solid and then filed into the proper shape, while the English and other ordinary hooks have a barb which is raised by cutting into the wire. These are inferior in temper and durability to the best hooks.

Fish'ing Creek, tp. of Granville co., N. C. Pop. 2413.

Fishing Creek, tp. of Warren co., N. C. Pop. 1598.

Fishing Creek, tp. of Wilkes co., N. C. Pop. 542.

Fishing Creek, post-tp. of Columbia co., Pa. P. 1372.

Fishing Frog. See ANGLER.

Fishing River, tp. of Clay co., Mo. Pop. 2798.

Fishing River, tp. of Ray co., Mo. Pop. 1653.

Fish'kill, post-tp. of Dutchess co., N. Y., on the E. bank of the Hudson River. The Fishkill Mountains are in the S. part. The Fishkill River intersects the town, which has important manufacturing, agricultural, and railroad interests. It contains twenty-two churches and numerous thriving villages, of which the more important are the following: (1) FISHKILL, post-v. on the Dutchess and Columbia division of the New York Boston and Montreal R. R., 5 miles from the Hudson River. It has a national and savings bank, a weekly newspaper, a machine-shop, four churches, and a union free school. Pop. 737.—(2) FISHKILL ON THE HUDSON, or FISHKILL LANDING, a beautiful post-v. on the Hudson River and the Hudson River R. R., 58 miles from New York, is the S. W. terminus of the Dutchess and Columbia division of the New York Boston and Montreal R. R. It has a national and a savings bank, four churches, a machine-shop, two newspapers, an armory, and many fine residences. It has a steam-ferry running to Newburg. Pop. 2992.—(3) The villages of Matteawan, Glenham, Wappinger's Falls, and many others belong to this township. The more important are noticed under their alphabetical heads. Pop. of tp. 11,752. G. W. OWEN, ED. "JOURNAL."

Fish Lake, tp. of Chisago co., Minn. Pop. 385.

Fish-Louse, a name applied to numerous parasites (generally entomostracous crustaceans) which infest fishes and whales. They are of the genera *Argulus, Caligus, Nicothoë, Dichelestium, Lernæodiscus, Jaculina, Chondracanthus, Achtheres, Anchorella, Lerneutoma, Tracheliastes, Lamproglena, Lernæa*, and many others; some of them are the most degraded forms now known of the crustacean type. To the above may be added certain parasitic cirripeds which in structure and habit are properly associated with the fish-lice.

Fish Oil, the oil of the menhaden or moss-bunker (*Alosa menhaden*) and of other fishes, which, not being marketable, are caught in large quantities for their oil on the Atlantic coast of the U. S. The refuse is dried and sold as "fish guano," and is a valuable fertilizer. The oil is used in dressing leather and in adulterating the higher-priced oils. Similar products are manufactured in Norway.

Fish Pond, tp. of Barnwell co., S. C. Pop. 1120.

Fish-skin, in mechanical arts. See SHAGREEN.

Fisk (FRANKLIN WOODBURY), D. D., b. at Hopkinton, N. H., Feb. 16, 1820; graduated at Yale in 1846, and at Yale Divinity School in 1852; was tutor in Yale College 1851–53; professor of rhetoric and belles-lettres in Beloit College 1854–59; was ordained at Chicago in 1859; and in the same year became professor of sacred rhetoric in the theological seminary of Chicago.

Fisk (JAMES), b. 1762, was a lawyer, and represented Vermont in the U. S. Congress from 1805 to 1809 and from 1811 to 1815; in 1815–16 was a judge of the supreme court of Vermont; then U. S. Senator from Vermont in 1817–18; afterwards, for eight years, collector of customs in the district of Vermont. D. at Swanton, Vt., Dec. 1, 1844.

Fisk (JAMES, JR.), b. at Pownal, Vt., Apr. 1, 1835, was a peddler in early life, but became a clerk and then partner in Jordan, Marsh & Co.'s dry-goods store in Boston, Mass. Removing to New York, he became a banker and vice-president of the Erie Railway, colonel of the Ninth regiment N. Y. S. M., and was assassinated by Edward S. Stokes Jan. 6, 1872.

Fisk (Rev. WILBUR), D. D., a son of Judge Fisk, was b. in Brattleborough, Vt., Aug. 31, 1792. Joined in 1812 the sophomore class in the University of Vermont, but spent his senior year at Brown University, where he graduated with high honor in 1815. Entering with great zeal upon the study of the law, he was arrested in his course by what threatened to be a fatal illness, and in 1818 was licensed as a local preacher in the Methodist Episcopal Church. He soon took high rank as a pulpit orator. Was in 1825 chosen first principal of the Wilbraham Academy, Mass., removing thither in 1826; in 1830 was chosen first president of the Wesleyan University, Middletown, Conn., and entered upon the duties of this office in 1831. Poor health compelled him to visit Europe in 1835–36. D. at Middletown Feb. 22, 1839. He was a man of the Fénelon type of character. Published *Calvinistic Controversy* (1837), *Travels in Europe* (1838), *Sermons and Lectures on Universalism, Reply to Pierpont on the Atonement*, and other tracts and sermons. (See his *Life*, by REV. JOSEPH HOLDICH, D. D., 1842.) R. D. HITCHCOCK.

Fisk'dale, thriving post-v. and manufacturing place in Sturbridge tp., Worcester co., Mass., on the Quinebaug River.

Fiske (Miss FIDELIA), a niece of Pliny Fiske, noticed below, b. at Shelburne, Mass., May 1, 1816. Graduating at Mount Holyoke Female Seminary in 1839, and subsequently a teacher there, she was brought into close contact with Miss Mary Lyon, and imbibed much of her spirit. In 1843 she went as a missionary to the Nestorians in Persia, and was the first principal of the female seminary at Oroomiah. In 1858, after fifteen years of service, she returned to America with broken health, and d. at Shelburne July 26, 1864. Dr. Rufus Anderson, of the American Board, has pronounced her the most Christ-like person he ever knew. Her *Life*, under the title *Faith Working by Love*, by a relative, the Rev. Daniel T. Fiske, D. D., was published in 1868. R. D. HITCHCOCK.

Fiske (JOHN), American sea-captain in the Revolutionary war, b. at Salem, Mass., Apr. 10, 1744, was captain of the Tyrannicide, the first war-vessel commissioned by the State of Massachusetts, July 8, 1776, and in her had many sanguinary conflicts. Dec. 10, 1777, he commanded the State ship Massachusetts; after the war he engaged in commerce, and was made major-general of militia in 1792. D. at Salem, Mass., Sept. 28, 1797.

Fiske (Rev. NATHAN WELBY), b. in Weston, Mass., Apr. 17, 1798; graduated at Dartmouth in 1817, in the same class with President James Marsh of Burlington, Vt.; was tutor from 1818 to 1820; graduated at Andover Theological Seminary in 1823, and was professor in Amherst College (first of Greek and Latin, and then of intellectual and moral philosophy) from 1824 to 1847. Was a critical linguist, an acute metaphysician, and a pungent preacher. His chief literary work was a translation (with large additions) of Eschenburg's *Classical Manual*, first published in 1836, and finally stereotyped in 1843. A posthumous volume of *Discourses*, with a memoir by Dr. Heman Humphrey, was published in 1850. D. in Jerusalem May 27, 1847, and was buried on Mt. Sion. He was the father of Mrs. Helen Hunt, known to the public as "H. H." R. D. HITCHCOCK.

Fiske (Rev. PLINY), a descendant of William Fiske of Suffolk, England, who came to Salem, Mass., in 1637, and shortly after removed to Wenham. In 1761, Ebenezer Fiske, the grandfather of Pliny, settled in Shelburne, Mass., where Pliny was b. June 24, 1792; graduated at Middlebury College in 1814, and at Andover Theological Seminary in 1818, in the same class with his biographer, Dr. Alvan Bond, and the veteran missionaries, Dr. Levi Spaulding and Dr. Miron Winslow. On Nov. 3, 1819, he sailed from Boston, in company with the Rev. Levi Parsons, to establish a mission under the care of the American Board in Palestine. Landed at Smyrna Jan. 15, 1820, and was afterwards at Scio, at Alexandria (where Mr. Parsons died), at Malta, and at Damascus, studying the modern Greek and Arabic languages. Prepared at length for his work, he went to Beyroot in May, 1825, and d. there, greatly lamented, Oct. 23, 1825. (See his *Life*, by ALVAN BOND, 1828; and SPRAGUE'S *Annals*, ii. 622.) R. D. HITCHCOCK.

Fiske (Rev. SAMUEL), a relative of Pliny Fiske, noticed above, b. in Shelburne, Mass., July 23, 1828; graduated at Amherst in 1848; was in Andover Theological Seminary from 1850 to 1852; was tutor at Amherst from 1852 to 1855, then travelled a year in Europe and the East; was settled over the Congregational church in Madison, Conn., in 1857; entered the Federal army as a private in the Fourteenth Connecticut regiment in 1862; became captain, distinguished himself in several battles, and fell at the head of his company on the second day of the bloody battle of the Wilderness, May 6, 1864, dying in the hospital at Fredericksburg May 22. He was a man of rare genius and force of character. His letters from Europe and the East, first published in the *Springfield Republican* under the *nom-de-plume* of "Mr. Dunn Browne," appeared in a volume in 1857. His *Experiences in the Army*, under the same assumed name, appeared in 1866. Prof. W. S. Tyler's discourse, preached at the funeral, was an admirable tribute to his memory. (See also *The Congregational Quarterly*, Jan., 1866, and the *New Englander*, Jan., 1866.) R. D. HITCHCOCK.

Fissiros'tres [Lat. *findo, fissum*, to "split," and *rostrum*, the "beak"], a name given by some naturalists to a sub-order of passerine birds, characterized by having the gap of the bill carried far back—frequently as far back as the eyes. The swallows are the typical fissirostral birds.

Fis'tula [Lat., a "pipe"], a term used in pathology to designate an abnormal canal, usually of small length and diameter, leading from one organ to another (vesico-vaginal fistula), or from some cavity of the body to the external world (gastric fistula, fistula in ano).

Fistula is called (1) complete, when it has two orifices; (2) incomplete or blind, when it has only one; (3) external, when the opening is through the skin; (4) internal, when it opens only into a cavity of the body. The two most

prominent characteristics of a fistula are the constant discharge from it of a thin purulent fluid, with which the secretions of the organ affected are mixed, and the obstinacy with which it resists the healing process. This latter results from the nature of the wall of the fistula, which in recent cases is formed of soft, unhealthy granulation-cells which have no tendency to unite to form either cicatrix or cuticle. In older cases the walls consist principally of condensed connective tissue, inseparable from the surrounding parts. A fistula of long standing also exerts a change in the tissues through which it passes, these becoming more dense, and finally indurated, and the integument around its orifice callous and sometimes warty.

Fistula is caused (1) by wounds which penetrate passages giving natural exit to the secretions, or those which follow a long and deviating course through many tissues; (2) by ulceration and the sloughing process; (3) by abscess. The last is the most frequent cause.

The passage of a bullet through any region of the body sometimes leaves a canal which fails to unite; and whenever a necrosis of bone occurs there are usually one or more tracks following a winding course from it to the outside of the body. These passages are often called fistulæ, but the more appropriate name for them is *sinus*.

Fistula commonly occurs in persons of an enfeebled constitution. Where it results from abscess it is more frequently the chronic than acute form which gives rise to it. Fistulæ were formerly supposed to furnish exit for morbid humors, and surgeons hesitated to attempt their cure. At the present time some surgeons refuse to operate on a fistula in ano in a patient having phthisis.

The cure of fistula depends upon producing union of its walls through the agency of healthy granulation-cells. This may be brought about by stimulating applications, as the injection of nitrate of silver, corrosive sublimate, etc. in solution, or the application of the red-hot iron. Where the walls are old and indurated, it is necessary to dissect them out and remove them altogether, bringing the lips of the wound together by sutures. The most common treatment consists in laying the fistula and soft parts above it freely open by an incision, and keeping the orifices of the wound apart, so that it may slowly heal by granulation from the bottom. There are other modes of cure, but they are less serviceable than the above, or else only applicable to special cases. G. H. Wynkoop.

Fistula, in horses, is the farrier's name for a deep-seated chronic abscess, usually situated upon the withers, and discharging pus through fistulous pipes or sinuses. When seated upon the top of the head it is called poll-evil. Blows and strains of the tendon of the nape are the most fruitful causes of the disease, which most frequently attacks old or ill-kept animals. The thorough application of hot caustic solutions is often curative; but sometimes it is well to lay open the sinuses and retrench unhealthy masses of granulation-cells.

Fit, a term employed by Newton in accounting theoretically, upon the corpuscular theory of light, for certain phenomena of refraction and reflection at the surfaces of transparent bodies. The term is meant to denote the periodical alternations of condition in the corpuscle, disposing it to be reflected or refracted. (See Thin Plates, Colors of.)

Fit. See Convulsion, Apoplexy, and Epilepsy.

Fitch, the commercial name of the fur of the European polecat (*Putorius fœtidus*). It is collected in Northern Europe, and though in general inferior in quality to the fur of martens and sables, it is very handsome and serviceable, and when it is in fashion brings a good price. The animal which affords it is often called *fitchet*. (See Polecat.)

Fitch. See Vetch.

Fitch (Charles Elliott), an American journalist, b. in Syracuse, N. Y., Dec. 3, 1835; graduated at Williams College in 1855, and at the Albany Law School in 1857; was admitted to the bar in Syracuse, and practised law till 1866, when he assumed editorial charge of the *Syracuse Daily Standard*, where he remained till 1873, when he became managing editor of the *Rochester Democrat and Chronicle*. J. B. Bishop.

Fitch (Ebenezer), D. D., b. at Norwich, Conn., Sept. 26, 1756; graduated at Yale College, New Haven, Conn., 1777; was tutor there 1780–83 and 1786–91; Oct., 1791, was principal of the Williamstown (Mass.) school, until its erection as a college; then its president from Aug., 1793, to May, 1815. Having been ordained as a minister in June, 1795, he was subsequently pastor of the Presbyterian church in Bloomfield, N. Y., from Nov. 29, 1815, to Nov. 25, 1827. D. at West Bloomfield, N. Y., Mar. 21, 1833.

Fitch (Eleazar Thompson), D. D., b. at New Haven, Conn., Jan. 1, 1791; graduated at Yale College in 1810; was Livingston professor of divinity in the theological department of Yale College 1817–52; author of theological reviews and articles for periodicals. A volume of his sermons has been published since his death. D. Jan. 31, 1871.

Fitch (Elijah), A. M., b. 1745; graduated at Yale College 1765; was Congregational minister in Hopkinton, Mass., from 1771 until his death Dec. 16, 1788. The *Beauties of Religion, addressed to Youth*, poem in five books, and *The Choice*, short poem (Providence, 1789), were his productions.

Fitch (James), b. at Bocking, Essex co., England, Dec. 24, 1622, came to New England when sixteen years of age; studied seven years under Hooker and Stone, and was pastor at Saybrook, Conn., 1646–60, and then at Norwich, where he was the first settled minister. He preached to the Mohegan Indians in their own tongue, and wrote *First Principles of the Doctrine of Christ* (Boston, 1679), etc. D. at Lebanon, Conn., Nov. 18, 1702.

Fitch (John), b. in Windsor, Conn., Jan. 21, 1743. His education was limited, but included the rudiments of surveying, subsequently of great service to him. After an apprenticeship at clockmaking he established a brass-foundry, and subsequently engaged in the manufacture of potash. In his twenty-sixth year he established himself at Trenton, N. J., as a silversmith. During the early part of the Revolution he had large contracts for the repair of arms, but when the British army entered Trenton his shop and its contents were burned. He served as lieutenant in the New Jersey volunteers, and afterwards resumed the business of repairing arms. Having accumulated about $4000 in Continental money, he procured an appointment as deputy surveyor for Virginia, sold his paper money for $100 in silver, and started for the Western wilderness. After suffering many hardships, he reached the place of destination and commenced his surveys. In 1781 he returned the owner of 1600 acres in the valley of Salt River, and spent some time in Philadelphia. In 1782 he raised a party of ten emigrants, and again started for the West. Having purchased a cargo of flour and groceries, he proceeded to the mouth of the Muskingum, where the party were attacked by Indians. Two of the number were murdered, and the remaining nine, including Fitch, were carried into captivity. After suffering great hardships and travelling with different tribes more than 1200 miles, in the mean time gathering information regarding the locality of lakes and rivers, he was purchased by a British officer at Detroit, became a prisoner of war, and was released at Montreal. Several years after his return he engraved on wood a rude map of the vast country through which he had passed, and worked off impressions of it by means of a cider-press at Warminster in Berks co., Pa.

The happy thought of propelling vessels by steam, he says, originated with him in 1784. He rapidly matured his plans, and in Aug., 1785, he petitioned Congress for aid in constructing his boat. In his statement before a committee appointed by the assembly of Pennsylvania he averred that he had seven different plans and four different models of steamboats. The records of the American Philosophical Society of Philadelphia show that "a model, accompanied by a drawing and description of a machine for working a boat against a stream by means of a steam-engine, was laid before the society by John Fitch on Sept. 27, 1785." With the pecuniary assistance of several gentlemen, Fitch immediately undertook to build a steamboat. In the *Columbia Magazine* for Dec., 1786, he gave a description of this vessel and its machinery. A steam cylinder over three feet long and one foot in diameter was placed horizontally in the bottom of the boat; the steam was let in at each end of the cylinder alternately, and after moving a reciprocating piston was discharged into a condenser, which formed a vacuum in the cylinder behind the moving piston. The force of the piston was transmitted to cranks on each side of the boat; which, by means of connecting bars, moved twelve paddles, three on each side being in the water and three out at the same time. The engine of Fitch was the first double-acting condensing engine, transmitting power by means of cranks, ever constructed; for although Watt had proposed to apply to his pumping-engine the double-acting piston devised by Delahire and used in his pump, the manner of its application being set forth by Watt in his patent of 1782, yet he did not construct a steam-engine producing a rotary motion and applicable to general use until several years later; and many years elapsed before he could lawfully employ the crank in connection therewith.

On May 1, 1787, Fitch's steamboat, The Perseverance, was put in motion on the Delaware River, and made three miles per hour. This speed did not satisfy Fitch, and various improvements were soon added, among which were a boiler and a condenser, both made of spiral pipes invented

by Henry Voight. A new cylinder, eighteen inches in diameter, was also constructed. The steamboat, with its greatly increased power, was successfully tested in the fall of 1788. The late Dr. Thornton, long at the head of the U. S. patent-office, and many other prominent men, certified that the steamer moved in dead water at the rate of 8 miles an hour, or 1 mile in 7½ minutes. With thirty passengers the vessel left Philadelphia and, moving against the current of the Delaware, reached Burlington, a distance of 20 miles, in 3 hours and 10 minutes. Dr. Thornton stated that the Perseverance afterwards made 80 miles in one day. This speed will excite wonder when the difficulty of keeping the piston tight against the comparatively rough interior surface of the cylinder is taken into consideration. The steamboat was run for some time as a packet to Burlington, but after several mishaps it was burned.

Fitch was sent to France by the steamboat company, under the auspices of Consul Aaron Vail, who was anxious to have a steamboat built in that country; but finding all the machinists engaged on government work, Mr. Vail furnished Fitch with means to return to his native country. He crossed the British Channel, and during his stay in London, in 1793, he published his pamphlet entitled *An Explanation for Keeping a Ship's Traverse at Sea by the Columbian Ready Reckoner*. He remained in London until his funds were exhausted, then secured a passage on a homeward-bound vessel, and landed at Boston in 1794 in a state of destitution. From that time to 1796 he resided with his brother-in-law at Sharon, Conn. In the *Documentary History of New York*, vol. ii. p. 585, will be found an interesting account of experiments subsequently made by Fitch in propelling a small boat by steam on the Collect Pond, formerly existing in the lower part of the city of New York. This boat was arranged with side wheels, and a screw propeller at the stern. In 1797, Fitch went to Kentucky to obtain possession of lands he had purchased while surveying there. Soon after taking up his residence in Nelson county, his health began to decline, and he died at Bardstown, Ky., July 2, 1798.

The career of Fitch was filled with thrilling adventures. It commenced amid the political troubles which culminated in the Revolution, and it terminated before his country had fully recovered from the shock of war. The failure of the inventor of the steamboat to realize his most sanguine hopes was chiefly due to a want of mechanical facilities for carrying into effect plans which, when subsequently modified and perfected by his ingenious countrymen Fulton and Stevens, proved to be not only feasible, but of inestimable value. SAMUEL D. TILLMAN.

Fitch (LE ROY), U. S. N., b. Oct. 1, 1835, in Indiana; graduated at the Naval Academy in 1856; became a master in 1859, a lieutenant in 1861, a lieutenant-commander in 1862, a commander in 1870; served on the Mississippi River from 1861 to 1865, during which period he was noted for his sound judgment, enterprise, and gallantry. Participated in the capture of Forts Donelson and Pillow, the reduction of Island No. 10, and the victory over the Confederate fleet at Memphis, Tenn.; and as commander of a division of gunboats was engaged in many brilliant operations, the conduct of which gained him the admiration of both the army and the navy. On July 27, 1863, Hon. Gideon Welles, secretary of the navy, addressed to him the following complimentary letter: "SIR: Since your attachment to the Mississippi squadron it has been gratifying to the department to observe the commendable zeal (as shown by reports to it) displayed by you in the execution of the duties with which you were entrusted. In affording convoy on the Tennessee and Cumberland rivers, in punishing and dispersing the guerilla bands which infested the banks of those streams, and in your timely and important assistance to the garrison at Fort Donelson when attacked on the 3d of February last by the forces under Gen. Wheeler and others, you have acted with promptness, and reflected credit on the naval service. Your recent pursuit of the flying guerilla Morgan—following him upwards of 500 miles, intercepting him, and frustrating him in his attempt to recross the Ohio, capturing his train, a portion of his guns, and routing his band—all of which materially crippled his strength and led to his final capture—gives additional evidence of your zeal and ability, and reflects additional credit on the service and yourself." D. Apr. 14, 1875. FOXHALL A. PARKER.

Fitch (THOMAS), governor of Connecticut from 1754 to 1766, b. in Connecticut 1699; graduated at Yale College 1721; practised law and filled the offices of counsellor, judge of the supreme court, chief-justice (1750–54), lieutenant-governor and governor. In 1766 was driven into retirement for having taken the oath of office prescribed in the Stamp Act in 1765, and d. July 18, 1774.

Fitch'burg, city, one of the capitals of Worcester co., Mass., on a branch of the Nashua River and at the junction of the Fitchburg, Cheshire, Fitchburg and Worcester, Boston Clinton and Fitchburg, and Vermont and Massachusetts R. Rs. It has 10 churches, 2 national and 2 savings banks, mutual fire insurance company, a public library, a county court-house, a county jail, 1 daily and 2 weekly newspapers, and manufactures of paper, chairs, machinery, woollen goods, rattan, etc. The annual product of the first four branches of industry amounts to $4,600,000. There are eighteen corporate companies in the city, with an aggregate capital of about $2,000,000. It has a paid fire department with electric fire-alarm telegraph, and an excellent system of water-works. Pop. 11,260.

J. E. KELLOGG, ED. "DAILY SENTINEL."

Fitchburg, post-tp. of Dane co., Wis. Pop. 1152.

Fitch'ville, post-tp. of Huron co., O. Pop. 795.

Fitz (HENRY), American telescope-maker, b. in Newburyport, Mass., 1808, was a printer and then a locksmith, but in 1835 made a reflecting telescope, and in 1844 invented a method of perfecting object-glasses for refracting telescopes, making the first one from the bottom of an ordinary tumbler. He finally made an instrument of 16-inch aperture, his telescopes having come to notice through the fair of the American Institute at New York in 1845. His instruments were so delicate that the change in the form of the object-glass by expansion, caused by passing the finger over it in a frosty night, could be detected. He was about visiting Europe to select a glass for a 24-inch telescope, and to take patents for a camera involving a new form of lenses, but d. in New York City Nov. 6, 1863.

Fitz'gerald (AUGUSTUS FREDERICK), third duke of Leinster, b. in London Aug. 21, 1791, succeeded to the title on the death of his father in 1804, and took his seat in the House of Lords; in 1831 was appointed lord lieutenant of the county Clare in Ireland and member of the queen's privy council. Was the grand master of the order of Freemasons in Ireland. For many years he was the sole Irish duke, and he also held the rank of first marquis and first earl among the Irish nobility. In politics he was a Liberal, but conservative on the question of a repeal of the union with England. In 1818 the duke married the daughter of the earl of Harrington. Four children resulted from the marriage, of whom the eldest, known as the marquis of Kildare, succeeded to the ducal honors of his father. D. at London Oct. 10, 1874.

The Fitzgerald family of Ireland is a very ancient Anglo-Norman one, long thoroughly Hibernianized, and the late duke was a descendant of the barons of Offaly, first ennobled in 1205. In 1747 his family was elevated to the British peerage, and in 1766 the then head of the family was created duke of Leinster.

Fitzgerald (Lord EDWARD), Irish revolutionist, b. near Dublin Oct. 15, 1763, having served in the British army as aide-de-camp to Lord Rawdon in America, travelled in North America, and imbibed republican ideas, from 1788 to 1790, and was a member of the Irish Parliament in the latter year. In Paris, in 1792, he publicly renounced his title, and was dismissed from the army. Becoming president of the United Irishmen in 1796, he was arrested May 19, 1798, receiving wounds in the arrest from which he d. in prison June 4, 1798. In Oct., 1798, a bill of attainder was passed against him, which was reversed in 1819.

Fitzgerald (Rt. Hon. JOHN DAVID), P. C., Q. C., LL.D., b. in Dublin in 1816, was educated at Trinity College, Dublin; called to the bar in 1838, and became a Q. C. in 1847. In 1855–56 was solicitor-general of Ireland, and in 1856–58 and 1859–60 attorney-general. In the House of Commons he represented Ennis from July, 1852, to Feb., 1860, and was then made a judge of the court of queen's bench in Ireland, where he is also a commissioner of national education, of charitable donations and bequests, and of endowed schools. In 1856 he was sworn of the privy council.

Fitzgerald (PERCY HETHERINGTON), M. A., F. S. A., b. at Fane Valley, county of Louth, in 1834; educated at Stonyhurst College, Lancashire, and Trinity College, Dublin; came to the Irish bar, and was for a time a crown prosecutor on the north-eastern circuit. Has written largely in *All the Year Round, The Dublin University Magazine, Household Words*, etc., nearly all his productions being works of fiction, with a *Life of Sterne* and *Life of Garrick*.

Fitzgerald (WILLIAM), D. D., Anglican bishop of Killaloe, Kilfenora, Clonfert, and Kilmacduagh, Ireland, b. in Ireland Dec. 3, 1814, and educated at Trinity College, Dublin, where he had B. A. in 1837, and of which he became a fellow. In 1840 he wrote in opposition to *The Tracts for the Times*. In 1848 was appointed professor of moral philosophy in Trinity College, and in 1853 professor of ecclesiastical history. Has edited *Constable's Ethics* and *Butler's Analogy*, and is author of one of the answers to

Essays and Reviews. He was joint editor of *The Irish Church Journal* with Dr. Abeltshauser, was consecrated to the see of Cork in 1857, and transferred to his present see in 1862.

Fitzgerald (Sir William Robert Seymour Vesey), D. C. L., G. C. S. I., English member of Parliament and governor of Bombay, b. in 1818; graduated at Oriel College, Oxford, in 1837, and had M. A. in 1844, and D. C. L. in 1863. In Jan., 1839, was called to the bar at Lincoln's Inn, and gained a seat in Parliament for the borough of Horsham in June, 1848, being re-elected in 1854. Was in the earl of Derby's cabinet in 1859 as under-secretary for foreign affairs, and was made governor of Bombay in 1866, being made a privy councillor Dec. 28th of that year, and sailing for India Feb., 1867. The same year he was nominated grand cross of the order of the Star of India.

Fitz'hugh (Andrew), b. in Virginia in 1795, was a midshipman U. S. navy June 8, 1811, lieutenant Apr. 21, 1816, master Feb. 9, 1837, captain Feb. 14, 1843. D. in Fairfax co., Va., Oct. 2, 1850.

Fitzhugh (William), delegate to the Continental Congress from Virginia 1779–80; b. in 1726; d. in 1809.

Fitzpat'rick (Benjamin), U. S. Senator, b. in Greene co., Ga., June 30, 1802, emigrated to the valley of the Alabama River, near Montgomery, Ala., in 1815; studied law, and began to practise in 1821, and being soon chosen solicitor of his judicial district held the position until 1829. Was presidental elector in 1840, and governor of Alabama in 1841–45. In 1852 he was appointed U. S. Senator from Alabama, and then elected to the same position for the term ending in 1861. He left the Senate in Feb., 1861, and took an active part in the Confederate cause. Was often president *pro tem.* of the U. S. Senate, president of the Alabama constitutional convention in 1865, and a delegate to the Philadelphia Union National convention in 1866. D. in Autauga co., Ala., Nov. 25, 1869.

Fitzpatrick (John Bernard), D. D., b. of Irish parents in Boston, Mass., Nov. 1, 1812, was educated at Boston, at the College of Montreal, and the Sulpitian Seminary, Paris. In 1840 was ordained a Roman Catholic priest; in 1844 was consecrated coadjutor-bishop of Boston, *cum jure successionis;* and in 1846 succeeded Bishop Fenwick in the bishopric. D. Feb. 13, 1866. Bishop Fitzpatrick was a man of learning and ability, and received his doctorate from Harvard University.

Fitzpatrick (William John), Irish author, b. Aug. 31, 1830, is a magistrate and grand juror for the county of Dublin, and has published *Life, Times, and Contemporaries of Lord Cloncurry, The Friends, Foes, and Adventures of Lady Morgan, Memoirs of Archbishop Whately,* etc.

Fitzroy' (Robert), English vice-admiral, meteorologist, and navigator, b. July 5, 1805, entered the British navy Oct., 1819; was lieutenant in Sept., 1824, and took part in a government expedition to the coast of South America in 1828 and 1831. (Charles Darwin accompanied the latter expedition as naturalist.) In 1841, Fitzroy was M. P. for Durham, and governor of New Zealand from 1843 to 1846. In 1854 became superintendent of the meteorological department of the board of trade, rear-admiral in 1857, and in 1862 established a system of "storm-warnings." Was made vice-admiral in 1863, and d. at Norwood Apr. 30, 1865. With Capt. King he wrote *Narrative of the Surveying Voyages of H. M. S. Adventurer and Beagle, 1824–33* (1839), and himself published *Barometer Manual* (1861) and *Weather-Book* (1863).

Fitzsim'mons (Thomas), b. in Ireland in 1741, was a merchant in Philadelphia, Pa., and commanded a volunteer company in the Revolutionary war. Was for many years a member of the Pennsylvania State assembly; in 1782–83 a delegate to the Continental Congress, and in 1787 to the Federal constitutional convention. From 1789 to 1795 was M. C. His firm subscribed £5000 to supply the American army in 1780. Mr. Fitzsimmons was president of the Philadelphia chamber of commerce and of the North American Insurance Company. D. at Philadelphia, Pa., Aug., 1811.

Fitzwil'liam, post-tp. of Cheshire co., N. H., on the Massachusetts State line and on the Cheshire R. R., 27 miles N. W. of Fitchburg, Mass. It contains two post-villages (Fitzwilliam and Fitzwilliam Dépôt), and has important manufactures of cooperage and wooden wares. Pop. 1140.

Fiu'me, an Austrian seaport on the coast of the Adriatic, at the mouth of the Fiumara, where it falls into the Gulf of Quarnero, 40 miles S. E. of Trieste. The most important branch of its industry is shipbuilding, for which the splendid forests of the Julian Alps afford the greatest facilities. The most important branch of its trade is the export from Hungary, to which two railways extend. Pop. 13,314; with surroundings (district of Fiume), 17,884.

Five Forks, a name given to a locality in Dinwiddie co., Va., the junction of the White Oak and Ford's road with the one leading to Dinwiddie Court-house. An important battle was fought here Apr. 1, 1865.

Battle of. The possession of this radiating centre was one of great strategic importance, inasmuch as by Ford's road the Southside R. R. could be reached, and, indeed, the whole country which the intrenched Confederate lines were intended to cover. Isolated from the extreme right of his main lines some 4 miles, to Lee it was regarded of such importance that he had detached, from the already attenuated force by which this line was held, 15,000 men, by which to hold it. The attempt to gain possession of this position had been made (Mar. 30–31) by Gen. Sheridan, with momentary success (Mar. 31), during the absence of most of the Confederate force, engaged in fighting Warren on the White Oak road, but which now, being recalled, regained possession, driving Sheridan back towards Dinwiddie Court-house. On the morning of Apr. 1, Sheridan renewed the attempt. His force now comprised his own cavalry, to which McKenzie's division had been added—about 9000 in all; together with the Fifth corps, numbering, at this time, 12,000 to 13,000. During the previous night Sheridan had been placed in command of the entire force. His plan of attack was to force, by means of his cavalry, the enemy within his works at Five Forks, holding him there by demonstrating upon his right, while under cover of this feint the Fifth corps should strike his left flank, thus detaching the whole body from Petersburg and assuring its capture. At daylight the fulfilment of this plan was successfully inaugurated; by 2 p. m. the enemy was forced behind his works, and Merritt began his work upon the Confederate right. To guard against attack from the Petersburg lines, McKenzie's division was detached to watch the road leading thence. In the mean time, the Fifth corps (Warren) had reached its position, and now advanced towards the White Oak road, crossing which it changed front, thus facing westward at right angles with the road. McKenzie now returning, having met and driven back a body of Confederates, was sent around to the right of Fifth corps. Ayres' division, forming the left of the line, was first engaged by skirmishers, which were driven back, the division advancing up to the breastworks, encountering a severe fire which extended to the left of Crawford's division (forming the right of the attacking line). The latter officer, to withdraw his exposed flank, obliqued to the right, thus uncovering Ayres' right, which now gave way under the hot flank-fire; Warren, however, at once throwing in Griffin's division, which had been massed in rear of Crawford, the line was repaired, Crawford swinging out towards the Ford road, in the enemy's rear. Ayres' division by a brilliant charge now carried the right of the intrenchments, capturing upwards of 1000 prisoners; while Griffin, whose line overlapped the Confederate position, took the works on the left and rear, with 1500 prisoners. Crawford, meanwhile, had gained Ford's road, down which he now advanced, and Merritt forcing the attack from the S., the Confederates were nearly surrounded, leaving the White Oak road to the west the only means of escape. Before this road could be reached the victorious Union army, pouring in from every direction, compelled the surrender of nearly all the Confederate force, pursuing such as escaped till after dark. Over 5000 prisoners were captured, with four guns. The Union loss was not above 1000, all told. The effect of this decisive battle was to determine Lee to abandon Petersburg, which he did under cover of night (Apr. 2), but not before his entire outer line of works had been carried during the day. One week later Lee surrendered his army at Appomattox Court-house.

Five Islands, post-v. of Colchester co., N. S., on the Basin of Minas, has considerable mineral wealth and manufactures of baryta paint, an imitation of white lead; also shipbuilding, and a cataract 90 feet high. Pop. about 600.

Five Mile, post-tp. of Hale co., Ala. Pop. 766.

Five Points, tp. of Elmore co., Ala. Pop. 370.

Five Points Mission. Long before 1850 the Five Points had come to be regarded as the plague-spot of America—the synonym of all social and moral deformity—the Sodom of the nineteenth century. How to deal with it, and with the ever-increasing class of which it was the exponent, had become a question difficult of solution. There were four churches and two mission-stations either within or immediately on its borders. These had failed to make any perceptible impression upon this mass of impurity or to retard its steady increase. Yet over this moral waste many wept and prayed. In May, 1850, Rev. Lewis M. Pease, of the New York Annual Conference of the Methodist Episcopal Church, was appointed a missionary to this field, under the auspices of the Ladies' Home Missionary Society of this Church. To the character and wants of

this locality he was no stranger, for he had been for years quietly studying both, yet with little hopes of ever applying the means which he had devised. When the time came to test the practicability of his plans he gave to his work all the love, enthusiasm, and ability he possessed, with no thought of failure, but with success ever as real, with him, as it became in the results of after years.

Aided by an advisory committee, he secured a room on the corner of Cross and Little Water streets, the very heart of the Five Points. The next step was to gain an influence over the children. This end was sought to be accomplished through their physical necessities. While the missionary was yet unknown to them he engaged with a number of boys in a game of marbles first, and then in a wholesome lunch. During the next few days he was frequently accosted by, "Say, mister, ain't you goin' ter have a Sunday-school? And you'll have cake too, won't you?" When the time came for the school there was no lack of children; and for apparent badness of material this first gathering was never surpassed. There were singing, dancing, laughing, crying, swearing, praying, strangely intermixed, and all equally earnest. A visit to the two schools now upon the Five Points will afford ample proof that from such chaos order can be evolved. The great secret of success was found to lie in attending first to the physical well-being of the children.

At this time every house in this vicinity was a den of infamy, and to lead their inmates to a better life was the work of the missionary—the means to be used, tracts, Bibles, exhortation, and prayer. Repeated failures made it apparent that as first means such agencies were not only inadequate, but inappropriate. The great first want was honest industry and proper home-influences. With much difficulty these were provided, and for years hundreds, otherwise hopeless, found their way back to virtue and respectability. The owners as well as the keepers of disreputable houses were indicted, and their trade in virtue broken up. House after house was secured by the missionary until eight were joined for the purposes of a Home. During years of varied industries here not one article was purloined, though abundant opportunities offered for so doing. Thousands of garments were given out to be manufactured by the poor. When the rescued were placed in situations and homes, as they came to be by hundreds annually, they more than fulfilled the utmost hopes entertained of them.

Employment and a home provided, the next step was a day-school. Two years before this the church of the Ascension of New York had contributed means for a day-school on the Five Points, at the solicitation of the widow of Rev. Dr. Bedell. The fund, so long kept in waiting, here found a channel for its appropriation, but with the understanding that the school should not be denominational. Sept., 1850, was the date of its commencement. This was the first of a class of schools in this country known as industrial schools. For fifteen years this school derived its entire support from the church of the Ascension.

The work of Mr. Pease, in its directly religious aspects, was denominational, and sustained by the Methodist Episcopal Church, but in its educational, industrial, and home features it was catholic, deriving its supplies from the general public. At the close of the first year the work had assumed such proportions it was deemed best to leave Mr. Pease to the temporal, and have another missionary appointed to attend to the strictly spiritual interests. Rev. John Luckey was thus appointed in May, 1851. During this and the succeeding year the famed "Old Brewery" was purchased, and a house erected on its site by the Ladies' Mission for the prosecution of their part of the work, while Mr. Pease retained the old ground. Here the agencies of the two became somewhat modified, the Ladies' Mission employing more of the temporal than at first, and Mr. Pease using all the spiritual ones ordinary in such an enterprise.

Thus were the two institutions originated, and thus have they grown up on the Five Points, great moral landmarks of the nineteenth century. The House of Industry was incorporated in Mar., 1854. Up to this period its expenses had been $48,981.87, its earnings $26,684.20, and its donations received $23,938.53, while it had provided for more than 2000 of the once wretched denizens of this region.

L. M. Pease.

Fixed Air, a name given by Dr. Black to Carbonic Acid (which see). That this gas was liberated in the burning of lime was known to Van Helmont, who called it *gas sylvestre*, but Dr. Black's name came into more general use. Fixed air is properly carbon dioxide, CO_2; carbonic acid is formed by combining this with water; it is H_2CO_3.

Fixed Oils, those oils which are not volatile without decomposition, in contradistinction to the volatile or essential oils, which evaporate at ordinary temperatures. (See Oils and Fats.)

Fixed Stars. See Stars.

Fix'ing, a name applied in Photography (which see) to the removal of the unchanged silver salts after the picture has been developed.

Fix'ture [Lat. *figo*, supine *fixum*, to "fix"], an article or structure which, in itself personal property, has been made an annexation or become accessory to real estate. There has been a bewildering variety of legal definitions given to the term, and it is hardly possible to fix upon any which would reconcile their various discrepancies and receive general acceptation; but the one here stated will probably make as near an approximation to accuracy and completeness as any that have been suggested. Annexations of this nature, when made under certain conditions and circumstances, still continue to be considered chattels, while in a different class of cases they are regarded as constituting a part of the realty, merely as a result of the change that has been effected in their situation and relations. Two structures identical in every respect, not only in construction, but also in the manner of their attachment to a house or land and in the uses to which they are applied, may be treated in law at one time as personalty, at another as realty; and as the rules as to management and disposition would be essentially diverse in the two cases, and additions to real property are very common for purposes of improvement, trade or manufacture, agriculture, etc., the "law of fixtures" is manifestly of great importance. The subtlety of the distinctions resorted to makes the subject one of exceptional intricacy, and has been the cause of much conflict in the decisions.

The question to be determined in every instance is, Has an addition to land become itself real property? It was formerly a well-established legal principle that such a result was consequent upon every case of attachment, and the rule was stated in a concise Latin maxim, as if universally applicable (*quicquid plantatur solo, solo cedit*—whatever is affixed to the soil belongs to the soil—*i. e.* becomes a part of it), but the exceptions which have been established have become so numerous that the formerly received doctrine, though still applicable as a general principle relating to fixtures, can no longer be regarded as of much practical value. In the elucidation of the subject the primary and fundamental inquiry must be whether there has been a true annexation in the legal meaning of the term. This annexation may either be *actual*, as where there is some real substantial attachment to land or buildings, or it may be merely *constructive*, as in cases where, though there is apparently no connection, and the articles are easily portable or removable, they are yet properly considered as appurtenant to certain real property and indispensable to its integrity. Thus, machinery attached to buildings, furnaces, mirrors fastened to walls, etc. would be illustrations of actual fixtures, while door-keys, window-blinds, or bells temporarily detached, fences that have been removed, but are to be replaced, etc., would constitute *constructive* fixtures. Such articles as the latter kind are, by common consent and necessarily, considered essential to the complete idea of a dwelling or a plot of land, as being requisite for its ordinary and proper use. But if, on the one hand, things originally chattels have been completely incorporated into real property, as where boards are fashioned into floors or plaster wrought into walls, or, on the other hand, chattels are merely suffered to rest upon land or lie within buildings, but are not naturally considered as essential thereto, no difficulty can arise as to whether the articles are real or personal. They are real in the former instances, and personal in the latter, beyond any possibility of doubt.

After the subject of annexation has been considered, another leading inquiry is the presumable intention with which the erections or additions were made, and by the establishment of what principles the requirements of a wise and judicious public policy would best be promoted. As the standard of "public policy" is necessarily very indefinite and general, it might be expected that the conclusions to be derived from its application would be largely determined by the more specific inquiry as to "intention," if the results which the latter afforded were entirely consistent with public welfare; and such seems to have been the case, since the rules referred to both these criteria mainly coincide. One test, however, serves to supplement and modify the other. In examining into the intent with which fixtures were erected, the actual purpose is not so much in question as the reasonably and justly *presumable* intention which the law can gather from all the attendant circumstances and the relations of the parties concerned to have been the instigating and guiding motive. When, for instance, a person sells land with cer-

tain additions upon it of the equivocal nature of fixtures, and which the purchaser may naturally have presumed to pass with the grant, and to have been intended for the permanent improvement of the property, the law will not permit the vendor to claim that his actual intent, though secretly indulged, was to consider the articles as personalty and remove them for his own use. An intent is fastened upon his conscience which his acts fairly and justly warranted, and which alone is consistent with any understanding which the opposite party could have formed under the circumstances. The dictates of public policy also support the same rule, since otherwise fraud could be readily committed, and free transfers of property would be hampered by suspicion and uncertainty. But if a vendor's actual intention is made known to the purchaser at the time of sale in regard to additions strictly within the class of fixtures, or if a chattel mortgage has been made in regard to them, which the purchaser can ascertain, presumed intent will coincide with actual intent, and the relations of the parties will be determined accordingly. Again, when additions for purposes of trade are made upon leased property by a tenant for years, it is necessarily presumable that he does not intend that they shall be permanent attachments, but that he only purposes their maintenance during the time of his tenancy. Considerations of public policy also support this conclusion, since the establishment of a prohibition upon tenants to erect fixtures which they could remove when their interests expired would materially interfere with the leasing of property and with commercial enterprise and progress. In all cases, however, in which specific contracts are made, or persons have a clear understanding of the terms upon which their interests are created, no opportunity for presumption can exist, and if the agreements be legal public policy can interpose no obstacle. The parties may determine upon what stipulations they will.

On these grounds has been made a division of the parties in regard to whom questions concerning fixtures most generally arise into two great classes: (*a*) One class consists of those interested in property on which fixtures have been erected by one having a *permanent* interest therein; (*b*) the second class is where the fixtures were annexed by one having only a *limited* interest in the land. Under the first class questions arise (1) between heir and executor of one adding fixtures to land; (2) between mortgagor and mortgagee of property on which fixtures had been erected by the former; (3) between vendor and vendee of land with fixtures thereon; (4) between vendor and contractor to buy land under similar circumstances. Under the second class questions occur (1) between landlord and tenant where the latter erects fixtures after the commencement of his lease; and (2) between tenant for life and remainder-man or reversioner. When the interests of all those varieties of parties grouped under the first class are concerned, the presumption is quite rigid that attachments to the land constitute a part of it, and consequently are governed by all the rules appertaining to real estate. Fixtures, therefore, which the law would presume to have been attached for permanent continuance will pass to heirs rather than to executors, will be conveyed under a deed or mortgage of the property to the vendee or mortgagee, or will be included within the contract of one who agrees to purchase the land. But a large number of annexations may, even in this class of instances, be considered as personal property, for those additions, as has been stated, are alone treated as realty in regard to which the legal presumption is that they were added for the *permanent improvement and habitual enjoyment* of the premises. In order to determine whether such a presumption can justly be entertained, regard is had to a variety of tests, as, for instance, to the nature of the annexation, whether bulky and unwieldy or light and easily removable; to the adaptability of the attachment to the proper and natural use of the building in which it is placed, or of the land with which it is connected; and to many diverse considerations which must evidently depend upon the circumstances of each particular case. If a building were erected in such a location and with such peculiarities of construction that it could only be used to advantage by the employment of certain machinery which had been placed within it, or could be adapted to different purposes only at great expense, the deduction would be necessarily made that such machinery was intended to be no mere temporary attachment, but that it was designed for permanence.

One test of considerable importance and frequent application is to consider the manner in which the fixture is joined to or connected with the property to which it is attached—whether it can be removed without injury to the premises, or whether its fastenings can be readily detached. This was formerly said to be the chief distinguishing test in all questions concerning fixtures, the statement being made that all objects firmly fastened were real property, while those not so annexed remained chattels; but this rule would exclude all constructive fixtures from the category of realty, and cannot be upheld. The criterion is only valuable as indicative of intention to have the articles remain constant attachments to the land. But it is so indefinite and general in its character, and leaves so much room for fine-drawn distinctions and delicate subtleties of discrimination whose reasonableness is oftentimes difficult to discern, that to this cause alone is attributable much of the confusion in the legal decisions upon the subject of fixtures. Thus, machinery attached to a building by means of rods passing through joists and there secured by nuts has been held to be real estate, while looms merely fastened to the floor by screws have been considered personalty. Some courts have gone so far as to hold that articles fastened by bolts or nails would become realty, when if fastened by screws they would still remain chattels, since screws can be so much more readily removed that it is natural to believe that in the latter case a removal was intended. Other courts deny the distinction. In regard to such objects as stoves, boilers, kettles, and various articles of machinery of moderate size, the cases have exhibited much discrepancy. Buildings erected upon wooden blocks merely are generally considered chattels. In New York a statue resting upon a pedestal in the garden of a dwelling-house has been decided to be real property as between a mortgagor and a mortgagee, as probably erected for permanent continuance. The rolling-stock of railroads is by some courts considered real, by others personal property, in perplexing variety. As between mortgagor and mortgagee the decisions preponderate that it may be treated as real estate. But by a recent decision in New York it has been held to be personal property. (*Hoyle* vs. *Plattsburg and Montreal R. R. Co.*, 54 New York 314 [1873]).

But it would be useless to multiply illustrations; only the general principle can be satisfactorily stated. In New York a particular provision has been established by statute in regard to the conflicting claims of heir and executor. In accordance with this, "things annexed to the freehold or to any building for the purpose of trade or manufacture, and not fixed into the wall of a house so as to be essential to its support, are deemed assets, and go to the executor." The common-law rule is that trade-fixtures, in regard to the rights of those classes of persons that have hitherto been considered, are not to be treated differently from fixtures of other kinds, but in the relations of landlord and tenant it will be seen that they attain to great importance.

In regard to the rights of those persons forming the second class above mentioned—viz. landlord and tenant and tenant for life and remainder-man—the law concerning fixtures is very different. Both the question of presumed intent and the dictates of public policy, as has been seen, lead to conclusions essentially diverse from those which have been stated as applying to other cases. But the doctrine of presumed intention is not carried so far as to permit a tenant to erect anything he may choose upon his landlord's premises, with the privilege of removing it when his tenancy is ended, since the landlord's interests, which are equally deserving of protection, might be unduly sacrificed. The tenant, therefore, may only take away additions he has made when they belong to one of these special classes. (1) He may remove all fixtures which he has erected for purposes of trade or manufacture. This rule is established to promote business enterprise. Thus, brewing-vessels, cider-mills, closets, shop-counters, engines, presses, etc. may all be rightfully removed. The rule has also been extended to buildings constructed by the tenant for purposes of trade, as, *e. g.*, additions to an inn, tavern-keeping being deemed a species of trade. The removal must be made by the tenant so as not to injure the landlord's premises. (2) In the U. S. the general rule is established that fixtures annexed for agricultural purposes may be removed. In England a contrary rule was maintained at common law, but some exceptions have been established by statute. Nursery trees would be an illustration of agricultural fixtures. (3) Articles erected for domestic use and convenience and the necessary enjoyment of the premises are, in general, removable. This privilege would not probably extend to objects of mere ornament. In any case, it is necessary that the tenant should exercise his right of removal before the expiration of his interest and his yielding up possession, as otherwise he will be deemed to have abandoned the fixtures to his landlord. But the executor of a tenant for life, as the necessity of the case demands, has a reasonable time after the tenant's death to take away the fixtures.

The rights of landlord and tenant may be variously modified by mutual agreement. They may contract to consider certain articles chattels which would otherwise become real estate according to general rules, and *vice versâ*.

It is quite common to find a provision in leases that the fixtures at the end of the term shall be taken by the landlord at a valuation made in a specified manner; as, *e. g.*, by appraisers selected by the parties. By such an agreement, matters which, legally speaking, would be real estate may be made to appertain so far to the tenant as to entitle him to compensation. (Consult AMOS AND FERARD on *Fixtures;* WASHBURN on *Real Property;* CHITTY on *Contracts*, etc.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Flac'cus, a *cognomen* of several Roman families, of which the most important belonged to the gentes Fulvia, Valeria, and Pomponia. The poet HORACE (which see) also bore this name. Among the illustrious men of the name we may mention (1) LUCIUS VALERIUS FLACCUS, consul with C. Marius in 100 B. C., censor in 97, and again consul in 86 B. C., when he was murdered by Fimbria.—(2) Q. FULVIUS FLACCUS, consul 237, 224, and 212 B. C., often prætor, and distinguished in the second Punic and many other wars, in which he was fortunate; but his character is stained by his cruel treatment of the Campanians. His family produced many public men, among whom his son, Q. Fulvius Flaccus (d. 173 B. C.), and his grandson, M. Fulvius Flaccus, were the most renowned. The former was a distinguished general in Spain—the latter a partisan of the Gracchi, and was put to death 121 B. C.

Flaccus (CAIUS VALERIUS), an epic poet who flourished in the reign of Vespasian. He is supposed, from some words of Martial, to have been a native of Padua, though, from the name given in the Vatican manuscript (G. Valerius Flaccus Balbus Setinus), it is thought that he was born at Setia. He d. in the reign of Domitian, probably about A. D. 89, and Quintilian speaks of his death as a loss to literature. He was the author of a poem entitled *Argonautica,* on the expedition of the Argonauts, in imitation of the poem of Apollonius of Rhodes, which extended to eight books, but was left unfinished. His style is an imitation of that of Virgil, but more declamatory and artificial. Its involved construction and too crowded figures often produce obscurity, while the poet too often and on too slight occasions calls in the aid of the gods. The best editions are those of Burmann, Utrecht, 1702, Leyden, 1724; of J. A. Wagner, Göttingen, 1805, 2 vols.; and of G. Thilo, Halle, 1863. H. DRISLER.

Flaccus (SICULUS), a writer on agriculture who probably lived soon after the reign of Nerva. Nothing is known of his life. Of his extant fragments the most important is *De Conditionibus Agrorum,* which is full of legal learning and valuable information.

Flaccus (VERRIUS), a freedman by birth, distinguished as a grammarian and teacher at Rome under Augustus. He was so successful in his method of instruction that the emperor placed his own grandsons under his charge, and allowed him to bring his other pupils into the Palatium, on the condition that no additions should be made to their number. At his death, under Tiberius, a statue was erected to him in the forum at Præneste. He was the author of several works, historical, antiquarian, and grammatical, the most important of which, and the one the loss of which is most deplored, was entitled *De Significatu Verborum.* This is referred to occasionally by later grammarians, and a few extracts from it (and the other writings of Flaccus) have been collected by Lindemann in his *Corpus Grammat. Latinorum,* but it was superseded in general use by the abridgment of Festus, which no doubt caused the final disappearance of the larger treatise. (See FESTUS, POMPEIUS.) A brief notice of Flaccus is given by Suetonius in his *De Grammaticis et Rhetoribus.* H. DRISLER.

Fla'cius, Flach, or **Vlacich Francowitz** (MATTHIAS), one of the greatest Lutheran scholars and polemics, "the Achilles of pure Lutheranism," of the second generation of the era of the Reformation, b. Mar. 21, 1520, at Albona, in Venetian Illyria (hence *Illyricus*). He desired to become a monk, but was dissuaded by Lupetinus, provincial of the Minorites, who put into his hands some of Luther's writings and counselled him to study theology in Germany. He went to Bâle 1539; became private teacher at Tübingen 1540; went to Wittenberg 1541. Out of great spiritual darkness and distress, connected with his views of election, he was led by Luther, of whose faith he became one of the most earnest defenders. He received the chair of Hebrew 1544; in 1545 he married; 1547 the Schmalcald war compelled him to leave Wittenberg. In the time of theological conflict on the Adiaphora which followed the INTERIMS (which see), Flacius took a position of uncompromising fidelity to the principles of Luther, which Melanchthon and his school were perilling by indecision. He was a defender of the faith against open enemies and misjudging friends. (See OSIANDER, MAJOR, STRIGEL, SCHWENKFELD, SYNERGISM.) In Magdeburg he began (1557) his immortal church history, the *Magdeburg Centuries,* in which he was the main worker, though he had a body of able colaborers, among whom were Wigand, Judex, Faber, and Nicholas Amsdorf. Brischar, a Catholic divine, says: "It is impossible to ignore the erudition, the acuteness and the gift of combination which express themselves in this book." The *Catalogus testium Veritatis* (1556) was meant to trace in a long line of witnesses the evangelical protest of the ages against the errors of Rome. In the same interest he published the *Missa Latina* (1557), a copy from a missal of about A. D. 700. In 1561 he was dismissed from the University of Jena for his resistance of the encroachments of the state on the liberties of the Church. His whole after-life was one of wandering and suffering, amid which he finished his other great works, the *Clavis Scripturæ Sacræ* (1567) and his *Glossa on the New Testament.* He d. in the hospital at Frankfort Mar. 11, 1575, at the age of fifty-five, having displayed a tenacious courage, mostly for the truth, not unlike that of Luther. "He was," says Kling, "a man of faith, one of that cloud of witnesses of whom the world was not worthy." A lack of metaphysical accuracy in the use of language—which, however, he finally modified—involved him in a controversy which arose from his assertion that ORIGINAL SIN (which see) is a substance, and not accidental. This view, called "Flacianism," was condemned, in the strict sense of its phraseology, in the CONCORD, FORMULA OF (which see). Its adherents were styled Flacians and Substantialists. (*Lives* by RITTER, 1725; TWESTEN (vindicating Flacius), 1844; PREGER (the best), 2 vols., Erlangen, 1859–61 (reviewed in the *Bibliotheca Sacra,* 1862).) C. P. KRAUTH.

Flag, the name of various long-leaved aquatic plants, such as sweet-flag (see ACORUS CALAMUS), blue-flag (see IRIS), and cat-tail flag (see CAT'S TAIL). The fixed seaweeds are often called flags.

Flag. Webster defines *flag,* "that which *flags* or hangs down loosely" (Lat. *flaccere*); "an ensign or colors;" a cloth bearing usually certain devices and attached to a staff; it is synonymous with the Fr. *drapeau.* It is, in fact, one of the forms of *insignia* by which nationality is distinguished—by which the sway or jurisdiction of a political power is asserted. Hence, its predominating use in those organizations of a country by which its sovereignty and jurisdiction are asserted and maintained—*i. e.* the army and navy. Hence, too, its powerful appeal to the patriotism of all those who see in it the symbol not only of their country's power, but of its claim upon themselves. Pendent over a fortress or ship, and throwing out, with the varying breeze, its folds to the four quarters of the heavens, it seems to hold above them the imperial ægis of a nation's power. A history of such "insignia" would occupy volumes. The Chinese flags or banners are said to have been, in essentially their present forms, in existence at a date earlier than the siege of Troy. The term "vexillum" of the Romans applies to anything that is *borne as an ensign,* whether it be a flag or banner, or some other device; but it became specifically applied to the *drapeau à croix* (*i. e.* a flag suspended to a horizontal cross-piece, attached by cords to the upright staff, with which arrangement the term "banner" has become identified) after the time when the emperor Constantine introduced the LABARUM (which see); and *this* form of flag has been ever since affected by the Church, as it is now. It is also the most usual form of the banners of lay societies.

In this country, during the early days of the Revolution, the colonists made use of flags of various devices; the first legally established national emblem was that adopted by Congress June 14, 1777, which provided that the flag of the thirteen United States should be thirteen stripes, alternately red and white; that the union be thirteen stars, white in a blue field, representing a new constellation: this form was altered by act of Jan. 13, 1794, which provided that after May 1, 1795, the flag of the U. S. should consist of fifteen stripes, etc., and fifteen stars, etc.; in 1818, however, act of April 4, the flag was re-established as thirteen horizontal stripes, alternately red and white; the union to consist of twenty stars, white, in a blue field; one star to be added to the union on the admission of every new State; the addition to be made on the 4th day of July succeeding such admission. This flag went into effect July 4, 1818, and is the present prescribed national emblem of the U. S. of America.

In the U. S. army the garrison flag is the national flag, 36×20 feet; the storm flag is 20×10 feet; and the recruiting flag 9 feet 9 inches by 4 feet 4 inches. Each artillery regiment has two silken colors—the first, the national emblem, 6 feet 6 inches fly and 6 feet deep on the pike; the number and name of the regiment embroidered with gold on the centre stripe. The second, or regimental color, to be yellow, of same dimensions as the first, bearing in the centre two cannon crossed, with the letters U. S.

above and number of regiment below. Infantry regiments have likewise two colors of silk and of similar size—the first of which is the national flag, with the number and name of the regiment in silver on the centre stripe; the regimental color to be blue, with the arms of the U. S. embroidered in silk on the centre; the name of the regiment in a scroll underneath the eagle. Camp colors are 18 inches square, of bunting—white for infantry, red for artillery, with the number of the regiment thereon. Each mounted regiment has a silken standard bearing the arms of the U. S. embroidered in silk on a blue ground, with the number and name of the regiment in a scroll underneath the eagle. Each company has a swallow-tailed silken guidon, half red, half white, divided at the fork, the red above; on the red the letters U. S., and on the white the letter of the company in red.

There are flags also which are symbols of individual authority. Among such are royal standards, flag officers' flags, etc. An admiral's flag is usually the flag of the country which such admiral serves, with the exception of the union. The flag of the admiral, vice-admiral, and rear-admirals of the U. S. is rectangular, and consists of thirteen alternate red and white stripes. The admiral hoists this at the main; the vice-admiral at the fore; the rear-admiral at the mizzen. Should there be two rear-admirals present, the junior hoists a flag at the mizzen similar to the one described, with the addition of two stars in the upper left-hand corner. The commodore's flag differs from that of the admiral's in form alone, it being a swallow-tail instead of rectangular.

Should the President go afloat, the American flag is carried in the bows of his barge or hoisted at the main of the vessel on board of which he may be. In foreign countries the royal standard is worn at ceremonies in honor of the sovereign or at which the sovereign may be present.

The white flag is the symbol of peace, and is used as the flag of truce or in token of surrender.

The red flag, bidding defiance, is often used by revolutionists. In our service it has a more peaceful signification, and when hoisted at the fore of a vessel shows that she is receiving or discharging her powder.

The yellow flag shows a vessel to be in quarantine.

Flags are said to be at half-mast when they are hoisted but half the height at which they are ordinarily worn, and in this position designate mourning.

Dipping the flag is a salute to a fort or passing vessel by lowering it slightly and hoisting it again. (See Gen. S. Hamilton's *Hist. American Flag.*) J. G. Barnard.

Flag′ellants [Lat. *flagellum*, a "whip," "scourge"], a name given to companies of persons in the Middle Ages who marched and sang and scourged themselves in public places for their own and others' sins. Self-flagellation, as a penance, had its origin in the monasteries, and is of early date. It was first recommended to others than monks about the year 900 by Regino (d. 915), abbot of Prüm in Rhenish Prussia, in his *De Disciplina Ecclesiæ*, ii. c. 442, but it did not become a popular penance till after the time of Peter Damiani (1007–72 A. D.), by whom it was earnestly advocated. During the thirteenth, fourteenth, and fifteenth centuries the Flagellants became a sort of intermittent order of fanatics, frequently reappearing here and there in times of extraordinary declension or distress. Three such outbreaks are specially prominent: 1, in Upper Italy, 1260 A. D., in connection with the struggle between the Guelphs and the Ghibellines; 2, in 1349 A. D., while the Black Plague was raging; 3, in 1414, when so many good men were waking up to the corruptions and errors of the papal Church. The Flagellants generally enrolled themselves for the term of 34 days—a day for each year in the life of Christ. Stripped to the waist and scourging themselves with knotted whips, they marched with songs and banners from town to town. In market-places they would fling themselves upon the ground, with arms extended in the form of a cross, plying their whips till the blood came. Blood so drawn was thought to have an atoning efficacy. Other wild notions were entertained. The celebrated John Gerson (1363–1429) wrote against them, and they were condemned by the Council of Constance (1414–18). Their last appearance in Germany was in 1481. In spite of all their extravagances, their existence served as a sort of protest against the blind ritualism of the age. (See Boileau's *Histoire des Flagellans* (1701), and Delolme's *History of the Flagellants among Different Nations* (1785); but the standard authority on the subject is Dr. E. G. Förstemann's *Die christlichen Geisslergesellschaften* (1828).) R. D. Hitchcock.

Flageolet′, a musical instrument consisting of a wooden or ivory tube with a mouth-piece at one end, the other end being open. It has one large aperture near the mouth-piece and six or more finger-holes. Its invention is ascribed to one Flavigny in 1580, but the flutes of the ancients, like those of some modern barbarous nations, were simply flageolets.

Flaget (Benedict Joseph), D. D., Roman Catholic bishop of Bardstown, Ky., b. in France Nov. 7, 1763, was consecrated Nov. 4, 1810. The name of the diocese was changed, and he became in 1848 bishop of Louisville. D. Feb. 11, 1850. His *Life* has been written by Archbishop M. J. Spalding.

Flagg, tp. of Ogle co., Ill. Pop. 2288.

Flagg (Azeniah C.), American Democratic politician, b. in Clinton co., N. Y., in 1790, served as a soldier in a New York regiment in the war of 1812, participating in several engagements; in 1823–24 represented Clinton co., N. Y., in the State legislature, and was secretary of New York State from 1826 to 1833. In 1834 he was appointed State comptroller, and held the office for five years. In 1842–46 he was reappointed to the same position. He contributed for years to the Albany (N. Y.) *Argus*, opposed the U. S. Bank, and was a founder of the Barnburner (afterwards the Free-Soil) party. He was elected comptroller of New York City in 1852 and in 1855. In 1859 he became blind, and d. in New York City Nov. 25, 1873.

Flagg (Edmund), American journalist and author, b. at Wiscasset, Me., Nov. 24, 1815; graduated at Bowdoin College, Me., 1835; taught at Louisville, Ky.; was admitted to the bar in 1837; practised with S. S. Prentiss at Vicksburg, Miss., in 1844–45; conducted the St. Louis (Mo.) *Evening Gazette*, and was reporter of the county courts. In 1848–50 was secretary to E. A. Hannigan, U. S. minister at Berlin, Germany; in 1850–51 consul at Venice. Since 1854 he has been chief clerk of a commercial bureau in the state department at Washington, D. C. Mr. Flagg has contributed to and conducted during his life Prentice's *Louisville* (Ky.) *Journal*, the *St. Louis Daily Commercial Bulletin*, *Louisville* (Ky.) *Literary News-Letter*, and published *The Far West* (2 vols., 1838), *Carrero, or the Prime Minister; Venice, The City of the Sea*, dramas, etc.

Flagg (George Whiting), a painter, b. in New Haven, Conn., June 26, 1816, a nephew of Washington Allston, with whom he studied, and from whom he derived his most earnest impulses toward excellence in his profession. His passion for art was intense and appeared early. Was considered in his youth a prodigy, and great expectations were cherished of him. His boyhood was passed in Charleston, S. C., his youth in Boston, his early manhood in London. His principal pictures in America are in New Haven—*The Landing of the Pilgrims, The Landing of the Atlantic Cable, The Good Samaritan, Washington receiving his Mother's Blessing*. They were painted for James Brewster, Esq. In London he painted portraits mainly, though his taste for composition pictures occasionally showed itself. The *London Art Journal* spoke in praise of a canvas of his, *Columbus and the Egg*: "It is generally low in tone, but rich and harmonious in color, and the heads are distinguished by much nobility of character." Hawthorne's *Scarlet Letter* gave him a subject, and Byron's *Haïdee* another. His resemblance in style to the artists of the Venetian school is due probably to his close association with Allston. Mr. Flagg has been a sufferer from ill-health, and consequently has done comparatively little work in later years. At present he is living at New Haven. O. B. Frothingham.

Flagg (Jared Bradley), D. D., brother of George, b. in New Haven June 16, 1820; began drawing at the age of thirteen; studied with his brother and uncle; devoted himself mainly to portrait-painting; went in 1849 to New York, and exhibited in the National Academy his *Angelo and Isabella*, which secured his election as an academician. In 1854, Mr. Flagg engaged in the study of theology, and took deacon's orders in the Protestant Episcopal Church. After living in Brooklyn, L. I., for some years as rector of Grace church, he removed to New Haven, and thence to New York. His clerical duties have not put a stop wholly to his career as an artist. He has painted many portraits, some ideal pieces, and has been active in the establishment of the art-gallery at Yale College. O. B. Frothingham.

Flagg (J. F. B.), M. D., American physician, b. in Boston, Mass., 1804, resides in Philadelphia, Pa., and has written *Ether and Chloroform, their Employment in Surgery, Dentistry, Midwifery, Therapeutics, etc.* (1851).

Flag Officer, a term applied to those officers who command fleets or squadrons, and are thereby entitled to hoist a flag at the mast-head of the vessel (called the flagship) in which they sail, as the token of their authority. Flag officers, in our navy as well as those of other naval powers, are divided into the grades of admiral, vice-admiral, rear-admiral, and commodore. Their stations in time of action or of tactical exercise depend somewhat upon the size of the fleet; but the commander-in-chief and the commanding

officers of divisions, if large, should have no fixed position, but be at liberty to move at their discretion. They should ordinarily, however, be found near the centres of their commands. They direct the fleet or squadron under their command as to their diplomatic as well as to their naval relations. RAYMOND P. RODGERS, U. S. N.

Flag'staff Plantation, tp. of Somerset co., Me. P. 112.

Flag'stone, stone cut or split in thin layers, and used for walks, floors, etc. In all cities and towns the consumption of stone for this purpose is large; and since the best quality of flagging is comparatively rare, it becomes an article of very considerable value, and one which in its production and transportation gives employment in the U. S. alone to some thousands of workmen and several millions of dollars of capital. Good flagging is strong and smooth without being slippery; hence, a stone which will furnish it must be readily worked into slabs of from two to four inches in thickness, with an area of from ten to a hundred or even more square feet, and one on which a uniform surface can be readily produced. By far the greater part of flagging used is composed of stone which splits readily into slabs of the proper thickness, and of which the natural surfaces are so smooth as to require little dressing. The rock which best fulfils these requirements is generally a laminated sandstone, but mica-slate, marble, and granite are frequently used for the walks of our cities. Some of our limestones cleave readily and afford a handsome flagging, but when worn smooth in wet weather they become slippery, and from this cause dangerous. The same objection holds against granite. This material is frequently wrought into slabs of large size, which are so laid as to stretch entirely across the sidewalk in front of business buildings; but, while very strong and durable, and forming a convenient roof to vaults below, they are rough and uncomfortable to the feet when new, and are dangerously smooth when worn. The perfection of flagging is found in a strong, fine-grained sandstone laid in accurately joined flags of considerable size, of which the surfaces have been sawed or rubbed. Even when wet the grain of such a stone holds the foot firmly and makes walking easy and pleasant. Marble flagging has, from its crystalline, granular texture, the same excellence with sandstone, but it is much more expensive. Some varieties of mica-slate afford good flagging, like that in front of the Capitol at Washington, which is clean, bright, and silvery in appearance and pleasant to the feet; but it wears unevenly, and is apt to crimp at the edges. One of the best varieties of flagging known in the world is that most generally used in New York, and popularly known as the *bluestone.* This is a fine-grained, somewhat metamorphosed sandstone, derived from the Hamilton group, and chiefly quarried on the Hudson at Rondout. It lies in strata from half an inch to six inches in thickness, which cleave readily, work with accuracy, and are very strong. A belt of this formation stretches across from the Hudson to the line of the Erie R. R. near Port Jervis; much good stone coming to market from the last-mentioned district. As this stone is so readily quarried, and the facilities for its transportation are so great, it is furnished in New York at a very low rate; and the inhabitants of this city may congratulate themselves upon having an inexhaustible supply of such material to meet the great demand created by the rapid extension of its street lines. Slabs of any required dimensions can be furnished at the Rondout quarries, and in several instances they have been laid in New York 12 by 15 feet in area. The natural surface of these flags is so smooth that they usually require but little dressing. Where more perfect finish is desired they are crenelled, sawed, or rubbed. When so treated this stone affords a walk not surpassed in excellence by that made from any other material. Another excellent flagging-stone, which has recently found its way to the New York market, is the "Buena Vista flagging," which comes from Southern Ohio. This is a fine-grained sandstone, considerably softer than the Rondout flagging. It is brought in large slabs, of which the surfaces are sawed. When accurately laid, these form a sidewalk scarcely excelled by any other. It is, however, somewhat less durable than the bluestone.

Artificial flagging made from some preparation of asphalt or hydraulic cement has of late come into quite general use, and is, in the judgment of many, destined to supersede stone flagging. While well adapted to certain kind of walks, especially those which traverse public parks, it is very doubtful whether the asphalt or cement can ever be given the strength and durability necessary for the walks of our crowded thoroughfares. (See FLEXIBLE SANDSTONE.)
J. S. NEWBERRY.

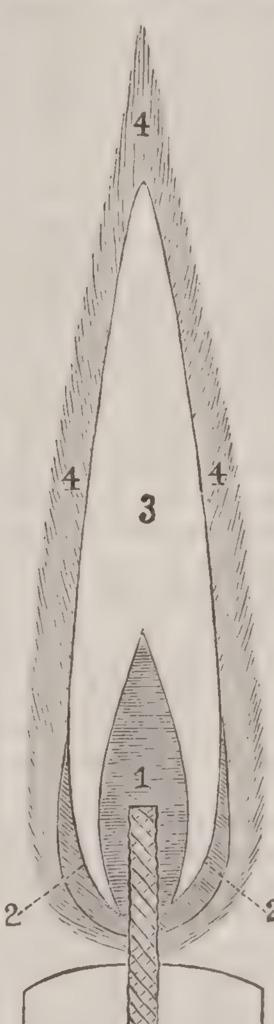
Flahaut de la Billarderie, de (AUGUSTE CHARLES JOSEPH), COUNT, French general and diplomatist, b. at Paris Apr. 20, 1785, entered the army at the end of 1799, became a colonel in 1809, and was aide-de-camp to Napoleon in 1813. In Oct., 1813, distinguished himself at Leipsic, and was made a general of division and count of the empire. In June, 1815, fought at Waterloo; in 1830, by the Revolution, was restored to his peerage and rank in the army; was ambassador to Berlin in 1831, to Vienna in 1841–48; was made senator in 1853; was ambassador to London Dec., 1860, and d. in Paris Sept. 2, 1870.

Flam'borough Head, a promontory on the Yorkshire coast, England. It is formed by a range of steep, almost perpendicular chalk-cliffs from 300 to 450 feet high, and bears on its headland a lighthouse whose revolving light (lat. 54° 7′ N., lon. 5′ W.) can be seen at a distance of 30 miles. Across the peninsula runs a ditch with ruins of old fortifications, called "Danes' Dyke."

Flamboyant [Fr. "flaming"], a style of Gothic architecture which was exhibited in France after the decline of the art had commenced. It takes its name from the somewhat flame-shaped tracery which is so frequent in this style. It prevailed chiefly in the fifteenth century. The Flamboyant style is marked by great attention to the minute details of ornamentation, and a too general neglect of the total effect. Hence it is regarded as a debased style.

Flame [Lat. *flamma*], a mass of visibly glowing gas; ordinarily, of a gas in process of combustion with air or oxygen. But flame may accompany the combination of any gaseous bodies, provided the action be sufficiently intense to produce luminosity; or it may even result from the intense heating of a gas whose nature is not thereby changed. As a consequence of their high temperature, the gases constituting a flame will have a tendency to rise and form upward currents; this fact, and the circumstance that combustion as well as cooling proceeds from the outside inward, determines the erect and tapering form of undisturbed flames.

Structure of a regular Hydrocarbon (candle, lamp, or gas) *Flame.*—In a candle-flame we readily distinguish four distinct portions, differing both in their aspect and in the nature of the processes producing them: 1. Immediately surrounding the wick there is a dark space of conical shape (No. 1 of figure) filled with the combustible gases formed by the first action of the heat on the fuel (wax, tallow, etc.), together with those flowing in through the base of the flame. The temperature in this dark space is quite low, and it is void of oxygen, so that neither will gunpowder explode nor phosphorus burn in it. 2. Surrounding the base of the dark cone and the lower portion of the luminous part is a cup-shaped zone (No. 2), of a blue tint, faintly luminous, but sharply defined. It results from the sudden and complete combustion of the gases of the dark cone, with a full supply of air (or oxygen) striking them from without. When the natural draught is artificially increased beyond a certain limit, the edges of the blue cup contract, and finally coalesce above, suppressing the luminous part, and forming a short conical blue flame; or if the blowpipe be used, there results an elongated cone, forming part of the "oxidation flame" of blowpipe practice, but itself possessing a slight reducing action. Its temperature is high. 3. Above the dark cone (1) lies the luminous portion of the flame (No. 3), when it exists at all; its extent depending (other things being equal) upon the relative amount of carbon present in the fuel. In a wax, tallow, or coal-gas flame it forms a slender rounded cone with hollow base; while in that of alcohol it appears as a thin paraboloid (inverted cup-shape) zone. Its prominent characteristic is the separation of highly heated and therefore luminous carbon, out of its combinations with hydrogen, by the intense heat of No. 4, the exterior zone of final and complete combustion. The latter, a faintly luminous halo (the "outer veil"), surrounds the flame on all sides, and is its hottest portion. The maximum of temperature is a little *above* the point of the luminous cone, where we also find the highest *oxidizing* power; while just *within* the luminous point high temperature and the presence of free carbon co-operate to produce the most energetic *reducing* action.



Flame.

Luminosity of Flames.—The luminosity of flames varies between wide limits, from the faintly luminous and (in

daylight) almost invisible flames of hydrogen, carbonic oxide, or sulphur, to the intense brilliancy of the "Bude light," in which coal gas is burnt with pure oxygen. Frankland has shown that faintly luminous flames may become intensely so when the gases are strongly compressed during combustion. Under ordinary circumstances, however, useful luminosity is dependent upon the presence in the flame of a sufficient (yet not excessive) amount of a highly heated solid; usually carbon, which in ordinary candle, lamp, or gas flames is liberated from the combustible gases by the influence of the high temperature of the exterior portions of the flame, through which no free oxygen can pass inward. But when illuminating gas is, previous to combustion, mixed with air or oxygen sufficient for the complete combustion of all its ingredients, the separation of carbon, and consequent luminosity, will be suppressed, while the temperature is greatly increased. This is the principle upon which the "Bunsen burner" is based, the body of whose flame represents the blue cup (No. 2) or the "oxidation cone" of the blowpipe. By varying the supply of air the flame may thus, at will, be made to exert an oxidizing or a reducing effect—a principle of most important practical application in the management of the reverberatory and gas furnaces used in metallurgical operations, where the flame, urged either by draught or blast, or by both combined, is readily varied in character to suit the requirements of any stage or kind of process.

Feeble luminosity may also be caused by an inadequate amount of carbon in the fuel, or by an excessive supply of carbon, or fuel. In the former case, however high the temperature, sufficient solid carbon is not separated to throw out light; as in the alcohol flame. In the second (as in a turpentine or coal-oil flame in open air), a sufficiency of air cannot find access to the very dense combustible vapor to produce a high temperature. Hence, the carbon is but feebly ignited, and much of it escapes unburnt as smoke or soot. The remedy is to adequately increase the supply of air by means of draught (chimneys) or blast.

The temperature of flames depends primarily upon the nature of the fuel, upon the rapidity and completeness of combustion, and upon the amount of inert gas mixed with the active ingredients. The hottest flame is that of pure hydrogen burning with half its bulk of pure oxygen; but a hydrogen flame burning in air is less hot, because four-fifths of the air is an inert gas (nitrogen), which has also to be heated. Still less hot is the flame of coal gas in air, because it consists in part of carbon, whose combustion generates less heat than does that of hydrogen.

When, in a mixture of combustible gas or vapor with air or oxygen, either of the two is present in great excess over the proportion required for complete combustion, the mixture will either not burn at all, or will burn with a quiet flame. But if neither be in great excess, a flame will instantly fire the entire mass, and an *explosion* ensues. To prevent the flame of the miner's lamp from thus setting fire to explosive mixtures of marsh gas and air formed in coal-mines ("fire-damp"), a fine wire screen, through which flame will not communicate, is made to enclose the lamp flame.

The color of flames depends essentially upon the substances that are vaporized within them, and is very characteristic, especially when observed with the spectroscope. Thus, compounds of sodium (such as common salt) produce a yellow tint; copper, green and blue; calcium (lime), orange red; strontium, crimson ("red fire"); potassium, violet, etc.

The appearance of flame is sometimes presented by dense masses of small particles, either themselves red hot or strongly illuminated from an outside source. Such is doubtless the nature of the immense sheets of "flame" often reported by unskilled observers as issuing from volcanoes during eruptions; which are in reality but jets and clouds of volcanic ashes and smoke lighted up by the fiery masses in the crater. *True flame* (of hydrogen, sulphur, etc.) is also sometimes emitted from volcanic vents, but much more rarely, and on a comparatively small scale.

E. W. HILGARD.

Fla′men, the name given to a Roman priest, devoted to the service of one deity. They were at first three (established by Numa), but were increased ultimately to fifteen, constituting two distinct classes—viz. (1) the *Flamines majores*, consisting of only three, the *dialis*, *martialis*, and *quirinalis*, consecrated the first to Jupiter, the second to Mars, and the third to the deified Romulus, and selected from the descendants of patricians only; and (2) the twelve *Flamines minores*, who usually were of the plebeian order. The office was for life, but a flamen could forfeit it by neglect of duty, and was liable to removal if an ill-omened event disturbed any of his sacred performances. Their characteristic dress was the *apex*, a cap either conical or close-fitting, having at the top a pointed piece of olive-wood, surrounded at its base by a lock of wool (*filum*, whence, according to Varro and Festus, the word *flamen* was obtained, but by Plutarch derived from *pileum*, "hat"), the *læna* or mantle, and the laurel wreath. The most distinguished of the flamens was the *dialis*, who was required to be the son of parents united in marriage by confarreation. The *flamen dialis* immediately after his appointment, though a minor, was relieved from parental control, and became *sui juris*. He was never required to give oath, had a seat in the senate *ex officio*, and, like the highest officers of state, had the use of the *sella curulis* (or chair of state) and of the *toga prætexta*, the assistance of a lictor, the right of sanctuary for his house, and the high prerogative of procuring pardon or respite for criminals. On the other hand, the *dialis* suffered numerous restrictions and deprivations; as, *e. g.*, he was not allowed to mount, or even to touch, a horse, wear a ring, or to touch a dead body. He was forbidden to sleep out of his own bed for three consecutive nights, to leave the city even for a single night (a rule modified by Augustus and Tiberius), and was obliged to resign and remain single upon the decease of his wife, who assisted him in the performance of some of his sacred functions. She was called *flaminica*, and was subject to restrictions like those by which her husband was fettered. In Rome's earlier days the flamens were nominated by the *comitia curiata* (in the case of the dialis three being designated), but after the enactment of the Lex Domitia (B. C. 104) they were named by the *comitia tributa;* and when thus nominated were received and installed into office by the *pontifex maximus*. (See FESTUS, s. v. *Maximæ dignationis* and *Majores flamines;* RAMSAY, *Manual of Roman Antiquities*, s. v.; SMITH, *Dictionary Greek and Roman Antiquities*, s. v., where the Latin authors are freely referred to.)

J. H. WORMAN.

Flamin′go (*Phœnicopterus*, Linn.), a genus of birds

Flamingo.

remarkable for the length of their necks and legs, webbed feet, and curiously curved lamellar bills. This genus constitutes the anomalous family of the Phœnicopteridæ, the affinities of which are probably with the Anseres, or swimming-birds, though it is still placed by many with the Grallæ, or waders. Several species are known. *Phœnicopterus ruber*, Linn., is met with on the Florida keys; *Phœnicopterus antiquorum*, Tem., occurs on the southern coasts of Europe.

EDWARD C. H. DAY.

Flamin′ian Way [Lat. *Via Flaminia*], the principal northern road which led from ancient Rome. It was laid out from the Flaminian gate of Rome to Ariminum by C. Flaminius the Elder in 220 B. C., during his censorship, and with its subsequent extensions and branches finally reached nearly all the large towns of Northern Italy. Its remains are still visible at various points.

Flamini′nus (TITUS QUINTIUS), a great general of the Romans, b. about 230 B. C., became quæstor in 199 and consul in 198; invaded Epirus, which he subjugated; gained in 197 the great battle of Cynoscephalæ over Philip, the last king of Macedon; proclaimed at the Isthmian Games, in 196, the independence of Greece; overthrew the tyrant Nabis in the Peloponnesus in 195; triumphed in 194; was ambassador to Greece in 192–190; censor in 189; envoy to Prusias of Bithynia 183, designing to arrest Hannibal, who was an exile there. D. about 174 B. C.—His brother, LUCIUS QUINTIUS FLAMININUS, was an able general and admiral, notorious for vice and cruelty.

Flamin′ius (CAIUS), an eminent Roman of plebeian birth, became tribune 232 B. C., and carried an agrarian

law against the strongest opposition; was prætor in 227; as consul in 223 defeated the Insubrian Gauls and triumphed, but was deprived of his office by the senate; was magister equitum to M. Minucius Rufus 221, but both had to resign immediately, on account of the squeaking of a mouse, an evil omen; was one of the censors in 220, and constructed the Flaminian Way and the Flaminian Circus; again consul in 217; marched against Hannibal, and was defeated and slain in the battle of Lake Thrasymene June 23, 217 B. C. Flaminius was a man of singularly bold and decided character, hated by the aristocrats and idolized by the common people.—His son, CAIUS FLAMINIUS, was an able general, consul in 187 B. C.

Flammarion (CAMILLE), French astronomer, b. at Montigny-le-Roi (Haute-Marne) Feb. 25, 1842, studied in the imperial observatory from 1858 to 1862, when he became editor of *Cosmos.* In 1865 was appointed scientific editor of the *Siècle;* in 1868 made several balloon ascensions to study the atmosphere at great altitudes. Has written *La Pluralité des Mondes Habités* (1862), *Les Mondes Imaginaires et les Mondes Réels* (1864), *Les Merveilles Célestes* (1865), *Dieu dans la Nature* (1866), *Histoire du Ciel* (1867), *Contemplations Scientifiques* (1868), and *Voyages Aériens* (1868); has some distinction as a popular writer and Spiritualistic lecturer.

Flam'steed (JOHN), first English astronomer royal, b. at Denby, Derbyshire, Aug. 19, 1646; graduated at Cambridge University, taking M. A. there in 1664; early began the study of the stars; was ordained as clergyman, and obtained the living of Bristow, Surrey, in 1684. He had been appointed astronomer royal in 1675, and finished the observatory of Greenwich in 1676. Here he passed his life in observation, determining the position of 2934 stars; erected a mural arc in Sept., 1689; quarrelled with Sir Isaac Newton, but ultimately adopted his philosophy, and d. Dec. 31, 1719. His great work was *Historia Cœlestis Britannicæ,* published in 1725 in 3 vols., the first trustworthy catalogue of the fixed stars.

Flan'ders, formerly the name of the territory comprising the two provinces of Belgium, East and West Flanders, the southern portion of the province of Zealand, in the Netherlands, and the two departments of France, Nord and Ardennes. In the latter part of the ninth century this territory was given by the French king Charles the Bald as a fief to his son-in-law, Baldwin with the Iron Arm, count of *Vländergan,* who gave the country its name, and who by his prudent management laid the foundation of that agricultural, industrial, and commercial prosperity which soon afterwards made it powerful. A spirit of independence and republicanism sprang up with material success, and the relation between the Flemish towns and the counts of Flanders was often very loose. On the marriage of Marguerite of Flanders to Philip the Bold of Burgundy (1384), Flanders became united to Burgundy, and a century later (1477), on the death of Charles the Bold, it passed, together with this country, to the House of Habsburg by the marriage of Mary of Burgundy to the archduke Maximilian. On the abdication of Charles V., in 1556, Flanders and Burgundy came into the possession of the Spanish line of the House of Habsburg with Philip II., but the territory of Flanders was soon considerably diminished, a northern portion of it being transferred to the States General by the Peace of Westphalia (1648), and a southern portion being conquered by Louis XIV., and secured to him by the Peace of Utrecht (1713). The remainder of Flanders fell again, by the Congress of Rastadt (1714), to the Austrian line of the House of Habsburg, but in 1794 it was conquered by the French and incorporated with the French republic, and afterwards with the empire, until the Congress of Vienna (1814) conferred the territory on the kingdom of the Netherlands, to which it remained united till the formation of the kingdom of Belgium in 1831, of which kingdom it forms two provinces—East and West Flanders. But under all these changes Flanders was always rich and prosperous, for it was industrious and enterprising, and it was always independent or fighting for its independence. Flemish influence on commerce and industry, on literature and art, on morals and fashion in Europe, has been very considerable, and to the student who wishes to understand the relation between energy and prosperity, and between prosperity and morals, its history is a rich source of information.

FLANDERS, EAST, province of Belgium, bounded N. by Holland. It has an area of 1146 square miles, with a population of 837,726, or 731 to the square mile; it is the most thickly-peopled region in Europe. Its surface is a low and level plain belonging to the Scheldt basin. Its soil, though in many places sandy, has been made exceedingly fertile by spade cultivation and an excellent system of manuring. Flax and hemp are its most valuable productions; linen, laces, damasks, and bobbinet its most valuable manufactures. Its principal towns are Ghent and Dendermonde.

FLANDERS, WEST, province of Belgium, bounded N. by the North Sea and W. and S. by France. It has an area of 1237 square miles, with a population of 668,976. Its surface is flat, for the most part belonging to the Scheldt basin, but with a range of low, sandy hills along the coast. Its soil is sandy, but well cultivated and fertilized, though not so productive as that of East Flanders. Its principal towns are Bruges and Ostend.

Flanders, post-v. of Long Island, in Southampton tp., Suffolk co., N. Y. Pop. 160.

Flanders (BENJAMIN FRANKLIN), b. at Bristol, N. H., Jan. 26, 1816; graduated at Dartmouth College 1842; went to New Orleans in Jan., 1843; studied law and taught there; edited *The Tropic;* held some municipal and public positions; was forced to flee to the Northern States in Jan., 1862, for Unionism; returned to New Orleans when it was captured by the Union forces; was city treasurer in 1862, and member of Congress from Louisiana from 1863 to 1867; then military governor of the State 1867–68.

Flanders (HENRY), American legislator, b. at Plainfield, N. H., has published *Treatise on Maritime Law* (1852), *Treatise on the Law of Shipping* (1853), *Lives and Times of the Chief-Justices of the U. S.* (2 vols., 1855–58), *Memoirs of Cumberland* (1856), *The Principles of Insurance,* etc.

Flandrin (JEAN HIPPOLYTE), b. at Lyons, France, Mar. 23, 1809, was the son of a miniature-painter; studied with Ingres and at Rome; obtained a high rank as an historical and portrait painter, and won numerous medals and distinctions; executed remarkable frescoes and glass-window paintings for many of the principal churches of Paris and other leading cities of France, as well as works for various government buildings. His last great undertaking, the fresco-painting of the Strasburg minster, he did not live to finish. D. at Rome Mar. 21, 1864.—His brothers, AUGUSTE (1804–42) and JEAN PAUL (b. 1811), also attained distinction as painters.

Flan'nel [perhaps allied to the Lat. *velamen,* or the Celtic *gloan,* "wool"], a fabric formerly made of wool alone, and still chiefly made of that fibre; but there are silk-mixed, linen-mixed, cotton-mixed, and all-cotton flannels. Flannels with a cotton warp are called dometts. All-cotton goods, baize-woven and having a dense nap on one side, are called canton or cotton flannels. In general, flannels have a loose-twisted yarn, and hence their superior warmth. There are many varieties—some twilled and others not—from the translucent gauze undershirting to heavy homespun flannels. Choice flannels are used for men's suits and for ladies' opera-cloaks. Many fancy flannels are now printed in colors.

Flash (HENRY LYNDEN), b. in the West Indies in 1837, published a successful volume of poems in 1860. Was educated in Georgetown College, D. C., and in Kentucky, and afterwards removed to Alabama. Has made various contributions to periodical literature.

Flat, a musical character (♭), the effect of which is the lowering of the note to which it is prefixed a minor semitone. On the organ and other keyed instruments each black (or short) key is the *flat* of the white key on the right hand, and also the *sharp* of the white key on the left. But as E and F, B and C, are only a major semitone apart, and have therefore no intervening black key, F♭ and C♭ are produced by striking the white keys E and B, being the next on the left hand respectively. A double flat (𝄫) lowers a flattened note a semitone further, which is effected by playing the white key next below (or on the left side of) the flat. An *accidental* flat is one which affects only a single note, or its repetitions in the same bar, except when the first note of the next bar is a mere prolongation of the preceding one. One or more flats placed at the clef, as B, E, A, D, etc., affect all the notes of similar name in every octave throughout a movement, unless contradicted by a natural (♮). WILLIAM STAUNTON.

Flat Branch, tp. of Shelby co., Ill. Pop. 989.

Flat'bush, the central town of Kings co., N. Y., is on Long Island, 4 miles S. of Fulton Ferry, Brooklyn. It is a beautiful village, and is one of the wealthiest places in the State in proportion to its size. It contains the county almshouse, nursery, hospital, and lunatic asylum, a fine academy, a fine town-hall, a free public school, a weekly newspaper, four churches, hook-and-ladder and fire companies, and the county military parade-ground, which adjoins Prospect Park, Brooklyn, and covers 40 acres. Flatbush is connected with the Brooklyn ferries by horse railroads. It is remarkable for the antiquated palatial style of many of its old dwellings. Its people are largely of Dutch descent. Flatbush was the scene of an important

battle (Aug. 27, 1776) between the Americans and the British and Hessian troops. Pop. of tp. 6309.

H. J. EGGLESTON, ED. "KINGS CO. RURAL GAZETTE."

Flat Creek, post-tp. of Barry co., Mo. Pop. 1571.

Flat Creek, tp. of Pettis co., Mo. Pop. 1651.

Flat Creek, tp. of Stone co., Mo. Pop. 595.

Flat Creek, tp. of Buncombe co., N. C. Pop. 1168.

Flat Creek, tp. of Lancaster co., S. C. Pop. 2088.

Flat Creek, tp. of Mecklenburg co., Va. Pop. 2328.

Flat Fish. See PLEURONECTIDÆ.

Flat′head In′dians, properly called **Se′lish,** and named **Hopil′po** by Lewis and Clarke. The name is incorrect, as, unlike the tribes mentioned below, they do not flatten the heads of their infants. By the labors of Father de Smet (see SMET, DE, P. J.) and other Jesuit missionaries they have all become Roman Catholics. They have adopted the dress and habits of white men, and are uniformly peaceful towards the whites. In 1871 they were removed by the U. S. government from their old abode on the Bitter Root River to the Jocko Valley, Mon. Their language is very hard to learn. (See its grammar—*Grammatica Linguæ Selicæ*, by MENGARINI, 1861.) It is affiliated with those of nearly all the tribes of their vicinity, who together constitute the Selish family, none of whom flatten the head. In 1872 the number of Flatheads on the reservation was put at 460, but it is understood that many of the tribe are not on the reservation.

II. The real Flatheads of the Pacific coast are mainly of the now nearly extinct Chinook group of fish-eating tribes. They flatten the skull of the infant, either by binding a board upon the forehead, so as to depress and flatten the top of the head, or by fastening a pad of grass upon the forehead. The operation lasts for several months, but its effects slowly wear away, and by the time manhood is reached the head is of nearly normal shape. It does not appear to affect the intellect. The same custom anciently prevailed among the Chickasaws, Choctaws, the Natchez (who flattened the head vertically), the Caribs, the Toltecs, the ancient Peruvians, and others; but the practice at present appears to be everywhere nearly extinct.

Flathead (or **Selish**) **Lake** lies in Missoula co., Mon., W. of the Rocky Mountains. Its waters flow through Flathead River into the Columbia.

Flathead Pass, in Mon., a gap in the Rocky Mountains; elevation, 6769 feet. Through this the Flatheads, Bannocks, and Shoshones have been accustomed to send hunting-parties eastward, and the eastern tribes to send war-parties westward of the mountains.

Flat′lands, post-tp. of Kings co., N. Y. Pop. 2286.

Flat Lick, tp. of Johnson co., Ill. Pop. 1180.

Flat River, tp. of Person co., N. C. Pop. 958.

Flat Rock, post-tp. of Clay co., Ala. Pop. 945.

Flat Rock, tp. of Randolph co., Ala. Pop. 901.

Flat Rock, tp. of Bartholomew co., Ind. Pop. 1543.

Flat Rock, tp. of Henry co., O. Pop. 1184.

Flat Rock, post-tp. of Kershaw co., S. C. Pop. 3755.

Flat Rock Spring, at Saratoga Springs, N. Y., has saline chalybeate waters much resembling those of the famous High Rock Spring.

Flat′tich (JOHANN FRIEDRICH), b. at Beyhingen, Würtemberg, in 1713; studied at Tübingen, and held several Protestant pastorates, the last at Münchingen (1760–97). He was one of the most famous instructors of South Germany, and had a wide influence in his time. His works on practical education were reprinted in 1856 at Heidelberg. D. at Münchingen in 1797.

Fla′vel (JOHN), English nonconformist clergyman, b. in Worcestershire about 1627, was educated at Oxford, and became rector of Dartmouth in 1656, but was ejected for nonconformity in 1662, and afterwards preached in private houses. His works are highly prized, and are *Husbandry Spiritualized* (1669), *A Saint Indeed* (1673), *Divine Conduct* (1678), *The Touchstone of Sincerity* (1679), *Personal Reformation* (1691), *Remains* (1691), *Exposition of the Assembly's Catechism* (1692), *The Soul of Man* (1698), *Methods of Grace* (1698). His complete *Works* were published in 1820 in 6 vols. D. at Exeter, and was buried June 29, 1691.

Flavia′nus, patriarch of Antioch in the fourth century; in early life was a lay monk, zealous for the faith; and, according to Theodoret, he, with Diodorus, his associate, first devised the choir and introduced the responsive singing of the Psalter. In 381 A. D. he was chosen bishop of Antioch to succeed Meletius, but was not fully acknowledged by all factions until 390. In 387 he interceded with Theodosius the Great for the seditious people of Antioch. He strongly opposed Arianism and the Mersulians, and d. in 404 A. D. Chrysostom was one of his pupils.—Another Flavianus was bishop of Antioch 498–511, when he was deposed and banished to Petra, where he d. in 518 A. D. He is honored as a saint by the Roman Catholic Church.

Flavia′nus, SAINT, became bishop of Constantinople 446 A. D., and was from the first opposed by Theodosius II., the emperor, who favored the Eutychian heresy. Flavianus called a synod which deposed and excommunicated Eutyches (448), but in 449 the emperor convened a council at Ephesus (the robber council), presided over by Dioscurus, bishop of Alexandria, who was the enemy of Flavianus. The latter, who was present, was deposed and ordered to be banished, but was set upon and so beaten by the Egyptian party that he d., 449 A. D.

Fla′vine, a preparation of QUERCITRON BARK (which see, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.).

Fla′vius, the name of many eminent Romans, mostly of the gens Flavia, an ancient plebeian stock, but many of the Flavii who figure in history were undoubtedly not of this gens, and were indeed not even Romans in a strict sense.—CNEIUS FLAVIUS, a Roman jurist who was curule ædile in 303 B. C., was the son of a freedman and secretary to Appius Claudius Cæcus. His publication of the *Jus Flavianum*, embracing the secret rules of judicial procedure, hitherto known only to pontiffs and patricians, caused great indignation, and made him exceedingly popular with the common people.—Vespasian, Constantine the Great, and many other Roman emperors bore the name of Flavius.

Flax. Like the more important cereal grains flax was known throughout the ancient seats of civilization in the East. It is therefore impossible to determine where it originated. It is known throughout the civilized world, and valued as an almost indispensable adjunct of our civilization. Its botanical name is *Linum usitatissimum*. The genus *Linum* contains several species, of which this is the only one of especial value or of commercial importance. The *plant* is an annual of quick growth, and probably a race which originated from a species still indigenous to Southern Europe. It grows from one to three feet high. The leaves are alternate upon the straight slender stem and branches. The flowers, which are in loose terminal panicles, are blue, about an inch in diameter, having a calyx of five sepals, a corolla of five petals, five stamens, and a pistil having five styles. The petals drop within a few hours after the flowers open, and the seed-heads, called *bolls*, form rapidly, becoming finally nearly globular. These consist of ten cells, each containing a flat oval seed of a reddish-brown color, very smooth and glossy. When the plant grows by itself in good soil, it branches freely, blossoms profusely, and yields a proportionately large quantity of seed. When, however, many plants are crowded together, each one grows as a single upright stem, bearing a few blossoms and little fruit at the summit. The valuable portions of the plant are the fibrous coating of the stalk, and the seed. The *stalk* is a woody cylinder, more or less pithy and hollow when dry, and enclosed in a bark consisting of long, strong, silky fibres cemented together by a kind of glue, and encased in an outer bark or skin, which adheres as if glued to the fibre. The *fibre*—when freed from all else, so far as possible, by the processes of rotting, to destroy the glue; breaking, to free it from the woody part of the stalk; scutching, to whip out the small particles of bark and stalk adhering; hatcheling, to straighten it and free it from tangles—is nearly pure bast fibre, is of a light grayish-brown color inclining to green, exceedingly tough, adapted to spinning and weaving, capable of being bleached to snowy whiteness and of taking a variety of colors in dyeing, which it holds faster than cotton, though it does not take readily so many dyes.

The ultimate filaments are hollow, thick-walled, and thus nearly solid cylindrical cells, which are terminated by exceedingly attenuated points. They are semi-transparent, of a silky lustre, and under the microscope the walls of the tube appear like a double line through the centre. These filaments vary in thickness from $\frac{1}{650}$th to $\frac{1}{5000}$th of an inch, according to the measurements of Mr. John Phin, who describes the cells as jointed, apparently like the stalks of the bamboo cane. (See FIBRES.) When the fibre is separated from the bark and wood of the stalk, as above indicated, it appears in market in two principal forms—namely, "dressed flax" and "tow," which are each of several qualities.

The *seed* consists of the embryo or kernel and its outer coverings, principally its reddish-brown shell, which is very mucilaginous, yielding, particularly to hot water, a thick, glairy gum, becoming quite viscid when cold. The kernel is rich in a valuable oil, which possesses the property of "drying" or hardening on exposure to the air to a remarkable degree (see LINSEED OIL), by which process of

drying it gains, instead of losing weight. Powdered flax-seed and powdered oil-cake (linseed-meal) are much used in medicine and surgery for poultices, epithems, etc., and are useful on account of their long retention of heat and moisture.

FLAX-CULTURE. Flax is a plant of rapid growth, for, being sown in April or May and harvested early in August, it is less than three months in possession of the ground. When raised for seed it makes considerable drafts upon the soil, which should therefore be rich and in fine tilth. As it is almost impossible for manure to be evenly distributed through the soil the first season, it is best to grow it upon land heavily dunged the previous year as for a corn-crop, but dressed the same season with wood-ashes or some other "hand manure" which can be evenly applied and is adapted to the wants of the land. Good wheat-soils are especially favorable to flax. Heavy clays, coarse gravels, light sands, and peaty soils are not so. Moderately stiff soils should be ploughed in autumn, light ones early in the spring. As soon as weeds begin to germinate and grass to grow the land should be thoroughly and evenly ploughed and harrowed. If the weather be not favorable to sow, the harrowing may be repeated, and thus successive crops of weeds killed in the seed-leaf. Finally, when the ground is warm in spring, the seed should be sown. The practice in Europe is to sow very early; in this country flax should not be sown until after the oat-crop is in—say from the 15th of April to the 1st of May in the Middle States. The quantity of seed sown to the acre depends upon the object for which the crop is raised; if principally for seed, half a bushel to three pecks is used; if for fibre mainly, a bushel to a bushel and a half is employed. It is very important that the sowing should be even, for otherwise the tendency to branch is great, and those plants which are least crowded will grow coarser and larger, ripen their seed unevenly, and cause the crop of lint to be of unequal fineness, and to leave much more of the fibre in the tow than otherwise need be. Flax should be sown as carefully as fine grass-seed, and to enable the sower to handle it more easily it is sometimes soaked a short time in cold water and then rolled in plaster. It should be harrowed in evenly with a light harrow. Some farmers, who raise flax for the lint principally, preferring that no horse should tread upon the land after sowing, brush the seed in with a heavy hand bush harrow, made like a stable broom by inserting short pieces of brush in a hard-wood head five or six feet long. This is drawn over the ground by means of handles attached at right angles, or nearly so, to the brush. It is most important that the flax should get the start of the weeds, and when it is about three or four inches high it should be carefully examined, and if necessary weeded at once—an operation best done in moist weather and by women and children, who go upon the crop without shoes, and work facing the wind, so that the breeze may favor the downtrodden plants to rise again. It is better to let the weeds grow than to weed the crop after the plants are six or eight inches high, or to do this hurriedly, mashing and bruising the plants. After this the crop is "laid by" until pulling-time.

Pulling.—Flax is ready to pull when it changes color decidedly after blooming, becoming of a yellowish or golden-brown color, two-thirds of the bolls being plump and beginning to turn brown, and the leaves having shrivelled and dried upon the lower half of the yellow stalks. Pulling should take place a little earlier than we describe if lint be the principal object, but a little later if the seed pays best. This is done by grasping a handful of stalks in one hand near the tops, and then pulling them with both hands, giving a *steady jerk*, so to speak. This handful is not laid down, but held while other handfuls are pulled, until as much is gathered as can conveniently be grasped; then it is bound after "butting" the roots even. Stalks which fall out and scatter are used for bands. These bundles are set up in long shocks, to become cured thoroughly before stacking. The drying process is greatly shortened if, instead of binding as soon as pulled, the gavels are spread out on the ground, so as to be turned and sunned on both sides before binding.

If the fibre is an important object with the farmer, the flax should be pulled as described, but otherwise it may be mowed with a scythe or cradle, or with a reaper, cutting close as possible to the ground. In using the scythe the swath must be thrown towards the standing flax; thus, the stalks are all left leaning against the flax, and may be gathered and laid in gavels to dry or be bound into sheaves.

Thrashing.—After drying and standing in the stacks, or not, as the case may be, the seed may be thrashed off by a flail or by beating the heads of the sheaves against a block of wood, which easily removes the bolls. On a large scale the seed is most easily removed by holding the bundles spread out, fan-shaped, upon the cylinder of a thrashing-machine, the "concave" being taken off. After this the flax is ready to be subjected to the process called

Retting (*rotting*).—This is conducted either under water, or upon the grass, where the flax is exposed to the action of the dew and sunshine. In "water-rotting" the flax is subjected in the bundles to the action of *soft* water in pools called "dams." The methods of setting or laying the bundles are various, and the rapidity of the action depends upon the warmth and softness of the water, varying from four to fourteen days. It is more uniform if it does not progress very rapidly. During the whole process it must be kept submerged, being weighted with stones. Waters containing iron or other mineral matters are likely to stain the fibre and to hinder the action. It requires some experience to know exactly when to remove the flax, for a few hours may make a considerable difference in the amount of fibre realized. If too much rotted, the lint will break and tangle, and be lost in the tow. If too little rotted, the fibre will break up with the stalk, and be scutched out with the shives. When the rotting (or retting) has been continued long enough, the woody part of the haulm separates easily and completely from the fibrous bark, which itself is easily divided upon the finger into individual fibres. When, however, the process has gone too far, the fibre is weakened, but this can only be quickly detected by the most experienced. When sufficiently rotted, the flax bundles are lifted from the water, opened, and spread upon the grass until perfectly dry. Then they are rebundled and housed until they can be conveniently subjected to the next process, which is

Breaking.—This is accomplished by machines called flax-breaks, which are variously constructed, but all accomplish the same end—namely, the breaking up of the stalks without doing violence to the fibre. A flax-break in common use and easily constructed consists of several hickory slats hinged at one end upon a form, and fastened at the other end into a heavy wooden head. These slats when let down occupy a horizontal position, and shut in between other similar fixed slats, but do not touch them. By means of a handle attached to the head the movable slats are raised up and down by one hand, while the flax held in the other is thrust in and drawn through, and thus "broken," so that the "shives," or pieces of broken stalk, or "boon," may be whipped or "scutched" out.

Scutching or *swingeing* is the next operation, and one performed both by simple hand-appliances and by more complicated machinery. The essential implements are the scutching-block and the scutching-knife. The former is an upright hard-wood board set in a block or fixed in any convenient place. It has in it a large notch, with one edge horizontal and cut to a sharp edge, the bevel being altogether upon one side. This notch is to receive a handful of flax, which resting upon the sharp wooden edge, hangs over upon one side. The scutching-knife is made of hard wood also, and must be nine or ten inches broad and very thin. With this the "hand" of flax is struck sharp blows as it is turned in the notch, the knife being brought down close, parallel with the side of the board. Thus, the fibre is freed from most of its adhering impurities, and in this condition is usually baled and marketed in this country, but before it can be spun much more is necessary. In this condition the lint and the tow remain together, only the coarsest tow being separated from the fibre by the scutching process.

Hatcheling or *heckeling* consists in drawing the hands of flax-fibre through combs of long iron teeth set filling a circle or a square. The instrument is called a "hatchel" or "heckel," and there are usually two hatchels used—one, coarse, for a preliminary operation, the other, fine, for finishing. The hand of flax is hatcheled from the tips to the middle—first one half, and then the other; the tow being left in the teeth of the hatchel, and the teeth being frequently cleaned of the same. The ends accomplished by this process are three—namely, the subdividing of the fibres into their finest filaments, the separation and removal of all broken or short fibres (the tow), and the laying of the lint parallel and untangled. The operation requires considerable skill, and upon it depends to a great extent the value of the result. It will be long before American farmers to any great extent will prepare their flax-fibre for market by the careful dressing practised in Germany, Holland, and Great Britain; but until this is done the value of the crop will be greatly less than it might otherwise be. In general, this crop is and will be cultivated in this country mainly for the seed, the lint being roughly treated and sold for cordage and for coarse fabrics. The amount produced in 1870, according to the U. S. census for that year, was 27,133,034 pounds of flax and 1,730,444 bushels of seed. More than half—namely, 17,880,000 pounds of the lint—was raised in Ohio alone, and the great bulk of the seed was raised in Ohio, Indiana, and Illinois, Ohio

producing more than one-third of the entire amount—namely, 632,000 bushels. During the "cotton famine" caused by the late civil war greatly increased interest was manifested in flax-culture, and great efforts were made to treat the fibre so that it could be worked upon cotton machinery; but these efforts resulted in no marked success, and were given up when cotton again became abundant.

M. C. WELD.

Flax, New Zealand, the *Phormium tenax*, a large perennial, liliaceous plant, native of New Zealand, and grown for its fibre, which is exported to some extent, and used as a substitute for hemp, which is inferior to New Zealand flax in strength, but superior in durability. The fibre is obtained from the long and flaglike leaves, which are two to six feet long and one to three inches broad.

Flax, Purging, the *Linum catharticum*, a plant resembling the common flax on a small scale. It is a European annual, and has been considerably used in medicine as a gentle hydragogue cathartic.

Flax'man (JOHN), the most poetical sculptor that England has produced, was b. in the city of York July 6, 1755. He was the second son of John Flaxman and his wife, whose maiden name was Lee. When he was only six months old his father, who had gone to York from London, where he had failed to find sufficient work in his trade of modeller in plaster, returned to the capital, taking his family with him. Cunningham says that the elder son, William, distinguished himself as a carver in wood. The elder Flaxman was a good workman and a good father; his plaster casts were in great favor with artists, and, although not an artist himself, he had sense and perception enough to encourage the early indications of talent in his afterwards famous son. When Flaxman was ten years old his mother died, and soon after the father married a second wife, whose maiden name was Gordon. This lady proved a good mother to her husband's children, and in time gave them a sister, who later in life was a beloved inmate of Flaxman's married household.

Flaxman was born into the world a feeble child, and was brought up with difficulty. For a long time he moved about with the help of crutches, and this weakness kept him much within doors. He loved to sit behind his father's counter in the shop, surrounded by the images of gods and goddesses, where he would amuse himself for hours with his pencil and paper, and where he often saw notable people, artists and literary men, his father's customers, who would sometimes chat with the boy or amuse themselves with looking at his childish attempts at drawing. Roubiliac, the sculptor, was one of these visitors, and Cunningham says that in his day there was a studio-legend that Flaxman had been for some time under the direction of the Frenchman, who had declared he saw no symptoms of talent in him. There could be no foundation for such a legend, because Roubiliac died in 1762, when Flaxman was seven years old. But if Flaxman was spared the injury that so meretricious a sculptor as Roubiliac might have done him, he was not left to grope his way without aid. Another of his father's visitors was the Rev. Henry Mathew, a clergyman of some note in his day, who, though now forgotten, has a substantial claim to our gratitude for his kindness, not only to Flaxman, but to William Blake. Mrs. Mathew was one of the most distinguished of the circle of Blue-stockings whose works and ways fill such a space in the literary and social gossip of the time. Her husband brought young Flaxman to her, a feeble child moving slowly on crutches, but with fine eyes and a beautiful forehead; and in this excellent lady he found a kind and sympathizing friend. She knew how to train and develop his mind, and to encourage his talent without spoiling him. He was eleven years old when he first knew Mrs. Mathew, and he frequently visited her house in the evening to hear her read Homer and Virgil and discourse upon sculpture and poetry. It is said that while Mrs. Mathew read Homer, Flaxman would sit by her side, and as she commented on the pictorial beauty of his poetry, the child would embody such passages as caught his fancy. A Mr. Crutchely, having seen some of these youthful performances (many of which have been preserved), commissioned from him a set of drawings in black chalk. These subjects, six in number, were all drawn from the Greek poets, and they have an interest for us as having been the modest precursors of those illustrations of Homer, Æschylus, and Pindar which were to carry Flaxman's name and fame to every part of Europe and America. At the age of fifteen Flaxman entered the Royal Academy as a student; in 1770 he exhibited a figure of Neptune in wax (this was the era of waxwork); and during the next five years he sent ten pieces to the Academy. Among his early works were his own portrait-bust, quarter size, modelled in his twenty-third year, two statues, *Grecian Comedy* and a *Vestal*, and many portrait-busts of his friends.

Either Mr. Mathew or Stothard had introduced him to Blake, who was two years his junior, but their tastes were so similar that an introduction was hardly needed. It was in the nature of things that a strong friendship should spring up between these two, great alike in art (though with such different greatness) and in force and purity of personal character. Flaxman remained under his father's roof until 1782, when he married, at the age of twenty-seven, Ann Denman, an amiable and accomplished woman with a love of art and literature, and in full sympathy with her husband's tastes and pursuits. She d. in 1820. Flaxman and his wife had no children. In 1787, Flaxman went to Italy, taking his wife with him, and remained there for seven years, living for the greater part of that time in Rome. While in Italy he made for Mrs. Hare Nayler the well-known series of designs in outline for the *Iliad* and *Odyssey;* for the countess Spencer the illustrations to Æschylus, and for Mr. Thomas Hope the illustrations for the *Divina Commedia* of Dante. He was an acute observer, and studied closely the remains of ancient sculpture in Rome, making many memoranda which were afterwards embodied in his *Lecture on Sculpture.* While in Rome he executed several works in marble, but none of them of much importance, if we except the *Cephalus* and *Aurora*, a commission from Mr. Thomas Hope. Shortly after his return to England he made his statue of Lord Mansfield. In 1797 he was elected an associate of the Royal Academy, and in the same year he sent to the exhibition three sketches in bas-relief from the New Testament and the statue for the monument of Sir William Jones. In 1800, being then in his forty-fifth year, Flaxman was elected a member of the Royal Academy, and on this occasion he presented to the Academy a marble group, *Apollo and Marpessa*, in compliance with the rules of the institution, which require from each new member a specimen of his skill. He now produced in rapid succession many of his best works—the monument in memory of the Baring family; the Lushington monument; the monument to the countess Spencer; to Mrs. Tighe, the poetess; with others to the memory of the Tarborough family, to Mr. Edward Balme, and to the Rev. Mr. Clewe. Flaxman was at his best in these religious subjects, for he was in full sympathy with Christianity, and unconsciously expressed his own devout, amiable character in these works, full of tenderness and spiritual feeling, and with a grace sometimes suggesting the Greek, sometimes the early Italian, but, after all, leaving an impression wholly English. His historical-allegorical monuments cannot be so thoroughly enjoyed. Flaxman's genius was not of the heroic type, and though it is not necessary to accept Mr. Ruskin's grunting disparagement of him, yet it is true that his field was a narrow one, and that he blundered when he tried to climb. He was a Fra Angelico born out of due time, and in the dull, mechanical England of his day, instead of Italy, where he would have been at home. Mr. Ruskin says of his *Dante* that "it contains, I think, examples of almost every kind of falsehood and feebleness which it is possible for a trained artist, not base in thought, to commit or admit, both in design and execution." This criticism, though true of the *Dante*, is balanced by no recognition of what is true and lovely in Flaxman's other work, where he was more at home—in the *Homer* especially, and in those simple groups in marble for which Mr. Ruskin can say no more than that they "were always good and interesting." It does not even do justice to the *Dante*, in which—with much that is weak and pretentious, as there is even in Blake, and must, from the nature of the case, be in every one who attempts the task of illustrating Dante—there is some happy and ingenuous design. The world has been kinder to Flaxman than Ruskin would have it, and as his name has long been a dear one to the world of humble lovers of art, it is pleasant to know that in the new birth of art in England, in a time that brings back "the touch of a vanished hand and the sound of a voice that is still," the name of Flaxman is also dear to many of those who have led the van in the new revolution.

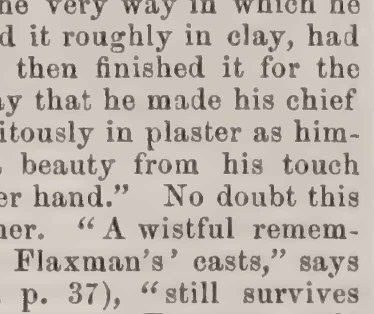
Among the statues made by Flaxman were those of Sir Joshua Reynolds, of Sir John Moore, of Pitt, of Joseph Warton, of George Stevens, of the rajah of Tanjore, of the missionary Schwarz, of Lord Cornwallis, and of Warren Hastings. In 1810 the Royal Academy created a professorship of sculpture, and requested Flaxman to fill the chair. "A small premium was offered for six annual lectures," says Cunningham, "and, as money was never his object, he proceeded to fulfil the duties of his office with enthusiasm and knowledge. His first lecture was delivered in 1811." He gave in all ten lectures, and these are the subjects: 1, English sculpture; 2, Egyptian sculpture; 3, Grecian sculpture; 4, Science; 5, Beauty; 6, Composition; 7, Style; 8, Drapery; 9, Ancient art; 10, Modern art. They were published in 1829 in one vol., with 52 plates.

With all his mildness of manner and real gentleness of disposition, Flaxman was capable of noble anger, and ready enough at need to express it. When in Italy he had bluntly expressed to the ambassador of the French, who proudly showed him a medal of Bonaparte, his contempt for the plunderer of Italy and the trampler upon the liberties of France. When the Peace of Amiens once more opened Paris to the English, Flaxman again visited the capital to see the glories of the Louvre, splendid in its stolen peacock plumes. In Paris, David called on him, but the English sculptor drew himself up, held his hands behind his back, and refused the proffered civilities of the friend of Marat.

Besides his *Lectures on Sculpture,* Flaxman produced some minor writings, not perhaps of much importance. A chapter on the character of Romney's works for Hayley's *Life* of Romney is mentioned by Cunningham, and he also contributed to *Rees' Cyclopædia* the articles, "Armor," "Basso-Rilievo," "Beauty," "Bronze," "Bust," "Composition," "Cast," and "Ceres." The articles on "Armor" and "Basso-Rilievo" were illustrated by Blake, who also made some slight illustrations, says Gilchrist, for a *Letter* which Flaxman addressed to the committee for raising a monument to commemorate the naval triumphs of Great Britain. In his sixty-sixth year Flaxman modelled for Lord Egremont a statue of the archangel Michael vanquishing Satan, and finished the celebrated *Shield of Achilles,* ordered by Rundell & Bridge, the silversmiths. This is one of the most beautiful and characteristic of his productions; indeed, Flaxman was never happier than when working in bas-relief, for which he had a genius all his own. Cunningham says that "the very way in which he made it was peculiar; he modelled it roughly in clay, had it cast into plaster of Paris, and then finished it for the silver-moulder. It was in this way that he made his chief works; no one could work so felicitously in plaster as himself; it carried a softness and a beauty from his touch which it could derive from no other hand." No doubt this skill was inherited from his father. "A wistful remembrance of the superiority of 'old Flaxman's' casts," says Gilchrist (*Life of Blake,* vol. i. p. 37), "still survives among artists." Besides these two works, Flaxman made in these later days his statues of *Psyche,* the *Pastoral Apollo, Michael Angelo,* and *Raphael,* with those of Kemble and Robert Burns.

Flaxman died, after a brief illness, on Dec. 7, 1826. He was buried in the churchyard of St. Giles-in-the-Fields on Dec. 15th, the president and council of the Royal Academy assisting at his funeral. (His *Life* has been well and sympathetically written by ALLAN CUNNINGHAM in the 3d vol. of his *British Painters, Sculptors,* and *Architects,* London, 1830. There are also some valuable memoranda in ALEXANDER GILCHRIST's *Life of William Blake,* London, 1867.) CLARENCE COOK.

Flea, the common name of the insects of the family Pulicidæ, wingless creatures regarded by some as constituting a separate order, Aphaniptera, but more generally considered as degradational forms referable to the Diptera, or two-winged insects. They grievously infest the higher animals, the common flea (*Pulex irritans*) attacking man as well as beast, while other species attach themselves to the dog, cat, mole, and various other mammals and birds. The *Sarcopsylla penetrans,* or chigoe, is another flea which seriously troubles man. Most of the fleas are distinguished by great powers of leaping. Many anecdotes are related of fleas trained to perform curious feats which have been often exhibited in public. It is doubtful whether there is any training in the case. The feats which seemingly evince intelligence are probably acts necessitated by the mechanical conditions to which the insect is subjected.



Flea.

Flea'bane [so called from their insecticide powers], a name given to various herbs of the order Compositæ, especially to those of the genus *Erigeron.* The *Erigeron Canadense* and *Philadelphicum* yield strong-smelling, volatile oils which are sometimes used in medicine as diuretics. The allied genera, *Pulicaria* and *Conyza,* are called fleabanes in England. The destructive powers of various composite plants upon insects appear to reach their maximum in *Pyrethrum carneum* and *roseum* of Asia and Europe, the leaves of which are largely used as an ingredient of the Persian insect-powder, so deadly to insect vermin.

Flea Hill, tp. of Cumberland co., N. C. Pop. 1899.

Flea'wort Seed (*Semen psyllii*), the seeds of *Plantago Psyllium,* a kind of plantain of Europe and Barbary. The seeds are mucilaginous, like flaxseed, and are sometimes used for the same purposes in medicine. They are not often brought to America.

Flèche, La, town of France, in the department of Sarthe, on the Loire. It has a military school for the education of the sons of poor officers or distinguished soldiers. Pop. 7077.

Fléchier (ESPRIT), b. at Pernes, France, June 10, 1632; was educated by the Fathers of Christian Doctrine at Avignon; taught rhetoric at Narbonne; went to Paris in 1661, where his talents as a preacher won him great preferments. In 1673 he was admitted to the Academy; in 1685 became bishop of Lavour, and in 1687 was translated to Nîmes, where he was beloved alike by his own Church and by the Huguenots. D. at Montpellier Feb. 16, 1710. His *Oraisons Funèbres, Panégyriques des Saints,* and *Lives* of Theodosius the Great and of Ximenes are his principal works.

Fleet [allied to the word *float*]. An assembly of twelve or more vessels takes the name of *fleet,* and is divided into three divisions, of one, two, or three squadrons, each squadron comprising not less than four vessels. (*Parker's Tactics.*) The term fleet implies not only a collection of ships of war of a sovereign state, but is applied as well to a number of merchant-vessels employed in a particular branch of commerce. RAYMOND P. RODGERS.

Fleet Mar'riage. The Fleet prison in London, like Gretna Green in later times, and May Fair and the Savoy at a somewhat earlier date, was long a famous resort for clandestine marriages. Fleet marriages are first mentioned in 1613, and in 1754 were forbidden by statute. The officiators were Church of England clergymen in prison for debt. The most famous Fleet marriage was that of Henry Fox, afterwards Lord Holland, to Georgina Caroline Lennox, daughter of the duke of Richmond. (See J. S. BURN, *History of the Fleet Marriages,* 1834.)

Fleet Prison, or **The Fleet,** in London, was in use before 1200, both as a debtors' and king's bench prison. It was such until 1641, when, on the abolition of the Star Chamber, it became, like the Marshalsea, a debtors' prison. It was burned in 1381 by Wat Tyler, in 1666 at the Great Fire of London, and in 1780 by the Gordon rioters. In 1842 it was abolished by statute, and in 1845 pulled down. It was the scene of many disgraceful abuses.

Fleet'wood (JOHN), D. D., English theologian, published *The Christian Prayer-Book* (1772), *The Christian Dictionary* (1773), *Life of Christ, and the Lives of the Apostles, John the Baptist, and the Virgin Mary* (1813), the last often reprinted.

Flem'ing, county in the N. E. of Kentucky, bounded on the W. by the Licking River. Area, about 500 square miles. The E. portion is mountainous, the soil very productive. Cattle, grain, tobacco, and wool are staple products. Cap. Flemingsburg. Pop. 13,398.

Fleming, post-v. and tp. of Cayuga co., N. Y., on the Southern Central R. R. The town lies on Owasco Lake. Pop. 1207.

Fleming (JOHN), Scotch clergyman and naturalist, b. near Bathgate, Linlithgowshire, 1785; preached in Shetland and at Flisk, Fifeshire; appointed to the chair of natural philosophy at King's College, Aberdeen, 1832; resigned the position in 1843, having identified himself with the Free Church, and became professor of natural science in the Free Church College of Edinburgh 1845. D. Nov. 18, 1857. The *Philosophy of Zoology* was published about 1822; *History of British Animals,* in 1842; *Molluscous Animals, including Shellfish,* in 1837.

Fleming (THOMAS), soldier in the Revolution, commanded the troops from Botetourt co., Va., in the battle of Point Pleasant with the Indians, being thrice wounded, and was appointed colonel Mar. 2, 1776. D. Aug., 1776.

Fleming (WILLIAM), b. in 1754, was a citizen of Cumberland co., Va.; educated at William and Mary College; was in the Virginia conventions and the house of burgesses (1775–76), and in the latter year was one of the committee on Independence; became a judge of the general court, and was for a time presiding judge of the court of appeals; was in the U. S. Congress 1779–81. D. Feb. 2, 1824.

Flem'ingsburg, post-v., capital of Fleming co., Ky., 17 miles S. of Maysville, on the C. F. and P. G. R. R., and 4 miles S. of the Maysville and Lexington R. R. It has 2 banks, 2 schools, 1 college, 7 churches, 1 newspaper, 2 large flouring-mills, 2 distilleries, 3 hotels, Masonic and Odd Fellows' Hall, and an artesian well 1700 feet deep. Principal business, raising wheat, corn, tobacco, etc. Pop. 425.

C. H. ASHTON, ED. "FLEMINGSBURG DEMOCRAT."

Flem'ington, post-v., capital of Hunterdon co., N. J., on the Central R. R. of New Jersey, 50 miles from New York. It has 2 newspapers, a national bank, 2 hotels, 4

churches, and a large number of stores and shops. It is in a rich agricultural district, and has an extensive trade with the surrounding country. Pop. 1412.

W. G. Callis, Ed. "The Hunterdon Republican."

Flemington, post-tp. of Taylor co., West Va., on the Baltimore and Ohio R. R. It is the seat of West Virginia College and a normal school. Pop. 942.

Flem'ingville, post-v. of Owego tp., Tioga co., N. Y., on the Southern Central R. R., 4 miles N. of Owego. Pop. 91.

Flem'ish Language and Literature. With the exception of some slight differences in pronunciation and orthography, the Flemish (or Vlaemisch) language is identical with the Dutch. The difference is a difference of name only, and the true name is "Flemish" or "Vlaemish;" "Dutch" or "Hollandish" did not come into common use until a comparatively late period. Now, Flemish designates the Dutch language as far as it is spoken by the inhabitants of the Belgian provinces of East Flanders, Antwerp, Limburg, West Flanders, and Brabant; and the most interesting feature in its present history is the contest which takes place within the boundaries of the Belgian kingdom between this branch of the Germanic tongue and the Walloon, a French dialect spoken by the inhabitants of the other Belgian provinces, Liège, Hainaut, Namur, and Luxemburg. The division is nearly equal, the Flemish having a numerical superiority of half a million, and the Walloons having politically and socially the advantage of their compatriots. In 1869 there were reported 180,000 Flemish-speaking people in France.

When the Belgian provinces were overrun by the armies of the French republic in 1794, and subsequently united to France by the treaty of Campo Formio, French became not only the official, but gradually also the literary, language of the country. Flemish ceased to be used in newspapers, pamphlets, and works of science and imagination; nay, it even ceased to be the conversational medium of the higher circles of the Flemish population. And, singularly enough, the establishment of the kingdom of the Netherlands in 1815, and the annexation of Belgium to Holland, did not materially alter this course of affairs. The interests of these two countries were so unlike that they were almost foreign to each other, and the partiality of the Dutch government for its Dutch subjects was so marked that a kind of hatred sprung up between the two countries. The Dutch government tried to gain the sympathy of the Flemish population of Belgium by patronizing their native language; but even these attempts at reconciliation were received with suspicion and mistrust, and it was not until after the separation of Belgium from Holland in 1830 that the Flemish movement became an open and acknowledged tendency in the life of its inhabitants. Willems, who at his death (in 1846) stood at the head of this movement, and was one of the most popular men among the Flemings, was twenty years earlier very unpopular among the same men, and on account of the same ideas, simply because these ideas were then espoused by the Dutch government. But after the separation the movement grew rapidly, carried on by men like Willems, Blommaert, Conscience, Van Duyse, Snellaert, Snieders, and Van Ryzwick. In 1860, 76 political newspapers and 31 weekly and monthly periodicals of miscellaneous character were issued in the Flemish language; and the *Nederduitsch Tijdschrift,* commenced in 1862 by Emmanuel Hiel, is the most spirited and elegant periodical in Belgium, and a competent rival of French publications of the same kind. A reconciliation between the Flemings and the Dutch has also taken place; linguistical congresses of scholars and writers from the two countries have been held and attracted much attention; and at present it seems rather questionable whether the strong community of commercial and industrial interests, which in the Belgian kingdom keeps the Flemings and the Walloons together, will be strong enough to conquer the elements of dissension and jealousy which differences in origin and character, in language and ideas, cannot fail to generate.

Clemens Petersen.

Flem'ming (Paul), M. D., b. at Hartenstein, Saxony, Oct. 17, 1609; studied medicine at Leipsic, and took his degree at Leyden. In 1633 he joined the legation sent to Russia by the duke of Holstein-Gottorp, and was attached to the Persian embassy 1635–39; married an Esthonian lady, and d. at Hamburg Apr. 2, 1640. He wrote *Geistliche und Weltliche Poemata* (1642), including the fine hymn *In allen meinen Thaten;* also Latin poems, love-songs, and a pastoral called *Margenis.*

Flens'borg, handsome and thriving town of Sleswick, at the W. end of Flensborg Fjord. It has good shipyards, excellent oyster-beds, some tobacco manufacture and spinning, and sugar-refining industry. Pop. 21,325.

Flers, town of France, in the department of Orne. It has considerable linen manufactures. Pop. 10,054.

Flesh [from the Ang.-Saxon], in a narrow sense includes only the muscular tissue of animals, especially of the vertebrates, and in a still narrower popular sense the muscular tissues of fishes, reptiles, and birds are excluded; but as ordinarily used the name applies to all solid animal tissues, excluding the bones. The flesh of animals comprises in this sense not only muscles, but fasciæ, fibrous, adipose, and other tissues, cartilage, nerve-substance, the parenchyma of the viscera, etc.; each of which is described under its alphabetical head. (See Meat Extract.)

Flesh-Fly, the common name of various insects of the order Diptera, family Muscidæ, of which the best known is the *Sarcophaga carnaria,* the common flesh-fly. The *Musca* (or *Lucilia*) *cæsa, Musca* (or *Calliphora*) *vomitoria,* and other species are common to both continents, and deposit their already-hatched larvæ upon fresh meat and decaying animal matter—sometimes on the wounds of soldiers—giving rise to a most disgusting crop of maggots. A single female sometimes deposits 20,000 maggots.

Flesh Juice. See Meat Extract.

Fletch'all, tp. of Worth co., Mo. Pop. 582.

Fletch'er, post-v. of Brown tp., Miami co., O. P. 306.

Fletcher, tp. and post-v. of Franklin co., Vt., 30 miles N. N. W. of Montpelier. Pop. 865.

Fletcher (Andrew) **of Saltoun,** Scotch publicist, b. at Saltoun in 1653, opposed the royal court in the Scottish Parliament in 1681, and was forced to retire to Holland. Returned to England in 1683; took part with the duke of Monmouth in 1685; served in Hungary against the Turks in 1686; returned to England with William of Orange in 1688; brought forward the bill of security in the Scotch Parliament in May, 1703; opposed the union in 1706; and d. in London in 1716. His *Political Works* were published in 1737.

Fletcher (Benjamin), a soldier of fortune who was governor of the province of New York (1691–98), succeeding Sloughter and preceding the earl of Bellomont. He was a dissolute man, and in New York attempted to establish the Church of England in opposition to the wishes of the people. Was also (1693–95) governor of Pennsylvania by the illegal commission of William and Mary.

Fletcher (James Cooley), clergyman, traveller, and author, b. at Indianapolis, Ind., in 1823; graduated at Brown University in 1846, studied theology at Princeton Seminary, N. J., then at Paris, France, and in Geneva, Switzerland, marrying there a daughter of Dr. C. Malan. Went in 1851 to Rio de Janeiro, S. A., as chaplain missionary of the American and Foreign Christian Union and the American Seamen's Friend Society. Here he was also secretary of the U. S. legation. Returning to the U. S. in 1854, he again visited Brazil in 1855, and travelled extensively in the empire. Having returned to the U. S., he issued his *Brazil and the Brazilians,* in connection with Rev. D. P. Kidder, D. D.—an illustrated imperial octavo. Has since then again visited Brazil, and the edition of his great work issued in 1868 contains the result of tours made during the years 1862–65. Has written for the *New York Observer, Evening Post, Journal of Commerce,* etc. In 1869 was appointed U. S. consul to Oporto, Portugal.

Fletcher (John), English dramatist, b. in Northamptonshire in 1576, was educated at Cambridge, and became the friend of Francis Beaumont. D. in London in 1625, of the plague. Was sole author of *The Faithful Shepherdess, The Scornful Lady* (1616), *The Spanish Curate,* comedy (1622), *Rule a Wife and Have a Wife,* comedy (1624), etc., besides his share in the long line of plays in which his name is inseparably associated with that of Beaumont.

Fletcher (John William), originally **de la Fléchière,** b. at Nyon, Switzerland, Sept. 12, 1729; studied at Geneva; served in the Portuguese and Dutch armies; visited England, and became a minister of the Established Church in 1757, being vicar of Madeley. Wrote in defence of Wesley's Arminianism. The countess of Huntingdon appointed him president of her theological school at Trevecca, Wales, 1768. D. at Madeley Aug. 14, 1785, his principal work being *Checks to Antinomianism.* All his writings were published in 8 vols. He was one of the founders of Methodism, and a man of great industry and piety and of most amiable and saintly character. He was also a keen polemic.

Fletcher (Phineas), English poet, b. about 1584, entered Cambridge University in 1600, and was rector of Hilgay, Norfolk, in 1621; d. there about 1660. Wrote various poems—*The Locustæ, or Apollyonists,* a satire against the Jesuits (1627), rare; *Sicelides, a Dramatic Piece* (1631), *Joy in Tribulation* (1632), *The Purple Island, or The Isle of Man,* together with *Piscatoric Eclogues and other*

Poetical Miscellanies (1633), etc. He was a cousin of Fletcher the dramatist, and brother of Giles Fletcher (1588–1623), a clergyman, and author of the fine poem *Christ's Victory and Triumph* (1610).

Fletcher (RICHARD), LL.D., b. at Cavendish, Vt., Jan. 8, 1788; graduated at Dartmouth College in 1806; studied law with Daniel Webster; was admitted to the bar in 1809; and settled at Salisbury until 1825, when he removed to Boston, Mass. Was member of the Massachusetts legislature; a representative in the U. S. Congress in 1837–39; judge of the Massachusetts supreme court 1848–53; and d. June 21, 1869, at Boston, bequeathing $100,000 to Dartmouth College.

Fletcher (WILLIAM A.), American jurist, b. in Massachusetts; settled in Michigan about 1820; practised law at Detroit; was attorney-general of the Territory; in 1835 chief-justice of the supreme court of the State; retired from the bench in 1842, and resumed his practice. The *Revised Statutes of Michigan* were published by him in 1838. D. at Ann Arbor, Mich., 1855.

Fleur de Lis [Fr. for "flower of the lily"], often Anglicised into **Flower de Luce,** the flower of the *Iris sambucina* (order Iridaceæ), a plant native in the south of Europe and cultivated for many centuries in gardens. This flower is famous as the emblem of the French kings, whose arms in later times were azure, three fleurs de lis, or, borne two and one. Many curious legends were related as to the origin of this emblem. The historical fact appears to be that the Frankish kings employed the fleur de lis as a kind of badge long before the proper rise of heraldry. The heraldic fleur de lis is a common bearing upon arms in other countries.

Fleurus, town of Hainaut, Belgium, 7 miles N. of Charleroi. Here Gonsalvo of Córdova was defeated by the dukes of Brunswick and Saxe-Weimar Aug. 29, 1622; Waldeck was defeated by Marshal Luxembourg July 1, 1690, and the prince of Coburg, having gained here a virtual victory over Jourdan, June 26, 1794, lost its fruits, and indeed the whole of Belgium, by bad strategy after the fight. The battle of Ligny, 1815, took place a mile or two N. of Fleurus. Pop. 4093.

Fleury (CLAUDE), ABBÉ, French ecclesiastic and historian, b. at Paris Dec. 6, 1640, was advocate to the Parliament of Paris 1658–67, and tutor to the princes Conti in 1672; in 1689–1707 sub-preceptor with Fénelon to the dukes of Burgundy, Anjou, and Berri. Was prior of Argenteuil in 1707, confessor to Louis XV. 1716–22, and d. July 14, 1723. Published *Morality of Christians, Ecclesiastical Law, Historical Catechism* (1683), etc., but his greatest work is his *Ecclesiastical History* (20 vols., 1691–1723).

Fleury (ÉMILE FÉLIX), French general, b. in Paris Dec. 23, 1815; entered the army in 1837; served eleven campaigns in Algeria; was sub-lieutenant in 1840, captain in 1844, major in July, 1848, and on his return to France a general of brigade Mar. 18, 1856, and general of division Aug. 13, 1863. Was a thorough Napoleonist, and became officer of the Legion of Honor in 1849, grand officer Aug. 13, 1859. Was summoned to the French senate by decree Mar. 15, 1865, was chief equerry to Napoleon III. Dec., 1865, having received the grand cross of St. Anne in 1864. In 1866 was sent on a diplomatic mission to King Victor Emmanuel, and in Sept., 1869, became French ambassador at St. Petersburg. In Sept., 1870, resigned this position, and with his family retired to Switzerland.

Fleury, de (ANDRÉ HERCULE), CARDINAL, b. at Lodève, France, June 22, 1653; studied at the Jesuit College, Paris; was made bishop of Fréjus 1698; in 1715 became preceptor to Louis XV.; in 1721 was admitted to the Academy; in 1726 assumed the position of prime minister of France, and was made a cardinal. His policy was to foster the sciences and arts, to increase the internal prosperity of France, and to reduce the expenses of the government; but his foreign policy lacked vigor. D. at Paris Jan. 29, 1743.

Fleury, de (LOUIS), CHEVALIER and VISCOUNT, French lieutenant-colonel in the American Revolutionary army, having received a captain's commission from Washington; served at Fort Mifflin on the Delaware and at the battle of Brandywine, and was promoted to be lieutenant-colonel Nov. 26, 1777. In the winter of 1777–78 he was sub-inspector under Steuben; June 4, 1778, adjutant-general of Lee's division; in July, 1778, was second in command of a battalion of light infantry in the Rhode Island expedition, and then commanded a battalion of light infantry under Washington. He received the thanks of Congress and a silver medal for gallantry in the storming of Stony Point, July, 1779. Returned to France in 1780 with Rochambeau, becoming one of his officers.

Flexibil'ity [from the Lat. *flecto, flexum,* to "bend"], that quality by which certain bodies may be made temporarily or permanently to change their form under the influence of mechanical forces. Thus, a long leaden rod held by one end in a horizontal position is bent downward by its own weight. Flexibility, though not the opposite of brittleness, cannot be predicated of brittle bodies.

Flex'ible Sand'stone, sometimes called **Itacol'umite,** a metamorphic siliceous rock found in the Southern Alleghanies, and especially in Brazil. It occurs in thin layers, which are to a certain degree flexible, but are not elastic. Such sheets may be bent forward and backward hundreds of times without breaking. The cause of this peculiar property of itacolumite has been much discussed. Prof. Wetherell of Philadelphia, after a careful microscopic examination of the granules of quartz which compose this rock, announced that he had discovered that they are elongated and interlocked, each particle working in a kind of joint. This statement has been denied by subsequent observers, but the weight of authority is in favor of its acceptance. Gold and diamonds are frequently found with itacolumite, and it has been thought that the association of the two latter was something more than accidental. No relationship has, however, been proved to exist between them.

J. S. NEWBERRY.

Flex'ure of Beams. A beam or girder is defined by Rankine as "a bar supported at two points, and loaded in a direction perpendicular or oblique to its length." The term *beam* is sometimes, as is the case of a tie or collar beam, used where the strain is in the direction of the beam, but such use is exceptional, and in this article beam and girder will be considered as synonymous. If it is supported at but one point it is called a semi-girder. A beam or girder may be a continuous solid, like a trunk of a tree, or it may be an assemblage of many members united to form an artificial bar. Such girders are variously known as braced girders, frames, and trusses.

The greater portion of the following summary of the laws of the strains in various kinds of beams will be condensed from Story's *Theory of Strains in Girders and Similar Structures,* a standard work on the subject; to which book, among many others, reference is made for fuller discussions than are possible in the limits of the present article.

The following mechanical laws are the basis of the theory of strains:

Resolution of Forces.—If three forces meet and balance at a common point, three lines parallel to their directions will form a triangle whose sides will be proportional to these forces.

If it is known that three forces balance, and that two of them meet, the line of direction of the third must pass through their point of intersection.

Law of the Lever.—If a weight rests on a beam supported at its two extremities, the part of the weight which is upheld by either support will be to the whole weight as the distance between the weight and the other support is to the distance between the supports. The upward reaction of either support is equal and contrary to the pressure on it.

Equality of Moments.—When any number of forces, acting in the same plane on a rigid body, balance, the sum of the moments of the forces tending to turn it in one direction around any given point is equal to the sum of the moments of those tending to turn it in the opposite direction.

When any number of forces acting in the same plane have a single resultant, the sum of the moments of the forces around a given point is equal to the moment of their resultant.

The moment of a force around a given point is the product of the intensity of the force by its lever-arm, the latter being the perpendicular let fall on it from the given point.

The ordinary girder has an I cross-section, the top and bottom being called *flanges,* and the vertical connection the *web.* Tubular or double-webbed girders are those whose cross-sections are a hollow rectangle or a ring.

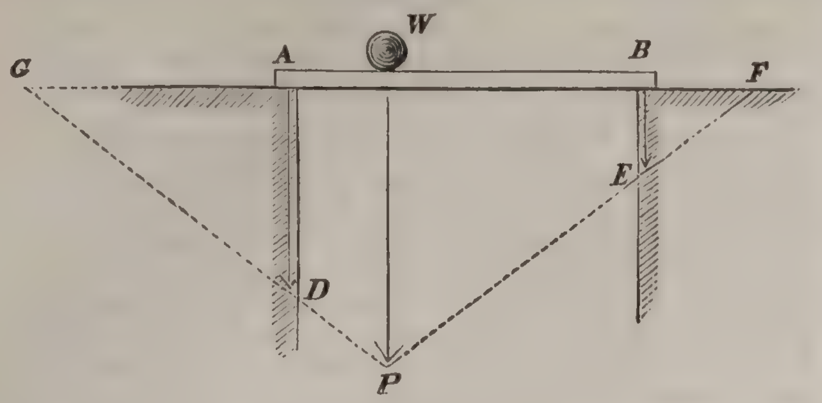
Throughout the discussion that follows the girders are supposed to be without weight, unless the contrary is stated.

The strains that act on material bodies may be divided into two great classes—tensile, tending to pull bodies apart; and compressive, tending to crush them. As a matter of convenience and of clearness these names are generally limited to forces acting in the direction of the axes of bodies, or nearly so. Forces acting at right angles to the axes are termed transverse forces; those that tend to break bodies by twisting are torsional forces; and those that act to make the elementary transverse sections of a body separate from the sections on either side are called shearing forces. The shearing forces on horizontal beams are vertical in direction.

In Fig. 1 the weight W on the beam A B is transmitted

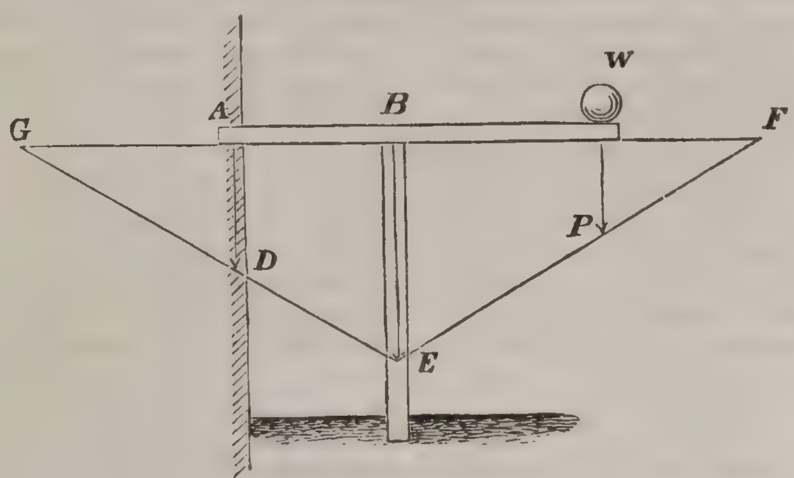
through the beam to the abutments. The nearer abutment

FIG. 1.



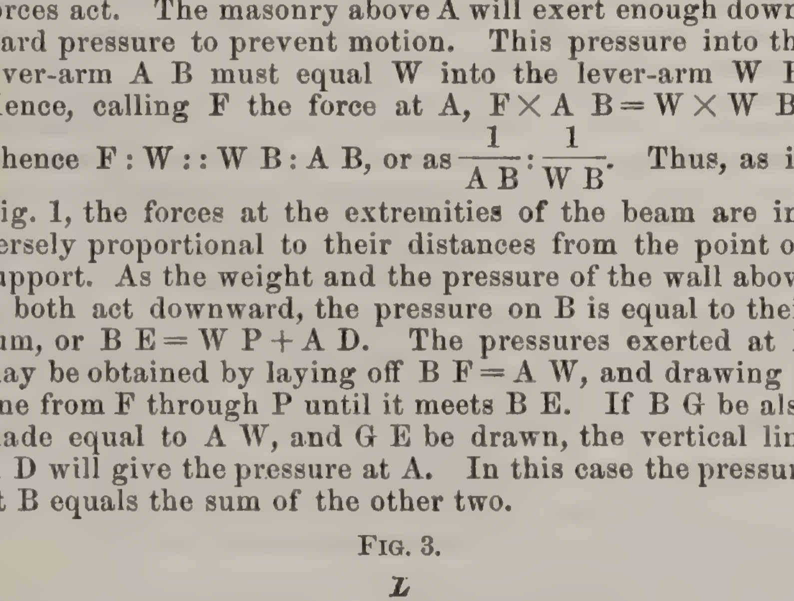
supports the greater part of the load. If we represent the weight by the line W P, abutment A will support the portion equal to A D, and abutment B the portion equal to B E. The amount of the weight on each abutment will be just equal to the upward force that would be required at that abutment to support that end of the beam in case the abutment were removed. The amounts of these weights may be determined graphically by laying off on each side of the point W distances W F and W G, each equal to A B, and connecting F and G with P. If lines parallel to W P be drawn from A and B, the distances intercepted on these lines, when measured by the same scale that was used in laying off W P, will give the amounts of the weight which are borne by each abutment. In all positions of W it is equal to A D + B E. If the weight, as in Fig. 2, be out-

FIG. 2.



side of the points of support, we shall have it acting to depress one end of the beam, while the wall above A will hold down the far end, B being the fulcrum around which the forces act. The masonry above A will exert enough downward pressure to prevent motion. This pressure into the lever-arm A B must equal W into the lever-arm W B. Hence, calling F the force at A, F × A B = W × W B; whence F : W :: W B : A B, or as $\frac{1}{A\,B}:\frac{1}{W\,B}$. Thus, as in Fig. 1, the forces at the extremities of the beam are inversely proportional to their distances from the point of support. As the weight and the pressure of the wall above A both act downward, the pressure on B is equal to their sum, or B E = W P + A D. The pressures exerted at B may be obtained by laying off B F = A W, and drawing a line from F through P until it meets B E. If B G be also made equal to A W, and G E be drawn, the vertical line A D will give the pressure at A. In this case the pressure at B equals the sum of the other two.

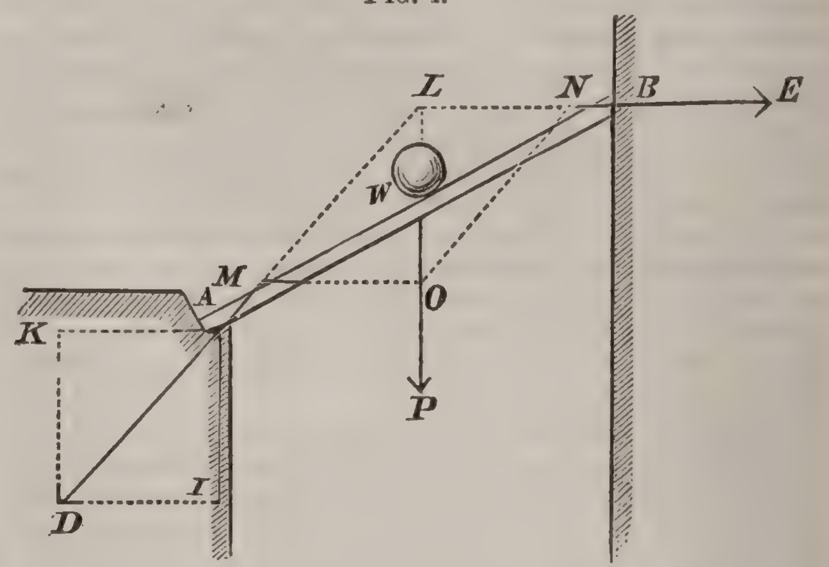
FIG. 3.



If the beam be inclined, as in Fig. 3, the resolution of forces would take place in a similar manner. Resolving the weight W P into its components W H and W C, we find that the former is transmitted directly to A, where it becomes A K, and is resisted by the abutment. Considering only the force W C at right angles to the beam, we find, as in Fig. 2, the two pressures B E and A I. The former is the only pressure on abutment B, but the latter must be combined with the force A K, and there will result a pressure A D on abutment A.

The same result could have been obtained as follows. We know the direction, intensity, and point of application of the weight, and the points of application of the two reactions. We also know the line of direction of the reaction of the right abutment, as it must be perpendicular to the beam. Therefore, drawing B L perpendicular to the beam, and prolonging it until it meets W P prolonged upward, we find L the point of intersection of the three forces. Connecting this with A, we have the direction of the pressure on the left-hand abutment. Laying off L O = W P, and constructing the parallelogram L M O N, we find L N and L M as the pressures on the two abutments. They agree with what we have found by the other method.

FIG. 4.



If, as in Fig. 4, the beam rests against a vertical wall, forming what is generally known as a shed-roof, the direction of the resistance of the right-hand abutment is changed, and there is a corresponding change in the intensities of the developed pressures. In Fig. 3, B E had a vertical component; in this case it has none, but the component A I is equal to the weight W P, showing that the whole weight is transmitted to the left-abutment. The pressure A D is therefore greater than the original weight.

If in the cases above given the weight, instead of being concentrated, were uniformly distributed, the pressures on the abutments would be obtained by replacing the distributed weights by a single weight equal to their sum and located at their centre of gravity.

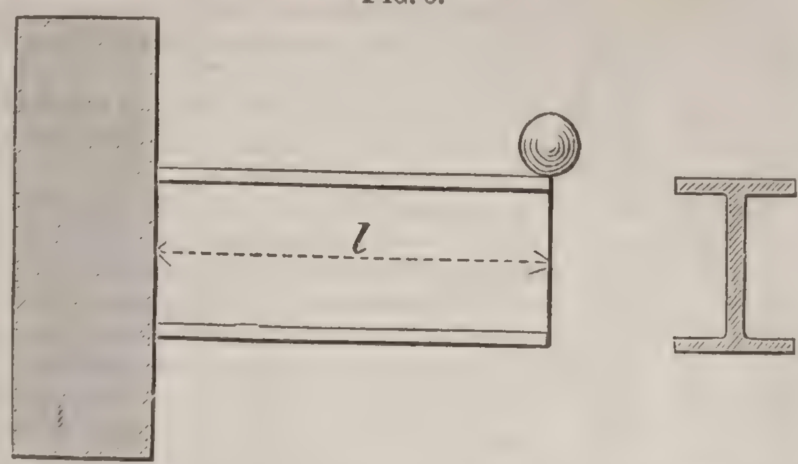
When a weight is placed at the extremity of a semi-girder, it tends to shear or separate the section on which it rests from the one adjoining it. The molecular forces prevent this separation, and the tendency to shear is transmitted to the next section, and thus to the abutment. Thus, a vertical force equal to the weight is transmitted from section to section to the point of support. This strain is called the shearing strain. Its action in solid girders is obscure, but it must act on non-horizontal lines, as it is a well-known mechanical law that vertical forces can only generate strains that are vertical or have vertical components.

When the vertical web of a girder with horizontal flanges is open-work, like latticing, the shearing strain is altogether transmitted through the bracing, the flanges being capable of conveying strains in the direction of their length only; but when the web is continuous, as in a plate girder, it is probable that a small amount of shearing force acts upon the flanges also. If, however, one or both flanges are curved, the whole or a considerable portion of the shearing-strain is conveyed through that part of the flange which is sloped, the amount depending on the angle of inclination. In this case the web has less duty to perform than if the flanges were horizontal, and its sectional area may therefore be reduced. It will also be observed that the diagonal strains developed by the shearing force in a continuous web have horizontal components within the web itself, and, consequently, a continuous web aids the flanges to a certain extent, for those parts of the web which adjoin the flanges share the horizontal strains in the latter; and this flange-action of the web is greater the thicker the web is. When, however, the web is very thin, the total amount of this flange-action of the web is small compared with the strain in the flanges themselves, and may therefore be neglected without introducing any serious error. In the following discussions the web will not be considered except when it is expressly so stated.

In the flanged semi-girder shown in Fig. 5 it may be proved that the horizontal strain of tension in the upper

flange is equal to the horizontal strain of compression in the lower flange; also, that the weight which it is capable

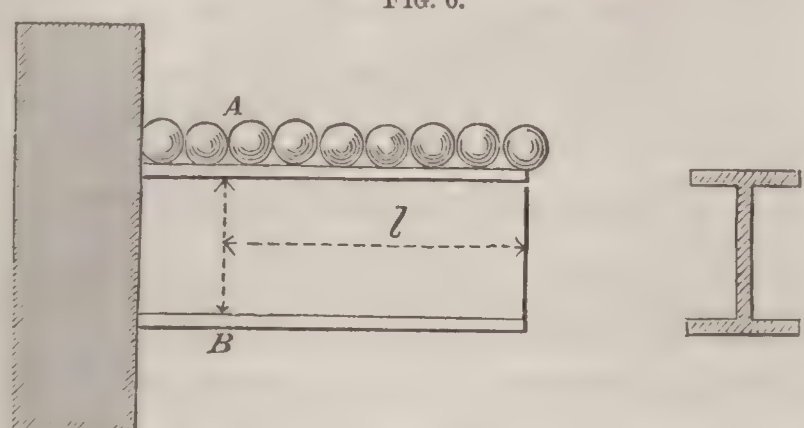
Fig. 5.



of supporting varies directly with its depth and inversely with its length. When both flanges are horizontal the strains per square inch in the flanges are inversely proportional to their areas. It follows from this that to ensure the greatest strength with a given amount of material in a girder with horizontal flanges, the sectional areas of the flanges should be inversely proportional to the maximum strains per square inch which can be permitted in the respective flanges.

The shearing strain is the same at each vertical section, and is equal to the weight at the extremity.

Fig. 6.



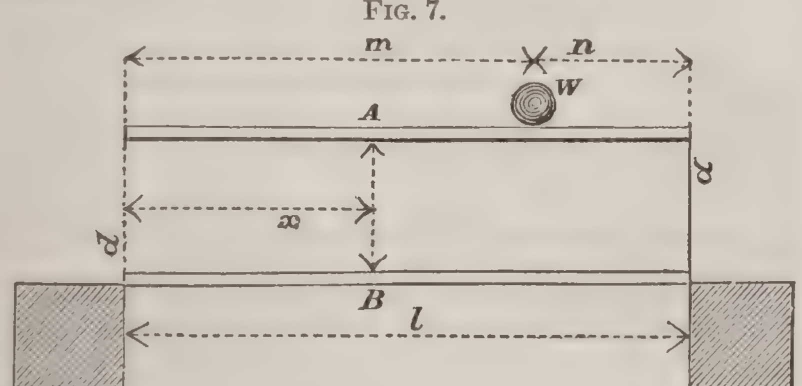
In a flanged semi-girder uniformly loaded we shall find the following expression for the strain in either flange at any section, as A B:

$$F-\frac{w\,l^2}{2d},$$

in which F is the strain, w the weight on each lineal foot, l the length from the end to the assumed section, and d the depth.

The shearing strain at any section of this girder is equal to the weight between it and the outer end; it therefore increases towards the abutment. If the flanges are parallel, all of the shearing strain will pass through the web, and therefore the latter should increase in thickness toward the abutment.

Fig. 7.



In a flanged girder resting on two supports, as in Fig. 7, and supporting a single weight, the horizontal strain in either flange at any section, as A B, will be found by taking the moments of all the forces around A or B. We thus obtain

$$F=\frac{n\,x\,W}{d\,l},$$

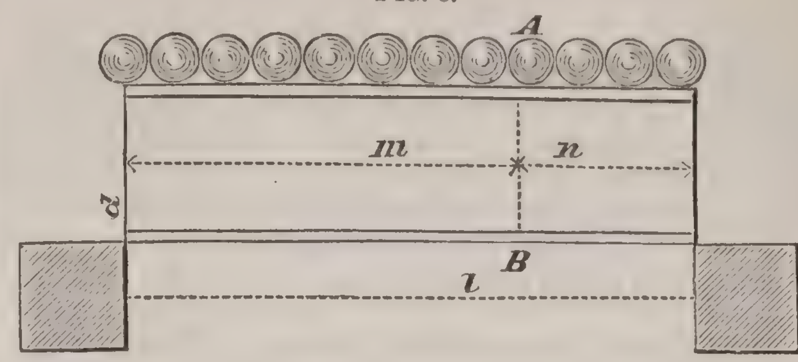
in which F is the strain, x the distance of the section from one of the abutments; and the other letters are explained by the figure. It will be found that the maximum strains at any point of either flange occur when the weight rests on that point. In this case $x=m$, and the strain is

$$F=\frac{m\,n\,W}{d\,l}.$$

If the weight be a moving one, the greatest strain in either flange will be found when the weight is at the middle of the girder. The shearing strain in each segment of the girder is uniform, and is equal to the portion of the weight transmitted to the abutment through that section.

If several weights rest on a girder, the strains should be calculated for each separately, and then added.

Fig. 8.



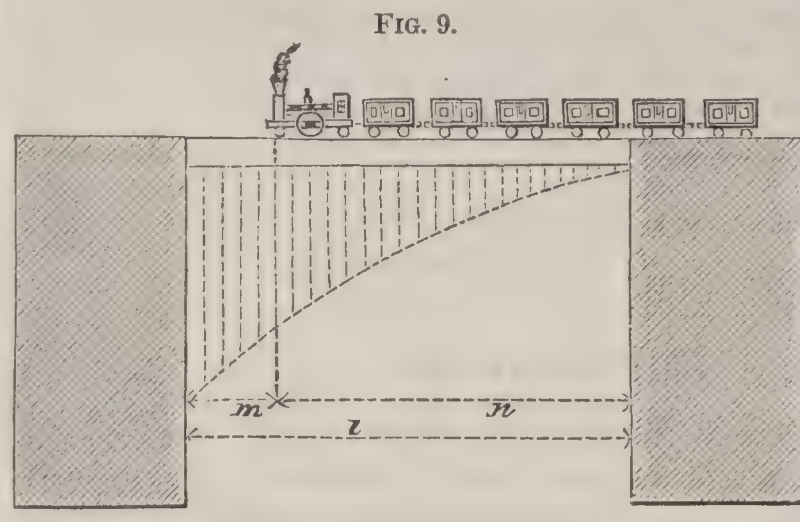
In a uniformly loaded girder, as in Fig. 8, we have

$$F=\frac{m\,n\,w}{2d}=\frac{m\,n\,W}{2dl},$$

the nomenclature being the same as in Fig. 7. W is the total weight on the girder, and therefore it equals wl.

Comparing this value of F with that previously found for a single weight, we find that the strains at any point in the flanges due to a single weight resting on this point are twice as great as would be produced if the same weight had been uniformly distributed. The shearing strain at the middle of a uniformly loaded girder is 0, and at any other point it is equal to the weight on the girder between that point and the middle.

Fig. 9.



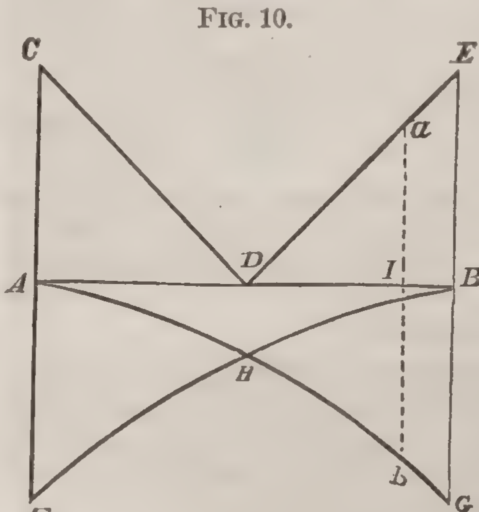
Suppose a girder partly loaded with a uniform train weighing w tons per running foot. Its weight, as in Fig. 9, is $w\,n$, and its moment around the right abutment is $w\,n\times\frac{n}{2}=\frac{w\,n^2}{2}$. The moment around the right abutment of the pressure on the left abutment (R) is Rl. Hence,

$$Rl=\frac{w\,n^2}{2}.$$

R therefore varies as the square of n. But R is the shearing strain through the segment in front of the train. It therefore varies as the ordinates of the dotted parabola represented in the figure. When the train comes from the left, a similar parabola is generated, whose vertex is at the left end of the girder.

The maximum shearing strains on any girder traversed by a passing load may be found from Fig. 10. The two triangles A C D and D E B represent the shearing strains from the permanent load which is the weight of the structure. The two parabolas F H B and A H G represent the shearing strains from the passing load. At any point I the ordinate ab represents the maximum shearing strain from the permanent and the moving loads.

Fig. 10.



The maximum strains in the flanges will be found when the load covers the whole girder.

Transverse Strain.—In any body under transverse strain the *neutral surface* is that surface at or near the centre of body where compression ceases and extension begins. The *neutral axis* of any cross-section is the intersection of this section with the neutral surface. In every girder the horizontal forces in any cross-section must balance, otherwise the girder would separate at this place. The *moment of rupture* of any cross-section is the sum of the moments of the horizontal forces in that section which tend to produce rupture. It will always be represented by the symbol M.

To calculate the strength of solid rectangular or solid round semi-girders we have the following:

$$W=\frac{a\,d\,S}{l},$$

in which W is the breaking weight, a the area of the cross-section of the girder in square inches, and S a number determined by experiment, and called the coefficient or modulus of rupture. The value of S for different substances can be obtained from tables prepared for this purpose.

The following formulas can readily be deduced:

Semi-girder loaded uniformly........................ $W=\frac{2a\,d\,S}{l}$.

Girder loaded at intermediate point............ $W=\frac{a\,d\,l\,S}{m\,n}$.

Girder loaded at centre................................ $W=\frac{4a\,d\,S}{l}$.

Girder loaded uniformly.............................. $W=\frac{8a\,d\,S}{l}$.

The breaking weights of similar girders, which determine their strengths, are therefore found to vary as their cross-sections.

If the law of uniform elastic reaction holds good in girders subject to transverse strains, the neutral axis of any cross-section will pass through the centre of gravity of the section. Assuming this law to be true, for lack of a more exact assumption, we find the following moments of rupture for various cross-sections. In these expressions M is the moment of rupture, b the breadth, d the depth, r the radius, t the thickness of hollow sections, and f the horizontal strain per square inch on the fibres in the section, whose distance from the neutral axis is c.

Solid rectangle.. $M=\frac{b\,d^3\,f}{12c}$.

Solid square with one diagonal vertical.................. $M=\frac{b^4\,f}{12c}$.

(In this case b is the side of the square.)

Solid circle.. $M=\frac{\pi\,f\,r^4}{4c}$.

Circular ring of uniform thickness........................ $M=\frac{\pi\,f\,r^3\,t}{c}$.

Solid ellipse with one axis horizontal.................... $M=\frac{\pi\,b\,f\,d^3}{4c}$.

(b is the horizontal semi-axis, and d the vertical.)

Elliptic ring with one axis horizontal...... $M=\frac{\pi\,d^2\,f\,t}{4c}\,(3b+d)$.

(b is the exterior horizontal semi-axis, and d the exterior vertical.)

Flanged girder or rectangular tube, omitting the web.. $M=\frac{a_1 a_2\,d^2\,f}{A\,c}$,

in which a_1 = area of upper flange, a_2 the area of lower flange, d the depth of the web, and $A=a_1+a_2$.

Flanged girder or rectangular tube, including the web.............. $M=\frac{f}{c}\left\{\left(a_1+\frac{a_3}{3}\right)h_1{}^2+\left(a_2+\frac{a_4}{3}\right)h^2\right\}$,

in which a_3 is the area of the web above the neutral axis, a_4 the area below the neutral axis, and h_1 and h_2 the corresponding heights of the web.

Flanged girder with equal flanges.............. $M=\frac{d^2\,f}{12c}\,(6a+a')$.

(a = area of either flange, a' = area of web.)

Rectangular tube with equal flanges......... $M=\frac{f}{12\,c}(b\,d^3-b_1 d_1{}^3)$.

(b_1 = internal breadth, d_1 = internal depth.)

Square tube of uniform thickness, with sides or diagonal vertical.. $M=\frac{2\,b^3\,f\,t}{3\,c}$.

Semi-girders Loaded at the Extremity.—To apply these values for the moment of rupture to semi-girders of any of the sections indicated, we have only to substitute in the equation

$$W\,l=M,$$

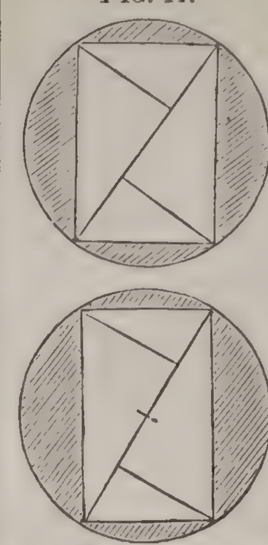
the particular value of M given above. To get breaking weights, substitute for f the breaking strain per square inch of the particular substance, and for c the distance from the neutral surface or centre of gravity to the outermost fibres.

The following facts may be easily deduced:

A solid square semi-girder is 1.4 stronger when its sides are vertical than when its diagonal is.

To cut a rectangular girder of the maximum strength out of a round log, draw a diameter and divide it into three equal parts. At one of the points of division erect a perpendicular. From the point at which it cuts the circumference draw lines to each end of the diameter, and they will be the sides of the cross-section of the required girder. According to Humber, the stiffest solid rectangular girder that can be cut out of a cylinder is obtained by dividing a diameter into four parts and proceeding as before. The strength of a solid square girder is 1.7 times that of the inscribed cylinder.

FIG. 11.



The centre of a cylindrical girder may be removed without seriously diminishing its strength, and therefore it is more economical to make such girders hollow. It may also be shown that the transverse strength of a hollow cylinder is to that of a solid cylinder of the same weight approximately as the diameter of the former is to the radius of the latter.

A square tube of uniform thickness, with its sides vertical, is 1.4 times stronger than when its diagonal is vertical. Square and round tubes of equal weight are about equally strong when the square tube is strained parallel to its sides. Round tubes, however, should be preferred wherever the strain is liable to come from various directions, as square tubes are much reduced in strength when strained in the direction of the diagonals.

A continuous web in a girder with flanges of equal area does theoretically as much duty in aid of the flanges as if one-sixth of the web were added to each flange and the web were made of bracing.

Semi-girders Loaded Uniformly.—The breaking weights for uniform loads may be obtained, as for single loads, by using the equation

$$\frac{W}{2}\times l=\frac{w\,l^2}{2}=M,$$

in which W is the total weight on the girder, and w is the weight on each unit of length.

Girder Supported at Both Ends, and Loaded at Intermediate Point.—Let x = the distance of any transverse section from the end of the girder which is farthest from the weight.

f = the strain per square inch on the extreme fibres at top or bottom.

Also let m and n be the two segments into which the weight divides the girder, b the breadth, d the depth, r the radius, t the thickness; and we obtain the following:

Solid rectangular girders.. $W=\frac{f\,b\,d^2\,l}{6\,n\,x}$.

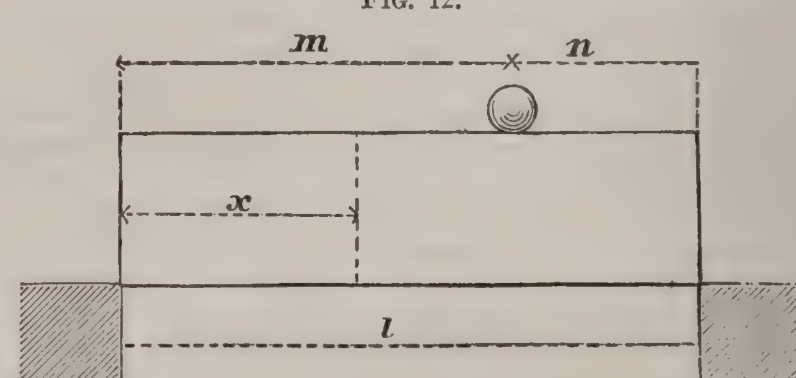
Solid round girders.. $W=\frac{\pi\,f\,l\,r^3}{4\,n\,x}$.

Hollow round girders of uniform thickness........... $W=\frac{\pi\,f\,l\,r^2\,t}{n\,x}$.

Flanged girders or rectangular tube, including web,

$$W=\frac{f\,l}{c\,n\,x}\left\{\left(a_1+\frac{a_3}{3}\right)h_1{}^2+\left(a_3+\frac{a_4}{3}\right)h_2^2\right\}.$$

FIG. 12.



In the last formula all the terms are the same that were used before in the similar case of a semi-girder.

Girders Supported at Both Ends, and Loaded Uniformly.—For girders loaded uniformly we have the general equation

$$W=\frac{2\,l}{m\,n}\times M,$$

m and n being the two segments of the girder. To get the breaking weights of such girders we have only to substitute for M its value depending on the form of cross-section. We therefore readily deduce—

Solid rectangular girders.. $W=\frac{f\,b\,d^2\,l}{3\,m\,n}$.

Solid round girders.. $W=\frac{\pi\,f\,l\,r^3}{2\,m\,n}$.

Hollow round girders, uniform thickness .... $W=\frac{2\,\pi\,f\,r^2\,t\,l}{m\,n}$.

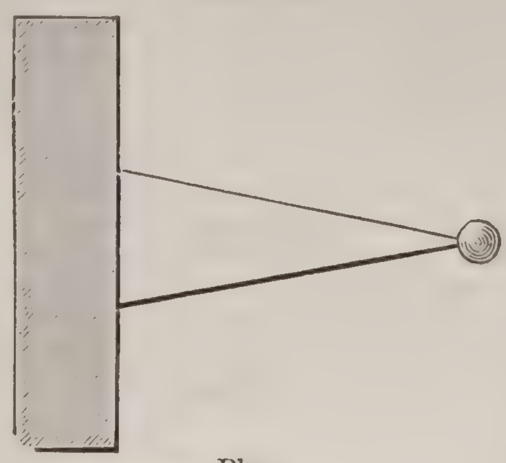
Flanged girders or rectangular tubes including web,

$$W=\frac{2\,f\,l}{c\,m\,n}\left\{\left(a_1+\frac{a_3}{3}\right)h_1{}^2+\left(a_2+\frac{a_4}{3}\right)h_2^2\right\}.$$

UNIFORM STRENGTH.—A girder is said to have uniform strength when one part is as apt to break as another. The construction of girders thus proportioned is evidently the most economical use of a given amount of material.

From the formulas already given the following forms for uniform strength can readily be deduced:

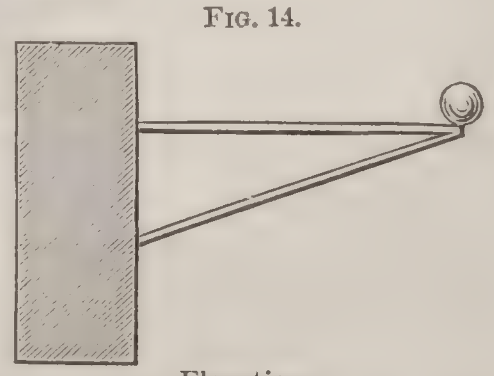
FIG. 13.



Plan.

Flanged semi-girder of uniform depth, loaded with a weight at the outer end; its plan will be a triangle with the weight at its apex.

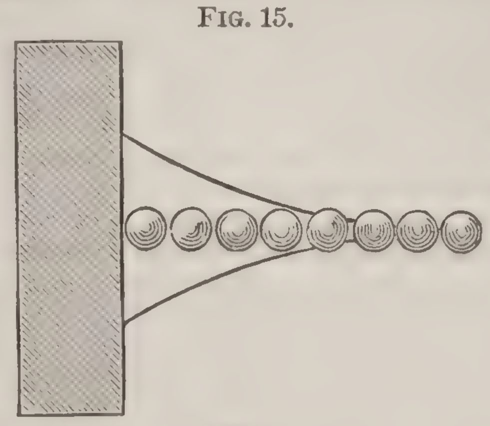
FIG. 14.



Elevation.

Flanged semi-girder of uniform width, loaded with a weight at the outer end; its elevation will be a triangle with the weight at its apex. The strain in the inclined flange will exceed that in the horizontal one in the ratio of their respective lengths.

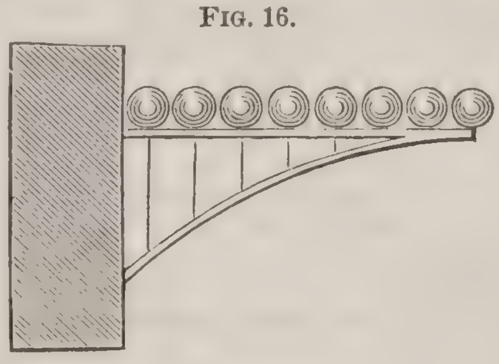
FIG. 15.



Plan.

Symmetrical flanged semi-girder of uniform depth and uniformly loaded; its plan will be bounded by two parabolas, with a common vertex at the outer end of the girder, and their axes at right angles to that of the girder.

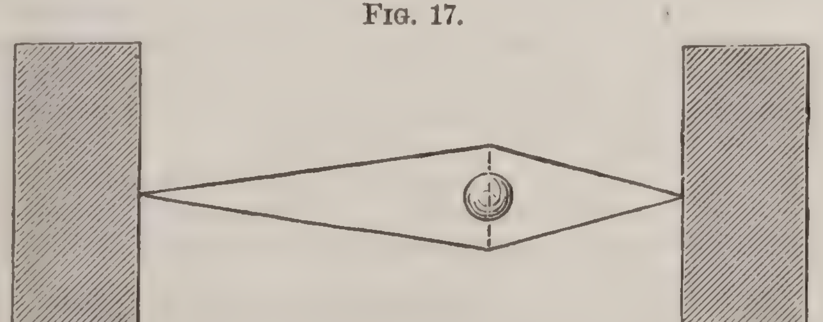
FIG. 16.



Elevation.

Flanged semi-girder of uniform width and uniformly loaded; its lower flange will be a parabola, with its vertex at the outer end of the girder, and its axis a vertical line through the same point.

FIG. 17.

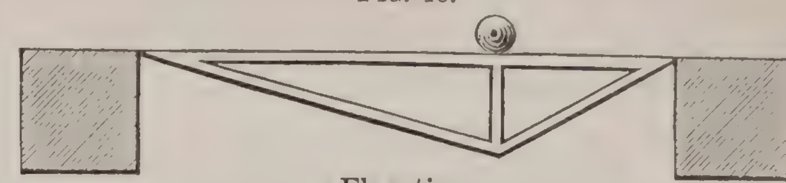


Plan.

Flanged girder of uniform depth, supporting a single fixed weight; its plan will be two triangles having a common base under the weight.

Flanged girder of uniform width, supporting a single

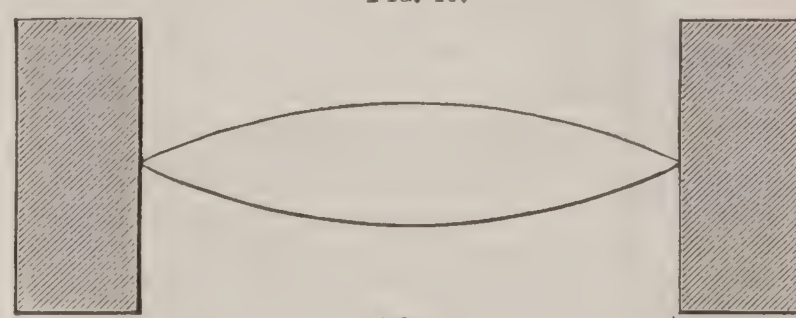
FIG. 18.



Elevation.

fixed weight; its elevation will be a triangle, with its apex down and immediately under the weight.

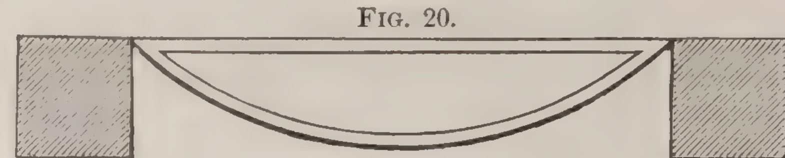
FIG. 19.



Plan.

Flanged girder of uniform depth, supporting a single *moving* weight; its plan will be two parabolas, with their vertices at the middle of the span, and their concavities turned toward each other.

FIG. 20.



Elevation.

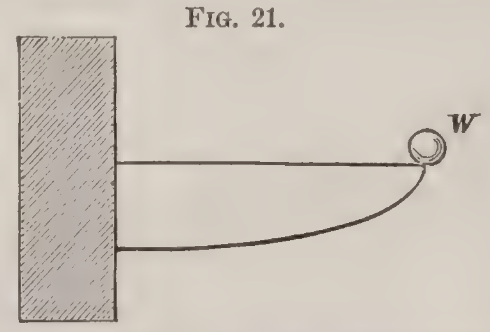
Flanged girder of uniform width, supporting a single *moving* weight; its elevation will be a parabola, with its axis vertical and at the middle of the span.

Flanged girder of uniform depth and uniformly loaded; same plan as Fig. 19.

Flanged girder of uniform width and uniformly loaded; same elevation as Fig. 20.

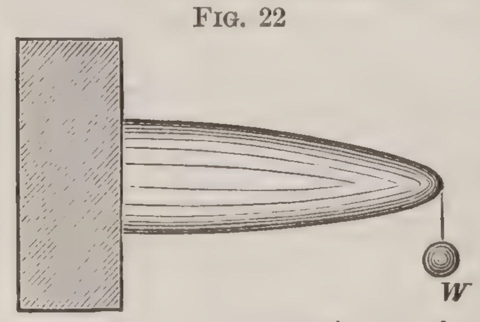
Solid rectangular semi-girder of uniform depth, supporting a weight at the outer end; same plan as Fig. 13.

FIG. 21.



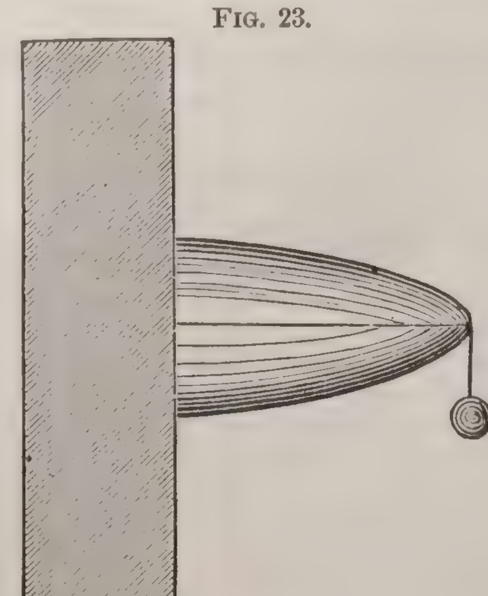
Solid rectangular semi-girder of uniform width, supporting a weight at the outer end; its elevation will be a parabola, with its vertex at the outer end and its axis horizontal.

FIG. 22



Solid round semi-girder, supporting a single weight at its outer end; it will be a solid of revolution formed by revolving a cubic parabola around a horizontal axis. (Equation of cubic parabola $y = ax^3$.)

FIG. 23.

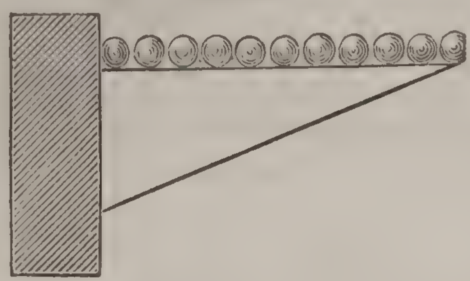


Hollow round semi-girder of uniform thickness, support-

ing a single weight at its outer end; it will be a hollow solid of revolution formed by revolving a parabola around a horizontal axis.

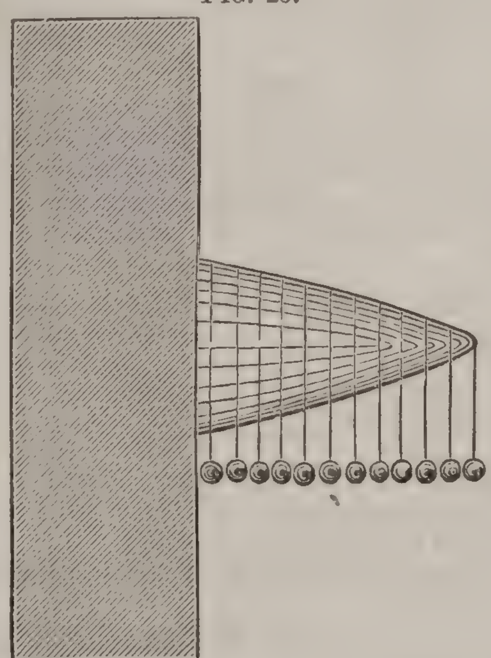
Solid rectangular semi-girder of uniform depth and uniformly loaded; same plan as Fig. 15.

FIG. 24.



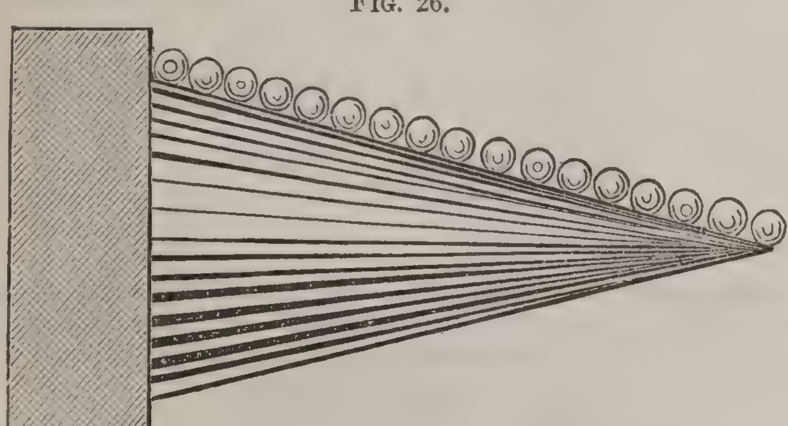
Solid rectangular semi-girder of uniform width and uniformly loaded; its elevation will be a triangle, with its apex at the outer end.

FIG. 25.



Solid round semi-girder uniformly loaded; it will be a solid of revolution formed by revolving a semi-cubic parabola around a horizontal axis. (Equation of semi-cubic parabola $y^2 = p^2x^3$.)

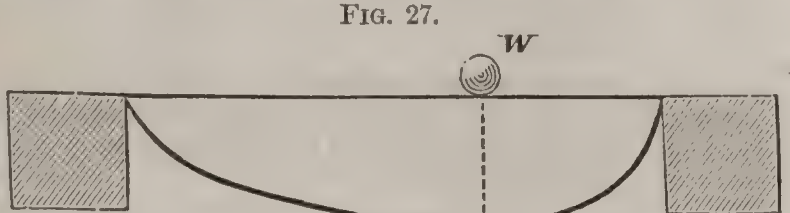
FIG. 26.



Hollow round semi-girder of uniform thickness and uniformly loaded; it will be a hollow cone with horizontal axis.

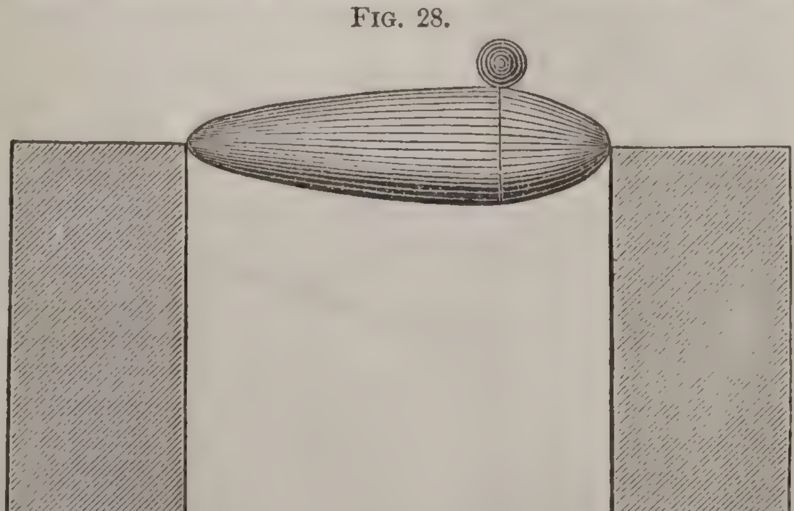
Solid rectangular girder of uniform depth, supporting a single fixed weight; its plan will be the same as Fig. 17.

FIG. 27.



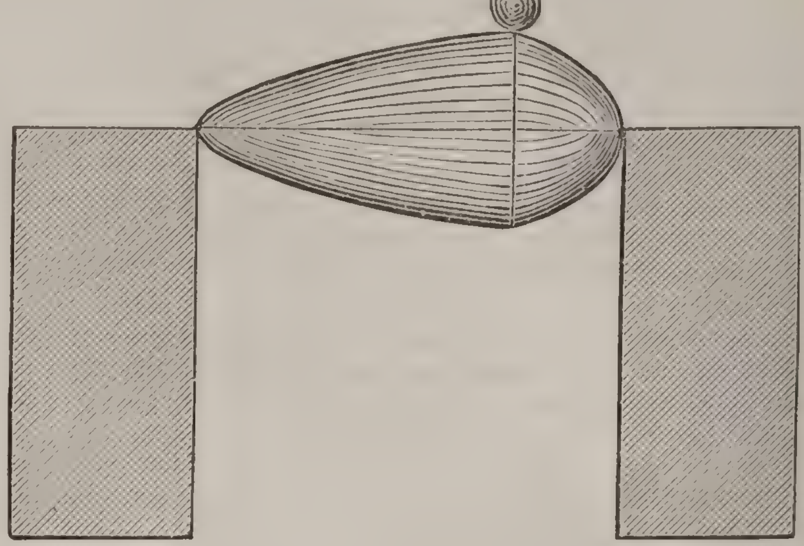
Solid rectangular girder of uniform width, supporting a single fixed weight; its elevation will be bounded on the under side by two parabolas, having their vertices at either end of the girder and their axes horizontal.

FIG. 28.



Solid round girder, supporting a single fixed weight; it will be a solid of revolution formed by revolving around their common axis two cubic parabolas, with vertices at the points of support. The solid will be in the shape of a spindle.

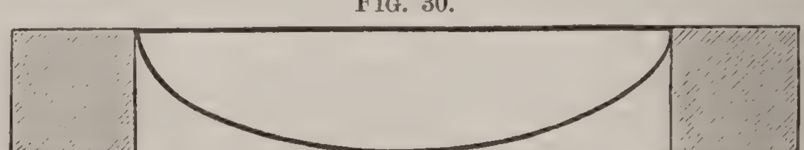
FIG. 29.



Hollow round girder of uniform thickness, supporting a single fixed weight; it will be a hollow solid of revolution formed by revolving around their common axis two parabolas, with vertices at the points of support.

Solid rectangular girder of uniform depth, supporting a single *moving* weight; same plan as Fig. 19.

FIG. 30.



Solid rectangular girder of uniform width, supporting a single *moving* weight; its elevation will be bounded on the under side by a semi-ellipse, with vertices at the points of support, and the top of the girder as one of its axes.

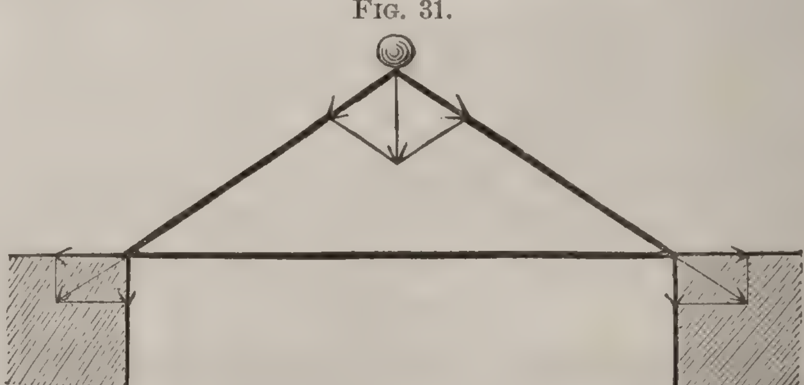
Solid rectangular girder of uniform depth and uniformly loaded; same as Fig. 19.

Solid rectangular girder of uniform width and uniformly loaded; same as Fig. 20.

Theory and practice do not agree very well in the matter of the strength of girders, and the formulas given for solid girders give results much smaller than the actual fact.

This is probably due to the fact that the neutral axis does not pass through the centre of gravity, as has been assumed. Mr. Hodgkinson concluded, from his experiments on a cast-iron girder, that the neutral axis was at a distance from the compressed side equal to from one-fifth to one-sixth the depth. Similar results were found by Barlow in experimenting upon the strength of timber. The whole subject is not yet well understood. It is safe, however, to conclude that the tensile and compressive strength of materials cannot be determined with accuracy from experiments on transverse strains.

FIG. 31.



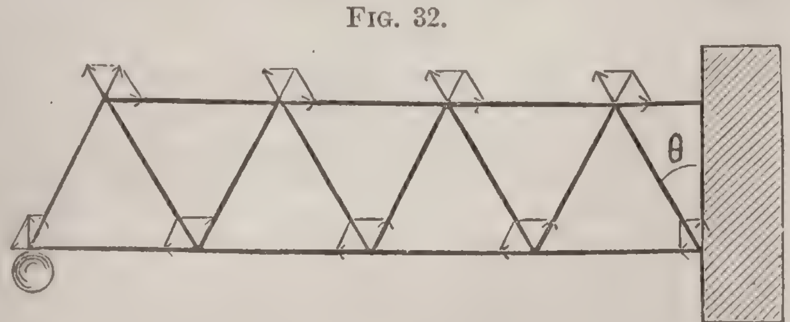
The primary object of bracing is to change transverse strains into longitudinal ones. The best bracing is made up of triangles, as they are the most stable of geometrical figures, having the least tendency to change shape under pressures at the apexes. In the frame represented in Fig. 31 the weight is resolved into two components, $W a$ and $W b$, which go to the respective abutments. Here they are resolved into horizontal and vertical components, the former of which balance through the tie-beam A B, and the others, each of which is equal to half of W, press vertically on the supports.

The following are the technical terms used in bridge-building: The top of a bridge truss is variously called the top chord, the top, the boom, and the upper flange. The first name is generally used in the U. S. Similarly, the bottom of a bridge is known as the bottom chord, the bottom, and the bottom flange. The intermediate members

are known as the bracing or the web. Braces under tension are called ties; those under compression, struts. Vertical struts are generally called posts. The intersection of a brace with a chord or flange is called an apex. The distance between two adjacent apexes is called a panel or bay. When the moving load is carried on the top of a bridge the latter is called a deck or undergrade bridge; when carried on the bottom, a through or overgrade bridge. As a matter of convenience, tensile strains are generally marked *minus* (—), and compressive strains *plus* (+).

The strain on any member from different weights is the algebraic sum of the strains from each weight. The same member may sometimes be extended and sometimes be compressed, but it can only sustain one kind of a strain at a time. A uniformly distributed load is assumed, for convenience of calculation, to be concentrated at the apexes, each apex supporting a weight equal to that on the adjacent half panels.

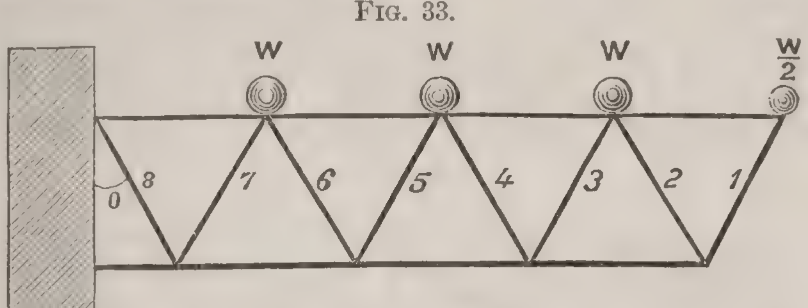
FIG. 32.



The accompanying diagram represents the effect of a single weight at the extremity of a braced semi-girder, showing how the weight is transmitted through the braces in succession to the abutment. It will be seen that the strains are equal on all the braces, but that while the strain on the outermost brace is compressive, that on the second is tensile, that on the third compressive, etc., alternating thus to the abutment. All the strains in the top chord are tensile, and they increase in amount from the weight to the abutment, each brace bringing up a new tensile strain, which is added to that previously developed. The least tension is in the segment nearest the weight, and the greatest in that adjoining the abutment. In the bottom chord the strains are compressive, increasing in amount towards the abutment.

Designating the angle of each brace with the vertical by θ, we find that the strain on each brace is W sec. θ. The strain on the outermost segment of the top chord is W tan. θ, while the increment of strain from each brace except the last is $2 \times W$ tan. θ. The increment from the last is W tan. θ. The compressive strain on the bottom chord from each brace is 2 W tan. θ. The sum of the tensile strains on the top chord, which is the strain on the segment nearest the abutment, is 8 W tan. θ, and the compressive strain on the corresponding segment of the bottom chord is likewise 8 W tan. θ.

FIG. 33.



In a semi-girder uniformly loaded, as in Fig. 33, each weight will be transmitted to the abutment, as in Fig. 32. The outermost weight passes through all the braces, the next through all but the two outer, and so on to the abutment. The sum of the strains on any brace is equal to the sum of the strains from each weight considered separately. Calling this sum Σ, we have the following:

$$\Sigma = n\,W \text{ sec. } \theta\,;$$

in which n is the number of weights that pass through the brace. For instance, one full weight and a half of a weight pass through 3 and 4. Therefore, for these two $n = 1\frac{1}{2}$. By summation of the strains in each chord we find the following for any panel of the loaded chord:

$$F = \left\{ m\,(m-1) + \tfrac{1}{2} \right\} W \text{ tan. } \theta\,;$$

and for any panel of the unloaded chord,

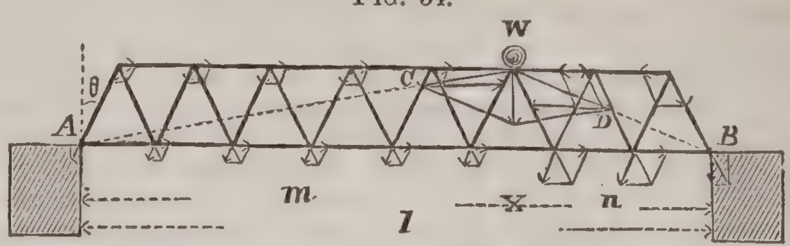
$$F = m^2\,W \text{ tan. } \theta,$$

in which F is the strain on the panel, and m is the number of the panel from the outer end.

The chief practical use of the calculations on semi-girders is in the construction of drawbridges.

If the semi-girders thus far examined had been lattice trusses, in which each brace is intersected by one or more others, it would only be necessary to make separate calculations for the braces of each system, taking account only of the weight on the apexes of that system, and to add together all the strains on the chords.

FIG. 34.



In the girder or truss shown in Fig. 34 we know, on the principle of the lever, that the resolution of the weight will take place on the lines W A and W B. The course of W C, the component that goes to A, may readily be traced, as also that of W D, that goes to B. The direction in which the forces act shows whether they are tensile or compressive. It will be seen at a glance that while in the semi-girder the top chord was in tension and the bottom chord in compression, the reverse holds in the full girder or truss.

Calling θ the angle of inclination to the vertical, and m and n the two segments, we have

Strain in each diagonal in left segment.......... $\Sigma = \frac{m}{l} W$ sec. θ.

Strain in each diagonal in right segment......... $\Sigma = \frac{n}{l} W$ sec. θ.

The diagonals which meet at the weight are under the same kind of strain (in this case compression). Those that meet at any other apex are under opposite strains.

If x represents the number of apexes (both chords included) between any panel and the abutment of the segment to which it belongs, we shall have the following:

Panel in right segment (x measured from right abutment),

$$F = \frac{mx}{l}\,W \text{ tan. } \theta.$$

Panel in left segment (x measured from left abutment),

$$F = \frac{nx}{l}\,W \text{ tan. } \theta.$$

The maximum strains will be found under the weight.

Moving Load.—As the load changes its position the strains in the braces vary, changing from tension to compression, and *vice versâ*, as it passes each apex. If the upper chord supports the load, the maximum compression in any brace will occur when the weight is passing its upper extremity, and the maximum tension when passing the adjoining apex at that side to which the brace slopes. If the lower chord supports the load, the maximum tensile strain in any brace occurs when the weight is passing its lower end, and the maximum compressive strain when passing the adjoining apex on that side to which the brace slopes upward. The maximum strain in any panel of the unloaded chord occurs when the moving load is in the vertical line passing through that panel. The maximum strain in any panel of the loaded chord occurs when the passing load rests on the adjoining apex at the same side as the centre. If a single load traverses a lattice truss, only one system of triangulation will be strained at a time.

FIG. 35.

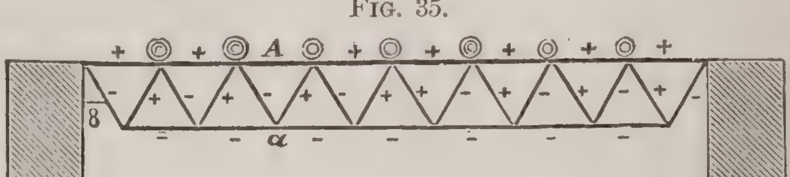


Fig. 35 represents a triangular truss uniformly loaded. The weights on the left of the central line are transmitted to the left abutment, and those on the right to the right abutment, half of the central weight going to one abutment and half to the other. The strains in the diagonals therefore increase toward the abutments, and those in the chords increase toward the centre. The character of the strains on each member is indicated by the sign + for compression, and — for tension.

Strain on a brace, $\Sigma = n\,W$ sec. θ, n representing the number of weights between any diagonal and *the centre.* Any two diagonals equally distant from the centre sustain all the intermediate load, on the principle of the *counter-balancing of equal weights similarly situated on symmetrical trusses.* The strains on the chord panels are obtained from the law that *the increment of strain developed at any apex is equal to the algebraic sum of the horizontal components of the strains in the intersecting braces.* The total strains on any panel are obtained by properly summing up the increments of strain from the braces. The easiest way to do this is by means of a diagram, the details of whose construction may be found in Storey *On Strains.* They may also be found by forming a table of the strains which each weight would produce if acting separately, and obtaining their algebraic sum. It is well in complicated trusses to

check results by calculating the strains in one or more panels on the principle of moments. For instance, in Fig. 35, taking moments around a, the moment of the strain in panel A, acting with a lever-arm equal to the depth of the truss, will be equal to the moment of the reaction of the left abutment (whose lever-arm is two panels and a half), diminished by the moments of the first two weights (whose lever-arms are a panel and a half, and half a panel respectively). In this equation all the quantities are known except the strain in A, which is easily deduced. The moments of the forces at a do not enter the equation, as their lever-arms are zero. It is easy to show that when two diagonals meet at a loaded apex the strain in the one more remote from the centre is the greater by W sec. θ; also, that the strains in two diagonals that intersect at an unloaded apex are equal in amount, but opposite in character.

All bridges must be calculated as always sustaining a permanent or dead load, which is the weight of the structure, and as also sustaining a moving or live load, gradually advancing from one end and gradually passing off at the other. Each member of the truss must be capable of sustaining with the prescribed degree of safety the greatest strain which can come on it from any combination of the two loads. As the effect of the moving load is to cause strains on the braces that sometimes are similar in kind to those caused by the permanent load, and sometimes are opposite, the best method of calculation is to determine the permanent strains due to the weight of the structure, and then to take each weight separately, and determine the strain caused by it on each one of the diagonals. The sum of all of these strains will give the maximum strain due to the moving load. On all but the diagonals of the extreme panels there will be two kinds of strain. By adding to the permanent strains the temporary ones of the same kind, we determine the maximum degree of this class of strains. When the permanent strains are less than the temporary ones of opposite kind, we subtract them, and thus obtain the maximum degree of the latter kind of strain. If the permanent strains are the greater, the brace will only be subjected to one class of strains, the temporary strain being insufficient to reverse the permanent one.

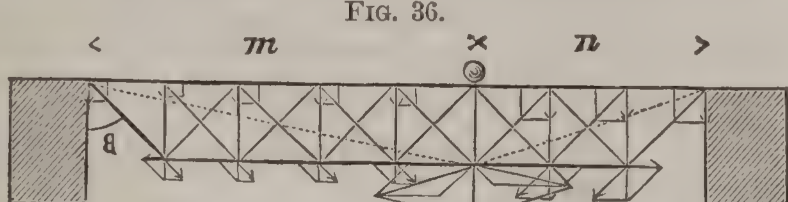
The greatest strains in the chords are found when the whole bridge sustains the maximum load that can come on it.

The maximum strains on the braces may be expressed by equations, but they are too complicated to find a place here.

Lattice Bridges.—The strains in lattice bridges may be calculated as in other bridges, provided care is taken to keep the systems of triangulation separate, and to get the strains on the diagonals only from the weights that act on the system to which they belong. As the greatest strains in the chords occur when the whole bridge is covered, they are easily found by a proper summation of the increments of strain brought up by the diagonals. The method of tabulating the strains due to each weight is the simplest and most satisfactory. In lattice bridges, as usually built, the end pillars must be made capable of safely resisting the transverse strains brought upon them by the end diagonals. A better method of construction is to change the angles of these diagonals, and to bring their lower ends to the end of the bottom chord.

There is no theoretic advantage in lattice trusses, but there is a practical advantage in the support that is given to braces under compression by those that intersect them. However, this form of truss is not in favor in the U. S.

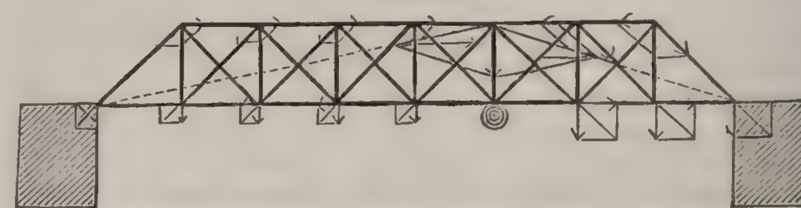
FIG. 36.



In the truss represented in Fig. 36 the bracing is composed of diagonals and of vertical posts under compression. As $\frac{n}{l}W$ goes to the left abutment and $\frac{m}{l}W$ to the right, the strains on the posts will be the shearing strains, and will be $\frac{n}{l}W$ in the left segment, and $\frac{m}{l}W$ in the right segment. The method of transmittal is clearly indicated in the diagram. It will be observed that in the case represented the only braces under strain are those that are parallel in their respective segments to the two that meet at the apex under the weight. The strains in these diagonals are equal in each segment, being obtained by multiplying the shearing strains by sec. θ. The increments of strain in the chords at each apex are $\frac{n}{l}W \tan. \theta$ in the left segment, and $\frac{m}{l}W \tan. \theta$ in the right.

In this truss the boards are at once transferred by the posts to the bottom chord, whence they pass up the diagonals to the next posts, and so forth. The determination of the strains under a permanent load and under a rolling load may be made as heretofore indicated. When this truss is uniformly loaded, the only braces under strain are those in each half truss that incline upward toward the nearest abutment. The strain on each of these braces is $n\,W$ sec. θ, and the increment of strain at each apex equals $n\,W$ tan. θ, n being the number of weights between any brace and the middle of the truss. The other braces are strained when the truss is loaded unequally. The strain on each post is $n\,W$. In this truss there are no members under opposite strains at different times. All the posts sustain compression only, and all the braces tension only.

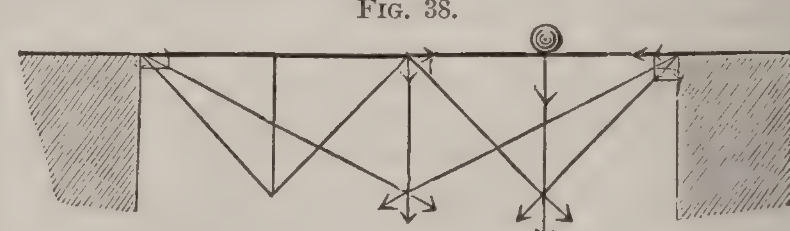
FIG. 37.



There is another form of this truss in which the posts are vertical ties sustaining tension, and the braces are inclined struts under compression. The methods of calculation, however, are not changed, nor are the results changed in magnitude, the only difference being that the strains in the bracing are different in character. This truss is less economical than the other, since the cross-section of a tie does not change, whatever be its length, while an increase in the length of a strut compels an enlargement of its cross-section. It is therefore more economical to make the longer braces ties, and the shorter ones struts.

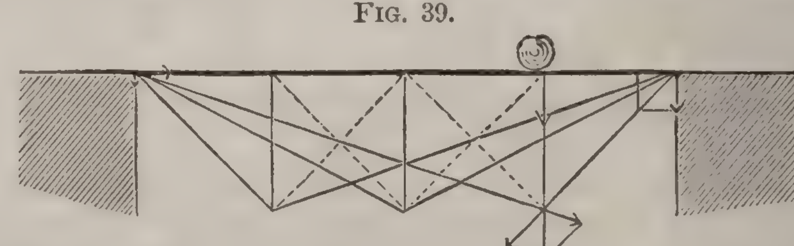
Lattice Bridges with Vertical Posts.—In these bridges calculation is at fault if the braces are made to act as ties or struts at will. They should either be designed to act as ties only, or the posts should be omitted.

FIG. 38.



In the form of bridge truss shown in Fig. 38, known from its inventor as the "Fink suspension truss," the transmission of a single weight is indicated by the diagram. There is no bottom chord, and as all the weights ultimately reach the ends of the top chord, the strain in this is uniform throughout. The posts are all under compression and the ties under tension. This truss is very well adapted to preserving its form under all changes of temperature. It is better adapted to use as a deck than as a through bridge.

FIG. 39.



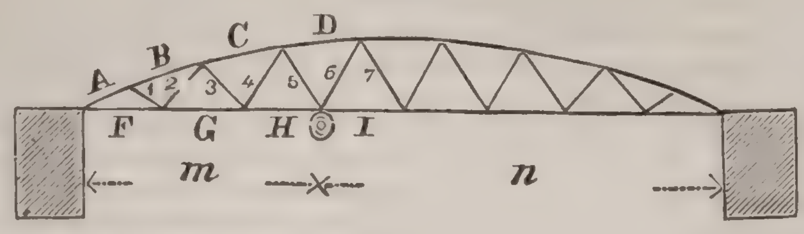
The truss shown in Fig. 39 is known from its inventor as the "Bollman." In it the resolution of strains is exceeding simple. Each post rests on a pair of suspending rods, which immediately resolve the weight into its components, and carry the latter directly to the ends of the top chord. The strain on the latter is therefore uniform throughout. Strictly, it can hardly be called a truss, as each suspending system is entirely independent of the others, the only common member being the top chord. Experience has shown that the panel ties, indicated by dotted lines, are necessary to the stability of the combination. Their only apparent office is to prevent flexure in the top chord. This system is not as economical as those previously indicated.

There are many other forms of truss, which lack of space compels us to omit. Those specially adapted to roofs will be found under that head.

Bowstring Girders.—This is a common form of bridge, which differs somewhat from those previously given. Owing to the lack of parallelism in the chords the strains on the braces are not susceptible of representation by simple formulas. The strains may be calculated by moments, or by

resolving the known strains at either abutment into their components along the different members, thus gradually

Fig. 40.

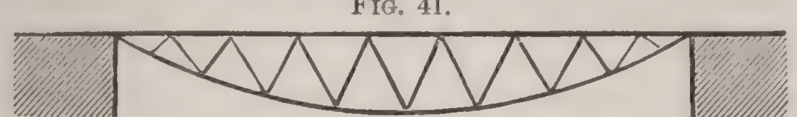


working towards the middle. The pressure on the left abutment, from the weight W, is

$$\frac{m}{m+n}W,$$

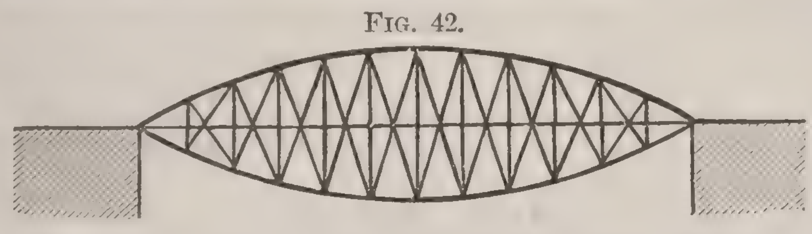
and its direction is vertically downward. As it is the resultant of the strains in A and F, the two latter may be found by a parallelogram of forces. The strain in A is the resultant of that in B and brace 1; these two can therefore be found. The strain in brace 1 is the resultant of the strain in brace 2 and the increment of strain in panel G; these may therefore be found. The total strain in G is this increment increased by the strain in F. The strain which generated the strains in B and brace 2 (which may be found from them) is the resultant of the strains in panel C and brace 3, both of which can thus be found. By this method all the strains due to this weight may be found, and their values may be determined by the scale. Proceeding in a similar manner for every other weight on the girder, and tabulating and properly combining the results, we can find the maximum strains on each member. It will be found that the strains on the chords are nearly uniform throughout, but the strains in the braces increase towards the centre of the girder, the reverse of what takes place in the truss with parallel chords. The strains on the braces are all tensile, except that small compressive strains may come on the middle braces. But these will not appear in large girders, whose permanent weight is very much greater than the passing load. It is a practical objection to this form of truss that it is not well adapted to receive top lateral bracing near its extremities. After calculating the strains by diagram, they should be verified by calculating some of the chord strains by moments. As the weight of the upper

Fig. 41.



chord or arch does not rest on the lower chord, it is more accurate to omit it from the permanent load, and to calculate its effect separately as an arch with a tie.

Fig. 42.



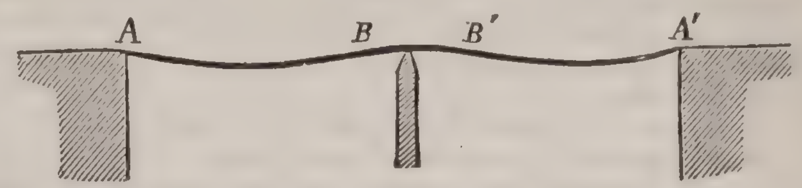
The method of calculation indicated applies equally well to fish-bellied girders, as Fig. 41, or lenticular girders, such as Fig. 42, which is the style of truss used for the Saltash bridge.

Camber and Deflection.—Bridges are generally built with a slight camber or upward arching, so that when they are in use, and all the parts have got exactly fitted to their places, the chords will be horizontal. In the central span of the Boyne lattice bridge, which is 267 feet between centres of piers, the camber at the centre during construction was $3\frac{1}{2}$ inches. When the false work was removed this was reduced to $1\frac{1}{2}$ inches, and finally, after four months' use, it was found to be less than 1 inch. The deflection of a bridge under a load is almost entirely due to the shortening of the upper flange and the lengthening of the lower one, and is practically unaffected by the kind of bracing. A lattice bridge and a plate girder should deflect equally. At the opening of the Newport and Cincinnati railroad and highway bridge, whose channel span is 420 feet in length—being the longest truss in America—the deflection at the middle under a weight of five locomotives coupled together was $1\frac{1}{16}$ inches. The object of giving a bridge a camber is rather for the sake of appearance than from necessity. Unless a bridge deflects so much as to change the vertical pressure on the abutments into an oblique one, there is no appreciable diminution of strength.

Continuous Girders.—A girder or truss is called continuous when it has one or more intermediate supports between its extremities.

When a loaded girder is balanced on a single pier at or near its centre the upper chord is subject to tension and the lower one to compression, and the girder becomes curved, with its convex side uppermost. being in fact, two semi-girders connected together. If, however, the pier be removed, and the girder be supported at its extremities, the

Fig. 43.



strains in the chords are reversed, the upper one being compressed and the lower one extended, and the girder becomes convex on its lower side. If, while in the last position, the central pier be replaced so as to form two spans, the girder becomes continuous, and partakes of the nature of both of the previous cases. Each chord is compressed in some places and extended in others, and becomes a waved line.

The girder may be conceived to be divided into three segments. The central segment B B′ is the union of two semi-girders which balance on the central pier. The segments A B and B′ A′ are two girders, supported at one end by the central segment, and at the other by the abutments. The central segment therefore sustains at each extremity half the weight of an end segment, besides its own proper load. The points B and B′, where the curvature changes, are called the *points of inflection*. At these points the strains in the chords change their character, the strains at the points themselves being zero. The chords therefore might be severed at these points without danger. The connections would be maintained by the bracing.

The positions of the points of inflection are changed by the moving load, as the effect of this load is to increase the deflection of the segment which it covers. The effect of a load on A B is to bring B nearer to the central pier, and to carry B′ farther from it. As this is the maximum length of A B, its strains must be calculated for that length. The same thing would hold for A′ B′ when the train came from the other direction. The central segment B B′ becomes of its maximum length when the whole girder is uniformly loaded, and the points of inflection must be determined for this length also. If the strengths of the chords be calculated for the conditions that give the maximum length of the segments, they will evidently be strong enough for any other cases. The maximum strains in the braces occur before the moving load has covered the first segment, and therefore when the point of inflection is nearer the abutment than it subsequently becomes. The point of inflection must therefore be determined when each brace has its maximum strain.

The greatest pressure on any abutment is half the load on the adjacent segment when the latter has its maximum length. The greatest pressure on the central pier is equal to the load on the central segment when of maximum length, increased by the sum of the synchronous pressures on the two abutments.

The easiest way to determine in advance the points of inflection in a girder is to find them by trial on a small pine model. In practice, the point of inflection may be fixed at any assumed point of the top chord by severing the chord at that point, and slightly lowering the outer end of the segment that rests on the abutment until the severed ends just separate. The point of inflection in the lower chord will be very nearly vertical under that in the upper chord. The point of inflection in the adjoining span can be found from the known strains in the chords over the central pier. The operation of severing one of the chords was tried at the Boyne viaduct, and proved successful.

In a continuous girder of three spans the maximum strains in the chords are as follows: in the side span when both side spans are covered by the moving load, and the centre span is free; in the centre span when it alone is covered; over either pier when the passing load covers the centre span and the adjacent side span, leaving the farther side span uncovered.

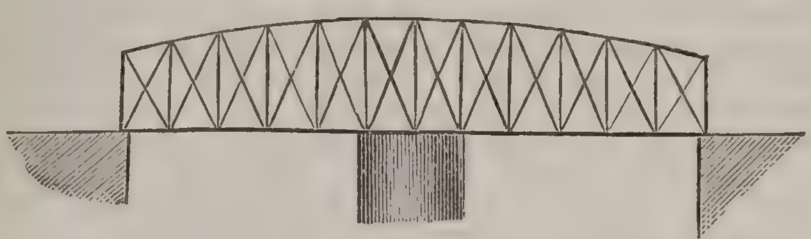
When a continuous girder supports a permanent load the strains in the bracing are not affected by points of inflection, but only the strains in the chords. The advantage of continuity arises from two causes: first, from the smaller amount of material in the chords; secondly, from the removal of a certain portion of their weight from the central part of each span to a position nearer the piers. The latter is but a trifling advantage in continuous girders of moderate spans (say under 150 feet) which support passing loads, for the part so removed forms but a small proportion of the total weight. In the case of a fixed load, however, the saving from this cause is considerable; but when acted upon by a moving load the advantages of continuity are liable to be overrated, especially in girders of small spans, for it will be evident, on a little reflection,

that when the points of inflection move under the influence of the passing load, a greater amount of material is required than if their position remained stationary; and this, moreover, introduces the necessity of providing for both tension and compression in those parts of the chords which lie within the range of the points of inflection; this latter objection is perhaps of little consequence when wrought iron is used.

A subsidence of any of the points of support of a continuous girder will cause a change of strain, whose amount it is quite impossible to foresee, and which may seriously injure the structure, or perhaps render it dangerous. Hence, continuous girders should be avoided when the foundations of the piers are insecure. In bridges of large span, where the permanent load constitutes a large portion of the whole weight, the advantage of continuity is very considerable.

Girder with Fixed Ends.—If a uniformly loaded girder of uniform section is built into a wall so that its ends are rigidly held—as, for instance, the lintel of a door—the strain in the flanges at the centre will be one-third of what it would be if the ends of the girder were merely resting on the walls, and it will be just half of the strains in the flanges at the ends.

Fig. 44.



Drawbridges.—The usual type of drawbridge in the U. S. is the one shown in Fig. 44. The truss is symmetrical, and rests on a turn-table on the central or pivot pier. Two equal openings are provided when the draw is turned. The strains on such a drawbridge are very different when it is shut from what they are when it is open. When the draw is shut, the truss is a continuous one of two spans, and liable to be acted upon by the moving load. When the draw is swung open, the moving load cannot come on it, and it consists of two semi-girders or cantilevers, connected together over the pivot pier. In the first case the top chord is under tension for a certain distance over the pivot pier, and under compression throughout the rest of its length. The reverse holds for the bottom chord. The positions of the points of inflection and the strains must be found as indicated for continuous girders. In the second case the top is in tension and the bottom is in compression. It is therefore necessary to make these chords so that they will be able to resist both kinds of strain.

The practice among the most successful American bridge-builders in planning drawbridges is to consider the permanent load as at all times supported by the pivot pier, whether the draw be open or shut. The rolling load only comes on when the draw is shut, and it is provided for by considering the draw as a continuous girder on three supports. The depth of drawbridges is generally made greater over the pivot pier than at the ends. This gives an increase of depth where it is needed, while the truss is kept shallow at the ends, where any increase of weight beyond what is absolutely needful is injurious, as increasing the strains when the draw is open. Drawbridges are turned by gearing on the circumference of the pivot pier worked by hand or by steam. The drawbridge over the Mississippi at Louisiana, Mo., gives two clear openings on each side of 200 feet.

Counter-bracing.—Braces are so placed as to carry weights from the centre towards the abutments. Tie-braces, therefore, have their feet nearest the centre of the truss, and strut-braces have their heads nearest the same point, so that when the weight has passed through either it is one or more panels on its journey to the proper abutment. When loads are uniformly or symmetrically distributed, they go undivided to the nearest abutment, and there is no need of counter-braces. When a load is not uniformly distributed, a portion of it must cross the centre, and go to the farther abutment. Counter-braces are those whose feet if they are ties, or whose heads if they are struts, are farthest from the centre, and their office is to carry to the farther abutment portions of the unbalanced weights which must cross the centre. Some engineers use them only in those parts of the truss where the temporary strains from the moving load exceed the permanent strains from the weight of the bridge, and are opposite in kind. Others use them throughout the truss. The former is the more general practice.

Angle of Economy.—Mr. Stoney concludes that in isosceles bracing the best angle for the braces, in order that they may transmit strains to the supports with the least amount of material, is 45°. He also concludes that when vertical posts are used the best angle for the bracing is about 55° with the vertical. The writer (see *Iron Truss Bridges for Railroads*) concludes that for a series of strut-braces the angle with the vertical should be about 40°, and that for a series of tie-braces the angle should be 45°.

Arched Bridges.—The graphic method of calculating the strains in braced arches has been indicated as the easiest. In the first printed report of the Illinois and St. Louis Bridge Company, dated May, 1868, is given in full the analytical method used in calculating the arches of their great bridge, to which reference is made. It will only be necessary to state here that their arches were assumed to be circular with the ends fixed. At the close of this article will be found a diagram of the strains on one of the side spans of this bridge.

Tubular Bridges.—The first tubular bridge was that known as the Britannia, and its dimensions were determined by experiment on a model 78 feet in length, or about one-sixth the length of the greatest span. The following formula for the breaking weight was deduced from the experiment:

$$W = C \times \frac{Ad}{l},$$

in which W is the breaking weight in tons, A the square inches of metal in the cross-section, d the depth in inches, l the length in inches, and C a constant which for rectangular tubes was found to be 21.5.

Both top and bottom of the Britannia bridge are cellular. This form, however, is not now considered the best distribution of metal. It is believed that if the metal in the top cells were concentrated into a pile of plates at the centre of the cell, more strength would be secured, and the danger of corrosion would more readily be provided for. In later bridges the bottom has always been made without cells. The strains in the top or bottom flanges can be obtained from the formulas already given for flanged girders. The strains in the web are only the shearing strains, and the minimum thickness of the web can be found by dividing the greatest shearing strain by the greatest permissible strain per square inch. The web is always strengthened by vertical angle-irons. The general opinion among American engineers is that the day of tubular bridges has passed away, and that they are in every way inferior to open-work truss bridges.

Depth of Truss.—The strains in the bracing are independent of the depth of the truss, but those in the chords vary inversely as the depth. Therefore, within certain limits it is economical to make trusses deep, as the strains on the chords—and therefore their dimensions—are diminished, while the amount of material in the bracing is only increased by the increase in length of each brace. The following table, taken from Vose's *Manual for Railroad Engineers*, shows the usual practice in the U. S.:

Span, in feet.	Depth of truss, in feet.	Ratio.
100	17	$\frac{1}{6}$
150	21	$\frac{1}{7}$
200	25	$\frac{1}{8}$
250	28	$\frac{1}{9}$
300	30	$\frac{1}{10}$
400	40	$\frac{1}{10}$

Rolling Load on Bridges.—The magnitude of the rolling or live load which should be safely carried by bridges is differently estimated in different countries. According to Mr. James Laurie, C. E., the English authorities assume $1\frac{1}{2}$ tons per running foot for each track on short railroad bridges, and 1 ton on longer ones. He states that in France a *dead load* of $1\frac{1}{2}$ tons per running foot is used in testing railroad bridges of less span than $66\frac{1}{2}$ feet, and $1\frac{1}{5}$ tons, which is sometimes reduced to $1\frac{1}{20}$ tons, for bridges of longer span. They are also tested by running trains on at various speeds. In this country the Pennsylvania and the Baltimore and Ohio R. Rs. have adopted a rolling load for all bridges of $1\frac{1}{2}$ tons per track per running foot. The shorter the span the greater should be the assumed rolling load, on account of the greater relative length of bridge that will be covered by the locomotive. A span of 5 feet, as a cattle-guard, may have to sustain from one pair of locomotive drivers a load of 10 tons on its middle point, which is a rolling load of 2 tons per foot of its length. In proportioning highway bridges it is safe to assume a load of 80 pounds per square foot of surface, although, according to Trautwine, the French laws assume a maximum load of only 42 pounds per square foot. Experiment has shown that with picked men it is possible to get a load of 120 pounds per square foot, but such loading can scarcely occur in practice. Allowance must be made in highway bridges for heavy concentrated loads, depending

on the locality. The London bridges are sometimes traversed by loads as great as 34 tons on four or six wheels.

Factor of Safety.—The usual formulas for strength of materials give the weights under which they will just break. In designing bridges the maximum strains on the members are multiplied by some number, usually 5 or 6, and the members are then proportioned so that they will just break under the augmented strains. This multiplier is called the *factor of safety.*

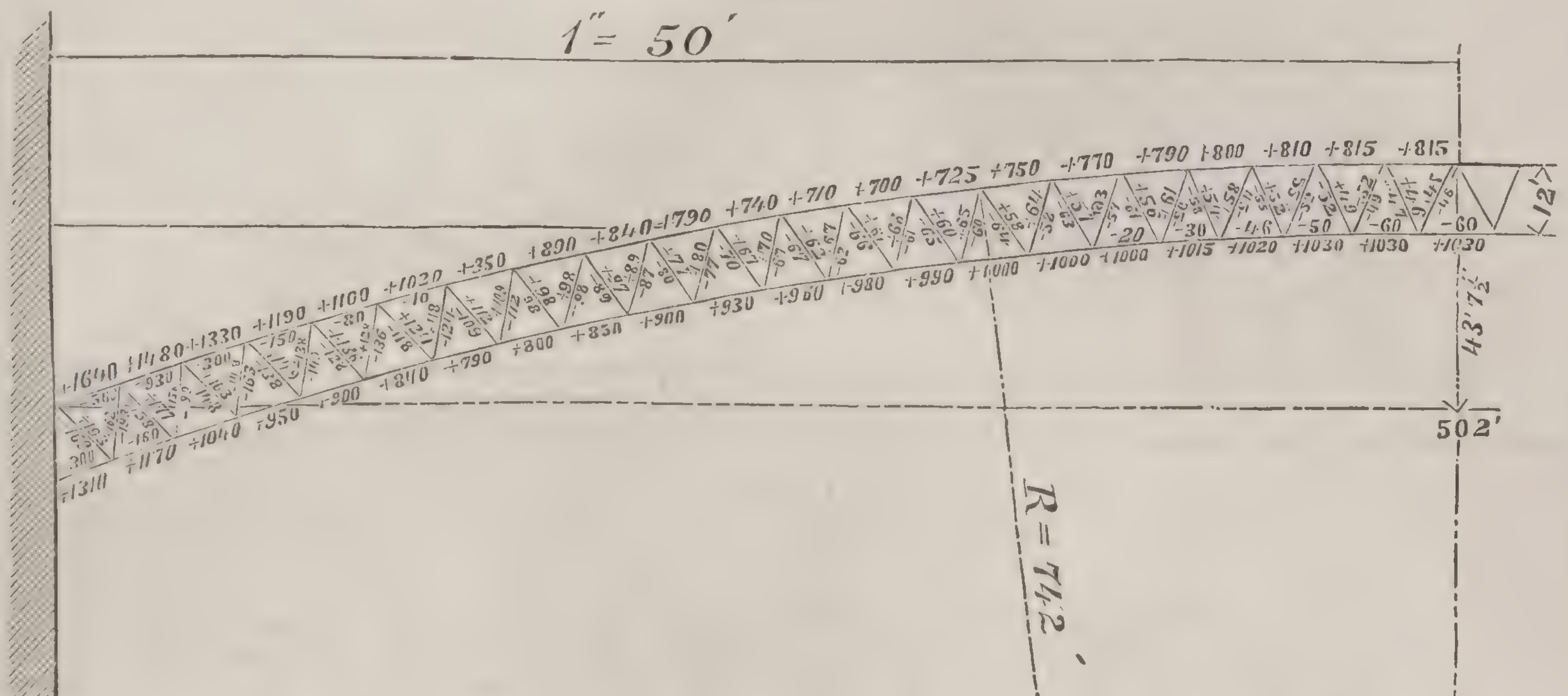
Designing of Bridge Trusses.—The work of designing bridge trusses consists of two distinct parts. The first thing to be done is to determine the length of the span, and next the kind of truss to be used, and its depth. Then the strains on all the members must be calculated, assuming an approximate weight of bridge. The calculations are the same whether the bridge is to be of wood or of iron, the only difference being that the bridge weight will vary according to the material used. After the first determination of strains the sizes of the different members can be settled, and a more exact determination of the bridge weight can be made. The strains being known in character and magnitude, it is a problem in mechanical engineering to design suitable members to meet these strains.

Strain Sheets.—The following diagrams of various styles of bridges in use in the U. S. have been kindly furnished by the builders. On each member is placed the maximum strain in tons which it is expected to sustain. Compressive strains are marked + and tensile strains —.

Fixed Bridges.

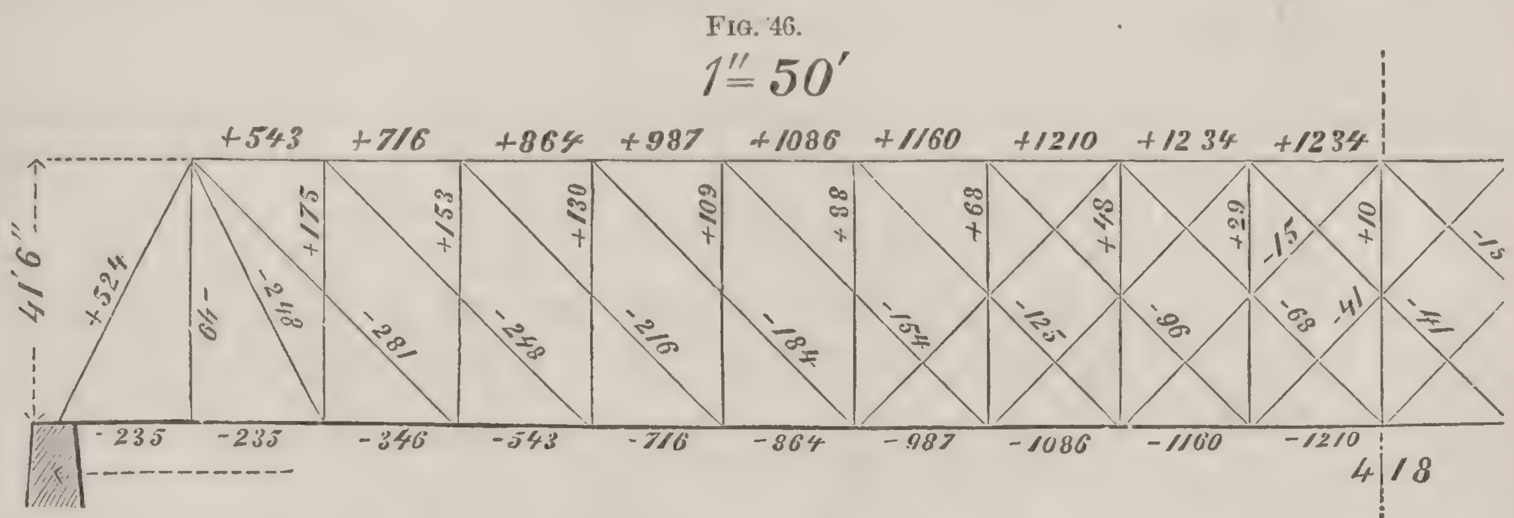
Bridge over the Mississippi at St. Louis, Messrs. Eads, Flad & Pfeifer, engineers.—This bridge is composed of four arched trusses, and carries a double-track railway tangent to its lower chord at the middle, and a wide highway 26 feet above. On a single arch the assumed permanent load is 1 ton per lineal foot, and the rolling load 0.8 ton. (Fig. 45 shows side span.)

Fig. 45.



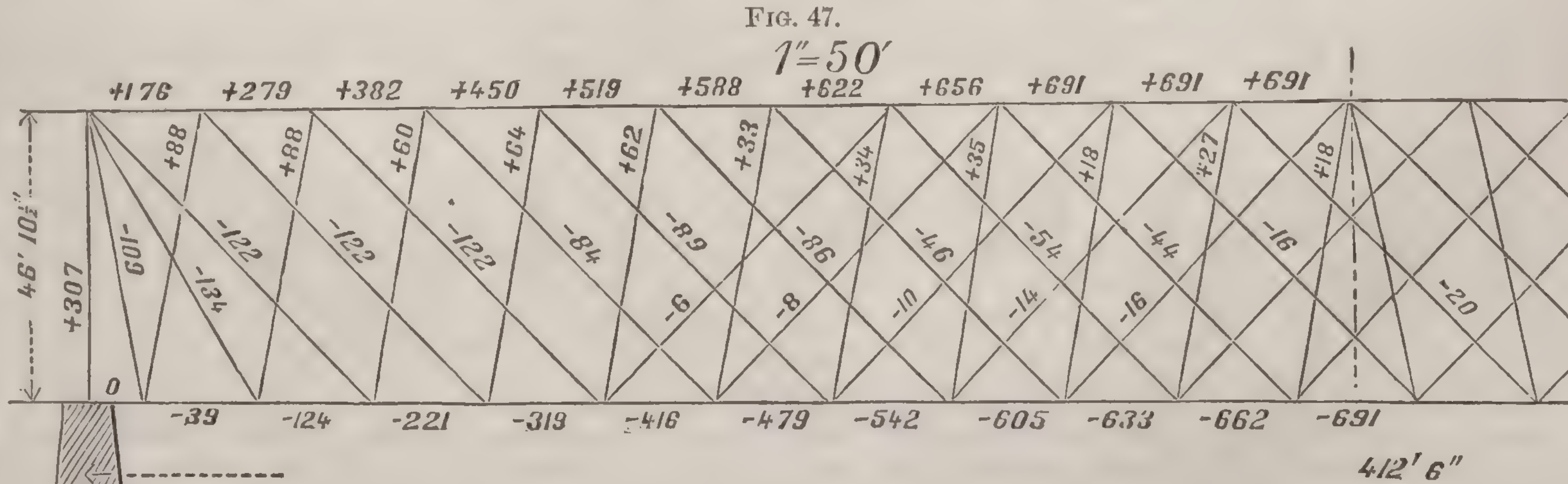
Bridge over the Ohio at Cincinnati, built by the Keystone Bridge Company, J. H. Linville, president.—This bridge carries a single-track railway on a level with its bottom chord, and outside of each truss is a highway sustained by cantilever beams suspended below the trusses. The permanent load of the bridge is $2\frac{1}{2}$ tons per lineal foot, and the rolling load is taken at $1\frac{1}{2}$ tons for the railway, and $\frac{3}{4}$ of a ton for the highway, making a total rolling load of $2\frac{1}{4}$ tons. Each truss supports one-half of these weights. (Fig. 46 shows channel span.)

Fig. 46.



Bridge designed by McNairy, Claflin & Co.—This bridge is on the plan invented by the late S. S. Post. The assumed permanent load is 1.8 tons per foot, and the moving load $1\frac{1}{4}$ tons per foot. (See Fig. 47.)

Fig. 47.



Bridge over the Ohio at Louisville, Messrs. Fink & Vaughn, engineers.—This bridge is a Fink triangular truss, and it carries a single-track railway, with sidewalks for foot passengers. The permanent load on this span is 2 tons per lineal foot, and the moving load 1.3 tons. (Fig. 48 shows Indiana channel-span.)

Bridge over the Missouri at Leavenworth, built by the American Bridge Co., L. B. Boomer, president.—This is a Post bridge, and is designed for a single-track railroad, besides being used for highway traffic when not occupied by cars. The permanent load on this span is 1.6 tons per lineal foot, and the moving load is assumed as 1.5 tons for two panels, 1.25 tons for the next two panels, and 1.12 tons for the remainder of the bridge. (See Fig. 49.)

Bridge over the Missouri at St. Charles, built by the Bal-

Fig. 48.

$1'' = 50'$

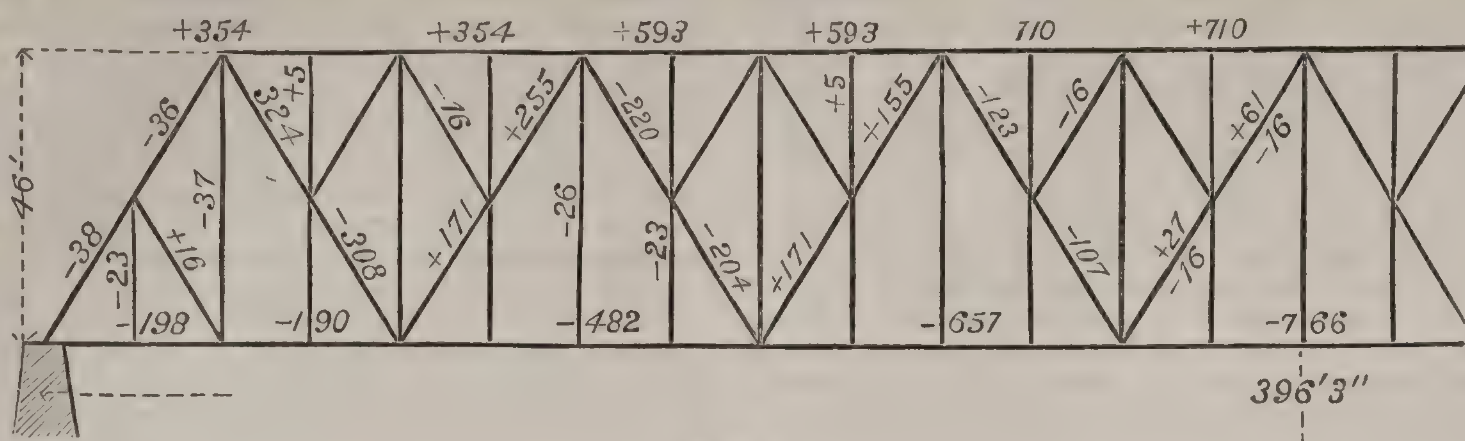
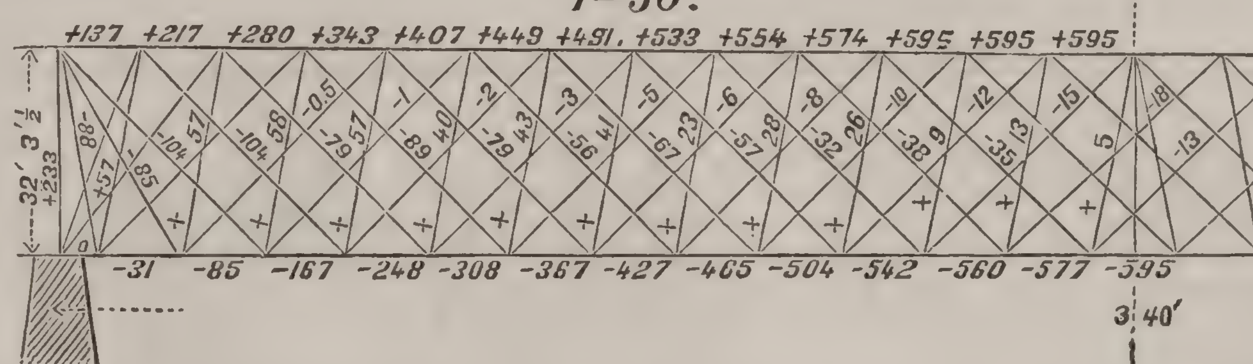


Fig. 49.

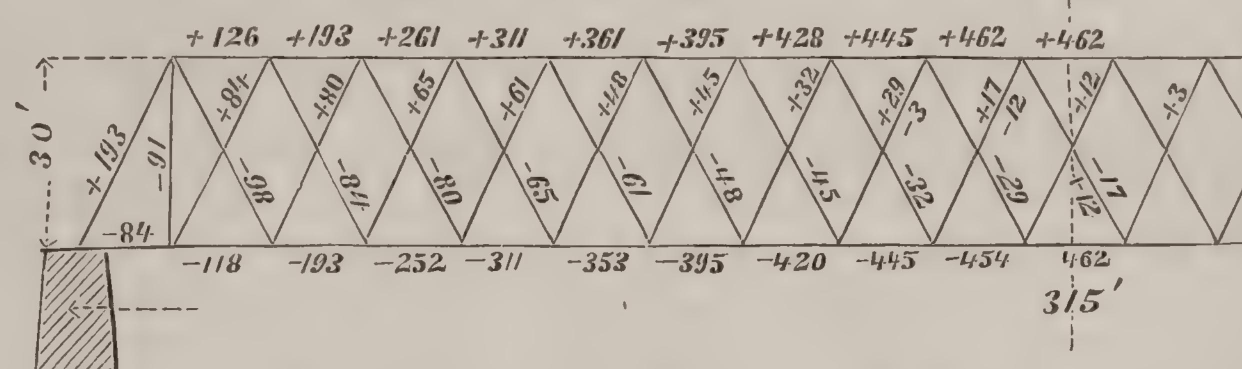
$1'' = 50'$



timore Bridge Co., C. Shaler Smith, president and chief engineer.—This is a double triangular bridge, carrying a single-track railway. The permanent load on one truss is 1.12 tons per lineal foot, and the assumed rolling load is the same; but in tie and post strains allowance is made for the concentrated weight of the engine. (See Fig. 50.)

Fig. 50.

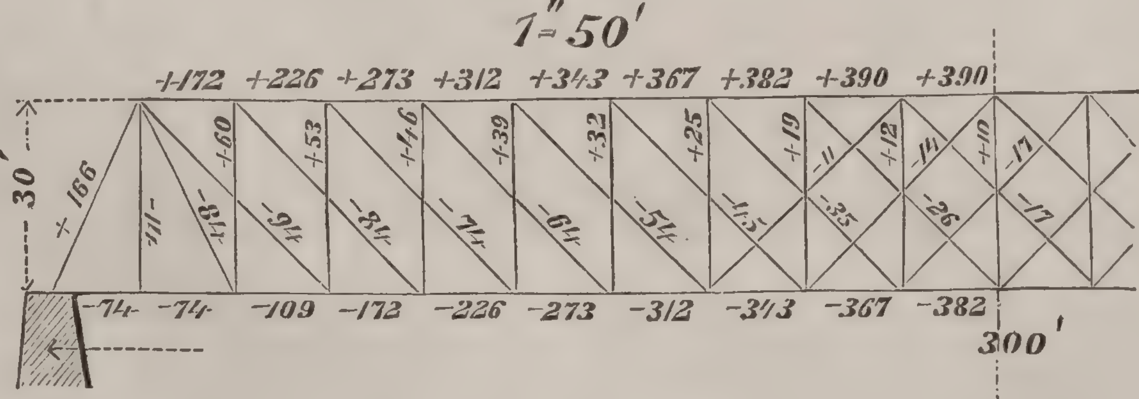
$1'' = 50'$



Bridge designed by the Detroit Bridge Co., W. S. Pope, president and engineer.—This is a Whipple bridge, designed for a single-track railway. The assumed permanent load of bridge is 1.05 tons per lineal foot, and the assumed roll-

Fig. 51.

$1'' = 50'$

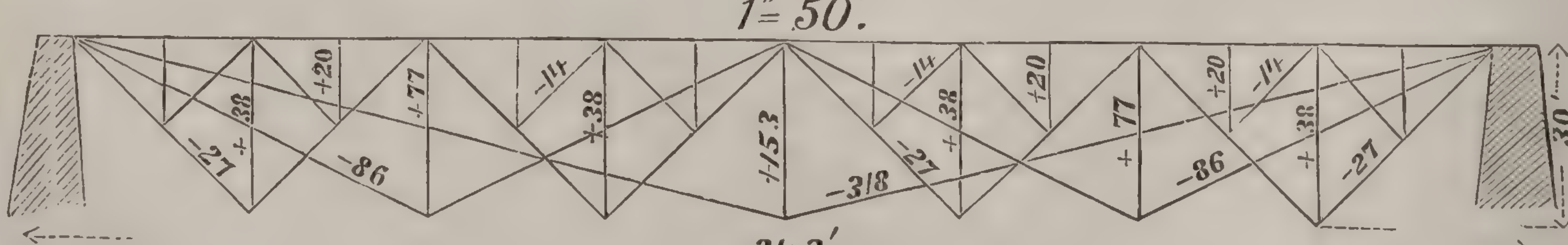


ing load is 1.3 tons per foot on 100 lineal feet, and 0.90 ton on the rest of the bridge. (See Fig. 51.)

Bridge over the Ohio at Louisville, minor span, Messrs. Fink & Vaughn, engineers.—This is a Fink suspension

Fig. 52.

$1'' = 50'$



truss, carrying a single-track railway and footwalk. The permanent load on this span is $1\frac{1}{4}$ tons per lineal foot, and the assumed rolling load 1.3 tons. (See Fig. 52.)

Bridge over the Connecticut at Middletown, built by the Keystone Bridge Co., J. H. Linville, president.—This is a single-track railway bridge, and may be called a long-panel lattice bridge, or a triangular bridge of four systems of triangulation. The permanent load is 0.8 ton per lineal foot, and the assumed rolling load 2 tons per foot. (See Fig. 53.)

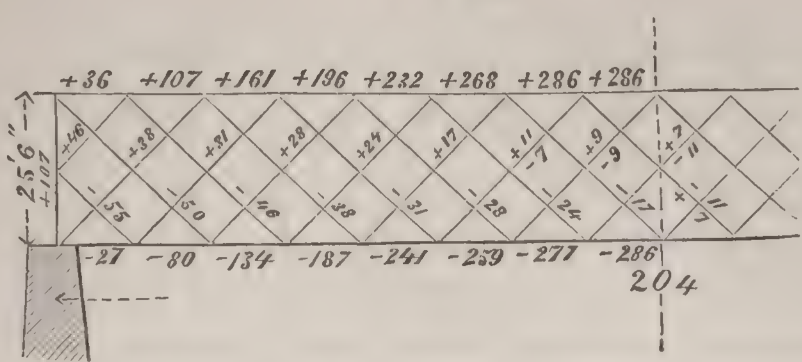
Bridge over the Connecticut at Windsor Locks, Messrs. James Laurie and Theodore G. Ellis, engineers.—This is a Whipple single-track railway bridge. The assumed permanent load, allowing for snow, is 1.68 tons per lineal foot, and the rolling load 1.12 tons. (See Fig. 54.)

Drawbridges.

Drawbridge over the Mississippi at Rock Island, built by the Baltimore Bridge Co., C. Shaler Smith, president and chief engineer.—This drawbridge is a reversed Whipple, carrying a highway on its lower chord, and a single-track railway halfway between the two chords. The permanent load is 1.85 tons per lineal foot, and the rolling load $2\frac{1}{2}$ tons per foot. (See Fig. 55.)

FIG. 53.

1″ = 50′



Drawbridge over the Missouri at Boonville, built by the American Bridge Co., Messrs. Hemberle & Coolidge, engineers.—This is a Post drawbridge for a single-track railway. The permanent load is one ton per lineal foot, and the rolling load $1\frac{1}{4}$ tons per foot. (See Fig. 56.)

Drawbridge designed by the Detroit Bridge Co., Willard S. Pope, president and chief engineer.—This is a modified Whipple drawbridge for a single-track railway. The permanent load is 0.95 ton per lineal foot, and the assumed rolling load is $1\frac{1}{4}$ tons per foot. (See Fig. 57.)

Drawbridge designed by McNairy, Claflin & Co.—This is a Post drawbridge, carrying a single-track railway. The permanent load is 0.75 ton per lineal foot, and the assumed rolling load is 1.5 tons per foot. (See Fig. 58.)

Drawbridge over White River, near Jacksonport, Ark., built by the Baltimore Bridge Co., C. Shaler Smith, president and chief engineer.—This drawbridge is composed of two Pratt trusses, with independent suspension system for sustaining the cantilevers when the draw is open. The bottom chords are stiffened with Phœnix columns, so as to resist the compressive strains generated when the draw is open. The suspension rods pass over a tower which is hinged at a, a, so as not to interfere with the contraction of the top chord. Therefore in this drawbridge the girder is not continuous. The permanent load is $\frac{1}{2}$ ton per lineal foot, and the assumed rolling load is 1.12 tons per foot. (See Fig. 59.)

Drawbridge over the Cumberland at Clarksville, Albert Fink and F. W. Vaughn, engineers.—This is a Warren girder, or triangular drawbridge for a single-track railway.

FIG. 54.

1″ = 25′

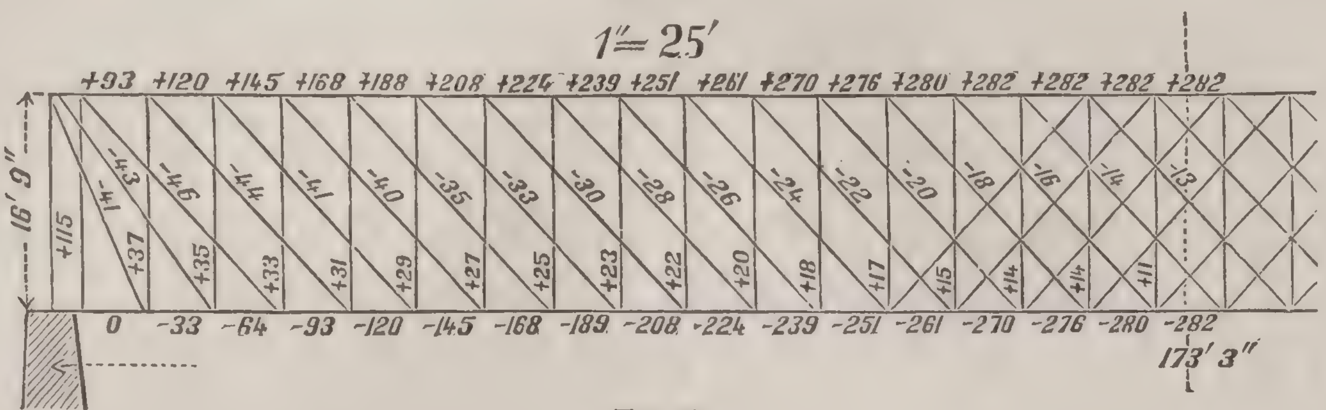


FIG. 55.

1″ = 50′

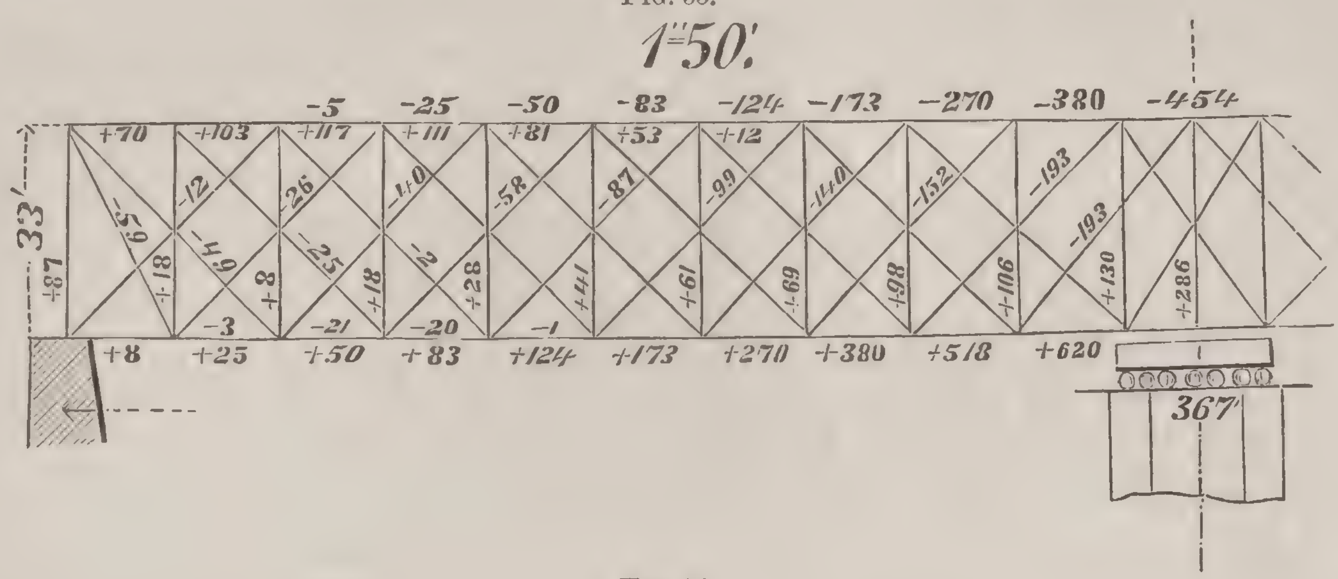


FIG. 56.

1″ = 50′

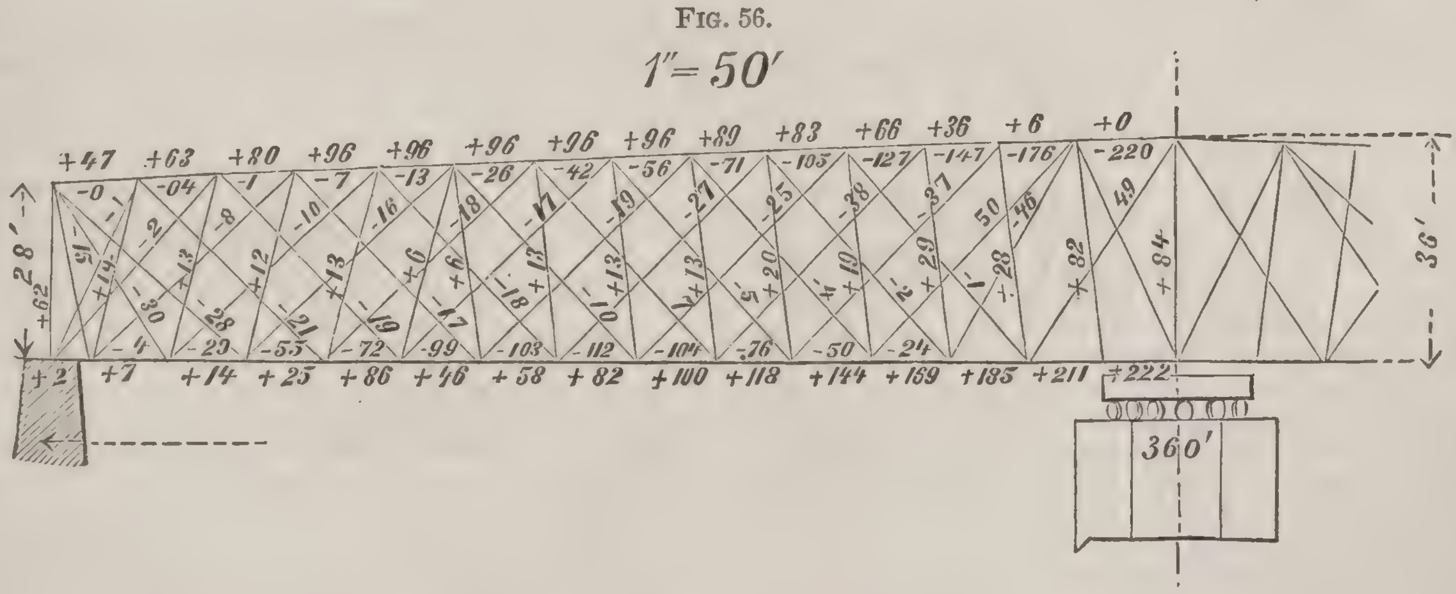


FIG. 57.

1″ = 50′

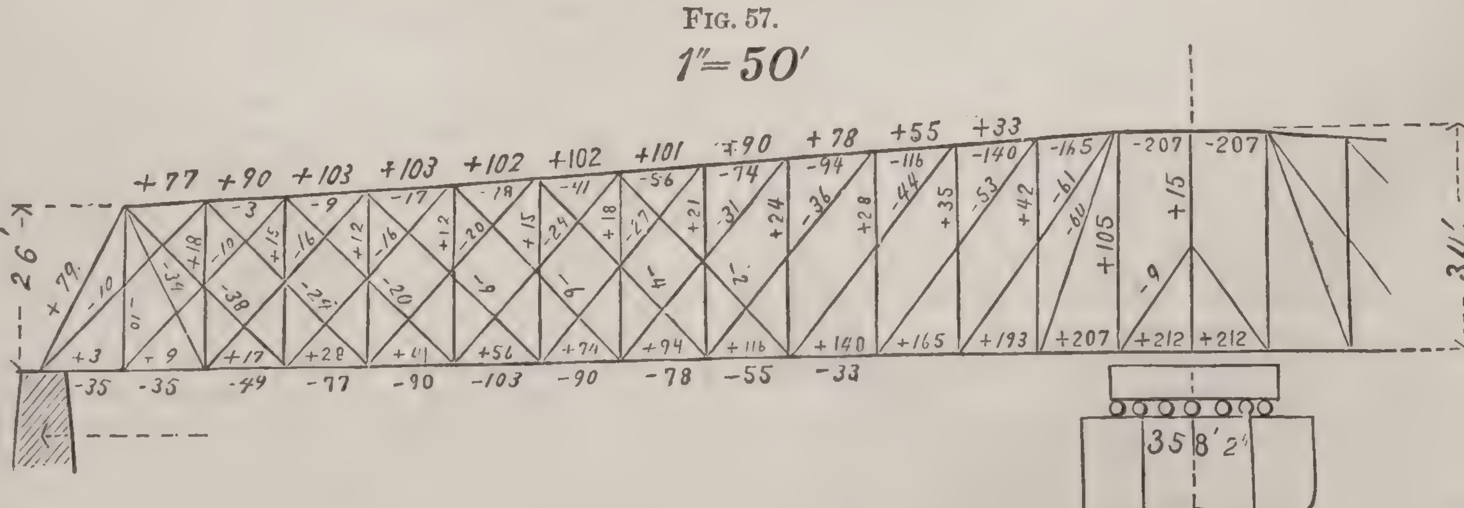


Fig. 58.

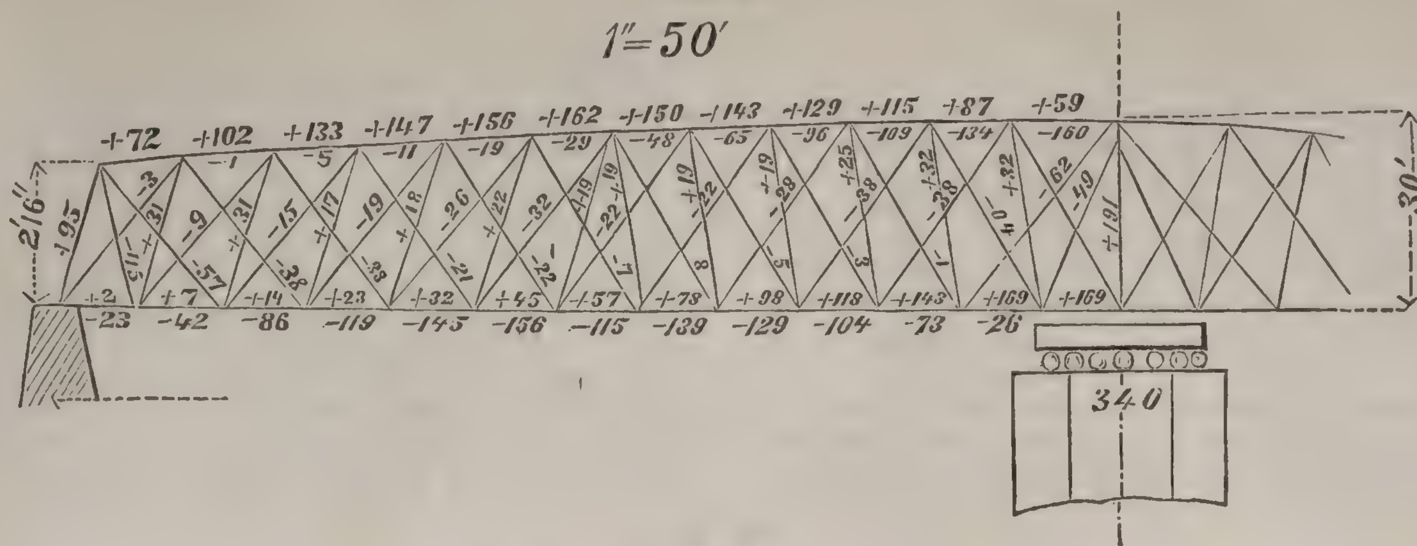


Fig. 59.

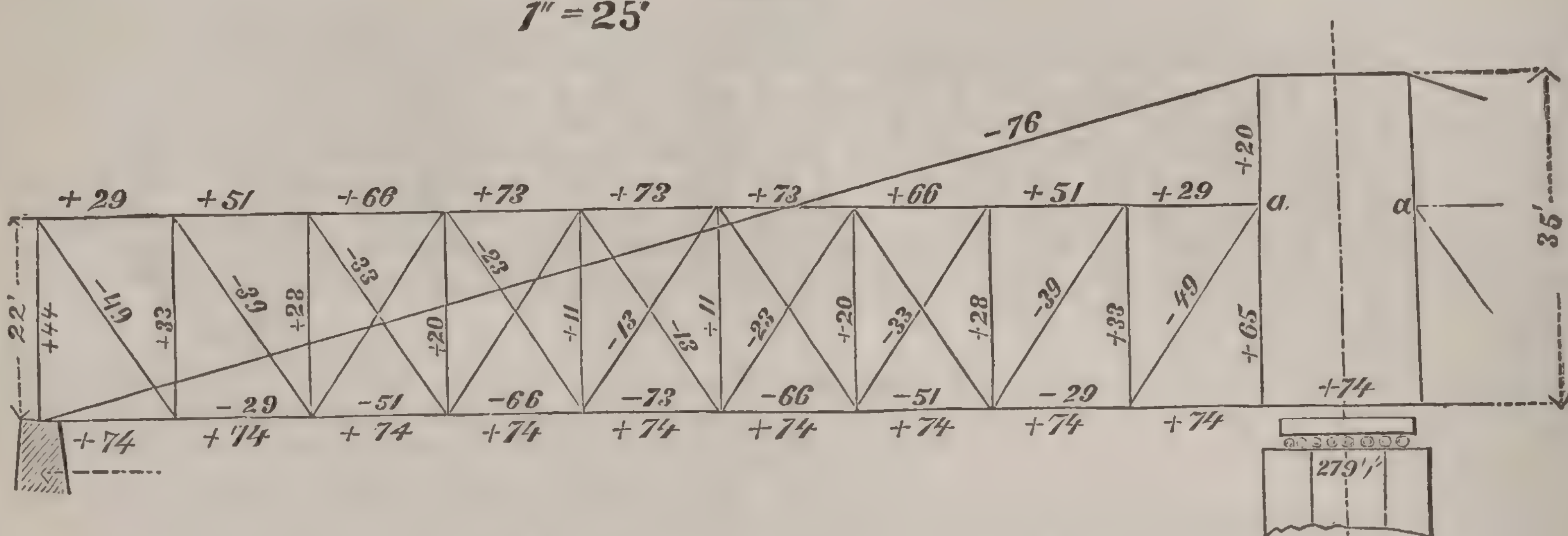
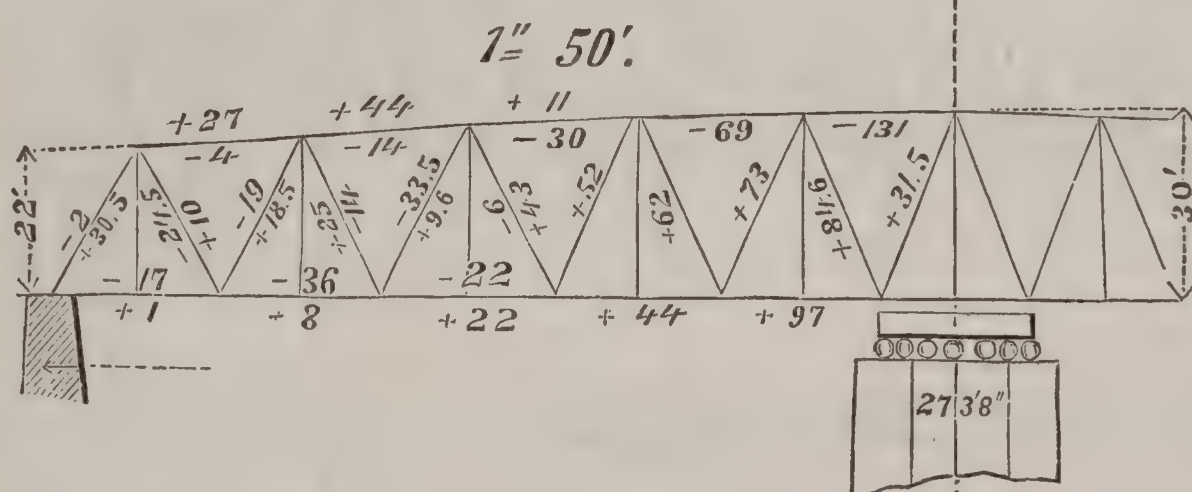


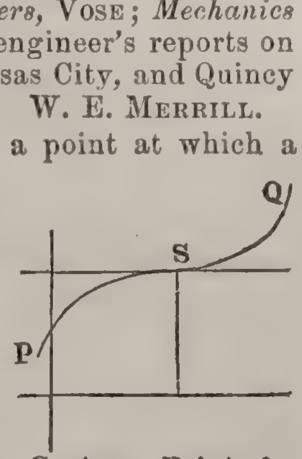
Fig. 60.



The permanent load is 0.55 ton per lineal foot, and the rolling load 1.12 tons per foot. (See Fig. 60.)

(For further information reference is made to the following publications: *Long-span Railway Bridges*, Baker; *Theory of Bridge Construction*, Haupt; *Cast and Wrought Iron Bridge Construction*, Humber; *Iron Truss Bridges for Railroads*, Merrill; *Civil Engineering*, Rankine; *Strains on Structures of Ironwork*, Shields; *Strength of Bridges and Roofs*, Shreve; *Theory of Strains*, Stoney; *Engineer's Pocket-Book*, Trautwine; *Wrought-Iron Bridges and Roofs*, Unwin; *Manual for Railroad Engineers*, Vose; *Mechanics of Engineering*, Weisbach. See also engineer's reports on the Britannia, Victoria, St. Louis, Kansas City, and Quincy bridges.) W. E. Merrill.

Flexure, Point of Contrary, a point at which a curve from being concave in a given direction becomes convex, or the reverse. Thus, S is a point of contrary flexure (or a point of inflection) of the curve P S Q, because at this point the curve ceases to be concave downward, and becomes convex downward —that is, concave upward. When a curve is concave downward, the differential of the ordinate decreases algebraically as the abscissa increases; the second differential of the ordinate is therefore *negative*. When the curve is convex downward, the differential of the ordinate is an increasing function of the abscissa, and consequently the second differential of the ordinate is *positive*. Hence, at a point of inflection the second differential must change sign, which it can only do by reducing either to 0, or to ∞ —. At a point of inflection the *radius of curvature* of the curve changes sign —. At such a point the radius of curvature is usually equal to infinity—that is, for an infinitesimal distance the curve may be regarded as a straight line. W. G. Peck.



Contrary Point of Flexure.

Flied'ner (Rev. Theodor), D. D., one of the most successful Christian philanthropists of the century, and founder of the institution of Protestant deaconesses, was b. Jan. 21, 1800, the son of a clergyman at Eppstein near Wiesbaden, and d. at Kaiserswerth, the scene of his labors, Oct. 4, 1864. He was a plain, unpretending German pastor of great working power, indefatigable zeal, fervent piety, and rare talent of organization. Left an orphan at the age of thirteen, he studied at Giessen, Göttingen, and Herborn, was for one year tutor in a family at Cologne, and began to doubt his fitness for the ministry when he received and accepted in Nov., 1821, what he considered a providential call, with the promise of a salary of 180 Prussian dollars, from a small Protestant colony at Kaiserswerth, a Roman Catholic town of 1800 inhabitants on the Lower Rhine, below Düsseldorf. He walked there to save expense to the poor congregation. Four weeks after he had entered upon his duties the silk-factory of Preyer & Peterson, which furnished the chief support to his parishioners, failed. But this failure proved his success. It led him to undertake, in the spring of 1822, a collecting-tour to keep the struggling congregation alive. At first he was shy and discouraged, but a brother pastor, Döring of Elberfeld, told him that he needed only three requisites, "patience, impudence, and a ready tongue," and introduced him to a Mr. Frowein, who gave him 40 thalers. By the end of the same week Fliedner could return with 1200 thalers. This was only the beginning of much greater things. By experience and perseverance he became one of the greatest beggars in the service of Christ. The same year (June 1, 1823) he made a tour to Holland and England, which not only resulted in a permanent endowment of his congregation, but suggested to him the idea of his benevolent institutions. "In both these Protestant countries," he tells us himself, "I became acquainted with a multitude of charitable institutions for the benefit both of body and soul; I saw schools and other educational organizations, almshouses,

orphanages, hospitals, prisons and societies for the reformation of prisoners, Bible and missionary societies, etc. etc.; and at the same time I observed that it was a living faith in Christ which had called almost every one of these institutions and societies into life, and still preserved them in activity. This evidence of the practical power and fertility of such a principle had a most powerful influence in strengthening my own faith." The practical Christianity and philanthropy of Holland and England inspired Fliedner to similar zeal, and he repaid the debt by the happy influence which his deaconesses' establishment exerted upon England and other countries. Many a visit to Kaiserswerth since that time has been an inspiration to noble deeds of charity.

Fliedner made two more journeys—to Holland, England, and Scotland (in 1832 and 1853), in the interest no more of his congregation, but of his institutions. He also visited the U. S. in 1849. Twice he travelled to the East—in 1851, to aid Bishop Gobat in founding a house of deaconesses in Jerusalem, and again in 1857, when he was, however, too feeble to proceed farther than Jaffa.

In his work he was powerfully aided by both his first and second wife, who seemed predestinated for him, and had the charge of his institutions at home while he was promoting their interest abroad. "Twice," said he, "have I experienced that in seeking some one for the service of the Lord, I have found the best blessing for myself." King Frederick William IV. of Prussia and his queen Elizabeth took the most cordial interest in his labors for the sick and poor, granted him several audiences, furnished him liberally with means, and founded a Christian hospital with deaconesses at Berlin (Bethany) after the model of Kaiserswerth.

Fliedner's Institutions.—In the parsonage garden at Kaiserswerth there still stands the little summer-house, with one room of ten feet square and an attic over it, which was the first asylum for released female prisoners and the humble cradle of all Fliedner's institutions.

The most important of these is the institution of *Evangelical Deaconesses,* founded in 1836. It was intended to be, and is in some sense, a revival of the apostolic office of deaconesses, which continued in the Church for several centuries, but it resembles more the active sisterhoods of the Roman Church, and may be regarded as a Protestant counterpart of the Sisters of Charity, divested of all ascetic and monastic features. The apostolic deaconesses, such as Phœbe, were congregational officers, and visited the sick and the poor at their homes. The Kaiserswerth deaconesses may also be employed for parochial activity (*Gemeindepflege*), but they are usually connected with hospitals, orphan asylums, prisons, and other public institutions. The immense usefulness of regularly trained nurses is apparent in every large city at all times, and more especially in times of war and raging epidemics. This was strikingly illustrated by experience in the Crimean war (1856), which first popularized the institution in England through the labors of Miss Florence Nightingale; in the Sleswick-Holstein war (1864), the Prussian-Austrian war (1866), the Franco-German war (1870), as well as in our own civil war (1861–65).

The ordinary government of the mother institution is in the hands of the principal chaplain or superintendent. The sisters have a vote in the election of the head-sisters or matrons and in the admission of new deaconesses. Applicants must be from 18 to 40 years of age, of sound health, Christian character, and good elementary and domestic training; they must furnish a narrative of their previous life, and give the motives which induce them to devote themselves to this life. They must undergo a probation from six months to three years, according to circumstances. After this they are either dismissed or consecrated to the work. They take no vows, but engage themselves to the institution for five years, at the end of which they are at liberty to leave or to renew their engagement; but they can leave at any time and marry by giving three months' previous notice. They wear a simple, cheerful, and convenient blue dress and apron, with a white cap and collar, and receive, besides free living, twenty-five dollars a year as pocket-money; when sick or disabled they are supported by the institution, unless they have sufficient means of their own. They are divided into two classes—nursing sisters (*Pflegeschwestern*) and teaching sisters (*Lehrschwestern*). The former attend to the care of the sick, the poor, the children, and the prisoners and fallen women (*Krankenpflege, Armenpflege, Kinderpflege, Gefangenen- und Magdalenenpflege*); the latter train probationers for the office of deaconess, teach orphans, conduct infant schools and higher schools for girls.

With the House of Deaconesses at Kaiserswerth are connected a hospital, an infant school, an orphan home, an asylum for insane females. In 1850 more than sixty Kaiserswerth deaconesses were at work in different places. At the time of Fliedner's death the number of deaconesses exceeded 400, in 1866 it amounted to 490, in 1873 to 547 (including 144 probationers). Many clergymen also applied to Fliedner for parish deaconesses, who labor under the direction of the pastor and congregation. In the Austro-Prussian war of 1866 the various "deaconess houses" of Germany furnished 284 nurses to the military hospitals, besides receiving a large number of sick and wounded into their own establishments; and of these nurses, 46 were from Kaiserswerth. The Mother House fulfils the mission of a large normal school for the training of women to the care of the poor and suffering, and has given rise to many similar institutions in Germany and other lands. There Florence Nightingale was inspired for her noble mission in the Crimean war, and Dr. Passavant for the establishment of a Christian hospital in Pittsburg. Institutions of deaconesses and Christian hospitals have since been founded, mostly, though by no means exclusively, after the model, and with more or less co-operation, of Kaiserswerth —at Paris (founded by Rev. Vermeil and Rev. Valette, 1841), at Strasburg (1842), at Echallens in the Canton de Vaud (1843), at Dresden (1844), at Berlin (1847), at Pittsburg (1849), at Riehen near Bâle (1852), at Neudettelsau and Stuttgart (1856), at Zürich (1858), at Hamburg (1859), at London (1861), at Copenhagen (1862), at Constantinople (1852), at Alexandria (1857), at Smyrna (1853), at Jerusalem (1851), at Brooklyn, N. Y. (1874). In the year 1873 there were 34 houses of Protestant deaconesses, with more than 1700 sisters.

Literature.—Fliedner: *Collectenreise nach Holland,* Essen, 1831, 2 vols.; *Buch der Märtyrer der evangel. Kirche,* 1852 *seq.*, with a supplement, in 3 vols.; *Kurze Geschichte der Entstehung der ersten evang. Liebesanstalten zu Kaiserswerth (des Asyls, der Diakonissen-Mutter-Hauses und des Hospitals),* 1856; Jul. Disselhoff (Fliedner's successor): *Nachricht über das Diakonissenwerk in der christlichen Kirche . . . und über die Diakonissen-Anstalt zu Kaiserswerth,* 5th ed. 1867; Catherine Winkworth: *Life of Pastor Fliedner of Kaiserswerth,* translated from the German (which first appeared in the *Kaiserswerth Almanac* for 1866), London, 1867; Miss Florence Nightingale: *Account of the Institution for Deaconesses,* London, 1851; Dean Howson (of Chester): *Deaconesses,* London, 1862; W. F. Stevenson: *Praying and Working,* 1862, republished in New York; J. M. Ludlow: *Woman's Work in the Church,* London, 1866; also the annual reports and other periodical publications of Kaiserswerth.

Philip Schaff.

Flin'ders (Matthew), English navigator, b. in Lincolnshire in 1760; went to New Holland in 1795, and with Bass discovered Bass's Straits in 1798. Exploring the southern coast of Australia, he discovered the Gulfs of Spencer and St. Vincent. Putting in at the Isle of France, he was held prisoner by the French there from 1803 to 1810, but was released, and d. in England July 19, 1814. Published *Voyage to Terra Australis* in 1814.

Flinn, tp. of Lawrence co., Ind. Pop. 967.

Flint, a variety of quartz, massive, dull-colored, and dark, with translucent edges, found especially in nodules in chalk-beds, and on microscopic examination found to consist largely of the fossil frustules of diatoms, the spiculæ of sponges, and the like. Its nodules frequently enclose a large fossil. Specific gravity, 2.6. In pre-historic times it was extensively used as the material for knives, arrowheads, and other weapons, its peculiar conchoidal fracture and sharp edges fitting it well for such uses. Its use for striking fire with steel and tinder is a thing of the past, as is its employment for a similar use in firearms. Flint is employed in making some kinds of glass, and ground flints are an ingredient of porcelain-ware. Flint is in some places used as a building-stone. In the U. S. the hornstones of the palæozoic limestone strata pass into flint, and have been shown to be of precisely similar origin to the true cretaceous flint.

Flint, tp. of Benton co., Ark. Pop. 1701.

Flint, post-tp. of Pike co., Ill. Pop. 403.

Flint, city and tp., capital of Genesee co., Mich., at the junction of the Chicago and Lake Huron and the Flint and Père Marquette R. Rs., 60 miles N. W. of Detroit. The Michigan Institution for the Deaf, the Dumb, and the Blind is located here. It has 2 national banks, 3 weekly newspapers, a city hall, a court-house, a large union schoolhouse, 7 churches, 11 steam saw-mills (manufacturing about 50,000,000 feet of lumber annually), and a ladies' library association. City pop. 5386; tp. additional, 2142.

R. W. Jenny, Ed. "Genesee Democrat."

Flint (Abel), D. D., b. at Windham, Conn., Aug. 6, 1765; graduated at Yale College 1785; was tutor at Brown University 1786–90; and was ordained minister of the Sec-

ond Congregational church in Hartford, Conn., Apr. 20, 1791. D. Mar. 7, 1825. Published *Geometry and Trigonometry, with a Treatise on Surveying* (1806), and translated sermons of Massillon and Bourdaloue.

Flint (Austin), M. D., a distinguished author, professor in several medical colleges, etc., b. in Petersham, Mass., Oct. 20, 1812; graduated in the medical department of Harvard University 1833; was one of the founders of the Buffalo Medical College, and professor of theory and practice in it from 1847 to 1853. Also established the Buffalo *Medical Journal*. In 1844 was called to the Rush Medical College in Chicago. Occupied for four years the chair of theory and practice in the medical department of the University of Louisville, and for three winters (1858–61) was professor of clinical medicine in the New Orleans School of Medicine. He removed to New York City in 1859, was made one of the attending physicians to Bellevue Hospital, and appointed to the chair of principles and practice of medicine and clinical medicine in the Bellevue Hospital Medical College, a position he now holds. Also for a brief time filled a professorship in the school of the Long Island Medical College Hospital. Dr. Flint is the author of several standard works in the profession. In 1852 he published clinical reports *On Continued Fever; Chronic Pleurisy* in 1853; *Dysentery*, 1853; *Physical Exploration in the Diagnosis of Disease of the Respiratory Organs*, 1856; *Diseases of the Heart*, 1859–70; *Principles and Practice of Medicine*, 1866. Some of these works have passed through several editions. Paul F. Eve.

Flint (Austin, Jr.), M. D., son of the preceding, b. at Northampton, Mass., Mar. 28, 1836; studied medicine 1854–56 at the University of Louisville, Ky., and graduated 1857 at the Jefferson Medical College, Philadelphia; was editor of the Buffalo *Medical Journal*, and professor of physiology and microscopical anatomy in the University of Buffalo 1858–59; became professor of physiology in the New York Medical College 1859, and in New Orleans Medical School 1860; studied in Europe under Bernard and Robin, and in 1861 became professor of physiology and microscopical anatomy in Bellevue Hospital; has held the chair of physiology in Long Island College Hospital; author of *The Physiology of Man* (5 vols., 1866 *seq.*), *Manual of Chemical Examination of Urine* (1870), and *New Excretory Function of the Liver* (1869), which received a prize from the French Academy of Sciences. His last appointment is that of surgeon-general of New York State, by its governor.

Flint (Charles Lewis), b. at Middleton, Mass., May 8, 1824; graduated at Harvard University in 1849; studied law, but in 1852 became secretary of the State Board of Agriculture of Massachusetts, a position which he still holds (1874). Besides full and valuable annual reports, he has published *The Agriculture of Massachusetts* (3 vols., 1853–54), *Grasses and Forage Plants* (1857), *Milch Cows and Dairy Farming* (1859), Harris's *Insects Injurious to Vegetation*, and, with G. B. Emerson, *Manual of Agriculture*, a text-book for schools.

Flint (Henry), b. at Dorchester, Mass., 1675; graduated at Harvard University in 1693; was tutor in Harvard College, Mass., 1705–54, and d. Feb. 13, 1760. In 1700 was made a fellow of Harvard University. A volume of twenty of his sermons was published in 1739.

Flint (Henry M.), American writer in the New York *World* over the signature of "Druid," wrote also *Life of Stephen A. Douglas, Mexico under Maximilian, History and Statistics of the Railroads of the U. S.*, and d. at Camden, N. J., Dec. 12, 1868.

Flint (Jacob), American clergyman, b. at Reading, Mass., Aug. 7, 1768; graduated at Harvard University 1794, and was ordained, June 10, 1798, as minister at Cohasset, Mass. Published a history of that town in *Massachusetts Historical Collections*, etc., and d. Oct. 11, 1835.

Flint (Joshua Barker), M. D., b. at Cohasset, Mass., Oct. 13, 1801; graduated at Harvard University in 1820; practised in Boston from 1825 to 1837; was professor of surgery in the Louisville (Ky.) Medical Institute from 1837 to 1849, and from 1849 to his death at Louisville, Mar. 19, 1864, had the same chair at the Kentucky School of Medicine in that city. Was for several years a member of the Massachusetts legislature.

Flint (Micah P.), b. at Lunenburg, Mass., in 1807; studied law, and was admitted to the bar in Alexandria, Miss. In 1826 he published at Boston *The Hunter, and Other Poems*, contributed freely to the *Western Review*, and d. in 1830. A son of Rev. Timothy Flint.

Flint (Timothy), b. at Reading, Mass., July 11, 1780; graduated at Harvard University in 1800; was a Congregational minister at Lunenburg, Mass., from 1802 to 1814. In Sept., 1815, went as missionary to the Mississippi Valley, and was afterwards farmer and teacher at Cincinnati, O., and on the banks of the Red River in Louisiana. Returned to Massachusetts in 1825, and turned his attention to literature. In 1833, at New York, edited the *Knickerbocker;* in 1827–30 edited *The Western Monthly Magazine.* Returned to New England 1840 from the South-west. Mr. Flint published *Geography and History of the Western States in the Mississippi Valley* (1828), besides various novels, *Lectures on Natural History*, etc.; had considerable fame as a chemist and was one of the most active and noteworthy of the American *littérateurs* of his time. D. at Salem, Mass., Aug. 16, 1840.

Flint Glass, one of the varieties of glass which contain a large percentage of lead. Powdered flint was formerly used in the manufacture, whence the name. The best of white sand (51 parts), a tolerably pure carbonate of potash (16 parts), minium or litharge (28 parts), and saltpetre ($4\frac{3}{4}$ parts) are used as principal ingredients; a little manganese, arsenic, baryta, and lime are added to correct any discoloration. Flint glass is used largely in the manufacture of achromatic lenses, and grades inferior to the very finest are used in making bottles, table-ware, and other glass goods, either blown or moulded. (See Glass.)

Flint Hill, tp. of Coosa co., Ala. Pop. 637.

Flint Implements, a name used to designate the tools made of stone, chiefly of flint, used by savages who have no knowledge of metals. If we assume that man's original condition was a savage one (which is by no means universally conceded to be true), it is probable that his clothing and utensils have been the result of a long series of discoveries and inventions, which have been the means of a series of advancing steps towards civilization. It is certain that very early races, like modern savages, fabricated their implements from stone, and chiefly from flint, and that at a later stage bronze, and at a still later stage iron utensils were employed. The period during which any people have employed stone implements only may be termed the *stone age*. The pre-historic Stone Age has been subdivided into, first, the time when only the rough flints or flakes of stone were used, or the *Palæolithic;* and, second, the time when the edges of the knives were sharpened and the surfaces polished, or the *Neolithic.*

The more common flint implements are known as *celts*, from the Welsh *cellt*, a "flint." They are the more common hatchets, adzes, or chisels of stone, and are of three sorts: first, those which have been simply chipped out in a more or less careful manner; second, those which, after being fashioned by chipping, have been ground at the edges; and third, those which have been smoothed over the whole surface. The implements are hatchets, adzes, chisels, gouges, picks, perforated axes, hammers, mining-tools, pestles, grindstones, whetstones, saws, scrapers, awls, drills, knives, daggers, lance or spear heads, javelins, arrow-heads, flaking-tools, sling-stones, balls, slick-stones, sinkers, weights, disks, cups, spindle-whorls, and personal ornaments.

The presence of manufactured celts is sufficient evidence of the existence of man in the absence of his bones. As the flints have been found in connection with the remains of extinct animals, some have supposed that in palæolithic times man was contemporary with the woolly elephant and rhinoceros, cave lion, cave bear, cave hyæna, hippopotamus, and others. In the neolithic period the animals were chiefly those of existing races, the ones just mentioned having disappeared. C. H. Hitchcock.

Flint River rises in Clayton co., Ga., and flows first in a S. S. E. and then in a S. S. W. course to the S. W. corner of the State, where, joining the Chattahoochee, it forms the Appalachicola River. It is 300 miles long, and navigable during high water to Albany by light-draught steamers, and at all times by larger steamers to Bainbridge, 50 miles from its mouth.

Flint River, in Michigan, rises in Lapeer co., flows 100 miles W. and N. W., and falls into the Shiawassee, an affluent of the Saginaw. Its lower part is navigable.

Flint River, tp. of Des Moines co., Ia. Pop. 1278.

Flint'shire, maritime county of North Wales, England, situated between the Irish Sea and the river Dee. Its area is 289 square miles; pop. 76,245. The coast is low and sandy, except along the estuary of the Dee. Parallel with the Dee runs a range of hills, rising in Garrey to 825 feet. The plains and the vales are fertile, and produce wheat, oats, and barley. The hills yield coal and ores of iron, zinc, copper, silver, and especially lead; one-fourth of the lead produced in Great Britain is supplied by Flintshire. Cotton is the main manufacture. Flintshire sends two members to Parliament, one for the county and one for the district of Flint. Flint, Mold, St. Asaph's, and Hawarden are the chief towns.

Flint'stone, post-tp. of Alleghany co., Md. Pop. 1284.

Flip'pen Bar'ren, tp. of Marion co., Ark. Pop. 350.

Float'ing Bat'teries, a name given to the heavier and more cumbrous class of iron-clad or shot-proof vessels. In the great siege of Gibraltar (1779–83) the assailants employed them, but without success. At Kinburn in 1854 they were used with advantage against the Russians, but at present they are built almost exclusively for defensive purposes.

Floating Islands are either artificial or natural. To the former class belong the *chinampas* of the Mexican lakes, which were observed by Cortez, and some of which still exist. They are formed by placing the lake mud upon floats or rafts of wicker-work covered with *tulé* reeds. In the lakes around Cashmere there are floating gardens made by placing lake mud upon large strips of marsh turf. The object of this process is to escape the floods which frequently destroy the crops in the lowlands of that region.

Natural floating islands are found in many lakes. They frequently consist of considerable pieces of marsh turf held together by willow roots and the like, and torn from their soft muddy beds by inundations or swift currents. Some of these, anchored by long roots, rise and fall with the water. Some are buoyed up, apparently by bubbles of marsh-gas beneath the surface. Several floating islands in Europe are large enough to serve as pastures. Floating islands occur in many American lakes which are being filled by the growth of vegetation and the formation of peat. A typical example of these may be seen in Lake Menomenauk on the line between Massachusetts and New Hampshire. This island has an area of about 5 acres, and is covered with small trees from 5 to 25 feet in height. It was formerly in Winchendon, Mass., but has now floated 2 miles up the lake, and into New Hampshire. In the great flood of 1874 several islands or natural rafts from the Mississippi were observed floating out to sea, bearing a freight of living animals, birds, and reptiles. Similar floats, with living trees, have been seen over 100 miles from the mouth of the Ganges in time of flood. Doubtless both plants and animals have had their habitats widely extended in this way.

Floating Warehouses have been constructed, chiefly in French ports. They are designed for the reception of gunpowder, nitro-glycerine, petroleum, and other unusually dangerous wares. They are anchored in places which are remote from quays, shipping anchorages, or buildings, and are thus not only less liable to be fired, but in case of their explosion will do comparatively little damage to other property.

Flobecq, town of Belgium, in the province of Hainaut, has distilleries, weaving and spinning factories, and corn and oil mills. Pop. 5258.

Flodden Field, the last point of the Cheviots, the place where King James IV. of Scotland, after crossing the Border on Aug. 22, 1513, with an army of over 30,000 men, took up his position, and where, on Sept. 9, the bloody battle was fought in which the king was killed and the Scottish army destroyed.

Flodoard, or **Frodoard,** canon of Rheims, b. at Épernay 894 A. D., opposed the intrusions of the civil power into the affairs of the Church, and was imprisoned therefor; author of French annals (*Chronicon*, 919–966); a history of the Rhemish Church; the *Triumphus Christi*, a metrical work, etc. He became an abbot, and d. Mar. 28, 966. His *Chronicon* is a work of much value to the historian. Large portions of his writings are extant, and have been printed.

Floetz, a German term formerly applied to the stratified or sedimentary rocks.

Flog'ging, the infliction of stripes or blows of the whip or scourge, especially when directed by a court of justice or other public authority. Corporal punishment has from the earliest ages been inflicted as a recompense for various offences. In the form of the bastinado it is still extensively employed in the East. In ancient Rome scourging might not be administered to a citizen, for it was looked upon as giving the deepest dishonor to its victim. It was, however, frequently employed as a punishment for those who were not citizens, and was administered with a rod. In modern Europe it is not quite extinct. Its severest form is by the knout in Russia, where it is much less frequent and severe than it formerly was. In Great Britain it exists as a means of prison discipline, as well as a regular punishment in the army and navy. In the U. S. army and navy it has been abolished, as well as in most of the States, Delaware being (1874) a noteworthy exception. Flogging in the public schools is perhaps not unknown in the regions remote from the influence of the progressive spirit of the time, but the mild forms of corporal punishment usually employed in our schools do not deserve so harsh a name as flogging.

Flood, tp. of Darlington co., S. C. Pop. 862.

Flood (Rt. Hon. Henry), an Irish orator, b. 1732, was educated at Dublin and Oxford; first entered the Irish Parliament in 1759; was sworn of the privy council for Great Britain as well as for Ireland in 1775; was vice-treasurer of Ireland 1775–81; and entered the British Parliament in 1783. His speeches are noteworthy for their fine style and logical method. He was an eloquent advocate of reform for Ireland, but the purity of his motives has been questioned. Author of some poems and a vol. of *Speeches* (1787). D. Dec. 2, 1791. (See his *Life and Correspondence*, by W. Flood, 1838.)

Flood-plain, a plateau which borders many streams above their general water-level, but which is covered by their periodical or occasional floods. The flood-plain is swept by, and often covered with, deposits from the turbid waters of freshets. Thus, it is built up to and maintained at a nearly uniform height. When left beyond the reach of the stream by the cutting down of its bed, the flood-plain becomes a terrace. J. S. Newberry.

Floor, the lower surface of any room in a building, or the upper surface of the structure which separates one story of a building from another. Floors are usually horizontal, but are sometimes inclined, or so curved as to present an upward concavity, especially in public halls and theatres. Floors are variously supported according to the purpose of their construction. Ordinarily, the floor-boards are laid upon simple joists, which are stiffened by struts, the ceiling of the room below being applied to the lower edges of the same joists. For deadening the sounds which may pass through floors, sometimes a double series of joists, or even a more complicated system of carpenter-work, is used. Floors are best made of narrow boards, the timber of the long-leaved Southern pine being a favorite material. A handsome floor may be made by alternate strips of pine and black walnut. Such floors are usually kept oiled or waxed with beeswax, and should be often rubbed and polished. Parqueterie, veneers, wood-carpeting, encaustic tiles, and even mosaics, are sometimes seen upon floors, but less frequently in this country than in Europe. Here the cheapness and excellence of carpets are such that persons in very moderate circumstances can afford to buy good carpets, which not only may be tastefully and artistically designed, but are conducive to health and comfort. The floors of warehouses for heavy goods require special constructions, such as trusses or arches, for their support.

Floor-cloth is composed of oil-painted canvas, both sides being painted with one or more coats, and afterward printed on one side with designs in colors. Floor-cloths are usually printed by hand by the old method of block-printing. The compounds linoleum, kamptulicon, and the like are substitutes for common floor-cloths, and are made by patented processes. India-rubber is an ingredient of some of these, and they are often stiller under foot, and warmer, but less durable than good oil-cloth.

Flo'ra was early worshipped among the Romans as the goddess of flowers and of spring, and was identified with the Grecian Chloris. A temple was vowed to her by Tatius, and a flamen appointed to serve at her altar. Her temple was situated near the Circus Maximus, and an annual festival was held in her honor between the 28th of April and the 3d of May, when every licentious extravagance was indulged in by the populace. She was represented bearing the cornucopia filled with flowers. A late tradition says that she was a wealthy courtesan who bequeathed her riches to the city on condition that she should be worshipped.

In botany, the term *flora* is applied to the collective vegetation of a country or district, and has been extended in its significance so as to include the fossil forms of plant-life found in any geological formation. The name is to botany what *fauna* is to zoology. It is applied also to a work which enumerates and describes the plants of any particular country. A *flora* would include only such plants as were indigenous to the region, or such adventitious ones as had become completely naturalized. The author sometimes endeavors to present his flora in such a way that it may be not merely a list of plants of the specified region, but an indication also of their geographical distribution, habits, and utility. In writing the name of such a work the term *flora* is followed by an adjective expressing the country included, as *Flora Americana*, *Flora Lapponica*, etc. W. W. Bailey.

Flora, tp. of Boone co., Ill. Pop. 1273.

Flora, post-v. of Clay co., Ill., 94 miles E. of St. Louis, Mo., at the crossing of the Ohio and Mississippi and the Springfield and Illinois South-eastern R. Rs. It has 6 churches, is the place of the district fair, contains about 50

stores and shops, 1 national and 1 savings bank, 2 flouring-mills, 1 weekly newspaper, and 2 monthly magazines. Pop. 1339. M. L. WILSON, PUB.
"SOUTHERN ILL. JOURNAL" AND "MONTHLY LETTER-BOX."

Flora, tp. of Renville co., Minn. Pop. 269.

Flora Falls, a beautiful cascade and post-v. of Stony Point tp., Rockland co., N. Y., on Flora Creek, which has worn a ravine in the sandstone for 100 feet.

Floréal (the "flowery"), the eighth month in the republican calendar of France, which from Nov. 24, 1793, to Sept. 9, 1805, was used in place of the Gregorian. Floréal began Apr. 19–22, and ended May 18–21.

Flore, Order of [so called from *Floris* (a place near Cosenza), the seat of the first abbey], a branch of the Cistercians, including convents of nuns as well as those of monks. It was founded by Joachim of Floris in 1189, and being suspected of maintaining the heresies of its founder, it never flourished. In 1505 most of its convents joined the Cistercians and other orders.

Flor′ence [It. *Firenze*], province of Italy, comprises an area of 2144 square miles, with a population of 766,824. It is one of the most productive provinces of the country; wheat, wine, and silk are extensively produced.

Florence [It. *Firenze*, with the epithet *La Bella*], a city of Italy, is situated in lat. 43° 46′ 36″ N. and lon. 11° 15′ 30″ E., in the beautiful valley of the Arno, mostly on the northern bank. Pop. in 1871, 167,093. It is one of the most beautiful and interesting cities of Italy, and a principal seat of art and science. Great and splendid even in former times, it made great progress in size and beauty, as the capital of the new kingdom, from 1865 to July 1, 1871. The inner part of the city was formerly surrounded by a wall, but gardens, palaces and monasteries cover the neighboring hills. During the recent expansion of the city the wall was thrown down on the eastern side, and here a new city arose, in the midst of which is situated the beautiful Piazza d'Azeglio. The inner part of the city has been made brighter by the construction of new and wider streets, and new and beautiful palaces are added to the great number of old and celebrated monuments. The Arno, dammed up to 100 paces breadth, is provided with quays, called *Lungarno*, and six bridges connect the different parts of the city with each other. These bridges and quays, with the Via della Scala and Via Maggio, form the liveliest parts of the city, and more than twenty public squares, surrounded by beautiful buildings, adorn it. Among these public squares the most remarkable is the Piazza del Granduca, now called the Piazza della Signoria, which is very rich in works of art. It contains the great fountain, adorned with twelve bronze statues by Gian of Bologna; the beautiful equestrian statue in bronze of Cosimo I., by the same artist; the colossal Neptune and the Tritons of marble by Ammanato; and the statue of Hercules by Bandinelli. The old palaces stand, generally, among common houses in narrow streets, and their heavy and massy architecture gives them a gloomy character. In the Middle Ages they served as strongholds. They were built of large blocks of freestone, with battlements, and often with towers, but without any exterior embellishments. They are now, moreover, blackened by age. In the interior they contain courtyards, with arcades from which stairs lead into the halls. One of the most interesting palaces is the Palazzo Vecchio, or Palazzo della Signoria, at one time the seat of the Florentine magistrature, and from 1865 to 1871 of the Italian Parliament. The Palazzo Pitti, built by Brunelleschi, and the residence of Victor Emmanuel while in Florence, is one of the most magnificent palaces which exists. It contains the Galleria Pitti, the finest collection of pictures in the world, and the Pitti and Uffizi collections are now connected by a long gallery, passing over the Ponte Vecchio.

Remarkable among the ecclesiastical buildings is the cathedral, 555 feet long, 340 feet broad. Arnolfo da Colle commenced the building, and continued it until 1310; Giotto succeeded him, and Brunelleschi finished it in 1436. The marble covering of the cathedral is rich and varied; especially is that of the campanile delicate and fine in color. Very interesting is the construction of the vaults of the baptistery of San Giovanni, belonging to the cathedral and situated to the west; and widely known are the three doors of bronze, especially that of the eastern gate by Ghiberti. The church of Santa Croce, commenced in 1294 by Arnolfo di Cambio, 371 feet long and 113 feet broad, has eleven chapels, and contains the tombs of Michael Angelo, Alfieri, and Machiavelli, and a monument of Dante. A most interesting building is the Loggia dei Lanzi, a hall commenced in 1376, and finished by Benci di Cione and Simone di Francesco Falenti after a plan by Orcagna. It contains masterpieces of marble and bronze—the Vestals, the Centaur, Ajax with the corpse of Patroclus. Between the Loggia dei Lanzi and the Palazzo Vecchio is situated the Palazzo degli Uffizi, containing the world-famous collections of statuary in marble and bronze (the group of Niobe and the Medicean Venus), of cameos, pictures (*Venus* by Titian, the *Holy Family* by Michael Angelo), and crayons.

Florence has two forts, but is not regularly fortified. The industry of the city, formerly flourishing, is remarkable now only in works of art, mosaic, and jewelry; its manufactures of silk, velvet, and woollen have decreased very much.

Florence, originally a Roman colony in Etruria, was a flourishing city at the time of Christ. Under Totila it was destroyed, but rebuilt under Charlemagne. The German emperors, especially Otho the Great, favored the city in many ways; and as its position was of much consequence in military respects, many knights settled here, and early the nobles held the ascendency. Parties fought in Florence as in other cities; nevertheless, in the ninth and tenth centuries it became a centre of civilization, and increased its political importance by conquering the neighboring cities and towns. In the beginning of the twelfth century it threw off the authority of the German emperors and established a republic, and in 1198 it headed the union of the Tuscan cities against Philip of Suabia. In the beginning of the thirteenth century Florence was governed by a podestà, who, however, held the supreme authority only in matters of justice; the administration and the political power depended on six consuls and a municipal council of 100 citizens. The republic had an oligarchical character, but although it was convulsed by the civil wars between the Guelphs and the Ghibellines, the city still increased in power. In 1078 the enlargement of the city made a second wall necessary, and between 1284 and 1327 the third wall, the present one, was built. In 1222, Florence conquered Pisa, and gained great commercial advantages; in 1332 it conquered Pistoja, in 1333 Massa, and soon it ruled over the whole of Tuscany. The authority of the nobility began to decrease; the citizens acquired ascendency, and in 1378 the democracy gained a decided victory, Salvestro de Medici, a plain citizen, becoming gonfaloniere. It was, however, Giovanni de Medici, the banker of the pope and a man of immense wealth, who founded the house. At his death in 1428 he left two sons, Cosimo and Lorenzo, from the latter of whom the dukes of the sixteenth century descended. Cosimo acquired great fame during the Council of Florence in 1439, and his grandson, Lorenzo the Magnificent, added still more to the splendor of the house. In 1478 the conspiracy of the Pazzi against the Medici failed, and in 1492, Pietro succeeded his father Lorenzo as gonfaloniere. Pietro, however, was expelled, and Savonarola established a kind of theocracy, but was burnt as a heretic in 1498. By the victory of Alessandro of Medici (Aug. 12, 1530) the republic was finally overthrown, and (July 29, 1531) Alessandro was declared duke of Florence. He was killed in 1539, but his son succeeded as grand duke. After the death of the last Medicean grand duke the government of Tuscany, whose capital Florence was, fell to Francis, duke of Lorraine, later an emperor of Germany. His descendants were expelled by the French in 1799. In 1801, Tuscany became a part of the kingdom of Etruria under Louis of Parma. In 1808 it came under the sway of France. In 1814 the grand duke Ferdinand III. once more took possession of the country, but in 1859 his son, Ferdinand IV., had to abdicate, and May 22, 1860, Tuscany was incorporated into the kingdom of Italy, and Florence was the capital of the kingdom until in 1871 this dignity was conferred on Rome. A. NIEMANN.

Florence, a post-v. and tp., capital of Lauderdale co., Ala., is at the head of navigation on the N. bank of the Tennessee River and on a branch of the Memphis and Charleston R. R. It contains the State normal school and a flourishing female college, has 2 weekly newspapers, 3 churches; also 2 churches and a school for colored people, 1 hotel, and the usual number of shops and stores. There are 2 cotton-factories located near Florence. Principal business, farming. Pop. of v. 2003; of tp. 2528. JONES & POWERS, EDS. OF "TIMES & JOURNAL."

Florence, post-v. of Pima co., Ara., on the Gila, 60 miles N. of Tucson.

Florence, post-v. of Idaho co., Id., in Florence Basin. It is believed to be the highest town in the U. S. It is 11,100 feet above the sea-level. Florence Mountain, on which it stands, is over 13,000 feet high. Florence has very productive gold-mines.

Florence, tp. of Stephenson co., Ill. Pop. 1185.

Florence, tp. of Will co., Ill. Pop. 875.

Florence, tp. and post-v. of Benton co., Ia., on the

Chicago and North-western R. R., 15 miles W. by S. of Cedar Rapids. Pop. of v. 313; of tp. 1290.

Florence, city of Marion co., Kan., at the junction of the Cottonwood River and Doyle Creek, on the Atchison Topeka and Santa Fé R. R. It has good school advantages, usual religious denominations represented, a stone-quarry, a bank, and a grist-mill. Pop. about 300.
E. W. Hoch, late Ed. "Pioneer."

Florence, post-v. of Boone co., Ky. Pop. 374.

Florence, thriving post-v. of Northampton tp., Hampshire co., Mass., on the New Haven and Northampton R. R., 3 miles N. W. from the village of Northampton, with which it is connected by a street railroad. It has manufactures of sewing-machines, cotton, silk, woollen, and other goods, and has excellent social and educational advantages. (See Northampton.)

Florence, post-tp. of St. Joseph co., Mich. Pop. 970.

Florence, tp. of Goodhue co., Minn., on Lake Pepin. Pop. 760.

Florence, post-v. of Haw Creek tp., Morgan co., Mo. Pop. 53.

Florence, tp. and post-v. of Douglas co., Neb., on the Omaha and North-western R. R. and on the Missouri River, 5 miles by rail and 15 miles by steamer above Omaha. Pop. of tp., 395.

Florence, post-v. and tp. of Oneida co., N. Y. P. 2299.

Florence, post-tp. of Erie co., O. Pop. 1341.

Florence, tp. of Williams co., O. Pop. 1678.

Florence, post-v. of Darlington co., S. C., at the junction of the North-eastern, the Cheraw and Darlington, and the Wilmington Columbia and Augusta R. Rs., 102 miles N. of Charleston. It has grown remarkably since 1860, when its site was a pine forest. It has railroad shops, some 30 stores, a mill, machine and other shops, 8 churches, 2 fire-engine companies, a weekly newspaper, a large trade in cotton and in other goods, and a hotel which cost $25,000. Wm. Little, Ed. "Pioneer."

Florence (Thomas B.), American Congressman, b. in Philadelphia, Pa., Jan. 26, 1812, published and edited a Democratic newspaper there for several years; was for nine years secretary of the board of controllers of public schools in Philadelphia, and was a Representative from Pennsylvania in Congress from 1850 to 1859. Established the *National Democratic Review*, edited the *Constitutional Union* in Washington, D. C., and was in the national union convention at Philadelphia in 1866. D. July 3, 1875.

Florence, Council of (1439–42 A. D.). This was not a separate council, but, along with that of Ferrara, only the continuation of the Council of Bâle, the seventeenth of the twenty œcumenical councils acknowledged by the Church of Rome. The Council of Bâle was opened Dec. 14, 1431. Called in the interest of reform, the attendance at first was small, the pope, Eugenius IV., being hostile. In 1434 a reconciliation was brought about, and the pope took the direction of affairs into his own hands. On Jan. 8, 1438, the council was transferred to Ferrara, and in Jan., 1439, to Florence, where its sessions continued at intervals until 1442. But its interest culminated in the summer of 1439, when the reunion of the Greek and Latin churches was thought to have been accomplished. More than 500 Greeks, including the Greek emperor and the patriarch of Constantinople, were in attendance, having joined the council at Ferrara. Four points were under discussion: 1, the Filioque of the Latin Creed; 2, the use of unleavened bread in the Eucharist; 3, purgatory; 4, the papal supremacy. The first three points were settled by compromise; the fourth by the submission of the Greeks. But the impulse to this settlement was imperial, the Greeks desiring Occidental assistance in beating back the Turks. The "reconciliation" had no roots in the hearts of the people, and in 1443 the patriarchs of Alexandria, Antioch, and Jerusalem united in denouncing the Council of Florence. Meanwhile, the remnant of the council summoned by Eugenius IV. continued to sit at Bâle; in 1440 elected an antipope (Felix V.), who resigned in 1449; removed to Lausanne July 24, 1448, and dissolved Apr. 25, 1449. (See Mansi's *Councils*, vol. xxix.; Harduin's *Councils*, vols. viii. and ix.; and Hefele's *Conciliengeschichte*, vol. vii., part 2, 1874.) R. D. Hitchcock.

Flor′entine Acad′emy (*Accademia Fiorentina*), a learned association of Florence, was founded in 1540. With it the Accademia della Crusca was finally united.

Flor′entine Work, or **Pie′tra Du′ra** [It. for "hard stone"], a beautiful kind of ornamental work composed of black (or less frequently white) marble inlaid with brilliantly colored stones. Florence is the most famous seat of this industry, or rather art, but the Russians excel the Italians. The workmen of Agra and Delhi in India anciently produced fine work of this kind, but there is reason to think it in part (at least) the work of Italian artists.

Floren′tius, the name of several men eminent in history and in letters. Among them are Florence (Florentius) of Worcester, a learned monk who d. in 1118; author of a Latin chronicle, the first written in England after the Norman Conquest.—Florentius Radenius, b. at Leerdam in the Low Countries in 1350; was educated at Prague; succeeded Gerhard Groot as director of the Brethren of the Common Life. D. 1400. (See his *Life*, by Thomas à Kempis.)—Another Florentius (*François Florent*) was a Burgundian jurist, who d. Oct. 29, 1650; author of *Dissertations* on the canon law (1632) and *Disputations* regarding consanguineous marriages (1636).

Flo′res, the westernmost island of the Azores, in the Atlantic Ocean, in lat. 39° 25′ N. and lon. 31° 12′ W. Its name was given it by the Portuguese in allusion to the flowers with which it is covered. Pop. 10,522. Chief town, Santa Cruz.

Flores, an island of the Malay Archipelago, and the largest of the chain that extends from Java to Timor. Its length is 200 miles, its breadth about 35 miles. It is hilly, with some lofty volcanic peaks on its S. side. It exports sandal-wood, beeswax, and horses. The native inhabitants are Negrillos. On the coast are settlements of Malays.

Flo′resville, post-v., cap. of Wilson co., Tex.

Flo′reyville, post-v., cap. of Bolivar co., Miss.

Flo′rian, Saint, patron saint of Poland, was a Roman soldier, b. in Noricum of Christian parentage, and drowned in the river Enns in Austria during the Diocletian persecution, on account of his voluntary confession of the Christian faith. He was buried where now stands the magnificent Augustinian abbey of St. Florian, 3 miles S. W. of Enns, but his relics were translated to Rome, whence in 1183 they were taken to Cracow. In legendary lore he is honored as the extinguisher of conflagrations. He is commemorated on Mar. 4th.

Florian, de (Jean Pierre **Claris**), b. at the Château de Florian, in Gard, France, Mar. 6, 1755; entered the service of the duke of Penthièvre; was patronized by Voltaire, and attained fame as a writer of fables, romances, comedies, and pastoral poems; was imprisoned in Paris by the republicans, and d. at Sceaux Sept. 13, 1794. Some of his plays still keep the stage, but his romances *Galatée* and *Estelle*, his *Fables*, and the translation of *Don Quixote* are his best works.

Flor′iculture [Lat. *flos, floris*, a "flower," and *cultura*, "attention"], the cultivation of flowers, whether pursued for profit or for enjoyment. Not only for the supply called for by the flower-markets of all large cities, but to satisfy an important commercial demand—that for artificial perfumes—has floriculture become an industrial pursuit. Thus, rose-culture in India, Persia, Turkey, and France, and in the latter country the production of violets, jessamine, orange-flowers, tuberoses, heliotropes, jonquils, etc., are found very profitable, and are conducted on a large scale. In ancient Athens, as well as in aboriginal Mexico—the one the most refined of cities, the other a scarcely more than barbarian town—there were famous flower-markets. Even among the rudest savages the love of flowers is not unknown. India, Japan, and especially China, have done much for the development of garden-flowers, which are indeed almost as much the product of art as of nature. But, though often monstrosities to the eye of the botanist, hardly any objects in the world are more beautiful or more replete with fine æsthetic and moral influences than garden-flowers. Says Solon Robinson (*Facts for Farmers*, p. 500), "We are just as well satisfied of the beneficial moral effect of flower-cultivation as we are that the effect of their beauty upon the senses of nearly all beholders is pleasing. . . . A love of flowers is a love of the beautiful; a love of the beautiful is a love of the good. . . . There is no spot on the farm that grows such a paying crop as the little parterre . . . devoted to the cultivation of flowers. If it does not pay in golden coin, it does in all that makes life worth staying here for." Parlor and green-house floriculture, the Wardian case, and the flower-border each require special skill, to be acquired by experience and the study of works specially devoted to the subject. In the U. S. floriculture for profit is carried on in the vicinity of all considerable towns to some extent, but the flower-markets of New York and New Orleans have long been the most celebrated. The cultivation of flowers for market is an important industry in those parts of New Jersey near New York, but the U. S. census does not publish separate statistics for this branch of gardening. Throughout the year the New York flower-markets receive ample supplies, principally from New Jersey, and the number of kinds of flowers supplied, even in the coldest months, is very great.

Flor'ida, the most southern of the States of the Ameri-

can Union, lying between the parallels of lat. 24° 30′ and 31° N., and between the meridians of lon. 79° 48′ and 87° 38′ W. from Greenwich. The peninsula of Florida forms the eastern barrier or boundary separating the Gulf of Mexico from the Atlantic Ocean. It is bounded N. by Georgia and Alabama; E. by the Atlantic Ocean; S. by the Gulf of Mexico and the channel between Florida and Cuba, which forms one of the outlets of the Gulf of Mexico; W. by the Gulf of Mexico and the Perdido River, which separates it from the Gulf portion of Alabama. Its area is estimated at 59,268 square miles, or 37,931,520 acres, but this is only an approximation, as its surface has never been accurately surveyed. The peninsular portion of the State is about 375 miles long, with an average breadth of about 90 miles. Negotiations have been commenced between Alabama and Florida for the purchase by the former of the seven counties lying between the Chattahoochee and Perdido rivers, thus giving Alabama her entire southern coast-line on the Gulf. This may eventually be done, but as yet very little progress has been made in the negotiations.

Face of the Country, Coast-Line, Rivers, Lakes, etc.—The State has a coast-line of more than 1150 miles, indented with a large number of spacious bays, harbors, and estuaries, affording great advantages for the development of trade and safe and convenient retreats for vessels exposed to the violent gales which occasionally rage off this coast. On the Gulf coast the principal harbors are Pensacola, Appalachicola, St. Mark's, Cedar Keys, Tampa, Charlotte, and Key West; and on the Atlantic, St. Augustine, Fernandina, Port Orange, and Jacksonville on the St. John's River.

The principal rivers are the Appalachicola, which farther N. takes the name of Chattahoochee from its principal affluent; the Ocklockonnee, the Perdido, the Suwanee, St. Mary's, and St. John's. The last-named river, with its branches, furnishes nearly 1000 miles of river navigation, and for 150 miles from its mouth is 2 miles wide. It is a somewhat sluggish stream, and for more than 200 miles runs nearly parallel with the Atlantic. The Wethlacoochee, which discharges its waters into the Gulf, is a very considerable stream, as are also Peace Creek, which falls into Charlotte Harbor, and the Caloosahatchie River, which falls into the Gulf still farther S. Kissimee River, which connects several of the smaller lakes with Lake Okeechobee, is a navigable stream.

The largest bays are on the Gulf coast. Prominent among these are Perdido, Pensacola, Escambia, Choctawhatchee, St. Andrew's, Alligator, Appalachee, Deadman's, Horseshoe, Wacasse, St. Joseph's, Tampa, Hillsboro', Sarasota, San Carlos, Costigo, Charlotte Harbor, Caximbus, Gallivans, Bahia, Ponce de Leon, White Water, and Florida bays; while on the Atlantic, near the southern extremity of the peninsula, is Bay Biscayne. The coast has also a number of sounds, those on the Gulf being St. Rosa Sound—uniting Pensacola and Choctawhatchee bays—St. George's Sound, and on the Atlantic coast, Barnes and St. Lucie's sounds.

Florida abounds in lakes. Okeechobee, the largest, has not been fully explored, but is said to extend over an area of more than 650 square miles. The largest of the other lakes are Ahapopka, Istokpoga, Orange Lake, Kissimee, Cypress, Lake George, Lake Lamona, Lake Washington, Tohopokaliga, Alligator, Dunn's Lake, Lake Harris, Lake Griffin, Lake Trati-Apopka, Lake Jessup, Lake Monroe, Santa Fé Lake, etc.

Not the least striking geographical feature of Florida is the Everglades, which occupy a portion of the lower part of the peninsula. This delta-like expansion consists of numerous streams, which in a wet season form a continuous though mostly shallow sheet of water, and forms the marshy outlet of Lake Okeechobee, extending to the Gulf of Mexico in a south-westerly direction. It is nearly 90 miles in length, and from 30 to 50 in width, comprising an estimated area of 3600 square miles, or 2,204,000 acres. The Everglades, when partially inundated, resemble an immense lake studded with a vast number of islands, varying from a fraction of an acre to hundreds of acres in extent. These islands have a very rich soil, and when reclaimed are well adapted to the growth of plantains and bananas, but in their wild state are generally covered with dense thickets of shrubbery and vines, and occasionally with pines and palmettos. N. of the Everglades the country is generally level, the most elevated point in the central portion of the peninsula being considerably less than 200 feet above the level of the sea; from this point the surface slopes gradually towards the coast on either side. Between the Suwanee and the Appalachicola the surface is more elevated, and occasionally diversified with hills; W. of the Appalachicola the surface is generally level.

Florida has many beautiful springs, some of immense size, and strongly impregnated with sulphur and lime. Good water may be found in almost any section at the depth of from 15 to 20 feet.

S. of the mainland, and extending from Cape Florida on the peninsula, a series of islands, sandbanks, reefs or keys, attached and belonging to the State of Florida, extend south-westward a distance of 220 miles in a curve, terminating in a cluster of sandbanks and rocks known as Tortugas. These keys are separated from the mainland by Florida Bay, Bay Biscayne, Carp's and Barnes sounds. S. of this series of keys, with a navigable channel intervening, lies the Florida Reef, being a long, narrow coral reef, here constituting the left bank of the Gulf Stream. Key Largo is the longest and Key West the most important of these keys. On the latter the city of Key West is located, one of the largest cities in the State, and an important naval station.

Geology and Mineralogy.—The whole State belongs to the alluvial and diluvial formations. It is often spoken of as an immense sand-bar; this is not true. The diluvial portion of the State, the interior and highest portion of the peninsula, consists for the most part of clay intermingled with a calcareous formation. The coral-beds, some of them of great age, underlie most of the State, where, as in all the swampy and low-lying portions, as well as in the alluvium which prevails for perhaps 25 or 30 miles on either coast, the covering of these coral-beds is a deposit from the ocean or the Gulf, and has been so much fertilized by the decay of its luxurious vegetation, that it is uncommonly fertile. On much of the land the live-oak and other oaks, pines, and hickory grow luxuriantly. But few valuable minerals have thus far been brought to light in the State, and it is hardly probable that any considerable number will be found, for alluvial and diluvial lands are not often rich in them. Ochre, amethyst, pit-coal, topaz, agate, carnelian, chalcedony, iron ore, calcareous limestone, silicified shells, and corals are found in limited quantities along the coasts and in the interior. The *coquina* of Florida, a shell-conglomerate, affords a fine building material. The beauty of the sea-shells of the Floridian coast, and especially along the keys around the southern extremity of the peninsula, has been often remarked.

Soil and Vegetation.—The soil of Florida is generally a light, sandy loam, with a substratum of clay, and sometimes intermixed with the latter. It is of all qualities, from the dry sand of the pine barrens to the fertile hummocks and bottom-lands, and in the marshes are inexhaustible vegetable deposits which make most excellent fertilizers. The pine barrens, the poorest lands in the State, although apparently worthless for agricultural purposes, are, in reality, very productive when properly cultivated, experience having proved that they are eminently adapted to market-gardening. In the order of productiveness the swamp lands rank first, the low hummocks second, the high hummocks third, and the pine, oak, and hickory lands fourth. The swamp lands are of comparatively recent formation, and are still receiving additions to their surface. In the cultivation of these lands ditching is indispensable, but they are intrinsically the most valuable lands in the State, being as fertile as the hummocks, and much more durable. They are especially adapted to the cultivation of the sugar-cane, and crops of four hogsheads of sugar per acre are not uncommon. The low hummocks require some ditching, and are also suitable to the cultivation of cane. Of the adaptability of the high hummocks for general cultivation mention has already been made. Nearly all the grains and fruits of the temperate zone may be raised in the northern part of the State; the eastern and central portions of the peninsula produce the various semi-tropical fruits in abun-

dance; and in that portion of the State S. of the line of frosts the fruits of the tropics may be cultivated without difficulty. Every section of the State is adapted to the growth of Indian corn. On the rich bottom-lands the average crop is 55 bushels to the acre. The short staple (or upland) and the long staple (or sea-island) cotton are both cultivated, the former being usually grown in the western part of the State, and the latter in the eastern. The yield of the short staple is from 200 to 300 pounds per acre on ordinary soils, but with good care, upon rich land, 500 pounds may be produced. Under favorable circumstances from 300 to 400 pounds of the long staple can be grown upon an acre. The soil and climate of Florida are eminently adapted to the growth of sugar-cane, and its culture is increasing, since it has been discovered that a large capital is not necessary to success in its culture, and that a number of proprietors cultivating small areas have received as great profit from the cane as could be derived from any other product. In Volusia county one field of ten acres produced at the rate of 1500 pounds of sugar and 300 gallons of molasses to the acre. The ordinary yield of sugar per acre in Florida is nearly twice that of Louisiana, and the cultivation much easier. Below the frost-line on the peninsula the sugar-cane reaches perfection, which it cannot in Louisiana or elsewhere in the U. S. Cuba tobacco was grown in some parts of the State before the war, and its cultivation is again becoming common. The average yield of this plant is 700 pounds per acre. Sweet potatoes produce abundantly in all parts of the State, yielding from 100 to 300 bushels per acre, and next to Indian corn form the principal article of vegetable food of the masses. Irish potatoes, although not so productive as in the North, may yet be made an exceedingly profitable crop, as they may be planted in January and ripen in May, when they are shipped at a small expense to Northern markets and sold for good prices.

A large area of the lowlands is well adapted to the culture of rice, the average yield being 40 bushels to the acre. During the British occupation indigo was the main staple, but it is not at present cultivated. The plant now grows wild in many parts of the State. Sisal hemp, introduced from Yucatan, has proved a great success. It may be grown anywhere S. of the frost-line, and with very little care a ton of cleaned hemp can be made to the acre, worth $300 per ton. Coffee has been successfully grown in the southern portion of the peninsula. The pea-nut (or ground pea) produces abundant crops. The *Zamia integrifolia*, a wild arrow-root, yielding a nutritious starch, grows in the S. part of the State. Wheat has been raised in Northern Florida, but is an uncertain crop. Rye and oats are cultivated to some extent, but chiefly for forage. All varieties of hemp grow luxuriantly, and may be cultivated with assurance of remunerative return.

Almost every description of garden vegetables found in the markets of this country can be raised here with great success. Owing to the fact that the season is from four to six weeks earlier than any other part of the Atlantic coast, many vegetables, including tomatoes, peas, beans, cucumbers, potatoes, melons, cabbage, and beets, are shipped to Northern ports at great profit; and with the establishment of direct lines of steamers between the ports of the State and the principal Northern ports, thus avoiding the delays and injury of transshipment at Savannah or Charleston, the gardeners of Eastern Florida are enabled to place vegetables in the Northern markets in good condition long in advance of those of other localities.

In this genial climate all the semi-tropical fruits, such as the orange, lemon, lime, olive, fig, citron, pineapple, banana, guava, and the palm, are produced in as great perfection as in the more tropical climate of Brazil and the West Indies, and with far less attention and greater immunity from injury by insects or vicissitudes of climate than the common fruits of Northern orchards. The oranges are especially celebrated for their superior flavor. It is not known whether this fruit is indigenous, but it is now found growing wild in almost every section of the State. A large number of orange-groves have been established within the past few years, and the exportation of the fruit has already become one of the most important branches of trade. The groves are established by transplanting the wild orange trees during the winter, and budding them in the summer with the sweet orange. Raised from the seed, the orange begins to bear in from seven to ten years, but the budded trees generally produce fruit in three or four years. The yield of single trees varies from 100 to 10,000 oranges, according to age, situation, and treatment. One hundred trees are planted to the acre, and as the fruit can be sold on the trees at $15 to $20 per thousand, enormous profits can be derived from a small area of land. The lemons of Florida are far superior to those of Sicily, Italy, or Spain. The lemon, lime, citron, and shaddock are propagated in the same manner as the orange; all of them in greater perfection than in other countries. The pineapple is grown, with slight protection in winter, as far N. as St. Augustine, but 100 miles S. of this point they are produced in great perfection, frequently weighing nine or ten pounds each. The guava, another tropical fruit, trained in bush form, is attracting much attention, and its cultivation is beginning to be largely undertaken. The banana may be successfully cultivated as far N. as Fernandina, and where once established a plantation of this fruit needs no renewal, and 1 acre will produce as much food as 45 acres of potatoes. Figs, pomegranates, olives, and various kinds of berries are produced in abundance. S. of lat. 28° N. the date-palm is grown with great success. Apples and pears have not been so successful. The peach, the nectarine, and the plum do well, and are less subject to disease and injury from insects than in the North. The grape grows luxuriantly, and is found wild in many parts of the State. The black and white Hamburg, Muscat, and other foreign varieties reach the greatest perfection. The scuppernong is most generally cultivated, and makes excellent wine. The sugar-apple, alligator-pear, plantain, and cocoanut are strictly tropical fruits, but they may all be raised without difficulty in the southern portion of the peninsula. Ginger, cinnamon, pepper, pimento, cloves, and the other tropical spices are all successfully cultivated in Southern Florida.

In the growth and variety of its forest trees Florida has few rivals on the Atlantic slope. The live-oak, the most valuable timber for shipbuilding, is abundant here; indeed, the peninsula may be considered its original home. Various other species of oak, the swamp cypress, the yellow pine, and other choice varieties and species of the pine, hickory, magnolia, the great dogwood, and the bay-laurel are abundant here. The castor-oil bean (*Ricinus palma Christi*), elsewhere a graceful annual shrub, here becomes a majestic perennial tree. Satin-wood and lignumvitæ abound on the keys and islands, as well as many of the West India forest trees, including mahogany, various palmettos, Jamaica kino, several mangroves, the deadly manchineel, the torch-wood, the canella, and a curious parasitic tree incorrectly called India-rubber (*Clusia flava*).

Zoology.—Of the mammals there are few very formidable wild animals. The bear—the brown or black bear of the Southern States—is somewhat numerous. There are probably a few wolves, though this has been doubted. The opossum, the raccoon, the woodchuck or ground-hog, and various species of rats, mice, and bats, are common in Middle and South Florida. There are one or two species of deer, and rabbits, squirrels, etc. abound. The alligator, often of large size, is found in great numbers on the St. John's River, Suwanee, Appalachicola, and Perdido, as well as in all the larger lakes, and is abundant in Lake Okeechobee and the Everglades. There is a true crocodile in South Florida, and the manatee or sea-cow is still found in the sounds and bays. Shad of fair quality are found in the larger rivers early in the season, and immense quantities of mullet, bass, sheepshead, lake-trout, and other varieties of fish suitable for the table are taken. Turtles are very plenty on all the keys, and the green turtle, the delight of epicures, is supplied largely from this region. Other species of turtles are common, and various species of cuttle-fish, some of them of gigantic size, are found along the coast. Sharks are plentiful also, especially on the southern coasts. Wild-turkeys, many species of ducks, and other swimmers and waders, hawks, kites, eagles, vultures (the king vulture, hardly inferior in size to the condor, and heretofore supposed to be peculiar to Mexico, has recently been seen here), and owls are abundant throughout the peninsula. Of smaller birds there is an immense variety, though the major part (excepting always the mocking-bird) are more remarkable for their plumage than their song. In the lowlands and the swampy or marshy regions the insect pests are numerous at certain seasons, sand-flies, mosquitoes, black-flies, etc. being plentiful enough; but there are extensive districts in the State where these are not abundant, and some where they are not known.

Climate.—Though in the latitude of Northern Mexico, the Desert of Sahara, Central Arabia, Northern Hindostan, Northern Burmah, and Southern China, the climate of Florida, tempered by the Atlantic breezes on one side and those of the Gulf on the other, is far more temperate and equable than that of any of those countries. The Spanish records at St. Augustine show that for 100 years the mean temperature of the winter months averaged a little over 60° F., and of the summer months 86°. The extremes of the year, taking the peninsula together, are about 35° as the coldest and 95° as the hottest temperature, and neither extreme is reached more than twice or three times in the year. The summer may be said to last seven or eight months, and during the whole period there are very few uncomfortably hot days, the sea-breezes tempering the air, and the nights

are uniformly cool. The rainy season extends over three or four months, but there are only more frequent showers, and sometimes heavy and drenching rains, but seldom of more than four hours' duration. Occasionally there are long droughts in some sections, and excessive rain in others.

The following table, made up from the army meteorological record in regard to three points, and from private observations in regard to the other four, gives the mean temperature of each month at most of the points named for twenty years, and the rainfall of most for 1871–72:

Places.	Latitude.	Mean temperature, January.	Mean temperature, February.	Mean temperature, March.	Mean temperature, April.	Mean temperature, May.	Mean temperature, June.	Mean temperature, July.	Mean temperature, August.	Mean temperature, September.	Mean temperature, October.	Mean temperature, November.	Mean temperature, December.	Mean temperature, yearly average.	Yearly rainfall in 1871 and 1872.
St. Augustine.......	29° 53′	57.03	59.94	63.34	68.78	73.50	79.36	80.90	80.56	78.60	71.88	64.12	57.26	69.61	47.86
Tampa Bay..........	27° 56′	61.53	63.54	67.72	71.82	76.64	70.46	80.72	80.43	78.28	74.02	66.94	61.99	71.92	33.17
Key West............	24° 36′	66.68	68.88	72.88	75.38	79.10	81.63	83.00	82.90	81.92	78.11	74.66	71.03	76.51	36.49
Jacksonville.........	30° 15′	59.38	55.50	61.20	67.20	75.70	79.20	84.10	84.40	77.20	73.00	62.70	53.30	69.60	53.95
Fort Dallas..........	25° 45′	66.40	66.60	70.40	75.60	77.00	80.50	82.10	81.80	79.60	77.90	71.30	66.80	74.80	32.97
Fort Meyers, or Punta Rassa......	27°	63.40	68.00	72.20	73.80	80.10	81.20	82.90	83.10	81.70	77.70	71.50	64.70	75.00	40.87
Lake City, 1871....	30° 06′	49.00	53.50	57.60	71.60	78.10	79.30	81.20	79.40	76.50	71.00	63.00	53.00	67.80	47.12

Area and Disposition of Public Lands.—Of the 37,931,520 acres forming the estimated area of the State, 28,092,489 acres had been surveyed up to June 30, 1872, and 9,839,111 acres were still unsurveyed. Of the 28,000,000 acres of surveyed land, there had been sold, at that date, 1,832,431 acres; entered under the homestead law, 389,147; granted for military services, 465,942; officially approved under railroad grants, 1,760,468; approved as swamp lands given to the State, 10,901,207 (of these lands, which are sold by the State at 70 cents per acre, 6,617,177 acres remained unsold July 1, 1873); granted for internal improvements, 500,000 acres; granted for schools and universities, 1,000,663; granted to individuals and companies, 52,114; granted for deaf and dumb asylums, 20,924; and confirmed private land-claims, 3,784,303; making in all 20,669,061 acres disposed of. Including the unsurveyed portion of the State, there are 17,262,459 of public government lands now for sale. Included in this area, however, are the numerous lakes in the State. Besides these there are 6,617,177 acres of the swamp lands for sale by the State at 70 cents per acre. In 1870 there were only 2,373,541 acres of the entire area of the State in farms, and of these only 736,172 acres of improved lands. In the four years which have since elapsed it is believed that the amount of farming lands has more than doubled, and that the improved lands now exceed 2,000,000 acres. The average size of farms in 1870 was 232 acres; the value of farms, $9,947,920, and of farming machinery, etc., $505,074.

Agricultural Products.—In 1870 the value of all farming products, including betterments and addition to stock, was $8,909,746; of animals slaughtered, $520,966; of home manufactures, $131,693; of forest products, $7965 (this must have been exclusive of live-oak timber, lumber, and woods for cabinet use); of market-garden products, $31,983; of orchard products, $53,639; the amount of wages paid to farm-hands during the year, including the value of board, was $1,537,060. Wheat is not grown in any appreciable quantity in Florida, and in 1870 only 545 bushels of rye were reported; of Indian corn, 2,225,056 bushels were reported that year; of oats, 114,204 bushels; of barley, 12 bushels. The number of horses in the State in 1870 was 14,451; of mules, 8835; of neat cattle, 453,451; of sheep, 26,599; and of swine, 158,908. The value of all the live-stock in the State was put down at $5,212,157. Of other agricultural products, there were 39,789 bales of cotton, partly of long staple or sea-island; 37,562 pounds of wool; 17 bales of hay; 401,687 pounds of rice; 157,405 pounds of tobacco; 952 hogsheads of cane-sugar, and 344,339 gallons of cane-molasses; 10,218 bushels of Irish potatoes, and 789,456 bushels of sweet potatoes; 64,846 bushels of peas and beans; 12,049 pounds of beeswax, and 395,278 pounds of honey; 19,479 gallons of domestic wine; 100,989 pounds of butter; 25 pounds of cheese; 3002 gallons of milk sold.

Of many of these products we have no statistics later than 1870, but of some we have approximate reports. There can be no doubt that there is a great advance in the amount of orchard products; the culture of the orange and lemon has become very popular, and is constantly increasing. This is said to be the most profitable fruit to cultivate in the U. S. Nearly 3,000,000 orange trees have been planted since 1870, and most of these will be in bearing by or before 1875. These will add millions to the value of orchard products in the State. The grape, olive, fig, and guava are being cultivated also for market. A beginning has been made also in marketing early and very late peaches, bananas, pineapples, cocoanuts, limes, pomegranates, etc. The cotton production had increased to 47,125 bales in 1872, and in 1873 was estimated at 45,590 bales. The crop of Indian corn in 1873 was somewhat in advance of that of the census year, reaching, in round numbers, 2,320,000 bushels. The crop of Irish potatoes in 1873 was estimated at 13,000 bushels, and of sweet potatoes at 1,037,000 bushels. The production of cane-sugar and molasses is increasing every year; and though the cane was injured by severe storms in 1873, the yield was about 1300 hogsheads of sugar and nearly 500,000 gallons of molasses. Florida is the only State in the Union in which the sugar-cane tassels. The tobacco crop (Cuban tobacco is raised exclusively in Florida) is also constantly increasing, and exceeded 200,000 pounds in 1873. The agriculture of the State is unquestionably improving rapidly. The cattle of Florida are small, hardy, and make tender and juicy beef, but are not of much value as milk-producers. There is room for great improvement in crossing them with some of the larger breeds. Some portions of the State afford fine pasturage, but much of the grass is sour, coarse, and wiry. The State abounds in materials for efficient fertilization. There are extensive beds of marl, a rich muck from all the lakes, and establishments for the manufacture of fish-guano and kelp waste on the coast.

Industry, Manufactures, etc.—Florida has not hitherto been largely engaged in manufactures. The census of 1870 reports 659 establishments, driven by 126 steam-engines and 79 water-wheels, employing 2749 hands, all but 79 of them men; using a capital of $1,679,930; paying wages annually to the amount of $989,592; using materials valued at $2,330,873; and yielding a product of $4,685,403. While it is probable that these figures, as in most of the States, materially understated the amount of the manufacturing industry of the State, it is certain that it has greatly increased within the past four years. The manufacture of pine lumber and spars alone now employs a capital of $8,000,000, and yields an annual product exceeding $5,000,000. The preparation of live-oak timber for shipbuilding purposes is another large and important industry, and the various choice woods for cabinet and ornamental purposes found in the southern portion of the peninsula are also being prepared for market in considerable quantities. Naval stores, turpentine, rosin, pitch, and tar, are now manufactured in large quantities from the vast pine forests of the State. In 1871, 1872, and 1873 large tracts were sold, and numerous turpentine distilleries erected for this manufacture. Flouring and grist-mills (mostly occupied with the grinding of Indian corn) employ now a capital of about $200,000, and produce meal, etc. to the amount of about $825,000. The various manufactures connected with the trades of carpentering and building employ a capital of about $125,000, and turn out products valued at nearly $1,000,000. The manufacture of cigars from the excellent Cuban tobacco grown in Florida, as well as from that brought from the neighboring island of Cuba, has kept pace with the increasing production of tobacco. It now employs over $500,000 of capital, mainly in Key West and its vicinity, about 1000 hands, and produces cigars to the value of nearly $1,500,000. The sponge-fisheries of this region are another considerable branch of industry, sending to market from $125,000 to $150,000 worth of sponges annually. The fisheries of the southern portion of Florida form another important industry. Not only are immense quantities of fish shipped from these keys and the coast to Havana, Norfolk, Baltimore, and New York, but great numbers of green turtle are also forwarded. Salt is manufactured by solar evaporation from sea and lagoon waters at various points. Cotton-seed oil is another product. The other branches of manufacture employ small capital, and are not largely productive.

Railroads and Canals.—The railroads of Florida are—1. The Jacksonville Pensacola and Mobile Railway, 209 miles in length, from Jacksonville on the St. John's River to Chat-

tahoochee Landing on the Chattahoochee River, near its junction with the Appalachicola. This railway passes through Tallahassee, and a branch 21 miles in length connects that city with St. Mark's at the head of Appalachee Bay. Another branch road, 48 miles in length, from Live Oak to Lawton in Georgia, connects this railway with the Atlantic and Gulf Railway and with the whole system of Georgia railways. 2. The Atlantic Gulf and West India Transit Company's Railway (late Florida Railway), 157 miles in length, extending from Fernandina at the mouth of St. Mary's River on the Atlantic to Cedar Keys on the Gulf. 3. The St. John's Railway, from St. Augustine to Tocoi on the St. John's River, a distance of 15 miles. 4. The Pensacola and Louisville R. R., running from Pensacola to Pollard, Ala. There are short railroads running from Pensacola, Ellaville, etc. into the forests to supply timber for the mills. Two other railways have been projected—one, the Great Southern R. R., from Jacksonville, along the St. John's River and the chain of lakes, passing Lake Okeechobee on the E. side, and passing from one key to another till it reaches Key West. This line would be 600 miles or more in length, and though the grades are easy it would not find sufficient business to pay for its construction, as for one-third of the distance it must be built on expensive piling. The other is an extension of the road from Cedar Keys along the Gulf shore to Fort Poinsett at Cape Sable; though not so long as the other, it is liable to the same objections.

There have been numerous canal projects, most of them having in view the shortening the distance between New Orleans and the other cities of the Gulf and the Atlantic coasts. Most of these have fallen through for want of interest on the part of those who would be most benefited by them; but a recently proposed route, in connection with the grand and practicable scheme of sheltered and protected navigation inside the line of islands and sandbars, from New Orleans to Charleston, and perhaps to Norfolk, merits notice. The projectors of this route propose to cut a canal from Appalachee Bay, just below St. Mark's, to the Suwanee River at about the parallel of 30° 12′, and then to improve the navigation of that river to admit of the passage of first-class Mississippi steamers to the great bend of the river, lon. 82° 40′ W., and thence to cut another canal through Okeefenokee Swamp to the St. Mary's River. Another canal, already in progress, extends from the Upper St. John's River, probably in the vicinity of Orlando and Lake Washington, to Indian River, an estuary along the coast, a distance of 6 miles, and then extends Indian River through Lake Worth to Biscayne or Miami, in lat. 25° 45′. The whole amount of cutting will not exceed 25 miles, and only one lock will be required.

Telegraphs.—The Atlantic coast-line of the Western Union Company extends to Key West, from which point an ocean cable is laid to Havana, and connects there with the Gulf cable and the Brazilian cable. Another company owns lines in the W. part of the State.

Finances.—According to the census of 1870, the total assessed valuation of Florida in that year in real and personal estate was $32,480,843, of which $20,197,691 was real estate, and $12,283,152 personal. The true valuation, according to the estimates of the U. S. marshal, was $44,163,655. The valuation for purposes of taxation in 1873 a little exceeded $30,000,000, but in this valuation many vested interests are not included; and as every man makes his own valuation for this purpose, it does not represent the property of the State at anything like its true value. The receipts of the State treasury for the year ending Dec. 31, 1873, from the collection of taxes and licenses applicable to general State expenses, were $320,836.66, and the expenditures, excluding the borrowed money and interest on 1871 bonds, were $314,817.11. Of this, $246,711.65 were for the regular expenses of 1873, and $68,105.46 were used in payment of expenses incurred previous to 1873, including debt due lunatic asylum, bank-note company, etc. This was the first year since reconstruction (1867) in which the receipts had not fallen below the expenditures. The aggregate amount of the deficiencies of the six years and two months ending Jan. 1, 1873, was $349,593.97.

The following statement of the comptroller exhibits the indebtedness of the State as it stood Jan. 1, 1874:

Total debt and interest, to be exchanged for the bonds of 1873	$490,937.75
Bonds of 1871	350,000.00
Bonds of 1873 sold and delivered	265,000.00
Bonds of 1873 sold, but not delivered, and held to obtain funds to pay for 21 hypothecated bonds of 1868	15,000.00
Bonds of 1873 exchanged for 18 bonds of 1868, with accumulated interest	20,000.00
Bonded debt due school fund	190,752.63
Bonded debt due seminary fund	71,292.45
	$1,402,982.83
Brought forward	$1,402,982.83
Deduct amount of bonds in sinking fund for payment of bonds of 1871	8,700.00
	$1,394,282.83
Add interest due Jan. 1, 1874, to school and seminary funds	9,960.01
Add interest due Jan. 1, 1874, upon the bonds of 1871	29,575.00
Add interest due Jan. 1, 1874, upon bonds of 1873	12,660.00
Total bonded debt and interest due thereon to Jan. 1, 1874	$1,446,477.84
Less money in the treasury, applicable to payment of interest of 1871 and 1873 bonds	16,254.36
Total bonded debt and interest, less cash in treasury, applicable in payment of interest	$1,430,223.48

Aside from this debt, the State has issued to the Jacksonville, Pensacola and Mobile Railway Company bonds to the amount of $4,000,000, but for these it has a statutory lien upon the road, and negotiations are now in progress by which it is expected that bondholders will take the lien on the road and the bonds of the company in lieu of the State bonds. These bonds are largely held in Holland.

Commerce.—The commerce of Florida is large in proportion to her population. Fernandina, St. Augustine, Jacksonville, Port Orange, and Biscayne are all considerable ports on the Atlantic shore; Key West, at the southern extremity, has a very large commerce with the Atlantic ports, New Orleans and Mobile, and the West Indian ports; and on the Gulf coast, Pensacola, Appalachicola, St. Mark's, Cedar Keys, Tampa, and Punta Rassa are important seaports, with a constantly increasing commerce. Of course, by far the greater part of the commerce of the Floridian ports is with other ports of the U. S., and its amount cannot be ascertained; but the foreign commerce of the ports of Fernandina, Key West, and Pensacola is also of considerable magnitude. For the year ending Dec. 31, 1873, the imports into the ports of Florida were $512,815; the domestic exports, $3,742,548, and the foreign exports, $1102. This was aside from the large amount of fruits, fish, turtles, lumber, etc. indirectly exported through New York, Baltimore, Mobile, and New Orleans. Of the coast-trade, the commodities shipped from the port of Key West alone to New York and New Orleans amount in the aggregate to more than $4,000,000; while the ship-timber, spars, and yellow-pine lumber shipped from Pensacola amount to nearly as much more.

Banks, Savings Banks, Trust Companies, etc.—There were in 1873 in Florida no national banks or State banks having circulation; two savings banks, branches of the Freedmen's Saving and Trust Company, and four other private banking-houses—three at Jacksonville and one at Fernandina. There were not in 1873 any fire, marine, life, or accident insurance companies reported in the State.

Population.—The organization of Florida as a Territory was authorized by act of Congress in 1819, but as possession was not given to the U. S. by the Spanish government until July, 1821, it was not actually organized until after that time. The first census of the Territory was taken in 1830, and at that time it had 34,730 inhabitants, of whom 18,385 were whites, 844 free colored, 15,501 slaves, and an indefinite number of Indians. In 1840 there were 54,477, of whom 27,943 were whites, 817 free colored, 25,717 slaves. In 1850 the number of inhabitants was 87,445, of whom 47,203 were whites, 932 free colored, 39,310 slaves; there were probably at this time 600 or 700 Indians not enumerated. In 1860 the population was 140,424, of whom 77,746 were whites, 932 free colored, and 61,745 slaves, with 500 to 600 Indians not enumerated. In 1870 the true population was 188,248, of whom 96,057 were whites, 91,689 free colored, and 502 Indians. The density of the population at the periods of the different enumerations has been—in 1830, 0.58 inhabitants to a square mile; in 1840, 0.92 to a square mile; in 1850, 1.48 to a square mile; in 1860, 2.65 to a square mile; in 1870, 3.17 to a square mile. Of the present population, excluding the Indians, 94,548 are males and 93,200 females; 32,873 males and 31,024 females are of school age (between 5 and 18 years); 34,539 males are of military age (between 18 and 45); 39,907 males are above 21 years of age, and of these 38,854 are citizens. Of the present population, 182,781 (91,573 males and 91,208 females) are natives of the U. S., while 4967 (2975 males and 1992 females) are of foreign birth. Of the whites, 91,395 (46,136 males and 45,259 females) were natives, and 4662 (2817 males and 1845 females) were of foreign birth; of the colored race, 91,689 in number (45,594 males and 46,095 females), 91,384 (45,436 males and 45,948 females) were natives, and 305 (158 males and 147 females) were of foreign birth. Of the colored race, 80,338 (40,151 males and 40,187 females) were blacks, and 11,351 (5443 males and 5908 females) mulattoes. Of the blacks 223, and of the mulattoes 82, were of foreign birth.

Education.—In 1870, 12,778 (all but 21 of American birth) were reported as attending school in some portion

of the year; of these there were 4195 white males and 4059 white females; 2241 colored males and 2283 colored females; 66,238 persons of ten years and over could not read, and 71,803 (all natives except 568) could not write; 18,904 of these were whites (10,141 of them females), 52,094 (26,941 of them females) were colored. In 1870 there were 377 schools of all classes in the State, taught by 482 teachers (254 males, 228 females). In the schools 14,670 pupils were represented to have been taught during some portion of the year; of these, 6788 were males and 7882 females; the income of these schools was $154,569, of which $6750 was from endowments, $73,642 from taxation and public funds, and $74,177 from other sources, including tuition, and in Florida the Peabody fund. Of these 377 schools, 226, taught by 265 teachers (169 males and 96 females), were public schools, having 10,132 pupils (4674 males and 5458 females). These schools had an income of $76,389; $61,552 of it from taxation and the public funds. There were 10 classical, professional, or technical schools, with 32 teachers (16 male and 16 female) and 580 students (318 males and 262 females), and having an income of $11,005, of which $2100 was from endowment, $4870 from taxation and public funds, and $4035 from tuition and other sources. There were also 141 other private schools, part of them boarding-schools, with 185 teachers (69 males and 116 females) and 3958 pupils (1796 males and 2162 females). These schools had an income of $67,115, of which $59,305 was from tuition. Of the schools in the State, 2 were normal schools, 4 high schools, 5 graded common, and 215 ungraded common; there were 10 academies, no colleges, 135 day and boarding schools, and 6 parochial and charity schools. The amount expended for public schools in the State in 1873 was stated at $107,723.93.

Constitutional one-mill tax from the counties............	$80,000.00
Private contributions..	10,000.00
Peabody fund..	8,800.00
Interest on school fund, $14,873.23, issued in warrants which sold at 60 cents..	8,923.93
	$107,723.93

There is no college or university in the State, but the legislature chartered in 1871 an agricultural college, and the land-scrip, 90,000 acres, was granted to it, and sold for $80,000; the trustees have advertised for propositions for a site for the college. There are no professional or scientific schools as yet established in the State.

There were 75 public libraries reported in the census of 1870, having 25,374 volumes, of which the State library at Tallahassee, with 7000 volumes, and 5 court or law libraries, with 4182 volumes, were the only ones of considerable size; and 178 private libraries, with 87,554 volumes.

There were in the State 23 newspapers and periodicals in 1870, having an aggregate circulation of 10,545 copies, and an aggregate annual issue of 649,220 copies. There were at that time 2 tri-weeklies, with a circulation of 820 copies; 1 semi-weekly, with 300 circulation; and 20 weeklies, with 9425 circulation. In 1872 there were 1 daily, 1 tri-weekly, 1 semi-weekly, 21 weeklies, and 1 monthly, and the circulation had increased about 2500 copies.

Churches.—In 1870 there were 420 church organizations of all denominations, with 390 church edifices, 78,920 sittings, and church property valued at $426,520. Of these, there were reported 127 regular Baptist churches, 123 church edifices, 21,100 sittings, $53,460 of property. At the close of 1873 there were reported 251 Baptist churches, 165 ministers, and 17,004 members; 100 Sunday-schools, with 5910 teachers and scholars. In 1870 there were 17 Protestant Episcopal churches, 13 church edifices, 4600 sittings, $71,100 of property; there were in 1873 but 9 churches, 10 clergymen (9 officiating), 816 communicants, 1045 Sunday-school teachers and scholars, and contributions to the amount of $8823. In 1870 the census reported 235 Methodist churches, 215 church edifices, 42,600 sittings, and $140,700 of church property. These statistics, which refer to the Methodist Episcopal Church South, have doubtless increased somewhat, especially in the value of church property. There was in 1870 one Mormon congregation, with one church edifice, 50 sittings, and $150 of property. Of Presbyterians (Presbyterian Church South) in 1870 there were 29 churches, 29 church edifices, 6620 sittings, $70,310 of church property. The later returns give but twenty ministers of the Presbyterian Church, South residing in Florida, but probably some of them may have, like other clergymen in the South, more than one charge. In 1870 there were reported 10 Roman Catholic organizations, and 9 church edifices, 3950 sittings, $90,800 of church property. In 1873 there were 12 congregations, 19 churches and chapels, 39 missions, and 15 clergymen. The Catholic population is stated at 10,000.

Constitution, Courts, Representation in Congress, etc.—The State is now organized under the constitution of 1868, the third adopted by the State since its first admission to the Union in 1845, and the one under which it was admitted anew to representation in Congress in June, 1868. This constitution provides that slavery shall not exist in the State; that there shall be no civil or political distinction on account of race, color, or previous condition of servitude; and that the State shall ever remain a member of the American Union, the people thereof a part of the American nation, and any attempt, from whatever source or upon whatever pretence, to dissolve said Union or to sever said nation, shall be resisted with the whole power of the State. The governor and lieutenant-governor are chosen by the qualified electors of the State* at the time and places of voting for members of the legislature, and hold office for four years. The secretary of state, treasurer, comptroller, attorney-general, superintendent of public instruction, commissioner of immigration, and adjutant-general are appointed by the governor and confirmed by the senate, and hold their offices the same time as the governor, or until their successors shall be qualified.

The senators, 24 in number, are chosen for four years, and the members of assembly, 53 in number, for two years. The sessions of the legislature are annual, and begin regularly on the Tuesday after the first Monday in January. The session lasts 60 days. The pay of members of both houses is $500 per year, and a mileage allowance of ten cents per mile. Educational qualifications are to be prescribed for electors after 1880. The judicial power of the State is vested in a supreme court, circuit courts, county courts, and justices of the peace. The supreme court consists of a chief-justice and two associate justices, who hold their offices for life or during good behavior. They are appointed by the governor and confirmed by the senate. The clerk of the supreme court, appointed by the justices, is also librarian of the supreme court library. There are seven circuit judges, appointed by the governor and confirmed by the senate, who hold their office for eight years. They hold two courts a year, each in his own circuit. These circuit courts are courts of original jurisdiction. There is a county court in each county. The county court judges, who are also appointed by the governor and confirmed by the senate, hold office for four years. They may be reappointed. The superintendent of public instruction, secretary of state, and attorney-general constitute the board of education. Florida has a State penitentiary at Chattahoochee.

Under the new apportionment since the census of 1870, Florida has two representatives in Congress, both elected at large. There are, of course, two U. S. Senators.

Counties.—There are 39 counties in the State, having the annexed population respectively in 1850, 1860, and 1870:

Counties.	Pop. in 1850.	Pop. in 1860.	Pop. in 1870.	Counties.	Pop. in 1850.	Pop. in 1860.	Pop. in 1870.	Counties.	Pop. in 1850.	Pop. in 1860.	Pop. in 1870.
Alachua........	2,524	8,232	17,328	Hernando........	926	1,200	2,938	Nassau............	2,164	3,644	4,247
Baker............	New	county.	1,325	(called Benton, 1850)				Orange............	466	987	2,195
Bradford........	New	county.	3,671	Hillsboro'........	2,377	2,981	3,216	Polk	New	county.	3,169
Brevard.........	......	246	1,216	Holmes...........	1,205	1,386	1,572	Putnam	687	2,712	3,821
Calhoun........	1,377	1,446	998	Jackson..........	6,639	10,209	9,528	Santa Rosa......	2,883	5,480	3,312
Clay	......	1,914	2,098	Jefferson.........	7,718	9,876	13,398	St. John's........	2,525	3,038	2,618
Columbia	4,808	4,646	7,335	Lafayette........	......	2,068	1,783	Sumter............	......	1,549	2,952
Dade.............	159	83	85	Leon...............	11,442	12,343	15,236	Suwanee.........	......	2,303	3,556
Duval............	4,539	5,074	11,921	Levy	465	1,781	2,018	Taylor	......	1,384	1,453
Escambia......	4,351	5,768	7,817	Liberty	......	1,457	1,050	Volusia............	......	1,158	1,723
Franklin.......	1,561	1,904	1,256	Madison..........	5,490	7,779	11,121	Wakulla..........	1,955	2,839	2,506
Gadsden........	8,784	9,396	9,802	Manatee..........	......	854	1,931	Walton............	1,817	3,037	3,041
Hamilton......	2,511	4,154	5,749	Marion............	3,338	8,609	10,804	Washington.....	1,950	2,154	2,302
				Monroe...........	2,645	2,913	5,657				

* "Every male person of the age of twenty-one years and upward, of whatever race, color, nationality, or previous condition, who shall at the time of offering to vote be a citizen of the U. S., or who shall have declared his intention to become such in conformity to the laws of the U. S., and who shall have resided in Florida for one year, and in the county for six months, next preceding the election at which he shall offer to vote, shall in such county be deemed a qualified elector at all elections under this constitution."—*Constitution of 1868.*

Principal Towns.—Jacksonville, on the St. John's River, in Duval co., is the largest city in the State. In 1870 it had 6912 inhabitants, and is supposed now to have about 8500. It is the great resort of invalids from the North. Many of them, however, pass on to higher points on the St. John's River. The only other towns or cities having over 5000 inhabitants are Key West in Monroe co. and Pensacola in Escambia co., which, with its suburb, Warrington, is the site of the U. S. navy yard. Tallahassee, in Leon co., the capital of the State, has about 2500 inhabitants (2023 in 1870), and Fernandina in Nassau co. (1722 in 1870) and St. Augustine in St. John's co. (1717 in 1870), the oldest settlement in the U. S., have nearly as large a population. Of towns of from 1000 to 2000 inhabitants the principal are Appalachicola in Franklin co., Monticello in Jefferson co., and Milton in Santa Rosa co. Lake City in Columbia co., Pilatka in Putnam. Ocala, Cerro Gordo, Cedar Keys, and Tampa are also thriving towns.

History.—Florida was probably discovered by Columbus or some of his lieutenants before the commencement of the sixteenth century; but Ponce de Leon, who landed at St. Augustine in 1512, is the first European who is known to have landed on its shores. He landed on Palm Sunday (the *Pascua Florida*, or Feast of Flowers, of the Catholic Church), and the name of the peninsula, Florida—a name extended by the Spaniards to a region of indefinite extent northward and westward—is said by some writers to have been bestowed upon it from this cause, while others attribute it, with perhaps more probability, to the profusion of wild flowers found on its broad savannas. Ponce de Leon hoped to find in this beautiful land the fabled fountain of perpetual youth, but after a long and wearisome quest he returned unsatisfied. Four years later he visited it again in search of gold, but was driven away by the stalwart Indians of the peninsula. In 1520, Vasquez, another Spaniard, landed with some troops at St. Augustine, but his expedition came to naught; nor were those of the Florentine Verazzani in 1523, and the Spaniard De Geray in 1524, more successful. In 1526, Pamphilo de Narvaez obtained from Charles V. a grant of all the lands from Cape Florida to Rio Panuco, and in 1528 landed at Appalachee with an army of 440 men; but he was vigorously resisted by the Indians, and at last perished, with most of his troops, by shipwreck near the Panuco. In 1539 a wiser explorer, Fernando de Soto, penetrated into the interior of Florida, and after numerous adventures and a greater measure of success in winning the confidence of the Indian tribes than any of his predecessors had realized, penetrated to the Mississippi, and died there in 1542. Having thus explored a considerable portion of Florida, though they had not established any colony there, the Spanish government claimed it as their rightful territory. In the year 1562, the brave Admiral de Coligny, desirous to rescue his Huguenot followers from the cruel persecutions to which they were subjected in France, made preparations to send them to America, and in the winter of 1563–64 a company of them under Laudonnière were landed on the coast below St. Augustine, and had just established themselves on their new territory, when, early in 1565, the Spanish freebooter Don Pedro Menendez pounced upon them, murdered nearly the whole of them, and hanged them on the trees in the vicinity, with an inscription over their heads, that they were killed "not as Frenchmen, but as heretics" and enemies of God. Leaving a garrison there, Menendez proceeded to the present site of St. Augustine, and there founded the first permanent settlement on the peninsula. The situation was admirably chosen. His raid on the innocent Frenchmen did not, however, long pass unrevenged. Dominique de Gourgues, a French adventurer, a man of great bravery, at the head of a few volunteers landed at the site of the former French colony, seized the garrison which Menendez had left there, and hanging them on the same trees on which the bodies of his unfortunate countrymen had been suspended, put an inscription over their heads, that they were hung "not because they were Spaniards, but because they were traitors, cut-throats, and murderers." The Spanish colony at St. Augustine, defended by a strong fort, increased, and other colonies on the E. coast were established. In 1586 it was captured by Sir Francis Drake, but was probably soon restored to the Spaniards, and for nearly a century later, though it had become a somewhat important Spanish settlement, and its great cathedral indicated the strength of the Catholic power there, yet it made no figure in history. The buccaneers visited it repeatedly, and sometimes exacted a heavy reward for its ransom from destruction, but it had no part in the great movements of European powers on this continent. In 1682 the Frenchman La Salle established some colonies in what was then West Florida, but now Louisiana or Mississippi, and in 1696 the French settled at Pensacola. From 1702 to 1710 the English colonies of South Carolina and Georgia repeatedly attacked St. Augustine, which it was alleged had become a rendezvous of freebooters. In the wars which followed some years later in the eighteenth century between Great Britain and Spain, Cuba was captured by the English, and in 1763 Florida was ceded by Spain to Great Britain in exchange for the "Queen of the Antilles." Emigration to Florida followed this cession almost immediately, and was becoming considerably extensive when by the treaty of 1783 the country was re-ceded to Spain. During the Revolutionary war numerous privateers were fitted out on the Florida coasts, and greatly harassed the people of Georgia and South Carolina. In 1778 the British general Prevost marched from Florida upon Savannah and other towns of Georgia, and captured them. The citizens of the Southern States were greatly annoyed by frequent incursions and raids from Florida, and when Louisiana was ceded to the U. S. in 1803, the terms of the treaty gave the U. S. government a claim to the lands lying W. of the Perdido River, then known as a part of West Florida, and it was accordingly occupied by military posts in 1811. During the war of 1812, a British expedition having been fitted out from Pensacola, Gen. Jackson marched upon that town and captured it. In 1818 it was again captured by Jackson, as was also Fort St. Mark at the head of Appalachee Bay, but both were subsequently restored to Spain. In 1819 the U. S. government entered into negotiations with Spain for the purchase of Florida, and the treaty having been ratified by both parties, in July, 1821, the sovereignty was formally transferred to the U. S. An organizing act had been previously passed, but the Territory was not fully organized until 1822. Immigration into the Territory commenced almost immediately, but the Seminoles, a warlike and ferocious race of Indians, occupied most of the best lands, and fiercely resisted the progress of the immigrants. In 1835, open war commenced between the Seminoles and the settlers, and the U. S. government commenced a costly warfare which continued for seven years. The Seminoles, though comparatively few in numbers, yet occupied positions almost impenetrable, and in a climate which was deadly to the whites. At length, after great expense and the loss of many lives, the Seminoles were prevailed upon to migrate to the Indian Territory W. of the Mississippi. Five or six hundred of them, however, remain in the Everglades, and send a representative to the legislature. After the removal of the Indians in 1842 the Territory grew rapidly in population, and in 1845 was admitted into the Union as a State. Its fine climate and its facilities for agriculture, though but slightly developed, attracted immigrants, but the presence of slavery in a community of but small wealth was a hindrance to its prosperity. In 1860 it had a population of but 140,424, of whom about one-half were slaves, and seemed to lack enterprise. In the events which preceded the late civil war the State took an active part, and on Jan. 10, 1861, passed the ordinance of secession. The State did not send a very large quota of troops to the Confederate armies, as its own exposed situation compelled their retention to defend their own territories. The battle of Olustee, fought in Feb., 1864, and resulting in a defeat of the Union troops, was one of the severest of the minor battles of the war. The Federal loss in killed and wounded was about 1200. Florida was one of the first States to return to the Union, having called a convention which met Oct. 25, 1865, and repealed the secession ordinance, recognized the Emancipation Act, repudiated the Confederate debt, and formed a new constitution. After the passage of the Fourteenth and Fifteenth amendments of the Constitution of the U. S., and their ratification by the State, another convention was called, the State constitution further modified, and the State readmitted to the Union in June, 1868. Since her readmission the State has been gradually but steadily improving in its financial and political character. The tide of immigration has again set toward it; its credit, at one time in some peril, has been restored; its educational system is becoming much more efficient; and though the last census revealed an alarming amount of illiteracy, yet the authorities are making every effort to make their schools better and to diffuse more widely a liberal public-school education.

Governors of Florida.

Territorial Governors.		State Governors.	
Andrew Jackson	1821–22	William D. Moseley	1845–49
William P. Duval	1822–34	Thomas Brown	1849–53
John H. Eaton	1834–36	James E. Broome	1853–57
Richard K. Call	1836–39	Madison S. Perry	1857–61
Robert R. Reid	1839–41	John Milton	1861–65
Richard K. Call	1841–44	Wm. Marvin, *Provis'l*	1865–66
John Branch	1844–45	David S. Walker	1866–68
		Harrison Reed, 1868–Dec. 31, '72	
		O. B. Hart...Jan., 1873–Mar., '74	
		M. L. Stearns	1874–

Popular and Electoral Vote for President.—As Florida

was not admitted to the Union till 1845, her first Presidential vote was cast in 1848. She did not vote in 1864 and 1868, but at all the other elections since 1848 her vote has been recorded:

Election Years.	Electoral Vote.		Popular vote.					
	Elect. Votes.	For whom cast.	Candidate.	Popular Vote.	Candidate.	Popular Vote.	Candidate.	Popular Vote.
1848	3	Zachary Taylor	Lewis Cass	1,847	Zachary Taylor	3,116		
1852	3	Franklin Pierce	Franklin Pierce	4,318	Winfield Scott	2,875		
1856	3	James Buchanan	James Buchanan	6,358	Millard Fillmore	4,833		
1860	3	John C. Breckenridge	J. C. Breckenridge	8,543	John Bell	5,437	Stephen A. Douglas	367
1864								
1868								
1872	4	Ulysses S. Grant	Horace Greeley	15,427	U. S. Grant	17,763		

L. P. Brockett.

Florida, tp. of Parke co., Ind. Pop. 2110.

Florida, post-tp. of Berkshire co., Mass. Here is the Hoosac Mountain, pierced by the celebrated Hoosac Tunnel (which see). There are manufactures of lumber. Wool, live-stock, and maple-sugar are the other products of considerable importance. Pop. 1322.

Florida, post-v. of Jefferson tp., Monroe co., Mo. Pop. 120.

Florida, tp. of Montgomery co., N. Y., on the S. of the Mohawk and on the Erie Canal. It is chiefly agricultural, and contains several villages. Pop. 3002.

Florida, post-v. of Warwick tp., Orange co., N. Y., on the Pine Island branch of the Erie R. R. It is the seat of S. S. Seward Institute, founded by the father of the late Hon. W. H. Seward. It has three churches. Pop. 459.

Florida Keys, a group of small islands lying off the extremity of Florida, partly in Dade and partly in Monroe co. The keys are based upon the Florida Reef, a coral reef of great extent and of much danger to mariners. The extreme western group of keys is the Dry Tortugas (which see). Besides these, the W. coast of Florida is lined with keys or islets, from Cedar Keys southward; but the Florida Keys proper are on the reef. The soil of some is productive of tropical fruits, sweet potatoes, etc.; others are hopelessly barren. Many of them have jungles of mangroves, with some pine, buttonwood, sweet bay, palmetto, and other trees. In general their flora is quite distinct from that of the mainland, and is West Indian rather than continental in character. Some, like Key Biscayne, are ridges of siliceous sand, but most are masses of broken coral, shells, etc., with calcareous and foraminiferous sand. Some, like Double-headed-shot Key, are composed of rocky, rounded, treeless knolls; others, like Sugar-loaf Key, are dead levels, with woods and numerous lagoons. Some are dunes of sand, held in place by a creeping vine, *Batatas littoralis*. Many are covered in part with grasses. Sugar-loaf Key covers some 50 square miles, inclusive of its lagoons. Salt Key and others have valuable lakes of intensely salt water. Indian Key, Key Largo (40 miles long), and Plantation Key are the most important as regards soil. Key West, or Thompson's Island, contains the city of Key West. The islands are healthful except during epidemics of yellow fever. They are the resort of innumerable birds, and abound in rare mollusks and fishes. The sponge-fishery is an important industry.

Florid'ia, t. of Sicily, 7 m. W. of Syracuse. Pop. 7030.

Flor'id Style (*Contrapunto fiorito*, or *Stylus floridus*), in music, a species of composition more free, ornate, and discursive than would be admissible in the earlier and more severe modes of "strict" counterpoint. The old masters were accustomed to arrange their elementary exercises in harmony in five "classes," styles, or forms, in each of which the student was to practise with a rigid adherence to the rules set forth and illustrated in those "classes." The first class consisted of the simplest application of harmony to a plain theme or choral, note against note. By progressive steps the pupil reached the fifth class, denominated the *florid*, in which room was given for the play of the imagination, and for the free use of certain harmonies and progressions which were interdicted under the preceding classes. In modern schools of music the florid style has, for the most part, supplanted those more strict and severe forms of composition which the masters of a former age regarded as the foundation of all excellence. Relaxation of old rules and the introduction of many new and beautiful combinations have now brought the florid style into such general use as almost to banish both the use and the study of strict counterpoint, except in music for the church. William Staunton.

Flor'in [It. *fiorino*, either from *Florence*, where it was first coined, or from the figure of a lily which it bore], a Florentine coin first struck in gold in 1254. Gold and silver coins called florins, and of various values, have since been coined in many countries. England struck a gold florin in 1343. At present the English two-shilling silver piece, first coined in 1849, bears the official name of florin. It has nearly the value of the Austrian new silver florin, a unit of account, worth 48.6 cents of our money.

Florin'ians, a sect of Gnostics of the second century, named from the founder, Florinus. (See Gnostics.)

Flor'isant, post-v. of St. Ferdinand tp., St. Louis co., Mo., on the Missouri River, 15 miles N. W. from St. Louis. It was settled by the French. It has manufactures of importance. The Jesuits and nuns of Loreto have important establishments here.

Flori'nus, a Roman presbyter and heresiarch of the second century, who was deposed by Eleutherius. His followers were called Florinians. His heresy was a form of Gnosticism (which see), essentially the same with that taught by Valentinus.

Flo'rus, a Roman historian, of the circumstances of whose life very little is known, and whose full name is a matter of dispute. In the earlier editions of his history he appears as L. Annæus Florus, and is supposed to have been a member of the family to which Seneca belonged. Duker, following Vossius (*Hist. Lat.*), infers from his style, family name, and the age in which he lived, his identity with the poet Annæus Florus, who interchanged sportive verses with the emperor Hadrian. Though in the preface to his work he speaks of a revival of Roman vigor under Trajan, and would seem therefore to have lived in his reign or in that of Hadrian, Titze, who has devoted much study to the subject, rejecting the passage as an interpolation, maintains that he is the Lucius Julius Florus to whom two of Horace's epistles are addressed, and places him therefore in the time of Augustus. The researches of Otto Jahn and Halm, based upon a thorough examination of the best existing codex, give the name as Julius Florus. From this author we have a concise and highly rhetorically written history of the Roman people from King Romulus to Augustus Cæsar. In the earlier editions the work was entitled *Epitome Rerum Romanarum*, and was divided arbitrarily into four books. But Jahn and Halm, following the Bamberg codex, give the title *Epitomæ de Tito Livio Bellorum omnium Annorum DCC. libri duo*. The first book contains the account of the external wars of Rome, while the second deals chiefly with the domestic contentions and the seditions of the people, and the wars in which Augustus was engaged, ending with the closing of the temple of Janus as the token of universal peace. The work of Florus, taken, as the name indicates, in the main from Livy, is a concise but interesting record of the progress of the Roman people, written in a rhetorical and rather ambitious style, without much regard to accuracy of facts or of dates, and is to be regarded rather as a panegyric than a history. The best of the earlier editions are those of Duker, Leyden, 1722, re-edited by Hübner and Jacobitz, Leipsic, 1832, 2 vols.; and of Titze, Prague, 1819; more recent and critical those of Otto Jahn, Leipsic, 1852, and of Halm, Leipsic, 1854. (See *Das Geschichtswerk des Florus*, von J. Reber, Freising, 1865; C. Heyn, *De Floro Historico*, Bonn, 1865.) H. Drisler.

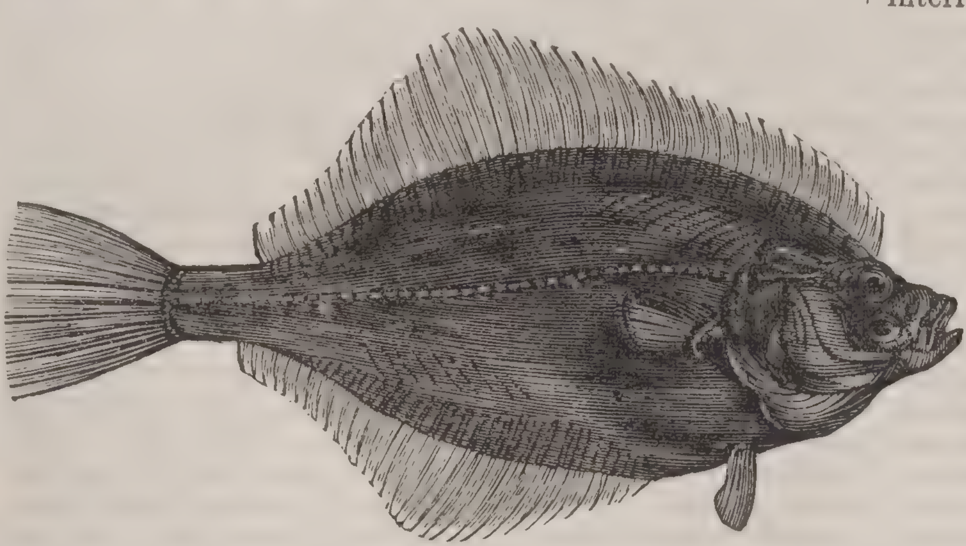
Florus (Drepanius), a Gallo-Roman divine of the ninth century, a deacon at Lyons, is remembered as the opponent of Gotteschalk and Scotus Erigena; against the latter he wrote *Liber de Predestinatione* (852 a. d.); author also of extant Latin hymns, tracts *De Actione Missarum* and *De Electionibus Episcoporum*, a commentary on the Epistles of St. Paul (compiled from St. Augustine), and other works. D. about 860 a. d.

Floss Silk is silk which has been broken in the reeling. It is steeped in water, pressed, dried, oiled, carded, and spun on a flax-wheel into soft, coarse yarn, which is made into shawls, stockings, dress-goods, and other fabrics, either alone or mixed with cotton or wool.

Flo'tow, von (Friedrich Ferdinand Adolph), a German composer, b. at Tentendorf, in Mecklenburg-Schwerin, Apr. 27, 1812. A passion for music diverted him from the diplomatic career his parents had marked out; went to Paris and took lessons in composition from Reicha. His first operas, produced when he was scarcely eighteen, were rejected by the theatrical managers. But he persevered, and in 1838 obtained great success by his *Le Naufrage de la Meduse*, which was performed fifty-four times in a single season at the theatre of the Renaissance. From that time his operas followed in easy succession: *Le Forestier*, 1840; *L'esclave de Camoëns*, 1843; *Alessandro Stradella*, 1844; *L'ame en peine*, 1846; *Albin*, 1856; *Martha*, 1858; *Zilda*, 1866. The last three, written in German, are favorites on the German stage with the lovers of light opera. *Martha* is popular everywhere, and is better known in America than any other of all Flotow's works. Flotow, after living several years in Paris and a short time in his native place, took up his abode in Schwerin, where he is superintendent of the court theatre. In 1864 was made corresponding member of the French Institute. O. B. Frothingham.

Flot'sam [Sax. *fleoten*, to "float"], a legal term employed in reference to the law concerning wrecks. It denotes goods which float upon the surface of the water when a ship is sunk or they are thrown overboard as a measure of safety. By the common law, if no owner appears to claim them after their recovery, they belong to the Crown. (See Jetsam and Ligan.)

Floun'der, a name given to various marine fishes of the family Pleuronectidæ. They are flat, and swim with one side, not one edge, uppermost; both eyes are on the upper side, and the lower side is much whiter than the other. Several species occur in the American waters, where they are caught for market, and are regarded as tolerable food.



Flounder.

Flour [a word kindred to *flower; i. e.* the "flower" or choicest part of the wheat]. When dry wheat is crushed, as in a mortar or between revolving millstones, the product is a powder mixed with scales, known as whole meal. The process of sifting or bolting separates the whole meal into two portions, known as flour and bran. The latter consists of the outer woody portion of the grain, with adhering portions of the interior; and flour is the name given to the remainder. The latter is white—the former is reddish or grayish. This simple nomenclature was suited to the earliest forms of milling. It applies as well to rye, except in the matter of color, as to wheat, and more or less to other grains, and to some extent to seeds.

With refinements in the art of making bread, cake, and pastry came a demand for finer flours. New modes of milling were introduced, and the product was separated into more numerous grades. It was customary, a few years ago, comparatively speaking, in this country, to divide the product into three grades—flour, connell, and bran. The flour, including so much as could be separated of the requisite whiteness, amounting to some 70 per cent., was removed by bolting from the remainder; and this remainder, by passing over a coarser sieve, was divided into larger scales and fragments called bran, and lesser scales and fragments called connell. The latter is also known as shorts and middlings. These three have been further increased by improved appliances both in this country and England, and especially in Hungary. The grades of flour produced by the best mills number ten.

The principles which have guided the inventor of milling devices will be best understood after a study of the *structure of the wheat grain.* The grain of wheat has the form of an irregular oblong spheroid, having a longitudinal groove on one side, and terminating at one end in minute vegetable hairs or bristles, and at the other in a slightly corrugated surface covering the germ. If this grain be moistened and rubbed with a dry rough cloth, there will be detached from the surface two outer coats composed of woody fibre. Within there is a thin coat, also composed of woody fibre, which, from the peculiar network of fibres and tubes, suggesting the appearance of cigars placed side by side, has been called the cigar-coat. This is succeeded by another coat of exceeding tenuity, like the others chiefly composed of woody fibre. Within these is the nutritious portion of the grain. There is first a framework of cells entirely enveloping the white portion of the flour. The cells are filled with a class of nitrogenous bodies of albuminous character and certain mineral salts, almost wholly phosphates, of which the chief is the phosphate of potassa, with much smaller proportions of phosphates of magnesia, lime, soda, and iron, the whole, with the cell framework, being known as the gluten coat. At the germ end of the berry, opposite the brush end, there are certain organic forms, constituting the embryo of the grain. The whole of the remaining interior is occupied by a framework of coarse, open cellular tissue, filled with starch grains, which are coarse, and others, exceedingly minute, containing albuminoid or nitrogenous constituents. If a sharp knife be passed through a plump berry of wheat perpendicular to its axis halfway from end to end, and the section so exposed be treated with solution of iodine, the entire surface bordered by the gluten coat, but not including it, will be changed from whiteness to dark purple, demonstrating the presence and extent of the starch. If another section be exposed to the action of a solution of blue vitriol in ammonia (ammonio-sulphate of copper), the starch of the interior will be but little affected, but the gluten coat which surrounds it will have become green, from the formation of phosphate of copper. A solution of ammonio-nitrate of silver (nitrate of silver dissolved in ammonia) will color the gluten coat yellow, from the formation of phosphate of silver. If the crushed berry be treated with weak acetic acid, and the result of the digestion be filtered and ammonia added to the clear liquor, there will be separated from the solution on standing minute crystals of phosphate of magnesia and ammonia. If a drop of nitrate of silver dissolved in water be poured upon the flour, no change will take place, but if nitrate of silver dissolved in ammonia be poured upon the flour, it will yield, as already observed, the yellow compound of phosphate of silver. Strong nitric acid will color the flour orange, from its action on the albuminoid substances. If a quantity of flour intimately mixed to a stiff emulsion with water is set aside at a temperature of about 70°, after a while it will begin to evolve bubbles of gas, and after a longer time it will become acid and offensive to the taste, and the liquid will contain phosphoric acid, readily recognizable by chemical tests.

The phosphatic and nitrogenous constituents and the starch all have nutritive value, and are indispensable as elements of food. Of these, the starch is far the most abundant, constituting about 70 per cent. of the whole grain. The nitrogenous constituents or the albuminoid bodies constitute from 12 to 18 per cent., and the phosphatic salts about 2 per cent., the rest being mainly woody fibre. Of the nutritious portions, weight for weight, the phosphatic constituents are undoubtedly entitled to the first rank. The portion of the nitrogenous constituents lodged with the phosphates in the cells of the gluten coat have been shown by Mègè Mouriés to be peculiarly susceptible to fermentation when exposed to a moist atmosphere. They are encased in capsules impervious to the air in the berry. If these capsules be ruptured or crushed, exposure to the air is inevitable.

On this structural peculiarity of the grain rests the foundation of a philosophical system of milling. The larger the percentage of the interior of the berry in flour, the less must be its nutritive value; and correspondingly, the larger the percentage of the gluten coat in flour—the chief deposit of the phosphates—the greater its nutritive value; and in bran, the smaller the percentage of adhering gluten, the more nearly worthless as an article of food the bran would be. If it were practicable to reduce the percentage of pure starch and increase the percentage of phosphatic and nitrogenous constituents, the nutritive value of the flour would be augmented.

The presence of minute particles of woody fibre in the flour gives to it a yellow shade. That system of milling which should most nearly remove all the woody fibre, and none of the gluten or phosphates, from the flour would accomplish one of the chief ends to be gained.

To appreciate the difficulties that present themselves to the inventor of milling machinery, let us consider the berry as we find it in commerce. It is very rare that any considerable quantity of wheat is to be found in the market absolutely free from foreign ingredients, such as chaff, frag-

ments of straw, oats, chess, mustard, cockle, grass-seed, sand, etc.; it is rarer still to find wheat grains uniformly filled out and without shrivelled or blasted kernels. Wheat is sometimes plump, the starch of the interior being mealy, so that if the berry were cut in halves it would be easy with a pin to detach all the white interior, leaving two cups lined with the gluten coat and invested with the woody bran-case. The wheat is sometimes slightly shrunken, hard and brittle from the surface to the centre, and cuts like the rind of old cheese. It is sometimes shrivelled, as if its growth had been arrested at the commencement of the period when the berry is in what is technically called "the milk," or as when it has been struck with rust—a microscopic vegetable growth accompanying the loss of milk from the berry. It is plain that shrivelled berries in the process of milling would for the most part be resolved into fine bran, and so be with difficulty separated from the flour, and thus the flour be discolored and rendered less nutritious. It is plain, too, that the plump berry with the mealy interior would be easily mashed in the process of grinding, while the hard, brittle berry would more easily be cracked.

Purification of Commercial Wheat.—Two principles underlie most of the devices for separating the light grains from the heavy, and the foreign seeds, grains, and other impurities from the wheat. The one is the process of sifting—the other, that of exposing a thin cascade of falling grain to a current of air. To these a third has been added, that of centrifugal force, taking advantage of unequal specific gravity and unequal extent of surface. In the sifting process advantage is taken of the unequal sizes and of the different shapes of the bodies to be separated from each other. It is easy to see how light grains and chaff and bits of straw and dust would be farther diverted from a perpendicular in falling through a stratum of air driven by a revolving fan. This principle was illustrated in the earliest times, when the mixed wheat and chaff were tossed together into the air, to be separated by the wind before reaching the ground, and is the principle underlying the ordinary fanning-mill. The separation of mustard and cockle and grass-seed from the wheat may be easily effected by passing the mixed grains over inclined plates perforated with holes large enough for the smaller seeds to pass through, but not large enough for the wheat. The oat grain is separated by taking advantage of its elongated form. The mixed oat and wheat grains are discharged in a thin sheet upon an inclined thin iron plate perforated with round holes at intervals nicely determined by experiment, abundantly large for the ready passage of both the wheat and oat grains if presented end foremost perpendicularly to the surface of the plate. But as the plate is inclined, each berry must be tipped forward in order to enter a hole. An individual hole is of such diameter that when the wheat grain, sliding forward, carries its centre of gravity beyond the support of the upper edge of the hole, there will be no room for the prow—the forward end of the grain—to sweep downward through the hole without striking the lower margin, and thus the wheat grains are separated. The oat grain, however, in sliding down the inclined plane, before its centre of gravity has passed beyond the support of the upper margin of the hole, will, by reason of its prolonged keel, extend over the lower margin of the hole, and thus fail to fall through. As the oat advances the centre of gravity will pass beyond the lower edge of the hole, and gain the support of the continuous surface before the tail of the berry will have lost the support of the upper edge. Fragments of straw and chaff pass on with the oats.

The dust, smut, and rust which may cling to the berry are separated by discharging the impure grain into the space between what may be regarded as a vertical cylinder, the surface of which is covered with brushes, and a closely-fitting iron case perforated with numerous slits or holes, which serve the double purpose of making the surface rough and providing an escape for the separated dust. Round seeds are separated by taking advantage of the superior velocity they acquire in rolling down an inclined plane, as compared with the long grains, which slide. The former leap an opening into which the latter drop.

By these and kindred processes it is now practicable to obtain good wheat from a sample of spring wheat of which not more than one-half is fit for making flour, by the complete separation of every foreign matter from the sound, serviceable wheat grains. Such an achievement a few years ago would have been regarded as practically beyond the reach of mechanical contrivance.

The wheat thus prepared is a structure the chemical, physiological, and mechanical composition of which we have already glanced at. If the grain of wheat be subjected to pressure, as in a vice, so that its diameter shall be lessened by a certain definite amount, the interior may be partially pulverized without rupturing the surface. If the pressure reducing its diameter by the same amount be of the nature of impact or of a blow, the interior will be cracked, but not pulverized, with the probable rupture of the surface. If the pressure of the vice be continued until the grain is flattened, the product will be large scales and powder. If the blows be repeated with change of position of the berry, the product will be dust, fragments including the inner layers of the bran, the gluten coat, and starch extending to the centre of the berry, and the outer scales of the woody covering more or less separated from the gluten coat. The product derived from pressure may by sifting be separated into its constituents of scales (or bran) and powder (or flour). The bran will contain a large proportion of the gluten coat; the flour will consist of starch, with associated albuminoids, and gluten-cells detached from the bran. In the case of reduction by blows the dust will be chiefly composed of starch (which, it will be understood, though by far the largest constituent, may contain a larger percentage of the nitrogenous constituents than the gluten coat), the scales will be mainly of woody fibre, and the lumps or groats will be composed of starch, with the associated albuminoids on the interior, more or less of the bran coat on the exterior, and the gluten coat between. The dust may be easily removed by bolting; the outer scales of bran, mainly of woody fibre, may be easily separated by a current of air directed upon a thin cascade of the mixture—the bran-scales, with a given weight of material, presenting a greater extent of surface to the blast than the compact granules from which they are to be discharged.

It is plain that, weight for weight, the groats contain much more nutritive matter relatively than either of the two portions which have been separated from them. If, now, these groats be subjected to attrition among themselves, their corners will be rounded off, the scales on the outside of the gluten coat will be more or less detached, and the starch on the interior will be more or less worn off. The tenacity of the gluten coat will tend to preserve its integrity, while the relative friability of the starch in the interior and the fibrous texture of the outer covering of the gluten coat will facilitate their separation under the influence of attrition. If, now, the process of attrition be intermittent and alternating with the process of bolting and the use of the fan-blower, the groats will ultimately assume the form of little concave disks, largely freed from the bran without, and for the most part freed from the starch within. As these alternating processes have been worked, there will have been produced successively a series of brans growing richer in gluten, and a series of starches growing richer in gluten, and a final result of groats consisting mainly of gluten, with scarcely any starch or bran.

The two plans of reduction thus illustrated may be regarded as exhibiting the principles underlying the extremes of high and low milling; in practice, however, no such extreme is attained. The best forms of low milling include more or less of the principle of impact, and the best forms of high milling take advantage more or less of the principle of pressure without impact.

Milling.—The trituration of wheat is now almost universally accomplished between what are called millstones. These are two short cylinders of hard stone placed one over the other, having the two horizontal surfaces between them peculiarly grooved to fulfil the office which they are expected to perform. To understand this office we must take into account a property of the gluten to which no allusion has as yet been made.

Gluten.—If a handful of flour be moistened with water and fashioned into dough, and then continuously kneaded in a slender stream of falling water, the starch will gradually be separated from the dough, and there will remain at length pure gluten, a singularly tenacious and homogeneous substance. On drying, this body will become quite hard and somewhat brittle. On subjecting it to moderate heat after it has been thoroughly dried at common temperatures, it will be found to lose weight. It will have parted with water of hydration. On withdrawing the heat the gluten will re-absorb this water of hydration from the air at common temperatures, and recover its original weight. In the same manner the gluten of the flour subjected to heat will part with its water of hydration; and this escape of water will be accompanied more or less with the rupture of the cells in which the gluten is encased. The openings through which the moisture has escaped will permit the air to enter, and with it more or less the germs of microscopic vegetation, which, taking root in the gluten, produce the well-known effect described in the term *musty*, the flour acquiring an unpleasant odor and an inferior taste, the gluten at the same time losing an appreciable portion of its tenacity, and the bread made from it acquiring a less palatable flavor and being less light.

It is obviously desirable, therefore, that in the process of grinding the wheat the wheaten meal should be sub-

jected to as little friction with the millstones as may be, or within certain limits, successively to interrupt the process and allow the materials to cool. The surfaces of the millstones present a series of grooves, or lands and furrows. These are oblique in some instances, and curvilinear in others. Great ingenuity has been displayed in the conformation and arrangement of the grooves with a view to attaining the best results. If it were the sole object to have the wheat pass through the stones without abrasion, it is manifest that the best form of the groove would be that which a grain of wheat would pursue discharged from the hopper and traversing the surface of the millstone under the influence of the centrifugal force. This path has been ascertained by allowing grains of wheat coated with plumbago to fall upon a smooth millstone, the surface of which has been chalked, so as to receive the marking of the plumbago as the stone was revolved with its determined velocity. The calculated direction of this curve has been found to coincide very precisely with the path as ascertained by experiment. The curves of the upper (the running) stone being reversed, as compared with the curves of the lower stone, the action of the edges of the opposing curves is to some extent like that of shears, and when the grains have been broken they fall into the grooves of the lower stone, and are gradually pushed to the periphery with but little further friction. Among the best results that have been attained in this direction are those of the Istvan steam-mills at Debreczin in Hungary, under the direction of the engineer in charge, Prof. Pekar, in which with a stone fifty-four inches in diameter, the width in grinding surface from the periphery inward is only nine inches. This gave nearly 80 per cent. of flour, with 20 per cent. of bran and 3 per cent. of waste.

The primary function of the grooves is that of trituration. As the grooves present one vertical surface, from the bottom of which the depth lessens by an ascending inclined plane, it will be seen that the grooves in the upper and nether stones provide that in the process of milling the action shall be in some degree like that of shears, in some degree that of impact, and in some degree that of mashing; and the relative measure of these will be determined by the distance of the stones from each other when in service. The stones may be placed so far asunder that the wheat will pass through without being crushed at all. In this case the interval must exceed the greatest length of the kernel of wheat. With the distance a little less than this the brush at the end of the kernel opposite the embryo will be cut off. As the distance is further lessened the grains will be cracked, until they may be brought so near that the gluten cells will be crushed, and the moisture evolved from them, in consequence of the heat produced by friction, will soften the gluten and cause the stones to adhere and the milling to be arrested. Between these extremes the art of the miller so adjusts the distance and velocity that, taken in connection with the other mechanical appliances of his mill, he is enabled to turn out the best product, in condition and quality, which the grain submitted is capable of yielding.

Walz Muhl of Hungary: Grinding between Grooved Steel Rollers.—As one of the results of the study of the nature of the grain, a process of milling has been perfected in which the millstones are replaced by pairs of small horizontal steel rollers, the surfaces of part of which are traversed by small, sharp grooves parallel to the axis of the rollers. These pairs of rollers are arranged in sets of three, one above the other, with considerable intervals between, so that the heat produced by the slight crushing will be counteracted as the product passes through the air on its way from one pair of rollers to the next. These pairs of rollers are adjusted so that the crushing effect of any one pair is slight, and as many as six or seven sets, making from eighteen to twenty-one pairs of rollers, according to Kick's account of the Pesth Walz Muhl, so called, are necessary to produce the various grades of flour. These in the Austro-Hungarian classification number ten in all, besides the groats and bran. At intervals the products of the several sets of pairs of rollers are subjected to processes involving bolts and currents of air to separate the flour-dust as detached and the bran produced.

The operations for grinding and bolting other flour-producing grains than wheat (such as rye, spelt, buckwheat, etc.) are essentially similar to the milling of wheat, but the details vary with the different grains. None of these products are of sufficient commercial importance to warrant an elaborate notice in the present work. In composition these flours differ considerably from that of wheat and from each other.

Grading Flours.—The relative quantities of the different grades of flour vary with the kind and excellence of the wheat employed. The following list, taken from the record of a mill near Trieste, the products of which were on exhibition at the Vienna International Exposition, will illustrate the refinement to which the art of milling has been brought:

Groats, A and B		2 per cent.	41 per cent. of extra flour.
Flour,	No. 0	5 " "	
"	" 1	12 " "	
"	" 2	6 " "	
"	" 3	6 " "	
"	" 4	5 " "	
"	" 5	5 " "	
"	" 6	14 " "	38 per cent. medium and common flour.
"	" 7	9 " "	
"	" 8	5 " "	
"	" 9	10 " "	
Bran		18 " "	79 per cent.
Loss		3 " "	

Of these quantities, in a comparison with a view to determine the best work of a system of milling, a mixture of the first total 45 per cent. is taken.

Low Milling.—In this country the prevailing process is that of low milling, as better meeting the general demand, and as yielding at the same time adequate profit to the miller. The first step in the first-class mills, after the removal of the foreign seeds and shrunken berries and dirt, is to pass the wheat through a smut-machine, which, besides removing any smut or dust, largely removes the outer coat of the berry, together with the brush of vegetable hairs at one end, and more or less of the germ at the opposite end. It is then ground, and the product passed through the bolting cylinders or sieves, which separate the flour from the connell or middlings and coarser bran. The middlings, which consist of coarse gritty flour, or what are called fine grits and fine bran, which together pass through the same meshes of the bolt, are then discharged upon a slightly inclined sieve, which is subjected to a gentle jarring action. The meshes of the sieve are sufficiently large to let the whole product pass through, but the bran is kept above by a current of air sweeping upward through the sieve, sufficiently strong to keep the bran from falling, but not strong enough to keep the gritty flour from passing through the meshes. These fine grits, or "groats," are in some mills separately ground, and sold by themselves as an extra quality of flour. In most they are conducted back to be mixed with fresh wheat as it enters the run of stones, and incorporated with the general product, and separated with the fine flour in the next bolting.

Judging Flour.—The excellence of flour may be judged in some degree by its shade of color—the presence of minute particles of bran tending to give it a yellowish hue; by its freedom from musty odor or taste—proving that it has not been overheated and is comparatively new; and by the elasticity and tenacity of the dough which it yields when mixed with a small quantity of water and kneaded. To this may be added the odor which the dough in thin layer yields when submitted for a brief time to a sharp baking temperature of about 400° F.

Composition of Flour.—It has been convenient to treat of the composition of wheat as including the outer envelope, bran; the inner envelope, the gluten coat; and the mass of the interior, the starch and associated albuminoids. Proximate physical analysis and detailed chemical analysis have shown a much greater variety than would be indicated by these three. Of the outer coats there are five that may be readily separated from each other—the gluten coat, consisting of the framework of cells and the capsules and their contents of minute grains that fill the cells, the loose cellular tissue spanning the whole interior of the berry and supporting the starch-cells and their contents: opposite the brush end, distinguished as a tuft of vegetable hairs, there is the complete structure of the embryo. The outer coats contain, besides the woody fibre and cellular tissue of their structure, various inorganic substances, including silica. The gluten coat contains, besides the framework of cellular tissue, various nitrogenous substances, the chief of which is gluten—albumen, glutin, mucin, and cerealine, which differ from each other mainly in their solubility in water and in their susceptibility to fermentation and disintegration. Besides these there are contained bibasic phosphates, of potassa—the most abundant—then magnesia next,—lime, soda, iron, in combination with which the nitrogenous bodies above mentioned seem more or less to play the part of bases; and in addition to these oil and sugar.

The interior, besides the open cellular tissue and starch-granules, contains albuminoid bodies, kindred with those of the gluten coat, and in some grains in larger proportion; and a small percentage of phosphates. The ratio of phosphates in the interior to the salts in the bran and gluten coats is about as 1 : 10. The embryo contains, besides its organic texture, the nitrogenous and phosphatic constituents found in the gluten coat.

The following analyses by Dempwolff show the percentages of the proximate constituents of the wheat, the nitrogen and phosphates in the different grades of wheat flour:

In 100 parts are—	Water.	Ash phosphates.	Nitrogen.	Albuminoids.	Starch.	Cellulose.
Groats and extra imperial	10.6	0.41	1.80	11.7	70.0	7.29
Roll flour	10.5	0.60	2.08	13.3	67.2	8.40
Bread flour	10.7	0.96	2.40	15.4	63.4	9.80
Dark flour	8.5	1.55	2.30	14.9	61.0	14.05
Bran	10.7	5.46	2.20	14.3	43.6	25.95

The following analyses of the flour of the Pesth Walz Muhl (cylinder mill), made by the writer, show the relations of the phosphoric acid to the nitrogen in the different grades into which the flour is resolved in that renowned mill. (It should be remarked that the so-called "groats" are masses of the interior of the berry.)

	Water.	Ash.	Phosphoric acid.	Nitrogen.	Albuminoids, calculated.
Groats	10.57	.42	.20	2.24 / 2.27	14.65
No. 0	10.37	.43	.14	1.68	10.76
No. 1	10.23	.41	.21	1.68 / 1.68	10.76
No. 2	10.47	1.03	.22	1.72	11.02
No. 3	10.07	1.02	.17	1.72	11.02
No. 4	10.24	1.19	.25	1.74	11.15
No. 5	9.66	.69	.35	1.80	11.54
No. 6	11.12	1.04	.24	1.84	11.79
No. 7	10.99	0.81	.21	1.80	11.54
No. 8	9.86	1.01	.36	1.90	12.18
No. 9, coarse bran.	9.71	7.32	2.14	1.98	12.69
No. 10, fine bran	11.01	4.21	.70	2.20	14.16

The constituents of the gluten coat when moistened with water spontaneously undergo chemical changes. The starch and sugar by themselves, similarly treated, experience no change. But when the starch and gluten are mingled together and mixed with an adequate quantity of water, the changes which the nitrogenous bodies experience are transferred to the starch, and that is also converted into new substances. At a moderately low temperature the starch is converted into lactic acid. At a temperature of from 70° to 80° F. the starch is converted first into a kind of dextrine, then into grape-sugar, and then this grape-sugar into alcohol and carbonic acid; at a more elevated temperature butyric acid, succinic acid, hydrogen, with carbonic acid and other volatile products, are produced. In the art of bread-making advantage has been taken of this susceptibility to fermentation, producing volatile products, to give to the moistened flour or dough, and ultimately to the loaf, the quality of porosity or cellular structure. This quality of the loaf, as is well known, facilitates digestion. The later refinements in the production of fermented bread have been directed to securing from sound flour that kind of fermentation only which yields mainly alcohol and carbonic acid, and is called vinous fermentation. Incidentally with these products there is yielded a certain amount of gum, and sometimes of sugar, beyond that converted into alcohol and carbonic acid, and also an agreeable volatile essential oil or ether, which imparts to the fresh loaf a pleasant aroma.

There are two principal modes of effecting fermentation —one by the introduction of the purified yeast-plant (now an article of manufacture and commerce on a large scale in Austria, and in a condition more or less pure in various other parts of Europe, and recently in this country, and known as press-yeast); and the other by the incorporation with fresh flour and water of a portion of the fermenting dough of a previous batch, which is of course filled with yeast-germs. This yeast-plant, when mingled with the flour and water, grows at the expense of the flour, and if skilfully manipulated yields only the products of vinous fermentation, but where neglected and allowed to become old and to undergo spontaneous decay, or where impure from the presence of germs of putrefactive fermentation, the bread produced takes on the offensive qualities of the yeast, and instead of being grateful to the palate and uniformly porous, may be offensive to the taste and smell, and heavy or sodden, or partially filled with bubbles of irregular and greatly unequal size. The presence of acid in the yeast tends to liquefy the gluten, and deprive it of the quality of tenacity upon which the production of pores of uniform size depends, and which when destroyed permits the bubbles of gas in the dough to break through their walls and run together, producing on the one hand great cavities, and on the other heavy streaks in the bread.

Unfermented Bread.—In view of these difficulties, incidental to the process of vinous fermentation, effort was made long since to convert flour into porous bread without the aid of fermentation. As the porosity was due solely to the spontaneous evolution of the gas from every point in the interior of the dough, it was evident that so far as cellular structure was concerned it need not be produced from fermentation. It would only be necessary to mix, by the process of sifting, a finely powdered alkaline carbonate with the flour, and then make the flour into dough by incorporating with it acidulated water. The acid of the acidulated water, combining with the alkali, would set the carbonic acid free, which, taking on the gaseous form in every part of the loaf, would make it porous. This principle was illustrated early in the use of sour milk as the acidulated solution. The lactic acid of the milk, combining with the soda or the potash of the alkaline carbonate, drove the carbonic acid out. In place of the sour milk, hydrochloric acid was employed, producing the porous structure by the evolution of carbonic acid, and when carbonate of soda was used yielding common salt in the bread.

Self-raising Flour.—It was obvious from the experience with lactic acid and hydrochloric acid that if an acid which has a solid form, and is not hygroscopic at common temperatures, but readily soluble in water, were pulverized and mixed with bicarbonate of soda in proper proportions to yield a neutral compound of the acid and alkali, there would be practicable yeast-powder—that is to say, a preparation in the form of powder which would fulfil, upon the addition of water, the office of yeast. The substance chosen for this purpose was tartaric acid, or its compound with potassa, the bitartrate of potassa or cream-tartar. This, mingled with bicarbonate of soda in proper chemical proportions, is intimately incorporated with the flour by the process of sifting, and the mixture constitutes what has been called a *self-raising flour.* The form in which this yeast-powder has been produced is in glass bottles or tin cases in quantities suited to domestic use, the preparation of the self-raising flour being made by the cook on the occasion for each batch of bread or cake.

The preparation of self-raising flour on a commercial scale was instituted in England in the use of tartaric acid. This was first intimately incorporated in given proportion with flour, and then an equivalent of bicarbonate of soda was incorporated with another portion of flour, and then these two portions of flour were intimately mixed together. This so prepared self-raising flour, to which has been added the proper proportion of salt, on a mixture with a proper quantity of water or milk, yields, by the action of the tartaric acid on the bicarbonate of soda, carbonic acid gas, rendering the moistened flour porous; in which condition it is put into the oven and baked.

In place of the tartaric acid, which yields no nutritive value to the flour, there has been introduced the use of acid phosphate of lime in the form of powder, with a view to restoring the phosphates lost with the bran in the ordinary process of bolting. The acid phosphate prepared from bones, besides acid phosphate of lime, contains acid phosphate of magnesia and iron, and when mingled with the bicarbonate of soda in flour yields a product containing neutral phosphates in condition to be converted into acid phosphate by the gastric juice, and taken up in the processes of digestion and assimilation. (See BREAD.)

Bread is also made from a mixture of rye flour and wheat flour, and from whole wheat meal, as well as from oat meal and corn meal. These are to some extent mingled with each other, and with rice and potato flour. E. N. HORSFORD.

Flour Manufacture, New Process of. A large proportion of the most valuable part of the wheat is, in the old flouring process, carried off as "middlings," a product chiefly used for feeding stock and for distilling. For many years experiments have been made in Europe and the U. S. with a view to preventing this waste. A plan introduced from Paris in 1872 by a Mr. Lacroix, a manufacturer of Faribault, Minn., and subsequently much improved by Mr. George C. Smith and others, has been very successfully and extensively employed in the North-west. The grinding is done at a relatively low speed of the stones, and the flour is consequently coarser or "higher" than ordinary. Bolting-cloths of large capacity are employed, a strong blast of air passes up continuously through the bolt for the prevention of clogging, and the upper side of the bolt is acted upon by a system of brushes, which facilitates the process. There are, in fact, several processes, but in all the principle is essentially the same; excepting that in some of the best no brushes are employed. Already (1874) the following results have been accomplished: (1) the amount of flour yielded by a bushel of wheat is increased more than 8 per cent.; (2) the quality of the flour is vastly better than that previously made; (3) spring wheat, the sort most abundantly produced, is becoming the highest in value, since the new processes are thus far failures when applied to winter wheat. At present (Nov., 1874) "new-process" flour is quoted in New York at the highest figures. The result of the new inventions may in time become very

important to consumers, manufacturers, and producers alike.

Flourens (GUSTAVE), French *littérateur* and politician, b. at Paris Aug. 4, 1838, was deputy professor at the College of France in 1863; fought in Crete against Turks 1865–68; took part in the electoral movement at Paris 1868; was arrested Apr., 1869, and the same year was wounded in a duel with Paul Granier de Cassagnac; took part in the Communal insurrection in Mar., 1871, and was killed near Paris on Apr. 3, 1871. *Discours du Suffrage Universal* (1865), *Question d'Orient* (1867), *Science de l'Homme* (1869), *Paris Delivrée* (1871), were his productions. He was a son of Prof. M. J. P. Flourens.

Flourens (MARIE JEAN PIERRE), French physiologist and author, b. at Maureilhan Apr. 15, 1794, became M. D. 1813, and a resident of Paris 1814; admitted to the Academy of Sciences in 1828; professor of comparative anatomy in 1832; perpetual secretary of the Academy of Sciences in 1833; and member of the French Academy in 1840. His *Researches on Irritability and Sensibility* appeared in 1822; *Researches on the Properties and Functions of the Nervous System in Vertebrate Animals* in 1824; *Analysis of the Labors of Cuvier* in 1841; *Buffon, Histoire de ses Idées et de ses Travaux*, in 1844; *Theory of the Formation of the Bones* in 1847; *Course of Comparative Physiology*, 3 vols., 1854; *Human Longevity, and the Quantity of Life on the Globe*, in 1854. D. near Paris Dec. 6, 1867, having been made peer of France in 1846, and grand officer of the Legion of Honor Aug. 11, 1859.

Flournoy' (THOMAS S.), b. in Virginia, was M. C. from that State 1847–49. Was killed in battle in Virginia in June, 1864, fighting for the Southern Confederacy.

Flow'er [Lat. *flos, floris;* Fr. *fleur*]. The organs of fructification of a phænogamous plant, with the envelopes or peculiar leaves which enclose or surround them, constitute the flower. Yet some flowers are destitute of all envelopes or leaves, and the flowers most prized for ornament, such as full "double" roses or camellias, consist wholly of leaves. The latter are botanically monstrosities, and incapable of performing their office of propagation. Even normal flowers are so various that, for rightly defining or understanding them, it is needful to take a complete flower as a pattern.

A complete flower consists of its essential organs of two kinds, male and female; the latter in the centre, surrounded by the former, and these surrounded by two floral envelopes, the leaves of the blossom, as they are sometimes called. The outer envelope is the *calyx* or flower-cup (and this is the meaning of the word, the same as "chalice"), for the leaves which compose it are often consolidated more or less into a cup. These calyx-leaves when separate are named *sepals*. The calyx is more commonly green and leaf-like, but by no means always so. The inner floral envelope, whether in form of a cup or of separate leaves, is the *corolla*, and its separate leaves or pieces are called *petals*. The corolla is usually the attractive part of a flower, the texture delicate, and the color white, blue, red, yellow, or some other color than that of the herbage. The functions of the floral envelopes are, in part, protection of the essential organs within, while the calyx, when green and sufficiently ample, may contribute to their nourishment, acting in the same manner as foliage. As to the gayly-colored parts, such as the corolla, it is now well made out that they subserve an important use in attracting insects, etc. to the blossom, thereby aiding fertilization. The fragrance subserves the same end, and the nectar produced by most colored flowers, and by many that are not brightly colored, is the real attraction to insects and their wages for the service which they perform.

The organs next within the corolla are the *stamens*, the male or fertilizing organs. The essential part of a stamen is the *anther*, a case usually of two cells or compartments, containing *pollen*, a powdery substance consisting of minute grains. The anther is commonly borne on a stalk-like support, the *filament*. In the centre are the female or seed-bearing organs, one or more—the *pistils*. A pistil consists of two essential parts—viz. the *ovary* (in Latin, *ovarium*), which contains *ovules*, destined to become seeds; this is surmounted by a *stigma*, which is a knob, line, or other surface receptive of the pollen, which falls upon or is in some way conveyed to it, and which serves to fertilize the ovules, so that an embryo is formed and they become seeds. (See PHYSIOLOGY, VEGETABLE.) In most flowers the stigma is elevated more or less above the ovary upon a column often resembling the filament of a stamen; this is called the *style*; it is not essential and is often wanting.

A name sometimes employed to denote the envelopes of a flower taken together is the *perianth*. This term is seldom used, however, except where there is only a single envelope, or where both calyx and corolla are combined into one cup, as in the lily-of-the-valley and hyacinth, or appear so much alike as seemingly to form one circle, as in true lilies. A technical name for the stamens of a flower, taken together, is *andrœcium;* for the pistils, taken together, *gynæcium;* but these terms are not often used. The axis of the flower, the apex of the flower-stalk out of which all the organs grow, is the *receptacle* or *torus*. The idea of the flower, morphologically, is that the receptacle is axis or stem, and that the sepals, petals, stamens, and pistils respectively answer to leaves, more or less transformed and adapted to special functions. (See BOTANY.)

A *complete* flower, as above described, is one which possesses all these organs. A *symmetrical flower* has the same number of parts of each set or circle—2, 3, 4, 5, or whatever the ground-plan of the particular blossom may be. A *regular* flower has all the parts of each set alike; in an irregular flower some are unlike the others in size or form. A *perfect* or *hermaphrodite* flower has both stamens and pistils. In *unisexual* flowers these organs occupy different blossoms, either borne on the same plant (*monœcious*) or on different plants (*diœcious*); the flowers which bear stamens only are *staminate* or *male*, sometimes also called *sterile;* those with pistils only, *pistillate*, *female*, or *fertile*. Flowers which want all floral envelopes are called *naked*, or *achlamydeous;* those which want the corolla are *apetalous;* those in which the corolla consists of separate petals, *polypetalous;* those in which the petals are combined into a cup or tube, *monopetalous*, or, better, *gamopetalous*, or, still better but less commonly, *sympetalous*.

There are also in some plants *neutral* flowers—*i. e.* where some of the blossoms are destitute both of stamens and pistils. These are either wholly abortive or rudimentary, destitute of function, or else such as consist of a showy perianth only, usually a corolla, which is much more conspicuous than that of the perfect flowers. Of this sort are the outer flowers of the cluster in *Hydrangea* and the *rays* or ray-flowers of sunflower. Their use doubtless is to attract insects, etc. to the feeding-ground in the cluster they encircle. What were formerly called *compound* flowers, of which the sunflower is a good and familiar illustration, are dense clusters or heads; and, when their marginal flowers are thus enlarged and attractive, and especially when they are *ligulate* or strap-shaped (as in sunflowers, where they are neutral, or in asters, where they are pistillate and fertile), these heads do bear much resemblance to single blossoms, the ray-flowers imitating petals. In some flower-clusters the show or attraction, ordinarily the function of petals, is assumed by leaves of the *involucre* surrounding the head, as in flowering dogwood (*Cornus florida*), or by leaves still more distant from the flowers themselves, as in *Poinsettia*.

In *anthesis* (*i. e.* in the expansion of the blossom) some flowers are fugacious or ephemeral, opening but once and for a brief period; some continue for days, and even a week or more, either remaining expanded or more commonly opening and closing by night or by day or at particular hours, according to the species. Some evening primroses open in twilight, and fade the next morning; others open in the morning and fade at night; still others open in daylight and for several successive days. Poppies drop the calyx when the petals expand, and the petals at or before sunset. Cistuses and rock-roses open in the morning and cast their petals at nightfall. The night-blooming *Cereus* expands its huge and magnificent flower at evening, to close with the light of the next morning, and to collapse into an unsightly and deliquescent mass. On the other hand, some of the most showy orchids of conservatories retain their beauty and freshness for weeks.

W. W. BAILEY. REVISED BY A. GRAY.

Flower (WILLIAM HENRY), F. R. S., English surgeon, b. at Stratford-on-Avon Nov. 30, 1831; was educated at University College, London, and at Middlesex Hospital; entered the army as assistant surgeon in Apr., 1854; served in the Crimean war; was assistant surgeon and demonstrator of anatomy at the Middlesex Hospital, and in 1861 conservator of the museum of the Royal College of Surgeons; since 1869 he has been Hunterian professor of comparative anatomy and physiology. Published *An Introduction to the Osteology of the Mammalia* (1870), and memoirs on anatomical and zoological subjects.

Flow'erfield, post-v. and tp. of St. Joseph co., Mich., on the Michigan Southern R. R., Kalamazoo division. Pop. of v. 210; of tp. 1538.

Flower-Pot, a vessel usually of burnt and unglazed clay, with a perforated bottom and a saucer, designed for holding earth for the growth of plants in houses or greenhouses, or for other special uses in gardening. There are also various ornamental forms, such as rustic and pendent flower-pots. For window-gardening costly encaustic-tile boxes are fashionable, and are often highly ornamental.

Flow'ers, the name formerly given to sublimates, such as flowers of sulphur, benjamin or benzoin, antimony, arsenic, zinc, etc.; only used now in connection with sulphur.

Flowers, Artificial. This art or branch of manufacture is of very old date. Flowers and leaves of painted linen have been found in tombs at Thebes, and the Egyptians also invented flowers of horn shavings stained in various colors. The Chinese have made artificial flowers from very remote times of the pith of a kind of bamboo. Crassus was the first in Rome who had them made of real gold and silver. During the Middle Ages they were much used, not only in the Roman Catholic Church and with a symbolical signification, but also at secular festivals and merely as ornaments. They were generally made of paper, satin, silk, metal, and wax, and the most celebrated were made in Italy. But in 1728, Seguin, a botanist and chemist, began the manufacture in Paris, employing parchment for the flowers and bristles of the wild-boar for the stems, and his imitations were so successful as to arouse the jealousy of the painters. From this time the manufacture steadily increased and developed in France, which still stands at the head of this kind of industry. The French wholesale houses engaged in this business have each some special branch. Thus, one makes only roses; another, wild flowers; a third, leaves. The workpeople earn from two to six francs a day, according to their skill. Of the money received by the Parisian manufacturers, three-fifths are paid to the workpeople, one-fifth covers incidental expenses, and one-fifth defrays the whole cost of materials. According to the latest decennial report of French manufactures, it appears that in 1866 the exports to all countries amounted to 8,065,587 francs, of which the U. S. received 1,034,886, and Great Britain 6,152,454. (*Tableau décennale du Commerce de la France avec ses Colonies, etc., 1857 à 1866.*) From the reports of the Exhibitions, etc., it would appear that notwithstanding the check given to French industry by wars, etc., this amount has more than doubled during the last eight years. It is comparatively only of late that English flower-making has rivalled the French manufacture. It was introduced into England during the French Revolution of 1790 by refugees, who employed the art as a means of subsistence.

The principal tools used by artificial florists are: *stamps*, a kind of knives of various sizes and shapes, by means of which leaves and petals are cut out very rapidly. The material to be shaped is laid, folded several times, upon a leaden table, and the stamp is driven through it with a hammer. This part of the work is done by men. Stamps (or, as they are often called, *irons*) were invented in Switzerland at the beginning of the last century. Leaves and petals had previously been cut out with scissors. *Goffering-irons* of different kinds, the commonest being a ball of polished iron fastened to a handle, are used to hollow the petals. *Moulds* called *veiners* are, as the name indicates, employed to vein the leaves. *Burnishers* of glass or agate give the petals the polished appearance of most real flowers. Many other tools exist, but of late years their use has greatly diminished. The florist's fingers, guided by skill and taste, are found better than any mechanical appliance. The best flowers are carefully painted by hand. (See *Dictionnaire Universel du XIXe Siècle*, Larousse, art. "Fleurs Artificielles;" and *Art of Making Paper Flowers*, by Mrs. Bartlett (New York).) JANET TUCKEY.

Flowers, Colors of. Although the coloring principles contained in many of the most important vegetable dyestuffs have been isolated and their composition and chemical relations clearly established, as in the case of madder-root, Brazil-wood, logwood, quercitron bark, indigo, weld, archil, etc., and some of them, as the alizarine of madder, have been produced artificially, the colors of flowers have, with few exceptions, thus far resisted all attempts at isolation. This is perhaps partly owing to their fleeting character and the changes which they so readily undergo. The colors of flowers often change spontaneously during the life of the flower. The flowers of *Myosotis versicolor*, the common garden weed forget-me-not, open with a yellow tint, but soon change to blue. The *Cheiranthus mutabilis* opens yellow, then changes to orange, red, and finally to purple. Some flowers even change color during the day. Garden phlox is blue in the early morning, and pink in the middle of the day. *Hibiscus variabilis*, which is white in the morning, is pink at noon and bright red towards night. The colors of flowers are very sensitive to chemical reagents. The petals of the purple or violet dahlia are reddened by acids, the purple being restored by alkalies, but changed to green by an excess of alkali; a red rose is bleached by sulphurous acid, but the color is restored by dilute sulphuric acid.

Many flowers contain more than one coloring-matter. The petals of the safflower yield a yellow color to water and a red principle to alkalies. The orange-colored *Tropæolum majus* yield a purple coloring-matter to boiling water, becoming yellow; boiling alcohol then extracts a purple substance. When the purple is absent the flowers are yellow; when present, they exhibit various shades of brown. The flowers of the brown *Calceolaria* yield two similar colors under like treatment.

In but few cases have the coloring-matters of flowers been isolated and their nature determined with any certainty. The coloring-matter of the saffron crocus (*Crocus sativus*) has been isolated, though not in a pure state. It is known as *saffranin*, and is supposed by Rochleder to be identical with *crocin*, $C_{29}H_{42}O_{15}$, the coloring principle of Chinese yellow berries. (See SAFFRON.) The red coloring principle of the safflower (*Carthamus tinctorius*) is a very important dye. (See SAFFLOWER.) It is called *carthamin*, $C_{14}H_{16}O_7$. The blue and red pigments of flowers are generally soluble in water, while the yellow matters are often resinous, and dissolve only in alcohol and ether. They are generally very fugitive, and consequently of little value in dyeing.

Schübler and De Candolle claimed the existence of two distinct series of colors in flowers—the xanthic, which produce yellow and red tints, and the cyanic, which produce blues; both formed from chlorophyl (plant-green), the former by oxidation, the latter by deoxidation. Their views have not been confirmed. The term *cyanin* is applied now to the blue coloring-matter of flowers. It is contained in violets, iris, etc., and in many red and black flowers. It is extracted by alcohol; the solution is evaporated, and from the residue the cyanin is dissolved out by water. It is then precipitated by acetate of lead; the lead is separated from the precipitate by sulphuretted hydrogen; the solution is evaporated by dryness; the coloring-matter extracted by absolute alcohol, and precipitated by ether in blue flocks. Cyanin is a blue amorphous body, soluble in water and in alcohol. It is decolorized by reducing agents, as sulphurous acid, but regains its color when exposed to the air. It is colored red by acids, green by alkalies. To this is ascribed the fact that some flowers of the borage and mallow families are red in the bud, turn blue when they open, and become green as they fade. These reactions render cyanin useful for the preparation of test-papers. A tincture of the petals of *Iris germanica* or *Iris pumila* is well adapted for this purpose. Hope applied the name *erythrogen* to a flower-pigment which is reddened by acids, but Féhal considers it identical with cyanin. Some red flowers, as varieties of the aloe, contain a red principle sparingly soluble in water, but readily soluble in alcohol, which is not changed by acids or alkalies.

Xanthin, *xanthein*, and *xanthogen* are names given by different chemists to yellow principles obtained from flowers, but their exact composition and chemical relations have not been satisfactorily settled. C. F. CHANDLER.

Floy (JAMES), D. D., b. in New York Aug. 20, 1806; studied for a time in Columbia College, and afterwards in London; became a preacher in the Methodist Episcopal Church in 1833; preached in New York, Brooklyn, N. Y., New Haven, Conn., etc.; edited *The National Magazine* and *Good News;* edited the works of Stephen Olin, and served on the "committee on versions" of the American Bible Society. *Old Testament Characters, Guide to the Orchard and Fruit-Garden*, etc. were from his pen. He was prominent as an anti-slavery leader. D. in New York Oct. 14, 1863. ABEL STEVENS.

Floyd, county of Georgia, bordering on Alabama. Area, 540 square miles. The surface is in part mountainous, and much of the soil is productive. Wheat, dairy products, and cotton are staples. Iron and lead ores and other valuable minerals abound. The county is traversed by the Selma Rome and Dalton R. R. Cap. Rome. Pop. 17,230.

Floyd, county of Indiana, bordering on the Ohio River. Area, 148 square miles. The surface is broken by knobs and bluffs. Iron ore, building-stone, and timber are abundant. Cattle and grain are the agricultural staples. The manufactures are diversified and very important. It is traversed by the Louisville New Albany and St. Louis and the Louisville New Albany and Chicago R. Rs. Cap. New Albany. Pop. 23,300.

Floyd, county in the N. of Iowa. Area, 480 square miles. This county is undulating prairie, well watered, and produces good crops of grain. It is intersected by the Iowa Central, Milwaukee and St. Paul, and the Cedar Falls and Minnesota R. Rs. Cap. Charles City. P. 10,768.

Floyd, county in the E. of Kentucky. Area, 500 square miles. The surface is mountainous, but affords good pasturage. Immense quantities of excellent bituminous coal occur here, but it is not much wrought. Corn and cattle are the staple products. Cap. Prestonsburg. Pop. 7877.

Floyd, county in the S. S. W. of Virginia, lying N. W.

of the Blue Ridge. Area, 280 square miles. It is mountainous, but produces grain and tobacco, and has abundant pasturage and fine water-power. Copper and iron ores and other valuable minerals abound. Cap. Jacksonville or Floyd Court-house. Pop. 9824.

Floyd, tp. of Warren co., Ill. Pop. 1146.

Floyd, tp. of Putnam co., Ind. Pop. 1269.

Floyd, tp. and post-v. of Floyd co., Ia., on the Mona branch of the Iowa division of the Illinois Central R. R. Pop. 1328.

Floyd, post-v. of Carroll co., La. Pop. 157.

Floyd, post-v. (Floyd Corners) and tp. of Oneida co., N. Y. It has 3 churches and 4 cheese-factories. Pop. of v. 95; of tp. 1209.

Floyd Court-house, post-v., county-seat of Floyd co., Va., is 180 miles W. S. W. from Richmond. Called also Jacksonville (which see).

Floyd, tp. of Scott co., Va. Pop. 1171.

Floyd (John), b. in Beaufort, S. C., Oct. 3, 1769; moved to Georgia in 1791; was brigadier-general of the Georgia militia Aug., 1813, to Mar., 1814; commanded at the battle with the Creek Indians at Autossee, Ala., Nov. 29, 1813, and at the battle at Camp Defiance, Ala., Jan. 27, 1814. Was often in the State legislature; M. C. in 1827–29; and also major-general of the State militia. D. in Camden co., Ga., June 24, 1839.

Floyd (John), b. in Jefferson co., Va., was many years in the Virginia legislature, was M. C. from that State from 1817 to 1829, and governor of Virginia 1830–34. D. at Sweet Springs, Va., Aug. 16, 1837.

Floyd (John Buchanan), b. in Montgomery (now Pulaski) co., Va., 1805; graduated at South Carolina College 1826; studied and practised law; removed to Helena, Ark., 1836, returning to Virginia in 1839; member of Congress from Washington co., Va., 1847–49; governor of Virginia 1850–53; took an active part in favor of the nomination and election of James Buchanan as President, by whom he was appointed secretary of war Mar., 1857. During his term of office he used his power in dispersing the U. S. army to distant and not easily accessible parts of the country, in transferring arms and ammunition to Southern arsenals, and generally in preparing for the conflict which it now appears he must have been aware was impending between the North and the South. On the secession of South Carolina he became a zealous sympathizer with the secession movement, opposed the reinforcement of the forts and troops in Charleston harbor, and upon President Buchanan refusing to withdraw the U. S. forces from that harbor, resigned his office. Was indicted by the grand jury of the District of Columbia as being privy to the withdrawal of a large amount of bonds from the Department of the Interior, but having left Washington, was never brought to trial. Was appointed brigadier-general in the Confederate army, and commanded in 1861 in Western Virginia. His operations here were unsuccessful, and severely commented upon by the Virginia press. Was subsequently transferred to Kentucky, and at Fort Donelson commanded a brigade, being senior officer, but abdicated his command and withdrew, the night previous to the surrender, with Gen. Pillow and some 5000 men. He afterward held several unimportant commands, and d. at Abingdon, Va., Aug. 26, 1863.

Floyd (Gen. William), b. in Suffolk co., L. I., Dec. 17, 1734; was in the Continental Congress 1774–83, and signed the Declaration of Independence; was again in Congress 1789–91; was a presidential elector 1800, 1804, 1820, and was a prominent State legislator. He served actively in the Revolution, in which he lost much property. In 1803 he removed to Western, Oneida co., N. Y., where he d. Aug. 4, 1821.

Floyd's, tp. of Horry co., S. C. Pop. 630.

Floyd's, tp. of Newberry co., S. C. Pop. 2133.

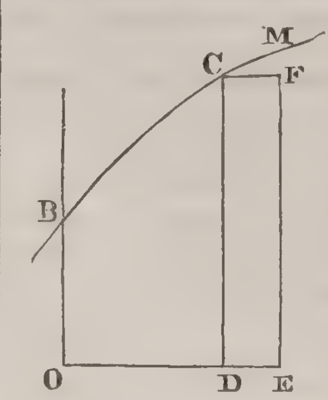
Fludd (Robert), M. D. (*Robertus de Fluctibus*), "the Searcher," an English Rosicrucian and alchemist, b. at Bearstead, Kent, in 1574; entered St. John's College, Oxford, in 1591; studied five years on the Continent; took his medical degree at Oxford 1605, and d. at London Sept. 8, 1637. He was a famous physician, and the author of numerous obscure Latin works, theosophical, philosophical, and mathematical, but his enigmatical style prevents the intelligent study of his works. His doctrine was a refined dualism; his writings have only an historic value. Kepler, Gassendi, and P. Mersenne were his adversaries. Some critics have found atheism, fraud, and all manner of follies in Fludd, while others regard him as a great though misguided genius, and a man of exalted piety.

Flue. See Chimney.

Flu'ents and **Flux'ions** [Lat. *fluo*, *fluxum*, to "flow"]. These terms are so connected that they can best be defined together. The *fluent*, or flowing quantity, as the term signifies, is the same as the *function* in modern calculus; and the *fluxion* is its *differential*.

The idea of fluents and fluxions, as first developed by Newton, was based on the idea of motion. According to this view, we may conceive a plane curve or line to be generated by a point moving uniformly in the direction of some fixed line, and having at the same time a transverse motion, which varies according to some law; which law determines the nature of the curve. The part of the curve that has been generated up to any instant of time is called the *fluent*, and the infinitesimal element of the curve that is generated in the next infinitely small, but constant, period of time is called the *fluxion*. Excepting the case of the straight line, both fluent and fluxion are variable.

Let C be the position of the generating point at any time t, OE the line in whose direction motion is uniform, and OB a perpendicular to OE. Let CF be the distance through which C moves in the direction OE, and FM the distance through which it moves parallel to OB in the next infinitely small, but constant, period of time dt. Then will M be the position of the point at the end of the time $t + dt$, and CM will be the portion of the curve generated during the time dt. The indefinite portion of the curve BC is the *fluent*, and the infinitesimal element CM is its *fluxion*.



If, in addition to the two motions already explained, we conceive the generating point to have a third motion in the direction of a line perpendicular to both OE and OB, it will generate a line in space, which may be a straight line, a plane curve, or a curve of double curvature. As before, the part generated up to the end of the time t is the *fluent*, and the part generated during the infinitesimal time dt is its *fluxion*.

It is easy to conceive that such laws of motion may be assigned as to cause the generating point to describe any curve whatever. It is also plain that if we know the laws of its motion, the nature of the curve may be determined. It is on these principles that the science of fluents and fluxions rests. Returning to the figure already referred to, the line OD is the abscissa of the point C, and DC is its ordinate. Whilst C is moving to M, each of these elements varies by an infinitely small amount, and these variations are the fluxions of the elements. DE is the fluxion of the abscissa, and under the supposition made it is *constant;* FM is the fluxion of the ordinate.

If we suppose the ordinate DC to move with the generating point, it will generate a plane area, limited by the curve, the axis OD, and any two ordinates. The part of this area that is generated up to the end of the time t is a fluent, and the part generated during the time dt is its fluxion. In the case considered the area CBOD is the fluent, and the area MCDE is its fluxion. If we suppose the plane area to turn around OE as an axis of revolution, the curve BC will generate a surface, and the area CBOD will generate a volume of revolution; at the same time the line CM will generate the fluxion of the surface, and the area MCDE will generate the fluxion of the volume.

If we suppose a plane curve to move uniformly in some fixed direction, varying in magnitude according to a determinate law, it will generate a surface which we may regard as a fluent, and the portion generated in an infinitesimal portion of time will be its fluxion. In like manner, if we suppose a plane area to move uniformly in a fixed direction, the bounding line varying in magnitude according to any determinate law, it will generate a volume which we may regard as a fluxion, and the portion of this volume generated in the time dt will be its fluxion.

In accordance with these views, any magnitude may be regarded as flowing from a point; for a moving point may be made to generate any line, a moving line of varying magnitude may be made to generate any surface, and a moving plane area of varying magnitude may be made to generate any volume.

The system of fluents and fluxions was admirably adapted to convey a clear idea of the nature of the infinitesimal calculus, but has been superseded by the method of integrals and differentials principally on account of its cumbrous methods of notation.

The methods of notation are explained below:

Variables are denoted by final letters of the alphabet, as x, y, z, etc., and their fluxions are indicated by the same letters with a dot over each. Thus, the fluxions of x, y, z, etc. are represented by the symbols $\dot{x}$, $\dot{y}$, $\dot{z}$, etc. Since fluxions are usually variable, they may in turn be regarded as

fluents, whose fluxions may be found; these are denoted by the same letters with two or more dots, according to their order. Thus, $\ddot{y}$ denotes the fluxion of $\dot{y}$; $\dddot{y}$ denotes the fluxion of $\ddot{y}$; $\ddddot{y}$ denotes the fluxion of $\dddot{y}$: and so on. The number of dots denotes the order of the fluxion.

If the fluent is a radical, as $\sqrt{x-y}$, or a fraction, as $\frac{x}{y}$, it is enclosed in a parenthesis, and a dot is placed over it in the manner of an exponent. Thus, the fluent of $\sqrt{x-y}$ is written $(\sqrt{x-y})^{\cdot}$; the fluxion of $\frac{x}{y}$ is written $\left(\frac{x}{y}\right)^{\cdot}$; and so on.

Sometimes the fluxion is denoted by the letter F, and the fluent by the letter f. Thus, $F(\sqrt{x-y})$ is equivalent to $(\sqrt{x-y})^{\cdot}$, and $F\left(\frac{x^2}{y}\right)$ to $\left(\frac{x^2}{y}\right)^{\cdot}$. Also, $f\,(\dot{x}\sqrt{a+bx^2})$ is equivalent to *the fluent whose fluxion is* $\dot{x}\sqrt{a+bx^2}$, and $f\left(\frac{b\dot{x}}{a+x^2}\right)$ to *the fluent whose fluxion is* $\frac{b\dot{x}}{a+x^2}$.

W. G. PECK.

Flue, von der (NIKOLAUS), SAINT, b. at the estate of Fluehli, Unterwalden, Switzerland, Mar. 21, 1417, of a good family; was carefully educated; became a distinguished soldier, and for nineteen years was state councillor and judge. In 1467 he left his children, and went to live among the Alps, a hermit, bareheaded and barefooted; and we are told that for twenty years he ate only the eucharistic bread. In 1477 he began to preach in his little chapel, and in 1481 he visited the Diet at Stanz and prevented the breaking up of the confederation. D. Mar. 21, 1487. In 1669 he was canonized. He was commonly known as BROTHER KLAUS.

Flü'gel (GUSTAV LEBRECHT), German Orientalist, b. at Bautzen Feb. 18, 1802, educated at Leipsic, became the pupil in 1827 of Von Hammer at Vienna. The *Arabic Anthology of Thâalibi* (fugitive poetry), published in 1829, led to his appointment on a scientific mission by the Austrian government. In it, for three years, he travelled in Hungary, Styria, parts of Germany, and in France. Became professor in the College of Meissen in 1832; resigned 1850; published his *History of the Arabs* in 1833, and an edition of the Koran, and subsequently a *Concordance of the Koran.* In 1835–54 appeared, at the expense of the London Oriental Society, his Latin translation of *The Encyclopædic and Biographic Dictionary of Hadschi-Chalfa*, with commentary; wrote also *Mani und Seine Lehre*, 1862; published Arabic, Turkish, and Persian MSS., and other works. D. at Dresden July 5, 1870.

Flügel (JOHANN GOTTFRIED), German lexicographer, b. at Barby on the Elbe, 15 m. from Magdeburg, Nov. 22, 1788; spent ten years in the U. S. (1810–19); was professor of the English language in the University of Leipsic 1824–38, when he was appointed U. S. consul at Leipsic, where he d. June 24, 1855. He published, besides other works, a *Merchants' Dictionary, in German, English, and French* (3 vols., 1840; 2d ed. 1854), but is best known by his *Complete English-German and German-English Dictionary* (2 vols., 1830), in the last edition of which (1852) he was assisted by his son, Dr. Felix Flügel. R. D. HITCHCOCK.

Flu'id [Lat. *fluidus*, from *fluere*, to "flow"], a body whose particles move over each other without sensible resistance, yielding to the slightest pressure. Such bodies under the influence of natural forces assume forms of static equilibrium. Such forms will be changed by the action of any new force, but will be immediately restored when the disturbing force is withdrawn. Fluids are of two classes, liquid and aëriform. The property which distinctively characterizes aëriform fluids or gases is that they are perfectly elastic; whence it follows that, temperature remaining constant, their volume is always inversely as the pressure to which they are subjected. This law is subject to a practical qualification, in regard to which see GAS. With diminished pressure, therefore, they tend to expand indefinitely; but as expansion is accompanied by depression of temperature, the process may be naturally arrested by the condensation of the body to the liquid state. This is what happens with the aëriform bodies called *vapors*, which differ from permanent gases only in being condensable at temperatures naturally occurring. Liquids are but slightly reduced in bulk by pressure—to common observation not at all. A liquid introduced into a vessel having a capacity greater than its bulk occupies but a part of the vessel; whereas the smallest portion of any permanent gas fills the containing vessel entirely, however large it may be. Liquids are sometimes called non-elastic fluids, and sometimes *dense* fluids. The terms are convenient, but neither of them is severely correct. When elastic fluids are spoken of, aëriform bodies are always intended. Some writers have been disposed to restrict the term *liquid* to such dense fluids as have the property of *wetting* the solid bodies immersed in them. Water, alcohol, and oil are examples of this kind; mercury is an example of the other. But such distinctions will not hold universally. Water will not wet a charred cork; mercury will readily wet gold or silver or lead or zinc, though it will not wet platinum, nor iron, nor glass, nor stone, nor wood, nor organic or mineral substances generally. F. A. P. BARNARD.

Fluid'ity, the condition of matter in which its molecules glide upon each other without sensible resistance from cohesion. Though the term *fluid* is applied to bodies both liquid and gaseous, the word *fluidity* in its ordinary sense is understood of liquids only. Brande distinguishes the state of fluidity as that state in which bodies are capable of forming *drops*, since this property belongs neither to gases nor to finely comminuted solids. The formation of drops is evidence that the molecules, notwithstanding their freedom of motion, adhere to each other with a certain tenacity. They adhere in like manner to solids capable of being wetted by them; as when, in lifting the finger from a vessel containing water, a drop remains suspended at its extremity.

The three physical states of matter, the solid, the fluid, and the gaseous, are commonly explained on the hypothesis that the molecules are subject to the action of two opposing forces, the one attractive and the other repulsive. When these two forces are in equilibrium, fluidity is the result. When the attractive force predominates, the body becomes solid. When the repulsive force is in excess, the molecules tend to recede from each indefinitely, and the gaseous state supervenes. The physical state of a body is determined by the conditions in which it is placed—mainly as it respects temperature and pressure. By properly managing these, any solid not liable to be chemically altered in the process may be made to pass successively into the fluid and the gaseous state. F. A. P. BARNARD.

Fluke-worm, a name applied to various entozoic worms, constituting the order TREMATODA (which see). They are as a rule flat and oval, smooth, soft, and not jointed, and are mostly hermaphrodite, having sexual organs which constitute a large part of the organism. Some are produced by simple generation, but many striking examples of alternate generation and parthenogenesis occur in the order; for instance, in *Distoma* and other genera. The disease called "rot" in sheep is caused by the presence of flukes in the biliary passages. The endemic hæmaturia of the Cape of Good Hope and the dysentery of the Nile basin are examples of diseases in man caused by these parasites. As a rule, the flukes have, when perfect, an alimentary canal without vent.

Flume, The, in the Franconia Mountains, and in the town of Lincoln, Grafton co., N. H., is a cleft between two walls of rock through which flows a small stream. This stream, just below, falls over 600 feet down The Cascade. It is one of the finest resorts of the White Mountain region.

Fluohy'dric (or **Hydrofluor'ic**) **Acid,** HF, was first prepared (containing silica) by Scheele in 1771. Gay-Lussac and Thénard first obtained it pure in 1808, but they regarded it as an oxygen acid. Ampère in 1810 suggested that it was a hydracid analogous to hydrochloric acid—a view which was confirmed by Davy. *The aqueous acid* is produced by the action of sulphuric acid on metallic fluorides, fluor spar or cryolite being generally employed, the operation being conducted in leaden or platinum vessels, as the acid rapidly corrodes glass and porcelain.

$$CaF_2 + H_2SO_4 = CaSO_4 + 2HF.$$

The acid distils over, on the application of heat, as a gas holding a certain proportion of water; it is condensed in a small quantity of cold water placed in the receiver, and must be preserved in bottles of lead, platinum, or gutta percha. The concentrated aqueous acid is a colorless liquid, sp. gr. 1.06; on dilution its density increases to 1.15. The strong solution gives off fumes which are very caustic and irritating, and the liquid itself is extremely corrosive. On the skin it produces painful ulcers, difficult to heal. It dissolves metals readily, with the liberation of hydrogen—even copper, silver, and the elements silicon, boron, zirconium, titanium, and tantalum; but not gold. Ignited silicon and titanium require for their solution a mixture of hydrofluoric and nitric acids. Silica and the silicates (glass, porcelain, etc.) are energetically attacked by this acid. Silica dissolves to a clear solution with elevation of temperature, forming hydrofluosilicic acid, $2HF,SiF_4$. With silicates it forms silicofluorides — $CaSiO_3 + 6HF = CaF_2.SiF_4$. Placed upon glass, heat is evolved, fumes of SiF_4 are given off, and a roughened spot is produced. This action upon glass distinguishes it from all other acids.

The anhydrous acid is prepared by heating a mixture of fluoride of lead and charcoal in a current of dry hydrogen in a platinum tube, or by heating the dry acid fluoride of potassium, HF,KF, in dry hydrogen. It is a colorless gas, which is condensed by freezing mixtures to a mobile liquid, sp. gr. 0.9879, boiling at 67° F. (19.4° C.), fuming in the air and rapidly absorbing water. It is one of the most dangerous substances known to chemistry. Gore (*Jour. Chem. Soc.* [2], vii. 368) examined it very carefully, with a view to determining its true character and settling the question as to the character of fluorine. He found that its gas did not attack glass in the absence of aqueous vapor, and that it did not contain oxygen. He concludes that in chemical properties it lies between hydrochloric acid and water, most nearly allied to the former. He also calls attention to the fact that the atomic weight of F (19) lies between those of oxygen and chlorine (16 and 35.5), and that the sum of the atomic weights of oxygen and fluorine nearly equal that of chlorine.

Uses.—The aqueous acid is extensively used for etching glass, designs being produced by first tracing them in a coating of wax or varnish previously applied to the surface. Lines etched by the vapor of the acid are opaque—by the liquid, transparent. For etching with vapor a leaden box is employed containing a mixture of fluor spar and sulphuric acid. The waxed plate is placed over it, waxed side down, and a gentle heat is applied to the bottom of the box. The acid is very useful in the laboratory for decomposing silicates for analysis. C. F. CHANDLER.

Fluores'cence [Lat. *fluor*, a "flowing"] is the name given to an action by which certain substances absorb light-waves of certain lengths when exposed to them, and then re-emit the same energy in waves of greater length. For example, when violet light falls on a solution of chlorophyl (the green coloring-matter of leaves), it is changed into or re-emitted as crimson light, whose waves are about twice as long as those of the violet light to which they owed their origin. This action finds its analogy in the process by which light-waves falling on dark-colored bodies are converted into the longer waves of heat. As to the process by which this result is effected, we know nothing beyond the fact that an absorption and re-emission does take place; which appears from the fact first shown by Stokes, that if the light falling on the fluorescent substance is polarized, the light emitted by fluorescence is entirely without polarization. As to the phenomenon in its various modifications, a vast amount of detail has been accumulated during the few years which have elapsed since Stokes in 1852 first recognized this action.

To understand clearly the relation of fluorescence to other departments of physical optics, a few general statements must be recalled. Thus, we must in the first place remember that, according to our established theory, light is a wave or vibratory motion, and differences of color are simply differences in the lengths (or, what is the same thing, frequency of recurrence) of these waves. Thus, red light is simply light made up of long waves, which therefore succeed each other at longer intervals; and blue light is only light made up of shorter waves, which therefore succeed each other more quickly. White light is moreover a compound of a multitude of waves of every possible length, or, in other words, a mixture of light of all colors.

Easy as it might appear to change the lengths of light-waves, and so alter the color of the light, this is nevertheless one of the most impossible of changes, except in the case of our present subject; and until this action was pointed out by Stokes no one had dreamed of its existence. With this above-named exception, substances, even the most brilliantly tinted, have not the minutest power of changing the lengths of the light-waves which they reflect or transmit, but owe their brilliant hues solely to their power of extinguishing certain rays, while they transmit only others; and thus, when illuminated with white light, which contains all colors, they glow with those tints which they reflect or transmit, having in one way or another suppressed the rest. Thus, a scarlet flower does not look red because it has any power of converting other colors into red, but simply because when white light falls on it all but the red waves are suppressed, and these alone are reflected.

So with transparent colors. Red glass is only red because it refuses to transmit any but the red waves of light. If no red waves are present in the illuminating light, the most vivid red object looks absolutely black, or devoid of all color whatever. This is well illustrated by the effect of illuminating brightly colored objects of various tints with light of a single color—say yellow, which is easily obtained by burning an alcohol lamp with some common salt on the wick. All color then vanishes, and we have only shades of yellow and black.

There exists, then, the almost universal rule that wave-length or color is an unchangeable property in light rays, and that blue can no more be transmuted into yellow than lead into gold. It is to this all but universal rule that the present subject is the sole and therefore startling exception. The first recorded observation in this direction is by Sir David Brewster in 1833, in the *Edinburgh Philosophical Transactions*, vol. xii. p. 542. In 1846, in the 16th volume of the same, he published a further account of some phenomena now known to belong to our present subject, as also in the *Philosophical Magazine* of June, 1848. In 1845, Sir John Herschel described certain appearances in solutions of quinine under the name of "superficial color" or "epipolic diffusion." In none of these papers was the true nature of the action recognized.

In the *Philosophical Transactions* for 1852, part ii. p. 466, appeared a paper by Prof. G. G. Stokes, filling more than 100 pages, and not only recounting a vast number of observations and experiments, but also pointing out the true nature and relation of this remarkable action. He showed that the action of fluorescence consisted in a change in the wave-length or color of light, brought about by some bodies in the course of what otherwise generally resembled an ordinary irregular or scattering reflection. In this same essay is developed the only general law which up to the present time has been discovered in connection with the subject of fluorescence—namely, that the light developed by this action is always of a greater wave-length than that by which it is excited. Thus, violet rays falling on an acid solution of sulphate of quinine will develop by fluorescence from it rays of blue and other still greater wave-lengths, such as green, yellow, red; but there will be in the fluorescent light no trace of violet or other shorter waves. Again, certain red rays will excite fluorescence in a solution of chlorophyl, but this fluorescence will consist only of still longer-wave red light.

Shorter waves than these red ones can be developed by fluorescence in this substance, but only by the action of yet shorter waves in the exciting light.

In 1850, Ed. Becquerel published in the *Annales de Chemie et de Physique*, 3d series, vol. lvii. p. 101, an account of a long series of experiments upon bodies which he designates as "phosphorescent." According to his definition, all fluorescent bodies would come under the description of phosphorescent substances, or, what will be an easier transition to us in the present case, we may say that phosphorescent bodies are those in which the "fluorescent" emission continues for an appreciable time after the exciting light has ceased to act. Thus, if violet light falls upon a certain sulphide of calcium, not only will this emit green waves, but if carried away from the violet light into a dark room, green rays will be emitted for a minute or more. This action, however, seems to have all the other characteristics of Stokes's "fluorescence;" and indeed this characteristic of duration seems to be the only one by which the two actions can be distinguished. As Stokes was the first to investigate the action, it would seem that his name has the prior claim. It should be remembered that the phosphorescence above mentioned has no connection with chemical phosphorescence or the slow combustion of phosphorus.

In his large work entitled *La Lumière*, published in 1867–68, Becquerel devotes over 200 pages to the same subject. In the *Comptes Rendus* of Aug. 3, 1872, he moreover published an abstract of researches on the same class of properties in certain salts of uranium, and in the *Ann. de Chem. et Phys.* for December of the same year appeared the entire memoir. Hagenbach in *Poggendorff's Annalen*, vol. cxlvi. pp. 65, 232, 375, 508, has discussed the fluorescent properties of a vast number of substances. Besides these, many brief notices have appeared on certain points from time to time. Lastly, the present writer has devoted much time to the study of fluorescence, chiefly in the salts of uranium and in certain hydrocarbons found in coal-tar and in petroleum distillates. Some of the results so obtained will be discussed farther on.

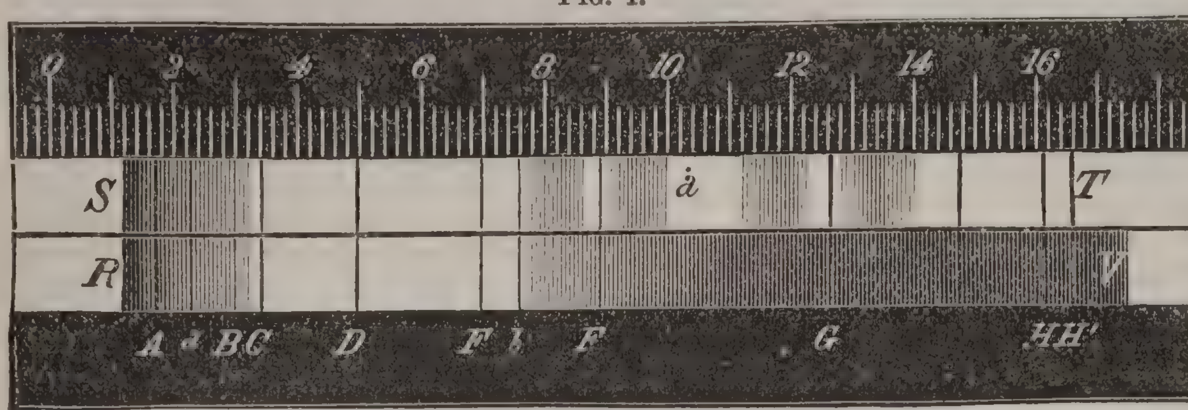
Returning to the characteristics of fluorescent action, as developed by Stokes and others, we observe—

1st. That the power of exciting fluorescence is not confined to any class of rays, though it is general only for the very short ones like the violet. These, indeed, will develop fluorescence in all bodies capable of exhibiting this phenomenon at all. The longer waves, on the other hand, only excite fluorescence in some substances. Thus, for example, as already stated, chlorophyl in solution has fluorescence excited by rays of various tints, including those as low as the red; so also with extract of stramonium-seeds in alcohol; so also guaiacum in alcohol, which is excited by rays as low as almost to the orange; turmeric in alcohol, excited by rays as low as the yellow-green; litmus, by rays as low as the red; and similarly with many other bodies as shown by Hagenbach. On the other hand, solution of sulphate of quinine shows no fluorescent action under the influence of any rays lower than the indigo. So likewise with æsculine,

the principle found in the bark of the horse chestnut, with solution of bichlor-anthracene in alcohol, of bisulpho-bi-chlor-anthracenic acid in water, and many others. In each and all of these, however, fluorescence is excited by the violet rays, those rays being pre-eminently fluorogenic.

2d. In most bodies there are several special wave-lengths

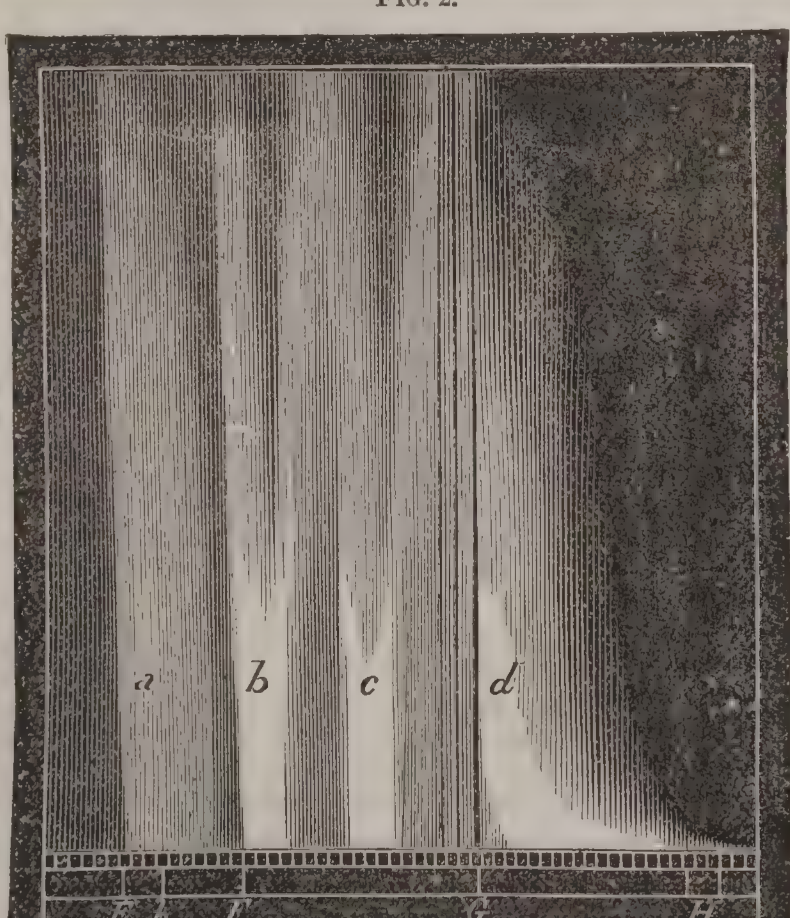
Fig. 1.



which excite fluorescence better than those between. Thus, for example, suppose a continuous spectrum, or one from sunlight, to fall on a screen partly coated with a fluorescent body, as in Fig. 1, where R V represents the solar spectrum falling on the part of a screen covered only with paper, and S T the part painted with a certain fluorescent substance (in this case a hydrocarbon discovered by the present writer in petroleum distillates, and named thallene); then, while the natural spectrum R V would show red at A and B and C, orange at D, green at E, blue at F, indigo at G, and violet fading into darkness at H H, the upper one on the thallene, though corresponding with the other up to F, would show at that part and above only green of various intensity. In other words, all the rays of shorter wave than F would excite green fluorescence in the thallene, but not all equally. The waves of the length corresponding to F would have a more powerful effect than those above until we came to the part between 10 and 10.5 on the scale, where again the waves of these lengths had a powerful effect, lost in turn above until we come nearly to G; and again lost, but recovered with vastly increased power, at 14 of the scale, above which the effect is most powerful and unvaried, as far as any rays at all are obtainable.

Such maxima and minima of excitability in various parts of the spectrum constitute striking features in many fluorescent bodies much studied by Stokes, and yet more fully investigated since by Hagenbach. In the case of liquids, they were likewise examined by Stokes and by Hagenbach, who threw a spectrum on the side of a tank containing the substance. The effect so obtained is often very beautiful. Thus, Fig. 2 shows the appearance given by a solution of

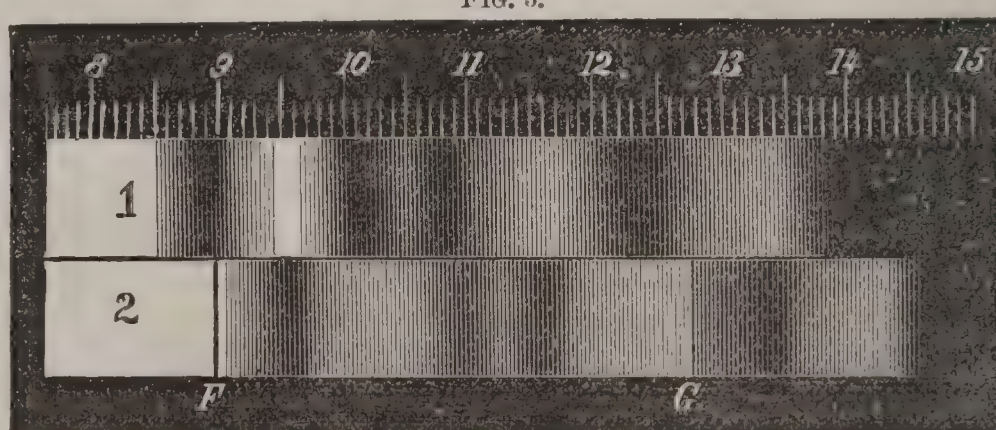
Fig. 2.



thallene in benzole, looking down upon a rectangular tank against one side of which a solar spectrum is thrown. We there see a powerful fluorescence excited by the rays immediately above F, another by those halfway between F and G, and again a strong action above G. As might naturally be expected, where light is thus powerfully active in developing fluorescence it is quickly absorbed, and thus we have the dark blades running in from the opposite side of the tank, which simply indicate that the corresponding rays are absorbed in producing the brilliant streaks *b c* and *d*.

This correlation of absorption and fluorescent excitement is an important fact, much studied by Stokes and also by Hagenbach; and it may in general be stated that in all cases just those rays or waves which most powerfully excite fluorescence are most absorbed; and thus if light which has traversed a fluorescent body is analyzed by a prism or spectroscope, just those rays will be missing which most powerfully excite fluorescence; or, in other words, absorption bands or dark spaces will be found in those parts of the spectrum. Thus, if a thin layer of the substance thallene, whose maxima of fluorescent excitement are shown in Fig. 1, is so placed that sunlight after passing through it is examined with the spectroscope, bands such as are

Fig. 3.



represented in 1 of Fig. 3 will be apparent, and these will be found to correspond exactly with the maxima of fluorescence as given in Fig. 1. 2 of Fig. 3 shows the absorption bands of the solution of the same, whose maxima of fluorescence are given in Fig. 2.

We must not, however, suppose because all fluorescence must have its corresponding absorption, that all absorption has its corresponding fluorescence. There are multitudes of absorbing bodies which have no fluorescence, such as permanganate of potash, salts of didymium, some aniline colors, etc.; and there are also some fluorescent ones, such as the uranic salts, which besides the absorption correlative with fluorescence, have a very complicated selective absorption which has seemingly no direct relation to fluorescence. Thus, the nitrate of uranium shows a broad absorption of all rays above the green, with exception of a narrow part in the lower blue, corresponding to its fluorescence; but besides this it shows eight narrow, regularly spaced dark bands which have no relation to its fluorescence.

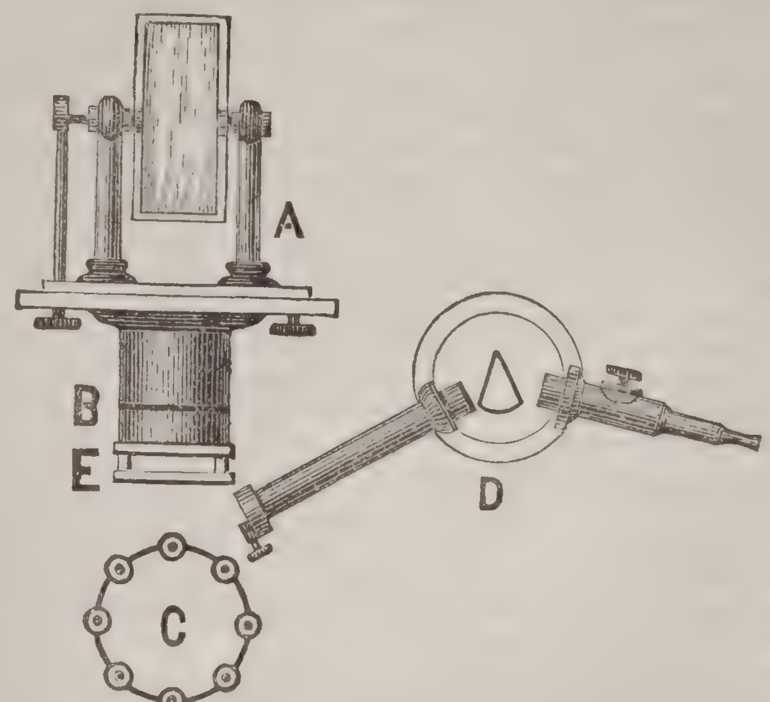
We have thus far considered the relation of the exciting light to the fluorescent body, but there is an equally important department of the subject in the character of the light emitted by the body in its act of fluorescence. In other words, we have seen that certain bodies react with certain waves so as to absorb and re-emit them with new wave-lengths; our attention, however, having thus far been directed only to what wave-lengths would react with the different substances. Now we turn to consider what wave-lengths are produced by this action, or to study the composition of the emitted light of fluorescence.

With many substances this emitted light is composed, like that of luminous hot solids, of an indefinite variety of wave-lengths. In other words, when analyzed by the prism it yields a continuous spectrum or band of blended colors. So is it with the light given by a solution of sulphate of quinine, of æsculine, of stramonium, of morin, etc. With chlorophyl, on the other hand, we have the dispersed light made up almost exclusively of certain red waves, so that, examined with the prism, it shows a red stripe and a very faint green one only. So likewise with the red platino-cyanide of magnesium, whose fluorescent light resolves only into a red band. Yet again, nitrate of uranium yields a green fluorescence, which, however, divides by the prism into seven well-defined stripes, including red, orange, and green tints, but very sharply divided by dark spaces, indicating the absence of waves of certain lengths.

This department of the subject was ably opened up by Stokes, who studied a number of uranium compounds and some other materials in this relation by the use of a prism. Becquerel applied the spectroscope in the same way, as also did Hagenbach, and a yet more extended investigation has been carried out by the present writer by the further

developments of the same methods. The method pursued may be briefly stated as follows: Sunlight is thrown by the mirror of a porte-lumière (A, Fig. 4) through a window

Fig. 4.



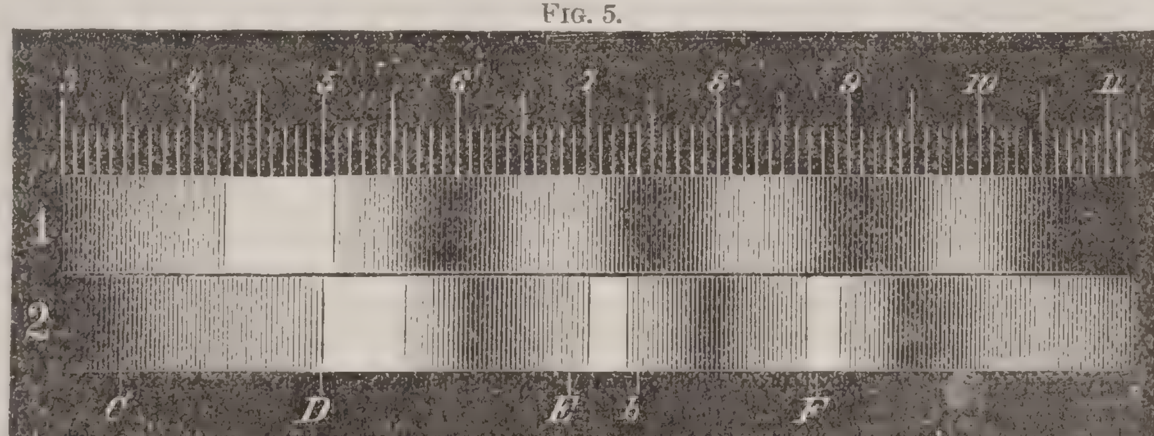
upon a lens at B, in front of which is placed a tank E containing a solution of ammonio-sulphate of copper, by which all but the blue and violet rays are absorbed. At a point where the transmitted rays are most concentrated they fall upon the substance to be examined, which is supported by a revolving table E, which enables the observer to bring various bodies rapidly into identical positions for comparison. The nature of the emitted light is then examined by aid of a spectroscope placed at D.

For example, a portion of thallene being placed as indicated, we see with the spectroscope such a spectrum as is shown at 1 of Fig. 5, consisting of a broad red and yellow band, 3.5 to 5.5; a narrower green one, 6.4 to 7.2; another bluish green, 7.8 to 8.7; and a fainter blue one, 9.5 to 10.3. The spectrum shown at 2 of the same figure is that given by the solution of thallene in benzole.

In a combined research made by the writer and Dr. H. C. Bolton on the uranium salts, a great number of their spectra have been compared, measured, and mapped, of which one or two examples will suffice. Thus, 1 of Fig. 6 shows the spectrum of the fluorescent light emitted by the double oxychloride of uranium and potassium, while 2 of the same figure gives that of the oxychloride of uranium.

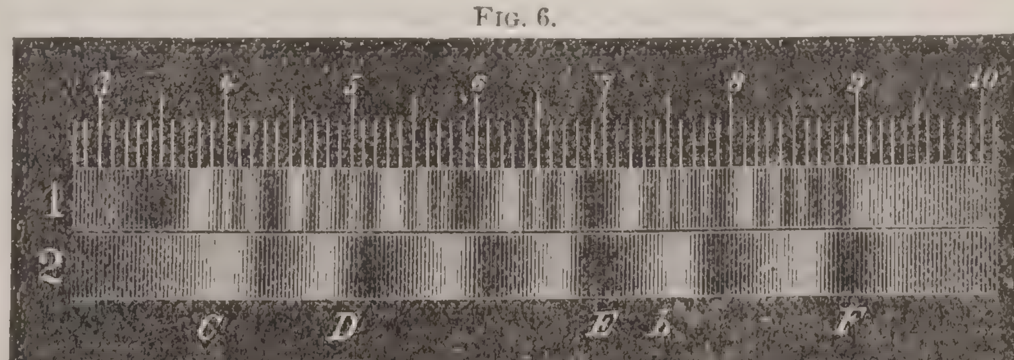
To illustrate one out of many of the applications which have been made of this study of these spectra, one case will

Fig. 5.



suffice. Having heated for a certain time some of the ammonio-uranic sulphate whose normal spectrum is shown at 1 of Fig. 7, the present writer found that it showed the

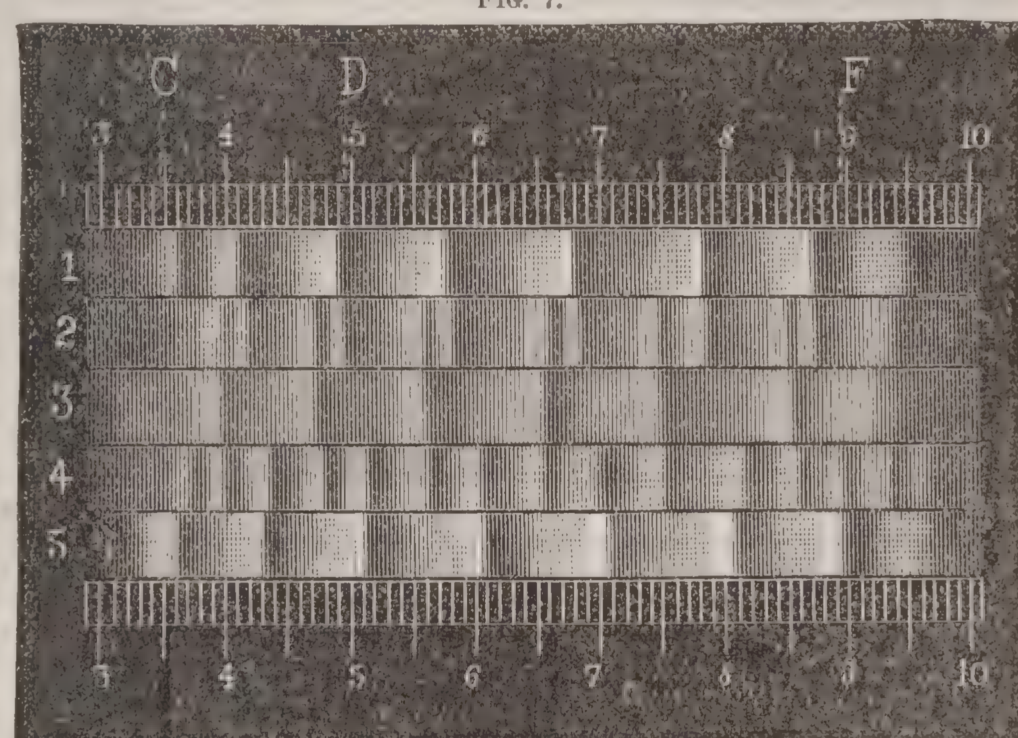
Fig. 6.



spectrum given at 2 of the same figure, in which to the bands of the normal spectrum were added as many more, each located a little farther down than its corresponding band in the first spectrum. Now, it was evident that water was being driven off from the salt in the process of heating, and therefore natural to suppose that these new bands belonged to a spectrum of the anhydrous salt which was being formed in admixture with the other. By continuing the heat until no more vapor escaped, the body was found to yield the spectrum shown in 3 of Fig. 6, which was thus probably the spectrum of the anhydrous salt; and in fact the salt in this state, being submitted to Dr. Bolton for analysis, proved to be the anhydrous ammonio-sulphate of uranium. But this was not all. On further heating to a temperature approaching redness, the spectrum changed to the appearance shown at 4 of Fig. 6, fumes evidently consisting of ammonium sulphate being given off; and on continuing the heat until these fumes were no longer evolved, the spectrum assumed the character shown in 5 of Fig. 6. This material again being submitted to Dr. Bolton, and analyzed by him, proved to be an ammonio-diuranic sulphate, a salt not before known to chemistry.

Fluorescent Phenomena.—Among the more striking phenomena involving fluorescence are the following: By means of a mirror placed outside of a window we reflect a beam of sunlight through a hole in a shutter into an otherwise darkened room. Over this hole we place a sheet of dark violet-colored glass or a tank containing a strong solution of ammonio-sulphate of copper. This will admit none but the violet and actinic rays, and the room will be to the eye almost perfectly dark. If now, however, we

Fig. 7.



place in the line of the violet beam a mass of uranic nitrate, it will blaze out with a magnificent green color, lighting up the whole room. A mass of chromate of potash or ferrocyanide of potassium similarly placed will have no such effect, but will remain dark and dead in the violet rays. Or if into a jar of pure water illuminated as above we throw some fragments of the bark of the horse chestnut, beautiful streams of luminous blue will seem to run down from it as the æsculine it contains dissolves in the water.

A clear and perfectly transparent solution of sulphate of quinine, slightly acidulated with sulphuric or tartaric acid, will under like conditions seem to be opaque, with a *luminous* milky precipitate. Designs drawn on paper with quinine sulphate, invisible in ordinary light, shine out with a phosphorescent luminosity when held in this violet light, and similar drawings made with a varnish thickened with thallene will have a yet more brilliant effect. In place of sunlight, the electric light or that given by burning magnesium may be employed in the same way. By employing muslin of the color of thallene, and attaching to it a design cut from sheets of paper coated with thallene, a screen may be prepared which by gaslight, or the electric light filtered through yellow, green, or red glass, will show no pattern whatever; but when illuminated by the electric light filtered through cobalt blue glass, it will show the thallene design as if on fire on a background as dark in appearance as black velvet.

It is well known that the visible violet rays do not represent the shortest waves existing in sunlight or the electric light, but that if this light is passed through a

prism of quartz, and the resulting spectrum is received on a sensitive photographic film, there will be an impression extending above the limit of the visible violet to a distance many times the length of the whole visible spectrum.

If in place of the sensitive film a screen of some powerfully fluorescent substance is used, these invisible light-waves will be rendered sensible by the fluorescence which they will develop on the screen; and we shall see this greatly elongated spectrum with perfect distinctness. (*Stokes, Phil. Mag.*, 1862, p. 599.) The most effective screens for this purpose are made with the platino-cyanide of barium in a certain state which is very difficult to secure, even with the purest product, or with thallene or an analogous body found in coal-tar distillate, called chrysene.

The violet-colored light produced by a powerful electric discharge in rarefied nitrogen is very rich in fluorescence-exciting rays, and advantage has been taken of this in the construction of certain forms of Geissler tubes (see article on ELECTRICITY for drawings of some of these), in which arrangement is made to pass a discharge through an exhausted tube, which is either made of "canary glass" (glass stained with oxide of uranium), which is a highly fluorescent substance, or the tube itself being of ordinary glass, it is surrounded by a glass jacket which can be filled with a fluorescent solution.

The most powerfully fluorescent bodies known are the following:

Solids:

Thallene, emerald green.
Chrysogen, light green.
Chrysene, yellow green.
Platino-cyanide of barium, uranic salts generally, and especially certain phosphates, double oxychlorides and sulphates, also canary glass, emerald green.
Platino-cyanide of magnesium, red.
Platino-cyanide of potassium, blue.
Solarized thallene (petrolucene), blue.
Anthracene, purplish blue.

Solutions:

Acid quinine sulphate in water, blue.
Alkaline or neutral æsculine in water, blue.
Bichlor-anthracene in alcohol, purple.
Bisulpho-bichlor-anthracenic acid in water, purple.
Extract of stramonium-seeds in alcohol or water, green.
Solution of morin, obtained from fustic or Cuba-wood in water with alum, green.
Alcoholic solution of chlorophyl, best obtained from tea-leaves exhausted with water previously, red.

The above list includes only some of the more brilliantly fluorescing bodies, and might be greatly extended, as can be seen by a reference to the various original investigations quoted above. HENRY MORTON.

Flu′oride of Alu′minum and So′dium (*Cryolite*), $6NaF,Al_2F_6$, a beautiful white mineral found in large quantities in Greenland. It is now extensively employed for the preparation of hydrofluoric acid, of alumina, sulphate of alumina, alum, caustic, and carbonate of soda. Its use for these purposes is a monopoly in the U. S. in the hands of the Pennsylvania Salt Manufacturing Co., which has works at Tarentum, Pa., and at Philadelphia. (For the processes employed see SODIC CARBONATE.) A beautiful opaque white glass, called "hot-cast porcelain," is made by fusing together 30 parts of cryolite, 100 parts of quartz sand, and 10 parts of oxide of zinc. By the aid of metallic oxides a great variety of colors can be given to this, and all the spotted and mottled marbles are thus imitated in a much harder and more durable material. (See GLASS.) C. F. CHANDLER.

Fluoride of Calcium. See FLUOR SPAR, by EDWARD C. H. DAY, M. D.

Flu′oride of Sil′icon, SiF_4, a colorless gas produced by the action of hydrofluoric acid on silica and silicates, as glass, etc. It is best prepared by heating in a glass flask a mixture of fluor spar, quartz sand, and sulphuric acid:

$$(1)\quad CaF_2 + H_2SO_4 = 2HF + CaSO_4.$$
$$(2)\quad SiO_2 + 4HF = SiF_4 + 2H_2O.$$

The gas must be collected in dry receivers over mercury. It is colorless, is very pungent and suffocating, fumes in the air, and has a density of 3.60 (air = 1). In contact with water it is decomposed, forming fluosilicic acid and gelatinous silica—$3SiF_4 + 2H_2O = 2H_2SiF_6 + SiO_2$. The experiment must be very carefully conducted to avoid serious accident. (See FLUOSILICIC ACID.) C. F. CHANDLER.

Flu′oride of So′dium, NaF, obtained by saturating hydrofluoric acid with sodic carbonate. This is probably the cheapest soluble salt of fluorine. According to Jean (*Chem. News*, xvii. 252) it can be prepared very readily by fusing together 100 parts of fluor spar, 140 of calcic carbonate, 200 of sodic sulphate, and an excess of carbon. Water extracts nearly pure fluoride of sodium, leaving an insoluble oxysulphide of calcium. C. F. CHANDLER.

Flu′orine, a non-metallic element belonging to the group which includes chlorine, bromine, and iodine. It occurs abundantly in fluor spar, which is a fluoride of calcium; in cryolite (fluoride of aluminum and sodium), topaz, mica, amphibole, chondrodite, tourmaline, apatite, and numerous other minerals. It is very generally diffused, occurring in all rocks in small quantities. It is also found in almost all waters in minute quantities; in plants, especially in grasses and Equisetaceæ; and in animals in the bones, teeth, brain (*Horsford*), blood, urine, milk, etc. The name fluorine is derived from fluor spar, from *fluo*, to "flow," because this mineral has long been used as a flux.

As early as 1670, Schwankhardt of Nuremberg observed that glass could be etched by fluor spar and sulphuric acid. Scheele in 1771 referred this action to a peculiar acid liberated by the sulphuric acid. Of fluorine in the free state little is known. Fluorides are readily decomposed by chlorine, yielding chlorides. Fluorine is undoubtedly set free at the same time, but as it enters into combination with the material of almost every vessel that can be used to collect it, its isolation becomes a matter of great difficulty. Souyot (*Compt. Rend.*, xxii. 960) decomposed fluoride of silver by chlorine or iodine in a vessel of fluor spar, and obtained a colorless gas which did not bleach vegetable colors, but which decomposed water and attacked most metals. Frémy (*Compt. Rend.*, xxxviii. 393; xl. 966), by decomposing fused fluoride of potassium by the voltaic current, obtained a gas having similar properties. He also obtained a gas which corroded glass by the action of chlorine and of oxygen, on red-hot fluor spar. H. Reinsch (*N. Jahrb. Pharm.*, xi. 1), by heating a mixture of cryolite, plumbic peroxide, and acid potassic sulphate, obtained a colorless gas consisting largely of oxygen, but containing another gas possessing a pungent odor, like that of nitrous acid, which he supposed to be fluorine. Kämmerer (*J. pr. Ch.*, lxxxv. 452), by heating iodine with fluoride of silver, obtained a colorless gas which did not attack glass, could be collected over mercury, and was rapidly absorbed by potassic hydrate. Prat (*Compt. Rend.*, lxiv. 345, 511) claims that fluor spar and other metallic fluorides are oxyfluorides (an old idea), and that by heating fluor spar with potassic chlorate, a mixture of oxygen and fluorine is liberated, from which the fluorine can be absorbed by silver. He also finds that by passing the mixed gases over heated baryta the oxygen is absorbed, leaving the fluorine. He describes the fluorine as a gas heavier than air, nearly colorless, fuming in the air, smelling like chlorine, bleaching indigo, etc. P. Cillis (*Zeitsch. f. Ch.* [2], iv. 660) repeated Prat's experiments, and concludes that his statements are entirely erroneous. From the nature of the compounds of fluorine it is supposed to be a gas, to possess color like chlorine, atomic weight 19, equivalence 1, molecular weight 38, molecular volume 2, density 19 (H = 1), 1.31 (air = 1). One litre weighs 1.7 grammes or 19 criths. Its symbol is F.

The detection of fluorine is effected by decomposing the supposed fluoride with sulphuric acid in a vessel of lead or platinum, and allowing the hydrofluoric acid liberated to act upon glass, which is etched or roughened by it. If silica is present, fluoride of silicon will be evolved. In this case the experiment should be conducted in a test-tube, and the gas passed into water, which decomposes the fluoride of silicon, forming a gelatinous precipitate of silica and hydrofluosilicic acid, which remains in solution. On saturating this with ammonia it is decomposed, with the formation of fluoride of ammonium and a further precipitate of silica. The mixture is filtered, and the clear filtrate evaporated to dryness, and tested with sulphuric acid and glass, as when silica is absent. (*Q. J. Chem. Soc.*, v. 151.) Sullivan gives a delicate method for detecting fluorine in siliceous rocks in the *Lond. and Ed. Phil. Mag.*, xxvii. 229. Nickles (*Compt. Rend.*, xliv. 679) recommends rock-crystal in place of glass, as some other acids corrode the latter. Fluorine may be detected in many minerals by mixing them with phosphorous salt, and heating in an open glass tube with the aid of the blowpipe. Hydrofluoric acid is evolved, which corrodes the tube.

Compounds of fluorine with hydrogen, boron, silicon, sulphur, phosphorus, and nearly all the metals have been described, but none are known with oxygen, chlorine, bromine, or iodine. Solid fluorides have no metallic lustre; most of them fuse readily; when dry they are not decomposed by heat, though many of them are volatile without decomposition. The fluorides of hydrogen, ammonium, tin, and silver are readily, the fluorides of sodium, potassium, and iron sparingly, soluble in water; most of the other fluorides are insoluble in water. Some fluorides, as HF, SiF_4, BoF_3, are gases; TiF_4 is a fuming liquid. Fluorine manifests a strong tendency to form double fluorides;

some of which, containing hydrogen, possess acid properties:

Cryolite	$6NaF,Al_2F_6 = Na_6Al_2F_{12}$.
Fluohydrate of potassium	$HF,KF = HKF_2$.
Borofluoride of potassium	$KF,BF_3 = KBF_4$.
Hydroborofluoric acid	$HF,BF_3 = HBF_4$.
Silicofluoride of potassium	$2KF,SiF_4 = K_2SiF_6$.
Hydrofluosilicic acid	$2HF,SiF_4 = H_2SiF_6$.

This tendency of fluorine to form double salts has suggested the idea that it is diatomic and analogous to oxygen, with an atomic weight of 38. This theory would make hydrofluoric acid, H_2F, like water, H_2O. The two salts of potassium would be K_2F and KHF, corresponding to K_2O and KHO. The theory, however, which is generally accepted, considers fluorine as monatomic, with an atomic weight of 19, and analogous to chlorine. The investigations of Gore (*J. Chem. Soc.* [2], vii. 368) confirm the latter theory. C. F. CHANDLER.

Fluor'otype, a photograph taken upon paper treated with a compound containing fluoride of sodium or some other equivalent fluoride. This process was brought forward by Mr. Robert Hunt in 1844. (See PHOTOGRAPHY, by PROF. C. F. CHANDLER, PH. D., LL.D., M. N. A. S.)

Flu'or Spar, Flu'or, or **Flu'orite** [from *fluo*, "I flow," in allusion to its use as a flux in metallurgical operations], a mineral composed of fluoride of calcium (F48.7%, Ca51.3%). It crystallizes in the monometric system (in cubes, octahedra, etc.), and has a perfect octahedral cleavage. Its hardness is 4 (see HARDNESS), and its specific gravity 3.18. It occurs frequently very perfectly crystallized, and of beautiful and bright colors; pulverized, it becomes below a red heat brilliantly phosphorescent. It is sometimes carved into ornaments, and is used in the arts as a source of hydrofluoric acid for etching, and, as above stated, as a flux. EDWARD C. H. DAY.

Fluosil'icates, salts formed by replacing the hydrogen in fluosilicic acid by metals. (See FLUOSILICIC ACID.)

Fluosilic'ic (Hydrofluosilic'ic or **Silicofluor'ic) Acid,** $2HF.SiF_4$. This acid is formed by the action of water on the fluoride of silicon—$3SiF_4+2H_2O=2H_2SiF_6+SiO_2$. As the gelatinous silica formed would quickly close a moist delivery-tube, it is necessary to arrange the apparatus in such a manner as to prevent the contact of the gaseous SiF_4 with water before it is clear of the end of the tube. The flask containing the mixture of fluor spar (or cryolite), quartz sand, and sulphuric acid (see FLUORIDE OF SILICON) is provided with a delivery-tube which dips beneath the surface of mercury, above which the water is placed. The gas passes through the mercury, and on reaching the water is decomposed. The silica set free forms an envelope round the bubble of gas as it rises through the water, often forming a complete tube to the surface of the water. Finally, the liquid becomes thick and gelatinous from the separated silica. By squeezing in linen, and finally filtering through paper, the acid is rendered clear. According to J. Lawrence Smith (*Reports U. S. Com. to Paris Exp.*, 1867), Du Motay and others have simplified the manufacture of this acid to a degree which will extend its use to many important industries. A mixture of fluor spar, alumina, silica, and carbon is made into bricks and melted in a blast furnace. Fluoride of silicon is evolved, and a fusible slag is from time to time drawn from the furnace. The gas is conducted through a series of five wooden chambers, containing inclined shelves of glass which are moistened by a spray of water. Silica is deposited at the bottom of the chambers, and the acid solution passes from chamber to chamber, and may thus be concentrated to between 5° and 10° B. (1.034 to 1.070), equivalent to from 4 to 8½ per cent. of acid. The acid thus prepared costs about four times the price of its equivalent quantity of sulphuric acid. Hydrofluosilicic acid is a sour, fuming liquid, which can be evaporated in platinum vessels without leaving a residue. It does not attack glass except when evaporated in it, when fluoride of silicon is first given off, leaving hydrofluoric acid, which corrodes the glass. Stolba has given (*J. F. pr. Ch.*, xc. 193) a table showing the percentage of acid in solutions of different densities from 0.5 to 34 per cent. The following are a few of the figures: 1.004 = 0.5 per cent.; 1.008 = 1; 1.0161 = 2; 1.0407 = 5; 1.0834 = 10; 1.1281 = 15; 1.1748 = 20; 1.2235 = 25; 1.2742 = 30; 1.3162 = 34. Chloride of barium gives a crystalline precipitate, BaF_2,SiF_4, in solutions of the acid; chloride of potassium, a transparent gelatinous precipitate, $2KF.SiF_4$. When ammonia is added to the acid, even with the greatest care, a portion of the acid is decomposed, with the precipitation of silica, while the rest is changed to the ammonium salt, $2NH_4F,SiF_4$: $2HF,SiF_4 + 6NH_4HO=6NH_4F+SiO_2+6H_2O$. A similar decomposition occurs whenever the acid is neutralized by a base. In the laboratory the acid may be used as a test for barium and potassium. In the arts it is suggested as an agent for removing potassa from sugar and syrups in sugar-refining, especially when beet-sugar is employed, which contains much potassa, which interferes with the operations of refining. It may also be used for making chloric acid from chlorate of potassa. It is proposed to make it the agent for preparing useful salts from the chloride of potassium, found at Stassfurt. The acid, being added to a solution of this salt, precipitates silicofluoride of potassium, setting free hydrochloric acid—$2KCl + 2HF,SiF_4 = 2KF,SiF_4 + 2HCl$. This salt can be used as a substitute for borax, and in place of carbonate of potassa in making flint glass. It is sold in France at 10 cents a pound. It can be converted into caustic potassa by first heating in retorts, when fluoride of silicon is driven off, to be again converted into hydrofluosilicic acid, and fluoride of potassium remains behind. This salt is readily decomposed by lime or carbonate of lime, forming caustic or carbonate of potassium and fluoride of calcium, to be used again. Thus, the acid becomes a mere agent, to be used again and again to extract potassa from the native chloride. (See articles on this acid and its applications in WAGNER'S *Jahresberichte*, 1865, p. 277; 1867, p. 221; 1869, pp. 330, 417; 1870, p. 206.) C. F. CHANDLER.

Flush'ing [Dutch, *Vliessingen*], seaport of the Netherlands, in the province of Zealand, strongly fortified. It is situated on the island of Walcheren, at the mouth of the Western Scheldt, and in connection with the ports of Rammekens and Breskens, it commands the entrance of the Scheldt. It has an excellent harbor and extensive dockyards. Pop. 11,800.

Flushing, tp. and post-v. of Genesee co., Mich. Pop. of v. 687; of tp. 1919.

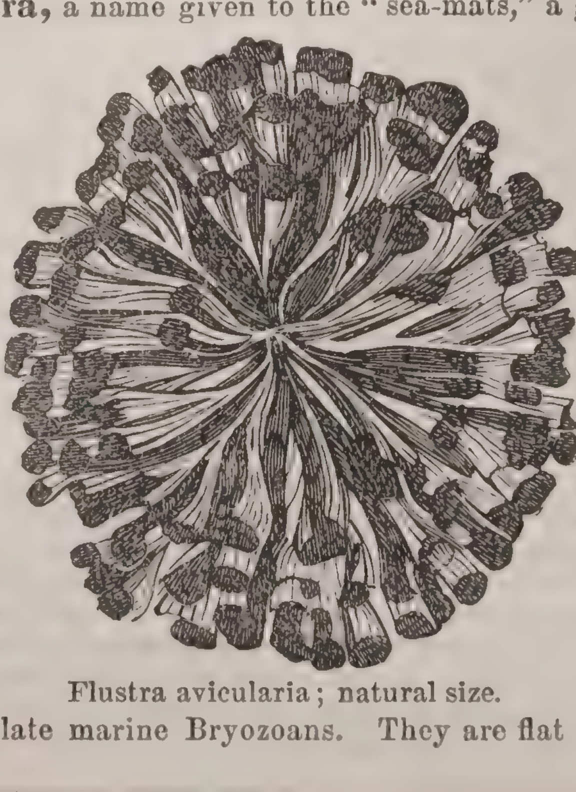
Flushing, a post-v. and tp. of Queens co., N. Y., at the head of Flushing Bay, 7 miles from New York City, to which it has half-hourly trains by the Flushing and the Flushing and North Side R. Rs., also steamboat communication. It has 1 State and 1 savings bank, several institutions of learning, an infant asylum, 8 churches, 3 newspapers, and the modern improvements, including gas and water. Gardening, the nursery business, and fruit-raising are leading pursuits. It is a handsome and rapidly-growing town. Pop. of v. 6223; of tp. 14,650. W. R. BURLING, PUB. "TIMES."

Flushing, tp. and post-v. of Belmont co., O. Pop. of v. 206; of tp. 1484.

Flus'ser (CHARLES W.), U. S. N., b. Sept. 27, 1833, in Annapolis, Md.; graduated at the Naval Academy in 1850; became a lieutenant in 1855, a lieutenant-commander in 1862. In 1862 commanded the Commodore Perry at the capture of Roanoke Island, in the action with the enemy's gunboats and batteries at Elizabeth City—where he "took the flagship Sea Bird in gallant style, running her down and sinking her"—and in a severe engagement near Franklin, Va. In 1863 participated in various skirmishes in co-operation with the army, and on Apr. 19, 1864, fell mortally wounded on the deck of the Miami, a wooden vessel, in an encounter with the iron-clad ram Albemarle, near Plymouth, N. C. His eulogy is written by Rear-admiral Lee in these words: "Lieutenant-commander Flusser was killed on the deck of the Miami in a night-action with a ram. This brave officer was a native of Maryland and a citizen of Kentucky. His patriotic and distinguished services had won for him the respect and esteem of the navy and the country. He was generous, good, and gallant, and his untimely death is a real and great loss to the public service."

FOXHALL A. PARKER.

Flus'tra, a name given to the "sea-mats," a genus of



Flustra avicularia; natural size.

infundibulate marine Bryozoans. They are flat and leaf-

shaped, and are generally confounded by the uninstructed with pale brown sea-weeds. But each leaf-like body consists of a mass of horny cells; and if the living frond be placed in a vessel of sea-water, many little tentacles may be observed playing briskly about. The genus belongs to the order Gymnolæmata, sub-order Chilostomata, group Radicellata, family Flustridæ.

Flute [said to be from the Lat. *fluta*, a "lamprey," which has seven holes upon its side, to which the holes of a flute were likened], a musical instrument made of ebony, box, ivory, or silver, and consisting of a tube closed at one end, and having one large hole on the side, into which air is blown directly from the lips or through a mouth-piece. It is generally made with three joints or in four pieces, has six finger-holes, and a variable number of keys which open or close other holes. Flutes are made with various compass of sound, those of the highest register receiving the name of piccolo. The flutes of ancient Egypt, Chaldæa, Greece, and Rome were blown into at one end. The emperor Nero was a famous flute-player, and won 1800 prizes by his skill, or more probably by the subserviency of his subjects. Ptolemy (XI.) *Auletes*, a depraved king of Egypt, was so named for his skill in flute-playing.

The nose-flutes of the South Sea Islanders are flageolets, or straight pipes, into one end of which the performer blows through the nostril.

Fluvan'na, county of Virginia, bounded on the S. by the James River. Area, 170 square miles. A portion of the surface is broken and sterile, but the remainder is fertile, producing grain and tobacco. Cap. Palmyra. Pop. 9875.

Flux [Lat. *fluo*, to "flow"], a substance or mixture used to promote the fusion of bodies. Limestone is the usual flux for ores of iron in the blast furnace; it unites with the alumina and silica of the ore, forming a fusible slag. To flux silica and silicates, alkaline or basic fluxes are selected, as carbonate of soda or potassa, litharge, lime, or carbonate of lime; fluor spar is very effective. For lime, alumina, oxide of iron, etc. acid fluxes are selected, as borax, silica, glass, etc. Nitre and litharge are both oxidizing agents and fluxes, while cyanide of potassium is a reducing agent as well as a flux; it frees metals, such as lead, from sulphur and from oxygen. *White flux* is a mixture of carbonate, nitrite, and nitrate of potassa, prepared by projecting a mixture of equal parts of nitre and argol or crude cream of tartar into a hot crucible in successive small portions. It is an oxidizing flux. *Black flux* is prepared of the same materials and in the same manner as white flux, but the quantity of argol employed is double that of the nitre. As this proportion of nitre is not sufficient to completely oxidize the carbon of the argol, the mixture contains only carbonate of potassa and carbon. It consequently reduces metallic oxides by the union of the carbon with the oxygen. *Morveau's reducing flux* is composed of 16 parts of window-glass, 2 of calcined borax, and 1 of charcoal. *Flux for colored flames* before the blowpipe.—To enable the lithium, sodium, potassium, strontium, copper, etc. contained in minerals to color the blowpipe flame, Poole recommends a flux composed of 1 part of fluor spar and 2 parts of sulphate of lime (selenite). *Deflagrating fluxes*, for decomposing silicates, are very convenient in qualitative analysis, as they enable the student to do without the platinum crucible. For the detection of alkalies a flux composed of nitrate of baryta and charcoal is prepared. This is mixed with the finely pulverized mineral, placed on a plate of sheet iron, and fired with a match. On treating the residue with water a solution will be obtained which can be tested as usual for potassa and soda. For the detection of other bases a flux composed of carbonate of soda, nitrate of soda, and charcoal is employed; the residue, after deflagration, being treated with hydrochloric acid, evaporated to dryness to render the silica insoluble, moistened with hydrochloric acid dissolved in water, filtered, and tested for bases as usual. This flux may also be used for the decomposition of insoluble sulphates of barium and strontium. On treating the residue after deflagration with cold water, and filtering, the sulphuric acid will be found in the filtrate, and the bases on the filter as carbonates. C. F. CHANDLER.

Fluxions. See FLUENTS AND FLUXIONS, by PROF. W. G. PECK, LL.D.

Fly, a name applied to many insects, mostly belonging to the order Diptera, and more especially to the families Muscidæ (house-flies, flesh-flies, blow-flies, etc.) and Œstridæ (bot-flies). The common house-fly (*Musca domestica*) is universally prevalent. Flies, though often a serious annoyance, are extremely useful as scavengers and preventers of disease. Many species, especially in hot countries, inflict severe and sometimes dangerous bites upon men and beasts.

Fly-Catchers, a name applied at first to birds of the genus *Muscicapa*, now applied to a large number of American birds, none of which are of the above genus. They are assigned to the Tyrannidæ and other families of the section Clamatores or shrieking birds, and the order Passeres. They are distributed in many genera. These birds all have the habit of lying in wait until insects come near them, when they dart upon them with wonderful quickness. The *Tyrannus Carolinensis*, or king-bird, is one of the best known. The Savannah fly-catcher, *Milvulus Savanna*, is found in the Southern States.

Fly Creek, post-v. of Otsego tp., Otsego co., N. Y., has 3 churches, a machine-shop, foundry, and manufactures of agricultural tools.

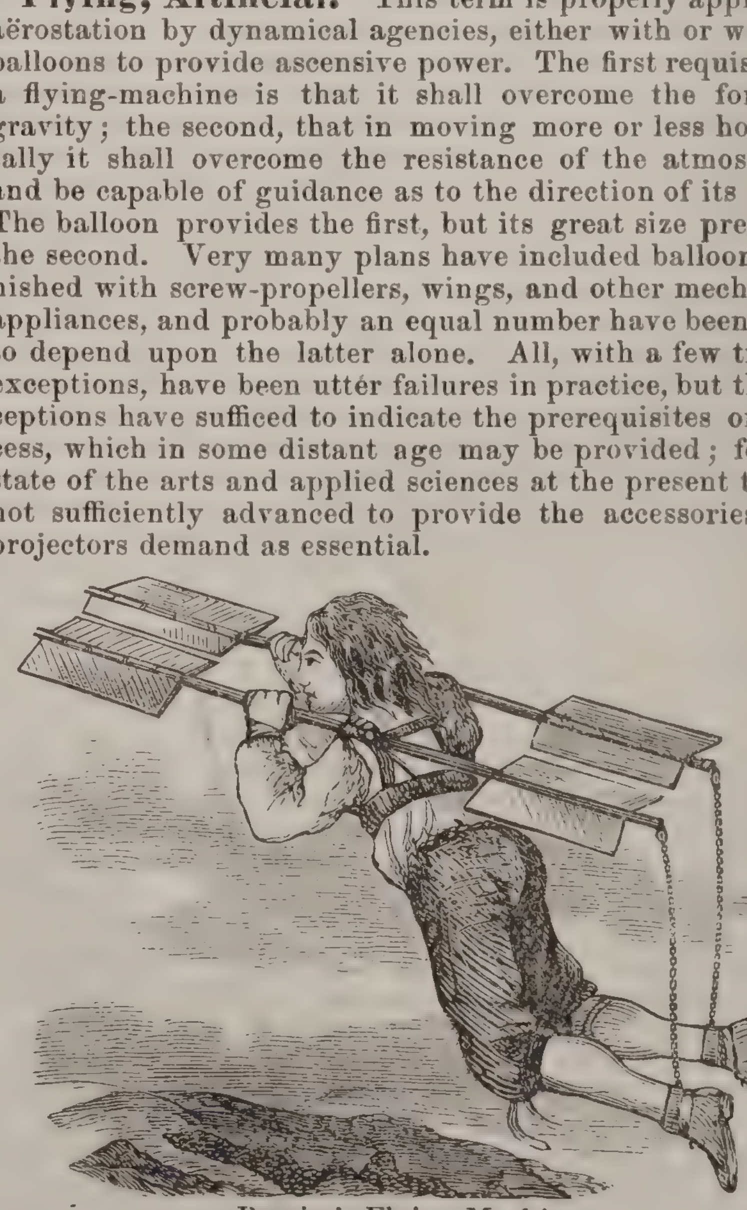
Flygare (EMILIE). See CARLÉN, E. F.

Fly'ing, the motion of a living animal through the air when propelled by its own wings. Among vertebrates, most birds and all the bats possess, and the pterodactyl and some other fossil reptiles once possessed, the power of flight. It is probable that flying fishes also have a limited power of true flight, the pectoral fins serving as wings. Many insects also have the power of flying, but their wings, though functionally analogous, are not structurally homologous to those of vertebrates. In the latter the wing is the representative of the arm and hand or anterior limb of other vertebrates. The so-called flight of the flying squirrels, flying dragons, etc. is by no means a true flight. The parachutes (not wings) of these animals enable them to glide safely through the air, simply prolonging the leap of the creature, or at most joining to a parachute-action that of a sail or a kite.

The *mechanics* of flying is not yet well understood. In some birds the shape of the quills is such that at the stroke of the wing the greatest possible surface is opposed to the air; while in the *recovery*, or expansion of the wing, the edge of the quill-feather is opposed to the air. Bats are thought to partially fold the wing during the recovery, and the same may be true of some insects, and even birds. The more rapid closure of the wing also secures a greater resistance from the air during the stroke than can be offered during the expansion of the wing.

There are many varieties of flight among birds; of these among the most remarkable is the sailing motion, in which the wings are but slightly moved. There is considerable doubt as to the means by which such birds as the condor and albatross can maintain their long and almost motionless poise in the air.

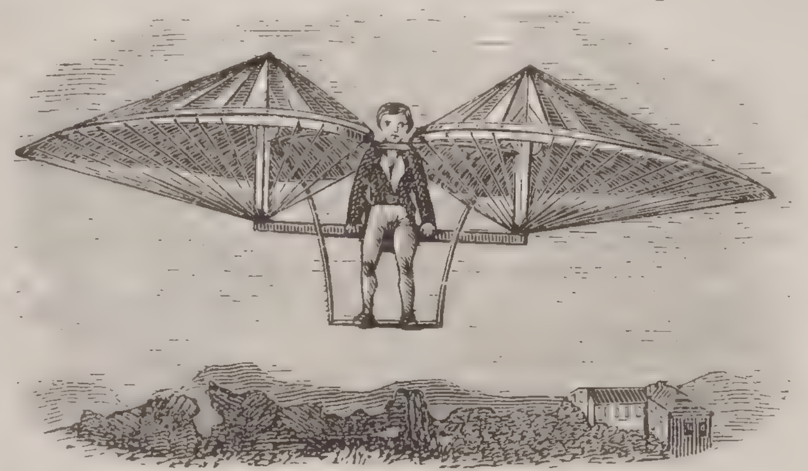
Flying, Artificial. This term is properly applied to aërostation by dynamical agencies, either with or without balloons to provide ascensive power. The first requisite of a flying-machine is that it shall overcome the force of gravity; the second, that in moving more or less horizontally it shall overcome the resistance of the atmosphere, and be capable of guidance as to the direction of its flight. The balloon provides the first, but its great size precludes the second. Very many plans have included balloons furnished with screw-propellers, wings, and other mechanical appliances, and probably an equal number have been made to depend upon the latter alone. All, with a few trifling exceptions, have been utter failures in practice, but the exceptions have sufficed to indicate the prerequisites of success, which in some distant age may be provided; for the state of the arts and applied sciences at the present time is not sufficiently advanced to provide the accessories that projectors demand as essential.



Besnier's Flying-Machine.

The first authentic account of a flying-machine that operated at all is that of one Besnier, a locksmith of Sablé, France. As nearly as can be ascertained from the imperfect record left by him, his apparatus comprised four rect-

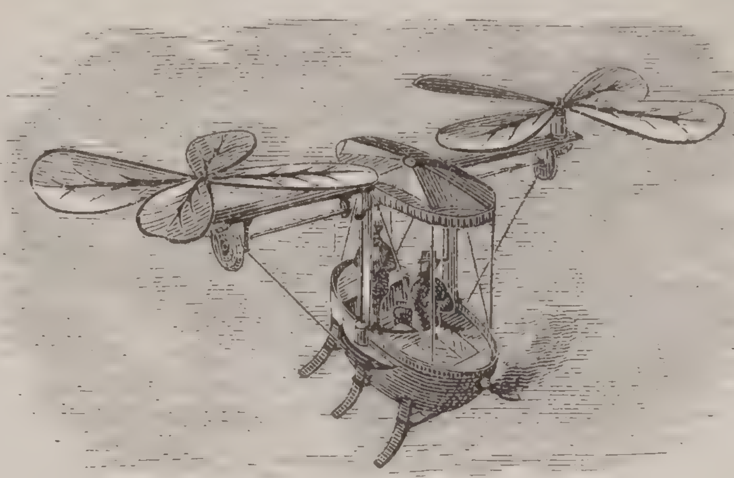
angular wings arranged in pairs at opposite ends of two rods passing over the shoulders, the rear extremities of the rods being connected by cords to the ankles of the wearer, to enable the legs to assist the arms in giving a vibratory movement to the rods, and consequently to the wings. Besnier was not enabled to rise direct from the ground, but by starting from an elevation he flew across rivers of considerable width, and a pair of wings which he sold to another was used with a similar success. This was in the latter part of the seventeenth century. About a century and a quarter later one Jacob Degen, a prisoner at Vienna, constructed an apparatus having two umbrella-like wings of large area worked by manual power. With this machine he rose to a height of fifty feet, as measured by a cord attached to prevent escape and held by the jailer. This was done in two minutes' time, but the effort quite exhausted the strength of the adventurous mechanic. These experiments of Besnier and of Degen are perhaps the most



Jacob Degen's Flying-Machine.

notable on record of those in which muscular power alone has been employed. Both comprised wings attached to the body, in substantial imitation of those of a bird; and the futility of all such devices is shown by the fact that while the pectoral muscles of a bird exceed in weight all the other muscles, in man they form but one-seventieth part of the whole, and no assistance from the legs can compensate the enormous disproportion. Hence, artificial flying, if ever practised, must depend primarily upon motive-power in lieu of physical energy.

Before proceeding to the consideration of the flying-machines devised or tested in this country, we may fitly consider those of England, where projects looking to the navigation of the air antedated somewhat the earlier American experiments, though no more successful than the latter. In 1815, Messrs. Pauly and Egg secured the first British patent for an aërial machine. In this a balloon of fish or bird-like form was to have "wings or fins" and a "tail," which were to be of silk stretched upon whalebone strips fastened to operating staves. The inventors also proposed to use the fins and tail without the balloon. Eleven years later, James Viney and George Pocock obtained a patent for the use of kites for "raising weights or persons in the air." In 1840, Moses Poole suggested propellers for moving "vessels floating in the air." Two years later, William Henson brought forward a most elaborate scheme for artificial flying, which attracted much attention at the time, the bill to incorporate a company to work the machine having been introduced in the House of Commons by Mr. Roebuck. The apparatus was to carry "letters, goods, and passengers." It comprised a horizontal plane composed of wire and hollow wooden bars, arranged on the principle of a trussed girder and covered with silk. This plane was furnished with propellers driven by a steam-engine. A tail capable of being brought to any desired angle to the horizontal was arranged, to quote the inventor, "so that when the power acts to propel the machine, by inclining the tail upward the resistance offered by the air will cause the machine to rise, and when the tail is reversed the machine is propelled downward, and passes through a plane more or less inclined to the horizon as the inclination of the tail is greater or less." The machine was to be guided laterally by a vertical rudder. The engine, passengers, freight, and fuel were to be located in a car placed midway in the plane. The apparatus entire would weigh about 3000 pounds, the horizontal plane or silk-covered frame was to have an area of 4500 square feet, and the tail to have 1500 square feet. A high-pressure copper boiler of peculiar construction was to furnish steam to the engine, the latter being, moreover, provided with a condenser, in which condensation was to be effected by air-currents instead of water. It was not expected that the ponderous machine would lift itself from the ground, but it was to be started from an elevated point by running down hill on wheels upon a suitable track until the plane, being caught and buoyed up by the atmosphere underneath, should be floated off into space, whereupon the propellers would be put in operation to keep it in motion when once fairly launched. Five years later, two propellers, arranged to

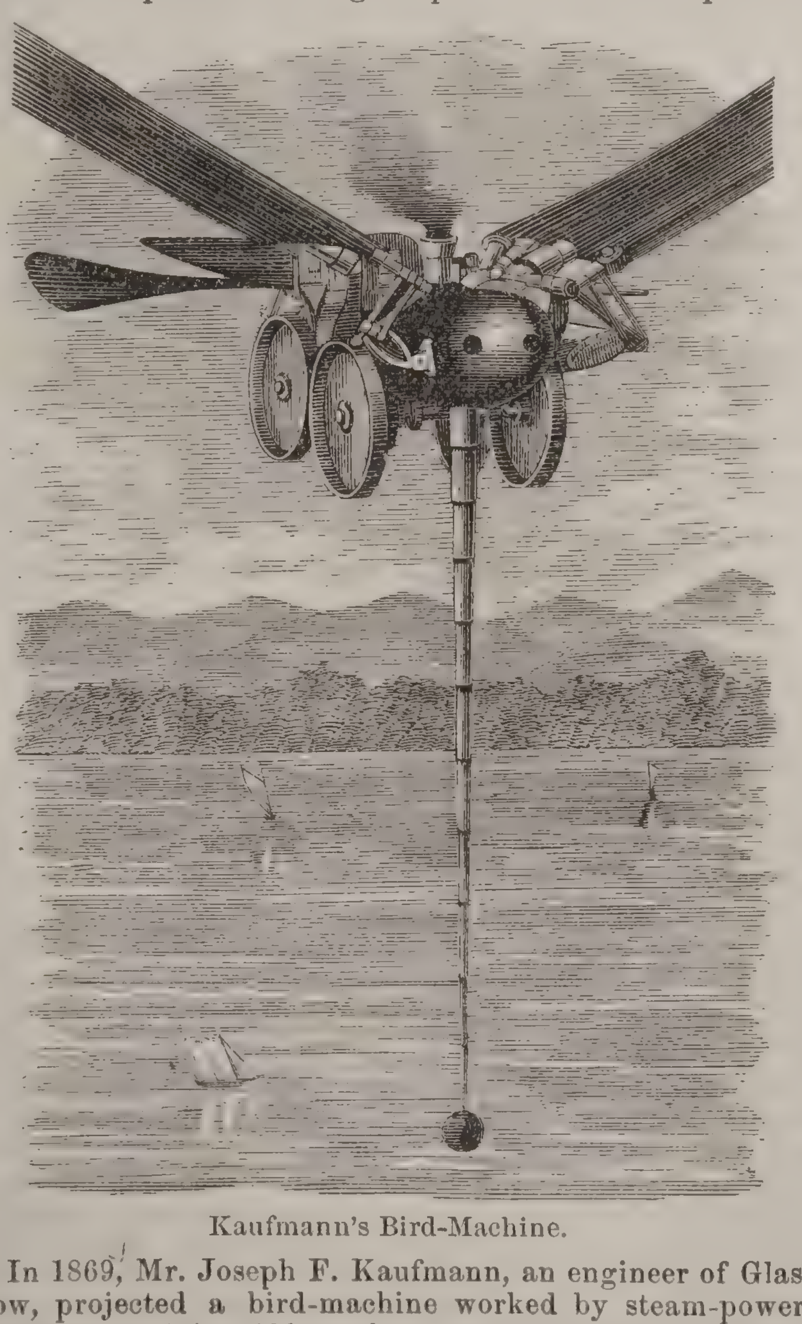


"Two-Propeller" Flying-Machine.

work in opposite directions at the front and stern of an aërial carriage—a system since revived in various shapes —were proposed by Von Hecke. In 1853, J. H. Johnson patented, as a communication from abroad, an elongated balloon used in connection with "parachute or umbrella-shaped propellers," which opened when pushed against the atmosphere, and closed when retracted, being simply a modification of the well-known duck's-foot propeller tried on vessels in the infancy of steam navigation; this apparatus was to have triangular sails fore and aft to prevent it from rolling, and ballast was to keep it at any desired angle to the horizontal. In 1861, J. S. Phillips applied for, but did not obtain, provisional protection on "the propulsion of a plane against the atmosphere" by means of feathering paddles fixed on the peripheries of revolving wheels, the paddles being made of flexible material, and collapsing during one-half of their revolution, and opening against the atmosphere during the other half.

These examples illustrate the drift of invention in England, as relates to artificial flying, previous to the year 1866, when renewed interest was given to the subject by the organization of the Aëronautical Society of Great Britain, under the presidency of the duke of Argyll. Of course, a much larger number than here described were patented anterior to 1866, and of these twenty-two were designed to work wholly by mechanical means, and twenty by such means in conjunction with balloons. Of these, again, sixteen had propellers, eighteen were provided with rudders, ten specified steam as the motive-power, twenty-four were to have wings, and in eight tails were essential to their equipment. Of course, several of these devices were shown in one and the same apparatus. The plans evolved before the Aëronautical Society were for the most part revivals of previous systems, but the discussions led to the formulation of numerous data that, perhaps, may be of use as the basis of calculations for future machines. According to elaborate estimates of the ratio that should exist between the surface of an aërial machine, made by Mr. Thomas May, a machine with one horse-power of propelling power should have 1.455 square feet of sustaining surface, with an average weight of one and one-tenth ounces to the square foot. By increasing the power to that of four horses, with the same weight of machine (100 pounds), 91 square feet, with an average of $17\frac{1}{2}$ ounces to the foot, would be required. This has reference, of course, to the area of a plane; and the deductions are followed up by the same writer by others concerning speed at different angles to the horizon, as follows: "Supposing, first, that the angle is 45° to start with, and the speed 10 miles an hour, the thrust (of the propeller) would be equal to the load, 100 pounds; but as it gathers way the thrust decreases, and when going 17 miles an hour the angle would be reduced to 30° and the thrust to 58 pounds; going on again to 27 miles an hour, the angle would be reduced to 20° and the thrust to 36.7 pounds; and still further increasing the speed to 59 miles an hour, the angle would be 10° and the thrust only 17 pounds." The greater angle and greater thrust with the lower speed would be the necessary incidents of rising at the start. Another member, Mr. Harrison, proposed to propel the inclined plane by an apparatus resembling a velocipede, and suspended from the plane, the front wheel to actuate two propellers rotating in opposite directions, in order that their operation should not twist the machine around, and located one on each side of the rider. But, as we have seen, no mere muscular power can be sufficient for the work, and hence the vital necessity of a motor that shall combine great power with little weight. The efforts of the society to secure such an engine led to the construction of at least one steam-engine of remarkable lightness in proportion to its power, but its durability may be questioned. It received the prize of £100 at the exhibition of the society in 1868, and was probably the lightest ever

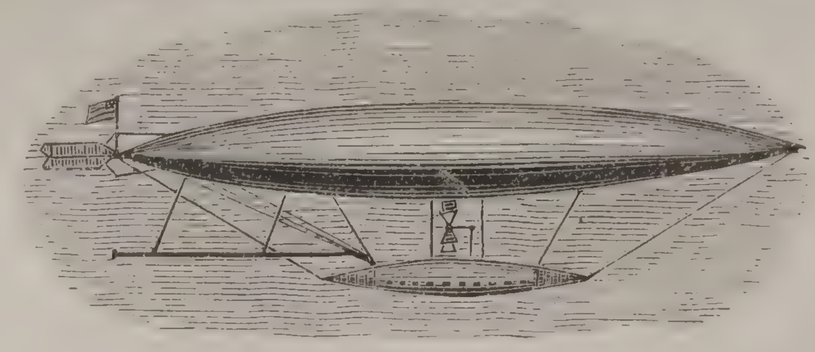
made. The following sketch is from the London *Mechanics' Magazine:* "The cylinder was 2 inches in diameter, stroke 3 inches, and it worked with a boiler pressure of 100 pounds per square inch, the engine making 300 revolutions per minute. In the jurors' report the data for estimating the power are taken as follows: Area of piston, 3 inches; pressure in cylinder, 80 pounds per square inch; length of stroke, 3 inches; velocity of piston, 150 feet per minute; $3 \times 80 \times 150 = 36,000$ foot-pounds. The weight of the engine and boiler was only 13 pounds. The engine, boiler, car, and propellers together were afterward weighed, but without water and fuel, and were found to be 16 pounds." The ratio of weight to power in this engine is remarkable, but probably strength was sacrificed to lightness; and even under the most favorable conditions the weight would doubtless have to be somewhat greater. But the advance is manifestly great when it is remembered that the engines proposed for Henson's flying-machine were calculated to weigh 150 pounds per horse-power. The load of fuel and water would be a serious drawback, but it is just within the bounds of possibility that liquid hydrocarbons for the one and air-condensers for the other would obviate the excessive load. Another member, Mr. A. Alexander, C. E., made the following estimate, based on the flight of a pigeon weighing two pounds: "180 completed strokes per minute, the centre of pressure of wings moving 9 inches, or per complete stroke 1 foot 6 inches; then 1.5 feet $\times$ 180 strokes $= 270$ feet, and $270 \times$ weight of bird, or 2 pounds $= 540$ foot-pounds. This in a minute is 0.0163 horse-power, and hence, if the proportion is to be maintained, one horse-power must not weigh over 122 pounds." Allowing 15 per cent. for loss in transmission, the permissible weight would be reduced to 103.7 pounds per horse-power, including, of course, fuel, water, aërostat, and load. Mr. Alexander advocated screw-propellers as equivalents of vibratory wings, and his calculations appear to have had special reference thereto. In commenting upon Mr. Alexander's paper, Mr. Wenham gave the results of his own observations of the pelican, a bird whose wing-strokes can be readily counted. The number of strokes being 70 per minute, and having at the middle of the wing a sweep of 2 feet, the weight of bird 21 pounds, $70 \times 2 \times 21 = 2940$ foot-pounds, or $\frac{1}{11}$ of 1 horse-power—about one-half that of a man. According to this estimate, 1 horse-power should sustain 231 pounds in a flight equal to that of the pelican.



Kaufmann's Bird-Machine.

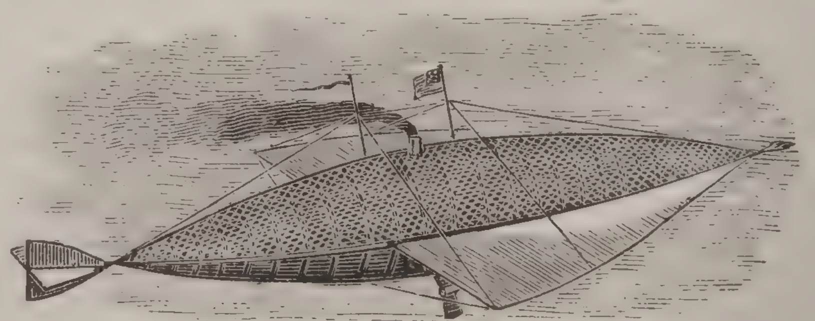
In 1869, Mr. Joseph F. Kaufmann, an engineer of Glasgow, projected a bird-machine worked by steam-power, with wings giving 120 strokes per minute, and a pendent weight designed to keep the machine in equilibrio when elevated in the air. Lateral guidance was to be had by means of a flat rudder answering to the tail of a bird.

The first projector of flying-machines of any note in the U. S. was Rufus Porter, who at the date of the present



Rufus Porter's Aëroport.

writing (Nov., 1874) is still living at New Britain, Conn., at upward of fourscore years of age. He claims to have conceived the main features of his "aëroport" in the year 1820, but it was not until 1833 that a working model was constructed. This was at Bristol, Conn. Fourteen years afterward he made another, which was exhibited in New York City. These were actuated by springs connected with propellers. About the same time, or a little later, he proceeded to Washington, D. C., and constructed a working model operated by steam. Porter's apparatus, it must be explained, comprised a cigar-shaped balloon, with a car or saloon suspended underneath, the car carrying the motive-power for propelling the whole. The Washington model had a balloon twenty-two feet in length and four feet in diameter. It was made of fine oiled silk stretched upon an internal skeleton or frame consisting of twelve rods three-eighths of an inch in thickness, and joined at their ends to form the pointed extremities of the balloon. The saloon, three feet below the balloon, was suspended therefrom by cords, and was seven feet long, ten inches in diameter, furnished with a row of miniature windows in each side, and, except that it was square in its cross-section, conformed on a smaller scale to the shape of the balloon. The machine was provided with a pair of screw-propellers, and with "a four-leaved rudder;" in other words, one having its cross-section thus, +. This model rapidly made the circuit of the hall in which it was tested in Washington. Soon after this it was publicly tried in the Merchants' Exchange in New York City, and, as one of the journals of the day declared, "made the circuit of the rotunda eleven times like a thing instinct with life." At a still later date the inventor built what would have been a full working machine had it ever been quite completed. It was 160 feet long, the balloon being 16 feet in diameter at the centre and made of varnished linen; the car or saloon was 60 feet in length and 8 in diameter, and contained, within a chamber 6 feet by 5 in horizontal area, the steam-engine designed to furnish motive-power to a pair of six-bladed propellers, connecting with the engine by endless-chain belts. The rudder was four-leaved, as in the smaller models, and capable of vertical or horizontal adjustment by four steering lines extended to and within the saloon. The buoyant power of this apparatus, over and above its own weight, would have been 700 pounds had it, as was intended, been filled with hydrogen gas. But it failed, because it was found impossible to prevent the leakage of the hydrogen to an extent that wholly destroyed the lifting power of the balloon. The production of a varnish practically impervious to the thinner gases, notably of hydrogen itself, is one of the most important problems yet to be solved before the balloon, either alone or in conjunction with operating mechanism, will develop its fullest utility.



Marriot's Avitor.

In 1869, Porter's cigar balloon, with certain additions, was revived at Shell Mound Lake, Cal., by Mr. Frederick Marriot, who termed it the "Avitor." The balloon had a length of 37 feet and a diameter of 8, and, like that of Porter, tapered to points at the ends. It was surrounded by a longitudinal frame of wooden strips firmly wired together, the frame being attached in position by bands and straps. This frame was provided at its forward half with two laterally projecting wings, and at the rear was furnished with the four-leaved rudder, and at the sides by two propellers operated by a small steam-engine. This apparatus worked well in a still atmosphere, but proved a failure in brisk winds.

Another American flying-machine was that devised by

S. P. Andrews, and tried with uncertain results in the vicinity of New York about the same time that the Avitor was the subject of experiment in California. In this the balloon comprised three cylindroids with pointed ends (each cylindroid 100 feet long and 20 in diameter) secured in position side by side. The balloon, as thus constructed, contained upwards of 80,000 cubic feet of gas, and had a buoyant power of about 5700 pounds. The balloon was furnished with a rudder, and had suspended 30 feet below it a saloon 16 feet long, in which was a ballast-car capable of being moved from end to end of the saloon. By bringing the ballast-car to one end of the saloon the apparatus was made to incline from 10° to 20°; and the balloon, rising with a surface of 6000 square feet, moving against the superincumbent atmosphere, was expected to move forward in the direction of its elevated end simultaneously with its ascent, ballast being thrown out to secure the latter. About the year 1866 a flying-machine, comprising a metal cigar-shaped body, furnished with propellers, was constructed under the auspices of the U. S. government, but is reported to have been finally abandoned.

Of proposed machines that have attracted less attention, because evidently less plausible in their theory of operation, a few may be mentioned as illustrating the different principles of construction on which inventors have proposed to work. Among these was the steam-rocket flying-machine, in which a fish-shaped balloon, furnished with the four-leaved rudder, was to carry beneath it a car for passengers and a steam-boiler, from which, through suitably arranged pipes, steam was to be carried to the rear of the balloon, and there ejected against the atmosphere. Another is a modification of the two-propeller plan, without a balloon, which has met with much favor among English projectors, the two propelling wheels revolving in opposite directions to counteract any tendency of the machine to turn around. In the modification just indicated the propellers are arranged horizontally on opposite ends of a horizontal bar, and worked by crank and suitable gears, rods, etc. by manual power of passengers in a car suspended from the bar.

The available data on artificial flying are scant, and the facts here given have been derived from isolated and widely-scattered sources. The British patent-office has published in pamphlet form brief extracts of English patents, prior to 1866, relating to aëronautics. The London mechanical journals reported with considerable fullness the proceedings of the Aëronautical Society during its existence, and the U. S. patent-office reports, if diligently searched, will be found to show some curious devices, of which, for want of space, no mention has here been made. (For a thorough mathematical investigation the reader is referred to that of M. Guiture Lambert, *De la locomotion mécanique dans l'air et dans l'eau*, Paris, 1864; also for summary thereof to Aëronautics, by Gen. J. G. Barnard, U. S. Army.) JAMES A. WHITNEY.

Fly'ing Dragon, or **Fly'ing Lizard,** a name applied to a species of lizards belonging to the genus *Draco* and closely allied genera of the family Agamidæ, in which the ribs are elongated and exserted, supporting lateral expansions of membrane which serve the animals as parachutes. The type of the group is *Draco volans* of the Indian Archipelago. The term flying dragon, in addition to its mythological application, has sometimes been applied to the extinct *Pterodactylus*. E. C. H. DAY.

Fly'ing Fish, a term applied to various fishes that are enabled by means of very enlarged and elongated pectoral fins to support themselves for a brief time in the air. Of these the most remarkable are species of the family Exocœtidæ, and others of the genus *Dactylopterus* of the Triglidæ or family of gurnards.

Fly'ing Fox, a name sometimes given to the *Galeopithecus*, but more frequently applied to the fox-bats, or bats of the genus *Pteropus*. E. C. H. DAY.

Flying Gurnard. See DACTYLOPTERUS.

Fly'ing Le'mur, an aberrant form, variously classified with the Insectivora, the Cheiroptera, or placed near the Lemuridæ, amongst the Quadrumana. *Galeopithecus*, having a parachute-like membrane extending between the fore and hind limbs, and thence to the tail, is popularly known by this name. E. C. H. DAY.

Flying-Machine (addendum to AËRONAUTICS). The experimental construction of M. Dupuy de Lôme (see above article, vol. i.) is styled by him *"L'Aérostat dirigeable muni d'un propulseur,"* and is described with an account of an experimental ascension given by the inventor himself, in the *Revue Maritime et Coloniale*, vol. xxxiv., 1872; also, more briefly, in *Engineering*, Mar., 1872, and *Prof. Papers R. E.*, vol. xxi. The aërostat consists of a fusiform balloon (a figure generated by an arc of a circle turning about a horizontal axis) and a suspended car, to which by a central shaft, with screw-blades, the motive-power is applied. The balloon is made of silk, kept always distended by means of a smaller internal balloon, into which atmospheric air can be pumped in case the outer one by escape of gas becomes flabby. The car, of light material, long and narrow (somewhat boat-shaped), is suspended by an arrangement of netting peculiar and regarded as an important discovery. The length and greatest diameter of the balloon are 118½ and 48¾ feet respectively; length and greatest width of car, 41¼ and 10⅝ feet; diameter of driving screw, 29½ feet. The screw is driven by four or by eight men, working at a crank (*treuil*); the steering rudder is a triangular sail attached to a boom, 19½ feet long, beneath the balloon, and worked by steering ropes led down to the car. With eight men an estimated speed of 12½ kilomètres (8 miles) per hour could be obtained. Total weight, 1.75 tons; of crew, provisions, etc., 1.45; or 3.85 tons in all, which is about the "ascensional force" of the balloon. A successful "trial-trip" was made at Vincennes, Feb., 1872, and a speed of about 10¼ kilomètres (6 miles) attained. This balloon would carry an eight-horse power steam-engine (provided the risk of fire in connection with a hydrogen gas balloon be overcome), which would give a speed of 22 kilomètres (14¼ miles).

A Spanish engineer, M. E. Heriz, has recently published a memoir, in which, concurring with M. Lambert (see vol. i.) as to the principles governing *form*, he differs as to the principle of self-sustentation, maintaining that the aërial ship, made heavier than the air, must depend upon mechanical power not only for horizontal propulsion, but for sustentation. In this he differs less from De Bruignac, whose inclined planes are analogous to the rudder for vertical steering or "parachute" of Heriz. He sums up: To navigate the air, the balloon must give way to the aërial ship; iron to aluminium for a Behrens rotary engine; steam to vapor of ether, with petroleum for combustible. His propeller consists of two driving helices on the same axis, but turning contrariwise. (See *Revue Maritime et Coloniale*, Apr., 1875.) J. G. BARNARD.

Fly'ing Pha'langer, a name given to several marsupials of Australia and the neighboring islands which are surprisingly like the flying squirrels in appearance and habits. They are, in fact, the marsupial representatives of those squirrels. The species are rather numerous. The largest, the *Petaurus flaviventer*, is twenty inches long, and its tail measures eighteen inches. The smallest, *Acrobates pygmæus*, is two inches long, and its tail is of the same length. One of the most beautiful of these creatures is the *Petaurus ariel*.

Fly'ing Squid, a name given to the Cephalopods of the genus *Ommastrephes*, of which there are some fourteen species known, varying in length from one inch to four feet. They have a remarkable power of leaping from the water, whence the name. They are preyed upon by sperm-whales, birds, and fishes, and are largely employed as bait by fishermen. The pen or bone is ribbed. One species is greatly prized as food at the Sandwich Islands.

Fly'ing Squir'rel (*Pteromys*, Cuv.), a remarkable genus of the Sciuridæ, characterized by a hairy expansion of the skin between the fore and hind limbs, by which the animal is enabled to glide from tree to tree in very prolonged leaps. The common species of the U. S. is *Pteromys volucella*.

Flynn, tp. of Sanilac co., Mich. Pop. 131.

Fly-wheel, the heavy wheel attached to engines and various kinds of machinery, and designed to act as a reservoir of living force or momentum. It serves to carry the motion of cranks beyond dead-points, and tends to equalize motion when the work is variable in character.

Fo, the Chinese BOODDHA (which see), often confounded with **Fo-Hi** (Fuh-hi), with whom, however, he has nothing in common. The name is derived from *Buddha*, of which word it is a very corrupt form.

Fobes (PEREZ), LL.D., b. at Bridgewater, Mass., Sept. 21, 1742, graduated at Harvard University in 1762, and was ordained at Raynham, Mass., Nov. 19, 1766; in 1786 became professor of natural philosophy in the College of Rhode Island. Published *Sermon on the Death of Pres. Manning*, 1791; *Election Sermon*, 1775; and *Topographical Description of Raynham*, in 1794. D. Feb. 23, 1812.

Fo'cus [Lat., "hearth," "fire-place"], a point at which rays of light meet after deviation by a lens or mirror.

FOCUS OF A CONIC SECTION. A point on the principal axis through which a double ordinate to that axis is equal to the parameter. The ellipse and hyperbola have each two foci, and the parabola has one. In all the conic sections the foci possess the remarkable property that they are the only points in the plane of the curve from which the distance to any point of the curve can be expressed rationally in terms of the abscissa of that point. The name *foci* was given to

these points from the property that rays of light proceeding from one focus and reflected from the curve pass through the other focus. In the *ellipse* rays of light from one focus reflected from the curve pass directly through the other focus; in the *hyperbola* rays of light from one focus reflected from the curve take such directions that on being produced backward they will pass through the other focus; in the *parabola* we may suppose a second focus on the principal axis at an infinite distance, in which case rays from either focus reflected by the curve will go to the other focus. In the last case rays from the second focus are parallel to the principal axis, and after reflection they go to the first focus; rays from the first focus are parallel to the principal axis after reflection. If either of these curves is revolved about its principal axis, it will generate a surface of revolution whose foci are identical with those of the generating curve. Rays of light from either focus of such a surface will be reflected from the surface in accordance with the laws already explained.

Focus of a Lens or Mirror. The point from which rays of light proceed before being deviated by a lens or mirror is called a *radiant* point; if the rays converge before deviation, they must be produced beyond the lens to meet, and this point of meeting is called a *virtual radiant*. The point at which the rays meet after deviation is called a *focus;* if the deviated rays diverge after deviation, they must be produced backward to meet, and this point of meeting is called a *virtual focus*. The radiant point and focus are reciprocal; that is, if the focus be taken as a radiant, the radiant will become the focus. Any two points so related with respect to a lens or mirror are called *conjugate foci.* The *principal focus* of a lens or mirror is the focus that corresponds to rays parallel to the axis. In this case the radiant point is on the axis at an infinite distance. Rays proceeding from the principal focus are so deviated as to be parallel to this axis. In this case the focus is on the axis at an infinite distance. In all cases the conjugate foci are on a line through the optical centre of the lens or mirror.

W. G. Peck.

Fœ'tus [Lat. *fœtus* or *fetus*, originally a verbal noun from the obsolete *feo*, to "generate"], the name given to the young of viviparous and oviparous animals from the time of their complete formation until birth. To the stages of development preceding the formation of all the parts the term *embryo* is applied. In general use the young of the *human* species is meant when the word *fœtus* is used, and in that sense it will be employed in this article.

The brief history of the embryo and fœtus is as follows: A germ-cell (ovum) and a sperm-cell (spermatozoon), coming in contact with each other, unite, most probably by the passage of the latter through the envelope and into the substance of the former. A peculiar vital power resides in the germ-cells and sperm-cells after union, which is without parallel elsewhere. The germ-cell discharged from the ovary, if uninfluenced by the presence of a sperm-cell, pursues a retrograde course, and finally disappears. The sperm-cell discharged from the testicle, after a time, the exact limits of which are not known, likewise perishes. Each of these cells by itself, therefore, only retains its vitality for a short time after it ceases to be an integral part of the ovary or testicle which produced it. But as soon as union has taken place there is a generation of a new vital force, which enables them not only to live, but to expand into the development of all the organs and tissues of the body; and this without any other assistance than that derived from the absorption of nourishment from the blood of the mother.

As the result of such union of the cells, there first appears a breaking up of the substance of the ovum, so as to form two layers of cells, from the external of which, by progressive development, are formed the body, head, and limbs, while from the internal the stomach, liver, intestines, etc. and generative apparatus are developed. After the formation of these two layers there appears a longitudinal groove on the surface of the external layer, called the "primitive trace." This widens and becomes club-shaped anteriorly and pointed posteriorly; and at the same time, by rapid increase of the thickness of the walls on either side of it, these meet together and unite, thus converting the primitive trace into a tubular canal, which is enclosed on all sides. In this canal nerve-tissue is developed, and it becomes the spinal cord, while its enlarged anterior extremity becomes the brain. Prolongations of the thickened portion which behind shuts in the primitive trace push on anteriorly from either side, and are called the "abdominal plates." They finally meet in the front of the body and unite in the median line. At the bottom of the primitive trace, and parallel with it, is a cartilaginous cord, which later on becomes bony and constitutes the backbone, while from its sides processes pass down in the abdominal plates to form the ribs.

Very soon two anterior offshoots from the body appear, and two posterior. It is by a prolongation of these that the arms and legs are formed; and, curiously enough, their development takes place in a direction contrary to what we would expect. First of all, the fingers and toes appear; then the wrists and ankles; then the fore arms and legs; then the elbow and knee joints; then the arms and thighs; and finally the shoulder and hip-joints. In the head the various organs of the brain are being formed, and as offshoots from the cerebral vesicles we have the eyes, which at first are wide apart and situated on the sides of the head, but which afterwards come to be nearer together and in the front of the face, owing to the more rapid growth of the posterior and lateral parts of the head; by which means the relative position of the parts in front is changed. The ears also are formed from offshoots of other cerebral vesicles. The eyelids are formed by prolongations of the integument, which grow so rapidly that by the end of the second month they are in contact with each other, and their edges grow together and remain adherent until the seventh month.

The skin at first is very thin and transparent, but it gradually becomes thicker, and is so plentifully supplied with blood-vessels that even at birth it is very ruddy in color. The hairs are a part of the integument, and appear at about four and a half months. The nails commence to grow about the third month, but their complete formation is delayed until the fifth.

Simultaneously with the processes just described other changes are going on in the *internal layer* of cells. At first a spherical membrane, it gradually becomes elongated, and forms a nearly straight cylindrical tube. Its further changes consist in its increase in length and diameter, and its becoming very much convoluted. This is the intestine, and its anterior extremity widens, with a constricted orifice, to form the stomach. As yet there is no communication between it and the outside of the body, neither is there any division of the trunk into abdomen and chest. The next thing is the formation of a mouth by the liquefaction of a part of the front of the face. By a continuance of the same process a canal is excavated from the back of the mouth, or *pharynx*, as it is called, down into the stomach; and in this way the gullet is formed. Upon each side of this, by a protrusion which starts from the pharynx, the lungs are formed, which grow downward into the abdomen. Then a partition stretches across this which divides it into two portions. The partition is the *diaphragm*, and the cavity above it is the chest, containing the lungs and the heart—an organ which makes its appearance some time before the fifteenth day as an outgrowth from the fibrous coat of the intestine.

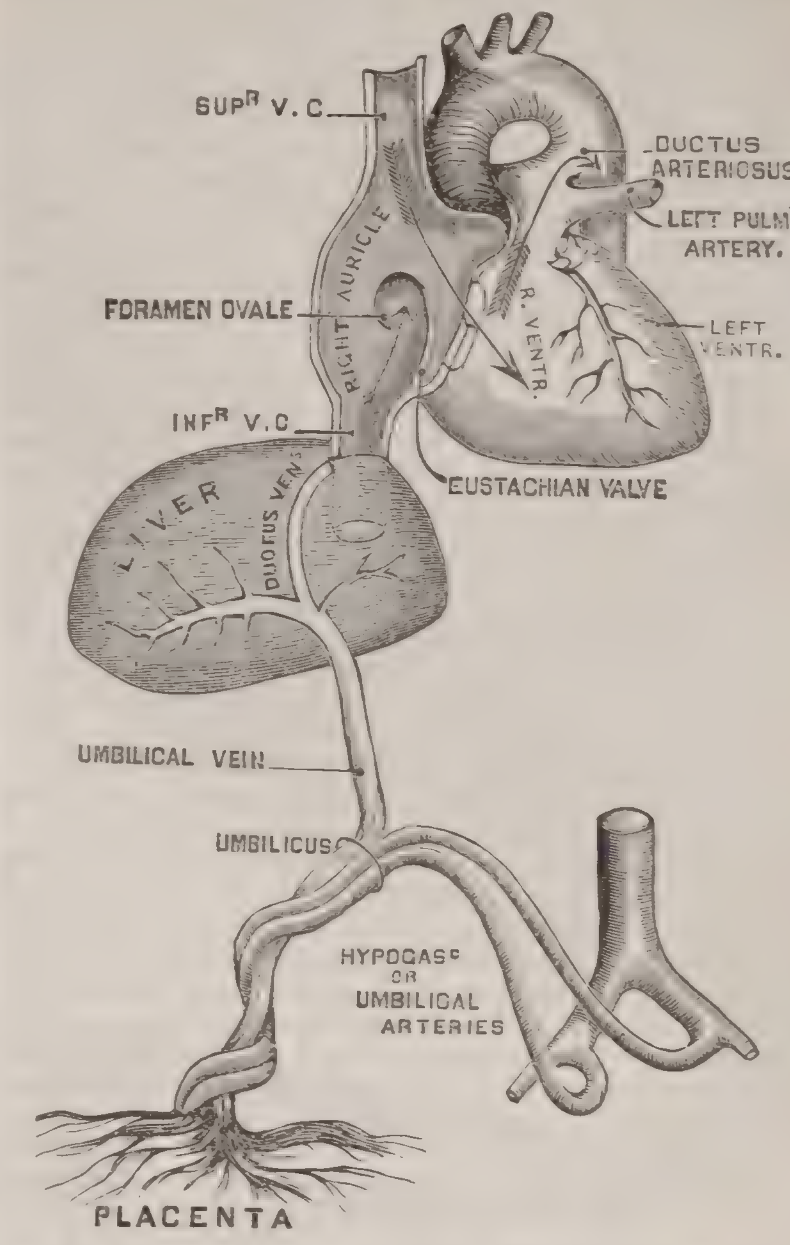
Besides the intestines, the abdomen contains the liver, pancreas, spleen, kidneys, and internal organs of generation. The liver takes its origin from the upper part of the intestine during the third week. This organ is from the first of very large size comparatively, for between the third and fifth weeks it weighs half as much as the whole of the body. From this time on its proportionate weight diminishes until birth. By the third month the gall-bladder is formed, and during the next six weeks various changes take place looking toward the complete histological development of the organ, which by the end of this time is fully accomplished. In the neighborhood of the liver, a little after its formation, the spleen and pancreas are developed. The kidneys themselves do not appear until the seventh week, but as early as the end of the fourth week bodies of very similar structure, and having the same function, are to be seen in each side of the abdomen, which rapidly grow until they extend over its whole length. These are the "Wolffian bodies," and as their function is temporary their existence is short. Gradually becoming smaller, they disappear in the early part of the third month, the kidneys having by this time grown sufficiently large to perform the duties for which the Wolffian bodies were created. Directly in front of the latter, which are themselves in front of the kidneys, at the end of the seventh week those internal organs of generation begin to be formed which are known as the "pars genitalis" of the "uro-genital sinus." At this early period they are precisely alike for both sexes, but as development proceeds they acquire the characters belonging to each sex. The "pars urinaria" of the "uro-genital sinus," separated by a partition from the "pars genitalis," contains the termination of the ducts leading from the kidneys, and, gradually growing in an upward direction, becomes the urinary bladder.

It remains to describe the manner in which the embryo and fœtus obtain the nourishment necessary for their growth. It will be remembered that the internal layer of cells becomes elongated to form the intestine. Within this layer is contained the yolk of the egg, which consists of albuminous and fatty material. But the whole of this layer does not go to the formation of the intestine. A part of it

becomes shut out of the body by the rapid growth of the abdominal plates. That portion which is shut out, and contains much of the nutritious yolk, is called the "umbilical vesicle," and its cavity is continuous with the cavity of the intestine by a small opening for a short time. The first nourishment of the embryo is derived by the liquefaction and direct absorption of the yolk. Very soon, however, two blood-vessels shoot out from the heart, and, bending backward, unite into one trunk, from which branches are given off to supply different parts of the embryo, and also to form a network of vessels over the surface of the umbilical vesicle and the membrane immediately surrounding the embryo. This network is called the "area vasculosa," and it is in it that the absorption of the liquefied food-yolk takes place. The blood of the area vasculosa, surcharged with nutritious materials, is returned to the body of the embryo by two veins called "omphalo-mesenteric," while the blood sent to it from the body goes by two arteries, also called omphalo-mesenteric. Before long the two omphalo-mesenteric arteries and veins are replaced by one trunk each. Gradually, the food-supply of the umbilical vesicle becoming exhausted, it shrivels up, and the omphalo-mesenteric artery and vein become proportionately insignificant. By this time the growth of the embryo has assumed such proportions that a new food-supply must be procured, and also a means of discharge for its own used-up materials. The organ which now appears to perform this double office is the "placenta," or afterbirth, as it is commonly called. Both the fœtus and the mother contribute to the production of this organ. The embryo furnishes itself almost immediately with a membranous covering called the "chorion." At first smooth, it very soon becomes velvety by the growth from its surface of minute projections, which give off numerous small branches like the roots of a tree. At about the end of the second month the chorion commences to get smooth by the gradual disappearance of the velvety growths over two-thirds of its surface. Those of the remaining third continue to increase and grow, and minute blood-vessels from the intestine of the embryo penetrate them to their farthest extension. Turning now to the uterus of the mother, we find that as soon as impregnation has taken place its mucous membrane becomes thickened and its blood-supply increased. In its natural condition this mucous membrane has a great number of little depressions or follicles in it, each one of which is surrounded by a moderately close network of blood-vessels. As soon as the impregnated egg finds its way into the womb it is grasped by its mucous membrane, which rapidly thickens and grows up around it, so that after a while the embryo is entirely shut up in a wall of uterine mucous membrane. The projections on the surface of the chorion immediately insinuate themselves into the follicles of the mucous membrane, which increase in size to correspond with their continued growth. The mucous membrane which is in contact with that portion of the chorion which is becoming smooth grows thinner and thinner by expansion from the enlarging embryo, while at that spot where the villosities are increasing it becomes thicker and more vascular. The villosities, which at first merely penetrated the uterine follicles, now become adherent, and the walls of the villosities and follicles fuse together. The blood-vessels surrounding the follicles increase to such an extent that each follicle seems to be bathed in a lake of blood. The wall just described now disappears, the walls of the uterine and fœtal blood-vessels come in contact with each other, and, finally fusing together, the placenta is formed. It is therefore a mass of blood-vessels, derived partly from the mother and partly from the fœtus. It commences to grow about the latter part of the second month, and its structure is completed by the end of the third.

The blood-vessels passing from the fœtus to the placenta and back again are four—two umbilical arteries and veins. After a time one of the veins disappears, leaving two arteries and one vein, which, being twisted together, form the "umbilical cord." The blood of the fœtus therefore, contaminated by circulation through its body, is sent through the umbilical arteries to the placenta. Here it is brought into almost actual contact with the blood of the mother. From it it takes oxygen and nutritious ingredients, and to it it gives up carbonic acid and excrementitious matters, and returns to the fœtus by the umbilical vein.

During the time of the placental circulation the course of the blood in the fœtus is as follows (see diagram): The pure blood returning from the placenta by the umbilical vein goes at once to the liver, a part of it supplying that organ, while another part passes directly through it by the "ductus venosus" to enter the "inferior vena cava." The blood of the inferior vena cava passes up into the "right auricle," whence, being directed by the "Eustachian valve," it goes into the "left auricle" through the "foramen ovale." From thence, passing into the "left ventricle," it is discharged into the "aorta," and supplies



mainly the head and upper limbs. The blood returning to the "right auricle" by the "superior vena cava" passes at once into the "right ventricle," and from this to the "pulmonary artery." A small part of this blood is sent to the lungs (for at this time they are in a rudimentary condition), but by far the greater part passes through the "ductus arteriosus" into the aorta, from whence it is distributed throughout the body.

This mode of circulation remains until birth, when the ductus venosus and ductus arteriosus become obliterated, the foramen ovale becomes closed, and the Eustachian valve disappears. By means of these changes all the blood of the venous system is carried to the right auricle to be discharged into the right ventricle, from which it goes to the lungs by the pulmonary artery. After becoming aërated in the lungs it returns by the "pulmonary veins" to the left auricle, through which it passes into the left ventricle, and from thence into the aorta, through which, by its branches, it is distributed to the whole of the general system. This is the plan of the adult circulation, and it continues through life without change.

The development of the fœtus goes on without producing any conscious impressions in the mother, other than certain sympathetic conditions in other organs, until "quickening," which commonly occurs about the eighteenth week. Hence many suppose that a child is without life until that time. But we have seen that the fœtus is endowed with life, growth, and vitality of its own from the very moment that conception occurs. Hence, viewing the subject with reference to abortion, if it is wrong to destroy a fœtus of five months because it has quickened, it is just as wrong to destroy one of six weeks or two months. It is a destruction of *life* in either case, the only difference between the two being in the extent and direction of its manifestations. The development of a fœtus ordinarily goes on for forty weeks, and by the act of parturition it is expelled from the womb to enter a new phase of existence. But it does not seem to be absolutely necessary that the period of gestation should be as long as this. Abundant experience has shown that children born after having completed their seventh month in the womb with care have a reasonable chance of living; and a child has lived which, it seems to be conceded, was born in the middle of the twenty-third week after intercourse. Sometimes the period of gestation extends beyond forty weeks, but the best authorities will not concede a greater protraction than from four to six weeks. (See EMBRYOLOGY, by PROF. J. C. DALTON, M. D., M. N. A. S.) G. H. WYNKOOP.

Fog. A fog has properly been defined as a cloud at the

surface of the earth. It is produced by the condensation of the vapor of the atmosphere into liquid particles of extreme minuteness. De Saussure thought these particles were vesicles, and not solid globules, and that their suspension in the atmosphere was due to the rarefaction of the air within them, caused by the radiant heat absorbed from the sun. But later meteorologists do not subscribe to this hypothesis—first, because it is impossible to conceive of any operation of nature by which such hollow globules could be formed; and, secondly, the formation of the rainbow is in strict accordance with the laws of the refraction of light from solid globules. Furthermore, Plateau of Ghent has shown by a very ingenious experiment that the particles of fog do not contain air. For this purpose he filled a glass tube, closed at one end, with cold water; then gradually inverted it with such precaution that the water was sustained in the tube by the pressure of the atmosphere. Under the mouth of this tube was placed a rising column of steam or visible vapor, which being condensed by the surface of cold water with which it came in contact, the contractile power of the bubbles would in this case eject any air which might be contained in them into the column of water, where its presence would in due time be made manifest, especially by the aid of a magnifying-glass. No air was found in this experiment. The suspension of the cloud is due to the extreme fineness of the globules, and also perhaps slightly in the daytime to the higher temperature of the air which surrounds them. The rising of a fog from the surface of the earth is evidently due to the latter cause, when the source of vapor is cut off. A fog is produced when a gentle current of warm air surcharged with moisture passes over a colder surface, as is the case especially on the lower Mississippi River during the prevalence of a warm southerly wind in the early spring. At this season of the year the water of the lower river, having come from a northern latitude, is much colder than the air above it, and hence a precipitation of the vapor takes place.

A fog, however, is not produced in absolutely still air even when resting on a colder surface. In order to this effect it is necessary that two strata of air be mingled with each other, one of which, being the colder, precipitates on itself, as it were, the particles of invisible vapor of the other. This fact is illustrated by the phenomenon of dew, in which atmospheric vapor is condensed into water without producing fog. In this instance the process may be conceived as follows: An indefinitely thin stratum of air resting directly upon a surface cooled by radiation deposits its moisture, leaving it unsaturated; the vapor of the stratum immediately above it is then diffused into the first stratum; the second is then unsaturated, and diffusion takes place into this from the third stratum, and so on, without the production of a fog. If, however, the radiation takes place into a clear sky from a sloping surface of ground, the colder and consequently heavier air resting on such surface will roll down into the valley, and there, mingling with the warmer saturated air, produce a fog. A fog is also produced when a current of cold air passes over warmer water or a warm damp soil. Water evaporates at all temperatures, and in the case just mentioned the vapor as it rises is condensed into visible fog. But the density of fogs produced in this way is not usually as great as that which is generated by the other process.

The eastern coast of the U. S. is especially subject to fogs, the cause of which will be readily seen, from what we have before mentioned, when we consider the relative position of the currents on the western side of the Atlantic Ocean. First, a cold polar current coming out of Baffin's Bay is thrown by the revolution of the earth laterally against the coast of North America from Labrador to Cape Hatteras, where it passes under the Gulf Stream. Contiguous to, but outside of, this current, and moving in an opposite direction, is the great Gulf Stream, an immense body of warm water, which throughout its whole course across the Atlantic heats and saturates with vapor the air immediately over it. Now, it must be evident that whenever the wind is in such a direction as to blow this warm and saturated air across the cold surface of the polar current, mingling the heated and moist air with the colder stratum, a fog must be the result. Hence, the fogs on the Banks of Newfoundland, and also along the coast of Maine, whenever the wind is in a southerly direction, especially in the warm summer months. As we proceed southerly along the coast the direction of fog-bearing wind is more and more easterly. Fogs are also produced on the western coast of North America when the wind from the exterior ocean passes across the coast current which comes from the N. The production of fog is in this case more complex, since the coast current is in fact the eastern portion of the great Gulf Stream of the Pacific. The northern part of this current is warmer than the surrounding ocean, while in its southern portion its temperature is less than that of the water through which it is passing. But in either case a fog will be produced when a wind of opposite temperature blows from the exterior ocean across this current. On the same principle fogs are produced in other parts of the world; and their existence may be inferred from the relative position of the cold and warm currents of the ocean. Fogs are sometimes associated with smoke in the atmosphere; minute particles of carbon radiating heat tend to become colder than the surrounding air, and thus condense the particles of vapors around them. London and other cities of England are frequently covered with fogs of this kind. JOSEPH HENRY.

Fog'áras, a fortified town of Transylvania on the Aluta, gives name to a Catholic archbishop's see of the Roumanian rite. Pop. 4714.

Fogg (GEORGE GILMAN), editor and Congressman, b. at Meredith, N. H., May 26, 1813; graduated at Dartmouth College, 1839; practised law at Gilmanton, N. H., in 1842; and was in the State legislature in 1846. From 1846 to 1861 edited the *Independent Democrat* at Concord, N. H.; in 1846 was secretary of state of New Hampshire; from 1861 to 1865 was U. S. minister to Switzerland; and in 1866–67 U. S. Senator in place of D. Clark, resigned.

Fog'gia, or **Capitana'ta,** province of Apulia, in Southern Italy, washed on the N. and E. by the Adriatic, into which extends the peninsula called Gargano. The province, as a rule, is mountainous, well watered, and very fertile of grain, oil, wool, etc. Cap. Foggia. Pop. 322,758.

Foggia, town of Southern Italy, the capital of the province of Capitanata. It is a beautiful city, situated in the rich plain of Apulia, whose commercial centre it is. Pop. 38,138.

Fo'go, a port of entry of Newfoundland, and capital of Fogo Island district, 122 miles N. W. of St. John's. Lat. of Fogo Cape, 49° 41′ N., lon. 54° W. It has important fisheries and considerable trade. Pop. 740.

Fo'go, or **Fue'go,** one of the CAPE VERDE ISLANDS (which see), consists of one single volcanic cone rising 9157 feet above the sea, and surrounded at the base with a steep wall of immense lava-blocks. The soil is extremely fertile, and produces grain, wine, fruits, and tobacco of the very first quality. But, besides suffering occasionally from the eruptions of the volcano, of which that in 1847 was very destructive, the island lacks water, and the droughts are sometimes so prolonged as to cause famine, during which thousands of the inhabitants are starved to death. Before 1834 the population numbered about 17,000, but in the three dry years it sank to 5600, and it has risen very slowly since.

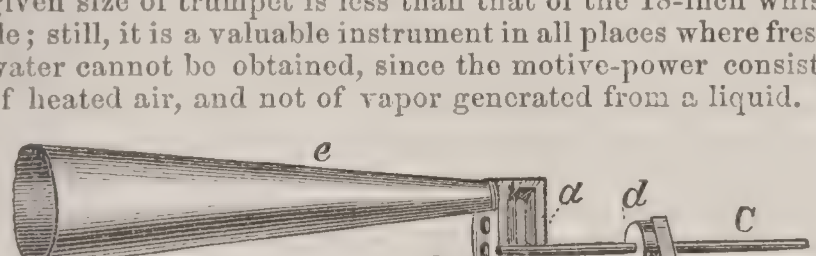
Fog-Signals. In various parts of the world, and especially on the coast of the U. S., fog-signals are indispensable aids to navigation. Along the eastern coast of the U. S. fogs prevail almost continuously at certain periods of the year; and as the shore is exceedingly precipitous, the sounding-line cannot be used with any certainty, and therefore fog-signals must be resorted to. Attempts have been made in France and England to penetrate fogs by means of lights of intense character, such as those of aluminium and electricity; but that these could not be successful must be evident from the consideration of our every-day experience, that a mile of cloud—or, in other words, of fog—shuts out the image of the sun. Recourse must therefore be had to sound, which, when of a powerful character, is not materially affected in its propagation by fog.

For the production of sound for this purpose bells, gongs, whistles, trumpets, and sirenes have been used by the lighthouse board of the U. S. Although a powerful sound may be produced by a cannon, the shortness of its continuance, and the blending of the echo with the original impulse, render it less favorable to the precise determination of its direction than the prolonged sound produced by the trumpet or the whistle. Bells, even of a large size, give too feeble a sound to be distinguished across the breakers at a sufficient distance or in opposition to the wind; they are only used when a signal is required to give warning of danger at a short distance at intermediate positions. They are rung by a weight wound up at intervals, the descent of which is regulated by the vibration of a pendulum with clock escapement. In some cases an automatic apparatus actuated by the waves of the sea has been used for ringing a bell, but this device has not found favor with the U. S. lighthouse board, since every automatic instrument is liable to get out of order, and so fail to point out the direction of danger at a time when it is expected to do so. Uninterrupted action is a fundamental principle of lighthouse signals.

Gongs, although they appear to produce a powerful sound when near the ear, in reality give an impulse of too feeble a character to be heard under all circumstances at a distance.

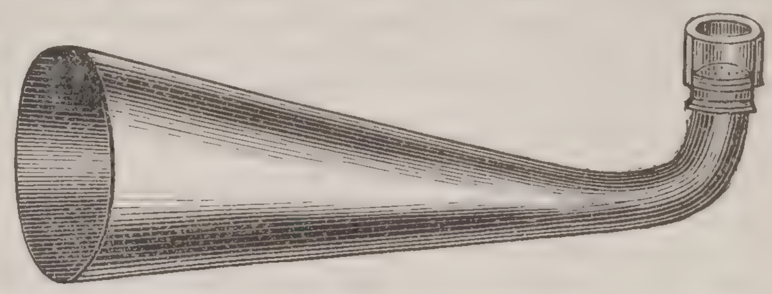
The mechanisms which have been found to produce sound of the greatest penetrating power are those which depend upon the principle of resonance, such as the organ-pipe, the trumpet, and the whistle, in which the air itself becomes the sounding body, as well as the medium of conduction of the sound. Of this character is the ordinary locomotive whistle, in which the vibration is produced by a thin sheet of air striking against the edge of a resounding cavity called the bell. The stiffness—if we may use the expression—of the sheet of air depends upon the tension of the steam in the boiler; and in order that the vibration of this sheet may be in unison with the reverberation of the air in the resounding cavity, the sheet must be increased and diminished in length; which is effected by a screw, the turning of which increases or diminishes the distance between the narrow opening through which the sheet is emitted and the lower edge of the bell-shaped cavity. As the loud sound is produced in this instrument by the vibrations of the air in the resounding cavities, the form or material of the enclosure of the latter has little effect upon the result. Instead of a metallic cylinder, we may use a square wooden box, the orifice through which the sheet is ejected being made to correspond in form. The locomotive whistle is the simplest of the more powerful of the fog-signals employed by the lighthouse board of the U. S. It is actuated by an ordinary locomotive steam-boiler at a pressure of from 50 to 75 pounds per square inch. The sound is distinguished from that of locomotives and steam-vessels by the length of the blast and the interval between two soundings; and these are regulated and produced automatically by a small engine attached to the boiler, which opens and closes the valves, letting on and shutting off the steam at the proper intervals. The whistles employed are from eight to twelve inches in diameter.

The next powerful instrument used is that called the reed or Daboll trumpet, actuated by air condensed in a reservoir by means of an Ericsson caloric (or heated-air) engine. In this instrument the trumpet itself is the resounding cavity, and the reed by its vibration produces the requisite motion of the air. The reed, consisting of a bar of iron, is, in the larger class of trumpets, eighteen inches in length, two inches in width and three-quarters of an inch in thickness at the fixed end, thinning gradually toward the free end. In order to the best effect, sound from these two parts must be in unison, and for this purpose means should be provided for gradually increasing or diminishing the length of the trumpet. With a given stiffness of the reed the pressure of the air in the reservoir cannot exceed a given intensity, since beyond this the reed cannot recoil, and the orifice remains closed. A pressure of from 10 to 15 pounds per square inch is the maximum employed. This instrument is the most economical of power, giving the greatest amount of sound with a given expenditure of fuel. Its range of power, however, with a given size of trumpet is less than that of the 18-inch whistle; still, it is a valuable instrument in all places where fresh water cannot be obtained, since the motive-power consists of heated air, and not of vapor generated from a liquid.

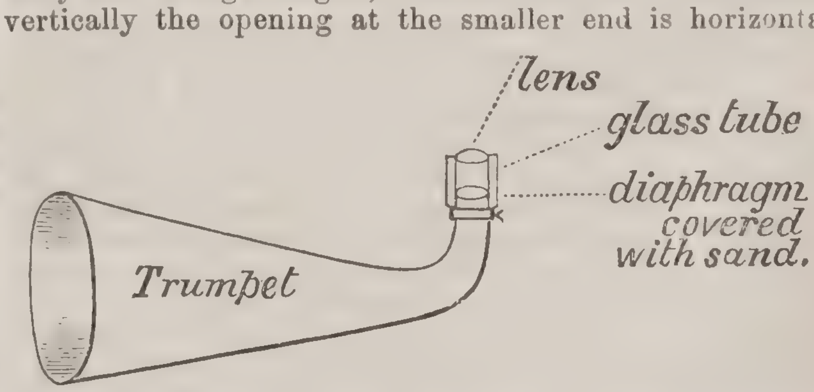


Explanation.—*a*, steam drum, with one hole on front face; *b*, revolving plate, perforated with eight holes and supported on the shaft *c*; *d*, a pulley, to which rapid motion is given by a band and driving-wheel; *e*, resonator or trumpet.

Another instrument, and the most powerful of all yet employed, is the sirene trumpet. The part of this which gives the impulse to the air producing the sound consists of a flat drum, or, in other words, of a hollow cylinder with a short axis, one head of which is perforated with an orifice, which admits the steam from a pipe connected with a locomotive-boiler. The other head of the drum is perforated with eight holes, before which, and almost in contact with this head, is a revolving disk also perforated with eight holes. At each revolution of the disk eight holes are alternately opened and shut, allowing egress to as many impulses of steam, which in turn produce a violent agitation of the air, giving rise to a most powerful sound, reinforced by the resonance of a trumpet of suitable length. The disk is made to revolve at the required velocity by a small engine attached to the boiler, the motion being transmitted by a band over pulleys of proper size. The sound from this instrument can be distinctly heard in still air at a distance of from 20 to 30 miles, even during the existence of a dense fog. The sirene has been long known to physicists as the invention of Cagniard de Latour, but its application as a fog-signal and the addition of the trumpet have been patented by Messrs. Brown of New York. The sirene trumpet is usually operated at a pressure of 75 pounds of steam, generated in a locomotive-boiler. It is not improbable that a better effect would be produced by using condensed air, since the space immediately around the point of origin of the sound is filled with steam, which must have an effect upon its subsequent transmission to the air. On the other hand, however, the increased complexity of machinery would probably more than neutralize any increase of effect from the change in question. By increasing the number of revolutions of the disk the pitch of the sound may be changed, and by this means the fact has been established that a medium pitch gives a sound of a greater penetrating power than one lower or higher. It is probable that the effect upon the tympanum of the ear will be in proportion to the quantity of air moved, multiplied by the square of the velocity, since at a very high pitch the amplitude of vibration must be exceedingly small, as well as the quantity of air put in motion, and the effect will be less. The shrill sound of the boatswain's whistle is heard more distinctly at a moderate distance, not on account of its more penetrating power, but on account of its dissimilarity to the ordinary coexisting sounds. It is impossible to judge of the penetrating power of a sound by its effect upon the ear when placed near its origin. To ascertain this it is usual for the observer to separate himself gradually from the place of origin of the different sounds of which the penetrating power is to be compared; the relative penetrating power being determined by the distance at which the sounds can be heard. To obviate



the inconvenience of going off, it may be, a distance of many miles, an instrument has been employed by the writer of this article, consisting of a horn, of which the mouth is about nine inches in diameter and the axis about four feet in length. The smaller part of this horn is gradually bent at right angles, so that when the mouth is held vertically the opening at the smaller end is horizontal.



Across this smaller end is stretched a delicate membrane on which fine sand is strewn. When the instrument is held in the hand horizontally, and the mouth is directed towards a sounding instrument, the sand, protected from the wind by a cylinder of glass, is observed to be agitated. The instrument is then carried off from the source of sound until the sand ceases to be moved. The measured distance at which the agitation ceases is taken as the relative penetrating power of the sound under examination as compared with the standard instrument, such as a reed horn or a bell. This instrument has been found by repeated comparison to give the same relative indications as those of the ear. Its degree of sensitiveness will depend upon the relative size of the mouth and of the smaller orifice. In the more perfect form of the instrument it is so constructed as to be capable of a slight increase or diminution in length—an adjustment which is necessary in order that the horn may not be in unison with the sound to be measured, since in that case the resonance would produce an exaggerated effect in the increase of distance at which the agitation of the sand would take place. With an instrument of this kind having a small mouth a series of experiments have been made to determine the number and best form of the openings in the head of the drum and the revolving plate of the sirene, without going to a distance of more than a few rods from the instrument.

In experimenting with sounds of such powerful magnitude as those produced by the instruments we have described, certain peculiarities are observed which escape detection in ordinary acoustic investigations with sounds of inferior power. The first to which we call attention is

that of the great divergence of powerful sounds. It is well known that there is a striking analogy between the reflection of sound and that of light—that sound, like light, may be concentrated and directed in parallel lines by concave reflection; but this appears to be true only to a limited extent, and perhaps for more feeble sounds, since we have found that although the sonorous ray from a parabolic reflector, in the focus of which a powerful steam-whistle is sounded, is more powerful in the direction of the axis of the reflector than in any other at a comparatively short distance—for example, a mile or so—yet when the distance is increased to four or five miles the effect of the reflector is almost entirely lost, and the sound in the line of the axis may be heard apparently with the same intensity behind as before the reflector. This lateral divergence of the sound explains some abnormal phenomena which have been observed; for example, when a building or an elevation of ground exists between the observer and the reverberating body, the sound of the latter may be distinctly heard at a distance, but is lost on gradually approaching it in a direct line, the observer falling, as it were, into the sound shadow. This frequently happens in cases where the instrument is placed on one side of an island. At a distance it is heard almost equally well in every direction, while nearer it can only be heard on one side of the island.

Another set of phenomena which are conspicuously presented in the observation of loud sounds are those which result from the effect of the wind. It is a fact of daily observation that sounds are heard farther with the wind than against it, and that even a gentle breeze produces a remarkable effect in the way of increasing or diminishing the intensity of a given sound. The explanation of this phenomenon is by no means simple; which will be evident when we reflect that the velocity of sound is at the rate of 700 miles an hour, while that of a wind which will nearly obliterate the perception of the sound at a given distance may be only 3 or 4 miles per hour. The only explanation of the effect of a wind on sound is that first indicated by Prof. Stokes of Cambridge. To understand this, let us recall the fact that a beam of sound consists of a series of waves the length of the crests of which is at right angles to the direction of the sound. Now, although the wind may have very little effect upon the absolute velocity of these waves, it may materially affect their relative position, and consequently the direction of the sound. To render this plain, let us suppose the beam of sound to be represented by a series of parallel rods which in still air are perpendicular to the horizon. Let us next suppose a wind blowing against the sound—that is to say, towards its origin; the stratum of this wind next the earth will be the most retarded, on account of friction and other resistance; the one next above less retarded; and so on towards the upper stratum, which will have the greatest velocity. The effect of a moving river of air of this character will be to cause the perpendicular rods representing the waves of sound to lean, as it were, backward, and the sound itself to take a direction upward, passing far above the ear of an auditor placed on the surface of the earth at a distance to the windward of the origin of the sound. An opposite effect will be produced by a wind in the direction of the sound; the upper part of the rods or waves will be inclined downward, and the sound, which in still air would pass above the ear of the observer, would in this case be thrown down upon it. In accordance with this hypothesis, it must be evident that a variety of phenomena in regard to sound must result from the slight changes in the intensity and direction of the wind. Thus, a sound which may be heard at a distance of 10 miles with a slight wind against it is lost on approaching its origin, or even becomes inaudible at several intermediate points by an imperceptible increase in the velocity of the wind at the surface—a greater change perhaps taking place above. That this phenomenon cannot be explained by the interposition of strata of air acoustically rendered flocculent and opaque by an admixture of invisible vapor, is evident from the fact that in a case of this kind the whistle from an approaching vessel has been continuously heard while the sound from the instrument on shore has been, as stated above, interrupted in its passage.

That a sudden change in the condition of the air by its saturation with moisture will have some effect in the propagation of feeble sounds, is evident from both experiment and analogy; but this cause is entirely insufficient to produce the effects we have described, since they are exhibited without any apparent change in the hygrometrical condition of the atmosphere. Besides this, the fact that they depend upon the direction of the sound with reference to the wind is conclusive evidence that they are the result of the latter. From a series of observations by two observers, A and B, each sounding a powerful instrument, it frequently happens that when A can distinctly hear the sound from B, the sound from A cannot be heard by B. To explain this phenomenon on the principle of an acoustic opacity produced by flocculency would require a medium which would transmit sound in one direction, and not in the opposite.

JOSEPH HENRY.

Fo-Hi (*Fuh-hi*), a half-mythical character in Chinese history, b. in Shen-Si, became emperor, or rather king, and reigned B. C. 2952. He introduced social order, music, writing, and marriage, and established a kind of mystic religion, which superseded to a great extent the ancient star-worship. He was the reputed author of the *Yih-King*, the most venerable of the Chinese classics still extant, but written mostly in a character now unreadable, although its teachings are known from commentaries. Since Fo-Hi and his family were miraculously saved from a flood, some have considered him the Chinese Noah, but the flood was not improbably an overflowing of the Hoang-Ho.

Föhr, an island of Denmark, off the W. coast of Sleswick, in the North Sea; area, 25 square miles. Pop. 5000. It is a good bathing-place, and exports a great quantity of oysters to Hamburg.

Foil [Lat. *folium*, "leaf"], thin sheets of metal (gold-foil, tin-foil, etc.) thicker than the leaf-metal of commerce. Gold-foil is obtained by beating. It is in fact unfinished gold-leaf, and is chiefly used by dentists for stopping decayed teeth. Tin-foil is obtained by rolling the metal or by shaving a thin layer from a block of tin in an ingenious machine, which not only cuts off the foil, but rolls and stretches it at the same time. It is of late much adulterated by lead. Pure tin-foil is of great use in chemistry and the arts. Foils of copper and other metals are used for the backing of gems by the lapidary. The skilful use of nicely-colored foils sets off and greatly heightens the effect of most precious stones.

Foix, town of France, in the department of Ariège, at the foot of the Pyrenees. It was the birthplace of Gaston de Foix and the residence of the counts of Foix. It has some trade in iron. Pop. 5507.

Fo-Kien, a province of China, situated between lat. 24° and 28° N. and lon. 116° and 121° E., and bounded E. by the China Sea, W. by the Nan-Ling range. Its area is 39,183 square miles, with a population of 14,779,158 inhabitants. The Min is its chief river; Foo-Chow-Foo its capital city. It is mountainous, and produces the best black tea.

Foktcha'ny, or **Fokcha'ni,** a town divided by the Milkow in two parts, one of which belongs to Moldavia, the other to Wallachia. In population it is the third in rank of the cities of Roumania. Pop. 37,504.

Folc-Land, a term of the Anglo-Saxon laws and institutions, used to designate lands owned by the community at large, and not by individual proprietors—that is, lands the title of which was held by the state, although the possession and usufruct might be temporarily enjoyed by private persons; literally, *folk* or *people land*. The researches of Sir Henry Maine and other recent writers have rendered it probable, if not indeed certain, that the original form of property was that of ownership by a community, and that the notion of individual ownership was subsequent in time and derivative in its nature. That this primitive mode of proprietorship existed among the ancient Germans, and was the basis of their tribal polity, is ascertained beyond the possibility of doubt. When their institutions first came within the observation of the Romans, land was owned by the community. The territory of a tribe, being divided into cantons and then into townships (marks), was allotted at regular intervals by the tribal authorities to the individual freemen; such distribution, according to Cæsar, being made annually. Mr. Kemble is of the opinion that this common or public land did not embrace all the territory belonging to a tribe, but that the notion of private, absolute proprietorship had already become familiar to the Teutonic peoples. It is certain that at the epoch of the final overthrow of the Western empire this notion was established as a part of their tribal institutions. Upon the barbarian invasions of Gaul, Spain, Italy, etc. the provincial owners were at once deprived wholly or partially of their lands. Of the territory thus seized by the conquerors, a portion was divided in unequal amounts among the warriors and heads of families, who took an absolute property or inheritance in their allotments, and who thus became, according to the nomenclature of the modern law, *allodial* proprietors. The remainder of the territory belonged to the community, and, as a more regular and firm political organization grew up, it was held under the control and at the disposal of the supreme authority—king or assembly of the people. Of this public land, a part was appropriated to the uses of the government and to the support of the Crown; a part was from time to time granted to allodial proprietors; while another part was bestowed

upon individuals, not in absolute ownership, but as benefices to be held in consideration of fealty and services rendered, so that the beneficiaries or tenants enjoyed the usufruct only (*dominium utile*), the ultimate ownership (*dominium directum*) remaining in the state. In respect to the modes of ownership, there thus existed simultaneously among the Teutonic successors to the Western empire three varieties or species of land: (1) the public land, owned by the state and under its immediate control; (2) allodial land; (3) land held by tenure from the state or from some superior lord, to which the name *feudal* was subsequently applied. In the lapse of time, and especially during the periods of internal discord, the allodial mode of proprietorship very generally disappeared, the allodial proprietors finding it for their advantage to voluntarily change their lands into feudal benefices, and by this means to obtain for themselves as vassals, and for their estates, the protection of powerful superior lords.

The foregoing description applies in all its substantial features to the history of land tenures among the Anglo-Saxons in England. Separated at first into a number of petty states, each under the headship of a military chief whose authority in civil affairs was merely nominal, and preserving their ancient forms and modes of local administration in full vigor, they converted the land which they had seized from the Britons partly into allodial estates of inheritance granted to individual freemen, while they retained the greater part as the property of the public, and held it at the disposal of the state. As the former portion was granted to the recipients thereof by means of written charters or deeds, it collectively received the appellation "*boc-land;*" the latter, belonging to the people at large, was appropriately termed "*folc-land.*" "Folc-land" was, then, land the *title* to which was in the community as a whole, but not necessarily that which was actually *possessed* and used in common. While some of it might be suffered to remain in common—and in fact a tract of common land seems always to have been left in every Saxon township, as afterwards in every Norman manor—it might also be granted by the state to separate and individual occupants. Such grants, however, could not be for a longer period than the life of the grantee; to confer an inheritance would be to change its nature from folc-land to boc-land. Those who thus obtained temporary possession and usufruct of tracts of folc-land held them subject to heavy burdens. Among these burdens resting upon the occupant were his liabilities to render military service, to contribute to the repair of roads, bridges, and fortifications, to pay various dues to the king, to furnish transportation for public messengers, to furnish provision, horses, and carriages for the king on his travels, and even to provide for the royal hawks, hounds, and horses. Tracts or parcels of folc-land might thus be held by freemen of every degree, noble or not noble, and even by the king himself. An ancient document, preserved from the time of King Alfred, shows that a nobleman owning great estates of boc-land was also possessed of a life interest in certain folc-lands, and these latter he prays the king to continue to his son after his own death.

In addition to these donations or grants, in which the recipient acquired no absolute or inheritable estate, and which did not change its nature, folc-land was the source —or, so to speak, fund—out of which gifts were made in perpetuity to the military or civil servants of the state as rewards or compensation for their services. The tract thus transferred, however, was at once severed from the mass of folc-lands, and passed into the class of boc-lands. If the grant was to a military servant—a thegn—the term "thegn-land" was applied to the portion so conveyed; if to a civil officer, the corresponding designation was "reeve-land" (gerefa-land). Indeed, Mr. Kemble supposes that all the territory in a Saxon kingdom was at first considered as folc-land, and that whatever estates of inheritance were held by private persons were derived from this original source; so that every particular case of boc-land had been at some time carved out of the soil once belonging to the people. All boc-land was held by the proprietors under the particular limitations contained in the first charter or grant and under the common burdens imposed by the law. Although there was doubtless some variation in the extent and character of the limitations prescribed to the first grantee, there was a general sameness among them all. The estates were inheritable and alienable, and, although subject to certain common services due to the Crown, it is clear that these services were far less onerous than those which were required from tenants during the flourishing periods of the feudal system under the Norman kings. The gifts of the people's land to private persons which have been thus described are intended to embrace also those made to the Church, which obtained in this manner vast quantities of the public domain.

Another use to which the folc-land was put was the maintenance of the Crown and the defraying of the public expenses. Income was derived from some portions of it which were granted to life-tenants upon the payment of rents, which were generally, however, products of the soil, and not money. Other portions were retained for the actual use of the Crown, in all respects resembling the demesne-lands of a manor occupied, cultivated, and enjoyed by the lord thereof for his personal convenience and benefit. As the royal prerogative increased in strength, these lands came to be regarded as the private property of the king.

Folc-land, being the property of the people as a whole, could not be alienated or changed into boc-land without some act of the government. In the earliest periods of the Saxon commonwealths the "gemote" or general assembly of the nation alone possessed this power. In later times the charters or deeds ran in the name of the king, but still required the assent of his "witan" or council of advisers. As the royal powers increased, and the king came to be regarded as the representative of the state and as embodying in himself the supreme authority, the theory was suggested, and in time was adopted, that the folc-land belonged to him in his official capacity—that it was to be used for his maintenance, and employed by him at his pleasure in rewarding his servants. When this notion was universally accepted the term "folc-land" disappeared from ordinary speech and from the language of all official writings, and that of "*terra regis*" or "crown-lands" was substituted.

From the foregoing sketch it is apparent that the description of folc-land given by many legal text-writers, which makes it synonymous with "common land," or land possessed "in common" or by the common people, is altogether a mistaken one. Sir William Blackstone has fallen into a still graver error in his statement that it was land possessed by the serfs or villeins alone, and therefore belonging, together with themselves, their families, and their effects, to the lord of the soil. (For an exhaustive discussion of the subject, with a citation of ancient documents and proofs, the reader is referred to the following authorities: *The Saxons in England*, by JOHN MITCHELL KEMBLE, M. A., F. C. P. S., vol. i. chs. ii. and xi.; *Inquiry into the Rise and Growth of the Royal Prerogative in England*, by JOHN ALLEN, pp. 129–155; *The Rise and Progress of the English Commonwealth—Anglo-Saxon Period*, by FRANCIS PALGRAVE, F. R. S., F. S. A., pp. 65–104; *A History of England under the Anglo-Saxon Kings*, translated from the German of Dr. J. M. LAPPENBERG, by BENJAMIN THORPE, F. S. A., vol. ii. pp. 323–326.) JOHN NORTON POMEROY.

Földvár, or **Foldvar Duna,** town of Hungary, on the right bank of the Danube, in the county of Tolna. It occupies a strong and picturesque position. It has important sturgeon fisheries and a heavy trade in wine, grain, and salt. It is a point of considerable strategic importance. Pop. 12,382.

Fo'ley (JOHN HENRY), R. A., sculptor, b. in Dublin May 24, 1818. His first impulse toward sculpture came from his step-grandfather, who was a sculptor in that city. When Foley was thirteen years old he entered as a student in the Dublin Royal Society, and obtained a number of prizes. Came in 1834 to London, and entered the Royal Academy as a student. He first exhibited in 1839; his *Death of Abel* and *Innocence* of that year announced the entrance of a strong man into the profession of sculpture. Produced in 1840 *Ino and Bacchus*, which was purchased by the earl of Ellesmere, and made him a European reputation. Entered in 1844 into the competition for the decoration of the palace at Westminster with statues, exhibiting his *Ino and Bacchus* and a figure made for the occasion, *A Youth at a Stream*, and as one of the successful candidates received the commission to make a statue of John Hampden, now in the Houses of Parliament. Later, Foley made for the same building a statue of Selden, and another of Sir Charles Barry. In 1856, Foley produced his bronze equestrian portrait-statue of Lord Hardinge for Calcutta. This is counted his finest work, and it was so much admired that efforts were made to have it duplicated for England, but though the names of the most distinguished men in literature, art, and society were appended to the appeal to the public, money sufficient was not forthcoming, and the project had to be abandoned. Later, he made an equestrian statue of Outram, also in bronze, which added greatly to his reputation. Foley was of a sensitive disposition and rather recluse in his habits, and somewhere about 1864 he took offence at the way in which his statues were treated by the "hangers" at the Royal Academy exhibition, and never afterward would contribute any work of his to the exhibition, nor take any advantage whatever of his membership. He made the statue of the prince-consort for the national memorial in Hyde Park at the personal request of the queen, and he also made the group of *Asia* for the

same unfortunate monument. Among his other works must be mentioned statues of Oliver Goldsmith and Edmund Burke for Dublin, and a statue of Father Mathew for Cork. The Oliver Goldsmith has been particularly praised. Foley was a sculptor of whom any nation might be proud. He was born an artist, and he lived in his art, through which he expressed a nature glowing with Irish fire, with manly pride, and with a fellow feeling for noble, heroic character that has given his statues of his great countrymen a place apart in the sculptures of modern times. Foley's latest work was a statue in bronze of the Confederate general Stonewall Jackson, a commission from the State of South Carolina.—A brother of the sculptor, EDWARD FOLEY, acquired considerable distinction for his skill in manipulating marble, and the statues of John Foley owe much to his brother's workmanship. Unfortunately, Edward Foley's habits were his ruin, and he died, not without strong suspicion of suicide, by drowning in the Regent's Canal a few weeks before his more distinguished brother. John Henry Foley d. in London Aug. 27, 1874. He was buried in St. Paul's Cathedral Sept. 5. CLARENCE COOK.

Fol'ger (PETER), American writer, b. in England 1617, went from Norwich in 1635, and with his father settled at Martha's Vineyard, Mass.; in 1663 removed to Nantucket. His daughter Abia was Benjamin Franklin's mother. From 1673 he was clerk of the courts, and wrote several pieces, among them, in poetry, *A Looking-Glass for the Times, or the Former Spirit of New England revived in this Generation* (1675), reprinted 1763. D. at Nantucket 1690.

Folia'tion and **Fo'liated** [Lat. *folia*, "leaves"], terms applied to sedimentary rocks composed of very thin layers, or metamorphic rocks which show slaty cleavage.

Foli'gno, town of Central Italy, in the province of Umbria. Its manufactures of woollens and parchment are celebrated. It is an unattractive place, a bishop's see, and is connected by rail with Florence, Rome, and Ancona. It is the Roman *Fulginium*. Pop. 7891.

Fol'ker, tp. of Clarke co., Mo. Pop. 824.

Folkes (MARTIN), LL.D., F. R. S., b. at Westminster, England, Oct. 29, 1690; studied at Saumur and Clare Hall, Cambridge; became in 1741 president of the Royal Society; published valuable papers on antiquities, astronomy, etc.; was a man of great learning and fine literary attainments; now chiefly remembered for his *Tables of English Gold and Silver Coins* (1736). D. June 26, 1754.

Folkland and **Boc-Land.** See FOLC-LAND, by PROF. J. N. POMEROY, LL.D.

Folk-Lore, a word recently introduced into the English from the German to indicate the knowledge which has been gained from a scientific study of popular traditions and tales. The Brothers Grimm in their *Kinder und Hausmärchen* may be said to have inaugurated the study, and since the publication of that work many others have been diligently collecting in all parts of the world the stories which have been orally transmitted from generation to generation. These stories have been taken from the lips of unlettered men and women among different nations all over the earth. The Germans, Danes, Russians, Highlanders, Irish, North American Indians, Zulus, South Sea Islanders, Hindoos, have all contributed to the general fund. The tales thus gathered have been carefully compared with each other, analyzed, and traced back to their oldest forms. Many new and important facts have been discovered in these old wives' fables concerning the literary character of our ancestors, their household utensils, habits of life, sports, worship, moral qualities, superstitions, and ideas of another world. The study has also been of great service to the ethnologist, the historian, and the philologist in showing popular affinities, giving additional information about early migrations, and unfolding more clearly the meaning of words. Says one of the ablest investigators of this folk-lore: "One of the many indications of that synthetic and reconstructive rather than analytic and destructive tendency which marks the second half of the nineteenth century is the fact that historical scholars are beginning to look on popular legends and romances, not certainly with the uncritical credulity of the days before Niebuhr, but with the belief of finding in them such records of historical evidence as will pay the trouble of investigating them."

The Germans have done more than any others in developing this new science. Their most important works upon it are *Kinder und Hausmärchen*, by the Brothers Grimm; *Deutsche Mythologie*, by Jacob Grimm; *Die Herabkunft des Feuers und des Göttertranks*, by Adalb. Kuhn; *Norddeutsche Sagen, Märchen, und Gebräuche*, by Kuhn and Schwartz. Several important works have also been published in English upon the subject. Among these the best for reference are Campbell's *Tales of the West Highlands;* Dasent's *Popular Tales from the Norse;* Kelly's *Curiosities of Indo-European Tradition and Folk-lore; Popular Romances of the Middle Ages*, by Cox and Jones; *Myths and Myth-Makers*, by John Fiske; *Fictions of the Irish Celts*, by Kennedy; *Curious Myths of the Middle Ages*, by Baring-Gould; *Popular Epics of the Middle Ages*, by Ludlow. L. C. SEELYE.

Folk'stone, town of England, on the S. E. coast of Kent. Steam-packets sail hence to Boulogne. It is 83 miles by rail S. E. of London, and is a favorite bathing-place. Pop. 12,694.

Fol'len (CHARLES THEODORE CHRISTIAN), PH. D., LL.D., a writer, reformer, and liberal preacher, b. at Romrod, in Hesse-Darmstadt, Sept. 4, 1796; was educated at Giessen, where there were many schools of learning, preparatory to the university. Sharing the German enthusiasm of 1814, the youth joined the army that resisted Napoleon. The campaign ended, he returned to Giessen to pursue his studies, and soon became known as a leader among the ardent patriots as well as the diligent students of the university. Earnest, bold, ready with tongue and pen, he drew on himself the suspicion of the authorities, but the degree of doctor of civil and ecclesiastical law was given him in 1818, and he remained at the university as a lecturer on jurisprudence. His patriotic feelings bringing him into sympathy with the people, and making him their advocate against the oppressive edict that would compel them to pay the debts of the war, made him especially obnoxious, and though he gained his point, he ruined his professional prosperity. A similar fortune awaited him at Jena, whither he removed from Giessen. Thrice he was arrested on charges of implication with revolutionists, and, though acquitted, was forbidden to continue his lectures. At Giessen the authorities were on the watch for him, and he fled to Paris. Paris was soon left for Switzerland. At Chur (Coire), the capital town of the Grisons, he was appointed professor of Latin and history in the cantonal school, but being a liberal in theology as well as in politics, his lectures gave offence to the Calvinistic ministers; so that, finding his position uncomfortable, he resigned it and left, carrying with him testimonials of character and learning. Next he lectured on law and metaphysics at Bâle, but his reputation went with him; the allied powers demanded his surrender, orders came for his arrest, and again he fled under cover of a chaise-boot, this time through Paris to Havre, whence he embarked for the U. S. Here, thanks to influential friends—La Fayette among them—he found welcome. A few months after he landed, in the autumn of 1825, he was made tutor of German at Harvard College. Three years later, having in the mean while studied divinity with Dr. Channing, and been admitted to the Unitarian ministry, he was appointed professor of ecclesiastical history and ethics in the Cambridge Divinity School; in 1830 the professorship of German language and literature was conferred on him. In the five years he held it he did much to make that department attractive by the charm of his manner and the life of his intelligence. His German Grammar and Reader outlived, as text-books, his time. The Christian ministry, however, had greater attractions for him than the professorship, and for a short time (1836–37) he was pastor of the First Unitarian church in New York, following Rev. Wm. Ware. His freedom of speech about slavery cut short his ministry there, and in 1839 he accepted a call to East Lexington, Mass., where he had hardly established himself when he was lost in the steamer Lexington, which was burned on Long Island Sound Jan. 13, 1840.

Dr. Follen was a frequent lecturer, a copious contributor to magazines, a philosophical writer of ability. He was interested in all questions of social reform, but especially in the question of slavery. The frankness with which he uttered the convictions of an abolitionist on this then unpopular subject materially compromised his professional and literary success. His writings, with memoir, were published in 5 vols. at Boston in 1841. O. B. FROTHINGHAM.

Follen (ELIZA LEE), wife of Dr. Follen, daughter of Samuel Cabot, b. in Boston Aug. 15, 1787. She, like her husband, whom she married in 1828, was an earnest abolitionist from first to last, and a diligent writer. Her writings are mainly of a religious character, and are intended for the moral instruction of the young. Her little books for children are deservedly popular for their purity and practical wisdom. Her *Selections from Fénelon, Well-spent Hours, Married Life*, exerted wholesome influence in their time. The memoir of her husband was from her pen. *The Child's Friend* under her editorship (1843–50) was a favorite household magazine. D. Jan. 26, 1860. O. B. F.

Fol'let (DAVID LYMAN), an American lawyer, b. July 17, 1836, at Sherburne, Chenango co., N. Y., educated at Cazenovia Seminary, N. Y., was admitted to the bar in 1858 at Binghamton, N. Y., and settled at Norwich, the

capital of his native county. In 1867 was appointed assessor of internal revenue for the nineteenth district, and held the position until the abolishment of the office. In 1871 became the attorney for the New York Oswego and Midland R. R., and has frequently distinguished himself by his legal attainments. He is prominent in the counsel of his political (Republican) friends, and in 1874 was elected by a large vote justice of the supreme court of N. Y. State.
JAMES H. WORMAN.

Fol'ly Is'land, in Charleston co., S. C., extends S. W. from Lighthouse Inlet to Stono River, having Folly Island River on the N. W. and the ocean on the S. E. It is in part heavily timbered. It was the scene of important operations during the civil war.

Fol'som (GEORGE), LL.D., b. in Kennebunk, Me., May 23, 1802; graduated at Harvard University, Mass., in 1822, and studied law. In 1830 published a *History of Saco and Biddeford, Me.;* in 1837 removed to New York and became a member and librarian of the New York Historical Society; in 1841 edited a volume of its *Collections;* afterwards translated the *Despatches of Hernando Cortes;* in 1843 published the *Political Condition of Mexico;* in 1858, *Documents Relating to the Early History of Maine.* He was a member of the New York State senate in 1844–48, and *chargé d'affaires* to the Netherlands 1850–54. Mr. Folsom delivered several lectures before the New York Historical Society, and was president of the American Ethnological Society. D. at Rome, Italy, Mar. 27, 1869.

Folsom (LEVI), M. D., b. in Limerick, Me., in 1802; studied at Exeter, N. H.; practised medicine with success in Limerick, Me., Lowell (1833–36), Boston (1836–37), and New Bedford, Mass. (1837–53), and afterwards in Cincinnati, O., and in New York City (1858–67). D. in New York Oct. 27, 1867.

Folsom (NATHANIEL), b. at Exeter, N. H., 1726; commanded a company at Fort Edward 1755, and a regiment of militia before the Revolution; as brigadier-general of the New Hampshire forces served in the siege of Boston until July, 1775; was a member of the Continental Congress 1774–75 and 1777–80; councillor in 1778; and president of the convention which framed the constitution of New Hampshire in 1783. D. at Exeter May 26, 1790.

Folsom (NATHANIEL SMITH), b. at Portsmouth, N. H., Mar. 12, 1806; graduated at Dartmouth College 1828, and at Andover (Mass.) Theological Seminary in 1831; ordained at Bradford, Mass., 1831; was missionary in Liberty co., Ga., in 1831–32; was professor in Lane Seminary and in Western Reserve College from 1833 to 1836; was pastor of the Congregational church at Francestown, N. H., from Oct. 12, 1836, to Aug. 21, 1838; then of a church at Providence, R. I., 1838–40; of a Unitarian church at Haverhill, Mass., 1840–47; edited the *Christian Register* 1847–49 at Charlestown, Mass.; and was professor of literature and biblical interpretation at Meadville College, Pa., from Sept., 1849, to 1861. He published an address on temperance (1839), and an *Interpretation of the Prophecies of Daniel* (1842).

Fol'som Cit'y, a post-v. of Sacramento co., Cal., on the S. bank of the American River and on the Sacramento Valley R. R., 25 miles E. by N. of Sacramento, is a pleasant town in a picturesque wine and raisin growing region. Placer-mining, granite-quarrying, and the collecting of paving-stones from the river-bed are carried on in the vicinity. Folsom City has a weekly newspaper and some fine buildings.

Foltz (PHILIPP), b. May 11, 1805, at Bingen on the Rhine, studied art at Mentz and Düsseldorf, and became a professor of painting at Munich and director of the royal galleries. He helped to design the frescoes of the Glyptothek and the Arcades at Munich. He produced some remarkable portraits and some fine historical and rural scenes.

Folz, or **Folcz** (HANS), b. at Worms in 1478, became a Protestant of Nuremberg, and was by profession a barber. He was one of the most noteworthy of the German mastersingers, and besides mastersong wrote dramatic Shrovetide pieces and rhyming tales. His lyrics are often spirited, graceful, and of high moral tone and much literary merit; but his other writings are often marked by needless coarseness and a roughly vigorous style of humor.

Fomenta'tion [Lat. *fomentatio*, from *foveo*, to "soothe," to "cherish;" also to "bathe"], in therapeutics, the application of hot epithems, wet or dry (wet fomentation, dry fomentation), to diseased parts. Fomentations act chiefly by the heat and moisture they convey to the surface treated, but they are sometimes medicated. Fomentation is usually a safe, and often an effective, means of treating many diseases.

Fom'ites [Lat., the plu. of *fomes*, "fuel"], a term much employed in sanitary science to denote objects, such as clothing, furniture, bedding, wall-paper, etc., by which the infection of certain diseases is retained, and by which disease may be propagated.

Fonblanque (ALBANY WILLIAM), a London journalist, b. in 1797, was the son of John de Grenier Fonblanque (1759–1837), a famous equity lawyer, and a brother of John Samuel Martin Fonblanque (1787–1865), an able writer on law-reform. Mr. Fonblanque was (1820–46) editor of *The Examiner*, and was distinguished for literary abilities and for his useful labors as a publicist. He was (1846–72) chief of the statistical department of the board of trade and comptroller of the corn returns. D. at London Oct. 13, 1872.

Fon'da, post-v. of Pocahontas co., Ia., on the Iowa division of the Illinois Central R. R., 225 miles W. of Dubuque and 100 miles E. of Sioux City. It has several stores, shops, and hotels, and one newspaper. Principal business, farming and dairying. Pop. about 300.
M. D. SKINNER, ED. "TIMES."

Fonda, post-v., cap. of Montgomery co., N. Y., on the Mohawk River and the New York Central R. Rs., and the terminus of the Fonda Johnstown and Gloversville R. R. It has a national bank, 1 newspaper, 2 flouring-mills, 3 churches, 3 hotels, and the usual number of stores, shops, etc. Principal business, farming and dairying. Pop. 1092.
C. B. FREEMAN, ED. "MOHAWK VALLEY DEMOCRAT."

Fonda's Bush, a v. of Broadalbin tp., Fulton co., N. Y., is the seat of thriving manufactures. (Post-office, BROADALBIN.) Pop. 987.

Fond du Lac, county of Wisconsin, at the S. end of Winnebago Lake, whence the name (Fr., the "end of the lake"). Area, 754 square miles. The county is divided by a steep limestone ridge. The W. part is prairie, the E. timbered land. The soil is very fertile. Cattle, grain, wool, hay, and dairy products are the staples. The manufactures include carriages, flour, lumber, saddlery, metallic wares, etc. It is traversed by the Sheboygan and Fond du Lac and the Lake Superior line of the Chicago and North-western R. Rs. Cap. Fond du Lac. Pop. 46,273.

Fond du Lac, tp. and post-v. of Tazewell co., Ill., opposite Peoria, Ill., and near the S. extremity of Peoria Lake. Pop. 889.

Fond du Lac, tp. and post-v. of St. Louis co., Minn., on the Northern Pacific R. R., 15 miles S. W. of Duluth, at the head of navigation of the St. Louis River, near the head of Lake Superior. It is an old settlement, once a very important station of the American Fur Company. It has good water-power. Pop. of tp. 800.

Fond du Lac, city of Fond du Lac co., Wis., on Lake Winnebago, at the mouth of the Fond du Lac River, 148 miles from Chicago, 63 from Milwaukee, 65 from Green Bay, and 43 from Sheboygan, thus enjoying the advantages of four competing lake-ports. It is the junction of three railway lines—the Chicago and North-western, to Chicago on the S. and Green Bay and Lake Superior on the N.; the North-western Union, to Milwaukee on the S.; and the Sheboygan and Fond du Lac, to Sheboygan on the E. and the Fox River on the W. Steamer lines connect with ports on Lake Winnebago. Fond du Lac county embraces some of the finest agricultural property in the West, and in the State stands fourth in wealth and population. The city is delightfully situated on a plain surrounded by hills and in the midst of generous groves. It contains many elegant residences, costly business-blocks, and heavy manufacturing establishments. Water is supplied from about 1000 artesian wells, the mineral properties of which have rendered the place famous. The hotels are numerous, provided with modern appliances, and enjoy an enviable reputation. Fond du Lac has 20 churches, 3 public halls, an opera-house, 2 public libraries, and several public gardens for out-door amusements. There is a steam fire department and a fire-alarm telegraph. There are within the city limits 12 steam saw-mills, 1 extensive car-works, 1 blast furnace, 1 threshing-machine works, 4 flouring-mills, 5 sash, door, and blind factories, 3 foundries and engine-works, several shingle-mills, 10 wagon and carriage works, 2 paper-mills, 2 agricultural works, 2 stave-factories, 1 drug-factory, 1 very large tannery, 6 planing-mills, 1 plaster-mill, 6 cigar-factories, 1 large soap-factory, 3 candy-factories, 1 steam bakery, 1 oil-factory, 1 plough-factory, 5 banks, and 1 steam printing-office; and many other branches of manufacturing industry are represented. There are 4 newspapers and 2 independent job printing-offices. Pop. 12,764; of tp. 1266.
TIM. F. STRONG, JR., ED. "FOND DU LAC JOURNAL."

Fon'di, town of Italy, in the province of Terra di Lavoro, is miserably built, dirty, and unhealthily situated, but the surrounding districts are very fertile, and were

famous in ancient times for the wine they produced (*vinum Cæcubum*). It is enclosed by cyclopean walls, and has a fine cathedral. Pop. 6478.

Foner'den (John), M. D., b. in Baltimore in 1804; graduated in 1823, and soon after became a distinguished physician and philanthropist. He was pre-eminently the friend of the friendless, and on more occasions than one went into the cell of a raving maniac, soothed him by a few kind words, unlocked the door, and walked with him through the hospital grounds. Paul F. Eve.

Fonse'ca, Bay of, or **Gulf of Conchagua,** extends into Central America from the Pacific Ocean, and has the state of San Salvador on the N. W., Nicaragua on the S. E., and Honduras at its head. Length, 40 miles.

Fonseca, da (Pedro), D. D., "the Portuguese Aristotle," was b. at Costizada in 1528; became a Jesuit in 1548; held professorships at Coimbra and Evora; resided at Rome 1572–79; was the instructor of Molina; wrote commentaries on Aristotle (4 vols., 1572–1602), *Institutiones Dialecticæ* (1564), and a treatise on foreknowledge and free-will (1588). D. at Lisbon Nov. 4, 1599.

Font [Lat. *fons*, a "fountain"], a vessel used in churches to contain the baptismal water. The font is smaller than the baptistery, the latter being in general designed for the administration of the ordinance by immersion, while the font was used in the other and later modes of baptism. It is usually of stone, sometimes of silver or other metal, ordinarily stands near the entrance of the church, and often is enclosed by a rail. The font is frequently fashioned with much taste and skill. The name *font* is often incorrectly applied to the stoup, stock, or *bénitier*, a vessel containing holy water, and placed near the entrance of Roman Catholic churches.

Fontainebleau, town of France, in the department of Seine-et-Marne, 35 miles S. E. of Paris. Its palace, built in the twelfth century and enlarged and embellished in each succeeding century, is one of the most magnificent buildings in France. The forest which surrounds it, and which is wholly laid out as a landscape-garden, comprises 64 square miles. Pop. 11,939.

Fonta'na (Domenico), an Italian architect and engineer, b. 1543, is chiefly remembered for his great feat, the transportation of the Egyptian obelisk to the square of St. Peter's, Rome, in 1586, for which he received great honors. The obelisk had been brought to Rome in Caligula's time. He also finished the cupola of St. Peter's basilica, finished the palace of Monte Cavallo, and planned the Vatican Library. D. 1607.

Fontana (Prospero), b. at Bologna in 1512, was a painter of much ability, but a too rapid and careless worker. His portraits won him much fame, but were not equal to those of his daughter Lavinia (1552–1614), a clever and painstaking artist. He instructed the Caracci. D. 1597.

Fontanel' [Fr. *fontanelle;* Lat. *fons palpitans*], the soft palpitating spot upon the head of a young infant; so called because its throbbing was likened to the welling up of a fountain. The fontanels are usually from four to six in number, but only one or two are easily detected in most cases. The great fontanel is at the crossing of the coronal and sagittal sutures. It is generally closed by the development of the neighboring bones within two years after birth. The smaller posterior or bregmatic fontanel is at the junction of the sagittal with the lambdoidal suture, and closes in a few months after birth. There are also two sphenoidal and two mastoidal or Gasserian fontanels, but they are very small, and generally close soon after birth. The two principal fontanels are of great importance in midwifery, as they enable the skilful practitioner to determine the position of the fœtus in head presentations.

Fontanel is also a small issue or artificial ulcer made by the surgeon for its derivative effect. A common dried pea, a lump of beeswax, or other hard mass is kept in a small cut under the skin, causing a flow of pus. The fontanel, though a valuable therapeutic means, is at present not much employed.

Fontanel'la (Francesco), b. at Venice June 28, 1768; became a priest, and was for a time professor of grammar in Venice, and afterwards professor of Latin eloquence at Udine, but his principal employment was proof-reading; author of Greek and Hebrew grammars and lexicons, and of several learned philological treatises. D. at Venice Mar. 22, 1827.

Fontanelle, post-v., cap. of Adair co., Ia., about 70 miles W. of Des Moines, midway between the Chicago Rock Island and Pacific and the Burlington and Missouri River R. Rs. It has 2 hotels, 2 weekly newspapers, and several dry-goods and grocery stores. It is a trading town for a considerable district. Its public schools are efficient. Principal business of the vicinity, farming. Pop. about 500.
James M. Gow, Ed. "Adair County Reporter."

Fon'te Avella'na, Order of, a monastic order established 1001 at Fonte Avellana, near Faenza, Italy, by Ludolf, bishop of Iguvium. In 1570 it was united to the Camaldulians. St. Peter Damian was its most famous member.

Fontenay-le-Comte, town of France, in the department of Vendée, on the Vendée. It has great linen manufactures and tanneries. Pop. 7971.

Fontenelle, tp. and post-v. of Washington co., Neb., on the Fremont Elkhorn and Missouri Valley R. R., 10 miles N. E. of Fremont, and on the Elkhorn, here crossed by a bridge. It has a fine soil, and is the seat of Nebraska University. Pop. of tp. 400.

Fontenelle, de (Bernard de Bovier), French author, b. at Rouen Feb. 11, 1657; admitted to the French Academy in 1691, and to the Academy of Sciences in 1697, of which he was perpetual secretary from 1699 to 1741. D. at Paris Jan. 9, 1757. His *Dialogues of the Dead* was published in 1683, *Discourse on the Plurality of Worlds* in 1686, and *Essay on the Geometry of the Infinite* in 1727. Wrote also *History of Oracles*, and in forty years composed eulogies on about seventy members of the French Academy of Sciences.

Fontenoy, a v. of Belgium, in the province of Hainaut. Here was fought, May 11, 1745, the famous battle between the French under Marshal Saxe and the allied English, Dutch, and Austrians under the duke of Cumberland, in which the French won a great victory.

Fontevrault, small town of France, in the department of Maine-et-Loire. In its church are the tombs of Henry II. and Richard I. of England. This church, now a prison, is nearly all that remains of the ancient abbey of Fontevrault, once the mother-house of the monastic order of Fontevrault, founded 1100, and broken up at the first Revolution. The order contained monks and nuns, and was at one time Augustinian, but became an independent congregation.

Fonvielle, de (Wilfrid), French aëronaut and popular scientific writer, b. at Paris in 1828, was a teacher of mathematics, then a journalist and aëronaut. During the siege of Paris he escaped from the city in a balloon. *L'Homme Fossile* was published in 1865, *Les Merveilles du Monde Invisible* in 1866, *Éclairs et Tonnerres* in 1867 (translated into English as *Thunder and Lightning*), *L'Astronomie Moderne* in 1868. Accounts of his balloon ascensions were published in 1871 under the title of *Travels in the Air.* He has written several political pamphlets.

Foo-Chow, popularly called **Hok-Chin,** is the capital of the Chinese province of Fo-Kien, the residence of the viceroy of Fo-Kien and Che-Kiang, the seat of several high civil and political authorities, and stands on the river Min, 35 miles from its mouth. The number of its inhabitants is variously given. According to Scherzer and the *Missionary Herald* (Boston, Feb., 1872) it is about 1,000,000, but others call it 800,000, 600,000, and 500,000. The number of 600,000, which has been adopted by Behm and Wagner in *Bevölkerung der Erde* (Gotha, 1874), seems to come nearest to the truth. The town is beautifully situated on both banks of the river, which rise in terraces and are connected by stone bridges; it has an excellent harbor, and is surrounded with an old wall 30 feet high, 12 feet thick, and surmounted with high towers. Its general aspect is most striking; the broad river is entirely covered with floating houses and innumerable junks, and stretches through the valley like a boisterous market-street, while on both sides the town rises like an amphitheatre. The town itself is dirty, however, and makes a poor impression on account of its miserable buildings, though its streets are lined with shops crowded with goods and stirring with traffic. The most remarkable institution of Foo-Chow is its arsenal. It is a perfectly modern establishment, is under the direction of a Frenchman, and has 50 European engineers, teachers, and superintendents, and about 1200 Chinese workmen. It was founded in 1867. China has only three other arsenals arranged on the European plan—namely, those of Shanghai, Nanking, and Tientsin. But its greatest importance is derived from its tea-trade, and from the circumstance of its being open to foreign commerce. Its position offers a cheap and convenient communication with the interior, and since 1853—in which year the firm of Russell & Co. shipped the first cargoes of tea directly from Foo-Chow to Europe and America—its commerce has increased so rapidly that as a tea-market it now ranks next to Shanghai: 550,239 piculs of tea were exported in 1867; 603,770 in 1868; 581,003 in 1869. The business of the foreign houses in Foo-Chow is confined to

the exportation of tea, the importation of opium and lead, and ship-brokerage. Although, with respect to the inland traffic, the harbor is of great consequence as a market for building-timber and paper, and although large quantities of cotton and woollen goods are imported, yet the foreign houses have very little to do with these branches of the trade. The Chinese merchants carry them on; all woollen goods are bought by Chinese houses in Hong-Kong and shipped to Foo-Chow on European vessels. The value of imported foreign goods has during the last few years amounted to about $6,000,000 annually; that of imported Chinese produce to about $3,000,000, and that of the entire exportation to about $35,000,000. About 500 vessels of 250,000 tons burden annually clear the harbor.

AUGUST NIEMANN.

Food, a substance which supports the functions and powers of the body—one by which the body may live, act, and grow. It is not one which simply satisfies or arrests appetite, for a nauseous smell or a mental shock will do that; nor one simply which gives a sense of satisfaction at the stomach and removes craving for food, like the lump of clay which is swallowed by savages in the absence of food; yet food does both. Neither is it a substance which controls and regulates the functions, for that is the special duty of a medicine; and yet it so far governs that it increases the activity of some or all of them. With want of food there is a natural subsidence of vital action, accompanied by craving for food and appetite or relish for it, whilst after food has been eaten the action of the heart, lungs, and other organs is increased, heat is generated, appetite is arrested, and a sense of satisfaction is felt, whilst a glow of warmth pervades the whole body. After an interval of three or four hours appetite and a sense of want of food return, and the process of renewal must be repeated.

Hence food must be identical with the elements of our bodies, or be capable of transformation into them, supplying the want caused by waste and the material required for growth. It must also be adapted to the needs of the infant as well as those of man at all ages and in various conditions of season, climate, modes of life, and exertion. Its nature must be such that it can be digested within the usual period, lest the body starve whilst food is within it; but this is commonly assisted by the process of cooking, which by softening the food shortens the term subsequently required for digestion. Thus, a piece of the bark of a tree contains the elements of food, but in a form most difficult of digestion. When in periods of great privation it has been eaten, it has been first broken up into the smallest pieces, immersed and then boiled in water to soften the fibre and to cause the starch-cells to burst. Or, again, to give the ordinary food of man, which requires four or five hours to digest, to an infant whose functions are performed so rapidly that it must receive food every two hours, would starve the child, whilst food would accumulate in the stomach and bowels, and destroy the appetite for it. An infant cannot live well even on bread, which is the staff of life to man.

Classification.—As foods have two very evident duties to perform—viz. to maintain the heat of the body and to supply material for growth—they have of late years been divided into *heat-generators* and *flesh-formers*, the former consisting of carbon, hydrogen, and oxygen, and the latter of these elements, with the addition of nitrogen. Hence, the two classes are likewise called, respectively, *hydro-carbons*, or carbo-hydrates, and *nitrogenous;* but, although two, they are so nearly one that in nature they are invariably found and eaten together at each meal. Thus, the three great hydro-carbons are fat, sugar, and starch; but fat is found with lean flesh in animals and with albuminous matter in seeds, both of which are rich in nitrogen; whilst sugar and starch never exist alone, but always with juices and tissues containing nitrogen, from which they may be separated by artificial means. Hence, whilst one kind of food may contain a far greater proportion of nitrogen than another, and may therefore be *par excellence* a nitrogenous food, all foods contain carbon or hydrogen, or both, in large quantities, and are therefore heat-generators.

The classification of foods on their chemical constituents is thus shown to be of comparatively little importance, and as we proceed to further regard their origin from vegetables and animals, the same fact will be yet more evident. A vegetable food is derived from the soil and air, and when eaten becomes flesh; but when we eat the flesh of animals we eat that which was previously derived from vegetables, and we may therefore be said to eat vegetables specially prepared and transformed by animals for our use. When the refuse of flesh is eventually given to the earth, it again produces vegetables, and thus the round of creation and transformation of food is complete. This implies that vegetable and animal foods have the same elements, or are capable of transformation, the one into the other; and so bread, meat, and milk, however different in appearance, have their essential elements in common. It also leads to the inference that as animal food is a nearer approach to the composition of our own bodies, it should be, as it is, more readily and quickly appropriated by us than vegetable food. It is also a more compendious food.

Foods will be considered in this article under the two general heads of solids and fluids, the former being divided into three classes, according to their source—viz. mineral, vegetable, and animal.

I. Solid Foods.

A. *Mineral Food.*—The bones, nearly every soft tissue, and the blood require mineral matters combined with acids, and foods supply them in about the following proportion: Common salt, or chloride of sodium, is found in water and in many animal and vegetable substances, but it is usual to eat from one-quarter to one-half an ounce daily with our food. Potash is supplied by lemons, oranges, grapes, pineapples, strawberries, mulberries, tamarinds, apples, and nearly all fruits, as well as by potatoes, cauliflowers, cabbages, cucumbers, artichokes, asparagus, rhubarb, and nearly all garden vegetables. Sulphur is contained in albumen (as the white of eggs), fibrine, and caseine in proportions of $3\frac{1}{2}$ to 7 parts in 1000. Iron enters into the composition of most vegetable foods, as potatoes, carrots, cucumbers, peas, cabbages, and mustard, and into many animal substances, as milk and flesh. Alumina exists in carrots, and silica, or flint, in potatoes, wheat, rice, and numerous vegetable structures. Phosphorus, when combined with a base, as lime, magnesia, soda, potash, etc., is found in nearly all vegetable and animal foods. Thus, there are in blood 0.14; barley, rice, and oats, 0.22 to 1.32; milk, 0.56; wheat, 0.8 to 2.0; potatoes, 2.5; caseine, 13.2; and in bones, 27 to 72. It is also found in fibrine, albumen, the brain, and numerous other structures of the bodies of animals.

From this statement it follows that whilst the need of the body for mineral matter may be supplied in very different quantities, a mixture of foods is the most fitting; and with such we may be assured that a sufficient quantity is afforded. But of all classes those which contain fresh vegetable juices appear to be the most important, for without them the nutrition of the body cannot be long maintained.

B. *Vegetable Foods.*—The lowest classes of vegetables which supply man with food are the lichens, fungi, mosses, and sea-weeds. Lichens and mosses are ordinary articles of food in the northern regions, as in Lapland and Greenland, and supply food to man and beast for several months in the year. Iceland moss (*Cetraria Islandica*) has long been appreciated in more southern climates for its mucilaginous quality, and is eaten alone, as an infusion in hot water, or made into various compounds, as Iceland moss cocoa. It is deficient in flavor, and requires the addition of sugar and a condiment, but it produces a more valuable infusion than linseed tea. Reindeer moss (*Cladonia rangeferina*) has similar qualities, but is inferior as a nutriment, since, whilst the former yields about 30 per cent. and the latter has only about 1 per cent. of starch, the potato usually contains about 18.0 or 19.0 per cent. of starch: it is inferior in that respect to Iceland moss. Irish or carrageen moss (*Chondrus crispus*) (a sea-weed), is not equal in nutritive value to Iceland moss, but is a well-known article of food or physic. Sea-weeds have long been in use as food in Scotland and the more northern islands of Europe, particularly when other vegetable food is scarce. They have also been used in periods of abundance by a few persons, so that laver (*Porphyra laciniata* and *vulgaris*) is eaten with roast meat at the most luxurious tables. There are many edible sea-weeds, but as all have a bitter flavor, which soda only partially removes, they are not likely to be generally used as food. They, however, rank very high in nutritive value, for they are said to contain 10 to 15 per cent. of nitrogenous and 60 to 70 per cent. of carbonaceous matter, and therefore merit the attention of countries having a wide seaboard and a poor population.

Mushrooms (*Fungi*) constitute a large class of vegetables, many of which have most attractive colors, and not a few very repellant odors. There is great difference of opinion as to their edible qualities, some asserting that nearly every kind may be eaten, whilst others allow but one or two kinds, and particularly the common edible mushroom of small size (*Agaricus campestris*). It is quite certain that persons have been poisoned by eating mushrooms, and therefore that all mushrooms cannot be edible. In chemical composition this class of vegetables ranks somewhat high, but they are very light in structure, and from the bulk required at a meal could not become a necessary article of food. They are generally luxuries, or, when made into ketchup, may be called condiments. Truffles, whether white or black (*Rhizophagon album* and *Tuber cibarium*), grow about one

foot in depth under ground, to the size of a potato, and are now more fashionable than useful food.

Succulent Vegetables.—This very large class of foods is eaten chiefly for their juices and starch, and are prized according to the abundance of those elements and their flavor.

The potato (*Solanum tuberosum*) occupies the first place in temperate climates, on account of the large quantity of starch and potash which it contains, and its agreeable flavor. It is a native of N. and S. America, but has become acclimatized in all except very hot and very cold climates. It contains only about 2.1 per cent. of nitrogenous matters and salts, and is therefore not fitted to be a sole article of food. The greater the specific gravity the larger is the quantity of starch which it contains; so that with a specific gravity of 1.123 there is 24.14 per cent. of starch, whilst with a specific gravity of 1.090 the starch is only two-thirds of that quantity, or 16.38 per cent. The sweet potato (*Batatas edulis*) and the yucca are eaten largely in America. The yam (*Dioscorea alata, batatas,* or *sativa*) is a common food in China and many other countries, and contains a quantity of starch scarcely less than that of the common potato, but is not equal to the latter in flavor. There are many edible tubers bearing starch growing in South America, and also a few in North America, as the prairie turnip (*Apios tuberosa*), which contains a larger proportion of edible matter than the common potato. The artichoke (*Cynara scolymus*) is valued for its flavor, as well as for its nutritive qualities, but it is yet more valuable for its large proportion of salts, of which more than one-half are potash, whilst the leaves yield 40 per cent. of salts of lime. The *Helianthus tuberosus*, or Jerusalem artichoke, has edible and quite nutritious tubers, which are, however, rarely used as human food.

The fruit of the bread-fruit tree (*Artocarpus incisa*) and of the plantain (*Musa paradisiaca*) may be regarded either as culinary vegetables or fruits, but from the quantity of nutritive material which they afford they belong rather to the former. The bread-fruit is always cooked by baking in an earthen oven or on heated stones, and then resembles wheaten bread.

The carrot (*Daucus carota*), parsnip (*Pastinaca*), beet (*Beta vulgaris*), turnip (*Brassica*), vegetable marrow, and pumpkin (*Cucurbita*) occupy a position between potatoes and ordinary green vegetables, since they contain a larger quantity of starch and sugar, and are therefore more nutritious, than the latter. They are nearly equal in nitrogenous elements—viz. about 1.3 per cent.—but in reference to sugar they vary as follows: turnips, 2.1 per cent.; parsnips, 5.8; carrots, 6.1; and beets, 10.5. Swedish turnips contain more carbonaceous matter (starch and sugar) than the white variety, but the flavor is harsher, though in the U. S. the more delicate varieties are highly prized as food for man.

All the well-known succulent vegetables, as spinach, turnip-tops, cabbage (*Brassica*), broccoli, cauliflower, sea-kale, tomatoes, nettles, lettuce, dandelion, endive, chicory, may be regarded as nearly alike in nutritive value, whilst they vary extremely in flavor, and are chiefly valuable for their fresh juices. They should be well cooked, for if eaten in large quantity they do not readily digest. No part of a dietary is more valuable than the abundant supply of such substances, but when eaten raw or in salad, it should be in moderation. Cucumbers (*Cucumis*) are regarded apart from this class, since they are always eaten raw, and many believe them to be injurious to health; but if prepared like other raw vegetables, and without vinegar, they rarely disagree. Rhubarb (*Rheum*) has the character of a fruit rather than a vegetable, and has juices so valuable that it is scarcely possible to eat too much of it. Wild lettuce (*Lactuca sativa*) is poisonous, whilst when cultivated it is both harmless and agreeable.

Fruits may now be considered, since they are more like succulent vegetables than any other productions in the composition of their juices and their uses in the animal economy. It is needless to cite them by name, since they are well and widely known, and it would be impossible to refer to more than a very small proportion of them. No products are so universal and none so agreeable. All agree in having a larger proportion of sugar and vegetable acid than occurs in ordinary vegetables, and flavors of infinite variety and delicacy. Some, as the date, are so valuable as to be a chief support of life, but the characteristic of the class is to afford agreeable and refreshing rather than nutritious elements. It is, however, worthy of note that in these qualities the choice fruits of our gardens and hot-houses far excel those of the products of Eastern climates, whilst the chemist has produced substances which closely imitate the flavor of all the most appreciated fruits. The following table may be useful, as it contains the percentage quantities of water, sugar, and free acid in our ordinary fruits:

	Water.	Sugar.	Free acid.
Grapes, generally	79.8	13.8	
Klaubegen, ripe	...	10.59	
White Austrian	...	13.78	
Red Asmannshäuser, ripe	...	17.28	
Oppenheim, ripe	...	13.52	
" overripe	...	15.14	
Johannisberg	...	19.24	
Mulberries	84.7	9.19	1.86
Bilberries	77.5	5.78	1.34
Blackberries	86.4	4.44	1.18
Cherries, black	79.7	10.70	0.56
" sweet, light red	75.3	13.11	0.35
Apples, English golden pippin	81.8	10.36	0.48
" English russets	82.0	6.83	0.85
Pears, sweet red	85.0	7.94	trace.
Strawberries, wild	87.0	4.55	1.33
" cultivated	87.4	7.57	1.13
Raspberries, wild	83.8	3.59	1.98
" cultivated, red	86.5	4.70	1.35
Plums, green gages, yellow	80.8	2.96	0.96
" " large and sweet	79.7	3.40	0.87
Apricots, large	82.1	1.50	0.76
" small	83.5	2.73	1.60
Peaches, Dutch	84.9	1.58	0.61
Gooseberries, large red	85.5	8.06	1.35
" small	84.8	8.23	1.58
Currants, white	83.4	7.12	2.53
" red	85.2	6.44	1.84

Seeds.—The seeds of plants have so much in common that they may be treated under one head, notwithstanding their infinite variety of flavor and diversity of production. The most highly nitrogenized seeds are peas, beans, lentils, and numerous other products of pod-bearing plants, called pulses, or dahls and grain in India, and frijoles in Mexico. While potatoes contain about 2 per cent. of nitrogenous matter, peas have 23 and lentils 25 per cent., and are the most highly nitrogenized natural foods known to mankind. They are also rich in starch, for peas contain 55 per cent. of that substance. Whole nations are largely indebted to these foods for their highest nourishment, and it seems as if the nitrogenous vegetable food were more suitable to the body in hot climates than meat. The 4 ounces of dahls which each inhabitant of a large part of India eats daily is to the rice accompanying it that which buttermilk is to the potato in Ireland; and it is scarcely possible to overestimate its value. The flavor is, however, somewhat harsh as compared with that of fine wheaten flour, and with the luxurious habits of the age the latter, although affording less nutriment, is preferred. The most agreeable member of this class in Europe is the haricot bean, which is in almost daily use in France, and is served alone or with meat and sauce. All such foods require to be well cooked by boiling, and the skins should be rejected. They are deficient in fat, and being highly nitrogenized demand an abundant addition of that food. When eaten too abundantly and constantly they are liable to produce skin-disease and indigestion. The least nutritious seed in extensive use is rice, for it contains but 6.3 per cent. of nitrogenous matters, and the next is millet, with 9 per cent.; yet these substances supply the chief food of more than one-half of the inhabitants of the world. At the same time they supply a proportionally greater amount of starch—viz. rice, 79.1, and millet, 74 per cent., as against 55.4 per cent. in peas. Experience has shown that whatever may be the use of nitrogen, it is eaten less abundantly in hot than in cold climates, whilst starch, and probably sugar, are the reverse. They are regarded as insufficient to maintain strength in our climate. But it is needless to discuss this statement, since we have substances which are better and cheaper than either rice or millet, and therefore do not find them necessary foods. As a part of a dietary they are agreeable and valuable, but new rice should not be eaten. Ground rice is commonly added to fine wheaten flour to make it whiter. It cannot alone be made into a loaf, but small cakes and biscuits are prepared with it. Parched rice made into *sulpawn* is in common use in the East.

The seeds which supply our staple vegetable foods occupy a position between these and peas, and have a close similarity in their nutritive qualities—viz. wheat, maize, and oats, which possess 11 to 12 per cent. of nitrogenous and 75 to 80 per cent. of carbonaceous matter. They differ in flavor, so that both maize and oats are said to be rough, whilst wheat has a softer and perhaps sweeter flavor; and although wheat has the preference, wherever it is grown each kind of corn has its advocates. Regarded simply as nutritive foods, one may be substituted for the other, but in practice they are not interchangeable. Thus, wheat when ground can be made into loaves, biscuits, and pie-crusts, whilst maize and oat meal are made only into small or thin cakes. Moreover, wheaten bread may be eaten alone with a relish, whilst corn cake and oat cake are repulsive unless accompanied by fat, milk, or sweets. This appears to be due to the greater ease with which the starch-cells in wheaten flour are acted upon by heat and

water, so as to become a soft and homogeneous mass, whilst both maize and oat meal remain rough and gritty unless cooked for a much longer period and with the grains loosely separated.

Bread which is made from wheat may have all or any part of the husk or bran of the grain in it. If there be much, it is called brown bread, and as the flinty covering of the bran is indigestible, it is very apt to cause purging, and is the rich rather than the poor man's food. White flour has lost the nitrogen of the bran, but it is more digestible, and therefore more useful, and probably the most nutritious kind is that known as seconds or households. Fourteen pounds of fine white flour should make 19½ to 20 pounds of bread. Passover cakes are made from the finest and purest flour. Oat meal is never met with entirely devoid of the hard and indigestible skin, to which also it owes its high percentage of nitrogen; but when the whole grain has been decorticated it is known as groats. Maize is the only grain under consideration which is eaten whole in its unripe condition and when full of milky juices, but whole ripe wheat is steeped in water to make frumenty, and both the oat grain and the skin of the oat meal are used to make foods in Wales and Scotland under the name of *sowens* and *sacan* or *slymru*. Very valuable preparations for infants' food and puddings are now made from them, as corn flour and semolina.

The nutritive qualities of all these grains vary with climate and season, so that moderately hot and dry climates and seasons produce the best wheat, and the highlands better oats than the lowlands. The *tortilla* is a cake prepared in Mexico and South America with ground maize, whilst johnny cake and corn bread are commonly made in North America from the same grain.

Rye and barley, although inferior grains, are largely eaten by the poorer inhabitants of Northern and Central Europe. Their proportion of nitrogenous matter is only from 7 to 8 per cent., and therefore but little exceeding that of rice and millet, whilst the carbonaceous is 78 to 80 per cent. An improved food is made by a mixture of rye and wheat called *maslin*, which is in use in Northumberland and North Yorkshire, and it is not unusual to add a little rye meal to wheat meal in making bran bread, with a view not to increasing the nutritive value of the latter, but to keep the bread moist. The Norwegian *flödegröd*, or cream porridge, is made by boiling barley meal in cream, during which process it is stirred with a *grödstick* twisted between the palms of the hands.

The following table shows the percentage composition of the chief representatives of this class of seeds and foods:

	Water.	Nitrogenous.	Carbonaceous, including Sugar.	Starch.	Fat.	Salts.
Maize	14	11.0	0.4	64.7	8.1	1.7
Millet	13	9.0	74		2.6	2.3
Rice	13	6.3	0.4	79.1	0.7	0.5
Oat meal	15	12.6	5.4	58.4	5.6	3.0
Wheaten flour, seconds	15	10.8	4.2	66.3	2.0	1.7
Wheaten bread	37	8.1	3.6	47.4	1.6	2.3
Barley meal	15	6.3	4.9	69.4	2.4	2.0
Rye meal	15	8.0	3.7	69.5	2.0	1.8

Nuts.—There are numerous seeds which are regarded as fruits from their agreeable flavor and unfitness to be eaten as standard articles of food, such as the cocoa-nut (*Cocos nucifera*), Brazilian nut (*Bertholletia excelsa*), earth-nut (*Arachis hypogæa*), walnut (*Juglans*), chestnut (*Castanea*), and almonds (*Amygdalus communis* and *amara*), constituting a very large class, and found in almost every part of the world except the extreme N. and S. They are rich in albuminous, saccharine, and fatty elements, and supply a much larger quantity of nutriment than our ordinary cereals. The cocoa-nut is doubtless the most valuable nut in hot countries, both as yielding fluid and solid food, besides oil and fat for commercial purposes; whilst the edible chestnut is the most useful in temperate climates, and supplies a larger proportion of starch and smaller proportion of fat than the cocoa-nut. The nutritive value of these products has not yet been sufficiently appreciated.

Starchy Foods.—Foods which are composed almost exclusively of starch are artificial, for they must be prepared by man from natural foods. Such are sago, tapioca, arrow-root, cassava meal, and manioc. None are absolutely destitute of nitrogen, but the quantity is so small that it may be practically discarded in our calculations. Sago is obtained from several palms by beating and washing the pith, whilst all the others are extracted from the roots of plants. Arrow-root is prepared from the *Maranta arundinacea*, or even the potato, and the others from the *Jatropha* and other euphorbiaceous plants, which contain poisonous juices until expelled by heat. The process is the same in all—viz. to beat the root and wash and dry the fecula. The size and color of the grains depend upon the mode of preparation. All are practically equal in nutritive value, but Bermuda arrow-root is preferred in the market. These foods may be readily distinguished from each other by the microscope, which shows the figure and size of the starch-cells. As all are really starches, their respective values depend upon flavor and abundance in the market, and not upon their relative usefulness in the system. All alike require to be sufficiently cooked, so as to burst the cells and to thicken the fluid in which they are macerated, and for the use of young infants must be given with milk and other nitrogenous food. Hence, they are of even less value than the potato as separate foods, but as adjuncts are most agreeable, and therefore useful.

Sugar is found in almost every kind of vegetable foods, but particularly in fruits, where it is called fruit or grape sugar; in the sugar-cane (*Saccharum officinarum*) and Chinese sugar-grass (*Sorghum saccharatum*), where it is known as cane-sugar; and in milk, as milk-sugar. The composition of sugars varies only in the elements of water, and that of cane is $C_{12}H_{11}O_{11}$; but all are not equal in sweetening properties. The quantities per cent. found in certain foods are as follows: raw sugar, 95; treacle, 77; buttermilk, 6.4; carrots, 6.1; parsnips, 5.8; oat meal, 5.4; skim milk, 5.4; new milk, 5.2; barley meal, 4.9; wheat flour, 4.2; rye meal, 3.7; wheaten bread, 3.6; potatoes, 3.2; turnips, 3.1; peas, 2.0; Indian meal and rice, 0.4.

The largest source for the sugar-market is doubtless the sugar-cane, and the next beet-root (*Beta vulgaris*), but a considerable quantity is obtained in North America from the sugar-maple (*Acer saccharinum*). In India much is extracted from the juices of various palm trees, and particularly of the wild date and the *Arenga saccharifera*. The juice is expressed from the whole substance of the cane and beet-root by great pressure, whilst the tree of the sugar-maple is tapped for the exudation of the juice, and the male flower of the palm is cut off for the same purpose. In all cases there are impurities with the sugar, which are extracted by the addition of quicklime and by the removal of a scum which arises with furious boiling. The liquor is then evaporated and crystallized in vacuum pans, leaving an uncrystallizable sugar in the form of treacle. The crystals are further purified, either by the aid of moist clay or by the centrifugal process. Refined or loaf sugar is purified by treating the dissolved crystals with bullocks' blood, and again concentrating and crystallizing in the vacuum pan, and the uncrystallizable syrup is removed from the crystals. That kind of raw sugar is the best which has the largest crystals and the least proportion of moisture; and of loaf sugar that which is the whitest and hardest. Golden syrup is produced in refining sugar.

Honey is not the product of the bee, as many believe, but is simply collected by that useful insect from flowers, and has a flavor varying with its source. Some of the finest is obtained from Mount Hymettus in Greece, whilst that procured from certain plants, as the azaleas, is said to be poisonous.

Manna as ordinarily obtained is derived from the juices of the manna ash, growing in Southern Europe. It is also found as a deposit upon the trees and ground under certain conditions of weather and climate, when it is in grains as small as a coriander-seed, and if not carefully picked will be mixed with other substances. Its peculiar substance is called *mannite*.

C. *Animal Foods.*—All kinds of flesh have their essential properties in common, and for ordinary dietetic purposes are interchangeable; but as lean corresponds with lean and fat with fat, the true distinction is the proportion of one to the other: thus, there is the largest proportion of fat in the pig, and a greater in sheep than oxen as ordinarily fed and when ready for the butcher. The same quantity of food produces a larger quantity of fat in one than in the other: thus, with 100 pounds of nitrogenous food the pig produces 13.5 pounds of fat, the sheep 4.2 pounds, and oxen 4.1 pounds, while the same quantity of carbonaceous material produces 18.5 pounds, 9.4 pounds, and 7.2 pounds in the three classes.

The flesh of all animals consists of bundles of extremely fine tubes which contain the meat juices. The better the breed and feeding, the richer are the juices in flavor and fat, whilst the older the animal, the tougher are the fibres or tubes and the tissue which connects them. Each class of animals has its own special characters, but the quantity of meat depends upon these two conditions. This is true of the nitrogenous part of an animal, but the fat, which is carbonaceous, is nitrogenous only to the extent of the fine tissues in which it is contained. Beef has always been regarded as the kind of flesh which gives the best nutriment to the eater, whilst mutton and poultry are softer in texture and more delicate in flavor. The flesh of wild animals approaches to, if it does not excel, beef in nutritious qualities, but it is almost always harder, and requires a degree of decomposition to separate its fibres. The rich

flavor of wild game seems to be due chiefly to the activity of the animal, and is nearly lost with domestication. Pork and veal have always been regarded as less digestible than beef, but this depends upon the quality and age of the animals. Some pieces of pork are hard, and masticated with difficulty, whilst other kinds are soft, and easily crushed by the teeth. Very young veal has fibres so soft that the teeth can scarcely grind them, whilst a calf eight or ten months old affords meat as easily masticated and digested as mutton.

The juices of flesh are obtained when making beef-tea and Liebig's extract of meat. In the former the meat is cut into extremely small portions and heated for some time with a little water, whilst in the latter the flesh is boiled down and all the fat, fibrin, and albumen removed. Both contain nearly all the salts which were present in the flesh, but the latter has a larger portion of extractives, containing the peculiar flavor of the meat. Liebig's extract is valuable as a nervine stimulant and meat flavorer, but is not a rich nutrient in the ordinary sense of the word, and should not be depended upon to serve as food without admixture of other nutritious substances.

The flesh of fish contains more phosphorus, and differs little from that of animals in chemical composition, but much in texture and flavor, and the nearest approach is found in salmon and sturgeon. The proportion of fat and oil to flesh is in some kinds greater than that of quadrupeds, for the eel contains 50 per cent., herring 30 per cent., and a salmon in fine condition 10 to 20 per cent. White-fish usually contains less than red-blooded fish, but some of the former, as the cod, lay up a large store of oil in the liver. Fish is rich in phosphorus. On the whole, fish is excellent food, but not equal to flesh, nor sufficient to maintain full health and strength. Leprosy is found chiefly in fish-eating and poverty-stricken populations. The roe of fish is a luxury, and contains both albuminous and fatty matters, and when obtained from the sturgeon and some other fish, and prepared, is called *caviare*. It is eaten raw in Sweden and Russia as an appetizer before dinner. The gelatinous parts of fish, as the head and fins, are also much prized, but unless eaten in great quantity do not suffice for a meal. When fish, as herring, is cheap, it is the cheapest of all animal foods in the market in proportion to the nutriment contained in it, but its price is subject to great variation. Oysters are delicacies rather than necessary food, whilst lobsters and similar shell-fish are too indigestible to be eaten by some persons with impunity.

Eggs consist chiefly of albumen, but the yolk contains oil, and there are also sulphur and other elements which have a certain nutritive value. They are not fitted to supplant flesh, but rank next to fish. All have the same nutritive value in proportion to their size, but some are repelling in flavor, as those of fish-eating birds, whilst others are delicious, as those of well-bred and well-fed barndoor fowls. Those of the plover are amongst the most delicate in flavor. It is not desirable that they should be boiled hard, unless to be grated down, but they may be boiled, as in puddings, when well divided into the semi-liquid state. The highly nutritious quality of an egg may be appreciated from the following percentage analysis, and but few know that it contains so large a proportion of fat as is shown in the following statement: thus, dry matter, 30; dry fat, 11.0; carbon, 17.52, or carbon and nitrogen reckoned as carbon, 20.56; mineral matter, 1.4; nitrogen, 2.0; besides water.

Gelatine is a very valuable food, notwithstanding the erroneous inferences which have long been made from the report of the French gelatine commission, and in composition is practically identical with albumen. Isinglass from the gut of the sturgeon is the best form of it, but in China certain birds' nests, with which soup is made, have the preference. It is, however, usually obtained from the bones, skins, and hoofs of animals, of which it constitutes about one-half.

Caseine is obtained principally from milk, but exists largely in peas and almonds, and has the same nutritive character as albumen and gelatine. As ordinarily found in cheese, it is mixed with a proportion of fat (butter), and by drying, as well as by decomposition, acquires a flavor very different from that of fresh curd. Whilst the latter may be eaten with impunity, the former is digested with difficulty and requires careful mastication. Skim-milk cheese contains a larger proportion of nitrogenous and a less proportion of carbonaceous matter, as shown in the following percentage analysis:

	Water.	Nitrogen.	Fat.	Salts.
New-milk cheese, very good	36	28.4	51.1	4.5
Skim-milk cheese	44	44.8	6.3	4.9

The proportion of fat varies much in the best kinds of cheese, as from 18.7 in Neufchâtel to 32.3 in Roquefort, whilst in an ordinary Cheshire cheese it is 26 per cent. The chemical composition of all these elementary substances, and also of flesh if perfectly freed from fat, is almost identical, and may be illustrated by that of albumen, which is C., 53.4; H., 7.0; O., 22.1; and N., 15.7. Hence, the nitrogenous element is somewhat more than one-sixth, and the carbonaceous more than one-half of the dried substance.

Offal.—The offal of animals are the head, feet, liver, lungs, and heart, whilst the blood and bowels may be added to the list for dietetic purposes. The heart consists of muscular fibre or flesh, having, however, a firmer texture, is not so easily masticated, and is much inferior to other flesh as food. The lungs and liver consist largely of albuminous, and the head and feet of gelatinous matter, and whilst not equal to flesh are very good foods, and might be eaten by the poor more largely than at present with advantage. Tripe is prepared chiefly from the stomach of the ox, and contains much fat as well as albuminous and gelatinous substances. Its flavor is delicate, and it is quickly digested. Blood is less valuable as a food than any of the foregoing, but as it contains all the elements under discussion, besides iron and other valuable mineral matters, it should be eaten. When heated to 212° F. it loses any diseased taint that it might have acquired. The nutritive elements in liver and tripe may be ascertained from the following percentage analysis, and compared with a similar one on vegetable foods already given:

	Water.	Nitrogenous.	Fat.	Salts.
Ox liver	74	18.9	4.1	3.0
Tripe	68	13.2	16.4	2.4

The next is a more elaborate analysis of fresh blood (per cent.): water, 77.9; fibrine, 0.22; fatty matter, 0.16; seroline, 0.002; phosphorized fat, 0.049; cholesterine, 0.009; saponified fat, 0.1; albumen, 6.94; blood-corpuscles, 14.11; extractive matters and salts, 0.68; chloride of sodium, 0.31; other soluble salts, 0.25; earthy phosphates, 0.033; iron, 0.057.

The time required for the digestion of these animal substances was well investigated by Dr. Beaumont, with the following results: pigs' feet and tripe, 1 hour; whipped eggs, salmon-trout, and venison steak, 1½ hours; ox liver and dried codfish, 2 hours; roasted eggs, 2¼ hours; turkey, gelatine, goose, sucking pig, and lamb, 2½ hours; fricasseed chicken and boiled beef, 2¾ hours; roasted beef and boiled mutton, 3 hours; roasted mutton, 3¼ hours; stewed oysters, cheese, hard-boiled or fried eggs, 3½ hours; fried beef, boiled and roasted fowls, roasted ducks, 4 hours; and pork, 5¼ hours.

Fats.—The richest hydro-carbonaceous food is fat, for its elements are C_{77},H_{12},O_{11}, whilst those of starch and sugar are respectively C_6,H_{10},O_5 and C_{12},H_{11},O_{11}. It is customary to reckon fat as equal to two and a half times its weight of starch. All fats have nearly the same composition when freed from water and the tissues in which they are contained, so that one may be substituted for another; but they differ in flavor and the temperature at which they liquefy. So also oils remaining liquid at ordinary temperatures may be eaten instead of solid fats. The fats of meat, butter, lard, and dripping are the fats in most general use, and in their natural state the last contains the greatest proportion of the hydro-carbons, since it has the least proportion of water. The fat of meat is selected simply for its flavor, but butter varies with its manufacture, since it may contain ½ an ounce to 3 ounces of water and ¼ ounce to 2 ounces of salt in the pound. Its flavor is due largely to the food of the animal—as, for example, turnips—and the nature of the animal, for it has a much stronger flavor when produced from the goat or the buffalo than from the cow. A clarified butter called *ghee* is used in India, but is by no means so agreeable as our butter. It is prepared from milk (not cream) by first adding *dhye*, or sour milk, and afterwards hot water, and by churning. In a few days it becomes rancid, and is again clarified, and then kept for use in closed pots. Fat of every kind becomes rancid, unless subjected to some preserving process. Thus, fine sugar is used in condensed milk, salt is added to butter and lard or rubbed into pork or other meat fat, and a patent has recently been granted to Mr. Craig under which mutton or beef fat or suet is rendered hard and white, and may be kept almost without further chemical change for years. The quantity which is consumed by an adult daily is probably 2 to 4 ounces in temperate regions, but in cold climates as many pounds are eaten if obtainable.

There are no animal oils which are avowedly used as food in temperate climates, but in the far North whale oil or seal oil is taken either with or without the solid mass which constitutes the blubber. Lard oils and other animal oils are used largely to adulterate vegetable oils, and fish oils are used as medicines. Vegetable oils are, however, in great request in all temperate and hot climates, and are derived from the seeds of many plants, and particularly from

the pulpy pericarp of the olive, and are a much more agreeable and convenient food than butter. The finest salad oil, expressed from the olive berry without heat, and the oil of cucumbers, are deliciously mild in flavor, and good food. No separated vegetable fat is ordinarily used as food in this climate, but both fat and oil are eaten largely in certain seeds, as the Brazilian nut (*Bertholletia excelsa*), the cocoa-nut (*Cocos nucifera*), and almonds (*Amygdalus*). Fats and oils derived from various seeds are much more commonly used in India and other hot countries than in Europe and America.

Condiments.—Condiments are rather adjuncts to food or appetizers than food, although vegetable substances used therein are nutritious. This term includes pickles and sauces, which are almost innumerable, besides pepper, mustard, and vinegar, alone or in combination with other substances. The luxurious habits of the day lead to a free use of these substances, but he who would retain a natural taste for food and a good digestion should either eschew them or use them in their milder forms and in great moderation.

II. Fluid Foods.

Milk is the type of nutritious fluids, since it contains all the elements of nitrogenous and carbonaceous foods in a fluid form. It is therefore adapted to every condition of man, but particularly to such as require the immediate use of food, as in infancy and when there is not time for prolonged digestion. It contains caseine and albumen as its chief nitrogenous elements, and sugar and fat as its carbonaceous, besides salts of the most valuable kinds. The proportion of each varies in different animals and with age, food, and climate, whilst certain special flavors, as hircic acid in goat's milk, mark each kind. With so much variety it is impossible to give more than a general analysis, but even that has at least a comparative value, as in the following table:

	Sp. gr. + 1000.	Water.	Solids.	Nitrogenous compounds.	Sugar.	Fat.	Salts.
Goat	33.53	84.49	15.61	3.51	3.69	5.68	0.61
Sheep	40.98	83.23	16.77	6.97	3.94	5.13	0.71
Mare	33.74	90.43	9.57	3.33	3.27	2.43	0.52
Ass	34.57	89.	10.99	3.56	5.05	1.85	0.54
Woman	32.67	88.9	10.92	3.92	4.36	2.66	0.13
Cow	33.38	86.4	13.59	5.52	3.8	3.61	0.66

The salts in milk are small in quantity, but of the utmost value in nutrition, and consist of the following in 100 parts: potash, 23.46; soda, 6.96; lime, 17.34; magnesia, 2.20; chloride of potassium, 14.18; chloride of sodium, 4.74; phosphoric acid, 28.40.

Human milk is the standard of comparison for the food of infants, and varies in quality with health, food, production, and anxiety, but a mixture of two-thirds of ordinary cow's milk with one-third of water and one-half an ounce of milk-sugar or cane-sugar in a pint is a tolerable approximation. Ass's milk is sometimes substituted, and equal parts of it and cow's milk fairly represent human milk. For adults the milk of the cow, goat, and sheep is preferable. Skimmed milk has lost nearly all its fat or butter, and if kept in hot weather becomes sour. The addition of half an ounce of suet in a pint makes it equal to new milk. Buttermilk differs little from skimmed milk, except that it has become more sour by the transformation of sugar into acid, and it is in constant use as a food in Ireland, Wales, and many other countries. Whey is much less valuable, since it has lost both the fat and the cheese, but it offers an agreeable acid in warm weather, and the useful salts of milk. It is, however, never absolutely destitute of fat and caseine, and has some nutritive value from its milk-sugar. Preserved milk may be made from either new or skimmed milk, or with a part only of the cream removed. It may be simply condensed, so that four parts become one, in which state it will remain good from one to four weeks, or it may be preserved so as to remain undecomposed for many months by the addition of refined sugar and an alkali, and by evaporation. A one-pound tin contains three to four ounces of sugar, and as sugar is destitute of nitrogen, the proportion of nitrogen in the milk is thus reduced. The proportion of nitrogen to carbon in natural milk is about 1 to 12, which is little more than in bread, whilst in sugar-preserved milk it is about 1 to 20; and it is more fattening and less flesh-forming than natural milk.

Tea, Coffee, Cocoa, Chocolate.—These substances, from which so large a proportion of our beverages are made, have elements in common by which a sort of unity is given to the whole—viz. the chemically identical compounds called *theine* in tea and *caffeine* in coffee; while the *theobromine* of cacao and chocolate, though by no means of the same composition, is believed to have analogous effects upon the animal economy. The quantity is too small to be regarded simply as a nutrient, but it is believed to exert a peculiar action on the nervous system. (See Tea.)

Tea should always be prepared with water which has just begun to boil, and before the air is expelled, and the water should be from a running stream, and soft, or be softened by the addition of a pinch of carbonate of soda. It has a very powerful action on the respiratory system, by which that function is greatly increased, and also over the nervous system, by both of which wakefulness is very commonly produced. It should be taken with food after a good meal, rather than alone or when fasting. It is especially fitted for warm weather, when there is a desire to cool the body, for it produces perspiration. Europeans and Americans drink a much stronger infusion than the Chinese, but do not do so with impunity, for it is apt to produce nervous and mental excitement and indigestion, and is not unfrequently followed by a reaction in which the spirits and vital powers are depressed.

In preparing coffee for the table it should be freshly ground, and may be mixed with one quarter of its volume of chicory, and infused in boiling water ten minutes or longer, after which it should be boiled for a minute before being served. Hot new milk should be added to it in equal parts. It is a powerful respiratory excitant, but differs from tea in that it tends to dry the skin and to increase the force of the heart's action, and thus it more nearly resembles animal food than tea.

Chicory has an analogous action to coffee (but in greatly inferior degree), so that the addition of it to coffee is not without value. It is prepared from the root of the well-known vegetable after it has been roasted with fat, dried to a brown color, and ground into powder. (See Coffee.)

Chocolate and cocoa are produced from the seed of the *Cacao theobroma*, the pods of the ground-nut *Arachis hypogæa*, the cacao-shrub of Zanzibar, and other plants. The nuts are coarsely broken and called cacao-nuts, after which they are carefully ground under a considerable pressure, and with wheels having a very smooth surface, so as to be reduced to an impalpable powder. Sugar is usually added in preparing chocolate, but not so generally to produce cocoa. The peculiar principle which they possess is called *theobromine*, of the formula $C_7H_8N_4O_2$, but the flavor depends upon volatile oils and fat, which constitute 34 to 37 per cent. of the whole.

Alcohols.—The limits of this article do not allow us to do more than give a general sketch of these important substances, but the subject is discussed at length in our works on *Foods* and *Practical Dietary*. Ordinary or ethylic alcohol is the product of the fermentation of saccharine substances, whether they be malt, grain, potato, beetroot, sugar, or molasses, and comes over, mixed with other compounds, in distillation. The portions which distill early in the process are the finest and purest, and are used for the manufacture of the finest essences and spirits, whilst the later are mixed with an increasing quantity of fusel oil, until at length they are fit only for the manufacture of varnish. Alcohol is an artificial and not a natural product, and in the process referred to is mixed with a proportion of water, but it is possible by a further process to remove the water, when the remaining fluid is called absolute alcohol, of the formula C_4,H_6,O_2, and specific gravity 0.793. It is never sold in this form for use as food, but is mixed with water, and when about equal quantities of water and absolute alcohol are added together, *proof spirit* is produced, with a specific gravity of 0.920. When spirits of various kinds are manufactured they are prepared of various strengths, but usually brandy is imported at 1° or 2°; whisky at proof, or 10° over proof; rum at 25° to 35° over proof; and gin at 17° under proof; which means that if a number of gallons of water equal to the degrees over proof were added, the result would be proof spirit. The retailer often lowers the quantity of the spirit by adding water, so that he may sell the same spirit at 10° to 30° under proof.

It is denied by many that alcohol is a food, since they say it is not decomposed and transformed, but leaves the body in the same or an analogous condition to that in which it entered; whilst others dispute the inference, because the alcohol administered in any one experiment has in no case been all recovered in the excretions. In our experiments on respiration the action of alcohol when it was tolerably pure was to slightly increase the vital actions, but when mixed with much fusel oil it diminished them, and acted as a narcotic poison. Its action was not, however, regular and progressive, like that of food, but irregular and jerky, so that it rather disturbed than increased vital actions. It, however, exerts a physical action, which in part goes temporarily to diminish the necessity for food, in that it dries the skin and thus saves heat; whilst if it be strong it locally stimulates the mouth, throat,

and stomach. It also tends to harden food, and so far to interfere with the digestion of it; and it has been proved to lower the temperature of the body, which is not the characteristic of a food. But alcohol is only one of the elements in this class of fluids, and does not therefore give a uniform character to them all. The essential oils in brandy and other spirits, which are developed in the manufacture or produced by time, give approved flavors, and rum contains a large quantity of sugar, by which it increases the respiratory actions in a degree far beyond other spirits. Alcohol remains in the tissues for a period of one or two days, and as the aim should be to rid the body of it, those forms are the best which increase some diminishing action, as that of the lungs or kidneys. The addition of juniper berries to hollands and gin effects the latter object, but if habitually indulged in may go beyond the necessities of the case and bring on kidney disease. Rum is the least hurtful of spirits—a quality which is owing probably to the eliminating action of sugar. Wines, when the product of the grape only, obtain the alcohol which they possess from the fermentation of the sugar in the juice of the grape, and if the fermentation be complete, no sugar remains. Sugar bears a proportion to the other elements of the juice, and as the quantity of alcohol produced is a measure of the sugar, it is also a measure of all the elements; and therefore, as is the alcohol in natural wine, so is the value of the grape-juice. Thus, the wines of comparatively cold climates, as the Rhine and north of France, do not yield more than 9 to 16 per cent. of alcohol, whilst those of hotter climates and volcanic soils, as Greece, yield 26 or 27 per cent. The latter therefore are fuller in body than the former, and so far should be more valuable as food.

The salts in wine are very valuable as food, as, for example, the tartrates and malates of potash, which give a tartness (but not from a free acid) to natural wines, and are deposited with age, or more rapidly when gypsum (sulphate of lime) is added, which sets free the vegetable acids. When the wine is red the coloring-matter and tannin are deposited with them and form a crust; but in old white wines the tartar may be seen as a whitish powder, moving as the bottle is turned up. The chief advantage of such wines (apart from alcohol), when comparatively new, lies in these salts, but when older in the essential oils and ethers.

There is a flavor and bouquet connected with each kind of wine which gives pleasure to the consumer, and introduces it into the class of luxuries. Such as are in general favor command prices far beyond their value as food, and indeed beyond any value besides that of rarity. Their choice qualities are due partly to growth, for one plot of ground may produce flavors far superior to that of an adjoining vineyard; partly to selection of the ripest grapes and care in the manufacture; partly to the process of maturation, which cannot be determined beforehand; and partly to the age of the wine, and hence skill and capital are largely required to produce a luxurious if not a dietetic wine. The production of this class of wine is most rapidly extending, and now embraces the central parts of Europe, large districts in America, as in Ohio and California, Italy, Greece, Hungary, Australia, and the Cape of Good Hope; but hilly or mountainous ranges, with a warm soil and sunny skies, without extremes of heat and cold, are the most suitable, and the limits may be indefinitely extended.

Fortified wines (and therefore adulterated) are those to which alcohol is added which was not produced from the grapes under manipulation, and which are commonly of inferior quality. Such are port, sherry, and madeira, which are rather weak ardent spirits or liquors than wines. The strength of these wines is from 38 to 42 per cent. of alcohol, and the objects of the manufacturers are to gratify a taste for strong liquors and to preserve the wine. They are prepared for particular markets, and not for home consumption, so that such port and sherry as are sent to England are not drank in the countries of their production. The alcoholic strength of champagnes varies very much, but seldom exceeds 20 per cent.

A chief effect of the addition of alcohol is to arrest the fermentation, and a quantity of grape-sugar remains in the wine which may doubtless ferment in the body, and by producing acetic acid may cause acidity of the stomach. True champagne and other effervescing wines are prepared from ordinary grapes, but the juice is chosen with great care as to its flavor, bouquet, and sugar, and such a combination is made as will produce the quality of champagne which the manufacturer desires. It is fermented in large vats or in smaller casks, after which it is drawn off, fined, and placed in underground cellars. Here it is frequently racked and fined until the following April, when it is bottled, and for three weeks again ferments freely. It is then kept under watch for two, three, or four years, during which time it is at first turbid, but afterwards deposits a substance which by proper inclination of the bottle is left upon the cork; and the latter being skilfully removed, allows the deposit to escape. In this state the wine is matured, and called *vin brut;* and if the quality of the grape was fine and the subsequent treatment successful, the wine is very dry and has the flavor of the grape. Messrs. H. & G. Hirsch of Mayence prepare Rhine and Moselle wines in this state for the market with great success, but it is much more common to add a sweet compound of the finest sugar-candy, champagne, and old cognac or other liquors, by which the required sweetness and alcoholic strength is produced. The quantity of this liqueur is usually from 2 to 6 per cent., but it varies with the natural richness of the juice of the grape converted into champagne. The recent vintages of 1865 and 1868 form the finest *vin brut.* The effervescence is creamy rather than frothy, and rises in bubbles for hours rather than discharges the gas at once, and the bouquet and aroma are perfect. The Muscadine, Lemel, and Frontignac grapes have special odors which remain in the champagne, and some of the ripest bunches are allowed to hang in the cask. Red grapes naturally give a slight tinge to the wine, but pink champagne is artificially colored with cochineal. It is said that a bitter principle is added to certain kinds to modify the sweetness. There are certain wines, as Frontignac, Cyprus, and Tokay, produced from grapes which are allowed to dry upon the vine, and thus become raisins. The flavor readily proves this fact, and as the resulting wine is never perfectly fermented, it is rich and luscious, and contains much sugar. From the foregoing observations it will be seen how readily fictitious wines may be made, either with inferior wines or without grapes, as is commonly effected at Hamburg, Cette, and in the south of France. EDWARD SMITH.

Foolahs. See FELLATAHS.

Fool, Licensed, or **Court Jester,** called also **Clown,** a personage found in the courts of kings and nobles of mediæval Europe, whose employment it was to amuse the household by witty and mirth-provoking acts and sayings. The custom originated in the East, and was not unknown in ancient Greece and in the Roman empire. More than one fool was often kept, and at some courts there were large numbers of buffoons. Court fools were sometimes persons of weak intellect or dwarfs, but were often men of exceedingly sharp wit, and even of learning and talents. Such was John Heywood, the poet and dramatist, who was jester to Henry VIII. The published volume of the jests of John Scogan, fool to Edward IV., show that the coarsest and stupidest jests were tolerated by that monarch. The same thing is shown by the extant writings of John Skelton, who, though a priest, united the office of court-jester to that of poet-laureate. Several volumes of jokes ascribed to Archy Armstrong, court-fool of Charles I., are extant. The reputed jests of this personage and of Patrick Bonnie, a Scottish buffoon, are largely current among the British peasantry. Fools enjoyed large license in the exercise of their profession, but were made the victims of all sorts of practical jokes designed to promote the mirth of the idle people with whom they were associated. Says Ascham (*Tox.*, book i.), speaking of those who oppose archery-practice, "they be not moche vnlyke in this poynt to Wyll Somer the king his foole, which smiteth him that standeth alwayes before his face, be he neuer so worshipfull a man, and neuer greatly lokes for him whiche lurkes behinde an other man his backe that hurt him in dede"—a passage which illustrates at once the license accorded to fools and the stupid abuse to which they were subjected. This Somer lived at the court of Henry VIII. Many jesters seem to have been self-constituted ones. Thus, More (*Utopia*, lib. i., Robynson's translation), speaking of a jester at Cardinal Morton's court, says, "There chaunced to stand by a certain iesting parasite or scoffer which wold seme to resemble and counterfeit ye foole. But he did in suche wise counterfeit that he was almost the verye same in dede that he labored to represent; . . . he himselfe was oftener laughed at than his iestes were," etc. A fool's cap and bells, a bauble (consisting of a stick with a bladder at the end), a coat of motley or of calfskin, and an ass's ears were the usual badges of this office, but the jesters of the better class were not always thus decorated. The names of a large number of French and German jesters and fools have been preserved, some of them apparently men of refinement and real wit, and others of all the grades of stupidity, even to idiocy. C. W. GREENE.

Fools, Festival of [Lat. *Festum Stultorum* or *Festum Fatuorum*], a mediæval Christian merry-making, of fantastic and childish character, which fell especially upon Holy Innocents' Day (Dec. 28), but had more or less to do with the whole period between Christmas and Epiphany (Jan. 6). Exercises were held in the principal church edifice of the

place; a mock pope, archbishop, or bishop was chosen; and all the most sacred rites of Christianity were travestied. The wild license which reigned resembled that of the old Roman *Saturnalia*. The leading performers were of the lower clerical orders, especially the subdeacons; hence another name for the festival, *Festum Hypodiaconorum*, with some reference to Saint Stephen, who is commemorated on the 26th of December. The aim professed was to interest young and ignorant people in the story of the Advent, but profaneness soon got the better of piety in the matter. This festival, which is first mentioned by the Parisian Ritualist, John Beleth, in the latter half of the twelfth century, originated apparently in France, and was more popular there than anywhere else, though observed also in Spain, in Germany, and in England. In spite of repeated condemnations by prelates and councils, it survived the Protestant Reformation, one instance of its observance being reported as late even as 1644. R. D. HITCHCOCK.

Fools' Par'sley (the *Æthusa cynapium*), a poisonous umbelliferous plant, so called because it somewhat resembles in appearance the smooth-leaved varieties of parsley, so that people who have by mistake gathered it for parsley have been seriously poisoned by it. It is a native of Europe, naturalized in the U. S. It may be distinguished by its acrid taste and fetid smell; its general umbels have no involucre; its minor umbels a partial involucre of three leaves; in both respects quite unlike parsley. It is an acro-narcotic, causing numbness, faintness, and dimness of vision. Give as an antidote a thorough emetic, followed by wine or other gentle stimulant.

Foo'see, or **Fu'si-ya'ma,** the highest mountain of Japan, on the island of Niphon, stands completely isolated and rises 12,440 feet above the sea. According to Japanese historians, this mountain suddenly emerged in one single night in the year 285 B. C., and a corresponding depression formed the lake of Mitsoo at the same time. Although it has had no great eruptions since 1760, it is still an active volcano, and the natives regard it with a kind of religious awe. Its crags are filled with idols, which annually are visited by crowds of pilgrims.

Foo-Shan, or **Fou-Schan,** town of China, in the province of Quang-Tong, 20 miles N. E. of Canton, is said to have 200,000 inhabitants.

Foot, in anatomy. See FOOT, STRUCTURE OF THE, by PROF. EDWARD HITCHCOCK, A. M., M. D.

Foot, the name of the unit of linear measure in common use in the U. S. and in England. All the nations of Europe and their colonies or dependencies employ, or have employed, a unit of length having in each language a name of the same significancy as *foot* in English. This identity of name indicates similarity of origin, which was therefore unquestionably the length of the human foot. No two peoples, however, have agreed in the value assigned to their foot-measures. No two provinces, and hardly any two considerable towns even, have had the same foot. Nor have any of these measures corresponded very nearly with the presumed prototype; nearly every one of them being greater, and many of them much greater, than the average length of the foot of an adult man. In the volume of *Investigations in the Military and Anthropological Statistics of American Soldiers*, by Dr. B. A. Gould, published in 1869 among the memoirs of the U. S. Sanitary Commission, are given measurements of nearly 16,000 individual men, volunteers for the army, of various races and nationalities, 11,000 being white and the rest colored. The mean length of the foot was found for no nationality to exceed $10\frac{24}{100}$ inches, and for none to fall short of $9\frac{89}{100}$; the mean value for the total being $10\frac{058}{1000}$, or about one-twentieth of an inch above ten inches. It is probable that the foot-measures in use in the later centuries have been in general entirely arbitrary. The account commonly given of the adjustment of the British standard yard in the year 1101 from the arm of the king, Henry I., is probably a true one; and the British foot is simply one-third of the British yard. But it was doubtless otherwise in the earlier ages. The ancient Greeks first used this measure, and their Olympic foot was said to have been determined by the length of the foot of Hercules. This, according to the best authorities, was about equivalent to $12\frac{14}{100}$ English inches. But there were among them other foot-measures materially differing from this. Thus, the Macedonian foot was $14\frac{08}{100}$ inches; the Pythian, $9\frac{72}{100}$ inches; and the Sicilian, $8\frac{75}{100}$ inches. In more recent times the diversity has been almost endless. In Italy the foot was, not long ago, $11\frac{62}{100}$ inches in Rome, $13\frac{68}{100}$ in Milan, and $23\frac{22}{100}$ inches in Lucca. In France it was $9\frac{76}{100}$ inches in Avignon, $9\frac{79}{100}$ inches in Aix-en-Provence, $10\frac{57}{100}$ inches in Rouen, $14\frac{05}{100}$ inches in Bordeaux, while the *pied-du-roi* of Paris was $12\frac{79}{100}$ inches. In Switzerland it was $10\frac{52}{100}$ inches in Neufchâtel, $11\frac{33}{100}$ inches in Rostock, $11\frac{99}{100}$ inches in Bâle, and $19\frac{21}{100}$ inches in Geneva. In the Spanish peninsula it was $10\frac{12}{100}$ inches in Aragon and $10\frac{96}{100}$ in Castile. In Germany it was $9\frac{25}{100}$ in Wesel, $10\frac{89}{100}$ inches in Bavaria, $10\frac{998}{1000}$ inches in Heidelberg, $11\frac{45}{100}$ inches in Göttingen, and $13\frac{12}{100}$ inches in Carlsruhe. And in the Netherlands it was $10\frac{86}{100}$ inches in Brussels and $11\frac{28}{100}$ in Liège. Alexander's *Dictionary of Weights and Measures* (Baltimore, 1850) gives more than 100 foot-measures, all differing from each other. Dourstier's *Dictionnaire Universel des Poids et Mésures, Anciens et Modernes* (Brussels, 1840) makes the number more nearly 1000. The confusion resulting from this great diversity was intolerable. The inconvenience caused by it in business transactions prepared the public mind of Europe early in this century to receive with favor the new system of metrology called the metric, introduced first into France at the close of the last. The foot has therefore ceased to be the legal unit of length in all the countries of Europe except Great Britain, Russia, Turkey, and the Scandinavian peninsula, and the mètre has taken its place. The Russian unit of length, the *sagene*, was fixed by Peter the Great after his sojourn in England in 1698, at exactly seven British feet. The foot of the U. S. is identical with that of Great Britain, from which it is copied. In both countries the legal standard is properly the yard of thirty-six inches. The copy of the British standard, by which the U. S. standards were till recently adjusted, is a brass bar prepared by the celebrated Troughton of London to the order of Prof. F. R. Hassler, the first chief of the U. S. Coast Survey, and superintendent of the bureau of weights and measures at Washington. It is eighty-two inches in length, and the thirty-six inches between the twenty-seventh and the sixty-third divisions were taken as the prototype yard of the U. S. A few years since, however, a copy of the British prototype, officially certified, has been substituted for the Troughton bar, and the standards furnished the several States are now carefully adjusted by this. F. A. P. BARNARD.

Foot. In organ music, directions are often given for the use of 4-foot, 8-foot, or 16-foot stops. The meaning is this: the lowest note on the key-board (C. C.) is assumed as the standard for such designations. Now, to produce the sound C. C., an open pipe 8 feet long is required; its octave *above* will be given by a pipe 4 feet long; the double octave, 2 feet, and so on; and for the intermediate notes the pipes are properly graduated in length. A set of pipes of this description is therefore called "an *8-foot stop*" (as the *open diapason, dulciano, trumpet*, and several others). Such stops give the ordinary, standard, or concert *pitch*. If another range of pipes be added, sounding an *octave lower*, they will be of double length, and it will be called "a 16-foot stop" (as the *double-diapason*, or *bourdon*). On the other hand, the *principal* is an octave *higher* than the open diapason; consequently, its pipes are only half as long, and it is called "a 4-foot stop." The *fifteenth*, in like manner, being tuned an octave above the principal, is "a 2-foot stop," its lowest pipe being of that length. In a large organ there are many stops belonging to each of these classes, the largest pipe of a 32-foot stop sounding C. C. C. C. WILLIAM STAUNTON.

Foot (SOLOMON), lawyer and U. S. Senator, b. at Cornwall, Vt., Nov. 19, 1802; graduated at Middlebury College, Vt., in 1826; was principal of Castleton Seminary in 1826 and 1828; tutor in Vermont University in 1827; professor of natural philosophy in the Academy of Medicine at Castleton, Vt., 1828–31; was admitted to the bar in 1831, and settled at Rutland, Vt. In 1833, 1836–38, and in 1847 was in the Vermont legislature, and Speaker of its House for his last three terms. Was M. C. 1843–47, and U. S. Senator from 1850 to his death, at Washington, D. C., Mar. 28, 1866. Mr. Foot was for some years president *pro tempore* of the U. S. Senate; was a Whig in politics, and a man of great probity and wisdom in public and in private life.

Foo'ta (or **Fu'ta**) **To'ro,** a territory of Western Africa, in Senegambia, between lat. 15° and 16° 25′ N., consists mostly of low, flat, extremely hot, but very fertile and not unhealthy plains, covered in many places with immense forests. It is inhabited by about 800,000 Mohammedan negroes, who cultivate rice and cotton, have built large cities, established a kind of theocratic government, and started several branches of manufacturing industry. To Medinalla, the chief town, hundreds of Mohammedan youths, Moors and negroes, gather to study the Koran, and in Canel are rich iron-mines and large smelting-houses, in which a very good cast iron is produced.

Foo'ta Jal'lon is the name of a wild and mountainous region of Senegambia, the highest of that portion of Western Africa in which the rivers Senegal, Gambia, and Grande have their sources. The elevation of the country may not average much above 2000 feet, but some peaks are so high that they are said to be covered with snow during the rainy season. The mountains are rugged and

abrupt, and clad as they are with dense forests, they present most striking and beautiful scenery. Timbo, the capital, is situated in lat. 10° 25′ N. and lon. 10° 40′ W.

Foot-Ball, a game played in the open air with a large hollow ball made of gum-elastic or of the bladder of an ox covered with leather, the latter kind being preferred. This ball is kicked to and fro by a greater or less number of players arranged in two parties, each of which tries to send the ball to the goal of the opposite party, and to keep it from their own goal. The game is a favorite one at many schools, and the rules for playing it are quite various.

Foote, county of the S. W. of Kansas. Area, 720 square miles. It is traversed by the Arkansas River.

Foote (Andrew Hull), b. May 4, 1808, at New Haven, Conn., entered the navy as a midshipman Dec. 4, 1822; became a lieutenant in 1830, a commander in 1852, a captain in 1861, a rear-admiral in 1863. Among the distinguished men of the navy at the breaking out of the civil war, perhaps none stood higher in the estimation of his brother-officers than Andrew H. Foote, and certainly no appointment gave greater satisfaction to the service than his, in the fall of 1861, to the command of the Western flotilla, then in course of construction for the purpose of opening the navigation of the Mississippi River. "The service," says Secretary Welles in his report of 1862, "was anomalous in its character, and there was with many great incredulity as to the utility and practicability of gunboats in carrying on hostilities on the rivers, where it was believed batteries on the banks could prevent their passage. There were also embarrassments for want of funds and of material for naval purposes, there being no navy-yard or naval dépôt on the Western waters. All these difficulties were met and surmounted by the energetic and efficient officer to whom the duty was entrusted, whose perseverance and courage in overcoming the obstacles that impeded and retarded his operations in creating a river navy were scarcely surpassed by the heroic qualities displayed in subsequent well-fought actions on the decks of the gunboats he had under so many discouragements prepared." On Feb. 6, 1862, Foote took Fort Henry after a most obstinate fight; on the 14th of the same month engaged Fort Donelson, for an hour and a half, with four iron-clads and two wooden gunboats, and so demoralized its garrison as to ensure an easy victory over it by the army on the following morning; and on the 7th of April, after many a hard-fought action with its numerous batteries, received the surrender of Island No. 10, considered by the Confederates, next to Vicksburg, their most important stronghold on the Mississippi. Unfortunately, however, the flag officer had received a severe wound at Fort Donelson, which from neglect had become so serious as to endanger his life, and now, in the full tide of success, he was forced to resign his command to another and return to his home. On June 16, 1862, he received the thanks of Congress and was made a rear-admiral, and on the 22d of that month was appointed chief of the bureau of equipment and recruiting. On June 4, 1863, he was ordered to relieve Rear-admiral Dupont off Charleston, and on his way to his command was taken ill at New York, where he d. June 26, 1863. The loss sustained by the navy in the death of this gallant admiral was almost irreparable, for he had long been looked up to as the best type of a naval officer. An humble and devout Christian, endowed with the noblest attributes of humanity, and possessed of unflinching moral and physical courage, he taught those who served under him, both by precept and example, not only to fight but to pray, turned many a profligate from the error of his ways, smoothed many a dying seaman's pillow, and finally laid down his life with calmness and resignation in the full faith of a blessed immortality. (See his *Life*, by J. M. Hoppin, 1874.) Foxhall A. Parker.

Foote (Henry Stuart), b. in Fauquier co., Va., Sept. 20, 1800; graduated at Washington College, Va., in 1819; was licensed to practice law in 1822; removed to Tuscumbia, Ala., in 1824; edited a Democratic paper, and in 1826 established himself at Jackson, Miss. Was presidential elector in 1844, and in 1847 was elected U. S. Senator, which position he held until 1852. Was elected governor of Mississippi over Jefferson Davis in that year. In 1854 removed to California; in 1858 settled at Vicksburg, Miss., and at the Southern convention at Knoxville, Tenn., in May, 1859, spoke against disunion; was a member, however, of the Confederate Congress. In 1866 he published a *History of the Secession Struggle.*

Foote (Joseph Ives), D. D., b. at Watertown, Conn., Nov. 17, 1796; graduated at Union College in 1821, and at Andover (Mass.) Theological Seminary in 1824. From Oct., 1826, to 1832, was Congregational pastor at West Brookfield, Mass., then in Salina, N. Y., in 1833–35, in Cortland, N. Y., 1835–37, and in 1839 entered upon a Presbyterian pastorate in Knoxville, Tenn. In 1840 was appointed president of Washington College, Tenn. A volume of his sermons, with memoir, was published at New York in 1841. D. Apr. 21, 1840.

Foote (Samuel), actor, wit, and dramatist, "the English Aristophanes," b. at Truro in 1720; studied at Worcester College, Oxford (whence he was expelled for indiscretions), and at the Middle Temple, but indulged in gaming and other excesses until his considerable fortune was expended; and in 1744 he made his appearance as Othello at the Haymarket, but his success was small until he began to play in pieces written by himself; and his best characters were ludicrous imitations of living public men. From 1747 to 1767 he conducted the Little Haymarket Theatre without license, no one daring to enforce the law against him for fear of his terrible mimicry. He wrote at least twenty-seven plays of small literary merit, of which twenty or more have been printed. His humor was of the broadest and noisest kind, and his jests were often practical ones, not without a large element of brutality. An accident which led to the loss of a leg was followed by paralysis, and the last years of his life were passed in great physical and mental distress. D. at Dover Oct. 21, 1777.

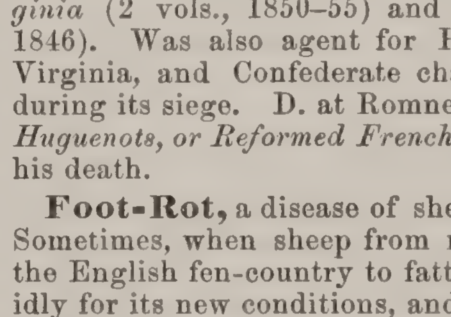
Foote (Samuel Augustus), LL.D., U. S. Senator, b. at Cheshire, Conn., Nov. 8, 1780; graduated at Yale College in 1797, and practised law in Cheshire; was representative in Congress from Connecticut in 1819, 1823, and 1833; Speaker of the Connecticut assembly in 1825–26, and Senator in Congress from 1827 to 1833. In 1834 was governor of Connecticut, and in 1844 presidential elector. D. Sept. 16, 1846. Senator Foote offered in the U. S. Senate the resolutions upon which the great debate occurred between Hayne of South Carolina and Webster of Massachusetts.

Foote (William Henry), D. D., b. at Colchester, Conn., Dec. 20, 1794; graduated at Yale in 1816; taught at Falmouth and Winchester, Va.; studied in Princeton (N. J.) Theological Seminary; was licensed by the presbytery of Winchester Oct., 1819; preached in Virginia; was agent of the central board of missions; prepared *Sketches, Biographical and Historical, of the Presbyterian Church in Virginia* (2 vols., 1850–55) and in *North Carolina* (1 vol., 1846). Was also agent for Hampden-Sidney College in Virginia, and Confederate chaplain at Petersburg, Va., during its siege. D. at Romney, Va., Nov. 28, 1869. *The Huguenots, or Reformed French Church,* was published after his death.

Foot-Rot, a disease of sheep which is rare in the U. S. Sometimes, when sheep from rocky pastures are taken to the English fen-country to fatten, the hoof grows too rapidly for its new conditions, and when it has become long it may become cracked and broken, or in part separated from the fleshy part of the foot. Sand and grass may lodge on the raw surface, and lead to active inflammation. The cure is in removal of the foreign matter, clipping of the hoof, and the application of stimulants and caustics, with removal to a dry pasture. (See Foul in the Foot.)

Foot, Structure of the. *Foot of Mammals.*—The foot (*pes*) in mammals, and in some other vertebrates in distinction from the hand (*manus*), is the last member or terminal segment of the pelvic girdle, or lower limb. The fore limbs are more generally used for the support, and the hind limbs for the propulsion of the body. Hence, "the manus is commonly shorter and broader than the pes" (*Prof. Owen*), and but few animals use the foot (hind) for prehension or defence, save in flight. The exception to the rule that the hand is smaller than the foot is seen in the mole, or in the seal and walrus, which are deficient in the hind foot.

Fig. 1.

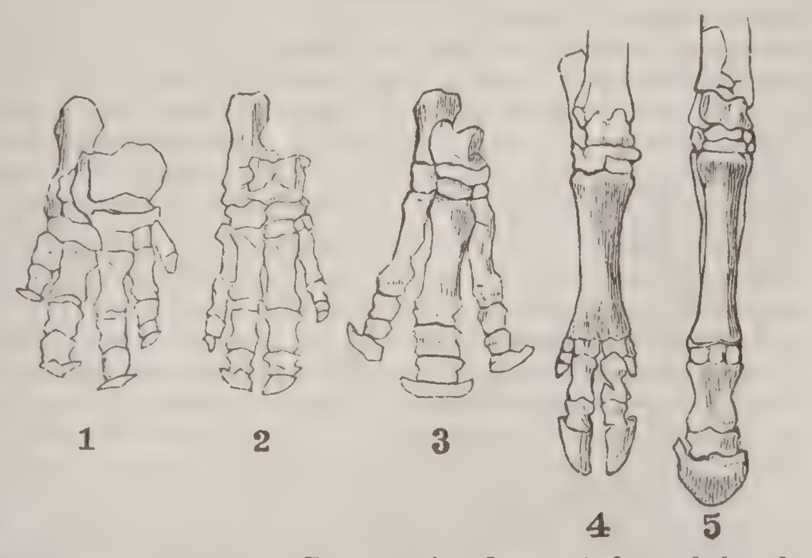


Fore Foot of the Mole. Hind Foot.

The foot is divided into three portions: (1) a group of more or less rounded bones called the tarsus or instep; (2) a row of long bones placed side by side in front of the tarsus—the metatarsus; (3) the phalanges of the digits, or the toes. The complete tarsus consists of seven bones—the astragalus, calcaneum, navicular, internal, middle, and outer cuneiform, and the cuboid. The chief variations in number are from six to eight. The general arrangement of these bones is in two rows—the proximal, or those articulating with the bones of the leg, and the distal row, those joining the metatarsus. The bones of the metatarsus usually correspond in number with the digits, and at their proximal ends the first, second, and third bones are supported respectively by the three cuneiform bones of the tarsus; the cuboid supporting the fourth and fifth. Upon each joint between the metatarsus and the toes are often

found a pair of sesamoid bones, for the mechanical advantage of the tendon gliding over them. These are best seen in the mole and tiger. The digits never, except in abnormal instances, exceed five in number on each foot in any existing vertebrate animal above the rank of fishes, and in the class Mammalia, except the Cetacea, the number of phalanges is limited to two in the first digit, and to three in each of the other digits in both fore and hind feet. (*Prof. R. Owen.*) The hallux or great toe, though in man very strong, and one of the largest digits, is in many mammals entirely wanting, rudimentary, or inconsiderable in length. In many climbing animals it is considerably developed and has prehensile characteristics. This is well shown in the gorilla and orang. The other digits vary in number from

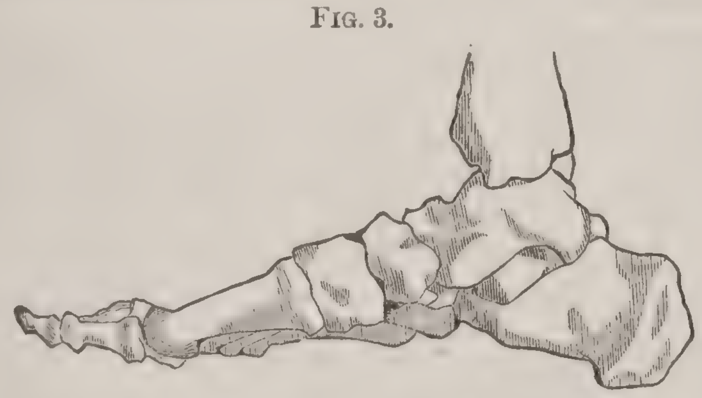
Fig. 2.



Simplification of the Digits, *after Owen*.—1, foot of the elephant; 2, foot of the hippopotamus; 3, foot of the rhinoceros; 4, foot of the deer; 5, foot of the horse.

one to five, as is illustrated respectively in the horse and the elephant. (Fig. 2.) This modification of the digits is accounted for by their diminution and simplification in a definite order. Thus, in a four-toed animal the great toe is wanting, as in the hippopotamus; in a three-toed animal the outer or smallest digit and the hallux—seen in the rhinoceros; in a two-toed animal, such as the cow or deer, both of those already mentioned and the second digit; and in the one-toed animal, such as the horse, only the third digit remains. That this is the order of disappearance is known by the absence of the corresponding metatarsal bone, each one of which has its definite attachment to one or more of the tarsal bones.

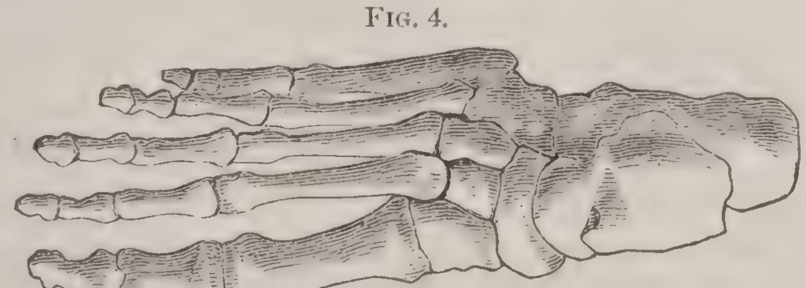
Fig. 3.



A Side View of the Bones of the Human Foot.

The Human Foot.—The human foot illustrates the general points of osteology already described, and at the same time is specially modified for its uses peculiar to man, the upright animal. And, as it might properly be stated, the foot is merely a hand modified for a base of structure to support the body. It is always larger than the hand, mainly in length and thickness; is also narrower, and of an ovoidal figure, the long axis reaching from before backward. The longest transverse diameter of the foot is the anterior one, in order to place on a broader base the support to the body, which is carried before the centre of the body in walking. The solid parts of the foot are more firm

Fig. 4.

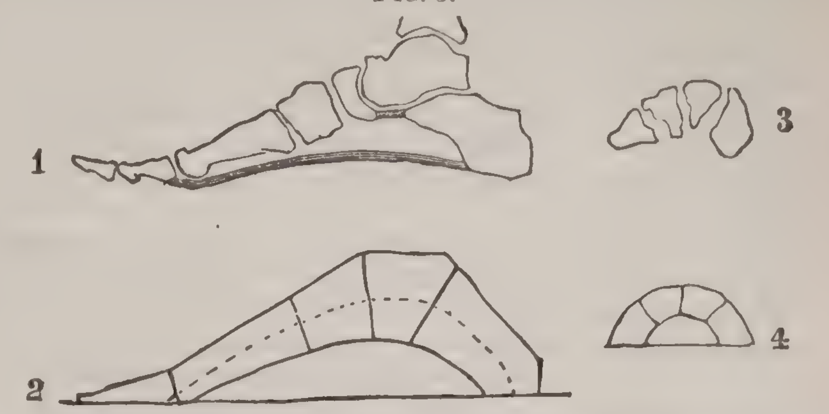


Skeleton of the Human Foot (*original*).

than the corresponding parts of the hand, and the movable parts of the foot less movable than those of the hand, in order to make the foot as perfect an organ as possible to give support and the surest and most facile locomotion of the body. (Fig. 4.)

The foot is constructed of two arches (Fig. 5), one from

Fig. 5.



1, A view of the natural position of the bones forming the front arch of the foot; 2, a diagram of the same; 3, view of the bones of the side arch of the foot; 4, a diagram of the same. (1, 2, *original;* 3, 4, *after Holden.*)

front to rear, and another from side to side. The antero-posterior arch has for its points of support the heel and forward ends of the metatarsals, and the lateral the cuboid on the outside and the inner cuneiform on the inside. The segments of these arches, however, are not inflexible, but are made to yield among themselves, each a little, by the interposed cartilages. There is also a special arrangement, known as the Y-shaped calcaneo-scaphoid ligament, holding the keystone of the arch, which by its elasticity aids much in securing the beautiful spring of the body in motion. And as this ligament is attached to the heel-bone, it is called by the Germans the spring-bone.

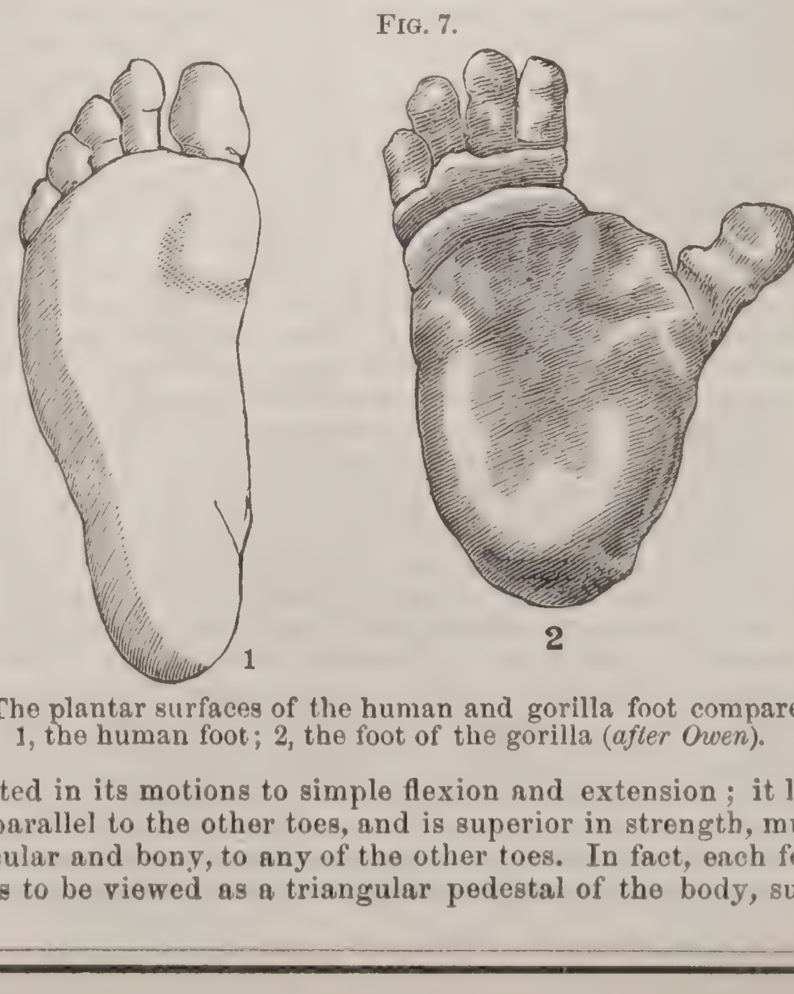
One modification of the typical foot of mammals to the special structure of man is the angle of the plane of the foot and the leg. In the horse the angle averages 12°, while in man it is 90°. The design of this variation is to give as secure a leverage as possible to the muscles which must keep the weight of the body securely supported so far above the point of support, about two-thirds of the weight of the body being above the hips. Another peculiarity of the human foot is the great projection and horizontal direction of the heel, or, as some one has said, "ex calce hominem." In all animals it is the largest of the tarsal bones, as it is the lever for moving the foot; but in animals which assume the semi-erect attitude we find either a greater development of this bone or larger development of the muscles of the "calf." Hence, the small "calf" of the negro is attributed by anatomists to the larger heel-bone, the smaller muscles being compensated by a longer lever at which to apply the power. (Fig. 6.)

Fig. 6.

Illustrating the attachment of the muscles of the calf (1) of the human leg to the os calcis (2). (*Original.*)

The articulation of the great toe with the inner cuneiform bone is another special modification of the foot as pointing only to the erect position of the body. In the semi-erect apes, the gorilla especially, this joint is marked by a considerable degree of mobility, and the foot resembles a hand. (See Fig. 7.) But in man's foot the great toe is lim-

Fig. 7.



The plantar surfaces of the human and gorilla foot compared: 1, the human foot; 2, the foot of the gorilla (*after Owen*).

ited in its motions to simple flexion and extension; it lies parallel to the other toes, and is superior in strength, muscular and bony, to any of the other toes. In fact, each foot is to be viewed as a triangular pedestal of the body, sup-

ported respectively at the three angles of the great toe, heel, and little toe; so that we find the greatest muscular power furnished to each of these portions of the foot.

The superior length of the great toe is a characteristic of the human foot; for, while the second digit projects farther forward than does either of the other toes when the foot is viewed as a whole, yet the great toe itself alone, if compared with any other of the rows of phalanges, obtains the longest measure.

Although the foot, when compared in structure adapted to delicate operations, with the hand, is very far inferior to it, yet it is astonishing what remarkable work can be accomplished by it when the hands are wanting. Thus, we hear of and see persons continually who carve, write, and paint in a remarkable manner with their toes instead of fingers; so that the phrase "pes altera manus" is often not far from the truth.

Probably no organ in the body has been more abused by the fashion of its dress than has the foot. From time immemorial, and by almost the entire human race, it has been squeezed into an unyielding case of hard leather, never so large as the foot itself when resting on the ground, and with a high appendage called the heel, from whence have come corns, bunions, *et id omne genus* of similar accessories of civilization. EDWARD HITCHCOCK.

For'age, food or fodder, food for animals. The word is also used as a verb, when it means to collect supplies generally for both man and beast, from an enemy by force, from friends by impressment, but giving to friends receipts, to be paid ultimately.

The daily ration of forage in the army of the U. S. is for each horse 14 pounds of hay and 12 pounds of grain, either oats, corn, or barley. For a mule the daily ration is 14 pounds of hay and 9 pounds of grain. The blades of Indian corn are used for forage in absence of hay. The consumption of forage in a large and active army is enormous. Its weight, owing to the number of animals employed in military operations, is about 4½ times as great as that of the subsistence supplies for the same army. There were issued from the dépôt of Washington during the war of 1861–65 4,500,000 bushels of corn, 29,000,000 bushels of oats, and 490,000 tons of hay. Partial reports of the quartermaster-general show issues of forage during the war as follows:

22,816,271 bushels of corn, costing	$29,879,314
78,663,799 bushels of oats	76,362,026
1,518,621 tons of hay, costing	48,595,872
Total	$154,837,212

The weight of these supplies in pounds was—	Corn	1,277,711,176
	Oats	2,517,241,568
	Hay	3,037,242,000

making a total of 6,832,194,744 pounds—numbers, like infinity, difficult to realize, but interesting as showing the magnitude of the operations necessary to provide and distribute these few items of the expenses of war.

M. C. MEIGS.

Fora'men [Lat., an "opening," from *foro*, to "pierce"], (plural **Foram'ina**), in anatomy, denotes in general any natural opening through a substance; more particularly an opening through a bone. It is especially applied to the bony passages through which the nerves and blood-vessels enter and leave the skull and spinal canal.

Foraminif'era [Lat. *foramen*, an "aperture," and *fero*, to "bear"], an order of Protozoa, usually characterized by the possession of a shell pierced by numerous minute orifices, through which filaments (*pseudo-podia*) are protruded. The shell is generally composed of carbonate of lime, but it may consist of particles of sand cemented together, or may be chitinous. The animal may be simple, or may repeat itself indefinitely by budding. The shell is filled with organic matter called *sarcode*, and a layer of sarcode often exists on its outside. The pseudo-podia reach the exterior by perforations in the walls of the shell or by its mouth. The Foraminifera may be divided into two groups, according as their walls are or are not perforated by foramina. In those with calcareous shells, in which the walls are not perforated, the substance of the shell is porcellanous and opaque white. In those in which the shells are calcareous and imperforate, they are vitreous. The arenaceous shells may or may nor be perforated, their texture in either case remaining the same. The Foraminifera are also classified by the forms of the shells. A few of them remain through life as simple cells; *e. g. Orbulina.* More generally, however, the shell becomes many-celled by the budding of the sarcode. In this case the walls between the cells are perforate, and the sarcode in all is so connected as to have a common vitality. The multiplication of the cells in the Foraminifera takes place in several different ways, and hence the resulting aggregate form is very unlike in the different genera and species. Some form elegant discoid spirals (as *Robulina* and *Rotalia*), and this form is called nautiloid; sometimes the added cells compose a constricted or beaded tube, as in *Nodosaria.* In some cases also the shell is much flattened and disk-like (*e. g. Nummulites*); sometimes it is fusiform by lateral elongation, as in *Fusilina.* Most of the Foraminifera are microscopic, but in a few cases the shell attains a diameter of an inch or more.

In a geological point of view, the Foraminifera are of great interest, as they are found in all the formations, from the oldest to the newest, and they frequently make up the chief part of great rock-masses. For example, the chalk is mainly composed of the calcareous shells of Foraminifera, so small that perhaps half a million are contained in a cubic inch. So also the limestones of the Carboniferous age are sometimes largely composed of *Fusilina*, and the Eocene limestones of *Nummulites.* A special interest in late years has been excited in this group by the alleged discovery of a huge Foraminifer (*Eozoon Canadense*) in the Laurentian rocks of Canada, a formation previously considered entirely destitute of fossils. The organic nature of *Eozoon* is, however, doubted by many zoologists, though asserted by even higher authority. Its true character must therefore be considered as not fully demonstrated. By most palæontologists the singular discoid, "engine-turned" fossils called *Receptaculites*, found in such abundance in the Lower Silurian limestones, are thought to be Foraminifera, but Billings considers them sponges related to the Foraminifera. (See PROTOZOA.) J. S. NEWBERRY.

For'bach, town of German Lorraine (Elsass-Lothringen), near the Prussian frontier, 12 miles N. W. of Saargemünd. Near here (Aug. 6, 1870) the French under Frossard were badly beaten by the Germans under Prince Frederick Charles. Coal is mined in the vicinity. P. 5428.

For'bes (CHARLES STUART), English naval officer, b. at Richmond, Surrey, in 1829, entered the navy in 1841; served in the first China war in the Yang-tze-Kiang, and in New Zealand in 1844–45. Promoted to the rank of lieutenant, he served during the Russian war in the Baltic Sea, having previously been with the first expedition sent out to find Sir John Franklin. He took the gunboat Algerine to China in 1857, and for service in the Canton River in Apr., 1858, was made commander. In 1860 was an amateur in the Garibaldian campaign. Published *Iceland, its Volcanoes, Geysers, and Glaciers* (1860), *The Campaign of Garibaldi in the Two Sicilies* (1861), and *A Standing Navy, its Necessities and Organization.* In 1870 he became a captain, and went upon the reserved list.

Forbes (EDWARD), F. R. S., English naturalist, b. in the Isle of Man Feb., 1815, began the study of medicine at Edinburgh in 1830; founded the Botanical Society of Edinburgh in 1836; visited Paris and the Mediterranean in 1837; was naturalist of the expedition to Lycia in 1841; professor of botany at King's College, London, in 1842; F. L. S. in 1843; assistant secretary to the Zoological Society in 1844; F. R. S. in 1845; professor of natural history at the School of Mines in 1852, and in the same year president of the Geological Society; professor of natural history at Edinburgh 1853. D. Nov. 18, 1854. Published *History of British Star-Fishes* in 1841, and, with Hanley, *History of British Mollusca* in 1853, besides other important works, including a great number of valuable papers upon zoological, botanical, and literary subjects. (See *Memoir* by the late DR. GEORGE WILSON and ARCHIBALD GILKIE, London, 1861.)

Forbes (JAMES DAVID), D. C. L., F. R. S., British physical philosopher, b. at Calinton, near Edinburgh, Apr. 20, 1809; was professor of natural philosophy in the University of Edinburgh in 1833; published *Travels in the Alps* in 1843; made discoveries in the laws of glacial motion, and in the phenomena of radiant light and heat in relation to polarization; and received the Rumford medal and that of the Royal Society of London. In 1860 became principal of the United Colleges in the University of St. Andrew's. *Norway and the Glaciers Visited in 1851* was published in 1853; *A Tour of Mont Blanc and Monte Rosa* in 1855. He published many valuable papers, mostly upon questions in physics. *The Sixth Dissertation*, prefixed to the *Encyclopædia Britannica*, was his production. D. in Clifton, England, Dec. 31, 1868.

Forbes (JOHN), b. at Petincrief, Fifeshire, Scotland, 1710, became lieutenant-colonel in the Scotch Greys in 1745. After service in the German war, Dec. 28, 1757, was made brigader-general in America. Nov. 25, 1758, taking possession of Fort Du Quesne, Pa., he named it Pittsburg in compliment to the English prime minister. D. at Philadelphia, Pa., Mar. 11, 1759.

Forbes (Sir JOHN), F. R. S., English physician and medical writer, b. in Banffshire, Scotland, Oct. 18, 1787;

entered Marischal College in 1805, and was in the English navy as assistant surgeon in 1807; was made M. D. in Edinburgh in 1817; and settled in London in 1840. Became physician extraordinary to the prince consort the same year, and soon after to Queen Victoria; knighted in 1853. D. at Whitechurch, London, Nov. 13, 1861. Translated the works of Auenbrugger and Laennec on auscultation and percussion (1824); was an editor of the *Cyclopædia of Practical Medicine* (1833–35); published *Manual of Select Medical Bibliography* in 1835; and afterwards edited the *British and Foreign Medical Review. Physician's Holiday, or a Month in Switzerland in 1848,* was published in 1849; *Memoranda made in Ireland* in 1852; and *Nature and Art in the Cure of Disease* in 1857.

Forbes (JOHN MURRAY), D. D., of Columbia College, New York; S. T. D. by Vatican degree of Pope Pius IX.; b. May 5, 1807; graduated at Columbia College in 1827, and at the General Theological Seminary of the Protestant Episcopal Church in 1830. Before graduation, though receiving his diploma by a special vote of the board of trustees, he became assistant professor of ancient languages in Trinity College, Hartford, but resigned this position on receiving orders from the Rt. Rev. Bishop Hobart in Trinity church in August of the same year. In 1834 became rector of St. Luke's church, New York, and whilst holding this position was appointed by the standing committee of the General Theological Seminary to act temporarily as professor of pastoral theology and pulpit eloquence in that institution. In 1844 and 1847 represented the diocese of New York, as one of her clerical delegates, in the General Convention of the Church. In 1849, in company with Drs. Newman, Manning, and others, he entered the Church of Rome, and became shortly after pastor of St. Ann's Roman Catholic church in New York. In 1852 was appointed by the Rt. Rev. bishop of South Carolina his theologian in the plenary council of the Roman Church, held that year in the city of Baltimore, and in 1854 acted as theologian to the Rt. Rev. bishop of Boston in the provincial council held in New York. In 1859, Dr. Forbes returned to the Protestant Episcopal Church, assigning his reasons for the change in the following brief but comprehensive note, addressed to most Rev. John Hughes, D. D., archbishop, etc.: "It is now nearly ten years since, under your auspices, I laid down my ministry in the Protestant Episcopal Church to submit myself to the Church of Rome. The interval, as you know, has not been idly spent; each day has had its responsibility and duty, and with these have come experience, observation, and the knowledge of many things not so well understood before. The result is, that I feel I have committed a grave error, which, publicly made, should be publicly repaired. When I came to you, it was, as I stated, with a deep and conscientious conviction that it was necessary to be in communion with the See of Rome; but this conviction I have not been able to sustain in face of the fact that by it the natural rights of man and all individual liberty must be sacrificed; nor only so, but the private conscience often violated, and one forced, by silence at least, to acquiesce in what is opposed to moral truth and justice. Under these circumstances, when I call to mind how slender is the foundation in the earliest ages of the Church upon which has been reared the present papal power, I can no longer regard it as legitimately imposing obligations upon me or any one else. I do now therefore, by this act, disavow and withdraw myself from its alleged jurisdiction." In 1862, after the alteration of a canon by the General Convention of the Episcopal Church affecting his case, Dr. Forbes was restored to the exercise of his ministry in that body, and in 1869 was appointed, by an almost unanimous vote of the board of trustees, dean and permanent executive officer of the General Theological Seminary of the Protestant Episcopal Church in the U. S.—an office held by him until the year 1872. Some few printed sermons, essays, and reviews are the only known productions of his pen.

F. A. P. BARNARD.

Forbidden Fruit, a name given in different countries to fruits which, according to tradition, represent the fruit of which Adam and Eve ate at the time of man's fall in Eden. One of these is a sort of thick-skinned orange (*Citrus Aurantium*, var. *Paradisi*), which bears marks which are likened to tooth-marks. The skin is the part eaten; the pulp is very sour, but the skin is soft and pleasant to the taste. Another kind is a small shaddock (*Citrus decumanus*). Still another is the poisonous fruit of *Tabernæmontana dichotoma* of Ceylon, a tree of the order Apocynaceæ. This fruit appears as if bitten; hence the tradition.

For′bush, tp. of Yadkin co., N. C. Pop. 1429.

Forcade-Laroquette, de (JEAN LOUIS VICTOR ADOLPHE), LL.D., b. at Paris in 1820, a half-brother of Marshal St.-Arnaud; became an advocate in 1841, and received the doctorate in 1846; became master of requests in 1852; director-general of forests 1857; director-general of customs-revenues and indirect contributions, and counsellor of state; minister of finance 1860–61; vice-president of the council of state 1863; minister of agriculture, public works, and commerce 1867; was one of the chief promoters of the Havre marine international exposition; minister of the interior 1868; was distinguished for parliamentary eloquence, and was an imperialist of liberal views.

Force, a term applied to denote any action between material bodies by which they change, or tend to change, each other's condition. Every change of condition of a material body implies motion of some kind, either, first, of the mass (molar), or, secondly, of its component particles (molecular). Our earliest idea of force is derived from the resistance of matter to the touch. Matter itself becomes known at the same time; and as we perceive it to have extension, we acquire also simultaneously the idea of space. Matter may be defined as something impenetrable which occupies space. Nothing is known of force except as a cause producing, or tending to produce, motion or change of motion in matter. Force, therefore, is the efficient cause of all physical phenomena, including not only those commonly called mechanical, but also those attendant on heat, light, electricity, and chemical action. Mechanical forces are such as produce their effects upon masses of measurable magnitude directly. They are distinguished as dynamical (producing actual motion) and statical (held in check by opposing forces). Statical forces may be compared with each other by means of the efforts or pressures they exert, which may be measured by a spring balance or by opposing them to known forces through an intervening lever. But as static forces produce motion if opposed by resistances less than themselves, such forces may also be measured by their relative power to generate motion when all resistance is removed. A heavy body resting upon a support exerts a pressure which is due to the force of gravity acting statically. If the support be removed, the body falls. We have the means of ascertaining experimentally the velocity imparted by gravity to a falling body in a unit of time; and this furnishes us with a natural standard for measuring other forces. Observation again tells us that the pressure exerted by a mass in consequence of gravity is proportioned to the mass. It shows us, however, also, that every mass of matter, whether small or great, falls, if unsupported, with the same velocity. By experiments made with Atwood's machine, and in other ways, it is found that if the force which acts upon the same mass is increased or diminished, the velocity generated is also increased or diminished proportionally. It may therefore be said, briefly, that forces are proportional to the masses moved and to the velocities generated at the same time—in other words, that force is as the product of velocity into mass. This product is called moment. Putting, then, f for force, p for pressure, m for mass, and v for velocity, we have $f \propto p$; and $f \propto mv$. Moment as well as pressure may accordingly be taken as the measure of static force; but in this expression v represents what is called a *virtual* and not a real velocity, being that which the mass m would take on if the system were to be set in motion.

When a force acting continuously produces motion or overcomes a resistance through space, it is said to do work. If the resistance is simply the inertia of a constant mass, the work done will consist in accelerating velocity. If the resistance is external (as of friction opposing motion on a horizontal plane), the work done will consist in transferring the mass from one point to another in space. In either case the measure of the work will be the force acting or the resistance opposing, multiplied by the distance passed over. For external resistances, as of friction just mentioned, this is self-evident. For the resistance of inertia it may be shown to be true by considering the case of gravity. The increments of velocity imparted by gravity in successive equal instants of time to a body falling from rest are equal; but the minute spaces passed over in these successive instants, being proportional to the successive actual velocities, form an arithmetical series. (See FALLING BODIES.) The sum of this series gives the total space fallen, which is $\frac{1}{2}vt$. Now, mg being the measure of the static force of gravity, $\frac{1}{2}mgvt$ represents the work of gravity in putting a body into motion with the velocity v. And as $gt = v$, we obtain finally for work (W), $W = \frac{1}{2}mv^2$. Any other constant force, as f, greater or less than gravity, will generate the velocity v in a time proportionally less or greater; but the work done will in all cases be the same, and will be independent of both force and time. For, as $ft = v$, and as v is, by hypothesis, constant, ft is constant also, and $W = \frac{1}{2}mfvt$ is invariable, whatever be the value of f. In like manner, the work which may be done by the moving mass in overcoming resistance to its motion is equally independent of time, while the space through which it may move in expending the force accumulated in

it will be inversely as the resistance it encounters. Thus, a heavy ball rolling over smooth ice, being but slightly retarded by friction, will roll very far, but a hammer or bullet suddenly arrested will exert an enormous and even destructive pressure.

We thus see that the power of a moving mass to do work is proportioned to the square of the velocity of motion, while the power of a simple pressure to hold in check an opposing pressure is proportioned to the virtual velocity only. For distinction, the product mv^2 is called the *vis viva*, the living force, or the kinetic energy, and mv the moment. By *energy* is meant the capacity of a body to do work. This may depend on its position or condition, and is then called *potential energy*. The body is doing no work, but may be made to do work by some change in one or both the respects mentioned. A clock-weight wound up, the mechanism being at rest, is an example of energy of position. Gunpowder is an example of energy of condition. *Actual* energy is that exercised by a moving mass, and is equivalent to living force. A pendulum at the end of its swing possesses only potential energy, and in the middle of the swing only actual energy.

Thus far we have confined ourselves to the relations of force and energy in mechanics. We now proceed to consider them in their wider significations. The forces of nature which are characteristically different from each other may be stated as follows: 1, gravitation; 2, molecular force; 3, chemical affinity; 4, heat and light; 5, electricity; 6, vital force. Gravitation, which is the attraction between bodies at a distance, is proportional directly to the product of the two masses, and inversely to the square of the distance between them. Molecular force is the attraction between the particles of bodies, and is manifested in solids and liquids by their cohesion and elasticity, and in liquids additionally in capillarity and osmose. Chemical affinity resembles the force last named in acting at insensible distances, but differs in being manifested only between unlike substances. Heat is supposed to be a mode of vibratory motion actuating the molecules of every material substance. Elevation of temperature is explained as an increase in the energy of the vibrations and an enlargement of their amplitude, whereby the volume of the combined mass is expanded, and ultimately the cohesion and even the affinities of its molecules are overcome. These vibrations are supposed to be propagated from body to body by undulations in an exceedingly rare medium filling all space, called ether. When these undulations fall within certain definitely assigned limits as to length, they have power to affect the retina of the eye, and thus give rise to the phenomena of light. Electricity is a very energetic force, the physical theory of which is still unsettled. It produces, according to circumstances, attractions and repulsions between masses and between molecules. Magnetism is but a form of electrical action. Vital force is more obscure as to its manner of action than any other; and it is even denied by many physicists and physiologists that any such distinctive force exists, all the phenomena ascribed to it being attributed to electricity, chemical affinity, and heat. There is no doubt, however, that there exists in the nervous centres of living animals a certain power which can cause contraction of the muscles of the body by exciting the proper nerves. The velocity with which this message is transmitted is by no means great, not exceeding twenty or thirty mètres per second. When a whale is struck by a harpoon, such is the size of the animal that quite an interval elapses before the brain can be informed of the fact and can put the muscles of the tail in operation; so that before this effect is produced the whalers have time to retreat.

Having thus classified forces, we may still further distinguish the kinds of energy dependent on them as follows: Kinetic energy exists in the four forms, A, of bodies in motion; B, of radiant heat and light; C, of electricity in motion; and D, of absorbed heat. Potential energy may be, E, position of the body in regard to gravity or other force acting at a distance; F, molecular separation; G, chemical separation; and H, electrical separation. In the first four of these forms work is obtained directly from the motion of the body or its molecules; in the second four, it is derived from an alteration of its condition.

Whenever energy in one form disappears, it reappears in another, and this property is known as the transmutation of energy or the correlation of forces. (See CORRELATION OF FORCES.) For example, the energy of a moving body suddenly arrested in its motion is converted into heat; the energy of an electric current may be transformed, in an electro-dynamic engine, into kinetic energy or into potential energy of chemical affinity in electrolysis. In general, such transformations are not from one form of energy into a single other form only. The moving body arrested expends come part of its energy in molecular separation (fracture of the opposing body), some part in giving motion to the fragments, and the rest in heat. The energy of the electric current is distributed between mechanical motion, heat, and chemical separation. But if in every such case we could collect and reunite all these fractions of distributed energy, we should find their sum just equal to that which has disappeared; and this leads us to one of the grandest generalizations of modern times, the doctrine of the persistence of force, or the conservation of energy, expressed in the proposition that energy, like matter, is indestructible, so that, however its form may change, its total quantity is for ever constant.

With the demonstration of this doctrine a fatal blow has been given to an illusion which from the earliest times has exercised a singular fascination over many ingenious minds—the belief in the possibility of a perpetual motion. By this was meant, not the eternal persistence of motion in a body which encounters no resistance whatever—for in this sense the doctrine of the conservation of force is also a doctrine of perpetual motion—but the delivery at one part of a mechanical contrivance of a greater amount of kinetic energy than that which is applied at another to set the contrivance in operation. The history of this delusion is given elsewhere. (See PERPETUAL MOTION.)

Measure of Forces.—In order to compare quantities of any kind it is necessary that we have some definitely fixed units of measure. By the aid of such units the relative magnitudes of quantities of the same kind are expressible in abstract numbers. And when quantities of different kinds are in the relation of dependent variables, the laws which connect them may be expressed by comparing the abstract numbers which denote their relations of magnitude among themselves. For this purpose it is necessary to take as a starting-point some state of the related quantities of which the conditions are definitely known. Take, for instance, the law of pressure and volume in gases, commonly called the law of Marriotte. If the elasticity of air compressed in a cylinder by a force of 20 pounds to the square inch maintains the piston at the height of 4 feet, 40 pounds to the square inch will reduce this height to 2 feet. We have here a variety of units, and the numbers are unnecessarily large. It would be simpler to say that if under a pressure of 1 (unit of force) the air compressed occupies 2 units of volume, then a pressure of 2 units of force will reduce it to 1 unit of volume. It is therefore desirable that, in order to compare with facility the relations of quantities of different kinds, the units shall be so chosen as to have the simplest possible relations between each other.

The centimètre, gramme, and second have been recommended by the British Association for the Advancement of Science as fundamental units on which to establish other unit measures of quantity and energy for physical purposes, called, therefore, derived units. These fundamentals are sometimes referred to as the "B. A. units" or the "C. G. S. units" (centimètre, gramme, second).

Since, when bodies move uniformly, $s=vt$, the unit of velocity will be naturally that found by making s and t equal to the fundamental units C and S; that is, it will be that velocity which will carry a body 1 centimètre in 1 second. In the same way, if a be put for acceleration, $v=at$; and putting v and t each unity, a is the force required to generate a velocity of 1 centimètre in 1 second. The unit of mass is deduced from the two forms above given for expressing statically the force of gravity—viz. $mg=w$. This gives us $m=w \div g = w \div 981$ centimètres, this last expressing nearly the accelerative force of gravity. If $w=1$ gramme, m is a little over a milligramme. As all the derivative denominations of this system are decimal multiples of the unit, the introduction of an incommensurable divisor, as in this case, is an incongruity to be regretted, but it is unavoidable. Since g, however, varies in different latitudes (though only slightly), it is advisable to employ, as has been proposed by Sir William Thomson, the value of g at Paris, which is 980.87 centimètres. Hence, putting $m=1$ and $w=1$, the unit of mass is 1 gramme divided by 980.87. The unit of force $f=ma$ is found by making $m=1$ and $a=1$, when $f=$ the force required to produce in the mass of 1 gramme the unit of acceleration, which, as above, is 1 centimètre in 1 second. But the mass of 1 gramme is, as we have seen, the weight of 1 gramme divided by 980.87. Hence the unit of force, compared with gravity, is $\frac{1}{981}$st part as great, or, expressed as weight, is slightly over a milligramme. This unit of force is called a *dyne*. The unit of work, $W=fs$, is found by making f and $s=$ unity, and is therefore 1 dyne acting through the space of 1 centimètre. This is called an *erg*. The higher denominations in this system are formed by decimal multiplication; and inasmuch as, in consequence of their minuteness, the quantities which we deal with every day exceed them a thousand or a million times, a short mode of writing and naming these multiples has been

adopted; thus: a gramme being 981 dynes, and a kilogramme 981,000 dynes, a mass of 1,000,000 dynes would not greatly exceed a kilogramme. And 1,000,000 dynes is written 1×10^6 dynes, or *one dyne-six*. So, the circumference of the earth being 4,000,000,000 centimètres, is written 4×10^9 centimètres, and is read *four centimètre-nines*. If division is to be expressed, the ordinal numbers are used. Thus, 1 milligramme $= \frac{1}{1000}$th gramme, is written 1×10^{-3} gramme, and read *one gramme-third*. This system of units has not been generally accepted as yet in the scientific world. Still less has it been introduced into the arts of industry. (For the units now generally employed in this and in other countries for computing the force of engines, water-powers, or animals, or calculating the work performed by any of these motive-powers, see DYNAMIC UNITS.)

Passing from mechanical to physical units, the most important of all, whether in its scientific or its industrial relations, is the unit of heat, which is the amount of heat necessary to raise the temperature of 1 kilogramme of water 1° C. The number of units of work necessary to generate this amount of heat is called the *mechanical equivalent of heat*. Much careful labor has been expended in the attempt to determine this important constant (for an account of which see HEAT). The value commonly received is 423 kilogrammètres, or 423 kilogrammes raised 1 mètre high. The corresponding value for British units and the Fahrenheit thermometer is 772 foot-pounds, or 772 pounds raised 1 foot high. The derived unit of heat on the B. A. system would be the amount necessary to raise the temperature of one gramme of water through 1° C. The mechanical equivalent of this would be 42,300 grammes raised one centimètre, or 42,300 gramme-centimètres, or centigrammètres; which, in ergs, would amount to 41,491,000, or 41 erg-sixes + 491 erg-threes. (For electrical units see ELECTRICITY.)

Sources of Energy.—The immediate sources of energy in our planet are numerous, embracing, as sources of kinetic energy, the radiation of the sun, the motion of air and water, and the muscular force of animals; and, as sources of potential energy, water accumulated above the general level in lakes and rivers or lifted by the tides, unequal distribution of temperature on the earth, wood, coal, native sulphur, and other combustible minerals, and food as the source of kinetic muscular force. All these, however, except the tides and some unimportant cases under the head of combustibles, are originally derived from the great source first named—viz. the solar radiation. The internal heat of the earth, sometimes exhibited in volcanic action, is a source of energy practically unavailable; but its gradual decline, causing contraction of the interior mass, permits the energy of gravitation occasionally from being potential to become active, and to manifest itself in earthquakes. Tidal action requires some explanation. To an observer on the moon the tidal wave, if visible, would appear as a mass of water nearly at rest, under which the earth is revolving like a car-wheel under the brake. The energy therefore is derived from the motion of the earth, and since this energy is continually converted by friction into other forms, there is a constant drain upon its source; or, in other words, it is continually making the earth turn more and more slowly. This effect is of course exceedingly slight, but it is supposed to account for the astronomical phenomenon known as the secular acceleration of the moon's mean motion, the moon appearing to move faster since the earth moves more slowly. The ultimate result will be that the time of revolution of the earth around its axis will at length equal the time of revolution of the moon around the earth, or the latter will always turn its same face towards the moon. Now, if the moon ever contained a liquid like our ocean, a similar effect would be produced on it, only in a much more marked manner, owing to the larger size of the earth. The necessary result would be that which has actually occurred—that the times of revolution of the moon around its axis and around the earth would be equal.

Although in a system of bodies in communication with surrounding objects the total amount of energy is always constant, yet all of it is not available to do work. For instance, if two bodies, one warmer than the other, are thus isolated, the heat passes from the first to the second, and is thus able to do work; as soon, however, as they both attain the same temperature, the available energy is exhausted, and although their actual temperature may be very high, they have no power of doing work until brought in contact with some cooled body. This available energy is known as the *entropy* of the system. In any actual case a considerable portion of the energy of a body is lost by being converted into a form from which we cannot reconvert it into work. Thus, a heated body when used as a source of energy begins at once to lose its heat by radiation, by heating the surrounding air, and by conduction through its support, the energy being here converted into heat but little above that of surrounding bodies, and therefore not readily convertible into work. A similar loss takes place with an electrified body, since there is no perfect non-conductor of electricity. In the case of motion we cannot avoid the resistance of the air or of friction; and often some surrounding bodies being set in vibration, a portion of the energy is converted into sound. The effect of all this is slightly to warm the various bodies moved, and thus again the energy is brought into a form from which it cannot easily be brought back. This is what is known as the dissipation of energy.

The grandest application of these laws is in astronomy to the determination of the source of energy in the solar system. We have already seen that the effect of a liquid on a satellite is to act as a brake to alter the time of rotation, until it is finally rendered the same as the time of revolution in the orbit, so that the same face shall always be turned towards the primary. The planets would also be affected in the same way, both by their satellites and by the sun itself; and although the problem becomes one of great complication, probably the final result would be the conversion of nearly all the kinetic energy of rotation into heat, which would eventually radiate into space. The far greater energy derived from the sun is also rapidly passing off into space. The total amount received by the earth, great as it is, is almost infinitesimal compared with the amount radiated into space, and thus lost. This energy is estimated at the surface of the sun to be equivalent to 7000 horse-power for each square foot of surface. This amount of energy is so great that if the sun were a mass of burning coal, it would be wholly consumed in 5000 years, and in 5000 years more would have cooled down 9000° C. Since geology proves that for hundreds of thousands of years the temperature of the earth has been about the same as at present, evidently chemical combination is not sufficient to account for this vast fund of energy. The nebular hypothesis assumes that the matter of the solar system was originally distributed through space, and the planets and sun formed by its condensation. Here there would be an enormous source of energy, since the potential energy due to the distance of the particles would by the force of gravitation become kinetic in their approach to each other. On making the calculation, however, the energy thus set free proves to be as much too great as the other was too small; and this theory also must be rejected. The view now held with regard to the source of the sun's heat is that it is due simply to its contraction. The mass of the sun is so great that on the most unfavorable supposition the heat set free by the diminution of potential energy due to its contraction would supply the present loss for 7000 years before the whole mass would have altered its temperature by 1° C. Still, enormous as this supply is, it must eventually be exhausted, and then, by the dissipation of energy, be finally converted into radiant heat and diffused through space. The final result, therefore, would be that all bodies would assume the same temperature; there would be no further source of energy; physical phenomena would cease, and the physical universe would be dead. Such, at least, is the present view of this stupendous question. E. C. PICKERING.

Force (MANNING), b. at Parsippany, N. J., in 1789, joined the Methodist Episcopal Church in his seventeenth year, and in 1811 entered the Philadelphia conference, and filled most of the prominent appointments within its bounds. For twenty-two years was presiding elder in different districts, and was elected to the General Conference in 1824, 1828, 1836, 1840, and 1848. He was superannuated in 1860. D. Feb. 22, 1862, near Andover, N. J. He was of fine personal appearance, generous in heart and noble in sentiment, and beloved by preachers and people. J. H. WORMAN.

Force (PETER), an American historian and journalist, b. at Passaic Falls, N. J., Nov. 26, 1790; came to New York at an early age, where he learned and followed the trade of printer till 1815, when he moved to Washington, where in 1820 he commenced the publication of *The National Calendar*, a volume of national statistics, which he published annually until 1836. He also published (1823–30) a political newspaper, *The National Journal*, which was, during President J. Q. Adams's administration, the official organ. By desire of the government he undertook in 1833 the preparation of a documentary history of the American colonies, a labor to which he devoted thirty years, during which time nine folio volumes were published, entitled *American Archives*. While thus engaged he accumulated a valuable library relating to early American history, consisting of books, documents, manuscripts, maps, etc., which were purchased by the U. S. in 1867, and added to the Congressional Library. From 1836 to 1840, Mr. Force was mayor of Washington, and subsequently was president of the Na-

tional Institute for the Promotion of Science. He also published several volumes of historical tracts relating to the American colonies. D. at Washington, D. C., Jan. 23, 1868.

Forcelli'ni (Egidio), a distinguished Latin lexicographer, was b. at Fener, near Feltre, in the Venetian territory, Aug. 26, 1688. From the poverty of his parents he was deprived of early advantages, but having entered the seminary of Padua, he by his marked abilities and devotion attracted the notice of Facciolati, then director, who soon engaged his aid in carrying out his own designs for improving the Latin dictionaries then in use. In 1705, under the direction of his teacher, Forcellini began the revision of the book called *Calepinus* (see Facciolati), and finished it at the end of 1718. Facciolati meantime had conceived the plan of a complete dictionary of the Latin language, which should comprise all the words of existing authors, as well as those found in inscriptions and on medals. The execution of this great work devolved entirely upon Forcellini, and to him this credit belongs, though he enjoyed throughout the whole period the counsel and supervision of his old teacher. A brief memorandum of Forcellini states that he began the work at the end of 1718, and bestowed three and a half years on the letter A. In 1724 he was called away to be professor of rhetoric and director of the seminary at Ceneda, and was obliged to suspend work on the dictionary till his recall to Padua in 1731. From this time he labored steadily for eleven years without interruption, for the next eleven, with more or less hindrance, till the completion in 1753; two years were given to revision, and eight years to the transcription, which was finished Nov. 13, 1761. Forcellini d. at Padua Apr. 4, 1768, one year before Facciolati, and three years before the publication of the work that had occupied nearly forty years of his life. The title-page sets forth fairly the relation of the two editors: *Totius Latinitatis Lexicon Consilio et cura Jacobi Facciolati opera et studio Ægidii Forcellini alumni Sem. Patav. lucubratum.* The work, after lying ten years, was published in 4 vols. folio, under the care of Cognolati, who wrote the preface. A new edition appeared in 1805, and a third, revised with additions by Furlanetto, Padua, 1823–31, 4 vols. 4to. An edition with the Italian explanations translated into English was issued by G. Bailey, London, 1828, 2 vols. 4to. Furlanetto's edition was reproduced in Germany with much improvement by Voigtländer and Hertel, Schneeberg, 1829–45, 4 vols. fol. Two new editions are now (1875) issuing from the press. (See J. B. Ferrari, *Life of Forcellini*, Padua, 1792.) H. Drisler.

For'ceps [Lat.], in surgery, an instrument for seizing, and often for removing, bodies which cannot conveniently be seized by the hand. Forceps are of many forms. Special kinds are used for special purposes, as for drawing teeth, for cleansing sores, for seizing a bleeding artery, for extracting bullets, for assisting in the birth of the fœtus, and for many other uses.

Forch'hammer (Johan Georg), b. at Husum, Sleswick, July 26, 1794; became a distinguished Danish geologist, mineralogist, and chemist; was the associate of Oersted, and long held the chair of geology at Copenhagen; author of works on the geology of Denmark (1835), of Scandinavia (1843), and a manual of chemistry (1834–35). D. at Copenhagen Dec. 13, 1865.

Forchhammer (Peter Wilhelm), distinguished as a traveller and archæologist, was b. at Husum (in Sleswick) in 1803. He studied at the Lyceum in Lübeck, and then at the University of Kiel, where he took his doctor's degree in 1828, and resided for a time as private teacher. In 1830, after spending some months in Paris and London, he set out for Greece, and spent three years in explorations and study. On his return to Germany he published the results of his investigations, and then revisited Greece in 1839, on which occasion he accompanied King Otho through the northern provinces. He also visited Asia Minor to make a survey of the plain of Troy. Having been appointed professor extraordinary at Kiel in 1836, he returned, after visiting Egypt and Rome, to enter upon his duties in 1842, and founded, in conjunction with Jahn, the archæological museum. He contributed valuable articles on Grecian and Roman archæology and topography to many of the leading periodicals. His principal works are *Hellenika*, vol. i. (the only one), Berlin, 1837; *Topography of Athens*, Kiel, 1841; *Description of the Plain of Troy*, Frankfort, 1850; *Halkyonia*, Berlin, 1857; *The Cyclopean Walls*, Kiel, 1847. H. Drisler.

For'cible En'try and Detain'er. A forcible entry consists, in law, in an unlawful entry upon lands or tenements, accompanied by the exercise of force or by the use of such threats and menaces as overawe those rightfully in possession and prevent their resistance. Forcible detainer consists in wrongfully keeping possession of lands or tenements by force and threats whether the original entry were forcible or peaceable. Entry and detainer are usually included in the same act. This offence is generally prohibited by statute, declaring that "no entry shall be made upon lands except in cases where entry is given by law, and that in such cases it shall be made only in a peaceable manner, not with strong hand nor with multitude of people." The remedies are by public indictment for breach of the peace, by private action against the wrong-doer when he has no claim to the property, and by special proceedings under a statute if any, as is generally the case, be provided. When entry is made by one who seeks to justify his act by a plea of ownership, as by a landlord against a tenant holding over after his term, the tenant, as is generally maintained, cannot bring a private action for the offence, but the landlord is nevertheless punishable for the violation of the peace. When special statutory remedies are provided, they usually consist of measures adapted to put the party dispossessed again into possession of the premises, while necessary costs and expenses are exacted of the person making the wrongful entry. George Chase. Revised by T. W. Dwight.

For'cing, among gardeners, is properly the production of any fruit or flower out of its proper season by the judicious use of hot or cold frames, stimulating ammoniacal fertilizers, and other like appliances. The term may also be extended to the growing, by similar means, of exotic, and especially tropical, fruits or plants in an uncongenial climate.

Ford, county of N. E. Central Illinois. Area, 450 square miles. It is very level and fertile. Grain and hay are important crops. It is intersected by the Illinois Central, the Gilman Clinton and Springfield, and the Toledo Wabash and Western R. Rs. Cap. Paxton. Pop. 9103.

Ford, county in the S. W. of Kansas. Area, 900 square miles. It is intersected by the Arkansas River and the Atchison Topeka and Santa Fé R. R. It has fertile bottom-lands and fine upland pastures. Cap. Dodge City. Pop. 427.

Ford (Gabriel H.), b. at Morristown, N. J., 1764; graduated at the College of New Jersey at Princeton in 1784; was admitted to the bar in May, 1789; was presiding judge of the court of common pleas for the eastern district of the State; and (1820–40) justice of the supreme court. D. at Morristown, N. J., Aug. 27, 1849.

Ford (John), English dramatist, b. at Ilsington, Devonshire, in 1586; entered the Middle Temple, London, Nov. 16, 1602, and appears to have followed the legal profession with some success; but as early as his eighteenth year published *Fame's Memorial*, a tribute to the memory of Charles Blount, Lord Mountjoy and earl of Devonshire; then wrote several plays not now extant; and finally produced about sixteen others, most of which were performed between 1628 and 1639. D. probably about 1640. "It is greatly to be deplored," says Allibone, "that his taste was as bad as his genius was splendid, and that his licentiousness disgusts even whilst his imagination charms."

Ford (Lewis de Saussure), M. D., LL.D., professor forty-two years in the Medical College of Georgia, b. at Washington's head-quarters in Morristown, N. J., Dec., 1801; took his degree in medicine from the College of Physicians and Surgeons of New York City in 1822, and the honorary degree of LL.D. was conferred on him by the University of Georgia at Athens in 1868. Removed to South Georgia in 1822, and to Augusta, Ga., in 1827, where he assisted in organizing the Medical College of Georgia in 1832—an institution in which he has held ever since the professorship either of chemistry or practice of medicine. Prof. Ford contributed valuable essays on paroxysmal fevers, intermittent, simple, complicated, or malignant, from 1836 to 1845, through the *Southern Medical and Surgical Journal.* Paul F. Eve.

Ford (Sallie Rochester), American authoress, b. in 1828 in Kentucky; was Miss Rochester, and married Rev. S. H. Ford, Baptist preacher at Louisville, Ky., in 1855. Contributed to the *Christian Repository*, published by her husband, as also to his *Southern Repository*, at Memphis, Tenn., and has written *Grace Truman* (1857), *May Bunyan* (1860), *Romance of Freemasonry; Romance of Morgan and his Men* (1864).

Ford (Seabury), American lawyer and politician, b. at Pomfret, Conn., Oct. 15, 1801; graduated at Yale College, New Haven, Conn., in 1825; practised law at Burton, O.; was often member and once Speaker of each branch of the Ohio legislature; governor of Ohio 1848–50, and major-general of militia. D. at Burton May 8, 1855.

Ford (Thomas) was taken by his parents to Illinois in 1804; practised law, and was judge of the supreme court, and governor of Illinois 1842–46. Wrote *History of Illinois from 1818 to 1847* (1854). D. at Peoria, Ill., Jan., 1851.

Ford'ham, post-v. and station on the Harlem R. R., 10 miles from the Grand Central Dépôt, New York, was in 1874 annexed to New York City. It is the seat of St. John's College, a Jesuit institution; also of an academy for ladies, a theological school, a female deaf-mute asylum, and other Roman Catholic institutions. Pop. 2151.

Foreclosure. See MORTGAGE, by PROF. T. W. DWIGHT, LL.D.

For'eign Attach'ment, a process of attachment by which the property of a foreign or absent debtor in the hands of third persons, or debts due him from them, may be levied upon for the discharge of his indebtedness to a suing creditor. This form of procedure has existed in England from a very remote period, but only in a few of the larger cities, as London, Liverpool, etc., and owes its origin to immemorial usage in these particular localities, but does not constitute a part of the general common law. In these cities it still subsists in its ancient form, but a process of a similar nature has been established to operate uniformly throughout the realm, which is known as garnishment. This statutory proceeding, however, is applicable not only with reference to foreign but also to domestic debtors; and since it gives a right to seize upon their effects and credits only after the recovery of judgment, it is less beneficial than the special system of foreign attachment. In a number of the States of the Union a process similar to foreign attachment has been adopted by statute, providing for a levy upon the property of absent, non-resident, and absconding debtors, but its extent of application is not always the same. Garnishment, which is known in some parts of the country as the "trustee process," may commence with the suit, and includes both foreign and domestic attachment, and is the term generally used to designate the case where a debtor's property or credits may be attached in the possession of third persons. The statutes of the respective States must be consulted. (See GARNISHMENT.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

For'eign Judg'ment, the judgment of a foreign tribunal. As no state is under any obligation to enforce laws which are not of its own creation, the effect to be given to foreign judgments must depend entirely upon the comity of nations in their mutual relations with one another. But the general voluntary acceptance among the states of Christendom of the doctrines of international law has also extended to the recognition of the validity of such judgments when rendered by tribunals having jurisdiction of the cause determined, and when the proceedings were characterized by no fatal irregularity or fraud. Due inquiry may be instituted in regard to the authority of the foreign court and the conduct of the suit, in order to ascertain whether any oppression was exerted or injustice done; but if no error appears the decree is sustained. This practice operates as a great preventive of vexatious and protracted litigation, by which defendants might otherwise be persecuted and the courts heavily burdened, while it nevertheless tends to secure the administration of full and exact justice.

In all cases when it is desired to introduce into any court the proof of a foreign judgment in order that it may be inquired into or enforced, it must be proved and authenticated as a matter of fact. This may be done either by an exemplification of a copy of the judgment under the great seal of a state, or by a copy sworn to as correct by a witness who has compared it with the original, or by the certificate of an officer properly authorized by law to give a copy; which certificate must itself be properly authenticated. When the tribunal rendering the judgment is one whose acts are recognized by the law of nations, such as a court of admiralty, etc., an exemplification under the seal of the court will be sufficient.

The several States of the American Union are, as regards the proceedings of the State tribunals, regarded as foreign to one another, and judgments rendered in each are accordingly, on general principles of law, sustainable in the others as foreign judgments. But as these States are subordinate to one general government, the effect to be given in one to the judicial acts of another has not been left to depend simply upon inter-State comity. In the U. S. Constitution is contained a provision that "full faith and credit shall be given in each State to the public acts, records, and judicial proceedings of every other State, and that Congress may prescribe the manner in which such acts, records, and proceedings shall be proved, and the effect thereof." In pursuance of this authority the following enactment has been passed by Congress, establishing a mode of proof which is, however, not exclusive of any which the State itself may see fit to adopt. "The records and judicial proceedings of the courts of any State shall be proved or admitted, in any other court within the U. S., by the attestation of the clerk and the seal of the court annexed, if there be a seal, together with the certificate of the judge, chief-justice, or presiding magistrate, as the case may be, that the said attestation is in due form. And the said records and judicial proceedings, authenticated as aforesaid, shall have such faith and credit given to them, in every court within the U. S., as they have by law or usage in the courts of the State from whence such records are or shall be taken." If a judgment, therefore, would be conclusive in the State in which it was rendered, it is conclusive in every other State. It is not, however, put upon the same footing in all respects as a domestic judgment. No execution can issue upon it without a new suit in the courts of the State where it is sought to be enforced. It is moreover established that the above statute does not prevent an investigation into the jurisdiction of the court in which the judgment was rendered, or an inquiry as to the point whether it was obtained by fraud.

Some special remarks should be made as to judgments affecting the *status* of a person or thing, commonly called judgment *in rem.* An illustration of such a judgment as to a thing is a proceeding in a prize court to ascertain the title to a ship; of such a judgment as to a person, a divorce from the marriage contract. The peculiarity of such a judgment is, that of its own force it establishes the fact which it announces. A judgment in a prize court that a ship is American makes it American everywhere, even though the court may have proceeded on an erroneous principle of law. In this respect such a judgment differs widely from one between persons (*in personam*), as that requires an act of the executive power (see EXECUTIVE) to carry it into effect.

As to the effect of a decree of divorce, there is a diversity of opinion. The English courts hold that no foreign court can dissolve an English marriage in such a sense that its decree will be recognized in England. In this country a divorce granted in any State between parties who are domiciled there will be recognized in every other State, if the court had jurisdiction over the parties and there is no fraud. The same rule prevails if the plaintiff be domiciled in a State, and the other party makes due appearance either in person or by attorney to defend the action. For this purpose it is held that a married woman may acquire a different domicile from that of her husband. But if a person residing in one State goes into another and obtains a divorce without the presence of the other party, the decree will not in general be respected in the State of the latter's domicile. The reason is, that the court is not considered to have jurisdiction over the absent defendant. (See DIVORCE, MARRIED WOMEN, etc.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Foreign Laws, the laws of foreign countries. Foreign laws have no absolute binding force beyond the boundaries of the country in which they are enacted or established, and, like FOREIGN JUDGMENTS (which see), owe their efficacy in other states entirely to the obligations assumed by international comity. In the administration of justice the courts of one country are frequently under the necessity of adjudicating upon questions arising under a different system of laws, in reference to which the obligations of the parties concerned were created or by which their interests ought rightfully to be governed; and it therefore becomes requisite that the laws of the foreign state be proved in order that a decision may be given in accordance with them. For example, the administration of the personal assets of an intestate must be governed by the law of his domicile at the time of his death; the interpretation and enforcement of contracts are controlled by the "law of the place of the contract"—*i. e.* of the place where it was to be carried into effect according to the intention of the parties. (See INTERNATIONAL LAW, PRIVATE.) In cases of such a nature courts will not take judicial cognizance of foreign laws, but will require specific proof of their contents. When written laws are to be proved, they are authenticated by the exemplification of a copy under the great seal of a state, or by a copy sworn to as an accurate counterpart of the original, or by a certificate in proper form of an officer legally authorized to give a copy. Unwritten laws, customs, and usages are proved by parol evidence, by introducing the testimony of persons to whom such laws are known (experts).

The States of the Union are foreign to one another as regards the system of laws established in each, but their close connection and intimate relations have caused, quite generally, a relaxation of the strict rules prevailing in reference to the laws of different nations. A majority of the States, therefore, follow the practice of accepting a printed volume purporting on the face of it to contain the statute laws of another State, or perhaps even of foreign countries, as *prima facie* evidence of such laws. In New York the rule has been established by statute that printed copies of statutes or of reports of judicial decisions shall be received

as presumptive evidence. There is an act of Congress providing "that the acts of the legislatures of the several States shall be authenticated by having the seal of their respective States affixed thereto." This method, however, is not considered exclusive of any other modes of proof which the States have seen fit to adopt. Unwritten laws of the several States must be proved, as in other cases, by parol testimony, unless some special statutory provision is made relaxing the usual rule.

The States in their relations with the Federal government are not regarded as foreign, but domestic, and when the public laws of any one of them are to be examined and applied in the Federal tribunals, no proof is necessary. These courts take judicial notice of such laws in the same manner as each State by itself applies its own enactments, without requiring testimony in reference to them as matter of evidence. In like manner the State courts take judicial notice of the laws of Congress.

George Chase. Revised by T. W. Dwight.

Foreknowl′edge is God's absolute knowledge or Omniscience (which see) from eternity—His knowledge conceived of, as in advance of, before, the thing known. All human knowledge is, strictly speaking, simultaneous with the object it contemplates, or, in a looser sense, may be subsequent to it. In the doctrine of Predestination (which see) foreknowledge is regarded in its relation to the salvation of men. It is admitted by all thorough theologians that the foreknowledge of God is *dialectically* distinct from His foreordination or eternal purpose, but as to the question whether or how an absolute (that is, an infallible) foreknowledge (which is conceded by both sides) can be consistent with a conditional foreordination, they answer differently. It is also admitted on both sides that there is no interval of time between the foreknowledge and the foreordination of God; both are alike eternal. The question is, Which is properly put first in the system, in the order of nature and of logic? Out of the different answers to these questions have arisen, in large part, the conflicts between Arminianism (which see) and Calvinism (which see). The Calvinists make the foreknowledge subsequent to, and dependent on, the foreordination; the Arminians in some cases invert the relation, and make the purpose or ordination of God dependent upon what He foreknows. In the one system the two are distinct, but not separable; in the other they are separable as well as distinct. C. P. Krauth.

Foreland, North and **South,** two promontories of England, on the E. coast of Kent, 16 miles apart. They consist of chalk-cliffs 200 feet high, on which lighthouses are raised to warn the ships from the Downs and Goodwin Sands, which extend along the coast between them. Lat. of North Foreland, 51° 22′ N., lon. 1° 27′ E.; lat. of South Foreland, 51° 8′ N., lon. 1° 22′ E.

Foren′za, town of Southern Italy, in the province of Basilicata. Pop. 6129.

Foreordina′tion, ordination or decree in advance, the eternal appointment of all ends, and of all men to those ends, by God. When predestination, as some of the Fathers and of the Calvinistic divines have used the term, covers all the acts of God's will, it is synonymous with foreordination. When predestination is confined, as it is in Scripture usage, to the purpose of God in regard to salvation, foreordination is related to predestination as a whole to a part. (See Foreknowledge.) C. P. Krauth.

Fore′rius, or **Foreiro** (Franciscus), b. 1523 at Lisbon of noble stock; entered the Dominican order 1539; studied at Paris, and acquired a brilliant reputation as a linguist, theologian, preacher, and writer; became instructor of the prince Antonio and preacher to the king of Portugal; was prominent in the Council of Trent 1561–64; was one of the committee which revised the missal and breviary and prepared the Tridentine catechism; became confessor to Cardinal Borromeo; and in 1588 provincial of the Dominicans of Portugal. D. at Almeida Jan. 10, 1587. His chief work is a translation into Latin of Isaiah, with a commentary (1563).

Foreshor′tening, in drawing, painting, and engraving, the apparent projection of an object forward or backward from the plane where it is drawn. It takes its name from the fact that while it conveys a just impression of the real length of a figure, it is in fact *shortened* in order to convey that just impression. This invention is ascribed to Cimon of Cleonæ. It was practised with great correctness and boldness by Raphael, Tintoretto, Michael Angelo, and Correggio.

For′est, county in the N. N. W. of Pennsylvania. Area, 376 square miles. Much of the surface is rough and broken, and is covered by heavy pine and hemlock forests which produce large quantities of lumber. The Allegheny River and the Oil Creek and Allegheny River R. R. traverse the W. part of the county, which produces bituminous coal and some petroleum. Cap. Tionesta. Pop. 4010.

Forest, tp. of Sierra co., Cal. Pop. 748.

Forest, post-tp. of Livingston co., Ill., on the Toledo Peoria and Warsaw R. R., 5 miles E. of Fairbury. Pop. 1084.

Forest, tp. of Winnebago co., Ia. Pop. 179.

Forest, tp. of Genesee co., Mich. Pop. 1564.

Forest, tp. of Rice co., Minn. Pop. 577.

Forest, post-v., cap. of Scott co., Miss., on the Vicksburg and Meridian R. R., about midway between Jackson and Meridian. It has 10 stores, 3 churches, 1 newspaper and printing-office, a Masonic lodge, and a union Sunday school. The educational advantages are good. The court-house and jail have recently been located here. Pop. about 500. S. Davis, Ed. "Forest Register."

Forest, post-v. of Jackson tp., Hardin co., O., at the crossing of the Cincinnati Sandusky and Cleveland and the Pittsburg Fort Wayne and Chicago R. Rs.

Forest, tp. of Bedford co., Va. Pop. 2809.

Forest, tp. of Fond du Lac co., Wis. Pop. 1417.

Forest, tp. of Richland co., Wis. Pop. 926.

Forest, tp. of Vernon co., Wis. Pop. 662.

For′estburg, post-v. and tp. of Sullivan co., N. Y. Dairy products, lumber, and leather are manufactured. The township is traversed by the Monticello branch of the Erie R. R. Pop. 915.

Forest City, thriving post-v. of St. Francis co., Ark., on the Memphis and Little Rock R. R., 45 miles W. by S. of Memphis, Tenn. It has a weekly newspaper.

Forest City, post-v. of Forest tp., Sierra co., Cal. Pop. 152.

Forest City, tp. of Howard co., Ia. Pop. 832.

Forest City, post-v., cap. of Winnebago co., Ia., 140 miles W. of the Mississippi River. It has one newspaper. Principal business, farming. Pop. 155.

Halvorsen & Chase, Props. "The Winnebago Press."

Forest City, tp. and post-v. of Meeker co., Minn. Pop. of v. 181; of tp. 401.

Forest City, post-v. of Lewis tp., Holt co., Mo., on the Kansas City St. Joseph and Council Bluffs R. R. and on the Missouri River, 99 miles by rail above Kansas City. Pop. 676.

Forest City, post-tp. of Sarpy co., Neb. Pop. 383.

Forest City Plantation, tp. of Washington co., Me. Pop. 81.

Forest Culture. See Arboriculture, by J. J. Thomas.

For′ester, tp. and post-v. of Sanilac co., Mich., on Lake Huron. Pop. of v. 233; of tp. 670.

For′est-fly, a name given to those insects of the family Hippoboscidæ, order Diptera, which have well-developed wings. This family includes many of the ticks. All are parasitic. The larvæ are hatched in the oviduct, and turn to pupæ just after birth. The *Hippobosca equina* is a European horse-fly. Others infest sheep, deer, birds, and bats in this country.

For′est Grove, post-v. of Washington co., Or., 23 miles W. of Portland, and on the Oregon Central R. R. It is the seat of Pacific University (Congregationalist), and has one weekly newspaper.

For′est Hill, post-v. of Placer co., Cal., 6 miles S. of Downieville.

Forest Hill, post-tp. of Monroe co., West Va. Pop. 1920.

Fores′ti (E. Felice), LL.D., Italian patriot and scholar, b. near Ferrara about 1793; practised law at Ferrara; was prætor of Crespino in 1816; was arrested Jan. 7, 1819, as one of the Carbonari, and imprisoned at Spielberg until Aug., 1836, when he was permitted to come to America. Was professor of Italian in Columbia College, New York, and a teacher for more than twenty years. Appointed in 1858 as U. S. consul at Genoa, d. there Sept. 14 of that year, having published in the *Watchman and Crusader*, in 1856, *Twenty Years in the Dungeons of Austria*, a biographical sketch; also published *Chrestomazia Italiana*, 1846, and an edition of Ollendorff's Italian grammar, New York, 1846.

Forest Lake, post-tp. of Susquehanna co., Pa. P. 995.

Forest Laws. A forest, under the ancient English law, was a tract of woody country in which the sovereign enjoyed an exclusive right of hunting game. Forests were not necessarily enclosed, but they were under the special protection of certain courts termed "forest courts," and a particular system of laws was established to prevent any

violation of the king's rights. By force of these laws any injury done to the soil or trees of a forest, or to the game sheltered within its limits, received appropriate punishment. Both these courts and laws have now fallen into complete desuetude.

George Chase. Revised by T. W. Dwight.

Forest Marble, a series of laminated shelly limestones, forming, locally in England, a part of the lower Oolitic strata. (See Jurassic.)

Foreston, Ill. See Forreston.

For'estport, post-v. and tp. of Oneida co., N. Y. It has manufactures of leather and lumber. Pop. 1276.

For'est Prai'rie, tp. of Meeker co., Minn. Pop. 315.

For'estville, post-v. of Bristol tp., Hartford co., Conn., on the Hartford Providence and Fishkill R. R., 17 miles N. E. of Waterbury.

Forestville, post-v. of Delaware tp., Sanilac co., Mich., on Lake Huron, at the mouth of Cherry Creek. Pop. 121.

Forestville, post-tp. of Fillmore co., Minn. Pop. 599.

Forestville, post-v. of Chautauqua co., N. Y., on the Erie R. R., 8 miles E. of Dunkirk. It has 3 dry-goods stores, 2 hardware, 3 groceries, 1 bank, 1 newspaper, an excellent graded school, 3 churches, 1 agricultural and family paper, 2 hotels, 1 flouring and 2 lumber mills, and several shops. Principal business, farming and dairying. Pop. 722.

A. G. Parker, Ed. "Farmer."

Forestville, post-tp. of Door co., Wis. Pop. 351.

Forey (Elie Frédéric), marshal of France, b. in Paris Jan. 10, 1804, was educated at Dijon and admitted to St.-Cyr in 1822, where he became instructor. Was in the first Algerine expedition, in garrison duty in the Pyrenees, and returned as captain to Africa; was at the head of a battalion of *chasseurs-à-pied* in 1840, and went through four other African campaigns, returning to France a colonel. A general in 1848, he took an active part in the *coup d'état* of Dec., 1851, and was made general of division and commander of the Legion of Honor in 1852. For a time he had command of the siege force before Sebastopol in the war with Russia. In 1857 was nominated to the first division of the army of Paris, and, commanding this division during the Italian war in 1859, gained the battle of Montebello; distinguished himself at Magenta and Solferino, being wounded at the latter. Gen. Forey commanded the French expedition against Mexico resolved upon in 1861, stormed Puebla, and threw open the road to the capital; was made marshal for the achievement, and received command in France of the second *corps d'armée* Dec. 24, 1863. In 1867 commanded the camp of Châlons, received the grand cross of the Legion of Honor in 1859, and came to the senate Aug. 16 of that year. D. at Besançon June 20, 1872.

For'far, For'farshire, or **An'gus,** a maritime county of Scotland, bounded by the German Ocean, the Frith of Tay, Kincardine, Aberdeenshire, and Perthshire. Its surface is very varied, ranges of hills, the Sidlaw and the Oatlaw, alternating with valleys, the Vale of Strathmore, and the plain along the Tay, and its soil is fertile and well watered by the Tay, the North and South Esk, and the Isla. It has 240,010 inhabitants, and is a seat of the manufacture of coarse linen.

Forfar, the capital of Forfarshire, situated in the Vale of Strathmore. It has important manufactures of heavy shoes and coarse linens, and is connected with Aberdeen by the Scottish Midland Junction Railway. It has fine public buildings, and is a thriving town. Pop. 11,031.

For'feiture [Low Lat. *forisfactura*, from *foris*, "without," and *facio*, to "make"], a loss of property to the state or an individual as a penalty for the commission of some offence. Forfeiture is either civil or criminal. In civil forfeiture the property passes into the possession of some individual who has been injured by the violation of his rights through some neglect or transgression of duty on the part of the property-owner. There are several classes of cases in which this penalty might be incurred at common law, and in some of them it is still retained. Thus, in former times if an owner of a limited interest in real property, as a tenant for life or for years, attempted to convey a larger estate than he himself possessed by making a feoffment in fee-simple, not only did the grantee receive nothing, but the grantor's entire interest was forfeited to the reversioner or remainder-man. But at the present day this rule has no application, and an excessive grant is operative as a valid transfer of the grantor's actual interest, and of nothing more. In like manner, a tenant might forfeit his estate by disclaiming the title of him under whom he held, or the commission of waste might entail a like result as the effect of a judgment in an action of waste. The effect of disclaiming the title would be to enable the landlord to treat the tenant as a disseisor (see Disseisin), and thus to forfeit his estate. The action of waste has been discarded in a number of the States, and even in those which still retain it an action to recover merely the damages sustained is more usually brought than one for forfeiture. One very important case of civil forfeiture is that which occurs when the breach of the condition in a grant has been committed. The grantor may re-enter upon the premises and recover them as his own property. (See Conditions.) This form of forfeiture depends upon the stipulations of the parties, while other forms are referable to rules of law applying irrespective of any agreement.

Criminal forfeiture, under the English law, was the general penalty inflicted for acts of felony and treason, the offender's lands, chattels, or both, being confiscated by the Crown. (See Felony.) The same penalty has been retained until the present, but with considerable relaxation of its former severity. Attainder for felony entails the entire loss of goods and chattels, but, except in the case of murder, the forfeiture of the criminal's interest in lands in such cases only extends to the profits accruing during his life, and afterwards restoration of the land is made to relatives. When murder is committed the right of retaining and enjoying the profits of the land continues in the estate a year and a day after the wrong-doer's death, with power to commit waste. The only offence which now results in a complete confiscation of the offender's property, to be for ever vested in the Crown, is that of treason. There are a few minor offences to which this kind of punishment is also attached. For instance, striking a person in the superior courts at Westminster, or drawing a weapon upon a judge there presiding, causes a forfeiture of the profits of the offender's land during his life. Forfeiture, in all cases after conviction and attainder, has a retrospective operation, so as to nullify all transfers or incumbrances that may have been effected since the commission of the offence.

In the U. S., forfeiture, as a general mode of punishment for crimes, has never existed. There is a provision in the Constitution that "no attainder of treason shall work corruption of blood or forfeiture, except during the life of the person attainted." This restriction appears to have been copied in substance from the English statutes of 7 Anne c. 21, and 17 Geo. II., c. 29. The language of the first of these acts is, "that no attainder for treason shall extend to the disinheriting of any heir, nor to the prejudice of the right or title of any person or persons other than the right or title of the offender or offenders during his, her, or their natural lives only; and that it shall be lawful to every person to whom the right or interest of any lands, etc., after the death of any such offender should or might have appertained if no such attainder had been, to enter into the same" (sec. 10). Though this phraseology is much more explicit, it is altogether probable that the framers of the Constitution intended to accomplish the same result by a brief form of expression, and to save to the widow of a traitor her dower, and to the heir his estates. Of course it must be understood that this section of the Constitution applies to the result of judicial proceedings, and does not prevent Congress in the case of civil war from treating rebellious subjects as enemies under the law of nations, and seizing their property in that character. This limited authority to declare forfeiture for treason was never exercised until after the breaking out of the civil war in 1861. A previous law of Congress, passed in 1790, had expressly waived the right to impose such a punishment by providing that "no conviction or judgment for any capital or other offence shall work corruption of blood or any forfeiture of estate." The crisis of the civil war was thought to demand more stringent coercive and punitory measures, and in 1862 an act was passed providing for the confiscation of the property of certain classes of persons, but containing the restriction that no punishment or proceedings should be construed to work a forfeiture of the real estate of the offender longer than his natural life.

There are certain specific classes of offences in regard to which particular statutes have been enacted by Congress exacting the forfeiture of property employed as a means of committing the wrongful act or used in an unlawful transaction; but forfeiture in such cases applies only to the particular property designated, and not generally to chattels or lands, as in the other instances which have been mentioned. Thus, laws have been passed from time to time providing that smuggling or importation of goods under fraudulent invoices shall cause a forfeiture either of the entire invoice or of the property wrongfully imported. Acts of piracy entail a forfeiture of the piratical craft and its appurtenances. The same was formerly true of vessels engaged in the slave-trade.

The constitutions of many of the States of the Union, or the laws which they have enacted, contain substantially

the same provisions, prohibiting the general forfeiture of a criminal's property, as the laws enacted by Congress.

George Chase. Revised by T. W. Dwight.

Forge, a workshop and plant for the working by the hammer, or the hammer and rolling-mill combined, of wrought iron, steel, copper, etc. at a red or white heat. The Bloomary (which see) is often called a forge. The different forms of forge are very numerous, according to the kind of work to be turned out. The aid of steam is often called in, not only to furnish the air-blast, but to move powerful hammers, to hoist and turn masses of iron, and the like. The rolling-mill, a comparatively recent invention, has for some purposes superseded the forge.

For'gery, the wrongful making or alteration of a writing with intent to deceive and defraud by its fictitious appearance of genuineness. Lord Coke quaintly describes the term as "metaphorically taken from the smith, who beateth upon the anvil and forgeth what fashion and shape he will." The essential criminality of the offence lies in its tendency to prejudice the rights and interests of innocent third persons, by giving to an instrument an apparent legal efficacy which it would not otherwise have possessed; and the application of this test as a criterion determines both the kind of writings of which forgery may be committed, and how great a degree of change is necessary to be effected in their form and appearance in order to constitute the crime. Thus, the writing must be of such a nature that, whether fictitiously fabricated as a whole or only in part, its use and circulation would be calculated to occasion pecuniary loss, or some infringement upon or injury to legal privileges, or the creation of a liability to which the person injuriously affected ought not to be subjected. The instrument must be legally capable of effecting a fraud. Hence, if its only tendency would be to injure some person's feelings, violate his confidence, or convey false information, without otherwise affecting his interests, no forgery would be committed. But whenever the writing might be made the foundation of a legal liability, as if one should wrongfully make or alter a note or a bill of exchange, or wherever it might cause a wrongful disposition of property or occasion the loss of a situation of pecuniary benefit,—in these and similar cases the unwarrantable falsification is sufficient to constitute the offence of forgery. Not only, therefore, instruments which are manifestly of a pecuniary nature, by directly entitling their possessor to the receipt of money, may be forged, but a letter of recommendation to a servant or a schoolmaster by which he might obtain a lucrative position, or a representation as to the financial credit and standing of a merchant by reason of which those trusting him might be deceived, would come within the same category. The same is true of instruments which unwarrantably prejudice any legal right by effecting a fraud, as a deposition to be used on the trial of a cause in court or a copy of a writing to be used in evidence. If a writing be invalid on its face, it cannot be the subject of forgery, since its power to prove deceptive would be nullified by its own contents. But the invalidity must be readily apparent, for if only discoverable upon examination—though but slight examination would be required—the criminal nature of the instrument is in no way diminished.

The degree of fabrication or alteration of an instrument need be only sufficient to render a fraudulent deception possible. Consequently, not only need the entire contents not be fictitious, but a very slight change, either by insertion, alteration, erasure, or other material modification of the terms of any writing, which would be effectual in giving it a seeming validity or varying its tenor, would be enough to constitute forgery. This may consist either in the addition of a false signature to a true instrument or a real signature to a false one, in the insertion of paragraphs or clauses, or the change of words, or even of letters, if the legal effect of the instrument be thereby altered. Appending the signature of a fictitious person or of one no longer living to an instrument is as fraudulent an alteration as imitating the name of a person still living and generally known. A printed or engraved document, as a railroad-ticket or pass, may be forged, as well as one that is in writing; but when the thing in which the alteration is effected is one which does not consist, in its essential nature, of some form of language, no change of words used in connection with it will be sufficient to constitute forgery. Therefore, the change of an artist's name in the corner of a painting, in order to deceive the public and fraudulently induce a purchase for more than its value, is not forgery.

As in other criminal offences, an evil intent is a necessary element in the offence of forgery. But this principle does not require that there should have been a definite purpose to injure a particular person, but only that the instrument forged shall be intended to be used as if it were genuine. Consequently, if the wrong-doer in using the fictitious paper faithfully designs to take such subsequent measures as shall avert all possibility of injury, he is nevertheless guilty of the crime. By so employing the instrument that others may be defrauded he is conclusively presumed in law to have been actuated by criminal motives. But if a person, believing himself with good reason duly authorized to act as agent in the use of another's signature, does employ it, and has in fact no justification, he is not chargeable with forgery, because his wrongful act was induced by no fraudulent purpose. Generally, wherever an actual forgery is committed, intent is presumed from the mere circumstance that the act was committed.

It is not necessary that any actual injury should result from the offence. It is sufficient, at common law, that the writing has such a deceptive character that if once put into circulation it will, according to natural and reasonable anticipation, entrap and mislead those to whose hands it comes, to the injury of their lawful interests. Whether the person whose writing is imitated or whose name is assumed be immediately affected by the forgery, or loss is occasioned to third persons, is entirely immaterial. The offence is complete without regard to the persons affected.

Besides forgery prejudicial to the rights of individuals, there exist, both at common law and by statute, varieties of this offence more immediately affecting the public. Of this nature are false and fraudulent alterations of any matter of record or of any authentic matter of a public nature, as a parish register, etc. Various statutes in England have specified numerous other instances in which fabrication or alteration of public documents is made punishable.

In the U. S., Congress and the State legislatures severally have enacted special laws against forgery. This crime against the general government can be punished only under the acts of Congress; but, as a general rule, it is held that the State statutes, unless inconsistent with the common law, do not supersede the principles of the common law, so that an offender may be prosecuted either under the statute or not, as may be thought desirable. Some States, however, have discarded the common-law procedure entirely.

The offence of uttering forged instruments—*i. e.* of attempting to effect a fraudulent deceit by making actual use of them—was not a necessary ingredient in the crime of forgery at common law, but was specifically provided for by statutory regulations. In some of the American States uttering has been made an essential element in this offence, while in others it is still considered a distinct crime. (The statutes of the separate States must be consulted.) The word, as used in extradition treaties between the U. S. and foreign nations, would have a signification confined to that in which the word was employed in the general jurisprudence of the respective nations. It would not include the special statutory definition of forgery in one of the States. (See Extradition for authorities.)

George Chase. Revised by T. W. Dwight.

Forget-me-Not [Ger. *Vergissmeinnicht*], the *Myosotis palustris* of Europe, a plant of the borage family, sparingly naturalized in the U. S., and prized by people of many nations as the emblem of constancy in friendship and love. Many other species of the genus are known, chiefly European; the above is the typical species. The U. S. have a number of forget-me-nots, mostly common to the two hemispheres. They generally have brilliant blue flowers. Mouse-ear and scorpion-grass are popular names for this genus. Many varieties appear in cultivation.

Forge Village, manufacturing post-v. of Westford tp., Middlesex co., Mass., on the Stony Brook R. R., 5 miles E. by N. of Ayer. Stony Brook affords good water-power.

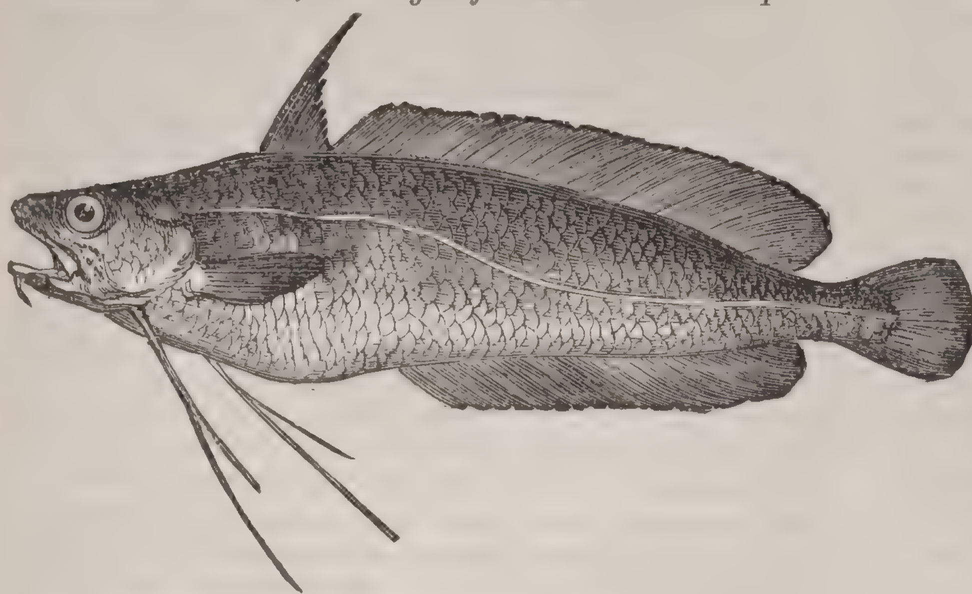
For'ging, the reduction of iron or steel at a high temperature to any desired shape by means of blows of the hammer. Some kinds of work are still forged by hand, but most forging is done by the steam-hammer, though some work is finished by hand. The rolling-mill has also to some extent superseded the forge, doing its work in general much more rapidly, and often just as well as the older process. Very recently a new method of shaping iron has been introduced, in which hydraulic pressure is substituted for the blows of the hammer. (See Hydraulic Forging; see also Iron and Rolling-Mill.)

Fork, a piece of table cutlery employed for holding the food in cutting it with the knife and for conveying food to the mouth. It was probably employed to some extent in the twelfth century, and then gradually came into general use. A bronze two-pronged fork at Kouyunjik, and a silver two-pronged one on the Esquiline Hill, were found in 1874, supposed to have been ancient table-forks. Cheap forks are made of steel or iron, but at most tables silver forks or plated ones are now generally used. There were at first but two prongs, but of late four- and five-pronged forks are more frequent.

Fork, post-tp. of Mecosta co., Mich. Pop. 162.

Fork, tp. of Anderson co., S. C. Pop. 1562.

Forked Beard, the *Phycis furcatus* and *Raniceps tri-*



Great Forked Beard.

furcatus, marine fishes of the cod family found on the European coasts, and so called from their forked barbules. The former is the greater, the latter fish the lesser forked beard. The forked beards of the U. S. waters (*Phycis chuss* and *tenuis*) are called hake, but are much superior in quality to the true hake.

For'kel (Johann Nikolaus), German musical composer and author, b. at Meeder, near Coburg, Feb. 22, 1749; studied at Göttingen 1769–79; was director of music to the university in 1779; member of the academy of Stockholm 1804. D. Mar. 17, 1818, at Göttingen. Published *General History of Music* (2 vols., 1788–1801, unfinished), *Life of Sebastian Bach* (1803), etc.

Fork'land, post-tp. of Greene co., Ala. Pop. 2789.

Fork Lick, tp. of Webster co., W. Va. Pop. 671.

Fork River, tp. and v. of Wayne co., N. C. Pop. of v. 811; of tp. 1611.

Forks, tp. of Northampton co., Pa. Pop. 1450.

Forks, tp. of Sullivan co., Pa. Pop. 854.

Fork's Plantation, tp. of Somerset co., Me. Pop. 159.

Fork'ston, post-tp. of Wyoming co., Pa. Pop. 576.

Fork U'nion, post-tp. of Fluvanna co., Va. Pop. 2794.

Forli', province of Italy, on the Adriatic, and formerly a part of the pope's dominions. Area, 716 square miles. Its coast-region is low and unhealthy, but very productive. Sulphur is mined, and the manufacturing interests are important. Pop. 234,090.

Forli, town of Italy, in the province of the same name, beautifully situated between the rivers Ronco and Montone, at the foot of the Apennines. Among its many interesting monuments are the Palazzo Guersini, designed by Michael Angelo, and the cathedral, with notable pictures by Carlo Cignani and Guido. Pop. 17,723.

Forlorn Hope [Fr. *les enfants perdus,* "lost children"], a name given to a party of picked troops selected for some desperate enterprise in war. The men are usually volunteers, and the honor accruing to them is great in proportion to the peril to which they are exposed.

Form [Lat. *forma,* perhaps a transposition of the Gr. μορφή]. The history of this as a philosophical term begins with the doctrine of Pythagoras respecting numbers. In them is to be found the first dawn of the thought of a principle of form, which was developed by Socrates and Plato into the famous doctrine of ideas (= forms, εἴδη, ἰδέαι). To these, in opposition to Heraclitus's theory of universal flux, Plato assigned an independent and eternal existence (Aristotle, *Metaph.* bk. i. cap. vi.), and made them the archetypes of which individual things are the more or less imperfect copies, existing through participation. Aristotle severely criticised the Platonic doctrine, denying the independent existence of archetypal *forms,* and making *form* one of the four αἰτίαι, or grounds of existence. He, however, uses the term in a narrower and in a wider sense. In the former it is the second of the αἰτίαι, constituting, as the inner principle of realization (distinguished from μορφή, or external form), the substance of things. In its wider signification it includes formal, efficient, and final causes, and thus stands opposed to the material principle as actuality to potentiality. In this sense the spiritual is pure form, and the soul the "form of forms." (See Biese, *Philosophie des Aristoteles,* vol. i. p. 439; Trendelenburg, *Aristotelis de Anima lib. iii.,* pp. 301 *seq.;* Bonitz, *Aristotelis Metaphysica,* p. 325 *et passim;* Von Hertling, *Materie und Form,* pp. 48 *seq.;* Ueberweg, *Hist. of Philosophy* (Eng. trans.), vol. i. p. 162; Grote, *Aristotle,* vol. i. p. 354; vol. ii. p. 354, *et al.;* Lewes, *Aristotle,* p. 117.) The term underwent little change of meaning until the time of the Neo-Platonists, who tried to fuse the teachings of Plato and Aristotle. In Plotinus, *form,* instead of being conceived as an αἰτία, is placed in the category of substance, constituting, along with matter (ὕλη), which is not regarded as its substratum merely, substance. (Plotin., *Enneads,* ii., bk. iv.; Kirchner, *Die Philosophie des Plotin.,* pp. 106 *seq.;* Richter, *Plotin's Lehre vom Sein,* pp. 96 *seq.*) From the Neo-Platonists we pass to the Scholastics, who were mostly guided by the authority of the ill-understood philosophy of the ancients, especially of Aristotle. Robert Greathead, for example, who wrote commentaries on Aristotle, distinguished three kinds of forms—form immanent in matter, abstract form, and immaterial form. Albertus Magnus held that form existed potentially in matter; and Thomas Aquinas recognized a *forma substantialis,* or objective universal, and *formæ accidentales,* or subjective abstractions. With him, as with Aristotle, God is pure form—immaterial, as being entirely actual, without potentiality.

Bacon, the most successful of the opponents of Scholasticism, flattered himself that he had broken with antiquity more than he really did. He identified form with law or mode, and even maintained that, as far as thought is concerned, the form of a thing is the very thing itself. (*Nov. Org.* ii. 13.) The philosophy of Bacon and Locke came to a standstill with Berkeley and Hume, and the reaction called forth, on one hand, the Scotch or common-sense philosophy—on the other, the Kantian or critical philosophy. In the latter the word *form* has a purely transcendental meaning—that is, the forms, whether of intuition or of thought, are regarded as native to the mind and prior to experience. The *forms* of intuition are space and time. The *forms* of thought are (*Proleg.* pt. ii. § 20)—

1. Quantity.	2. Quality.	3. Relation.	4. Modality.
Unity,	Reality,	Substance,	Possibility,
Plurality,	Negation,	Cause,	Existence,
Totality.	Limitation.	Reciprocity.	Necessity.

These categories of the understanding stand opposed to the transcendental object or *Ding an sich* (thing in itself), which corresponds to the Aristotelian ὕλη, but is treated less philosophically. Since Kant, this has been the meaning of *form* in German philosophy, except that since Hegel *form* has been conceived as objective as well as subjective, pure knowing being identical with its object. In the Scotch and modern materialistic and cosmic schools the word has no true philosophic meaning. Thomson calls *form* "the means of viewing objects presented to the mind." (*Outline of Laws of Thought,* 2d (English) ed., p. 34.) Thomas Davidson.

Form. In musical composition, this term refers, in part, to rhythmical structure in phrases, sections, periods, etc.; but it also denotes the characteristic outlines, grouping, and configuration of musical ideas, to which it is the office of rhythm merely to give shape and symmetry, even though such ideas are often too wild to be restrained by any system of arbitrary rules. The study of "form" takes precedence of harmony, just as, in drawing, the study of outline takes precedence of light, shade, and coloring, though by culture the mind conceives of form and its ornamentation without this distinction. Wm. Staunton.

For'mal, in philosophy, is a term applied to qualify the idea of cause. The formal cause (Aristotle, *Metaphys.* v. 2) is the form, archetype, idea, or pattern of anything. Thus, the intention or design (idea) of the artist is a formal cause of the statue. The formal cause is the *quidditas* of the Schoolmen.

Formates, salts of formic acid.

Forma'tion, a convenient but not accurately limited term in geology. Properly speaking, it refers to a stratum or series of strata which have a certain unity; as the "Clinton formation," which is equivalent to the "Clinton group," a subdivision of the Silurian system; the "Hamilton formation," an important subdivision of the Devonian. It is also as often applied to an entire system, as the "Silurian formation," the "Carboniferous formation," etc. The theory in the coinage of the word was that it should designate certain strata which were formed by one general, common cause, even though that cause might vary in the nature and in the intensity of its action, and which, though differing in their lithological character and fossils, had still some things in common which served to bind them together. J. S. Newberry.

For'mes (Karl Jean), a famous basso singer, b. at Mühlheim, in the grand duchy of Baden, Aug. 7, 1818.

The possession of a voice of singular depth, compass, and purity, capable of great expression, was the occasion of his forsaking the ecclesiastical calling he had already entered on, and betaking himself to the stage. Driven from Vienna on account of his revolutionary opinions, he repaired to London, where he was considered the rival of the celebrated Lablache. In 1857, Formes came to the U. S., to renew his triumphs on the lyric stage and in oratorio. He liked the American people, institutions, and ideas, reappeared season after season in New York, and, as it was said, purposed at one time making this country his home. In later years his voice gave way, but, being gifted with uncommon dramatic power, he attempted drama in London. In this he failed. Besides being a great artist, one of the greatest of this generation, a singer of equal power in comedy and tragedy, as grand in Elijah as he was droll in Leporello, Karl Formes is a man of unusual intelligence and breadth of humanity—a man of mind. His best-remembered parts are Marcel, Leporello, Bertram, Figaro, Sarastro, Plunkett.

O. B. FROTHINGHAM.

For'miæ, a city of ancient Italy, on the site of the town now called *Formia*. Its origin is unknown. It was on the Appian Way and on the Sinus Caietanus, and has always been famed for its beautiful situation. Cicero and many other Romans had villas here, and at Formiæ the great orator was murdered. A structure called the tomb of Cicero is still shown.

For'mic Ac'id, $HCHO_2$, the simplest member of the fatty series of acids, derives its name from the ant (*formica*), from which it was first prepared. It occurs in the juice of the stinging nettle and in other plants; in the ant, especially the red ant, and is projected by it as a means of defence; in some caterpillars; in human blood, urine, flesh-juice, and perspiration; in some waters. It is formed by a great variety of chemical reactions. Potassic hydrate heated in carbon monoxide is changed to potassic formate—$CO + KHO = KCHO_2$. Potassium spread on the inner surface of a jar of carbon dioxide over water is converted into a mixture of potassic formate and acid carbonate—$CO_2 + K_2 + H_2O = KCHO_2 + KHCO_3$. Wood-spirit (wood-naphtha or methylic alcohol) is oxidized in presence of platinum black into formic acid—$CH_4O + O_2 = HCHO_2 + H_2O$. It is prepared (1) by distilling red ants, previously mashed; (2) by distilling 10 parts of tartaric acid, 14 parts of manganese dioxide, and 35 parts of water; (3) by distilling 1 part of starch with 4 parts of water, 4 parts of manganese dioxide, and 4 parts of sulphuric acid, added in small quantities; (4) by gently heating 10 parts of oxalic acid, with 10 of glycerine and 2 of water, to about 212° F. for twelve or fifteen hours, then adding 5 parts of water and distilling. The addition of water and distillation are repeated till 60 parts of dilute acid have been distilled off. The pure concentrated acid is prepared by saturating the impure dilute acid with plumbic carbonate, crystallizing the plumbic formate, and heating it in a current of sulphuretted hydrogen. The formic acid distils over, and may be freed from sulphuretted hydrogen by a current of carbon dioxide. The concentrated acid is a thin, transparent, colorless liquid, sp. gr. 1.22, boiling at about 212° F. It fumes in the air, and is very corrosive,a single drop placed on the skin causing intolerable pain and producing a painful ulcer. It (or its salts) reduces the oxides and many of the salts of mercury, silver, and gold, forming metallic precipitates.

C. F. CHANDLER.

Formica'tion [Lat. *formica*, an "ant"], a morbid sensation felt in the skin, so called from its resemblance to the feeling produced by the crawling of ants. Formication is a part of the complex sensation called numbness—that which is experienced when after compression of the nerves of the leg the "foot is asleep." In addition to indicating irritation of a nerve by pressure, etc., formication is the result of any kind of irritation of those parts of the nervous centres which are connected with sensitive nerves. Hence, this morbid sensation is often a symptom, and an early symptom, of cerebral or spinal disease. Numbness is often confounded with anæsthesia (loss of sensibility), but this is an error, since numbness almost always coincides with the preservation of sensibility. E. C. SEGUIN.

Formic Ethers, formates of the alcohol radicals, as ethylic formate, $C_2H_5.CHO_2$.

Formo'sa (Port. "beautiful"), [Chinese *Tai-Wan*, "terrace"], an island in the China Sea, 90 miles off the coast of the Chinese province of Fo-Kien, to which it belongs. Its length is 237 miles, its average breadth 70 miles. It is intersected from N. to S. by a range of high volcanic mountains. The eastern part is inhabited by the aborigines, the western by Chinese settlements, which comprise about 500,000 inhabitants. The capital, Tai-Wan, was opened to foreign commerce in 1858. With Fo-Kien, Formosa has a very lively trade, importing tea and different kinds of manufactures, and exporting rice, inferior tea, brimstone, drugs, timber, and provisions. Formosa is called the granary of Fo-Kien, and its rice, besides being very abundant, is of a superior quality. The Chinese settlers are described as enterprising and progressive people; about the aborigines little is known. The wild tribes make use of several languages, and are probably of various origin. The climate is wet and disagreeable. In the interior there have been found remarkable geyser-fields abounding in native sulphur and metallic ores. Good lignitic coal is mined. Formosa in 1874 was invaded by the Japanese, who punished a native tribe for the murder of Japanese sailors, and for some months occupied a part of the island —a proceeding which came near involving Japan in a war with China; but finally China paid the expenses of the invasion, and the Japanese evacuated the island. Most of the native races by no means regard the Chinese as their masters, but consider them base and cowardly intruders.

Formosa, tp. of Halifax co., N. C. Pop. 2957.

Formo'sus, bishop of Porto, became pope in 891; d. in 896. His election caused much controversy during and after his pontificate, since the canons at that time forbade a transfer of bishops from one see to another; and Pope Stephen VI. caused his body to be dug up and cast into the Tiber as an intruder, but John IX. reversed this action as far as possible.

Formulæ, Chemical. See CHEMISTRY, by PROF. GEORGE F. BARKER, M. D.

For'ney (JOHN WEISS), American politician and journalist, b. at Lancaster, Pa., Sept. 30, 1817; apprenticed in the office of the *Lancaster Journal* in 1833, and in 1837 was editor and joint-proprietor of the *Lancaster Intelligencer;* in 1840 he united the two papers. In 1845, in Philadelphia, and thereafter, he edited the *Pennsylvanian*, Democratic journal. In 1851–55 was clerk of the U. S. House of Representatives, editing the *Washington* (D. C.) *Union*, Democratic. Aug. 1, 1857, began the *Press*, Democratic daily newspaper, at Philadelphia, supporting Stephen A. Douglas and opposing the administration of President Buchanan. Was after that clerk of the 36th Congress. At the opening of the civil war of 1861–65 he took strong ground for the vigorous prosecution of the contest by the U. S. government, and has since acted with the Republican party. From 1861 to 1868 was secretary of the U. S. Senate, as well as corresponding editor of the *Press*. Also started during this time the *Washington* (D. C.) *Chronicle*, weekly, which became a daily in Oct., 1862. He travelled in Europe in 1868, and on his return published his letters to the *Press* and *Chronicle* as *Letters from Europe* (1869). Sold his property in the *Chronicle* in 1870, but is yet connected with the *Press*.

For'rest (EDWIN), an American actor, b. in Philadelphia Mar. 9, 1806; d. there Dec. 12, 1872. When a mere boy, not twelve years old, he performed as an amateur, taking female and juvenile parts, Young Norval in Home's play of *Douglas* being particularly remembered. His first appearance on the public stage was at the Walnut Street Theatre, in the rôle of Douglas, on Nov. 27, 1820. A long and enterprising professional tour in the Western cities, during which he undertook characters in Shakspeare, gave him experience and reputation; so that, after filling engagements in Albany and Philadelphia, he presented himself before the New York public at the Park Theatre in the character of Othello. This was in 1826. His success was signal. A natural genius, aided by hard study and set off by a superb form and a noble presence, commanded attention. At the Bowery he was a special favorite. There and at the Park he played long engagements, but, not satisfied with local fame, visited all the principal cities of the U. S. His chief characters were Othello, Macbeth, Hamlet, Richard III., varied by parts like Metamora and Spartacus, which his fine physique and immense energy made effective and kept popular. In 1835, Mr. Forrest made a professional visit to England and the Continent, finding warm friends, conspicuous among whom was the late Mr. Macready, to whom he was indebted for much kindness. In 1837, on the occasion of a second visit, he married Catharine Sinclair, daughter of the popular ballad-singer. After 1845 two years more were spent in England. During this visit his friendly relations with Mr. Macready were broken. His partisans entered zealously into the quarrel, which broke out in the bloody riot of May 10, 1849, when Macready was playing at the Astor Place Theatre in New York. The same year painful difficulties between Mr. and Mrs. Forrest culminated in separation, and in 1852 the wife obtained a verdict of divorce in the New York courts, on the ground of her husband's infidelity. Mr. Forrest resisted, and appealed from court to court till all legal resources were exhausted, alienating from himself all the while the sympathies of the best people. Mr. Forrest announced his retirement from the stage in 1858, but accepted engage-

ments and played at intervals till 1871, when compelled by ill-health to desist. After this he appeared as a public reader of Shakspeare, in which capacity he was heard by a New York audience but a few weeks before his death. He died of a sudden attack of apoplexy.

Edwin Forrest was enriched by his profession. He built a stone castle on the Hudson, now a Catholic convent, and later a spacious and elegant residence in Philadelphia, where he had a splendid library, especially rich in Shakspearian literature, and where he exercised a generous hospitality. He was a man of literary taste, excellent scholarship in his profession, open manners, ardent impulses, impetuous feelings, and frank disposition. A large part of his great fortune was left by him to establish an asylum for aged and indigent actors. His library, with its best treasures, was destroyed by fire Jan. 15, 1873. (Full justice to the best side of Edwin Forrest's character and the more delicate features of his art is done by Rev. Wm. R. Alger in his newly-written biography.) O. B. FROTHINGHAM.

Forrest (FRENCH), American naval officer, b. in Maryland in 1796, became a midshipman 1811; lieutenant Mar. 5, 1817; commander Feb. 9, 1837; captain Mar. 30, 1844; and was dismissed Apr. 19, 1861. He distinguished himself in the war of 1812 on Lake Erie, and in the fight between the Hornet and the Peacock, Feb. 24, 1813. In the Mexican war was adjutant-general of the land and naval forces. Followed the State of Virginia when she seceded from the Union, and was acting assistant secretary of the Confederate navy. D. at Georgetown, D.C., Dec. 22, 1866.

Forrest (NATHAN BEDFORD), b. in Bedford co., Tenn., July 13, 1821. In 1834 his father removed to Mississippi, and died in 1837, leaving a large family dependent upon the subject of this sketch. With this responsibility upon him, he devoted himself to farming, being able to give to his own education only a few of the winter months. By energy and good management he had by 1840 secured comparative prosperity for the family, now reduced by death. Entered in 1842 business in Hernando, Miss., where he remained till about 1851; removed to Memphis, Tenn., in 1852, and became a real-estate broker and dealer in slaves; in 1859, having amassed a considerable fortune, he disposed of a large portion of his Memphis business and purchased extensive plantations in Coahoma co., Miss., and became a large cotton-grower, acquiring a large fortune. Though opposed to disunion, he was an ardent States Rights man in politics, and when war became inevitable he espoused the Southern cause with his usual energy. In June, 1861, he joined the Tennessee mounted rifles as a private, but in July, at the request of Gov. Harris of Tennessee, consented to undertake raising a regiment of cavalry, in which he was successful, equipping them largely from his own private means. On the organization of the regiment in October he was chosen lieutenant-colonel, and the day following moved his men for Fort Donelson. Their first engagement was with the U. S. gunboat Conestoga at Canton Landing. At Fort Donelson, Forrest bore a conspicuous part, and on the final determination to surrender he remonstrated, and was allowed to attempt an escape with his men before a flag of truce was sent. In this he was successful, reaching Nashville with the main part of his force Feb. 18. On Mar. 10 his regiment reassembled at Huntsville, and a few days later marched to Iuka, Miss.; his force was now increased to ten companies, of which he was chosen colonel. Engaged at the battle of Shiloh (Pittsburg Landing) Apr. 6–7, 1862; wounded in combat Apr. 8. In the following June he was assigned to the command of cavalry at Chattanooga, and participated in the attack on Murfreesboro' July 13; appointed brigadier-general July 21, 1862, and placed in command at Murfreesboro' Sept., 1862; in command of brigade Dec. 4, 1862, and engaged in the action of Parker's Cross-roads Dec. 31, 1862, and battle of Chickamauga Sept. 19–20, 1863. Transferred to North Mississippi in Nov., 1863, he was appointed a major-general the following month, and assigned to the command of Forrest's cavalry department; in command of forces at the capture of Fort Pillow Apr., 1864; promoted to be lieutenant-general Feb., 1865; surrendered at Gainesville May 9, 1865; was subsequently president of the Selma Marion and Memphis R. R. Co. until 1874, when he resigned.

Forrest (URIAH), b. in St. Mary's co., Md., 1756; was lieutenant-colonel in the Maryland line, and was so wounded at Germantown that he never fully recovered. Was made auditor of Maryland; was a member of the old Congress in 1786–87; often in both branches of the legislature of Maryland; major-general of militia; M. C. 1793–95. D. near Georgetown, D. C., July, 1805, being then clerk of the circuit court of the District of Columbia.

For'rester (ALFRED HENRY), ("Alfred Crowquill"), English artist and comic writer, b. in London in 1805; educated at Islington; was a notary in the Royal Exchange, but retired about 1839. Began contributing to periodicals at the age of sixteen, and afterwards drew, modelled, and engraved on steel and wood to illustrate his own writings. *Leaves from my Memorandum-book* (1826) was followed by *Eccentric Tales* (same year). In 1828 contributed to the *Humorist* in *Colburn's Magazine*, with Theodore Hook, Disraeli, and others; then to *Bentley's Miscellany, Punch, The London Illustrated News*, etc. Has exhibited large pen-and-ink drawings at the Royal Academy, and gained some repute as a designer and modeller. *Wanderings of a Pen and Pencil, The Comic Arithmetic, Phantasmagoria of Fun*, etc. are among his works. D. in London May 26, 1872.

For'reston, post-v. and tp. of Ogle co., Ill., on the Illinois Central and Chicago and Iowa R. Rs. It has 1 bank, 2 hotels, 7 churches, dry-goods, grocery, drug, hardware, boot and shoe shops, etc., a planing and a flour mill, 2 carriage-factories, a public high school, and one weekly newspaper. Principal business, farming. Pop. of tp. 2177.
G. L. BENNETT, ED. "JOURNAL."

Forshey (Col. CALEB GOLDSMITH), A. M., b. in Somerset co., Pa., July 18, 1812; educated at Kenyon College, O., and at the U. S. Military Academy at West Point; was professor of mathematics and civil engineering at Jefferson College, Miss., 1836–38; was thenceforth engaged for many years in engineering works in Mississippi, Louisiana, and Texas; was in charge of the U. S. survey of the Mississippi delta 1851–53; chief engineer of the Galveston Houston and Henderson Railway 1853–55; planned the present bridge across Galveston West Bay; founded the Texas Military Institute 1855, conducted it until 1861, when, though opposed to secession, he took service in the Confederate army as lieutenant-colonel of engineers; served on the James River, and afterward as chief engineer on the staff of Gen. Magruder; planned the defences of the Texas frontier and the operations for the recapture of Galveston and the Texas coast. Since the war he has been engaged in railway construction in Texas 1865–71, on the improvements at the mouth of the Mississippi, and in the U. S. engineer service on the Red River and in Galveston Bay 1874–75. Prof. Forshey was one of the founders of the New Orleans Academy of Sciences 1853, and was its first vice-president; has contributed largely to the scientific reviews and periodicals of the South-west, is a man of culture and untiring industry, and is esteemed a high authority upon the subjects embraced in his book, *The Physics of the Mississippi River*.

För'ster (ERNST JOACHIM), a German painter and writer on the history of art, b. in Münchengossenstadt Apr. 8, 1800. His early studies were in theology, philosophy, and philology in the universities of Berlin and Jena, but at the age of twenty-three he devoted himself to painting, under the teaching of Cornelius, one of the founders of the school of which Kaulbach was the most distinguished pupil. Förster's hand is seen in frescoes in the Aula at Rome, in the Glyptothek and Arcade at Munich, and in the chapel of San Georgio at Padua, whose frescoes he restored. But his chief labor has been literary. He has written a *History of German Art* (3 vols., 1851), a *History of Italian Art* (1869), *Studies Relating to the History of Modern Art* (1835), *Letters on Painting* (1838), *Monuments of German Architecture, Sculpture, and Painting* (1855), and guide-books to Munich, Italy, and Germany of great merit. He has written besides a life of Jean Paul Richter, and edited several of his works. Förster was the discoverer of several ancient pictures in Italy, notably of the old frescoes of Avanzo in Padua, which he restored. O. B. FROTHINGHAM.

For'ster (CHARLES), b. in Ireland about 1790; educated at Trinity College, Dublin; became rector of Stistead, Essex, in 1838; author of *Mohammedanism Unveiled* (1829), *The Historical Geography of Arabia* (1844), *The One Primeval Language* (1851), *The Israelitish Authorship of the Inscriptions near Sinai* (1856), and other works. His Oriental theories were formerly popular, but have been overthrown by the discovery of the cuneiform inscriptions.

Forster (JOHANN GEORG ADAM), b. near Dantzic Nov. 27, 1754, accompanied his father (Johann Reinhold Forster) around the world in 1772–75; was professor of natural history at Wilna in 1784, and librarian to the elector of Mentz in 1788; envoy to Paris in 1792, and d. there Jan. 11, 1794. Published *History and Description of the Bread-Fruit* (1784), *Views of the Lower Rhine, Brabant, Flanders, etc.* (3 vols., 1791), etc. A collection of his letters was published by his widow (2 vols., 1828). He made a translation of the *Sakuntâlâ* into German, was the tutor of Humboldt, and one of the fathers of modern German literature.

Forster (JOHN), English author, editor, and critic, b. at Newcastle in 1812; was educated for the bar, but devoted himself to literature, contributing to the *London*

Examiner, of which he was editor for ten years; to the *Edinburgh* and *Quarterly Reviews*, the *Foreign Quarterly Review*, of which he was editor, etc. He also edited the *London Daily News* for a year. In 1855 was secretary to the lunacy commission, and in 1861 became a commissioner in lunacy, and retains the office, 1874. His works have been, *Statesmen of the Commonwealth of England* (1831–34), *Life of Oliver Goldsmith* (1848), *Biographical and Historical Essays* (1859), *Arrest of the Five Members by Charles I.*, and *Debate on the Grand Remonstrance* (1860), *Sir John Eliot, a Biography, 1590–1632* (1864), *Walter Savage Landor, a Biography, 1775–1864* (2 vols., 1868), and *Life of Charles Dickens* (vol. i. in 1871; vol. iii. in 1874).

Forster (William), English philanthropist, b. at Tottenham, near London, in 1784; became a minister of the Society of Friends in 1803, married Anna, sister of Thomas Fowell Buxton, in 1816. In 1820 visited the U. S.; in 1838 settled as a preacher near Norwich, England; in 1844–45 labored as such in France; in 1846 travelled in Ireland to relieve the distresses there caused by famine. Commissioned in 1849, by the London Yearly Meeting, to present an address on slavery and the slave-trade to rulers in Christendom, he had interviews with European monarchs, and in 1853 with the President of the U. S. and several Southern State governors. D. on the Holston River, Blount co., Tenn., in 1854.

Forster (Rt. Hon. William Edward), English Liberal statesman and orator, b. at Bradpole, Dorset, July 11, 1818; was educated at Friends' School, Tottenham, and is a worsted manufacturer at Bradford. Was first returned to the House of Commons Feb., 1861, for Bradford, and has been in Parliament since then. Was under-secretary for the colonies in Lord John Russell's administration from Nov., 1865, until July, 1866, and vice-president of the committee of council on education in 1868. Mr. Forster is magistrate and deputy lieutenant for the West Riding of Yorkshire. He had much to do with passing through the House of Commons the Education Bill in 1870 and the Ballot Bill in 1871. Mr. Forster is a son of the philanthropist William Forster, and a son-in-law of the late Dr. Arnold of Rugby. In 1874 he visited the U. S.

Forsyth′, county in the N. of Georgia. Area, 250 square miles. The Chattahoochee bounds it on the E. The surface is broken, the soil fertile, especially in the valleys. Grain is produced, and gold, silver, copper, and precious stones have been found. Cap. Cumming. P. 7983.

Forsyth, county of N. W. Central North Carolina. Area, 250 square miles. The surface is hilly, but fertile. Grain and tobacco are the chief products. The geological formation is granitic. Iron ore is found. Cap. Winston. Pop. 13,050.

Forsyth, post-v., cap. of Monroe co., Ga., on the Central R. R., 25 miles N. W. of Macon. It has a good male school, and is the site of Monroe Female College; has 2 hotels, 3 churches, 2 private banks, a large cotton trade, and a weekly newspaper. Its climate is fine. Pop. of district, 1510. H. H. Cabaniss, Ed. "Monroe Advertiser."

Forsyth, post-v., cap. of Taney co., Mo., 45 miles S. E. of Springfield, on the left bank of White River. It has 3 dry-goods, 1 drug, and 1 grocery store, a steam saw, flouring and grist mill, 2 blacksmith-shops, 1 weekly newspaper, 1 turning-lathe, 1 cabinet-shop, Freemasons', Odd Fellows', Good Templars', and Grangers' lodges, and 1 hotel. Principle business, farming. Pop. 87.

Brown & Depley, Eds. "Pioneer Farmer."

Forsyth (Benjamin) was appointed lieutenant of infantry for North Carolina Apr. 24, 1808, and was captain of riflemen July 1, 1808; commanded in the victorious assault on Gananoque, U. C., Sept. 21, 1812, and in the capture of a British guard at Elizabethtown, U. C., Feb. 7, 1813, for which, in the same month, he was made brevet lieutenant-colonel; May 27, 1813, he was distinguished in the capture of Fort George, U. C., and was killed at Oldtown, N. Y., June 28, 1814, in a fight with the British and Indians.

Forsyth (John), b. at Fredericksburg, Va., Oct. 22, 1780; graduated at Princeton in 1799. His father, a Revolutionary soldier of English birth, removed to South Carolina, and thence to Augusta, Ga. John became a distinguished lawyer; was attorney-general of Georgia in 1808; was in Congress 1813–18 and 1823–27; U. S. Senator 1818–19 and 1829–37; governor of Georgia 1827–29; U. S. minister to Spain 1819–22; U. S. secretary of state 1835–41. D. at Washington, D. C., Oct. 21, 1841.

Forsyth (John), a son of Hon. John Forsyth (1780–1841), well known for many years as editor of the *Mobile* (Ala.) *Register*, was b. at Augusta, Ga., Oct. 30, 1812; took the first honor at Princeton in the graduating class of 1832; was an officer in the Mexican war, in which he served with distinction, and was U. S. minister to Mexico from 1856 to 1858. He was a Douglas elector in Alabama in 1860, and was one of the three Confederate commissioners to visit President Lincoln in Mar., 1861. During the war between the States he was on the staff of Gen. Bragg, and was the author of that officer's address to the people of Kentucky in 1862. He has held many important public positions in Alabama, and is still editor of the *Mobile Register*.

A. H. Stephens.

Forsyth (William), Q. C., English barrister, b. in 1812; educated at Trinity College, Cambridge; graduated in 1834; called to the bar at the Inner Temple in 1839, and became in 1857 queen's counsel, and bencher of the Inner Temple in 1859. Is standing counsel to the secretary of state in council for India, and since 1868 commissary of the University of Cambridge. His work *On the Law of Composition with Creditors* was published in 1841; *Hortensius, or The Duty and Office of an Advocate*, 1849; *On the Law relating to the Custody of Infants*, 1850; *The History of Trial by Jury*, 1852; *Napoleon at St. Helena, and Sir Hudson Lowe*, 1853; *Life of Cicero*, 1864; *Cases and Opinions in Constitutional Law*, 1869; *The Novels and Novelists of the Eighteenth Century, in illustration of the Manners and Morals of the Age*, 1871. He has also contributed to the *Quarterly* and *Edinburgh Reviews*.

Forsy′thia [named in honor of William Forsyth (1737–1804), a Scotch gardener and pomologist], a genus of shrubs of the order Oleaceæ. The *F. viridissima* and *F. suspensa*, small Chinese shrubs, now very common in cultivation, are very hardy, and conspicuous for their yellow flowers in early spring before the leaves.

Fort. See Fortification, by Capt. O. H. Ernst, U. S. Army.

Fort (George Franklin), A. M., M. D., b. at Pemberton, Burlington co., N. J., May, 1809; graduated M. D. at the University of Pennsylvania 1830; became a successful practitioner; was governor of New Jersey 1851–54, and was afterwards a judge of the court of errors and appeals. He held other public positions, and d. at New Egypt, Ocean co., N. J., Apr. 22, 1872.

Fort (Tomlinson), M. D., an eminent physician, statesman, and author, b. in Warren co., Ga., July 11, 1787; d. in Milledgeville May 11, 1859. His father was a soldier in our Revolution. He took his M. D. in 1810 from the University of Pennsylvania, and practised in Milledgeville, where he acquired distinction as a physician and politician. He commanded a company in the Indian campaign in Florida in 1812, and was wounded in the knee. Endowed with genius, industry, and ambition, he soon became a popular man, and was elected to Congress 1827–29. He published a work on the practice of medicine. Few in his day attained greater influence; and none were more sincerely deplored at his death, which occurred after the practice of his profession for nearly half a century. Paul F. Eve.

Fort Ab′ercrombie, post-v. and military post of Richland co., Dak., on the Red River.

Fort Ad′ams, a fortification constructed on Brenton's Point, entrance to Newport harbor, R. I. This work, planned and built 1828–38 by the late Gen. J. G. Totten, subsequently chief engineer U. S. A., is one of the few works of the system of sea-coast defence designed to sustain a regular siege. Its land fronts are elaborately arranged according to the principles of the art as then received.

Fort An′cient, post-v. of Washington tp., Warren co., O., on the Little Miami R. R. Pop. 43.

Fort Ann, post-v. and tp. of Washington co., N. Y., on the Champlain Canal and the Rensselaer and Saratoga R. R. It is mountainous and has several small lakes. The old British Fort Ann was built in 1709, and was captured from the Americans in 1780. Woollen goods and iron are manufactured in this town. Pop. of v. 639; of tp. 3329.

Fort Ar′buckle, post-v. of the Chickasaw Nation, Indian Territory.

Fort At′kinson, post-v. in Washington tp., Winneshiek co., Ia., on the Chicago Milwaukee and St. Louis R. R.

Fort Atkinson, post-v., cap. of Jefferson co., Wis., on the Wisconsin division of the Chicago and North-western R. R., on Rock River, near Lake Koshkonong. It contains a large manufactory of furniture, an extensive wagon-factory, 2 foundries, a large steam flouring-mill, and a steam tannery. It has 1 national bank, 2 weekly newspapers, 5 schools, 5 churches, and 12 stores. Pop. 2010.

W. D. Hoard, Ed. "The Jefferson County Union."

Fort Barran′cas, Fla., a small work located on the N. side of Pensacola Bay, on the bluff overlooking the old

Spanish fort San Carlos de Barrancas, which may be said now to form a part of the work above named, designed, in conjunction with other works, for the defence of Pensacola harbor and the U. S. navy-yard therein located. In 1861 this fort was garrisoned by a small body of artillery under command of Maj. Adam Slemmer. Upon the surrender of the navy-yard (Jan., 1861) by Com. Armstrong of the navy, Maj. Slemmer abandoned this work, and succeeded in transferring his command to the more important work, Fort Pickens, on Santa Rosa Island, opposite. Barrancas, falling into the hands of the Confederates, was held until the evacuation by them of Pensacola in the following year.

Fort Bay'ard, post-v. of Grant co., N. M.

Fort Bend, county of Texas, intersected by the Brazos River. Area, 920 square miles. It contains much fertile but heavy clay prairie and a large area of productive bottom-land, which is well timbered. Cattle, corn, sugar, and cotton are produced. It is traversed by the Buffalo Bayou Brazos and Colorado R. R. Cap. Richmond. Pop. 7114.

Fort Ben'ton, post-v., county-seat of Choteau co., Mont., on the left bank of the Missouri River, at the head of steamboat navigation, 2508 miles above St. Louis and 40 miles below the Great Falls.

Fort Bid'well, post-v. of Modoc co., Cal., 160 miles E. of Yreka.

Fort Branch, post-v. of Gibson co., Ind., on the Evansville and Crawfordsville R. R.

Fort Brid'ger, post-v. and military station of Uintah co., Wy., in a wide plain at the base of the Uintah Mountains, is more than 6000 feet above the sea-level. It is 10 miles S. E. of Carter, a station on the Union Pacific R. R. Lat. 41° 18′ 12″ N., lon. 110° 32′ 38″ W.

Fort Calhoun', tp. and post-v. of Washington co., Neb., on the Missouri River and the Omaha and Northwestern R. R., 21 miles above Omaha. Here stood the old Fort Calhoun, now abandoned. P. of v. 236; of tp. 868.

Fort Car'roll, an unfinished casemated work built upon an artificial foundation in the Patapsco River, about 8 miles below Baltimore, for the defence of the channel of approach to that port.

Fort Cas'well, an enclosed brick work on Oak Island, at the mouth of Cape Fear River, N. C.; commenced 1826. On the secession of North Carolina this work fell into the hands of the Confederates, by whom it was held until the fall of Fort Fisher (Feb., 1865), when it was abandoned and blown up. It has not yet been repaired (1874).

Fort Chis'well, tp. of Wythe co., Va. It contains a part of WYTHEVILLE (which see), the county-seat. P. 4034.

Fort Clark, county-seat of Kinney co., Tex. Pop. 395. (P. O. name, BRACKETTSVILLE.)

Fort Clinch, an unfinished fortification on the N. end of Amelia Island, Fla. It defends the entrance into Cumberland Sound. It was seized by the Confederates in 1861, but abandoned to the Federal forces Mar. 2, 1862. It was the first of the captured U. S. forts to be repossessed by the military of the U. S.

Fort Col'lins, post-v., cap. of Larimer co., Col., on the Cache la Poudre River, 60 miles N. W. of Denver. It has an excellent water-power, 1 grist-mill, and other manufactories in course of construction; 1 newspaper, the only one in the county, and a circulating library. The Colorado Agricultural College is located here, and two parks are already laid out. The town is rapidly building up. Principal business, agriculture.

J. S. MCCLELLAND, ED. "LARIMER CO. EXPRESS."

Fort Columbus. See GOVERNOR'S ISLAND, N. Y.

Fort Col'ville, post-v., county-seat of Stevens co., Wash. Ter., on the E. bank of the Columbia River. It is an old trading-station of the Hudson's Bay Company. Pop. 57 (garrison).

Fort Con'cho, post-v. of Bexar co., Tex.

Fort Constitu'tion, a new enclosed pentagonal casemated work in Portsmouth harbor, N. H., for the defence, in conjunction with other works, of that port and the U. S. navy-yard therein located; commenced in 1863, on the site of an old work of same name.

Fort Cov'ington, tp. and post-v. of Franklin co., N. Y., 15 miles N. W. of Malone, and on the navigable Salmon River, 5 miles from its mouth and 1 mile from the Canada line. The village has 66 business-houses, 3 hotels, 4 churches, a weekly newspaper, and an academy. Dairying and farming are the leading interests. Fort Covington is memorable for the sufferings of the U. S. army at this point in the winter of 1813–14. Pop. 953; of tp. 2436.

W. E. MANSON, PROP. "ST. LAWRENCE VALLEY RECORD."

Fort Craig, post-v. of Socorro co., N. M., 35 miles S. of Socorro and on the Rio Grande.

Fort Cum'mings, post-v. of Grant co., N. M., 50 miles N. N. W. of El Paso.

Fort D. A. Rus'sell, a military station in Laramie co., Wy. Ter., 3 miles from Cheyenne, with which it is connected by a branch of the Union Pacific R. R. There are near by extensive U. S. storehouses. Lat. 41° 8′ N., lon. 104° 45′ W.

Fort Da'vis, post-v. of Presidio co., Tex. Pop. 615.

Fort Del'aware, a casemated fort (built 1835–60) on Pea Patch Island, opposite Delaware City, for the defence of Delaware River and the port of Philadelphia against maritime attack. It is situated in Red Lion hundred, New Castle co., Del. During the civil war it was a place for the confinement of Confederate prisoners.

Fort Dodge, a city, cap. of Webster co., Ia., on the Des Moines River, at the junction of the Dubuque and Sioux City and the Des Moines R. Rs. It has 7 churches, 1 large graded school, 1 Catholic seminary, 2 weekly and 1 monthly newspaper, 2 national, 1 savings, and 1 private bank, a foundry, a furniture-factory, 1 steam and 1 water-power grist-mill, 1 plaster and stucco mill, several hotels, fine quarries of building-stone, large deposits of gypsum, coal, fire-clay, and water-lime, 1 blind-factory, and 1 general repair-shop with steam-power. Pop. 3095.

S. R. TRAIN, ED. "FORT DODGE TIMES."

Fort Dodge, tp. and military post of Ford co., Kan. The tp. includes Dodge City, the county-seat, on the Atchison Topeka and Santa Fé R. R., 352 miles W. S. W. of Atchison. Pop. 427.

Fort Dun'can, a military post at Eagle Pass on the Rio Grande, in Maverick co., Tex. Pop. 294.

Fort Duquesne. See PITTSBURG.

For'te [It.], in music, loud, strong. It is generally marked *f*. *Mezzo forte* is a medium degree of loudness, marked *mf*. *Fortissimo* is the superlative, *very* loud, marked *ff*, or sometimes *fff*.

Fort Ed'ward, tp. and post-v. of Washington co., N. Y., on the E. bank of the Hudson River, and on the Rensselaer and Saratoga R. R. at the junction of the Glen's Falls branch, 28 miles N. of Troy, on the Champlain Canal. A dam 900 feet long and 27 feet high crosses the Hudson, and affords great water-power. The village is finely situated, has a seminary and collegiate institute, 2 national and 1 State bank, 2 weekly newspapers, and extensive manufactures of iron, lumber, castings, machinery, stoneware, and other kinds of goods. Fort Edward has some remnants of the old fort of this name. The first fortification here was built in 1709; another and larger one in 1755, called Fort Lyman, but the present name was soon substituted in honor of Edward, duke of York. It was a point of importance during the old French and Indian wars, and was occupied during the Revolution by British and Americans in turn. Pop. of v. 3492; of tp. 5125.

Fort El'lis, a military post in Gallatin co., Mon., on the E. bank of Mill Creek, 3 miles above Bozeman. It is beautifully situated in a pleasant and fertile region, abounding in good lignitic coal.

Fort E'rie, post-v. of Bertie tp., Welland co., Ontario, Canada, on Lake Erie, at the head of the Niagara River, opposite Buffalo, N. Y., with which it is connected by a railroad bridge. It is on the Great Western Railway. Pop. about 1000.

For'tescue (CHICHESTER SAMUEL PARKINSON), English statesman, b. in 1823; graduated B. A. at Christ Church, Oxford University, in 1844; took the chancellor's prize for the English essay in 1846; has been a Liberal member of Parliament for the county of Lowth from 1847; was a lord of the treasury 1854–55; under-secretary of state for the colonies 1857–58 and 1859–65. Was made chief secretary for Ireland Nov. 20, 1865, and again in Dec., 1868, having been sworn a privy councillor in 1864. In Dec., 1868, was a member of Mr. Gladstone's cabinet, and Jan., 1871, president of the board of trade.

Fortescue (Rt. Hon. HUGH), EARL, English statesman and author, b. Apr. 4, 1818; educated at Harrow; entered Parliament in 1841; in Dec., 1854, was chosen for Marylebone; resigned and was called to the upper House for his father's barony of Fortescue Dec. 5, 1859, succeeding as third earl Sept. 14, 1861. In 1846–47 was a lord of the treasury, secretary of the poor law board 1847–51, besides being chairman of several successive metropolitan commissions of sewers. Retired from Parliament after 1858 in consequence of ophthalmia, contracted in visiting a hospital with a view to his successful parliamentary motion for sanitary reform, having lost one eye and having suffered in the other. He has written *The Health of Towns*

(1844), *Official Salaries* (1852), *Representative Self-Government for the Metropolis* (1854), *Parliamentary Reform* (1859), *Public Schools for the Middle Classes* (1864).

Fortescue (Sir John), English chief-justice of the king's bench, b. probably about 1395, became serjeant-at-law 1429; one of the king's serjeants in Easter, 1441; chief-justice Jan. 25, 1442, to Easter, 1460; escaped with Henry VI. into Scotland at the end of Mar., 1461; was attainted of high treason 1463; escaped with Queen Margaret to the Continent; was pardoned by Edward IV. Oct., 1473, and was living in Feb., 1476. Wrote *On the Praises of British Laws*, in Latin, between 1461 and 1470.

Fort Fair'field, post-v. and tp. of Aroostook co., Me., on the New Brunswick line. It has 3 churches, and manufactures of lumber, carriages, etc. A fort was built here during the so-called "Aroostook war" (1839). Pop. 1893.

Fort Fet'terman, a military station and post-v. of Albany co., Wy., on the S. bank of the North Platte, at the mouth of La Poele Creek. Lat. 42° 49′ 8″ N., lon. 105° 27′ 3″ W.

Fort Fish'er. In the spring of 1865 the only important seaport remaining open to the Confederates was that of Wilmington, N. C., which, from the peculiarities of the harbor, could only be effectually closed by the capture of its strong defensive earthwork, Fort Fisher, situated upon the peninsula between Cape Fear River and the Atlantic Ocean, about 1½ miles N. E. of Federal Point. The work presented two fronts: the first, or land-front, running across the peninsula, at this point 700 yards wide, was 480 yards in length; while the second, or sea-front, ran from the right of the first, parallel to the beach, to the Mound Battery, a distance of 1300 yards. The land-front was intended to resist any attack from the N., the sea-front to prevent an enemy's vessels from running through New Inlet or landing troops on Federal Point. For 5 miles N. of Federal Point this peninsula is sandy and low, not rising more than 15 feet above high tide, the interior abounding in fresh-water swamps, often wooded and almost impassable, while much of the dry land to within half a mile of the fort is covered with a low undergrowth, except a strip about 300 yards wide along the sea-shore. To secure possession of this fort a formidable fleet was collected in Hampton Roads, from which point it started Dec. 13, 1864, arriving off Federal Point on the evening of the 15th, but, owing to storms and other causes, it was not until the 23d that everything was in readiness. The troops forming the land-force of the expedition were from Gen. Butler's command, who accompanied them, and indeed took command of them, though Gen. Grant had intended Gen. Weitzel to control their operations. Among the preparations made by Gen. Butler, and from the effects of which great results were anticipated by him, was the filling of a vessel with powder (215 tons), to be exploded as near the fort as it could be brought. At 1¾ A. M. (Dec. 24) the boat having been towed to within 200 yards of the shore, and 1000 yards from the nearest point of the fort, the whole mass of powder was instantaneously ignited, but the effect was unimportant. At 11½ A. M. the fleet opened fire upon the fort, silencing its guns in an hour and a quarter. At 7 A. M. (25th) the bombardment was renewed, under cover of which a portion of the troops were disembarked, and a reconnaissance pushed to within 150 yards of the fort. Gens. Butler and Weitzel both agreeing that an assault with their force was impracticable, the troops were thereupon re-embarked, and returned to the James River. The fleet, however, remaining off Fort Fisher, Gen. Grant determined to renew the attempt. Accordingly, Jan. 2–3, 1865, a force of 8000 men was collected at Bermuda Hundred, to the command of which Gen. A. H. Terry was assigned. Embarking on the 4th and 5th, the transports rendezvoused off Beaufort, N. C., on the 8th, where they were detained until the 12th, arriving off Federal Point that night. At 8 A. M. (13th) the disembarkation was commenced under cover of the fire of the fleet, and completed by 3 P. M., pickets in the mean time having been thrown out, encountering the outposts of the enemy. Gen. Terry's first object after landing was to throw a strong defensive line across the peninsula above the fort, to guard against an attack from the rear. A favorable position was finally discovered about 2 miles from the work, and occupied by 2 A. M. of the 14th; by 8 o'clock a good breastwork was constructed from the river to the sea. The fire from the fleet, which had been maintained during the night of the 13th, was continued throughout that of the 14th. On the afternoon of the 14th, Curtis's brigade was pushed to within 500 yards of the fort, and a careful reconnaissance made, disclosing the fact that the front of the work had been seriously injured by the naval fire; whereupon an assault was determined upon for the next day. By daylight of the 15th the artillery was safely landed and placed in position. The plan of attack was for the army to assault the W. end of the land-face, while a column of sailors and marines should assault the N. E. bastion. At 8 A. M. all the vessels, except a division, opened their fire, which continued till 3.25 P. M., when the signal was given to change the direction of their fire to the upper batteries, and the attack was commenced by the sailors on one side and the soldiers on the other. The former, numbering 2000 sailors and marines, under Capt. K. R. Breese, advanced gallantly up the beach to the attack, but were exposed to so severe a fire that, after heavy loss, they were withdrawn. In the mean time, Curtis's brigade, leading the assault on the land-face, had passed through the palisades and effected a lodgment on the parapet. Gen. Ames, commanding the assaulting division, now ordering Pennypacker's brigade up to support the advance, his line overlapped Curtis's right, and the enemy were driven from the palisading which extended from the land-face to the river; then, pushing to the left, the two brigades drove the enemy from about one-quarter of the land-face. Bell's brigade was now moved up between the work and the river, where, though there was no regular parapet, abundant cover was afforded by excavations, ruins, etc., and by the huge traverses, from behind which latter the enemy stubbornly contested the advance, using them as breastworks; nine of these were successively carried by hand-to-hand fighting of the most desperate character; Terry in the mean time ordering Abbott's brigade into the work. The fighting for these traverses was continued till 9 P. M., when, two more of them being carried, a portion of Abbott's brigade drove the enemy from their last remaining stronghold, and the occupation of the work was completed. The enemy were pursued to Battery Buchanan, which was also captured, with its garrison, among them Gen. Whiting, the Confederate commander. Terry took 2083 prisoners, 169 pieces of heavy artillery, and many small-arms. The Union loss was, in killed, 110, wounded, 536. During the night of the 16th and 17th the enemy abandoned and blew up Fort Caswell and all their extensive works at Smithville and Reeves's Point, thus abandoning control of the mouth of Cape Fear River.

Fort Foote, Potomac River, Md., an enclosed barbette work with exterior batteries, forms the inner line of defence of the channel of approach by water to Alexandria and Washington. This work was constructed during the civil war for the purpose of defending, in connection with Battery Rodgers at Alexandria, the water-approach to the city. It is situated 6 miles below Washington, on a commanding bluff of the Maryland shore, 100 feet above the river.

Fort Fred Steele, a military post and post-v. of Carbon co., Wy., on the Union Pacific R. R. Elevation, 6840 feet. Here the railroad crosses the North Platte by a substantial bridge.

Fort Gaines, post-v., county-seat of Clay co., Ga., on the navigable Chattahoochee River and on a branch of the Central R. R. of Georgia. It has a commanding position, and a good trade in cotton. There are numerous ancient artificial mounds in the vicinity. Pop. 758.

Fort Gaines, an enclosed pentagonal work for defence of the sea-entrance to Mobile Bay, on the E. end of Dauphin Island, Mobile Bay, Ala.; commenced 1848 on the site of old Fort Tombigbee.

Fort Gar'land, a military post, post-v., and one of the principal towns of Costilla co., Col., on the Rio Grande, 90 miles S. W. of Pueblo.

Fort Gar'ry, the cap. of Manitoba and the N. W. provinces of Canada, is situated on the W. bank of the Red River of the North (in Manitoba), just below the mouth of the Assiniboin, 1110 miles W. N. W. of Toronto and 480 miles from Duluth. At the lower or stone Fort Garry the Canadian Pacific R. R. will cross the Red River. Fort Garry is the seat of the Anglican bishop of Rupert's Land. Elevation above sea-level, 640 feet.

Fort George, a fortification in Inverness-shire, Scotland, on a spit of land jutting out unto the Frith of Moray, was built in 1746 to keep the Highlanders in subjection.

Fort George (near Lake George). See Fort William Henry.

Fort Gib'son, post-v. and military post of the Cherokee Nation, Indian Territory, on the Neosho River, near its junction with the Arkansas, near the Missouri Kansas and Texas R. R., 166 miles N. N. E. of Denison, Tex.

Fort Gor'ges, an enclosed irregular hexagon casemated work, with exterior demilune, on Hog Island Ledge, Portland harbor, Me.; commenced in 1857.

Fort Gra'tiot, tp., post-v., and military post of St. Clair co., Mich., at the outlet of Lake Huron, opposite Point Edward, Ontario, Canada. Pop. of tp. 1032.

Fort Grif'fin, post-v. of Shackelford co., Tex. P. 297.

Fort Gris'wold, an open barbette battery on Groton Hill, E. bank of the Thames River, opposite New London, Conn. In 1781 the traitor Arnold conducted an expedition into Connecticut, burning the town of New London and massacring the garrison of this fort. A commemorative monument has been erected near the site.

Forth, a river of Scotland, rises from two different branches, the Avendhu and the Duchray, which unite at Aberfoyle. It then passes, with many windings and sinuosities, through the most picturesque and romantic part of Scotland, by Stirling, and a little above Alloa it empties itself into the arm of the North Sea called the Frith of Forth. It is navigable for vessels of 100 tons to Stirling, and to Alloa for vessels of 300 tons. It communicates with the Clyde through a canal 38 miles long.

Fort Hal'leck, a military post of Elko co., Nev., near the Humboldt River and the Central Pacific R. R.

Fort Halleck, post-v. and military post of Carbon co., Wy.

Fort Ham'ilton, post-v. and fort on the E. shore of the Narrows, the principal entrance to New York harbor, and, in conjunction with Fort Lafayette and the works on the opposite shore (Staten Island), intended to defend that entrance. It is in New Utrecht, Kings co., Long Island, N. Y.

Fort Har'ker, tp., post-v., and military post of Ellsworth co., Kan., on the Kansas Pacific R. R., 180 miles W. of Lawrence. Pop. 293.

Fort Hays, tp. and military post of Ellis co., Kan. Pop. 320. The situation is beautiful and commanding. It is on Big Creek, opposite Hays City, on the Kansas Pacific R. R., 250 miles W. of Lawrence.

Fort Hen'ry, a v. of Granville tp., Mercer co., O. Pop. 153.

Fort Hen'ry and **Fort Don'elson,** two Confederate works, the former on the right bank of the Tennessee River, the latter on the left bank of the Cumberland River, about 40 miles from where these rivers empty into the Ohio, distant from each other about 12 miles, and connected by a direct road. A combined land and naval attack for the reduction of these works having been determined upon, the naval force was entrusted to Com. A. H. Foote, and the land force, numbering about 15,000, assigned to Brig.-Gen. U. S. Grant. On Feb. 2, 1862, the naval fleet left Cairo, followed by the troops in transports, arriving next morning off Fort Henry, where it had been resolved to make the first attempt. This fort was defended by 17 guns and about 3000 men, under the command of Brig.-Gen. Tilghman. After landing the troops and making reconnoissances, the morning of Feb. 6 was settled upon for the combined attack; which was accordingly commenced at noon by the navy, the army having started an hour earlier with the expectation of cutting off the retreat should the fire of the navy compel the enemy to abandon the position; but Com. Foote attacked with such vigor as to compel the surrender of the work in but little more than one hour, while the army, being delayed by the condition of the roads, did not arrive till some time later; the Confederate garrison meanwhile escaping to Fort Donelson, with the exception of about 60 or 70 men, besides Gen. Tilghman and his staff, who surrendered with the work. After waiting a sufficient time to repair the damage sustained by the gunboats, Gen. Grant on the 12th moved with his army toward Fort Donelson, arriving before that work the same afternoon. In the mean time the garrison at Fort Donelson, consisting mainly of those who had escaped from Fort Henry, had been reinforced on the 9th by the command of Gen. Pillow, and on the 12th by that of Gen. Buckner from Bowling Green, and on the following day by the brigade of Gen. J. B. Floyd, who, being the senior officer, assumed command. This work, while it commanded well the river-front, was unprotected against an attack in the rear or land-front, the site being commanded by high ground, which was, however, secured and fortified before the arrival of the Union forces. Gen. Grant at once proceeded to invest the Confederate lines, and early on the morning of the 13th opened a vigorous cannonade, followed in the afternoon by an assault, which was, however, repulsed with considerable loss. On the 14th reinforcements to the number of 10,000 reached Grant, together with the fleet of Com. Foote, and a combined attack was determined upon. Being unable to get the new troops in position, the fleet opened the attack alone in the afternoon, but after an hour and a half, during which time every gunboat was disabled and 54 men killed and wounded, the fleet was compelled to retire. Gen. Grant now proceeded to complete his line of investment and await the reinforcement of his army. The Confederate commanders, however, realizing their danger, had agreed upon a vigorous attack, by which it was hoped to secure an avenue of retreat to Nashville; which, intended as a surprise, was commenced at 5 A. M. on the 15th, but was met by a fire from the Federal force, and a battle ensued with varying success until about 3 P. M., when a final advance was ordered by Gen. Grant along the whole line, which drove the Confederates back to their own lines, while on the left a position was gained within the Confederate works. The loss on each side during this day's conflict was, in killed and wounded, about 2000. Gen. Grant now made his preparations for a general attack the next morning; which, however, was not executed, for during the night the Confederate commanders, finding the Union line of investment completely restored, had determined upon a surrender. Pillow refused to consent to a capitulation, while Floyd acknowledged that "personal reasons" prevented him from acceding to such a decision, thus devolving the surrender upon Buckner. During the night Floyd managed to escape by steamers with some 1500 of his own command, as did Pillow and his staff, also Gen. Forrest with 300 or 400 men, by the river-road. At dawn of the 16th, Buckner addressed a communication to Gen. Grant, asking the appointment of commissioners to settle upon terms of capitulation and an armistice until noon; to which Grant sent his famous reply: "No terms other than unconditional surrender can be accepted. I propose to move immediately upon your works." Buckner, having no alternative, accepted these terms. About 10,000 prisoners, 48 guns, and large quantities of ammunition and supplies fell into Grant's hands.

Fort How'ard, city of Brown co., Wis., on the Chicago and North-western R. R. and on the W. side of Fox River, near its mouth, opposite the city of Green Bay. It has a national bank, 2 newspapers, 3 machine-shops and foundries, a large elevator, 6 churches, 3 railroads, 12 hotels, 2 boiler-shops, many large business-houses, 2 parks, a fine harbor, numerous lumber manufactories, and an extensive trade. More than 40 lumber and shingle mills market their products here to the annual amount of 79,000,000 feet of lumber, besides over 200,000,000 shingles and 6,000,000 staves. Pop. 2462. C. J. Pratt, Ed. "Herald."

Fort Hun'ter, post-v. of Florida tp., Montgomery co., N. Y., on the Mohawk, E. of the mouth of Schoharie Creek. It is on the site of an old Indian fortification. A British fort was built here in 1711. Pop. 200.

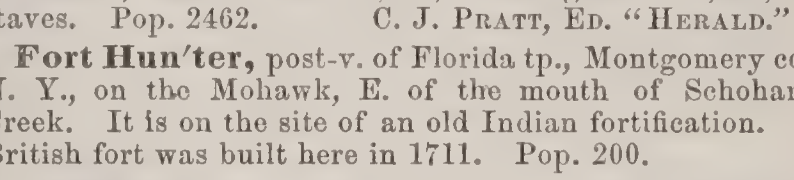
Fortifica'tion. Fortification, or the art of rendering a military position defensible against the attacks of superior numbers, is usually divided into two branches—permanent fortification and field or temporary fortification. Permanent fortifications are constructed to defend a position of permanent importance, and are made of durable materials. Field fortifications are intended to serve a temporary purpose, and the materials employed are those found most ready at hand. The principles of the art are essentially the same in both. Permanent fortifications being the more elaborate, it will be convenient, in a brief exposition of the subject, to consider that branch first. It will be necessary to assume that the reader is acquainted with the elementary terms employed.

I. Permanent Fortification.

General Definitions.—A modern fortress usually consists of an enclosure of earth and masonry, called the enceinte, or body of the place, secured by a citadel within, and strengthened by works on the exterior, called outworks.

The mass of earth employed to cover the bodies of the defenders while in action from the enemy's projectiles is called the parapet. It is raised upon another mass of earth called the rampart, R (Fig. 1).

Fig. 1.



Outside the rampart is the ditch, D, which is made deep and wide enough to offer a serious obstacle to the enemy; and beyond the ditch the covered way, C, and the glacis, G.

If the plan, or trace, of the enceinte should have the form of a simple polygon with only salient angles, the ditch would not be under the fire of the work, and an enemy having reached it would there find shelter. The arrangements by which the exterior slope and bottom of the ditch are brought under fire are called flanking arrangements. In general terms, they consist in arranging the sides of the polygon so as to make both re-entrant and salient angles. In small works, having only salients, galleries are sometimes built behind the counterscarp, having a fire upon the ditch. When the flanking arrangements

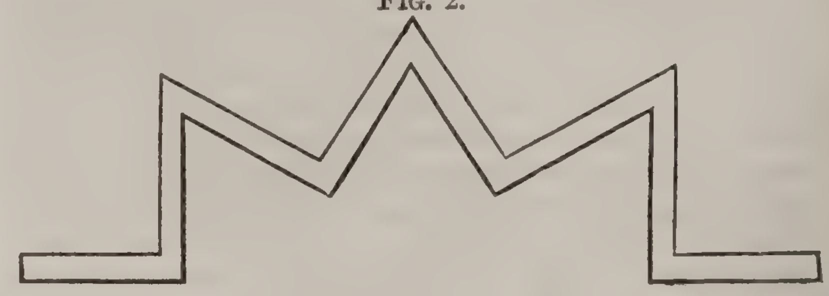
are imperfect, the space left unexposed to the fire of the work is called a dead space.

Systems of Fortification.—The main points to be attained in any fortification are—1st, to offer an obstacle to the advance of the enemy to a hand-to-hand conflict; 2d, to cover the defenders from his projectiles; and 3d, to thoroughly sweep with its fire all the ground within range on the exterior, including its own ditches. It is estimated that over 500 different methods of securing the above ends have been proposed. There are three principal systems, however, which these methods approach more or less closely, and which will alone be noticed. These are the tenailled (Fig. 2), the bastioned (Fig. 3), and the polygonal systems (Fig. 4). The figures represent the systems on a perfectly horizontal site, where there is nothing to cause irregularity. To avoid unnecessarily complicating the figures, only the magistrals, interior crests, rear lines of terrepleins, and foot of rampart slopes are shown. The heavy black lines are the interior crests; the stippled portions are the bottoms of the ditches. In Fig. 2 only the magistral and interior crest of the enceinte are shown.

It will be observed that the lines are straight in all of them. To make them curved would either scatter their fire or concentrate it upon a single point, since the direction of the line of fire is always assumed to be perpendicular to the interior crest, this being the most natural direction for the soldier to fire in, and the one which he will always employ at night. Moreover, if the lines were curved, it would not be possible to flank them, since the path of the projectile is a straight line.

Before describing these systems it should be noticed that the mere enclosing a given space by a rampart of the usual height will not necessarily of itself afford the required cover to the defenders. If the direction given to the lines is such that the enemy can place himself upon the prolongation of them, he can land his projectiles at one end of the terreplein and sweep it to the other; fire striking a line in such a direction is called enfilade fire. Should the enemy be able to take up a position from which he can fire over one portion of the enclosure, and strike in rear the parapet beyond, the latter is said to be exposed to reverse fire. Lines placed so as to be exposed to enfilade or reverse fires are faulty; and though it is not always possible to avoid so placing them, on account of the necessity of giving their fire a suitable direction, it is evident, in comparing the different systems, that the one which will least often require this fault will, so far, be the best.

Fig. 2.



The tenailled trace is shown in Fig. 2. This trace is simple, adapts itself well to irregular ground, and provides a cross-fire upon the approaches. At first glance it seems to be well flanked, but that is not the case. The greatest angle of depression at which artillery is fired is about 1 upon 6. Supposing the height of the gun to be 40 feet above the bottom of the ditch, it cannot strike this bottom at a distance less than 240 feet. Hence, there is a considerable dead space at each of the re-entrant angles. For the same length of parapet this trace encloses less space than either of the other traces. The great number and the sharpness of its salients render its faces peculiarly liable to enfilade and reverse fires.

Fig. 3.

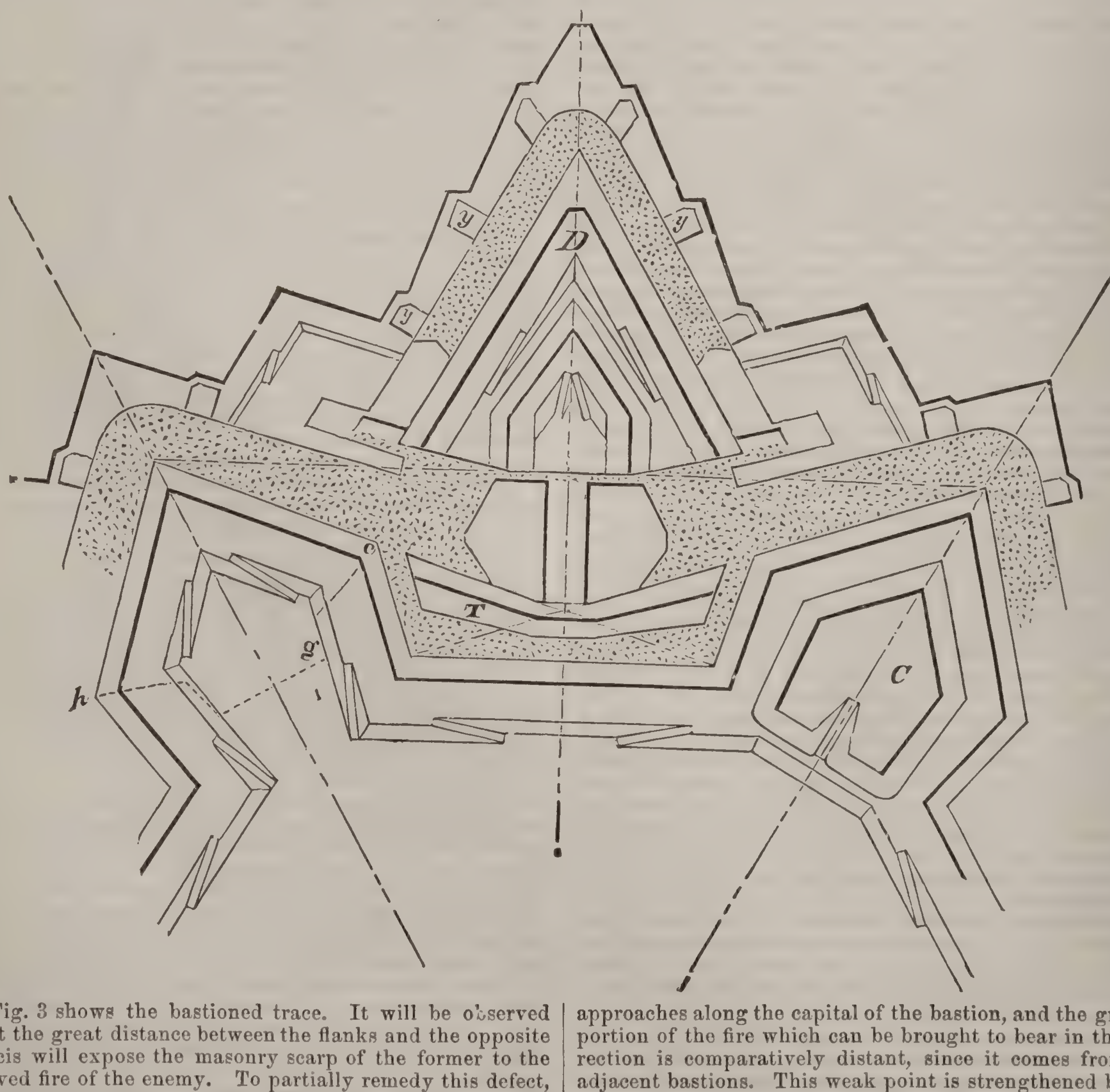
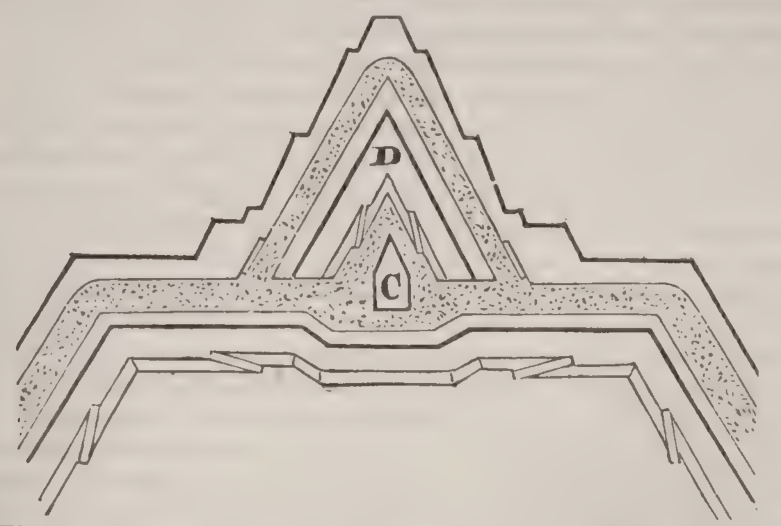


Fig. 3 shows the bastioned trace. It will be observed that the great distance between the flanks and the opposite glacis will expose the masonry scarp of the former to the curved fire of the enemy. To partially remedy this defect, and to cover the masonry of the curtain, the tenaille, T, was introduced. It is a low outwork, so constructed as not to interfere with the fire of the flanks upon the ditch in front of the bastion faces, and is armed with musketry. It creates, however, a considerable dead space.

In the attack of this enceinte the enemy would make his approaches along the capital of the bastion, and the greater portion of the fire which can be brought to bear in this direction is comparatively distant, since it comes from the adjacent bastions. This weak point is strengthened by the construction of the demilune, D. Two adjacent demilunes throw the bastion between them into a strong re-entrant, and add enormously to the strength of the front. The demilune serves also to mask the shoulder angles of the bastion and to cover the communications under the curtain.

In the employment of the bastioned system it would be very difficult to so place all of the lines that they will not be exposed to enfilade and reverse fires. The connection between its parts is so rigid that it adapts itself badly to irregular sites, and in very rough sites it is entirely inapplicable. The flanks being situated at a considerable distance from the faces to be flanked, a portion of the range of their guns is lost. The height of the parapet is limited by its length of front.

Fig. 4.



The polygonal trace is shown in Fig. 4. Its flanking arrangements are obtained by constructing a low casemated work, C, called a caponnière, either at the salient or at the middle of the face. To more perfectly secure the caponnière, a demilune, D, is constructed in front of it; this outwork serves also to cover the communications with the exterior, and to give a cross-fire upon the approaches.

In this system the faces are but little exposed to enfilade or reverse fires, since the enemy in placing himself upon the prolongation of one of them, will place himself within short range of the adjacent ones; and it is easy to cover these prolongations by adjacent outworks. For the same length of parapet more ground is enclosed than in either of the other systems. The length of a front—or, what amounts to the same thing, of the lines of defence—may be greater than in the bastioned, since the full range of the flanking guns is made available. This system adapts itself better to irregular sites.

Each of these systems has had its partisans. During the present century the contest between those of the bastioned and those of the polygonal has been especially sharp, and has resulted in the adoption, *theoretically*, of the polygonal system by all great nations except the French. Fortifications must, however, adapt themselves to the irregularities of the ground; and this fact is opposed to the universal employment of any fixed system. Enlightened engineers of all nations are therefore in the habit of using either or all of these systems combined, according to circumstances.

Principles of Fortification.—The more important fundamental principles in all systems are—

1st. They must have good flanking arrangements.

2d. The lines of defence must be as long as possible, supposing the dimensions of the fortress to permit it, in order to avoid short fronts and a multitude of flanks. Their length is limited by the range of the weapons used for flanking; and these weapons must be such as will throw a large number of projectiles heavy enough to disable men. Rifled artillery is not suitable; musketry and howitzers are generally used. The former may be replaced by the Gatling gun or the mitrailleuse, the effective range of which, for this purpose, is 800 yards; the howitzer must be retained for the purpose of occasionally throwing shells to destroy any temporary cover the enemy may erect.

3d. The enceinte must have a considerable command over the surrounding country and over the outworks. The height of the interior crest is limited by the necessity of thoroughly sweeping the ground on the exterior, and of covering the masonry from the direct fire of the enemy. It is rarely more than 25 or 30 feet above the natural surface of the ground.

4th. Masonry is not to be exposed to the direct fire of the enemy. This principle has applied until recently only to land defences. In sea-coast fortification it is frequently necessary to concentrate a large number of guns upon a confined space, and they are placed in tiers of casemates, one over the other. These works being subject only to fire from ships, the masonry was exposed with comparative impunity, since this fire is so unsteady as not readily to strike the same spot many times in succession. But a single shot from the powerful artillery of late years will do as much execution as a series of the old ones. Hence, it becomes necessary to greatly increase the thickness of the masonry masses where exposed, and to substitute iron for masonry about the guns. (See *Prof. Papers Corps of Engineers*, No. 21.) In some few cases, as at Spithead and Plymouth breakwater (England), the external walls are wholly of iron. In Europe, and especially England, casemates with iron fronts, or "shields," have within the last decade been extensively constructed. (See SHIELDS.) Works bearing iron revolving turrets, besides casemates or barbette gun emplacements, have been designed, and in one case at least such a work, bearing six turrets for two guns each, and with intermediate shields for two guns in each interval, has actually been constructed.

5th. The nearer the general direction of the fronts fortified shall be to a straight line the better, since thus a large amount of fire can be concentrated upon the approaches.

6th. The arrangement of the works must be such that, as far as possible, the prolongations of the parapets shall not be attainable by the enemy, and the terrepleins be covered against vertical fire. The first is secured by a proper placing of the lines, and the second by casemates and bombproofs.

7th. The outworks must be so arranged that their capture must necessarily be successive, thus introducing the element of time into the defence. If two outworks can be attacked simultaneously, their capture may require more material, but not more time, than if there were only one.

8th. All parts of a fortification should be equally strong. Hence, if one part is the stronger by nature, the others will demand more from art. This sometimes leads to the multiplication of works upon one or more of the fronts.

Accessory Defences.—The advance of an enemy is very seriously retarded by a judicious use of counter-mines. (See MILITARY MINING.) In addition to the works exterior to the enceinte, works are sometimes constructed within it, the object of which is either to defend the breach when made, or to get greater command over the approaches and bring a plunging fire to bear upon them. In the former case they are called interior retrenchments; in the latter, cavaliers. Interior retrenchments are generally arranged so as to isolate the salients, which are the parts usually breached, from the body of the work; they are provided with a ditch with revetted scarp and counterscarp, and are thoroughly flanked. The heavy dotted lines e, g, h, on the left of Fig. 3, show the direction sometimes given to the magistral of an interior retrenchment. Cavaliers may be placed anywhere on the perimeter of the enceinte; in plan they are generally drawn parallel to the magistral of the enceinte, C (Fig. 3).

When the face of a work is exposed to enfilade fire, the destructive effects of the latter may be much diminished by raising masses of earth at intervals along the terreplein. These masses are called traverses, y, y, y (Fig. 3); they extend across the terreplein in a direction nearly perpendicular to the interior crest, a narrow passage-way being left at one end for communication. When a parapet is exposed to reverse fire, a mass of earth is thrown up behind it and its defenders; this mass is called a parados. Both the parados and traverse may be utilized for the purpose of bombproofs and magazines.

It is of great importance to remove all obstacles which could afford cover to the enemy anywhere within range of the guns. Forests and buildings are cleared away, and inequalities of the ground graded off.

Economy of Fortification.—In determining upon the amount of money that can be assigned to the construction of fortifications, the latter should be regarded as so much insurance, and insurance not only against pecuniary loss, but also against national dishonor. Their extent at any given point must therefore depend upon the importance of the point and the risk of its capture. Among a warlike people the risk of capture will be less when the population is dense and reinforcements in material and men can readily be procured. Hence, an isolated point, with but a sparse population in its vicinity, will require the maximum percentage of its value for fortification, supposing always that the facilities for attack are the same, and that the site offers no great natural advantages to the defence. The points of greatest value with a nation having powerful neighbors are the great strategic pivots, the occupation of which by an enemy would endanger the life of the nation; such are, in Europe, the capital and great commercial centres. A very small percentage of their value will give very large sums for their defence, and European nations expend these sums without hesitation.

The size of the works is not always an indication of their strength, nor is their cost always proportionate to the value of the point defended, though their strength must be. Everything varies with the locality.

Permanent Fortifications in the U. S.—The frontiers which are exposed to attack being principally maritime, the fortifications of the U. S. consist almost entirely of batteries of heavy guns adapted to a contest with ships. To secure these batteries from a land attack, they are enclosed in rear

by a land-front, traced according to the principles above laid down, and made strong enough to hold an enemy in check until reinforcements can arrive. These land-fronts are seldom designed* to resist a regular siege for a great length of time, it being assumed that our vast resources in men and material, and our system of railroad and water communication, will enable us to bring a superior force to meet an enemy at any point, provided time is allowed us to assemble them; it is to gain this time that the land-fronts are constructed.

The essential feature of these works is the sea-front. Where space is available the guns are spread out in a single tier, and are generally arranged to fire over a parapet, or *en barbette*, as it is called. There is a battery of 15-inch guns, occupying both sides of a headland at the mouth of one of our harbors, said to be a mile long. The guns are usually placed in pairs, each pair being separated from the adjoining one by a high and thick earthen traverse, in which is a magazine or bombproof. In positions greatly exposed to enfilade sometimes there is a traverse for every gun.

Where the space is contracted it has been usual to mount guns in masonry casemates built tier over tier. Some of our works, built prior to 1860, have three tiers of casemates, and a barbette battery on top. This method of building was recognized throughout the world, and was the one generally adopted by us, up to the date of recent developments in the construction of guns and ships, by which the calibre, range, and power of the first were immensely increased, and almost impenetrable iron-clad vessels superseded wooden ones. The method is now discarded, and the question with us of adapting casemates to our sea-coast batteries has not come to a practical solution.

The majority of our present fortifications belong to what is known as the third system, the first comprising those built after the breaking out of the French Revolution in 1789, and the second those built just before the war of 1812. The works of the first and second systems were small and weak. The third alone was systematically planned after a comprehensive study of the coast and northern frontier; a board of engineer and naval officers was convened for the purpose, of which the celebrated French engineer Gen. S. Bernard and the late Gen. J. G. Totten were prominent members. It was commenced in 1816, and notwithstanding the vast extent of the coast it is now in a very fair state of defence. This third system, founded upon broad general principles which are perennial, is now in a measure behind the demands of the times as regards methods of construction. A new one has not been definitely fixed upon, but may be said to await further developments, while in recent constructions we have confined ourselves to earthen batteries for barbette guns. It is true that the enormous guns of the present day are greatly exposed when thus mounted, and need some means of protecting their gunners not demanded by the light guns formerly in use. One of the simplest means is a "counterpoise" or depressing carriage, by which the gun may be brought down behind the parapet for loading. Such carriages have been designed by (to mention two prominent names) Capt. Moncrieff in England, and Major King, corps of engineers, in this country. The carriage of the latter has been successfully subjected to prolonged experimental tests, and it is expected that this or an equivalent will soon be introduced into our new batteries, all of which are designed to receive them.

The scheme of defence, of which fortifications constitute one element, comprises a navy, fortifications, interior communications by land and water, and a regular army and well-organized militia. In the language of Gen. Jos. G. Totten, for many years chief of the engineer corps of the U. S. army, "The navy must be provided with suitable establishments for construction and repair, stations, harbors of rendezvous, and ports of refuge. All these must be covered by fortifications having garrisons of regular troops and militia, and be supplied with men and materials through the lines of interior communication. Not being required to remain in the harbor for their defence, the navy, pre-eminent as an offensive arm, will be prepared to transfer the war to distant oceans and to the shores of the enemy, and to act the great part which its early achievements have foretold, and to which its high destiny will lead.

"Fortifications should—1st, close all important harbors against an enemy, and secure them to our military and commercial marine; 2d, should deprive an enemy of all strong positions where, protected by naval superiority, he might maintain himself during the war, keeping the whole frontier in constant alarm; 3d, must cover the great naval establishments from attack; 4th, must protect the great cities; 5th, must prevent, as far as possible, the great avenues of interior navigation from being blockaded at their entrance to the ocean; 6th, must cover the coastwise and interior navigation, by closing the harbors and the several inlets which intersect the lines of interior communication, thereby further aiding the navy in protecting the navigation of the country; and 7th, must shelter the smaller towns along the coast, and also all their commercial and manufacturing establishments which are of a nature to invite the enterprise or cupidity of an enemy.

"Interior communications will conduct, with certainty, the necessary supplies of all sorts to the stations, harbors of rendezvous and refuge, and the establishments of construction and repair for the use both of the fortifications and of the navy; will greatly facilitate and expedite the concentration of military force, and the transfer of troops from one point to another; will ensure to these troops supplies of every description; and will preserve, unimpaired, the interchange of domestic commerce, even during periods of the most active external warfare.

"The army and militia, together with the *personnel* of the marine, constitute the vital principle of the system.

"It is important to notice the reciprocal relation of these elements of national defence: one element is scarcely more dependent on another than the whole system is to each one. Withdraw the navy, and the defence becomes merely passive; we expose ourselves the more to suffer the evils of war at the time that we deprive ourselves of all means of inflicting them. Withdraw interior communication, and the navy will often be greatly embarrassed for want of supplies, while the fortifications will be unable to offer full resistance for want of timely reinforcements. Withdraw fortifications, and the interior communications are broken up, and the navy is left entirely without collateral aid."

It must be borne in mind that the foregoing was written when our population was small and our present system of intercommunication by railroads and canals not in existence. The *practical application* of the principles laid down has been somewhat modified by these physical developments, but it is not the less interesting and important to understand this masterly exposition of the principles which govern our sea-coast fortification, as distinct from land fortification, which alone forms the subject of most treatises on the art.

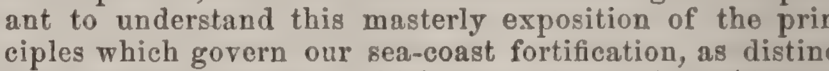
Although it is now the settled policy of the U. S. government to employ permanent fortifications upon the seaboard, this policy has been attacked by men in high station. (A full statement of the arguments for and against it may be found in vol. iv. *Reports of Committees 2d Session 37th Congress*, 1861–62.)

The application of steam to vessels of war brought with it the employment of torpedoes or other obstacles as a necessary complement to sea-coast fortifications. (See TORPEDOES.) The introduction of iron plating cannot impair the relative efficiency of guns in forts to those in ships, since this improvement is applicable to both, while the weight or thickness is in the fort unlimited. (See IRON-CLAD, IRON PLATING, SHIELDS.) At the present day one of the most important applications of permanent fortifications in Europe is to intrenched camps. (See INTRENCHED CAMPS, by GEN. A. BRIALMONT of Belgium.)

II. FIELD FORTIFICATION.

Modification of Foregoing Principles and Rules.—In field fortifications, which are constructed during the exigencies of war, the practical application of some of the foregoing principles is somewhat modified. The parapet, instead of being raised upon a rampart, is placed upon the natural surface of the ground. (Fig. 5.) The ditch is no great

FIG. 5.



obstacle to the advance of an enemy, and is not intended as such. It is excavated to procure earth for the parapet, and is made of the width and depth most convenient for that purpose, the scarp and counterscarp not being revetted. Some obstacle, however, is essential, as before announced, and in field works it consists of a line of obstructions placed about 50 yards in front of the ditch, *a* (Fig. 5). If possible, a second line should be established 50 yards farther to the front. The following are some of the obstacles most commonly employed: *abbatis*, formed of stout limbs of trees about 15 feet long, with the small branches cut off and the large ones pointed, laid as close together as possible, branches towards the enemy; *palisades*, or rows of stout stakes, about 10 feet long and 6 inches in diameter, planted about 3 feet deep in the ground, about 4 inches apart, their tops being pointed and inclined to the front; *trous-de-loup*, or excavations in the form of an inverted

* The few works—*e. g.* Fort Adams, Fort Monroe, etc.—which form the exception were designed and built half a century ago, before the resources and means of inland communication of the country had been developed.

cone, with pointed stakes at the bottom; they must be either so shallow as not to afford cover to skirmishers, or so deep that when a man has fallen into one he shall not be able to use it as a rifle-pit; *wire entanglement*, made by driving stout stakes into the ground about 7 feet apart, in three or more rows, arranged checkerwise, and connecting their tops by strong wires crossing diagonally about 1 foot or 18 inches above the ground; *torpedoes*. (See TORPEDOES.)

Inundations are sometimes made by damming back a water-course; if the overflow is fordable, it may be rendered impracticable by digging trous-de-loup, or irregular trenches, and by scattering about harrows, boards with nails in them, or crows'-feet.

The parapet being intended primarily as a cover, and not as an obstacle, no portion of it is revetted except the interior slope, which must be made steep to enable the defenders the more conveniently to fire over it. This is effected by the use of gabions, fascines, or sods, sometimes by logs, posts, barrels, sandbags, or any conveniently improvised means.

Outworks are seldom employed in field fortification, since, even if time permitted their construction, they would obstruct the fire of the enceinte on account of its low relief.

The application of the principle that the works must have good flanking arrangements is modified in the case of field works by the fact of their low relief, which removes to a certain extent the dead spaces in front of them; and further, by the situation of the point where the enemy's advance is checked. In the case of permanent works the enemy meets his most serious obstacle when he reaches the ditch, whereas in the case of field works an enemy having once reached the ditch will, in most cases, not delay to enter the works, and the real obstacles to his advance are found fifty yards from the ditch. Hence, while it is undoubtedly desirable to have good flanking arrangements, a field work may be in an excellent state of defence without them; whereas the want of them in a permanent work would be a vital defect. Indeed, in the case of a small field work it would be injurious to the defence to break up the lines into a series of small ones, scattering the fire in several directions, and rendering it insufficient in all.

Fortifications extending over the front of the position of an army are called intrenchments or lines. Continuous lines are those which extend continuously from one end of the position to the other. Lines with intervals are those in which only the most important points are occupied by detached works, the intervals being left open.

The great development of the front occupied by an army rendered it impracticable, until a recent date, to give to all parts of a continuous line the strength necessary to resist the attacks of very superior numbers; and an enemy forcing his way through at a single point could turn the whole line. Hence, in a strictly defensive position engineers preferred the line with intervals, concentrating all their means upon the detached works, and controlling the intervals by the fire of these works. The recent great improvements in the musket, particularly in loading, by means of which a thin line of troops can deliver a steady stream of fire, have changed the circumstances of the case. It has been definitely shown by many bloody experiments in the recent civil war (1861–65), and in the Franco-German war (1870–71), that a well-intrenched line, properly manned, cannot be carried by an open assault in front. (See *Professional Papers Corps of Engineers*, No. 20, Appendix F.) The experience of these wars has also shown that troops cannot be exposed for even a few moments without some cover, and that the ordinary enclosed field work of earlier days, unprovided with traverses or bombproofs, is of little use against the accurate and distant fire of modern weapons, while it will probably attract a concentrated fire from them. Hence result several important modifications in the application of field fortifications—viz.: 1st, the employment of continuous lines of low command and easy construction for the defence of an army's front; 2d, the constant use of intrenchments on the battle-field, thrown up in a few moments whenever the troops halt; and 3d, the greater care in the planning and construction of enclosed works when such are employed.

The works alluded to under the first heading are called rifle-trenches, popularly known in this country during the civil war as rifle-pits, which term is technically applied to another work. (See SIEGE.) Those under the second heading are used by armies something as the individual formerly employed the buckler and cuirass, and are called shelter-trenches. Rifle-trenches and shelter-trenches receive the generic name hasty intrenchments. Those under the third heading have received the appropriate name semi-permanent works.

Hasty Intrenchments.—In modern warfare the first duty of the troops upon halting after a march, when near the enemy, is to intrench themselves. During the varying tides of battle a point gained is at once intrenched. Cover for infantry is most rapidly obtained by excavating a trench about 1½ feet deep, and throwing the earth to the front to form a parapet. This can be widened in a few minutes, so as to afford cover to men lying down. (Fig. 6.)

FIG. 6.

There should be ready means of getting in and out of these trenches, both to the front and rear; the troops should be able to march straight over them when necessary. At intervals of about 100 yards ramps should be formed or breaks be left in the lines, which may here overlap, to enable artillery and cavalry to pass. The trace given to these trenches is evidently the same that would be occupied by a line of battle. No attention is paid to flanking arrangements, properly so called. Should the position be long occupied, the most important points are sometimes secured by enclosed works. Should the ground be occupied for a prolonged period, the trenches are deepened and widened until they become rifle-trenches. A trench 3 feet deep and a parapet 4½ feet high, giving a total cover of 7½ feet, is the greatest vertical dimension generally given them. The natural surface of the ground forms the banquette, the parapet being thrown forward sufficiently far for that purpose. In wooded regions a revetment of the interior slope is frequently formed of logs laid one over the other. Further strength is given to the line by some of the obstacles previously described, placed about 50 yards in front.

It is natural for men lying behind breastworks exposed to fire to crouch low, and thus to raise the muzzles of their muskets while they lower the butts, and fire too high. It is therefore important to provide loopholes along the parapet, to cover the heads of those firing. A log about a foot in diameter is sometimes laid on top of the parapet, notches being cut on the lower side about six feet apart. Loopholes may also be made of boards or of sandbags. A screen of any kind, even if not bullet-proof, is valuable; branches of trees are therefore sometimes employed.

At suitable points the artillery is posted, the terreplein being widened and embrasures cut for the purpose. If a position can be secured where the artillery could enfilade an attacking line, it would of course be occupied, as in posting troops for battle. This is not strictly a flanking arrangement, as the term is employed in fortification.

Woods in front of the works are cleared away and ditches filled up, these clearings being extended by degrees to the full range of artillery, should the position be long enough occupied. Ditches and similar obstacles running perpendicularly to the general direction of the defences may be left, as they will obstruct the circulation of the enemy's troops from one part of his line to the other. In long lines of rifle-trenches branches should be run back, at intervals of 500 or 600 yards, in a direction nearly perpendicular to the main line, to shut off the enemy in case of his forcing his way through, and prevent him from turning the whole line by his advantage at a single point.

The employment of enclosed works upon these hasty intrenchments is exceptional, since the labor and materials required to construct them in accordance with the demands of modern war cannot usually be provided.

Semi-Permanent Works.—At the breaking out of the civil war the strategic points of the U. S. were entirely unprovided with land defences. It became necessary to construct strong fortifications, with some durability, for large cities, in a short time. These circumstances gave rise to a new kind of fortification, combining certain of the arrangements of permanent with those of field works, and called by American engineers semi-permanent works. It is in this form that enclosed field works will generally be employed in the future; and it is to these that we must always look for the land defences of our cities. The most remarkable example of their application was in the fortification of Washington. (See *Prof. Paper C. E.*, No. 20.) This city was very much exposed, was of vital importance to the Union cause, and was loosely scattered over a wide area. It was necessary not only to keep out the enemy, but to keep out his artillery projectiles, which had a range of three or four miles. The first defences constructed were of the old field-work type, with thin parapets and steep scarps, and unprovided with bombproofs. They were located at the points most immediately requiring them, and some of them were laid out by the eye, the distances being measured by pacing: their weakness was recognized. As time and experience were gained, a system of great strength

was developed, the defences at the close of the war consisting of 68 enclosed forts and batteries, having an aggregate perimeter of 22,800 yards (13 miles), and emplacements for 1120 guns, 807 of which and 98 mortars were actually mounted; of 93 unarmed batteries for field-guns, having 401 emplacements; and of 35,711 yards (20 miles) of rifle-trenches, and 3 block-houses. The permanent garrison was about 18,000, though it was expected that this would be greatly reinforced in case of a persistent attack. The length of the line occupied was about 37 miles. "Every prominent point, at intervals of 800 or 1000 yards, was occupied by an enclosed work; every important approach or depression of ground unseen from the forts swept by a battery of field-guns, and the whole connected by rifle-trenches." These enclosed works were the semi-permanent works; they were located upon the principles of lines with intervals, the intervals being afterwards closed, as an additional precaution, by lines of rifle-trenches.

In these detached works bombproofs were provided for the men and material, embrasures for the guns, and well-ventilated magazines, lined in a substantial manner with heavy timber, for the ammunition, space being allowed for 100 rounds per gun. The depth of the ditches was usually 6 feet, their width being regulated by the amount of earth required for the parapets. Glacis were thrown up to bring the ground in front under the musketry-fire from the parapets. Traverses were erected wherever a line was exposed to enfilade or oblique fire. Great care was taken to provide each of the larger works with flanking arrangements. When this could not be otherwise secured, counterscarp galleries were employed. In many cases advanced works, in the shape of rifle-trenches connected with the main works, were constructed. Wells were dug to supply the garrisons with water. Instead of a steep scarp, liable to erosion, the exterior slope of the parapet was continued to the bottom of the ditch.

But the most remarkable improvement upon the old methods was in the structures within the works. In addition to the substantial and roomy magazines already referred to, the larger works were provided with filling-rooms, implement-rooms, service magazines, and guard-rooms, either in the traverses or in separate structures, while nearly all contained capacious bombproofs. The latter were generally arranged to serve the purpose of a parados, or traverse, or interior retrenchment, in addition to their primary object, and were provided with a banquette along the rear, from which musketry-fire could be delivered upon an assaulting party which had succeeded in mounting the front parapet. (An interesting and valuable account of these fortifications is given in detail in Gen. J. G. Barnard's *Defences of Washington*, published as *Professional Paper Corps of Engineers U. S. Army*, No. 20, in 1871.)

Block-Houses.—The case frequently arises where it is necessary for a point of considerable importance to be guarded by a small detachment of men, and where circumstances do not permit the construction of a semi-permanent work. Such would be a bridge upon a line of communications passing through the enemy's country which it is necessary to guard against cavalry raids. In this case, instead of the redoubt formerly employed, engineers preferably use the block-house. This is a building of which the sides are composed of heavy timbers placed vertical in juxtaposition, loopholed, and sometimes provided with embrasures for artillery. Earth is heaped up on the exterior to the height of the loopholes or embrasures, and a V-shaped ditch excavated to prevent the enemy using these against the defenders.

Historical Sketch of Fortification.—The origin of fortification is coeval with that of society. The character of the works has conformed to that of the weapons employed in the various ages of mankind. Thus, among the wild tribes of the infant world, armed with clubs and weapons of stone, a wooden barricade or a bank of earth surmounted by a hedge was an efficient defensive work. The introduction of cutting tools of metal rendered these an easy prey to the attack, and a wall of masonry became necessary. As nations grew in power the height and thickness of these walls increased; some are said to have been 100 feet high. The greater their height, the more difficult they were to scale, and the more efficient were the missiles thrown from them; while the greater the thickness, the more space was provided upon them for the engines of war. To procure great thickness two walls were often built parallel to each other, the interval between them being filled with earth. The walls of Babylon are said to have been 70 feet thick, and are supposed to have been built in this way. To cover the men and material on top of this rampart, a thin wall was built up at the front part of it to the height of a man, and furnished with embrasures, through which stones and arrows were discharged at the enemy. To obtain a fire upon the foot of the wall, brackets were built out, and upon them were placed parapet-walls with embrasures. The next improvement was to build towers projecting from the general face of the wall, and providing a fire parallel to it. The distance between these towers was about the range of an arrow. It is doubtful when the ditch was introduced, but it was probably at an early date. During the Middle Ages the art of fortification, like the other arts and sciences, rather retrograded than improved.

The invention of gunpowder caused a radical change in all the methods previously employed. The high walls presented a marked and vulnerable object to projectiles of cannon; they had to be very much lowered. The top of an ordinary wall did not afford room for the guns; space was procured by throwing up a bank of earth on the interior. The towers had to be very much enlarged to receive the guns; they thus expanded into bastions. The walls, though lowered, were still exposed to being breached from a distance; outworks were therefore thrown up in front of them.

The Italians being in advance of the rest of Europe in all the arts, it was with them that the first great changes originated—Verona was surrounded by a bastioned enceinte in 1527—though the first modern writer was the celebrated German painter, sculptor, and architect, Albert Dürer, whose book is dated 1527. His ideas showed great originality and sagacity. He provided casemates, and flanked the faces of his polygon by enlarged towers, which he called bastions, though they rather resembled the caponnière than the modern bastion. The second great name in the modern art is that of Daniel Speckle, also a German, b. in 1536 at Strasburg, which city he fortified. He enunciated the principles that masonry must not be exposed to the distant view of the enemy, and that the nearer the general direction of the line fortified shall be to a straight line, the better. The first prominent French writer was Errard de Bar-le-Duc, whose book is dated 1594. He enunciated the principles that the minimum salient angle shall be 60°, and that the outworks must be seen into and commanded by the works in rear. His work was followed by that of De Ville in 1629, who made some improvements in details. Following Errard and De Ville, the next master was the count de Pagan, whose work is dated 1645. He greatly increased the size of the demilune, and regulated the dimensions of the bastions and the distance between them, and improved the direction of the flanks and other details.

Vauban was born in 1633. Taking the method of Pagan, he enlarged the demilune, and provided it with an interior redoubt, invented the tenaille, enlarged the re-entrant places of arms, and constructed traverses along the covered way. Vauban restored 300 old fortresses, built 35 new ones, and besieged 53. He displayed extraordinary talent in adapting his works to the site, and he brought the bastioned system to a high degree of perfection. Coehorn was a contemporary of Vauban's, and adapted the system in a peculiar manner to the low lands of Holland. Vauban was followed by Cormontaigne, b. in 1696, who enlarged the demilune still further, introduced redoubts in the re-entrant places of arms, and made other improvements, leaving the system substantially as it is to-day.

The bastioned system was considered the only proper manner of fortifying until the latter part of the eighteenth century, when Montalembert, a French general of cavalry, produced his bold and original work. This "most intrepid of writers on fortification," as he has been styled, abandoned the bastioned trace, made large use of casemates, and used caponnières for flanking purposes, thus developing the ideas produced 250 years before by Dürer. He also advocated the tenailled system. It is upon the ideas of Dürer and Montalembert that the modern polygonal system is based, which is now receiving such general employment throughout Europe, except in France. For sea-coast fortification the casemates of Montalembert had a singular applicability. He is the first engineer who invented special designs for works "for the defence of ports," and he should be regarded as the originator of the casemated batteries subsequently so extensively employed by all nations.

(The literature of fortification is very large. For a technical study of the subject the reader is referred particularly to Zastrow's *History of Permanent Fortification*, originally published in German, but translated into French and published at Paris in 1856; Fallot's *Cours d'Art Militaire*, Paris, 1857; and the following works by Col. A. Brialmont, now major-general of the Belgian staff: *Études sur la Défense des États et sur la Fortification*, Paris, 1863; *Traité de Fortification Polygonale*, Paris, 1869; and *Fortifications à Fossées Secs*, Brussels, 1872.) (For attack and defence of fortifications see Siege.) O. H. Ernst.

Fort Independence, a pentagonal bastioned work with exterior open barbette batteries, located on Castle Island, Boston harbor, Mass.; commenced 1832. It forms

one of the defences of the inner harbor of that port, being distant about 3 miles from the city.

Fort Jack'son, a v. of Hopkinton tp., St. Lawrence co., N. Y., has manufactures of cooperage, lumber, starch, etc.

Fort Jackson, Savannah River, Ga., an open barbette battery, about 4 miles below Savannah, designed to defend the main channel and the passages which come into the river by the S.

Fort Jackson, a pentagonal bastioned and casemated brick work, with glacis and wet ditch, on the Mississippi River, 78 miles below New Orleans, at what is known as the "Plaquemine Bend." The designing of such a work on this soil was bold but successful; the considerable "settlement" has done no serious injury. In conjunction with Fort St. Philip, it defends New Orleans against maritime attack by the river. Mainly built from 1824 to 1832, though extensively repaired, enlarged, and modified since 1841. The forcing of the passage of these works and their capture by the fleet of Farragut constitutes the first great naval exploit of that commander. (See NEW ORLEANS.)

Fort Jef'ferson, Garden Key, Tortugas, Fla., an enclosed hexagonal casemated work, designed to command the harbor lying in this group of keys; commenced 1846.

Fort Kear'ney, a military post and v. of Kearney co., Neb., on the S. bank of the river Platte, and on the Burlington and Missouri River R. R., 125 miles W. of Lincoln, and nearly opposite Kearney, on the Union Pacific R. R.; lat. 40° 33′ N., lon. 99° 6′ W.

Fort Kent, post-v. and tp. of Aroostook co., Me., 126 miles N. by W. of Houlton, on the St. John River, has extensive water-power and manufactures lumber. Fort Kent was a fortification erected in 1841. Pop. 1034.

Fort Knox, an enclosed pentagonal work on the Penobscot River at the Narrows, opposite Bucksport, Me., intended for the protection of Bangor and the numerous flourishing towns on the Penobscot.

Fort La Fayette, a battery erected on Hendrick's Reef in the Narrows, New York Bay, under the guns of Fort Hamilton. During the late civil war it was used as a government prison for civilian offenders. It has since been partly burned.

Fort Lar'amie, a military post and post-v. of Laramie co., Wy., near the N. Fork of the Platte, on the Big Laramie, 89 miles from Cheyenne.

Fort Lar'ned, a military post and post-tp. of Pawnee co., Kan., 106 miles W. of Newton. Pop. 179.

Fort Leav'enworth, a U. S. military post and post-v. of Leavenworth co., Kan., on the Missouri River, 2 miles above Leavenworth. It was established in 1827. It is situated on a bluff 150 feet high. The U. S. reservation is 6 miles long and 1 mile broad. It is well laid out, and was until recently one of the most important of the U. S. military stations. Pop. of reservation, 1975.

Fort Lee, post-v. of Bergen co., N. J., on the Palisades of the Hudson River, opposite 160th street, New York City. It was once a military station, and fell into the hands of Gen. Cornwallis Nov. 18, 1776, who here captured large amounts of military stores.

Fort Liv'ingston, Grand Terre Island, entrance to Barataria Bay, La., an enclosed work with brick scarp and counterscarp and casemates, designed to guard the approaches to New Orleans by the numerous "bayous" which head near the margins of the Mississippi River and communicate with the sea by Barataria Inlet; commenced 1840.

Fort Ly'on, post-v. and military post of Bent co., Col., on the N. side of the Arkansas, 92 miles E. of Pueblo and 1 mile from Las Animas. The reservation has an area of 9 square miles. It is the chief military station in Colorado.

Fort McCla'ry, an enclosed pentagonal casemated work in Portsmouth harbor, N. H., for the defence of that port and the U. S. navy-yard therein; commenced in 1841, on the site of an old work of that name.

Fort McHen'ry, an enclosed bastioned pentagon, with exterior batteries, on the W. side of the Patapsco River, forming one of the defences of the channel of approach to Baltimore, Md. It is an old work (second system), built prior to 1812; an attack during the war of 1812–15 furnished the theme for the well-known words of the *Star-Spangled Banner*, by F. S. Key.

Fort McKav'ett, a military post and post-v. of Menard co., Tex.

Fort Mac'kinaw, a U. S. fort on Mackinaw Island, Mackinac co., Mich. It is 200 feet above the town of MACKINAW (which see).

Fort Macomb', Chef Menteur Pass, La., an enclosed work commenced in 1822. (See FORT PIKE.) Fort Macomb was formerly known as Fort Wood.

Fort Ma'con, an enclosed work on Bogue Island, entrance to Beaufort harbor, N. C.; commenced 1826.

Fort McPher'son, a U. S. military post of Lincoln co., Neb., on the S. side of the Platte, near Cottonwood Springs, and connected by a bridge with McPherson Station on the Union Pacific R. R. Lat. 41° N., lon. 100° 30′ W.

Fort McRee, a brick casemated battery, commenced in 1833 on "Foster's Bank," now a tongue of the mainland, at the entrance to Pensacola harbor, and opposite FORT PICKENS (which see). The sea has encroached on the site, and the work, when reoccupied in 1863 by the U. S. forces, was found to be in a ruinous condition.

Fort Mad'ison, city, the county-seat of Lee co., Ia., on the Mississippi River, 23 miles below Burlington, and on the Chicago Burlington and Quincy, the Burlington Fort Madison and South-western, and the Fort Madison and North-western R. Rs. It is opposite Niota, Ill., with which it is connected by ferries. It is the site of a fort built in 1808, and captured by the Indians in 1818. It is the seat of one of the State penitentiaries; has a fine academy, a court-house, jail, manufactures of sash, doors, blinds, castings, machinery, beer, flour, furniture, lumber, ploughs, leather, and other goods. It has a large trade, 9 churches, 5 public schools, a park, a public library, and 2 weekly newspapers, and occupies a beautiful and healthful site. Pop. 4011. J. G. WILLSON, PROP. OF "PLAIN DEALER."

Fort Madison, an old work on the left bank of the Severn River, Annapolis harbor, Md.

Fort Ma'rion, St. Augustine, Fla., an old enclosed work built by the Spaniards more than 100 years ago. It is the oldest fort in possession of the government, and is from its antiquity an object of attraction to strangers visiting St. Augustine. It is of not much value, but is kept in order to prevent its falling into decay.

Fort Mif'flin, one of the inner line of defences of the port of Philadelphia, Pa., located on Mud Island, Delaware River, below the mouth of the Schuylkill. It is one of the older (or second) system of works; built prior to 1812. Has since been modified and repaired.

Fort Mill, post-tp. of York co., S. C. Pop. 2473.

Fort Mit'chell, tp. of Russell co., Ala. Pop. 2032.

Fort Monroe', a fortification located on Old Point Comfort, Va., for the defence of Hampton Roads and the water-approach to Norfolk and the Gosport navy-yard. It stands on the N. side of the channel, Fort Wool (formerly Fort Calhoun) being on the S. side, about 1 mile distant. Fort Monroe might properly be called a fortress or fortified place, as it encloses a large area, and contains within it a number of detached buildings, such as officers' quarters, offices, barracks for soldiers, storehouses, a portion of the workshops of an arsenal, the artillery school of the service, a chapel, etc. etc. It was commenced in 1817, and was originally designed to mount 371 guns in casemates and *en barbette*, inclusive of mortars, field-pieces, and flanking howitzers. In plan it is an irregular hexagon, on two sides of which, comprising the three channel fronts, the armament is arranged in two tiers, one in casemates and one in barbette. On the other four sides, each being one front, the ramparts are solid, with the exception of some of the flanks, which are casemated. The work is bastioned, although unaccompanied by the usual outworks of the regular bastioned system. It is surrounded by a tide-water ditch, 8 feet deep at high water, exterior to which there is a casemated battery on the channel front to the left of the casemates of the main work, and a quadrilateral redoubt on the N. side, commanding the approach down the peninsula. This redoubt, like the main work, is surrounded by a wet ditch. The scarp-wall of the main work rises to the height of 17 feet above high water. The entire fort covers an area of 80 acres, and the distance around it, exterior to the ditches of main work and redoubt, is $1\frac{6}{10}$ miles. In its construction there has been expended $2,818,000. When certain modifications now in progress or approved are completed, it will mount 118 guns and 18 flank howitzers in casemates, and 51 heavy guns of modern calibres *en barbette*. Inasmuch as the exceptional magnitude of Fort Monroe, as compared with our other works of coast and channel defence, has been the subject of frequent, and sometimes of severe and perhaps not unjust, criticism, it may be said, in explanation, that this work was designed under the inspiration of Gen. Simon Bernard, a foreign engineer of eminence called into our service soon after the close of the war of 1812–14, with all the exaggerated ideas of warfare which the close proximity of belligerent nations in Europe had produced and rendered orthodox. But the more moderate opinions of our own mili-

tary engineers, moulded solely upon local circumstances and the necessities of our own country, so far prevailed as to restrict the introduction of a foreign system to the single case of Fort Monroe. We have no other work at all like it in any essential particular, and the error in this instance relates solely to magnitude, not to strength.

Q. A. GILLMORE.

Fort Montgom'ery, Rouse's Point, N. Y., an enclosed pentagonal work, commenced in 1841, constituting the defence of the outlet of Lake Champlain.

Fort Mor'gan, an enclosed casemated and bastioned pentagon of brick, with exterior batteries, located on the W. end of Mobile Point, Ala., at the entrance to anchorage in Mobile Bay; commenced 1819 on the site of old Fort Bowyer. An historic interest attaches to the latter work as having borne an important part in the war of 1812–15. It then consisted of only a small redoubt. In pursuance of the plan adopted by the British, "to destroy and lay waste all towns and districts of the U. S.," the Indian war was renewed on the southern frontier, and on Sept. 15, 1814, a combined naval and land attack was made upon Fort Bowyer, which at this time was but a small redoubt mounting 20 guns, and with a garrison of 120 men, officers included. The British force comprised 4 armed vessels, 590 men, and 90 guns, and a land force exceeding 700 men, of which 600 were Indians. The engagement, which lasted three hours, resulted in the total loss to the British of 1 ship and 232 men. The loss in killed in Fort Bowyer was but 8.

Fort Moultrie, on Sullivan's Island, entrance to Charleston harbor, S. C. A rude work of palmetto logs and earth, mounting 26 guns, was unsuccessfully attacked in 1776 by the British fleet of nine vessels (270 guns), under Sir Peter Parker, and thenceforth bore the commander's name, Col. William Moultrie. It was subsequently rebuilt in masonry with an imperfectly bastioned tracé, and described in official reports as a "work of some strength, but with scarp-wall so low as to oppose no serious obstacle to escalade." And such it was, essentially, at the time when (Dec. 26, 1860), abandoned by Major Anderson, it fell into Confederate hands, and in consort with batteries on Morris Island fired the first guns of the civil war upon the Star of the West, Jan. 9, 1861. (See FORT SUMTER.) The work in Confederate hands was reinforced by earthen batteries extending the whole length of Sullivan's Island. Since the war it has been very much modified to adapt it to receive modern heavy guns, protected by earthen traverses and parados.

Fort Niag'ara, N. Y., an enclosed work commanding the entrance into the Niagara River, at the mouth of which it is located. The old work of this name bore a prominent part in the war with Great Britain in 1812–15, and was the scene of stirring events, being surprised and captured in 1813 and most of its garrison slain.

Fort Onta'rio, an enclosed work on the right bank of the Oswego River, at its mouth, intended to protect the city of Oswego, N. Y., against naval attack. It occupies the site of old Fort Oswego, which in the war of 1812–15 was the scene of many exciting struggles, and was once captured by the enemy. The city has now, however, grown to such an extent as nearly to surround the present fort.

Fort Osage, tp. of Jackson co., Mo. Pop. 1695.

Fort Pick'ens, an enclosed casemated and bastioned pentagonal brick work, on Santa Rosa Island, Pensacola harbor, Fla., which harbor and the U. S. navy-yard at Warrington it is intended to defend. In Jan., 1861, Maj. Adam Slemmer abandoned the small work, FORT BARRANCAS (which see), opposite, and transferred his command to Fort Pickens, which he succeeded in holding until reinforced, thus saving to the government this important work. The navy-yard and works on the mainland, including Fort McRee, fell into Confederate hands, and desultory operations were carried on for some time between the two shores, exhibiting at one time the singular spectacle of two forts (Pickens and McRee) cannonading each other.

Fort Pike, Rigolets Pass, La., an enclosed brick casemated work, commenced in 1819, designed to defend, with Fort Macomb, the water-approaches to the rear of New Orleans by the two passes, Rigolets and Chef Menteur, leading from Lake Borgne to Lake Pontchartrain.

Fort Plain, post-v. of Montgomery co., N. Y., on the Mohawk River, the Erie Canal, and the New York Central R. R., 56 miles W. of Albany. It has 1 national bank, a seminary, a weekly newspaper, a spring and axle manufactory, 4 hotels, and a number of stores. Pop. 1797.

CHARLES BOWEN, ED. "MOHAWK VALLEY REGISTER."

Fort Por'ter, a small enclosed work, commenced in 1842, on the right bank of the Niagara River, at Black Rock, 2 miles below Buffalo, N. Y. It is a tower, and surrounded by a barbette battery, intended to command the entrance into Niagara River and the shore and anchorage in front of Buffalo.

Fort Preb'le, an old enclosed work situated on Preble Point, Cape Elizabeth, Portland harbor, Me., partly surrounded by a line of open barbette and casemated batteries.

Fort Pulas'ki, a fortification constructed on Cockspur Island, Ga., for the defence of Tybee Roads and the Savannah River approach to the city of Savannah, commenced in 1829. It is a brick work of five faces, casemated on all sides; walls 7½ feet thick at the base and 25 feet high above high water; mounting two tiers of guns, one in casemates and one *en barbette*. The gorge-face is covered by an earthen outwork (demilune) of bold relief. A tide-water ditch surrounds both main work and demilune, and separates the two. At the beginning of the civil war, in 1861, the work had cost $988,859, and was finished in all essential particulars, but had never been garrisoned or armed. It was originally designed to mount 150 guns of all calibres. The secession of the State of Georgia occurred Jan. 2, 1861, and her military at once took possession of Forts Pulaski and Jackson, the only defences on the Savannah River. On Nov. 29, 1861, the writer, then holding the position of chief engineer to the expeditionary corps commanded by Brig.-Gen. T. W. Sherman, made a military reconnaissance of Fort Pulaski, and pronounced "the reduction of that work practicable by batteries of mortars and rifled guns established on Big Tybee Island." Its capture having been determined upon, the island was occupied by the Union forces early in December. In order to invest the place, batteries were established in the marsh about 4 miles above the fort, commanding the Savannah River—one upon Venus Point, and another nearly opposite, on Bird Island. Another battery was placed upon a hulk anchored in Lazaretto Creek, S. of the fort.

"On Feb. 21, 1862, the first vessel with ordnance and ordnance stores for the siege arrived in Tybee Roads. From that time until the 9th of April all the troops on Tybee Island, consisting of the 7th Connecticut Vols., the 46th New York Vols., two companies of the Volunteer Engineers, and, for the most of the time, two companies 3d Rhode Island Vol. Artillery, were constantly engaged in landing and transporting ordnance, ordnance stores, and battery materials, making fascines and roads, constructing gun and mortar batteries, service and dépôt magazines, splinter and bombproof shelters for the relief of cannoneers off duty, and drilling at the several pieces.

"The armament comprised 36 pieces. No one except an eye-witness can form any but a faint conception of the herculean labor by which mortars of eight and a half tons weight, and columbiads but a trifle lighter, were moved in the dead of night over a narrow causeway bordered by swamps on either side, and liable at any moment to be overturned and buried in the mud beyond reach. The stratum of mud is about twelve feet deep, and on several occasions the heaviest pieces, particularly the mortars, became detached from the sling-carts, and were with great difficulty, by the use of planks and skids, kept from sinking to the bottom. Two hundred and fifty men were barely sufficient to move a single piece on sling-carts. The men were not allowed to speak above a whisper, and were guided by the notes of a whistle.

"The positions selected for the five most advanced batteries were artificially screened from view from the fort by a gradual and almost imperceptible change, made little by little every night, in the condition and appearance of the brushwood and bushes in front of them. No sudden alteration of the outline of the landscape was permitted. After the concealment was once perfected to such a degree as to afford a good and safe parapet behind it, less care was taken, and some of the work in the batteries requiring mechanical skill was done in the daytime, the fatigue-parties going to their labor before break of day and returning in the evening after dark. The batteries opened fire on the 10th of April." (For further particulars see GEN. GILLMORE'S *Report on the Siege and Reduction of Fort Pulaski, in Professional Paper No. 8 of the Corps of Engineers.* See also article BOMBARDMENT, by GEN. J. G. BARNARD, U. S. Army.)

Q. A. GILLMORE.

Fort Ran'dall, a military post and post-v., county-seat of Todd co., Dak., on the S. W. bank of the Missouri River.

Fort Recov'ery, post-v. of Recovery tp., Mercer co., O. Pop. 89.

Fort Ri'ley, post-v. and U. S. military post in Davis co., Kan., on the Kansas Pacific R. R., 68 miles W. of Topeka, at the junction of the Smoky Hill and the Republican rivers, and on the U. S. military road. It is in a delightful region. The reservation is of 20,000 acres. The Republican is here bridged. Pop. (garrison), 560.

Fort Royal, the capital of the island of Martinique, in the French West Indies, on whose W. side it is situated on a bay of the same name. It is the residence of the French governor. It is fortified, and has a pop. of about 12,000.

Fort St. Phil'ip, nearly opposite FORT JACKSON (which see), on the Mississippi River. The old river front, with low brick scarp and wet ditch, was built by the Spaniards. The "Plaquemine Bend" offers the lowest favorable locality for defending the river, though it is 15 miles above the mouths and 30 above the "Head of the Passes." The work was wholly enclosed by the U. S. authorities during the war of 1812–15, but is, like nearly all works of that and earlier date, of rude design both in trace and relief. Since 1841 it has undergone extensive repairs and modifications. Falling into the hands of the Confederates in 1861, it was, with Fort Jackson, recaptured by Farragut's fleet, Apr., 1862. The name of Fort St. Philip is familiar to the public through its vicinity to a proposed ship-canal for avoiding the shoals which bar the river mouths. (See NEW ORLEANS.)

Fort San'ders, a military post in Albany co., Wy., on the Union Pacific R. R., 3 miles S. E. of Laramie. Lat. 41° 13′ 4″ N., lon. 105° 40′ W.

Fort Scam'mel, an old enclosed barbette battery, located on House Island, Portland harbor, Me.; extensively repaired and modified since 1841.

Fort Schuy'ler, one of the defences of New York against maritime attack by the East River entrance, an enclosed pentagonal casemated masonry work with exterior batteries, situated on Throg's Neck, at the junction of the East River with Long Island Sound; commenced 1833.

Fort Schuyler, a small stockade on the site of the city of Utica, N. Y., was built in 1756. The place was called by this name until 1798, when it took the name of Utica.

Fort Schuyler, the name given in 1776 to the old Fort Stanwix which stood on the site of the present city of Rome, N. Y. It was unsuccessfully besieged by St. Leger's Tories and Indians in 1777, and was destroyed by fire and freshet in 1781. The building of Fort Stanwix cost the British government £60,000; it was built in 1758.

Fort Scott, city, capital of Bourbon co., Kan., 380 miles W. of St. Louis and 98 miles S. of Kansas City, Mo., on the Marmaton River and on the Missouri Kansas and Texas and the Missouri River Fort Scott and Gulf R. Rs. It has 2 national banks, 1 iron-foundry and machine-works, 1 grain-elevator, 3 large flour-mills, 1 woollen-mill, 1 paint and cement works, a match manufactory, a cracker and candy manufactory, 3 newspapers, and 267 business firms. Coal is found in this vicinity, 15 companies mining and shipping from this point. Hydraulic cement and mineral paints, umbers, yellow ochres, Spanish brown, Indian red, etc. are found in large quantities. Pop. 4174.

J. W. ALLAIRE, ED. "PIONEER."

Fort Sel'den, post-v. of Doña Aña co., N. M.

Fort Sev'ern, an old work on the left bank of the Severn River, Annapolis harbor, Md.

Fort Shaw, post-v. of Lewis and Clarke co., Mon.

Fort Sill, post-v. of the Choctaw Nation, Ind. Ter.

Fort Smith, city of Sebastian co., Ark., at the confluence of the Arkansas and Poteau rivers, on the Indian Territory border, 150 miles W. of Little Rock. It has 9 churches, good schools, 1 bank, 3 newspapers, 4 hotels, machine-shops, wagon-factories, saw and grist mill, cotton-gin, planing-machine, a Masonic lodge, chapter, council, and commandery, an Odd Fellows' lodge and encampment, and lodge of K. P. Its principal trade is in cotton, hides, pelts, furs, lumber, corn, wheat, and coal. It is the head of navigation, and has several railroads projected to it. Pop. 2227.

J. H. SPARKS, ED. "HERALD."

Fort Snel'ling, an old U. S. military post in Hennepin co., Minn., at the junction of the Minnesota and Mississippi rivers, opposite Mendota, and 2 miles below the Minnehaha Falls. It was founded in 1820, and is the oldest settlement in what is now Minnesota. It is a post-v. on the Milwaukee and St. Paul R. R.

Fort Spring, tp. of Greenbrier co., West Va., on the Chesapeake and Ohio R. R. Pop. 901.

Fort Stock'ton, military post, Presidio co., Tex. P. 458.

Fort Sul'livan, an old work on Dudley's or Treat's Island, designed for the defence of the harbor of Eastport, Me.

Fort Sul'ly, a military station and post-v. of Sully co., Dak., on the E. bank of the Missouri River. The old Fort Sully is lower down, on the same side of the river, in Hughes co.

Fort Sum'ter, Charleston, S. C., is noted for being the place where the American civil war was inaugurated, Apr. 12, 1861, and as the scene of several severe military and naval conflicts during that war. The work, begun in 1829, is located upon a shoal on the S. side of the entrance to the inner harbor, distant about 1 statute mile S. W. from Fort Moultrie, and $3\frac{1}{2}$ miles from Charleston city. The land nearest the work is Cummings Point, on the N. end of Morris Island, about $\frac{3}{4}$ of a mile distant, in a southerly direction. The fort was built of brick on a rip-rap foundation, the exterior wall being 38 feet high and $7\frac{1}{2}$ feet thick, and was designed to mount 136 guns arranged in three tiers, two in embrasure and one *en barbette*. It never received its entire armament, as none of the embrasures of the second tier were finished when the civil war broke out. The openings left for them were therefore walled up with brick, in order to render the work as strong as possible to resist the threatened attack of the Confederates. Up to that time a little more than $1,000,000 had been expended upon it, and its armament comprised 6 24-pounders, 41 32-pounders, 10 8-inch Rodman guns, 10 42-pounders, 3 10-inch columbiads, and 8 8-inch sea-coast howitzers.

South Carolina formally seceded Dec. 20, 1860, in the midst of the wildest rejoicing and exultation throughout the South. The entire force of U. S. troops in Charleston harbor at the time consisted of two companies of the First U. S. Artillery and 9 musicians, a total of 75 enlisted men, under the command of Major Robert Anderson. This handful of men, which had hitherto occupied Fort Moultrie in consequence of the unfinished condition of Fort Sumter, was quietly transferred to the last-named work during the night of Dec. 26th—an event at once followed by the seizure, by the State authorities, of all the other forts in the harbor, and the U. S. arsenal, post-office, and custom-house in Charleston city. The construction of batteries on Morris Island was begun, the coast and harbor lights were extinguished, and the buoys removed from the channel to prevent the sending of reinforcements and supplies to Fort Sumter. On Jan. 9, 1861, the steamer Star of the West arrived in the harbor with provisions and 250 Federal soldiers. In attempting to reach Fort Sumter she was fired into and struck from batteries on Sullivan's and Morris islands, and abandoned the enterprise. As Major Anderson's provisions would be exhausted on the 15th of April, official notice was conveyed to Gov. Pickens of South Carolina on the 8th that supplies would be conveyed to the fort at all hazards. Its surrender was demanded by Confederate general Beauregard at 2 P. M. on the 11th, and declined. To another communication of the same date, Major Anderson replied that the work would be evacuated on the 15th unless "controlling instructions" or "additional supplies" were received by that time. This response not being deemed satisfactory, Major Anderson was notified at 3.20 A. M. on the 12th that fire would be opened on the fort in one hour, and the cannonading began at the appointed time. At noon on the same day a fleet of vessels from New York, with provisions for the garrison, appeared off the harbor and exchanged signals with the fort, but made no attempt to land any supplies, without which the contest must necessarily be of brief duration. On the afternoon of the 13th terms were arranged, under which the garrison marched out on the 14th with the honors of war, saluting the flag with fifty guns.

The brick buildings erected inside the fort for quarters and barracks were burned down during the action by hot shot from the enemy's batteries, but the work itself had received no material injury. Contemporaneous opinion, outside a somewhat restricted military circle, very generally conceded the difficulty, if not the impracticability, of throwing reinforcements and supplies into the fort during the attack, but in the light of subsequent events such an enterprise loses most of the elements of extreme hazard. The lower embrasures, 41 in number, and each nearly 2 feet wide and 3 feet high, were only 4 feet, in many places not over 3 feet, above the enrockment at the foot of the outer wall, and not more than 10 feet distant from the water, which encircled the fort on every side. If 30 or 40 small boats carrying rations and soldiers, and manned by such men as a call for volunteers would bring out in any fleet of U. S. merchantmen, had attempted to make a landing simultaneously on all sides of the work during the night of the 12th, a large proportion of them would doubtless have succeeded. The opposition, if any, would have come from boat-parties similarly organized, which, at the worst, would only place the combatants on a footing of theoretic equality, in which the best men and the best weapons would win.

The Confederates, upon getting possession of Fort Sumter, at once proceeded to augment its offensive and defensive strength. Rifle-guns were added to the armament; many of the casemates were filled up with sand; sand traverses were constructed between the barbette guns; and the magazine walls were strengthened. They held undisturbed possession for a period of two years.

On Apr. 7, 1863, a gallant attack was made upon the fort by a naval force of nine iron-clads, carrying 23 guns, under command of Rear-Admiral S. F. Dupont. The vessels engaged were the Weehawken, Passaic, Montauk, Patapsco, New Ironsides, Catskill, Nantucket, Nahant, and Keokuk. The combat lasted one hour and forty minutes, when the

View of Fort Sumter from Morris Island, Aug. 16, 1863.

fleet withdrew, at 4 P. M., with the intention of renewing the engagement the next morning. The monitors had received so much injury, however, that the project was abandoned. The Keokuk, a thin-armored, double-turreted monitor, sunk the next day from the injuries received in her hull, although she had been under fire only thirty minutes. She had been struck 90 times, and 19 shots pierced her through at and below the water-line. In this engagement the ranges varied from 550 to 2100 yards. The fleet, armed almost exclusively with 11-inch and 15-inch smoothbores, with a few 150-pounder rifles, fired only 139 times. Of these, 54 15-inch shells, 43 11-inch shells, 22 11-inch solid shot, and 5 150-pounder rifle projectiles were fired at Fort Sumter, and the rest at Forts Wagner and Moultrie. Fort Sumter was subsequently bombarded, its batteries destroyed, and the walls upon two of its faces demolished, from batteries established by the Union land forces on Morris Island. The first fire from the breaching batteries opened Aug. 17, 1863. At 12 P. M. on the night of Sept. 8th the fort was assaulted by a naval column of 500 men in small boats, which was repulsed with heavy loss. A preliminary summons for its surrender had been made by Admiral Dahlgren, and declined.

A prominent historian of the war asserts, on the alleged authority of the naval commander, that co-operation from the army was expected in this assault, in accordance with previous arrangement. Such is not the case. On the contrary, although an assault had been ordered by the commander of the land forces the same night, the admiral was informed that the column could not start from the creek W. of Morris Island until midnight, in consequence of low tide. The naval column left the fleet at 10 P. M., and by midnight had been repulsed and withdrawn. The only arrangement between the navy and army commanders consisted in the adoption of a watchword to prevent unpleasant collisions on the water between the two forces. Each enterprise was organized with ample strength to act alone, and was intended to be entirely independent of the other, and no reference whatever to any expected co-operation from the army was made by the admiral or by any of his subordinates in their official reports of the action.

The Fort Sumter garrison subsequently constructed additional shelters, galleries, and quarters within and under the ruins, and maintained possession until the final evacuation of Charleston and all its defences, Feb. 18, 1865.

The work is now being rebuilt on a modified plan. When completed it will mount — large guns *en barbette* and — guns in casemate. (For demolition of Fort Sumter see GEN. GILLMORE'S *Report on Engineer and Artillery Operations against Charleston;* also article BOMBARDMENT, by GEN. J. G. BARNARD, U. S. Army.) Q. A. GILLMORE.

Fort Tay′lor, an enclosed casemated pentagonal brick work in Key West harbor, Fla.; commenced 1845.

Fort Tomp′kins, on the W. side of the Narrows, entrance to New York harbor, has a fixed white light; lat. 40° 36′ 1″ N., lon. 74° 2′ 56″ W. (See STATEN ISLAND.)

Fort Trum′bull, one of the defences of New London harbor, Conn., on the W. bank of the Thames River; it is an enclosed pentagonal work with exterior barbette batteries; commenced 1838 on the site of an old work of that name.

Fortu′na [Gr. Τύχη], the goddess of good-luck, worshipped at many places of Italy, Greece, and Asia Minor. She is often represented holding in her hand a rudder or the horn of plenty, with a ball or globe at or under her feet—sometimes with a wheel. But she was especially honored at Rome, where she had several temples and bore many surnames.

For′tunate Islands (*Fortunatæ Insulæ*, Μακάρων νῆσοι), an ancient name for a group of supposed islands of the ocean stream, whose happy climate is celebrated by Homer. The geographers identified them with what are now called the Canary Islands, but the term in a wide sense seems to have included the Azores, Madeira, and the Cape Verde group. The delightful climate of all but the most southerly group of these islands justifies the name.

Fortunatia′nus (ATILIUS), a Roman grammarian, author of a treatise on metres, and especially on the metres employed by Horace. The work is compiled from previous writers for the use of a young Roman of senatorian rank, to whom the author recommends the careful study of Horace. In order to explain for him the metres of the poet, Fortunatianus gives first a summary of the different kinds of feet and the principal metres, with some of the leading rules of prosody. He then takes up and analyzes the Horatian measures. The work is given in Gaisford's *Script. Lat. Rei metricæ*, Oxford, 1837, and in the new edition of the Latin grammarians by Keil. H. DRISLER.

Fortuna′tus, the hero of an old romance, the first known edition of which appeared in German at Frankfort in 1509, the second in 1530. Fortunatus, after great sufferings, receives an inexhaustible purse and a wishing-cap, which finally proves the ruin of him and his sons. Another popular character, Fortunio, is believed to have been at first identical with him. The story of Fortunatus was dramatized by Hans Sachs, *Der Fortunatus mit dem Wunschseckel* (1553), and by Dekker, *Pleasant Comedie of Old Fortunatus* (1600). The principal European languages have the tale in various forms. Its authorship is not known, but some of its materials are very old. The "inexhaustible purse" of Fortunatus forms one of the prominent features of the strange tale of *Peter Schlemil* (by Chamisso), who for it sold his shadow.

Fortuna′tus (VENANTIUS HONORIUS CLEMENTIANUS), bishop of Poitiers at the close of the sixth century, a Latin poet of the transition period, wrote on a great variety of subjects; owes his reputation mainly to three or four beautiful Latin hymns. He was b. in Northern Italy, in the neighborhood of Ceneda and Treviso, about 530 A. D., but received his education at Ravenna, where he studied grammar, rhetoric, and jurisprudence, devoting considerable attention also to eloquence and poetry. About 564 he left Italy for France, where he spent the rest of his life. He was favorably received at the court of Siegbert, king of Austrasia, in honor of whose marriage with Brunhilda he composed an epithalamium, and resided there for some time as a sort of court-poet. After visiting Tours in fulfilment of a vow to St. Martin, he repaired to Poitiers, where he met Radagunde, the queen of Clotaire I., who was living in a cloister which she had founded in the vicinity, and attracted her attention and regard. He here took orders, became a presbyter, and almoner and chaplain of the queen, and under her patronage devoted himself to ecclesiastical studies and literary production. On the death of the bishop of Poitiers, Fortunatus succeeded to the episcopate (probably in 599), which office he retained till his death, about 609. His works are very numerous in prose and verse, consisting of lives of distinguished

men, bishops, confessors, and others; explanation of the Lord's Prayer and of the Creed; an epic poem in four books on the life of St. Martin, chiefly copied from the narrative of Sulpicius Severus; and nearly 300 poems, collected in eleven books, on a great variety of subjects and in different metres. Fortunatus stands on the borderline, as it were, of the old classical poetry and the mediæval accentual (of which he was one of the first writers, if not the first), adopting in his poems both varieties, and showing no great regard for Latin quantities. His works were published by Brower, Fulda, 1603; the best edition by Luchi, Rome, 1786, 2 vols. 4to. His beautiful hymn, *Vexilla regis prodeunt*, was adopted by the Church, and has been translated into several modern languages (into English by J. M. Neale in *Mediæval Hymns*, and by Mrs. Charles in *Christian Life in Song*). It, with several others, appears in the greater collections, but is made generally accessible in Trench's *Sacred Latin Poetry*, London, 1874, 3d ed., and in March's *Latin Hymns*, New York, 1874. (See BORMANN, *Ueber das Leben d. lat. Dichters Ven. Fortunatus*, Fulda, 1848; GUIZOT, *History of Civilization*, 18th lecture; EBERT, *Gesch. d. Christlich-Lateinischen Literatur*, Leipsic, 1874, pp. 494–516.) H. DRISLER.

For'tune, port of entry and fishing-town of Burin district, Newfoundland. Pop. 805.—Another Fortune, on the "French Shore," N. F., has a fine harbor. Pop. 15.—Still another place, called Fortune Harbor, on the N. E. coast of N. F., 28 miles from Twillingate, has a pop. of 230.

Fortune (ROBERT), English author and botanist, b. in Berwickshire in 1813; educated at a village school in the Merse, selected horticulture as his occupation, and was employed in the botanical gardens of the Scotch capital, then in those of Chiswick. In 1842 was made collector of plants for the Botanical Society of London in Northern China; in 1847 published *Three Years' Wanderings in China*. Visiting China in 1848 to make investigations concerning the tea-plant for the East India Company, he published, after an absence from England of three years, his *Two Visits to the Tea Countries of China*. *Residence among the Chinese Islands, on the Coasts, and at Sea, being the Third Visit, from 1853 to 1856*, followed. Has also contributed to the *Athenæum*, and in 1859 collected in China, for the U. S. government, the seeds of the tea-shrub and other plants.

Fort U'nion, a military station and post-v. in a beautiful valley of Mora co., N. M., 18 miles E. of Mora.

Fortu'ny (MARIANO), a Spanish artist, b. in Reus, Catalonia, June 11, 1839; d. in Rome Nov. 21, 1874. Fortuny was one of the leaders in the circle of artists who have made themselves famous under the title of the French-Spanish school—a title that needs, however, both to be enlarged and explained. The school includes, besides French and Spanish artists, many Italians, and it is not, in any formal or deliberate sense, a school at all, but only a protest, half unconscious, on the part of several young men of genius of different nationalities, who found themselves in Rome pursuing their studies, against the classical traditions that inherit from David, and that have so long bound the French and Germans hand and foot. It declared war, too, with the literary and anecdotic art so much the fashion in our time—the art of the costumer and of the *bric-à-brac* shop—and rallied a small band, few in number, but strong in youth and zeal, to the support of a more manly style. The inspiration of these new men has come not from Raphael, nor indeed from any Italian, either directly or indirectly, but from Velasquez and Goya and the gold and azure of the Spanish air. If any Italians moved Fortuny and Regnault, they were Titian and Tintoretto and Giorgione, but they forgot them all in the presence of Velasquez, and called him alone master and lord. Fortuny's training began in the Academy of Barcelona, where the pale traditions of Overbeck held sway, Claudio Lorenzales, the director of the academy, having been one of Overbeck's pupils; but academies and imitators could not teach Fortuny anything, and it is said that some lithographs by Gavarni gave him the first living impulse. In 1856 he gained the academy prize, which entitled him to live and study in Rome for a certain number of years at the expense of the state; and once established there, he deserted the galleries and the old masters for the streets, and found his subjects in the life that swarmed about him in the osterias and in the lanes and alleys, filling his sketchbooks with the original but certainly far from aristocratic types that abound in that region. In 1859 he joined his compatriot, Gen. Prim, count of Reus, in his expedition to Morocco, and in Africa he was taken captive by the charm of that splendid barbarism, in which Regnault, too, found such delight as made him forget Italy; and he returned to Europe with a world of studies, which were afterward, whether as studies or as pictures, to make him fame and fortune. In Madrid he had studied Velasquez and Goya, and when, on his return from Morocco to Rome, where he finally fixed his home, he visited Paris, he was strongly attracted by the pictures of Meissonier, and the influence of that master is marked in his works, in spite of the wide difference in the technics of the two men. A German critic (*Zeitschrift für Bildende Kunst*, vol. ix., 1874) not unhappily calls Fortuny "a link between Goya and Meissonier." The reputation of Fortuny dates from the year 1866, when he came to Paris. Here he entered into most profitable business arrangements with the house of Goupil, who introduced his works to the whole art-loving world, not only in Europe, but in America. In 1869 several of Fortuny's pictures were exhibited in Paris, and in the Salon of 1870 Regnault's *Salome* and the *Education of a Prince* by Zamacois made the names of these three young men known as the founders of a new school—a school that within four years was destined to be deprived of their illustrious leadership. Regnault died first, Zamacois next, and now that Fortuny has gone, new triumphs must wait for a new leader, since no one of equal power and originality is left to carry on their work. In 1868, Fortuny married Mademoiselle Madrazo, a sister of Madrazo the artist, and a daughter of the distinguished director of the Royal Museum of Madrid, himself an artist and come of a family of artists. Madame Fortuny accompanied her husband on all his journeys, easily and happily suiting herself to his artist-life and delighting in his success. In the pictures which he painted after his marriage we often find her face and figure. Two children are the fruit of this marriage. The names of Fortuny's best-known pictures are *A Spanish Marriage, The Serpent-Tamer, The Amateur of Prints, A Fantasia at Morocco, The Sword-Sharpener, The Academicians of Arcadia*. The sketches made by Fortuny in Morocco, in Spain, in Italy, and even in the environs of Paris, count by hundreds. He acquired a great reputation as an etcher, and many of his most remarkable works in this kind have been reproduced by the heliogravure process, and published by Goupil & Co. Fortuny's death was the result of a gastric fever brought on by imprudently working out of doors in the autumnal rains. He left two unfinished pictures on his easel—*The Sea-shore at Portici* and *The Interior of a Village Meat-shop*. Fortuny worked with great difficulty, composing and painting with extreme care. He thus produced comparatively little, and his pictures were much sought for. *The Spanish Marriage* was sold by him for 75,000 francs, and many of his water-colors fetched 15,000 or 18,000 francs. One of his best pictures, *The Serpent-Tamer*, is owned by Mr. A. T. Stewart of New York. CLARENCE COOK.

Fort Val'ley, post-v. of Houston co., Ga., on the South-western R. R., 29 miles S. W. of Macon, at the junction of the Columbus Eufaula and Perry branches. It is a centre of business in agricultural products, and is a fine cotton market. It has a bank, agricultural works, 2 churches, 2 hotels, 2 newspapers, male and female schools, and about 25 stores. P. 1333. W. T. CHRISTOPHER, ED. "MIRROR."

Fort'ville, post-v. of Vernon tp., Hancock co., Ind., 15½ miles S. W. of Anderson, on the Columbus Cincinnati and Indianapolis R. R. Pop. 387.

Fort Wadsworth. See STATEN ISLAND.

Fort Wagner. See MORRIS ISLAND, by GEN. Q. A. GILLMORE, U. S. Army.

Fort Wal'lace, post-v., tp. and U. S. military post, built of handsome stone, in Wallace co., Kan., on the Kansas Pacific R. R., 353 miles W. of Topeka. Pop. 396.

Fort Wal'la Walla, a military post in Walla Walla co., Wash. Ter., N. of the village of Walla Walla. The old Fort Walla Walla was a Hudson's Bay Company's post on the Columbia, at the mouth of the Walla Walla River.

Fort War'ren, George's Island, Boston harbor, Mass., a large pentagonal casemated work, with exterior batteries in cover-face and ravelin; commenced 1833. It forms the outer defence of Boston harbor. It was designed and built under the supervision of the late Bvt. Brig.-Gen. Sylvanus Thayer.

Fort Wash'ington, suburban village of New York City, on the Hudson River and the Hudson River R. R., in the N. part of Manhattan Island. During the Revolution it was an important point. It was taken, with 2600 prisoners, by the British Nov. 16, 1776, after a gallant defence. The fort stood between what are now 181st and 186th streets, on the highest land upon the island. Some remains of it still exist.

Fort Washington, Potomac River, Md., an old enclosed work with open exterior batteries, intended for the defence of the channel approaches to Washington, D. C.; commenced 1816.

Fort Wayne, city, cap. of Allen co., Ind., at the con-

fluence of the St. Mary's and St. Joseph rivers (which form the Maumee), 94 miles from Lake Erie. The city is regularly laid out in well-paved streets, and covers an area of nearly 10 square miles. The religious and educational advantages are represented in 19 public and parochial schools, 27 churches, 2 colleges, and 1 academy. There are 2 well-appointed libraries, containing 6000 volumes; also 3 daily, 1 tri-weekly, 1 semi-weekly, 5 weekly, and 1 monthly newspaper. Three national and one private bank represent a capital of $1,500,000. Railroads leave the city in eight directions. The extensive shops of the Pittsburg Fort Wayne and Chicago and the Toledo Wabash and Western R. Rs. are located here. The Wabash and Erie Canal also passes through the city. The city has 144 manufacturing establishments, is lighted with gas, and has street railroads running in various directions six miles. It is surrounded by a fine agricultural community, and is one of the leading cities of Northern Indiana, drawing trade from Michigan, Northern Indiana, and Northern Ohio. The number of the different business-houses is about 1600, which includes wholesale establishments. Average mortality for the last ten years, 1 in 55. Pop. 17,718. W. Fleming, Ed. "Sentinel."

Fort Wayne, a U. S. fortification in Springfield tp., Wayne co., Mich., just below Detroit. It is intended to command the navigation of the Detroit River.

Fort Wil'liam, an important trading-post of Algoma district, Ontario, Canada, on the N. shore of Lake Superior, 143 miles from Duluth, and at the mouth of the river Kaministiquia; lat. 48° 23′ N., lon. 89° 27′ W.

Fort Wil'liam Hen'ry, a fortress near the head of Lake George, N. Y., erected in 1755 by the British forces under Sir William Johnson. It became an important strategic point in the last French war in the colonies, and was captured by the French and Indians in 1757. It was in the present tp. of Caldwell, Warren co., N. Y. Its site is occupied by a hotel. Fort George, half a mile to the E., was built in 1759 by Gen. Amherst.

Fort Winneba'go, tp. of Columbia co., Wis. P. 709.

Fort Win'throp, one of the defences of Boston harbor, Mass., on Governor's Island, the former site of old Fort Warren. It is a small enclosed quadrangular work, with exterior open barbette batteries; commenced 1844.

Fort Wood. See Bedloe's Island.

Fort Wool, a large unfinished enclosed casemated work on "rip-rap" foundation, formerly called Fort Calhoun, designed for the defence of Hampton Roads, Va.

Fort Worth, post-v., cap. of Tarrant co., Tex., has an altitude of 1108 feet above the sea, 109 above Trinity River, on the S. bank of which it is situated, at the junction of the Texas Pacific, the Trans-Continental, and the Fort Worth and Denver City R. Rs. It has a number of stores, shops, etc., 2 banks, 3 newspapers, 2 churches, 4 schools, and 5 hotels. Pop. about 2300.
B. B. Paddock, Ed. "Fort Worth Democrat."

Fort Yu'ma, a military post in San Diego co., Cal., on the Colorado River, almost opposite Arizona City, and near the S. E. corner of the State. Pop. 331.

Fo'rum [etymologically connected with *forare* and the Greek πόρος, and so originally a "passage-way"] was applied first to the open space before a tomb, as appears from one of the laws of the Twelve Tables. It was also the designation of an open space in the Roman camp of early times, close to the prætorium, or general's tent. The term was usually applied to an open place in Rome, like the Greek ἀγορά, for the assembly of the citizens for business, for legal transactions, for the administration of justice, and for the sale and purchase of goods. With the growth of the city the necessities of the people required more than a single forum, and convenience separated them into those devoted to public affairs (*fora civilia*) and those which were more strictly markets or bazaars (*fora venalia*). The Roman forum differed in shape from the ἀγορά of the Greeks, for while the latter was usually square, the former was oblong, the length exceeding the width by one-third, according to Vitruvius. The most celebrated and the most important of the *fora civilia* was the Forum Romanum, sometimes called Magnum, and from its pre-eminence simply Forum. This was the earliest, and for a time the only one, and was situated in the valley between the Capitoline and Palatine hills, and with it is associated very much of the interest of the public and private life of early Rome. It was the very heart of the city, the centre of all its life and activity, and in it were gathered daily those whom business summoned, the orators and public men of the day with their bands of clients, as well as the idlers who sought only to be amused, with trains of quacks and mountebanks, so pleasantly described in Horace. (For a description of the buildings in and around the Forum, see Rome.) Immediately adjoining this a new forum was erected at great expense by Julius Cæsar, which was called from him Forum Julium, and was dedicated B. C. 45, after the battle of Pharsalus. It contained a temple of Venus Genitrix, in allusion to his descent from the goddess. This still failing to accommodate the increasing pressure of the business of the courts, Augustus constructed still another, which received from him the name Forum Augusti. It contained within it a temple of Mars Ultor, which Augustus had vowed to erect on avenging the death of his adoptive father. This forum was more contracted than Augustus had designed, on account of the refusal of some owners of houses to part with their property. These three are sometimes distinguished as the *tria fora*. Still other fora were erected by the later emperors, partly to facilitate business, but chiefly to adorn the city. Among these may be named the Forum Transitorium (so called because a passage-way ran through the whole length of it leading to the Forum) or Forum Nervæ, begun by Domitian and completed by Nerva; and the most magnificent of all, the Forum Trajani, or Ulpium, immediately adjoining the Forum Julium and Forum Augusti, and having connected with it the Basilica Ulpia and the famous Columna Trajani, still standing. The second class of fora was devoted to market transactions, and they derived their names from the articles sold in them—*e. g. forum olitorium*, the vegetable market; *forum piscarium*, the fish market; *forum boarium* (cattle), *forum suarium* (swine), etc. The word forum was applied (in the latter sense of a market, and also of a place at which the prætor held his circuit, administering justice) to villages or stations in the provinces of Italy (like the use of the term "court-house" in Virginia), from which grew up in time even flourishing towns; such were, among others less important, Forum Appii in Latium on the Appian Way; Forum Aurelii or Aurelium in Etruria; Forum Cornelii in Cispadane Gaul, now Imola; Forum Gallorum in Cisalpine Gaul, now Castel Franco; Forum Julii or Julium in Gallia Narbonensis, now Fréjus; and another, or Forojulium, in the country of the Carni, now Cividale; Forum Sempronii in Umbria, now Fossombrone.
H. Drisler.

Forum, in law, a court or judicial tribunal; a place where a remedy is sought. The Roman Forum was the place where the courts were held, and the name was, from this circumstance, introduced into the English law to denote a place of trial, and has been retained as a convenient designation in certain phrases until the present time. Thus, the phrase *lex fori*, in which the term is most generally employed, means the law of a place or court where an action is instituted. (See Lex Fori.) *Forum contractus* is the court of the place where a contract is made. *Forum domicilii* is used to denote the court or place of a person's domicile; *forum rei sitæ*, the tribunal where the property in litigation is situated. There are various other phrases embodying the term, which it would be useless to enumerate. In all of them the word is used in the same general meaning. George Chase. Revised by T. W. Dwight.

For'ward, tp. of Allegheny co., Pa. Pop. 1300.

Forward, tp. of Butler co., Pa. Pop. 1025.

Forward (Walter), American lawyer and Congressman, b. in Connecticut in 1786, removed to Pittsburg, Pa., in 1803, and studied law, commencing its practice in 1806; began to edit the *Tree of Liberty*, a Democratic newspaper, at Pittsburg in 1805. He was M. C. from Pennsylvania in 1822–25. In 1824–28 he supported John Quincy Adams, and was thence identified with the Whig party. He was active in the convention of 1837 to revise the constitution of Pennsylvania; in Mar., 1841, was appointed first comptroller of the U. S. treasury; was secretary of the U. S. treasury in 1841–43; in 1849–52 U. S. *chargé-d'affaires* to Denmark, and then presiding judge of the district court of Allegheny co., Pa. D. at Pittsburg, Pa., Nov. 24, 1852.

Forward (William A.), a native of New York, served in the Canadian insurrection of 1836–38, for which he was imprisoned and banished; removed in 1845 to Florida, where he held various public positions; was a judge of a State circuit court 1852–57, and of the supreme court of Florida 1859–65. D. at Pilatka, Fla., Oct. 19, 1865.

Forwarding, in commerce. See Warehouseman, by Prof. T. W. Dwight, LL.D.

Foscara'ri (Egidio), b. at Bologna Jan. 27, 1512; became a Dominican; in 1544 was made a prior and inquisitor at Bologna, and later bishop of Modena. He was frugal, modest, and austere, and devoted much time and money to the poor and to the reclamation of the vicious classes. Paul V. imprisoned him for heresy, but Pius IV. vindicated him, and in 1561 he entered the Council of Trent, in which he assisted Forerius and Leonardo Marini in preparing the Catechism and correcting the Missal and Breviary. D. at Rome Dec. 23, 1564.

Fos'cari (Francesco), doge of Venice 1423–57, b.

1372; warred with the duke of Milan in 1426 (peace concluded Apr. 26, 1433), 1438 (peace again Nov. 20, 1441), and 1452 (peace Apr. 9, 1454). The Venetians obtained possession of Crema, Bergamo, and Brescia, but Foscari was deposed by the Council of Ten Oct. 23, 1457, and d. Nov. 1, 1457. His sufferings and those of his son, who was banished as a traitor in 1445, are the subject of Byron's *Two Foscari.*

Fos'colo (Nicolò Ugo), b. at Zante Jan. 26, 1777; was in the Lombard Legion in 1799; in the French army in 1805; was professor of Italian eloquence at Pavia in 1808; returned to Milan in 1813; visited England in 1816. D. near London Oct. 10, 1827. His remains were exhumed June 7, 1871, and reinterred at Florence, Italy, June 24, 1871. Wrote *I Sepolcri*, elegiac poem, in 1807, besides *Ricciardo*, tragedy, *Discourse on the Text of Dante* (1826), *Essay on Petrarch, Letters of Jacopo Ortis*, etc.

Fos'dick (William Whiteman), American poet, b. at Cincinnati, O., Jan. 28, 1825; graduated at Transylvania University in 1845; practised law in Covington, Ky., but soon settled in Cincinnati, where he wrote *Tecumseh*, drama. *Malinìztic the Toltec* and *The Cavaliers of the Cross*, novels, were published in 1857, after two years' travel in Mexico in 1847–49. From 1851 to 1858 practised law in New York City, publishing in 1855 *Ariel, and Other Poems*. Edited *The Sketch Club* in Cincinnati, O., and d. there Mar. 8, 1862.

Foss (Archibald Campbell), a Methodist divine of note, b. at Phillipstown, Putnam co., N. Y., Mar. 6, 1830; graduated at Wesleyan University in 1852 with the highest honors of his class, and at once joined the New York Conference of the Methodist Episcopal Church, of which his father, Rev. Cyrus Foss (who d. in 1849), had been a member. Archibald served several important churches, and in 1858 became associate pastor with Dr. John McClintock at St. Paul's, New York City. In 1860–62 he occupied the chair of Latin and Hebrew in his alma mater; from 1863 to 1866 was presiding elder of the Poughkeepsie district; in 1867 was offered, but declined, the professorship of biblical exegesis in the Drew Theological Seminary, then presided over by his former associate, Dr. McClintock; in 1868, while preaching at Sing-Sing, his health failed, and he travelled in Italy and Switzerland, and d. at Clarens, Switzerland, Mar. 30, 1870. He possessed genuine character and individuality, and was eminently successful as a minister, because he had great literary taste and qualification, coupled with an enlivening geniality. J. H. Worman.

Foss (Cyrus David), D. D., b. at Kingston, N. Y., Jan. 17, 1834, a brother of A. C. Foss; graduated at Wesleyan University in 1854; taught mathematics in Amenia Seminary, N. Y., 1854–55, and was its principal 1856; entered the Methodist Episcopal ministry, and has held important pastorates, chiefly in New York and Brooklyn, 1859–74; was a delegate to the General Conference of his Church in 1872; became president of Wesleyan University, Middletown, Conn., 1875.—His brother, William Jay Foss, was b. at Verbank, N. Y., Nov. 23, 1835; graduated at Wesleyan University in 1856; was a tutor there 1857; became a preacher of much promise in the Methodist Episcopal Church. D. June 1, 1859.

Fos'sa Maria'na, a famous canal or system of canals cut by the great Marius (b. c. 102) from the Rhone to near the Gulf of Stomalimne (L'Estouma). There was, as late as the fourth century, a port "Fossæ Marianæ," at the sea-terminus, and this port was in face of the modern village of Foz. "The camp of Marius having been at Arles, it follows that the *fossa* must have been conducted, parallel to the Rhone, to this place. It might, however, and even must, have struck the river by a more direct course. Desjardins delineated its junction as about 6 English miles above the ancient, and 15 above the present, Rhone-mouth, and about 16 miles from its sea-terminus." (*Aperçu historique sur les embouchures du Rhône*, E. Desjardins—ouvrage couronné par l'Académie.) "The mouths of the Rhone, on account of the obstacle opposed by the sea, accumulate a great quantity of detritus, thrown back by the waves into (or upon) the deep mud, rendering the entrance difficult and even dangerous. To occupy his army while encamped here, Marius caused a large canal to be dug, into which he diverted a large part of the river, conducting it to a place on the sea-shore safe and commodious." (*Ibid.*, and Plutarch, *Life of Marius.*) G. C. Simmons.

Fossa'no, town of Northern Italy, in the province of Cuneo, on the left bank of the Stura. It has two annual fairs and a considerable trade in agricultural produce, and is a bishop's see. Pop. 7279.

Fos'sil [Lat. *fodio, fossum*, to "dig"]. A fossil is the body or any known part or trace of an animal or plant buried by natural causes in the earth. The moulds of shells, the impressions left by the feet of animals in walking, implements of stone or metal and other works of human art which have been accumulated naturally into rubbish-heaps, are thus strictly fossils. Perhaps the marks of rain, wind, waves, and shrinkage through heat should be included. Early writers believed fossils the result of certain laws of nature, and never animated; others suggested they might be relics of the Noachian deluge; but it is now generally conceded that they indicate the nature of the life of numerous successive periods in the earth's history from the *Eozoic*, or the *dawn* of life, to the latest vessel sunk in the chalky depths of the ocean. A few fossils have been preserved entire, like the elephants and rhinoceroses found encased in frozen mud and sand in Siberia. The relics are usually *petrified*, or rendered stony through the infiltration of mineral matter. The organic particles are slowly replaced, through chemical forces, by mineral atoms, but arranged in the same manner, so that the characteristic structure of the plant or animal is preserved. Microscopic sections show unmistakably the peculiar internal features of the pine, oak, or palm, though the substance is changed to flint. Fossils indicate the former existence of organic races now entirely extinct; that, as a whole, each successive period contained more highly organized structures than its predecessor; that tropical forms once flourished in the polar regions; that each epoch was characterized by peculiar groups. Hence, formations are identified in new countries by means of fossils. C. H. Hitchcock.

Fos'sil Bot'any. The study of fossil botany presents peculiar difficulties to the palæontologist, from the fragmentary character of most plant-remains, and from the incomplete preservation of their perishable tissues. Of many extinct species of trees, in which the individuals may have been 100 feet in height, the only traces yet obtained are a few leaves, of which the outlines and the nervation are imperfectly preserved. All botanists know how variable the leaves of trees are; and since they often find much difficulty in discriminating between genera and species when many entire individuals, complete in root, stem, leaf, flower, and fruit, are before them, it is not surprising that they have little faith in the deductions made from a few variable and incomplete organs. No doubt the inherent difficulties of the subject have favored hasty generalization—have, in fact, led fossil botanists into many errors—and should inspire a proper caution; yet many fossil plants have been discovered, and the preservation of some of them is so complete, that they afford material for legitimate and important deductions in regard to the history of plant-life on the globe; indeed, we may say that the generalities of this history are already pretty well established.

The study of fossil plants was hardly begun before the commencement of the present century, but since then many sagacious, conscientious, and learned scientists have devoted their lives to it, with such success as not only to add largely to our knowledge of the vegetable kingdom in the present as well as in past ages, but to win for themselves lasting fame.

A brief sketch of the groups of fossil plants of which the remains have been discovered, and of the different floras which have flourished on the earth's surface during the successive geological ages, is given below.

The table in the article Botany of the present work (first volume) shows the principal groups into which plants have been divided; but a sixth class, called Protophytes, and containing microscopic cryptogamous plants, often forming siliceous frustules, is generally recognized. Such plants are the Diatoms and Desmids.

On comparing the plants of the groups as given in the table alluded to, they will be found to form a series of which the members increase in complexity of structure from the Protophytes to the Angiosperms, and, as in the animal kingdom, the simplest forms are reckoned to be lowest, the most complex highest, in the scale. In the life-history of plants, as in that of animals, we also find that the lower forms appear first, their remains being found in all the oldest fossiliferous formations, the higher groups coming in successively in the later geological ages, and the present flora, like the present fauna, being the most highly organized of all. In further comparing the records from which we attempt to make up the past history of animals and plants, it should be remembered—1st. That plants have power to assimilate inorganic substances—a power which animals do not possess. Hence, the animal kingdom is dependent on the vegetable for its support, and in fact rests upon it as a base. Plants must therefore have preceded animals on the globe, or at least must have appeared simultaneously with them. 2d. The sea is the mother of continents, and, with the exception of a few fresh-water deposits, all our fossiliferous strata are sediments deposited from the sea. Hence, aquatic species of animals and plants are far more likely to be preserved than those which do not inhabit the water, and the speci-

mens we have obtained of extinct faunas and floras give but a partial view of the life of each period, from the fact that the aquatic species are much more fully represented than the terrestrial. 3d. In all the later geological ages the flora has been mostly terrestrial, while the fauna has been more largely aquatic. Animals have also, more generally than plants, some hard and imperishable organs, and hence the extinct faunas are more complete than the floras. 4th. The remains of the marine fauna of the globe which are exposed to our inspection are contained in sediments laid down by the sea in successive invasions of the land; and these invasions were followed by periods of retirement —periods of immense duration—during which no record was made except in the depths of the sea-basins, or in other countries where submergence took place at the same time. Hence, for any one country the records of marine life constitute a series of chapters separated from each other by long blank intervals. The genetic relations of the different extinct marine faunas are, therefore, necessarily obscure, and will perhaps never be fully determined, since we have not access to those portions of the record which form the connecting links in the chain of being. On the other hand, the succession of land-plants on any continent may have been unbroken; at least its continuity has been greater than that of the marine fauna accessible to us. As a consequence, we may expect that, though having its peculiar imperfections, to which reference has been made, the record of plant-life contained in the shore-deposits and old lake-beds of our continents, when carefully studied, will throw important light on the great questions of evolution and the origin of species. Extreme care will be necessary, however, in prosecuting this study, to gather as much and as complete material as possible, and to read from it only such lessons as it may clearly and unmistakably teach. The progress of science has been much retarded by hasty generalization from collections of imperfectly preserved fragments of plants. From their lower position in the scale, plants are less instinct with life than animals, and their organs or fragments of organs are much less significant than the better preserved and more characteristic portions of animal structures from which so much has been learned.

Life-History of the Different Groups of Plants.—Combining the observations made by fossil botanists in various countries, we are able to deduce some interesting facts in regard to the history of the different orders of plants. Premising that much of the evidence is negative, and that future observation may extend the range of some of the groups upward or downward, the following brief sketch is offered as a summary of our present knowledge on the subject.

1st. The PROTOPHYTES have not been certainly identified in any but the more recent deposits. This has created some surprise, from the *a priori* probability that the lowest forms of plant-life would be fully represented in the oldest formations, and from the fact that thick and widespread strata, mainly composed of the shields of Diatoms, are found in the Tertiary and beneath our present peat-beds. The absence of Protophytes from the Palæozoic rocks may be explained, however, by the fact that only such as secreted calcareous or siliceous crusts or shields could under any ordinary circumstances be preserved. These may have been few in the earlier geological ages, or, what is more probable, their minute and delicate shells have been obliterated by solution. We know that the shields of Diatoms are more soluble than most forms of silica, and it is highly probable that many of the older beds of flint and chert have obtained their material from this source. It is also true that some of the minute plants which secrete lime, and which have usually been classed as Algæ, may be more properly considered Protophytes. These abound in our present seas, and probably did so in those of former ages; and they may have contributed largely to the formation of the great beds of non-fossiliferous limestones which make up so much of the Palæozoic series of rocks, their individual forms being here entirely lost. Some of the most important Tertiary deposits composed of the shields of Diatoms are those of Bilin and Planitz in Bohemia, Richmond, Va., and Monterey, Cal. The Desmids, which are not siliceous, are frequently found in flint, dating as far back as the Cretaceous age, but Diatoms are much more rare in such circumstances. The minute organic forms found in the chert of the Corniferous limestone, figured by Dana, and considered Protophytes, are thought by some microscopists to be rather animal than vegetable.

2d. THALLOGENS.—The Algæ now abound in all seas, and their remains are found in rocks of all ages from the Lower Silurian to the present time. In the Lower Silurian strata sea-weeds are the only plants of which we find unmistakable traces. The discovery of plants of higher organization in the Lower Silurian, and even in the Cambrian rocks, has been announced, but the evidence on this point is at least doubtful. A large number of fossil sea-weeds have been described, but since the cellular tissue of which they were composed has almost uniformly disappeared, and nothing but the casts of their external forms are preserved, their relations to living sea-weeds are obscure. The plants found in the Cambrian rocks have been described as species of the genus *Eophyton.* In the Potsdam sandstone what seem to be fossil sea-weeds are met with (*Palæophycus*, etc.), but their true nature is yet doubtful. In the limestones of the Trenton period are many Algæ, described under the names of *Palæophycus, Licrophycus, Buthotrephis, Phytopsis, Sphenothallus,* etc.

In the Upper Silurian sea-weeds are common, the most important one being *Arthrophycus Harlani*, a characteristic fossil of the Medina sandstone. In the Upper Silurian also begins the remarkable genus of Fucoids called *Spirophyton*, which runs through the Devonian and Carboniferous systems, and is well known as the *Cauda-galli,* or cocks-tail Fucoid.

In the Upper Devonian and Lower Carboniferous rocks is found a singular group of organisms which have been described by Prof. Hall under the name of *Dictyophyton,* and another no less remarkable, called *Uphantænia* by Vanuxem. The true relations of these fossils are still doubtful, though they are generally thought to be Algæ. They were usually conical in form, frequently peculiarly angled and tuberculated, and have the surface marked by a strong rectangular reticulation.

In the later geological formations the Algæ become more numerous, and approach more nearly in character to those of the present day. About 50 genera, including more than 150 species, of these fossils have been described by different authors. To these should be added 39 species of Chara, plants allied to, and sometimes classed with, the Algæ, and which secrete lime in their tissues. These latter are abundant in the present day, and from their power to resist decay should be perfectly preserved in the fossil state; but all the fossil species known, except one or two doubtful ones, are Tertiary, and the peculiar group which they form had probably no existence previous to that age. The seeds of Chara—minute spherical or oval bodies marked with spiral ridges—are very common in the Tertiary beds, but similar bodies found in the Corniferous limestone, and considered to be the seeds of Chara, are more likely to prove Foraminifera.

The Lichens, so abundant at the present day, are hardly known in the fossil state. This is somewhat remarkable, as many of them have hard tissues and distinctly defined forms, such as would naturally be well preserved. They are, however, exclusively terrestrial, and on that account were much less likely to be fossilized than the aquatic Thallogens. It is also true, as suggested by Schimper, that, producing no deciduous foliage which could be carried by the wind into lake or stream, they are not likely to be found except on the trunks of trees to which they were attached. Probably careful search will lead to the discovery of many more lichens attached to fossilized tree-trunks, but it is quite certain that if these plants had been as abundant in the forests of the Coal period as in those of the present day, they would have been found in connection with the perfectly preserved impressions of the external surfaces of trees in our coal-mines. We are therefore justified in concluding that the lichens were much less abundant in the Carboniferous age than at the present time. The only fossil lichens known are a few species found in amber and in the Tertiary lignites. Those from the amber are very perfectly preserved, and belong to the same genera, and in some instances to the same species, with the lichens most common in Europe and America at the present time.

Fungi are almost as rare as lichens in the fossil state; possibly, for the reason that they are all terrestrial, and most of them are soft and perishable. There must be other reasons, however, why they are so rare, or we should have frequently found them attached to the tree-trunks so abundant in the coal-strata. Quite a large number of Fungi have been described by Unger, Goeppert, Heer, etc., chiefly the smaller forms which encrust leaves. These are almost exclusively from the Tertiary, but three species have been found on the leaves of ferns and cycads in the Rhætic beds of Franconia, and as many more attached to ferns and in the Coal formation of Saxony. A few small species have also been found in the amber. The fossil described by Lindley and Hielton under the name of *Polyporites Bowmani,* found in the coal-strata, and thought to be a fungus, is almost certainly the scale of a ganoid fish. *Gyromyces ammonis* of Goeppert, a minute flattened spiral organism very common in the coal-measures of Europe and America, and considered a fungus by Goeppert and Lesquereux, is undoubtedly a shell, and has been described as such with the name of *Spirorbis.*

Anogens.—The plants of this group—which include the mosses and Hepaticæ—form a most conspicuous feature in the present vegetation of the world. The mosses especially, with their immense number of genera and species, and with their beautiful and varied forms, are, in the tropical and temperate climates, hardly excelled in numerical force or interest by any other group of plants. They cover like a carpet millions of square miles of the surface, and as they produce almost unaided the beds of peat which stretch continuously through great areas of the temperate zone, they have much economical as well as scientific importance. The liverworts are less abundant than the mosses, but they too are scattered over the entire habitable globe, and form a long list of genera and species. Such being their development in the present flora, it has been a matter of much surprise that no traces of the Anogens are found in any of the older geological formations. Both mosses and liverworts occur in considerable abundance in the Tertiary strata, especially in the amber and lignite, to the formation of the latter of which they seem to have contributed largely. The species of mosses and liverworts found in the amber are so perfectly preserved that their generic and specific characters may often be determined with accuracy; and it is an interesting fact that all the species so determined are closely allied to, and some are identical with, those now growing in Europe. The *Marchantia polymorpha*, a liverwort, is perhaps the most widely distributed of all living plants. This would indicate that the species has been long in existence, but it has not been certainly recognized as fossil except in extremely modern travertine. An Eocene species, however (*Marchantia Sezannensis*), closely resembles it, and may have been its progenitor.

The entire absence of Anogens from the older floras proves that these plants, though so low in the scale, are of quite modern date—a fact not without interest and significance in the history of plant-life on the globe.

Acrogens.—Although the Ferns, Lycopods, and Equiseta are numerously represented in our present flora, they are perhaps nowhere predominant forms of vegetation, and generally hold not only a subordinate but an insignificant place in the local living floras. These plants are, however, worthy of great respect, if, as in human families, age can make them respectable, since we have reason to believe that they constituted the first forms of terrestrial vegetation which existed on the globe. Like many other ancient families, too, they have seen better days, for both in numbers and dimensions they are now but ignoble representatives of the varied and beautiful flora which their progenitors formed on the continents of Devonian and Carboniferous age. They then developed into families, genera, and hundreds of species altogether unknown at the present day, many of which held individuals that in dimensions and beauty are scarcely exceeded by our most majestic forest trees. Of the three great orders united in this class, the Lycopods seem to have been the first in point of time, as also in their subsequent development. These are now represented by the species of *Lycopodium* (ground-pine), of which all are small. The first traces of Lycopods are found in the Upper Silurian rocks of Canada, England, Germany, and Bohemia. These were the forerunners of the Lepidodendra, the great scaly-trunked trees of the coal-flora. In the Devonian age the Lycopods were excelled both in numbers and size by the ferns and conifers, but in the coal-flora they overshadowed all other forms of vegetation. The Lepidodendrads, of many genera and species, were here associated with perhaps as many kinds of Sigillariæ, whose fluted and reticulated stems attained equally gigantic dimensions. There were also Lycopods, but of high organization, approaching the Gymnosperms in structure. At the close of the Palæozoic ages the Lycopods seem to have nearly disappeared, as no important member of the group has been found in the Mesozoic or Tertiary rocks. The ferns first made their appearance in Devonian strata, where, without any preliminary history now known to us, they suddenly acquired greater relative and absolute importance than they have at the present day. In the Middle and Upper Devonian tree-ferns were already numerous, and attained greater dimensions than any now living. We find traces also here of considerable variety among them, as shown by the structure of their trunks. The smaller ferns were also probably abundant in the Middle Devonian, though circumstances were not favorable to their preservation, the trunks of the tree-ferns, wave-worn and floated far from their places of origin, alone remaining to represent the flora of which they formed part. Of the ferns of the Upper Devonian and Carboniferous several hundred species have been described; and everything indicates that they formed a much more highly organized, diversified, and beautiful group of plants than the fern-flora of the present day. In the Mesozoic and Tertiary rocks the remains of ferns abound wherever circumstances favored their preservation, though we nowhere find in these later formations anything like the number and variety obtained from the coal-measures. This is doubtless in part due to the peculiar conditions under which the coal-beds were formed—conditions which caused a large part of the then existing species to be preserved; and yet in the Mesozoic and Tertiary strata coal-beds exist which rival the more ancient ones in thickness and extent, but the number of species of ferns found in them is comparatively small. The poverty of the roof-stones of the Cretaceous and Tertiary lignite-beds in fern impressions, as compared with these overlying the coal-strata, will strike the most superficial observer. We may therefore conclude that the Ferns, like their associates, the Equiseta and Lycopods, reached their golden age in the Carboniferous period. The Equiseta—of which we now have a few humble forms in our scouring-rushes—almost universal in distribution, but all small, attained in the Devonian and Carboniferous ages nearly the dimensions of forest trees, and also numerically formed one of the most important elements in the flora. These were the *Calamites*, so abundant in the coal-strata, and the allied *Asterophyllites*, *Sphenophyllum*, *Annularia*, etc. In the Mesozoic ages species of the genus *Equisetum* seem to have existed, and, we may say, to have flourished, since their trunks sometimes attained the diameter of five or six inches, but the Calamites and their allies had then altogether disappeared—destroyed by the same influences, doubtless, that ended the existence of their Carboniferous associates, *Lepidodendron* and *Sigillaria*. In Tertiary times the Equiseta were larger and more numerous than now, but had already shrunk to be an altogether unimportant portion of the flora. The history of the order Acrogens, so far as we can trace it, is in strong contrast with that of the other groups of Cryptogams, as they seem to have begun at a very early period in the world's history with a degree of development—as regards numbers, magnitude, and rank—far beyond what they have at the present day; and after maintaining their importance through two great geological ages, they lost it as suddenly as it was acquired. In later times they have fallen lower and lower, until they now have comparatively few representatives, and these have degenerated, not only in size and in numbers, but in botanical rank.

Endogens.—The great group of endogenous plants, among which are the palms, the lilies, and the grasses, now includes some of the most beautiful forms of vegetable life. They give character to the vegetation of many parts of the earth's surface, and, since they include the cereals, we must consider them as of as great value to man and animals as any other botanical group. This interesting flora, in striking contrast with the last mentioned, is of comparatively modern date, and is now at its period of greatest development. Some doubt has been expressed in regard to the date of the appearance of monocotyledonous plants on the globe, but up to the present time very few traces of them have been found in Palæozoic rocks. That this order existed and contained flowering plants in the Carboniferous age, seems proven by the discovery of a flower-spike, called *Pothocites*, in the coal-measures of Scotland. In the Triassic, Jurassic, and Cretaceous formations they are represented by many genera belonging to the families of the yuccas, the screw-pines, and the palms, while the Gramineæ and Cyperaceæ—the great inferior families of the order—do not appear earlier than the Tertiary. Palms appear in the Cretaceous, and have been found in strata of this age in various parts of America and Europe. The oldest representatives of the family are fan-palms, of the genus *Sabal*, similar to those growing in our Southern States. In the Tertiary age the monocotyledonous flora rapidly expanded until it assumed great importance, and we find there remains of a large number of species of grasses, sedges, lilies, etc., together with the earlier appearing and higher groups already mentioned. We thus see that the Endogens are not only of modern date, but that they begin in, and continue through, the Mesozoic ages, represented only by their highest groups, the inferior families coming in at a later date.

Exogens.—Full descriptions of all known exogenous plants could not be given in this entire work, as they make up much the greater volume of the present vegetation of the globe. The time-history of this group may, however, be much more briefly written, as they for the most part belong to the present or to a very recent geological age. Of the higher division of the Exogens—the Angiosperms—no unquestionable traces have been found in rocks older than the Cretaceous. There they came in—as it appears to us, suddenly and in great force and variety—and before the close of the Cretaceous age they had become the predominating type of vegetation, and the flora of the world had assumed nearly its present aspect. During the Tertiary epochs considerable additions were made to the group; among which are to be numbered some of the most beauti-

ful and useful of flowering and fruit-producing plants, and such as were best adapted to supply the wants of the great mammalian fauna that came on to the stage with them, and finally of man, the last and crowning member of the class. The inferior order of Exogens—the Gymnosperms, which include the conifers and cycads—have had a very different history, and one that offers another striking exception to the general order of progress which has prevailed in the organic world — viz. from the lower to the higher, the simple to the more complex. The conifers apparently began their existence among the first terrestrial plants, perhaps as far back as the later epochs of the Upper Silurian age. In the Devonian they existed in considerable numbers and attained large size, as numerous silicified trunks of coniferous trees have been found in the lower sandstones of Gaspé and in the Middle and Upper Devonian rocks of New York and Ohio. These have been described under the names of *Prototaxites*, *Dadoxylon*, *Nematoxylon*, *Ormoxylon*, etc.; the first of these is supposed by Dr. Dawson—as its name indicates—to have an affinity with the modern Taxineæ. *Dadoxylon* is allied, by the peculiar character of its dotted tissue, to the Araucarias, which, it may be said, constituted the most important group of conifers in both Palæozoic and Mesozoic times. Prof. Dawson refers the fossil woods found in the Upper Silurian rocks of both England and Canada to his genus *Prototaxites*, but by Mr. Carruthers these are considered as more probably the remains of Fucoids. In the Carboniferous age Araucarian conifers were abundant, and probably covered the highlands surrounding the coal-marshes with forests not unlike the pine forests of the present day. In the Mesozoic ages, *Walchia* of the Permian, *Voltzia* of the Triassic, and *Cunninghamites*, etc. of the Jurassic and Cretaceous, brought down the Araucarian line to the Tertiary, where the Sequoias in their great development formed the culminating group of this series. The few living species of *Sequoia* and *Araucaria*, such as the "red-wood" and "mammoth trees" of California and the Norfolk Island pine, afford us some indication of the grandeur and beauty of the forests which in ancient times were formed by this group. The pines and the firs (*Pinus* and *Abies*) apparently began in the Cretaceous age, since when they have been constantly increasing in importance, until they now constitute by far the larger part of the coniferous vegetation of the earth. Of the history of the other groups of conifers our limited space forbids more than the briefest notice. The yews made their appearance in the Tertiary, where the remains of four or five species have been found. *Podocarpus*—a genus now represented by 60 species inhabiting the tropics—began in the Mesozoic ages, and was quite abundant during the Tertiary. The genus *Larix*, of which there are eight living species, began in the Tertiary, and acquired there, at least, as great importance as it has now. *Taxodium* began in the Middle Tertiary, apparently with the two species that are now so widely spread over the North American continent. The arbor-vitæ (*Thuya*), with its allies, *Biota*, *Thuyopsis*, etc., began in the Mesozoic ages, where, as in the Tertiary, they constituted a striking and important feature in the flora. *Glyptostrobus*, one of the most beautiful and widespread conifers of the Tertiary, is now represented by a single species growing in China. *Salisburia* (the ginko, one of the most remarkable of living conifers) began in the Cretaceous, and was apparently widespread and flourishing in the Tertiary age. It has now but a single representative.

The Cycads, which apparently connect the conifers with the palms and ferns, made their first appearance in the Carboniferous. To this group the very abundant coal-plants known as *Nœggerathia* and *Cordaites* probably belonged, and we have reason to believe that the flowers and fruit of the latter are known as *Antholithes* and *Cardiocarpon*. In the Mesozoic ages the Cycads became, if not the predominating, at least the most characteristic, forms of vegetation. They then replaced the gigantic Acrogens of the coal-flora, and reached their golden age, which in botanical history is called the "age of Cycads." This extends from the beginning of the Triassic to the middle of the Cretaceous age, when the Cycads were overshadowed and almost exterminated by the development of their congeners the conifers, and the advent of the Angiosperms. In Tertiary time the Cycads filled the same subordinate position in the vegetable world that they now occupy.

Angiosperms.—The details of the history of this highest, most modern, and prevailing type of vegetation would occupy far more space than the necessary brevity of this article will allow. This subject, indeed, more properly belongs to recent botany, and will be found referred to elsewhere. As has already been mentioned, the Angiosperms make their appearance abruptly in great numbers in the upper part of the Cretaceous formation. The minor and herbaceous elements in this flora have left almost no traces, and our view is limited mainly to the arborescent vegetation. This we find to have assumed at once nearly the aspect of that of the present day. A large number of living genera formed part of the first broad-leaved forests of which we have any knowledge. *Quercus*, *Populus*, *Platanus*, *Salix*, *Fagus*, *Sassafras*, *Liriodendron*, *Magnolia*, *Liquidambar*, *Betula*, *Ficus*, *Acer*, *Juglans*, and a number of other living genera, were here well represented. Special interest attaches to certain members of this group—namely, *Magnolia*, *Platanus*, *Liriodendron*, *Sassafras*, and *Liquidambar*—as the living species of the genera, though few in number and restricted in their range, include some of the noblest and most beautiful of living trees, and they were formerly much more numerous, and were spread over North America, Europe, and perhaps Asia. *Liriodendron* has but one living species, but the genus began in the Cretaceous in America, and in the Miocene Tertiary age a species hardly different from our tulip tree grew in Greenland, Iceland, and on the continent of Europe as far south as Italy. *Sassafras* has now but two living species—one growing in North America, the other in Java; but this is also a genus that dates back to the Cretaceous, and was the associate of the tulip tree during the Tertiary in Europe and the Arctic regions. The *Magnolias* have been a marked feature in the American forests ever since the advent of the Angiosperms in the Cretaceous. They were also common in Europe during the Tertiary, and traces of them have been found there in the Upper Cretaceous rocks, but none are now living there unless introduced. America has now two "planes," both noble trees, but species of *Platanus* were growing here in the Cretaceous age, and in the Tertiary were other species, two of which had leaves sometimes eighteen inches in diameter; and they must have been much more imposing than those now living. Hence, we see that, like our grandest conifers, the Sequoias, some of the most beautiful of our broad-leaved forest trees are only the lingering remnants of a splendid arborescent flora which covered our continent in past ages.

Floras of the Different Geological Ages.—In the preceding notes the life-history, so far as it is known, of each of the more important groups of plants has been briefly sketched. A few words are yet needed, descriptive of the grouping of plants in the different geological ages, in order to convey a definite idea of the changes that have taken place in the vegetation of the globe.

Eozoic Flora.—No distinct traces of plants have yet been found in the Eozoic rocks, and it is doubtful whether any such will ever be discovered, since their metamorphism is so complete that their fossils of all kinds have been pretty much obliterated. We find, however, in the Laurentian rocks beds of graphite which rival in magnitude the coal-beds of later date, and everything indicates that, like beds of coal, they have been formed from vegetable tissue. Whether the plants from which this carbon was derived were terrestrial or aquatic, we have no means of determining, but the purity of the deposits is in some cases such that it seems almost impossible that they could have been marine. Prof. Hunt has suggested that these beds of graphite may be of animal origin, but we have no example in subsequent geological history of the accumulation of animal carbon in anything like such quantity and purity.

Cambrian Flora.—Many so-called Fucoids occur in the Cambrian rocks of England, but they are for the most part casts of annelid burrows. In the "fucoidal sandstone" of the Lower Cambrian of Sweden and in the Arenig rocks of Wales unmistakable plant-remains are found which have been described as Exogens, and given the name *Eophyton*. The true character of these fossils is, however, very doubtful, and they afford no satisfactory proof of the existence of higher plants than sea-weeds in this age.

Lower Silurian Flora.—As has been mentioned, all the plants of the Lower Silurian, so far as yet known, are Fucoids. These are quite abundant, but generally show no traces of structure, and their affinities cannot be definitely determined. Certain casts, apparently of plant-stems, found in the Lower Silurian rocks near Cincinnati, have been pronounced by Lesquereux to be species of *Sigillaria*, but this conclusion is not sustained by any evidence yet adduced. Carbonaceous matter is extremely abundant in some portions of the Lower Silurian system, especially in the Utica slate, but it is there apparently derived from Fucoids, or perhaps from animal organisms. In the Lower Silurian rocks of Ireland beds of anthracite occur from one to twelve feet in thickness, sufficiently pure to be used as fuel, but no distinct plant-impressions are associated with them.

Upper Silurian Flora.—Up to the present time most of the plants taken from the Upper Silurian strata are unmistakably sea-weeds. Prof. Dawson has, however, reported the discovery of *Psilophyton* in the Gaspé limestones, and this genus, which is largely developed in the Devonian, is either a Lycopod or a connecting link between the Lyco-

pods and Ferns. Lycopodiaceous plants have been discovered by Geinitz in the Upper Silurian of Lobenstein, Germany, and by Barrande in Bohemia; so that we have satisfactory evidence of the existence of land plants near the close of the Silurian age.

Devonian Flora.—Fucoids are abundant in the Devonian rocks, and some of them have been already referred to (*Spirophyton, Dictyophyton, Aphantemia*, etc.). In the Corniferous limestone of Ohio several tree-ferns and branches of *Lepidodendron* have been found, which were probably floated from an island situated where Cincinnati now is. These indicate the existence of a highly organized acrogenous flora on the land at that time; and it is almost certain that these arborescent plants were associated with many smaller species of which no traces have yet been discovered. In the Middle and Upper Devonian the remains of an abundant and varied flora have been met with in different countries, especially in New York and Canada. From these localities Prof. Dawson has obtained and described more than 100 species, which include various conifers already enumerated, and species of most of the genera of plants found in the coal-flora. Devonian plants have also been found at Perry, Me., at Lewis's Tunnel, W. Va., and at various localities in Ireland and Scotland. The most striking features in this Devonian flora are the many genera of conifers and tree-ferns, and especially the species of *Psilophyton*, the latter nowhere occurring in rocks of later date. The species of *Lepidodendron, Sigillaria, Syringodendron*, etc. are comparatively few and small, and it is evident that in the Devonian flora the Ferns constituted a much more important element than the Lycopods, both as regards numbers and size. From the Hamilton beds of Western New York, Prof. Dawson has received specimens of fossil wood which he has described under the name *Syringoxylon*, and has referred to the Angiosperms. Further observation is required, however, before the existence of plants of this order in the Devonian age can be considered as proven.

Carboniferous Flora.—The flora of this age is now so well known that no detailed description of it is here necessary. Including stems, leaves, and fruits, the number of species of plants already described from the Carboniferous system exceeds 500. Of these by far the larger part are Ferns, of which, however, the arborescent forms seem to have been rare. The next group in importance, and far exceeding the Ferns in dimensions, are the Lycopods, represented by *Lepidodendron, Sigillaria*, etc. After these come the *Equiseta*, including the genera *Calamites, Calamodendron, Asterophyllites, Sphenophyllum, Annularia, Volkmannia, Huttonia*, etc. Some of this group were arborescent in their habit, while others were aquatic, either immersed or floating. These singular plants must have constituted a peculiar and beautiful feature in the Carboniferous flora, and one of which we can get no adequate idea from our little scouring-rushes. The Cycads were apparently represented in the coal-flora by *Cordaites, Nœggerathia, Whittleseya*, etc.; the Endogens by a few flowering plants. The conifers were unquestionably abundant during the Carboniferous age, and grew to the size of our pines. They belonged, however, to the Araucarian branch of the family. They were for the most part confined to the highlands, where their trunks and leaves were rarely preserved; but in the sandstones of the coal-measures—which mark periods of inundation—their silicified trunks are not unfrequently met with. The fossil fruits found with the coal-plants are often exceedingly numerous, and mainly belong to the genera *Trigonocarpon* and *Cardiocarpon*. Of these, the first has been compared to the fruit of *Salisburia*, and hence has been supposed to belong with some coniferous plant; but no known conifer is correspondingly abundant, and these nuts were probably borne by some of the species of *Sigillaria*, which, as has been stated, seems to be intermediate between the Lycopods and Gymnosperms. The *Cardiocarpa* were probably the seed-vessels of *Cordaites*, a Cycad.

The Permian flora is essentially a continuation of that of the Carboniferous period, and no palæontological reasons exist for separating the two formations.

The Triassic Flora.—Passing from the Palæozoic to the Mesozoic ages, we enter a new world, both as regards plants and animals. The most noticeable trees of the Trias are the peculiar conifers *Albertia* and *Voltzia*. They are both Araucarians, but quite different from those which preceded and followed them. Ferns were numerous in the Triassic age, but, as we infer from the collections made in the coal-basins of Richmond and Los Bronces, they were for the most part of different genera from those found in the Carboniferous rocks. They were also very much less numerous. The *Calamites* of the Carboniferous age have a feeble representation in the Triassic, but these die out and give place to true *Equiseta*. The great Lycopods of the coal-period seem to have all perished at the close of the Palæozoic ages, as we find no traces of them in the Triassic. The most conspicuous and characteristic feature in the Triassic flora is the great development it exhibits of the family of Cycads. These were so numerous, so varied and showy, that they have caused the chapter of botanical history which includes the Triassic and Jurassic ages to be entitled the "reign of Cycads." The flora of the Trias has, as yet, been imperfectly studied in America, but large collections of Triassic plants have been made in the coal-basins of Richmond, Va., Deep and Dan Rivers, N. C., at Los Bronces, Sonora, and at Abiquia, N. M. Descriptions of these have not yet been published, but they form a flora essentially like that of the Trias in the Old World, being composed of the same genera, and in part of the same species. The most striking of American Triassic plants are Cycads of the genera *Otozamites, Podozamites*, and *Pterozamites*, and also the great monophyllous Ferns (*Tæniopteris*). Silicified trunks of coniferous trees are in some places exceedingly abundant in the American Trias, and show that forests of gigantic trees covered portions of the continent in that age. Not a trace of an Angiosperm has, however, as yet, been found among all the Triassic plants.

The Jurassic Flora.—No Jurassic plants have yet been met with in America, but in the Old World a long list of genera and species has been made from those taken from the Lias and Oolite of England and the Jura of the Continent. In all its most characteristic features the Jurassic flora resembles the Triassic, and their differences are too much matters of detail to be enumerated here.

The Cretaceous Flora.—During the first half of the Cretaceous age the Cycadaceous flora of the Trias and Jura seems to have continued without marked change. At the period of the deposition of the Lower Cretaceous strata of America—equivalent to the Middle Cretaceous of Europe—a revolution had, however, taken place in the plant-life of the globe, and the "reign of Angiosperms" had been inaugurated. In the Lower Cretaceous sandstones of New Jersey, Kansas, and the Far West, the remains of at least 100 species of arborescent Angiosperms have been found, and with these scarce a trace of Cycads, and very few Ferns. This formation is the result of the invasion of the continent by the sea, and the accumulation along the advancing shore-line of beds of sand which included leaves and tree-trunks, washed from the neighboring land. We have, therefore, in this deposit proof that between the time of deposition of the Upper Triassic strata and the formation of the first of our series of Cretaceous rocks, the continent was overspread with forests of broad-leaved trees which, in size and variety, rivalled the forest growth of the present day; and also that in this ancient forest were oaks, sycamores, magnolias, beeches, willows, and other genera which are among the most common and characteristic trees of our present flora. The origin of this great group of Angiospermous trees is, as yet, entirely unknown to us. Possibly, connecting links will yet be discovered between the floras of the Trias and Cretaceous, but as far as our observation yet extends the transition is sudden from the Cycadaceous forests of the Trias, in which not a trace of an Angiosperm has been found, to the Angiospermous forests of the Cretaceous, which, so far as yet known, contain no Cycads. The Upper Cretaceous strata of the Far West—Colorado, Wyoming, Utah, etc.—contain important beds of lignite, and associated with them a large number of fossil plants. Some 250 species have been described from this formation, mostly from detached leaves. The aspect of the flora they represent is so modern that the strata which contain it have been considered by Lesquereux as Eocene Tertiary; but, aside from the fact that no plants from these beds are certainly identical with Eocene species, the plant-bearing strata are intercalated with, or overlaid by, others which contain so many well-marked Cretaceous mollusks and vertebrates that there can be no reasonable doubt of their Cretaceous age. The coal-strata of Vancouver's Island also contain many impressions of angiospermous leaves, and these, too, have been pronounced Eocene by Lesquereux. The evidence is, however, overwhelming that they are Cretaceous. One of the most distinctly marked plants found on Vancouver's Island is *Sequoia Reichenbachi*, a well-known European Cretaceous plant. It also occurs in Alameda co., Cal., associated, as on Vancouver's Island, with *Baculites* and *Ammonites*.

The Tertiary Flora.—The Angiosperms predominate in the Tertiary flora, and the generalities of its features have been already given in what has been said of the life-history of that group. The flora of the Tertiary is also so varied that any detailed description of it would carry this article far beyond its prescribed limits. A few general conclusions, drawn from the observations made on the Tertiary flora, are therefore all that can with propriety be added to the notes already given.

1st. Everything indicates that the flora of the Tertiary was directly derived from that of the Cretaceous age, and

has in turn given birth to the flora of the present day; the most common genera of the Cretaceous Angiosperms having living representatives, and some of these running back into the Tertiary; *e. g. Onoclea sensibilis, Taxodium distichum, Corylus Americanus*, etc.

2d. No traces have been found in America of the Indo-Australian flora which flourished in Europe in the Eocene period; such plants as have been obtained from our Eocene strata belonging to the temperate flora which has prevailed over so much of America since the Cretaceous age.

3d. Fan-palms grew in the Miocene period as far N. as the line of the British possessions, indicating a climate as warm as that of New Orleans at the present time.

4th. In the Miocene Tertiary luxuriant vegetation covered the northern portions of the continent, even to the Arctic Sea, and at least 100 species of arborescent plants have been obtained from the Miocene beds of Alaska, British America, and Greenland.

5th. So large numbers of the Arctic American Miocene species are found in European deposits of the same age that we are compelled to infer a land connection between the two continents in this age; also this community of character has been considered indicative of the colonization of Europe by the American Angiospermous flora in the Miocene age. The similarity of the flora of Japan to that of Eastern America would seem to indicate a connection also between America and Asia in the Tertiary.

6th. The Pliocene flora of Central and Eastern America shows no marked changes from the Miocene, but approaches more to the vegetation of the present time, the proportion of living species becoming greater. In Europe also the Pliocene flora resembles the present European flora more than does the Miocene flora, but the difference is due to the gradual disappearance of the American types common there during the Miocene, and the substitution of probably Asiatic forms better suited to a cooler climate.

7th. With the approach of the Glacial period the temperate flora of the Tertiary was driven southward, where it could retreat; where it could not, it was destroyed, and even the lowlands were occupied by an arctic vegetation. When, however, the climate ameliorated after the Ice period, the boreal plants moved northward, or climbed mountains where they found a permanent arctic temperature. This is proven by the distribution of alpine species, and in the community of character exhibited in the detached and often widely separated colonies of arctic plants.

General Divisions of the History of Plants.—If we now take a retrospective view of the ground gone over, and combine the facts briefly stated on the preceding pages, we shall find that the history of plant-life is susceptible not only of a division into epochs, as we have already divided it, but also into ages. Of these there are four, each of which is characterized by the prevalence and predominance of one of the great groups of plants. Following the example of the palæontologists who have traced the history of animal life, we can designate each of the great botanical ages by the name of the reigning type of plants, as follows:

1st. *The Reign of Thallogens.*—This includes the Cambrian and Silurian divisions in geological history. During this age the sea-weeds were the prevailing and almost the only existing type of plants.

2d. *The Reign of Acrogens.*—This includes the Devonian and Carboniferous ages, and was marked by the great development of Ferns, Lycopods, and Equiseta, which were not only the highest and most prevalent forms of vegetable life, but attained greater dimensions and higher rank than they did at any subsequent period.

3d. *The Reign of Gymnosperms.*—This reaches from the beginning of the Triassic to the middle of the Cretaceous, and during this botanical age the Cycads and conifers overspread the earth, and acquired greater relative and absolute consequence than at any time before or since.

4th. *The Reign of Angiosperms.*—This is marked by the sudden advent and rapid expansion of the Angiosperms at the middle of the Cretaceous age; since when they have maintained their supremacy on the surface of the globe, apparently increasing in numbers and perfection of organization to the present day.

The exceptions to the general rule of progress expressed in the above table should not be here forgotten, as they have an important bearing on the question of the cause of this advance which seems to have prevailed in plant-life considered as a whole, and on the origin of the almost infinite diversity which we see in the flora of the present day. These exceptions are, briefly—1st, the early appearance of the conifers, which came in at the close of the Silurian or in the beginning of the Devonian age, and have since held on the "even tenor of their way;" 2d, the rapid development of the Acrogenous flora of the Devonian, and its attainment of higher rank in the Devonian and Carboniferous ages than any Acrogens have held since; 3d, the introduction of the Endogens at the close of the Carboniferous or beginning of the Mesozoic age, with the highest groups of the order, the lower appearing subsequently; 4th, the modern date of mosses, liverworts, lichens, and fungi, when all these hold a low place in the scale, and in regular order should have appeared in the earlier geological ages.

J. S. Newberry.

Fossil Fishes. Like most other aquatic animals, fishes at death are often buried in the sediments which accumulate at the bottom of the water in which they live. Here their remains are almost beyond the reach of change, and are indefinitely preserved. Hence, like mollusks, radiates, and crustaceans, fishes are frequently found in the stratified rocks, which are consolidated sediments that in former ages accumulated at the bottom of salt or fresh water. Already many hundred species of fossil fishes have been obtained from the strata of the different geological formations, and they constitute an exceedingly interesting and important element in the life-history of the globe.

The sediments which accumulate at the bottom of the open sea are calcareous, and these contain the remains of pelagic fishes—sharks, etc.—while along the shores, and in bays, rivers, and lakes, mechanical sediments—clay and sand—are deposited, and fishes and other marine animals, on sinking to the bottom, will be here preserved in what subsequently become strata of shale and sandstone.

Since all the organisms possessing hard parts—like shells, bones, teeth, and spines—are sure to leave some record of their existence in the sediments of the medium in which they live and die, we ought to find traces of fishes in the strata deposited during all the ages in which fishes existed. It is indeed probable that we have done so, since the remains of fishes have been found in all of the geological formations of more recent date than the Lower Silurian. The rocks of that age seem to afford a very full record of the fauna then existing; but though the most minute and careful search has been made in many countries, no well-marked remains of fishes have been anywhere found in them. We therefore conclude that no fishes lived in the Lower Silurian seas.

In ascending the geological scale traces of fishes are first met with in the upper portion of the Upper Silurian system. In America the Upper Silurian rocks have as yet yielded no fish-remains, but fishes have been found in strata of this age in England, Russia, Germany, and Bohemia. In the deposits of later date the remains of fishes become more and more abundant as we approach the present time, and the study of this series of fossils has thrown much light on the life-history of the globe. As is the case in other departments of palæontology, most fossil fishes are different from those now living, and they form many orders, families, genera, and species which are now extinct.

As among mollusks, crustaceans, radiates, and vertebrates of other classes, the most ancient fossil fishes are most unlike those living at the present time, and the sequence of forms which the fossil fishes of the different ages present has an interesting and important bearing upon the great questions of the origin and development of life which now occupy the attention of scientific men. The study of fossil fishes has only recently been taken up, our knowledge of them is yet very imperfect, and every year sees some important additions made to it. The conclusions deduced from it are therefore to a certain extent provisional, and such as are liable to be considerably modified by future discovery. The revelations which have been made through the labors of Agassiz—who should be considered the father of fossil ichthyology—of Hugh Miller, Pander, Owen, Egerton, Huxley, Lutken, and others are, however, of the greatest interest and value, and are such as permit us to indicate the generalities at least of the history of ichthyic life on the earth. The knowledge we have gained on this subject may be briefly summarized as follows:

1st. Fishes constitute the lowest group of vertebrate animals, and they are the first of vertebrates to make their appearance in geological history.

2d. The earliest traces of fishes are found in the Upper Silurian rocks of the Old World, and, according to our present knowledge, in the Devonian strata of America. The next higher group, amphibians, appear first in the Lower Carboniferous, true reptiles in the Upper Carboniferous and Permian, mammals in the Trias.

3d. The oldest fishes known were of small size and few in number as compared with the associated forms of life. They belong to two groups — viz. the Elasmobranchs (sharks, etc.) and the Cephalaspids, or buckler-headed fishes, a group long since extinct, and which will be described farther on.

4th. The seas of the Devonian age were well stocked with fishes, some of which attained a size scarcely inferior to the largest now living. They belonged to the sub-classes of the Elasmobranchs, Placoderms, and Ganoids. The De-

vonian fishes collected in America are mainly from open-sea deposits, are as yet comparatively few in number, and are mostly of large size. In the Old World the fishes obtained from Devonian rocks include a great number of genera and species, are generally imbedded in mechanical sediments, are for the most part small, and were probably the inhabitants of rivers, bays, and other shallow waters In consequence of the abundance of fishes found in the Devonian rocks, this chapter in the life-history of the globe has been called the "Age of Fishes."

5th. In the Carboniferous age fishes were numerous and varied in structure, but they were no longer the monarchs of the animal world, as the sceptre here passes from them to the amphibians, into which they pass by insensible gradations. In the open seas of the Carboniferous age sharks existed in large number and attained great size, the great Placoderms and Ganoids of the Devonian age, to which the Elasmobranchs had been subordinate, having mostly disappeared. In the rivers, lakes, and bays of the Carboniferous continents numerous Ganoids, large and small, existed, among which may be mentioned the huge carnivorous *Megalichthys* and *Rhizodus*, and their prey, the small, elaborately ornamented Ganoids, *Palæoniscus*, *Cœlacanthus*, *Amblypterus*, and *Eurylepis*.

6th. In the Trias the fishes were altogether subordinated to the amphibians, but from the nature of the Triassic deposits we have a very imperfect view of the fish-life of the period. The rivers, lakes, and bays were, as we know, inhabited by shoals of small Ganoids—*Palæoniscus*, and the allied genera, *Catopterus*, *Ischypterus*, and *Dictiopyge*—for we find their remains in the lagoon and estuary deposits of Richmond, New Jersey, the Connecticut Valley, etc. In the Old World the Trias has furnished, with many other fishes, the teeth of *Ceratodus*, supposed to be generically identical with barramunda, a Dipnoan of Australia.

7th. The fishes of the Jurassic were sharks and Ganoids, and were very numerous. The sharks were mostly Cestracionts, allied to *Cestracion Philippi*, the Port Jackson shark; the Ganoids had rhomboidal scales and tails but slightly vertebrated. Of these there were many genera and species. They were mostly small, but the largest (*Lepidotus*) was six feet in length and very robust.

8th. The Cretaceous age is marked in the history of fishes by the appearance of the great sub-class of the Teleosts, or true bony fishes, such as the salmon, pike, etc. They constitute the majority of the fishes of the present day, and are generally placed at the summit of the class of fishes. In these we find the vertebral column bony throughout, and tail equally lobed.

9th. In the Tertiary age the Teleosts gradually superseded the Ganoids, while the sharks attained dimensions unknown before or since, the largest (*Carcharodon megalodon*) having attained a length of 50 to 60 feet, with cutting teeth as large as one's hand.

10th. In the present age the Teleosts have almost entirely replaced the Ganoids, and have become the prevailing type of ichthyic life. The Ganoids, if we exclude from them the Dipnoi, are now reduced to seven genera—viz. *Acipenser*, *Lepidosteus*, *Amia*, *Scaphiorhyncus*, *Polyodon*, *Calamichthys*, and *Polypterus*; of these, the first is common to all parts of the northern hemisphere, the succeeding four are exclusively North American, while the last two are African. If we accept Dr. Gunther's classification, and unite the Dipnoi with the Ganoids, we must add two more to the list of the living genera—viz. *Lepidosiren* and *Ceratodus*, the three species which represent these inhabiting, one South America, one Africa, and one Australia.

The classification of fossil fishes is a matter of considerable difficulty; their soft parts have always disappeared, and generally more or less of the bony structure is wanting. Hence, it is often impossible to determine their exact relations to each other or to living species. There are also so many missing links in the chain of succession that the origin of the diversified forms which we find in the class is beyond the reach of our present (and it may be of all our future) knowledge. The fauna of the sea contained in each of the great geological formations is a single chapter in a long history, and one which is not only disconnected with those which precede and follow it, but is perhaps separated from them by long intervals of which we have as yet no record. Could we follow the seas in their ebbs and flows, and thus get a connected history in the sediments deposited from them, we should doubtless there learn what was the true origin of the class of fishes, and by what influences the little group of pioneers, of which we have discovered the remains in the Upper Silurian rocks, became so much expanded and diversified in after times. The oldest of fishes known to us, though comparatively few and small, and having a less complex (and, as we may say, less perfect) organization than most of the fishes of the present day, are still much more highly organized than some living fishes, if we include *Amphioxus*, *Petromyzon*, and *Myxine* in the class, and are certainly far from being embryonic in character. It may also be said that they are so far removed from the crustaceans and mollusks with which they are associated as to offer no suggestions of relationship or derivation. So, too, in tracing the subsequent history of fishes, the new forms with which we meet seem to come in and go out abruptly; that is, the evidences of transmutation are wanting, so that, however probable it may be from extraneous considerations that the later forms are all derivations from the earlier, the proof of genetic relationship is yet wanting. A large part of the missing links may be hidden in the blanks of the record, but, as we now see it, the "genealogical tree" of fishes looks more like a bundle of independent shoots rooting at different levels than a single trunk with divergent branches. A certain progress is, however, distinctly discernible in the successive phases of fish-life presented in the different geological ages. For example: as a general, and perhaps universal rule, in all the older fishes the spinal column was cartilaginous, while at the present day nearly all fishes have bony vertebræ. So all the ancient fishes have vertebrated tails—that is, the vertebral column was prolonged over or through the caudal fin—while in most modern fishes the spinal column terminates abruptly in a semicircular bone from which the fin-rays radiate equally. The Teleosts of the present time generally have the spinal column composed of bone, but they are for the most part destitute of the cumbrous offensive and defensive armor with which the older fishes were loaded. This is an evidence of superiority, as it indicates the substitution of sentient nerve for insensible bone. The active and intelligent Teleosts were more than a match in the struggle of life for the sluggish and heavy-armed Ganoids and Placoderms, just as man unarmed is the superior of brutes, however well furnished with weapons. There are, however, some facts in the history of fishes which cannot be explained through any suggestions yet made by material philosophy. These are—1st. The Elasmobranchs have continued to exist in great numbers since the Silurian age, and are now perhaps as numerous and powerful as ever, while they have apparently undergone no considerable change of structure, but have retained their embryonic features of a cartilaginous skeleton and vertebrated tail unmodified. 2d. The living Ganoids, such as our sturgeons, gar-pikes, etc., though few in number, counting genera and species, are in individuals numerous, powerful, and apparently prosperous. These, however, we find to have so far followed the prevailing fashion as to have substituted bony vertebræ for the cartilaginous spines of their predecessors, and to have adopted in some cases homocercal instead of heterocercal tails. 3d. The Dipnoi (*Lepidosiren*, etc.) are, judging from their organs of respiration and circulation, the highest of fishes, and are apparently a connecting link between fishes and amphibians, but in them the vertebral column is cartilaginous.

Several different systems of classification of fossil fishes have been suggested, of which the first and simplest is that of Agassiz. He divided the class of fishes into four orders, distinguished by the character of their scales—viz. *Placoids* (sharks, rays, etc.), *Ganoids* (fishes with bony and enamelled scales and plates, including Ganoids proper, Placoderms, *Cephalaspis*, and Acanthodians), *Cycloids* (fishes with smooth circular scales, like the salmon), *Ctenoids* (fishes with serrated scales, like the perch). Subsequently, Müller, Owen, Huxley, Lutken, Gunther, Cope, and Gill have proposed systems of classification of fishes including more or less of the fossil forms.

The orders into which Huxley divides the class PISCES are as follows: 1, PHARYNGOBRANCHII (*Amphioxus*); 2, MARSIPOBRANCHII (lamprey and hag); 3, ELASMOBRANCHII (sharks, rays, and chimeras); 4, GANOIDEI (Ganoids); 5, TELEOSTEI (bony fishes); 6, DIPNOI (*Lepidosiren*, etc.).

Some of the more recent writers on the classification of fishes exclude the Pharyngobranchii and the Marsipobranchii from the class PISCES; and as they do not occur in the fossil state, they need not be further considered here. Of the four remaining orders of Huxley, Dr. Gunther unites the Dipnoi with the Ganoidei, being led to this conclusion by his studies of the barramunda, with which he associates *Ceratodus* of the Carboniferous and *Dipterus* of the Devonian. He also unites all the Ganoids of Agassiz, including the Dipnoi with the Elasmobranchs in one group, *Palæichthes*, which includes all the Palæozoic fishes. He also suggests that the Elasmobranchs were the *marine* Palæichthes, while the Ganoids were the *fresh-water* Palæichthes. To this rule there are, however, some marked exceptions, as the huge Ganoids—*Dinichthys*, *Onychodus*, etc.—inhabited the Devonian seas, while in the sediments of the lakes, rivers, and bays of the Carboniferous age we find the spines of sharks which must have been of great size (*Gyracanthus*, *Ctenacanthus*, *Edestus*, etc.). The truth seems

to be, that in the Devonian age the Ganoids—including Placoderms—were greatly developed, inhabiting and ruling alike deep and shallow, salt and fresh waters, while in the Carboniferous the Elasmobranchs correspondingly predominated, and the Ganoids were driven from the sea, and even in lakes, rivers, and bays maintained with the Elasmobranchs and amphibians an unequal struggle.

The following schedule will represent the more detailed classification of fossil fishes according to the present state of our knowledge:

CLASS PISCES.

SUB-CLASS ELASMOBRANCHII.

Order 1, Squalidæ.	3, Chimæroidei.
2, Raidæ.	

SUB-CLASS GANOIDEI.

Order 1, Amiidæ.	6, Placodermi.
2, Lepidosteidæ.	7, Acanthodidæ.
3, Crossopterygidæ.	8, Pycnodontidæ.
4, Chondrostidæ.	9, Dipnoi.
5, Cephalaspidæ.	

SUB-CLASS TELEOSTEI.

Order 1, Physostomi.	4, Pharyngognathi.
2, Acanthini.	5, Lophobranchii.
3, Acanthopteri.	6, Plectognathii.

1. *Elasmobranchii.*—As has been stated, the Elasmobranchs seem to be represented in the oldest remains of fishes known, and they have continued to exist in large numbers from the Devonian and Carboniferous ages to the present day. The earliest Elasmobranchs seem to have been sharks. Some of them had very much the structure, and probably the habits, of our living sharks, but much the larger number belonged to families nearly or quite extinct, such as the *Petalodonts, Hybodonts,* and *Cestracionts;* the latter represented in the living Port Jackson shark. The Rays began with the Carboniferous, and have been increasing in importance up to the present time. The Chimæroids are now represented by two genera only, *Chimæra* and *Callorhynchus,* of which there are but three or four species living. Until recently the Chimæroids were supposed to have begun in the Jurassic, and to have attained their maximum development in the Tertiary, but the discovery of the teeth of the genus *Rhyncodus* in the Corniferous limestone of Ohio proves that they date back to the Devonian age.

2. *Ganoidei.*—This group, as at present constituted, includes among its living and fossil genera a multitude of forms which seem to have but little in common, and since the soft parts of the fossil species have disappeared, it may never be possible to determine with accuracy the precise relations of the different fishes which are now grouped under this name. All those now associated together have these characters in common, however—that the head is roofed with bony plates covered with enamel; the body is usually protected with scales or plates, also covered with enamel; the tail is vertebrated, and the vertebral column is altogether or in part cartilaginous. The scaled Ganoids are divided into two groups, one of which has round, imbricating, and the other rhomboidal scales. In most instances also the tails of Ganoids are very unequally lobed, the vertebral column being prolonged into the upper lobe. The older Ganoids have this character most distinctly marked, while in some of the Mesozoic and modern species the tail is very slightly vertebrated, and has nearly the same form as in the Teleosts. In the living sturgeons it is, however, exceedingly heterocercal. In a peculiar extinct family of Ganoids, the *Cœlacanthini,* the tail is equally lobed, but the vertebral column is prolongated through its centre, and a minute supplemental caudal fin is borne by its extremity. The sub-class Ganoidei is divided into the following orders:

1. *Amiidæ.*—In this group are included Ganoids which have cycloidal scales, a præoperculum, a single median jugular plate, branchiostegal rays, non-lobate paired fins, and heterocercal tails. The vertebral column is ossified. The Amiidæ have but a single living representative (*Amia*), which inhabits the rivers of North America. During the Tertiary age several species of *Amia* lived in the great lakes then existing in the western part of this continent. Some of these were much larger than any now living. No more ancient traces of this order have been detected.

2. *Lepidosteidæ.*—This order includes the greater number of Ganoids known. They have rhomboidal and enamelled scales, a præoperculum, branchiostegal rays, non-lobate paired fins, and usually heterocercal tails. *Lepidosteus* (the gar-pike) is the living type of this group. Several species of this genus now inhabit the rivers and lakes of North America, and the remains of others have been found in Tertiary rocks. In the Cretaceous, Jurassic, and Triassic strata the Lepidosteidæ are represented by numerous genera—*Dopedius, Lepidotus, Æchmodus,* etc.—and in the Palæozoic formations by *Palæoniscus, Amblypterus,* and *Eurylepis* in the Carboniferous, and perhaps by *Cheirolepis* in the Devonian.

3. *Crossopterygidæ.*—This order has recently been described by Huxley. Its most striking character is found in the lobate paired fins which have their central portions covered with scales. The scales of the fishes of this order may be cycloid or rhomboid. The dorsal fins are either two in number, or very long, single, or composed of many subdivisions. There are no branchiostegal rays. The jugular plates are two principal, with sometimes several supplementary ones. The tail is heterocercal or traversed centrally by the vertebral column (diphycercal). The living members of this order are *Polypterus* of the Nile, and *Calamichthys* of Western Africa, but many of the genera represent the Crossopterygidæ in the Devonian and Carboniferous formations—viz. *Osteolepis, Megalichthys, Holoptychius, Rhizodus,* the American genus *Onychydos,* and some others. A remarkable family included by Huxley in this order is the Cœlacanthini. These are represented in the chalk by *Macropoma,* in the Jurassic by *Undina,* in the Permian and Carboniferous by *Cœlacanthus.* All this family of fishes have hollow fin-rays—whence their name—elliptical jugular plates, two dorsals sustained by palmated interspinous bones, and diphycercal tails, through which the vertebral column extends, and bears at its extremity a minute supplementary caudal fin.

4. *Chondrosteidæ.*—In the fishes of this order the body is generally protected by bony plates, though sometimes naked. Neither the pectoral nor ventral fins are lobate. The branchiostegal rays are few or wanting; the tail is heterocercal, the teeth small or absent. The living members of this order are the sturgeons (*Acipenser*), which inhabit the rivers of all the northern hemisphere, and *Polyodon* and *Scaphiorhynchus,* found only in North America and Eastern Asia. In the Jurassic rocks the sturgeons are represented by *Chondrosteus,* and probably in the Devonian by *Macropetalichthys.*

5. *Cephalaspidæ.*—These form a remarkable group of small fishes which occur only in the Devonian and Upper Silurian rocks, and include the oldest fishes yet known. They have the head and the anterior part of the body covered with a bony shield, and the posterior portion with scales. The type of this order is *Cephalaspis,* and its other members are *Pteraspis, Auchenaspis, Scaphaspis, Menaspis,* etc. The relations of the Cephalaspids to living fishes are uncertain. Huxley has pointed out their resemblance to the Chondrosteans, comparing *Cephalaspis* with *Scaphiorhynchus,* and *Pteraspis* with *Polyodon* (*Spatularia*). Excepting one species of *Cephalaspis* (*C. Dawsonii*), found by Prof. Dawson in the Devonian rocks of Gaspé, none of the Cephalaspidæ have been found in America.

6. *Placodermi.*—This is the name given by Pander to a group of fossil fishes called Placoganoids by Owen, which includes *Coccosteus, Pterichthys, Asterolepis,* and *Heterosteus,* and also the gigantic fishes recently found in the Devonian rocks of Ohio, *Dinichthys* and *Aspidichthys.* In the Placoderms the head and anterior portions of the body were protected by a buckler or carapace composed of thick bony plates, which had the external surface studded with points of enamel. Behind this the body was either naked or covered with angular enamelled scales. The vertebral column was generally cartilaginous, but a *Coccosteus* with bony vertebræ is reported by Murchison to have been recently discovered. (*Siluria,* p. 478.) The affinities of the Placoderms are still matters of doubt and discussion. Huxley and Owen have both suggested their relationship with the living Siluroids, some of which have similar bony carapaces. Their dentition is, however, quite different, and that of *Dinichthys* and *Coccosteus* considerably resembles that of the Dipnoi. The Placoderms are eminently characteristic of the Devonian age, and the larger members of the group were not only the most highly organized, but were from their size and armament the most formidable, of then existing animals. In *Dinichthys,* the largest of the Placoderms yet discovered—of which two species have been found in the Huron shale of Ohio—was the most remarkable of all known fossil fishes. In dimensions it was gigantic, and it was furnished with offensive and defensive armor of the most formidable and effective character. Its size may be conjectured from the fact that a single plate occupying the centre of the back was more than two feet long and broad. The head was about three feet in diameter and length, the mandibles were two feet in length by six inches in depth, solid bone throughout.

7. *Acanthodidæ.*—These were small fusiform fishes, of which the remains are not rare in the Palæozoic rocks of the Old World, but have not yet been met with in America. Their geological range is from the base of the Devonian to the Permian. A large number of species

have been described by Agassiz, Sir Philip Egerton, and others in the genera *Acanthodes*, *Diplacanthus*, *Climatius*, *Parexus*, etc. The Acanthodians derive their name from the spines which are set at the anterior margins of the fins and elsewhere on the body. These spines are planted in the integuments like those of sharks. The surface of the body in the Acanthodians was covered with closely-set, shagreen-like scales. The vertebral column was cartilaginous, the cranium mostly so. By Prof. Agassiz the Acanthodians were regarded as Ganoids. Mr. James Powrie considers them as Elasmobranchs, while Prof. Huxley suggests that they are connecting links between the two.

8. *Pycnodontidæ.*—These, like the Acanthodians, are of somewhat questionable relations, though generally considered as Ganoids. In some points of structure they resemble the Plectognaths, Teleosts, *Balistes*, *Cestracion*, etc., but the spinal column was cartilaginous, and the dentition consisted of a series of bony and enamelled bosses set in a kind of pavement, and adapted to crushing mollusks and crustaceans. The Pycnodonts range from the base of the Carboniferous to the Tertiary, but are now all extinct. Though not uncommon in the Old World, few Pycnodont fishes have as yet been found in the rocks of America. *Platysomus* has been obtained from the coal-measures of Illinois, and *Pycnodus* from the green sand of New Jersey.

9. *Dipnoi.*—This order has among living fishes but three known representatives—viz. *Lepidosiren* (*Protopterus*) *paradoxa* of South America, *Lepidosiren annectens* of Africa, and the recently discovered *Ceratodus Fosteri* (the barramunda) of Australia. These are, however, of great zoological interest, as they seem to be a sort of connecting link between fishes and amphibians. They were, in fact, until recently, classed with the Amphibia, and were considered as the lowest order of this class. They are now, however, placed among fishes, of which they are regarded as the highest order. In their anatomical structure they exhibit a mingling of high and low characters. The heart has two auricles and one ventricle. The respiratory organs are double, consisting of gills in a branchial chamber, and also of true lungs in the form of a double cellular air-bladder. The body is fusiform and fish-like, covered with cycloid scales. The fins in *Lepidosiren* are slender, many-jointed rods, of which the pectorals only have a narrow membranous fringe: in *Ceratodus* they are broader, and are all bordered with membranes. In contrast with the amphibian character which they present, the Dipnoans have a cartilaginous vertebral column, such as is found in the lowest groups of fishes. The interest of the Dipnoi has been increased by the researches of Dr. Gunther, who seems to have proved that the barramunda is generically identical with *Ceratodus* of the Trias, and also that quite a number of much more ancient fishes—such as *Ctenodus* of the coal-measures and *Dipterus* of the old red sandstone—also belonged to this group. Should this conclusion be confirmed, it will produce quite a revolution of opinion as to the classification of some of the older fishes.

Teleostei.—In the Teleosts the endoskeleton is well ossified. The cranium is largely bony, and the mandible is present. The gills are free, and a bony gill-cover and branchiostegal rays are always developed. A bulbus arteriosus exists at the base of the brachial artery, but this is never rhythmically contractile, and only a single row of valves separates it from the ventricle. None of the true Teleostei are proven to have existed before the Cretaceous age. Since that time, however, they have been constantly increasing in numbers and relative importance, until in the present age they outnumber all other forms of fishes. As the fossil Teleosts closely resemble the fishes of the present day, they can be best studied in connection with them, and therefore but few words will be given to them here.

Among the Cretaceous Teleosts one of the best known forms is *Beryx*, a Percoid genus which occurs in the Tertiary, and is now living in the Atlantic. *Osmeroides* is another common Cretaceous Teleost, of which we have no living representatives. It is supposed to be allied to the salmons. Of the most important living groups, the Clupeidæ (herrings) begin in the Cretaceous period. The Murænidæ (eels) appear for the first time in the Eocene. The Cuprinidæ (carp, etc.) commence in the Tertiary, and were numerous in the fresh-water lakes of that period. The Salmonidæ (salmon and trout) are of modern date, scarce any representative of the family being found in strata older than the Post-Tertiary. The Siluridæ (cat-fishes) are also nearly without representatives in the fossil state, unless, as has been suggested, the Placoderms were their progenitors. The Gadidæ (cod family) begin in the Eocene Tertiary. The Pleuronectidæ (flat-fishes) have one representative in the Eocene, but are rarely found fossilized.

Of the Percoid fishes (Acanthopteri), the perches, mullets, mackerels, gurnards, etc., nearly all the families and genera appear first in the Tertiary, but the Cretaceous date of *Beryx* has been already noticed.

The Plectognathi, which include the trunk-fishes, file-fishes, and globe-fishes, have some of the characters of the Ganoids, as the vertebral column is often cartilaginous and the exoskeleton consists of ganoid plates, scales, or spines. Of the Lophobranchii, which includes the singular pike-fishes and sea-horses, some Tertiary representatives are known, but they belong mainly to the present fauna.

J. S. Newberry.

Fos'sil Foot'prints. Soft mud that receives impressions made by the feet of animals in walking will retain the markings when the sediment has become hardened into stone. The first scientific notice of such impressions appeared in *Trans. Roy. Soc. Edinburgh* in 1828, by Dr. Duncan. The principal European localities are the worm-burrows of the old red sandstone of Forfarshire, and various English Carboniferous sandstones; the trails on Cambrian rocks; crustacean imprints in the Devonian flagstones of Scotland; fish-spine marks upon the Scottish Carboniferous rocks; reptilian and other tracks upon the Triassic of Great Britain and Saxony; crustacea in the Wealden, etc. In America are the crustacean impressions of Canada of Cambrian age; reptilian tracks in the Pennsylvania Carboniferous; crustacea and worms in the Clinton group in New York; and others. The best known are the 153 species of Ichnites described in the Massachusetts geological reports. First noticed by Pliny Moody in 1800, seen by Simeon Draper of Greenfield (Mass.) in 1835, thought by Dr. James Deane from their form and succession to be the footprints of birds, they were first described in print by Pres. E. Hitchcock in 1836. Those in the Connecticut Valley may be thus grouped: 1 marsupial; 17 thick-toed birds; 17 narrow-toed birds (?); 21 ornithic reptiles, the *Herpetoids* of Dana and *Dinosaurs* of English writers; 25 reptiles and amphibia; 17 batrachians; 6 chelonians; 2 fish; 24 insects; 21 larval and lower articulata; and at least 2 mollusca. The largest bird agrees in size and race with the *Dinornis* of New Zealand, discovered about 1839. The track of the *Otozoum*, the largest batrachian, is 20 inches long, and resembles the impression made by the *Cheirotherium* of England, save in the absence of one toe. One species of batrachian is named from the resemblance of saucer-shaped hollows, crowded together promiscuously, to the mud-nests made by living tadpoles. Some that seemed avian at first are now referred to the Dinosaurs. The Hitchcock Ichnological Museum at Amherst, Mass., contains over 20,000 ichnites, including the type-specimens of all the New England species. It was founded by Pres. E. Hitchcock, and now belongs to Amherst College.

C. H. Hitchcock.

Fos'sil For'ests. Petrified forests are frequently referred to in the notes of travellers taken in different countries, but it is more than doubtful whether any of the collections of petrified tree-trunks really deserve the name applied to them, as they generally, perhaps universally, consist of trees which have been buried in earth or rock, there silicified, and subsequently exposed by the washing away of the material which once surrounded them. The most celebrated of the fossil forests of which we have any record are those of Egypt near Cairo, of Nubia, of Silesia, and of the island of Antigua in the West Indies. Other accumulations of silicified wood are known to occur in the interior of Chili, in New Zealand, and in Abyssinia. It is also true that in the interior of our own continent, in Oregon, Nevada, and Arizona, as great and remarkable collections of silicified tree-trunks exist as any found in other parts of the world. On the banks of the Little Colorado, in Arizona, for example, not less than 1000 cords of silicified wood may be seen piled up in one locality. Here we find trunks, of all sizes up to six feet in diameter, most perfectly and beautifully preserved. Sometimes they are simply replaced by white silica, which shows the woody structure as distinctly as it could have been seen in the living tree; in other cases the trunks are now masses of solid jasper, looking like huge sticks of red sealing-wax; in other cases still, the wood is opalized or agatized, or filled with chalcedony or crystallized quartz, stained with the most brilliant colors. In this region the history of the vast accumulation of silicified tree-trunks is easily read, and it will probably serve to explain many similar cases. The banks of the Little Colorado are formed of Triassic marls, here more than 1000 feet in thickness. These contain immense numbers of silicified trunks of coniferous trees. As the marls are very soft, they have been extensively eroded, leaving the silicified wood either on the surface—where trees 40 to 60 feet in length may often be seen, with all their parts in contact—or accumulated at the bottom of the slopes bordering the valleys from which the marls have been removed. Hot water has much greater

power than cold to dissolve silica; and it is probable that thermal waters have had much to do with the silification of the tree-trunks in the localities where they are found in great numbers. In our own country we know that volcanic phenomena have been displayed on a grand scale throughout all the region where we find the fossil wood; and it is also a district in which thermal springs carrying large quantities of silica are still numerous, and are now displaying their petrifying powers. We have reason to believe that in the later geological ages hot springs were even more abundant, and we may conclude they were more potent, than they now are. What we know of the geology of the island of Antigua is confirmatory of the view that thermal waters have played an important part in the silification of the fossil wood found there; and this will very likely prove true in regard to the other cases cited.

In the drift deposits of Southern Ohio is found an old soil in many places thickly strewed with interlaced prostrate trunks of trees which grew upon it; and in a few cases these are found buried erect. This old forest was plainly submerged by the sinking of a land-surface or the elevation of the water-level over it, resulting in its burial beneath many feet of gravel and sand. As yet, the trees here are not mineralized, and have the appearance of partially decayed wood; but if the subsidence had been occasioned by volcanic action, and hot water had been poured out freely, we should undoubtedly have found the trunks silicified, as we do at the Cascades of the Columbia, where a volcanic outburst at a much later date buried quantities of trees and changed them to masses of silica.

J. S. NEWBERRY.

Fossil Fruits. See FOSSIL BOTANY, by PROF. J. S. NEWBERRY, M. D., LL.D., M. N. A. S.

Fossombro'ne (a corruption of the ancient *Forum Sempronii*), small town of Central Italy, in the province of Pessaro-Urbino, on the left bank of the Metauro. Its silk is considered the best in Italy. Pop., with surroundings, 8464.

Fos'ter, county in the N. E. of Dakota, traversed by the Shyenne and James or Dakota rivers. Area, 1764 square miles.

Foster, post-v. in Bracken co., Ky., on the Ohio River. Pop. 191.

Foster, tp. of Faribault co., Minn. Pop. 304.

Foster, tp. of Luzerne co., Pa. Pop. 2999.

Foster, tp. of Schuylkill co., Pa. Pop. 1001.

Foster, post-tp. of Providence co., R. I., on the Connecticut State line. In has considerable manufacturing interests. Pop. 1630.

Foster (ABIEL), b. at Andover, Mass., Aug. 8, 1735; graduated at Harvard in 1756; was pastor of a Congregational church, Canterbury, N. H., 1761–79; was sent in 1780, and often afterwards, to the legislature; was in the U. S. Congress 1783–84, 1789–91, and 1795–1803. In 1784 became a judge, and afterwards chief-justice, of the common pleas court of New Hampshire. D. at Canterbury, N. H., Feb. 6, 1806.

Foster (BENJAMIN), D. D., b. at Danvers, Mass., June 12, 1750; graduated at Yale 1774; was minister of the Baptist church in Leicester, Mass., 1776–82; preached two years in Danvers, Mass., and in Jan., 1785, was called to the First church in Newport, R. I.; after the autumn of 1788 was pastor of First Baptist church in New York City, where he d., in consequence of his labors during the prevalence of yellow fever, Aug. 26, 1798. Published *The Washing of Regeneration, Primitive Baptism Defended,* and a *Dissertation on the Seventy Weeks of Daniel.*

Foster (BIRKET), English artist, b. at North Shields, Northumberland, in 1812, was educated at Hitchen, Herts, and at sixteen was placed with Mr. Landells, wood-engraver. At the age of twenty-one he started for himself, illustrating several children's books and drawing for *The Illustrated London News.* He has since illustrated Longfellow's *Evangeline,* Beattie's *Minstrel,* Goldsmith's *Poetical Works,* etc., and especially a volume devoted to English landscape, with letter-press from Tom Taylor (1863). In 1860 was chosen a member of the Water-Color Society, and has been very successful in that branch of art; has some distinction also as a wood-carver.

Foster (DWIGHT), b. at Brookfield, Mass., Dec. 7, 1757, and graduated at Rhode Island College in 1774; became a lawyer at Brookfield; was a prominent legislator of Massachusetts, and judge, and afterwards chief-justice, of the court of common pleas; was in Congress 1793–99, and a U. S. Senator 1800–03. Was a son of Judge Jedediah Foster (1726–79).

Foster (JEDEDIAH), American judge, b. at Andover, Mass., Oct. 10, 1726; graduated at Harvard University 1744; practised law at Brookfield, Mass.; was in the Worcester county convention Aug., 1774, and delegate to the Provincial Congress 1774–75; he was negatived as a councillor by the English general Gage in 1774, but re-elected in 1775; was judge of the superior court in 1776, then judge of probate, and a justice of the court of common pleas of Worcester co., Mass.; also a member of the convention which formed the constitution of Massachusetts. D. Oct. 17, 1779.

Foster (JOHN), English essayist and moralist, b. at Halifax Sept. 17, 1770. He was a weaver in his youth, but, having been educated at Bristol College (Baptist), preached to Baptist congregations at Chichester (1797), at Downend, near Bristol, and at Frome. In 1817 resigned the ministerial office and devoted himself thenceforth to literature, having indeed begun to write for the *Eclectic Review* in 1806. *Essays in a Series of Letters to a Friend* (1805)—1, *On a Man's Writing Memoirs of Himself;* 2, *On Decision of Character;* 3, *On the Application of the Epithet Romantic;* 4, *On Some of the Causes by which Evangelical Religion has been rendered Unacceptable to Persons of Cultivated Tastes*—gave him his especial reputation as an original thinker. Wrote also on *The Evils of Popular Ignorance,* etc. Sir James Mackintosh called him one of the most profound and eloquent writers that England has produced. D. Oct. 15, 1843.

Foster (JOHN GRAY), an American officer and general of volunteers, b. in Whitefield, Coos co., N. H., May 27, 1823; graduated at West Point July 1, 1846, and entered the U. S. army as second lieutenant of engineers. During the war with Mexico (1847–48) he served with a company of sappers and miners, participating in the siege of Vera Cruz and the battles of Contreras, Churubusco, and Molino del Rey, in which latter he was severely wounded; engaged in construction of fortifications and on coast survey duty 1848–54; assistant professor of engineering at West Point 1855–57; as engineer in construction of Forts Sumter and Moultrie, S. C., and works in North Carolina 1857–61. On the outbreak of the civil war he was chief engineer of the fortifications in Charleston harbor (rank of captain), being at Fort Sumter during its bombardment and at its surrender; appointed brigadier-general of volunteers Oct., 1861, and commanded brigade on Gen. Burnside's expedition to North Carolina, distinguishing himself at the capture of Roanoke Island, Feb., 1862, Newbern, and Fort Macon, N. C.; appointed major-general of volunteers July, 1862, and assigned to command of department of North Carolina (18th army corps); conducted various expeditions, and engaged in the battle of Kinston, siege of Washington, attack on Newbern, N. C., etc.; raised to command of department of Virginia and North Carolina July, 1863, and that of the army and department of Ohio Dec., 1863; department of the South May, 1864; and of department of Florida 1865; mustered out of volunteer service Sept., 1866. Returning to duty with his corps, he was placed in charge of works for the preservation and improvement of Boston harbor, and construction of defences of Portsmouth harbor, N. H. His submarine engineering operations in removing rocks from the channel of entrance to Boston harbor were conducted with much ability and professional skill. General Foster had risen through the successive grades to be lieutenant-colonel of engineers 1867. For gallant and meritorious conduct in battle in Mexico he was brevetted first lieutenant and captain; for similar services during the civil war he received all the brevets from major to that of major-general U. S. A. Author of *Notes on Submarine Blasting in Boston Harbor;* also article BLASTING in this work. D. at Nashua, N. H., Sept. 2, 1874. GEORGE C. SIMMONS.

Foster (Col. JOHN WELLS), LL.D., b. at Brimfield, Mass., in 1815; studied at Wesleyan University, Middletown, Conn., and in 1836 removed to Zanesville, O., where he became a lawyer. He assisted in the Ohio geological survey of 1837, and wrote a report of his labors; went in 1845 to the copper-region of Lake Superior, and with Prof. J. D. Whitney made a survey of that region, a government report of which was published 1850–51. Removed next to Massachusetts, and then (1858) to Chicago. He published *The Mississippi Valley* (1869) and *Pre-historic Races of the U. S.* (1873), and many scientific papers. He was for some time land commissioner of the Illinois Central R. R., and president of the Association for the Advancement of Science. D. at Chicago June 27, 1873.

Foster (LAFAYETTE SABINE), LL.D., b. Nov. 22, 1806, in Franklin, Conn., was the son of Capt. Daniel Foster, who was present at the battle of Saratoga and with Washington at White Plains. His paternal grandmother was Hannah Standish, a descendant of Miles Standish. He was educated at Brown University, and graduated there in 1828 with the highest honors; studied law with the Hon. Calvin Goddard of Norwich, and was admitted to the bar in 1831.

Repeatedly elected to the General Assembly of Connecticut from Norwich, he was Speaker of the house of representatives in 1847, 1848, and 1854; mayor of Norwich in 1851 and in 1852, receiving on his last election every vote cast. In 1854 was elected U. S. Senator for six years, and at the close of that term was re-elected for six years longer. While in the Senate he served on the committee of Revolutionary pensions, on private land claims, on public lands, on pensions, on the judiciary, and on foreign relations, occupying for some time the second place. On the last-named committee he was chairman a considerable portion of the war. In Mar., 1865, he was elected president *pro tem.* of the Senate. When Mr. Johnson, the Vice-President, became President by the death of Mr. Lincoln on Apr. 14, 1865, Mr. Foster became acting Vice-President of the U. S., and held that position for two years. In 1870 he was again elected to represent Norwich in the general assembly of Connecticut, and was chosen Speaker of the house of representatives. Subsequently during the same session he was elected a judge of the supreme court of errors and the superior court of Connecticut, which office he still holds (1874). For this office he received every vote in the senate, and 197 out of 202 in the house. J. WATTS DE PEYSTER.

Foster (LEMUEL), a Presbyterian minister, b. at Hartland, Conn., Nov. 24, 1799; graduated at Yale 1828; at the New Haven Divinity School 1831; labored in Bloomington, Ill., 1833–39; at Bethel, Ill., 1839–46; at Upper Alton, Ill., 1846–54; at Atlanta, Ill., 1854–59; at Onarga, Ill., 1859–63; at Blue Island, Ill., 1863–70; at Washington Heights, Ill., 1870–72. Mr. Foster was highly successful in building up new churches and schools, and was not only a preacher, but a school-teacher and journalist. D. at Washington Heights, Ill., Apr. 1, 1872.

Foster (NATHANIEL GREENE), a celebrated jury lawyer in Georgia, b. in Greene co. in that State, Aug. 25, 1809; graduated at the State University in 1830; admitted to the bar in 1831; commanded a company in the Seminole war in 1836; was then solicitor-general of Ockmulgee circuit; five years member of the State senate; and member of Congress from 1857 to 1859. D. in 1871. His residence was Madison, Ga. He was famous for the many humorous and apt anecdotes he interwove in his speeches before juries. Some of "Foster's stories" will long be remembered in Georgia. He became a Baptist minister before he died. A. H. STEPHENS.

Foster (RANDOLPH S.), D. D., b. at Williamsburg, O., Feb. 22, 1820; studied at Augusta College, Ky., and in 1837 entered the Methodist Episcopal ministry; held important stations in the Western States; was transferred in 1850 to the New York Conference; chosen in 1856 president of North-western University; in 1858 became a professor in Drew Theological Seminary; and in 1872 was elected a bishop in his Church. Residence, Cincinnati, O. Author of *Objections to Calvinism*, 1849; *Christian Purity*, 1851; *Ministry for the Times*, 1855; *Theism*, 1872. ABEL STEVENS.

Foster (STEPHEN), b. at Andover, Mass., Feb. 15, 1798; graduated at Dartmouth College in 1821, and at Andover (Mass.) Theological Seminary in 1824; ordained in Oct., 1824, he was minister at Greenville and Knoxville, Tenn.; then professor of Latin and Greek, and afterwards president of the College of East Tennessee at Knoxville. D. there June 11, 1835.

Foster (STEPHEN COLLINS), b. at Pittsburg, Pa., July 4, 1826; produced many popular melodies—*Oh, Susannah, Nelly was a Lady, Old Uncle Ned, Camptown Races, Old Folks at Home* (for which he received $15,000), *Willie, we have Missed You, Come where my Love lies Dreaming, Old Dog Tray*, etc.—and d. in New York City Jan. 13, 1864. Of these he produced both words and music. His songs were mostly simple and unambitious productions, but were highly popular at home and abroad.

Foster (STEPHEN SYMONDS), American anti-slavery agitator, b. at Canterbury, N. H., Nov. 17, 1809; graduated at Dartmouth College in 1838; studied theology, and married Abby Kelley Dec. 21, 1845. He resides on a farm near Worcester, Mass., and has published *The Brotherhood of Thieves, a True Picture of the American Church and Clergy*, and many articles on the slavery question.

Foster (THOMAS F.), a lawyer and politician of distinction in Georgia, was b. in Greensborough, Ga., Nov. 23, 1790; graduated at the State University in 1812; studied law at Litchfield, Conn., and was admitted to the bar in his native town in 1816, where he continued to reside until his death in 1847. He was for many years a distinguished member of the State legislature, and was member of Congress from 1829 to 1835 and from 1841 to 1843. A. H. STEPHENS.

Foster (WILLIAM S.), b. in New Hampshire, was appointed lieutenant of infantry Mar., 1812; captain Mar., 1813; brevet major for "gallant conduct in the defence of Fort Erie," Aug. 15, 1814; major of 4th Infantry July 7, 1826; lieutenant-colonel June 8, 1836; and brevet-colonel for service in Florida, particularly at the battle of Okeechobee, Dec. 25, 1837. D. at Baton Rouge, La., Nov. 26, 1839.

Fos'ter's Bar, tp. of Yuba co., Cal. Pop. 524.

Fos'ter's Chap'el, tp. of Blount co., Ala. Pop. 310.

Fos'ter's Store, tp. of Tuscaloosa co., Ala. Pop. 1104.

Fosto'ria, post-v. of Seneca co., O., 13 miles W. of Tiffin, on the Lake Erie and Louisville, the Baltimore Pittsburg and Chicago, and the Mansfield Coldwater and Lake Michigan R. Rs. The Atlantic and Lake Erie and the Columbus and Toledo R. Rs., not yet completed, are to pass through it. It has a private bank, a weekly newspaper, several mills, foundries, and machine-shops, 4 hotels, 5 churches, etc. Agriculture is the leading pursuit. Pop. 1733. J. V. JONES, ED. "REVIEW."

Foucault (JEAN BERNARD LÉON), French natural philosopher, b. at Paris Sept. 18, 1819, had his attention turned to optics by the invention of Daguerre, and in 1844 invented an apparatus by which electric light is used in optical experiments, microscopic researches, etc. He demonstrated the earth's rotary motion on its axis by the pendulum and gyroscope in 1851, was physicist to the Imperial Observatory (1854), and a member of the French Institute. In 1855 obtained the Copley medal of the Royal Society for measuring the velocity of light. D. Feb. 13, 1868.

Fouché (JOSEPH), Napoleon's minister of police, b. at La Martinière, near Nantes, May 29, 1763. His delicate constitution prevented him from following the profession of his father, who was a sea-captain. He studied theology, but did not take holy orders. After living for some years as a teacher of philosophy, he became an advocate, married, founded a republican club in Nantes, and was elected a member of the National Convention in 1792. As such, he voted for the death and immediate execution of Louis XVI., and followed Collot d'Herbois to Lyons, where he partook with great gusto in the butcheries which were deemed necessary to reduce the city to obedience. On his return he was chosen president of the Jacobin Club, but after the execution of Robespierre (July 28, 1794), when he felt that the time of terrorism had nearly run out, he gave up his career as a furious revolutionist, and tried to excuse his violences and cruelties by ascribing them to orders from Robespierre. He was nevertheless driven out of the Convention as a terrorist Aug. 9, 1795, and even for some time held in arrest. After being restored to liberty by the general amnesty of Oct. 26, 1796, he bought Barras, whom he resembled in many respects and surpassed in all, even in treachery, by betraying Babeuf, and was sent as ambassador, first to the Cisalpine Republic, and then to Holland, whence he was called to Paris and made minister of police July 31, 1799. In this position he was of great service to Napoleon, but in the beginning of his career Napoleon felt aversion to traitors and distrust of mercenary characters; he watched Fouché, and suddenly dismissed him, Dec., 1802, at the same time rewarding him by making him rich. In two years, however, Napoleon learned to feel otherwise, and (July 10, 1804) Fouché was made minister of police for the second time. Reconciliation had now become his great idea, and the interior quiet and order in France during the empire were no doubt due to him to a great extent. He had an unfailing eye for any breach in a man's character or in the state of society, and an unerring hand in finding the real causes of personal actions and social movements. Napoleon appreciated his talents, made him duke of Otranto, and gave him a large pension. Nevertheless, he dismissed him once more (June 5, 1810). At that time Napoleon had opened secret negotiations with the English court, and Fouché happened to thwart and spoil his plans. He often happened to do so, and although Napoleon speaks somewhat haughtily about him in his memoirs, he seems to have feared him. He tried to keep him away from France even when he was compelled to use him. In 1813 he made him governor of Illyria, and sent him to Italy to watch Murat. Nevertheless, Fouché became minister of police a third time on Napoleon's return from Elba, and he played a very conspicuous part in all the proceedings which led to the final abdication of the emperor, the formation of a provisional government, and the re-establishment of the Bourbons. He remained in office under Louis XVIII., but his position between the liberal and the ultra-reactionary party was untenable. On Sept. 19, 1815, he went to Dresden as ambassador. The law of Jan. 16, 1816, however, which exiled all who had voted for the death of Louis XVI., affected also him, and deprived him of his office. During the remainder

of his life he resided in Linz, and in Trieste, where he d. Dec. 25, 1820. In private intercourse he was smooth, eloquent, sometimes fascinating. But he was only an egotist, and his egotism made him treacherous. He was not a common scoundrel, however. He wished to serve the greatest, and never betrayed a man until the man began to degenerate. CLEMENS PETERSEN.

Fouche Lefave, tp. of Perry co., Ark. Pop. 403.

Fougères, town of France, in the department of Ille-et-Vilaine, at the junction of the Nançon and the Conesnon. It is famous for its dyeing, especially of scarlet, whose delicate tints are due to certain qualities of the waters of the Nançon. Pop. 9470.

Fou'la, an island in the Atlantic, belongs to the Shetland group, but lies solitary 20 miles W. of it. It is a granite block rising 1369 feet above the sea, and inhabited by 250 persons, who carry on some fishing, farming, and hunting of wild-fowls. It is supposed to be the ancient *Ultima Thule*. Lat. 60° 9′ N., lon. 2° 6′ W.

Foulard [Fr.], a light fabric of silk, sometimes containing cotton, and used principally for ladies' dresses. It is chiefly of French manufacture, but represents a class of goods largely made in Japan, India, etc.

Fould (ACHILLE), French statesman, b. at Paris Nov. 17, 1800, was in the Chamber of Deputies in 1842 and 1846, in the Constituent Assembly in 1848, and in July, 1849, was a member of the Legislative Body. Prince-President Louis Napoleon made him minister of finance Oct. 31, 1849, but he retired in Oct., 1851, filling the position, however, for a second period from Dec. 2, 1851, to Jan. 25, 1852; then made senator, minister of state and of the house of the emperor in 1852; commander of the Legion of Honor Dec. 8, 1852; then a third time finance minister from Nov. 12, 1861, to Jan. 1, 1867. D. near Tarbes Oct. 5 of the same year. He was of Hebrew stock.

Fou'lis (ROBERT and ANDREW), Scotch printers, brothers, b. at Glasgow—Robert, Apr. 20, 1707; Andrew, Nov. 23, 1712; began business in 1740, and became printers to the University of Glasgow in 1743. Andrew d. Sept. 18, 1775, and Robert in 1776. They made fortunes by printing, and lost them in founding an academy of painting and sculpture at Glasgow, the collection of paintings being sold by auction in 1776. Their editions of Greek and Latin classics were noted for accuracy and elegance.

Foul in the Foot, a contagious disease of sheep, characterized by ulcers and granulations between the toes. Caustic and stimulant applications, such as oil of turpentine, followed by tarry applications, are generally curative. The cause and nature of this disease are not well understood.

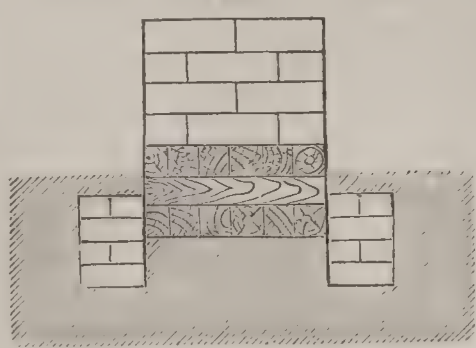
Founda'tion [Lat. *fundatio;* Fr. *fondation*], that upon which the main structure rests. The *body of the foundation* consists of the main part of those masses of masonry or timbers of which it is formed. The *bed of the foundation*, which is sometimes referred to as distinct from the foundation proper, is the prepared surface on which the foundation rests. It may be a grillage, or pounded stone, or a body of cement, or simply of pounded earth. There are many examples to which the term cannot properly be applied. When the foundation is made upon rock the surface should be properly prepared. The rock should be tested as to its soundness and its supporting power, and if it is to be exposed to the elements the effect of such action should be determined. If it is sound, it should be so dressed that its surface will be normal to the line of pressure. As the pressure in most cases is vertical, the surfaces should generally be horizontal. Where it costs too much to reduce the whole to a single horizontal surface, it may be cut into steps, as was done in the celebrated Eddystone lighthouse in the English Channel. But the method of steps should be avoided wherever it can be, for all artificial structures will settle more or less, and if there is a great difference between the highest and lowest steps, there may be unequal settling to such an extent as to damage the work. One of the early English engineers made a foundation for a bridge partly upon rock and partly upon sand, but the sand was washed out and the foundation destroyed. If the rock is unsound, being loose or porous, the upper part should be removed until suitable rock is reached. If the rock is very porous, it may be filled with cement to form the bed of the foundation. Large cavities may be arched if necessary.

In determining whether the supporting power is sufficient, the load to which it is to be subjected must be known. If it is found upon trial that it is not sufficient, the bed of the foundation should be enlarged, so that the pressure per square foot will be diminished. Some rocks decompose under the action of the weather. In such cases the surface-rocks should be removed, so that the bed of the foundation will be below the action of the frost.

Many expedients are resorted to in making foundations on soils. Most soils are so yielding in their nature that they must be confined to prevent spreading, as well as settling, when they are loaded with masonry. An instance is cited where borings were made for the site of Fort Livingston, La. The surface, but 2 or 3 feet elevated above tide-water, was fine sand, and apparently incompressible. The boring showed this stratum to be 15 or 20 feet thick, beneath which was a soft, saturated blue clay. It was considered that this soil needed no preparation, but very great settlement ensued. The amount depended more upon aggregate total masses imposed than upon the actual pressure (per square foot) of different parts. The sand (like all sands) was believed to be nearly incompressible, and the yielding doubtless took place in the clay. In such a case, if (as in the case of a fort) there are masses (earth and masonry) to be imposed covering a great area, neither piling nor grillages are likely to avail, and a previous *loading* before masonry is commenced seems indispensable if *settlement* cannot be tolerated.

When the foundation is composed of masonry, it is desirable to have the bed horizontal over the whole surface; and if the soil is yielding, it must be confined so as not to spread laterally (Fig. 1). Sometimes a grillage forms the bed. It is made by placing timbers or planks close to each other directly upon the soil, so as to form a kind of floor, and directly upon these is placed another layer, on which the timbers are placed crosswise of those immediately below. In many cases grillages and platforms have failed, either from the decay of the timber or from unequal settling of the soil beneath them, so that in many recent structures an "area" has been substituted with good results. An "area" consists of a mass of masonry, usually of uniform thickness, laid over the whole surface which is to be occupied by the foundation. The foundations of the capitol building at Albany, N. Y., are laid upon a large "area." The soil was excavated to a suitable depth, and the soil beneath thoroughly beaten. The surface was covered with small broken stone to a uniform depth of about six inches, and thoroughly grouted with cement. Successive layers of about the same thickness followed, each being thoroughly grouted, until a suitable thickness was secured. The large blocks of stone which form the foundation of the piers so nearly covered the whole bed as to prevent any upheaval of the soil and bed between the pieces.

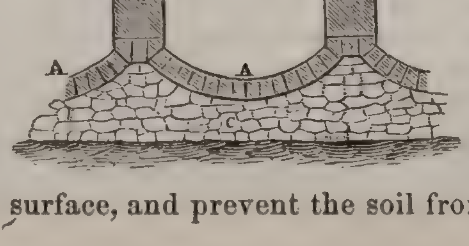
FIG. 1.



When the masonry is of rubble stone, it is better to form a bed of small stones of uniform size, well grouted, than to place large stones directly upon the earth, even if the spaces between them are filled with small ones; for the construction is not so homogeneous as when they are small, and there are not so many points of support on the earth. If, however, the stones have a flat-bearing surface, their size will make but little difference. Sometimes the base of the foundation may be spread out so much that even a mushy soil will sustain a very heavy load. The piers of a railroad bridge on the Montezuma Swamps in New York were so spread at the base that the pressure per square foot was about 300 pounds, or between 2 and 3 pounds per square inch, while the load on the pier was 130 tons.

When there are springs in the soil, the water must be prevented from washing out the cement, especially before it firmly sets. This may sometimes be done by a proper drainage, and sometimes by the use of heavy canvas which has been made impervious to water. One of the foundations of the Rochester bridge, England, was upon large cylinders, which were sunk 42 feet below the bed of the river and filled with masonry. The river, being tidal, rose and fell twice each day, and this action caused the water to flow in and out of the cylinder at the bottom, washing out the cement of the concrete. It was difficult at first to keep the water out, but at length a piece of stout canvas was cut one foot larger than the base of the cylinder, and when the water had subsided it was fitted all around the inside of the cylinder, and the concrete put on; which expedient proved successful.

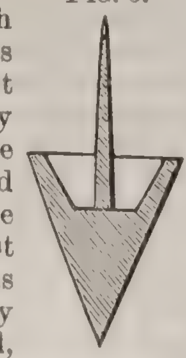
FIG. 2.



When a heavy structure rests upon isolated pillars or columns, and the soil beneath is compressible, the bases of the columns may be connected by inverted arches, as shown in Fig. 2, so as to distribute the pressure over the whole surface, and prevent the soil from rising between the piers.

The use of wooden piles is one of the most common elements in the preparation of the foundation in marshy soils. A grillage is often combined with the use of piles. The piles may be as long as they can be cut from a tree; and if they are not then long enough, they are driven farther by placing other piles on the tops of them and the driving continued. The second piece is called a punch. Formerly iron shoes (Fig. 3) were placed on the lower end of the piles to assist in penetrating the soil, but experiment has shown that this is a needless expense, as they will drive quite as well if simply sharpened, and in many cases they can be driven nearly as easily if the end is square.

FIG. 3.



When practicable, piles should be driven through the muddy soil to a firm subsoil beneath, but there are numerous cases where this is impracticable. When the end of the pile does not rest on a firm subsoil, the supporting power of the pile depends upon its friction between its surface and the soil, which friction may be sufficient to sustain immense structures. The supporting power of piles in practice, when they are held by friction, is usually determined by empirical rules. If we use the following notation—

W = the weight of the ram in tons;
H = the height in inches through which the ram falls for the last blow;
h = the distance in inches that the pile is driven by the last blow;
W_1 = the weight of the pile; and
P = the load which the pile will safely bear in tons—

then Major Sanders's formula becomes

$$P=\frac{H}{3h}W.$$

Molesworth's rule is

$$P=\frac{1H}{8h}W,$$

which is of the same form as the preceding when the weight of the pile is neglected.

McAlpine's rule, as deduced from his observations on the pile-driving at the Brooklyn navy-yard, is

$$P=\frac{80}{3}\left(W+0.228\sqrt{\frac{H}{12}-1}\right).$$

In this case the pile was driven to stoppage, as will be explained hereafter.

Weisbach's rule, as deduced from theoretical considerations, considering both the ram and pile as non-elastic, is

$$P=\frac{H}{h}\cdot\frac{W^2}{W+W_1}(W+W_1);$$

and if the weight of the pile be neglected, this becomes

$$P=\frac{H}{h}W.$$

An investigation of pile-driving when both the ram and pile are considered elastic, as developed by Airey, astronomer royal of England, is given in Mosley's *Mechanics and Engineering.*

The following rule for regulating the "load" to be imposed is given by Rankine (*Rules and Tables*):

Rock, moderately hard (strong as the strongest red brick)........ 9 tons per sq. ft.
Rock, of the strength of good concrete............ 3 " " "
" very soft........ 1.8 " " "
Earth, firm; hard clay; clean dry gravel; clean sharp sand prevented from spreading........... 1 to 1.5 tons "

Experiments at New Orleans give about 1500 pounds per square foot as a safe load for that alluvial soil, but there will be *settlement* in such plastic soils with very slight loads.

The following is a short abstract of the results of some experiments made by John Roy in the soils of New Orleans, La., in 1851–52:

Area pressed, inches.	Weight applied, pounds.	Weight per square inch, pounds.	Sinkage in inches.	Duration of the experiment, days.
$1\times 1 = 1$	102	102	11	30
$1\times 2\frac{7}{8} = 2\frac{7}{8}$	$293\frac{1}{4}$	102	$26\frac{3}{4}$	30
$4\times 4 = 16$	1632	102	78	30
$1\times 16 = 16$	1632	102	33	30
$4\times 4 = 16$	1632	102	120	161
$1\times 1 = 1$	18	18	$\frac{5}{8}$	3
$\frac{3}{4}\times 1 = \frac{3}{4}$	$13\frac{1}{2}$	18	$\frac{5}{8}$	3
$5\times 16 = 40$	642	$16\frac{1}{20}$	$\frac{7}{8}$	99
$12\times 12 = 144$	2452	$17\frac{3}{4}$	$\frac{1}{8}$	107

The larger surfaces sink more in proportion to their area than smaller ones. This is probably due to the fact that the lateral surface is less in proportion. Thus, in a piece which is 1 inch square the perimeter is 4, and in one which is 4 inches square it is 16; hence their perimeters are as 1 to 4, while their areas are as 1 to 16. The friction on the lateral surfaces is an important element.

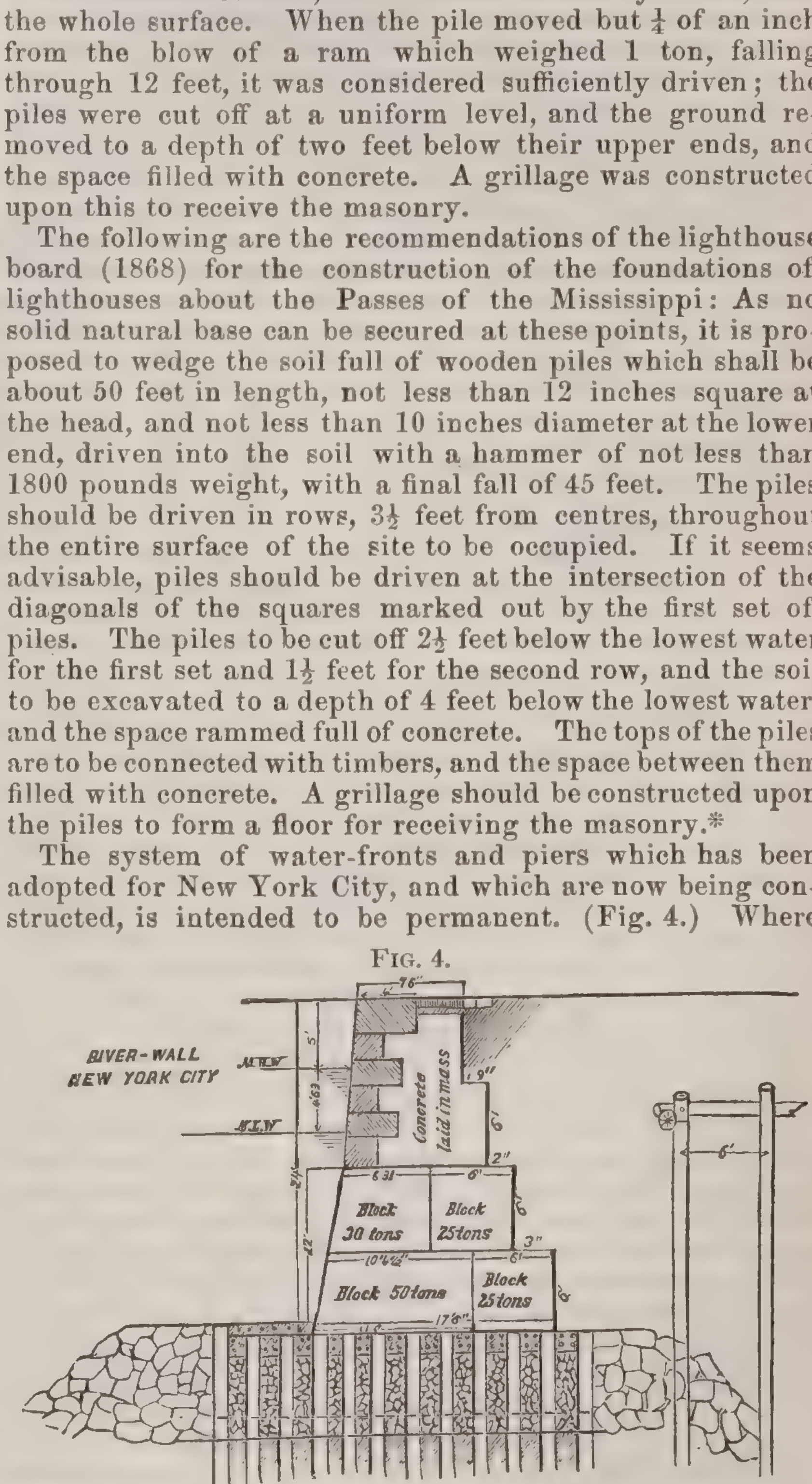
The several piers of the railroad bridge at Havre-de-Grace, on the Susquehanna River, were established in different ways. For pier No. 3 piles were driven into the soil, and sawed off at a uniform level of 40 feet below the surface of the water. A platform or grillage of timber, strongly ironed, upon which the pier was to rest, was constructed near the site and floated over the piles, and placed between two substantial construction piers. Six lowering screws, each $3\frac{1}{2}$ inches in diameter, were attached to the platform and to the construction piers, for the purpose of lowering the grillage. An iron caisson was constructed upon the grillage, and the masonry begun within, and the whole gradually lowered by means of the screws. When the masonry had nearly reached the top of the caisson another section was added, and so continued until the grillage rested upon the heads of the piles.

The foundations for the Grimsby docks on the Humber, begun in 1846, rest on piles which were generally driven 5 feet between centres, but in some cases only 4 feet, over the whole surface. When the pile moved but $\frac{1}{4}$ of an inch from the blow of a ram which weighed 1 ton, falling through 12 feet, it was considered sufficiently driven; the piles were cut off at a uniform level, and the ground removed to a depth of two feet below their upper ends, and the space filled with concrete. A grillage was constructed upon this to receive the masonry.

The following are the recommendations of the lighthouse board (1868) for the construction of the foundations of lighthouses about the Passes of the Mississippi: As no solid natural base can be secured at these points, it is proposed to wedge the soil full of wooden piles which shall be about 50 feet in length, not less than 12 inches square at the head, and not less than 10 inches diameter at the lower end, driven into the soil with a hammer of not less than 1800 pounds weight, with a final fall of 45 feet. The piles should be driven in rows, $3\frac{1}{2}$ feet from centres, throughout the entire surface of the site to be occupied. If it seems advisable, piles should be driven at the intersection of the diagonals of the squares marked out by the first set of piles. The piles to be cut off $2\frac{1}{2}$ feet below the lowest water for the first set and $1\frac{1}{2}$ feet for the second row, and the soil to be excavated to a depth of 4 feet below the lowest water, and the space rammed full of concrete. The tops of the piles are to be connected with timbers, and the space between them filled with concrete. A grillage should be constructed upon the piles to form a floor for receiving the masonry.*

The system of water-fronts and piers which has been adopted for New York City, and which are now being constructed, is intended to be permanent. (Fig. 4.) Where

FIG. 4.



Foundations of water-fronts on North River, New York.

rock cannot be reached, piles are driven as close to each other as possible, and sawed off at a uniform level, about 15 feet below low water. A grillage is made upon these, and the masonry built upon it. The lower part of the masonry is made of large blocks of cement (artificial stone), composed at first, by volume, of 1 part of Portland cement, 2 of sand, and 5 of stone (Bergen trap). Afterwards they were composed of 1 part of cement, $2\frac{1}{2}$ of sand, and 6 of broken stone. The upper part of the wall is faced with granite, backed with concrete. The piles are protected in many cases, both on the land and water sides,

* The notion of "wedging the soil" may be considered questionable without detriment to the use of the piles; while extremely *yielding*, the soil, thoroughly *saturated with water*, and composed of clay, extremely fine sand, and a minute quantity of vegetable matter, is probably as *incompressible*, in the proper sense of the term, as anything we know of. (In the article LIGHTHOUSE CONSTRUCTION the actual foundation of the new S. W. Pass lighthouse will be described.

by masses of rubble stone. Some of the piles in the piers in the wharves of Jersey City were drawn in by hand. A rope was attached to the upper end of a pile and passed off in opposite directions, passing under a pulley near the surface of the water. The pile was erected in place, and several men took hold of the rope, and as soon as the pile was dropped they ran directly away from the pile, pulling on the rope as hard as they could until the pile came to rest. These piles were sufficiently firm, and did good service. The foundation of an ore-dock at Milwaukee, Wis., rests on piles that were not driven to stoppage. At a depth of about 30 feet they struck a firmer substratum, but one which could be easily penetrated. If the pile passed this substratum it could then be driven 75 feet as easily as it was the first 25 feet. The piles generally were driven only to the firmer substratum. The dock, not being uniformly loaded, settled unequally. The foundations of a grain-elevator in the same city were made on similar soil, but it settled unequally. The tracks of many railroads in this country where they cross marshes rest on piles that were driven lightly, for fear that full blows of the hammer would drive them too far, but in all such cases there will be settling. Such examples should not be followed in making permanent works where it is possible to avoid them. Where a firm substratum cannot be reached screw-piles have been used with good success. The blades are made broad, so as to give a large area for support, and the end of the pile is pointed to aid the penetration. They are forced into the soil by turning them like an auger. (Fig. 5.) They have been used in the construction of many lighthouses on the sea-coast. On one railroad in Brazil they were used in the construction of bridges in fifteen out of seventeen river-crossings, with

Fig. 5.

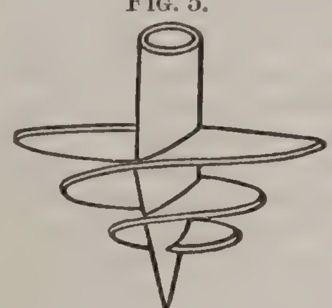
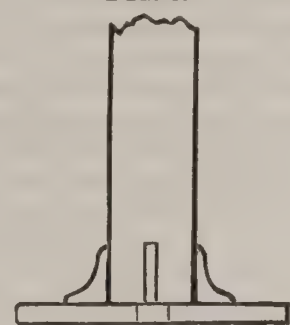


Fig. 6.



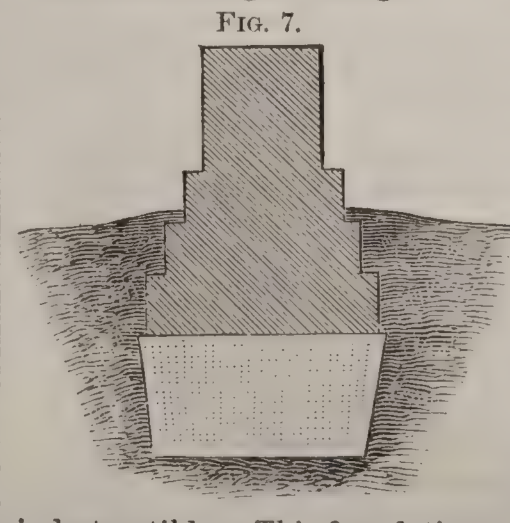
Elevation of a Disk Pile.

good success. Piles having a disk (Fig. 6) at their lower ends for the purpose of giving greater supporting area have been successfully used in India. The foundation for the dry dock of the Brooklyn navy-yard has many points of interest. It was engineered by J. W. McAlpine. It was begun in 1841 and completed in 1851. It contains 13,837 cubic feet of masonry, resting upon 38,532 cubic feet of piles. The foundation was made 42 feet below the surface of the ground and 37 feet below mean tide. Borings to the depth of 60 feet brought up sand and clay and fresh water, but there was relatively only a small amount of clay. The first 10 feet were composed chiefly of vegetable decomposition. When confined, and not mixed with water, it was very firm and unyielding, presenting a strong resistance to penetration. When saturated with water it became a semi-fluid. A coffer-dam was constructed and the soil excavated to a depth of 10 feet below low water. Springs of fresh water were discovered near the bottom of the foundation, which proved to be very troublesome. The upward pressure of the water was so great as to raise the foundation, however heavily it was loaded. The first indication of undermining by these springs was in the settling of the piles which supported the pump-well. The well was changed to another place, but the spring followed and compelled another change. This spring was driven away from the old well by driving piles until it was filled up, but it immediately burst up among the foundation piles of the dock near by. In a day it made a cavity in which a pole was run down 20 feet below the foundation timbers. Into this hole were thrown 150 cubic feet of stone, which settled 10 feet during the night, and 50 cubic feet more were thrown in the following day. This drove the spring to another place, where it burst through a bed of concrete two feet thick. This new cavity was filled with concrete, but the precaution was taken of putting in a tube, so as to permit the water to escape; still it burst through, and the operation was repeated several times, until it finally broke out through a heavy body of cement 14 feet distant. In this place it undermined the foundation piles. These were then driven deeper by means of followers, and a space of 1000 square feet around the spring was then planked, forming a floor on which was laid a layer of brick in dry cement, and on that a layer of brick set in mortar, and the foundation was completed over all. Several vent-holes were left through the floor and foundation for the escape of the water. There were 6549 bearing piles, averaging 32 feet 7 inches long. They were driven 3 feet from centre to centre, and afterwards as many driven as could be forced into the soil. Whenever a pile was driven more than 3 inches by the last blow of a 2000-pound hammer falling 35 feet, another was driven by the side of it. In many cases the foundations are made upon a grillage without the use of piles. The St. Charles Hotel in the city of New Orleans was laid on a grillage of heavy flatboat gunwales of 60 to 80 feet in length, 20 to 30 inches in width, and 6 to 12 inches thick, laid about 6 feet below the sidewalk. It was destroyed by fire in 1857, and during its existence of fourteen years previous it settled two feet. It was immediately rebuilt on its old foundations, and it settled one foot more during the next fifteen years. The grillage which was made for the foundations of Fort Jackson, La., was exceedingly strong—one of the strongest in the South-west. The subsoil is very compressible, and thoroughly saturated with water to the depth of 11 feet below the natural level of the country—the depth of the foundation. The earth at the bottom of the excavation was covered with a plank floor, and timbers 12 inches thick and 15 to 24 inches wide were laid edge to edge close to each other, forming a solid floor. Crossing these were other timbers of the same size as those in this floor, laid 3 feet from each other, centre to centre, and the spaces between filled in with brick masonry and concrete. The grillage and foundations of the casemates were constructed in the same manner, but the settling was so uneven that at the end of seven years it was necessary to make some parts of the structure lighter and load other parts more heavily. The tower of the First Presbyterian church, New Orleans, was founded on a grillage, and settled 5½ inches in eleven years. The custom-house at New Orleans, La., is founded upon a plank flooring laid 7 feet below the street pavement. A timber grillage is laid upon the floor, consisting of logs 12 inches in diameter laid side by side, over which are similar logs placed transversely, 2 or 3 feet apart in the clear. The spaces are filled with concrete, and an additional thickness of 1 foot of concrete placed over the whole. The walls of the interior subdivisions rest upon inverted arches, thus using the entire surface included within the outer walls for supporting the building.

Those	walls	which	are	2 ft. 6 in. thick	rest	on	grillage	10 ft.	wide.
"	"	"	"	4 ft.	"	"	"	15 ft.	"
"	"	"	"	9 ft.	"	"	"	20 ft.	"

The building was commenced in 1848, and progressed from time to time until 1860, when the granite walls were 75 feet above the concrete base to the architrave line of the entablature, and all the iron floor-beams of the fourth story finished. From 1848 to 1851 the maximum settlement was 22.57 inches, and the minimum in the same time was 15.63 inches, making a difference in the settlement of the various parts of 6.94 inches. During the year 1857–58 the maximum settlement was 3.50 inches, and the minimum 0.66 inches; and in 1858–59 the maximum settlement was 2.63 inches, and in some places nothing. In 1864 the walls varied 3 inches from a level. The grillage covers a surface of about 300 feet square, but it failed to secure an even settlement of the walls. The noted Fort Sumter in Charleston harbor is founded on an artificial island of stone. During the years 1840–50 it was observed to settle constantly, though less in amount each succeeding year. The towers of the suspension bridge over the Ohio at Cincinnati are 242 feet high above the bed of the foundation, and the bed of the foundation on the Cincinnati side is 12 feet below low water. The foundation was made upon a bed of compact gravel, although limestone rock was only 12 feet deeper. Upon the gravel was laid a timber platform 110 feet long by 75 feet wide, composed of twelve courses next to the river, and stepped off on the land side to eight courses. The timber was composed of pine, oak, maple, hickory, buttonwood, elm, beech. The length of the logs varied from 25 to 40 feet. They were flattened on two sides, so as to make a uniform thickness of 12 inches, the other sides being left rough. The courses crossed at right angles, and each stick was secured by rag-bolts 1 inch in diameter. All the spaces between the timbers were filled with clean gravel and broken stone. The pressure upon the timber foundation for the loaded bridge is, according to computation, less than 55 pounds per square inch. Timber constantly submerged in fresh water is nearly indestructible. This foundation was made by the late John

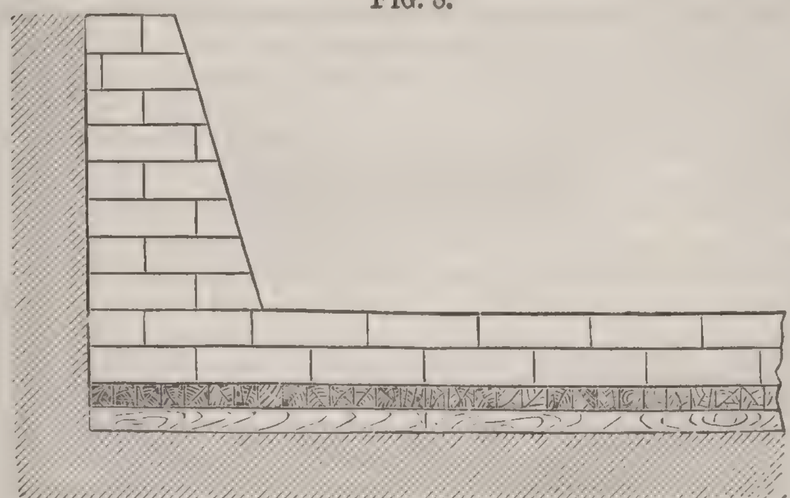
Fig. 7.



A. Roebling, who had a high opinion of timber foundations when resting upon soil and the timber constantly submerged.

In some cases sand answers a good purpose in forming the bed of the foundation. It readily adjusts itself to the inequalities of surface and of pressure, and causes the pressure to be uniform over the whole surface. If there is unequal settling, the sand easily adjusts itself to the new bed. It should be confined laterally, and should be moistened before the masonry is placed upon it. Yielding soils may

Fig. 8.



be prevented from rising to such an extent as to damage the structure by loading the soil for some distance outside of the foundation. It is nearly equivalent to making a very broad foundation. The soil may be covered with a grillage and loaded with soil or masonry, or an inverted arch may be used, as in Fig. 9. In making foundations under water a coffer-dam is often used for excluding the water during the progress of the work. This is an old and successful device where it can be used. To construct it, a row of piles is first driven, and their tops are connected so as to prevent them from spreading from the inward pressure, and braced to prevent their being crowded inward by the pressure of the water from the outside. Other piles or planks, called sheeting-piles, are driven firmly into the soil as close to each other as possible, and their upper ends secured to the frame of piles previously formed. Another row of sheeting-piles is then formed, so as to leave a space of from 5 to 15 or 20 feet between them, depending upon the depth of the water and the quality of the puddling material. The space between the two rows of sheeting-piles is then filled with clay, or a mixture of clay and sand, put down in layers and thoroughly puddled. One of the most serious difficulties to be contended with is the leakage underneath the dam. It may not be possible in loose soils to stop this entirely, but in all cases the main piles, and especially the sheeting-piles, should be driven to a firm soil, and all the loose soil should be removed before the puddling is put in. When the water is deep, in order to give additional security a row of piles may be placed entirely outside the dam, and the space filled in with suitable puddling material. But when the

Fig. 9.

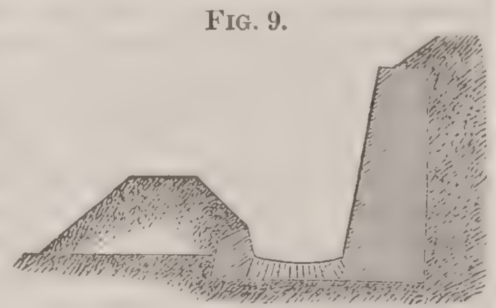
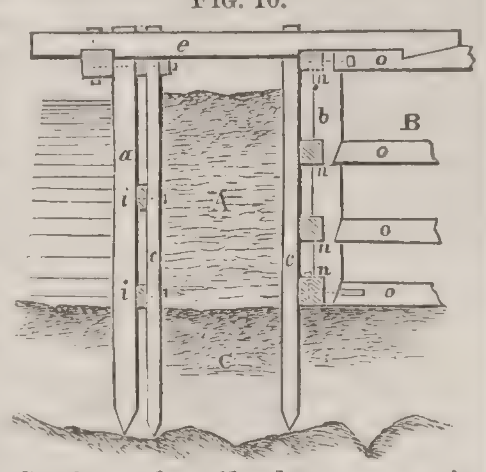
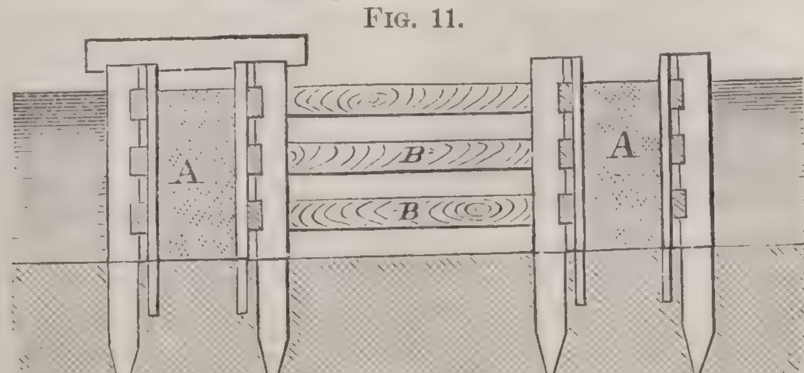


Fig. 10.



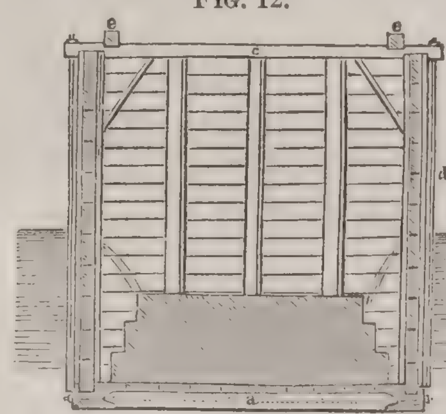
Section of coffer-dam: *a*, main exterior piles; *b*, strong square beams, corresponding to *a*, on which the wales *n*, *n* are notched and bolted; *c*, sheeting-piles; *e*, cross-pieces; *oo*, horizontal shores buttressing opposite sides of dam; A, puddling; B, interior space; C, mud, etc.

Fig. 11.



depth is considerable, there is danger of the dam being forced inward by the pressure of the water from the outside. One of the best means of preventing such a result is to place heavy timbers within the dam which shall reach from side to side, and serve as struts for supporting the sides. Thus, A A (Fig. 11) are the sides of the dam, and B B the timbers which support the sides. They should be placed so as to be out of the way of the masonry as much as possible. It may be necessary to remove them as the work progresses, but in that case the dam can be supported by props extending from the masonry to the walls of the dam. A *caisson*, or water-tight box, has been resorted to in some cases. Where a coffer-dam cannot be constructed, and where it is considered safe to have a timber bed rest directly on the soil in the bed of the stream, it may properly be used. The bottom of the caisson should be composed of strong timbers, which should be sufficiently numerous to support the structure which is to be placed upon it. If the soil is yielding, it may be best to make the whole bottom of planks, forming a grillage. The last courses must be water-tight. The sides are so constructed that they may be easily removed after the foundation is completed, but when the box is completed it should be nearly or quite water-tight. It is floated to the place where the foundation is to be made, and the masonry is begun on the inside, and built up in the same manner as if on a solid bottom. When the caisson is sufficiently loaded by the masonry it will sink to the bottom. If it does not rest evenly on the bottom, it may be desirable to raise it again and remove the obstructions underneath. To facilitate this process, it is advisable to have some side-gates, so as to let water in and cause it to settle before it is fully loaded; in which case the gates may afterwards be closed and the water pumped out, and the box again floated. After the foundation is carried above the surface of the water the sides may be removed. The foundations of the Victoria tubular bridge in the St. Lawrence River near Montreal furnish an example in which both coffer-dams and caissons were used in making a foundation for a pier. The stream is quite rapid and deep, and the bottom was covered with large boulders, so that it appeared quite difficult to secure a good bed for the foundation. A caisson, A, was brought to the proper place and sunk and securely anchored. At the corners were strong posts. Holes were made through them, and the holes continued by drilling into the rock, and a strong 2-inch iron bar put into it, as shown in the cross-section (Fig. 14). The space A was a box having a tight bottom, and a floor at about half its height from the bottom for receiving stone for sinking it and keeping it in place. It had a strong flat deck for receiving the machinery. The sides of the caisson were vertical, but had a sharp point projecting

Fig. 12.



Cross-Section and Interior View of a Caisson.

Fig. 13.

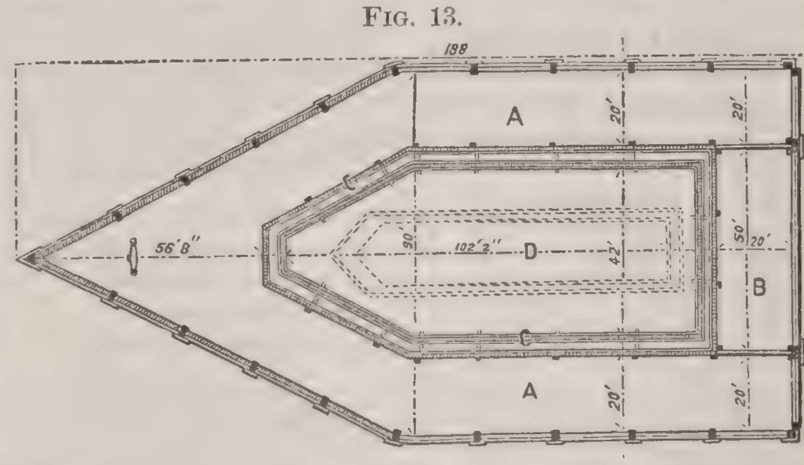
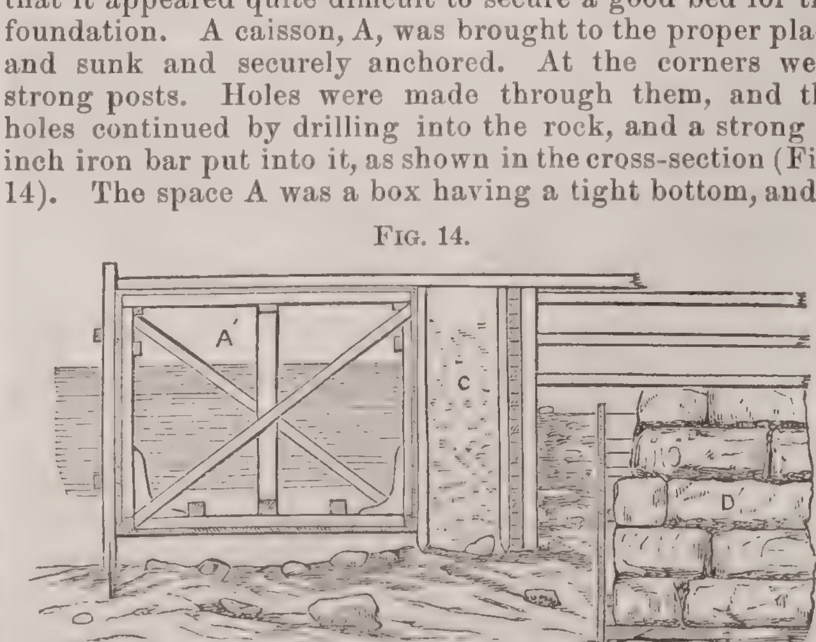


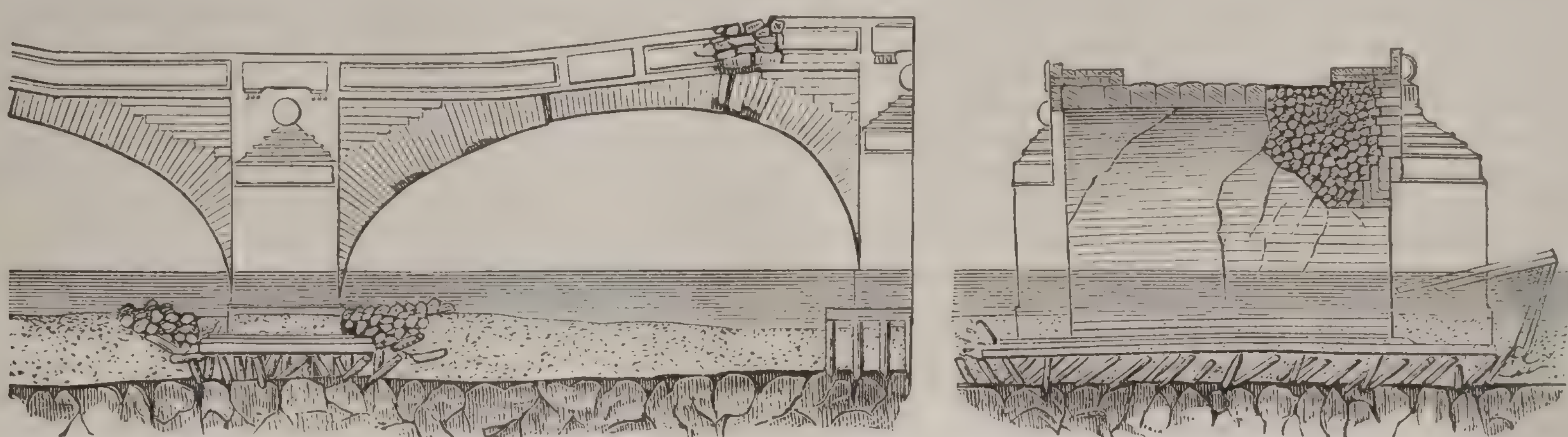
Fig. 14.



A′, cross-section of caisson; *c*, cross-section of puddling; D′, foundation courses of piers.

up stream, as shown in the figure, to serve as a breakwater. The space C, which was about 4 feet wide, was filled with puddled material, so as to prevent the water from running into the inner space D. The water was then pumped out of the space D, and the bed prepared for the masonry. The rectangular piece B was so constructed that it could be taken out and floated off. The bridge at Tours, France, is one of the most interesting structures of the last century. It is composed of fifteen stone arches, each having a span of 75 feet, a versed sine of 25 feet, and a thickness at the crown of 4 feet. The intrados has 11 centres, thus making it approximate closely to the arc of an ellipse. The entire length of the bridge between the abutments is 436.58 mètres. It was begun in 1716, and was over five years in process of erection. (*Ponts et Chaussées*, 1839, 2d semestre, p. 86.) Several of the central piers were made on pile foundations. The piles were cut off at a uniform level and capped with a grillage. The eighth pier, which was one of those thus constructed, on Aug. 28, 1777, sunk suddenly 1.12 mètres on the up-stream side, and 1.44 mètres on the down-stream side, and moved up stream 0.92 of a mètre for the part up stream, and 0.325 of a mètre for the part down stream. This produced a great and serious distortion, as shown in Fig. 15. The pier at its base spread 0.595 of a mètre

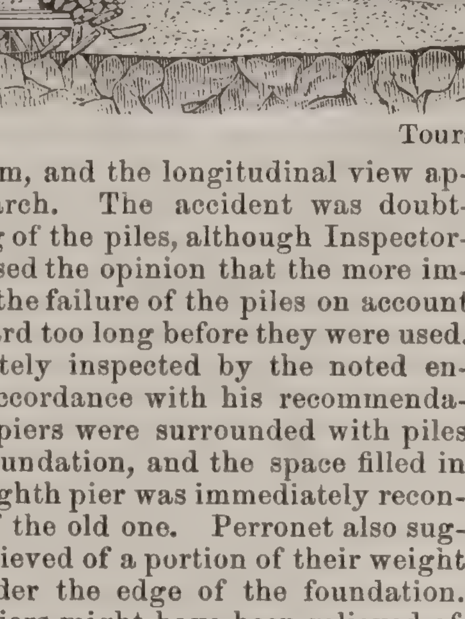
FIG. 15.



Tours Bridge.

in the movement up stream, and the longitudinal view appeared like a rampant arch. The accident was doubtless due to the overturning of the piles, although Inspector-General de Limay expressed the opinion that the more immediate cause was due to the failure of the piles on account of their exposure in the yard too long before they were used. The bridge was immediately inspected by the noted engineer Perronet, and in accordance with his recommendation several of the other piers were surrounded with piles some distance from the foundation, and the space filled in with large stones. The eighth pier was immediately reconstructed upon the ruins of the old one. Perronet also suggested that the piles be relieved of a portion of their weight by building masonry under the edge of the foundation. He also showed that the piers might have been relieved of 400,000 kilogrammes by making the intrados the arc of a circle, instead of elliptical. The bridge settled unequally at other points, and was the source of great expense in repairs. Since 1835 several of the pile foundations have been injected with concrete. The unequal settling broke the parapet walls, so that they had to be renewed. The failure to make a suitable foundation for this heavy structure is too evident to make comment necessary. On the Eastern Bengal R. R., where it crosses the Gorai River, piers were constructed of two cylinders, forming two large piers, which were 37 feet 6 inches apart. The first cylinder was sunk 80 feet below low water, or 40 feet into the bed of the river; but as the scour was very deep the others were sunk 98 feet below low water. The earth within the cylinder was raised by a flow of water. C is a tube reaching down to the earth, B the level of the water in the stream, and A the height of the water in the cylinder. The depth of E below A was a head for producing the flow.

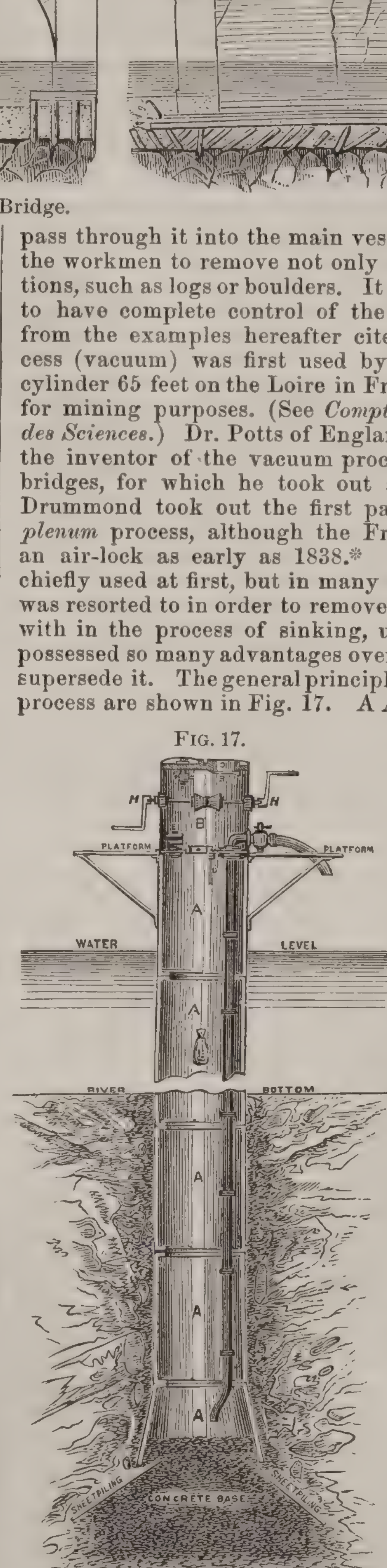
FIG. 16.



The earth was stirred by a rotating tool E. (See *Trans. Inst. Engineers*, vol. xxiv. p. 8.)

A novel but successful process, called "pneumatic," has been largely used of late years for sinking large cylinders and inverted caissons in deep water. There are two general methods — viz. the "vacuum" and the "plenum." The vacuum process consists in exhausting the air from the cylinder, thus using the pressure of the atmosphere upon the top to force it down. Exhausting the air causes the water to flow into the cylinder past the lower edge, thus loosening the soil and causing the cylinder to sink rapidly. By reversing the process the water may be forced out, and then by suddenly relieving the pressure the pile will sink again. The plenum process consists in forcing air into the cylinder or vessel, so as to exclude the water, and forcing the pile down by a load which is placed upon it. A cage or air-lock, as hereafter described, is connected with the main vessel in a suitable way, and so constructed that men may pass through it into the main vessel. This process enables the workmen to remove not only the soil, but any obstructions, such as logs or boulders. It also enables the engineer to have complete control of the sinking, as will appear from the examples hereafter cited. The pneumatic process (vacuum) was first used by M. Triger in sinking a cylinder 65 feet on the Loire in France. It was for a shaft for mining purposes. (See *Comptes Rendus de l'Académie des Sciences.*) Dr. Potts of England has the credit of being the inventor of the vacuum process for sinking piles for bridges, for which he took out a patent in 1848. Lord Drummond took out the first patent in England for the *plenum* process, although the French engineers had used an air-lock as early as 1838.* The vacuum process was chiefly used at first, but in many cases the plenum process was resorted to in order to remove obstacles which were met with in the process of sinking, until it was found that it possessed so many advantages over the former as to entirely supersede it. The general principles involved in the plenum process are shown in Fig. 17. A A is a large iron cylinder which is represented as already sunk some depth into the earth. B B is a tube through which the compressed air passes into the cylinder. E is an air-lock, or small compartment, which has two doors, both opening inward. When the cylinder A A is filled with compressed air, it will keep the door F closed, and a free passage may be had through the door C. If F is opened and C closed, the pressure of the air inside will keep the latter closed, and a free passage may be had through the former. The main object of filling the lower part with compressed air is to force the water out, and keep it out, so that men may work inside the cylinder. To do this it is only necessary to make the pressure of the compressed air per square inch equal to that of the water outside. When this is done the upward pressure of the air may prevent the pile from sinking, and it will be necessary to place a load upon it to force it down. In many cases, as will appear hereafter, permanent masonry

FIG. 17.



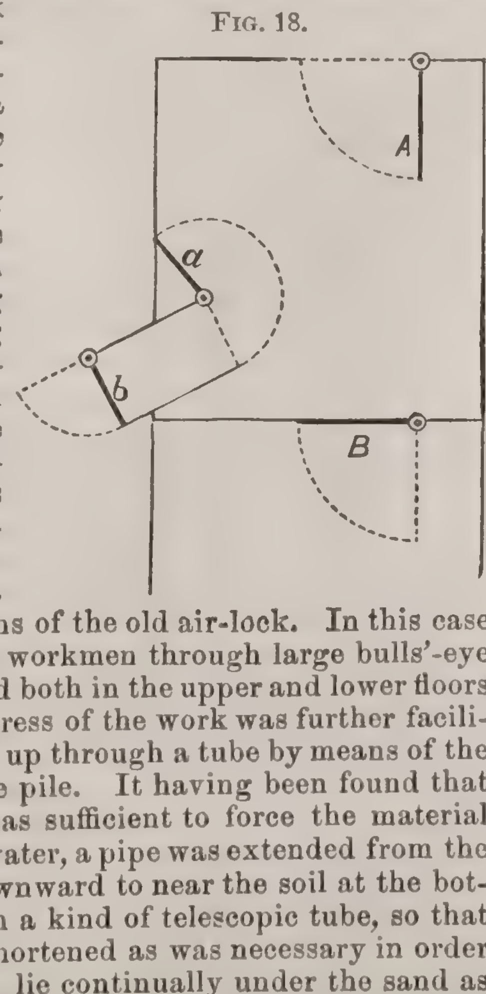
* According to *Engineering* (Apr., 1872), the first use of "compressed air" in sinking cylinders for foundations was about 1852, at the Rochester bridge, England.

is built upon the column whilst it is being sunk. To enter the tube, the lower door F of the air-lock is closed, whilst the lower part of the cylinder is filled with compressed air, and by means of a stopcock or other suitable device the compressed air from the upper part is permitted to flow out; and when the internal air is reduced to the atmospheric pressure, the door C is easily opened and the workmen may pass in. After they have passed in the door is closed, and by opening another stopcock the air is allowed to flow from the lower part of the cylinder A into the space E; and as soon as equilibrium is restored, the door F is easily opened, and workmen may then pass freely into the lower part and proceed with their work. The excavated material may be raised in any suitable way into the upper chamber E, and then by closing the door F and opening the outer passage C, it may be discharged. Other methods will be given in the following examples.

When the pneumatic cylinder cannot be extended down to rock, or even to unyielding soil, its supporting power may be greatly increased by enlarging the foundation at its base. This is accomplished by removing the soil from under the edge of the cylinder and filling the space with concrete. The foundation of the Harlem bridge in New York City was enlarged in this way. The soil was sandy and very loose, and the workmen found it difficult to remove any portion of the soil without its caving in and immediately filling the space which they had excavated; but after a few experiments they learned to manage it. They found that by forcing in some polling-boards, and removing the soil underneath them as quickly as possible, and then quickly filling the space with concrete, they could do it successfully. They would remove and fill only a small space at a time; and instead of removing the adjacent earth immediately, they would go to some other portion of the base and repeat the operation. In this way the whole base was enlarged from 6 feet in diameter to 10 feet. In a similar way the foundation of the London Chatham and Dover railroad bridge at Blackfriars, England, was enlarged from 18 feet to 21 feet in diameter.

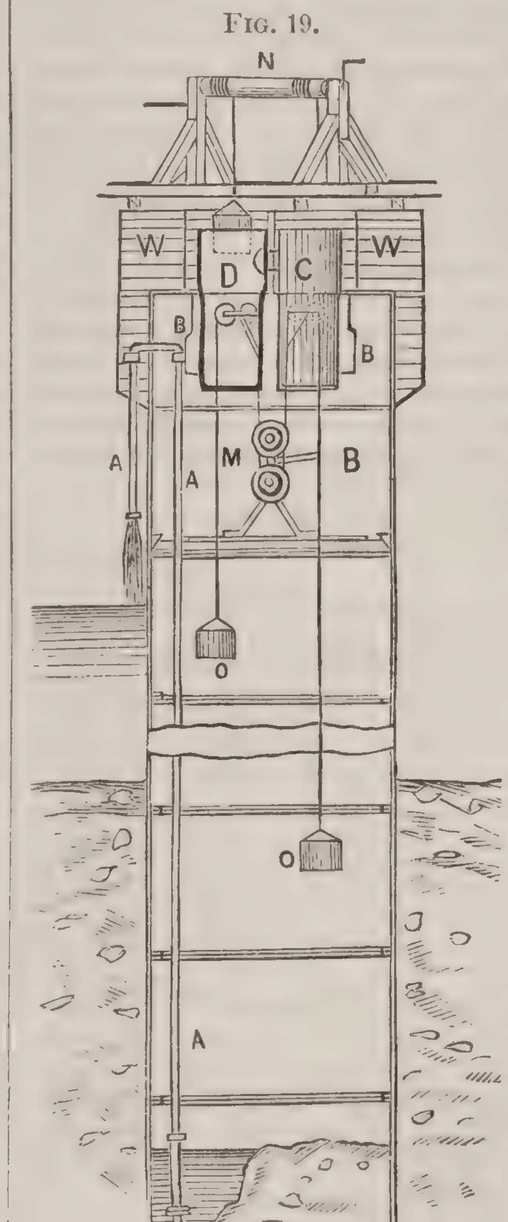
In the Harlem bridge the piles were 6 feet in diameter, and cast in lengths of 10 feet. The air-lock was of the same diameter as the cylinder, and 6 feet high. The valves or man-holes were 20 inches in diameter. The piles were sunk 50 feet below the surface of the water, and 30 feet below the surface of the river-bed. A tank, which consisted of the shell of a steam-boiler, was placed on the shore to serve as a reservoir for the compressed air. This was connected with the cylindrical pile by means of flexible pipe. The air in the pile was permitted to discharge freely at certain times through stopcocks, causing a rapid sinking of the pile. By means of a stopcock in the pipe leading from the tank the movement could be quickly checked when desired, by letting the air flow from the tank into the cylinder. In a pneumatic foundation in the Savannah River, on the line of the Charleston and Savannah R. R., the work was carried on similarly to that at Harlem, but the progress of the work was greatly facilitated by the use of a secondary air-lock which was designed by the engineer in charge. This was so designed that the excavated material which was brought into the main air-lock could be discharged at any time, and the work go on without interruption. The secondary air-lock was inclined like a spout, and had an outside and an inside door. By closing the outside door and opening the inside one, it could be filled with material; and by closing the inside and opening the outside one, the material would slide out. In this way the discharge could be almost continuous, and the progress which was made in excavating and sinking was nearly three times that which was made by means of the old air-lock. In this case light was supplied to the workmen through large bulls'-eye glasses which were placed both in the upper and lower floors of the air-lock. The progress of the work was further facilitated by forcing the sand up through a tube by means of the pressure of the air in the pile. It having been found that the pressure of the air was sufficient to force the material above the surface of the water, a pipe was extended from the upper end of the pile downward to near the soil at the bottom, and terminated with a kind of telescopic tube, so that it could be extended or shortened as was necessary in order that the lower end could lie continually under the sand as the pile moved downward. It was necessary to reduce the section of the mouth of the pipe at the lower end, so as to prevent anything from entering it which could not pass freely through the pipe. This method of removing the soil was used in making the foundations of the Omaha and Leavenworth bridges, and to some extent in the East River bridge. It is sometimes difficult to keep the pneumatic piles vertical as they are being sunk. As soon as they begin to incline, efforts should be made to bring them to an erect position. This may sometimes be done by driving wedges under the lowest edge of the cylinder, and then suddenly relieving the air-pressure. The wedges form an obstruction, so that when the pressure is relieved the lower side will sink slower than the other. But this is not always effectual. The engineer of the Omaha bridge, in order to bring the tube to an erect position, adopted the ingenious plan of boring several holes on the upper side of the tube and letting the compressed air flow through them, thus loosening the soil on that side, and relieving it of friction, and thus permitting that side to sink the fastest; but this did not always effect the desired object. In the Omaha bridge strong levers were tried for the purpose of drawing the tube into an erect position. A heavy pull was thus brought to bear whilst the pile was sinking, but with very little effect. While sinking one of the piles in the Savannah River holes were bored on the upper side, as in the Omaha bridge, and levers used at the same time, without bringing it to an erect position; but at the same time that both these appliances were used the upper end was beaten with a ram, and the erect position was quickly secured. The jar produced by the ram appeared to loosen the soil, and gave great effect to the other means which were used.

Fig. 18.



It has been ascertained that concrete will harden very slowly under great pressure, and it has been questioned whether it will ever become very hard. The hardening has been greatly facilitated in such cases by using a porous brick in a dry state, instead of stone, as was done at Szegedin, Hungary; and also by inserting in the body of the concrete $\frac{1}{2}$-inch gas-pipes, as was done by the chief engineer, McAlpine, at the Harlem bridge, the object being to permit the compressed air to diffuse itself throughout the mass of the concrete. In some cases in Europe double air-locks have been used, such as at the Szegedin bridge over the river Theiss, Hungary (Fig. 19), for the purpose of saving time; but as they are not as serviceable as the supplementary air-lock used in the Savannah River, it is only necessary to refer to them as an historical fact. Each air-lock is substantially the same as the single ones before described. The material is lifted into them alternately, and discharged from one whilst the other is receiving its load. In the bridge over the river Theiss at Szegedin each pier was composed of two piles or columns filled with béton, and each supports one track of the railroad. The soil was alluvial, in alternate layers of sand and compact clay for an indefinite depth. The piles were sunk about 30 feet below the surface of the bed, or 40 feet below the surface at low water. Twelve piles were driven into the bottom of the columns to the depth of 20 feet below the bottom. To provide against a scour, sheeting-piles were driven about 2 feet from the pier and completely around it, and the space filled with concrete; and in addition a large quantity of stones was put outside the piles, extending outward

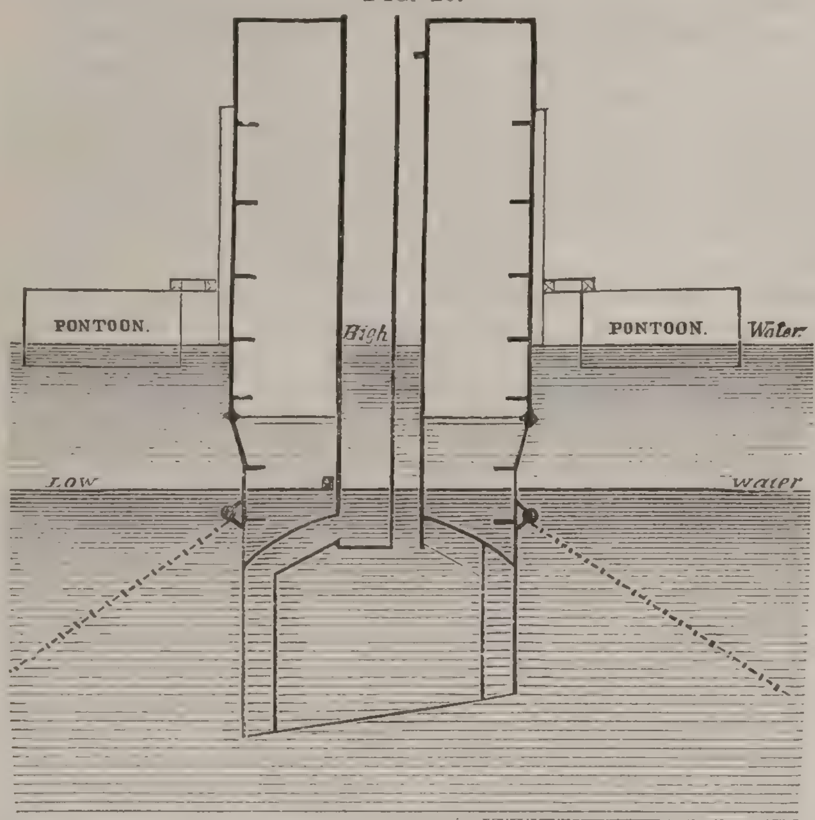
Fig. 19.



Longitudinal Section of Pile A, bell or working-chamber B, and air-locks C, D, used on the bridge at Szegedin over the river Theiss, Hungary: A, water discharge-pipe; B, equilibrium tubes of air-lock; C, elevation of air-lock; D, longitudinal section of air-lock; M, hoisting-gear in the bell; N, hoisting-gear for air-lock; W, counterpoise to compressed air.

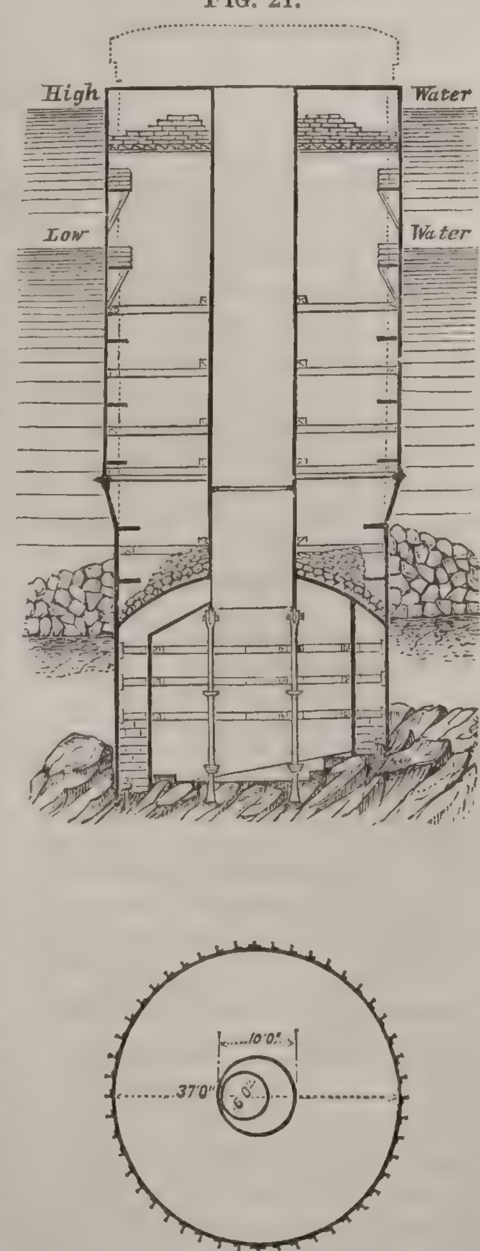
about 10 feet from the piles. The concrete for this structure was mixed by mechanical means. A wooden cylinder about four feet in diameter, which was firmly hooped on the outside and lined with sheet iron on the inside, was supported on an axis which was inclined $\frac{1}{13}$th to the horizon, and made to revolve by means of a belt from a steam-engine, making from 15 to 20 revolutions per minute. The cylinder was fed through a hopper at the upper end, and its contents discharged at the lower end thoroughly mixed.

FIG. 20.



The centre pier of Saltash bridge, on the Cornwall Railway, England, was sunk to a greater depth by the plenum process than any pier which had been previously sunk by this method. This bridge crosses the river Tamar at Saltash, about 3 miles above Plymouth. The site for this bridge was selected in 1845, but the bridge was not begun until 1853. The two river-spans are each 455 feet. The centre pier (Figs. 20 and 21) carries one-half of each of these spans. It consists of a column or circular pillar of solid masonry 35 feet in diameter, and 96 feet high from the rock on which it rests to above high water. Upon this are placed four octagonal columns of cast iron 10 feet in diameter, carried up to a height of 100 feet above high-water mark. The pressure on the bottom of the pier is about 10 tons per square foot, including the load upon the bridge. The character of the bed of the stream and the rocky bottom were determined by means of 175 borings made through a cylinder which was 6 feet in diameter and 85 feet long. The cylinder was used on account of the great velocity of the stream and the rise and fall due to the tides. It was slung between two gun-brigs, and when in the desired place it was sunk a few feet into the mud, and kept in position whilst the borings were made. In this way it was found that the surface of the rock where the pier was to be established was very irregular, but had a general slope, as shown in Figs. 20 and 21. A wrought-iron cylinder of boiler plates, 37 feet in diameter and 90 feet in length and open at the bottom, was constructed on the shore, floated to the place where the pier was to be made, and sunk through the mud to the rock. It was with some difficulty that the cylinder was brought to a full

FIG. 21.

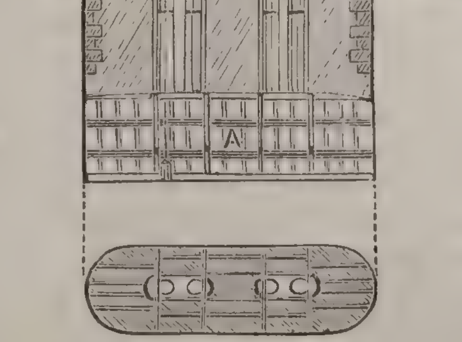


bearing and to an upright position. Within the large cylinder was a 10-feet cylinder, placed concentrically with the former, and the two thoroughly connected by means of tie-rods; and within this was a 6-feet cylinder. The lower end of the cylinder was provided with an annular space about four feet wide and divided into 13 air-tight compartments which were connected with the 6-feet air-cylinder extending through and to the top of the 10-feet cylinder. The lower compartments were covered with a dome-like partition at about the height of the mud. It was supposed that the mud would prevent the inflow of water, but it was found necessary to resort to air-pressure to keep it out. The water and mud were first removed from the air-space, and a ring of granite ashlar masonry 4 feet thick and about 7 feet high was put in place, as shown in Fig. 23. In attempting to pump out the water and mud from beneath the dome, it was found that there was a leak of such magnitude that it was necessary to use air-pressure again. The rock was finally reached, and dressed to a level surface. Before the air-pressure was applied, about 750 tons of ballast was put upon the cylinder to prevent its floating, part of which was placed above the dome, and a part on the upper deck, as shown in the figure; and to add to the security in case there was a sudden inflow of water, the cylinder was anchored vertically to the rock by means of tie-rods and lewis bolts. The masonry was then built up to the springing line of the dome, after which the dome was cut away, as well as the lower part of the 10-feet cylinder, and the masonry was carried upward, having a diameter about 2 feet less than that of the upper part of the cylinder. When the masonry reached the height of the surface of the water, the upper section of the cylinder was unbolted from the lower, and the upper portion was removed, leaving the lower portion undisturbed.

The foundation of the Korono bridge in Russia is similar to several others which were built on the railway between Warsaw and St. Petersburg. The materials being mostly shipped from foreign countries, economy in the plans was especially studied. The air-chamber D was made as small as possible, and all the cylinder above it was made water-tight by having all its joints packed with rubber. The air-chamber was made of wrought-iron inverted plates, and the cylinder above it of cast iron, and where they were exposed to shocks they were $2\frac{1}{2}$ inches thick. The diaphragm was made in sections, so that it could be easily removed. This bridge had four piles, each 11 feet 6 inches in diameter, sunk to a depth of 39 feet below low water through granitic sand. The two upper piers are to support an ice-breaker. The cylinders which compose the pile were generally made of cast iron, bolted together in sections. In the construction of the Hermitage wharf on the Thames, England, aponite (Ransom's artificial stone) was used. It was made into cylinders 8 feet in diameter and 9 inches thick. It cost from one-half to three-fourths as much as iron, and was used with good success.

Pneumatic Caissons.—The essential difference between the pneumatic pile, as above described, and a pneumatic caisson, is one of degree rather than one of quality, the latter being sufficiently large to envelop the entire masonry of the pier. In ordinary cases the pier is sunk to the required depth before it is filled with concrete or masonry, but in the caisson the masonry is built upward while the whole pier is being sunk downward, the masonry thus forming the load for forcing the caisson into the soil. The general arrangement of the parts is shown in Fig. 22. The lower portion, A, is a large compartment in which the laborers excavate the earth. The outside wall is strong enough to resist the inward pressure of the water and soil. Its lower edge is made comparatively thin, so as to force itself more easily into the soil. The roof is sufficiently strong to support all the masonry which will be put upon it. The air-bells C C contain double air-locks, as before explained. D D are cylindrical passages to form a communication between the air-bells and the lower compartment. The workmen pass up and down the passages D D. The air-locks are not always placed at the upper end of the communicating shafts, but in many important structures

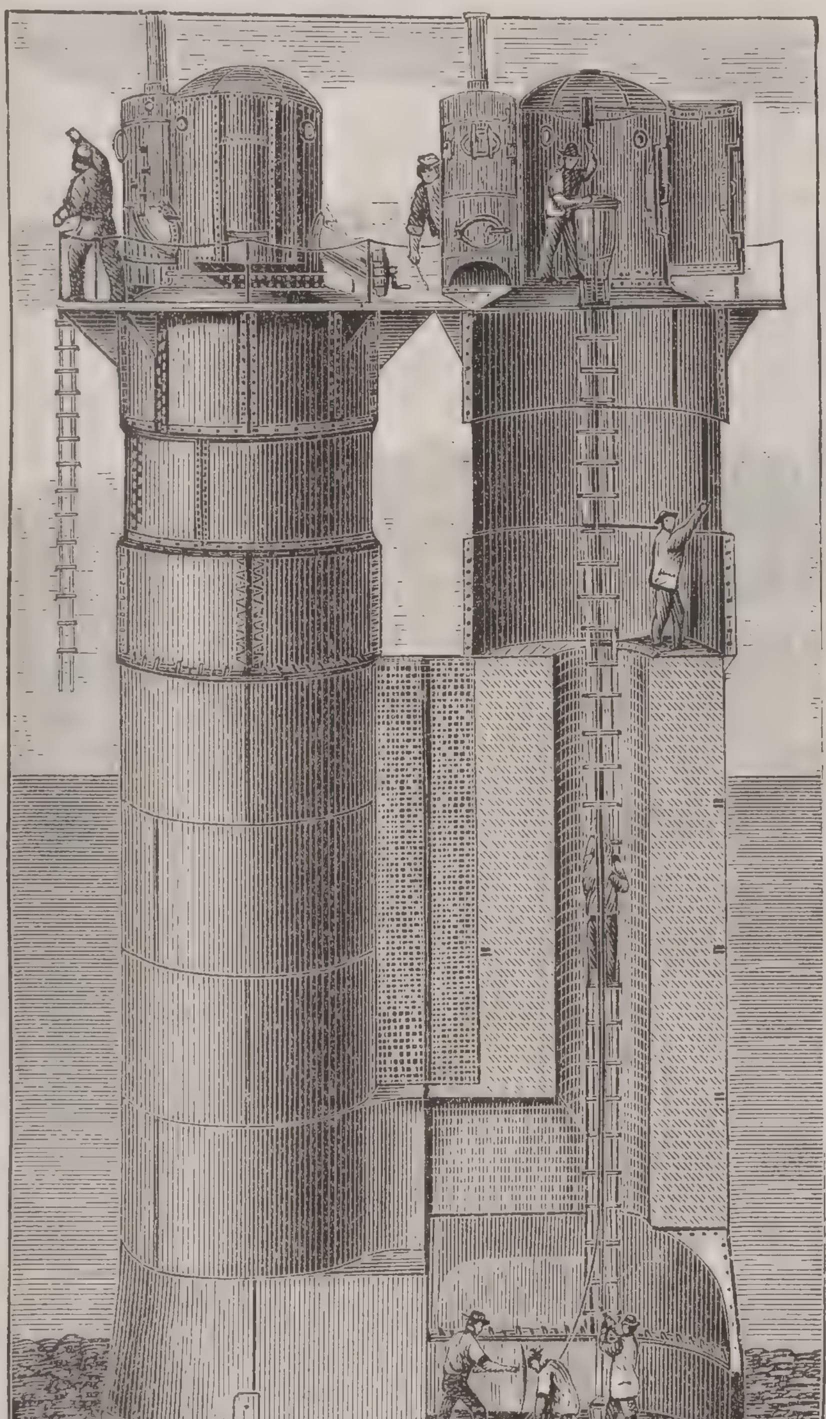
FIG. 22.



of recent date they have been placed at the lower end of the passage, and are made to open directly into the lower compartment. The excavated material is sometimes raised through shafts which are designed especially for that purpose. In a bridge at Nantes each air-lock was divided into three compartments—one for the workmen to pass through, which would contain four at a time; one for the barrows by which the excavated soil was removed; and one for the concrete which was to fill up the lower working chamber after the excavation was completed. In the bridge at L'Orient, over the Schorff, the caissons were made of sheet iron, in zones which decreased in thickness from the top to the bottom, but as they were not properly braced, they became distorted on account of the external pressure of the water. The caissons were about 40 feet long and 12 feet wide. The bells or air-locks were 10 feet high and 8 feet in diameter. The lower compartment was about 10 feet high, and the cylinders which formed the communication with it were 2½ feet in diameter.

Tay Bridge.—This English bridge, built in 1873, has 89 spans, and is 10,320 feet from shore to shore. The pier

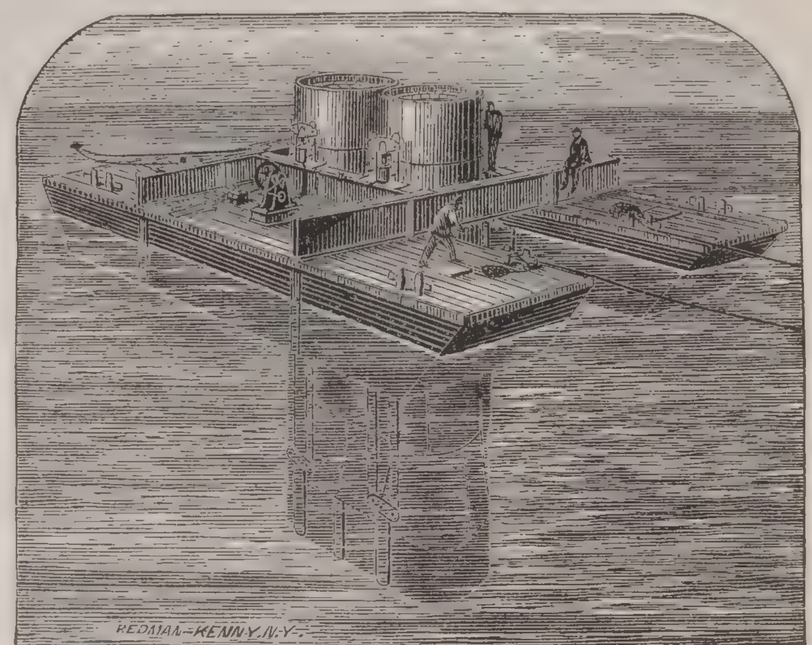
FIG. 23.



Sinking the Caissons.

shown in Fig. 23 is composed of two columns, which are so joined at the bottom as to form one large compartment under the whole pier. At first, single columns were used, and sunk separately, but their bases were so narrow that several of them overturned whilst they were being sunk; but no such difficulty was experienced after their bases were joined as shown in the figure. The base of the lower chamber is made of wrought iron, and is 22 feet 7 inches long, 10 feet 6 inches wide, and 3 feet high. This is surmounted by a conical cast-iron frame 5 feet high, and forming a flange 2 feet 6 inches wide, upon which the masonry was built. The body of the cylinders is made of cast iron, ¾ of an inch thick, 9 feet 6 inches in diameter, and in sections about 4 feet long. These were surmounted with air-locks which had supplementary locks for discharging the material. One set of air-locks was made to answer for all the piers by removing them from one to the other as needed. A space of about 2 inches was left between the masonry and the inside of the cylinder, which was afterwards filled with concrete. A cylindrical space of about 4 feet diameter was left inside, through which the workmen passed from the lower chamber, and through which also the excavated material was raised. After the pier was sunk to a permanent position, the lower chamber was filled with concrete, in the proportion of 1 of sand to 3 of broken stone. Concrete was run in, so as to thoroughly fill all the space about the flanges carrying the masonry, after which the cylindrical passage was filled. The piers were first built up 15 feet high near the shore,

FIG. 24.



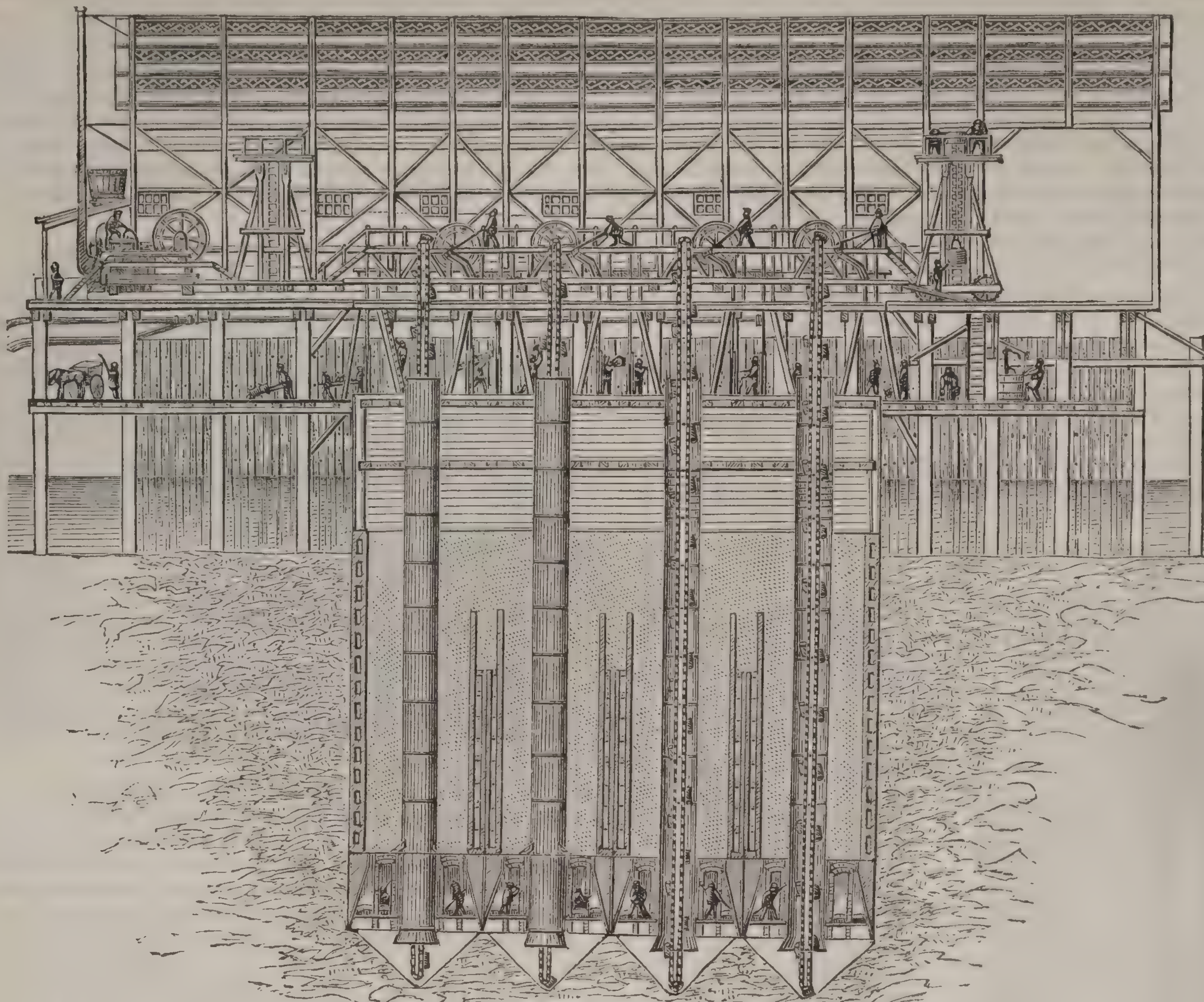
Floating the Piers into Position.

and the pontoons, which carried a set of girders, floated over them at high tide; and as the tide lowered the girders were left hanging upon brackets which were attached to the piers, and the pontoons were floated away. The piers were then built upward to such a height that the top would be above water when the piers rested upon the bottom. The girders were then connected by the wrought-iron lowering chains to the wrought-iron links near the bottom, as shown in the figure. The pontoons were then floated under the girders at low tide, and as the tide raised the whole were floated, and towed to their permanent position. The pontoons were then anchored, and the piers were gradually lowered by means of hydraulic rams which were placed on the girders. These rams had a stroke of 12 inches. As the lowering proceeded, links which were about 4 feet long were added. The lowering took place during ebb tide, and as it sunk into the bottom it was carefully watched to see if it retained its vertical position. If it did not, the hydraulic pumps were set to work to bring it into the proper position. As it moved downward it was steadied by chains which were attached to the last pier which was finished, and extended to the one being sunk, and also by means of two hydraulic telescopic legs.

Kehl Bridge.—The foundations of the bridge built in 1859 over the Rhine at Kehl (Figs. 25 and 26) were made upon four caissons, which in the first foundation were independent, but afterward they were bound together, so as to make one caisson having four compartments. Each of these compartments had their tubes leading upward, the central one being nearly 5 feet in diameter, and kept constantly full of water; and the other two, each 3 feet 3 inches in diameter, were supplied with ladders and winches, and served merely as passages for the workmen. The air-tubes were used alternately—one being used whilst the other was being lengthened. The compressed air kept the water out of the caissons, whilst workmen, passed down and standing upon temporary floors, excavated the material and fed it under the central tube, where it was dredged and raised to the surface. Each of the piers was sunk to the depth of 65 feet and 9 inches below low water. The first was put down in 55 working days, the second in 31, the third in 25, and the last in 24. In some of the caissons the wrought iron forming the rim was buckled by the external pressure. This was provided against by brick arches which were built between the sides. The masonry was advanced so that its weight was kept slightly in excess of the friction. The plan adopted in making these foundations was found to be a very great improvement, in regard to cost and facility of construction, over that of separate tubes, and marks a new era in the construction of pneumatic foundations. In making the foundations for the bridge over the Rhone at La Voulte the working chamber was a single compartment, instead of being divided into several. The materials were raised by a single dredge placed at the centre of the pier. In this bridge, as well as in the Kehl, the caissons were regulated in their descent by means of chains and screws which were attached to the external frame.

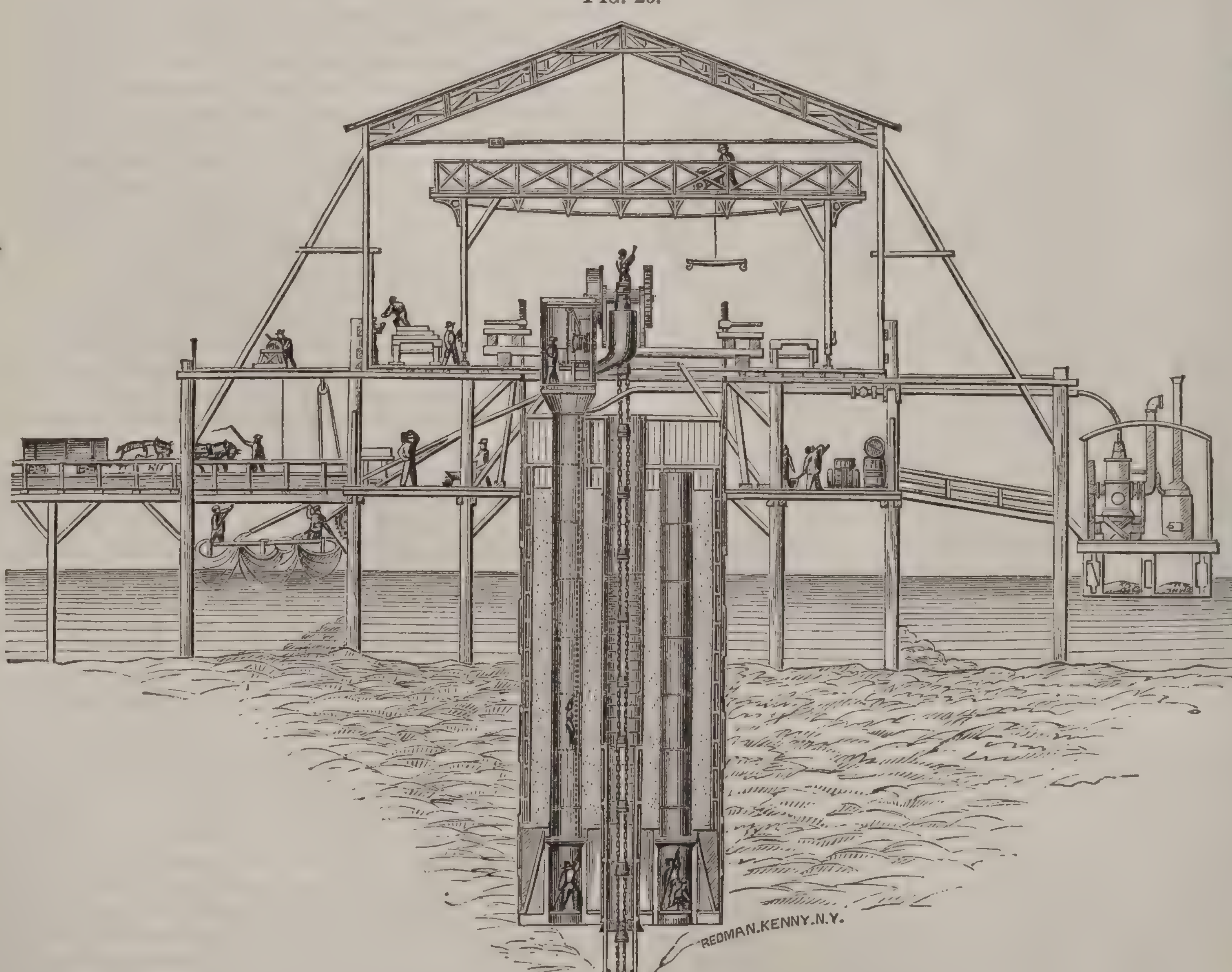
St. Louis Bridge.—The shifting character of the bed of the Mississippi River, and the great depth of the scour,

Fig. 25.



Longitudinal Section: Shore Pier of Kehl Bridge (French side).

Fig. 26.

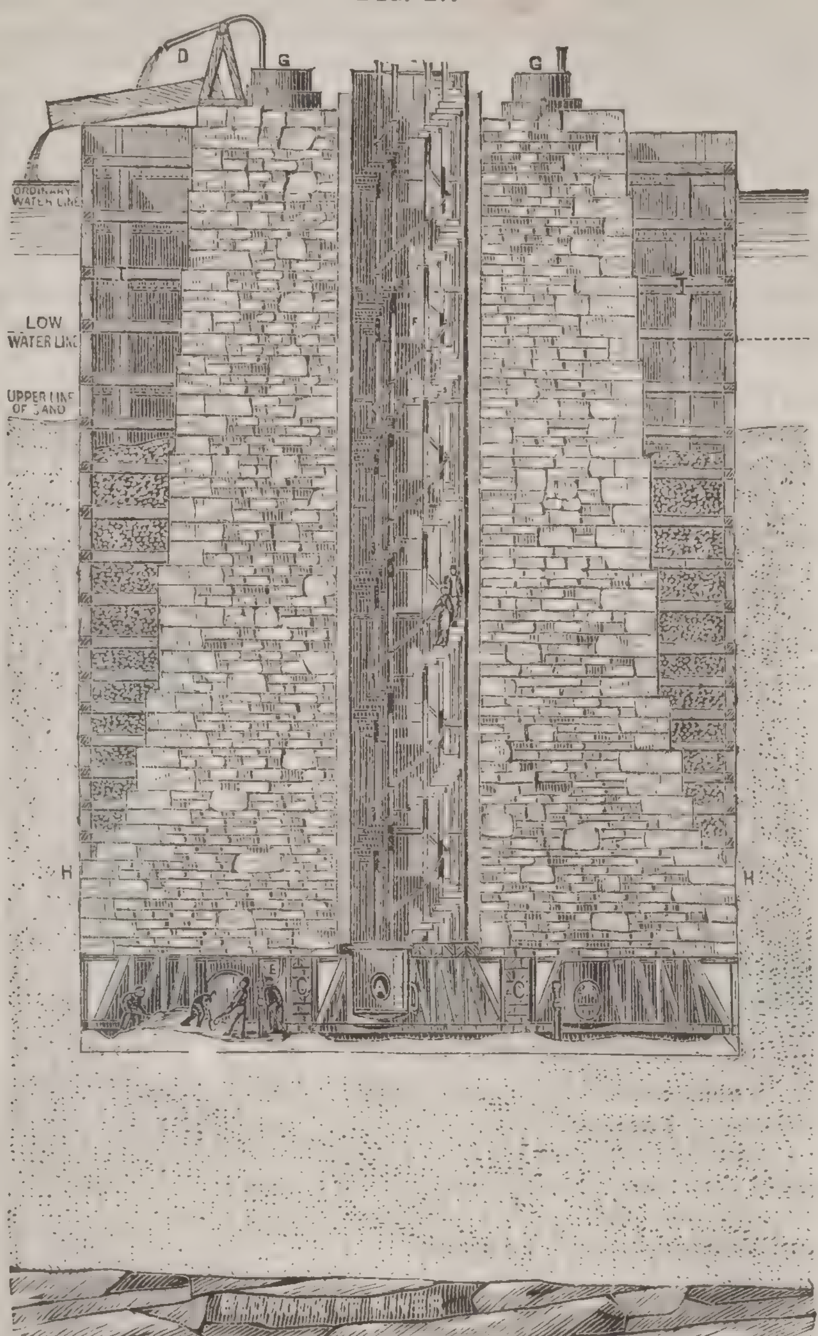


Cross-Section: Shore Pier of Kehl Bridge (French side).

make the establishment of permanent foundations in it very difficult. The rock underlying the river opposite St. Louis dips to the eastward, the depth at the W. abutment being only 13 feet below extreme low water, while at the E. abutment it is 94 feet, and 136 feet below high-water mark. There are two piers in the body of the stream, which are essentially alike, except that the easterly one is deeper than the other. (See Bridges.) They were built in a large caisson (Fig. 27), having one large air-compartment in the base, where the workmen excavated the material. This compartment was 9 feet high, the sides being of $\frac{3}{4}$-inch plate iron for the larger, and $\frac{5}{8}$-inch for the smaller pier.

Two massive timber beams or piles C C were built up from the sand for supporting the roof of the chambĕr. The roof

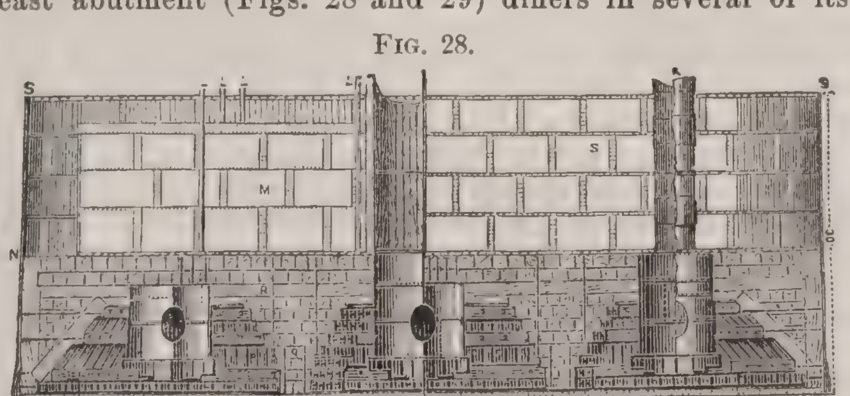
Fig. 27.



Section of East Pier and Caisson, showing the interior of the main entrance-shaft and air-chamber, and the working of one of the sand-pumps, Illinois and St. Louis Bridge: A, air-locks; B, air-chamber; C, timber girder; D, discharge of sand-pump; E, sand-pumps; F, main entrance-shaft; G, side shaft; H, iron envelope; I, bracing for shell.

was composed of ½-inch plate iron. Over this, and running transversely to the timber beams, are thirteen iron girders, L, which are riveted to the roof. The masonry rests upon the girders. The bottom was excavated as evenly as possible all over, so that the timber beams and sides of the caisson would sink evenly. There were openings through the wooden beams, so that communication could be had with all parts of the chamber. The support given by the timbers, the buoyant force of the air, and the friction upon the sides were the only means relied upon to sustain the pier during its gradual descent to the rock. The air-locks A A A were located in the roof of the air-chamber, and communication was had with them through brick wells F G, thus avoiding the necessity of adding new joints under the locks as the sinking advanced. The sand was forced out at D by means of a sand-pump placed at the lower end of the tube at E. The sand-pumps were designed especially for this work by the engineer, Capt. Eads, and were operated by means of a stream of water which was forced through them in the well-known way. The east abutment (Figs. 28 and 29) differs in several of its

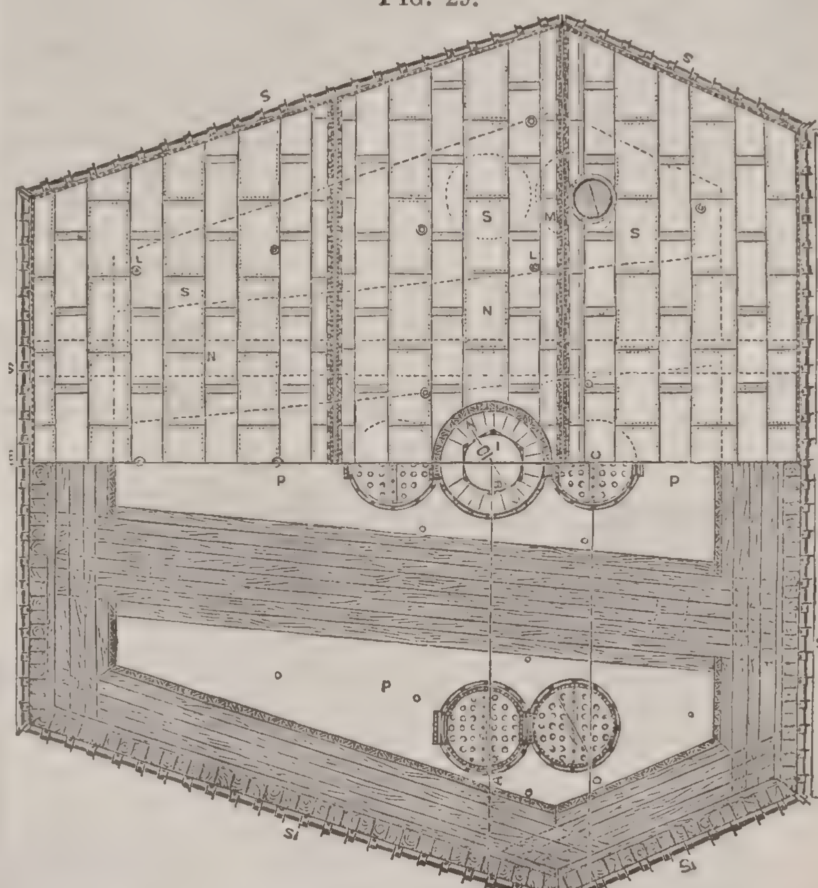
Fig. 28.



Caisson for East Abutment, St. Louis Bridge: I, main shaft; K, side shafts; L, pipes for air and sand-pumps; M, iron girders; N N, iron deck; O, air-locks; P, air-chamber; Q, timber girders; R, timber deck; S S, iron envelope; T, timber sides.

details from the piers. It is especially noted as being the deepest foundation ever constructed by the pneumatic process. When it touched the rocky bottom it was 110 feet below the upper surface of the water in the river. The main shaft had two air-locks at its lower end, each 8 feet in diameter, having about four times the capacity of those used in the piers. There were also two other shafts and air-locks, which were used for additional security. Every

Fig. 29.

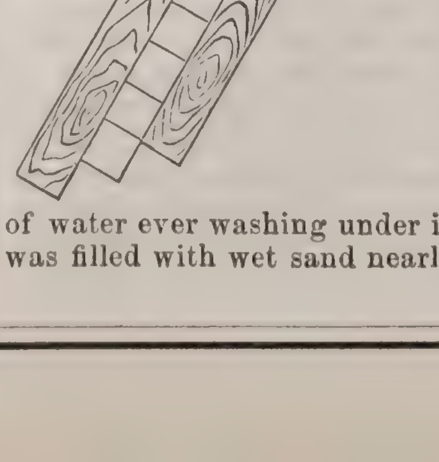


Caisson for East Abutment on the Illinois and St. Louis Bridge: I, main shaft; K, side shafts; L, pipes for air and sand-pumps; M, iron girders; N N, iron deck; O, air-locks; P, air-chamber; Q, timber girders; R, timber deck; S S, iron envelope; T, timber sides.

precaution was taken to secure the safety of the workmen. Telegraphic communication was established between the top of the masonry in the pier and the large compartment at the base. Previous experience had raised a doubt in the minds of many whether workmen could endure a pressure of over three and one-half atmospheres above that of the ordinary atmospheric pressure; but it was found that by making frequent changes, not keeping them in the compressed air for more than one hour at a time, they suffered but little inconvenience. But several who remained in several hours under a much less pressure were paralyzed, and a few died from the effects of the confinement.

In all the preceding cases to which we have referred the walls of the caisson which enclosed the masonry were extended upward so as to exclude the water, but in the E. pier and E. abutment they were extended upward only 12 or 15 feet above the roof of the air-chamber. The sides of the roof of the chamber having been made practically water-tight, it was only necessary to make the shafts water-tight to exclude water from the chamber. This was done by lining them with white pine pieces, which were arranged like the staves of a cask, and were 10 inches thick at the lower end, and gradually diminished to 3 inches at the top. Candles and oil lamps burned much more rapidly in the compressed air than usual, and it was very difficult to extinguish them. It was found, also, that if the clothes of the workmen caught fire, it was difficult to extinguish them, although they were of woollen material. It was therefore thought advisable to enclose the lamps in a very strong glass case or vessel which communicated freely with the external air, and then admit compressed air into the vessel through an air-cock, so that the supply could be limited. A cock in the tube leading to the external air enabled them to prevent the escape of the air whilst changing a lamp or supplying oil. After the E. pier reached the rock the air-chamber was filled with concrete. In the E. abutment all depressions in the rock were filled with concrete, so as to make an even bearing surface, and it was continued up, so as to prevent the possibility of water ever washing under it; and then the entire space was filled with wet sand nearly up to the roof, and the re-

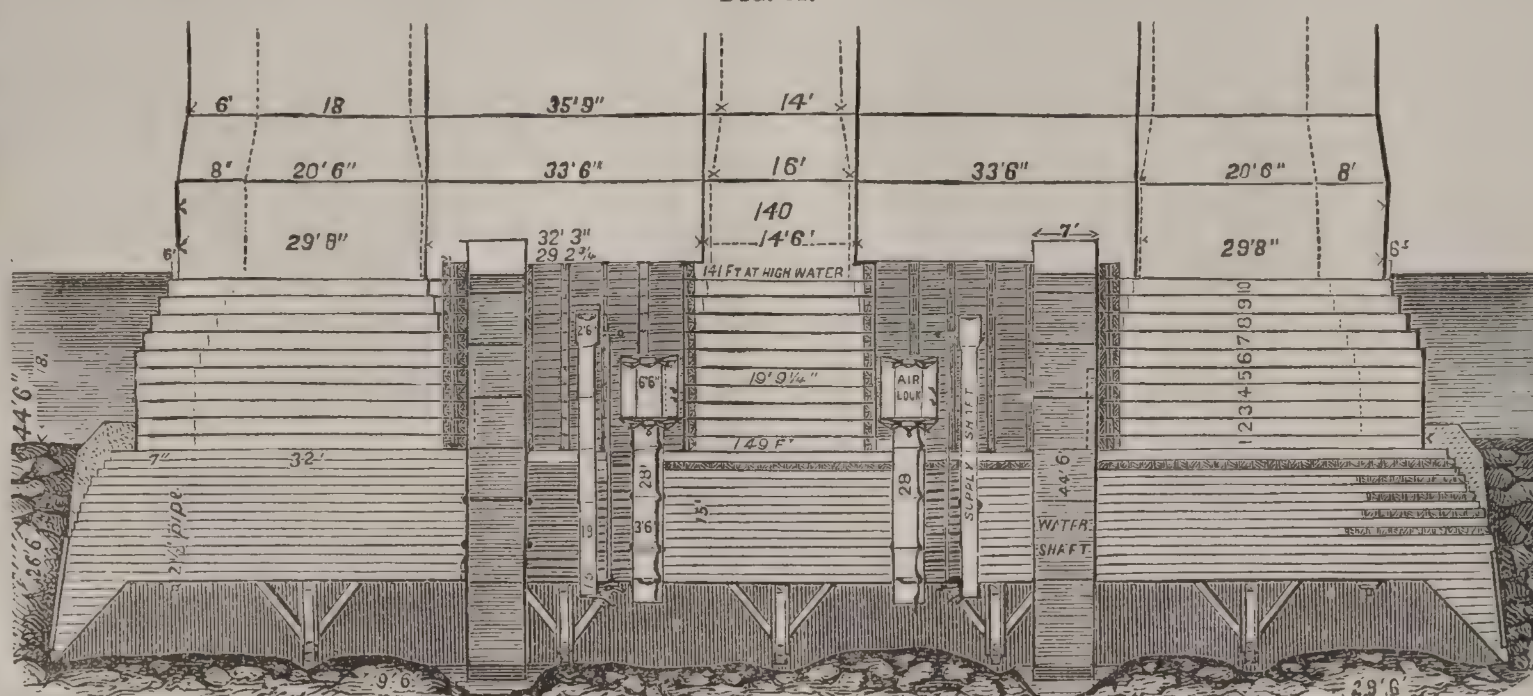
Fig. 30.



maining space was rammed full of concrete. This greatly cheapened the process of filling, and it was supposed to be as good as if it were all concrete. The piers of the iron bridge over the Missouri River at St. Joseph, Mo., were sunk to solid rock by the pneumatic process—a depth of 50 feet below the surface of the water. The walls of the caisson were composed of three layers of timbers. In the outer layer the timbers were nearly vertical, and placed close side by side. In the next layer they were horizontal, and terminated 1 foot higher at the bottom than the outer ones. The inner layer had its timbers parallel to the other, but terminated 2 feet above the outer ones. These were firmly bolted to each other. This arrangement of stepping at the lower edge enabled them to regulate the descent better than if it were square on the bottom. If the material was hard, they would excavate under the edge, so that it could force its way more easily. If it was soft, they would leave more material under the edge, thus giving it a broad bearing surface to check its progress.

East River Bridge.—(For a description of this bridge see East River Bridge.) The foundations on the Brooklyn and New York sides are substantially alike. Each was built upon a large caisson and sunk by the pneumatic process. The Brooklyn caisson is 168 feet long by 102 feet wide. The New York one is 172 feet long by 102 feet wide. The lower edges of the sides are V-shaped, and are 9 feet thick

Fig. 31.



where they join the roof, sloping down to a round edge. The inner slope is 45°, and the outer is 10°. The lower edge, or shoe, is formed by a semicircular casting, protected by a sheet of boiler plate, extending up 3 feet on the sides. A heavy oak sill, 2 feet square, rests directly on this casting. The succeeding three courses are of yellow pine, and are laid lengthwise; after which the alternate ones are heading courses. The whole V is thoroughly held together by means of screw-bolts and drift-bolts. In addition there are heavy angle-irons uniting the V to the roof. The immediate roof is composed of five courses of 12-inch square yellow pine sticks, laid close together, bolted sideways and vertically, and having a set of bolts running through the whole of the five courses. The caisson was made air-tight, as far as practicable, by completely covering it with tin between the third and fourth courses, and extending it down on the sides to the shoe. The tin on the outside was protected by a sheeting of yellow pine. Before the tin was put on, the seams were caulked inside and out for a depth of 4 inches. The space between the timbers was filled with hot pitch and grout, and the inside of the air-chamber was coated with an air-tight varnish. The excavated material was mostly raised through water-shafts. There were two of these in each caisson, 7 feet by 6 feet 6 inches, made of ⅜ boiler plate properly stiffened. They were open at the top and bottom, the lower ends being 21 inches below the edge of the caisson, and the upper end being kept constantly above the upper surface of the masonry. The pressure of the air within the caisson kept the column of water in the shafts at the same height as the water in the river. The excavated material was thrown by the workmen into the depression beneath the water-shaft, from whence it was taken by a clam-shaped dredge and raised through the water-shaft to the top of the masonry, from whence it was removed. Much material was blown out through vertical pipes by the pressure of the air in the caisson, as before described. The air-locks were placed at the lower ends of the entrance shafts, and were constructed in the usual manner. As soon as the caisson was put in place, several courses of stone were built upon it to sink it to the bottom. Air was then forced in to expel the water. As the tide rose it would tend to float the caisson; one end would rise and let a quantity of air escape, which would permit the caisson to sink again, but would leave a foot or more of water on the bottom. The air would soon expel the water, and the operation would be repeated. The soil was very full of boulders, most of them so large that they had to be split before they could be removed. After the caisson was sunk a depth of 25 feet, they were blasted by means of gunpowder without damage. Boulders under the shoe were sometimes removed by drilling a hole through them, and putting in a charge of powder and blowing them bodily into the chamber. Boulders were found 14 feet long and 5 feet in diameter. On the Brooklyn side the dredges which worked in the water-shafts were unable to dredge the native soil at the bottom of the shaft. Whenever this occurred, the shaft was closed at the top and the air entered above the water, driving it down into the air-chamber, and a pit with sloping sides was excavated by hand-labor. The pit was then filled with water, and the air in the shaft allowed to escape gradually, until the column of water balanced the pressure of the air. Once the dam about the pit washed away, and let the water fall below the end of the shaft, and all the compressed air suddenly escaped from the caisson. It took with it water, mud, and stones, and produced a frightful noise, but caused no damage. The roof of the Brooklyn caisson once caught fire. The compressed air caused it to burn vigorously, and it was found impossible to extinguish it by ordinary means. Carbonic acid gas produced but little effect upon it, and it was found necessary to completely fill the caisson with water; which was safely done. After the caissons were sunk to the depth required, they were filled with concrete, consisting of 1 part of Rosendale cement, 2 of sand, and 4 of small-sized gravel. The sand and cement were mixed above and passed through one shaft, and the gravel through the other. The cement was built up in bulkheads all around, only 4 or 5 feet in thickness, and as they approached the roof they were filled up on the back side first, leaving a sloping upper surface, and the remaining space thoroughly rammed full with flat-faced iron rammers. The Brooklyn caisson was founded on a firm, compact subsoil at a depth of 50 feet below the surface of the water, and the New York one also rests on a very compact stratum, 2 or 3 feet thick on the bed-rock at a depth of 78 feet. The effect of compressed air was so serious upon the men that before the New York caisson reached the proper depth the hours of labor had to be reduced to two for a shift. A few deaths occurred from the effects of being in the compressed air, and scarcely any escaped without being affected by intense pain in the limbs, or by a temporary paralysis of the arms and legs, from which, however, they soon recovered. The pneumatic caisson is not considered as cheap as other modes of making foundations where other processes can be used. But in rapid streams and under deep water no plan has been devised which enables the engineer to have such complete control of the work in passing obstructions in the soil and securing with certainty an even foundation upon solid rock, or upon a firm substratum when rock cannot be reached. (See *Trans. Inst. Civ. Engineers*, Eng.; *Notes on Foundations*, by Gen. Delafield, U. S. A.; Mahan's *Civ. Eng.; Report Illinois and St. Louis Bridge; Rep. East River Susp. Bridge; Jour. Frank. Inst.; Annales des Ponts et Chaussées; Ponts et Chaussées.*) De Volson Wood.

Foundation, in law. In its most enlarged legal signification the term "foundation" is used to denote the establishment of a corporation of any kind, and in this sense

the sovereign or state is said to be the founder of all corporations, since their original creation is due to royal charter or legislative grant, express or implied. But in its narrower, yet more usual and important meaning, *foundation* refers to the establishment of eleemosynary or charitable corporations or institutions by private endowment; and it is sometimes, though less commonly, by a natural transfer of application, used to indicate the endowment itself. A large variety of the most beneficial institutions which have been created for the common welfare of society, and have contributed largely to the promotion of civilization, have owed their origin and maintenance entirely to private munificence. Such are colleges and seminaries of learning, hospitals and asylums, and the various associations for the relief of the aged, the destitute, and the afflicted which exist at the present day in such abundance. There is vested at common law in the creator of such charities the right to exercise a power of supervision over the management of the corporate revenues and the methods of corporate action and government. This is called "a power of visitation," and is judicial in its nature, but not legislative. It corresponds to a great degree with the right of control exercised by government over civil corporations through the agency of the courts, which is also sometimes termed a power of visitation. Such a prerogative vested in an individual founder is regarded as the bestowal of a just and reasonable jurisdiction over the disposal of his own property, and the power is one which descends to his heirs. (See VISITATION.) But the visitorial authority is not generally retained at the present day by founders of corporations, but is vested in boards of trustees. In the Andover Theological Seminary this visitorial authority is still retained, a board of visitors—three persons—having a certain control—whose terms are fixed in the original foundation of the seminary—over the trustees. In the U. S. the appointment of boards of trustees is the more common practice, so that the rights and privileges consequent upon a charitable "foundation" are now exercised by such governing bodies, and are quite generally defined by the act of incorporation. Charitable purposes may also be accomplished without any corporate authority, through the medium of trustees appointed by the founder either by deed or will. These trusts are under the supervision of the courts of chancery. The same remark is applicable to the funds of charitable corporations, which may be called to account for a breach of trust. (See CORPORATIONS and TRUSTS.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Found'er (*Laminitis*), an inflammation primarily attacking the laminæ of the horse's foot. This disease may follow overdriving, exposure to cold when perspiring, overfeeding, or giving food or drink too soon after hard work; long-continued driving on pavements or on frozen ground and bad shoeing are fruitful causes. The fore feet are usually affected alone, but the fore legs and chest-muscles sometimes share in the disease; and these muscles undergo a sort of atrophy (chest-founder) in consequence of its long continuance. The disease resembles rheumatism in many respects. Like that, its acute form is attended by great fever and pain. Bleeding is admissible in a young strong horse suddenly foundered. The shoes should be taken off, the hoof covered with a hot poultice. Litter the stall heavily, and in severe cases sling the horse up from the floor. After the acute stage is over put the horse to pasture if possible, and let him run as long as you can spare him, except in severe weather, when he should be housed. A foundered horse can be detected by his mincing gait, by his resting his fore foot upon the toe, by a hot or contracted hoof, and by delicate signs recognized with difficulty by any except practised observers. For an established founder there is no possible cure.

Found'ling Hos'pitals, institutions for the reception and support of infants and children that have been abandoned by their parents or guardians. Such institutions are maintained by government appropriations or by private or sectarian associations. Children found abandoned are known as foundlings, and the cause of their desertion is in most cases illegitimate birth, though not a few are born in wedlock and are abandoned by parents unable to provide for them. The necessity of providing for such children, and restraining infanticide, long since led to the establishment of foundling institutions by most civilized nations. Amongst the ancients, from the power given by the laws to male parents over the life of their offspring, it is undoubted that infanticide, as amongst some Eastern nations at present, was the prevailing means of solving the difficulty which the establishment of foundling hospitals was intended to meet. In Rome and Athens infanticide is known to have been practised, and in the former there is ground for believing that deformed children were put to death by law. By the ancient Egyptians, however, infanticide was punished by a law compelling the guilty parent to pass three days and nights embracing the body of the child, which was fastened to the parent's neck. Where infanticide was not resorted to on account of the stringent laws against it, desertion was largely practised, and prevailed extensively in all the states of ancient Greece excepting Thebes, where both the abandonment and destruction of offspring were forbidden. Both Athens and Rome at an early period had institutions for the reception and education of foundlings. In the former the abandoned children were exposed in the *Cynosarges*, and in the latter at the *Columna lactaria*, a pillar in the public market-place. Foundlings were generally the property of those who took them under their protection, and were generally educated and treated as slaves.

As early as the sixth century a species of foundling hospital existed at Treves, where a marble basin was located in front of the cathedral, in which parents could deposit children they wished to abandon, the care of such foundlings being given by the bishop to members of the church. In Rome also, in the sixth century, public institutions existed for the reception of foundlings, called by Justinian *brephotrophia;* and in the seventh century similar ones existed at Anjou in France. One was established at Milan in 787 by an arch-priest named Datheus, for the object of preventing infanticide. The children received at this institution were nurtured by hired nurses until the age of seven, when they were discharged as free-born. In 1070 a foundling hospital was established at Montpellier, and a second one in 1180, known as the Hospital of the Holy Ghost. In 1200 one was established at Eisenbeck, and in 1212 one in Rome. In Florence a magnificent one, the Spedale degli Innocenti, still in existence, was established in 1317. Similar institutions were founded in Nuremberg in 1331, in Paris in 1362, and in Vienna in 1380. The Hôtel Dieu of Lyons, founded in 1523, was one of the first in France where foundlings were not only received, but were educated; and in 1536 a similar one was established by Francis I. In Paris in 1563 a foundling hospital was established by the Church, and managed by an association of priests. In this children received a careful education, many of the boys being trained for the priesthood. The refusal of this institution to receive illegitimate children necessarily left those unfortunates to become the victims of misery. Recognizing the necessity of providing for abandoned infants, Saint Vincent de Paul, by his eloquent pleadings, collected funds sufficient to establish a new foundling hospital in 1640; which during his lifetime was managed by a committee of ladies. In 1670 this hospital was converted into a public one by Louis XIV., and subsequently it was enlarged, and received annually about 2000 foundlings, who were chiefly from the provinces. After 1789 the French republic assumed the charge of foundlings, and in 1793 the terrorists declared them all to be *enfants de la patrie*. An imperial decree in 1811 continued the arrangement by which foundling hospitals had become government institutions and the foundlings children of the state. It further ordered the establishment of such hospitals in each arrondissement of France, the children to be suckled and weaned in the institutions, and kept in them until six years of age, when they were to be entrusted to respectable persons, who received a stipend for their support and education. This stipend is yearly reduced until the children attain the age of twelve, when the able-bodied boys are placed at the disposal of the minister of the marine, while delicate ones are provided with suitable work. All foundlings are the property of the state, and if not taken into public service at the age of twelve are apprenticed. It was not many years before the facilities for the disposal of children afforded by the law produced a great increase in the number of foundlings in France. In 1784 the number was estimated at 40,000; in 1811, at 69,000; 1819, at 99,346; 1825, at 117,305; 1830, at 118,073; 1833, at 129,699. Prior to 1811 the reception of foundlings was public, but by the decree of that year each hospital was provided with a turning-box in which the child could secretly be deposited. After 1834 most of the hospitals had suppressed the turning-boxes, from a conviction that the great increase in the number of foundlings since 1811 was due to their use. In 1852, however, M. Ulysse Ladet wrote a series of papers advocating their restoration, but was opposed on the ground that they encouraged parents to abandon their offspring. On the other hand, the statistics of infanticide are decidedly favorable to the turning-boxes. The question of the public or secret reception of abandoned children, and consequently of the use or suppression of turning-boxes, is one that must be decided by considerations aside from infanticide, and is at present receiving careful attention in most countries. In most of the Roman Catholic countries of Europe the same system as that in force in France for the care of abandoned children was adopted, and in many exists to the present

day. Prior to the separation of Holland and Belgium, 19 foundling hospitals were in existence. In 1815 they maintained 10,739, and in 1826, 13,220 foundlings. In 1859 the number of children abandoned in Belgium exceeded 8000, or 1 child to every 18 born, notwithstanding that since 1834 the turning-boxes have been abolished, though foundling hospitals for the open reception of children are very numerous. In France likewise, since 1834, the secret reception of foundlings has been declared illegal, and consequently the turning-boxes abolished. In 1784 a large foundling hospital was established in Vienna by Joseph II. In 1759 a similar institution was opened in London by Thomas Coram; since 1760, however, this institution has been open only for the reception of poor illegitimate children of known parentage. In 1762 a foundling hospital was founded in Moscow by Catharine II., being afterwards greatly enlarged, so as to include a lying-in department and schools. In 1859 the entire number of its inmates was 25,000, of which 600 were infants, with about 5000 children farmed out to the peasantry, women receiving about five rubles a week for caring for a child. The Vospitatelnoi Dom in St. Petersburg was founded in 1772, also by Catharine II., as a branch of the one in Moscow, and like the latter has since been greatly enlarged, and has a lying-in department and a school. In 1790 it contained 300 children, and in 1837 about 25,000. In 1859 it annually received about 7000 foundlings, many of whom are brought as far as from Siberia and Bessarabia. On this account the mortality amongst the infants has been large, many being received in a dying condition from exposure. According to the laws of Russia, all foundlings are the property of the government, and the army and navy are largely recruited from this class. Owing to the prevalence of the crime of infanticide in China, a foundling hospital was established about 1856 in Canton, but the number of children received has been exceedingly small in proportion to the births. In the city of Mexico there has long been a *cuna* or foundling hospital capable of accommodating 600 children. It is maintained solely by private means, and receives the supervision of certain ladies. The infants are kept in the institution one month, and are then sent to the country or villages in charge of a nurse, who is responsible to some party in the neighborhood. These children after a certain age are generally adopted by respectable persons. In the foundling hospital in Rio de Janeiro all the male children are apprenticed at maturity to trades, and the girls are educated to make able and useful wives. At each anniversary men desiring to marry attend, and after due certification of their characters are allowed to select one of the marriageable girls, with whom a small dowry is given from the hospital funds. The great hospital of Santo Spirito in Rome has a foundling department capable of holding 3000 children, and it annually receives about 800, many of whom are farmed out in the country. At Naples the foundlings receive more attention than in any other Italian city. Its hospitals receive annually about 2500 infants, of whom a large number are of legitimate birth, abandoned on account of poverty. The Dei Trovatelliale Annunziata in Naples, which was founded in the thirteenth century, has an educational establishment which annually costs 400,000 lire. This institution alone receives 1900 foundlings annually in the turning-box. Every foundling received has a number fastened around its neck to aid in future recognition. Two infants are given in charge of one out-door wet-nurse, and on attaining the age of eighteen months are entrusted to the nuns for further care; 37 per cent. of the nurslings are thus cared for, 19 per cent. are paid for by the institution, and others are taken charge of by their parents. Only 12 per cent. are returned again to the institution, the rest being retained by those having them in care; especially is this the case with the boys, as they can be made useful after the seventh year. All the children remaining in the institution after the age of seven are transferred to the orphan asylum, where they are taught some trade. Every infant received in the foundling hospital of Florence is farmed out, the wet-nurses receiving ten francs a month, and a further gratuity if they retain the foundlings until their eighteenth year. The girls on being married receive 235 francs. From 1855 to 1865, 1403 received this reward. In 1867 there were 83 organized foundling hospitals in Italy; from 1863 to 1866 these institutions received 33,222 foundlings—3.85 per cent. of the whole number of births in the kingdom. Of these 33,222 children, a large number were of legitimate parentage. The foundling institution in Rome is at present conjoined with the large institution for the poor and sick, and is conducted in like manner as the one in Naples. Almost all the infants are farmed out, only the weakly ones being retained, numbering about 60 or 70. For the infant farmed out under one year of age the institution pays the wet-nurse a small sum, and arrangements are made for the permanent care of some. From 1830 to 1840 the average yearly number of foundlings was 834, while from 1860 to 1865 it reached 1116. In the Madrid hospitals the infants are also farmed out until seven years of age, when they are transferred to the college of the "Forsaken" (*Desamparados*) to be educated. In Portugal the number of illegitimate children exceeds that in Spain, and consequently the number of abandoned infants is great. The Santa Casa de Misericordia in Lisbon contains an immense foundling department, conducted in a manner similar to those in Spain. The foundling hospitals of St. Petersburg are divided into the following departments: 1, the nursery; 2, twelve country districts, to which the foundlings are sent to be educated; 3, a hospital in the city for the crippled and incurable; 4, a country institution for the residence of children of legitimate parentage. In 1864 the number of foundlings amounted to 6181, of which 422 were legitimate. A large majority of the infants were but a week old. The number of foundlings received in the Moscow institution from 1862 to 1864 was 35,387, of whom 10,000 died in the same period. The infants are cared for by wet-nurses selected carefully from those offering their services. The foundling hospitals in Vienna and Lower Austria receive infants on the following conditions: declaration of the community to which the infant or mother belongs, of her religion, and proof of its illegitimacy in case it is to be received permanently. Admission is free to infants born in hospitals. Admission is granted to illegitimate children on payment of a stipend by the relatives or townships of the mothers. The infant's maternity is known only to the authorities, and such information is given on presentation of the certificate given the child's mother on its admission. The institutions provide for the children until their tenth year, after which its support must be assumed by its native village or town. While in charge of the institution the children are raised either within or outside the buildings; in both cases they are universally wet-nursed. During the five years from 1863 to 1868 the Vienna foundling hospital received over 54,478 infants. In the Prague foundling hospital the children are only kept a short time, and are then farmed out in the country, only those being kept in the institution who are feeble, and for whom nurses cannot be found outside. Those given in charge to outside parties are still claimed by the institution, and at their sixth year they receive a free schooling. At the age of ten years the institution relinquishes all claim to the child, when the village or town of the mother must provide for its support, or its own mother may reclaim it on proving her ability to provide for it. In Munich the following rules for the care of illegitimate children are strictly enforced: It is a misdemeanor to take charge of such children under eight years of age without approval of the police authorities, and such permission is refused unless the character, circumstances, and locality of the petitioner are satisfactory. The infants given in charge of nurses are first examined by medical men, and no women are allowed to receive foundlings to the neglect of their own children. In France at the present time the same rules are observed as laid down in the decree of the emperor Napoleon in 1811, of which a portion is already noticed. Reclamations are not frequent, the majority being boys. In 1853 the number reclaimed in all France was 4390. The management of the London Foundling Hospital at present is as follows: The governors meet once a week to receive petitions for the admission of children. A child can only be received upon personal application of the mother, who is obliged to state the circumstances requiring her to abandon her child, and to give her name, residence, age, date of child's birth, sex, father's name and occupation. Shortly after admission the infants are sent into the country, where they remain until their fifth year, when they are returned to the institution, where they are educated. At the age of fifteen the girls are apprenticed out as domestic servants until the age of twenty. The boys are apprenticed at the age of fourteen as mechanics until they attain the age of twenty-one years. In both cases those to whom they are apprenticed are held to a strict accountability for their physical and moral well-being. After the termination of the period of apprenticeship the institution ceases to exercise any control over the foundlings. At the present day in England the boarding-out system for foundlings is being extensively tried, and meeting with great approval. The advantages claimed for this method are that the children are removed from pauperizing tendencies, and are put upon an equal footing with other children. It is claimed that foundlings thus brought up have in most instances become good men and women. In Scotland the boarding-out system has been widely adopted, and from its marked success has won universal approval. In the U. S. the care of foundlings in institutions is the universal system, and most of the larger cities have their foundling hospitals, either under control of and supported by private and sectarian associations, or the State government. The

city of New York has a large foundling hospital on Randall's Island, capable of receiving 1200 infants yearly. It is under municipal control. Within a few years the large foundling hospital of the Sisters of Charity has been established in New York City from money received from the State and other sources. It is wholly under control of the Roman Catholic sisterhood, and is most admirably managed. Boarding-out the infants to responsible women is largely practised by this institution, and with good results. At both institutions the infants are secretly received, no questions being asked of those bringing the infants to the hospitals. The opinion of those who have given the subject their careful attention is adverse to large asylums for infants, and statistics show that under such circumstances the mortality is larger than among the poorest people. B. F. DAWSON.

Foun'dry, an establishment for shaping metallic figures by pouring the molten material into moulds in which it cools and is solidified. The operation is called casting or founding. Metal casting was successfully practised in ancient Assyria, Babylonia, Phœnicia, and Greece; and the Chinese and Japanese have long excelled in casting both iron and bronze. In modern times in more highly civilized lands casting has attained great perfection. Iron founding, brass, bronze, and type founding are special forms of the art. Of especial importance is the formation of the mould, within which, if the casting be hollow, a *core* is placed. The mould is in general formed of loam, moulding-sand, plaster, or even, for some articles, of metal. For small and nice objects pounce, or powdered cuttle-bone, is sometimes used for making the mould. The core is always of some material which will yield during the contraction of the metal. Type-foundries employ steel moulds. In the iron-foundry the metal is generally melted in a furnace of the form called *cupola;* coke, charcoal, and in this country anthracite, are employed in melting the iron. For many forms of nice casting, requiring clean edges and well-defined lines, bog iron, which is often heavily charged with phosphorus, is preferred, since it is more perfectly liquid when in a molten condition than most other kinds of iron. The variety of articles now manufactured in the foundry is very great. The principle employed in all kinds of casting is very obvious and simple, but the practical details are very numerous, and can be properly learned only by experience.

Foun'tain [Fr. *fontaine*, from Lat. *fons*, a "spring of water"] is strictly the name of any spring of water, but in this sense it is now generally applied to famous or historic springs, as the fountain of Arethusa, of Cyane, of Bandusia, or of Vaucluse. More often at present it designates an artificial basin and jet for the flow of water from aqueduct-pipes. Fountains are designed not only for use, but for decoration, and hence they are often elaborately fashioned after artistic designs.

Fountain, county in the W. of Indiana. Area, 400 square miles. It is bounded on the W. by the Wabash River. It is generally level, has a black fertile soil, and abundance of fine timber. Block coal and iron ores abound. Cattle, grain, and wool are produced. There are considerable manufactures of carriages, wagons, boots, and shoes. It is traversed by the Indianapolis Bloomington and Western R. R. Cap. Covington. Pop. 16,389.

Fountain, tp. of Monroe co., Ill. Pop. 2977.

Fountain, post-tp. of Fillmore co., Minn. Pop. 1037.

Fountain, tp. of Juneau co., Wis. Pop. 599.

Fountain City, post-v. of Buffalo co., Wis., on the E. bank of the Mississippi River, 10 miles N. W. of Winona, Minn., in a rich agricultural district. It has 2 large steam saw-mills, 1 steam flour-mill, 1 machine-shop, 1 newspaper, several stores, 3 churches, and 5 hotels. Pop. 867. JOSEPH LEITCHT, ED. "REPUBLICAN."

Fountain Creek, tp. of Iroquois co., Ill. Pop. 503.

Fountain Green, post-tp. of Hancock co., Ill. P. 1475.

Fountain Prairie, tp. of Columbia co., Wis. P. 1286.

Fouqué (FRIEDRICH HEINRICH KARL), BARON DE LA MOTTE, German poet and novelist, b. at Brandenburg Feb. 12, 1777; served in the campaigns of 1792 and 1813; retired from the army, on account of ill-health, as major, and resided at Paris, at Halle, and on his estate of Neunhausen. *Undine* was written in 1813, *Corona*, poem, in 1814, *Der Zauberring* ("The Magic Ring") in 1816, *Eginhard und Emma*, drama, and *Bertrand du Guesclin*, epic poem, in 1821. D. at Berlin Jan. 23, 1843.

Fouqué (HENRI AUGUSTE), BARON DE LA MOTTE, Dutch general, b. at The Hague 1698; served in the Prussian army against Charles XII. of Sweden 1715; acquired the friendship of the Prussian prince-royal, afterwards Frederick the Great, and received a command from him in 1740; rose to the rank of a general (1759) in the wars of Frederick; was wounded and taken prisoner at the battle of Landschut in 1760; and d. at Brandenburg May, 1774.

Fourchambault, town of France, in the department of Nièvre, on the Loire. It has very extensive iron-smelting furnaces and forges. Pop. 5348.

Fourche, tp. of Pulaski co., Ark. Pop. 601.

Fourcroy, de (ANTOINE FRANÇOIS), COMTE, French chemist and politician, b. at Paris June 15, 1755; became M. D. in 1780; from 1784 to 1809 was professor of chemistry at the Jardin du Roi; in 1785 was admitted to the Academy of Sciences; was a member of the National Convention in 1792, and of the Committee of Public Safety in 1794; of the Council of Ancients in 1795; appointed minister of public instruction Sept. 15, 1802. D. at Paris Dec. 16, 1809. *System of Chemistry* (11 vols. 8vo) was issued in 1801, *The Philosophy of Chemistry* in 1792.

Four Evan'gelists, The, four small islands at the entrance of the Strait of Magellan, which, together with eight other small islands running 15 miles farther out in the Pacific, form the group called "The Twelve Apostles."

Fourier (FRANÇOIS MARIE CHARLES), the founder of the social system called Fourierism, b. Apr. 7, 1772, in Besançon, and educated in the college of his native city. He had both talent and inclination for studies, especially for mathematics, music, geography, and natural history, but when he was eighteen years old his father put him into the office of a merchant in Lyons as a clerk, and commerce became his business in life, very much against his will. In 1793 he inherited a fortune from his father, but lost it the same year on account of the revolutionary disorders in Lyons, in which he became entangled. He was imprisoned first in Lyons, then in Besançon, and he escaped only by becoming a dragoon in the Revolutionary army. Having been discharged from the military service in 1795 on account of ill-health, he returned to his commercial pursuits, residing in Marseilles till 1825, in Lyons till 1832, and then in Paris, where he d. Oct. 10, 1837. He lived very retired, held always inferior positions, and had only miserable salaries. In his few leisure hours he wrote his books, and with his scanty spare money he published them. They made no sensation, they hardly attracted any attention, and yet every single day of his life, on returning home from his office, he expected to find some enthusiastic millionaire waiting for him, ready to invest his millions in a social experiment according to the new theory. His first book, *Théorie des quatre mouvements et des destinées générales*, was published in 1808; his second and most important, *Traité de l'association domestique agricole*, in 1822; and a sort of compendium of both, *Nouveau monde industriel et sociétaire*, in 1829; but they found only very few readers. It was not till 1831, when the social schemes of St.-Simon and of Robert Owen were much discussed, that Fourier attracted any attention for his own ideas by his savage attacks on these two reformers, *Pieges et Charlatanisme des Deux Sectes Saint-Simon et Owen, promettants l'Association et Progrès.* From that time several talented disciples gathered around him—Madame Clarisse Vigoreaux, Victor Considerant, Cantagrel, Hennequin, and Mennier. A monthly paper, *La Phalange*, was issued, and later on even a weekly, *La démocratie pacifique*. In England and the U. S. Fourierism found warm adherents in Hugh Doherty and Albert Brisbane, and practical experiments were made both in France and America. They failed, however, and at present the whole idea seems to have lost its hold on the public interest.

The negative side of Fourier's writings, his criticism, is very brilliant. It is bitter, but it is acute, often strikingly true, and always full of noble suggestions. But the positive side of his system is theoretically a failure, and where it also has proved a failure practically the reason is hardly that the experiments have been made with insufficient means, but that the fundamental idea is incompatible with human nature and human destiny. Fourier considers our civilization, in its present shape, as the root of all our vices and the cause of all our miseries; and his views and arguments on this point carry a kind of conviction with them in all their critical details. But the remedy he prescribes, his ideal of a new civilization, his social system, is fantastic, and, what is worse, no remedy at all. Its speculative part, the foundation of the system in the nature of the universe and the human soul, is awkward and insufficient, and its practical part, the phalanstery, where 1800 people live, work, and enjoy together in one building, is a dream, which perhaps would do away with much vice and misery, but which certainly would also do away with much virtue and all heroism. In order to gain freedom in a comfortable but narrow sense of the word, Fourier cuts it off in its large and dangerous but inspiring sense. In order to secure to each individual a certain amount of enjoyment, he cuts off from mankind the prospect of an infinite degree of happiness.

In order to get rid of the errors, crimes, and horrors in which human destiny is involved, he lowers this destiny to an eating, drinking, dancing, and sleeping mediocrity. He is not at war with morals and religion, but he has no use for them. He acknowledges property as a reward to labor and talent, but does not understand it as a necessary complement to the human personality. His phalanstery is the monastery of the Middle Ages revived. To some people it means an asylum, but to others an iron cage. As a critical ferment, however, the value of the works of Fourier and his disciples is considerable. CLEMENS PETERSEN.

Fourier (JEAN BAPTISTE JOSEPH), BARON, French mathematician and natural philosopher, b. at Auxerre Mar. 21, 1768, was a moderate friend of the popular cause in the Revolution, but was twice imprisoned by the ruling party. He was sub-professor in the Polytechnic School 1794–98; accompanied Bonaparte to Egypt as savant in 1798; was prefect of Isère at Grenoble Jan., 1802–15; in 1816 was admitted to the Institute, in 1817 to the Academy of Sciences, and to the Académie Française in 1827. The same year he was president of the council of the Polytechnic School. D. at Paris May 16, 1830. His *Théorie Analytique de la Chaleur* was published in 1822, and he left an *Analysis of Determinate Equations*, published in 1831.

Fourier (PIERRE), known as THE BLESSED PETER FOURIER, b. at Mirecourt, in Lorraine, Nov. 30, 1565, became a Premonstratensian monk, and in 1595 parish priest of Martaincourt, where he founded the congregation of Notre Dame (see NOTRE DAME, CONGREGATION OF), or "Ladies of the Congregation;" and soon after instituted a reform in the Premonstratensian order. D. at Gray Dec. 9, 1640, and was beatified 1730.

Four Lakes, in Dane co., Wis., discharge their waters into Catfish River. They are situated in a beautiful and fertile region. First Lake is 3 miles long and 2 miles wide. Second Lake, the next above, is rather longer. Third Lake (Lake Monona) is 6½ miles long and 2 broad. Fourth Lake (Lake Mendota) is the highest; it is 6 miles long and 4 broad. Between the last two lakes stands Madison, the capital of the State. These lakes are deep, clear, and cold, and are largely fed by springs.

Four Mile, tp. of Wayne co., Ill. Pop. 1817.

Four Mile, tp. of Polk co., Ia. Pop. 531.

Four Mile, post-tp. of Dunklin co., Mo. Pop. 830.

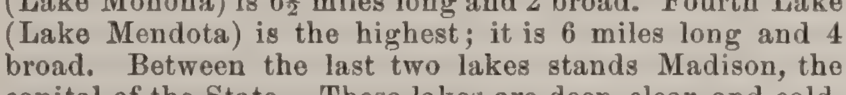
Four Mile, post-tp. of Otoe co., Neb. Pop. 571.

Four Mile, tp. of Barnwell co., S. C. Pop. 1935.

Fournet (VICTOR), b. at Paris May 15, 1801; d. at Lyons Jan. 8, 1869. Was educated at the French School of Mines; graduated doctor of science, and rendered great services to dynamical geology, metallurgy, and mineralogy; demontrated *Fournet's law*, establishing the exact order of the metals as regards their "sulphurability;" was an industrious meteorologist and observer of physical phenomena; introduced great improvements in the treatment of lead ores; was a member of many learned societies, and author of numerous scientific papers of value.

Fourth, in music, an interval comprising four degrees of the scale, or the distance, *e. g.*, from C to F, D to G, etc. Fourths vary in quality or compass according to their place on the scale, numbering from four to six semitones. They are regarded as threefold—viz. the perfect (or major), containing two whole tones and one semitone; the diminished, one whole tone and two semitones; and the superfluous (or augmented), three whole tones; thus:

Perfect. Diminished. Superfluous.



In harmony, the fourth is regarded as a consonance when it occurs as the complement of the perfect fifth, as in the second inversion of the triad. In other cases it is treated as an imperfect dissonance. (See INTERVAL.)

WILLIAM STAUNTON.

Fourth, tp. of Richland co., S. C. Pop. 7687.

Fouvent-le-bas, a v. of France, in the department of Haute-Saône. In 1800, Cuvier discovered in three large grottoes situated in the vicinity a great number of fossil bones of quadrupeds, and in 1827, Thirria determined some of these bones as remains of the rhinoceros, elephant, hyæna, lion, etc.

Fowl [Ger. *Vogel*, a "bird"], in its original meaning as a synonym of *bird*, is antiquated and nearly obsolete, except as a name for domesticated birds of the sub-class Cursores and order Gallinæ. This order contains the common domestic fowl (*Gallus domesticus*), the peacock, guinea-fowl, turkey, etc., all of which are noticed under the proper heads. The domestic fowl is of probable Asiatic origin, but recent observers report the discovery of the bones of the domestic fowl in European kitchen-middens of supposed pre-historic date. (See COCK for some notice of its probable descent.) It was well known to the Greeks, Romans, Etruscans, and, as Cæsar says, to the ancient Britons also. There are innumerable breeds and varieties, among which may be mentioned the Dorking, the game-fowl, the black Spanish, the tall Chinese breeds, the Polish, the Crèvecœur, the Houdan, the little Bantams, the Leghorn, etc. They are valued for the great number and excellence of their eggs, and for their flesh, which is excelled by that of no domestic bird except the turkey. The various breeds differ much in respect to color, disposition, hardiness, size, and fattening and laying qualities.

Fowle (DANIEL), b. about 1715 at Charlestown, Mass., became a printer of Boston in 1740; published various periodicals, and with Gamaliel Rogers issued the first American edition of the New Testament; was arrested in 1755 on suspicion of printing *The Monster of Monsters*, a severe political brochure, and after a short imprisonment left Boston, and in 1756 began to publish the *New Hampshire Gazette* at Portsmouth, where he d. June, 1787.

Fowle (WILLIAM BENTLEY), b. at Boston, Mass., Oct. 17, 1795; became a bookseller, and in 1821 engaged with success in teaching; became in 1842 publisher of the *Common School Journal*, which he edited 1848–52; published several text-books for schools. D. Feb. 6, 1865.

Fow'ler, post-v. of Benton co., Ind., on the Cincinnati Lafayette and Chicago R. R., 28 miles N. W. of Lafayette; has a weekly newspaper.

Fowler, post-tp. of St. Lawrence co., N. Y., has four churches, and beds of iron-ore. Pop. 1785.

Fowler, post-tp. of Trumbull co., O. Pop. 871.

Fowler (CHARLES U.), D. D., American Methodist clergyman, b. in Upper Canada in 1837; came with his parents to the U. S. in 1840, graduated at Genesee College, N. Y., in 1859, and studied at Garrett Biblical Institute, Evanston, Ill. In 1861 he entered the Methodist ministry, preaching in Chicago, Ill., until 1872, when he was chosen president of the M. E. North-western University at Evanston, Ill.

Fowler (JOHN), b. in 1817; was pupil of J. F. Leathes, hydraulic engineer; at the age of twenty-seven was selected as engineer for the construction of the large group of railways known as the Manchester Sheffield and Lincolnshire. Settling in London, he has been continuously employed in laying out railways, docks, etc. in the United Kingdom and on the Continent. He is the constructor of the Metropolitan Inner Circle (underground) Railway in London, with its peculiar locomotive engines and plant, consulting engineer to the Manchester Sheffield and Lincolnshire Railway, etc., and engineer-in-chief to the government of Egypt; was at one time president of the Institution of Civil Engineers, London.

Fowler (JOSEPH SMITH), b. at Steubenville, O., Aug. 31, 1822; graduated at Franklin College 1843, and was four years a mathematical professor there; studied law in Kentucky, but removed to Tennessee; resided in Springfield, Ill., 1861–62, in consequence of the proclamation of Jefferson Davis; became in 1862 comptroller of Tennessee under the governorship of Andrew Johnson; U. S. Senator from Tennessee 1866–71.

Fowler (REV. LITTLETON), a distinguished minister of the Methodist Episcopal Church, South, b. in Tennessee Sept. 12, 1802; was licensed to preach in Kentucky Sept. 30, 1826. After filling responsible stations in Kentucky, Tennessee, and Alabama, he went in 1837 as missionary to Texas, and in 1838 was made superintendent of the Texas mission, which extended all over the republic. He was a delegate to the General Conference which met in New York in 1844, and was a member of the Louisville convention at which the M. E. Church, South was organized; shortly after which he d. He was an eloquent and a successful preacher. T. O. SUMMERS.

Fowler (LORENZO NILES), b. in Cohocton, Steuben co., N. Y., June 23, 1811, was for many years the business-partner of his brother, O. S. Fowler, and is the author of several books upon subjects of the same class with those treated of by his brother. He has also lectured extensively in the U. S., Canada, and Great Britain. In 1863 he became a resident of London.—His wife, LYDIA FOLGER, b. at Nantucket, Mass., in 1823, graduated at the Syracuse Medical College, and has lectured on physiology, phrenology, and the diseases of women. She is the author of several popular scientific works.

Fowler (ORIN), b. at Lebanon, Conn., July 29, 1791; graduated at Yale 1815; entered the Congregational ministry; became a missionary in the West; settled in 1819 as pastor at Plainfield, Conn.; was twenty years a minister of

Fall River, Mass.; often in the State legislature; in Congress 1848–52; distinguished as a temperance and anti-slavery orator; author of a treatise on *Baptism* (1835); *Historical Sketch of Fall River* (1841). D. at Washington, D. C., Sept. 3, 1852.

Fowler (ORSON SQUIRE), b. at Cohocton, Steuben co., N. Y., Oct. 11, 1809; graduated in 1834 at Amherst College, and with his brother, L. N. Fowler, became widely known as a lecturer, and as writer, editor, and publisher of books and periodicals upon phrenology, health, self-culture, education, and social reform; retired in 1863 from his business in New York, and removed to Boston, Mass., still continuing to write and lecture; is the author of numerous well-known works upon the subjects indicated above.

Fowler (WILLIAM CHAUNCEY), LL.D., b. in Clinton, Conn., Sept. 1, 1793; graduated at Yale in 1816; was tutor 1819–23; pastor of a Congregational church at Greenfield, Mass., 1825–27; professor of chemistry and natural history in Middlebury College, Vt., 1827–38; professor of rhetoric and oratory in Amherst College 1838–43; a son-in-law of Noah Webster, and editor of the University edition of Webster's *Dictionary* (1845); author of a treatise on *The English Language* (1850); of two English grammars; of *The Sectional Controversy* (1863); *Chauncey Memorial* (1856); *History of Durham, Conn.* (1866), etc. Resides in Durham.—His daughter, MRS. EMILY ELLSWORTH FORD, published a volume of poems in 1872.

Fow'lerite, crystallized rhodonite from Franklin, N. J.

Fowler's Solution [named from Dr. Thomas Fowler of Stafford, England (1736–1801), its inventor], a solution of arsenite of potash in water, flavored and colored with compound tincture of lavender. Each fluidrachm contains the equivalent of half a grain of arsenious acid. The dose is five or ten drops once, twice, or thrice daily. It is used in many diseases, especially skin diseases and malarial fevers and their sequelæ, and is sometimes very useful in epilepsy and neuralgia. It is a powerful tonic, and should be used only under the eye of a competent physician.

Fowles (JAMES H.), Episcopal clergyman in the U. S., b. at Nassau, N. P., in 1812; graduated at Yale College, New Haven, Conn., in 1831; was licensed by the New York presbytery in 1833, and afterwards ordained by Bishop Bowen of South Carolina. In 1845 settled as rector of the church of the Epiphany, Philadelphia, Pa. D. in 1854. Wrote *Protestant Episcopal Views of Baptism*, etc. (1846), *Thirty Sermons*, published after his death with memoir.

Fowl'ing, the taking of wild fowl either as a sport or as a means of livelihood. The term in the ordinary use would hardly include the shooting of grouse, pheasants, quails, and other land-birds, but is limited to the hunting of wild ducks, geese, and other water-fowl, and perhaps the shore-birds, such as the rail and plover. Not the fowling-piece alone, but also nets, snares, stalking-horses, birdlime, punts, screens, sneak-boats, decoys (living or artificial), and the like, are legitimate means of fowling. The water-spaniel is the best retriever for this work. Fowling, as pursued in Great Britain, has a strange and complicated vocabulary of its own, which it is incumbent upon gentlemen sportsmen to employ. Fowling as a means of livelihood is an important industry, chiefly in cold latitudes. In the Orkneys and other smaller British islands, as in Labrador, birds are pursued not only for their flesh and eggs, but for their feathers, which constitute an important article of commerce. This kind of fowling is a very arduous and dangerous pursuit. In many parishes of the east of England fowling-rights are attached to many rectories and other church livings, which derive hence no small part of their revenue. But this is far less prevalent now than formerly.

Fowl'ing-piece. See SPORTING-ARMS, by GEN. P. V. HAGNER, U. S. A.

Fowl Meadow Grass, an excellent grass for hay—the *Poa serotina* of the U. S., Canada, and Europe—growing in wet lands. The *Glyceria nervata* of the Northern States is called by the same name. It grows in wet land, and resembles the former in appearance and value.

Fownes (GEORGE), F. R. S., b. 1815; was professor of practical chemistry in the University College, London. D. Jan., 1849. Author of the Actonian prize essay on *Chemistry as exemplifying the Wisdom and Beneficence of God* (1844), and several popular works on chemistry.

Fox [Ger. *Fuchs*], the common name of those forms of the family Canidæ which are externally distinguished by a slender muzzle, vertical pupil, and an elongated bushy tail. Several distinct genera are thus confounded which differ from each other in some remarkable characters. Of these forms one genus (*Vulpes*) is common to the entire northern hemisphere, and has also numerous representatives in Asia and Africa. The most familiar species is the common or red fox of Europe and North America, and embraces several varieties, of which the most characteristic is the prairie or long-tailed fox (*Macrurus*) of the South-western U. S. Another related species, of smaller size, is the swift or kit fox (*Vulpes velox*) of the Western prairies. A third congeneric species with strongly-marked characters is a native of the Arctic circle, and has hairy feet, whence it is called *Vulpes lagopus*. The genus *Vulpes* is very closely related to *Canis*. Another genus (*Urocyon*) has much external similarity to *Vulpes*, but is distinguished from it by several very important anatomical characters. It is peculiar to North America, and embraces a single well-determined species (*Urocyon virginianus*); but there is an insular and tropical race which is much smaller, and has been considered as a distinct species, and named *Vulpes littoralis*. THEO. GILL.

Fox, tp. of Kendall co., Ill. Pop. 1265.

Fox, tp. of Black Hawk co., Ia. Pop. 812.

Fox, tp. of McDonald co., Mo. Pop. 529.

Fox, tp. of Carroll co., O. Pop. 1119.

Fox, tp. of Elk co., Pa. Pop. 1188.

Fox, tp. of Sullivan co., Pa. Pop. 443.

Fox (Sir CHARLES), English civil engineer, b. at Derby in 1810, was designed by friends to follow the medical profession, but studied engineering and was first employed by Ericsson. At the commencement of the construction of the London and Birmingham Railway Company's line he was appointed its assistant engineer by Robert Stephenson, and remained with the company five years, or a year subsequent to the opening of the railway. Then he joined the late Mr. Bramah in establishing the firm of Bramah, Fox & Co., afterwards Fox, Henderson & Co. He drew the plans for the building for the Great Exhibition in Hyde Park in 1851, spending eighteen hours per day in their execution for seven weeks, and being knighted for the work. He constructed the Sydenham Crystal Palace and many extensive railway and engineering works, and was senior partner in the firm of Sir Charles Fox & Sons, civil engineers. D. June 17, 1874.

Fox (Rt. Hon. CHARLES JAMES), the second son of Henry, Lord Holland, by Georgiana Carolina, daughter of the duke of Richmond, a descendant of Charles II., was b. in London Jan. 24, 1749, and educated at Eton and at Hertford College, Oxford. He did not graduate, but travelled 1766–68 upon the Continent, where he acquired a lifelong fondness for Italian literature. In 1768 he took a seat in Parliament for Midhurst, from which borough he was elected before he came of age. In 1770 he became a junior lord of the admiralty, and in 1773 a lord of the treasury, whence he was dismissed in 1774 by Lord North on account of his independent spirit. From this time he stood by the side of Burke and the Liberals, and assailed with most brilliant and effective eloquence the administration of Lord North, foretelling the eventual defeat of the British arms in North America. In 1780 he was chosen to represent Westminster in Parliament. In 1782 he was secretary of state for foreign affairs under the marquis of Rockingham, and in 1783 was secretary of state in the Portland ministry. In 1783 he introduced his India bill for the relief of the inhabitants of British India, but the East India Company, the king, and the House of Lords combined to defeat him, and he resigned. He stood again for Westminster, and was elected, but was unseated through the influence of the ministry. He entered Parliament for a Scottish burgh, and punished the offending magistrates of Westminster by a successful suit at law. He now became the prime leader of the Liberal party, from which Burke was so soon to secede; joined heartily in the prosecution of Warren Hastings; opposed with all his powers the policy of Pitt and his interference in continental affairs; supported Wilberforce in his efforts for the abolition of the slave-trade; and hailed from the first the French Revolution as the harbinger of a new era of freedom. Between Napoleon and Mr. Fox there was a mutual respect, which amounted almost to a personal friendship. From 1797 to 1802 he absented himself from Parliament completely. In 1806 he entered the ministry as secretary for foreign affairs, and in a personal note addressed to Napoleon offered peace, but did not live to see it effected. D. at Chiswick Sept. 13, 1806. He left no legitimate children. Mr. Fox was brought up by his father to a loose way of private life. An inveterate gambler, a hard drinker, the greatest spendthrift of his day, he was still a man of most generous and noble impulses and of kindly and genial disposition. To the consummate excellence of his oratory Burke, Mackintosh, Parr, Franklin, and all the best critics of his time bear the amplest testimony. His political views were always liberal and progressive, always far in advance of his time. His incomplete *History of the Reign of James II.* was published in 1808, and some minor works, and six volumes of his speeches appeared in 1815.

Fox (Charles James), b. at Antrim, N. H., Oct. 11, 1811; graduated at Dartmouth 1831; was law-partner with Hon. Daniel Abbot of Nashua, N. H., in 1834; member of the New Hampshire legislature in 1837; county solicitor 1835–44; member of a commission to revise the New Hampshire statutes in 1841–42; went to Egypt in 1843, and to the West Indies in 1844; compiled with Rev. Samuel Osgood, D. D., *The New Hampshire Book of Prose and Poetry* (1842), published the *History of Dunstable* (1846), and the *Town Officer* (1843). D. at Nashua, N. H., Feb. 17, 1846.

Fox (Charles Richard), English general, natural son of the third Lord Holland, b. in 1796, was in the navy from 1809 to 1813; served at the sieges of Cadiz and Tarragona; entered the 85th regiment in 1815, and was for years aide-de-camp to Sir F. Adams, at Corfû. He commanded the 34th regiment in America; was then in the grenadier guards, and aide-de-camp to King William IV. and to Queen Victoria. He sat in Parliament for Calne in 1831, and afterward for Tavistock, Stroud, and the Tower Hamlets, and was for some time surveyor-general of the ordnance under the Whig government. Became a general in 1863. D. 1873.

Fox (George), founder of the Society of Friends, b. at Drayton-in-the-Clay (now Fenny Drayton), Leicestershire, July, 1624, was the son of pious Christopher Fox, weaver, called among his neighbors "righteous Christer." His parents were both members of the Church of England. Fox was early bound apprentice to a shoemaker and glazier, but in 1643 abandoned this occupation, and in 1647–48 began itinerant preaching. For this he was repeatedly arrested and imprisoned from 1649 to 1666, but submitted as one ready to lay down his life for his faith. In 1652 he formed congregations in Lancashire. In 1669 he married Margaret, widow of the Welsh judge Thomas Fell, and in 1671 visited America. At Barbadoes, on this journey, he drew up a paper setting forth the belief of the Friends as to the fundamental doctrines of Christianity. In Mar., 1673, he embarked for England. He was soon imprisoned again in Worcester jail, remained in confinement a year, and was freed through the influence of Sir Matthew Hale. In 1677 and 1681 he visited the Friends in Holland, and established monthly, quarterly, and yearly meetings there. He returned to England, and d. in London Jan. 13, 1691, having continued his public addresses to within a few days of his death. His writings were published in three vols. folio—viz. 1, *Journal of his Life, Travels*, etc., 1694; 2, *Collections of many Select and Christian Epistles, Letters, and Testimonies written by George Fox* (1698); 3, *Gospel Truth Demonstrated in a Collection of Doctrinal books given forth by George Fox, containing Principles Essential to Christianity and Salvation held among the people called Quakers* (1706). (Consult Sewell's *History of the Quakers;* Jonah Marsh's *Life of Fox*, 1848; Janney's *Life of Fox*, etc., 1853; C. H. Spurgeon's *George Fox*, an address to the Society of Friends, London, 1866; Tallack's *George Fox, The Friends and the Early Baptists*, London, 1868; H. Weingarten's *Revolutionskirchen Englands*, Leipsic, 1868; and for a full account of Fox's writings and publications, Joseph Smith's *Catalogue of Friends' Books*, Barclay's *Apology* (London, 1678), and T. Evans' *Exposition of the Faith of the Religious Society of Friends* (Philadelphia, 1828), for determination of the doctrinal views of Fox and the early Quakers.)

Fox (Gustavus V.), b. at Saugus, Mass., June 13, 1821; midshipman U. S. navy in 1838, and served for nineteen years on different stations, in the Coast Survey, in command of mail-steamers, and in the war with Mexico. Resigned in 1856, and became agent of the Bay State Woollen Mills at Lawrence, Mass. In Feb., 1861, was sent for by Gen. Scott, at the instance of Postmaster-General Blair, in reference to throwing supplies and troops into Fort Sumter; but Pres. Buchanan refused at that time to allow the expedition. Subsequently, Mr. Lincoln approved the plan, sending Capt. Fox to Fort Sumter to communicate with Maj. Anderson, and on his return directed him to carry out his plan, which was, however, virtually thwarted by the withdrawal of the Powhatan for another expedition, that of reinforcing Fort Pickens. The expedition, thus mutilated, could only proceed to Charleston harbor, where the Confederates, learning of its departure, had already opened fire upon the fort it was destined to relieve, but for which it was shorn of its essential strength. It could only serve to bring away Maj. Anderson's command after his surrender. Communication with Washington being cut off, Capt. Fox then applied to William H. Aspinwall and W. B. Astor, who fitted out a steamer (the Yankee), of which he was appointed an acting captain, and in which he sailed for Chesapeake Bay, the occupation of which he deemed vital. Mr. Lincoln now conferred upon Capt. Fox the appointment of assistant secretary of the navy, which position he held till the close of the war. In this capacity he is thus mentioned to the writer by a prominent member of Mr. Lincoln's cabinet: "Fox was, in my opinion, the really able man of Lincoln's administration. . . . He planned the capture of New Orleans and the opening of the Mississippi, and generally the operations of the navy. He had all the responsibility of removing the superannuated and inefficient men he found in charge. . . . He selected Farragut. Gen. Grant constantly consulted him. . . . Not the least meritorious part of his services is, that he sought only to make them useful, claiming neither then nor now the fame due to his services." Nor does this imply any disparagement of the secretary (Mr. Welles), whose department, the most perfectly managed in this supreme crisis of any of the great government departments, improvised a navy and never failed to meet all requirements. Soon after the close of the war Congress created an additional assistant secretary of the navy to enable the government to send Capt. Fox to Russia to present to the emperor Alexander II. the congratulations of the American Congress on his escape from menaced assassination. This mission marks the high estimate formed of Mr. Fox's talents and services during the war by the government. Russia alone, of the great powers of Europe, having taken a decided stand for the American Union, the mission was of great importance. Regardless of self, he had declined to ask an admiral's commission, which he might have obtained, accepting the Russian mission as his sole reward, and on his return resigned his official appointments and resumed the charge of extensive woollen manufactories in Lowell. More recently he has become a member of an important business house in Boston. J. G. Barnard.

Fox (John), b. at Boston, Lincolnshire, England, in 1517; entered Brasenose College, Oxford, in 1533; chosen a fellow of Magdalen College in 1543; became a Protestant, and in 1545 was deprived as a heretic; was tutor to the children of Sir Thomas Lucy, and later (1547–53) to those of the earl of Surrey; was ordained deacon by Ridley 1550; lived at Bâle during Mary's reign; returned in 1559; became a prebendary of Sarum 1563; and d. in London Apr. 18, 1587. He is chiefly remembered as author of the *Acts and Monuments* (1563), well known as Fox's *Book of Martyrs.*

Fox (Luke), an English navigator who in 1631 commanded an expedition in search of a north-west passage. He discovered Cumberland Island and other important points of Arctic America.

Fox (William Johnson), b. at Uggeshall Farm, near Wrentham, Suffolk, in 1786. His father was a weaver. The boy gave early evidence of remarkable ability, and was sent to Homerton College (Hackney), then under the care of Dr. Pye Smith, to be educated for the Christian ministry among the Independents. But his opinions led him away from that connection; he became a preacher of Unitarianism, till, departing still farther from the accepted belief, he separated from all denominations, and took an isolated position as a rationalist preacher in South Chapel, Finsbury, London. Here he attracted attention by the speculative boldness of his views, his innovations on the ordinary customs of worship, and the secular tone of his discourses. His audiences, though never very numerous—the chapel was a small one—were composed of people remarkable for intelligence and influence on the world of mind. He was a powerful teacher, with a strong infusion of the social agitator. His interest in politics made him a leader among the Liberals. No abler speaker addressed the meetings of the Anti-Corn-Law League; no abler writer took up the pen for the most extreme measures of the "party of progress." His *Letters of a Norwich Weaver Boy*, which were printed in the newspapers, did powerful service. His *Lectures to the Working-Classes* were widely read, and did much to prepare the way for present movements. In 1847, Mr. Fox was elected to Parliament from Oldham, was defeated in 1852, and re-elected the same year to fill a vacancy caused by death. At the general election in 1857 he was again defeated. D. in London June 3, 1864. The writings of Mr. Fox are comprehensive and vigorous. Three volumes of sermons show what he was as a pulpit-orator; a book on *The Religious Ideas* shows the cast of his philosophic thought. Mr. Fox was warmly interested in American institutions, and cordial in his welcome to leaders of American thought. In religious belief he resembled the Transcendental Unitarians. He was a theist and an idealist. The two points of his creed were "the perfection of divinity—the immortality of humanity." O. B. Frothingham.

Fox'boro', post-v. and tp. of Norfolk co., Mass., 21 miles S. W. of Boston, on the Boston and Providence and Mansfield and Framingham R. Rs. It contains a large straw-hat and bonnet manufactory, carpet-lining, box, soap, and spring-bed factories, 1 furnace, a granite-quarry, and several minor industries. It has 2 local papers, 1 savings bank, a public library, public buildings worth

$90,000, 5 churches, and 2 hotels. Principal business, manufacturing. Pop. 3057.

Robt. W. Carpenter, Ed. "Journal."

Fox'burg, post-v. of Richland tp., Clarion co., Pa., on the Allegheny River and the Allegheny Valley R. R., 58 miles below Oil City.

Fox Creek, tp. of Clay co., Ala. P. 839.

Fox Creek, tp. of Randolph co., Ala. Pop. 972.

Fox'croft, post-v. and tp. of Piscataquis co., Me., 60 miles N. N. E. of Augusta, has manufactures of machinery, farming tools, lumber, flannels, mouldings, carriages, etc., and is the seat of an academy. Pop. 1178.

Foxglove. See Digitalis.

Fox'hound, a variety of the dog, bred principally in Great Britain and Ireland, and adapted to the national sport of fox-hunting. The foxhound is a cross of the bloodhound, whence it derives its keen power of scent; the greyhound, which gives its speed; and the bulldog, which has conferred upon its descendant its own courage and persistency. At present, however, the breed of foxhounds is regarded as well established, requiring no further cross with either of the original stocks. This is about two feet high.

Fox-Hunting, one of the national sports of England, is a very different pastime from what is called by that name in the Northern States of America. Here the acquisition of the fur is a principal object; the fox is followed by one or more hounds and by the huntsman, often alone and on foot, and he shoots the fox with a rifle. But in England the fox is followed by a pack of from 40 to 120 dogs, and by a large number of gentlemen and ladies on horseback. As they ride in the chase the party are under the charge of a master, the hounds being in the care of a huntsman and "whippers-in" or whips. The bolder members of the hunt leap their horses over fences, gates, and hedgerows, and all feel at liberty, when necessary, to rush headlong through grain-fields and other growing crops—an outrage which seems to be justified by public opinion. The fox is not shot, but when caught by the dogs the huntsman cuts off his brush (tail), pads (feet), and mask (face), which are given as trophies to those who may be present, or "in at the death," as it is called. The flesh is cut up and given to the dogs, to be devoured on the spot.

Fox Indians, called by themselves **Outaga'mie** (that is, "Foxes"), **Musqua'quink,** "red-clay men," a tribe of North American aborigines of Algonkin stock, have, ever since known to white men, been intimately associated with the Sac (or Sauk) tribe, and the two together are always spoken of as Sacs and Foxes (which see).

Fox Islands, in Lake Michigan, are two in number, the North and South Fox. They belong to Chandler tp., Manitou co., Mich. Pop. 44.

Fox Islands, Pacific Ocean. See Aleutian Islands.

Fox Lake, post-v. and tp. of Dodge co., Wis., is located upon the outlet of a small, beautiful lake 60 miles N. W. of Milwaukee, and is connected by horse-railroad with the Milwaukee and St. Paul R. R. It is the seat of the Wisconsin Female College, has a graded public school, 5 churches, 1 State bank, 1 newspaper, 1 hotel, a foundry, a flouring-mill, a brewery, Odd Fellow, Masonic, Good Templar, and Granger lodges, and the usual number of stores and shops. Pop. of v. 1086; of tp. 1916.

John Hotchkiss, Ed. "Fox Lake Representative."

Fox Mills, tp. of Wilcox co., Ala. Pop. 720.

Fox River, a stream rising in Green Lake co., Wis., and, taking a S. and S. W. direction, approaches to within $1\frac{1}{2}$ miles of the Wisconsin River, with which it is connected at Portage City by a canal. It flows then by a circuitous N. and N. E. course to Green Bay, Wis., into which it falls at the town of that name. The improvement of this river by lock and dam navigation, and by jetties, is being carried on by the U. S. government as the connecting-link of communication between the Atlantic and the great system of internal navigation furnished by the Mississippi and its tributaries. The route leads from the Mississippi by way of Wisconsin River, the Upper Fox, Lake Winnebago, and Lower Fox River to Green Bay, and thence by way of the lakes to the Atlantic Ocean, and is one of the great routes set forth by the Senate committee on cheap transportation.

Fox River rises in Waukesha co., Wis., flows S. and S. W., emptying into the Illinois River at Ottawa, Ill. It furnishes abundant and well-improved water-power.

Fox River, post-v. of Fox tp., Gaspé co., Quebec, Canada, has a shallow harbor, much resorted to during westerly winds by American mackerel-vessels. It has a courthouse, thriving cod-fisheries, and a good soil. Pop. 450.

Fox River, tp. of White co., Ill. Pop. 1867.

Fox River, tp. of Davis co., Ia. Pop. 1256.

Fox Shark, or **Thresher,** the *Alopias vulpes*, a shark of the Atlantic and Mediterranean, is twelve to eighteen feet long, the tail about as long as the body. It boldly attacks the whale, striking fearful blows with its tail; whence it is called thresher. It devours great numbers of small fishes.

Fox Shark.

Foy (Maximilien Sébastien), b. at Ham, France, Feb. 3, 1775; entered the army in 1791; served with distinction in the republican wars; was in Massena's and Moreau's Swiss and German campaigns, but his known coldness towards Napoleon tended to check his promotion. In Italy and the Peninsula he so skilfully and valiantly supported the cause of France that in 1810 he was made a general of division. At Waterloo he received his fourth wound in battle. In 1819 he was sent to the Chamber of Deputies, where he appeared in a new *rôle*, that of a liberal orator; but the toil and excitement of public life, joined to the effects of his old wounds, soon wore out his strength, and the disinterested patriot, the able and fearless soldier, the gifted champion of liberty, d. at Paris, Nov. 28, 1825. The people subscribed freely for his children, whom he left poor. He left *Speeches* (2 vols., 1826) and *History of the Peninsular War* (unfinished, 4 vols., 1827).

Foy'ers, or **Fyers,** a river of Scotland. It rises in the Monadleadh Mountains in Inverness-shire, and after running 12 miles N. it falls into Loch Ness. It forms two falls—an upper one of 30 feet, and a lower one of 90 feet, of which the latter is the finest fall in Great Britain.

Foyle, a river of Ireland. It is formed at Lifford by the junction of the Finn and the Mourne, and after a course of 14 miles it falls into Lough Foyle, an inlet of the Atlantic on the northern coast of Ireland. It is famous for its salmon-fisheries, and is navigable for vessels of 600 tons to Londonderry, 4 miles from the Lough.

Frac'tions [Lat. *frango, fractum*, to "break"]. If an integral unit is divided into any number of equal parts, each part is called a *fractional unit.* If the integral unit is divided into *two* equal parts, each part is called a *half;* if into *three*, each part is called a *third;* if into *four*, each is called a *fourth;* and so on. These units are written $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, etc. A fraction is a fractional unit or a collection of fractional units. Thus, *one-half, two-thirds, four-ninths*, etc. are fractions; they may be written $\frac{1}{2}$, $\frac{2}{3}$, $\frac{4}{9}$, etc.

Every fraction consists of two parts—a *denominator*, which shows the value of the fractional unit, and a *numerator*, which indicates the number of times this unit is taken. Thus, in the fraction $\frac{a}{b}$ (read a divided by b), the denominator is b and the numerator is a. The denominator shows that the integral unit 1 is divided into b equal parts to form the fractional unit $\frac{1}{b}$, and the numerator shows that a of these parts are taken. The fraction $\frac{a}{b}$ is therefore equivalent to a times the quantity $\frac{1}{b}$.

Fractions are divided into two classes—*vulgar* or *common fractions*, and *decimals.* Vulgar fractions are those in which the denominator is expressed; decimals are those in which the denominator is simply indicated. The denominator of a common fraction may be any quantity whatever; the denominator of a decimal is always some power of 10. The denominator of a decimal may be written out in full, in which case it is a decimal fraction, which differs in no respect from a common fraction.

Vulgar Fractions.—Vulgar fractions are expressed by writing the numerator over the denominator, with a line between them, as $\frac{a}{b}$. This is one of the methods of indicating division; a fraction is, in fact, equivalent to the quotient of the numerator by the denominator.

The two parts of a fraction are called *terms*, and according to their relative values the fraction is said to be *proper* or *improper;* if the numerator is less than the denominator, the fraction is *proper;* if the numerator is greater than the denominator, the fraction is *improper.* A proper fraction is always less than 1, and an improper fraction is always greater than 1. It may happen that the terms of a fraction are equal; in this case the expression is equal to 1, and is fractional only in *form.*

Fractions are *similar* when they have a common denominator—that is, when they have the same unit; they are *dissimilar* when they have different units. Thus, $\frac{3}{7}$ and $\frac{5}{7}$ are similar—$\frac{3}{7}$ and $\frac{4}{5}$ are dissimilar. Dissimilar fractions can be made similar as follows: find the least common multiple of the denominators for a common denominator of the required fraction; divide this by the denominator of each fraction, and multiply the quotient by the corresponding numerators for the numerators of the required fraction. This transformation, as well as many others, depends on the general principle that we may perform the same operation on both terms without changing the value of the fraction.

Fractional Expressions are those that contain a fraction in any form, They may be mixed, complex, or compound. A mixed fraction, or mixed number, is composed of an integral and a fractional part, as $3\frac{1}{8}$, $5\frac{2}{7}$. A complex fraction is one in which at least one of the terms is fractional as $\frac{3\frac{1}{2}}{5}, \frac{2\frac{1}{4}}{3\frac{1}{5}}, \frac{3}{5\frac{1}{7}}$. A compound fraction is a fractional part of a fraction or mixed number, as $\frac{1}{2}$ of $\frac{2}{5}$, $\frac{1}{3}$ of $5\frac{1}{4}$. Any one of these may be reduced to the form of a simple fraction—that is, to a form in which both terms are entire—by means of the general principle already given.

1. *To Reduce a Mixed Fraction to a Simple Form.*—Multiply the entire part by the denominator of the fractional part, and to the result add the numerator of the fraction; then place the result over the denominator of the fractional part. Thus, $a+\frac{b}{c}=\frac{ac+b}{c}$; also $2\frac{1}{4}=\frac{9}{4}$. By reversing the preceding rule simple fractions may sometimes be transformed into mixed fractions. In this case we perform the indicated division, continuing the operation as far as possible: we then add to the quotient a fraction formed by writing the remainder over the divisor. Thus, $\frac{9}{4}=2\frac{1}{4}$.

2. *To Reduce a Complex Fraction to a Simple Form.*—Reduce both terms to simple fractions having a common denominator; then suppress the denominator. Thus,

$$\frac{7\frac{2}{5}}{9\frac{3}{4}}=\frac{\frac{37}{5}}{\frac{39}{4}}=\frac{\frac{148}{20}}{\frac{195}{20}}=\frac{148}{195}.$$

3. *To Reduce a Compound Fraction to a Simple Form.*—Reduce the component parts of the fractions to simple forms, and then multiply the numerators together for a new numerator, and the denominators together for a new denominator. Thus, $\frac{2}{3}$ of $\frac{4}{5}$ of $5\frac{3}{4}=\frac{2}{3}$ of $\frac{4}{5}$ of $\frac{23}{4}=\frac{184}{60}$. If a fraction has any factors common to both terms, they may be struck out. The resulting fraction is then said to be in its simplest form. In this case the terms are prime with respect to each other.

Fractional quantities can be added and subtracted, multiplied and divided, with the same facility as entire quantities. In what follows we shall suppose every fractional expression to have been reduced to a simple form.

1. *To Add Fractions.*—Reduce them to a common denominator; then find the sum of the numerators, and write it over the common denominator. Thus,

$$\frac{3}{4}+\frac{5}{7}=\frac{21}{28}+\frac{20}{28}=\frac{41}{28}; \text{ also } \frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}.$$

2. *To Subtract one Fraction from another.*—Reduce them to a common denominator; then subtract the numerator of the subtrahend from that of the minuend, and write the difference over the common denominator. Thus,

$$\frac{5}{9}-\frac{3}{7}=\frac{35}{63}-\frac{27}{63}=\frac{8}{63}; \text{ also } \frac{a}{b}-\frac{c}{d}=\frac{ad-bc}{bd}.$$

3. *To Multiply one Fraction by another.*—Multiply the numerators together for a new numerator, and the denominators for a new denominator. Thus,

$$\frac{3}{5}\times\frac{4}{7}=\frac{12}{35}; \text{ also } \frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}.$$

4. *To Divide one Fraction by another.*—Invert the divisor, and proceed as in multiplication. Thus,

$$\frac{3}{5}\div\frac{4}{7}=\frac{3}{5}\times\frac{7}{4}=\frac{21}{20}; \text{ also } \frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}.$$

Entire quantities may be regarded as fractions having a denominator equal to 1. Hence, the rules for operating on fractions include the case in which some of the quantities are entire.

The rules above given may often be simplified by striking out factors that would otherwise be common to both terms of the result.

Decimal Fractions and Decimals.—A decimal fraction is a fraction whose denominator is some power of 10. When the denominator is expressed, it differs in no respect from a common or vulgar fraction; when the denominator is indicated, but not expressed, it is called a *decimal.* Decimals differ from common or vulgar fractions only in their mode of expression. A decimal may be expressed by writing its numerator, and then placing a *decimal point* (.), so that the number of figures following it shall be equal to the number of ciphers in its denominator. Thus, the fractions $\frac{3}{10}, \frac{145}{1000}, \frac{2564}{10000}$ may be written .3, .145, .2564. If the number of ciphers in the denominator is greater than the number of figures in the numerator, the requisite number of ciphers must be prefixed to—that is, written before—the numerator. Thus, $\frac{3}{100}=.03$, $\frac{7}{10000}=.0007$. If the number of ciphers in the denominator is less than the number of figures in the numerator, the result consists of an integral part and a decimal. Thus, $\frac{118}{10}=11.8$. Such expressions are called *mixed decimals.*

Decimals may be read as common fractions, or they may be read like whole numbers:

1. When read as common fractions, we disregard the decimal point and prefixed ciphers, and read the given figures as a numerator: we then supply the denominator, remembering that it is equal to 1 followed by as many ciphers as there are places of figures in the given decimal. Thus, the decimal .014 is read *fourteen-thousandths.*

2. When read as whole numbers, we commence at the decimal point and separate the decimal into periods of three figures each, annexing ciphers, if necessary, to complete the last period; we then read each period in order, calling its name as in whole numbers. The name of the first period is *thousandths*, that of the second period is *millionths*, that of the third *billionths*, and so on. The decimal .01406, for example, when pointed off becomes .014,060; it is then read 14-*thousandths* and 60-*millionths.* This method of reading decimals is entirely the same as that of reading whole numbers; this should be the case, since both are formed according to the same general laws.

Decimals may be transformed and operated on by means of the following principles:

1. Moving the decimal point one place to the right is equivalent to multiplying the decimal by 10.
2. Moving the decimal point one place to the left is equivalent to dividing the decimal by 10.
3. Annexing ciphers, or striking out terminal ciphers, does not change the value of a decimal.

The rules for addition and subtraction of decimals are the same as in whole numbers; the rules for multiplication and division differ only in the method of pointing off the result.

1. *To Multiply one Decimal by another.*—Neglect the decimal points and multiply as in whole numbers; then point off as many decimal places in the product as there are in both factors. Thus, $2.5\times4.16=10.400=10.4$.

2. *To Divide one Decimal by another.*—Annex as many ciphers to the dividend as may be desirable; divide as in whole numbers, and point off from the right of the result as many decimal places as the number of such places in the dividend exceeds that in the divisor. Thus, $1.38483\div60.21=.023$.

To convert a decimal into an equivalent vulgar fraction, neglect the decimal point and all the ciphers that precede the first significant figure, and take what remains for a numerator; then write 1, followed by as many ciphers as there are places of figures in the given decimal for a denominator. Thus, $.0036=\frac{36}{10000}$.

To convert a vulgar fraction into an equivalent decimal, reduce the fraction to its simplest form, and to the resulting numerator annex as many ciphers as may be necessary; then divide the result by the denominator, and point off from the right of the quotient a number of decimal places equal to the number of annexed ciphers. There may be two cases: 1. The denominator may contain no prime factor except 5 or 2. In this case the fraction is of the form $\frac{a}{5^m\times2^n}$. If $m>n$, annex m ciphers to the numerator, which is equivalent to multiplying it by 10^m, or $5^m\times2^n$; if $m<n$, annex n ciphers to the numerator, which is equivalent to multiplying it by 10^n, or $5^n\times2^n$; then will the result be exactly divisible by the denominator, and the number of decimal places will be equal to the highest exponent of 5 or 2. Such decimals are called *terminating decimals.* 2.

The denominator may contain some other factors besides 5 and 2. In this case the fraction is of the form $\frac{a}{5^m \times 2^n \times c}$. After annexing a suitable number of ciphers to the numerator, we can divide out the factors 5^m and 2^n, but the factor c will remain, and there will result a fraction in which the denominator is prime with respect to the numerator, and also with respect to all powers of 10. Hence, no matter how many ciphers we annex to the numerator, the result will not be exactly divisible by the denominator. But if the division is carried sufficiently far, we shall, after exhausting the significant figures, find a remainder equal to some preceding one, and from this time forward the figures of the quotient will be repeated in the same order as before, and so on continually. Such decimals are called *repeating decimals.*

In all cases a vulgar fraction is equivalent either to a terminating or to a repeating decimal; and *conversely,* every terminating or repeating decimal is equivalent to some vulgar fraction.

RATIONAL FRACTIONS.—A rational fraction, in analysis, is one in which all the exponents of the variable or variables are whole numbers. The coefficients of the different powers of the variables may be either rational or irrational, entire or fractional, positive or negative. Every rational fraction that is a function of one variable may be reduced to the form $\frac{Ax^m + Bx^{m-1} + Cx^{m-2} + \ldots + K}{A'x^n + B'x^{n-1} + \ldots + K'}$.

If $m > n$, the operation of division may be applied and continued till the highest exponent of x in the remainder is at least 1 less than in the denominator, and the fraction will then take the form

$$x + \frac{A''x^{n-1} + B''x^{n-2} + \ldots + K''}{A'x^n + B'x^{n-1} + \ldots + K'},$$

in which the entire part is a rational fraction of $\frac{x}{x}$. The fractional part can be resolved into *partial* fractions—that is, fractions whose denominators are either binomial factors of the first degree with respect to x, or some integral power of such factors—whenever the denominator can be resolved into such factors. This resolution is of much use in the integral calculus. The following are the methods of resolving fractions of this kind into partial fractions:

1. *When the Binomial Factors of the Denominator are Real.*—Write the given fraction equal to the sum of as many partial fractions as there are units in the highest exponent of the variable in the denominator, whose numerators are constants to be determined, and whose denominators are the different powers of the factors of the first degree, from the m^{th} to the 1st inclusive, m being the number of times that any factor enters; then clear the equation of denominators, and equate the coefficients of the like powers of the variable in both members; from these equations find the values of the constants, and substitute them in the assumed partial fractions: the resulting fractions will be the partial fractions required. Thus, let it be required to separate the fraction

$$\frac{x^3 + x^2 + 2}{x^5 - 2x^3 + x}$$

into partial fractions. The factors of the denominator are $x(x+1)^2$ and $x - 1^2$. Hence, by the rule

$$\frac{x^3 + x^2 + 2}{x^5 - 2x^3 + x} = \frac{A}{x} + \frac{B}{(x+1)^2} + \frac{C}{x+1} + \frac{D}{(x-1)^2} + \frac{E}{x-1}.$$

Clearing of denominators, and equating the coefficients of like powers of x, we obtain a set of equations from which we find $A = 2$, $B = -\frac{1}{2}$, $C = -\frac{8}{4}$, $D = 1$, and $E = -\frac{3}{4}$.

Hence,

$$\frac{x^3 + x^2 + 2}{x^5 + 2x^3 + x} = \frac{2}{x} - \frac{1}{2(x+1)^2} - \frac{8}{4(x+1)} + \frac{1}{(x-1)^2} - \frac{3}{4(x-1)}.$$

2. *When the Factors of the Denominators are all Imaginary.*—In this case we suppose the denominator to be resolved into factors of the second degree, each of which, when placed equal to 0, will give two imaginary roots. We then write the given fraction equal to the sum of as many partial fractions as there are single factors of the second degree in the denominator, their numerators being of the form $Mx + N$ (M and N being constants to be determined), and their denominators being the different powers of the factors of the second degree from the m^{th} to the 1st inclusive, m being the number of times any factor is taken. We then proceed as before.

VANISHING FRACTIONS.—A vanishing fraction is a fraction that reduces to $\frac{0}{0}$ for a particular value of the arbitrary quantity that enters it, in consequence of the existence of a common factor in both terms, which factor reduces to 0 for that particular value. Thus,

$$\frac{x^2 - a^2}{x^3 - a^3} = \frac{(x-a)(x+a)}{(x-a)(x^2 + ax + a^2)}$$

is a vanishing fraction, which reduces to $\frac{0}{0}$ when $x = a$; the common fraction which produces this result is $x - a$. If we strike out this factor, and then make $x = a$, we find for the true value of the fraction,

$$\frac{a + a}{a^2 + a^2 + a^2} = \frac{2a}{3a^2} = \frac{2}{3a}.$$

Every vanishing fraction may be considered as a particular case of the fraction

$$\frac{M(x-a)^n}{N(x-a)^m},$$

in which M and N are functions of x that do not contain the factor $x - a$. This fraction becomes $\frac{0}{0}$ for the value of $x = a$ in consequence of the existence of the factor $x - a$ in both of its terms. To find the true value of such a fraction, we must get rid of the factor $x - a$ in one or both terms, and then make the supposition that $x = a$. There may be three cases:

1. If $m > n$, the fraction can be reduced to the form

$$\frac{M}{N(x-a)m-n},$$

which, for $x = a$, becomes ∞.

2. If $m = n$, the fraction can be reduced to the form of M divided by N, which, for $x = a$, becomes

$$\left(\frac{M}{N}\right)x = a = \frac{A}{B}, \text{ a finite quantity.}$$

3. If $m < n$, the fraction can be reduced to the form

$$\frac{M(x-a)n-m}{N}$$

which, for $x = a$, becomes 0.

These are the only cases that can arise; hence, the true value of a vanishing fraction, for the particular value of the variable that reduces it to $\frac{0}{0}$, is either *infinite, finite,* or *zero.*

The method above indicated enables us to find the true value of the fraction when the factor that vanishes is obvious; if this factor is not obvious, the true value of the fraction may be found by either of the following methods:

1. Substitute for the variable that value which reduces the common factor to 0 *plus* a variable increment; reduce the result to its simplest form; and then make the increment equal to 0. Thus, to find the true value of $\frac{x - x^4}{1 - x}$ when $x = 1$, we make $x = 1 + h$; this gives

$$\frac{1 + h - (1 + 4h + 6h^2 + 4h^3 + h^4)}{1 - (1 + h)},$$

which reduces to $3 + 6h + 4h^2 + h^3$; making $h = 0$, we have the required value, equal to 3.

2. Differentiate both terms of the fraction, and in the results make the particular supposition; if both do not reduce to 0 or ∞, what the first becomes, divided by what the second becomes, is the true value of the fraction. If both reduce to 0, find the second differentials of the two terms, and substitute as before; continue this operation until two differentials of the same order are found that do not both reduce to 0 or ∞; then what the first becomes, divided by what the second becomes, is the true value of the fraction. Thus, in the example just given the differential of the numerator is $dx - 4x^3dx$, and the differential of the denominator is $-dx$, neither of which reduces to 0 when $x = 1$. The first becomes $dx - 4dx$, and the second becomes $-dx$, when $x = 1$. Hence, the true value of the fraction under the hypothesis $x = 1$ is 3, the same as before.

There are many functions which can be reduced to the form of a vanishing fraction, and treated accordingly. The most important of these are the following:

1. Let $\frac{p}{q} - \frac{v}{s}$ be an expression in which p, q, v, and s are functions of x, such that for $x = a$ both q and s reduce to 0; then will the given expression reduce to $\infty - \infty$ for the same value of x. If we reduce the given fraction to a common denominator, we have after reduction $\frac{ps - vq}{qs}$, which is a vanishing fraction for $x = a$.

2. Let $\frac{p}{q}$ be a fraction such that both p and $\frac{q}{q}$ reduce to ∞, for $x = 0$; then for the same value of x the given expression will become $\frac{\infty}{\infty}$. The given fraction is equal to $\frac{1}{q} \div \frac{1}{p}$, which for $x = a$ is a vanishing fraction.

3. Let pq be a function such that for $x = a$, p reduces to 0, and q to ∞; then for the same value of x the given expression will become $0 \times \infty$. The given product may be written $p \div \frac{1}{q}$, which for $x = a$ is a vanishing fraction.

W. G. PECK.

Frac'ture [Lat. *fractura*, from *frango*, *fractum*, to "break"], a rupture of a solid body, usually caused by violence. (1) In mineralogy, the appearance of the fresh surface when a mineral breaks, disclosing its texture, and furnishing a characteristic by which it may be identified. Thus, the fracture is said to be *even* when it forms a face or plane of some extent; *uneven*, when the surface is rough and unequal; *conchoidal*, or shell-like, when concave on one side and convex on the other; *splintery*, when the surface presents the appearance of numerous thin-edged scales; and *hackly*, when covered with numerous fine sharp points or inequalities. (2) In surgery, the term fracture is used to indicate a rupture, or solution of continuity, occurring in osseous tissue, or in rare cases in cartilaginous tissue partly ossified. The separation, in early life, of two portions of the same bone, held together by cartilaginous tissue, is not accounted a fracture. Fractures may be *simple*, *compound*, *complicated*, or *comminuted; complete* or *incomplete; oblique, transverse*, or *longitudinal*. By *simple* fracture is meant one in which no wound exists admitting air to the seat of fracture. A *compound* fracture is one in which such a wound does exist. A *complicated* fracture is one in which some other serious injury is inflicted, at or near the site of the fracture, other than the rupture of the osseous tissue, or in which, from the situation of the rupture, the healing process cannot progress as favorably as is usual; as when a large blood-vessel or nerve-trunk is torn by the broken bone, or when the fracture extends into a joint-cavity. A *comminuted* fracture is one in which the bone is broken into several small pieces at the point of rupture, and is rarely produced except by direct violence, as by a blow or crushing force. A *complete* fracture is one in which the rupture extends through the whole thickness of the bone, while if only a portion of the fibres are broken, as sometimes happens in children, the fracture is called *incomplete*, or the "green-stick fracture" of some writers, from its resemblance to the fracture produced by bending a stick of green wood until some of the fibres give way. The terms *transverse, oblique*, and *longitudinal* refer to the direction of the rupture in relation to the long axis of the bone, the great majority of the fractures of the long bones belonging to the second class. The term *stellate* is applied to a series of fractures radiating from a centre, as seen sometimes in fracture of the skull from a wound produced by a pointed instrument.

Causes of Fracture.—These may be *external*, from violence adequate to break a normal bone, or *internal*, the bone being too fragile to resist ordinary forces. External causes embrace *direct violence*, where the rupturing force is applied opposite the point where the bone breaks (as a blow or crushing force which fractures the bone at the point of contact); and *indirect* violence, where the bone is bent beyond the power of its elasticity to restore itself, and gives way, usually at some distance from the point of application of the fracturing force (as when a fall upon the shoulder fractures the collar-bone). *Muscular* force is generally acknowledged as a cause of fractures, especially in particular situations—*e. g.* fracture of the point of the elbow or of the knee-pan. The *internal* or predisposing cause is a brittleness of the bones called "fragilitas ossium," which occurs sometimes in early or middle life as a result of disease (although it may occur in those otherwise healthy), and almost universally in advanced life from the preponderance of earthy and deficiency of elastic matter.

The signs of fracture are *pain, swelling*, and *tenderness* at the point of fracture, *change in shape* of the limb, *false point of motion*, and *crepitation*, though any, or even all, of these signs may be absent. The pain comes from laceration of some nerve-filaments and pressure upon others by the broken bone, or by the blood escaping from torn vessels, which gives rise to the swelling that occurs at first, the subsequent swelling being due to products of inflammation or of the reparative process. The change in shape is due partly to this swelling, and partly to displacement of the broken bones, either by muscular action or by movements of the patient. The false point of motion comes of course from the want of continuity of the bone, and the crepitation is a fine grating elicited when the ends of the broken bone are gently rubbed together, and which may be appreciated by the ear or touch. If the fracture be *impacted*—that is, if the broken ends are firmly locked together, as sometimes happens—none of these signs may be present in a marked degree, and some of them, such as crepitation and false motion, not at all.

Fractures generally unite by the deposition of bony material between and around the broken ends of the bone, forming an exception to the rule that prevails for most other structures, that union after rupture is effected by means of fibrous or connective tissue; and the reason is apparent, since fibrous tissue does not form a sufficiently rigid bond of union to enable the bone to perform its functions, as we see in cases of so-called "ununited fracture," when the union is of a fibrous nature. The union of a simple fracture consists of two processes—one to accomplish a temporary purpose, the other for the permanent union; the former to support and bind together the fragments, while the latter consolidates them. A few days after the fracture the bone, its periosteum (membrane surrounding the bone), and the neighboring tissues pour out a quantity of plastic material around and between the broken ends, which gradually hardens, and at the end of the fourth week consolidates the fragments. This is called the "provisional callus," and the hardening process continues until it is converted into bony tissue. The plastic material effused *between* the fragments is much slower in ossifying than that which is internal or external to it; and this, which is destined to form the permanent bond of union, is called the "definitive callus." While the definitive callus is forming the provisional callus is gradually being absorbed; and finally, many months after the fracture, the provisional callus entirely disappears, and the fragments are united by the definitive callus alone, which is true bone; and the site of the fracture may be indicated only by a slight enlargement at that point. The union of *compound* fractures is entirely different. In these the provisional callus is almost or quite absent, and the definitive callus is formed by a process of granulation from the ends of the fragments, the granulations being gradually converted into bony tissue. It is a process requiring several months, or sometimes years, and is attended with a greatly increased amount of danger from exhaustion through long-continued suppuration and absorption of purulent material. The difference in the mode of union seems to be due to the irritation produced by the air, or something conveyed by the air to the wound.

The *treatment* of fractures consists essentially in restoring the fragments to their original position, and holding them there by some form of rigid apparatus which shall not cause discomfort or injury to the patient. Of course general treatment is to be employed also if the circumstances require; but simple fracture in a healthy individual requires no special medication or system of dieting, as the old modes of practice were wont to inculcate. The rigid apparatus used to retain the fragments in their proper position is called a splint, which consists of two kinds—padded and moulded. If the splints are made of straight, inflexible material, they cannot be adapted to the irregularities of the limb without more or less padding at certain points; while if made of material which at the time of its application is soft and pliable, it may be moulded to the shape of the limb, and, becoming hard and rigid, will serve to support and retain the fragments. Splints of the first variety are made of wood, sheet iron, tin, zinc, etc., while gutta-percha, felt, sole leather, starch, soluble glass, or plaster of Paris are used for the second class. Fractures sometimes fail to unite, and are called ununited fractures. This may be the consequence of faulty position of the fragments, or of something interposed between the broken ends, impeding union, but it more frequently arises from some constitutional defect. The location of the fracture may prevent union, especially if either fragment be poorly supplied with blood, as in certain fractures of the neck of the thigh-bone, which frequently unite only by fibrous tissue. Ununited fractures may often be made to unite by irritating the parts at the site of fracture, as by rubbing the bones together, drilling them by means of a long needle, or by wiring the bones together. SAMUEL ST. JOHN.

Fra Dia'volo ("Brother Devil"), the Italian sobriquet of Michele Pezza, a Calabrian goatherd, b. 1760, who became successively a stockinger, a soldier, a monk (with the name of Fra Angelo), and the leader of a band of atrocious robbers. He took service in 1799 against the French, and held a colonel's commission; was captured by the French and hanged in 1806 as a robber, notwithstanding his pardon and commission from the king of Naples. The Fra Diavolo of Auber's opera has little or nothing in common with the historical character.

Fra'ga, town of Spain, in the province of Huesca, on the Cinca. Pop. 7229.

Frail'ey, tp. of Schuylkill co., Pa. Pop. 1322.

Frailey (JAMES MADISON), U. S. N., b. May 6, 1809, in Maryland, entered the navy as a midshipman May 1, 1828; became a passed midshipman in 1836, a lieutenant in 1841, a commander in 1861, a captain in 1866, a commo-

dore in 1870; retired in 1872. Commanded the steamer Quaker City, South Atlantic blockading squadron, in 1862–63, and the steam-sloop Tuscarora, North Atlantic blockading squadron, in 1864–65, taking part in the engagement between the blockading squadron and the iron-clads off Charleston Jan. 31, 1863, and in both attacks on Fort Fisher in the winter of 1864–65. FOXHALL A. PARKER.

Fra′mingham, post-tp. of Middlesex co., Mass., is 22 miles W. of Boston, on the Boston and Albany R. R., about halfway between Boston and Worcester. It contains three thriving villages—Centre and South Framingham and Saxonville. It has a national and a savings bank, the oldest normal school in North America, a weekly newspaper, a first-class carriage manufactory, large factories of straw goods, shoes, etc., the extensive Saxonville woollen-mills, several churches, a soldiers' memorial library building, with a valuable town library, etc. South Framingham is at the junction of five railroads, and is an important business-centre. The town contains some of the best farms in the county, and the agricultural interests are important. Pop. 4968. C. M. VINCENT, ED. "GAZETTE."

Fra Morea′le [so called because he was once a brother of St. John of Jerusalem], the title of MONTREAL D'ALBANO, a gentleman of Provence who distinguished himself as a condottiere in the service of Louis I., king of Hungary, in his Neapolitan wars (1347–51). After the close of the war Montreal remained in Naples at the head of a "company of adventure," a body of brigands afterwards styled "The Great Company," which from Montreal's skilful combination of license and discipline soon won a terrible fame. Following the example of the duke of Athens and the German Werner (known as Duke Guarniari, the self-styled "enemy of God, of pity, and of mercy," who had led 2000 German *barbute*, or armored *horsemen*, in Northern Italy), Montreal, in 1353, entered upon a course of wholesale brigandage. Queen Joanna I., to rid the kingdom of such a pest, sent a force which besieged him at Aversa, 9 miles N. of Naples. He was compelled to give up his plunder and leave the kingdom. With a small body of followers he took service under John of Vico, lord or tyrant of Viterbo and Orvieto. He also wrote letters to all the "constables" commanding "companies of adventure" in Italy, offering them regular pay and stipulated service, with every form of the license then permitted to soldiers of fortune. By these promises he brought to his standard 1500 men-at-arms, making his whole force probably equivalent to 9000 cavalry, for 1500 heavy-armed horsemen were accompanied by 3000 mounted archers; 1000 *coutilliers*, or esquires, and 1000 pages, light-armed horsemen; besides 2000 footmen. With this band he marched in 1353 against Malatesta, tyrant of Rimini, who had commanded Joanna's troops against him at Aversa in 1352. Montreal appointed secretaries, treasurers, councillors, and justiciaries to maintain order, and a rigorous system of internal justice among his men, while against the inhabitants of the states he ravaged every license was permitted. All booty was divided among his followers according to a fixed system. A certain part was sold to merchants who followed his camp under Montreal's safeguard. He became the terror of Italy, and the soldiery flocked from every quarter to his service. Bulwer's picture of him in *Rienzi* is not exaggerated. Having ravaged Malatesta's lands, and compelled him to pay a heavy ransom, he formed an alliance with Perugia, which he meant to take for his base of operations against the other Tuscan towns. Sienna was forced to give him provisions and free transit, Florence to pay him 28,000 florins, and Pisa 16,000. He afterwards entered the pay of a Lombard league against the archbishop of Milan, Visconti the Terrible, one of the most powerful of the Italian "kinglings." Montreal contemplated the establishment of a permanent dominion, perhaps with Rome itself for his capital. He left his main force under the self-styled Count Conrad Londo, a Suabian, and with a small force he went to Perugia and Rome, probably to make arrangements for removing his force to the south of Italy. But at Rome he was arrested by command of Cola di Rienzi, one of the few who really owed Montreal a debt of gratitude, for the latter had been his steady friend in time of need. Accused and convicted of acts of high-handed brigandage, he was beheaded on Aug. 29, 1354. Thus perished a great military organizer, disciplinarian, and statesman, worthy of mention as one of the ablest of the condottieri—men who, with all their terrible crimes, have been justly called memorable as furnishing one of the links which connect the swift decline of the military discipline of antiquity with its regeneration under Charles VII. and Louis XI. of France. The fate of the "Great Company" is interesting. Londo was defeated July 24, 1358, and made prisoner at the Pass of the Scalella by the Apennine mountaineers, to whom he paid a great ransom. Next he led 20,000 men against Florence, but was killed in a battle near Novara in 1363. His brother Lucius took service as a mercenary in the Florentine "war of liberty" (1376–77) against the pope. Here the remnant of the "Great Company" did excellent service. J. WATTS DE PEYSTER.

Franc, the unit of account in the monetary system of France, adopted under the republic in 1795; also, the silver coin representing the same unit. In the general reform of French metrology which took place in the year above mentioned, the following were the governing principles: 1st, to derive the units of measure, weight, and value, mediately or immediately, from the linear unit called the mètre, which is the base on which the whole system rests; 2d, to derive the higher and lower denominations in each series from the corresponding unit by decimal multiplication and division. The unit of capacity was derived immediately from the basic unit of length; the unit of weight from the unit of capacity; and the unit of value, the *franc*, from the unit of weight. (See METRIC SYSTEM.) The franc is divided into 10 *decimes* and 100 *centimes*; the denomination *decime* has fallen into disuse. The copper coins which represent this value are stamped "*ten centimes*." The coinage in silver consists of single francs and pieces of five francs and of fifty and twenty centimes. The gold coins are pieces of five francs, ten francs, and twenty francs; the latter commonly, but not legally, called napoleons. The copper coins are of ten centimes, five centimes, and a very pretty but rather useless little piece of one centime. The one-centime pieces are hardly seen except at the post-offices.

The monetary system of France was adopted by Switzerland May 7, 1850, and on Dec. 23, 1865, a quadripartite treaty was entered into between France, Belgium, Switzerland, and Italy, which makes this system common to all those countries until Jan. 1, 1880, if not sooner repealed. Austria has assimilated her system to that of France by making her ten-florin piece equal to twenty-five francs. Spain, Sweden, and Greece have shown a disposition to conform their coinage to the same system. A silver coin of the value of half a franc has been struck by the Spanish mint, and the mint of Sweden seven or eight years ago issued a carolin of the value of ten francs in gold. This was merely experimental, and is not at present coined. The principality of Roumania has adopted the French system in full. Ten years ago there seemed to be a possibility, and even a probability, that the franc would become, before the close of the century, the monetary unit for all continental Europe. The occurrence of the Franco-German war, bringing with it the consolidation of the German states, and the adoption for the empire of a new monetary unit, out of harmony equally with those of France, England, and the U. S., has not only extinguished this prospect, but rendered hopeless every other scheme which had been imagined for the unification of the monetary systems of the world.

The weight of the silver franc is five grammes = $77\frac{1}{6}$ grains troy. It is composed of an alloy consisting of 9 parts by weight of silver and 1 part base metal (copper). Twenty silver francs therefore weigh 100 grammes; and as the French law makes both the gold and the standard silver coins equally legal tenders for all sums, and fixes arbitrarily the relative value of the two metals for equal weights in the ratio of 1 to $15\frac{1}{2}$, it follows that twenty francs in gold weigh $6\frac{452}{1000}$ grammes, very nearly; and this is the weight of the gold napoleon. But inasmuch as the relative value of gold and silver bullion has been till recently represented by a ratio of about 1 to $15\frac{38}{100}$, it follows that 100 grains of silver in bullion have been during this period equivalent to $6\frac{502}{1000}$ grains of coined gold; that is to say, have been worth more than a gold napoleon. Silver bullion therefore brought more in the market of France than silver coin. Hence, silver coin of standard fineness long ceased in that country to be a part of the circulating medium. The standard silver franc and half franc has consequently ceased to be struck; and in order to provide a currency of small coin for daily use in petty transactions, the government of France and the other parties to the quadripartite treaty of 1865 resorted to a debased coinage, composed of an alloy containing only 835 parts of silver in the thousand, instead of 900. This is a legal tender only for sums below five francs.

The name *franc* did not originate with the monetary system of 1795. It has been in use since the fourteenth century, and applied to coins of very different values, both gold and silver, at different times. The legal monetary unit in France before the introduction of the franc was the *livre Tournois* (of Tours). It was slightly less in value than the coin by which it was superseded, 81 livres being equal to 80 francs. F. A. P. BARNARD.

France. I. BOUNDARIES, GEOGRAPHICAL POSITION, DIMENSIONS, AREA, DEPENDENCIES.—France extends in Western Europe over a space of 12° 20′ lon.; in lat. 42° 20′ to 51° 5′ N. (See Map of Europe in Vol. I. of this work.) It

is bounded N. by the German Ocean, the Strait of Calais, and the English Channel, which separate it from England; W. by the Atlantic Ocean; S. by the Pyrenees, which separate it from Spain; S. E. by the Mediterranean; and E. by the Alps, where the frontier runs along the principal ridge from Colla Lunga to Mont Dolent, the utmost point of the group of Mont Blanc. The boundary-line then descends to the Lake of Geneva, and, curving around the territory of Geneva, it follows the ridges of the Jura Mountains to the pass at Belfort, traversing which it follows the ridge of the Vosges. S. of the Donon, the principal peak of the Lower Vosges, it leaves this ridge, and ceases to depend upon natural lines, following an arbitrary one, which, passing between Nancy and Metz, proceeds to Longwy, keeping S. of the tortuous Semois, and reaches the North Sea, crossing the Maas N. of Givet, the Sambre N. of Maubeuge, and the Scheldt N. of Condé. Thus, France touches Spain on the S., Italy on the S. E., Switzerland, the German Empire, Luxembourg, and Belgium on the E., and the Netherlands on the N. The greatest extension of the country, from N. to S., is 9365 kilomètres (5819 miles), from E. to W., 891 kilomètres (554 miles); the greatest diagonal, from Finistère to Mentone, is 1078 kilomètres (670 miles). Its area is over 528,000 square kilomètres (203,900 square miles), Corsica included; the area of France represents $\frac{1}{18}$th part of Europe and $\frac{1}{250}$th part of the land-surface of the earth.

Annexed to France are Corsica and Algeria, which latter comprises a large territory S. of the Mediterranean, with an area of 25,000 square kilomètres (9,653,000 square miles). The colonies of France are not numerous; the French have no talent for colonization. France possesses in Africa, besides Algeria, Senegal, the small establishments of Côte d'Or, Gaboon, the island of Mayotte and its dependencies, Nossi Bé, Sainte Marie de Madagascar and Réunion (Ile Bourbon); in Asia, the five cities of Mahé, Karikal, Pondicherry, Yanaon, and Chandernagore in Hindostan; in Indo-China, French Cochin-China; in Oceanica, New Caledonia, the Marquesas, and the Society Islands (under French protection); in South America, French Guiana; and in the West Indies, Martinique and Guadaloupe; to which must be added the two small islands, St. Pierre and Miquelon, situated N. of Newfoundland. The total area of the territories belonging to France is not far from 1,000,000 square kilomètres, and, together with France proper, 1,500,000 square kilomètres, or 580,000 square miles—viz. nearly $\frac{1}{90}$th part of all the land of the globe.

II. Physical Geography. 1. *The Surface.*—The surface of France, considered in general, presents a plane, gently inclined from S. W. to N. W.; that is, from the Alps and the Pyrenees to the Atlantic Ocean. To the E. a long depression cuts this plane; it is the valley of the Rhone, on whose western side rise the Cévennes, from which the waters of the three great basins of France flow in an almost parallel direction. Thus, the orographic system of the country is composed of—1, an outer belt of chains, comprising the Vosges, Jura, Alps, and Pyrenees; 2, an inner belt, comprising the Cévennes and their continuations; and 3, the ramifications issuing from the Cévennes, and comprising the group or central plateau separating the basins of the rivers which flow to the Atlantic.

The *Vosges* stretch from N. to S., parallel with the Rhine, for a length of 260 kilomètres. Their summits are rounded, and generally covered with turf; now and then the rock juts through. Their sides are clad with magnificent forests of beech and fir. The southern part of the Vosges is the highest; its average elevation is 1000 mètres; the highest peaks are Guebwiller (1426 mètres) and Giromagny (1250 mètres). The northern part, from the neck of Saverne to the group of the Palatinate, rises hardly more than 600 mètres; the principal passes of this chain are those of Saverne, Sainte Marie aux Mines, Bussang, and the picturesque Schlucht. The Vosges are separated from the Jura Mountains by a considerable depression, with the vale of Valdieu, which the strategists call the pass at Belfort, and which forms one of the principal thoroughfares by which to pass the frontier of France.

The *Jura Mountains* are principally composed of limestone, called Jurassic; they are only partially French. Less rude and not so richly wooded as the Vosges, they have more plastic grandeur. Instead of the rounded summits, we meet here long, parallel ridges, which support three galleries of plateaus. The general direction of these ridges is a curve concentric with the general curve of the Alps, and on the line of this curve are found the depressions of the lakes of Leman, Neuchâtel, and Bienne; which circumstance has given rise to the belief that the Jurassic regions were lifted and wrinkled by the same force which made the Alps emerge. These wrinkles present along their course many traverse breaks, forming picturesque fissures which are called "cluses," and which serve as outlets for the streams which form in the intervals between the wrinkles. The Jura group rises from France towards Switzerland; its highest peaks, from which the view extends uninterruptedly to the splendid snow-curtain of the Alps, are the Crêt de la Neige (1723 mètres), the Reculet (1720 mètres), the Dôle (1681 mètres), and the Great Credo (1690 mètres); its length from the Rhône to the Rhine is 300 kilomètres (124 miles).

The *Alps* form the great arc of a circle which surrounds Northern Italy on three sides. The French part of the Alps has a length of about 450 kilomètres (280 miles), and consists of the Pennine, Graian, Cottian, and Maritime Alps. The Pennine Alps, whose Celtic name means "the high Alps," extend from St. Gothard to Mont Blanc, whose beautiful group supports 28,200 hectares of glaciers, and whose highest peak, white with snow, rises 4810 mètres, and surpasses all other mountains in Europe, not only in height, but also in beauty. The Graian Alps, whose Celtic name means "the rocky tops," contain the Little St. Bernard and terminate at the road of Mont Cenis, which formerly was the principal passage across the Alps, but which now has been superseded by the remarkable tunnel through Mont Cenis (12,200 mètres long). The Cottian Alps extend to the pyramid of Mont Viso (3810 mètres), and form an acute angle, at whose head stands Mont Thabor (3212 mètres). The Maritime Alps terminate at Col di Tenda, after describing a large arc of a circle, with the concavity turned towards Italy.

Towards Italy the slopes of the Alps are abrupt. In France they project long and powerful arms toward the Rhône—namely, the Alps of Valais, whose nucleus is formed by the Buet; the Alps of Faucigny and Chablais; the Alps of Savoy, with the beautiful group of the Great Chartreuse; the Alps of Dauphiné, which communicate with the Pelvoux and its immense glaciers, whose highest peak is called, quite poetically, La Barre-des-Ecrins (4103 mètres), and with Devoluy, a dull and gloomy group; the Alps of La Maurienne; and finally the Alps of Provence, which contain Mont Ventoux in the N., the mountains of Les Maures, with their pine-covered summits, and those of L'Estérel, which are of volcanic origin, and overlook the beautiful city of Nice.

The *Pyrenees* are inferior to the Alps; they are one-third lower, not so vast, and quite of a different aspect. They stand like high walls, with sharp, conical summits, separated by very high passes; they extend from W. to E., and to the N. project a regular series of buttresses and vales, one very similar to the other. The ridges, generally insuperable, are more pointed and more austere than those of the Alps; eternal snow, however, is more rare. The principal peaks, most of which are outside of the line of the watershed, are, in the eastern Pyrenees, Mont Canigou (2786 mètres); in the central Pyrenees, Pic de Corlette (2920 mètres), Cylindre du Marboré (3322 mètres), Maladetta (3404 mètres), the highest peak in the whole chain, Mont Perdu, and the Pic du Midi de Bigorre (2909 mètres); and in the western Pyrenees, Vignemale (3298 mètres) and Pic du Midi d'Ossau (2967 mètres).

The main body of the Pyrenees, composed of granite, schist, and limestone, extends over a length of 350 kilomètres (217 miles), and with a breadth of 100 kilomètres (60 miles) in the centre, and of 50 kilomètres at the extremities. From the centre proceed the long ranges of hills which, curiously arranged like a fan, separate the valleys of the Gaves. From the Pic de Corlette issue two secondary chains, the Corbières, of which the southern is high, pointed, and granitic, and the northern flat and calcareous.

This chain is continued by the Cévennes, which begin at the neck of Naurouze, and extend over a length of 475 kilomètres (295 miles). They are divided into the southern Cévennes, which are rocky and granitic chains whose principal peak is L'Aigoual (1568 mètres); the central Cévennes, which comprise the mountains of Gévaudan and Vivarais, and whose most remarkable peaks are the Gerbier de Jonc (1562 mètres), the Mézenc (1766 mètres), and the Lozère (1702 mètres); and finally the northern Cévennes, which again are subdivided into the mountains of Lyonnais, Beaujolais, and Charolais, which fall to an average height of 550 mètres.

To the N. the Cévennes are continued by the Côte d'Or, which produces the finest wine in France, the plateau of Langres, and the Faucilles Mountains, which communicate with the Vosges. N. of the Faucilles Mountains extend the plateaus of Lorraine, L'Argonne, with its famous defiles, and the Ardennes, covered with forests and deeply cut by the streams which traverse them. Between the Ardennes and the sea stretch the plains of Flanders and the fertile and well-cultivated plains of Artois and Picardy, which are continued westward to the sea by the plains of Caux.

To the W. of Côte d'Or, whose average height is 500 mètres, is found a small granitic group, elevated from 800 to

900 mètres, which is called Morvan; on account of its strategical position it is considered the citadel of France. Still more westerly, and N. of the Loire, stretches the immense plain of the Beauce, the vast granary of France. Between the Beauce and Finistère are the heights of Perche and Maine, from which a double granitic range traverses Bretagne from E. to W. N. of Maine are the graceful and fertile hills of Lower Normandy, and finally the peninsula of Cotentin, terminating in Cape de la Hague and the high hills which enclose the naval port of Cherbourg.

Between the Loire and the Garonne are the remarkable summits of the central group which in remote ages separated the gulf of the Seine from that of the Garonne. This group comprises very different chains: the granitic mass of the Margeride, from 1100 to 1600 mètres high; the mountains of Auvergne, whose highest peak is the Plomb du Cantal (1858 mètres), an old volcano, and in the centre the groups of Cézallier and Mont Dore, which contain the Puy de Sancy (1886 mètres), the highest peak in Central and Northern France, and which project towards the N. W. a granitic spur, the mountains of Lower Auvergne, and towards the N. the chain of the Puys, a curious line of old, extinct volcanoes, now covered with verdure, but whose craters are still distinguishable, as are also the immense streams of lava, which in the country itself are called *chéires*. Puy de Dôme (1465 mètres) and Puy de Pariou are the most remarkable of these volcanoes—the one on account of its height, the other on account of its form. With the mountains of Lower Auvergne connect the granitic mountains of Limousin, which attain their greatest height in Mont de Meymac (978 mètres) and Mont Odouze (954 mètres), and which from that point slope down through the sterile plateau of Millevache to Mont Jargean (950 mètres). The central group contains several secondary ridges: to the N., a chain whose elevation seldom surpasses 1000 mètres, though in a few points it reaches 1600 mètres. It is divided into the mountains of Velay (basaltic), Forez (granitic), and Madeleine (porphyritic), and runs off from the mountains of Vivarais, forming a high barrier between the Loire and the Allier. To the N. W. the granitic mountains of La Marche communicate with Mont Odouze. To the S., and detaching itself from the chain at Mont Lozère, stretches the vast region of the Causses, high calcareous plateaus deeply cut by the valleys of the Tarn, Lot, and Aveyron. These plateaus, Causse de Sauveterre, Causse Méjean, the Black Causse, Causse de Séverac, de Concourès, the plateau of Larzac, and Causse de Quercy, comprise nearly the whole of the old province of Rouergue. To the S., finally, are the mountains of Aubrac, a granitic group slightly connected with the mountains of Margeride.

Corsica is traversed from N. to S. by a chain of high mountains whose most elevated summit is Monte Rotondo (2764 mètres).

2. *Hydrography.*—The flowing waters form in France seven principal basins—namely, those of the Seine, Loire, Garonne, Rhine, Maas, Scheldt, and Rhône. In the first three basins, those situated in the interior of the great arc of a circle formed by the Pyrenees, Cévennes, and Ardennes, the water runs towards the N. W. to the English Channel and the Bay of Biscay; in the next three, situated to the N. of the Faucilles and the Ardennes, it runs northward to the North Sea, and in the basin of the Rhône it runs southward.

France possesses more than 200 streams which are fit for navigation or flotation of craft. Their length, as far as utilized, is 11,000 kilomètres (6200 E. m.), of which 8800 kilomètres (5500 E. m.) are used for navigation. The principal rivers in the *basin of the Seine* are the Seine, which waters Paris, Rouen, and Hâvre, where it forms a vast estuary, and its affluents—to the right, the Aube, Marne, and Oise, with its feeder the Aisne; and to the left, the Yonne and the Eure. Among the secondary basins belonging to that of the Seine are those of the Somme and the Orne. *In the basin of the Loire,* flow the Loire, which passes by Nevers, Orléans, Blois, Tours, Nantes, and St.-Nazaire, and its affluents—from the right, the Maine; and from the left, the Allier, Cher, Indre, and Vienne. The Vilaine forms a secondary basin, and becomes navigable at Rennes. *In the basin of the Garonne,* we find the Garonne, which, after its junction with its principal affluent, the Dordogne, forms the beautiful river Gironde, on whose borders stands Bordeaux. Its principal tributaries, the Tarn, Lot, and Dordogne, join it on the right side. To this basin belong those of the Charente and the Adour, which latter passes by Tarbes and Bayonne. *In the basin of the Scheldt,* the Scheldt and its affluent, the Scarpe. *In the basin of the Maas,* the Maas, which in France is called the Meuse, and which receives at Namur, from the left, the Sambre. *In the basin of the Rhine,* the Rhine, which is navigable from Bâle to the sea, and runs through Strasburg, Mainz, Coblentz, and Cologne. In the Netherlands it divides into several branches, of which the two principal ones, the Lech and the Waal, mix their waters with those of the Maas. Its principal affluent, the Moselle, waters Metz, and receives the Meurthe, which passes through Nancy. *In the basin of the Rhône,* the Rhône, which traverses Lake Leman and waters Geneva and Lyon; it receives from the right the Saône, which is greatly increased by the waters of the Doubs. It then proceeds towards the Mediterranean, where it forms its vast marshy delta. S. of Lyon its principal affluents are the Isère, Drôme, and Durance, which carry to it nearly all the water flowing into France from the Alps. To the same system belong the basins of the Var and the Aude.

Besides these great streams, several regions must be noticed which are naturally covered with ponds. They are the Sologne and the Brenne, S. of the Loire; the Dombes, E. of Lyon; and the great marsh of Lower Poitou.

The coast of the North Sea is low, partly marshy, and, down to the mouth of the Somme, bordered with a line of dunes, broken only by Cape Gris-Nez, which forms the nearest approach to England. Along the English Channel the coast of Normandy is bordered by cliffs which, cut and beaten in every direction by the sea, rise to the height of 250 mètres, and run along to Cape de la Hève, W. of which the coast opens to the estuary and bay of the Seine. Then comes a line of low and very dangerous rocks, after which comes the sandy and marshy estuary of Carentan, which touches the peninsula of Cotentin. This peninsula, flat in its southern part, rises to the N. between the points of Barfleur and La Hague, where its coast attains a height of 150 mètres. In the angle formed by the peninsula of Cotentin and the northern coast of Finistère lies the bay of Mt. St. Michel, remarkable for the exceptional height of its tides (15 mètres), and defended to the N. by the English islands of Jersey, Guernsey, Alderney, and Sark. The passage between these islands and the coast is very dangerous to navigate. The whole northern coast of Finistère is strewn with dangerous reefs extending to Pt. St. Mathieu, which forms the extremity of Bretagne. At this point the coast suddenly retreats, and forms the vast roadstead at the head of which stands the naval port of Brest. From Brest to L'Orient, which also is a naval port, the coast is lower, but still hilly. Remarkable is the small gulf of Morbihan, studded with low islands, and the peninsula of Quiberon. Then comes the mouth of the Loire, and between the Loire and the Charente a succession of dunes and extensive marshes. Along the coast from Finistère to the Charente are situated the islands of Ouessant (Ushant), Groix, Belle Ile, Noirmoutiers, Yeu, Rhé, and Oléron. Farther S. the ocean receives the Gironde, which is deep and broad, like an arm of the sea. From the Gironde to Spain the coast is traced as a straight line bordered by vast dunes, which are broken only to the right of the basin of Arcachon and at the mouth of the Adour.

Along the Mediterranean the western coast is low, and its gracefully rounded heads conceal a series of marshes, of which the most important are those of Than and Mauguio, but especially that of Berre, which separates Marseille from the mouth of the Rhône. At Marseille the coast rises, and from here to the Italian frontier it presents a picturesque and much-indented line of headlands and bays. The road beyond the Hyères Islands, around the so-called Corniche, is admired by all tourists. The tide, so strong on the shores of the ocean, is very insignificant on those of the Mediterranean.

The western coast of Corsica is steep and abrupt, the eastern low and marshy.

3. *Climate.*—The mean temperature of France is 12½ degrees Centig., or 55° Fahr. To the W. the isothermal lines are raised northward by the heating influence of the southwesterly winds and the Gulf Stream; to the E. they are lowered when removed from these influences. Rain is frequent and more abundant on the western coasts and in the mountainous regions (33 inches on the Atlantic border; 23 inches in Paris; 39 inches in Morvan; 40 to 45 inches on the slopes of the Alps and Pyrenees). Although the climate is generally temperate and mild, it nevertheless presents five different types, which are called the Sequanian (from the *Seine*), Vosgian, Rhodanian, Mediterranean, and Girondin. The Sequanian climate reigns N. of the Loire; its mean temperature is 52° Fahr.—in winter 38° F., in summer 66° F. The prevailing winds are W., S. W., and S.; the first two are rain-bearing. The Vosgian climate is more extreme; its mean temperature is 49° F.; rain is less frequent. The mean temperature of the Rhodanian climate (the valley of the Rhône) is 52° F., but the hot and dry southern winds (sirocco or foehn), alternating with the cold northern, produce sudden changes in the temperature. Rain is abundant in the Alps. The Mediterranean climate is warmer, its mean temperature being 57° F. The summer is hot and dry; the autumn is rainy, and disagreeable on account of the cold and impetuous N. E. wind called the mistral. The

climate in general is milder in the winter and hotter in summer than the Sequanian climate. N. W. and S. W. winds alternate, and produce rapid changes in the atmosphere.

III. Agriculture.—France presents four agricultural belts, which traverse it from S. W. to N. W.—namely, that of the olive, bounded by a line which connects the foot of the Corbières with the Alps of Dauphiné; that of the maize, whose northern boundary runs from the island of Oléron to the middle of the Vosges; that of the vine, which ceases at a line drawn from the mouth of the Loire to the source of the Oise; and N. of this line the belt of the apple tree. The system of small holdings prevails in France, the average size being 10½ hectares; the largest number of great holdings is found in the central part of the country. The cultivation of cereals occupies 15,000,000 hectares, and yields 250,000,000 hectolitres. Wheat is produced, especially in the north-eastern part of the country (in an average year 7,000,000 hectares, yielding 100,000,000 hectolitres); spelt (1,300,000 hectolitres); rye (2,000,000 hectares, 25,000,000 hectolitres); barley, in the same regions as wheat, but on poorer soil (1,000,000 hectares, 20,000,000 hectolitres); oats in the N. W. (3,000,000 hectares, 75,000,000 hectolitres); maize in the south-eastern and south-western parts (600,000 hectares, 10,000,000 hectolitres); millet in the western part (40,000 hectares); buckwheat in Bretagne, Normandy, and on the central plateau (700,000 hectares, 10,000,000 hectolitres); rice in the southern part, but only in small quantities. Of garden-vegetables and root-crops there are raised the true potato (1,200,000 hectares, producing 100,000,000 hectolitres), cultivated over the whole territory; kidney beans (200,000 hectares); broad beans (150,000 hectares), and in smaller quantities peas and lentils. Vegetables are raised, especially around the large cities (there are 1300 kitchen-gardens around Paris). The beet-root, cultivated especially in the N. E., occupies 130,000 hectares, and produces 44,000,000 quintals, from which more than 200,000 tons of sugar are extracted. Of textile plants, flax and hemp occupy 200,000 hectares. Of oil-seeds, colza, rape, and poppy cover 300,000 hectares, which yield 3,500,000 hectolitres of seed. The olive of Southern France gives the best table-oil; from that part of the country come also madder, saffran, and other dyestuffs. Tobacco is cultivated in several establishments under the superintendence of the state, which holds a monopoly of this product (about 250,000 quintals). The natural meadows (Bretagne, Normandy, the coasts, and the mountains) cover 5,000,000 hectares, and produce 15,000,000 tons of hay. There are also artificial meadows, in which clover, lucerne, and grass are sown (2,700,000 hectares), and common pasturages in the mountains (6,000,000 hectares). One of the most important resources of France is the vine (2,500,000 hectares in 78 departments, producing 60,000,000 hectolitres of wine, of which one-third is for exportation). The production falls into seven groups—Burgundy, Bordelais, Champagne, Rhône, the central part of the country, Charente, and the southern part. Charente produces by the distillation of its wines the most excellent brandies. Other products of the vine are table-grapes and the raisins of Provence.

The northern part of the country produces excellent cider and perry, the quantity amounting to one-tenth of that of the wine. The manufacture of beer is important in the northern and north-eastern parts and in Lyon, the quantity amounting to one-eighth of that of the wine. Fruits are largely exported—apples and pears from the N., oranges, lemons, and pomegranates from the S.; excellent peaches, strawberries, and currants are grown near Paris; apricots in the central part; cherries near Paris and the coasts of the Channel. Dried fruits—pears, apples, prunes, figs, almonds, and nuts—come from the central and southern regions.

Of trees important to industry, France possesses the walnut, olive, and chestnut (Corsica, Provence and the central plateau), whose wood is used for cooperage and the fruit for food; the white oak and the mulberry, so important for the silk cultivation in the basin of the Rhône. The forest trees are—of hard wood, oak, elm, ash, hornbeam, beech, chestnut, etc.; of soft wood, alder, poplar, aspen, willow, birch, etc.; of resinous wood, fir, larch, and pine. There are in France 8,500,000 hectares of forest (in the N. E., in the Alps, the Landes, and the Pyrenees).

France possesses of live-stock 3,500,000 horses, 800,000 asses and mules, 12,000,000 horned cattle, 30,000,000 sheep, 1,500,000 goats, and 5,000,000 swine. The other domestic animals are rabbits in the surroundings of Paris; turkeys, ducks, geese in Orne, Maine, and the vicinity of Toulouse; pigeons, and especially chickens. The value of the annual production of eggs and poultry amounts to 100,000,000 francs, of which production 28 per cent. is for export.

The value of the annual production of honey and wax in France amounts to 24,000,000 francs; there are about 3,000,000 hives. The silkworms furnished, before the prevalence of disease among them, 25,000 tons of cocoons. The production of game—hares, partridges, wild-ducks, rabbits, pheasants, roebucks, wild-boars, etc.—amounts to one-third of that of poultry. Martens, foxes, otters, and other beasts and birds yield furs and feathers to the value of 30,000,000 francs a year.

The fisheries are very important. The trade in sea-fish exceeds 60,000,000 francs a year. The oysters of Cancale and Marennes are much esteemed, but the beds are nearly exhausted. For pisciculture there was formerly an excellent establishment at Hüningen; it is now carried on at Concarneau, and by its aid the oyster production in the basin of Arcachon has been developed considerably.

Of the 53,000,000 hectares of French soil one-half is under tillage, of which three-fourths are in cereals, one-fifth is in artificial meadows and industrial plants, and one-fifth in fallow. More than one-fifth is in natural meadows and pasturage, one-twentieth in vineyards, one-fifth in orchards, woods, and forests, and the rest in roads, private grounds, etc. The *relative* value of the products was in 1869 nearly 5,000,000 francs for cereal grains and straw, 2,000,000 for hay and pasturage, 1,500,000 for industrial plants, 1,500,000 for beverages, and 6,000,000 for domestic animals, of which one-third of the value was in horses, one-half in horned cattle, and one-tenth in sheep.

IV. Industry.—1. *Mining Industry.*—Granite occurs especially in Cotentin, the Chausey Islands, and several points of Bretagne, in the Vendée, Limousin, the Alps, and the Vosges. Among the volcanic products are noticeable the basalt of Auvergne and the porphyry of Corsica, Var, and Epinal. Excellent slate-quarries are found in the vicinity of Angers. Bayonne gives feldspar and asphaltum from the clay-schist of Ain. France is rich in marbles for building purposes. The most remarkable quarries are at Boulogne, Maubeuge, and Givet in the N.; at Le Mans and Sablé (Sarthe) in the W.; at Chomerac (Ardèche), La Droix (Côte d'Or), Châtillon (Loiret), and several other places in the central part of the country; at Campan, St.-Béat (a beautiful white marble), Castéra-Verduzan (a beautiful yellow marble), and Caunes in the Pyrenees, at Grenoble in the Alps, at Laveline in the Vosges, and at Corte in Corsica. A fine lithographic stone is found at the Vigan (Gard). Different kinds of freestone abound. The most beautiful are those found in the vicinity of Paris, at Creil (Oise), Crouy (hard), Bourgogne (very fine), Euville in Lorraine, etc. Chalk is found at Rouen, Meudon (in the vicinity of Paris), Troyes, and in Touraine, etc. Of siliceous materials, France produces the excellent millstones from La Ferté-sous-Jouarre, a repository of 3000 hectares, yielding 3500 stones a year. These stones have a wide fame; remarkable are also those from Lesigny (Creuse), Bergerac (Dordogne), etc.; and the sandstone of Fontainebleau, with which Paris is paved, and of the Vosges Mountains. The best plaster is that from the vicinity of Paris; the best cement comes from Boulogne, Vassy (Yonne), Pouilly (Côte d'Or), and Grenoble. Besides the common potter's clay, which is found everywhere, a finer sort of clay is found at Gien and Limoges, from which a celebrated *faïence* is made. Porcelain clay is found at St.-Yrieix. France produces both rock-salt and sea-salt. The former is found especially in Lorraine, near Nancy, and in the Jura, at Salins and at Lons-le-Saulnier; the second is produced from salt-marshes on the Atlantic from the mouth of the Loire to the Gironde, and on the coast of the Mediterranean. The annual production exceeds 500,000 tons.

Of mineral and thermal springs there are four groups: 1, that of the Vosges, generally chalybeate (Plombières, Bussang, Luxeuil, and Bourbonne-les-Bains); 2, that of the Jura and the Alps, chloric and sulphurous (Salins and St.-Gervais in the Jura, Aix-les-Bains in Savoy, Allevard-Uriage in Dauphiné, Condillac and Montélimart in the valley of the Rhône, and Aix in Provence); 3, that of the centre, whose waters generally are chalybeate and carbonated, and rise from the volcanic group of Auvergne (Évaux, Néris, Pougues, Bourbon-l'Archambault, Vichy (the most important thermal spring in France, especially for bowel complaints), St.-Galmier, Vals, Royat, Mont Dore, Balaruc, Bourboule, and Chaudes-Aigues); 4, that of the Pyrenees, whose waters generally are sulphurous (Amélie-les-Bains, Ax, Bagnères-de-Luchon, Barèges (the strongest sulphur spring in France), Bagnères-de-Bigorre, St.-Sauveur, Cauterets, and Eaux-Bonnes). Besides these four groups must be mentioned the sulphur springs of Enghien in the vicinity of Paris and of Bagnoles (Orne), the chalybeate springs of Forges-les-Eaux (Seine-Inférieure), and the famous springs of St.-Amand.

France is poor in metals with the exception of iron. Argentiferous lead is found at Pontgibaud (Puy-de-Dôme), Vialas (Lozère), etc.; copper in the Alps and Corsica; zinc in small quantities in Gard and the Pyrenees; man-

ganese at Romanèche (Saône-et-Loire); antimony in Haute-Loire, Cantal, and Corsica; nickel in small quantities in Isère (Les Chalanches); tin in Limousin and Bretagne; gold-dust in the sand of the Rhône, but not in sufficient quantities to make the extraction remunerative; iron pyrites for sulphuric acid is largely worked in Gard, Ardèche, Rhône, and Vosges. The total value of these several products is 6,500,000 francs, of which 3,500,000 are for lead alone. The importation of gold and silver amounts to 700,000,000 or 800,000,000 francs; that of copper, lead, tin, and zinc to 100,000,000 francs.

In 1815, France produced about 900,000 tons of coal and 110,000 tons of pig iron, and consumed 1,000,000 tons of coal and 110,000 tons of pig iron. In 1866 she produced 12,000,000 tons of coal and nearly 1,500,000 tons of pig iron. In the last half century the consumption of coal has increased tenfold and that of pig iron a hundred-fold. Anthracite is mined in Hautes-Alpes and Fréjus in Var; lignite in Aisne, Manosque, and Aix in Provence (200,000 tons); and peat in the Pas-de-Calais, Somme, Aisne, Oise, Seine-et-Oise, Vosges, and Jura. The alluvial districts of Seine-Inférieure, the valley of Grésivaudan, in Isère and Marais de Fos (Bouches-du-Rhône), 400,000 tons. The collieries, numbering 590 and comprising an area of more than 5500 sq. kilomètres, are located in 71 basins and distributed in four groups: 1, That of the N., which, on the northern slope of the Ardennes, comprises the beautiful basin of Valenciennes (Anzin, Denain, Aniche, Douai, etc., probably stretching as far as the Boulonnais), and which yields one-fourth of the whole production. 2, That of the E., which was very important before the war of 1870, but of which only a few collieries at Ronchamp (Haute-Saône) have remained in French possession. 3, That of the centre, which extends from the foot of the Morvan and around the granitic districts of the central plateau. Its mines are numerous and often very rich: Épinac, 160,000 tons; Blanzy and Montchanin, 700,000 tons; Dieuze, 100,000 tons; La Chapelle-sous-Dun; Ahun, Commentry, 780,000 tons; Bert, Fins, St.-Eloy, Brassac, etc. In the great basin of the Loire, yielding one-fourth of the whole production, are Rive-de-Gier, Firminy, St.-Etienne, where the heaviest seam attains a thickness of 12 mètres; the basin of Alais (Bessèges, Porte, La Grand-Combe, etc.); St.-Gervais and Graissesac (150,000 tons); Carmaux (100,000 tons); Aubin (500,000 tons). 4, That of the W., from the foot of the granite of the Vendée and of Maine. Here are found the mines of Vouvant and Chantonnay; the basins of the Lower Loire (100,000 tons), Maine (100,000 tons), Cotentin, and Littry. Besides these four groups, the collieries of La Tour-du-Pin and the Drac must be mentioned (100,000).

Iron ore is not often found in France in veins (Vosges and Pyrenees), but more frequently in beds (carbonate of iron in the coal-regions, oxide of iron in the Jurassic regions, cretaceous iron in Le Creusot, in Franche-Comté, Isère, Ardèche, and Aveyron); and oftenest as alluvial or bog ore (Ardennes, Champagne, Bourgogne, Franche-Comté, Berri, Poitou, Périgord, and Landes, where it is found in beds of a thickness of 30 mètres). The iron-mines, numbering about 240, comprise an area of 1200 sq. kilomètres, and yield annually 3,000,000 tons of raw ore. The principal deposits are those of Vassy (Haute-Marne), yielding 500,000 tons a year; Châtillonnais, which form a belt stretching through three departments; Franche-Comté, which are situated between Langres, Vesoul, Besançon, and Dijon; of the department of Cher, which are the richest in France, and yield one-fifth of the whole production.

The manufacture of pig iron and steel is increasing in France. In 1870, 1,000,000 tons of pig iron and about 40,000 tons of steel were manufactured.

2. *Manufacturing Industry.*—Hydraulic motors are manufactured especially in Paris, where all kinds of industry are united, and in Chartres, Essonnes (Seine-et-Oise). Steam-engines are manufactured at Paris, Rouen, Hâvre, Lille, St.-Quentin, Lyon, Marseille, and Nantes. In 1820, France possessed only 65 steam-engines; in 1840, 2600; and now about 20,000. The number of movable and fixed motors, taken together, amounts to 29,000, with a power equal to that of 675,000 horses. Agricultural machines are made in Paris, Liancourt (Oise), Nancy, Meaux, Orléans, and Bourges. Spinning and weaving machines are made—for cotton, in Paris, Rouen, and St.-Quentin; for flax, in Lille; for wool, in Roubaix, Elbeuf, Louviers, and Sedan; for silk, in Lyon and St.-Chamond; for hosiery, in Nîmes. Sewing-machines are made in Paris and Lyon. Machine-tools are made in Paris, St.-Denis, Rouen, Creusot, etc.; tools for naval woodwork, in Hâvre. Metallic wares are made in Paris, Villedieu (Manche), and Guise (Aisne). Hardware is made for tools in Paris and St.-Etienne; for buildings, in Charleville (Ardennes), L'Aigle (Orne), Rugles (Eure); for the household, in Paris and Lille. Arms are manufactured at Paris, Châtellerault, St.-Étienne, Charleville, Tulle, etc.

Alcohol is made from wine (500,000 hectolitres) at Herault and Charentes, and from beet-root (1,000,000 hectolitres) in French Flandre. Chemicals are manufactured in Paris and its vicinity, at Lille, St.-Gobain, Rouen, Cherbourg, Lyon (dyestuffs), Montpellier, Marseille, Bordeaux, etc. The consumption of sulphuric acid in France is 50,000 tons. Oils are made from olives in Provence, Roussillon, and Southern Languedoc; from nuts, in Charente and Dordogne; from colza and flax-seed, in Flandre; from rape-seed, at Caen and in Franche-Comté. Candles and other chandlery products are made at Paris, Lyon, Montpellier, Marseille, and Lille; soaps, at Marseille, Nantes, Hâvre, Amiens, Rouen, Elbeuf, Rheims, and Lyon; toilet soaps, at Paris; hair-dressing articles, at Givet, Paris, Château-Renault, and Grenoble; glue, in Flandre, at Paris, and Givet.

Milling is carried on extensively at Corbeil (Seine-et-Oise), between the Beauce and the Brie, the two great wheat-fields of France; at Gray, Poitiers, Marseille, Hâvre, etc. The so-called *pâtes d'Italie* are made especially in Paris, but also in Marseille, Lyon, Clermont-Ferrand.

Of preserved food may be mentioned the sardines of Bretagne, the meat-pies of Nérac, the pastries of Toulouse, the brandy-pickles of Troyes, Lyon, Arles, and Bayonne, and the preserved viands of Nantes, Bordeaux, Marseille, and Mons. Cheese-making is much developed in France. The most famous kinds of cheese are the Maroilles, Brie, Camembert, Neuchâtel, Livarot, Pont-l'Evêque, and Isigny; those of Jura resemble the gruyère of Switzerland; the Septmoncel and Mont d'Or cheeses are made of goat's milk. The manufacture of beet-root sugar is carried on especially in the N. W. (Paris, Lille, Valenciennes, Douai, Arras, Péronne). More than 200,000 tons of sugar are produced from roots grown in France; the total production is 325,000 tons, of which 225,000 tons are consumed in the country. The raw sugar from the colonies is refined at Marseille, Bordeaux, Nantes, and Hâvre. Confectionery is principally made in the great cities; the confections of Verdun and the jellies of Bar-le-Duc may be mentioned. Liqueurs are distilled at Paris, Chartreuse, and Cette. In the Vosges excellent cherry brandy (Kirschwasser) is made. Chocolate is manufactured in Paris, Noisiel, Bayonne, and the Nord. Vinegar is made in Charente and Orléans; mustard is prepared extensively in Paris, Bordeaux, and Dijon; drugs mainly in Paris.

Cotton Stuffs.—120,000 tons of cotton are annually imported. It employs 7,000,000 spindles and 150,000 looms. The territory in which this industry is carried on may be divided into four regions: 1, that of the E., formerly comprising Alsace, is now nearly confined to the valleys of Lorraine, especially at Senones (Vosges), to which may be added Bar-le-Duc, Nancy, and Troyes; 2, that of Normandy, whose principal market is Rouen; the factories are at Rouen, Gisors, Evreux, Falaise, Flers (Orne), and in the district around Cholet; 3, that of the N., whose most important market is St.-Quentin, and whose most extensive factories are at Amiens, which annually produces 100,000 pieces of cotton velvet, Lille, Tourcoing, Roubaix, etc.; 4, that of Lyonnais, whose centre is Tarare and Roanne and Vichy. The manufacture of printed calicoes is now, since 1870, confined to Paris and Rouen.

Linens.—Of textile plants, hemp and flax are indigenous in France. The production and importation, whose value amounts to 60,000,000 francs, employ more than 630,000 looms. This industry is principally located in the northern part of the country. In Flandre (Lille and its environs, Armentières, Dunkerque (Dunkirk), for veils; Valenciennes and Cambrai for laces; Abbeville for spinning, Amiens for plain stuffs; St.-Quentin for damasks, etc.). In Normandy and Maine (Le Mans for coarse stuffs; Laval, Fresnay-sur-Sarthe, Alençon, Lisieux, Vimoutiers for sheetings; Vire, Bernay, Angers, and Cholet for handkerchiefs; Hâvre, Angers). In Bretagne in the linen manufactures of Landerneau. Besides these there are some points in the Vosges, Béarn, and Dauphiné where this industry is prosecuted.

Woollens.—Besides the indigenous produce, France imports annually wool to the amount of 200,000,000 francs. Its manufacture is carried on in seven regions: 1, That of the N.—Roubaix and Tourcoing for fancy goods; Cateau-Cambrésis, Fourmies, and Sains for merinoes; St.-Quentin and Guise for light stuffs; Amiens for velvet; D'Utrecht and Abbeville for heavy cloths; Mouy for furniture cloths. 2, That of Normandy (Elbeuf and Louviers for heavy cloths, Lisieux, Vire, etc.). 3, That of Ardennes (Sedan for fine cloths, Rheims). 4, That of the E. (Nancy). 5, That of Isère (Vienne). 6, That of Languedoc (Lodève for heavy cloths, Bédarieux, Carcassonne, Mazamet, Mende, etc.). 7, That of the centre (Limoges for flannels; Châ-

teauroux and Romorantin for army cloths; Orléans for blankets, etc.). Shawls are made at Paris and Lyon; tapestries (besides the celebrated Gobelins at Paris) at Beauvais, Aubusson, Nîmes, Roubaix, and Tourcoing.

Silks.—It is principally in the valley of the Rhône that silks are manufactured, as it is the region of the silkworm. Besides the indigenous produce, France imports annually raw silk to the value of over 100,000,000 francs. The winding and spinning are done principally in Ardèche, Drôme, Vaucluse, Gard, and Hérault. For weaving Lyon and the department of the Rhône are the most noted places (120,000 looms); next, St.-Etienne and St.-Chamond (ribbons and brocades), Nîmes (light stuffs), Tours (furniture silks). Lace is made at Alençon, Bayeux, Caen, Chantilly, Bailleul, Lille, Arras, Mirecourt, employing 100,000 women.

Tulle is principally made in Calais, St.-Pierre-les-Calais, and Lyon; embroidery in Nancy and in the Vosges; small wares in Lyon and Paris. Hosiery is manufactured in Troyes, the whole of Champagne, Amiens (woollen, 25,000 hands), Falaise, Lyon, and Nîmes (silk). Straps are made in Rouen and Paris; buttons in Paris and Creil. In drapery, making up, and *modes* Paris is the principal centre; her products are very remarkable, and are exported to the value of hundreds of millions. Hats come especially from Paris, but also from other great cities (felt hats from Aix); kid gloves from Paris and Grenoble; boots from Paris, Bordeaux, and Marseille. In jewelry no place in France, and perhaps none in the world, can rival Paris, which also manufactures watches, though this industry has another very important centre in Besançon, where the mounting of the pieces manufactured in the Jura Mountains is done. Perfumery is made in Paris and in Provence.

V. Commerce. 1. *Means of Communication.*—The roads of France are divided into three classes—national roads, maintained at the expense of the state, and extending 35,000 kilomètres (21,740 E. m.); departmental roads, maintained at the expense of the departments, and extending 45,000 kilomètres (27,960 E. m.); and parochial roads, maintained by the communes, and subdivided into three grades, of which the first extends 75,000 kilomètres (46,604 E. m.), the second 75,000 kilomètres (46,604 E. m.), and the third 340,000 kilomètres (211,270 E. m.). Only the last grade of the last class is on the natural soil.

The water-roads, on which the interior navigation takes place, comprise the navigable courses of the rivers, extending 9400 kilomètres (5840 E. m.), and the canals, extending 4800 kilomètres (2980 E. m.). The first French railroad was constructed in 1828, from Andrezieux to St.-Étienne and Lyon; horses were used on this road until 1832, when the first locomotive was employed. The next railroad was that from St.-Germain to Paris. The real system of railways was commenced in 1847; its actual length is 16,000 kilomètres (9940 E. m.), its proposed length 20,000 kilomètres (12,430 E. m.). These railways have cost 6 milliards, of which the state paid one, and they are worked by companies which have a lease on them for 99 years, at the end of which term they become the property of the state. There are six great companies—namely, that of the West, the North, the East, the Paris Lyon and Mediterranean, the Orléans, and the South; and 23 small ones, which only work 1350 kilomètres (940 E. m.), and of which the principal are those of Charentes, Vendée, Orléans, Châlons, etc. All the great companies, with the exception of that of the South, have the heads of their lines in Paris, where they are connected by belt-lines. The traffic on the French railways amounts to 100,000,000 passengers, the larger part of whom travel less than 20 kilomètres (12½ E. m.), and 38,000,000 tons of merchandise, which generally travels more than 150 kilomètres (93 E. m.). The receipts amount to 700,000,000 francs, of which one-third is for passengers. The traffic conveying merchandise on the water-roads is about one-half of that on the railways. The steam navigation in the basin of the Seine is equal to that in all the other basins together.

The post and telegraph follow the great roads of communication. Both are regulated by the state. The first transports annually about 700,000,000 articles, letters, postal cards, etc. (350,000,000 letters). The postage of a letter is 0f. 25, of a postal card 0f. 15. But this institution does not offer to the public the same facilities for sending printed matter, etc. as it does in other countries—for instance, England. The telegraph conveys more than 3,000,000 messages of an average price, for France, of 0f. 60, over 30,000 kilomètres of lines (18,640 E. m.).

The traffic on the sea is not prosperous. The number of vessels has remained stationary for about thirty years, though their tonnage has been doubled. The effective force of the commercial fleet (with the exception of craft employed in the fisheries of the coast) is 15,600 vessels, of about 1,000,000 tons burden. The general movement amounts to more than 16,000,000 tons. The coasters make annually 76,000 voyages; the ports in which the coasting trade is most active, are Marseille, Hâvre, Bordeaux, Nantes, Rouen, Dunkerque (Dunkirk), Cette, Arles, Tournay, Charente, and Libourne. The ports for the equipment of fishing-vessels are Gravelines, Boulogne, Dieppe for herring; Douarnenez for sardines; Granville for oysters. The great sea-traffic which exists between France and England, and between France, Italy, Turkey, Spain, and Russia, starts partly from Marseille and Hâvre, ports of first rank, and partly from Bordeaux, Nantes, and Dunkerque, ports of second rank. The cod-fishery employs 500 vessels, but for several years no whaling fleet has been equipped.

2. *Money and Measures.*—The great Revolution of 1789 gave France the metrical system, so admirably founded in reason, and now adopted by the greatest part of continental Europe. The basis is the mètre—that is to say, the $\frac{1}{10000000}$th part of the quadrant of the meridian passing through Paris (according to measurements made at the end of the eighteenth century by French astronomers), and the scale is arranged in accordance with the decimal system. The French money basis is the Franc (which see). The mints of Paris and Bordeaux produce yearly from 200,000,000 to 400,000,000 francs in coin, chiefly in gold. Before 1870, France possessed 4½ milliards of money. Besides the ordinary commercial paper, which is used principally in the great financial and banking establishments of Paris, France employs bills on the Banque de France, an institution whose credit is equal to that of the state, and which, through the central bank of Paris and the 80 provincial banks, discounts about 6 milliards a year, and puts into circulation bills of its own to the amount of 2 milliards. In May, 1874, the balance of the bank showed a deposit of 3,226,000,000 francs.

3. *Interior Commerce.*—The interior commerce of France circulates annually more than 29 milliards. The increased facilities for communication have served to increase the interior commerce; thus, the number of letters has increased fivefold since 1830. Besides the great cities, in which the retail business, and the manufacturing centres, where the wholesale business is carried on, there are throughout the whole of France periodical markets much frequented by the agricultural population. The most important of these markets are the cattle-market of La Villette in Paris, the fair of Guibray near Falaise, and that of Caen, where there is a large trade in horses.

4. *Foreign Commerce.*—The general commerce of France, with the exception of that of the precious metals, comprises more than 8 milliards, of which 4 are for importation and more than 4 for exportation; half a century ago it did not exceed 1 milliard. It takes place mostly by sea. That of the precious metals exceeds generally 1 milliard, of which 700,000,000 are for importation. The special trade transit and storage comprise 5¾ milliards, of which 2¾ are for importation, and 3 for exportation; the importation of natural produce and raw materials for manufacturing amounts to 2 milliards, that of other materials and objects of consumption, 800,000,000.

France draws silk (worth 350,000,000) from China, Japan, Bengal, the Levant, Italy; cotton (from 200,000,000 to 425,000,000) from the U. S., India, Egypt, Turkey; wool (250,000,000) from Australia, the Cape of Good Hope, La Plata, Turkey, the Levant, Germany, and finer sorts from Spain and Southern Russia; flax, hemp, and jute (from 30,000,000 to 90,000,000), the first from Belgium, Russia, England, Germany; the second from Italy and Russia; the third from India; hides, skins, and peltry (100,000,000) from La Plata, Brazil, Australia, Russia, and Germany.

Commodities.—France imports sugar (100,000,000) from her colonies, and to some extent from Mauritius, the Antilles, Brazil; coffee (80,000,000) from Brazil, India, the Greater Antilles, Peru, Venezuela; tobacco (20,000,000) from the U. S., the Greater Antilles, Algeria, and Turkey; cocoa (10,000,000) from Brazil, Antilles, Peru, Venezuela; vanilla (1,500,000); spices (4,000,000); gums (8,000,000) from Senegal, Egypt, Turkey; bark (5,000,000) from tropical America and the U. S.; dyewoods (12,000,000) from Central America, Brazil, Senegal; indigo (20,000,000) from India, Java, the Antilles, and Guatemala.

France imports copper (45,000,000) from England, Peru, Chili, the U. S., Spain, Russia; lead (15,000,000) from Spain, Italy, Algeria, England; zinc (18,000,000) from the Netherlands, Belgium, Prussia; tin (10,000,000) from the Netherlands, England, India, Peru; iron (10,000,000) from England, Prussia, Belgium, Sweden; sulphur (5,500,000) from Sicily; coal (100,000,000) from Belgium, Prussia, England; petroleum (15,000,000) from the Levant and the U. S.

Building timber (130,000,000): pine is received from the N. of Europe, Switzerland, Germany; oak from the U. S., Austria, and Belgium. Among other materials for manufacturing industry, oil-seeds (50,000,000), tallow (20,000,000) from the same countries as hides; olive oil (30,000,000)

from Italy; fat oils (10,000,000) from Germany; potash (8,000,000) from America, Italy, and the Netherlands.

Animals (75,000,000) come from Germany, Belgium, Switzerland, Italy; fertilizers (20,000,000) from Peru, Chili, La Plata, Russia, Germany, Belgium; seed corn (25,000,000) from England, Germany, and the U. S.; eggs of silkworms (10,000,000) from China and Japan; timber from Germany and the Scandinavian countries.

France imports salt fish (20,000,000), cheese (18,000,000), fruit (20,000,000), rice (10,000,000), salted and smoked meat (5,000,000), hops (4,500,000). The importation of cereals varies from 30,000,000 to 300,000,000, and takes place from Southern Russia, Egypt, Algeria, and the U. S. Horses (10,000,000) come from Germany, England, and Belgium.

The importation of manufactured articles forms only one-fourteenth of the whole, and comprises woven fabrics (wool, 40,000,000; flax and hemp, 14,000,000; cotton, 15,000,000; silk, 10,000,000; hair, 5,500,000) from England, Germany, Belgium, Switzerland, and Italy; yarn (wool, 1,000,000; cotton, 7,000,000; flax, 2,000,000) from England, Belgium, and Germany; mattings and plaitwork from the same countries and from Russia; straw hats (10,000,000) from Italy, Peru, and Brazil; feathers (5,000,000) from England, Germany, Italy, Algeria, Egypt, and La Plata; machines (12,000,000) and tools (5,500,000) from England, Belgium, and Germany; watches (3,000,000) from Switzerland, Germany, and England.

Exports.—These consist chiefly of manufactured articles, the value of which amounts to 1,600,000,000; that of the total exportations to 3 milliards. It comprises woven fabrics (silk, 420,000,000; wool, 335,000,000; cotton, 95,000,000; flax and hemp, 25,000,000) to Germany, the U. S., Spain, and Switzerland; yarn (cotton and wool, 20,000,000; linen, 21,000,000) to the same countries; articles of toilet (furnishing goods, 120,000,000; modes, 20,000,000; perfumery, 15,000,000) to America, England, Belgium, Spain, and the Levant; chemicals (60,000,000) to Belgium; madder and indigo (20,000,000) to Belgium, Spain, Switzerland, Italy, and England; drugs (10,000,000); soap (6,000,000), stearine and candles (5,000,000), sugar (100,000,000) to Turkey, the Levant, England, and Italy; toys, haberdashery, etc. (200,000,000) to England, Belgium, Germany, Italy, and Spain; skins (150,000,000) to England, Spain, and Turkey; tools (40,000,000), machines (8,000,000), and arms (8,000,000) to England, Italy, Spain, South America, and the colonies; jewelry (20,000,000) to America, Turkey, Egypt, and Spain; watches (8,000,000) to Italy, the Levant, America; paper (35,000,000) to England, Spain, America, and Turkey; pottery and glassware (32,000,000) to Italy, the Levant, Belgium, and England; musical instruments (8,000,000) to England, the U. S., Belgium, and Spain. Of other products are exported, wine (230,000,000) and brandy (50,000,000) to England, Russia, Belgium, Switzerland, Italy, Germany, Egypt, Brazil, the U. S., and La Plata; textile fibres (silk, 100,000,000; cotton, 60,000,000; wool, 30,000,000; hair, 25,000,000) to Switzerland, England, Germany, Spain, and Italy; cereals in very variable quantities; cheese and butter (65,000,000); eggs (35,000,000); dried vegetables (8,000,000); fruit (20,000,000) to England, Belgium, and Austria; oil (10,000,000) to the U. S., Switzerland, and the colonies; salt-water fish (20,000,000) to the U. S.; salted meat (8,000,000) to England; horses (20,000,000) and cattle (30,000,000) to England, Spain, Belgium, and Italy; seed corn (30,000,000) to England and Germany; hides (14,000,000) to England; oleaginous seeds (15,000,000) to England and Belgium; wood (34,000,000) to Belgium, Germany, and Spain; madder (12,000,000) to England, the U. S., and Switzerland; copper (8,000,000) to England, Italy, etc.

7. The balance of importations and exportations with respect to different countries with which France holds the most important commercial relations is shown by the following table:

	Imports in francs.	Exports.
England	700,000,000	1,000,000,000
Belgium	300,000,000	260,000,000
United States	50,000,000 (1869)	108,000,000
	194,000,000 (1871)	347,000,000
Switzerland	100,000,000	221,000,000
Italy	240,000,000	274,000,000
Germany	166,000,000	214,000,000
Spain	54,000,000	157,000,000
Turkey	136,000,000	64,000,000
Russia	100,000,000	26,000,000
Egypt	71,000,000	57,000,000
Brazil	52,000,000	75,000,000
La Plata	75,000,000	49,000,000

8. The transit trade carries 3,500,000 of quintals, valued at 800,000,000 francs. The temporary importation amounts, when entering France, to 100,000,000, and when leaving to 200,000,000.

9. *Custom-houses.*—The most important are—

	Tons.	Duty.
Marseille	1,500,000	1,500,000 fcs.
Hâvre	800,000	1,300,000
Boulogne	175,000	600,000
Dunkerque	475,000	230,000
Bordeaux	900,000	430,000
Nantes	435,000	110,000
Jeumont	1,500,000	115,000
Lille	140,000	130,000
Paris	130,000	500,000

The warehouses contain merchandise to the value of about 500,000,000 francs.

VI. The Press and Periodical Publications.—The total number of periodical publications (newspapers, magazines, etc.) is 2500, of which 775 are published in Paris and 1725 in the provinces. They represented the following specialties:

	Paris.	Provinces.		Paris.	Provinces.
Political	48	1001	Technical	60	9
Administration	15	30	Commercial	39	51
Religious	58	112	Financial	44	4
Military	16	112	Literary	77	55
Law	31	25	Art	52	5
Scientific	64	58	Modes	37	2
Medicine	40	32	Sports	10	1
Agriculture	32	120	Sundry	99	44
Industrial	32	17			

The most important political journals are published in Paris.

VII. The population of France is increasing, but not in so large a ratio as that of other countries in Europe. About 150 years ago it was estimated at 20,000,000, and at the time of the Revolution (1789) at 25,000,000. In 1831 it was 32,500,000, and in 1866, 38,000,000. On account of the loss of territory occasioned by the late war it is now only 36,100,000; an average of 69 inhabitants to each square kilomètre. At the time of Cæsar 10,000,000 Gauls lived poorly on a much larger territory, while the 36,000,000 Frenchmen of to-day live in comparative comfort. The total number of births annually is 1,000,000. A little more than one-half of the births are male, but the total number of women is a little greater than that of men (501 women to 499 men). The number of deaths annually is 850,000; of marriages 300,000, of which 250,000 are first marriages. The majority of the population (29,000,000) is settled in the country; about 19,000,000 live by agriculture. The town population (people who live in communes numbering more than 2000 souls) amounts to more than 10,000,000, of whom the larger part follow some trade or profession. There are in commercial business about 4,000,000. The manufacture of textile fabrics, clothing, toilet articles, and buildings employs each about 1,000,000 hands; next come the preparation of food, transportation, mining, and quarrying, 500,000. The ten departments in which the population is densest, and which owe their prosperity especially to manufactures or commerce, are Seine, Bouches-du-Rhône, Rhône, Loire, Nord, Loire-Inférieure, Gironde, Var, Vendée, and Corsica. We find 42 towns which have over 30,000 inhabitants; 20 number between 30,000 and 50,000 inhabitants—namely, Rochefort, Poitiers, Béziers, St. Denis, Bourges, Dunkirk, L'Orient, Cherbourg, Clermont-Ferrand, Troyes, Avignon, Boulogne, Caen, Grenoble, Tourcoing, Dijon, Tours, Le Mans, Orléans, Besançon; 13 between 50,000 and 70,000 inhabitants—namely, Nice, Rennes, Nancy, Limoges, Angers, Montpellier, Nîmes, Brest, Versailles, Toulon, Rheims, Roubaix, and Hâvre; 8 with more than 100,000 inhabitants—namely, Rouen (102,000), Paris (1,851,292), St.-Étienne (111,000), Nantes (119,000), Toulouse (125,000), Lille (158,000), Bordeaux (194,000), Marseille (313,000), and Lyon (323,000).

The length of life has increased in France in a very remarkable degree, probably on account of the development of the industry and agriculture of the country. The average lifetime, which was 28 years in 1789, is now 37 years. The race is strongest and most robust in the N. and N. E.

With respect to religions, France contains only a small number of Jews (50,000), mostly living in Lorraine and the department of the Seine. The 600,000 French Protestants, mostly Calvinists, live in Franche-Comté and in the S. (Languedoc, Dauphiné, Savoy, and Guyenne). The rest of the population is Roman Catholic.

In ethnological respects the French nation is a very mixed race. The first occupants of the soil did not form a homogeneous mass. They consisted of three nations: Kymris Celts, tall and blonde, in the N. E.; true Celts, small and short, in the centre and W.; Basques, in the S.; and besides these three races there was perhaps a fourth aboriginal race, from which the inhabitants of Central France may have inherited certain traits, and of which memorials are found in the caves and in the megalithic monuments. This original stock, composed of four partially unknown elements, received manifold influences from the successive conquering races. The Romans ascended along the Rhône and de-

scended along the Garonne; the Visigoths settled in the basin of the Garonne; the Normans at the mouths of the rivers and in Normandy; the Arabs in Roussillon, Lower Languedoc, and Provence. Later on came the English into the S. W., and the Spaniards into Flandre and Franche-Comté. And to these influences must be added that of more recent immigrations. At the census of 1866 there lived on French soil 635,000 foreigners, attracted by the beauty of the climate and the facility of living—namely, 276,000 Belgians, 107,000 Germans, 100,000 Italians, 42,000 Swiss, 33,000 Spaniards, 30,000 Englishmen, and 10,000 Poles. Thus, the French nation is not, properly speaking, a *race*, though the Gallic element is predominant. From this diversity of origin of the population it is a natural result that in certain regions of the country the national language is placed in a sort of competition with other idioms. Thus, in the department of Nord there are from 150,000 to 200,000 persons who generally use the Flemish language. Before the dispossession of Elsass and Lothringen 1,300,000 or 1,400,000 French citizens used a German jargon. In the W. 1,300,000 persons speak Breton, a Celtic idiom nearly allied to the Welsh. In the S. W. 120,000 Basques speak a language whose origin, like that of their race, is entirely unknown, unless it be aboriginal. The 260,000 inhabitants of Corsica are Italians with respect to the language which is spoken in their towns, and which is to be distinguished from the numerous dialects spoken among their mountains. The French themselves, numbering 35,000,000, make use of two great dialects—*langue d'oïl*, which is the proper French language, and *langue d'oc*, which is rather a Romance language. But this distinction is now of very little consequence, as the *langue d'oc* exists only in the form of a jargon, very variable according to the locality in which it is spoken, and steadily retreating before its conquering rival, the *langue d'oïl*.

VIII. Constitution and Administration.—1. *Administrative Divisions.*—The principal divisions of France were, before the great Revolution of 1789, for administrative purposes intendancies, and for military purposes provinces. The first were in reality the most important, but the second were the best known; they were founded in the nature of things, and they correspond at this day to old customs. There were 32 great and 8 small governments, forming what to-day is called the "old provinces" of France. For this organization the Constituent Assembly of 1790 substituted the division into departments, districts, cantons, and municipalities or communes, and, somewhat modified, this division has been finally adopted, and is that still existing, only that arrondissements, less numerous and more extensive, have been substituted for the districts. The division of the departments does not coincide exactly with that of provinces; it was the idea of the Constituent Assembly to break the provincial traditions. The names of the departments have generally been borrowed from the physical geography. Now (in 1875) France comprises 36 old provinces, forming 86 departments, 362 arrondissements, 2700 cantons, and 36,000 communes; the number of the two last divisions is subject, however, to some variation. The following table gives the relation between the provinces and the departments, and the capitals of the latter.

1. North-West.

Provinces.	Departments.	Capitals.
Flandre	Nord	Lille.
Artois	Pas-de-Calais	Arras.
Picardie	Somme	Amiens.
Normandie	Seine-Inférieure	Rouen.
	Eure	Evreux.
	Calvados	Caen.
	Orne	Alençon.
	Manche	St.-Lô.
Bretagne	Ille-et-Vilaine	Rennes.
	Côtes-du-Nord	St.-Brieuc.
	Finistère	Quimper.
	Morbihan	Vannes.
	Loire-Inférieure	Nantes.
Anjou	Maine-et-Loire	Angers.
Maine	Mayenne	Laval.
	Sarthe	Le Mans.
Ile de France	Seine-et-Oise	Versailles.
	Seine	Paris.
	Seine-et-Marne	Melun.
	Oise	Beauvais.
	Aisne	Laon.

2. North-East.

Provinces.	Departments.	Capitals.
Champagne	Ardennes	Mézières.
	Marne	Châlons.
	Aube	Troyes.
	Haute-Marne	Chaumont.
Lorraine	Meuse	Bar-le-Duc.
	Meurthe-et-Moselle	Nancy.
	Vosges	Epinal.
Alsace	Belfort	Belfort.
Franche-Comté	Haute-Saône	Vesoul.
	Doubs	Besançon.
	Jura	Lons-le-Saulnier.
Bourgogne	Ain	Bourg.
	Saône-et-Loire	Mâcon.
	Côte-d'Or	Dijon.
	Yonne	Auxerre.

3. South-East.

Provinces.	Departments.	Capitals.
Lyonnais	Loire	St.-Étienne.
	Rhône	Lyon.
Dauphiné	Isère	Grenoble.
	Drôme	Valence.
	Hautes-Alpes	Gap.
Savoie	Savoie	Chambéry.
	Haute-Savoie	Annecy.
Comtat Venaissin	Vaucluse	Avignon.
Provence	Bouches-du-Rhône	Marseille.
	Var	Draguignan.
	Basses-Alpes	Digne.
Comté de Nice	Alpes Maritimes	Nice.
Corsica	Corse	Ajaccio.
Languedoc	Haute-Loire	Le Puy.
	Ardèche	Privas.
	Lozère	Mende.
	Hérault	Montpellier.
	Aude	Carcassonne.
	Tarn	Alby.
	Haute-Garonne	Toulouse.
	Gard	Nîmes.
Roussillon	Pyrénées-Orientales	Perpignan.
Comté de Foix	Ariège	Foix.

4. South-West.

Provinces.	Departments.	Capitals.
Guyenne and	Hautes-Pyrénées	Tarbes.
Gascogne	Gers	Auch.
	Tarn-et-Garonne	Montauban.
	Aveyron	Rodez.
	Lot	Cahors.
	Dordogne	Perigueux.
	Lot-et-Garonne	Agen.
	Gironde	Bordeaux.
	Landes	Mont-de-Marsan.
Béarn	Basses-Pyrénées	Pau.
Angoumois	Charente	Angoulême.
Aunis and Saintonge	Charente-Inférieure	La Rochelle.
Poitou	Vendée	La Roche-sur-Yon.
	Deux Sèvres	Niort.
	Vienne	Poitiers.

5. Centre.

Provinces.	Departments.	Capitals.
Touraine	Indre-et-Loire	Tours.
Orléanais	Loir-et-Cher	Blois.
	Eure-et-Loir	Chartres.
	Loiret	Orléans.
Berry	Cher	Bourges.
	Indre	Châteauroux.
Marche	Creuse	Guéret.
Limousin	Haute-Vienne	Limoges.
	Corrèze	Tulle.
Auvergne	Cantal	Aurillac.
	Puy-de-Dôme	Clermont-Ferrand.
Bourbonnais	Allier	Moulins.
Nivernais	Nièvre	Nevers.

2. *Communal and Departmental Administrations.*—The commune represents the elementary unit of the territorial division and of the administrative organization. It is a part of the territory comprising either a town or one or more villages, with their annexes and fields. It is governed by a *maire*, deputies, and a municipal council. The maire was formerly elected by the municipal council, but he is now, according to a recent law, appointed by the government, and chosen as far as possible from the municipal council. He is assisted by one or more deputies, who are appointed in the same manner, and who take his place in case of absence. The municipal council, of which the maire is the president, and which is composed of from 10 to 36 members elected by the inhabitants of the commune, exercise within the very narrow limits of the law a deliberative power in all communal affairs, issuing either decisions or deliberations or simple advice. It holds annually four sessions, generally of ten days each. Paris and Lyon have special administrations; their municipal councils elect their presidents and vice-presidents. The prefect of the department has a right to enter the council, and has under him the maires of the different arrondissements of these cities; the maires are appointed by the government.

The canton generally consists of 10 communes. It is not, properly speaking, an administrative division, but it serves as a basis for the election to the general council and to the council of the arrondissement. It is specially a judiciary circumscription. Recruiting for the army takes place at the principal town of the canton.

The arrondissement consists, generally, of 8 cantons. It is governed by an under-prefect, who ranks next to the prefect of the department. The arrondissement, however, in which the capital of the department is situated is governed by the prefect himself. The under-prefect is appointed by the chief of the state (the President of the republic). He is assisted by a council of the arrondissement, which consists of as many members as there are cantons, but which plays a somewhat weak part. It assembles on the call of the prefect; it deliberates on the

public works, and it assesses the direct contributions upon the communes.

The department consists, generally, of 4 arrondissements, and is the only division of any great consequence in an administrative point of view. The prefect, who governs it, is appointed by the President of the republic on the nomination of the minister of the interior, and he can be recalled. He represents the government; brings the laws and the ministerial orders into execution; superintends and maintains public order, and exercises a sort of police inspection over the towns. He introduces all affairs concerning the department, and executes the decisions of the general council and of the departmental committee, within the limits of the law. The deliberative power pertains to the general council, composed of as many members as there are cantons, though not more than 30, who are elected for nine years and renewed by thirds. It deliberates and votes on all departmental affairs; in the interval between its sessions it assigns its power to a departmental committee, which superintends the administration of the commune. Besides these two powers there is a third administrative power, exercised by the council of the prefecture, which decides on all demands for reductions in contributions, etc. Relief to the poor and the sick must be provided for by the commune; the communal hospitals are governed by a committee of five members, appointed by the prefect and presided over by the maire. The arrondissements have, generally, hygienic committees, physicians for infants, committees for inspecting the drug-shops, etc. Every department must have a lunatic asylum.

3. *Army.*—Nothing definite can as yet be said of this subject, as at this moment (June, 1874) the French army is in a state of reorganization. This, however, is an outline of its actual but provisional state, in accordance with laws recently enacted by the National Assembly: It consists of (1) volunteers or re-enlisted men, who form about one-tenth of the annual contingent, and (2) young men twenty years of age and fit for military service, whom the laws of recruiting summon annually to form what is called "the contingent." These young men serve five years in the active army, then five years in the territorial army, and at last six years in the reserve of the territorial army. The enforcement of the new laws will give, in time of peace, an army of 450,000 men, and in time of war an active army, with its reserves, of 775,000 men, a force in garrison of 610,000 men, a territorial army of 580,000 men, and reserves for the territorial army of 620,000 men; total, 2,685,000. In the same manner as in Germany and Austria young men who fill certain conditions (unmarried, scholars, etc.) can be exempted from serving more than one year of the five they owe to the state by submitting to certain examinations and by paying 1500 francs.

France is divided into 19 military regions, occupied each by an army corps. The head-quarters of these divisions are Paris, Amiens, Rouen, Le Mans, Orléans, Châlons, Besançon, Bourges, Tours, Rennes, Nantes, Limoges, Clermont-Ferrand, Lyon, Marseille, Montpellier, Toulouse, Bordeaux, and Algiers. Each of these divisions consists of 8 subdivisions. There are, besides, two military governments—those of Paris and Lyon. Each army corps consists of 2 divisions of infantry, which have each 1 battalion of chasseurs and 4 regiments, forming 2 brigades, 1 brigade of cavalry of 2 regiments, 1 brigade of artillery, 2 regiments of engineers and military equipment. Finally, there are, besides these 19 army corps, 34 regiments of cavalry, destined to eventually form divisions of cavalry.

4. *The Navy.*—The French fleet consists of 467 vessels, of which 339 have steam-power. Of this number, 38 are ships of the line (2 iron-clad), and 43 frigates (14 iron-clad). The *personnel* consists of (1), 2550 officers; (2), a body of mechanics; (3), 16,000 marines, *gendarmerie*, artillery, infantry; (4), a corps of naval engineers; (5), the naval commissariat, analogous to the intendancy and administration of the army; (6), the crews (29,000 men), recruited either by voluntary enlistments or from a portion of the army contingent, or by drafting those men from the seaboard whose names are entered on the naval registers. The maritime territory of France is divided into 5 maritime arrondissements, commanded by a maritime prefect, who has the rank of vice-admiral. The capitals of these five arrondissements are the five military ports Cherbourg, Brest, L'Orient, Rochefort, and Toulon.

5. *Finances.*—The budget of the commune is prepared by the maire, voted by the municipal council, and approved by the departmental committee of the general council. The departmental budget is prepared by the prefect, and discussed and voted by the general council. The budget of the state is prepared by the ministers, presented by the President of the republic, and discussed, article by article, by the National Assembly one year in advance. After the close of the inspection which the budget has thus undergone the accounts are examined and verified by the court of accounts. The departmental expenses exceed 350,000,000. The expenses of the state are as follows, the figures being approximative:

1. Public debt and dotations	1,209,000,000
2. General service of the ministries:	
Justice	34,000,000
Foreign affairs	11,000,000
Interior	88,000,000
General government of Algeria	25,000,000
Finances	18,000,000
War	480,000,000
Navy and colonies	154,000,000
Public education, fine arts, worship	96,000,000
Agriculture and commerce	17,000,000
Public works	133,000,000
3. Cost of collection	259,000,000
Total	2,525,000,000

The receipts of the general budget come from the following sources:

1. Ordinary budget:	
Direct taxes	433,000,000
Domains and forests	53,000,000
Indirect taxes and revenues	1,943,000,000
Universities	4,000,000
Algeria	20,000,000
Revenues from civil pensions	15,000,000
Sundry	52,000,000
2. Budget extraordinary:	
Surplus from last year, foreign indemnities, sale of rentes, etc.	5,000,000
Total	2,525,000,000

The following are some details of the different receipts: The direct taxes arose to 682,000,000, consisting of land-tax, 356,000,000; personal tax, 105,000,000; tax on doors and windows, 64,000,000; tax on patents, 157,000,000. Of indirect taxes the most important are—the custom-houses, 307,000,000; tax on beverages, 340,000,000; salt-tax, 9,000,000; duty on sugar, 94,000,000; the monopoly of the state on tobacco, 225,000,000; on matches, 16,000,000; duties levied on travellers on the railways, 68,000,000; duty on paper, 10,000,000. The indirect taxes are collected in different ways—the direct by collectors. Each arrondissement has a receiver, who sends the funds received from the agents to the general treasury of the department or disposes of them according to its orders. In Paris is a central cashier, who knows the general state of the treasury from day to day, and directs with precision the vast money movements of the ministry of finance. At the head of the financial system stands the court of accounts. Finally, may be mentioned the sinking fund for the payment of the public debt. The debt of France is, in consequence of the war with Germany, about 18 milliards.

6. *Justice.*—Justice is administered in France in the name of the chief of the state. There are three different jurisdictions: (1) The civil jurisdiction, which takes cognizance of all personal or real relations of the citizens. The civil law, the law of civil process, and the commercial law are its rules. It is exercised by justices of the peace, of whom there is one in each canton who conciliates, if possible, or decides cases of minor importance, including annually about 2,500,000 cases, of which at least three-fourths are conciliated, and 220,000 are closed by definitive judgments. Above them are the civil tribunals, or "tribunals of first instance," which pronounce annually on about 140,000 cases. There are in France 80 *conseils de prud-hommes*, of whose members one-half are elected by the employers and one-half by the employés, and who in the manufacturing towns act as justices of peace in cases between employer and employed; they treat annually 40,000 cases, of which more than two-thirds are conciliated. In the manufacturing and commercial cities there are 216 tribunals of commerce, whose members are elected, and which pronounce in first instance on about 230,000 cases annually, of which one-fourth are conciliated and two-thirds closed by definitive judgment. Above the civil tribunals and the tribunals of commerce there are 26 courts of appeal, which judge about 12,000 cases annually. (2) The criminal jurisdiction. The simple misdemeanors come before the tribunals of police. The maires and justices of peace exercise this jurisdiction in 40,000 cases annually. Offences are brought before the tribunals of correction, which form a particular branch of the civil tribunals, and which can administer from six days' to five years' imprisonment. Grave crimes, which lead to infamy and severe punishment, are brought before the courts of assize, of which there is one in each department. They are composed of three magistrate-judges and a jury. The jury is composed of twelve citizens chosen by lot from a list which the administration prepares in accordance with the law. The jury decides the point of fact, the judges apply the law. From the verdict of the court of assize there is no appeal. Besides the magistrature which judges there is a magistrature which administers—that is to say, performs the office of public

prosecution. To each court of appeal a general procurator is attached, assisted by several advocates or deputies. To each civil tribunal, and under the authority of the general procurator, is attached a procurator of the republic, assisted by one or several substitutes. At the tribunals of the police the office of public prosecutor is performed by the maire or the commissioner of police. The public prosecutor interferes only exceptionally in civil cases. In criminal cases, on the contrary, he acts a principal part. He orders the examination of the offence or crime, has the accused person arrested, superintends the trial, accuses before the judges, and proceeds with the execution of the verdict given. When an offence comes to his knowledge he brings the case before the examining judge, who decides whether it is of such a nature as to be brought before a court of assize. Above all the other tribunals is the court of cassation, which secures the exact application of the law, and any verdict given by any tribunal may be brought before it. By its decrees it confirms or reverses the verdict given, and in case of cassation the suit is recommenced before another tribunal instituted by the court of cassation. The convicts receive their punishment, according to the gravity of their offence, in the police prisons, in the departmental prisons, which also serve as jails (387 jails, with room for 25,000 inmates), in the penitentiary colonies for young convicts, in the central prisons for those sentenced to compulsory labor, in the houses of detention for local crimes, and in the penal colonies of Guiana and New Caledonia. With the administration of justice are furthermore connected the notaries, who receive acts and contracts and give them the character of authority; the attorneys, who represent the parties before the tribunal; and the sheriffs, who carry the summons, serve the judgment, and regulate its execution.

7. *Public Education.*—There is in France a system of public education which is administered by the commune, the department, and the state, and a free education given by private institutions. There is a primary and a secondary instruction, which latter is divided into the classical, the industrial, and the higher instruction. Primary instruction is given in the communal schools, which are under the direction of lay teachers appointed by the prefects. Each commune of 500 souls is obliged to have a school for boys and one for girls. There are more than 4,000,000 pupils distributed in 53,000 public schools and 16,000 free schools; and besides these there are about 30,000 educational institutions of a higher grade, *cours d'adultes*, and a number of infant schools, which prepare children under seven years of age for the primary schools. The teachers are educated in 81 primary normal schools, about one for each department. The secondary, classical, or industrial instruction is given by the state in the lyceums, by the communes in the communal colleges, and by the clergy or by laymen in seminaries. There are 75 lyceums, which are generally situated in the capitals of the departments, and contain more than 20,000 pupils; 250 colleges, with 25,000 pupils; and 1000 free establishments, numbering nearly 65,000 pupils. The classical schools give diplomas as *bachelier-ès-lettres* and *bachelier-ès-sciences.* In order to educate professors, the state has established for the classical branch the high normal school, and for the industrial branch the special normal school of Cluny. The higher instruction is given by the universities (*facultés*), of which there are 15 for literature and science, 10 for law, 7 for theology, and 3 for medicine. The universities confer grades of *bachelier, licencié*, and *docteur.* The Collège de France and the Museum of Natural History, both in Paris, represent the independent studies; the Conservatoire des Arts and Métiers (for arts and trades), in Paris, is a sort of industrial university.

Besides the military schools above mentioned, may be named—(1) in Paris, l'École Polytechnique, for officers and state engineers; the Central School of arts and manufactures, for civil engineers; the School of fine arts, for painters, sculptors, and architects; the Conservatoire, for musicians and actors; the School for living Oriental languages. (2) Outside of Paris there are three schools of the arts and trades, several schools of fine arts (Dijon, Toulouse, etc.), 3 schools of agriculture, 1 of horticulture, 3 for veterinary surgeons, 1 for miners at St.-Etienne, and 1 for mining engineering; to which may be added several communal and private institutions, such as schools for drawing, Central School in Lyon, the school for watchmaking in Besançon, the excellent industrial school in Mulhouse (before the war), etc. (3) In foreign countries the French school in Rome for a limited number of artists, painters, sculptors, architects, and musicians, chosen by competition; and the schools of Rome and Athens for the study of ancient literature, to which the pupils are chosen from among the pupils of the high normal school. The administration of each of the sixteen academies, or territorial circumscriptions of public instruction, is confided to a rector assisted by an academical council. The rector has under his orders an inspector of the academy and several inspectors of the primary instruction. Algeria has a separate academy. The instruction is facilitated by libraries, which exist in most of the towns, and which are being founded in the communes, in the primary schools, in the regimental schools, and at the museums. There are learned societies in almost all the departments, and some of them enjoy a very high reputation. Paris contains a great number of these (Association Française pour l'Avancement des Sciences, Société de Géographie, de Géologie, d'Anthropologie, Association Polytechnique, Société d'Agriculture, etc.), besides several great public institutions, such as the Observatoire, the Bureau des Longitudes, the Medical Academy, and L'Institut de France, composed of five academies (Académie Française, des Inscriptions et Belles-Lettres, des Sciences, des Beaux-Arts, des Sciences Morales et Politiques), each of which contains 40 members (Académie des Sciences 66) chosen by the members themselves.

8. *Worship.*—There are in France three forms of *worship* recognized by the state and maintained at its expense—the Roman Catholic, the Protestant, and the Jewish.

(1) *The Roman Catholic Church.*—The parish is the elementary unit, and there is one or more parishes in each commune. Of the parishes, some are *curacies*, others *succursals.* The former number 45,000; the priest is irremovable, appointed by the bishop and approved by the state. The priests of the latter are simply appointed by the bishop, and may be removed by him. Above the priest is placed the bishop. According to the concordat of 1801, there are 84 dioceses and 67 bishoprics in France, nearly one in each department; the see of the bishop is generally in the capital of the department. The bishops are appointed by the chief of the state, and canonically instituted by the pope. Above the bishops stand the archbishops, who administer their own dioceses and exercise authority over ecclesiastical provinces or archbishoprics consisting of several dioceses or bishoprics. There are 17 archbishoprics, corresponding nearly to the old provinces from the Roman period—namely, Paris, Rouen, Tours, Cambray, Rennes, Rheims, Besançon, Lyons, Chambéry, Avignon, Aix, Toulouse, Bordeaux, Auch, Alby, Bourges, and Sens. Above the archbishops are five cardinals.

(2) *The Protestant Church.*—This comprises two denominations recognized by the state—the Calvinistic and the Lutheran. In both of them the parish has its minister and presbyterial council, which administer under the authority of the consistory. In the Calvinistic Church the ministers are chosen by the consistory, and the superior authority is exercised by the synod, consisting of five consistorial churches, and by the central council of the Reformed Church. At Montauban is a theological university. In the Lutheran Church the ministers are chosen by a directory, which acts under the authority of the consistory.

(3) *The Jewish Church.*—A communal rabbi presides at each synagogue, assisted by officials who are under the authority of a departmental consistory, which again ranks under the central consistory of Paris, presided over by the grand rabbi.

Algeria forms one archbishopric (Algiers) and two bishoprics (Oran and Constantine). It has two Protestant consistorial churches and three Jewish consistories.

9. *Central Government.*—Since the revolution of Sept. 4, 1870, France is ruled by a republican government. As yet, however, the National Assembly has not decided on the definitive form of government and constitution. The executive, administrative, and judiciary powers are vested in the President of the French republic. The legislative power is exercised by the National Assembly. The present President is Marshal de MacMahon. The duration of his power has been fixed at seven years from May, 1873. He exercises the executive power under the control of the National Assembly, which elected him. He chooses and dismisses the ministers and presides in the council of ministers. He can enter the Assembly and demand to be heard, but as yet he has communicated with it only by messages. He is assisted by a council of state, whose members are elected by the National Assembly. The ministers are nine: 1, the minister of justice, under whom is placed the national printing establishment; 2, the minister of foreign affairs; 3, the minister of the interior, under whom are the prefects and maires, consequently the whole general, departmental, and communal administrations of France; 4, the minister of finance; 5, the minister of war; 6, the minister of the navy and colonies; 7, the minister of public education, fine arts, and worship; 8, the minister of agriculture and commerce, who by a singular anomaly has not the administration of the forests and the tobacco manufactories, which belong to the minister of finance; 9, the minister of public works. The National


MAP OF
FRANCE
West Longitude East from Greenwich
Longitude East from Washington
Scale of Eng. Miles
ENGLISH CHANNEL
BAY OF BISCAY
MEDITERRANEAN SEA
NORTH SEA
GULF OF LYONS
GULF OF GENOA
STRAIT of DOVER
BRISTOL CHANNEL
ENGLAND
BELGIUM
RHENISH PRUSSIA
HOLLAND
BADEN
SWITZERLAND
ITALY
PIEDMONT
LOMBARDY
TYROL
SPAIN
CORSICA
LONDON
Greenwich
Canterbury
Dover
Southampton
Brighton
Portsmouth
Isle of Wight
Plymouth
Dartmouth
Falmouth
Lands End
Scilly Is.
Lizard Hd.
CHANNEL ISLANDS
Guernsey
Jersey
BAY OF MT. ST. MICHEL
Ostend
BRUGES
GHENT
ANTWERP
BRUSSELS
MAESTRICHT
AIX LA CHAPELLE
LIEGE
NAMUR
MONS
COLOGNE
DUSSELDORF
COBLENTZ
TREVES
MENTZ
MANNHEIM
STRASBOURG
Basel
Zurich
CONSTANCE
Schaffhausen
Lake of Constance
Lucerne
Bern
Lausanne
L. of Geneva
GENEVA
PENNINE ALPS
GRAIAN ALPS
MILAN
TURIN
ALESSANDRIA
GENOA
Monaco
Dunkirk
Calais
Boulogne
FLANDERS
NORD
LILLE
ARTOIS
PAS DE CALAIS
ARRAS
SOMME
PICARDY
AMIENS
Dieppe
Cherbourg
Le Havre
SEINE-INFERIEURE
ROUEN
BEAUVAIS
OISE
AISNE
LAON
MEZIERES
Sedan
ARDENNES
Reims
ILE DE FRANCE
PARIS
VERSAILLES
SEINE ET OISE
SEINE ET MARNE
MELUN
MARNE
CHALONS SUR MARNE
BAR-LE-DUC
MEUSE
LORRAINE
METZ
MEURTHE
MOSELLE
ALSACE
VOSGES
EPINAL
HAUTE-MARNE
CHAUMONT
AUBE
TROYES
CHAMPAGNE
Sens
NORMANDY
MANCHE
Bayeux
CAEN
Honfleur
Lisieux
St LO
CALVADOS
EURE
EVREUX
ORNE
ALENCON
EURE ET LOIR
CHARTRES
Brest
FINISTERE
St BRIEUC
COTES DU NORD
BRETAGNE
QUIMPER
ILLE ET VILAINE
RENNES
MORBIHAN
Lorient
VANNES
Belle Isle
MAINE
MAYENNE
LAVAL
LE MANS
SARTHE
ORLEANNOIS
LOIRET
ORLEANS
Montargis
YONNE
AUXERRE
LOIRE-INFERIEURE
NANTES
ANGERS
MAINE ET LOIRE
ANJOU
TOURS
TOURAINE
INDRE ET LOIRE
BLOIS
LOIR ET CHER
CHER
BOURGES
BERRY
CHATEAUROUX
INDRE
NIVERNOIS
NIEVRE
NEVERS
BURGUNDY
COTE D'OR
DIJON
HAUTE SAONE
VESOUL
BELFORT
BESANCON
DOUBS
JURA
LONS LE SAULNIER
FRANCHE COMTE
SAONE ET LOIRE
MACON
BOURG EN BRESSE
AIN
HAUTE-SAVOIE
SAVOIE
CHAMBERY
VENDEE
LA ROCHE SUR YON
POITOU
DEUX SEVRES
NIORT
Fontenay
POITIERS
VIENNE
MOULINS
BOURBONNOIS
ALLIER
MARCHE
GUERET
CREUSE
Ile de Re
LA ROCHELLE
Rochefort
Oleron I.
CHARENTE INFERIEURE
SAINTONGE
ANGOUMOIS
ANGOULEME
CHARENTE
LIMOGES
HAUTE VIENNE
LIMOUSIN
PUY DE DOME
CLERMONT FERRAND
LYONNOIS
LYONS
RHONE
LOIRE
St ETIENNE
ISERE
GRENOBLE
CORREZE
TULLE
PERIGUEUX
DORDOGNE
CANTAL
AURILLAC
AUVERGNE
HAUTE LOIRE
LE PUY
ARDECHE
PRIVAS
VALENCE
DAUPHINE
DROME
HAUTES ALPES
GAP
GIRONDE
BORDEAUX
GUIENNE
LOT
CAHORS
LOT ET GARONNE
AGEN
RODEZ
AVEYRON
MENDE
LOZERE
TARN ET GARONNE
MONTAUBAN
ALBY
TARN
GARD
NISMES
COMTAT VENAISSIN
VAUCLUSE
AVIGNON
BASSES ALPES
DIGNE
COMTE DE NICE
ALPES MARITIMES
NICE
PROVENCE
BOUCHES DU RHONE
Aix
MARSEILLES
VAR
DRAGUIGNAN
Toulon
Isles of Hyeres
LANDES
MONT-DE-MARSAN
GASCONY
GERS
AUCH
Bayonne
BEARN
PAU
BASSES PYRENEES
TARBES
HAUTES PYRENEES
TOULOUSE
HAUTE GARONNE
HERAULT
MONTPELLIER
Cette
Beziers
CARCASSONNE
AUDE
LANGUEDOC
COMTE DE FOIX
FOIX
ARIEGE
ROUSSILLON
PERPIGNAN
PYRENEES ORIENTALES
C. Creus
Mouths of the Rhone

Assembly represents the nation, by which it is elected and in whose name it exercises the sovereign power. The executive power it has conferred upon the President of the republic; the legislative power it has kept for itself. The laws are promulgated in the name of the president of the National Assembly. It was elected by universal suffrage, in accordance with the law of June, 1849.

CAPTAIN PRUDENT, *French Top. Engineer.*

France, The History of, begins in the fifth century with the conquest of the Roman province of Gallia Transalpina by the Franks, a Gotho-Germanic tribe, who settled in the country and gave it its name. Ancient Gaul (Gallia Transalpina) was originally inhabited by three different nations—the Belgians, in the N. and E.; the Celts, in the W. and centre; and the Aquitanians, in the S. Along the Mediterranean coast several Greek colonies were situated, among which was Massilia. These nations, subdivided into many different tribes, the Batavi, Helvetii, Suessiones, Ædui, etc., were subdued by Cæsar between 58 and 52 B. C., and the whole country reduced to a province of the Roman empire. Roman institutions, language, civilization, and religion soon took root among the people, and the country flourished; but in the fifth century A. D. the Roman empire had become too weak to defend this its best province against the invading barbarians. The Visigoths conquered the southern part, and connected it with Northern Spain; the Burgundians established an independent kingdom in the E.; and in 486, Khlodwig or Clovis, chief of the Salian Franks, a grandson of Merovæus and founder of the *Merovingian* dynasty, defeated the Roman governor, Syagrius, at Soissons, and took possession of the whole northern part of the country to the Loire. In 507 he also defeated the Visigoths at Vouillie, and added their possessions N. of the Pyrenees to his dominions, thus forming a kingdom which comprised nearly the same area as modern France, with the exception of the eastern districts between the Rhine, the Saône, and the Rhone, which were occupied by the Burgundians. Persuaded by his wife Clotilda, he embraced Christianity, and by this step he succeeded in reconciling the clergy, and, through them, the Gallo-Romanic population to his rule; so that at his death in 511 a Frankish empire was actually consolidated in Gaul. The further development of this new kingdom was seriously impeded, however, by civil wars between the eastern Franks (Austrasia) and the western (Neustria), brought on by the dangerous custom, common to all Gotho-Germanic nations, of dividing the kingdom at the death of the king between his sons. But fortunately, during the last kings of the Merovingian dynasty, who were men of weak characters and with no talents as rulers, a new family rose into power, capable of keeping the empire united in spite of the tendencies to separation which it contained, and capable of defending it against the most formidable enemies from without. Pepin of Héristal, *major domus* to Clovis II., established the authority of Austrasia firmly in the dominions of Neustria, and his son, Charles Martel, succeeding him in his position as *major domus*, a sort of viceroyship, routed the Saracens at Tours in 714. Charles Martel's son, Pepin the Short, confined, with the consent of the clergy and the pope, the last king of the Merovingian dynasty, Childeric III., in a monastery, and ascended the throne himself in 752, thus founding the *Carlovingian* dynasty. The Merovingian kings had established a Gotho-Germanic empire on Roman soil; during the reign of the Carlovingian dynasty this Gotho-Germanic empire became French. After the formation of a new kingdom followed the formation of a new nation. Pepin the Short ruled with great vigor, and made one very valuable addition to his dominions—namely the coast-regions along the Mediterranean, which hitherto the Arabs had held. His son, Charlemagne, from 768 to 814 conquered Lombardy and the northern part of Spain; subdued the Saxons along the Elbe and converted them to Christianity; threw back the Avars in Hungary; and ruled from the Eider and the Baltic to the Ebro and the Mediterranean, and from the Atlantic to the Theiss. By establishing this vast empire he laid the foundation of modern Europe. Although at this time the different tribes of the Gotho-Germanic race had formed several empires, and in several places commenced the development of individual forms of civilization, still the settlement was not yet final. They were still on the move, wandering to and fro, partly impelled by their own unstable instincts, partly disturbed by new swarms which from Asia continued to pour into Europe. This migratory state of society Charlemagne brought to an end. He stopped the invasions from Asia, and he compelled the tribes to stay where they were. By transforming the chiefs of the tribes into feudal lords, vassals with power, but also with responsibility, and by introducing Christianity and the institutions of the Roman Catholic Church throughout his realm, he secured the first rudiments of order. Civilization began

on a grand scale, and one of its very first results was the formation of the different nationalities. At the beginning of Charlemagne's reign people from the Danube, the Rhine, the Seine, and the Loire spoke the same language; thirty years after his death an interpreter was necessary. The name of "France" occurs for the first time in history in the middle of the ninth century. After the death of Louis le Débonnaire, a son of Charlemagne, the empire was divided between his three sons by the treaty of Verdun in 843. Louis the German received that part which lay E. of the Rhine, and which was called Deutschland (Germany); Charles the Bald received that part which lay W. of the Scheldt, Meuse, Saône, and Rhône, and which was called France; the long strip of land stretching between these two boundary-lines from the North Sea to the Mediterranean was given to Lothair, together with Italy and the title of emperor. As soon as the treaty was concluded wars broke out between the contracting parties, and these wars did not cease until a new dynasty, which had grown up on French soil, and which entertained no general Gotho-Germanic (but simply French) ambition, ascended the throne of France. It was, however, not so much their imperial ambition as their utter inability which cost the Carlovingian kings their crowns. There were forty hereditary (*i. e.* independent) vassals in the territory of France. One of them was the duke of Normandy, formerly the chief of the Norse pirates, to whom Charles the Simple had given in 912 the beautiful province W. of the Lower Seine, in order to stop his invasions. Another was the count of Paris, one of whose family, Count Odo, was chosen king in 887, and vindicated himself against Charles the Simple till his death, in 898. A third was the duke of Lorraine, who offered his allegiance to the king of France or to the emperor of Germany, just as he liked. To a man who had no other purpose than to govern these forty vassals the task might prove difficult enough, and it became fatal to any one who besides had Gotho-Germanic ambitions. When, at the death of Louis V. in 987, the vassals passed by the proper heir, Charles of Lorraine, because he had given his allegiance to the German emperor, and chose for king Hugh Capet, count of Paris, duke of France, and founder of the *Capetian* dynasty, there was a French nation, but there was hardly a French kingdom in existence.

The consolidation of the royal power and the establishment of the absolute monarchy are the leading ideas in the history of France under the two following dynasties—the House of *Capet*, from 987 to 1328, and its collateral branch, the House of *Valois*, from 1328 to 1589. Not that they are the sole motives in all the various events which crowd its pages during this period, but they are the common result of them all. The Crusades acted chiefly as a vent for the romantic ambition of the feudal lords, and as a means of rallying them around the person of the king. The Church was usually an ally of the Crown, and for the time from 1309 to 1377, while the pope resided at Avignon and two œcumenical councils were held here in 1326 and 1377, even a very submissive ally. The Reformation was actually used as a means of curbing and destroying the heads of the nobility, and the very moment it became a party against the absolute power of the king it was crushed. The wars with England and Austria were thoroughly dynastical, and could not help attaching a particular importance to the representative of the dynasty. The development of the cities was furthered and privileges were granted to the burghers, but only so far as to enable the third estate to form an effective opposition to the nobility, but not so far as to make it capable of checking the royal power. And even the nobility itself was made a monarchical instrument. It lost its power, but not its splendor. It was transformed from a feudal aristocracy into a court nobility. And it is this same idea, the establishment of the absolute monarchy, together with the consequences following therefrom, which gives the history of France its paramount importance in the history of Europe. How early a powerful national feeling was developed in France was shown under Louis VI. (1108–37). In the long wars which he waged against Henry I. of England about Normandy, which by the Norman conquest of England threatened to become lost to the French crown, Henry succeeded in forming a formidable alliance with the German emperor. But, although the relations between the French king and the French vassals—the counts of Flanders, Champagne, Lyon, Provence, Toulouse, etc.—were very loose, in this emergency an army of 200,000 men was immediately formed for the defence of France. Louis VI. was a sagacious ruler. He abolished serfdom in his own territories, and formed his cities with their adjacent districts into corporations. But by his example he compelled his neighbors to do the same, and thus he sowed a very fertile seed of opposition to the feudal lords among their own subjects. Philip Augustus (1180–1223) made the first steps toward centrali-

zation, and made them successfully. He formed a chamber of peers, a sort of council of state, consisting of six secular and six ecclesiastical members, which tended to secure uniformity in the actions of the king and his vassals; and he established the right of appeal from the decision of the feudal lord to the royal court; which measure, in the course of time, seriously impaired the influence of the lord. Meanwhile the Crown grew richer. Philip Augustus conquered Normandy, Maine, Touraine, and Poitou from the English after the battle of Bouvines in 1214; Philip III. (1270–85) acquired Toulouse and Venaissin by negotiation; and Philip IV. (1285–1314) received Navarre, Champagne, and Brie by marriage. This latter prince could afford to treat the order of the Templars in the most arbitrary and despotic manner, and on one occasion, when the nobles pressed him too hard, he baffled all their exertions by convoking for the first time (Mar. 28, 1302) the general estates, in which assembly the burghers took seats and voted beside the nobility and the clergy. On the accession to the French throne of the House of Valois, in 1328, with Philip VI., nephew of Philip IV., the terrible wars with England began, the English king, Edward III., claiming the crown of France as a grandson of Philip IV. These wars lasted one hundred years. Vanity and treason were the fuel, bankruptcy and misery the result. But when at last the Maid of Orléans succeeded in rousing the national feeling to an unconquerable height, and carried, in 1429, Charles VII. to Rheims to be crowned, it is curious to notice how all the enthusiasm of the people was concentrated on the person of the king. In spite of all the incapacity and corruption which royalty had exhibited in France during these one hundred years, it had become very dear to the French people; and although persons like Louis XI. (1461–83) and Catharine de Medici, who actually governed France during the reign of her three sons, Francis II. (1559–60), Charles IX. (1560–74), and Henry III. (1574–89), were not fit to make royalty charming to the minds of the people, they were eminently fit to make it respected and feared. Charles IX. had all the leaders of the Protestant party murdered at the massacre of St. Bartholomew in 1572; Henry III. had all the leaders of the Roman Catholic party murdered one after the other. When (in 1589) Henry IV. ascended the throne and founded the *Bourbon* dynasty, he must have felt quite lonesome in France; at all events, the royal power stood now victorious, undisputed, and alone.

There was, indeed, something exalted and solemn about the royal power as it was exercised by Cardinal Richelieu under the reign of Louis XIII. (1610–43), but the impression was utterly changed by the magnificent but challenging arrogance of Louis XIV., who said, "L'état c'est moi." During the first years of the reign of Louis XIV. (1643–1715) France was eminently prosperous, and held the most prominent place not only in European politics, but in European civilization. Louvois and Colbert were excellent ministers; the treasury was full; commerce and industry flourished; the army and navy were in an effective state; Turenne, Condé, and Luxembourg brought home great victories, and new provinces were added to the kingdom. The king was exceedingly prodigal, but his prodigality was accompanied by an elegance and taste which spread a magnificent and even blinding radiance around him; all other kings tried to imitate him. Corneille, Racine, Molière, Boileau, Bossuet, and Fénelon had the ear of the world, and dictated the taste in all other literatures. But after some years the true character of the absolute monarchy became apparent. In 1685 the king revoked the Edict of Nantes because his mistress, Madame de Maintenon, was under the control of the Jesuits. Thereby the guaranty of religious freedom which was given to the Protestants by Henry IV. in 1598 was destroyed, and persecutions immediately began. Thousands of the most industrious and intelligent citizens of France were exiled. Some of the most prosperous branches of French industry stopped; the revenues decreased, and an uneasy feeling crept into the hearts of the people. The king's prodigality, however, did not decrease with his diminished revenues; on the contrary, his passion for stupendous buildings and gorgeous court magnificence grew stronger as he grew older. His second war (from 1689 to 1697) was not successful, and in his last (from 1700 to 1713) failure followed failure. Both were begun for reasons of mere vanity, but, although his armies were defeated time after time, his arrogance did not abate. In many districts of France food began to become scarce, but the Jupiter residing at Versailles heeded it not. When he died he left a debt of 3,500,000,000 livres, a country utterly exhausted, a court more demoralized and more expensive than any other institution which modern civilization has ever seen, and a people deeply discontented, though perhaps as yet unconscious of the reasons of its discontent. Under his successors, Louis XV. (1715–74) and Louis XVI. (1774–93), the consciousness came, and with it the crisis.

The French court was the government of France. There was no constitution, and such fragments of a constitution as existed were either out of working order on account of disuse—the general estates had not met since 1614, the assembly of the notables not since the first year of Louis XIII., the Parliament of Paris not with full authority under Louis XIV.—or if capable of working, they worked against each other, and produced only confusion. Thus, the archbishop of Paris forbade a Jansenist priest to administer the sacrament of the Lord's Supper; the Parliament of Paris gave the priest a permit; the council of state cashiered the permission; the Parliament issued a new warrant; the priest was imprisoned by a royal order. The only valid authority was the king; he could interfere even with the courts of justice by his *lettre de cachet*. He governed France by the court and an immense tail of officials; 250,000 were employed to gather the land and income tax alone. There were about 4000 offices which conferred nobility on their incumbents—that is, exemption from taxation and from military service. These offices were sold, and the sale was not a fraud on the administration, but a financial operation of the government. It cost 60,000 francs to become a member of the Parliament of Paris, 500,000 francs to become its president. Offices were sometimes sold to three or four persons, who alternately held them for one or two months. The people under this government consisted of three classes—the nobility, the clergy, and the third estate. The nobility comprised a long scale of different degrees of rank, from the forty-four peers of the realm to the swarm of parvenus who had received their nobility from an office; and this scale was expressed by an intricate system of etiquette. But all nobles—and their proportion to the whole population was as 1 to 250—were exempted from land-tax, from military service, from contributions to the maintenance of roads, etc.; they paid only an insignificant class-tax; and on such conditions the nobility held more than one-half of the soil of France, enjoying the right of hunting, exercising police superintendence, administering justice, etc. The Church owned a little over one-sixth of the soil, from which it derived an income of 160,000,000 livres a year, and on which it paid no regular taxes. Of these 160,000,000, 40,000,000 were received by the active servants of the Church, the curates, the priests; the rest was swallowed by the appanages of the prelates or spent in benefices which the king bestowed on the younger members of the noble families, and which enjoined no kind of service on the beneficiaries. The third estate had the whole burden of the defence of the country, the whole burden of the defrayment of the public expenses, the whole burden of productive labor, and in the fulfilment of these duties it was trammelled by the most absurd laws political economy ever saw.

Between the different provinces there were raised artificial bars at which a toll was levied. Different systems of taxation reigned on the two sides of these bars, and prevented a natural adjustment between supply and demand—when, for instance, there was scarcity of wheat in one province and superfluity in another. The duke of Orléans, the infamous regent during the minority of Louis XV., made an enormous fortune by corn speculations. The cost of production of 1 hundredweight of salt amounted to about 1½ livres, but on account of the salt-tax its market value rose in Bretagne to 44 livres, in Maine and Anjou to 61 livres. A fortune could be made simply by transporting salt over the boundary of Bretagne and Anjou, and consequently about 1600 men were yearly punished for smuggling.

Between this people and this government stood a numerous class of writers—Voltaire, Rousseau, D'Alembert, Montesquieu, Diderot, and many more—whose glory has faded very much since it became evident that their positive ideas were wrong, but who conferred a great benefit not only on France, but on Europe, by their criticism of the actual state of affairs. The dignity of human nature is greater than the Encyclopædists dreamt of, but we have discovered it from the higher level to which they raised us. With matchless eloquence, with irresistible wit, they showed that faults and demoralization on the one hand were the true causes of the misery and degradation on the other, and they taught men not to take the world as it was, but to try to make it what it ought to be. This was the situation to which the absolute monarchy in France came: a corrupt government, falling short of means by which to gratify its vicious appetites, a hard-toiling people, pinched by hunger and almost driven to despair; and between them a literature which told the starving man who it was that stole his food. The result could be nothing else than the *Revolution*.

Money was wanting; the state was on the verge of bankruptcy. The king first tried different ministers of finance:

Necker, but he only revealed the state of affairs to the public, and informed the people that His Majesty had used 860,000,000 of livres for his own person; Calonne, but he only increased the debt by his chimerical speculations, which destroyed much private capital and the last rest of public confidence; Brienne, but he could do nothing when the nobility and the clergy absolutely refused to be taxed. The king then recalled Necker, and convoked the general estates to meet at Versailles May 25, 1789. In this assembly the votes were cast not by poll, but by class, and thus the third estate was completely overruled by the two privileged estates. The third estate protested against such an order of conducting business, and demanded a vote by poll. The two other estates refused. On June 17 the third estate constituted itself the National Assembly, and invited the two other estates to participate in its debates; on the 20th the Assembly pledged itself by oath not to separate until a constitution was made; and on the 23d it declared its membership inviolable. To this the king answered by dismissing Necker and ordering the concentration of a body of troops at Versailles. But on July 12th the first insurrection took place in Paris; on the 13th a national guard and revolutionary municipal boards were formed; on the 14th the Bastille was stormed, and on Aug. 4th the National Assembly—or, as it was generally called, the Constituent Assembly—abolished all feudal and manorial rights. The royal princes fled, the emigration began. On Oct. 5th the mob of Paris, followed by the national guard, rushed out to Versailles, and, after massacring the royal guard, they carried the king and queen back to Paris, whither also the Constituent Assembly removed. July 14, 1790, the constitution was ready, the king took his oath on it, and those of the nobility and clergy who refused to do so were thrown into prison. Still, the excitement and disorder in Paris increased every day, and on the frontier the royal princes organized corps of *émigrés*, while Austria, Prussia, Saxony, England, and Spain formed an alliance and offered the king their help against his subjects. June 20, 1791, he and the queen tried to flee, but were stopped at Varennes, brought back to Paris, and confined in the Tuileries. On Sept. 14th he had to take oath on a new constitution, and then the Constituent Assembly considered its work as done, dissolved, and gave place for the Legislative Assembly.

This Assembly met Oct. 1, 1791. Meanwhile the protests of the foreign courts against the constitution, the royalist insurrections in Calvados and Vendée, and the movements of the emigrants on the frontier caused a terrible excitement in Paris. War was declared against Austria and Prussia, and when reports came of the defeat of the French armies, and when, moreover, the king, in confidence of help from the approaching Austrians, assumed a more decided attitude towards the Legislative Assembly, the excitement grew into wild fury. Armed bands broke into the Tuileries June 20, July 5, and Aug. 10. On the last occasion the Swiss guard was horribly massacred, and the king and the royal family were compelled to seek refuge in the Legislative Assembly, from which they were brought to the Temple as prisoners. Robespierre, Marat, and Danton swayed the Parisian populace through the club of the Jacobins and through Marat's paper. On the news of the Prussian invasion of Champagne and the fall of Verdun a tribunal of national defence was formed, the constitution abolished, the Legislative Assembly dissolved, and a National Convention convoked.

The National Convention, which met Sept. 21, 1792, consisted of two parties—the Jacobins, generally called the "Mountain," and comprising the most radical democrats—men without any definite ideas, but determined to carry the passion of the hour to its last consequences; and the Girondists, the representatives of law and order under the form of a constitutional monarchy, who were men of probity and talent. The Jacobins were in the majority, and on Sept. 25th, on the motion of Collot d'Herbois, France was declared a republic. Their power was still more strengthened by the success of the war. The Prussians were driven back, Dumouriez conquered Belgium, Custine crossed the Rhine, and Montesquiou entered Savoy. They felt that they were irresistible, and they pushed forward, trampling down everything which opposed them. The king was brought to trial Dec. 11th, and executed Jan. 21, 1793. The Girondist leaders were arrested June 2, 1793, and executed Oct. 31. A committee of public safety was formed and invested with absolute power. The Convention passed a decree against all who were "suspected," and Barère declared that "terror" was the order of the day. Terror was indeed the weapon the Jacobins employed. In Bordeaux, Marseille, and Lyon counter-revolutions took place, but they were put down with a cruelty and violence which the world had not seen since the days of the Roman emperors. The government was a perfectly unlimited despotism, exercised not by one, but by many. He whom the Parisian mob lifted on their shoulders became a despot for the hour, and he could do with lives and property as he liked. No institution could withstand these surges. The Christian religion was formally abolished, and the worship of "Reason," represented on the occasion by a danseuse from the opera, was introduced.

At this moment, however, a reaction began to set in. Not that the Reign of Terror ceased and the cruelties stopped. But the revolutionary frenzy had reached its culmination. The movement could go no farther; it had to turn. In the excesses of Hébert and his party, especially in the abolition of religion, there was something which actually offended and disgusted Robespierre. He was thoroughly in earnest. He wanted a perfect democracy, with "liberty and equality," and he was willing to go through the terror of anarchy in order to break down the old social order and produce the new. But anarchy itself was not his ideal. Hébert and twenty of his party, the *Enragés*, were arraigned as vicious men and traitors to their country, and brought to the guillotine on Mar. 24, 1794. A worship of the Supreme Being was substituted for that of Reason. But the reaction, once begun, could not be stayed. Hébert was followed by Danton (Apr. 5), and Danton by Robespierre himself (July 28). The Jacobins were now without leaders, and on Nov. 11 their club was closed. During the first half of the year 1795 the Convention debated and adopted a new constitution, which placed the executive power in the hands of a Directory of five, and the insurrection against this new constitution, brought about by the intrigues of the radical democrats and the royalists, was successfully put down by the young general Bonaparte; the mob of Paris was disarmed Oct. 5.

The situation of the Directory was, nevertheless, by no means an easy one. From without it was attacked by England, Austria, and Russia. But this part of its duty it discharged with great success. By regular conscription it brought 200,000 men into the field. The war was everywhere carried on in the enemy's territory, and the armies of the young republic seemed to be unconquerable. Foreign countries were subdued, and French ideas were impressed on Europe, not by mere eloquence, but by the aid of arms. In the interior, however, the government of the Directory was much less successful. La Vendée was still in uproar, and when more peaceful and conciliatory measures were adopted, the royalists returned and began their intrigues. At the election of 1797 they gained the majority in the representation, and the government had to use very harsh—not to say terroristic—means in order to save itself. The Tuileries was surrounded with troops and cannons, and the royalist members were arrested. Their election was declared illegal, and they were banished from the country. Also the financial difficulties proved too great for the government. In spite of the enormous sums which it drew from Belgium, Germany, and Italy, the Directory was unable to pay the public debt. It had to declare the state bankrupt and reduce its obligations to one-third their amount. Under these circumstances there arose a general feeling of the necessity of concentrating the government in one single individual, and when (Nov. 9, 1799) General Bonaparte overthrew the government of the Directory by military force and grasped the reins himself, most people in France approved of the measure.

(For the rest of the history of France see the articles NAPOLEON, LOUIS XVIII., CHARLES X., LOUIS PHILLIPPE, NAPOLEON III., and the FRANCO-GERMAN WAR. The chief works narrating the entire history of France are, MARTIN, *Histoire de France* (16 vols., 1855–60), and MICHELET, *Histoire de France* (17 vols., 1833–66).) CLEMENS PETERSEN.

Fran'cestown, tp. and post-v. of Hillsborough co., N. H., 25 miles S. W. of Concord. It has 1 national and 1 savings bank, an academy, and manufactures of soapstone goods, cooperage, etc. Pop. 932.

Franche-Comté was the name of one of the old provinces of Eastern France, which now is divided into the three departments of Doubs, Haute-Saône, and Jura.

Fran'chise, in law, a particular privilege conferred by government on individuals or corporations which does not belong to the citizens of a country generally by common right. Franchises are created either by express legislative grant or by prescription, which presupposes a grant. In England the varieties of franchise are very numerous, and include such rights as these: to have wrecks, estrays, treasure-trove, or forfeitures; to hold fairs or markets; to establish and maintain ferries; to have a forest, chase, park, warren, or fishery, etc.

In the U. S. the classes of these special privileges are greatly reduced in number, and they are, almost without exception, vested in corporations. The most usual and important are the privileges of maintaining ferries, bridges, turnpikes, and railroads, and the right to be a corpora-

tion for any purpose. The bestowal of these constitutes a contract between the State and the possessor of the franchise, and the latter thereby assumes certain obligations as a consideration for the rights conferred upon him. If the privilege be to construct and maintain a common highway or provide any means of public transportation, there is annexed to the grant a power of taking tolls from those who enjoy the superior facilities afforded, as a means of remuneration; and the owner of the franchise must in return provide proper accommodations for the public, take all reasonable measures to promote the safety and comfort of travellers, and be ready at all proper times to give them passage. For any violation or neglect of these duties he may be made to respond in damages, or he may even be deprived entirely of the power with which he had been entrusted. On the other hand, while he enjoys his privilege it is a right of property which cannot be destroyed by the government for the creation of other franchises or public works, in the exercise of the power of eminent domain, without adequate compensation being made. (See Eminent Domain.) An interesting question has frequently arisen in the courts as to whether the government is, in like manner, restricted from creating other franchises which would not directly destroy or divest any previously existing right of the same kind, but would seriously interfere with its exercise and diminish its value, as by establishing a new ferry or bridge in the immediate neighborhood of another. It has been asserted by some jurists that at common law any such infringement upon franchises was a nuisance, which might be prevented by injunction or be made the subject of an action for damages. But the U. S. courts have decided that there is, in such cases, no violation of proprietary rights, and that the State is under no obligation to make recompense. Public grants are to be construed strictly, and no implications of the kind under consideration are to be annexed to them. In some instances express terms are inserted excluding all interference within a specified distance, and a protecting stipulation is thus made expressly a part of the contract, which the State cannot violate without making compensation.

A franchise is generally included in law among incorporeal hereditaments. But as it is usually conferred upon a corporation, which is regarded as having a perpetual existence, it can scarcely ever be said to pass as an inheritance. But it has this quality when vested in an individual, and it clearly indicates the nature of a franchise as a right of property, an incorporeal hereditament being regarded as real estate. (See Ferry, Railways, Turnpike, Corporations, etc.)

In political law, the word "franchise" is sometimes used as an equivalent to the right to vote for candidates at a public election. The right of citizens of the U. S. to vote is now, to a certain extent, guarded by the U. S. Constitution, which provides (Amendment 15th) that it shall not be denied or abridged by the U. S., or by any State, on account of race, color, or previous condition of servitude, and that Congress shall have power to carry this provision into effect by appropriate legislation. (See Vote and Voting.)

George Chase. Revised by T. W. Dwight.

Fran'cia (José Gaspar Rodriguez), D. D., LL.D., known as **Dr. Francia,** b. at Asuncion, Paraguay, in 1757, became a Franciscan, and was trained at the University of Córdova, now in the Argentine Republic. His father is variously stated as having been French, Portuguese, and Brazilian. The young Francia received doctorates in divinity and canon law, and was for some time a theological professor, and then gained distinction as an advocate in Asuncion. In 1811, when Paraguay became independent, he was made chief of the junta; in 1813, one of the consuls; in 1814, dictator for three years; in 1817, dictator for life. He forbade any one to enter or leave the country; compelled every one to work for a living; seized the goods of the rich and gave to the poor; enforced popular education; and compelled the people to obey the laws by means of new and frightful penalties. He lived in almost complete isolation. When sixty-nine years old he forgot his priestly vows and took a wife. One of the most unaccountable acts of his life was the imprisonment of the botanist Bonpland for ten years. He d. Sept. 20, 1840. Though a cruel man and a rigorous tyrant, Dr. Francia was generally beloved by his subjects.

Fran'cis I., king of France, was b. at Cognac Sept. 12, 1494. He was the son of Charles, count of Angoulême, and succeeded his cousin and father-in-law, Louis XII., Jan. 1, 1515. In the following July he named his mother regent, and set out at once for the conquest of the Milanese territory, which was defended mainly by Swiss mercenaries. He won the great battle of Marignano, the "battle of the giants" (Sept. 14–15), where he displayed much valor and skill, and was knighted on the field by Bayard. Thereupon followed his entry into Milan, the league with the Swiss, the founding of Hâvre de Grace, and the alliance with the emperor Maximilian against the Turks. In 1518 he won Tournay from the English, and in 1519 began his rivalry with Charles V. in the contest for the imperial crown. Francis, irritated by his defeat, was led by feelings of jealousy to acts of hostility. In June, 1520, he met Henry VIII. of England on "the field of the cloth of gold," between Guisnes and Ardres, and on the Pale of Calais, desiring to win Henry's friendship by displays of chivalric pageantry and acts of princely courtesy. Charles, more politic, won Henry's favor partly by flattery, but more by the promise of the papacy to Wolsey, whose powerful influence was thus obtained. In 1522, Francis began the war against the emperor, the pope, and England, most unwisely attacking at once Navarre and the Netherlands. Prosper Colonna, at the head of the Italian troops, rapidly dispossessed Francis of his Italian possessions, except Cremona; the French were routed in Navarre; and on the eastern frontier the only advantage was the check given to Charles at Mézières. Meanwhile, the English invaded the N.; the constable Bourbon went over to the enemy; Bonnivet was driven out of Italy; Bayard was slain, Provence overrun by the Germans, and the queen died. Francis, however, rapidly cleared Provence of his enemies, and followed them into Piedmont, but was defeated and captured at the great battle of Pavia, where he performed prodigies of valor. He was kept a close prisoner at Madrid for one year; but England, Venice, Rome, and Genoa demanding his release, the emperor liberated him, after exacting the most humiliating conditions, which were, under the protest of Francis, confirmed by an oath, from which the pope hastened to release the French king. The war was at once renewed in Italy; Rome was sacked by the constable Bourbon, the pope imprisoned, and the French army under Lautrec was destroyed before Naples by a loathsome disease, hitherto unknown in Europe. Francis thereupon challenged Charles to mortal combat, but the latter, though pretending to accept, took such care of himself that a combat of words alone followed. In May, 1529, both parties were exhausted, and the Peace of Cambray ensued, though the war broke out afresh in 1534 and 1542, each time with apparent but not permanent advantage to France. The latter part of the king's reign was marked by terrible persecutions of the Protestants, in which many thousands of his subjects were slain and banished. Francis d. at Rambouillet Mar. 31, 1547. The character of Francis is marred by jealousy, libertinism, religious bigotry, and extravagant love of military glory. His conspicuous merits were valor, frankness, generosity, good-breeding and a love for the liberal arts. When compared with that of his great rival, Charles V., the character of Francis seems almost admirable.

Francis II. of France, b. at Fontainebleau Jan. 19, 1543, was the son and successor of Henry II., and came to the throne in 1559. He is chiefly noteworthy as the first husband of Mary queen of Scots. The king was feeble of body and mind, and the Guises were the real rulers of France. The great events of this reign were Condé's Huguenot conspiracy against the Guises, and the many consequent executions. Francis d. at Orléans Dec. 5, 1560, and the crown went to his brother, Charles IX.

Francis I., emperor of Germany, b. Dec. 8, 1708, succeeded his father, Leopold, as duke of Lorraine in 1729, and in 1735 received Tuscany in exchange for Lorraine, succeeding the last Medicean as grand duke in 1737. In 1736 he married the arch-duchess Maria Theresa, and became generalissimo against the Turks. In 1741 he was declared co-regent with his wife, and in 1745 was chosen emperor. Most of his attention was given to Tuscany, and Maria Theresa was the true sovereign in Germany. D. at Innspruck Aug. 18, 1765.

Francis II. of Germany, son of Leopold II. and grandson of Francis I., was b. at Florence Feb. 12, 1768; served in youth as titular chief commander, under Laudon, against the Turks, and was present at the taking of Belgrade 1789; succeeded his father in 1792, in which year war was declared against him by France at the beginning of the Revolution. He commanded in person on the Rhine, but with no success. Napoleon's brilliant operations in Northern Italy followed, and the Treaty of Campo Formio (1797) robbed him of Belgium, the Milanese, and part of the Rhine provinces. In 1799–1800 he joined Russia and Great Britain in another war, but Moreau in Germany and Napoleon in Italy (Marengo, June 14) brought this war to a termination favorable to France in 1801. In 1804, Francis took the title of emperor of Austria, joined the third coalition of 1805, and was compelled by the calamities of Ulm and Austerlitz to renounce his title of emperor of Germany (1806), together with his claim to Venice and the Tyrol. This was the end of the Holy Roman Empire. The Peace of Tilsit

forced him to a fourth calamitous war, which ended at Wagram 1809. In 1810 his daughter, Maria Louisa, was given by him in marriage to Napoleon. He joined the allies, and took part in the battle of Leipsic and the occupation of France in 1813. Napoleon's final overthrow left Francis stronger than ever before. He became a leading figure in the Holy Alliance, and Austria's name was for years after the symbol of despotism and reaction against liberal politics. D. at Vienna Mar. 2, 1835.

Francis I., king of the Two Sicilies, b. at Naples Aug. 19, 1777; became duke of Calabria in 1799; succeeded his father, Ferdinand I., in 1825, having previously been associated with the constitutionalist and revolutionary party. Nevertheless, his reign was one of cruel tyranny and corruption. D. at Naples Dec. 8, 1830.

Francis II. of the Two Sicilies (FRANCESCO D'ASSISI MARIA LEOPOLD), b. at Naples Jan. 16, 1836, succeeded his father, Ferdinand II. ("Bomba"), in 1859, and adopted his father's reactionary policy. His realm was invaded and quickly overrun by Garibaldi's forces in 1860, and when Gaeta, his last stronghold, was surrendered (1861), Francis escaped to Rome, and has since lived in retirement.

Francis (CONVERS), D. D., b. at West Cambridge, Mass., Nov. 9, 1795; graduated at Harvard in 1815; studied divinity at Cambridge, Mass.; held a Unitarian pastorate at Watertown, Mass., 1819–42; was Parkman professor of pulpit eloquence and pastoral care in the Cambridge Divinity School 1842–63; wrote biographical, historical, and other papers, including contributions to Sparks's *Biographical Collections*, the publications of the Massachusetts Historical Society, etc. D. at Cambridge Apr. 7, 1863.

Francis (JOHN M.), b. in Prattsburg, Steuben co., N. Y., Mar. 6, 1823. After receiving a common-school education, he was at the age of fourteen put as apprentice to the printing business. In 1843 he was employed as editor of the *Wayne Sentinel* at Palmyra, N. Y. After studying law for some months he became in 1845 leading editorial writer of the *Rochester Advertiser*, and in 1846 performed a similar service for the *Troy Budget*, of which he was afterwards editor and associate proprietor. After serving on the *Troy Post* and the *Troy Whig*, he established the *Troy Times* in 1851, and has since remained controlling proprietor of that journal. In 1871 he was appointed by President Grant U. S. minister to Greece, which position he resigned Nov. 17, 1873. J. B. BISHOP.

Francis (JOHN WAKEFIELD), M. D., LL.D., b. in New York Nov. 17, 1789; graduated at Columbia College in 1809; in 1811 received his medical degree at the New York College of Physicians and Surgeons; became the partner of Dr. Hosack, his preceptor, with whom he published (1810–14) the *American Medical and Philosophical Register;* in 1813 became professor of materia medica in Columbia College and lecturer in the College of Physicians and Surgeons; went to Europe and studied under Abernethy; returned to New York, and held in the last-named school successively the chairs of the institutes of medicine, of medical jurisprudence, and of obstetrics; was professor of obstetrics in the Rutgers Medical College 1826–30; was an editor of a medical journal 1822–24; engaged actively in benevolent enterprises, in literary and in reformatory work; author of various professional and biographical works and of many scientific papers; was a member of many learned societies. An able practitioner, a pleasing writer, an able and popular instructor, his social qualities, his literary tastes, and benevolence rendered him one of the most useful citizens of his time. D. in New York Feb. 8, 1861.

Francis Joseph, emperor of Austria and king of Bohemia, Hungary, etc., was b. Aug. 18, 1830, son of the archduke Francis Charles and nephew of Ferdinand I., whom he succeeded in 1848. The Hungarian war was inherited, not brought on, by him, and since its close the emperor has become personally highly popular in his dominions. The Franco-Italian war of 1859 and the Prusso-Italian war of 1866 considerably reduced the area of his dominions, but the Austrian policy has become every year more liberal, and the industrial progress of the country has been remarkable. (See AUSTRO-HUNGARIAN MONARCHY for a full sketch of the events of his reign.)

Francis (JOHN BROWN), b. in Philadelphia May 31, 1794, was a grandson of Nicholas Brown of Providence, R. I.; graduated at Brown University in 1808; received a mercantile education in the famous business-house of Brown & Ives, Providence; studied law at Litchfield, Conn.; was in the Rhode Island legislature 1821–29; in the State senate 1831, 1842, and 1849–56; governor of Rhode Island 1833–38; U. S. Senator 1844–45, and held other positions of honor and trust. D. at Warwick, R. I., Aug. 9, 1864.

Francis (SAINT) **of Assisi,** founder of the orders of Franciscans in the Roman Catholic Church, was b. in 1182 at Assisi, and named GIOVANNI BERNARDONE, but called FRANCESCO by his father, a rich merchant who traded much with France, whence the child's name. He was a thoughtless, gay youth, and served as a soldier against the troops of Perugia, but was taken prisoner and confined for a year. This imprisonment, and a consequent sickness, led him to make a vow to renounce the world—a vow which he soon forgot. But warned, as he conceived, by a voice from Heaven, he took a final vow of poverty. One day, as he was praying in church, the crucifix, we are told, spoke and bade him repair the walls of God's house. Francis stole and sold a horse and some rich goods belonging to his father, and offered the money to the priest of the church, who refused it; whereupon Francis cast the money into the street, and took up his dwelling in the church, the repair of which he undertook by begging and by the labor of his own hands. The father of Francis flogged and imprisoned him for a time as a thief (1206), and Francis formally refused all inheritance in his father's property. He now begged money for the repair of the churches; washed the feet of beggars and lepers, and kissed their sores; clothed himself in a robe of serge sewed with packthread and tied about the waist with a rope; ate the meanest food, and covered it with ashes, and wept and fasted almost continually; slept on the ground, and used a stone for a pillow. In 1209, having a few personal followers, he drew up a monastic rule for them, which was in 1210 approved by Innocent III., and in the same year Francis was made a deacon, the highest clerical position he would receive. In 1212 he was joined by Saint Clara and her two sisters, the original Clarisses or Poor Clares of the Order of Saint Francis. In 1219 he joined the crusaders at Damietta; in 1221 he founded the Tertiary Order. Soon after, as we are told, he had a vision of Christ, and received upon his hands, feet, and side the *stigmata*, or marks resembling the wounds of Christ. (See STIGMATIZATION.) Among his numerous reputed miracles was the healing of the infant Bonaventura, afterwards a distinguished saint. Saint Francis d. Oct. 4, 1226, and was canonized in 1228. Through whatever of invention and myth there may be in the stories of the life of Saint Francis, we may discern in him the lover of his kind, the faithful, earnest toiler for the spiritual and physical well-being of his fellows. Even the beasts and birds experienced his kindness, and he preached to them as to his brethren. He was cruel to no one except himself. He taught his followers that it was not maceration and fasting that led to spiritual advantage, but that such advantage sprang from the love which prompted to self-renunciation. His own self-inflicted sufferings were endured for the purpose of enabling him to control his appetites. His life has been written by Thomas de Celano, Bonaventura, Luke Wadding, Voigt, Chavin, Hilyot, Chalippe, F. Morin, Böhringer, Hase, Papini, Da Magliano, and many others.
CHARLES W. GREENE.

Francis (Sir PHILIP), K. B., b. at Dublin Oct. 22, 1740, was the son of Philip Francis (1700–73), an Anglican clergyman and translator of Demosthenes and Horace. Young Philip entered public life in 1756, under the patronage of Henry Fox (see HOLLAND, LORD), as a placeman in the state department, and held afterwards various places in the civil service at home and abroad until 1772. He was a member of the council for Bengal 1774–80, and the constant opponent of Hastings, by whom he was badly wounded in a duel. He entered Parliament in 1784, and finally left it in 1807. He was prominently connected with the Hastings trial, in which his revengeful spirit is supposed to have been a principal element. Throughout a large part of his public life he was an ardent and active advocate of reform measures. At present he is chiefly remembered as perhaps the author of the *Junius* letters; although the question has not yet been settled, the weight of the evidence is generally regarded as favorable to the theory of his authorship of those letters. (See JUNIUS.) D. in London Dec. 22, 1818. None of his acknowledged writings are now important.

Francis Xavier, SAINT (FRANCISCO DE XAVIER), "patron-saint and protector of the East," was b. of a noble family at the castle of Xavier, in Navarre, Apr. 7, 1506, and took his name *Xavier* from an estate of his mother's. He was educated at the college Sainte-Barbe, Paris, taught philosophy with applause in the College of Beauvais, and received the doctorate from the Sorbonne. In 1534 he joined the new society proposed by his fellow-student and compatriot Loyola, and in 1537 they, with a few others, the germ of the future Society of Jesus, went to Rome and received the papal benediction upon their new enterprise. He now toiled with zeal in the Italian prisons and hospitals, and in 1541 was sent by Loyola to Goa, India. On the way he cared for the sailors sick of scurvy, and preached with great power and effect. During his ten years' apostleship in India, Ceylon, Japan, and Malacca he baptized, we

are told, more than 1,000,000 persons, and planted the faith in 52 kingdoms. Much of his remarkable success was doubtless due to the exercise of the Jesuit practice of "accommodation." He d. of fever, in the island of Sancian (Hiang-Shan), near Macao, China, Dec. 2, 1552, and was canonized in 1622. Many miracles are ascribed to him by Roman Catholic writers. (The standard *Life* of this saint is that of Bartoli (1666); also written by Tursellini (1594), Bouhours (1682; in English by John Dryden, 1688), Sandoval (1619), Toscano (1658), Raybois (1838), Reithmeyer (1846); by H. Venn, Protestant (1862), and by H. J. Coleridge.)

Francis de Paul (SAINT), b. at Paola, in Calabria, in 1416, became a Franciscan in youth, but assumed the life of a hermit near his native town. He soon acquired a wide fame by the terrible austerities of his life, and his reputed miracles brought to him many followers. In 1436 he established the order of Hermits of Saint Francis, afterwards called Friars Minims, Bon Hommes, and Fathers of Victory. In 1482 he visited Louis XI. of France, who hoped in vain to be cured by him of his long and at last fatal illness. He remained in the service of Charles VIII. and Louis XII. of France, and d. at Plessis-les-Tours Apr. 2, 1507. He was canonized in 1519.

Francis de Sales (SAINT) was b. at the Château de Sales, near Annecy, Savoy, Aug. 21, 1567, of noble parentage; was educated at Paris and Padua, where he was passed a doctor of laws when twenty years old; embraced a clerical life, and as deacon and provost of the cathedral of Geneva won fame as an eloquent preacher; became a priest in 1593; went on a mission to Savoy, whence in 1598 he procured the expulsion of certain Protestant ministers. He was then sent by the pope to convert Beza, to whom he offered a cardinalate, but all in vain. In 1599 he became coadjutor, and in 1602 bishop, of Geneva. In 1610 he founded, with Madame de Chantal, the order of the Visitation, with the mother-house at Annecy. D. at Lyon Nov. 28, 1622. He was distinguished for zeal, charity, purity, eloquence, and personal excellence. His complete works have been often published. The most famous are *L'Introduction à la vie devotée* (1608), and *L'Amour de Dieu* (1616). There are many memoirs, chiefly French. Canonized 1665.

Francis'cans, Mi'norites (*Fratres Minores*), **Gray Friars** (in England and Ireland), sometimes called also **Seraphic Brethren,** one of the great mendicant orders of the Roman Catholic Church. Its founder, son of a wealthy merchant, Pietro Bernardone (and christened Francesco, "the Frenchman," because his father was absent in France at the time of his birth), was b. at Assisi, in Central Italy, in 1182. A wild youth sobered by adversity, he gave himself up in 1207 to a life of most passionate religious devotion, choosing absolute poverty as the badge of a new apostolate which should carry the gospel to the poor. The founding of the order dates from May 16, 1209, when he was joined by two companions at the church of the Virgin at Portiuncula. In that same year the order was provisionally sanctioned by Innocent III., commended to the favor of the fifth Lateran Council in 1215, and finally established by Honorius III. in 1223. The rule was given in 1210. In 1224 Saint Francis had the famous vision, when, as his followers believed, the five wounds of our Lord were miraculously impressed upon his body. He d. Oct. 4, 1226, and was canonized by Gregory IX. in 1228. The female order of CLARISSINES (St. Clara), which took its rule from him in 1224, dates from 1212. His TERTIARIES date from 1221. And so he is called the founder of *three* orders. Mediæval Europe owes much to the Franciscans. They went everywhere, and were like flames of fire wherever they went. First of all, they roused the masses. Poor men, wearing nothing but brown frocks girded about the waist by bits of rope, brought the gospel home to the poor. By and by they made themselves felt in every walk of life. Assisi became the acknowledged capital of Christian art. Thomas de Celano, author of *Dies Iræ*, and Jacopone da Todi, author of *Stabat Mater*, were both of them Franciscans; pontiffs like Nicholas IV., Alexander V., and Sixtus V. were Franciscans; but, above all, some of the greatest and best of the Schoolmen, such as Roger Bacon, Duns Scotus, Bonaventura, Alexander of Hales, and Ockham, belonged to the same order. The war between Thomists and Scotists was still more a war between Dominicans and Franciscans. Even in the lifetime of Saint Francis strife arose in regard to the strictness of the rule. The extreme asceticism which originally inspired the order has repeatedly reacted against its declining discipline. Hence, such temporary offshoots as the Cæsarines (1236–56), the Celestines (1294–1307), and the Clarenines (1302–1506). The Capuchins (dating from 1525) are still in existence. Hence also, especially, the great schism of 1368, which established the two branches of milder Conventuals and more rigorous Observants. The numerical strength of the order was greatest about fifty years after its foundation, when it had between 7000 and 8000 convents and nearly 200,000 monks. In the fifteenth century it declined, and was again greatly weakened near the close of the eighteenth century. At present the number of monks is nearly 100,000, and they are found in almost every part of the world.

(The literature of the subject is voluminous. The *Life* of Saint Francis was first written by THOMAS DE CELANO in 1229; then by the three associates, LEO, RUFINUS, and ANGELUS, in 1246; and by BONAVENTURA in 1261. These may all be found in the *Acta Sanctorum*, 2d vol. for October. Of modern *Lives* of the saint, we have, amongst others, in English, RICHARDSON (2 vols., 1854); in French, MALAN (1855); in German, HASE (1856). For the history of the order we have the *Annales Minorum* of LUKE WADDING, who in the early part of the eighteenth century edited the first 16 vols. of a work, the 23d and 24th vols. of which appeared in 1859 and 1860.) R. D. HITCHCOCK.

Francis'co, tp. of Buckingham co., Va. Pop. 1615.

Fran'cisville, post-v. of Salem tp., Pulaski co., Ind. It has one weekly newspaper. Pop. 281.

Franck'e (AUGUST HERMANN), a great German Lutheran divine and philanthropist, b. Mar. 23, 1663, in Lübeck; commenced his studies at Erfurt 1679, continued at Kiel, and finished them at Leipsic in Hebrew, Greek, and theology. He delivered theological lectures in Leipsic 1689–90, was dean in Erfurt 1690–91; in 1691 was called to the new university of Halle as professor of the Greek and Oriental languages, and as pastor of the suburban town of Glaucha. Breithaupt and Lange were his associates in the faculty and in the spirit of practical energy in which he followed up the work of SPENER (which see). In 1715 he became pastor of the church of St. Ulrich. He was founder of the greatest orphan-house of Protestant Europe, of a free school, a free table for students, and of a seminary for teachers. In 1698 these institutions were brought together in one great edifice. The whole was sustained by private beneficence or by the judicious labor connected with the orphan-house. Among its useful appendages was a publishing establishment, from which were issued many valuable books, especially the cheap Bibles of the Canstein Institute. After his death, June 8, 1727, the work was carried on by his son and by Frelinghausen, his son-in-law. The best biographies of Francke are by Niemeyer, 1794; Guerike, 1827 (translated into English); Kramer, 1861; Eckstein, 1863.
C. P. KRAUTH.

Francoa'ceæ, a small natural order of stemless exogenous herbs, chiefly Chilian. Lindley regards them as having affinity to *Dionæa*. They have astringent qualities, but none are important. The principal genus is *Francoa*.

Franco-German War (1870–71). Under the statesmanlike leadership of Bismarck, Prussia wholly gave up, in 1866, its modest and somewhat ambiguous attitude of former days, and on the basis of the very decided impression which its victory over Austria produced, it took the hegemony in Germany. But thereby the old enmity between France and Germany was immediately rekindled. The government of Napoleon III. could not but feel a depressing influence from the astonishing success of Prussia. It was itself based on the success of its foreign policy. Its important reforms in the field of political economy had found only a cold reception, and Napoleon understood that it would be very difficult for him to maintain himself as emperor of France when he could not maintain the French empire as leader of Europe. Perpetually stirred up and irritated by the opposition, the national feeling of France began to rise against a ruler who suppressed her freedom without increasing her fame and power. The French people felt its pride offended, and the cry was heard, "Revenge for Sadowa!" Thus, after 1866 the imperial government tried its utmost to put the French army with the greatest possible rapidity on a footing which would enable it to declare war against Prussia, while at the same time it endeavored by diplomatic means to gain such concessions from Prussia as might look like compensations for the aggrandizement of that power. It failed, however, in both plans. The introduction of the Chassepot guns was carried through with great rapidity; at the end of 1869 the entire body of infantry was provided with this weapon. But the reorganization of the army met, in general, with so much opposition from the side of the representatives of the people that, especially after the death of the energetic Marshal Niel, only a few reforms of any consequence could be effected. By the army law of Feb. 1, 1868, presented and carried by Niel, the time of military service was fixed at five years in the active army and four years in the reserve, and an active national guard was formed, in which all those who bought themselves off from military service,

or who remained after the annual conscription (100,000 men) was filled, were compelled to serve. On paper the active army and the reserve amounted, according to this law, to 900,000 men, and the national guard, which was to be used for the defence of the frontier, to 550,000 men. But how small a part of this immense army was actually mobilized and fit for battle the year 1870 showed. And even this army suffered from peculiar weaknesses, arising from a policy whose aim had been to make it a support of the dynasty rather than the defence of the nation.

The attempts at inducing Prussia to yield and surrender territory were entirely frustrated by the proud but prudent stubbornness of Bismarck, who after 1866 began to show himself not as a Prussian minister, but as the chancellor of the North German Confederation and a German patriot. In Aug., 1866, he declined an offensive and defensive alliance offered through Benedetti, which stipulated that Prussia should consent to the annexation of Luxembourg and Belgium to France, and France recognize the appropriations which Prussia had made and the intimate connection with Southern Germany which she wished to accomplish. During the following years he several times refused similar propositions which were made to him under different forms, and in the spring of 1867 he took so decidedly a national position in the Luxembourg question that France, not yet ready for war, was compelled to stop short of her demands. Meanwhile, the North German Confederation became more and more consolidated every year, and in Southern Germany an inclination to the North began to show itself. Napoleon believed that a complete political union of the whole of Germany was not far off, and he understood fully that such a combination would make his adversary superior in power. He therefore determined, reluctantly, it is said, presuming that his army was fit for battle, and considering the war unavoidable, to strike now rather than later on. In the middle of May he appointed Gramont minister of foreign affairs in the cabinet of Ollivier, and from that moment the French policy assumed a decidedly warlike course, especially influenced by the empress Eugénie, who was entirely under the control of the Ultramontane party.

Soon after, the question of the Spanish crown furnished the issue. On July 3, 1870, Marshal Prim, the president of the Spanish ministry, communicated to the court in Paris that Prince Leopold of Hohenzollern had declared himself willing to accept the royal crown of Spain, and the imperial government determined to use this event for the humiliation of Prussia or as a cause of war, probably hoping that the case would be considered as merely concerning the Prussian dynasty, and that King William, moved by this consideration, would yield, whereby, to the eyes of the French people and all the world, a diplomatic victory of great political consequence would be gained. King William would be induced to forbid Prince Leopold, as a member of the House of Prussia, to accept the Spanish crown. On July 4 the French *chargé d'affaires*, Le Lourd, who represented the French government at Berlin during the absence of the ambassador, Benedetti, appeared in the office of the foreign ministry of the North German Confederation and set forth the painful impression which the candidature of Prince Leopold had made in Paris. The under-secretary of state, Von Thiele, answered that the question did not concern at all the Prussian government. The next day the duke de Gramont declared in the Corps Législatif that no foreign power would be allowed to disturb the balance of the political system of Europe, and slight the interests and the honor of France, by placing one of its princes on the throne of Charles V. This declaration—which, however, was severely attacked by the opposition, especially by Emanuel Arago, Crémieux, Picard, and others—produced great excitement in the whole nation, and attracted serious attention from all other powers. All felt that France intended war, but the public opinion generally went against the disturber of the peace. In Germany both the press and the people in general remained perfectly calm, partly because they confided fully in their own power and the wisdom of the Prussian government, partly because they did not believe that the French really desired a war. The French government, however, persevered in the course it had assumed. On July 9, Count Benedetti appeared before King William, who was at Ems using the waters, and proposed, in his peculiarly insinuating manner, that the king should command the prince to withdraw his acceptation of the Spanish crown. But King William, although unguided by his ministers, felt immediately the consequence of this seemingly unimportant question, and gave an answer which conformed to his dignity without offending France. He emphasized that he had given his consent to the prince's acceptance of the crown, not as king of Prussia, but as chief of the family, and he declined to recall the consent. On July 11 the French ambassador repeated his demand in a more impressive manner, even threatening with war, but he received the same answer from the king. Once more he returned to the same topic (July 13, in the morning), and this time still more urgently; and when the king told him that the prince had renounced the Spanish crown on the previous day of his own free will, the ambassador asked him to declare publicly that he approved of the renunciation, and would not permit any resumption in the future of the candidature of the prince. Such a declaration—given, for instance, in the form of a letter to the emperor Napoleon—would be necessary in order to still the excitement of the French people. This demand the king refused peremptorily; and when Benedetti asked for another audience later on in the same day, and designated the repetition of this demand as the purpose of the audience, the king declined to receive him.

While the renunciation of Prince Leopold was hailed in Germany and everywhere as a guaranty for the preservation of peace, the party at the court of Napoleon III. which wished the war on any account, succeeded in making its views predominate, reckoning much on aid from other powers, especially from Austria; on which point they were supported by Gramont's reports on the feeling in Vienna. The Austrian cabinet had, indeed, given assurances which looked much like a promise of alliance, and which might lead a sanguine politician to reckon on aid from that side. There were also some prospects of an alliance with Italy, and the participation of Denmark in the war was more than probable. The emperor himself never overlooked the fact that none of these alliances could be actually realized until the French army had achieved some signal success, but such a success might be hoped for by an immediate attack, by a surprise; and it was determined to declare war. A distorted representation of the previous negotiations was laid before the representative assembly (July 15), alleging a gross affront offered to the French ambassador; and, although vehemently opposed by some members, especially by Thiers, the Assembly voted, nearly unanimously, 500,000,000 francs for the war. This was the actual declaration of war; the formal followed July 19.

Meanwhile, the government of the North German Confederation had taken the possibility of war under consideration. On July 11 a council of ministers was held at Berlin, presided over by the minister of war. The question of making some preparatory steps was debated, but in full confidence of the perfect working capacity of the army organization it was decided not to give any pretext for war by preliminary arming. The council knew that even if the South German states did not participate in the war, the North German Confederation could send to the frontier within two weeks an army of 511,826 men, with a reserve of 265,082 men in garrison and 180,672 men of the second call; thus placing a force of 975,256 men, including the staff, against the French army. Count Bismarck, who was on his estate at Varzin, repaired to Berlin on July 12th, and the same day arrived Gen. von Moltke from Schweidnitz. It was Bismarck's plan to go to Ems on the 13th, but the tidings of the renunciation of the prince reached Berlin on the 12th in the evening, and the plan was given up. On the 13th several high officers of the staff received long furloughs, and Admiral Prince Adalbert of Prussia was sent with his squadron on a trip to the South. So peaceful an aspect had affairs at Berlin. But on the 15th the report of what had taken place at Paris wholly changed the situation. The king left Ems for Berlin that day, and on arriving at the Brandenburger dépôt, where he was received by the crown prince, Bismarck, Moltke, and Roon, he heard of the vote of the representative assembly in Paris. He gave immediate orders for the mobilization of the whole army of the North German Confederation. The next day the Federal Council assembled, and the Parliament was called for July 19. In Southern Germany the French challenge produced, contrary to French expectations, the same outburst of patriotic enthusiasm as in the North. Louis II. of Bavaria took the lead in this national movement, and ordered the mobilization of his army (July 16). Baden, Hesse, and Würtemberg followed the example. The question hardly came up whether or not a *casus fœderis* existed; the South German states joined the North German Confederation by the force of a natural instinct.

Even now, while the arming went on in France and Germany with the utmost energy, and before any encounter had taken place between the two armies, the superiority of Germany began to show. The rash challenge of France had made people believe that her army and navy were ready to strike a blow at the very first moment—a blow so decisive in its character as to counterbalance the disadvantageous impressions she had made by breaking the peace. But as day after day elapsed and nothing particular happened, and as it at last became evident that it cost Napoleon great exertions to mobilize his army, an unprejudiced esti-

mation of the position took place, and the result was advantageous to Germany. Austria felt as yet by no means inclined to join France, Italy remained perfectly neutral, and Denmark saw no reason why it should enter on so dangerous an undertaking as a war with Germany. Towards the establishment of this general neutrality Bismarck's diplomatic actions contributed very much. He made known to the world, through a notice in the *London Times* (July 25), and through a communication of July 28 to the German ambassador in London (Count Bernstorff), the proposition of common land-robbery which the French government had made to him from time to time, and the denials of Benedetti and Gramont he disproved (Aug. 10) by communicating a letter of Aug. 6, 1866, from the former, containing a project of re-establishing the frontiers of France as they existed in 1814.

The attitude of England was principally determined by these revelations, and France had to fight the war alone. She proceeded very slowly. It was not until July 22 that Admiral Bouet-Willaumez received the command of a so-called Baltic fleet, consisting of fourteen iron-clad frigates and a number of minor vessels suited for shallow waters; which fleet was destined to be followed by a transport fleet under Admiral de la Roncière le Noury, with 30,000 troops. And when he arrived at Cherbourg to enter on his commandership he found that not only was the number of the ships short, but even *personnel* and *matériel* were wanting. On July 24 he had to go to the Baltic with seven frigates and one corvette, in order not to lie wholly idle. He went to the Sound, returned then to the gulf of Jade, but saw nothing of the German fleet, and proceeded to the Baltic. He accomplished no results, however—especially none in Denmark, as Napoleon did not send an ambassador to the king until after the declaration of war, and the efforts of the duke of Cadoro were paralyzed by the counteraction of England and Russia and the news of the battles of Wörth and Saarbrücken. Along the coast nothing of importance was effected; the decision was to be made on the French-German boundary. But here, too, a singular contrast showed itself between the actual military operations and the haughty haste of the diplomatic preliminaries. If Napoleon had ever had a plan of operations, he was soon compelled to give it up on account of the state of his army and the attitude of Southern Germany. It cannot be doubted that even before the first battles were fought a complete lack of plan and decision reigned at the French head-quarters. On July 14 the reserve was called in, but while the greatest exertions were made to collect a strong force on the German frontier, the bad organization of the army and the defective system of its mobilization caused an indescribable confusion in all military branches and on all the railways and at the dépôts.

The chief defects of the organization proved to be the division of each army corps into small bodies of troops scattered over the communes, and the accumulation of the material of war at a few isolated points. The whole formed one mass of confusion. The chief defect of the mobilization consisted in sending the regiments to the frontier before they had received their reserve and material, so that they had to accomplish their equipment far from their quarters and in the midst of the whole mass of troops. To all this was added the fact that the actual strength of each single body of troops fell very much short of the amount which Le Bœuf had figured out on paper, and in which the emperor had trusted. The whole force which on the French side was ranged in the front line—that is, all the corps which were ready for battle at the end of July and in the beginning of August—numbered hardly more than 250,000 men. And this force, moreover, was dispersed in the following manner: 1st corps, 37,440 men and 120 guns, under MacMahon, was at Strasburg; next to it was the 5th corps, 28,080 men and 90 guns, under De Failly, at Bitsch; to the left, opposite Saarbrücken, was the 2d corps, 28,080 men and 90 guns, under Frossard; the 3d corps, forming the reserve of the 2d, 37,440 men and 120 guns, was at Metz, under Bazaine; and to the left of this, at Diedenhof (Thionville), was the 4th, 28,080 men and 90 guns, under L'Admirault. The 6th corps, 37,440 men and 120 guns, under Canrobert, was concentrated at Châlons; the guard, 17,280 men and 72 guns, under Bourbaki, at Nancy; and the 7th corps, 27,360 men and 90 guns, under Douay, at Belfort. Napoleon later on asserted that this arrangement was based on the idea of forming a strong army at Strasburg to push rapidly forward toward the Main. Be this as it may, it is certain that the corps stood too far apart when the fight began, to give each other sufficient support.

In Germany the state of affairs showed quite another aspect. Even the mobilization of the army exhibited a superiority, which later on became evident also in its strategic and tactical management. It was decided, although an early French invasion was not anticipated, that all the different army corps should be put in complete war-trim in their garrisons, while small bodies of troops should try, by clever operations on the frontier, to produce an impression of their being strong corps. The plan succeeded completely. The French were deceived with respect to the strength of the German garrisons along the frontier, and in the last week of July three powerful armies were formed, undisturbed, at Coblenz, Mentz, and Mannheim. The first army, under Gen. von Steinmetz, numbered 61,000 men and 180 guns, and consisted of the 7th army corps under Von Zastrow, the 8th under Von Göben, and the 1st and 3d divisions of cavalry. It formed the right wing, with Coblentz for its head-quarters. The second army, under Prince Frederick Charles of Prussia, numbered 206,000 men with 534 guns, and consisted of the guard, under Prince August of Würtemberg; the 3d and 4th army corps, under Von Alvensleben; the 9th, under Von Manstein; the 10th, under Von Voigts-Rhetz; the 12th, under the crown prince of Saxony; and the 5th and 6th divisions of cavalry. It formed the centre, with its head-quarters in Mentz. The third army, under the crown prince of Prussia, numbered 180,000 men, with 480 guns, and consisted of the 5th army corps, under Von Kirchbach, the 11th, under Von Bose, the 2d and 4th divisions of cavalry, the 1st and 2d Bavarian army corps, under the generals Von der Tann and Von Hartmann, and the combined corps of Würtemberg and Baden, under Von Werder. Thus, the force of the first line amounted to 447,000 men, with 1194 guns. The 6th army corps, under Von Tümpling, the 1st, under Von Manteuffel, the 2d, under Von Fransecky, the 17th division of infantry and the 17th brigade of cavalry, were in Silesia, around Berlin, and in Sleswick-Holstein, to meet any attack by Austria or Denmark; and the whole country was divided into governments, in which experienced generals were at the head of the reserve and the troops of the second call. The commander-in-chief was King William of Prussia, and his chief of staff was Gen. von Moltke. In his suite were the chancellor, Count Bismarck, the minister of war, Von Roon, and the quartermaster-general, Von Podbielski. The commander-in-chief of the French army was Napoleon III.

On July 30 the strategical evolution of the German army on the Rhine was finished, and the march toward the French frontier, which as yet the French had not crossed, began. On July 28, Napoleon arrived at Metz with his son, while the empress Eugénie remained in Paris at the head of a regency. Napoleon was wavering and doubtful concerning the success of the war, and his chief of staff, Le Bœuf, showed himself as incompetent to lead an army as to organize one. Under the painful feeling of having entered on an undertaking too great for his strength, Napoleon issued, on the day of his arrival, a proclamation to the army which did not satisfy the soldiers, as it spoke of the toils of a long campaign, and they already felt uneasy on account of the general inactivity and the many contradictory dispositions. Several days passed away, with indifferent marches and counter-marches on the left wing, until at last (Aug. 2) the corps of Frossard made a real attack on the Prussian position at Saarbrücken in presence of the emperor and his son. The Prussians had as yet no reserve, and their whole force consisted only of one battalion and some squadrons. After protracted firing they retreated; Frossard occupied Saarbrücken, and the emperor hastened to send a brilliant report of victory to Paris, in which he mentioned the bravery of his son. On the same day King Wilhelm arrived at Mentz, and from that moment the serious and systematic manner in which the Germans conducted the war led to decisive encounters.

The armies had now approached very near to the frontier, the left wing, the third army, nearest. On Aug. 4 the crown prince of Prussia gave orders to pass through the forests of Bien by four different roads, and to throw back the enemy wherever he should be met. This blow was directed against the corps of Marshal MacMahon, who had been compelled to occupy a position very much scattered, in order to watch and secure all important points. His 2d division, under Gen. Douay, was at Weissenburg, the 1st, under Gen. Ducrot, to the E. of Wörth, and the rest of the corps at Strasburg, while the cavalry was widely spread in order to cover the whole sweep between the Rhine and the Vosges. Gen. Douay, who was nearest to the threatened point, heard of the approach of the enemy Aug. 3, in the evening, but only in an indefinite way. He reported to Ducrot, and received orders to take up the battle if it were offered. The German attack was made earlier and more forcibly than Douay expected. The firing between the French outposts and the German vanguard began at 9½ A. M. (Aug. 4). Large masses of the artillery and infantry of the third army soon drew up, and the attack was made with such force as to make resistance impossible. Douay himself fell in the battle, and his troops retreated

with great loss and in wild disorder. (*Weissenburg.*) As soon as the news of this defeat reached Marshal MacMahon he determined to throw immediately all disposable troops against the enemy. As he could add only one division of the 7th corps to his own, he could not reckon on meeting the crown prince with more than 50,000 men. Nevertheless, he determined to make head against the superior force, and chose a very good position at Wörth. On Aug. 5 the crown prince advanced to Sulz, with the 5th and 11th army corps in the centre, on the road to Hagenau, the Bavarians to the right, the Würtemberg-Baden corps to the left. In the night his head-quarters were at Sulz; the corps stood at Lembach, Ingolsheim, Preuschdorf, Sulz, Aschbach, Schoenenburg, and Sahl. No dispositions for attack were made the next day, as it was not intended to give battle that day. On Aug. 5, MacMahon occupied the position at Wörth; the division Dumesnil of the 7th corps was coming. He expected the corps of Failly, which the emperor had placed at his disposal, to arrive the next day. At daybreak on the 6th small skirmishes arose between the outposts, which, against the wishes of the commanders, grew into a general fight at 9 A. M. The larger part of the German corps was still far off. The French fought bravely, and they were well led. They made several assaults, and up to 1 P. M. the battle was undecided. But at that time the whole German force had come up, and the decision began to appear. The fight about the village of Froschweiler formed the crisis of the bloody battle. After several furious assaults, especially by the cavalry, MacMahon had to yield to the press of the German columns, and when at 3½ P. M. he gave up Froschweiler the battle was ended. The French fled to the mountains in utter confusion and consternation. Only the division of Guyot de Lespart, which had just arrived, and which was all the support the marshal received from the 5th corps at Bitsch, met the enemy and stopped the pursuit. (*Wörth.*)

This decided victory, which left 6000 prisoners (among whom were 100 officers), 2 eagles, 6 mitrailleuses, and 35 guns in the hands of the Germans, was of great consequence, both in military and political respects. The news that the flower of the French army, the African troops, under the best general, had been completely vanquished, filled all Germany with proud confidence, and destroyed every hope of alliance which Napoleon still might entertain. And the French were defeated on the same day not only on the right, but also on the left wing, at Saarbrück. The corps of Frossard, which on the 2d had made the rather theatrical assault on Saarbrück, retired, on hearing of the defeat at Weissenburg, into a firm position between Forbach and Saarbrück, on the heights of Speichern. Napoleon had returned to Metz. The corps situated between Metz and the frontier were distributed without plan, and pushed to and fro to no purpose. On the day of the battle at Wörth the flanks of the first and second army approached the frontier. The 7th army corps was to advance to the Saar; the vanguard of the second army stood near Saargemünd. An attack on the corps of Frossard was not yet intended. But when the cavalry division (Rheinbaben) of the first army reported that, contrary to expectation, the enemy had retreated to the heights of Speichern, Gen. von Zastrow ordered this position to be reconnoitred; and when the 14th division advanced beyond Saarbrück (Aug. 6), a skirmish began with some advanced bodies of French troops. The fight grew hot, and could not be broken off. The French were driven from the ground in front of their position, and although neither Gen. von Steinmetz nor Zastrow had ordered it, both the brigades advanced from two sides against the front of the immensely strong position. The battle was fought on the German side with great boldness, but it caused a heavy loss, and on account of the weakness of the assailants it lasted several hours without bringing any decisive result. The 14th division received so much reinforcement from the 8th and 3d army corps, parts of which hurried to the place on hearing the cannonade, that it could hold the ground which it had gained in the beginning. But the battle was not decided until the 13th division, advancing from Völklingen on Forbach, threatened the French on their left wing and rear. About 9 P. M. they retreated to Blittersdorf. (*Saarbrück.*) On both sides the battle was fought with the greatest exasperation, and the losses were enormous; each army reckoned about 4000 dead and wounded. But the result had a very bad influence on the French army. While on the German side the different divisions supported each other to the utmost, and without any previous agreement, the French felt that their generals lacked spontaneous energy. The corps of Frossard could as well have been reinforced as the German division. Marshal Bazaine was only 5 miles away from the battle-field, and the din of the battle could be heard by him distinctly. Thus, both the wings of the French army were completely defeated, the 2d as well as the 1st corps; the original position could not be held any longer; the whole force fell back.

The defeat in the field caused an immense reaction politically. Paris dreamt of nothing but victory. On the very day when both battles were lost, a false rumor had spread that the Prussians were totally defeated, Prince Frederick Charles taken prisoner, and Landau occupied. Paris was greatly excited. But soon the news was contradicted, the excitement suddenly changed, and on the 7th the regency was compelled to employ extraordinary measures of mobilization. The empress issued a proclamation in which the defeat was acknowledged, and firmness and order were urgently entreated. The acting minister of war presented a decree which asked for the enrolment of all active citizens between 30 and 40 years of age in the stationary national guard, the employment of the national guard of Paris in the defence of the capital, and the enlistment of all citizens under 30 years of age into the active national guard. Besides the department of Seine, the military districts of Lille, Châlons, Strasburg, and Lyon were on Aug. 8 declared in a state of siege, and the representative assembly was called to meet on the next day. The official journal of the 8th gave a picture of the reigning despair; it besought all the peoples of Europe to stand by France. On the 9th the representative assembly commenced its sittings, and in the Corps Législatif a real storm arose against the ministry of Ollivier. The ministry was compelled to give in its resignation, and Gen. Cousin de Montauban, Count de Palikao, was requested by the empress to form a new cabinet, in which he himself held the ministry of war, Admiral Rigault de Genouilly that of the navy, and Prince la Tour d'Auvergne that of foreign affairs. All unmarried men between 25 and 35 years of age, who before had been legally free of military service, and widowers without children, were now called in, unless already enrolled in the national guard. Companies of volunteers were also to be formed. The regency considered necessary even the barbarous measure of expelling all Germans living in France.

Meanwhile, the military position of the two armies formed itself in the following manner. The effect of the defeats of Aug. 4 and 6 was that, without any definite plan for the continuation of the defensive war, all the French corps, conglomerated into two large masses, retreated along the line of the Moselle. Two different armies were thus formed —the army of Metz, generally called the Rhine army, and the army of Châlons. The former consisted of the 2d, 3d, 4th, and 6th corps and the imperial guard; the latter of the 1st, 5th, and 7th corps, to which was added the 12th corps, formed later on. The commander-in-chief of the Rhine army was Marshal Bazaine from Aug. 12; under the moral pressure of his own incompetency and the general contempt, the emperor himself drew back. MacMahon commanded the army of Châlons.

Meanwhile, the German armies streamed over the frontier into France, pursuing the advantages already gained. Wheeling around to the right, the first army proceeded very slowly, the third very rapidly. Advancing two days' march in front of the main body, the cavalry divisions formed a line of observation. The crown prince marched his army in five separate columns through the Vosges, in spite of the fortresses of Bitsch, Lichtenberg, Lützelstein, and Pfalzburg, which should have stopped the passage; the division of Baden he sent to besiege Strasburg. The three armies then crossed the plateau of Lorraine without resistance, the first taking the direction towards Metz, the second towards Pont-à-Mousson, and the third towards Nancy. On Aug. 13 the royal head-quarters were in the castle of Herny, 15 miles from Metz. The first army, to which the 1st corps and the 1st cavalry division had been added, stood on the 14th, at noon, on the line of St.-Barbe-Frontigny, with its outposts 5 miles from Metz, and in immediate contact with the enemy; the second army began at the same time to cross the Moselle at Pont-à-Mousson; the third approached Nancy with its main body. It was believed that the Rhine army would give battle at Metz on the 15th (the Napoleon day), but it looked singular that the French did not occupy the Moselle line in its whole length, but allowed themselves to be flanked by the second army at Pont-à-Mousson. Under these circumstances the king ordered that the first and second armies should remain in close connection, in order to receive battle on the right bank of the Moselle, but that one part of the second army should try, at the same time, to get into the rear of the army at Metz and cut off its retreat to Paris. The third army was employed to secure this movement from any attack by MacMahon.

On the French side the greatest confusion prevailed. When Bazaine became commander-in-chief instead of the emperor, Garras took the place of Le Bœuf as chief of staff, but he was perhaps even more incompetent than his predecessor. A council of war was held on the 13th, and deter-

mined that the army, which was encamped entirely on the right bank of the Moselle, and under the protection of the guns of Metz, should retreat on the next day to Verdun. Early on the 14th the retreat began. It took place through the fortress and on the left bank, but was effected very slowly. As soon as the commander of the German outposts, Maj.-Gen. von Goltz, observed the enemy's movements in the afternoon, he advanced his brigade immediately and attacked. His purpose of keeping the French back and effecting a postponement of the retreat succeeded completely. By the French larger and larger bodies were opposed to the attack of the Germans, whose mass also increased with every hour, and a real battle developed—the battle at Courcelles—in which on the German side the 1st and 7th corps, and on the French the 3d and a part of the 4th, participated. It was very bloody; the French lost about 4000 men, the Germans about 5000; but the latter were victorious, and pursued the enemy to the glacis of the fortress. The whole next day (Aug. 15) was entirely lost to the French; they remained in Metz and on the left bank of the Moselle, repairing the losses of the last battle.

To the Germans, on the contrary, the day was immensely valuable; it gave the second army time to approach the enemy's line of retreat. Only the 1st army corps remained to watch Metz from the E.; the 7th and 8th were pushed near to the Moselle, S. of Metz, and the whole second army was to try to reach, as rapidly as possible, the road from Metz to Verdun. This operation was very difficult to effect. The whole course of the Moselle from Metz to Frouard is very winding, and is hemmed in by abrupt and forest-clad hills, which present formidable obstacles to the moving columns of a large army. Only two stationary bridges, at Pont-à-Mousson and at Novéant, lead across the river, which rushes through a narrow valley. The mountains of the Moselle are narrow, on the right bank rising to the height of 1000 feet, and with only a few difficult side-valleys at Corny, Arry, and Chambley; to the S. of Pont-à-Mousson they become broader and higher, and are cut by valleys which lead to Dieulouard and Marbache. On the left bank the mountains are more abrupt, several hundred feet higher, and have an average breadth of 5 miles. They slope gently down to the W., while they break off precipitously toward the river. Only a few narrow defiles lead to the N. W. from the Moselle to the road between Metz and Verdun. N. of Pont-à-Mousson are only the two valleys in which Gorze and Orville are situated. Thus, in order to approach the French line of retreat without incurring too many stoppages and too much confusion, the army had to take a circuitous course—first to the S. and S. W., and then, wheeling round, to the N. between the mountains of the Moselle and the Meuse. This operation was effected by Prince Frederick Charles during the 15th and 16th of August. Only one corps, however, the 3d, under Lieut.-Gen. von Alvensleben, and the 5th and 6th cavalry divisions, had reached far enough on the morning of the 16th to surprise the retreating army of the enemy. Thus, this small force had a task of the greatest importance and difficulty. Bazaine had ordered that the retreat should begin on the morning of the 16th, and take place along both the roads leading to Verdun; but the slowness with which the park and train columns were developed, and the delay caused by the participation of the 3d and 4th corps in the battle of Courcelles, prevented the army from effecting the march with due celerity and order. Napoleon had already left it under a strong escort. Bazaine expected an attack, but he had no idea of its direction or of its purpose. At 9½ A. M. the French outposts on the plateau of Vionville noticed the approach of the enemy, and almost immediately after the German regiments of cavalry fell on the bivouacs of the French cavalry, which were situated to the S. of the great road. The attack caused in the first moment a great confusion, but in the next the French corps took energetic measures of defence. In tactical respects the French army had many advantages over the German, but its strategical position was desperate. Even if it succeeded in defeating completely the present attack, it would still continue to be exposed during its whole march to new attacks by the rest of the German army, which pushed forward in larger and larger curves. It did not succeed, however, in defeating its first enemy. The 3d corps was sufficient to stop the retreat. Marshal Bazaine showed himself in this difficult position an incompetent commander. He knew not whether to proceed or retreat; he did not understand how to deploy his army; he did not see whether he was most threatened on the left or on the right wing. Thus, his army remained crowded together in a small space, and, singularly enough, it held two lines of retreat—one to Metz, and one to Verdun. Nevertheless, at several points the French troops gained advantages. They succeeded in checking, and partially repelling, the 3d corps and the reinforcement which first arrived, the 10th corps. Between 2 and 3 P. M. the French front had turned toward the S. and threatened to flank the German left. The fight was continued till night came, and the darkness ended it without any decisive result. Both armies bivouacked during the night in their positions.

This battle (*Vionville*) was comparatively the most bloody in the whole war. On the French side 120,000 men, on the German 60,000, were under fire. The loss on each side comprised about 16,000 men, dead and wounded. But it frustrated the intended retreat to Verdun, and compelled Bazaine to remain at Metz. On the 17th he went back to the heights which extend from St.-Privat to Rozerieulles, and took up a defensive position. On the German side it was determined to wait for the arrival of the corps still on the march, and then to push forward in a northern direction, in order to prevent any attempt at retreat. The king arrived at Gorze on Aug. 17, at 6 A. M., and inspected the battle-field. After ascertaining that the French had left their positions, he made through Von Moltke a new disposition, according to which the second army should advance on the 18th at 5 A. M. to Echelons, between Ville-sur-Iron and Rezonville, while the 7th and 8th corps should meet any attack on the right wing of this army from Metz. These operations were effected on Aug. 18 with accuracy, and at 10 A. M. it was ascertained with certainty that the enemy did not retreat, but occupied a position W. of Metz, with his front facing W. The German attack was planned accordingly: the right wing was to first engage the enemy, then the centre should attack, and at last the left wing was to strike a decisive blow by its pressure on the right flank of the French army. And thus the battle was carried out. (*Gravelotte.*) The right wing, consisting of the 7th and 8th corps, and the centre, consisting of the 9th and 3d corps, fought in front, and held the enemy engaged, without pressing him too hard, until the left wing, consisting of the Prussian guards and the Saxons, could surround the right wing of the enemy. The decisive point of the battle was St.-Privat. Here the circuit of the Saxons forced the French to yield at 7 P. M. On the French left wing the battle lasted still longer; the victory was gained here by the arrival of the 2d German army corps. The losses were very heavy. The French, numbering about 140,000 men, lost 609 officers and 11,605 men; the Germans, numbering 211,000 men, lost 904 officers and 19,658 men. The result of the battle was that the French army was shut up in the fortress of Metz under such circumstances that army and fortress paralyzed each other. As the army was much too large for a garrison of the fortress, it would soon use up the provisions, and then the fortress would have to capitulate with the army. Calculating thus, the German commander-in-chief ordered the investment of Metz, and disposed of the first and second army, under the command of Prince Frederick Charles, for this purpose. From this force, however, the 4th and 12th corps, the guards, and the 5th and 6th cavalry divisions were separated and formed into a fourth army, under the command of the crown prince of Saxony, who was now to push forward towards Paris, together with the crown prince of Prussia and the third army. Where the army of Châlons was, nobody knew, but it was expected to be found somewhere on the way to Paris. On the French side the first plan was that the army of Châlons should retreat to Paris, but the regency feared that the return of Napoleon, who accompanied this army, would occasion a revolution in Paris; and it also hoped that MacMahon would be able to relieve Bazaine at Metz. For these reasons Count Palikao ordered Marshal MacMahon to break up from Châlons with his army, now numbering 140,000 men, and move northward in a circuit around the German army towards Metz. After much opposition the marshal, as well as the emperor, yielded. MacMahon had first led the army to Rheims (Aug. 21), but when the regency persevered in its determination he broke up from Rheims on the 23d, was at Rethel on the 24th, and at Chêne Populeux on the 27th. But on that day the outposts fell in with the vanguard of the German army, and a cavalry encounter ensued at Buzancy. On the 25th the movements of MacMahon were noticed by the Germans, and the third and fourth armies, which were pushing forward to Paris, and then in the neighborhood of Châlons and Vitry-le-François, were immediately ordered to march to the right. On the 26th both armies wheeled around to the N., and followed MacMahon in forced marches in order to place themselves between him and Metz. On the 28th the French head-quarters were at Stonne, and MacMahon intended to return, as he saw that the Germans approached him. But he received from Paris the imperative order to push forward, and he obeyed. He first thought of going to Stenay, and from that place to Montmédy, but the Germans already occupied the first town. They marched very rapidly, while the French army had made only 60 miles in 6 days. On the 29th, MacMahon removed his head-quarters

to Raucourt, and the army began to cross the Meuse at Mouzon.

Meanwhile, the two German armies, which were drawn nearer together, and already had adopted the plan of pressing MacMahon towards Belgium, came in contact with the right flank and front of the French, and by the encounters at Nouart and Beaumont on the 30th they threw parts of the French vanguard back in confusion on the main body. On the 31st they advanced so near to the army encamping around Sédan that in the evening the guards stood at Carignan, the 12th corps at Mairy, the 4th at Mouzon, the 1st Bavarian at Remilly, the 2d Bavarian at Raucourt, the 5th at Chéhéry, the 11th at Douchéry, the Würtemberg at Boutancourt, and the 6th at Attigny and Semny. The plan was to contract this curve still closer to the French army on the 1st of September, and to attack on the 2d. It was observed, however, that the French were in a wavering and uncertain condition, so that their crossing the Belgian frontier seemed by no means improbable; and for this reason the king ordered the attack on the army of MacMahon, which was very densely concentrated around Sédan, on the next morning. During the night the Würtemberg and the 11th corps crossed the Meuse at Douchéry, in order to cut the French off from the road to Mézières. The French were in a very bad situation. MacMahon had ordered the concentration of his army around Sédan in despair, for the insignificant fortress could give no shelter to the army. He formed his army in a half circle around Sédan, with the two wings resting on the Meuse, as he might expect an attack from any side; but in this position the army had no line of retreat. The 13th corps, under Vinoy, had arrived at Mézières, but no communication could be effected with it. At the dawn of Sept. 1 the German army commenced its attack (*Sédan*), and soon it grappled the French army, which was concentrated on a narrow space, in shape like a pair of tongs. The battle began at Bazeilles, and drew E. of Sédan farther and farther to the N.; on the other side of the fortress it developed somewhat later, but in the same manner, until at last the wings of the German armies united on the plateau of Illy, thus forming a circle which completely surrounded the French. Already, in the beginning of the battle, the French army had lost its commander-in-chief. MacMahon, severely wounded by a splint from a shell, gave up the command to Gen. Ducrot, from whom Wimpffen reclaimed it as the senior officer. Thus, the command and the plan changed several times. It was the idea to break through the German lines somewhere, in order to afford an escape for the emperor, and he himself sought for a long time on the battle-field for such an opportunity; but the undertaking was evidently hopeless, and the army, as its leader, had to submit to its frightful fate. A powerful artillery dashed its missiles from all sides into the orderless and rambling bodies of troops; the shells fell in great number, both in the city and on the battle-field, and, on account of the compactness of the French position, every ball found its man. As, at last, shortly after 3 P. M., one more large battery in the German centre, at Fresnois, opened fire on the city and caused a conflagration, offers to conclude a capitulation were made from the French side. At the same time, however, and before he knew that a French officer with a flag of truce was approaching, the king ordered the fire to be suspended, and sent Col. von Bronsart to Sédan with a summons to surrender the fortress and the army. When Bronsart asked for the commander-in-chief, he was, to his great surprise, introduced to the emperor, who, concerning the negotiations of capitulation, referred him to Gen. Wimpffen. Napoleon then sent the following letter to the king: "As I have not fallen at the head of my soldiers, I surrender my sword to Your Majesty." When this letter was brought to the king by Gen. Reille, adjutant-general to the emperor, the king demanded the capitulation of the French army as the first condition, and declared that he then would accept the imperial sword, and charged the chancellor and his chief of staff with the necessary diplomatic and military negotiations.

The war had arrived at a point where the re-establishment of peace seemed to be possible. The situation was so decisive that it seemed necessary for France to accept even very hard conditions. Yet there appeared to be a difference between the interests of the French sovereign and those of the French nation. Napoleon would not conclude a peace which might make his dynasty impossible; and as soon as he ascertained that Germany would demand the surrender of some frontier districts, he preferred to withdraw from the direction of the negotiations. On the other hand, Germany could not conclude a peace which would be nothing but an armistice, and disappoint the just demands of her people. Count Bismarck felt it his duty to establish a safer frontier by the annexation of the French districts in which the fortresses of Strasburg and Metz are situated, and to compensate the German people for its immense sacrifices by recovering those ancient German countries. The preliminary, purely military negotiations between the generals Wimpffen and Moltke were broken off in the evening of Sept. 1, because the former would not consent to the captivity of his army, and Napoleon was determined to treat personally with the chancellor. Early on Sept. 2 a conference, which lasted several hours, took place at Douchéry, in the hut of a weaver, between the emperor and Count Bismarck; Moltke also participated now and then. But no agreement was arrived at. Napoleon thought that he could not consent to the conditions of peace which were offered, and he preferred to be treated as a prisoner of war, leaving the negotiations of peace to the regency. Thus, the purely military negotiations recommenced, and in the forenoon Gen. Wimpffen concluded the capitulation of Sédan, by which 84,433 men, 39 generals, 230 officers of the staff, and 2095 subaltern officers were surrendered into German captivity. After the conclusion of the capitulation the king and the captive emperor had a conversation of a quarter of an hour at the palace of Bellevue. Napoleon went through Belgium to the palace of Wilhelmshöhe at Cassel, which was designated as a residence for him, and the French army was sent to Coblenz, Mentz, and other German fortresses.

The news of the catastrophe, which arrived at Paris on Sept. 4, caused an immense commotion. Jules Favre and his friends assailed the regency in the Corps Législatif, and demanded the deposition of the emperor. The turbulent elements of Paris filled the streets with tumult and thronged into the hall of the Corps Législatif, which assembly they dispersed. The members of the opposition then assembled at the Hôtel de Ville and formed a provisional government of national defence. Gen. Trochu, who had been governor of Paris since Aug. 17, was elected president; Jules Favre, vice-president; Ferry, secretary; the other members were Arago, Crémieux, Gambetta, Garnier-Pagès, Glais-Bizoin, Pelletan, Picard, Rochefort, and Jules Simon. This government determined immediately on the abolition of the senate and the Corps Législatif. At 1 o'clock P. M. the empress left the Tuileries and fled to England.

The military situation of France was very bad. Not only the army of Châlons was lost, but the Rhine army had also suffered considerably. It had tried to make sallies from Metz Aug. 31 and Sept. 1 (*Noisseville*), but the result was that it became completely shut up in the fortress. The French government counted on the perseverance of Bazaine, and it reckoned that a considerable force would be detained before Metz, which the Germans would miss in their further progress. But it had absolutely no troops at its disposal to place against the German army in the field, and it could not prevent the enemy from laying siege to Paris. The only hope was that the new and numerous levies would soon be able to act as real troops, and the greatest energy was displayed in their training, equipment, and organization. The task was much facilitated by the importation of arms and munitions from England and America. Paris—thus reckoned the French government—would hold out long enough to be relieved by the new army. From the beginning of its functions the government declared that it would carry on the war to the very last, and not surrender one stone of its fortresses or one inch of its soil.

To take Paris was considered by the Germans as the most important task of the war, and immediately after the capitulation of Sédan the victorious armies began to move towards the capital. They pursued two parallel roads, and, arriving before Paris, the third army wheeled round to the S., so that on Sept. 19 the investment of the city was complete. The idea was to compel it to surrender by starving it. On account of its extent and the number of its inhabitants, this plan seemed the best. To attack it was very difficult. It had sixteen strong forts, and numerous well-built fortifications between and behind the forts. The works were mounted with very heavy ordnance served by marines, and the large army which was garrisoned in the city, although not disciplined or organized, could be very dangerous in a fight on the walls and in the streets. This army consisted of 100,000 real soldiers—marching regiments, marines, gendarmes, and fugitives from the previous battles; and in addition 100,000 men of the active national guard of the provinces and 200,000 men of the national guard of Paris. The strength of the besieging army was only 122,000 infantry and 24,000 cavalry, with 622 cannon. The complete investment of Paris, extending over a line of 50 miles, was carried out on Sept. 19, after some fighting at Châtillon, Meudon, Plessis-Picquet, and Moulins de la Tour. The fourth army took position to the N. and E., the third to the S. and W.; and the positions were everywhere fortified to withstand the sallies from Paris. In order to organize a resistance against the invasion of the provinces, two members of the provisional gov-

ernment, Crémieux and Glais-Bizoin, were sent to Tours, and on Oct. 6 they were joined by Gambetta, who left Paris in a balloon. Thiers commenced a tour to the different European courts to ask for their intervention, though without any result.

Meanwhile, after taking the fortress of Toul on Sept. 23, and that of Strasburg on Sept. 27, the Germans opened a safe and rapid communication with Germany, which enabled them to draw reserve troops, ordnance, and other requisites of war to the army around Paris. On Oct. 21 this army numbered 202,000 infantry, 33,794 cavalry, and 898 guns. Heavy cannons were still wanting, however, to commence the bombardment. At the end of September, Jules Favre had commenced negotiations with Count Bismarck concerning an armistice, but they led to nothing, and the war was continued with energy. On Oct. 5, the 4th cavalry division, which was posted S. of Paris in observation, noticed a French force drawing northward. It was the 15th corps, under Gen. Motterouge, the first rudiment of the army of the Loire, now forming. An army was immediately formed, under the Bavarian general von der Tann, consisting of the 1st Bavarian army corps, the 22d division, and the 2d, 4th, and 6th cavalry divisions, and on Oct. 26 this army advanced from Paris against the French. On Oct. 10, Gen. von der Tann met them before Orléans, took 3000 prisoners and 3 guns, threw them back on the other side of the Loire, and occupied Orléans on the 11th. Gambetta, the head of the delegation at Tours, recalled De la Motterouge, and appointed D'Aurelle de Paladines in his place. This general began to organize a larger army at Blois and Salbris, while Tann remained in Orléans, and only sent out detachments to Châteaudun and Chartres to disperse swarms of tirailleurs. On the other sides of Paris small encounters with newly-formed bands took place at this time, and the German army had to enlarge its line of occupation, S. to the Loire, W. to the Eure, N. to the lines of Vernon, Gournay, Breteuil, Montdidier, and Soissons. The Parisian garrison made several sallies—on Sept. 23 against Villejuif in the S. and Le Bourget in the N.; on the 30th against Villejuif, Chevilly, Thiais, and Choisy-le-Roi; on Oct. 13 against Châtillon and Bagneux; on the 21st against Malmaison and Buzenval; and on Oct. 28 the Parisians took Le Bourget, from which they were expelled, however, two days afterward. They appeared in large masses and fought well, but could not compare with the experienced and well-conducted Germans, and were always thrown back with heavy losses.

In September an obstinate war arose in the Vosges, and soon expanded over the departments of Vosges, Haut-Rhin, Haut-Saône, Doubs, Haute-Marne, Aube, and Côte d'Or. After taking the fortress of Strasburg, which was commanded by Gen. Uhrich, Gen. Werder moved towards Troyes and Châtillon with the 14th corps, consisting of 23 battalions, 20 squadrons, and 72 guns, and fought at Raon l'Étape, the Oignon, Etuz, and Cussey against Garibaldi's corps and other companies of volunteers. At the end of October he had confined the enemy to Besançon, and took up a position of observation at Gray. On Oct. 27 an important event took place; Metz capitulated. After the unsuccessful sallies on Aug. 31 and Sept. 1, Bazaine kept quiet, and the several sallies made after Sept. 22, and made with partial success, had no other purpose than the acquisition of provisions. Famine and sickness beset his army, and made it, from the middle of October, incapable of further operations. The German army, too, suffered very much from its long inaction in the wet weather; it had 15 per cent. sick.

At last, Bazaine determined to capitulate; first he tried, however, to enter into political negotiations. He sent Gen. Boyer to the head-quarters of the king of Prussia at Versailles, asking for conditions which would give him political influence. It was in vain. He had to conclude a purely military capitulation with Prince Frederick Charles, by which the fortress of Metz, with all its stores of arms and ammunition and an army of 180,000 men, was surrendered to the Germans. All France was filled with terror and fury, and Gambetta indulged in the most vehement accusations against the "traitor" Bazaine. For the Germans it now became possible to employ the first and second army on the Loire and in the N.

Operations on the Loire.—The French army of the Loire, numbering about 70,000 men, with Gen. d'Aurelle de Paladines for commander-in-chief, and consisting of the 15th corps, under Gen. Martin des Paillères, and the 16th corps, under Gen. Chanzy, started (Nov. 8) from Mer, Suevres, and Marchenoir, where it had been stationed since Nov. 3, and moved towards Orléans, which Gen. Tann occupied with the 1st Bavarian corps and the 2d cavalry division. It was D'Aurelle's plan to reach the road from Châteaudun to Orléans on the 9th, and place himself between that part of the enemy which was at Orléans and that which was at Chartres, thus cutting off Tann. Tann, however, noticed the manœuvre, and in the night before the 9th he concentrated his corps at Coulmiers and called in the troops at Chartres. On the 9th the battle of Coulmiers took place, in which Tann was compelled to retreat. He went to Toury and joined (on the 10th) the 22d infantry and the 4th cavalry divisions, after which he waited for another attack. But D'Aurelle was not able to follow. He marched to Orléans, took up a fortified position, and waited for reinforcement. Meanwhile, the 17th infantry and the 6th cavalry divisions were sent to Gen. Tann, and the grand duke of Mecklenburg-Schwerin was appointed commander-in-chief of the combined force at Toury. Prince Frederick Charles, who since Nov. 2 had been on the march from Metz through Troyes, was ordered to push forward his army, consisting of the 3d, 9th, and 10th corps and the 1st cavalry division, to the middle course of the Loire, and seek the enemy. But until the prince arrived the grand duke had to watch alone the whole extensive region between Paris on the one side and Orléans and Le Mans on the other. The 15th and 16th French corps remained quiet at Orléans, but at Mer and Blois the 17th corps had been organized under Gen. Durrien, and numbered 40,000 men, and it was pushed forward to Châteaudun. Gambetta, who, in fact, was the strategical leader on the Loire, intended a concentric advance on Paris of all three corps. This plan was not executed, as D'Aurelle considered the army too weak, but the movement of the 17th corps occasioned the grand duke to turn to the W. He left the 2d cavalry division at Toury, and marched the main body towards Chartres on the 13th of November, in order to meet any attack on the army around Paris. But when he arrived at Allonnes, on the evening of the 13th, he learnt that a considerable force, advanced parts of D'Aurelle's corps, had been noticed at Artenay, and for this reason he sent only the 22d infantry division towards Chartres, while he remained himself with the main body at Allonnes. On the 14th French squadrons were observed marching through Dreux towards Houdan, and only two days' march distant from Versailles, the German head-quarters. Versailles was consequently strongly garrisoned, and the 5th cavalry division and some infantry were sent against the new enemy. But in order to secure all threatened points the grand duke marched (Nov. 15) the 17th division to Rambouillet, the 1st Bavarian corps to Auneau, and left the 22d division and the 6th cavalry division in Chartres, the 4th cavalry division at Voves, and the 2d at Toury. At the same time, however, the front of the second army appeared at Fontainebleau, and the grand duke was ordered to confine himself to the region W. of Paris, while Prince Frederick Charles was to look after that S. of the city. The prince was reinforced by the 2d, the grand duke by the 5th cavalry division. In accordance with these dispositions, the grand duke pushed the 17th division forward to Maintenon on the 16th, and drew the other troops nearer to Chartres. The 22d division, the 1st Bavarian corps, and the 6th cavalry division were sent to Châteauneuf on the 17th. All these divisions came into contact with the enemy, troops newly organized by Gen. Fiereck. The 17th division fought at Dreux on the 17th, the other divisions on the 18th at Châteauneuf, Digny, and Courville. The grand duke followed the retreating enemy, under continual small engagements, to Nogent le Rotrou, and was on Nov. 22 on the line of Bellême, Le Theil, La Ferté-Bernard, and Authon. Here he received orders from Versailles to march to Beaugency, as the main body of the enemy still rested on the Loire.

The French army had increased considerably. Its right wing had been strengthened by the 18th corps, formed at Nevers under Gen. Abdelal, but destined to operate under the immediate leadership of Gambetta; and the 20th corps, consisting of fragments of Cambriel's corps, which were brought from Besançon to Gien and placed under Gen. Crouzat. It was Gambetta's idea that these corps, in connection with the 15th corps, should make a sally towards Paris over Pithiviers. He calculated that this sally would strike the advancing army of Prince Frederick Charles on the flank. The prince marched with a broad front in a southwestern direction. He had his head-quarters in Pithiviers on Nov. 20, and on the same day he concentrated his 3d corps on this place; the 10th reached Montargis; and the 9th rested on the road from Orléans to Paris, in the neighborhood of Angerville. On Nov. 21 the army numbered 49,607 infantry, 10,166 cavalry, and 276 guns. On the 24th all the corps made reconnoissances towards the French front, and an encounter took place between the 10th German and the 20th French corps at Bois Commun. The prince observed that the French occupied a very extensive line along the forest of Orléans, and determined to wait till the grand duke could join him in order to attack the whole line. The intended French sally on the right wing was delayed several days, as Gambetta and the deputy Freycinet, his right

hand in military affairs, met with opposition from D'Aurelle. At last it was executed on Nov. 28 by the 18th and 20th corps under telegraphic advice from Tours, but it failed, as it was met at Beaune-la-Rolande by the 10th German corps. A bloody fight ensued, but the French had to yield in spite of their great bravery. On Nov. 30 the grand duke united with the right wing of the second army, and the force under the supreme command of the prince now amounted to 85,000 infantry, 18,000 cavalry, and 484 guns, while the French army of the Loire numbered about 200,000 men. Another moment of great consequence had come, and it called forth great exertions and important battles in and before Paris.

Paris from the end of October to the beginning of December.—The loss of La Bourget and the capitulation of Metz depressed the Parisians very much, and when Thiers, on his return from his diplomatic tour, opened negotiations for an armistice, hopes of peace awoke. The general relaxation of spirit even induced the Socialists to make an attempt (Oct. 31) to seize the reins of the government, but the attempt failed. Then the news of the victory of the army of the Loire, brought to Paris by a carrier pigeon, changed the situation suddenly and completely. Paris determined to try its utmost. Gen. Trochu had now completed the organization of the Parisian army. In November there existed three armies: the first, under Gen. Thomas, consisting of 300,000 national guards, was employed in the defence of the city line and the maintenance of public order; the second, under Gen. Ducrot, formed of troops of the line and active national guards from the provinces, and numbering 120,000 men, with 80 batteries, was to make sallies; the third, under the special command of Gen. Trochu himself, formed of regular troops and marines, and numbering 80,000 men, defended the outworks. The idea was to break through the German lines with the second army, and establish communication with the army of the Loire. Gen. Trochu believed that the end of November would be the right moment for the execution of this plan. The German army around Paris was reinforced (Nov. 10) by the 2d army corps, which, on its arrival from Metz, united with the right wing of the third army on the left bank of the Seine.

On Nov. 24 and 25 the Parisians began to make preparations for the great sally. They built bridges at St.-Denis and Bezons. On the 26th and 27th they built works on the peninsula of Gennevilliers. These measures, however, were mere feints, as the sally was not intended to take place here, but in the S. E. In the night before Nov. 27 a preliminary attack was made on the 6th corps at Choisy-le-Roi; a bridge was built a little below this place, and on Nov. 28 all the armed masses were gathered on the eastern front of Paris. During the night before Nov. 29 a heavy fire was directed from the forts against the German positions, especially against the Saxons and Würtembergers on the eastern front, and it was kept up during the next day and night. On the morning of the 30th, after a demonstrative sally against the 6th corps, an attack with considerable force took place in the S. E. It was effectively supported by a cannonade from all the adjacent forts, especially from Mont Avron, which had been mounted and garrisoned two days previously. At the same time Vice-Admiral de la Roncière le Noury concentrated, as a demonstration, a force of troops at St.-Denis, and two divisions were pushed forward, for the same purpose, on the peninsula of Nanterre. The main body of the attacking army, numbering about 50,000 men, turned against the Saxons and Würtembergers at Champigny, Brie, and Villiers; one division, numbering about 20,000 men, pushed forward towards Mesly and Montmédy. Brie and Champigny fell into the French hands, but Villiers was stubbornly defended. At Mesly and Montmédy the Parisians were thrown back by the Würtembergers and the 7th Prussian brigade. The attempt at breaking through had failed, and the coldness of the night made the Parisians, who encamped in the open air without any covering, completely incapable of fighting on the next day. The 1st of December passed quietly, but the Germans reinforced all the threatened points with divisions of the 2d and 6th corps. On Dec. 2, in the dusk of the morning, the Germans resumed the offensive. Brie and Champigny were partly retaken, but the fight was fierce, and as the French too received reinforcement, it lasted till night. On the morning of Dec. 3 the Parisians left the left bank of the Marne and retreated to the city, with a loss of about 10,000 men. The German army had also lost heavily during these three days—163 officers and 3341 men. The failure of this violent and obstinate attack was a hard blow for the defence of Paris, as from this moment any prospect of breaking through the German lines from within the city was completely closed.

Operations of the Army of the Loire in December.—The army of the Loire, on which, to a great extent, the hope of a successful resistance to the invasion rested, suffered at the same time great defeats. In connection with the sally from Paris the deputies at Tours determined to make a powerful sally from Orléans, in spite of the defeat at Beaune-la-Rolande. It was Gambetta's plan that the left wing should wheel round to the right and push forward towards Pithiviers, and the centre occupy Orléans and support the left wing, while the right wing should engage according to circumstances, yet with a general tendency towards Pithiviers. In accordance with these dispositions, Chanzy pushed forward on Dec. 1 with the 16th corps, and in the neighborhood of Loigny he met the vanguard of the grand duke. He threw it back, and determined to pursue his advantages on Dec. 2. But in the evening news arrived of a great victory achieved by the Parisians, which filled the troops and the generals with enthusiasm. The 17th corps marched during the night in the direction of Patay and St.-Peravy, in order to support the 16th corps. D'Aurelle also pushed one part of the 15th corps forward. Meanwhile, the grand duke made his dispositions to assume the offensive on the 2d, and both armies met at Loigny. The Bavarians were first thrown back, but the 17th division retook the position. The 16th, 17th, and parts of the 15th corps, the left wing and the centre of the French army, were defeated by the German right wing (*Loigny*); Loigny and Poupry were stormed by the Germans; and in the evening the French were driven back to Artenay and Patay. On the same day Prince Frederick Charles received orders to attack Orléans, and he immediately made his dispositions for a concentrated attack of all the corps. The French army stood in a very bad position, with its wings widely separated and the centre very weak. Gen. d'Aurelle considered it best to make a general retreat to the left bank of the Loire. With fighting at Chevilly, Chilleurs, Neuville-aux-Bois, Artenay, and Patay on Dec. 3, and at Cercottes, Gidy, St.-Peravy, Ormes, and Orléans on Dec. 4, the army of the Loire was completely driven back and compelled to give up Orléans, although the deputies at Tours insisted to the very last moment on its being held. At midnight the grand duke occupied Orléans. The French army, which in the fight of the last days had lost 12,000 prisoners, 60 guns, and about 6000 dead and wounded, separated under the pressure of the pursuit into two parts. The 18th and 20th corps retreated to Gien and Sully, the 15th to Salbris, and the 16th and 17th to Beaugency and Blois. Gen. d'Aurelle resigned his command on Dec. 6, and the 16th and 17th corps, forming the second army of the Loire, were placed under Gen. Chanzy, and the other three corps, forming the first army of the Loire, under Gen. Bourbaki.

Prince Frederick Charles made immediate preparations to pursue the enemy in all directions. The 2d corps was to follow the right bank of the Loire to Gien; the grand duke to move to Tours; the 6th cavalry division and four battalions to Vierzou; and the 9th and 10th corps were to remain at Orléans as a reserve. All these divisions came in contact with the enemy, especially the grand duke, who met Gen. Chanzy. On Dec. 7 the 17th division first encountered the enemy at Meung, and threw him back. Advancing farther on the following day, a battle was developed between Beaugency and the forest of Marchenoir. As Chanzy had been reinforced by the 21st corps, organized at Le Mans, and by parts of the 19th corps, he ceased retreating, and took up the offensive. He had 120,000 men, and with this force he made every effort to cut off the grand duke from the road to Tours. He had to yield, however, and on Dec. 8, Beaugency was occupied by the Germans. But the resistance of the French was so obstinate that Prince Frederick Charles sent the 10th corps to the grand duke. On the 9th the battle was renewed. Chanzy attempted to surround the German wing from the forest of Marchenoir; he did not succeed, but the battle was undecided on this day. On the 10th the French attacked and took several villages, but ultimately they were thrown back. On the 11th the 10th corps arrived, and, thus reinforced, the grand duke began to pursue the slowly retreating enemy. During the three battle-days the grand duke lost about 4000 men; Chanzy still more, besides 5000 prisoners. Chanzy now altered the direction of the retreat. After Dec. 11 he moved westward, probably determined by the advance of the 9th German corps, which pushed forward along the left bank of the Loire and occupied Vienne, the suburb of Blois, on Dec. 10. The deputies at Tours fled the same day to Bordeaux. But the pursuit of Chanzy's army was continued only for a few days, as Prince Frederick Charles was afraid Bourbaki's army would advance towards Paris in the mean time. For this reason he ordered, on Dec. 16, when it became apparent that Chanzy had retreated on Le Mans, that the 9th corps should occupy Orléans, the 3d, Beaugency, the 10th and the 1st cavalry division, Tours, and the grand duke a central position around Chartres.

Operations of the Army of the North until the end of

1870.—After the capitulation of Metz, Gen. von Manteuffel, with the 8th and the largest part of the 1st corps and the 3d cavalry division, numbering 38,244 infantry, 4433 cavalry, and 180 guns, moved westward to meet the French force newly organized in the northern departments. On Nov. 20 he occupied a line from Compiègne to Noyon, and pushed forward towards Amiens. The organization of the army of the north was originally entrusted to Gen. Farre, but on Oct. 22, on his removal from Metz, Bourbaki had received the command, and, on his being called to the Loire, Gen. Faidherbe was appointed commander-in-chief. He did not enter on his office, however, until Dec. 3, and meanwhile Gen. Farre had the command. He held, with 25,000 men, an extensive intrenched position at Amiens, and Gen. Manteuffel encountered him, after some small skirmishes, at Quesnel and Mézières on Nov. 27. A battle ensued. The French were defeated, but not pursued. Amiens was occupied the following day, and on Dec. 1, Manteuffel continued his march to Rouen, in order to attack a division of the enemy which was posted there under Gen. Briand. The fortress of La Fére, besieged since Nov. 16 by the brigade Zglinitzki, capitulated on Nov. 27. The first army marched, with the 8th corps on its right wing, through Foix and Forges, and with the 1st corps on its left wing, through Breteuil; and on Dec. 4 it surprised Gen. Briand between Forges and Buchy, defeated him, and occupied Rouen the following day. From here Manteuffel sent out detached columns to Dieppe and in the direction of Hâvre.

Meanwhile, Gen. Faidherbe had organized another army with great energy, and marched it from Lille towards Paris. The interruption of the telegraphic communication between Amiens and Rouen, and the appearance of French troops at Bapaume and Roye, called forth from the German side rapid counteraction. Manteuffel received orders to concentrate his army at Beauvais, while Gen. von Kameke, who had taken Thionville on Nov. 24 and Montmédy on Dec. 17, should occupy Mézières, and the detachment encamping there march to St.-Quentin. On Dec. 20, Faidherbe rested with three divisions, under Lecointe, Paulze d'Ivoy, and Moulac, numbering 40,000 men, with 78 guns, between Péronne and Corbie, behind the Somme. He had at one time proceeded still farther southward, attempting to relieve Paris, but on the advance of Manteuffel he had returned and chosen a good position behind the Somme, in order to draw reinforcements to him and act on the defensive. On Dec. 20 a short fight took place between his outposts and a reconnoitring detachment from Amiens. On the 23d, Manteuffel had drawn together so much of his scattered force as to take the offensive. Faidherbe now held an extensive intrenched position at the small river Hallue. He made an obstinate and well-conducted resistance to the enemy, who numbered about 20,000 men, and he kept the greater part of his position. On the 24th both armies were again ready for battle, but in the evening the French made preparations for a retreat, which was carried on the following day in the direction of Douay. The Germans followed through Albert to Bapaume, Achiet, and Bucquoi, but here they stopped, surrounding Péronne. Manteuffel sent out detached columns in different directions, and ordered the 8th army corps to take up its position at Bapaume. Meanwhile, about 20,000 Frenchmen appeared in the vicinity of Rouen, advancing on both sides of the Seine. Gen. von Bentheim, who was at Rouen, hastened to meet them; on Dec. 31 he threw them back and stormed the fortified castle Robert le Diable. The first army now took up a position with the 1st corps at Rouen, and the 8th at Somme. Faidherbe reorganized his army in the northern fortresses. Mézières capitulated in the night between Dec. 31, 1870, and Jan. 1, 1871.

The War in the South-East to the end of 1870.—At the end of October, Gen. von Werder received orders to secure the march of the second army from Metz to Orléans from any French attack on its left flank, and to pursue the investment of the fortresses of Schlettstadt, Neu-Breisach, and Belfort. Accordingly, Werder took up a position at Vesoul, and sent Gen. von Beyer with the main body of the troops of Baden to occupy Dijon. Beyer met with an obstinate resistance at Dijon on Oct. 30, and could not take the town until next day after severe fighting. Belfort was surrounded by Gen. von Frischow on Nov. 3; Schlettstadt surrendered on Oct. 25 to Gen. von Schmeling, and on Oct. 27 he began to besiege Neu-Breisach, which surrendered Nov. 10. The siege-train was then carried to Belfort. Having secured the march of the second army, Werder undertook in the middle of November a march in the direction of Dôle, and destroyed the railway from Besançon to Lyon. On reconnoitring Auxonne he saw that the fortress could not be taken by one stroke, and he then took up a central position at Dijon. The troops under Garibaldi and Cremer remained around Châlons and Chagny, but on Nov. 20, Werder learned that the corps of Michel, which hitherto had been stationed in this neighborhood, had marched westward. On Nov. 26, Garibaldi ventured an attack on Dijon with 18,000 men and 12 guns, but was thrown back to Autun in utter confusion. Werder remained quiet at Dijon, and the 7th corps, arriving from Metz on Dec. 9, established communication between him and Prince Frederick Charles, occupying a position on the line between Chaumont and Joinville. After the defeat of the French army of the Loire at Orléans, Werder, commanding the 14th, and Gen. von Zastrow, commanding the 7th corps, received orders to secure the communication between the second and third armies, and to watch the movements of the French forces combined under Bourbaki. The German forces were divided and employed in different undertakings. Several encounters ensued. Gen. von Glämer met Cremer at Nuits on Dec. 18. Cremer held a good position, and had 18,000 men, but was defeated. Gen. von der Goltz beat several battalions of active national guards and troops of the line in the neighborhood of Langres. On Dec. 26 it became evident to Werder that a French army was approaching from the W., and he accordingly drew together his whole force at Vesoul. Von Zastrow marched from Auxerre back to Châtillon. The expected attack did not take place, however; Bourbaki's army was not yet ready for the offensive.

Before Paris the situation had continued essentially the same since the unsuccessful sally on Nov. 30. In the middle of December it was observed by the Germans that the French were preparing a sally to the E., and on Dec. 20 stronger forces were concentrated on the threatened points, French columns having assembled at Noisy-le-Sec and Merlan. On Dec. 21, in the morning, the Parisians made a heavy attack both on Le Bourget and on Stains. At noon an attack was directed against Maison Blanche, occupied by the Saxons, and Ville Evrart. Although they had gained several advantages, the Parisians were thrown back towards evening, but they remained during the night outside of the walls of Paris, at Noisy-le-Sec, Bobigny, Bondy, and Mont Avron, and on the following day they tried to push forward in the valley of the Marne with two brigades. They remained outside on the 23d too, but returned to Paris on the 24th. On the German side preparations had been made since Dec. 4 for an artillery attack on the city, especially for a bombardment of Mont Avron. On Dec. 27 the bombardment began, and a few days after Mont Avron was taken. Against the south-western front too 275 guns were brought into position at the end of the year, in spite of the difficulties arising from the distance between the terminating point of the railway, Nanteuil, and the point designated for the park of artillery, Villacoublay. The command of the engineers was entrusted to Maj.-Gen. von Kameke, that of the artillery to Maj.-Gen. Prince Hohenlohe, and the Germans only waited for a clear day in order to begin the bombardment.

The beginning of the year 1871 brought the last great battles and the decision of the war. On the French side the government of national defence having brought hundreds of thousands under arms since Nov. 2, 1870, by enormous conscriptions, determined to try, at every point of the war-theatre, to make one last great effort to conquer the invaders. On the German side it was determined to meet the attempt by giving up the passive attitude of the last weeks and assuming the offensive, keeping the defensive only in the S. E., where Bourbaki might make an attack. Before Paris the bombardment was to begin in order to exercise the last moral pressure on the defence, already slackening. From Orléans, Prince Frederick Charles was to take the offensive against Chanzy at Le Mans, and in the N. the first army should advance against Faidherbe.

Operations around Le Mans.—On Jan. 1, 1871, Prince Frederick Charles received orders to attack Gen. Chanzy, and the 13th corps, under the grand duke of Mecklenburg, and the 2d and 4th cavalry divisions were once more placed under his command. While he advanced the 5th cavalry division was to secure his right flank. The prince left the Hessian division at Orléans, one detachment at Blois, another at Gien, and on Jan. 5 he began the operations against Le Mans with 57,737 infantry, 15,426 cavalry, and 318 guns. On Jan. 6 the first encounter took place between the prince and the French army, which also was advancing on the offensive, and now followed daily battles on ground much cut up and in extremely rough weather, snow alternating with mist, until on the 12th the French army was completely defeated. On the 10th, 11th, and 12th the battle raged in the immediate neighborhood of Le Mans. Chanzy's army was compelled to retreat to Alençon and Laval, leaving 18,000 prisoners, 20 guns, and 2 colors in the hands of the Germans, and having lost 10,000 dead and wounded. The German army lost 180 officers and 3470 men. The pursuit was effected by detached columns, while the main body of the second army remained at Le Mans, and the 13th corps marched to Alençon.

In the S. E. the war lasted longer. In the beginning of January, Bourbaki began to operate here with an army of about 140,000 men and 300 cannon, formed of the 15th, 18th, 20th, and 24th corps. In the last days of December and in the beginning of January he had concentrated this army at Besançon, using the railways which from Nevers and Lyon centre at this fortress, and he now began to advance in the direction of Belfort. The 24th corps formed his right wing, moving along the Jura. Garibaldi and Cremer were to operate at Dijon, in order to secure his left flank. Bourbaki was at Dijon on Jan. 2, and on the 5th and 6th skirmishes with the German outposts took place at Vesoul. On the 6th and 7th the Germans ascertained the concentration of the enemy at Besançon, and dispositions were made accordingly. Zastrow was ordered to gather his army corps at Châtillon-sur-Seine; Francesky to advance with the 2d corps from Montargis over Joigny and Tonnerre to Nuits; and Werder to cover the besieging army at Belfort, and to operate so as to prevent the enemy from throwing himself upon the 2d and 7th corps. Moreover, in order to impair Bourbaki's communications from behind, the railways from Langres to Chaumont, from Epinal to St.-Loup, and from Mühlhausen to Bâle were destroyed, and the ministry of war in Baden was applied to for the formation of a reserve force in Southern Baden to prevent the French from crossing the Rhine. In order to procure a perfect co-operation of all the different corps in the S. E., Gen. von Manteuffel was called from the army of the north and appointed commander-in-chief of the 2d, 7th, and 14th corps. He was, in general, instructed to threaten Bourbaki's army in the flank and rear with the 2d and 7th corps, while Werder met him in the front. It was Gambetta's plan that Bourbaki should cut off the German communication between the Rhine and Paris, thereby making a continuation of the siege of Paris impossible, relieve Belfort, and fall into Baden with one part of his army. Bourbaki's army was capable of doing this, so far as regards its numerical strength; with the troops of Garibaldi and Cremer it numbered about 180,000 men. But the troops were newly levied and newly organized, and equipments and provisions were deficient. The rough season also offered a great obstacle.

Gen. von Werder retreated slowly before the French army from Vesoul to Belfort, always in close contact with the enemy, and trying to detain him by detaching the brigade Goltz and the 4th reserve division in a demonstration against his left flank. The attempt succeeded completely. In the actions at Marat and Villersexel, Bourbaki wasted time and strength, employing a large force against a weak enemy. Thus, the French did not attack the German position on the Lisaine before Belfort until Jan. 15, and in the mean time Werder had made extensive preparations for a tenacious defence. For three days Bourbaki tried with his dense columns to defeat the enemy, but in vain; on the 18th he had to retreat, leaving behind him 8000 dead and wounded. But now Werder began to pursue him, and at the same time Manteuffel appeared from the N., cutting off his retreat to Lyon and pressing him towards Switzerland. Garibaldi, who was at Dijon to cover the rear of the great French army, did not accomplish this object. On Jan. 12, Manteuffel entered on his command of the 2d and 7th corps, and pushed forward immediately in a south-eastern direction to Selongey, Prauthoy, and Longeau, sending Gen. Kettler with a detachment against Dijon, to keep Garibaldi engaged. The 7th corps reached the eastern points of Côte d'Or on Jan. 16, and Selongey on the following day. As the situation at Belfort became perfectly clear on this day, and as the victory over Bourbaki followed on the 18th, an attempt could now be made to prevent the French army at Besançon from any further retreat. The army under Manteuffel changed its march, and proceeded still more directly to the S. On Jan. 20 the 7th corps crossed the Saône at Savoyeux, and the 2d took Pesmes; on the following day the former reached Dampierre, and the latter Dôle. Dijon was passed by, and Garibaldi, at the head of more than 20,000 men, was kept completely in check by a single detachment. On the 22d the reconnoitrings extended beyond the Doubs; on the 23d the road from Besançon to Lons-le-Saulnier was occupied, and thus the French were cut off from the direct line of retreat to Lyon. The 14th division had on the same day an engagement at Darnemarie, and ascertained the presence of the 20th, later on that of the 15th and 18th French corps. On Jan. 25 the 7th corps stood at St.-Vit and Quingey, and the 2d corps behind it on a line from Salins to Dôle. The 14th corps also advanced from the N. W. against the French army at Besançon. On Jan. 25 the division of Schmeling occupied Baume-les-Dames on the Doubs, to the N. E. of Besançon. From Blamont, nearer to the Swiss frontier, Gen. von Debschütz advanced in order to co-operate with Gen. von Schmeling against the road from Besançon to Pontarlier. At the same time Gen. von Werder had reached the vicinity of Rioz, just N. of Besançon, with three brigades of his corps, and occupied the passages across the Oignon, at Voray, Étuz, and Pin. Thus, Bourbaki at Besançon was surrounded by a circle which was open only towards Switzerland in the direction of Pontarlier. The unfortunate general fell into melancholy on account of his defeats, which destroyed the last hope of France, and as he now saw that he would have either to capitulate or to retreat on Swiss soil, he gave up the command to Gen. Clinchant and shot himself through the head, causing, however, only a severe wound.

On Jan. 25, in the morning, Gen. Clinchant commenced the general retreat to Pontarlier of the whole corps concentrated around the fortress of Besançon; only the cavalry division and about 8000 infantry had escaped to Lyon by Lons-le-Saulnier before the Germans cut off their retreat. On Jan. 28 the French army was in the vicinity of Pontarlier, on the Swiss frontier, facing N. W., with the 18th corps to the right, the 15th in the centre, at Sombacourt and Chaffois, and the 20th to the left, at Frasne; the 24th corps, which had arrived in great confusion, was behind the centre and formed the reserve. Manteuffel made the following dispositions for the attack on the French army, which had been brought into a position so very unfavorable: the 7th corps was to push forward against Pontarlier, the 2d to cut off all the roads to Lyon as yet free; and the division of Schmeling was to attack from the N. On Jan. 29 the 2d corps reached Les Planches after a short fight, and the 14th division threw the 15th French corps back to Pontarlier, beyond Sombacourt and Chaffois.

In the mean time the events of Paris had come to a decision, and in the negotiations concerning an armistice between Count Bismarck and Minister Favre particular notice was taken of the peculiar situation in the S. E. As Bismarck demanded, and Favre peremptorily refused, the surrender of the fortress of Belfort, Favre proposed as an expedient to let weapons decide with regard to Belfort and the whole south-eastern theatre of war; and thus the armistice of Jan. 28, 1871, did not comprise these fields. Favre telegraphed the conclusion of the armistice to Gambetta, but forgot to mention that an exception was made with respect to the departments of Côte d'Or, Jura, and Doubs. As now Gambetta simply showed to the generals of the republic a conclusion of an armistice, while Count Bismarck communicated to the German generals the article of exception also, misunderstandings arose. On Jan. 30 the German army continued its attack on Pontarlier, and when the 2d corps occupied Frasne and made over 3000 prisoners, Gen. Clinchant referred to the armistice and proposed to enter into negotiations. Gen. von Manteuffel refused; he advanced, occupied on the 31st the pass St.-Marie in the mountains S. of Pontarlier, and rested on Feb. 1, at noon, with his columns before Pontarlier, ready for battle. On the same morning, however, Gen. Clinchant had concluded a convention with the Swiss commander-in-chief, Gen. Herzog, according to which the French army should retreat into Switzerland and be disarmed there. The retreat began on the very day the convention was concluded, Feb. 1, and only a rear-guard remained still on French soil to cover the retreat. In the afternoon the German brigade Du Trossel attacked this rear-guard, occupied Pontarlier, made 4000 prisoners, and took a great number of carts loaded with provision and arms. In the afternoon Manteuffel had his head-quarters at Pontarlier, while the French army withdrew into Switzerland by several mountain-roads, the main body by way of Verrières. The small republic of Switzerland was completely inundated with French fugitives. Some 85,000 men, with 10,000 horses, both men and animals in a miserable condition from cold and famine, were received and provided for. The rest of the army was scattered; 15,000 men were taken prisoners in the last days, and 20,000 escaped to the S. Garibaldi, heavily pressed by Gen. Weyhern, appealed first to the armistice, but, as this was not recognized by the Germans, he retreated to the S., and escaped by rail. Belfort capitulated on Feb. 16, and thus in this region too the war was ended.

In the N. Gen. von Göben took the command in Manteuffel's place on Jan. 8. Very soon after the battle at the Hallue, Faidherbe had taken the offensive once more, and he now tried to relieve Péronne. The 15th division and the detachments of Göben and Prince Albrecht of Prussia were in the vicinity of Bapaume to cover the siege of Péronne. Their vanguard was defeated by the French on Jan. 2, but Gen. von Kummer concentrated the 15th division at Bapaume, Gen. von Göben sent reinforcement, and on Jan. 3 a successful resistance was made to Faidherbe. In the night before Jan. 4 the French retreated, and Péronne capitulated in the night between Jan. 9 and 10. After repeated reconnoitrings and demonstrations on both sides, the French army of the N. was concentrated around

St.-Quentin on Jan. 16, and Gen. von Göben took up a position accordingly 10 miles W. and S. of St.-Quentin, in order to prevent the march of the enemy to Paris. On Jan. 19 the Germans attacked the enemy, who were in a half circle around the city, and defeated him after a fight of seven hours. The French were compelled to flee in confusion, and were pursued the following days to Cambrai and Landrecies. From Jan. 25 to 27, Göben returned to his position behind the Somme, and with the armistice of Jan. 28 the war operations ceased.

Besides several minor sallies Paris ventured upon a large engagement on Jan. 19, probably in concert with the last movements of Gen. Faidherbe. In the beginning of 1871 the lack of provisions in the great city became serious, and the military commanders were without hope. From the German side the bombardment began on Jan. 5, first of the outworks of the southern front, then of the city, and finally also of the northern front, but it did not produce the intended impression; instead of exercising a moral pressure, it stimulated the population, suffering under the monotony of a passive resistance, to new energy. Gen. Trochu was urged more than ever to make a sally *en masse*. Trochu, who considered the defence of Paris a completely aimless undertaking, and who during the whole siege followed the wishes of the population rather than military plans, yielded also now to public opinion and arranged a sally. On Jan. 19, and under his own command, more than 100,000 men pressed forward towards Versailles in three columns. But there was little consistency in the attack. Gen. Ducrot, who commanded the right wing, was delayed three hours, and thereby the centre was placed in a bad position. The French columns soon fell into a devastating infantry-fire, and were also terribly cut up by the artillery, especially by four batteries placed at St.-Michel and by flank-fire from the 4th corps. After losing about 7000 men, dead and wounded, they were compelled to retreat without having gained any advantages. The 5th corps, which from the German side participated in the battle, lost 38 officers and 599 men. This catastrophe at last brought the wish for peace into the ascendency. On Jan. 23, Jules Favre appeared at Versailles to negotiate concerning an armistice. After three days' negotiation between him and Count Bismarck, an agreement was arrived at that hostilities should cease at 12 o'clock in the night before Jan. 27, and the provisioning of Paris immediately begin. Indeed, there was great danger that a part of the population might be starved to death. On the 28th a convention was concluded containing an armistice of twenty-one days and the capitulation of Paris. The armistice was considered as preliminary to peace; its purpose was the convocation of a French national assembly. A line of demarcation was to separate the two armies from each other; the outworks of Paris were to be surrendered to the German army, which, however, should not enter into the city; the garrison of Paris was to be disarmed and considered as prisoners of war, yet remain in the city; only the national guard were to keep their arms to maintain order. The German officials were to help the French in the provisioning of Paris; and Paris was to pay 200,000,000 francs for the expenses of war. The armistice comprised also the naval forces, which, however, had not been of much consequence in this war.

On July 26, 1870, Admiral Bouet-Willaumez had gone from the North Sea into the Baltic, as he lacked coal, and intended to take in provisions in the Bay of Kjöge. On Aug. 7 he arrived at Marstall, and sailed by Wismar, Rostock, Swinemünde, and Kolberg, where land-batteries were erected. The French fleet had no landing-troops, and its vessels drew too much water to approach the coasts. After the battle at Wörth the admiral received orders to remain in the Baltic and confine himself to the blockade of the harbors. On Aug. 12, Admiral Faurichon appeared at Heligoland with 8 iron-clads and blockaded the northern harbors. The German fleet could not compare with this squadron, and remained quietly in the fortified harbors. In the middle of September, Faurichon returned to Cherbourg and took charge of the ministry of the navy. Bouet-Willaumez also returned to Cherbourg at the end of September, and another squadron, under Admiral de Gueydon, was sent into the North Sea. The French ships, however, confined their activity to the seizing of German merchant-vessels.

The National Assembly met at Bordeaux Feb. 12, 1871. It had to decide whether peace should be concluded or whether the war should be continued. Further resistance, however, seemed a complete impossibility. France was utterly exhausted and completely defeated; her long and desperate resistance, possible only on account of the heroism of the population, had increased her loss; 400,000 French soldiers, among whom were 11,860 officers, were in German captivity; about 100,000 men were disarmed in Switzerland, and the army of Paris, numbering more than 150,000 men, would, according to the convention, also have to go to Germany as prisoners of war if hostilities were recommenced. Furthermore, the active troops were in a miserable state. Not only all the officers, but also all the trained soldiers, had either become prisoners by the great capitulations of Sedan and Metz, or they were wounded or dead. The active troops consisted of recruits led by a few generals. Not only in quality, but also in number, they were inferior to their adversaries. On Mar. 1, 1871, the Germans had on French soil 569,875 infantry and 63,465 cavalry, with 1742 guns, and in Germany was an army of 250,000 men under arms. The eight French corps numbered not more than 250,000 men. An immense quantity of war-material had fallen into German hands—1835 field-pieces, 5373 heavy guns, and over 600,000 small-arms. Furthermore, all important strategical points were in the possession of the German army, and it held Paris in its hands. Under such circumstances all parties in the National Assembly, with very few exceptions, agreed that peace was necessary. On Feb. 13 the provisional government of national defence transferred its power to the Assembly; and on Feb. 17 the chief of the executive power of the French republic, the former minister of Louis Philippe, Adolphe Thiers, was sent to the German head-quarters at Versailles, where King Wilhelm of Prussia, emperor of Germany, had resided since Jan. 18, to negotiate for peace. On Feb. 21, Thiers arrived, accompanied by a diplomatic committee. The armistice was prolonged to Feb. 26. The demands of the German government were very heavy; the cession of Alsace and Lorraine, with Metz, Strasburg, and Belfort, and the payment of six milliards, were demanded. By their stubborn perseverance and by the support of the English government the French negotiators succeeded in securing Belfort as a French possession and in getting the war expenses decreased by one milliard. On Feb. 26 the preliminary peace of Versailles was signed; Alsace and the largest part of Lorraine were ceded; five milliards were to be paid as war expenses; and German garrisons were to remain on French soil until full payment was made. Concerning the payment and the occupation, it was specially stipulated that one milliard should be paid in the course of the year 1871, and the rest in three years. The German troops should evacuate the city of Paris and the forts on the left bank of the Seine immediately after the ratification of the preliminary peace, and as soon as possible the departments Calvados, Orne, Sarthe, Eure-et-Loir, Loiret, Loir-et-Cher, Indre-et-Loire, and Yonne completely, and the departments Seine-Inférieure, Eure, Seine-et-Oise, Seine-et-Marne, Aube, and Côte d'Or to the left bank of the Seine. After the ratification of the definitive peace and the payment of one half milliard the departments between the right bank of the Seine and the eastern frontier should be evacuated, and after the payment of two milliards only the departments Marne, Ardennes, Haute-Marne, Meuse, Vosges, Meurthe, and the fortress of Belfort, with its surroundings, should be occupied. An interest of 5 per cent. should be paid on the three milliards whose definitive payment was postponed. The preliminary peace also contained stipulations concerning the delivery of the prisoners of war and the government of the occupied French districts. This agreement was laid before the National Assembly by Thiers on Feb. 28, 1871, and accepted by 546 votes against 107 on Mar. 1. On the same day a part of Paris was occupied by 30,000 German troops. On Mar. 3 the ratifications of the preliminary peace were exchanged at Versailles, Paris was evacuated, and the removal of the German army to the right bank of the Seine was ordered. Mar. 13 the German emperor left Versailles for Berlin. May 10, 1871, the definitive treaty of peace was concluded at Frankfort-on-the-Main, and on account of the rapid payment of the war expenses the last German soldier left French soil in July, 1873. (See MOLTKE'S *Military Hist. of the War*.)

AUGUST NIEMANN.

François, town of Martinique, in the West Indies, on the eastern side of the island, has a good harbor. Pop. 7997.

Fran'colin, a name applied to gallinaceous birds of a group allied to both pheasants and partridges, more closely perhaps to the latter. They are found in the Old World, chiefly in Africa. The *Francolinus vulgaris* of Europe, Asia, and Africa is a finely variegated bird which frequents sunny plains in warm countries. Its size is that of the partridge. Its flesh is prized as food. The sanguine francolin (*Ithaginis cruentus*) is a splendid bird of the Himalayas—not very good as food, but remarkable for having the legs provided with several spurs. There are numerous other species.

Franco'nia [Ger. *Franken*] was the name of an old independent territory situated along the Rhine, the Neckar, and the Main, among whose dukes the German empire more than once elected its ruler. It underwent many changes and modifications until, at the dissolution of the

German empire in 1806, it was divided between Bavaria, Saxony, Hesse, and Baden.

Franconia, post-tp. of Chisago co., Minn. Pop. 650.

Franconia, tp. and post-v. of Grafton co., N. H., in the Western White Mountain region, is a place of summer resort. It has valuable iron-mines, and manufactures of iron, lumber, starch, wooden-ware, etc. It is 85 miles N. by W. of Concord. Pop. 549.

Franconia, tp. of Montgomery co., Pa. Pop. 1959.

Franconia Mountains, the western cluster of the White Mountain group, are in Grafton co., N. H., and are separated from the main group by the Notch. As a whole, the Franconia Mountains are not as high as the others, but the presence of little lakes adds a charm of their own. Mt. La Fayette, or the Great Haystack, is 5290 feet high. Echo Lake, Eagle Cliff, the Profile Rock, Profile Lake, Bald Mountain, Walker's Falls, the Basin, the Flume, the Pool, and Georgiana Falls are attractive points. The mountains have deposits of iron ore.

Fran'eker, town of the Netherlands, in the province of Friesland. Its university, which in 1811 was abolished by Napoleon, and in 1816 transformed into an athenæum, was a very celebrated institution in the days of Vitringa, Hemsterhuis, and Valckenaer. Pop. 5867.

Francs Tireurs ("free marksmen"), a name applied during the late Franco-German war to the members of the French guerilla-parties who carried on an annoying partisan warfare against the Germans.

Frangipa'ni, a once illustrious family of Rome, having also allied lines of the same name in Naples and Croatia. The family is traced as far back as the seventh century, and even claims to date from pagan Rome. During the eleventh, twelfth, and thirteenth centuries the name, already illustrious, became one of the most splendid in Italian annals, but rapidly declined thereafter. The name, it is claimed, signifies the "bread-breakers," from the charities of its founders.—Among its prominent members were CENCIO, a Ghibelline of the twelfth century; GIOVANNI, in the thirteenth century, a soldier and founder of the Neapolitan line; CORNELIO (d. 1581), a great Friulian advocate, living at Venice; CLAUDIO CORNELIO, his son (1533–1630); NICCOLÒ, a Venetian painter of the sixteenth century; FRANZ CHRISTOPH, a Croatian conspirator (1630–71).

Fran'gulin, $C_{20}H_{20}O_{10}$, the yellow coloring-matter of the berry-bearing buckthorn (*Rhamnus Frangula*). It is a glucoside, being resolved by acids into sugar (glucose) and frangulic acid, $C_{20}H_{20}O_{10} + H_2O = C_6H_{12}O_6 + C_{14}H_{10}O_5$.

Frank (JACOB JOSEPH), a Jewish fanatic, founder of a sect, b. in Poland in 1712, travelled in different parts of Russia and Turkey. In 1750, having acquired celebrity as an expounder of the Cabbala, he declared the Talmud unfit for religious guidance, and substituted for it the *Zohar*, one of the Cabbalistic works. He accepted the doctrine of the Trinity. His followers, who soon became numerous, were called *Frankists*, or, as they preferred to call themselves, *Zoharites*. Their confession of faith was in substance as follows: No religion can exist without the knowledge of God; all other religion is an outward service of works; piety and the love of God are the effects of a profound acquaintance with His nature, and this must be sought in the study of His law, from which it must be deduced by tradition; the doctrine of Moses and the prophets has an inward meaning far deeper than that of the letter, and without which it is the source of errors and mistakes; there is one only God, the Creator and Preserver of all things, but revealed in three persons; God has appeared upon earth in human form, but after the entrance of sin He laid aside this form, and has since taken it again for the expiation of sin; He will once again appear in human nature, finally to deliver man from sin. Jerusalem will never be rebuilt, and a terrestrial Messiah is not to be expected. His Jewish brethren, offended at the doctrine, demanded the interference of the authorities, and Frank thought it wise to embrace Roman Catholicism. He was baptized at Warsaw Dec. 25, 1759, the king himself being represented by proxy as his godfather. But Frank was soon accused of heresy, and was finally imprisoned. During the invasion of Poland by the Russians he was released by them in 1773. He now retired to Austrian territory, and in 1776, under special protection from the empress Maria Theresa, settled at Vienna, until, hunted down by the police, he felt it safer to remove to Brünn, the capital of Moravia. His followers had largely increased, and he now lived supported by them in princely splendor. He left his mansion daily to attend the service which he celebrated for his adherents, always riding in a richly-adorned carriage, surrounded by a retinue of persons mounted on splendid horses and attired in glittering raiment. In 1786, Frank established his residence at Offenbach, where he made even greater display. He declared himself the true Messiah, and was by his followers believed immortal until his death from apoplexy Dec. 10, 1791. The Frankists continue to this day in parts of Poland, dispersed among all (even the highest) classes of society. Their profession of faith, published at Lemberg, indicates a greater leaning towards Judaism than Christianity. (See JOST, *Geschichte des Judenthums und seiner Sekten*, iii. 184; DA COSTA, *Israel and the Gentiles*, p. 512–518; GRÄTZ, *Frank und die Frankisten*, Breslau, 1868.) JAS. H. WORMAN.

Frankalmoign' [Norman Fr., "free alms"], in English law, the tenure, chiefly of lands, by spiritual service, as where a sole or aggregate corporation holds an estate of some private person, who gives it to God as free and perpetual alms. Tenures by frankalmoign were forbidden to be created after the eighteenth year of Edward I., but there are in England many examples dating from before that time, now chiefly ecclesiastical foundations or parish glebes. Frankalmoign implied no fealty or service, as did some other similar tenures.

Frank'enberg, town of Saxony, on the Zschopau. It has very large cotton and linen manufactures. Pop. 9710.

Frankenberg, von (JOHANN HEINRICH), count and cardinal, b. at Glogau Sept. 18, 1726; studied at Breslau and Rome; became coadjutor to the archbishop of Göritz 1749; archbishop of Mechlin 1759; cardinal in 1778; became involved in a contest with the civil power, in which he defended the claims of the Church; was deposed by the emperor Joseph II., and d. at Breda June 11, 1804.

Frank'enhausen, town of Germany, in the principality of Schwarzburg-Rudolstadt, has salt-works, saltpetre-refineries, and manufactures of articles of mother of pearl. Pop. 5078.

Frankenia'ceæ, a natural order of herbs and undershrubs, none of which are North American. They are few and unimportant. Their nearest allies are the violets and Caryophyllaceæ.

Frank'enstein, town of Prussia, in the province of Silesia. It has considerable manufactures of broadcloth and linen. Pop. 7328.

Frank'enthal, town of Bavaria, in the Palatinate. A canal 60 feet broad connects it with the Rhine. It has manufactures of cloth, cotton, linen, gold and silver wire, etc. Pop. 7021.

Frank'ford, post-v. of Sidney tp., Hastings co., Ontario, Canada, on Trout River, 14 miles N. W. of Belleville, has good water-power and considerable trade and manufactures. Pop. about 900.

Frankford, post-v. in Dagsborough hundred, Sussex co., Del. Pop. 149.

Frankford, tp. of Mower co., Minn. Pop. 674.

Frankford, tp. of Sussex co., N. J. Pop. 1776.

Frankford, tp. of Cumberland co., Pa. Pop. 1369.

Frankford, formerly a borough, now a part of Philadelphia, Pa., in the N. E. part of the city, has important manufactures. Tacony Creek flows between Frankford and the main part of the city. It contains a celebrated insane asylum. (See PHILADELPHIA.)

Frank'fort, tp. and post-v. of Franklin co., Ala. Pop. of v. 162; of tp. 1517.

Frankfort, tp. and post-v. of Will co., Ill., on the Joliet and Northern Indiana R. R., 13 miles E. of Joliet. Pop. of tp. 1924.

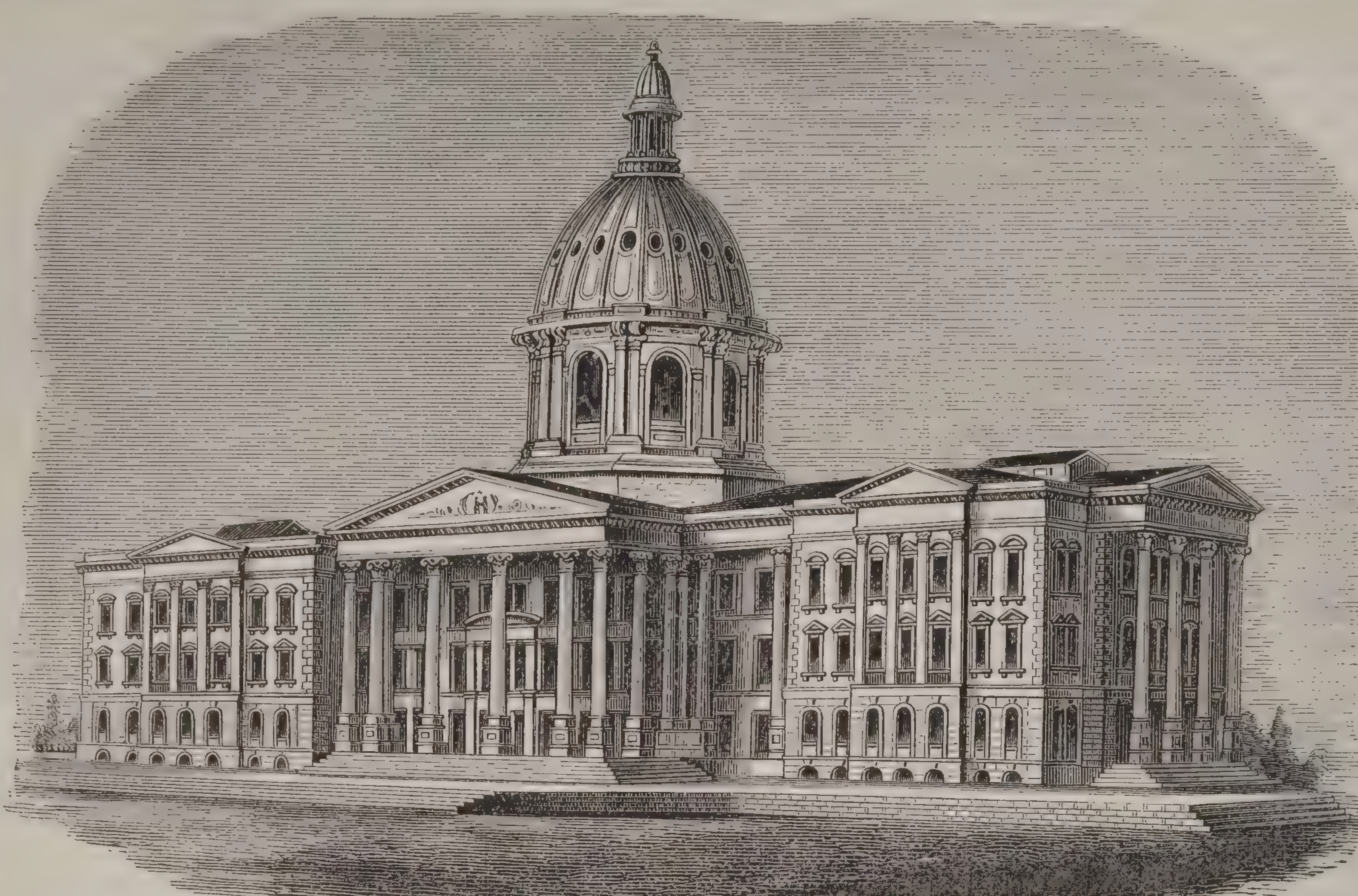
Frankfort, post-v., county-seat of Clinton co., Ind., is in a fertile region, and is 46 miles N. W. of Indianapolis. It is on the Logansport Crawfordsville and South-western, the Lafayette Muncie and Bloomington, and the Frankfort and Kokoma R. Rs. It has 2 banks, 2 weekly newspapers, an opera-house, 3 churches, a fine graded school building, hotels, stores, etc. Farming is the principal business. Pop. 1300. E. H. STALEY, ED. "CRESCENT."

Frankfort, tp. of Montgomery co., Ia. Pop. 437.

Frankfort, post-v. of Marshall co., Kan., on the Vermilion River and on the central branch of the Union Pacific R. R., 78 m. W. of Atchison. Has good water-power.

Frankfort, capital of Kentucky, also of Franklin co., situated in a rotunda of hills upon either side of the Kentucky River, on the Louisville and Lexington R. R. It is noted for the picturesqueness of its scenery and the fine drives in the vicinity. It contains 9 churches, 3 banks, a fine public school building, a high school, a seminary for young ladies, an institution for the training of feeble-minded children, 1 tri-weekly newspaper (which is published daily during the session of the legislature), gas and water works, a steam fire-engine, a cotton-mill, a barrel-manufactory, a pottery, 5 saw-mills, 2 flouring-mills, 5

distilleries, and the State prison. It has a fine hall which has a capacity for seating 1000 persons. The Capital Hotel, of stone, was erected by the city at a cost of $120,000, but is now owned by private parties. The Frankfort cemetery is very beautiful, and in it repose the remains of many of Kentucky's great and gallant men. Nearly all the various benevolent orders have lodges in the city, and the Odd Fellows own a handsome temple. Five turnpikes terminate here. Pop. 5396. H. A. M. HENDERSON,
ED. "KENTUCKY FREEMASON," and *Supt. Public Instruction.*



State Capitol, Frankfort, Ky.

Frankfort, post-v. and tp. of Waldo co., Me., on the W. side of the Penobscot, 15 miles S. of Bangor. It has granite-quarries and manufactures of lumber, shipping, and cooperage. Pop. 1152.

Frankfort, post-v., capital of Benzie co., Mich., on the E. shore of Lake Michigan, 140 miles N. of Grand Haven. It has a bank, a newspaper printed by steam, a public library, a silver cornet band, a church, 3 hotels, a blast-furnace, 5 saw-mills, 2 shingle-mills, a park, a fire company, and a number of stores. Principal business, lumbering, iron manufacturing, farming, and fruit-raising. It has a good harbor. Pop. about 1500.
CORNELL & HOSNER, EDS, "EXPRESS."

Frankfort, tp. of Wright co., Minn. Pop. 564.

Frankfort, post-tp. of Knox co., Neb. Pop. 63.

Frankfort, post-v. and tp. of Herkimer co., N. Y., 10 miles E. by S. of Utica, on the Central R. R. and on the Mohawk, has manufactures of cheese, lime, matches, woollens, etc., and one bank. Pop. 1083; of tp. 3065.

Frankfort, a v. of Concord tp., Ross co., O., near the Marietta and Cincinnati R. R. Pop. 519.

Frankfort, post-tp. in Mineral co., W. Va. Pop. 957.

Frankfort, post-tp. of Pepin co., Wis. Pop. 340.

Frankfort, Council of, a synod noted in church history for its decided action against the worship of images, was called by Charlemagne A. D. 794, and, according to Dupin (*Eccles. Hist.*, cent. viii.), was attended by 300 bishops, who came from Germany, Gaul, Spain, Italy, and England, besides two delegates from the pope. This council condemned also the Adoptianists. (See HEFELE, *Concilien-geschichte*, iii. 635 *seq.*; LANDON, *Manual of Councils*, s. v.)
J. H. WORMAN.

Frankfort-on-the-Main [Ger. *Frankfurt-am-Main*] was in commercial respects the most important, and on account of its historical relations the most famous, of the four free cities of Germany. It is now in the limits of the province of Hesse-Nassau, Prussia, to which it was annexed in 1866. It is situated on the right bank of the Main, over which an old stone bridge of fourteen arches, built in 1340, crosses to its suburb, Sachsenhausen. The city proper, whose population amounts to 91,040, is as beautiful as interesting. It is entered by seven large gates, two of which, the Gallus Thor and the Eschenheimer Thor, have been preserved in their old form; the other five are buildings of modern style. But the walls and ditches which formerly stretched between these gates have been transformed into charming promenades, where splendid villas and resorts of amusement alternate with almost rural surroundings. Among its public squares are the Rossmarkt, with the monument of Gutenberg, designed by Launitz, and the Götheplatz, with the statue of Goethe by Schwanthaler. Among its public buildings the most remarkable are—the Römer, an old building, in whose Wahlzimmer the electors met, and in whose Kaisersaal the elected emperor gave his first banquet; and the cathedral of St. Bartholemew, a Gothic structure begun in 1238 and finished in the sixteenth century, in which the coronation of the German emperors took place. On account of its geographical position, easily communicating with all the chief points of Europe, it early attracted attention. It was a favorite residence of Charlemagne. In 1257 it was made a free city. After the days of Frederic Barbarossa it became the place for the election of the German emperors, and by the "Golden Bull" (in 1356) Charles IV. transformed this custom into a right. Napoleon made it the capital of a great principality. In 1848 and 1849 the German Parliament sat here. After 1816 the meetings of the German Diet, in which Frankfort enjoyed an independent vote in the full council, and a vote in conjunction with the three other free cities in the limited council, were held here; but the city sided with Austria in the war of 1866, and consequently lost her autonomy in that year. Of late some branches of its trade have decreased. Leipsic has superseded it in the book-trade, but as a moneyed centre it still occupies the principal place. Frankfort is the banking-house of Germany. Its exchange rules the money-market of Germany, and exercises considerable influence throughout the world.

Frankfort-on-the-Oder, city of Prussia, in the province of Brandenburg, on both sides of the Oder. It has considerable manufactures of linen, cloth, hosiery, gloves, leather, and earthenware, and a very extensive trade. Its three annual fairs have more than 10,000 visitors, especially dealers from Poland. Its university, which was founded in 1506 by the elector Joachim I., was moved to Breslau in 1811. Pop. 43,211.

Frankfort Springs, post-v. of Hanover tp., Beaver co., Pa., 26 miles S. W. of Pittsburg. It has two medicinal springs, Leiper's and Cave Springs, which have saline chalybeate waters. The last-mentioned spring arises in a large and very remarkable cave, and is much visited by tourists and invalids. Pop. 155.

Frank'furter (MOSES BEN SIMEON), a Jewish scholar and printer, flourished at Amsterdam between 1700 and 1762. He edited the *Great Rabbinic Bible* (Amsterdam, 1724–27, 4 vols. fol.), which is one of the most valuable contributions to the critical study of the Old Testament

Scriptures. The Hebrew Bibles are printed from this text. (See FÜRST, *Bibliotheca Judaica*, i. 295; ETHERIDGE, *Introduction to Hebrew Literature*, p. 101.) J. H. WORMAN.

Frank'incense [Lat. *thus*], a name applied to various fragrant gums and resins. It anciently designated the substance now known in commerce as OLIBANUM (which see), the product of *Boswellia serrata*, an East Indian tree, and of *Plœsslea floribunda*, an African tree, both of the order Terebintaceæ. The frankincense of Sierra Leone is from the *Daniellia thurifera*, a large mountain-tree of that region. In England the frankincense of the shops is nothing but common turpentine, such as is exported from the Southern U. S.

Frank'ing Priv'ilege, the right of sending letters or packages free by mail. The post-office having been originally established solely for governmental purposes, the carriage of official correspondence remained for a long time its only business. The grant to the University of Paris and the well-known concessions of the German princes to the counts of Thurn and Taxis having placed the post in the position of a carrier for hire, free correspondence between officers of the government and other favored persons came gradually to be regarded in the modern light of a privilege. In England the right was claimed by the House of Commons in 1660, and privately allowed to members by the Crown, which had hitherto enjoyed it in connection with the entire control and revenues of the post-office. In 1666 a clause was inserted in the bill granting the post-office revenues to the king which exempted from postage the correspondence of members of the House of Commons. The Speaker, in putting the question on the clause, said "he was ashamed of it." The bill passed the lower House, but the clause was dropped in the House of Lords. The privilege, however, continued under special agreement with the Crown until it was expressly confirmed by the act 4 Geo. III. c. 24, by which each member was allowed to send free not more than ten letters a day, and to receive fifteen, each letter to weigh not more than one ounce. Up to 1837 only the name of the member was required to be written by himself on the back of the letter; by a statute of that year he was required to write the entire address, the town, and the day of the month, and to post the letter on the same day. Owing to the high rates of postage the privilege in England was greatly abused. Investigations instituted by the House of Commons in 1735 and 1764 showed a regular trade in authentic franks, and extensive forgeries. One man was proved to have forged and sold over 14,000 in five months. In 1838, during the agitation of Rowland Hill's postal reform, the quantity of free matter was estimated at from 10 to 30 per cent. of the entire business of the post-office. In 1839 the privilege was abolished by the passage of Rowland Hill's act. In France in 1841 the number of free letters was over 12,000,000, and in 1850 38,000,000.

In the U. S. the first appearance of the franking privilege after the assumption of the post-office by the Continental Congress was in Jan., 1776, when it was granted to all private soldiers actually in service for letters written by and to themselves. The ordinance of 1782, repealing previous legislation with regard to the post-office, made free all letters, packets, and despatches to and from the members and secretary of Congress while actually attending, the commander-in-chief and the separate army commanders, the heads of the departments of finance, war, and foreign affairs of these U. S. on *public service;* also, single letters directed to any officers of the line in actual service. In 1791 an act of Congress extended the privilege to official letters of the treasurer, comptroller, auditor, and assistant secretary of the treasury. The act of the next year, establishing the post-office, exempted from postage all letters to and from the President and Vice-President; all letters, not exceeding two ounces in weight, to and from Senators and members of the House of Representatives, the secretary of the Senate, and the clerk of the House, during actual attendance in session and twenty days thereafter; to and from the secretaries of state, war, and the treasury, and the postmaster-general, their assistants and bureau officers, and the commissioners for settling accounts with the States: "provided, that no person shall frank or enclose any letter or packet but his own." "Each before-named person shall deliver any letter enclosed to him, addressed to another, to the post-office, noting the place whence it came, and postage shall be charged thereon." The franking officers were required to furnish specimens of their signatures to postmasters. Subsequent legislation extended the privilege, with various modifications, to newly-created cabinet and bureau officers; to Presidents and to their widows during life; to delegates from the Territories (commencing with Wm. Henry Harrison, delegate from the Territory north-west of the Ohio) on the same terms as members of Congress; to deputy postmasters on letters not over half an ounce in weight; to newspapers for purposes of exchange; and to the adjutant-generals of States for certain correspondence relating to the militia. Deputy postmasters were allowed two cents for each free letter delivered other than their own. The time within which members of Congress could frank was extended to thirty, and subsequently to sixty, days before and after each session. Provision was made for the payment of postage on the excess in weight of their letters over two ounces. Executive officers were allowed to receive newspapers free, as also members and officers of Congress during the time above limited. A fine of $50 was imposed for the forgery of a frank, and of $10 for its use on letters not written by the respective franking officers, except in the case of cabinet officers, who were allowed to frank for each other. In 1808 the privilege was first extended to cover public documents, members and delegates in Congress being authorized to transmit free the President's message and accompanying papers of that year. Similar acts were passed, being generally the first of their respective sessions, in 1810, 1811, 1812, and following years, and the authority extended to the secretary of the Senate and clerk of the House. In 1813 the report of the foreign relations committee on said message and documents was added to the list, and at the same session all "executive documents." In 1820 all documents printed by order of either House were included, and the time of franking not limited. The governors of States were also allowed to exchange State documents free of postage. The act of March 3, 1845, by which inland postage was reduced to five cents, reserved to members and delegates in Congress and to the Vice-President the right to frank and receive free letters not exceeding two ounces in weight (any excess to be paid from contingent funds) and documents printed by order of either House; to the third assistant postmaster-general and to postmasters the right to frank letters on post-office business by endorsing them as official, a false endorsement to be punished by $300 fine. The franking privilege, as it regarded all other persons, was abolished, officers of the government previously enjoying it being directed to keep quarterly accounts of postage, and pay it from their respective contingent funds. This partial reform did not last long. The privilege of members and delegates was extended to the session following the term for which they were elected; certain postmasters were allowed to frank their private letters not over one half ounce in weight; letters to the army in Mexico or on the frontier were allowed to go free, and the widows of ex-Presidents Adams, Polk, and Taylor were, by special acts, granted the franking privilege. The provision of the act of 1845, requiring accounts to be kept of official postage, was repealed, and $200,000 per annum appropriated therefor. This was subsequently increased to $500,000. In 1851 the free exchange of newspapers was re-established. From this time to 1863 a few minor extensions of the privilege were granted, including the carriage of books and documents for the Congressional Library. By the act of Mar. 3, 1863, the privilege was conferred upon and limited to the following persons and articles: the President and his private secretary; the Vice-President; chiefs of executive departments; such heads of bureaus and chief clerks as might be designated by the postmaster-general, for official letters only; Senators and Representatives in Congress for all correspondence, documents printed by authority of Congress, speeches and proceedings therein, and printed matter addressed to them, said privilege to commence with their term of office and to continue until the first Monday in December after its close; to all government officers for letters endorsed official and addressed to the heads of their respective departments; to postmasters for endorsed official correspondence with each other, a penalty of $300 being provided for false endorsement; to publishers of newspapers for their exchanges; and to senders of petitions to either branch of Congress. The weight of the above-named articles, excepting petitions and public documents, was limited to four ounces. Members of Congress were also authorized to frank "seeds, roots, cuttings, and scions," the weight to be fixed by the postmaster-general. With very slight modification, such as the extension of the privilege to cover "Smithsonian exchanges," medals or other testimonials voted by State legislatures to soldiers, etc., and a provision requiring franking officers to write their signatures, instead of using *fac-simile* stamps, as had become quite customary, this law remained in force until Jan. 31, 1873, when the following act was passed: "That the franking privilege be, and the same hereby is, abolished from and after the first day of July, A. D. 1873, and that thenceforth all official correspondence, of whatever nature, and other mailable matter sent from or to any officer of the government or person now authorized to frank such matter, shall be chargeable

with the same rates of postage as may be lawfully imposed upon like matter sent by, or addressed to, other persons: provided, that no compensation or allowance shall now or hereafter be made to Senators, members or delegates of the House of Representatives on account of postage." A subsequent act of the same session repealed all laws for the transmission of free matter. At the same session $1,865,900 was appropriated for the purchase of stamps at their face-value for the use of the executive and departments, the secretary of the Senate, the clerk and sergeant-at-arms of the House. This was supplemented at the next session by a deficiency appropriation of $180,000, while for the fiscal year ending June 30, 1875, only $577,000 was appropriated.

The varying course of legislation on this subject serves to show the attempts which have been made from time to time to reform the abuses of the franking privilege. Its abolition had been steadily recommended by the postmasters-general, and their recommendations supported by statistics and estimates showing the vast burden it imposed upon the post-office department. As far back as 1854 the Washington post-office sent out in one month 815,021 pounds of free matter. Mr. Creswell, late postmaster-general, to whose determined efforts the final abolition was in great measure due, estimated in his report for 1872 that the free matter would, if paid for, represent a revenue of $3,500,000. Sufficient time has not yet elapsed since the abolition of the franking privilege to determine the direct saving to the revenue occasioned thereby. Should the privilege not be re-established, a great incidental saving will undoubtedly be made in the printing of public documents, heretofore sent out gratuitously by members of Congress. ROBERT B. LINES.

Frank'inmuth, tp. of Saginaw co., Mich. Pop. 1488.

Frankists. See FRANK (JACOB JOSEPH).

Frankl (LUDWIG AUGUST), b. of Jewish stock at Chrast, Bohemia, Feb. 3, 1810; studied medicine, and became secretary to the Jews of Vienna and professor of æsthetics 1851; established a Jewish school at Jerusalem 1856; author of numerous popular poems in German; also of a history of the Jews in Vienna (1847–53), and some volumes of Eastern sketches.

Frank'land (Sir CHARLES HENRY), BART., b. in India May 10, 1716, was the son of the governor of the East India Company's factory in Bengal. In 1741 he became collector of the port of Boston, Mass. He is chiefly known by the romantic story of his love for Agnes Surriage, a beautiful young woman, a servant at an inn in Marblehead. Frankland made her his mistress, and afterwards his wife. According to the popular belief, he married her in consequence of her rescuing him from the ruins of Lisbon at the great earthquake, Nov. 1, 1755. In 1757 he became British consul-general at Lisbon. Lady Agnes resided after his death (which occurred at Bath, England, Jan. 11, 1768) at the Frankland mansion, Hopkinton, Mass., but at the outbreak of the Revolution went to England, and d. there Apr. 23, 1783. (See his *Life* (1868), by ELIAS NASON.)

Frankland (EDWARD), PH. D., D. C. L., F. R. S., b. at Churchtown, Lancashire, England, Jan. 18, 1825; was educated at London, Marburg, and Giessen; has held successively professorships of chemistry in Owens College, Manchester, Bartholomew's Hospital, the Royal Institution, and the Royal School of Mines; became president of the London Chemical Society 1871; author of published researches upon questions of organic chemistry; on the methods and materials for artificial illumination; on drinking-water and its impurities; the sewage question, etc.

Frank'lin, county of the N. W. of Alabama. Area, 590 square miles. It is bounded on the W. by Mississippi. The soil is fertile, and produces corn, cotton, and tobacco. Bituminous coal is found. Cap. Russellville. Pop. 8006.

Franklin, county of Arkansas, lying on both sides of the Arkansas River. Area, 770 square miles. The surface is broken, and abounds in timber, coal, and iron ore. The bottom-lands are very fertile. Cattle, hay, grain, and cotton are produced. The county is traversed by the Little Rock and Fort Smith R. R. Cap. Ozark. Pop. 9627.

Franklin, county in the W. of Florida. Area, 600 square miles. It is nearly level, and not extensively cultivated, but contains much excellent soil. It is bounded on the S. by the Gulf of Mexico. Excellent timber abounds, and the fisheries are important. Cap. Appalachicola. Pop. 1256.

Franklin, county in the N. of Georgia, bounded on the N. E. by South Carolina. The county is well watered, fertile, and produces grain. The surface is uneven. Iron ore is abundant. There is a good supply of water-power. Cap. Carnesville. Pop. 7893.

Franklin, county in the S. of Illinois. Area, 424 square miles. It is traversed by the Big Muddy River, and has a fertile soil. Cattle, wool, grain, and tobacco are produced. Timber is abundant. Cap. Benton. Pop. 12,652.

Franklin, county of Indiana, bordering on Ohio. Area, 395 square miles. The surface is in part hilly, the soil calcareous and productive. Cattle, wool, and grain are the staples. The manufactures include lumber, cooperage, harnesses, cotton goods, paper, and flour. It is traversed by the Whitewater Valley R. R. and by the Whitewater River and its forks. Cap. Brookville. Pop. 20,223.

Franklin, county in N. Central Iowa. Area, 576 square miles. It is well watered and productive. Grain is the principal product. It is traversed by the Central R. R. of Iowa. Cap. Hampton. Pop. 4738.

Franklin, county in the E. of Kansas. Area, 576 square miles. It is chiefly undulating, fertile prairie. Live-stock, grain, and wool are produced. It is intersected by the Marais des Cygnes and by the Lawrence Leavenworth and Galveston and other railroads. Coal is mined here. Cap. Ottawa. Pop. 10,385.

Franklin, county of N. Central Kentucky, intersected by the navigable Kentucky River. Area, 200 square miles. It has a productive calcareous soil. Live-stock, tobacco, grain, and wool are staples. The county is traversed by the Louisville and Lexington R. R. Cap. Frankfort. Pop. 15,300.

Franklin, parish in the N. E. of Louisiana. Area, 740 square miles. Its surface is uneven, but productive. Corn and cotton are staple crops. It is partly bounded on the W. by the navigable Bayou Bœuf. Cap. Winnsborough. Pop. 5078.

Franklin, county of Maine, bordering on Canada. Area, 1600 square miles. Its northern part is unsettled, and is chiefly forest-land, broken by mountain-ranges. Much of the southern portion is very fertile. Cattle, grain, wool, and dairy products are the staples. Carriages, lumber, and wooden wares are extensively manufactured. The Androscoggin R. R. terminates in this county. Cap. Farmington. Pop. 18,807.

Franklin, county of Massachusetts, bordering on New Hampshire and Vermont, and intersected by the Connecticut River. Part of its surface is broken by hills and mountains, but the alluvial lands and much of the elevated portions are very fertile, producing grain, tobacco, fruit, wool, and hay. Cattle, horses, and sheep are bred extensively. The manufactures include lumber, furniture, wooden wares, cotton goods, cutlery, etc. The county is traversed by the Vt. and Mass., the New London Northern, and the Connecticut River R. Rs. Cap. Greenfield. Pop. 32,635.

Franklin, county in the S. W. of Mississippi. Area, 590 square miles. The surface is broken, the soil along the rivers fertile, producing cotton, corn, and rice. Pine timber is abundant. Cap. Meadville. Pop. 7498.

Franklin, county of Missouri, bounded on the N. by the Missouri River. Area, 874 square miles. The county is uneven and bluffy, but very fertile, producing cattle, grain, tobacco, fruit, and wool. Lead, iron, and copper ores are abundant and good. Wine, carriages, brick, flour, lumber, charcoal, cooperage, iron, and clothing are among the articles manufactured. It is intersected by the Atlantic and Pacific R. R. Cap. Union. Pop. 30,098.

Franklin, county of Nebraska, bordering on Kansas. Area, 576 square miles. It is intersected by the Republican River. It is in a good grazing and farming region. Cap. Bloomington. Pop. 26.

Franklin, county of New York, bordering upon Canada. Area, 1718 square miles. The northern portion is generally fertile, producing grain, potatoes, cattle, wool, hay, butter, and cheese. The southern portion is in part occupied by the Ausable Mountains, a part of the Adirondack group. This region is productive of timber and iron, but is sparsely inhabited. Lumber, starch, iron, brick, flour, leather, etc. are manufactured. The county is intersected by the Ogdensburg R. R. Cap. Malone. Pop. 30,271.

Franklin, county in the N. N. E. of North Carolina. Area, 450 square miles. It is traversed by Tar River. Its surface is undulating. Cotton, corn, and tobacco are produced. Gold is found. Cap. Louisburg. Pop. 14,134.

Franklin, county of Central Ohio. Area, 530 square miles. It is traversed by the Scioto and other streams. Its surface is quite level and very fertile, producing grain, hay, tobacco, wool, and live-stock. The manufactures include carriages, railroad cars, iron, boots and shoes, metallic wares, tobacco, cigars, confectionery, and harnesses. The county is traversed by several railroads which centre at Columbus, the county-seat and capital of the State. Pop. 63,019.

Franklin, county of Pennsylvania, bounded on the S. by Maryland. Area, 740 square miles. It consists mainly of a broad and exceedingly fertile valley between two

ridges of mountains—Cove Mountain on the N. W. and South Mountain on the S. E. Grain, live-stock, wool, dairy products, and hay are the agricultural staples. Carriages, flour, cooperage, harnesses, metallic wares, furniture, leather, lumber, paper, and woollen and cotton goods are manufactured. Iron ore, slate, and limestone are obtained. The county is traversed by the Franklin, the Cumberland Valley, and other railroads. Cap. Chambersburg. Pop. 45,365.

Franklin, county of Tennessee, bordering upon Alabama. Area, 615 square miles. The E. part is broken by spurs of the Cumberland Mountains, and contains important beds of coal and iron. The soil is fertile. Cattle, grain, and wool are staple productions. The county is traversed by the Nashville and Chattanooga R. R. and its branches. Cap. Winchester. Pop. 14,970.

Franklin, county of Vermont, bounded on the N. by Canada and on the W. by Lake Champlain. Area, 630 square miles. The surface is uneven, but very fertile. Grain, live-stock, wool, hay, and dairy products are the staples. Flour, cooperage, leather, lumber, carriages, furniture, harnesses, woollen goods, and metallic wares are among the manufactures, for which the Missisquoi and Lamoille rivers furnish water-power. It is intersected by the Vermont and Canada and other railroads. Cap. St. Albans. Pop. 30,291.

Franklin, county of Virginia, in the S. part of the "Piedmont region," S. E. of the Blue Ridge. It is drained by affluents of the Staunton River, and, though hilly, is very fertile. Grain and tobacco are staple products; iron ore is found. Cap. Rocky Mount. Pop. 18,264.

Franklin, post-tp. of Henry co., Ala., on the Western R. R., 34 miles from Montgomery. Pop. 1040.

Franklin, tp. of Macon co., Ala. Pop. 1294.

Franklin, tp. of Calhoun co., Ark. Pop. 438.

Franklin, tp. of Chicot co., Ark. Pop. 344.

Franklin, tp. of Drew co., Ark. Pop. 567.

Franklin, post-tp. of Fulton co., Ark. Pop. 580.

Franklin, tp. of Grant co., Ark. Pop. 298.

Franklin, tp. of Independence co., Ark. Pop. 559.

Franklin, tp. of Izard co., Ark. Pop. 660.

Franklin, tp. of Little River co., Ark. Pop. 388.

Franklin, tp. of Union co., Ark. Pop. 799.

Franklin, post-tp. of Sacramento co., Cal. Pop. 1272.

Franklin, tp. and post-v. of New London co., Conn., on the New London Northern R. R., 20 miles N. of New London. Pop. 731.

Franklin, post-v., cap. of Heard co., Ga., on the E. bank of the Chattahoochee River, 60 miles S. W. of Atlanta. It has a good water-power, 1 steam saw and grist mill, 15 or 20 stores and shops, a court-house, 2 churches, and 1 weekly newspaper. M. M. Barron, Pub. "News."

Franklin, post-v. of Oneida co., Id., on the Utah Northern R. R., 61 miles from Brigham.

Franklin, tp. of De Kalb co., Ill. Pop. 1004.

Franklin, tp. and post-v. of Morgan co., Ill., on the Jacksonville North-western and South-eastern R. R., 13 miles from Jacksonville. Pop. 2057.

Franklin, tp. of De Kalb co., Ind. Pop. 1243.

Franklin, tp. of Floyd co., Ind. Pop. 793.

Franklin, tp. of Grant co., Ind. Pop. 1471.

Franklin, tp. of Harrison co., Ind. Pop. 1402.

Franklin, tp. of Hendricks co., Ind. Pop. 1316.

Franklin, tp. of Henry co., Ind. Pop. 1579.

Franklin, post-v. and tp., cap. of Johnson co., Ind., on the Cincinnati and Martinsville and the Jefferson Madison and Indianapolis R. Rs., 27 miles E. of Martinsville. It has a college, a high school with a $55,000 school building, 5 churches, a gas-works, Masonic, Odd Fellows, Knights of Pythias, Sons of Temperance, and Foresters orders, 2 weekly newspapers, 2 national banks, 2 planing-mills, 3 flouring-mills, 3 saw-mills, and a fair retail trade. Pop. of v. 2707; of tp. 2903. H. C. Allison, Ed. "Jeffersonian."

Franklin, tp. of Kosciusko co., Ind. Pop. 1280.

Franklin, tp. of Marion co., Ind. Pop. 2376.

Franklin, tp. of Montgomery co., Ind. Pop. 1683.

Franklin, tp. of Owen co., Ind. Pop. 1512.

Franklin, tp. of Pulaski co., Ind. Pop. 226.

Franklin, tp. of Putnam co., Ind. Pop. 1266.

Franklin, tp. of Randolph co., Ind. Pop. 1537.

Franklin, tp. of Ripley co., Ind. Pop. 1961.

Franklin, tp. of Washington co., Ind. Pop. 1366.

Franklin, tp. and v. of Wayne co., Ind. Pop. of v. 80; of tp. 1385.

Franklin, tp. of Allamakee co., Ia. Pop. 850.

Franklin, tp. of Appanoose co., Ia. Pop. 888.

Franklin, tp. of Bremer co., Ia. Pop. 643.

Franklin, tp. of Clarke co., Ia. Pop. 677.

Franklin, post-tp. of Decatur co., Ia. Pop. 466.

Franklin, tp. of Des Moines co., Ia. Pop. 1549.

Franklin, tp. of Fremont co., Ia. Pop. 2232.

Franklin, tp. and v. of Lee co., Ia., on the Burlington and South-western R. R. Pop. of v. 628; of tp. 1872.

Franklin, tp. of Linn co., Ia. Pop. 2738.

Franklin, tp. of Marion co., Ia. Pop. 768.

Franklin, tp. of Monona co., Ia. Pop. 856.

Franklin, tp. of Monroe co., Ia. Pop. 613.

Franklin, tp. of Polk co., Ia. Pop. 654.

Franklin, tp. of Story co., Ia. Pop. 924.

Franklin, tp. of Washington co., Ia. Pop. 816.

Franklin, tp. of Bourbon co., Kan. Pop. 1207.

Franklin, tp. of Franklin co., Kan. Pop. 1021.

Franklin, tp. of Jackson co., Kan. Pop. 2325.

Franklin, post-v., cap. of Simpson co., Ky., on the Louisville and Great Southern R. R., 134 miles S. of Louisville, Ky., and 51 N. of Nashville, Tenn. It has 4 churches, 2 colleges (male and female), 1 weekly newspaper, 1 woollen-factory, 2 flour-mills, and about 40 stores. Pop. 1808.
John Brevard, Ed. "Franklin Patriot."

Franklin, post-v., cap. of St. Mary parish, La., on Bayou Têche, 30 miles W. of Brashear City. It has 1 hotel, 1 weekly newspaper, and several churches and stores. Pop. 1265. W. B. Merchant, Ed. "The Brashear News."

Franklin, tp. and post-v. of Hancock co., Me., 11 miles E. of Ellsworth, has a harbor at the head of Frenchman's Bay, good water-power, shipbuilding, and manufactures of lumber. Pop. 1042.

Franklin, tp. of Carroll co., Md. Pop. 2037.

Franklin, post-v. and tp. of Norfolk co., Mass., on the Boston Hartford and Erie R. R., 28 miles from Boston. It has 1 national and 1 savings bank, 6 churches, a library, 1 weekly newspaper, and several manufactures of woollen and straw goods. Dean Academy is situated here. Pop. 2512.
James M. Stewart, Ed. "Register."

Franklin, tp. of Houghton co., Mich. Pop. 2163.

Franklin, tp. of Lenawee co., Mich. Pop. 1459.

Franklin, post-v. of Oakland co., Mich.

Franklin, tp. of Wright co., Minn. Pop. 797.

Franklin, tp. of Dent co., Mo. Pop. 848.

Franklin, tp. of Grundy co., Mo. Pop. 1029.

Franklin, post-tp. of Howard co., Mo., on the Missouri River, opposite Booneville. Pop. 2474.

Franklin, tp. of Miller co., Mo. Pop. 622.

Franklin, tp. of Newton co., Mo. Pop. 1238.

Franklin, post-tp. of Richardson co., Neb. Pop. 225.

Franklin, post-v. of Merrimack co., N. H., at the junction of the Pemmigewasset and Winnipiseogee rivers, which form the Merrimack, and on the Northern R. R., 18 miles N. of Concord, at the junction of the Bristol branch. It has a savings bank, a weekly newspaper, a large paper-mill, machine-shops, wood-working shops, several woollen-mills, 5 churches, 3 hotels, etc. The New Hampshire Orphans' Home is in this town, 3 miles S. of the village, on the farm once owned by Daniel Webster. Pop. of tp. 2301.
O. A. Towne, Ed. "Merrimack Journal."

Franklin, tp. of Bergen co., N. J. Pop. 2899.

Franklin, post-v. of Essex co., N. J., on the Erie R. R., Newark branch.

Franklin, tp. of Gloucester co., N. J. Pop. 2188.

Franklin, tp. of Hunterdon co., N. J. Pop. 1342.

Franklin, tp. of Somerset co., N. J. Pop. 3912.

Franklin, tp. of Warren co., N. J. Pop. 1655.

Franklin, post-v. and tp. of Delaware co., N. Y., 4 miles E. of Otego on the Albany and Susquehanna R. R., and 5 miles N. of Merrickville on the New York and Oswego Midland R. R. It has 1 national bank, 1 weekly newspaper, an excellent school, 5 churches, 1 hotel, and a number of stores. It lies in a very pleasant and fertile valley. Principal business, farming and dairying. Pop. of v. 681; of tp. 3283. Theo. Smith, Ed. "Register."

Franklin, tp. of Franklin co., N. Y., on the Saranac, has iron-mines. Chief pursuit, lumbering. Pop. 1195.

Franklin (P. O. Franklin Iron-works), a v. of Kirkland tp., Oneida co., N. Y., on the New York and Oswego Midland R. R., 11 miles from Utica, has a furnace which usually turns out 8000 tons of iron a year. Pop. 379.

Franklin, post-v., cap. of Macon co., N. C., situated in a deep valley on the Little Tennessee River, 44 miles N. W. of Walhalla, S. C. Pop. of tp. 1310.

Franklin, tp. of New Hanover co., N. C. Pop. 1309.

Franklin, tp. of Rowan co., N. C. Pop. 1184.

Franklin, tp. of Surry co., N. C. Pop. 629.

Franklin, tp. of Adams co., O. Pop. 2172.

Franklin, tp. of Brown co., O. Pop. 1225.

Franklin, tp. of Clermont co., O. Pop. 3298.

Franklin, tp. of Columbiana co., O. Pop. 866.

Franklin, tp. of Coshocton co., O. Pop. 972.

Franklin, tp. of Darke co., O. Pop. 1366.

Franklin, tp. of Franklin co., O. Pop. 2629.

Franklin, tp. of Fulton co., O. Pop. 999.

Franklin, tp. of Harrison co., O. Pop. 1153.

Franklin, tp. of Jackson co., O. Pop. 1665.

Franklin, tp. of Licking co., O. Pop. 847.

Franklin, tp. of Mercer co., O. Pop. 831.

Franklin, tp. of Monroe co., O. Pop. 1418.

Franklin, tp. of Morrow co., O. Pop. 1011.

Franklin, tp. of Portage co., O. Pop. 3037.

Franklin, tp. of Richland co., O. Pop. 943.

Franklin, tp. of Ross co., O. Pop. 1082.

Franklin, tp. of Shelby co., O. Pop. 839.

Franklin, tp. of Summit co., O. Pop. 1887.

Franklin, tp. of Tuscarawas co., O. Pop. 998.

Franklin, tp. and post-v. of Warren co., O. It has 1 national bank and 1 weekly newspaper. Pop. of v. 1832; of tp. 3012.

Franklin, tp. of Wayne co., O. Pop. 1302.

Franklin, tp. of Adams co., Pa. Pop. 2176.

Franklin, tp. of Allegheny co., Pa. Pop. 716.

Franklin, tp. of Beaver co., Pa. Pop. 676.

Franklin, tp. of Bradford co., Pa. Pop. 705.

Franklin, tp. of Butler co., Pa. Pop. 1047.

Franklin, borough of Cambria co., Pa. Pop. 426.

Franklin, tp. of Carbon co., Pa. Pop. 1912.

Franklin, tp. of Chester co., Pa. Pop. 922.

Franklin, tp. of Columbia co., Pa. Pop. 506.

Franklin, tp. of Erie co., Pa. Pop. 994.

Franklin, tp. of Fayette co., Pa. Pop. 1299.

Franklin, tp. of Greene co., Pa. Pop. 1500.

Franklin, tp. of Huntingdon co., Pa. It contains iron-mines and furnaces. Pop. 1355.

Franklin, tp. of Luzerne co., Pa. Pop. 644.

Franklin, tp. of Lycoming co., Pa. Pop. 739.

Franklin, tp. of Snyder co., Pa. Pop. 934.

Franklin, tp. of Susquehanna co., Pa. Pop. 849.

Franklin, city, cap. of Venango co., Pa., on the Allegheny River at the mouth of French Creek. It is on the lines of the Allegheny Valley, the Atlantic and Great Western R. Rs., and the Jamestown and Franklin R. R., a branch of the Lake Shore and Michigan Southern R. R. It contains 8 churches, 5 banks, 3 stone-quarries, 1 union school building and several private schools, 2 flouring-mills, 3 machine-shops, 2 planing-mills, 2 carriage-factories, 10 hotels, 2 weekly newspapers, 2 lubricating-oil refineries, 2 illuminating-oil refineries, 2 building and loan associations, and about 50 stores. Incorporated 1868. Pop. 3908.

John H. Whitaker, Ed. "Venango Spectator."

Franklin, tp. of Washington co., Pa. Pop. 1074.

Franklin, tp. of Westmoreland co., Pa. Pop. 1796.

Franklin, tp. of York co., Pa. Pop. 910.

Franklin, post-v., county-seat of Williamson co., Tenn., is on Harpeth River and on the Louisville Nashville and Great Southern R. R., 18 miles S. of Nashville. It has a national bank, 10 churches, a Masonic temple, a weekly newspaper, 2 flouring-mills, a furniture-factory and planing-mill, 2 steam cotton-gins, 2 carriage-manufactories, and other business enterprises. It is the seat of Tennessee Female College, a prosperous institution, of Harpeth Male Academy, and of other schools, some of them free. It is in a rich and well-peopled district. Here Gen. Van Dorn was repulsed by Gen. Granger Apr. 10, 1863, and here, Nov. 30, 1864, a bloody battle was fought between the forces of Gen. Hood and those of Gen. Schofield. (See Franklin, Battle of.) Pop. 1552.

Thos. E. Haynes, Ed. "Review and Journal."

Franklin, tp. and post-v. of Franklin co., Vt., on the Canada line. Pop. 1612.

Franklin, tp. of Rockingham co., Va. Pop. 3200.

Franklin, tp. of Southampton co., Va. Pop. 1564.

Franklin, tp. of Braxton co., West Va. Pop. 1279.

Franklin, tp. of Marshall co., West Va. Pop. 1610.

Franklin, post-v. and tp., cap. of Pendleton co., W. Va., on S. branch of the Potomac, has churches, schools, a newspaper, factories, and stores. Pop. 1209.

S. D. Gordon, Ed. "Examiner."

Franklin, tp. of Kewaunee co., Wis. Pop. 1280.

Franklin, tp. of Manitowoc co., Wis. Pop. 1597.

Franklin, tp. of Milwaukee co., Wis. Pop. 2090.

Franklin, tp. of Sauk co., Wis. Pop. 786.

Franklin, tp. of Vernon co., Wis. Pop. 1231.

Franklin, Battle of. After the fall of Atlanta (Sept. 2, 1864), Gen. Sherman encamped his army in its vicinity. His line of communications now extended to Nashville, or, properly speaking, to Louisville, a distance of 500 miles, every foot of which had to be protected. The Confederate authorities, aware of the necessity of drawing or forcing Sherman from Georgia, determined upon an invasion of Tennessee, and on Oct. 1, Hood, who had succeeded (July 17) Johnston in command of the Confederate army, crossed the Chattahoochee with 40,000 men to destroy Sherman's communications, invade Tennessee, and thus force him to retreat. Sherman, becoming aware of this intention, had sent (Sept. 28) Gen. Thomas to Nashville, and, perceiving the impossibility of maintaining his long lines of communication, the plan of abandoning them and striking for the Atlantic coast was proposed and finally determined upon. Sending back the 4th corps (Stanley) and 23d corps (Schofield) to report to Thomas at Nashville, Sherman (Nov. 12) severed his communications and proceeded on his famous "march to the sea." After Sherman's departure Gen. Hood, under orders of his government, continued his sortie towards Nashville, frequently engaging the Union troops, under Schofield, who continued to fall back before Hood's advance, until, arriving at Franklin, Tenn. (Nov. 30), Hood followed in such close pursuit that Schofield was compelled to give battle here. Of Hood's movement Grant says: "Hood, instead of following Sherman, continued his march northward, which seemed to me to be leading to his certain doom. At all events, had I had the power to command both armies, I should not have changed the orders under which he seemed to be acting." Franklin is situated on the S. bank of Harpeth River, 18 miles S. of Nashville. The river here so bends as to surround more than half the town, leaving only the S. and W. exposed. Gen. Schofield's object was to get his trains across the river and away to Nashville; Hood's object was to attack before he could do so. Schofield disposed his cavalry along the N. bank above and below the town to guard the fords, on the heights of which bank a part of his artillery was also placed. His army numbered about 17,000 men, all told, but of these only about 10,000 were available to maintain his perilous position on the S. side of the river. The 23d corps, covering the Columbia and Lewisburg roads, formed the centre of his line; Kimball's division, 4th corps, the right, both flanks resting on the river; two brigades of Wagner's division were posted in front. Hastily-constructed breastworks were thrown up along the main line, reaching from river to river, behind which artillery was thickly strewn. At 4 P. M. Hood attacked Wagner in his advanced position, who, maintaining the defence too long, was finally driven back in confusion, with a loss of 1000 men, into and through the centre of the main lines. Re-forming his lines, Hood threw his men within the broken Union lines, capturing 8 guns. At this critical moment Col. E. Opdycke (125th Ohio), commanding the brigade of Wagner's division which had been left within the main lines, without waiting for instructions, led his brigade into the gap, forcing back the Confederates and recapturing the guns. Of this exploit Gen. Thomas reported that "it saved the army from destructive defeat." Four different assaults were made by the Confederates, the battle lasting till a late hour, but each time they were repulsed with great loss. At midnight Schofield withdrew his troops and train to Nashville, meeting little molestation. Confederate loss, nearly 6000 in killed, wounded, and prisoners; Union loss, 189 killed, 1033 wounded, 1104 missing.

Franklin (Benjamin), LL.D., F. R. S., was b. at Boston, Mass., Jan. 17, 1706. His father was an intelligent and devout chandler of English birth; his mother, the daughter of Peter Folger of Nantucket, a prominent citizen. Benjamin was the fifteenth of a family of seventeen children. To keep him from going to sea, he was apprenticed to his brother James, a printer, and by much reading, careful and assiduous writing (as much as possible after the style of the *Spectator*), together with the unassisted study of mathematics, he acquired such knowledge

and facility in writing that he ventured to print his thoughts upon public affairs in his brother's newspaper, the *New England Courant*. His papers were well received by the public, but the discovery of their authorship led to a quarrel between the brothers. The newspaper was for a time published in Benjamin's name during an imprisonment of James to which he was subjected for political reasons. In 1723 the young apprentice, wearying of the tyranny he experienced, broke his indentures and ran away, first to New York, and thence to Philadelphia, where he found employment as a journeyman printer. He was in England 1725–26, having been sent by Sir William Keith, the governor, who promised to set him up in business as the public printer of Philadelphia, but failed to keep his promise. After his return to Philadelphia he married (1730), established the *Pennsylvania Gazette*, and soon found himself a person of the first consideration, not only in Philadelphia, but throughout the provinces, for his talents as a writer and his sound judgment in public and business affairs. He established the Philadelphia Library in 1742, and the American Philosophical Society and the University of Pennsylvania in 1744; carried on his famous investigations into the nature of lightning 1746–52, and still later resumed them; and for his papers on the subject he was elected F. R. S. in 1775 and received the Copley gold medal. In 1753 he was made postmaster-general for the colonies, and several times served efficiently as commissioner to the mother-country and to the various colonies. From St. Andrew's, Oxford, and Edinburgh in 1764 he received the degree of LL.D. He did his best to prevent the Revolutionary war by trying to avert the injustice which caused it; procured the repeal of the Stamp Act 1766; and ever warmly sustained the colonial rights, though by a considerable party his patriotism was somewhat later sharply questioned. In 1775 he was chosen to the Congress, and in 1776 he was one of the signers of the Declaration of Independence, having been also one of the committee to draft that instrument. He was (1776–85) employed in the diplomatic service of the U. S., chiefly at Paris, where his influence in behalf of his country was powerful and serviceable in the highest degree, and where his simplicity, dignity, and wisdom made him highly popular. He was president of the Pennsylvania supreme council (in effect governor of the State) 1785–88. In 1787 he was one of the delegates to the convention which drew up the U. S. Constitution. D. at Philadelphia Apr. 17, 1790.

Of the writings of Franklin, the *Busybody*, a series of admirable papers somewhat after the manner of the *Spectator*, but far more readable, and the incomplete *Autobiography*, are the best known, but his political, anti-slavery, financial, economic, and scientific papers are all noteworthy. He published the famous *Poor Richard's Almanac* (1732–57), which was extensively reprinted in Great Britain. In youth he was an avowed skeptic in religious matters and of somewhat loose morals, but his practical good sense enabled him to correct his way of living, and he in later life treated the Christian religion with reverence, though never avowing his faith in any religious system.—His only son, William (1729–1813), was illegitimate; was royal governor of New Jersey 1762–76; but became a royalist, went to England, and d. there.—His grandson, William Temple Franklin (1760–1823), was his grandfather's secretary in Paris and the editor of his writings. (See Lord Jeffrey's articles, *Edinburgh Review*, July, 1806; Aug., 1817; Bancroft's *History of the U. S.*, vol. ix. ch. xxix.; A. Norton's article in the *North American Review*, vol. vii.; Condorcet, *Éloge de Franklin*, 1790; Mignet, *Vie de Franklin;* Bauer, *Washington und Franklin*, Berlin, 1803–06; C. Schmaltz, *Leben Benj. Franklins*, 1840. In 1868 a corrected edition of Franklin's *Autobiography* was published by John Bigelow, from MSS. found in Paris. See also Brougham's *Statesmen of the Time of George III.*, vol. ii.; Parton's *Life and Times of B. Franklin*, 1864; and Theodore Parker's *Historic Americans*, 1870.) H. H. McFarland.

Franklin (Jesse), b. in Surry co., N. C., in 1758; attained the rank of major in the Revolutionary war; was in the house of delegates 1794 and 1799–1805; was in Congress 1795–97; a State senator 1805–06; U. S. Senator 1807–13; commissioner to the Chickasaws 1816; governor of N. C. 1820–21. D. in Surry co., N. C., Sept., 1823.

Franklin (Sir John), D. C. L., F. R. S., rear-admiral, b. at Spilsby, Lincolnshire, England, Apr. 16, 1786; went to sea in childhood; entered the navy; served at Copenhagen, Trafalgar, and New Orleans (1815), and was wounded in the gunboat fight on the latter occasion; led Arctic expeditions 1818, 1819, and 1825; became post-captain and F. R. S. 1823; knight and D. C. L. 1827; was governor of Tasmania 1836–43, where he was greatly beloved. In 1845 he set out on his last polar expedition in command of the Erebus and Terror. Many expeditions were sent out in search of the Franklin expedition, and from time to time various relics of it were found; and in 1859 Capt. F. L. McClintock found at Point Victory in the Arctic region conclusive documentary evidence that Franklin d. near Lancaster Sound June 11, 1847, and there is no doubt that all his men also perished, though some long survived.—Franklin's first wife, Eleanor Ann Porden (1795–1825), was a poet; his second wife, Lady Jane, *née* Griffin, was famed for her philanthropy and her labors for the recovery of her lost husband. D. in London July 18, 1875.

Franklin (Thomas L.), D. D., b. at Philadelphia Apr. 10, 1820, graduated at the Philadelphia Classical Institute 1837; at Trinity College, Hartford, Conn., 1841; and at the Theological Seminary of Virginia 1844; entered the ministry of the Protestant Episcopal Church; was missionary committee of the diocese of New York 1853; of Western New York 1869–70; founded the Jane Grey School, Mt. Morris, N. Y., 1866; was its rector 1866–70; has been active in the work of building churches and rectories, and has occupied various important pastoral charges in his Church.

Franklin (William Buel), b. in York, Pa., Feb. 27, 1823; entered the Military Academy at West Point June, 1839; graduated June, 1843, and was assigned to the corps of topographical engineers; served in the war with Mexico on the staff of Gen. Wool, in what was called the Chihuahua column; was on Gen. Taylor's staff in the battle of Buena Vista, and was brevetted first lieutenant for "gallant and meritorious services" in that battle; served at the West Point Military Academy as acting assistant professor of natural and experimental philosophy from Sept., 1848, to Jan., 1852; professor of engineering and natural and experimental philosophy at the New York Free Academy (now College of New York) from Jan. to Apr., 1852; on lighthouse duty as inspector and engineer from 1853 to 1857; engineer-secretary of lighthouse board from Mar., 1857, to Nov., 1859; engineer in charge of Capitol at Washington from Nov., 1859, to Mar., 1861; in charge of bureau of construction and repair and superintendent treasury extension from Mar. to May, 1861; appointed colonel of the 12th U. S. Infantry May 14, 1861, and brigadier-general U. S. volunteers May 17, 1861; commanded a brigade in Heintzelman's division at the battle of Bull Run, July 21, 1861; commanded a division in front of Washington until Mar., 1862, when he was assigned to Gen. McDowell's corps; detached and joined Gen. McClellan in front of Yorktown in Apr., 1862; organized and commanded 6th corps May, 1862; commanded at the battle of West Point May 6, 1862; commanded at the affair of Golding's Farm June 27, 1862, and at the battle of White Oak Swamp June 30, 1862; appointed major-general July 4, 1862; commanded the left at the battle of South Mountain, Md., Sept. 14, 1862, capturing Crampton's Gap; present at the battle of Antietam Sept. 17, 1862, in command of the 6th corps, relieving Gen. Sumner's command after 12 o'clock; assigned to the command of the left grand division Army of the Potomac Nov., 1862, consisting of the 1st and 6th corps; commanded left wing at the battle of Fredericksburg Dec. 12 and 13, 1862; relieved from duty in the Army of the Potomac Jan. 25, 1863; assigned to duty in the department of the Gulf July, 1863; in command of expedition against Sabine Pass Sept., 1863, which was repulsed; in command of troops occupying Northern Louisiana 1863–64; in command of the 19th corps and troops of the department of the Gulf, forming the Red River expedition, in Mar. and Apr., 1864, until joined by Gen. Banks on the evening of Apr. 6; in the battle of Sabine Cross-roads, as second in command, on Apr. 7, and in the battle of Pleasant Hill on Apr. 8; wounded and lost two horses shot under him Apr. 7; conducted retreat to Alexandria, and directed Col. Bailey to make arrangements for the relief of Admiral Porter's fleet by the Red River dam; on sick leave on account of wound from June to Nov., 1864; captured on a train from Baltimore to Philadelphia July, 1864, escaping during the next night; president of a board for retiring disabled officers from Nov., 1864, to Nov., 1865; resigned as major-general of volunteers Nov. 9, 1865, and as colonel of the 12th Infantry Mar. 15, 1866. He now resides at Hartford as vice-president and general agent of Colt's Fire-arms Manufacturing Co.; president of commission for laying out Long Island City 1871–72; president of the board of commissioners for building new State-house 1872–73; consulting engineer of same 1874. Joseph Henry.

Franklin Grove, post-v. of China tp., Lee co., Ill., 88 miles W. of Chicago, on the Chicago and North-western R. R. It has 3 churches, a union school, 1 hotel, 12 stores, 4 grain-elevators, 1 hay-press, and other business enterprises, and 1 weekly newspaper. Pop. 757.

D. H. Spickler, Ed. "Franklin Reporter."

Franklin Island, off the coast of Knox co., Me., on

the W. side of the entrance to the river St. George, has a brick lighthouse with a flashing light, standing at the N. point of the island; lat. 43° 53′ 31″ N., lon. 69° 22′ 10″ W.

Frank'linite [in honor of *Dr. Franklin*], a mineral found associated with red oxide of zinc, found both amorphous and crystalline, chiefly at the Mine Hill and Stirling zinc-mines in Sussex co., N. J., and also found at Altenburg, near Aix-la-Chapelle, Germany. It contains from 66 to 69 parts of peroxide of iron, with from 10 to 22 parts of oxide of zinc, and about the same proportion of oxide of manganese. Franklinite is worked for making zinc paint, and the residue, itself called franklinite, is used as an iron ore, and is considered especially useful in making Bessemer steel. It makes a white cast iron like *Spiegeleisen.*

Franklin Lake, in Elko co., Nev., lies E. of the lofty East Humboldt Mountains. It is nearly fresh, very shallow, and is fed by springs doubtless derived from the mountain-snows. The *tulé* (*Scirpus validus*) grows abundantly in the lake, which has no outlet.

Franklin Plantation, tp. of Oxford co., Me. P. 178.

Frank'linsville, tp. of Randolph co., N. C. P. 1528.

Frank'linton, cap. of Washington parish, La., 68 miles N. of New Orleans, on Bogue Chitto. Pop. 121.

Franklinton, tp. and post-v. of Franklin co., N. C., on the Raleigh and Gaston R. R., 27 miles N. E. of Raleigh. Pop. of v. 305; of tp. 1956.

Franklinton, a former post-v. of Franklin tp., Franklin co., O., was in 1872 made a part of the city of Columbus. Pop. (1870) 690.

Frank'lintown, post-b. of York co., Pa. Pop. 181.

Frank'linville, post-v. and tp. of Cattaraugus co., N. Y., has a free academy and several mills. Pop. 1559.

Frank Marriage, a peculiar species of entailed estate formerly in use under the English law, consisting in a gift of land by a father or kinsman to a daughter or cousin and her husband at the time of her marriage, upon the implied condition that the land was to descend to the issue of the marriage. On birth of issue the condition was regarded as performed, and the estate became alienable. But the passage of the statute *De donis conditionalibus* caused such estates, like others held in tail, to be controlled by the terms of the gift, and to be reserved exclusively for the issue for whom they were originally intended; so that the power of alienation was thus taken away. Such estates were afterwards subjected to the same changes as all entailed estates. (See ENTAIL.) GEORGE CHASE. REV. BY T. W. DWIGHT.

Frank Pledge. In the early period of English history the counties of the realm were divided into hundreds, and the hundreds were still further subdivided into tithings, which received their name (Sax. *teothung*, "a company of ten") because each was composed of *ten* freeholders. These, with their families, all dwelt together, and were free pledges—*i. e.* sureties—for the good behavior and obedience to the law of one another. Upon the commission of an offence by any one of them, the others were obliged to have him forthcoming to answer the requisition of the law, or, in case of his escape, to bear the burden of any penalty that might be imposed.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Franks, The. 1. *The Name and Peoples Embraced thereunder.*—The name [Ger. *frank;* Fr. *franc;* It. *franco;* Eng. *free*] is of later origin than the first historical appearance of the different peoples designated thereby, and shadows forth that new element of individual freedom which the Teutonic peoples were destined to contribute to European civilization. The tribes embraced two and a half centuries later under this name had already, during the reign of Augustus (27 B. C.–14 A. D.), appeared upon the Rhine, and in their contact with the Roman civilization been drawn into historic notice. The Bructeri, Chamavi, Amsivarii, Catti, Chassuarii, and especially the Sygambri, mentioned by the Latin historians of this period, were the tribes which formed the nucleus of the later confederation of the "Franci." They had already at that time, in small pioneer groups, pushed across to the *left* bank of the Lower Rhine, while they occupied the territory on the right from the mouth of the Ems to the Sieg and Werra. After the middle of the fourth century appear the two groups of this Frankish confederation under the names Salian and Ripuarian—the former inhabiting the districts of the Lower Rhine, Meuse, and Scheldt, and deriving its name probably from the river Sala (present Yssel); the latter inhabiting the territory of the Middle Rhine in and about the present city of Cologne, and named from its riparian situation.

2. *Their Place in Teutonic History.*—Their problem in the civilization of Europe was the mediation of the Roman-Christian civilization with the Germanic; or, better, it was theirs to receive the inheritance of the Roman-Christian culture—to form, reform, develop, and supplement it by and with the freshness and vigor of the Germanic nature, and at the same time *be* formed, reformed, developed, and modified by it. The sinking Roman world delivered to the Franks the world-historic inheritance which it had itself received, increased and stamped with the forms and characteristics of its own nature; theirs it now became to take up this world-civilization, and by the developments and modifications to which they subjected it, and it them, to present it as their form of the world-civilization, and be presented by *it* as *its* first expression through the Germanic man, and so furnish the connecting link between the antique classic world, with its speculative and ritualistic religiosity, and the scientific political world of the new time, with its ethically religious view.

3. *The Characteristics and Conditions which made the Franks the first World-historic People of Germanic Nationality.*—*a. Their Geographical Position and Agricultural Nature.*—We find them as early as the middle of the fourth century separated into the two branches of Salian and Ripuarian, and occupying the fertile plains on the lower course of the Scheldt, Meuse, and Rhine. While thus the other German tribes, during the great "wandering of the peoples," separated themselves entirely from their original homes, and, spreading themselves like a thin lamina over other nationalities, were soon absorbed by and disappeared in the same, the Franks, on the other hand, maintained their geographical connection with the old Germanic home, from which they continued to draw new freshness and vigor by which to oppose the deteriorating and disorganizing influences of the decaying Roman world. Sustained thus from behind, they pushed gradually and peacefully (as compared with the warlike convulsions which the great immigration was elsewhere producing) forward, never forgetting in their new acquisitions the worth and importance of the old; *settling* their lands as they gained them, and reducing them to cultivation; uprooting and destroying the scanty remnants of the Celtic, and at first of the Roman-Christian, civilization; in a word, thoroughly "Germanizing" as they pressed forward.

b. Their Attitude towards the Roman State.—While we find the other German tribes and peoples, for the most part, waging an open and unceasing warfare with the Romans for supremacy and existence, the Franks, on the other hand, after the first brushes of conflict with the Roman commander Aetius in Gaul, who in 428 A. D., and again in 431 A. D., checked their south-westward movement, acknowledged the political supremacy of the Roman state, occupied peacefully the land as far as the Somme by consent of the Roman commander, and tolerated the Roman rites and religion, while their king Clovis received distinguished Romans at his court; in a word, they gradually and almost unconsciously, both to themselves and their national opponents, secured to themselves the *substance* of power, leaving to the Romans only the outward show. And not until the Roman governor, Syagrius of Soissons, had separated himself by his own usurpatory act from the source of his authority in Ravenna or Constantinople, and thus lost in the eyes of his Roman-Gallic subjects his show of legitimacy, did the Frankish king Clovis abolish these scanty remnants of Roman supremacy, and, while extending his dominions to the Loire, joined to the *substance* of the power which he already possessed the outward *form* of sovereignty (486 A. D.). Under such circumstances neither the Roman emperor at Constantinople nor the Roman-Gallic subjects took any offence at this procedure. On the contrary, after Clovis's victory over the Visigoths (507 A. D.) the emperor Anastasius bestowed upon him the dignity and title of a Roman patrician, and appointed him Roman proconsul in Gaul; and though the Frank owed his supremacy, for the most part, to his own good sword, yet he was by no means blind to the advantage of the legitimation of his title in the eyes of his Roman-Gallic subjects by the legitimate Roman emperor. He received the dignity with reverence, caused the ceremony of coronation to be performed upon himself, and was greeted by his subjects as consul and Augustus, thus settling all dispute between Frank and Roman in regard to the right of his sovereignty.

c. Their Attitude towards the Orthodox Romish Church.—We have already remarked that the Franks in their earliest appearance on the Scheldt began to root out and destroy the scanty remnants of the Roman-Christian as well as of the Celtic culture, but that, as they proceeded towards the S. W., and occupied the lands to the Somme under the recognition of the political supremacy of the Roman governor at Soissons, this opposition to the Christian culture was changed to *tolerance*, which of itself gave to the Franks a very great advantage in their relation to the Roman-Gallic population as compared with the other German tribes

upon Gallic soil, since these, for the most part, were *Arian* Christians, and unceasing in their persecution of the orthodox branch of the Church, to which the Roman-Gallic inhabitants for the most part adhered. If mere tolerance, therefore, produced such advantage, what if the Franks should become the outspoken defenders of Romish-Christian orthodoxy? Yea, what if they should become orthodox Christians themselves? But here was a difficulty, or rather a great series of seemingly insurmountable difficulties. In the nature and history of the Franks every presupposition and condition for such a conversion seemed to fail. First of all, the readiness to break with the past, the despair of coming to anything upon the old lines of activity, the repentance and consciousness of imperfection necessary to a change of religion, were entirely wanting—yea, inconceivable—to the young, fresh, hopeful, active Germanic nature, all glowing with the recollection of its heroes of the past, and striving to imitate them. Then, again, the Christian religion was the religion of the Romans, their national enemy. The Christian God, according to their way of thinking, gave to the Romans their victories and brought to the Germans their defeats. To become a Christian was therefore to become a Roman in sympathy—in other words, a traitor. Then, again, the (at that time) emphasized principles of Christianity found but little sympathy in the nature of the German. The lowly, patient, and humble Jesus was anything but *his* idea of a perfect manhood. A proud, vigorous, belligerent, and successful individuality was to him the only example worthy of imitation. And when we turn to the speculative and moral sides, it was no better. The preliminary philosophical study and development of language necessary to convey and receive such ideas—as, for instance, the doctrine of the Trinity—were entirely wanting, while the principle of blood-revenge for injury to one's self or family was the German-heathen correspondent in morals to that of brotherly love in Christianity. Many years of contact with the Romans had perhaps, in some features, softened the bluntness of the opposition; still, the Franks remained entirely true to their heathenism, and the only perceivable effect of this contact was an indifferent toleration for Christianity as *one of the Roman institutions*. All *natural* conditions were thus lacking, and nothing short of a course of events *miraculous* in their nature to *the minds of the Franks* could secure their conversion; and such a conversion must and did establish peculiar, and in some respects dangerous, relationships to the ecclesiastical power. About 493 A. D. the Frankish king Clovis took for his consort an orthodox Christian, Clotilda, daughter of King Chilperic of Burgundy, who shortly before the marriage of his daughter had been murdered by his own brother Gundobald, also king in Burgundy, and an *Arian* by profession. The orthodox Christians of Gaul believed that difference of creed was the cause of the murder, and it fired their souls with hatred against Gundobald. Clovis inherited by his marriage with Clotilda, according to the German law of blood-revenge, the duty of revenging the blood of his father-in-law. Here, at least, was one point of sympathy between him and the orthodox inhabitants of all Gaul. Clotilda lost no time in attempting by her persuasions to extend this sympathy on the part of her consort, but in vain. Clovis gave way only so far as to allow his first-born son to receive the Christian baptism. A few days afterward the babe sickened and died. A second was born to him, and likewise, through the persuasions of Clotilda, subjected to the Christian rite. In five days this child sickened and came near unto death. It is difficult for men of our day and way of thinking to represent to themselves the thoughts and emotions of Clovis at this critical juncture. In allowing these acts he had been a traitor to the gods of his fatherland—those gods who had rewarded with victory and success his devotion to them, and who now punished his treason. It was therefore a matter of no small moment that this child recovered, and that the Christian God thus vindicated himself (so to speak) and his power in the eyes of Clovis. Thus aroused, disturbed, and excited in spirit, the Frank neared the decisive instant. The Alemanni, a warlike German tribe occupying both sides of the Rhine from Mayence to Bâle, pressed hard against the Ripuarian Franks, whose king, Sigebert, with the aid of Clovis the Salian, prepared to meet them in battle. The conflict took place in the neighborhood of the present city of Zülpich (496 A. D.). The Franks fell by thousands; complete destruction threatened them. In this moment of despair, and doubt in the power and inclination of the gods of his own worship to save him, Clovis lifted his eyes to heaven and pledged himself by an oath to receive the Christian God, the God of his Clotilda, if that God would only prove his power and favor by securing to him the victory. Then, inspired by the sublime loftiness of this wager of his faith, he plunged once more into the heat of the battle, and *won*. The God of the Christians had by this *miracle* vindicated his right and claim to the faith, the devotion, and the sword of the Frank; and the conversion was complete. Clovis, with 3000 of his followers, received immediately the Christian baptism from the hand of the bishop Rhemigius of Rheims, and vowed their allegiance to the orthodox Church. The *manner* of this conversion was the *undoubting reception* by the Franks of the Romish-Christian Church *in its totality as the infallible organ of the invincible God*. Neither the reasonableness of the orthodox doctrine nor the examples of its votaries had produced this change in the Frankish mind, but the Christian God had proved himself the *superior God* of the universe in the miracle of the victory over the Alemanni, and had also manifested therein his *favor* for the Franks. And that was enough for them. Under his favor and by his power the Frank now felt himself invincible and called upon to subdue the world to his sceptre. But the Frank knew nothing of this God *save as presented by this Church through its priesthood*. This Church was to him a *prehistoric* institution. He knew nothing of its origin or development into its then existing ecclesiastical form. The command of the *priest* was to him the command of the Christian God, and service to the *Church* was service to that God. In a word, *the manner of the conversion of the Franks to the Romish-Church Christianity forestalled all distinction between that Church and Christianity, and bound the hopes of the Frank for victory and success together with faith in the invincible divine power of that Church*.

Enabled thus, by their geographical position, to draw continually fresh vigor from the old Germanic home, legitimized politically by the Roman emperor in the eyes of the Roman-Gallic subjects, drawn into most intimate sympathy with the same through the bonds of a common religion, and inspired with the idea of being the favored people of the invincible God, the Franks rapidly overcame all opposition on the part of other tribes and peoples, and at the death of Clovis (511 A. D.) had extended their kingdom and sovereignty from the Garonne and the borders of Septimania to the mouth of the Scheldt, and from the Atlantic on the W. to Thuringia on the E.

4. *The Merovingian Government.*—Through the long years of constant warfare and motion during the immigration of the Teutonic peoples the chief command in war and in immigration had gradually become hereditary, chiefly because, in the absence of other educational means, the father would most naturally train up his own son to the *duties* of the chief command. The assumption of a state of peace at the close of the "great wandering" was gradual, and the ruler in the half-nomadic war continued the ruler in peace, the military leader became the king, the "Herzog" became the "König." The first Frankish king of whom we have any mention was Clodio, while the second, Merovius, founded the dynasty which Clovis fixed firmly in power. The government was thus, by the nature of its origin, a monarchy—not a constitutional or absolute or feudal monarchy, nor yet a military monarchy in the modern sense of that term, but the patriarchal monarchy in its most warlike type. The king's court was the central point of the government. No distinction was made between the king's private property and the state treasury. The officers of his household were *ex officio* the highest officers of the state, the major-domo at their head. The government was administered through the agents of the king—viz. counts and bishops—and these officials, as well as all servants and favorites of the monarch, were paid or rewarded by grants of land, the only species of property at hand in sufficient quantity for the purpose at that stage of Teutonic civilization. The lands thus granted were already inhabited and cultivated by a Romish-Gallic peasantry; and, since no distinction had as yet arisen between public and private functions, the king's grant of land transferred the people dwelling thereon to the political jurisdiction of the grantee—that is, exempted the inhabitants of these grants from the *immediate* power of the king. Of course such an economy of the treasury must, sooner or later, result in the exemption of the entire territory of the Frankish crown from the immediate power of the king, and raise up a powerful and defiant nobility which he could not control. This cause, taken together with the conflicts engendered by the absence of any fixed law of succession within the royal family itself, and the degeneration of the Merovingian dynasty through contact with the decaying Roman world, brought the Frankish state, after an existence of more than two and a half centuries, near to its dissolution.

5. *The Carlovingian Reform.*—The Carlovingian dynasty was in its origin the ducal house of the Ripuarian Franks. This branch of the Frankish folk had remained upon the soil of the fatherland, and, though united with the Salians in the confederacy of the Franci, had preserved the Germanic freshness and vigor, while the closer contact of the

latter (the Salians) with the decaying Roman world upon Gallic soil had produced weakness and decline. As at the close of the seventh and the beginning of the eighth century the dissolution of the Frankish state became imminent, three mighty dukes of the Carlovingian House, Pepin von Landen, Pepin von Heristal, and Charles Martel, gradually and successively gathered into their own hands all political power—first in Austrasia, the more German half of the kingdom, sometimes wearing here the title of major-domo, to lend the show of legitimacy, sometimes not; and then in Neustria, the more Romanic half, where, having no ducal authority, the office of the major-domo was always assumed for the sake of legalizing their sovereignty over their West Frankish subjects. By the influx of this fresh and vigorous German element the process of dissolution was checked and the unity of the Frankish state restored. The Carlovingian dukes broke the independent power of the defiant nobility; brought the royal domain back to the ownership of the Crown; established the principle that the grant of crown-lands meant only the grant of the use of the same, and that only upon condition of service to the state; extended the boundaries of the kingdom; planted the Church in new places; lent their aid to Boniface in the conversion of the Thuringians, Frisians, and part of the Saxons; and successfully defended the European-Christian civilization against the terrible Moslem invasion. Not until they had virtually ruled the Frankish state for more than fifty years, and had grounded their power through these mighty achievements, did they move for the possession of the crown in their own name and right. It was Pepin le Bref who submitted this question first to an assembly of the magnates of the kingdom, and then, after receiving their approval of his design, took one more step in the legitimation of his title, which, at the same time that it accomplished most thoroughly its aim, laid also the foundation for ideas, conceptions, and claims which from that day to this have filled the centuries with intellectual contest, and oft with bloody warfare: we mean the appeal of Pepin to the Roman pontiff for the recognition of his authority as king of the Franks. Upon the reception of the affirmative reply of Pope Zacharias, Pepin was crowned and anointed by the presiding bishop at Soissons in May of 752 A. D. From this time forward the unity of Church and State in the Frankish kingdom became closer and closer. The bishops exercised more and more of the functions of political officers over the inhabitants of the bishoprics. The extension of the kingdom by Pepin and Charlemagne was at the same time a missionary movement for the planting of new churches, the establishment of new dioceses, and the conversion of new peoples. At length, after the mighty Charlemagne had reduced to the sway of his sceptre all the territory of Europe, from the Ebro to the Eider, and from the Frisian coast to Dalmatia and the southern shores of Italy, Pope Leo III. set the crown of the Roman emperor upon his head in the church of St. Peter's at the grave of the apostles, and the Roman people greeted him as emperor and Augustus (Christmas Day of the year 800). With this it was *said* that the Roman-Christian empire of Constantine had been restored—restored *as the feudal grant of the Roman pontiff to Charlemagne.* We do not believe that Charlemagne himself so considered it. He undoubtedly thought that it was the Romans' way of acknowledging that which already existed independent of them. This is clearly seen in the fact that Charlemagne crowned with his own hands his son Louis the Pious as his imperial successor, without any regard to the pope. Still, the manner of the origin of the imperial title gave a color and a moment to the papal assumption of the power to grant and confiscate thrones which the entire Middle Ages did not shake off. During the reign of Charlemagne (768–814) the Frankish state stood at the summit of its power and glory. But the strength and endurance of personal government always depend upon the capacity of the ruler, and when the mighty personality which created the great empire was no more, and his only surviving son, Louis the Pious—a character to wear a cowl, but not a crown—succeeded to the sovereignty, the dissolution began. The wealth of the Crown and the powers of the state were squandered upon the clergy, and the latter half of the weak monarch's reign was a constant scene of conflict between his sons in regard to the succession. At length it came, after the father's death (840 A. D.), to the compact of Verdun between them (Aug., 843 A. D.), according to which the eldest, Lothair, received Italy, the beautiful Burgundian lands, the valleys of the Meuse and Moselle, and the present Holland, and called after his name Lothairingia or Lorraine. Louis the German received the more German portion of the empire, E. of Lothair's kingdom; and Charles the Bald, the Romano-Gallic portion, W. of the same. We may therefore look upon this compact of Verdun as the birth-moment of the three great nationalities—German, French, and Italian—whose friendships and hostilities, workings and interworkings, influences and reflex influences upon each other, have formed the substantial part of European continental history for the last thousand years. The peoples out of whom these three great nationalities were to be developed had been bound together in this mighty political structure of the Frankish state. By the power of this unity, whose chief and fundamental bond was a common religion and a common Church, they had succeeded to the inheritance of all that was destined to be of world-historic value in the civilization of the Roman world. Amid all the wreck and ruin of the centuries of the "great wandering," the Church alone, of all institutions, had stood firm, and now, as the established religion of the Frankish empire, it transmitted to all the peoples of this great state-unity the culture of the Roman world, which it had accumulated and preserved. In this the Frankish state had accomplished its work in the world-historic plan. The peoples brought together to participate in a common civilization by it now separate, each to go its own way—each to develop, supplement, and work up in its own way that which it had received—each to make its own valid at the expense of the rest. The elements clash against each other; sharpen, purify, and develop, thereby, themselves and each other; fall into false connections; become again dissolved, until at last the proper affinities, positions, and relations begin to be found, and the active, intelligent, and reflected harmony of the new time begins to appear. (Sources: *Monumenta Germaniæ Historica*, edited by PERTZ; WIETERSHEIM'S *Geschichte der Völkerwanderung;* WEBER'S *Geschichte des Mittelalters;* WAITZ'S *Deutsche Verfassungsgeschichte;* GIESEBRECHT'S *Geschichte der deutschen Kaiserzeit;* RÜCKERT'S *Culturgeschichte des deutschen Volks;* GREGOROVIUS'S *Geschichte der Stadt Rom im Mittelalter;* MARTIN'S *Histoire de France;* GUIZOT'S *Histoire de Civilisation en France;* HALLAM'S *History of the Middle Ages.*) J. W. BURGESS.

Franks, tp. of St. Francis co., Ark. Pop. 1906.

Franks'town, post-v. of Douglas co., Col., on the Territorial road from Denver to New Mexico, 30 miles S. of Denver. It has a brewery, hotel, several stores, and one weekly newspaper. Chief business, cattle-raising and dairying. E. H. STURDY, ED. "DOUGLAS CO. NEWS."

Frankstown, post-tp. of Blair co., Pa., 3 miles E. of Hollidaysburg. Pop. 1553.

Frank'ton, post-v. of Pipe Creek tp., Madison co., Ind. Pop. 270.

Frank'town, post-tp. of Washoe co., Nev. Pop. 271.

Franktown, post-tp. of Northampton co., Va. Pop. 2270.

Frank'ville, tp. and post-v. of Winneshiek co., Ia. Pop. 1154.

Fran'zensbad, or **E'gerbrunnen,** a v. of Bohemia, in the county of Eger. It is a celebrated bathing-place. The waters of its four cold mineral springs are mostly used for drinking, and are very efficacious in scrofulous diseases; 300,000 bottles are annually exported.

Frasca'ti, town of Central Italy, 12 miles from Rome, on the slope of the Alban Hills, and celebrated as a summer resort. It was built, after the destruction of ancient Tusculum in 1191, on the ruins of a villa overgrown with underwood (*frasche*), whence its name. The villas of Aldobrandini, Piccolomini, and Rufinella are celebrated. Pop. 5000.

Fra'ser (ALEXANDER CAMPBELL), LL.D., b. at Ardchattan, Argyleshire, Scotland, Sept., 1819; educated at the University of Edinburgh; in 1846 appointed lecturer on mental philosophy in the New College, Edinburgh. From 1850 to 1857 was editor of the *North British Review*, succeeding Sir William Hamilton in the latter year as professor of logic and metaphysics in the University of Edinburgh, which chair he at present (1875) retains. Besides many valuable contributions to the *North British Review* and other periodicals, he is the author of *Essays in Philosophy* (1856), *Rational Philosophy* (1858); in 1871 he published a collected edition of the *Works* of Bishop Berkeley, with dissertations and annotations; also the *Life and Letters of Bishop Berkeley, with an account of his Philosophy.*

G. C. SIMMONS.

Fraser (CHARLES), an American painter, b. in Charleston, S. C., Aug. 20, 1782; studied law, was admitted to the bar, and practised with such success that his art-studies were suspended. In 1818 renounced the profession of the law and devoted himself to painting. In the department of miniature he chiefly excelled, though historical subjects and landscape tempted him. His popularity in his native city was great. At an exhibition of his works held there in 1857 there were 313 miniatures and 139 paintings in oil

of other styles. Mr. Fraser was a man of letters, as well as an artist. D. in Charleston Oct. 5, 1860.

O. B. Frothingham.

Fraser (Simon), a gallant Scottish officer who entered the 2d Highlanders in 1757, after service in Holland; served on the Continent with honor; in 1761 became major of the 21st Foot, and received the various grades of promotion up to that of brigadier-general, to which rank he was appointed in 1776. He served with skill and valor under Burgoyne in America; gained an advantage over the Americans in the action at Hubbardton, Vt., July 7, 1777; bore a prominent part in the battles at Stillwater, N. Y., in the second of which he was mortally wounded, and d. on the following morning, Oct. 8, 1777.

Fraser (Simon). See Lovat, Lord.

Fraser River, in British Columbia, is, next to the Columbia and the Yukon, the largest American river falling into the Pacific. It rises by two forks, one of which flows S. E. from near 54° N. lat. and 125° W. lon. for 250 miles, while the other flows from the Rocky Mountains (in lat. 53° 25′ N., lon. 118° 40′ W.), and reaches the junction after a N. W. course of 200 miles. The union is near Fort George (about 53° 25′ N. lat., 122° 40′ W. lon.). The course of the main stream is southward for 800 miles. Large steamers ascend it 150 miles from its mouth to Fort Hope, and at high water they can go 12 miles farther up. Large sea-going vessels mostly stop at New Westminster, 75 miles from the Gulf of Georgia. The Fraser River is chiefly important for the rich gold-mines along its banks, and for its salmon fisheries, which are destined to become of the first importance. The river flows throughout a great part of its course in deep cañons, with a rapid current. Its mouth is near the U. S. line, on the Gulf of Georgia. Fraser River affords five species of salmon, and in the spring its estuary contains millions of the *oulachon*, or candle-fish, a fine smelt (*Thaleichthys Pacificus*), which is very valuable for food and oil. Along its banks there are good timber and fur regions and some fine grazing-lands. The lower Fraser Valley is densely timbered.

Fraserville, Canada. See Rivière du Loup.

Frater′nities [from the Lat. *fraternitas*, "brotherhood"], voluntary associations of men for mutual benefit, benevolence, or pleasure. Such are the numerous secret and benevolent societies, and in a large sense the term may include the orders of the Church and the monastic and sacerdotal congregations, and even the orders of knighthood; also guilds, trades unions, and the like. Among the laity of the Roman Catholic Church there are numerous associations called fraternities, sodalities, confraternities, arch-confraternities, etc., designed for benevolent or devotional purposes. Some of these are very extensive and have many branches, while others are quite local and confined to one parish. (See Freemasonry, Odd Fellows, Druids, Guild, etc.)

Fra′tres Arva′les [from *arvum*, a "field"], a college of twelve priests in ancient Rome, established at a very early period. According to the legend, Acca Larentia, the nurse of Romulus, lost one of her twelve sons, and Romulus took his place, and gave to himself and brothers the name Fratres Arvales. The office of these priests was for life, and was not lost even by exile and imprisonment, while their duties were connected with agriculture, one of them being to celebrate each year, in May, a festive procession in honor of the gods who preside over the fields. They chanted hymns also, one of which, contained in an inscription of A. D. 218, is regarded as one of the earliest specimens of the Latin language. The tablet containing the inscription is preserved in the sacristy of St. Peter's. (See Klausen, *De carm. fratr. arval.*, Bonn, 1836; Corssen, *Origines*, Berlin, 1846; Donaldson's *Varronianus*, London, 1860, p. 232; Wordsworth, *Early Latin*, pp. 185–188.) H. Drisler.

Fratricel′li [the equivalent of *Fratres Minores*, the "Lesser Brethren," an official title of the Franciscans], a name given to certain zealots of the twelfth, thirteenth, fourteenth, and fifteenth centuries, who were originally Franciscans, but, adopting extravagantly ascetic habits and heretical doctrines, they were condemned in 1302 by Boniface VIII. The Celestines and the Benedictines of Flore seem to have led the movement at first. The Fratricelli suffered much persecution, and thousands were put to death. They paid almost divine honors to Saint Francis, and are accused of calling the works of Joachim of Flore their everlasting gospel. They believed in a new dispensation to take the place of that of the New Testament, and were distinguished for austerities and blind ascetic zeal.

Frat′ta Maggio′re, town of Southern Italy, in the province of Naples. Its rope-works and silk are celebrated. Pop. 10,687.

Fraud [Lat. *fraus*]. Fraud of which the law takes cognizance has the effect to render voidable every transaction into which it enters as a constituent material element. But, as the essential qualification contained in this statement implies, it is not every perpetration of fraud that warrants legal interposition. In the sphere of morals all deceptive artifices for the purpose of misleading, every form of crafty imposition with the design of taking advantage of a person's confidence or credulity, are reprehensible as violations of the law of moral duty. But the enforcement of ethical obligations, simply on account of their rightful binding force upon the conscience, is, and must necessarily be for obvious reasons, altogether impracticable in courts of justice. Those forms of fraudulent practices, therefore, which legal methods are competent to examine and punish must be considered as included within the category of acts fraudulent in a moral sense, but not coextensive with it. And yet the precise line of demarcation cannot be definitely drawn, though certain general principles may be stated upon which the distinction essentially depends. The first of these, and the most important, is, that no dependence is to be placed upon the inherent quality of actions without regard to their natural or necessary consequences. The law considers the *results*, either actual or to be reasonably presumed, of every act concerning which question may arise as to its fraudulent character, and exerts its remedial agency only when injury to individuals or to the public welfare has, in fact, been occasioned or is to be naturally expected, and then only in behalf of the party whose interests may be prejudiced. Moreover, the injury must consist in an interference with some legal right or violation of some legal duty resulting in actual or probable pecuniary loss on the part of the person against whom the deception is practised, or serious public detriment. It follows, therefore, as a deduction from this rule, that the same act, though done with intent to deceive, may sometimes be deemed fraudulent in law, and at other times not fraudulent, while in a moral aspect it would be fraudulent in all such cases. The distinction drawn in ordinary language between *deceive* and *defraud* serves to illustrate, in some degree, the difference between moral and legal fraud. Any adequate definition of fraud in law which will distinguish the character of actions considered simply in themselves is an impossibility. This fact has been so generally recognized by the courts that the attempt to frame such a definition has been pronounced contrary to the policy of the law. It is none the less true, however, that there are numerous classes of actions whose tendency to impair legal rights is so uniform and natural that they may be generally pronounced fraudulent when considered simply in themselves. But these can be more advantageously enumerated than defined. Another characteristic of acts deemed fraudulent in law is an intent, either actual or presumed, to occasion harm or damage to another. The principle is the same as in morals—that a wrongful purpose is necessary to render a deceptive act culpable. In a large class of cases, however, a fraudulent intent is presumed from the nature of the transaction. Hence arises the doctrine of constructive fraud, to be hereafter noticed. Actual fraud, on the contrary, consists in intentional deception, artifice, or concealment, with the view or expectation that a person will be misled, and the actual misleading him to his injury. Both actual fraud and constructive fraud are, with but few exceptions, within the cognizance of courts either of law or courts of equity under the division of jurisdiction which exists in the English and American systems of jurisprudence. (See Common Law, Equity.) The chief exception to equity jurisdiction in questions of fraud is in relation to wills. Wills of personal estate are considered in probate or surrogate courts—those of real property in the common-law tribunals. But the general jurisdiction of equity over the subject of fraud is very comprehensive, and cases of constructive fraud particularly are much more commonly considered in equity than at law. The legal remedy consists merely of an award of damages to the injured party, while the modes of equitable relief, which admit the setting aside of a fraudulent transaction or the enforcement of the specific performance of an agreement, are oftentimes much more beneficial and desirable. It has been said that equity would presume the existence of fraud upon slighter evidence than would be required in courts of law, but this assertion is hardly sustainable. The more extensive jurisdiction of equity in cases of fraud is to be attributed especially to the superiority of its remedial processes. It will therefore be most expedient, in the further consideration of this subject, to state only the body of principles which have been established in equity, since they not only include those maintained at law, but are still more extensive in scope.

I. *Actual Fraud.*—Cases of this kind may be divided into two principal classes. The first class includes those forms of fraud which occur between parties who are under no legal incapacity, and who are in no mutual confidential

or fiduciary relations with each other. The second class of frauds embraces those whose origin is chiefly attributable to the mental infirmity or legal disability of the persons injured, by reason of which imposition and deception may be more readily practised than is usually possible.

1. In the first class of cases it is only necessary to have regard to the conduct of those committing the fraud and the nature of the transaction in which it occurs, without reference to the peculiar condition of those injured. The fraud perpetrated may be either, as it is termed in Latin phrase, *suggestio falsi*, the statement of an untruth, an open misrepresentation, or *suppressio veri*, concealment or suppression of the truth.

(*a*) *Suggestio Falsi.*—There are various elements necessary in an actual misrepresentation in order that it may furnish a ground of action. (1) The falsity of the statement must be known to the party making it, or else he must be justly chargeable with the possession of such knowledge. If he is perfectly honest in his belief of the truth of his representation, and is guilty of no imprudence or negligence in making the statement, he is not answerable for any injurious consequences that may result on the theory of fraud, though the transaction may perhaps be set aside on the ground of mistake. (See MISTAKE.) If his conviction was formed upon evidence sufficient to satisfy a reasonable mind, he would be justified in asserting as a fact what he properly deemed to be such. But if, while aware that his opinion is founded upon mere rumor, conjecture, or trivial testimony, he states it as matter of positive knowledge on his part, in order to induce others to act upon the faith of it, or with good reason to suppose that they will so act, he is deemed as culpable in law as if he actually knew that he was giving erroneous information. The statement, under such circumstances, of what one does not know to be true is said to be as unjustifiable as the statement of what one actually knows to be false. In like manner, if the means of information are peculiarly accessible to the person making the representation, and he is aware that his assertion will be acted upon, his failure to acquire the necessary information may constitute a fraud. (2) The statement must be made with intent to influence some person's action, or upon the understanding or reasonable belief that such a result is likely to ensue. In cases of this latter kind the nature of the concomitant circumstances would be sufficient evidence of fraudulent intent. If erroneous assertions be simply made in casual conversation as matter of gossip or common interest, or if they be stated merely as opinions, or if no transactions are contemplated or known which could be affected by confidence in the statements, any resulting deception and loss constitutes no legal injury. (3) The misrepresentation must be as to some *material* fact constituting an inducement to the act or omission of the other party. The test of materiality is whether, if the party had known the truth, he would have engaged in the transaction by which loss was sustained. (4) The person to whom the misrepresentation was made must rely upon it as a motive to his action, and must be justified in such reliance upon grounds of ordinary prudence and caution. If, notwithstanding the false statements, the person to whom they are made relies entirely upon his own judgment and sagacity, he will not be permitted to maintain an action on the ground that he was deceived, and sustained injury in consequence. When persons deal at "arms' length," as it is termed, there is no room for one to allege deceit against the other. Moreover, if reliance upon the false representations were an act of folly, such as no sensible man would have been guilty of, the courts will afford no relief. If the fact which is misstated is plainly within observation, and one acts upon faith in the falsehood, rejecting the evidence of his own senses, his injury is the result of his own wrong, and not of another's. But if some examination be necessary to detect the error, and the party to whom the representation is made acts with ordinary prudence, confidence in the representation will not be unreasonable, and the deceiver will be responsible. Moreover, if mere belief be stated as belief, opinion as opinion, or supposition as supposition, no person is justified in acting upon it as if it were an expression of actual truth, and if he does must suffer the consequences. So, if a person knows a representation made to him to be false, such knowledge will prevent any allegation on his part of fraudulent deception. (5) The party deceived must have sustained an injury. Wrong without loss no more gives a cause of action than loss without wrong. Fraud and damage must coexist as cause and effect. This rule is, however, more formal than substantial, as injury may be presumed so far at least as to entitle one to nominal damages.

(*b*) *Suppressio Veri.*—A concealment of the truth, by reason of which injury is occasioned, is not to be deemed fraudulent under all circumstances, but only where a person is bound in conscience and duty to make disclosure in order to prevent undue advantage being taken of another. If a vendor knows that there are latent defects in his goods of which the buyer is not aware, and that the consummation of the intended purchase would not be effected were it not for such a misunderstanding, and the buyer cannot discover the defects by ordinary observation, a failure to remove the delusion is equivalent to an express misrepresentation; but if no confidence is reposed in the person making the concealment, the other party preferring to trust to his own judgment, no wrong is done by a failure to reveal a secret source of mistake. And if a defect be patent and readily discoverable upon examination, the maxim of *caveat emptor* will apply, and a seller will be under no obligation to protect a purchaser who by his own imprudence fails to profit by opportunities of discovery within his reach. There are, moreover, cases in which a delicate sense of moral duty would prompt to disclosure, while no similar obligation would be imposed in law. If, for instance, a man knowing of the existence of a valuable mine upon another's land, of which the latter was ignorant, should buy the property without mentioning this important fact, his action would be deemed justifiable. The same view would be taken in many forms of speculation where persons enjoying peculiar facilities for acquiring information about the value of property buy or sell without communicating knowledge which would materially modify the terms of the negotiation. In contracts of certain kinds, however, the fullest information and good faith is requisite, or the contract will be invalid. This is true in cases of suretyship and insurance. Dealings between parties between whom fiduciary relations subsist must also be marked by the most complete confidence and frankness. (For fraudulent warranties, see WARRANTY.)

2. The second class of cases of actual fraud includes deceptions rendered possible by mental infirmity or want of ordinary discretion on the part of those injured. Persons under such disability are incapable of giving that free and rational consent which is necessary to render their acts valid. The mental aberration may be so complete as entirely to prevent a legal transaction, as in cases of lunacy, idiocy, or dementia, or there may be only such a degree of weakness of intellect that undue influence may be more or less readily exercised by designing persons. In instances of this latter kind dealings which can be proved to have been conducted with entire fairness will be sustained, but they will be subjected to a careful scrutiny, and the burden of proof may be cast upon the person profiting by the transaction to show its fairness. For similar reasons, if there be such a degree of drunkenness as to utterly deprive a person of his reason and understanding, dealings with him to his disadvantage will be deemed fraudulent unless there is clear evidence to the contrary. Acts of infants and their contracts, except for necessaries, are judged voidable on account of their lack of reasonable discernment and discretion. Similar protection is afforded to persons under duress or in such extreme necessity that undue advantage is taken of them.

II. *Constructive Fraud.*—The peculiarity of this is that no intent to defraud necessarily exists, but is presumed as an inference of law. Cases under this head may be divided into three classes. The first includes contracts which are deemed fraudulent as contrary to public policy; the second, injurious acts which arise from some peculiar confidential or fiduciary relation between the parties; while the third embraces transactions which operate substantially as frauds upon the rights of third persons.

1. The principal varieties of contracts invalid, as in contravention of public policy, are—(1) Marriage-brokage contracts, by which a person agrees to give another a reward if he will negotiate a marriage for him. Money paid on such a contract may be recovered back. (2) Rewards promised for influencing another person to make a will in a particular manner. (3) Contracts in general restraint of marriage, because they are detrimental to the general welfare of society, which is promoted by suitable marriages. The restraint is "general" when a person is bound not to marry at all, or to marry nobody except a particular person who is under no corresponding obligation. (4) Contracts in general restraint of trade, as tending to promote monopolies and discourage business industry and enterprise. (5) Various other contracts founded upon violations of public trust and confidence, as, *e. g.*, agreements to procure the passage of legislative acts by unjustifiable means, contracts for the buying and selling of public offices, agreements for the composition of a felony, wager contracts, usurious contracts, etc. In like manner, contracts founded upon corrupt considerations or moral turpitude are void. Of this sort are all agreements given to procure the commission of a public crime, or the omission of a public duty, or an offence against chastity.

2. In cases of constructive fraud arising from some con-

fidential or fiduciary relation between the parties the peculiar nature of the wrong lies in its being an abuse of confidence lawfully reposed. Oftentimes there is some actual deceit or imposition practised, but this is not necessary in order that the transaction may be invalidated. A wrongful intent may be presumed from the want of that perfect openness and fairness which the relation demands. The relations of the parties may be of various kinds: (1) *Parent and Child.*—Conveyances by children to parents are subjected to careful scrutiny on account of the danger that they may have been procured by an undue exercise of parental authority. Even after a child has attained his majority, the presumption is that parental influence continues for at least some short period, and mutual dealings to the child's detriment must be proved to have been attended with the utmost good faith or they will not be sustained. (2) *Guardian and Ward.*—A guardian will not be permitted to reap any advantage from dealings with his ward until the influence which his position of authority gives him has entirely ceased. A settlement or contract favorable to the guardian immediately after the ward reaches his majority is looked upon with great distrust. (See GUARDIAN.) (3) *Attorney and Client.*—In any transactions to which this relation gives rise it is a general rule that the attorney shall not gain any advantage to himself at the expense of his client beyond the amount of his just and fair professional compensation. (4) *Physician and Patient.*—Similar principles prevail in reference to this special relation. (5) *Trustee and Cestui que trust.*—A trustee is bound not to place himself in any position antagonistic to the fulfilment of the duties of his trust, and can derive no personal benefit to himself in the discharge of such duties. A purchase by a trustee from his *cestui que trust*, even though it cannot be proved to be unfair, may be set aside at the latter's desire. It is thought wise to *disable* him from dealing with the beneficiary in order that he may be under no temptation to profit by a breach of trust. (6) Other fiduciary relations, as between principal and agent, partners, creditor and surety, etc., are governed by similar principles.

3. Transactions deemed fraudulent because they unwarrantably compromit the rights and interests of third parties afford ground for equitable relief on account of their pernicious tendency, although the persons immediately concerned may have acted freely and willingly. But the third persons who are injured must stand in some peculiar relation with one of the immediate parties to the transaction, and the injury must be dependent upon this relation. There are several classes of cases to which this doctrine is applicable. (1) Relief will be granted in what are called catching bargains with heirs or expectants during the life of their parents or other ancestors. By bargains of this kind are meant agreements to purchase the expected interest for a present sum, and by such transactions, of which the ancestor is ignorant, he is deceived into leaving his property to other persons than those to whom he believed it would pass. Sales of expectancies are, in general, only made by those who are improvident and necessitous, and will never be sustained unless the purchaser can establish that there was no fraud, but that a fair and adequate consideration was given. Upon the same principle, *post-obit* bonds given by heirs and expectants are set aside. These are securities promising, for a present loan, to pay a larger sum, exceeding the legal rate of interest, upon the death of the person from whom the expectancy is to be received. (2) Conveyances to defraud a party to a marriage are constructive frauds, as if either party to a marriage contract should enter into an agreement with a third person by which the other party would be defrauded of reasonable expectations. (3) Conveyances to defraud creditors and purchasers are of the same character. (These are considered under the head of FRAUDULENT CONVEYANCES.)

Only an enumeration of the more important classes of fraudulent devices can be attempted. Frauds, as has been said, are infinitely various. But this general *résumé* of the leading principles appertaining to the subject shows that the jurisdiction of the courts in cases of this nature is very comprehensive and very salutary. The advanced and enlightened doctrines of equity are in furtherance of the highest practicable standard of morality which human tribunals can be deemed capable of adequately enforcing.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Frauds, Statute of, a celebrated statute, originally enacted in England in the reign of Charles II. (1677), for the prevention of frauds and perjuries, requiring the use of written instruments in many classes of contracts and in the various modes of transfer of different interests in property. The imperfection and danger of oral testimony as an adequate means of proof of the nature of past transactions, especially when valuable interests are at stake, renders this statute one of the most salutary measures of legislation in English jurisprudence, and its importance has been so fully recognized in this country that it has been substantially re-enacted in nearly every State, and in some of them its provisions have been made still more comprehensive and stringent. The difficulty of ascertaining the exact nature of certain agreements into which parties have entered, if dependence were to be placed chiefly or entirely upon the vague and unsatisfactory remembrance of witnesses, would prove a very serious interference with the proper administration of justice, and would afford an opportunity and a powerful temptation to unprincipled men to fabricate evidence in the furtherance of fraudulent designs. The chances of detection would be too meagre to be of any practical value. Where discrepancies in testimony can be attributed to a natural forgetfulness, rather than to any wrongful intent, discrimination between honest and dishonest claims becomes wellnigh impossible. Moreover, a very slight change in the terms of a stipulation has oftentimes a serious influence upon the interests of those whose rights are in controversy, and witnesses with every intention to be accurate would unavoidably differ in their accounts of the same occurrence. Writing exhibits the precise nature of an agreement, unaffected by the contrariety of testimony, or by the mental reservations of the parties concerned. Written documents, moreover, remain as a perpetual memorial of the events which they record, while the removal of witnesses by death would not unfrequently render it impossible to secure the requisite oral testimony if this alone were necessary to be introduced. The adequate protection of private rights, therefore, and the furtherance of the remedial operations of the courts, render the requirement of written evidence, in many cases, a necessity.

The scope of the statute is very comprehensive. It includes within its provisions the subject-matter of a variety of contracts, and also transfers of land by way of devise. Certain sections require writing in the creation, assignment, or surrender of leases; others apply to devises; others to declarations and assignments of trusts (but these will be considered more conveniently under the specific topics LEASE, WILL, TRUSTS, to which reference may be made). The sections which it will be most desirable to examine in this connection are those which most particularly affect the law of ordinary contracts. These are the fourth and the seventeenth of the original English statute. By the fourth section it is provided that "no action shall be brought (1) whereby to charge any executor or administrator upon any special promise to answer damages out of his own estate; (2) or whereby to charge the defendant upon any special promise to answer for the debt, default, or miscarriage of another person; (3) or to charge any person upon any agreement made upon consideration of marriage; (4) or upon any contract for the sale of lands, tenements, or hereditaments, or any interest in or concerning them; (5) or upon any agreement that is not to be performed within the space of one year from the making thereof; unless the agreement upon which such action shall be brought, or some memorandum or note thereof, shall be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized." The requirement of signing which the statute imposes is sufficiently complied with if the name be written in any part of the instrument for the purpose of authenticating it. In some of the American States, however, the language of the statute is not "signed," but "subscribed;" and this renders it necessary that the signature be at the end of the writing. The form of the instrument is immaterial. The object is to secure correct and adequate documentary evidence of the intent and agreement of the parties; and it is therefore sufficient if the stipulations which are concurred in are embodied in separate letters or in distinct instruments, provided the contents of each have so intimate a connection with, and so evident a reference to, the matter contained in the others that the entire contract is manifestly ascertainable only from a comparison of all the writings. But the whole agreement must be deducible from the connected instruments, without its being necessary to supplement them by parol declarations.

The statement of the consideration of the contract is required in England and some of the States, but in others the consideration may be proved by extraneous evidence. The statute, it will be noticed, provides that the signature of a properly authorized agent will be equally valid with that of the party actually interested. Such authority may be given either orally or by writing, provided the act to be done does not require the execution of a deed or other conveyance. Where the conveyance must be under seal, so must the authority be. A single person may act as agent for both parties to the contract, as, for instance, an auctioneer or broker, whose signature will be binding upon either vendor or purchaser. The signature to the instrument

may be written either in ink or in pencil, or will be sufficient if printed, if this mode of authentication is usually adopted by the person to be charged or is sufficiently authorized by him.

Under the first clause of the section it has been decided that if an executor or administrator give bonds for the faithful discharge of his duty, a subsequent promise to pay a debt of the testator will be construed as charging the assets derived from the testator's estate, and not the representative's own property, so that no writing will be necessary. A promise made by an administrator before letters of administration are issued to him from which he derives his authority is also not within the requirement of the statute. The second clause, applying to promises "to answer for the debt, default, or miscarriage of another," necessitates the use of writing in all contracts of guaranty. (The rules upon this subject will be considered under the special title GUARANTY.) The third clause, referring to "promises made in consideration of marriage," is held to apply to promises of settlement, advancement, or other provision in anticipation of marriage, but not to promises to marry, which may therefore be made orally, unless they fall within the fifth clause referred to below. The written promise, to be enforceable, must be effectually operative in inducing the claimant under it to enter into the marriage contract. Hence, when a father made a written promise of advancement to his daughter in case she was married to a particular person, but the intended husband did not know of the promise, nor act upon the faith of it in marrying her, he was not allowed to enforce the promise. The fourth clause, concerning contracts for the sale of real estate or any interest therein, does not require writing in the sale of crops or annual industrial products. If, however, the sale is of standing trees or products not the result of annual cultivation, the better opinion is that the case falls within the statute. When both land and its products are sold to the same individual, the entire contract must be in writing. A mere license to use land does not create any legal interest in the property, and need not be written to be valid, though in such case it is in general revocable at will. The fifth clause relates to "agreements that are not to be performed within the space of one year from the making thereof." Under this provision it is not necessary that an oral agreement be actually fulfilled within the limits of a year from the time when it was made in order to be sustainable, but only that it be capable of fulfilment within that period in the contemplation of the parties when they enter into the stipulations. The actual result may show that the anticipations were unrealized, but the validity of the engagement, though it be unwritten, is in nowise impaired.

The other section of the statute which especially relates to ordinary contracts—viz. the seventeenth—provides that "no contract for the sale of any goods, wares, or merchandise for the price of £10 sterling or upwards, shall be allowed to be good except the buyer shall accept part of the goods so sold, and actually receive the same, or give something in earnest to bind the bargain or in part payment, or that some note or memorandum in writing of the said bargain be made and signed by the parties to be charged by such contract, or their agents thereunto lawfully authorized." In the statutes of the American States the principal alteration made in these terms is by the specification of a different sum of money. The sum generally established is fifty dollars, but in some of the States it is thirty dollars or forty dollars. This section is distinguished from any others contained in the statute by authorizing various modes of giving validity to contracts besides the single method of writing. This diversity is established on account of the comparatively greater frequency with which contracts for the sale of goods are made, and on account of the great inconvenience that would ensue if formal and precise agreements were always necessary to be prepared to effectuate such ordinary transfers. There is, however, this disadvantage—that by dispensing with the requirement of writing in every case the difficulty of proving the terms of many contracts is much increased; but the greater facility with which business operations may be conducted is deemed amply compensatory for this defect. The first mode mentioned by which the sale may be rendered valid is by delivery and acceptance of the goods. Both these prerequisites are absolutely essential in the absence of writing or part payment. A mere expression of final agreement to the terms of the sale of specific chattels is not, as in ordinary transactions of the kind, sufficient to impose a liability upon the purchaser. The delivery may be either actual or constructive. Constructive delivery occurs when means of readily taking possession of the goods are given to the purchaser, which he may exercise in exclusion of the vendor's claim. Thus, the delivery of a key giving access to a warehouse in which the merchandise is deposited is equivalent to a complete transfer of possession. The same purpose is accomplished by giving an order upon a bailee of the goods, which the bailee accepts. The delivery of an integral part of the articles sold is virtually a delivery of the whole. Acceptance on the part of the buyer must be manifested by a suitable act. It is thought by some that there are two acceptances—one, to satisfy the statute of frauds; the other, to preclude the purchaser from objecting that the goods did not correspond with the statute. Accordingly, the former acceptance might have been made, while the purchaser might be still able to return the goods, on the special ground that they did not comply with the contract. As a second method of binding the bargain, earnest may be given. Earnest is a token or pledge passing between the parties by way of evidence or ratification of the sale. The article given must have some appreciable value, even though this be quite insignificant. A chip or pebble would be inadequate, while a cent or a ring would suffice. The effect of earnest is to impose upon the seller an obligation to retain the goods subject to the demand of the purchaser; but the latter must pay the purchase-money upon obtaining delivery. The giving of earnest was a common practice in the early history of English law, but it has now fallen into general desuetude. Thirdly, part payment may be made. This has the same effect as the giving of earnest. There must be an actual transfer of a portion of the price agreed upon, since the liquidation of a former debt as a part of the consideration for the sale will not be sufficient. Fourthly, the agreement or some note or memorandum thereof must be in writing. The principles applying when this mode of authenticating the contract is adopted have been already considered.

It has been much questioned whether executory contracts for the sale of goods which were not in existence in the form contemplated by the parties at the time when the agreement was made are within the statute of frauds. It is now, however, generally settled, contrary to the rule formerly prevailing, that such contracts, if they have reference substantially to a sale of chattels, even though these must necessarily be fabricated out of certain materials before delivery can be made, are within the statute, and must consequently be in writing. But if the contract is essentially for the performance of work and labor about certain chattels, the requirements of the statute have no application.

Courts of equity, as well as courts of law, are bound to comply with and enforce the provisions of the statute of frauds. But where strict compliance would produce hardship and injustice, as sometimes proves to be the case, courts of equity have power to grant special relief, even though the precise letter of the law be violated. Thus, if a contract which ought to have been in writing is fully set forth in the bill of the plaintiff in equity, and is confessed by the answer of the defendant, it will be enforced, since there can be no danger of the commission of fraud, and the defendant may be deemed to have waived his right of defence under the statute by failing to urge it. If, however, he adduces and maintains such a defence, it will be effectual to protect him against the plaintiff's claim. In like manner, specific performance of an oral contract will be decreed if it has been partly carried into execution. This principle is established because a different rule would enable fraudulent designs to be consummated, which it was the design of the statute to prohibit. But the part performance must be something more than the part payment of the price. Moreover, the act must be done solely with a view to the performance of the agreement. An illustration of such a part performance would be the act of making improvements upon land by a purchaser in pursuance of an oral contract for its purchase. A still further exception to the statute is where an agreement is intended by the parties to be reduced to writing in the appropriate manner, but this is prevented by the fraud or cunning shrewdness of one of the parties. Equity follows the spirit of the statute by preventing the commission of fraud wherever it is possible. (See SPECIFIC PERFORMANCE.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fraud'ulent Convey'ance, a conveyance the object, tendency, or effect of which is to defraud another not a party to such conveyance, or the intent of which is to avoid some debt or duty due by or incumbent on the party making it. Such conveyances are declared invalid by two famous English statutes, which have been re-enacted throughout the U. S. with substantially the same provisions. By one of these, passed in the thirteenth year of the reign of Queen Elizabeth (1571), and commonly referred to as the statute 13 Eliz. ch. 5, all fraudulent conveyances, gifts, or alienations of lands or goods whereby *creditors* might be in any wise disturbed, hindered, delayed, or defrauded of their just rights, are rendered utterly void; but the act does not extend to any estate or

interest in lands *on good consideration*, and *bona fide* conveyed to any person not having notice of such fraud.

The points deserving particular attention in the provisions of this act are—that it applies to chattels as well as to lands; that it protects only the interests of defrauded *creditors;* and that the exception refers only to *lands* conveyed upon "good consideration" *and* to a "*bona fide*" grantee. Both these latter characteristics are necessary to the conveyance to render it not fraudulent, and if there were only a "good consideration" *or* a "bona fide" transfer, the privilege of the exception would not be available, and creditors might impeach and overthrow the conveyance. By a good consideration, as the phrase is here used, is intended every kind of consideration known to the law, whether it belong to the class more specifically termed "good" or meritorious considerations, by which is meant motives of natural affection founded on relationship, or to the class known as valuable considerations, which include every mode of pecuniary return for a promise or grant. If, therefore, there be an actual fraudulent intent in making a conveyance, and this be known to the grantee, so that he becomes a participant in the wrong committed, it is immaterial, as regards the validity of the conveyance, that there was an adequate consideration, even of a pecuniary nature. The fraud would be fatal. But if the purchaser for a valuable consideration acted innocently, under the influence of an honest belief that the conveyance was unobjectionable, his right to the property would be superior to the claims of creditors. But questions of most importance and difficulty have arisen under the statute in regard to the effect of voluntary conveyances, by which is meant, in a legal sense, those which are intended as mere gifts or are made merely upon meritorious considerations of natural love and affection. The principle is maintained in law, as well as in the sphere of morals, that "a man must be just before he is generous;" and if one under a burden of indebtedness disposes of the property, which ought to be used in satisfying the claims of his creditors, in gratuities to his relatives or friends, a fraudulent intent is imputed to him as a necessary presumption, without the need of positive proof. But if the property transferred were in no way essential to the maintenance of the debtor's full solvency, the conveyance would, according to the prevailing opinion, be sustained. A person, for instance, might possess ample means to discharge all his obligations after bestowing a portion of his property in gifts upon others, and the conveyance would then be deemed valid, as involving no reasonable implication of dishonest intention. To impose any prohibition upon those whose debts bear but a small proportion to their actual resources, preventing them from disposing of at least a part of the surplus in voluntary conveyances if they so desired, would be manifestly unjust, since the rights of creditors would receive, without such a rule, full and adequate protection, to which alone they are entitled. It has been decided in England that a voluntary conveyance is not fraudulent unless it transfer property which might be taken in execution for the payment of debts, since otherwise creditors receive no injury. This doctrine has been somewhat controverted in this country, though it has nevertheless been generally sustained. However, if the law of the State permits property which cannot be taken on an *execution* to be seized by some other process for the payment of debts, it would be a fraud upon creditors to withdraw it from their reach. When the gratuitous disposition of property is injurious to subsequent rather than antecedent creditors, the presumption of a fraudulent purpose is not so readily entertained. If it were proved that such an act formed a part of a preconceived scheme to incur indebtedness after the means of payment had been bestowed upon others, the conveyance would justly be invalidated. But in the absence of such evidence no conclusion could be fairly drawn, from the mere circumstance of a gift to a wife, child, or friend which was not at the time prejudicial to the interests of any other persons, that the transfer was made in the prosecution of a fraudulent purpose.

The second statute against fraudulent conveyances is known as the statute 27 Eliz. ch. 4, enacted in 1585. It enacts that the conveyance of any interest in lands for the intent and purpose to defraud and deceive subsequent *bona fide purchasers* of the lands for a good consideration shall be utterly void. This act differs from the previous one in applying simply to lands, and in protecting the interests of purchasers instead of creditors; but it contains similar provisions declaring the validity of any previous conveyance if it be upon valuable consideration and to a *bona fide* purchaser. It has been adjudged in England, in the interpretation of this statute, that if the previous conveyance be voluntary, it is void as to a subsequent purchaser, even though he had notice before he received his deed that such a conveyance had been made. This doctrine has been generally rejected in the courts of the U. S. as inequitable, and the principle adopted that the receipt of notice gives a person intending to purchase ample opportunity to protect his own interests, and if he is guilty of imprudence in accepting the conveyance he ought to receive no assistance from the courts. This seems the better doctrine. Under both statutes voluntary conveyances are never set aside as between the immediate parties, but only in favor of creditors or purchasers.

George Chase. Revised by T. W. Dwight.

Fraun'hofer, von (Joseph), b. at Straubing, Bavaria, Mar. 6, 1787, was brought up to his father's trade as a glass-worker, but studied optics, astronomy, and mathematics, and in 1806 became a director of the mathematical institute of Munich. In 1815 he observed, measured, and described with admirable fidelity the dark lines of the solar spectrum, called Fraunhofer's lines, first noticed by Wollaston in 1802 (see Spectroscope), and in 1817 was admitted to the Academy of Sciences, Munich. He was a partner in the manufactory of optical apparatus at Benedict-Beuren, which in 1819 was removed to Munich. He made many improvements in fine glass-making, in dioptric instruments, and in the machinery for the manufacture and finishing of lenses; made the noble refracting telescope of the Dorpat Observatory; in 1823 became professor and director of the Cabinet of Physics, Munich. D. at Munich June 7, 1826.

Frau'stadt, town of Prussia, province of Posen, has a large corn and cattle trade. Pop. 6515.

Frax'in, or **Pa'viin,** $C_{16}H_{18}O_{10}$, a fluorescent glucoside found in the bark of the ash (*Fraxinus excelsior*), in the horse-chestnut with æsculin, and in some other barks. It is sparingly soluble in cold water. Its very dilute solution exhibits by daylight a beautiful blue-green fluorescence. Dilute sulphuric acid converts it into fraxetin and glucose. C. F. Chandler.

Fray Ben'tos, town of Uruguay, South America, on the left bank of the Uruguay, is noteworthy as one of the principal places for the manufacture of meat-extract, to which industry it owes its foundation a few years ago and its present prosperity. Pop. 3000.

Fraxinel'la, the *Dictamnus albus* or *Dictamnus Fraxinella*, called bastard dittany, an aromatic European herb which is sometimes raised in gardens. It abounds in volatile oil to such an extent that in warm, still weather the air becomes charged with an inflammable vapor. This phenomenon is best shown by enclosing the plant in a box or Wardian case. The plant belongs to the order Rutaceæ.

Frazee' (John), an American sculptor, b. in Rahway, N. J., July 18, 1790; commenced business as a stone-cutter in New Brunswick 1814; later opened a marble-yard on Broadway, N. Y. From 1819 till 1823 his work was chiefly in mantlepieces and monuments. His first bust, a head of John Wells, was executed in 1824. He subsequently made busts of Chief-Justice Marshall, Dr. Bowditch, Daniel Webster, Gen. Jackson, John Jay, Judges Story and Prescott. Crawford the sculptor took his first lessons in statuary from Frazee and his partner Launitz. D. at New Bedford, Mass., Mar. 3, 1852. O. B. Frothingham.

Fra'zer, tp. of Colleton co., S. C. Pop. 827.

Fra'zeysburg, post-v. of Jackson tp., Muskingum co., O., on the Pittsburg Cincinnati and St. Louis R. R., 49 miles N. E. of Columbus. Pop. 325.

Fra'zier's Farm, Battle of, June 30, 1862. Continuing its retreat towards the James, the Army of the Potomac had, by the morning of June 30, 1862, crossed the White Oak Swamp; the extreme advance had, indeed, reached the river, while the artillery was parked on Malvern Hill. Closely following came the Confederate army in two columns, commanded by Jackson and Longstreet; the former following direct by way of White Oak Swamp, while the latter, making a détour of the swamp, hastened forward to intercept the retreating army, the two wings to unite upon Jackson's emerging from the White Oak Swamp. To prevent this union was McClellan's first concern. Leaving Franklin with the divisions of Smith and Richardson and Naglee's brigade, the artillery under the direction of Capt. Ayres to guard the passage of the swamp, he hurried the remainder of his army, with its train, along the Quaker road to the James. By daylight, Jackson, having repaired the Grapevine bridge across the Chickahominy in his front, resumed pursuit, arriving at White Oak Creek by noon, to find the bridge across the creek and marsh also destroyed. Attempting to pass by the ordinary crossing, he was prevented by the fire of the batteries on the opposite side, and all his efforts to force a passage at this point were successfully repulsed. Longstreet meantime, by his détour, had flanked the swamp, and moved rapidly along the New Market road, bisecting at right angles the Quaker road, by which latter McClellan was passing, arriving about

noon within a mile of the junction of the two roads; which point he discovered to be occupied by the Union forces. By gaining possession of this important point he would cut the retreating army in two; and, though Jackson had not been heard from, the latter determined to attack. The Union line was formed at right angles with the New Market road, in front of the Quaker road. McCall's division of Pennsylvania Reserves held the point of intersection; Sumner in the rear and to the left of McCall; Hooker on the left and in advance of Sumner; on McCall's right was Kearney's division. Longstreet's own division formed the right of the Confederate line; that of A. P. Hill the left—all under Longstreet. At 3 P. M. Longstreet attacked the left of McCall's division, which hereupon changed front, and a vigorous fight of two hours' duration ensued, McCall holding his position. Meanwhile, desperate assaults were made upon the Union batteries on the right and centre, which were as often repulsed; but finally, by a determined charge, the 55th and 60th Virginia regiments succeeded in capturing Randall's battery after a desperate hand-to-hand fight with the supporting regiment. A renewed effort upon McCall's left meanwhile had succeeded in turning that flank, but the Confederates, following up their success, were taken in turn by a flank fire from Hooker, driving them across Sumner's front and on McCall's centre, which, with the right, remained unshaken; and Hooker and Kearney, now advancing, recovered part of the ground lost and repelled further attempts, which were continued till a late hour of the night. Jackson had during all this time been within sound of the battle, but all his efforts to cross the marsh and creek were repelled; and the battle was fought on the Confederate side by the divisions of Longstreet and A. P. Hill. Immediately after the close of the fight the Union troops resumed their retreat, together with Franklin's force, and by morning of the next day the whole army had arrived and were in position at Malvern Hill, and communication with the James ensured. The Union loss in this action, which is also known as Glendale and New Market Cross-roads, was about 1800 in killed and wounded; the Confederate loss about 2000.

Fre'co, tp. of Ouachita co., Ark. Pop. 868.

Frederi'ca, post-v. in South Murderkill hundred, Kent co., Del., 13 miles S. of Dover. Pop. 588.

Frederi'cia, town of Denmark, in Jutland, at the entrance of the Little Belt. It is fortified, and has considerable manufactures of tobacco. Pop. 7186.

Fred'erick, county of Maryland, extending from Pennsylvania to the Potomac River. Area, 642 square miles. On the W. is the South Mountain, and the Catoctin range breaks the surface of the county, the soil of which is very fertile. Limestone, copper, marble, iron, and marl are abundant. Live-stock, grain, tobacco, wool, and hay are staple products. Flour, cooperage, leather, carriages, saddlery, cigars, metallic wares, clothing, furniture, etc. are among the manufactures. It is traversed by the Baltimore and Ohio and other R. Rs. Cap. Frederick. Pop. 47,572.

Frederick, the most northern county of Virginia, bounded on the N. E. and N. W. by West Virginia. Area, 378 square miles. It is a part of the fertile Valley of Virginia, and is broken by mountains. Grain is extensively produced. Flour is the principal article of manufacture. It is traversed by the Winchester and Strasburg R. R. Cap. Winchester. Pop. 16,596.

Frederick, tp. and post-v. of Schuyler co., Ill., on the Illinois River and the Rockford Rock Island and St. Louis R. R., 4 miles N. of Beardstown. Coal is found in the vicinity. Pop. of v. 669; of tp. 956.

Frederick, post-tp. of Montgomery co., Pa., on a branch of the Philadelphia and Reading R. R. Pop. 1818.

Frederick I., emperor of Germany. After Henry IV., emperor of the Holy Roman Empire, had been thoroughly humiliated by Pope Gregory VII. in the celebrated snow-covered courtyard of Canossa, he determined upon surrounding himself with a new and reliable set of followers. In pursuance of this policy he created Count Frederick von Büren duke of Suabia, and at the same time bestowed upon him the hand of his daughter Agnes. Von Büren shortly after removed his castle to the summit of a mountain named Hohen Stauffen, and was thenceforth always called by that name, though his family was also known by the name of Weiblingen, from the castle Weibling—a name which was changed subsequently by the Italians into Ghibelline. When Henry IV. died, Frederick served Henry V. with the same fidelity. Upon the death of the latter emperor the Salic line of German emperors became extinct, and a new election was ordered. Frederick was an applicant for the crown, but his haughty manner set the electors against him, and Lothair of Saxony was elected. Upon Lothair's death, which followed soon after his election, Conrad von Hohenstauffen, duke of Franconia and brother of Frederick, was elected king of Germany, but he was never crowned emperor by the pope. In 1147, when Bernard of Clairvaux started the second great crusade, Conrad was, after a long resistance, induced to join it, and took with him his nephew Frederick (b. 1121), son of Frederick of Suabia, whose merits made themselves so apparent to Conrad that after his return from the crusade, and when he felt his end approaching, he recommended his nephew to the German electors as his successor. Frederick Barbarossa (so named on account of his red beard) was thirty-one years old when the German princes elected him their king. He at once restored the Guelphic duke, Henry the Lion, to his dukedom of Bavaria, of which Conrad had dispossessed him, and having brought order into all the political affairs of Germany, went to his Lombardian possessions, where the larger cities had raised various disturbances. Frederick speedily restored order, and having proceeded to Rome, was there crowned emperor of the Holy Roman Empire in 1155 by Pope Adrian IV. He was in the zenith of his glory when he returned to Germany from this first expedition. Literature, art, and sciences now began to flourish in Germany, under Frederick's fostering care, as they had never flourished before. The cities of Lombardy, however, did not leave him long rest, and even the destruction of Milan by Frederick on his second expedition did not succeed in suppressing the spirit of revolt. Supported by the pope, Alexander III., three more insurrections took place, and when Frederick for the fifth time entered Italy to subdue his refractory subjects, he was terribly beaten at the battle of Legnano (1176). He then made peace with the pope, whose influence was supreme with the people of Lombardy, and hastened back to Germany to punish Henry the Lion, who had, forgetful of all Frederick's past generosity, refused to accompany him on that fifth expedition, and had thus virtually brought about its disastrous end. This was the beginning of the endless conflicts between the Ghibellines (Frederick's party) and the Guelphs (the party of Duke Henry). Henry was dispossessed of all his lands, and retired to the court of his father-in-law, Henry II. of England. His two dukedoms, Bavaria and Saxony, were divided into smaller parcels among the emperor's friends, and thus Frederick put an end to the overbearing rule of the great German dukes and made the imperial rule supreme in Germany. He now went once more to Italy, but this time in peace, and was everywhere received in triumph. His son Henry was crowned king of Lombardy (1186), and married to Constance, the heiress of the crown of the Two Sicilies. Upon his return Frederick organized the great crusade, in which Richard Cœur de Lion also took such prominent part. The unhappy conclusion of that crusade he was fortunately spared witnessing. While advancing in triumph at the head of his troops, after having stormed and taken the capital of the sultan of Credi, he was drowned in attempting to cross the Calycadnus, June 10, 1190, or, as some say, d. of a fever.

A. E. KROEGER.

Frederick II. of Germany, b. at Jesi, in the March of Ancona, Dec. 26, 1194. He was the son of Henry VI., and, though elected king of the Romans in 1196 and king of Naples and Sicily in 1209, and though duke of Suabia by inheritance, he did not succeed to the imperial crown until 1215, when, by the aid of the Ghibellines and Innocent III., his guardian, he successfully asserted his claim against Otho IV., promising the pope to go at once upon a crusade; but his long delay caused him much trouble with the popes, and the failure of his first two expeditions caused him to be twice excommunicated; and though at last he spent fifteen years in the Holy Land in successful warfare, taking Jerusalem (1229) and crowning himself king, he was never forgiven, and after his return was twice more excommunicated, and was involved in lifelong wars incited by the popes. D. at Fiorenzuola Dec. 13, 1250.

Frederick III. of Germany. This title is sometimes given to the duke of Austria, elected emperor in 1314, who reigned as joint emperor with Louis IV. from 1325 to his death, Jan. 13, 1330. By others he is reckoned as a king of Germany, but not an emperor. The Frederick III. of history was a son of Ernst, duke of Styria and Carinthia, b. at Innspruck Dec. 23, 1415; in 1440 was elected emperor. He reigned fifty-three years, the longest German reign, but this period was one of almost continual civil wars. The emperor was a man of virtue, fond of learning and quiet, and in spite of the confusions of his reign managed to strengthen greatly his own family, which for almost 400 years retained the imperial dignity, and which still bears sway in Austria. D. at Linz Aug. 19, 1443.

Frederick I., the first king of Prussia, was b. at Königsberg July 22, 1657; succeeded his father, Frederick William the Great, as elector of Prussia, with the title of

Frederick III., in 1688. Deformed and feeble from infancy, his training was slighted, but on coming to power he declared null the will of his father, by which his half-brothers received a part of his inheritance, and thereafter by skilful diplomacy greatly strengthened his influence in foreign parts, at the same time enriching his treasury with foreign gold, obtained by the lending of troops, and from time to time enlarging his boundaries at the expense of small neighboring states. In 1701, with the purchased consent of the emperor, he took the title of king. He maintained a splendid court, and was personally popular, though his excessive taxation was a grievous burden to the people. D. at Berlin Feb. 25, 1713.

Frederick II., called THE GREAT, king of Prussia from 1740 to 1786, was b. Jan. 24, 1712. His father, Frederick William I., was a rough, narrow-minded despot, subject to fits of senseless frenzy, and spending his time on the parade-ground, where he displayed no other talents than those of a drill-sergeant, or in the smoking-room, where he more than once was taken in by diplomatists who condescended to flatter his coarseness. The queen, Sophie Dorothea, a Hanoverian princess and sister to George II. of England, was a lady of refinement and education, rather than of talent and character; she suffered immensely from the violence of her husband, but, although she was without power, she was not without dignity. By her and by his earliest surroundings a taste for poetry and music was awakened in Frederick, and in after years this taste, strengthened by a natural talent, grew into a passion; he played the flute with great skill and delicacy, and his verses, although without poetic merit, were not without spirit. But this passion brought him into dangerous collisions with the father, who despised poetry and music as much as the son abhorred drilling and smoking. He was repeatedly exposed to the harshest treatment, and at last he determined to flee to his uncle, George II., but the plan was discovered; one of his helpers, Keith, escaped, but the other, Katt, was beheaded, and he was dragged to the window himself to look at the execution. It was indeed the king's idea to have the prince sentenced to death, and only the interference of the kings of Sweden and Poland saved his life. He was pardoned at last, but he was placed in a somewhat subordinate position in the civil administration, and was shortly after married against his will to Elizabeth Christine, princess of Brunswick-Bevern. Ruppin and Rheimsberg were then given him for support and residence. During his residence at Rheimsberg, however (from 1734 to 1740), he succeeded in somewhat mitigating his father's wrath by the administrative talent, the sense of order and economy, and the spirit of enterprise he evinced; and his intimate correspondence with Voltaire, his curious book against Macchiavelli, and his talents for entertaining and charming people who visited him drew the eyes of Europe on him.

On May 31, 1740, Frederick William I. died, leaving to his son a well-furnished treasury and an army of 70,000 men ready for battle. Shortly after, the emperor, Charles VI., also died, and, according to the Pragmatic Sanction, his daughter, Maria Theresa, succeeded to all his possessions. But in Dec., 1740, Frederick marched his army into Silesia, and without any declaration of war seized this whole province of the Austrian empire. At Mollwitz, his first battle, he fled, believing all to be lost, but his generals gained a brilliant victory, and the ridicule which by this curious opening of his military career he threw over his own name he very soon silenced by giving proofs of a most decided military talent. The rapidity of his movements, the decisiveness of his actions, amazed his adversaries, and after the victory at Chotusitz he kept Silesia by the Peace of Breslau (1742). Two years after, however, he had to fight again for his conquest, but his victories at Hohenfriedberg, Sorr, Hennersdorf, and Kesselsdorf compelled Austria once more to leave Silesia a Prussian possession by the Peace of Dresden (1745). This seemingly so unprovoked attack on Austria has often been denounced as a mere robbery, but the House of Hohenzollern had old claims on certain parts of Silesia, and the negotiations which the late emperor had carried on concerning a renunciation of these claims and a compensation in some other place looked very much like mere shifts. But the king of Prussia could by no means suffer himself to be slighted in that way. The kingdom of Prussia was only forty years old, and comprised only 2,000,000 inhabitants; it was recognized by the other European powers with a smile rather than with respect, and the king had to vindicate his position with audacity or to give it up entirely. There was hardly anything to blame in Frederick's proceedings with respect to Silesia, and, on the whole, he was as far from being a moral monster as from being a moral ideal. It is true he scoffed at religion, and the liberality with which he received and treated the Austrian Protestant immigrants was the result of religious indifference, worldly prudence, and perhaps some humane sympathy. It is also true he laughed at morality, and no falsehood, no trick, was too low for him when it was useful; his hirelings stole by help of false keys documents for him from the royal archives in Dresden. But he had, nevertheless, in certain relations a strong sense of duty, and as far as this sense went he discharged his duties with an energy and honesty which command respect. His relations to his own subjects show quite another man than his relations to foreign courts exhibit. From the documents stolen in Dresden, Frederick learned that there existed an alliance between Austria, Saxony, and Russia, apparently for the purpose of humiliating Prussia. He immediately threw his army into Saxony (Aug., 1756), and thus began the famous Seven Years' war, in which France and Sweden joined the allies, and England was the only power which sided with Frederick. Austrian, Saxon, and French armies entered his country from the S. The Swedes took his cities and closed his ports to the N., and from the E. the Russian hordes penetrated into the heart of his kingdom, plundered his capital, devastated and burnt his cities, murdered and massacred everywhere. He won great victories at Prague, Rossbach, Zorndorf, Torgau, and Freiberg, but he also suffered great reverses of fortune at Hochkirch and Kunersdorf, and the circle of his enemies was drawn closer and closer upon him. Still, to the very last his energy was unwearied, his perseverance unbroken, his resources unexhausted, and by the Peace of Hubertsburg (1763) he yielded not an inch of his land to his enemies; on the contrary, he secured to Prussia the final possession of Silesia and a respectable place in the political system of Europe. Indeed, all Europe was filled with his praise. He conquered his adversaries as much by the admiration he compelled them to feel for him as by his real talents; and his friends represented him as a prey for his neighbors' rapacity, as the champion of the Protestant religion, as a martyr for freedom, as a hero. But there was nothing heroic in this disciple of Voltaire, who always carried poison in his waistcoat pocket, except perhaps that heroism of despair which even egotism is capable of. In a hero there must be a positive idea, but there was no other idea in Frederick the Great than his own *I;* and that which alone can reconcile us to his enormous egotism is that he never separated himself from his people. He would probably never have bought the happiness of his subjects by sacrificing himself, but as little would he ever have secured his own interests by sacrificing the welfare of his subjects.

The whole character of Frederick's government shows, however, that he understood the relation between himself and his people only as a relation between king and subjects. That these subjects were a people, a nation, he had no idea of. He wished the Prussians to be better educated and become more enlightened, but only because he believed that thereby they would become better subjects. He wished science and art to flourish in his kingdom, but only because it would spread new splendor around the king. The wonderful progress which German civilization made in his time through Kant and Goethe he despised; he imported his philosophers and poets from France, and what was German he did not and would not understand. All his own writings are in French. This entire ignorance of certain ideas which in our days play the most prominent parts in politics explains many actions of Frederick the Great which otherwise would be without any excuse at all; as, for instance, his participation in the first division of Poland in 1772. He did not understand that in history the dismemberment of a nation corresponds to a murder in individual life. He no doubt considered the division as the easiest, most sensible, and most businesslike solution of a difficult and dangerous problem, and of course this view was to some extent promoted by the circumstance that the solution was advantageous to himself. He incurred, however, great odium, even among his contemporaries, for his action in this case, and traits of his private life and of his diplomatic negotiations utterly disparaging of his character were circulated with great malignity. He had fallen behind his time; he soon fell even behind himself. His quick and refined sensibility of former days became capricious, his energy restless, his wit coarse, his contempt and suspicion more cynical; at last a kind of stupor seemed to petrify him. He d. Aug. 17, 1786, sitting full dressed in his field-chair alone in the room. CLEMENS PETERSEN.

Frederick Charles Nicholas, FIELD-MARSHAL PRINCE, b. at Berlin Mar. 20, 1828, a nephew of the emperor William of Germany; was educated at Bonn; entered the army in youth; served with distinction in Sleswick (1864); had an important share in the victory of Sadowa (1866), where he displayed great energy and skill; commanded the second German army (consisting of six army-corps, with some 260,000 men and 500 guns) in the Franco-German war; had command in the siege-operations against Metz; after the surrender was made a field-marshal,

and afterwards dispersed the army of the Loire in a six weeks' campaign.

Frederick William (THE GREAT), eleventh elector of Brandenburg, b. Feb. 6, 1620, succeeded his father, George William, in 1640, and found his dominions in a deplorable state of ruin, caused by the ravages of the Thirty Years' war and by the misrule of his predecessors; made an advantageous peace with Sweden (1648); reorganized the army; joined Sweden against the Poles in 1655, and freed Brandenburg from the Polish sovereignty, and was himself recognized as sovereign of Prussia (1663); took a leading part (1672–73) in the war with Louis XIV., and Louis having induced the Swedes to invade Prussia, the elector routed them at Fehrbellin (June 18, 1675), and by 1679 had expelled them from Prussia and Pomerania, but by the treaty of St.-Germain gave up a large part of his conquest in exchange for French gold. In 1685 he greatly enriched his provinces by offering an asylum to the French Protestants. The last years of his reign were devoted to the development of the material prosperity of his territories. D. at Potsdam Apr. 29, 1688.

Frederick William I., king of Prussia, b. at Berlin Aug. 15, 1688, succeeded his father, Frederick I., in 1713. He maintained a great standing army and a full treasury; forced the surrender of a large part of Swedish Pomerania to his sway, but paid for it from his treasury (1720); abolished feudal tenures (1717); was often cruel and unjust, as in the treatment of his son, the future Frederick the Great; had a whimsical passion for forming a guard of giant soldiers, for whom he found giant wives. His character was unamiable and full of apparent contradictions, and the ruling purpose of his life, to all appearance, was the assurance of the future greatness of his own family through the military and material greatness of Prussia. D. at Potsdam May 31, 1740.

Frederick William II., king of Prussia, b. Sept. 25, 1744, succeeded his uncle, Frederick the Great, in 1786, and by a natural reaction from the enforced severity of his previous life entered upon a course of immoderate luxury. The trans-Rhenish provinces were lost to the French republic in 1795, but his share in the second and third partitions of Poland (1793–95) largely extended his sway. His extravagance and tyranny were offset by legal reforms and the encouragement of Prussian industries. D. Nov. 16, 1797.

Frederick William III. of Prussia, b. Aug. 3, 1770, succeeded his father, Frederick William II., in 1797; undertook at once the reform of the abuses of his father's reign, and by treaties increased his dominions. He kept the peace with Napoleon, but having exchanged Franconia for Hanover, which was ceded to him by the French (1805), he was involved with England, and felt compelled to demand neutrality of Napoleon. The latter fell upon him, and the battles of Jena, Auerstadt, Eylau, and Friedland, followed by the Peace of Tilsit (1807), made Prussia virtually a French province, and reduced it to half its former extent; but thorough political reforms, the abolition of serfdom, the sale of royal domains and of church property, and the reorganization of the army, went far toward making the calamity of Prussia a great blessing. In the Russian invasion of 1812 the Prussian contingent was very wisely allowed to escape unharmed by Diebitsch; and in 1813 the War of Liberation from the French was inaugurated; the battles of Lützen, Bautzen, Leipsic, and Brienne, and the occupation of Paris by the allies followed, and Prussia became more powerful than ever before, chiefly at the expense of Saxony. At Waterloo the Prussian army too performed a most important part. In the closing years of his reign a conservative policy was adopted. D. June 7, 1840.

Frederick William IV. of Prussia, b. Oct. 15, 1795, was carefully educated; served in the wars against Napoleon, and was exceedingly popular in early life. In 1840 he succeeded his father, Frederick William III., and by his reactionary policy disappointed the high hopes which had been indulged regarding him. The affairs of the Zollverein (established 1819) were so managed as to increase Prussian influence, and internal improvements were pushed forward, but in 1841 the king refused the request of the estates for a constitution, and repeatedly declared that the estates should be convened only at his own will, and then only as an advisory body, with no legislative power. The revolution of 1848 followed, but the victories of the army gave the king confidence, and in place of the constitutions proposed by the revolutionists, he promulgated one of his own and dissolved the popular assembly. In 1849 he declined the imperial crown tendered him by the Frankfort Diet. In 1858 he became insane, and d. Jan. 21, 1861.

Frederick William, crown prince of Germany and Prussia, b. near Potsdam Oct. 18, 1831, son of the present emperor, William I., was educated at Königsberg; married in 1858 the eldest daughter of Queen Victoria; entered the military service in early life; bore an important part in the Austro-Prussian war of 1866, in which he commanded the second army, numbering some 125,000. During the Franco-Prussian war he led the third army, which consisted of about 200,000 men and 500 guns; won the victories of Weissenburg and Wörth, and bore a distinguished part in the succeeding events of that war. He has the rank of general field-marshal and general inspector in the German army.

Frederick City, cap. of Frederick co., Md., is situated in a rich and fertile valley on the Baltimore and Ohio R. R., which connects it with the cities of Washington and Baltimore, also with Pennsylvania and the West. It lies within 3 miles of the Monocacy battle-field, and 12 miles from the battle-field of South Mountain. The Confederate army, under Gen. Robert E. Lee, occupied Frederick City for six days from Sept. 6, 1862, and on the 12th of the same month the Union army, under Gen. McClellan, entered and occupied the city. On July 9, 1864, it was again occupied by the Confederate army, under Gen. Jubal Early, who demanded and received as a ransom from her citizens $200,000. The remains of Francis S. Key, a native of Frederick county, and the author of *The Star-Spangled Banner*, are buried in the cemetery adjoining the city, and the body of Roger B. Taney, late chief-justice of the Supreme Court of the U. S., is interred in the old graveyard belonging to the Catholic church of Frederick City. Barbara Frietchie, the good old dame who has been immortalized in verse by the poet Whittier, is buried in the same cemetery with Francis S. Key, and not far from the spot where his remains repose. Frederick City is noted for its good health, its pure mountain-air, and the excellent quality of its water. It has 4 national and 2 State banks, the deaf and dumb institute of Maryland, 2 colleges, 2 female seminaries, public schools, 12 churches, 3 foundries, one fruit and vegetable canning establishment, which in the busy season affords employment for 500 hands; 3 planing mills, 4 large tanneries, 6 hotels, 3 newspapers, 2 fire insurance companies, 3 brick manufactories, fine dry-goods, grocery, and drug stores, gas and water works, 3 fire companies, temperance and Christian associations, Masonic, Odd Fellows, Improved Order of Red Men, Harrigari, and Knights of Pythias lodges; 10 turnpikes into the city, 2 coach-factories, 2 flour-mills, 1 nunnery, 1 novitiate, and a new, very large, and magnificent city hall. Pop. of city, 8526; of tp., exclusive of city, 3378.

CHARLES COLE, ED. "THE MARYLAND UNION."

Fred'ericksburg, post-v. of Posey tp., Washington co., Ind. Pop. 160.

Fredericksburg, post-tp. of Chickasaw co., Ia. P. 611.

Fredericksburg, a v. of Salem tp., Warren co., O. Pop. 64.

Fredericksburg, post-v. of Salt Creek tp., Wayne co., O., on the Cleveland Mount Vernon and Delaware R. R. Pop. 539.

Fredericksburg, post-v. of Bethel tp., Lebanon co., Pa. Pop. 480.

Fredericksburg, post-v., cap. of Gillespie co., Tex., 85 miles W. of Austin, has 5 churches, a convent school, 3 other schools, 3 flouring and 3 saw mills, 2 weekly newspapers (1 English and 1 German), and a lively trade in wheat, corn, and merchandise. The situation is elevated and healthful. It was settled in 1846 by a German colony. Pop. 1164, much increased since the census.

T. W. SWILLING, ED. "SENTINEL."

Fredericksburg, city of Spottsylvania co., Va., on the S. bank of the Rappahannock River, at the head of tide-water, 92 miles from its mouth. The river is navigable for steamers and sailing vessels. It is on the Richmond Fredericksburg and Potomac R. R., 60 miles S. of Washington, 13 miles S. of the Potomac, and 61 miles N. of Richmond, and on the (incomplete) Fredericksburg Orange and Charlottesville R. R. It has a very great water-power, for a dam has been constructed across the Rappahannock just above the city, rendering available the whole water-power of the river. This dam, built under the supervision of Mr. John Chase of Holyoke, Mass., is 900 feet long and 18 feet high, giving a fall of 48 feet 2 inches, and affording some 4000 horse-power, of which only one-tenth is now utilized. There are several large flouring-mills, which produce the wheat flour for which Fredericksburg is so famous; also 2 large iron-foundries, an extensive woollen-mill, and a paper manufactory. Fredericksburg was the scene of several bloody contests during the late civil war. It has a national bank, 8 churches, and 4 semi-weekly newspapers. Pop. 4046. J. H. KELLY, ED. "HERALD."

Fredericksburg, Battle of. The Union Army of the Potomac, resting on its arms after the battle of Antietam, had been reorganized and equipped when (Oct. 26–

Nov. 2, 1862) it crossed the Potomac River at Berlin, 5 miles below Harper's Ferry. The Confederate army of Northern Virginia lay, meanwhile, in the vicinity of Winchester. Directing his course southward towards Warrenton, McClellan, by guarding the passes of the Blue Ridge, through which he threatened to issue, succeeded in screening his intention so far that on the arrival of the army at Warrenton (Nov. 9), while one-half of Lee's army, which had moved parallel with McClellan's, was at Culpeper, the other half, under Jackson, was scattered through the Shenandoah Valley, the two wings separated from each other by fully two days' march. McClellan's intention appears to have been, by moving obliquely westward from Warrenton, to interpose his army between the dismembered Confederate forces; but on the night of Nov. 7 he was relieved from his command and succeeded by Gen. A. E. Burnside. Gen. Burnside assumed command unwillingly, and publicly expressed his sense of inability to command so large an army. Accepting the direction thus reluctantly, he abandoned McClellan's plan of operations, and halted his army at Warrenton for the purpose of consolidating the six corps of which it was composed into three grand divisions of two corps each. The right grand division was placed under Gen. Sumner; the centre grand division under Gen. Hooker; and the left grand division under Gen. Franklin. Richmond being Burnside's objective point, he submitted a plan to the general-in-chief, in which he declared his intention of moving his army to Fredericksburg, from which he proposed to advance upon Richmond by the line of the railroad. This project was at first disapproved at Washington, but finally assented to, and on Nov. 15 the army was put in motion for Falmouth, on the N. bank of the Rappahannock, to cross thence to Fredericksburg opposite, and secure possession of the heights in rear of that city. In pursuance of this plan, Sumner's grand division, in advance, reached Falmouth on the 17th. At this time Fredericksburg was occupied by but one regiment of cavalry, four companies of infantry, and a light battery, which latter opened fire on Sumner's advance, but was soon silenced by the fire of a Union battery; the river was besides, at this time, fordable at points, and Sumner on the night of the 17th asked for orders to cross and take possession of the city, which Burnside declined to give "until his communications were established." During the 19th and 20th the remainder of the army arrived and took position along the Rappahannock. In the mean time, Lee, discovering Burnside's intention, directed Longstreet from Culpeper to Fredericksburg, where his advance arrived on the 19th, to which point Jackson was also ordered, arriving in the vicinity a few days later. The task of obtaining possession of the heights had even now become formidable, but a further delay was occasioned by the non-arrival of the ponton trains which had been ordered from Washington, and it was not until Dec. 10 that the preparations for crossing were completed, by which time the entire Confederate army had arrived, and the ridge in rear of Fredericksburg been fortified. The river at this point takes a nearly southerly direction, on each side of which are commanding heights; those on the S. (or W.) rise at a distance of from one-third of a mile to 2 miles beyond the river-bank, extending from above and to the rear of the city some 6 miles down to Massaponax Valley, gradually diminishing in height and sinking away towards this point, leaving a broken intermediate plain, which, in rear of Fredericksburg, is traversed by a canal, at right angles with which, and leading up to the heights, run the telegraph and plank roads. Back of this first ridge is an elevated plateau, and then a second terrace of hills, also fortified. The plain of a third of a mile deep between Fredericksburg and the first ridge was the theatre of Sumner's operations. The heights on the N. (or E.) bank fall rapidly down to the river, commanding those on the opposite bank, which latter, however, command the intermediate plain, across which they can only be assailed. This position in rear of the town formed the left of the Confederate line, held by Longstreet's corps, extending to the river above, the right of which was held by Jackson's corps, 2 miles below the town; Stuart, with two brigades of cavalry and his horse artillery, forming the extreme right, extending to Massaponax Creek. The preliminary preparations being completed, it was determined to force the passage of the river the next morning (Dec. 11). Burnside's plan was to cross by five ponton bridges—three opposite the city, and two below some 2 miles; on the former of which Sumner's and Hooker's divisions were to cross; Franklin's and part of Hooker's on the latter; the rest of Hooker's to be held in reserve. The spanning of the river at the latter point, where the plain attains its greatest width and was swept by the Union artillery, was accomplished by noon; but the attempt above was met by a severe fire from the sharpshooters posted behind the walls and houses along the river front, compelling the cessation of work, notwithstanding the severe bombardment to which the city was subjected by the Union batteries, firing it in several places, but which was without effect upon the low ground held by the sharpshooters, until, by the happy suggestion of Gen. Hunt, chief of artillery, several ponton boats were filled with troops and rowed to the opposite bank, from which they drove the Confederates, and the bridges were soon after established. No attempt had been made by Lee from the heights to oppose the crossing. The entire division of Sumner was crossed over that night and the next day, and the city occupied, Franklin crossing at the same time below. The 12th was consumed in completing the crossing of the river and disposing the forces.

Thus, two days had elapsed since the commencement of the crossing, by which time the Confederate army had assembled in its naturally strong positions, now strengthened by fortifications, whereas the only hope of a favorable result to Burnside's plan lay in the crossing being made a surprise. For prudential reasons alone the plan should now have been abandoned, or at least new dispositions adopted for its execution. To add to the critical situation, a misunderstanding occurred between Gen. Burnside and his division commanders as to the part to be taken by them the coming day. The plan of attack, as determined upon the night of the 12th, was for Franklin, with his division and a part of Hooker's, to make the attack in force on the left, while Gen. Sumner's attack on the heights in rear of the town was to be made contingent on Franklin's success. The terms of Burnside's instructions to Franklin on the morning of the 13th, however, led him to conclude that Burnside had altered his determination of the night previous, and now contemplated only an armed reconnaissance with a single division. In this interpretation Franklin was supported by his corps commanders, Reynolds and W. F. Smith. Sumner's instructions were to "form a column of a division for the purpose of pushing in the direction of the telegraph and plank roads, and seizing the heights in rear of the town, holding another division ready to advance in support." The morning of the 13th opened with a heavy fog, which filled the valley and delayed operations for some time. About 10 A. M. the fog lifted, disclosing Franklin advancing, who, construing Burnside's orders liberally, advanced Meade's division, with Gibbon's in support on the right, and Doubleday's in reserve. Advancing along the plain, Meade's left soon encountered a fire from Stuart's batteries, placed on the Port Royal road, which being soon silenced, he moved forward, shelling the wooded heights in his front, and causing considerable damage to Jackson's advanced line, but without drawing its fire till he arrived at short range, when the Confederate batteries opened with shell and canister, doing much damage, through which Meade continued, driving three Confederate batteries back from in advance of the railroad, and attacking vigorously Hill's division, pierced its lines, sweeping it back to the right and left, capturing 200 prisoners. Crossing the railroad and pushing up the ridge, he met Gregg's brigade holding a line along a new military road constructed for affording direct communication between the wings of Lee's army, behind which was Jackson's second line. For a moment Gregg mistook the advancing column for a body of Confederate troops, and withheld his fire, but soon discovering his error, the brigade now poured in its fire at close range, and Early's division advancing, Meade was assailed in front and on both flanks, and driven back with much loss. Gibbon, who had not advanced as far as Meade, now met the retreating columns, somewhat checking the pursuit, but Jackson being reinforced from Longstreet's right, the two divisions were driven still farther back. In the mean time, Birney's division from Hooker's grand division had been sent forward, and now opened such a fire upon the Confederates that they abandoned further pursuit, and retired to their old position on the crest.

On the right affairs were still more serious. In obedience to his instructions, Sumner had ordered forward French's division (2d corps) from Fredericksburg about noon, to be followed and supported by Hancock's. Moving out on the telegraph and plank roads and crossing the canal, French, under cover of a knoll, deployed his columns with brigade front. Even while emerging from the town the Confederate batteries on the heights opened a destructive fire, to which the Union batteries on the opposite bank could not reply without endangering their own men. As his advance line, Longstreet held the stone wall and rifle-pits along the telegraph road at the foot of Marye's Hill. Of this position Gen. Kershaw (Confederate) says: "Marye's Hill, covered with batteries, falls off abruptly toward Fredericksburg to a stone wall which forms a terrace on the side of the hill and the outer margin of a road which winds along the foot of the hill. This road is about 25 feet wide, and is faced by a stone wall about 4 feet high on the city side.

The road, having been cut in the side of the hill in many places, is not visible above the surface of the ground." This position was of such strength, the defenders being under complete protection, that but 1700 men were found necessary to occupy it. Moreover, the whole plain, a quarter of a mile in width, over which the attacking army must pass, was swept by a direct and enfilade fire from the batteries crowning the semicircular crest above on the plateau, behind which lay the main body of the Confederates. By his orders nothing remained but for French to assail the position. Advancing his columns upon the narrow plain, they were at once met by a fire from the batteries above, which ploughed through their ranks; but, closing up, they pressed forward and had crossed about half the interval when they were met by volley upon volley of musketry from the sunken road, before which their shattered columns fell back with a loss numbering nearly half their force. Following close behind came Hancock, who now advanced, joined by such of French's command as retained their organization, up to and beyond the point reached by French, but were compelled to retire by the same deadly fire with a loss of more than 2000 men. Howard's division now at hand, with Sturgis' and Getty's divisions (9th corps), advanced to the support of the 2d corps, with the only result of holding an advanced line on the plain under a constant artillery fire. Burnside, who had witnessed from the opposite shore the failure of the repeated assaults, still determined to carry the crest that night, and ordered Hooker in to renew the assault. Hooker crossed with three divisions, and after communicating with those who had gone before, returned to Burnside and endeavored to dissuade him from further attack. Burnside, however, was immovable. Already two batteries had been thrown forward to within 150 yards of the enemy's line, and an attempt made to open a breach, but no fire could touch the sunken road, and the effect was imperceptible. About sunset Humphrey's division was ordered to renew the assault with unloaded muskets, there being no time to load and fire. Advancing nearly up to the stone wall, they too were met by the same resistless shower of bullets, and, like those who had gone before, driven back with a loss of 1700 out of 4000 in the short space of 15 minutes. The attack was not renewed by Hooker. "Finding," says he, "that I had lost as many as my orders required me to lose, I suspended the attack, and directed that the men should hold for an advanced line a ditch which would afford shelter." The Confederates rested on their arms that night, anticipating a renewal of the attack next day, for they were unaware of the loss they had inflicted. Gen. Burnside indeed determined to renew the assault, and had given orders to that effect, when he was finally dissuaded by the earnest entreaties of Gen. Sumner, who agreed with every other corps commander upon the hopelessness of such an assault. Both armies remained in position till the night of the 15th, when, during a violent storm, Gen. Burnside withdrew his forces to the N. bank of the river. The Union loss at Fredericksburg is officially reported at 1138 killed, 9105 wounded, and 2078 missing; total, 12,321. The Confederate loss was 595 in killed, 4061 wounded, 563 missing; total, 5309. Eight days later Gen. Burnside was removed from the command of the army.

Fred'ericktown, post-v., cap. of Madison co., Mo., on the St. Louis and Iron Mountain R. R., 105 miles S. of St. Louis and 4 miles from the celebrated Mine la Motte lead-mines. It has a number of stores and shops, 4 schoolhouses, 5 churches, and 1 weekly newspaper. Pop. 601.
E. P. Caruthers, Ed. and Pub. "The Bee."

Fredericktown, post-v. of Knox co., O., on the Lake Erie division of the Baltimore and Ohio R. R., 45 miles N. E. of Columbus; has 4 dry-goods, 2 drug, and 2 hardware stores, 1 bank, 2 hotels, 1 plough and farm-bell foundry, 2 carriage manufactories, 1 weekly newspaper, and 3 churches. Pop. 690. C. W. Townsend, Ed. "Independent."

Fred'ericton, a beautiful city, the cap. of New Brunswick and of York co., is situated on a plain on the right bank of the river St. John, 84 miles from its mouth. It is finely laid out, and has many handsome buildings. Among the public buildings of importance may be named the government-house, the province building, court-house, city hall, barracks, the exhibition building, the dépôt of the Fredericton Railway (which extends 22 miles to Fredericton Junction (Blissville) on the European and North American Railway), the University of New Brunswick, a flourishing institution, 8 churches, Christ church cathedral (Anglican), the custom-house, jail, etc. Fredericton is the seat of an Anglican bishop. The river is navigable to this point by large steamers; above, small steamers ply during high water, proceeding as far as the Grand Falls. A steam-ferry connects it with St. Mary's, on the opposite bank of the river. The city is lighted with gas. Besides the institutions already mentioned there are several libraries, a reading-room, a bank, a Baptist seminary, 4 weekly newspapers, circuit, divorce, vice-admiralty, jurisdiction, probate, piracy, and county courts, a collegiate school, provincial training and model schools, and a steam fire department. The city is divided into five wards—Wellington, St. Ann's, Carleton, Queen's, and King's. Pop. in 1871, 6006.

Fredericton Junction. See Blissville.

Frederi'ka, post-tp. of Bremer co., Ia. Pop. 389.

Fred'erikshall, town of Norway, in the stift of Aggershuus. It is a strong fortress. Here Charles XII. of Sweden was killed in 1718. It has a fine harbor. Pop. 7408.

Fred'erikshamn [Finnish, *Hamina*], town of Russia, in the grand duchy of Finland, on the Gulf of Finland, in lat. 60° 27′ N. The treaty by which Finland was ceded to Russia was signed here in 1809. Pop. 3278.

Fred'erikstad, a fortified seaport of Norway, 50 miles S. E. of Christiania, at the mouth of the Glommen, has a spacious harbor, a good trade, and thriving manufactures. Pop. with surroundings, 6833.

Fredo'nia, post-tp. of Chambers co., Ala. Pop. 1186.

Fredonia, post-v. of Ohio tp., Crawford co., Ind. Pop. 72.

Fredonia, post-v. of Concord tp., Louisa co., Ia., on the Cedar River and the Chicago Rock Island and Pacific R. R. Pop. 150.

Fredonia, post-v., cap. of Wilson co., Kan., near Fall River, and on the M. and N. R. R., in a fine farming region. It has 3 churches, 2 banks, 2 schools, a weekly newspaper, 3 hotels, a mill, etc. W. A. Peffer, Ed. "Journal."

Fredonia, post-v. of Caldwell co., Ky. Pop. 155.

Fredonia, tp. of Calhoun co., Mich. Pop. 1031.

Fredonia, post-v. of Chautauqua co., N. Y., in Pomfret tp., and on the Dunkirk Warren and Pittsburg R. R., 40 miles S. W. of Buffalo and 3 miles from Lake Erie. It has a State normal school (built by the village at a cost of $100,000), 2 weekly newspapers, 5 churches, and a street-railroad running to Dunkirk, 3 miles distant. The village has for more than forty years been lighted with natural gas, obtained by boring into the bituminous shale; one of the gas-wells is over 1000 feet deep. The raising of garden-seeds and of grapes, and the manufacture of carriages, are extensively carried on. There are 2 fire companies, 1 national and 2 private banks, and various public and private halls. The first grange of the Patrons of Husbandry was organized here. The first academy in Western New York was established here in 1824; its library of some 2000 volumes has been transferred to the normal school building. Pop. 2546. W. McKinstry, Ed. "Censor."

Fredonia, post-v. of McKean tp., Licking co., O. Pop. 99.

Fredonia, post-tp. of Ozaukee co., Wis., on the Wisconsin Central R. R., 33 miles N. of Milwaukee. P. 1688.

Free'born, county of Minnesota, bordering on Iowa. Area, 720 square miles. It is fertile, and diversified by timber, prairie, lakes, and streams. Grain, hay, and dairy products are the staples. It is traversed by the Southern Minnesota R. R. Game is abundant. Cap. Albert Lea. Pop. 10,578.

Freeborn, post-tp. of Freeborn co., Minn. Pop. 362.

Freeborn, tp. of Dunklin co., Mo. Pop. 1104.

Free'burg, post-v. of St. Clair co., Ill., on the St. Louis Alton and Terre Haute R. R., 22 miles S. E. of St. Louis. Pop. 920.

Freeburg, post-v. of Snyder co., Pa. It has 2 churches, an academy, 1 musical college, a town-hall, 5 dry-goods stores, a drug-store, 3 hotels, 1 grist-mill, 2 weekly newspapers, a marble-yard, etc. Principal business, farming and ore-mining. D. B. and C. F. Moyer, Eds. "Courier."

Free Chap'el, tp. of St. Clair co., Ala. Pop. 873.

Free Church of Scotland. The movement in the Church of Scotland which terminated in the formation of the Free Church is closely connected with controversies which have lasted for more than 300 years. (For the earlier history of these controversies we refer the reader to the article Scotland, Reformed Church of.) In 1647 an act of the Assembly of the Scottish Kirk was passed, adopting the Westminster Confession with two modifications—the one in favor of the system of Presbytery, which is omitted from the Confession, and the other affirming the right of the Church to meet in synods and assemblies without the consent of the magistrate.* On Mar. 9, 1649, the Scottish Parliament passed an act abolishing patronage in the Kirk, as being unlawful and unwarrantable by the word of God

* Innes, 65.

and contrary to the doctrines and liberties of the Church. The General Assembly in June of the same year passed an act entitled "The Directory for the Election of Ministers," in which it was declared that the kirk session, or board of elders elected by the congregation, should elect the minister, and intimate their election to the congregation for their approbation; if the majority dissented, another election was to take place. No minister was to be settled but "upon the suit and calling of the congregation." The session elected, but the congregation must mark their consent by an orderly call before the settlement could take place. This Assembly completed what is usually spoken of as the Second Reformation of the Kirk, in which the great principles of her Presbyterian constitution and her inherent right of spiritual jurisdiction were vindicated.*

After the restoration of Charles II. patronage was restored in connection with the introduction of the episcopal form of church government.

We pass on to the union of the two kingdoms of England and Scotland and the merging of the two legislatures in one Parliament. This was preceded by a succession of legislative acts which were intended to secure to the Scottish nation, by the most solemn guaranties, the maintenance of the doctrines, principles, and government of the Kirk. In 1705, the act for securing the Protestant religion and Presbyterian church government was passed by the Scottish Parliament, and was afterwards incorporated into both the Scottish and English acts for ratifying and approving the union. This act received the royal sanction in 1707, when the union was consummated, and has been regarded by Scotchmen not as a simple legislative statute, but as a fundamental and essential condition of the treaty of union.† This important act not only confirms the act of 1690, ratifying the Confession of Faith and settling the Presbyterian church government, but also the other acts which followed that, abolishing the royal supremacy, and substituting the election of the session and the call of the congregation for the presentation by lay patrons. But in 1711 the famous act of Queen Anne for the restoration of patronage was passed, and on this act the present practice of patronage in the Church of Scotland rests. All parties in the Kirk united in resisting the restoration of patronage; the General Assembly, while yielding to it, continued for many years to protest against it. Lord Macaulay thus speaks of the serious consequences of this alleged breach of the constitution of the Church of Scotland: "The British legislature violated the articles of union and made a change in the constitution of the Church of Scotland. From that change has flowed almost all the dissent now existing in Scotland. Year after year the General Assembly protested against the violation, but in vain, and from the act of 1711 undoubtedly flowed every secession and schism that has taken place in the Church of Scotland."‡

The question here arises as to whether the terms of the Revolution settlement, subsequently ratified by the treaty of union between England and Scotland, are legally so stringent that they could not be altered by subsequent legislation without a breach of the covenant. It must be noticed that it has proved to be impossible for one generation to bind all those who succeed it in any department of human interest, and least of all in the sphere of religion. The acts that were embodied in the treaty of union required all university professors to sign the Confession of Faith and submit to the government and discipline of the Kirk. This was, equally with the abolition of patronage, a fundamental condition of the union; but in 1853 a Universities (Scotland) Act was passed by the Parliament which limited this subscription to theological professors. In the present condition of parties in Scotland the right of the legislature to make this change will scarcely be questioned. The subject in its purely legal aspect is not without difficulties, but it cannot be maintained that the legislature of to-day is bound to perpetuate what it regards as inexpedient or even wrong, because it was a condition of the treaty of union 200 years ago.

It must, however, be borne in mind that the act of Queen Anne which abolished patronage was in direct opposition to the declared principles of the Church of Scotland and to various solemn acts both of the General Assembly and of Parliament. No change in the opinions of the Scottish Church or nation had taken place to warrant such a breach upon the constitution of the Kirk, and the measure was passed in spite of the earnest remonstrance and protest of the Church and nation. Apart, therefore, from the grave question in reference to the irrevocableness of any statute, the act itself was unwarranted, and its consequences were as serious as Lord Macaulay has represented them to be.

The history of the Church of Scotland from 1711 to 1834 is marked by many instances of the intrusion of ministers into parishes against the will of the people. In 1736 the Assembly passed an act against the intrusion of ministers into vacant parishes, and up to 1784 the Assembly continued from year to year to remonstrate against the law of patronage, and instructed each succeeding commission § to make application to the king and Parliament for redress of the grievance. A case of disputed settlement under the patronage act led to the first Secession, in 1733, and another case of the same kind led to the formation of the Relief Church in 1752.

A full statement of the facts of these Secessions belongs properly to the history of the United Presbyterian Church in Scotland. From the time of the second Secession the dominant party in the Church continued to enforce the law of patronage for many years, but a minority within the Church continued to protest against the intrusion of ministers and to contend for the doctrine of spiritual independence. About the beginning of this century the party opposed to patronage, now known as the "Evangelical party," was greatly increased. The settlement of Dr. Andrew Thomson as minister of St. George's church, Edinburgh, in 1810, and the subsequent publication of the *Christian Instructor* under his management as editor, gave a great impulse to the Evangelicals.‖ In his work of rousing the energies of the Scottish people to seek ecclesiastical reform he was joined by Dr. Thomas McCrie, the historian, and shortly afterwards, in 1815, Dr. Thomas Chalmers was removed from the country parish of Kilmany to the Tron church of Glasgow, and threw all his talents and energies into the same great work. These three ministers were of those men who stamp the impress of their own characters upon the age in which they live, and were influenced by the same strong, lofty views of the independence of the Church, and by the same ardent love for the principles which they regarded as fundamental to the constitution of the Reformed Church of Scotland. In 1825 an anti-patronage society was formed, the most active member of which was Dr. Andrew Thomson, but the majority of the Evangelical party declined to unite with it, and continued to seek the regulation and control of the law without contemplating its total abolition. In 1832 overtures from three synods and eight presbyteries were laid on the table of the General Assembly, representing that the call had been reduced to a mere formality, and praying that measures be adopted to restore it to its constitutional and salutary efficiency. A motion declaring it to be inexpedient to take any action was carried by a majority of 42. At the Assembly in 1833 no less than 45 overtures asking for the restoration of the call to its proper place in the constitution of the Church were presented. Dr. Chalmers moved that the dissent of a majority of the parishioners be conclusive against the settlement of a minister, provided the objections were not founded on malice or caprice. A motion, in effect continuing the practice then in use, was carried by a majority of 12. The agitation of the subject was continued, and at the General Assembly of the following year (1834) a great number of overtures brought up the discussion of the call, and a motion made by Lord Moncrieff to the same purport as that made by Dr. Chalmers in the preceding year was carried by a majority of 46. The act on calls, generally known as the "veto act," was only a half measure; instead of giving any direct efficacy to the call of the people, which was what the constitutional principles of the Church warranted, it simply rendered the dissent of the people conclusive against the presentee; but the passage of this act marks the beginning of the "ten years' conflict" between the ecclesiastical and the civil power in Scotland. The first case that arose under this new act will serve as an illustration of the conflict which was carried on between the co-ordinate courts. The church and parish of Auchterarder having become vacant in Aug., 1834, on Sept. 16 thereafter the earl of Kinnoul, as patron, issued a presentation in favor of Mr. Robert Young, a licentiate of the Church. The call was laid before the presbytery on Oct. 14, and in terms of the veto act and its relative regulations the matter was brought before the parishioners. The call was signed by the earl of Kinnoul's factor, not a resident in the parish, and by two heads of families. On the other hand, 287 heads of families, being communicants, subscribed a dissent from the call; in consequence of this the presbytery rejected Mr. Young as presentee to the parish. Mr. Young appealed first to the synod, and afterwards to the Assembly, but both of these courts reaffirmed the decision of the presbytery by large majorities. Thereupon the

* Baillie, Hetherington, and Innes. † Act of Security, Innes, 117. ‡ Macaulay, *Speeches*, ii. 180.

§ The commission of Assembly is a kind of committee of the whole, which has power to meet at any time of the year in reference to any matters which may affect the interests of the Church.

‖ We use the terms *Evangelicals* and *Moderates* to save circumlocution.

earl of Kinnoul and Mr. Young instituted a process in the court of session,* contending that the rejection of Mr. Young as presentee was *ultra vires* of the presbytery, in violation of the statutes, and to the serious injury of their patrimonial rights as patron and presentee. The presbytery of Auchterarder asked advice of the commission of Assembly which met Nov., 1835, and the commission instructed their procurator, or legal agent, to conduct the defence at the expense of the Church. On Mar. 8, 1838, the court gave its decision by a majority of three—the numbers being eight and five—to the effect that the presbytery had acted to the hurt and prejudice of the patron and presentee, illegally and in violation of their duty, and contrary to the provisions of the statute of Queen Anne for the restoration of the rights of patrons. At the next meeting of the presbytery of Auchterarder the whole matter was referred to the synod, and from thence sent up to the General Assembly, which met in May, 1838. The Assembly authorized the procurator of the Church to appeal the case to the House of Lords, and on May 3, 1839, the judgment of the House of Lords was given to the effect that the appeal be dismissed and the decision of the court of session affirmed. Thus, the highest legal judicatory in the kingdom declared the veto act to be illegal, and that the law recognizes neither the call nor the objections of the people in the appointment and ordination of a minister to a parish, and that if they interfere with the patron in the exercise of his right, they must be put down. A crisis had now arrived, and the General Assembly of 1839 met prepared to deliberate on the course to be taken. Dr. Cook, as leader of what was called the Moderate party, moved, in effect, that as the veto act had been pronounced illegal by the supreme civil tribunals of the country, the General Assembly should instruct all presbyteries to proceed in the settlement of parishes according to the practice which prevailed previously to the passing of that act. Dr. Chalmers, as leader of the Non-intrusion party, moved a resolution affirming the readiness of the Church to give obedience to the civil courts so far as the civil rights and emoluments of the Church were concerned, but at the same time declaring the principle of non-intrusion to be an integral part of the constitution of the Reformed Kirk of Scotland, and that the principle could not be abandoned; therefore no presentee should be forced upon any parish contrary to the will of the congregation. This resolution further provided for the appointment of a committee with instructions to confer with the government of the country with a view to the restoration of harmony between Church and State. This motion was carried in the Assembly by a majority of 49; it declared in effect that the civil courts might do what they chose with the emoluments of the parish of Auchterarder, but that the Church courts could not proceed at the dictation of these courts to the ordination and settlement of Mr. Young. Thus terminated for a time the Auchterarder case, but the collision between the Kirk and the civil courts continued.

The position of the Church was becoming more and more difficult and complicated. The Non-intrusionists were willing to abandon the temporalities of the benefices, and claimed for the Church only spiritual and pastoral rights; but this was met, on the part of the civil courts, by the principle that ministers of the National Church were statutory functionaries, bound to perform their duties as fixed by the supreme courts, and that they could not evade these duties by merely abandoning the emoluments. Meanwhile, some attempts were made to afford relief from this conflict of jurisdiction by means of legislation. In May, 1846, the earl of Aberdeen brought forward a bill on the Church question, but it failed to meet the difficulties, inasmuch as it acknowledged the validity neither of the veto nor of the direct call, and left the proceedings of the Church courts subject to the review of the court of session. After a second reading it was withdrawn. The General Assembly of 1842 transmitted to the Crown "the Claim, Declaration, and Protest anent the encroachments of the court of session." "The Claim of Rights," as it was called, is a most valuable historical document, gathering up the principles of the majority in the Assembly, and giving a comprehensive statement of the scriptural, constitutional, and legal grounds on which these principles rested, of the wrongs which the Church had sustained from the civil courts, and of the claim for protection which she put forth. It closed with a solemn declaration that at all hazards the Church was prepared to defend and maintain her inalienable rights. Towards the close of the same year (1842) a convocation was called to take into consideration the position of the Church in relation to the civil courts. This meeting was opened on Nov. 17, and about 450 ministers were present. A memorial to government was subscribed by nearly all the ministers present, by which they committed themselves to the relinquishment of the Church temporalities if they could no longer hold them in consistency with the free and full exercise of their spiritual functions. Mr. Maule introduced a motion into the House of Commons, Mar. 7, 1843, to the effect that the House should resolve itself into a committee to take into consideration the grievances of which the Church of Scotland complained; 76 voted for this motion, and 241 against it, but the Scottish members voted in the proportion of 2 to 1 in its favor. It was felt in Scotland as a grievance that in a purely Scottish question the voice of Scotland, as expressed by her representatives, was overborne by the votes of English and Irish members. With this decision the negotiations for relief from the conflict of opposing jurisdictions by means of legislation came to an end.

The Assembly met on May 18, 1843. That day witnessed a transaction which profoundly agitated the Scottish nation; a thrill of enthusiasm passed from heart to heart such as had not been felt for centuries. After the usual preliminary services the Rev. Dr. Welsh, as moderator, impressively declared that it was impossible to constitute a free Assembly under the conditions of establishment as now fixed by the civil authorities, and then read the protest. The protest having been laid on the table, he rose and left the chair, and proceeded up the aisle to the door; he was speedily joined by Dr. Thomas Chalmers, and they were followed by over 400 ministers and a still larger number of elders. They were received by the people outside the church with an irrepressible cheer, and as the crowd fell back on either side to allow them to pass out, they spontaneously, though without any previous arrangement, fell into a line three abreast, and thus made their way to the large hall at Cannonmills which had been prepared for their reception. Dr. Chalmers was elected the first moderator of the Free Assembly, and the Secession was completed by the subscription of the act of separation and disruption. Four hundred and seventy ministers thus abandoned the Church of Scotland as by law established, renouncing all rights and emoluments in that Church. A yearly revenue of more than £100,000 sterling was voluntarily relinquished. We can quite understand how the fire of a holy enthusiasm would glitter in many an eye as they witnessed this example of the supremacy of conscience amid many temptations to compromise with the civil authorities. One great service which the disruption rendered to the common cause of Christianity was the testimony that it bore to the existence and power of a self-sacrificing attachment to the cause of Christian truth. Here was a company of nearly 500 ministers who, rather than do what they believed would be hurtful to religion, resigned their secure emoluments and threw themselves and their families upon the providence of God. The deed took many by surprise, and closed many a lip that had sneeringly proclaimed that the ministers would cling to their manses and stipends. It filled every generous mind, every lover of the noble and heroic in every land, with a glow of admiration. Whatever opinion men held of the merits of the previous controversy, the disruption itself made a deep and broad impression that the sacrifice it involved was made at the shrine of conscience. Nor was it done in the heat of a momentary impulse. It was reached by slow and well-measured steps calmly and deliberately taken, and the truest honor is due to the men who thus rose at the call of duty above all personal, all earthly considerations.

It is necessary to notice that the Free Church thus constituted held strongly to the principle of a religious establishment. The testimony of the Church of Scotland has always been that Christ is not only Head over the Church, but also Head over nations and states as such; and it was held by the leaders of the Free Church movement, and especially by Dr. Chalmers and Hugh Miller (who as editor of the *Edinburgh Witness* did much to prepare the people for the disruption), that this doctrine of Christ's headship involved the duty of the civil magistrate to support the Church of Christ in the land over which he rules.

The distinctive principles of the Free Church may be summed up under two heads: (1) The right of those who are members of the Church, and in full communion with her, to have the uncontrolled power of choosing their own pastors. At the beginning of the conflict it was simply asked that no pastor should be intruded by a patron or by a Church court upon an unwilling people, but as the battle went steadily on this claim was intensified, and the abolition of patronage was demanded as a right. The right of a call in some form or other has always been claimed by the Church of Scotland for the people. It is not necessary to review the facts on this subject; the only question is as to whether an Established Church, having no power but what the state has conferred on it, is not bound to acquiesce in the legis-

* The court of session is the supreme civil court in Scotland, having jurisdiction in all civil cases of whatever nature. It was instituted in 1532. The number of judges is thirteen—the lord president, the lord justice's clerk, and eleven ordinary lords.

lation of the state and the decisions of the civil courts. The Claim of Rights maintains that the restoration of patronage by the act of Queen Anne was a breach of contract as ratified in the treaty of union; but it was held, on the other hand, that the Establishment is not founded on contract at all, inasmuch as the legislature of one period cannot be bound by the acts of their predecessors. That the constitution of the Church of Scotland involves the right of congregations to elect their ministers cannot be doubted, and we find that after the dust of the conflict had cleared away the Church of Scotland once more, under the leadership of such men as the late Dr. McLeod and Dr. Caird, continued to claim for the people this right of electing their ministers. (2) The second great principle asserted by the Free Church was the right of the Church through its courts and under Christ, and in accordance with the word of God, to regulate all purely spiritual and ecclesiastical affairs. The Evangelical party in the Church of Scotland maintained that in matters so purely spiritual as the exercise of discipline over their own members and office-bearers they could not be interfered with by the civil courts. They were quite willing that the civil courts should assume the direction of the civil or pecuniary interests of their members, but when the court of session reviewed and reversed, declared null and void, the ordinations, suspensions, and depositions which the Church courts had pronounced and ratified — when it prohibited ministers whom the Church courts had appointed to preach in certain districts from exercising within these districts any function of their ministry—it was felt that the Church was stripped of her independence, and the doctrine of Christ's headship over the Church thrust aside. The appeal to the British Parliament to sustain the Church's claim to a separate and exclusive jurisdiction in things spiritual and ecclesiastical was rejected; and now it was left for those who contended for the Church's freedom and independence either to surrender the liberties and privileges which they regarded as in harmony with all the principles and statutes upon which the Kirk of Scotland was established; or to disobey the law as now declared and to submit to whatever penalties might be inflicted; or to quit the Establishment, and so relieve themselves from legal obligations which they could not conscientiously discharge. At once they chose the latter as the only open and honorable course for them to take, and rather than sacrifice the spiritual independence of the Church, they paid the forfeit of their livings.

When the Free Church was thus constituted a great work was before it. Churches had to be created, provision made for the support of the ministry, a college to be organized and sustained, and missionary operations to be carried on. So much energy and zeal were put forth that within three years and a half after the disruption over $2,000,000 had been expended on churches and manses, and $350,000 had been obtained for educational purposes. In its subsequent history the Free Church has afforded the noblest demonstration of the power of a Christian Church to maintain an educated ministry, and at the same time to prosecute missionary and other benevolent enterprises with increasing liberality. The Free Church annually raises over $400,000 for the sustentation fund, and through its agency the ministers in the poorest parishes receive adequate support. Nearly all the foreign missionaries connected with the Established Church took part with the Free Church, and on this Church, even amid its own early struggles, the support of these missions devolved. It has missions in India, in Eastern Europe, in Asia Minor, and in Africa; it has contributed largely to the evangelization of the colonies, especially Canada and Australia; and it makes grants from year to year to evangelical societies on the continent of Europe. Free Church schools have been established through Scotland, and there are three theological colleges sustained with efficiency. Whatever may be said of the principles maintained by the Free Church, there can be only one estimate of the character and worth of the outgoing ministers, and of the zeal and liberality and success with which that Church has so far prosecuted its work.

David Inglis.

Free Cities, or, as they generally were called during the Middle Ages, **Imperial Cities,** were those German towns which governed themselves by elected magistrates, and formed independent communities, subject only to the emperor. They were a natural creation of the unsettled state in which society found itself early in the Middle Ages, and which made it necessary for the most peaceful industry and commerce to wear helmet and sword and protect themselves by walls and towers against the robberies of the knights. And they obtained their privileges from the emperor on account of the support they were capable of giving him in his quarrels with the nobility and clergy. Under the altered circumstances which modern society presents these free cities became first a curiosity and then a nuisance, and most of them were incorporated into neighboring states. In 1866, Frankfort-on-the-Main was annexed to Prussia, and Hamburg, Lübeck, and Bremen, which in the same year became members of the North German Confederation, are now the only free cities left. (See Hanse Towns.)

Free Congregations [Ger. *Freie Gemeinden*], an association of German Rationalists who were originally called "Protestant Friends." At first many of them professed to be Christians, but now they reject the doctrine of a miraculous revelation, and generally that of a personal Deity. They have been subjected in Germany to very oppressive laws; nevertheless, they had in 1868 in Germany 121 congregations, with 25,000 members, besides at least five German congregations in the U. S.

Freed'man [Lat. *libertus, libertinus*], in ancient Rome a free man who had been a slave. Slaves liberated by certain forms, or owned with certain conditions before liberation, or over thirty years old at the time of acquiring freedom, became not only freedmen, but Roman citizens; others belonged to the class Latini; still others (*dediticii*) had no recognized political existence. The descendants of freedmen were free, but even when citizens they did not have the rights of the gens.

Freedmen's Bureau. *Introductory.*—Preliminary to the establishment of the bureau officially known as the "Bureau of Refugees, Freedmen, and Abandoned Lands," new problems were pressed upon the attention of the American people by results flowing directly from the great war of 1861–65. Between four and five millions of people were suddenly set free from chattel slavery; a large class also of the poor white population of the Southern States were disturbed, and sought refuge and supplies for their necessities in the cities and villages. The pauper class had become so much increased from the late slaves and the whites in 1865 that at one time the army alone was feeding upwards of 140,000 of such dependants. Society in the South at the close of the war was completely broken up. The questions at that time discussed in Congress were such as these: "What shall be done with the South? what shall be done with the negro? what shall be done in the work of reconstruction as a stepping-stone to political existence, to political equality?"

After lengthy discussion the object was effected by the passage of what is popularly known as the "Freedmen's Bureau Act," establishing a bureau in the war department; the act was approved Mar. 3, 1865. To this bureau were committed the supervision and management of abandoned lands, and the control of all subjects relating to refugees and freedmen from any district of country within the territory embraced in the operations of the army, under rules and regulations prescribed by the head of the bureau and approved by the President. The bureau was to be under the "management and control of a *commissioner* to be appointed by the President, by and with the advice and consent of the Senate." Yet a clause of the act permitted the detail of all officials from the army, provided there should be no increase of pay or allowances to those so detailed. The original act of Congress would seem to confer powers sufficiently broad, yet subsequently the work of the bureau was enlarged to embrace "the supervision and care of all loyal refugees and freedmen, so far as the same shall be necessary to enable them as speedily as practicable to become self-supporting citizens of the U. S., and to aid them in making the freedom conferred by proclamation of the commander-in-chief, by emancipation under the laws of States, and by constitutional amendment available and beneficial to the public."

In fact, until the subsequent acts of reconstruction had been passed and put into active operation this bureau had in its hands pretty much the entire machinery of government and responsibility so far as the classes named in the act were concerned. How the powers conferred were used will appear to some extent in the following brief sketch of the operations of the bureau.

The Commissioner.—In speaking of the commissioner selected to perform the administrative duties a congressional investigating committee in 1870 introduce what they have to say by showing something of the anticipated scope and purpose of the bureau. They quote from the solicitor of the war department substantially as follows: "The work laid out for the bureau of emancipation is of immense magnitude. Two and a half millions of wards driven from their accustomed shelter by the sharp catastrophes of war, landless, houseless, homeless, appeal to the government to guard and save them. From their earliest years deprived of the light of knowledge, they are children able as yet to see only the star of freedom. They feel with hope and confidence that the flag which brings to them liberty will spread over them the mantle of its protection. In the heart

of this great people every pulsation throbs for freedom. The instincts of national honor will allow no faltering and no failure in our duty to the oppressed freedmen, who stand shoulder to shoulder in this struggle for our country's safety and renown. The plan proposed in this bill is for the organization of a bureau in the war department. Perhaps this is the best means of commencing the great work, but I think the time will soon come, if it has not already arrived, when the duties of this bureau will require the powers and merit the dignity of a separate executive department. There are several subjects which might be advantageously grouped together, and ought to be placed under the management of one controlling mind. Among them are the following: 1, taking possession, on behalf of the U. S., of all real estate abandoned by its owners; 2, taking possession of all real estate forfeited to the U. S. to be sold for taxes, whether bought in by order of the President of the U. S. or sold to settlers and others; 3, taking possession of all lands confiscated to the U. S.; 4, taking possession of all personal property of the enemy derelict, abandoned, or captured, except prizes at sea; 5, taking care of, and making provision for, all persons now freed or hereafter to be freed under any laws of the U. S. or proclamations of the President or acts of manumission; 6, taking care of all colored men in the rebellious districts who were free before the war, and of all fugitives thereto from loyal States; 7, all legal proceedings for the confiscation of property in the courts, the U. S. attorneys or special attorney to act under orders of the new department so far as respects these proceedings; 8, the administration of all laws, rules, and regulations relating to the migration of colored people; 9, and of laws relating to the compensation, if any, which the government may hereafter give to aid loyal States in emancipating slaves; 10, all other matters relating to the emancipation and its processes, its rules and regulations, etc., and the protection of the interests of the colored men on one hand and the U. S. on the other.

"These subjects are intimately connected together. They would require genius and active energy of the most powerful executive talent. The secretary of war and of the treasury are already so overwhelmed with labor and responsibility that it is ungenerous to demand of either of them to assume this herculean task. The labors of this emancipation department will be unsurpassed by those of any other executive minister. Its importance to the ultimate issue of the war, to the reputation of our country abroad, to the moral character of our people in the Southern States, to the treasury, to the soldier, and to the industrial interests of this great nation, can hardly be overestimated. Whoever is competent to fill the office of secretary of emancipation should have a seat in the cabinet."

Commissioner. — Gen. Howard was appointed commissioner May 12, 1865, and immediately commenced the organization of his bureau.

Assistant Commissioners.—The assistant commissioners soon appointed or detailed from the army were—Col. O. Brown for Va., head-quarters, Richmond, Va.; Col. E. Whittlesey, for N. C., head-quarters, Raleigh, N. C.; Gen. R. Saxton for S. C., Ga., and Fla., head-quarters, Beaufort, S. C.; Col. T. W. Osborn for Ala., head-quarters, Mobile, Ala.; Chaplain T. W. Conway for La., head-quarters, New Orleans, La.; Col. Samuel Thomas for Miss., head-quarters, Vicksburg, Miss.; Gen. C. B. Fisk for Ky. and Tenn., head-quarters, Nashville, Tenn.; Gen. J. W. Sprague for Mo. and Ark., head-quarters, St. Louis, Mo.; Col. Jno. Eaton, Jr., for a district near Washington, head-quarters, District of Columbia. The ensuing September a few changes were made: Gen. Saxton's district was reduced to South Carolina and Georgia, head-quarters at Charleston, S. C.; Gen. Davis Tillson took Georgia as sub-assistant for a time: he was soon made a full assistant, reporting directly to Washington; Gen. Wager Swayne was assigned to Alabama, and Col. T. W. Osborn to Florida; Texas meanwhile had been opened to us, and Gen. E. M. Gregory assigned, with head-quarters at Galveston, Tex. These assistants were, many of them, replaced by others for various causes. For example, Gen. J. M. Schofield and Gen. A. H. Terry had Virginia in succession; Gen. N. A. Miles and Col. J. V. Bomford, North Carolina; Gen. R. K. Scott, South Carolina; Gen. C. C. Sibley and Col. J. R. Lewis, Georgia; Gen. Wm. P. Carlin, Tennessee; Gen. J. C. Davis and Gen. S. Burbank, succeeding each other in Kentucky; Gen. C. H. Howard, District of Columbia, including in his district parts of Virginia, West Virginia, Maryland, and Delaware; Gens. A. Baird, J. H. Mower, Col. W. H. Wood, and Gen. R. C. Buchanan, Louisiana; Gen. C. H. Smith, Arkansas; Gens. Chas. Griffin, J. B. Kiddoo, and J. J. Reynold, Texas; Gen. E. M. Gregory was transferred to Maryland, and Gen. E. Whittlesey to Washington.

Sub-Assistants.—Each assistant commissioner's district was divided into a number of sub-districts, and a sub-assistant assigned to each. For the most part an army officer, or a volunteer officer "retained in service" by special act of Congress, occupied this position. In addition to these officials there was in each State, besides the ordinary staff of an officer commanding a district, a *superintendent of education.*

Where Located.—Perhaps the briefest possible method of giving any sort of view of the organization and magnitude of the work of the Freedmen's Bureau is to take up in succession each branch of the commissioner's *home office* and explain its operations. This office was first located in Washington in a large dwelling-house at the corner of I and 19th streets, Washington, D. C. After a time a building nearly opposite was added for the assistant commissioner of the district and contiguous territory. Subsequently, after the erection of the Howard University, the bureau was moved into the main building of that institution, renting such portions of it as could be spared from the use of students.

Adjutant's Division.—The organization grew up rapidly from the different kinds of work presented in the operations immediately rendered necessary. First, an immense bundle of reports and communications was put into the hands of the commissioner by Mr. Stanton, then secretary of war. It was plain that the necessary correspondence would increase. Naturally assimilating all matters to the rules of the war department, an *adjutant's division* was instituted, with all the necessary clerks, books, and papers. To this division was assigned first Lt.-Col. Saml. L. Taggart, then Col. J. S. Fullerton. He was succeeded by Gen. Max Woodhull; the latter by Cols. Samuel Thomas and A. P. Ketchum, followed by Gen. E. Whittlesey.

Quartermaster's Division.—Official and private letters began to multiply from all quarters. Disorganization of society was having its necessary fruits in destitution, crowding of people into the cities, and sickness. To meet the destitution in food and clothing that the army had been temporarily supplying to some 140,000 dependants, the *quartermaster's division* was established, the officer in charge doing really the ordinary duty of both commissary and quartermaster. Lt.-Col. Geo. W. Balloch of the commissary department first conducted this branch, but after his services were needed elsewhere, Gen. H. M. Whittlesey was detailed. The latter, after some four years' service, was succeeded by Maj. J. M. Brown. This branch took the charge of all clothing received and sent, of all school-buildings to be rented, constructed, or finally disposed of, and generally of the issuance of supplies of all kinds to the destitute.

Special Commissary Division.—When a severe famine took place, ranging along the Southern coast in Mar., 1867, and a special appropriation was made by Congress for all classes of starving people, a separate division was made under Gen. E. Whittlesey. It met the temporary necessity, and was then closed.

Medical Branch.—The sickness was so extensive, and the number of orphan children and aged infirm people so great, that a medical branch was early organized, and these several classes put under its supervision. Dr. Caleb W. Horner started the division, and was followed successively by Dr. L. A. Edwards, U. S. A., and Dr. Robert Reyburn.

Land and Claim Division.—Maj. Wm. Fowler (succeeded by Gen. A. P. Howe and Mr. Wm. P. Drew) took charge of the "abandoned land" division. The abandoned property that came under the supervision of the bureau was upwards of 800,000 acres of lands, besides 3373 town-lots. The work in this division conformed to the changing policy of the government in the South, where the property was situated. A portion served the purpose of revenue for a time. A careful record was taken, plans were entered upon for the settlement of freedmen, and afterward modified or abandoned. Finally, all or nearly all was restored to the former owners. Gen. Howard's report of Dec., 1865, recommends as conditions of pardon extended to certain of these—"1st, That the land-owner agree to set apart and grant title, in fee-simple, to each head of family of his former slaves a homestead varying in extent from five to ten acres, to be secured against alienation during the lifetime of the grantee. 2d, That others be like conditioned according to their circumstances, to be determined by a committee appointed by the President." This method was not adopted by President Johnson, who had already become reconciled and friendly to those he was ostensibly pardoning. The commissioner, speaking of this plan of restoration, says: "The uncertainty of the tenure of the bureau over property, which is the result of the policy of restoration adopted, has rendered the division and assignment of land to refugees and freedmen impracticable." The bureau aided quite extensively in attempting the settlement of freedmen on the public lands under the Homestead law, but was never very successful in isolating independent

families of refugees or freedmen, as occurs with many of our Northern emigrants. For a time the freed people were quite gregarious, choosing villages and cities, where there were churches and soon schools springing up, or seeking temporary labor on plantations for wages.

Transportation.—Speaking of the subject of transportation, which belonged to the quartermaster's division, the report to Congress in 1866 says: "At the beginning of this year assistant commissioners and planters asked that the freedmen be transported back to their old homes, where they could be employed at good wages. As this change would in a great measure relieve the government of their support, it was thought best to grant transportation to those either dependent or likely to become so immediately, and by this means place them in the way of permanently caring for themselves. During this year (1866) 387 refugees and 6352 freedmen (men, women, and children) were transported to places where there was employment for them and assured support. In 1867 this relief was much increased, the number of refugees sent being 778, and freed people 16,931.

Claim Division.—To the land division was assigned, after a time, what was called, after the lands had been all restored, "the claim division." This was organized to take up the work undertaken and left by the Sanitary Commission, of aiding soldiers in the collection of bounties, prize-money, and other dues, without charge to them. This division applied in the bureau to the *colored* (soldiers, sailors, and marines) alone. The number of such claims in process of settlement in Dec., 1867, was over 4000, in 1868 upwards of 17,000. The commissioner's report for 1869 uses these significant words: "It is not possible by any machinery to furnish absolute security to both claimants and the government against fraud. The inventions of cupidity are almost infinite, and when no other scheme is successful the last resort of baffled dishonesty is to turn upon the bureau agents with false charges in the public prints for the purpose of getting them disgraced and removed."

School Division.—The school division was organized very soon after the bureau went into operation, under the charge of Mr. J. W. Alvord. Mr. Alvord had his representative school superintendent in each State or district, who aided the assistant commissioner of the State or district in all educational efforts, and made frequent and full reports to Washington. The first circular touching upon this subject is dated May 19, 1865, and certifies to all interested that the educational and moral condition of these people (freedmen and refugees) will not be forgotten. The commissioner adds at the close of his instructions, "that in all this work it is not my purpose to supersede the benevolent agencies already engaged in it, but to systematize and facilitate them." His theory of this proper and permanent relief to the multitudes suddenly come to the responsibility of caring for themselves and families was in the channel of public instruction, especially in the schools. The results—viz. the rapid decrease of the dependants, and the intelligent apprehension of the new rights and privileges conferred upon the freed people—were everywhere proportioned to the light and knowledge that came through the schools established.

The Teachers.—An extract from the bureau report for 1869, p. 12, gives a slight insight into the difficulties met and the changes accomplished: "Too much praise cannot be bestowed upon the noble band of Christian teachers who have carried on successfully this work of education. Many of them have come from the very best circles of refined and cultivated society, and have been exposed to privations, hardships, and perils which would have discouraged any who were not moved by the spirit of the Divine Teacher. To them belongs the credit, in great measure, for all that has been accomplished. *They* have done the hard work; *they* have been the rank and file in the long fight with prejudice and ignorance. When they first entered the field as teachers, so general and bitter was the opposition to the education of the blacks that scarcely one white family dared to welcome them with hospitality. When they were insulted and assailed very few had the courage to defend them, but their good conduct finally overcame prejudice, and better sentiments have gradually grown up in many parts of the South. Hostility to teachers and schools has in a great measure ceased."

Benevolent Societies.—The bureau co-operated with the benevolent societies and church commissions throughout the country, and extended its school-work till it ceased by law—leaving, besides the nuclei for common schools, six universities quite firmly established, and upwards of twenty institutions that rank as colleges and normal schools. In the argument of Edgar Ketchum, Esq., before the House committee on education and labor he says: "In the first year there were 96,778 pupils reported, and there were 975 schools. The schools are now (in 1870) 2118, and the pupils 250,000." Thus, the bureau afforded a beginning, a nucleus, for the present extensive system of education in all the Southern States.

Bounty Division.—The "bounty division" was added by act of Congress Mar. 29, 1867. Mr. Ketchum says of this: "The soldiers were everywhere defrauded by agents. Since Apr. 17, 1867, the total amount of the bounties paid to soldiers through the agency of the bureau has been $5,831,417.89. . . . A part of the system is a full, complete, and minute record of each case, so that its history can be easily traced." The amount of this bounty fund expended finally reached upwards of $8,000,000 before it passed into the hands of the army officers now disbursing it.

Financial Division.—The general partition of the office which embraced the payment of bounties as an item was called the "financial division." Geo. W. Balloch, detailed from the commissary department of the army with the rank of lieutenant-colonel (afterwards brevet brigadier-general by promotion), was assigned to this important division in June, 1865. The receipts and expenditures in this division during its entire existence amounted to a little more than $13,000,000 for bureau purposes proper, and upwards of $8,000,000 for payment of bounty and prize-money to colored soldiers and sailors, making the grand total upwards of $21,000,000. Gen. Balloch was discharged in 1871. For a time Gen. Howard made the disbursements himself, and then was succeeded by Maj. J. M. Brown, who continued the work till it closed. Upon the question of carefulness and honesty on the part of officers of this bureau many public and bitter accusations were made and many examinations took place. A special court of inquiry was finally ordered by Congress, which reported, exonerating the officers of the bureau from all charges, and highly commending the commissioner.

General Work.—The commissioner kept many things that had to be done by the bureau under the immediate control of his inspectors and aides. The chief clerks contemplated by the first bureau law were—first, F. W. Owen, succeeded by J. A. Bemis, then in succession J. B. Littlewood, H. D. Beam, and J. H. Cook. These often had, in addition to the charge of records, inspection duty to perform during their respective terms of service. The inspectors proper were Gen. W. E. Strong, Gen. F. D. Sewall, and J. M. Langston, Esq. These, with the aides, Lt.-Cols. H. M. Stinson, Fred. W. Gilbreth, Capts. Joseph A. Sladen and M. C. Wilkinson, and Lieut. J. H. McBlair, went frequently from place to place, inspecting books and accounts and reporting upon the condition of the people and the conduct of officers and agents. Matters especially looked into through this channel of activity were, in addition to those already mentioned, "labor questions" (written contracts and joint companies were the stepping-stones to the independency of the late slaves). Of course the free system gave rise to many complaints and much friction; an inspector started at once for the scene of a serious trouble or riot, settled the matter, if possible, and reported. Out of the "labor questions" naturally came the questions for courts—next "bureau courts and magistrates." These were kept up till the testimony of black men was received in the State and local courts. It was first accepted in Alabama by the strenuous efforts of Gen. Wager Swayne, and then quickly extended to other States.

The Freedmen's Banks for a considerable time enjoyed the bureau countenance and aid. "The attempted system of apprenticing blacks and other substitutes for slavery were looked into by the inspectors, and hindered. For a while, too, the subject of the marriage relation gave rise to much perplexity. There were so very many who had been married several times, or there had been so little recognition of marriage at all before freedom, that the difficulties were great. Agents saw to it that the marriage ceremony was performed and a careful record kept. In fact, scarcely any subject that has to be legislated upon in civil society failed at one time or other to demand the action of this singular bureau. In time bureau courts gave place to others—bureau contracts and bureau marriages to local and clerical. The pauper class was gradually transferred; the asylums and hospitals one after another assumed by societies or towns; questions of land-titles closed; in brief, all operations were purposely reduced and transmuted into the common system of government in this country. The last things of importance given up were the schools, one asylum at Washington, and the payment of bounty.

The bureau has been called a political machine. This is somewhat true: it fitted, or helped vastly to do so, the half citizen looking to full rights and responsibilities. Mr. J. M. Langston, identified by birth with the black man, spoke earnestly and constantly as the commissioner sent him out, urging schools and churches, promoting education, morality, economy, endurance, and independence; and though

there may not have been any direct instruction to him and to the other inspectors and aides to make *political* converts to the party of freedom and progress, yet doubtless the positive effect was just this; so that to the bureau, its schools, teachers, agents, and inspectors was due in some measure the strong bias of the colored voters in favor of the Republican party. The bureau was abnormal—a machine to relieve the shock when passing over the rough transition roadway. Its work, in its mistakes and in its successes, is now a subject of history. O. O. HOWARD.

Free′dom, tp. of Polk co., Ark. Pop. 257.

Freedom, tp. of Carroll co., Ill. Pop. 811.

Freedom, post-tp. of La Salle co., Ill. Pop. 1262.

Freedom, tp. of Palo Alto co., Ia. Pop. 161.

Freedom, post-tp. of Bourbon co., Kan. Pop. 815.

Freedom, post-tp. of Waldo co., Me. Pop. 716.

Freedom, post-tp. of Carroll co., Md. Pop. 3008.

Freedom, tp. of Washtenaw co., Mich. Pop. 1261.

Freedom, tp. of Waseca co., Minn. Pop. 832.

Freedom, post-tp. of La Fayette co., Mo. Pop. 2559.

Freedom, tp. and post-v. of Carroll co., N. H., 70 miles N. E. of Concord. It has a savings bank, and manufactures of leather, lumber, and bricks. Pop. of tp. 737.

Freedom, tp. of Cattaraugus co., N. Y., has quarries of good building-stone. Pop. 1371.

Freedom, tp. of Henry co., O. Pop. 812.

Freedom, post-tp. of Portage co., O., on the Atlantic and Great Western R. R. Pop. 781.

Freedom, tp. of Wood co., O. Pop. 1089.

Freedom, tp. of Adams co., Pa. Pop. 449.

Freedom, post-v. of Beaver co., Pa., on the Ohio River and the Pittsburg Fort Wayne and Chicago R. R., 3 miles E. of Beaver.

Freedom, tp. of Blair co., Pa. Pop. 1020.

Freedom, post-tp. of Outagamie co., Wis. Pop. 1330.

Freedom, tp. of Sauk co., Wis. Pop. 778.

Free′hold, an estate of inheritance or for life in real property. It was in ancient times termed a frank-tenement (a word having the same meaning as "freehold"), and denoted an estate held by a freeman independently of the mere will of the feudal lord. It includes those estates to which the mode of conveyance by feoffment with livery of seizin was, in the early common law, exclusively appropriate, and this characteristic was once used as a means of defining its extent of application; but since the abolition of feoffment such a mode of description is no longer possible. (See FEOFFMENT.) But though the ceremony of livery of seizin no longer exists, the term "seizin" has still been retained as applicable to freehold interests alone, while all inferior estates are said to exist only in "possession." An estate of freehold may be either corporeal, as in land, or incorporeal, as in rents or franchises. Freeholds of inheritance are fees simple (see FEE) and fees tail. (See ENTAIL.) Freeholds not of inheritance are life estates, which are either *conventional* or *legal*. Those which are conventional may be either (1) for one's own life, (2) for the life of another, or (3) for some indefinite period, which may possibly last during the period of one's life. Legal life estates are (1) curtesy, (2) dower, and (3) jointure. (See ESTATE FOR LIFE, DOWER, JOINTURE.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Freehold, a post-v. and tp., cap. of Monmouth co., N. J., is 24 miles E. of Trenton and 16 miles W. of Long Branch, and is the E. terminus of the Freehold and Jamesburg R. R., which here joins the line of railroad to Long Branch and Squam Village on the sea-shore. It has 6 churches, 2 large boarding-schools, 3 public schools, 2 weekly newspapers, 2 national banks, 1 iron-foundry, 1 machine-shop and planing-mill, 4 hotels, a number of large stores, the usual number of mechanics' shops, and is lighted with gas. In 1778 it was the head-quarters of the British army during the battle of Monmouth, which was fought in the immediate vicinity. It is in the centre of a rich agricultural district. Pop. of tp. 4231.

JAMES S. YARD, ED. "MONMOUTH JOURNAL."

Freehold, post-tp. of Warren co., Pa., on the Atlantic and Great Western R. R. Pop. 1316.

Free′man, a man who is not a slave, or, in a narrower sense, a citizen or burgess who has certain specified rights. In ancient Rome freemen (*liberi*) were of two classes—*ingenui*, or free-born, and *liberti* or *libertini*, freedmen who had been slaves. The two classes had a distinct legal status, but the sons of freedmen were *ingenui*, though without tribal privileges.

Freeman, post-tp. of Franklin co., Me. Pop. 608.

Freeman, tp. of Freeborn co., Minn. Pop. 694.

Freeman, post-tp. of Crawford co., Wis. Pop. 1279.

Freeman (EDWARD AUGUSTUS), D. C. L., b. at Harborne, Staffordshire, England, 1823; was chosen a scholar of Trinity College, Oxford, 1841; a fellow in 1845; examiner in law and modern history at Oxford 1857–58, 1863–64; author of *Church Restoration*, 1846; a *History of Architecture*, 1849; *Architectural Antiquities of Gower*, 1850; *Window-Tracery in England*, 1850; *Llandaff Cathedral*, 1860; *Poems* (with G. W. Cox), 1850; *History of the Saracens*, 1856; *History of Federal Government*, 1863 (incomplete); *History of the Norman Conquest*, 4 vols., 1867–72 (unfinished); *Old English History*, 1869; *History of Wells Cathedral*, 1869; *Historical Essays*, 1871–73; *Growth of the English Constitution*, 1873; *Comparative Politics*, 1873, etc.

Freeman (JAMES), D. D., a Unitarian clergyman, the first in the U. S. to call himself so. By his means the "King's chapel" in Boston, the oldest Episcopal church in New England, became the first Unitarian church in New England, and consequently in America. He was b. in Charlestown, Mass., Apr. 22, 1759; was graduated from Harvard College in 1777; was chosen reader of King's chapel in 1782; became Unitarian; carried his people with him; induced them to alter the Prayer-Book in accordance with the new theology; and in 1787 was ordained pastor of the church by the wardens and people. The connection remained unbroken till his death, Nov. 14, 1835. Dr. Freeman was an accomplished scholar, a pure writer, a social, philanthropic man. He was one of the founders of the Massachusetts Historical Society. To the last Dr. Freeman continued a member of the Boston Ministerial Association, though differing so much in opinion from the rest that there was no professional exchange of pulpits. O. B. FROTHINGHAM.

Freeman (JAMES EDWARD), a painter of historical and *genre* subjects and of portraits, was b. in Nova Scotia. While he was still very young his parents removed to Otsego, Otsego co., N. Y. His early life was one of hardship, and it was with difficulty that, impelled by his desire to become an artist, he made his way to New York and entered the National Academy of Design as a student; made an associate in 1831, and an academician in 1833; married in 1834 a lady of Italian and English parentage, by name Latilla (see LATILLA), with some talent as an artist. Since 1840 Freeman has lived in Rome. CLARENCE COOK.

Free′man's, tp. of Franklin co., N. C. Pop. 1318.

Free′mansburg, post-b. of Bethlehem tp., Northampton co., Pa., on the Lehigh and Susquehanna R. R. Pop. 643.

Free′masonry is undoubtedly an ancient and respectable institution, embracing among its members men of every rank and condition of life, of every nation and clime, and of every religion which acknowledges a Supreme Being and has faith in the immortality of the soul; it stands preeminent among the institutions established for the improvement of mankind—as far above other secret associations in usefulness as it is beyond them in age. But its origin may be said to have been lost in remote antiquity. Neither tradition nor history can point with certainty to the precise time, place, or manner of its commencement. The popular faith of many of its disciples ascribes its foundation to circumstances connected with the erection of the first Jewish temple by King Solomon; others trace it to the Eleusinian mysteries, in which we find that the doctrine of immortality, as well as other great truths of natural religion, was taught; others, again, find its origin among the warrior-monks of the Crusades; and yet again there are scholars who have endeavored to raise the veil from the Druidical mysteries, with the view of showing an origin for Masonry among their wise men. It is difficult, if not impossible, amid all these views, to arrive at what may be regarded as correct history. That the name, *Free and Accepted Mason*, and the present ceremonials and government of the craft, are of modern origin, not having existed farther back than the beginning of the eighteenth century, is certainly true. But at the same time the idea of the association was in existence then, and had been from remote time. Societies of masons were then also extant. The author of these lines is a member of a Scottish lodge whose written records extend back to 1599, and, if tradition can be relied on, English master-builders met at York A. D. 926, during the reign of Athelstane. We shall endeavor to show that the society may lay claim to a very early origin, and to have existed from remotest ages to the present time under different forms and different appellations. We claim for the commencement of secret moral associations an origin as ancient as that of the Pyramids of Egypt, and find in the mysteries carried on by the priests

of Osiris and Isis the same method of instruction and of initiation and similar legendary history which the imaginations of 4000 years have altered to suit new views and the political and other necessities of their time.

Every human institution is subject to great and numerous variations; the different aspects under which they appear, and the principles by which they are governed, depend on the advance of civilization, the nature of the protecting government, and the peculiar habits and opinions of the members themselves. Before letters were advanced, and when the art of printing was unknown, the discoveries in the arts and sciences must, of necessity, have been known to but few individuals. The pursuit of science was a secondary matter, and questions of philosophy were solely the prerogative of priestcraft. Agriculture was the grand pursuit of life. But architecture soon, in the natural order of things, arose as a science, and human skill was called into play. The triumph of mind over matter was the great feat of the first architects, who were also the first natural philosophers. There is no speculation in the statement that these formed themselves into an association for mutual improvement at an early date; their architectural monuments, preceding the authentic records of history, are with us to this day; and traditions inform us that this union of scientific men differed from the Freemasons of to-day in little more than in name. The arts and sciences were cultivated in Egypt and the adjacent countries in Asia while all the other nations were involved in ignorance. Of these sciences, astronomy, geometry, and architecture took the first rank. Here alone should we look for the origin of the Masonic society. Doubtless, at first it was a mutual-improvement association simply, and those only would be admitted whose occupation was subsidiary to the great art. But the priesthood, ambitious of erecting great temples to their deities, and anxious to acquire all knowledge which could give them a further hold on a superstitious people, sought to participate in the learning of the architects. They were admitted, and added science to their already mystic lore. Once admitted to the fraternity, they connected the mythology of their country and their metaphysical speculations concerning the nature of God with the exclusively scientific teachings of the builders, thereby producing that combination of science and theology which forms such a conspicuous part of the principles of Freemasonry. Hence, we derive what may be regarded as a simple sun-worship, overlaid with mystic speculation and scientific inquiry. The fraternity and priestcraft soon became one, imparted their knowledge in symbolic and hieroglyphic instruction,accompanied by particular rites and ceremonies. We know nothing of the nature of these mysteries, but as the Eleusinian and other mysteries took their rise in Egypt, we may judge of the source of the fountain by the nature of the stream.

Egypt was now the centre of civilization, and her immense population necessitated emigration. The first colony of the Egyptians was that conducted by Inachus about 1950 B. C.; Cecrops arrived in Attica in 1657 B. C.; Cadmus came from Phœnicia to Bœotia in 1594 B. C.; and Danaus to Argolis in 1586 B. C. The savage inhabitants of Greece regarded with awe the magic feats of the immigrants, and as they gradually obtained an insight into the arts and sciences came to regard them as gods. In the reign of Erichthonius, 1500 years before our era, the mysteries of Eleusis were established in Greece in honor of Ceres, who, in search of her daughter, had visited Triptolemus at Eleusis, and taught him the arts of agriculture and the doctrine of the immortality of the soul. Soon after, the Panathenæa were established in honor of Minerva, and the Dionysia in honor of Bacchus, who had instructed the Greeks in many useful arts, especially in the culture of the vine. These mysteries were all closely connected with the development of the arts and sciences; and if our theory concerning the origin of knowledge in Egypt be correct, it follows that the Eleusinia and Dionysia were scientific bodies whose art was tinctured with the fables of Egyptian mythology. It is not alone from conjecture that we argue. We have information from Meursius and other writers concerning the Eleusinian mysteries, which shows that they bore a striking resemblance to modern Masonry. (See article "Eleusinia" in the *Encyclopædia Britannica;* also ROBERTSON's *Greece*, bk. i. p. 127.) That Socrates, Diogenes, Agesilaus, and Epaminondas never partook of those mysteries, and even condemned them for admitting men of low worth, is no valid objection to the nature and morals of the society. Many hold these objections to modern societies, even to the Church, forgetting that the saint and sinner often kneel at the same altar. The mysteries of Ceres were introduced into Athens about 1356 B. C., and with slight variations were observed in Phrygia, Cyprus, Crete, and Sicily. They even reached the capital of France, the name of which West derives from *Par-Isis*, because built beside a temple of the goddess Isis; and it is highly probable they were carried into Britain and other northern regions. In the reign of the emperor Hadrian they were introduced into Rome (117 A.D.), and were conducted there in a similar manner to those in the village of Eleusis. In the beginning of the fifth century Theodosius the Great prohibited the pagan theology in his empire, and thus the Eleusinians came under the ban of justice.

The Dionysia, or mysteries of Bacchus, were closely connected with those of Ceres, and perhaps more so with those of the Masons. The connection between the Eleusinians and Dionysians appears from the accepted belief that Ceres was the mother of Bacchus; and Plutarch assures us that the Egyptian Isis was the same as Ceres, that Osiris was the same as Bacchus, and that the Dionysia of Greece was but another name for the Pamylia of Egypt. As Bacchus was the reputed inventor of theatres and dramatic representations, that particular class of persons who possessed the exclusive right of erecting temples, theatres, and other public buildings in Asia Minor were styled the *Dionysian artificers.* They were initiated into the mysteries of their founder, and consequently into those of Eleusis. But in the degenerate days of Greece they also degenerated, and brought disgrace upon an association founded for the promotion of virtue and the improvement of art. About 1000 B. C. the people of Attica resident in Asia invented the Doric and Ionian orders of architecture, and returned them to the mother-country, making the name of the Dionysian artificers the synonym of talent and scientific skill. We find them established in a kind of college at Teos, and making themselves known to each other in travelling by words and signs. They were also divided into bodies or lodges, governed by a master and an assistant, and holding a solemn entertainment once a year, at which they sacrificed to the gods and contributed to the wants of widows and distressed. Their monuments in the Turkish cemetery of Erakli continue to this day. (*Chandler's Travels.*) Attalus, king of Pergamos, was a member of the order. The opinion, therefore, that the Freemasons flourished at the building of King Solomon's temple may not be so absurd as is often supposed. We have seen that the mysteries of Ceres and Bacchus existed 400 years before King Solomon, and there are strong reasons for believing that the Dionysian architects existed prior to the founding of the first temple. Since Josephus informs us (bk. viii. ch. v.) that the Grecian orders were employed at the building of the temple, we are authorized not only to infer that the Dionysian artificers existed prior to the reign of Solomon, but also that they aided him in erecting his magnificent edifice to the God of Israel. Nor is this all. The Holy Scriptures inform us that Hiram, king of Tyre, assisted King Solomon in his work with materials and operatives, and that he sent to superintend the latter a cunning artificer in brass and iron—Hiram, the son of a widow of Tyre. The commerce with Tyre, the vicinity of Jerusalem to Egypt, the connection of King Solomon with the royal family of that country, the progress of the Egyptians in architecture, and their attachment to symbolic teaching, may all go to relieve the Freemasons from the charge of credulity. It has been objected that the establishment of such an organization of builders in Judæa by King Solomon would have been heard of in future times, and have attracted the notice of sacred and profane writers, and that this is not the case. On the contrary, we find the body of Essenes, whose origin, doctrines, and principles have caused so much discussion among theological writers. In them we find strong distinctive points showing a similarity with modern Masonry. It is true that we do not find the Essenes particularly devoted to architecture, but we find them general students of the arts and sciences. Pliny refers them to an origin so remote that they must have been contemporary with King Solomon, and Basnage, who regards them as more recent, still assigns them a date under Antigonus (300 B. C.). Scaliger holds that they descended from the Chasidim so honorably mentioned in the history of the Maccabees. These Chasidim were of the choice sons of Israel, illustrious for charity and piety, and were sworn to keep the temple from injury and decay and to adorn its porches. The Essenes adopted many of the Egyptian mysteries, and received all ranks into their body. They spread beyond Judea, and existed in all parts of the world, uniting the studies of ethics and natural philosophy. They endured much persecution from the Romans, and were abolished about the middle of the fifth century A. D. It has been supposed by some philosophers that Pythagoras derived his mysteries, instituted at Crotona, chiefly from the Essenes, who were highly respected, during his travels in Egypt and Syria. The Pythagoreans were undoubtedly connected with the Essenes, and the Essenes with the Chasidim.

The chief difference between the ancient and modern mysteries lies in the points which concern religion. This arises from the introduction of Christianity and the great changes which have been effected in religious knowledge.

Although Freemasonry claims to be of all religions, yet there is no doubt that since its modern establishment as a society in England it has received a stamp of Christianity which marks that origin. Many of the prayers and other portions of the ritual in America, the constant use of the Lord's Prayer and versicles in England, the exclusion of Jews in Prussia, prove this to be the case. During the Dark Ages the political and intellectual condition of society was opposed to the progress of Freemasonry; indeed, after the suppression of heathen rites in the fifth century but few of the devotees kept up secret organizations. But we have the authority of Gibbon and others that they were never completely abolished; which fact leads us to connect the heathen mysteries with that trading association of builders which appeared under the special sanction of the Church of Rome. There was an insatiable taste for finery and display in church architecture, and to encourage the building profession the pope and other potentates of Europe conferred upon their "guilds" the most important privileges, and even allowed them to be governed by their own laws, customs, and ceremonials. These guilds were composed of men of many nations—Italians, Greeks, French, German, Flemish, etc.; they were called *Free* Masons, and travelled from land to land, erecting those gorgeous cathedrals and abbeys which gratified the pride of the priests. They had a thorough organization.

It seems to us, in the latter half of the nineteenth century, strange and inconsistent that the Romish Church, ever afraid of secret organizations, should have sanctioned, and even protected, this institution. But it is to be borne in mind that the pontiffs and bishops, instead of approving Freemasonry by their patronage, only employed it as an instrument for the gratification of their pride and ambition, and that in after ages the Roman popes deprived the fraternity of the very privileges which had been bestowed on them unasked for, and persecuted with relentless hate the very men whom they had voluntarily taken into favor. Still, at this period, wherever the Romish religion was found, the Freemasons flourished. They penetrated even into Scotland, where the abbeys of Melrose and Jedburgh, the chapel of Holyrood, and the cathedral of Glasgow still attest their skill. In this little land the principles of the society long remained, ages after they had been extinguished in continental kingdoms. And in this manner it was from Scotland that these principles again issued to spread over not only the Continent, but all portions of the civilized world. Why the Freemasons existed longer in Scotland and England than in other countries is not exactly known, but we must impute it to favorable circumstances of political government, or to a superior policy pursued by the craft in avoiding the machinations of their enemies. Hence we can explain the large number—nearly 100—of Masonic degrees of European nations which had the name of Scottish. Scotland seems the very Fairyland of continental Masonry.

Freemasonry was early introduced into England, but whether from the Scotch Masons at Kilwinning, from the relics of the Knights Templar, or from other brethren on the Continent, there is no means of ascertaining. The English brotherhood claim that Saint Alban the Martyr was the first who brought the society to England about the end of the third century; that the brethren received a charter from King Athelstane, whose brother Edwin summoned all the lodges in England together at York to form the first grand lodge of England. (PRESTON'S *Illustrations of Masonry.*) But these are merely assertions, not capable of demonstration. It is, however, certain that Freemason lodges were held at York and Kilwinning, and that these lodges exercised a controlling influence over the bodies of architects in other parts of the country. But their power was gone; architects were becoming common; the sciences were studied by others; the Church of Rome regarded the association more as an enemy than as a friend, and having no longer any use for it cast it off, and thus its prestige was gone. The year 1350 is that assigned for the revision of the York Constitutions under Edward III. We know little of the craft for some time till again it makes its appearance June 24, 1502, and lays the foundation of Henry VII.'s chapel in Westminster Abbey. Thirty years after it must have reasserted its position, as the intelligence spread by it had awakened the fears of the ultramontane clergy; it was accused of bringing schisms into the Church and sedition among the people, of aiding the Reform of Luther, and of desiring to avenge the death of Jacques de Molay. This induced them to have a general convocation, at which they drew up a formal declaration of principles, since known as the "Charter of Cologne." In 1561, Queen Elizabeth became jealous of the society, and sent an armed detachment to break up the annual meeting at York. The officers sent in command made so favorable a report of the institution that the queen revoked her order, and ultimately became protectress of the fraternity. In the reign of James I. the society flourished, and the celebrated Inigo Jones became its grand-master in 1607, and inspired great spirit into the lodges. It was shortly after this that men, not architects nor masons, but eminent for learning, knowledge, or position, were admitted as honorary members of the body under the designation of *accepted* brethren; hence the origin of the present style of the society, *Free and Accepted Masons.* Elias Ashmole, the great antiquary, was so accepted, and took upon himself the task of recomposing the rituals of the order. His rituals were accepted in London, and shortly after all through England, and with slight changes are those now in use in England and America. After the beheading of Charles I., Masonry took a political bias, thus deserting its principles, and was employed by the partisans of the Stuarts. Charles II. was so pleased with the zeal displayed in his behalf that on his restoration to the throne he termed it the *royal art,* owing to his belief that it had mainly contributed to his restoration.

In 1700 the Masonic corporations, except in England, were dissolved, and even in that country were no longer busy with operative masonry. Notwithstanding the zeal of Sir Christopher Wren, the number of Masons continually diminished, the annual feasts were neglected, and the four lodges remaining in London were almost deserted. Differences of opinion as to what persons should be "accepted" kept the craft at variance. Wren died in 1716. In 1717 the four English lodges met to found a grand lodge and elect a new grand-master. George Payne was elected grand-master, and the three symbolic degrees were alone recognized. This is the date very commonly assigned by anti-Masons as that of the commencement of the society. The grand-master collected all the papers, MSS., rituals, etc., intending to frame a code for the fraternity, but unfortunately in 1720 many of them were committed to the flames by over-scrupulous members of the body itself. The succeeding year the order recommenced its sway on the Continent. Under the authority of England a lodge was established at Dunkirk, and another at Mons. Mr. Payne soon secured all the remains of the collected documents, from which he drew up a historical sketch of the order, afterwards referred to Mr. Anderson, who revised, and in 1722 was authorized to publish it. Hence come the "Anderson Constitutions" of 1722–25, by which the craft is at present governed. In 1725 we find Masonic lodges established in France, and two years later a grand lodge was established in Ireland. In 1732 the "grand lodge of York," or that of the so-called "Ancient Masons," recognized the necessity of union, and incorporated itself with the grand lodge of England. In 1733 the first provincial grand lodge was established at Boston, U. S. In 1735 we find the first modern systematic prosecution of the order commenced by the States General in Holland, who interdicted the meetings of the craft.

During all this period the Scottish Masons had been carrying on their labors with the peculiar system of an hereditary grand-master, created by James I. (Scotland) for the Rosslyn family in 1430. The prosperous state of the English lodges excited their Scottish brethren, and at a meeting held in 1736 the baron Sinclair resigned his hereditary position. This led to the formation of the present grand lodge, of which the baron was the first *elected* grand-master. Since that date several scions of the Rosslyn family have filled the chair by election, among them Earl Rosslyn, the present commissioner of the Kirk of Scotland. In 1738, Pope Clement XII. issued the first bull of excommunication against the Freemasons, immediately followed by an order of Charles VI. prohibiting the meetings in Austria. In 1738, Frederic II., king of Prussia, was initiated. His association with the Scottish rite of Thirty-three Degrees (*Ancien-Rite-Accepté*) is now a part of Masonic history everywhere. The lodge of Three Globes at Berlin, founded by Baron Bielefeld in 1740, was raised to the dignity of a grand lodge by Frederick the Great, who was elected grand-master and continued in office till 1747. In 1751, Freemasonry had found its way into all civilized countries. Its dogma of liberty, equality, and fraternity, however, alarmed the kings and clergy; Russia, France, Hamburg, Florence, and Geneva fulminated edicts against the order; Portugal, Naples, and Spain followed their example, and the terrors of the Inquisition were brought into use. The story of John Coustos has few parallels in the history of persecution. But, notwithstanding, the society flourished. The grand lodge Royal York was founded in Berlin in 1765. In 1772 the grand orient of France was chartered, and the order found its way into many of the American colonies. "High degrees" now appeared more frequently, and at the opening of the present century there were in existence at least ten "systems," which have since become extinct or have been greatly modified. In 1813 the two rival grand lodges of England were united. In the next year Pope

Pius VII. denounced the order; so did the emperor of Russia in 1822, the king of Portugal in 1824, and the king of Spain in 1828. From 1827 to about 1835 a terrible excitement, fostered for political ends, called the "Morgan Excitement," raged through the U. S., and for a time almost crushed Masonry. The order was charged with the murder of a man of that name—a charge probably false—and with being the enemy of a free republic. The good sense of the people prevailed, and the phœnix rose again. There are now in the U. S. no fewer than 44 grand lodges, which comprise over 600,000 active members. The fear is that Masonry is becoming too popular for its own good. Each grand lodge has exclusive jurisdiction *in its own territory* over what are called the first three, *Blue* or *Ancient* degrees. Nearly every State has a grand chapter, the ruling power of the degrees up to the seventh, or the Royal Arch. Next follow the grand councils of Royal and Select Masters, which exist in most of the States, and also govern these degrees. The "American Rite" is closed by the commanderies, which are the representatives of the ancient Knights Templar. Here, then, are three more degrees, making thirteen in all. Each grand lodge is independent, but most of the State grand chapters acknowledge one head, styled the General Grand Chapter of the U. S. So also the grand commanderies of States owe common allegiance to the Grand Encampment of the U. S., which holds triennial sessions, is regarded as the most distinguished branch of the society, composed as it is mainly of the present or past grand commanders of States, and representing over 70,000 men of high standing. There are also in the U. S. two bodies of the "Ancient and Accepted Scottish Rite"—one for the North and one for the South. They have control of a series of thirty-three degrees, an elaboration of other Masonic legends, and their history would occupy many volumes. (See PIKE's *Morals and Dogma of Freemasonry;* FOLGER's *History of the Ancient and Accepted Rite*, etc.)

There are at present seventy-nine ruling powers in Masonry in the world, whose Masonic population may be estimated at 3,000,000. In the jurisdictions where grand lodges exist there are generally also grand chapters and councils, grand commanderies and consistories; but on these there is no need to dilate. GEORGE S. BLACKIE.

Free Methodists, a small sect found chiefly in Western New York, Illinois, and Michigan. They reported in 1868, 85 preachers and 4839 members, and in 1873, 90 preachers and 6000 members.

Free′port, post-v., cap. of Stephenson co., Ill., 121 miles W. of Chicago, on the Illinois Central, Chicago and North-western, and the Western Union R. Rs. It has 2 national and 2 private banks, 4 weekly and 2 monthly newspapers, a good water-power, numerous manufactories, foundries, mills, a woollen-mill, etc., good school buildings, 14 churches, 2 insurance companies, and good hotels. A beet-sugar factory is in full operation, and is a success. It has a fine court-house and the Illinois Benevolent Society. Pop. 7889. THOMAS, BREED & HAWS, PUBS. "JOURNAL."

Freeport, post-v. and tp. of Cumberland co., Me., 17 miles N. E. of Portland, on Casco Bay and on the Portland and Kennebec R. R. It has 4 churches, some shipbuilding and other manufactures, besides commercial and fishing interests. Pop. 2457.

Freeport, post-v. of Hempstead tp., Queens co., N. Y., on the Southside R. R. of Long Island, 22 miles from New York; has a weekly newspaper.

Freeport, post-tp. of Harrison co., O. Pop. 1015.

Freeport (OREGON P. O.), a v. of Washington tp., Warren co., O. Pop. 37.

Freeport, post-b. of South Buffalo tp., Armstrong co., Pa., 28 miles N. of Pittsburg, on the N. bank of the Allegheny River and the West Pennsylvania and Allegheny Valley R. Rs. It has 2 banks for savings and deposit, 2 large grist-mills, large steam-tannery, 2 oil-refineries, 1 whisky distillery, 2 planing and saw mills, 1 sash and door factory, 1 chemical works, 2 woollen-mills, gas-works, 9 churches, 5 hotels, 1 weekly newspaper, the usual number of stores, etc. Pop. 1640.

SIMON SHOOP, PROP. "NEW ERA."

Free Soil, post-tp. of Mason co., Mich. Pop. 142.

Free-Soil Party, a former political party of the U. S., was composed of the Liberty party of 1846, the Barnburner Democrats of New York, and of a considerable number of Northern Whigs who favored the Wilmot proviso, a proposal to prohibit slavery in the territories acquired from Mexico. In 1848, at Buffalo, they nominated Martin Van Buren and Charles Francis Adams for President and Vice-President. The ticket did not receive any electoral votes, and only 291,000 popular votes. In 1852 at Pittsburg they nominated John P. Hale and George W. Julian, who received 157,000 popular votes. In 1856 the Free-Soil party was merged into the new Republican organization.

Free Spirit, Brethren of the. See BRETHREN OF THE FREE SPIRIT.

Free′stone, county of Central Texas, bounded on the E. by Trinity River. Area, 900 square miles. The soil is very productive. Cotton, corn, live-stock, and fruit are extensively raised. It is well watered and heavily timbered. Mineral springs are found at several points. Cap. Fairfield. Pop. 8139.

Free Style, in musical composition, that which admits of certain progressions, harmonies, and traits of ornamentation forbidden by the rules of "strict" counterpoint. (See FLORID STYLE.)

Free Thinker, a name given to the deistical writers of England in the seventeenth and eighteenth centuries. It was bestowed on John Toland, who in 1697 was called, in a letter to Locke, "a candid free thinker." In 1709, Lord Shaftesbury spoke of "our modern free writers." The title of Anthony Collins's work, written in 1713, *A Discourse of Free Thinking, occasioned by the Rise and Growth of a Sect called Free Thinkers*, proves that the name was then in use with a somewhat definite application. However originating, by whomsoever bestowed, it was accepted by the rationalists as descriptive of their position as men who thought freely—that is, outside of the usual lines on ecclesiastical and theological subjects. The reproach that became associated with the term in the common mind was due to the prejudice against the unbridled exercise of reason on the Christian Scriptures and Creed, whatever the special opinions professed might be. The chief names among the English free thinkers are Hobbes, Hume, Shaftesbury, Bolingbroke, Herbert of Cherbury, Tindal, Toland, Chubb, Woolston, and Collins. These names represent widely different phases of opinion, from simple deism to theism of a pure quality, and widely different intellectual attitudes, from philosophical skepticism to the blunt criticism of common sense. The free thinkers were not, strictly speaking, a sect; they entered into no league; they started no propaganda; they established no school; they put forth no creed—not even a creed of negation; they held nothing in common but a belief in the validity of reason in the sphere of faith. They were simply individual scholars, writers, talkers, who freely, with various measure of ability, uttered their doubts in regard to the system of "revealed religion." Their temper differed as widely as their genius or culture. Some were trained scholars, polished writers, wits, men of fashion, citizens of the world, men of letters, political and social philosophers; others were poor, uneducated, unrefined. Some were masters of *persiflage;* others employed none but the homeliest speech. Their deism was of every shade. For the most part, they held very positive religious ideas; they stood by the broad facts of human consciousness, maintained the existence and unity of a personal God, affirmed the perfect order of the universe, and prophesied the future welfare of all mankind. There was not an avowed atheist among them, not a professed materialist, unless it were Coward. They were unanimous in their desire—apparently an earnest one—to elevate religion to a spiritual sphere, and to emancipate it from dogmatism and formalism. Lord Herbert of Cherbury, who had perhaps more influence than any other in shaping the free-thinking mind of England, an elder brother of George Herbert the poet, believed the true religion to be universal, commended by its intrinsic evidence to the human mind, and attested by the intuitions of the soul. His five points of belief were—the existence of one supreme God; the duty of worship; piety and virtue as the means thereof; the efficacy of repentance; the existence of rewards and punishments here and hereafter. If any, like Bolingbroke, doubted the immortality of the soul, they were actuated in part by the thoroughness of their faith in an active law of retribution, which needed no after life for its vindication. Coward, who wrote in the spirit of a materialist, affirmed immortality as a divine gift to man, while denying that it was a natural inheritance.

Free thinking in England was colored by French infidelity, but always preserved a character of its own. The term "free thinker" is misapplied to the Frenchman of the eighteenth century, the contemporaries of Voltaire, the *esprits forts* who were the precursors of the French Revolution. These men, forced into antagonism to a despotic system in Church and State, bent all their efforts to overthrow it. Hence their vehemence of thought and speech; hence their acridity of temper; hence the audacity of their speculations, the severity of their denials, and the philosophical rigidity of their speculation. They were less free thinkers than aggressive thinkers. To them the name *doctrinaire* applies. They did aim at propagandism; they did attempt to form a school; they constituted an aristoc-

racy of intellect, a clique of philosophers. They had little sympathy with the common mind, and little faith in the intuitions of the common heart. For English common sense they substituted Parisian wit, and for English seriousness Gallic levity. The English free thinker pushed his inquiries into the wide field of religious speculation; the French *esprit fort* took up an ultimate position outside of all religious confessions, and defended it. Both the Englishman and the Frenchman were by their principles compelled to be champions of human rights. The former expressed the spirit of sturdy self-reliance that characterizes the British mind; the latter, in contending against oppression in Church and State, advocated principles that afterward bore fruit in the Revolution that laid Church and State prostrate. Still, the spirit of the Englishman was more democratic.

The term "free thinker" is even less applicable to men like Strauss, Paulus, Baur, and the German rationalists than to Diderot, D'Holbach, D'Alembert, and Voltaire. For these men, though professing in some respects the same opinions with the Englishmen, arrived at them by different methods, and held them in a different spirit. Closet-students, scholars, and philosophers by profession, they published the result of their labors in a calmly scientific temper, as if unaware of opposing powers. They did not plume themselves on their freedom; they were not apostles of liberty; they made no war on institutions. The Englishman is the only genuine free thinker. The Frenchman is a *philosopher*—the German is a *rationalist.* Both are in advance of the free thinker in clearness of thought and statement, nicety of discernment, and adequacy of learning. The free thinker belongs to the last generation. The scientific thinker, the true thinker, is taking his place. (For the history of free thinking see LECHNER, *Geschichte d. Deismus*, and ADAM STOREY FARRAR, *Critical History of Free Thought.*) O. B. FROTHINGHAM.

Free-Town, town of Western Africa, in lat. 8° 20′ N., lon. 13° 9′ W., is the capital of the English settlement of freed negroes in Sierra Leone, and stands in a low, hot, unhealthy, but extremely fertile and beautiful plain near the mouth of the Bunck, and surrounded by an amphitheatre of lofty, forest-clad mountains. It is well built, though most of its houses are of wood, and contains 24 churches, belonging to 19 different Christian denominations; many schools, and two lighthouses. It is one of the most prosperous towns of Western Africa. Pop. 18,035.

Free′town, a post-tp. of Bristol co., Mass., on a branch of the Old Colony R. R. and on the New Bedford and Taunton R. R. It is 45 miles by rail S. of Boston. Its inhabitants are engaged in market-gardening, cranberry-culture, and lumbering. Charcoal, nails, etc. are manufactured. There are 6 churches, 3 bleacheries, and a mineral spring. Pop. 1372.

Freetown, tp. of Cortland co., N. Y., has a cheese-factory. Pop. 906.

Free Trade, in a literal sense, means trade or commercial intercourse free from artificial interference or restriction. As generally used, however, the term has a wider and more complex meaning, and may be regarded as the expression of a principle of political economy, which holds that the prosperity of a state or nation can best be promoted by freeing the exchange of all commodities and services between its own people, and between its own people and the people of other nations and countries, to the greatest extent possible, from all interferences and obstructions; but more especially from interferences and obstructions of an arbitrary, artificial character, resulting from legislation or prejudice. Free trade, as an economic principle or politico-commercial system, moreover, is the direct opposite to the so-called principle or system of *protection*, which maintains, on the contrary, that a state or nation can most surely and rapidly attain a high degree of material prosperity by "protecting" or shielding its domestic industries from the competitive sale or exchange of the products of all similar foreign industries; the same to be effected either by direct legislative prohibition of foreign commerce, or by the imposition of such discriminating taxes on imports as shall, through a consequent enhancement of prices, interfere to a greater or less extent with their introduction, free exchange, and consumption. An explanation of either of these terms, therefore, involves a presentation of the arguments, based on theory or experience, which may be adduced in support of the respective economic systems for which they are the expressions, and a review of the premises of the one almost necessarily requires a conjoint statement of the claims of the other.

It is also essential to clearly appreciate, at the outset of any explanation, the relation which "free trade" and "protection," regarded as economic systems, sustain to the subject of taxation and revenue—a matter about which there is no little of popular misconception. The nature of this relation may be stated as follows: The command of revenue being absolutely essential to the existence of organized government, the power to compel contributions, or, as it is termed, "to tax," is inherent in every sovereignty, and rests upon necessity. The truth of this principle the advocates of free trade and protection alike fully recognize. The former, however, maintain that in the exercise of this right by the state or sovereignty the object of the tax should be rigidly restricted to supplying the necessities created by legitimate public expenditures—or, in other words, that taxes should be levied for revenue purposes exclusively—and that, subject to such limitations, the question as to what forms taxation had best assume becomes a mere question of experience and expediency, preference being always given to those forms which involve the least waste, cost, and personal annoyance in collection, which are most productive in revenue, and which interpose the minimum of interference and restriction on the inter-exchange of commodities and services. Free trade as an economic principle is not, therefore, as is often assumed and supposed, antagonistic to the imposition of equitable duties on imports, provided the end sought to be attained is simply revenue, and the circumstances of the state render such form of taxation expedient. Protection, on the other hand, on the ground of advantages accruing directly or incidentally, advocates and defends the imposition of taxes on imports for purposes other than revenue. Protection, therefore, to the exact extent to which it attains its object, is obviously antagonistic to revenue, inasmuch as revenue is only received on those commodities which *come in*, while protection is only secured when the importation of commodities is restricted or made difficult. The adjustment of a tariff for revenue in such a way as to afford what is termed "incidental protection"—an idea much favored by American politicians—is based on the supposition that by arranging a scale of duties so moderate as to only restrict and not prevent importations, it is possible to secure a sufficiency of revenue for the state, and at the same time stimulate domestic manufactures by increasing the price of competitive foreign products. That the double object thus aimed at is capable of attainment cannot be doubted, but that the project is also one of the most costly of all methods of raising revenue will appear evident if it is remembered, that while revenue to the state accrues only from the tax levied on what is imported, the tax arising from the increase of price is paid equally by the nation upon all that is sold and consumed in competition with the foreign article. A tariff for revenue so adjusted as to afford incidental protection is therefore a system which requires the consumers, who are the people, to pay much in order that the state may receive little.

With these preliminary statements the essential points of the argument in favor of free trade as contradistinguished from protection may be stated as follows, the experience of the United States, where the principles of protection have been recently applied more systematically and extensively than ever before, being particularly referred to in the way of illustration:

1st. The highest right of property is the right to exchange it for other property. That this must be so will appear evident if it is remembered, that if all exchange of property was forbidden each individual would be assimilated in condition to Robinson Crusoe on his uninhabited island; that is, he would be restricted to subsist exclusively, or in the main, on what he individually produced or collected; be deprived of all benefits of co-operation with his fellow-men, and of all advantages of production derived from diversity of skill or diversity of natural circumstances. In the absence of all freedom of exchange between man and man civilization would obviously be impossible; and it would also seem to stand to reason that to the degree in which we impede or obstruct the freedom of exchange—or, what is the same thing, commercial intercourse—to that same degree we oppose the development of civilization.

2d. Any system of law which denies to an individual the right to freely exchange the products of his labor, by declaring, as is generally the custom, that A, a citizen, may trade on equal terms with B, another citizen, but shall not under equally favorable circumstances trade with C, who lives in another country, reaffirms in effect the principle of slavery, for both slavery and the artificial restriction or prohibition of exchanges deny to the individual the right to use the products of his labor according to his own pleasure, or what may seem to him the best advantage; or, in other words, the practical working of both the system of human slavery and the system of protection is to deprive the individual of a portion of the fruits of his labor without making in return any direct compensation. The argument

that is generally put forth by the advocates of protection in justification of legislation restricting freedom of exchange, or in defence of the pithily-expressed proposition, "That it is better to compel an individual to buy a hat for five dollars, rather than to allow him to purchase it for three," is, that any *present* loss or injury resulting from such restriction to the individual will be more than compensated to him *indirectly* as a member of society or citizen of the state. But this plea is the same in character, and just as legitimate, as that which was formerly put forth in defence of the system of negro slavery—namely, that the system was really for the good of the persons enslaved, and that any suffering or deprivation endured by the slave for the good of society—meaning thereby the masters—would be fully compensated to him, through moral discipline, in the world to come. It is also to be noted that this same species of argument—*i. e.* indirect or future individual or society benefit as a justification for present personal restriction or injury—has always been made use of in past ages as a vindication and in warrant for persecution on the part of the state for heresy or unbelief, and also for the establishment of state religions and enforced conformity thereto.

3d. The general result for which all men labor is to increase the abundance or diminish the scarcity of those things which are essential to their subsistence, comfort, and happiness. Different individuals have different aptitudes, or are endowed with different natural capacities for making the various forces of nature and varieties of matter available for production. One man is naturally fitted to excel as a farmer, another as a mechanic, the third as a navigator, the fourth as a miner, engineer, builder, or organizer and director of society, and the like. The different countries of the earth likewise exhibit great diversity as respects soil, climate, natural products, and opportunity. It would seem clear, therefore, in order that there may be the greatest material abundance, that each individual shall follow that line of production for which he is best fitted by natural capacity or circumstances; and that, for the determination of what that line must be, the promptings of individual self-interest and experience are a far better guide than any enactments of legislatures and rulers possibly can be; and, finally, that the greatest possible facility be afforded to producers for the interchange of their several products and services. So true, indeed, are these propositions that mankind in their progress from the rudest and most incipient social organizations to higher degrees of civilization invariably act in accordance with them, and, as it were, instinctively. Robinson Crusoe upon his uninhabited island and the solitary settler in the remote wilderness follow of necessity a great variety of occupations, as that of the farmer, hunter, builder, blacksmith, fisherman, tailor, and the like. But as rapidly as the association of others in the same neighborhood admits, the solitary man abandons his former diversity of employment, and devotes himself more or less exclusively to a single department of industry, supplying his want of those things which he does not himself produce by exchanging the surplus product of his labor for the surplus product of his neighbors, who follow other and different industries. To take advantage of natural facilities for intercommunication between man and man for the purpose of exchanging services or commodities, it is to be further observed, that settlements in all new countries commence, if possible, in close proximity to navigable waters, and that if commenced inland, one of the first efforts of the new society is the construction of a path or road which will enable its members to hold communication with some other settlements or societies. Next, as population and production increase, the rude path or trail gives way to a well-defined road, the ford to a bridge, the swamp to a causeway, the pack carried upon the backs of men and animals to the wagon drawn by horses, the wagon to the railway-car, the boat propelled by oars and sails to the boat propelled by steam, and finally the telegraph, annihilating space and time;—all efforts and achievements for the single object of facilitating intercommunication between man and man, and removing obstructions in the way of interchanging human services and commodities. Free exchange between man and man—or, what is the same thing, free trade—is therefore action in accordance with the teachings of nature. Protection, on the other hand, is an attempt to make things better than nature made them. Free trade, or the interchange of commodities and services with the minimum of obstruction, by rendering commodities cheap, tends to promote abundance. Protection, by interference or placing obstructions in the way of exchanges, tends to increase the cost of commodities to the consumer, and thereby promotes scarcity. Protection, effected by legislative restriction on exchanges, acts, therefore, in the sense of all those things which render transportation onerous; or, in other words, it is an obstacle in the same sense as a bad road, a precipitous range of mountains, an intervening desert, or a wide expanse of ocean abounding in risks to navigation; the general effect of all which is to augment in various degrees to consumers the difference between the producing and consuming price of commodities. All the people of the United States instinctively rejoice at the announcement of every new discovery in the construction or propulsion of vessels, whereby the time and cost of transporting commodities across the Atlantic from Liverpool to New York, or across the Pacific from China and Japan to San Francisco, are diminished; and yet they do not revolt at the inconsistency of imposing taxes, for purposes other than to meet the necessities of the state, on the landing of the commodities thus transported; which are precisely equivalent in effect, as regards the consumer, to substituting slow-sailing vessels of small tonnage in the place of ocean steamers, or of so widening the expanse of ocean to be traversed that the time employed in transportation (and the consequent increased cost of freight and risk) shall be expressed by months rather than by days. A few illustrations derived from the actual experience of the U. S. are here pertinent to the argument.

Upon the coast of Nova Scotia, within a short distance of the United States, there are coal-mines of great value as respects quantity and quality, and which, unlike any others in the whole world, are located so advantageously in respect to ocean navigation that almost by the action of gravity alone the coal may be delivered from the mouth of the pit upon the deck of the vessel. For many years the government of the United States has imposed a tax on the landing of this coal within its territory, of one dollar and fifty cents per ton. Now, if we assume that coal upon a well-managed railroad can be transported for one cent per ton per mile, the effect of this tax upon the people of New York and New England is precisely equivalent to a removal of these coal-mines of Nova Scotia from a point on the seaboard to a location one hundred and fifty miles inland. But it would also seem to stand to reason that if the removal of these mines one hundred and fifty miles into the interior was a benefit to the people of the United States, a further augmentation of their distance from the seaboard to five hundred or a thousand miles would be a still greater blessing, and that their absolute annihilation would be the most superlative good of all.

Again, some years since an English engineer, Mr. Bessemer, devised a new process for the manufacture of steel. He did not claim to make anything new; he did not claim to make steel of a quality superior to what was made before; but he did succeed in showing mankind how to make an indispensable article in the work of production *cheap*, which was before *dear*. Immediately on the assured success of the invention the advocates of protection in the United States asked Congress to impose such a duty on the import of this steel as would, through a consequent increase of its price to American consumers, almost completely neutralize the only benefit accruing from the knowledge and use of the new process—namely, its *cheapness*—and succeeded in obtaining, and still (1875) have a duty that in a great degree accomplishes such a result.

From the above propositions and examples it would seem evident that the direct effect of a protective duty, when it is really operative, is to compel, on the part of the community employing such an agency, a resort to more difficult and costly conditions of production for the protected article; and also, that when a state or community adopts the protective policy it also commits itself to the endorsement of the principle that the development and propagating of obstacles is equivalent to, or the surest method of, developing or propagating riches—a policy and a principle which, if logically and practically carried out, would lead to disuse of all labor-saving machinery.

The advocate of protection, however, meets this averment, as well as the argument embodied in the coal and Bessemer-steel illustrations above given, by saying that by prohibiting or restricting the importation and use of foreign coal and steel a demand will be created for a corresponding additional quantity of similar American products. The immediate result of this will be that an additional opportunity will in consequence be afforded to American citizens desirous of following the occupations of coal-miners or transporters or steel-makers; and, the results of their labor and expenditure remaining in the country, the national wealth will be thereby augmented, whereas if the same amount of labor and expenditure is diverted to, and takes place in, a foreign country, the results will be exactly opposite.

In answer, now, to this, it may be said, *First*, That the amount of consumption in the two instances, and consequently the results of consumption, will not be the same: for whatever increases the price of a useful commodity diminishes its consumption, and, *vice versâ*, whatever di-

minishes the price increases consumption. *Second,* To admit the desirability of creating an opportunity of employing labor through the agency of a tax on all consumers of coal and steel to do work that would yield to the same consumers a greater product of the same articles if performed elsewhere, or an equal product at less cost, is to admit that the natural resources of a country are so far exhausted that there is no opportunity for the truly productive employment of labor—an argument which, however effective in overpopulated countries, can have no possible application in a new country like the U. S., whose natural resources, so far from being exhausted, are yet, as it were, unappropriated and unexplored. Again, a tax levied in pursuance of legislative enactment for the maintenance of such labor is clearly in the nature of a forced charity, while the petitioners for its enactment answer in every particular to the definition of the term "pauper"—namely, one who publicly confesses that he cannot earn a living by his own exertions, and therefore asks the community to tax themselves or diminish their abundance for his support. *Third,* The only true test of the increase of national wealth is the possession of an increased quantity of useful things in the aggregate, and not in the amount of labor performed or the number of laborers employed, irrespective of results. A tariff from its very nature cannot create anything: it only affects the distribution of what already exists. If the imposition of restrictions by means of taxes on imports enables a producer to employ a larger number of workmen and give to them better wages than before, it can only be accomplished at the expense of the domestic consumers, who pay increased prices. Capital thus transferred is no more increased than is money by transference from one pocket to another, but on the contrary is diminished to just the extent that it is diverted from employing labor that is naturally profitable to that which is naturally unprofitable. And herein is exposed the fallacy of the averment that duties levied on the import of foreign commodities protect home industry. It may be conceded that certain industries, as the result of such duties, may be temporarily stimulated, and the producers obtain large profits by a consequent increase in the price of their products; but then it is at the expense of those who pay the increased price, who are always the domestic consumers.

To further make clear this position, the following illustration, drawn from actual American experience, is submitted: For a number of years subsequent to 1860 the government of the U. S., with a view of protecting the American producer, imposed such a duty on foreign salt as to greatly restrict its import and at least double the price of the article, whether of foreign or domestic production, to the American consumer. The result was, taking the average price of No. 1 spring wheat for the same period in Chicago, that a farmer of the West desirous of buying salt in that market would have been obliged to give two bushels of wheat for a barrel of salt, which without the tariff he would have readily obtained for one bushel. If, now, the tax had been imposed solely with a view to obtaining revenue, and the farmer had bought imported salt, the extra bushel given by him would have accrued to the benefit of the State; and if the circumstances of the government required the tax, and its imposition was expedient and equitable, the act was not one to which any advocate of free trade could object. But in the case in question the tax was not imposed primarily for revenue, as was shown by the circumstance that imports and revenue greatly decreased under its influence, and the salt purchased by the farmer in Chicago was domestic salt, which had paid no direct or corresponding tax to the government. The extra bushel of wheat, therefore, which the farmer was compelled to give for his salt accrued wholly to the benefit of the American salt-boiler, and the act was justified on the ground that American industry, as exemplified in salt-making, was protected. And yet it must be clear to every mind that if the farmer had not given the extra bushel of wheat to the salt-boiler, he would have had it to use for some other purpose advantageous to himself—to give to the shoemaker, for example, in exchange for a pair of brogans. By so much, therefore, as the industry of the salt-boiler was encouraged that of the farmer and the shoemaker was discouraged; and, putting the whole matter in the form of a commercial statement, we have the following result: under the so-called "protective system" we have a barrel of salt and two bushels of wheat passed to the credit of what is called "home industry," while under a free system we have a barrel of salt, two bushels of wheat, and a pair of shoes. Protection, therefore, seeks to promote industry at the expense of the products of industry; and its favorite proposition, that though under a system of restriction a higher price may be given for an article, yet all that is paid by one is given to some other person in increased employment and wages, has this fallacy—namely, that it conceals the fact that the price paid by the consumer would have been equally expended upon something and somebody if the consumer had been allowed to buy the cheap article instead of the dear one; and consequently the loss to the consumer is balanced by no advantage in the aggregate to any one. "When a highwayman takes a purse from a traveller, he expends it, it may be, at a drinking-saloon, and the traveller would have expended it somewhere else. But in this there is no loss in the aggregate; the vice of the transaction is that the enjoyment goes to the wrong man. But if the same money is taken from the traveller by forcing him to pay for a dear article instead of a cheap one, he is not only despoiled of his just enjoyment as before, but there is a destructive process besides, in the same manner as if the loss had been caused by making him work with a blunt axe instead of a sharp one. Whenever, therefore, anything is taken from one man and given to another under the pretence of protection to trade, an equal amount is virtually thrown into the sea, in addition to the robbery of the individual."

To render the illustration derived from the transaction in salt, above given, more complete, attention is asked to the following additional historical circumstances. In the valley of Kanawha, West Virginia, there are salt-springs which furnish brine in abundance and of great strength and purity. The same springs also furnish conjointly an inflammable gas, which flows with such force and quantity that it is used both to lift the salt-water into tanks at considerable elevation and to subsequently evaporate the brine by ignition under the furnaces, without the necessity of resorting to the use of any other fuel whatever. Salt at this point can therefore be produced at a nominal cost, and with advantage even over solar evaporation, inasmuch as all expense of pumping the salt-water into vats in the first instance is entirely obviated. During the war, in order to deprive the army and the people of the Southern Confederacy of a supply of salt, the springs in question at Kanawha were temporarily destroyed by the Federal forces; and an important natural supply of salt to the country being thus cut off, the manufacturers of salt in Ohio, from springs less advantageously productive, obtained for a time a larger market and higher prices for their more costly competitive products. With the close of the war and the reopening of the Kanawha salt-works, the advantages thus gained at the expense of the salt-consumers bid fair to be put an end to; but in order to perpetuate them the Ohio salt-manufacturers united, and, having at a large annual expense leased the Virginia springs, abandoned and absolutely forbade their utilization.

4th. As has been already shown, any increase in the price of domestic products consequent on the imposition of taxes on the import of corresponding products of foreign origin is paid by the domestic consumer. Hence, a result alike deducible from theory and proved by all experience—that not only does protection to a special industry not result in any benefit to the general industry of a country, but also that its beneficial influence on the special industry itself is not permanent, but temporary. Thus, all taxes tend to diffuse themselves, and, if levied permanently and with any degree of uniformity, do diffuse themselves almost with infallibility. The price of no article can be permanently advanced by artificial agencies, or otherwise, without an effort on the part of every person directly or indirectly concerned in its consumption to protect and compensate themselves by advancing the price of the labor or products they give in exchange. If sufficient time is afforded, and local exchanges are not unduly restricted, this effort of compensation is always successful. Hence, from the very necessity of the case no protective duty can be permanently effective; hence, also, it is that protected manufacturers in every country always proclaim, and no doubt honestly feel, that the abandonment of protection, or even its abatement, would be ruinous. Of this the recent experience of the U. S. affords a most curious and convincing illustration. Thus, in 1862–63, in order to meet the expenses of a great war, the government imposed excise or internal taxes on every variety of domestic manufactures, and in accordance with the principles of equity, imposed what were claimed to be corresponding taxes on the import of all competing foreign products. Soon after the close of the war, however, when the cessation of hostilities diminished the necessity of so large revenues, the internal taxes were all repealed, but in no one instance was there a protected manufacturer found who took any other position than that a repeal of the corresponding tariff would be most disastrous to his business. The tariff, as originally raised to compensate for the new internal taxes, was therefore left in a great degree unchanged. That the principle here laid down, of want of permanency in protective agencies, is furthermore admitted by the protected manufacturers themselves as a result of their own experience,

is also proved by the following striking testimony forced out under oath before a government commission from one of the foremost of their number in 1868—the late Oakes Ames of Massachusetts:

Question. "What, according to your experience, was the effect of the increase of the tariff in 1864 on the industries with which you are specially acquainted?" *Ans.* "The first effect was to stimulate nearly every branch—to give an impulse and activity to business; but in a few months the increased cost of production and the advance in the price of labor and the products of labor were greater than the increase of the tariff, so that the business of production was no better, even if in so good a condition, as it was previous to the advance of the tariff referred to."

5th. Upon no one argument have the advocates of protection relied more in support of their system than that contained in the assumption already referred to—that if there were no restrictions on trade the opportunity to labor created by protection, and the results of the expenditure of the earnings of such labor, would be diverted to other countries to their benefit, and to the corresponding detriment of that country which, needing protection by reason of a necessity for paying higher wages or other industrial inequalities, abandons it; or, to speak more specifically, it is assumed that if the U. S. were to adopt a policy of free trade, England would supply us with cotton and metal fabrications; Germany, with woollen goods; Nova Scotia, with coal; the West Indies, exclusively with sugar; Russia, with hemp and tallow; Canada, with lumber; and Australia, with wool—that thereby opportunity to our own people to labor would be greatly restricted, and the wages of labor reduced to a level of the wages of foreigners. Specious as is this argument, there could not be a greater error of fact or a worse sophism of reason. None of the commodities mentioned will be given by the producers resident in foreign countries for nothing. *Product for product* is the invariable law of exchange, and we cannot buy a single article in any market except with or by a product of our own, or for money which has been obtained by the exchange of some product for it. Nothing, therefore, can or will be imported unless that in which it is paid for can be produced at home with greater final advantage. Hence, also, it is in the nature of a truism to assert that it is for the interest of every community that its industry should be directed to the production of such articles as are attended with greater final advantage, in preference to those which are attended with less; as inevitably would be the result if the business of production and exchange was not obstructed by legislative enactments, but left to the guidance of individual self-interest.

From these premises we are warranted in regarding the following deductions as in the light of economic axioms: 1st. A nation or community can attain the greatest prosperity, and secure to its people the greatest degree of material abundance, only when it utilizes its natural resources and labor to the best advantage and with the least waste and loss, whatever may be the nominal rate of wages paid to its laborers. The realization of such a result is hastened or retarded by whatever removes or creates obstructions or interferences in the way of production and exchanges. 2d. The exports on the whole of any country must and always do balance its imports; which is equivalent to saying that if we do not buy we cannot sell, while neither buying nor selling will take place unless there is a real or supposed advantage to both parties to the transaction. 3d. As a nation only exports those things for which it possesses decided advantages relatively to other nations in producing, it follows that what a nation purchases by its exports it purchases by its most efficient labor, and consequently at the cheapest possible rate to itself. Hence, the price paid for every foreign manufactured article, instead of being so much given for the encouragement of foreign labor to the prejudice of our own, is as truly the product of our own labor as though we had directly manufactured it ourselves. Free trade, therefore, can by no possibility discourage home-labor or diminish the real wages of laborers.

The favorite protectionist argument, that if trade is unrestricted, and the people of a country, under the inducement of greater cheapness, are allowed to supply themselves with foreign commodities, the opportunities for the employment of domestic labor will be correspondingly diminished, is an argument identical in character with that which has in past times often led individuals and whole communities to oppose the invention and introduction of labor-saving or "labor-dispensing" machinery. To sift thoroughly this sophism, it is sufficient to remember that labor is exerted not for the sake of labor, but for what labor brings, and that human wants expand just in proportion to the multiplication of the means and opportunity of gratifying human desires. If the wages of a day's labor would purchase in the market one hundred times as much as at present, can any one doubt that the demand for the necessaries and luxuries of life would be increased a hundred-fold? If the people of the U. S. could obtain the products of the labor of other countries for nothing, could the labor of the whole world supply the quantity of things we should want? In short, the demand for the results of labor can never be satisfied, and is never limited except by its ability to buy; and the cheaper things are the more people will purchase and consume. Nothing, therefore, can be more irrational than the supposition that increased cheapness, or increased ability to buy and consume, diminishes or restricts the opportunity to labor. If by the invention of machinery or the discovery of cheaper sources of supply the labor of a certain number of individuals in a department of industry becomes superfluous or unnecessary, such labor must take a new direction, and it is not to be denied that in the process of readjustment temporary individual inconvenience, and perhaps suffering, may result. But any temporary loss thus sustained by individuals is more than made up to society, regarded from the standpoint of either producers or consumers, by the increased demand consequent on increased cheapness through greater material abundance, and therefore greater comfort and happiness. About the time of the invention and introduction of the sewing-machine into Europe the benevolent people of a city in Germany where the industry of needlewomen was a marked specialty formed an organization to lessen in a degree the injury which it was believed would inevitably accrue from the supplementation of a great opportunity to labor by the poor which was threatened. After the lapse of a few years, however, when society, as represented by the whole people of the city, obeying their natural instincts, had determined to have, and had obtained, a cheaper source of supply for their needle-products than before, the organization referred to instituted an investigation, the result of which showed that by reason of a greater consumption of sewed goods, consequent on their cheaper supply, the number of persons engaged in the operating of sewing-machines was greater than what had formerly found employment by the needle, and that wages had increased rather than diminished.

6th. The averment that prohibition or restriction of foreign imports encourages diversity of domestic industry, is answered by saying, that when any trade can be introduced or undertaken for fiscal or public advantage, private enterprise is competent to its accomplishment. "To ask for more is only to ask to have a finger in the public purse." It may be possible to conceive of specific cases in which it might be politic for a government to give an advantage for a limited time and for a definite object. But protection, as an economic system, cannot rightfully claim any support from such an admission, inasmuch as its demand is that the public shall be obliged to support all manufacturing enterprises upon no other ground but that they cannot support themselves.

7th. Protection, it is alleged, has a tendency to make what are termed manufactured products cheaper. A very fit and cogent answer which has been made to this assertion of the opponents of free trade is, that if protection is to be recommended because it leads ultimately to cheapness, it were best to begin with cheapness. Another answer is to be found in the circumstance that not a single instance can be adduced to show that any reduction has ever taken place in the cost of production under a system of protection, through the agencies of new inventions, discoveries, and economies, which would not have taken place equally soon under a system of free trade; while, on the contrary, many instances can be referred to which prove that protection, by removing the dread of foreign competition, has not only retarded invention, but also the application and use of improvements and inventions elsewhere devised and introduced. Thus, referring to the experience of the U. S., where the system of protection has in general prevailed for many years, it is a well-known fact that the department of industry which has been distinguished more than any other by the invention and application of labor-saving machinery is that of agriculture, which has never been protected to any extent; and for the reason that the country which raises a surplus of nearly all its agricultural products for sale in foreign countries never can be. On the other hand, in that department of industry engaged in the primary manufacture of iron, which has always been especially shielded by high restrictive duties, not only from foreign competition, but also from the necessity of the exercise of economy and skill, the progress in the direction of improvement has been so slow that according to the report of the geological survey of Ohio for 1872–73 there is hardly a furnace in that great iron-producing State that can be compared with the best European furnaces, either in respect to construction, management, or product; many

Ohio furnaces unnecessarily wasting one-fourth of the metal in the ore in the process of smelting.

It is also pertinent to this department of the subject to notice the idea adopted by a school of American economists or politicians, that it is for the advantage of a country to endeavor to effect a reduction of prices by the creation, through legislation or otherwise, of an excessive or artificial stimulus to production. That the creation of an artificial stimulus to domestic production—such as is almost always temporarily afforded by an increase of the tariff or by war, which necessitates extraordinary supplies—does have the effect in the first instance to quicken certain branches of production, and subsequently reduce prices through the competition engendered, cannot be doubted; but experience shows that in almost every such instance the reduction of prices is effected at the expense or waste of capital, and that the general result, in place of being a gain, is one of the worst events that can happen to a community. Thus, the first effect of creating an extraordinary domestic demand is to increase prices, which in turn affords large profits to those in possession of stock on hand or of the machinery of production ready for immediate service. The prospect of the realization of large profits next immediately tempts others to engage in the same branch of production—in many cases with insufficient capital, and without that practical knowledge of the details of the undertaking essential to secure success. As production goes on, supply gradually becomes equal to, and finally in excess of demand. The producers working on insufficient capital or with insufficient skill are soon obliged, in order to meet impending obligations or dispose of inferior products, to force sales through a reduction of prices, and the others, in order to retain their markets and customers, are soon compelled to follow their example. This in turn is followed by new concessions alternately by both parties, which are accompanied by the usual resort of turning out articles or products of inferior quality, but with an external good appearance—slate being substituted in the place of coal; cinder in the place of iron; shoddy in the place of wool; starch and sizing in the place of cotton; pasteboard in the manufacture of boots and shoes in the place of leather; and clay in the manufacture of paper in the place of fibre. And so the work of production goes on, until gradually the whole industry becomes depressed and demoralized, and the weaker producers succumb, with a greater or less destruction of capital and waste of product. Affairs having now reached their minimum of depression, recovery slowly commences. The increase of the country causes consumption to gradually gain on production, and finally the community suddenly becomes aware of the fact that supply has all at once become unequal to the demand. Then those of the producers who have been able to maintain their existence enter upon another period of business prosperity; others again rush into the business, and the old experience is again and again repeated. Such has been the history of the industry of the U. S. under the attempt to restrict the freedom of trade by high duties on imports, frequently modified; and such also was the effect of the war from 1861–65. To use a familiar expression, it has always been either "high water" or "low water" in the manufacturing industry of the country—no middle course, no stability. What the people have gained at one time as consumers from low prices they have more than compensated at another by the recurrence of extra rates, and as producers by periodical suspensions of industry, spasmodic reduction of wages, and depression of business.

Meantime, the loss to the country from the destruction of capital and the waste and misapplication of labor has been something which no man can estimate. One of the most striking illustrations of this experience, selected from many examples afforded by the U. S., is the following: In 1864–65 it was found that the supply of paper of domestic manufacture was insufficient to meet the consumption of the country, and that the supply from abroad was greatly impeded by an unusually heavy duty imposed in time of war on its import. The price of paper in the country accordingly rose with great rapidity, and the profits of the paper-manufacturers who were then in possession of the machinery of production became something extraordinary. The usual effect followed. A host of new men rushed into the business and old manufactories were enlarged, so that during the years 1864–66 it was estimated that more paper-mills were built in the U. S. than during the whole of the twelve years previous. As a matter of course, the market became overstocked with paper, prices fell with great rapidity, many abandoned the business through inclination or necessity, and many mills and much machinery were sold for less than the cost of construction; while in the spring of 1869 the paper-makers met in convention to consider the desirability of decreasing the production of paper—or, what is the same thing, of allowing their capital and their labor to remain unemployed—on account of the unprofitableness of the business. In October of the same year a storm of great violence swept over the northern portion of the country, and in the flood which followed many mills engaged in the manufacture of paper were so injured as to temporarily render them incapable of working. A leading journal in one of the paper-manufacturing districts, devoted to the advocacy of protection, in commenting on the effects of the storm, used this language: "There seems to have been unusual fatality among paper-mills, but this disaster will work to the advantage of those who escaped the flood, and we doubt not that those that did stand will do a better business in consequence of the lessened supply;" or, in other words, the condition of this particular industry had become so bad through the influence of a fiscal policy based on the theory of protection that the occurrence of a great public calamity, with a vast attendant destruction of property, had come to be regarded in the light of a public blessing.

8th. It is clear that one of the essential attributes of a just law is that it bears equally upon all subjected to its influence, and that an unjust law must necessarily be also injurious. A system of law imposing protective duties must, in order to be effective, be partial and discriminating, and therefore unequal and unjust; for if a law could be devised which would afford equal protection to all the industrial interests of a nation, it would benefit in fact no interest by leaving everything relatively as before; or, in other words, the attempt to protect everything would result in protecting nothing.

Any system of laws founded on injustice and inequality cannot, furthermore, be permanent. The possibility that it can be further changed to meet the further demands of special interests, and the instinctive revolt of human nature against legal wrong and partiality, continually threaten its stability. Hence, a system of industry built upon laws establishing protection through discriminating taxes can never have stability of condition; and without such stability there can be no continued industrial prosperity. Apart from these considerations, in a free government, also, where the people enjoy the right to choose and to change their law-makers at comparatively short intervals, the opinions of the masses will change according to the light they receive; and as their opinion changes, so must necessarily the policy of the government. Tariffs framed to regulate and direct industries can therefore never be permanent under governments that admit the right of the people to vote and to think. Nothing less than a despotism, and an ignorant despotism at that, can maintain a protective tariff at any given standard for any lengthened period. On the other hand, one of the strongest arguments in behalf of freedom of trade is, that it makes every branch of industry independent of legislation, and emancipates it from all conditions affecting its stability other than what are natural, and which can in a great degree be anticipated and provided against.

9th. "A tariff on imports," it is sometimes alleged by the advocates of protection, "obliges a foreigner to pay a part of our taxes." To this it may be replied that if there were any plan or device by which one nation could thus throw off its burden of taxation in any degree upon another nation, it would long ago have been universally found out and recognized, and would have been adopted by all nations to at least the extent of making the burden of taxation thus transferred in all cases reciprocal. If the principle involved in the proposition in question, therefore, could possibly be true, no possible advantage could accrue from its application. But the point itself involves an absurdity. Taxes on imports are paid by the persons who consume them; and these are not foreigners, but residents of the country into which the commodities are imported. A duty on imports may injure foreigners by depriving them of an opportunity of exchanging their products for the products of the country imposing the duty, but no import-taxes will for any length of time compel foreigners to sell their products at a loss, or to accept less than the average rate of profit on their transactions; for no business can permanently maintain itself under such conditions. Where a nation possesses a complete monopoly of an article, as is the case of Peru in respect to guano, and to a great extent with China in the case of tea, the monopoly always obtains the highest practicable price for its commodities, and the persons who find their use indispensable are obliged to pay the prescribed prices. The imposition of a tax on the import of such commodities into a country may compel the monopoly, for the sake of retaining a market, to reduce their prices proportionally; and in such cases the nation imposing the impost may to a degree share the profit of the monopoly. But the price to the consumers is not diminished by reason of the import-duty, and the cases in which any interest has such a complete control over the

supply of a product as to enable it to arbitrarily dictate prices are so rare as hardly to render them worthy of serious consideration in an economic argument.

10th. Another powerful argument in favor of free trade between nations is, that of all agencies it is the one most conducive to the maintenance of international peace and to the prevention of wars. The restriction of commercial intercourse among nations tends to make men strangers to each other, and prevents the formation of that union of material interests which creates and encourages in men a disposition to adjust their differences by peaceful methods rather than by physical force. On the other hand, it requires no argument to prove that free trade in its fullest development tends to make men friends rather than strangers, for the more they exchange commodities and services the more they become acquainted with and assimilated to each other; whereby a feeling of interdependence and mutuality of interest springs up, which, it may be safely assumed, does more to maintain amicable relations between them than all the ships of war that ever were built or all the armies that ever were organized. Of the truth of this the experience of England and the U. S. in respect to the "Alabama claims" is a striking example. The moral and religious sentiments of the people of the two countries undoubtedly contributed much to restrain the belligerent feelings that existed previous to the reference of the claims to arbitration; but a stronger restraining element than all, and one underlying and supporting the moral and religious influences, was a feeling among the great body of the people of the two nations that war, as a mere business transaction, "would not pay;" and that the commerce and trade of the United States and Great Britain are so interlinked and interwoven that a resort to arms would result in commercial ruin and permanent and incalculable impoverishment to both countries.

11th. The question here naturally arises, if the above propositions in favor of free trade are correct, and if the doctrine of protection is as false and injurious as it is represented to be, how happens it that free trade does not at once meet with universal acceptance? and how is the adherence of many men of clear intellect and practical experience to the opposite doctrine to be accounted for? One of the best answers to these questions was given by the celebrated French economist Bastiat, in an article written many years ago, entitled *That which is Seen, and That which is Not Seen,* in which he showed that protection is maintained mainly by a view of what the producer gains and a concealment of what the consumer loses; and that if the losses of the million were as patent and palpable as the profits of the few, no nation would tolerate the system for a single day. Protection accumulates upon a single point the good which it effects, while the evil which it inflicts is infused throughout the community as a whole. The first result strikes the eye at once; the latter requires some investigation to become clearly perceptible. The doctrine of protection is also an inheritance of the past, and has all the support which custom, dogma, and prescription can give it. Mankind also divide themselves into two classes —producers and consumers, buyers and sellers. The interest of producers and sellers is that prices shall be high, or that there shall be scarcity; the interest of consumers and buyers is that prices shall be low, or that there shall be abundance. But every person will at once admit that it is for the general interest that there shall be abundance, rather than scarcity. But in the case of individuals controlling large agencies for production, their interests as producers and sellers of large quantities of commodities may be made greater than their interests as consumers, if by the aid of legislation the price of what they produce can be raised, by discriminating laws disproportionately over what they consume, or to the cost of production. Men of this class are generally rich beyond the average of the community, and therefore influential in controlling legislation and in determining fiscal policies; and it is but natural that in so doing they should consult their own interests rather than the interests of the masses.

12th. It only remains to briefly notice the testimony of history in respect to the influence of free trade as an economic principle upon the development of nations and the progress of civilization.

In the earlier ages in Europe the principle that trade or commerce is mutually advantageous, and that after every fair mercantile transaction both parties are richer than before, was not understood. On the contrary, the generally accepted theory among both nations and individuals in respect to trade was pithily embodied in the old proverb, "What is one man's gain must be another man's loss." Commerce, therefore, it was assumed, could benefit one country only as it injured some other. In accordance, therefore, with this principle, every state in Christendom, in place of rendering trade and commerce free, exerted itself to impose the most harassing restrictions on commercial intercourse, not only as between different countries, but also as between districts of the same country, and even as between man and man. Country was accordingly separated from country and town from town as if seas ran between them. If a man of Liege came to Ghent with his wares, he was obliged first to pay tolls at the city's gates; then when within the city he was encumbered at every step with what were termed "the privileges of companies;" and if the citizen of Ghent desired to trade at Liege, he encountered the same difficulties, which were effectual to prevent either from trading to the best advantage. The revenues of most cities were also in great part derived from the fines and forfeitures of trades, almost all of which were established on the principle that if one trade became too industrious or too clever, it would be the ruin of another trade. Every trade was accordingly fenced round with secrets, and the commonest trade was termed, in the language of the indentures of apprentices, "an art or mystery." If one nation saw profit in any one manufacture, all her efforts were at once directed to frustrate the attempts of other nations to engage in the same industry. She must encourage the importation of all the raw materials that entered into its production, and adopt an opposite rule as respected the finished article. At the close of the sixteenth century England undertook the woollen manufacture. By the act of the 8th of Elizabeth the exporter of sheep was for the first offence to forfeit his goods for ever, to suffer a year's imprisonment, and then have his left hand cut off in a market-town on market-day, there to be nailed up to the pillory. For the second offence he should be adjudged a felon, and suffer death. At a later period, in the reign of Charles II., it was enacted that no person within fifteen miles of the sea must buy wool without the permission of the king; nor could it be loaded in any vehicle, or carried, except between sunrising and sunsetting, within five miles of the sea, on pain of forfeiture. An act of Parliament in 1678, for the encouragement of woollen manufactures, ordered that every corpse should be buried in a woollen shroud. In 1672 the lord chancellor of England announced the necessity of going to war with the Dutch and destroying their commerce, because it was surpassing that of Great Britain; and even as late as 1743 one of England's greatest statesmen (Somers) declared in the House of Lords that "if our wealth is diminishing, it is time to ruin the commerce of that nation which has driven us from the markets of the Continent, by sweeping the seas of their ships and blockading their ports." By the treaty of Utrecht, which concluded the great war of England and Spain against Louis XIV. and his allies, England, being able to dictate the terms, secured the adoption of a section by which the citizens of Antwerp were forbidden to use the deep water that flowed close by their walls; and it was further expressly stipulated that the capacious harbor of Dunkirk, in the north of France, should be filled up and for ever ruined, so that French commerce might not become too successful.

There was, however, one notable exception to the all but universal acceptation in Europe during the fifteenth, sixteenth, seventeenth, and eighteenth centuries of the doctrine, that the commercial and industrial prosperity of nations was dependent on monopolies and interferences with trade-production and exchanges; and that exception was found in the case of Holland. In a remarkable pamphlet entitled *The True Interest and Political Maxims of the Republic of Holland,* published by Cornelius de Witt, and translated into English in 1746, this great statesman of the Netherlands shows "that the Dutch, though not producing a bushel of wheat, ate the whitest bread in Europe; and, though not producing a sheaf of hemp, a single plank, or any iron, had the best fleet which then sailed the sea; because Holland had wealth to pay for these commodities; and possessed this wealth because its trade and all exchanges were left unfettered, unimpeded, unlegislated upon; and that by this free trade the Netherlands became both the most peopled and the richest country on the earth, and loans could be effected there for a lower interest than anywhere else."

With the progress of civilization, and the consequent diffusion of information, the arbitrary restrictions on trade above noticed, which were formerly so common in Europe, have almost entirely disappeared, and men now wonder that any benefit could ever have been supposed to have accrued from such absurd and monstrous regulations. But the change to a more liberal state of things, though constant, has been slow, and the policy of the Middle Ages, in the process of modification and extinction, gave place to the so-called and more modern policy of "protection," which, while clearly recognizing the impolicy of interfering with domestic exchanges, regards foreign trade as something different from any other trade, which it is for the interest

of the state to interfere with and regulate. But under the same influences of a progressive civilization this system too, in like manner, is disappearing.

In this work of progress Great Britain took the lead in 1841; not from a change in popular sentiment due to better acquaintance with theoretical principles, but from a realization on the part of all classes of the people of the results which the recognition and practice of the policy of protection during a period of many years had entailed upon the country. These results Mr. Noble, in his work, *Fiscal Legislation of Great Britain,* thus describes: "It is utterly impossible," he says, "to convey by mere statistics of our exports any adequate picture of the condition of the nation when Sir Robert Peel took office in 1841. Every interest in the country was alike depressed; in the manufacturing districts mills and workshops were closed and property depreciated in value; in the seaports shipping was laid up useless in the harbor; agricultural laborers were eking out a miserable existence upon starvation wages and parochial relief; the revenue was insufficient to meet the national expenditure; the country was brought to the verge of national and universal bankruptcy." England, therefore, as it were, under compulsion, and with very grave doubts on the part of many of her ablest financiers and economists, under the lead of Sir Robert Peel abandoned protection as the national policy, and gradually adopted the opposite principle of free trade with all the world. The same author above referred to, writing in 1865, draws the following picture of the results of the change of policy referred to, based on the experience of near a quarter of a century: "It has rendered agriculture prosperous, largely augmented rent, vastly extended manufactures and employment, increased the wages of labor, and, while securing the collection of an increased revenue, has by improving the value of property lessened the burden of taxation. It has been shown, also, that each successive development of this beneficent legislation has extended these results."

The experience of Belgium is even more instructive. During the French occupation of this country under the First Napoleon the protective system was carried out, practically and under military rule, to a degree rarely if ever equalled. Not only was the introduction of all foreign goods into the country strictly forbidden, but all goods of foreign production found within the state were seized and burned, and the persons concerned in their importation summarily and severely punished. The result of such a system was that when the Dutch reassumed the sovereignty in 1814 the whole country had become desolated and to a considerable extent depopulated. The Dutch, however, brought in a new fiscal and commercial policy, one cardinal feature of which was a limitation of duties on imports to *three* per cent. on raw materials and six per cent. on manufactured articles. Under this liberal legislation the principal manufactures of Belgium again sprang into existence. But a deep-rooted antagonism between the Dutch and the Belgians led to a separation of the two countries in 1830, when, mainly through a hatred of the old government and its policy, the previous free-trade legislation was repealed, and from 1830 to 1855 high protective and discriminating duties were imposed on imports. But in 1851 the finance minister, in his place in Parliament, declared that if this policy was continued it would prove the ruin of the whole system of domestic industry; and in 1855 the Parliament and the people so fully acquiesced in his opinion that protection in Belgium was swept away at once and for ever, and the duties on imports arranged purely with a view to revenue.

In 1860, France followed the examples of England and Belgium, and abrogated to a very great extent the restrictions which it had formerly imposed on foreign commerce. Although consequent disaster to French industrial interests was by many confidently predicted, the result showed that the progress of the trade of France with foreign countries was more than twice as great during the seven years immediately succeeding the full operation of the new policy as it was during the twenty-one years immediately previous. Speaking more specifically, France in 1859, under a restrictive system, exported manufactured articles to the value of $260,000,000; in 1867, under a freer system, this same class of exports had increased in value to $556,000,000. In 1859 the general foreign trade of France was returned as amounting to $1,082,000,000; in 1866 it was $1,625,000,000. In fact, so marked has been the increased commercial prosperity of France under a comparatively liberal fiscal policy that the French nation, although strenuously urged to abandon it after the disasters of the war of 1872, and under a pressing necessity for more revenue, have nevertheless refused to do so.

Similar illustrations might also be given from the history of the commercial and fiscal experience of the states comprising the German Zollverein. In short, all the leading commercial nations—the United States only excepted—have of late years relaxed their commercial systems, and progressed in a greater or less degree towards free trade. In the U. S., on the contrary, the principles of the protective system have since 1860 been reapplied, and are still maintained, with a degree of rigidity and on a scale of magnitude which have no precedents in recent commercial history. The general result has been (1875) to assimilate the industrial condition of the country to the condition of Great Britain in 1841 (before described), when the protective system was from necessity abandoned. In place of effecting national industrial independence, or emancipation from national dependence on foreign skilled labor, as it was confidently claimed that the system would do, it has, in fact, produced the exact contrary result; the import of the products of foreign skilled labor having greatly increased, while the export of similar products has comparatively and absolutely diminished. The inability to export such products, moreover, has practically limited the growth of the so-called manufacturing industries of the country to the demand for domestic consumption, and forbidden any enlargement of them consequent upon the increasing ability and desire of other nations to consume, and the increased facilities for effecting international exchanges. As a further legitimate sequence, the commercial marine of the U. S. has been all but annihilated, as is shown by the fact that while in 1860, 71 per cent. of the total foreign trade of the U. S. was carried in American bottoms, in 1873 the proportion was less than 30 per cent. One of the most striking illustrations that could possibly be presented of the evil effect of commercial restrictions in limiting trade and industry, and consequently national development, is to be found in the history of the commercial relations between the U. S. and the British North American provinces. Thus, in 1852–53, in the absence of anything like commercial freedom, the aggregate exchanges between the two countries amounted to only $20,691,000. The subsequent year a treaty of reciprocity went into effect, whereby the people of the two countries were enabled to trade and exchange their products with little or no obstruction in the form of import-duties. The result was that the aggregate of exchanges rose the very first year of the operation of the treaty from $20,691,000 to $33,494,000, which subsequently increased, year by year, until it reached the figure of $55,000,000 in 1862–63, and $84,000,000 in 1865–66. In this latter year the treaty of reciprocity was repealed, and restrictive duties again became operative. The result was that the annual aggregate of exchanges immediately fell to $57,000,000, and in 1873, seven full years after the expiration of the treaty, when both nations had largely increased in wealth and population, the decrease of trade consequent on the abrogation of the treaty had not been made good.

Again, in 1873, the freight—meaning thereby commodities—transported on the railroads of the U. S. was probably in excess of 200,000,000 tons. If we assume each ton to be worth, on the average, $50, the value of the exchanges effected through the agency of the railroads of the U. S. was in excess of $10,000,000,000; or, in other words, the population of the country being 40,000,000, every 4,000,000 of the people exchanged commodities among themselves, through the agency of railroads, to the extent of $1,000,000,000. It is true that much of this freight was transported backward and forward in different forms over the same routes, and did not all represent a direct movement between the producers and consumers; but it is safe to assume that not a ton was transported a single mile except for the real or supposed advantage of the owner. Now, on the North American continent there are about 4,000,000 of people inhabiting the British provinces and 40,000,000 inhabiting the territory of the U. S. The line which separates them is an imaginary or geographical one, and not a physical one, and, were it not for commercial restrictions arbitrarily imposed by the legislators of the two countries, men and commodities could pass as freely as they now do between different sections of the provinces or different States of the American Union; and yet these same restrictions were sufficient in 1873 to reduce the aggregate value of the commercial exchanges between the 4,000,000 of people in Canada and the 40,000,000 of people in the U. S., through every variety of instrumentality, to the sum of $82,000,000; while the same number of people on one side of the line, in the U. S., exchanged between themselves, through the agency of railroads alone, to the extent of $1,000,000,000. It is also curious to note of the people of the U. S. that so well satisfied are they of the principles of free trade when applied to domestic transactions, that they will not allow the creation or maintenance throughout the whole of the broad territory they inhabit of the slightest artificial obstruction to the freest exchange of products or to the freest commercial or personal movement; and

that, too, notwithstanding the different States and Territories into which the country is divided differ among themselves in respect to wages of labor, prices of commodities, climate, soil, and other natural conditions, as widely as the U. S. as a whole differs from any other foreign country with which it is engaged in extensive commercial intercourse. And yet we have the striking and anomalous circumstance that a very large number—perhaps a majority—of the American people regard trade with foreign nations as something very different from trade among themselves, and as such, therefore, to be subjected to entirely different laws and conditions. But a slight examination ought, it would seem, to satisfy, that foreign trade presents no element peculiar to itself, but only the same elements which domestic trade presents, and that, consequently, the same laws and conditions that are applicable to domestic exchanges are equally applicable to foreign exchanges. Men, moreover, do not engage in any trade, foreign or domestic, for mere enjoyment or pleasure, but for the material gain which accrues to both parties. They desist from it also so soon as the mutual advantage ceases. The relation, then, which government ought to sustain to the whole question of exchanges is well expressed in the answer which the merchants of France gave to Colbert more than a century and a half ago, when he asked their advice and opinion "how he could best promote commerce"—"*Laissez-nous faire*" ("Let us alone").

(For further information on the subject of free trade reference is made to the following publications: BASTIAT'S *Sophisms of the Protectionists* (American translation); *Catechism on the Corn Laws*, THOMPSON, London (scarce); *Does Protection Protect?* GROSVENOR; *Reports of the Special Commissioner of the Revenue of the U. S.*, 1865–70; *The Parsee Letters*, published by the *New York World*; *Notes on the Fallacies Peculiar to American Protectionists*, LIEBER; and the various treatises on political economy by MILL, MACLEOD, CAIRNES, AMASA WALKER, PERRY, etc.) (See PROTECTION and TARIFF.) DAVID A. WELLS.

Free'ville, a v. of Dryden tp., Tompkins co., N. Y., at the crossing of the Southern Central and Ithaca and Cortland R. Rs.

Free-Will, or **Freedom of the Will** (see WILL). Freedom, with reference to the will, has been variously defined, the definition as a rule being the result of a theory, not a preliminary to it. The conflict has been in part on the question whether the will is free. (See FATALISM, NECESSITY.) But more generally it has turned upon the question, What *is* the freedom of the will? each party here conceding its freedom, but not in the sense claimed by the other. The point of division is this: Does the will necessarily and solely decide under the influence of determining causes or motives external to itself, or is its ultimate decision a self-conditioned, self-determined act? The objection ordinarily made to the first view is that it reduces the will to a necessity which destroys accountability; the objection to the latter view is that it seems to give absoluteness to the finite, a power of origination to the creature, or to make the human will a final cause, and thus to remove it out of the category of all other created things. The great argument for the second view is the seeming consciousness and the indisputable sense of accountability. The great argument for the first view is its consonance with the law of causality. (See CAUSE.) In theology the question of free-will is associated with the doctrines of the FALL, GRACE, PREDESTINATION, and SIN. (See those articles.) In the history of the doctrine the names of Augustine and Pelagius are specially representative. The Greek Church had a semi-Pelagian leaning; the Latin Fathers tended to the views which came into full expression in Augustine. The mediæval theology prevailingly leaned to semi-Pelagianism. It praised Augustine, but followed Pelagius. In the Reformation the Lutheran and Calvinistic churches took strong ground against the entire Pelagian tendency, while Erasmus and Zwingli were in various respects in affinity with it. The theory of SYNERGISM (which see) was an attempt at harmonizing the two views. The latest theology is largely synergistic. The churchly theologians of our time, standing fast, in the main, by the old confessional position, yet give more prominence than the old divines did to the reality and value of the general operations of God's grace and providence on men at large, in supplying the defects of moral nature, and in preparing them for the more specific regenerating work of grace. (For the philosophical aspect of the question see FATALISM, MATERIALISM, PANTHEISM.) The two latest works of marked ability on the subject are by Scholtens and Luthardt, the former maintaining, the latter rejecting, the doctrine of determinism. (For literature of the subject see WILL.) C. P. KRAUTH.

Freewill (or **Free**) **Baptists.** This title properly covers several organizations of Baptists, such as Freewill Baptists, Free Baptists, General Baptists, and Separate Baptists, as they agree in doctrine and are in intimate fellowship. Their doctrinal peculiarities are a belief in a general atonement, the possibility of salvation to all men, the freedom of the will, involving man's ability to choose or refuse to accept Christ, and the original, inalienable right of true believers to commemorate the death of our Lord and Saviour in His supper. In other respects they do not differ from the larger Baptist body. They are tenacious for a converted church membership, the baptism of believers only, immersion only for baptism, the independence of the local churches, the right of every member, male and female, to vote and speak in the business and social meetings of the churches, and the separation of Church and State.

Previous to 1750 the Baptists in America lacked the elements of growth. In more than a hundred years they had not attained to a membership of over 3000 in the whole country, and these were mainly immigrants from Great Britain, scattered from Maine to the Gulf of Mexico. Some of them held to limited, and some to general, atonement; some were for open, and some for close communion, but they were all sadly deficient in spiritual power. In no proper sense can they be regarded as the legitimate parents of the existing Baptist family, which has now grown to millions, they having contributed to this great body of Christians little more than a name. Both branches of Baptists really had their birth in the great revivals under Edwards, Wesley, and Whitefield. The Methodists and Baptists had a common spiritual parentage; have grown with marvellous and about equal rapidity under the mighty impulse received from the great revivalists. They were born in revivals, and have grown by their continual recurrence. From 1745 to the end of the century many separate congregations were formed of persons who were not satisfied with the cold, formal, powerless life in the regular New England churches. The new churches were known as New Lights and Separatists. A large portion of them ultimately rejected the doctrine of infant baptism, and adopted immersion only as baptism, which made them Baptists in fact, and led them finally to take that name. Their zeal and spiritual power were such that they soon filled the whole land with their doctrine, and planted churches with marvellous rapidity. Great freedom of thought, independence of inquiry, and boldness of utterance prevailed among them, and no little diversity on many points of doctrine and practice. Some were high Calvinists, others believed in general atonement; some rejected unimmersed believers from the Lord's table, others invited them. Discussions were often sharp, but zeal for souls overshadowed every other impulse and gave character to all their measures. As early as 1751 there were several churches in Rhode Island and Connecticut that held to a general atonement and free communion. In 1785 they formed the Groton Union Association, which in 1790 contained 10 churches and 1521 members. From this location and this type of Baptists colonies went out to various sections, preaching a free gospel and the oneness of saints. Shubael Stearns, with others, went to North Carolina in 1751, and planted churches which spread all through Virginia, Tennessee, and South Carolina, and extended over the whole South and Southwest. They were known as Separate Baptists. From 1780 to 1800 a movement was inaugurated to effect a union between them and the section known as regular Baptists, which was mainly successful, under an agreement that they should not be required to subscribe to the severer doctrines of Calvinism. But some of the Separatists declined to enter into the union; a portion who did do so afterwards withdrew. A section of them in North Carolina and Tennessee afterwards took the name of Freewill Baptists, another portion took that of General Baptists, while some held, and still hold, to the old name of Separate Baptists. Previous to 1783 a colony removed from the churches in Westerly, R. I., and Stonington, Conn., to Rensselaer co., N. Y., under the lead of Benjamin Carpe. A church was formed, great revivals followed, and churches multiplied, spreading westward through the State and into Canada. They took the name of Free Communion Baptists, but have since dropped "Communion," and use the shorter name of Free Baptists. They were not Calvinists really, though generally believing in the "perseverance of the saints." In 1779 a discussion arose among the Baptists in New Hampshire on the doctrines of Calvin, which resulted finally in a division. Benjamin Randall, a young man converted under the preaching of Whitefield, was called to an account for holding to a general atonement and the ability of sinners to accept of Christ: and he was disfellowshipped. He united with a church in Strafford, which endorsed his views, was ordained at New Durham in 1780, and in connection with others of like faith labored with great zeal and abundant success for the conversion of sin-

ners and the founding of churches. Their opponents called them "Freewillers," but they rejected that name, claiming that they were Baptists, and continued to do so until 1800, when the name had become so fixed upon them that they adopted it without further opposition.

Neglect to provide an educated ministry, and to give their ministers a proper support, so that they could give their whole time to the gospel, has seriously hindered the growth of Free Baptists. They have confined their labors chiefly to rural districts, and in the great rush of population to cities and villages have been constantly depleted and kept weak. But in the last twenty-five years they have rapidly changed for the better in these respects; education has become general, and the ministry is fairly supported. They now have three colleges, and a fourth in process of erection, two theological schools, and a large number of academies of a high order. Bates College, at Lewiston, Me., has an invested capital of over $500,000; Hillsdale College, at Hillsdale, Mich., a capital of over $200,000; Ridgeville College, at Ridgeville, Ind., a capital of about $100,000; and the new college at Rio Grande, O., a capital already secured of about $150,000. The aggregate membership of the several bodies of Free Baptists is not far from 150,000. They sustain a vigorous mission in India, employing thirteen missionaries and quite a number of native helpers. The difference between Free Baptists and the larger Baptist body is rapidly decreasing; the doctrines of general atonement, freedom of the human will, and free communion are received with more and more favor among all classes of Baptists; and it is fondly hoped that the time is at hand when all will be united in bonds of fraternal fellowship. G. H. Ball.

Free′zing, the change from a liquid to a solid state, resulting from the abstraction of heat. The zero of the centigrade thermometer, equivalent to 32° F., is the freezing-point of water in ordinary conditions. It has been shown by Dr. James Thomson and his brother Sir William that the increase of pressure upon water, and upon all substances which expand in freezing, will lower the freezing-point. Under a pressure of 13,000 atmospheres water will not freeze at Fahrenheit's zero. On the other hand, such substances as paraffin, which contracts in freezing, have the freezing-point raised by pressure. Artificial freezing can be best induced by the liquefaction of solids or the evaporation of liquids. These processes absorb heat—that is to say, they render it *latent*—and by abstracting it from the surrounding substances freeze the latter. In most cream-freezers the liquefaction of a mixture of pounded ice and salt is the means employed. In artificial ice-making machines the evaporation of ammonia or of the most volatile ethers is the essential element. The most efficient freezing-mixture now known is that of liquid nitrous oxide and carbon disulphide, which has produced a temperature of —220° F. (For freezing of the person see Frost-bite.)

Freezing, Artificial. Artificial freezing has been performed, as a mere laboratory experiment, ever since the middle of the seventeenth century. In 1665, Robert Boyle, fellow of the Royal Society, published his success in the repeated freezing of water and other liquids by various chemical mixtures. He attempted mercury, but remarks, "we could not at all freeze this extravagant liquor, though we tried it more than once." Leslie's freezing of water by sulphuric acid in a vacuum in 1810, and Faraday's long-subsequent achievement of solidifying water by sulphurous acid evaporating in a red-hot crucible, are only two of the many well-known varieties of this class of experiments. In what follows we shall briefly refer to four natural principles or methods by which the freezing of water has long been attempted on a considerable scale, and with more or less success for economic purposes.

1. *The Intermixing of Various Chemical Substances.*—Thus, a solution of nitrate of ammonia in water depresses temperature 46° F. The nitrate may be recovered by evaporation, and employed again. (For other and considerably more frigorific combinations, see article Freezing Mixtures.) They all depend upon producing a solution the specific heat of which is greater than that of the components that enter into the solution. But the superior efficacy of the ordinary mixture of common salt with comminuted ice is mainly due to the consequent liquefying of the ice, by which an absorption of 142° (79° C.) of caloric is necessary for the latent heat of liquefaction.

2. By far a more powerful and a more manageable principle is the absorption of caloric into vapor expanding and escaping from a volatile liquid. The vapor of water is supereminent in requiring no less than 967° (537° C.) of *latent heat*, while ammoniacal vapor requires 925° (514° C.), and sulphuric ether about 164° (91° C.). Yet another facility afforded by the more highly volatile liquids is the low temperature at which volatilization or ebullition takes place under the ordinary atmospheric pressure. Thus, sulphuric ether boils at 95° (35° C.). Faraday published in 1825 his observation that certain of the hydrocarbons boil at or near the freezing-point of water. Pure ammonia boils at —36° (—38.5° C.), while carbonic acid becomes unmanageable by the great tension of its vapor at ordinary temperatures.

3. The re-expansion of compressed air, as well as of other gases, is powerfully refrigerative. The heat developed by compression is first to be absorbed by cold water. Then the re-expansion against pressure *extinguishes* caloric in the gas sufficient, if abstracted from its own weight of water, to depress the latter in temperature at the rate of one degree for each unit of energy expended in expansion, or for the amount of work necessary to raise the same weight 772 feet against gravity. It was a natural although erroneous expectation of the early experimenters upon this principle of refrigeration—and of Leslie himself—that the compressed air when expanded to its original tension would show a depression of temperature of as many degrees as had been abstracted during the compression. But since the physical theory of this subject has been more fully investigated, such an expectation has been shown to be unwarranted.

4. A frigorific agency, not dependent like the foregoing upon either mechanical force or chemical reactions, is afforded, under favoring circumstances, by radiation into the cosmical spaces. Robert Boyle quotes from "the diligent Olearius," more than two centuries ago, a statement that ice was ordinarily produced in the hot climate of Ispahan, the capital of Persia, in layers a finger thick, by pouring water at successive intervals in the night "upon a shelving pavement of freestone or marble." It has moreover long been known that in Bengal and other provinces in India ice is obtained for domestic use by exposing at night shallow earthen vessels resting upon a flooring of dry stalks and leaves in pits two feet deep. Information has also recently come to us through Baptist missionaries in Eastern China as to the existence of a similar practice in that region. In these instances merchantable cakes are produced by superimposing the thin layers one upon another, to unite by simple regelation. This method has been attempted both in England and France with success as a mere experiment, but not to the extent of economic value. It is a study for philosophers to explain how it could succeed, even as an experiment, in a warm or temperate atmosphere. There is testimony, however, that, in advance of the modern ice-machines, Persia, India, and China have been the homes of an economic ice-production; and for purposes of luxury vessels of ice produced by chemical mixtures have long been in Europe, and in Paris especially, an article of use at table, in addition, there and everywhere, to the ices and creams congealed in vessels surrounded by ice and common salt.

To the utilization of chemical affinities for frigorific purposes the only requisites are a simple commixture or solution of the substances employed, and a flow of the cold mixtures upon or along metallic sheets or surfaces containing the substances to be cooled. Non-conductors of heat are employed for protection externally against radiation and the atmospheric warmth. In the employment of volatile liquids the evaporation is effected by drawing off or exhausting the vapor from the cooling vessel as fast as it is formed, either by a gas-pump or by the affinity of a liquid or other substance which will absorb the vapor with great avidity. Such, for example, is the affinity of water or of chloride of silver for ammoniacal gas, or of sulphuric acid or anhydrous chloride of calcium for watery vapor. Another mode of disposing of the vapor might be, in certain instances, to condense it upon a cold surface present in the evaporating vessel or in communication with it. A familiar illustration of this last expedient is the philosophical apparatus known as the "cryophorus;" another is the common laboratory paradox of making water to boil in a flask by affusion of cold water on the outside.

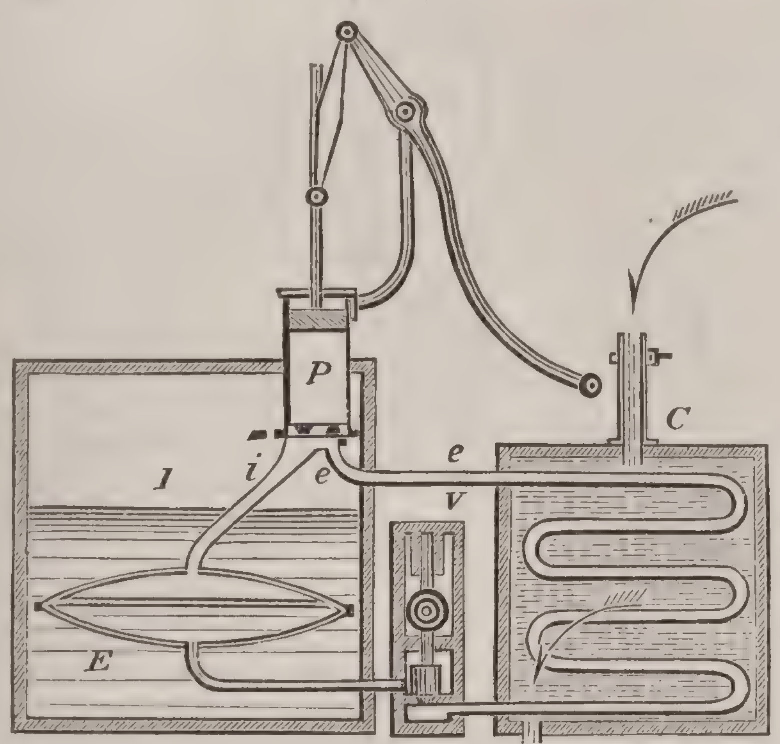
Within the last quarter of a century the utilization of the foregoing principles and processes has risen to the rank of a new art and manufacture. Its principal centres or localities at the present time are New Orleans, La., and Victoria and Sydney, with one or two other prominent localities, in Australia. At New Orleans some 50 tons a day are now the average production, at a first cost of $7 to $8 a ton, and a selling price of $15 to $20. The production, both there and in Australia, where a different process is used, approximates to seven tons of ice produced for every ton of coal consumed. In the U. S. and in Asia there are many scattered machines, concerning which we have no distinct information. Our object is to supply a succinct account of this new art from its origin to the present time.

The purposes to which refrigeration on a large scale may be usefully applied are numerous. Prominent among them are the preservation of perishable articles in storage, of

meats and fruits in transit by railroads or in ships, the cooling of liquors and condensing of vapors in brewing and distilling, and the regulation of temperature in buildings. Each of these purposes will have its own methods and forms of apparatus. But, inasmuch as these miscellaneous applications are but incidents and offshoots of the main invention, as well as because none of them have hitherto been characterized by any signal success, the following descriptions will be confined to the apparatus and operations specially adapted to the manufacture of ice.

Historically, as well as naturally, the progress of this branch of invention has related, first, to methods *for producing cold,* and afterwards to the methods of *applying the cold* with commercial economy. The first available apparatus for the *continuous production* of cold was the invention of a citizen of the U. S. in England, where his invention was patented in 1834.* Perkins proposed to operate by a gas-pump P (Fig. 1) which should evaporate sulphuric ether in a vessel E surrounded by water or other liquid in I, and force the ether vapor, through *e*, with compression, into a metallic coil in C, cooled by water flowing outside in contact with it. The cold and pressure restore the ether to its liquid condition, and the superior pressure in C forces this liquid, through the weighted valve in the vessel V, back into E, to be evaporated anew. The liquid in I will be cooled, and, in case it is water, may be congealed on the outside of E. But the apparatus is obviously not adapted to congelation, but only to refrigeration on a small scale.

FIG. 1.



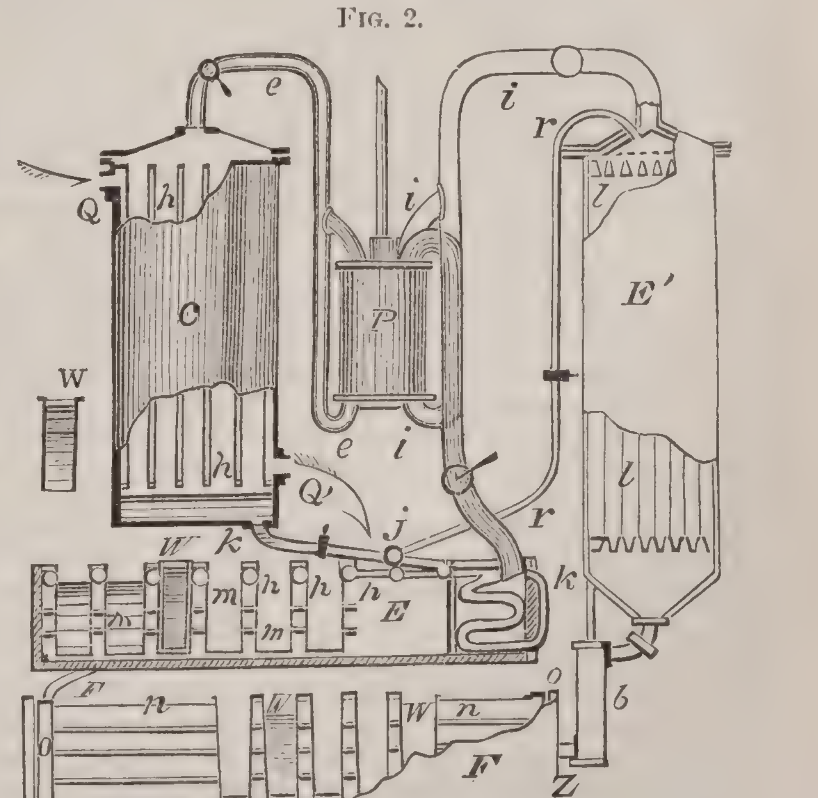
Perkins was soon followed by imitators, especially in France, but, with one exception, they added nothing essential. This exception was the French patent of E. Bourgois, taken out in 1846 for the employment of the hydrocarbons, among other volatile liquids, as Perkins had employed ether, and by an apparatus operating on the same principles, although widely different in form and construction. This apparatus, also, like the former, was obviously meant for very limited uses. Its suggested use of the hydrocarbons was no doubt derived from Faraday's discovery, made known in the *Philosophical Transactions* of 1825, that certain of those liquids have the valuable property, for this use, of being far more volatile than ether, and even of boiling at or near the freezing-point of water.

None of these inventions availed anything for commercial use; yet the American Perkins has undoubted priority, for as much as relates to the continuous production of cold. But in 1848–49 another citizen of the U. S.,† without any knowledge of the Perkins method, reinvented it in a form and with an apparatus fitted to the largest practical use by steam or other power. His invention embraced — as shown by his English patent (No. 13,167) of July, 1850, and the specifications of his fundamental U. S. patent of 1853—those novel forms of apparatus for *applying the cold,* when produced, to the manufacture of ice in commercial quantities, without one or another of which no ice-machine in the world now operates for this manufacture. The first ice-machines covered by this patent were constructed on a small scale at the Cuyahoga Works at Cleveland, O., in 1850. Thence onward to 1856 larger machines were operated, which realized the result, at that time truly surprising, of turning out in a few hours of any day of the summer season nearly a ton of sound, clear, and merchantable ice, in blocks a foot square and six inches thick. This thickness more than doubles what is now attempted by working ice-machines; and it imposed a load which, with other hindrances, interfered with the immediate introduction of the machine into the Southern States of the Union; but public attention was excited both at home and abroad, to these "Cleveland results." ‡ In 1858 the English machine of James Harrison, which he had patented in Mar., 1856, was brought out in London,§ and soon after set up in Australia. It was patterned after one of the modes of construction described in Twining's fundamental patent of 1853, and to this day, both in Australia and elsewhere in the British provinces, all the ice-machines are understood to copy that pattern with certain improvements in details by the original constructor, Daniel Siebe. A sketch of the Harrison machine will be given in outline further on.

The commercial adaptations of Twining's invention, both to the cold-producing and the cold-applying uses on the largest scale, are exhibited in the annexed figure (2). In this sketch the deeply shaded parts represent the same as shown in the patent of 1853, but the fainter outlines are modifications, although covered by that patent, by which the best "Cleveland results" were obtained.

In the shaded parts of Fig. 2 the double-acting gas-pump P draws through *i*, from the "freezing cistern" E, the vapor of "a volatile liquid — as alcohol, ether, sulphuret of carbon, etc."—and forces it through *e* into the pipes *h* of the "restorer" C, where it is restored to a liquid condition by the aid of cold water flowing through Q into and pervading the condensing vessel C, and wasting through Q′, as shown. But the restored liquid re-enters E automatically through the regulated pipe and cock *k*. After coiling around in the anterior compartment, to be cooled by exposure to the issue of cold vapor into *i*, the pipe is prolonged so as to form the so-called "percolator" *p*. Now, the freezing cistern E is a tight box—of which there may be any number side by side—divided across by the equally tight "water-chambers" *m*, open at top. These may be filled with water to be frozen, or, better, they may receive separate "water-vessels" (or moulds) W, with brine or other uncongealable liquid between to assist conduction. The chambers *m* do not fill entirely across, but hug one side of E, from side to side, alternately, so as to afford a zigzag channel along and through E and around *m*, through which a cold vapor or liquid may course across and back alternately, and refrigerate the contents of *m*. This is one form of operation; and the vacant spaces shown between the chambers, and supported across by stays, are sections of the channel.

FIG. 2.



A second form or mode of applying the cold is the following: The "percolator" *p* traverses the upper back angle of E inside throughout, and opposite each cross-vacancy between the chambers *m*, and through them at top, throws off lateral branches, shown in circular section at *p*, *p*, and pierced with minute orifices, which eject the volatile liquid supplied from C through *k*, upon the interior surfaces of the containing plates or sides of *m*, to run down these surfaces in a condition favorable to evaporation, and cool through the plates the liquid in the chambers. In certain cases it was provided that these interior surfaces might be coated with thin absorbent sheets.

* Jacob Perkins, inventor of a new steam-generator and of other novelties much noted at the time. For cooling, see his patent No. 6662.

† Alexander C. Twining, LL.D., then professor of mathematics, natural philosophy, etc. in Middlebury College, Vt.

‡ See the *Cleveland Herald*, and especially "Ice by Machinery" in the *New York Scientific American* of Sept. 13, Nov. 15, and Dec. 13, 1856.

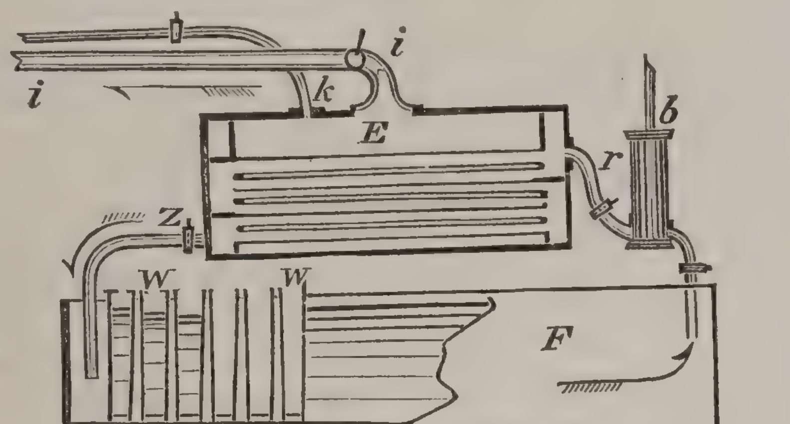
§ See the *Illustrated London News* of May 27, 1858.

A third mode specified in the same patent was the simple one of partially filling the above-described channels between and around *m* by the volatile liquid, the latter as it evaporates escaping through *i*, while the waste is resupplied through *k*.

Still a fourth form or method was described, but reserved for another patent, which was subsequently taken; this will be mentioned below. First, however, let it be observed that the best Cleveland results were obtained by a freezing cistern or refrigerator F, in which flattened or oval copper tubes *n* were ranged one above another, forming parallel vertical sheets or "stacks," between which the vessels W were set, side by side, in an uncongealable liquid, as shown in outline merely. The cold liquid was circulated by a force-pump *b*, which drew it from the separate evaporating vessel E′, and returned it to the colander at top of the same, to run down on the cloths *l*, and be cooled anew. The circulating liquid was ether, and it became cooled, while running down the cloths or sheets *l*, by its own partial evaporation, maintained by F. This vapor, after condensation in *c*, is returned by *k* into *r* by simply turning the uniting cock *j*.

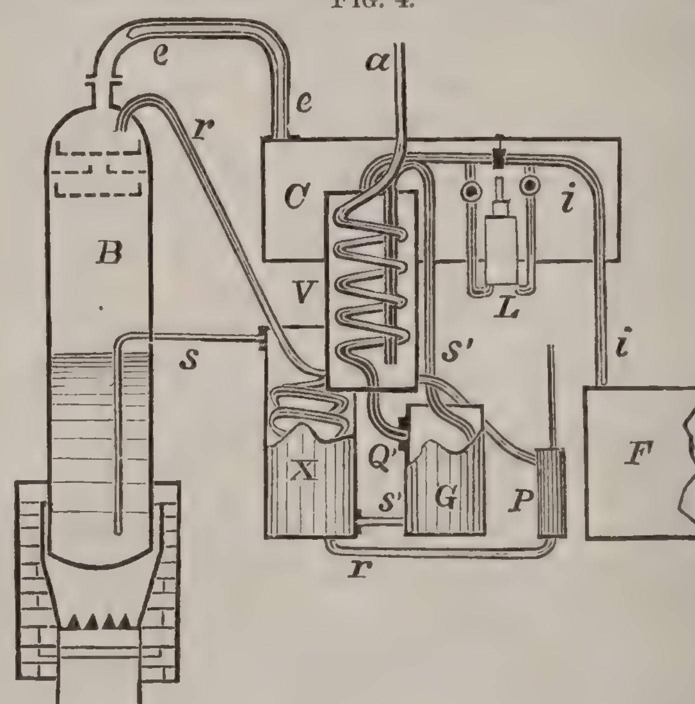
The English machine of Harrison is shown by Fig. 3 in its distinctive features. The following quotation from the above-described fundamental U. S. patent of 1853 exactly anticipates and describes its plan and operation—viz.: "There may be an auxiliary cistern of a tubular, or coiled, or other convenient form, which may hold or be open to ether, and be surrounded by the alcoholic or other suitable mixture or liquid to be cooled by contact with the auxiliary cistern, and by the exhaust of *a* (the gas-pump) evaporating ether within the latter. The liquid thus cooled may flow or be drawn out of its containing vessel into *d* (the freezing cistern), and there perform the freezing office heretofore ascribed to the ether." In Fig. 3 the cooling or evaporating vessel is E. The horizontal pipes within it are submerged in ether; and a circulation back and forth is maintained by the force-pump *b*, and determined by the interior partitions, so that the brine or uncongealable liquid to be cooled is drawn from the trough F by *b*, and forced back into it through *z*. Meanwhile, the ether is constantly evaporated by a gas-pump through *i*, and the restored vapor sent back in a regulated current of liquid through *k*. The water-vessels or moulds are arranged side by side in F, and the cold brine or medium from E flows through it with a slight descent. The vessels nearest *z* are first frozen, and removed, after which the lower vessels are successively and mechanically pressed forward, and the newly-filled vessels placed at the vacancy thus formed at the lower end of the trough. Our object does not call for, nor our space allow, further details.

Fig. 3.



It was not until after the English machines had become an assured success, and publicly known as such, that M. Ferdinand P. Carré of Paris, France, undertook his enterprises in refrigeration, which were at first simply a reproduction of the American inventions above described, but resulted in the successful application to the ice-manufacture of his very effective apparatus and combination for producing cold by ammoniacal gas, without mechanical appliances for evaporating and recondensing. Carré's fundamental principle and process had been known on a small scale by Faraday, and they had been made known by him by publication in the *Transactions of the Royal Society* so early as 1823. In fact, Carré's simple intermittent apparatus, as patented in 1859 in France and in 1860 in the U. S., exhibits no considerable advance upon that of Faraday. But the ultimate development of the ammonia-machine, as shown in his English patent of Oct. 15, 1860, must ever form an epoch of the highest importance in the history of the ice-manufacture. Attempts have been made to deprive M. Carré of the credit of his invention. Nearly five years subsequent to the date just mentioned a patent was applied for in the U. S. by Messrs. J. Mignon and S. H. Renart, in their own claim, for the selfsame contrivance, and the application was granted; yet, notwithstanding this, we have done M. Carré the justice to ascribe to him the full credit of the apparatus which is familiarly known by his name. We have to regret that a similar spirit of fairness has not been exhibited toward our own countrymen by foreign writers, even when speaking under the responsibility of official obligation. The early machines of Carré, as has just been stated, and his early patents, were simply the ether cold-producing apparatus of Perkins, combined with the cold-applying apparatus of Twining; yet the French commission appointed in 1858 to examine and report on this ether-machine did, through M. Gaugain, ascribe the credit wholly to Carré, as was claimed by him, and as such sequestered it for the honor of France. Yet the ammonia-machine itself, both as originally patented by Carré, and subsequently patented again under a different claim in America, is, in all its apparatus for the application of cold, from beginning to end—in other words, from the escape of the gas out of the retort in which it is expelled from its aqueous solution, up to its final discharge from the refrigerator into the vase of absorption—simply a reproduction in every essential detail of the U. S. patent of 1853. Carré's real improvement consisted in the choice of such a volatile substance as, by its peculiar affinities, permitted him to dispense with mechanical compression on the one hand to reduce it to the liquid state, and with mechanical exhaustion on the other, to remove it, after it has served its purpose, from the refrigerator. We present below the distinctive features of this invention.

Fig. 4.



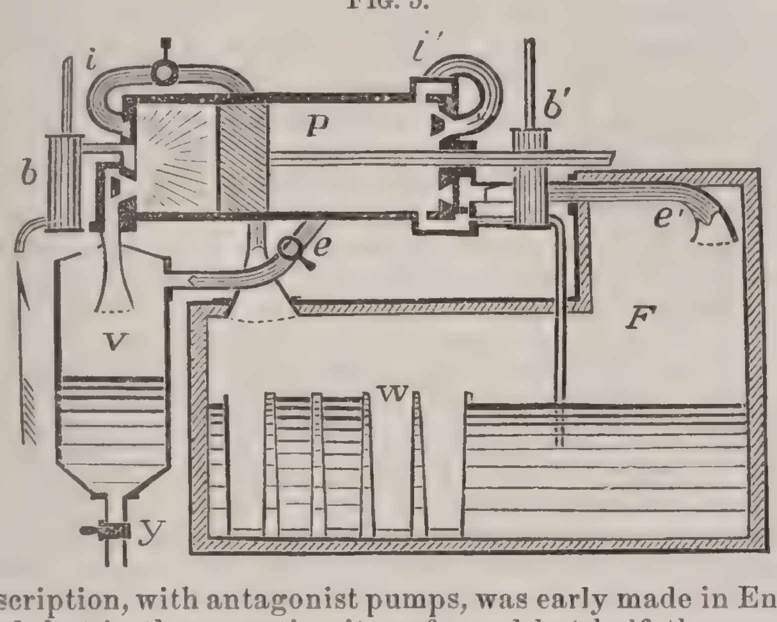
The retort B contains aqua ammoniæ in a state of ebullition over a furnace. The expelled ammonia, after being purged of watery vapor by permeating a shower of relatively cool return liquid coming through *r* into colanders at top, is forced through *e* into the pipes of the condenser or liquefier *c*, and condensed by cold water flowing around those pipes, similarly to the like in Fig. 2. We refer to the descriptions of that preceding figure for the consecutive treatment and performance of the volatile liquid after its issue in vapor from the retort till its escape from the tubular refrigerator F by evaporation in its parallel vertical sheets or stacks of metallic pipe. These last are analogous to *n*, and they admit the moulds W between them, with the uncongealable liquid perfecting contact between the moulds and the refrigerating surfaces. Returning to Fig. 4, we have the cold vapor drawn through *i* into the vase of absorption V by its affinity for, and solution in, the cooled and weak liquid which enters at top through *s′*. The heat evolved by this solution is abstracted by cold water flowing through the coil Q Q′. This solution, or "rich liquor," is drawn out by the exhaust and force-pump P, and thrown back into B. On its way it acquires heat by rising in a coil up through the "exchanger" X, which is traversed in the opposite direction by hot "weak liquor" coming from the retort through S. Equally, the hot liquor parts with caloric, and afterwards is further cooled in the coil *s′* which traverses G, surrounded by cooling water. Lastly, it is discharged into V at top, to perform the requisite absorption of the cold gas from F. That cold vapor, on its way, has contributed to cool the water for freezing, which is contained in a long sleeve, not shown, but surrounding the entire upper segment of *i*. But the rich liquor is showered into B through *r* and top colanders.

The Carré machine, notwithstanding this simplicity and directness of action, is encumbered by its great first cost of construction, and is subject to leakage and a rapid corrosion of the pipes, which have not a lifetime of more than five to six years. Its chief disadvantage, however, is the drawback upon evaporation imposed during much of the year in hot climates, by a reaction in the refrigerator from the vase of absorption of the large amount of pressure due to the high temperature of the natural cooling waters. A

very simple and inexpensive remedy for this defect has, it is true, been invented and patented by the originator of the Cleveland results; but the sagacity of operators has not yet made it available to their manufacture. This is partially exhibited at L, by the broken lines in the figure. These tracings show simply a small transfer-pump between V and F, which interposes a bar to the excess of pressure in the vase, and will by opposite and corresponding actions at once invigorate absorption in that vessel and evaporation in the refrigerator.

It remains to describe another American invention—an atmospheric ice-machine of great theoretical beauty. It was invented by Dr. John Gorrie of New Orleans, and patented both in this country and in England about 1850. It forms the basis of the present Windhausen machine; which last is, to our view, apparently the less simple of the two, whether in construction or operation, although perhaps the more effective. But its merits—for certain valuable refrigerating purposes at least—are not yet ascertained to their full probable extent. Fig. 5 exhibits the Gorrie invention, using, however, but a single air-pump, whereas the original plan embraced an antagonist pump as well. There is a freezing-room F in which the moulds W are set in a bath of uncongealable liquid, as shown, and with air of freezing temperature, or nearly that, above. The piston of P, while moving towards the head, draws in air from F, and by its return stroke first compresses the air, and then forces it with great pressure into the strong reservoir V, while the force-pump *b* injects in spray a mass of cold water, which is also forced into V, and there separates from the air and escapes through the regulated aperture *y*. But the same return stroke opens the exit-pipe *e* for the compressed air in V to expand into P, and assist its mechanical operation. At the same time *b′* injects a mass of the uncongealable liquid drawn from the bath below, and forces it back intensely cooled by the expanded air into F through *e*, together with the air received from V. (Fig. 5.) A large machine of this

Fig. 5.



description, with antagonist pumps, was early made in England, but in the operation it performed but half the promise, and was ruptured during action—perhaps by accumulation of the injected liquids. Very probably, however, the Gorrie invention has never yet received its best form and development.

In addition to the foregoing, a passing notice is due to the machine of Charles Tellier. This, it is true, does not differ essentially from the ether machine which has been described already. In fact, a complete explanation of Tellier's operation will be found in the third mode of that described above under Fig. 2—that is to say, the mode in which the chambers *m* are directly filled with water to be frozen without emptying the moulds W or the uncongealable liquid; and in which the evaporating channels between the chambers are kept nearly full, or sufficiently supplied with volatile liquid which the gas-pump is constantly evaporating. Two things, however, are peculiar. The first is, that when the chambers are frozen throughout, and the evaporating channels emptied of the liquid, vapor enough of the condenser or restorer *c* is admitted to these channels to condense upon the interior surface of the plates and thaw the ice-cakes loose. The other is, that methylic ether is employed as the volatile liquid. It possesses the advantage of a boiling-point at atmospheric pressure, several degrees below the freezing-point of water, and yet of condensing with a manageable tension at ordinary temperatures. It is easy to conceive of good results from a machine operated under such conditions.

A comparatively inferior consideration is due to the sulphuric-acid apparatus of Mr. Edmond Carré of Paris, which operates on the principle applied by Leslie two-thirds of a century ago. This apparatus is described fully in the report on the Paris Exposition above referred to, at p. 367. But the constantly recurring necessity of renewing the acid employed for this apparatus prohibits practically its extended use. Speculatively, it may deserve mention also that an analogous idea, but free from the like objection, is found in Twining's English patent of 1850. An apparatus is there drawn and described, on a scale adequate to continuous economic operation, in which water, slowly percolating into shallow vessels in a vacuum, is partially evaporated, and its vapor arrested by a cold surface from which the frosty deposit is removed by revolution across fixed edges, the water in the pans being solidified into cakes.

The foregoing descriptions have been prepared with a more careful endeavor to discriminate justly between opposing claims, because the priority due to American inventors has in every instance been appropriated to foreign patentees, and the periodical press of our own country has too generally failed to correct the injustice. It is true, indeed, of the ammonia or Carré machine that in respect to the means employed for the production of cold, it is in many respects original, availing itself very felicitously of the peculiar properties of the substances employed as the vehicle of heat, and exhibiting a high degree of ingenuity and of skill in the adaptation of means to ends on the part of its inventor; but for the manufacture of ice it is safe to say that neither that machine nor any other in the world does, or at present can, be economically maintained in operation without a fundamental indebtedness to American patents.

F. A. P. Barnard.

Freezing Mixtures. When solids are liquefied (fused or dissolved) they absorb a certain quantity of heat, which is thus rendered latent—is no longer indicated by the thermometer. This heat is called *latent heat of fusion or fluidity.* If we mix equal weights of water at 0° C. (32° F.) and water at 79° C. (172.4° F.), the temperature of the mixture will be the mean of the two temperatures, or 39.5° C. (103.1° F.). But if we repeat the experiment with snow or pounded ice at 0° C. and water at 79° C., the temperature of the whole will be only 0°, *but the ice will have been melted.* A quantity of heat, represented by 79° C. (174.2° F.), will have been apparently lost in melting the ice. If we place in a warm room two vessels, one containing a kilogramme of water at 0° C., the other a kilogramme of snow at 0° C., we shall find when the snow is melted that its temperature is only 0°, while the temperature of the water in the other vessel has risen to 79° C. (174.2° F.). This principle is true of all solids: they absorb in melting a certain quantity of heat, without indicating by the thermometer any increase in temperature. The following table exhibits the latent heats of fluidity of a few solids, expressed in heat-units—*i. e.* the quantity of heat necessary to raise one kilogramme of water 1° C.:

Latent Heat absorbed by 1 Kilogramme in Melting.

Ice	79	units.
Sulphur	80.5	"
Spermaceti	82.22	"
Lead	90	"
Beeswax	97.22	"
Zinc	274	"
Tin	277.77	"
Bismuth	305.55	"

The solution of most salts in water is attended with absorption of heat as the salt is liquefied. The following table contains a few illustrations of this principle:

Mixture.	Thermometer sinks—	Cold produced.
Nitrate of ammonia 1 part Water 1 "	From + 50° F. to + 4° F. " + 10° C. to − 15.55° C.	46° F. 25.55° C
Chloride of ammonium 5 parts Nitrate of potassa 5 " Water 16 "	From + 50° F. to + 10° F. " + 10° C. to − 12.22° C.	40° F. 22.22° C.
Chloride of ammonium 5 parts Nitrate of potassa 5 " Sulphate of soda 8 " Water 16 "	From + 50 F. to + 4° F. " + 10° C. to − 15.55° C.	46° F. 25.55° C.
Nitrate of ammonia 1 part Carbonate of soda 1 " Water 1 "	From + 50° F. to − 7° F. " + 10° C. to − 21.67° C.	57° F. 31.74° C.

The most remarkable salt in this respect is the sulphocyanide of ammonium. Phipson (*Chem. News*, xviii. 109) states that on dissolving this salt in an equal weight of hot water at 96° C. (204.8° F.), he was surprised to see the outside of the vessel covered with hoar-frost, and on introducing a thermometer into the solution he found its temperature to be 2°–3° C. below zero (28.4°–26.6° F.); 98°–99° C. of heat (176.4°–178.2° F.) had been required to liquefy the salt. By employing acids instead of water still greater reduction of temperature results:

Mixtures.	Thermometer sinks—	Cold produced.
Sulphate of soda...... 3 parts. Nitric acid, dilute..... 2 "	From +50° F. to — 3° " +10° C. to — 19.44°	53° F. 29.44° C.
Phosphate of soda.... 9 parts. Nitric acid, dilute..... 4 "	From +50° F. to — 12° " +10° C. to — 24.44°	62° F. 34.44° C.
Sulphate of soda....... 8 parts. Hydrochloric acid.... 5 "	From +50° F. to — 0° " +10° C. to — 17.78°	50° F. 27.77° C.
Sulphate of soda...... 5 parts. Sulphuric acid, dilute 4 "	From +50° F. to + 3° " +10° C. to — 16.11°	47° F. 26.11° C.
Sulphate of soda...... 6 parts. Nitrate of ammonia.. 5 " Nitric acid, dilute.... 4 "	From +50° F. to — 14° " +10° C. to — 25.55°	64° F. 35.55° C.

In a suitable apparatus a mixture of 6 parts sulphate of soda (Glauber's salt) and 5 parts hydrochloric acid will freeze 5 parts of water. The best results are obtained when considerable quantities are employed. The lowest temperatures are produced by mixing snow or pounded ice with the salt employed. The salt causes the snow to melt, with the absorption of its heat of fusion, and the water produced dissolves at the same time the salt, which in turn absorbs its latent heat. Such mixtures are used for freezing ice-cream and water-ices, champagne, etc., and for condensing very volatile vapors. The temperature of ice-cream is often 15° F. or lower; 2 parts of pounded ice and 1 of salt are used for ice-cream; 3 parts of crystallized chloride of calcium (cooled to 0° C. = 32° F.) and 2 of snow will freeze mercury, producing a temperature of — 45° C. = — 49° F.

The following are mixtures which may be used for freezing:

Mixtures.	Thermometer sinks—	Cold produced.
Snow or pounded ice 2 parts. Common salt........... 1 "	To — 5° F. " — 20.55° C.	
Snow or pounded ice 5 parts. Common salt........... 2 " Sal-ammoniac......... 1 "	To — 12° F. " — 24.44° C.	
Snow or pounded ice 24 parts. Common salt..........10 " Sal-ammoniac......... 5 " Nitre...................... 5 "	To — 18° F. " — 27.78° C.	
Snow or pounded ice 12 parts. Common salt.......... 5 " Nitrate of ammonia 5 "	To — 25° F. " — 31.67° C.	
Snow...................... 3 parts. Sulphuric acid, dil'te 2 "	From +32° F. to — 23° " + 0° C. to — 30.55°	55° F. 30.55° C.
Snow...................... 8 parts. Hydrochloric acid... 5 "	From +32° F. to — 27° " + 0° C. to — 32.78°	59° F. 32.77° C.
Snow...................... 7 parts. Nitric acid, dilute... 4 "	From +33° F. to — 30° " + 0° C. to — 34.44°	62° F. 34.44° C.
Snow...................... 2 parts. Chloride of calcium, cryst.................... 3 "	From +32° F. to — 50° " + 0° C. to — 45.5°	82° F. 45.55° C.
Snow...................... 3 parts. Potash..................... 4 "	From +32° F. to — 51° " + 0° C. to — 46.1°	83° F. 46.11° C.

(For further information on this subject consult COOKE'S *Chem. Physics;* GANOT'S *Physics;* URE'S *Dict.*, "Freezing;" WATT'S *Dict.*, "Heat.") C. F. CHANDLER.

Fregel'læ, an ancient Volscian town, colonized by Rome in 328 B. C. It stood on the right bank of the Liris, probably nearly opposite Ceprano, and commanded the passage of the river. It was large, opulent, and faithfully devoted to the interests of Rome, but in 125 B. C. it was utterly destroyed by L. Opimius, in consequence of an insurrection. Its ruins doubtless afforded materials for building Fabrateria and other towns near by.

Fregenal' de la Sier'ra, town of Spain, in the province of Badajoz, Estremadura. Pop. 6948.

Frei'berg, town of Saxony, on the Münzbach, at the foot of the Erzgebirge. It is situated in one of the richest mining-regions of Europe, no less than 1500 mines of silver, copper, and lead being worked in the neighborhood, and is the centre of the administration for the Saxon mines. Its mining school, having thirteen professors, a library of 18,000 volumes, a most excellent collection of minerals bequeathed to it by Werner, is a very celebrated institution, and visited by students from all European countries. Pop. 21,673.

Frei'burg, town of Germany, in the grand duchy of Baden, on the western slope of the Black Forest. Its cathedral, commenced in 1122 and finished in 1514, with a tower 367 feet high, is one of the finest specimens of Gothic architecture in Germany. It has a well-frequented university, and some manufactures. Pop. 24,599.

Freiburg, canton of Switzerland, between Berne, Vaud, and the Lake of Neuchatel. Its area is 565 square miles; its population 110,832, of which 93,951 are Catholics and 16,819 Protestants; about 90,000 speak French and 20,000 German. The southern part is mountainous, though none of the peaks reach the snow-line; the northern part is more level. The whole canton abounds in excellent pastures, and although it has some manufactures of straw-plait, leather, and tobacco, cattle-breeding and dairy husbandry are the main business of the inhabitants. The cheese from this canton is said to be the best produced in Switzerland.

Freiburg, a quaint but picturesque old town of Switzerland, the capital of the canton of Freiburg, on the Sarine, over which is built a suspension bridge 906 feet long, 28 feet wide, and 175 feet above the water. Its cathedral is a fine building, with a famous organ having 7800 pipes. Its tanneries and dye-houses are remarkable. Pop. 10,904.

Freiburg (*Unterm Fürstenstein*), town of Prussian Silesia, 35 miles by rail W. S. W. of Breslau. It is a picturesque walled town, with thriving manufactures. P. 6792.

Freight. This term is employed in a variety of significations. In common parlance it denotes goods or cargoes transported from one place to another by carriers, while in its usual legal acceptation it applies to the price to be paid for such transportation. It is also sometimes employed to designate the compensation paid for any use of vessels, including the carriage of passengers. It will only be necessary, however, to consider it with reference to the second of these meanings. The nature of the obligation to pay freight, its amount, and the time of payment may be varied to a great extent by the stipulations in the contract of affreightment, evidenced by the charter-party or the bill of lading. Thus, the shipper of goods may hire the entire capacity of a vessel or some specific portion for a gross sum agreed upon or at certain rate per ton, and he will then be bound to pay for the entire space engaged, even though it be not used, the amount paid for the space not occupied being termed "dead freight." Or the agreement may be to pay only according to the quantity of goods actually shipped, and the sum due might then be varied at the option of the shipper. If no definite stipulations were made in regard to the freight, a contract for its payment would still be implied by law, and its amount would be determined by the usage of trade and the circumstances of the particular case. The general principles governing the contract of affreightment, and not often modified by particular agreement, are—that the ship-owner after receiving a cargo on board has a right to retain it until the completion of the entire voyage of transportation; that his right to claim freight does not exist until the final destination is reached; and that he has then a lien upon the goods for the satisfaction of his proper charges. A partial completion of the voyage only will not give the ship-owner or master a right to insist upon the payment of any freight whatever. The consignor may demand an entire fulfilment of the contract and delivery of the cargo at its destination, and if compliance be refused he may retake his goods and is discharged from all obligation. The lien of the carrier differs from most liens of a maritime nature, in that it depends upon the possession of the goods, and if delivery be made he has only a personal claim against the consignee or consignor. But if there is only a partial delivery of the cargo, the lien on the remainder is not destroyed, but subsists as a security for the entire claim. A carrier's lien is generally enforced in a court of admiralty. The amount of freight-money payable is sometimes diminished by the arrival of the goods at their destination in a deteriorated condition or diminished in quantity. If the injury is occasioned by the negligent stowage or packing of the cargo, or by any default on the part of the master, the damage sustained may be deducted from the freight. But if the deterioration occurred by reason of natural causes, and could not have been prevented by reasonable care, as if the loss should be occasioned by natural waste, decay, or evaporation, or by unavoidable perils of the sea, the carrier is not answerable for the accident, and no diminution from the entire freight is allowed. If articles arrive in substantially the same form as when shipped, even though there may have been a change in their quality affecting their value, it is a general rule that full freight has been earned. Under no circumstances can a cargo which has arrived be abandoned to the ship-master because its value has been so much diminished as to be less than the sum demanded for transportation. If the carrier is responsible for the loss, a counter-claim may be set up against him to neutralize his demand, or, as in England, a separate action may be instituted. If the carrier is not in fault, the goods must be received and the entire freight liquidated.

An apportionment of freight sometimes results as the consequence of a disaster upon the voyage, by which a vessel is compelled to put in at an intermediate port for repairs. The carrier has a right in such cases to retain the goods if he desires, complete his repairs with reasonable expedition, and proceed to his destination, or he may send

them forward by some other vessel and thus earn full freight. But if, notwithstanding the carrier's readiness to complete the transportation, the owner of the cargo desires to have it returned to him, and the carrier consents, there is still a claim for a *pro rata* freight, determinable, according to the general rule, by estimating the amount of the voyage completed upon the arrival of the ship at the port of necessity. But if in such a case the owner should absolutely refuse to allow retention of the goods by the ship-master, and take them from him against his will, freight for the entire voyage may be demanded, because the shipper is alone in fault. And if, on the other hand, the owner of the vessel is in the wrong by refusing to proceed with his voyage according to the terms of the agreement, he is entitled to no compensation whatever.

It is a general principle of the marine law that the earning of freight is a necessary prerequisite to the payment of the seamen's wages, or, as the terse legal maxim expresses it, "freight is the mother of wages." The reason of this rule is based upon the policy of stimulating the sailors to a careful performance of their duties and to the exertion of every effort to prevent disaster to ship or cargo, that the voyage may be successfully completed. But the application of the rule is not extended farther than this reason for its adoption would justify. For if the loss of freight be attributable to the wrongful act of the ship-master or the owner of the cargo, it would be grossly unjust to deprive the seamen of their just compensation; and though the vessel should be wrecked and abandonment become necessary, yet if the sailors used all practicable measures to ensure her safety and reach port, their claims for wages could be enforced. The rule that wages shall depend upon the earning of freight has been abolished in England by statute, but the same result is practically obtained by the provision that a failure on the part of a seaman to exert himself to the utmost to save the ship and cargo shall defeat his claim. In the U. S. the common-law doctrine has not been altered. (See SHIPPING.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Frei'ligrath (FERDINAND), b. June 17, 1810, at Detmold, Germany; entered upon a mercantile life, performing also literary work which attracted much attention. His first volume of poems (*Gedichte*, 1838; 20th ed. 1862; 31st, 1874) won him a pension, which he renounced in his *Glaubensbekenntniss* (1844), a work so full of republicanism that he was prosecuted, and fled to London. He returned and took part in the revolution of 1848; was imprisoned and tried for the political opinions expressed in his poems, and, though acquitted (in the first jury-trial ever held in Prussia), was compelled to leave the country; returned to London 1851, and in 1868 removed to Stuttgart. Among his works are *Ça Ira* (1846); *Die Revolution* (1848); *Neuere Politiche Gedichte* (1849), a masterly translation of Victor Hugo's poems; translations of Burns, of Longfellow's *Hiawatha*, and many English poems. His more recent songs, such as *Hurrah, Germania*, and *Die Trompete von Gravelotte*, are, like all his works, highly popular.

Freind (JOHN), M. A., M. D., F. R. S., b. at Croton, North Hants, England, 1675; was trained at Christ Church, Oxford, where he became chemical professor in 1704; attained great distinction as a physician of London; now chiefly remembered for his valuable *History of Physic* (1725–26). D. July 26, 1728.—His brother, ROBERT FREIND, D. D. (1667–1751), was a celebrated Latin scholar; and WILLIAM FREIND, D. D., Robert's son, was a dean of Canterbury and a prominent preacher.

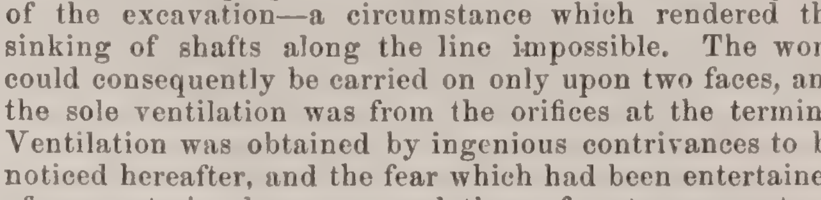
Freins'heim, or **Freinshe'mius** (JOHN), a learned classical commentator, was b. at Ulm in 1608; studied at Marburg and Giessen; went to Strasburg, where he found a patron in Bernegger, rector of the college; published an edition of Florus, with useful notes, in 1632; was made professor of eloquence in the university of Upsala, and after five years' service was librarian and historiographer to Queen Christina. Compelled by ill-health to leave Sweden, he was appointed in 1656 honorary professor at Heidelberg, where he d. Aug. 31, 1660. His labors were devoted mainly to the elucidation of the Latin historians. Besides Florus, he edited Quintus Curtius (Strasburg, 1640, 2 vols. 8vo), in which the missing books were supplied by himself; he supplied also in a continuous narrative, from scattered hints in other writers, the missing books of Livy, first published together by Doujat in the Delphin edition (1679–82). These *Supplements* have been reprinted in some of the later editions of those authors. H. DRISLER.

Frei'sing, or **Frei'singen,** town of Upper Bavaria, on the Isar, 21 miles N. E. of Munich, has a gymnasium, theological, normal, and agricultural schools, and an interesting old cathedral. Pop. 7778.

Fréjus [Lat. *Forum Julii*], an ancient town of Var, France, on the Mediterranean, 45 miles N. E. of Toulon, on the railway to Nice. It is a bishop's see, and has some Roman remains. Its harbor, once a Roman naval station of importance, is almost entirely filled by silt from the river Argens. Pop. 2887.

Fréjus, Col de, Tunnel of, or **Tunnel of Mont Cenis.** The Col de Fréjus is a depression in the crest of the Cottian Alps, lying about 16 miles S. W. from the summit of the Mont Cenis pass, and rising to the height of about 9500 feet above the sea. In consequence of a popular misapprehension as to the exact locality of the gallery excavated under this col by the governments of Italy and France between the years 1857 and 1871, this great work has been known until recently as the Mont Cenis tunnel, but it is now acquiring its proper designation as the tunnel of the Col de Fréjus or Mont Fréjus. Although surpassed in length by some mining adits, this tunnel is the longest subterranean route yet constructed for commerce and travel. Its execution was attended with many difficulties, the greatest perhaps consisting in the abrupt rise of the mountain on both sides to the height of 5283 feet, or a mile perpendicular above the culminating point of the excavation—a circumstance which rendered the sinking of shafts along the line impossible. The work could consequently be carried on only upon two faces, and the sole ventilation was from the orifices at the termini. Ventilation was obtained by ingenious contrivances to be noticed hereafter, and the fear which had been entertained of encountering large accumulations of water was not realized, only two small springs, both slightly mineral, having been met with. Geologists had predicted the character of the rock to be traversed, and their calculations were nearly verified. For a distance of not far from 6 miles from the southern entrance the excavation was in calcareous schist, then followed about 1000 feet of calcareous gypsum and dolomitic rock, then about the same distance of refractory quartzite, and finally about $1\frac{1}{4}$ miles of anthriciferous formation.

The excavations consist of a straight gallery, A B, through



the mountain, and two junction-galleries, C D and E F, to connect with the railway at Bardonneche in Piedmont on the southern, and Modane in Savoy on the northern side. The straight gallery A B is 38,173 feet in length; the junction-galleries C D and E F nearly 2500 and 1500 feet, respectively. The termini at A and B are left open for ventilation and convenience of access, but the railway-track is laid along the line D C E F. The length of the subterranean way traversed by the trains is 42,158 feet, or less than 30 yards short of 8 English miles. The total length of excavation in the straight and junction galleries is 44,117 feet, or 8 miles 626 yards.

The entrance at D is 4236 feet above the sea-level. From this point the grade ascends for 2625 feet at the rate of 2.64 feet per mile; then at the rate of 1.73 feet per mile for 7200 feet; then at 2.64 per mile for 8500 feet; then a summit-level of 1082.4 feet at a height of 4244 feet above the sea; then a uniform descending grade of about 115 feet to the mile to the northern terminus, which is at the height of 3801.4 feet above the sea, or 434.60 feet lower than the southern entrance. The difference in grade of course occasions a difference of some minutes in time in the passage of the trains in the opposite directions.

In the southern portion of the tunnel the arch is a curve of seven centres, with its crown at the height of 19.68 feet above the track; a width of 26.24 feet at the spring, and 25.81 feet at the level of the rails, including a sidewalk or footpath 28 inches in width on each side. On the northern division the arch is the segment of a circle, its crown being 1 foot lower than on the southern. The total amount of rock excavation is computed at nearly 1,000,000 cubic yards. The lining or revetment is of stone of the thickness of from 28 to 40 inches. Where the rock is a quartzite (about $\frac{1}{4}$th of a mile) there is no lining needed, and no revetment has been constructed. About 16,000,000 brick were used for backing and other subsidiary purposes; about 15,000 tons of lime were employed in the masonry, and 1200 tons of gunpowder in blasting. The total cost is computed at about $15,000,000. From 1857 to 1861 the drilling in the southern division, and from 1857 to 1863 that in the northern division, was executed by hand-labor; after those dates by machine-drills driven by compressed air forced into tubes by the power derived from the torrent Medozet near Bardonneche and the Arc at Modane. The air thus supplied not only furnished the necessary mechanical power, but ventilated, and by expansion and escape from the machines cooled the gallery to a moderate temperature. In 1863, the year after the introduction of

the machine-drills, the rate of progress in excavation, including both ends, averaged 7 feet per day; but as experience was gained and mechanical arrangements perfected the rate gradually increased, until in the last year the daily average, including both faces, rose to 14 feet 9 inches, although the distance from the entrance was so much increased.

Near the centre of the tunnel is established an observatory. The temperature at this point is constant at about 85° F., but how far the thermometer is affected by the heat and vapor from the locomotives, the animal warmth from the many laborers and travellers in the tunnel, it is difficult to say. Upon the removal of the last partition of rock between the laboring-parties, a strong current of air poured through from the north, and this, as might be expected from the difference of atmospheric pressure at the two extremities, is said to maintain itself constantly, thus greatly facilitating the ventilation.

As early as 1832, when there were no railroads in Italy, a peasant mountaineer named Médail suggested the possibility of connecting Savoy, then a province of the kingdom of Sardinia, with Piedmont by means of a tunnel under the Col de Fréjus. The project was entertained by the local authorities of Chambéry, and in 1845 the Sardinian government was induced to employ engineers to survey and plan the work. Maus, a Belgian, engaged in this service, invented a drilling-machine which was subsequently perfected by Bartlett, Sommeiller, Grandis, and Grandoni. Colladon of Geneva made the important suggestion that the tunnel might be ventilated, and mechanical force at the same time supplied to the drills, by means of compressed air, and established the practicability of this by trial on a relatively small scale. In 1856 experimental borings were made, and the work was regularly commenced in Aug., 1857, and continued day and night, without interruption, until Oct., 1871, when it was completed. On the cession of Savoy to France in 1860 the empire agreed to pay 32,000,000 francs, or half the estimated expense of the work, but the whole labor was performed under the supervision of the engineers employed by Italy.

The connecting line between the tunnel and the railway from Turin to Susa passes through grand scenery, and was a work of great cost and difficulty. Between Bardonneche and Bussoleno on the plain of Piedmont the railway traverses twenty-three rock-tunnels, measuring all together 4½ miles, and there are numerous bridges, viaducts, embankments, and cuttings of no small magnitude in the course of the same short distance.

(See *Traforo delle Alpi* and other official reports. Popular illustrated works on the subject are Corvino, *Da Torino à Chambéry* (12mo, Turin, 1872); Bignami, *Cenisio e Fréjus* (12mo, Florence, 1871); Bonjean, *Le Mont Cénis* (12mo, Paris, 1871).) George P. Marsh.

Fre′lighsburg, post-v. and port of entry of St. Armand tp., Missisquoi co., Quebec, Canada, near the Vermont line, has a valuable mineral spring and a weekly newspaper. Pop. about 600.

Frelinghuy′sen, tp. of Warren co., N. J. Pop. 1113.

Frelinghuysen (Frederick), b. in New Jersey Apr. 13, 1753; graduated at Princeton 1770; was in Congress in 1775, in 1778–79, and in 1782–83; served with much distinction in the Revolutionary war, rising from the grade of captain to that of colonel; and after the war served as major-general on the Western frontier against the Indians; was a U. S. Senator from New Jersey 1793–96; was an able lawyer, and held various other public offices. D. Apr. 13, 1804.

Frelinghuysen (Frederick Theodore), b. at Milltown, N. J., Aug. 4, 1817, a nephew of Theodore Frelinghuysen, who adopted him as a son; graduated at Rutgers College 1836; was called to the bar in 1839; was appointed attorney-general of New Jersey 1861 and 1866; U. S. Senator 1866–69, and elected again to the U. S. Senate in 1871 for the full term. Resides in Newark, N. J.

Frelinghuysen (Theodore), LL.D., son of Gen. Frederick Frelinghuysen, b. at Millstone, N. J., Mar. 28, 1787; graduated at Princeton 1804; was admitted to the bar 1808; was a captain of volunteers 1812–15; was attorney-general of New Jersey 1817–29; U. S. Senator 1829–35; mayor of Newark 1837 and 1838; removed to New York 1838; chancellor of the University of New York 1838–50; president of Rutgers College, New Brunswick, N. J., 1850–62. D. at New Brunswick Apr. 12, 1862. In 1844, Mr. Frelinghuysen was Whig candidate for Vice-President on the Clay ticket. In public life his acts were ever regulated by exalted moral and religious principles. He favored all measures which might tend to alleviate human misery or misfortune, and was a leader in many charitable and religious enterprises; was for years president of the American Tract, Temperance, and Bible societies and the American Board and other missionary societies. His qualities as a lawyer and statesman were of a high order.

Frelinghuysen (Theodorus Jacobus), b. at Lingen, East Friesland (now in Germany), about 1691; was ordained to the Reformed ministry in 1717; came in 1720 to America, and became the Dutch pastor at Raritan (now New Brunswick), N. J., and preached in that region nearly thirty years with great zeal and success. His five sons, Theodore, John, Jacobus, Ferdinandus, and Henricus, were all ministers of the Reformed Church.

Fre′man, tp. of Woodruff co., Ark. Pop. 487.

Fremont′, county of S. Central Colorado. Area, about 1800 square miles. Its surface is diversified by fertile parks and sublime mountains. Coal, iron, silver, copper, petroleum, building-stone, timber, and medicinal springs abound. It is traversed by the Arkansas River and by a branch of the Denver and Rio Grande R. R. Cap. Cañon City. Pop. 1064.

Fremont, the south-westernmost county of Iowa. Area, 500 square miles. Its soil is fertile. Grain, cattle, and lumber are the chief products. The surface is somewhat broken, but contains much prairie. The county is traversed by the Kansas City St. Joseph and Council Bluffs and a branch of the Burlington and Missouri River R. Rs. Cap. Sidney. Pop. 11,174.

Fremont, tp. of Ouachita co., Ark. Pop. 242.

Fremont, tp. of Santa Clara co., Cal. Pop. 2018.

Fremont, tp. of Yolo co., Cal. Pop. 91.

Fremont, tp. of Lake co., Ill., contains Fremont Centre P. O. Pop. 1015.

Fremont, tp. and post-v. of Steuben co., Ind., on the Fort Wayne Jackson and Saginaw R. R., 50 miles N. of Fort Wayne. Pop. of v. 392; of tp. 962.

Fremont, tp. of Benton co., Ia. Pop. 946.

Fremont, tp. of Bremer co., Ia. Pop. 613.

Fremont, tp. of Buchanan co., Ia. Pop. 554.

Fremont, tp. of Butler co., Ia. Pop. 655.

Fremont, tp. of Cedar co., Ia. Pop. 1160.

Fremont, tp. of Clarke co., Ia. Pop. 484.

Fremont, tp. of Fayette co., Ia. Pop. 499.

Fremont, tp. of Hamilton co., Ia. Pop. 390.

Fremont, tp. of Johnson co., Ia. Pop. 965.

Fremont, post-v. of Mahaska co., Ia.

Fremont, tp. of Page co., Ia. Pop. 307.

Fremont, tp. of Winneshiek co., Ia. Pop. 661.

Fremont, post-tp. of Lyon co., Kan. Pop. 549.

Fremont, tp. of Isabella co., Mich. Pop. 342.

Fremont, tp. of Saginaw co., Mich. Pop. 170.

Fremont, tp. of Sanilac co., Mich. Pop. 640.

Fremont, tp. of Tuscola co., Mich. Pop. 664.

Fremont, tp. of Winona co., Minn. Pop. 1006.

Fremont, city, cap. of Dodge co., Neb., on the Union Pacific R. R., at the junction of the Sioux City and Pacific and the Fremont Elkhorn and Missouri Valley R. Rs., 45 miles W. of Omaha. It has a court-house, a manufactory, 2 steam-mills, 2 newspapers, 1 national and 1 private bank, 5 churches, and a fine hotel. There is a splendid bridge over the Platte near the town. Pop. 1195; of Fremont tp. 1703. Fred. Nye, Ed. "Tribune."

Fremont, post-tp. of Rockingham co., N. H., 30 miles S. E. of Concord, has manufactures of carriages, boxes, lumber, etc. Pop. 527.

Fremont, tp. of Steuben co., N. Y. Pop. 1119.

Fremont, tp. of Sullivan co., N. Y., has manufactures of leather and lumber. It contains numerous lakes and streams. Pop. 2218.

Fremont, post-v. of Wayne co., N. C., on the Wilmington and Weldon R. R., 11 miles N. of Goldsboro', has 2 large lumber-mills, a school, 2 churches, a weekly newspaper, cotton-gins, grist-mills, a large wool-carding establishment, 5 benevolent societies, several stores, and a rapidly increasing population. It has a good trade in cotton, lumber, and naval stores, and there is a mineral spring in the vicinity.

E. R. Ellis, Ed. "Free-Will Baptist Advocate."

Fremont, a v. of German tp., Clark co., O. Pop. 218.

Fremont, city, the county-seat of Sandusky co., O., on Sandusky River and on the Lake Shore and Michigan Southern R. R., 30 miles E. of Toledo. It is the terminus of the Lake Erie and Louisville R. R. It contains the county buildings, 1 national and 1 private bank, 2 hotels, 3 weekly newspapers, 7 churches, and manufactures of

cars, engines, boilers, sash, doors, blinds, tubs, staves, and barrels, and other wares. The late Sardis Burchard gave two valuable tracts of land to the city for parks, and presented $50,000 for a public library. The city has also purchased the Fort Stephenson property, the scene of Croghan's victory, as a public park, on which the library building will be erected. The public schools have a high reputation. Pop. 5455.

A. H. Balsley, Ed. and Prop. "Journal."

Fremont, tp. of Waupacca co., Wis. Pop. 651.

Fremont (John Charles), b. in Savannah, Ga., Jan. 21, 1813. His father was a French immigrant. He received a good education, though left an orphan when four years old, and when seventeen years old graduated at Charleston College, S. C.; taught mathematics; turned his attention to engineering, and was recommended to the government to be employed in the Mississippi survey. He afterwards served at Washington in constructing maps of that region. Having received the commission of a lieutenant of engineers, he proposed to the war department to penetrate the Rocky Mountain region. His plan was approved, and in 1842 he explored the South Pass. Soon after he planned a new expedition to Oregon. He approached the mountains by a new route, examined the region S. of the South Pass, turned aside to the Great Salt Lake, and connected his exploration with that of Wilkes's expedition. He also conducted another party, which discovered new and grand features in Alta California, the great basin called by his name, the Sierra Nevada, the San Joaquin and Sacramento valleys, and determined much of the geography of the far western regions. In 1845 he was again on the road to the Pacific to examine in detail the Pacific slope—a journey which resulted in giving many new facts of importance to the world, and indeed gave California to the U. S. After the conquest of Upper California, in which he bore a conspicuous part, he was involved in a quarrel between two other officers, and was deprived of his commission by sentence of a court-martial. The President offered to reinstate him, but he declined. He retrieved his honor by the survey of a route for a great road from the Mississippi to San Francisco; pierced the hitherto unknown country of the Apaches; defeated or terrified the hostile savages; and in 100 days after leaving Santa Fé stood by the Sacramento; was sent as one of the first U. S. Senators from California, serving 1849–51. He was in 1856 the first Republican candidate for President, in opposition to Mr. Buchanan, the Democratic candidate, and though he received a large vote (114 electoral votes to 174 for Buchanan and 8 for Fillmore) he was defeated. In 1861–62 he served in the Union army as a major-general, and by the Cleveland convention of 1864 was again nominated for President, but soon withdrew his name from the candidacy. He has since the war been chiefly occupied in forwarding the interests of a Southern trans-continental railroad. (See *Dictionary of Congress*, by Charles Lanman.) ✓ A. H. Stephens.

Fremont' Cen'tre, post-v. of Newaygo co., Mich., on the Muskegon and Big Rapids R. R., and 10 miles N. E. of Newaygo. It has a church, a school, a weekly newspaper, 3 lumber and shingle mills, a chair-factory, a stave-mill, a tannery, and several stores. It is in a fertile region, abounding in pine and hard-wood timber. Fremont Lake, just S. of the town, is a pleasant summer resort.

Platt & Matthews, Pubs. "Times."

French, county in the N. N. E. of Dakota. Area, 1728 square miles. It contains the W. part of Devil's Lake, and has salt deposits.

French, tp. of Adams co., Ind. Pop. 824.

French (Augustus C.), a native of New Hampshire, was educated at Harvard College; became a lawyer of Illinois, a law professor of McKendrie College, and was governor of Illinois 1846–53. D. at Lebanon, Ill., Sept. 4, 1864. ✓

French (Benjamin F.), b. in Richmond, Va., June 8, 1799; received a classical and legal education; author of poems and papers in periodicals, and became a planter and merchant of Louisiana. Published *Biographica Americana* (1825), *Memoirs of Eminent Female Writers* (1827), *Historical Collections of Louisiana* (1846 *seq.*), *History of the Iron Trade in the U. S.* (1858), *Historical Annals*, and other works. Was a liberal benefactor of the Fisk Free Library in New Orleans, and afterwards removed to New York. ✓

French (Mrs. L. Virginia), b. on the Eastern Shore of Virginia in 1830, was a Miss Smith; was educated in Pennsylvania, and in 1848 became, with her sister, a teacher of Memphis, Tenn., where she wrote much under the name of "L'Inconnue." In 1852 she became connected with the *Southern Ladies' Book* of New Orleans. In 1853 she was married to Mr. J. H. French of McMinnville, Tenn., and was for a time editor of the *Crusader*, Atlanta, Ga. Among her works are *Wind-Whispers*, poems (1856), *Iztalilxo*, a tragedy, and *Legends of the South.*

French (William Henry), an American officer and general of volunteers, b. at Baltimore, Md., Jan. 13, 1815; graduated at West Point July 1, 1837; entered the army as second lieutenant of artillery; served in the Seminole war in Florida, and on the Canada border during the disturbances 1837–38, and on garrison duty till 1847. During the war with Mexico he served on the staff of Gen. Patterson as assistant adjutant-general, and as aide to Gen. Pierce, being engaged at the siege of Vera Cruz, the battles of Contreras and Churubusco, and the capture of the city of Mexico; served against the Seminole Indians in Florida 1850–52, and on garrison and frontier duty till 1861, when he was at Fort Duncan, Tex., which post he abandoned and transferred his command to Key West, Fla., where he took command. Appointed a brigadier-general in Sept., 1861, he served in the army of the Potomac during the Peninsula campaign in Virginia, at Yorktown, the battles of Fair Oaks, Gaines's Mill, Peach Orchard, Savage Station, Malvern Hill, etc.; in the Maryland campaign he was engaged at the battle of Antietam Sept., 1862; appointed a major-general of volunteers Nov., 1862; he served in the Rappahannock campaign in the battles of Fredericksburg, Dec., 1862, and Chancellorsville, May, 1863; commanded 3d army corps from July, 1863, to May, 1864, when he was mustered out of the volunteer service. For gallant and meritorious services in battle in Mexico he was brevetted captain and major, and for similar services during the civil war he received the successive brevets from lieutenant-colonel to major-general U. S. A. Served on the Pacific coast from 1865 to 1872, in command of 2d Artillery. Gen. French has passed through the successive grades to that of lieutenant-colonel, he being at present (1875) lieutenant-colonel of the 2d U. S. Artillery, and in command at Fort McHenry, Md. George C. Simmons.

French Ber'ries, the name given by dyers to the dried berries of various species of *Rhamnus* or buckthorn, which are brought from the Mediterranean countries, and produce a very bright but not very permanent yellow dye. They are also called Persian and Avignon berries. (See Persian Berries.)

French Broad Riv'er rises in Henderson co., N. C., near the Blue Ridge, flows N. W. into Tennessee, receives the Nolichucky, turns S. W., and joins the Holston (now called Tennessee) 3 miles above Knoxville. There is delightful scenery along its banks. It is navigable 30 miles to Dandridge by steamboats. It is some 200 miles in length.

French'burg, post-v., cap. of Menifee co., Ky. It is about 50 miles E. of Lexington.

French Chalk, a variety of talc, the hydrated silicate of magnesia.

French Creek, tp. of Edwards co., Ill. Pop. 1132.

French Creek, post-tp. of Allamakee co., Ia. P. 791.

French Creek, post-tp. of Chautauqua co., N. Y., in the south-westernmost corner of the State. Pop. 973.

French Creek, post-tp. of Mercer co., Pa. Pop. 999.

French Creek, tp. of Venango co., Pa. Pop. 1330.

French Horn, a metallic wind instrument, consisting of a tube which is usually convoluted, so as to make it more portable. It increases in diameter from the mouth-piece to the bell or flaring open extremity. It is provided with several longer or shorter mouth-pieces, by means of which the key is varied, and the whole is provided with valves and keys.

French Lake, tp. of Wright co., Minn. Pop. 221.

French Lan'guage and Lit'erature. The French, like the Italian, Spanish, and other Romanic languages, is the old popular Latin in a modern form. It has been developed in France chiefly through Celtic and Teutonic influences, combined with those of climate and condition.

Celtic.—Though the primitive language of the country was the Celtic, it was almost entirely supplanted by the Latin in consequence of the Roman conquest. During the centuries of absolute subjection to Rome the native distinctions were mostly lost. Adopting the Roman customs and laws, the people considered themselves Romans. They spoke only the Latin language, except in a few sections of the country, where the Celtic retained its independence, and where it is spoken in a corrupt form, to some extent, even at the present day (particularly in Brittany). Though comparatively few Celtic words were incorporated in the new speech, yet the influence of race and character upon the Latin was very powerful, and was especially marked in the pronunciation, in the modification of the sounds of

certain letters, or in the introduction of new sounds, as *u*, *é*, *e* mute, and the liquids *l* and *n*.

Teutonic.—The Teutonic influence was introduced chiefly in the fifth century, through the invasion of the country by various German tribes—at first by the Burgundians and Goths in the E. and S., and subsequently by the Franks in the N., who, under their youthful leader Clovis, won a decisive victory over the last Roman governor of Gaul in A. D. 486. The German conquerors, inferior in numbers and in civilization, gradually adopted the language of their subjects. Unable to discern the delicate distinctions of sound which gave to the Latin terminations the various shades of signification, they were content to learn one or two forms of a word, which soon became the representatives of all. The Teutonic influence was therefore marked not so much by the number of new words introduced into the vocabulary (about 450, relating to war, hunting, and the feudal relations), as by the modification of the form of the Latin words by abbreviation, the loss of terminations, the contraction of syllables, etc.

Romance.—This modification of the spoken Latin had been going on insensibly nearly 400 years, when the fact seems to have been recognized that the language of the people was quite distinct from the written Latin which was used in churches, convents, and courts of justice. Therefore, by a decree of the Council at Tours in A. D. 813, the bishops were directed to translate their sermons into Romance (*Roman*), the modified Latin, the popular speech. The Frank kings and their principal followers, who had continued to use the German, were subsequently obliged to adopt the Romance, and after the final division of Charlemagne's empire German was restricted to Germany and the eastern section of Gaul. With the exception of a fragment of a glossary (*Glosses de Reichenau*) written about A. D. 768, the oldest known documents of the Romance are the oath of Louis the German and that of the army of Charles the Bald taken at Strasburg in 842. In them we have a sort of photograph of the language in its transition state. For two centuries the transformation went on rapidly, the language rising to new life as society entered on its new relations in feudalism.

Langue d'Oc and Langue d'Oïl.—The northern and southern sections of the country being practically independent of each other, and characterized by different conditions, the various dialects of each assumed a form and method of pronunciation peculiar to itself. Hence arose in the ninth and tenth centuries the recognition of two general divisions or groups of dialects, named, from the affirmative adverb in each, the *Langue d'Oc* and the *Langue d'Oïl*. The former, in which the Teutonic influence was less marked, was spoken in the entire section S. of the river Loire. It became more and more distinct from the latter, and developed rapidly under the favoring circumstances of climate, condition, and culture till in the eleventh century it began to be employed in Provençal poetry. For the next 200 years its harmonious musical character, as displayed in the songs of the Troubadours, which were sung in all the principal courts of Europe, rendered it extremely and almost universally popular. This popularity declined in the latter part of the thirteenth century, and in consequence of the political subjugation of the people the language soon came to be regarded only as a dialect or patois, which is still spoken in some of the departments of Southern France. The *Langue d'Oïl* was spoken in the provinces of the N. and E. It was considerably modified by the Normans, who made conquests and settlements under Rollo the Dane in 912. Adopting the language of the country, they introduced a few new terms relating particularly to the sea, and quickened it with new life by kindling a lively imagination with the mythology of the Danes, the wonderful stories of dwarfs and giants, of genii and fairies. This language was not uniform, like that of the S., but existed as distinct dialects, with some literature, particularly in the independent provinces of Normandy, Picardy, Burgundy, and the Isle of France. The dialect of the latter, occupying a central position, modified somewhat by the other three, soon took the pre-eminence, owing to the political supremacy of Paris. As the monarchy supplanted the feudal hierarchy, and Paris became the capital not of the Isle of France alone, but of the other provinces, its language was also gradually adopted by writers in all sections of the country, and the other dialects sank to the condition of patois, traces of which still exist in the common speech of the uneducated. Though recognized as the *French* language probably as early as the eleventh century, it did not become widely known in Europe till after the conquest of Constantinople (1204). It then gained great popularity, and was employed by several foreign writers. In it Dante's teacher, Brunetto Latini, wrote his *Tresor*, giving as one reason, "perche la parlatura francesca e più dilettevole è più comuna che tutti li altri linguaggi."

Old French.—During the twelfth, thirteenth, and early part of the fourteenth centuries the language existed in a form now called Old French, which was intermediate between the synthetic Latin and the analytic French. It retained two forms of case, the nominative and accusative, the latter representing all shades of the objective idea. Following the Latin usage, the letter *s* was the sign of the subject in the singular and of the object in the plural number.

Example.	*Singular.*	*Plural.*
Subject,	*amis, murs;*	*ami, mur.*
Object,	*ami, mur;*	*amis, murs.*

After the fourteenth century these distinctions of case were lost, and the objective form alone was used in each number. Many other Latin forms also disappeared, and the language began to assume those characteristics which are peculiar to modern French. During these centuries (twelfth to fifteenth) many Greek and some Oriental words were introduced, particularly in writings on philosophy and medicine. But all learned and scientific terms admitted later than the eleventh century do not generally conform strictly to the laws of formation which obtain in the Old French.

Modern French.—With the fifteenth century commenced the formation of the classic and modern French. Very marked changes were effected in grammatical forms, in orthography, and in syntax. The language became more analytic. It was more simple and less like the Latin. In the sixteenth century the Italian influence was quite marked, and many Italian and some Spanish words were introduced. These additions were richer in simple and comic than in noble and serious terms.

During the previous centuries of formation and growth the French had been generally regarded as suited only to the common people, while the Latin was employed at court and by the educated classes generally, both in conversation and in literature. But with the accession of Francis I. (1515) a very decided improvement was effected. He adopted the French at court, prohibited the use of Latin at the public tribunals, and by royal decree recognized the French as the national language. Thenceforth it received the attention of the great and learned. The transformation which had been wrought in the fourteenth and fifteenth centuries had caused the old literature to be neglected and forgotten, and had thus left the language exposed to greater modification through foreign influence. But Marot and Malherbe, Amyot and Montaigne, did much to increase its vigor, to purify and enrich its form. Rabelais gave it suppleness and vivacity, Calvin firmness and precision. The French Academy exerted its authority, and under its auspices, aided by the pens of Voiture and Balzac, Corneille and Descartes, the rules and standards of pure French became established. This language, forcible and elegant in Pascal, copious and free in La Bruyère, harmonious and noble in Fénelon, majestic and sublime in Bossuet, reached its maturity and comparative perfection in the latter half of the seventeenth century. In the eighteenth century, though considered fixed in regard to correctness of form and perfection of style, the language gained somewhat in copiousness and variety. Under the fiery trials and terrible struggles of the Revolution it found new energy of expression, while during the present century a large number of words have been introduced from England, Germany, and other sources. There have also been some modifications of orthography, but the structure of the sentence, the syntax, the general form and character of the language, have remained unchanged.

Grammatical Changes.—Like the other Romanic languages, the French has lost the Latin system of declension, and supplied its place by the use of prepositions. The article has been introduced (derived from the demonstrative pronoun *ille, illum*, etc.). With three exceptions, comparison is expressed by the adverbs *plus* and *moins* (PLUS and MINUS), followed by the conjunction *que* (QUAM). In the conjugation of verbs new compound tenses have been added, some personal endings have been dropped, the passive voice has been lost, and its place supplied by the past participle, combined with the forms of the verb *être* (ESSE). In place of the Latin adverbial endings E and TER, we find a new form, the Latin ablative MENTE, as *sincèrement* (SINCERA MENTE), with a sincere mind (or manner), sincerely.

Changes of Form.—The form of the Latin has undergone more striking changes in French than in any other Romanic language, owing to a more marked difference in climate, race, and primitive idiom. The Latin word is uniformly abbreviated, but its radical element is generally preserved. These changes, through a tendency to secure greater ease in pronunciation by assimilating, softening, adding, omitting, and transposing letters, have been brought about by a gradual process of transition, extending a thousand years through Merovingian Latin and Old French to its modern

form; as (L.) ADRIPARE, (M. L.) ARRIPARE, (M. L.) ARRIBARE, (F.) *arriver;* (L.) TURBARE, (O. F.) *torver,* (O. F.) *trover,* (F.) *trouver;* (L.) SPATULA, (M. L.) ISPATULA, ESPATULA, (O. F.) *espatla, espalle, espaule,* (F.) *épaule;* the last appearing for the first time officially in the 3d ed. of the *Dictionnaire de l'Académie* in 1740.

Accent.—The accented syllable of the Latin is uniformly the last effective syllable of the French word. The exceptions are "learned words" of modern introduction. Examples, ARTICULUM, *article;* MORTALEM, *mortel;* SEDITIONEM, *sédition;* FRAGILEM, *frêle, fragile.*

Vowels.—All vowels, which follow the accent in Latin, disappear in French, or pass into the mute *e;* as CANTARE, *chanter;* HORAM, *heure;* TABULAM, *table;* VIRTUTEM, *vertu.* When two or more syllables precede the accent, the nearest, if short, generally disappears; otherwise, the vowels are retained, though sometimes changed; as MONITATEM, *bonté;* TESTAMENTUM, *testament;* VESTIMENTUM, *vêtement.* The accented Latin vowels quite uniformly undergo the following changes: (*a*) when short, they pass into diphthongs, A, E, I, O, U becoming respectively *ai* (or *e*), *ie, oi, eu, ou,* as AMO, *aime;* FERUM, *fier;* NIGRUM, *noir;* NOVEM, *neuf;* LUPUM, *loup;* (*b*) when long by nature or increment, A, E, O become *e* (*ie* or *ai*), *oi* (or *i*), *eu;* but I and U remain unchanged; as NASUM, *nez;* LEGEM, *loi;* SOLUM, *seul;* AMICUM, *ami;* MURUM, *mur;* (*c*) when long by position, I and U become *e* and *ou* (or *o*), while A, E, O remain unchanged; as FIRMUM, *ferme;* SURDUM, *sourd;* ARBOREM, *arbre;* TERRAM, *terre;* CORPUS, *corps.*

Consonants.—The permutation of consonants is limited to those of the same class or group (as labials, liquids, etc.), the strong passing to the weak, and the weak interchangeable. Thus B and V are interchangeable, but never become *p,* though P may become *b* or *v,* while P and V both may become *f;* as HABERE, *avoir;* VERVECEM, *brebis;* DUPLUM, *double;* RIPAM, *rive;* CAPUT, *chef;* VICEM, *foix.* L and R are interchangeable, M becomes *n,* and N may become *l* or *r;* as ALTARE, *autel;* ULMUM, *orme;* REM, *rien;* ORDINEM, *ordre.* T and D are interchangeable, and T may become *s;* as TUNC, *donc;* VIRIDEM, *vert;* RATIONEM, *raison.* C sometimes becomes *s* or *x;* when initial before A, *ch;* and when followed by T, it forms, like *i,* a diphthong with the preceding vowel; as PLACERE, *plaisir;* VOCEM, *voix;* CAMPUM, *champ;* FACTUM, *fait.* G and DI become *j;* as GAUDERE, *jouir;* DIURNUM, *jour.* Q (or QU) may become *c;* as QUARE, *car;* QUINQUE, *cinq.* There are some exceptions to the general phonetic laws, but they are mostly due to early corruptions in the popular Latin or to some accidental causes not fully understood.

Characteristics.—The chief characteristics of the French language are precision and perspicuity: "What is not clear is not French." Hence its almost uniform use in diplomacy since it was first employed at the conferences of Nimeguen in 1678. For the last 200 years it has to a great extent taken the place of the Latin as the language of intercommunication among scholars and scientific men. As the exponent of the character, habits, and tastes of those who have formed it, the language reveals a nation remarkable for vivacity, sociability, business capacities, and scientific attainments.

LITERATURE.—French literature undoubtedly commenced in the eleventh century, but no existing works have a date prior to the twelfth century. The earliest composers, called Trouvères, were generally men of little education. Having no acquaintance with the literature of Rome or Greece, they sung in an original artless style the sentiments and noble deeds of Christian and feudal heroes. As the poetry developed under the hands of the monks and others with the advance of learning, it assumed a narrative or epic form, depicting the serious and thoughtful character of the people, in striking contrast with the lyric poetry of the Troubadours in the South, which was lively and emotional.

Chansons de Gestes.—Among the early poems of the Trouvères were the *Chansons de Gestes*—songs celebrating the most illustrious deeds of noble warriors. These have been grouped in three cycles, the first relating to Charlemagne and his paladins; the second, to King Arthur and the Knights of the Round Table; the third, to Alexander and the heroes of ancient time. Of the first cycle, the earliest and most important is the *Chanson de Roland,* which describes, in about 4000 verses, the betrayal and defeat of Roland and his braves in the valley of Ronceveaux, and the vengeance which was inflicted upon the victors by Charlemagne. In this poem the emperor is always triumphant and invincible, but in later poems he is represented as weak and cowardly in action, though bold in words, indicating the decline of royalty and the increasing power and popularity of feudalism. These historico-legendary poems were written in verses of ten syllables each, arranged in monorhyme stanzas of unequal length. The cycle of Arthur was founded upon Celtic legends, and was written in verses of eight syllables. The principal poems were those of Merlin, "the enchanter," of Lancelot of the Lake, of Perceval, and the search of the Holy Graal. The *Roman de Brut* (1155) was a fabulous history of the kings of Britain from the capture of Troy to 689 A. D. It was partly a translation of an earlier work, and was written in verse by Robert Wace, who wrote also the *Roman de Rou,* a long history of the dukes of Normandy. In the third cycle the heroes of Greece bear the impress of the character, habits, and chivalric sentiments of the Middle Ages. The principal poem, *Alexandre le Grand,* was written in verses of twelve syllables (hence the name "Alexandrine verse").

The *Fabliaux* were short poetical tales—some moral, most satirical and witty, presenting the comic side of life and character. They were numerous and popular, and form an important part of the early literature. Though mostly anonymous, the names of several poets who have rendered them in verse are known, of whom one of the ablest was Rutebeuf.

Allegorical and Didactic Poems.—Among the most noted productions of the feudal period were the *Roman de Rénard* and the *Roman de la Rose.* Both works were remarkably popular, and foretokened the decline of feudalism. They were a satire on the age in which might prevailed over right, and cunning and fraud supplanted bravery and integrity. The former existed in several branches, forming "more than 80,000 verses." The characters were all animals, but the tricks by which the fox beguiles and dupes his enemy and victim, the wolf, together with characteristic moral allusions, give a vivid picture of the spirit and tendency of those times in regard to the institutions then existing. The *Roman de la Rose,* a learned but somewhat tedious poem (of more than 22,000 verses), was written, with an interval of forty years, by Guillaume de Lorris (d. about 1260) and Jehan de Meung (d. near 1320). Under the figure of a dream the former produced an allegory of love—the latter a "sort of encyclopædia."

Lyric Poetry.—The earliest lyric poet of any note was Count Thibaut of Champagne (1201–53), who imitated the Troubadours, but relieved their monotony by the introduction of Northern vigor and wit. Basselin (d. about 1418) wrote comic songs celebrating the praises of wine. Charles of Orléans, a royal poet (1391–1465), sang in beautiful verses the praises of chivalry as it shone in its bright glory before disappearing on the rise of new manners at the dawn of modern civilization. Villon, the type of the Parisian populace of his time, with all its beauties and deformities, was a bad man but an excellent poet. His chief work, *Le Grand Testament,* in connection with the pathos and beauty of many minor pieces, secured for him, in the opinion of Boileau, the first place among the old French poets.

History.—The first important work in prose literature was the *Histoire de la conquête de Constantinople,* by Villehardouin (about 1167–1213). It was a simple story of events described by a man who participated in them, and who simply related what he had seen and heard. In the *Mémoires* (a life of Saint Louis), Sire de Joinville (1223–1317), the model of the feudal baron, delineates with more freedom his own personal impressions, as well as the life of "the most pious king" and the exploits of the last Crusade. Froissart (1337–1410) gives in his *Chroniques* a vivid picture of chivalry in its grandeur and in its decline. This Herodotus of his age, a faithful searcher after truth and an artless story-teller, travelled over Europe, and daily registered what he saw and heard. His descriptions are sometimes Homeric, but his history reveals an utter lack of unity and a strange complication of chronology. With Commines (1445–1509) we see the dawn of history in its modern and philosophical sense. In his *Mémoires* (a history of Louis XI. and Charles VIII.) he presents not mere chronicles, but the causes of events and their results. A depicter of character, he manifested also a political wisdom far in advance of his age. In this connection should be noticed also Christine de Pisan (1363–1420), considered a Cicero in eloquence, a Cato in wisdom; Alain Chartier (1386–1458), "father of French eloquence," author of *Quadriloge Invectif,* a work remarkable for political influence and literary beauty; and Jean Gerson (1363–1429), whose claims to the authorship of the *Imitation of Christ* are by many considered superior to those of Thomas à Kempis.

Drama.—The early dramatic writings (*mystères*) bore a religious character. The subjects were biblical, and the actors and scenery were connected with the Church. The first company, organized in 1402, called "La Fraternité de la Passion," represented the entire life of Christ in a mystery-play consisting of 67,000 verses, employing eighty-six actors, and occupying several weeks in the representation. Not long after, a company of lawyers' clerks (La Basoche) began to represent the moralities, allegorical subjects. From

their secular profession being under less restraint, they represented farces and amusing scenes from common life, and thus originated modern comedy. A third company, whose sole object was fun and ridicule, carried their plays to such an extreme of personal satire, license, and abuse that all their dramatic representations were prohibited under severe penalties in 1540.

The early literature was in its most flourishing condition in the thirteenth century. Its glory and influence were not limited to France, but extended throughout Catholic and feudal Europe. French works were everywhere read, translated, and imitated; and their influence may still be traced in the literature of Italy, Spain, England, and Germany. In the fourteenth and fifteenth centuries the institutions of the country were changing—the ideas of the people, and even their language, undergoing modifications. In this transition from the old which was declining to the new which was forming there was not a favorable field for literature, and only a few works were produced worthy of notice.

The Renaissance.—While France had thus lost her literary pre-eminence, Italy and Spain had entered upon a brilliant career under the influences which followed the revival of ancient art and learning, the study of the Greek and Roman classics. The literature of those countries, reacting upon that of France, opened a new period in French literature, the Renaissance of the sixteenth century. Some writers like Ronsard (1524–85), and Du Bellay (1524–60), chief of the "Pleiad," strove to give the native speech a classic form and character by too closely imitating the Italian style, introducing new forms from the Latin, and even adopting Greek and Roman customs. This tendency to a style that was unnatural was somewhat counteracted by the writings of Marot (1495–1544), the leading poet of the century. He endeavored to enrich and purify the popular dialect—to bring it and the language of scholars into one harmonious idiom. His translation of the Psalms has been highly esteemed by the French Protestants, while his secular pieces—odes, epigrams, epistles, and fables—are characterized by a lively humor and elegance of expression. Amyot (1513–93) exerted a similar influence in prose by the pure and classic style of his translations, especially of Plutarch. The best history of the times was written in Latin by De Thou (1553–1617). Brantôme (1527–1614) and others wrote valuable *Mémoires*. The *Heptaméron* of Margaret of Navarre (1492–1549) and the *Nouvelles* of Despériers (d. 1544) took the place of the old *fabliaux* in popular esteem. Bodin (1530–96) gained a great reputation by his treatise *De la République*, but the most important work in politics was the celebrated *Satire Ménippée*. This century was especially an age of inquiry and discussion. The dogmas and customs of the preceding age were criticised, and new systems, intellectual, social, and religious, were proposed. Rabelais (1483–1553), "the great jester of France," in his *Vie de Gargantua et de Pantagruel*, satirized almost everything his age accepted in a style that was coarse, licentious, and profane, though inspired perhaps with a true spirit of reform. Montaigne (1533–92) in his *Essais* became the founder of a new branch of literature. He studied man himself, and sought to answer the question *Que sais-je?* His work is interesting and instructive, but his philosophy has a skeptical tendency. Calvin (1509–64) as a Reformer brought the disconnected doctrines of the Protestants into a complete system. His *Institution de la religion Chrétienne* and his wonderful influence in that age secured for him the title of "one of the fathers of the French language."

At the beginning of the seventeenth century, Malherbe (1556–1628), "the tyrant of words and syllables," the creator of a new taste in literature, wrote poetry more remarkable for beauty of language and grace of expression than for originality of thought. His rival, Regnier (1573–1613), gained quite a reputation as a satirist. The *Lettres* of Balzac (1588–1654) and Voiture (1598–1648) were valuable as the expression of society. During the early part of this century Spanish influence was strongly marked, but comparatively few works were written worthy of special notice. Authors were mostly connected with the literary circle of the Hôtel de Rambouillet, or wrote under the patronage of Richelieu.

Age of Louis XIV.—The period occupied by the life and reign of Louis XIV. (1638–1715) was so remarkable in every department of literature and art as to have secured a place among the great epochs of the world, like that of Pericles in Greece and of Augustus in Rome. It was essentially a religious age. The forms of religion were observed and honored, and the literature was pervaded with a Christian spirit which inspired some of its noblest monuments. At the same time the masterpieces of the Greek and Roman mind were studied and imitated, while the absolute will of the king had great influence in directing and controlling the most important movements of the age. Thus, French literature again attained that supremacy in Europe which it had held in the twelfth and thirteenth centuries, but from causes and merits which were quite unlike. In the early time it was through its originality, its perfect and harmonious expression of the sentiments, beliefs, and manners of that age; in the later, it was its perfect form, its elegant style, and, soon after, the boldness of its philosophy, which gave it almost universal favor.

In *Philosophy* the highest place belongs to Descartes, who had just drawn (1637) the attention of the world to his *Discours de la Méthode*, "the first masterpiece of modern French prose." Throwing off the shackles of routine and of past ages, he opened with wonderful genius a new field, and developed a system which was almost universally adopted by the great philosophers of that and the succeeding century. Pascal followed with his *Lettres provinciales* and *Pensées*—the former full of vigor, the latter deep, but disconnected and incomplete. Malebranche met with extraordinary success in his *Recherche de la Vérité*, and aimed to harmonize philosophy with religion in his *Méditations chrétiennes et métaphysiques*.

In *Poetry*, Corneille rose from the intrigues and farces of his contemporaries to the heights of the classic drama. In his *Cid*, *Cinna*, *Les Horaces*, and *Polyeucte* he portrayed in elevated style the noblest elements of character—love, honor, patriotism, and religion—and thus secured the title of *Corneille le grand*, the father of modern tragedy. Close beside him in importance (and so close that his countrymen have never decided which was foremost) stood Racine with his *Andromaque*, *Phèdre*, *Iphigénie*, *Esther*, and *Athalie*, portraying the more tender emotions of the heart. Inferior perhaps to Corneille in grandeur of thought, he was superior in the beauty and elegance of his style. Molière, a poet and an actor, a master in comedy, with no rival but Shakspeare, wrote a great variety of plays, of which the most perfect are the *Misanthrope*, *Tartuffe*, and *Les Femmes savantes*, though less humorous than *L'Avare*, *Le Bourgois gentilhomme*, and *Le Malade imaginaire*. La Fontaine, the "inimitable," produced a great number of *fables*, many of which form a perfect drama in miniature. Boileau, the severe critic, wrote *L'Art poétique*, also *Epîtres*, *Satires*, and *Le Lutrin*—works characterized by practical common sense and tending to elevate the popular taste.

Eloquence was confined to the pulpit, which alone offered a free field for oratorical talent. There Bossuet, Bourdaloue, Massillon, Flèchier, and Fénelon won great honor by their sermons and funeral orations. Fénelon wrote also numerous other works, and rendered his name immortal by producing the *Aventures de Télémaque*, a classic story, a model of style and of morals.

In *History*, Bossuet wrote the *Histoire des variations des Eglises protestantes*, a masterly polemic treatise, and the eloquent *Discours sur l'histoire universelle*. Fleury gave a candid account of Christianity in his *Histoire ecclésiastique*, and Cardinal de Retz described the wars of the Fronde in his *Mémoires*. The unrivalled *Lettres* of Madame de Sévigné gave a vivid picture of the court, of society, and of the times, while a similar view was given in another manner by Mme. de La Fayette in her *Zaïde* and *Princesse de Clèves*—works remarkable for simplicity, truth, and good taste.

In *Morals*, La Rochefoucauld wrote the *Maximes*, which are disconnected, and relate chiefly to self-love as a motive of action. La Bruyère in his *Caractères* sought to promote true reform by separating what is true and noble from the weak and vain.

Belonging partly to this period and also to the succeeding, Le Sage should be noticed for his comedies, the best of which is *Turcaret*, and for his popular romance *Gil Blas*, a true picture of manners. Fontenelle established his fame by his *Dialogues des morts* and *Entretiens sur la pluralité des mondes*. Marmontel was best known as the author of *Bélisaire* and *Les Incas*, though his *Mémoires* and *Éléments de la littérature* are instructive and interesting. The *Mémoires* of St.-Simon and the *Histoire ancienne* of Rollin were noted for originality and good judgment.

The eighteenth century presented a striking contrast to the preceding both in character and literature. It was an age of skepticism and revolt against accepted doctrines and established usages. Writers, occupied with social and political reforms, neglected poetry, and sought the practical rather than the ideal. In this age Voltaire was chief, exercising a controlling influence upon the thought of his time, not only in France but in all Europe. A voluminous rather than a profound writer, he worked in almost every department of literature. His best works are the *Henriade*, an epic poem, *Histoire de Charles XII.*, *Essai sur les mœurs et l'esprit des nations*, and *Siècle de Louis XIV*. Montesquieu wrote the *Lettres Persanes*, sparkling with wit and brilliant in style, in which religion and philosophy, the

laws and customs of society, were made the objects of the finest pleasantry. But genius rather than wit was displayed in his *Considérations sur la grandeur et la décadence des Romains*, a work of sound logic, of profound and comprehensive thought. His *Esprit des lois*, which is said to have restored the lost charters of the human race, exerted a wide political influence. J. J. Rousseau assumed the *rôle* of reformer. Though acting the part of a cynic rather than a Christian moralist, he advanced new and valuable ideas on education in *L'Émile*, and in his *Contrat social* propounded political theories on the rights of man which produced their fruit in the Revolution of 1789. His *Nouvelle Héloïse*, a romance of the passions, contains some grand descriptions, but is often exaggerated in style and false in theory. His *Confessions*, interesting though sad, reveal an immoral life and an unsound philosophy. But all his works are remarkable for eloquence, for brilliancy of style, and for individuality of thought. Buffon in his *Histoire naturelle* undertook to describe the universe in its full extent and in detail. He reduced disconnected facts to a system, and formed a science which, with some modifications, is still received. His style is beautiful and grand. In some of his descriptions of the greatness and littleness of man and nature his language is sublime. After these four leaders may be noticed Bernardin de St.-Pierre, a great lover of nature and virtue, who unfolded in his *Études de la Nature* and *Harmonies* the laws of the world under a paternal watchful Providence, and wrote *Paul et Virginie*, a literary gem in style and sentiment; André Chénier, lover of antique genius, revealing its modest beauties in more modern style; Delille, celebrated for his translations; Mirabeau, whose orations were of remarkable force and power; Beaumarchais, who displayed the talent of a satirist, moralist, and comic writer in his *Mémoires*, *Le Barbier de Seville*, and *Le mariage de Figaro;* La Harpe, the critic and dramatist; Lebrun, the lyric poet; Condillac, the metaphysician; and Diderot, the materialist, a prolific writer on all subjects, and author, in connection with D'Alembert, of the famous *Encyclopédie*. Helvetius in his work *De l'Esprit*, Baron d'Holbach in his *Système de la Nature*, and Lamettrie in his *L'homme Machine*, all manifested a spirit extremely hostile to religion.

In the nineteenth century literature assumed a new—or at least a greatly modified—form, corresponding to the new political and social condition under which it flourished. The influence of English and German literature was also manifest in a style more free and vigorous. The classic models of the seventeenth century were set aside, and new models created, drawn from nature and from man emancipated and animated with real Christian sentiment. The principles which had been shaken in the preceding age were re-established on a new basis. Chief in this literary reform was Chateaubriand. Rejecting the impiety of Voltaire, purifying the principles of Rousseau, he sought in his *Génie du Christianisme* to bring men back to faith by portraying the benefits of Christianity with such a wealth of brilliant imagery and poetic beauty as to win affection, while his *Martyres* revealed the superiority of Christian to pagan morals and life. Scarcely less was the influence exerted by Madame de Staël with her popular romance *Corinne* and her philosophical treatise *De l'Allemagne*, revealing the forms of German thought and manners, and inspiring love for all that is beautiful and good.

Romanticists.—During the Restoration the literary reform reached its extreme development in *romanticism*, the complete emancipation of literature from conventional rules—the recognition of that which is beautiful in itself, without regard to the usages and models of the past. Among the most prominent in this movement were Victor Hugo and Alexandre Dumas, who, after a severe struggle with the classicists, secured the acceptance of such works as *Hernani*, *Marion Delorme*, and *Henri III.*, in which may be traced the influence of Shakspeare and Schiller, though the imitation was by no means a true resemblance. They were assisted in this work by Alfred de Vigny, author of *Cinq-Mars*, Alfred de Musset, the humorist, and the brothers Deschamps. As lyric poets those authors produced works more rich and varied than the lyric poetry of France could previously boast; but, giving unlimited sway to instinct and fancy, they sometimes degenerated into license, and the results were unequal and incomplete. But of all French poets, Lamartine possessed the most soul, and displayed it in the most perfect poetry. His *Méditations poétiques* and *Harmonies poétiques et religieuses*, written with a marvellous power of description in a style glowing and picturesque, were elevating in sentiment and extremely popular. While the poetry of Lamartine charmed the imagination, the *Chansons* of Béranger delighted the senses. Delicate in sentiment, witty, practical, and patriotic, they reached the popular heart, and rendered their author preeminently the national poet. Delavigne gained a good reputation with his *Messéniennes*, in which he gave a poetic

expression to the current of popular thought and feeling. As dramatists, Andrieux, A. Dumas, O. Feuillet, Victor Hugo, J. Sandeau, and E. Scribe have won distinction.

In romance the most successful writers have been V. Hugo, A. Dumas, George Sand (Madame Dudevant), Eugène Sue, Balzac, Jules Sandeau, F. Soulié, O. Feuillet, and Edmond About. Archæology and Oriental literature have been cultivated by Champollion, Baron de Sacy, Renan, and Rémusat. In natural history and mathematics Cuvier stands prominent with his great work on the *Règne animal*, also St.-Hilaire, the zoologist, and Jussieu, the botanist, Dufrénoy and Élie de Beaumont, the geologists and mineralogists, Gay-Lussac, the chemist, Biot, the physicist, Arago, the physicist and astronomer, and Lagrange and Laplace, the mathematicians. In political science De Tocqueville has won a favorable distinction by works relating to American institutions. Nodier, a royalist in politics, was a charming story-teller and a learned philologist. Constant, a Protestant and an orator, was chief of the liberal school. Courier, also a liberal, wrote pamphlets of great force with classic purity in style. In essays and criticism many have gained great distinction. Among the most eminent should be noticed Ampère, Gautier, Girardin, Janin, Renan, St.-Beuve, and Taine. In philosophy, Bonald, Joseph de Maistre, and Lamennais opposed the unchristian teaching of the school of Voltaire by treating of law, duty, and God as supreme and absolute. Royer-Collard, Cousin, and Jouffroy sought to harmonize liberty with law, philosophy with religion, by propounding an eclectic philosophy intermediate between the materialism of the eighteenth century and the absolutism of the Catholic school, and thus devoted themselves to the impartial search for truth among the doctrines of all systems. This eclecticism of Cousin has been advocated by Jules Simon, while positivism has been affirmed by Auguste Comte in his *Cours de philosophie positive*.

History.—In this department French literature is particularly rich in this century. Previously, with few exceptions, historical works had been bare chronicles or learned memoirs, seldom combining interest with truth. But in this period history was animated with the new life that had been revealed in poetry. Of the philosophic school the chief is Guizot, revealing in his *Histoire de la Civilisation* a breadth of view, an accuracy of analysis, and a precision of statement which have been unsurpassed. While Guizot explains the reason, the idea of history, De Barante (of the descriptive school) paints a fine picture, almost a romance, in his *Histoire des ducs de Bourgogne*. Augustin Thierry contributed much to historical study, both critical and descriptive, in *Lettres sur l'histoire de France* and *Histoire de la conquête d'Angleterre par les Normands*, the latter being especially descriptive. Villemain, in his *Cours de littérature française* and *Histoire de Cromwell*, gave models of eloquence, as well as of historical composition, delicate in taste, pure in style, and sound in criticism. Sismondi, lacking in sentiment, sometimes too severe in criticism, displays a wonderful amount of learning in his *Histoire des Français*, *Histoire des Républiques italiennes*, and *De la littérature du midi de l'Europe*. Michelet, bold, brilliant, imaginative, learned, in his *Précis de l'histoire moderne* traces the prevailing law and unfolds the results of first causes in a style poetic and attractive, but sometimes misleading. Mignet, in his *Révolution française*, presents ideas rather than men. St.-Beuve deserves mention here for his *Histoire de Port-Royal;* Louis Blanc, for his *Histoire de la Révolution française;* and Henri Martin, for his *Histoire de France*, which in the 3d ed., after more than thirty years of labor bestowed upon it, is the most complete and valuable yet produced. Thiers, endowed with a comprehensive intellect and admirable common sense, quick to see, to understand, and to explain, appropriating information drawn from every source, rose to the first rank by his *Histoire de la Révolution française*. Though his judgment is sometimes warped by his admiration of success, his *Histoire du Consulat et de l'Empire* is a masterpiece in comprehensiveness and perspicuity, in sustained interest, and in grace and naturalness of style. His speeches from the tribune in the Assembly at Versailles, by their vigor of style, range of thought, and impressiveness of appeal, have secured for him the first rank also in statesmanship and oratory. The establishment of the Republic will doubtless open a wider field for oratory than has hitherto been afforded. The speeches of Louis Blanc, Gambetta, Ledru-Rollin, and others have already gained a reputation nearly equal to that of Mirabeau.

(Works of reference: E. Littré, *Histoire de la langue française* (2 vols., 1867); *Dictionnaire de la langue française* (4 vols. 4to, 1873); G. Paris, *Grammaire de la langue française* (1874); A. Brachet, *Grammaire historique de la langue française* (1867) and *Dictionnaire étymologique* (1868); Diez, *Grammaire des Langues Romaines*, traduite

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French Lick, post-tp. of Orange co., Ind. French Lick Springs are some twelve in number, and are situated in a delightful valley, 9 miles from Georgia Station on the Ohio and Mississippi R. R. They have copious saline sulphur waters, which are very useful in a wide range of diseases. Pop. 1599.

Frenchman's Bay, in Hancock co., Me., an arm of the Atlantic extending inward 30 miles, with a general width of some 10 miles. Mt. Desert Island lies on the W. side of its entrance, and Schoodic Point on the E. It is deep, free from ice in winter, and abounds in good harbors. Lat. 44° 15′ N., lon. 68° 25′ W.

French Polish, a solution of $1\frac{1}{2}$ pounds of shell-lac in 1 gallon of alcohol, or 12 ounces of shell-lac, 2 ounces of elemi, 3 ounces of copal in 1 gallon of alcohol.

French Prophets, Protestant enthusiasts, who arose in France, principally after the unfortunate termination of the religious wars in the Cevennes. (See CAMISARDS.) They were originally Huguenots, and were for the most part honest, but the sufferings they had endured under persecution had exalted their minds until they believed themselves directly inspired of God. The earliest traces we find of such enthusiasts in Dauphiny and Vivarais as far back as 1688, but they were few in number until the opening of the eighteenth century, when they amounted to many thousands of both sexes. They believed themselves under the immediate influence of the Holy Ghost, went into trances, saw visions, and were by the populace generally treated with superstitious awe and veneration. About 1706 some of their prophets went over into England and Scotland, and rapidly gained converts on British soil. They were even joined by parties of some influence. They predicted the speedy establishment of the Messiah's kingdom, and pretended to possess the gift of tongues and the power of working miracles. Their pretensions, however, brought on their overthrow. They had persisted that Dr. Eames, one of their number who had died, could be raised from the dead, and failing in this they speedily declined in influence and numbers. Their actions, however, left a stigma upon all Protestant refugees in Great Britain. (See HUGHSON, *A Copious Account of the French and English Prophets, etc.* (London, 1814); SMEDLEY, *Hist. Ref. Rel. in France*, iii. 253 *seq.*) The sect also existed in Germany and America, and from this sect in England sprang the SHAKERS (which see). JAS. H. WORMAN.

French Purple, a beautiful dye obtained from lichens. (See ARCHIL.)

French River, in Ontario, Canada, is the outlet of Lake Nipissing, and flows into Georgian Bay, Lake Huron; lat. of mouth, 45° 53′ N., lon. 81° 5′ W. Length, 55 miles. It is a swift stream, whose lower course looks as if it were cut artificially through the rocky walls. There are many rapids, but the stream is the channel of a considerable fur-trade.—Another French River flows into James's Bay through the estuary of the Abbitibbe River.

French's Creek, tp. of Bladen co., N. C. Pop. 1176.

French'town, tp. of Monroe co., Mich. Pop. 2115.

Frenchtown, post-b. of Hunterdon co., N. J., is beautifully situated on the Delaware River and the Belvidere division of the Pennsylvania R. R. It has a national bank, 4 churches, 3 hotels, a number of stores, and 2 weekly newspapers. The most important business is the manufacture of spokes, hubs, etc. There are also manufactures of iron and brass castings, regalias, carriages, sash and blinds, distilled liquors, etc. P. 912. CHAS. S. JOINER, ED. "PRESS."

Freneau (PHILIP), b. of Huguenot ancestry at New York Jan. 2, 1752; graduated at Princeton, N. J., in 1771, and while there was the associate of James Madison. He went upon several mercantile voyages to the West Indies, in one of which he was taken prisoner by the British, and suffered much during his consequent imprisonment. During the Revolution he produced much prose and verse, chiefly of a burlesque character, which afforded a very effective support to the patriotic cause. He was editor of the *Daily Advertiser*, New York, 1791, and of the *National Gazette* of Philadelphia, 1791–93, and translating clerk for Mr. Jefferson, then secretary of state. Freneau was a violent Anti-Federalist; edited in 1795 the *Jersey Chronicle*, and in 1797 the *Time Piece*, New York, after which he again became a shipmaster. He published four volumes of poetry and several collections of letters and miscellanies. He led a somewhat irregular life, and perished in a snow-storm near Freehold, N. J., Dec. 18, 1832. Some of his poems have very considerable merit.

Frenta'ni, an ancient race of Central Italy, Samnite in blood, but not in name, for they were the allies of Rome in the Samnite wars; lived in a fertile hilly region bounded E. by the Adriatic and S. by the river Tifernus. Long the allies of Rome; joined (B. C. 90) in the Social war, and probably were enfranchised with the other Italians.

Frère (CHARLES THÉODORE), a French painter, b. in Paris in 1815; was a pupil of Coignet and Roqueplan, and made his first public appearance at the exhibition of 1834. Two years later he went to Algeria, traversed the desert, visited the lands of the East, and was at the taking of the city of Constantine by the French on Oct. 13, 1837. His pictures mostly represent Eastern scenes and manners, streets, squares, market-places, bazaars, cafés, with an occasional reminiscence of military life. They are of small size and elaborate execution, rich and harmonious in color, correct in drawing, and pleasing in tone. The artist has been twice honored with the medal — once in 1848, and again in 1865. O. B. FROTHINGHAM.

Frere (Rt. Hon. Sir HENRY BARTLE EDWARD), K. C. B., G. C. S. I., D. C. L., a nephew of J. H. Frere, b. in 1815; was educated at the India College, Haileybury; entered the Bengal civil service 1833; became resident in Scinde 1856; served with distinction during the Indian mutiny; was governor of Bombay 1862–67; was sworn of the privy council 1873; president of the Royal Geographical Society 1873–74; negotiated the treaty of 1873 with Zanzibar, by which the latter power agreed to co-operate in efforts to suppress the slave-trade.

Frere (Rt. Hon. JOHN HOOKHAM), M. A., b. in London May 21, 1769; was educated at Eton and Caius College, Cambridge, where he took his master's degree in 1795; at once entered the foreign office; was in Parliament 1796–1802; under-secretary of state for foreign affairs 1799; became envoy to Portugal 1800; envoy to Spain 1802–04; privy councillor 1804; minister to Spain 1808–09; married the countess of Erroll 1816; removed to Malta 1821. D. at the Pietà, Malta, Jan. 7, 1846. He was a poet of much merit, and one of the founders of the *Quarterly Review;* author of *King Arthur and his Round Table* (1817, under the pseudonym of "Whistlecraft"); published *Translations of Several Plays of Aristophanes* (1840), *Theognis Restitutus* (1842), and other writings, mostly humorous. (See his *Works*, with memoir, 1872.)

Frère (PIERRE ÉDOUARD), a French painter in genre, b. in Paris Jan. 10, 1819, pursued the course of study at the École des Beaux Arts; worked in the studio of Paul Delaroche, and in 1843 exhibited his first picture in the Salon. He is a prolific artist, but careful, with a pure sentiment, a delicate taste, and a fine pencil. His subjects are chosen from humble (frequently from domestic) life, comprising interiors with children, chamber scenes, incidents of labor or amusement, graceful idyls of common experience in great variety, the feeling sometimes bordering on the sentimental, but always healthy and sweet. Numerous examples of his work have come to this country, and been eagerly bought. The lithographer has made his best pieces familiar to all frequenters of print-shops. M. Frère has received two third-class medals—in 1850 and 1855—and a second-class medal in 1852. At the close of the exposition of 1855 he was decorated with the cross of the Legion of Honor. O. B. FROTHINGHAM.

Fre'richs (FRIEDRICH THEODOR), M. D., b. at Aurich, Hanover, Mar. 24, 1819; graduated at Göttingen and studied at the leading European capitals; became an exceedingly popular medical lecturer at Göttingen; went in 1851 to Kiel and assumed charge of the hospital; became in 1852 professor of pathology and therapeutics at Breslau and director of the school of clinical medicine. He has since removed to Berlin. His most popular and valuable work is a *Practical Treatise on Diseases of the Liver*, which has been translated into English and French.

Fréron (ELIE CATHERINE), b. at Quimper, France, 1719; was educated at the College Louis-le-Grand, Paris; left the Jesuits, among whom he was a professor, in 1739, for some unknown cause, but still wore the garb of a cleric. Disappointed of a benefice, he entered upon the life of a journalist. His periodical, *Lettres de Mme. la Comtesse de* ——— (1746–49), was suppressed, and soon reappeared as *Lettres sur quelques écrits du ce temps* (1749–54). His *Année Littéraire* (1754–76) was finally suppressed by his enemies, and he d. of chagrin Mar. 10, 1776. He is remembered for his lifelong hostility to Voltaire and the Encyclopédists, who fully returned his hatred; for his zealous championship of ecclesiastical and monarchical ideas; and as one of the founders of journalistic criticism. His works are mostly

criticisms, poems, translations, and papers on subjects of no permanent interest; author of a *History of Mary Stuart* (1742) and a *History of Germany* (1771).—His son, LOUIS STANISLAS (1757–1802), is remembered as a bloodthirsty Jacobin, who became an equally cruel reactionist.

Fres'co [It. "fresh"], or **Fresco-Painting,** a term somewhat vaguely applied to different methods of mural decoration in colors or in *chiaroscuro*, but which, strictly speaking, belongs only to paintings executed on fresh or moistened plaster. In the so-called *buon fresco*, or true fresco, mineral colors, mixed with water or lime-water, are applied directly to the smooth wet face of good lime mortar—the last very thin layer, called the *intonaco*, being of a particularly fine quality—in which case a new chemical combination takes place, and a crystalline surface almost impervious to moisture is formed. The practice of staining walls with colors in this way may be traced even to Egypt and Greece, but it is somewhat doubtful whether it was ever applied to works of high art till towards the end of the fourteenth century. The earliest specimens of *buon* fresco are probably those of Pietro d'Orvieto (continued by Benozzo Gozzoli) in the Campo Santo at Pisa, although Förster credits the evidence that Altichiero and Avanzo had employed this process earlier at Padua. Albert Ilg, in the notes to his translation of Cennini, declares that *buon fresco* was practised even in the Roman period, and occasionally ever since; that it was known in Byzantium; and that the art has been handed down traditionally in the convents of Mount Athos to the present day. However this may be, the works of Giotto and his contemporaries, though always spoken of as frescoes, were not executed in this way. The usual method of painting on plastered walls, in his time, was to allow the plaster to dry thoroughly and then to re-wet such portions of it as the artist could cover with color at a single sitting. This is called by later Italians *fresco secco*, or dry fresco. Many suppose that the old Roman frescoes were generally executed in this way, but there is much difference of opinion on the subject. Some of them are certainly in *tempera*, and others in *encaustic*. (For further information as to the methods employed in producing the frescoes of Pompeii and Herculaneum, and for interesting chemical experiments upon these frescoes, see OVERBECK'S *Pompeii* (second revised ed., 1866), vol. i., ch. 3.) After the beginning of the fifteenth century *buon fresco*, or painting on undried plaster, became the favorite art of the greatest Italian masters, and Masaccio, Mantegna, Demonias, Ghirlandajo, Francia, Perugino, Luini, Fra Bartolommeo, Raphael, Michael Angelo, Correggio, all gloried in it and became glorious through it. The swiftness of execution required by the rapid drying of the mortar, the impossibility of correcting a mistake without removing a portion of the plaster, the vast spaces to be filled, at once demanded and permitted the exercise of the highest artistic faculties; and Michael Angelo went so far as to declare oil-painting to be work for only women and children. One obvious advantage of fresco over oil-painting is that, from the absence of all gloss of surface, the picture may be seen equally well from every point of view; another is its greater durability under the same exposure. The subject to be represented on the wall was first drawn and shaded on paper backed with cloth; this cartoon, as it was called, or a tracing from a portion of it, was then applied to the wall, the outlines were carefully pricked through into the wet plaster, and a fine black powder being blown or sifted into the perforated lines, a distinct drawing was left behind. Old cartoons pierced in this way are still extant, and the black dots can be detected in the outlines of many a beautiful old fresco. Careful inspection will also frequently show where the work of one day is joined to that of another, for the mason was obliged to lay the plaster from day to day as the artist covered it. To name the great frescoes of Italy would be to give the list of a large proportion of her finest pictures. Those of Giotto may perhaps be best studied at Assisi and Padua—those of Fra Angelico, at Florence and Orvieto. The S.S. Annunziata at Florence possesses some of Andrea del Sarto's best frescoes—the exquisite Madonna del Sacco and a series of scenes from the life of Philippo Benizzi. The Camera of San Paolo at Parma contains surpassingly beautiful frescoes by Correggio, not to speak of the domes of San Giovanni and of the cathedral, once miracles of this art by the same hand, but now wellnigh ruined by rain and dampness. The Sistine Chapel at Rome is considered by many as Michael Angelo's crowning work, and the Stanze of Raphael, also in the Vatican, are counted among the noblest efforts of that splendid genius. Perhaps, however, no artistic production has ever received higher praise than Leonardo da Vinci's *Last Supper* in the convent of Sta. Maria delle Grazia in Milan. Unhappily, this wonderful work, though possessing all the freedom, power, and grandeur of the true fresco, was painted in oil, and consequently has almost entirely perished. For the same reason there is little to be hoped for it in the way of restoration by the newly-invented process which has been applied during the present year (1874) to the old water-color frescoes of Assisi, and which is said to have given them almost their original brilliancy.

The objection against frescoes, that they are not movable, is a serious one, but where time can be allowed for the tedious process they may be transferred from the wall to cloth, much in the same way as oil-pictures are removed from wood or from one canvas to another. Small frescoes in exposed places are frequently sawed out of the wall with a sufficient thickness of the plaster to keep them from falling in pieces, and so preserved. This art, though so eminently suited to brilliant architectural decoration, declined after the age of the great masters, and the only Italian painters who have acquired even a moderate reputation for fresco in recent times are Benvenuti, Appiani, and Cammuccini. (See KUGLER'S *Hand-Book of Painting*.) In Germany, however, *fresco secco* has been lately revived in a novel form through the invention, by Prof. von Fuchs, of a solution of silica called water-glass. Repeated applications of this solution are made to the surface of the best well-dried common mortar; after which it is again allowed to dry thoroughly. The whole surface is then rubbed and polished; after this it is twice rewashed with the water-glass, and once more left to dry completely. Mineral colors, prepared in water, are then applied for the decoration, and the artist can correct or change as freely as if working in oils and on canvas. When the whole is finished the entire surface is carefully sprinkled over with the solution, after which the painting is believed to be secure against atmospheric influences. This kind of fresco is called *stereochrome*, and may be seen in its highest perfection in Munich and Berlin, where Kaulbach, Overbeck, Cornelius, Schnorr, and other great German artists have exerted their best powers. The late attempts at fresco-painting in England and America (as, for example, in the Parliament House in London and the Capitol at Washington) have been less successful; the same must be said of recent mural painting in France. (See OVERBECK'S *Pompeii* (Leipsic, 1866); also translations, by ALBERT ILG, of *Cennino Cennini* and *Heraclius*, Nos. 1 and 4 in the series; *Quellenschriften für Kunstgeschichte* (Vienna, 1871–73).) GEORGE P. MARSH.

Frese'nius (KARL REMIGIUS), b. at Frankfort-on-the-Main Dec. 28, 1818; studied at Bonn and Giessen, and became Liebig's assistant; entered in 1845 upon a chemical professorship at Wiesbaden; founded the *Zeitschrift für analytische Chemie* in 1862 at Brunswick; author of *Anleitung zur qualitativen Analyse* (1841) and *Anleitung zur quantitaven Analyse* (1846), both works of great value, besides treatises on the various German mineral waters, etc. His principal works are translated into many European languages, and have gone through many editions at home.

Fresnel (AUGUSTIN JEAN), F. R. S., an illustrious French physicist and inventor, b. at Broglie, Eure, in Normandy, May 10, 1788; was educated at Caen and at the École Polytechnique and the École des Ponts et Chaussées, Paris. He was a government engineer for eight years in the Vendée, and as a pronounced royalist was placed, during the "Hundred Days," under the surveillance of the police. He returned in 1815 to Paris, and his researches on the aberration, diffraction, and polarization of light at once placed him in the front rank of physicists. In 1819 he was appointed, with Arago and Mathieu, as one of the lighthouse commissioners of France; in the same year he gained the prize of the Academy of Sciences for a memoir on the diffraction of light—a work which was crowned in 1819. In 1823 he was unanimously chosen to the Academy. In 1824 he was made secretary of the lighthouse commission, and in the same year his health, always feeble, gave way, and he never again was able to work. D. at Ville d'Avray, near Paris, July 14, 1827, and on his deathbed received the Rumford medal of the Royal Society, London.

Fresnel's great life-work was compressed into five years (1819–24). That work, for which commerce, and indeed the whole human race, owes him a debt of gratitude, was the perfecting of the dioptric system of illumination for lighthouses. His system has received comparatively few improvements, and is now almost universally employed in lighthouses. (See LIGHTHOUSE ILLUMINATION, by PROF. JOSEPH HENRY, LL.D., M. N. A. S.)

Fresni'llo, town of Mexico, in Zacatecas, has a good mining-school, and is situated in a rich mining district. Pop. 7015.

Fres'no, county of S. Central California. Area, over 8000 square miles. A portion of its surface is very arid and sandy. Wool-growing, stock-raising, and mining are the chief pursuits. Gold and quicksilver are among the

products. It is watered by numerous branches of the San Joaquin and other streams. Cap. Millerton. Pop. 6336.

Freund (WILHELM), PH. D., b. of Jewish parents at Kempen, Prussia, Jan. 27, 1806; studied at Breslau and Berlin; has been an instructor in Breslau, Berlin, Hirschberg, London, and Gleiwitz; author of *Wörterbuch der lateinischen Sprache* (4 vols., 1834–45), the basis of Andrews' and William Smith's Latin dictionaries and of the larger work of Riddle and White; also author of two smaller Latin dictionaries; has been engaged for several years in issuing, under the title *Freund's Schüler-Bibliothek*, a series of annotations to the Greek and Latin authors usually read in the German gymnasia.

Frews'burg, post-v. of Carroll tp., Chautauqua co., N. Y., on the Dunkirk Warren and Pittsburg R. R. P. 379.

Frey, or **Freyr,** in Scandinavian mythology, the brother of Freya and the son of Njörd. He is beloved of all gods and men, and is himself the god of pleasure and fruitfulness. To him Loki gave the ship Skidbladnir, which always had a fair wind, and which, though capacious enough for all the gods, could be folded up and carried in the pocket. He also gave him the swift, golden-bristled boar Gullinbursti, which could traverse air, sea, or land. He is the husband of Gerda, the beautiful daughter of the giant Gymir, for whose love he forfeited his good sword, which the gods sorely needed for their defence. He was especially worshipped in ancient Sweden.

Frey'a, or **Frey'ia** (the "beloved"), the Scandinavian Venus, called also Vanadis, daughter of Njörd, the air-god, and wife of the god Odur, for whom she perpetually weeps tears of gold. Half the heroes who die in battle belong to her, doubtless because of old the passion of love was so fruitful a cause of wars. Friday (*dies Veneris*) is Freya's day, or, as others say, Frigga's day. (See FRIGGA.)

Frey'städtel, or **Galgocz,** town of Hungary, on the Waag, manufactures wooden articles and trades in cattle and timber. Pop. 6098.

Frey'tag (GEORG WILHELM FRIEDRICH), b. at Lüneburg, Germany, Sept. 19, 1788; studied at Göttingen, and became an army chaplain; studied the Oriental languages under De Sacy; was professor of Arabic at Bonn 1819–61; author of Arabic text-books and translations, and of an important *Lexicon Arabico-Latinum* (1830–37). D. at Bonn Nov. 19, 1861.

Freytag (GUSTAV), PH. D., b. at Kreuzberg, Prussian Silesia, July 13, 1816; studied at Berlin and Breslau; took his doctorate in 1838, and was a privatdocent at Breslau; produced successful plays, tales, and poems; was editor of the Leipsic *Grenzboten* 1848–70; and held for some years a court position at Gotha. Of his numerous works, the best known in this country are *Sollen und Haben* ("Debit and Credit"), of which there are several English translations; *Bilder aus der deutschen Vergangenheit;* and *Die verlorene Handschrift* (1864), translated by Mrs. Malcolm under the title *The Lost Manuscript*, London, 1865, 3 vols.

Fri'ar [Lat. *frater;* Fr. *frère*, "a brother"], a member of a monastic brotherhood, especially one who belongs to one of the mendicant orders—the Franciscans, Augustinians, Carmelites, and Dominicans. The Dominicans were called *Black* Friars, from their garments, and also *Preaching* Friars. The Franciscans were *Grey* Friars; the Carmelites at one time were called *Barred* Friars, from their striped robes, but in later times they were called *White* Friars. Monks not priests are called friars in Ireland, of whatever order; but after taking priests' orders they lose this distinctive name. The Franciscans are called *Friars Minor*, and there is a small order called *Friars Minims*. (See MINIMS.) *Crutched* Friars were canons regular of the Holy Cross.

Friar's Point, post-v., cap. of Coahoma co., Miss., on the Mississippi River, 110 miles below Memphis, to which place it has a daily packet-line. It has 1 weekly paper, and good white and colored schools and churches. It is in a rich cotton-growing country. Pop. about 400.

H. J. SANDERSON, ED. "WEEKLY DELTA."

Frick (CHARLES), M. D., b. in Baltimore, Md., Aug. 5, 1823; d. in that city Mar. 25, 1860. He began life as a civil engineer, but in 1843 commenced the study of medicine; graduated in 1845, and twelve years afterwards was elected a professor in his alma mater, the University of Maryland. He contributed some valuable articles to the *American Journal of Medical Sciences*, and in 1850 published a work on renal diseases. Dr. Frick died young, suddenly in the midst of his usefulness, leaving a blessed memory to all who knew him. He fell a victim to professional zeal. He had always been peculiarly susceptible to throat affections, and a few days after performing tracheotomy on a negro woman he was taken ill. The same operation having been decided upon in his own case, he rose from the bed, made every preparation for it, handed the knife to the surgeon, threw back his head, and indicated by the finger the point to be opened. His ready submission to God's will and noble courage marked the Christian hero.

PAUL F. EVE.

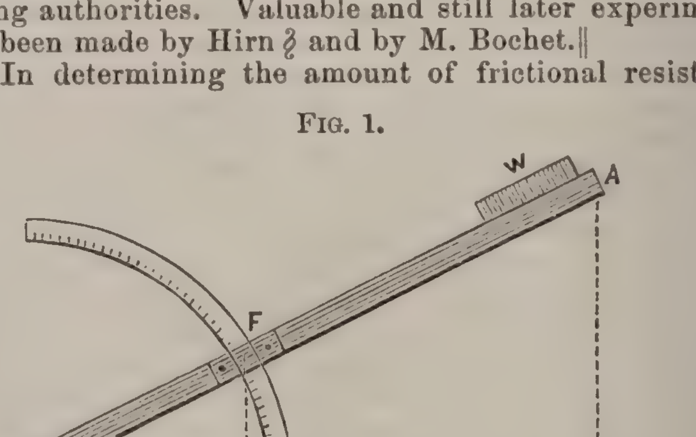
Fric'tion [from the Latin *frico*, to "rub;" Fr. *frottement;* Ger. *Reibung*]. 1. Friction is that force, always acting as a resistance, which is experienced when it is attempted to move one body upon another which is pressed into close contact with it. It is generally supposed to be due to the interlocking of the asperities of the two surfaces, and to abrasion by tearing them off. Thomson* supposes all friction to produce electricity, and Tait expresses the opinion that "it is probable that all friction, perhaps not excepting that caused by actual abrasion, is due to the production of electricity."† Friction is of two kinds—sliding friction, which is encountered when one body is forced to slide upon another; and rolling friction, which is that resistance which is met with when it is attempted to cause one body to roll upon another. The friction of a sled upon the ground or of a sleigh upon snow illustrates the first kind. The resistance of a carriage or of a railroad train consists principally of the rolling friction of the wheels upon the road or upon the track, and of the sliding friction of the wheels with their axles. When two bodies are at rest and in contact, it requires more force to get up relative motion than to overcome friction after that motion has commenced. The "friction of rest" or "friction of quiescence" is therefore greater than the "friction of motion." This difference is most marked with comparatively soft materials and with great pressures. A slight jar will usually reduce the friction of quiescence to that of motion.

2. In order to determine the real expenditure of power in doing work, and to ascertain the efficiency of machines, it is necessary to learn the amount of frictional resistance to be encountered, and to estimate the quantity of work which may be expected to be absorbed by it in each case. It is this force which has most effect in reducing the efficiency of mechanical combinations, and the losses from this cause alone are frequently very serious, amounting to 25, or even 50 per cent.

3. The investigation of the laws of friction and the determination of the "coefficient of friction" have employed many of the most distinguished philosophers and engineers. The earliest extended researches were those of Coulomb, made during the latter half of the last century, and published in 1785.‡ They are given in full in his *Théorie des Machines Simples, etc.*, 1821. The investigations of George Rennie, as published in the *Philosophical Transactions of the Royal Society* in 1829, and those of Gen. Morin, recorded in the *Mémoires de l'Institut* for 1833, were more extended and valuable. The latter, which were made under the direction of the French government, are regarded as most accurate and reliable, and are usually accepted as standard; with his *Nouvelles Experiences* they are quoted by all engineering authorities. Valuable and still later experiments have been made by Hirn § and by M. Bochet.‖

4. In determining the amount of frictional resistance

FIG. 1.

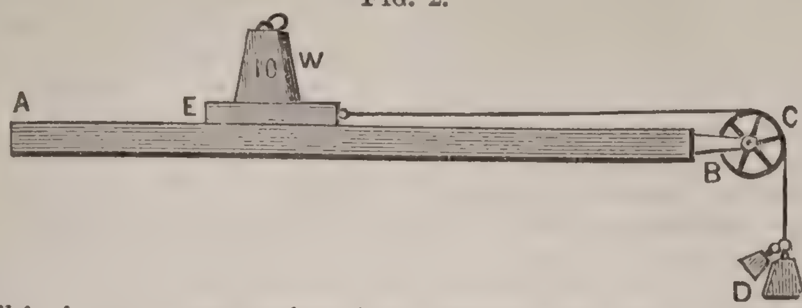


the apparatus used is generally very simple. Fig. 1 represents one of these instruments. A plane A B is placed horizontally, and loaded with a weight W. The plane is then raised at the end A until the weight begins to move. The force of friction of rest has then a ratio to that component of the force of gravity producing pressure, which is equal to the ratio of the perpendiculars A D and F E to the bases B D and B E—*i. e.* the "coefficient" of friction of quiescence is measured by $\frac{W \sin.i}{W \cos.i} = \frac{F}{P} = \tan.i = f$. The angle $FBE = i$ is the "limiting angle of resistance." Similarly, the "coefficient of friction of motion" is determined by noting at what angle motion will just commence, and will continue with uniform velocity after having been started by a slight jar.

* *Bakerian Lectures*, 1856. † *Sketch of Thermidynamics*, p. 63. ‡ Young's *Nat. Philosophy*, vol. ii. § *Polytechnisches Centralblatt*, 1855. ‖ *Annales des Mines*, 5me série, p. xix.

5. The "tribometer" of Coulomb is shown in Fig. 2.

FIG. 2.



This is more convenient in operation, and gives more reliable results, than that just described, in which there is often found difficulty in distinguishing between the friction of motion and that of rest. A horizontal table A B is fitted at one end with a pulley C. A block E slides on this table, and carries a weight W of any desired magnitude. The block is drawn along the surface by a suspended weight D, which is adjusted until just sufficient to produce or to continue motion. The nature of the rubbing surfaces and the amount of pressure upon them are readily changed, and the results obtained are quite reliable.

6. In experimental determination of rolling friction, cylinders, or rollers, of various sizes and weights are used in place of, or are placed under, the sliding block.

7. In ascertaining the friction of axles and of shafts revolving in their journals a shaft capable of being loaded to any required extent and driven at any required speed is used. A thermometer has sometimes been attached to indicate changes of temperature of the lubricant, or any warming of the journal due to the development of heat, into which form of energy the work done in friction is always converted. The first experiments of this character were made at the Brooklyn navy-yard by Messrs. King, Stivers, and Price, a board of U. S. naval engineers.

8. A later and more complete apparatus for similar experiments is "Thurston's apparatus for testing lubricants," as made at the Stevens Institute of Technology,* and which is shown in Figs. 3 and 4. It was patented Dec. 24, 1872. A shaft A is carried by a pair of journals B B, and is driven

FIG. 3.

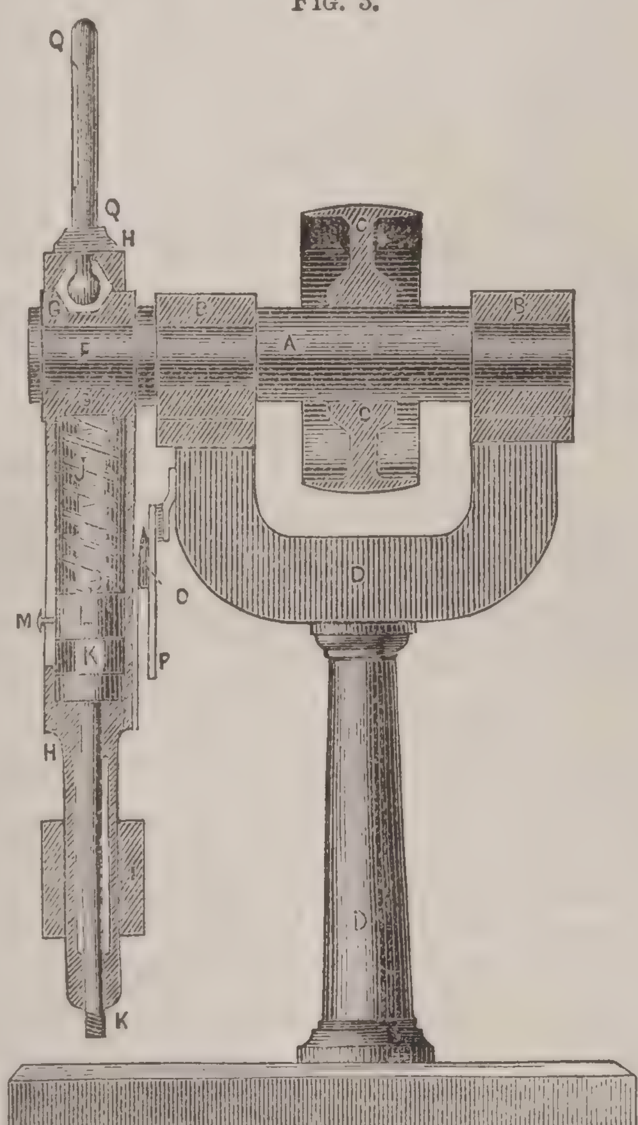
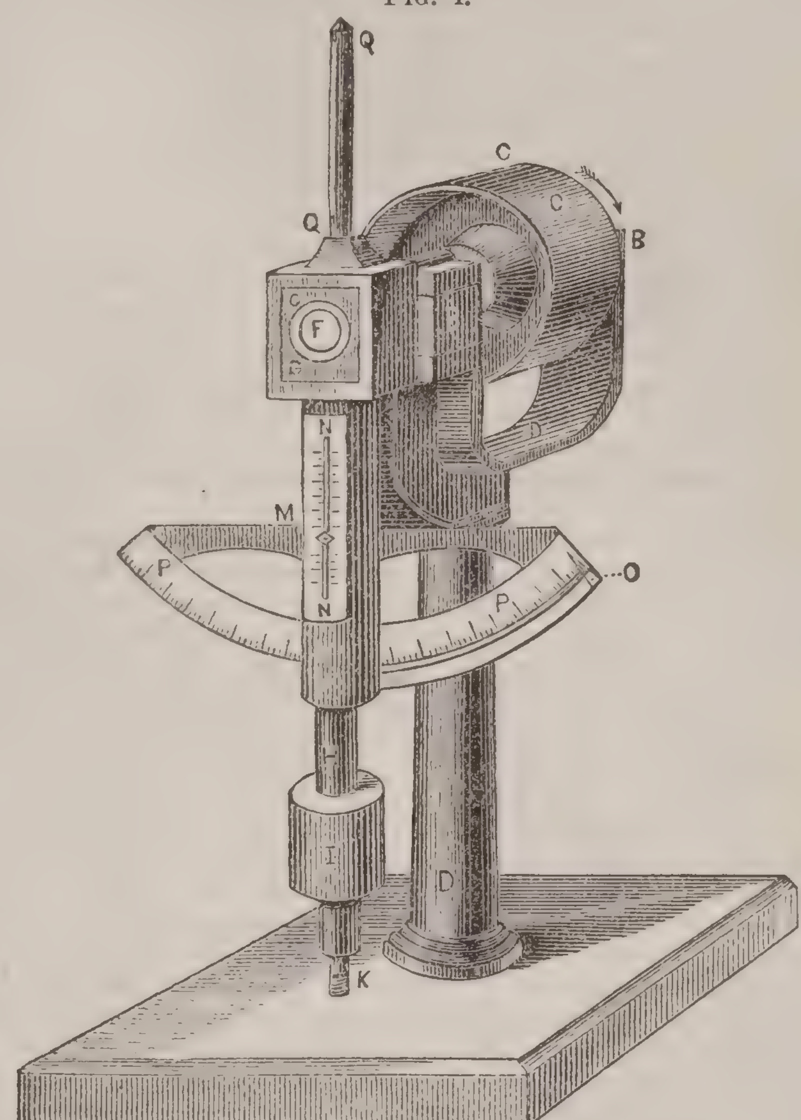


FIG. 4.



Sectional and Perspective Views of Thurston's machine for testing lubricants.

by a pulley C. At the outer extremity is a third journal F, grasped by a pair of "brasses" G G, which are caused to exert any required pressure by means of a helical spring J, compressed by a screw K K, working in the supporting nut L. The degree of pressure is shown by a pointer M traversing the scale N N. The arm H which carries this portion of the instrument is suspended so as to swing about the journal F, and is loaded by a fixed weight I. A pointer O, traversing a graduated arc P P, indicates the deviation of this loaded arm from the perpendicular, and the resulting moment equal to that exerted by the friction of the shaft in its bearing F G. The scale N N bears two graduations, one of which, as just stated, indicates the pressure on the journal, while the other set of figures have such values that when the reading on the arc P P during any experiment is divided by the number on N N opposite that which indicates the pressure on the journal, *the quotient will be the coefficient of friction.* A thermometer Q Q, the bulb of which is inserted in a cavity in the upper "brass" G, serves to indicate the temperature of the bearing at every instant. Thus, coefficients of friction are readily determined for any kind of rubbing surfaces and for any kind of lubricant. The durability of any unguent, its capacity for resisting high temperatures or great pressures, and its general behavior under any conditions of use, may be learned. The relative values of several lubricants are ascertained with facility, testing them under the precise conditions as to pressure, velocity of rubbing, and character of surface to which it is proposed to subject them, and the kind of work to which any one of them is best adapted is indicated by the results of a series of tests under varying conditions.

9. By experiments made as indicated the following law has been proven to exist within certain limits: Frictional resistance is simply proportional to the force with which the rubbing surfaces are pressed together, and is independent of the extent of those surfaces and of the velocity of rubbing. The law is departed from whenever the surfaces are subjected to such intensity of pressure as to become abraded or fractured. It is also inaccurate where the surfaces are separated by an unguent, and are of such great area that the resistance due to viscosity of the lubricant becomes considerable as compared with the resistance of true friction. In this case the resistance varies approximately in proportion to the area of the surfaces in contact. This latter case occurs less frequently than the preceding. Great variations of velocity also cause a modification of the law, the friction becoming slightly less with high speeds.

10. The resistance due to friction is obtained by multiplying the pressure borne by the surfaces in a direction perpendicular to their planes by the coefficient of friction f. The following are values of f for the most frequently occurring cases, as given by Morin:†

No.	Surfaces.	Unguent.	Angle i.	$f = \tan. i$.
1	Wood on wood......	None......	14° to 26½°	0.25 to 0.50
2	" " "	Soap......	2° to 11½°	0.04 to 0.20
3	Metal " "	None......	26½° to 31½°	0.50 to 0.60
4	" " "	Water....	15° to 20°	0.25 to 0.35
5	" " "	Soap......	11½°	0.20
6	Leather on metal..	None......	29½°	0.56
7	" " " ..	Greased..	13°	0.23
8	" " " ..	Water....	20°	0.36
9	" " " ..	Oil.........	8½°	0.15
10	Smoothest and best lubricated surfaces..................	....	1¾° to 2°	0.03 to 0.036

* *Journal Franklin Institute*, July, 1873, p. 1.

† *Notions Fondamentales de Mécanique.*

The value of f for earth varies from 0.25 for wet clay to 1.10 for gravelly soil; a usual value is 0.50. The coefficient of quiescence very commonly exceeds that of motion about 40 per cent.

11. The maximum pressure which the more frequently used unguents will bear varies with the speed of the rubbing surfaces, the liability to heat being measured by the product of pressure into velocity—*i. e.* by the quantity of energy expended in a given time. At a uniform speed of 200 feet per minute, the maximum per square inch, as determined by experiments on new iron shafts running in loaded bearings, is as follows, when the elevation of temperature of bearing is not above 50° F.:

Winter sperm oil	65 lbs.	Best mineral oil	65 lbs.
Summer " "	75 "	Light " "	55 "
Winter lard	55 "	Lightest " "	30 "

At lower speeds and with very hard and smooth surfaces much higher pressures may be allowed. Steel crank-pins for steam-engines are sometimes subjected to a pressure of 1200 pounds or more per square inch, with a velocity of rubbing of about 50 feet per minute; but this should be regarded as a maximum pressure, and should not be approached when possible to avoid it. Sperm oil, lard oil, and lard or tallow are the best lubricants for use on heavy machinery. Lubricants having less "body" are more suitable for light machinery. All of the fixed animal, mineral, and vegetable oils are frequently employed, and plumbago and soapstone are sometimes used.

12. The temperature at which oils lose their fluidity has some influence upon their value in special cases. Winter lard oil begins to thicken at 40° F., and congeals at 25°. Winter sperm thickens at 48°, and becomes solid at 36°. Summer sperm oil thickens at 66°, and freezes at 56°. Heavy mineral oil thickens at 43°, and solidifies at 20°. Light petroleum thickens at 34°, and freezes at 18°. Very light mineral oil thickens at 18°, but remains liquid at 0° F.

13. Since both pressure and velocity of motion have an influence in determining the value of a lubricant, that which is best adapted for any special case should always be selected after trial under the precise conditions of actual use, both of speed and pressure, whenever possible.

14. Work lost in overcoming friction gives rise to heat to the amount of one British thermal unit for each 772 foot-pounds so expended. Where this evolution of heat does not produce overheating of the bearing surface or burning of the unguent, it does no harm. The amount of pressure thrown upon the surfaces exposed to friction should always be carefully kept far below the limit at which heating is liable to occur at the proposed velocity of rubbing.

15. The diameter of the journal of a revolving shaft is fixed by the consideration of the stress which it has to bear; its length is determined by the magnitude of frictional resistances and the limit of pressure admissible. The following formula was first proposed by the writer in 1862, from observation of and experiment upon the crank-shafts of naval steamers:

$$P=\frac{60{,}000ld}{V},\text{ or } l=\frac{PV}{60{,}000d}\dots\dots\dots(1).$$

Rankine in 1865 published the following, as derived from locomotive practice:

$$p=\frac{44{,}800}{60\,V+20}\dots\dots\dots(2).$$

In these formulas, l represents the minimum length of bearing in inches; d is its diameter, V the velocity of rubbing in feet per minute, p the maximum pressure per square inch of longitudinal section of the bearing, and P the maximum total load on the journal in pounds. Mr. J. D. Van Buren published in 1869 the formula deducible from (1):

$$l=\frac{PN}{350{,}000}\dots\dots\dots(3),$$

where P is the total working load on the bearing of a crank-pin in pounds, and N the number of revolutions per minute. Mr. T. Skeel in 1873 gave the following:

$$l=\frac{IHP}{130\,s}\text{ to }\frac{IHP}{150\,s}\dots\dots\dots(4),$$

in which IHP represents the "indicated horse-power" transmitted by the crank-pin, and s is the stroke of piston in inches. All of these formulas will be found useful for plane as well as cylindrical surfaces.

16. Good practice is generally considered to dictate a limit of pressure as low as 800 pounds per square inch for other metals than steel. With thorough lubrication, which should always be carefully provided, and pressures below the maximum, the kind of metal of which the bearing surfaces are composed does not usually affect, in any appreciable degree, the amount of frictional resistance.

In general, to reduce the amount of power lost in friction, parts should be made as light as possible consistently with proper strength; rubbing surfaces should be given as great an area as possible; the velocity of rubbing and distances moved over should be kept well below the maximum due the pressure; and lubricants should be carefully chosen. A common length of journal for shafting, as made by the best builders, is four times the diameter. With ample surface and effective lubrication, wear becomes imperceptible. Heavy weights are often carried on rollers, and wagons and carriages are mounted on wheels, rolling friction being thus substituted for the more serious form of sliding friction. "Friction-wheels" supporting the shafts of grindstones, or as applied in the "Atwood machine," also illustrate this case.

17. Although, in the operation of machinery and in many other instances, friction is an annoyance and the cause of even very serious losses, it is also frequently very useful. The friction of the driving-wheels of the locomotive upon the track is essential to the useful application of its power. "Friction-gearing," driving by the friction produced by contact and mutual pressures of the smooth peripheries, has now many important applications. Nails, screws, and wedges would have no value except for the frictional resistance which retains them in place when once "driven home." The checking of the recoil of ordnance and of the motion of railroad trains is accomplished by "friction-brakes." Even the act of walking becomes impossible when, as upon smooth ice, the foot finds no frictional resistance to its movements.

18. *Rolling friction* has been found to be governed by a law which is expressed with approximate accuracy by the formula given by Coulomb:

$$F=f\frac{R}{r}\dots\dots\dots(5),$$

in which F represents the resistance, or the required force of traction to overcome it, when R is the load expressed in similar units of force, and r is the radius of the roller on which the load is carried. The coefficient of friction as determined by experiment is represented by f. The experiments of Gen. Morin confirm the deductions of Coulomb, while those of Dupuit and those of Poirée and Sauvage give results in which F varies nearly as the square root of r. The formula above given is generally adopted. Coulomb found the value of f for rollers of elm to be 0.032; Weisbach and De Pambour found the value for railroad car-wheels to be very closely 0.02. The total resistance of railroad trains on level grades and under favorable conditions is usually from 8 to 10 pounds per ton weight of train at all ordinary speeds. For vehicles mounted on wheels the tractive force is $2F$, since the impelling force is applied at the axis and its lever-arm has but one-half the length assumed in the formula. The value of f is subject to great modifications with different surfaces, and by the effect of the load in altering the form of the wheel or the roller, and in indenting and compressing the surface on which it moves.

19. The frictional resistance of *pulleys* arises in a great degree from the rigidity of their cordage. This was found by Coulomb to be proportional to the tension, to increase nearly as the square root of the cube of the diameter of the rope, and to be inversely proportional to the diameter of the sheaves over which the rope passes or of the cylinder around which the rope winds. Weisbach has shown that this rigidity is due principally to the lateral friction resisting the slipping of the fibres among each other, and that it is less with greased or tarred ropes than with dry cordage; and also that wire ropes offer less of this kind of resistance than ropes of hemp.* Where a rope is wound several times around a cylinder, the resistance increases in a geometrical ratio. It is for this reason that the strongest rope may be broken by the friction produced by a few turns taken about a post, as is sometimes seen in the common practice of seamen "rendering" a line around the "bitts" in checking the motion of a vessel.

20. *Fluid friction*, so called, is a resistance due to viscosity of the fluid, and to the resistance of the inertia of those particles which are subjected to change of motion. The resistance of well-formed vessels is caused almost entirely by "fluid friction." The amount of this resistance is given by Rankine† at "1 pound per square foot of surface moving ten knots" (nautical miles) "per hour." By Isherwood‡ it is stated to be "0.45 pound per square foot of surface moving with a velocity of 10 feet per second." This resistance varies directly as the area of surface and nearly as the square of the velocity. The coefficient decreases with increase of velocity. R. H. THURSTON.

* *Zeitschrift für Ingenieur-wesen*, vol. i. 1848. † *Shipbuilding*, p. 81. ‡ *Engineering Precedents*, vol. i. p. 13.

Fri'day [either "Freya's day," *dies Veneris*, or "Frigga's day;" Ger. *Freytag;* Fr. *Vendredi*], the sixth day of the week, following Thursday and preceding Saturday. In the Eastern, Latin, and Anglican churches all Fridays except Christmas (or in some Roman Catholic dioceses all Fridays except those in Advent, but always the Ember Day in Advent) are fasts of obligation, in memory of the passion of our Lord, which is especially commemorated on GOOD FRIDAY (which see). In the folk-lore of many nations Friday is considered an unlucky day, doubtless on account of the religious associations connected with it.

Fried'berg, manufacturing town of Prussia, in the province of Brandenburg, is situated between several small lakes. Pop. 5621.

Fried'ensville, post-v. of Upper Saucon tp., Lehigh co., Pa., and has important zinc-works.

Fried'land, town of Mecklenburg-Strelitz, Germany, 30 miles N. E. of New Strelitz. It has a brisk trade and thriving manufactures. Pop. 5031.

Friedland, town of Prussia, 27 miles E. of Königsberg. Here the allied Russians and Prussians were defeated by the French June 14, 1807.

Friedland, town of Bohemia, 68 miles N. of Prague. Wallenstein, whose castle is close by, took his title of duke from this town. Pop. 4331.

Fried'länder (DAVID), a Jewish scholar, b. at Königsberg, Prussia, Dec. 6, 1750, was attracted to Berlin by the reform labors of Moses Mendelssohn, after whose decease he became himself the leader of the Berlin Jews in educational and social reforms. He even went so far, at one time, as to propose a union of the Jewish with the Christian Church, but as he had asked that the Jews be admitted into the Christian fold without acknowledging the Messiah, its living Head, the ecclesiastical authorities of Prussia rejected the proposal. The literature occasioned by this proposal is quite extensive; the most valuable pamphlets are mentioned in GRÄTZ (p. 174, note 2). Friedländer founded with Itzig, his brother-in-law, a free school for the Israelitish youths of Berlin, and he labored in this connection and as an author, as well as a citizen, for the social and political elevation of his people. D. Dec. 25, 1834. (See JOST, *Geschichte des Judenthums*, etc., iii. 316 *seq.;* GRÄTZ, *Gesch. der Juden*, x. 162 *seq.*, 171 *seq.*)

JAMES H. WORMAN.

Friend'ly (or **Ton'ga**) **Islands,** a group of islands, sometimes made to include the Feejee Islands, situated in the Pacific Ocean between lat. 13° and 25° S., and lon. 172° and 177° E. Their number is over 150, of which the smaller ones generally are of coral formation, while the larger ones are of volcanic origin. They have few native animals, but are rich in yams, sweet potatoes, and bread-fruits.

Friends, or **Quakers,** a society of professing Christians, better known in the past to the world at large by the name of "Quakers." They at first called themselves "Friends" or "Friends of Truth," and they still retain among themselves the title of the "Society of Friends," by which they are now becoming more generally recognized. The term "Quaker" had its rise from the following incident: George Fox, usually called the founder of the society, in the course of his ministry and persecutions was in 1660 brought before Justice Bennet at Derby, England, "who," says Fox, "was the first that called us 'Quakers,' because I bade him tremble at the word of the Lord." This term, though given in scorn to the Friends, they have never felt ashamed of, remembering its scriptural authority in such texts as these: "The Lord reigneth; let the people tremble;" "Hear the word of the Lord, ye that tremble at His word;" "The earth shall quake—the heavens shall tremble," etc., setting forth the exaltation of God and the dependence and nothingness of man. Thus, the terms "Quaker" and "Quakerism" have become incorporated into the history and literature of the society, and also into general literature, taking a coloring quaint and classical in the prose of Southey, Coleridge, and Howitt, and in the poetry of Lamb, Lloyd, Barton, Longfellow, Whittier, and others. Robert Barclay in 1690 entitled his learned work on the doctrines of the Friends, *An Apology for the true Christian Divinity as the same is held and preached by the people called, in scorn, Quakers;* and Sewell entitled his noted work, *Sewell's History of the People called Quakers.* In a brief sketch of this portion of the Christian Church a cursory glance only can be given at its rise, its early history, its essential doctrines, its church order and government, its influence upon the Christian world, and its present position and prospects. "The rise of the people called Quakers," says Bancroft, "is one of the memorable events in the history of man. It marks the moment when intellectual freedom was claimed unconditionally by the people as an inalienable birthright." It may be added, it marks the period when the conflict for liberty of conscience resulted, through persecutions passively endured, in a permanent victory. Nor can the early history of the Friends be regarded as unique and isolated. The true causes of these spiritual phenomena, and of all others in the progress of Christian truth, are deep-seated and remote. All the religious societies which have arisen since the Reformation appear to have aimed at a more fervent piety than was found among the sects from which they sprang. They strove to realize a greater conformity to the apostolic pattern. In the Reformation itself we find the germs of those principles which were subsequently developed and carried out by the founders of the Society of Friends. Sentiments very similar to those held by Friends on the subjects of the indwelling and guidance of the Holy Spirit, on baptism and other church ceremonies, on wars and oaths, and a ministry based upon education and human appointment, were entertained by individuals at different periods before the preaching of Fox. Early in the seventeenth century there was a marked movement in this direction, which prepared the way for the more full presentation of the gospel in its original simplicity by George Fox and his co-workers. And it may here be remarked, to correct a popular error, that these fundamental doctrines were not set forth before the world by their advocates as new truths, but as pure, unencumbered, primitive Christianity; and further, that George Fox himself did not labor to found and organize a new sect, but was earnest in proclaiming the truth which he felt had been revealed to him. In this work he found ready hearers among those of similar convictions and experience. Thus, being brought to Christ by the revelation of His Spirit in their own hearts, these individuals were brought into unity of doctrine and purpose, one with another, as a Church, of which they regarded Christ alone the Founder, and over which, according to the Scripture, they believed Christ alone to be the Head, and by His Spirit the personal, perceptible, immediate guide in all things. Upon this simple apostolic basis the early Friends became associated, and from this cardinal doctrine of the enlightening and directing power of the Holy Spirit spring all their distinguishing views. And in common with their brethren of the other Protestant churches of their times, to the early Friends it was given not only to believe in Christ, but to suffer for His sake. Although some of the Protestants earlier organized, as the Baptists and Presbyterians, first met the force of persecution, yet upon the unresisting Friends at last the pitiless storm fell most heavily. All this sad ecclesiastical story is of course interwoven with political events. The hopes of greater toleration for Protestants which the short reign of Edward VI. had given birth to were completely extinguished by the inglorious one of his sister Mary. When Elizabeth succeeded to the throne she found herself surrounded by papists strongly attached to their religion and zealous for its support. Refusing to hazard the peace of the realm by too great or sudden alterations, her policy led her to pursue a cautious course in changing the existing order of things, so that the doctrines and forms of worship revived and established by her left the minds of many Protestants dissatisfied. The spirit of inquiry was abroad in increasing vigor and activity, and various classes of dissenters sprang up, united in a strenuous opposition to the Romish Church, combined also with a degree of discontent with the existing established religion. These disputes and dissensions, which had been carried on with increasing acrimony through the reigns of Elizabeth and James I., began to assume under Charles I. a most serious aspect, threatening to destroy the peace of the kingdom. His arbitrary assumptions augmented the difficulties, which finally culminated in the civil war, and in 1648 brought the king to the scaffold, and set up the new form of government. Under the rule of Cromwell and of the Puritans more just and tolerant measures were gaining ground in the minds of men when they received a check by his death in 1658. On the accession of Charles II. to the throne in 1660 flattering promises were made by him of "liberty to tender consciences" "in matters of religion," but they proved delusive. Given up to his own pleasures, he allowed the clergy to carry out their plans for the control of the Church, without inquiring into the sufferings sustained by his subjects. Of these sufferings the Society of Friends, both in Great Britain and in the American colonies, partook largely. It is estimated that during the winter of 1662 between 4000 and 5000 of their members were incarcerated in the foul jails and dungeons of Great Britain. In 1672, Charles II. issued a declaration to suspend the operation of penal laws against nonconformists, which was followed by a bill to exempt dissenters from penal laws, introduced into Parliament in 1680. (For further details respecting this interesting period of church history as regards the Friends, who suffered more severely than any

other class of dissenters, we would refer the inquirer to SEWELL'S *History*, to GOUGH'S *History of Friends in Ireland*, and to BOWDEN'S *History of Friends in America*.) It was during this period of trial to the Church that the Society of Friends was gathered and organized, thriving, like the oak, "amid the rude concussions of the storm." And it was in 1646, during the first stages of these civil and religious commotions, that George Fox, then in his twenty-third year, began his labors as a minister of the gospel. (To the account of his ministry and the details of his life, as recorded in his celebrated *Journal*, we would direct the reader who desires to gain a just conception of his character and of the principles he promulgated. "One of the most extraordinary and instructive narratives in the world," says Sir James Mackintosh of this book. "Every page of George Fox," says Spurgeon, "is pure gold.") With regard to his personal convictions of the truth which he proclaimed, he says, "The Lord God opened to me by His invisible power how every man was enlightened by the divine light of Christ: I saw it shine through all, and that they who believed in it came out of condemnation into the Light of life, and became children of the light; but they that hated it and did not believe it were condemned by it, though they made a profession of Christ." In describing his mission as a minister he says, "I was sent to turn people from darkness to light—to the grace of God and to the truth in the heart that came by Jesus, that all might come to know their salvation nigh. I saw that Christ died for all—was a propitiation for all, and that the manifestation of the Spirit of God was given to every man to profit withal. These things I did not see by the help of man, nor by the letter of Scripture, but I saw them in the light of the Lord Jesus Christ, and by His immediate Spirit and power, as did the holy men of God by whom the Holy Scriptures were written; yet the Holy Scriptures were very precious to me, for I was in that Spirit by which they were given forth." Upon this vital and comprehensive scriptural doctrine, that all spiritual knowledge comes through the revelation of the Lord Jesus Christ by His Spirit, and that He is Head, "personally and perceptibly," over all things to His Church, rests the whole superstructure of the doctrines, mode of worship, and church order of the Friends. This superstructure we will now briefly examine; remarking, first, that nothing is farther from the fact than the idea often met with that Friends avow no settled religious creed. On the contrary, the things most surely believed and professed among them since Fox and Burrough and Howgill and Barclay began their ministry have been openly published in hundreds of volumes of the writings of the Church, and are nothing less than the cardinal doctrines of the gospel in all their fulness as set forth in Holy Scripture, and as witnessed to by the Holy Spirit in the heart, according to the texts, "He that believeth" "hath the Witness in himself;" "the Spirit beareth witness, because the Spirit is truth," etc. These doctrines have never been offered as speculations or opinions, but as matters of personal and church experience. The apostolic word is *know:* "We *know* we have passed from death unto life;" "We *know* that the Son of God is come, and hath given us an understanding that we may *know* Him that is true." Among many similar bold and clear declarations of faith put forth by early and later Friends may be cited some passages from the letter of George Fox to the governor of Barbadoes in 1671: "We do own and believe in God, the only wise, omnipotent, and everlasting God, who is the Creator of all things and the preserver of all that He hath made—God over all, blessed for ever! We do own and believe in Jesus Christ, His beloved and only-begotten Son, in whom He is well pleased; who was conceived by the Holy Ghost and born of the Virgin Mary; in whom we have redemption through His blood, even the forgiveness of sins; by whom were all things created in heaven and in earth. We believe that He was made a sacrifice for sin who knew no sin—that He was crucified for us in the flesh, was buried and rose again the third day for our justification, and ascended into heaven, and now sitteth at the right hand of God. This Jesus, who was the foundation of the holy prophets and apostles, is our foundation; for we believe there is no other foundation to be laid but that which is laid, even Christ Jesus; who tasted death for every man, shed His blood for all men, and is a propitiation for our sins and for the sins of the whole world, according to the testimony of John when he said, 'Behold the Lamb of God, who taketh away the sin of the world!'" On these cardinal doctrines, as also upon those of the offices of the Holy Spirit, the fall of man, justification by faith, on sanctification, on the inspiration and authority of the Holy Scriptures, the writings of George Fox and his contemporaries, Penn, Penington, Barclay, and others, are full and explicit. They declare that "we believe also in the Holy Spirit, the Comforter, the promise of the Father, whom Christ declared He would send in His name to lead and guide His followers into all truth, to teach them all things, and to bring all things to their remembrance; we believe that a manifestation of the Spirit is given to every man to profit withal; that He convicts for sin, and through obedience to His manifestations gives power to the soul to overcome and forsake sin, and through His transforming power unites the soul to Christ in the new creation, according to the Scripture, 'If any man be in Christ, he is a new creature.' We believe the Holy Spirit opens to the mind the mysteries of salvation, and that the saving knowledge of God and of Christ can only be obtained through the revelation of the Spirit, for the apostle says, 'What man knoweth the things of a man save the Spirit of man which is in him? even so the things of God knoweth no man but the Spirit of God.' We believe in the fall of man; that man was created in the image of God, understanding the divine law and holding communion with his Maker; that through transgression he lost this happy state and heavenly image, and that until renewed by the regenerating power of the heavenly Man, Christ Jesus, he is dead to the divine life in which Adam originally stood; but we do not believe that sin is imputed to any until they transgress the divine law after sufficient opportunity has been given to understand it. Hence it follows that children cannot be sinners from their birth, although they inherit the seed of sin; yet they are also through Jesus Christ heirs of His grace and partakers of His sacrifice made for the sins of the world; and if they die in infancy we believe they are saved through the atonement of our Saviour." On the subjects of sanctification and justification the belief of the Friends has ever been that the great design of our Creator in sending His beloved Son into the world was the redemption of man from the fall, that he might be restored into unity and fellowship with God. "For this end He hath communicated to every man a measure of that light and grace which came by Jesus Christ; and as many as resist not this light, but receive and obey it, it becomes in them a holy, pure, and spiritual birth, bringing forth holiness, righteousness, purity, and all those other blessed fruits which are acceptable to God; by which holy birth—Jesus Christ formed within us—we are sanctified, and are also justified in the sight of God, according to the apostle's words, 'But ye are washed, but ye are sanctified, but ye are justified in the name of the Lord Jesus and by the Spirit of our God.' We consider, then, our redemption in a twofold respect. The first is the redemption performed and accomplished by Christ for us, in His crucified body without us; the other is the redemption wrought by Christ in us, which no less properly is accounted a redemption than the former. The first is that whereby a man as he stands in the fall is put into a capacity of salvation, and has conveyed to him a measure of that power, virtue, spirit, life, and grace that was in Christ Jesus, which is the free gift of God; the second is that whereby we witness and know this pure and perfect redemption in ourselves by the inward appearing of our Saviour by His Spirit to set up his kingdom in our hearts, and to bring us, as we submit to His will and government, into the glorious liberty of the sons of God."

As regards the so-called sacraments of the Church, the Society of Friends never assumed a merely negative position, but one emphatically positive. Its founders in ceasing from man turned to the Lord. The Holy Spirit who led them out of material forms led them into the spiritual substance. While rejecting the typical baptism of water, they accepted in its fulness the heart-cleansing baptism of the Holy Ghost. They renounced the outward ordinance of communion, because in the obedience of faith they had been brought to know of the spiritual supper of the Lord —the bread of life and the wine of the kingdom. These views the Friends regard as the result of the scriptural truth that Christ is all in all to believers, and that they are spiritually complete in Him. The views also of Friends on divine worship they believe to be the inevitable consequence of the fundamental scriptural principle of all worship—that it must be in spirit and in truth. "If we should deny this way of worship," says Isaac Penington, "we should deny Christ: men cannot worship in spirit and in truth as they please, but must wait, in the silence of the flesh, for God's Spirit to quicken them into spiritual worship." Neither is their doctrine of a free gospel ministry negative—as of a ministry merely unpaid, or not depending upon intellectual education or upon human ordination —but of a ministry whose freedom consists in this, that it is exercised under the immediate teaching of the Holy Spirit, and that it stands not in the wisdom of man, but in the power of God. Friends accept the apostolic standard as expressed by Paul: "I certify you, brethren, that the gospel which was preached of me was not after man, for I neither received it of man, neither was I taught it, but by the revelation of Jesus Christ;" and also the ex-

hortation, "As every man hath received the gift, even so minister;" "If any man minister, let him do it as of the ability which God giveth." And upon the same basis of the immediate Headship of Christ in the Church rest the views of the Friends upon church order and government. Gathered out of every sect and rank, the early Friends were not brought together like loose and disjointed stones in a chaotic mass, but it was their belief that it was the will of God by the same divine power which had called them individually to Himself to build them up together, a spiritual house. "We can boldly declare with a good conscience, in the sight of God," says William Penn, "that the same Spirit which leads us to believe the doctrines and principles of the truth, and to hold and maintain them in their primitive and ancient purity, as set forth by the apostles of Christ in the Holy Scriptures,—I say, this same Spirit doth now lead us into the like holy order and government to be exercised among us which was exercised among them." Robert Barclay, too, in his elaborate chapter on this subject, premises, "First, Jesus Christ, the King and Head of the Church, did appoint and ordain that there should be order and government in it. Secondly, the apostles and primitive Christians, when they were filled with the Holy Ghost and immediately led by the Spirit of God, did practise and commend such order and government. Thirdly, the Church of Christ hath the same necessity now as of old to exercise this authority—hath the same power to do so, and is led by the same Spirit into the same practices."

Our limits will not permit details upon the order, discipline, and church government of the Friends. We would refer for these to their doctrinal writings and books of "discipline." But it may be here remarked, as a broad practical principle underlying all the transactions of the Church, that it is evidently not in accordance with the high standard of church unity and spiritual guidance which Friends profess to adjust and settle questions that come before them by a numerical majority or vote. It is their custom, therefore, and the only way of proceeding consistent with their doctrines, to endeavor in all the transactions of the Church to wait for and obtain the immediate guidance of the Holy Spirit as the true spirit of judgment. And on any occasion where this unity of feeling is wanting and cannot be attained to they either dismiss the question or defer it for future action. And the writings of the Church fully set forth that the experience of the Friends gives confirming evidence to them that the Lord Jesus by His Spirit grants wisdom profitable to direct, and remains to be the immediate counsellor of His people, collectively as well as individually. The influence of some distinctive principles of the Friends upon the world at large has often been the subject of remark by writers outside of the society. Their early opposition to slavery and the slave-trade, their testimony against all wars as at variance with the gospel of peace, the recognized position and sphere of woman in the affairs of their Church, and their most prominent scriptural doctrine of the personal experimental work of spiritual religion in the heart by and through the immediate perceptible operations and indwelling of the Spirit of God, are views that are finding increasing acceptance throughout Christendom. As to their benevolent and humanitarian efforts as individuals and as a Church—efforts conspicuous, perhaps, in proportion to their numbers—we sometimes hear these commented on as if their association as a religious body was primarily one of simple philanthropy and moral reform. But is it not in justice due to them, and to the operative principles of the gospel which they in common with all other Christians advocate, to assign the self-sacrificing labors of such missionaries as Fox and Penn, Woolman and Wheeler, Allen, Grellet, Foster, and Fry, to that love to God which is the true source of love to man—to that ardent zeal for the honor and glory of God which is inseparable from the welfare of man? On the present position and prospects of the society our remarks must be brief. The sentiment is sometimes volunteered by popular writers that Friends have already done their work, and that their disintegration and disappearance from the field of action is to be looked for. This assumption, it seems to us, does not well accord with the evident fact that in the universal upheaval and unsettlement of religious feeling in the present day there is an increasing inquiry after that radical and unchanging truth that comes by the immediate revelation of God, by His Spirit, to the human soul, as it did in the apostolic times; and this truth involves what is *essential* and *permanent* in Quakerism. Respecting the statistics of its present church membership—stated to be ———, including Great Britain and America and some small communities on the continent of Europe and in Australia—it may be remarked that these figures indicate no decrease in the aggregate of numbers. Therefore, with all due allowance made for the existence of disturbing elements, and for that want of entire internal harmony of sentiment—of which, in common with other church organizations of the present day, the society has a share—we see no reason to suppose that the simple, pure, spiritual principles of the gospel as set forth in the Holy Scriptures will ever want experimental witnesses and advocates, or be without an organized Church to make the labors of such advocates more effectual. EDWARD BROWN.

Friends Creek, tp. of Macon co., Ill. Pop. 1538.

Friend'ship, tp. of Greene co., Ark. Pop. 394.

Friendship, post-v. and tp. of Knox co., Me., on the sea-coast, 14 miles W. by S. of Rockland. Pop. 890.

Friendship, tp. and post-v. of Allegany co., N. Y., on the Erie R. R., 21 miles N. E. of Olean, has 4 churches, an academy, a newspaper, 10 stores, a furnace, and a national bank, and is the seat of Baxter's Musical University. Principal business, farming and cheese-making. Pop. of v. 474; of tp. 1528. R. R. HELME, ED. "REGISTER."

Friendship, post-tp. of Guilford co., N. C., on the North-west N. C. R. R. Pop. 1348.

Friendship, tp. of Clarendon co., S. C. Pop. 1440.

Friendship, post-v., cap. of Adams co., Wis., on the Little Roche-à-Cris River. It contains the county buildings, a fine school-house, 2 mills, 2 hotels, a wagon and carriage manufactury, several shops, and a job and newspaper printing-office. The projected Chicago and Superior R. R. is graded to within half a mile of the village. Pop. 76. S. W. PIERCE, ED. "PRESS."

Friendship, tp. of Fond du Lac co., Wis. Pop. 1101.

Friends of God, a body of religious persons in the fourteenth century who consituted an unorganized brotherhood. Some were laymen, like Nicholas of Bâle, their greatest leader. Others were monks, like Tauler, the great Dominican mystic, Heinrich Suso, and the master Eckart, who was somewhat strongly pantheistic in his views. The movement was apparently, to some extent, affiliated with that of the "Brethren of the Free Spirit," but seems to have avoided the excesses and immoralities ascribed to that body. The Friends of God adhered to the Church, but attempted great reforms within it.

Friendsville, post-tp. of Wabash co., Ill. Pop. 1216.

Friendsville, post-v. of Susquehanna co., Pa. P. 223.

Fri'erson's, tp. of Tuscaloosa co., Ala. Pop. 946.

Fries (ELIAS), b. in Sweden Aug. 15, 1794; became adjunct-professor of botany at Lund 1819; professor there 1828; received the professorship of economy at Upsala in 1834, and that of botany also in 1851; became in 1853 rector of the university. Is chiefly distinguished as a student of the mosses, sea-weeds, lichens, etc.; author of *Systema Orbis Vegetabilium* (1825), *Corpus Florarum Provincialium Sueciæ* (1835), *Summa Vegetabilium Scandinaviæ* (1846–48), and other works.—His son THEODORE is professor of botany at Upsala, and conducted a botanical expedition to Spitzbergen.—Another son, M. E. P. FRIES, is a distinguished student of cryptogamic botany.

Fries (JACOB FRIEDRICH), b. at Barby, near Magdeburg, Aug. 23, 1773, was trained in the Moravian seminary of his native place, and then studied at the universities of Leipsic and Jena; began in 1801 to lecture at Jena, and in 1805, after having travelled in Germany, Switzerland, France, and Italy, was made professor of philosophy and elementary mathematics at Heidelberg; in 1816 returned to Jena as professor of theoretical philosophy, and, though deposed for political reasons (from 1819–24), he remained there until his death, Aug. 10, 1843. In philosophy he followed the doctrines of KANT (which see), but he believed that his master's method needed perfecting, because it confounded psychological ideas with philosophy properly so called, and does not strictly distinguish the aids that psychology furnishes to metaphysics from metaphysics themselves. By a blending of Jacobian conceptions with the philosophy of Kant, Fries developed the doctrine that the sensible is the object of knowledge, the supra-sensible the object of faith (rational faith), and the manifestation or revelation of the supra-sensible in the sensible the object of presentiment. He called his system "philosophical anthropology," since he made all further knowledge dependent on man's self-knowledge. Dr. Edwards thus comments upon it: "The philosophy of Fries commends itself in this, that it preserved the formal logical reflection of Kant, without sharing in the metaphysical insipidity—yea, emptiness—of the contents of that philosophy." (*Bibliotheca Sacra*, 1850, p. 780.) His most important work is *Neue Kritik der Vernunft* (Heidelberg, 1807; 2d ed. 1828–31). (See HENKE, *Jakob Friedrich Fries, aus seinem handschriftlichen Nachlasse dargestellt* (Leipsic, 1867, 8vo); UEBERWEG, *Hist. Philos.* (New York, 1873, ii. 195, 201–203).) JAS. H. WORMAN.

Frie'ser, von (Richard), Baron, president of the Saxon ministry, was b. Aug. 9, 1808, at Thürnesdorf, near Königstein in Saxony, and educated in the royal school of Meissen. He studied first at the mining-school at Freiberg, then at the universities of Göttingen and Leipsic, and entered the service of the government in 1834, occupying an inferior position in the ministry of the interior. In May, 1849, when the revolution broke out in Dresden, he distinguished himself by his coolness and his firm adherence to the government, and in the midst of the general confusion took charge of the ministry of the interior, first provisionally, but soon definitely. Differences between him and the minister of state, Von Beust, caused him to retire in 1852, but in 1859 he was recalled and appointed minister of finance. In 1866 he was a member of the committee which governed the country during the war and the absence of the king, and after the war he took charge also of the ministry of foreign affairs. In 1867 was a deputy from Saxony to the council of the North German Confederation. In 1870 he showed great energy in the negotiations with the South German states concerning their becoming members of the German empire, and served effectively in the establishment of the unity of Germany. August Niemann.

Fries'land, province of Holland, bounded N. and W. by the North Sea and the Zuyder-Zee, and E. and S. by Groningen and Overyssel. Its area is 1200 square miles; its population 292,354, of Frisian race, a proud, independent, but loyal people, with a peculiar fitness and fondness for abstract science, especially mathematics. They are Calvinists. The country is low and level, intersected by canals, and offering excellent pastures. Butter and cheese are the main exports; flax and hemp are grown in large quantities. The principal town is Leeuwarden. What is known as East Friesland is a part of Germany, in the province of Hanover. Pop. 25,894. (See Frisian Language.)

Frieze [perhaps for "*Frisian* cloth"], a coarse woollen cloth having a shaggy nap upon one side, and once much employed for making cloaks and for jackets for laboring men. The Low Countries were a principal seat of the frieze manufacture, and Ireland still manufactures handwoven friezes of good quality.

Frieze [It. *fregio*, "trimming," "decoration"], in classic architecture, the central member of the entablature, between the cornice and the architrave, often enriched with sculptures, but sometimes plain. When swelled or puffed out, as in some modern Italian examples, it is a *pulvinated* or *cushioned* frieze. In any style of building an enriched horizontal band may take the name of *frieze*.

Frig'ate [Fr. *frégate*; Sp. *fragada*], a ship of war rating inferior to ships of the line and larger than sloops of war, and carrying from 28 to 50 guns, the latter usually arranged upon two decks—the main and the spar deck. Steam-frigates of late usually carry a less number of guns. The name was originally applied to a long, sharp vessel of the Mediterranean propelled by both oars and sails.

Frigate Bird, or **Man-of-War Bird,** the *Atagen aquila* (*Tachypetes* or *Fregata aquilus*), a large pelican of nearly all tropical seas. It has a small body, a long tail, and wings often eight or ten feet in expanse, and is capable of very long, graceful, and powerful flight. It can neither swim nor wade, but catches the flying-fish in the air, and causes the gannet and other fishing birds to disgorge their prey, which it dexterously seizes in the air. The frigate bird is glossy greenish or brownish black, with a scarlet pouch on the throat. A second species is reported from the south-west Pacific.

Frig'ga, in the Scandinavian mythology, the wife of Odin and the most venerable of goddesses. She dwelt at Fensalir, and was the goddess of marriage and of fruitfulness. Some say that *Friday* was "Frigga's day;" others say that "Freya's day" is intended. (See Freya.)

Frig'id Zone [Lat. *frigidus*, "cold"], in geography, the arctic and antarctic regions; the portions of the earth's surface which lie respectively N. of the arctic and S. of the antarctic circle. The N. and S. frigid zones have each an area of very nearly 8,229,748 square miles, and within these zones the sun does not rise and set every day of twenty-four hours. (See Earth, by Prof. Arnold Guyot, Ph. D., LL.D., M. N. A. S.)

Fringe [Heb. *gedil*, "twisted thread"—*i. e.* a "tassel," Deut. xxii. 12; a "festoon" for a column, 1 Kings vii. 17; *tsitsith*, a "flower-like projection"—*i. e.* "tassel," Num. xv. 38–41; the "forelock," Ezek. viii. 3], an ornament appended to the four corners of the outer garment worn by the Israelites, and put there as a reminder of their allegiance to Jehovah and to assist them in the faithful observance of the Decalogue. As the Hebrew law is said to contain altogether 613 commandments, Jewish tradition has so arranged it that the word ציצית, which is numerically 600, with 8 threads and 5 knots holding these together, should constitute a perfect symbol of the Law; and to this day every orthodox Jew observes the law in the wearing of the fringe. Obliged by untoward circumstances to relinquish the large outer fringed garment, they wear it instead in a smaller form as an under-garment. (See also Talith.) This explains why the poor woman with the issue of blood was so anxious to touch the hem (fringe) of Christ's garment (Matt. ix. 20; compare xiv. 36 and Mark vi. 56, where the same words, in the original κράσπεδον, is rendered "border"). The Pharisees, delighting in outward show, enlarged the size of the tassels of their fringed garments as marks of special sanctity. (Matt. xxiii. 5.)

Fringed garments, elaborately wrought, were very common among the ancient Egyptians and Babylonians, but they were *ornamental* in purpose. They were especially used in state dresses. (See Maimonides, *Jod He-Chezaka*, i. 100 *seq.*; the Hebrew Prayer-Book, *Derech Ha Chajim* (Vienna, 1859), p. 21 *seq.*) James H. Worman.

Fringe Tree, or **Old Man's Beard,** a beautifully ornamental shrub of the U. S., growing as far N. as Pennsylvania and southward to Florida. It is the *Chionanthus Virginica*, of the order Oleaceæ. Its petals are white and curiously fringed, whence the name. It has an oval purple fruit, and leaves which are extremely variable in shape. Other species are found in Australia and the tropical regions of both hemispheres.

Fringillidæ. See Finch.

Fri'o, county in the S. of Texas. Area, 1050 square miles. Stock-raising is the chief pursuit. There is much excellent land along the streams, with good timber. The remaining part of the surface is rolling prairie and hills, covered with mesquite-grass. Cap. Frio Town. Pop. 309.

Frio Town, post-v., cap. of Frio co., Tex.

Fris'che Haff ("Fresh-water Sea"), a lagoon with an area of 318 square miles on the coast of Prussia. In ancient days it formed a lake receiving the waters of the Pregel, Frisching, Passarge, and Vistula, and separated from the Baltic by a very narrow band of land, the Frische Nehrung. But in 1510 the Baltic broke through the Nehrung and formed a permanent passage from 10 to 15 feet deep, called the Gatt. Frische Haff is so shallow that all large vessels have to load and unload at Pillau, situated at the Gatt, from which the cargoes are transported over the Haff on lighters.

Fri'si (Paolo), F. R. S., b. at Milan, Italy, Apr. 13, 1728; became a Barnabite monk; held professorships of philosophy at Casale and the Barnabite College, Milan; became in 1755 professor of morals and metaphysics at Padua; in 1756 professor of mathematics in Pisa; and in 1764 took the mathematical professorship at the University of Milan, where he d. Nov. 22, 1787. He was profoundly versed in mathematics and physics, and possessed a positive character, in consequence of which he was involved in perpetual controversies. His works include a *Disquisitio Mathematica* (1751) upon the physical cause of the earth's figure and motion; *De Atmosphæra cœlestium corporum* (1758); *De Inæqualitate motus planetarum* (1760); *Del modo di regulare i Fiumi e i Torrenti* (1762); and many others.

Fris'ian Language and Literature. The most powerful idea of the European civilization in the nineteenth century is that of nationality. The wars of the first Napoleon awoke it, and in the next generation it was ready for action. Greece, Hungary, Italy, Roumania, and Germany are its works; Scandinavia is one of its promises, Panslavism one of its dreams. It was the secret of the success of Cavour and Bismarck; it is the explanation of the fate of Napoleon III. Its literary influence has not been less than its political. The history of Europe has been rewritten from the standpoint of this new idea, and in order to procure the necessary materials old and forgotten literatures have been excavated and ransacked, and dialects and languages about to die out have been photographed and studied with the utmost care. Among these the Frisian language is one of the most interesting, forming an intermediate link between the Icelandic and the Anglo-Saxon language, illustrating many curious laws of transition, and explaining many peculiar features of character. It comes nearer the English than does any other continental language now spoken.

The Frisians, called by the Romans *Frisii*, in the Middle Ages *Frisones* or *Frisiones*, and by themselves *Frisan*, were a Teutonic race which was first heard of in 13 b. c., when Drusus found them dwelling, together with the Batavi, the Bructeri, and the Chauci, on the north-western coast of Germany, between the mouth of the Rhine and the mouth of

the Ems. He made them tributary, but in 28 A. D. they rose against the Roman dominion, and, although they were subdued, the Frisian answer to Roman oppression was always rebellion. They were at that time an expanding race. They wholly absorbed the Chauci, and as the Frankish tribes drew southward Frisian tribes stepped in and possessed themselves of the land as far as the mouth of the Scheldt. They also spread toward the N., along the coast of the German Ocean, as far as Jutland, where they were known under the name of *Strand Frieser*. Soon, however, the Franks turned their arms northward. In 689 the Frisian chief Ratbad was defeated at Dorsted by Pepin de Héristal, and he and his subjects, the *Frisii majores*, or West Frisians (who occupied districts which are now W. of the Zuyder-Zee), were compelled to embrace Christianity. In 734 the same fate overtook that part of the *Frisii minores*, or East Frisians, who lived in the region now between the Zuyder-Zee and the Ems. Charles Martel defeated their chief, Poppo, in a bloody battle, and afterwards sent the holy Bonifacius into the country to preach Christianity among them. Finally, Charlemagne subdued (785) the rest of the East Frisians inhabiting the districts between the Ems and the Elbe. By his *Lex Frisionum* the whole territory of the Frisians was divided into three parts, of which that part situated in the W. fell to Charles the Bald at the division of the Carlovingian empire, and in time was merged into the present Dutch provinces of Holland, Zealand, Guelderland, and Utrecht, losing its Frisian character almost entirely. The two other parts, both situated farther E., but separated from each other by the Ems, fell to Louis the German, and received the names, respectively, of West and East Friesland, of which the former is the present Dutch province of Friesland, and the latter belongs to Hanover. Here the Frisian character prevailed, and the language has survived until our days. The first who called the attention of scholars to the Frisian language was the Danish philologist Rasmus
22 Rask, whose grammar of the language, *Frisish Sproglære* (Copenhagen, 1825) was translated into Dutch in 1832 by Hettema. It was followed in 1840 by a dictionary by Richthofen, *Altfriesisches Wörterbuch*, an excellent work; while J. Grimm's treatment of the subject is weak and sometimes erroneous. In its oldest form the Frisian language exists only in law-books. Each "gan" or district had its own laws, written in its own dialect, and these law-books are interesting, not only as linguistical remains, but as moral illustrations. While the whole of Southern and Middle Europe adopted the Roman law, the Teutonic races of the North—the Norwegians, Swedes, Danes, and Frisians—developed law-systems of their own, wholly independent of the ideas of Roman jurisprudence. Of the Frisian law-books, the most remarkable are the *Asegabuch*, written in 1200, and valid for all Frisians; the *Emsiger Domen*, from 1312; the *Brokmerbrief* and the *Recht der Rüstringer*, from the middle of the fourteenth century. They have been collected and published in Richthofen's *Friesische Rechtsquellen* (Göttingen, 1840). Specimens of a more recent form of the language are *Friesche Rymlerye*, by Gysbert Japicx (1684); the witty comedy, *Waatze Gribbert's brilloft* (1712), and the novel, *It libben fen Augtje Ysbrants* (1714). In our days the Frisian language has disappeared from church, school, court, and educated people's conversation. It is now spoken only by the peasants of a few islands in the German Ocean, such as Heligoland, and of a few isolated parishes of Oldenburg, Hanover, and some towns of the Netherlands, such as Molquerum, Hindeloopen, and Leeuwarden; but is broken up in dialects which are unintelligible outside of their native places. Mr. A. Hettema has written much both in and about the Frisian tongue; his poem, *De Lapekoer* (1822), attracted much attention, and was translated into German in 1847. CLEMENS PETERSEN.

Frisians. See FRISIAN LANGUAGE and LITERATURE; also FRIESLAND.

Fristoe, tp. of Benton co., Mo. Pop. 1401.

Frit, the semifused materials for making glass or glaze. (See GLASS, by C. G. LELAND, A. M., and PORCELAIN, by PROF. C. F. CHANDLER, Ph. D., LL.D., M. N. A. S.)

Frith (WILLIAM POWELL), R. A., an English artist, b. at Studley, near Ripon, in 1819; became an exhibitor in 1839; has since produced many paintings, among which we may notice a scene from the *Vicar of Wakefield*, 1842; *The Village Pastor*, 1845, which made him an A. R. A.; and *The Railway Station*, 1862; entered the Royal Academy in 1852, and received important foreign distinctions.

Frit'illary [from the Lat. *fritillus*, a "dice-box," from the dice-like marks on the petals], the *Fritillaria maleagris* of Europe, a liliaceous plant common in cultivation. The flower is spotted with purple, red, and yellow; hence it is often called checkered lily. Many varieties are grown in gardens. The crown imperial (*Fritillaria imperialis*) is a fine showy flower of Persian origin. There are some twenty species. Of these, the *Fritillaria atropurpurea*, *pudica*, etc. grow in the U. S. in the far West.

Fritz'sche (CHRISTIAN FRIEDRICH), b. at Nauendorf, Germany, Aug. 17, 1776; was educated at Franke's orphan asylum and at Leipsic; became a Lutheran divine, and in 1830 professor of theology at Halle. Author of *Vorlesungen über den Abendmahl; De anamartesia Jesu Christi* (1835–37); *De Revelationis Notione* (1828); was one of the authors of the *Fritzschiorum opuscula academica* (1838) and *Nova opuscula* (1846). D. at Zürich, 1850.—His sons, FRANZ VOLKMAR (see below), KARL FRIEDRICH AUGUST (1801–46), OTTO FRIDOLIN (b. 1812), and ADOLF THEODOR HERMANN (b. 1818), are or were all university professors and authors of learned works, mostly upon topics connected with Latin and Greek literature or the writings of the early Christian period.

Fritzsche (FRANZ VOLKMAR), a distinguished philologist and editor, son of the learned theologian C. F. Fritzsche, was b. at Steinbach, in Saxony, Jan. 26, 1806; studied philology at the University of Leipsic under Beck and Hermann; held the position of assistant teacher (collaborator) for some years in the Thomas school in Leipsic, and was called thence to the professorship of eloquence and poetry in Rostock 1828. His earliest literary labors were connected with the style and writings of Lucian (Leipsic, 1826, 1828), some of whose dialogues he edited (*Dialogi Deorum*, Leipsic, 1829). He subsequently devoted his attention to the Greek theatre and the Greek dramatists, especially the comedians. Besides the *Quæstiones Aristophaneæ* (Leipsic, 1835) and *De Dætalensibus atque de Babyloniis* (Leipsic, 1831), he edited, with a copious commentary, the *Thesmophoriazusæ* of Aristophanes (Leipsic, 1838), and the *Ranæ* (Zürich, 1845). In defence of his old teacher, Hermann, against Otfried Müller, Fritzsche published a *Recension des Buches Æschylos Eumeniden von K. O. Müller* (Leipsic, 1834), to which was added a second part, 1835. H. DRISLER.

Friu'li [Ger. *Friaul;* Lat. *Forum Julii*, now *Cividale*, one of its towns], the name of a territory along the northern and north-eastern Adriatic, which in the Middle Ages formed an independent duchy, but which is now divided into the province of Undine, belonging to Italy, and the district of Görz-Gradiska, belonging to Austria. The Friulians speak a Romanic dialect (the Friulian) containing copious Celtic elements.

Friz'zlesburg, post-v. of Carroll co., Md. Pop. 161.

Fro'ben, or **Frobe'nius** (JOHANN), a learned printer, was b. at Hammelburg, in Franconia, in 1460. He received his education at the University of Bâle, then served as corrector under Amerbach and Petri until 1491, when he established his own printing-office in Bâle. His first publication was a Latin Bible, and he is said to have been the first, or among the first, to introduce into Germany the use of Roman letters. Froben was a warm friend of Erasmus, and the publisher of many of his works (issued collectively by Jerome Froben, 1540, 8 vols. folio). The advantages offered by the press of Froben and the correctness of his publications, among which was a splendid edition of the *Adagia*, were among the inducements that drew Erasmus from England to settle at Bâle, 1515. (DRUMMOND'S *Life of Erasmus*, vol. i., p. 244.) In this year Froben put to press the first *published* edition of the Greek text of the New Testament, edited by Erasmus. (*Tregelles on the Printed Text of the Greek Testament*, p. 19.) He undertook, also, under the supervision of Erasmus, the publication of the more important Latin Fathers —*e. g.* Jerome, on whom Erasmus had bestowed much careful study and labor (1516); Cyprian and Rufinus (1520); Tertullian (1521); Ambrose (1527); Augustine (completed 1528–29). He had intended to supplement these by a similar edition of the Greek Fathers, but he died before his plans were matured (1527). His design was, however, carried out by his sons, Jerome and John, and his son-in-law, Nicolas Bischop (Nicolaus Episcopius). Froben's publications, mostly in folio, are noted for their general correctness. The character of the old printer is presented in a pleasing light by Erasmus in one of his letters (*Ep.* dccccxxii.). (See DRUMMOND'S *Life of Erasmus*, London, 1873, vol. ii., p. 273 *seq.*) H. DRISLER.

Fro'bisher (Sir MARTIN), an English navigator, b. at Doncaster, Yorkshire, the first Englishman to sail in search of a north-west passage. After an unsuccessful endeavor for fifteen years to obtain the necessary assistance, he was finally aided in his enterprise by Dudley, earl of Warwick, and others, and sailed from Deptford in June, 1576, with three vessels of small size. On July 28, Frobisher reached that part of Greenland which he named Meta Incognita, and Aug. 11 passed through the strait to which he gave his name. Among the minerals brought back by him, gold was discovered, and in consequence a second expedition

was fitted out, which sailed from Harwich May 31, 1577; the result of this expedition caused a third to be made in 1578, which, however, arrived so late in the season as to be compelled to return at once. This was the last of Frobisher's voyages. In 1585 he accompanied Sir Francis Drake to the West Indies, and for his services against the Spanish Armada was knighted in 1588. In 1594 he was sent to aid Henry IV. against the Spaniards and Leaguers, and in an attack upon them at Croyzon, near Brest, was mortally wounded, and d. at Plymouth Nov. 7, 1594, soon after having returned his fleet in safety. G. C. Simmons.

Fro'bisher Strait, an arm of the sea in British North America, between Hudson Strait and Northumberland Inlet, extending westerly from the ocean at the entrance of Davis Strait; it is 240 miles long, and has a mean width of 30 miles.

Froe'bel (Friedrich) was b. Apr. 21, 1782, at Oberweissbach, in Thuringia, where his father was the laborious pastor of seven villages. His mother died before his remembrance, and his half orphanage had a prevailing influence on his destiny, giving him a very sad childhood, that quickened his sensibility and stimulated him to reflection, which he manifested by asking strange questions concerning human discords. An affectionate elder brother, to divert his mind from such subjects, undertook to teach him the sexual system of botany, and show him how, by the union of opposites, harmony and beauty gradually grow out of differences. Not long after, being put to school by a maternal uncle, in the first hour of it he heard a discourse by the teacher on the text, "Seek ye first the kingdom of God and His righteousness, and all these things shall be added unto you;" this gave to him the joyful conviction of there being a law, which, gradually discovered and intelligently obeyed, would bring peace and harmony into the human universe; and when, in 1792, he heard a rumor rife among the peasantry, that the world was coming to an end, he says he did not believe it, because the will of God had not been brought about—a wonderful thought for a child ten years old. At thirteen he was apprenticed to a forester, who taught him wood-lore and mathematics, in which he made great attainments. Later, he went to the University of Jena, and studied the natural sciences; and became in 1813 curator of the mineralogical museum of Berlin, where he made acquaintance with his first wife, whose tastes drew her to the museum, and who learned of Froebel much of the laws of life, which were the theme of his thought. He left the museum to enlist in the army, but he never was in a battle. He prized, however, the opportunity of learning the military drill, and made the acquaintance in camp of Middendorf, Langethal, and Birop, who later became lifelong coadjutors with him in the work of education. It was after the war, when he was in Frankfort-on-the-Main with the intent of going into an architect's office, that he met the educator Grüner. It was at the time of the reform of education in Germany, and his camp-companions were teaching in Frankfort. In the frequent discussions of methods Froebel's originality struck Grüner, who persuaded him to give up architecture and take a class in his school. He visited Pestalozzi then for the first time, but two years after went again, taking with him the two sons of a Frankfort gentleman, who had been confided to him to be educated. He remained at Yverdun this time nearly two years, making himself a pupil with his two pupils. After that, he and Middendorf began a school in Keilhau with six pupils, two of whom were these two boys, and the others the children of his brothers, one of whom had died. Karl Froebel, one of these children, now an old man keeping school in Edinburgh, describes this school as a paradise of children, but says that during the whole period of his stay (from 1816 to 1826) it was in a chronic state of bankruptcy. The plan was to educate the children by putting them at work, and making nature itself and what they produced artistically by horticulture and their own hands, *their books.* It was while here that Froebel married his first wife and former pupil in mineralogy. They never had children of their own, but she made his school a happy family for the twenty years that she lived with him. But they did not confine themselves to Keilhau, where Middendorf only remained steadily and after the death of Froebel. They had schools in Switzerland at Watersee, Burgdorf, and Willisau. Some time during this interval Froebel went to Göttingen University and studied comparative philology, making himself thoroughly acquainted with Latin, Greek, and Sanscrit, and all to complete his own education for his duties. In 1839 he lost his faithful wife, and it was not till 1840 that he founded his first kindergarten at Brandenburg. Twenty-three years before he had published his first work, *Menschenerziehung* ("Human Education"), in which may be discerned the seeds of the kindergarten. He there gives the process of human development in the child, echoed in history. But at that time it was his idea that the child until he was seven years old should be exclusively educated by the mother. Later, he saw that it was simply impossible for mothers with several children and other family duties to devote themselves to the development, mental as well as moral and physical, of each child, but that from the time children were three years old till seven, it was a relief for both parties to have them gather into companies, to be taken care of for several hours of every day by a kindergartner, thoroughly instructed in the process of development and the method of the kindergarten. (See Kindergarten.) For the next twelve years he devoted himself to the education of kindergartners and the establishment of kindergartens. The last attempt was at Hamburg, where he was invited in 1850. He elaborated the method, and has left it a gospel to childhood, for its principle is that free creativeness is at once the means and end of human education, and begins in spontaneous play, so guarded and guided as to coincide with God's creativeness. He married one of the kindergartners whom he educated, and she kept a kindergarten in Hamburg for twenty years after his death, which took place June 21, 1852, at Rudolstadt, where he had a school for training kindergartners. It was in the course of these last twelve years that he published another most characteristic work, *Die Mütter-und Kose-Lieder* ("Mother's Cosseting Songs"), illustrated by plates and notes addressed to the mother, interpreting to her her instincts, and giving her hints for her motherly prattle with her little children. The reform of education begun by Rousseau, and carried on by Fichte, Pestalozzi, and Diesterweg, finally culminated in Froebel's discovery of the method, as well as principle, of educating the human being in its first years purely by means of its own spontaneous activities, genially interpreted to him by guiding him to produce effects corresponding to the works of God. Elizabeth P. Peabody.

Froebel (Julius), nephew of Friedrich, b. in Griesheim, Germany, in 1806; studied at several German universities; held professorships of mineralogy and other sciences at Zürich 1833–44; edited a radical political paper; removed to Prussia, but was obliged to go to Dresden for political reasons, and his pamphlets on public affairs were suppressed; took part in the revolution of 1848, and entered the Frankfort Parliament; was arrested and tried for a political offence at Vienna, but escaped conviction; removed to Switzerland, and thence to the U. S.; was editor, newspaper correspondent, lecturer, and merchant in New York, Nicaragua, Northern Mexico, and California; in 1857 went to Germany, and became again involved with the authorities; removed to London; became in 1862 an editor in Vienna; and in 1867 founded a journal in Munich, and in 1873 became German consul at Smyrna. Author of *Grundzüge eines Systemes der Krystallogie* (1843); *System der Socialen Politik;* 2 vols. of American travels (1857–58); *Theorie der Politik* (1861); *Die Wirthschaft des Menschengeschlechts* (1870), and other works.

Frog [cognate directly with the Anglo-Saxon *frogga*, and intermediately with the German *Frosch* and Dutch *vrosch*, and contrasting with the Latin *rana* and its related terms], a name applied to many of the leaping tailless Batrachians. The frogs are the typical representatives at once of a class (the Batrachians or Amphibians) and an order (the Anura or Salientia), and are divisible into several distinct families and numerous genera and species. As representatives of the family Ranidæ, the true frogs are distinguished by a peculiar sternal apparatus, the manubrium being a robust bony style, the xiphisternum generally similar, and the arciform cartilages wanting; the skull has no fronto-parietal fontanel; there are no teeth on the lower jaw; the tongue has a broad free margin, is attached in front and free behind, and is more or less deeply notched behind; the ear is perfectly developed, the tympanum, cavum tympani, and Eustachian tubes being present; there are no parotoid glands. The family is represented by a number of genera, the largest of which is that of the typical frogs (*Rana*), of which there are about forty species, found in almost all portions of the world except Australasia and South America.* (For metamorphoses of frog see cut in article Batrachia.) Nearly a dozen are found in the U. S.: the best known are—1, the common bull-frog (*Rana Catesbyana*); 2, the shad-frog (*Rana halecina*); 3, the wood-frog (*Rana sylvatica*); 4, the marsh-frog (*Rana palustris*); and 5, the spring-frog (*Rana fontinalis*). (1) Much the largest of these, and only rivalled in size by a species (*Rana tigrina*) of the East Indies, is the bull-frog. This, like its fellows, feeds upon worms, mollusks, and insects, and it is said that to those in the Zoological Gardens of London are sometimes given sparrows, which they greedily devour; its color is green, bronzed

* A single species of *Rana* only is found in South America.

with olive, and with dusky blotches. (2) The shad-frog is

The Common Frog (*Rana temporaria*).

recognizable by its eye-like spots, which are dark brown bordered with yellow, and in allusion to which it is also called leopard-frog; the name shad-frog has been derived from its appearing in spring nearly at the same time as the shad. (3) The wood-frog may be known by its reddish-brown color, and by a dark bridle-like stripe passing from the snout and through the eye backward: it is most abundant in woods, and is very closely related to or identical with the *Rana temporaria* of Europe. (4) The marsh-frog has about four to six rows of quadrate dark spots on the back and sides, and is also called the tiger or pickerel frog. (5) The spring-frog is of a bright green color, with a yellow throat, and with a very large tympanum; it is one of the most common species, and one of the most esteemed as a delicacy for the table. Although not universally popular, there is an increased tendency to the appreciation of the frog as a delicacy for the table in this country, as there has long been in France; and in most of our large cities frogs can be obtained in select places in proper season. The abhorrence which is sometimes expressed respecting the use of frogs' flesh for the table can be only due to irrational prejudices, for it certainly yields a most tender and delicate morsel. In France, as is notorious, as well as in Southern Europe, it is generally a favorite article of diet, and forms the object of an extended industry. Froggeries abound in which the animals are raised and kept. In the materia medica frogs' flesh was formerly quite popular among European physicians as an antiscorbutic. The common frogs have long been favorite subjects for experimentation among physiologists, the delicacy of their tissues enabling the circulation of the blood to be readily perceived; they are also celebrated in connection with the history of galvanism, Galvani having been led to his discovery by the consideration of the phenomena exhibited by them when experimenting with the common European species. THEODORE GILL.

Frog Fish. See ANGLER.

Frog-Spawn, properly the name of the well-known gelatinous mass enclosing the ova of frogs; but the name is extended in rural districts to some of the large green fresh-water Algæ, which form slimy masses in streams and ditches—notably to those of the family Batrachospermaceæ, of which *Batrachospermum moniliforme* is a very common species both in Europe and the U. S.

Frog-Spittle, Cuckoo-Spit, or **Toad-Spit,** a frothy substance often seen on grasses, weeds, and even trees, very closely resembling human saliva in appearance. On examination it will be found to contain one or more grubs, the larvæ of various leaf-hoppers—insects of various families of the Hemiptera. In Europe the larva of *Cicada spumosa* is a very common cause. In the U. S. the genera *Heleochara* and *Aphrophora* are among the froth-producers. This froth consists of the sap of the plant. These insects are great pests to vegetation, and very numerous in species. The popular names for this frothy substance arose from old and entirely unfounded fancies.

Froissart (JEAN), b. at Valenciennes, France, in 1337; was destined by his father for the Church, and took holy orders, but falling in love with a lady of high rank, went to England, where he was (1361–66) secretary and chapel-clerk to Queen Philippa, a liberal patroness. He travelled much in Flanders, France, Scotland, Italy, and other countries; became canon of Chimay 1390. The time of his death is not known. He compiled for the duke of Brabant a collection of ballads and songs called *Meliador*, but is chiefly memorable for his immortal *Chronicles*, the most important written historical monument of the Middle Ages that we possess. Froissart's *Chronicles* are of great value, but are not so much an accurate history as a faithful picture of his times, and of their places, customs, and people. They range over all Western Europe, for Froissart, a churchman and scholar, living in unsettled times before the feeling of nationality had been well developed, is quite destitute of patriotic feeling. The favorite English version of this fine old author is that of Johnes (1803–05, often reprinted), but the old translation by Lord Berners (1523–25) is correct and much more spirited. Buchon's edition (1824) is the best of the original French text.

Frome, town of England, in Somersetshire, on the Frome. It has considerable manufactures of broadcloth and cassimeres. Pop. 9752.

Fromentin (ELIGIUS), b. in France, became a priest and Jesuit; came to the U. S., married and settled in New Orleans; was U. S. Senator from Louisiana 1813–19; became a judge of the New Orleans criminal court in 1821, and was appointed soon after U. S. judge in West Florida during Jackson's governorship; resumed legal practice in New Orleans, and d. there Oct. 6, 1822.

Fromentin (EUGÈNE), b. at La Rochelle, France, Dec., 1820; has attained distinction as a painter of well-executed Algerine and Arabian scenes, remarkable for brilliancy of color. Author of *Dominique* (1863), a novel, and of several other volumes, chiefly descriptive of his travels as an artist.

Fronde [Fr. for a "sling;" the name was probably given from an incident in a street-fight early in the struggle; according to others, from the calumnious squibs and slanders hurled by the anti-Mazarin party at the court], a faction of French nobles who opposed Cardinal Mazarin during a part of the minority of Louis XIV. The breaking up of the feudal system and the policy of Richelieu had finally led to a centralized despotism, against which (Aug. 27, 1648) the people of Paris rose in arms. In the October following the popular demands were acceded to, but the malcontent nobles seized the opportunity of trying to overthrow Mazarin and regain their old power. The struggle lasted from 1649 to 1652, and as far as military results were concerned were favorable to the nobles, and they had the grandest opportunities for making a great constitutional reform; but as they had no strong leadership, no fixed principles, and no definite object except self-aggrandizement, Mazarin in 1653 snatched from his mutually jealous and strangely frivolous enemies the fruits of their victory. The war of the Fronde was one of the most ridiculous and useless contests in history. (See *Les Mazarinades*, a large collection of lampoons on the court; ST. AULAIRE, *Hist. de la Fronde*, 1841; the histories of BARANTE and FITZPATRICK; COUSIN, *La Fronde en Paris*.)

Front'al Bone [from the Lat. *frons, frontis*, the "forehead"], in the vertebrate skeleton, one of the most important bones of the skull. It is regarded as representing the neural spine of the second cephalic vertebra. In man it has two parts, a vertical and an orbito-nasal portion, the former the bony portion of the forehead, the latter forming part of the roof of the orbits of the eyes. It is developed from two centres, and at birth is divided vertically into two lateral halves by the frontal suture, which sometimes persists through adult life. The vertical part consists of an outer and inner hard layer, separated to some extent by a diploë, a soft cancellous tissue furnished with large veins. Just above the eyes the diploë is wanting, and its place is occupied by the frontal sinus, a cavity in two parts, each of which communicates with the nasal passages.

REVISED BY WILLARD PARKER.

Frontenac, county of Ontario, Canada, bounded on the S. by Lake Ontario and the river St. Lawrence. Area, 323 square miles. It is traversed by the Rideau Canal and the Grand Trunk Railway. Cap. Kingston. Pop. 28,717.

Frontenac, de (LOUIS DE BUADE), COMTE, b. in 1621 in France; served in the army in Italy, Flanders, Germany, and Candia, and received many wounds. In 1672 was appointed governor-general of Canada by Louis XIV., having already won a wide renown for valor. He was a relative of Madame Maintenon and the husband of a court beauty, who used her influence against him. His first governorship of New France (1672–82) was marked by the building of Fort Frontenac (now Kingston, Ont.) and the expeditions of La Salle, Marquette, and Joliet; but Frontenac, a man of great abilities, was hampered by the action of

his intendant and of Laval, bishop of Quebec, so long the virtual ruler of Canada. He was accordingly recalled, but in 1689, Canada being almost ruined under his successors, he was sent out again. He now punished the Iroquois terribly, destroyed, through his lieutenants, the English marine in Hudson's Bay, ravaged Newfoundland, terrified all the English-speaking coast-towns as far S. as New Jersey, captured Pemaquid, Casco, Salmon Falls, Schenectady, and in 1690 repulsed the forces of Phips before Quebec—an event which Louis XIV. commemorated with a medal. This able soldier d. at Quebec Nov. 28, 1698.

Frontier′, county in the S. S. W. of Nebraska, watered by branches of the river Platte. Area, 972 square miles. Cap. Stockwell.

Fronti′nus (SEXTUS JULIUS), a Roman writer, distinguished also in civil and military affairs, was b. about 40 A. D., though the exact year is not known. His first appearance in public life was as *prætor urbanus* in A. D. 70, under Vespasian. Tacitus, in his *Life of Agricola*, tells us that he was appointed to the chief command in Britain, and that he conducted himself with ability, subduing the warlike tribe of the Silures. He was succeeded by Agricola, and on his return to Rome escaped the suspicions and jealousy of Domitian by living a retired and studious life. He was twice honored with the office of consul, and in A. D. 97 was appointed by Nerva *curator aquarum* (superintendent of aqueducts), to which appointment no doubt we owe his most valuable publication. He died probably in 103. Frontinus has left us a work on military tactics, presented in the form of a series of anecdotes of distinguished kings and commanders, entitled *Strategematicon libri IV.* To each of the four books a brief preface is prefixed detailing the chief subject of the book. More important than this is the other extant work of Frontinus, *De Aquæ ductibus urbis Romæ liber*, in which he describes the construction and maintenance of those vast and expensive structures which made Rome enviable among ancient cities for its ample water-supply. Besides these, several treatises on land-measurement are attributed to Frontinus, fragments of which are contained in the collection of Agrimensores, or *Rei Agrariæ Auctores*, by Goesius (Amsterdam, 1674, 4to), and in *Gromatici Scriptores*, by Lachmann and Rudorff (Berlin, 1840–52, 2 vols.). The best editions of the *Strategematica* are those of Oudendorp (Leyden, 1731, and again 1779) and of Schwebel (Leipsic, 1772); of the *De Aquæ ductibus*, those of Polenus (Padua, 1722, 4to) and of Dederich, with German translation (Wesel, 1841); a new recension of the text of both works by Dederich (Leipsic, 1855). H. DRISLER.

Frontlet. See PHYLACTERIES.

Fron′to (MARCUS CORNELIUS), a distinguished public speaker and rhetorician, was b. at Cirta, in Africa, in the reign of Domitian or Nerva. Having removed to Rome, he soon attained high distinction as a teacher of eloquence, and won the special favor of Hadrian and Antoninus Pius, by whom he was entrusted with the education of the imperial princes, M. Aurelius and L. Verus. In 143 he held for a short time the office of consul, but he declined, on the plea of ill-health, the charge of a proconsular province. He was held in high honor by his contemporaries, and ranked among the most distinguished orators. He even had a body of followers, who took him as their model, and were called after him, *Frontoniani.* He d. about the year 168. Until 1815 no remains of Fronto were known to exist, except a doubtful treatise, *De Differentia verborum.* But in that year Mai discovered in the Ambrosian Library at Milan a palimpsest MS. which contained a number of the letters of Fronto, which he published. Subsequently, being transferred to the Vatican in Rome, Mai discovered there more than a hundred additional letters, a portion of the correspondence of Fronto with the emperor Antoninus Pius and with his former pupils, Marcus Aurelius and Lucius Verus. He issued a new edition of his work, in which these were incorporated (Rome, 1823; reprinted 1846). A complete edition of the writings of Fronto, founded on a new recension of the MSS., was published by S. A. Naber (Leipsic, 1867). H. DRISLER.

Front Roy′al, post-v. and tp., cap. of Warren co., Va., is situated at the base of the Blue Ridge, on the line of the Manassas branch of the Orange Alexandria and Manassas R. R. It contains 4 churches, 2 hotels, some 10 stores, sumac-mills, and a large steam-tannery, and has 1 religious and 1 secular newspaper. In its vicinity are large flouring-mills, steam-tanneries, and spoke and rim factories. Pop. of v. 705; of tp. 1872.

CLARK, LOVELL & BAILY, EDS. "WARREN SENTINEL."

Froschweiler. See WÖRTH.

Frosino′ne, town of Italy, identical with the ancient Volscian *Frusino*, about 50 miles S. E. of Rome, and is a bishop's see. Pop. 9234.

Frossard (CHARLES AUGUSTE), b. Apr. 26, 1807, received his military education at the École Polytechnique in Paris and at the school of artillery and engineering in Metz. He entered the army Oct. 1, 1827; participated as a lieutenant in the campaign in Belgium in 1831 and 1832; became a captain in 1833; distinguished himself in Algeria; was appointed adjutant to the engineering corps in France in 1837; and was in 1846 engaged in the erection of the fortifications of Paris. In 1847 he became an officer of ordnance to King Louis Philippe; took part in the siege of Rome in 1849; became a colonel in 1852; director of the department of fortification in Oran in 1853; and in Jan., 1855, he received the command of the second engineering corps of the Crimean army. He conducted the engineering operations for reducing the Malakoff, was wounded, and in May, 1855, promoted to a generalship, and received, after the fall of Sebastopol, the cross of a commander of the Legion of Honor. In the winter of 1855–56 he commanded the engineering department of the army of the Orient, and in June, 1856, he accompanied Count Morny on his embassy to the crowning of the emperor Alexander of Russia. In the Italian war in 1859 he was chief of the whole engineering department, and after the war he received the grand cross of the Legion of Honor. Shortly afterwards he was appointed to the conspicuous and influential position of governor to the imperial prince. After this active and successful career, Frossard had the misfortune in the war against Germany (1870–71), as commander of the second army corps, first to arrange the comedy of the attack on Saarbrücken (Aug. 2, 1870), and then to be thoroughly beaten out of the place on Aug. 6. He led his corps back to Metz, and participated in the battles of Vionville and Gravelotte (Aug. 16 and 18, 1870). On the capitulation of Metz (Oct. 27, 1870) he fell into German captivity. He has written *Rapport sur les opérations du 2me corps de l'armée du Rhine dans la campagne de 1870* (Paris, 1871). D. Sept. 3, 1875. AUGUST NIEMANN.

Frost [allied to *freeze;* Ger. *Frost*] properly designates frozen dew, rime, or hoar-frost, often called *white frost*, to distinguish it from *black frost*, which is the effect produced upon herbs and leaves by the freezing of their juices. The freezing of soil-moisture is popularly called frost also, and we even see in books of science such expressions as "the effect of frost on iron." Here "frost" can only mean cold weather or low temperature. Hoar-frost is frozen dew, or rather a deposit of minute ice-crystals in the place of dew, for the freezing does not follow the formation of the dew-drop. The conditions for the formation of white frost are precisely those requisite for the formation of dew (see article DEW, by F. A. P. BARNARD), except that those conditions (radiation of heat, etc.) act more powerfully on account of the lower temperature of the earth and air. The presence of considerable bodies of water diminishes frost powerfully, because water by day absorbs and by night radiates much heat. Thus, Western Michigan is rendered a good peach-region by the W. winds, tempered by the influence of Lake Michigan. Thick clouds, or even a dense smoke, will act as a blanket over the earth, and diminish or prevent the deposit of frost. The fact that low lands are usually visited by frost much earlier in the autumn and later in the spring than the neighboring hill lands is believed to be partly due to the constitution of the soils. Dark alluvial soils radiate heat the more readily. Again, the colder air settles down upon the low grounds, and the hills are more exposed to the winds, which tend to prevent the formation of dew. The hygienic effect of frost is generally salutary. Malarial fevers are favorably modified by it, and the spread of cholera and of yellow fever is usually checked at once. Some forms of milk-sickness in cows are, however, attributed to feeding upon forage which has been touched by black frost.

Frost (JOHN), LL.D., b. at Kennebunk, Me., Jan. 26, 1800; graduated at Harvard in 1822; taught in Boston and Cambridgeport, Mass.; removed in 1828 to Philadelphia, where he was a teacher until 1845. He produced a prodigious number of books, some of which had a large sale. Among these are a *Pictorial History of the World, Pictorial History of the U. S., Lives of American Generals,* etc. D. in Philadelphia Dec. 28, 1859.

Frost (WILLIAM EDWARD), R. A., b. at Wandsworth, Surrey, England, Sept., 1810; attained distinction as a portrait-painter, but since 1839 has chiefly painted mythological pictures. In 1870 he was chosen to the Royal Academy. His *Prometheus Bound* (1859) won the gold medal of the Academy, and his *Una Alarmed by Fauns* (1843) won a prize of £100, and was purchased by the queen.

Frost-bite and **Free′zing** are conditions caused by the action of cold upon the animal economy. Frost-bite is local and partial—freezing is general and more or less

complete. Severe frost-bite may lead to gangrene, but the milder forms often result in nothing worse than chilblains, which are very annoying, but not dangerous. General freezing, if rapid, may result in speedy death; but more frequently the vital functions pass for a time into a state of abeyance, which may last, it is said, for some days, and then be terminated by death. In recovering frozen and unconscious persons it is held that a very slow restoration of the normal temperature is safest, apparently because sudden warmth arouses those dormant energies which demand immediate aëration of the blood, which failing, death at once ensues. It is, however, suggested that very rapid warming might, in many cases, secure all the advantages of slow restoration of temperature, and experiments on some of the lower animals seem to favor this idea.

Revised by Willard Parker.

Frost'burg, post-v. of Alleghany co., Md., is situated on a plateau between Savage and Dan's mountains, 1255 feet above Cumberland and 1792 feet above tide, immediately over the great coal-basin of Western Maryland, and 17 miles by the Cumberland and Pennsylvania R. R. from Cumberland. It has 14 churches, a large school, numerous stores and shops, 2 foundries, a fire-brick manufactory, 2 hotels, and 1 newspaper. Pop. of tp. 6131.

J. B. Oder, Ed. "Frostburg Mining Journal."

Froth Fly. See Frog-spittle.

Froth'ingham (Ellen), daughter of N. L., b. in Boston Mar. 25, 1835, devoted herself to the study of the German literature and language, and has distinguished herself by remarkably fine translations of three difficult masterpieces—Lessing's *Nathan der Weise* (1868), Goethe's *Hermann und Dorothea* (1870), in verse, and Lessing's *Laokoon* (1874). Miss Frothingham has lived and studied in Germany, but resides in Boston.

Frothingham (James), b. in Charlestown, Mass., 1786; began as a chaise-painter in his father's chaise manufactory; went on from color to drawing, then to making likenesses in chalk, until he came out a painter in oils. After a little incidental instruction in preparing and applying colors, the young man of twenty entered on a professional career as a portrait-painter, which, though not remunerative or eminent, was in a high degree respectable. His best patrons were in New York and Salem. His copies of Stuart's *Washington* gained for him much commendation, but his own portraits are not without decided merits in fidelity and in color.

Frothingham (Nathaniel Langdon), D. D., b. in Boston, Mass., July 23, 1793; entered Harvard College at the age of fourteen in the class of 1811; in 1812 received the appointment of teacher of rhetoric and oratory at Harvard; prepared for the ministry, and in 1815 became pastor of the First church in Boston; visited Europe in 1826, and afterwards in 1849; retired from the pulpit in 1850, and devoted himself to literature, living, with the exception of eighteen months abroad in 1859–60, in Boston. Dr. Frothingham was a frequent contributor to the *Christian Examiner* and other religious periodicals. A volume, *Sermons in the Order of a Twelvemonth* (1852), contains some of his most finished pulpit productions; his pamphlet discourses number fifty or sixty. He wrote many choice hymns, which are favorites with Unitarian congregations; published two volumes of *Metrical Pieces*, one in 1855, the other in 1870, all marked by refinement of sentiment and felicity of diction; and contributed to literature poetical translations from the Greek, Latin, Italian, and German. His rendering into English of the minor poems of Goethe, Schiller, Rückert, Von Zedlitz, and Von Auersperg, is considered of high excellence. Dr. Frothingham was one of our earliest students of German, and did good service in introducing the finest German thought to American readers. D. in Boston Apr. 4, 1870, after a long affliction of blindness.

Frothingham (Octavius Brooks), third son of N. L., was b. in Boston Nov. 26, 1822; was educated at the Public Latin School; graduated at Harvard College in the class of 1843; studied theology at Cambridge; was settled in Salem, Mass., Mar. 10, 1847; removed to Jersey City, N. J., in Apr., 1855; and after a ministry of four years, in the spring of 1859 went to New York and established the Third Unitarian society, of which he still continues pastor. Mr. Frothingham belonged to the extreme left or radical wing of the Unitarians for a time, but became at last a rationalist, and assumed the attitude of an independent preacher. From the beginning he has been president of the Free Religious Association, of which he was one of the founders in 1867, the aim whereof was the emancipation of religion from all sectarian limits, the reconciliation of faiths, and the application of the scientific method to the study of theology. This position places him outside of Christianity as a special religion, and forbids his calling himself by any particular name. Mr. Frothingham is the author of several books—*Stories from the Lips of the Teacher* (1863); *Stories of the Patriarchs* (1864); *A Child's Book of Religion* (1866); *The Religion of Humanity* (1873); *The Life of Theodore Parker* (1874); *The Safest Creed*, a volume of discourses (1874). He has published also a lecture, *Beliefs of the Unbelievers*, and upwards of 100 pamphlet sermons, besides numerous contributions to papers and magazine literature. For a year he was art-critic for the New York *Tribune*, and is a regular contributor to the *Index*, an organ of free religion printed in Boston, and representing the latest phase of dissent from the theological system of Christendom. In 1864 he translated a volume of *Essays* by Ernest Renan.

Frothingham (Richard, Jr.), b. at Charlestown, Mass., Jan. 31, 1812; for many years a prominent Democratic legislator and journalist of Boston, Mass.; mayor of Charlestown 1851–53; member of the constitutional convention of 1853; author of several historical works, mostly relating to the Revolutionary period in Massachusetts.

Froude (James Anthony), LL.D., b. at Dartington, Devon, England, Apr. 23, 1818; educated at Westminster and Oriel College, Oxford, where he graduated with honor; became a fellow of Exeter College 1842; was ordained a deacon in 1845, but soon changed his religious opinions, which had been extremely High Church; published *Shadows of the Clouds* (1847), a tale, and *Nemesis of Faith* (1849), which were condemned by the authorities of the university, and he, as a consequence, lost an appointment as teacher in Tasmania. In 1850 he began to write for *Fraser's Magazine*, the *Westminster Review*, and other periodicals. His greatest work, *The History of England from the Fall of Wolsey to the Defeat of the Spanish Armada* (12 vols., 1856–70), is remarkable for the novel views taken of many of the leading characters who figured during the time of which it treats, and for the abundance of fresh material introduced. In 1869 he was made rector of the University of St. Andrew's. In 1871 he resigned the editorship of *Fraser's Magazine*, and in 1872–73 lectured in the U. S. Besides the above works he has written *The Book of Job* (1854); *Short Studies on Great Subjects* (1867); a little book on *Calvinism* (St. Andrew's, 1871); *The English in Ireland in the Eighteenth Century* (3 vols., 1873–74).

Fro'zen Wells. Certain wells in the Northern U. S. contain ice during the whole or part of the year, sometimes rendering the drawing of water impracticable. Examples are in Brandon, Vt., Owego, N. Y., Lyman, N. H., and Ware, Mass. The first is 35 feet deep, dug in 1858 through gravel and marly clay. The frozen mass of gravel is about 15 feet thick, showing itself at 14 feet below the surface. In the winter the water freezes entirely over, and in the summer the stones of the walls are lined with ice several inches thick, the temperature rarely rising above the freezing-point. At numerous localities in the same region, also in the Alps, the Jura, and the Ural Mountains, ice accumulates in rock-caverns and among the fragments at the base of precipices, sometimes sufficiently abundant to be an article of commerce. The caverns usually have two lateral openings. This causes a current of air, which evaporates the water upon the sides and floor of the cavern, thus producing congelation, since in this way an immense amount of heat is taken up into the latent state. Less ice is formed in the winter than in the summer in the caverns. At Monte Testaceo in Rome this principle is employed for the artificial manufacture of ice. It has been suggested that the freezing of water in the wells may be due to the interpenetration of the interstices of the gravel with air which has motion in one or the other direction according to circumstances, and thus removes so much heat as to freeze the water. In the Brandon example particular excavations near the well may possibly give rise to the air-currents, and deposits of clay may prevent the access of external heat. Or if the ice be not annually renewed by means of the currents, it is possible the frozen area may be a remnant of the glacial sheet which enveloped most of the northern continents during the Drift period. Under favorable conditions such masses may be preserved for thousands of years, and form a nucleus to which more frost may be added at certain seasons of the year.

C. H. Hitchcock.

Fructidor ("fruit-month"), in the French republican calendar of 1792–1806, the twelfth and last month in the year, extending from Aug. 18 to Sept. 16. In the year 5 (1796–97) occurred the "*coup d'état* of the 18th Fructidor" (Sept. 4, 1797), in which Augereau, acting for the majority of the Directory, removed the minority from that body.

Fruc'tose, or **Fruit-Sugar** (also called **Inverted Sugar**), a mixture of equal numbers of molecules of dextro-glucose and lævo-glucose. It occurs in ripe acidulous fruits, and is produced from cane-sugar (saccharose) by the action of acids:

Saccharose. Dextro-glucose. Lævo-glucose

$$C_{12}H_{22}O_{11} + H_2O = C_6H_6O_6 + C_6H_6O_6.$$

Dextro-glucose rotates the plane of polarized light to the right 56°; lævo-glucose to the left 104°; hence, a mixture of the two in equal quantities rotates to the left. As cane-sugar rotates the plane to the right, the action of acids, producing fruit-sugar, is called inversion. (See GLUCOSE and SUGAR.) C. F. CHANDLER.

Fruit [Lat. *fructus*], in a wide sense, is the perfected ovary of a flowering plant, with its proper envelopes. Some fruits, like the strawberry, result from the blending of many ovaries with a fleshy receptacle. In others, as the fig, the fleshy receptacle is hollow, and the whole inflorescence, including many pericarps, is blended in the fruit. A fruit consists of the seed and its surrounding PERICARP (which see); and fruits receive various general names according to the nature of the pericarp. Thus, we have the achenium, the samara, the drupe, the pome, the berry, the sorosis, the pepo, and many other forms of fruit, of which the more important are noticed in this work under their alphabetical heads. (See FRUIT-CULTURE, by F. R. ELLIOTT.)

Fruit-Culture. *Its History.*—The first records of fruit-culture give the fig, almond, peach, orange, citron, apples, pears, cherries, plums, quinces, service-berries, gooseberries, grapes, mulberries, strawberries, currants, raspberries, and all the nuts now in cultivation. The first list of varieties contains 22 sorts of apples, both sweet and acid. The variety without kernels, of which some noise has been made lately, was then known. The pears numbered 36 varieties, summer and winter, melting and granulous or hard; peaches had only reached 4 sorts; quinces, 3; medlars and services, 5; apricots and almonds, 4 each. The plums were mostly of dry or prunic varieties, together with what we now call damsons. No white or green sweet, juicy sorts were then known. Cherries numbered 8, and among them a hard-fleshed sweet one, like that we now call bigarreau, was known, as well as the black and red. These last were probably mazzards. The sour or morello class was known. Of the olive 4 sorts are noted. In grapes no varieties are enumerated, they being then only recorded where the fig and orange were grown. The early records only state they were many, and of colors from greenish-white to black. Of mulberries they had 2 varieties of black, and of the blackberry only 1. Strawberries were so abundant in the fields that they were not cultivated. Hazel-nuts and filberts, walnuts, soft and hard shelled, were grown, but our hickory and butternut and black walnut were not then known. They do not belong to the climate from which our first record of fruit-growing is taken. Of chestnuts they had 6 sorts. The grape and the olive were the only fruit-crops grown for profit. The list here referred to gives the status of fruit-culture in about 300 or 400 of our present era. In Italy, some 200 years after the above, the peach and cherry had reached 20 varieties each, and the plum we now cultivate as green gage was known. The morello cherry had become well known. The grape was abundant, and trained upon high trellises or tall poles, connected by a few slats at the tops, and then interlaced by the vines. In the N. of Italy the pear and quince were grown to weigh from two to three pounds each. Virginia and California may to-day equal the product of 1200 years ago, but they do not surpass it. Melons were largely grown in great variety 800 to 900 years since. These, with other fruits suited to the warm climates, were more grown and esteemed than those of the temperate sections. The Romans were the first introducers and disseminators; to them France, England, etc. are indebted. In the sixteenth century the practice of hastening the ripening of fruits by laying hot limestones underneath the branches of trees and watering with hot water was known. France has grown and distributed more fruit trees than any other nation. Her nurseries amount to about 16,000 acres; her orchard-gardens, like those of the U. S., have never yet been correctly enumerated, but at a rough estimate perhaps 200,000 acres would not more than cover the number. Only the common fruits are natives of Germany, although it now grows many of the choicest, first obtained from Italy, and from which have been produced fine sorts from seeds. The S. of Germany, as a rule, is the only part suited to the finer fruits, although in sections of Austria and Prussia fruits grow as well as they do in South Germany. The apple, pear, cherry, etc. were grown there in A. D. 800, and grafting was then practised, as well as the making of wine and cider. In Erfurth, where Reichart expended his talents, fruit-growing as early as 1100 became popular, and received government protection. In 1105 a proclamation required every landholder to plant yearly at least twelve fruit trees, so that for many years from 30,000 to 40,000 trees were annually planted. The increase of fruit-culture from this time forward for some fifty years was astonishing. It then flagged, owing to wars and troubles of various sorts. The pestilence of 1683 was one of the agents in checking vine-culture especially. Russia has done little in the growing of fruits in the open air, although apples, some of fine quality, are produced, and a few pears and cherries; these are mostly around Moscow and St. Petersburg. The cranberry, the currant, and the quince are grown in certain sections, and some varieties of the grape are grown profitably on the banks of the Pruth, and at or near Soudak in the Crimea, where the prospect is that the grape can be grown so successfully that not only the fruit, but superior wines, will be abundant for consumption. Upon the banks of the Molotschna, which falls into the Don, grapes are grown, and the wines from them appreciated. Poland, like Russia, has to rely mainly upon the apple, pear, and currant, and can claim little for outdoor hardy fruit-growing. Spain, where more varieties of fruits can be grown than in any other territory, deserves little credit on account of progress; either everything grows so readily that care and labor are unnecessary, or the climate takes from the people all desire of exertion for improvement. The only work she has ever issued touching horticulture in Spain was in 1546. Some of the finest wines of the world are made in Spain. Greece can grow almost all varieties of fruits, and abounds in peaches, olives, grapes, etc. Turkey, in the vicinity of the Bosphorus, is fine for fruits. The native fruits of the British Islands were of a poor nature, and the improved varieties were introduced by the Romans. England had no fruit of value until the close of the tenth century, and then little besides the grape. About the first work touching fruits was in 1500, but in 1521 appeared a work by Arnold treating of grafting, planting, and altering of fruits. In 1557, Tusser gave a list of fruits, enumerating nearly every species, but speaks hesitatingly of the success of all but a few when grown in the open air. In 1629 was the first English record of varieties in cultivation, and was by Parkinson, but many of them were never grown in the open air. He enumerated 58 sorts of apples, 64 of pears, 61 of plums, 21 of peaches, 5 nectarines, 6 apricots, 36 cherries, 23 grapes, 3 figs, besides quinces, medlars, walnuts, etc. The covering of melons, while ripening, with straw at night, as now practised in sections where the days are clear and warm and the nights cool, was advised by him. Scotland and Ireland at the same period showed about the same progress as England, but rarely grew others than apples, pears, cherries, gooseberries, currants, etc., counted as hardy fruits. The orchards, nurseries, and commercial gardens of the British Islands perhaps equal those of France, and may be summed up as comprising most of the hardy fruits, while the tender sorts, as peaches, figs, etc., are mostly grown under artificial protection. With the various sections, leaving what we term the British Islands above noted, we have Asia, Asia Minor, and Persia, but we find nothing relating to fruit-growing that shows any idea other than to eat of what Providence has given for their healthful support. The Chinese in early times grew few fruits but such as were natural to their climate—oranges, mangoes, etc. At the present time they grow nearly all varieties of fruits. North America, including Canada and the U. S., and even Mexico, had most of its fruits introduced by the French and the Romish missionaries. Some few apples, pears, etc. were brought by the Pilgrims who landed on the New England coasts, and others, as peaches, etc., by the early Virginians. The monks or Catholic priests introduced the European vine, although the wild varieties were all through the country, as well as wild cherries, plums, apples, etc. The French may be said to have been strictly the pioneers in apple and pear growing, and to-day many of the varieties standing in the front rank date their introduction back to the French; and the basis of fruit-culture in this country may be said to date from about 1650. Most of the grapes now grown in California were introduced by the Jesuit fathers, and it may be said that wherever the Romish missionaries settled the grape was a specialty with them. The earliest of their works as to the culture and introduction of the vine in any country is near A. D. 800. The first record of commercial nurseries for the growth and sale of trees in the States was about 1798, and they numbered four or five; now (1874) the number of cultivators may be estimated at 500, who occupy, say, 500,000 acres. The estimate of the orchards of the country can be only an estimate, as there is no definite record of even any one State or Territory. The writer, from the best records he can find, would place them at, say, 900,000 acres—this to include all the fruits. In the first obtainable list of fruits in the U. S. apples numbered 133; apricots, 6; cherries, 15; nectarines, 5; peaches, 38; pears, 66; plums, 18. This list was made in 1798, and we find little change, nor any list of grapes or the small fruits, until after 1815, when

the culture of fruits became a feature of interest to every intelligent cultivator of the soil.

South America, with a climate of great capabilities for the growing of fruits, has done but little. There is hardly a fruit but can be grown there by merely planting, but the people are too languid and devoid of refinement to improve and cultivate when the rough natural products of the country supply their wants. The vine and the peach, with the olive and orange, are the principal cultivated fruits. The history of fruits in the West Indies and in Australia discovers the fact that in the former only tropical fruits are successful, while in Australia almost any fruit can be grown successfully, but those of the northern temperate climates, like our Middle States, cannot be grown with the flavor, aroma, and keeping qualities that they have here. The lists of fruits and dates already given are those of the earliest history of which we have record, but all the nations have advanced in collections of varieties, and also in systematic knowledge of culture. France, the British Islands, and the U. S. have without doubt increased most rapidly in varieties, while Germany has produced the most new valuable pears, and the U. S. the most apples, hardy good grapes, and peaches. The lists in the books of varieties now grown give, as to their origin, one-fourth of the pears, apples, plums, cherries, quinces, and peaches to England; of hardy grapes she has produced none, but of apricots, currants, and nectarines perhaps more than any other country. Germany has produced the most varieties of pears during the past 200 years, while France has grown and offered for sale more sorts of fruits than any other country except the U. S. The lists now enumerated and described in the States may be estimated as about 10 of almonds and about 2360 of apples; and besides these there are nearly an equal number of names that stand as synonyms. Of pears there are of distinct varieties about 1270, and about 1410 of synonyms, some of these latter being attached to two or more varieties. Peaches are described to the number of over 300 varieties, while the local synonyms are one-half that number. Many of the old varieties are, however, not to be found in any collection. Nectarines now number 30 varieties, with 71 synonyms. Cherries number about 230, to which there are 327 synonyms. Apricots are comprised in 50 varieties, with 74 synonyms. The list of strawberries now numbers over 300, while many have been lost or discarded. Hardy native grapes number over 300, and currants about 30.

Statistics of Orchard or Fruit-culture.—The U. S. census has since 1850 given decennial statements as to the value of orchard products for all counties in the U. S. A few States and counties have attempted to gather similar statistics, but so far nothing has been published of reliability except the statement of Michigan. That State gives, as its orchard and small fruit-crop products for 1874—

Money value	$3,537,278
The wine value, from grapes	22,015
Total	$3,559,293

Now, if we carefully study the extent of territory of each State, and its suitableness to fruit-culture, with the period in which cultivation has prevailed, we think the following may be an approximate estimate for 1873–74:

The six New England States	$6,000,000	North Carolina	$100,000
New York	7,000,000	South Carolina	20,000
New Jersey	2,000,000	Georgia	100,000
Delaware	1,500,000	Alabama	25,000
Maryland	1,500,000	Florida	25,000
Pennsylvania	3,000,000	Mississippi	20,000
Ohio	6,900,000	Arkansas	10,000
Indiana	3,000,000	Louisiana	70,000
Illinois	4,600,000	Texas	30,000
Michigan	3,559,293	Kentucky	60,000
Wisconsin	200,000	Tennessee	40,000
Iowa	150,000	Nebraska	10,000
Kansas	30,000	Minnesota	10,000
Missouri	1,500,000	Oregon	250,000
Virginia	1,200,000	California	6,000,000

The sum-total values of the fruits grown yearly in the territory of the U. S., and including Texas, we think we have carefully and moderately estimated, and it foots up $46,724,293. As before said, Michigan is the only State that pretends to give statistics of the value of her fruit-products, and upon a belief that she has told the truth, we have made up our estimate of other States and Territories. In connection, it may be fairly stated that fruit-food is a part and parcel of the support of human life, sought for and eaten by all and every man, woman, and child.

Authorities.—Of those upon fruits and fruit-growing we shall attempt to go back to but few outside of the U. S. Of the English authors, we note Arnold in 1521, Tusser in 1570, Knight in articles from 1795 to 1803, Bridgeman in 1720, Forsyth in London in 1824, and Ronalds in 1831. In this country, Coxe in 1817, we think, was the first; then Prince in 1828, Manning and Kenrick in 1844, Fessenden in 1828, Thomas Bridgeman in 1844, A. J. Downing in 1845 (2d ed., revised and corrected by his brother, Charles Downing, in 1870), J. J. Thomas in 1846, P. Barry in 1847, F. R. Elliott in 1853, Warder on the apple in 1867, Fuller on small fruits, Cole and Waring on general fruits, Fuller, Mead, Hurman, and Strong on grapes.

Production of Trees from Seedlings and Cuttings in the Nursery.—The production of new varieties is from seeds, taken usually from the hardiest and best varieties of their kind. Improved sorts are usually gained from seeds taken from fruit of trees of varied sorts allied in nature and standing near each other, or by artificial impregnation of the inflorescence of varieties allied to each other, but that do not naturally intermingle. The largest number of best fruits have come from nature's own commingling. The growing of seedlings of all the fleshy fruits, as apples, pears, plums, peaches, grapes, etc., is simply to gather the best seeds, and from the time of gathering to keep them packed in moist sand or moss, exposed to out-door temperature, and shaded from the sun. The same care is required with all the nut fruits. The latter should never be permitted to become dry, while the seeds of the pear and apple can be so permitted (but it is better not), and then before planting carefully soaked in tepid water until the germ starts. The best time for sowing seeds is just as the ground in spring is free of frost. Nearly all seeds should have one to one and a half inches of soil over them, and while the peach, plum, apple, etc. will grow without it, all the nut family should have light mulching over them of half-rotted leaf-mould or tan-bark. The currant, gooseberry, and grape can be grown from what are termed cuttings—*i. e.* pieces of wood of the past year's growth, having upon each three to four buds. The best season for making and planting these cuttings is in the autumn as soon as the wood and foliage are ripe. The ground is then warm, and if well prepared, the cutting placed in the ground, leaving only one bud an inch above the surface, the earth trodden hard at its base, and then drawn up loose and covered with a mulch of litter two inches deep, successful growth will be the result in spring.

Planting and Treatment in the Field.—The ground should be first carefully cultivated and made loose deeply, well enriched one year before planting. Just before planting it should be thoroughly and deeply ploughed or dug. The trees or plants, vines, etc. should be taken up carefully, and when planting make the hole so that the tree has one inch of earth above that in which it originally stood. The base of the hole should be like an inverted bowl—*i. e.* highest and rounding at the centre. The roots should carefully spread, so that no one lies upon another, and the earth should be spread and intermingled by pressure of the outspread fingers of the operator, who upon his knees on the outside of the hole should hold the tree upright with one hand and spread the roots while he mingles and presses the earth closely with the other until the roots are all covered; then the surface-soil, two to four inches deep, should be lightly spread, and never trodden upon by the foot. The firm packing of the lower roots is a guarantee that the tree will not be moved by the winds without staking, and if the base is so packed in the setting with the fingers that the earth is against every part of a root, not one tree or vine would ever die from the removal and replanting. If the planting is performed in autumn, then, as soon as the frost has penetrated two inches into the ground, there should be spread over the ground, two feet from the base of the tree, a mulch of litter, saw-dust, tan-bark, etc. If the planting is done in spring, the mulch should not be applied until heat and drought seem to require it to shade the soil around the roots from the sun; but the surface soil should from week to week be lightly raked over with a fine short-toothed iron rake. In following years it is best to keep the surface of the ground, whether orchard or vineyard, frequently stirred, either by plough or cultivation, for six to ten years. The keeping of the ground in condition for a supply of food to the trees, etc. may be done by sowing with corn, buckwheat, rye, clover, etc., and ploughing it under as soon as it reaches one foot high.

The Pruning of Trees and Vines.—Great diversity of opinion exists touching the how and when to prune trees or vines. If the operator will study nature in the pruning of fruit trees, he will note that any cutting of limbs from the time the buds start their growth in spring until they have ripened the last bud of the season creates disease of the roots, sometimes exhibiting itself in what is called canker, sometimes in blight, etc. Again, in the forming of the body, and in determining the height at which the branches should spring, we should consider *first*, the order of nature; *second*, the necessities of culture. Nature, when trees stand and grow in the open ground, where the sun and air reach all points, starts the branches from one to two feet from the

ground. This shades the foundation from the sun, and holds a balance of lever-power against high winds. The successful cultivator should heed this point when in his orchard he is required to keep the ground cultivated; and, so heeding it, should grow all the varieties propagated to make dwarf trees—*i. e.* the apple upon the paradise or Doucain stock, the pear upon the quince, the peach on the plum, etc., with branches one to two feet from the ground. The standard apple, pear, plum, peach, etc. in open field orchards should, on the other hand, have their first branches start at four to five feet from the ground. In the pruning of inner branches, and the shortening-in of such as seem to grow more than the rest of the tree, the best time is a week or two before the swelling of the buds in the spring. Where a great deal is to be done, a part may be performed as soon as the wood has ripened its terminal bud in the autumn, and the leaves begin to fall. The pruning of grapevines was commenced in this country from the methods followed with a different species of grape upon the Rhine, and from the practice common in glass structures, where variety and fine bunches are more sought for than a productive crop; but American grapes cannot be confined like the European, neither can health or longevity be maintained by following European teachings. In pruning our native grapes, as soon in autumn as the fruit and wood has mainly ripened is the time to operate. The stems to be left should be not too large nor very long, but of good medium size, well ripened to a deep rich brown; they should not be, upon vigorous vines, less than three to four feet long, and each stem should have the two or three lower buds rubbed out, leaving three to five fruiting buds upon the remainder of the stem or cane; and when vines are left four feet long and having seven or eight buds, the two lower ones should be rubbed out, and then the five left have two rubbed out at equal divisions. This done, no further pruning is needed for the year. Keep the vines from the ground by tying to wires or stakes.

Lists of Fruits for Planting.—It is not practicable to prepare lists of varieties of fruits adapted to different sections of the country, for the reason that from Maine to California no select list would be accepted or popular as a whole. As an illustration of the differences of locality, the Family apple grown in the State of New York becomes ripe in November. It originated in Georgia, and there ripens in July. In thirty and more years of experience and observation of varieties grown in nearly every State, having had them gathered and sent from time to time to note and compare, we have come to the conclusion that no list can be made complete and satisfactory unless its author describe the soil in which the fruit should be grown, its time of ripening in each section or locality, and its value as a family or market fruit. As to what varieties to plant, we say: First, prepare your ground; then, having made up your mind for what purpose you want to grow fruit, go among the growers within fifty miles of your location; compare their soil, position, and elevation with your own; ask what varieties are with the growers most successful and profitable; make notes of each reply; go home and balance up the list. In all this, however, remember that for family use there are to be planted few of a kind, while for market the value of each variety must be estimated by size, color, quality, and firmness for transportation. A medium-sized fruit, with more or less of red or golden yellow upon it, is usually the most profitable. Large, white, tender-skinned, or sweet fruits are not generally profitable.

Gathering and Keeping of Fruits.—No variety of fruit should be gathered when there is any moisture upon it. Strawberries, raspberries, and blackberries are to be gathered just when fully ripe. Peaches, if for shipment, should be left upon the trees until they are well colored and will give to the pressure of the inside of the thumb. If wanted for family use, either for the table or canning, they should remain upon the tree until they are really soft and juicy. The same holds with plums, apricots, and nectarines. These four named sorts may be counted ripe when the side next the sun is a little soft. Care should be taken in all fruits not to rub off the bloom by handling in the gathering. The best way is to hold a soft-lined basket in the left hand underneath the fruit, and with the right hand loosen it carefully at the junction of the branch and stem. The ripeness of pears is decided by the lifting of the fruit, when, if nearly or quite ripe, it will separate readily at the junction of the stem with the spur. Most if not all pears will do this, when if left upon the tree they would hang from six to twenty days, and when gathered be found decayed at the core and all their flavor destroyed. If gathered when the stem readily separates from the spur by raising, they are hard, but by laying them in a dry, cool room between layers of flannel or any woollen fabric, a few days only will ripen them into color and juiciness. The very late autumn and winter varieties should hang upon the tree until near the time of a sharp frost. They should then be gathered, and each pear wrapped in soft paper, packed in boxes four to six inches deep and holding each two tiers, or about a peck, then placed in a cool, dry room, and kept just above frost. Many varieties now carelessly and hastily ripened and sold in October and November can be kept until December and March. The gathering of early-ripening summer apples is done when a soft jar of the limb causes them to drop from the spur. The later-ripening summer varieties, as well as the early varieties of autumn, should be gathered as soon as they show the color belonging to them, and on opening are found with dark-brown seeds. So gathered, and kept in a cool, dark, airy place, they will remain good a long time. The late fall apples and the early winter sorts will do to gather at about the same time, or say as soon as the seeds show a brownish-black color. They should be kept separate, and examined twice a week. As soon as a moisture appears upon any fruit, it should be taken out, wiped dry, and disposed of. The best winter-keepers should be gathered just before severe frosts. They should be laid carefully in barrels or shallow boxes as gathered from the tree, the barrels or boxes stacked upon rails or bars, to keep them from the ground, then covered with boards to keep off the rain, when usually they may be left without injury until midwinter.

F. R. ELLIOTT.

Fruit'land, tp. and post-v. of Muskegon co., Mich. Pop. 228.

Fruit'port, post-v. of Muskegon co., Mich., on Spring Lake, at the mouth of Grand River, 5 miles E. of Lake Michigan, on the Chicago and Michigan Lake Shore R. R., 116 miles from Chicago. It is in the great fruit-region of Michigan, has a magnetic mineral spring, and is a place of summer resort. It has fine hotel accommodations.

Fruit'ville, tp. of Currituck co., N. C. Pop. 600.

Fry (BENJAMIN ST. JAMES), Methodist clergyman and journalist, b. June 16, 1824, studied at Woodward College, O.; joined the ministry in Ohio Conference in 1847; served as chaplain in the U. S. army from 1861 to 1864, and was chosen by General Conference to be editor of *The Central Christian Advocate,* St. Louis, in 1872. *Lives* of Bishops McKendree, Whatcoat, C. Roberts, and *Property Consecrated,* a prize essay, were written by him.

Fry (CARY H.), b. in Kentucky; graduated at the U. S. Military Academy in 1834, entering the 3d Infantry as brevet second lieutenant; resigned in 1836 and practised medicine, but on the outbreak of war with Mexico aided in raising the 2d Kentucky Volunteers, and was appointed its major. In the battle of Buena Vista the regiment performed distinguished service, and upon the fall of its colonel and lieutenant-colonel, Major Fry was left in command. His regiment being disbanded June, 1847, he resumed the medical profession until 1853, when he was appointed a paymaster in the army, and for five or six months in 1862 was acting paymaster-general. For twenty years he did faithful service, and was deputy paymaster-general and brevet brigadier-general U. S. A. at the time of his death, which occurred at San Francisco, Cal., Mar. 5, 1873.

G. C. SIMMONS.

Fry (ELIZABETH), daughter of John Gurney, and wife of Joseph Fry of London, was b. at Bramerton, Norfolk, England, May 21, 1780; was bred up a Friend, and under the ministrations of William Savery, an American Quaker, she in 1798 became awakened to a new religious life; was married in 1800, and then resumed her former habit of visiting the poor and sick, afterwards extending her attention to seamen, prisoners, outcasts, and the vicious classes, not only in London, but in all parts of Great Britain and Ireland, and later even in many continental countries. In 1813 she became an occasional preacher, and notwithstanding the great extent, importance, and success of her benevolent labors, she found time to train with care and thoroughness a large family of her own. She d. at Ramsgate Oct. 12, 1845. (See her *Memoirs*, by T. TIMPSON, 1846; by her daughters, 1847; by S. CORDER, 1853.)

Fry (JAMES B.), an American officer, b. Feb. 22, 1827, in Carrollton, Greene co., Ill.; graduated at the U. S. Military Academy 1847; was commissioned as brevet second lieutenant in the Third U. S. Artillery, and joined it in the city of Mexico during the Mexican war; served as assistant instructor of artillery at the Military Academy in 1847, and again in 1853–54, and as adjutant of the Military Academy 1854–59; appointed assistant adjutant-general 1861; chief of staff to Brig.-Gen. McDowell during his campaign of 1861, taking part in the first battle of Bull Run; as chief of staff to Maj.-Gen. Buell in 1861–62, taking part in the battle of Shiloh, the advance upon and siege of Corinth, the operations in Northern Alabama, and the battle of Perryville; provost marshal-general of the

U. S. (brigadier-general) from 1863 to 1866 under enrolment act of 1863, passed to enforce military service after the system of voluntary enlistment had proved inadequate. As provost marshal-general he put into the army by conscription, substitution, and voluntary enlistment 1,120,621 men; arrested and returned to the army 76,562 deserters; made an exact enrolment of the national forces, showing that there remained in the country liable to conscription, but not called out, 2,254,063 men; and collected, under a money-commutation clause of the enrolment act, $26,366,-316.78. His *Final Report of the Operations of the Bureau of the Provost Marshal-general of the U. S., from the commencement of the business, Mar. 17, 1863, until the Bureau terminated by law, Aug. 28, 1866,* is published in parts i. and ii. as a Congressional document. Promoted through various grades to lieutenant-colonel in the adjutant general's department and brevet major-general U. S. army; served since 1866 as adjutant-general of the military divisions of the Pacific, the South, and the Atlantic. G. C. SIMMONS.

Fry (WILLIAM HENRY), an American journalist and composer, b. in Philadelphia Aug., 1815, son of Wm. Fry, proprietor of the Philadelphia *National Gazette.* At an early age the musical talent of the son was manifested, and in 1835 his first orchestral compositions, consisting of four overtures, were performed by the Philadelphia Philharmonic Society, and an honorary medal conferred by it upon the author; became associated with his father's paper in 1839, and editor of the Philadelphia *Ledger* 1844. His first opera to be produced entire was *Leonora,* performed in Philadelphia in 1845, an Italian version of which was given in New York in 1858. From 1846 to 1852, Fry resided in Europe, principally in Paris, and was engaged as correspondent to several leading American journals. Returning to America in 1852, he delivered that year a course of lectures upon the history of music, illustrated by the symphonies *The Breaking Heart* and *A Day in the Country,* composed for the occasion; these, with others of his compositions, were performed by the celebrated band of M. Jullien in his concerts. He also composed a *Stabat Mater* with complete scores, vocal and orchestral, and many unpublished pieces. Upon his return from Europe he joined the editorial staff of the New York *Tribune,* where he continued until his death, which occurred Dec. 21, 1864, at Santa Cruz, West Indies, where he had gone for the benefit of his health. G. C. SIMMONS.

Fryeburg, tp. and post-v. of Oxford co., Me., on the Portland and Ogdensburg R. R., 49 miles N. W. of Portland. It has an academy, and manufactures of leather, carriages, etc. Pop. 1507.

Fryeburg Academy Grant, tp. of Oxford co., Me. Pop. 38.

Fryx'ell (ANDERS), a celebrated Swedish historian, was b. at Hesselskog, Dalecarlia, Feb. 7, 1795, and studied philosophy and theology at the University of Upsala. From 1822 to 1836 he was director of one of the most prominent educational institutions of Stockholm, and in 1824 he wrote a grammar of the Swedish language, which is used in all the higher schools of the country. In 1836 he was appointed provost of North Wermland, an ecclesiastical position in the Lutheran Church intermediate between minister and bishop; but in 1847 he resigned this office in order to devote himself entirely to historical studies. History is cultivated in Sweden with great interest and with superior talent, but among the many able and even brilliant productions which this branch of Swedish literature contains, Fryxell's *Berättelser ur Svenska Historien* (34 vols.) occupies a foremost place. In the Scandinavian countries this book is much read and highly esteemed, and parts of it have been translated into German and French. Its style is fluent and lively, its narrative brisk and graphic, and as the author has made very extensive studies of archives not only in Sweden, but in Poland, Prussia, and Denmark, his work is exceedingly rich in details at once new and authentic. In his leading views he forms an opposition to Geijer, who may be considered as the historian of the democratic party. In the Swedish history the aristocracy has played the most conspicuous, and at times a most brilliant part, but although it has kept itself tolerably free from such crimes as have tarnished the reputation of the French and Polish aristocracies, it has in the last century been the subject of very severe attacks from the historians of the democratic party. These attacks occasioned Fryxell to write his book *Dur aristokrat-fordömandet in Svenska historien* (4 vols., 1845–50), in which he defends the Swedish aristocracy, without defending the crimes it may have committed or the general injustice of its political preponderance. The book gave rise, nevertheless, to a very fierce contest between the two historical schools, which spread from science into politics, and from politics into personalities. CLEMENS PETERSEN.

Fu'ad Pa'cha, a Turkish statesman, a son of the poet Izzet Molla Kischedji-Zadek, was b. at Constantinople in 1814. In 1840 he was secretary to the embassy in London, and then, until 1848, interpreter in the ministry and commissioner-general in the principalities of the Danube. In 1849 he became minister of the interior, and from Aug., 1852, to Mar., 1853, from May, 1855, to July, 1857, and in Jan., 1858, he occupied the position of minister of foreign affairs. He participated as a plenipotentiary in the Conference at Paris. In 1860 he punished the Druses and Mohammedans for their persecution of the Christians, and in Nov., 1861, was appointed grand vizier. In Feb., 1862, he took charge of the finances, and in Feb., 1867, was appointed minister of foreign affairs for the fourth time, while his friend, Aali Pacha, was appointed grand vizier. Fuad Pacha was a man of French education and tendencies, a great admirer of France and Napoleon III., and the chief support of the reform party in the Turkish empire. In 1868 he induced the sultan to make a tour in Western Europe and to visit the courts of Paris, London, and Vienna, in order to make him see with his own eyes the advantages of European civilization. In his political activity he was very successful, especially in crushing the revolution of Crete in 1867 under very difficult circumstances, as the sympathy of the great powers was very doubtful. But at the end of 1868 symptoms of a fatal disease showed themselves in his constitution, and he d. in Nice, France, Feb. 3, 1869. He wrote a grammar of the Turkish language, which has been translated into several languages. AUGUST NIEMANN.

Fucaceæ. See SEA-WEEDS.

Fu'ca, de (JUAN), a Greek navigator whose real name was APOSTOLOS VALERIANOS, a native of Cephalonia; was many years in the Spanish service, and in 1592 discovered the channel known as the Strait of SAN JUAN DE FUCA (which see). This he professed to consider a passage joining the Atlantic and the Pacific. D. in Zante in 1602.

Fuch'sia, a genus of dicotyledonous plants, belonging to the natural order Onagraceæ, and named after Leonhard von Fuchs, a celebrated German botanist (b. in Suabia in 1501, d. in Tübingen, where he was a professor, in 1566). The popular name of the genus is "ear-drop," from the appearance of the pendulous flowers. These are very showy, and of a red, violet, or rose color in their native state. They sport and hybridize easily, and hence result the numerous varieties known in floriculture. Those with white or cream-colored tints are the most highly prized. The tube of the calyx is showy in appearance, like the corolla, and is extended much beyond the ovary. It is bell-shaped or tubular, with four spreading lobes. The petals are also four in number, and the stamens eight. The style is long and thread-shaped, and surmounted by a club-shaped stigma. The flowers are on axillary peduncles. The plants are mostly smooth, with opposite or whorled leaves. They are either tender shrubs, climbers, or trees, natives of South America as far as Fuegia, and also of the southern parts of North America; and New Zealand has some native species. Their best known habitat is the Andes of Chili and Peru. The species now in cultivation have been so much changed by art that it is often difficult to recognize their origin. They may be divided into short and long flowered and panicled fuchsias. The plant forms a berry which is sweet or only pleasantly acid, and which is eaten in the countries where it is native. A black dye is said to be formed from the wood in Chili. Fuchsias are easily propagated by cuttings, and have become so abundant that they are within the reach of even the poorer classes, in whose windows or small garden-plots they are often seen growing. They thrive in a light rich soil. They grow well in the open air in the summer time, but in the northern U. S. have to be housed in winter. There is no class of plants except the geraniums with which the gardener has been able to do so much. There appears to be no limit to the curious freaks of color which they may be made to assume, and it is even said that they occasionally become striped. They are familiar to all in conservatories and in floral ornamentation. W. W. BAILEY.

Fuch'sine, aniline red. See ANILINE COLORS, by PROF. C. F. CHANDLER, PH. D., LL.D., M. N. A. S.

Fu'cino, or **Cela'no** [Lat. *Fucinus*], **Lake and Tunnel of.** This lake lies about 50 miles eastward of Rome, at the height of 2200 feet above the sea, in a mountain-basin in the Apennines having no known natural outlet. The ancient and mediæval accounts of the dimensions of Lake Fucino and of the fluctuations of its level are conflicting; but though its waters were undoubtedly partially carried off through natural conduits or fissures or porous strata in the subjacent rock, its depth and superficial extent have at all times been subject to great variation arising chiefly from the varying humidity or dryness of the seasons. In 1816

it covered 42,000 acres, with a maximum depth of 75½ feet; in 1835 its area was but 33,000 acres, its greatest depth 34 feet. The occupation and cultivation of the debatable zone, of about 9000 acres, between these extremes was of course attended with risk of loss, and at low water the freshly bared soil sent up miasmatic exhalations prejudicial to the healthfulness of the adjacent country. To obviate such evils, and to gain an addition of fertile soil for agricultural purposes by permanently reducing the lowest known level of the lake, Julius Cæsar contemplated the excavation of a tunnel under the mountain-ridge on the western side of the basin to discharge the superfluous water into the river Liris, now called the Garigliano, the bed of which is 62 feet lower than the bottom of the lake. The work was actually commenced by Claudius, and substantially completed after eleven years of labor. The length of the Claudian tunnel was 18,506 feet, or rather more than 3½ miles, with an inclination of about $\frac{1}{1000}$, and a cross-section measuring 102 square feet, admitting a delivery of 424 cubic feet to the second. The tunnel was admirably engineered, and, with the important exception of the exclusive use of the chisel instead of blasting, the methods of excavation, as appears by ancient bas-reliefs and by utensils occasionally found along the line, much resembled those employed at the present day, though the shafts, both vertical and oblique, for extraction, access, and ventilation, were much more numerous than it would now be found economical to sink. The execution of the work by the constructors, as is now ascertained, was most unfaithful, and though the emissary appears to have served its purpose for some time, it was soon obstructed and fell into total decay. Indeed, the fact that a species of fish peculiar to the lake was never found in the Garigliano until after the recent reconstruction of the tunnel, has led some to question whether the Roman gallery was really ever opened at all. At various subsequent periods attempts were made to restore the tunnel, but it does not satisfactorily appear that anything was effected until the present generation, when, by the enterprise and liberality of Prince Alessandro Torlonia of Rome, the entire line has been rebuilt at a cost of more than $6,000,000, and on a far grander scale than that of the ancient imperial work. The new tunnel, which is designed not simply to lower, but to drain the entire lake, follows the original course, and, though at a somewhat lower level, includes the entire ancient channel, every vestige of the Roman tunnel having been necessarily removed in excavating the new. It is constructed with the utmost solidity, being everywhere lined with a thick revetment of cut stone; its cross-section measures 215 square feet, allowing a discharge of 2400 cubic feet to the second; and, as its axis is lower than that of the Claudian emissary, and the bottom of the lake has been considerably raised in later ages by wash from the shores, the new tunnel is longer than the old by 2200 feet. Hence, its total length falls little short of 4 miles. From the entrance of the emissary a canal 8 miles long and 62 feet wide at bottom, requiring 4,000,000 cubic yards of cutting, has been excavated to the deepest part of the lake, which will soon be drained to the bottom. The technical difficulties arising from various causes—among which the infiltration and pressure of the water, and especially the loosening and shattering of the earth and rock along the line by the falling in of the old tunnel, deserve particular notice—were extreme, and it may be doubted whether modern engineering has anywhere triumphed over more formidable obstacles, whether as regards intrinsic difficulty or danger of life to those engaged in the execution. To the honor of Prince Torlonia, at whose sole cost this stupendous enterprise has been accomplished, it ought to be mentioned that in encouraging the laborers by his actual presence in the tunnel at the most dubious and perilous crises of the work, he has displayed a personal heroism even more admirable than the munificence which has marked his financial arrangements. The original engineer of the Torlonian emissary was De Montricher, the designer and constructor of the celebrated aqueduct of Marseilles, after whose death worthy successors were found in Bermont and Brisse. (See KRAMER, *Der Fuciner-See*, 4to, Berlin, 1839; LEON DE ROTRON, *Proscingamento ad Lago Fucino*, 8vo, Vienna, 1871.) GEORGE P. MARSH.

Fucus. See SEA-WEEDS.

Fu′cusine, an organic base, $C_{15}H_{12}N_2O_3$, obtained from sea-weeds.

Fu′el [Fr. *combustible;* Ger. *Bernstoff*]. Every substance is a fuel which may be used for the generation of heat by its combustion in air. Many chemical reactions evolve heat from factors which are in no proper sense fuels; *e. g.* lime slaking with water, sulphuric acid mingled with water, quicklime drenched with sulphuric acid, and other like cases, evolve much heat from molecular motion in substances wholly incombustible. Properly speaking, only carbon and hydrogen, and the compounds of these two factors with each other, and with oxygen, nitrogen, etc., are fuels. This classification includes all the forms of coal, coke, charcoal, wood, turf, oils of every kind, and combustible gases, such, for example, as escape from artesian borings in oil-bearing and saliferous strata. It excludes sulphur, whether free or evolved from the roasting of ores, although this element is practically utilized as a source of heat in some chemical and metallurgical processes, as in burning sulphur to form oil of vitriol.

With the exception of animal oils (and even these remotely form no exception), all descriptions of fuel are of vegetable origin. This assumes the vegetable origin of all forms of fossil fuel, which is now generally admitted. However various the forms conferred by the processes of life, we find by analysis only carbon, hydrogen, oxygen, and nitrogen, with water, and variable but generally very small quantities of mineral elements. Submitted to ultimate analysis, we obtain only carbonic acid, water (with sometimes traces of ammonia from the nitrogen), and an ash. By the proximate analysis of organic bodies—*e. g.* in their destructive distillation, as in the process of coaling of wood and coking of bituminous coals—we obtain combustible gases, as marsh-gas, heavy carburetted hydrogen, carbonous oxide, and free hydrogen, carbonic acid, acetic acid, and free carbon, which represents by its skeleton the form of the wood or other fuel used in the process.

Fuels differ very greatly in the amount of volatile matters they contain or which are produced from them in the process of combustion. Thus, wood and turf contain a large percentage of free water, which is driven out or evaporated during combustion, while, in common with bituminous coals and lignites, they evolve also a large volume of combustible gases, tar, and other pyrogenic products. Such fuels burn with abundant flame, often with smoke, from imperfect combustion, and are well adapted to the generation of steam, the production of illuminating gas, and are preferred in many metallurgical processes. On the other hand, anthracite coal—of the harder variety—coke, natural or artificial, and charcoal from wood, burn with but little flame and no smoke, evolve little or no watery vapor, and from their firmness under the weight of a load and the high temperature they evolve are specially adapted to smelting iron and other metals, and to the production of a steady, intense, and long-continued heat for any purpose. Fuels also differ much in the amount of *ash* left by their combustion. In a few cases the ash is less than 1 per cent. of the weight of the fuel (*e. g.* albertite). The best coal yields 5 per cent. of ash or thereabouts, while many more contain 10 or even 20 and more per cent. of incombustible mineral matter. The presence of foreign matter of an incombustible nature in fuel is a loss of useful effect, not only by reducing the actual amount of carbon, etc., but in that it requires a certain amount of fuel to fuse the ash into a slag, which then encumbers the fire by clinkers. Water is another foreign element which greatly reduces the value of fuels. The common experience of the superior excellence of well-seasoned wood over green or recently cut wood is a familiar example. Water not only impedes combustion by reducing its temperature, but a large amount of heat is removed and rendered useless in converting the water into vapor. Furnaces have been constructed, however, for the purpose of consuming wet fuel, such as tan-bark, bagasse of sugar-cane, etc., in which, by an ingenious arrangement of parts, a high temperature and intense combustion are maintained, even when very wet fuel is used. One of these will be noticed hereafter. Even coal contains some moisture, and the varieties of lignite a much larger amount, while even well-dried wood retains 20 per cent. of water. Fuels containing oxygen also produce water in the act of burning, thus consuming a further quantity of heat. Even the hydrocarbon gases distilled in the combustion of coal are produced at the expense of a certain number of units of heat. It has therefore been asserted—and is often assumed to be true—that the total economical or useful effect of a fuel may be calculated from the known quantity of fixed or non-volatile carbon which it contains. It is, however, demonstrable that this statement, however theoretically correct, is not supported by experiment, as we shall see farther on.

The value of the Pennsylvania anthracite (see ANTHRACITE) over all other coals as an agent for the production of high heats, especially in the high furnace and in the reduction and smelting of metals, is now generally admitted. The superior evaporative power of anthracite was first demonstrated by the researches of Prof. Walter R. Johnson in 1844, by an elaborate series of experiments undertaken for the U. S. navy, and published in a *Report to the Navy Department of the U. S. on the Evaporative Power and other Properties of American Coals* (28th Cong., 1st Sess., Senate Doc., pp. 607, 860, Wash-

ington, 1844). These researches were not confined to anthracite coals, but were extended also to natural coke, artificial coke, mixtures of anthracite and bituminous coals (Class I.); to free-burning bituminous coals of Maryland and Pennsylvania (Class II.); bituminous coking coals from Eastern coal-field of Virginia, in the neighborhood of Richmond (Class III.); and finally to foreign bituminous coals and those of similar constitution W. of the Alleghany Mountains, and dry pine wood (Class IV.).

The highest evaporative power, as in the production of steam, is not, however, found in anthracite, but in the semi-bituminous coals, like those of Broadtop and the Cumberland region, and the coal of the Cruzot Basin, in which the proportion of hydrogen or volatile hydrocarbon is not greater than can be perfectly consumed in the furnace and flues of steam-boilers. This fact was first demonstrated by the researches of Johnson, and has since been confirmed by those of Sir Henry de la Beche and Dr. Playfair in their report on the coals suited to the steam navy of Great Britain (1848). The latest researches on this subject are those of Messrs. Scheurer-Kestner and Meunier on the coals of Rhenish Prussia and Belgium (abstracted in *Comptes Rendus*, tom. 66–69, and *in extenso* in the *Bulletins de la Soc. Industrielle de Mulhouse*). The calculations of Mendenhall on the heating powers of some Ohio coals (*Geol. Survey of Ohio*, 1870) point in the same direction, as also those of Raymond on the lignites of the West.

Bituminous Coal.—This coal contains a variable quantity of volatile matter, expelled as combustible gases when heated in close vessels, and leaves behind coke of variable strength, according as the coal is treated, and varying also with the amount of volatile matter expelled, and its physical and chemical constitution. Heated at lower temperatures, many of the coals of this class produce hydrocarbon oils, while coal-tar is a product of their destructive distillation at all temperatures, whence the name *bituminous*. When these coals agglutinate to form a hollow fire, they are called caking coals or fat coals. The mass softens and becomes pasty under heat and semi-viscid. This softening takes place below redness at the stage of incipient decomposition, and is attended with the escape of gas, which often blows bubbles, leaving the mass porous, and escapes in jets of smoke and yellow, smoky flame. With a higher heat in close vessels (gas-retorts) the escape of gas ceases gradually, and finally leaves a porous brittle mass of gray-black color and submetallic lustre, which is coke. The gas expelled in this way from bituminous (gas) coals varies from 25 per cent. to 50 per cent., and in the cannel coals rises even to 60 per cent.; the more common average being about 35 per cent. for gas-coals. The semi-bituminous coals of Pennsylvania and Maryland yield only from 12 to 20 per cent. of volatile matter. The *non-caking* or *free-burning* bituminous coals are like the caking coals in appearance, and often closely resemble them in ultimate composition, but they leave no proper coke. This is the character of the *lignites*, so called, of Colorado and Wyoming, more particular mention of which is made beyond.

Cannel Coal (which see) is a fuel of inconstant properties, owing its character, apparently, to local peculiarities of origin. *Torbanite, albertite, wollongongite*, and *grahamite* are bituminous minerals of exceptional richness in volatile hydrocarbon. The *torbanite*, or "bog-head" cannel, seems like a clay saturated with bituminous matter. It yields over 68 per cent. of gas and nearly 23 per cent. of ash, and only 8.8 of fixed carbon. *Albertite*, on the contrary, leaves only 0.10 per cent. of ash, and is regarded by Dana as an asphaltum, although commercially sold as an enriching coal. It is probably an inspissated and oxygenated petroleum filling a fissure in the rocks, and is not a bed. Wollongongite (described on the last page of the present article) is another remarkable substance whose value as a gas-enricher is noticed in the article on Gas-lighting (which see). *Grahamite* is another asphaltum-like hydrocarbon, from near Parkersburg in West Virginia, described by Henry Wurtz. Grahamite seems to have had an origin similar to albertite, and like it fills a fissure, and is not a bed. It has been largely used for enriching illuminating gas, as "Ritchie mineral," but is now said to be exhausted.

The following comparison of the illuminating power of various well-known cannel and other gas-coals of England and the U. S. is taken from a paper by the writer on the "wollongongite" (*Am. Jour. Sci.* July, 1869). The standard sperm candle in use among gas engineers consumes 120 grains of sperm per hour. The total economical value of any gas-coal is obtained by multiplying the candle-power of the gas produced from one ton of the coal into the volume of the gas: thus, as the wollongongite yields 13,716 cubic feet of gas, *one* foot of which has an illuminating power of 26.54 candles, therefore we have $26.54 \times 120 \times 13716 \div 7000 = 6251.26$ pounds of sperm as the value of the gas from one ton of this mineral:

				1 cubic foot = candles.
Wollongong cannel..	= lbs. of sperm	per ton,	6251.26	26.54
Boghead cannel.......	= "	"	*1967.10	
" "	= "	"	†2755.6	10.38
" "	= "	"	‡1235.	5.29
Albert coal, N. B.....	= "	"	§3016.37	11.73
Peytona cannel........	= "	"	§1440	8.4
Lesmahago cannel...	= "	"	1529	8.77
Capeldræ	= "	"	1670	10.01
Donibriste	= "	"	1277.5	7.51
Wigan	= "	"	627.4	3.04
Pelton Main (caking)	= "	"	532	3.12
Ramsay's (Newcastle)	= "	"	553	3.33
Westmoreland, Pa....	= "	"	§541.25	3.32

Brown Coal [Ger. *Braunkohle, Pechkohle; lignite*].—This variety of coal differs from bituminous coal chiefly in containing a larger amount of constitutional oxygen, more combined water, and in being, generally, more friable. Its powder is distinctly brown, and not black, whence its name; but it is sometimes of a pitchy black color and fine lustre. It is found in more recent geological horizons than the coals before named. The deposits of this variety of coal opened in Colorado, Wyoming, and Utah Territories, are remarkable for extent, thickness, and uniformity, affording an inexhaustible supply of excellent fuel in a region for the most part destitute of forests and remote from all other sources of fuel-supply. Similar beds are found also in California and elsewhere on the Pacific coast. The brown coals are not caking coals, but are free-burning coals, yielding much gas, and are good steam coals, but not well adapted to carry the burden of the high furnaces for iron, although perfectly well adapted to general metallurgical use and to the Siemens gas furnace. Their calorific force is also remarkable, as will be seen further on.

Chemically considered, all the coals are oxygenated hydrocarbons, the amount of oxygen they contain gradually increasing from the anthracites, where it is as low as 1 to 2 per cent., in the caking and non-caking coals, 4 to 12 per cent., and in the brown coals, 18 to 30 per cent. or more, averaging in the last-named variety about 22 per cent. In a few of the anthracites there appears to be an entire absence of oxygen, and the presence of so large a preponderance of pure carbon seems hardly consistent with the view expressed by Berthelot, that the anthracites are in their totality hydrocarbon compounds like other coals, but rather that a portion of these compounds normal to the so-called bituminous coals has escaped the caking process which has more or less completely converted them by heat under pressure into anthracite. The fact, first thoroughly demonstrated by the brothers Rogers, that the volatile matter in the anthracites regularly increases in the Appalachian beds as the flexures of the strata die out going westwardly, until they are undisturbed in the bituminous coal-fields on the western slopes of that line of upheaval, seems to leave no reasonable doubt at once of the cause and its effects, which afford us the only rational explanation of the phenomena in question. The researches of Pumpelly, Richtofen, and others in the vast coal-fields of China have demonstrated that anthracite coal exists in geological horizons much more recent than was formerly supposed true—even as late as the Cretaceous and Tertiary eras—and that its existence there is clearly due to the coking of bituminous or brown coals by heat.

Charcoal and Coke have already been described under their appropriate heads (which see). Charcoal prepared from hard woods at a high temperature is the purest form of carbon available as a fuel, being entirely free of sulphur and yielding only a little alkaline ash, with a small amount of silica. Burning to carbonic acid by oxygen, it forms the standard of comparison for the heat evolved by other less pure forms of fuel. By the experiments of Favre and Silbermann it gave per pound of fuel 8080 calories (Cent.), equal to 14,544 calories F. Coke is less efficient than charcoal, just in proportion to the amount of ash it leaves, and this is usually about 15 per cent. But owing to its much greater strength under the crushing weight of the high furnace, as well also as its greater cheapness, it is the preferred fuel for the high iron furnace. The sulphur it retains from the pyrites found in the crude coal may be almost completely removed by proper mechanical treatment of the coal before coking. For this purpose the coal is crushed and washed in an apparatus similar to that used in the concentration of metallic ores, by which the pyrites is removed by virtue of its greater density, and the coke prepared from coal so treated is found to yield iron of a very superior quality, owing to its almost complete freedom from sulphur. In the process of coking in suitable ovens

* Advertisement of the proprietors. † Dr. Fyfe.
‡ Manhattan Co. § My own results.

the fine coal unites into compact prismatic masses, of a submetallic lustre, sonorous when struck, like cast iron.

LIQUID FUELS.—The hydrocarbon oils found so abundantly in Pennsylvania and elsewhere, and produced artificially by the distillation of bituminous schists, offer a valuable resource for fuel in certain situations where their abundance enables them to compete with solid fuel. For example, the light naphtha forming from 20 to 25 per cent. of the first product of the distillation of Pennsylvania petroleum is extensively employed in the oil-regions as a steam fuel and for the distillation of the crude oil in its first stages of treatment. For this purpose the naphtha in vapor is burned from jets in wrought-iron pipes arranged beneath large boilers and pierced with numerous fine holes, the supply of air being regulated to secure a complete combustion. The exact value of light naphtha thus used as a source of heat has not apparently been practically determined in comparison with other liquid fuels. But a series of experiments are cited in the *Report of the Commission appointed to Inquire into the Several Matters relating to Coal in the United Kingdom* (1871), in which the materials employed were crude petroleum, crude paraffine oil, dead oil or creasote, and their calorific power and evaporative efficacy, determined by trials in the large way under steam-boilers, as compared with coal, under the direction of Prof. W. J. Macquorn Rankine. The results are given in the following table:

For one pound of—	Total quantity of heat generated.	Quantity of heat available for producing steam.	Quantity of water heated from 60° to 212° F., and converted into steam at 212° F.	Temperature of the fire or flame.
	Heat-units.	Heat-units.	Lbs.	F.
Crude petroleum.....	20,000	16,847*	15	4646°
Crude paraffine oil..	20,000	16,847*	15	4646°
Heavy oil—oil from either slate or coal.	20,000	16,847*	15	4646°
Dead oil, or creasote.	16,626	14,567*	13	4495°
Coal { from.............	13,890	10,001†	8.95	2500°
Coal { to..................	14,833	10,817	9.67‡	2500°

The use of the vapor of the liquid hydrocarbons used under boilers, and even under the iron stills employed in the distillation of coal-tar of gas-works, as well as of petroleum products, has given most satisfactory results, reducing the time required for distilling a given charge fully one-half, and acting almost without injury to the stills, which are rapidly injured by the use of coal-fires. This difference is probably in great measure due to the much smaller amount of air required to feed the vapor-flame than is used for a coal-fire; 300 cubic feet of air (24 pounds) to the pound of coal being required, while not over half that amount is required to burn the hydrocarbon vapor supplied by a blast of its own production in place of the draft of a high chimney required for air burning coal. The oxidation of the iron surface is thus largely saved, and the injury from sulphur in coal completely saved by the use of the hydrocarbon vapor. The conclusions reached by the commission referred to are that the evaporative efficacy of liquid fuel for generating steam is much greater than that of coal; and that on board ships there is an important saving of space for storage, as well as in labor of stoking, removing ashes, etc., with a proportional reduction of running expenses; while steam could be raised much quicker by the use of liquid fuel, and save the cost of banking up fires, and the immersion of the vessel more evenly maintained by tanks between the outer and the inner skins of the vessel, to be filled with water as the oil is removed. On the other hand, certain obvious dangers attend the storing and use of volatile hydrocarbons, while the odor of the heavy or dead oils would be very annoying, however carefully stored on board ship. These objections do not appear to have been overcome, while for various purposes on land they have little force. Thus, in ironworks dead oil has been used with advantage in the furnaces for heating iron plates, etc. It has been found possible to produce a higher, steadier, and more even heat with liquid fuel than with coal, while 8 hundredweight are said to have replaced a ton of coal, and the time occupied in heating the iron is said to have amounted to only one-fourth, or even one-fifth, that required with coal. So that there was a manifest economy in the number of furnaces required to do a given amount of work. Thus, for instance, while the heating of a half-inch plate sufficient for bending would require from 15 to 20 minutes with coal, it would require only four or five minutes with the liquid fuel; and a 4-inch armor plate requiring three hours to heat with coal required only 38 minutes with the liquid fuel. The "scale" of magnetic oxide of iron formed in the process of heating is much less when liquid fuel is used than with coal, for the reason that there is less free oxygen from the air present, while the vapor of the hydrocarbon affords a reducing flame. In fact, the use of liquid fuel when burnt with a blast affords the same advantages as the gas furnace introduced by Mr. Siemens, of which we speak farther on. The unprecedented increase in the production of petroleum not only in Pennsylvania, but in other parts of the world also, and which seems far from having reached its limits, renders the use of liquid fuel a subject, at the present time, of considerable importance. It is largely a question of relative cost, and it is obvious that it must needs be a very low cost indeed which will enable any description of liquid fuel to compete with coal. Crude petroleum at \$2 per barrel of 43 gallons costs per ton of 2240 pounds about \$22, against bituminous coal at \$7 in New York, or fully three times the cost of coal, weight for weight. It is therefore obvious it is only in certain unusual conditions that there can be any possibility of using petroleum in place of coal, as where coal is very dear and petroleum very cheap, or where, as at the oil-works, crude naphtha has little or no value, and is practically a waste product; or, lastly, where the nature of the process is such as in reheating furnaces and other metallurgical processes, that a reducing flame and the absence of sulphur are important considerations.

* It is here assumed that the oil is burnt with only just enough air for combustion, and that the effete gas is discharged at 600° F.

† Burnt, as usual, with twice the air necessary for combustion.

‡ The evaporative duty here assigned to coal is probably higher than that actually obtained on the average in steam vessels, to the extent of about 20 per cent.; seven pounds of water converted into steam per pound of coal consumed being nearer the actual average obtained with coal in steam vessels.

GAS.—The use of a natural flow of marsh-gas from artesian borings as fuel is possible only in certain limited areas, but is by no means an uncommon circumstance. But the introduction of Siemens' gas furnace has demonstrated that the use of fuel in the state of gas offers for many purposes singular advantages both as respects economy, efficiency, and convenience. Natural gas, chiefly marsh-gas (C_2H_4), was early observed in the salines of the Kanawha, and has been successfully used as fuel to heat the kettles of certain salt-works. In the town of Erie, Pa., gas obtained from artesian borings has also been used under steam-boilers to produce steam; and the marsh-gas from an artesian well near Rochester has been conveyed into that city for economical purposes. In the oil-regions of Pennsylvania the use of the gas escaping from the artesian wells is frequent for producing steam. The town of Fredonia in New York was as early as 1830 lighted by a natural flow of marsh-gas. In 1863 a company was formed at Birmingham, England, to provide a supply of heating gas from coal for domestic and manufacturing purposes at the rate of 6*d.* per 1000 cubic feet, but the bill necessary to carry it into effect was thrown out in the committee of the House of Lords, because their lordships thought that if this was as good a plan as it was represented to be, the existing gas companies would be sure to carry it into effect. This was a favorite plan of Mr. C. W. Siemens, the inventor of the regenerative furnace, who proposed to place his gas-producer at the bottom of coal-pits, providing a gas-shaft to conduct the gas to the surface, thus saving the lifting of the coal, while giving to the ascending column of gas an amount of forward pressure sufficient to carry it several miles to the place of consumption. This plan would not only effectually ventilate the coal-mines, without involving any danger, but would also save the loss on the small coals now useless, and amounting to fully one-fifth of the whole product, which now is left unused in the pit. A similar plan has been proposed by Mr. Henry Wurtz in this country for utilizing the coal-dust which in the anthracite regions of Pennsylvania forms mountains of waste carbon. For this purpose Mr. Wurtz proposed to produce hydrocarbon gas from vapor of water acting on the anthracite at a red heat, sending the gas ($H_2 + CO$) to the points of consumption in large conduits, aided by mechanical pressure if needful to propel the gas. An important economy of fuel now completely unutilized might thus be obtained. A similar plan for the distribution of heating gas has lately been taken up in Berlin, Prussia.

The dynamical theory of heat as proposed by Joule and Mayer about 1846, led Mr. Siemens to take up a line of investigation with a view to a realization of some of the economic results which that theory rendered possible, and the fruit of these investigations is seen in "the regenerative gas furnace" now so well known, and which may be truly said to have worked a revolution in the methods of producing, applying, and economizing heat. The burning of a pound of carbon in pure oxygen to carbonic acid, as before stated, evolves 8080 calories or units of heat (= 14,544 English units). As each unit of heat is convertible into 774 units of force or mechanical energy, it follows that one pound of carbon represents really $14{,}544 \times 744 = 10{,}820{,}736$ units of potential energy. The

mechanical power set free in the combustion of one pound of pure carbon is as much, therefore, as would be required to raise nearly 11,000,000 pounds weight one foot high. This would sustain the work called a horse-power for about $5\frac{1}{2}$ hours. This is a result quite unattainable in practice, of course, since, if for no other reason, we can never employ the two elements of combustion in a state of purity, and the oxygen is unavoidably mixed with about four times its own volume of inert nitrogen.

To realize how wide the margin for improvement was in the application of heat for smelting and metallurgical purposes prior to the invention of the regenerative gas furnace, and what this invention has done to economize fuel, it is only necessary to consider a few simple facts. The heat needed to smelt a ton of iron or steel, or to raise the temperature of a like quantity of iron bars to the welding point of malleable iron, is obviously very much more in excess of the amount theoretically required for these purposes than is required in the production of steam, because it is unavoidable that the products of combustion in the ordinary form of heating furnaces should leave the furnace at the temperature of combustion, while only the small excess stored up in the heated iron could be utilized. The remainder escaped unutilized into the chimney, and was lost. Taking the specific heat of iron at .114 and the welding heat at 2900° F., it would require $.114 \times 2900 = 331$ units of heat to heat up one pound of iron. Assuming that a pound of common coal develops 12,000 heat-units, one ton of coal should heat up to the welding point 36 tons of iron. But the ordinary reheating furnace heats only about $1\frac{3}{4}$ tons of iron, and therefore produces only about one part in twenty-one of the maximum theoretical effect. In melting steel in pots, in the ordinary Sheffield furnace for that purpose, $2\frac{1}{2}$ tons of coke are consumed to one ton of steel melted. Assuming the melting-point of steel at 3600° F., and its specific heat at .119, it takes $.119 \times 3600 = 428$ heat-units to melt a pound of steel; while with 12,000 units at the heat-producing point of common coke, one ton of such coke should theoretically melt 28 tons of steel. In other words, the Sheffield pot furnace utilizes in the melting of steel only $\frac{1}{70}$th part of the theoretical heat of combustion. Here there was obviously a wide margin for securing an important portion of this great loss, and the regenerative gas furnace is the means which in the hands of Messrs. C. W. and Frederick Siemens has so far solved the problem, in part at least. (See article FURNACE.)

The regenerator or accumulator of heat Mr. Siemens recognized as due, so far as the philosophical principle is concerned, to the Rev. Dr. Sterling of Dundee in 1817. The same principle was recognized and applied in France by the patent of M. Franchot (1836) in an atmospheric engine which had what he called a "calefactor," a series of pipes through which the escaping warm air passed and imparted its heat in part to a current of cool air arising around them in an opposite direction. Capt. Ericsson's caloric engine (1850) had a regenerator formed of meshes of iron wire—100,000,000 meshes for each engine—which accumulated the heat from the escaping air and imparted it to the returning air again. Mr. Siemens' regenerators accomplish for high temperatures what these earlier contrivances accomplished for low temperatures. But it was Dr. Robert Hare of Philadelphia, inventor of the compound or oxy-hydrogen blowpipe, who in 1802 first announced the principle that in order to obtain the maximum effects of heat "the body to be heated must be sustained in an atmosphere of burning gas," and that charcoal impinged upon by a jet of oxygen did not fulfil this condition. Hence, Hare, after discussing the fundamental defects of Lavoisier's methods, says with great sagacity, "To avoid these evils, it was thought desirable that means might be discovered of clothing the upper surface of any body which might be subjected to this species of operation with some burning matter, of which the heat might be equal to that of the incandescent carbon with which the lower surface might be in contact; or by which bodies might be exposed on solid supports to a temperature equal or superior to that of the porous charcoal uniting with oxygen. It soon occurred that these desiderata might be attained *by means of flame* supported by the hydrogen and oxygen gases; for it was conceived that, according to the admirable theory of the French chemists, more caloric ought to be extricated by this than by any other condition. . . . Such was the reasoning which originated the desire of employing the flame of the hydrogen and oxygen gases. But before this could be accomplished, it was necessary to overcome the difficulty of igniting a mixture of these aëriform substances without the danger of an explosion." (TILLOCH'S *Phil. Magazine*, xiv. 1802.)

In the Siemens furnace the objects to be heated are sustained on a solid support in an atmosphere of burning gas, the oxygen of the atmosphere arriving by one inlet, and the combustible gases by another, and the two uniting in a true Hare's blowpipe flame to do their work. The accessory contrivances, so essential in the economy of fuel, for the alternation of the flow of gas and air through the regenerative cellular flues of fire-brick, are evidences of a high degree of inventive skill applied to the solution of a problem which, in its essential features, was clearly set forth by Robert Hare in 1802.

It is evident from these facts, which could be greatly extended did space permit, that for many purposes gas is the best form in which fuel can be applied for producing the highest temperature with the least loss of heat, and that the gas regenerative furnace of Siemens is the invention which has advanced us in the right direction more than any other improvement yet made in the generation and application of heat.

WOOD.—The value of wood as fuel depends mainly on its density in the dry state. Wood is composed of carbon, hydrogen, and oxygen, with a small proportion of nitrogen, and the mineral matter derived from the soil, constituting, when burned, its ash. Fresh or green wood contains from one-fifth to one-half its weight of water, which diminishes its value as fuel more than its proportion by weight, since a certain amount of heat is absorbed in converting this water into steam. Exposed to dry air, wood gradually loses a portion of its water, but being, by its porous nature, peculiarly liable to absorb moisture, it will take up a portion of water from damp air, so that, however well "seasoned" wood may be, it is never free from hygroscopic moisture, and is always in a condition of unstable equilibrium in this respect. Hence, furniture and the woodwork in houses in a climate subject to such extremes of temperature and moisture as that of the U. S. is ever liable to change its dimensions between summer and winter. Air-dried wood may be deprived by artificial heat of a further portion of its moisture (kiln-drying). Rumford, who heated various kinds of air-dried wood at the temperature of 240° F. until they ceased to lose weight, obtained the following results:

100 parts of		100 parts of	
Oak wood lost	16.64	Fir wood lost	17.83
Elm " "	18.20	Birch " "	19.38
Beech " "	18.56	Lime " "	18.79
Maple " "	18.63	Poplar "	19.55

Rumford determined the amount of water absorbed by dry wood in the different seasons of the year in France, with the following results:

Species of wood.	100 parts in weight of dry wood cut into thin shavings and exposed to the air, contained water—		
	In summer, at a temp. of 62° F.	In autumn, at a temp. of 52° F.	In winter, at a temp. of 45° F.
	Parts.	Parts.	Parts.
Poplar	6.25	11.35	19.55
Lime	7.78	11.74	17.50
Oak	8.97	12.46	16.64
Elm	8.86	11.12	17.20

From a comparison of these results it appears that woods when exposed to the air at a temperature of 45° F. contain twice the quantity of water they do when the temperature of the air is at 60° F. Rumford found that a sound oak beam which had been in a dry place for over 150 years still contained over 10 per cent. of water, and that a cubic inch of such wood contains more than half a cubic inch of air.

An elaborate series of experiments was made by Mr. Marcus Bull in 1823–24 to determine the heat evolved in the combustion of the principal varieties of wood used as fuel in the U. S. He tested over forty sorts of wood, determined the specific gravity of the dry wood; its weight per cord (128 cubic feet) in pounds avoirdupois; the product of charcoal from 100 parts of dry wood by weight; the specific gravity of the dry coal; the weight of coal in one bushel; and the pounds and bushels of charcoal from one cord of dry wood. The fuel was burned in a small stove in a room surrounded with another apartment to cut off radiation, and the comparisons were made by observing by the differential thermometer the times during which 10° of heat were maintained in the room by the combustion of one pound of each fuel. He found that the shellbark hickory (*Carya alba*) gave the maximum result measured in terms of *value;* for while the *times* in which equal *weights* of different woods maintained a uniform difference of 10° of temperature varied only between 6 hours and 6 hours and 40 minutes, the *value* measured in terms of equal volume varied between $10 for the shellbark hickory and $4 for Lombardy poplar (*Populus dilatata*) per cord measure. Bull's results have not found place in the literature of fuels generally, and are referred to usually in the most cursory manner. We therefore append his tabular statement, containing his most important results on the more frequently occurring American woods. For a description of his methods of calorimetry reference may be had to his memoir (*Am. Phil. Trans.* iii. 1–63, 1826).

Common names of woods.	Botanical names.	Specific gravity of dry wood.	Pounds avoir. of dry wood in one cord.	Product of charcoal from 100 parts to weight of dry wood.	Specific gravity of dry coal.	Pounds of dry coal in one bushel.	Pounds of charcoal from one cord of dry wood.	Bushels of charcoal from one cord of dry wood.	Time 10° of heat were maintained in the room by the combustion of one pound of each wood.	Value of one cord of each wood, as compared with shellbark hickory as the standard, at $10 per cord.
									H. M.	
White ash	Fraxinus Americana	.772	3450	25.74	.547	28.78	888	31	6.40	$7.70
Apple tree	Pyrus Malus	.697	3115	25.	.455	23.41	779	33	6.40	7.00
White beech	Fagus ferruginea	.724	3236	19.62	.518	27.26	635	23	6.	6.50
Black birch	Betula lenta	.697	3115	19.40	.428	22.52	604	27	6.	6.30
White birch	Betula alba	.530	2369	19.	.364	19.15	450	24	6.	4.80
Butternut	Juglans cinerea	.567	2534	20.79	.237	12.47	527	42	6.	5.10
Red cedar	Juniperus Virginiana	.565	2525	24.72	.238	12.52	624	50	6.40	5.60
American chestnut	Castanea vesca	.522	2333	25.29	.379	19.94	590	30	6.40	5.20
Wild cherry	Prunus serotina	.597	2668	21.70	.411	21.63	579	27	6.10	5.50
Dogwood	Cornus florida	.815	3643	21.	.550	28.94	765	26	6.10	7.50
White elm	Ulmus Americana	.580	2592	24.85	.357	18.79	644	34	6.40	5.80
Sour gum	Nyssa multiflora	.703	3142	22.16	.400	21.05	696	33	6.20	6.70
Sweet gum	Liquidambar styraciflua	.634	2834	19.69	.413	21.73	558	26	6.	5.70
Shellbark hickory	Carya alba	1.000	4469	26.22	.625	32.89	1172	36	6.40	10.00
Pignut hickory	Carya porcina	.949	4241	25.22	.637	33.52	1070	32	6.40	9.50
Redheart hickory	Carya "	.829	3705	22.90	.509	26.78	848	32	6.30	8.10
Witch hazel	Hamamelis Virginica	.784	3505	21.40	.368	19.36	750	39	6.10	7.20
American hornbeam	Carpinus Americana	.720	3218	19.	.455	23.94	611	25	6.	6.50
Hard maple	Acer saccharinum	.644	2878	21.43	.431	22.68	617	27	6.10	6.00
Soft maple	Acer rubrum	.597	2668	20.64	.370	19.47	551	28	6.	5.40
Large magnolia	Magnolia grandiflora	.605	2704	21.59	.406	21.36	584	27	6.10	5.60
Chestnut white oak	Quercus bicolor	.885	3955	22.76	.481	25.31	900	36	6.30	8.60
White oak	Quercus alba	.855	3821	21.62	.401	21.10	826	39	6.20	8.10
Shellbark white oak	Quercus obtusiloba	.775	3464	21.50	.437	22.99	745	32	6.20	7.40
Barrens scrub oak	Quercus Catesbæi	.747	3339	23.17	.392	20.63	774	38	6.30	7.30
Pin oak	Quercus palustris	.747	3339	22.22	.436	22.94	742	32	6.20	7.10
Scrub black oak	Quercus ilicifolia	.728	3254	23.80	.387	20.36	774	38	6.30	7.10
Red oak	Quercus rubra	.728	3254	22.43	.400	21.05	630	30	6.20	6.90
Black jack oak	Quercus nigra	.694	3102	22.37	.447	23.52	697	29	6.20	6.60
Rock chestnut oak	Quercus Prinus monticola	.678	3030	20.86	.436	22.94	632	28	6.	6.10
Yellow oak	Quercus Prinus acuminata	.653	2919	21.60	.295	15.22	631	41	6.10	6.00
Spanish oak	Quercus falcata	.548	2449	22.95	.362	19.05	562	30	6.20	5.20
Yellow pine	Pinus mitis	.551	2463	23.75	.333	17.52	585	33	6.30	5.40
Jersey pine	Pinus inops	.478	2137	24.88	.385	20.26	532	26	6.40	4.80
Pitch pine	Pinus rigida	.426	1904	26.76	.298	15.68	510	33	6.40	4.30
White pine	Pinus Strobus	.418	1868	24.35	.293	15.42	455	30	6.40	4.20
Yellow poplar	Liriodendron tulipifera	.563	2516	21.81	.383	20.15	549	27	6.10	5.20
Lombardy poplar	Populus dilatata	.397	1774	25.	.245	12.89	444	34	6.40	4.00
Sassafras	Sassafras officinale	.618	2762	22.58	.427	22.47	624	28	6.20	5.90
Wild service	Amelanchier Canadensis	.887	3964	22.62	.594	31.26	897	29	6.20	8.40
Sycamore	Platanus occidentalis	.535	2391	23.60	.374	19.68	564	29	6.30	5.20
Black walnut	Juglans nigra	.681	3044	22.56	.418	22.	687	31	6.20	6.50

The elementary composition of wood of different sorts presents a very close resemblance. Thirteen different woods offer the following mean result: carbon, 49.22; hydrogen, 6.25; oxygen, 44.02; nitrogen, 0.90. The differences are within 1 per cent. for the extremes; oak contains about 2 per cent of nitrogen. The *ash* of wood varies from 8 per cent. in fir to $2\frac{1}{2}$ per cent. in oak. It contains potash, with a little soda as distinguishing constituents (hence, *potashes*), much lime and magnesia, with variable but small proportions of iron, manganese, phosphoric acid, chlorine, copper, etc.

Peat and Turf.—In many northern countries the vegetation of mosses, ferns, sedges, confervæ, rushes, reeds, and numerous small plants accumulates in swamps, morasses, and low places, each winter adding its quota to the mass of decomposing vegetable matter, in its turn the soil of a new vegetation the ensuing spring. Thus, considerable accumulations are formed in process of time, the lower portions of which are black, unctuous, and somewhat dense, and are called *peat*, while the upper layers are spongy, fibrous, and less perfectly decomposed, and are called *turf*. In Holland, North Germany, Ireland, Scotland, and some parts of North America this material is rather extensively used as fuel. Air-dried peat contains from 15 to 20 per cent. of water, and its ash varies from 4 or 5 to 25 per cent., or more, averaging in the denser varieties about 15 per cent. The ash is very poor in potassa and soda, abounds in lime and free sand, while it is remarkable for containing notable quantities of phosphoric acid and sulphuric acid, and sometimes it contains iron pyrites in quantity sufficient to permit its use for the manufacture of green vitriol. (*Karsten.*) No means have yet been devised by which peat can be economically manipulated to compete with coal as fuel at present prices.

Calorific Power and Calorific Intensity are terms employed with a well-defined meaning in treating of the combustion of fuel. *The calorific power of* a body is the total number of heat-units it is capable of imparting, *e. g.*, to water, when it is burned in pure oxygen. The combustion of fuel means only its union with oxygen. But this action never happens in practice without the presence of the inert nitrogen of the air, and of vapor of water and of other products of combustion, all of which require, each, a specific amount of heat to raise them to the average temperature of combustion; and this *specific heat* is obtained at the expense of the heat evolved by carbon and hydrogen of the burning body uniting with oxygen. If the specific heat of water is taken as unity, the results of the best experiments give for the specific heat of oxygen 0.218, nitrogen 0.244, hydrogen 3.405, steam 0.475, carbonous oxide (CO) 0.248, carbonic acid (CO_2) 0.216. The true temperature of combustion will therefore be the quotient found by dividing the total calories (heat-units) generated by the burning of a unit of carbon or of hydrogen in pure oxygen by the sum of the products of the weights of the products of combustion by their respective specific heats. Thus, 1 kilo. of carbon combining with $2\frac{2}{3}$ kilo. of oxygen, forming $3\frac{2}{3}$ kilo. of carbonic acid (CO_2), generates 8080 units of heat. The weight of the CO_2 into its specific heat $= 3\frac{2}{3} \times 0.216 = 0.792$, and the temperature evolved would be $\frac{8080}{0.792} = 10202°$ C., which is its Calorific Power. But considering the nitrogen of the air, which takes no part in the combustion, the statement of weights into specific heat for the products of combustion would be 0.792 for the CO_2 produced $+ 8.88 \times 0.244 = 2.167$ for the nitrogen = total 2.96, and the temperature produced would be $\frac{8080}{2.96} = 2730°$ C.; which quantity is called the Calorific Intensity of carbon, as distinguished from its Calorific Power. So for hydrogen burning in oxygen to form steam, 29,032 heat-units are generated (or if the steam is condensed 34,462 units), the temperature (theoretical) of the combustion will be $\frac{29632}{9 \times 0.475 = 4.275} = 6931$. If, however, the hydrogen burns in air, the common case, the addition of the nitrogen will reduce the temperature to

$$\frac{29632}{(9 \times 0.475) = (4.275) + (26.64 \times 0.244 = 6.5) = 10.775} = 2750,$$

or about the same temperature as is produced by the perfect combustion of carbon in air. These are max-

imum temperatures, and much exceed any results obtained in the arts, as there is a large amount of heat lost by radiation, conduction, fusion of cinders, evaporation of water in fuel, etc. It will be understood that while the calorific power of carbon and hydrogen are respectively 8080° and 29632° C., their calorific intensity (or *pyrogenic power*) is 2730° and 2750° C.

The value of any fuel as a source of heat may be determined *theoretically*, if its chemical composition is known by the methods of calculation just illustrated. But there are so many circumstances, some of them not well understood, affecting the results so obtained that we must look to the results of actual trial in some form of experimental apparatus. The calorimeter of Rumford, modified and perfected by Favre and Silbermann and others, has been chiefly employed in these researches. (See HEAT.) Berthier, assuming the accuracy of Welter's theory, that the heat evolved by combustion is directly proportioned to the amount of oxygen consumed, proposed to estimate the calorific power of fuel by burning it into CO_2 by means of the oxygen contained in litharge, and to ascertain the amount of oxygen abstracted by weighing the button of lead produced. With carbon alone, and in the absence of other reducing agents, this method is capable of producing accurate results. While it fails in absolute accuracy in many cases, yet owing to its simplicity it is much used for near approximations.

The evaporation of water in a well-constructed steam-boiler affords more trustworthy results for determining the value of fuels than any laboratory methods are capable of producing or than can be deduced by computation from the chemical constitution of the fuel. This statement is confirmed by the results of Walter R. Johnson (1844) already quoted, of the British commissioners (1871), and of Scheurer-Kestner and Meunier (1869). Space is wanting to quote these results in any desirable fulness. A single example from the last-named research must suffice, as showing how unsafe it is to calculate the value of a fuel on its elementary composition alone. The example chosen is the comparison offered between the exactly identical chemical composition of the coal of Ronchamp and that of Cruzot, and the calorific value of these two coals as determined by their power to evaporate water. The masses of these two coals would justify the inference that they were of identical value, while there is an experimental difference between them of 500 calories in evaporative power.

	Cruzot.	Ronchamp.
Carbon	88.40	88.42
Hydrogen	4.41	4.41
Oxygen and nitrogen	7.19 = 100	7.17 = 100
Heat of combustion	9117	9628

This identity of chemical composition disappears when the two coals are examined separately for their volatile portion and coke (ash being deducted), thus:

	Cruzot.	Ronchamp.
Fixed carbon	80.01	71.60
Volatile carbon	8.41	16.80
	88.40	88.42

Of all the coals examined by Messrs. Scheurer-Kestner and Meunier, that of Cruzot gave the highest heating power, and yet by the elementary composition there should have been no difference between it and the coal of Ronchamp. These authors say that in our present state of ignorance on the subject of the constitution of coals and their molecular structure, no safe conclusions can be drawn from theoretical considerations, but that in all the fuels of which they have determined the heat of combustion the results obtained have exceeded the theoretical sum of the heats of combustion of the elements. Hence the importance of more extended researches upon the value of our coals by the method of evaporation of water.

The calorific value of the lignites of Western America has been lately discussed by Prof. R. W. Raymond, commissioner of mines. (*Report 1873*, p. 370.) The results obtained from a calculation of the elementary constitution of these fuels places them much higher in the scale of calorific value than was anticipated. That from Cañon City, Col., for example (and there are others nearly as good), has a calorific power of 7439 and calorific intensity of 2683, which differs from that of pure carbon by only 641 and 47 calories respectively. We are as yet almost completely ignorant of the molecular structure and evaporative power of these valuable fuels, which are the only resource for the metallurgy and industry of a vast area destitute of all other resources for artificial heat. *Wollongongite*, which we have alluded to above, is a hydrocarbon mineral resembling succinite (of the nature of amber) from Australia. It occurs in cubical blocks without lamination; breaks in broad conchoidal surfaces, extremely tough and resounding like hard wood under the blows of the hammer. H. = 2 to 2.5. G. = 1.04 – 1.49. Lustre, resinous, somewhat silky. Color, greenish-black and brownish black. Streak, light brown to yellowish. No odor when rasped. Tasteless. Sectile, the thin shavings curling up under the knife. Not electric by friction of the mass, but the chips cut off by the knife are highly electric. Translucent in thin shavings, and under the microscope transmits amber-yellow light. Alone in a test-tube does not melt, decrepitates, and distills a copious flow of oil of a yellow color and heavy odor, giving off much gas. Insoluble in alcohol, ether, or benzole, but is slightly dissolved in carbonic disulphide, to which it imparts a slightly yellowish tinge. It is readily kindled in thin splints by a match, burning with a brilliant flame and much smoke. The analysis in a platinum crucible yields the following results: Volatile matter, 82.5; fixed carbon, 6.5; ash, 11.0 = 100.0. From these characters this substance obviously resembles succinite, and is probably as well entitled to a place in the system as albertite, bathillite, or torbanite.

Formerly, fuel was interesting to mankind chiefly as the means of producing artificial heat in cold climates and for its use in the culinary art, which distinguishes civilized man from the savage. But the wonderful advance in modern times in chemical and metallurgical arts, and, above all, the universal introduction of steam as a motor and a vehicle for the transportation of heat, has given to fuel a value before unknown, leading not only to the development of all its available sources of supply, but to the study of its economical application with a view to obtaining from it the greatest useful effect and benefit possible. The phenomena and laws of combustion, and the methods of calculation of calories, are more fully discussed under HEAT; here we have confined ourselves chiefly to the considerations which concern the economic value of fuel.

For a fuller discussion of this subject consult PERCY'S *Metallurgy*, vol. i., and the French ed. of the same, 1864 (*Traité Complet de Métallurgie*); KNAPP, *Chemical Technology* by RONALDS and RICHARDSON, vol. i., pp. 8–99; PECLET, *Traité de la Chaleur*, 3me ed., 1861, 3 vols.; W. R. JOHNSON, *Experiments on the Evaporative Power and Other Properties of American Coals* (1843), Cong. Doc. 28th Cong. 1st Sess. (Senate, 386); WATTS'S *Dictionary*, Art. "Fuel;" AD. WURTZ, *Dictionnaire de Chimie*, "Houille;" MARCUS BULL, *Experiments to Determine the Comparative Quantities of Heat Evolved in the Combustion of the Principal Varieties of Wood and Coal used in the U. S. for Fuel*, etc., *Trans. Am. Phil. Soc.*, Phila., iii. pp. 1–63, read Apr., 1826; COUNT RUMFORD (Benjamin Thompson): Rumford's most important papers on fuel and its use will be found in vols. ii. and iii. of *The Works of Rumford*, published by the American Academy of Arts and Sciences, Boston, 1870–73; in vol. iii. are his well-known papers *Of the Management of Fire and the Economy of Fuel*, pp. 1–167, and his Essay X., *On the Construction of Kitchen Fireplaces and Kitchen Utensils*, etc.; DE LA BECHE and LYON PLAYFAIR, *First Report on the Coals suited to the Steam Navy* (Jan. 5, 1848), and *Appendix* by PROF. J. WILSON; *Experiments on the Evaporative Power of the Coals*, by PROF. WILSON and MR. W. J. KINGSBURY; *Experiment for Determining the Coefficient and Evaporative Power of Wood*, etc., by J. ARTHUR PHILLIPS; *Chemical Analyses of Coals*, by F. C. WRIGHTSON; *Ultimate Analyses of Coals*, by MR. H. HOW; and lastly, *Calorific Value of Coals*, by J. A. PHILLIPS, all in *Memoirs of the Geol. Survey of Great Britain*, ii. pp. 539–630, 1848; *Report of the Commissioners appointed to Inquire into the several Matters relating to Coal in the United Kingdom*, 1871, *Blue Book C.*, 435, 3 vols. (See minutes of Committee B *On Waste in Combustion* for testimony of Mr. C. W. SIEMENS, WM. MENELAUS, ISAAC LOWTHIAN BELL, Sir WILLIAM ARMSTRONG, Dr. W. FAIRBAIRN, Capt. ANDREW NOBLE, Dr. NEIL ARNOT, E. A. COWPER, HENRY BESSEMER, and others.) For an important memoir *On the Combustion of Coal*, quoted in the text, see M. A. SCHEURER KESTNER ET MEUNIER (*Bull. Soc. industr. de Mulhouse*, 1869), cited in *Comptes Rendus de l'Acad. des Sci.*, t. 66, 67, 68, and 69, 1866–69; KERL'S *Metallurgy*, by CROOKES and RÖHRING, in 3 vols.: vol. iii. *Steel—Fuel—Supplement*, John Wiley & Son, New York, 1870, 8vo. Chapter second of this treatise, covering 264 pages, offers a full and satisfactory discussion conveniently accessible to American readers, with the important advantage of full references to all the more important sources of original information. JOHN ARTHUR PHILLIPS, *Metallurgy* (1874), Art. "Fuel;" ISAAC LOWTHIAN BELL, *Chemical Phenomena of Iron Smelting*, London, 1872; THOMAS BOX, *Practical Treatise on Heat*, London, 1868; CHARLES SCHINZ, *Researches on the Action of the Blast Furnace*, translated by Maw and Müller, London, 1870, etc., etc. (See also in the present work the articles ANTHRACITE, COAL, CHARCOAL, COKE, CANNEL COAL, LIGNITE, PEAT; also the articles GAS-LIGHTING, FURNACE, HEAT, FLAME, METALLURGY; while the fuels suitable for various special uses are noted in the different articles on industrial processes and appliances.)

B. SILLIMAN.

Fuen'te de Can'tos, town of Spain, in the province of Badajoz, has important copper-mines in the vicinity. Pop. 6385.

Fue'ro [Sp. for "forum"—that is, a seat of justice], the Spanish name for the old local codes of certain towns and districts, chiefly in the N. of Spain. The fueros are very ancient, and are regarded with jealous affection by the places that possess them. They are mostly of Basque and Gothic origin.

Fuer'te de Andal'gala, town of the Argentine Confederation, in the province of Catamarca, has obtained some importance from the discovery of rich copper-mines in its vicinity. Pop. about 5000.

Fuerteventu'ra, one of the Canaries, lying S. of Lanzarote, from which it is divided by the Strait of Bacayna. Its area is 758 square miles, with 10,996 inhabitants. Cabras, a town on the E. coast, has a good harbor.

Fug'ger, a celebrated German family, now represented by two lines of princes and several lines of counts and "most illustrious counts."—JOHANN FUGGER, a rich weaver of Augsburg in the fourteenth century (d. 1409), was the founder. His descendants became leading bankers, miners, and merchants, and the family was ennobled in 1504. Several were distinguished soldiers and statesmen, and many were liberal patrons of art. The Fuggers are Roman Catholics.

Fughet'ta [It.], in music, a composition in fugue style, but usually shorter, less elaborate, and with more freedom of movement and structure than the regular fugue.

Fu'git, tp. of Decatur co., Ind. Pop. 1630.

Fu'gitive from Jus'tice, one who, having committed a crime within one jurisdiction, flees into another to escape punishment. Between the different civilized nations numerous treaties have been formed providing for the arrest of such fugitives and their delivery to the authorities of the country in which the crime was committed, upon proper demand. A return of criminals fleeing from one State of the Union into another may, in like manner, be effected under the provisions of the U. S. Constitution and the laws of Congress. (A full discussion of this subject will be found under the title EXTRADITION.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fu'gitive-Slave Law. At the time of the adoption of the U. S. Constitution the necessity of making provision for the protection of a right of property in slaves against inter-State interference, as an indispensable prerequisite to the formation of any stable and harmonious union, was generally recognized. Slavery was firmly established throughout a large section of the country, whose inhabitants considered its maintenance as essential to the welfare of their domestic interests and the development of their resources. But unless some restraint were placed upon the legislation of those States in which slavery did not exist, and of those in which it might, at some future day, be abolished, one part of the country, it was evident, might be made a refuge and an asylum for the slaves from another, and their reclamation prohibited. It had been established as a principle of the law of nations that the institution of slavery, being in derogation of natural rights, must be considered as a mere municipal regulation, whose sustentation could only be made obligatory within the limits of the nation in which it existed. The power which would be possessed by any State whose policy was opposed to slavery of taking advantage of this doctrine, and making proclamation of freedom to all slaves coming within its borders, might, and probably would, be employed to incite slaves to flight or insurrection, and rights of property of great value might thus be destroyed. These anticipations were manifestly reasonable in view of the fact that under the previous Confederation the rendition of slaves had generally been secured only with great difficulty, and on some occasions had been found altogether unattainable. Constant strife and animosity would undoubtedly have been the result of leaving the question of slavery to be determined by the legislation of the States themselves, especially since the growing sentiment of the injustice of any form of human bondage would have been a continually increasing motive for its repression. To prevent these probable evils a provision was inserted in the Constitution, at the instance of representatives of the slaveholding States, in the following terms: "No person held to service or labor in one State, under the laws thereof, escaping into another, shall, in consequence of any law or regulation therein, be discharged from such service or labor, but shall be delivered up on claim of the party to whom such service or labor may be due." No reference was made to the existence of slavery in express terms, inasmuch as it was the determination of the convention in which the Constitution was framed that it should contain no direct recognition or legalization of the system; but the desired purpose was attained as effectually as if the word "slave" had been distinctly employed. The understood intention of this provision was that fugitive *slaves* might be reclaimed, and, in the opinion of Judge Story, it was considered so fundamental an article that without its adoption the Union could not have been formed. In the exercise of the constitutional power thus created, Congress in 1793 passed a law providing measures for the recapture of slaves by their masters. Summary proceedings of a ministerial nature were instituted, by which a recovery might be obtained with all practicable expedition, and heavy penalties were imposed for hindering or obstructing a slave-owner or his agent in seizing fugitives and carrying them back again into servitude. The machinery of the courts was put at the disposal of the slave-proprietors to effect the restoration of their property.

In the interpretation of this act by the courts it was decided that the subject of the surrender of fugitives from service was exclusively within the sphere of congressional legislation, and could not be abridged or interfered with by any action on the part of the States; and the provisions in the act were adjudged to be constitutional both by the tribunals of the general government and of some of the States separately. The practical and necessary effect was that the free States were deprived of all power to remedy or stay within their borders practices which were felt to be most serious evils. The clause in the Constitution, it was determined, manifestly contemplated the existence of a positive unqualified right on the part of the owner of the slave which no State law or regulation could in any way qualify, regulate, control, or restrain. "The right to seize and retake fugitive slaves, and the duty to deliver them up, in whatever State of the Union they may be found, is, under the Constitution, recognized as an absolute positive right and duty, pervading the whole Union with an equal and supreme force, uncontrolled and uncontrollable by State sovereignty or State legislation." (*Prigg* v. *Commonwealth of Pennsylvania*, 16 Peters R. 542.) It was held that the owner of a slave was clothed with the authority to seize and recapture him wherever he might be found, without any resort whatever to judicial process, provided the recapture could be made without any breach of the peace or illegal violence. The slave might be retaken upon Sunday or in the night-time, or from a dwelling in which he was under protection; and if the owner were resisted in his attempt to make the capture, he was authorized to use sufficient force to overcome the unlawful opposition. In the first years after the enactment of this law the enforcement of its provisions was accomplished with but little difficulty, since the condition of public opinion was marked by a general uniformity of belief as to the desirableness of slavery as a social institution, and the protection of a master's claim to a fugitive was considered as the maintenance of a lawful right of property. But the great industrial and social development of the free States, together with the influences of a natural feeling of humanity, could not suffer the previous state of opinion to continue. It is not surprising, therefore, that the act of 1793 became difficult of enforcement, and that numerous and sometimes irresistible obstacles were opposed to those attempting to carry its provisions into effect. Hence resulted great resentment and constant irritation at the South, which the earnest appeals of the few advocates of abolition in the free States, and the determined opposition manifested to the extension of slavery to the Territories, served continually to heighten. To preserve their institution, and hoping to effectually overcome the growing tendency to interfere with the means for its protection which had previously been enjoyed, the slave States demanded a more stringent and efficacious law to secure the rendition of escaped slaves. The hostility to slavery had not as yet attained such general extension and acceptance as to prevent this demand from being granted, and in 1850 a new fugitive slave law was passed. As this new enactment contained substantially the same provisions as the law of 1793, as well as more stringent regulations, an exposition of its contents will give a comprehensive survey of the entire legislation for the reclamation of fugitive slaves from the time when the first law upon the subject was passed down to the abolition of slavery during the war of 1861–65. The judicial functions exercised under the act were vested in certain U. S. officers called commissioners, and in the judges of the circuit and district courts and of the superior courts of Territories. Upon the escape of a fugitive his owner or a duly-authorized agent was empowered to obtain from either of these officials a warrant for his apprehension, or to make the arrest without process, provided that were possible. After the arrest the slave was required to be brought before the commissioner or court, in order that the claim of the alleged owner might be summarily determined.

Upon the exhibition of satisfactory proof of the rightfulness of the owner's title by the introduction of testimony or of depositions taken in the State from which the slave had fled, together with proof by affidavit of the slave's identity, of the fact that he owed service to the claimant, and that he had escaped, it was made the duty of the judicial officer before whom the proceeding was instituted to deliver to the owner a certificate stating the substantial facts which had appeared upon the investigation, and authorizing the immediate removal of the fugitive to the State from which his escape had been made. The testimony of the slave himself was declared inadmissible. The final certificate granted was made conclusive of the right of removal, and all power of appeal was denied. Any attempt to prevent an owner or his agent from arresting his slave, or to rescue the fugitive after being taken into custody, or the rendering of any assistance to a slave in making his escape, or the concealment and protection of him with knowledge that he was a fugitive, were declared highly penal, and the slaveholder was also authorized to bring a civil action for damages. All citizens were commanded to aid the proper officers in the execution of the law and in overcoming resistance wherever their services might be desired.

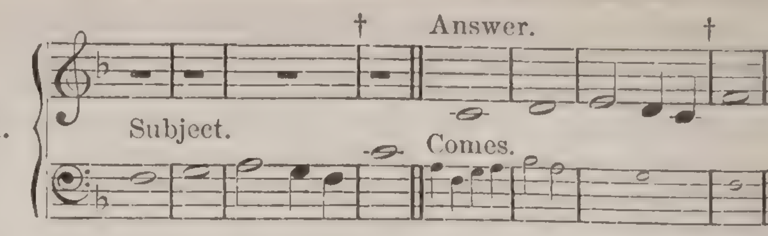
An examination of these various provisions will disclose the immense power with which slaveholders were entrusted. The judicial proceedings were made entirely *ex parte;* efficient safeguards were not provided to prevent the commission of perjury; all right of appeal was prohibited; and citizens who might be inclined to interfere to protect the slave from injustice and violence were deterred by the imposition of heavy penalties. The constitutionality of this law was sustained, and it was adjudged enforceable under like circumstances and in the same manner as had been decided with reference to the previous law of 1793. The evils arising from the severity of the fugitive laws wrought their own remedy, and the excesses committed under them were undoubtedly beneficial in the end. These awoke the North to a clear sense of the enormity of slavery, and were chiefly instrumental in effecting that change of public opinion which culminated in the formation of the Republican party in 1856, and its elevation to supremacy in the national government in 1860. The civil war which followed had slavery as its ultimate cause, and achieved the extinction of slavery as its leading result. The fugitive-slave laws, flourishing as they did in contravention of the civilization of the age, must ever be a painful reminiscence in the nation's past history, but the entire destruction of slavery could never have been accomplished so speedily had not their severity aroused the large masses of the people to indignation and a purpose of resistance.

George Chase. Revised by T. W. Dwight.

Fugue [It., Sp., and Lat. *fuga;* Fr. *fugue;* Ger. *Fuge*], a branch or species of musical composition, in which a certain theme or subject (consisting of a short melodious phrase) is first given out by one of the parts, and then taken up successively by the other parts, elaborately treated in various keys and with various harmonies, with the view of developing its beauty or interest by presenting it in a diversity of aspects and relations. "The designation of *fugue,*" says Albrechtsberger, "doubtless originated from one part apparently *flying* before another, while the pursuing part, or answer, imitates the intervals of the first subject, generally precisely on the fifth above or fourth below, or on the octave above or below." Fugues are written for two, three, four, or more voices or parts, each of which in turn takes up the leading theme, and afterwards continues its course as tributary to the general harmony. Besides the *simple* (*i. e.* a fugue with only one theme or subject) there are also *double* fugues, with two or more subjects. Fugues are also distinguished as *strict* or *free;* fugues in double counterpoint of the octave, tenth, or twelfth, etc.; and others in which the *motion* of the theme is changed into the *reverse* or the *retrograde,* as will be hereafter illustrated. A *choral* fugue is one in the course of which a plain choral song or chant is introduced as a new element, standing out in bold and stately form amid the interworking of the other parts, and giving an air of grandeur and sublimity to the whole composition.

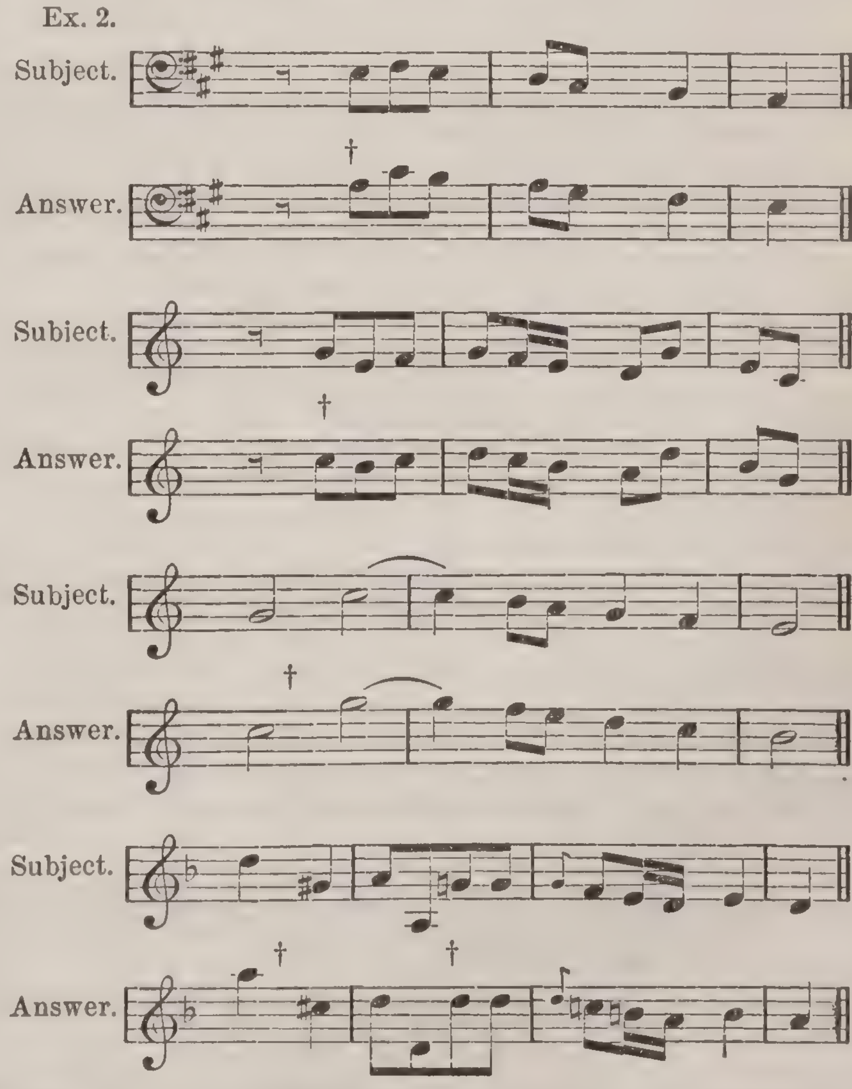
The principal or leading theme of a simple fugue is called the "subject," or "*dux.*" The fugue commences with this, either in the bass or some other part, at the pleasure of the composer. The subject thus given out by the leading part is taken up by one of the other parts and in another key (or grade of the scale), usually by the dominant in answer to the tonic, or by the tonic in answer to the dominant. This is called the "answer." Meanwhile the first part proceeds in notes forming an accompaniment to the answer, and for this reason it is called *comes,* or the companion. See this illustrated in Ex. 1, where the comes is given in small notes:

Ex. 1.



The comes may also be so constructed as to form in itself a second *subject,* to be worked out and interwoven with the harmonic web of the fugue in like manner with the principal subject. In this case the composition becomes a *double* fugue, having two leading themes. It is important that the comes should *not* be written in notes equivalent in time to those of the dux or subject, but with shorter or longer notes, or with a different style of movement, in order that the "subject" may be clearly distinguishable from its accompaniment. A fugue subject also should have such strongly marked features, either in time, rhythm, or melody, as to make it distinctly recognizable whenever it recurs in the progress of the fugue. It is desirable also that it should be capable of *augmentation* and *diminution*—*i. e.* of having its notes extended to double their length or contracted to one-half. If the fugue is to contain a *stretto* (or compression), the first notes of the subject should be so chosen as to render this practicable and easy. But of this, and of augmentation, diminution, etc., further notice will be taken presently. In writing a proper "answer" to the theme or subject, certain rules were prescribed by the old masters and very strictly observed. The leading rules were these: that "when the principal subject commences on the tonic (key-note), and ends on it or on its second or third above, the answer is usually written a fifth above or fourth below (which is the same thing) as soon as the first subject is ended, or even before it is completed. When the subject moves from its principal key to the dominant, the answer which follows must move from the fifth to the tonic, and *vice versâ.* When the subject begins and ends in the dominant, the answer must begin and end on the tonic." To carry out these rules, however, it will be found that the answer cannot always be an *exact* imitation of the subject, but will require a change of one or two of its notes, which will thus differ in progression from the corresponding notes of the subject. Hence, a progression of a *second* in the subject may be changed into a *third* in the answer, a fourth into a fifth, a seventh into an octave, and *vice versâ.* The following instances are from Albrechtsberger and Beethoven, and the mark † indicates the change:

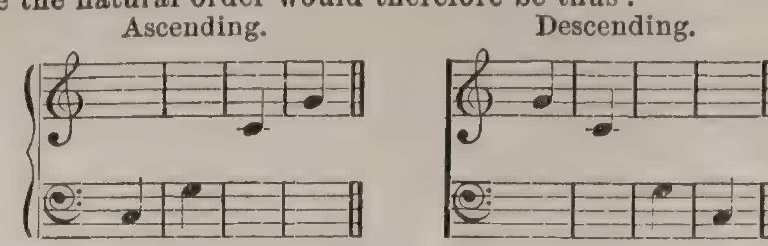
Ex. 2.



(See also Ex. 1 at the mark †.) Though the observance of these rules seems indispensable in certain cases, yet it is evident that when the subject or theme is the expression of some distinct and well-formed musical idea, the arbitrary change of one or more of its intervals must seriously impair its beauty, and produce a kind of antagonism or contradiction between the theme and its response. For this reason modern writers are far less stringent than the ancient masters in enforcing the rules in question, believing that there are other ways of reaching the end proposed, and that the

melody of the theme must not be disturbed except under the stress of great necessity.

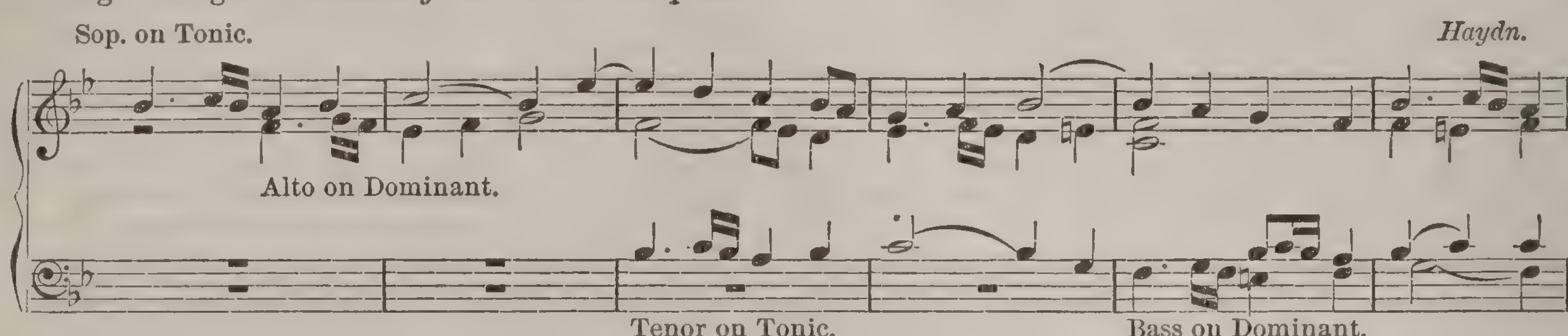
The next point is the "exposition," or first entrance of the several parts of the fugue. This is very much at the composer's pleasure, but there is nevertheless a certain discretion to be exercised in determining the order in which the parts shall enter. Theorists agree in this, that "the most usual and beautiful manner of introducing the parts of a fugue is to let them succeed each other in their natural order, ascending or descending, although other introductions are permitted. These successions should occur alternately on the tonic and dominant." In a four-part fugue the natural order would therefore be thus:

Ex. 3.


An instance of the entrance of parts in this order, *ascending*, is given in the next example:

Ex. 4.

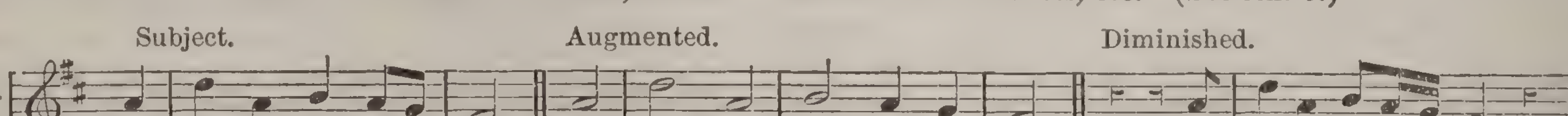

The following is a regular *descending* entrance of the parts:

Ex. 5.


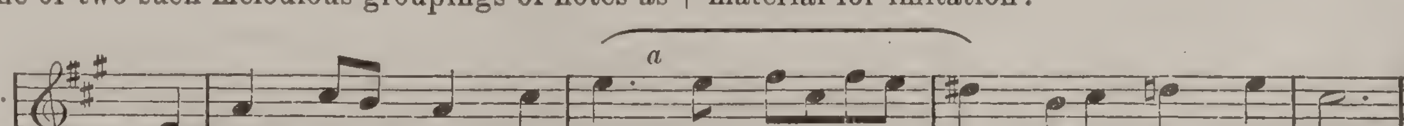
In case this natural order of the parts is not observed, it is desirable that the theme should be answered in the part contiguous to it, or most resembling it, as the tenor by the bass or alto, and the alto by the soprano or tenor, thus avoiding the harsh effect and thinness resulting from too great distance and contrast between the subject and the response. For this reason the order of tenor, bass, soprano, and alto, or alto, soprano, bass, and tenor, is preferable to the mixed succession of bass, soprano, tenor, and alto, or soprano, tenor, bass, and alto, etc. When the subject has been taken up by all the parts, and the four threads of the harmony thus prepared for further progress, the ingenuity and skill of the composer and his power of invention are called into action for the interweaving and drawing out of the web in new forms of beauty, graceful excursions into related keys, both major and minor, the judicious "repercussion" or re-entrance of the leading theme in the various parts, the development of every element of interest in it by new harmonic embellishments, contrasts of light and shade in its treatment, imitations, reversions, sequences, and other artistic devices, till the whole structure grows into one consistent form of beauty, symmetrical in its several parts and complete in the unity of its governing idea.

In the progress of the work, the first transition, or change of key, is usually by modulation into the scale of the dominant. The other related keys—viz. the relative minor, subdominant, supertonic, and mediant in *major* fugues, and the relative major, subdominant, submediant, and subtonic in *minor* ones—are those which come next in order, and are used by the composer when and where his course of thought may require them. In modern fugues modulations into various other keys are often made with fine effect, as from C major to C minor, A♭, B♭, E♭, F minor, A major, and even into D♭ and other remote scales. Great judgment, however, is necessary in the use of all extraneous keys in reference to the time allotted them, lest the original key of the fugue should be forgotten or rendered doubtful, and its relations to the transient keys be so disturbed as to impair the unity and final effect of the whole composition. As a mere continuous repetition of the original theme in various keys and parts would soon become monotonous and wearisome, a skilful fugue-writer always avoids this by the use of digressions and other devices, such as the augmentation or diminution of the theme, double-counterpoints, imitations, both simple and canonical, the temporary abandonment of the theme, and a resuming of it only after hinting at it (as it were), and making several trials to grasp it. The stretto and the organ-point also are important elements of interest, the latter, in particular, being often among the grandest features of a well-wrought fugue.

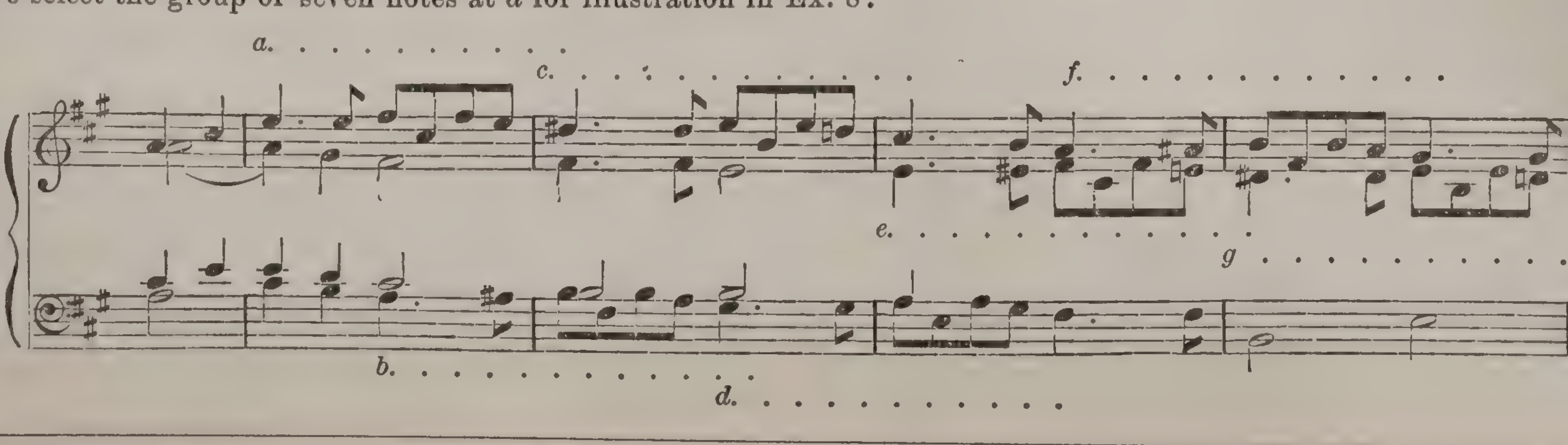
On several of these points it may be expedient to append a brief explanation. The "augmentation" of a theme or subject is (as already said) the extension of its notes to double their original length, as of quavers into crotchets, crotchets into minims, and minims into semibreves. "Diminution," on the contrary, is the contraction of the notes into half their original length, as of semibreves into minims, minims into crotchets, etc. (See Ex. 6.)

Ex. 6.


"Imitation," as occurring in the progress of a fugue, is a repetition of a short fragment of melody on different grades of the scale, and by the same part or various parts in succession. A fugue-subject may be so ingeniously formed as to contain one or two such melodious groupings of notes as may thus be separately treated by way of digression or episode. In imitation great exactness is not always required, a strong general resemblance being sufficient in this species of ornament. In the following theme each bar contains material for imitation:

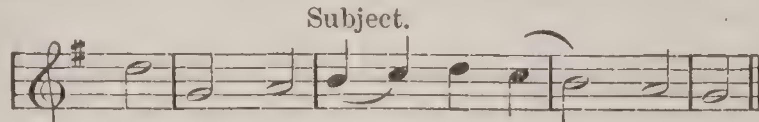
Ex. 7.


But we select the group of seven notes at *a* for illustration in Ex. 8:

Ex. 8.


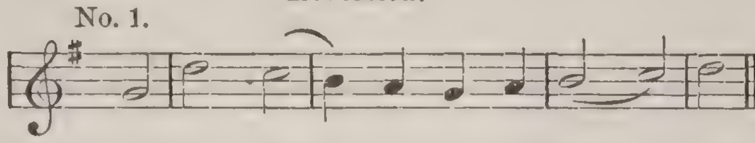
Here the group *a* . . . . . is imitated in the bass at *b*, in the soprano at *c*, in the bass again at *d*, in the alto at *e*, in the soprano at *f*, and in the alto again at *g*, the whole forming an outgrowth and playful reinforcement of a single idea or musical thought. "Reversion" is, as it were, the turning of the subject *upside down*, so that the ascending notes now descend, and the descending notes ascend, as in this example:

Ex. 9. Subject.



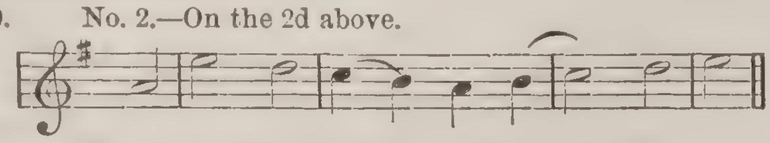
Reversion.

No. 1.

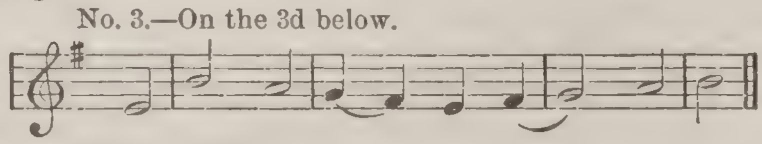


Such reversions may be effected on other intervals or grades of the scale besides that of the original subject, thereby carrying the harmony also into other keys, and producing unexpected variety, thus:

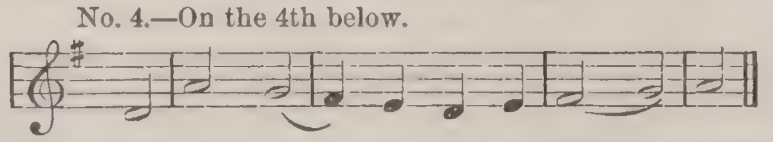
Ex. 10. No. 2.—On the 2d above.



No. 3.—On the 3d below.

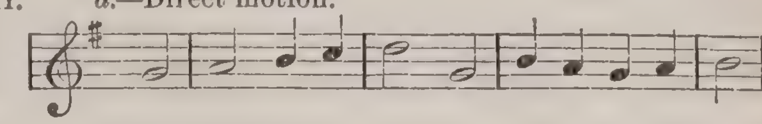


No. 4.—On the 4th below.

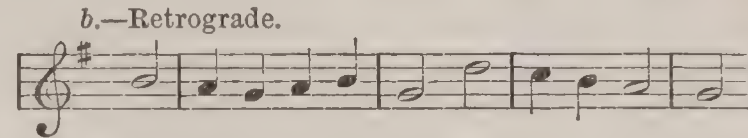


Of these four reversions, however, two only—viz. the 2d and the 3d—are in *exact* correspondence with the original in respect to the succession of *whole* tones and *semitones*. These two are therefore called *strict* reversions. The others—viz. the 1st and 4th—are *free*, or less exact in their resemblance to the pattern. The reader may compare the places of the semitones as indicated by the mark ⌣. "Retrograde" motion is another of the curious methods resorted to by the old fugue-writers to produce variety, and present their themes in every possible form, even including distortion. Retrogression does not consist in any change of the notes themselves, but in reading the subject (or a portion of it) *backward*, as at *b* in the example:

Ex. 11. *a.*—Direct motion.



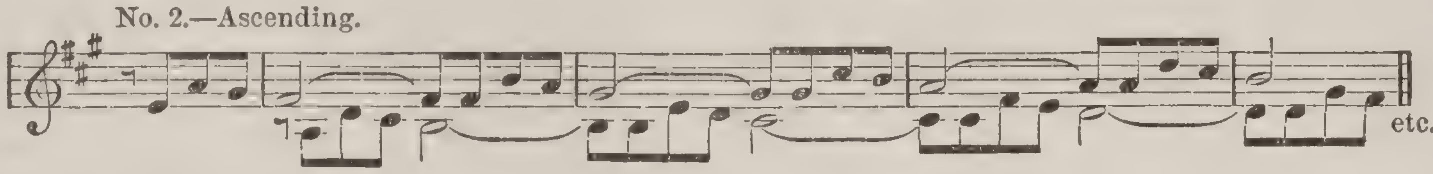
b.—Retrograde.



This may also be used as a continuous phrase or period, the latter strain answering the former, or *vice versâ*. Imitations of this sort may, like the preceding "reversions," be used in various keys, and also on various grades of the scale, without change of key. "Sequences" are of frequent use in fugues, and, aside from their own peculiar and often beautiful effects, are better fitted than any other device to give force to a musical thought by clear and pleasing iteration. A sequence is simply a series or chain of notes formed by the repetition (any number of times) of a musical group or melodious figure, with accompanying harmony, the whole rising or falling by regular steps of the scale. The sequence is usually founded on a succession of thirds and sixths (or of chords of the seventh) in equal motion; and may be either diatonic or chromatic. Illustrations of both are seen in the next example:

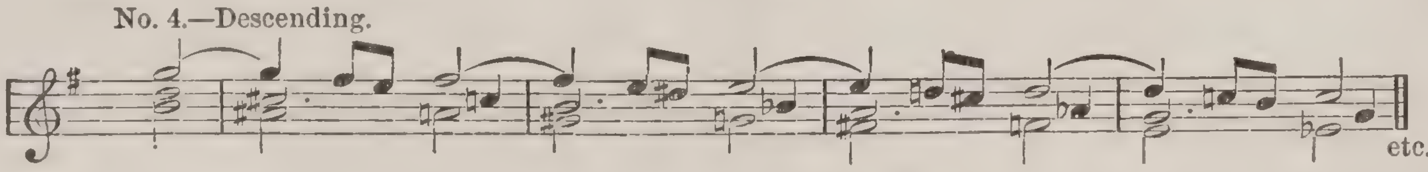
Ex. 12. No. 1.—Descending.

No. 2.—Ascending.



No. 3.—Descending.

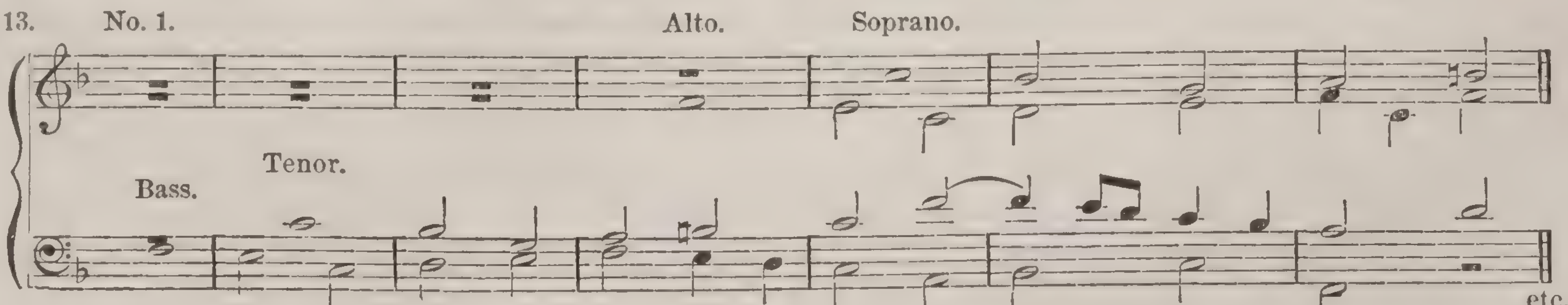
No. 4.—Descending.



Another means of relieving the monotony occasioned by the continual repetition of the theme is the use of *intermediate* or *intervening* subjects—*i. e.* new lines of thought suggested by the principal subject, or calculated to set it off by contrast. Such digressions are often rich in form and ornamentation, and may be so contrived as to convey *hints* of the fugal theme in various keys and relations, thus creating a new interest in it and a longing for its recurrence.

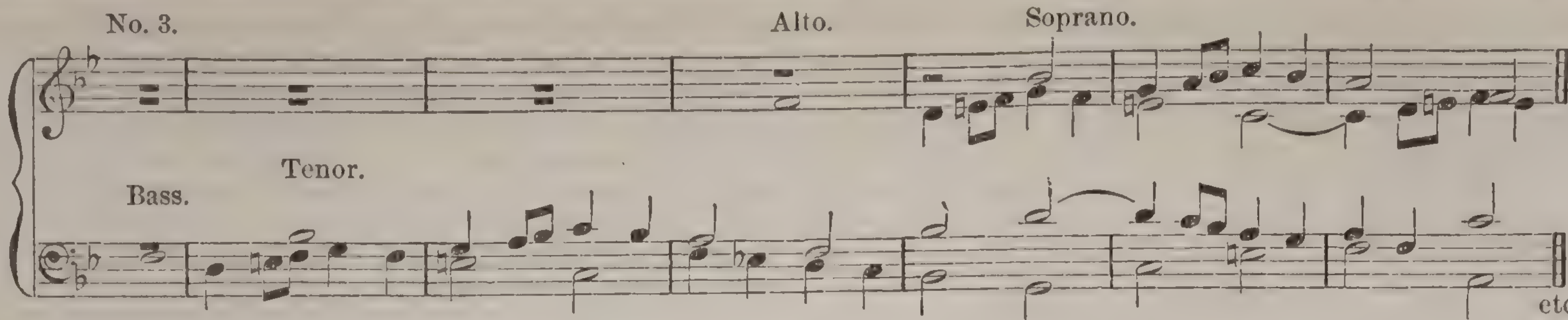
The "stretto" generally occurs near the end of the fugue, though many long fugues have more than one stretto. It is formed by the principal subject commencing as at the beginning, and the other parts taking it up in succession at the shortest practicable distance, as of one or two bars, or even less. The following strettos from Albrechtsberger will furnish sufficient illustration on this point:

Ex. 13. No. 1. Alto. Soprano.



No. 2. Alto. Soprano.

No. 3.

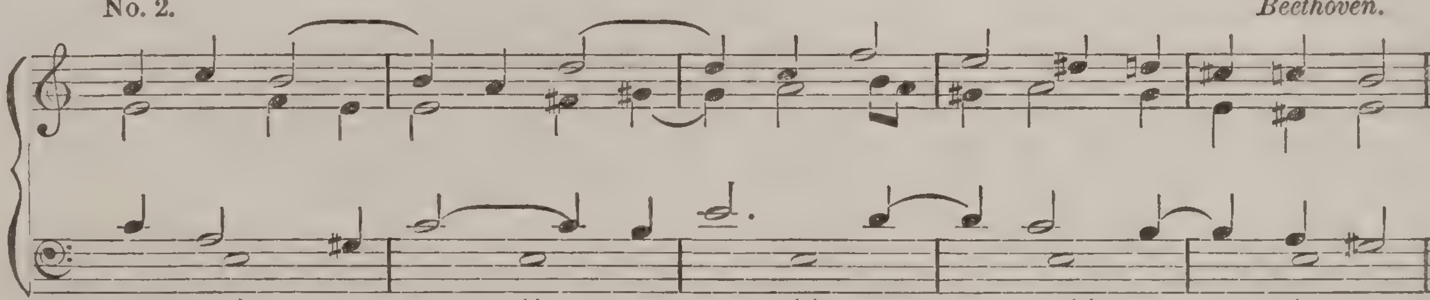


The "organ-point," one of the grandest features of the fugue, is "a series of harmonic combinations (chiefly consisting of suspensions) formed over one long-sustained bass-note." (*Beethoven.*) Being, as it were, the culminating point or climax of a long preceding train of harmony, the principal organ-point has its place near the end of the fugue, with the dominant for its bass. After this generally follows a stretto, and frequently another organ-point, founded on the tonic, to extend and embellish the final cadence. The organ-point furnishes room for an almost unlimited display of rich and varied combinations, the unity of which is nevertheless always perceptible, through the restraining effect of the governing bass-note. Specimens of organ-points, both diatonic and chromatic, are given in the example following:

Ex. 14. No. 1. *Wanhal.*

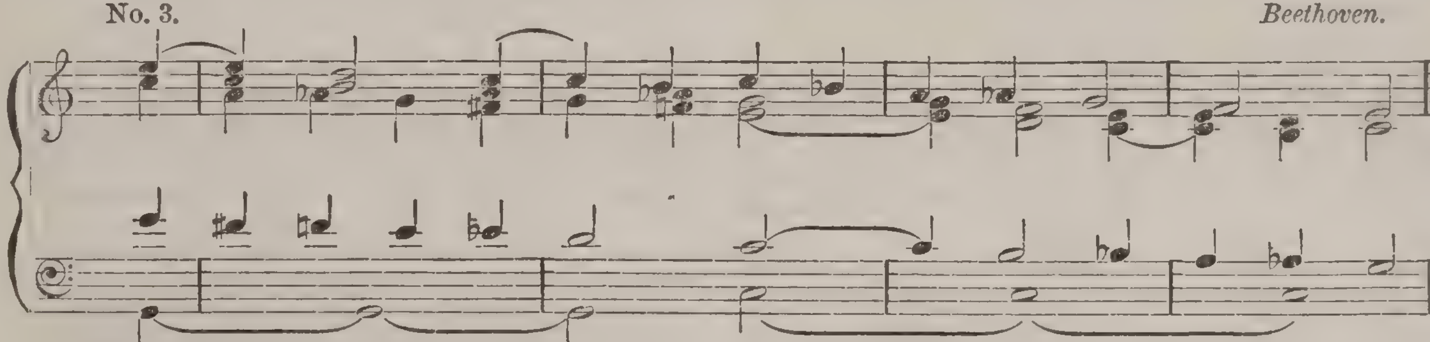
Ped.

No. 2. *Beethoven.*



Ped.

No. 3. *Beethoven.*



Ped.

A full and accurate knowledge of the peculiarities of this species of composition is best acquired by the study and careful analysis of the masterly fugues of Marpurg, Bach, Handel, Albrechtsberger, Cherubini, and other profound writers of this school. WILLIAM STAUNTON.

Ful'co, or **Foulques** (anglicised *Fulk*) **of Neuilly,** one of the greatest pulpit-orators of the Middle Ages, and the chief preacher of the fifth crusade, flourished in the second half of the twelfth century. In the first years of his priestly office he led a life of miserable slackness, if not of gross vice, but in seeking to supplement his imperfect ministerial education by attending the lectures of Peter the Chanter, a theologian distinguished for his piety, Fulco's heart was touched, and he tried to atone for his past life by the severest asceticism. In a coarse cowl and girt with leather he journeyed as a preacher of repentance, and fearlessly condemned the vices of learned and unlearned, high and low. His words wrought such compunction that people scourged themselves, threw themselves on the ground, confessed their sins, and declared themselves ready to reform their lives and redress the wrongs they had done. "Many," says Jacob of Vitry, "inflamed with the fire of love and incited by his example, began to teach and to preach, and to lead not a few to repentance." Such a man was eminently qualified to advance the interest of the crusade movement which was just then being preached by Pope Innocent III. Peter the Chanter had been looked to as the great preacher of the fifth crusade, but his sudden death at the very inauguration of the movement led Innocent to select Fulco, and he was asked not only to preach repentance, but to request men to give proof of penitence by hastening to the land of promise. Fulco promptly complied with the papal commission, and of all "orators who blew the sacred trumpet" he was the most successful. He did not, however, live to see the results of the crusade. He died of fever at Neuilly while the crusaders were still at Venice, in 1201. (See VILLEHARDOUIN, *Histoire de la Conquête de Constantinople* (trans. by T. Smith, London, 1829, 8vo); MILMAN, *Hist. Latin Christianity*, bk. ix. ch. vii.; COX, *The Crusades* (New York, 1874).) JAS. H. WORMAN.

Ful'da, town of Germany, in the electorate of Hesse-Cassel, on the Fulda. Its cathedral, built in the style of St. Peter's church in Rome, is a beautiful and interesting building. Pop. 9339.

Ful'ford (Rt. Rev. FRANCIS), D. D., b. at Sidmouth, England, in 1803; was educated at Exeter College, Oxford, where in 1825 he received a fellowship. He afterwards held prominent positions in the Church of England, and in 1850 became lord bishop of Montreal and metropolitan of Canada. D. at Montreal Sept. 9, 1868. He was an eloquent preacher, and published *Sermons, Progress of the Reformation*, etc.

Fulgen'tius (FABIUS CLAUDIUS GORDIANUS), SAINT, bishop of Ruspe in Numidia, "the Augustine of the sixth century," b. at Telepte in Africa 468 A. D., was intended for civil life, but became disgusted with the world and retired to a monastery at Byzacena, and later lived at Sicea. About 500 he visited Rome. On his return to Africa he founded a monastery, and became greatly distinguished for learning and devotion. In 504 he was made bishop of Ruspe, and now became one of the ablest apologists of Catholic Christianity. The Arian Vandals predominating, he got frequently into difficulty, and was twice banished to Sardinia. In 523 a favorable change in the government brought about a recall of Fulgentius and all other expelled bishops, and thenceforward he enjoyed the possession of his see till A. D. 533, when he died. He was renowned for piety, learning, and every virtue. He is commemorated in the Church of Rome on Jan. 1. His writings are mostly against Arianism and Pelagianism. His most important work is *De veritate prædestinationis et gratia Dei*, directed against the Pelagianism of Frustus of Rhegium. Fulgentius explained "the system of Augus-

tine with consistency, but carefully avoided the harsh points of the Predestinarian view." (NEANDER, *Ch. Hist.* ii. 650; cf. HAGENBACH, *Hist. Doctr.*, § 114.) Yet even Fulgentius held in this very work that all unbaptized children, even such as die in the womb, are consigned to damnation. WIGGERS, *Darstellung des Semipelagianismus* (Hamburg, 1833), ii. 356. Editions of his writings: Bâle, 1556, 1566, 1587; Antwerp, 1574; Cologne, 1618; Lyons, 1633, 1652. 1671; best, that of Paris, 1684, 4to; Venice, 1742, fol., and in MIGNE, *Patrologia Latina*, t. lxv. JAMES H. WORMAN.

Fulgentius (FABIUS PLANCIADES), a Latin grammarian of whose life nothing certain is known. He is supposed, from his writings, to have been born or to have lived in Africa about the beginning of the sixth century A. D. Under his name three works have come down to us, which, though written in a slovenly and diffuse style and full of inaccuracies, still have a value in preserving certain details elsewhere omitted. The first of these works is entitled *Mythologicon* or *Mythologiarum libri III.*, of considerable service in the study of ancient mythology, but full of strange explanations. The second is *Expositio Sermonum Antiquorum*, or, more correctly, *De abstrusis Sermonibus*, a brief list of rare or obsolete expressions, with explanations, most of which have no value. The third is *De Expositione Virgilianæ Continentiæ* (contents, subject-matter), or *De allegoria librorum Virgilii*, an allegorical explanation of Virgil's *Æneid*, as representing human life. Fulgentius appears further, from some expressions, to have been a Christian, and is sometimes confounded with Fulgentius, bishop of Ruspe, whose theological writings are extant. (See account of him in preceding article.) Another work has come down to us in part which is ascribed by Teuffel (in his *Hist. Rom. Lit.*) to this Fulgentius, though the name of the author is given as FABIUS CLAUDIUS GORDIANUS FULGENTIUS, and he is generally considered to be distinct from the grammarian and the bishop. The title of the work was *Liber voluminum xxiii. de ætatibus mundi et hominis*, in as many books as the letters of the alphabet, with the trivial intent, apparently, of enabling him to omit in each book one letter. Of the 23, only 14 have been preserved; edited by J. Hommey, Paris, 1696. The works of the grammarian Fulgentius are best edited in the *Auctores Mythographi Latini*, by Van Staveren, Leyden, 1742. (See *Fulgentius de abstrusis Sermonibus*, by Dr. L. LERSCH, Bonn, 1844; LINK, *Der Mytholog. Fulgentius*, Würzburg, 1867; JUNGMANN, in *Ritschl's Act. Soc. Philol. Lips.*, vol. i., Leipsic, 1870.) H. DRISLER.

Ful'gurites [Lat. *fulgur*, "lightning"], tubes of vitrified sand found in sandbanks and sandy soils. They are produced by the intense heat of electrical discharges, which fuses the sand together. (See SILICA.)

Ful'ham, a western suburban parish of London, in Middlesex, on the Thames opposite Putney, and in the Kensington district. It contains an old palace of the bishops of London. Pop. 23,378.

Ful'kerson, post-tp. of Scott co., Va. Pop. 1576.

Full, in music, complete, entire, usually implying loudness. "Full," in church music, denotes those movements or pieces which are to be sung by all the voices in chorus, as contradistinguished from solos, duets, trios, or verse passages. Full *organ* is the loud or great organ, with all or nearly all of its stops in use. Full *swell* is the same in reference to the "swell" of an organ. Full *harmony* is that in which all the parts are complete, without omission of intervals; this requires four parts at the least. Full score is a copy of a composition with all its parts entire.

WILLIAM STAUNTON.

Ful'ler (ANDREW), b. at Wicken, Cambridgeshire, England, Feb. 6, 1754; became the Baptist pastor of Soham in 1775, and in 1782 removed to Kettering; bore a prominent part in the propagation of Calvinistic doctrines of a less extreme type than generally prevailed at that time in his denomination, and was one of the leaders in the revival of the foreign mission-work among the English Protestants. Author of *The Gospel Worthy of all Acceptation*, 1784; *Dialogues and Letters*, 1806; *Calvinistic and Socinian Systems Compared*, 1793; *The Gospel its own Witness*, 1800; and of many other treatises. His complete *Works* (8 vols., 1824) have been often reprinted. D. at Kettering, North Hants, May 7, 1815. Fuller's writings are all characterized by intense devotion to "evangelical" Christianity, by vigorous common sense, and by a subtle insight into men and things. He has been styled "the Franklin of theology." An edition of his works in 3 vols. 8vo is published by the American Bible and Publication Society.

Fuller (ARTHUR BUCKMINSTER), b. at Cambridgeport, Mass., Aug. 10, 1822, was a brother of the celebrated Margaret Fuller (Marchioness d'Ossoli); graduated at Harvard University 1843; studied theology at Cambridge Divinity School, and removed to Illinois as teacher and preacher; was pastor of a Unitarian church in Manchester, N. H., 1848–53; in Boston, 1853–59, and then settled at Watertown as a pastor. At an early period of the civil war he volunteered his services, and was appointed chaplain of the 16th Mass. Vols. He exerted a truly wonderful influence among the men, by whom he was greatly loved, not only for his kindness and care, but for his patriotism and fearlessness. At Fredericksburg he accompanied a few companies of his regiment across the Rappahannock under a deadly fire, when he was killed by a sharpshooter Dec. 11, 1862. He was the editor of his sister's works, and was the author of several published discourses.

Fuller (JOHN W.), b. at Cambridge, England, July, 1827, came in 1833 to the U. S. with his father, a Baptist preacher; was a bookseller in Utica, N. Y., and Cleveland, O.; became colonel of the 27th Ohio Volunteers 1861; served (1861–65) with distinction in the Western armies; became a brigadier-general of volunteers 1864, and a division commander in the 17th corps; brevet major-general of volunteers 1865.

Fuller (MARGARET). See OSSOLI.

Fuller (RICHARD), D. D., b. at Beaufort, S. C., Apr. 28, 1804; graduated at Harvard in 1824; became a lawyer when twenty years old, and at once attained great reputation and success. After recovery from a severe illness he united with the Protestant Episcopal Church, but in 1833 entered the Baptist ministry at Beaufort. Since 1847 he has been pastor of the Seventh Baptist church, Baltimore, Md., and is regarded as one of the ablest and most eloquent preachers of his denomination. Author of *Letters on the Roman Chancery* (1840, addressed to Bishop England); *Correspondence on Domestic Slavery* (1845, addressed to Dr. Wayland); a treatise on *Baptism and Communion* (1849), volumes of sermons, etc.; and was one of the editors of the *Psalmist*, a hymn-book.

Fuller (RICHARD FREDERIC), brother of A. B. Fuller, b. at Cambridge, Mass., May 15, 1821; graduated at Harvard 1844; became a lawyer of Wayland, Mass., where he d. May 30, 1869. Author of *Visions in Verse*, and a *Life* of A. B. Fuller, 1864.

Fuller (THOMAS), D. D., b. at Aldwinkle, North Hants, England, June, 1608; graduated at Queen's College, Cambridge, with the highest honors; became a master in 1628, fellow of Sidney-Sussex and prebendary of Sarum 1631; was a member of the convocation 1640; was made chaplain to Charles II. in 1660. Through the civil war he was chaplain in the king's army. Author of *David's Hainous Sinne* (a poem, 1631); *History of the Holy War* (1639); *Good Thoughts in Bad Times* (1645; 2d "century" of the same, 1646); *Good Thoughts in Worse Times* (1646); *Mixed Contemplations in Better Times* (1660); *Pisgah-sight of Palestine* (1650); *Holy and Profane State* (1642); *Church History of Britain* (1655), and *Worthies of England* (1662); and a few less important works. His writings are remarkable for quaintness of style, for wit, sagacity, learning, and moral elevation; and the *Good Thoughts, Worthies, Church History*, and *Holy and Profane State* are English classics. D. Aug. 15, 1661.

Fuller (TIMOTHY), b. at Chilmark, Mass., July 11, 1778; graduated at Harvard in 1801; studied law with Levi Lincoln, and entered upon successful practice in Boston; was a prominent Democratic orator; State senator 1813–16; was in Congress 1817–25; Speaker of the House in Massachusetts 1825, and one of the governor's council in 1828; was the father of Margaret, Arthur B., and R. F. Fuller, and published several orations, speeches, etc. D. at Groton, Mass., Oct. 1, 1835.

Ful'ler's Earth, a greenish-white oolitic clay, chiefly found in Bedfordshire, Kent, and Surrey in England, and at many points on the Continent. From one-fourth to one-fifth of the mass is alumina, the rest chiefly silica and water, with some lime and other ingredients. It was formerly much used by cloth-dressers for cleansing the oil from woollen fabrics. Though in part superseded by soap, it is still used to a considerable extent by European manufacturers because it is much cheaper than soap, and if of good quality is scarcely less effective. Cimolian earth and various argillaceous substances share this detergent property.

Ful'lersville, a village of Fowler tp., St. Lawrence co., N. Y., was once the seat of iron-works, etc. Pop. 149.

Ful'lerton (WILLIAM), A. M., an eminent lawyer and jurist, was b. at Wawayanda (then a part of Minisink), Orange co., N. Y., May 1, 1818; graduated at Union College, Schenectady, N. Y., in 1838; became a successful lawyer, and was for some time partner of Hon. Charles O'Conor; was appointed one of the judges of the supreme court of New York in 1867, and elected without opposition to fill a vacancy, and held the office until 1868, when he

returned to legal practice in New York City, where he now holds a prominent place in his profession.

Ful'ling, an operation by which fabrics made of carded wool are shrunk, thickened, and partially felted. The woven goods are scoured and boiled (to remove knots and lumps), then soaped very thoroughly, and finally either beaten in the fulling-stocks or passed through great rollers. This operation is much like the previous scouring, except that fuller's earth, hog's dung, and urine are used in the scouring, while soap and hot steam are used in the fulling proper. The fulling process lasts from 48 to 65 hours. When complete, the threads of the cloth are scarcely perceptible, the tendency to unravel is overcome, and the cloth shrinks often nearly one-fourth in length, and sometimes about one-half in breadth. The shrinkage is much less when dyed wool has been used.

Full Power. In diplomacy this name is given to a document emanating from a regular government, and certifying that a diplomatic agent is authorized to conclude a treaty or other diplomatic arrangement with another government. It sometimes forms a part of a letter of credence, but usually is a separate paper. The letter of credence is the introduction of the diplomat to the government to which he is sent. The "full power," which is to be exhibited, but not handed over, shows what he is empowered to do. An important question has long been agitated, whether, if the agent makes a treaty or convention in accordance with his full power, he binds his principal conclusively. (For a discussion of this point we refer to WHEATON'S *Elements*, part iii., §§ 256–263, and to what is said in the article INTERNATIONAL LAW, PART I., under treaties of peace.) T. D. WOOLSEY.

Ful'mar, a name given to several sea-birds of the genus *Fulmarus*, web-footed birds that feed upon fish, dead whales, cirripeds, mollusks, etc. The best known is the *Fulmarus glacialis*, fulmar or fulmar petrel of the North Atlantic. This bird is much sought for by the fowlers upon the cliffs of St. Kilda, who gather its eggs (which are highly prized), its feathers and down, and the fish-oil in its stomach, which is commercially valuable. Another species is the *Fulmarus giganteus* of the Pacific, a bird as large as a goose. The genus has been made, by the late George R. Gray, to include thirty-six species, under eleven sections, some of which other authors recognize as distinct genera.

Ful'minates. The fulminates are salts of fulminic acid. Fulminic acid is not known in the free state. Its probable formula is $C_2N_2H_2O_2$. It forms salts with a great number of bases, but only a few of them are of importance.

Fulminating Mercury, Mercuric Fulminate, Fulminate de Mercure, Knallquacksilber.—Fulminating mercury has the composition indicated by the empirical formula $Hg''C_2N_2O_2$. It is best prepared by the action of a strongly acid solution of mercury nitrate upon alcohol. Dissolve 1 part of mercury in 12 parts of nitric acid (sp. gr. 1.3); pour this solution into 11 parts of alcohol of 85 to 88 per cent.; place the vessel containing the mixture over a water-bath until the solution becomes turbid, darkens in color, and begins to show signs of ebullition, giving off dense white fumes; remove it from the bath, and the action will continue with vigorous effervescence and abundant evolution of heavy white ethereal fumes. The solution should not fill more than one-third of the vessel, in order to avoid boiling over. The reaction should be allowed to continue until heavy white fumes are no longer given off, and the solution becomes clear or nearly clear. Fill up with cold water, and on standing a short time the fulminate will settle to the bottom of the vessel. Wash by decantation or upon a filter. If during the reaction red fumes are given off, cold alcohol must be added in small quantities. The operation should be conducted at a distance from a flame or fire, as the fumes evolved are very inflammable. Thus produced, fulminating mercury is a brownish-white crystalline powder. It can be recrystallized from boiling water in white silky needles. Theoretically, there should be obtained from 1 part of mercury 1.42 parts of fulminate, but in practice no more than 1.18 to 1.24 can be produced. Some of the mercury remains in the solution, and some escapes with the vapors. The vapors given off are very complex, containing, besides mercury, a large quantity of nitrous ether (sweet spirits of nitre), nitrogen and oxides of nitrogen, carbonic acid, acetic acid, formic acid, acetic ether, formic ether, aldehyde, etc. Fulminating mercury is only very slightly soluble in cold water, but more soluble in boiling water. It is dissolved by ammonia.

Fulminating mercury is highly explosive, and its explosion is easily brought about. Its explosive action is so sudden that it may be said to detonate. It explodes when heated to 186° C. or if exposed to a strong blow. If between iron and iron, a moderate blow suffices, but if on wood, or between wood and copper, the explosion is accomplished with difficulty. It is fired by contact with strong nitric or sulphuric acid (if perfectly dry), and by a spark from flint and steel or by the electric spark. It is also very sensitive to friction. If wet with water it will not explode, and may be handled with safety. Its explosive force is somewhat greater than that of gunpowder, but its explosion is so much more rapid that its explosive effect is very different; for, while it is more violent than gunpowder, its sphere of action is of very limited extent. Fulminating mercury is therefore of no practical value as an explosive agent in blasting or gunnery, but the readiness with which it may be fired makes it of great importance as a means of causing the explosion of other substances. In addition, experiment has shown that fulminating mercury is especially fitted for this use. All the principal explosive agents in use are more sensitive to it than to any other substance, and under its influence many of them exercise a much greater effect than when fired in any other way. Fulminating mercury is thus used in percussion-caps, primers, friction-primers, fuzes, exploders, etc. In percussion-caps, primers, and friction-primers it is rarely used pure, but is mixed with saltpetre, mealed powder, or other bodies.

Percussion Powder (*U. S. A. Ordnance Manual*).—Drain 2 pounds fulminate on blotting-paper till it retains 20 per cent. of moisture. Add 60 per cent. of its weight of refined, pulverized nitre; thoroughly mix and dry. In the fuzes or exploders largely used for firing nitro-glycerine and its preparations (dynamite, giant powder, lithofracteur, dualin, etc.) and gun-cotton, fulminating mercury, or something nearly equal to it, must be employed in order to obtain the proper effect. It is much the best and safest way to use the fulminate itself. The preparations often used in place of it are more dangerous and less effective. For this purpose the fulminate is used pure, and in quantities of about 15 grains to each exploder.

Fulminating Silver, Argentic Fulminate, Fulminate d'Argent, Knallsilber.—Fulminating silver is prepared like fulminating mercury, silver nitrate being used instead of mercury nitrate. It has the composition indicated by the empirical formula $Ag_2C_2N_2O_2$. The greatest care must be used in its preparation, as it is much more easily exploded than fulminating mercury. Very large vessels must be taken, and in stirring wooden sticks must be used, not glass rods. Fulminating silver can be exploded when wet, although not so easily as when dry. When perfectly dry it explodes on the slightest provocation. It should be kept in paper boxes loosely covered. Its explosion is very violent, but very local.

Fulminates of the other metals may be prepared from fulminating mercury by the appropriate reactions, but no use is made of them. Fulminating copper has sometimes been used in sensitive fuze compositions. (See also EXPLOSIVES, by GEN. H. L. ABBOT, U. S. Army.) W. N. HILL.

Ful'ton, county of Arkansas, bordering on Missouri. Area, 658 square miles. The soil is very fertile, though broken into a series of ridges. Corn, wheat, tobacco, fruit, and live-stock are produced. The county abounds in valuable metallic ores, which have, however, not received extensive exploitation as yet. Cap. Salem. P. 4843 (in 1870, since which time the area has been considerably reduced).

Fulton, county in the N. W. of Georgia. Area, 200 square miles. It has the Chattahoochee River on its N. W. side. The surface is uneven, the soil good. Grain is the chief crop. The county has important manufactures, and is traversed by numerous railroads, centring at Atlanta, the county-seat and capital of the State. Pop. 33,446.

Fulton, county in the W. of Illinois. Area, 870 square miles. The Illinois River flows along its S. E. border, and Spoon River intersects the county, which is very fertile and well timbered. Cattle, grain, and wool are staple products. Harnesses, lumber, carriages, and flour are manufactured. There is considerable prairie-land, some water-power, and abundance of coal. The Lewiston branch of the Chicago Burlington and Quincy and the Toledo Peoria and Warsaw R. Rs. traverse the county. Cap. Lewistown. Pop. 38,291.

Fulton, county in the N. of Indiana. Area, 366 square miles. It is traversed by the Tippecanoe and its branches. Its surface is level and well timbered. Cattle, grain, wool, hay, and lumber are abundantly produced. There is much iron ore and good water-power. The county is intersected by the Chicago Cincinnati and Louisville R. R. Cap. Rochester. Pop. 12,726.

Fulton, the south-westernmost county of Kentucky. Area, 200 square miles. The surface is somewhat broken, the soil fertile. Corn and tobacco are the chief crops. The Mississippi River and the Nashville and North-western R. R. furnish abundant means of transportation. Cap. Hickman. Pop. 6161.

Fulton, county of E. Central New York. Area, 544 square miles. It is hilly and rolling, and mountainous in the N. part. Branches of the Mohawk afford abundant water-power. The southern part has much fertile land, but is chiefly adapted to pasturage. Cattle, wool, potatoes, dairy products, and hay are the agricultural staples. The manufactures include gloves, mittens, leather, dressed skins, and lumber. Building-stone is abundant. Cap. Johnstown. Pop. 27,064.

Fulton, county of Ohio, bordering upon Michigan. Area, 337 square miles. It is a level and fertile region, producing grain, cattle, wool, hay, butter, and cheese. Lumber is sawed extensively. The county is traversed by the Michigan Southern Air-Line and other railroads. Cap. Wauseon. Pop. 17,789.

Fulton, county of Pennsylvania, bordering upon Maryland. Area, 380 square miles. It is mountainous and densely timbered, with fertile soil in the valleys, producing grain and wool. Cap. McConnellsburg. Pop. 9360.

Fulton, post-v. of Hempstead co., Ark., on the Red River and on the Cairo and Fulton R. R., 125 miles S. W. of Little Rock.

Fulton, tp. of Polk co., Ark. Pop. 196.

Fulton, post-v. and tp. of Whitesides co., Ill., at the river terminus of the air-line branch of the Chicago and North-western R. R., and at its junction with the Western Union R. R. The Mendota branch of the Chicago Burlington and Quincy R. R. also terminates here, as will the projected Clinton Lafayette and La Salle R. R. It has direct communication with the Northern and Southern markets both by river and rail, and E. and W. by its railroads. It is also the southern terminus of the Diamond Joe line of steamers, which during the season bring down millions of bushels of grain from Wisconsin, Minnesota, and North-western Ill. and on their return trip take up large quantities of merchandise, agricultural implements, etc. The Diamond Joe line have a large boatyard here. Fulton has 1 newspaper, an excellent graded school, a large elevator, 2 pipe-factories, a stoneware factory, 2 saw-mills, 2 carriage-factories, a bed-spring factory, and its lumber interests are very large. The Northern Illinois College is situated here. Pop. of v. 1875; of tp. 2162.
George Terwilliger, Ed. "Fulton Journal."

Fulton, tp. of Fountain co., Ind. Pop. 916.

Fulton, tp. and post-v. of Muscatine co., Ia., on the Chicago Rock Island and Pacific R. R., 16 miles W. of Davenport. Pop. of v. 108; of tp. 1276.

Fulton, tp. of Webster co., Ia. Pop. 106.

Fulton, city of Fulton co., Ky., at the crossing of the Memphis and Paducah and the New Orleans Chicago and St. Louis R. Rs. It has 3 churches, 2 seminaries, 3 benevolent societies, a weekly newspaper, 26 business-houses, and manufactures of wagons, tobacco, flour, lumber, etc. Cotton-ginning and wool-carding are also carried on. Incorporated 1873. J. N. Bolen, Prop. "Gazette."

Fulton, tp. of Gratiot co., Mich. Pop. 1170.

Fulton, post-v., county-seat of Itawamba co., Miss., on the Tombigbee River, at the head of high-water steamboat navigation. Pop. 132.

Fulton, city and tp., cap. of Callaway co., Mo., 15 miles from the Missouri River, on the Chicago and Alton R. R., midway between Jefferson City and Mexico. It is the seat of Westminster College, the deaf and dumb and the insane asylums of the State; also 2 State institutions, male and female, under the control of the Presbyterian Church. It has 2 savings banks and 2 weekly newspapers. Principal business, farming and stock-raising. Pop. 1585; of tp. 4565. J. B. Williams, Ed. "Telegraph."

Fulton, post-v. of Oswego co., N. Y., on the Oswego River, 25 miles N. of Syracuse and 12 miles from Oswego, on the Oswego Canal, Midland R. R. and the Delaware Lackawanna and Western R. R. It has 2 national and 1 savings bank, 2 newspapers, 2 hotels, a good water-power, several flouring-mills, and other manufactories. There are also 7 churches, a first-class seminary, and 5 common school buildings. Pop. 3507. Bennet Bros., Props. "The Fulton Patriot and Gazette."

Fulton, tp. of Schoharie co., N. Y. Pop. 2700.

Fulton, post-tp. of Davie co., N. C. Pop. 2320.

Fulton, tp. of Fulton co., O. Pop. 1328.

Fulton, tp. of Lancaster co., Pa. Pop. 1888.

Fulton, post-tp. of Clarendon co., S. C. Pop. 1087.

Fulton, a v. of Washington tp., Ohio co., W.Va. P. 333.

Fulton, post-tp. of Rock co., Wis. Pop. 2168.

Fulton (Justin D.), D. D., b. Mar. 1, 1838, at Sherburn, Madison co., N. Y.; graduated at the University of Rochester 1851, and at Rochester Theological Seminary 1853; ordained to the Baptist ministry at St. Louis (where he edited the *Gospel Banner*) in 1854; settled in Sandusky, O., 1856; Albany, N. Y., 1859; Boston, Mass., 1863; and Brooklyn, N. Y., 1873. Author of *Roman Catholic Element in American History, Rome in America, Woman as God Made her, Radicalism, The Sabbath, Life of Timothy Gilbert*, etc. An energetic and able defender of "evangelical" religion, Baptist principles, temperance, and the rights of man; an equally fearless and outspoken opponent of what are known as "woman's rights." J. H. Gilmore.

Fulton (Robert), b. at Little Britain, Lancaster co., Pa., in 1765, of Scotch-Irish stock; went to Philadelphia when seventeen years old, and practised the art of miniature-painting there and in New York with such pecuniary success that he was soon able to purchase a farm for his mother's support, whereupon he went to London and became a pupil of West; and throughout life he retained his early fondness for art, in which he from time to time made attempts, the fruits of which, in some instances, still exist, and show that Fulton had very considerable power and capacity as an artist. In England he met with the duke of Bridgewater, the father of the English canal system; with Lord Stanhope, an enthusiastic mechanician; and with Watt, the inventor of the steam-engine; and by their direct or indirect influence his attention was turned strongly to mechanical invention, his true field of labor. His machines for marble-sawing, rope-making, flax-spinning, and removing earth from excavations soon after appeared. His *Treatise on the Improvement of Canal Navigation* (1796), and a series of essays on canals, were followed by a British patent for canal improvements, consisting chiefly in the substitution of inclined planes for locks. He resided in Paris 1797–1806, and there brought forward a submarine torpedo-boat for maritime defence, which was successively rejected by the French, the British (1805), and the U. S. governments (1810). In 1803 he undertook the construction of a steamboat on the Seine, having in 1793 addressed a letter upon the subject to Lord Stanhope, himself an experimenter in steam navigation. Fulton (in 1803), in company with Henry Bell, the first successful British steam navigator, visited the Clyde, where Symington's Charlotte Douglas, a steam canal towboat, was then plying. But Fulton's Seine experiment was but partly successful. Aided, however, by Chancellor Livingston, then U. S. minister in France, he purchased (1806) a powerful Boulton and Watt engine and shipped it to New York, where, after careful study of the defects and merits of previous attempts in the same direction, he built and launched (in 1807) the Clermont, his first successful steamboat, which, however, attained a speed of only five miles an hour when going up the North River. His first U. S. patents (1809 and 1811) covered only some points regarding the attachment of the paddle-wheels to the axle of the crank, and throughout life Fulton was involved in lawsuits with parties infringing upon his claims. He constructed many steamboats, ferry-boats, etc., among the most remarkable of which was the U. S. steamer Fulton the First (built 1814), the first war-steamer ever constructed. From mistakes in her model she never attained much speed, and in 1829 was blown up by accident. Fulton d. at New York Feb. 21, 1815. Fulton's great merit was his persistency in the belief that steam navigation was a *desideratum* of American commerce. Millar's successful double boat of 1788 was a plaything; Symington's towboat of 1803 was not adapted to its special purpose of canal service; John Fitch's machinery had fatal errors of construction; and of the many other previous experiments with steam as a motive-power for vessels, all the rest were clear failures. Fulton and Fitch alone, up to that time, labored in this field of experiment with a fixed and serious purpose. C. W. Greene.

Fulton (William S.), b. in Cecil co., Md., June 2, 1795; graduated at Baltimore College in 1813; served as a volunteer in the war of 1812; became the secretary of Gen. Jackson in Tennessee; studied law; was the first Territorial secretary of Arkansas; governor of Arkansas 1835–36; U. S. Senator 1836–44. D. at Rosewood, Ark., Aug. 15, 1844.

Ful'tonville, post-v. of Montgomery co., N. Y., on the S. side of the Mohawk River, 40 miles W. of Albany on the Erie Canal. It has a steam-elevator, a steam-foundry and machine-shop, 4 steam-mills, 2 churches, flourishing schools, 2 hotels, several stores, a weekly newspaper, and is connected with Fonda, the county-seat, and the Central R. R. dépôt by an iron bridge costing $50,000. Pop. 1117.
T. R. Horton, Ed. "Montgomery Co. Republican."

Ful'via, a Roman lady, daughter of M. Fulvius Bambalio, was the wife of P. Clodius, by whom she had a daughter, Clodia, afterwards wife of Augustus. After the murder of Clodius, she married C. Scribonius Curio, and her

third husband was Mark Antony, whom she loved sincerely, and for whose sake she abandoned the dissolute habits of her earlier life, entering heartily into his ambitious plans, and behaving with great cruelty to his enemies. When her husband was dallying with Cleopatra she created an insurrection for the purpose of recalling him, but was driven from Italy. At Athens she met her husband, who treated her with great harshness, whereupon she retired to Sicyon, and soon after d. of chagrin (B. C. 40), and Antony married Octavia, sister of the future emperor Augustus. Fulvia left two sons by Antony.

Fumiga'tion [Lat. *fumigatio*, from *fumus*, "smoke"], (1) the application of fumes, gas, or vapor to purify clothing, goods, or apartments supposed to be imbued with some infectious or contagious morbific matter. This may be effected by hot air, strong oxidizers, ozone, chlorine, permanganates, vapors of nitric, chlorhydric, sulphurous, or carbolic acids, which destroy the effluvia by decomposing them chemically, and substituting harmless compounds, or by extinguishing cell-life in the cryptogamic and infusorial organisms, which, in some instances at least, constitute the infection. The process of deodorizing by burning fragrant pastilles, coffee, etc., or by vaporizing vinegar or other powerfully odorant substances, simply disguises or overpowers, but does not neutralize, the objectionable effluvia. (2) The act of applying smoke or vapors medicinally. Thus, stramonium, benzoin, the sulphide or oxide of mercury, etc. are used as fumigations in affections of the throat and lungs, and are introduced either by diffusing the vapors through the air to be respired or by means of cigarettes and pipes in which the medicines are "smoked." The introduction of nitrous oxide gas, ether, chloroform, etc., as for anæsthetic purposes, is appropriately termed *inhalation*. SAMUEL ST. JOHN.

Fu'mitory, the *Fumaria officinalis*, a weed of Europe, now naturalized in the U. S., belonging to the order Fumariaceæ. Its name is from the Lat. *fumus*, "smoke," referring to the odor. It is a rather handsome herb, with a strong, disagreeable taste. Its sap abounds in saline matter and a principle called fumarin. Fumaric acid is also reported to be found. This herb is in parts of Europe valued as a tonic, diaphoretic, and aperient, and is esteemed for the treatment of skin diseases. The climbing fumitory of the U. S., called also mountain fringe, is a delicate biennial, the *Adlumia cirrosa* (order Fumariaceæ), which is very fine in cultivation when trained in a shady place upon latticework.

Funchal' [Port., "place of fennel"], the capital of the island of Madeira, situated on its southern coast. It is a handsome place, with a good harbor, and the centre of the wine-trade of the island, and is a bishop's see. Lat. 32° 37′ N., lon. 16° 54.5′ W. Pop. 18,161.

Funck, or **Func'cius** (JOHN NICHOLAS), a distinguished Latin scholar, b. at Marburg Mar. 29, 1693; appointed in 1730 professor of eloquence and librarian in the academy at Rinteln, at which place he d. Dec. 17, 1777. His chief contribution to classical learning is a history of the Latin language, which he divides into periods corresponding to the different periods of man's life, to each of which a separate treatise is devoted. The titles and dates of publication are—1, *De Origine Latinæ linguæ tractatus* (Giessen, 1720; 2d ed. Marburg, 1735); 2, *De Pueritia Latinæ linguæ* (Marburg, 1720); 3, *De Adolescentia ling. Latinæ* (ib., 1723); 4, *De Virili Ætate ling. Latinæ*, in 2 parts (ib., 1727–30); 5, *De imminenti linguæ Latinæ Senectute* (ib., 1736); 6, *De Vegeta ling. Lat. Senectute* (ib., 1744); 7, *De inerti et decrepita ling. Lat. Senectute* (Lemgo, 1750). Besides these, Funccius published the fragments of the *Laws of the XII. Tables* (Rinteln, 1744), a volume of academic dissertations, and several minor works.

H. DRISLER.

Func'tion [from the Lat. *fungor, functus*, to "perform"]. One quantity is said to be a function of another when it is so connected with it that no change can be made in the latter without producing a corresponding change in the former. (See CALCULUS.) Thus in the equation $y^2 + x^2 = R^2$, y is a function of x, and x is a function of y. When two varying quantities are connected by an equation, either may be taken as the function, and the other is then called the independent variable. The fact that two varying quantities are so related that one can be regarded as a function of the other may be expressed by the following notation: $y = f(x)$, $x = f'(y)$, $f(x,y) = 0$. The first of these expressions indicates that y is some function of x; the second, that x is some function of y; and the third indicates a functional relation between x and y, without specifying which is the function, or which the independent variable. A quantity is a function of two or more variables when it is so connected with them that no change can be made in either of the latter without producing a corresponding change in the former. Thus, in the equation $x^2 + y^2 + z^2 = R^2$, y is a function of x and z; z is a function of x and y; and x is a function of y and z. The fact that a quantity is a function of two or more variables may be expressed by functional equations like the following: $y = f(x,z)$, $z = f(x,y)$, $f(x,y,z)$. The first shows that y is a function of x and z; the second, that z is a function of x and y; and the third shows that x, y, and z are so related that any one may be regarded as a function of the other two.

Geometrical Representation of Functions.—Every function of one variable may be represented by the ordinate of a curve whose abscissa is the corresponding value of the independent variable. For, let $y = f(x)$, and suppose x to have in succession every value from $-\infty$ to $+\infty$; for each value of x there will be one or more values of y, either real or imaginary; each real value of y and the corresponding value of x will be the co-ordinates of a point, and these points, taken together, will constitute a curve whose equation is $y = f(x)$. This curve is called the curve of the function. In like manner, every function of two variables may be regarded as the ordinate of a surface whose abscissas are the corresponding values of their variables. If $z = f(x,y)$, we may assign values at pleasure to x and y, and these, together with the corresponding value of z, will be the co-ordinates of a point of the surface represented by the given equation. If we suppose y to remain constant whilst x assumes every value from $-\infty$ to $+\infty$, the given equation will represent a section of the surface by a plane parallel to the plane xz, and at a distance from it equal to the assumed value of y; if we suppose x to remain constant whilst y varies, the given equation will represent a section of the surface parallel to the plane yz, and at a distance from it equal to the assumed value of x.

Classification of Functions.—Functions are divided into two classes—*algebraic* and *transcendental*. Algebraic functions are those in which the relation between the function and the independent variable may be expressed by means of the ordinary operations of algebra; that is, *addition, subtraction, multiplication, division, raising to powers denoted by constant exponents*, and *extraction of roots indicated by constant indices*. Thus, in the expressions $y^2 = 2px^3 + \sqrt{x}$, $y = x^2 - 3\sqrt[5]{x}$, y is an algebraic function of x. Transcendental functions are those in which the relation between the function and the independent variable cannot be expressed by the ordinary operations of algebra. Thus, in the expressions $y = \log x$, $y = \sin x$, y is a transcendental function of x. Transcendental functions may be *logarithmic, exponential*, or *trigonometric*. Logarithmic functions are those in which the relation between the function and variable are expressed by means of logarithms, as $y = \log x$; exponential functions are those in which the variable enters an exponent, as $y = e^x$; trigonometric functions are those in which the relation between the function and variable is expressed by means of some trigonometrical element, as $y = \sin x$. Trigonometrical functions are also called circular functions.

Functions are either *explicit* or *implicit;* explicit functions are those in which the value of the function is directly expressed in terms of the variable, as $y = mx + nx^2$; implicit functions are those in which the function is not directly expressed in terms of the variable, as $ay^2 + bx^2 + c = 0$; in this case the value of y can be found by solving the equation which contains it. Implicit functions are sometimes expressed by two or more equations, as $y = f(z)$ and $z = f'(x)$; in this case y is an implicit function of x. Functions are *increasing, decreasing*, or *periodic;* an increasing function is one that increases as the variable increases, as $y = \sqrt{2px}$; a decreasing function is one that decreases as the variable increases, as $y = \frac{a}{x}$; a periodic function is one that increases and decreases alternately as the variable increases, as $y = \sin x$. If the independent variable increases uniformly, equal values of the function recur at equal intervals; thus, in a cycloid of an infinite number of branches, equal ordinates of the ascending or of the descending portion recur at intervals that are separated by the length of the generating circumference. All the trigonometric functions are periodic. The differential of a function is the result obtained by subtracting any state of that function from its consecutive state; hence, the differential of an increasing function is *positive*, and the differential of a decreasing function is *negative*. Functions may be *continuous* or *discontinuous;* a continuous function is one in which the difference between any two consecutive states is less than any assignable quantity, as $y = \sin x$; a discontinuous function is one in which the difference of two consecutive states may be greater than any assignable quantity, as $y = \tan x$. If we suppose x to increase uni-

formly from 0 to ∞ in the equation $y = \sin x$, the value of y will increase continuously till $x = \frac{\pi}{2}$; it will then decrease continuously till $x = \frac{3}{2}\pi$; it will then increase continuously till $x = \frac{5}{2}\pi$, and so on, giving a continuous periodic function; if we suppose x to increase uniformly in the equation $y = \tan x$, the value of y will always increase, but when the value of x passes through the values $\frac{\pi}{2}$, $\frac{3\pi}{2}$, $\frac{5\pi}{2}$, etc., the value of y will change from $+\infty$ to $-\infty$, giving a discontinuous periodic function. The law of continuity is the basis of many of the principles employed in the general theory of numerical equations. The principle of discontinuity accounts for many singular solutions in the higher mathematics.

Interrupted functions are those that are interrupted in value as the variable increases; that is, they are functions in which certain values of the function have no consecutive states. Thus, in the equation $y = ax^2 + \sqrt{x \sin^2 x}$, the values of y are real for all positive values of x, and imaginary for all negative values of x, except those that reduce $\sin x$ to 0, that is, for those values of x that are equal to some multiple of π. The function y is therefore interrupted between $x = -\infty$ and $x = 0$, and it is continuous between $x = 0$ and $x + \infty$. The curve of this function consists of two parts; the part on the left of the origin is made up of a series of disconnected points lying on a parabola whose equation is $y = ax^2$, and whose abscissas are equal to $n\pi$, n being successively equal to $-1, -2, -3$, etc.; the part on the right of the origin is made up of a series of links, such that all chords parallel to the axis of y are bisected by the parabola whose equation is $y = ax^2$. These links touch each other at points on the diametral parabola whose abscissas are equal to $n\pi$, n being successively equal to 1, 2, 3, etc. Functions are *direct* or *inverse*. If two variables are so connected that they vary together, we may regard the *first* as a direct function of the *second;* in which case the *second* is an inverse function of the *first*. Thus, if we regard the *sine* as a direct function of the *arc*, we must regard the *arc* as an inverse function of the *sine*. These relations are expressed by the symbols $y = \sin x$ and $x = \sin^{-1} y$. The latter expression is read *x is the arc whose sine is y*. The following table exhibits the forms to which all elementary functions of one variable may be reduced. They are arranged in pairs, each pair being correlative, so that if one is regarded as direct, the other is its inverse form:

1st pair	$y = x + a$	Sum.
	$x = y - a$	Difference.
2d pair	$y = ax$	Product.
	$x = \frac{y}{a}$	Quotient.
3d pair	$y = x^m$	Algebraic power.
	$x = \sqrt[m]{y}$	Algebraic root.
4th pair	$y = a^x$	Exponential.
	$x = \log y$	Logarithmic.
5th pair	$y = \sin x$	Direct circular.
	$x = \sin y$	Inverse circular.

Certain definite integrals, from constant use, are coming to be considered as elementary functions. W. G. PECK.

Func'tus Offic'io [Lat., "having discharged a duty"], a term applied in law to some person whose legal functions in a special instance have been exercised and thereby terminated, or to some instrument which has been put to its appropriate use and has thus spent its force. When an agent has fulfilled all the duties laid upon him, he is *functus officio*. So is a bill of exchange upon which payment has been made, or a warrant which has been used in the arrest of a prisoner. GEORGE CHASE. REV. BY T. W. DWIGHT.

Fundamen'tals [Lat. *fundamentum*, the "foundation"], or **Fundamental Articles of Faith,** those doctrines which are involved in the right of a system to exist—its foundation. It is a relative term, and when a doctrine is asserted to be fundamental a necessary question always is, To *what?* It is also expressive of degrees of necessity, and allows of the questions, In what respect? How far? It is therefore never a defining word till it has been defined. There may be a perfect agreement on the general sense of the word, and a total diversity as to the propriety of its application. Fundamentals are more or less generic as that to which they are related has more or less of the generic in it. If a doctrine be conceded to be fundamental to Christianity, it must be held by every one entitled to the name of Christian. But each body has doctrines fundamental to its system which are not held by the entire Christian Church. Fundamentals have been divided into—(1) primary, the explicit knowledge of which is necessary to salvation, and as (*a*) constituent, (*b*) conservative, either as antecedent or consequent; and (2) secondary, implied in the first. Involuntary ignorance of the secondary does not remove the foundation of salvation, but denial of them does. The doctrine of fundamental articles has been most agitated in the earliest and latest efforts to unite the Lutherans and the Reformed. C. P. KRAUTH.

Fundamental Bass, in music, the lowest term of a chord when that chord is in its original or natural form—the root or tonic as contradistinguished from the bass of *inverted* chords.

Fundamental Chord. 1, a chord in its original or normal form, not inverted; 2, a chord not accidental, anomalous, derived, etc., but essential and indispensable; as, *e. g.*, the major and minor triads and the chord of the seventh.

Funds, The Funding System, Sinking Fund. National debts are composed generally of successive loans which have been negotiated at different periods. These may not carry a uniform rate of interest or have the same date of maturity, but the debt as a whole, including all its divisions, is characterized as *the public funds*. The funding of a debt consists in dividing it into parts or shares, which are represented by certificates, and on which interest is paid to the holder. These certificates are known as stock or bonds, indifferently. No way has ever yet been invented by which certain branches of civil service can be carried on without the levying of a tax and the necessary appendage of a public treasury. The trite proverb, "What is everybody's business is nobody's business," contains the precept of municipal administration in contrast with individual direction. There are many branches of social economy which by their nature are beyond the scope and power of private management, as the laying out of high-roads, the supply of wholesome water in cities, lamps, police, and the support of the tribunals of justice. Advancing to matters of national concern, such as the common defence and those improvements of transportation which are the correlatives of natural resources and the common basis of material development, it is manifest that a public treasury and public legislation and administration are the inevitable steps of social improvement, and hence the constitution of public credit, whereof the funding of debt is a necessary consequence. Although national debts have generally originated in the emergencies of war, this fact has no logical connection with their administration, which for the greater part is in the interests of peace. There are no extremes of social necessity which do not carry with them or develop mitigations of a compensating kind. Thus, with all the impressions of the late civil war in the U. S. fresh in the national mind, and many of its calamities yet unrepaired, the burden of the debt is held to be light in contrast with the benefits of a renewed civil constitution, which ensures a higher national life in the future, and a foundation of material prosperity which was impossible under the old laws. The most opposite opinions have prevailed among statesmen and economists concerning the nature of a public debt, of which the principle of funding is the vital element. Some of the old British writers have maintained that "debt and wealth are synonymous"—that "increase of debt is a true increase of riches." Others hold the opposite theory, that "poverty, misery, and the national debt are synonymous terms." The fact that a government bond, representing a certain portion of the national debt, and bearing interest, is convertible into money, or capable of being used like money as a medium of exchange, is the source of the error that it is *de facto* the equivalent of money, and of the plausible deduction that national debt is money. This delusion disappears when we reflect that the property of the country is annually reaped over, and a great harvest of its productions appropriated to the payment of yearly interest on the bond, and finally to the redemption of the principal. It is to be observed, however, that there is no logical connection between the origin of a national debt and the uses to which the bonds based on it are applied. That the documents representing a debt may be used as money, and may be made subservient to the public good by the improvements which are effected by such use, is a simple proposition, and demonstrably true. A nation may advantageously incur debt for the maintenance of its harbors, and thence may follow direct commercial benefits far outreaching the cost. The whole question of funding is therefore a question of discretion on the part of the legislature. Many eminent writers—and among them, Adam Smith—fall into the error of repudiating the whole system of funding, because of the abuses which have been associated with it, and especially the facility of increasing a national debt and oppressing the people by taxes. But, notwithstanding all such abuses, the balance of benefit is on the side of funding, which is no more than to say that national

credit, wisely administered, is a source of wealth and prosperity to a country. There are no examples in history of successful and advanced national development without it. Before the introduction of the funding system into England the financial history of the British government was a history of continuous fraud and dishonesty. Richard I. pawned the revenues of the kingdom to pay the expense of the crusades to the Holy Land; Henry III. pawned the crown jewels and regal ornaments and robes of state to raise money; Richard II. was deposed for extorting £1,100,000 from his subjects on false pretences; the two Edwards, I. and III., and the two Henrys, IV. and VIII., defrauded their creditors of immense sums. In the reign of Elizabeth the people demanded repayment of the money borrowed by her predecessors, and obtained it. At Cromwell's death the debt of the kingdom was £2,474,290, of which the creditors were defrauded by Charles II. on the Restoration, excepting £664,226, on which interest was allowed. This was the beginning of the present debt. William III. introduced the system of funding, which originated with the republics of Venice and Genoa, and it has remained essentially unaltered to the present day. In its usual administration, in the U. S. as well as in England, it is open to question whether it is entirely just towards the creditor. If it be clearly understood beforehand that a government has the right to take advantage of a peculiar state of the market, and to replace any part of its debt at a lower rate of interest, although such a proceeding might partake somewhat of the nature of repudiation, yet, as the creditor is forewarned, no moral default could be charged on the government; but a strict regard for equity would seem to demand that the creditor should have a corresponding right when the market changes back to its former condition. To reduce his income is to deprive the creditor of a part of his capital. The transactions of the British exchequer following the peace of 1815 furnish a striking example of the possibilities of financial administration in emergency. In consequence of the rise of public securities the interest on exchequer bills was reduced (1817) from 5¼ to 3¼ per cent.; and while only the sum of £3,000,000 was added to the debt, more than £23,000,000 were cancelled. Another operation was to convert 3 per cent. stock into 3½ per cents., whereby the holders of the former were induced to buy into the latter at an advanced price. The result was an increase of £3,000,000 in the debt, while more than £19,000,000 were cancelled (1818). Another measure was the reduction of 5 into 4 per cents. The bank, co-operating with the exchequer, increased its circulation of bills, and lowered the rate of interest from 5 to 4 per cent. By this stroke the sum of £140,250,828 of 5 per cents. was converted into £147,263,328 of 4 per cents., at a yearly saving of £1,222,000 interest and scarcely any increase of the debt. In 1824, 4 per cents. to the amount of £76,806,852 were changed into 3½ per cents., with no change of the capital. Such transactions as these do not heighten our esteem for the rules of administration of national debts. They betray shortsightedness in the managers. The true principles of fiscal policy are such as give permanency and unfaltering confidence in the government, which is the best preparation for emergencies in the future, and of vastly greater consequence in the end than any transient gains by tricks which are more befitting gamblers on the street-corner than the representatives of a great nation.

Sinking Fund.—The first regular plan for the gradual extinction of the national debt of Great Britain was a sinking fund, proposed by the earl of Stanhope, and adopted by Sir Robert Walpole in 1716. The operation of the plan was not encouraging. The payments in liquidation of the debt from 1716 to 1728 amounted to £6,648,000, and the increase of the debt for supplies was about the same. It was found to be much easier to lay hands on the accumulated fund than it was to negotiate new loans, which meant the imposition of new taxes. The plan of holding the fund inviolable for the purpose of liquidation was soon abandoned. In 1733 began the regular practice of resorting to it for the supplies of the year whenever there was a deficiency in the general accounts. In 1792, when the war with France began and new loans became necessary, a sinking fund of 1 per cent. was created on the nominal sum of each loan, which was expected to redeem it in forty-five years. But in the succeeding years loans to the amount of £86,796,375 were contracted without any provisions for their discharge. In fact, it was already apparent that the sinking fund was a delusion and a snare. It was likely to be seized in case of emergency, without the least regard to the end for which it was created. After many experiments and modifications it was finally abandoned in 1828, as a stated part of the financial system, by act of Parliament, which declared that for the future "the amount of the sinking fund be the actual surplus of the revenue over the expenditures." But the same kind of financial tricks already described were continued on one pretence or another. In 1829, debt to the amount of £4,900,000 was created, giving a reduction of £6,000,000; in 1830 the sum of £154,000,000 was added to the debt, and a reduction of capital effected of £168,000,000. This was at the expense of the public creditors. To tell the plain truth, it was nothing less than repudiation. Notwithstanding these facts—which have long been matter of authentic history—the delusion of the sinking fund has been adopted in the U. S., and is pursued with all the seriousness of children who endow their dumb toys with life and understanding. While it is allowed that some advantage may be gained by combining in one sum the remainders of appropriations which would otherwise lie dead and fruitless, and funding them on interest, it is apparent beyond all dispute that the rule adopted by the British Parliament is the true one—viz. that the only actual sinking fund is in the surplus of revenue over expenditures. Everything else for purposes of liquidation is a delusion and a snare. J. S. GIBBONS.

Fun'dy, Bay of [once called *Fundy Bay*, a corruption of the Fr. *fond de la baie*, the "Head of the Bay," which is a name still given to the upper part of the Bay of Fundy], an arm of the Atlantic extending N. E. between New Brunswick on the N. W. and Nova Scotia on the S. E. Its N. E. extremity divides into two parts—Chignecto Channel, the north-westernmost, itself dividing into Shepody Bay and the Cumberland Basin, the latter reaching to within 13 miles of Northumberland Strait, from which it is intended that a canal shall be cut; the N. E. arm of the bay is composed of Minas Channel and Basin and Cobequid Bay. Spring tides, in parts of the Bay of Fundy, have been known to rise over 70 feet, and come pouring in like an immense *bore*. The funnel-shaped and rapidly narrowing entrance to the bay enables a disproportionately long tidal wave to enter, and as it becomes narrower and shallower the height is necessarily increased. The remarkable tidal peculiarities render navigation dangerous, except to navigators who are familiar with it. Its fisheries are of great importance.

Fü'nen, or **Fuhnen** [Dan. *Fyen*], next to Seeland, the largest of the Danish islands, separated from Seeland by the Great Belt and from Jutland by the Little Belt. Area, 1123 square miles. Pop. 182,816. It is low, but hilly, partly covered with forests, and very fertile. The principal towns are Odense, Svendborg, and Nyborg.

Fu'neral, Funeral Rites [Lat. *funus, funeris*, a "dead body"]. The disposal of the bodies of the departed has in all ages and in nearly all countries excited a profound interest in the living. The two principal modes which are and have been observed are *burial* in the earth or sea, and *cremation*, incineration or burning. Burial has been practised from remote pre-historic times, as is shown not only by the most ancient existing records, but by the examination of cairns and sepulchral mounds in many countries. Burials are either in graves, in which the body (usually either enclosed in a coffin or cist, or among ruder peoples simply wrapped in grave-clothes) is covered directly with the earth, or it is placed in a subterraneous chamber called a vault, tomb, or sepulchre. The *embalming* of dead bodies (see EMBALMING and MUMMY) is a process anciently very prevalent in Egypt and some other countries preparatory to burial. Burial in the sea takes place from ships which are too far from the land to permit interment to take place. The body, placed in a suitable canvas sack, is (very commonly after the reading of the short and impressive burial-service of the Anglican Church) committed to the sea, shot or other suitable weights being attached to the feet. Burial in the earth is usually accompanied by ceremonies prompted at once by affection and by the religious faith and sentiments of the friends of the deceased. Masses and requiems are prescribed in the rituals of some Christian churches; eulogies, elaborate *oraisons funèbres*, or formal sermons are pronounced at or soon after the funerals of distinguished persons; but more commonly in Protestant communities a simple liturgical service, or a still less formal scriptural reading, followed by a few words of sympathy and religious counsel, with a prayer for the living friends, completes the service. Music is not universal at funerals; when used it is either in a minor key and expressive of grief, or of a kind intended to inspire hope and religious faith. A simple bier, or, in the case of public characters of distinction, a more or less imposing catafalque or hearse is employed for the support of the coffin; and funeral cars (also called hearses) are almost uniformly employed in carrying the dead to the grave. The custom of having hired mourners to bewail the dead is at present prevalent chiefly in the East. The *hearse*, in strict language, is the candle-frame used in Roman Catholic ser-

vices for the support of burning tapers. (For an account of places of burial see CEMETERY, by JOHN JAY SMITH.) The dead are almost always buried in the supine position, very commonly with the head toward the E.—a custom which may have a religious significance, but which prevailed to some extent among the aborigines of North America. Some of these peoples, however, like the Kaffirs, buried the dead in the sitting posture—a custom which was once common in the south of Britain, as is shown by the examination of sepulchral mounds referred somewhat doubtfully to a pre-historic age. Recent observers have discovered in North Carolina graves in which the dead were placed very near the surface of the ground, and covered with soft clay, which was afterwards hardened by fire. Many Western aboriginal tribes suspended their dead in trees or placed them upon raised platforms—a practice which may have been designed to keep them from ravenous beasts. Some Indian tribes carry the bones of the dead with them on their migrations; others have the greatest horror of ever speaking of the dead; while among some tribes there prevails a system of ancestral worship which recalls that so prevalent in China, and a solemn dance is held yearly at the burial-place. The Parsees expose their dead until the kites and vultures have removed the soft tissues, when the bones are placed in an ossuary. A very similar practice obtains among some wild South American tribes. In many European monasteries there are ossuaries for the bones of the deceased brothers. Burial is believed to have prevailed quite as extensively in ancient Greece as burning did; and it was undoubtedly far more prevalent in Rome than burning until a comparatively late period of the republic.

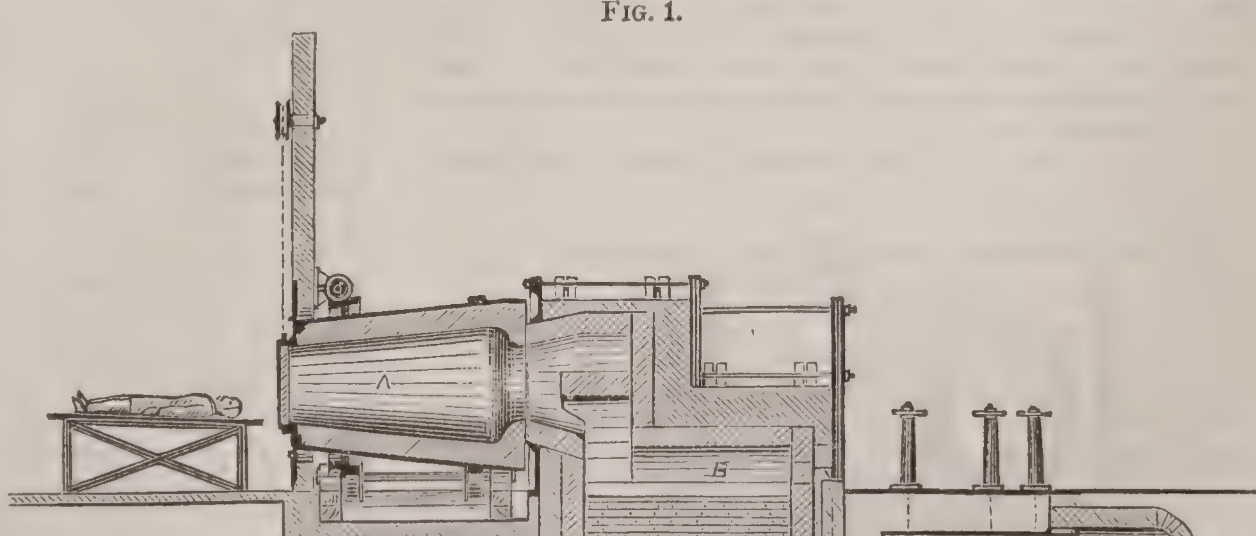
2. *Cremation, incremation,* and *incineration* are names given to the practice of burning the dead. This practice certainly prevailed in pre-historic Europe, but probably not in the most remote periods. The cases of incremation narrated in the Old Testament would seem to be exceptional ones (1 Sam. xxxi. 12; Amos vi. 10, etc.). The practice was common in Greece, Rome, Etruria, and other ancient countries, and was finally extinguished by the spread of Christianity, which introduced a belief in a future resurrection, not, indeed, incompatible with the practice of cremation, but in the simple minds of the early believers at least repugnant to their sentiments. The ancient practice was to burn the dead upon a funeral pyre of wood, upon which oil, incense, and spices, and sometimes food and clothing, were placed (a practice reminding us of the custom so prevalent among savages of burying food and weapons with the dead, and of sacrificing horses, dogs, or even slaves, for the service of the departed). Finally, the embers were quenched with wine, and the ashes, placed in a CINERARY URN (which see), were deposited in a sepulchre (*columbarium*) or subterranean cell, or in some cases buried in the earth at the spot where the incremation took place. The use of some kind of cinerary urn for the ashes was to some extent prevalent throughout Western Europe in ante-Roman times, if we can rely upon published estimates as to the date of certain supposed pre-historic remains. At present, the combustion of the dead is frequent, but by no means universal, in Hindostan. In North-western British America there are tribes which practice cremation, and so do some of the tribes of the Shoshone family. Funeral urns are found in ancient North American mounds filled with ashes and half-burned bones. Some California Indians burn their dead, and use the ashes for a sort of paint, with which they besmear themselves in the funeral dance. (See the article on modern cremation below, by S. SEXTON, M. D.)

Besides the two principal modes above indicated, and that of exposure already referred to as prevalent in some countries, there are some other exceptional methods of disposing of the dead. The Fans of West Africa eat their dead, or, as they pretend, exchange their bodies for those of other tribes, which are eaten. In some Pacific islands the sick and aged are buried alive for the sake of economy; in India the burial and burning of living persons were religious ceremonies, now suppressed by law. Very considerable numbers of corpses are thrown into the sacred rivers of India, and it is also customary to take a part of the body from the funeral-pile and cast it into the river. In South Africa some tribes drag the bodies of women into some waste place for wild beasts and vultures to devour. The Chinooks and other fish-eating Indians on the lower Columbia River adorned the dead with their finest clothing and ornaments, placed the body in a canoe and allowed it to float out into the sea; and similarly other tribes floated their dead into large lakes and rivers. Many of the Pacific coast Indians not only avoid all reference to the departed by name or by any allusion, but all the property, and even the house, of the deceased are burned; and this burning is the essential part of the funeral ceremony.

C. W. GREENE.

CREMATION.—During the years 1873–74 great efforts were made on the continent of Europe, in England, and in the United States to establish cremation as a means of disposing of human bodies after death wherever it should be desired. This recent movement developed the fact that a great number of people would regard the practice with favor. In London, Paris, New York, Vienna, Berlin, Leipsic, and Dresden the feeling manifested itself in public meetings, organization of societies, and extended discussion in the press. Many experiments were made both with human remains and those of the inferior animals to ascertain the quickest and least objectionable method; for this modern revival of burning, though the practice has prevailed to a greater or less extent through nearly the whole historic period of man, is to be based upon scientific appliances which would attain the object in view quickly and inoffensively. Prof. Brunetti of Padua, Italy, was prominent among the first in the movement. Shortly afterwards Sir Henry Thompson of London wrote an exhaustive article upon the subject, urging its adoption with much force. About the same time public attention was aroused in New York, the idea receiving the approval of many influential and intelligent citizens. Simultaneously in Germany and in Switzerland even more earnestness was shown. Mr. Philip H. Holland of London replied to Sir Henry Thompson at considerable length, but the opposition was much less than might have been expected. This was doubtless due in great part, however, to the general belief that the agitation was purely theoretical, and that there was no immediate prospect of the successful establishment of the practice. Women have been prominent among cremationists, and any general adoption of the system will be largely owing to their advocacy. In England Lady Rose Mary Crawshay, and in New York a lady whose name has not been made public, have written able arguments in its favor. There are two distinct classes of arguments—hygienic and sentimental—in favor of cremation. The sanitarian urges the danger to the living of placing beneath the surface of the earth great numbers of the dead near large cities, to gradually decompose, thus contaminating the water and poisoning the air by the liberated gases, the overloaded soil being able to do its work of disinfection only to a limited extent. In general importance, however, the sentimental influences are greater both for and against burning, and it will be long before it is accepted as a civilized custom. It is a notable fact that it has been inaugurated practically by women, Lady Dilke of England, and another, a German, having

FIG. 1.



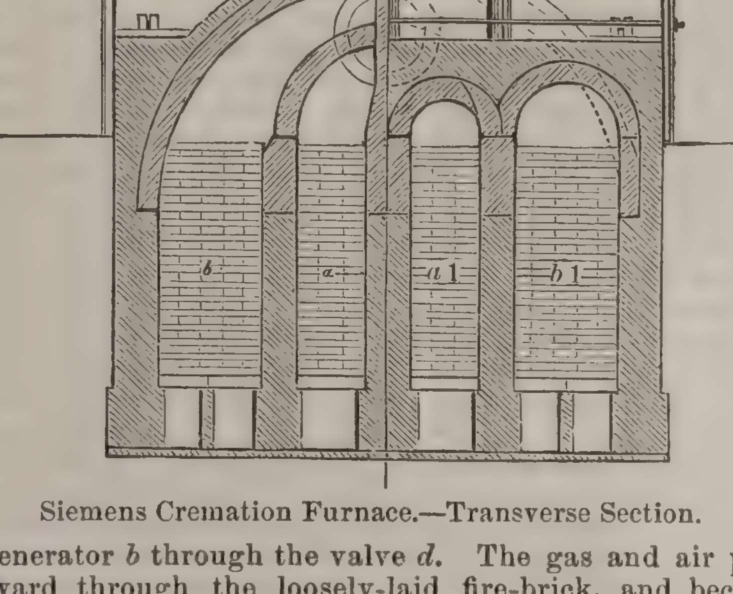
Siemens Cremation Furnace.—Longitudinal Section.—Scale $\frac{3}{32}''$ to a foot.

been cremated at Dresden. The fear of being buried alive is very general, and is a powerful cause acting in favor of cremation. It simplifies very much the funeral rite, and hence from its economy commends itself to a large class.

The most important objection raised against such total and rapid destruction of the body is medico-legal, as it is claimed that evidences of poisoning and violence would be destroyed. This is met by the statement that necessarily there would be a more careful examination of bodies before burning, and probably a more general detection of crime. Cremation will be for many years after its adoption confined to large towns. The expense necessarily incurred in the erection of furnaces and other apparatus would indicate the probable formation of joint-stock companies to accomplish it. Two societies have been organized in New York City—one among the English, and the other among the German portion of the population—and it is probable that in a few years this rite will be available for those who prefer it. In Dresden, as stated before, a furnace is in operation. The disposal of the ashes is left to the choice of the survivors. They may be placed in the family vaults already built in many of our beautiful cemeteries, or new devices may be adopted as the custom becomes popular.

Cremation Furnace.—The Siemens cremation furnace consists of, first, the furnace A (see Fig. 1), in which the body is placed for cremation; and, secondly, the regenerator B, in which the gas and air used for combustion are heated before entering the cremation-chamber A. The gas for combustion is prepared at a distance from the furnace, and led to it through underground flues (for general description of these furnaces see FURNACE (Siemens iron)). The regenerators (*a*, *a* 1, *b*, *b* 1, Fig. 2) consist of fire-brick chambers filled with fire-brick laid loosely, having regular spaces between them through which the air and gas can pass. The gas is admitted at the bottom of the regenerator *a* through the valve *c*, and the air at the bottom of the

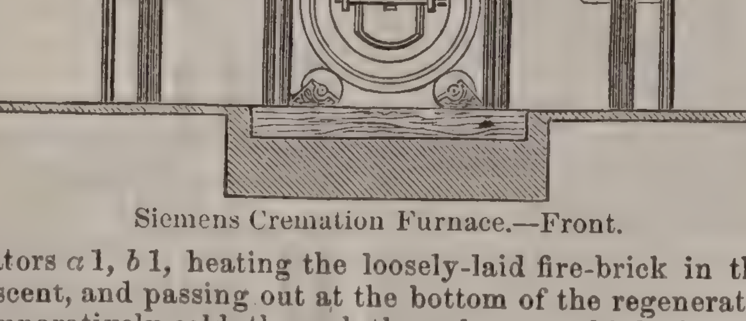
FIG. 2.



Siemens Cremation Furnace.—Transverse Section.

regenerator *b* through the valve *d*. The gas and air pass upward through the loosely-laid fire-brick, and become heated by contact with them—in what way will be shown presently. The heated gas and air unite at the entrance to the cremation-chamber, where combustion ensues, producing an intense heat and flame that reach to the door at the farther end of the furnace. The burnt gases, after circulating through the furnace, pass back again to the end of the furnace at which they entered—the entrance and exit passages being separated vertically by a thin diaphragm of fire-brick—and downward through the regen-

FIG. 3.



Siemens Cremation Furnace.—Front.

erators *a* 1, *b* 1, heating the loosely-laid fire-brick in their descent, and passing out at the bottom of the regenerators, comparatively cold, through the valves to a high chimney-stack, whence they escape into the air. At stated intervals the butterflies in the valves are reversed, by which the currents of air and gas are changed, so that they pass upward through the regenerators *a* 1 and *b* 1, become heated in their passage through them, and after combustion in the furnace pass downward through the regenerators *a* and *b*, which absorb their surplus heat. This reversing the currents is done every half hour. The furnace is raised to a strong heat before the body is introduced, and after the body is in the furnace and the door closed, the amount of gas supplied to the furnace is gradually diminished, as the gases coming from the body are sufficient to support combustion. In this way no foul vapor can escape into the air, every particle being oxidized; and when the process is completed—which takes about half an hour—nothing is left in the furnace but a small quantity of white ash, which is carefully collected and placed at the disposal of the friends. SAMUEL SEXTON.

Fünf′kirchen [Ger. "five churches;" Slavic, *Pecs*, "five"], town of Hungary, in the district of Baranga. Its cathedral is the largest and handsomest church building in Hungary. It has a college and other important educational institutions, and is a bishop's see. Its trade is very active. It has interesting remains of the Roman and Turkish periods, for the Turks held this town 1543–1686. Pop., with suburbs, 24,014.

Fun′gi [plu. of Lat. *fungus*, a "mushroom"]. In botany, the Cryptogamia or flowerless plants include in the higher section ferns, mosses, liverworts, etc.; and in the lower Lichens, Fungi, and Algæ. Sometimes the two first are associated together as Mycetales or Fungales,* their relations being so intimate that no sharp line of separation can be drawn between them, but for the present purpose we shall regard them as distinct. A logical definition of what constitutes a fungus can scarcely be accomplished, but for general purposes it may be sufficient to describe a fungus as a cryptogamic plant of the inferior section, closely related to lichens, mostly epiphytal or hysterophytal (sometimes epizoic), deriving nourishment by means of a mycelium from the substance on which it grows, and never producing the peculiar green bodies (found in lichens) known as gonidia. To this, as well as every other definition hitherto attempted, some exceptions may be taken. The mycelium is at times nearly obsolete, and when growing on inorganic substances it can hardly be assumed that nourishment is derived from the matrix. On the one hand, some Fungi can scarcely be distinguished from lichens, and on the other from Algæ, whilst in the majority of cases they are prominently distinct. H. C. Sorby, F. R. S., has recently shown† that when examined by spectrum analysis this close affinity exists between individuals and small groups of lichens, Fungi, and Algæ, so that not only structurally, but also chromatologically, there is an intimate relation between them. The localities in which these plants are found are as variable as the plants themselves. Some of the larger forms occur in every description of soil, but in most cases arise from decomposed vegetable or animal matter; others affect decaying wood, and others flourish on what would appear to be healthy and vigorous growing trees. Smaller forms occur on decaying organic substances of all kinds; some are parasitic upon and destructive to living plants; a few on living animals, and others submerged in water or developed on such inorganic matrices as naked stones, leaden cisterns, plastered walls, dirty glass, or such eccentric habitats. The conditions which seem most favorable to the development of Fungi are moderate but continuous moisture, a close, damp atmosphere, shady situations, and neither extreme of heat or cold. To this rule, again, there are exceptions, as certain Fungi reach their maturity during winter, and others flourish in profusion in the tropics, but in temperate countries the damp, mild autumnal weather produces the most prolific crops of Fungi. The geographical distribution of Fungi cannot be mapped so satisfactorily as that of the Phænerogamia, inasmuch as they have been less studied or collected by travellers, and there are immense tracts of which the flowering plants are moderately known, but the Cryptogamia are either wholly unknown, or only partially known from a few casual specimens. An attempt has been made by the younger Fries‡ to indicate the features of geographical distribution; but this is necessarily very imperfect and unsatisfactory, even when undertaken by one who had the greatest facilities of any living botanist—through his illustrious father—for the accomplishment of such a sketch. Imperfect as it is, this essay may be perused with profit, as we can only introduce here one or two of the general conclusions arrived at by the author. The fleshy Hymenomycetes, of which the common mushroom (*Agaricus*) may be accepted as the type, flourish most in the colder portion of the temperate zone; the hard Polyporei are tropical, although extending into the temperate zone; whilst *Hexagona* and *Favolus* are intertropical, and do not extend into temperate climes. "When the majority of the species of a genus are of a fleshy consistence, it may

* Rev. M. J. Berkeley, *Introduction to Cryptogamic Botany*, p. 235.
† H. C. Sorby, F. R. S., *Researches in Chromatology*, in *Proceedings of the Royal Society for 1873*.
‡ M. E. P. Fries, in the *Transactions of the Academy of Upsala for 1857*, and *Annales des Sciences Naturelles*, 1861, xv. p. 10.

generally be concluded that that genus belongs to a northern region, even if it should have some representatives in lands which enjoy more sunshine." Most of the Auricularini are cosmopolitan, whilst the Gasteromycetes belong to the warmer division of the temperate and to the tropical zone. The subterranean Fungi are more freely developed in warm climates. Of the more microscopic forms even less is known, but it may be predicated that sphæriaceous Fungi are common both to the temperate and torrid zones, whilst *Mucedines* are almost universal in their distribution, and the coniomycetous Fungi parasitic upon living plants present themselves wherever their host flourishes or an allied species of phænerogamic plant is found. Various conditions of elevation, hydrography, forest, and desert influence or modify these general conclusions.

The relation of Fungi to the human subject is still a matter of controversy, some eminent men contending that many of the "ills that flesh is heir to" may be attributed to minute Fungi, and that many diseases are of fungoid origin; whilst others contend that Fungi are not the cause, but when present are subsequently developed in unhealthy tissues. The minute unicellular bodies which form the basis of much of this controversy are so simple that they cannot satisfactorily be referred to Fungi or Algæ, much less to any definite group of either, and their development has yet to be traced. Whatever may be the result of inquiries in this direction, we do not think it justifiable to assert that minute Fungi have any important or extensive influence in causing disease in the human subject. Much has been written of the associations of fungal spores with cholera, scarlatina, typhoid fevers, measles, diphtheria, etc.,* but the views advocated have not been established, and the theory still remains as much as ever the subject of controversy. In favus and other skin diseases the evidence is strong in favor of fungoid development, but Dr. Tilbury Fox has distinctly intimated his belief that they only exist as accidental products; for he says, "in reference to human parasites, the medical man has little time (and opportunity) to study them in a botanical sense, and regards them with little concern compared with what he considers the more important—viz. the diseases in which they occur; in other words, *as accidental products*."† Too many fatal cases of poisoning by Fungi have occurred to leave any doubt of the deleterious effect of numerous species on the human subject. None of these are better known than the fly agaric (*Amanita muscaria*), which has a wide distribution, is readily distinguished by its brilliant coloring, and everywhere is acknowledged as dangerous. This is but one out of many species that are undoubtedly poisonous, and it may be observed that even species which are known to be wholesome or inert when properly cooked or eaten whilst fresh, may become injurious when kept long enough for their chemical constituents to undergo change or modification. Unfortunately, no concise and definite rules can be laid down whereby poisonous may be distinguished from edible Fungi, except by a botanical knowledge of the species. To aid in this, Mr. Worthington Smith has published in England two large colored sheets of the most common poisonous and esculent species found in that country.‡

In European countries the common mushroom (*Agaricus campestris*) enjoys the widest popularity as an esculent, especially the cultivated varieties. The meadow mushroom (*Agaricus arvensis*) is scarcely inferior, though stronger in flavor, and is preferred by many to the cultivated species. In France the champignon (*Marasmius oreades*) is largely eaten, and in Austria *Agaricus melleus*, which has no admirers in England, finds a constant place in the markets during the summer. Truffles (*Tuber æstivum*, etc.) and morels (*Morchella esculenta*) are favorites not only in Europe, but also in the vales of Cashmere, where two or three species of morels are dried for consumption throughout the year. The great puff-ball (*Lycoperdon giganteum*) is increasing in reputation as a breakfast delicacy in Great Britain, whilst *Lactarius deliciosus*, the chantarelle (*Cantharellus cibarius*), and the hedgehog fungus (*Hydnum repandum*) have each their circle of admirers. Numerous other species are also more or less eaten by mycophagists, although they are never found in the public markets. *Boletus edulis* cut in slices and dried may be purchased throughout the year in most of the continental cities. In Tahiti the Jew's ear (*Hirneola auricula Judæ*) is dried in large quantities and exported to China, whilst a species of agaric (*Agaricus subocreatus*) comes into the markets of Singapore, and another dried agaric (*Agaricus fossulatus*) is sent from the Cabul hills into the plains of North-western India. Several species of *Cyttaria* are eaten in the southern parts of South America, and in Australia the *Myletta australis* is a favorite article of food. In fact, a very long catalogue might be made of the species which are more or less consumed in different parts of the world; but we must rest content with suggesting some of the most important or interesting, referring the reader to more special treatises for further information.§ The cultivation of Fungi for esculent purposes has not hitherto been successful with any other species than the ordinary mushroom. Attempts were made in France for the cultivation of truffles, at first apparently with considerable promise, but ultimately without much satisfaction. There is no good reason to suppose it impossible or improbable that many species might be cultivated if proper care, time, and attention could be devoted to experiments in that direction. Fungi useful to man in medicine or the arts are by no means numerous or of importance. Some species of *Polyporus* have been employed as styptics or beaten till soft and used as amadou. One species in Burmah has a good reputation as an anthelmintic. Some species of *Polysaccum* and *Geaster* are employed medicinally in China. Species of *Elaphomyces* were at one time supposed to possess great virtues, now deemed apocryphal. *Ergot*, developed on rye, wheat, and the germen of various grasses, still maintains its position in the pharmacopœia, but is almost the only fungus now employed (and that sparingly) by the legitimate medical practitioner.

Many very serious diseases in plants are undoubtedly produced by Fungi.‖ First in importance is the potato murrain, which originates in a white mould called *Peronospora infestans*. Another mould of the same genus is destructive to young onions, and another to lettuce, spinach, and other garden produce. The vine disease is occasioned by *Oidium Tuckeri*, and is a great pest in some grape-growing countries. The hop disease is another pest which has its origin in a fungus, *Sphærotheca Castagnei*. Peas are subject to the attacks of *Erysiphe Martii*; cabbages suffer from *Cystopus candidus*, from which turnips are not wholly exempt; and grain-crops have their pests in the red rusts (*Trichobasis rubigo* and *lineare*), in the corn mildew (*Puccinia graminis*), in the smut (*Ustilago segetum*), and in bunt (*Tilletia caries*). Indian corn suffers also from the attacks of *Ustilago maydis*. The seeds of all graminaceous plants are also liable to become ergotized. Plum, pear, apricot, and other fruit trees, as well as roses and other garden flowers, suffer from microscopic Fungi belonging to numerous and diverse genera.

The classification of Fungi must necessarily be noticed here in a concise and cursory manner, and without reference to the modifications proposed by different authors, but in accordance with the method most generally adopted. It may be premised that in all systems the fructification is of primary importance. We assume that there are not less than 20,000 described species, all of which can be arranged in two groups, having reference to the mode in which the fruit is developed. In one group the spores (analogous to the seeds of higher plants) are naked—that is, not enclosed in spore-bearing sacs or capsules—and these are called Sporifera. In the other group the spores, generally in definite numbers, are enclosed in rounded or elongated membranous sacs, and these are called Sporidiifera. By general consent, the spores when contained in these membranous sacs, or *asci*, are known as *sporidia*, and when naked are simply known as *spores*. Following this order, we commence with the *Sporifera*, or spore-bearing Fungi, the term *spore* being here applied in the limited sense to which we have alluded. The one common feature which pervades this group is the production of the spores simply and singly upon little short, often nearly obsolete pedicels or sporophores, and *not* enclosed in special sacs or membranous envelopes. In some cases the spores are produced on an exposed surface, or *hymenium*; in others the spore-bearing surface or hymenium is enclosed within a common envelope. In others, again, there is no exposed surface or hymenium, but the spores are produced on the stem or branches of threads, such threads being usually gregarious and forming mouldy patches; whilst, finally, the

* See *Zeitschrift für Parasitenkunde*, edited by Drs. Hallier and Zürn.

† *Skin Diseases of Parasitic Origin*, by W. Tilbury Fox, M. D. (London, 1863), p. 103.

‡ *Mushrooms and Toadstools*, by W. G. Smith (London, 1867).

§ *A Treatise on the Esculent Funguses of England*, by Dr. Badham (London, 1863); Roques, Jos., *Histoire des champignons comestibles et vénéneux* (Paris, 1841); Fries, E., *Sveriges ätliga och giftica Svampar* (Stockholm, 1861); Persoon, C. H., *Traité sur les champignons comestibles* (Paris, 1818); Trog, J. G., and Bergner, J., *Die essbaren, verdächtigen und giftigen Schwämme der Schweiz* (Bern, 1844); Vittadini, C., *Funghi Mangerecci* (Milan, 1835); Lenz, H. O., *Die nutzlichen und schadlichen Schwämme* (Gotha, 1831); Cordier, F. S., *Hist. et Descr. des champignons alimentaires et vénéneux* (Paris, 1836); Barla, J. B., *Les champignons de la Province de Nice* (Nice, 1859); Harzer, C. A. F., *Abbild. der verzüglichtem essbaren, giftigen und verdächtigen Pilze* (Dresden, 1842); Krombholz, I. V., *Der essbaren, schädlichen und verdächtigen Schwämme* (Prague, 1846).

‖ See *Smut, Rust, Mildew, and Mould*, by M. C. Cooke, M. A., with plates, 2d ed. (London, Hardwicke, 1871).

spores may form the principal feature, the pedicels being very rudimentary or nearly obsolete. These four methods of spore-production form the basis of the four subdivisions or families into which the Sporifera are divided, and may be technically stated as follows:

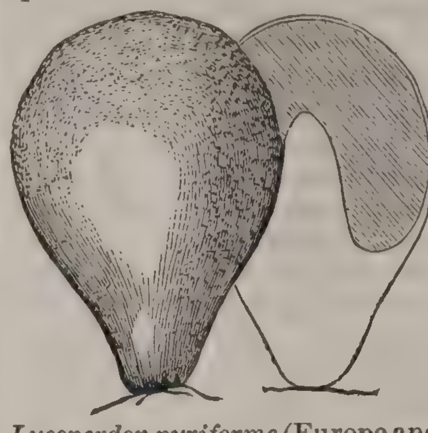
Hymenium present.
- Hymenium (or fruit-bearing surface) free, mostly naked or soon exposed: I. HYMENOMYCETES.
- Hymenium enclosed in a peridium, which is ruptured when mature: II. GASTEROMYCETES.

Hymenium absent.
- Spores naked, mostly terminal, on inconspicuous threads, free or enclosed in a perithecium: III. CONIOMYCETES.
- Spores naked, on conspicuous threads, rarely compacted, small: IV. HYPHOMYCETES.

It will be observed that the names applied to these four families each in turn represents the characteristic feature of the family. In Hymenomycetes the *hymenium* is the prominent feature; in Gasteromycetes the peridium which encloses the hymenium (*gaster*, a "belly") is the chief characteristic; in Coniomycetes the dust-like spores (*konis*, "dust") are the most prominent; and in Hyphomycetes the threads (*hypha*) are the distinguishing characteristic. The Hymenomycetes are regarded by some as the highest development of Fungi. The hymenium or spore-bearing surface is variable in form. In the Agaricini the hymenium is a membranous expansion distributed in folds or gills over the under surface of a pileus or cap; in the Polyporei the hymenium lines the inner cavity of pores or tubes; in the Hydnei the hymenium clothes the surface of prickles or spines; and in the Auricularini the hymenium is spread more or less evenly over the under surface of the pileus, which is often resupinate. In all these the hymenium is normally inferior, whilst in the Clavariei the entire fungus is clavate or branched, and the hymenium covers the entire surface. In the Tremellini the substance is gelatinous, and lobed or somewhat discoid; the hymenium is imperfect and superior, and in many respects this order differs in spore-development from the preceding orders of this family. The common mushroom is a good illustration of the structure which prevails in the Agaricini.* The mycelium consists of slender, branched, rootlike filaments, which penetrate the soil. From this mycelium proceeds an erect stout stem, or stipe, bearing at its apex an expanded cap or hood, the under surface of which is covered by the folds or plates of the hymenium. The spores are quaternary—that is, four spores are produced on the tips of short spicules which crown the apex of the sporophores. The sporophores are distributed over the whole surface of the hymenium, intermixed with cysts or basidia, the true function and relations of which are involved in mystery.† It will be observed that the spores are naked, and when mature fall readily from their slender supports upon the soil beneath. In form they are mostly spherical, ovate, or elliptical, the surface being smooth or warty, colorless or colored, according to the species to which they belong. The difference in color in the spores of the agarics forms the basis of classification in the genus *Agaricus*, in which the species are distributed amongst five sub-genera according to the color of the spores.

Coprinus micaceus (Europe and U. S.), order Agaricini.

The Gasteromycetes differ from the preceding in the hymenium being enclosed in an outer peridium. When fully matured they resemble more or less globose sacs, ruptured above, and filled with a dusty mass of spores and threads. In their early stage the spores are often quaternary, but are soon free.‡ This family may be again divided into two sub-families, in one of which the approach is towards the hymenomycetous type, and the other the coniomycetous. The first sub-family contains (1) the subterraneous species, or Hypogæi, in which the hymenium is persistent, the inner mass not becoming dusty except when decayed; (2) the Phalloidei, in which the hymenium is deliquescent, are terrestrial; and (3) the Nidulariacei, a somewhat aberrant order, in which the spores are compacted into disciform bodies enclosed in an outer peridium. In the other sub-family are contained (1) the Trichogastres, and (2) the Myxogastres; the former are cellular at first, but the hymenium soon dries up into a dusty mass of threads and spores; the later are gelatinous at first, but are soon resolved also to a dusty mass of threads and spores. The Myxogastres are very interesting objects of study, and have been the subject of considerable speculation. At one time Prof. de Bary propounded the belief that they were intimately associated with low forms of animal life, and could not be retained with Fungi, but has since renounced that opinion. The basis of this belief was derived from the study of their gelatinous stage, in which the substance resembles sarcode, and relations with amœboid forms were supposed to exist.



Lycoperdon pyriforme (Europe and U. S.), order Trichogastres.

The third family of sporiferous Fungi is Coniomycetes, in which the hymenium proper is almost obsolete, and the whole plant consists of spore-like bodies, borne on short, often evanescent sporophores, and either seated on a cushion-like stroma or enclosed in a peridium. "This family is distinguished by the vast predominance of the reproductive bodies over the rest of the plant, if not in size, at least in abundance, and from the ease with which in general they fall from the point of attachment; in consequence of which, as the name implies, they have a dusty appearance, and often soil the fingers of those who handle them. In some cases there is a decided perithecium or peridium; in others there is no approach to such an organ, and in very nearly allied productions it may be either present or entirely absent. Many of the genera are doubtless conditions of higher forms."§ In one section of this family the species are found growing on dead or dying plants; in the other, they are parasitic on living plants.

In Sphæronemei there is a more or less distinct perithecium which originates beneath the cuticle of dead or dying plants. The spores are produced in the interior on the tips of slender threads, and when mature are ejected through an apical mouth or by rupture of the perithecium. In Melanconei the species have similar habitats, but there is no definite perithecium, and the spores usually ooze out in a pasty, black, or colored mass. In the Torulacei the species are entirely superficial, consisting of compound or concatenate spores, produced in patches on the surface of decaying plants, sometimes springing from a decided stroma, and sometimes only from a delicate mycelium.

The section including species parasitic on living plants contains the Æcidiacei, in which there is a distinct cellular peridium, and the Cæomacei and Pucciniæi, in which there are none. The Æcidiacei chiefly affect the leaves of growing plants, and are produced beneath the cuticle, through which they burst, then the peridium ruptures in a stellate manner, the teeth are reflexed, and the chains of spores are exhibited seated in a fringed cup, forming a beautiful object for the microscope. This is the typical form, subject to slight variations. In the Cæomacei the spores are produced in definite or indefinite patches on the green parts of plants, bursting through the cuticle and becoming diffused as a rusty or dingy blackish powder. To this group the red rust and the smut and bunt of corn belong. The spores are mostly globose or nearly so, and the fructification in many genera is very complex.‖ In the Pucciniæi the spores are elongated, septate, and borne on more or less elongated persistent peduncles. In this order the tufts of spores, or *sori*, are definite, sometimes compact, and at others pulverulent. In *Podisoma* the spores are invested in gelatine, resembling in some respects the Tremellini.¶ The late Prof. Œrsted was of opinion that he had demonstrated the relations of *Podisoma* to *Ræstelia*, and it is probable that further observations may confirm the belief that the *Puccinia graminis* of wheat and grasses is another stage of the *Æcidium* of the barberry, although at present we do not consider the fact satisfactorily established.

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* See *Anatomy of a Mushroom*, in *Popular Science Review* for 1869, vol. viii. p. 389.

† *Grevillea*, 1873, p. 41; 1872, p. 181.

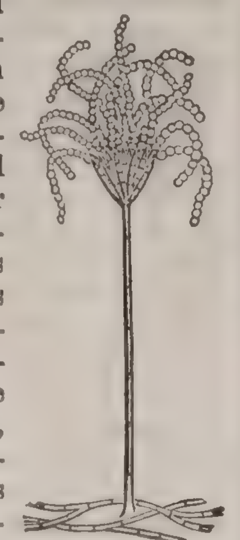
‡ *Sur la fructification des genres Lycoperdon, Phallus*, etc., par Rev. M. J. Berkeley, in *Ann. des Sci. Nat.*, 1839, vol. xii. p. 160; *De la fructification des Scleroderma*, par L. R. et C. Tulasne, in *Annales des Sci. Nat.*, 1842, vol. xvii. p. 1.

§ Berkeley's *Introduction*, p. 315.

‖ Tulasne, L. R. and C., *Mémoire sur les Ustilaginées*, in *Ann. des Sci. Nat.*, 1847, vii. p. 12, 73; *Mémoire sur les Uredines et les Ustilaginées*, in *Ann. des Sci. Nat.*, 1854, ii. p. 78; *Contributions to the Biology of the Ustilaginæ*, by Dr. A. Fischer von Waldheim, translated for the *Transactions of the New York State Agricultural Society for 1870*; *Microscopic Fungi Parasitic on Living Plants*, by M. C. Cooke, in *Popular Science Review*, 1864, pp. 20, 178, 317, 469.

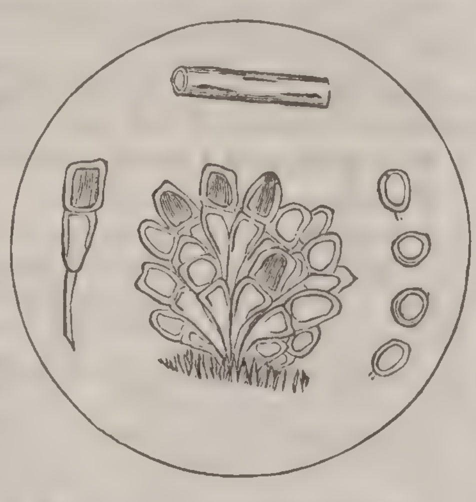
¶ *Notes on Podisoma*, by M. C. Cooke, in *Quekett's Journal*, ii. p. 255.

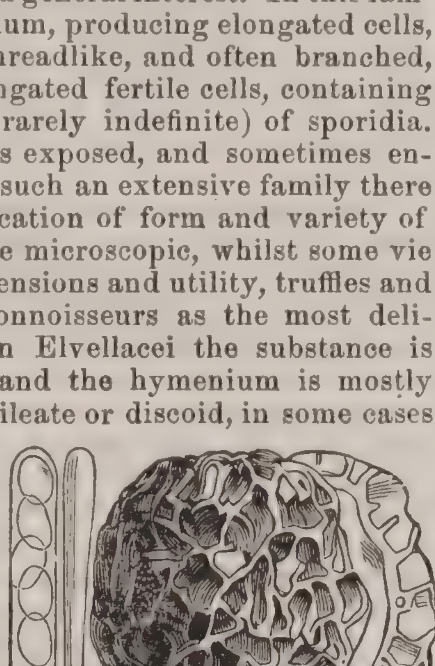
The fourth family of sporiferous Fungi is Hyphomycetes, in which the naked spores are borne on conspicuous threads. In this family the threads are very prominent, and they constitute the majority of what are popularly known as "moulds." Sometimes, as in Isariacei and Stilbacei, the threads are compacted together into a kind of common stem, but in the remaining orders the threads are free or anastomosing. The two principal orders are the Dematiei or black moulds, and Mucedines or white moulds. In the former the fertile threads are more or less carbonized, and in the latter are almost colorless or faintly colored. Amongst the Mucedines are grouped the moulds so injurious to vegetation, of which the potato-mould (*Peronospora infestans*) may be accepted as the type. And here also the widely diffused, almost ubiquitous, *Aspergillus* and *Penicillium* will be found. The relations of moulds to other Fungi have of late received considerable illustration in the works of Tulasne, De Bary, and others.* A great number of them are probably the conidia of ascomycetous Fungi. The last order is Sepedoniei, in which the threads are hardly distinct from the mycelium, and the spores are profuse, thus approximating more closely than any other of the Hyphomycetes to the Coniomycetes. This cursory glance at the principal groups must suffice for our review of the classification of sporiferous Fungi.



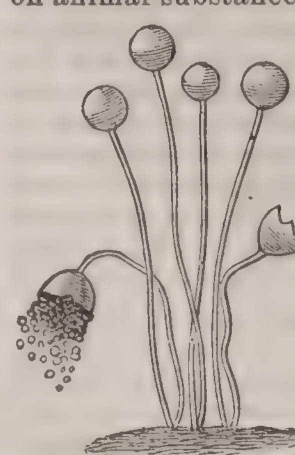
A fertile plume of *Penicillium*, with pencils of spores; magnified 150 diameters.

The Sporidiifera, as we have already intimated, are more complex, inasmuch as the sporidia are produced in definite or indefinite numbers (usually eight or some multiple of eight) in membranous sacs or asci. In one of the families, called Ascomycetes, these asci are formed from the fertile cells of a hymenium, and in the other family of Physomycetes the sporangia or spore-bearing cells are seated on threads (in this respect resembling the moulds or Mucedines), and no definite hymenium is present. The Ascomycetes are second only to Hymenomycetes in number of species, wide distribution, and general interest. In this family there is a cellular hymenium, producing elongated cells, some of which are barren, threadlike, and often branched, mixed with more or less elongated fertile cells, containing usually a definite number (rarely indefinite) of sporidia. This hymenium is sometimes exposed, and sometimes enclosed in a perithecium. In such an extensive family there is necessarily a great modification of form and variety of size. A large proportion are microscopic, whilst some vie with Hymenomycetes in dimensions and utility, truffles and morels being esteemed by connoisseurs as the most delicious of esculent Fungi. In Elvellacei the substance is fleshy, waxy, or tremelloid, and the hymenium is mostly exposed. These are either pileate or discoid, in some cases brightly colored and attractive, and either several inches in diameter or so minute as scarcely to be distinguished by the naked eye. In Tuberacei the hymenium is complicated and enclosed in a peridium. The species are subterranean, in which respect it is analogous to the Hypogæi of gasteromycetous Fungi, but differs in the sporidia being contained in asci. The structure of the Tuberacei is well illustrated in the works of Vittadini, Corda, and Tulasne.† In the Phacidiacei the perithecium is hard or coriaceous, and the hymenium is at length exposed. In Sphæriacei the perithecia are either carbonaceous or membranaceous, sometimes confluent with the stroma, pierced at the apex, and the hymenium is at length diffluent. The stroma is occasionally highly developed, and is clavate, as in *Torrubia*, or clavate, branched, or horn-like, as in *Xylaria*, or broadly effused, as in *Hypoxylon*. The fruit is sometimes very large, multiseptate, and colored. The habitats are also as variable as the plants themselves—dead insects, dung, rotten wood, dead or living leaves, old paper, old rags, matting, nuts, bark, twigs, herbs, lichens, mosses, and even parasitic on other Fungi. In Perisporiacei the perithecia are free, always closed, and mostly membranaceous. The asci become evanescent as the spores approach maturity. Some of the species of Erysiphei are very destructive to plant-life. Many have their perithecia furnished with hooked or branched fulcra, which render them beautiful objects for the microscope.‡ In Onygenei the receptacle is clavate and the asci spring from the threads. The species are developed on animal substances, and remind one of Stilbacei amongst the Sporifera. The Physomycetes are sporidiiferous moulds, in which bladder-shaped sporangia or fertile cells are scattered on threads "which are not compacted so as to form a distinct hymenium." In this family the number of sporidia contained in a single vesicle is indefinite. In Antennariei the threads are felted and moniliform, and the sporangia are irregular. In the Mucorini the threads are free and the sporangia are terminal or lateral. In some species a complex system of fructification has been discovered, two or more threads by conjugation producing a special organ which develops into a fertile sporangium.§





Morchella esculenta, the common edible morel of Europe and the U. S., order Elvellacei.



Mucor caninus (a U. S. and European species), showing the bursting of the ripe terminal sporangium.

Following the same method as that adopted for the *Sporifera*, we append here the characters of the two families composing the *Sporidiifera*, viz.:

Hymenium present.	Asci formed from the cells of a fertile hymenium: V. ASCOMYCETES.
Hymenium absent.	Fertile cells (sporangia) seated on threads which are not compacted into a hymenium: VI. PHYSOMYCETES.

Within the limits of this article it would have occupied too much space to enumerate the orders, sub-orders, and genera of Fungi, for which we must refer the reader to some special mycological work.

It will already have become evident that the fructification of Fungi is of very great importance in classification. This is more and more evident as we become acquainted with the variable modes in which the one great end is attained. In some cases we have conidia, spermatia, pycoridia, and ascospores. In some species only conidia are as yet known, and in others only ascospores. In some species conidia are produced on the branches of mucedinous threads and resting spores, enclosed in oogonia, on the mycelium. Some forms of fruit are exceedingly minute and simple, others are large, colored, and complex. Some germinate and reproduce their kind direct, others through a kind of alternation of generations. Polymorphism in Fungi is an interesting, but at the same time a complex study, and much still remains to be discovered of the relations of one form to another.‖

The Messrs. Tulasne have illustrated polymorphism by one common species of *Sphæria* found on pea and bean stems and various herbaceous plants. This species is *Sphæria* (*Pleospora*) *herbarum*. The sporidia are eight, contained in elongated membranaceous asci, each being ovate-oblong or elliptical, amber-colored, divided by numerous septa with transverse divisions. These are the ascospores. Another condition of this same plant forms a mould in sooty patches on all kinds of decaying vegetable substances; there is a profuse mycelium from which arise jointed threads, and the conidia are elliptical and ultimately septate. This mould is known as *Cladosporium herbarum*. Another species of mould is sometimes found associated with, or parasitic upon, the *Cladosporium*, which is called *Alternaria tenuis*. It consists of chains of spores resembling inverted jointed clubs, and according to Tulasne is but another condition of *Sphæria herbarum*. Still another phase is to be found in a black mould (*Macrosporium sarcinula*) which grows on decaying gourds. In this form the spores are clavate, with numerous septa, and constricted at the joints. Besides these are bottle-

*Tulasne, L. R. and C., *Selecta Fungorum Carpologia*, Paris; De Barry on *Peronospora*, in *Ann. des Sci. Nat.*, 4 ser. xx. p. 5; *Microscopic Moulds*, by M. C. Cooke, in *Journ. Quekett Club*, vol. ii. p. 61; *Polymorphic Fungi*, in *Popular Science Review*, 1871, p. 25.

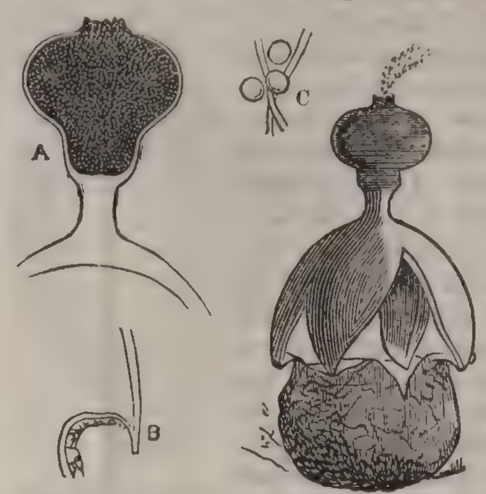
† Tulasne, L. R. and C., *Fungi Hypogæi*, Paris, 1851; Corda, A., *Icones fungorum hucusque cognitorum*, Prague, 1837–42; Vittadini, C., *Monographia Tuberaceorum*, 1831.

‡ Léveillé, J. B., *Organization etc. d'Erysiphe*, in *Ann. des Sci. Nat.*, 1851, xv. p. 109.

§ *Sexual Reproduction in the Mucorini*, by A. de Bary, translated in *Grevillea*, vol. i. p. 167.

‖ *Polymorphic Fungi*, in *Popular Science Review*, vol. x. p. 25.

shaped cysts containing naked spores capable of germination. Here are five phases or different forms of the same (presumed) fungus. It is probable that in addition to these spermatia may be found or traced to some already known coniomycetous species. This is not an isolated instance, but one out of many which the same authors believe that they have satisfactorily traced. Very many others are with good reason suspected. It is not improbable that the majority of species of *Sphæria* have conidia in the form of moulds (Hyphomycetes) and spermatia produced either in carbonaceous perithecia or spurious conceptacles (Coniomycetes). The section of coniomycetous Fungi including the species parasitic on living plants contains numerous examples of dimorphism or polymorphism; it is rather the rule than the exception. The uniseptate spores of *Puccinia* are preceded by, or associated with, unicellular spores of *Trichobasis*, and these again are in many cases believed to be related to the elegant "cluster-cups" of the genus *Œcidium*, and probably also to the permanently stipitate, unicellular spores of *Uromyces*. In *Phragmidium*, again, the spring spores are a *Lecythea*, and the summer spores of *Melampsora* are *Lecythea*, whilst the final and winter spores are not perfected till the leaves on which the fungus is parasitic have lain on the ground through the greater part of the winter, and become decayed. In *Coleosporium* at different periods of the year spores are produced which differ in character and facility of germination. The relations between *Ræstelia* and *Podisoma* have already been alluded to. In *Tilletia* (bunt) there is an alternation of generations,* the areolate spores on germination producing elongated fusiform bodies, which are the spores of the second generation; these conjugate and produce long elliptical spores of the third generation, which in turn germinate and produce similar spores of the fourth generation. Continually additions are being made to our knowledge of the germination and development of minute Fungi. The Saprolegniæ (if included with Fungi, as they seem to warrant) afford instances of the occurrence of active zoospores, as also do the Peronosporiei and *Cystopus*. Some interesting phenomena are exhibited by certain species to which a passing allusion may be made. In some species of *Boletus*, for instance, when cut and exposed to the light, the surface more or less speedily assumes, by oxidation, a bright blue color. It has been asserted that this coloration is due to aniline or a nearly allied substance. Some species of *Polyporus* (as *Polyporus sulfureus*) exhibit on the surface numerous crystals of oxalate of lime. Certain agarics when wounded exude a milky juice in more or less profusion, which is either white or colored. The odor in some species is very strong; in *Phallus* and *Clathrus* exceedingly disagreeable; in some agarics resembling the odor of bugs; in others, as in *Agaricus odorus* and *Agaricus fragrans*, very agreeable; and in others resembling new meal, whilst in a few the peculiar scent of garlic is unpleasantly perceptible. Still more striking is the luminous property possessed by some exotics, and even under certain conditions by natives of temperate climates, as of the U. S. Humboldt describes the phosphorescent appearance of *Rhizomorpha* when growing in mines. Gardner records a Brazilian species of agaric which gives out at night a bright phosphorescent light, somewhat similar to that emitted by the larger fire-flies, having a pale-greenish hue.† Drummond reported from Swan River the occurrence of agarics growing on tree-stumps which emitted a bright light during the night. Dr. Hooker observed the same kind of thing in the Himalayas, and the phenomenon is a familiar one in the U. S., where it has the rustic names of "fox-fire" and "fire-wood."‡ In the south of Europe *Agaricus olearius* is well known for its luminous properties. Mr. Hugh Low states that he has seen the jungle in Borneo all in a blaze of light, by which he could see to read as he was riding across the island by the jungle-road. Worthington Smith writes of *Polyporus annosus*, found in mines in Wales, being so bright that it could be seen in the dark at a distance of twenty yards. He also alludes to *Polyporus sulfureus* as occasionally luminous in England. A striking example is recorded by Rev. M. J. Berkeley, in which a log of timber 24 feet long had the inside of the bark covered with a white mycelium. This was so luminous that when wrapped in five folds of paper the light penetrated through all the folds on either side as brightly as if the specimen was exposed. Scarcely less remarkable is the peculiar coloring which some species impart to the matrix on which they vegetate. In the case of *Helotium æruginosum*, and one or two closely allied species, the old wood on which the fungus grows is permanently colored of a bright verdigris-green. In other instances, as in that of *Sphæria rubellum* and *Sphæria rhodobapha*, some tint of red is imparted to the matrix. Blackened or carbonized matrices are more common. If space permitted we might allude to the singular forms which some species assume—the stellate puff-balls (*Geaster*), the singular *Aseröe*, the coralline *Clathrus*, many of the minute but beautiful species of the Myxogastres, and the elegant Mucedines. The rapidity of growth; the profusion of spores, and the facility with which they are diffused; the relation of some species to fermentation, and of others, such as *Merulius lacrymans* and *Polyporus destructor*, to decay in timber; and kindred topics might lead us to expand this article to double its present dimensions, but we leave it thus as suggestive rather than exhaustive, hoping that it may be sufficient to induce the reader to seek in special works for such further information as he may desire, and which we have been compelled to exclude. (See FERMENTATION and GERM-THEORY.) M. C. COOKE.



Geaster fornicatus (North American species, reduced): A, section of inner peridium; B, tip of lobe; C, group of spores, magnified.

* Cooke on *Bunt Spores*, in *Journ. of Quekett Club*, vol. i. (1869), p. 167.
† *Gardner's Chronicle*, Sept. 21, 1872.
‡ Hooker's *Journal*, 1840, vol. ii. p. 426.

Funk's Grove, tp. of McLean co., Ill. Pop. 818.

Funks'town, post-v. of Washington co., Md., 92 miles N. W. from Annapolis. Pop. of v. 671; of tp. 1649.

Fur. See FURS AND THE FUR TRADE, by L. P. BROCKETT, A. M., M. D.

Fur'ca, a mountain of Switzerland 8268 feet high, in the canton of Valais, W. of St. Gothard.

Fur'guson's Cove, v. of Mendocino co., Cal. Pop. 40.

Furies. See EUMENIDES.

Fu'rius, the name of many Roman historical characters, mostly of the old patrician gens Furia; but some plebeians and many people of Tusculum bore the name also. The most famous of all was L. Furius, a prætor who overthrew the Gauls in the great battle of Cremona (200 B. C.), and received a triumph.

Furlanet'to (GIUSEPPE), successor in Latin lexicography to Facciolati and Forcellini, was b. in Padua Aug. 30, 1775; was educated at the seminary in Padua; became corrector of the seminary press; professor in the College of Sta. Justina; teacher of church history in the seminary; professor of hermeneutics in the university; and finally director of the seminary. In 1816 he published two fasciculi of additions to the Lexicon of Forcellini, and then undertook a thorough revision of the whole work, which was published in 4 vols. 4to, Padua, 1823–31. D. Nov. 2, 1848. H. DRISLER.

Fur'long [Ang.-Sax. *furlæng*—*i. e.* the "length of a furrow"], forty rods in linear measure; the eighth of an English or U. S. statute mile, corresponding to the *stadium*, which was the eighth of a Roman mile. There are also several local furlongs, and the word is sometimes used for the name of a square or land measure.

Furlong (HENRY), a Methodist divine, b. at Baltimore, Md., Mar. 21, 1797, entered the ministry of the Methodist Episcopal Church in 1816, and soon became one of the leaders in the Baltimore Conference. He filled important appointments in Virginia, Maryland, and Pennsylvania. In 1860–61 he was chaplain to the Union seamen's bethel at Baltimore. D. Aug. 29, 1874. He was counted among the fathers in Methodism, and enjoyed the fellowship of Bishops McKendree, George, Roberts, Soule, Waugh, and Bascom. J. H. WORMAN.

Fur'man (RICHARD), D. D., b. at Esopus, N. Y., in 1755; removed in childhood to South Carolina with his father, who carefully educated him. When eighteen years old he became a Baptist preacher, attained wide usefulness, and was an eloquent patriot during the war for independence. He became a pastor in Charleston in 1787. D. in 1825. Author of various published discourses.

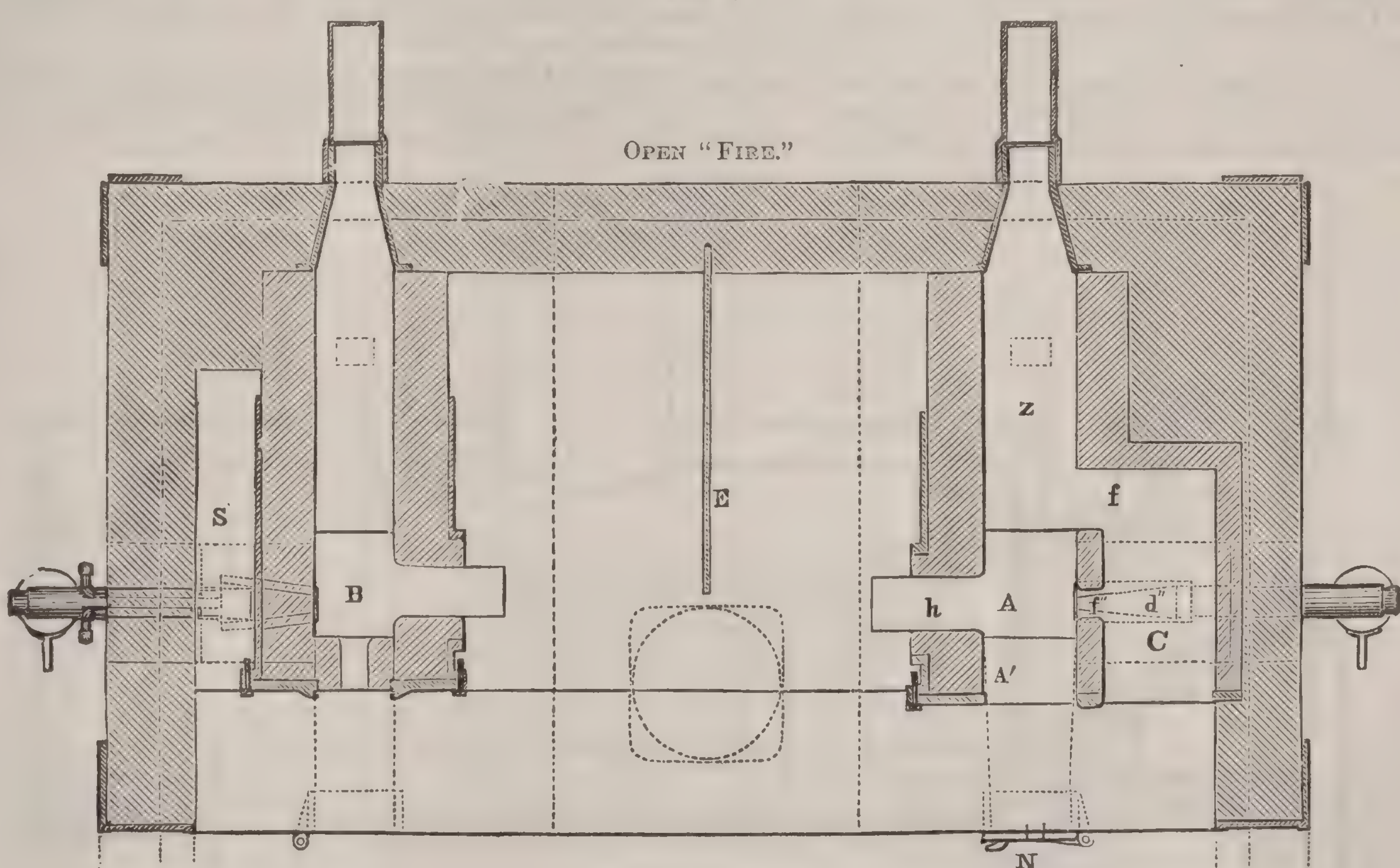
Fur'nace [Lat. *fornax*]. The use of furnaces for imparting heat under various conditions is common to nearly all the industrial arts, especially to the treatment and utilization of metals and minerals. While special varieties of heating apparatus will be described or referred to in articles on manufactures wherein such apparatus is employed, the general principles of furnaces, and their classification according to the methods of utilizing fuel, are subjects of sufficient individuality and magnitude to warrant a separate essay; and as nearly all important types of furnaces

are employed in the iron and steel manufacture, the illustrations will be drawn from this source. Furnaces may be classified as follows: I. According to the methods of applying heat. (1) *Open fires*, in which the material under treatment is heated in the fuel-chamber either in contact with the fuel or with the heat radiated directly from it, or with both. Iron-smelting or blast furnaces are of this class, but as complex chemical processes other than those generating heat take place in them, they are better referred to in a separate article. Furnaces for heating steam-boilers are of this variety, and are considered in the article STEAM-ENGINE. The metallurgical furnaces of this class are the cupola for melting iron for castings, etc.; the smith's "fire" in all its forms; the pot-furnace for melting steel in crucibles; also the usual forms of cementing furnaces. In pot and cementing furnaces the vessel that holds the metal, rather than the metal itself, is in direct contact with the fire. All forms of apparatus for heating air for domestic, metallurgical, or manufacturing purposes, by means of conducting walls placed between the heat-imparting medium and the air to be heated, are properly classified as "stoves," and are treated in various articles referring to the warming of buildings, also under the head BLAST FURNACE. The Bessemer converter and the "sponge" or ore-reducing furnace are of this class, and will be treated under STEEL. (2) *Reverberatory furnaces*, in which the material under treatment is heated in a chamber separate from and adjoining the fuel-chamber by means of the hot gaseous products of combustion and by radiation from the heated walls of the chamber. Most of the furnaces used in the wrought-iron and steel manufacture are of this class. The principal varieties are the puddling furnace, the "heating" furnace, the open-hearth or Siemens-Martin steel furnace, and the "air" furnace, which is a reverberatory melting furnace.

II. Furnaces are further classified according to the method of utilizing the fuel: (1) *Coal furnaces*, in which the heat utilized is the *direct* product of the combustion of solid fuel. (2) *Gas furnaces*, in which the fuel enters the furnace in the form of a gas; in metallurgical furnaces this is chiefly carbonic oxide; if bituminous coal, wood, or peat is employed, some hydrocarbons are present. To say that in the coal furnace fuel is used where it is burned, and that in the gas furnace fuel is made into gas in one place and used in another, would not accurately distinguish between the two varieties, because the gas-producer may be a part of the furnace where the heat is utilized, and yet the combustion which produces the carbonic oxide gas may be a distinct chemical process from the combustion which generates the utilized heat. The blast furnace and the cupola are necessarily coal furnaces; the other furnaces enumerated, whether the heat is applied in the chamber where combustion takes place or in an adjoining chamber, may be either coal or gas furnaces.

Description of Furnaces.—Of the *open fires*, the smith's fire or forge is the oldest and the most common. It consists, in its simplest form, merely of a pile of coal from one to two feet in diameter, beneath which a blast is forced through a tuyere leading from a hand-bellows. Iron or steel bars inserted in the fire may receive a welding heat. In large smith-shops, such as those connected with extensive machine-shops, these fires, sometimes 50 or more in number, are arranged in a suitable building, each with its blast-pipe from a common power blowing-machine, and its water-bosh, anvil, and other appurtenances, and its chimney or a flue leading to a common chimney. The fire is usually placed on a cast-iron table, or rather a shallow tank on legs, at a convenient height. The tuyere is constructed in various ways, many of which are the subjects of patents. A portable smith's forge is usually a light iron stand holding the platform for the fire, and also some form of hand blowing-machine and a water-bosh. The portable forge is chiefly used for heating rivets for ship and boiler work. A

FIG. 1.



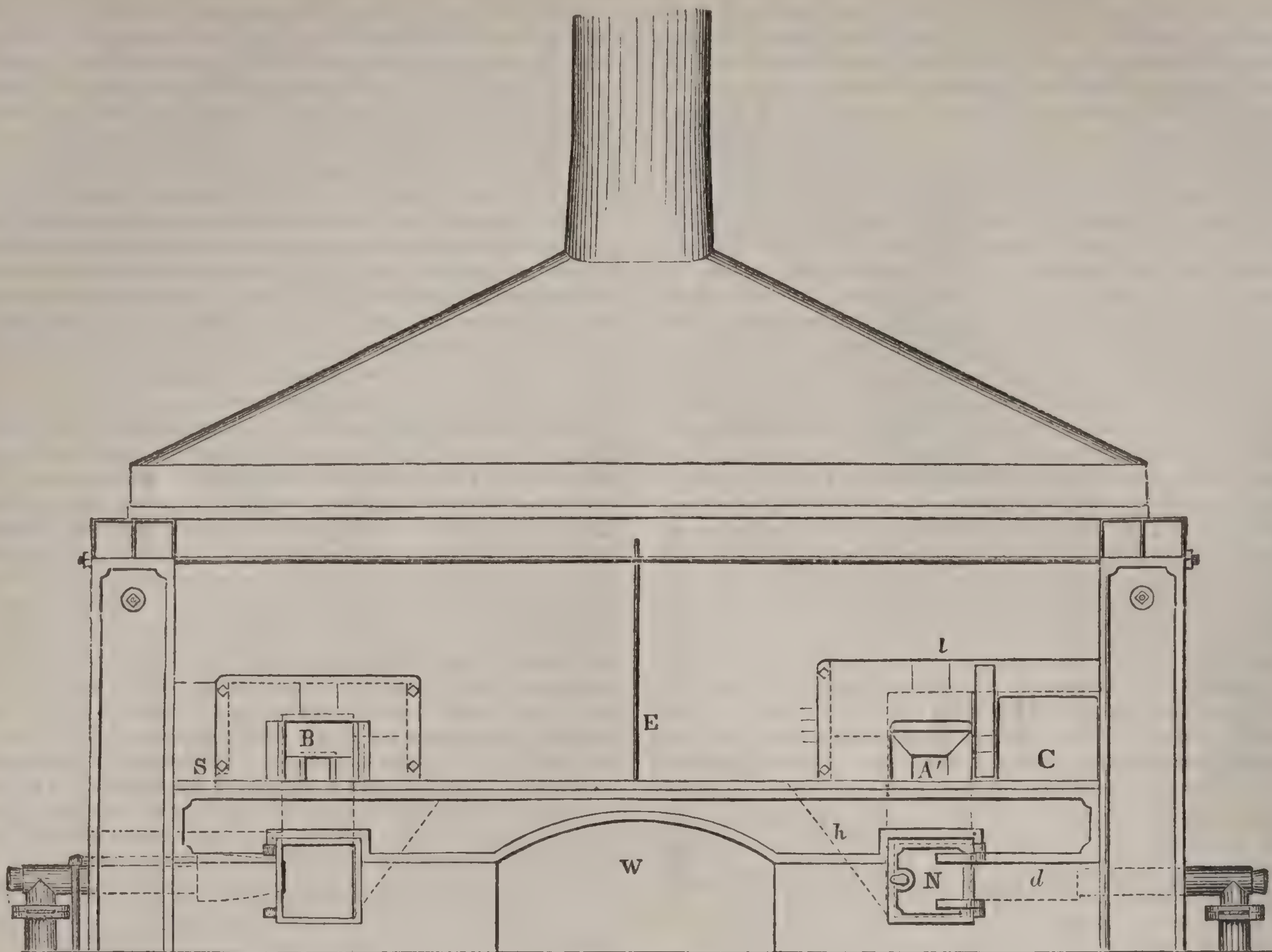
Horizontal Section.

more elaborate form of open fire is shown in horizontal section by Fig. 1, and in front elevation by Fig. 2. It is largely employed in crucible steel works for heating small ingots and bars. The "cold" or cogging fire consists of a pit A, 14×16 inches in plan and 2 feet deep, without grate-bars, in which the fire is urged by a blast entering the tuyere *d*. The ashes are withdrawn at N, and the ingots are inserted at A′, having been previously warmed in the "smoke-hole" C, into which flame enters at *f f*. Coal is fed down the incline *h* into the pit A. The extension Z is for the accommodation of long bars. The gaseous products of combustion pass, partly and in a regulated degree, into the general chimney through the holes *l l*, and partly through the mouths and feed-holes of the fires. The water-bosh is placed under the arch W, and the coke and coal for use lie on the platform above it, being divided by the partition E. The "hot" or welding fire B is a pit 16×12 inches in plan, and otherwise similar to the cogging fire. Its tuyere is protected by a water-casing. The fuel is coke. S is an iron tray containing welding sand. The fire-pits are built of fire-brick, the most refractory kind being required in the welding fire, where the most exposed parts last but a month. The two fires consume about 15 bushels of coal and 15 bushels of coke in 9 hours to heat and reheat 45 cwt. of steel. Casting the ingot in an iron mould chills its surface, so that sudden heating would "burn" it. It is therefore warmed slowly in the smoke-hole, then heated in the cogging fire, and partially drawn under a power-hammer; then it is reheated as often as required in the welding fire.

The earliest smelting furnaces were open fires, not much larger than smiths' forges, and the same crude apparatus is still employed where fuel is plentiful both for smelting ore and for decarburizing crude cast iron.

The reverberatory heating furnace for solid fuel, as employed for heating iron and steel masses of 300 to 2000 pounds weight, is shown in vertical section by Fig. 3. The fire on the grate A is urged by the draft of a high chimney, or usually by a power-fan. The masses to be heated are inserted and withdrawn through the doors J by hand, or by machinery if they are very heavy. The bottom of the furnace is a bed of sand which is compacted by partial

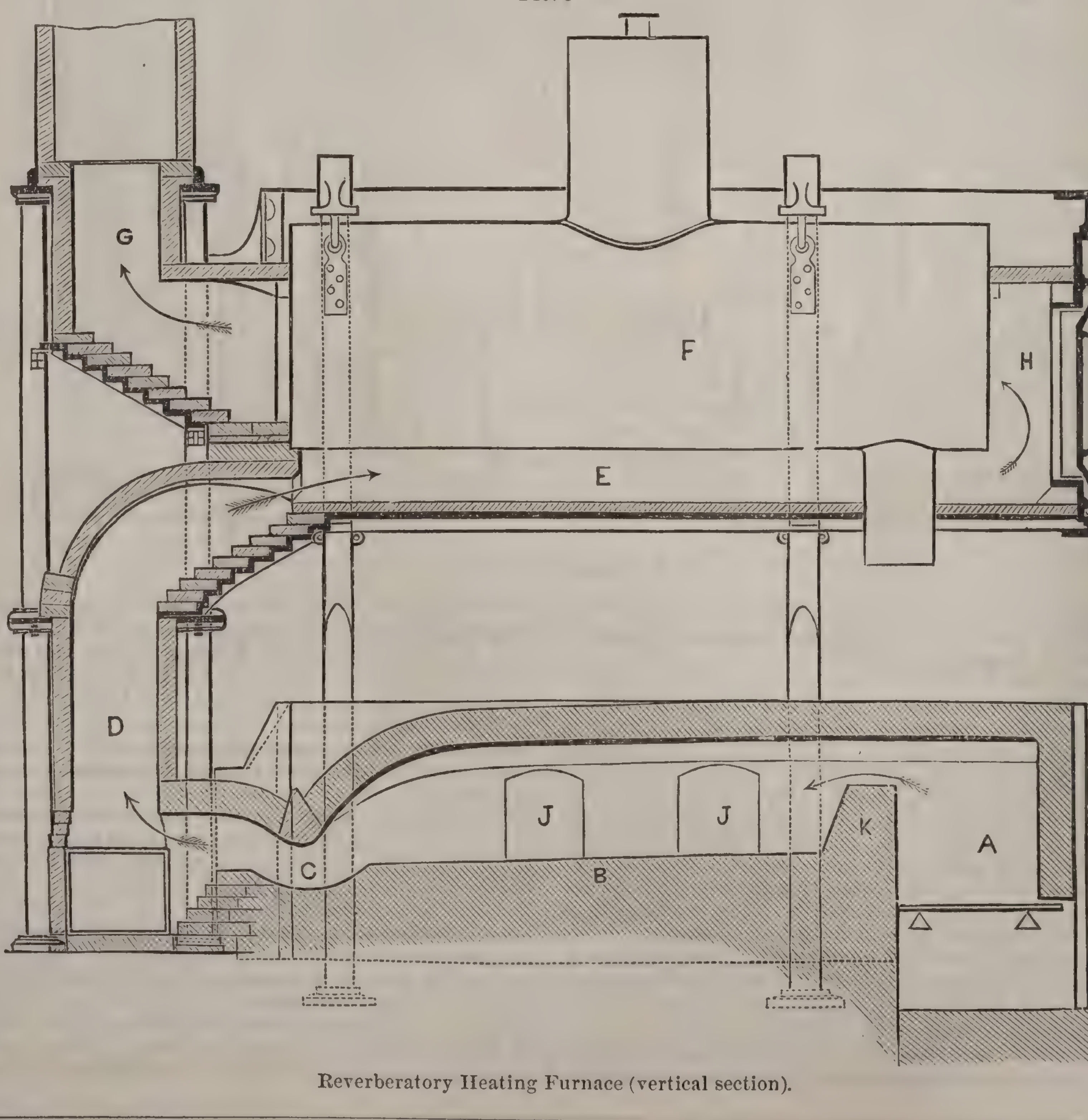
FIG. 2.



Front Elevation.

fusion. The metal is separated from the fuel and shielded from the direct impact of the flame by the bridge K. The flame, passing along under the roof of the furnace, heats the metal below, partly by contact and partly by radiation. The flame-current is "reverberated" by the roof and sides, so as to roll down upon and over the metal. The contracted

FIG. 3



Reverberatory Heating Furnace (vertical section).

throat C tends to check the expansion, and hence to maintain the temperature of the burning gases at this point, although the furnace "works" hotter at the bridge than at the throat. The shape of the roof, the size of the throat, and the height of the bridge are the subjects of endless modifications to suit the nature of the work and also the caprices of the workmen. Cinder that forms from the oxidizing metal and the melting sand-bottom when high heats are employed accumulates and is tapped off at C. The furnace is a strongly bound iron shell lined with fire-brick. Upon a bed 10 to 12 feet long, six 7 × 7-inch iron rail piles can be heated to welding in 1½ hours with about 1000 pounds of coal per ton of iron. The engraving also shows one of the various arrangements of boilers for utilizing the waste heat of the furnace. The boiler F and its brick casing are placed over the furnace (to save room), and upheld by iron columns. The hot products of combustion pass up the flue D, under the boiler at E, and through the boiler flues into the chimney G. The tubes are accessible for cleaning through the doors H. In mills for rolling iron rails all the steam for driving the engines may be generated by the waste heat from the furnaces. Steel-heating furnaces are worked at a lower temperature, and the boilers over them do not furnish all the required steam.

The reverberatory melting furnace, or "air" furnace for solid fuel, is of similar construction. In the older form (Fig. 4) the flame and any free air it may contain are drawn from the fire-box A along the roof of the furnace, and do not come into very direct contact with the metal lying on the bed B. In the later form (Fig. 5) the flame from A is thrown by the roof directly upon the iron lying at B. This furnace therefore melts faster, but it oxidizes the metal more rapidly. The average air furnace melts 2 tons of pig-iron with a ton of coal. In foreign practice reverberatory melting and heating furnace fires are maintained by the draft of large and high chimneys. The same is true of the reverberatory furnaces almost universally employed in this country for melting iron for cannon and rolls. But in our later foundry and rolling-mill practice fires are maintained more uniformly and with less expense by blast from power blowing-machines, usually rotatory high-speed fans. Iron melted in an air furnace, as compared with that melted by direct contact of fuel in a cupola, escapes contamination by the sulphur and phosphorus in the fuel, and its carbon and silicon may be oxidized to any extent required for castings in the air furnace, thus increasing its strength. The recent practice of melting 5 to 20 per cent. of soft steel scrap, as required, with cast iron in the cupola is found to make equally strong castings for many purposes.

Fig. 4.

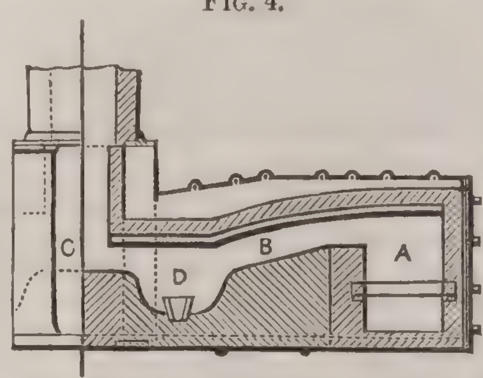
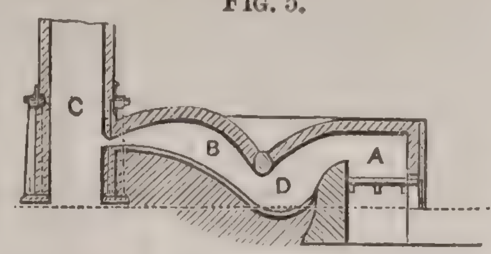
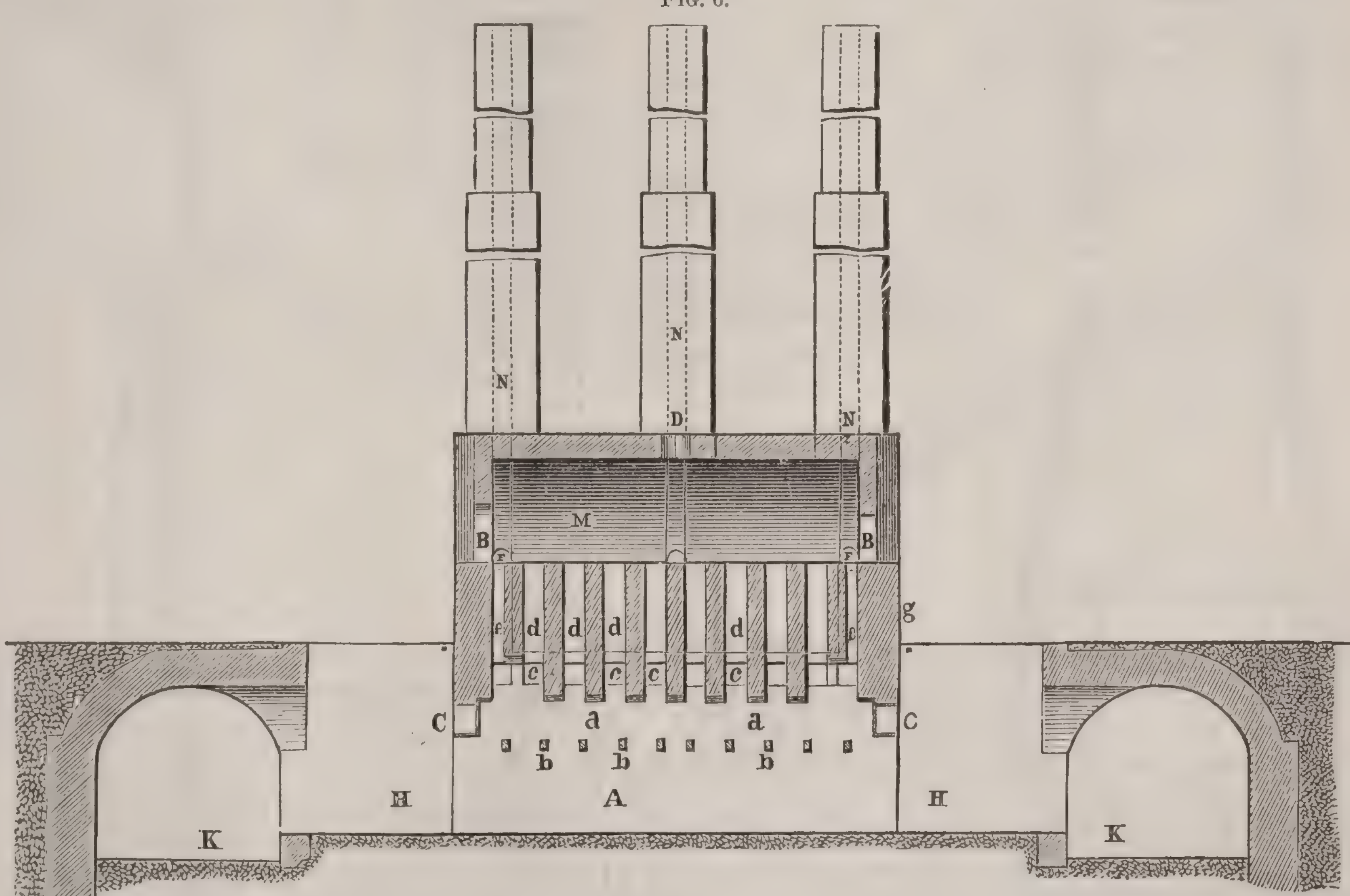


Fig. 5.



The cementing furnace is shown in vertical section by Fig. 6, and in horizontal section by Fig. 7. It is employed for heating wrought iron in contact with carbon to make carburized iron, called "blister steel," which is then rolled into marketable shapes or broken up and melted in crucibles to make cast steel. The same general type of furnace is suitable for annealing metals and for reversing the operation of cementing—viz. heating bars or castings in contact with oxide of iron to withdraw carbon. The furnace consists of two pots or troughs of refractory material (defined in Fig. 7 by the letter G at the four corners of each pot), each about 13 × 4 feet in plan and 4 feet deep, capable of holding 15 tons of iron bars. The pots are surrounded and heated by means of numerous flues *c*, which pass under the bottom and up the sides, and flues *d e*, all of which convey flame from the common fire A to the chamber *m*, whence it is discharged by the chimneys N. The fire-grates lie on the bearing bars *a* (Fig. 6), and form a fireplace about 16 inches wide and 18 feet long. The large doors B B give access to the pots. H H are pits at each end of the furnace for working the fires, and K K are tunnels connecting the pits of a series of furnaces through which fuel is brought and ashes are removed. Layers of charcoal about ¼ inch thick and layers of iron bars are laid alternately in the pots (in such manner that no bars shall touch each other) until the pots are full. Then sand and a cover of fire-clay is tightly rammed upon each pot, and the doors B B are closed with brick walls, except a sight-hole in each. A fire is then built upon the grate at *a*, and a yellow to white heat is maintained on the pots for 6 to 10 days, according to the degree of carburization required. Test bars are from time to time withdrawn at the hole *g* to ascertain the progress of the cementation, and when it is completed the ash-pit doors are closed and the fire is allowed to smoulder and go out. The pots are then opened and the bars are removed. Furnaces for heating retorts in the production of illuminating gas are simpler forms of the above-described apparatus.

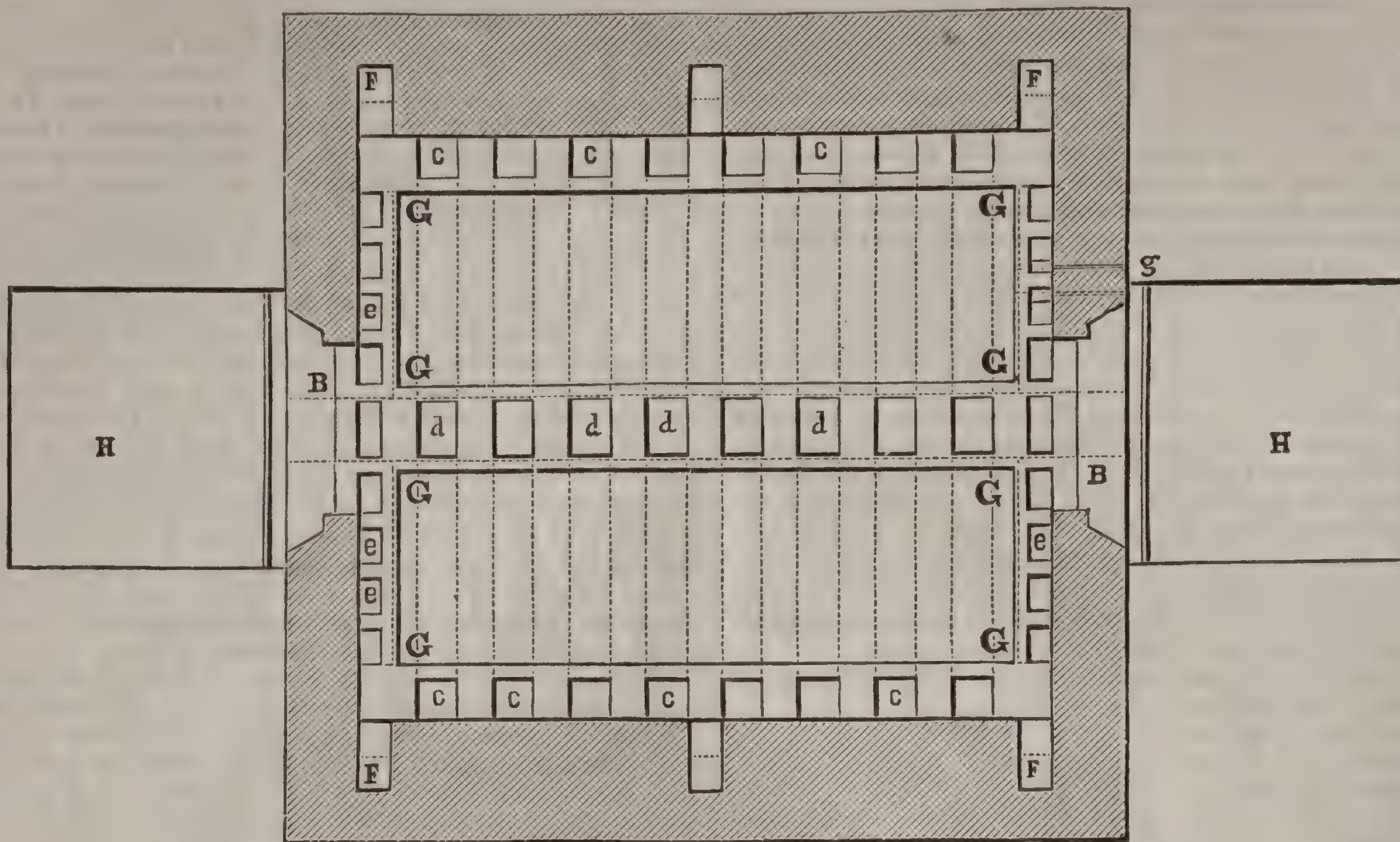
Fig. 6.



Cementing Furnace (vertical section).

The cupola furnace, in a form commonly used for melting iron in foundries, is shown in vertical section by Fig. 8. It consists of a plate-iron shell lined with fire-brick. The internal diameter is ordinarily from 3 to 6 feet. The engravings show a Mackenzie cupola, which is elliptical in cross-section in order to shorten the travel of the blast from the tuyere B to the centre of the cupola. The tuyere

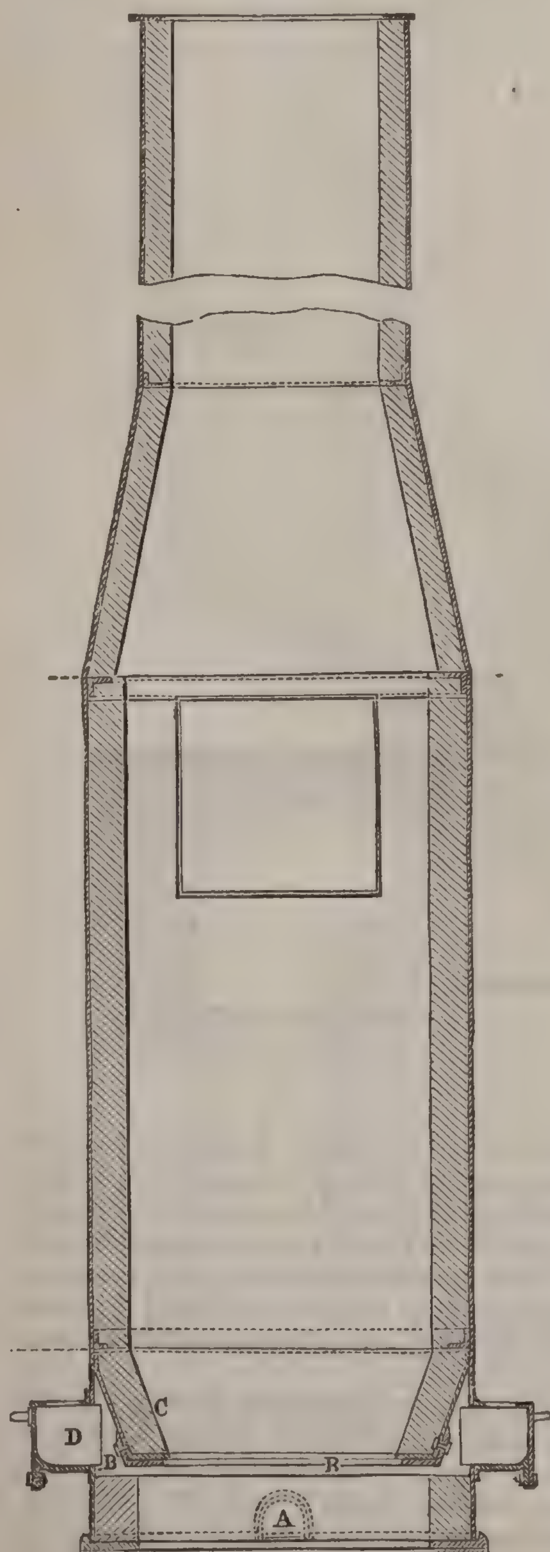
FIG. 7.



Cementing Furnace (horizontal section).

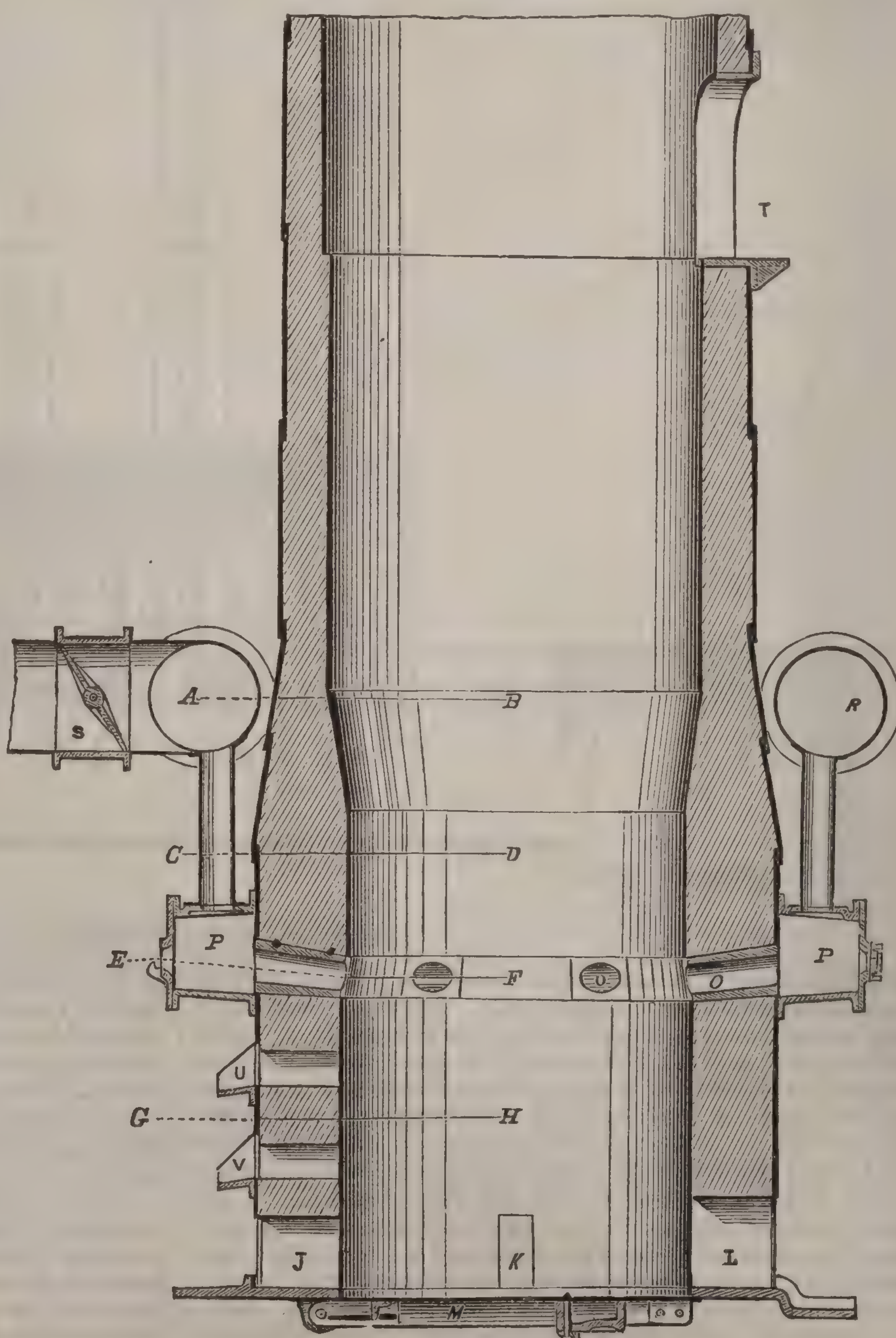
is a slit 1 inch to $1\frac{1}{2}$ inches high, and extending entirely around the furnace. Air is supplied through the wind-boxes D from a high-speed fan or a piston blowing-machine at a pressure of $\frac{3}{8}$ pound to 1 pound, according to the amount and duration of the work. The furnace is narrowed at the melting zone by the boshes C. Iron (either pig or cast scrap) and anthracite coal or coke are charged in alternate layers, and the melted metal accumulates in the hearth below the tuyeres, and is tapped off at A. Bituminous coal, being compacted by the heat and the pressure of superincumbent charges, will not permit free passage of the blast, and is hence an unsuitable fuel for cupolas. From 5 to 10 pounds of iron are melted with a pound of coal, according to the kind and size of furnace. When

FIG. 8.



Cupola Furnace (vertical section).

FIG. 9.

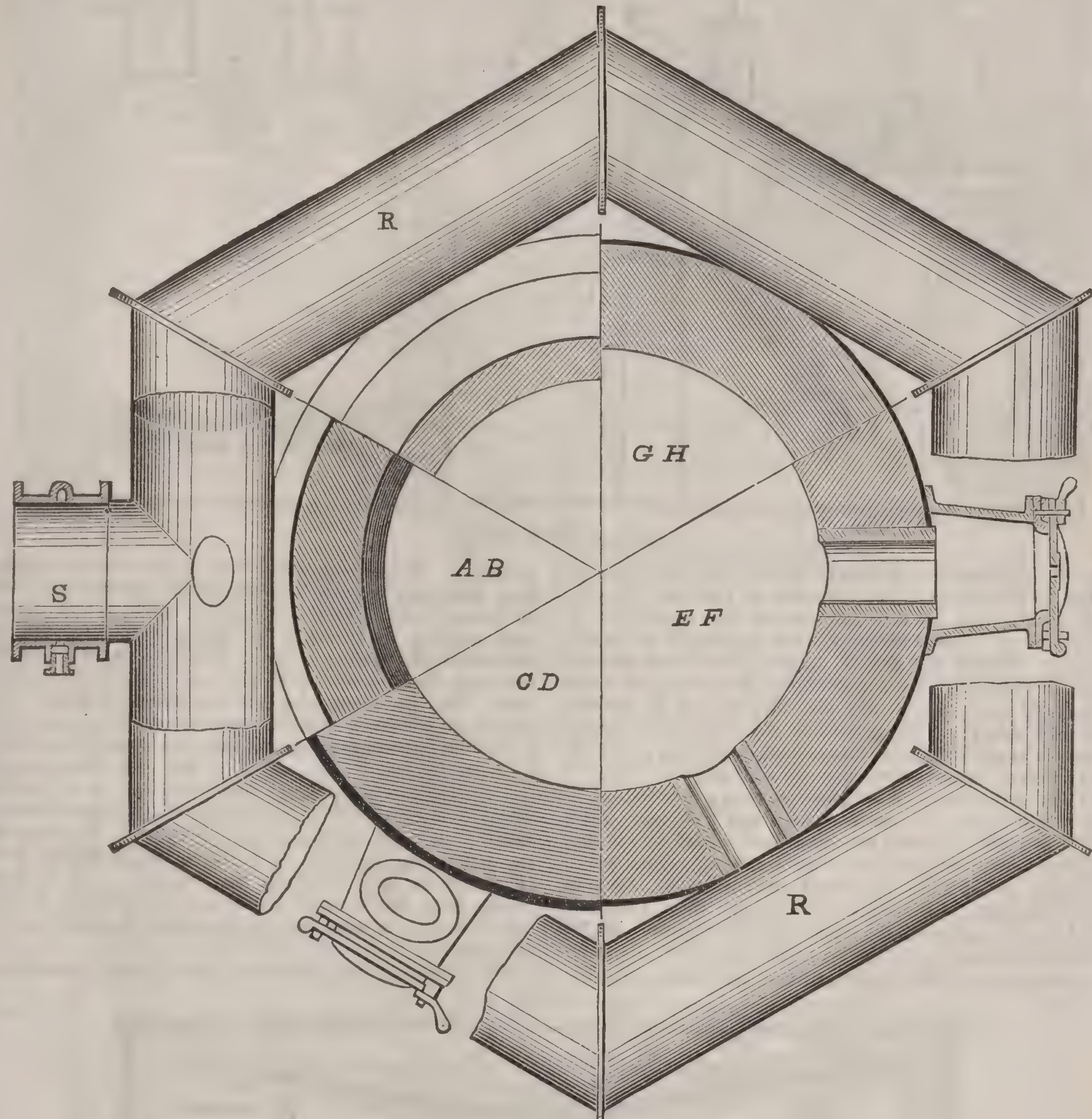


Vertical Section.

the day's melting is over the bottom doors are opened and the sand bottom and the slag and any remaining iron are dropped into the pit below.

For delivering regular quantities of melted iron for many consecutive hours—for instance, 6 tons an hour for a day and a night in a Bessemer steel-works—modifications of the cupola are required, as shown in the vertical section Fig. 9 and the cross-section Fig. 10. In the foundry cupola (Fig. 8) the hearth is shallow, so that the bed-charge of coal (which must reach above the tuyeres) may be light; and since the furnace is run but a few hours at a time, this hearth is large enough to contain the slag. If a great quantity of iron is required, large cupolas or a number of cupolas are employed. But when the furnace must melt continuously for many hours, the hearth H (Fig. 9) is enlarged to accommodate a considerable quantity of melted metal and slag, and the tap-holes U V are provided to discharge the slag as it accumulates; otherwise it would rise and clog the tuyeres and form "scaffolds," which are masses of slag and coal that chill upon the walls. The

Fig. 10.



Cross-section.

tuyeres O are cast-iron tubes, generally six in number, with a 5 × 8-inch hole in each, and are so arranged that they can be cleared while in operation by inserting a bar through doors in the wind-boxes P. In a cupola of 5 feet internal diameter the bed-charge of coal, to reach above the tuyeres, is about 2½ tons. Upon this are placed 3½ tons of pig iron and 100 pounds of limestone (to make the cinder fluid); then 600 to 700 pounds of coal, 3½ tons of iron, and 100 pounds of limestone, followed by coal, iron, and limestone in the last-named proportions. The fire is maintained by draft through the holes J K L till the bed-charge is thoroughly alight; these holes are then closed and blast is applied through the tuyeres O. When some 15 tons of iron have been melted and tapped out at L, the slag-hole U is opened. As the hearth fills again with iron the slag floating upon it runs out; and when the iron has risen to U, it is again tapped off at L. The slag-hole now remains open, and the cupola is worked continuously as last described.

The Gas Furnace.—The mere mingling of combustible gas and air is but one element in the production of the great and manageable heats obtained in a gas furnace. The regenerative principle—*i. e.* utilizing the otherwise waste escaping heat to raise the temperature of the entering air and gas—is the subject of those modern improvements which are bringing the gas furnace into almost universal use. There are two systems of regeneration: 1st, the one by means of which Messrs. C. W. and F. Siemens of London have developed the highly perfected and generally used Siemens' furnace. This consists in passing the heated products of combustion, as they leave the furnace, over vast surfaces of brick, upon which they deposit their heat. The entering air and gas are then passed over these hot brick surfaces, and, so to speak, wash off the heat from them and take it up themselves. Meanwhile, the escaping products of composition are heating other brick surfaces, which in their turn yield their heat to the incoming gases. This is the alternating system. The heat in a coal reverberatory furnace probably never exceeds 3500° F.; that produced in a gas furnace by direct combustion is the same, plus the heat returned by the regenerators, and may reach 4500° F., which is the heat at which dissociation commences, and is therefore the maximum attainable by the combustion of the gases employed. 2d. The other form of regenerator is, properly speaking, a stove, in which the outgoing gases pass on one side of thin conducting partitions, while the incoming gases flow along the opposite side, the heat being continuously transmitted through the partitions. This continuous system of regeneration, although employed in a limited or an imperfect manner long prior to Siemens' experiments, and considerably improved by Gorman in the English furnace bearing his name, has recently been raised to the Siemens' standard of excellence by Sellers, and also by Frank, in this country. The gas-producer

has also been the subject of many modifications to suit different fuels. The one illustrated in longitudinal section by Fig. 10 A and in cross-section by Fig. 10 B is the form used by Siemens for bituminous coal. It is a strongly bound fire-brick chamber, from 7 to 8 feet square in its largest dimensions and 7 feet deep. Coal charged through

FIG. 10 A.

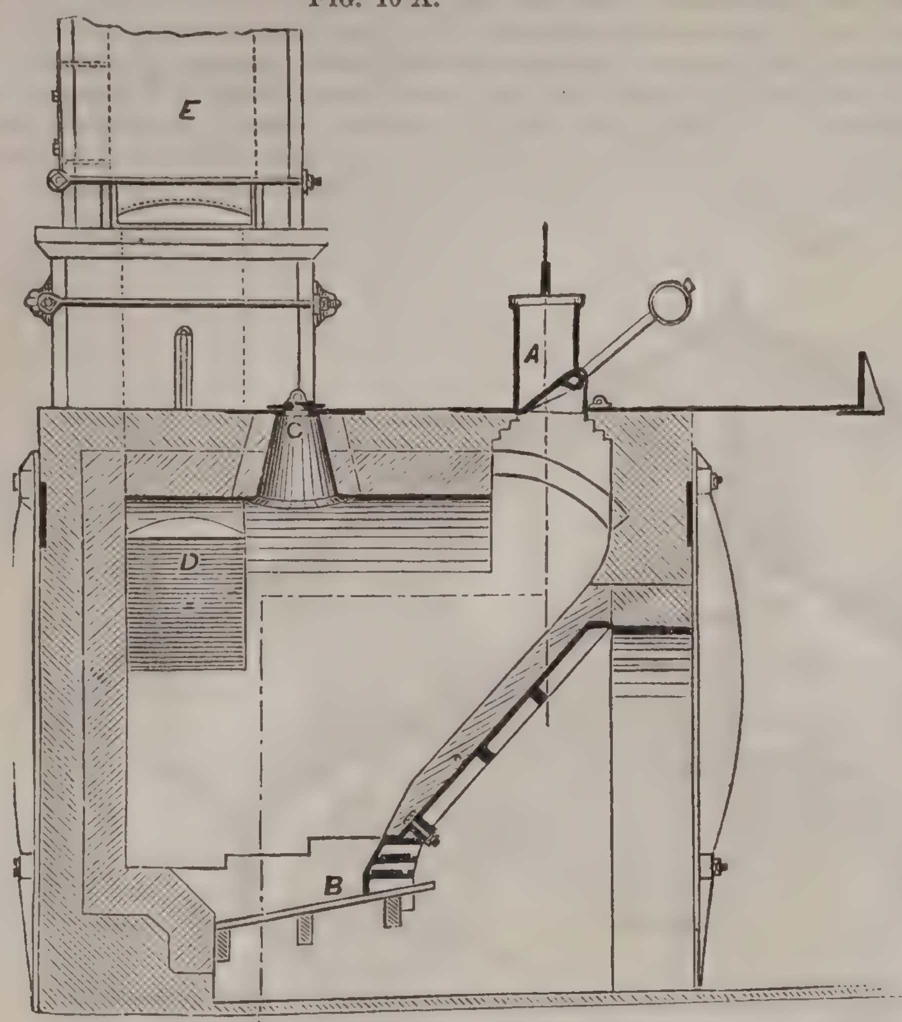
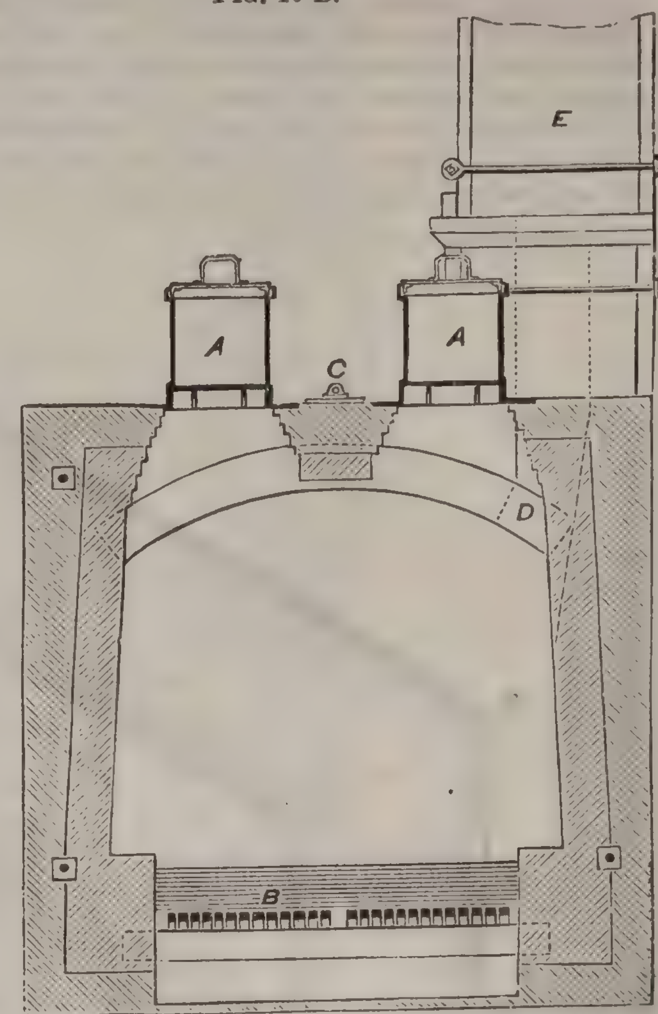


FIG. 10 B.

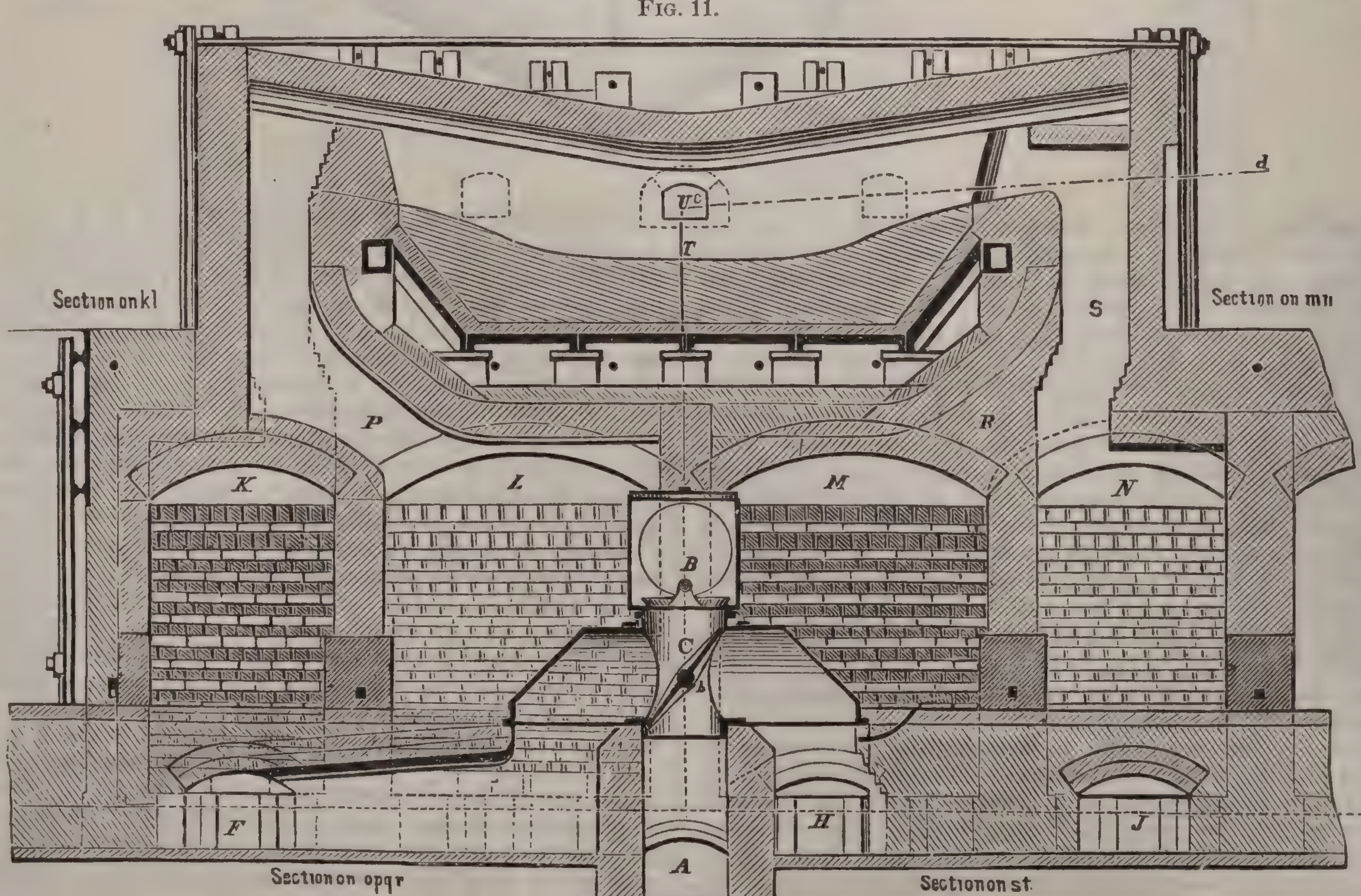


Siemens Gas-Producer.

the gas-tight hopper A is slowly burned on the grate B. The fire is stirred by a bar inserted at the hole C. By means of the flue D the gas enters the gas-stack E, which is also the outlet of three other producers arranged around it. Thence the gas is conducted by brick or iron flues to the furnaces, which may adjoin the producers or be hundreds of feet away. Air for combustion is usually drawn into the grate by means of the furnace chimney, but blast is beginning to be introduced under the grates in order to better control the rate of combustion. Some 2 tons of coal are burned in 24 hours in each producer. The anthracite producer is usually larger and has more grate surface, and jets of steam are employed, chiefly to soften the clinker. The use of water as a means of furnishing combustible gases has not proved advantageous, because their combustion produces no more heat than that abstracted in decomposing the water into these gases. Bituminous coal having been lighted in the producer, the volatile constituents, chiefly hydrocarbons and water, are first evolved. Of the remaining 60 or 70 per cent. of solid carbon, that next the grate is burned to carbonic acid, which, by rising through two or three feet thickness of incandescent carbon, is changed to carbonic oxide. The gases passing to the furnace consist chiefly of carbonic oxide, 25 per cent., hydrocarbons, 10 per cent., and nitrogen, 60 per cent. The producer and gas-flue should contain a slight excess of pressure over the atmosphere to prevent the inflow of air through crevices, and the consequent combustion and waste of gas. Placing the gas-producers below the furnace, or supplying them with air by a fan rather than by the furnace chimney draft, best accomplishes this result. Another means of producing such a plenum is the sheet-iron cooling tube, in which the gas from the stack E (Fig. 10 A) falls towards the furnace, and is thereby cooled from 300° or 400° down to 200° or 250°, thus gaining 15 to 20 per cent. in weight, which urges it forward to the furnace.

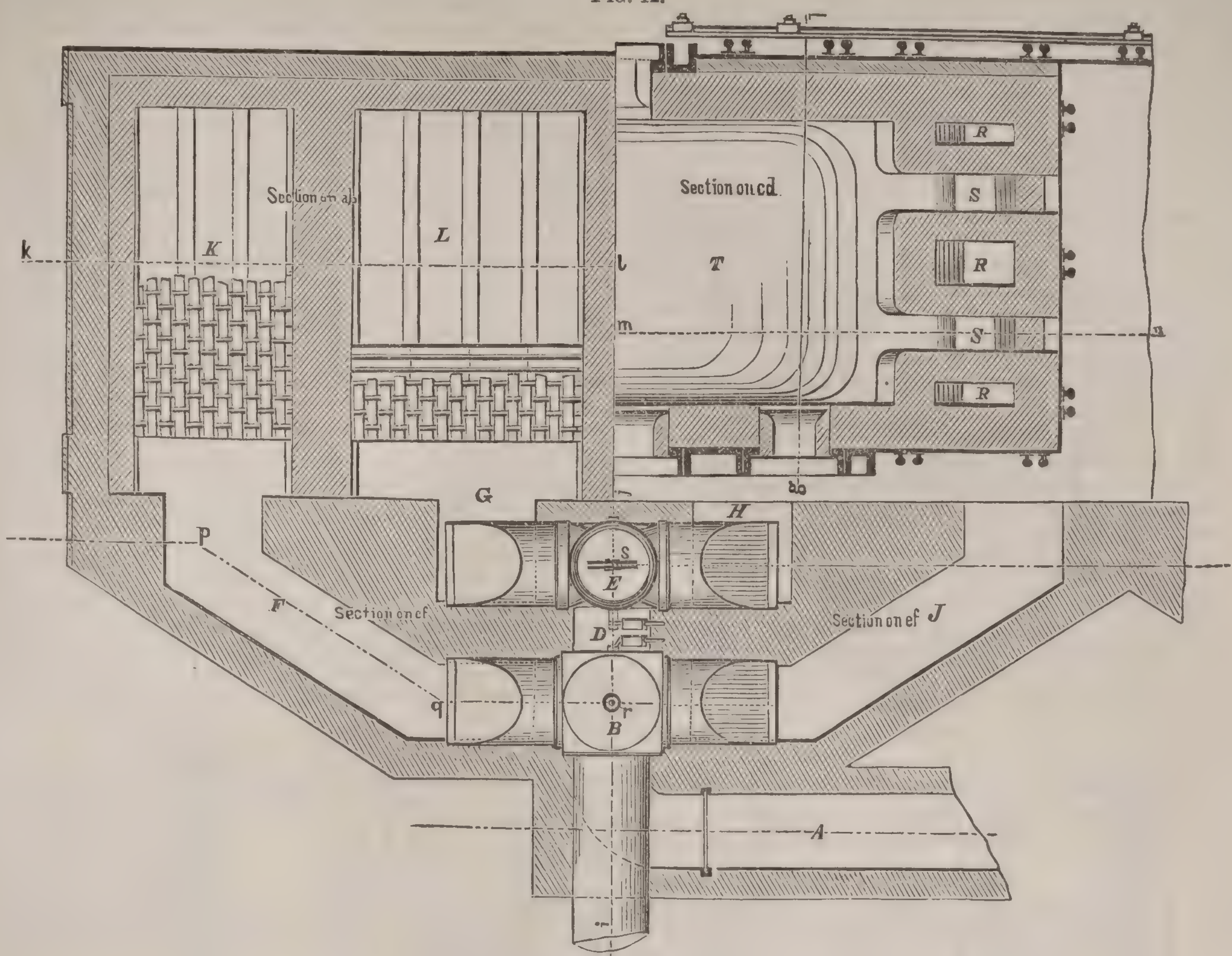
The Siemens Gas Furnace.—The general structure and

FIG. 11.



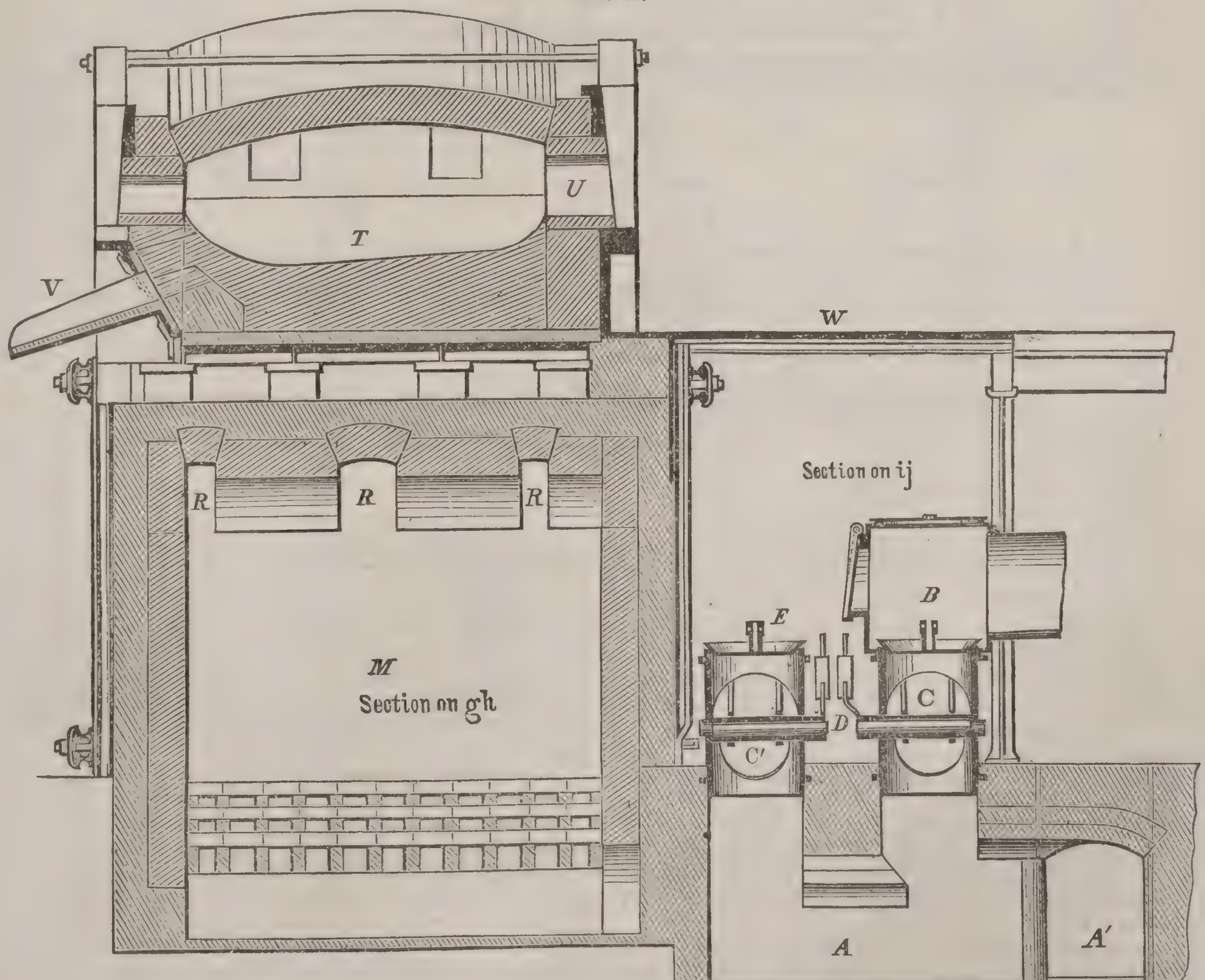
Siemens Gas Furnace.

Fig. 12.



Siemens Gas Furnace (horizontal section).

Fig. 13.

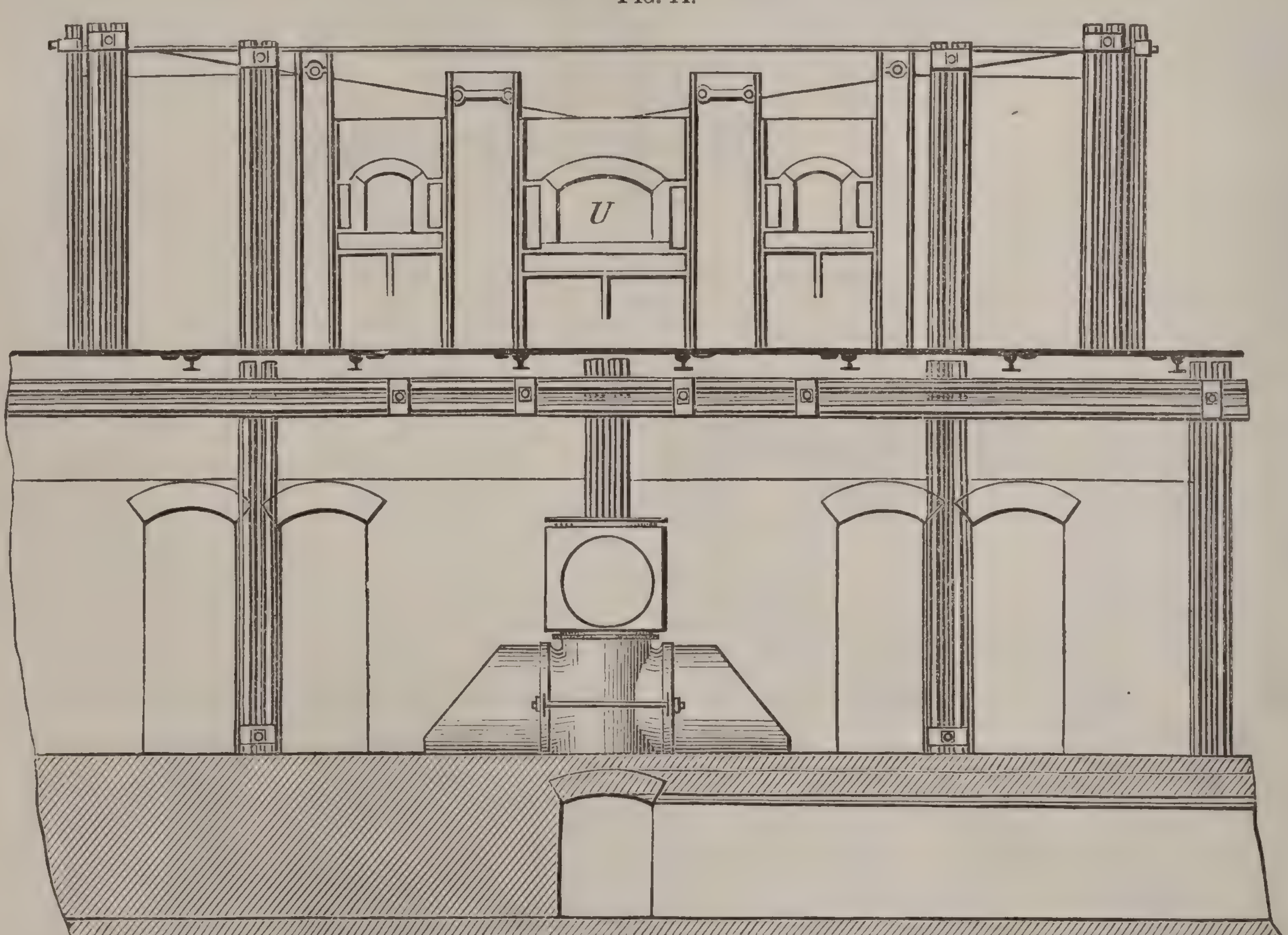


Siemens Gas Furnace (cross-section).

details of this furnace, for both melting and heating, are illustrated by Figs. 11 to 14, which represent a 5-ton open-hearth furnace for the manufacture of Martin steel out of cast and wrought iron, as built by Mr. S. T. Wellman for the Otis Iron and Steel Co., Cleveland, O. Above the floor-line W (Fig. 13) the furnace is a rectangular iron box about 22×10 feet in plan, strengthened with buckstaves, roofed and lined with fire-brick, and furnished with charging doors U, like the ordinary reverberating furnace. The sand-bed or hearth T upon which the materials are melted

rests in a heavy cast-iron basin, beneath which there is free circulation of air to preserve the parts from excessive heat. By means of the spout V the steel is conducted to the casting ladle. Fig. 14 is an exterior view of the charging side of the furnace and of the regenerator below. The regenerator consists of four fire-brick chambers K L M N (Fig. 11; shown in horizontal section at Fig. 12, and in cross-section at Fig. 13), which are filled with a checkerwork of fire-bricks stacked loosely together, so as to present the largest amount of surface to any gas entering the chamber. From each of the end chambers K N two gas-ports S lead up into the furnace (as shown on the right of Fig. 11, and in plan on the right of Fig. 12). From each chamber L M three air-ports P (Fig. 11) and R (Figs. 11 and 12) lead up alongside the gas-ports to a higher point in the furnace, in order to promote a more thorough mixture of air and gas. The ports thus form a sort of vast argand burner at each end of the furnace. The gas, air, and reversing valves and flues are shown in cross-section at Fig. 13, in plan (laid over a horizontal section of the flues) at Fig. 12, and in longitudinal section (laid over a longitudinal section of the regenerators) at Fig. 11. The operation is as follows: Gas from the producers, regulated by the puppet-valve B, passes down through the reversing valve C (Fig. 11), which is so set as to throw it into the flue F and the regenerator K, where it percolates through the mass of red to yellow hot brickwork, and thence passes at an equally high temperature into the furnace. Meanwhile, air, regulated by the valve E, is drawn by the furnace chimney into the reversing valve C′ (Fig. 13), which, being set similarly to C, guides the air through the flue G into the regenerator L where it is also heated red hot, and in this condition it passes up the port P, and meets the red-hot gas at the mouth of the furnace. The combustion is instantaneous, and intense enough, if the gas is not carefully regulated, to melt down the roof of the furnace. The flame is thrown down by the roof upon the bath of metal in the hearth T; thence it passes down the ports R S (Fig. 12) into the two regenerators M N (Fig. 11), which absorb its heat; and thence it escapes through the flues J H under the two reversing valves C C′, and into the chimney-flue A A′. After 20 or 30 minutes, the two left-hand regenerators having been somewhat cooled by the ingoing air and gas, and the two right-hand regenerators having been highly heated by the outgoing products of combustion, the valves C C′ are reversed by means of the handles D, when immediately the currents begin to move in the opposite direction; the gases pass into the furnace at R S and out through the regenerators K L. The chief advantages of the gas furnace over the coal furnace are — 1st, Less than half the coal is required for a given heat; but since the escaping heat of the gas furnace is expended in regenerating gas rather than in raising steam, additional coal must be burned under the boilers, so that the fuel-saving is reduced in rolling-mills to about 25 per cent. 2d, The saving in the oxidation of the iron heated is about 3 per cent.—a greater economy than that in fuel—and is due to the complete command of the chemical character of the flame. The prevention of smoke, the saving of space and labor, and the cleanliness of works are also considerable advantages. It will be observed, by comparing the open hearth with the pot furnace and the puddling furnace hereinafter described, that the use of gas and of regeneration may be adapted to any required shape of furnace and to all varieties of work. In the glass manufacture, for example, they are largely employed. In the gas *heating* furnace the bed is usually made much larger than in the coal reverberatory (Fig. 3), because uniformity of temperature can be much better maintained. The largest practicable coal furnace will heat, for instance, 6 or 7 three-rail steel ingots weighing a ton each; a perfectly manageable gas furnace, 20 × 12 feet on the bed, will hold 15 or 18 such ingots. The continuous regenerator will be described in a following paragraph.

Fig. 14.



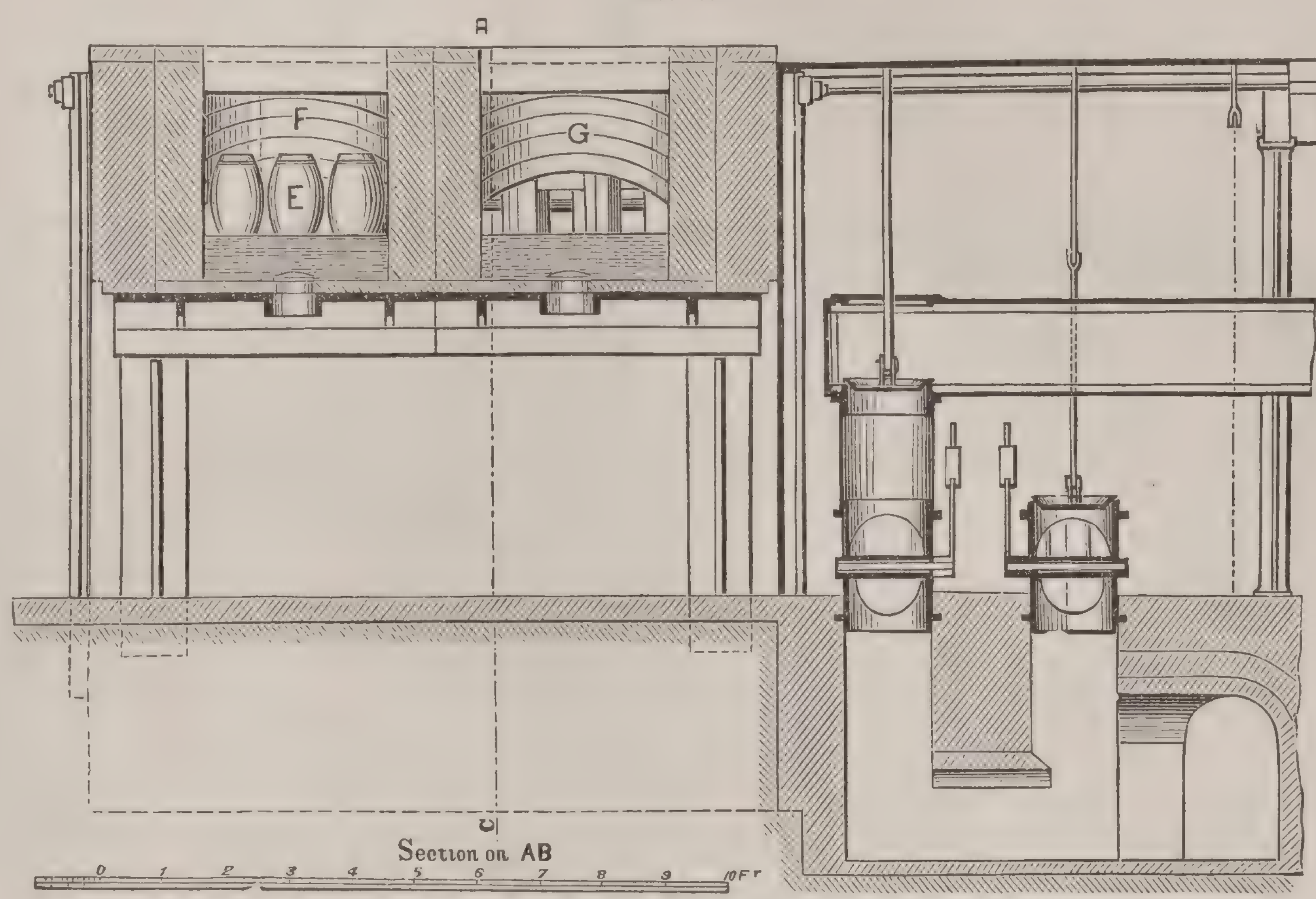
Siemens Gas Furnace (exterior view of the charging side, and of the regenerator below).

The Pot Furnace.—This is a small furnace, worked at a very high temperature, for heating fire-clay or plumbago crucibles or pots in which steel, brass, and other metals are melted. In the manufacture of crucible steel the pots containing the ingredients (chiefly wrought iron or cemented steel, and a little carbon and manganese) are about 15 inches high by 10 inches in diameter. From two to six of them are placed in a "melting-hole," which is a fire-brick furnace just large enough to hold them and the fire in which they are partially buried. The top of the furnace opens, by means of a lid, on the general floor of the building; a grate beneath communicates with a subterranean ash-pit and gangway. The fire in a coal furnace is urged by a powerful blast, and the escaping heat from a long row of melting-holes passes under a common steam-boiler. When the metal is ready to cast, the lid of the furnace is drawn to one side, the pot is lifted out, the cover of the pot is removed, and the metal is poured into a mould. Figs. 15 and 16 are respectively a longitudinal and cross-section of a Siemens gas-pot furnace. The general structure of a melting-hole and the situation of the pots E, whether coal or gas fuel is used, are shown at F G. The structure and operation of the regenerative apparatus will be understood by referring to the foregoing description of the open hearth. Gas and air, entering the hot regenerators I H respectively, mingle and burn as they enter the melting-hole G; thence they pass into and heat the regenerators J K. By means of the reversing valves the currents are changed from time to time, in order to maintain a uniform temperature in the furnace.

The Puddling Furnace.—This is a reverberatory furnace,

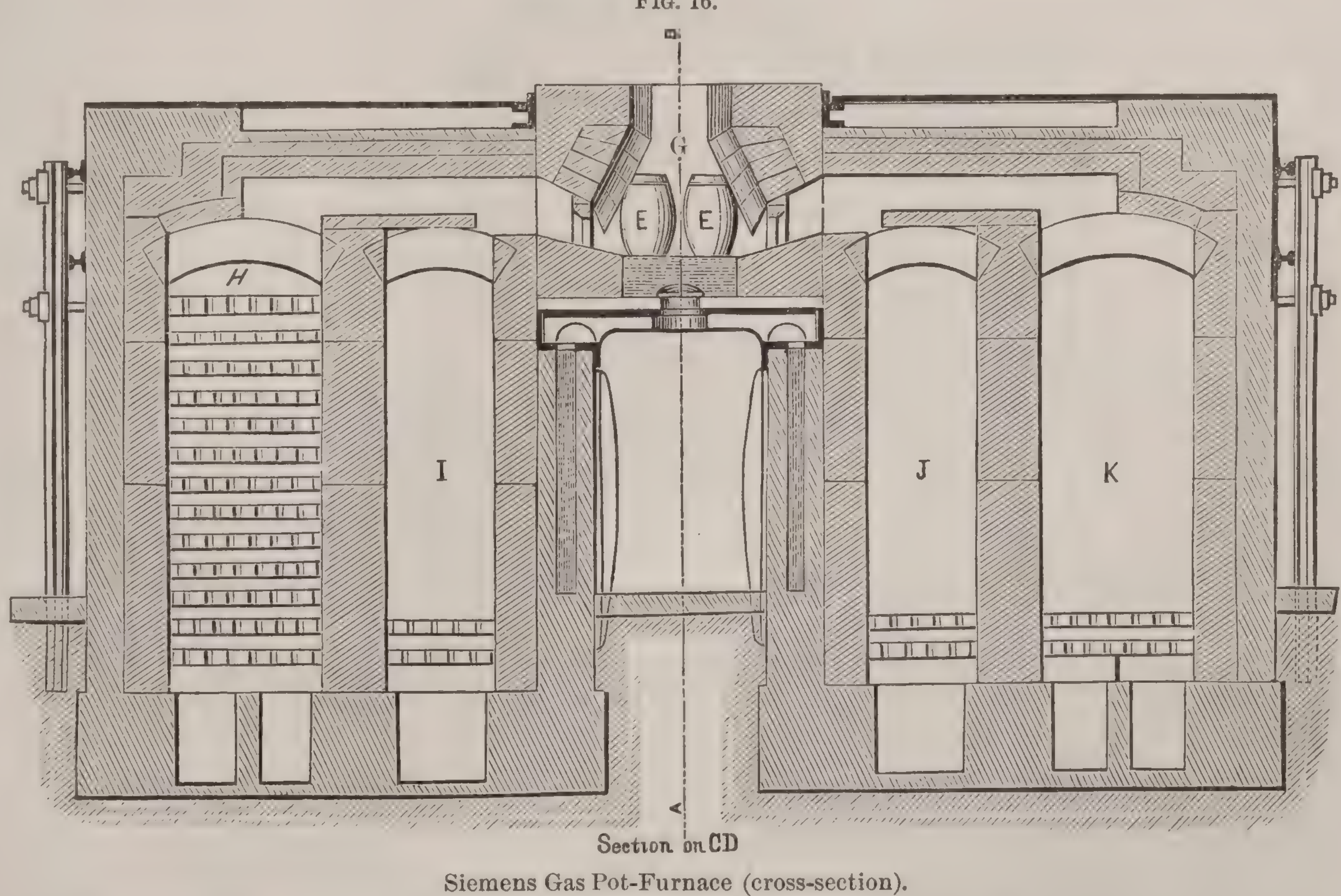
in which crude cast iron is melted and subjected to the oxidizing action of air and of oxide of iron, in order to remove its carbon and silicon, and thus convert it into a pasty mass of malleable iron. Its general construction is like that of the heating furnace (Fig. 3), except that its hearth is formed like that of the open-hearth furnace (Figs. 11 to 14). When gas fuel is employed the regenerative system is substantially that shown in the last-named engravings. The single puddling furnace has a door at one side of the hearth, by which the iron is inserted and the "ball" is removed. Through a notch in the door the workman inserts the "rabble" or hooked iron bar by which he stirs the bath and forms the iron into balls. A double furnace has doors on both sides, through which two men work in the same bath. The product of a double furnace is about two tons in ten hours. Many attempts have been made to increase the product of the puddling furnace, and to relieve the severe manual labor of stirring the charge, by mechanical appliances, chiefly by means of the revolving furnace. These contrivances, especially the successful rotary furnace of Danks, will be referred to in the article on the IRON MANUFACTURE. The general features of rotary furnaces are shown in the following engraving (Fig. 18). The wrought-iron chamber B is lined with refractory material, and supported on rollers at W and by a trunnion at Y. It is rotated in either direction as required, and it is also removed from or placed against the gas-entrances p n by means of a small steam-engine and gearing, not shown in the engraving. The furnace is constantly filled with flame, and the contained fluid iron and slag are stirred either violently or gently by its fast or slow rotation. One end of the Danks furnace is set against a firebox like the firebox

FIG. 15.



Siemens Gas Pot-Furnace (longitudinal section).

FIG. 16.



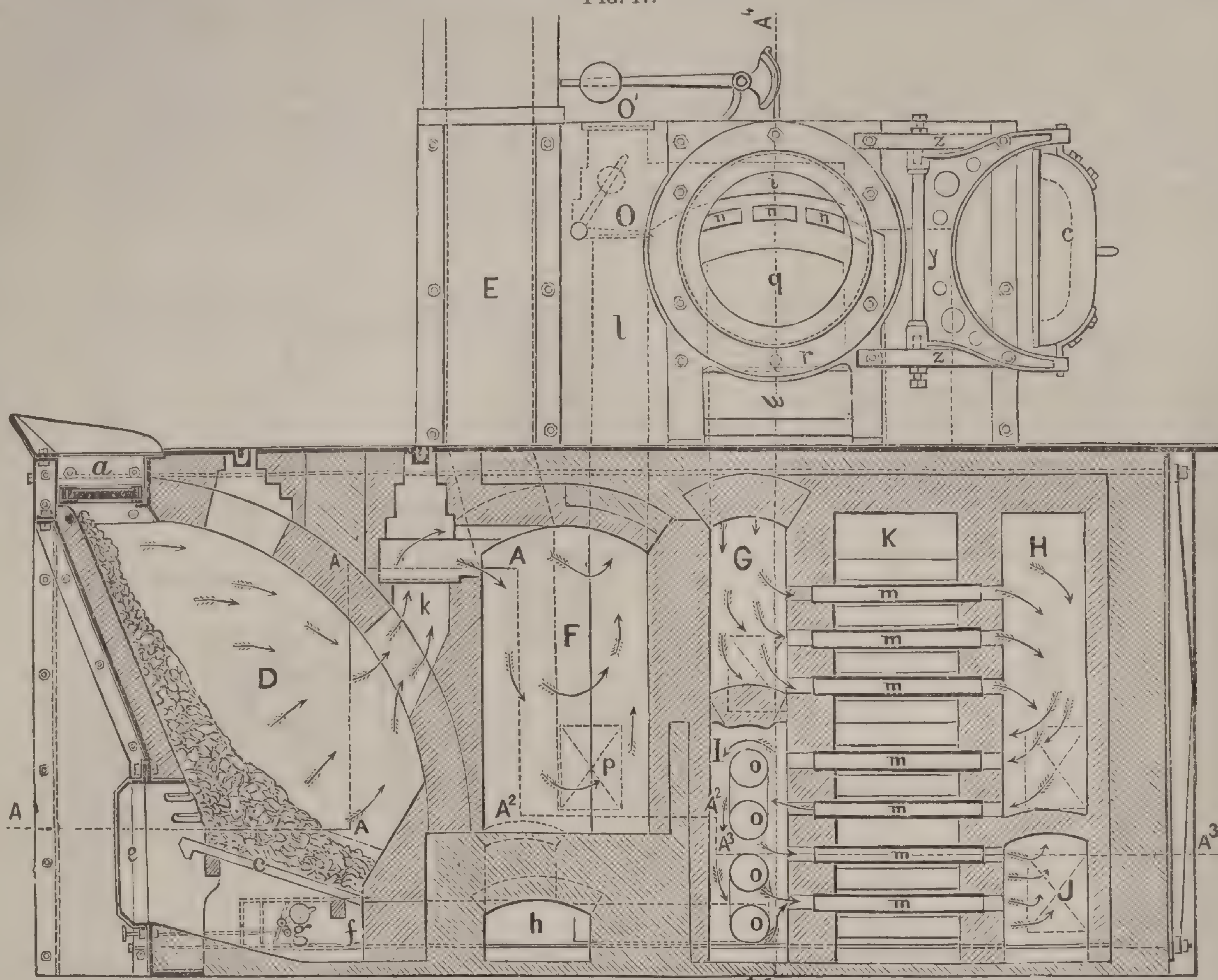
Siemens Gas Pot-Furnace (cross-section).

of the ordinary reverberatory (Fig. 3), and a removable uptake covers or uncovers the other end. In the Sellers furnace, here shown, gas from a producer entering at l, and air at n, unite at the top of the furnace, reverberate as shown by the arrows, and pass from the same end of the furnace at g into the regenerator.

The Continuous Regenerator.—Figs. 17 and 18 illustrate generally the rotary puddling furnace as above described, and also the gas-producer, boiler, and continuous regenerative system, as applied to gas, puddling, and other furnaces by Messrs. William and George H. Sellers of Philadelphia. The regenerator consists of the three chambers G K H (Fig. 17), and the fire-brick tubes m. Fig. 18 is a vertical section through the chamber G, looking into the ends of the tubes. The products of combustion continually flow out of the furnace at g (Fig. 18), into the chamber G;

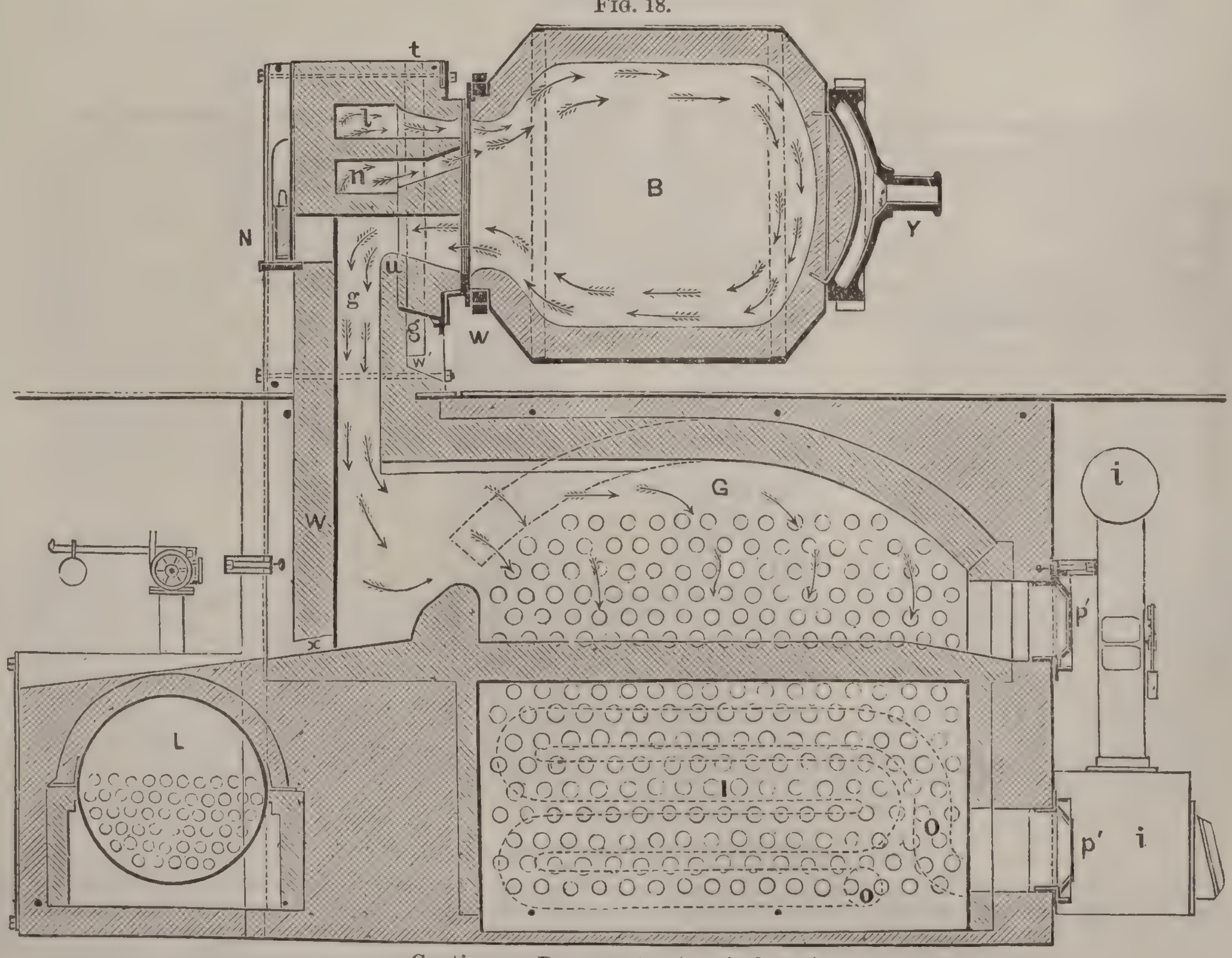
thence through the upper series of tubes to H; thence through the middle series of tubes to I, and thence to the flue J, which conducts them through the boiler L into the chimney E; or they may pass directly to the chimney. Meanwhile, the incoming air for combustion, entering the chamber K at p', continually flows around the tubes, and thence into the furnace at n (Fig. 18). Thus, the escaping heat of the furnace is transmitted through the walls of the tubes to the entering air. An important feature of this system of continuous regeneration is that the air entering the bottom and rising through the chamber K encounters successively hotter tubes, and receives its highest tempera-

FIG. 17.



The Continuous Regenerator.

FIG. 18.



Continuous Regenerator (vertical section).

ture just as it enters the furnace from the escaping gases just as they leave the furnace. For various purposes sufficient heat is obtained by regenerating the air alone, especially when the producer (D, Fig. 17) is close to the furnace, so that the gas loses none of its initial heat in long conduits and cooling-tubes. When a greater temperature is required in the furnace, a part of the escaping heat is applied to the entering gas also by means of a similar re-

generator. The regeneration of either the air or the gas alone is obviously not peculiar to the continuous system. In the apparatus illustrated various improvements are introduced: the escaping gases leave the regenerator at a sufficient temperature to raise steam in the boiler L for operating the rotary puddling furnace; the producer D has a closed ash-pit, and air is supplied to it, and also to the regenerator, by means of a fan instead of chimney draft, so that the working may be more nicely regulated; and the gas deposits any dust and ashes that may rise with it in the chamber F before passing into the furnace. An arrangement is also shown for heating the air in the tubes O (a small continuous regenerator) before it enters the producer.

Conclusion.—A treatise on furnaces without descriptions of the different smelting furnaces, and of numerous standard forms of apparatus for applying heat in the various arts, is obviously incomplete: they are all, however, special applications, and as such are described in the treatises on these arts, and they are all modifications of the typical forms herein described. In those arts where fuel is used on the largest scale, such as the manufacture of wrought iron, steel, and glass, and where the highest temperatures are required, the grand improvement of the period, already becoming general, is the use of gaseous fuel, and its regeneration by means of the escaping heat of the furnace. One, at least, of the most important modern manufactures—that of open-hearth steel—is the direct result of the regenerative gas furnace. Heat of sufficient intensity and of suitable chemical character was unattainable by any other known means. The temperature of dissociation having been attained, further improvements would appear to lie in the direction—1st, of economy—less than one-tenth of the theoretical value of fuel is utilized in the best furnaces; 2d, of more enduring refractory materials — fire-bricks are melted at easily attainable heats, and all refractory compounds are soon destroyed by chemical reaction with the ingredients under treatment. ALEX. L. HOLLEY.

Furnace (HEATING). See WARMING.

Fur′nas, county of Nebraska, bounded S. by Kansas. Area, 900 square miles. It is watered by the Republican River, and affords good grazing. Cap. Beaver City.

Furnes [Flemish *Veurne*], town of Belgium, in the province of West Flanders, at the junction of three canals, has a large trade in corn, butter, cheese, and linen. P. 4694.

Furness (HORACE HOWARD). See APPENDIX.

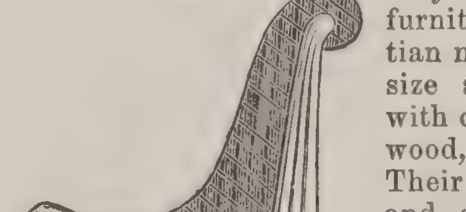
Fur′ness (WILLIAM HENRY), D. D., a clergyman, b. in Boston, Mass., Apr. 20, 1802; a graduate of the Boston Latin School and of Harvard College, 1820; studied theology at Cambridge, and was ordained pastor of the First Congregational Unitarian church in Philadelphia in 1825; there he has since remained. Dr. Furness is widely known as an author; has published a volume of prayers (1850), a volume of sermons (1855); has written devotional poetry of tender feeling; has made numerous translations from the German poets, and has published a volume of prose tales from the German (1856). He has printed many sermons in pamphlet, has contributed articles to the *Christian Examiner*, mostly on his favorite subject, the New Testament Gospels, and was for three years editor of the *Diadem*, an annual published in Philadelphia. But his name will be remembered in connection with the anti-slavery movement, in which he took an intense interest, and on which he frequently and earnestly preached; and with the attempt to recover the character of Jesus by a fresh study of his biographers. His chief literary works were on this theme, the successive volumes being simply attempts at more complete and convincing statement. The first, *Remarks on the Four Gospels*, appeared in 1836; *Jesus and His Biographers*, in 1838; a *History of Jesus*, in 1850; *Thoughts on the Life and Character of Jesus of Nazareth*, in 1859; *The Veil partly Lifted*, 1864; and *Jesus*, in 1871. He also translated from the German, with notes and comments, Dr. Daniel Schenkel's *Characterbild Jesu*, an elaborate essay written as a reply to Renan's work (2 vols., Boston, 1866). (For an estimate of his view of Jesus see the *North Amer. Review* for Oct., 1850.) Dr. Furness is remarkable for a spirit of noble and pure enthusiasm, for earnestness of religious conviction, and for delicacy of literary taste. His fame as a preacher stands very high. In sectarian controversies he has never taken part, nor has he been interested in the extension of the Unitarian faith as a peculiarity, preferring to stand outside of organizations. O. B. FROTHINGHAM.

Furness (WILLIAM HENRY, JR.), son of the above, an artist, b. in Philadelphia May 21, 1828; d. in Cambridge, Mass., Mar. 4, 1867. On leaving school at the age of sixteen, he went into a counting-room, but was there only one year, his passion being for art. His skill in crayon portraits gained him reputation and money; he went to Brooklyn, N. Y., thence soon after to Boston, where a residence of two or three years enabled him to accumulate sufficient means by his pencil to spend more than two years abroad, studying art in Düsseldorf, Munich, Dresden, and Venice. On his return he established himself as a portrait-painter in Philadelphia, married, removed his studio to Boston, and lived in Cambridge. His improvement as an artist was rapid, and at the time of his death he stood in the front rank of his profession. His best work is marked by firmness of drawing, truth of color, fidelity to characteristic traits of feature, and fine feeling of expression. His genius was delicate, his spirit gentle, his taste refined; but earnest study saved him from weakness, and his simple love of truth imparted to his portraits a living charm. He was fortunate in his subjects. Charles Sumner, Lucretia Mott, Dr. Furness, John W. Field, Hamilton Wilde the painter, J. P. Lesley, the daughter of R. W. Emerson, with many persons besides of intellect and character, sat to him. But his best work gave only the promise of what he might have done had he lived. O. B. FROTHINGHAM.

Furni′ture [Fr. *fournir*, to "furnish"]. The furnishing of houses with utensils and ornaments will represent the kind and degree of civilization among any people. With savages, furniture is of a very rude and coarse description, and needs little remark. The furniture of the dwelling of an opulent Persian, Assyrian, or Syrian 2500 years ago (and it has changed but little in the lapse of centuries) may be very briefly described. Entrance was through the centre of the windowless front by a broad, low door—through which the horses or asses also found their way—into the inner court, with its fountains, its garden, and its flowers, from which there was an ascent by a flight of steps to the gallery of the second floor. Opening from this gallery were large rooms, the floors covered with mats, and with broad divans ranged along one side covered with rich shawls, while on the opposite side were closets and chests or coffers richly adorned, or perhaps inlaid with copper, silver, and gold wrought with great skill. In these were kept the costly robes and jewels and the rare and costly perfumes which formed a large item in the wealth of the Oriental nobleman. The dining-room was furnished with a table occupying three sides of a square, with couches on which the guests reclined, placed around the table on the outside of the square. The banquet was likely to be served with dishes of gold and silver, massive and precious, but without forks or spoons. The kitchen utensils were few in number, made of metal, and each one served for several purposes. The cooking was done by an open fire.

The Egyptians, who were for many centuries the most refined and civilized of all the nations of the world, were the earliest to provide abundant furniture for their dwellings, and, with the possible exception of the Phœnicians, the most skilful in its construction. A Theban mummy-case, which from the inscription seems to have been made about 1600 B. C., or almost 3500 years since, now preserved in the Louvre, has its corners very carefully dovetailed, though no other nation made use of this form of joint for many centuries later. These mummy-cases (Fig. 1), often encrusted with ivory or with the precious metals, formed at a very early period a part of the furniture of the dwelling. Egyptian nobles had chairs of great size and beauty, ornamented with carvings and bas-reliefs in wood, ivory, or metal. (Fig. 2.) Their bedsteads were massive and decorated with abundant sculptures in bas-relief, and their mirrors of polished metal were large and adorned with carvings of animal life.

FIG. 1.



Mummy-case in Oak.

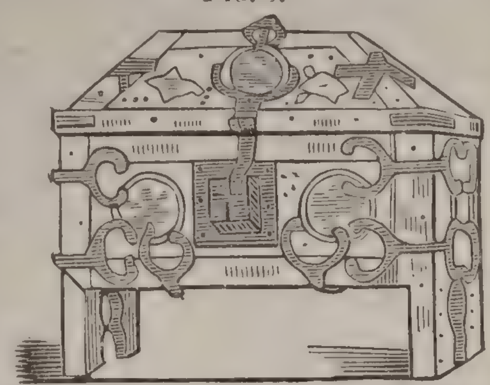
FIG. 2.

Egyptian Throne, or state chair.

The intellectual Greek led too public a life, and was too fully devoted to public displays in art, literature, and philosophy, to give any considerable attention to the decoration of his dwelling. Hence, while all the public edifices, temples, theatres, statues, and paintings of Greece are models of excellence, we have no contemporaneous representations, either in painting, carving, or sculpture, of the interiors of dwellings. We know, indeed, that the Greeks reclined at their meals upon the triclinia or couches around the table, which formed three sides of a hollow square—except the Lacedæmonians, who adhered to the benches

and the sitting posture; that they were also simpler in decoration than the Oriental nations; that their beds and bedsteads in some of the Grecian cities, especially in Corinth and the half-Grecian city of Ephesus, were the most costly and ornamental of all their furniture, calling into exercise the genius of their most eminent sculptors and carvers; and that aside from coffers for their treasures and jewels, closets for their valuable rolls of papyrus or parchment, and wardrobes for their clothing, all much plainer than those of the Orientals, their houses must have been bare of furniture.

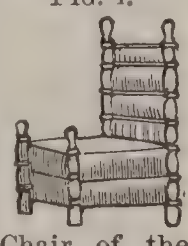
Fig. 3.



Coffer or strong-box of the twelfth century.

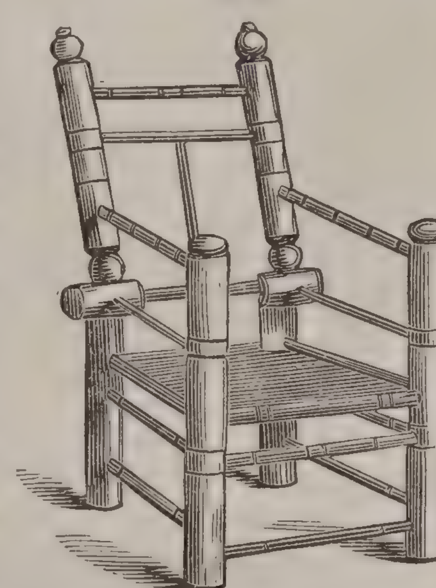
The Roman, with far less artistic taste than the Greek, had a more practical character. In the early history of republican, and even regal Rome, home had its attractions, and such adornments as would enhance these were sought. The couches, chairs, tables, beds, coffers, strong-boxes, libraries, and closets depicted in the paintings on the walls of Pompeiian dwellings, or if of metal preserved there, indicate that great advances had been made in the production of furniture, and that Roman artists had followed Egyptian models in household decoration. As luxury increased, this decoration extended to the smaller and more portable articles of furniture. Many of these were of exquisite workmanship. When the Western empire collapsed, sinking under the inroads of Goth and Hun, all this luxury vanished, and there came in its place the ruder and simpler forms of Gothic art. (Figs. 3 and 4.) The movements which led to the revival of letters and of high art led also, by gradual steps, to the improvement of this Gothic furniture, and demonstrated that in skilful hands even its rude arches, its heavy timbers, and its rough, unhewn beams and rails were capable of being transformed into forms of great beauty and delicacy. (Fig. 5.)

Fig. 4.



Chair of the twelfth century.

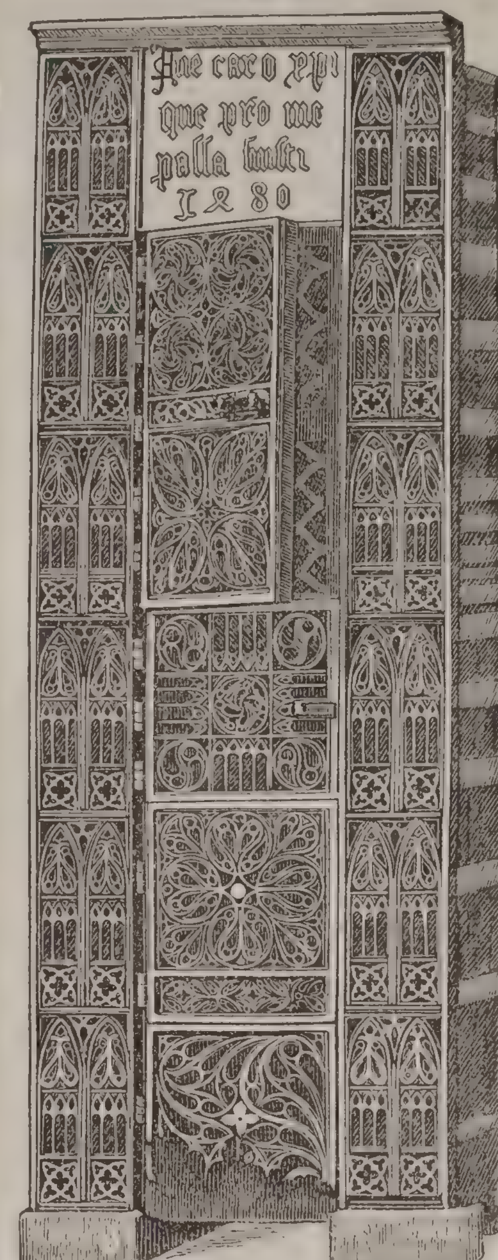
Fig. 5.



Baron's Chair of the fifteenth century.

Among the earliest artists to evolve these new beauties from what had hitherto seemed coarse and crude were the Scandinavians—Swedes and Norwegians. Some of their church-stalls, wardrobes, bedsteads, etc. made in the fourteenth century developed in a remarkable degree the capacity of the Gothic architecture for delicate traceries and artistic effect. The introduction of the ogival style in the ornamentation of furniture, which was first attempted in the fifteenth century, added greatly to the beauty of the larger and heavier articles. (Fig. 6.) About the beginning of the sixteenth century the architectural style known as the *Renaissance* began to be applied to the larger articles of household furniture. The Renaissance, though professedly a *revival* of the ancient classic art of Greece and Rome, was really a combination, more or less complete, of the architecture of the luxurious period of the decadence of the Roman empire with the more ornamental styles of the later Gothic. In its application to furniture, however, a better effect was produced than in the development of its bizarre features in large public edifices. The principal artists and architects who were instrumental in introducing the Renaissance style into furniture were the Germans—Gabriel Krammer of Cologne; Jacob Guckeisen and Wendel Dietterlin of Strasburg; Jan Fredeman van Jode (called De Vries or the Frisian), a Dutch designer and engraver; a little later Krispin van Passe, also a Hollander, and the French architect Jacques Androuet, called Ducerceau; and at a later period Undentroh, a German architect. All except the last three belonged wholly to the sixteenth century. The era of Louis XIV. (1643–1715) was, so far as both architectural art and the designing of elegant furniture was concerned, a period of decadence; the style known among architects as the *Rococo* prevailed both in furniture and building; there was great splendor in gilding and bronze, but the designs were not artistic, and there was an incongruous mingling of ancient and modern styles which was almost entirely devoid of character or of the best effect (Fig. 8); and though curiosity-hunters are sometimes in raptures over the barbaric splendors of some of the furniture of the era of *le Grand Monarque*, there is little in it to satisfy a refined and cultivated taste. The latter part of the eighteenth century was marked by a very general return in architecture and the other fine arts to classic models, and these were copied so closely, and with so little regard to the advance which civilization had made in 2000 years, that they preserved all the faults without any considerable portion of the spirit of the classic age. During the present century the various eras of Gothic architecture and the Renaissance period have found their admirers, and the prevalent tendency of the age is rather to the florid or decorated Gothic and the Italian styles of the Renaissance than to the pure classic or the silly and unmeaning vagaries of the rococo style. There have been some indications both in England and the U. S. of an attempt at the creation of a new and distinctly original style of architecture, and of its application to the best qualities of furniture; but it must be confessed that there is far too general a tendency to rest contented with variations and new combinations of the classic, Gothic, and Renaissance designs. Some of these are very tasteful, and possess high merit of a certain order, but there are certainly resources in nature as yet unused by art, and it only needs the vivid perceptions of genius and the skilful hand of the master to bring them out and delight the world by new revelations of the beautiful. The large use of iron and steel, and later of the rattan, in the production of furniture has had an influence, thus far, to subordinate beauty to use. The furniture is cheap, strong, durable, and in general not objectionable in form, but for the most part it is not artistic or beautiful. When we have attained such

Fig. 6.



Closet for missals, etc. of the church of Egebrae, Norway, made in 1480.

Fig. 7.

A Hanging Dressing-Table with shelves, in oak, Renaissance style, designed by Fredeman van Jode.

control over these materials as to make them plastic and readily moulded for use in all their forms, we may be able to unite beauty and usefulness; and then will be the best

FIG. 8.

Easy-Chair of violet ebony, the seat and back covered with Gobelins tapestry (about 1715).

opportunity for the introduction of new conceptions and designs, which in the end shall make the American styles of architecture, whether in building or furniture, as famous as have been the Greek or the Gothic in the past.

We have thus far said nothing of the furniture produced by the Chinese, Japanese, and other nations of the extreme East. Their cabinets and coffers, their lacquered wares, and their porcelain are certainly very attractive, and in a certain sense beautiful; their inlaid or marqueterie work is admirable, and much of their carving is of great delicacy of finish; but their designs are exceedingly grotesque, their perspective is constantly at fault, and their hinges, locks, and metal-work are mostly worthless. They develop no new designs; their work a thousand years ago was from the same patterns and quite as perfect as now.

In the matter of inlaying, mosaics, and marqueterie the Italians, French, and Hollanders have, in the last three centuries, attained the highest excellence. The Russians are also very skilful in some descriptions of this work. A large table of malachite in various figures and shades inlaid in marble, presented more than twenty years since by the czar Alexander II. to Hon. Thomas H. Seymour, then U. S. minister at St. Petersburg, is one of the finest examples of this kind of work. *Marqueterie* (the term used for inlaying figures with fine wood, ivory, or shells, in distinction from *mosaic*, which is the inlaying with precious stones or metals) is so abundant among the dealers in antique furniture that unless the designs are of special excellence they attract very little attention, and hardly bring any advance of price.

But while artistic furniture delights the eye and gratifies the refined taste, it is not to be forgotten that in the present artificial condition of society, furniture is a necessity, and not a luxury, to the greater part of the civilized world; and while we are entitled to ask that the forms of even the most common articles of furniture should not be rude or uncouth, we can hardly look for any considerable development of artistic excellence in the cheaper grades. Much of the furniture put upon the market has not even the merit of durability; it is cheap, and answers a tolerable purpose so long as it lasts. Made by machinery, often ill fitting in its parts, its defects concealed by glue, putty, paint, and varnish, its merits are few and its deficiencies many. A higher grade of furniture is made by hand, mostly by German, Dutch, or French workmen, and, though not of remarkable elegance, is substantial, durable, and serviceable. Probably more than nine-tenths of the furniture manufactured in the U. S. belongs to these two classes. In the division of labor which is the result of a dense and highly civilized population the production of furniture has been subdivided more, perhaps, than any other branch of mechanical industry. Thus, there are at least a dozen classes of manufacturers of chairs of different patterns—dining, common, cane-seat, easy, upholstered, office, and other chairs. Others make a specialty of sofas, tête-à-têtes, and divans; others of lounges; others, still, of sofa-beds; while yet others make only ottomans. There are eight or ten classes of manufacturers of different styles of tables; one producing only dining-tables, another ironing-tables, another card-tables, another small stands, another library-tables, another carved or inlaid tables; and so on. The manufacture of bedsteads is divided into nearly as many classes, though the best manufacturers have their finest bedsteads manufactured under their own direction; there are numerous manufacturers of what are known as chamber sets, consisting of bedstead, bureau, washstand, commode, small table, and three or four chairs. Some confine themselves to sets coated with an enamel or gilded, and having a very tasteful appearance, though they are not always durable. Others make only maple sets, stained, painted, varnished, or gilded; others make these sets of ash, black walnut, butternut, or a combination of two woods; while the better class are of cherry, mahogany (both now out of fashion), black walnut, or rosewood. Above these in quality come the carved, ornamented, or inlaid sets, which are really artistic and command a high price. The minor articles of household furniture are also very largely distributed among specialists, the best general manufacturers confining themselves to the larger articles. Library furniture — bookcases, tables, cabinets, stands, clocks, etc.—is a specialty by itself, into which very few general manufacturers enter. There is room in this for artistic display, and it is often improved.

The manufacture of iron or steel furniture, or furniture in part of iron or steel, does not to any great extent belong to the class of household goods. (Fig. 9.) The French

FIG. 9.

French Iron Bedstead.

and Germans have, however, made some artistic bedsteads and tables of iron, and our own manufacturers some of the cheaper bedsteads. The willow or wicker furniture and the rattan furniture (the latter owing its introduction almost wholly to the energy and efforts of the late Cyrus Wakefield) are more widely used in dwellings, and are easy and comfortable, though not specially artistic.

The processes of the manufacture of household furniture are briefly these: In the cheaper goods the basis or framework, and sometimes the entire article, is of some of the common woods—pine, bass-wood, white-wood, or soft maple; the frame is usually put together with dovetailed joints and glue, and by the aid of Blanchard's lathe for turning irregular surfaces and the various scroll and endless saws, etc. the desired form is obtained. Where the wood is to be exposed it is now veneered with mahogany, black walnut, or rosewood, sufficient pressure being applied to make the veneer adhere closely and firmly. If only small portions of the wood are to be seen, sometimes the solid black walnut, oak, or ash is used, or the wood, as in bedsteads, tables, etc., is rubbed smooth, stained, grained, treated with acid, or enamelled. If veneer is used, it is pumiced, varnished, pumiced again, and again varnished or rubbed very smooth, oiled, shellacked, or waxed. Ornaments, as handles, scrolls, knobs, or pieces in imitation of carving, are screwed and glued on, and the necessary trimmings—locks, slides, catches, castors, etc.—having been put on and another coating of oil or varnish applied, the article is ready for the market. Very much of this furniture is made in the rough at factories in well-wooded districts, and sent to the large cities to be finished. The table, bureau, and washstand tops are usually cheap marble slabs. Some of the articles, as the lounges, sofas, easy-chairs, tête-à-têtes, etc., are upholstered—that is, the seats are constructed with spiral springs, the lower portion of the coil being firmly sewed to heavy webbing, which is in turn fastened to the bottom of the seat either by nails, slats, or a board; over these springs is a covering of bur-

laps, on which is packed some elastic substance, curled horsehair being the best, but whalebone shavings, tow, bass-wood, or palm-leaf shavings, curled husks, or a compound known as "excelsior," being often used on the cheaper work; the seat is then confined in the form and pattern designed by a covering of heavy unbleached sheeting or drilling drawn tightly over it and nailed. This in turn is covered with haircloth, reps of various colors, woollen or silk brocatelle, broadcloth, morocco, or patent leather. In the number and quality of the springs, in the character of the elastic covering, and in the goods employed for the outside covering, as well as in the way this is attached to the sofa, lounge, or chair, there are abundant opportunities for fraudulent and imperfect work, some of which is difficult of detection. The character and integrity of the manufacturer are the best safeguards against this.

The better grades of furniture are made, except the drawers, those portions of the frames which are covered by upholstery, the slats or spring bottoms of the bedsteads, etc., of the solid woods—black walnut, rosewood, oak, satinwood, curled or birdseye maple, and the like—but often the panels, etc. are veneered with what are called French or veined veneers of the same description of wood, or sometimes of some contrasting wood. This class of furniture is for the most part made by hand, and not by machinery; there is considerable carving of the simpler sort about it, and it is very highly finished. The patterns vary greatly, according to the taste of the manufacturers; some confine themselves to Gothic styles, earlier, mediæval, or later, and more or less florid and flamboyant; some prefer the Renaissance designs, and make these of Florentine, Venetian, Roman, or Dutch styles; some, again, affect the classic styles, though generally those of the decadence period, and a few venture upon the absurd rococo styles. There ought to be—but there is not—a true American style, deriving its inspiration from our forests, our plants, fruits, and flowers, and copying nature as it exists here. There are still higher grades of furniture, on which has been expended the abundant labor of the sculptor and carver's art in bas-reliefs on oak, rosewood, and walnut, but these are rare productions, those who have the wealth and taste to seek for such work generally preferring the antique furniture of the sixteenth, seventeenth, and eighteenth centuries, with its elaborate and artistic carvings. It is becoming somewhat common among our wealthier citizens in the large cities who are building fine residences to summon to their aid "furniture-designers"—a profession which, though well known in Europe, is comparatively new here—and the size, height, location, and outlook from each room being noted, they design for it the appropriate furniture, carpets, curtains, and decorations. These designs are usually worked out by the manufacturer, who employs the designer, and who has a high reputation for artistic work. This method of furnishing a house, while it requires large means for its successful adoption, is undoubtedly a great advance towards high art, and prevents those blunders and incongruities in the artistic arrangement of a home into which persons of wealth and considerable culture, but of defective art-education, are liable to fall.

The extent and importance of the furniture manufacture in the U. S. may be appreciated from the following statistics: In 1850 there were 4242 establishments, employing 22,010 hands, and capital $7,303,358, using raw material to the value of $6,890,546, and producing furniture to the value of $17,663,054. In 1860 the number of manufactories had slightly diminished, there being but 3594 reported, but these employed 27,106 hands and a capital of $13,629,526; paid $8,909,998 in wages, used $8,181,250 worth of raw material, and produced furniture to the value of $25,632,293—an increase of 50 per cent. on the amount for 1850. In 1870, 5981 manufacturers were reported, employing 53,298 persons and a capital of $43,947,913, paying $21,574,531 as wages, using $25,843,170 worth of raw material, and producing furniture to the value of $69,082,684—an increase of over 200 per cent. in ten years, and of 400 per cent. in twenty years. (For much information concerning American furniture we are indebted to Messrs. W. P. Kingman & Co., New York.) L. P. Brockett.

Fur'nius (Caius), a friend of Cicero, who was tribune of the people 50 B. C.; opposed Octavius and favored Mark Antony during the triumvirate, but was pardoned by Augustus; attained consular rank, and in 21 B. C. was prefect of Hither Spain.

Furr, tp. of Stanley co., N. C. Pop. 1044.

Furruckabad', city of British India, the capital of the district of the same name, situated on the Ganges, on the road between Calcutta and Delhi. It is one of the commercial centres of Upper Hindostan. Pop. 60,000.

Furs and the Fur Trade. The use of the skins of wool-bearing and fur-bearing animals as convenient and readily adapted clothing goes back, according to the Sacred Records, to the time of the expulsion of the first pair from Eden. This costume is used among all savage and half-civilized nations in cold climates, and some of those in semi-tropical regions. But apart from the use of these skins of animals as clothing, there grew up, at a very early date, a demand for the finer and more beautiful furs for purposes of ornament and luxury. We find numerous evidences of this both among sacred and profane writers. They were used for the decoration of the tabernacle in the wilderness, the badgers' skins which formed the outermost covering of the sacred edifice being, in the opinion of biblical critics, the skins of the fur-seal (the badger being unknown in Egypt, Arabia, or Palestine), while below this covering was another of rams' skins dyed red (Ex. xxxvi. 19). Costly furs formed a part of the luxurious coverings of couches in the palace of Sardanapalus. Herodotus tells us that the inhabitants of the shores of the Caspian Sea were clad in the rich fur of the seal, and Ælianus and Plutarch both speak of the Pontic mouse (generally supposed to have been the ermine), whose rich fur made warm and beautiful robes, and was used as the covering of couches in the palace of Pharnabazus. The Chinese and Japanese have used furs as articles of luxury for at least 2500 years (the Chinese probably for more than 3000), and the robes of ermine, sable, and fiery-fox furs worn by the nobles of both nations are remarkable for their beauty. The choicest and finest furs (except the sable, which was not known at that time) were very generally worn as articles of luxury by the effeminate Roman aristocracy in the decline of the Roman empire. In the fourth century of our era the furs of the beaver (then known as the Pontic dog), the ermine, the seal, and several species of fox were in great demand. The tribes of Goths, Huns, and Ostrogoths which were migrating in such hosts from the north brought with them the choice furs of the Arctic regions, and during the Middle Ages they became articles of luxury throughout Southern and Central Europe. In the twelfth century the lighter-colored furs were almost universally dyed of a brilliant red color. In the wars with the Saracens the Christian princes imitated their foes in their habits of luxury, and costly furs from the East were used to such an extent that they wellnigh ruined the nations of Europe. Sumptuary decrees were issued about A. D. 1200 by Richard I. of England and Philip II. of France, prohibiting the wearing of these costly furs either by princes or people, but before the close of that century Louis IX. of France appeared in public with a surcoat lined with the skins of 746 ermines. Not long after this the privilege of wearing particular kinds of choice furs was granted to certain noble families in Germany, France, and Italy, but each one was restricted to a single kind of fur, and was permitted to put a figure of the animal producing it in his armorial bearings. Thus, the ermine, the sable, the Hungarian squirrel, the Podolian or fiery fox, and possibly also the beaver and the wolf, came to find a place in the coats-of-arms of some of the highest aristocracy of continental Europe.

For many centuries the Baltic ports were the great dépôts of the fur-trade, the furs being brought thither from Livonia, Sweden, Norway, Northern and North-eastern Russia, and later also from distant Siberian settlements by caravans which deposited them at the great market-towns of Moscow and Nijni-Novgorod. The discovery of the American continent soon changed the current of this traffic, for, though sables and ermines still came only from Russia, Siberia, and Northern Europe, yet the American forests and waters furnished in countless numbers the beaver—then regarded as one of the choicest of furs—the pine and stone martens, the mink, lynx, badger, raccoon, the choicest and most beautiful species of the fox, including the silver, white, cross, blue, and red fox, and the seal and sea-otter, the Virginia opossum, the muskrat, and among larger animals the bison, arctic, grizzly, and black bears, and the large gray wolf. This fur-trade was almost wholly monopolized by three or four great trading companies within 100 or 150 years after the discovery of the continent. The Dutch East India Company was first in the field, and carried on a thriving trade almost exclusively in furs with its trading-posts of New Amsterdam (New York), Beaverwyck (Albany), and one or two points on the Delaware River, as well as at several points on the coast of Maine, from 1609 to about 1684. The French very soon established themselves in the same traffic in Canada and farther N. and W., their chain of forts and trading-houses extending at one time from Hudson's Bay to New Orleans, and nearly all actively engaged in the fur-trade. A class of half-breed *voyageurs* and *coureurs du bois* grew up in this traffic, who were, and are to this day, skilful and successful hunters and trappers, though a more reckless crew of vagabonds could hardly be found. When the British government had by wars and treaties succeeded to the pos-

session of most of this region, the Hudson's Bay Company (chartered in 1660) took possession of these northern hunting-grounds and employed these half-breed voyageurs. For almost 200 years this great company monopolized the traffic in furs. It had indeed a somewhat powerful rival in the North-west Company after about 1790. In 1805 the latter company established trading-factories on the Pacific coast, and in 1808, John Jacob Astor established the American Fur Company, with its line of posts across the continent, intending to form a dépôt for furs at the mouth of the Columbia River and ship the furs directly to China and India from that point. He subsequently changed its name to the "Pacific Fur Company," and was on the high road to success when in 1813 his resident partner there treacherously sold out the whole establishment to the North-west Company, on the plea that the British, with whom we were then at war, would have captured it. The Russian-American Fur Company, having its principal trading-post at Sitka in Alaska and subordinate posts on the Yukon, carried on an immense traffic for many years, but in 1867 transferred its property and rights to the U. S. simultaneously with our purchase of Alaska. The trade in furs conducted by citizens of the U. S. has been extensive, but in a greater degree the result of individual enterprise than of the management of gigantic corporations. Mr. Astor, after the treacherous transfer of the Pacific Fur Company to the North-west Company, confined his operations to the region E. of the Rocky Mountains, and with his partner and successor, Mr. Ramsey Crooks, transacted for many years a profitable business in furs. St. Louis was one of the principal dépôts of the fur-trade from 1763 to 1859. The first great establishment there was founded by Laclede, Maxon & Co. in 1763. The brothers Auguste and Pierre Chouteau were connected with it very early, at first as employés, and subsequently as partners, and up to 1808 they employed a large number of trappers and voyageurs, and were very successful. In 1808 the brothers Chouteau and several of their associates formed the Missouri Fur Company, which prospered greatly until 1813 or 1814, when, in consequence of the war with Great Britain, it was dissolved, and several of its members conducted the business independently. In 1827 the Rocky Mountain Fur Company of St. Louis was formed, and sent its trappers to the Pacific coast. The perils of the business were very great—40 men out of every 100 perished in its service—but such was the fascination of this life of adventure that enough were always ready to supply the place of the slain. After some years of successful business this company was dissolved. In 1834, Pierre Chouteau, Jr., who had been brought up in the business with his father and relatives, organized the firm of Pierre Chouteau, Jr., & Co., a name which for the next twenty-five years was familiar to all the trappers and hunters from the Mississippi and the Great Lakes to the Pacific. In 1859 the business was sold to Martin and Francis Bates of St. Louis and New York, who still conduct it, though not on as extensive a scale as formerly. After the consolidation of the North-west Company with the Hudson's Bay Company in 1821, and the expiry of the latter's charter and license in 1859, the fur-trade became more widely diffused in the hands of individuals, and while the aggregate amount collected each year is much greater than it was thirty years ago, the opportunities for acquiring colossal fortunes in it have passed away. Furs are made up now at more than twenty points in the N. and W., and London and Leipsic are becoming the best markets even for American furs, as they have long been for those of Europe, Asia, and South America. In 1870 the Alaska Company, of which Hon. Henry P. Haven of New London, Conn.—long known from his connection with the whale fishery—is a prominent owner and officer, leased from the U. S. the islands of St. Paul and St. George, the largest islands of the Aleutian group, in lat. about 56° 30′ N., about 250 miles N. W. of the coast of Alaska, for the purpose of conducting the trade in catching the sea-otter and fur-seal on those islands. They pay an annual rent of $55,000 for the islands, and a revenue tax of $2.62½ on each fur-seal taken and shipped from the islands, the government requiring that the number taken annually shall not exceed 100,000. It generally ranges from 96,000 to 98,000. These skins are worth from $30 to $45 each, but, taking into the account all the expenses of the business, the margin of profit is not very large.

The furs principally worn in this country are those of the Alaska seal or sea-otter; the fur-seal, of which not over 300,000 are taken annually; the sable, usually called the Russian sable, though the finest specimens come from North-eastern Siberia or Kamtchatka. This animal belongs to the genus *Mustela*, to which our weasel and the pine, stone, and fisher martens, and the mink, as well as the European polecat or fitch marten, also belong. It is a very beautiful animal, about four times the size of the weasel, and its fur is distinguished from all other furs by the hairs turning and lying equally smooth in either direction; this may be tested by blowing it. It is of a rich dark brown, approaching black. Only about 15,000 of these are caught yearly, but they range in value from $20 to $150 per skin, though the very finest rarely reach our market. A fine set of these furs ranges from $800 to $1800. The kolinski or Japanese sable is more plentiful, about 75,000 being caught annually, but is almost wholly taken up in the European, and especially in the English, market, and is hardly known here. The pine marten, or Hudson's Bay sable, is still more abundant, about 200,000 being taken annually; its color is a lustrous brown, and it is sometimes colored and passed off as the Russian sable, but the fraud is easy of detection. It is an excellent fur, but is just now not much in fashion, other furs having taken its place. The stone marten is of inferior quality, and of yellowish-brown color. It is often colored in Europe, where it is much used, but is not now sold here, though twenty-five years ago it was somewhat popular. The fisher marten is a scarce and valuable fur, only about 10,000 being caught annually. It is sold mostly in Europe. The mink is a favorite fur here at the present time, and has been for twelve or fourteen years past. There is a great diversity in its quality. The best specimens are a dark chestnut-brown, approaching to black, and resemble the Russian sable in color and fineness more nearly than any other fur. The greater part are somewhat lighter in color, and the poorest are of a yellowish-brown hue. About 250,000 are taken annually. The ermine, called in England the stoat, is very abundant in the northern portions of America, Europe, and Asia, and about 400,000 are taken yearly. It is pure white in winter, except the tip of its tail, which is jet black; in summer it is yellowish-brown; it does not become so perfectly white in more southern latitudes. Its fur was once prized very highly, and was only allowed to be worn by the highest nobility and on the official robes of judges and magistrates. It is still considered a valuable fur, though somewhat less esteemed than formerly. The skunk (*Mephitis Americanus*), though removed from the genus *Mustela* or marten in which it was formerly placed, belongs to the marten family. It is a well-known and mal-odorous depredator on hens' roosts in the country, and very abundant. Its fur is fine, and that portion of it which is black is very beautiful. For the past twelve or fifteen years it has been growing in favor, and when the black portions are selected and thoroughly deodorized, it makes up very elegantly, and is largely sold under the name of black marten. Probably not less than 200,000 are taken annually. These are the principal furs sold here in the form of collar, boa, and muffs; the seal-skin and sea-otter are also made up in ladies' jackets, gloves, and caps, and in gentlemen's caps, collars, and gloves. These are the only furs which are dyed successfully and retain both their color and gloss. Cheaper fur sets are made of Siberian squirrel, a very pretty slate-colored fur, muskrat, French rabbit or coney, common rabbit, wild-cat, house-cat, and occasionally of badger, Virginia opossum, or raccoon. The greater part of the latter skins are, however, exported to Germany and Poland, where they are largely used for trimming overcoats. The muskrat fur is mostly employed in the hat manufacture. About 3,000,000 muskrats are caught annually, and nearly 2,000,000 exported. A cheap imitation of seal-skin is made from this fur by dyeing. The choicer grades of fox furs are used here to some extent for trimming, but very rarely, if at all, for muffs, collars, or tippets. The color of the white fox is only white in winter; in summer he is brown, gray, or bluish, and is then called a cross or pied fox. The choicest of all the Arctic varieties of fox is the silver fox. Its color when in prime fur is a deep glossy bluish black, with a silvery grizzle on the forehead and flanks. One of these skins has been sold for $500 in London. Not more than from 1000 to 2000 of these are caught annually, and not more than 6000 or 7000 of the blue fox, about 10,000 of the cross fox, 65,000 of the white fox, 25,000 of the gray fox, 40,000 of the kit fox, and over 300,000 of the red fox. The greater part of these go to Europe. The skins of the different species of bears, wolves, Canada lynxes, badgers, panthers, and wild-cats, as well as those of the buffalo, are made up into carriage robes, and are in great demand both in Europe and America for this purpose.

Our article will hardly be complete without a brief account of the processes of preparing these furs for wear. As brought to the manufacturers, they have been usually merely stretched and dried by the captors, or possibly a solution of alum has been applied to the flesh side. If not to be manufactured immediately, they are strewn with camphor, protected from dampness, and every few weeks carefully beaten with a stick. When they are to be dressed for making up into muffs, collars, etc., they are placed in tubs with

a quantity of rancid butter, and then trampled by the bare feet of men until the pelt is softened and partially tanned. They are next scraped on the flesh side with a strip of iron to remove portions of the flesh or cellular tissue which have adhered to the skin, and the grease is removed by trampling them again very thoroughly with fine sawdust of mahogany, lignumvitæ, or some other hard wood. They are next beaten many times, and the fur combed out. They are now ready for cutting out and making up into the various patterns of collars, boas, muffs, jackets, caps, gloves, etc. In making up fur goods, some manufacturers cut the skins into very narrow strips, and by carefully matching every scrap, however small, and sewing the whole neatly, they save nearly or quite 40 per cent. in material, and as the seams are all covered the appearance of the new goods is the same to the purchaser as if the articles had been made from nearly entire skins; but when the changing styles of fashion require these costly furs to be made over, the purchaser finds, too late, that he has been defrauded, and that what had presented so beautiful an appearance at first is worthless for all future service. The largest and best houses have steadily opposed this fraudulent system, and the fur-buying public are beginning to learn that though the prices may be slightly greater at first, there is a great advantage in purchasing (especially in costly furs) those which have a permanent value and can be remodelled without serious loss. We are indebted to Frederick Gunther, Esq., of New York for many facts and statistics.

L. P. BROCKETT.

Fur-Seal, a name given in common to those species of the family Otariidæ, or eared seals, which possess an abundant and dense under-coat of fine fur. Several species, representing two genera, belong to this group, and are all, to a greater or less extent, the objects of eager search. The species of the Alaskan seas is the *Callorhinus ursinus*; the southern species have not been identified with complete certainty, but three species at least are generally recognized—viz. *Arctocephalus Falklandicus*, *A. cinereus*, and *A. antarcticus*. (See OTARIIDÆ.) THEO. GILL.

Fürst (JULIUS), b. May 12, 1805, at Zerkowo, Prussian Poland, where his father, a learned Israelite, was lecturer of the synagogue, was intended for the rabbinate, and when only twelve years old he was already versed in the Old Testament Scriptures, Jewish tradition, and Hebrew literature. He first learned the German language at the age of thirteen, and three years later he stood at the gates of a gymnasium in Berlin asking for admission to the *secunda* (or second highest class), and in 1825 was ready for the university. For a while he studied at the high school of that place, but, induced by the probability of securing a very prominent position among the people of his native province, he took up the study of Jewish theology at Posen. During his stay there he became alienated from Jewish orthodoxy, and in 1829 finally determined to give up the theological field. He went to Breslau to pursue Oriental and antiquarian studies, and in 1831 to Halle. In 1833 he went to Leipsic to become a journalist, few positions of literary eminence being then open to Jews. But his learning secured him an appointment as lecturer at the university, in which school he labored with great distinction. In 1864 he was made a professor, and enjoyed the same advantages as his Christian colleagues possessed. D. Feb. 9, 1873. His historical, critical, and lexicographical works are numerous, and yet everything he wrote found favor, and all his publications are widely circulated. Particular mention deserve his *Concordantiæ librorum Sacrorum veteris Testamenti Hebraicæ et Chaldaicæ* (Leipsic, 1837–40); *Bibliotheca Judaica* (Leipsic, 1849–54, 4 vols. 8vo); *Hebräisches und Chaldäisches Handwörterbuch* (Leipsic, 1857–60), which is fast superseding Gesenius's work, especially in English-speaking countries, for which a translation was made by Dr. Davidson (London, 1865–66; New York, 1867); *Geschichte des Karäerthums* (Leipsic, 1862–65, 2 vols. 8vo). From 1840 to 1851 he also edited *Der Orient*, a paper noted for the value of its contributions. JAMES H. WORMAN.

Fürst'enwalde, town of Prussia, in the province of Brandenburg, on the Spree. It has considerable linen manufactures. Pop. 8197.

Fürth, town of Bavaria, at the junction of the Rednitz and the Pegnitz. It is the most flourishing manufacturing town of the kingdom. Its articles of brass, bronze, horn, and bone are celebrated. Pop. 24,569.

Furze, or **Gorse,** the *Ulex Europæus*, an interesting Old World shrub of the order Leguminosæ, having numerous solitary golden-yellow flowers of much beauty. It has several varieties, some of which are cultivated in gardens. Furze is grown as a cover to foxes and as sheep-pasture. In Belgium the waste sandy lands yield large crops of furze, which is gathered when green, cut fine in a mill, and fed out to live-stock as a forage-plant.

Fuse. See FUZE, by GEN. H. L. ABBOT, U. S. Engineers.

Fusee' [Lat. *fusus*, "spindle"], in the machinery of watches and chronometers, a cone spirally grooved, connected with a chain which may be wound upon the grooved cone. One end of this chain is attached to the base of the fusee, the other to the barrel or box containing the mainspring. The barrel, when the watch is wound up, rotates, being moved by the uncoiling of the main-spring. As the spring uncoils it loses its elastic force, but as a compensation the chain acts upon a longer lever, since, as the fusee rotates, the *point d'appui* of the chain continually approaches the base of the fusee. In this manner the uniform rate of driving force is maintained.

Fu'seli (JOHN HENRY), (originally *Füssli*), b. at Zürich, Switzerland, Feb. 7, 1741, was the son of a painter, and became a clergyman in 1761, but a political pamphlet written by him and his friend Lavater led to his expatriation. After this he lived chiefly in England as an artist; studied in Italy 1770–77; had good literary abilities and great knowledge, particularly of the languages; possessed a singularly ungovernable temper and a pungent wit. His paintings are not remarkable for correct drawing, but display a powerful and somewhat fantastic imagination; and similar extravagances occasionally disfigure his literary works (*Lectures on Painting*, *History of Arts*, translation of Lavater's *Aphorisms*, etc.). D. in London Apr. 16, 1825.

Fu'sel Oil, a collective name for a variety of alcohols and compound ethers which are produced during vinous fermentation, and which pass over with the alcohol when fermented liquors are distilled. It is, in fact, to the fusel oil that the different kinds of spirits owe their distinguishing qualities, as when the fusel oil is completely removed from them pure alcohol, more or less dilute, alone remains. Fusel oil varies with the material from which the spirits are prepared: that from the potato consists chiefly of amylic alcohol, with some propylic and butylic alcohol, etc.; that from Indian corn is chiefly amylic alcohol, with compound ethers consisting of the acetate, caprylate, formate, caproate, and œnanthylate of ethyl and amyl. Fusel oil from beet-molasses contains butylic and amylic alcohols, and compound ethers of valerianic, caproic, œnanthylic, caprylic, and pelargonic acids, with ethyl, amyl, etc. The fusel oil from marc brandy contains considerable propylic alcohol, with methylic, ethylic, butylic, amylic, and caproic alcohol. Ethylic or common alcohol is contained in all fusel oil. The following table exhibits the alcohols found in fusel oil, with their boiling-points and specific gravities:

Name.	Formula.	Sp. gr.	Boiling-point.
Methyl alcohol	CH_3OH.	0.798	66.6° C. = 152° F.
Ethyl "	C_2H_5OH.	0.794	78.4° C. = 173° F.
Propyl "	C_3H_7OH.	0.820	96° C. = 204.8° F.
Butyl "	C_4H_9OH.	0.803	110° C. = 230° F.
Amyl "	$C_5H_{11}OH$.	0.811	132° C. = 275.6° F.
Hexyl "	$C_6H_{13}OH$.		

The following acids have been observed in fusel oils, either free or forming compound ethers with the alcohol radicals methyl, ethyl, etc.:

Formic	$HCHO_2$.	Caproic	$HC_6H_{11}O_2$.
Acetic	$HC_2H_3O_2$.	Œnanthylic	$HC_7H_{13}O_2$.
Propionic	$HC_3H_5O_2$.	Caprylic	$HC_8H_{15}O_2$.
Butyric	$HC_4H_7O_2$.	Pelargonic	$HC_9H_{17}O_2$.
Valerianic	$HC_5H_9O_2$.	Capric or rutic	$HC_{10}H_{19}O_2$.

Amyl alcohol, being in most cases the predominating constituent, is often called fusel oil, even when freed entirely from the other alcohols, etc. It is a colorless liquid, having a peculiar sickening odor which causes coughing. It has a burning taste. Sp. gr. 0.811 at 19° C.; boils at 132° C.; burns with a white smoky flame; freezes at −22° C.; is soluble in alcohol and in ether; nearly insoluble in water. The ordinary amyl alcohol is said by Pasteur to consist of two liquids, having the same composition and vapor density, but differing in optical properties—one rotating the plane of polarized light to the left, while the other is inactive. Some of the compound ethers of amyl derived from this alcohol, as the acetate, butyrate, valerianate, etc., constitute the fruit essences, strawberry, pineapple, banana, apple, pear, etc., now so generally used for flavoring confectionery, syrups, etc.

Defuselation of Alcohol.—As the fusel oil has a higher boiling-point than common alcohol, it distils over with the last portions which come from the still, and in the column still, when the more condensable vapors are liquefied and flow back to the still, the greater part of the fusel oil remains behind. Thus, alcohol nearly free from fusel oil can be obtained. To completely remove it other means must be resorted to. Filtration over fresh wood-charcoal is the process most generally employed. Sometimes the vapor of the alcohol is passed through a chamber filled with charcoal. The following substances have also been recommended: binoxide of manganese for filtration; slaked lime, soda lye, chloride of lime, manganate of soda, milk,

olive oil, and soap. The process of aging or keeping really results in a partial defuselation of spirits; by oxidation the fusel oil is gradually changed, probably to compound ethers, and the flavor and *bouquet* of the spirits are greatly improved. Spirits are not considered suitable for medicinal use till they are two or three years old.

Detection of Fusel Oil.—On distilling whisky and other spirits, and diluting the distillate with water, it is often rendered milky by the fusel oil which separates. By allowing spirits to evaporate slowly from the hand, or from a glass which has been rinsed out with it, the peculiar smell of the fusel oil comes out after the ethylic alcohol has evaporated. By mixing ether with the spirits, and then adding water, which causes a layer of ether to separate, the oil may be extracted. On evaporating some of the ethereal layer on a watch-glass the fusel oil is left behind. Nitrate of silver is not a very reliable test, as it is blackened by a great variety of substances. (See FERMENTATION and WHISKY.) C. F. CHANDLER.

Fusibil'ity, the property by which solids become fluid when heated. Most solids are fusible; some, however, undergo decomposition without fusing. The temperature at which solids melt (the melting-point) differs greatly for different substances, but it is always constant for the same substance. The temperature remains constant during the entire period of melting. (See FREEZING MIXTURES.) Many bodies are usually liquid (melted), because the temperature of the air is much above their melting-points. Most solids when heated to their melting-points pass from solids to perfect liquids, but some pass through an intermediate pasty condition (*vitreous fusion*) before they become fluid. This property in glass enables workmen to blow and press it into form, and the forging and welding properties of wrought iron and platinum are due to the same circumstance. The *freezing-point* is the temperature at which the melted body solidifies; it is generally identical with the melting-point. We can, however, often cool a liquid below its melting-point without its solidifying. We may cool water, if we keep it perfectly still, to —15° C. (+ 5° F.) without its freezing, but if we drop in a grain of sand or agitate it, it at once rises to 0° C. (32° F.) and freezes. A *change of volume* occurs at the moment of melting, usually an expansion, but in the case of water and a few metals it is condensation. The melting-points of bodies are slightly affected by pressure—that of ice being lowered, that of wax being raised. Substances which expand on liquefying have their melting-points raised—those which contract have their melting-points lowered. Mixtures, as of fatty acids, alkaline chlorides, or alkaline carbonates, or of metals (see FUSIBLE METAL), often fuse at temperatures below the melting-points of the simple bodies. FLUXES (which see), partly by their chemical action in reducing compounds to the metallic state, and partly by presenting a readily fusible medium, promote the fusion of metals. The following table of melting-points is taken from Pouillet:

Names.	Centigrade.	Fahrenheit.
Mercury	—39°	—38.2°
Ice	0	+ 32
Phosphorus	43	109.4
Spermaceti	+ 49	120.2
Stearine	49–43	120.2–109.4
Potassium	58	136.4
White wax	68	154.4
Stearic acid	70	158.
Sodium	90	194.
Iodine	107	224.6
Sulphur	114	237.2
Tin	230	446.
Bismuth	202	395.6
Lead	320	608.
Zinc	360	680.
Antimony	432	809.6
Silver	1000	1832.
Gold	1250	2282.
White cast iron	1050–1200	1922–2192
Gray " "	1100–1200	2012–2192
Steel	1300–1400	2372–2552
Wrought iron	1500–1600	2732–2912

C. F. CHANDLER.

Fu'sible Cal'culus, in pathology, one of the most common of the forms of urinary calculus. It is often large, brittle, soft, smooth, and whitish. It contains the ammonio-magnesian phosphate, mixed with calcium phosphate and some animal matter, and fuses into a glass without much difficulty before the blowpipe; whence the name.

Fu'sible Met'als, alloys which melt at comparatively low temperatures. It is a curious fact that alloys often melt at temperatures far below the melting-points of their constituents. Bismuth, fusing at 202° C. (395.6° F.), tin, at 230° C. (446° F.), and lead, at 320° C. (608° F.), form alloys which melt in boiling water. Cadmium lowers the melting-point still farther.

FUSIBLE ALLOYS.

Bismuth.	Lead.	Tin.	Cadmium.	Melting-points.
8	5	3	..	100° C. = 212° F.
2	1	1	..	93.9° C. = 201° F.
5	3	2	..	92.8° C. = 199° F.
8	4	2	2	71.1° C. = 160° F.

The second alloy of the table is a most remarkable one; when it cools from fusion it expands while still soft, and when used for taking impressions of dies reproduces the finest lines with the greatest accuracy. The last alloy of the table has been used by dentists for filling teeth, being applied in the melted state with little tools like soldering-irons. Plugs of fusible metal, mixed to fuse at certain definite temperatures, have been suggested as safety-valves for steam-boilers. They are found, however, to undergo changes in use which modify their fusibility, making them entirely unreliable. C. F. CHANDLER.

Fusigna'no, town of Northern Italy, in the province of Ravenna, on the Senio. Pop. 5242.

Fus'tian [from *Fostat*, a suburb of Old Cairo, where it was first made], a cotton fabric resembling velvet. In addition to the usual warp and weft, there is an additional weft, which is brought above the surface in loops. When these are cut, the ends rising above the surface produce a short fur, which entirely hides the tissue beneath. This is smoothed by shearing, singeing, and brushing.

Fus'tic [remotely from the Lat. *fustis*, a "stick"], a name applied to several yellow dyewoods. (1) True fustic, tree-fustic, yellow Brazil-wood, old fustic, etc., is the wood of *Morus* (*Broussonetia* or *Maclura*) *tinctoria*, a fine large tree of the order Moraceæ growing in the West Indies and South and Central America. It affords a very permanent and valuable yellow dye, and is largely exported to Europe and the U. S. (2) Bastard fustic, which is believed to be a smaller variety of the same wood, but is inferior in quality. (3) Young fustic, fustet, or Venetian sumach, called also Hungarian or Zante fustic, is the wood of *Rhus Cotinus*, a sumach tree of the Levant, whence it is exported. It makes a brighter yellow than old fustic, but one which is not so permanent. No kind of fustic is of much practical value except when compounded with other dyestuffs. Mixed with other appropriate dyes, fustic is of great value in obtaining green, yellow, orange, brown and drab tints, and even blacks and reds; but it is necessarily excluded from blues, violets, purples, and kindred shades. The fustics are employed for cottons, woollens, and silks.

Futak, town of Hungary, on the Danube. It has considerable trade, and its annual fair is visited by merchants from Turkey and Greece. Pop. 7800.

Futtehpoor', the capital of the district of the same name in British India. The town is of both commercial and military importance. Pop. 16,000.

Fu'ture Es'tate, an estate which is to commence in possession at a future day; an estate in expectancy. Under this general designation are included estates in remainder, reversions, contingent, shifting, and springing uses, and executory devises. In New York an important change has been made by statute in the common-law system of estates, and the term "future estate" has been adopted as a specific technical name for all estates in expectancy except reversions, the various separate titles previously in use having been discarded. A "future estate" is there defined as an "estate limited to commence in possession at a future day, either without the intervention of a precedent estate, or on the determination, by lapse of time or otherwise, of a precedent estate created at the same time." Such future estates are declared to be vested or contingent. "They are vested when there is a person in being who would have an immediate right to the possession of the lands upon the ceasing of the intermediate or precedent estate. They are contingent whilst the person to whom, or the event upon which, they are limited to take effect remains uncertain." (An exposition of the law relative to future estates will be found under the separate titles REMAINDER, REVERSION, USES, EXECUTORY DEVISES, etc.)
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Fu'ture State, that condition into which human beings enter after death, and which will continue for ever. Nature gives no answer to the question, "If a man die, shall he live again?" Men die, and, so far as we can see, death is an eternal sleep; our senses do not make us acquainted with any *post-mortem* life. The body is resolved into its constituent elements, which are indistinguishable from other particles of carbon, hydrogen, oxygen, nitrogen, etc. As to the disembodied spirit, that is not cognizable by our senses, nor in any other way has it manifested its existence, the miracles of Scripture being here, of course, excepted. Yet an existence after death—an immortality, not simply of the species, but of the individual—has been held by all nations in every age of the world. This belief has been generally

restricted to the soul: it has been held in connection with the belief in God, though, like it, the dogma has assumed a thousand absurd and grotesque forms, as in the eschatologies of Egyptians, Chaldees, Persians, Hindoos, Chinese, Greeks, Romans, Scandinavians, Celts, the aborigines of America, and the degraded tribes of Africa and Australasia. All of these nations and peoples have believed in the existence of a supernatural Power and in a future state. The universality of this belief shows that it has its foundation in a divine revelation, or in the innate sentiments of our nature, or in both united. The traditions of the most cultivated nations trace the belief to pre-historic times, and favor the opinion that it originated in divine revelation. But there are certain arguments for the immortality of the soul, involving a future state of retribution, which must always have had great force among every people who have not been sunk into the lowest depths of barbarism. There is an argument drawn from congruity which has always been considered of great weight. Man possesses capacities which are not fully exercised, and desires which are not and cannot be gratified, in the present life; these postulate a future state. The mind is capable of indefinite expansion and development. One stage of advancement prepares for another, and so on *in infinitum;* and as the infinite attributes of God and the boundless immensity of the universe are objective realities to which the immortality of the soul stands subjectively related, the mind of man, which is so adapted to the contemplation of those grand themes, demands an eternity for their exploration. We shrink back from annihilation, nonentity; we love life; we want to live for ever. The instinct is fixed deep and ineradicably in our nature.

"'Tis immortality deciphers man,
And opens all the mysteries of his make:
Without it, half his instincts are a riddle—
Without it, all his virtues are a dream."

So far as we can discover, "the beasts that perish" have neither capacity nor hope of any future life. They gratify their propensities, propagate their species, and subserve various purposes in the economy of Providence; and that is all. But it is not so with man. As in the fœtus there are rudimentary organs which postulate a higher state of existence than that in the womb, so there are in man undeveloped forces and infinite capacities which foretoken another, a higher, and an eternal state of being. Addison puts the argument with great force into the mouth of Cato when he is reading Plato on the immortality of the soul:

"It must be so. Plato, thou reason'st well,
Else whence this pleasing hope, this fond desire,
This longing after immortality?
Or whence this secret dread and inward horror
Of falling into naught? Why shrinks the soul
Back on herself, and startles at destruction?
'Tis the divinity that stirs within us;
'Tis Heaven itself that points out an hereafter,
And intimates eternity to man.
The soul, secured in her existence, smiles
At the drawn dagger, and defies its point.
The stars shall fade away, the sun himself
Grow dim with age, and nature sink in years,
But thou shalt flourish in immortal youth,
Unhurt amidst the war of elements,
The wreck of matter, and the crash of worlds."

There is an ethical argument of still greater force. The inequality of men's conditions and the imperfection of retributions, divine and human, in the present life, demand a future state. Reason asserts that God must justify his ways to men, the guilty conscience forebodes a coming judgment, and oppressed innocence naturally looks forward to a future state of being for the justice denied in the present. These arguments have great force, though they stop short of demonstration. Some derive an argument for the immortality of the soul from its immateriality and indivisibility; but the most that can be said of this is, that it seems to favor the doctrine in question. But the soul, immaterial and uncompounded as it is, could not live except by the power of God, and the body, material and divisible as it is, by that power may be made immortal. The deductions of reason and the *dicta* of tradition receive confirmation from the clear and authoritative determinations of the Holy Scriptures. That the sacred records were written by divine inspiration, and are therefore of infallible authority, admits of ready and satisfactory proof, but it cannot be adduced in this place. That the doctrine of a future state was an essential element in patriarchal and Mosaic theology is evident. We have, indeed, no detailed account of the faith and worship of the patriarchs, but the translation of Enoch, and the fact that Jehovah called himself the God of Abraham, Isaac, and Jacob centuries after their death—whereas, as Christ argues, "He is not a God of the dead, but of the living, for all live unto him" (Luke xxi. 37, 38)—and the testimony of Paul (Heb. xi.), declare plainly that they did live after their death. The patriarchs considered themselves "strangers and pilgrims on the earth," and "they desired a better country—that is, an heavenly." Without endorsing Warburton's paradox in his *Divine Legation of Moses,* that that lawgiver, unlike all heathen lawgivers, did not inculcate the doctrine of future retribution because the Hebrew theocracy was to be administered by a miraculous dispensation, it may be admitted that it is not set forth as a sanction of the laws of the Jewish commonwealth. But it does not follow from this that the doctrine was not known or inculcated. The contrary is obvious. As Enoch's translation demonstrated a future state to the patriarchs, so the translation of Elijah demonstrated it to the Jews. In the Psalter the felicities of the heavenly state are brought to view as the object of the greatest desire; in Proverbs and Ecclesiastes the retributions of the future state are adduced as the great incentives to virtue; *e. g.* "The wicked is driven away in his wickedness, but the righteous hath hope in his death" (Prov. xiv. 32); "Fear God, and keep his commandments; for this is the whole duty of man"—or, "this concerns all men"—"for God shall bring every work into judgment, with every secret thing, whether it be good, or whether it be evil" (Eccles. xii. 13, 14). The Hebrew word *sheol* (rendered *hades* in the LXX.) may not refer to a place of future punishment, or to the state of the soul after death, but to the grave, or poetically to the abode of the dead, with reference to the body—as Whitby seems to have proved in his dissertation on the subject appended to his notes on Acts ii.—yet as the wicked are represented as separated from the righteous after death, and as the righteous have their eternal home in heaven, the wicked must be excluded from that abode of innocence and bliss. The New Testament is more explicit on these points. In one place (Luke xvi. 23) the term *hades* is used parabolically for the place of torment, the later Jews, after the Greeks, using the word for the abode of the soul, as well as that of the body, after death. Josephus says the Pharisees and Essenes held that the souls of the wicked shall be punished with eternal punishment, and that there is appointed for them an eternal prison; which he calls *hades.* Peter borrows the Greek *tartaros* to designate the place of future punishment (2 Pet. ii. 4). The later Jews also used the term *Gehenna*—from the Heb. *Ge-hinnom,* the Valley of Hinnom, where infants were burnt in honor of Molech—to designate the place of future punishment. It is thus used in Matt. x. 28; Luke xii. 5: "Fear not them which kill the body, but are not able to kill the soul; but rather fear Him which is able to destroy both soul and body in hell"—γεέννῃ. Other figurative terms are employed to denote the state of future punishment, which is set forth as severe and eternal (Matt. xxv. 46; Rom. ii. 5–11; 2 Thess. i. 6–10, *et al.*). The retributions of the future state will be graduated according to the character and acts of every one—in the punishments of the wicked, as well as in the rewards of the righteous (Luke xii. 47, 48; 2 Cor. v. 10; Gal. vi. 7, 8). What positive punishments will be inflicted over and above the natural consequences of sin, the reproduction of character, and the like, are not clearly revealed. Many of the later Jews, the Fathers of the Church, the Schoolmen, and some modern divines, understand the passages which speak of fire and brimstone in a literal sense; but as chains, worms, etc. cannot be so understood, those texts are to be taken in a metaphorical sense. The New Testament says nothing about the termination of the existence or of the punishment of sinners in the future state, though some of the Fathers and the Restorationists of modern times have maintained that all the damned—wicked angels and wicked men—will be ultimately restored to virtue and happiness. The Romanists hold that those alone will be so restored who die "in venial sin" and remain a while in an intermediate place, which they call "purgatory;" of which, however, nothing is said in the Bible. There is a passage in an apocryphal book of no authority (2 Macc. xii. 39–45) which is cited in favor of purgatory, but it proves too much, as the dead for whom Judas is said to have offered a sin-offering, that they might be delivered from sin, had died "in mortal sin," and all such, according to the Romish standards, are consigned to eternal punishment. The words *aiôn* (used 128 times in the Greek Testament) and *aiônios* (used 71 times), like Heb. *olam,* express the idea of duration extended to the utmost limit predicable of the subject. When applied to God they denote unending existence; and as they are used of the retributions of the future state, there is no reason why they should not be understood in their proper sense. This is confirmed by those numerous and explicit passages which affirm of the righteous that they shall never die—that they shall have a crown of life, an inheritance incorruptible, undefiled, and that fadeth not away—that they shall ever be with the Lord (John vi. 50, 54; viii. 51; xi. 25, 26; 1 Cor. ix. 25; 1 Thess. iv. 17; Jas. i. 12; 1 Pet. i. 4; Rev. ii. 10, *et al.*); and those which affirm of the

wicked who are cast into *gehenna* that their worm dieth not, and the fire is not quenched, and that, dying in their sins, where Christ is they cannot come, but they shall be punished with everlasting destruction from the presence of the Lord and from the glory of His power (Mark ix. 42–48; John viii. 21; 2 Thess. i. 7–10). If there is to be any termination of the varied states of the righteous and of the wicked, or of the existence of either, God has not seen proper to reveal it. The Scriptures say nothing about an intermediate *place*—a region between heaven and hell. They do, however, recognize an intermediate *state*. This is the state of disembodied spirits between death and the resurrection. The souls of the wicked go to hell immediately after they are dismissed from their bodies, but they are not formally judged till the resurrection (Luke xii. 20; xvi. 22, 23; John v. 28, 29; 2 Pet. ii. 4–9; Rev. xx. 11–15; xxii. 10–15). So the souls of the righteous at death go immediately to heaven, where they are happy in the presence of God and the angels, though they will not receive their full reward till the resurrection, when body and soul will be glorified together. This is the teaching of the Old Testament (cf. Gen. v. 24; 2 Kings ii. 11; Isa. lvii. 1, 2). This was the belief of the later Jews; *e. g.* Wisdom of Sol. (iii. 1–4): "But the souls of the righteous are in the hand of God, and there shall no torment touch them. In the sight of the unwise they seemed to die, and their departure is taken for misery, and their going from us to be utter destruction; but they are in peace. For though they be punished in the sight of men, yet is their hope full of immortality." This remarkable passage is an echo of Isa. lvii. 1, 2. They spoke of "paradise," according to the oracle of the Chaldees, as "the glorious country of the soul;" and prayed for the dying, "Let his soul be in paradise." Philo speaks of paradise as "the symbol of a soul leaping for fulness and greatness of joy." The New Testament abounds with passages to the same effect: "The beggar died, and was carried by the angels into Abraham's bosom" (Luke xvi. 22)—a term by which the Jews designated paradise; thus, when Rab. Judah died, they said, "This day he sits in Abraham's bosom." So Christ on the cross promises the penitent robber, "To-day shalt thou be with me in paradise" (Luke xxiii. 43), by which he means heaven, as appears from the other two places in which the word occurs in the New Testament (2 Cor. xii. 1–4; Rev. ii. 7; cf. xxii. 14); in the latter of which it refers to the abode of the righteous after the resurrection, showing that paradise does not differ locally from heaven. Παράδεισος = *paredesa*, Sanscrit, a "place of beauty;" *pardes*, Armenian, a "pleasure garden;" Heb. *pardes*, a "park," as that of the Persian king spoken of in Neh. ii. 8 (cf. Eccles. ii. 5; Cant. iv. 13). The LXX. use this word for the garden of Eden—hence its use in the New Testament—as the earthly paradise was a striking symbol of the heavenly. Some of the Fathers, followed by certain moderns, held that paradise is a different locality from heaven, though, as Tertullian called it, "a place of divine delights," where, as Irenæus says, the righteous see the Saviour as well as in heaven, and as the pseudo-Justin says, "The souls of the righteous go to paradise, and there converse with Christ by vision." Stephen when dying said, "Behold, I see the heavens opened, and the Son of man standing on the right hand of God"—"Lord Jesus, receive my spirit" (Acts vii. 55–60). Paul says, "Whilst we are at home in the body, we are absent from the Lord. We are willing rather to be absent from the body, and to be present with the Lord" (2 Cor. v. 1–9); "For to me to live is Christ, and to die is gain; yet what I shall choose I wot not, for I am in a strait betwixt two, having a desire to depart and to be with Christ, which is far better; nevertheless, to abide in the flesh is more needful for you." (Phil. i. 21–24; cf. 2 Tim. iv. 6–8; Heb. xii. 22–24; Rev. vii. 13–17.)

It thus appears that the disembodied spirits of the righteous are in heaven, happy and holy, and sure of their final reward at the resurrection and general judgment. As the victorious athletes in the ancient Grecian games were all crowned together after all had contended for the prize, so Paul represents all the Christian athletes who are successful in the strife waiting at the goal for their several crowns. They are at rest; they are in the society of angels and saints and Christ, in the presence of God; they are as happy as they can be in a disembodied state, but "mightier joys ordained to know" when they shall receive their glorified bodies. Thus Paul: "For I am now ready to be offered, and the time of my departure is at hand. I have fought a good fight, I have finished my course, I have kept the faith. Henceforth there is laid up for me a crown of righteousness, which the Lord the righteous Judge shall give me at that day; and not to me only, but unto all them also that love His appearing" (2 Tim. iv. 6–8). The day here spoken of is the time of Christ's second advent, when the dead shall be raised, the earth and the works therein shall be burned up, the general judgment shall take place, and the retributions of the eternal world shall be awarded. The eschatology of the Bible is full and clear as to all these points. (Cf. Eccles. xii. 13, 14; Dan. xii. 2, 3; Matt. xiii. 30–50; xvi. 27; xxv. 31–46; Mark ix. 41–48; xvi. 16; Luke xvi. 19–31; John iii. 36; v. 28, 29; viii. 24, 51; xi. 23–26; xiv. 1–3; Acts xvii. 31; xxiv. 15, 25; Rom. ii. 5–16; xiv. 10–12; 2 Cor. v. 9, 10; Gal. vi. 7, 8; 1 Thess. iv. 13–18; 2 Thess. i. 5–10; 2 Tim. iv. 1–8; Heb. vi. 1–12; ix. 27, 28; x. 26–31; xi.; 2 Pet. ii. 4–9; iii.; 2 John 8; Jude; Rev. xx.–xxii.) These passages unequivocally set forth the eschatological points in question, so that the only way to evade their force is to deny their divine authenticity, which is not to be discussed in this place. The doctrine of the resurrection seems to have been almost lost from the traditional systems of the heathen world, but it is clearly inculcated in the Bible. Such passages as Ps. xvi. 8–11; Dan. xii. 2, 3, were understood by the ancient Jews as we understand them. Indeed, the doctrine of the resurrection was held tenaciously by the Jews in every age, except by the Sadducees, who constituted but a small sect. The apocryphal books of Judith (xvi. 17) and 2 Macc. (vii.) are explicit on this subject. Thus, the seven Maccabean martyrs encouraged one another with the assurance, "The King of the world shall raise us up, who have died for His laws, unto everlasting life." Addressing their persecutor, they said, "As for thee, thou shalt have no resurrection to life." Martha expresses the orthodox faith of the Jews when she says of her deceased brother, "I know that he shall rise again in the resurrection at the last day." So Paul, in defending himself from charges brought against him by the Jews, says, "And have hope towards God, as they themselves also allow, that there shall be a resurrection of the dead, both of the just and unjust" (John xi. 24; Acts xxiv. 15). Some of the strongest prejudices against Christianity were occasioned by this doctrine. The Athenians listened attentively to Paul while he discoursed on other points, but when they heard of the resurrection of the dead, they could listen to him no longer, they considered the dogma so absurd (Acts xvii. 32). Philosophers who hoped for the immortality of the soul never dreamed of the resurrection of the body. They did not consider it possible or desirable. They regarded the body as the prison and tomb of the soul, and a great encumbrance, from which they should be relieved for ever at death. Celsus says, "The hope of the resurrection of the flesh is the hope of worms, a filthy, an abominable, and impossible thing, which God neither will nor can effect." Some early Christian heretics for similar reasons denied the resurrection, or explained it away, as some do now, by saying it "is past already" (2 Tim. ii. 17, 18). Some modern sects hold that the resurrection-body is evolved at death, and becomes at once the vehicle of the spirit, thus denying the intermediate state of disembodied spirits, and conflicting with the Scriptures, which set forth the resurrection as taking place "at the last day"—at the second coming of Christ—at the time of the general judgment. The possibility and certainty of the resurrection is argued by Paul from the resurrection of Christ, who is "first fruits of them that slept"—or that shall sleep (that is, die) to the end of time. The model of the resurrection-body is set forth in Luke xx. 27–39; 1 Cor. xv.; Phil. iii. 20, 21, where it is stated that it will not be constituted of gross materials like the present body, but will be free from all animal propensities, infirmities, and everything that would make it other than a suitable vehicle for the glorified and immortal spirit; in short, "the body of our humiliation will be changed, and made like the glorious body of the Saviour." The objection to the possibility of the resurrection is removed when it is shown that the same omnipotence that called it into existence is pledged for its restoration; and the objection to its desirableness, by the character of the body thus raised. It will not be a hindrance, but a help, to the immortal soul. Thus, as the sublime prayer in the burial service of the Church of England expresses it, "We, with all those that are departed in the true faith of Thy holy name, may receive our perfect consummation and bliss, both in body and soul, in Thy eternal and everlasting glory." A small amount of matter will suffice for the resurrection-body, and it can be composed of some of the identical particles which belonged to the body that was laid in the grave, or of elements of the same kind, adapted and adjusted to each individual soul, as in that will consist the proper personality and identity of man. Thus, each will be readily distinguished from all the rest, and no question need be raised as to the recognition of friends in heaven.

"Eternal form shall still divide
The eternal soul from all beside,
And I shall know him when we meet!"

The gross and grotesque notions of the resurrection held

by many of the Jews, and by some of the Fathers (*e. g.* Augustine, *City of God*, book xxii.), and endorsed by most of the mediæval Schoolmen, and by not a few modern divines, have no countenance in Scripture, as they are abhorrent to reason, and have done not a little to prejudice men against this doctrine of Christianity. It is not, therefore, "a thing incredible that God should raise the dead." There is a solid foundation for our faith in the resurrection of the dead and the life of the world to come. These tenets are the most powerful incentives to virtue, and they afford the greatest support under the ills of life, and the strongest consolation against the fears of death. (See CALVIN'S *Institutes*, part i. c. 2; part ii. c. 29; TURRETINI, *Opera, Locus Vicesimus*; STANLEY'S *History of Philosophy—Pythagoras and the Chaldaic Philosophy, comprising the Oracles of Zoroaster*; *Catechism of the Council of Trent*, arts. 5, 11, 12 of the Creed; PEARSON *On the Creed*, arts. 11, 12; PLATO'S *Phædo*; CICERO'S *De Senectute*; SALE'S *Koran*; TUCKER'S *Light of Nature*; ARCHDEACON BLACKBURN'S *Historical View of the Controversy concerning an Intermediate State, Works*, vol. iii.; ARCHBISHOP WHATELY'S *Scrip. Revelations concerning a Future State*; BISHOP LAW'S *Theory of Religion*; HORSLEY'S *Sermons*, ser. 12, 20, 36, 43; DREW *On the Immateriality and Immortality of the Soul*; WATSON'S *Institutes*, part i. c. 2; part ii. c. 29; DWIGHT'S *Theology*, ser. 163–171; HUDSON'S *Debt and Grace*; LANDIS *On the Immortality of the Soul*; CLARK'S *Israel in Egypt*, pp. 185–230; FISKE'S ESCHENBURG'S *Classical Literature*, ii. 32, 33, 34, and works there cited; MCCLINTOCK AND STRONG'S *Cyclopædia*, art. "Immortality," and works there cited.) T. O. SUMMERS.

Fuze, a device whereby an explosion may be effected at a safe distance from its destructive action. The charge may be in motion or be stationary, and a short, or a long, or an indefinite time may be desirable between the act of the operator and its effect. Hence numerous and widely different contrivances are employed. For projectiles, including shells, case-shot, carcasses, explosive bullets, and grenades, fuzes are classified as time, percussion, concussion, and combination fuzes, but confusion often exists in the use of these terms. Time fuzes consist of cases of paper, wood, or metal containing the ingredients of gunpowder, varied to suit the required rate of burning. Being selected or cut to the proper length, they are inserted in the fuze-hole of the projectile, where, being ignited by the flame of discharge or by a match, they communicate fire to the enclosed bursting charge at the desired point of the trajectory. To this class belong most fuzes used with smooth-bore ammunition, such as the Bormann and its numerous modifications, the mortar, and the sea-coast fuze. Percussion fuzes are designed to cause an explosion only after the projectile strikes the object. As this is difficult to effect unless a particular point is brought into contact, the class is practically restricted to use with rifled arms, or with grenades, like Ketchum's, provided with some guiding device. One of the simplest forms consists of an ordinary percussion cap upon a gun-cone, placed within a plug at the point of the projectile; a small priming communicates the explosion to the interior. The cone may be fixed, or, as in the Parrott, Schenkl, and Absterdam fuze, be attached to a movable plunger. In the former case a thin exterior covering is crushed by the impact, and the cap is thus exploded; in the latter case the same result follows from the inertia of the plunger, which, when the projectile is suddenly stopped, brings the cap into violent contact with the thick exterior cover. For incendiary shells the Tice fuze, belonging to this class, was found to be serviceable in the late war in the U. S. It contained a small vial of fulminate, which the shock of discharge left, by an ingenious contrivance, unprotected among some loose shot. They caused an explosion at the first impact, however slight. If the percussion cap is made to ignite a time fuze, the explosion may readily be delayed; but it is hardly possible in any way to render the action so instantaneous as to prevent the projectile from burying itself before the fragments can be scattered by the bursting charge. In breaching a masonry wall or penetrating an iron-plated ship this delay is advantageous, since it adds the force of the explosion to the original impact, and thus shatters and enlarges the crater, or carries destructive fragments of the plate and backing into the vessel. Indeed, it has been found well in the latter case to dispense with fuzes entirely, and to place the bursting charge in a flannel bag, in order to retard the explosion which is produced by the sudden shock. For use against troops or earthworks, however, the unavoidable delay is for obvious reasons objectionable. Experiment has shown that a projectile imbeds itself in an old earthen parapet fully three-fourths of its maximum penetration before explosion, and that at this depth the effect of the shells of field and ordinary siege guns is nearly or quite harmless. Concussion fuzes are employed to obviate a difficulty peculiar to rifled guns—viz. that the length of the projectile, and, in many varieties, its expanding base, cuts off the flame of discharge from a time fuze, and thus prevents its ignition. In them the shock in the bore of the piece is utilized to ignite a time fuze of proper length for the range required. To this class belongs the "McEvoy attachment," consisting of a hollow wooden cylinder fitted to the projecting end of an ordinary time fuze; within is a gun-primer loaded with lead, which, ignited by inertia at the discharge, fires the fuze. A better application of the same idea is displayed in the Sawyer fuze. Many other inventions, some mechanical and some depending on the use of fulminates, have appeared, but the supposed superiority of the next class has often caused it to be preferred. For one purpose, however, the concussion fuze is especially adapted. It may be desirable—as, for instance, in shelling a working-party with a view to interrupting its labor—to have mortar-shells fall in its vicinity liable to explode at any time within an hour. The McEvoy-Beardslee fuze is designed to meet this case. A small vial of sulphuric acid is placed in a plug containing chlorate of potassa and sugar, but separated from it by several thicknesses of slowly absorbing paper. The shock breaks the vial, and, after a time, depending upon the number of thicknesses of paper, the acid soaks through to the powder, detonates it by contact, and thus ignites the bursting charge. The combination fuze consists of a time or concussion fuze, with some additional device by which explosion at once results when the projectile strikes. One of the simplest fuzes of this class is the Splingard, which consists of a time fuze containing in its axis a long hollow cone of plaster of Paris open at the bottom. Weakened by the burning away of the supporting composition, this cone breaks, and admits the flame at once to the interior at any impact occurring before the expiration of the time for which it was prepared. To this class belong the Schenkl fuze used in the U. S. during the late war, the most elaborate form of the English Armstrong fuze, and many others.

When the explosive is stationary, as in ordinary or military mining—including torpedoes planted for the defence of a river or harbor—quite different fuzes are necessary; which may be classed as time, contact, or electrical. The first class ordinarily consists of trains of quick-match, ignited by slow-match cut to a sufficient length to allow the operator to escape to a safe distance before the explosion. Various kinds of match are employed. Thus, the Bickford fuze (gunpowder priming) burns from $2\frac{4}{10}$ to 4 feet per minute, the Ord fuze (gun-cotton priming) about 15 feet per second, and the Gomez fuze (fulminate priming) about 300 feet per second. The old powder-hose burned very rapidly, and was therefore usually ignited by a piece of port-fire which consumed at a rate of about 1 inch per minute. For military purposes, except in cases of necessity, these trains have been quite superseded by electricity; but the Gomez fuze, which is violently explosive, may sometimes be advantageously employed to spread combustion rapidly through large masses of gunpowder, such, for example, as the load of a fireship set adrift against a bridge or fleet. The primary ignition may be effected by clock-work so arranged as to release a trigger after the desired lapse of time. Contact fuzes for the torpedo service are analogous to percussion fuzes for the artillery, and many devices are employed. A projecting lever may be so arranged that upon contact with a vessel it shall set free a trigger, and thus explode a common gun cap. A similar plan has been used with drifting torpedoes designed to float freely with the current, coupled in twos by a rope. When the latter is fouled upon the anchor-chains the torpedoes are brought alongside, and held there by the tide, which is thus enabled to act upon a wheel armed with vanes like a windmill. The revolutions, transmitted to a screw axle, soon release a trigger, and thus cause a blow to be delivered upon a pin resting on a gun cap. A sensitive fulminating priming, protected by a thin copper or lead cap so placed as to be crushed by the blow of the ship, is another form of this fuze. Still another consists of a bottle of sulphuric acid imbedded in a mixture of chlorate of potassa and sugar; the ship, by striking a projecting pin, breaks the bottle and thus ignites the torpedo. Ordinary cannon primers may be so arranged as to explode in a similar manner. Many of these devices are equally applicable to small mines buried in the ground in front of fortifications, to be fired by men or horses charging over them. The great objection to the whole class is that they debar a route to friends as well as to foes. Electrical fuzes, being perfectly under the control of the operator, obviate this difficulty. Many varieties, adapted to the different forms of electrical action, have been invented. The oldest contrivance, and that still most employed, is based upon the property possessed by a voltaic current of heating any poor conductor introduced into its circuit. A very thin

wire of platinum, German silver, or iron, from a quarter to half an inch in length, is soldered so as to form a bridge between two stout parallel copper wires imbedded in a plug of wood, gutta-percha, India-rubber, or other non-conducting material. The free ends of these wires being attached to the leading wires from a powerful voltaic or magneto-electric battery, the passage of the current reddens the bridge and thus explodes a priming packed around it. The chief advantage possessed by these over other electrical fuzes is, that they admit of easy and accurate testing by the passage of a current through them too feeble to dangerously heat the bridge. As the electrical resistance of the latter is usually less than an ohm, giving a current-strength requisite for ignition of from one-half to three farads per second, this condition is easily fulfilled. Various primings, such as gunpowder, gun-cotton, fulminating mercury, compounds of chlorate of potassa, etc., may be employed around the bridge; and for the detonation of gun-cotton or any of the nitro-glycerine explosives a copper cap may advantageously be added, charged with about fifteen grains of some violent fulminate sure to be ignited by the priming. Similar in principle to the foregoing is the Beardslee fuze, which is adapted to an alternating magneto-electric current possessing a comparatively high electro-motive force, although less than that from a frictional machine. The stout wires are connected by a very short plumbago line drawn with a soft lead pencil upon the end of the wooden plug. The priming is good rifle powder. The electrical resistance of these fuzes is variable, ranging between 500 and 5000 ohms, and their testing, although possible, is not satisfactory. The Von Ebner fuze, used in the Austrian torpedo service, is adapted to the extra current from a large primary coil, which, with an electro-motive force rather less than that of most magneto-electric machines, may be made to possess enormous quantity. The fuze bridge at first consisted of a plumbago line primed with fulminating mercury and a mixture of sulphuret of antimony and chlorate of potassa, but at present only the latter mixture is employed. To fire any considerable number of such fuzes as the foregoing it is necessary to make use of a derived circuit, and hence the explosion, although nearly, is not absolutely simultaneous. This is a serious objection in blasting with the modern detonating compounds. To overcome it, fuzes adapted to electricity of high tension, such as condensed frictional or secondary currents, have been prepared. They are made by replacing the bridge with a layer of some chemical compound which is so strongly polarized by the passage of the spark as to induce explosion. Such primings are the following, some of which, however, are sufficiently conducting to allow the use of magneto-electric, and even voltaic, currents. The Slatham compound is subsulphide of copper; that of Abel is 45 parts of subsulphide of copper, 10 parts of subphosphide of copper, and 15 parts of chlorate of potassa; that of Dowse is fulminating copper; that of other parties (including Mr. Abel in his submarine fuzes) fulminating mercury, with a greater or less proportion of some conducting substance, like graphite or powdered metal, added for conductivity. Of all this class, the fulminating copper priming makes the most sensitive fuze. It may easily be so prepared as to explode in a dry atmosphere when the exposed ends of the wires are brushed with a feather, or when an ebonite comb is passed through the hair of a person grasping one wire terminal, the other being insulated in the air. One hundred blast-holes may be fired simultaneously with such fuzes, connected in straight circuit, when a good ebonite frictional machine with a suitable condenser is employed; but it is needless to add that their use is criminally dangerous. Safe fuzes, which will fire from twenty to thirty charges in this manner, are in the market; and in the U. S. this method of blasting is employed nearly to the exclusion of all others where many simultaneous discharges are necessary. H. L. Abbot.

Fuzelier (Louis), b. in Paris in 1672; was a most prolific writer of plays, mostly comedies and lyric tragedies of small merit, but with occasional very clever passages. His best piece was *Momus Fabuliste*, a one-act play. Nearly all his long list of plays are very lively productions, with an easy style of versification which won him much popularity; but all are now forgotten. Fuzelier was (1744–52) conductor of *Le Mercure*, in which he published many articles. D. at Paris Sept. 19, 1752. Fuzelier was a zealous collaborator with Lesage in the work of supplying light plays for the second-class theatres, but many of his pieces were acted at the Théâtre Français.

Füzes Gyarmat, town of Hungary, 50 miles N. of Békés. It is situated among marshes abounding in herons, turtles, and crabs. Pop. 5735.

Fy'ens, or **Fie'nus** (Thomas), b. at Antwerp, in the Low Countries, Mar. 28, 1567; studied medicine with great success at Leyden and in Italy, whose schools then abounded with famous instructors; became in 1593 professor of medicine at Louvain, and soon had a European reputation for skill; was for a time court-physician to the duke of Bavaria, and afterwards first physician to the archduke Albert at Brussels. Author of some very curious medical works, of which *De Cauteriis* (1598) and *De præcipuis artis chirurgicæ controversiis* (1649) are the most noteworthy. At present his works have only an historic value. D. Mar. 15, 1631.—His father, John Fienus (d. 1584), was a famous physician, author of a singular work, *De Flatibus*.

Fyfe (Robert Alexander), D. D., b. Oct. 20, 1816, in the parish of St. Andrew's, province of Quebec; graduated at Madison University and Newton Theological Institution 1842; pastor of Baptist churches in Perth, Ont., Warren, R. I., Milwaukee, and Toronto. In 1860 appointed principal of the Canadian Literary Institute at Woodstock, Ont., a position which he still holds.

Fyne, de (Passchier), b. Jan. 31, 1588, at Leyden, in the Netherlands; became a Reformed minister and joined the Remonstrant or Arminian party; was silenced by the Calvinists, but continued to preach with great zeal and courage; was subjected to sharp persecutions, but was finally allowed to assume (1638) a pastorate at Haarlem, where he d. in 1661. Of his existing writings, his account of the Collegiants or Rhynsburgers is highly valued.

Fyrouz' I., an Arsacide king of Persia (the name is also spelled Feroze and Firouze), usually identified with the Pacorus of the Greek and Latin writers, called also Arsaces XXIV. as king of Parthia; reigned 83–103 A. D. The name *Fyrouz* signifies "victorious."

Fyrouz II., a Sassanide monarch of Persia (the Perosis of Byzantine writers), reigned 458–484 A. D. He succeeded his younger brother, Hormuz, whom he overthrew by the aid of the White Huns and put to death. A dreadful famine marked the first part of his reign, and the king became involved in wars with the White Huns, who finally defeated him with great slaughter, Fyrouz and twenty-nine of his sons being among the slain. The accounts of historians regarding many points of his reign are conflicting, for some celebrate his valor, benevolence, and virtue, while others regard him as a tyrant and a coward. He is named Fyrouz the Brave by some writers, and by others, Fyrouz the Bad.

Fyrouz III., titular king of Persia, son of Yezdejerd III., the last Sassanide monarch. Expelled by the Mohammedans from Persia, he fled to the domains of the Chinese emperor Kao-Tsoung (Tait-Song), by whom he was recognized, and who by fruitless negotiations strove to restore him to the throne. He is the *Pilouse* of Chinese historians, and seems to have been a Chinese viceroy in Bokhara. D. 679. His son, Ninus, was the last Sassanide who bore the royal title.

Fy'rouz (or **Feroze**) **Shah I.** (Rokn-ed-Deen, the "support of the Faith"), a Mohammedan king of Delhi who succeeded his father, Altamsh, in 1236, having previously been governor of Lahore. He was a vicious prince, and was deposed by the sultana Rezia, his sister, in 1236.—Fyrouz Shah II. (Jelal-ed-Deen, "glory of the Faith") reigned at Delhi 1289–96; was an Affghan usurper who succeeded the last Gouride sovereign, and who is chiefly memorable for his cruelties; was murdered by his nephew and successor, Allah-ed-Deen, in 1296.—Fyrouz Shah III., king of Delhi, b. 1296; succeeded Mohammed III. in 1351; abdicated 1386, and d. 1388. His reign was memorable for its tranquillity and the material prosperity of the kingdom. He founded in 1354 a city now called Ferozepoor (which see), formerly Fyrouzabad, and began the construction of the great canal-system now known by his name. (See Feroze Shah, Canal of.)

Fyt, or **Feydt** (Jan), a Flemish painter, b. at Antwerp in 1609. As a painter of animals he was excelled by no Flemish artist except perhaps Snyders. His dogs, and especially his greyhounds, are regarded as the best ever painted. His birds and furred animals rank also with those of the first masters; but his best pictures are those of dead game. His management of light and shade is effective, but his drawing is not always perfect. He etched a number of valuable plates after his own works. He excelled also in flower and fruit pieces, and in representations of vases, bas-reliefs, and marble works. His coloring is true, his touch bold, vigorous, and effective, and his finish excellent. D. 1671.

Fyzâbâd', town of British India, in the province of Oude, on the right bank of the Ghoggra. The government had its seat here until 1775, when it moved to Lucknow. The population of Fyzâbâd is estimated at 100,000, but the town is now falling into decay.

G.

G is a consonant, and the seventh letter in most modern European languages. In English it has (1) a hard sound, which is that of the mute *k*, *plus* a vocalization; and (2) before *e*, *i*, and *y* it has the soft sound of *j*. (3) When it follows *n*, the two usually stand for the nasal sound of *ng*, especially at the end of a word. In the midst of a word the *g* following *n* sometimes retains the *j* sound, as in *manger;* sometimes the *g* not only unites in the nasal *ng* sound, but it has a secondary hard *g* sound, as in *anger;* again, *ng*, even in the midst of a word, may have its appropriate nasal sound without qualification, as in *hanger*. In chemistry G stands for glucinum.

G, in music, the fifth degree in the ascending scale of C, major or minor, being the dominant in that scale. *Gamut G* is the note on the lowest line of the bass stave, a seventh below F on the clef line. *Double G* is one octave lower than gamut G, on the space below three ledger lines. G *dur* is the German for G major, and G *moll* for G minor. *Gis*, in German, is G sharp. G *in alt*, the first note in alt, situated one octave above the treble clef line. G *in altissimo*, a note one octave higher than G in alt, or a fifteenth above the treble clef line. Its place, as the first note in altissimo, is on the fourth ledger line above the stave.

Ga'bii, an ancient Latin city which stood 12 miles E. of Rome, on the banks of a small lake in a volcanic crater, from which flows the stream called Osa, and not far from the Lake Regillus, now drained. In early Roman days it was an important town. Cicero, Horace, and Juvenal allude to its decay, but it afterwards revived and became a bishop's see, but is now deserted. It anciently had quarries of a valuable volcanic stone, and gave name to the Gabine cincture. (See CINCTURE.)

Gabin'ius (AULUS) became tribune at Rome in 66 B. C.; brought forward and carried the law which gave Pompey the supreme command against the pirates; served under Pompey 64–63, and gained immense wealth; was prætor in 61; consul in 58; proconsul in Syria and Judæa 57; restored Ptolemy Auletes in 55; was exiled for corruption 54–49. D. about 47 B. C. Gabinius was a man of corrupt and abandoned character.

Ga'bion [It. *gabbia*, a "cage," from Lat. *cavus*, "hollow"], in military operations, a hollow cylinder of sticks set in a circle and wattled together, somewhat in the manner of a basket. It is of various dimensions, and is designed to be set on end and filled with earth or sticks. Gabions are proof against ordinary musket-balls, and are useful in repairing breaches and in constructing field-works, etc.

Ga'ble, that part of the outer wall of a building which lies between the slopes of the roof and above the upper line of the side walls, called in classic architecture the *pediment*. The bounding lines of the gable were in the richer forms of the Gothic treated with great freedom and decorated with profusion of ornament, and were frequently broken by corbie-steps and other diversities. Small gables are called gablets, and are introduced into the decoration of many Gothic exteriors.

Ga'blenz, von (LUDWIG KARL WILHELM), BARON, Austrian general, a son of the Saxon lieutenant-general Gablenz, b. at Jena July 19, 1814, and educated at the military academy of Dresden. He served first in the Saxon horse-guard, but in 1833 entered the Austrian service, and became, after six years, a captain of horse. He was a handsome and elegant man, with a winning address, and was often employed in honorary service. During the long period of peace he travelled much, even in the interior of Africa. In 1848 he fought in Italy under Radetzky with great distinction, and was made a major of the staff. He next became chief of staff to Count Schlick; distinguished himself especially at Kaschau; obtained the Maria Theresa cross, and was promoted to be colonel. Soon after he was employed in diplomatic negotiations. In 1853 was appointed director of the bureau of statistics in Vienna; in 1859 distinguished himself in the disastrous battle of Solferino, and by his defence of Caoriana covered the retreat of the centre. In 1863 he was made a lieutenant-marshal, and in 1864 received the command of the 6th army corps, which, together with a Prussian corps, and with the Prussian field-marshal Wrangel as commander-in-chief, was sent against the Danes in Sleswick-Holstein. As governor of Holstein he made a very favorable impression by his liberality. In 1866 he commanded the 10th army corps, and at Trautenau on June 28 he gained the only advantage which the Austrians could boast of in that disastrous war. He also took part in the battle of Sadowa, and was sent to the Prussian head-quarters to negotiate after the battle. When the war was over he retired, and was chosen member for life of the Austrian Upper House, in which he belonged to the liberal party. In 1867 he entered once more into service, and became commandant of Croatia and Sclavonia; in 1868 was made a general of horse, and in 1869 general in command of Hungary. Nov. 28, 1871, he retired. Becoming implicated in stock speculations which proved unfortunate, he shot himself in Zürich Jan. 28, 1874. A. NIEMANN.

Ga'blonz, town of Bohemia, on the Neisse, the centre of a manufacturing district where more than 6000 men are employed in the fabrication of ornamental glassware.

Gaboon', a river in Western Africa, falls into the Atlantic near the equator. In 1845 the French planted a colony here on account of the ivory with which the vicinity abounds; the colony was broken up in 1871, but has since been re-established. The Gaboon colony has several interesting missions, Roman Catholic and Protestant.

Ga'briel [Heb., "mighty one of God"], the name of the heavenly being who communicated prophetic tidings to Daniel, and foretold in later times the birth of Jesus Christ and of St. John the Baptist. Gabriel in Jewish, Christian, and Mohammedan traditions is reckoned as one of the great archangels.

Gabriel Channel, between Tierra del Fuego and Dawson's Island, is 25 miles in length, and in breadth varies from half a mile to three times that distance. On the S. there is a great glacier between Mounts Sarmiento and Buckland. The shores are abrupt masses of slaty rock, and the channel is subject to violent whirlwinds.

Gabriel, St., Orders of (Roman Catholic), (1) a congregation of lay conventual brethren (*conviventes*) and of non-conventual gentlemen (*confluentes*) at Bologna. They are engaged in the work of instruction. (2) The "Brothers of St. Gabriel" in France were founded in 1835 by the abbé Deshayes. They are engaged in instructing the young, especially in rural places, chiefly in matters of doctrine.

Gabriel's Creek, tp. of Madison co., N. C. P. 1372.

Gad [Heb., "fortune" or "troop"], seventh son of Jacob by Zilpah, and founder of the Israelitish tribe of Gad, which, after the conquest of Canaan under Joshua, settled E. of the Jordan, N. of Reuben, and S. of the half-tribe of Manasseh; but we subsequently find the Gadites far to the N., E., and S. of their prescribed limits. They were a warlike, nomadic people, and disappear after the time of Tiglath-Pileser IV., who carried them into captivity 740 B. C.—GAD, the "king's seer," a prophet who was a personal follower of David, wrote a book of the acts of David, which is not extant, and of which we have no account except in 1 Chron. xxix. 29.

Gad'ara, town of Palestine, the capital of Peræa, was situated E. of the Jordan, 8 miles S. E. of Lake Tiberias, in the district of Gadaritis, or country of the Gadarenes. In the time of Josephus it was an important place, strongly fortified and celebrated for its hot springs. It is now only a heap of ruins, but it contains some fine remains of what were formerly its public buildings, and some very interesting artificial excavations, which are probably alluded to in Luke viii. 26–36. The place is supposed to be the same as that which Matthew calls Gergesa and the country of the Gergesenes, as no traces of any city of the latter name have ever been found.

Gade (NIELS WILHELM), b. Feb. 22, 1817, at Copenhagen; received a musical education, and in 1841 the musical society gave him a prize for his first overture, *Echo of Ossian*. His first symphony, in C minor, attracted still greater attention, and on the invitation of Mendelssohn he went in 1843 to Leipsic, where, with a few interruptions, he resided till 1848 as director of the concerts of the Gewandhaus. On his return to Copenhagen, in 1848, he became director of the musical society, and developed a great activity as a composer. His compositions comprise nearly all the different forms of his art, but he has been most successful in a kind of dramatic composition with solo, chorus, and orchestra, the most celebrated of which are *Comala*, *The Elf-King's Daughter*, and *The Crusaders;* he has written only one opera, *Mariotta*. His earlier overtures and sym-

phonies unfold a most original picture of the Northern character, and the above-mentioned dramatic compositions, of a later date, contain many exceedingly interesting and even brilliant descriptions. He is stronger than Mendelssohn, but his form is less perfect; he is clearer than Schumann, but he has not his wealth of ideas.

Gad-Fly. See HORSE-FLY.

Gad'idæ [from *Gadus*, one of the genera], a family of fishes of the series Teleostomi, sub-class Teleostei, order Teleocephali, and sub-order Anacanthini. It includes the cod, haddock, hake, etc. The old family Gadidæ is in the Smithsonian arrangement divided into four—Bregmacerotidæ, Ranicepitidæ, Gadidæ, and Merluciidæ.

Gadjatch, town of Russia, in the government of Poltava, stands at the confluence of the Khoral and Psiol. Tobacco is extensively cultivated in its vicinity. P. 6874.

Gads'den, county of Florida, bordering on Georgia. Area, 330 square miles. The surface is undulating, the soil productive. Tobacco, rice, corn, fruit, and cotton are raised. The county is well timbered, and is traversed by the Jacksonville Pensacola and Mobile R. R. The navigable Appalachicola River flows along the W. border. Cap. Quincy. Pop. 9802.

Gadsden, post-v. and tp., cap. of Etowah co., Ala., 120 miles N. E. of Montgomery, on the line of the East Alabama and Cincinnati R. R., 52 miles W. by S. of Rome, Ga., on the N. bank of the Coosa River, at the southern terminus of Lookout Mountain, in the midst of the Coosa coal-fields and iron deposit. It has 8 steam-mills engaged in cutting yellow-pine lumber, inexhaustible forests of which lie along the Coosa; 4 churches, 5 schools, and 1 newspaper. Pop. of tp. 2203. W. M. MEEKS, ED. "TIMES."

Gadsden (CHRISTOPHER), an American statesman and distinguished patriot, lieutenant-governor of South Carolina, b. in Charleston, S. C., in 1724; educated in England, returning to Charleston in 1741; engaged in a mercantile business, in which he was largely successful. In 1765 he was appointed a delegate to the Congress which met at New York in October to petition against the Stamp Act; was also chosen member of Congress in 1774; he was among the earliest advocates of republican principles and American independence; colonel and brigadier-general of South Carolina vols. in 1775, and engaged in the siege of Charleston in 1776; during the siege of Charleston, while lieutenant-governor in 1780, he, with five of the council, remained within the lines of the city; several months after the capitulation he was arrested by order of Lord Cornwallis and transported to St. Augustine, where a parole was offered him, which he refused, and remained in close confinement for forty-two weeks. In 1782 he was chosen governor of South Carolina, but declined the office, continuing, however, his exertions for the good of his country, both in the assembly and council. D. Aug. 28, 1805.

Gadsden (CHRISTOPHER EDWARDS), D. D., b. at Charleston, S. C., Nov. 25, 1785, a grandson of Christopher Gadsden; graduated at Yale 1804; became a deacon in the Protestant Episcopal Church 1807; a presbyter 1810; held rectorships in Berkeley and in Charleston, S. C.; was consecrated bishop of South Carolina 1840; was editor of the *Gospel Messenger*. D. at Charleston, S. C., June 24, 1852. Founder of the Protestant Episcopal Society, and a devoted friend to the colored race, for whom he labored much.

Gadsden (JAMES), an American statesman and soldier, b. at Charleston, S. C., May 15, 1788; graduated from Yale College 1806, and engaged in commercial business in Charleston until 1812, when he was appointed second lieutenant of engineers U. S. army; served during the war with Great Britain (1812–15); as aide-de-camp to Gen. Jackson 1816, with whom he served in Florida; promoted to be captain 1818, and appointed colonel and inspector-general U. S. army 1820, but was not confirmed by the Senate; member of the legislative council of Florida Territory (1824), and commissioner to treat for the removal of Seminole Indians to Southern Florida; U. S. minister to Mexico 1853, and negotiated the purchase of Arizona, which purchase is known by his name. D. at Charleston, S. C., Dec. 26, 1858. G. C. SIMMONS.

Gads'den Pur'chase, a name given to that part of Arizona and of New Mexico which lies S. of the river Gila. This region was purchased from Mexico for the U. S. by Gen. James Gadsden by convention dated Dec. 30, 1853, the U. S. paying $10,000,000, and Mexico giving up a large amount (stated at from $15,000,000 to $30,000,000) in claims for Indian depredations. The sale was very unpopular in Mexico, where it was a principal cause of Santa Aña's banishment as a traitor (1855). Area of Purchase, 45,535 square miles.

Gad'wall, or **Gray Duck** (*Chaulelasmus streperus*), a wild duck of Asia, Europe, America, and North Africa. It is very quick, and hard to shoot, but is highly prized for the table. It inhabits both fresh and saline marshes, and is a bird of passage.

Gael'ic Language and Literature. The term Gaelic (from *Gadhel*, "wanderers," a common name of the Irish and Highland Scotch, and not from the word *Gallus*, a "Gaul") or Gadhelic, in a wide but appropriate sense, is synonymous with the Erse or north-western group of Celtic tongues, including the Irish, the Manx, and the Highland Scotch. Indeed, the three may be regarded as dialects, or rather groups of dialects, of the same mother-tongue. But the name is more commonly limited to the Celtic language spoken in some of the islands and in parts of the Highlands of Scotland. It is also prevalent in Cape Breton and in some other British colonial possessions. The Gaelic differs from the Irish in its vocabulary, retaining words which the Irish has dropped, and dropping words which the Irish has retained; and in both words have changed their primitive meanings; new idioms have arisen in each, and new grammatical forms; and each has numerous peculiarities of pronunciation, the Irish retaining more of the characters of the ancient tongue. The use of Gaelic is fast diminishing.

The Gaelic literature is much less extensive and important than the Irish. The most famous work in the language is the so-called Ossianic poems, of which Macpherson professed to give the world a translation. It is now generally conceded that though Macpherson gave them form and connection, he freely used old materials, both traditional and manuscript; that his work is in parts of great antiquity, and that some of his materials may fairly be considered Ossianic. But Ossian (or Oisin) was himself an Irishman, contemporary with Saint Patrick, and there are very considerable Ossianic remains which are strictly Irish. Most of the extant literature is either poetical, traditional, or religious, and the last-mentioned is of the Protestant period. Gaelic versions of the Bible have been published in 1690, 1767–87, and 1826, besides several incomplete versions. Some of the published Gaelic literature is quite recent, and Canada has at least one Gaelic poet, Mr. Evan McColl of Kingston, Ont. (See ARMSTRONG'S and the Highland Society's Dictionaries, 1825, 1828; STEWART'S *Grammar*, 1801; *Bibliotheca Scoto-Celtica*, by JOHN REID, Glasgow, 1832.)

Gae'ta [Lat. *Cajeta;* see Virgil, *Æn.* vii. 1], a strongly fortified sea-coast town of Southern Italy, in the province of Caserta, about 40 miles N. W. of Naples; lat. 41° 30' N., lon. 13° 40' E. It was an ancient Greek colony, is most picturesquely situated on a steep promontory overlooking the Bay of Gaeta, was a favorite resort of the Roman aristocracy—Cicero, Augustus, Tiberius, Faustina, and many others had luxurious villas here—and monuments of this period still exist, as the tomb of Lucius Munatius Plancus, the reputed founder of Lyons, and that of Sempronius Atratinus. The famous duodecagonal column or tower, inscribed with the Greek and Latin names of the winds, is now a ruin. Gaeta has the honor of being the first among the Italian towns to form, after the downfall of the Roman power, an independent communal government, such as gave birth to the great republics of Genoa, Venice, and Florence. This little commonwealth was a republic in the time of Charlemagne; coined money and was ruled by its own dukes or doges until 1230. It sustained many noteworthy sieges during the Middle Ages, and has drawn to itself the interest of the present century as the retreat of Pius IX. in 1848–49, and as the last, and indeed only, stronghold that made a spirited resistance in defence of the ex-king of Naples. It was during this siege that rifled cannon were first used as battering-guns on a large scale. The citadel surrendered to Gen. Cialdini on Feb. 13, 1861, after three months' defence. The population of the town in 1871–73 was about 5000, chiefly occupied in the coasting-trade and in fisheries.

Gætu'lia is the ancient name for the western part of the desert of Sahara. It was situated S. of Mauritania and Numidia, and inhabited by the Gætulians, who are supposed to have been the aboriginal Berbers, and to be represented in our time by the Tuaricks. The Gætulians first came in contact with the Romans during the war with Jugurtha, in whose army they served as light cavalry. They were subdued by Lentulus, who from his victory over them received the surname of *Gætulicus*.

Gaff, in a sailing vessel, is the spar to which is bent the upper edge or head of a fore-and-aft sail. Gaff is also the lever, often hooked or barbed, with which fishermen handle large fishes; also the artificial spur of steel or other metal worn by game-cocks in matches.

Gage, county of Nebraska, bordering on Kansas. Area, 864 square miles. The soil is good, especially along the streams. The pasturage is excellent. Grain is the staple product. The southern part of the county is occupied by the Otoe reservation. Cap. Beatrice. Pop. 3359.

Gage (Frances Dana), b. at Marietta, O., Oct. 12, 1808, daughter of a Mr. Joseph Barker and wife of J. L. Gage; became early distinguished as a temperance orator and an agitator upon slavery and woman's rights; removed in 1853 to St. Louis, where she suffered much from her peculiar opinions and acts; became an editor in Ohio; served without pay in the care of sick and wounded soldiers 1861–65, and also instructed the freedmen. Disabled in 1867 by ill-health, she ceased her active and very useful labors. Author of a volume of clever *Poems*, *Elsie Magoon*, a tale, and of the widely known and admirable pieces for the young signed "Aunt Fanny."

Gage (Thomas), the last governor of Massachusetts appointed by the king, and commander-in-chief of the British force in America, b. in England, a son of Viscount Gage; was appointed governor of Montreal in 1760, and on the departure of Gen. Amherst succeeded him as commander-in-chief of the British forces in America. Being considered the most suitable person to execute the tyrannical laws of Parliament intended to subdue the rebellious spirit manifested in Massachusetts, he was appointed governor in that province, and arrived in Boston May 17, 1774. Several regiments soon followed him, the repair of fortifications on Boston Neck was begun, the powder in Charlestown arsenal was seized, and detachments sent out to Salem and Concord to take possession of stores, which led to the battle of Lexington. In May, 1775, the provincial congress of Massachusetts declared Gen. Gage unworthy of obedience, and the exercise of his functions was henceforth confined to Boston. In June he issued a proclamation offering pardon to all rebels excepting Samuel Adams and John Hancock, and established martial law. The battle of Bunker Hill occurred a few days later, after which Gage was relieved by Sir William Howe, and returned to England the following October, where he d. Apr. 2, 1787. Geo. C. Simmons.

Gagetown, post-v., cap. of Queen's co., New Brunswick, on the W. bank of the river St. John, 30 miles below Fredericton, with which it is connected by daily steamboats in the season of navigation. Pop. of v. about 300; of sub-district, 1282.

Gail (Jean Baptiste), a learned Hellenist, was b. at Paris in 1755; appointed assistant to Vauvilliers in the chair of Greek in the College of France 1791; became titular professor 1792; curator of the Greek and Latin MSS. in the Imperial Library and member of the Institute of France in 1809. He aided greatly in restoring the study of Greek in France, and published a large number of works illustrating the classic Greek authors, but his writings are not held in high estimation. His principal works are—*Theocritus*, with translation, 1792; *Anacreon*, 1793; *Homer*, 1801, 7 vols.; *Xenophon*, 1797–1815, 10 vols. 4to; *Thucydides*, 1807, 10 vols. 8vo; and a collection of philological essays and memoirs entitled *Le Philologue*, 24 vols. 8vo. D. 1829. H. Drisler.

Gail (Jean François), son of the preceding, was b. in Paris in 1795; was for a time assistant to his father in the College of France. Published in 1821 *On the Nature of the Bacchus-Worship in Greece;* in 1825 an edition of the *Periplus* of Scylax; an edition of the *Geographi Græci Minores*, of which 3 vols. appeared 1826–31; and, in conjunction with Longueville, a translation of Matthiæ's Greek grammar, 4 vols. D. 1845. H. Drisler.

Gaillac, town of France, in the department of Tarn, the centre of a rich wine-district. Pop. 7834.

Gaillard (Edwin), M. D., b. in Pineville, St. Stephen's parish, Charleston district, S. C., Mar. 13, 1796; graduated in New York 1819; was prominent in his district as physician and surgeon. D. Oct. 11, 1834, from the effects of a large and laborious practice, at the early age of thirty-seven. He was the father of the distinguished professor, editor, etc., now of Louisville, Ky., of this name. Paul F. Eve.

Gaillard (Edwin Samuel), A. M., M. D., LL.D., b. in Charleston district, S. C., Jan. 16, 1827. Took his literary degree 1845 at Columbia, S. C.; received first honors in South Carolina Medical College 1854; went to Europe 1860; returning thence, settled in New York City. In June of that year he was awarded the "Fiske Fund Prize" for his essay on ozone. During the war of 1861–65 he filled every position in the Confederate army from assistant surgeon of a regiment to that of medical director of army and inspector of hospitals. He established the *Richmond and Louisville Medical Journal* 1866; was elected professor in the Medical College of Virginia 1867; and received the prize for an essay on diphtheria 1867. Removed to Louisville, Ky., with his journal, by the unanimous request of the Medical Society of that State, 1868, and is now professor of the principles and practice of medicine in the Louisville Medical College. In 1873 the University of North Carolina conferred upon him the title of LL.D. When it is known that Dr. Gaillard lost his right hand at the battle of Seven Pines, near Richmond, Va., 1862, and now edits the largest and most successful monthly medical journal in the U. S., and has just commenced another, called the *American Medical Weekly*, none can deny him energy of the first order. His great capacity for labor has placed him in the front rank of his profession. Paul F. Eve.

Gaillard (John), b. in St. Stephen's, S. C., was U. S. Senator 1804–26, and often acting president of the Senate. D. at Washington, D. C., Feb. 26, 1826.

Gaillard (Peter Cordes), M. D., son of Peter G. Gaillard, b. Aug. 29, 1815; succeeded Dr. S. H. Dickson in 1858 as professor of medicine in South Carolina Medical College; was also assistant editor of the Charleston *Medical Journal* and president of the South Carolina Medical Society; was distinguished for attention to hygiene and sanitary science; believed that yellow fever was imported, and in a modified way contagious; and to the last was wholly devoted to his duties as an instructor and physician. D. Jan. 14, 1859. Paul F. Eve.

Gaillardet (Théodore Frédéric), an author and dramatic writer, b. in Paris in 1805, was at first known through the celebrated drama *La Tour du Nesle*, performed in Paris for the first time in 1832, and the authorship of which he claimed against Alexandre Dumas *père*. After this he came to New York, and founded the Franco-American paper *Le Courrier des États-Unis*, of which he is still the Paris correspondent. He is the author of the *Mémoires du Chevalier d'Eon* and of the *Professions de foi et considérations sur le système Républicain des États-Unis*. Félix Aucaigne.

Gaines, tp. of Genesee co., Mich., on the Detroit and Milwaukee R. R. Pop. 1316.

Gaines, tp. of Kent co., Mich. Pop. 1205.

Gaines, post-v. and tp. of Orleans co., N. Y., on the Erie Canal. Pop. of v. 250; of tp. 2196.

Gaines, post-tp. of Tioga co., Pa. Pop. 440.

Gaines (Edmund Pendleton), an American general, b. in Culpeper co., Va., Mar. 20, 1777; appointed second lieutenant 6th U. S. Infantry Jan., 1799, and first lieutenant Feb., 1802; U. S. collector of the port of Mobile, Ala., 1805; captain 1807; major and lieutenant-colonel 1812; colonel 1813; appointed adjutant-general (rank of colonel) 1813, and brigadier-general U. S. A., 1814; for gallant conduct in the defence of Fort Erie, Aug., 1814, where he was severely wounded, he was brevetted major-general, and received the thanks of Congress and a gold medal; similar testimonials were made to him by the States of Virginia, Tennessee, and New York. In 1816 he was appointed one of the commissioners to run the boundary with Creek Indians; engaged against Creek and Seminole Indians in command of Southern military district, when transferred to command of Western division; wounded by Seminole Indians in Florida 1836. D. at New Orleans June 6, 1849.

Gaines (John P.), an American soldier and legislator, b. in Kentucky; served in the war with Mexico as major in the Kentucky Volunteer Cavalry; captured at Incarnacion Jan., 1847; volunteer aide to Gen. Scott, and distinguished at Molino del Rey; M. C. from Kentucky 1847–49; governor of Oregon Territory 1850–53. D. in Oregon 1858. G. C. Simmons.

Gaines (Myra Clark), wife of Gen. E. P. Gaines and daughter of Daniel Clark, a citizen of New Orleans of Irish birth, who (according to testimony brought out by the famous lawsuit in which the daughter was long involved) in 1803 privately married Zulime des Granges, a Frenchwoman, the reputed wife of one Des Granges, who, it is alleged, had a wife living at the time of his marriage to Zulime. Myra, the second child of Mr. Clark by this woman, was b. in New Orleans in 1805, and was educated principally in Philadelphia, where she lived as Myra Davis, Clark and Zulime having separated, and the latter having married a third time. Clark d. in 1813, and the daughter in 1832 was married to W. W. Whitney, then a resident of New York. Shortly afterwards Mr. Whitney and his wife received notice from Mr. Davis, with whom Myra had been brought up, information of the fact that she was the legitimate daughter of Clark, and that not long before his death he had by will given his large estate entirely to her. After Mr. Whitney's death his widow married Gen. Gaines in 1839. The missing will was never produced, but its previous existence was sustained (1856) by the testimony of persons, some of whom professed to have seen it, and others to have heard Clark acknowledge its existence and his daughter's legitimacy. To prove her legitimacy was now necessary, since by the laws of Louisiana the child of an adulterous union could not inherit even by will of the parent. The U. S. Supreme Court finally decided this

point in her favor, after many years of litigation in the State and U. S. courts. She next (1856–67) successfully maintained an action in equity before the U. S. Supreme Court to recover her property, most of which was in New Orleans, and had been disposed of according to a will by which in 1811 Clark had devised his estate to his mother. In 1874, Mrs. Gaines had already recovered possession of several million dollars' worth of this property, and many minor suits for the recovery of the remainder were going on. The total value of the property before the war was some $30,000,000.

Gainesboro', tp. of Independence co., Ark. P. 618.

Gainesboro', post-tp. of Frederick co., Va. P. 2422.

Gainesboro, post-v., cap. of Jackson co., Tenn., on the Upper Cumberland River, 80 miles N. E. of Nashville. It has a newspaper, a Masonic hall, the lower part of which is used for a school-house, 2 hotels, and a number of stores and shops. Pop. about 300. WM. W. BAKER, ED. AND PUB. "JACKSON COUNTY NEWS."

Gaines's Mill. The wound received by Gen. Johnston at the battle of Fair Oaks proving severe, Gen. R. E. Lee shortly after succeeded him in chief command of the Confederate army. Following out the plan of his predecessor, which now met with less opposition, of concentrating an army about Richmond of sufficient strength to bear down upon that portion of the enemy upon the N. side of the river, crushing it or destroying its communications with the York River, Lee by the latter part of June, 1862, found himself at the head of an effective army of not far from 100,000 men, drawn from along the coast and throughout Virginia; including the corps of Jackson, 25,000 strong, which, under cover of an ostentatious movement of troops from Richmond, designed to convey the idea that Jackson was being reinforced in the Shenandoah Valley, had been withdrawn therefrom with such rapidity and secresy that neither McClellan nor the Union commanders in the Valley were fully aware of Jackson's movement until he reached Fredericshall about June 22 or 23. Meantime, McClellan had been considerably reinforced, the rolls of his army on June 26 showing a total of 156,318, with 115,102 "present for duty." Eleven bridges had been constructed across the Chickahominy, seven of them available for all service. The bulk of the army had been transferred to the right (S.) bank of the river, where its position had been strengthened by intrenchments; leaving Porter's corps, numbering 27,000, alone remaining on the left (N.) bank (June 24). During all this time McClellan had been in constant communication with Washington, continuing his demands for reinforcements, and reporting his daily expectation of advancing to attack the enemy. On the 25th he reported his bridges and intrenchments complete, and ordered an advance of the picket-line on the left, preparatory to a general forward movement, which he appears to have determined upon for the next day; the advance of this day being, he says, "to ascertain the nature of the ground and to place Heintzelman and Sumner in position to support the attack intended to be made by Franklin on the 26th and 27th." At 5 P. M. he telegraphed, "The affair is over, and we have gained our point fully;" but at 6.15 P. M. he sent another despatch to the effect that Beauregard had arrived at Richmond in strong force; that Jackson's advance was at Hanover Court-house; that the Confederate army now numbered 200,000 men; and that he should probably be attacked to-morrow (26th). Foreshadowing a disaster, he expressed his determination to "die with his army," and sought to throw the responsibility off his shoulders and place it "where it belongs." In truth, the whole force of Jackson had reached Hanover Court-house, but Beauregard was not, and had not been, near Richmond, being, in fact, in Alabama; while the Confederate army at the highest estimation not only did not exceed his own, but, on the contrary, he was at all times slightly superior in force. The long-contemplated attack, however, was destined to remain unaccomplished by McClellan, for Lee, having now completed his preparations, himself struck the first blow on the afternoon of the 26th. (See MECHANICSVILLE.) Being now fully aware of the presence of Jackson, and correctly interpreting the nature of Lee's plan to be the laying hold of his communications, and still overestimating the enemy's strength, McClellan determined on the night of the 26th to transfer his base to the James River—a change he had, indeed, contemplated for some time, and one which he had been free to make at any time since the destruction of the iron-clad Merrimack in May, and which was moreover his obvious base of approach to Richmond, for by it alone could the co-operation of the navy be secured; but, with his natural hesitancy where an alternative presented itself, he delayed doing from choice what he now felt compelled to do. The quarter-master at the White House was ordered to run the trains, loaded with provisions and ammunition, to the last moment, to load the wagons to their utmost with subsistence and send to Savage Station, destroying what could not be removed, and to throw all the supplies up the James River and establish dépôts there as soon as possible. This was accomplished, but only by the destruction of vast quantities of stores. The position of Porter's corps on Beaver Dam Creek being too far in advance to attempt to retain, it was withdrawn at 2 A. M. (27th) to a position stretching around the bridges and within supporting distance of the main army. The greater part of the trains and heavy guns were removed to the right bank during the night. Fearing that the immediate withdrawal of Porter's corps to the right bank would expose its rear to danger, and to gain time to make arrangements for the proposed change of base, McClellan determined to resist Jackson with this corps in its new position. This position was well selected on a range of heights between Cold Harbor and the Chickahominy. The new position was about the arc of a circle, covering the approaches to the bridges which connected the right wing with the troops on the opposite side of the river. Morell's division held the left of the line in a strip of woods on the left bank of the Gaines's Mill stream, resting its left flank on the descent to the Chickahominy, which was swept by the artillery on both sides of the river; the right of the line was held by Sykes's division, partly in woods and partly in open ground, reaching toward the rear of Cold Harbor. Each brigade had in reserve two of its own regiments. McCall's division was formed in second line. The cavalry, under Gen. P. St. George Cooke, was posted behind a hill in rear, to aid in watching the left flank and defending the slope to the river. The withdrawal of the Union army had been quickly discovered by the Confederates, who were soon in pursuit, a slight encounter taking place about noon at Gaines's Mill; but it was 2 P. M. before the division of A. P. Hill, which had been awaiting the arrival of Jackson, advanced alone to the attack in the direction of Cold Harbor, but was firmly met by Sykes's division and repulsed with heavy loss; to relieve Hill, Lee ordered Longstreet to make a feint on the Union left, but upon examination that officer, deeming a feint to be useless, determined upon an attack in force. Jackson, however, arriving on the Union right while dispositions to this end were being made, while D. H. Hill had made considerable advance in this direction, a general attack was now made along the whole line. By 3 P. M. the engagement became so severe that the entire second line and reserves were moved forward to sustain the first against repeated and desperate assaults along the entire Union front. Porter had already sent back for reinforcements, but owing to delays it was not till 3.30 P. M. that Slocum's division, which had been held in readiness, reached the field, increasing Porter's strength to about 35,000, now contending against double that number. So severely was Porter's line pressed that he was compelled to divide Slocum's division, and send parts of it, even single regiments, to the points most threatened. At 5 P. M. Porter reported his situation as critical, and French's and Meagher's brigades were sent to his support. On the right the division of Sykes, with Griffin's brigade, reinforced by Bartlett's brigade of Slocum's division, held its ground firmly, repulsing all attacks; on the left a stubborn resistance had also been made, but its lines were finally broken. This of itself need not have caused disaster, for at this juncture Porter called into action all his artillery, under cover of which he was withdrawing his men and effectively checking the enemy's advance, when Gen. Cooke, with the cavalry, attempted to charge the right flank of the Confederates on the left, as yet still within the woods. This charge was met by a withering fire, under which the horses, becoming unmanageable, wheeled about and dashed up the crest among the gunners, leading them to suppose the charge was being made by the enemy; and being without support, the batteries were hastily withdrawn, overrunning the retreating infantry, and causing the utmost disorder. An impetuous charge now made by the Confederates carried the crest, capturing 14 guns and driving the Union left to the Chickahominy; the key-point of the line being thus carried, the right, which up to this time had held its ground against Ewell's and D. H. Hill's divisions, was compelled to retreat, adding to the general confusion. At this critical moment the brigades of French and Meagher arrived upon the field, and, pushing through the stragglers, advanced rapidly to the front; encouraged by their presence, the retreating troops were rallied behind these fresh brigades, and advanced ready to meet another attack. But it was now dark, and though the reinforcement was slight indeed, yet the severe handling received by the Confederates, added to the knowledge of the arrival of fresh troops to the enemy, prevented Lee from following up his advantage. During the night the Union army was withdrawn to the right bank,

the rear guard of regulars crossing at 6 A. M. (28th), destroying the bridge behind them. During all this day McClellan had remained with the bulk of his army upon the S. side of the Chickahominy, confronted by but 25,000 Confederates, who, under Magruder, taking advantage of the nature of the ground, had kept up a great show and noisy demonstration, first at one point, then at another, deceiving McClellan and his division commanders, who believed they were confronted by a superior force, and their lines were maintained in readiness to resist an attack during the entire time that the disastrous action was occurring on the opposite bank; which, as may be supposed, the Confederate commander was careful to avoid, no serious fighting occurring on this side of the river. As has been seen, only one division and two brigades were sent to Porter's assistance, and of these only the division seasonably; so that it happened that Porter with 35,000 men was contending against a force double his own in numbers, while 25,000 men on the S. side held in check a force more than double this number. "Had Porter been withdrawn on the night of the 26th, our army would have been *concentrated* on the right bank, while two corps at least of the enemy's force were on the *left* bank. Whatever course we then took, whether to strike at Richmond and the portion of the enemy on the right bank, or move at once for the James, we would have had a concentrated army, and a fair chance of a brilliant result in the first place; and in the second, if we accomplished nothing, we would have been in the same case on the morning of the 27th as we were on that of the 28th, *minus* a lost battle and a compulsory retreat; or had the fortified lines (thrown up *expressly* for the object) been held by 20,000 men, as they could have been, we could have fought on the other side with 80,000 men instead of 27,000; or, finally, had the lines been abandoned with our hold on the right bank of the Chickahominy, we might have fought and crushed the enemy on the left bank, reopened our communications, and then returned and taken Richmond. As it was, the enemy fought with his *whole force* (except enough left before our lines to keep up an appearance), and we fought with 27,000 men, losing the battle and 9000 men. By this defeat we were driven from our position and our advance of conquest turned into a retreat for safety." (BARNARD, *Report on Peninsular Campaign.*) Says Gen. Magruder, commanding the Confederate forces on the right bank of the Chickahominy: "I considered the situation of our army as extremely critical and perilous. The larger part of it was on the opposite side of the Chickahominy, the bridges had all been destroyed, but one was rebuilt, and there were but 25,000 men between his (McClellan's) army of 100,000 men and Richmond. Had McClellan massed his whole force in column, and advanced it against any point of our line of battle, . . . its momentum would have ensured him success and the occupation of our works about Richmond; and consequently the city might have been his reward." The battle of June 27 was fought on the same ground where occurred the battle of Cold Harbor (June 3, 1864), but is familiarly known as the battle of Gaines's Mill; Lee calls it the battle of the Chickahominy. No official report of the aggregate loss on either side was made, but from the reports of division commanders the Union loss is estimated at upwards of 6000 (of which 2000 were taken prisoners) and 22 guns; the Confederate loss exceeded 9000 in killed and wounded.

Gainestown, post-tp. of Clarke co., Ala. Pop. 2409.

Gainesville, post-v. and tp. of Sumter co., Ala., on the right bank of the Tombigbee. It is the N. E. terminus of a branch of the Mobile and Ohio R. R., and has one national bank and an active trade. Pop. of tp. 3916.

Gainesville, post-v., cap. of Greene co., Ark., 73 miles N. by W. of Memphis.

Gainesville, post-v., cap. of Alachua co., Fla., on the Florida R. R., 98 miles S. W. of Fernandina. It has a large trade, a productive soil, and a fine climate. There are 3 academies, and 1 weekly newspaper. The surrounding scenery is fine.

Gainesville, post-v., cap. of Hall co., Ga., 53 miles N. E. of Atlanta, the capital of the State, on the Atlanta and Richmond Air-line R. R. It has 2 banks, 2 newspapers, 4 churches, a college, car-shops, machine-shops, mills, 4 hotels, and 60 stores. It is situated on the summit of the Chattahoochee ridge, that divides the waters of the Atlantic and Gulf. It has a number of fine springs—chalybeate, limestone, and freestone—and is therefore a very popular health-resort. Pop. 472. M. VAN ESTES, ED. "EAGLE."

Gainesville, post-v. of Hancock co., Miss. Pop. 71.

Gainesville, post-v., cap. of Ozark co., Mo.

Gainesville, post-v. and tp. of Wyoming co., N. Y., contains a female seminary and has manufactures of cheese, furniture, etc. Building-stone is quarried in the township. Pop. of v. 114; of tp. 1612.

Gainesville, post-v., cap. of Cooke co., Tex., 8 miles S. of Red River. It has a bank, a printing-office, 3 hotels, 2 institutions of learning, Masonic, Odd Fellows, and Good Templars lodges, 2 churches, fair-grounds, 2 mills, saddle and furniture factories, and 3 railroads chartered and to connect here. Principal business, farming and stock-raising. It has 2 weekly papers.
CHAS. M. BAILEY, ED. "GAZETTE."

Gainesville, post-tp. of Prince William co., Va., on the Washington City and Great Southern R. R. Pop. 1908.

Gains'borough, town of England, Lincolnshire, on the Trent. It has large manufactures of linseed oil, and carries on an important transit trade between the interior and the North Sea. Pop. 8724.

Gainsborough (THOMAS), an English painter of landscapes and portraits, b. in Sudbury, Suffolk, 1727; d. in London Aug. 2, 1788. He was an artist from childhood, for he sketched at ten and painted at twelve. Gravelot and Hayman were his instructors. When only sixteen years of age he painted landscapes and portraits in Hatton Garden. Marriage with a young lady of moderate fortune made him comparatively independent, and for several years he lived at Ipswich and Bath, painting portraits with rapidly increasing success. Returning to London in 1774, he gained reputation by portraits of the royal family and eminent people. They are done with a free hand, sketchily, with little color, but are faithful as likenesses and effective as pictures. The portraits of Mrs. Sheridan, Mrs. Siddons, and Mrs. Graham are among his best. Gainsborough's fame, however, rests on his landscapes, which, though not, strictly speaking, original in style, had a character of their own for simplicity of theme and treatment, subdued tone of color, and idyllic charm of feeling. He was a friend and rival of Sir Joshua Reynolds, was one of the original Academicians, and was, except for a short interval, a regular contributor from 1768 till 1784. He left 56 paintings and 148 drawings, which are much prized by connoisseurs. His favorite pictures are well presented in engravings. O. B. FROTHINGHAM.

Gais'ford (THOMAS), one of the most distinguished English classical scholars, was b. at Ifort, Wilts, Dec. 22, 1779; educated at Christ Church, Oxford; took orders in the Church, but devoted himself to classical learning; appointed professor of the Greek language in the University of Oxford in 1811, and dean of Christ Church in 1831. He was also one of the curators of the Bodleian Library and a delegate of the University Press. The letters of Wyttenbach show that Gaisford was regarded, after the death of Porson, as the best representative of English scholarship, and he was often consulted in regard to the MS. treasures in England. His literary activity was very great, and began early. His principal works are *Hephæstionis Enchiridion de Metris* (1810; reprinted in Leipsic, 1832); *Poetæ Græci Minores* (1814–20, 4 vols.; reprinted Leipsic, 1823, in 5 vols.); *Stobæi Florilegium* (1822, 4 vols.; reprinted Leipsic, 1823, 4 vols.); *Sophoclis Tragœdiæ* (2 vols., 1826; reprinted Leipsic, 1827, 8 vols.); *Herodoti Historiæ* (1824, 4 vols.; 3d ed., 1849; reprinted Leipsic, 1824); *Suidæ Lexicon* (folio, 3 vols., 1834); *Parœmiographi Græci* (1836); *Scriptores Latini rei Metricæ* (1837); *Eusebii Demonstratio Evangelica* (3 vols., 1852); *Etymologicum Magnum* (folio, 1848). He was elected a corresponding member of the Institute of France, and member of other learned societies. D. June 2, 1855. H. DRISLER.

Gaissin, town of Russia, in the government of Podolia, on the Soba. Pop. 7218.

Ga'ius, or **Ca'ius,** a famous Roman jurist of whose personal history little is known. He certainly wrote during the reigns of Hadrian and the Antonines. It is conceived from his style that he was only a teacher and writer upon the law, and not a practical jurisconsult. He was the author of numerous works upon the Roman law, of which the most important was the *Institutes*. This work was freely used in compiling Justinian's *Institutes*, and was the basis of the *Lex Romana Wisigothorum*, but was supposed to be lost. In 1816, Niebuhr discovered a palimpsest at Verona, which was afterwards found to contain, almost entire, the long-lost *Institutes* of Gaius. The palimpsest was afterwards deciphered, in spite of great difficulties, by Göschen and Bethmann-Hollweg, and the text was published first in 1821, again, much improved, in 1824, and in still better form in 1842. Other editions are those of 1829 and 1841, and the London text of 1869. There are at least three English and three French translations.

Galac'tine, a gelatine-yielding substance, said to occur in milk. (*J. Pharm.* [3], xxv. 423.)

Galactom'eter [Gr. γάλα, γάλακτος, "milk," and μέτρον, "measure"], otherwise called **Lactom'eter,** an instrument for determining whether milk has been watered or

not. In some cases it is a mere hydrometer or specific-gravity glass—in other cases a graduated test-tube, the richness of the milk being judged by the percentage of cream which appears after standing. (See MILK.)

Gala'go, a genus of lemurs, of which some four species are found in various parts of Africa. They are handsome, active, harmless creatures, living on fruit, acacia-gum, insects, and small birds and animals.

Galam Gum. See GUM.

Galan'gal, a stimulant, aromatic drug, derived chiefly from the *Alpinia officinarum*, of the order Zingiberaceæ, a native of Southern China. It resembles ginger, and is used for the same purposes, but is seldom seen in the U. S. *Greater Galangal,* a substitute for the true, is the root-stock of *Alpinia Galanga* of Java.

Galanthus. See SNOW DROP.

Gala'pagos Islands ("Tortoise Islands"), a group of thirteen small islands of volcanic origin in the Pacific, on the equator, and between lon. 89° and 92° W. The Ecuadorians planted in 1832 a penal colony here, which still exists. The islands, which now belong to Ecuador, are noticeable on account of the land-turtles (*Testudo nigra*) of large size which are found here in great numbers. The flora and fauna of the group are peculiar and highly interesting.

Gal'ashiels, town of Scotland, is situated on both sides of the Gala, partly in Selkirkshire and partly in Roxburghshire. It has large woollen manufactures. Pop. 9678.

Gal'ata, suburb of CONSTANTINOPLE (which see).

Gala'tia, or **Gallogræ'cia,** was a country in Asia Minor, situated between Paphlagonia, Pontus, Cappadocia, Lycaonia, Phrygia, and Bithynia, and inhabited by a colony of Gauls, who in the third century B. C. had invaded Greece, crossed the Hellespont, and subdued Troas, and who in 230 were compelled by Attalus I., king of Pergamus, to settle here. They formed a state with a democratic government, which in the days of Pompey was transformed into a monarchy, but shortly after they were conquered by the Romans, and their country was made a Roman province. In the fourth century Jerome says that the Galatians still spoke the same dialect as that spoken about Treves. The apostle Paul visited them twice, and addressed to them one of his earliest Epistles.

Galatia, post-tp. of Saline co., Ill. Pop. 1319.

Gala'tians, Epistle of St. Paul to the, was written from Ephesus in 55 or 56 to the disciples in Galatia, where Paul himself had founded churches. The occasion of the Epistle was the interference of certain persons who sought to impose Jewish laws on Paul's converts. He is led into a discussion of the relations of Christianity to Judaism, and his treatment of this question shows more of the influence of his rabbinical education than any other of his writings. This is, next to the Romans, the most important of his Epistles.

Galati'na, town of Southern Italy, in the province of Lecce, about 12 miles N. W. from Otranto. It claims to have been an early Greek settlement, and the name would seem to imply this, but there is no other evidence on the subject. The neighborhood is highly fertile, and the town itself contains several well-sustained charitable institutions and some handsome churches; among the latter, Santa Caterina, founded by a prince of Taranto ransomed from Turkish slavery by the inhabitants of Galatina. P. 10,334.

Galato'ne, town of the province of Terra di Otranto, Italy, 6 miles N. W. of Gallipoli. Pop. 4877; with surroundings, 5878.

Ga'latz, or **Galacz,** city of Moldavia, on the left bank of the Danube, which here is navigable for vessels of 300 tons. It is the great centre of trade between Vienna and Constantinople, exporting grain, wine, wool, and timber, and importing cloth, cotton, and silk goods, iron-ware, leather, and tobacco. The largest part of the old city consists of wooden huts; in the new city, however, are many handsome houses of stone. English and German merchants have begun to settle here, but in the main the trade is carried on by Greeks. Pop. 36,107.

Gal'axy [Gr. γαλαξίας, from γάλα, "milk"], or **Milky Way,** a circle of nebulous or cloud-like light spanning the entire heavens, with the appearance of which every one is familiar. One of the ancient philosophers is said to have conjectured that it was really formed of stars too small to be singly visible to the naked eye. This conjecture was strengthened by Galileo, who, scanning that part of the heavens with his telescope, found minute stars in great numbers; and it was entirely confirmed by his successors, especially by Herschel, in whose telescopes the cloudiness seemed to be entirely resolved into stars. The number of the smallest telescopic stars in the Galaxy is now known to be greater than in all the rest of the heavens, so that this cloudy girdle really forms the most important part of the visible universe. The problem of the structure of the Galaxy is therefore almost the same with that of the structure of the universe, and is still far from being satisfactorily solved. The most celebrated theory on the subject is that of Herschel, who considered that the aggregation of the stars in this belt was caused by the stellar system stretching out immensely farther in this direction than in others. In this theory the figure of the universe is that of a flat round disk, near the centre of which our sun is placed; and the reason so many more stars are seen in the Galaxy than elsewhere is simply the much greater space which the telescope looks through when pointed so as to look edgeways through the disk. This theory has been shown by Mr. Proctor to be extremely improbable. If the universe were so constituted, the density of the Milky Way would be nearly uniform, and it would shade off at the edges very gradually and uniformly. But a careful examination with the naked eye is sufficient to show that the object in question is composed principally of separate clusters or clouds of irregular form, between many of which comparatively dark spaces are seen, while in many other places there are spots of comparatively great brilliancy. Now, on Herschel's theory, or any other theory of uniform density of stars, these dark spaces could only arise from long holes and rifts extending through the Galaxy in the direction of the earth, and the brighter portions would have to be considered as long projections extending out from the direction of our sun. Indeed, one of these rifts, which in the summer and autumn may be seen in the southern portion of the Galaxy, is so striking that Herschel had to suppose an immense cleft in the stellar system to account for it. Now, the existence of long, narrow openings, all pointing to our sun, is so improbable that we may consider Herschel's views entirely untenable. The true constitution of the Galaxy is still one of the unsolved problems of astronomy. Probably it is a vast irregular ring of star-clusters, near the centre of which our sun is situated. But no certain data exist for fixing the position of this ring among the other stars, and our means of measuring the distances of the stars are too imperfect to enable us to collect such data. The solution of the problem must therefore be left to future generations. S. NEWCOMB.

Gal'ba (SERVIUS SULPICIUS), a Roman emperor, b. Dec. 24, B. C. 3, near Terracina; was adopted by his step-mother, a relation of the wife of Augustus; was prætor 20 A. D.; consul in 33; commanded in Gaul 39–41, defeating the Germans with severe loss; commanded with reputation in Africa 45–46, and attained great honors at Rome; held command in Spain 61–68; was then saluted emperor by his men, and went to Rome, where he succeeded Nero in 68, but his avarice and cruelty rendered him unpopular, and he was murdered by the prætorians Jan. 15, 69 A. D. Galba was the first emperor not of the Augustan family. He was succeeded by Otho.

Gal'banum [Gr. χαλβάνη; Lat. *galbanum*], one of the fetid gums; a gum-resin brought from the Levant, India, and Persia. It is the concrete juice of some unascertained umbelliferous plant, probably a *Ferula.* It is antispasmodic, expectorant, and stimulant, and is used as an ingredient of plasters. Therapeutically, it is regarded as intermediate between ammoniac and assafœtida.

Gale, Sweet Gale, or **Dutch Myrtle,** the *Myrica Gale,* a fragrant European and North American shrub, growing in cold, wet lands. It abounds in an essential oil. It has been used in medicine against the itch, and will keep away moths and other insect vermin. Hence the Scotch Highlanders make beds of the twigs, which are also sometimes an ingredient in home-brewed beer.

Gale, tp. of Trempealeau co., Wis. Pop. 1450.

Ga'len, tp. of Wayne co., N. Y., on the New York Central R. R., contains the village of CLYDE (which see) and other villages. Pop. 5706.

Galen, the Anglicized name of CLAUDIUS GALENUS, an illustrious physician of antiquity, b. at Pergamus, in Mysia, in 130 A. D. After eleven years of study with the most eminent medical teachers of Pergamus, Smyrna, Corinth, and Alexandria, he became physician to the gladiatorial school of his native town. When thirty-three years old he went to Rome, and remained four years, winning great applause by his skill as a practitioner and success as a teacher. He returned to Pergamus, but was soon afterward summoned by Marcus Aurelius and Verus, the emperors, to attend them at Aquileia; went thence to Rome again and became physician to the family of Marcus Aurelius. He afterwards returned to Pergamus, but probably visited Rome for the third (perhaps the fourth) time in his old age. The time and place of his death are not known with certainty. Suidas says that he died when seventy years old (about 200 A. D.), but Abulfaragius states that he died

in Sicily when eighty-eight years of age, and there are good reasons for believing that this may be correct. Galen was a man of great learning, but exceedingly vain of his attainments and skill, and speaks, probably with good reason, in terms of contempt of the medical men of his time, particularly of those at Rome. He found the medical profession divided into several sects and parties, but after his time there was but one, the Galenic; and for 1300 years his was by far the highest authority in the profession. Yet when tried by the standard of modern science, Galen's theories and practice are often childish and worse than useless, and he seems to have accomplished many of his cures by means of the unbounded faith which the people had in him, and which he had in himself, as a wonder-worker. He was a laborious dissector of animals, and practised surgery at Pergamus, but not at Rome. He wrote a vast number of treatises upon philosophy, logic, and medical subjects. Eighty-three genuine and many more spurious and doubtful medical works of Galen's are extant, besides numerous fragments, and large numbers are lost. Perhaps the most famous work was the *Ars Medica*, but his best treatises are those upon diagnosis and semeiology. The best edition of Galen is that by Kühn (20 vols., Leipsic, 1821–33). CHARLES W. GREENE.

Gale'na, the sulphide of lead, consisting of lead 86.6, sulphur 13.4, and the ore from which metallic lead is almost exclusively obtained. It crystallizes in cubes, has a blue-gray color and a highly metallic lustre, like that of freshly-cut metallic lead. Galena shows great diversity of physical characters. When distinctly crystallized it affords almost all the modifications of the cubic system, and when massive varies from a coarsely crystalline or laminated structure with large and brilliant cleavage surfaces to fine granular or fibrous. Galena generally, perhaps always, contains silver, sometimes in such quantity as to become a rich silver ore, and the diversity of physical characters which it exhibits has been supposed to be indicative of the percentage of silver in it, the fine-grained ore being thought to be the most argentiferous. No reliance can, however, be placed on this character, as the coarsely crystalline galena is sometimes very rich in silver—as that from the Chamberlain mine in Arkansas—while granular and fine-grained ore, like much of that from Ellenville, N. Y., and Lubeck, Me., may be nearly barren. Galena is a conspicuous element in many mineral veins, and is largely worked as an ore for lead or for the silver it holds. In Cornwall it is associated with tin; in the Hartz Mountains and in Transylvania the silver ore is chiefly argentiferous galena. The proportion of silver in galena varies from a few grains to 1000 ounces to the ton. In the U. S. galena is of very frequent occurrence in the veins contained in the crystalline rocks of the Alleghany belt of New England, the Adirondacks, and Canada. It is also found in the Silurian rocks of the Shawangunk Mountains, Rossie, N. Y., and Lexington, Ky., where it occurs in fissure-veins, and in the lead-regions of the Upper Mississippi and Southern Missouri, where it fills or lines crevices called *gash-veins* in the Galena and Lower Magnesian limestones—representatives of the Trenton and Calciferous groups of New York. Galena is met with throughout the silver-mining districts of Colorado, Utah, and Nevada, where it is generally rich in silver. Though not constantly present in the silver ores of this region, it is so abundant as to afford important aid in the process by which the silver is obtained from the ore.

Galena is frequently found in the ancient mounds of the Western States, and it is evident that the mound-builders attached some value to it; but no proof has yet been gathered that they smelted it or made any use of metallic lead. Probably they employed it for ornament, as they did the mica which they brought from North Carolina, and much of the copper they mined on Lake Superior. Some, and perhaps all, of the galena of the mound-builders came from Lexington, Ky., where they worked a large vein which contains much of it. J. S. NEWBERRY.

Gale'na, city, cap. of Jo Daviess co., Ill., on the Galena (or Fevre) River, 5 miles from its junction with the Mississippi, and on the main line of the Illinois Central R. R., 7 miles from Dunleith, 180 miles W. N. W. of Chicago, and 445 miles by water above St. Louis. It is built on bluffs on either side of the river, which is ordinarily navigable by steamboats. The town is named for the mines of lead-sulphide (galena) which abound in this vicinity. There are 72 lead-producing townships in Wisconsin and Illinois, for which Galena is the business-centre. These townships cover a million acres of land, mostly very fertile. The town is very picturesque by reason of the high and broken character of its site, is well built, and has abundant water-power, 2 national banks, a large pork-packing interest, manufactures of woollens, furniture, castings, lumber, flour, etc.; a heavy trade by rail and river in lead, grain, flour, pork, provisions, and lumber, of which the latter is an important article of receipt, while the others are largely shipped hence. Galena is the seat of the North-western German-English Normal School, has 12 churches, 4 weekly, 1 tri-weekly, and 1 daily newspaper, a handsome stone custom-house, and a fine high school, a good system of public instruction, 5 Roman Catholic schools, and a convent of Dominican nuns, who instruct 450 pupils. Pop. 7019.

Galena, tp. of La Porte co., Ind. Pop. 867.

Galena, post-v. of Kent co., Md. Pop. 307.

Galena, post-v., cap. of Stone co., Mo., on James River. Pop. 27.

Galeopithecus. See FLYING LEMUR and INSECTIVORA.

Gale'rius, or **Maxim'ian II.** (GALERIUS VALERIUS MAXIMIANUS, called also ARMENTARIUS), was a Dacian peasant, who served with such distinction in the Roman army that Diocletian gave him his daughter in marriage, and in 292 A. D. declared him Cæsar and Jovius. The failure of his expedition (297) against the Persians brought him into disgrace, but his second campaign won him great glory. He was the prime mover in the Diocletian persecution, for he always regarded the Christians with deep aversion. In 305 he became Augustus, jointly with Constantius Chlorus; in 307 the revolt of Maxentius robbed him of Italy and Africa, Gaul and Britain having been already lost to Constantine, but he still reigned in the East, and distinguished himself by important works of internal improvement. D. 311 A. D.

Gales (JOSEPH), b. 1760 in England; became a bookseller, printer, and publisher of the Sheffield *Register;* but his liberal principles involved him in troubles with the public officers, and in 1793 he sold his business to his assistant, James Montgomery, went to Philadelphia, edited the *Independent Gazetteer*, and, for the first time, published shorthand reports of the congressional debates. In 1799 he went to Raleigh, N. C., where he long edited the *Register*. D. at Raleigh Aug. 24, 1841.

Gales (JOSEPH), son of the foregoing, b. at Eckington, England, Apr. 10, 1786; studied at the University of North Carolina; learned printing in Philadelphia; went in 1807 to Washington, D. C., and was employed as assistant editor of the *National Intelligencer*, of which in 1810 he became sole proprietor; but in 1812 his brother-in-law, W. W. Seaton, became his partner. D. July 21, 1860, having maintained 53 years his connection with this journal.

Galesburg, city and tp., cap. of Knox co., Ill., 163 miles S. W. of Chicago, on the Chicago Burlington and Quincy R. R., at the point where the line from Chicago to Quincy crosses that from Peoria to Burlington, Ia. The railroad has extensive works here. There are also 2 iron-foundries and machine-shops, and manufactories of corn-planters, stalk-cutters, cultivators, and carriages and wagons. Knox College and Female Seminary and Lombard University are located here; the city also has a very comprehensive and well-conducted system of public schools, and a free library. There are two national and 1 savings bank, 2 good hotels, 15 churches, and several lodges of Masons and Odd Fellows. It has 1 daily and 3 weekly newspapers. Pop. of city, 10,158; of tp., exclusive of city, 878. S. W. GRUBB, ED. "REPUBLICAN REGISTER."

Galesburg, post-v. of Kalamazoo co., Mich., on the Michigan Central R. R., 9 miles E. of Kalamazoo. Pop. 140.

Galesville, post-v., cap. of Trempealeau co., Wis., 7 miles from the Mississippi on Beaver Creek, and 22 miles N. of La Crosse. It has a university, a graded school, a court-house, a newspaper, a flouring-mill, a cheese-factory, a stove-factory, barrel manufactory, steam saw-mill, and stores, 2 churches, 2 hotels, and an unlimited water-power. Pop. 1068. G. S. LUCE, ED. "JOURNAL AND RECORD."

Galia'ni (FERDINANDO), b. at Chieti, Southern Italy, Dec. 2, 1728; devoted himself with great success to the study of archæology, letters, history, and political and commercial science; visited England; published in 1750 his great work, *Della Moneta;* entered the Franciscan order; became councillor to the Neapolitan board of trade 1769; its secretary, 1770; finance minister, 1782. D. at Naples Oct. 30, 1787.

Galic'ia, a province of Austria, consisting of the old territories of Galicia, Lodomeria, Auschwitz, Zator, and Cracow, and now divided into two governmental districts, Lemberg and Cracow. It is bounded S. by Hungary, from which it is separated by the Carpathians; E. and N. by Russia and Poland, towards which it has no natural boundaries, except in some places where the Dniester and the Vistula make the line of demarcation. The surface is a terrace, through which the Carpathian Mountains gradually sink into the great East European plain. The soil is fertile, but the climate is cold—long winters with deep

snow and short hot summers. Grain, flax, hemp, and hops are grown, but the grape will not ripen. Fine horses and excellent cattle are reared, and the forests are peopled with deer and wolves. Of minerals, iron and rock-salt abound; the latter especially is of great importance. Galicia has an area of 29,941 square miles, with 5,145,129 inhabitants, Polish and Ruthenian Slavi, with the general character of the Polish society. There is a class of nobles, who have warlike passions, a romantic temper, and elegant manners; and there is a peasantry, rude, filthy, ignorant, and intemperate. But there is no middle class, no manufacturers, no merchants, except the Jews, who live in abject and miserable condition, despised and ill-treated both by the peasantry and the nobility. In this unfortunate structure of society lay the possibility of the division of Poland; and since Galicia (in 1772) came to Austria it has made great advances in the track of modern civilization, in spite of the rebellions which have convulsed it, and whose general character has been the murder of the nobility by the peasantry. The Ruthenians are mostly Roman Catholics of the Ruthenian rite; the Poles, Roman Catholics of the Latin rite; their number is about equal.

Galicia, the name of an old province of Spain, comprises the north-western part of the Peninsula, bounded S. by Portugal and N. and W. by the Atlantic, was in 1833 divided into four provinces, Corunna, Lugo, Orense, and Pontevedra. The surface is mountainous, traversed by several ranges of the Cantabrian Mountains, which reach the Atlantic in lofty and rugged promontories (Cape Ortegal and Finisterre), between which the estuaries of the rivers form the best and safest harbors in Europe (Ferrol and Corunna). The soil is fertile, the climate mild and moist; the ground partly covered with dense forests, affording also fine pasturage and arable lands. The inhabitants, numbering in 1867, 1,937,792, are a vigorous but not very intelligent race, which, however, on account of its industry and plain practical sense, forms one of the most honorable parts of the Spanish nation. Thousands of them emigrate each year to Portugal or to the other provinces of Spain, where they live for some years as workmen, and when they have saved a little money they return home. They are known as Gallegos.

Ga′lien, post-tp. of Berrien co., Mich., on the Michigan Central R. R. Pop. 856.

Gal′ilee [Heb. גָּלִיל, *Galil*, "a wheel" or "circle"], a name applied originally to the twenty towns round about Kedesh-Naphtali, given by Solomon to Hiram in return for services rendered in building the Temple at Jerusalem; but in the Roman period it was the name of the northernmost of the three great provinces of Western Palestine, including the ancient territories of Issachar, Zebulon, Asher, and Naphtali. Lower Galilee appears to have begun with the southern boundary of Esdraelon, and to have extended some 8 or 10 miles N. of Nazareth. All N. of that was called Upper Galilee. The whole province is supposed to have had an area of 2000 square miles. In the time of Christ it was the most densely peopled and thrifty portion of Palestine. According to Josephus, it contained 240 towns (*Autobiography*, 545), and was noted both for the fertility of its soil and the bravery of its inhabitants (*Jewish War*, 3, 3, 2). The population of the whole province, but especially the northern part of it, was largely heathen. This was so in the time of the Maccabees (1 Macc. v. 17–23). Strabo (b. 54 B. C.) says the province was "inhabited generally by mixed tribes of Egyptians, Arabians, and Phœnicians." (*Geog.* xvi. 2, 34.) In Isa. ix. 1, and Matt. iv. 15, it is called "Galilee of the Gentiles." The few Jews who lived there were far less bigoted than their brethren in Judæa. Hence, the greater part of Christ's life was spent in Galilee, and most of his disciples were Galileans. (For an elaborate argument in support of the position that the population of Galilee in the time of Christ was *not* mainly heathen, see the *Bibliotheca Sacra* for Jan. and for Apr., 1874.) R. D. HITCHCOCK.

Galilee, in certain ancient churches, the entrance-chapel or porch, usually at the W. end of the church, or, in other cases, a portion of the church whose floor was depressed one step below the rest, and beyond this portion women were not allowed to pass. In the galilee monks assembled to receive visits from their female relatives, for it was considered less sacred than the rest of the church.

Galilee, Sea of. See GENNESARET, LAKE OF.

Galilee, a v. and tp. of Great Beaver Island in Lake Michigan, belonging to Manitou co., Mich. It is a Mormon settlement. Pop. 203.

Galile′i (GALILEO), commonly called **Galile′o,** b. at Pisa Feb. 14, 1564. His father was a musician. In his boyhood Galileo studied the classics, invented small machines, became an accomplished musical performer, and showed great taste for painting, wherein he endeavored to detect the same law of harmony which he had learned from mathematics. His father wished him to study medicine, but his own inclination was for mathematical pursuits. The propositions of Euclid were taught him by Ostilio Ricci of Fermo, then master to the pages of the grand duke. At the age of twenty Galileo was already a distinguished geometrician. It was at this age that he noticed the swinging of a lamp in a church, and, observing that the oscillations were of equal duration, he inferred that this principle might be used to measure time exactly; but it was not until fifty years after, or about 1633, that he applied this observation to the construction of a clock. Galileo was also the inventor of the microscope, of the thermometer, the proportional compass, and of a telescope with a magnifying power of thirty. This last he presented to the Venetian senate, and was handsomely recompensed for it. By telescopic observations Galileo first discovered the mountainous character of the moon; he also detected the phases of the planet Venus, the satellites of Jupiter, the rings or ring of Saturn, the rotation of the sun and its corruptibility inferred from the spots upon its disk. As is usual with discoverers, many of his inventions were disputed by inferior geniuses; among them, the Milanese Baldassarre Capra asserted priority in the contrivance of the proportional compass, but failed to prove his claim, and his pamphlet was adjudged libellous. But great as was Galileo in astronomy, he was still greater as the founder of the experimental philosophy, as a physicist, and as a mechanician. He was the first to formulate the principle of *virtual velocities.* In 1630 was published at Leyden his book entitled *I discorsi e dimostrazioni matematiche intorno a due nuove scienze*—a work that attracted little notice at the time, but which Lagrange, in his *Mécanique Analytique*, considers as Galileo's most substantial title to scientific glory. In his treatise *Delle cose che stanno nell' acqua* he maintained and proved the so-called *hydrostatic paradox*, declaring that the form of bodies did not affect their power of flotation. Having discovered the isochronism of the pendulum, Galileo endeavored to use it for the purpose of measuring the pulsations of the arteries. In an essay, now lost, entitled *De visu et coloribus*, he established the profound truth of the laws of *consonance and dissonance*, or of the unity and variety of colors; a fact which daily observation and the history of language continue to confirm—language being only a modification of colors and of sounds. He also wrote a treatise on fortification; he maintained that longitude might be determined by the satellites of Jupiter. The sphericity of the earth had already been affirmed by the ancients, and also its motion as a body suspended and revolving in space. Eusebius of Cæsarea had stated the belief of Philotas, that the earth moved and revolved around a central fire in an oblique circle (for the precursors of Galileo see the learned and impartial memorial presented in 1873 to the Royal Institute of Science and Letters in Lombardy by the distinguished Piedmontese astronomer, Prof. Giovanni Schiaparelli). But what is most remarkable of all is the precision with which the antipodes and the attraction of the earth are spoken of as early as 1304 by the preacher Giordano da Rivalta, who said, "Whosoever might be beneath the earth on the other side of the world below would have his feet planted against our feet, and his soles would be opposite our soles. Thou wilt say: How, then, can he stand downward? and I reply to thee: To him who is below it will appear as if he were above, and as if he were standing erect as thou art. And if he should be raised up in the air—that is, drawn downward in respect to us—he would fall back again towards the earth, just as one here would fall from a tower. It will therefore everywhere seem to a man that the sky is infinite over his head, and, in fact, so it is—neither more nor less." Niccolò da Cusa, Domenico Maria Novara of Ferrara, Celio Calcagnini, and Copernicus successively prepared the way for the convictions and the demonstrations of Galileo concerning the revolution of the earth. He was, then, in this respect, not so much a new discoverer as a bold, earnest, and able expounder of a system which, in spite of the hostility of churchmen—it is known that even Luther and Melanchthon wrote against the Copernican system as contrary to the authority of the Bible—was destined to triumph through the clearness of evidence made accessible after Galileo's time to the people, whose good sense was prompt to accept the conclusions. His teachings, however, encountered enemies and opposition in his own day, but the first to excite persecution were the men of science themselves, who were unwilling to be suddenly convicted of ignorance, to confess their mistakes, and to be sent back to school. It was these very men who forced Galileo to fly from Pisa and seek the protection of Salviati when he had ventured to contradict, by experiments made from the top of the Leaning Tower, the theorem of Aris-

totle which declared that *the velocity of the motion of falling bodies is in proportion to their weight.* Salviati not only received him well, but recommended him to the Venetian Sagredo, who secured him the appointment of professor in the University of Padua. At Pisa, Galileo had received but 60 *scudi* annually; at Padua, he had at first double that sum, and afterwards, in 1610, 1000 florins, which was a very large salary for that period, there being required of him only thirty hours of instruction during the year, or, to speak more precisely, sixty half hours.

At Padua, Galileo enjoyed great liberty, and his real troubles only began some years later, when, not satisfied with teaching science, he ventured to declare "that in Scripture there were propositions which were false in the literal sense of the words; that even in matters of solemn dogma the forms of expression were sometimes inexact, out of regard to the incapacity of the popular comprehension; and that in all natural questions philosophical argument should have more weight than mere scriptural declaration." This was certainly very bold. Cardinal Baronius answered with much moderation, "that the Scriptures were given to teach men how to rise to heaven, not how the heavens were made." The court of Rome did not choose to show the same forbearance, and, being under pressure of evil influences, perhaps could not do so. Galileo was denounced, and summoned to appear before the Sacred Congregation of the Index to receive an admonition. He obeyed the summons; the inquisitors solemnly declared the Copernican theory of the revolution of the earth false and contrary to Holy Scripture, and condemned in the most absolute terms the propositions in regard to the central position of the sun, with the earth revolving round it. The report, though untrue, that Galileo had been included by name in this condemnation, soon spread through Tuscany, and he procured from Cardinal Bellarmin a certificate to the contrary. This certificate declared that the decision of the pope and the Congregation against the Copernican system had simply been communicated to Galileo. Though now free to leave Rome, the great astronomer continued to press, in safe quarters, his overwhelming arguments in favor of the rejected system, until recalled to Florence by the prudent friendship of the grand duke. Urban VIII., who, when only Cardinal Barberini, had greatly admired Galileo, and had declared himself of his opinion, being now pope, accepted the dedication of the *Saggiatore,* and exhorted Galileo to come again to Rome, where he was extremely well received in 1624. At this time he was occupied with the solar spots, as also with the tides, and he even returned again to discuss the subject of the earth's motion, notwithstanding the papal prohibition, at the same time, however, praying the grand duke "to consider it as mere poetry or as a dream; nevertheless, as the poets sometimes set a value upon their fancies, so I likewise have a certain esteem for this my novelty."

In 1632, Galileo published at Florence his celebrated *Dialogo sopra i due massimi sistemi del mondo, tolemaico e copernicano* (republished 1874 at Leghorn by Francesco Vigo). Urban VIII. was made to believe that the ignorant Simplicio was intended for him, and as there is no wound so deep as that of injured vanity, the pope now left the Congregation of the Index to do as they liked, on the ground that Galileo had violated the orders he had received. He was therefore summoned once more to Rome, and once more he obeyed the summons. Touching this trial much has been written to accuse, and much to defend, or at least to excuse, the Roman court. It has been asserted that Galileo did not retract until he had been subjected to torture, and that in uttering his retractation he added in a low tone, *E pur si muove* ("Still, it does move"). As to the latter tradition, it is of little consequence whether the protest was audible or suppressed by fear of the stake, but the question as to whether this great man was actually put to the rack cannot fail to be of the greatest interest. It is quite certain that at the time many persons believed Galileo had been literally tortured. It is also most certain that the Romish Church has done her utmost to keep secret the proceedings in the trial of Galileo, and the records exhibit certain *lacunæ* that may well have their significance. At any rate, though it may be doubtful whether Galileo was put to actual physical torture at Rome during his trial, it is most certain that he was threatened with it, and that he was exposed to cruel moral torture, while no menaces were spared to make him quail before his judges. On June 22, 1633, Galileo, at the age of seventy years, on his knees and clad only in a shirt of sackcloth, was forced to pronounce, in the presence of his judges and a large assembly of prelates, a most humiliating formula of abjuration. (See *Parchappe,* ch. viii. On the subject of the trial of Galileo, see the documents published by Silvestro Gherardi in the *Rivista Europea,* 1870, with the arguments which accompany them; also Prof. Govi's interesting pamphlet, Turin, 1872.) Galileo was at first sentenced to imprisonment at the good pleasure of the papal government, but he was afterwards allowed to retire under surveillance to his villa of Arcetri, on the Florentine hills, where he continued his work and his observations until he lost his sight. In this villa was inaugurated in 1873 the new astronomical observatory. Traditions of the blind Galileo are still preserved in that vicinity. A few years since Prof. Arcangeli, finding himself near the tower of Galileo in Arcetri, asked a peasant who Galileo was, and received for answer a strong expression of surprise that he should not know who that arch-magician was, who, being blind, divined the stars! Galileo died at the age of seventy-eight, on Jan. 9, 1642—the year of the birth of Isaac Newton—and was buried in the church of Santa Croce at Florence. For fuller information concerning Galileo, see NELLI, *Vita di Galileo;* CANTÙ, *Illustri Italiani; Galilei,* par le docteur PARCHAPPE; *Galileo e l'Inquisizione,* di MONSIGNOR MARINI (Rome, 1850); PHILARÈTE CHASLES, *Galileo Galilei;* LIBRI, *Histoire de la vie et des œuvres de Galilei;* and the splendid collection in 4to of the *Opere edite ed inediti di Galileo Galilei,* published at Florence by Eugenio Alberi at the expense of the grand duke. In 1864, on the occasion of a centennial celebration of the birth of Galileo by the University of Pisa, a discourse was published by Prof. Silvestro Centofanti, and a comparison between Galileo and Bacon, as founders of the experimental philosophy, by Prof. Pasquale Villari. ANGELO DE GUBERNATIS.

Gal'ingale, a name applied popularly to various plants, especially to certain sedges of the genus *Cyperus,* and more particularly to *Cyperus longus,* a bulbous sedge of Europe. Its bulbs have been employed in medicine, but are now more used by perfumers, who extract from them a substance having a fragrance like that of violets. Other species yield perfumes, especially in tropical lands.

Ga'lion, city of Crawford co., O., 64 miles N. of Columbus, on the Cleveland Columbus Cincinnati and Indianapolis R. R., at the junction of the Indianapolis division with the main line, and on the Atlantic and Great Western R. R. It has the shops of the railroads, 2 foundries, a large mill, 2 national banks, 2 newspapers, 2 hotels, 11 churches, a fine union school building, and a building association, and is rapidly growing. Railroad interests constitute the leading business. Pop. 3523.

ROWE & COONROD, EDS. "REVIEW."

Galipea. See ANGOSTURA BARK.

Gal'ipot [Fr.], the concrete turpentine which collects upon pine trees in the S. of France; called also *barras;* it is an article of commerce, and after melting and straining enters into some pharmaceutical compounds in European practice. (See TURPENTINE.)

Gall (FRANZ JOSEPH), M. D., b. at Tiefenbronn, in Baden, Mar. 9, 1758, of Italian descent on the father's side; studied at Baden, Bruchsal, Strasburg, and Vienna, where in 1785 he took his medical degree. From childhood he had noticed and extensively compared the differences in the shapes of men's heads, believing that these differences would afford the best index to the mental and moral characters of persons examined. In 1796 he began to lecture at Vienna upon his new theory, since widely known as the "science of phrenology" (see PHRENOLOGY); but the announcement drew upon him much censure, ridicule, and opposition, and in 1805 the Austrian government interdicted his lectures. In 1807 he repaired to Paris with his apostle Spurzheim; he became a practitioner of medicine, and in 1819 a citizen of France. D. near Paris Aug. 22, 1828. His principal works are *Philosophisch-Medicinische Untersuchungen* (1791), *Recherches sur le Système Nerveux* (1808), *Anatomie et Physiologie du Système Nerveux* (1810–19), and *Sur l'origine des qualités morales et de facultés intellectuelles* (1822–25).

Gal'lagher (WILLIAM D.), b. at Philadelphia Aug., 1808, the son of an Irish patriot and exile; removed in 1816 to Cincinnati; was apprenticed to a printer 1821; was for many years a journalist of Cincinnati; also edited journals in Xenia, O., and Louisville, Ky.; was employed in clerkships at Washington, D. C., 1850–53. Author of *Erato* (3 vols., 1835–37, poems), and another original volume (1846), besides a compilation of poems (1841), etc. He also prepared a *Social and Statistical View of the Mississippi Valley,* and accomplished much in developing a taste for literature in the West. In 1853 he became a farmer near Louisville, Ky., and was later employed in the treasury department at Washington. He has written much upon agricultural subjects.

Gallait (LOUIS), historical painter, b. at Tournay (Belgium) in 1810. His studies were pursued in Antwerp, but chiefly in Paris; his first pictures were exhibited in Brus-

sels, and soon gained for him fame; but he has been a more frequent contributor since 1835 to the French exhibitions. His great subjects are taken from the history of the Low Countries: *The Duke of Alba in the Netherlands, The Last Moments of Egmont, The Last Honors paid to Egmont and Horn, The Abdication of Charles V.* But he has painted other scenes, partly historical and partly imaginative: *The Death of Palestrina, Job and his Friends, Montaigne visiting Tasso, Baldwin crowned Emperor of Constantinople, The Temptation of St. Anthony*, etc. His paintings are of large size and full of action. M. Gallait is a member of the Royal Academy of Belgium, an honorary member of the Royal Academy of London, and a foreign associate of the Paris Academy of Fine Arts, in the place rendered vacant by the death of Overbeck. He obtained a medal in 1835 and the decoration of the Legion of Honor in 1841. He is a resident of Brussels. O. B. FROTHINGHAM.

Gal'land's Grove, tp. of Shelby co., Ia. Pop. 692.

Gal'la Ox, a breed of domestic cattle found in Abyssinia. Like most of the cattle of India, it has a hump upon the shoulders, but it is chiefly remarkable for its monstrous horns, which, considering the small dimensions of the animal, far exceed in relative size the horns of any other breed. This breed is apparently in every way inferior to the ordinary cattle of Europe and the U. S.

Gallara'te, town in the province of Milan, noted for its commercial and industrial activity. It is situated at the junction of the railways leading from Lake Maggiore and Lake Lugano to Milan, from which city it is about 25 miles distant. The first spinning-jennies ever used in Italy were introduced here by the family Ponti—a family to whose enlightened liberality this town is otherwise largely indebted. It contains many fine buildings, and great care and expense has been bestowed on a new cemetery, which is much praised. Pop. 7596.

Gal'las, a powerful native race of Eastern Africa, who have for years been gradually encroaching upon the Abyssinians proper. They seem to have originated far to the S. of Abyssinia. They are divided into many tribes, are partly Mohammedan, while the majority are pagans. They are remarkable for their bravery and savage character. They are dark-brown, with frizzled hair.

Gal'latin, county of Southern Illinois, bounded on the E. by the Wabash and the Ohio rivers. Area, 310 square miles. It is fertile and well timbered. Tobacco and grain are staple products. Coal is mined, and salt-springs are found here. It is intersected by the Springfield and Illinois South-eastern R. R. Cap. Shawneetown. P. 11,134.

Gallatin, county of Kentucky, separated from Indiana by the Ohio River. Area, 150 square miles. The soil is productive, the surface undulating and well timbered. Tobacco and grain are staple products. The county is traversed by the Louisville and Cincinnati R. R. Cap. Warsaw. Pop. 5074.

Gallatin, county of Montana, bordering on Wyoming. Area, 6200 square miles. It was in 1870 the foremost agricultural county in the Territory. Grain, live-stock, and dairy products are the staples. The county is traversed by the Yellowstone and numerous other streams. Much of it needs irrigation, and timber is rather scanty. A part of the county is in the Crow reservation. Gold and lignitic coal are abundant. Cap. Bozeman. Pop. 1578.

Gallatin, post-v., cap. of Daviess co., Mo., at the junction of the Chicago Rock Island and Pacific R. R. and the St. Louis Kansas City and Northern R. R., on Grand River. It has 2 banks, 13 stores, 2 newspapers, 2 hotels, a fine graded public school, and 4 churches. Pop. about 1500. J. T. DAY, ED. "NORTH MISSOURIAN."

Gallatin, tp. of Clay co., Mo. Pop. 2241.

Gallatin, tp. of Columbia co., N. Y. Pop. 1416.

Gallatin, post-v., cap. of Sumner co., Tenn., 26 miles from Nashville, on the Louisville Nashville and Great Southern R. R., and 3 miles from the Cumberland River. It has a large cotton-factory, a wool-factory, a national bank, a deposit bank, 2 large flouring-mills, a carriage-factory, an iron-foundry, a manufactory of agricultural implements, planing-mills, 2 newspapers, 7 churches, 4 hotels, and the usual number of stores, shops, etc. Pop. 2123.
T. BOYERS & Co., EDS. "EXAMINER."

Gallatin (ALBERT), LL.D., one of the most distinguished statesmen of America, b. at Geneva, Switzerland, of an ancient patrician family Jan. 29, 1761, and was the son of Jean de Gallatin by Sophia Albertina Rolaz du Rosey, his wife. His maternal grandfather was Albert Rolaz, Seigneur du Rosey, of Pays, now canton of Vaud in Switzerland. His ancestor, Jean de Gallatin, secretary to the duke of Savoy, removed from Bresse, now department of Ain in France, to Geneva, of which he became a citizen in 1510, and although he was created a viscount palatine (*vice-comes*) by Pope Leo X. (1522), he embraced the Reformation, and was one of the magistrates of the city in 1535, when Geneva became an independent republic. His wife was Perronnette d'Entremont, nearly related to Jacqueline d'Entremont, wife of the illustrious Admiral Coligny. Albert Gallatin was left an orphan in his infancy, and was educated under the care of a distinguished lady, a friend and relation of his mother. He graduated in 1779 at the University of Geneva, and being deeply imbued with the bold and liberal spirit of the times, he declined offers of honorable and advantageous employment under one of the sovereigns of Germany, and in opposition to the wishes of his family emigrated to the U. S. He landed at Boston July 14, 1780, and soon after his arrival proceeded to Maine, where he served as a volunteer under Col. Allen, made advances to the government for the support of the American troops, and in Nov., 1780, was placed in command of a small fort at Passamaquoddy, defended by a body of militia, volunteers, and Indians. In 1783 he was professor of the French language at Harvard University, and the following year, having received his patrimony from Europe, he purchased large tracts of land in Western Virginia, with a view of forming an extensive settlement; he was, however, prevented by the Indians; in 1786 purchased a farm on the banks of the Monongahela, in Fayette co., Pa.; in 1789 was elected a member of the convention to amend the constitution of Pennsylvania, and united himself with the Republican party; in 1790 was elected to the house of representatives of Pennsylvania, and continued to be re-elected till he took his seat in Congress; in 1793 was elected a Senator of the U. S., but his eligibility was contested on the ground of his not having been a sufficient length of time a citizen, and he lost his seat by a strict party vote. It was on this occasion that the doors of the Senate were, for the first time, thrown open to the public. The same year married in New York City a daughter of Com. James Nicholson. There was one service rendered by Mr. Gallatin at this time which he always looked upon as most important in its consequences and most honorable to himself—the head he personally made against what is commonly called "The Whisky Insurrection." In 1794, Mr. Gallatin returned to Fayette co. In Oct., 1794, was again elected, by the concurring votes of *all parties*, to the legislature, and on the same day was elected member of Congress for the adjacent district of Washington and Allegheny counties, in which he did not reside. In Dec., 1795, he took his seat in Congress, and continued there during three terms, and had been re-elected for a fourth term when, on the accession of Mr. Jefferson to the Presidency in 1801, he was appointed secretary of the treasury. Although Mr. Gallatin spoke on every important subject of debate that arose, he paid particular attention to the financial concerns of the country. It was on his motion that the committee of ways and means was first organized; and he explained his views in *A Sketch of Finances*, published in 1796, and in *Views of Public Debt, etc.*, published in 1800. The Congressional career of Mr. Gallatin was one of a splendor rarely surpassed.

In 1809, Mr. Madison offered him the state department, but he declined it, and remained at the head of the treasury department until 1813, a period of twelve years. While at the head of the treasury he exercised a great influence with the other departments and in the general administration of the government, especially in regard to its avowed policy of retrenchment and financial reform. On the offer of the Russian mediation in 1813, Mr. Gallatin proceeded to St. Petersburg as envoy extraordinary of the U. S., without, however, resigning the office of secretary of the treasury, it being his intention to resume the duties of that arduous and difficult office if he was not successful in negotiating an honorable peace. Previous to his departure he drew up a number of bills that were necessary to carrying into effect the system of taxation that he had recommended to Congress in his annual report and in a letter addressed by him in reply to one from the committee of ways and means; these bills were reported by the committee on Jan. 26, 1812, and were finally passed by Congress at their special session held on May 24, 1813, in the form in which they had been recommended by Mr. Gallatin and reported by the committee. Great Britain having refused the mediation of Russia, she agreed to treat directly with the U. S. Gottenburg was first selected for carrying on the negotiations, but Mr. Gallatin having arranged with Lord Castlereagh that they should be transferred to Ghent, he proceeded there in 1814, and in conjunction with his distinguished associates negotiated and signed the treaty of peace. In 1815 he went to London, where, with Messrs. Adams and Clay, he negotiated and signed a commercial convention between the two countries. In 1816, Mr. Madison was desirous that he should resume the place of secre-

tary of the treasury, but he declined, and went out to France as minister of the U. S., where he remained until 1823. He was twice deputed on extraordinary missions—in 1817 to the Netherlands, and in 1818 to England. He would not accept of a seat in the cabinet at Washington on his return in 1823. In 1824, when nominated for Vice-President of the U. S. by the Republican members of Congress, he declined the nomination. He also declined the Panama mission tendered to him by President Adams. He received the thanks of the government of the new republic of Greece for his efforts in their behalf. In 1826 he was appointed envoy extraordinary to England, returned to the U. S. in Dec., 1827, and resided in the city of New York; and, with the exception of the preparation of the argument to be laid before the king of the Netherlands on behalf of the U. S. in reference to the north-eastern boundary, which occupied him for the first two years, he held no public office. In 1830 he was chosen president of the council of the University of the City of New York. An early disciple of the school of Adam Smith, he was always strongly in favor of free trade, and assisted at the free-trade convention held at Philadelphia in 1831. The preparation of the memorial to Congress on behalf of said convention was committed to him. The same year (1831) he became president of the National Bank, which position he resigned in 1839, when he was succeeded by his eldest son, James Gallatin. He had been for several years, and was at the time of his death (Aug. 12, 1849), president of the New York Historical Society, and also president of the American Ethnological Society, organized under his auspices.

Besides his numerous writings on the currency and other subjects connected with finance, and his official papers, he published some elaborate works on the Indian languages, etc. In 1840 his essay on the north-eastern boundary appeared, which, together with his essay on the map of Mr. Jay, read before the New York Historical Society, displayed great research. In 1846 appeared his remarkable and unanswerable letters on the Oregon controversy. His beautiful essays on the Mexican war are still fresh in the recollection of all. They were addressed to the interests as well as the moral obligations of nations. He was from principle a sincere lover of peace; he had been opposed to the war of 1812, which had been forced on Mr. Madison's administration; and the last years of his political life in the diplomatic service of the country were employed in promoting that object. His last intellectual effort was a treatise on the languages and civilization of the Southern and Western tribes of Indians. His reputation extended from America throughout Europe. He left the impress of his great mind on the age in which he lived, and went to the grave universally honored. His career was alike honorable to the country of his birth and to that of his adoption. (*Proceedings of the New York Historical Society,* Oct., 1849.) ALBERT H. GALLATIN.

Gallatin City, a v. of Gallatin co., Mont. Pop. 53.

Gallatin, Mount, a mountain some 10,000 feet high, near the N. W. corner of Wyoming, and in the National Park. Near its base rise the Gallatin River and the E. fork of the Madison.

Gallatin River, one of the head-streams of the Missouri, rises in Montana, near the National Park. Its general course is northward through one of the most beautiful, healthful, and fertile parts of Montana. Length, 125 miles.

Gallaudet (EDWARD MINER), PH. D., LL.D., a son of Dr. T. H. Gallaudet, was b. in Hartford, Conn., Feb. 5, 1837; taught in the Hartford Asylum in 1856, and in 1857 took a prominent part in organizing the Columbia institution for the deaf and dumb. In 1864 he took the preliminary measures for founding the National Deaf-Mute College at Washington, of which he became president, acting also as professor of moral and political science. In 1868 he published a report of his observations in the deaf-mute schools of Europe. He is also author of other reports on deaf-mute education.

Gallaudet (THOMAS), D. D., son of Dr. T. H. Gallaudet, b. at Hartford, Conn., June 3, 1822; educated at Trinity College of that city, and graduated in 1842; was 1843–58 a professor in the New York institution for deaf mutes; took orders in the Protestant Episcopal Church 1850; became rector of St. Ann's church, New York City, in 1852, and instituted in it regular services for deaf mutes and their friends; general manager of the Church Mission to deaf mutes Oct., 1872; pastor of the sisterhood of the Good Shepherd at St. Barnabas House, Apr., 1869; chaplain of the Midnight Mission, Nov., 1871; has done much to promote the instruction of deaf mutes elsewhere, and has written largely upon the subject.

Gallaudet (THOMAS HOPKINS), LL.D., b. in Philadelphia Dec. 10, 1787, of Huguenot descent; graduated at Yale in 1805; was tutor there 1808–10; studied 1811–14 at Andover Theological Seminary; studied law also; visited Europe 1814–15 in the interest of the Hartford institution for deaf mutes, which he started, and to the superintendency of which he had been appointed; returned in 1816, accompanied by Laurent Clerc; was in charge of the asylum 1817–30, and afterwards remained a director; was chaplain of the insane retreat at Hartford 1838–51; author of *Sixteen Discourses* (London, 1818), *Bible Stories for the Young* (1838), *The Child's Book of the Soul, Youth's Book of Natural Theology* (1852); assisted in preparing a small English dictionary; edited *Annals of the Deaf and Dumb* (6 vols.), etc. D. at Hartford, Conn., Sept. 9, 1851. (See his *Life,* by H. HUMPHREY, 1858; H. BARNARD, *Tribute to Gallaudet;* DR. SPRAGUE, *Annals of the American Pulpit.*)

Gal'lauher, tp. of Clinton co., Pa. Pop. 252.

Gall-Bladder, a pear-shaped membranous sac, the reservoir for the bile, situated in a fossa on the inferior surface of the right lobe of the liver. It is about four inches long, and one in width at its broadest part, and in its natural undistended condition holds about an ounce. The gall-bladder consists of three coats—an external, derived from the serous membrane which lines the abdominal cavity; a middle coat, composed of muscular and fibrous tissue; and an internal mucous coat. A thick viscid mucus is secreted by the last-mentioned coat which sometimes plugs up the common bile-duct, thus giving rise to jaundice. The gall-bladder receives the bile secreted by the liver through the hepatic and cystic ducts. It discharges its contents through the common bile-duct into the upper portion of the small intestine. Besides being greatly distended with bile in consequence of obstructed ductus communis, the cavity of the gall-bladder may be almost entirely obliterated in consequence of obstruction in the cystic ducts. It also frequently contains biliary calculi. Many plant-eating mammals and some birds are without a gall-bladder; and there are a few mammals which have two. EDWARD J. BERMINGHAM.

Gal'le, or **Pon'to Gal'lo,** town of Ceylon, on the southern coast of the island, is fortified, well built, and has a good harbor. Its trade, however, is insignificant, compared with the fertility of the surrounding districts and the commercial advantages of its position. P., with surroundings, 27,873.

Gal'le (JOHANN GOTTFRIED), PH. D., b. at Pabsthaus, Germany, June 9, 1812; studied at Wittenberg and Berlin, and became astronomical assistant in the Berlin Observatory, under Encke; discovered three comets 1839–40; and in 1846, following the directions sent him by Leverrier, on the evening of the very day when he received those directions he found the planet Neptune. In 1851 he became professor of astronomy at Breslau; twice received the Lalande prize; author of numerous papers and some treatises on climatology and astronomy.

Gal'leass, a sort of galley formerly built in Spain and Italy. There were enormous towering structures at either end. As many as 300 galley-slaves were employed in rowing one of these vessels. They were much larger than the galleys, and (unlike them) had guns in broadside.

Gal'leon, a name given to a class of large ships formerly built in Spain. Some galleons were used in war, and had sometimes four gun-decks. Others were employed as treasure-ships in bringing the precious metals from America to Spain. They were large, clumsy structures, and were the easy prey of pirates and hostile navies. Their bulwarks were three or four feet thick.

Gal'lery [Fr. *galerie,* originally a hall for festivity], in architecture, may designate any long, narrow passage. Latterly, it generally designates a permanent platform or floor elevated above a part of the general floor of an apartment, and running along one or more sides of a room. Galleries may be let into the wall or supported on pillars. There may be two or more galleries, one above another. This is usually the case in theatres and opera-houses. On shipboard there is sometimes a gallery extending outward from the stern and quarters of a ship. In fortification a gallery is a long covered passage, either through earthwork or masonry, or underground. The term is also applied to a hall for the exhibition of works of art.

Gal'ley [Fr. *galée, galère*], a form of ship which is the direct offspring of the *navis* of the ancients. The Phœnician, Carthaginian, Greek, and Roman vessels, if of considerable size, were galleys. The name is properly given to a class of vessels formerly much used in the Mediterranean, and even now scarcely obsolete. They were long, narrow ships, which were propelled partly by sails, but chiefly by oars. They were used both in war and commerce. The oars were in one or more banks or tiers, and were often worked by convicts (as in France and other countries) or by slaves. The swift piratical galleys of Barbary were rowed by Christian slaves. In such cases

the rowers were chained to their oars. Several varieties of open boats are known as galleys.

GALLEY, in printing, is the tray of wood or metal in which the compositor deposits the types from the composing-stick as often as the latter is filled.

Gal'lia, commonly anglicized as **Gaul,** the name given by the Romans to the regions inhabited by Celts in Italy and what is now France. Celtic Italy was called Cisalpine Gaul, and that part N. of the Po was called Transpadane Gaul; while what is now France was Transalpine Gaul, Gallia Ulterior; also Gallia Comata, or "long-haired Gaul," from the length of the people's hair. Gallia Braccata, "breeched Gaul" (from the use of breeches as clothing), was also called Gallia Narbonensis, and was a strip along the Mediterranean coast of France.

CISALPINE GAUL, in a general way, may be defined as having had the Rubicon as its south-eastern and the Trebia as its south-western landmark. Traces of a Celtic language exist in the names of places still farther S., and Celts must early have had a strong foothold in Italy; and the native Celtic population was often reinforced by immigrant tribes from Transalpine Gaul, but the population certainly contained a larger Italian or non-Celtic element as far back as history goes. The Roman power gradually trenched upon Cisalpine Gaul, and it finally received a special form of government under the Romans.

TRANSALPINE GAUL, the Gallia of Cæsar, was divided in his time into Aquitania, which lay S. W. of the Garonne, whose people were probably of Basque race; Gallia Proper, or the region of the Celtæ or Galli, extending from the Garonne to the Saône and Marne; and Gallia Belgica, bounded E. by the Rhine. But there were certainly Germanic tribes on the left of the Rhine, as well as many Celts in the heart of Germany at this time. It has been conceived that the Belgæ were Gauls (Celts) of the Cymric branch, but the point has never been established; and it is certain that a large Germanic element existed there. Julius Cæsar and his successors adopted, with a large degree of success, the policy of Romanizing Gaul, and in later times, chiefly under Frankish influence, it became to some extent Germanized, and most of its distinctively Celtic traits disappeared. (See CELTS.)

Gallia, county of Ohio, separated from West Virginia by the Ohio River, its eastern boundary. Area, 420 square miles. Its surface is hilly, but it is fertile, producing cattle, grain, and wool abundantly. Coal and iron ore are found. Cap. Gallipolis. Pop. 25,545.

Gal'liard [Fr. *Gaillard;* It. *Romanesca*], a gay and lively dance of a kind now unfashionable or obsolete or nearly so, except among European peasants. Also the music for such a dance, which was smooth and melodious and in very quick time.

Gallia'te, town in the province of Novara, Italy, and near the city of Novara, possessing silk and cotton manufactories. The vicinity is considered very salubrious, and is much frequented in the summer for hunting and fishing, as well as for health. Pop. 7018.

Gal'lic Ac'id ($C_7H_6O_5 = H_3C_7H_3O_5$), discovered by Scheele, occurs in most astringent parts of plants, associated with tannic acid, as gall-nuts, sumach, divi-divi, green and black tea, sandal-wood, walnuts, etc. It may be extracted from infusions containing at the same time tannic acid by first precipitating that acid by gelatine, evaporating the filtrate to dryness, extracting with alcohol, and dissolving the gallic acid from the residue, obtained on evaporating the alcohol, in boiling water, which on cooling deposits crystals of gallic acid. It is purified by recrystallization and treatment with animal charcoal. Gallic acid is usually obtained by the fermentation of gall-nuts. The powdered gall-nuts are exposed to the air for a month or six weeks in a moist state, at a temperature of 20° to 25° C. (68° to 77° F.). The ferment appears to be the *Penicillium glaucum* and the *Aspergillus niger.* The mass becomes covered with these plants (mould), and the surface is frequently cleansed by removing this mould. When the fermentation is completed, the moist mass is pressed, and the residue is boiled with water to extract the gallic acid, which deposits in crystals as the solution cools. By redissolving in 8 parts of boiling water, and treating the solution with animal charcoal, the coloring-matters are removed. By this fermentation the tannic acid of the nut-galls, which is a glucoside (see GLUCOSIDES), assimilates the elements of water and yields gallic acid and glucose:

$$\underset{\text{Tannic acid.}}{C_{27}H_{22}O_{17}} + 4H_2O = \underset{\text{Gallic acid.}}{3C_7H_6O_5} + \underset{\text{Glucose.}}{C_6H_{12}O_6}.$$

By the action of acids or alkalies the tannic acid is decomposed in the same manner. Tannic acid is rapidly converted into gallic acid by boiling in dilute sulphuric acid. The gallic acid crystallizes in long silky needles or in triclinic prisms, which are inodorous and have an astringent taste. They dissolve in 100 parts of cold and in 3 parts of boiling water. The solution reddens litmus. They are very soluble in alcohol, less so in ether, and soluble in glycerine to the extent of 40 grains in a fluid ounce. Heated to 210° C. (410° F.), gallic acid is converted into pyrogallic acid and carbon dioxide:

$$\underset{\text{Gallic acid.}}{C_7H_6O_5} = \underset{\text{Pyrogallic acid.}}{C_6H_6O_3} + CO_2.$$

If exposed to the air, the aqueous solution of gallic acid, especially if alkalies are present, disengages carbon dioxide and deposits a black substance. Boiled with potassa, it is changed to black tanno-melanic acid. Warmed with concentrated sulphuric acid, it is changed to rufigallic acid. Gallic acid reduces gold and silver salts to the metallic state. It does not precipitate gelatine, which distinguishes it from tannic acid. With ferric salts (sesqui-salts) it produces a deep bluish-black color. Gallic acid expels carbonic acid from its salts, and being tribasic it forms three classes of salts, according as one, two, or three atoms of hydrogen are replaced by metallic radicals. There are also basic and acid salts. Hlaswetz (*J. pr. Chem.* ci. 113) claims that this acid is quadribasic. Gallic acid is employed in photography, but is not as useful as pyrogallic acid as a developer. It is the agent most frequently employed to reduce silver in hair-dyes. The most effective dyes consist of two fluids, to be applied successively—first, an ammoniacal solution of nitrate of silver; second, an alcoholic solution of gallic acid. In medicine, gallic acid is used as an astringent, especially for internal use, as tannic acid, though more powerful, is rendered insoluble by gelatine. It is used to check hæmorrhages from the chest and uterus; is used in pyrosis and for night-sweats of phthisis. For external use it is inferior to tannic acid.

C. F. CHANDLER.

Gal'licanism, the name generally applied to a movement within the Roman Catholic Church in France which wishes to vindicate the national position of the French Church against the encroachments of the papal court. The question is one of constitution and administration only, not of doctrines and dogmas; and the liberty which is desired is not a schism or the establishment of an independent Gallican Church, but simply a limitation of the papal authority in favor of the episcopal. From the very beginning the Gallican Church occupied a more independent position with respect to the pope than, for instance, the Church of Italy, and in the thirteenth century this independence became more distinctly defined. The Pragmatic Sanction of Louis IX. (1269) forbade the pope to levy money from the French clergy without the consent of the king, and placed the clergy under the authority of the royal courts in all civil cases. Certain decrees of the Councils of Constance (1414–18) and Bâle (1431–49) were condemned in Rome, but adopted in France by the assembly of the estates at Bourges (1438); and by the Pragmatic Sanction of Charles VII. these decrees, which placed the general council above the pope, forbade the pope to lay a tax on the appointment of bishops and prelates, and abolished the annates, were incorporated in the constitution of the Gallican Church. Nor was this Pragmatic Sanction a dead letter. In 1455 the bishop of Nantes appealed from a royal ordinance to the papal court, but the Parliament of Paris interfered, and declared that the bishop had violated the privileges of the Church and the laws of the nation. It was abolished, however, in 1516, by a concordat between Francis I. and Leo X.; Francis hoped to be invested with the fief of Naples, and his chancellor to be made a cardinal. But the Parliament and the university protested, and the decrees of the Council of Trent (1545–63), which defined the episcopal authority as derived from the pope, and not from Christ, were not adopted in France. The French people still clung to the Pragmatic Sanction of Bourges, and considered it as the constitution of the French Church, though it had been formally abolished. During the government of Richelieu and Mazarin the Church of France was drawn closer to Rome, but early in the reign of Louis XIV. its independence was once more asserted. The king had made the appointments to all the subordinate ecclesiastical offices in a diocese during a vacancy occurring in the episcopacy. The pope disputed this right, and now followed the "Declaration of the Clergy of France," drawn up by Bossuet, and sent to the pope in 1682. It maintained that in temporal matters the pope had no authority over the king, and that even in spiritual matters his judgment was not "irreformable;" his directions must agree with the decrees of the general councils and with such rules and customs as are generally adopted by the Gallican Church. In Rome the "Declaration" was publicly burnt, and Louis XIV. made some explanations and formal concessions, but in reality the position taken by the "Declaration" was maintained.

During the Revolution the constitution of the French

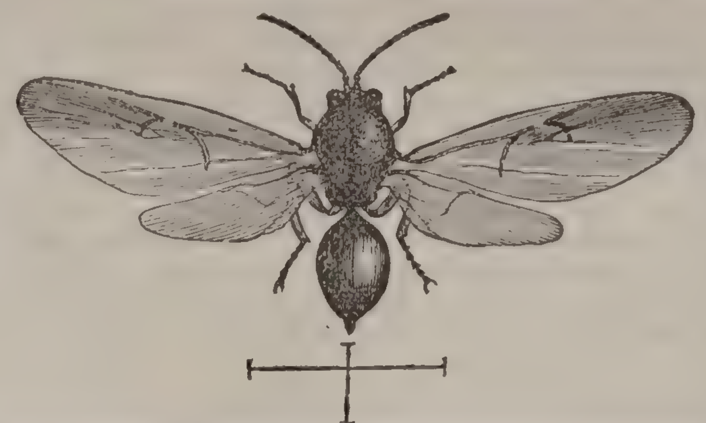
(or, as its Latin name is, the Gallican) Church was entirely broken up. The estates and revenues of the clergy were seized and confiscated, the schools and seminaries for their education destroyed, and the Church itself abolished. Most of the bishops fled and lived in exile. But in 1801, Napoleon opened negotiations with the pope concerning the re-establishment of the Roman Catholic Church in France, and in 1810 the Declaration of 1682 was promulgated as the fundamental law of the re-established Church. The pope refused to consecrate the bishops whom the emperor had appointed, but Napoleon took the pope prisoner and compelled him by the concordat of Fontainebleau (1813) to submit. As soon, however, as the pope reached Rome he declared the concordat null and void, and when the Bourbons returned to the French throne, and with them the exiled bishops, a new concordat was concluded (in 1817) by which the liberties of the Gallican Church were considerably restricted. The activity which the Jesuits began to develop, and the fanatical reaction which became more and more apparent in literature, especially through the writings of Joseph de Maistre, made the French people at last uneasy, and in 1824 and 1826 it was necessary for all bishops and teachers to declare publicly that they adhered firmly to the Declaration of 1682. But of late the question of Gallicanism, of the relation between the Gallican Church and the pope, has lost some of its interest, and has been merged into that of liberalism and ultramontanism—a question not of constitution and administration only, but also of doctrines and dogmas. The Vatican Council of 1870 gave the death-blow to Gallicanism and liberal Catholicism. Bishop Dupanloup of Orléans was the last distinguished Gallican; he first voted against papal infallibility, but afterwards submitted to the Council. CLEMENS PETERSEN.

Gallie′nus (PUBLIUS LICINIUS VALERIANUS EGNATIUS), son and successor of Valerian, was raised to the purple by his father in 253, and in 260 became sole emperor. His reign was greatly disturbed by the invasions of Germans, Franks, Goths, Sarmatians, Persians, and others, a dire pestilence decimated the people, and the so-called thirty tyrants created anarchy throughout the empire. Gallienus seems to have been a weak and sensual though personally brave man. He was killed by his own soldiers at the siege of Milan, 268 A. D.

Gallinaceous Birds. See RASORES.

Gall-Insects are usually defined as those which deposit their eggs in the tissues of plants, and as being confined to two of the seven Orders of true insects. They may be more correctly defined as insects which live within abnormal growths or excrescences produced on different parts of plants, either by the action of the indweller or by that of its parent; the animal in the one case being the architect of its own dwelling; in the other, born within its already constructed abode. These swellings exhaust more or less the parts of the plant on which they occur, and are sometimes so numerous as to destroy the entire plant. Many different families of insects are represented by gall-producers, and they occur in all the Orders except the two lowest—viz. the Straight-wing insects (Orthoptera) and the Nerve-wing insects (Neuroptera). Yet the gall-making habit is by no means common to all the other genera of the family, nor even to all the other species of the genus where it occurs; for the very same genus which contains species which make galls often—and, indeed, quite generally—contains other species that possess no such faculty. Gall-insects are preyed upon by a number of parasitic species which manage to reach them in their hidden recesses; and their galls are appropriated by a number of guest-insects or Inquilines. These do not properly come within the present scope; and those persons who wish to learn more about them will do well to consult the writings of Osten Sacken, Walsh, and Bassett in the *Proceedings* of the Philadelphia Entomological Society. The clearest idea of the different gall-insects, their characteristics and habits, will be conveyed by briefly considering them by Orders, and by mentioning a few species in each family which make the more common or conspicuous galls.

Order Hymenoptera, or Clear-wing Flies.—By far the greater number of gall-insects belong to the order Hymenoptera, or Clear-wing flies, and the family Cynipidæ, or gall-flies proper, is essentially a gall-inhabiting one. It comprises two divisions or sub-families, the Cynipidæ Psenides, or true gall-makers; and the Cynipidæ Inquilinæ, or guest gall-flies, which last do not construct galls of their own, but sponge upon the gall-substance produced by others. We have to deal, in this connection, principally with the first division. The typical genus, *Cynips*, has a curved ovipositor, which is more or less hidden within a valve in repose. Most of the oak-galls are produced by species of this genus. With the ovipositor just mentioned the female pierces the plant-tissues, and therein consigns an egg, together with a small quantity of a peculiar poisonous fluid. Under the influence of this fluid the gall rapidly



Fly belonging to the genus *Cynips*, the principal genus of Hymenopterous, gall-making insects. Hair-lines indicating natural size.

develops, and is generally fully formed before the egg hatches. The egg is whitish in color and soft. It invariably swells more or less by endosmosis of the surrounding juices, and the outer pellicle is so delicate that no shell is left in hatching; but the larva, or young gall-insect, seems rather to be gradually transformed from the egg. This larva is also whitish, very soft, and has an inconspicuous head and no legs. The body is more or less cylindrical, tapering to both ends, but more especially behind, and lies in a curved position within the cell. As the larva grows the gall-substance around its cell hardens into a cream or buff colored shell, which frequently separates entirely from its surroundings. This may perhaps be in part explained by the absorption of digested matter, as no fæces are found in the cavity, and if excreted and absorbed they would naturally cause increased hardening, and lessen the influence of the plant immediately around the cavity. Most insects, once out of the egg, go through somewhat sudden changes or transformations, especially from the larva to the pupa, and from the pupa to the imago or perfect state. But the chitinous integument of these gall-flies is so delicate that the larval molts are not traceable in any exuviæ left within the cell; while the change from the larva to the pupa, and from this to the perfect state, is comparatively slow, and partakes rather of the character of continued and uninterrupted development. The fly, once perfected, remains for a considerable time within its cell, but finally eats its way out of its prison.

One of the most interesting biological features of these gall-flies is the fact that two entirely different galls, produced on the same tree at different seasons of the year, may be made by insects specifically related. Thus, there is a large woolly gall, the deformation of a bud, which grows on our black oaks in spring, and which produces in summer a common gall-fly (*C. q. operator,* O. S.) which is bisexual. The female oviposits between the acorn and cupule of the previous year's setting, and the result is a pip-like gall (*Q. operatola*, Riley MS.) embedded in that position, and generally about half exposed. These fall with the acorn to the ground, and the second spring succeeding give forth flies which are all females, and which produce the woolly galls of spring. In the light of this dimorphism and this alternation of generations, the fact, long recognized, that certain galls produce nothing but females, becomes explicable; and there can be little doubt that all species known only in the female sex exist also in the bisexual form, though the gall producing this last may present an entirely different appearance to that producing the former. *Cynips q. spongifica* O. S., produces the well-known American oak-apple, a large, round, drab-colored swelling, filled with brownish spongy matter, and formed on the leaves of the Black oak (*Q. tinctoria*). Those formed in spring produce both sexes, while those formed in late summer—the progeny, no doubt, of the former—produce only females, which have been described as a distinct species (*C. q. aciculata,* O. S.), but which Walsh proved to be specifically related to the former. *Cynips q. inanis* O. S., produces the Bastard oak-apple, which is found on the leaves of the Red oak (*Q. rubra*), and differs from the preceding in being smaller, and in the more brittle central chamber being connected with the outer rind by radiating filaments. *Cynips q. prunus* Walsh, produces the Oak plum-gall, a large red-brown growth from the cupule of acorns of the Black and Red oaks. It is remarkable for remaining two, or even three, years in the gall before issuing. *Cynips q. ficus* Fitch, causes a number of compressed, fig-like swellings on the twigs of the White oak. *Cynips q. hirta* Bassett, is wingless, and forms pea-like galls, with a granulated surface, on the leaves of the Chestnut oak (*Q. montana*). An undescribed species forms a gall extending by a long peduncle from the margin of the leaf of the Yellow oak (*Q. coccinea*). *Cynips q. saltatorius* Edwards, covers the leaves of the different white oaks

with minute, seed-like galls, inserted, each in a pocket, on the under side. When mature the galls fall to the ground,

Bastard Oak-apple (formed by *Cynips q. inanis* O. S.), found on the Red oak, and showing the radiating fibres which support the central chamber. Color, drab.

and there keep up a constant jumping or bounding movement. The ground covered with these animated galls presents a curious spectacle, and few persons at first comprehend that the motion is imparted by the sudden jerking of the larva within, very much as a "skipper" would send a rounded body bounding if confined within one that scarcely admitted of the maggot's full expansion. *Cynips gallæ-tinctoriæ* (Geoff.) produces the gall-nut of commerce on *Quercus infectoria,* while *Cynips insana* West. produces on the same oak, in the country bordering the Dead Sea, the "mad apples" which Moore describes as

"Dead Sea fruits that tempt the eye,
But turn to ashes on the lips."

As *Cynips* proper works particularly on the oak, so *Rhodites* works on the Rose, and *Diastrophus* on the Raspberry and Blackberry. *Rhodites rosæ* (Linn.), common to Europe and America, forms a polythalamous, mossy gall on the twigs of the Rose, known as the *bedeguar* of the rose. *Rhodites bicolor* Harr., makes a cluster of pretty, round, and prickly galls on the leaf-stalk of the same plant; *R. radicum,* a large brown, irregular, polythalamous gall on the roots; and *R. ignota* O. S., a gall, resembling somewhat a beet-seed, on the leaf-stalk of the same. *Diastrophus nebulosus* O. S., makes a large, irregular, red-brown, polythalamous swelling on blackberry canes; and *D. cuscutæformis* O. S., forms a collection of one-celled galls of the same color, and more or less thickly covered with spinous fibres, on the same plant. *Antistrophus, Tribalia,* and *Ibalia* are genera of limited extent, the first containing (so far as yet described) but one species (*Antistrophus l. pisum,* Walsh and Riley), which makes a pea-like gall quite common on the stems of *Lygodesmia juncea,* growing on the plains of Colorado; the second also containing one species (*Tribalia batatarum,* Walsh), which forms a gall on the tuber of the potato; and the habits of the third being unknown.

Prickly Rose-gall (formed by *Rhodites bicolor* Harr.), growing on the leaf-stalk of the rose. Colors, green and rosy.

The next most extensive family of gall-making insects in this order is that of the Saw-flies (Tenthredinidæ). These flies are generally of larger size than the true gall-flies, and only comparatively few of the species of a few genera in the family (which is a very extensive one) possess the gall-making habit. The females are characterized by having a saw-like ovipositor, by the aid of which they insert their eggs in the tissues of plants, mostly of the willow (*Salix*) family. These eggs are also accompanied with a peculiar poison, which causes the gall to fully form, in most cases, before the young larva hatches. The larvæ—called "false caterpillars"—are at once distinguished from those of other gall-making insects by the large head, but more especially by having twenty legs (six true and fourteen false or prolegs). *Nematus salicis-pomum* Walsh, forms, on the leaf of the Heart-leaved willow, the Willow-apple gall, a beautiful growth, resembling a miniature apple, but perfectly tasteless. *Enura s. ovum* Walsh, forms the Willow-egg gall, a round or oval swelling, from one-third to one-half inch long, growing from the side of the twig of the same

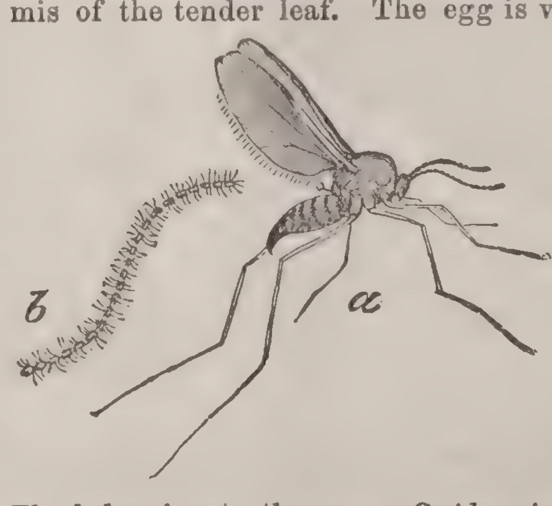
Willow Apple-gall (formed by *Nematus salicis-pomum* Walsh), growing on the leaves of the Heart-leaved Willow (*Salix cordata*): *a, a,* galls; *b,* larva enlarged; *c,* gall cut open. Colors, pale-green and rosy.

species of willow. *Enura s. gemma* Walsh, causes a curious and premature enlargement of the bud of the Humble willow (*Salix humilis*), from which the larva issues when mature and enters the ground. *Enura s. nodus* Walsh, causes elongate swellings of the stem of the Long-leaved willow (*S. longifolia*).

Saw-fly, belonging to the genus *Nematus,* the hair-lines showing natural size.

There is but one other Hymenopterous family—viz. the Chalcididæ—which furnishes gall-insects, and the gall-making habit in it is very exceptional, being confined to the genus *Isosoma,* while the other genera of the family are parasitic. *Isosoma hordei* (Harr.) is the well-known Joint-worm which does so much damage to wheat, rye, and barley by producing woody enlargements of the stalk just above the first or second knot.

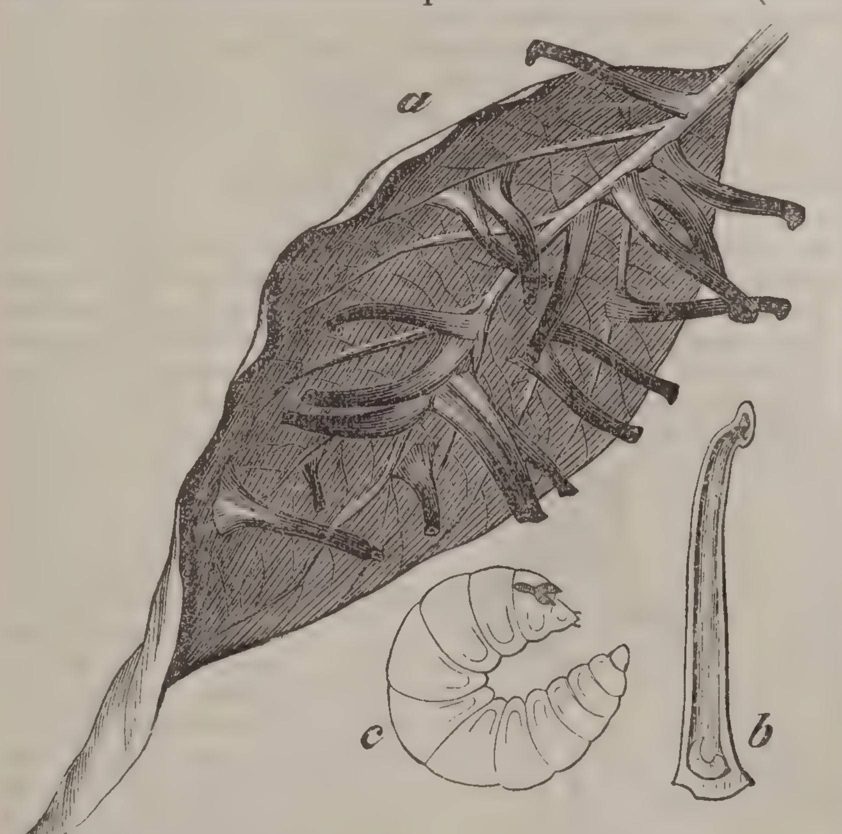
Order Diptera, or Two-wing Flies.—The gall-making insects of this Order belong mainly to two families—the Cecidomyiidæ and the Trypetidæ. The first contains by far the larger number of gall-making species, popularly known as gall-gnats or gall-midges. They are all of small size, and generally of obscure color, mostly black, and they look not unlike small mosquitoes. Many of the species so closely resemble each other that they are far more easily distinguished by the galls they produce than by any characters which the mature flies present. The female has a telescopic ovipositor, with which she is enabled to thrust her eggs into the soft parts of plants, such as the bud or the epidermis of the tender leaf. The egg is very small, soft, elongate, and usually deep orange or reddish. It is also accompanied by some secretion which acts on the plant and causes the gall to form before the larva hatches. These larvæ are legless, mostly cylindrical, and taper to each end, but they are easily distinguished from the larvæ of the true gall-flies—1st, by being more elongate and narrow; 2d, by being (with a few exceptions, in which they are white) of an orange color, varying to blood-red; 3d, by having a very small, pointed, and retractile head; 4th, by a very characteristic horny, usually forked, process called the "breast-bone." This process lies under the skin on the anterior joints of the body near the head, and is either Y-shaped, "clove-shaped," or oar-shaped. In either



Fly belonging to the genus *Cecidomyia,* the principal genus of Dipterous gall-making insects: *a,* female; *b,* male antenna; hair-lines showing natural size. Color, blackish.

case, the tips of the prongs—which are either two or three in number, and can be excerted upon the retraction of the head and anterior joint—are always armed with sharp points, which no doubt serve to lacerate the walls of the gall, and thus assist the insect in obtaining its food, as well as in making a passage-way for the future exit of the perfect insect. The gall-gnat larvæ either quit their galls and enter the ground to transform, or remain in them and spin a very delicate cocoon, like goldbeaters' skin, for the same purpose. In either case, the pupa, which usually is furnished with a pair of little horns on the head, works its way to the surface, in order that the perfect gnat may escape; whereas in the other two gall-making families we have considered the flies perfect within their respective galls, and either eat their own way out or pass through a passage-way partly prepared by the larva. *Cecidomyia salicis-strobiloides* O. S., forms the Pine-cone willow-gall, a deformation not unlike a pine cone, and quite common on the tips of the twigs of the Heart-leaved willow. *C. s. brassicoides* Walsh, forms the Cabbage-sprout willow-gall, a series of deformations not unlike cabbage-sprouts, along the leaves of the Long-leaved willow (*Salix longifolia*). The grapevine apple-gall (*Vitis pomum*, Walsh and Riley) is a polythalamous gall found on the Grapevine, and made by a yet unknown gall-gnat. In external appearance this gall so resembles a hickory-nut or a small apple that it has been looked upon by those not versed in entomology and vegetable physiology as a vegetable monstrosity produced by hybridization with those plants. Yet a glance at its internal structure, which shows a number of elongate cells, each occupied by an orange larva, at once reveals its nature. The Grapevine filbert-gall (*Vitis caryloides*, Walsh and Riley) is also formed by a yet unknown gall-gnat, and frequently presents the appearance of a bunch of filbert or hazel nuts, it being a collection of single galls springing from a common point, and each gall being one-celled. The grapevine trumpet-gall (*Vitis viticola*, O. S.) is a pointed, trumpet-shaped gall of a beautiful crimson color, growing numerously from the upper surface of the leaf of the Grapevine. *Cecidomyia solidaginis* (O. S.) produces a common gall in the shape of curled and dwarfed leaves at the tips of the Golden-rod (*Solidago*). The Dogwood tube-gall (*Corni-tuba*, Riley MS.) is a blunt-ended and tube-like growth quite commonly found on the under side of the leaf of the Dogwood (*Cornus*), and formed by a yet undescribed gall-gnat. *Cecidomyia q. pillulæ* (Walsh) forms pill-like galls of a blood-brown color, quite common on the leaves of the black group of oaks. *Lasioptera vitis* (O. S.) makes tomato-like swellings on the tender parts of the Grapevine.

Pine-cone Willow-gall (formed by *Cecidomyia salicis-strobiloides* O. S.), growing on the tips of twigs of the Heart-leaved Willow (*Salix cordata*). Color, glaucous green.



The Dogwood Tube-gall, growing on the leaf of the Dogwood: *b*, a section of one of the tubes, enlarged, showing the larva at the bottom; *c*, larva, greatly enlarged, showing "breast-bone."

The second family of Diptera containing gall-makers is the Trypetidæ, but few of the species, however, having the habit. These flies have something of the form and size of the common house-fly, but are much more brightly colored, the wings being transparent and marked with various-shaped cloudings. The larva is white and maggot-like, and contracts when full grown to a brownish, coarctate pupa within the gall. The fly escapes by continued fretting and moistening of a small space in its prison-wall, the face being temporarily very much swollen into a sponge-like mass for this purpose, and the gall-substance having generally become sufficiently soft by exposure to the weather to permit this kind of exit. The female has a boring ovipositor, by which she can force her eggs into the tips of herbaceous plants. *Trypeta solidaginis* (Fitch) forms the globular pithy swellings so commonly seen in winter, when the leaves have dropped, on the stem of Golden-rod (*Solidago*). *T. Diana* (O. S.) forms somewhat similar galls (*Artimisiæ indurata*, Riley) on the Sage-bush (*Artimisia tridentata*) of the Western plains.

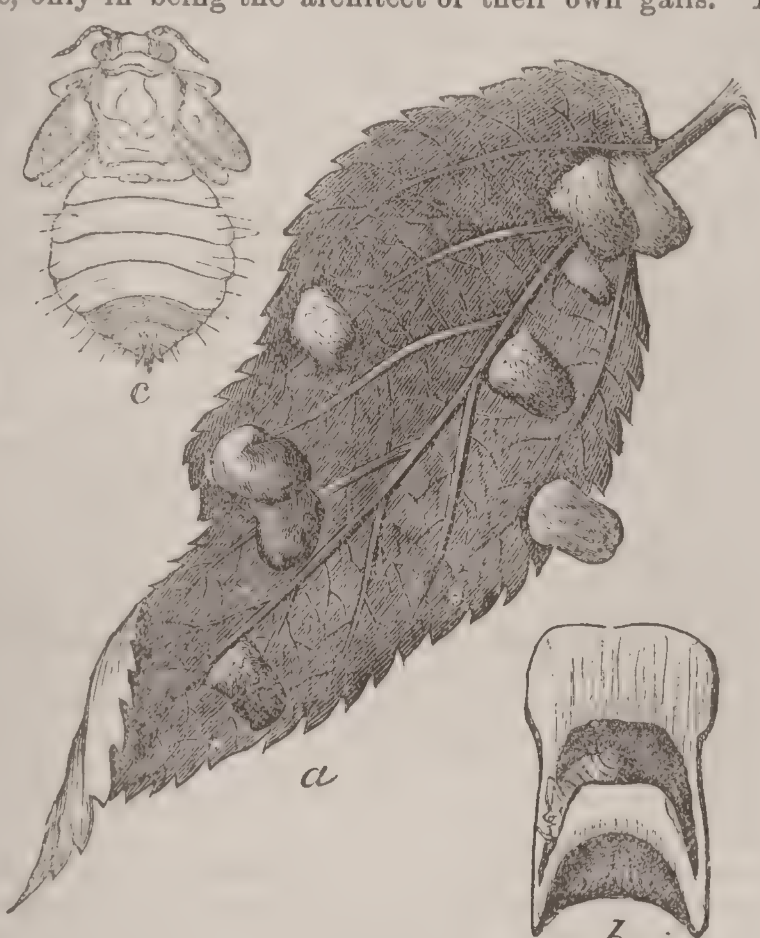
Order Hemiptera, or Bugs.—The American gall-making insects of this Order, so far as known, belong solely to the Homopterous division, or Whole-wing bugs, and are confined to two families—viz. the Plant-lice (Aphidæ) and Flea-lice (Psyllidæ). With the insects of all the Orders so far considered (where the insects undergo complete metamorphosis—*i. e.* the larva differs entirely from the imago in appearance), the gall is produced by the action of an irritating poisonous secretion inserted into the plant-tissue by the parent. With those now under consideration (in which the larva is born much more nearly in the image of the parent), the gall is also formed under the influence of a poisonous irritation, but this irritation is conveyed by the newly-hatched insect, principally by the insertion of its proboscis, very much as the common bed-bug causes irritation and swelling of human flesh by the insertion of its beak. In the Plant-lice the original architect of the gall breeds and dies within it, but her numerous young either issue as soon as born and found new galls, or else remain with their parent till full grown, when they also issue from their gall and scatter. In either case, the gall—which in most instances is never securely closed—gapes or cracks open to allow their exit. *Pemphigus vagabundus* Walsh, forms a large, irregular growth, like the cockscomb flower (*Celosia*) on Cottonwood. When found in early summer, it is green and shiny, and contains the single wingless architect. By fall it becomes dry and dark, and is crowded with winged lice, which are all females. These leave the gall, and in all probability lay eggs from which hatch bisexual young, the females of which form the spring mother gall-lice. *P. populicaulis* Fitch, makes a rose-tinted swelling at the juncture of the leaf and leafstalk of the same tree. *P. ulmi-fusus* (W. and R.) makes a large spindle-shaped gall on the leaves of the Red elm. *Byrsocrypta rhois* (Fitch) produces the Sumach gall, a large, hollow, reddish swelling on the leaf-stem of the Smooth and Staghorn sumachs, and has life-habits similar to *Pemphigus*. *B. ulmicola* (Fitch) makes a compressed gall like a cockscomb on the upper side of the leaves of the White elm. *Phylloxera* forms galls, mostly on the Hickory, sixteen distinct galls made by insects of this genus on Hickory in the U. S. being known to the writer. *P. vastatrix* Planchon, the notorious Grapevine Phylloxera, makes wrinkled pouch-like galls on the under side of the leaves of some vines. The mother-louse fills her gall with eggs, and the young hatching therefrom escape and found new galls, and become parthenogenetic mothers; this virginal reproduction continuing for several genera-

Poplar-stem Gall (made by *Pemphigus populicaulis*): *a*, incipient gall on the under side of the leaf; *b*, same on upper side; *c*, fully-formed gall, showing slit from which the insects escape; *d*, *e*, double galls, one each side of midrib; *f*, wingless female; *g*, winged female, showing pterogostic characters of the genus.

tions, until, with the fall of the leaf, the last generation creeps on to the roots. The Flea-lice form galls of various

Insect belonging to the genus *Psylla:* hair-lines natural size.

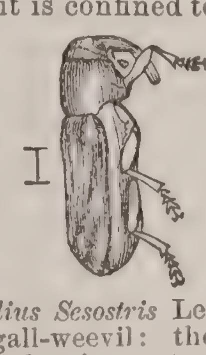
shapes and sizes on the stems and leaves of Hackberry (*Celtis*). In life-habits they differ from all the other gall-insects, and agree with their nearest relatives, the plant-lice, only in being the architect of their own galls. The



Hackberry Mamma-gall (made by *Psylla celtidis-mamma*): *a*, leaf with galls, natural size; *b*, section of gall enlarged, showing insect within; *c*, pupa, greatly enlarged, showing spines at tip of body, by which the gall is perforated for escape.

egg—glued in spring to tender leaf or twig—soon hatches, and under the irritation caused by the young *Psylla*, the gall soon imbeds it. Within this gall the insect dwells till it has acquired the pupa state, which is generally by the time the leaves begin to turn and drop. Then, by means of certain horny spines or thorns at the end of its body, this pupa works its way out of its prison, and once out soon gives forth the perfect fly. The galls made by these flea-lice are usually quite hard and woody, and generally one-celled. Most of them are yet undescribed. *Psylla celtidis-grandis* (Riley MS.) makes on the leafstalk a large grayish-yellow swelling, which is an exception in being polythalamous. The few cells it contains are more or less filled with a white flocculent matter secreted by the insect.

Order Coleoptera, or Beetles.—The gall-making insects of this Order in the U. S. belong to two families—viz. the Curculionidæ, or Snout-beetles, and the Buprestidæ, or Buprestians. In each family the habit is confined to a single genus, so far as now known; though, if we consider the gall making beetles of other countries, the genera might be multiplied, especially in the gall-making Curculionidæ or gall-weevils, and even two families (Sagridæ and Lamiadæ) added. The insects issue through a passage-way partly prepared beforehand by the larva. *Baridius Sesostris* Le C., forms the Grapevine wound-gall, a simple woody swelling of the tender cane with a fissure on one side. The beetle doubtless inserts her egg in a hole first made with her snout, and the gall is due perhaps more to this action than to that of the larva which hatches from the egg, and which is a whitish, cylindrical, wrinkled, legless grub, with a brown head. Among the Buprestians *Agrilus ruficollis* (Fabr.) makes the Raspberry gouty gall, a woody swelling of young



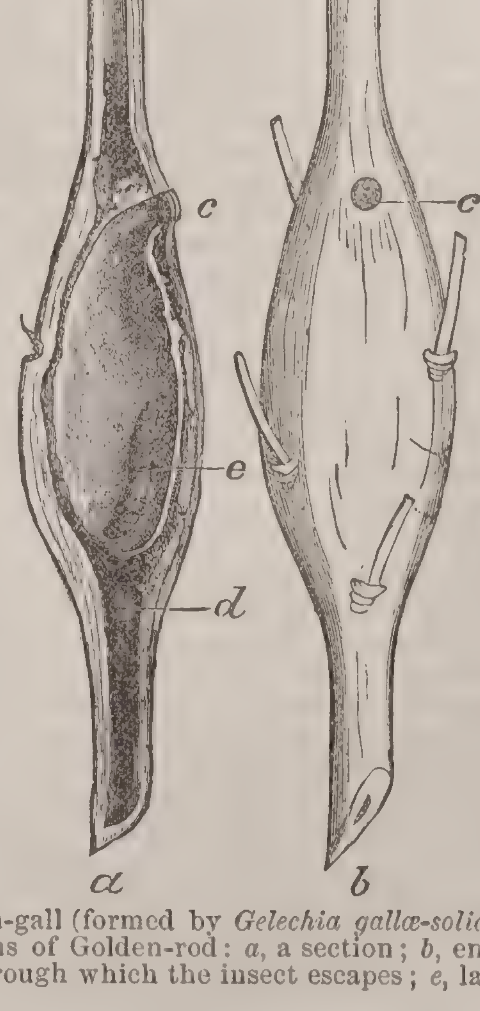
Baridius Sesostris Le Conte, a gall-weevil: the hair-line showing natural size. Color, shiny yellowish-brown.

raspberry canes, with numerous longitudinal slits. The beetle is one-fourth inch long, of a metallic green color, with a bright coppery thorax. The larva is quite elongate and thread-like, with a large flattened head, and two small horns at the end of the body. Several are generally found in the same swelling, and it is probably to their action alone that the gall is due.

Grapevine Wound-gall (formed by *Baridius Sesostris* Le Conte), and occurring on grape-canes. Colors, green and rosy.

Order Lepidoptera, or Scaly-wing Insects.—The gall-making habit obtains in but few of the insects of this Order, and these are confined to the Heterocerous division, or Moths, and almost entirely to a few genera in the family Tineidæ. The insects issue from the gall through a neatly contrived doorway. *Gelechia gallæ-solidaginis* Riley, forms elongate, hollow swellings on the stems of the Golden-rod. The parent moth deposits an egg on the stem of the young plant, and the young larva eats its way into the stem through a minute hole which subsequently closes up. This larva, like the gall-making saw-fly larvæ, has legs, but is readily distinguished from these last by its smaller head and by having but ten instead of fourteen pro-legs. When mature, it lines its gall with silk, eats a passage-way at the upper end, and stops up the hole with a little plug of liquid silk, so fitted that the moth in issuing can easily push it away from within, though it cannot well be pushed inward from without. After completing this doorway the larva retires to the bottom of its chamber, casts its skin, and becomes a brown chrysalis, from which, in due time, the moth bursts. *Walshia amorphella* Clem.,

Solidago Gall-moth (*Gelechia gallæ-solidaginis*), with wings expanded, and with wings folded.



Solidago Moth-gall (formed by *Gelechia gallæ-solidaginis* Riley), on the stems of Golden-rod: *a*, a section; *b*, entire gall; *c*, *c*, the door through which the insect escapes; *e*, larva; *d*, excrement.

forms a somewhat similar, but more solid and woody swelling on the stems of the False indigo (*Amorpha fruticosa*).

Acarina, or Gall-Mites.—These minute animals are not, strictly speaking, true insects, but belong to the class of

Arachnida (Spiders, etc.), which are distinguished from true insects by having, among other characters, eight instead of six true legs. Yet, as some systematists include them under the general term Insecta, they may come under the popular designation of "gall-insects." The more perfect galls produced by mites are pocket-shaped, and the mites which produce them belong mostly to the genus *Phytoptus*, which contains species of elongate form and possessing but six legs, in which respect they depart from the normal character of their class, and approach more nearly the true insects. None of these gall-inhabiting mites have yet been

Mite-gall, on leaf of Wild Cherry.

described in America. The Plum-leaf purse-gall (*Pruni crumena*, Walsh), which abounds on the upper side of the leaves of the wild plum, is made by an undescribed *Phytoptus;* and a similar but larger growth, made by a species of the same genus, is common on the leaves of the wild cherry. C. V. RILEY.

Gal'linule (*Gallinula*), a genus of wading birds, including the moor-hen of Europe (*G. chloropus*) and the Florida gallinule (*G. galeata*), besides various tropical species. *Porphyrio* (of which the best known species is *P. martinica* of the U. S. and tropical America—the purple gallinule) and other kindred genera contain birds called gallinules, all together constituting a sub-family (Gallinulinæ) of the family Rallidæ or rails.

Gal'lio, proconsul of Achaia (Acts xviii. 12), was probably Lucius Junius Annæanus Gallio, elder brother of Seneca the philosopher, adopted as a son by Junius Gallio, a celebrated rhetorician; but some suppose that the last-mentioned Gallio was the proconsul. The younger Gallio, according to Eusebius, committed suicide in 65 A. D. Several ancient writers speak highly of his character.

Galliot', a Dutch brigantine, broad, strong, and flat-bottomed, and having a gaff mainsail. The name was once given to a small galley.

Gallip'oli, a small, well-fortified maritime town of Italy, in the province of Lecce. It is situated on a high rock, formerly a promontory, but now entirely surrounded by the waters of the Ionian Sea, and only connected with the mainland by a fine bridge of twelve arches. The port (or rather *road*), accessible only on the E. side, is commanded by a strong castle. The town is supplied with good water, brought from the inland hills by an aqueduct which terminates in a superb fountain. This is an ante-Christian work, and the fountain is adorned with fine busts and bas-reliefs, and bears many Latin inscriptions. During the Middle Ages, Gallipoli sustained several romantic sieges. In 1429 the Turkish corsairs surprised the town and carried many of its inhabitants into slavery. In 1809 it was attacked by an English flotilla, which was vigorously repulsed. Gallipoli is at present a thriving commercial town, exports olive oil (which is stored in great tanks cut in the solid rock), and has some manufactories. The steam line from Naples to Ancona touches regularly here, and but for the insecurity of the harbor it might soon become an important place. It is a bishop's see. Pop. 9951.

Gallipoli [Gr. Καλλίπολις], city of European Turkey, in the province of Roumili, at the N. E. end of the Dardanelles, and about 110 miles W. S. W. of Constantinople. It is miserably built, but has two good harbors, large manufactures of earthenware and morocco leather, and carries on a very extensive trade. In its bazaars meet merchants of all nations, all tongues, all styles of dress, and during daytime the long alleys, stocked with all kinds of costly produce, present an extremely lively scene. Gallipoli was the first European town that fell into the hands of the Turks in 1357, nearly a century before the fall of Constantinople. It is the key to Constantinople and the Black Sea, and was occupied by the allied armies of England and France in 1854. It has a Greek bishop. Its population, which in 1810 was 15,000, and in 1815 was 80,000, is now about 20,000. REVISED BY R. D. HITCHCOCK.

Gal'lipolis', city and tp., cap. of Gallia co., O., on the Ohio River, about equidistant from Pittsburg and Cincinnati, with which cities it has regular packet-line connections. It is above the highest water-mark, and is the southern terminus of the Gallipolis McArthur and Columbus R. R. It has a national and private bank, 2 large woollen mills, furniture-factories, foundries, planing-mills, 9 churches, an academy, a high-school, 16 other public schools, and 3 weekly newspapers. Pop. of city, 3711; of tp. 868.
WM. NASH, ED. "GALLIPOLIS JOURNAL."

Gal'lipot, a glazed earthenware jar, such as is used by druggists for holding cerates, extracts, salves, and other similar preparations.

Gallisonnière, de la (AUGUSTIN FÉLIX ELISABETH **Barrin**), COUNT, b. at Anjou, France, 1742; served under his uncle, the governor-general De la Gallisonnière (see below), in the marine service in Canada; entered the army, serving against Hanover; was made *maréchal de camp* 1788, and grand-seneschal of the sword for Anjou 1789, by virtue of which office he was president of the nobles in the states-general in that year. He was chosen to preside over the assembled Three Estates at the beginning of the Revolution, and was premier deputy of the nobles in the Constituent Assembly. Some time after he became an *emigré* and fought against the revolutionists, but in 1801 returned, and was in public life under Napoleon. When the Bourbons returned he was made lieutenant-general, but retired from public life in 1815. D. Mar. 2, 1828. He wrote much upon the public affairs of his time.

Gallisonnière, de la (ROLAND MICHEL **Barrin**), MARQUIS, b. at Rochefort, France, Nov. 11, 1693, son of a distinguished general of the Knights of Malta; entered the French navy 1710; while having the rank of a captain was (1745–49) governor-general of Canada, where he displayed great energy in naval construction, and in establishing a line of forts between Canada and Louisiana. The Indians at first despised him for his small stature, but soon learned to love him and respect his abilities. His administration was marked by troubles with the English in Nova Scotia and the Ohio Valley. Gallisonnière next was chief of the bureau of maps and charts, with the rank of *chef d'escadre*. He performed much excellent scientific work in this position. In 1756 he defeated Byng off Minorca (for which defeat Byng was afterwards executed), but the fatigue and excitement of this action were too severe for Gallisonnière's health. He was obliged to give up the command, and d. soon after at Nemours, Oct. 26, 1756. He was very fond of botanical science; was deformed and of feeble health, but of very active mind.

Gallit'zin, post-v. and tp. of Cambria co., Pa., on the Pennsylvania R. R., 12 miles W. of Altoona. It has mines of bituminous coal. Pop. 977.

Gallitzin, a Russian princely house whose origin is Lithuanian, the prince Gedemin, the ancestor of the Jagellon princes, being also ancestor of the Gallitzins. The name comes from *Golitza* ("leather gauntlet"), a surname of Mikhail Ivanovitch Bulgak, one of the ancestors of the family, distinguished as the wearer of gloves of this kind. Ivan the Terrible in the sixteenth century made one of the family a boyar, and since that time there have been many diplomatists, generals, and politicians among the princes of this house.—PRINCE DMITRI (1735–1803), father of the missionary Gallitzin, was a diplomatist, and author of several scientific works.—His wife, AMALIE VON SCHMETTAU (b. at Berlin Aug. 28, 1748; d. near Münster Aug. 24, 1806), abandoned the society of her infidel husband, became a Roman Catholic, and was as distinguished for piety and literary talents as she had previously been for social talents and personal beauty. She occupied herself in religious and philosophical controversies, and attained a wide influence among the aristocratic families of Germany; an influence which was greatly forwarded by the stirring events of the latter part of her life.—PRINCE EMMANUEL (1804–53) was an active writer upon science and literary subjects, and an amateur musical composer and oil-painter.

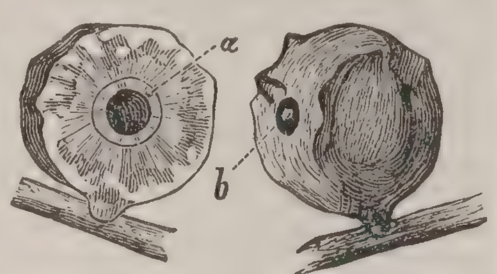
Gallitzin (DEMETRIUS AUGUSTINE), PRINCE, a son of the Russian ambassador at Paris, Prince Gallitzin, and of the Princess Amalie von Schmettau, was b. at The Hague Dec. 22, 1770. His father was a free-thinker, but in 1787 the young man followed his mother's example and became a Roman Catholic. He was an officer of the Russian guard, and served for a time as a staff officer in the Austrian force in Brabant, but in 1792 was dismissed, came to America, became a Sulpitian, studied theology at Baltimore, and in 1795 took priest's orders. He officiated at Conewango, Pa., and other places in the Middle Atlantic States. In 1798 he founded the Roman Catholic town of Loretto, Cambria co., Pa., expending a large fortune in the work. He bore the name of "Father Smith," and labored with the greatest zeal and self-denial. In 1809 he resumed his original name. He wrote *Defence of Catholic Principles* (1816), *Appeal to the Protestant Public* (1818), *On the Scriptures*, and other works. D. at Loretto, Pa., May 6, 1840.

His life has been written by T. Heyden, by H. Lemke (German), and by Sara M. Brownson (1873).

Gallitzin (Elizabeth), a cousin of Prince Gallitzin, b. in 1796, became a Roman Catholic, and at Rome joined the Society of the Sacred Heart. In 1840 she came to the U. S.; founded a school of the Sacred Heart in New York City, an institution at McSherrystown, Adams co., Pa., and a mission and convent, now at St. Mary's, Pottawattomie co., Kan. D. in St. James parish, La., Dec. 8, 1843.

Gal'livant's Ferry, tp. of Horry co., S. C. Pop. 1089.

Gall-Nuts are hard, woody, spherical swellings, of an olive-gray or bluish and more or less wrinkled exterior and yellowish-brown interior, formed by *Cynips gallæ-tinctoriæ* (Geoff.) on the twigs of a species of oak (*Quercus infectoria*) common throughout Syria and Asia Minor. They are collected by the poor, and exported from Smyrna, Aleppo, and other parts of the Levant, as well as from the East Indies, to all portions of the civilized world, and used for tanning and dyeing purposes, but more especially in the manufacture of the best writing-inks. They have no odor, but taste somewhat bitter, and are powerfully astringent. They give the following analysis: Tannic acid, 65; gallic acid, 2; ellagic and luteo-gallic acids, 2; brown extractive substance, 2.5; gum, 2.5; starch, 2; sugar, 1.3; chlorophyl and volatile oil, 0.7; woody fibre, 10.5; water, 11.15—total 100. They produce black dyes when mixed with solutions of sulphate of iron. In the manufacture of ink they are bruised and exhausted by three successive boilings, each time with a reduced quantity of water; and while the solution is warm a certain proportion of sulphate of iron and gum-arabic, also in warm solution, is added, and the whole allowed to remain for some time till all sediment is deposited. Gall-nuts are principally brought to America from Smyrna and Trieste, and they are so common near Aleppo that they are sometimes called Aleppo galls. Those gathered before the fly issues are known in commerce as "blue galls," and are most esteemed. The second gathering, or "white galls," from which the fly has escaped, are of inferior quality. Notwithstanding the recent discoveries in chemistry and the art of dyeing, these galls are still an important article of commerce; which fact attests their value as a cheap and effectual dye. C. V. Riley.



Gall-nuts: *a*, section, showing central chamber; *b*, hole from which the fly has issued.

Gal'lon [Fr. *galon*, a "grocer's box"], the standard unit of liquid capacity in the U. S. and of liquid and dry capacity in Great Britain. The capacity of the gallon has been very variable. It will facilitate the understanding of its changes to bear in mind that this measure was originally designed to be a measure not of bulk, but of weight. To carry out to its full extent the notion on which it was founded would have required that every commodity measurable in bulk should have had its own gallon, each holding the same weight, but the bulks varying inversely as the specific gravities. As this would have led to endless complication, early usage led to the adoption of two different gallons only, related to each other in capacity in the inverse ratio of the specific gravities of corn (wheat) and wine (the wine of Gascony, at that time a British province, being taken as the standard); these being supposed to represent the average of the two classes of exchangeable commodities, wet and dry. The ratio here spoken of was assumed to be that of 143 to 175. In British legislation the earliest definition of the gallon is found in an act of the 9th of Henry III. (1225), being the first act contained in the published statutes at large, which is a repetition of the Magna Charta of 1215. Ch. 25 of this act declares that "one measure of wine shall be through our realm, and one measure of ale, and one measure of corn, that is to say the *quarter* of London." The quarter of London is here spoken of as a measure existing and known, but its capacity is not distinctly set forth until the fifty-first year of the same king (1266), when it was declared by statute that "an English [silver] penny, called a sterling, round and without any clipping, shall weigh thirty-two wheat corns in the midst of the ear, and twenty pence do make an ounce, and twelve ounces one pound, and eight pounds do make a gallon of wine, and eight gallons of wine do make a London bushel, which is the eighth part of a quarter." Instead of the uncertain standard of thirty-two wheat-corns, it was natural that an arbitrary but fixed weight, representing the probable average weight of such wheat-corns, should come in time to be recognized; and this weight is shown by Secretary John Quincy Adams (*Report to the H. of R.*, Feb. 22, 1820) to have been equivalent to 22½ grains troy. An ounce was therefore 450 grains troy, a pound 5400 grains, and eight pounds, or the weight of one gallon of wine, 43,200 grains. As the weight of Gascon wine (taken as the standard) was held to be 250 grains to the cubic inch, this gallon of wine, by a computation founded on the definition above, could not have contained more than 172.80 cubic inches; and the wheat-gallon, or vessel containing the same weight of wheat, 211.44 cubic inches. Mr. Adams, however, finds that, by "the treatise of weights and measures of 1304," it appears that in actual usage, except for moneys and medicines, the pound contained fifteen ounces, and not twelve; so that the number of grains troy in a commercial pound was 6750, and in eight such pounds, or a wine-gallon, 54,000. This, divided by 250, gives 216 cubic inches, which is the eighth part of a cubic foot. Such was the capacity of the earliest wine-gallon known in England; and this would give 264⅓ cubic inches for the corresponding wheat-gallon, and 2114⅔ cubic inches for that of the bushel. A statute of Henry VI., however, of 1423, revived certain ordinances "of old time;"—ordinances which, not being embraced in the statutes at large, must antedate the Great Charter—according to which a different value of the gallon was derived from the mode of calculating tonnage. A ton of water was the weight of thirty-two cubic feet, and the eighth part of a cubic foot, or 216 cubic inches, was a gallon of water. Hence, the wine-gallon measure, being enlarged so as to hold the same weight of wine, became 217.6 cubic inches, requiring the wheat-gallon to be correspondingly modified, so that this became 266.17 cubic inches. But another rather inconsistent provision of this same statute required the hogshead to be of the capacity of eight cubic feet, but to hold only 63 gallons of wine; whence the wine-gallon was made 219.43 cubic inches, the wheat-gallon 268.53, and the bushel 2148.24; which last measure, as we shall see, was afterwards called the Winchester bushel.

The want of public standards in England was for some centuries a source of great confusion. Henry VII. attempted to supply this want, and an act of the twelfth year of his reign (1496) provided that a new standard gallon-measure should be constructed, and should remain in the king's treasury for ever. According to this act, the gallon-measure was to hold eight pounds of *wheat* (not wine) of twelve *troy* ounces each; that is, each ounce was to contain twenty pennyweights, and each pennyweight *twenty-four* grains, instead of twenty-two and a half, as earlier. This gallon had the capacity of 224 cubic inches; and being, by the terms of its definition, a wheat-gallon, it implied a wine-gallon of 183 cubic inches and a bushel of 1792 cubic inches. The statute seems to have been ignorantly prepared, and the two measures last named were so far below those in actual use that the corresponding standards were never constructed. But the gallon of 224 cubic inches, though made as a wheat-gallon, was afterwards interpreted (perhaps in some sort to compensate the blunder) as a wine-gallon, and another wheat-gallon was calculated from it, which ought to have been 274 cubic inches, but actually was 278, and from this was constructed a standard bushel of 2224 cubic inches, which, with the standard gallon-measure of 224 cubic inches, was deposited in the king's treasury, and both these remained in existence till 1834, when they were destroyed by fire.

The introduction of troy weight, however, into this act led to a modification of the old gallon of Henry III. in a manner not intended or anticipated. As, when the pennyweight was 22½ grains, the old sterling or Tower pound, which was the pound of commerce, contained 6750 grains, so when the pennyweight became 24 grains, the pound was assumed to contain, for this purpose at least, 7200 grains, and the gallon (eight pounds) 57,600 grains, giving a capacity of 230.4 cubic inches, which, for greater simplicity, was put in round numbers at 231. Such was the origin of the gallon which is at present standard in the U. S. The account given of this matter by Mr. Adams in his report above referred to is confused, unintelligible, and erroneous. Furthermore, the wheat-gallon of Henry III., being increased in like manner as the wine-gallon, became 282 cubic inches; a measure used in England for ale and beer down to Jan. 1, 1826, and in the U. S. somewhat later. A statute of 23 Henry VIII. (1531) sanctioned this gallon and its corresponding bushel of 2256 cubic inches. In the reign of Elizabeth a quarrel between the excise-officers and the dealers in herring led to the enactment of a statute (13 Eliz., 1570) that "32 gallons wine-measure, which is *about* 28 gallons by old standard, shall be the lawful assize of herring barrels, any old statute to the contrary notwithstanding." The "old standard" was the wheat-gallon of Henry III., which, as seen above, had the capacity of 264⅓ cubic inches. Inasmuch as $231 \times 32 = 264 \times 28 = 7392$,

it will be seen that this statute gives implicitly the legislative sanction to the wine-gallon of 231 cubic inches, which had grown out of a misinterpretation of the statute of 1496. In 1688 a new controversy arose as to the capacity of the lawful gallon, and the commissioners of excise addressed to the lords of the treasury a memorial on the subject, who in turn referred the question to Sir Thomas Powis, attorney-general. This officer, after a careful examination of the statutes, and particularly of the statute of 1496 just mentioned, reported that he "*did not know how 231 cubical inches came to be taken up*," but that nevertheless he "did not think it safe to depart from *the usage;*" showing that the wine-gallon of 231 cubic inches was now well established by common law, if not by statute. In the thirteenth year of William III. (1701) the Winchester bushel was declared by statute to be the standard for the measure of grain. Winchester was a royal residence from the time of Alfred to that of Charles II. In some respects it was more favored by these monarchs than even London. Alfred held here his *wittena-gemote*, or great state council, and under Athelstane there were six mints in this city, when London had but three. Henry III. built here a noble palace, of which the great hall still stands; and here Charles II. began another yet more splendid, which he did not live to finish. Here also Henry VIII. received the great German emperor Charles V. But what gives to Winchester its interest in connection with the subject of weights and measures is the fact that here were held annually four great fairs, one of which, beginning on Sept. 12, lasted for sixteen days, and was in early times the largest in England. Apparently, the bushel derived (1423) from the hogshead of 8 cubic feet and 63 gallons became the standard in these great markets, and hence acquired the name it bears at present. The Winchester bushel, therefore, properly contained 2148.24 cubic inches, and the Winchester gallon 268.53 cubic inches; but the standard bushel-measure constructed in the time of Henry VII. to represent this bushel was found by trial in 1696 to hold only 2145.6 cubic inches. What was the degree of accuracy of the measures in actual use under this name cannot now be known; but in 1700 the old difficulty between excise-officers and dealers broke out anew, and led to protracted and fruitless litigation; the consequences of which appear in two legislative acts—viz. 1st, the statute of William III. just mentioned, which not only established the Winchester bushel as the standard, but explicitly defined its capacity; and 2d, a statute of 5th Anne (1706), which in like manner established and fixed the wine-gallon. In both cases the definitions were given in terms of the linear dimensions of the vessels representing the measure. Thus, the bushel was to be of the capacity of a cylinder $18\frac{1}{2}$ inches in diameter and 8 inches deep; and the wine-gallon, the capacity of a similar vessel 7 inches in diameter and 6 inches deep; to which last definition the act added the words, "or any vessel containing 231 cubic inches and no more." This added clause conflicts slightly with the definition preceding, which would give for the gallon 230.91 cubic inches; but it is this clause which has ever since practically determined the capacity of the wine-gallon. The Winchester bushel, as computed according to the terms of the statute, contains 2150.4252 cubic inches, and the Winchester gallon, 268.8 cubic inches. This statute, nevertheless, did not effectually control usage; and even acts of Parliament as late as 31st and 45th George III. (1791 and 1805) recognize departures from it, requiring inspectors of corn returns to make comparison between the Winchester bushel and the bushel "commonly used," and to cause a statement of such comparison to be conspicuously exhibited. The acts of 1805, moreover, expressly mention $272\frac{1}{4}$ inches as the contents of the Winchester gallon, which is, of course, a gross legislative error. In 1818 a royal commission was appointed to inquire into the actual condition of British metrology, and to recommend measures for its reformation. As the result of their labors a bill was introduced into Parliament which, with slight modifications, became a law June 17, 1824, and was put into operation Jan. 1, 1826; which fixed the capacity of the gallon by requiring that it should be such as to contain 10 pounds avoirdupois, or "70,000 grains troy, of distilled water at the temperature of 62° F., weighed by brass weights under the barometric pressure of thirty inches," and stating at the same time the capacity thus determined to be $277\frac{274}{1000}$ cubic inches. This is the value of the *imperial* gallon; and since its introduction this is the only legal gallon in Great Britain for wet or for dry measure. The bushel derived from this holds 80 pounds of water under similar conditions, and contains $2218\frac{1907}{10000}$ cubic inches.

In the U. S. no system of weights and measures has been established by act of Congress. Our gallon, bushel, foot, yard, pound avoirdupois, and pound troy have been inherited from Great Britain. For purposes of coinage, only, the pound troy at the Mint in Philadelphia, copied from the British standard pound troy, has been made also the standard here. The control over the subject which is now practically exercised by the secretary of the treasury was originally assumed by Mr. Secretary McLane in 1832 as being the legitimate prerogative of that department. A resolution of the Senate of the U. S. of May 1, 1830, having ordered an examination to be made of the weights and measures in use in the several custom-houses, and these having been reported to be discordant, and some of them largely so, Mr. McLane, in communicating this result to the president of the Senate, added, "It is believed, however, that this department has full authority to correct the evil, by causing uniform and accurate weights and measures and authentic standards to be supplied to all the custom-houses." Mr. McLane accordingly proceeded to construct such standards, the superintendency of the construction being committed to Mr. F. R. Hassler, chief of the Coast Survey, by whom the previous examination and report had been made. This report, dated Jan. 27, 1832, stated the "legal capacity" of the gallon to be 231 cubic inches, and that of the bushel—the Winchester bushel being assumed to be legal—2150.42 cubic inches; but he placed the temperature of comparison at 39.83° F. (meaning the temperature of maximum density of water, which is more nearly 39.1° F.), and proposed (as he afterwards practised) the adjustment of these measures by making the gallon to contain $58,372\frac{1754}{10000}$ grains of distilled water of this density, and the bushel $543,391\frac{89}{100}$ grains. The British standard temperature of comparison being 62° F., it follows that the so-called Winchester bushel of the U. S. and the Winchester bushel of Great Britain, when compared at any common temperature, differ in capacity by more than a cubic inch and a half, the first-mentioned being the larger. Congress has since given a legal sanction to the proceedings of the treasury department above described, by the passage of a joint resolution (approved June 14, 1836) directing that a complete set of all the weights and measures adopted as standards be delivered to the governor of each State of the U. S. Occasional and partial attempts were made during the colonial period and after the Revolution, up to about 1820, to regulate measures of capacity by provincial or State legislation. (For an account of these the reader may consult the report of Mr. Adams, above referred to.) They were limited in general to a legislative sanction of the wine-gallon of 231 cubic inches, and of the Winchester bushel, or rather of the Winchester half-bushel of $1075\frac{2}{10}$ cubic inches. In 1829 an act was passed by the legislature of the State of New York to regulate measures of capacity, by which the gallon was made a measure capable of containing 8 pounds of distilled water at maximum density, or $221\frac{5112}{10000}$ cubic inches, being neither in simple relation (as it seems to be) with the imperial gallon, nor in harmony with the gallon of 231 cubic inches in common use. In the revision of the statutes in 1851 this act was repealed, and the measures fixed as above described by the treasury department of the U. S. were adopted as standards in this State. F. A. P. BARNARD.

Gallotan'nic Acid ($C_{27}H_{22}O_{17} = H_3C_{27}H_{19}O_{17}$), the variety of tannic acid or tannin which is found in the gall-nuts of *Quercus infectoria* and other species of the oak, in sumac, and in Chinese gall-nuts. It differs from caffe-tannic, catechu-tannic, morin-tannic, querci-tannic, and quino-tannic acids in certain important properties, although it resembles them in possessing a slight acid reaction, a rough astringent taste, coloring ferric salts blue-black or green, precipitating albumen and gelatine, and converting animal membranes into leather. (See TANNIC ACID.)

C. F. CHANDLER.

Gal'loupe's Island, in the outer harbor of Boston, Mass., was a military rendezvous during the late civil war. Pop. 39.

Gal'loway, tp. of Christian co., Mo. Pop. 480.

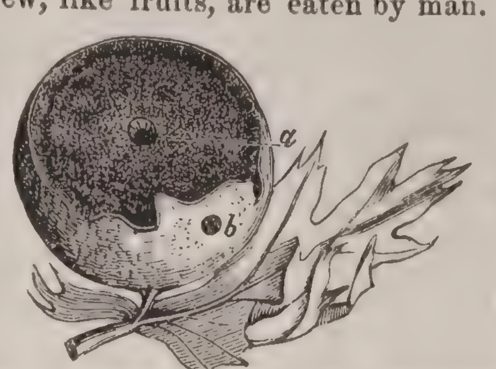
Galloway, tp. of Atlantic co., N. J. Pop. 2860.

Galloway (JOSEPH), LL.D., b. in Maryland, became a wealthy lawyer of Philadelphia; entered the Continental Congress in 1774, and was at first a warm patriot, but after the Declaration of Independence became a Tory, and in 1778 went to England; wrote a number of books and pamphlets upon American affairs, and some religious publications. D. in England Aug. 29, 1803.

Gal'lows, the structure by means of which capital punishment by hanging is inflicted. The culprit stands upon a platform, or drop, beneath a crossbar elevated upon two upright supports. A rope or halter hangs from the crossbar, and a noose at its end is placed upon the criminal's neck. He is hanged by the falling of the drop, or in some cases is drawn up from the platform by a heavy weight at the other end of the rope.

Galls. In the language of naturalists "galls" are abnormal growths or excrescences produced on growing or

living plants by one or more insects or closely allied mites, which develop and are nourished therein. These deformations are found on all parts of plants, and present a great variety of form, color, and texture—from the simple pouch-like bulging of the leaf to the most perfect and complicated structure. Many of them resemble familiar fruits, flowers, and vegetables, while a few, like fruits, are eaten by man. Take, in illustration, those occurring on the oaks. The bud may prematurely develop into a bunch of lanceolate leaves or become aborted into an acorn-like chamber. The tender leaf of spring, and even the blossoms, are beset with several green, and mostly globular, gall-growths. The more mature leaves furnish an infinite variety, from two-hundredths of an inch to over two inches in diameter, either globular, pedunculated, conical, cup-shaped, or clavate, and with a surface either smooth, reticulate, wrinkled, downy, woolly, or prickly.



A "monothalamous" gall:—Being the American Oak-apple (formed by *Cynips q. spongifica* O. S.) found on the Black Oak, and showing (*a*) the central cell in which the larva develops, and (*b*) the hole through which the fly issues. Colors, drab inside; yellowish-brown outside.

The fruit is deformed by large globular excrescences growing from the cupule; by hard cells within the cupule, and set in cavities with fimbriated mouths; by pip-like bodies between the acorn and cupule; or, finally, by stony chambers or indurations in the meat itself, without external indication. A multitude of different gall-growths affect stem, twig, and branch; while the trunk, and even the roots, are not exempt. The internal structure of galls is as varied as the external, but there is invariably a cell, within which the insect is nursed and nourished. This cell, in most succulent galls, is merely a cavity of various form in the general tissue; but it more often takes on the character of an oval chamber more woody than the surrounding substance, and which, though lying generally secure in said substance, is not unfrequently suspended to the general envelope by radiating fibres, in the same way that the hub is connected by spokes to the felly of a wheel; while more rarely it is entirely separated from its envelope and rolls around loosely therein. Galls are, in every case, the result of the combined action of an animal and vegetal organism, and would necessarily cease to exist if either of the organisms which jointly co-operate to produce them were swept out of existence. They have always interested the curious, and for a long time puzzled the philosopher, while to the uninformed of to-day they are, as they were universally in the days of Dioscorides, ascribed to spontaneous generation or to some freak of the plant bearing them. The diversity of form and character, and the constancy with which these characters are perpetuated according to the species, are remarkable when we consider the close resemblance in form and size which the gall-makers themselves present. Galls are technically separated into two groups—viz. the "monothalamous," or one-celled galls, each nourishing a single individual; and the "polythalamous," or many-celled, nourishing many individuals under a common envelope. Galls are produced either by the action of a peculiar poisonous fluid injected with the egg by the mother gall-insect, so that the young larva finds its habitation already prepared; or by the mechanical irritation (aided, most likely, by some similarly poisonous property) of the young larva, which is then the architect of its own house. In the former case the egg is generally inserted by the parent in the plant-tissues; in the latter, it is generally attached to the surface. The secretory organs of the plant are influenced by this poison very much in the same way that the human secretory system is influenced in producing the smallpox pustule when we insert vaccine matter into a child's arm. Galls, in a general sense, partake not only of the chemical character of the plant-juices, but of the consistency of the part upon which they are found. Thus, the nut-galls of commerce and most of the galls occurring on oaks partake of the bitter and astringent nature of these plants; yet some produced on the succulent parts of the same tree are pleasantly sub-acid. Few families of phænerogamous plants are free from these growths, but none have thus far been found on Fungi or on Mosses. The term "galls" is sometimes applied to those animal swellings produced by Dipterous larvæ, mostly belonging to the genus *Œstrus*, or by mites dwelling in or under the skin of birds and mammals. It is also applied to some of the swellings on trees and shrubs produced by the growth of cryptogamic parasitic plants. It should not be applied, as it sometimes is, to those plant-swellings and nodosities which are caused by the punctures of insects which always dwell exposed thereon, the difference between a gall and a mere swelling being that the architect of the former is hidden from view, and of the latter always exposed. C. V. Riley.

A "polythalamous" gall:—Being the Wool-sower gall (formed by *Cynips q. seminator*, Harris): *a*, showing a section; *b*, one of the pip-like kernels, showing woolly wing and the hole through which the fly escaped. Colors, light buff and rosy.

Gall Stones. See Calculus.

Gal'lup (Joseph Adam), M. D., b. at Stonington, Conn., Mar. 30, 1769; took his medical degree at Dartmouth College 1798; practised at Hartland, Bethel, and Woodstock, Vt.; was president and professor in the medical school at Castleton, Vt., 1820–23; lecturer in the State University, and one of the founders and first professors in the medical school at Woodstock, Vt. Author of several professional works, of which the most important was *On the Institutes of Medicine* (2 vols., 1839). D. at Woodstock, Vt., Oct. 12, 1849.

Gallup'pi (Pasquale), a Neapolitan philosopher, b. at Tropea, in Calabria, in 1770; d. at Naples in 1846. In 1819 he published the first two of his six volumes entitled *Saggio filosofico sulla Critica della Conoscenza*. In 1821 appeared his widely-known and often reprinted *Elementi della Filosofia ad uso dei giovinetti*. His greatest work, *Lettere sulle vicende della Filosofia relativamente ai principii delle Conoscenze Umane da Cartesio fino a Kant inclusivamente*, was published at Messina in 1827. In 1831 he was appointed professor of logic and of metaphysics in the University of Naples, and the year following he published the two first volumes of his *Filosofia della Volontà*, the two last appearing in 1839, and other smaller works in the mean time. Being elected a member of the Institute of France, he wrote for it two memoirs—one on transcendental idealism and absolute rationalism; the other, on the theodicy of the ancient philosophers. The last years of the life of Galluppi were embittered by poverty and by physical suffering.

Gal'lus (C. Aquillius), a Roman eques, distinguished as a jurist, pupil of the pontifex Q. Scævola, was prætor B. C. 66, along with Cicero. His life was devoted to the elucidation and application of the principles of law, and his opinions and edicts are quoted or referred to by Cicero and in the *Digest*. Gallus presided at the trial when Cicero delivered his oration *Pro P. Quintio*. A glowing eulogium is passed on the upright character and judicial eminence of Gallus by Cicero in his oration in defence of A. Cæcina. Besides the slight notices above mentioned, nothing of the productions of Gallus has been preserved. H. Drisler.

Gallus (C. Cornelius), the friend of Virgil, distinguished as a poet and soldier, was b. at Forum Julii B. C. 66. At the age of twenty his poetical abilities had attracted attention, and at the time of Cæsar's death (B. C. 44) he had attained sufficient distinction to make his adherence to Octavianus desirable. He commanded a division of the army against Antony at the battle of Actium, and soon after was sent to Egypt, of which he was made governor after its reduction to a Roman province. His conduct while in this office was made the subject of complaint to Augustus, who removed him from his position. The exact nature of his offence is not known. The senate instituted an investigation, and condemned him to exile with loss of his estates, upon which he put an end to his life (B. C. 26). Gallus composed four books of elegies, in which he sang the praises of Lycoris, and translated into Latin the poems of Euphorion of Chalcis. His poetry was greatly admired by his contemporaries, and is praised by Virgil and Ovid. All his writings have perished, though certain epigrams in the Latin *Anthology* pass under his name. The life of Gallus has been made the basis of a treatise on the manners and customs of the Romans in the time of Augustus, by W. A. Becker, translated by Rev. F. Metcalfe, London, 1853. (See Bähr, *Gesch. d. Röm. Lit.*, § 194; C. C. C. Völker, *Comment. de C. Cornelii Galli vita et scriptis*, 2 parts, Bonn, 1840, and Elberfeld, 1844.) H. Drisler.

Gal'ly Rock, tp. of Pope co., Ark. Pop. 1163.

Gally Rock, tp. of Yell co., Ark. Pop. 687.

Galt, post-v. of North Dumfries tp., Waterloo co., Ont., Canada, on Grand River and the Guelph branch of the Great Western Railway, 14 miles from Guelph. It has two

weekly papers, several branch banks, large manufactures, and abundant water-power. Pop. of sub-district, 3827.

Galt (Sir Alexander Tilloch), K. C. M. G., son of John Galt, b. at Chelsea, England, Sept. 6, 1817; entered the service of the British and American Land Company 1833; was its manager 1844–56; went into the Canadian Parliament 1849; finance minister 1858–62, 1864–66, under Cartier; was a principal founder of the railway-system of Canada; received his title in 1869; long a member of the Canadian Parliament from Sherbrooke, Quebec.

Galt (John), b. in Irvine, Ayrshire, Scotland, May 2, 1779; was employed for a time in mercantile pursuits; studied law, and afterwards spent three years in travelling in the Levant and Southern Europe, and after his return to London assisted his father-in-law, Dr. Alexander Tilloch (1759–1825), in the management of the *Star*, a newspaper. He afterwards produced a large number of dramas, novels, and other writings of unequal merit, many of them highly successful and marked by great originality. Among his best works are *The Ayrshire Legatees* (1820–21), *The Annals of the Parish*, *Lawrie Todd*, *Life of Byron*, and an *Autobiography*. From 1826 to 1829 he was in Canada, where he acted as agent for the Canada Company, and founded the town of Guelph, Ont. D. at Greenock Apr. 11, 1839. Mr. Galt was for a long time utterly helpless before his death, having received no less than fourteen strokes of paralysis.

Galt (Patrick Henry), an American officer, b. in Virginia; entered the army as third lieutenant of artillery in 1814; was adjutant at the Military Academy in 1821, and aide-de-camp to Maj.-Gen. Scott 1822–29; distinguished in the battle of Wahoo Swamp, Fla., Nov. 21, 1836, and in the Mexican war, where he commanded his regiment, with rank of major; brevetted lieutenant-colonel for gallantry at Contreras and Churubusco. D. at Philadelphia Jan. 9, 1851.

Gal'ton (Francis), F. R. S., a cousin of Charles R. Darwin, was b. at Duddeston, Warwickshire, England, in 1824; was educated at King's College, London, and Trinity College, Cambridge; travelled extensively in Africa; entered the British civil service in the board of trade; and is (1874) connected with the meteorological office. Besides books of travel, etc., he has written *Meteorographica*, 1863; *The Art of Travel*, 1867; *Hereditary Genius*, 1869.

Galu'sha (Jonas), a Revolutionary soldier, b. about 1751, was a judge of the Vermont supreme court 1795–97 and 1800–06; governor of Vermont 1809–13 and 1815–20. D. at Shaftesbury, Vt., Oct. 8, 1834.

Gal'va, city and tp. of Henry co., Ill., situated at the junction of the Chicago Burlington and Quincy R. R. and Keithsburg branch of the same; the Peoria and Rock Island R. R. also crosses the C. B. and Q. at this place. It is 141 miles W. by S. from Chicago and 45 miles from Rock Island, in a rich agricultural and coal region, on one of the highest points of the dividing ridge between the Mississippi and Illinois river-basins. It has 2 large public school-buildings, costing about $20,000, 8 church edifices, a large number of business-houses, 2 hotels, 1 national bank, and 1 newspaper. Nearly the whole business part of the place was destroyed by fire in Nov., 1872. It is, however, rapidly recovering from the effects, and already many new business-houses are up, and more projected. Pop. of city, 2160; of tp. 3096.
F. T. Ward, Ed. "The Galva Journal."

Galva'ni (Alvisio or Luigi), the discoverer of dynamic electricity, was b. at Bologna Sept. 9, 1737, and was in youth strongly inclined to enter the priesthood, but was deterred by his friends, and in 1762 graduated M. D. at Bologna; became a lecturer upon anatomy there, and gave special attention to comparative anatomy; made important observations upon osteology and the kidneys and ear of birds, and in 1786 was led to the discovery of electric currents by the accidental contact of the dissected legs of a frog with a scalpel, which provoked muscular contractions. In 1797 the death of his wife, the loss of his lectureship (for political reasons), and other misfortunes led to a chronic illness, of which he d. at Bologna Dec. 4, 1798.

Gal'vanism. (For a brief account of the general principles of this science as they are known at the present day, see under the article on Electricity, *Dynamical Electricity*, § 47.) It may not be amiss to mention in this place that the early investigator, Luigi Galvani (who was b. in 1737, and d. in 1798, and who gave his name to this important subject), actually concerned himself only with that department of it known now as "animal electricity," and died in the belief that all the phenomena he had observed resulted from electricity present in animal tissues. (See Electricity, § 77.) His theory was opposed by Volta, who has contested the honor of giving his name to this subject (which is often described as voltaic electricity), who maintained that the contact of dissimilar substances was the source of the energy displayed in this class of actions.

What we may call the present or chemical theory of dynamic electricity was first enunciated by Fabrioni so early as 1792. This theory was elucidated and extended by many others, among whom we may notice especially Davy and Faraday, and may now be regarded as the well-established theory of the voltaic pile or galvanic battery. It must not, however, be overlooked that a minute amount of excitement is believed to result from the mere contact of dissimilar bodies, though this, of course, can be no source of available energy, and is rather a subject of metaphysical than of practical interest in any discussion of electric phenomena. Henry Morton.

Gal'vanized Iron (an incorrect name) is sheet or other iron coated with zinc by dipping it into a bath of melted amalgam of zinc and mercury, containing a little sodium. The iron is first cleansed with sulphuric acid, and is then washed and scoured. Before galvanizing it is usually dusted with sal-ammoniac powder. The process was invented by C. F. Mallet in France, and improved by H. W. Crawfurd of England in 1837. It is a very useful treatment for iron roofs, telegraph wire, ships' bolts, etc., the zinc acting as a paint. Sometimes, before tin-plating, sheet iron is covered with a film of zinc, which makes the tin-plating more permanent. The name galvanized iron might properly be given to sheet iron coated with tin by an electro-plating process, which has been successfully tried. This material is sometimes afterwards dipped in a zinc bath, with beautiful results, but the process is an expensive one.

Galvanom'eter, an instrument for measuring dynamic electricity, is of various forms, the more important of which are described in the article Electricity (which see), by Prof. Henry Morton, Ph. D.

Galvan'oplasty (syn. *Electro-metallurgy*), the art of working in metals by the aid of electricity. The metals most readily separated from their solutions by electricity, and most useful when deposited, are copper, silver, gold, and nickel. The process is resorted to (1) for reproducing seals, coins, medallions, wood-cuts, engravings in metal, busts, bas-reliefs, etc.; (2) for coating base metals with silver, gold, nickel, or platinum; (3) for etching copper-plates for the engraver. (See Electrotype, Gilding, Nickel Plating, Photography, and Silver Plating.)
C. F. Chandler.

Gal'veston, county of Texas, bordering on the Gulf of Mexico. Area, 680 square miles, of which almost half is water. The soil is generally light, but live-stock, sea-island cotton, and garden products are raised. The county is traversed by the Galveston Houston and Henderson R. R. Most of the population is in Galveston, the capital. Pop. 15,290.

Galveston, post-v. of Cass co., Ind., on the Pittsburg Cincinnati and St. Louis R. R. (Indianapolis and Chicago division), 16 miles S. E. of Logansport. It has two weekly newspapers. Pop. 390.

Galveston, city, cap. of Galveston co., Tex., the principal seaport of the State, on Galveston Island, between Galveston Bay and the Gulf of Mexico. It is connected by railroads with all parts of the State to which railroads extend, and by regular lines of steamships with Liverpool, New York, New Orleans, and the ports of Western Texas as far as the Mexican boundary, and sail-vessels engage largely in direct trade with Great Britain and the continent of Europe, in the coffee-trade with Rio Janeiro, in the West India and Mexican trade, also in that with Northern U. S. ports. The exports of cotton for the year ending Sept. 1, 1872, were 333,502 bales, and the receipts from Sept. 1, 1873, to Feb. 10, 1874, were 272,776 bales, an increase of 40,023 bales over the same time in the previous year. The exports during the same commercial year, besides cotton, included 4000 bags of wool, 470,000 hides, 50,000 beeves, and large quantities of peltries, bones, horns, pecan-nuts, beeswax, hair, etc. The custom-house value of exports was $35,334,747; of imports, $298,811,831, including 42,500 bags of coffee, and 44,614 emigrants arrived at this port in the same year. There are 4 cotton-presses, with warehouses and yards occupying upwards of 40 acres of ground, and storing more than 100,000 bales of cotton. There are between 9 and 10 miles of street-railway, 2 libraries (1 numbering 9000 volumes), 15 churches, 31 schools, a Roman Catholic university, a medical school, an orphanage, 1 savings and 2 national banks, 2 iron-foundries, railroad-shops, machine-shops, gas-works, etc., 2 hospitals, 2 daily and 4 weekly newspapers. No epidemic disease has visited the city since 1867, and the usual health is remarkably good, the climate delightful. Oranges and other tropical fruits grow in the open air, and vegetable gardens flourish all the year. Galveston is the see of a Roman Catholic bishop. Pop. 13,818. Editor "News."

Gal'vez, de (Bernardo), Count, b. at Malaga, Spain, in 1756, was the son of the viceroy of Mexico, and nephew of Don José de Galvez, a high grandee of the Spanish court. In 1776 young Galvez became colonel of the Louisiana regiment, and was governor of Louisiana 1777–83. He captured Baton Rouge, Pass Manchac, Natchez, Mobile, and Pensacola from the British, and was made lieutenant-general, count, and captain-general of Louisiana and Florida. In 1784 he became captain-general of Cuba, and in the same year succeeded his father as viceroy of Mexico. He built the palace of Chapultepec. D. in Mexico Nov. 30, 1786.

Gal'way, county of Ireland, in the province of Connaught. Its western part along the Atlantic is wild and mountainous; the eastern part is flat. Good breeds of cattle and sheep are reared here. The fisheries are considerable, but agriculture is neglected. Area, 2447 square miles. Cap. Galway. Pop. 248,257.

Galway, town of Ireland, the capital of the county of Galway. It is situated on Galway Bay, at the mouth of the Corrib, and has a considerable retail trade, thriving fisheries, and some manufactures and commerce. It is the terminus of the Midland Great Western Railway, is the seat of one of the queen's colleges for Ireland, and has a Roman Catholic bishop. The town, with its suburbs, is virtually a county within itself. Pop. 13,184; with suburbs, 19,833.

Galway, post-v. and tp. of Saratoga co., N. Y., has a seminary and 3 churches. Pop. of tp. 2174.

Galway Bay is an inlet of the Atlantic, 20 miles long and from 18 to 8 miles broad, on the western coast of Ireland, protected from the swell of the ocean by the Arran Isles, and affording many advantages for the construction of a harbor of refuge.

Ga'ma (or **Grama**) **Grass** [said to be from *Gama*, one of the Maldive Islands, or from M. Gama, a gentleman of Mexico who first cultivated it], the *Tripsacum dactyloides*, a very large grass of North and tropical America, cultivated to a considerable extent as a forage-plant in the warm regions of both continents. The name is given in the Far West to various species of buffalo-grass (chiefly *Bouteloua*), which furnish good pasturage for stock.

Gama, da (Vasco), count of Vidigueira, was b. at Sines, in Portugal, in 1450; became a skilled mariner and a gentleman of the king's household, and in 1497 was despatched in command of the royal squadron to the East Indies by way of the Cape of Good Hope, lately discovered by Diaz. The Indian Ocean was then unexplored. Gama coasted the eastern shores of Africa, and visited India, returning to Lisbon in 1499. Cabral's expedition and the discovery of Brazil followed. Gama made his second voyage, with 20 ships, in 1502–03, and became involved in hostilities with the towns of the Malabar coast, which he punished severely. In 1499 he had received the title of admiral of the Indies. In 1524 he was sent out as viceroy. D. at Cochin, India, Dec. 25, 1524.

Gam'ala, a strong fortress and town of Palestine, besieged in vain by Agrippa, but taken by Vespasian after a brave resistance, when the survivors, 9000 in number, perished. It probably was at *El Hosn*, a steep hill opposite Tiberias, and on the E. side of the Sea of Galilee.

Gama'liel the Elder, a famous Jewish doctor and Pharisee, instructor of St. Paul. D. about 50 A. D. Tradition says he became a Christian, but the Jewish writings, in which his learning, justice, and wisdom are commemorated, do not allude to this conversion.—Gamaliel the Younger, grandson of the above (b. about 50 A. D., d. about 116), was also a famous rabbi, president of the school at Jamnia, and strove to blend Platonism with Judaism.

Gambetta (Léon), lawyer and politician, b. at Cahors of Genoese parents, Oct. 30, 1838, looks more like an Italian than a Frenchman, and is one-eyed. He was an obscure lawyer until 1868, when he pleaded in a political case which made him known to the masses. In 1869 he was therefore elected deputy to the Corps Législatif as representative of radicalism. On Sept. 4, 1870, Gambetta became a member of the revolutionary government. During the siege of Paris he left the city, and vainly attempted, from Tours, and afterwards from Bordeaux, to arrest the German invasion. In 1871 he was returned member to the Versailles National Assembly, abandoned the cause of his former friends of the Commune, and supported M. Thiers, after whose downfall Gambetta endeavored to become again the leader of the Left of the Assembly. Félix Aucaigne.

Gam'bia, a deep and powerful river which traverses the region of Western Africa known as Senegambia. It falls into the Atlantic at Bathurst, in lat. 13° 28′ N., lon. 16° 35′ W.

Gambia, a British settlement at the mouth of the river Gambia. Bathurst, on the island of St. Mary, is the principal station, and has a considerable export trade in gold-dust, ivory, wax, hides, and horn. The settlement has a population of 14,190, of which only 56 are Europeans.

Gam'bier, post-v. of Knox co., O., on the Cleveland Mt. Vernon and Columbus R. R., 9 miles E. of Mt. Vernon. It is the seat of Kenyon College (which see). Pop. 581.

Gambier Islands, a group of islands of coral formation in the Pacific Ocean, in lat. 23° 8′ S., lon. 134° 55′ W.; under the protectorate of France. Vessels going from Chili to Tahiti visit them to take in fresh water. Pop. 1500.

Gambier (James), Baron, G. C. B., b. in the Bahamas of Huguenot stock, Oct. 13, 1756; entered the British navy; served with distinction against the American Revolutionists and the French; rear-admiral 1795; vice-admiral 1799; admiral 1805; bombarded Copenhagen, and was made a baron 1707; was one of the commissioners who drew up the Treaty of Ghent 1814. D. at Iver, England, Apr. 19, 1833. His title is now extinct.

Gam'bir, or **Gam'beer** (*Terra Japonica*), a variety of catechu. It is the solid astringent extract obtained by infusing the leaves and shoots of the *Nauclea* (*Uncaria*) *Gambir* in warm water, and evaporating the solution to dryness. The best gambir is made at Rhio, in the isle of Brittany, in the Eastern Archipelago. It is principally exported from Singapore, in brown masses covered with matting. Its fracture is even and dull. It dissolves almost completely in boiling water, and its solution gives precipitates with glue and with sulphuric acid. Its peculiar properties, which make it useful in tanning leather, are due to tannic acid, which is called catechu-tannic acid, as it differs from gallo-tannic acid in giving a grayish-green precipitate with ferric salts, while the latter gives a bluish-black precipitate, and in giving no precipitate with tartar emetic. (See Tannic Acid.) C. F. Chandler.

Gambling, or **Gaming.** See Dice, Playing-Cards, Lottery, and Sport.

Gamb'ling-Hou'ses. It is humiliating to reflect that while the Mohammedan religion has always successfully repressed gambling, Christianity has witnessed its worst excesses. The most degrading form which this vice has assumed is that by which houses are dedicated to it. From the days of St. Louis, whose brother was an extravagant gambler, to those of Du Guesclin, who was not less insanely given to this degrading vice, we find in France men who were famed for honor and bravery rendered contemptible by this low form of avarice. In the reign of Charles VI. the Hôtel de Nesle in Paris was a noted gaming-house for the nobility, and there is an old poem which describes the infamous deeds of this mansion. (*The Gaming-Table*, by Andrew Steinmetz, vol. i.) From Louis XI. to Henry IV. gambling steadily progressed, until under this last monarch, who set the example by the most extravagant play, *academies de jeu*, or gambling-houses, were established everywhere in Paris in the teeth of the most stringent laws. During the reign of Louis XIII. 47 gaming-houses at Paris, which had been licensed, and from which several magistrates drew a perquisite of half a sovereign a day, were suppressed. Mazarin, under Louis XIV., developed gaming, and made the palace a mere gambling-house, as appears from the letters of Madame de Sévigné. When the play of *hoca* was prohibited in Paris under penalty of death, it was freely played at court. Gaming-houses were first licensed in Paris in 1775. Fouché received £128,000 for permitting them, and in these "hells" this minister of police employed 120,000 spies, who were also *croupiers*. It is to be remarked that in all countries a decline in public honesty and private decency has been in exact ratio to the spread of gambling; and this has increased as gaming-houses have existed. In such places cheating becomes a science, and the houses colleges of deceit. Loaded dice have been dug up in Pompeii, and the Egyptians knew how to throw a sure six; but it is in the great gaming-houses of modern times that a thousand means of systematically plundering the public are deliberately invented and practised. Under John Law, the gambler, all France became in one sense a "hell," and it was at this time that houses of play received this most appropriate name. Under the empire gambling became in reality "Napoleonic," and the Palace Royal, Frascati's, and other magnificent *enfers* witnessed the nightly ruin of families and fortunes. In 1836, by the motion of J. B. Delessert, all gambling-houses were closed on Jan. 1, 1838. Many have read the celebrated sketch, *The Last Night at Frascati's*. At present gambling in Paris is secret and illegal. It is chiefly conducted at houses where *lorettes* dine. After dinner the doors are closed, and cards, roulette, etc. are introduced. The great gambling-houses of Germany, now suppressed, were at Baden, Homburg, and Wiesbaden, to which may be added Spa and Aix-la-Cha-

pelle. These towns combined every attraction, and to the mineral springs which first made them places of resort were added walks, drives, gardens, balls, reading-rooms, and public music. The principal game at the public tables was trente-et-quarante ("30 and 40"), commonly called rouge-et-noir, and the second roulette. No skill was required to play at these; the coin laid on the red or black side of the table was either lost or returned double, or else on certain numbers, which appeared to give an even chance to the player, or to increase the profit with the risk in due ratio, as certain cards or the dropping of a ball on a certain number decided. But once in about fifteen times a certain "tie," or *zero*, gave all on the table to the bank; and on this tie the company supported the place, paid dividends, and paid immense sums to the government. At Spa the annual profit was £40,000. In 1872 all these moral pest-houses were put an end to. At present that at Monaco is the only one left, and there may be still beheld the spectacle of a prince so degraded as to live by vice, and to whom the *odor lucri* is indifferent. C. G. LELAND.

Gamboge, or **Camboge** [named from *Cambodia*, where it is obtained], the dried juice from the trunk of a tree growing in Cambodia and Siam, lately determined to be the *Garcinia morella*, variety *pedicellata*, order Clusiaceæ. Gamboge is a brittle resinous substance, odorless, but of acrid taste, orange-yellow in mass, and a splendid pure yellow in powder. It consists essentially of a gum and resin, without volatile oil. The resin, known as *gambogic acid*, forms on the average about 80 per cent. of good gamboge, and is the ingredient that yields the color and the medicinal power. Gamboge is imported from Canton and Calcutta in cylindrical rolls called pipe gamboge, and, though of inferior quality, in irregular masses called cake or lump gamboge. Medicinally, gamboge is a powerful irritating cathartic, producing watery discharges, and in full dose nausea and vomiting as well. From its harshness it is not used alone, but generally as an ingredient of the compound cathartic pill of the Pharmacopœia. In the arts gamboge is used as a pigment. It readily diffuses in water, forming a yellow emulsion. It is employed also to stain wood in imitation of box, to stain marble yellow, and the resin dissolved in alcohol is an ingredient of the gold-colored lacquer used for brass-work. EDWARD CURTIS.

Game-Laws, laws regulating the killing and taking of game. Under the English common law all game was regarded as the property of the king, and heavy penalties were imposed upon those who encroached upon the royal prerogative by engaging in the hunting of such animals. To kill a deer, it is stated, was considered almost as heinous an offence as to kill a man. But the severity of the punishment was relaxed in favor of offenders belonging to the nobility or the higher classes of society; so that, by force of custom, they came to enjoy a peculiar privilege and exemption. But at an early period the laws concerning the taking of game were defined by statute. The statute now in force has abolished all distinction of class in regard to the nature of the liability incurred by violating the law, and requires all persons desiring to hunt game, either upon their own land or that of another, to take out a yearly certificate by which permission is conceded. If the land belongs to some third person, his consent that a certificate may issue must be obtained. Poaching is punished with great severity. No person is authorized to sell game without procuring a license conferring the power. Minute and stringent regulations are established determining the times of the year when game may be taken by those possessing the privilege. The policy of the English legislation is to confine the right to kill game to the aristocratic and landholding classes; and the laws prohibiting interference with their privileges are consequently made very rigid and strictly enforced. In the U. S. the right to kill game is enjoyed equally by all citizens, and the only common-law restriction against its exercise arises from the necessity of avoiding the commission of a trespass upon the lands of other persons. But statutory provisions have been adopted in a large number of the States prohibiting the act of taking certain valuable kinds of game except at certain seasons of the year. (For details the statutes of each State must be consulted.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Games, Ancient. See GRECIAN GAMES, by PROF. H. I. SCHMIDT, S. T. D.

Ga'ming, in law. Gaming consists in the playing of games of hazard for money or some article of pecuniary value. At common law this was not recognized as a criminal offence, and was only made punishable when it had been employed as a means for the commission of fraud. Thus, cheating by the use of false dice or deceptive cards subjected the defrauder to indictment, and he was punished by fine and imprisonment. Public gaming-houses also were deemed common nuisances, and might be suppressed. But in all cases where the persons engaging in gaming were the victims of no imposition, acted of their own free consent, and the play was fairly conducted, not only was the act not deemed sufficiently reprehensible to deserve legal punishment, but the courts would lend their aid to enable the winner of money to recover it from the loser. But the pernicious influence of gaming upon social morals, and the aversion which it is apt to create in its votaries to the pursuit of ordinary methods of money-making, as well as the great opportunities which are afforded for deluding and defrauding the inexperienced and the young, have led to the enactment of statutes both in England and (without doubt) in all the States of the Union, making the practice unlawful and imposing penalties upon those engaging in it, or providing means for its repression. In England provision is made for the institution of summary proceedings to convict and punish the proprietors of gaming-houses, and it is declared that all contracts by way of gaming or wagering shall be void, and that no suit shall be brought to recover the money won. Bills and notes given for money won at play are void on account of the illegal consideration. In New York all wagers or bets upon any gaming or upon any uncertain event are pronounced unlawful, and all contracts for the payment of money when the question of chance is determined are void. If any money or property be deposited with a stakeholder to await the result of a game or wager, the depositor, whether he lose or not, may bring suit against the stakeholder or winner (if he receive it) to recover it. If, moreover, any person shall at any one time or sitting win any sum of money or value, he may be compelled to forfeit five times the value of the money or articles so won, to be recovered by the overseers of the poor. An habitual gambler has been adjudged to be an "improvident person," under a statute which makes "improvidence" a disqualification to hold the office of executor or administrator. In Massachusetts obtaining money by gambling is declared larceny. The provisions against gaming in the other States are of substantially the same purport, though they are not generally of such great stringency as in New York. In a number of the States it is the rule that if money put up as a stake be once paid to the winner, the loser cannot recover it.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Ga'ming-Hou'ses, houses kept for the purpose of enticing people to gamble for money or other articles of value. At common law these may be suppressed as public nuisances, on account of their tendency to produce public disorder by the assembling of many persons, or to promote cheating and other corrupt practices. It is necessary in order to sustain an indictment that the house be used commonly for gaming purposes. Such a use upon a single occasion would not be sufficient. There is no need that the house be open to the entire public; it will suffice if it be used by a class of persons. If the proprietor be merely a temporary occupant, he is liable to the same extent as if he were the owner of the premises. In a number of States statutes have been passed regulating or prohibiting the keeping of gaming-houses. In New York any person keeping a room or building for gambling purposes, or leasing it with knowledge that it is to be used in such a manner, may on conviction be subjected to a fine of not less than fifty nor more than five hundred dollars; and if any one shall inveigle another into a gambling-house, he may be held responsible for the money or property lost by the person so invited. (See GAMING.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Gam'marus [Lat. for "lobster;" Gr. κάμμαρος], a genus of sessile-eyed crustaceans of the order Amphipoda and family Gammaridæ. The genus includes the fresh-water shrimp (*Gammarus pulex* of Europe, *Gammarus minus* of the U. S.), common under stones, and some marine species.

Gam'mell (WILLIAM), LL.D., an American teacher and author, b. in Medfield, Mass., Feb. 10, 1812; graduated at Brown University 1831; tutor in that university in 1832, and subsequently professor of rhetoric and English literature till 1850, when he was transferred to the chair of history and political economy, which he continued to fill till 1864. He is the author of a *Life of Roger Williams* and of a *Life of Gov. Samuel Ward*, both of which were published in Sparks's *American Biography;* a *History of American Baptist Missions*, published in 1850, and of several discourses and essays, historical, biographical, and literary. He has also been a frequent contributor to the press in reviews, magazines, and newspapers. J. H. GILMORE.

Gam'ut, in music, the name commonly given to the series of notes forming the diatonic scale. The first attempt to adjust in a scientific manner the elements of the diatonic scale is usually ascribed to Guido d'Arezzo, a Benedictine monk of the tenth century. He had diligently

studied music, such as it then was, and by practice in his monastery became so sensible of the needless difficulties imposed upon learners for want of a clear and scientific arrangement of the various tones that he undertook the remodelling of the whole musical system. He commenced by altering the Greek *tetrachord* to a *hexachord*, adding one note below the lowest then in use. To this new or supplementary note he gave the name of *gamma*, from the third letter of the Greek alphabet. He had also been much impressed with the recurrence of certain syllables in the following verse of a hymn to St. John, then in frequent use:

"*Ut* queant laxis *Re*sonare fibris,
*Mi*ra gestorum *Fa*muli tuorum,
*Sol*ve pollute *La*bii reatum,
Sancte Joannes."

To the six notes of the hexachord he therefore appropriated these syllables—viz. Ut, Re, Mi, Fa, Sol, La, and by a combination of the word *gamma* and the syllable *ut*, the scale thus formed (*Si*, for the seventh grade, being added afterwards) acquired the name of the *gamm-ut*, or *gamut*. The scale as thus regulated by Guido appears to have embraced two octaves and a sixth in its range—*i. e.* the original gamut, its repetition in the octave, and six notes of a further series. WILLIAM STAUNTON.

Gananoque, flourishing v. of Leeds co., Ont., Canada, near the Grand Trunk Railway, and on the St. Lawrence, opposite the Thousand Islands. It has extensive manufactures, a great water-power, and is a place of summer resort. Pop. of sub-district, 2020.

Gan′dia, town of Spain, in the province of Valencia, on the Alcoy. It is, with respect to its situation, one of the most beautiful towns in Spain. Pop. 6479.

Gan′do, the name of a kingdom of Upper Soudan, Western Africa, is situated on both sides of the Niger, and is inhabited by a people of the Foolah race. On account of the fertility of the soil and the character of the inhabitants, this kingdom, in connection with Sokota, seems destined to be the centre of Mohammedan civilization in Western and Middle Africa. At present, however, the country suffers much from a bad administration. It has a capital of the same name.

Ganga. See SAND GROUSE.

Gan′ges [Gr. Γάγγης; Hind. *Gangâ*], the principal river of Hindostan, and (as well on account of its magnitude and physical character, exhibiting the most striking phenomena and working according to the most complex natural laws, as on account of its intimate connection with the civilization of the country, its religion, and its business) the most interesting river on our globe—more interesting even than the Nile. Its sources are in the Himalayas, its mouth in the Bay of Bengal. Its entire length is about 1500 miles; its general direction, first S. E., and then E. It begins its upper course, under the name of Bhagirathi, in lat. 30° 54′ N. and lon. 79° 7′ E., at an elevation of 13,800 feet, in the Himalaya Mountains, where, according to the celebrated old Sanscrit epos, *Ramayana*—which in many places is simply an allegorical description of the Ganges and its influence on human life—it became entangled in the hair of Siva on its descent from heaven to earth. It issues from under an immense bed of snow, piled up between three peaks from the height of 13,800 feet to 22,000 feet; rushes out from the Himalaya in wild torrents; joins the Alakananda, a river larger than itself; receives the name of Ganges; and, having descended more than 12,000 feet during a course of 160 miles, it enters at Hurdwar, at an elevation of 1024 feet, the plain of Hindostan, and begins its middle course. From Hurdwar to Seebgungi, where the lower course of the Ganges (the Delta) begins, the distance is nearly 1100 miles. At Hurdwar the Ganges becomes navigable—above Cawnpore only for river-craft and passenger steamers, but below Allahabad for large vessels. In spite of the frequent shoals which it forms at one season and removes the next, thus altering its banks from year to year, the middle channel of its bed is everywhere practicable for large vessels after its confluence with the Jumna. Below Allahabad it receives from the left the waters of the Goomty, Ghoggra, Gunduck, and Koose, and from the right those of the Tous, Kurumnassa, and Sone; and passing by the large cities of Benares, Patna, Bahar, and Moorshedabad on its way to Calcutta, it forms a most splendid highway of communication and traffic through one of the most fertile and most thickly peopled regions on the earth. The Delta of the Ganges begins at a distance of 200 miles from the sea, and forms a perfect wilderness of creeks and rivers, some of which are salt, and all of which are subject to tidal influences. The northern arms unite with the waters of the Brahmapootra; the southernmost, the Hoogly, opens the widest and deepest passage to the Bay of Bengal. According to the poet, this delta was formed by Siva squeezing the water from his hairs and letting it run out between his fingers; but according to the naturalist, it was formed, as all other deltas were formed, by the mud which the river carries along with it, and which, in the case of the Ganges, is of an amount so immense that its annual average has been computed at 534,600,000 tons. This large tract of low, flat, alluvial land is yearly inundated by the Ganges from the beginning of May to the beginning of November. In the middle of August only the houses built on mounds and the tops of the trees are seen; the whole landscape is one sheet of water, where large vessels and small boats, steamships and rafts, swarm and float along. In November, when the waters have subsided, acres of land have been carried away, and in other places acres of land have been formed. The river is worshipped by the natives as the goddess "Ganga." Not only are pilgrimages made to particular places on its shores, where ablutions are performed, the dying exposed, and the dead thrown in, but the whole Hindoo mythology is interwoven with symbols and pictures referring to it.

Ganges, post-tp. of Allegan co., Mich., on Lake Michigan. Pop. 1255.

Gan′gi, town of Sicily, in the province of Palermo. Pop. 10,535.

Gan′glion [Gr. γάγγλιον]. In very general terms, a ganglion is an accumulation of gray nervous matter or cineritious substance. More exactly, a ganglion, wherever found, consists of nerve-cells and nerve-fibres mingled in various proportions, and bearing relations (not fully known) to one another, of blood-vessels, and of a framework of connective tissue. The term (plu. *ganglia*) is also applied to parts of the gray matter of the brain and spinal cord, having more or less definite shapes and boundaries, and being the seat of certain functions; the optic thalami and corpora striata in the brain are ganglia. Ganglia answering to the specific definition given above are found attached to the posterior roots of the spinal nerves (and some cranial), upon the terminal branches of many nerves, and in greatest abundance and of greatest size in the so-called sympathetic nervous system. (See GANGLIONIC NERVOUS SYSTEM.) A ganglion may be round or flat, or of any shape (semilunar ganglion), and may be of microscopic size, or as large as a finger-nail. In the Invertebrata the nervous system is wholly made up of such ganglia united by nervous trunks (bundles of nerves). The exact functions of ganglia are not well known. In general terms, they have, or may have, all the attributes of a nerve-centre —*i. e.* be the standing-point of motor impulses and the reception-point of sensory impressions. Many reflex actions are wholly under the control of ganglia. E. C. SEGUIN.

Gang′lionic Ner′vous Sys′tem. The ganglionic or sympathetic nervous system is an appendage of the cerebro-spinal system, existing in a rudimentary condition in nearly all Vertebrata, and attaining its most complete development in man. It consists of ganglia placed in front of the vertebral column, on either side of it, from the base of the skull to the coccyx, or lowest bone of the spine. These ganglia are united by vertical nervous cords, which form the chains of the sympathetic. There are four pairs of ganglia in the head, three in the neck, twelve in the dorsal region, four in the lumbar, five in the sacral region, and one ganglion upon the coccyx. This single ganglion is the point of union of the two chains. From these ganglia nerves proceed in two directions: (1) to the spinal nerves and thence to the spinal cord; and (2) to various organs and to other ganglia near organs. These ganglia, of large size and great importance, are placed upon or near to the heart, lungs, stomach, liver, kidneys, intestines, uterus, bladder, etc. These ganglia are nearly all symmetrically placed on either side of the median line, and, together with intricate networks of nerve-fibres coming to and going from them, constitute what are called plexuses. Thus, we have cardiac plexuses, solar plexus, hypogastric plexus, etc. Some of the nerves connecting the vertebral chain of ganglia with the visceral ganglia are so important as to be designated by special names. The cardiac nerves extend from the cervical ganglia to the cardiac plexuses; the splanchnic nerves connect the dorsal ganglia with the semilunar ganglia, which lie behind the stomach and go to form the great solar plexus. All the ganglia referred to above are visible to the naked eye, but there are innumerable microscopic ganglia in the sympathetic; they are found between the muscular fibres and under the mucous membrane of various organs.

The functions of the ganglionic nervous system are motor, sensory, and nutritive; and are only imperfectly known. (1) The following are the chief movements which are controlled by the sympathetic: In the head certain movements of the iris (ophthalmic ganglion), of muscles of the internal ear (otic ganglion), of muscles of the soft palate (spheno-palatine ganglion); in the chest, the cardiac contractions

by the cervical ganglia and cardiac plexuses; in the abdomen, the peristaltic movements of the stomach and intestines, the evacuative movements of the bladder and uterus. The most striking peculiarity of this motor energy is that it is wholly withdrawn from the influence of volition—that it is manifested in an automatic, necessary way. It is also to be remembered that this motor energy is in part derived from the spinal cord by means of the fibres connecting the two systems. Motor energy is also shown in the range of the ganglionic nervous system in the movements of blood-vessels, arteries chiefly; and this so-called vaso-motor function is worthy of separate study. The anatomical basis of this function lies in this, that blood-vessels possess a muscular coat, and receive numerous filaments from sympathetic ganglia; some of the larger vessels even bear plexuses. Experimentation shows that if the ganglia or nerves supplying blood-vessels be removed or severed, the vessels relax and remain dilated; while, on the other hand, if these nervous elements be irritated (as by electricity), the vessels diminish in size by contraction of their muscular coats. In the parts supplied by vessels whose nerves have been cut we observe redness, increased heat, and greater activity of nutrition. This law, that the ganglionic nervous system controls vascular contractility, was enunciated by the distinguished American physiologist Brown-Séquard. It has since been shown that this function of the sympathetic nervous system is in great part borrowed from the spinal cord, the same effects being produced by section of ganglionic nerves and certain parts of the spinal axis; the chief vaso-motor centre for the body being in the medulla oblongata. The intimate connection between the two systems is shown in many normal and pathological actions. The cardiac movements, for example, occur under the immediate influence of ganglia of the sympathetic, but these movements are made faster or slower, or rendered irregular, by nervous excitations coming from the brain or spinal cord; physical and psychic pain may arrest the heart's action; certain emotions cause palpitation; others may cause intermittent cardiac contractions. The peristaltic movements of the stomach and the processes of secretion in its glands are produced by reflex actions, taking place chiefly within the circuit of the great sympathetic; yet active mental exertion or an emotion may arrest these actions, producing acute indigestion; and, *vice versâ*, an intense irritation of the stomach may cause many cerebral symptoms — headache, vertigo, mental depression. An emotion may produce jaundice, an evidence of disturbance of the secretory function of the liver by a cerebral influence. The various intestinal functions are done by the agency of ganglia and nerves of the abdominal sympathetic; but we find that irritation of the intestines (worms, undigested food) may set up violent actions of the spinal cord (convulsions in infants) or cerebral depression (melancholia in the adult); and the action of cold upon the skin of the body is a well-known cause of increased peristaltic action and secretion in the bowel (diarrhœa). Turning now to purely local vascular movements, it is a matter of common observation that we blush or turn pale in consequence of unexpressed mental states (emotions). The above facts justify the following generalizations: (1) that while many local movements (muscular and vascular) and secretions are under the immediate control of ganglia of the sympathetic system, the relations existing between this and the cerebro-spinal are most intimate, and that actions of a reflex order are constantly taking place, involving the activity of both systems, an impression made upon terminal cerebro-spinal nerves being capable of producing actions in organs supplied by ganglionic nerves, and an irritation of terminal nerves of the sympathetic being capable of setting up actions in the brain and spinal cord, and in parts supplied by nerves issuing from them. (2) The sensations arising in the ganglionic nervous system are usually vague and dull: in perfect health there are no visceral sensations. When excessively excited, however, the ganglia and nerves of this system are capable of evolving most intense pain (colic, passage of calculi, angina pectoris). (3) As regards the relations of the ganglionic nervous system to nutrition, properly speaking—*i. e.* intimate tissue-changes independent of vascular modification—we know little or nothing. The theory which would make the ganglionic nervous system the seat of the emotions has little in its favor; all that can be said is, that many emotions are expressed in part by actions (vaso-motor and secretory) produced by the activity of this system, the cerebro-spinal system having been the starting-point of the activity. E. C. Seguin.

Gang Mills, lumber-manufacturing v. of Trenton tp., Oneida co., N. Y. Pop. 104.

Gangrene [Gr. γάγγραινα], the death, or partial death, of an organ or any portion of the body. Debility from any cause, and especially from old age, is the great predisposing agency. Among the exciting causes may be mentioned mechanical injuries and obstruction either to the ingress of arterial blood to, or egress of venous blood from, a part. The immediate cause of the death of a part is always the complete cessation of the capillary circulation in it. A distinction is generally made into *wet* and *dry* gangrene, according to the condition of the part affected. Another division is into *constitutional* and *local*. Gangrene usually begins with a diminution in the sensation and temperature of the part, the cuticle becomes detached, and a serous fluid is found beneath it. The limb crackles under the finger, owing to the presence of gases which are evolved by the decomposing tissues. These symptoms increase until all sensation is lost, and the part becomes colored greenish-black by the sulphuretted hydrogen set free during the process. The treatment must necessarily vary according to the cause. The system should be supported, and inflammation, if present, allayed. If there be any chance of saving the part, the temperature should be kept up by warm fomentations. Edward J. Bermingham.

Gangue [Fr.], in mineralogy and mining, the mineral substance which surrounds an ore or a mineral, lying within the same vein, but not blended with the substance it encloses.

Ga'nier, tp. of Kankakee co., Ill. Pop. 1582.

Gan'jam, district of the province of Madras, British India. It lies along the Bay of Bengal, between lat. 18° 13′ and 19° 52′ N. Its area is 6400 square miles; pop. 926,930. It produces rice, maize, sugar, oil, and different dyestuffs. The principal town is Rosikoila.

Gannat, town of France, in the department of Allier, has a large trade in wine and corn. Pop. 5599.

Gan'net, a name applied to the sea-birds of the genus *Sula*. The Atlantic coasts of the U. S. have two species—the common gannet (*Sula bassana*), called solan goose in England, and the booby gannet (*Sula fiber*) of the Southern States. The former is extensively taken on northern coasts for its feathers and down. The eggs are also gathered, and the young birds are eaten. One of the principal guano birds of the southern hemisphere is a gannet (*Sula variegata*).

Gan'nett (Ezra Stiles), D. D., an American Unitarian clergyman, b. in Cambridge, Mass., May 4, 1801; d. near Boston Aug. 28, 1871. A student at Phillips Academy, Andover, a graduate of Harvard College in the class of 1820, and of the Cambridge Divinity School three years later, he passed at once into the ministry as colleague pastor with Dr. W. E. Channing, being ordained in Federal Street church, Boston, June 20, 1824. In that charge he remained till his death. His great activities were wholly devoted to his ministry; he was an ardent preacher, a keen theologian and controversialist, an impassioned writer and speaker on religious and ethical themes, and a consecrated pastor. His published discourses were numerous. He founded *The Scripture Interpreter*, edited for some years *The Monthly Miscellany*, and was joint editor with Dr. Alvan Lamson 1844–49 of *The Christian Examiner*. As a leader of his denomination he was known in England as well as at home. Its benevolent operations he had deeply at heart; and though both in theology and politics he was conservative, his passion for righteousness was felt in almost every movement of social philanthropy that was active in his generation. O. B. Frothingham.

Gano (Rev. Stephen), M. D., Baptist clergyman, b. in New York Dec. 25, 1762; was a surgeon in the Continental army, and having been ordained to the ministry Aug. 2, 1786, from 1792 to Aug. 18, 1828, when he d., was pastor of the First Baptist church at Providence, R. I.

Ganoids. See Fish, by Prof. T. Gill, M. D., Ph. D., M. N. A. S., and Fossil Fishes, by Prof. J. S. Newberry, M. D., LL.D., M. N. A. S.

Gansevoort (Peter), b. at Albany, N. Y., July 17, 1749; appointed major 2d New York regiment 1775, and accompanied the army of Montgomery in its invasion of Canada; lieutenant-colonel 1776, and commanded Fort George; the following year, while in command of Fort Stanwix, he successfully withstood a siege of nearly three weeks against the British and Indian forces under St. Leger, by which he prevented the latter from co-operating with Burgoyne; for which service the thanks of Congress were tendered him. In 1781 the State of New York appointed him brigadier-general, and in 1809 he was appointed in the U. S. army with the same rank. D. July 2, 1812.

Gan'son (John), b. in Le Roy, Genesee co., N. Y., Jan. 1, 1818; graduated at Harvard College in 1839; studied law, was admitted to the bar, and removed to Buffalo soon after, and reached the first place at the bar in Erie co. In 1862 he was elected to the State senate, and on the expiration of his term was elected to Congress, serving from 1863 to 1865. In 1864 was elected a delegate to the Chicago convention which nominated McClellan for the Presidency.

After serving out his term in Congress, he retired from political life and devoted himself to his profession, in which he attained eminent success and an ample fortune. In 1873 he was induced to accept the nomination for the State senate, and was elected by a large majority, serving, as before, on the judiciary committee. In politics he was a Democrat of the conservative school, always discharging his duties in accordance with his personal convictions, and not governed by mere party ties. D. at Buffalo, N. Y., Sept. 28, 1874.

Gantt, tp. of Greenville co., S. C. Pop. 844.

Gantt (Levi), b. in the District of Columbia 1817; graduated at the U. S. Military Academy July, 1841, and entered the army as brevet second lieutenant of infantry; promoted to be second lieutenant 1842, and first lieutenant 1847; served in the Florida war (1841–42), and in the war with Mexico (1846–47), being engaged in the battle of Monterey, siege of Vera Cruz, battles of Cerro Gordo, Contreras, Churubusco, Molino del Rey, and Chapultepec; in the last-named battle, while bravely leading a storming-party, he was killed Sept. 13, 1847.

Gan'ymede [Γανυμήδης], in Greek mythology, the beautiful son of Tros and Calirrhoë, stolen by Zeus, who sent his eagle, or came in the shape of an eagle, and took Ganymede to Olympus, where he became the cup-bearer of the gods. His myth is, however, variously stated.

Gap, a poorly built but beautifully situated town of France, in the department of Hautes-Alpes. It is a bishop's see. Pop. 8219.

Gap, tp. of Montgomery co., Ark. Pop. 528.

Gap Civil, post-v., cap. of Alleghany co., N. C., in a fine valley, 38 miles S. W. of Wytheville, Va. Pop. of tp. 958.

Gapes, a disease of fowls and other birds, caused by the presence of trematode worms (*Fasciola trachealis*) in the windpipe. The number of worms present is sometimes so great as to choke the bird. More commonly they cause inflammation and difficulty of breathing. A feather moistened with spirits of turpentine may be thrust into the windpipe, and turned about till the worms are removed. Similar organisms have been found in the air-passages of mammals, but their presence is not easily detected, nor is there any effective treatment.

Garaman'tes, the ancient name of a people of the great desert of Sahara. They were not negroes, and had a town called Garama (now *Germa*). They were warlike nomades, and were engaged in the caravan-trade across the desert, and their descendants probably still exist under other names.

Garanceux, a product of the action of sulphuric acid on waste madder. (See Madder.)

Gar'ancin, a preparation of madder, obtained by first exhausting the pulverized madder with water, treating it with sulphuric acid at 100° C. (212° F.), and again washing. For most purposes garancin is preferred to madder; it produces more brilliant colors, requires less after-treatment, and leaves the whites clearer. (See Madder and Calico-Printing.) C. F. Chandler.

Garci'a (Manuel de Populo Vicente), father of Mmes. Malibran and Viardot, was b. at Seville, Spain, Jan. 21, 1775; was a fine tenor singer, an able instructor, and a writer of operas, of which *The Caliph of Bagdad* is the best. D. in Paris June 9, 1839.—His son Manuel, b. 1805, in Madrid, attained a world-wide fame as a teacher of vocal music, chiefly in Paris and London. Author of works on musical instruction.

Garcila'so de la Ve'ga, "the Spanish Petrarch," b. 1503 at Toledo, was an officer in Charles V.'s army, and d. at Nice of a wound in 1536. His poems (*Obras*, 1553) are few, but of high excellence.

Garcilaso de la Vega, b. at Cuzco, Peru, 1530, was the son of the Spanish governor of Cuzco by a Peruvian princess of the Inca blood; served as a soldier in Europe, but is chiefly remembered for his *Commentaries*, a valuable narrative of Peruvian history before and during the war of conquest. D. in Spain about 1615.

Gard, department of France, bordering on the Rhône and the Mediterranean, and watered by the Rhône and its affluents, the Gard and the Ceze. From the Cevennes, which occupy its north-western part, the country slopes down towards, and become marshy along, the Mediterranean. Wine, olives, and silk are the main productions; coal is found. Area, 2291 square miles. Pop. 429,747.

Gar'da, Lago di (the ancient *Lacus Benacus*), the largest and one of the most beautiful lakes of Northern Italy, stretches nearly from N. to S. on the boundary between the Lombardian and Venetian territories. It is 33 miles long, 10 miles broad, receives several small streams from the Alps, and sends its waters through the Mincio to the Po. It is very rich in fish. On account of its fine climate and the beauty of its scenery its shores are lined with elegant villas.

Garda'ia, town of Algeria, in the Sahara, in lat. 32° 28' N. and lon. 4° 38' E. It is situated in an oasis watered by artesian wells 900 feet deep. It is fortified, and forms one of the principal stations on the caravan-route from the Mediterranean to the interior of Africa.

Gardele'gen, town of Prussia, in the province of Saxony, on the Milde. Pop. 6266.

Gar'den, tp. of Buchanan co., Va. Pop. 1045.

Garden (Alexander), M. D., F. R. S., was b. in 1728 in Scotland; graduated at Aberdeen in 1748; was a student under Dr. John Gregory; settled in 1752 at Charleston, S. C., where he acquired much wealth. He was an able botanist and zoologist, and in 1773 was chosen to the Royal Society. In 1783 he went to England, being a loyalist, and his property was confiscated, but afterwards given to his son. He became vice-president of the Royal Society, and died in London April 15, 1791. Linnæus named the beautiful genus *Gardenia* in his honor.

Garden (Major Alexander), a son of Dr. Alexander Garden, was b. at Charleston, S. C., Dec. 4, 1757; was educated at Westminster and the University of Glasgow; returned to South Carolina in 1780, and joined the Revolutionary army, serving under John Laurens, Greene, and Henry Lee. His father's confiscated property was given him after the war. His *Anecdotes of the Revolutionary War* (1822–28) is a valuable source of historical information. D. at Charleston, S. C., Feb. 29, 1829.

Garde Nationale. See National Guard.

Gar'den Cit'y, post-v. and tp. of Blue Earth co., Minn. Pop. of v. 368; of tp. 1391.

Garden City, Queens co., N. Y., lies N. of, and immediately adjoining, the town of Hempstead, 15 miles from New York, and accessible by the Long Island, Central, and South Side (L. I.) R. Rs. It comprises about 10,000 acres of very level meadows, formerly known as Hempstead Plains. The plot was a few years ago purchased by Alexander T. Stewart, Esq., who holds the entire property in fee. At this time of writing (Feb., 1875) there are on the premises about 75 finished houses of several grades of cost, renting from $150 to $800, the latter rental securing a house with gas and the modern improvements, spacious grounds, with stables and outbuildings. Many new dwellings are in course of construction. On the premises is a large hotel, with basement and mansard roof, furnished throughout in the best manner, and kept in a style equal to first-class city hotels. A park of about 20 acres, handsomely laid out and kept in the best order, surrounds the hotel. The hotel has accommodations for 100 guests. The streets and avenues of Garden City are wide, partly lighted with gas, and planted with ornamental shade trees. The whole property is supplied with abundance of pure water, and the neighborhood is healthy. Schools and churches are conveniently located near the premises.

Gar'den Grove, post-v. and tp. of Decatur co., Ia., 150 miles W. from the Mississippi River and on a branch of the Burlington and Mo. River R. R. It has a good steam flouring-mill, a fine new school-house and excellent schools, 2 churches, 2 hotels, 3 wagon-shops, 2 harness-shops, 3 blacksmith-shops, 2 restaurants, a drug-store, and three general stores. It has 1 weekly newspaper. Pop. of tp. 859. W. J. Wightman, Ed. "Decatur Co. Leader."

Garde'nia [named in honor of Dr. Alexander Garden of Edinburgh and Charleston, S. C. (1728–91)], a genus of plants of the order Rubiaceæ, including some of the most beautiful and fragrant shrubs and trees known. Among them, the *Gardenia grandiflora* and other species of China yield a valuable yellow dye; and the *Gardenia campanulata* of Chittagong is used in medicine. Many species are cultivated in green-houses. Some of these are called cape jasmine, and came originally from Eastern Asia and South Africa. Excellent timber and resins are produced by various species.

Gardening. See Horticulture and Landscape Gardening.

Garden Plain, tp. and post-v. of Whitesides co., Ill. The township is on the Mississippi River, and the village is 3 miles S. of Fulton, on the Mendota and Clinton division of the Chicago Burlington and Quincy R. R. Pop. of tp. 1091.

Garden Prairie, post-v. of Boone co., Ill., in Bonas tp., on the Galena division of the Chicago and North-western R. R., 21 miles E. of Rockford.

Garden Valley, a v. of Austin tp., Lander co., Nev. Pop. 28.

Garden Valley, tp. of Jackson co., Wis. Pop. 678.

Gar′diner, city and tp. of Kennebec co., Me., on the Kennebec River, 41 miles from its mouth, and on the Maine Central R. R. It is divided by the Cobbossee River, which here empties into the Kennebec, forming in its passage through the city a very valuable water-power. The Cobbossee is spanned by 8 dams within one mile from its mouth, with a total fall of 133 feet above low tide. It contains 9 saw-mills driven by water and 1 by steam, 3 large paper-mills, 3 manufactories of sash, blinds, and doors, one large gutter-factory (steam), 2 furniture manufactories, 1 small tannery, one leather-belting manufactory, 1 large brick grist-mill, 1 bran, flouring, and grist-mill, 1 woollen factory, 2 iron-foundries, 5 machine-shops, 1 fancy box manufactory, 1 manufactory of broom-handles, bed-slats, etc., 1 gas-factory, 1 axle-factory, 1 spring-factory, 2 brick manufactories, a pottery, 5 carriage, and other smaller manufactories. Opposite, in Pittston, is one of the most complete steam-mills in the State. Gardiner has 2 newspapers, 11 churches, 3 national and 1 savings bank, 2 public libraries, and a provident association. It is the head-quarters of the ice-business on the Kennebec, which is one of the greatest industries of the city. Pop. of tp. 4497. H. K. Morrell, Ed. "Home Journal."

Gardiner, post-tp. of Ulster co., N. Y., on the Wallkill Valley R. R., 81 miles N. of Jersey City. It has manufactures of leather and lumber. Pop. of tp. 1991.

Gardiner (George W.), b. in the District of Columbia; graduated at the U. S. Military Academy, and entered the army as third lieutenant of artillery in 1814, promoted to be first lieutenant 1818, and captain 1832; served in the war with Great Britain 1812–15; in garrison duty mostly 1815–35. In the Florida war he was engaged in Dade's battle with the Seminole Indians, Dec. 28, 1835, where the whole command save three fell without attempting to retreat. A beautiful monument was erected at West Point to Dade and his command.

Gardiner (John), son of Dr. Sylvester Gardiner (1707–86), b. at Boston, Mass., 1731; studied law in the Inner Temple, and was called to the bar in England, and practised in London and in Wales; was one of the counsel for Wilkes in 1764; became in 1766 attorney-general of St. Kitt's, West Indies; removed after the Revolution to Boston, Mass., and in 1786 to Pownalboro', Me. (then Massachusetts); was in the Massachusetts legislature 1789–93; procured the abolition of the laws of primogeniture in Massachusetts, the prohibition of special pleading, and the repeal of the anti-theatrical laws. He was one of the leaders of the original Unitarian movement in Boston 1787. Was drowned off Cape Ann Oct. 15, 1793. He was a man of great learning, wit, and eloquence, and a zealous republican.

Gardiner (John Sylvester John), D. D., son of John Gardiner (1731–93), b. at Haverfordwest, Wales, June, 1765; was educated by John Lovell of Boston, a famous teacher, and for six years was a pupil of Dr. Parr in England; was ordained in 1787 by Bishop Provoost, and was in charge of the Episcopal parish of St. Helena, S. C., 1787–91; assistant minister (1792–1805) and rector after 1805 of Trinity church, Boston, Mass.; was distinguished for eloquence and literary taste. D. at Harrowgate, England, July 29, 1830.

Gardiner (Stephen), D. D., LL.D., b. at Bury St. Edmunds, England, 1483; was educated at Cambridge, and became master of Trinity Hall; became Wolsey's secretary, and in 1528 was sent by Henry VIII. to Rome to further his application for divorce; became secretary of state 1529; bishop of Winchester 1531; ambassador to France 1533; chancellor of Cambridge University 1540; opposed, as far as he dared, the Reformation; came into great power on Cromwell's fall; married the king to Catharine Parr 1543; envoy to Flanders 1545; was imprisoned during Edward VI.'s reign; restored to his bishopric by Queen Mary and made lord chancellor 1553. D. in London Nov. 12, 1555. He was a severe persecutor of Protestantism, an able and ambitious public officer, and a man of extraordinary learning. Gardiner's principal writings are *De vera obedientia* (London, 4to, 1534–35; translated by M. Wood, 1553); *A Necessary Doctrine of a Christian Man*, 1543; *Sacrament of the Aulter*, 1551, and various tracts on religious and literary subjects. Ascham defends Gardiner, who was his benefactor.

Gardiner (Sylvester), M. D., b. at Kingston, R. I., 1707; studied medicine in Paris and London; became a practitioner of Boston, Mass., and also medical instructor and drug-merchant; acquired wealth; founded (1760) the present city of Gardiner, Me., and colonized it with Germans; was one of the founders of King's chapel, Boston; prepared and published a prayer-book; established a church and library at Gardiner; was a loyalist in the Revolution; went to England in 1776, where his family became allied by marriage with the nobility. He returned to America in 1785, and d. at Newport, R. I., Aug. 8, 1786. Some 100,000 acres of his lands were confiscated, but his heirs regained possession, and the property in Maine was entailed to his grandson, Robert Hallowell, who took the name of Gardiner.

Gardiner's (or **Gardner's**) **Island,** an island lying E. of Long Island, belongs to East Hampton tp., Suffolk co., N. Y. Area, 3300 acres. It is chiefly devoted to pasturage. It was colonized by the English in 1639. Here (in 1699) Capt. Kidd buried his treasures, which were afterwards dug up. Its N. point, in lat. 41° 8′ 18″ N., lon. 72° 8′ 13″ W., has a lighthouse.

Gard′ner, post-v. of Greenfield tp., Grundy co., Ill., on the Chicago and Alton R. R., 27 miles N. E. of Pontiac. Pop. 940.

Gardner, tp. of Sangamon co., Ill., is traversed by the Springfield and Illinois South-eastern R. R., and lies W. of Springfield. Pop. 1270.

Gardner, post-v. and tp. of Johnson co., Kan., on the Kansas City branch of the Leavenworth Lawrence and Galveston R. R., 30 miles S. W. of Kansas City. Pop. of tp. 944.

Gardner, post-v. and tp. of Worcester co., Mass., at the junction of the Vermont and Massachusetts and the Worcester Gardner and Winchendon R. Rs., and about 26 miles from Worcester, the county-seat. It is the chief seat of the chair manufacturing interests in this county. It contains 14 cane and wood seat chair manufacturing establishments, which give employment to 2000 men, women, and children. Over 200 different varieties of chairs are made and shipped to all parts of the world. The annual product of these factories is over $2,000,000. The town also contains a national and savings bank, a newspaper, and good public buildings. Pop. of tp. 3333.
A. G. Bushnell, Ed. "The Gardner News."

Gardner, tp. of Door co., Wis., on Green Bay, Lake Michigan. Pop. 403.

Gardner (Augustus Kinsley), A. M., M. D., b. at Roxbury, Mass., July 31, 1821; studied three years at Harvard College, which in 1852 conferred the honorary degree of A. M. upon him, he having taken the medical degree there in 1844; after which he studied in Europe; settled in New York, where he has occupied prominent positions in various hospitals, dispensaries, and asylums; was for a time professor of diseases of females and clinical midwifery in the New York Medical College; author of *Old Wine in New Bottles*, 1848; *Causes and Treatment of Sterility; Conjugal Sins; Our Children; Ships and Shipbuilders of New York;* and of many professional and other papers; has given special attention to the subject of importing foreign birds as destroyers of insect larvæ; to the establishment of drinking-fountains in New York; to the investigation of the swill-milk business; to the reformation of the established code of medical ethics; and to the influence of the sewing-machine upon health, etc. His enlarged edition of Tyler Smith's *Lectures*, and his translation of Scanzoni's *Diseases of Females*, are standard text-books.

Gardner (Charles K.), b. in New Jersey 1786; entered the U. S. army as ensign 6th Infantry May, 1808; subsequently served as captain 3d Artillery and major 23d Infantry. In the war of 1812 he was prominent as the adjutant-general of the division of the North, under Maj.-Gen. Brown, participating in the battles of Chrystler's Fields, Chippewa, and Niagara, and at the siege and defence of Fort Erie; appointed adjutant-general Mar. 12, 1814. In 1818, Gen. Gardner resigned from the army, and during the administration of President Jackson was first assistant postmaster-general; auditor of the treasury for the P. O. department under Van Buren's administration, subsequently commissioner to investigate and settle affairs connected with the Indians in the Southern States; was postmaster of the city of Washington during Polk's, and surveyor-general of Oregon during Pierce's administration; he was then transferred to an office in the treasury department, which he held till 1867, when he was compelled to resign from advanced age and infirmity. Possessing a literary mind, he was a frequent contributor to various periodicals and magazines, and was the author of a *Compend of Infantry Tactics, Dictionary of the Army*, etc. D. at Washington, D. C., Nov. 1, 1869.

Gardner (Harmony C.), authoress, was b. July 31, 1821, at East Weymouth, Mass. She was married, in 1842, to Rev. Abel Gardner, A. M. Her writings are numerous, and distinguished by their humor and high moral tone. Among them are *Rosedale, a Story of Self-Denial; Extracts from the Diary of a Country Pastor; Ellinor Gray; Annie Lee, and her Irish Nurse; Fault-finding, and What*

Came of It; Rosamond Dayton; The Power of Kindness; The King's Daughter; Miss Carrol's School; Harry Love; Holiday Poems; Mehitable, etc. ABEL STEVENS.

Gardner (Gen. JOHN LANE), b. in Boston, Mass., Aug. 1, 1793; entered the U. S. army in 1812 as third lieutenant of infantry; saw active service first in Canada; was wounded in the attack under Gen. Wilkinson on La Cole's Mill Mar. 30, 1814; was afterwards on the staff of Gen. T. A. Smith, and at the peace was transferred to the artillery. From 1820 to 1830 he served as assistant quartermaster-general, with the rank of captain. In 1833 he was brevetted major in the 4th Artillery; served with this regiment during the Florida war, and was reported as having shown "the utmost activity, skill, and intrepidity" at the battle of Wahoo Swamp; in Oct., 1845, was promoted to the full rank of major; commanded his regiment throughout the Mexican war, and was brevetted lieutenant-colonel for "gallant and meritorious service" in the battle of Cerro Gordo. At the battle of Contreras he commanded the right column of attack, and was brevetted colonel for gallant service. In 1849–50 he commanded the district of Florida; became lieutenant-colonel 1852, and some years later was placed in command of Charleston harbor, where he was stationed in 1860. Though having less than fifty effective men in Fort Moultrie, he obtained, by an arrangement with Col. J. P. Taylor, commissary-general (unknown to the secretary of war), six months' provisions, and announced his intention to defend the fort to the last extremity. Secretary Floyd thereupon relieved him from command, ordering him to report to Gen. Twiggs in Texas. Major Anderson, his successor, on removing his command to Fort Sumter, secretly carried thither the provisions which Col. Gardner's foresight had secured. He was promoted to be colonel of the 2d Artillery July 23, 1861, and in the following year, being disabled for active service, he was at his own request placed on the retired list, and employed on recruiting service. After the peace he was sent by Gen. Grant to his old command in Charleston. In 1865 he was brevetted brigadier-general "for long and faithful service." D. at Wilmington, Del., Feb. 19, 1869.

Gard'ner's, tp. of Wilson co., N. C. Pop. 1178.

Gardner's Island, one of the Thousand Islands in the river St. Lawrence, belongs to Clayton tp., Jefferson co., N. Y. Pop. 7.

Garesché (JULIUS P.), b. in Cuba, of parents who were American citizens, in 1821; graduated at West Point July, 1841, and entered the army as second lieutenant 4th Artillery; served on the northern frontier and in garrison duty 1841–46; in the Mexican war 1846–48; and from 1855 to 1862 as assistant adjutant-general in Washington, D. C.; promoted to be major and A. A. G. Aug., 1861. On the outbreak of the civil war he sought active service, and was appointed chief of staff to Maj.-Gen. Rosecrans, commanding the army of the Cumberland, having previously declined the commission of brigadier-general of volunteers. At the battle of Stone River, Tenn., in a gallant attempt to recover the battle, which then appeared to be lost, he, with the commanding general and his staff, dashed forward, and was struck in the head by a cannon-ball and killed, Dec. 31, 1862.

Gares'sio, town of Italy, in the province of Cuneo, dating back to the Roman period, remains of which are here often disinterred. It has an interesting mediæval history, was once a double-walled town, and now contains extensive ruins of convents, etc. Napoleon Bonaparte passed three months here in 1794, while commandant of artillery. Pop. 6882.

Gar'field (JAMES A.), b. in Orange, Cuyahoga co., O., Nov. 19, 1831; graduated at Williams College, Mass., 1856; studied and practised law; member of Ohio senate 1859–60. In the civil war he entered the service in 1861 as colonel 42d Ohio Volunteers, and served in S. E. Kentucky, where (Jan., 1862), in command of a brigade, he forced Humphrey Marshall with his command to evacuate Kentucky, for which service he was promoted to be brigadier-general of volunteers Jan. 11, 1862, and served at Shiloh, Corinth, etc.; in 1863, Gen. Rosecrans appointed him his chief of staff, with whom he continued to serve until Dec. 5, 1863, having in the mean time (Sept. 19, 1863) been promoted to be major-general of volunteers for gallantry at the battle of Chickamauga, when he resigned to occupy his seat in the 38th Congress, to which he had been elected, and since which has been re-elected to each succeeding Congress to the present (44th), serving as chairman of the committee on military affairs, banking, and appropriations. G. C. SIMMONS.

Gar-Fish, the name of several fishes: (1) Those of the genus *Belone* and family Scomberesocidæ, partly marine and partly fluviatile. The *Belone vulgaris* of the European seas is a long, active fish, with alligator-like jaws. It is prized as food, like *Belone longirostris* of the American seas and rivers. There are fresh-water species in various tropical countries. (2) The names gar and alligator-gar are given in the U. S. to the gar-pikes, of the genus *Lepidosteus*, of the family Lepidosteidæ. They are remarkable for their ganoid scales and the power of turning the head from side to side —a power which no other fishes possess. They somewhat resemble the true gars (*Belone*) in appearance, but are worthless as food. They are a kind of link between fishes and reptiles. Various species are found in the Northern lakes and Western and Southern rivers, and others in tropical America.

Gar'ganey, or **Summer Teal,** the *Anas querquedula*, a wild-duck of Europe, Africa, and Asia, highly prized as food. It is sixteen inches long, and beautifully variegated with white, brown, and green.

Gar'gano, a mountainous peninsula of Southern Italy, in the province of Capitanata, stretching 20 miles into the Adriatic. The northern range of its mountains is still famous for its honey, as it was in the time of Horace; the southern range is naked and cheerless.

Garget-Root, Poke, or **Skoke,** the *Phytolacca decandra* (order Phytolaccaceæ), a large perennial herb of the U. S., naturalized to some extent in Southern Europe. Its root is useful in veterinary practice, and in the diseases of mankind it has some power as an alterative. Its young shoots are used as a potherb, but should only be so used when very young, and care should be taken to boil them thoroughly, otherwise they may prove a powerful irritant poison. The berries afford a rich but fugitive purple, employed in France for coloring wines; but the berries share in the poisonous properties of the plant. The root, when given to cattle, is cut up into plugs, which are thrust into potatoes or turnips, and thus eaten. The root should not be given to the horse, for it is believed to be very poisonous to that animal. Several other species of *Phytolacca*, growing in China, India, Cayenne, Chili, etc., share the properties of this plant, and are used as potherbs to some extent.

Gar'goyle, in architecture, the carved lower end or outlet of the water-spout from the roof of a building. In mediæval times these were often curiously shaped in imitation of men, beasts, birds, and fanciful creatures. In quite recent times we find an absurd custom of making gargoyles without water-pipes, or any possible use other than that of grotesque adornment.

Garibal'di (GIUSEPPE), a great Italian general and patriot, b. at Nice July 4, 1807. In his youth he made many voyages as a sailor, but having taken part, in 1833 and 1834, in the movement of the Young Italians, which ended in the unhappy expedition of Savoy, he was driven into exile. In 1836 he arrived in South America, having served in the mean time in the French navy. He at once offered his services to the republic of Rio Grande, and showed such zeal in her defence that after having fought many a hard battle, and won especial glory in that of San Antonio, Feb. 6, 1846, he received the well-merited title of "the hero of Montevideo." Indeed, the narrative of the heroic exploits and the romantic adventures and escapes of Garibaldi during his South American campaigns forms one of the most stirring chapters in military story. Remote posterity will regard the life and labors of Garibaldi as mythic, or perhaps suppose, as the ancients thought of Hercules, that one fortunate hero has absorbed in his single name the fame of many. But he had not forgotten his native land; and, roused by the events of 1848, in April of that year, he, with his wife Anita, a Spanish American, and a few brave comrades, left Montevideo and returned to Italy. At the moment of his arrival the army of Charles Albert, at first successful in Lombardy, had begun to give way. Garibaldi offered him his services; they were refused. Finally, however, the provisional government of Lombardy, when the affairs of those provinces were already drawing near their sad conclusion, entrusted Garibaldi with the command of a body of volunteers. With these the brave Nizzard obtained some successes, though of small military importance. Lombardy having fallen once more wholly into the hands of the Austrians, Garibaldi offered his sword to the republic of Rome, and the supreme command was given to him and to Gen. Roselli. The glory of the admirable and heroic defence of Rome against French intervention in 1849 chiefly belongs to Garibaldi. Escaping from Rome, after the fall of the city, with 3000 of his followers, in the hope of being still able to effect something against Austria, he took refuge in San Marino, but being surrounded on all sides by the Austrian forces, he found himself obliged to disband his troops. His plan then was to make his way, with a few faithful companions, to Venice, which still held out. But the news soon arrived that Venice too had fallen. Nothing then remained but to seek a place of safety for his wife and him-

self; but Anita, exhausted by fatigue and privation, died in childbirth near Ravenna. The heroic patriot, alone in his grief, repaired to Chiavari in Liguria, and there the government of the king of Sardinia offered him the choice between prison and exile. Garibaldi sailed for Tunis, but through the intrigues of the French consul that town refused to receive him. Thereupon he went back to the island of Maddalena, near which lies the little islet of Caprera that was one day to become the solitary and renowned seat of the great captain. Here he provided for himself for some time by hunting and fishing, but finally went again to America. There he was prosperous in business, and was able on his return in 1854 to purchase the northern part of Caprera. Here he remained until 1859, in which year he organized and commanded the glorious band of the "cacciatori delle Alpi," or Alpine chasseurs—a body of volunteers that made the whole Lombard campaign, having crossed the Ticino eleven days before the French troops. After the peace of Villafranca, so unfortunate for Italy, Garibaldi formed in Central Italy the corps of the "cacciatori degli Apennini," or chasseurs of the Apennines, and trained them with the view of throwing himself upon the papal provinces and once more liberating Rome. The policy of Piedmont prevented him from carrying out this plan; but, on the other hand, Count Cavour assisted him in the expedition against Sicily with all the means he could dispose of without compromising his government. The island being in a state of insurrection, on May 5, 1860, Garibaldi sailed mysteriously from Quarto in Liguria with 1000 armed comrades, eluded the vigilance of the cruisers of the Bourbon fleet, and with astonishing boldness landed on May 11 at Marsala, gave battle near Calatafini on the 15th to the Bourbon army, which he defeated with his single thousand, and on May 27, after various partial but successful engagements and some most skilful manœuvring, entered gloriously into Palermo. This part of the Garibaldian legend is truly epic. The hero was soon regarded by the superstitious Sicilians as a saint, a liberating angel, invulnerable, and sent by God. At Palermo, Garibaldi assumed the dictatorship of the island. On July 20 he gained a new and decisive victory over the Bourbon troops; on the 28th the fortress of Messina fell into his hands. On Aug. 25 he gave battle at Reggio in Calabria, conquered, and then marched rapidly and victoriously upon Naples. The Bourbons were terrified; there were numerous desertions from the army; King Francis fled from Naples to Gaeta; Garibaldi alone, and to the astonishment of the world, entered triumphant into Naples, and was there proclaimed dictator of the Two Sicilies. Count Cavour feared that the victorious Garibaldi might prove untrue to the motto upon his banner, "Italy and Victor Emmanuel;" that a republic might be proclaimed at Naples; that Garibaldi might march upon Rome, and so draw upon Italy the indignation and the arms of France. He therefore sent, under the pretext of assisting him, a body of Piedmontese troops into the ex-kingdom of Naples. Garibaldi and the Piedmontese together gained the victory of Volturno, after which took place a *plebiscito* or *universal* vote for the annexation of the kingdom of the Two Sicilies to that part of Italy which was then governed by King Victor Emmanuel. The annexation being voted on Nov. 9, 1860, Garibaldi, after what may be styled emphatically the *gran dono* to King Victor Emmanuel—the bestowal of a kingdom which, had he wished, he might have made his own—retired, great as Cincinnatus of old, to his island solitude of Caprera. But he did not cease to occupy himself with his beloved Italy. The cession of Nice and Savoy to France having taken place, he entered the Italian Parliament and protested energetically against surrendering to a foreign power a portion of the Italian soil—that very soil where he, the liberator of Italy, first saw the light. Nevertheless, he did not lose heart; he knew that Venice and Rome were still to be liberated. For the former, in May, 1862, he undertook the expedition of Sarnico, which, through the intervention of the Italian government, was broken up in its very beginning; then that of Rome with the cry "Roma o morte!" ("Rome or death!"), which ended in the fatal battle of Aspromonte, where not the enemies of Italy, but Italian riflemen, assailed him, wounded him with a ball in the foot, and took him prisoner on Aug. 29, 1862—a day of mourning for Italy. On Dec. 19, 1862, Garibaldi, amnestied and with his wounds healed, returned to Caprera. In 1864, Gen. Garibaldi visited England, where he was received with most enthusiastic demonstrations by all classes. On the breaking out of the war of 1866 for the liberation of Venice, Garibaldi assumed the command of a body of volunteers, with whom he advanced into the Trentino, and the only Italian victories of the inglorious campaign of that year were those obtained by the Garibaldians. The following year Garibaldi once more attempted with his volunteers to liberate Rome; he entered the Campagna, defeated the papal troops at Montcrotondo on Oct. 25, 1867, and marched upon Rome; but near Mentana, meeting the French and papal army under the command of Gen. Failly—who by order of Napoleon III. was to make upon Italians the first trial of the "miraculous" powers of the newly-invented *chassepot*—he was defeated in spite of the most heroic efforts. Garibaldi was for some time held a prisoner in the fortress of Varignano, near Spezzia; afterwards he was permitted to return to Caprera. In 1870 the misfortunes of France and a warm appeal from Gambetta touched him, and decided him to hasten with his sword, his courage, his fortune, and his sons to the aid of the French republic against the Prussians. In France he received the command of a corps called the "volunteers of the Vosges;" his son Ricciotti on Oct. 19 obtained a small victory over the Prussians; and that these latter advanced no farther in that direction was wholly due to the corps commanded by Garibaldi. As an acknowledgment, after the capitulation of Paris he was elected deputy to the Assembly at Bordeaux, but there, in the attempt to exercise freedom of speech, French gratitude put him down by tumultuous demonstrations of ill-will, and, renouncing his deputyship, he returned to Caprera. Since 1870, Garibaldi has published three romances—*Clelia, Cantoni il Voluntario,* and *I Mille*—but all three are below mediocrity. The general has not had sufficient literary culture to be a good and tasteful writer, and his printed works are not calculated to increase his reputation. He is a man of heart and of action, but neither a statesman nor a man of letters.

The frequent collisions into which Garibaldi has been brought with the royal government, while they have not lessened his love for his native country—for Nice is essentially Italian—or his generous devotion to her good, have nevertheless produced in him an alienation of sentiment towards the dynasty and the governing classes in Italy, which, in combination with his ardent republicanism, has often led him to treat the present political organization of the people as a failure. This opinion cannot be admitted to be well founded; and in justice to the Italians and their government it must be remembered that the latter has repeatedly offered Garibaldi most tempting titles, honors, and rewards, which he has magnanimously declined; that though its unhappy dependence on France—a relation now, it may be hoped, severed for ever—has compelled it to resist his military movements, and even temporarily to restrain him of his liberty, yet it has always, up to the present day, shown him unbounded personal consideration; and that he enjoys, in the universal gratitude of his countrymen, the highest reward to which the soul of a patriot can aspire. Member of the Italian Parliament for 1875. (Among the numerous biographies of Garibaldi, one of the most faithful and valuable is that written by his venerable friend and former companion in exile at Montevideo, Giambattista Cuneo, Turin, 1865.)

F. A. P. Barnard.

Gariglia'no [Lat. *Liris*], a river of Southern Italy, which receives the water of Lago di Fucino, forms the marshes of Minturnæ (famous in the history of Marius and Sulla), and enters the Mediterranean 9 miles E. of Gaeta.

Gar'land, county of W. Central Arkansas. Area, about 540 square miles. Formed since the census of 1870 from Montgomery, Hot Springs, and Saline cos. Its surface is broken; the mineral resources great and varied. The county abounds in mineral and thermal springs, serviceable in many diseases. Cap. Hot Springs.

Garland, post-tp. of Penobscot co., Me., 25 miles N. W. of Bangor, has 3 churches, and manufactures of shoes, carriages, lumber, etc. Pop. 1306.

Garland (Augustus H.), a prominent lawyer, jurist, and politician of Arkansas, b. in Tipton co., Tenn., June 14, 1832, and educated at Bairdstown; studied law; removed to Arkansas, and soon rose to eminence; opposed secession as a policy until his State passed her ordinance withdrawing from the Union, then cast his fortunes with hers; was elected to the provisional Congress of the Confederate States in 1861; was re-elected to the House of the same Congress in 1862; was afterwards elected to the Confederate Senate, which office he held till the surrender in 1865. After the war he devoted himself with great success to his profession, and in 1874 was elected, by a very large majority, governor under the new constitution of Arkansas.

A. H. Stephens.

Garland (Hugh A.), b. in Nelson co., Va., June 1, 1805; graduated at Hampden-Sidney College 1825; was professor of Greek there 1825–30; became a leading lawyer of Mecklenburg co., Va.; clerk of the U. S. House of Representatives 1838–41; removed in 1841 to a farm near Petersburg, Va., and in 1845, having lost his property, removed to St. Louis, Mo., where he d. Oct. 15, 1854. Author of

Lives of Jefferson and John Randolph.—His son, HUGH A., a lawyer of Missouri and a Confederate colonel, was killed in battle in Tennessee in 1864.

Garland (JOHN), b. in Virginia in 1792, and appointed a first lieutenant 35th regiment of infantry, U. S. A., Mar. 31, 1813. At the close of the war with Great Britain he was retained in the army, and promoted to be captain in 1817, major in 1836, lieutenant-colonel in 1839, and colonel in 1849. He bore an active part in the war with Mexico, and in the taking of the city of Mexico was severely wounded; brevetted brigadier-general for gallant services. D. at New York June 5, 1861.

Garland (LANDON CABELL), A. M., LL.D., mathematician and scholar, b. at Lovingston, Va., Mar. 21, 1810; was educated at Hampden-Sidney College, Va.; was professor of chemistry at Washington College, Va., from 1830 to 1833, and in Randolph-Macon College, Va., from 1833 to 1835, then its president to 1846, and at the same time professor of pure and mixed mathematics. In 1847 he became professor of English literature, and afterwards of mathematics, in the University of Alabama, and in 1855 its president; since 1866, professor of physics and astronomy in the University of Mississippi; is professor-elect of physics in the Vanderbilt University at Nashville, Tenn. Has written on plane and spherical trigonometry, and also largely in the periodicals of the Methodist Episcopal Church, South.

Garlas'co, town of Italy, in the province of Pavia. It is of some interest as a Roman and a mediæval town, and contains monuments of the latter period. Pop. 6500.

Gar'lic, the *Allium sativum*, a cultivated plant allied to the onion (order Liliaceæ), and much used as a condiment in Southern Europe. The part chiefly employed is the bulb, or rather the collection of small bulbs (cloves of garlic). The wild species are numerous on both continents, especially on the eastern. Garlic has a taste resembling that of the onion, but much stronger. It is employed in medicine as a stimulant, expectorant, diaphoretic, and revulsive. It is for the most part used externally. It abounds in the peculiar volatile oil of garlic, to which it owes most of its active properties.

Garlic, Oil of, obtained by distilling the garlic bulbs, which yield about 0.2 per cent. of crude brown oil. By careful rectification about two-thirds of this is obtained as a pale yellow oil, lighter than water. By further treatment with chloride of calcium, and distillation from a little potassium, it is obtained pure and colorless. It consists of sulphide of allyl $(C_3H_5)_2S$, which was associated in the crude oil with oxide of allyl $(C_3H_5)_2O$ and another sulphur compound. This oil has the peculiar penetrating odor of garlic; it is also found in oils of onions, radishes, etc.

Oil of black mustard contains the sulphocyanide of allyl, C_3H_5CNS. These two oils are mutually convertible; by distillation with potassium the sulphocyanide is changed to sulphide; and by treating oil of garlic with corrosive sublimate, and distilling the precipitate with sulphocyanide of potassium, oil of mustard is produced. This oil is also found in horseradish, scurvy-grass, etc.

C. F. CHANDLER.

Garnavil'lo, post-tp. of Clayton co., Ia. Pop. 1226.

Gar'ner, tp. of Union co., Ark. Pop. 456.

Garner, post-v. of Hancock co., Ia., at the junction of the Milwaukee and St. Paul and the Iowa and Minnesota R. Rs., near the centre of the county, 1 mile from the county-seat, surrounded by good prairie-land, suitable for grain and stock-raising. It has 4 stores, a hotel, a saloon, a wagon-shop, a printing-office, a weekly newspaper, 2 storehouses for grain, a lumber-yard, and in its vicinity a good nursery; 80,000 bushels of wheat were brought here in 1874.

W. C. HAYWARD, ED. "SIGNAL."

Gar'nersville, a v. of Haverstraw tp., Rockland co., N. Y., has important print-works. It is 2 miles N. W. of Warren.

Gar'net, a precious stone belonging to the monometric or cubic system of crystallization, its secondary forms being generally the rhombic dodecahedron and trapezohedron. Specific gravity, 3.6 to 4.2; hardness, 6.5 to 7.5. It occurs in the mountainous regions of most countries, usually in mica-slate, hornblende-slate, and gneiss; less frequently in granite, serpentine, and lava. There are several varieties, differing in color and chemical composition, but agreeing in other properties. When colorless, the common garnet consists of silica, lime, and alumina in the proportion of about 38 parts of each of the two former to 24 of the latter. The precious or Oriental garnet (*almandine*) owes its fiery brightness to an infusion of about 40 per cent. of the protoxide of iron, the lime being absent. The composition of the *pyrope*, or Bohemian garnet, is somewhat different, comprising a less proportion of iron in the form of a peroxide; it has also an infusion of magnesia and the oxide of chromium. These, with the *essonite*, or cinnamon stone, found chiefly in Ceylon, and containing no iron, are the only varieties used in jewelry. There are also, however, the *grossularite* and *uwarovite*, green; the *colophonite* and *spessartine*, brown; the *ruccinite*, *melanite*, and *leucite*, yellow, black, and white respectively. The Oriental garnet, or almandine (so called from the city of Alabanda, where it was anciently wrought), is found in alluvial soil, into which it has been washed out of its matrix, in Pegu, Siam, Ceylon, and India. When very large, as is frequently the case, it is cut *en cabochon*—*i. e.* with a flat base and convex upper surface—and is then termed a *carbuncle*. The pyrope, or Bohemian garnet, found chiefly in Austria and Germany, is smaller, less splendid in tint, more common, and less esteemed. Notwithstanding its beauty, the commercial value even of the Oriental garnet has greatly declined in modern times, owing to the numbers brought into the market. A fine carbuncle, according to Mr. Emanuel, is worth about £20. They are sometimes sold as "Ceylon rubies." The garnet was frequently selected for engraving upon by the artists of the Roman empire; one of the finest specimens of antique skill, the head of Sirius in the Marlborough collection, is upon a garnet. It was also a favorite gem with the engravers of the Sassanian period, but is rarely employed now, owing to its hardness and brittleness, which too severely tax the abilities of modern artists.

R. GARNETT.

Gar'nett, a post-v., cap. of Anderson co., Kan., 52 miles S. of Lawrence, on the Pottawattomie River, a small tributary of the Osage or Marais des Cygnes. The Paola Garnett and Fall River and the Leavenworth Lawrence and Galveston R. Rs. intersect here. It has 2 newspapers, 2 banks, 2 large mills, a cheese-factory, an extensive planing-mill and furniture manufactory, 2 hotels, a college under the auspices of the United Presbyterian denomination, and 8 churches. The town has a large and very fine union school building. The village is well built, the business portion mainly of brick and stone. All departments of trade are well represented. Pop. 1219.

W. R. SPOONER, ED. "PLAINDEALER."

Garnett (ALEXANDER YELVERTON PEYTON), M. D., was b. Sept. 20, 1820, in Essex co., Va.; graduated in the medical department of the University of Pennsylvania 1841; entered the U. S. navy same year, and rose to full surgeon in 1848. Having been elected professor of clinical medicine in the National Medical College, he resigned his naval appointment in 1850. In 1861 he left the capital and returned to Virginia; went to Richmond, where he was appointed on the examining board of surgeons, then surgeon-in-chief to the military hospitals; and being the family physician of Mr. Jefferson Davis, accompanied him on the evacuation of that city in 1865. After the downfall of the Southern Confederacy, Dr. Garnett returned to Washington City, where he was re-elected professor in the National Medical College, which position he resigned in 1872; was made emeritus professor; and still resides in that city. PAUL F. EVE.

Garnett (JAMES M.), b. June 8, 1770, at Elmwood, Essex co., Va.; served several years as member of the legislature of that State, and served as a member of Congress from 1805 to 1809; was also a member of the constitutional convention of Virginia in 1829. D. at Elmwood May, 1843. A. H. STEPHENS.

Garnett (MUSCOE R. H.), b. in Essex co., Va.; educated at the university of the State; became a lawyer by profession; was a member of the constitutional convention of Virginia in 1850; was a member of the house of delegates of that State in 1853–54 and 1855–56; was a member of Congress from 1857 to 1859, and was re-elected to the 36th Congress, but resigned his seat on the secession of Virginia (1861), and d. during the war. A. H. STEPHENS.

Garnett (RICHARD BROOKE), b. in Virginia in 1819; graduated at West Point July, 1841, and entered the army as second lieutenant 6th Infantry; served in the Florida war and on garrison and frontier duty. On the outbreak of civil war he resigned from the U. S. army, May, 1861, and was appointed colonel in the Confederate army, serving in Western Virginia; but was afterwards promoted to be brigadier-general, and transferred to Gen. Lee's army and commanded a brigade. Killed at the battle of Gettysburg, Pa., July 3, 1863.

Garnett (ROBERT SELDEN), b. in Virginia in 1820; graduated at West Point July, 1841, and entered the army as brevet second lieutenant of artillery; served on the northern frontier and as assistant instructor of infantry tactics at West Point till 1844; was aide-de-camp to Gen. Wool in 1845. In the Mexican war he distinguished himself at the battles of Palo Alto, Resaca de la Palma, Monterey, and Buena Vista; was promoted to be first lieutenant Aug., 1846, and served as aide-de-camp to Gen. Taylor from

June, 1846, till Jan., 1849; was brevetted captain and major for gallant conduct at Monterey and Buena Vista; transferred to the infantry in 1848, and served against the Seminole Indians in Florida and on frontier duty in Texas 1850; as commandant of cadets at Military Academy 1852–54; appointed captain 1st Cavalry Mar. 3, 1853, and major 9th Infantry Mar. 27, 1855; he commanded the Yakima expedition in 1856, and the operations against Puget Sound Indians in 1858. On the outbreak of civil war he resigned from the U. S. army and espoused the cause of the Confederates, being appointed a brigadier-general and placed in command of the department of Western Virginia; at the action of Carrick's Ford, July 13, 1861, Gen. Garnett was killed while attempting to rally his forces. G. C. SIMMONS.

Garnier (JEAN LOUIS CHARLES), French architect, b. at Paris Nov. 6, 1825; entered the École des Beaux Arts 1842, and in 1848 gained the grand prize; subsequently travelled in Greece and Italy, where he continued his studies. In 1859, in open competition with the leading architects of Paris, his plans were unanimously adopted for the new Paris opera-house, which has but recently been completed under his direction. In 1864 the cross of the Legion of Honor was bestowed upon him.

Garnier-Pagès (LOUIS ANTOINE), a French author and statesman, b. at Marseilles July 18, 1803; made his *début* under the patronage of his brother, who was one of the leaders of the republican party under the Restoration. During the reign of Louis Philippe, Garnier-Pagès was a member of the Chamber of Deputies. In 1848 he secured the office of minister of finances in the provisional government of the republic, and became unpopular on account of the famous over-taxation called the "45 centimes." When the empire was established, Garnier-Pagès returned to private life until 1864, when he was elected deputy to the Corps Législatif. In 1869 he was elected again, but, though he sat on the opposition benches, his popularity was gone, and he did not exercise any influence upon the events which followed the revolution of Sept. 4, 1870. He has written an *Episode of the Revolution of 1848, History of the Executive Commission, History of the Revolution of 1848.* FÉLIX AUCAIGNE.

Gar'nishment [Fr. *garnir*, to "warn" or "furnish"], a process of attachment by which a creditor obtains the security of property belonging to his debtor which is in the possession of third persons. It consists in a *warning* or notification given to the person holding the property, who is called a *garnishee*, commanding him not to make payment or delivery to the debtor, but to be in readiness to answer the plaintiff's claim by retaining the property in his own hands. Whenever a debtor against whom an action is instituted has himself a claim against a debtor of his own, the latter may be made a garnishee. The system of garnishment in England grew out of the custom of foreign attachment, which has existed from time immemorial in London, Bristol, and a few of the larger cities, and which permits the enforcement of a plaintiff's demand against debts due the defendant from third persons. (See FOREIGN ATTACHMENT.) But garnishment, as established in 1854 and at present in use, has a considerably less extensive scope of application than foreign attachment, since it only permits the seizure of a debtor's property or choses in action after the recovery of judgment against him, instead of at the time when suit is brought. In the U. S. a different rule is generally maintained, and the process of garnishment is therefore made more completely remedial, and can be adopted with much greater advantage by a creditor. The necessity of delay until judgment is obtained gives a defendant an opportunity to enforce payment against his debtors, or to effect a compromise with them; and if he adopt this course, the judgment creditor may be left entirely remediless.

The effect of garnishment is to place the garnishee in a position resembling that of a trustee. On this account it is known in some of the States, especially in New England, as the "trustee process." If, after notice of attachment has been served upon the garnishee, suit is brought against him by his own creditor, A, for whose debt to the garnisher, B, the attachment has been made, the pendency of the attachment is sufficient to effect a stay of proceedings; and if judgment should be rendered against A in the action instituted against him by B, and execution should be levied against the money or effects in the hands of the garnishee, the latter would be relieved from all obligation towards A, and might plead the execution in bar of any subsequent action by that person against him. As a general rule, any person is capable of being made garnishee, not excepting corporations and persons acting in a representative capacity as executors and administrators. A non-resident person cannot be made garnishee unless he has property of the defendant in the State or is bound to pay him money within the State. But an officer of the law, as a clerk or receiver, or a trustee holding funds as agent of a court, a financial agent of the government, a sheriff holding funds in an official capacity, or an assignee in bankruptcy, cannot be made garnishees. The same is true of an agent, unless he has an independent control of the goods, since his possession is the possession of his principal. Provision is generally made for the examination of a garnishee under oath in relation to the nature and amount of his indebtedness, and he may make any defence against the attaching creditor which might be made against the person to whom the debt was primarily due or to whom the property was to be rendered. If the garnishee have any lien upon the articles in his possession, he is entitled to have it satisfied. The process of garnishment is virtually a secondary suit against some third person by a suing creditor, who claims the rights of the defendant against whom his primary action is brought. (See ATTACHMENT.)
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Garonne, a river of France, rises in the Pyrenees, within the Spanish frontier, at the foot of Mont Maledetta, becomes navigable at Cazères, is at Toulouse connected with the Mediterranean by a canal, joins at Blaze the Dordogne, and assumes the name of Gironde, entering the Atlantic through an estuary 50 miles long. It often overflows, and sometimes changes its bed, which makes its navigation difficult.

Gar'rard, a beautiful and fertile county of E. Central Kentucky. Area, 250 square miles. The surface is undulating. The soil is based upon limestone. Cattle, grain, tobacco, and wool are the chief products. It is traversed by a branch of the Louisville and Nashville R. R. Cap. Lancaster. Pop. 10,376.

Garrard (Col. JAMES), b. in Stafford co., Va., Jan. 14, 1749; served in the Revolutionary war and in the Virginia legislature, where he was an efficient friend of religious freedom. He removed early to Kentucky, and in 1782 settled in Bourbon co., near Paris. He became one of the most prominent citizens of Kentucky, of which he was governor 1796–1804. D. at Mount Lebanon, Bourbon co., Ky., Jan. 19, 1822.—His sons, Gen. JAMES and Col. THEOPHILUS T. GARRARD, were distinguished citizens of Ky.

Garrard (KENNER), b. in Kentucky in 1828; graduated at the U. S. Military Academy July, 1851, and entered the army as brevet second lieutenant of artillery; transferred to the 1st Dragoons in 1852, and received his full commission as second lieutenant Oct., 1853; promoted first lieutenant of cavalry 1855; captain 1861; and major 1863. Served principally in garrison and on frontier duty 1851–61, being captured at San Antonio, Tex., Apr., 1861, and not exchanged as prisoner of war until Aug., 1862, serving in the mean time in commissary department and as instructor and commandant of cadets at West Point. In Sept., 1862, he was appointed colonel 146th New York Volunteers, and was engaged in the battles of Fredericksburg, Chancellorsville, and Gettysburg. Appointed brigadier-general of volunteers July, 1863, he served with the Army of the Potomac till December, when he was placed in charge of the cavalry bureau at Washington. In Feb., 1864, he commanded a cavalry division in the Army of the Cumberland, was engaged in the various engagements about Chattanooga and in Georgia during the Atlanta campaign, pursuit of Confederate army to Dalton, and with his command in the 16th army corps at the battle of Nashville, Tenn., Dec., 1864. In the operations against Mobile, 1865, he led the party which stormed and captured Blakely. In Aug., 1865, he was mustered out of the volunteer service. For gallant services in the field during the war he was brevetted colonel, brigadier-general, and major-general U. S. A. Resigned 1866. G. C. SIMMONS.

Gar'rett, the westernmost county of Maryland, formed in 1872, bounded N. by Pennsylvania, and W. and S. by West Virginia. It is mountainous, has extensive forests, with fine pasture-lands, and abundant iron ore, soft coal, fire-clay, and hydraulic limestone. It is traversed by the Baltimore and Ohio R. R. and by the watershed between the Potomac and the Ohio river-valleys. Cap. Oakland.

Garrett, tp. of Douglas co., Ill. Pop. 1599.

Garrett (JOHN W.), b. in Baltimore July 31, 1820; educated at Lafayette College, Pa.; was for some years engaged in commercial business in Baltimore; was one of the capitalists who carried to completion the Baltimore and Ohio R. R.; became in 1857 one of its directors, and in 1858 its president.

Garrett (LEWIS), a minister of the Methodist Episcopal Church, South, b. in Pennsylvania Apr. 24, 1772; d. in Mississippi Apr. 28, 1857. He entered the Western Conference in Kentucky in 1794, and performed herculean labors in that State, Tennessee, Virginia, North Carolina, and Mis-

sissippi. He has left a little volume of *Sketches* of his life and times. . T. O. Summers.

Garrett (Thomas), a Quaker abolitionist, b. at Darby, Pa., Aug. 21, 1783; became a cutler and scythe-maker, and acquired wealth. In 1807 the kidnapping of a servant from his father's family made him a strong and active abolitionist. In 1820 he removed to Wilmington, Del., and became an iron-merchant, and after 1850 lost all his estate as damages for freeing slaves, but again acquired a competence. D. at Wilmington, Del., Jan. 23, 1871.

Gar′rettson (Freeborn), a noted preacher, was b. in Maryland Aug. 15, 1752; joined the Methodist ministry in 1775; was a chief founder of his denomination in Nova Scotia, in New York, and in Western New England. He took a prominent part in the organization of the Methodist Episcopal Church at Baltimore in 1784. D. Sept. 26, 1822.

Gar′rettsville, post-v. of Portage co., O., on the Atlantic and Great Western R. R., Mahoning division, 37 miles S. E. of Cleveland. It has a national bank, a savings and loan bank, a newspaper, a literary society library, machine-shops and manufactories, 3 churches, 2 hotels, and a number of stores. Principal business, farming and dairying. Pop. 658. Charles B. Webb, Ed. "Journal."

Gar′rick (David), an English actor, b. at Hereford Feb. 20, 1716. He was of French extraction. His grandfather, bearing the name of Garrique, a French Protestant, came to England on the revocation of the Edict of Nantes. His father was a captain in the English army; his mother was the daughter of a vicar of Lichfield cathedral. The lad's education seems not tô have been systematic or thorough. He attended the grammar school at Lichfield, but at the age of twelve or thirteen his studies were interrupted by a visit to an uncle in Lisbon. Subsequently, when eighteen years old, he became one of the pupils in Dr. Samuel Johnson's academy. His passion for the stage early showed itself in remarkable gifts for mimicry and recitation, and in a desire to frequent theatres. When but eleven years old he performed Sergeant Kite in the *Recruiting Officer* before a select company, being even then a juvenile manager. In 1735 he went to London with Dr. Johnson, proposing to study law, but gave it up, lacking the means of support. A short experience as a wine-merchant in partnership with his brother Peter satisfied him that trade was not his calling, and he adopted the theatrical profession, making his first appearance at Ipswich, under the assumed name of Lyddal, in the tragedy of *Oroonoko.* The effort was applauded, but not as rapturously as his subsequent appearance in comedy. On the strength of his provincial reputation he resolved to try his fortune in London, and, finding the popular theatres closed to him, made his first appearance on Oct. 19, 1741, at the obscure theatre in Goodman's Fields, the play chosen being *Richard III.* The success was wonderful. In a few weeks the house was crowded, people deserting Drury Lane and Covent Garden to see the man who so attractively introduced a natural school of acting in place of the artificial tradition of the English stage. At the close of the season of 1742 he played three nights at Drury Lane, and made an engagement there on a salary of £500 a year. Dublin was the next scene of his triumphs. There, in 1745, he joined Mr. Sheridan in the management of the Royal Theatre. Two years later he opened the Covent Garden Theatre, London, on which occasion he spoke the prologue written for him by Dr. Johnson, who recognized, as did all the judges, his distinguished talent. In June, 1749, Mr. Garrick married the Viennese dancer, Eva Maria Violetta, an amiable and accomplished woman, who had graced the boards of Drury Lane. She brought him a moderate fortune, and was to him a faithful wife. At this time Garrick was the greatest figure on the English stage. The public opinion of the Continent, which he visited in 1763, ratified the judgment of his countrymen. His return was welcomed with enthusiasm, the king himself bidding him play in *Much Ado about Nothing.* The Shakspeare Jubilee at Stratford-on-Avon, which continued three days and was represented ninety-two successive times at Drury Lane, was arranged by him in 1769. Four years after this the death of his partner, Mr. Lacy, threw on him the whole management of the theatre; his health failed; he played less and less frequently, and in 1776, after acting through his favorite characters—the last performance being for the benefit of the Decayed Actors' Fund, established by himself—he retired from the stage. His elegant villa at Hampton was the resort of men of taste and letters, wits, and dignitaries of Church and State; good people loved him, brilliant people admired; his vivacity, versatility, and kindness of heart gained him many friends. But his broken health was not restored by rest. An old disease tormented him continually. Finally, a sudden attack prostrated him; he was taken to his house in the Adelphi, London, and there d., Jan. 20, 1779. On Feb. 1 he was buried with great pomp in Westminster Abbey, beneath the monument to Shakspeare. Garrick was a man of varied talents; as an actor he excelled in the most opposite styles, in high tragedy and in broad farce; he was in his profession an author too; he wrote verses, prologues, epilogues, fárces, and adapted many plays for the stage. Though self-conscious and vain, he was popular for his friendly, generous, and charitable qualities, and respected for his solid virtues. In person he was of middle height, slight of figure, animated in countenance, quick and expressive in action, effective though not imposing in presence. His voice was musical, and his sensitive temperament made amends for the absence of great physical advantages. Pope said of him: "He never had his equal as an actor, and never will." Mrs. Garrick survived her husband many years. She was ninety-eight years old when she d., in full possession of her faculties, on Oct. 16, 1822. O. B. Frothingham.

Gar′rison (William Lloyd), the pioneer and leader of the modern anti-slavery movement in the U. S., b. in Newburyport, Mass., Dec. 12, 1804; served an apprenticeship to the printing business in the office of the *Herald* in his native place, and while doing so wrote extensively for that and other journals, mainly upon political topics, carefully preserving his incognito. A series of articles which he contributed to the Salem *Gazette* evinced such power that they were attributed by Robert Walsh to no less a personage than Timothy Pickering. Such was his ability that the proprietor of the *Herald* left him for some time, when he was but nineteen years of age, in full charge of his paper and business. Having ended his apprenticeship in 1825, he soon afterwards assumed the editorship of the *Free Press*, a new paper, in his native place. The paper not proving a success, he became, in 1827, editor of the *National Philanthropist*, published in Boston, and devoted to the cause of temperance. In 1828, at the earnest invitation of citizens of Bennington, Vt., he went to that place to edit a new paper, the *Journal of the Times.* It was mainly devoted to the support of John Quincy Adams for the Presidency, but Mr. Garrison took occasion therein boldly to declare his hostility to slavery, war, and intemperance. His anti-slavery utterances attracted the attention of Benjamin Lundy, a Quaker, who was engaged in the publication of the *Genius of Universal Emancipation* in Baltimore, and who went to Bennington to induce him to join him in the editorship of that paper. The *Journal of the Times* not having proved successful, Mr. Garrison yielded to the Quaker's persuasions, and went to Baltimore in the fall of 1829. In the very first number of the *Genius of Universal Emancipation* which appeared under his and Mr. Lundy's joint editorship was developed a radical difference in their opinions, Mr. Lundy advocating gradual and Mr. Garrison immediate emancipation as the inalienable right of the slave and the duty of the master. Subsequently another difference appeared, Mr. Lundy favoring and Mr. Garrison opposing the scheme for colonizing the slaves as a condition of emancipation. They were one, however, in a common hatred of slavery, and as each appended his own initials to whatever he wrote in the paper, the partnership was agreeable to both parties. In May, 1830, Mr. Garrison was convicted, by a court and jury of slaveholders, of a libel upon Capt. Francis Todd. The libel consisted in denouncing Capt. Todd as guilty of "domestic piracy" in conveying a cargo of slaves from Baltimore to New Orleans. For this he was sentenced to pay a fine of $50 and costs of court. Being unable to pay this money, he was committed to jail. His imprisonment awakened much sympathy in the Northern States, which found utterance through the press. His writings while in prison, especially several sonnets which he inscribed with a pencil on the wall of his cell, were widely copied and admired as expressions of the true spirit of liberty. At the end of seven weeks he was set at liberty, his fine being paid by Mr. Arthur Tappan, a merchant of New York. Henry Clay had made arrangements to do what Mr. Tappan did, but was too late. He now turned his steps toward the Northern States, delivering lectures in Philadelphia, New York, New Haven, Hartford, and Boston, in which he depicted the sinfulness and the cruelties of slavery, and sought to enlist the people in the work of promoting emancipation. He insisted that every slave had a right to immediate emancipation without expatriation, and that it was a sin to hold him in bondage for a single instant. Others had denounced slavery as an evil, but Mr. Garrison was the first to declare it a sin, and demand its immediate abolition in the name of God and of humanity. He thus became the leader of an anti-slavery movement founded upon the principle of immediate in distinction from gradual emancipation. He made special efforts to enlist the sympathy and co-operation of the clergy and the churches of different denominations, but without much success, slavery being powerful both in Church and State, and the popular contempt for

the negro such that it was not easy to excite sympathy in his behalf. On Jan. 1, 1831, he commenced, in partnership with Isaac Knapp, the publication, in Boston, of *The Liberator*, a weekly journal, the motto of which was, "My country is the world—my countrymen are all mankind." The voice of this paper was soon "heard around the world;" the North was deeply moved, while the South was filled with excitement and alarm. The dead calm that had followed the enactment of the "Missouri Compromise" of 1820 was completely broken up, and the discussion of slavery in all its relations to civil and religious institutions, went on with constantly augmenting force, in spite of every effort to arrest it, from that time until the war of 1861–65. *The Liberator* was kept alive only by great economy, diligence, and self-sacrifice on the part of its editor and its publisher. For a long time they set the types mainly with their own hands, while their small and obscure office was their only home, and they subsisted on the humblest fare. A Southern magistrate having begged the interposition of the mayor of Boston to suppress the "incendiary" sheet, that officer, the distinguished Harrison Gray Otis, wrote in reply that his agents had "ferreted out the paper and its editor, whose office was an obscure hole, his only visible auxiliary a negro boy, his supporters a very few insignificant persons of all colors." In Dec., 1831, the legislature of Georgia offered a reward of $5000 to any person who should arrest, bring to trial, and prosecute to conviction, under the laws of that State, the editor or the publisher. On Jan. 1, 1832, under Mr. Garrison's direct inspiration, was organized the New England Anti-Slavery Society, the first association ever formed in this country on the principle of immediate emancipation. He soon afterwards published his work, *Thoughts on African Colonization*, in which he contended that the colonization scheme was an ally of slavery. He soon afterwards went to England as an agent of the New England Anti-Slavery Society, and was warmly received by Wilberforce, Clarkson, Brougham, and the great body of English abolitionists, who were then on the eve of their great triumph over slavery in the West Indies. The act of emancipation was passed by the Parliament while he was there, in consequence of which he was able to persuade Mr. George Thompson, who had taken a very prominent part in the struggle, to come over to the U. S. and lend his aid to the cause here. In Dec., 1833, the American Anti-Slavery Society was organized in Philadelphia. The Declaration of Sentiments issued by the convention was from Mr. Garrison's pen, and embodied the doctrines of which he was the recognized champion. In Oct., 1835, a pro-slavery mob of "gentlemen of property and standing" broke into the anti-slavery office in Boston, dispersing a meeting of women, and seizing Mr. Garrison and dragging him through the streets with a rope around his body. His life was saved with great difficulty, and only by the city authorities taking him to jail for protection. He was released the next day, but was compelled to go into the country for safety. In 1838 he took a prominent part in the organization of the New England Non-Resistance Society, writing its Declaration of Sentiments. In 1839–40 the abolitionists were divided upon the question of admitting women to take part in the proceedings of the anti-slavery societies; Mr. Garrison warmly took the affirmative, and when the World's Anti-Slavery Convention, which met in London in 1840, refused to admit the women who were sent as delegates from this country, he declined to take a seat in the body himself. About this time there was also a division in the anti-slavery ranks upon the question of forming an anti-slavery political party. Mr. Garrison took the negative of this question, contending that the measure was unnecessary and unwise, and that its tendency would be to destroy the purity of the anti-slavery movement and postpone its triumph. He subsequently came to the conclusion that the conditions of union between the North and South, as expressed in the Constitution, were in themselves immoral, and therefore that it was wrong to take an oath to support that instrument. Henceforth he was an open advocate of the dissolution of the Union, which he declared to be, in Scripture phrase, "a covenant with death and an agreement with hell." In 1846 he went to England upon an anti-slavery mission for the third time. In 1843 he was chosen president of the American Anti-Slavery Society, and held the office until the close of the civil war in 1865, when, slavery having been abolished and its rehabilitation made impossible by an alteration of the U. S. Constitution, he resigned, announcing that his career as an abolitionist was ended, and that in his judgment the society ought to be dissolved. He continued the publication of *The Liberator*, however, until the close of that year, and in the last issue had the satisfaction of putting on record the official proclamation of the adoption of the amendment to the Constitution for ever prohibiting slavery in the U. S. His paper thus covered the whole period from the beginning of the agitation for the abolition of slavery in 1831 until the final and complete triumph of the cause in 1865. Mr. Garrison made another visit to England in 1867, when he was recognized and honored by the friends of freedom in England as the great leader of the anti-slavery movement in America. In 1843 appeared a volume of his *Sonnets and other Poems*, and in 1852 a volume of selections from his writings and speeches. OLIVER JOHNSON.

Gar'rot, a name sometimes given to ducks of the genus *Clangula*, including, besides other birds, the HARLEQUIN DUCK (which see) and the buffle-head or spirit duck (*Clangula albeola*) of North America, rare in Europe. The latter is very hard to shoot, and is not highly prized as food. (See also GOLDEN-EYE.)

Garro'te [Sp., a "stick"], a form of capital punishment employed in Spain and Spanish America. A metallic collar is put around the neck of the victim, and a screw at the back of the collar is turned in such a way that its point crushes the spinal cord, causing instant death. Originally a stout cord was tied about the neck, and the culprit was strangled by twisting the cord with a stick (*garrote*). Robbery, accompanied by choking of the person robbed, is often called *garroting*.

Gar'side (WILLIAM BRIGGS), M. D., b. at Harrison, Hamilton co., O., Feb., 1835; was educated at Farmer's College, O.; took his medical degree at the Physio-Medical College, Cincinnati, 1858, and New York Homœopathic College 1868; is lecturer on physiology in the New York State school for training nurses, and holds important positions in the Homœopathic Hospital and the Maternité, Brooklyn, N. Y.

Gar'ter, Or'der of the, the most illustrious British order of knighthood, founded, according to Selden, who follows Froissart, on Apr. 23, 1344, by King Edward III.; but the exact date is much disputed, some even tracing it back to 1192, when on St. George's Day, Richard I. made twenty-six of his best knights wear a thong of blue leather on the leg in a fight with the infidels. But the common tradition is that King Edward was dancing with the countess of Salisbury at a ball, when she let fall her garter, which the king at first tied about his own leg, but observing that the act excited much attention, he restored it to the fair owner, exclaiming, *Honi soit qui mal y pense*—"Evil be to him who evil thinks"—words which are still the motto of the order; and the king said further, "that shortly they should see that garter advanced to so high an honor and renown as to account themselves happy to wear it." The order was founded in honor of the Holy Trinity, the Blessed Virgin, St. Edward the Confessor, and St. George, but the latter was its principal patron. Ladies were admitted as late as the reign of Edward IV., since which time no ladies but the sovereign are received into it. At present there are, besides the sovereign, the prince of Wales and such other princes of the blood as may be chosen; twenty-five regular knights of the Garter, and extra knights are admitted by special statute; vacancies occurring in the regular knighthood of the Garter being filled from the extra knights, many of whom are foreign reigning princes. In 1874 there were forty-nine knights, none of a rank below that of earl. In 1873 the shah of Persia received the Garter. Anciently, gentlemen not of the titled nobility were admitted. The bishop of Winchester is prelate of the order, the bishop of Oxford is chancellor, the dean of Westminster is registrar, and there is a king of arms and an usher of the black rod; but none of these officials are knights of the Garter. The distinguishing badges of the order are the collar, badge, star, garter, George, and lesser George; there are also a mantle, surcoat, hood, hat, and plume appropriate to the order; and in strict language the knights are termed "knights of the Golden Garter," or "knights of the most noble order of St. George and the Garter."

Gar'ter Prin'cipal King of Arms, the chief herald of England and of the order of the Garter. As Principal king of arms he is the head of the college of heralds, subject to the earl marshal. As Garter king of arms he is independent of that officer. He takes precedence not only of Bath, Clarenceux, and Norroy kings of arms, but of Lyon and Ulster, the heraldic kings in Scotland and Ireland. According to most authorities, Henry V. first instituted this office, but others say that Henry VIII. first gave the title to Guienne king of arms, his first herald for the French possessions. At present (1875) this officer holds also the position of king of arms for the order of St. Michael and St. George.

Garth (Sir SAMUEL), M. D., b. at Bolam, Durham, England, in 1660; studied at Peterhouse, Cambridge; took his medical degree 1691; removed to London 1693; was physician to George I. and physician-general of the army;

became a Whig leader; joined the Kit-Cat Club, and was knighted 1714; and d., a Roman Catholic, at London Jan. 18, 1719. Chiefly remembered for his satirical poem, *The Dispensary* (1699), directed against the selfishness of the apothecaries who opposed the gratuitous distribution of medicines to the poor; translated a part of Ovid's *Metamorphoses*, and wrote *Claremont*, a poem, etc., and delivered the Harveian oration for 1697.

Gart'land (FRANCIS XAVIER), b. in Ireland in 1805, came to the U. S., and in 1850 was consecrated bishop of Savannah (Roman Catholic), the first of the title. D. at Savannah Sept. 20, 1854.

Gar'vin, tp. of Anderson co., S. C. Pop. 1577.

Garvin, tp. of Pickens co., S. C. Pop. 1478.

Ga'ry (GEORGE), a venerated Methodist divine, was b. at Middlefield, N. Y., Dec. 8, 1793; joined the Methodist ministry in 1809; occupied important churches in Western New York; was six times sent as delegate to the General Conference; appointed superintendent of the Oregon mission in 1844. D. Mar. 25, 1855. He was distinguished by his wisdom in council and the purity of his character.

Gas, a word invented by Van Helmont, and thus defined by him: Gas est spiritus non coagulabulis qualis è permentante vino; itemque ruber ille, qui chrysulcâ [aqua regia] operante eructatur, etc. (See J. B. VAN HELMONT, *Opera*, Francofurti, 1682, *explicatio*, after preface, and, very fully, chapters *Progymnaoma Meteori* and *Gas Aquæ*.)

Gas. According to the usual definition, *a gas is a permanently elastic fluid*—permanently elastic, that is, under the usual atmospheric conditions, and thus distinguished from a *vapor*, which is the aëriform condition of a substance normally existing in the liquid or solid state. By a *fluid* in this definition is designated a condition of matter in which the particles have great freedom of motion—a condition common both to gases and liquids. By *elastic* is meant a condition in which the material particles are in a state of tension, and in consequence of this tension exert pressure against every surface with which the body comes in contact. By virtue of its inherent elasticity a gas tends to expand indefinitely; and this tendency can only be restrained by enclosing it in some containing vessel whose form the aëriform mass assumes. By virtue of its fluid condition a gas transmits the pressure it exerts equally in all directions, and when at rest and under uniform conditions throughout its whole extent, a mass of gas presses against different surfaces with forces which are proportional to the area of those surfaces, and independent of their form or position. A liquid also, when rendered elastic by stress of any kind, transmits pressure equally in all directions, but this elasticity is dependent on the external force; it is not inherent in the liquid; and a liquid mass comes to rest in an open vessel, forming a definite surface of its own. The tension of an aëriform mass is measured by the pressure which this tension produces on the unit of area, and which may be estimated as so many pounds on a square inch, or so many grammes on a square centimètre, according as we use the English or the metric system of measures and weights. It may also be measured by the height at which it sustains a column of mercury in the tube of a barometer; and since, according to the laws of mechanics, this height is directly proportional to the pressure, so dissimilar a value as the height of a mercury column becomes a legitimate measure of the tension of a gas. We speak, therefore, of the tension of a gas as so many inches or so many centimètres of mercury, and in mathematical expressions we represent the tension of a gas by H, which stands for a certain number of inches or centimètres, the height of the mercury column which the tension supports. The normal tension of the atmosphere at the level of the sea supports a column of mercury 30 inches (or about 76 centimètres) high, but, as is well known, the tension lessens as we rise in the atmosphere, and at the same place it varies, within somewhat narrow limits, with meteorological changes. A tension of 30 inches in the English and of 76 centimètres in the metric system is called *one atmosphere,* and high tensions are usually estimated in *atmospheres*. The English standard temperature is 62° F., and the tension measured by a mercury column 30 inches high at this temperature corresponds to a pressure of $14\frac{68}{100}$ pounds on a square inch. The French standard temperature is that of melting ice, or 0° C., and a mercury column at this temperature 76 centimètres high corresponds to a pressure of 1033.3 grammes of a square centimètre. Remembering also that 30 inches equal 76.2 centimètres (very nearly), it is easy, by means of these standard values, to compare the various measures of tension.

The common mercurial barometer is simply a glass tube open at one end, which, having been filled with mercury and the open end temporarily closed, has been inverted and the aperture opened under a basin of mercury. The column of mercury falls in the tube until it balances the tension of the air, and slowly oscillates as this pressure varies. As in filling the tube great care is taken to drive out all the air, there is no atmosphere above the mercury, and therefore no pressure exerted upon the upper surface of the column. If, however, we introduce a small amount of gas or vapor into such a tube, a pressure will be at once exerted upon the upper surface which will depress the mercury column, and the vertical height through which the column is depressed is obviously the measure of the tension of the confined aëriform body. The value is easily ascertained by comparing the depressed column with a perfect barometer at its side; and this method of measuring tensions is capable of very wide application, but is necessarily limited to cases in which the tension is less than one atmosphere. The barometer itself, although exceedingly valuable for observing the varying tensions of our atmosphere, is not, on account of its size and shape, a convenient instrument for measuring the tension of a confined and limited volume of gas. Moreover, although theoretically we might have a barometer of any length, yet the difficulties connected with filling the tube increase so rapidly with the length that we are practically limited to something less than one mètre, and therefore the ordinary forms of the instrument could not, in any case, be used if the tension were much greater than one atmosphere. We can, however, use a mercury column for measuring tension up to several atmospheres by so arranging the apparatus that the pressure of the confined gas acting on the surface of the mercury shall force the liquid up a vertical glass tube open at the top, so that the column shall be lifted against the pressure of the atmosphere. Evidently, under such circumstances the height of the column measures the difference between the tension of the gas and the tension of the air; and to find the value of the first we must add to this height the height of the barometer at the time. Such an instrument is called a manometer, but, although susceptible of great accuracy, the mercurial manometer is difficult of application when the tension exceeds two or three atmospheres. The manometer which is usually used in the arts for measuring approximately the tension of steam consists of a spiral flattened metallic tube. The pressure of the steam on the interior of this tube tends to uncoil the spiral, and the motion, multiplied by a system of levers, appears in the movement of an index over a dial. The figures on the manometer usually used in this country indicate the number of pounds pressure per square inch above the atmospheric pressure; and a boiler is said to carry 25 pounds of steam, for example, when the pressure of the steam on the interior surface exceeds that of the air on the outer surface by 25 pounds per square inch. A metallic barometer is made on the same principle; and in another form of metallic barometer, called an aneroid, a tight metallic box, having a corrugated top, which rises and falls with the varying pressure, takes the place of the spiral tube.

Gases differ from liquids in their compressibility even more markedly than in their elasticity. Liquids are frequently called *incompressible fluids;* for even when exposed to the greatest attainable pressure, their volume alters so slightly that the shrinkage can be detected only by delicate experiments. Gases, on the other hand, are very *compressible fluids;* and the simple law which obtains between the volume and tension of a mass of gas is the most characteristic feature of the aëriform state. When a mass of gas is exposed to pressure the volume diminishes until the increased tension balances the pressure; and, if the temperature does not change, we find, in general, that the tension is inversely proportional to the volume—the less the volume the greater the tension; and on the other hand, when the gas is allowed to expand, the larger the volume the less the tension. If we represent by V and V′ two different volumes of the same mass of gas, and by H and H′ the corresponding tensions, measured by columns of mercury, $H : H' = V' : V$. Hence, $HV = HV'$; that is, for every mass of gas at an invariable temperature the product of the tension and the volume is a constant quantity. This law was discovered by the chemist Boyle in England in 1662, and verified by the Abbé Mariotte somewhat later; and it is by some called the law of Mariotte, and by others the law of Boyle. This law, however, is to be regarded as a typical condition of aëriform bodies, rather than a state which is ordinarily realized. There is no gas known which at the ordinary temperature absolutely obeys Mariotte's law. Except in the case of hydrogen, the tension increases as the volume diminishes less rapidly than the law requires, while that of hydrogen increases more rapidly. It is true that with oxygen, hydrogen, nitrogen, and a few other gases the deviations from the law are so small that in almost all cases the differences may be neglected without appreciable error; but with most gases the differences are very marked, and rapidly augment as the pressure increases. As the temperature increases these differences

lessen; and there is probably for every gas a temperature at which it exactly obeys the law. When this point is passed, differences again appear, but in the opposite direction; and we have in hydrogen a gas which at the ordinary temperature is beyond the typical point.

With certain very prominent exceptions all gases, by the combined action of pressure and cold, may be condensed to liquids, and the deviations from Mariotte's law we have just noticed are closely connected with the transition from the lighter to the more dense state of aggregation. When by pressing a piston into a cylinder we reduce the volume of a mass of sulphurous oxide gas, for example, we find that the tension increases, but in an ever-lessening ratio, up to a certain value. As soon, however, as this value is reached, a further reduction of volume causes no increase of tension, but a portion of the gas becomes a liquid, and afterwards the piston descends under a constant pressure until the whole mass is liquefied. It then occupies only a small portion of its original volume, and yields scarcely perceptibly to any further attempts to compress it. This greatest value which the tension reaches is called the *maximum tension* of the gas; and although it varies with the temperature, yet for a given temperature it has a definite value for each gas that can be liquefied by pressure alone. Those gases, however, which closely conform to Mariotte's law cannot be condensed by pressure alone; and there appears to be for each gas a temperature which has been called the *critical temperature*, below which the gas presents phenomena similar to those obtained with sulphurous oxide, as just described, and above which it is in a condition in which its tension increases indefinitely, however great the pressure to which it is exposed. If we define a perfect gas as one which conforms to Mariotte's law, such a gas, of course, could not be condensed to a liquid by pressure alone; and, as has been said, it is probable that every aëriform body can be brought into this condition by heat—at least when not chemically changed in the process. The *critical temperature*, therefore, must be passed before the body reaches the condition of a perfect gas; and this temperature seems to mark the transition from the state of vapor to the state of gas, and points out a more philosophical distinction between these two phases of aëriform matter than the popular definitions imply.

Another characteristic feature of gases appears in the fact that the same change of temperature causes in all of them the same change of tension or volume. When a gas is confined, the effect of heat is to increase its tension; when free to expand under a constant pressure, the effect is to increase its volume; and, as Mariotte's law requires, these two effects would be strictly proportional in every perfect gas. Since, under ordinary circumstances, the gases with which we have to deal are not perfect, this result, although very closely approached, is not absolutely realized, and in general the effects of heat on masses of different gases are not strictly identical, the slight differences observed being of the same order of magnitude as the deviations from Mariotte's law above referred to, and resulting doubtless from the same cause. Disregarding these slight differences, the effect of heat on all aëriform matter is correctly represented in the following illustration: Conceive of a vessel of invariable size containing air which at the temperature of melting ice has a tension of 273 millimètres, as shown by a barometer. If, now, this vessel is heated to the temperature of water when boiling under the normal atmospheric pressure, the tension of the confined air will become 373 millimètres; that is, between these two standard temperatures the tension increases 100 millimètres. Evidently such an apparatus would serve as a measure of temperature. The 273d division on the millimètre scale of the barometer would indicate the freezing-point, the 373d division the boiling-point of water, and the intermediate divisions would divide the difference between these two fixed points into 100 degrees. Such an instrument would serve as an air thermometer, and the degrees of temperature thus marked would closely correspond to those of the ordinary mercury thermometer, graduated on the centigrade system. The degrees of such a thermometer, however, are merely arbitrary points in the scale of temperature until we determine the relation between the change of tension and the amount of heat which enters or leaves the confined air. But if it can be shown that equal accessions of heat produce equal increments of tension, then it would follow that the air thermometer is an accurate measure of thermal values. Unfortunately, our experimental evidence on this point is not as direct as we could wish. The only safe standard to which we can refer our measures of heat is what we may call the fuel standard—that is, the weight of some combustible, like hydrogen, by whose burning the heat is generated; and could we show experimentally, for example, that the heat from one gramme of hydrogen increased the tension of our confined air exactly 100 times as much as that from one centigramme of the same fuel, and this, too, from whatever point on the scale of temperature we might start, then there could be no question that the increments of tension were the legitimate measures of the heat which entered the air, and therefore of the differences of temperature thus produced. Such direct observations, however, are impracticable; and it would not be possible with a few words to make clear to the reader how far the conclusion just stated is justified by such indirect experimental evidence as we have been able to obtain. It must be sufficient to say, first, that within moderate limits of temperature the experiments prove the increase of tension to be very nearly, if not exactly, proportional to the amount of heat which enters such a confined mass of air as is described above; and secondly, that the accepted theory of heat leads us to believe not only that the increase of tension is proportional to the accession of heat within the latitude and limits of error of our experiments, but also that in a perfect gas this law would hold without variation throughout the whole range of temperature.

Accepting, then, the law provisionally, we find that it leads us to a most remarkable conclusion. Starting with the apparatus assumed above at the temperature of melting ice, and the barometer indicating a tension of 273 millimètres, let us impart to the air successive increments of heat, and raise the temperature degree by degree, and the tension millimètre by millimètre, until the barometer marks 546 millimètres. Knowing the weight of the air, we can easily determine how much heat, estimated on the fuel standard, is required to produce this result; and we shall find that it is represented by a very small weight of hydrogen gas. If our theory is correct, $\frac{1}{273}$d of this amount would correspond exactly to one millimètre of tension, the same for the last degree as for the first. Returning now to the freezing-point, what must be the result if we withdraw heat in similar successive portions? Evidently, the temperature will fall degree by degree, as the tension is reduced millimètre by millimètre; and if the law holds to the last, when we have removed the quantity of heat represented by the same amount of hydrogen as before—that is, at 273 degrees below the freezing-point—the tension must fall to zero, and we there reach the absolute zero of the thermal scale. If, then, the law we have deduced from our experiments on the thermal relations of gases is well established, and holds to the end, the absolute zero of temperature is at 273 degrees below the melting-point of ice on the scale of the air thermometer; and, moreover, the amount of heat which natural bodies contain is very limited, and is equivalent to an amount of fuel which in many cases can be definitely stated. Of course, until the validity and scope of the law can be placed beyond doubt, this remarkable result must be regarded as only ideal. It should be added, however, that there are several natural phenomena which point to a definite lower limit of temperature, and, in one or two instances, which indicate the same limit as that just assigned. But even if our absolute zero is merely a fancy, the point we have assigned to it is the natural zero of the scale of the air thermometer, graduated as described above; and we find one great advantage in counting our degrees of temperature from this point; for the tensions of gases under constant volumes, or their volumes under constant tensions, are directly proportional to the temperatures thus expressed—at least within the limits of ordinary observations. Between the freezing- and boiling-points of water the degrees of a common mercury thermometer graduated on the centigrade system are essentially the same as those of our air thermometer, and hence by adding 273 to temperatures expressed in centigrade degrees, we obtain the values referred to the absolute zero, which we will call the absolute temperatures; and, as just said, the volume or tension of any mass of gas under otherwise constant conditions is proportional to the absolute temperature. Suppose we have measured 250 cubic centimètres of gas at 20° C., and wish to know how much it would measure under the same circumstances at 4° C. We first add 273 both to the 20° and to the 4°, and then make the proportion, $293 : 277 = 250 : x = 236.3 +$. Thus we reduce from one temperature to another all observations on the volume or tension of aëriform bodies, and we call the law we have been discussing on which the method is based the law of Charles. Charles was a French physicist, who near the close of the last century discovered the equality of the dilatation of the principal gases when heated from the freezing- to the boiling-point. We owe, however, our knowledge of the limitations of this general truth, as well as the exact measurement of the amount of expansion, to modern investigators, and especially to Regnault.

A third characteristic quality of aëriform matter is the power of motion inherent in its parts. The parts of a solid or a liquid show no disposition to leave the mass. Isolate in a vacuous space, so far as possible, a solid or liquid body;

no separation from the mass takes place, except in so far as by evaporation from the surface the material changes into the aëriform condition, and thus acquires power of motion. But open to a mass of gas an aperture into a vacuum, and the material rushes through the door with an enormous velocity. The rate of motion varies for different gases very greatly. The late Thomas Graham named this motion *effusion*, and showed experimentally that when other conditions were the same the rates of effusion of any two gases are inversely proportional to the square roots of their densities. In Graham's experiments the gases entered the vacuum through a pin-hole in a thin metallic plate, and he observed the number of seconds occupied by a given volume in passing through this narrow opening. He found slight deviations from the law in the times both of the very light and of the very heavy gases, but these he traced to the tubularity of the aperture, arising from the unavoidable thickness of the metallic plate. When a gas flows through a capillary tube into a vacuum, a wholly new class of phenomena appear, which entirely mask the law of effusion. The motion of a gas through a capillary tube Graham called *transpiration*, and he carefully observed the velocity of the flow of different gases under the same conditions. The effects thus obtained seem to depend not simply on the friction of the gas against the surface of the tube, but much more on the friction of the gas particles against each other, and the transfer of momentum which thus results; and a comparison of the velocity of transpiration with that of effusion has led to important conclusions in regard to molecular magnitudes. The inherent power of motion in a mass of gas is manifested not only by its *effusion* into a vacuum, but also by what is called its *diffusion* into the space already occupied by another aëriform body. If a jar of chlorine is opened on the table of a lecture-room, the presence of this suffocating gas will be perceived before long at the farther end even of a large hall, because this material, although two and a half times as heavy as air, slowly spreads through the whole space. Graham discovered that the relative rates of diffusion of different gases are precisely the same as their relative rates of effusion; or, in other words, that a gas diffuses through the space filled by another gas according to the same law which governs its effusion into a vacuum. As before, the relative rates of diffusion are inversely proportional to the square roots of the densities. Thus, oxygen, which is *sixteen* times *heavier* than hydrogen, diffuses *four* times *less* rapidly. But although an aëriform body offers no *permanent* resistance to the expansion of a gas, and the final result is the same as if it expanded into a vacuum, yet the velocity of the diffusion is vastly less than that of the effusion; and, to use an illustration of Dalton, one gas offers to another the same kind of resistance which stones in the channel of a stream oppose to the flow of running water. Loschmidt of Vienna has recently supplemented the experiments of Graham by measuring in a number of cases the absolute, as well as the relative, velocity with which diffusion proceeds. The phenomena of effusion and diffusion are obviously manifestations of the same mechanical condition that determines the pressure exerted by aëriform matter upon all surfaces against which it rests. Pressure implies the possibility of motion, for the same force which produces pressure will cause motion when the support is removed. And we have finally to consider a theory which attempts to explain what the mechanical condition thus indicated is.

The modern theory of chemistry regards every mass of matter as an aggregate of small isolated particles which cannot be further subdivided without destroying the identity of the substance, and these particles it calls molecules. The molecules of the same material are supposed to be alike in every respect, and those of different materials to differ in all those qualities which distinguish substances. Thus, a lump of sugar is an aggregate of very small isolated masses of sugar, each of the same weight and pattern. These molecules are not metaphysical abstractions, but, to use the words of Sir William Thomson, they are "pieces of matter of measurable dimensions, with shape, motion, and laws of action, intelligible subjects of scientific investigation." The lump of sugar is an aggregate of such pieces in the same sense that a stellar cluster is an aggregate of suns. So long as the sugar remains sugar, the integrity of the molecules is preserved, but when in a chemical process the sugar disappears and new products result, the sugar molecules are broken up and new molecules are formed from the fragments. In every chemical process the change takes place between molecules, and in these changes definite proportions by weight are preserved, because the different molecules have definite weights. When, for example, hydrochloric acid gas combines with ammonia gas, 36½ parts of the first substance unite with 17 parts of the second, simply because these numbers represent the relative weights of their respective molecules, which in the chemical process pair with each other, and form the molecules of the resulting product. This product is called sal ammoniac, and each of the molecules of this compound weighs 43½, the combined weight of its constituents. The modern theory of heat assumes that all thermal phenomena are the manifestations of molecular motions, and that molecular activity is the measure of that condition of matter which we call temperature. In a solid or liquid the molecules are crowded together, and, although in motion, their path is exceedingly circumscribed; but in a gas the molecules are widely separated, and their free path, although not larger than the waves of light, is still large as compared with their own dimensions. This path is limited by the frequency of their collisions; not only with each other, but also against the walls of the containing vessel. As the molecules are perfectly elastic, there is no loss of moving power in these collisions, and if the surrounding temperature is constant and the walls immovable, the total moving power of the molecules in a mass of gas remains invariable. There may result from the collision an accumulation of moving power in some molecules, and a corresponding loss to others, but the mean value will remain unchanged; and this mean value is the measure of the temperature of the aëriform mass. If the surrounding temperature is different from that of the gas, there will be a transfer of moving power through the walls of the vessel until a condition is reached where the transfer of moving power through the walls in one direction exactly balances the corresponding transfer simultaneously taking place in the opposite direction; and any two bodies are at the same temperature when thus related. Moreover, as any material walls must consist of molecules, power can most readily pass through such barriers, as along a line of ivory balls in a familiar experiment of mechanics. If a portion of the walls of a containing vessel are movable, the impact of the molecules may impart motion to the mass, as to the piston of a steam-engine or to a cannon-ball; if, however, the walls are fixed, the only effect of the colliding molecules is to produce pressure.

The pressure exerted by a gas being the effect of molecular impacts, the law of Mariotte is a necessary consequence of this mechanical condition. For if the temperature is constant, the molecules of the gas have a definite mean velocity and a definite mean momentum; and since, if we consider an interval sufficiently long, each molecule must on an average strike the sides of the vessel the same number of times and with the same average impulse, it follows that each molecule must contribute an equal share to the whole pressure. This pressure, therefore, other things being equal, must be proportional to the number of molecules in the vessel, or, what amounts to the same thing, to the quantity (or weight) of the given gas which the vessel contains; and this is a form of statement of Mariotte's law. According to this law, the pressure of a gas is inversely proportional to the volume, or, what comes to the same thing, directly proportional to its density; and our theory not only explains this general principle, but further shows that if different portions of gas are forced into the same vessel, each must exert its own pressure independently of the rest; and this, too, whether these portions be of the same gas or not. Assume next that while the number of molecules (that is, the quantity of gas) in the vessel remains the same, their mean velocity increases; it is evident that each molecule will now strike the sides of the vessel a greater number of times in a second, and also that the momentum of each impact will increase in the same proportion. Hence, the part of the pressure due to each molecule will increase not simply as the velocity, but as the square of the velocity; and, if we represent by m the common weight of the molecules of a given mass of gas confined to a constant volume, and by V their mean velocity, then the pressure exerted by the gas on the unit-area, or the height of the mercury column which measures that pressure, will be proportional to the product mV^2, or to $\frac{1}{2}mV^2$, which represents the moving power of the molecules. But the height of a mercury column so related (in the form of the air thermometer described above) is our actual measure of what we have called the absolute temperature; and thus we reach not only a perfect dynamical explanation of that feature of gases on which the air thermometer is based, but also a remarkable confirmation of the generalization we drew from these phenomena. Moreover, as the same general result must follow, whatever be the nature of the gas (m in our formula representing the molecule of any gas), we also find in our theory a simple explanation of the fact discovered by Charles, that all gases undergo equal changes of volume or tension when heated or cooled through the same number of degrees. Again, Prof. Maxwell has proved that if "molecules of different masses (that is, of different gases) knock about

together," the exchange of velocities which result from the collision will tend to bring the whole mass to a condition in which on an average every molecule, great or small, has the same moving power, the lighter molecules acquiring a sufficiently greater velocity to compensate for their smaller mass. This principle must be equally true when the molecules of the different gases are separated by any partition through which velocity may be transferred; and hence when masses of two different gases are at the same temperature $\frac{1}{2}mV^2 = \frac{1}{2}mV'^2$. From this theorem of molecular mechanics several important consequences follow. In the first place, equal volumes of different gases at the same temperature and pressure must contain an equal number of molecules. For, consider two similar vessels filled with different gases under these conditions. As we have seen, the part of the pressure due to a single molecule in either vessel is proportional to its moving power; and if the average value of the moving power of the molecules in the two vessels is the same, it is evident that the total pressure must depend in each case on the number of molecules, and, these pressures being equal, the number of molecules must be the same. This important truth, which is thus shown to be a necessary consequence of our dynamical theory, is known as the law of Avogadro or Ampère. It was first stated by Amedeo Avogadro, an Italian physicist, in 1811, and was reproduced by Ampère, a French physicist, in 1814. In the second place: the molecular weights of different substances must be proportional to their densities in the state of gas. For, if the unit-volumes of two gases contain, under like conditions, the same number of molecules, it is evident that the weights of these equal volumes must be as the weights of the molecules. Hence, molecules may be weighed against each other simply by determining gas or vapor densities; and since the results thus obtained closely correspond with the combining proportions of chemistry, the facts of this science furnish still further confirmations of our molecular theory. In the third place: if $\frac{1}{2}mV^2 = \frac{1}{2}m'V'^2$, then $V : V' = \sqrt{m'} : \sqrt{m} = \sqrt{\delta'} : \sqrt{\delta}$; and it follows that under like conditions the velocities of different molecules are inversely as the square roots of the densities of the aëriform masses of which they are parts; and here we see the simple mechanical principle underlying the laws of effusion and diffusion discovered by Graham. Moreover, our theory explains the peculiar relations of these two classes of phenomena. When the molecules of any gas rush into a vacuum, they hurry through the aperture with a rapidity which is commensurate with their great velocity; but when they rush into the equally empty space between the molecules of another gas, they are so jostled about in the frequent collisions which ensue that they make but very slow progress. Still, as the molecules of all gases are retarded in the same proportion, the relative rate of their motion forward is not altered thereby.

The dynamical theory enables us to calculate not only the relative but also the absolute velocity of the molecules of different gases. A cubic centimètre of hydrogen gas, at the normal temperature and pressure, weighs $\frac{895}{10000000}$ths of a gramme, and exerts a pressure of 1033 grammes on each face of the cube; and it is easy to calculate the velocity with which the parts of this small mass must move in order that the component in the direction of either face of the cube should produce such a pressure. The result is 1843 mètres in a second; and although the velocity of the molecules of other gases must be less in proportion as their mass is greater, according to the law already stated, the velocity is in all cases very large as compared with that of a rifle-ball. The velocity of the molecules of gases and their relative masses are values accurately known, because they are direct deductions from observations which can be made with great precision; and even if our theory is false and there are no such things as molecules, these values are quantitative relations which any new theory must equally explain. The scope of our dynamical theory, however, is far wider than could possibly be exhibited in a brief popular article. It embraces molecular magnitudes of which our knowledge is far less accurate and certain than in regard to those we have described, both because the relations involved are more doubtful, and because the values depend on measurements which are not susceptible of the same accuracy. Among these may be mentioned the length of mean path, the number of collisions in a second, and finally the number of molecules in a cubic centimètre of any gas under normal conditions, and the absolute diameter and mass of molecules of different kinds. We will conclude this article with a table taken from an article* on molecules by Prof. Clark Maxwell, in which the magnitudes are classified according to the certainty of our knowledge in regard to them:

Nature, Sept. 25, 1873.

Molecular Magnitudes.

	Hydrogen.	Oxygen.	Carbonic oxide.	Carbonic dioxide.
RANK I.				
Mass of molecules when that of hydrogen is 1...	1	16	14	22
Velocity (of mean square) mètres per second at 0° C................	1859	465	497	396
RANK II.				
Length of mean path in ten billionths (10^{-10}) of a mètre.................	965	560	482	379
Collisions in a second, number of millions.....	17,750	7646	9489	9720
RANK III.				
Diameter in hundred billionths (10^{-11}) of a mètre.........................	†58	76	83	93
Mass in ten million million million millionths (10^{-25}) of a gramme....	46	736	644	1012

In a cubic centimètre of any gas at the standard temperature and pressure there are nineteen million million million (19×10^{18}) molecules. J. P. COOKE.

Gascoigne (GEORGE), b. 1535, probably in Westmoreland, England; studied at Cambridge, and in 1555 was admitted to Gray's Inn; became distinguished as a dramatist, but being disinherited by his father, Sir J. Gascoigne, in consequence of his excessive expenses at court, he took ship for Holland 1572, where he served with distinction, but was made prisoner by the Spaniards, who sent him back to England, where he resumed his occupations as dramatist, courtier, and poet. D. at Stamford, Lincolnshire, Oct. 7, 1577. He was "the first English satirist" and "the first English critic in poesy;" now chiefly remembered for *The Steele Glas* (1576), a blank-verse satire, and *The Complaynt of Philomene*, a rhyming elegy (1576).

Gasconade, county of Missouri, bounded on the N. by the Missouri River. The surface is hilly, the soil of the lowlands fertile. Area, 540 square miles. Cattle, grain, wine, fruit, and wool are staple products. Iron, lead, sulphur, copper, burrstone, and limestone are among the mineral products. It is traversed by the Missouri Pacific R. R. Cap. Hermann. Pop. 10,093.

Gasconade River rises by several head-streams in Wright co., Mo., and flows nearly N. N. E. through a broken and densely-wooded region, which affords much timber. It is navigable at high water by small steamboats for 66 miles. It flows into the Missouri River 40 miles below Jefferson City.

Gascon′da, tp. of Laclede co., Mo. Pop. 655.

Gas′cony [Fr. *Gascogne*], an old province of France, between the Pyrenees, the Garonne, and the Atlantic. In the sixth century it received its name from the Basques (*Vascones*), who were driven by the Visigoths across the Pyrenees and settled here. Half a century later it became a part of Aquitania, and in 1152, when Eleanor married Henry Plantagenet, it became an English possession, and remained so until 1453, when the French reconquered it. It is now divided into four departments.

Gas-Engine, a name given to certain prime movers of moderate dimensions introduced in recent years, in which the motive-power is derived from the explosive energy of a mixture of inflammable gas with atmospheric air. These engines were originally operated by means of the gas in ordinary use for artificial illumination; but it has been found that the vapor of any volatile hydrocarbon will serve equally well; and this fact has contributed to the general availability, if not to the economy, of this source of motive-power. The earliest attempts to direct the energy of powerful explosives to the uses of the industrial arts were made with gunpowder. By exploding a moderate charge of gunpowder in a close chamber with valves opening freely outward, the air will be expelled from the chamber, and a vacuum or a near approach to one produced. The apparatus employed, however, by the early experimenters (among whom was the illustrious Huyghens) were exceedingly rude; and no economically useful results were reached in this direction. The possibility of securing a better success by the use of inflammable gas subsequently occurred to more than one inventor; and at length, as early as 1799, an engine was devised, and actually patented in France, by an ingenious artisan named Lebon, which was in every essential particular identical in principle and in construction with one of the most successful gas-engines of the present day; but which was nevertheless not a success, having attracted no notice in the scientific world of the

†Two million hydrogen molecules in a row would occupy a little over one millimètre.

period, and inspired no confidence in the industrial. The engine of Lebon had the general form of a reciprocating steam-engine, and operated as follows: From a reservoir containing a sufficient supply of inflammable gas, a certain measured charge was drawn and introduced, in mixture with a similarly measured charge of atmospheric air, into the cylinder, on alternate sides of the piston successively; and this mixture was then fired by means of the electric spark. The inventor seems to have overlooked no provision necessary to secure the success of his design. His engine was entirely self-regulating, and mechanically as well as theoretically it was a success. But economically it failed; for at that time inflammable gas had not been introduced for the general purposes of illumination, and its preparation for the engine involved a disproportionate expense; static electricity, so dependent on atmospheric conditions for its regularity of action, was the only known source of the electric spark; and finally the mechanic arts were yet unequal to the requisitions of a problem involving the peculiar difficulties which the construction of this engine presented.

A reproduction to all intents and purposes of the engine here described, was patented in France in 1860 by an inventor named Lenoir. A description of it in detail may be found in the *Annales du Conservatoire des Arts et Métiers*, of Paris, for the year 1866, and in the report by the present writer made to the government of the U. S. on the Machinery and Processes of the Industrial Arts and the Apparatus of the Exact Sciences in the Universal Exposition of 1867, which forms the third volume of the reports of the U. S. commissioners on that exposition. Such a detailed description is unnecessary here, since the particulars which it embraces, which relate to the mechanical expedients employed for introducing and firing the charge, and for maintaining the action when the motive-force is zero or negative, do not in any manner concern the principle. In its general appearance this engine very much resembles an ordinary reciprocating steam-engine; but there is a very important difference between the two, in the respect that, in the steam-engine, the pressure on the piston is maximum when the induction-valve is open; while in the gas-engine, on the contrary, in which the charge does not force its own way into the cylinder but is drawn in by the movement of the piston, the pressure during this period, as shown by the indicator card, is negative, and uniformity of movement can only be maintained by means of a heavy fly-wheel. The inequality of pressure at different periods of the effective stroke is also very great, the maximum being between five and six atmospheres, and the mean not more than half an atmosphere. The engine of Mr. Lenoir has found its way somewhat extensively into use, having been employed not only in Paris and most of the provinces of France, but also in other European countries including Russia, and in Cuba, Peru, and Chili. It cannot be called an economical source of power, since from the test experiments made on it by Prof. Tresca, assistant director of the Conservatoire, its consumption of gas under the most favorable circumstances amounted to two and seven-tenths cubic mètres (about 100 cubic feet) of gas per horse-power per hour. Six pounds of coal employed in raising steam would perform the same work, and at six dollars a ton would cost but two cents, while 100 cubic feet of illuminating gas costs in Paris about a franc, and in the cities of the U. S. 25 to 35 cents.

Another engine belonging to this class, and in many respects resembling the one just described, is that of Mr. Hugon, also of Paris. Hugon's engine employs two little constantly burning gas-jets placed just outside the valve-box, instead of the electric spark, to fire the successive charges in the cylinder. Two little movable jets in recesses constructed in a slider operated by the engine, are alternately lighted at the external burners, and then drawn inward by the slider, so as to inflame the charges at the proper moment. The movable jets are of course extinguished by the explosion; but on the reversal of the movement of the slider they are relighted again at the external burners. Another peculiarity of this engine is that, along with the explosive charge, there is introduced a small amount of water, which, being converted into steam by the heat generated in the explosion, moderates the violence of the action, and sustains better the pressure during the stroke. At the Universal Exposition of 1862 in London a gas-engine was exhibited by the well-known engineers W. and C. F. Siemens, in which this peculiarity—viz. the introduction of water into the cylinder—was carried much farther than it is done by Mr. Hugon, the object being to generate as much steam as the heat furnished by the combustion of the gas would allow. A regenerator was also employed to receive the heat of the exhaust gases, and to transfer it to the entering charge. Though no exact statements of the economy of working this engine appear to have been published, it would seem in theory to be preferable to either of those described above, both as it regards steadiness of action and the cost of maintenance. It appears, nevertheless, to have been abandoned. The consumption of gas in the Hugon engine, including that employed in maintaining the permanent lights, amounted to 2.6 cubic mètres per horse-power per hour. There is also in this engine the same inequality of pressure at different periods during the stroke, that has been remarked in the Lenoir engine.

In all engines of this class it is necessary that a current of cold water should be kept constantly circulating around the cylinder, to prevent its becoming overheated; and in order to facilitate this object, the cylinder is surrounded by a jacket, leaving a free interval for such circulation.

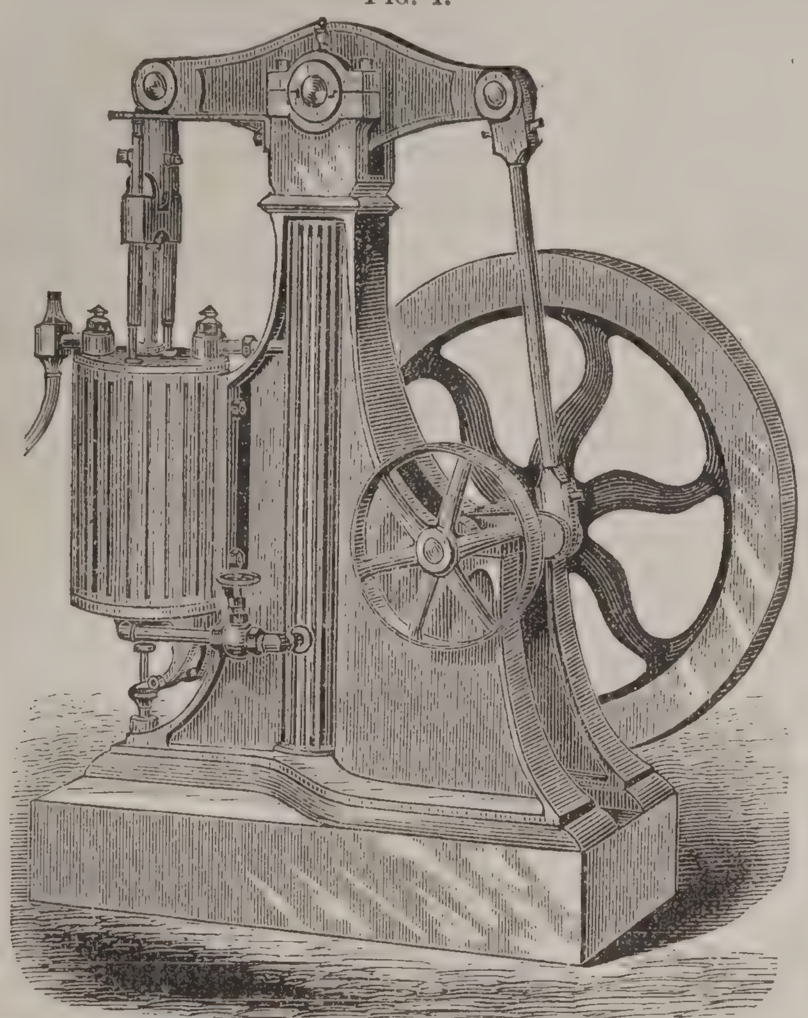
A gas-engine quite different in principle from either of the foregoing was exhibited at the Paris Exposition of 1867 by its inventors, Messrs. Otto and Langen, of Cologne in Rhenish Prussia. Externally, this engine presents the appearance of a Doric column, somewhat more than a mètre in height, upon the enlarged capital of which is fixed a horizontal plate which supports the arbor of the fly-wheel and other parts of the machinery. This column is the working cylinder. The mixed gases—common coal-gas and air—are introduced at its base, and fired by an ingenious mode of communication with a gas-jet which is constantly burning. The base is surrounded by a jacket between which and the cylinder itself there is maintained a refrigerating current. By the explosion of the gas, the piston, which is rather heavily weighted, is driven to the top of the cylinder. The collapse which immediately follows produces a partial vacuum beneath the piston; and this now descends, urged by the pressure of the atmosphere with its own weight superadded. In order to transfer this force to the working arbor of the machine, the piston-rod is on one side provided with a rack which acts on a spur-wheel on the arbor. This wheel is loose on the arbor, but is free to turn in one direction only—that is, the direction which corresponds to the rising of the piston. Two tall uprights serve as guides to the piston and give stability to the machine. When the piston descends, its energy is transferred to the arbor through the spur-wheel above mentioned. A fly-wheel maintains the movement during the intervals in which the piston is ineffective. (For a more full description of this engine see the report by the present writer, cited above.) From experiments made upon this engine with a Prony dynamometer before a jury of the exposition, it appeared that its consumption of gas amounted, on an average, to a very little over one cubic mètre (say 38 cubic feet) per horse-power per hour. It exhibits, therefore, a large economy over the engines of Lenoir and Hugon; but it is very noisy in its operation, and the violence of its action, during the first part of each pulsation, is such as to limit its employment to comparatively low powers.

It has been already stated that the vapor of the more volatile hydrocarbons may be substituted in all of these motors for the permanent inflammable gases, without prejudice to their mechanical efficiency; but in point of economy it is probable that coal-gas will generally be found to be the cheaper fuel of the two. (See FUEL.) Some inventions of this class have nevertheless been devised with special reference to the use of such vapors. One of these, by Mr. Julius Hock of Vienna, presented at the International Exposition in that city in 1873, and put forward with a good deal of pretension, as "differing completely from anything which had ever been done before," was nevertheless in every essential respect a Lenoir engine burning vapor instead of gas, and is therefore entitled to no further mention here.

A very different judgment must however be pronounced upon an American invention patented by George B. Brayton Apr. 2, 1872, and known as Brayton's Ready Motor, in which petroleum is the fuel ordinarily used, though it was originally designed for gas. This engine employs, like those already described, a mixture of gas or vapor with atmospheric air in explosive proportions—say one part of the former to twelve of the latter — but, unlike the others, it burns this mixture in the cylinder without explosion, and expends upon the piston the energy derived from its combustion with the same steady pressure as that exerted by steam in the steam-engine or by rarefied air in the hot-air engine. This remarkable effect is produced by the simple expedient of delivering the gaseous mixture into the cylinder through the meshes of a separating sheet of wire-gauze, and inflaming the mixture on the surface of the gauze next the cylinder. The same phenomenon occurs here which is seen in Davy's safety lamp. When the lamp is lighted and immersed in an explosive mixture, the gas which passes through the meshes of the wire-gauze cap burns quietly in the interior, so that the whole cap seems to be full of flame; but the gauze effectually prevents this

flame from reaching and igniting the mixture outside. So in this engine, the flame is confined to the cylinder and is prevented by the wire-gauze screen from running back through the passages and exploding the mixture in the reservoir. For greater security, two or three successive screens are introduced. As this engine is evidently destined to occupy a very important place in many industries, it seems to deserve a more particular description than we have

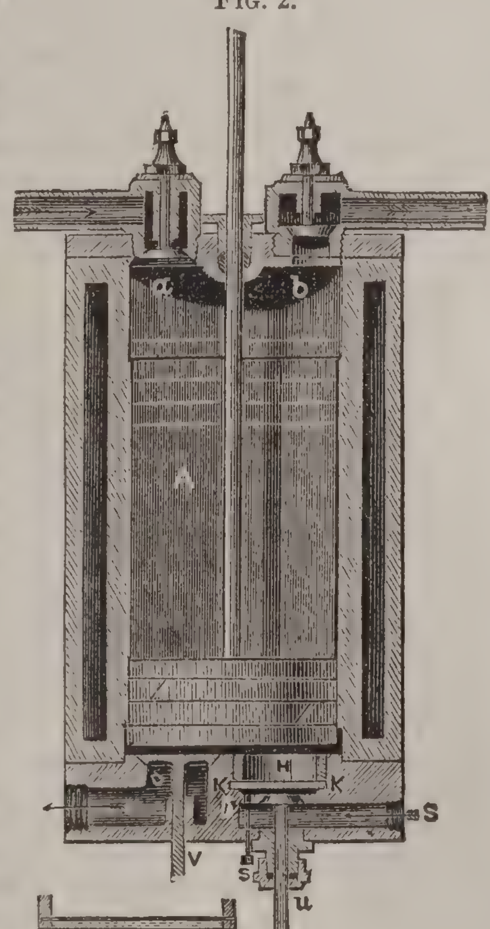
Fig. 1.



Brayton's High-Pressure Gas-Engine.

given to those previously mentioned. Fig. 1 presents a perspective elevation showing the cylinder, working-beam, fly-wheel, and driving-pulley with certain pipes the purpose of which will be better understood from Figure 2. This figure shows a section of the cylinder, piston, and valves of which there are four. As the engine is only single-acting, the upper valves *a* and *b* may for the moment be disregarded. The induction-valve is *u*, and the exhaust-valve, *v*. The valve *u* admits the combustible mixture to enter by the pipe S through the shallow chamber H, in which are placed the wire-gauze diaphragms *k k*, into the cylinder beneath the piston. Through the valve-seat there is made a small perforation which may be closed more or less nearly by the pointed screw *r*. The pipe S is that which, in Fig. 1, carries the screw-valve between the cylinder and a reservoir within the fluted column, in which a certain quantity of the combustible mixture is contained under pressure. When the screw-valve is opened, the gas, entering through S, makes its way by the small aperture in the valve-seat at *r* into the shallow chamber H. When it is desired to set the engine in motion, the piston is brought near the bottom of the cylinder by turning the fly-wheel, and a lighted match is introduced from without into the chamber H by an aperture not shown, which is then closed. The gas in H takes fire, and as the supply is continuous it continues to burn. The fly-wheel is then turned a little farther so as to open the induction-valve, when the engine immediately begins to operate. Its motion can only be arrested by cutting off the supply by means of the screw-valve.

Fig. 2.



Section of Brayton's Gas-Engine: induction chamber, enlarged.

We will now give attention to the valves at the top of the cylinder. The left-hand valve communicates with a gasometer which itself receives supplies through two inlets —one introducing atmospheric air and the other inflammable gas, in the proportion of twelve to one. As the piston descends, the cylinder behind it is filled through *a* with this explosive mixture. As it reascends, the valve *a* closes and *b* opens, the charge in A being forced through this into the reservoir from which the supply of the cylinder is drawn. The upper part of the cylinder is somewhat enlarged, so that when the piston is at its highest point, there still remains in it a quantity of gas equal to about one charge. It is easily seen that, if the cut-off is placed low, the volume of gas admitted at each stroke will be proportionally less than that driven into the reservoir; but as it is also obvious that, after running a short time, the *mass* of gas drawn out in a given time, must be exactly equal to that forced in in the same time, the pressure under which the engine works may be increased by shortening the cut-off, or diminished by lengthening it.

To prepare the engine to start, it is obvious that a certain pressure must first be got up in the reservoir. This need be only sufficient to set the engine running. After it has once started it will regulate itself, and will soon create the pressure due to the length of cut-off. In small engines this preliminary pressure may be got up by a few turns of the fly-wheel. For large ones a force-pump must be used; but when once got up, there is no need that it should run down, if the valves are close, even in long intervals of repose. As the reservoir has the capacity of only three or four charges, it is not a great labor to prepare it.

The efficiency of this engine is due to the expansion of the air introduced, and of the products of combustion (carbonic acid and steam) by the heat generated in the same combustion. The pressure in the cylinder is no greater than that in the reservoir. The opposing pressure is at first only that of the atmosphere, but rises towards the end of the stroke to be equal also to that in the reservoir. The action of the engine therefore in every respect resembles that of a hot-air engine; and it is to this class, rather than to the class of gas-engines, that it properly belongs. Though hot-air engines are in theory the most economical of engines driven by heat, the economy of theory has never been realized from them in practice, in consequence of the extreme difficulty of imparting heat to air. Radiant heat in this case produces but little effect; and to heat air thoroughly by contact requires a complicated construction which seriously impedes circulation and increases the resistance of friction. The Brayton motor has practically solved this difficulty, by mingling the fuel with the air itself, so that the whole heat of combustion is imparted to the air directly. It is therefore a hot-air engine without a furnace, or one in which the furnace is the cylinder itself.

The economical performance of this engine has been tested by Prof. R. N. Thurston of the Stevens Technological Institute, Hoboken, and R. H. Buel, Esq., mechanical engineer of New York. These gentlemen found the consumption of gas to amount to $32\frac{06}{100}$ cubic feet per horse-power per hour; being less than that of the Otto and Langen engine by about 18 per cent. But the steadiness of action of this engine adapts it to high as well as low powers; and it works silently while the one just mentioned creates an intolerable din. It is obvious that the Brayton engine might be made double-acting by employing separate pumps for the reservoir. F. A. P. Barnard.

Gaskell (Elizabeth Cleghorn, *née* Stevenson), b. at Chelsea, England, in 1811, married a Unitarian minister of Manchester; author of *Mary Barton*, 1848; *Moorland Cottage*, 1850; *Ruth*, 1853; *North and South*, 1855; *Round the Sofa*, 1859; *Sylvia's Lovers*, 1863; *Wives and Daughters*, 1866, and other novels, all of high moral purpose, and mostly written with cleverness; also of *The Life of Charlotte Brontë*, 1857. D. at Alton, Hampshire, Nov. 12, 1865.

Gas'kill, tp. of Jefferson co., Pa. Pop. 478.

Gas-Lighting [Ger. *Gasbeleuchtung;* Fr. *l'éclairage au gaz*]. 1. *Gas-Wells.*—Combustible gases issue from the earth in various parts of the world, constituting what are called gas-springs or wells. The holy fires of Baku, on the Caspian, and many of the sacred fires of the Greeks, were thus supplied with fuel. The Chinese have for ages used the gas which issues from some coal-beds near Peking for evaporating brines. In 1659, Shirley described a gas-well in Lancashire. Sir James Lowther in 1733 called attention to the gas which issued in a coal-mine at Whitehaven. This spring was afterwards walled in, and the gas burned through a 2-inch tube, and thirty years later it was proposed to light the streets of Whitehaven with it. Fredonia, N. Y., was lighted fifty years ago with natural gas, and the Kanawha salt-wells have long delivered gas in large

quantities. The city of Erie, Pa., has now thirteen gas-wells, bored as such, which furnish gas to be used as fuel under steam-boilers. One of these furnishes gas under a pressure of 200 pounds per square inch. The wells are 600 feet deep, cost $1500 each, and yield from 10,000 to 30,000 feet each per day. A wonderful gas-well occurs at Bloomfield, Ontario co., N. Y. It was bored to a depth of 500 feet for oil, and yields 800,000 feet daily of 14½ candle gas. A well at Burning Springs on the Little Kanawha, West Va., 900 feet deep and 4 inches in diameter, supplies, through a 2-inch pipe over a mile long, 28 boilers of 12 horse-power each, 50 stoves, and many lights. (See *Sill. Am. J. Sci.*, xlix., 1845, p. 406; article on Ohio gas-wells by J. S. NEWBERRY, *Am. Chemist*, i., 201, 1870; and article by H. WURTZ on American gas-wells, *Am. Gas-Light J.*, Dec. 2, 1871, p. 162.) The *fire-damp* of coal-mines is the same gas, which was produced during the formation of the coal from vegetable matter, and is liberated by the pick of the miner, to make an explosive mixture with the air of the mine. The gas which bubbles to the surface in stagnant pools is of the same character. In all cases these combustible gases consist chiefly of *marsh-gas*, or *methane* (CH_4), also called light carburetted hydrogen, with smaller proportions of ethane, propane, etc., the lighter members of the paraffin series of hydrocarbons, of which petroleum is chiefly composed. (See PETROLEUM.)

2. *Early History of Gas-Lighting.*—About the beginning of the seventeenth century Van Helmont noticed that when animal or vegetable substances were heated in close vessels, vapors or spirits were obtained which burned with a bright flame. Some time previous to 1691, Dr. John Clayton prepared gas from the bituminous coal of Wigan, collected it in bladders, and burned it for the amusement of his friends. In 1726, Dr. Stephen Hales made similar experiments with Newcastle coal. The bishop of Llandaff showed in 1767 how gas evolved from coal might be conveyed in tubes, and in 1786, Dr. Pickel, professor of chemistry at Würzburg, lighted his laboratory with the gas obtained by the dry distillation of bones. In 1787, Lord Dundonald of Culross Abbey in Scotland took out a patent for making coal-tar, and erected ovens for the purpose. The coal-gas produced was burned at the abbey as a curiosity. The real inventor of practical gas-lighting was William Murdoch, who in 1792 lighted his house and office at Redruth in Cornwall with gas made from coal, and astonished his neighbors still more by adapting the new light to a small steam-carriage in which he rode to and from the mines. He soon removed to Scotland, and in 1797 lighted his premises at Old Cumnock, in Ayrshire, with coal-gas. In 1798 he constructed gas-works at the shops of Boulton, Watt & Co. at Soho, and first publicly exhibited the gas in 1802 at the Peace of Amiens, when he showed two enormous flames of coal-gas burning from two copper vases at these works. In 1805 the cotton-mills of Phillips & Lee at Salford were lighted with gas by Boulton, Watt & Co., under the direction of Murdoch; and at about the same time the mills at Sowerby Bridge were lighted by the same firm, under the direction of Mr. Clegg. In 1799 the French engineer Le Bon took out a patent in France for making gas from wood, with which he proposed to light Paris. In 1804, Winsor lectured on gas at the Lyceum Theatre in London, exhibiting the gas, but making a great mystery of the process. He finally obtained permission to light a few street-lamps with gas in Pall Mall, which he did in 1809, and organized the National Light and Heat Co., applying for a charter, which was refused. A great newspaper war was then initiated by him, in order to create a popular interest in the new light. In 1810, Parliament authorized His Majesty to grant a charter within three years. On Dec. 31, 1813, Westminster Bridge was lighted, and soon after the oil-lights in the streets of St. Margaret's, Westminster, were replaced by gas, and the next year (1815) Guildhall was lighted. Still, prejudice against the new light was so intense, even on the part of men of science, that it seemed at one time to present an insurmountable obstacle to its further progress. Davy (afterwards Sir Humphry) ridiculed the idea by asking if it were intended to take the dome of St. Paul's for a gas-holder. The popular ignorance with regard to gases in general was so great that when gas was finally admitted into the House of Commons, the architect directed that the pipes be placed four or five inches from the walls, lest their heat should fire the building. Popular prejudice was by no means the only obstacle to the introduction of gas-lighting. The apparatus and machinery had to be invented; men had to be instructed to make them, and others to use them. Suitable pipes for distributing the gas could not be obtained. Wood and paper were patented, gun-barrels were screwed together, till finally wrought-iron pipes were supplied. In 1822 there were four great companies in London, using 1315 retorts and 47 gas-holders, and making 397,000,000 cubic feet of gas annually. Now, every large city in the civilized world is lighted by gas, giving rise, with the collateral business of making the fixtures, burners, etc., and working up the waste products, to one of the most extensive industries.

The manufacture of gas was first attempted in the U. S. at Baltimore, without success till 1821. It was introduced in Boston in 1822, and in 1823 the New York Gas-Light Co. was started, though it was not in successful operation till 1827. There are now probably 400 to 500 companies in the U. S., with an aggregate capital of $50,000,000 or more.

3. *Materials used for Making Gas.*—All vegetable and animal substances when exposed in close vessels to a red heat undergo destructive distillation, yielding gas, water, and tar, and leaving a residue of charcoal or coke. A few only are adapted for the economical production of illuminating gas. Bituminous coal is the material generally selected, though under certain circumstances several others have been, and are even now, employed. The most important of these are petroleum or some of its less valuable products (as naphtha or residuum), rosin, wood, peat, cheap oils, and fats. The mixture of hydrogen and carbonic oxide, called "water-gas," produced by passing steam over red-hot coke, charcoal, or anthracite, or a mixture of steam and petroleum vapor or gas through a red-hot retort, has been, and is now, employed with success in the manufacture of illuminating gas, its want of illuminating power being supplied by rich gases from other materials.

4. *Coal-gas* is made from bituminous coal. The following are the most important varieties of mineral coal:

1. Anthracite.
2. Bituminous, { Non-caking, Caking, Cannel.
3. Lignite, or brown coal.

In addition to these coals, there are bituminous shales, such as the Boghead mineral from Scotland, the Wallongongite from Australia, and the paper shales of Germany. There are also asphaltic minerals, which, while they are never used alone, are very important when added to poor coals, to the extent of 5 or 10 per cent., as enriching materials, for the purpose of improving the quality of the gas. The most important of these asphalts are albertite from Nova Scotia and grahamite from West Virginia. These asphalts produce large quantities of extremely rich gas, but their cost limits the quantity that can be used. Next to them in quantity and quality of the gas come the rich bituminous shales above mentioned, but they too are not found in sufficient quantities to be used alone. Of true coals, the cannels yield the richest gas, and in England they are sometimes used exclusively. The caking coal is, however, the chief material employed. The advantage of this variety of coal is due to its abundance and consequent cheapness, and to the fact that when heated it undergoes a kind of fusion, and furnishes a compact porous coke of great value as fuel. The gas from caking coal is inferior in illuminating power, but this deficiency is supplied by the use of a certain proportion of richer cannels and other enriching materials. The table on the next page illustrates the character of a few of the more important gas-coals and enrichers.

The percentage of sulphur in gas-coal is a matter of considerable importance, as, while about half of this sulphur remains in the coke, the other half passes into the volatile products, and is divided between the gas, the ammonia-water, and the tar. As the sulphur contained in the gas must be removed in the process of purification, the cost of this part of the process increases with the percentage of the sulphur contained in the coal. The sulphur is present in the coal chiefly in the form of iron pyrites (FeS_2). Some American gas-coals contain considerable percentages of sulphur. The Nova Scotia coals (Glace Bay, Bridgeport, International, etc.) contain from 3 to 5 per cent.; Red Bank, Pa., 0.89; Westmoreland, Pa., 1.50; Murphy's Run, West Va., 1.88 to 3.06; Orrell, Eng., 1.75 to 2.34. The last column in the above table shows the number of feet of gas purified by one bushel of lime, which is a tolerable indication of the amount of sulphur which goes into the gas.

The manufacture of coal-gas includes three distinct operations: (1) the distillation of the coal; (2) the separation of the water, tar, and other condensable matters—*condensation*; (3) the removal of sulphur compounds and carbonic acid—*purification.*

Retorts.—The distillation is effected in long horizontal, semi-cylindrical, D-shaped retorts of cast iron, or more generally of clay, which consist of two parts—the body and the mouthpiece. (Fig. 1, C.) They are closed when in use by a lid, properly luted and held in place by a screw. The retorts are set in groups or *benches* of three, five, six, or seven, heated by one fire of coke. In Paris the Siemens regenerating furnace has been introduced for heating gas-retorts. At the Vaugerard station one furnace furnished fuel for 128 retorts, set in benches of 8, with regenerating

	Volatile matter.	Fixed carbon.	Ash.	Gas per ton of 2240 lbs. in cubic feet.	Candle-power of gas.	Coke, per ton of 2240 lbs.		Gas purified by 1 bushel of lime, in cubic feet.
						Pounds.	Bushels.	
I. CAKING COALS.								
New Castle, England	32.70	65.55	1.75	10057	10.11	1536	49	3500
Glace Bay, Cape Breton	....	....	......	9560	12.50	1484	38	1945
Lingan, Cape Breton	35.20	60.80	4.00	9520	12.92	1450	42	2200
Block House, Cape Breton	40.80	57.70	1.50	10217	17.32	1460	40	2304
Pittsburg, Pa	36.76	51.93	7.07					
Westmoreland, Pa	36.00	58.00	6.00	10642	16.62	1544	40	6420
Sterling, O	37.50	56.90	5.60	10528	18.81	1480	36	3993
Despard, West Va	40.00	53.30	6.70	10765	20.41	1540	36	2494
II. CANNEL COALS.								
Kirkless Hall, England	40.30	56.40	3.30	10012	21.47	1410	36	2000
Darlington, O.	43.00	40.00	17.00	9800	34.98	1320	32	2806
Petonia, West Va	46.00	41.00	13.00	13200	42.79	1380	32	4510
III. ENRICHING MATERIALS.								
Boghead mineral, Scotland	51.60	15.70	32.70	13619	26.45	1378	35	3400
Grahamite, West Va.	53.50	44.50	2.00	15000	28.70	1056	44	
Albertite, Nova Scotia	57.70	41.90	0.40	14784	49.55	806	16.8	
Wollongongite, Australia	82.50	6.50	11.00	13716	131.00	424	......	5686

chambers beneath each bench. The saving in fuel is said to amount to 29 per cent. The coal is charged in at the front of the retort through the mouthpiece, generally in an iron scoop, which is inverted before it is withdrawn, leaving the coal evenly distributed on the bottom of the retort. When the distillation is completed, the lid is removed and the red-hot coke is drawn out into an iron wheelbarrow, spread out in the yard, and quenched with water. About one-third of the coke obtained is required for heating the retorts; the rest is sold. The work of charging the red-hot retorts and drawing the coke is very laborious and exhausting, and an effective machine for performing this duty has long been a desideratum. Such a machine has been invented by Mr. T. F. Rowland of Greenpoint, N. Y., and is figured and described in the *Coal and Iron Record* of Sept. 24, 1873. The working model certainly accomplishes all that can be desired. The intensity and duration of the heat to which the coal is exposed are matters of great importance. For iron retorts a dull cherry (1470° F.) to a clear cherry-red heat (1830° F.) is most suitable. For clay retorts a deep orange (2010° F.) to a clear orange (2190° F.), or even a white heat (2370° F.), is employed, the coal itself being exposed in either case to a temperature of 1500° to 1600° F. The effect of too low a temperature is to produce a larger proportion of condensable vapors, which are lost in the form of tar, while too high a temperature injures the quality of the gas by decomposing it into non-luminous marsh-gas and hydrogen. When the charge of 160 or 200 pounds of coal is first introduced into the hot retort, the outer layers only of the coal undergo distillation, yielding condensable vapors very rich in carbon; these, passing through the red-hot retort on their way out, are decomposed into fixed gases of high illuminating power. As the heat continues these outer layers of coal become converted into coke, which is soon raised to a red heat. In the mean time the heat reaches the interior of the charge, and the vapors produced, passing through the red-hot layers of coke, are in turn converted into fixed gas. As each successive portion of vapor has to pass over a larger surface of red-hot coke, it is more and more completely decomposed, and its percentage of carbon, and consequently its illuminating power, reduced. For this reason the quality of the gas deteriorates as the process of distillation continues, till finally little besides hydrogen is evolved. At the last stages of the process the sulphur contained in the coke is said to form bisulphide of carbon, which is a most objectionable impurity. It is considered better, therefore, to interrupt the process at the end of four hours than by continuing it to impair the quality of the whole product by the poor gases of the later stages of the distillation. To prevent the reduction of the illuminating power of the gas by too high a temperature, it is also necessary to remove the gas from the retort as soon as possible, and not to permit its pressure to be increased by obstacles to its ready escape. For the accomplishment of this object an exhauster, or gas-pump, is employed—not so much to suck the gas out of the retort (the partial vacuum produced in the retort rarely exceeds one inch of the water-column in the pressure-gauge) as to push the gas ahead through the condenser, washer, and purifiers into the holder, and thus make room for more gas to follow from the retort. The effect of too low heats is shown to an exaggerated degree in the following comparison of the results obtained from the same coal when distilled at a bright red heat for gas, and at a heat hardly red (750° to 800° F.) for coal-oil. One ton of 2240 pounds of Newcastle coal yielded—

I. When distilled for gas, at a high temperature.		II. When distilled for oil, at a low temperature.	
Gas	7450 cu. ft.	Gas	1400 cu. ft.
Coal-tar	18½ gals.	Crude oil	68 gals.
Coke	1200 lbs.	Coke	1280 lbs.

The Standpipe.—From the retorts the gas and vapors pass up through the ascension or *standpipe,* which is attached to the mouthpiece, to the *hydraulic main.*

The Hydraulic Main (Fig. 1, B).—This is a large horizontal tube half filled with tar which condenses from the gas, the constant level of which is maintained by an overflow to the tar-well. To prevent the escape of gas from the hydraulic main when the retorts are opened, the standpipe makes a double turn and enters the hydraulic main from above, its end dipping three or four inches into the tar, which makes an effective seal. The hydraulic main is really the first element of the condensing apparatus, for here the condensable vapors begin to separate, as tar and ammonia-water.

The Exhauster (not shown in Fig. 1).—From this main the gas passes to the *exhauster,* or gas-pump, which pushes it forward to the *condenser,* or refrigerator. There is a popular idea that the exhauster is a convenient device to enable the gas companies to draw in air through the open retorts, and thus dilute the gas. No one is more interested in preventing this than the gas companies, for air exerts a most fatal influence on the quality of the gas. Two per cent. of air diminishes the illuminating power of the gas 10 per cent., 5 of air, 30 per cent., 7 of air, 48 per cent., 10 of air, 66 per cent., and 20 of air, 88 per cent. The exhauster is provided with a special device to prevent the drawing in of air.

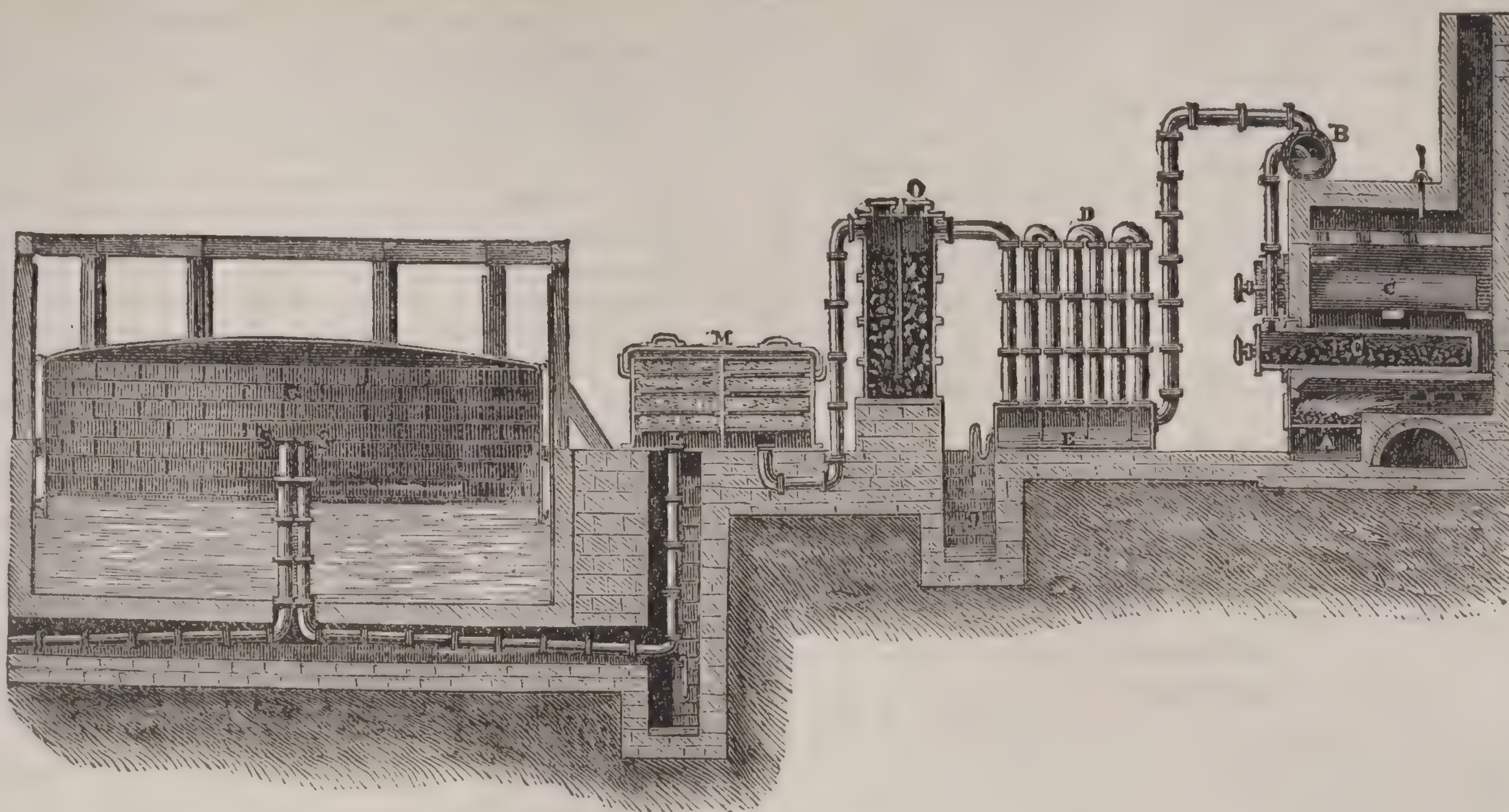
The condenser (Fig. 1, D) consists of a series of iron tubes placed in the open air, or more commonly in cisterns of cold water. By a simple contrivance (Fig. 1, E) the tar and ammonia-water which separate from the gas as it traverses the condenser readily flow off into their respective wells. From 50 to 100 square feet of tube-surface is allowed for every 1000 feet of gas to be cooled per hour. At the works of the New York Gas-Light Co. a multitubular condenser is in use, consisting of two sets of eight boxes, each containing 100 tubes, 3 inches in diameter and 15 feet long. The gas passes up in one set of tubes and down in the next, through the entire series of sixteen boxes, thus traversing 240 feet of 3-inch pipe, cooled by a constantly changing water-supply outside. The action of this condenser is more than its name implies. While the warm gas contains steam and various condensable vapors, which are liquefied and separated here, it also bears along a considerable quantity of tar, in the form of globules, spray, or fog, too minute to be deposited by gravity. This tar is already condensed to liquid, and it requires for its separation actual contact with a bath of tar, as in the hydraulic main, or with surfaces wet with tar, as in the tubes of the condenser; the tortuous journey is also favorable for the *licking up* of the tar-globules by the tarry surfaces.

The Washer (not shown in Fig. 1).—The gas next enters the *washer,* and then at many works a scrubber, both designed to render more complete the separation of the tar and ammonia, and also to separate some of the sulphur compounds. The washer consists of a series of compartments, through which the gas passes, and where it is exposed to jets of water. At the East-side works of the Manhattan Co. the washer consists of a series of 36 cells, 3 feet square and 10 feet high, each supplied with two jets of water, which enter at the side and are thrown into spray by impinging against an iron plate. The gas passes through the entire series.

The scrubber (Fig. 1, O) is a large chamber partially filled with coke, fragments of fire-brick or paving stones, which are kept constantly wet by a spray of water. It serves to remove the last portions of tar, etc.

Apparatus of St. John and Rockwell.—The free use of water on the gas is found to be objectionable, as some of the rich illuminating gases and vapors present are dissolved out by it, and the illuminating power is reduced

Fig. 1.



Coal-Gas Works.

thereby. For this reason dry scrubbing is sometimes resorted to, or washing and scrubbing with the ammonia-water derived from the gas itself. Messrs. St. John and Rockwell have devised an apparatus (figured and described in the *Am. Gas-Light Journal* of Jan. 16, 1875) which takes the place of condenser, washer, and scrubber, and entirely avoids the use of any water save that condensed from the gas. It consists of a series of compartments by which the gas from the hydraulic main is made to bubble through the tar and ammonia-water, and to pass over a latticework of iron, which catches the tar-globules. The writer tested this apparatus (now used by the Harlem Gas-Light Co.) for a week, using 163,120 pounds of Pennsylvania and 470,445 pounds of Murphy Run coal. The yield averaged 10,897 feet of 17.06-candle gas, which contained, after being purified with oxide of iron, only 2.65 grains of ammonia and 23.58 grains of sulphur in 100 cubic feet. Prof. Wurtz (*Am. Gas-Light J.*, Jan. 2, 1875) reported the results of his analysis of the gas before and after it passed this apparatus, as follows (the numbers in the first two columns represent grains in 100 cubic feet):

	Crude gas from hydraulic main.	Gas after passing the apparatus.	Percentage of each impurity removed.
Water	3515	2675	23.92
Tar	515	44	91.46
Soot, dust, etc	266	56	79.05
Naphthaline	123	25	79.77
Ammonia	339	237	30.18
Sulphuretted hydrogen	1235	1105	10.51
Carbonic acid	1698	1522	10.36

Products of the Distillation of Coal.—Before proceeding to describe the process of purification, it will be well to exhibit the composition of the products produced from the coal in the process of gas-making:

I. Coke.

	Per cent.
1, Carbon	90 – 95
2, Sulphide of iron (Fe_7S_8)	3 – 10
3, Ash	3 – 15

II. Ammonia-Water.

1, Acid carbonate of ammonia	NH_4HCO_3.
2, Hydrosulphate of ammonia	NH_4HS.
3, Sulphocyanide of ammonium	NH_4CNS.
4, Cyanide of ammonium	NH_4CN.
5, Chloride of ammonium	NH_4Cl.

III. Tar.

1. *Hydrocarbons.*

	Formula.	Sp. gr.	Boiling-points.	
1, Benzol	C_6H_6	.850	82° C.	= 179.6° F.
2, Toluol, methyl-benzol	C_7H_8	.870	111°	= 231.8°
3, Ethyl-benzol	C_8H_{10}	......	132°	= 269.6°
4, Xylol, dimethyl-benzol	C_8H_{10}	.867	140°	= 284.°
5, Cumol, propyl-benzol	C_9H_{12}	.870	153°	= 307.4°
6, Methyl-ethyl-benzol	C_9H_{12}	......	160°	= 320°
7, Tri-methyl-benzol (pseudocumol, mesitylene)	C_9H_{12}	......	166°	= 330.8°
8, Isobutyl-benzol	$C_{10}H_{14}$	......	159° C.	= 318.2° F.
9, Cymol, methyl-propyl-benzol	$C_{10}H_{14}$	.861	178°	= 352.4°
10, Di-ethyl-benzol	$C_{10}H_{14}$	......	178°	= 352.4°
11, Di-methyl-ethyl-benzol (ethyl-xylol)	$C_{10}H_{14}$	......	184°	= 363.2°
12, Amyl-benzol	$C_{11}H_{16}$	.859	193°	= 379.4°
13, Methyl-amyl-benzol	$C_{12}H_{18}$	......	213°	= 415.4°
14, Di-methyl-amyl-benzol (amyl-xylol)	$C_{13}H_{20}$	......	232°	= 449.6°
15, Phenylene	C_6H_4	......	91°	= 195.8°
16, Cinnamene, styrolene	C_8H_8	.924	145°	= 293°
17, Naphthalene	$C_{10}H_8$	1.153	220°	= 428°
18, Di-phenyl	$C_{12}H_{10}$	......	240°	= 464°
19, Anthracene	$C_{14}H_{10}$	1.147	300°	= 572°
20, Pyrene	$C_{16}H_{10}$			
21, Chrysene	$C_{18}H_{12}$			
22, Benzerythrene (*and probably*)				
23, Quintane	C_5H_{12}	0.60	30°	= 86°
24, Sextane	C_6H_{14}	.669	68°	= 154.4°
25, Other paraffines	C_nH_{2n+2}			
26, Quintene, amylene	C_5H_{10}	....	35°	= 95°
27, Sextene	C_6H_{12}	....	68°	= 154.4°
28, Other olifines	C_nH_{2n}			
29, Quintine, valerylene	C_5H_8	....	46°	= 114.8°
30, Sextine, diallyl	C_6H_{10}	....	58°	= 136.4°
31, Other acetylenes	C_nH_{2n-2}			
32, Dipropyl	$(C_3H_7)_2$	.678	68°	= 154.4°
33, Dibutyl	$(C_4H_9)_2$	.706	106°	= 222.8°
34, Diamyl	$(C_5H_{11})_2$	.741	158°	= 316.4°
35, Dicaproyl	$(C_6H_{13})_2$	.757	202°	= 395.6°
36, Other alcohol radicals	$(C_nH_{2n+1})_2$			

2. *Alcohols.*

1, Phenol, carbolic acid	C_6H_5OH	1.065	180° C.	= 356° F.
2, Cresol, cresylic acid	C_7H_7OH	...	200°	= 392°
3, Phlorol, phlorylic acid.	C_8H_9OH	1.037	195°	= 383°
4, Xylenol	C_8H_9OH	...	213.5°	= 416°
5, Thymol	$C_{10}H_{13}OH$	...	220°	= 428°
6, Methyl-thymol	$C_{11}H_{15}OH$			
7, Ethyl-thymol	$C_{12}H_{17}OH$			
8, Amyl-thymol	$C_{15}H_{23}OH$			

3. *Acids.*

1, Acetic	$H.C_2H_3O_2$	1.062	117.2°C.	= 243° F.
2, Butyric	$H.C_4H_7O_2$	.9817	164°	= 327.2°
3, Rosolic	$C_{20}H_{16}O_3$			
4, Brunolic	?			

4. *Bases.*

1, Ammonia	H_3N	Gas.		
2, Methylamine	CH_5N	Gas.		
3, Ethylamine	C_2H_7N	.696	19° C.	= 66.2° F.
4, Diethylamine	$C_4H_{11}N$	...	57.5°	= 135.5°
5, Aniline, phenylamine	C_6H_7N	1.028	182°	= 359.6°
6, Toluidine	C_8H_9N	...	205°	= 401°
7, Xylidine	$C_9H_{11}N$	...	215°	= 419°

	Formula.	Sp. gr.	Boiling-points.	
8, Cumidine	$C_{10}H_{13}N$	.952	225°C.	= 437° F.
9, Cymidine	$C_{11}H_{15}N$	...	250°	= 482°
10, Pyridine	C_5H_5N	.985	117°	= 242.6°
11, Picoline	C_6H_7N	.961	133°	= 271.4°
12, Lutidine	C_7H_9N	.946	154°	= 309.2°
13, Collidine	$C_8H_{11}N$	.921	179°	= 354.2°
14, Parvoline	$C_9H_{13}N$	...	188°	= 370.4°
15, Coridine	$C_{10}H_{15}N$	...	211°	= 411.8°
16, Rubidine	$C_{11}H_{17}N$	1.017	230°	= 446°
17, Viridine	$C_{12}H_{19}N$	1.017	251°	= 483.8°
18, Pyrrol	C_4H_5N	1.077	133°	= 371.4°
19, Leucoline, chinoline	C_9H_7N	1.081	238°	= 460.4°
20, Iridoline, lepidine	$C_{10}H_9N$	...		
21, Cryptidine, dispoline	$C_{11}H_{11}N$	...	273.9°	= 525°

5. *Pitch.*

Oxidized bituminous bodies, whose nature has not been accurately determined.

IV. Gas.

1. *Luminants.*

	Formula.	Density.
1, Vapors of paraffines	C_nH_{2n+2}	
2, Propyl	$(C_3H_7)_2$	
3, Other alcohol radicals	(C_nH_{2n+12})	
4, Olefiant gas, ethene	C_2H_4	.976
5, Propene	C_3H_6	1.490
6, Butene	C_4H_8	1.940
7, Vapors of other olifines	C_nH_{2n}	
8, Acetylene	C_2H_2	.920
9, Vapors of other acetylenes?	C_nH_{2n-2}	
10, Valelene?	C_nH_{2n-4}	
11, Benzole	C_6H_6	2.71
12, Vapors of toluol, xylol, etc	C_nH_{2n-6}	
13, Phenylene, etc.?	C_nH_{2n-8}	
14, Cinnamene, etc.?	C_nH_{2n-10}	
15, Naphthalene	$C_{10}H_8$	
16, Diphenyl, etc.?	$C_{12}H_{10}$	
17, Anthracene?	$C_{14}H_{10}$	
18, Pyrene?	$C_{16}H_{10}$	
19, Chrysene?	$C_{18}H_{12}$	
20, Phenol, etc. (alcohols)	$C_nH_{2n-7}OH$	
21, Bases above mentioned		

2. *Diluents.*

1, Hydrogen	H	.0691
2, Marsh-gas, methane	CH_4	.5594
3, Carbonic oxide	CO	.9727

3. *Impurities.*

1, Sulphuretted hydrogen	H_2S	1.1747
2, Ammonium sulphydrate	NH_4HS	
3, Bisulphide of carbon	CS_2	
4, Oxysulphide of carbon?	CSO	
5, Sulphurous acid (anhydride)?	SO_2	
6, Mercaptan, etc	C_2H_5HS	
7, Sulphur bases, etc		
8, Ammonium sulphocyanide	NH_4CNS	
9, Ammonium cyanide	NH_4CN	
10, Ammonium mono-carbonate	NH_4HCO_3	
11, Carbonic acid (anhydride)	CO_2	1.5240
12, Nitrogen	N	.9760
13, Oxygen	O	1.1026
14, Aqueous vapor (water)	H_2O	.6201

Purification.—The above-mentioned impurities, which are not separated from the crude gas either in the condenser, washer, or scrubber, are all more or less objectionable. All the sulphur compounds produce sulphurous acid, and probably some sulphuric acid, when the gas is burned, which vitiate the atmosphere, and may even cause serious damage to books, and silks and other textile fabrics. Ammonia is objectionable, because it attacks the fittings, corrodes the metres, and fixes the stopcocks. It also has the property of holding tar in suspension. When burned it is partially converted into nitrous acid. Ammonia is in some respects advantageous; it unites with the sulphuric acid produced during combustion, and forms harmless sulphate of ammonia; and it is also said to prevent the deposition of naphthalene in the mains. The nitrogen and oxygen which are generally present in gas are supposed to be entirely due to atmospheric air, which unavoidably gains admission when retorts are charged, purifiers changed, etc. Nitrogen diminishes slightly the illuminating power of the gas, as it absorbs a portion of the heat of combustion, without contributing either heat or light. It may also form nitrous or nitric acid, and thus vitiate the atmosphere. Oxygen is more objectionable than nitrogen; it diminishes the illuminating power of the gas very materially, as already stated in connection with the *exhauster*. Carbonic acid also occasions a considerable loss of light; 1 per cent. of this gas is said to diminish the illuminating power of coal-gas 5 per cent.

The following table, prepared by Firle (*Polyt. Centralblatt*, 1861, 811), indicates the percentages of the impurities at different stages of the manufacture at Breslau:

In the gas from—	Carbonic acid.	Sulphuretted hydrogen.	Ammonia.
1, The condenser	3.72	1.06	0.95
2, The scrubber	3.87	1.47	0.54
3, The washer	3.39	0.56	0.00
4, The Laming purifier	3.33	0.36	0.00
5, The lime purifier	0.41	0.00	0.00

A. Buhe (*J. f. Gasbeleuchtung*, 1869, 420) has given more elaborate statements, among which are the following:

Gas from Zwickau Coal.

In the gas from—	Carbonic acid.	Sulphuretted hydrogen.	Cyanogen.	Ammonia.
1, The hydraulic main.	2.91	.23	.07	1.10
2, The condenser	3.88	.40	.07	.24
3, The scrubber	3.86	.44	.06	.15
4, The washer	3.64	.34	.09	.04
5, The purifiers	4.11	.00	.00	.00

Gas from Nettlesworth (England) Coal.

In the gas from—	Carbonic acid.	Sulphuretted hydrogen.	Ammonia.
1, The hydraulic main	1.10	0.19	0.70
2, The condenser	1.04	0.09	0.88
3, The scrubber	1.00	0.10	0.66
4, The washer	0.98	0.01	0.39
5, The purifiers	1.13	0.00	0.00

There are four methods of purifying gas now in use:

1. *The Wet-Lime Process.*—This process involves passing the gas through milk of lime. It is the oldest process in use, and is very effective in removing both the sulphur compounds and the carbonic acid. It has been generally abandoned, however, on account of the difficulty of disposing of the foul milk of lime, called "blue billy." Occurring as a liquid, the "blue billy" is not easily transported; and as it does not rapidly undergo oxidation, it is not well adapted for use as a fertilizer. Running it into rivers and streams has been forbidden by law, as the pollution of the waters by it was intolerable, while the extremely offensive smell which it emits makes it impossible to store it until it becomes dry enough for transportation.

2. *The Dry-Lime Process.*—In this process dry or slightly moist hydrate of lime is placed on trays in iron boxes, through which the gas is made to pass. This process is very effective, and has very generally superseded the wet-lime process. It removes the sulphur compounds and the carbonic acid equally well. When the foul lime is removed, however, it evolves the same odor which caused the wet-lime process to be abandoned. When exposed to the air it rapidly undergoes oxidation, becoming heated in consequence. During this process it evolves sulphide of ammonium, and some other compounds whose exact nature is not known, but whose odor is extremely offensive. This is the cause of the "gas nuisance" so loudly complained of a few years ago, when all the New York companies employed this process of purification. After the oxidation of the foul lime is completed, it ceases to be specially offensive, the peculiar stench being evolved during the first hour or two of exposure. The offensiveness of this foul lime became such a constant cause of complaint in the large cities of Europe that the gas companies were compelled to abandon the process, as they had previously abandoned the wet-lime. A system of ventilating the foul lime has been invented, and is now in use at both the stations of the Manhattan Co. in New York, which effects its oxidation in such a manner that the offensive gases evolved are not permitted to escape into the atmosphere, but are passed through a washing apparatus, and finally through a special purifier, by which they are rendered comparatively inoffensive. This invention seems to obviate the nuisance of dry-lime purification.

3. *The Laming Process.*—In 1849, Mr. Laming introduced the hydrated sesquioxide of iron as a substitute for lime for purifying gas, preparing it of a suitable quality by mixing copperas (sulphate of iron) with slaked lime and sawdust, and exposing the mixture to the air to oxidize the protoxide of iron to the sesquioxide. The resulting mixture contains hydrated sesquioxide of iron, sulphate of lime, and sawdust. When an excess of hydrate of lime is employed, the resulting mixture contains this substance also. This material is very effective in removing the sulphur compounds from the gas. There is, however, some difference of opinion as to the completeness with which the carbonic acid is removed, due perhaps to variations in the proportions of the ingredients. Two important advantages attend the use of this mixture: first, when fouled it

does not evolve offensive odors on exposure to the air; second, by exposure to air the sesquioxide of iron, which has been changed to sulphide of iron in the purifier, is regenerated, the sulphur being liberated and sesquioxide of iron again formed. The mixture may therefore be used again and again, till it becomes so clogged with the sulphur liberated that it does not act promptly on the gas. It is then found to contain from 40 to 60 per cent. of sulphur, and may be used for the manufacture of sulphuric acid. I have seen mixtures which had been in use twelve months.

4. *The Iron-Ore Process.*—A few months after Laming introduced the artificial hydrated sesquioxide of iron in France, Mr. J. M. Hills applied the natural hydrated sesquioxide of iron, or "bog iron ore," in England. This material, like the Laming mixture, may be used again and again, and does not evolve offensive odors when exposed to the air. A modification of this process is now used by the New York Gas-Light Co. It was invented by Messrs. St. John and Cartwright, and has been in use nearly seven years, giving entire satisfaction. As the bog iron ores of this neighborhood are not sufficiently pulverulent to act promptly on the gas, Messrs. St. John and Cartwright add to the ore a quantity of iron borings or turnings, which they then convert into an artificial hydrated sesquioxide of iron by moistening the whole with ammoniacal liquor and exposing it to the air. The resulting mixture of natural and artificial oxide receives an addition of coarsely pulverized charcoal. This mixture is always sprinkled with ammoniacal water before it is placed in the purifier. In Germany several varieties of sesquioxide of iron are now in use, prominent among which are "the Oberuseler mixture," an iron ore containing some oxide of manganese; the "Mannheim oxide," and "Deicke's oxide," very pure artificial oxides of iron.

Extent to which the Different Methods of Purification are Employed.—The wet-lime method has been almost entirely abandoned. The only works at which I know it to be used at present are at Cork, in Ireland. These works are of moderate size, and are situated out of the city. Moreover, the gas is freed from ammonia by means of sulphuric acid before it comes in contact with the lime. The foul lime does not, therefore, evolve sulphide of ammonium when exposed to the air. The dry-lime process, though still in general use in this country, has been almost universally abandoned in Europe—abandoned, firstly, because the foul lime was an intolerable nuisance; secondly, because the process is too expensive, as the lime can be used but once, and when exhausted has but a trifling value as a fertilizer. The Laming mixture is now used in many of the European gasworks. All the gas supplied to Paris is purified by this material. The German gas engineers have found that this mixture owes its efficacy entirely to the oxide of iron which it contains, and that the sulphate and hydrate of lime present do not take any appreciable part in the purification. Hence they are abandoning this mixture for the natural or artificial oxides of iron, which are cheaper and more efficient. The iron-ore method is now most generally used in Europe, and has obtained a foothold in this country, being used by the New York Gas-Light Co., the Harlem Co., and several companies in Massachusetts and elsewhere. All the Liverpool gas, much if not all of the London gas, and that of most of the German cities, is now purified either by iron ore or one of the artificial oxides of iron.

Comparative Advantages of the Different Methods.—The lime methods effectually remove the carbonic acid, and reduce the sulphur compounds to a minimum. Were there no objections to the use of dry lime on the score of cost or offensiveness, I think this agent would be generally preferred. Lime was first abandoned on account of the nuisance which it occasioned, but the iron oxides are now actually preferred by the European gas engineers on account of their greater economy. Mr. King, the engineer of the Liverpool works, assured me that the oxide-of-iron purification, which he had used exclusively for the past seven or eight years, costs less than half as much as the dry-lime process used previously. Two objections are urged against the iron methods by those who are prejudiced in favor of lime. First, they do not remove carbonic acid; second, it is claimed that they do not remove the sulphur compounds as completely as lime. The first is generally conceded to be true. But the only objection to carbonic acid is that it reduces the illuminating power of the gas: 1 per cent. of carbonic acid diminishes the illuminating power 5 per cent. The average quantity of carbonic acid is, say $2\frac{1}{2}$ per cent.; then the illuminating power of the gas will suffer to the extent of $12\frac{1}{2}$ per cent., or one-eighth. There are two ways in which this difficulty can be effectually met: First, by using better coals for making the gas, or adding a few pounds of rich cannel or some other enriching material to the ordinary gas-coals; or secondly, by taking less gas from the coal. The last gas drawn from the coal is always inferior to that which comes off first. Mr. A. Buhe, already referred to, says: "It has become more and more the custom to leave the carbonic acid in the gas, and to neutralize its bad influence on the illuminating power by taking less gas from the coal, thus getting a better gas." Dr. Schilling says: "Carbonic acid is of no consequence to the consumer; cannel coal is the remedy." The second objection to the iron processes is the alleged imperfect removal of the sulphur compounds. None of the methods in use entirely remove the sulphur from the gas. The question arises, therefore, How much sulphur can be safely left in the gas? The English Parliament has answered this question by fixing the limit at 20 grains of sulphur to 100 cubic feet of gas; and to see that the companies come within this limit, chemists are appointed whose duty it is to analyze the gas and report its quality. I have before me the report of Dr. Letheby for the months of Jan., Feb., and Mar., 1869. He states the grains of sulphur found in 100 cubic feet of gas to be as follows:

	Maximum.	Minimum.	Average.
City of London Gas-Light and Coke Co.	18.92	11.70	15.00
The Gas-Light and Coke Co.	24.15	15.75	19.49
Great Central Gas Consumers' Co.	24.00	7.03	12.28

From this it will be seen that the gas of London, although purified by iron, does not average 20 grains of sulphur in 100 cubic feet. With regard to the Paris gas, which is purified by Laming's oxide-of-iron mixture, Prof. J. Lawrence Smith, one of the U. S. commissioners to the French Exposition of 1867, who is the president of the Louisville Gas Co., has given us a very decided opinion. On page 88 of his report, which was published by the U. S. government, he says: "The gas of these works is most thoroughly purified, and the dealers in silks and other delicate fabrics, who, a few years ago, always suffered more or less loss from the results of the combustion of impure gas acting on their fabrics, now no longer suffer from this cause." Dr. Letheby (*Journal of Gas-Lighting*, 1869, p. 83) has argued that 20 grains of sulphur should not be left in the gas, and proposes, therefore, as the most effective method of purifying gas, this treatment: first with ammoniacal liquor; second, with hydrated oxide of iron; third, with dry lime. As the iron will have removed the sulphuretted hydrogen, the refuse lime will not be offensive, while it will effectually remove the carbonic acid. This system of purification will, he thinks, reduce the quantity of sulphur to 10 or 12 grains per 100 cubic feet. Most gas engineers and chemists differ from Dr. Letheby on this point, however. Dr. Schilling says (in his *Journal für Gasbeleuchtung* for 1869, p. 484): "20 grains of sulphur in 100 cubic feet of gas are entirely unobjectionable. Under the most favorable circumstances, with no ventilation whatever, it would give the atmosphere of a room only 1 part of sulphurous acid in 500,000 parts of air." Prof. William Odling, secretary of the London Chemical Society, has spoken very clearly on this subject in his lecture to the British Association of Gas Managers, June 2, 1868, which appears in the *Journal of Gas-Lighting* for 1869, p. 81, and I have found that his views are those generally entertained by chemists and gas engineers. He said: "I am altogether at issue with the public when they maintain that the sulphur of gas produces, by its combustion, oil of vitriol, or that the amount of sulphur ordinarily contained in gas is of any consequence whatever; and a little consideration will, I think, satisfy you of the soundness of this position. We will assume that coal-gas contains not 20, but 40 grains of sulphur in 100 feet—a quantity, at any rate, greatly exceeding the reality. Now, making another extravagant assumption, that the whole of these 40 grains of sulphur would be completely burned—and in reality they would be burned very incompletely—they would furnish, by their combustion, 80 grains of sulphurous acid gas. This quantity of the produced sulphurous acid would occupy at ordinary temperatures about $\frac{1}{15}$th part of a cubic foot, and since 100 cubic feet of our coal-gas gives $\frac{1}{15}$th of a cubic foot of sulphurous acid, 1500 cubic feet of coal-gas would be required to furnish one cubic foot of the acid, even upon the extravagant assumptions we have purposely made. But the combustion of 1500 feet of coal-gas would produce something besides sulphurous acid. It would produce at least 1000 cubic feet of carbonic acid, and, in addition to its dilution by other gases and vapors, we should have our sulphurous acid diluted by 1000 times its volume of carbonic acid. Now, if we can get at the proportion of carbonic acid in the atmosphere of a room highly illuminated with gas, and take the $\frac{1}{1000}$th part of that proportion, we shall be able to form some notion of the amount of sulphurous acid present. You will remember that the amount of carbonic acid furnished by the breath of one individual is equal to that furnished by two 3-feet gas-burners, and that the maximum amount of carbonic acid found in the atmosphere of a crowded theatre was 0.32 per cent. Now, if, in addition

to our previous unreasonable suppositions, we further suppose that an atmosphere contains 0.2 per cent. of carbonic acid furnished by gas combustion, you will see that the whole matter becomes a *reductio ad absurdum*—that we might actually have one-half millionth part of sulphurous acid present in the air of a gas-lighted room." The facts and opinions here quoted effectually dispose of the second objection to oxide-of-iron purification.

Composition of the Purified Gas.—The following table shows the percentage composition of the purified coal-gas as it is delivered to consumers:

	Heidelberg.	Bonn.	Chemnitz.	London common.	London cannel.
Hydrogen............	44.00	39.80	51.29	46.00	27.70
Marsh-gas............	38.40	43.12	36.45	39.50	50.00
Carbonic oxide.....	5.73	4.66	4.45	7.50	6.80
Olefiant gas and other hydrocarbons	7.27	4.75	4.91	3.80	13.00
Nitrogen..............	4.23	4.65	1.41	0.50	0.40
Oxygen	not det.	not det.	0.41	not det.	not det.
Carbonic acid......	0.37	3.02	1.08	0.70	0.10
Aqueous vapor.....	not det.	not det.	not det.	2.00	2.00

The difference in the percentages of carbonic acid is largely due to the method of purification. When lime is used, nearly all of this gas is removed, otherwise not. As the specific gravity or density of the hydrogen and marsh-gas is much less than that of olefiant gas and the rich hydrocarbon vapors, the specific gravity of the gas made from the same coal is a tolerably accurate measure of its richness in illuminating constituents. The specific gravity of air is taken at unity (1000), hydrogen is 0.0691; marsh-gas, 0.5594; carbonic oxide, 0.9727; olefiant gas, 0.976; propene, 1.490; and butene, 1.940; benzol and other rich vapors, much higher. Hughes in his treatise on gasworks gives the following estimate of the specific gravities of gases of different illuminating powers: 12-candle gas, .400; 14-candle, .425; 16-candle, .450; 18-candle, .475; 20-candle, .500, etc. This would not be even approximate for gas containing much carbonic oxide, as that prepared by the aid of steam. (See WATER-GAS.)

As it is sometimes desirable to estimate the yield of gas from coals in percentages by weight, the following data will be useful: (1) the specific gravity is the ratio of weight compared to that of air as a unit; (2) 1000 cubic feet of air weigh 76.708 pounds avoir.; (3) multiply 76.708 by the specific gravity, and the product is the weight of 1000 cubic feet of the gas. Hydrogen has a specific gravity of .0691; $76.708 \times .0691 = 5.30$ pounds; marsh-gas = specific gravity .5594; 1000 cubic feet weigh 42.91 pounds; 1000 cubic feet carbonic oxide, specific gravity, $.9727 = 74.61$ pounds; 1000 cubic feet olefiant gas, specific gravity, $.976 = 74.86$ pounds.

The station-meter is the apparatus through which the purified gas next passes on its way to the holder. This is constructed on the same principle as the wet meter, described farther on; it measures the gas produced and registers the quantity in cubic feet.

The holder or gasometer is the vessel in which the gas is stored. It consists of an enormous bell, or a cylinder with a conical top, constructed of iron plates, and floating in a cistern of water. The bell is supported by chains led over pulleys fastened to iron columns, and provided with weights to counterbalance the greater part of the weight of the holder, which is not allowed to exert a pressure on the gas more than equivalent to a column of water six inches high, this pressure being sufficient to force the gas through the mains to the consumers. In order to economize depth in the cisterns, the holders are often telescopic. The largest holder in the world is in London; it is 230 feet in diameter, and holds 3,000,000 cubic feet of gas. The largest holder in the U. S. is that of the New York Gas-Light Co. on 21st street. It is 168 feet diameter, is supported by 16 columns 72 feet high, and stands 70 feet high when full. Its capacity is 1,500,000 cubic feet.

The governor or pressure-regulator is an automatic valve through which the gas passes from the holder to the consumers. It serves to regulate the pressure of the gas in the mains.

The mains distribute the gas throughout the city, being laid about three feet under ground. They are generally made of cast iron, and are from 24 inches down to 3 inches in diameter. They are cast in convenient lengths, one end being enlarged into a socket, which receives the small end of the next length. The joint is made tight with hempen rope and lead. A certain percentage of leakage is unavoidable, but this can be reduced to a minimum by the exercise of a little care. The best plan is to test each length of pipe by closing one end with a plug, connecting the other end with a small forcing air-pump, such as is used by gas-fitters, and while the pipe is immersed in water forcing air into it. Bubbles of air passing through the pipe will reveal every imperfection in the metal. The location of each leak can be recorded by making a circle around it with chalk. Small holes can be closed by hammering the metal together; if large holes are detected, the pipe should be rejected. Immersing the pipes in hot coal-tar is a very effective preventive of leakage. Leakage is said to often amount to 16 per cent. of all the gas produced, or even more; by the above-mentioned precautions it may be reduced to 2 per cent. As there is always a certain condensation of water and oily or tarry matter in the mains, receivers or *wells* are constructed at convenient points, and the mains are laid inclining towards them. From time to time the condensed liquids are pumped out of the wells into a portable tank and thrown into the tar-well at the works. Complaint is sometimes made of an excessive condensation of naphthalene in crystals or crusts, which seriously diminish the capacity of the pipes. According to J. Lawrence Smith, bitumenized iron pipe is extensively used for gas in France. It is made from 1¾ to 28 inches in diameter. The base of the pipe is sheet iron, leaded, varying in thickness according to the required size and pressure; each section of pipe is made of two sheets, that are first riveted together separately with tinned rivets, and plunged into a bath of melted lead; these two pieces of pipe are then riveted together, and the junction of the two well tinned. The entire pipe is now 13 feet long. On the ends are convenient sockets and spigots, made of a mixture of lead and antimony, which serve to unite the sections of pipe when laid in the ground. The exterior surface of the pipe is coated with tar, and around this is wrapped a cord; this cord is then covered with melted pitch, and the pipe then rolled in coarse sand until it has acquired a thickness of from one-fourth to five-eighths of an inch. Chameroy & Co. of Paris manufactured between the years 1838 and 1867, of this pipe for gas, 3160 miles; for water, 897 miles—of a total value of $7,708,400.

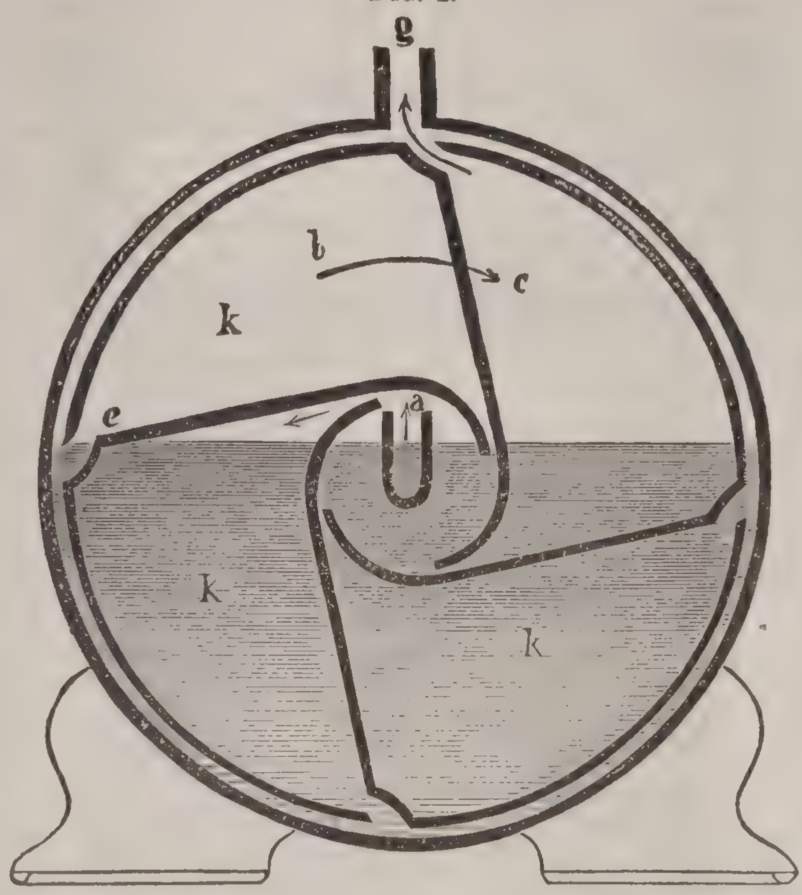
Service-pipes of wrought iron convey the gas from the mains to the buildings of the consumers. They should be protected when crossing sunken areas, as otherwise they are liable in cold weather to be entirely closed by the hoar-frost formed in them by the freezing of the aqueous vapor always present in gas.

The house-meter receives the gas when it enters the premises of the consumer, measures the quantity which passes through it, and records it in cubic feet on a series of dials. In the early days of gas-lighting, consumers were supplied by contract, according to the number of burners and the number of hours the gas was burned. To avoid excessive use beyond the time agreed upon, the gas was turned on and off the premises at the proper times by an employé of the gas company. Sir John Congreve invented an "hour-meter," to be connected with the inlet cock, which was simply a clock which ran only while the cock was open, and thus recorded the hours of consumption. This system resulted in an enormous waste of gas, as the consumer who paid as much for lighting one burner as for all his burners was sure to light them all. The ingenuity of the gas engineers was then severely taxed to invent a meter by which the quantity of gas actually consumed could be accurately measured. Their efforts were at last entirely successful, and the meters now in use are wonderfully simple and extremely accurate. The measurement of gas presents difficulties not encountered in any other case. The gas must be measured while in actual use, as no system of measurement and storage would be practical. Its flow must not be interrupted in the slightest degree, as otherwise the lights would be extinguished, or at least be made to flicker in a manner that would be unendurable.

Samuel Clegg in 1815 constructed the first meter, consisting of two gas-holders working alternately, which was a failure. In 1816 he invented a rotating meter, applying the principle on which all wet meters are now constructed. This meter was still very imperfect. In 1819, John Malam invented the four-chambered drum meter, which was improved by Crosley, Wright, and others, and is now in use. Malam also invented a dry meter in 1820, consisting of six bellows radiating from a shaft. In 1833, Bogardus, an American (Bojardin, a Frenchman, some say), invented a dry meter, which consisted of a vessel divided by a flexible diaphragm, which was the parent of all subsequent dry meters. Defries invented the three-chamber dry meter now in use, and Croll and Richards invented the two-chamber or double-bellows meter now very generally used. Two kinds of meters are now employed: (1) the "wet meter," which must be partially filled with water to be effective; (2) the "dry meter," which requires no liquid. *The wet meter* consists of a hollow metal case containing the measuring drum, and a box front containing the regulating valves and the gearing which connects the measur-

ing drum with the index dials. The measuring drum is divided into four compartments or chambers by oblique

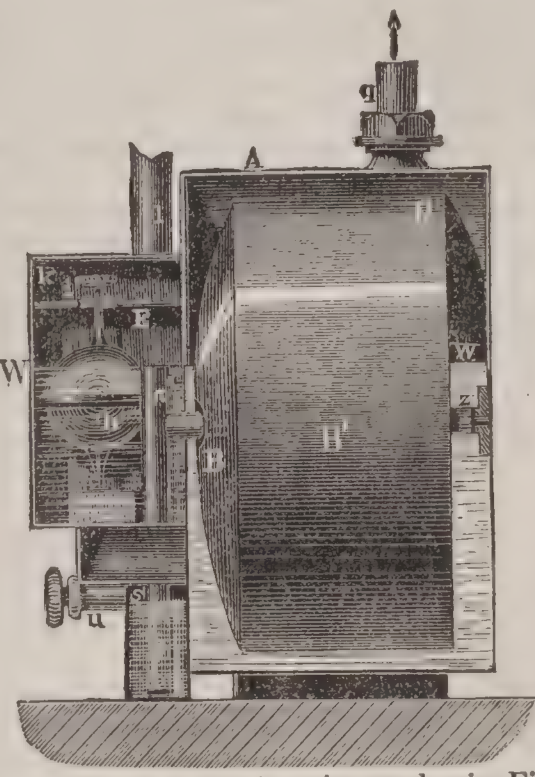
FIG. 2.



Vertical section of the early wet meter. The gas enters the chambers k at the centre through the tube a, and passes out through the slits e on the periphery of the drum, escaping at the outlet g.

partitions. This drum revolves upon a horizontal axis. It is immersed about three-fifths in water, receives the gas

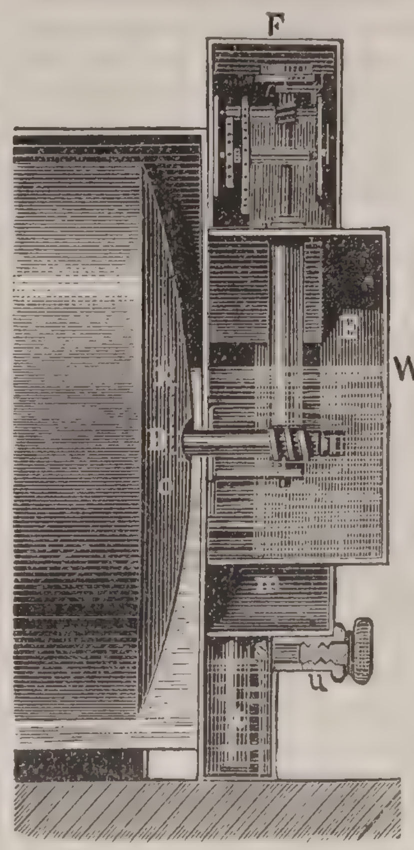
FIG. 3.



Section of the modern wet meter, shown also in Figs. 4 and 5. The gas enters by the inlet-pipe l to the space k, passes through the valve i to the space E, through the tube n to the space B of the drum, through the inlet slits to the measuring chambers, thence through the outlet slits to the space above the water-line W, and through the outlet pipe q to the burners. The tube n serves also as an overflow, and carries the excess of water to the waste-water cistern m (Fig. 4). W is the water-level, regulated by the overflow-tube n. If the level falls, the float h drops and closes the valve i, preventing the passage of gas through the meter.

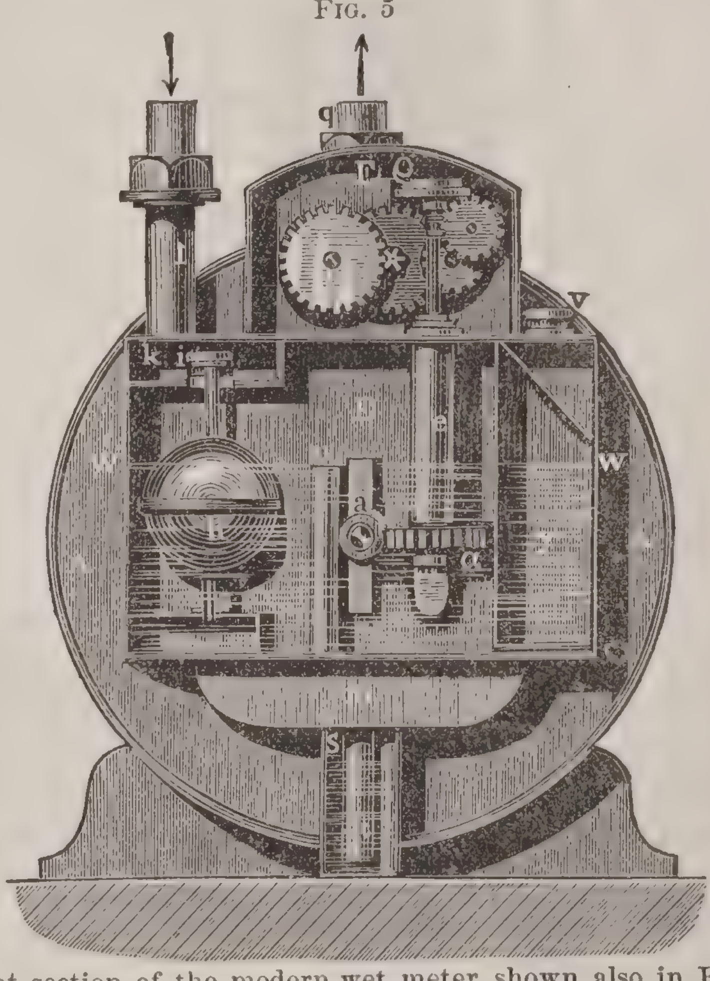
through inlet slits on one side, and discharges it through outlet slits on the opposite side. The compartments are occupied successively by gas and water. The position of the slits of each compartment is such that one or the other is always below the water-line; thus the gas can never enter the chamber and escape from it at the same time. The surface of the water forms the bottom of the measuring chamber, and the water-level determines the capacity of the gas space in each chamber. As the drum revolves, the inlet slit emerges above the water-line, when gas enters, imparting an impetus to the drum, which continues to revolve, the space in the chamber above the water-line receiving gas till the chamber is full. Although there are four chambers in the drum, the obliquity of the dividing partitions makes nearly a half revolution necessary to bring the outlet slit above the water-line; this occurs an instant after the inlet slit on the opposite side has passed below the water-line. As the chamber now passes below the water-level, the gas escapes, and the chamber is finally filled with water, the drum operating on the principle of a turnstile. It is the pressure of the gas acting on the compartments of the drum in succession that causes it to revolve. Unless there is a free escape for the gas from the meter through the burners, the rotation of the measuring drum ceases, as the pressure on the outlet side of the drum becomes equal to that on the inlet side, and there is no pressure against the compartments. The revolutions of the drum are registered by the action of an endless screw on its axis, which moves a train of toothed wheels bearing hands on dials, which indicate cubic feet. As the position of the water-line regulates the capacity of the measuring chambers, it is carefully protected by very simple devices. To prevent its falling by evaporation of water into the gas, and thus causing the meter to pass more gas than it registers, a float-valve is provided (h i, Figs. 3 and 5), which shuts off the gas as soon as it registers 2 or 3 per cent. against the company. To prevent its rising by the return of condensed water from the house-pipes into the meter, and thus registering against the consumer, the tube (n, Figs. 3 and 5) which admits gas to the drum is set in such a position that it serves as an overflow, conveying superfluous water to a waste-water cistern below. When this cistern is filled, the water rises and prevents the flow of the gas to the drum.

FIG. 4.



Section of the modern wet meter, shown also in Figs. 3 and 5, described under Fig. 3.

FIG. 5



Front section of the modern wet meter, shown also in Figs. 3 and 4. a is the screw on the axis of the drum which turns the toothed wheel a, the axis of which passes through the tube e to the system of wheels in the space F which move the hands on the index-dials shown in Fig. 8.

Thus, if the meter *tends* to become inaccurate, it refuses to deliver gas, and demands either a further supply of water or to be relieved of an excess; either of which forms of relief can be readily applied by any intelligent person who understands the construction of the meter.

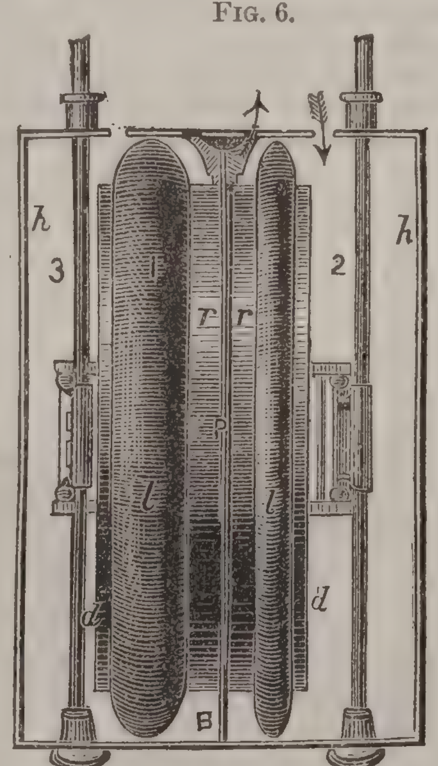
Meters are liable to freeze, when the drum becomes fixed and the flow of gas is prevented. A frozen meter may be readily thawed out by covering it with a cloth and pouring boiling water over it. In exposed positions the meter should always be protected by some non-conducting material, such as woollen cloths, felt, straw, tan-bark, sawdust, or sand, or the water in the meter may be replaced by glycerine or a solution of chloride of calcium in water, containing 4 pounds in each gallon. These liquids neither freeze nor evaporate.

When the gas goes out in a house supplied through a wet meter, it may be due to (1) a deficiency of water, (2) excess

of water, (3) freezing of the meter, (4) freezing of the service-pipe, (5) condensation of water in the house-pipes. The best and safest plan is to send for a gas-fitter or to the office of the company; but as the difficulty is most likely to occur during the evening, when help can rarely be obtained, it is well to know how to meet the emergency. (1) Close the cocks of all the burners which are open save one; (2) go to the meter with a candle, which must be held at a distance to avoid explosion; (3) turn off the gas at the main cock between the street service-pipe and the meter; (4) unscrew the plug *u* (Figs. 3 and 4) of the waste-water cistern, to let out any excess of water present; (5) unscrew the supply-plug *v* (Fig. 5) and the overflow plug (not shown in the figures, the tube *n* serving as an overflow in this meter), and pour in gently a small quantity of water till it issues from the overflow or at *u*. When it ceases to flow, carefully replace all the plugs and turn on the gas, when the meter will be in working order. (6) If the meter is frozen, pour boiling water over it, and run a little hot water through the orifice *v*, letting it escape at *u*, or at the overflow. (7) A frozen service-pipe generally necessitates an excavation and the application of heat outside the house. (8) Condensation in the pipes is first indicated by a flickering or jumping of the lights, due to the partial obstruction of the gas by the accumulation of water in the depressions in the line of pipe, which breaks it into bubbles. Removing a burner and blowing violently into the pipe will sometimes force the water beyond the hollow. The aid of the gas-fitter will generally be necessary to remedy this difficulty, by placing the meter in a cool situation or inclining the pipes so that condensed water will all trickle back to the meter.

The dry meter consists of two or three chambers, each divided by a flexible partition or diaphragm, by the motion

FIG. 6.

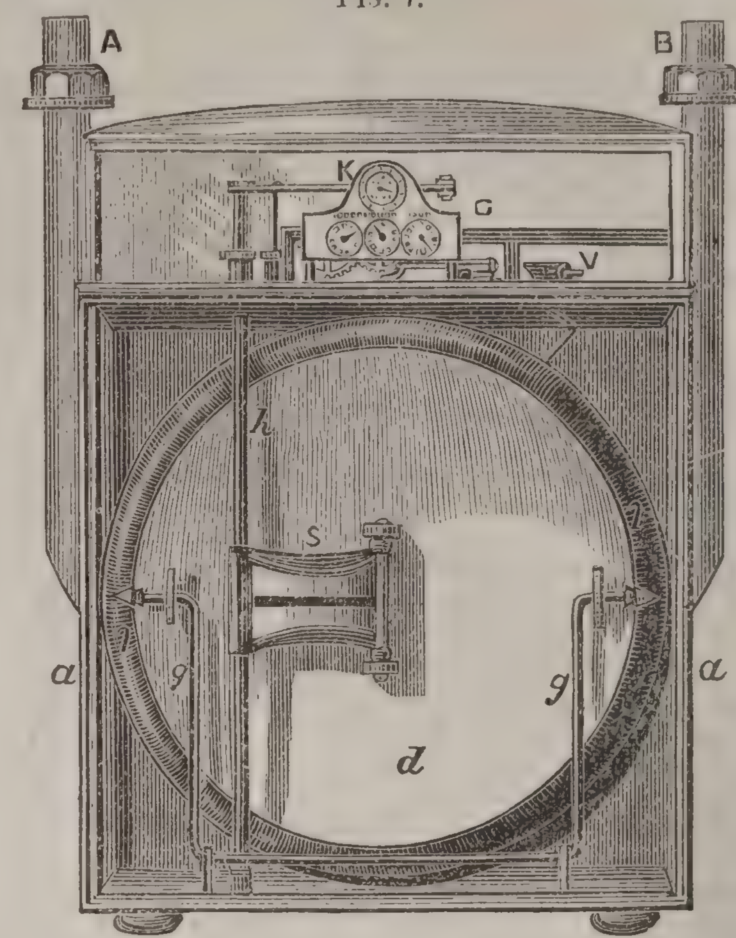


Side view of the measuring chambers of a dry meter. The case is divided by the partition P into two independent compartments; in each of these is a flexible chamber, formed by the rings *r r*, the disks *d d*, and the leather belts *l l*. Each disk is supported and kept in the same plane in its motion by means of the horizontal arm *s* (Fig. 7), and the guides *g g*. The rods *h h*, bearing the arms *s s*, pass through a stuffing-box into the upper chamber C, and bear horizontal jointed levers, giving motion to the slide-valves which regulate the flow of gas into the various compartments, and also working the system of toothed wheels which record the quantity of gas passing through the meter on the index-dials.

of which the capacity on one side is diminished, while that on the other is increased. By means of slide-valves like those of a steam-engine, worked by the movement of the diaphragms, the gas to be measured passes alternately in and out of each space. The movements of the partitions are recorded by clockwork on dials which indicate cubic feet. The diaphragms in all the chambers are so connected that they move in concert. The two-diaphragm meter of Croll and Richards (Figs. 6 and 7) is most used. Defries' three-diaphragm meter is also extensively employed. If a dry meter has been standing for some time, it sometimes fails to move, from the adhesion of the surfaces of the slide-valves. It can often be started by turning off the gas at the meter, opening all the burners in the house, and then turning the gas on at the meter again suddenly and fully. This treatment is specially effective just at dark, when the pressure in the mains is greatest. If the lights be unsteady with a dry meter, it is due to a stiffness of the working parts, and the meter should be repaired.

Comparative Advantages of Wet and Dry Meters.—Wet meters being simpler in construction, composed entirely of metal, and having no valves except the float, are most durable and less liable to get out of order. They are, however, liable to stop from freezing, from too much or too lit-

FIG. 7.

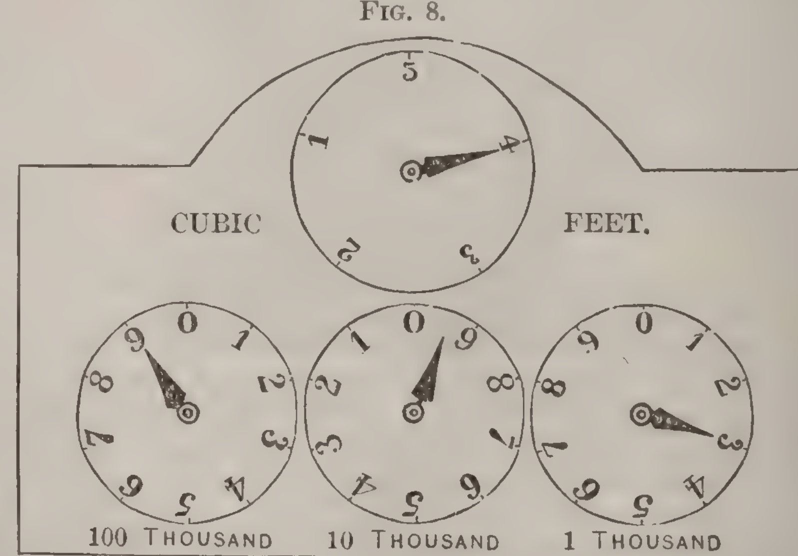


Front view of the dry meter. A is the inlet, B the outlet. The gas enters at A, passes to the valve-box V, enters the space 2 (Fig. 6), and the left-hand chamber *l r*, while its pressure forces the gas out of the space 3 and the right-hand chamber *r l*. When the left-hand chamber is full and its companion empty, the slide-valves reverse the flow of gas, and the empty chamber and the space 3 receive, while the full chamber and the space 2 deliver gas.

tle water, and from sending moisture into the pipes. They also register vapor of water as gas, though the quantity is too small to be of any consequence. The dry meter is not liable to any of these objections, but being more complicated and more delicate, it is more liable to wear and to get out of order. The inaccuracies which result from wear or corrosion are generally in favor of the consumer, as gas leaks from one space to another and escapes being measured. The dry meter is now more generally used.

The index of the meter is very simple. It consists of a number of dials like that of a watch, except that while the

FIG. 8.



The index of a dry meter.

hour and minute hands of a watch traverse the same dial, the different hands of the meter have each a separate dial. Fig. 8 is a dry-meter dial. The dial at the top, which indicates units of feet, is only used in testing the meter. The other dials show 89,300 feet to have passed through the meter; if a month hence the hands indicate 93,400, then 4100 feet will have passed the meter during the month.

The accuracy of the meters is very often questioned by consumers. The resemblance of the dials leads them to infer that, like clocks, the meters may run fast or slow. But the case is not parallel; the meter is an engine in which the gas is the motive-power, and unless the gas passes through the meter, it cannot move. On its dials are faithfully recorded the number of its revolutions in cubic feet. All waste and leakage is recorded as well as the useful consumption. Some think that the increased pressure makes the meter spin round faster and record against the consumer; but if he regulate the burners so as to prevent "blowing," he at once neutralizes the effect of the increased pressure. From the nature of things, the injury which the meter suffers in use must generally be against

the company. If a valve leaks or a rust-hole occurs in the measuring drum, or a crack in the leather, gas gets through without being recorded. Sometimes the valves of a dry meter become fixed in such a position as to let the gas through without moving. The meters are all tested by State inspectors by passing a certain number of cubic feet through each, and noting whether it is properly recorded on the dials. In New York and Massachusetts a meter is stamped correct when it varies less than 2 per cent.; in Ohio the tolerance is 3 per cent. Prof. Wormley, State inspector for Ohio, in testing 2321 new meters found only 13 that varied over one-half of 1 per cent. Mr. Stimpson, State inspector in Massachusetts, in one year tested 11,309 meters; only 148 failed to come within the requirements of the law. Very few of these varied 5 per cent.; 62 averaged 6.47 per cent. against the companies; and 85 averaged 4.5 per cent. short.

FIG. 9.

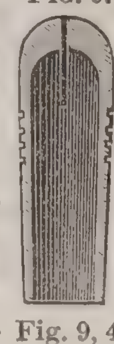


FIG. 10.

Fig. 9, 4-foot bat-wing, lava tip. Fig. 10, 2-foot fish-tail, lava tip.

Gas-burners now in use are of three kinds: (1) the *bat-wing*, a burner with a slit (Figs. 9, 11, 14); (2) the *fish-tail*, with two oblique holes in the end facing each other (Figs. 10, 12, 15, 18, 19); (3) the *argand*, a circular burner with a ring of small holes, and provided with a glass chimney and an interior supply of air (Figs. 16, 17).

FIG. 11.

FIG. 12.

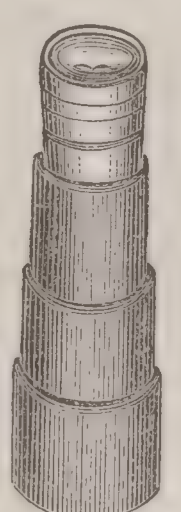


FIG. 13.

FIG. 14.

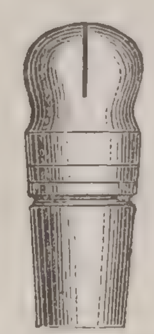
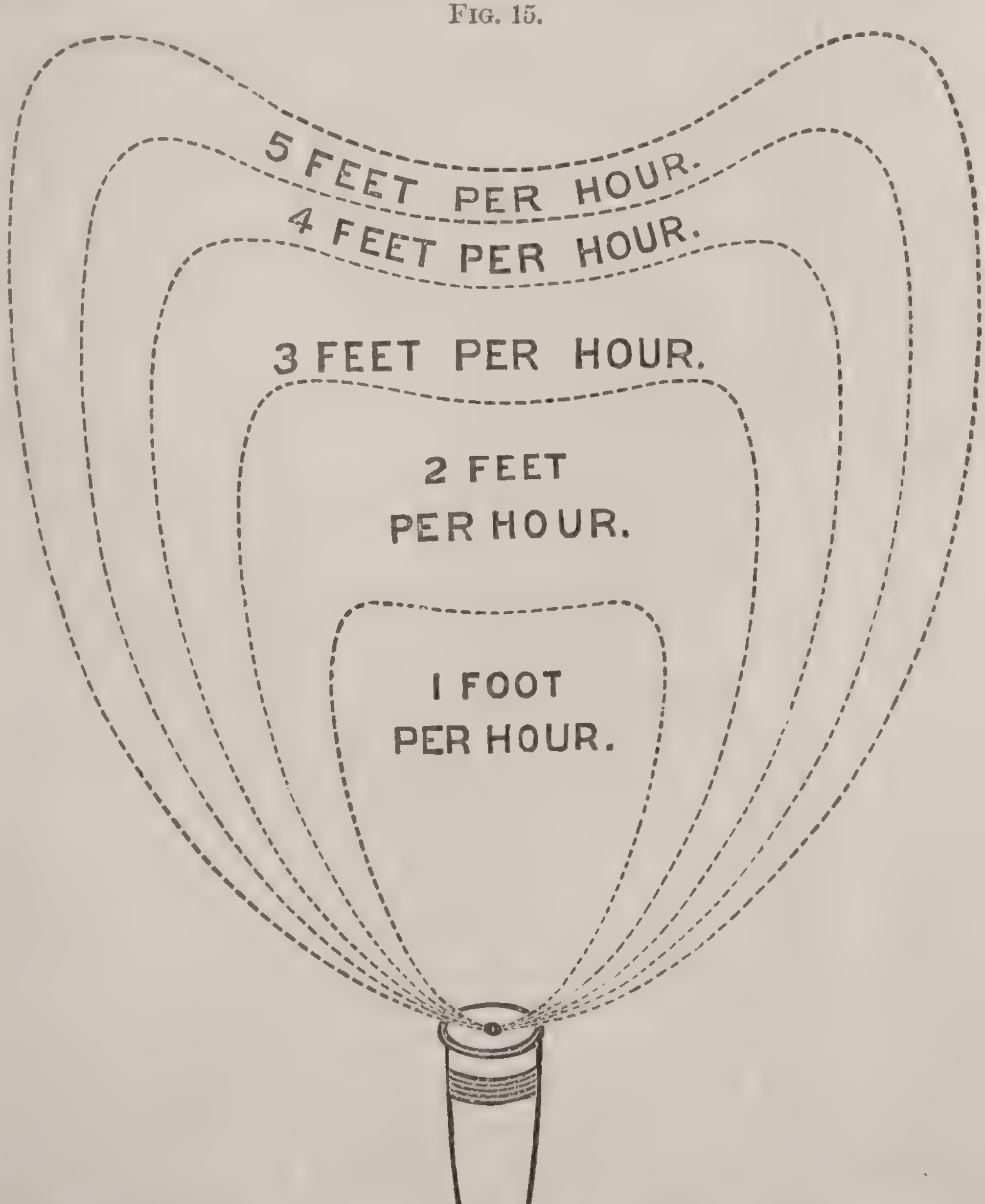


Fig. 11, 7-foot bat-wing, lava tip, mounted in pillar. Fig. 12, 6-foot fish-tail, lava tip, mounted in pillar. Fig. 13, brass pillar for lava tips. Fig. 14, 7-foot bat-wing, lava tip.

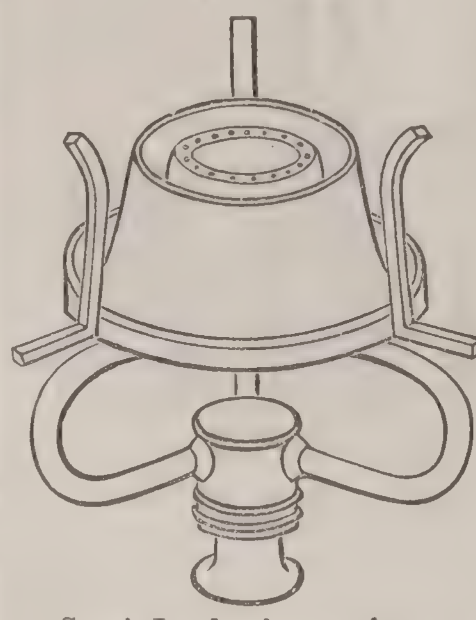
FIG. 15.



Form and sizes of flames from a 5-foot fish-tail, lava-tip burner.

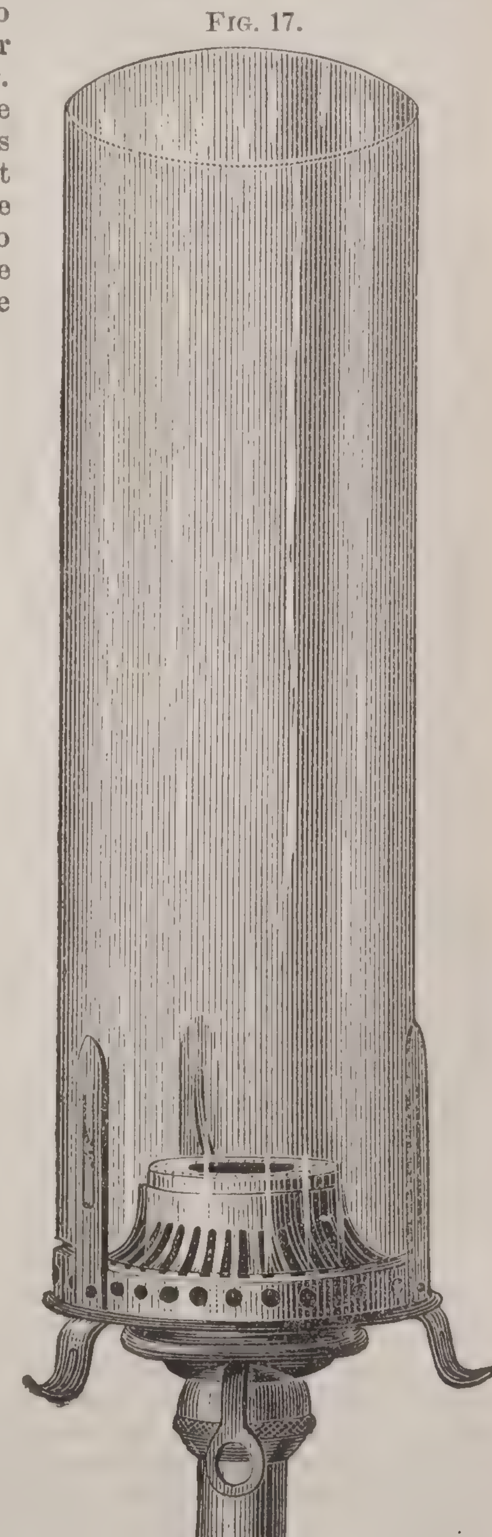
Burners are made of iron, brass, or soapstone ("lava"); the latter is preferable, as the holes are not liable to be stopped by rust. The amount of light produced by a given gas varies enormously with the conditions under which it is burned. The maximum amount of light is obtained by burning it on the verge of smoking, while in the Bunsen burner, used for heating purposes in chemical laboratories, the flame is blue and non-luminous. The loss of light is due to a too rapid mixing or contact of the gas with the air. This is controlled by the size and shape of the holes in the burner, the height of the chimney, and the distribution of the air (in the argand), and in all cases by the pressure. The holes and slits for rich gas should be small, as such gas requires more air than poor gas. Under the same pressure a burner which consumes 4 feet of gas per hour gives more light than two burners consuming each 2 feet. There is no economy of light in small burners. The pressure of the gas is a most important consideration. Argands give most light under a pressure of $\frac{1}{10}$ inch, bat-wings and fish-tails under a pressure of $\frac{3}{10}$ to $\frac{4}{10}$ inch. As gas is supplied to consumers under pressures varying from 3 or 4 inches down to $\frac{1}{10}$, it is very desirable to check the flow of gas when it is excessive. This can be done by the use of regulators, by turning the gas off at the meter, by partly closing the cocks on the fixtures, or by introducing a check into the burner. Check-burners should always be used; they are constructed in various ways—always by placing some obstruction in the way of the gas to retard its escape. A very simple plan is to screw a 5 or 6 foot burner over a 3 or 4 foot burner. With regard to a choice of form, the *argand* is best for ordinary gas; it gives a very steady flame and consumes the gas to the best advantage. The best form of argand made

FIG. 16.



Sugg's London burner, lava.

FIG. 17.



Gleason's noiseless argand burner, of brass, with valve.

in the U. S is shown in Fig 17. It is provided with a cut-off or check of very simple construction. The best

FIG. 18. FIG. 19. FIG. 20. FIG. 21.

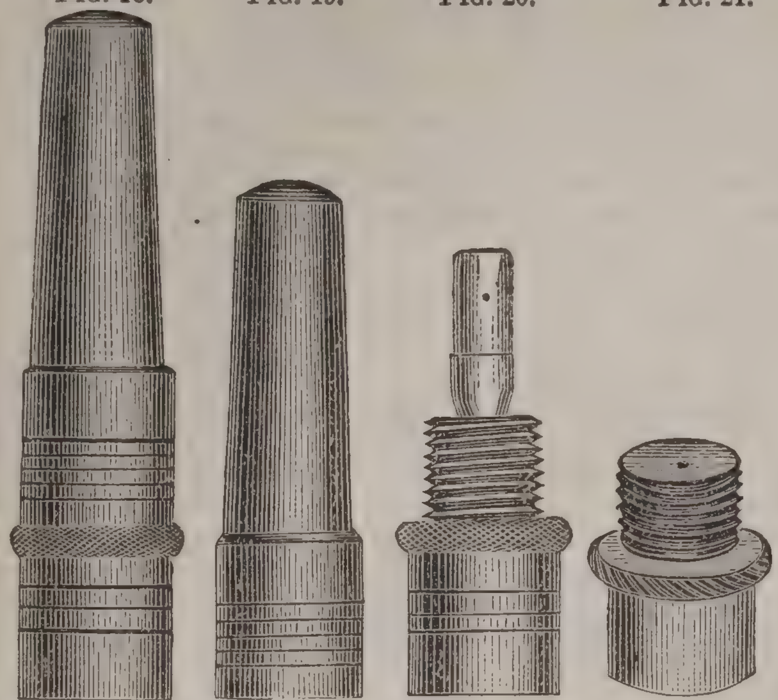


Fig. 18, check burner, a 5-foot burner screwed upon a 3-foot burner. Fig. 19, 5-foot brass, fish-tail burner. Fig. 20, 3-foot base for a check burner. Fig. 21, another base for a check burner.

burner yet constructed is Sugg's London burner, shown in Fig. 16 without its chimney. *Bat-wing* burners cannot be used in globes or shades, as the flame is so broad as to crack the glass; *fish-tails* must then be employed. Five or six foot lava-tipped check bat-wings are the most economical burners for general use. The gas referees of London found that some burners gave only one-fourth the light obtained from the same quantity of gas by a Sugg's burner. They estimated that the use of good burners in London would save one-fourth of the $10,000,000 annually paid for gas.

The loss of light by the use of shades, chimneys, etc. is very considerable, largely due to the conversion of light into heat. The following numbers, selected from the results of William King of Liverpool and Prof. F. H. Storer of Boston, are a sufficient illustration:

Description of glass.	Thickness of glass.	Loss of light
Clear glass (King)	......	10.57
Ground glass "	......	29.48
Smooth opal "	......	52.83
Ground opal "	......	55.85
Thick English plate (Storer)	$\frac{1}{3}$ inch	6.15
Crystal plate "	$\frac{1}{8}$ "	8.61
English crown "	$\frac{1}{8}$ "	13.08
Double English window "	$\frac{1}{8}$ "	9.39
Double German (Belgian) (Storer)	$\frac{1}{8}$ "	13.00
Single German (Belgian) "	$\frac{1}{16}$ "	4.27
Double German (Belgian) ground (Storer)	$\frac{1}{8}$ "	62.34
Single " " " "	$\frac{1}{16}$ "	65.75
Berkshire, Mass., ground (Storer)	$\frac{1}{16}$ "	62.74
Orange-colored window-glass "	$\frac{1}{16}$ "	34.48
Purple " " " "	$\frac{1}{8}$ "	85.11
Ruby " " " "	$\frac{1}{16}$ "	89.62
Green " " " "	$\frac{1}{16}$ "	81.97
A porcelain transparency "	$\frac{1}{16}$ "	97.68

Lighting gas by electricity has recently been introduced in theatres, halls, etc. with great advantage. As it is an instantaneous operation, it results in great economy by rendering it unnecessary to light the gas before it is actually wanted, and in sparing the attendants the great exertion required in applying the torch at great heights. It may be effected by stretching a fine platinum wire above each burner, and heating it to a white heat by a current of electricity when the gas is turned on. A better plan is to use the Ruhmkorff coil. In this case each burner is isolated from the house-pipes by a hard rubber connecting ring. A series of wires is then arranged by which the electric current is made to leap in sparks to the tip of each burner in succession when the gas is turned on. Systems have been invented by which the gas of the street-lights is turned on and off and lighted by electricity from a central office.

Pressure.—As already stated, a certain amount of pressure is required to force the gas through the street-mains, house-meters, pipes, and burners. The pressure is measured by the height of a column of water supported by the gas in a U-shaped tube, one end of which is open to the air, while the other is connected with the gas-supply. It is estimated that there should be a pressure of 1 inch at the entrance to the premises of every consumer, 0.2 inch being required to force the gas through the meter, 0.2 inch for the house-pipes, and 0.6 inch for the burners. This pressure is exerted by the weight of the great gas-holders at the works. Were the consumption of gas uniform during the entire twenty-four hours, the holder could be properly balanced once for all, and a uniform pressure would be exerted at all times—four or five inches are found to be necessary for large districts—but when no gas is burned, no pressure is required, and when little gas is burned, four or five inches would be excessive. Consequently, the pressure must be graduated according to the hourly consumption. For this purpose the *governor*, already mentioned, is employed at the works to regulate the flow, and consequently the pressure, of the gas from the holder to the street-mains. The following table exhibits the variation in pressure caused by irregularities of consumption. The holders of the New York Gas-Lighting Co. are on East 21st street; its district extends from Grand street to the lower end of the island at Whitehall street; Hester street is well within the district.

Pressure of the Gas in Inches of Water.

	3 P. M.	4 P. M.	5 P. M.	6 P. M.	7 P. M.	10 P. M.	12 P. M.
21st street	1.7	2.	5.5	4.2	2.9	1.9	1.0
Hester street	1.6	1.7	2.4	2.2	1.9	1.6	1.2
Whitehall street.	1.0	1.	0.6	1.1	1.1	1.0	0.8

It is thus seen that a uniform pressure throughout the district supplied is absolutely impossible. In order to secure a sufficient pressure at the extremities of the district, an excessive pressure must be produced at the intermediate points; and as the pressure must be varied from hour to hour at the works, it will vary at the premises of most of the consumers. The consumer must therefore regulate the pressure for himself: (1) by carefully adjusting the main cock at the meter; (2) by adjusting the cock at each burner; (3) by using check burners; (4) by attaching a regulator at the meter. It sometimes happens that the consumer cannot get sufficient pressure to supply his burners, when he of course fails to get the light he requires, and concludes that the gas is poor. This difficulty may be due to several causes: (1) insufficient pressure at the works; (2) the street-mains are too small or are obstructed; (3) the service-pipe is too small or obstructed; (4) the meter is too small or out of order; (5) the house-pipes are too small or obstructed; (6) the fixtures are obstructed; (7) the burners are too small, defective, or obstructed. By comparing notes with neighboring consumers, and consulting an intelligent gas-fitter, the real cause of the deficient light can generally be ascertained. In large buildings there should be a separate cock and regulator on each floor to prevent irregularity of pressure.

Regulators are constructed on the same principle as the governor at the works. They contain automatic valves which partially close when the pressure increases, and open when it diminishes. They may be applied to the entire supply of gas at the meter or to each burner.

The illuminating power of gas is dependent upon several conditions (see FLAME): (1) liberation of solid particles of carbon from the olefiant gas and rich hydrocarbon vapors by the heat of the flame, or the oxidation of the hydrogen at points in the flame when the supply of oxygen is not sufficient for both hydrogen and carbon; (2) to the temperature of the flame, which renders the carbon particles luminous; (3) to the density of the materials burned; (4) to the density of the products. These conditions depend upon the chemical composition of the gas and the manner of its combustion. Gases rich in olefiant gas and heavy hydrocarbons furnish the most luminous flames. The character of the burner, the dimensions of the chimney with argands, and the pressure determine the manner of combustion by regulating the supply and admixture of air. A low pressure with a burner which secures a supply of air just sufficient to prevent smoking—*i. e.* the escape of unconsumed carbon—secures the maximum amount of light. The pressure and quality of the gas being fixed, it was formerly supposed that the light produced was directly as the rate of combustion, and that consequently two like burners consuming each 3 feet of gas per hour would give the same amount of light as one similar burner consuming 6 feet. Recent investigations make it extremely probable that the amount of light increases as the square of the consumption. (*Farmer's Theorem.*) Consequently, the light from the two burners would be $3 \times 3 + 3 \times 3 = 18$, while that from the one 6-foot burner would be $6 \times 6 = 36$. Thus, the large burner gives twice as much light for the same consumption as the two small burners; hence, the economy of a few large burners over many small ones.

Carburetting or Carbonizing Gas.—It having been established that the illuminating power of gas depends upon the presence of heavy hydrocarbon vapors, numerous means have been contrived and patented for adding such vapors to the gas. The materials available are the naphtha of coal-tar and the naphtha of petroleum or coal-oil. Coal-tar naphtha is by far the most effective, though most

expensive. It consists of benzol, C_6H_6, and its homologues, which are very dense and very rich in carbon. Petroleum and coal-oil naphtha consist of hydrocarbons of the marsh-gas series (see PETROLEUM), such as quintane, C_5H_{12}; sextane, C_6H_{14}; heptane, C_7H_{16}, etc., in which the ratio of carbon to that of hydrogen is less than half what it is in benzol, etc. Dr. Letheby (*Chem. News*, xi. 1865, p. 126) found that while 1 grain per cubic foot of gas of some naphthas increased the illuminating power 9 per cent., the same quantity of other naphthas raised it only 1.69 per cent. Under favorable circumstances he found that a gallon of coal-tar naphtha would enrich 6000 feet of gas, adding over 10 grains per cubic foot, and increase its illuminating power 68 per cent., thus making it equal to 10,000 feet of the original gas. The practical gain is 4000 feet, costing the price of 1 gallon of naphtha, about $1. The conditions which effect the carbonization are, (1) quality of the gas, (2) quality of the naphtha, (3) construction of the carburetter, (4) temperature of the carburetter. The last condition is very essential to success. If the carburetter is placed in a warm situation, the naphtha evaporates too rapidly, the gas becomês overcharged, and the flames smoke. The burners must be adjusted to the character of the gas, and if the gas varies from day to day from irregularity in the carbonization, the annoyance becomes intolerable. Another difficulty arises from the condensation of the naphtha in the house-pipes and fixtures, by which they become obstructed and cease to deliver gas. These difficulties have led to the ill-success which has attended this apparently logical method of enriching gas.

Testing Gas.—In order to determine the value of gas for illuminating purposes, several modes of testing have been suggested: (1) Photometrical tests, by which the amount of light actually produced by a given quantity of gas is determined; (2) specific-gravity test; (3) tests for special objectionable impurities, particularly sulphur compounds and ammonia; (4) special tests intended to determine the comparative illuminating power of the gas: *a*, percentage of rich hydrocarbons condensed by chlorine, bromine, or fuming sulphuric acid; *b*, Henry's explosion test, showing the quantity of oxygen necessary to burn the gas and the quantity of carbonic acid produced; *c*, Fyfe's durability test, by which he determines the time required to burn a given volume of the gas through a jet $\frac{1}{35}$-inch in diameter with a flame 4 inches high; *d*, Erdmann's test, which determines the amount of air necessary to deprive the flame of the burning gas of a given size of all illuminating power; (5) gas analysis, by which the different constituents are accurately determined. The practical examination of gas is generally limited to the photometric test, the specific-gravity test, and the determination of ammonia and sulphur. For special purposes analysis is often resorted to. In England, where the quality of the gas is regulated by law, the specification is limited to photometric illuminating power and fixed maxima of ammonia and sulphur.

Photometric Test. (See PHOTOMETER.)—Two forms of the photometer only are used for testing illuminating gas: (1) Bunsen's photometer; (2) Lowe's jet photometer. *Bunsen's photometer*, as improved by Dr. Letheby, consists of a graduated bar about 98 inches long, placed on edge, having at one end a candle-holder, at the other a gas-burner. A saddle rests on the bar, and bears a disk of white paper made transparent by paraffine, except a spot in the centre. The instrument is set up in a dark room with dull black walls and ceiling. The test candle is of spermaceti, of uniform calibre, and of such a size as to consume as nearly as possible 2 grains of spermaceti per minute. The accessory apparatus consists of a balance to weigh the candle before and after the experiment, a governor to regulate the pressure of the gas, a pressure-gauge to show the pressure, a very accurate meter to show the consumption during each minute, a clock to strike minutes. The clock and meter are now combined with a single dial, bearing one hand to indicate minutes, and another to mark the consumption of gas, so arranged that when the consumption is exactly 5 feet of gas per hour the two hands move together, one exactly covering the other. To make a test the gas is lighted at the burner, the pressure regulated at 0.5 inch, the cock fixed so as to make the consumption as nearly as possible 5 feet per hour, or .0833 feet per minute. The candle is lighted, balanced, time when balanced noted, and the candle carefully placed in its socket at the end of the bar. The disk of paper is then moved along the bar till both sides are equally illuminated, which is easily determined by the disappearance to the eye of the opaque spot. This position of the disk is the point between the candle and the gas-burner at which equal quantities of light fall on the same area of surface. By the principle that the amount of light which falls on a given surface is inversely as the square of the distance, it is easy to determine the comparative illuminating power of the gas as compared with the candle. If the disk is midway between them, then the gas-flame equals the candle. If the disk is only half as far from the candle as from the gas, the gas-flame $= \frac{2 \times 2}{1 \times 1} = 4$ times the illuminating power of the candle. If one-third as far from candle, $\frac{3 \times 3}{1 \times 1} = 9$ candle-power; one-fourth, $\frac{4 \times 4}{1 \times 1} = 16$ candle-power. The bar being graduated on this principle, the observer, having found the proper position for the disk, reads the value of the gas-flame in candles. It is customary to make ten observations in as many minutes, and average the results. If on weighing the candle it is found to have consumed exactly 2 grains per minute, and if the meter shows a consumption of exactly 5 feet per hour, the test is complete. Otherwise, a correction must be made as follows: *Multiply the average observed candle-power by the grains of candle burned in 15 minutes, divide by the hourly consumption of gas, and divide the quotient by 6.* This gives the value of 5 feet of gas expressed in standard spermaceti candles burning 2 grains per minute or 120 grains per hour. (Note what has been already said with regard to Farmer's Theorem.) To determine the cost of such light, we have only to remember that 1 pound avoir. = 7000 grains. Thus, if the 16-candle gas costs $3 per 1000 feet, and spermaceti candles 40 cents per pound, 1000 feet of gas = 120 grains × 16 candles × $\frac{1000}{5}$ hours ÷ 7000 grains in a pound = 54.85 pounds; and 1000 feet of the gas ($3) furnishes as much light as 54.85 pounds of candles ($21.94). The same method of examination is applicable to oils and to the comparison of burners. The burner now used as the standard for ordinary coal-gas is Sugg's London patent (Fig. 16). *Lowe's jet photometer* is not properly a photometer. Its use is based on the production of a flame of a given height through the same single-jet burner. Under a standard pressure the flame will maintain a uniform height as long as the gas is unchanged in composition. The moment the density of the gas changes by the increase or decrease of any of its constituents, its flow—which is always inversely as the square root of its density—will be accelerated or retarded, and the flame will rise or fall. This instrument is an indicator of *constancy of quality*, not a photometer or *light-measurer*.

The Specific-Gravity Test.—As already stated, the chief diluents of coal-gas are hydrogen, specific gravity 0.069, and marsh-gas, 0.559, while the luminants are olefiant gas, 0.976, propene, 1.49, butene, 1.94, benzol, 2.71, naphthalene, 4.43, etc. The specific gravity of the mixture will depend, to a certain degree, on the ratio of heavy luminants to light diluents. This does not hold true in the presence of any considerable quantity of carbonic oxide, specific gravity 0.967, as when water-gas is a component, or of air, as in the Rand and Gale naphtha-gas. The table, at the end of this paragraph from Muspratt's *Chemistry*, will sufficiently illustrate the relation of specific gravity to illuminating power in coal-gas made by the usual process. The specific gravity was formerly determined by carefully weighing the gas in a light glass globe provided with a stopcock, making suitable corrections for temperature and pressure. Recently, a very simple method has been introduced, by which the operation can be accurately performed in a few minutes. The diffusive power of gases being inversely as the square root of the density, the density will be directly as the square of the diffusion. It is only necessary to determine the number of seconds required for equal volumes of air and of the gas to escape through the same opening, and to divide the square of the gas-seconds by the square of the air-seconds; the result is the specific gravity of gas.

$$\text{Sq. air-seconds} : \text{sq. gas-seconds} = \underset{\text{Sp. gr. of air.}}{1} : \underset{\text{Sp. gr. of gas.}}{x}$$

W. W. Goodwin, Esq., of Philadelphia, supplies the simple apparatus for this determination under the name of "the density test." (See *Am. Chemist*, ii. 177, 216.)

Name of Coal.	Cubic feet of gas per 2240 lbs.	Illuminating power, in candles.	Sp. gr. of gas.
1, Ponesfield	10,500	11.50	.398
2, Gosforth	10,000	12.00	.402
3, New Pelton	10,500	12.00	.415
4, West Hartley	10,500	12.50	.420
5, Pelaw	11,000	12.75	.420
6, Hasting's Hartley	10,300	12.50	.421
7, Leverson	10,800	12.50	.425
8, Pelton	11,000	14.00	.430
9, Washington	10,000	14.00	.430
10, Dean's Primrose	10,500	13.50	.430
11, Blenkinsop	9,700	14.00	.450
12, Washington cannel	10,500	18.00	.500
13, Pelton cannel	11,500	18.50	.521
14, Leverson cannel	11,600	18.00	.523

Impurities.—Ammonia is detected by moistened turmeric

paper; 2 grains in 100 cubic feet quickly redden it. It is determined by passing a measured quantity of gas through a glass tube filled with glass beads, moistened with a known quantity of a standard solution of oxalic acid. (See *Am. Chemist*, ii. p. 247.) Sulphur in the form of sulphuretted hydrogen is rarely found in purified gas, as it is all removed by the purifiers; but sulphur in other forms, bisulphide of carbon and sulphur compounds of unknown composition, is always present. Lime purification reduces the sulphur in these forms to 7 or 8 grains per 100 cubic feet. Iron purification is not so effective, as it leaves from 12 to 40 grains of sulphur per 100 cubic feet. (See what has been said under *Purification.*) The total sulphur is determined by burning a certain quantity of the gas through a Leslie burner, and collecting the sulphurous and sulphuric acids produced by ammonia, oxidizing all to sulphuric acid by bromine, and weighing as sulphate of baryta. (See *Am. Chemist*, ii. 247.) *Special tests* by chlorine, etc. are fully described in the works on gas mentioned at the close of this article.

Gas analysis, by which the more important gases are determined, is conducted over mercury in graduated tubes. (See BUNSEN'S *Gasometry*, translated by Roscoe, 1857; REGNAULT, *Cours élémentaire de Chemie*, Paris; *Neues Handwörterbuch der Chem.*, i. 493; WATTS, *Dict. Chem.*, i. 268; *Suppl.* 140; LETHEBY in *Am. Chemist*, ii. 177.)

The waste products of the manufacture of coal-gas consist of (1) coke, (2) ammoniacal liquor, (3) tar, (4) the spent lime or oxide of iron used in purification. (See lecture by Dr. Letheby on the waste products of coal-gas, *Chem. News*, xvi., 31, 44, 55, 68, 91, 95, 106.) *Coke*, the fixed residuum which remains in the retorts, and which amounts in quantity to about 66.66 per cent. of the coal, is a very valuable fuel and finds a ready sale. (See COKE.) *The ammoniacal liquor* is the source of nearly all the ammonia salts of commerce. By far the larger part of the nitrogen of the coal, which varies from less than 1 per cent. to nearly 2 per cent., is not converted into ammonia; it forms cyanides, sulphocyanides, bases, etc. The strength of the ammoniacal liquor depends chiefly upon the amount of water used in washing and scrubbing the gas. The strength of the liquor is estimated in degrees (Twaddle), or by the number of ounces of oil of vitriol required to neutralize a gallon. Each degree of Twaddle is equal to about 2 ounces of acid per imperial gallon. The liquor varies from 3° Tw. to 10° or 11° Tw. The maximum yield of ammonia is perhaps 45 gallons of 8-ounce liquor per ton of coal, equivalent to 34 pounds of sulphate of ammonia. The ordinary yield is about 25 gallons of 8-ounce liquor, equivalent to 20 pounds of sulphate of ammonia. In London only about half this quantity is obtained. In 1866 there were obtained at the Paris Gasworks 3000 tons of ammoniacal products, either sulphate or aqua-ammonia, from 421,000 tons of coal, or 0.712 per cent., or 16 pounds per ton. The ammoniacal liquor contains the ammonia in the form of hydrosulphate, acid carbonate, cyanide, sulphocyanide, chloride, and benzoate. By mixing it with lime and blowing steam through it the ammonia is expelled, and conducted to vats containing sulphuric acid, where it is absorbed and combined as sulphate, which is obtained in crystals on evaporation. This salt is used as a fertilizer, in the manufacture of alum, and for the preparation of other ammoniacal compounds. The tar is a very complex body. It was formerly thrown away, but is now the source of a great variety of useful products. The quantity obtained from a ton of coal varies with the character of the coal and the temperature to which it is exposed—the higher the heat the smaller the yield of tar; 11 to 18 U. S. gallons is the usual yield of tar from caking coals, the average being about 12 gallons. The Paris gasworks averaged 12¼ U. S. gallons in 1866. Cannel coals, used in some works in England and Scotland, yield a larger quantity. The principal constituents of the tar have been already enumerated in this article. The tar is used as a rough paint or varnish for iron and wood; for waterproofing paper and felt for roofing purposes; and for the manufacture of pitch for roofing, paving, etc.; NAPHTHA, DEAD OIL, BENZOL, TOLUOL, ANILINE, ANILINE COLORS, NAPHTHALENE, NAPHTHALENE COLORS, CARBOLIC ACID, CARBOLIC ACID COLORS, PICRIC ACID, etc., CRESYLIC ACID, ANTHRACENE, ARTIFICIAL ALIZARENE (which see; see also TAR). *The Refuse Oxide of Iron.*—The oxide of iron is used over and over again, being regenerated by exposure to the air, by which the sulphur extracted from the gas is liberated from the iron and left as free sulphur. When the proportion of sulphur reaches 40 or 50 per cent. the mixture is treated for the extraction of ammonia salts and sulphur, the purified oxide of iron being then returned to the gasworks to be used again. The refuse iron contains considerable cyanogen, which may be extracted by potash and sold as yellow prussiate. The *spent lime* is very offensive when fresh, as explained under *Purification*, and is useless for any purpose. After being weathered, however, it may be used with advantage as a fertilizer. Dr. A. Völcker gives the following analysis of weathered gas-lime; dried at 212° F.:

Caustic lime	18.23
Carbonate of lime	49.40
Sulphite of lime	15.19
Sulphate of lime (gypsum)	4.64
Magnesia and alkalies	2.53
Oxide of iron and alumina	2.49
Phosphoric acid	a trace
Insoluble sand, etc	0.28
Water of combination, with a little organic matter	7.24
	100.00

The fresh gas-lime contains considerable sulphide of calcium and hyposulphite of lime, which makes it useful for removing the hair from hides.

Gas from Coal-Tar.—Ever since the manufacture of coal-gas became an established industry the importance of converting the tar into gas, or of so conducting the destructive distillation as to prevent its formation, has been fully recognized, and the greatest variety of processes has been patented, all of which claim to make *more gas and better gas* from a ton of coal. The actual possibilities are estimated by comparing the weight of tar with the weight of gas from the same coal. 2240 pounds of average caking coal yield from 9000 to 10,000 cubic feet of gas of a specific gravity of, say, 0.430, equivalent to 296.86 or 329.84 pounds of gas. The same coal yields, say, 12 U. S. gallons of tar, the specific gravity of which is from 1.12 to 1.15, or 9.33 to 9.58 pounds per gallon, equal to 112 to 115 pounds. If this tar could be entirely converted into gas of .430 specific gravity, it would add 3394 to 3488 cubic feet to the yield of gas. The case is still more striking when, as in some cities in England and Scotland, cannel coal is exclusively employed, cannel coal yielding 10,000 cubic feet of gas having a specific gravity of .500, or 383.5 pounds of gas, yields, say, 30 gallons of tar, specific gravity 0.990, or 247.38 pounds of tar, which, if converted into gas of specific gravity .500, would add 6449 feet to the yield of gas. The proportion of carbon in coal-tar is so great, however, that under no system can it be converted into gas without the formation of a considerable proportion of fixed coke, probably from 25 to 40 per cent. of its entire weight. This fact reduces very considerably the possible gain of gas from the tar; in the case of caking coal, the usual material, from the 3394 to 3488 cubic feet of gas to not much above 2000 feet. To secure this gain, the tar, which has a market-value of from 33 to 50 cents per ton of coal, must be sacrificed, and more complicated apparatus and a larger consumption of fuel and labor must be resorted to. It is for these reasons that none of the methods suggested for producing gas from the tar have as yet been successful. In 1818, John Grafton patented the conversion of the tar into gas by delivering it into a second retort, heated to redness and filled with iron filings, coke, etc. In 1820, Mr. Lowe contrived an arrangement of five retorts—three below and two above—for the same purpose. The retorts were charged in the usual way with coal, and when the carbonization had gone on for three hours, the tar was admitted into the back part of the upper hotter retorts by a syphon tube. Some have mixed the tar with small coal, others with peat, sawdust, porous stones, etc. In 1827, Bernard Chaussenot patented in France the use of one vessel or retort heated to a low temperature for distilling "resin and all hydrogenous matters liquid and solid" into rich vapors, and a second retort heated to a high temperature for converting these vapors into permanent gas. This principle has been the basis of numerous patents—Robertson (in 1848), Gesner (1849), Hanson (1853), Gale (1858), Fryer (1868), Eveleigh (1870?), etc. While this principle has not been successful if applied to coal alone, it is probably essential to the production of gas from petroleum or any of its products, and is in successful operation in several works where petroleum naphtha is used as an enricher for coal-gas, as at the Harlem and the Mutual works in New York, the Citizens' and the People's works in Brooklyn, and many others. This is, after all, but a subdivision of the process which actually takes place in every coal-retort, as already stated in this article. The coal is always distilled at a low heat, and the condensable vapors are subsequently converted into permanent gas after they leave the coal.

V. *Oil-Gas.*—As a matter of fact, whenever oil is burned in lamps, it is first converted into gas at the wick. This is by far the most economical method of making oil-gas. Nevertheless, when gas-lights were first introduced coal was quickly replaced by oil. Cheap refuse oils and fats were employed, kitchen grease, and whale oil. The gas was obtained by allowing a stream of the oil or melted fat to trickle into a red-hot tube or a retort filled with coke or

similar porous solid. The oil was at once converted into a permanent gas, which, owing to the freedom of the oil from nitrogen and sulphur, contained no ammonia or sulphur compounds, and consequently required no purification, merely washing with water to condense the liquid products. A considerable residue of charcoal is always left in the retort. Oils and fats consist chiefly of oleine, $C_3H_5(C_{18}H_{33}O_2)_3 = C_{57}H_{104}O_6$, and stearine, $C_3H_5(C_{18}H_{35}O_2)_3 = C_{57}H_{110}O_6$, which are converted by destructive distillation into a mixture of gases consisting largely, often to the extent of 30 or 40 per cent., of rich olefines and benzole vapors, the remainder being hydrogen, marsh-gas, etc. Oil-gas is consequently a very heavy gas, its sp. gr. ranging from 0.600 to 1.100. Hydrogen = .0693, marsh-gas 0.5576, olefiant gas .9702, propylene 1.4553, butylene 1.9404, amylene 2.4255, benzol vapor 2.704. Oil-gas possesses a very high illuminating power, several times that of ordinary coal-gas, and must be burned through very small burners to prevent smoking. The yield of oil-gas depends upon the temperature at which the oil and its vapors are decomposed; a low temperature gives a smaller quantity of very rich gas, with the minimum deposit of carbon. A high temperature yields more hydrogen and marsh-gas, and a larger deposit of carbon. A gallon (U. S.) of oil weighs about 8 pounds; 1000 cubic feet .900 gas weighs 69 pounds. Were there no waste, and were it possible to obtain 8 pounds .900 gas from 1 gallon of oil, 8.63 gallons of oil would make 1000 cubic feet of gas. In practice the results are very variable, from 80 to 100 feet per gallon being reported. From 1824 to 1828 the New York Gas-Light Company used oil exclusively, selling gas at $10 per 1000 cubic feet.

VI. *Gas from Soap-Water.*—In some parts of Europe the refuse soap-water in which sheep, wool, etc. have been cleansed is employed for the manufacture of gas. It is treated either with lime, which forms an insoluble lime-soap which separates as a precipitate, or with sulphuric or hydrochloric acid, which frees the fatty acids as an oily layer. Both these products yield an excellent oil-gas by destructive distillation.

VII. *Rosin-Gas* was introduced when oil-gas became too expensive. The rosin was melted either alone or with a little oil of turpentine, and allowed to run into a red-hot retort containing coke, etc.; 100 pounds rosin yielded from 1000 to 1300 cubic feet of gas, which required no purification, except by cold water to condense certain oily vapors. The gas has a sp. gr. of 0.660 to 0.850, and is little inferior in illuminating power to oil-gas. From 1828 to 1848 the New York Gas-Light Company supplied rosin-gas to its consumers exclusively, at $7 per 1000 cubic feet. It was then replaced by coal-gas at $2.50.

VIII. *Wood-Gas.*—When dry wood is subjected to destructive distillation it yields (1) gas, (2) tar, (3) water containing acetic acid and wood naphtha, and leaves (4) a residuum of charcoal. In 1799, Lebon patented a process for making wood-gas, but his gas possessed so little illuminating power that the process was a failure. The gas obtained by heating wood to the temperature of boiling mercury contains—

Marsh-gas	7.0
Carbonic oxide	35.6
Carbonic acid	57.4
	100.

In 1849, Pettenkofer of Munich found that when the volatile products of the distillation of wood at a temperature from 482° F. to 572° F. (the gas, tar, etc.) were passed through a red-hot tube, the volume of the gas was increased, while by the decomposition of the tarry oils a considerable quantity of olefiant gas and rich hydrocarbon vapors were produced, a rich and valuable gas being obtained. The following analysis of crude wood-gas from the Munich R. R. station illustrates the result of the process:

Olefiant gas and rich hydrocarbon vapors	6.91
Marsh-gas	11.06
Hydrogen	15.07
Carbonic oxide	40.59
Carbonic acid	25.72
	99.35

This process has been introduced in many European cities where coal is not available. The wood is kiln-dried by the waste heat of the retorts, fir being generally selected. In some cases a little boghead mineral or other rich coal or shale is added as an enricher. The charge of 100 pounds or more of wood requires only one and a half hours' exposure to a low heat; consequently, 16 charges can be run off in 24 hours. The yield is from 500 to 600 feet of gas, and from 18 to 25 pounds of charcoal, from 100 pounds of wood. The charcoal is quenched with wet sand. The following analyses exhibit the composition of purified wood-gas: A is an average of 4 analyses by Reissig; B and C are by Gibbs and Genth; B, gas from old field pine; C, gas from small second-growth oak.

	A.	B.	C.
Olefiant gas and rich hydrocarbon vapors	7.86	10.57	6.46
Marsh-gas	25.38	21.50	33.12
Hydrogen	34.96	32.71	30.44
Carbonic oxide	31.80	27.11	26.11
Oxygen	none	0.16	none
Nitrogen	?	2.55	3.39
	100.	100.	100.
Specific gravity		0.663	0.580

Owing to the high specific gravity of wood-gas, often reaching .700, and the large percentage of carbonic oxide, the flame from an ordinary burner with small holes and high pressure is scarcely luminous, but from burners with large openings and low pressure the light equals and sometimes exceeds that of coal-gas. Liebig and Steinhill found the light from 4½ feet to be 20 per cent. greater than from the same amount of coal-gas. Among the advantages claimed for wood-gas are (1) cheapness of material; (2) smaller and simpler apparatus, owing to the short heats being one and a half hours; a wood retort will yield 10,000 feet in 24 hours, while a coal retort yields only 4000 feet in the same time; (3) more valuable in products, charcoal, tar (2 per cent.), acetate of lime (0.5 to 0.75 per cent.). This gas has been introduced in Switzerland, Norway, Sweden, Russia, etc. In 1856 wood-gas was made at the Philadelphia gas-works, and was found to be cheaper than coal-gas, and fully equal to it in illuminating power. (See *J. Frank. Inst.*, xxxii. 136; xxxiii. 313; xxxiv. 126, 349; also WAGNER'S *Jahresbericht* (vols. i. to x.) and *Handbuch der Holz- und Torf-gas Fabrikation*, Munich, 1863.)

IX. *Peat-Gas.*—The following products are obtained on subjecting air-dried peat to destructive distillation:

	Vohl.	Kam and Letheby.
Gas	17.625	25 to 58
Tar	5.375	2 " 5
Aqueous distillate	52.000	11 " 38
Charcoal	25.000	19 " 40
	100.	

The gas contains after purification—

	A.	B.
Olefiant gas and hydrocarbon vapors	9.52	13.16
Marsh-gas	42.65	33.00
Hydrogen	27.50	35.18
Carbonic oxide	20.33	18.34
Nitrogen	?	0.32
	100.	100.

The tar is rich in paraffine, burning and lubricating oils, and creosote (carbolic acid?); the aqueous distillate yields ammonia, acetic acid, and methylic alcohol; the charcoal is a valuable decolorizer and disinfectant. The yield of gas is variously stated at from 2.51 to 5.80 feet per pound, or from 5622 to 13,000 feet per ton of 2240 pounds. The gas is said to be of good quality, from 15.65 to 22.50 candles. (See W. REISSIG'S *Handbuch der Holz- und Torf-gas Fabrikation*, Munich, 1863; URE'S *Dict.*, article "Peat;" and *Report on the Nature and Products of the Destructive Distillation of Peat*, Parliamentary Blue-book, 1851.)

X. *Petroleum and Naphtha-Gas.* See PETROLEUM. XI. *Air-Gas.* See PETROLEUM. XII. *Water-Gas.* See WATER-GAS. XIII. *Oxy-hydrogen Gas-lighting.* See OXYGEN.

For further details with regard to gas-lighting the following works may be consulted: MUSPRATT'S *Chemistry;* MUSPRATT'S *Handbuch der Technische Chemie*, 3te Auf., 1875; WURTZ'S *Dictionnaire de Chimie; Neues Handwörterbuch der Chemie; Le Gaz;* WAGNER'S *Jahresbericht der Chemischen Technologie;* MATTHEWS'S *History of Gas-lighting*, 2d ed. 1832; BLOCHMANN'S *Beiträge zur Geschichte der Gasbeleuchtung*, 1871; *Abridgments of Specifications of Patents relating to the Production and Applications f Gas*, 1860; ACCUM'S *Practical Treatise on Gaslight*, 4th ed. 1818; ACCUM'S *Description of the Process of Manufacturing Coal-Gas*, 1819; BOWDITCH, *The Analysis, Technical Valuation, Purification, and Use of Coal-Gas; The Gas-Manager's Handbook*, THOMAS NEWBIGGING; BOWER, *Gas-Engineer's Book of Reference;* CLEGG, *On the Manufacture of Coal-Gas;* COLBURN, *The Gasworks of London; Gas-Consumer's Guide;* HUGHES, *Gasworks and Manufacturing Coal-Gas;* MASON, *The Gasfitter's Guide;* D'HURCOURT, *De l'éclairage du Gaz;* RICHARD, *Gas-Consumer's Guide;* SUGG, *Gas Manipulation, with a Description of the various Instruments and Apparatus employed in the Analysis of Coal and Coal-Gas;* WILKINS, *How to Manage Gas;* SCHILLING, *Handbuch für Steinkohlengas;* SCHILLING, *Traité d'éclairage par le Gaz;* KNAPP'S *Lehrbuch der Chem. Technologie*, 3te Auf., 1865; BOLLEY'S *Handbuch der Chem. Technologie*, 1862; and the authorities previously cited in this article.

C. F. CHANDLER.

Gasparin, de (Agénor Étienne), Count, b. at Orange, France, July 10, 1810, the son of Count Adrien Étienne Pierre de Gasparin (1783–1862), an Orleanist statesman of liberal views. The son was much in public life until 1846; disapproved of the revolution of 1848, and after Napoleon III. came into power retired to Switzerland, where he engaged in literary pursuits. D. at Geneva May 14, 1871. De Gasparin was a Protestant, a friend of safe reform measures, a pronounced enemy of slavery, and was the author of several volumes, chiefly upon religious and social questions; two of which, *Les États-Unis en 1861* (1861) and *L'Amérique devant l'Europe* (1862), maintaining the justice of the Federal cause in the U. S. during the recent civil war, were translated into English and widely read in the U. S.—Mme. Valérie Bossier de Gasparin, his wife, has also written much upon topics kindred to those discussed by her husband.

Gaspé, county of Quebec, bounded upon the N. and E. by the Gulf of St. Lawrence. It is rocky, but very fertile, and contains the eastern extremity of the Notre Dame Mountains. The fisheries are important. Lead, gold, and petroleum are reported as existing here. Grindstones are quarried. Cap. Percé. Pop., exclusive of Magdalen Islands, 15,557.

Gaspé Basin, a port of entry on Gaspé Bay, and in Gaspé co., Quebec, Canada, has a splendid harbor and is surrounded by a fertile region. It has cod and whale fisheries, a steam lumber-mill, and several new wharves. It is defended by Fort Ramsay. Pop. about 700.

Gas'per, tp. of Preble co., O. Pop. 895.

Gas'port, post-v. of Royalton tp., Niagara co., N. Y., on the Erie Canal, has a natural spring of burning gas. Here are a dry-dock and some manufactories.

Gassendi (Pierre), b. at Champtercier, Provence, Jan. 22, 1592; was a poor peasant's son, but by his remarkable precocity of intellect attracted the attention of a rich relative, who sent him to school. When ten years old he delivered a Latin address before the bishop of Digne; when nineteen (1614) took for a time the professorship of theology at Digne; became professor of philosophy in the university at Aix 1616; took priest's orders 1617; became canon and then provost in the diocese of Digne 1623, but did not assume the latter office for some years. At the same time he was pushing his researches in every department of human learning, and attained renown in many fields. He became in 1645 professor of mathematics at Paris. Galileo, Hobbes, Kepler, and Descartes were his friends and correspondents, and with the last mentioned he held a famous controversy, in which the learning, argumentative skill, and good temper of Gassendi gained a victory over his more original and brilliant, but less accomplished, opponent. Gassendi was an able opponent of the Aristotelian scholastic philosophy, and by his championship of Epicureanism drew upon himself the charge of infidelity; but he was a devout churchman and a conscientious conservative, who espoused the cause of physical science from a conviction of its truth, rejecting the old philosophy simply on account of its inconsistency with the facts of science, but adopting a new philosophy equally inconsistent with the doctrines of his own religious system. Molière was his pupil. D. at Paris Oct. 24, 1655. His best works are *De vita moribus et placitis Epicuri* (1647), *Syntagma Philosophiæ Epicuri* (1649), and the admirable *Lives* of Tycho, Copernicus, Regiomontanus, and Purbach. He published in 1630 a severe attack upon Robert Fludd. His *Institutio Astronomica* (1645), an able work, has a value now chiefly historical. His *Syntagma Philosophicum* (1658), a work of great erudition, sets forth his own eclecticism. His philosophy in some parts remarkably resembles that of Locke. His doctrine in some respects was identical with the sensualistic dogma of his friend Hobbes; and in spirit and manner Gassendi has much in common with Bacon, whose disciple he professed to be. He was a most amiable and benevolent man, austere in his life, and a laborious student. His cautious spirit led him to oppose the important physiological discoveries of Harvey and Pecquet. His *Life* was written by Bougerel (1637), by Sorbière (1658), by Camburat (1770), and by A. Martin (1853). C. W. Greene.

Gasse'rian Gan'glion [named from Giulio Casserio (*Gasserius*), 1556–1616, its discoverer], a large semilunar ganglion upon the large or sensory root of the fifth cranial nerve, near the apex of the petrous portion of the temporal bone. It is found in man and many of the lower animals, and at once recalls the ganglia upon the posterior roots of the spinal nerves, of which it is the analogue.

Gas Tar. See Tar, by Prof. C. F. Chandler, Ph. D., LL.D., M. N. A. S.

Gas'tein, a beautiful valley, some 30 miles long, in Austria, to the S. of Salzburg. It is traversed by the Ache, and has on either hand steep mountains with some glaciers, and containing mines of gold and silver. Here are three villages, Hofgastein, Dorfgastein, and Wildbadgastein, the last one of the most fashionable watering-places in Europe. It has thermal springs, renowned for their efficacy in the treatment of many chronic diseases. Wildbadgastein was in 1865 the place of the convention held by the sovereigns of Austria and Prussia and their diplomatic agents for the purpose of settling the affairs of Sleswick-Holstein.

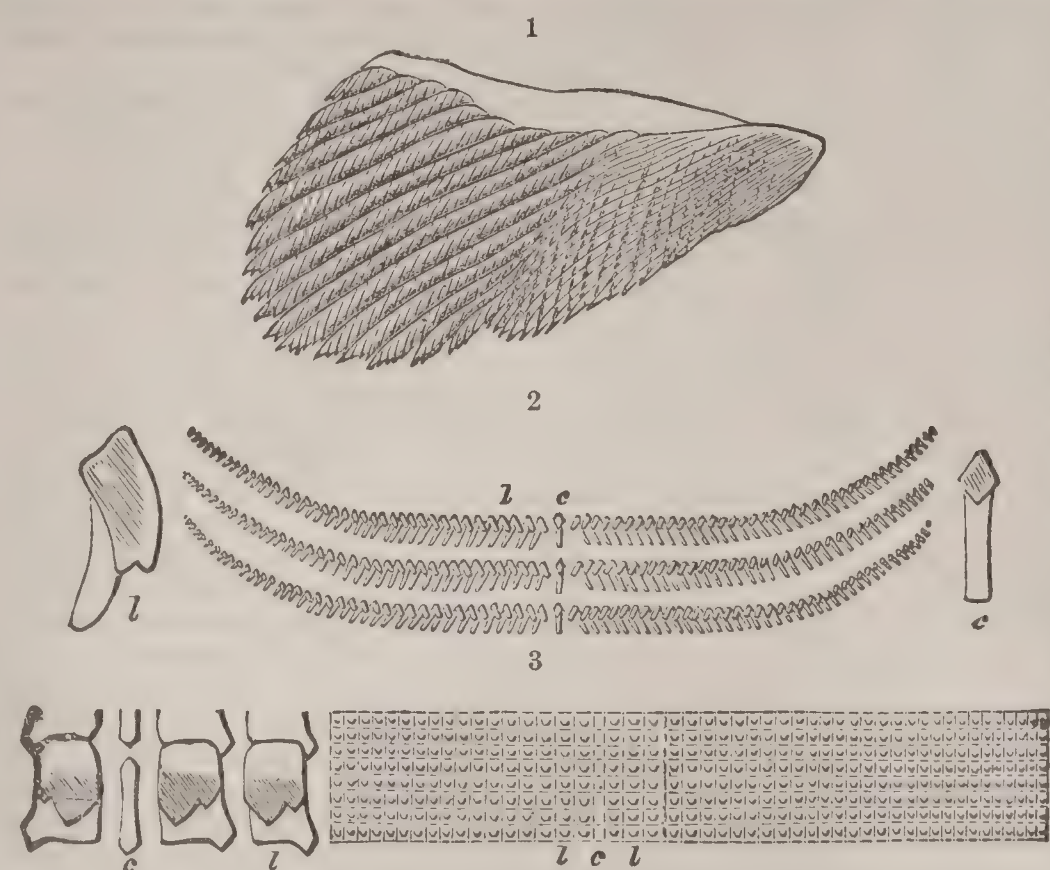
Gastein, The Convention of, was concluded at Wildbadgastein (Aug. 14, 1865) between Austria and Prussia, and was intended to regulate the relations of these two powers with respect to the duchies, Sleswick, Holstein, and Lauenburg, which they had taken from Denmark, and now occupied in common. By the convention they agreed that Sleswick should be placed entirely under Prussian, Holstein entirely under Austrian administration, while Lauenburg should be annexed to Prussia, Austria ceding its part of it for 2,000,000 thalers. Aug. 20 this convention was signed at Salzburg by the emperor Francis Joseph and King William. August Niemann.

Gas'teropods, or **Gas'tropods** [Gr. γαστήρ, "belly," and πούς, "foot"], a class of the typical mollusks or Mollusca vera (having three well-developed pairs of ganglia —that is, cerebral, pedal, and branchial or parieto-splanchnic), distinguished, in contrast with one or other of the remaining classes (Cephalopods and Lamellibranchiates), by the development of a head more or less differentiated from the body, and generally bearing eyes and tentacles; an "odontophore" (also called "radula" or "lingual ribbon") armed with chitinous "teeth" (rarely atrophied); a foot arising from the hæmal or ventral surface of the body (whence the name); and a mantle (at least in the young), which is undivided and continuous round the body, and which, in most forms, secretes a univalve or uniserial multivalve shell. These are the only characters which are common to all the members of this class (and even in a few cases one or other of the parts referred to is suppressed), but nevertheless the limits of the class, or at least the common agreement of all its constituents in positive as well as negative characters, is almost universally admitted. The most familiar representatives of the class are the ordinary univalve shells, and they will convey a good idea of the characters common to most of the species of the division; but a wider survey is necessary to check the impressions that would be derived from their uniformity in many characters. These typical forms have an unsymmetrical body, with the visceral sac spiral and separated, as a strangulated hernia, from the body, and fitting into a spiral shell secreted by a so-called mantle; a foot with a broad flat surface, separated by a decided constriction from the body; a well-developed head; and tentacles, on or near which are eyes at the anterior portion of the head. Many of them are also provided with a peculiar element which is generally either corneous or calcareous, and which is called the operculum; this is developed from a peculiar lobe of the foot, called the operculigerous lobe. None of these characters, however, are universal, and deviations from the type in such respects may be found in forms that are otherwise closely allied.

Inasmuch as the teeth of the lingual ribbon and the operculum are parts much used in classification, it is necessary to enter upon their consideration in more detail.

The lingual ribbon on which the so-called teeth are borne is called by Prof. Huxley "odontophore." The odontophore is well described by him as consisting "essentially of a cartilaginous cushion, supporting, as on a pulley, an elastic strap, which bears a long series of transversely disposed teeth. The ends of the strap are connected with muscles attached to the upper and lower surface of the hinder extremities of the cartilaginous cushions; and these muscles, by their alternate contractions, cause the toothed strap to work backward and forward over the end of the pulley formed by its anterior end. The strap consequently acts after the fashion of a chain-saw upon any substance to which it is applied, and the resulting wear and tear of its anterior teeth are made good by the incessant development of new teeth in the secreting sac in which the hinder end of the strap is lodged. Besides the chain-sawlike motion of the strap, the odontophore may be capable of a licking or scraping action as a whole." This organ is developed in almost all the Gasteropods, having recently been found in several forms to which it had been formerly denied, although none has yet been discovered in the Pyramidellidæ, Eulimidæ, and Styliferidæ. The number of rows of these teeth is generally coincident with other important characters, and, together with the structure of the teeth, form an excellent index to the relations of the various Pectinibranchiate forms. The chief modifications in the number in a transverse row and the form of

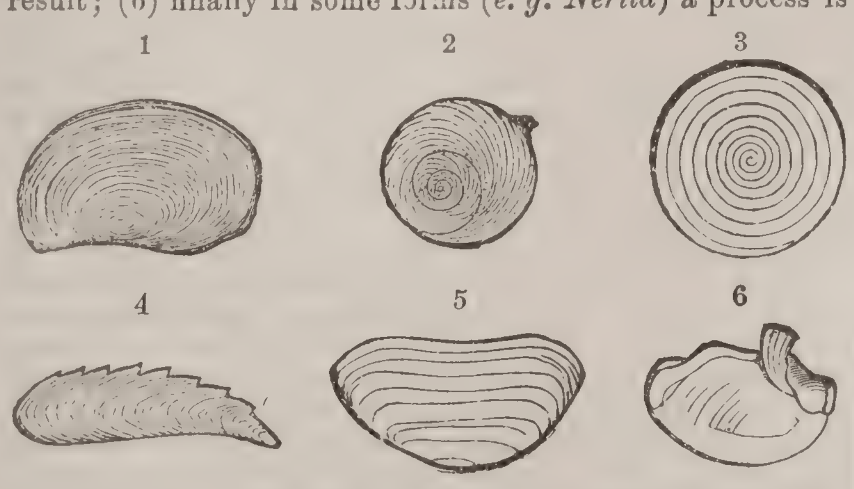
the several teeth are illustrated in the accompanying figures, and will obviate the necessity of further explanation, except to say that the number of rows is very considerable,



1. Buccal plate of *Triton*, magnified 40 diameters. 2. Section of lingual ribbon of *Siphonaria*, showing three complete rows of teeth: *l*, lateral teeth; *c*, central teeth. 3. Lingual teeth of *Achatina fulica*: *l*, lateral or pleural teeth; *c*, central or rhachidian teeth. Specimens of each at the left are more highly magnified.

and may amount to several hundred, and that the central teeth in a row are called "rachidian," and the lateral "pleural."

The operculum, although of less significance as an index of the relations of the superior combinations of Gasteropods, is very important for the determination of their minor affinities. The form is generally coincident with that of the aperture or mouth of the shell, but is sometimes much smaller. In the shells provided with a long siphon-like tube, the operculum is therefore elongated and more or less claw-shaped, while in those shells whose aperture is circular the operculum has a corresponding form. There is also a very considerable difference in the mode of growth in different forms. Commencing from the nucleus, (1) sometimes the increase takes place regularly around it (as in *Ampullaria, Viviparus*, etc.), in which case it is called concentric; in others the growth is in a spiral direction; (2) sometimes (as in *Turbo*) with a few rapidly widening whorls, in which case we have a paucispiral operculum; (3) sometimes (as in *Trochus*) with the whorls numerous and slowly increasing in width, and then a multispiral one is formed; (4) in others (as in *Strombus*) the increase is chiefly in a more or less curved axis, when an unguiculate or claw-shaped operculum is generated; (5) in others still (*e. g. Purpura*) the increase is from a marginal or lateral nucleus, and extends in a diverging direction from that nucleus, and an imbricated or lamellar operculum is the result; (6) finally in some forms (*e. g. Nerita*) a process is

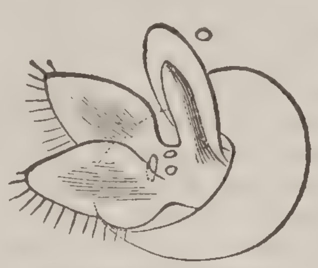


Opercula of (1) *Ampullaria*, (2) *Turbo*, (3) *Trochus*, (4) *Strombus*, (5) *Purpura*, (6) *Nerita*.

developed from the free terminal margin, and it is then said to be articulated. As to texture, there is also much difference, but there is no connection between texture and form, for the same shaped operculum (especially in the spiral type) may be either corneous or calcareous, or compounded of both kinds.

In almost all cases caution must be exercised lest the differences in one group prepossess us too much in favor of the value of any given characters, and induce us to apply to corresponding differences in another the same value. Thus, although in the ordinary types of Gasteropods (the Pectinibranchiates) the dentition of the lingual ribbon is an excellent index to the affinities of the groups, it fails in this respect in others, and especially in the Nudibranchiate and Tectibranchiate Gasteropods; but at the same time we must dismiss any prejudices respecting the value of the form of the shell in the determination of the affinities of the animals to which they belong; the same kind of shell may, for example, be common to forms that are radically different in their organization, and there is no *a priori* reason why the modifications of the shell should be of any greater value than those of any other single part of the organism. We should in all cases allow ourselves to be guided by the consideration of the sum-total of characters. Indeed, so far is the shell from being of paramount value, there are reasons derived from its development and teleology why it should be—as in fact it is—of comparatively little systematic importance. We need not be surprised, then, to find that shells like the polished *Helices* of the older writers should belong to forms which differ very much in other respects; again, the operculum in its modifications is very characteristic of many groups, while in others it is very variable, and may be present—and then variously modified, varying in structure and size—or absent in groups whose members agree in all essential respects.

It has already been remarked that the shell may be variously developed in members of the same natural group. In some it is capable of receiving and concealing the entire animal, and in others so reduced as to be almost or altogether wanting. Nevertheless, in the embryo the shell is present in almost all except the Chitonidæ or Polyplacophora. In that stage, too, in the normal Gasteropods which are developed in the ocean, there are a pair of ciliated fins which are the outgrowths from those portions of the foot called "epipodia," while the other portions of the foot are then scarcely at all developed; these epipodial wing-like fins are retained in a modified condition throughout life in one great group (sub-class Pteropoda) of the Gasteropods; but in most of them they soon become aborted and disappear, and the shell likewise becomes, in many forms, aborted. In all species retaining shells, this minute embryonic shell is retained for at least a portion of the life, and is distinguishable as the nucleus of the more fully developed form; in a number of forms, however, the nucleus is broken off as the shell increases in size.



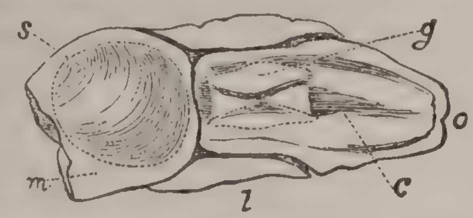
The fry of *Æolis*.

The principal modifications of structure are exhibited in the following groups, to which have been assigned the rank of sub-classes.

(1) The Dıœca have the body, as well as the heart and generative organs, more or less asymmetrical, with the abdominal viscera generally in a spiral sack, around which is secreted a univalve shell. The mantle extends in a roof-like manner behind the head, and leaves an extensive aperture into the branchial cavity; in this cavity and in advance of the heart (hence sometimes called Prosobranchiates) are situated the gills, which are generally pectinated, but sometimes plume-shaped, and otherwise formed, while sometimes they are modified for aërial respiration. The head is well developed, and tentacles, as well as eyes, are almost always present. The teeth of the odontophore are comparatively few in number in each transverse series; the generative organs (except in the Valvatidæ) are differentiated into distinct individuals, male and female (and hence the name of the sub-class). As an additional character, Prof. Huxley has also attributed to these, as well as to the Opisthobranchiates, an alimentary canal, "that is always bent upon itself, at first not to the neural, but to the hæmal or heart side of the body—the rectum very commonly opening into the mantle cavity above the cephalic portion of the body," and hence has distinguished these forms as a class under the name Branchiogasteropoda. To this sub-class belong the orders Pectinibranchiata, Rhipidoglossa, and Docoglossa.

(2) The Pulmonifera agree with the Diœca in the asymmetry of the body and of the organs of relation, and in the shell (except in its development). The mantle, however, is attached in front, and restricts the respiratory orifice to a contracted valve-like aperture. The respiratory cavity has its whorls partially modified into a vascular lung-like apparatus, and there are no gills; the head, tentacles, and eyes are essentially like those of the Diœca;

the teeth of the lingual ribbon are very numerous, comparatively similar, and in a transverse series; the generative organs are united in the same individual. The species, it is said by Prof. Huxley (but with very justifiable reservation), also agree among themselves, and differ from the preceding and the Opisthobranchiates in having the primary bend of the intestine not to the hæmal but to the neural side, "the eventual termination of the intestine on the hæmal side being the result of a second change in its direction;" and for this reason Prof. Huxley has separated this group as a sub-class named Pulmogasteropoda. The only order of this division is the PULMONATA, which includes all the inoperculate land and fresh-water shells.



Bullœa aperta: o, mouth; c, head, or cephalic disk; l, side-lobes of foot; m, mantle; s, shell; g, gizzard, the last two seen through the translucent integument.

(3) The OPISTHOBRANCHIATA form a third sub-class, and, like the preceding, have the body and principal organs asymmetrical; the mantle is variable in its development; there is no branchial cavity, but the gills are more or less exposed on the back and sides and towards the hinder part of the body, and they are generally arborescent or fasciculated; the head, tentacles, and eyes are generally (but not always) developed, but vary widely in form and connections in the different families; the teeth of the lingual ribbon are also extremely different in forms which in all other respects closely agree with each other; the generative organs are united in the same individual, as in the Pulmonifera; the intestinal canal, according to Huxley, corresponds in its flexures with that of the Diœca. In the group are two orders, the TECTIBRANCHIATA and the NUDIBRANCHIATA, both of which have shells in an embryonic condition, but in the latter order the shell is wanting in the adult.

(4) The POLYPLACOPHORA have the body and the visceral organs symmetrical; the heart is in the middle axis of the body, and is an elongated organ like the dorsal vessel of worms; the sexual organs are also symmetrical, and are repeated on each side; the form is a more or less elongated ellipse, and coextensive with the shell, which is formed of eight transverse plates arranged in a longitudinal axis, successively imbricated, and connected by a marginal leathery mantle; the gills are typically in two lamellar series, one on each side of the hinder part of the body, under the edge of the mantle; the head is scarcely differentiated externally, and there are neither tentacles nor eyes; the teeth of the odontophore are in considerable number in each transverse row. Such are the chief distinctive characters of the Chitons, which constitute this sub-class, as well as an order. It is to be further remarked


Dentition of *Chitonellus.*

that the development of these mollusks is quite dissimilar from that of the normal Gasteropods, there being no shell or epipodial appendages in the early embryo, as in those of the other groups; the shell is developed at a later period; its homology with the shells of the other Gasteropods is doubtful.

(5) The PROSOPOCEPHALA are another peculiar sub-class. These also have a symmetrical body and organs of relation; the shell is elongate-conic, and resembles in form an elephant's tusk; there are two gills, which are symmetrical and behind the heart; the head is rudimentary, and the eyes and tentacles are both wanting; the teeth on the lingual ribbon are few in the transverse series; the sexes are probably united in the same individual. This group has been, by some, considered as a class; by others, as a family of Pteropods; by others, still, as most nearly related to the bivalve mollusks; but by most as a family related to the Trochidæ. It comprises several forms, which are known popularly as "tooth-shells," and are combined in the family Dentaliidæ. (For further information see SOLENOCONCHÆ.)

(6) The PTEROPODA form the sixth and last sub-class, which resemble, in some respects, the embryonic stage of the typical Gasteropods, and have the epipodia of the foot extending into lateral fin-like appendages, while the rest of the foot is not developed; in other respects there is much variation among the members, which are distributed among two orders—the THECOSOMATA and the GYMNOSOMATA. All the species of the group are pelagic, floating upon the high seas, and are of small size. THEODORE GILL.

Gas'ton, county of North Carolina, bordering on South Carolina, and bounded on the E. by the Catawba River. Area, 350 square miles. Its surface is uneven, its soil fertile, producing grain and wool. Limestone, iron, gold, soapstone, iron pyrites, and baryta are abundantly found, and silver, copper, lead, zinc, tin, arsenic, bismuth, and many other metals are reported to exist. Cap. Dallas. Pop. 12,602.

Gaston, post-tp. of Sumter co., Ala. Pop. 480.

Gaston, a v. and tp. of Northampton co., N. C., at the junction of the Raleigh and Gaston and the Gaston branch of the Petersburg and Weldon R. R., 85 miles N. E. of Raleigh. Pop. 11; of tp. 2310.

Gaston (WILLIAM), b. at Killingly, Conn., Oct. 3, 1820; graduated at Brown University; studied law with B. R. Curtis of Boston; practised his profession at Roxbury (now a part of Boston, Mass.) until 1867, when he removed to Boston and became law-partner of Harvey Jewell and W. A. Field; was mayor of Roxbury 1861–62; State senator 1868; was elected mayor of Boston 1871, and again in 1872; was chosen governor of Massachusetts in 1874, having previously been several times a Democratic candidate for Congress, and once (1873) for governor.

Gaston (WILLIAM), LL.D., b. at New Berne, N. C., Sept. 19, 1778; studied at Georgetown College, Md.; graduated in 1796 at Princeton with first honors; came to the bar in 1798; was in Congress from North Carolina 1813–17, where he was one of the ablest of the Federalists; judge of the State supreme court 1835–44, although a Roman Catholic, and as such incapable of holding office by the constitution of North Carolina; opposed in 1835 the disfranchisement of free colored voters, which was provided for by the constitution of that year; declined the U. S. Senatorship 1840. D. at Raleigh Jan. 23, 1844.

Gaston de Foix, a nephew of Louis XII. of France, b. 1489; became duke of Nemours 1505; led the army of Louis XII. in Italy; vanquished the besiegers of Bologna; defeated the army of Venice near Brescia, and took the city by storm; won the great battle of Ravenna (Apr. 11, 1512), and by rash exposure after the victory was killed on the same day.

Gas'tric Juice [Gr. γαστήρ, the "stomach"], the fluid which in the stomachs of the higher animals adapts certain food-elements for immediate absorption into the circulatory system, and assists in the reduction of the residue to the substance generally known as chyme. Its existence, long before suspected, was first demonstrated by Réaumur in 1752. It is a clear yellowish liquid, with a strong acid reaction, a slight odor, and a saltish taste, and will keep with but little change for a great length of time. It holds in solution various inorganic salts (chiefly chlorides and phosphates); a nitrogenized substance, called pepsin or gasterase, precipitated from solution by lead-acetate and by alcohol; and a free acid, regarded by some as lactic, by others as hydrochloric, by others as a peculiar "chlorohydropeptic" acid, while some assert that a part or all of its acidity is due to acid phosphate of lime. By its action, either in the test-tube or in the stomach, albumen, caseine, fibrine, etc. are reduced to states in which they are called peptones (albuminose). Fats, sugar, and starch are not acted upon by it to any great extent, though it may assist in converting cane-sugar to grape-sugar, preparatory to its absorption into the nutritive fluid. It appears, further, that the action of the gastric juice upon meats and most other solid substances is not entirely final. While a certain amount of albuminose is made ready for absorption, and is actually taken up by the vessels of the stomach, the great bulk of the food is passed on as chyme, in a partly prepared state for the further action of the pancreatic secretion, the intestinal juice, and the bile, all of which play important parts in digesting food. The pepsin appears to act chiefly as a ferment or catalytic agent. The gastric juice is secreted by those stomach-tubes which contain pavement epithelium. The amount daily produced is placed at fourteen pounds, but as it is constantly being reabsorbed, there is at no time much of it present in the stomach. Its production appears to be to a great extent under the control of the pneumo-gastric nerves. REV. BY WILLARD PARKER.

Gas-Wells. See GAS and GAS-LIGHTING.

Gatch (PHILIP), b. in Maryland Mar. 2, 1751; entered the Methodist ministry in 1774; labored with great zeal and success in the Middle States and Virginia; removed in 1798 to a point near Cincinnati, where, after long and very useful services as a preacher, he d. Dec. 28, 1835.

Gatchi'na, town of Russia, 30 miles S. W. of St. Petersburg, has an imperial palace surrounded by one of the most beautiful parks in Europe. Pop. 8337.

Gates, county of North Carolina, bounded on the N. by Virginia and on the W. by the navigable Chowan River. Area, 500 square miles. Its surface is well timbered, and in some parts swampy. Grain, cotton, and forest products are exported. Cap. Gatesville. Pop. 7724.

Gates, tp. of Clarke co., Ala. Pop. 640.

Gates, post-tp. of Monroe co., N. Y. Market-gardening and the nursery-business are important industries. The township is the western suburb of Rochester. It has 3 churches, and is traversed by the New York Central R. R. Pop. 3541.

Gates (Horatio), b. in England in 1728; in early life entered the British army, attained the rank of major without purchase, and laid the foundation for his future military success. At the capture of Martinico he was aide to Gen. Monkton, and after the Peace of Aix-la-Chapelle was among the first troops to land at Halifax under Lord Cornwallis. He was with Braddock at his defeat in 1755, where he was shot through the body. At the conclusion of war he purchased an estate in Virginia, on which he resided till the commencement of war with Great Britain in 1775, when he was appointed by Congress adjutant-general with the rank of brigadier-general. He accompanied Gen. Washington when that officer went to take command at Cambridge, and in June, 1776, was appointed to the command of the army in Canada; in May, 1777, he was superseded by Gen. Schuyler, but in August following in turn superseded that officer in the northern department. The success which attended his arms in the capture of Burgoyne and surrender of the British army at Saratoga in October gave to him a brilliant reputation. After the capture of Gen. Lincoln he was appointed, June 13, 1780, to command the southern department; on Aug. 16 following he was defeated at Camden by Cornwallis, and in December was superseded by Gen. Greene, but restored in 1782, after the surrender of Cornwallis. After the peace he retired to his farm in Berkeley co., Va., where he remained till 1790, whence he went to reside in New York, having first emancipated his slaves. D. at New York Apr. 10, 1806. Geo. C. Simmons.

Gateshead, town of England, co. of Durham, on the Tyne, opposite Newcastle, with which it is connected by two bridges. It is chiefly inhabited by workingmen from the neighboring collieries and quarries (the famous "Newcastle grindstones"), and from the extensive iron manufactories of the town itself. Pop. 48,592.

Gatesville, post-v., cap. of Gates co., N. C., 140 miles N. E. of Raleigh. Pop. 156; of Gatesville tp. 1155.

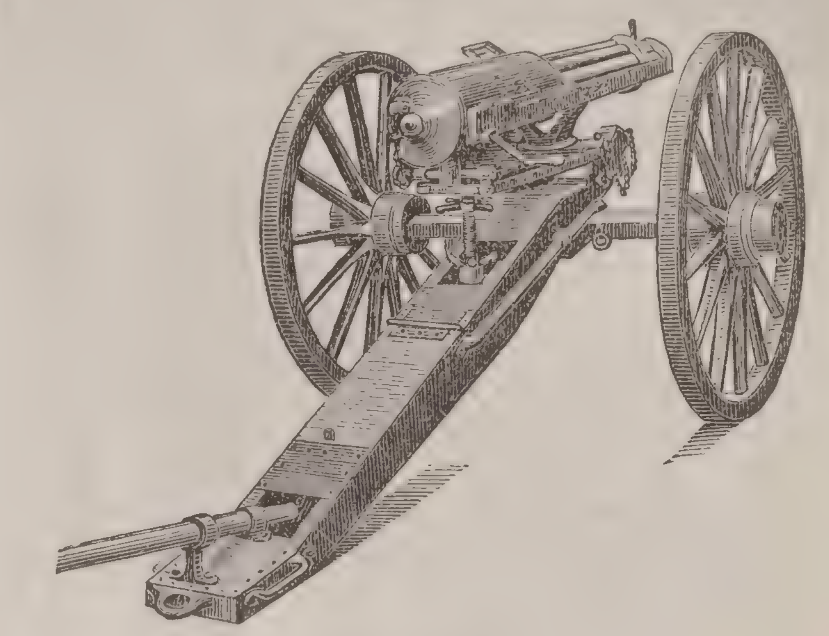
Gatesville, post-v., cap. of Coryell co., Tex., is on the Leon River, 40 miles from the Houston and Texas Central R. R., in the heart of a rich valley, which will soon be traversed by the Gulf Colorado and Santa Fé R. R. It has a large and elegant stone court-house, 2 churches, 1 school, 16 business-houses, 1 hotel, 1 saw and flouring mill, and 1 newspaper. Principal business, farming. Pop. about 800.
I. W. Vandiver, Ed. "Sun."

Gath, in Palestine, was one of the five cities of the Philistines, and, as it stood on the frontiers of Judah, it played a conspicuous part in the wars between those two peoples. Goliath was born there. Porter (1857) identifies it with *Tell-es-Sâfieh*, 10 miles E. of Ashdod. Thomson (*Land and Book*, 1858) thinks that Gath, Bethogabra, Eleutheropolis, and *Beit Jibrin* (about 5 miles S. E. of *Tell-es-Sâfieh*) are all one and the same city. At each of these points is a small modern village in the midst of ruins.
R. D. Hitchcock.

Gat'ling (Richard Jordan), an American inventor, b. in Hertford co., N. C., Sept. 12, 1818, and now residing in Hartford, Conn. His first invention was a screw for the propulsion of water-craft, in which he found, upon application for letters patent, that he had been anticipated a short time by Ericsson. He subsequently devised a machine for sowing wheat in drills, which found a ready sale in the West; and then studied medicine, attending lectures in 1847–48 at the Indiana Medical College, then located at Laporte, Ind., and in 1848–49 at the Ohio Medical College at Cincinnati, O. He also discovered a method of transmitting power through the medium of compressed air, and invented a double-acting hemp-break, still in use in some parts of the West for breaking hemp. Dr. Gatling's greatest invention, made in 1861–62, is the mitrailleuse, a repeating machine-gun, universally known as the Gatling gun. At the first trial of this gun, in the spring of 1862, it fired 200 shots per minute. After making some improvements in its mechanism, the arm was submitted to trial by our government at the Frankford, Washington, and Fort Monroe arsenals, and at other places, and has since been adopted into the service for use with troops and for the flank defence of fortifications. It has also been adopted by Russia, Great Britain, and other nations.

Gatling Gun, a repeating machine-gun or mitrailleuse invented by R. J. Gatling (which see), and shown on its carriage in Fig. 1. It is made of various calibres and weights. For mountain-service the lighter guns may be transported on animals and fired from a tripod. The gun consists of a number of simple breech-loading rifled barrels

Fig. 1.

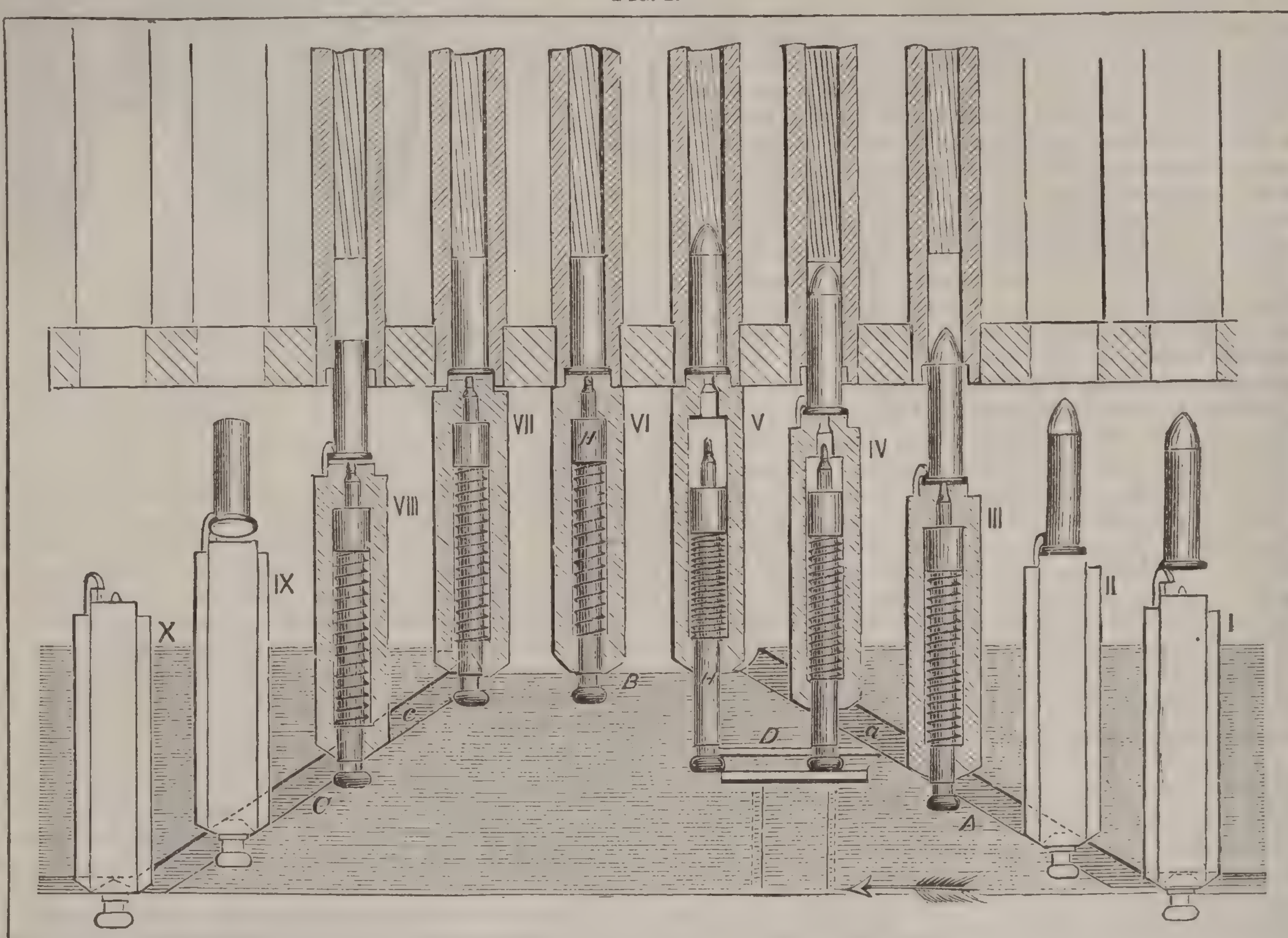


Gatling Gun.

grouped around and revolving about a common axis, with which they lie parallel. These component barrels are loaded and fired while revolving, the empty cartridge-shells being ejected in continuous succession. Each barrel is fired only once in a revolution, so that the ten-barrel Gatling gun fires ten times in one revolution of the group of barrels. The working of the gun is simple. One man places one end of a feed-case full of cartridges into a hopper at the top of the gun, while another man turns a crank, by which the gun is revolved. As soon as the supply of cartridges in one feed-case is exhausted another case may be substituted without interrupting the revolution or the succession of discharges. The usual number of barrels composing the gun is ten. The bore of each barrel extends through from end to end, and the breech is chambered to receive a flanged "centre-fire" metallic case cartridge of the kind used in the Springfield rifle and other small-arms. The breech-ends of all the barrels are firmly screwed into a disk or *rear barrel-plate*, which is fastened to the central shaft, while the muzzles pass through another similar disk, called the *front barrel-plate*, on the same shaft. The central shaft extends backward some distance behind the breeches of the barrels, and upon this extension, directly behind the open barrels, a hollow cylinder of metal called a *carrier-block* is fastened, in the exterior surface of which ten semi-cylindrical channels are cut, which form trough-like extensions of the cartridge-chambers of the barrels to the rear, and are designed to receive and guide the cartridges while they are being thrust into the barrels, and to guide the empty cases while they are being withdrawn. Behind the *carrier-block* the shaft carries another cylinder, called the *lock-cylinder*, in whose surface ten guide grooves are formed, which are in line with the barrels, and in which slide ten long breech-plugs or locks, called *lock-tubes* or *plungers*, by which the cartridges are thrust into the barrels, and which close the barrels and resist the action of the charges when they are fired. This cylinder is called the *lock-cylinder*, because each plug or lock is acted on by a spiral spring acting on a firing-pin or hammer, by which the charge is fired. The shaft, the group of barrels, the *carrier-block*, and the *lock-cylinder* are rigidly connected, and revolve together by means of a toothed wheel fastened to the shaft, and worked by an endless screw on a small axle located at right angles to the shaft, and furnished outside with a hand-crank. The revolution of the *lock-cylinder* carries the locks around with it, and imparts to them a longitudinal reciprocal motion by their rear ends sliding along a groove in the inclined surface of a stationary spiral cam, so that the several locks in succession are pushed forward towards their respective barrels. Fig. 2 shows the spiral cam and firing mechanism as they would appear if cut open longitudinally through the top and developed on a plane surface, the ten locks being shown in their relative positions abutting against the cam surfaces, six of them being shown in section. The diagram shows the ten locks, each at a different point in its revolution. When firing the locks and barrels move in the direction of the arrow-head, and each barrel is discharged near the lowest point in the revolution. At I the cartridge has just dropped in front of the lock; at II it is pushed somewhat forward; at III still more; at

IV it is nearly home, the head of the hammer being held back by the *cocking-rib* D, partly compressing the spiral mainspring; at V the lock has reached the straight transverse part of the cam, and its forward motion is arrested, and the mainspring is fully compressed; at VI the hammer, released from the *cocking-rib*, has sprung forward and exploded the cartridge; at VII the lock has commenced to retreat; at VIII it is still farther from the cartridge-chamber, and the empty cartridge case is partly withdrawn; at IX the empty case is dropping down from the gun; and at X the lock is fully drawn back, and is again about to assume the first position at I, ten shots, one from each barrel, having been delivered. The locks are made interchangeable, and spare locks are kept on hand. If one or more locks should become permanently disabled, and are not replaced, they can be removed through an opening in the cascabel plate, the gun remaining entirely serviceable, although with a proportionally diminished fire. The piece is elevated and depressed like the ordinary field gun, and in addition has an automatic oscillating movement for spreading its fire through a small sector. The *cases* for feeding the gun are long, narrow tin boxes, open only at the lower end, containing forty cartridges arranged horizontally one above the other. When firing the case stands

Fig. 2.



Gatling Gun, calibre 0.42 inch. Development of the spiral cam and firing mechanism, showing also the action of the locks relatively to the barrels.

in an upright position on the top of the gun, directly over the *hopper*. An able-bodied man can turn the crank of a .45-inch calibre gun forty times per minute for two or three minutes, or at the rate of 400 shots per minute. This is equal, as shown by competitive trials at Fort Monroe, to forty Springfield rifles served with average skill in the number of shots delivered. But at 150 yards the Gatling gun, using the oscillator, will hit a target 9 feet high by 45 feet long 38 per cent. more times than the forty rifles, and at 200 yards, 79 per cent. more. But the rifles, for an equal number of hits, would be more effective against a column of troops, by reason of their greater dispersion vertically. At about 200 yards one Gatling gun, used with the oscillator to spread the fire, would not deliver more than half as many hits against a column of troops as one 8-inch howitzer fired with double charges of canister, each containing 440 lead balls, but the disabling effect, hit for hit, would be much greater from the Gatling gun. Without the oscillator the Gatling gun will put every shot into a target 9 feet by 45 feet at a greater distance than 200 yards. At 500 yards, one Gatling gun fired with the oscillator gives 58 per cent. more hits in a target 9 feet by 45 feet than two 12-pounder Napoleon guns and one 8-inch howitzer together, each firing 1½ minutes. At 800 yards, target 9 feet by 45 feet, one Gatling gun hit 320 times, against 38 hits for two Napoleons and one 8-inch howitzer together, each firing 1½ minutes. In firing against time at a column of ten targets each 6 feet by 50 feet, representing a regiment of infantry in column, approaching or retiring from the battery, the nearest company being 1000 yards and the farthest 1150 yards distant, one Gatling gun gave 17 per cent. more hits than the 8-inch howitzer firing spherical case, and 144 per cent. more than the 4½-inch rifle firing shrapnell. At 1200 yards distant, target 9 feet by 45 feet, the Gatling gun fired without the oscillator gave 180 hits on the first trial, and 413 on the second. Number of shots fired at each trial, 600; time, 1½ minutes. The advantages possessed by this gun are the lightness of its parts; the simplicity and strength of its mechanism; the rapidity and continuity of its fire without sensible recoil; its effectiveness against troops; its general accuracy at all ranges attainable by rifles; its comparative independence of the excitements of battle; the interchangeableness of its ammunition with that of the same calibre of small-arms; and its great endurance. Its disadvantages compared with all shell-guns are its inability to deliver a curved fire, so as to reach behind intervening obstacles; its want of effectiveness against troops covered by rifle-pits and slight intrenchments, or lodged in houses or in heavy woods; and its entire want of breaching power. It is peculiarly adapted to the defence of intrenched positions and villages; for protecting roads, defiles, and bridges; for covering the embarkation or debarkation of troops or the crossing of streams; for silencing batteries by driving off the gunners; for increasing the infantry-fire at the critical moment of a battle; for supporting field batteries against assaults and charges; for covering a retreating column; and its economy in men for serving and in animals for transporting it. These guns are made of calibres of 1-inch, weight, 650 pounds; .75-inch and .65-inch, each weighing 450 pounds; .55-inch, weight 400 pounds; and .50-inch, .45-inch, and .42-inch, each weighing 200 pounds. The gun-carriage and limber complete for the three smaller calibres weigh 713 pounds. (For further details see report of a board of officers, of which the writer was a member, published by the ordnance department U. S. Army.)

Q. A. Gillmore.

Gauchos. See Guachos.

Gauden'tius, bishop of Brescia in the fourth century, is remembered for his discourses, of which twenty-one are now extant. He was the friend of Ambrose and Chrysostom. Of his life little is known.

Gauge, or **Gage,** an instrument for measuring capacity, dimension, or some special force. Thus, the diameter of wire is determined by the wire-gauge. The anemometer is sometimes called the wind-gauge. There are also steam-gauges, instruments to determine the pressure of steam in boilers, etc.

Gaug'ing is the finding the approximate capacity of vessels, and especially of casks containing liquids, by means of a graduated rule called the gauging-rod. Measurements by this rod, treated in accordance with certain specified mathematical formulas, give the contents with tolerable accuracy.

Gaul. See GALLIA.

Gaul'ey Moun'tains, in West Virginia, are a part of the ridge known farther S. W. as the Cumberland Mountains. The name is sometimes given to the Little Gauley Mountains in Nicholas co., and is sometimes extended indefinitely to the same range farther to the N. E. The mountains contain much wild and sublime scenery.

Gau'ley Riv'er, in West Virginia, rises in Pocahontas co., drains a valley having the Gauley and Birch Mountains on the N. W. and the Greenbrier Mountains on the S. and S. E. It falls into the Great Kanawha.

Gauls. See CELTS.

Gault, The, originally a provincial name for a stratum of stiff blue calcareous clay or marl occurring in several localities in the S. and E. of England, but now accepted as a geological term to designate a stratigraphical horizon in the Cretaceous formation of Europe. When represented in the series (and it is often wanting), this stratum of clay, varying in thickness from 80 to 200 feet, is regarded as the commencement of the Upper Cretaceous. It intervenes between the Lower and the Upper Greensands, and lithologically is very distinct from either; palæontologically, its fossils, abundant and often beautifully preserved, represent a fauna marked by a strong preponderance of forms identical with or closely related to those of the Upper Greensand or of the chloritic marl above. E. C. H. DAY.

Gaulthe'ria [named in honor of Dr. *Gaultier* of Quebec, a physician of the eighteenth century], a genus of shrubs mostly very small, found in North and South America, Asia, Australia, etc. Many of them produce edible fruits. The typical species is the *Gaultheria procumbens,* the wintergreen or checkerberry of the U. S. and Canada. Its fruit and young leaves are edible, and abound in the oil of wintergreen, a fragrant volatile oil used in pharmacy and confectionery. The *Gaultheria* (now *Chiogenes*) *hispidula,* the sweet birch (*Betula lenta*), and several other plants yield the same oil. The *Gaultheria Shallon* of the Pacific coast (the *Salal* of the Indians) is sometimes three feet high, and produces very pleasant edible berries, which are pressed into cakes and largely used for food.

Gault'ney's, tp. of Alexander co., N. C. Pop. 1126.

Gaur, a large and ferocious wild ox (*Bibos gaurus*) found in the jungles of parts of India. It has no dewlap, and is characterized by a high ridge along the back, caused by the great development of the spinous processes of the vertebræ. It is reported to be incapable of domestication, and so fierce that no tiger will molest it. It goes in herds. The gaur has been called the largest of the ox tribe. It is peculiarly marked by white hair upon the legs. When in herds, though a brave and spirited beast, it is not often vicious and irascible. Its flesh is excellent. Its voice is quite different from that of the ox.

Gauss (KARL FRIEDRICH), b. in Brunswick, Germany, Apr. 30, 1777; was educated at the expense of the duke of Brunswick, who had heard of his precocious mathematical talents; solved when eighteen years old the problem of the division of the circle into seventeen equal parts, and afterwards became famous for skill in the indeterminate analysis and in curious numerical questions; demonstrated Fermat's theorem; became in 1807 professor of astronomy at Göttingen and director of the observatory; received in 1810 the Lalande medal for calculating by a new method the orbits of Ceres and Pallas; was made in 1816 a court councillor, and in 1845 a privy councillor of Hanover; made after 1821 important improvements in geodetic methods and instruments; after 1831 devoted much attention to terrestrial magnetism. D. at Göttingen Feb. 23, 1855. Gauss is regarded as one of the first mathematicians of this century. His principal works are *Disquisitiones Arithmeticæ* (1801), *Theoria motus corporum cœlestium* (1809), *Theoria combinationis observationum* (1823), *Intensitas Vis Magneticæ* (1833), reports of the *Magnetischer Verein* (1836, with Weber, and 1837–40), *Atlas der Erdmagnetismus* (1840), *Dioptrische Untersuchungen* (1841), and collections of papers on geodesy and related subjects.

Gau'tama, properly the name of the great Solar race of East Indian warrior-princes, but more especially the name of SAKYA-MUNI (*Sakya* is a family name; *muni*= *μόνος*, "solitary"), otherwise called GAUTAMA BOODDHA, the alleged founder of BOODDHISM (which see). He was b. 624 B. C., the son of Suddhôdana, king of Kapilavastu, in the N. of India, and in youth was called *Siddhârta.* The story of his life is a tissue of monstrous fables, and H. H. Wilson supposes the whole to be perhaps allegorical; but it is generally believed that there is a historical basis to the story. In early life he was of ascetic habits, but, tempted by his father, he abandoned himself to every pleasure for a time; but his singular wisdom (which, like his other marvellous gifts, was the fruit of merits gained in previous states of existence) led him to renounce the world, and after years of profound study, severe bodily maceration, and long contemplation, he discovered the supreme truth that to return to the ignorance and state of non-sentient repose whence man sprang is the highest possible good and the final reward of the just and pure. After this discovery he was made a *booddha,* and after a time passed into Nirvana, or unconsciousness, having d. at Kusinagara in 543 B. C. His body was burned, but numerous relics of him were preserved and became objects of veneration. The Brahmans teach that he was the ninth *avatar* of Vishnu, sent to delude and destroy the Asura race.

Gautier (THÉOPHILE), b. at Tarbes, France, Aug. 31, 1811; studied at the College of Charlemagne, and tried, without success, to become an artist. In 1830 he published a volume of poems, and from that time took position as a Parisian *littérateur* of the romantic school; was 1836–56 art-critic and dramatic censor for the *Presse;* became literary editor of the *Moniteur Universel* 1856; of the *Journal Officiel* 1869. D. in Paris Oct. 23, 1872. Author of *Albertus* (poem, 1832), some pleasant books of travel, many good novels, and other works, among which are *Les grotesques* (1844), *Trésors d'art de la Russie* (with Richebourg, 1860–63), *Histoire de l'art dramatique en France* (6 vols., 1859), with several poems, librettos, and many fugitive pieces. His style is delightfully clear, but is without the piquancy so much affected by most French writers. His criticism shows the influence of the German philosophy, by which he was profoundly influenced, but without losing his own independence as a thinker.

Gauze, a light fabric of silk or silk and cotton, woven so loosely and with such delicate threads as to be quite transparent. It is believed to take its name from *Gaza,* in Palestine, where it was once made. Switzerland, France, and Scotland now chiefly produce it. The name is also given to other light fabrics, such as the woollen or silk-and-woollen material used for summer undershirts. Fine wire-cloth is called wire-gauze. It is often made of surprising delicacy and transparency.

Gau'zu-vi'va, the *Coassus nemorivagus,* a delicate little sheep-like deer of Brazil. It is of a grayish-brown color, and has small horns. It is but twenty-six inches long.

Gavarni, a name assumed by SULPICE GUILLAUME PAUL CHEVALIER, b. in Paris 1801; first published sketches of the valley of Gavarnie in the Pyrenees, whence his pseudonym; attained great fame by his humorous delineations of Parisian life, exposing the foibles of good society, as well as the laughable eccentricities of low life. He also illustrated several books, among which the best known is Sue's *Wandering Jew.* Gavarni's designs are very numerous. D. at Auteuil Nov. 23, 1866.

Gava'zzi (ALESSANDRO), an eloquent champion of Italian independence, unity, and evangelization, was b. at Bologna in the year 1809. In 1825 he joined the monastic order of Barnabites, and was afterward appointed professor of rhetoric at Naples. Shortly after the accession of Pope Pius IX. (1846) he removed to Rome, drawn thither by sympathy with the reformatory spirit of the new pontiff. In 1848 he was made suddenly famous by an impassioned oration which he pronounced in the Pantheon in commemoration of the patriots who had fallen on the plains of Lombardy in the war with Austria. The pope, who then shared in the national enthusiasm, appointed him chaplain-general and almoner of the Roman legion (16,000 strong), raised to take part in the struggle. These troops, which had marched to Vicenza, were soon recalled. But Gavazzi, instead of returning with them, broke with the pope, and became another Peter the Hermit, preaching a new crusade. Florence, Genoa, and Bologna, all rang with his appeals. The new republic made him chaplain-general of the army. The French occupation of Rome (in July, 1849) drove him into exile. He visited England, Scotland, the U. S., and Canada, lecturing against the Papal Church. In 1851, while in London, he published first his *Memoirs,* and a few months later his *Orations.* In 1860 he was with Garibaldi in Sicily. In 1870 he was again in England, and in 1873 came once more to the U. S. He is now (1875) an evangelist in Rome, and lectures on rational theology and homiletics in the college of the "Free Christian Church in Italy."

R. D. HITCHCOCK.

Gav'elkind, a system of land tenure prevailing in England in the county of Kent, by which the land of a father is equally divided at his death among all his sons,

or the land of a brother among all his brothers if he have no issue of his own. This custom is said by some writers to have existed universally throughout the kingdom before the Norman Conquest, and to have been retained by the inhabitants of Kent as a part of their ancient liberties. It is a peculiarity of this tenure that the estate has never been subject to forfeiture in case of attainder for felony, and when feoffment was in use as a mode of conveyance, the heir was capable of selling the land and giving livery of seizin at the early age of fifteen. (See FEOFFMENT.) The special mode of inheritance appertaining to lands held in gavelkind is distinct alike from the usual English system of primogeniture and the more equitable law of descent prevailing in the U. S., by which all the children of an intestate, females as well as males, take equal shares in the land. GEORGE CHASE. REVISED BY T. W. DWIGHT.

Ga'vi, town of Italy, in the province of Alessandria. It is of ancient origin, and is still surrounded by its mediæval wall with gates. The old fortress is now used as a prison. The parochial church, although much restored, dates back to the Carlovingian period. Pop. 6304.

Ga'vial, or **Na'koo** (the *Gavialis Gangeticus*), the largest of living Crocodilidæ, inhabiting some of the streams of India, and at times attaining a length of thirty feet. It is characterized by long and narrow jaws and has 120 teeth. The male has a large cartilaginous lump near the nostrils. This creature is inoffensive to man, feeding chiefly upon fishes and other small animals. Closely related African species are described.

Gavial.

Gavilan' Mountains, a group of mountains in Monterey co., Cal., near the Pacific coast. The highest point is Mt. Pacheco, 2845 feet high.

Gavot' [It. *gavotta;* Fr. *gavotte*], in music, a gay and spirited dance-tune, written in common time. It has two strains, each of which is repeated, the latter being usually the longer. The gavot was familiar in the seventeenth century and later, and often appears in connection with the *minuet*—as, *e. g.*, in the forty-eight sonatas of Corelli.

Gay, tp. of Taylor co., Ia. Pop. 248.

Gay (GEORGE WASHINGTON), M. D., b. at Swanzey, N. H., Jan. 14, 1842; graduated at Harvard Medical College 1868; one of the surgeons of the City Hospital, Boston, Mass.; author of various professional papers.

Gay (JOHN), b. in Devonshire, England, 1688; was apprenticed in London to a silk-mercer; published *Rural Sports*, a poem (1711), which won him Pope's lifelong favor; became in 1712 secretary to the duchess of Marlborough, and in 1714 secretary to Clarendon, who was then ambassador to Hanover; acquired wealth, but lost it in the South Sea Bubble, and after 1727 was a dependant upon the bounty of the duke of Queensberry. D. in London Dec. 4, 1732. Was the author of several very successful dramas, some fine ballads, and other poems remarkable for wit and other choice qualities, but some of his pieces are needlessly indelicate. The excellent *Fables* (1726) and *The Beggars' Opera* (1727) are especially noteworthy.

Gay (WINCKWORTH ALLAN), an American landscape-painter, b. in Hingham, Mass., Aug. 19, 1821; studied with Prof. Robert Weir of West Point, afterward with Constant Troyon in Paris; passed several years in Europe, but is best known in his own country in Boston, where his quiet, meditative pictures, chiefly of New England scenery, are much prized. O. B. FROTHINGHAM.

Gay'ah, city of British India, the cap. of the district of Bahar, on the Phalga, which empties into the Ganges. The Phalga is a sacred river, and more than 100,000 pilgrims visit it annually, which chiefly gives Gayah its importance. The city consists of two parts—the old city, inhabited by the Brahmans; and the new city, which is the business quarter. Pop. 35,000.

Gayal', a variety, perhaps a species (*Bos gavæus*), of the domestic ox, found in parts of Bengal and Farther India, where it is reared in great herds for its hide and flesh. It has very rich but scanty milk.

Gayarré (CHARLES E. ARTHUR), b. at New Orleans, La., Jan. 3, 1805, was educated at the College of New Orleans, and studied law in Philadelphia; admitted to the bar in 1829; was sent in 1830 to the legislature, and several times in later years; in 1831 became deputy attorney-general of Louisiana; presiding judge of the New Orleans city court in 1833; was elected in 1835 to the U. S. Senate, but did not take his seat; was secretary of state in Louisiana 1846–53. He is best known as the author of a series of important works upon the history of Louisiana, partly in French and partly in English (1830, 1847, 1848, 1851, 1852, 1854); *Philip II. of Spain* (a history, 1866); *Fernando de Lemos* (a novel, 1872), besides a drama and a number of lectures and printed addresses.

Gay-feather, a popular name for the *Liatris scariosa* and *spicata*, and perhaps for other species of that interesting genus of composite herbs. They grow extensively throughout most of the U. S.; have bulbous roots, a terebinthinate taste, and active medicinal properties. These plants are among those locally known as "rattlesnake master." They have beautiful purple flowers, and are worthy of extensive cultivation in flower-borders.

Gay Head, post-tp. of Dukes co., Mass., is a bold headland forming the W. portion of the island of Martha's Vineyard. It takes its name from the brilliant colors of its cliffs. To the geologist its rocks are peculiarly interesting from its miocene fossils—coprolites, bones, lignite, iron ore, etc. It has a flashing white light of the first order 170 feet above the sea; lat. 41° 20′ 52″ N., lon. 70° 49′ 47″ W. Most of the inhabitants are Indians, who gain a living by farming and fishing. They rear a breed of small horses called Gay Head ponies. Pop. 160.

Gayle (GEORGE W.), an able lawyer and Democratic politician of Selma, Ala., was U. S. district attorney under President Jackson, and became a prominent State legislator. His offer, during the late war, of a reward of $1,000,000, Confederate money, to any one who would destroy President Lincoln, led to his arrest after the war as an accomplice in the assassination of Mr. Lincoln, but he was released without a trial. D. Apr. 1875.

Gayle (JOHN), b. in Sumter district, S. C., Sept. 11, 1792; was educated at South Carolina College; removed in 1813 to Alabama; entered the legislature in 1817; became a district solicitor 1820; a judge of the Alabama supreme court 1823; in 1829 Speaker of the House; governor 1831–35; was in Congress 1847–49; became in 1849 a judge of the U. S. district court for Alabama, and d. at Mobile July 20, 1859. A man of brilliant talents, his usefulness was diminished by irregular habits.

Gay'ler (CHARLES), b. in New York in 1820; became connected with the press of Cincinnati; removed in 1850 to New York, and attained distinction as a journalist and writer of dramatic pieces, among which are *The Gold-Hunters; The Frightened Fiend*, operetta; *The Love of a Prince; Galieno Faliero; Isms; Taking the Chances; The Son of Night*, and many others, nearly all highly successful upon the stage.

Gay-Lussac (JOSEPH LOUIS), b. at St. Léonard, in the department of Haute-Vienne, France, Dec. 6, 1778. The French Revolution interfered little with his education, which was completed at the École Polytechnique. In 1800, Berthollet, on his return with Bonaparte from Egypt, chose Gay-Lussac for his assistant. In 1804, under the auspices of the Institute, Gay-Lussac, with Biot, made a memorable ascent in a balloon to investigate the intensity of the magnetic force. Shortly after he made another ascent alone, reaching the great height of 7016 mètres. These were the first balloon ascensions for scientific purposes, and resulted in showing that the magnetic force diminishes very little with the elevation, and in establishing the invariable composition of the atmosphere. Together with Humboldt, he proved that water is formed by the union of 100 volumes of oxygen and 200 volumes of hydrogen. He afterwards accompanied Humboldt on a scientific journey through Germany and Italy. He was elected a member of the Academy of Sciences in 1806, professor of chemistry at the École Polytechnique in 1809, and soon after professor of physics at the Sorbonne. In 1831 he was elected to the Chamber of Deputies; he did not, however, allow his public duties to interfere with his scientific pursuits, and in the following year accepted the professorship of chemistry at the Jardin des Plantes. In 1839 he was made a peer of France. After a long life, devoted to science, he d. in Paris May 9, 1850. Gay-Lussac made important contributions to nearly every branch of chemical and physical science. He discovered the law that all gases have the same coefficient of expansion; he made researches on iodine and on cyanogen, the latter inaugurating the theory of compound radicals. In connection with Thénard he conducted a remarkable investigation with the aid of an enormous voltaic pile which was placed at his disposal by the École Polytechnique. The results were published in two volumes—*Recherches physico-chimiques* (1811), and in memoirs read before the Institute. His valuable papers will be found in the *Mémoires* of the Society of Arcueil, and in

the *Annales de Chimie et de Physique*, of which he was an editor. (An interesting biography, with an analysis of his scientific labors, is contained in vol. iii. of Arago's biographical notices.) H. CARRINGTON BOLTON.

Gayo'so, post-v. and tp., cap. of Pemiscot co., Mo., is situated near the bank of the Mississippi River. It was located in 1852, and during the late war was nearly destroyed. It has a court-house, a church, a school-house, a hotel, 1 weekly newspaper, and a number of stores. Pop. of tp. 463. GEO. W. CARLETON, ED. "DEMOCRAT."

Gays'port, borough of Blair co., Pa., separated by a small stream from HOLLIDAYSBURG (which see). Pop. 799.

Ga'za ["the strong;" now *Ghuzzeh*], in Palestine, the southernmost and strongest of the five royal cities of the Philistines. Along with Damascus, it is one of the oldest cities in the world. Commanding the road to Egypt, it has been the scene of repeated and desperate struggles. Samson's exploits have made it famous. It was captured by Alexander the Great after a siege of nearly five months. In 634 it fell into the hands of the Saracens for a time, and since the battle of Holtin in 1170 has remained Mohammedan. Gaza is now about 3 miles from the Mediterranean, nearly the whole space between it and the sea being covered with ruins. It consists of a group of villages. The nucleus stands on a hill, with its buildings of stone, the suburbs containing only mud-hovels. The population is estimated at about 15,000, mostly Mohammedans.
R. D. HITCHCOCK.

Gaza (THEODORUS), b. about 1405 at Thessalonica; left that town on its capture by the Turks in 1430; was rector and professor of Greek in the gymnasium of Ferrara; was employed 1450–56 by Pope Nicholas V., and 1456–58 by Alfonso the Magnanimous of Naples. Bessarion procured him a small benefice in Southern Italy. D. in 1478. His Greek grammar (1495) was long famous. His letters, his Greek treatise on the calendar, and numerous translations from Latin to Greek and Greek to Latin, added to his merited reputation as a man of learning.

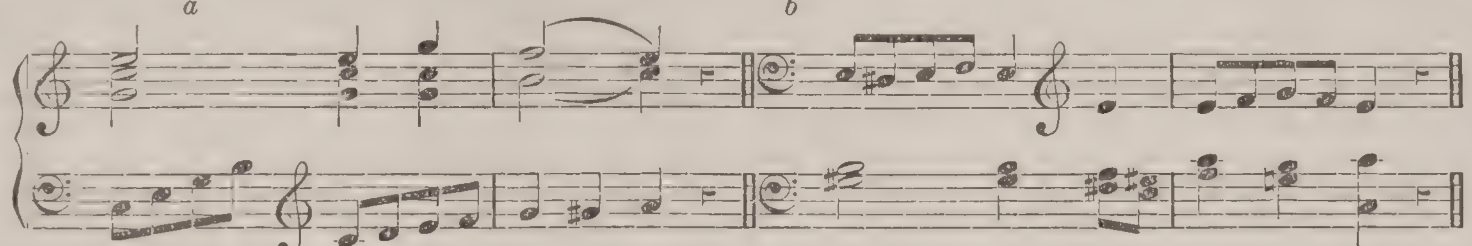
Gazelle [Arab. *gazâl*], the *Gazella dorcas* and the nearly allied species, antelopes of Africa and Asia. The above-mentioned species is found in Northern Africa, but the ariel gazelle of Asia is a more graceful variety of the same species. The gazelles are celebrated for their elegant forms and the beauty of their eyes. They are easily tamed, and become great favorites from the gentleness of their disposition. *Gazella Sœmmeringii* and *Isabella* are among the other closely-kindred species. Both are African.

Gazette [from *gazeta*, a former coin of Venice, worth about a farthing, which gave its name to a sort of news bulletin which sold for that price], a periodical, a printed journal; applied especially to the official newspaper printed semi-weekly in London, Edinburgh, and Dublin, and containing the new appointments and official acts and proclamations of government, bankrupt notices, and the like.

Gazetteer' [Fr. *gazetier*], a geographical dictionary; a work containing some account of civil and natural divisions in geography, of mountains, rivers, lakes, seas, etc., arranged in alphabetical order. Gazetteers often are local or national, but there are many, more or less complete, which describe places in all parts of the world.

G Clef, in music, the sign or mark indicating the treble staff. Its place is on the second line, or, rather, that line is the axis around which it entwines. This clef was originally compounded of the letters *g* and *s*—the former giving its location the name of G (as two octaves above gamut G), and the latter representing *sol*, or the fifth (in the scale of C) of the series of syllables used in solmization. The name G being thus given to notes on the second line, all others, above and below, on the same staff derive their names from it. In organ and pianoforte music the treble clef is prefixed to the part played by the right hand, and the bass, or F clef, to that for the left. Occasionally, however, when the left-hand part runs very high, the treble clef is temporarily substituted, as at *a* in the example:

a *b*



For a similar reason, the bass clef may be conveniently used in the right-hand part, as at *b*, where the right hand crosses the left. In vocal music the G clef is now very generally used, not only for the soprano, but also for the alto and tenor parts, instead of the C clef, in which these latter parts are more properly written. The *tenor* notes are thus really set *one octave above* their true place; and in consequence of this many false progressions, crossings, etc. are represented to the *eye*, though they do not exist in the actual performance. WILLIAM STAUNTON.

Gear'ey, post-v. of Roane co., West Va. Pop. 950.

Gearing. See WHEEL-WORK.

Gear'y (JOHN WHITE), b. in Mt. Pleasant, Westmoreland co., Pa., Dec. 30, 1819; studied at Jefferson College, Cannonsburg, Pa.; became a civil engineer. In the war with Mexico (1846–48) he went to the seat of war as lieutenant-colonel 2d Pennsylvania Vols., serving during the campaign from Vera Cruz to the city of Mexico with distinction; was wounded once; was promoted to the coloneley of his regiment, and on the capture of the city of Mexico was placed in command of the citadel. In 1849 he was appointed by President Polk postmaster of San Francisco, Cal., with authority to organize the postal service throughout our then new Pacific coast territory. Soon afterwards he was elected alcalde of the city, and was appointed by the military governor judge of the first instance for San Francisco. He remained in San Francisco till 1852, performing at different times the ex-officio duties of sheriff, recorder, probate judge, etc., and exercising a large influence in organizing the government of that city, whose first mayor he was (1850). Returning to Pennsylvania in 1852, he remained in private life till 1856, when he was sent by President Pierce to Kansas as governor. His territorial administration was not successful, and becoming involved in trouble with Judge Lecompte, Geary was forced to retire, returning to Pennsylvania and remaining in private life till the outbreak of the civil war (1861), when he raised and equipped the 28th Pennsylvania Vols., which regiment he commanded in several engagements in the Shenandoah Valley. In Apr., 1862, he was appointed brigadier-general, and the next year promoted to be major-general and placed in command of a division, remaining in active service till the close of the war. In 1866 he was elected governor of Pennsylvania by the Republican party, and re-elected in 1869. D. suddenly at Harrisburg Feb. 9, 1873.

Gear'y Cit'y, a v. of Wayne tp., Doniphan co., Kan., on the Missouri River. Pop. 102.

Geau'ga, county of N. E. Ohio, in the "Western Reserve." Area, 400 square miles. The surface is undulating and well timbered; the soil heavy, but very productive. Cattle, grain, fruit, wool, and dairy products are the staples. Cheese, carriages, and wagons are extensively manufactured. It is traversed by the Painesville and Youngstown R. R. Cap. Chardon. Pop. 14,190.

Gebang' Palm, one of the most valuable of known palms, the *Corypha Gebanga* of Java and the neighboring regions. It yields sago, roofing thatch, material for hats, fishing-nets, cloth, cordage, etc., and its roots afford a valuable remedy for the diarrhœa so prevalent there.

Geb'weiler, town of Upper Alsace, Germany (formerly *Guebwiller*, Haut-Rhin, France), in a valley near Mount Gebweiler, the highest point of the Vosges. It has important and varied manufactures. It is 14 miles S. S. W. of Colmar, on the river Lauch. Pop. 11,338.

Geck'o (so named from the cry of one of the species), a name given to numerous thick-tongued nocturnal lizards of the family Geckotidæ. There are not less than forty species, among which the *Ptyodactylus gecko* of Africa (whose footsteps were thought to be the cause of the leprosy, and which was considered able to eat steel) and the *Gecko verus* of Asia are among the best known. Other species are found in America, Australia, etc. They generally have the power of climbing walls, walking upon ceilings with the back downward, etc., after the manner of flies.

Ged'des, post-v. of Onondaga co., N. Y., on the Erie Canal, the Oswego and Syracuse R. R., and Onondaga Lake, 5 miles N. W. of Syracuse. Geddes in 1870 manufactured 1,411,474 bushels of salt from salt-wells. It has also extensive iron-works, potteries, etc. Pop. 3629. The township contains the State asylum for idiots. Total pop. 4505.

Geddes (JAMES), b. near Carlisle, Pa., July 22, 1763; removed to New York, and settled at Geddes, Onondaga co., N. Y. (named in his honor), 1794; was a prominent mover and agitator of the subject of a canal from Lake

Erie to the Hudson River, and in 1808 was appointed to make the preliminary surveys of the route, reporting the plan practicable and not difficult to accomplish: in addition to his duties of judge of Onondaga co., he accepted (1816) the appointment of engineer of the Erie Canal; appointed chief engineer of the Champlain Canal 1818; and in 1822 engineer to make surveys for a canal from the Ohio River to Lake Erie; in 1827 employed by the U. S. government to locate the Chesapeake and Ohio Canal, and 1828 by the State of Pennsylvania upon its canals. D. at Geddes Aug. 19, 1838. G. C. SIMMONS.

Ged'dings (ELI), M. D., was b. in Newberry district, S. C., in 1799; in 1820 was licensed by an examining board to practise medicine; in 1821–22 attended lectures at the University of Pennsylvania, and during 1824 removed to Charleston, where he received the first degree conferred by the medical college of his State (1825). Dr. Geddings then spent a year in Europe, studying his profession, and on his return home was appointed demonstrator in his alma mater. He subsequently filled the chairs of anatomy and physiology, then that of surgery, and that of the theory and practice of medicine; was also called to the universities of Maryland and New York City, where he was a professor for a short time; but having subsequently declined these and other calls tendered him, he now occupies his old position, that of surgery, in the school at Charleston. Beyond the allotted period of man, he still remains an active member of the profession. P. F. EVE.

Gedro'sia, the name given by Romans and Greeks to what is now the *Mekrân*, or coast-region of Beloochistan, a dry and unfruitful region.

Gee'long, town of Victoria, Australia, 40 miles S. W. of Melbourne, on Corio Bay, has 7 banks, 3 newspapers, fine public buildings, and is connected by rail with Ballarat and Melbourne. It is a centre of the Australian wool-trade. Pop. with suburbs, 22,618.

Geer (GEORGE JARVIS), D. D., b. Feb. 24, 1821, in Waterbury, Conn.; graduated at Trinity College, Hartford, in 1842, and in 1845 received the degree of A. M. from the same college; graduated from the General Theological Seminary 1845; ordained deacon in Christ church (Protestant Episcopal), Hartford, Conn., by Bishop Brownell, June, 1845; became rector of Christ church, Ballston Spa, N. Y., Sept., 1845; ordained presbyter in Ballston Spa by Bishop De Lancey June 11, 1846; became associate rector of the church of the Holy Apostles, New York, Nov., 1852; became rector of St. Timothy's church, New York, Oct. 22, 1857; received the degree of S. T. D. from Columbia College, New York, June, 1862; received the degree of D. D. from Union College, N. Y., in Aug., 1862. In 1858, as joint editor with Rev. Dr. Muhlenberg and Bishop Bedell, by appointment of the bishops, he published the *Tune-Book of the Protestant Episcopal Church;* in 1871 published a book on *The Conversion of St. Paul.* Is (1875) rector of St. Timothy's church, New York; was the first president of the Free Church Guild of New York; was a member of the General Convention of 1874 from the diocese of New York.

Geez. See ETHIOPIC LANGUAGE AND LITERATURE, by PROF. C. F. A. DILLMAN, PH. D.

Geffrard (FABRE), a president of Hayti, was b. at L'Anse à Veau, Hayti, Sept. 19, 1806, was the son of Gen. Nicolas Geffrard, who had co-operated with Dessalines and Pétion. Young Geffrard was early distinguished for ability, and though himself a *griffe* (three-fourths African blood), took the part of the mulattoes against the blacks. In 1845 he became a lieutenant-general, and in 1849 was made a duke by Soulouque. In 1858 he led in the revolution against Soulouque, and banished him in 1860. Geffrard was president of Hayti 1860–67, when he was himself banished, and retired to Jamaica.

Gef'le, town of Sweden, on the Gulf of Bothnia, 100 miles N. of Stockholm. It has considerable trade in iron, timber, tar, and flax. Pop. 13,315.

Gehen'na [Heb. *Ge-hinnom*, the "vale of Hinnom"], a deep gorge, the valley of Hinnom, lying S. of Jerusalem. It was called also Tophet, "place of fire," because the practice of burning infants as sacrifices to heathen gods was carried on here by idolatrous Jews (it is, however, denied by some that they were actually burned). To break up this detestable practice, Josiah defiled the place by making it the receptacle of human bones and of all sorts of filth. We are told that perpetual fires were kept up to destroy this offal; hence, Gehenna and Tophet became synonyms for HELL (which see).

Gei'ger Grade, tp. of Washoe co., Nev. Pop. 55.

Gei'jer (ERIC GUSTAF), one of the richest geniuses in modern Swedish literature, and its most celebrated historian, was b. at Ransäter, in Wermland, Jan. 12, 1783, and studied, after 1799, at the University of Upsala. In 1803 obtained the first prize from the Academy of Sciences in Stockholm for his dissertation on Steen Sturé; in 1806 graduated as a master of arts; in 1809 travelled in England; and in 1810 was appointed lecturer in history at the University of Upsala. After a short residence in Stockholm as inspector of the archives, he returned in 1815 to Upsala as professor of history, in which position he remained until in 1846 ill-health compelled him to resign. He retired to Stockholm, where he d. Apr. 23, 1847.

After the revolution of 1809, by which the liberty of the press was established in Sweden, a fierce contest arose in literature between the French classicism, represented by the Academy, and the romantic school, originated in Germany and represented in Sweden by two parties—the Phosphorists, headed by Atterbom, and the Goths, headed by Geijer and Tegnér. But while the Phosphorists, like their brethren in Germany, rushed through all countries and all ages in search of the most wonderful subjects and the most fantastic forms, the Goths concentrated themselves on the national, and took their subjects from the old Scandinavian sagas and the Swedish popular songs of the Middle Ages. The Goths did not take part in the battle, but when the fight was over they kept the field, and the articles of Geijer in *Iduna*, the organ of the party, as well as his poems, contributed very much to the establishment of the taste of the Swedish people, which had been roused, but also completely unsettled, by the Phosphorists. His poems are not numerous, neither have they the brilliancy of those of Tegnér, but they are very powerful. *The Viking* makes an impression as if it were not written on paper, but hewn in stone, and many of his psalms have been incorporated into the Swedish hymn-book. In connection with A. Afzelius he produced (1814–16) an edition of the Swedish popular songs in 3 vols., and to many of his own songs he composed beautiful melodies, which immediately became very popular. It was as an historian, however, that Geijer acquired his greatest fame, especially as author of *Svenska Folkets Historia* ("History of the Swedish People"), published in 3 vols. from 1832 to 1836, and translated into German by Leffler, into French by Lundblad, and into English by Turner. His first historical work was *Svea Rikes Häfder* ("Annals of Sweden"), 1825, a series of essays on the earliest history of Sweden. In 1839 he published *Sketch of the State of Sweden from Charles XII. to Gustavus III.*, and in 1844, *Life of Charles XIV. John.* He also edited the posthumous papers of Gustavus III. in 1843, and, in connection with Fant and Schroeder, the *Scriptores Rerum Suecicarum Medii Ævi*, from 1818 to 1828. His *History of the Swedish People* is a most remarkable book, and ranks among the very first works of historiography. It is not merely a history of Swedish politics, but a history of Swedish society in the true sense of the word—a history of the Swedish people, of their manners and customs, of their ideas and passions, of their character and destinies. It has no extraordinary force, either of description, analysis, or argumentation, but it has a most extraordinary power of unfolding views large, complete, calm, and yet inspiring by the restrained enthusiasm in which they are written. CLEMENS PETERSEN.

Geiss'ler's Tubes, tubes made of very hard glass, and containing each some one gas (oxygen, carbonic acid, nitrogen, hydrogen, etc.) in a highly rarefied state. Each end of the tube is pierced with an electrode from an induction coil; and if the glass, the rarefied gas or "vacuum," and the current be properly adjusted to each other, the most surprising and beautiful luminous appearances may be seen. The carbonic acid vacuum in a small spiral Geissler tube emits so much light that it has been employed in the endoscope as a means of illuminating the cavities of the human body for diagnostic purposes. Each gas gives its own peculiar light and spectrum.

Ge'la, city of Sicily, situated on the southern coast, was founded in 690 B. C. by a colony of Rhodians, and grew so rapidly that 100 years later it sent out a colony itself, which founded Agrigentum. Under its tyrants, Cleander, Hippocrates, and Gelon, it conquered the whole of Sicily, but in 485, when Gelon removed his residence to Syracuse, it began to decline, and in 280, Phintias, the tyrant of Agrigentum, utterly destroyed it by removing all its inhabitants to the new city he was founding. In the times of Augustus it lay in ruins, which can still be seen in the neighborhood of the present town of *Terra Nuova.*

Gela'sius I., SAINT, pope, succeeded Felix III. Mar. 1, 492, and, according to Protestants, was the first pope who claimed complete independence of the synods and the civil authority. He wrote against the Nestorian and Eutychian heresies, but several works ascribed to him are probably spurious. D. Nov. 19, 496, and was succeeded by Anastasius II.—GELASIUS II., POPE (GIOVANNI DI GAETA), succeeded Pascal II. in 1118, but was imprisoned in the

same year; escaped and fled to Gaeta. The emperor Henry V. caused the antipope Gregory VIII. to be chosen in his stead. Gelasius d. at Cluny Jan. 29, 1119, and was succeeded by Calixtus II.

Gel′atine, a semi-solid substance of a soft, tremulous consistence, produced from certain animal membranes (skin, fibrous tissue, etc.) by the action of hot water. Isinglass, calf's-foot jelly, glue, etc. are chiefly composed of gelatine. In its ordinary form it contains much water, which may be dried out, leaving a glassy, brittle mass, which swells, but does not dissolve, in cold water. The gelatine from cartilage is called chondrine, and is somewhat different from true gelatine. Dry gelatine is reported as consisting of 50.05 parts carbon, 6.9 hydrogen, 14.7 nitrogen, and 27.65 oxygen. (*Scherer.*) Others believe that it contains a little sulphur. It has been long known that it exists abundantly in bone-soups, etc. For a long time it was held to be innutritious, but at present a considerable (but not high) nutritive value is conceded to it. Gelatine is thrown down from the watery solution by alcohol, by a solution of corrosive sublimate, by tannic acid, and by chlorine gas. Gelatine is extensively used in the arts—as *finings* for beer, as a dressing for silk and other fabrics, as a coating for dragees and pills, as a material for the capsules which hold unpleasant medicines, for preparing tracing-paper, as a material for delicate casts, as the basis of numerous jellies for the table; and dried gelatine plates are employed in photo-lithography and the kindred arts. (See GLUE, ISINGLASS, etc.)

Gel′derland, province of the Netherlands, bounded by the Zuyder-Zee, Prussia, and the provinces of Overyssel, Utrecht, and Brabant. Area, 1972 square miles. Pop. 432,693. Along the rivers Rhine, Waal, and Yssel the soil is a rich loam, carefully cultivated, and large crops of wheat, rye, buckwheat, and tobacco are gathered. Farther back the ground becomes hilly and sandy, covered with large forests of pine and oak. Excellent cattle are reared; the horses are highly esteemed, both in France and Germany. Considerable brewing and distilling is carried on, besides manufactures of linen, paper, and leather. Principal towns, Arnheim, Nymwegen, and Zutphen.

Gel′dern, town of the Rhine province, Prussia, on the Niers, 17 miles S. W. of Wesel, and on the railway from Cologne to Cleves. It has important manufactures, and was the ancient capital of Upper Gelderland, which was ceded by the Netherlands in 1713 to Prussia. Pop. 5096.

Gelée (CLAUDE), better known as CLAUDE LORRAINE, where he was b. (in the little town of Chamagne) in the year 1600. His parents were poor, and the youth, early left an orphan, passed through severe struggles in pursuing the bent of his genius. His first studies were with an elder brother, a wood-engraver at Fribourg. Thence he went to Rome, thence to Naples, thence back again to Rome. He travelled through Romagna and Lombardy, worked some time in Venice, visited parts of Germany, studied the scenery of the Tyrol, remained a short time in Nantes, returned to Italy by way of Lyons and Marseilles, and finally made his residence in Rome, where his great works were painted and where he died, of gout, Nov. 21, 1682. During his lifetime this painter's fame was very high; his patrons were people of eminence in nearly all the great cities of Europe. Orders came from Antwerp, Amsterdam, and Madrid. After his death his reputation increased, and even yet he ranks with the greatest landscape-painters of the world. Claude was a close and patient student of the principles, rules, and forms of his art; he frequented the academy to make himself acquainted with the best models, paid careful attention to the anatomy of the human frame, and was interested in architecture, for which, in his youth, he had a strong predilection. But his passion was for natural scenery. In representing this he put forth all his power of observation, sentiment, imagination, and technical skill. His studies were made in the open air with the most painstaking accuracy. The foliage of trees, the shapes of mountains, the effects of light and shade on natural objects, were delicately noted and delineated. The gradations of light, the perspective, the impression of breadth and distance, have always been admitted to be admirable features in his work. On these he prided himself, not on the figures or architecture, which were incidental and conventional. The landscapes of Claude are not literal copies of nature, but copies of nature suffused with sentiment and feeling. According to Sir Joshua Reynolds, Claude was of opinion that taking nature as he found it seldom produced beauty. His paintings are therefore, to a greater or less degree, "compositions." Dr. Lübke (*Hist. of Art*, London ed., 1868) writes of Claude: "In his works there is all the splendor, light, untroubled brightness, and harmony of the first morning of creation in Paradise." The *Liber Veritatis*, as it is called, is a collection of drawings made by Claude himself for the purpose of identifying his pictures and detecting counterfeits. There were six volumes. The one at Chatsworth, containing 200 drawings, was engraved by Richard Earlom and published by Boydell. In person, Claude was dignified and winning; his disposition was amiable and peaceful; his moral character without stain. The smallness of his fortune at his death is ascribed to the munificence of his charities. His works commanded high prices, and were numerous. Smith's *Catalogue raisonné* describes 400 pieces. They are found in all the European galleries, but the most celebrated of them are in England. Their general character is familiar through engravings. For dissenting opinions in regard to the merits of Claude one should consult the *Discourses* of Sir Joshua Reynolds and Ruskin's *Modern Painters*. Sir Joshua was of opinion that before there was another Claude there would be another Raphael. Ruskin declares that "Claude's capacities were of the most limited kind," and that "his work resembled nothing that ever existed in the world."

O. B. FROTHINGHAM.

Gell (Sir WILLIAM), b. at Hopton, Derbyshire, England, 1777; graduated 1798 at Emanuel College, Cambridge, and took a fellowship; was knighted 1803; passed M. A. 1804; became chamberlain to the princess of Wales 1814; resided mostly in Italy, and d. at Naples Feb. 4, 1836. Author of a number of works, mostly illustrating the topography of ancient Greece and Italy, published in a costly style which deprived them of extended use.

Gellius. See AULUS GELLIUS.

Ge′lon [Gr. Γέλων], tyrant of Syracuse, was of an ancient family of Gela, and was chief commander of the horse to Hippocrates, tyrant of his native town, of which place he made himself master in 491 B. C., and became tyrant of Syracuse in 485. (*Müller.*) Having depopulated Camarina, Eubœa, and the Sicilian Megara, he enriched Syracuse with their spoils, and increased his population by enforced colonization and the enslavement of captives; destroyed the army of Carthage in the great battle of Himera (480 B. C.). D. 478 B. C. Gelon was an exceedingly popular ruler, his good fortune and lavish expenditures of money probably serving to conceal his faults from popular scrutiny. Though exceedingly ignorant and selfishly ambitious, his name became proverbial for goodness and wisdom.

Gelse′mium [from *gelsemino*, an Italian name for the jasmine], a genus of plants of the order Loganiaceæ. The yellow jasmine of the Southern States is a beautiful evergreen climber (the *Gelsemium sempervirens*), having large, yellow, fragrant flowers, appearing in early spring. The whole plant is poisonous, but is a valuable medicine. In a proper dose it has excellent sedative effects, but should be given with caution. An overdose causes great prostration and calls for stimulants.

Gem [Lat. *gemma*], in art and archæology, a small stone, generally precious as to material, cut in ornamental designs or with inscriptions. While on one side, gems are in close relation to the jeweller's art, since it is generally admitted that they are meant to be worn as personal ornaments, they are in reality, as consisting of miniature sculpture, more nearly allied to the highest art, since there are no objects known which in so small a sphere call for such elegance of taste and perfect skill. The two divisions of the art are the making of intaglios—which, as the name in Italian denotes, are *cut in* like a seal—and *cameos*, a word of doubtful origin, but which probably comes from a Greek term signifying "ground." Cameos are simply bas-reliefs, and the term minute sculpture is so naturally applicable to them that since the days of Greek art it has been usual to copy celebrated statues in this manner; and there can be little doubt that we have at present in this form the types of the most celebrated images of antiquity. Intaglios, the earliest gems, first appear as the *scarabs* (*scarabæi*) or beetle-shaped signets worn in rings by the Egyptians from a very early period, though those on hard stone are of course rare, owing to their greater cost, especially from the earlier dynasties. On the flat side was engraved the name of the king or of the wearer, and the other was shaped like a beetle. Many of these were exquisitely cut. This form of gem was of course oval, and pierced from end to end with a hole, through which there passed a strong wire, which kept the stone in place in a ring. When worn, the flat or seal side rested against the finger, but when used as a seal it was turned. The Greeks, though the latest in the field of gem-cutting, speedily excelled all their predecessors, for there were in this art few works of real excellence before they attempted it. The finger-ring, as is shown by the story of Prometheus, and its name *daktulion*, was a purely Greek invention. These were popular in Greece 600 years B. C., and about this time Herodotus mentions the famous emerald of Polynates (*Lib.* 37, c. 2) and the fame of its engraver, Theodorus of Samos, though he adds that in his time it held a low rank among

the jewels with which it was placed. Samos was the focus of the glyptical art of Greece, and there it was that Mnesarchus, the father of Pythagoras (B. C. 570), "sought rather for fame than for riches by engraving gems in the most skilful manner." Contemporary with the Greeks, the Etruscans attained great excellence in gem-engraving, manifesting profound knowledge of anatomy and high finish, but coupled with harsh realism, while the Greeks aimed at ideal beauty. On these early gems of Etruscan or Greek origin can be read, as in a book, the forms of their religion and the subjects of popular interest in politics, song, or fable, for centuries. The art finally attained its highest perfection in Sicily and Magna Græcia. Ælian observes that in Cyrene there was "a wonderful multitude of skilled gem-engravers, and that the poorest men there wore rings worth ten minæ." Among the Romans gem-engraving flourished, and under Augustus it reached its very highest point. Cabinets of gems became numerous, and most gentlemen prided themselves on possessing camei and intagli of value. The collections of Scaurus and Marcellus were doubtless of great extent, and Cæsar is said to have sent *six* such cabinets to the temple of Venus. Among the most celebrated intagli are the Ariadne, the Demetrius Poliorcetes of the Pulszky cabinet, and the portrait of Demetrius Soter, once the property of Horace Walpole. The latest intaglio in ancient style was the signet of Lothaire (A. D. 823). The finest sapphire ever cut is an intaglio of the Devonshire collection bearing a head of Augustus. Among the finest gems accessible to the public are, in the British Museum, the Cupid and Goose (aquamarine intaglio), the Julius Cæsar of Dioscurides, the Livia by Epitynchanus, cutter of the famous head of Germanicus in the Paris cabinet, the Perseus, Bacchus on red jasper, the wonderful Dying Amazon, the Cupid and Psyche (red sard), and the Laughing Faun by Ammanius. (See C. W. KING, *Antique Gems and Rings* (2 vols., London, 1872); MILLIN, *Introduction à l'Etude des Pierres gravées* (Paris, 1796); KÖHLER, *Geschnittene Steine* (St. Petersburg, 1851).) CHARLES G. LELAND.

Gema'ra [Chaldee, "completion," from *gemar*, "to make perfect"], that part of the Talmud which consists of commentaries upon the Mishna, or text. There is a Palestinian and a Babylonian Gemara. The Palestinian was finished about 350 A. D., the Babylonian about 500. Its authors were called Amoraim. The writings are partly of the class called Halacha (rules), and partly Hagada (legends). The language of the Talmud is partly Hebrew and partly Aramaic, the Hebrew of the Mishna being purer than that of the Gemara. The Babylonian Gemara is much more complete, voluminous, and valuable than the Palestinian. Only portions of the Gemara have ever been translated. (See ETHERIDGE'S *Introduction to Hebrew Literature*, 1856.)

Gem'ini (the "Twins"), a sign of the zodiac, into which the sun enters about May 21, and from which it passes June 21. Also, a constellation of the zodiac, now corresponding to the sign Cancer. Castor and Pollux are the two principal stars—the former a fine double one, the latter quadruple.

Gemis'tus (GEORGIUS), or **Georgius Pletho,** b. at Constantinople about 1390, held office under Manuel Palæologus in 1426; in 1438 was a delegate to the Council of Florence; was tutor to Bessarion and the associate of Cosimo de' Medici; was in 1441 engaged in the imperial service in the Peloponnesus, and is said to have lived one hundred years. He is chiefly remembered as a leader of the Restoration of learning; was the author of a great number of treatises on history, philosophy, geography, etc., many of which have never been printed, and was the prime mover in the revival of the Platonic philosophy in Italy.

Gemo'na, Italian town of considerable transit commerce, in the province of Udine. It has a fine cathedral and several other churches, containing interesting pictures by Pordenone, Cima da Conegliano, etc. The granite font in the Duomo is said to be a work of the eighth century. Many Roman antiquities are found here. It has an active and industrious population of about 7000.

Gems'bok [Dutch, *gemsbok;* Ger. *Gemse*, a "chamois," and *bok*, a "buck"], the *Oryx gazella*, the *kookam* of the natives, a fine large antelope of South Africa, found in small groups upon the open plains. It is often five feet long, and has straight horns two and a half feet long. It is courageous, and will successfully defend itself against the lion. It is hunted on horseback, and proves itself a swift and strong runner. It is asserted that it never drinks water, which is obtained in the succulent plants upon which it feeds.

Gems'horn, an organ-stop having conical tin pipes of very pleasant though peculiar tone.

Gemün'der (GEORG), b. at Ingelfingen, Würtemberg, Apr. 13, 1816; learned his profession, violin-making, in Paris, and in 1847 removed to Boston, Mass., where he acquired much fame as a musical-instrument maker. In 1852 he removed to New York. His violins took the first prize in the World's Fair of 1851, London, and a new violin shown by him at the Vienna Exposition of 1873 was pronounced an ancient Italian instrument of the best type. He makes use of the natural unprepared wood, believing that instruments made of artificially cured wood are sure to lose their value speedily.

Gen'der [from the same root with γίγνομαι, *genus*, etc.], in grammar, must not be confounded with sex in nature, though of course it was the observation of the latter which produced the former. The phenomenon of gender presents some of the hardest and most obscure problems which the science of language has to grapple with. Several languages —as, for instance, the Chinese, and, of the Turanian family, the Finnish and the Magyar—have no gender at all, and never have had. Others have had grammatical gender, but have lost it; as, for instance, the Persian, the Lettish, and the English. Some languages have only two genders, masculine and feminine; as, for instance, the Semitic and the Romanic. Others have three, masculine, feminine, and neuter; as, for instance, Greek, Latin, and German. Also the inflections or suffixes with which gender is expressed, and the influence which the gender of a noun may have on its attributes, present very intricate problems, and the question why a certain noun is masculine or feminine or neuter may bring the most learned grammarian to despair, while the most ignorant and unreflecting man never makes a mistake when he is born and bred to the language. There seem on this point to be particular laws hidden—laws of the imagination, which escape discovery because they are not actually at work at present.

Geneal'ogy [Gr. γενεά, "race," and λόγος, "discourse"], the science of descents. Genealogy, as a record of families, holds an intermediate place between biography, which treats of persons, and history, of which the subject is the rise and progress of the nation. The rules and principles of the three are not dissimilar, although the purpose of the first is a little different from the design of the other two. In England, as in most countries in which the feudal system has prevailed, the laws of the descent of families are intimately connected with those of the descent and tenure of lands. Where estates pass to a single heir, it is essential that the derivation of that heir from the blood of the first lord should be clearly proved; and as the lines of descent may become successively extinguished, the order in which collaterals succeed must be definitely settled. The latter is the work of the lawyer, and its principles are well stated in Blackstone's *Commentaries.* The former is the office of the genealogist, whose duty it is to trace out and record the history and growth of families and the relationship of the several branches to one another. Formerly, this was made the duty of the heralds, who in their periodical progresses through England inquired into the condition of all families which were entitled to bear arms, and recorded their pedigrees in the Herald's College. The "visitations," as the records of their labors are briefly called, are among the most important collections in the College of Arms in London. The visitations were discontinued about the middle of the seventeenth century. Since that time, although official records are still kept, they are derived from voluntary information. For many centuries great pains have been taken by the nobility and gentry to preserve the records of their descent. Every great house has its muniment-room, in which are preserved the title-deeds of the estate and documents relating to the history of the family. These precautions are necessary for the reason already given—viz. the possibility of remote collaterals being called to the succession. In America the work of the genealogist is a little different. The division of landed estates among the children or other representatives of the last proprietor obviates the necessity of the production of a single heir. The history of land-titles is provided for by a system of public records, and the functions of the genealogist are limited merely to the history of families. This, however, is a sufficient task. The immense field of investigation that is opened in tracing the ancestors and descendants of a single person is really astonishing. In the ascending line the ancestors double in every generation. In other words, in the first degree there are two ancestors; in the second, four; and in the fourth, sixteen; and by going back for twenty generations it will be found that every man has more than a million of ancestors. In the descending line the numbers are still larger. Every child of the common ancestor may become the founder of a family, and the relations of these several families to the main stock or oldest line of descent give rise to collaterals, all of whom should be included in a complete pedigree. The labors of American genealogists of late years have been turned in this direc-

tion. Undeterred by the greatness of the task, students have undertaken to record, for instance, all the ramifications of large families, usually beginning with some emigrant of the seventeenth century, and conscientiously tracing, in the male or female line, or sometimes in both, the history of his descendants.

The results of genealogical investigations are usually embodied either in pedigrees or family histories. The former are sometimes arranged as a tree, in which the common ancestor represents the root or stock, and the descendants are arranged in order in the branches. More commonly, however, pedigrees are constructed in the form of tables, in which the ancestor and the descendants, with a brief statement of the time of the birth, marriage, and death of each, appear in successive rows of squares or circles, properly connected by lines, which indicate the direct descent of every person. From these methods of arranging pedigrees are derived the common expressions, a family tree, a stock, branches, and lines of descent. The advantage of a pedigree is that it gives at a single view all the descendants of a common ancestor. The disadvantages are, that while it necessarily involves an extreme brevity, and sometimes even meagreness of statement, it nevertheless requires a great deal of room, and may readily become unmanageable from its size. Hence, genealogists more commonly adopt a narrative form, called a family history, by which means they are able to condense their records into a volume of moderate size, and at the same time to make their statements at greater length. The objections to this plan are, that unless it be managed with extreme care and system, it is sure to involve the reader in utter confusion in the course of a very few pages, and that under any circumstances the labor of consulting such a compilation is very great. To obviate the first of these objections in a measure, genealogists have adopted several methods of arranging the branches, and of designating the various lines of descent. The simplest method appears to be that of giving to every name its own number, which is placed before it in Arabic characters, and in designating the relations of every person to his parents and his brothers and sisters by Roman numerals. Some genealogists, however, prefer designating the successive generations, and not the individuals, by numbers. There is also a difference of opinion as to the order in which the successive lines of descent should follow one another, some thinking it better to take up the sons of the common ancestor in order, finishing the record of the descendants of the first before approaching the second, and so on through the whole; others recording every successive generation in its order. A question has also been raised, whether in such a history the descendants of daughters are entitled to stand side by side with those of sons. In England it is usual to exclude them, but there are special reasons for this in the connection of genealogy with the tenure of land. In male fiefs there can be no possibility of females or their descendants being called to the succession; and in those cases in which lands devolve upon an heiress, they descend afterwards either in the line of her husband, or, in the event of her dying without issue, to the collaterals of her father's family. In America, however, where the aim of the genealogist is strictly historical, this reasoning does not apply; and there probably is no good reason, beyond the inevitable increase of the labor of the genealogist and of the bulk of his volume, why the posterity of daughters should not be admitted into it. In answer to the second objection, it may be said that as a book of geography is rendered intelligible by means of maps, so it is easy for the reader of a family history to construct from it brief and compact pedigrees which will be apprehended at a glance.

Genealogy, as a science, insists upon evidence. No genealogist will accept a mere family tradition or an unauthenticated statement, but he always requires sufficient proof. In the great revival of the study which has taken place in the present century this has been found absolutely necessary, and has become the cardinal principle. There is so much uncertainty in family traditions that it is found that statements accepted by families and given in good faith are often not merely unfounded, but contrary to existing evidence. The principal sources of evidence are family records contemporaneous with the events which they commemorate, as, for instance, an account written by any person of his own children; public records, such as wills, deeds, and mortgages; church records, letters, and tombstones. A pedigree or a history of descents not authenticated by these or equivalent evidence is not to be trusted, and will surely be rejected by every well-trained genealogist. B. R. Betts.

Gen′eral, in certain Roman Catholic religious orders, the highest officer of the order. The general of the Jesuits is chosen for life, and holds one of the most influential positions in the Church. He lives in Rome. Most other generals hold office for three years, and they usually reside at Rome. The general of the Augustinians must be of one of the Calceate congregations. The Franciscans have three generals—one each for the Observantines, the Capuchins, and the Tertiaries—besides procurators-general for the Reformed and Alcantarine congregations, and a minister-general for the Conventuals. The general of the Dominicans is chosen for life. Since the time of Simon Stock the Carmelites have had an unbroken line of generals. Other orders have superior officers with special titles. Thus, the chief of the Minims is called "general corrector," the superiors of their houses being called "correctors." (See General Officer.)

General Assembly. In the Presbyterian Church the General Assembly is the highest of four courts, the other three being, in their order, session, presbytery, synod. (See Presbyterian Church.) In America there are at present three general assemblies: (1) that of the Presbyterian Church North; (2) that of the Presbyterian Church South; (3) that of the Cumberland Presbyterian Church. The highest court of the smaller Presbyterian bodies is the synod. A description of the General Assembly of the Presbyterian Church North will serve substantially for all others in the U. S. This court is constituted of an equal number of ministers and laymen. Its meetings are held annually in different parts of the country, as may be agreed upon. Its members are styled *commissioners*, and are appointed by the presbyteries in the following proportion: "Each presbytery consisting of not more than twenty-four ministers shall send one minister and one elder; and each presbytery consisting of more than twenty-four ministers shall send two ministers and two elders; and in the like proportion for every twenty-four ministers in every presbytery." Its officers are, a moderator, chosen annually; a stated clerk, who is also treasurer; and a permanent clerk. The term of the last two officers is indefinite. Temporary clerks are chosen each year to assist the permanent clerk in making a fair record of the proceedings, etc. The duty of the stated clerk is to keep the records and to publish them, together with such statistical tables as the Assembly may direct. Each Assembly is "constituted" by prayer, and "dissolved" at its close by formal proclamation of the moderator. In every case the constituting act is preceded by a sermon, which is generally preached by the retiring moderator. The business of each meeting is directed in accordance with a simple manual of general rules. The province of this court is thus defined by the constitution of the Church: "The General Assembly shall receive and issue all appeals and references which may be regularly brought before them from the inferior judicatories. They shall review the records of every synod, and approve or censure them; they shall give their advice and instruction in all cases submitted to them in conformity with the constitution of the Church; and they shall constitute the bond of union, peace, correspondence, and mutual confidence among all our churches. To the General Assembly also belongs the power of deciding in all controversies respecting doctrine and discipline; of reproving, warning, or bearing testimony against error in doctrine or immorality in practice in any church, presbytery, or synod; of erecting new synods when it may be necessary; of superintending the concerns of the whole Church; of corresponding with foreign churches on such terms as may be agreed upon by the assembly and the corresponding body; of suppressing schismatical contentions and disputations; and, in general, of recommending and attempting reformation of manners and the promotion of charity, truth, and holiness through all the churches under their care." To effect these varied purposes each Assembly appoints a number of standing committees, whose duty it is to bring all business before the court in its order. For conducting the benevolent and evangelistic work of the Church a number of boards have been established, such as that of foreign missions, home missions, education, etc. These boards report to each Assembly, and receive instructions. During the sessions popular meetings in the interest of these boards are held. The legislative work of the Assembly has, in this country, gradually become subordinate. Cases of appeal are often decided by "commissions" appointed for that purpose on the mutual consent of the parties concerned. Questions of constitutional law, however, are always decided by direct vote, and each decision is regarded as defining the law. The effect is the same as that of a decision of the Supreme Court of the U. S. In Scotland and Ireland the General Assembly is somewhat different from the above as to constitution and method, yet in all essential particulars the same. Z. M. Humphrey.

General Bass, in music, the equivalent in German for thorough bass, or the system of harmony, as commonly written and illustrated by figures over or under a bass.

General Convention, The, was originally an association of members of the English (afterwards Protestant Episcopal) churches in several of the U. S., formed after the Revolution for the purpose of promoting a closer union among those churches. During the period of colonial dependence the English congregations had been under the jurisdiction of the bishop of London. When, however, at the close of the war, his authority was withdrawn, they found themselves not only without episcopal superintendence, but without any bond of union beyond that of a common faith and a common liturgy; but as every State, before the adoption of the present Constitution, was regarded as an independent sovereignty, and as the churches in every State asserted for themselves the rights and powers of national churches, there was a real danger that even this slender bond of union might speedily be lost. The problems which the members of the "Church of England in America" were called upon to solve were these: First, to secure an episcopal succession; and, second, to arrange a system by which there might be, as the celebrated Dr. Chandler expressed it, "a uniformity, or at least a similarity—*qualis decet esse sororum*—through the different States." The first was accomplished, after some delay, by the consecration of Dr. Seabury in Scotland, and of other bishops in England, for America. (See EPISCOPAL CHURCH.) The second was attained by the establishment of a General Convention. On May 11, 1784, several clergymen and laymen, members of a society for the "relief of widows and children of clergymen"—a society which still exists—met at New Brunswick, N. J., ostensibly for the purpose of arranging the affairs of that society, but with the further design of consulting one another about the interests of the Church in the several States. In accordance with arrangements made at that meeting, clerical and lay delegates from New York, New Jersey, Pennsylvania, Maryland, and Delaware assembled in New York in October of the same year, and after agreeing upon certain fundamental principles, resolved that a convention should be held in Philadelphia in 1785. At the convention of 1785 delegates from the above-named States, as well as from Virginia and South Carolina, were present. A "general ecclesiastical constitution" was adopted, founded upon the declaration of principles of the previous year; active measures were taken for the revision of the Prayer-Book; and the union of the churches in the Middle and Southern States was regarded as complete. The churchmen of Connecticut, Rhode Island, New Hampshire, and Massachusetts, however, were not at first disposed to accede to these arrangements. They doubted the propriety of giving seats and votes to laymen in an ecclesiastical assembly, and they strongly objected to a provision by which the bishops were made amenable to their own conventions. The latter provision was corrected, and the objection to the former was apparently withdrawn; and in 1789, Bishop Seabury and delegates from the Eastern States took their seats in the General Convention. In the same year a constitution was adopted, which, though it has been amended from time to time, yet in substance continues in force to the present day. It provides that there shall be a General Convention of the Protestant Episcopal Church in every third year; that the convention shall consist of the bishops, who form a separate house, and of four clerical and as many lay deputies, who must be communicants, from every diocese; and that all acts of the convention shall be authenticated by both houses. The General Convention has power to consent to the formation of new dioceses, to provide the mode of trying bishops, and to establish and revise a Book of Common Prayer. These are all the powers which are given in its constitution. The other articles, which treat of the principles and rules relating to the establishment of new dioceses, of the qualifications for holy orders, and of the consecration of bishops for foreign countries, really confer no powers, and may perhaps be regarded as a concordat between the churches in the several States. In point of fact, however, the General Convention has never limited itself to the powers given by its constitution, but has gradually developed into the governing body of the Protestant Episcopal Church in the U. S. Its extra-constitutional acts (if such an expression may be allowed) appear to extend to all points of discipline and doctrine. It has enacted a code of canons for the government of the Church; it has founded a theological seminary; it has established a system of missions, both within the U. S. and in foreign countries; it has published a hymn-book; and it has lately passed a canon which touches the doctrine of the Holy Sacrament. It would, in fact, be extremely difficult to designate with precision the powers which the General Convention possesses or assumes. Some theologians are inclined to limit its functions strictly to those which are specified in its constitution. The obvious objections to this view are that it has not been adopted by the General Convention itself, and that if it be correct, most of the acts of that body are unconstitutional and without authority. Other divines are disposed to regard it as an ecclesiastical parliament, possessing powers as vague and unlimited as those of the Parliament of England; but here the question arises, Whence could such a body derive such powers? This question has never been answered, and indeed appears to be incapable of solution. The former view seems to be that of Bishop Seabury, Dr. Chandler, and other leading theologians of the last century; the latter was adopted by the late Dr. Francis Vinton in his work on the law of the Church. No attempt is made here to reconcile these conflicting views, or to commend either of them to acceptance. They are mentioned as historical facts. B. R. BETTS.

Gen'eral Is'sue. In the common-law system of legal pleading the general issue is a summary, unqualified denial of the material allegations contained in the plaintiff's declaration. It is called a general as distinguished from a special issue, because it brings at once into controversy the entire substance of the charges alleged, and not some specific portion. The denial does not consist of a negation of the complaint made in its express language, but certain particular formulæ have been established as appropriate in the various instances in which a plea of general issue may be introduced, and their use is obligatory. For example, in actions for torts, where a recovery of damages is sought, as in trespass or trover, the general issue is *not guilty;* in debt on simple contract it is *nil debet* ("he owes nothing"); in actions for a breach of covenant or upon an instrument under seal it is *non est factum* ("it is not his deed or covenant"). A plea by general issue affords an opportunity for the introduction of a great variety of testimony which would serve to prove that the defendant was subject to no liability; if specific assertions only were made in defence, it would be necessary for the proof to correspond with them, and the range of evidence could not, in general, be as extensive as under a comprehensive form of denial. (See PLEADINGS.) GEO. CHASE. REVISED BY T. W. DWIGHT.

Generaliza'tion, a term defined by Whately in his *Logic* as "the act of comprehending under a common name several objects agreeing in some point which we abstract from each of them, and which that common name serves to indicate." He illustrates the definition as follows: "When we are contemplating several individuals which resemble each other in some part of their nature, we can—by attending to that part alone, and not to those parts wherein they differ—assign them one common name, which will express or stand for them merely as far as they all agree; and which, of course, will be applicable to all or any of them; which process is called generalization, and each of these names is called a common term, from its belonging to them all alike; or a predicable, because it may be predicated affirmatively of them or any of them." Sir William Hamilton groups this act and its kindred processes under the name of "elaborative faculty," which is the faculty of perceiving relations, the discursive faculty, faculty of comparison, "the judgment—διάνοια, as opposed to the νοῦς." He makes generalization to be "nothing but comparison." "Under comparison may be comprised all the acts of synthesis and analysis, generalization and abstraction, judgment and reasoning." The several phases of this process he arranges in the following order: 1, Composition or synthesis; 2, abstraction, decomposition, or analysis; 3, generalization; 4, judgment; 5, reasoning or inference. "Generalization is dependent on abstraction, but abstraction is not dependent on generalization." Kant holds that every act of judging is an act of synthetical unity performed by means of the "transcendental unity of apperception;" *i. e.* it is rendered possible by the "I think" or Ego, or subject in consciousness, which furnishes the unity for the multiplicity of sensation, and in so doing generalizes. Generalization is the essential phase of the act of reflection which accompanies all acts of rational intelligence. Even the activity of sense-perception is accompanied, in a conscious being, by the dim perception of self or Ego, as pure subject of the act of perceiving. The Ego or subject is always generic and abstract; indeed, the highest genus, or ultimatum of abstraction, free from all empirical determinations or characteristics, and as a factor of all concrete knowing, furnishes to the thinking being the means of rising above the multiplicity of empirical details through attention to this abstract factor of perception; which act of attention is called "second intention," being attention to the mental process, while "first intention" is directed to the object of the senses—a distinction noted by Avicenna, the great commentator on Aristotle. "When one thing without difference abides," says Aristotle (*Post. Analyt.*, ii. 19), "the universal arises in the soul. Primary things [generic entities] become known to us through induction;" induction being the ascent from the particulars of sense to the generic entity of the pure Ego. Self-consciousness is the basis of

all generalization, being the act of reflection or of turning back upon itself—the thread upon which all the faculties of the soul are strung—memory, imagination, conception, inference, speculative insight. Thus, "second intention" has several degrees, which might be named third, fourth, and fifth intentions also, each higher faculty being the result of a new act of attention upon the activity of the next lower faculty. (See FICHTE; also articles on IDEALISM, NOMINALISTS, REALISM, SCHOOLMEN, for the ultimate bearing of this theory.) WILLIAM T. HARRIS.

Gen'eral Lien, a right to retain chattels which one has in his possession, that they may afford security not merely for the satisfaction of claims in reference to the specific articles themselves, but also for the settlement of a general balance of account. This form of lien is not favored by the law, and it exists therefore only in cases where it is created by contract express or implied, by the usage in a particular business, or by a previous course of dealing between the parties. Factors have by usage a general lien upon the goods of their principals for advances made and commissions. In like manner, an attorney has a general lien upon the papers and money of his client in his hands. But a general lien does not apply in regard to all debts which may be due, but only to those which have been incurred in the particular kind of business in which the person detaining the goods has from time to time been employed. (See LIEN.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Gen'eral Of'ficer. The word "general" is from the Latin *generalis*, meaning very much the same thing as our adjective, *general* (common to many, or the greatest number, widely spread, etc.). In such a sense the word qualifies the designation of an officer (*e. g.* commissary-general, quartermaster-general, etc.), carrying with it also the idea of "having charge" or right of command, whether in the civil, military, or ecclesiastical hierarchy. Thus, the superior of "The Society of Jesus" is styled "The General." According to Bardin (*Dict. de l'Armée*, etc.), the word *captain* (*i. e. head, chief*) became so common in the Middle Ages that the title "captain-general" was appropriated to one who commanded all the rest (*i. e.* when numerous independent bodies each with its *chief*, a *captain*, were combined). By ellipsis, the adjective has become substantive, and a GENERAL, without qualification, is, properly speaking, one *over all*—a "commander" in the highest sense of the term. And the grade of "general," when it exists, should indicate an officer clothed with right of supreme command. But the designation "general officer" is applied in a qualificative sense to any officer of higher rank than colonel, and in this use it properly distinguishes those officers who form component parts of the essential units of army organization (regiments and companies) from those whose sphere of command is not thus limited; while various distinctive titles are employed to give lustre to the office of *general*, such as "captain-general," "field-marshal," or (in France) "marechal de France." In England the sovereign is captain-general. The commander-in-chief (under the sovereign) is a field-marshal, a rank held also by three or four others. There are also numerous "generals," as well as lieutenant-generals, major-generals, etc.: BRIGADIER-GENERAL implies, in the English military hierarchy, the command of a *brigade* (*i. e.* two or more regiments temporarily or permanently united); MAJOR-GENERAL, in our service and in some others, the command of a DIVISION (*i. e.* two or more brigades temporarily or permanently united); while lieutenant-general, implying deputed power, has had the sense in France of "lieutenant du roi," or viceroy, or a general commanding in place of his sovereign; and also, and more commonly, the general of a division. But the actual standing of these two last-named grades depends upon arbitrary legislation or regulation. The function of "major-general" under Napoleon was that corresponding to our notions of "chief of staff"—one who is the organ of communication between the "general" and his subordinates. ("The military language of France," says Bardin, "offers frequent examples of such disparities.") "General de division" is in France the style and rank of a division commander, while Napoleon gave to the commanders of his corps d'armée, when first organized, the grade of "lieutenant-general," which before the creation of "army corps" was sometimes the special designation of a division commander when the *division* was the largest unit into which an army was divided. Afterwards, during the empire, commanders of corps d'armée were usually "Marechaux de France."

In our own history and service it does not appear that the Continental Congress regulated the grades of general officers, but accepted them (major and brigadier generals) as it found them in the several States (or colonies, rather). Washington was chosen as "commander-in-chief," without other designation. Under the existing Constitution a series of legislative acts has regulated the number of brigadier and major generals. That of Mar. 2, 1799, declares that a "a commander of the army of the U. S. shall be appointed and commissioned by the style of 'general of the armies of the U. S.;'" while it abolished the office and title of lieutenant-general, created ten months previously (May 28, 1798, when war with France was apprehended) and conferred upon Washington. The act of Mar. 16, 1802, provided for but a single general officer of the grade of *brigadier*. The war of 1812–15 of course caused the creation of numerous major and brigadier generals; the act of Mar. 2, 1821, provided for one major and two brigadier generals. In 1846 (Mexican war) the President was authorized to add one major-general (Zachary Taylor, Gen. Winfield Scott being then the single major-general) and two brigadier-generals to the military establishment. Subsequently (Feb. 15, 1855) the grade of lieutenant-general, *by brevet*, was revived to acknowledge "the eminent services of a major-general of the army in the late war with Mexico" (Scott). It would be impracticable to recapitulate the legislation during the civil war by which the number of major and brigadier generals on the army list was greatly augmented. The grade of lieutenant-general, never before conferred by our government upon any one except Washington (and by "brevet" on Scott), was renewed and conferred (Mar. 2, 1864) upon Gen. Grant. In 1866 the grade of general was created and conferred on the same officer; that of lieutenant-general, thus vacated, on W. T. Sherman. At the present time there are, besides the general and lieutenant-general (grades to expire with the lives of the present incumbents, Gens. Sherman and Sheridan), three major and six brigadier generals, besides the adjutant-general, the chiefs of engineers and of ordnance, the quartermaster, commissary, and surgeon generals, and the judge-advocate-general, who hold the latter rank.

J. G. BARNARD.

Gen'eral Rules of the Methodist Episcopal Church, written by John Wesley, in consultation with his brother, Charles Wesley, in 1743, and published in a small volume entitled *The Nature, Design, and General Rules of the United Societies in London, Bristol, Kingswood, and New Castle-upon-Tyne.* Thenceforward the "General Rules" were the only conditions of membership in the Wesleyan societies; and when Wesley sent over Dr. Coke to organize "the Methodist Episcopal Church in the U. S. of America," they were inserted in the *Discipline* of the latter, and remain there still, as the "terms of membership." In Stevens's *History of the Methodist Episcopal Church* it is said that "the Articles of Religion and the General Rules are both parts of the organic or constitutional law of American Methodism," but the General Rules prescribe the "only condition" of membership, without allusion to the Articles. Conformity to the doctrines of the Church is required by its statute law as a functional qualification for the ministry, but church members cannot be excluded for personal opinions while their lives conform to the practical discipline of the Church, and they can be tried and expelled for sowing dissensions in the societies, by inveighing against their doctrines or discipline; that is, in other words, not for their opinions, but for their moral conduct respecting their opinions. These Rules form a remarkably liberal platform of church communion. The same author remarks, in *The History of Methodism*, that it comprises not one dogmatic statement, and hardly what would be called an ecclesiastical requisition. It consists almost entirely of practical requirements. At a later date Wesley exclaims in his *Journal*, "Oh that we may never make anything more or less the term of union with us but the having the mind that was in Christ, and the walking as He walked!"

ABEL STEVENS.

Gen'eral Ship, a ship offered by her master or owners to the patronage of the general public for the carriage of goods upon a particular voyage. The offer is usually made by advertisement, stating the proposed voyage, the time of sailing, the names of the ship and master, and the character of the articles which will be received to form the cargo. If the goods brought for transportation by any person are of the kind described, the shipmaster is under the same obligation to receive them as are other common carriers. If there is any material violation of the terms of the advertisement, in consequence of which a shipper is injured, the owner of the vessel is obliged to make compensation for the loss. (See SHIPPING.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Gener'al's Isl'and, one of the sea-islands of McIntosh co., Ga. Pop. 49.

Genera'tion [Lat. *generatio*] will be more properly considered under the article REPRODUCTION (which see), by PROF. T. GILL, M. D., PH. D., M. N. A. S.

Genera'tion, Sponta'neous, the supposed (or real) origination of living organisms without parent organisms to produce them, out of inorganic, or at least non-living, matter, and under the influence of forces purely physical. The fact that the minuter forms of organic life, both animal and vegetable, constantly make their appearance wherever conditions exist favorable to their preservation, notwithstanding the absence of all evidence of pre-existing germs from which they may have sprung, has given rise to two opposing theories in regard to this matter—viz. first, that such germs do exist; that they pervade the atmosphere in countless numbers and in nearly all places; that they possess an almost indestructible tenacity of life, and are developed into active growth wherever they find a suitable nidus; and secondly, that no such organic antecedents are necessary at all: that these microscopic forms of life are constantly coming into existence *de novo* under the operation of the ordinary powers of nature, and therefore that they originate by a generation which is truly spontaneous. It is to be observed that the advocates of this latter theory do not necessarily reject the former. They admit its possible truth, but they deny that it embraces all the truth, or even the essential truth; for the germ-theory can only account for the propagation of life after life has originated, whereas the theory of spontaneous generation accounts for the origin of life itself. No subject in the history of science has been more sharply debated than this; and no subject has ever been experimentally investigated with greater zeal, with more earnest solicitude to reach the truth, or with results more singularly or persistently discordant.

The notion of spontaneous generation is not, by any means, of modern origin. It has been entertained by naturalists in every age since the dawn of scientific history. But the earlier naturalists—Aristotle and Lucretius, for instance—conceived that organisms of a high order of complexity, such as insects or fishes or reptiles, might be directly produced out of the moist earth softened by showers, or out of the slime and mud of rivers; whereas those of our time have long since abandoned any such extravagant notions, and confine themselves to the assertion that life in its spontaneous origin is manifested only under the simplest forms.

The latest example of an hypothesis resembling the ancient is found in the argument presented in a work entitled *Vestiges of Creation,* which appeared about thirty years ago, in which the experiments of Mr. Andrew Crosse upon electric currents of low intensity directed for a long time through a solution of inorganic salt were supposed to have produced an insect of the *Acarus* family, such an insect having actually made its appearance during the course of the experiment. But this result has long since been recognized to have been merely accidental, and probably owing to the presence of ova of the insect introduced in some unexplained way into the apparatus. The modern advocates of the theory of spontaneous generation hold, however—or at least most of them hold—only to the certainty of the spontaneous appearance of organisms of a very low type, called bacteria, vibriones, and monads—organisms familiar to the microscopist, and which are sure to make their appearance in every putrefying organic infusion.

Less than three centuries ago the belief here spoken of, that living things may originate without eggs or germs or living parents from which to proceed, may be said to have been universal in Europe. Of the truth of this belief there was supposed to be visible evidence in the invariable occurrence of maggots in putrefying flesh. Curiously enough, scriptural authority was cited in proof of this view, and the Old Testament story of the bees found by Samson in the carcass of the dead lion was presumed to confirm it. The doctrine was therefore held as matter of faith, and those who first assailed it were naturally accused of impiety and irreverence. Prominent, and perhaps first among these, was Francis Redi, an Italian philosopher, scholar, and poet (b. in 1626). He presented a conclusive disproof of the spontaneous generation of maggots in putrefying flesh, by simply enclosing, in open-mouthed jars covered with gauze, pieces of flesh still sound, and leaving them in the sun to putrefy. Putrefaction occurred as before, but no maggots made their appearance. The maggots, nevertheless, did appear on the gauze, and a little observation made their origin manifest. The flies, of which they are the progeny in the larva state, being attracted by the odor of the flesh, but unable to reach it, laid their eggs upon the covering of the jar, and out of these the larvæ were presently developed. Having demonstrated the falsity of the popular belief on this subject in a case so conspicuous, Redi naturally generalized his conclusion, and took the ground that no living thing comes into existence without deriving its life from something previously living. He did not say, as it has been said later, "*Omne vivum ex ovo,*" but "*Omne vivum ex vivo.*" He still believed that out of a living plant may arise a living animal, as the insect within the gall of the oak, or the worm within the fruit which presents no external puncture. His doctrine was therefore that which Huxley has named *biogenesis,* in contradistinction to spontaneous generation, called by him *abiogenesis,* and by Bastian *archegenesis.* But archegenesis had been put aside only to return again under a new form. Among the earliest revelations of the microscope was the remarkable fact that whenever a dead organic substance is infused in water, myriads of minute creatures presently make their appearance in the infusion, all possessing most extraordinary, and many of them very varied, powers of reproduction. They multiply by means of *ova,* by means of buds or gemmation, and by means of self-division or fissuration. All this was strongly favorable to the doctrine of biogenesis. Where so many means of reproduction existed, every one of them so effectual and sufficient, to provide that the same forms of life should be produced without any organic antecedents seemed "wasteful and ridiculous excess." This view, however, met here and there with a dissentient. About a century and a quarter ago, John Turberville Needham, an English naturalist, resorted to an experiment which, with various modifications, has been since many hundreds, and possibly many thousands, of times repeated, with the view thoroughly to test the question whether, in its application to infusorial life, the doctrine of biogenesis is universally true. He prepared an infusion, thoroughly boiled it in a flask, corked it tight, sealed the cork with mastic, and covered the whole with hot ashes, designing to destroy by heat any germs which might be in the infusion, in the substance infused, or in the air above the liquid in the flask. After some days or weeks he found that, notwithstanding all these precautions, living organisms did make their appearance in the flask, precisely such as in freely exposed infusions habitually appeared earlier. This experiment was immediately repeated by Spallanzani, an Italian ecclesiastic and naturalist; but Spallanzani, instead of corking his flasks and cementing his corks, sealed the vessels by fusing the glass, and having thus completely cut off communication with the outward air, kept them at the boiling temperature for three-quarters of an hour. No life appeared in the infusions of Spallanzani, and the doctrine of biogenesis was again apparently triumphant.

The question was, however, not yet universally admitted to be settled. Dissentients made themselves heard from time to time; among them Gleichen, Otho Müller, and Treviranus, the latter of whom pointed out the significant fact that while the species of infusorial animals found in infusions of the same kind were constantly the same, those which appeared in different infusions were not so. Early in the present century the celebrated naturalist Lamarck ranged himself on the side of spontaneous generation. Oken took the same view, and subsequently Bory St. Vincent, J. Müller, Dujardin, Burdach, and Pineau, while on the opposite side appeared, among others, Schwann, Schultze, and Ehrenberg. The experiments of Schultze and Schwann were remarkable. They were undertaken for the purpose of testing the accuracy of those of Spallanzani. Since those experiments had been made, the importance of air—or of oxygen, one of its constituents—to the maintenance of animal life had been discovered, and doubts had arisen whether in those experiments the air had not been rendered unfit for the support of life by the operations to which it had been subjected. In repeating the experiments, Schultze admitted to the flasks, after boiling the infusions, only such air as had been passed through concentrated sulphuric acid, and Schwann only such as had been conducted through red-hot tubes. No animalcules made their appearance; and these results, reached as long ago as 1836 and 1837, were regarded by the great body of naturalists as finally settling the question.

The controversy, however, after resting for twenty years, was revived and prosecuted with even more animation than before, by Mr. Pouchet, in the first instance, on the side of spontaneous generation, and Mr. Pasteur on that of biogenesis, but more recently by many naturalists of distinction, among whom may be named Dr. Jeffries Wyman of our own country, whose experimental researches tend rather to the support of the archegenetic theory, and Prof. Huxley of London, whose opinion, given on a survey of the whole history of the controversy, and expressed before the British Association in 1870, is very decidedly the other way. While the controversy was between Mr. Pasteur and Mr. Pouchet, there can be no doubt that, in the judgment of the world, the former had by far the best of the argument. His experiments, which were substantially repetitions of those of Needham and Spallanzani, but which were variously modified, so as to render his demonstrations in every possible way cumulative, seemed to have disposed of the doctrine of spontaneous generation effectually and

for ever. In multitudes of instances infusions hermetically sealed while boiling remained for indefinite periods of time free from all traces of organic life, while portions of the same infusions exposed side by side with these, but open to the air, were speedily swarming with animalcules. He found that even an unsealed flask, of which the neck had been stopped during the boiling only with a plug of cotton closely pressed together, continued to be equally free from these organisms so long as the stopper remained in its place. This last experiment presented a rather curious resemblance to that of Redi with his gauze-covered jar; for the cotton forming the plug was found, on a microscopic examination, to contain the germs which its presence had prevented from entering the flask. Mr. Pasteur finally found—and this result was long supposed to have furnished an unanswerable reply to all the arguments of the advocates of archegenesis—that flasks containing infusions treated by boiling as before, required neither sealing nor stopping with cotton to prevent invasion of the contained liquids by these low forms of life; provided only that the necks of such flasks had been originally bent over, so as to direct their mouths downward. This result he had predicted as probable, holding, as he did, that the germs by which such infusions are repeopled when the living embryos they may contain have been destroyed by heat, must necessarily subside into them from the air above. Though the preparations made by Mr. Pasteur date back at this time twelve years or more, many of them still remain in their original condition, showing, after even this great length of time, no signs of life or evidence of putrefaction. So lately as Nov., 1874, Mr. Balard, in presenting to the Academy of Sciences of Paris a paper by Mr. Servel detailing certain recent experiments made by him, which in his view seemed to demonstrate the spontaneous generation of bacteria in animal substances completely excluded from the air, took occasion to state that he had then recently examined, in Mr. Pasteur's laboratory, unsealed flasks containing blood drawn more than eleven years ago directly from the veins of living animals, in which, during all this time, no bacteria had appeared, and no putrefaction had taken place. He added that the albumen of eggs similarly preserved by Mr. Gayon, eighteen months previously, continued still to be unaltered in character, and perfectly fit for eating.

The experiments of Wyman, Bastian, Cantoni, and others more recent than those of Pasteur, have led to results singularly—and at present, we must say, unaccountably—at variance with his. Prof. Wyman found that bacteria will make their appearance in infusions which have not only been boiled before being sealed up, but which, after being sealed, have been kept at a boiling heat for many hours. He found, moreover, that these same organisms perish when exposed to a heat not over 134° F. Bastian, in a very extended series of experiments, has pushed the heat in the tubes containing his infusions as high as 300° F., maintaining this high temperature, in some instances, not less than four hours; and has yet found that living forms do not fail subsequently to make their appearance in them. Such forms appear also, according to him, in solutions containing nothing of organic origin whatever, but which are composed entirely of certain salts of soda and ammonia; and he even affirms that in such solutions he has occasionally seen very remarkable fungi to present themselves with their full fructification, drawings of which he has given in his work, recently published, entitled *The Beginnings of Life.*

It seems impossible that any candid reader, whatever may have been his previous prepossessions, should rise from the perusal of the extraordinary book just mentioned without feeling that if it does not embrace and contain the conclusion of the whole matter, it is at least for the present unanswerable. It leaves us, nevertheless, still perplexed, perhaps more deeply perplexed than before; for it is impossible to understand how the results reached by so many naturalists, all in the first rank of scientific investigators, all conscientiously laboring to elicit the truth of this great question, should be, after all, so singularly discordant. And another weighty consideration adds to this perplexity. It is the existence of a practical refutation of the conclusions of the class of experimenters to which Dr. Bastian belongs, which is presented under our eyes every day on the grandest scale in the operations of one of the most important departments of modern industry. This consideration cannot better be stated than in the words of Huxley. "There must," remarks this distinguished physiologist, "be some error about these experiments, because they are performed on an enormous scale every day with quite contrary results. Meats, fruits, vegetables, the very materials of the most fermentable and putrescible infusions, are preserved to the extent, I suppose I may say, of thousands of tons every year, by a method which is a mere application of Spallanzani's experiment. The matters to be preserved are well boiled in a tin case provided with a small hole, and this hole is soldered up when all the air in the case has been replaced by steam. By this method they may be kept for years without putrefying, fermenting, or getting mouldy." He argues—and the argument has a weight that must be felt—that there is no mode of explaining this universal and invariable result but the exclusion of germs from these cans. And, in view of the marvellous discrepancy between the results on the small and the grand scale placed side by side, one can hardly repress the suspicion that if there be any such thing as spontaneous generation, it is a thing which occurs only under rare and extraordinary conditions—which conditions Dr. Bastian has unintentionally succeeded in establishing—while as a matter of practical importance or daily interest it is as if it were not.

But if this admission be made, it is an admission, after all, of all that the doctrine of spontaneous generation demands; it is an admission that life can originate spontaneously, and therefore, by inference, that the earliest life probably did originate spontaneously. This is a doctrine so at variance with all that revelation has taught us of creation, that it cannot be received with satisfaction by any who desire to preserve their reverence for the Sacred Scriptures unimpaired. To such it may afford some gratification to know that the processes employed by Dr. Bastian have not escaped criticism, nor have his results been allowed to take their place among the truths of science unchallenged. Few men of eminence in the scientific world accept at the present time the doctrine of spontaneous generation, while very many reject it, and many are silent. Whether this great question will ever be settled to the universal satisfaction is extremely doubtful, but in view of the vast amount of conflicting and irreconcilable evidence hitherto presented, we are compelled to say of it, in our own day, *adhuc sub judice lis est.* (See FERMENTATION and GERM-THEORY.) F. A. P. BARNARD.

Genesee′, county of E. Central Michigan. Area, 500 square miles. The surface is dry, sandy, and undulating, with numerous forests. The soil is productive. Live-stock, grain, wool, and dairy products are the staples. The manufactures are important, including lumber, flour, furniture, carriages, saddlery, castings, metallic wares, and farming implements. The Flint and Père Marquette and other railroads traverse the county. Cap. Flint. P. 33,900.

Genesee, county of Western New York. Area, 507 square miles. It is generally level or undulating, and has an extremely productive limestone soil. Cattle, grain, fruit, wool, and dairy products are the great staples. Carriages, cooperage, saddlery, harnesses, flour, and lime are manufactured. Building-stone, muck, and marl are abundant and excellent in quality. Mineral springs are numerous. It is traversed by the New York Central and other railroads. Cap. Batavia. Pop. 31,606.

Genesee, tp. of Whitesides co., Ill. Pop. 1271.

Genesee, a v. and tp. of Genesee co., Mich., on the Otter Lake division of the Flint and Père Marquette Railway, 8 miles N. E. of Flint. Pop. of tp. 1666.

Genesee, tp. of Allegany co., N. Y. Pop. 888.

Genesee, tp. of Potter co., Pa. Pop. 767.

Genesee, post-tp. of Waukesha co., Wis. Pop. 1462.

Genesee Falls, tp. of Wyoming co., N. Y. It contains the village of PORTAGEVILLE (which see), and takes its name from the Portage Falls of the Genesee River, which are very romantic. Pop. 979.

Genesee River rises in Potter co., Pa., and flows in a general northward course through the State of New York, and after a course of some 120 miles falls into Lake Ontario 7 miles N. of Rochester. It is navigable for 5 miles by lake vessels. There are grand falls at Portageville, at Rochester, and other points in its course. The Genesee Valley Canal renders its waters available for navigation, and it affords abundant water-power at many places. The Genesee Valley is a very fertile and beautiful region.

Genese′o, post-v. and tp. of Henry co., Ill., is the centre of a large and productive agricultural district, situated on the Chicago Rock Island and Pacific R. R., 159 miles W. by S. of Chicago and 23 miles E. of Rock Island, on the Mississippi River. It is one of the most important grain and stock shipping-points on the above-named road. It contains a national and a private bank, an iron-foundry, agricultural implement, tub and pail, furniture, wagon and carriage, cigar, and other manufactories; also, 2 flouring-mills. Besides a flourishing high school there are several select schools, 2 newspapers, 11 churches, 3 hotels, and a large number of stores, saloons, etc. It is a thrifty, enterprising town. Pop. of v. 3042; of tp. 4081.

GEO. A. HOBBS, ED. "REPUBLIC."

Geneseo, tp. of Cerro Gordo co., Ia. Pop. 240.

Geneseo, tp. of Tama co., Ia. Pop. 580.

Geneseo, post-v. and tp., cap. of Livingston co., N. Y., 30 miles S. of Rochester, on the Genesee River and the Erie R. R. It has the county buildings, a State normal school, an academy, a union free school, a free public library containing over 8000 volumes, a free reading-room, 6 churches, waterworks, gas, a national bank and 2 banking-offices, a large number of stores, shops, and factories, 3 hotels, a weekly newspaper, and a large job printing-office. Assessed valuation, nearly $2,000,000. Pop. of tp. 3032.

JAS. W. CLEMENT, PROP. "LIVINGSTON REPUBLICAN."

Gene'sius (JOSEPHUS), or **Joseph the Byzantine,** author of a history of Constantinople in four books, relating to the period beginning 813 and ending 886 A. D. He lived in the tenth century. (Best edition by Lachmann, in *Corpus Byzant. Hist.*, Bonn, 1834.)

Gen'esis [Gr. *γένεσις*, "generation;" called in Heb. *bereshith*, "in the beginning," which is its first word in the Hebrew text], the first book of the Pentateuch, one of the most venerable and ancient of existing books, containing an account of the creation, of man's original happy state, his sin and fall, of the Deluge, and the restoration and dispersion of mankind, ending with the story of Abraham and his early descendants. Its authorship is ordinarily ascribed to Moses, but some have questioned its unity, regarding it as a compilation from various older records; and still others have questioned its historical character. (For a discussion of these points see PENTATEUCH.)

Genest, or **Genêt** (EDMOND CHARLES), a brother of Mme. Campan, was b. at Versailles Jan. 8, 1763, and brought up at the French court; produced when twelve years old a history of Eric XIV. (after Celsius's history), for which Gustavus III. sent him a gold medal; declared himself a republican; was 1789–92 chargé d'affaires at St. Petersburg; French minister to the U. S. 1793–94, when Washington demanded his recall, Genest having taken unwarrantable measures with the design of forcing the U. S. into a war with Great Britain. After his recall, Genest settled at Schodack, Rensselaer co., N. Y., was naturalized, and married first (1794) a daughter of George Clinton, and then (after 1810) a Miss Osgood. Was translator of Idman's treatise on the Finns and their language (1778). D. at Schodack, N. Y., July 14, 1834.

Gen'et, a name given to various carnivorous mammals

The Genet.

of the family Viverridæ and genus *Genetta.* There are several species, mostly African. The common genet, found wild from France to the Cape of Good Hope, is the best known. It is the *Genetta vulgaris.* At Constantinople and other places it is domesticated, and used to destroy rats and mice. It is gentle, and prized for its soft and beautiful fur. It has a faint smell of musk. Is reddish gray, mottled and streaked with black, brown, and white, and appears to be a connecting link between the civet family and the cats, which it resembles in its claws and the pupils of its eyes.

Gene'va [Fr. *Genève;* Ger. *Genf*], town of Switzerland, the capital of the canton of Geneva, is situated on both sides of the Rhône, at the point where it issues from the Lake of Geneva. Its industry is nearly confined to the manufacture of watches, music-boxes, and jewelry, which, however, is very considerable. Its trade is simply retail trade. Its monuments are of no great magnificence, but its beautiful situation, the celebrated part it has played in European civilization as the residence of Calvin, and the remarkable manner in which its citizens, through centuries and at every risk, have shown themselves equal to their position, have made Geneva one of the most conspicuous places in Europe. As it was, in the time of Calvin, a religious and ecclesiastical centre whose influence was felt throughout Europe, so it has become, since the end of the last century, the centre of a remarkable scientific activity. De Luc in meteorology, the great De Saussure in general physics and geology, De Candolle in botany, De la Rive in electricity, Pictet in palæontology, Merle d'Aubigné in history, are all masters of the first rank in their respective sciences. The educational institutions of Geneva and its scientific collections are very celebrated. The duke of Brunswick, who d. at Geneva Aug. 19, 1873, bequeathed to the city his whole fortune, about $20,000,000. Pop. 46,783; with suburbs, 68,165.

Geneva, canton of the Swiss Confederation, bounded by the Lake of Geneva, the canton of Vaud, and France. Its area is 109 square miles. Pop. 93,239. Its soil is not remarkable, but it has been most carefully cultivated for many generations, and now the whole canton looks like a garden. Its constitution (of 1847) is, of all the constitutions of the Swiss republics, the most democratic, and under its shelter the country is rapidly developing.

Geneva, county of Alabama, bounded on the S. by Florida. Area, 576 square miles. It is in the great pine-region of Alabama, and is intersected by the river Choctawhatchie, which will be of great service in carrying its stores of valuable timber to a market. Rice and tobacco are at present the principal crops. Cap. Geneva. P. 2959.

Geneva, post-v., cap. of Geneva co., Ala. Pop. 126.

Geneva, post-v. and tp., cap. of Kane co., Ill., on Fox River, 35 miles from Chicago, on the Chicago and North-western R. R., and is connected with Aurora by the Chicago Burlington and Quincy R. R., and with St. Charles by a branch of the Chicago and North-western R. R. It has an excellent water-power, 1 foundry, 3 grist-mills, elegant county and very commodious school buildings, 1 weekly newspaper, and 4 churches. P. of tp. 1829.

CHAS. ARCHER, ED. "KANE CO. REPUBLICAN."

Geneva, tp. of Jennings co., Ind. Pop. 2037.

Geneva, post-tp. of Franklin co., Ia. Pop. 445.

Geneva, post-tp. of Allen co., Kan. Pop. 634.

Geneva, tp. of Tuscola co., Mich. Pop. 152.

Geneva, tp. of Van Buren co., Mich. Pop. 1086.

Geneva, post-tp. of Freeborn co., Minn. Pop. 378.

Geneva, post-v. of Ontario co., N. Y., at the foot of Seneca Lake, halfway between Rochester and Syracuse, on the New York Central R. R., is the northern terminus of the Geneva and Ithaca R. R., of the South-western R. R., and also of Seneca and Cayuga Canal. A daily line of steamers ply between Geneva and Watkins, at the head of Seneca Lake. Geneva has 10 churches, is the seat of Hobart College, has a graded union school and 6 branch schools, 2 banks, and 2 weekly newspapers. It derives its prosperity from its nurseries, owned by 35 firms, which occupy about 10,000 acres of land in and near Geneva, giving employment to over 1000 laborers and hundreds of agents in every State in the Union and the Canadas. Over $1,000,000 worth of nursery stock is shipped annually from Geneva. It has also a paid fire department, two fine parks, waterworks, and a water-cure. Pop. 5521.

FRED. BENNET, PROP. "GENEVA COURIER."

Geneva, post-v. and tp. of Ashtabula co., O., on the Lake Shore R. R., 45 miles N. E. of Cleveland. It has a national bank, a savings bank, a normal school, 1 newspaper, 2 hotels, 5 churches, a large manufactory of farming tools, and a number of stores, etc. Pop. of v. 1090; of tp. 2298. W. P. SPENCER, ED. "TIMES."

Geneva, post-v. and tp. of Walworth co., Wis., 10 miles S. E. of the county-seat, is on Geneva Lake and the Northern R. R. It has a flouring-mill, a ladies' seminary, a fine union public school, a newspaper, 4 churches, 3 hotels, and the usual number of stores. Principal business, farming. Pop. of tp. 1040. ED. "INDEPENDENT."

Geneva Bay, a v. of Walworth tp., Walworth co., Wis. Pop. 997.

Geneva, Lake of, or **Leman,** is situated 1226 feet above the level of the sea, between Switzerland and Savoy (now a part of France), extending 45 miles from E. to W. in the shape of a crescent. Its width varies from 1 mile at the W. end to nearly 10 miles at the E. end, where its greatest depth reaches 980 feet. It is traversed by the river Rhône, which discharges in it its muddy waters, and issues from it at Geneva a pure and transparent stream of a deep blue color. This lake, which fills a vast basin between the snowy Alps and the Jura Mountains, is much celebrated for the grandeur of the surrounding scenery and the loveliness of its shores, which teem with thriving cities and picturesque villages.

Geneva, The Convention of, concluded at Geneva Aug. 22, 1864, was intended to decrease and mitigate by legitimate means the evils attending war, and especially to better the situation of the wounded by proper attendance and by declaring neutral the physicians and the entire medical staff. First, Switzerland, Baden, Würtemberg, Prussia, the Netherlands, Belgium, Denmark, Hesse, and Italy agreed that, in case of war, all persons belonging to the hospitals or employed in the administration, transportation, and moving of the wounded should be considered as neutrals, and respected as such by the belligerent parties as far as they were acting simply within the proper limits of their office; also those places on the battle-field where wounds are dressed, ambulances for the wounded, and buildings in which they were placed, should be considered neutral, and pains should be taken to avoid any concentration of the battle in the direction of any such point. In order to make such places and persons more easily recognized, it was furthermore agreed to distinguish the buildings and places by a white flag with a red cross, and the persons by a white band with a red cross, stamped by the respective military authorities, and to be worn around the arm. The ratifications of the convention were exchanged June 22, 1865; shortly after the governments of Greece, Great Britain, and Turkey acceded to it, and later those also of France, Austria, and the other European states. It contained also many germs fit for further development, and efforts have been made continuously since to extend and improve it. Thus, on Oct. 20, 1868, fifteen additional articles were agreed upon, chiefly relating to maritime wars. During the Franco-German war of 1870–71 it became apparent, however, that the humane intentions of the convention were in many ways frustrated or endangered by the very peculiarities of war, and by the passions which it necessarily excites. The enforcement of the laws agreed upon demands a calmness and judgment, an order and discipline, which the conquering party may have, but hardly the vanquished. In the summer of 1874 delegates from all the European powers met at Brussels on the proposition of the emperor Alexander of Russia, and the intention was to extend the principles of the Geneva convention to the population of the belligerent countries, to the organization of volunteers and reserve troops, and even to the arms and missiles employed; but the negotiations brought no results. Such humane measures are in opposition to the very nature of war, and in order to carry out the ideas of the Geneva convention it would be necessary to cease to make war. AUGUST NIEMANN.

Geneviève, Canons of St., a branch of the Canons Regular, first proposed by Charles Faure in 1614, who, with the assistance of Cardinal de la Rochefoucauld, established the new congregation. In 1634, Pope Urban VIII. confirmed the organization. They were called *Génevéfains* in France.

Geneviève, Daughters of St., called also **Miramions,** a former body of religious women in France who took no monastic vows, but devoted themselves to teaching and to caring for the sick. The order was founded in 1636 by Francesca de Blosset, and in 1665 was united to the proper Miramions (founded in 1661). The united order flourished, and attained extensive usefulness.

Gen′ghis Khan (the "greatest of khans"), originally **Temudjin,** b. Jan. 25, 1155, at Deylun Yeldâk on the Hoang-Ho, son of the chief of the Mongol tribe Neyrun; succeeded his father when thirteen years old, but a civil war followed, and in 1178 he was compelled to flee to Toghrul Ungh, khan of the Keraite Tartars, whose daughter he married, and whose armies he commanded with success. In 1203 he made himself master of the Keraites, and in 1204 utterly overthrew the Nayman tribes and made himself chief of Mongolia. In 1206 he was declared *Genghis Khan*, or chief of rulers, and the civilized Eigurs submitted to him. He soon published his great code; attacked Cathay or Northern China; crossed the Great Wall 1211; sacked and burned Peking 1215; exterminated some rebellious tribes; attacked Allah-ed-deen Mohammed, sultan of Carismia, 1218; had conquered all Toorkestan 1220; ravaged Balkh, Khorassan, and Persia; plundered all Asia as far S. as the Sutlej River; and penetrated Europe as far as the Dnieper, carrying slaughter and destruction everywhere. Genghis d. at Liupan in China Aug. 24, 1227. His four sons carried on his work of terror. Genghis was the founder of what became the Mogul empire. His chief capital was Karakorum in Tartary. It is stated that more than 5,000,000 persons were slain in his wars, which were carried on with the most heartless cruelty. But throughout his vast domains we are told that he enforced the strictest order, crime received dire punishment, a postal system was established, and all religions were tolerated.

Gen′ipap, the whitish-green fruit of *Genipa Americana*, a South American tree of the order Rubiaceæ. It has a rich purple juice and an agreeable vinous flavor. The fruit of *Genipa Brasiliensis* is not good until over-ripe, but is made into a confection. The juice of this latter fruit is used in dyeing, and affords a deep violet.

Gen′itive [Lat. *genitivus*, from *gigno, genitum*, to "beget"] is a grammatical term, the name of a case. In the Indo-Germanic languages certain relations between the different words of which a sentence consists are expressed by inflections or modifications of the words which are called cases, and are formed by adding different suffixes to the root. Latin has six cases; Greek and Icelandic, five; German, four; English and Danish, two—namely, the nominative and genitive; only in the pronouns is still an inflectional accusative left. In the Semitic languages these relations are expressed by prepositions, and in all modern European languages there is a tendency to obliterate cases and apply the system of prepositions. Thus, the Romanic languages have, properly speaking, no declensions at all. Of all cases, genitive seems to be the most obstinate. As above mentioned, it has still maintained itself in English, in which it is formed by the suffix *s*. It has lost, however, more than one-half of its original domain. Many relations which, in a language with its system of declensions still vigorous, would be expressed by putting the noun in genitive, must in modern English be expressed by the preposition *of*. Thus, the so-called *genitivus objectivus*—the noun in genitive denoting the object of the governing noun—cannot be used at present. It is possible to say in German, "Die Furcht Gottes," meaning the fear which man has of God, but it is impossible in English to speak of "God's fear." It must be expressed by "the fear of God." There is a great difference between "God's love" and "the love of God." Furthermore, of the different classes of *genitivus subjectivus*—the noun in genitive denoting the subject of the governing noun—only those can be used in which the genitive expresses the origin or the ownership; as, for instance, "the king's son" or "the merchant's house." In cases in which the word in genitive simply performs the function of an adjective, and only modifies or defines the general idea conveyed by the governing word, the relation must be expressed in English by *of*, or by the position of the two nouns; as, for instance, "an officer of the navy" or "a navy officer," but not "a navy's officer." The several modes in which the English language can thus signify relations which other languages denote by the genitive alone (as in Latin) or by prepositions alone (as in French), give it a great richness and a peculiar delicacy of expression. CLEMENS PETERSEN.

Ge′nius, plu. **Ge′nii** [Lat. (akin to Gr. γίγνομαι), *gigno, genui;* perhaps related to the Arab. *jinni*, plu. *jinn;* see JINN]. Among the Romans the genii were tutelary spirits attached to persons, peoples, or places. Genii were regarded as a kind of guardian angels, and correspond to the δαίμονες of the Greeks. The doctrine of genii was Etruscan. There were evil as well as good genii. These spirits received worship, especially at wedding festivities and other occasions of joy. Genii are figured in art as winged youths, or sometimes as serpents. In modern translations from the Arabic the JINN (which see) are often called genii, but whether the names are kindred to each other is a disputed question.

Genius, in literature and art, may be best and most easily defined by distinguishing it from its correlative, talent. Genius is exclusively a gift; talent is more or less an accomplishment. Genius refers to a faculty only as far as it is natural and spontaneous; talent, although it depends on a natural aptness or disposition, always involves the idea of training and education. It is impossible to speak of acquired genius; we even cannot speak of the education of genius. Although genius is apt to run wild from lack of knowledge, and although a person's lack of education may be the ruin of his genius, still, that which education brings to genius is only material for its activity and direction for its application; it adds nothing to the faculty itself. The faculty is complete by itself, or it is not genius. On the other hand, we speak of natural talents, thereby designating a fitness in the hand for the use of certain tools, a dexterity in the fingers for the performance of certain tasks, a disposition in the eye or the ear for distinguishing lines and sounds, forms and tones, a capacity in the mind for retaining names, handling figures, making mimicry, combining ideas, etc.; but we speak of natural talents as widely different from real talents, as the basis, foundation, opportunity only, which requires great exertions of training and education in order to be developed into actual talent. To say of a person that he has a natural talent involves a slight reproach, and is always felt so by the person himself; for, instead of taking it as a compliment, he immediately begins to defend

himself by explaining how he lacked time or means to utilize the natural opportunity and acquire a real talent. In speaking not of individuals, but of nations, genius refers to the general structure of the national mind, as it manifests itself in its difference from that of other nations, and for which there can be given no further account; while talent refers to those popular acquirements which the peculiarities of climate, surface of country, and political circumstances made it necessary for a people to have, and which then, by inheritance, became fixed as parts of its nature. Thus, we say of the Semitic races, which produced Judaism, Christianity, and Mohammedanism, that their genius is religious, and of the Indo-Germanic races, which in religion never reached farther than to mythology, but which have produced most of the poetry and art mankind possesses, that their genius is poetical. Or we say of the Americans that they have a mechanical talent; of the Jews, that they have a talent for trade; of the ancient Scandinavian women, that they had a medical talent—because we know the circumstances which made it necessary for these nations to acquire these accomplishments, and have seen how the individual acquirements by degrees developed into national talents.

Another distinction between genius and talent is this: genius is creative, talent only formative. Genius refers to the faculty as far as it produces something new and something perfect; the idea of perfection is an element of that of creation; if the new thing produced is poor, the creation is a failure. As far as the faculty only reduces into form or brings to manifestation, it is called talent. Thus, genius is nearly confined to the spheres of literature and art, and only exceptionally used in that of science, because literature and art must be creative in order to be anything, while science in its highest and noblest form is only discovering. Science describes things that are; literature and art invent things that shall be. Science defines the ideas which produce the world; literature and art create the ideals which govern mankind. In those departments of science in which invention plays a part the word genius is used, as invention is a sort of creation. We speak of a mechanical, mathematical, or military genius, because in mechanics, mathematics, and strategy inventions may be made. We even speak of a philosophical genius, because a philosophical system is in the deepest recesses of its origin a creation, an inspiration, exactly like that of a work of art; or—to use a strong but, with regard to certain modern philosophical systems, not altogether inappropriate appellation—a philosophical system is a useful invention which in course of time is sure to be superseded by another invention of the same kind still more useful. But we hesitate to use such an expression as an historical or a chemical genius. The meaning becomes equivocal. We feel instinctively that in these departments of science invention or creation is only the worst form of blundering. On the other hand, no one would ever call a singer or a pianist a musical genius on account of his rendering of a musical composition, however excellent the performance might be, for his performance requires only talent. There is a talent for writing verse, but if entirely unsupported by any poetical genius it does not constitute a poet; it only constitutes a rhymester. There is a talent for speech, but it does not always make people orators; it sometimes makes them talkers. Any faculty of the human mind has, so to speak, two poles, one turning towards the production of new ideas—genius; and the other turning towards the reduction of the idea into form—talent; the form being a poetical impersonation or a scientific proposition or a useful contrivance or a political measure. But these two poles are not, like the magnetic poles, necessarily connected with each other. Whether genius can exist without talent is a question whose solution depends upon the final definition of what genius is; but it is indisputable that talent can exist without genius. There are thousands of men of talent at this minute in New York, but perhaps not ten geniuses.

It is evident, however, that this distinction between genius as a natural power of creation, and talent as an acquired faculty of formation, does not fully answer the question, What is genius? One hundred years ago, when there still lingered in the word *genius* a remembrance of the tutelary god, of the Socratic dæmon, and creation simply meant production of something from nothing, the definition comprised within the above distinction was sufficient. Genius was considered an organ of the human mind, like memory and imagination—the organ of creation. But modern psychology has failed to find this organ, and modern metaphysics has destroyed the definition of creation as a production of something from nothing. "Of nothing comes nothing" is a rule not only in nature, but also in the mind, and wheresoever science can reach. What, then, does it mean to produce new and perfect ideas? Or, in other words, what is genius? Samuel Johnson said, "Genius is large general powers turned in a particular direction;" and with a little explanatory addition this definition agrees with the results of the latest psychological researches. How "large general powers," by being concentrated on one particular point, can produce ideas which, in this field, are new and perfect, is a question capable of being satisfactorily answered, but the definition seems to imply that a man of "large general powers" might turn these powers in any direction he liked, and thus become a military, mathematical, musical, or poetical genius, just as he chose; and such an inference would be very wrong. It is not the man who turns his "large general powers" in a particular direction and makes himself a genius; it is the presence of a particular talent. If a man of "large general powers" finds in his bodily and mental organization a natural disposition for a particular kind of exercise, which by training and education can be developed into a talent, and if he merges his "large general powers" into this particular talent, he is a genius. But if he turns them in some other direction, where he has no talent, or if he neglects to educate a talent of adequate proportions, he scatters them to the wind or breaks them. With this addition the definition explains the existence of talent without genius—of talent for legerdemain; and it also explains the existence of genius without talent—of scattered, broken, impotent, or, as Jean Paul called it, female genius. But even without any addition Samuel Johnson's definition shows a wonderful intuition. It alone can explain how new and perfect ideas are created, and it alone agrees with actual experience. No one ever met with a great genius in a small man. A painter who talks nonsense in politics is sure to paint nonsense on his canvas; a statesman who has no appreciation of art is sure to take imperfect measures in practice. "Large general powers" is the fundamental element of genius. CLEMENS PETERSEN.

Genlis, de (STÉPHANIE FÉLICITÉ DUCREST DE ST. AUBIN), COUNTESS, b. near Autun, France, Jan. 25, 1746; in 1761 was married to the count de Genlis; in 1770 became attached to the household of the duke de Chartres (afterwards the citizen Égalité); in 1782 became governor to his children, and, according to the popular opinion, was his mistress. In 1793 she was obliged to leave France. From Napoleon and Joseph Bonaparte she subsequently received liberal pensions. Among her best writings are the educational works designed for her young pupils, the Orleans princes, and *Mademoiselle de Clermont*, a short novel of great excellence. Her personal *Mémoires*, in ten large volumes, abound in scandal, and are full of malignant attacks upon the prominent persons of her time. D. at Paris Dec. 31, 1830. It is believed that Pamela, wife of Lord Edward Fitzgerald (1763–98), was her daughter by Philippe Égalité. It is noteworthy that when six years old the future Madame de Genlis entered the Church as canoness of Alix, with the title of countess of Lancy.

Gennes'aret, Lake of [now called *Bahr Tŭbarîyeh;* mentioned only four times in the Old Testament, where it is called *the Sea of Chinnereth* or *Chinneroth;* in the Apocrypha called *the Water of Gennesar;* by Josephus called *the Lake of Gennesar*, or *Tiberias;* in the New Testament called once *the Lake of Gennesaret*, but oftener *the Sea of Galilee*, or *Tiberias*], in Palestine, between lat. 32° 42′ and 32° 54′ N., is found by recent measurement to be 12¼ miles long and 6¾ miles wide. Its surface is 653 feet below the level of the Mediterranean. Its greatest depth is 165 feet. Its waters are clear, cool, and sweet, abounding with fish. Drs. Tristram and Günther report seventeen species of seven families, including an eel, a catfish, four species of perch, and several chubs and minnows. The perch, the most important of all, are *Hemichromis sacra*, *Chromis Andreæ*, *Chromis Simonis*, and *Chromis nilotica*. Its whole eastern side is bounded by a steep mountain-wall, rising nearly 2000 feet, and spreading off into the table-land of Bashan. On the western side there is a similar, though less lofty, wall along the southern half of the lake. The Plain of Gennesaret, famed in ancient times for its fertility, begins about 2½ miles N. of Tiberias, is about 3 miles long, and more than a mile wide. The upper part of this plain was watered by means of an aqueduct from Bethsaida, brought around the head of the promontory which forms the northern boundary of the plain. N. of this promontory the shore of the lake has a broad and gentle slope. Mount Hermon is in full view from every point. The climate is almost tropical. Though not wholly wanting in grandeur and beauty, the lake is noted rather for its historic associations. It was the centre of our Lord's ministry and the scene of many miracles. Nine cities then stood upon its shores; only two of which (Tiberias, with its 2000 inhabitants, and Magdala, with its 20 mud-hovels) now remain. Dr. Robinson reports only one boat on the lake in 1838, but in 1870 the writer of this article found four. The chief unsettled question is in regard to the site

of Capernaum. Some identify it with *Tell Hûm*, about 2 miles from the head of the lake; others with *Khan Minyeh*, under the promontory on the northern edge of the Plain of Gennesaret. Accepting this identification, *Tâbighah*, about three-fourths of a mile N. of *Khan Minyeh*, is Bethsaida, and *Tell Hûm*, about 1½ miles farther on, is Chorazin.

R. D. Hitchcock.

Gennesee′, tp. of Kandiyohi co., Minn. Pop. 361.

Geno′a, province of the kingdom of Italy, extending along the Gulf of Genoa. Area, 1250 square miles. Pop. 716,759.

Genoa, a large maritime and commercial town of Italy, on the gulf of the same name, in lat. 44° 21′ 18″ N., lon. 8° 54′ 24″ E. The whole Gulf of Genoa is more or less sheltered on the N. by the Apennines—which here approach the sea so boldly as to leave room for towns only at the openings of the mountain-valleys—and the port of the city is formed by a small bay, receding inland, between the torrents of Polcevera and Bisagno. The harbor, further sheltered by two piers—the Molo Vecchio, running from the E. side in a westerly direction, and the Molo Nuovo, from the W., south-easterly—is in no danger of being shoaled up, as are so many Italian seaports, for the shore-current is diverted from it by the headland of Portofino, and the little promontories of the Lanterna and the Carignano protect it from the torrent-wash. Still, this harbor, though safe and commodious for its size, is too small for the growing commerce of the town, and the great depth of the water makes its artificial enlargement, now a subject of discussion, very difficult. A railway connects Genoa with Turin (four hours distant), and a littoral line—opened in 1872–74, and running nearly parallel with the Corniche—affords easy communication with Nice and Marseilles on the W., and with Spezia, Florence, Rome, etc. on the S. Steamers run regularly to different Italian ports and to Marseilles and Tunis. The city presents an enchanting view from the water as it rises, amphitheatre-like, towards the summit of verdant and richly cultivated hills, overtopped by a strong city wall; while the turreted forts of a second line of defence crowning the barren heights beyond add greatly to the picturesque effect. Genoa contains many grand churches and palaces, with some fine streets, though, from the unfavorable form of the hills upon which it is built, the city communication is chiefly carried on by means of narrow, ill-lighted, sometimes stair-like thoroughfares, scarcely passable for mules. Many of the proud structures which once justified the haughty title of "La Superba," have fallen more or less into decay, and are now used as hotels or for other public purposes; but some of the old palaces are still occupied by descendants of the "merchant princes" who built them, and possess choice treasures of Italian art. The most noteworthy churches are: S. Maria di Carignano, of remarkable architecture; SS. Andrea and Ambrogio, begun in the sixth century; SS. Annunziata, very gorgeous; S. Lorenzo, the cathedral, built in 1100, and containing, among other curious relics, the glass cup, with its improbable traditions, brought from Cæsarea by the crusaders, and long believed to be an emerald. The Carlo Felice is the finest and most spacious of the several theatres. In the Piazza d'Acqua a monument has been erected within a few years to Christopher Columbus, who was born at Cogoleto, near Genoa. The favorite promenade is the elevated park called Acqua Sola, at the N. E. end of the city, behind which, through the Villa Negro, a winding ascent leads to a bastion 150 feet above the park itself, and commanding a noble view.

The traditional history of Genoa is very obscure, but Livy mentions it as adhering to Rome against Carthage, by which it was destroyed 204 B. C., and soon after rebuilt by its allies. An ancient bronze tablet, found in the Polcevera in 1506, commemorates the settlement, by Rome, of a dispute between Genoa and a neighboring town (187 B. C.). In the sixth century it fell into the hands of the Lombards, who in turn were dispossessed by Charlemagne. After the dissolution of the empire of the Franks it passed through much the same vicissitudes as other large Italian towns, suffering more, however, from the Saracens, whose depredations forced Genoa to strengthen her navy, thus laying the foundation of her great maritime power. For further security against the Mohammedans she formed an alliance with Pisa, but conflicts were afterwards frequent between the two commonwealths. With Venice also Genoa carried on wars disastrous to both, the Levant trade being the subject of their mutual jealousies, and the hostile galleys of the two republics encountered each other, with changing fortune, in all the waters of the Mediterranean. In 1240 Genoa was able to place the emperor of her choice, Michael Palæologus, on the throne of Constantinople, and received from him, in addition to her already extensive Eastern possessions, the cession of Galata and Pera, suburbs of Constantinople, which she retained till 1453, and of the port of Smyrna, so that for a time she controlled the commerce of India through the Black and Caspian seas. Corsica, Minorca, Almeria, Tortosa, Marseilles, Nice, etc. successively fell into the hands of the Genoese, and their dominion might have extended still wider but for their internal dissensions. The early government of Genoa, democratic in form, was very turbulent until 1270, when the famous Guelph "captains of liberty" assumed the control of the commonwealth under pretext of restoring order; and they retained their power about twenty years. The first doge was elected in 1339. In 1499, France obtained possession of Genoa, and the adventurous Marshal Boucicault was made governor of the city; but in 1528 the renowned Andrea Doria restored his country to independence. The conspiracy of Giovanni Fiesco, which has furnished the theme of so many dramas, occurred in 1547. In 1656 Genoa lost 70,000 of her citizens by the plague. In 1746 the Austrians made themselves masters of the city, but were driven out after holding it three months. The victorious Bonaparte in 1796 gave Genoa the title of the Ligurian Republic, but in 1802 he annexed both town and province to France. By the peace of 1815 the Genoese territory became a part of the kingdom of Sardinia, and is now a most important province of united Italy.

The Genoese are now, as they have always been, a bold, independent, energetic, and industrious people. Their commerce is wide and important; their manufactures are very considerable. Shipbuilding is carried on extensively, and this business has greatly increased during 1873 and 1874, many ships being built on commission for foreign countries. Elegant objects of household furniture in wood, such as chairs, tables, cabinets, etc., are manufactured on a large scale, and the silks, velvets, and laces, as well as the coral and silver filigree-work of Genoa, have a wide reputation. Among the coarser manufactures should be mentioned cotton goods, soap, candles, etc.; the extraction of oil is also an important industry. Recent changes in the methods of keeping the custom-house accounts lead to some confusion when comparisons are made with previous years, but the sums-total in 1873, as appear from the records of that year, are—exports (velvets, silks, laces, jewelry, gloves, etc.), $15,590,000; imports (raw cotton, cotton and woollen cloths, hides, dyestuffs, etc.), $63,930,000. The construction of the St. Gothard Railway, with the intended improvements in the railway connection with Genoa, will make this city the nearest Mediterranean port for Western and Central Germany, and consequently tend greatly to increase its commercial prosperity. The schools and charitable institutions of Genoa are numerous and well sustained. The municipality proposes to form a museum in the Villa Negro, now town property, by placing there the rich collections of the late prince Otho, of the marchese Lorenzo Pareto, and of the marchese Giacomo Doria, and to invite the last-named distinguished citizen to assume its direction. A princely gift has been recently made to the municipality of Genoa by the duke and duchess di Galliera. The duchess, being the only child of the Brignole-Sale house, has, with the consent of her husband and their son, bestowed the magnificent Brignole-Sale palace, with its superb collection of pictures and its rich and rare library, upon the city of Genoa, "for the promotion of the study of the fine arts and of classical literature." A large sum of money accompanied this munificent donation. Pop. in 1873, 161,669. Geo. P. Marsh.

Genoa, post-tp. of De Kalb co., Ill. Pop. 993.

Genoa, post-v. of Monroe tp., Wayne co., Ia. Pop. 87.

Genoa, post-tp. of Livingston co., Mich., on the Detroit Lansing and Lake Michigan R. R., 46 miles W. N. W. of Detroit. Pop. 992.

Genoa, post-v., cap. of Douglas co., Nev., on Carson River, 14 miles S. by W. of Carson City. It is pleasantly situated in a pine-region. Pop. of tp. 482.

Genoa, flourishing post-v. and tp. of Cayuga co., N. Y. It has several manufactories. Pop. of tp. 2295.

Genoa, tp. of Delaware co., O. Pop. 1050.

Genoa, post-v. of Ottawa co., O., on the Lake Shore R. R., 13 miles S. E. of Toledo. It is noted as a great lime-manufacturing town, and has lumber, washboard, wooden bowl, wagon, barrel, stove, hoop, and other manufactures. It has 5 churches, a superior graded school, and a German school. It is located in a good agricultural district. Pop. 558. Wm. Humlong, ex-Ed. "Enterprise."

Genoa, post-v. of Scioto tp., Pickaway co., O. P. 154.

Genoa, post-tp. of Vernon co., Wis. Pop. 685.

Genoa, a v. of Walworth co., Wis., on the Illinois State line, at the crossing of the Kenosha and the Fox River branches of the Chicago and North-western R. R., 27 miles W. by S. of Kenosha.

Genoa, Gulf of, is the name generally given to the Mediterranean N. of Corsica, where between Spezia and Oneglia the coast of Italy retreats with a large curve. It is a bay, however, rather than a gulf.

Genre Paint'ing [Fr. *genre*, a "kind" or "sort;" that is, painting of a special kind] occupies an intermediate position between the historical picture and the landscape, and is composed of elements borrowed from those two fields. It may accentuate these elements differently, and thus become subdivided itself into several branches. The historical character may predominate, and produce what is generally called the historical genre picture. The Berlin painter Adolph Mentzel's representations of the life and time of Frederick the Great, the Belgian painter Wapper's representation of Charles I. taking leave of his children, or Nicaise de Keyser's of the emperor Max visiting Memling, the numerous pictures in which the topics are taken from works of poetry, such as Ary Scheffer's *Faust and Marguerite*, from Goethe's *Faust;* Eugène Delacroix's *The Murder of the Bishop of Liège*, from Walter Scott's *Quentin Durward*, or his *Shipwreck*, from Byron's *Don Juan;* Gustave Doré's illustrations to Dante and Cervantes; W. Mulready's representation of scenes in Shakspeare and Molière;—all such pictures are not exactly historical painting, and yet they are so near to it that they cannot well be called simply genre painting. Or, on the other hand, the landscape character may be the predominant element, and produce what is generally called still-life painting. A great number of pictures by masters of the elder Dutch school, representing perhaps a decayed doorsill, on which a cat basks in the sunlight, or the interior of a poor room, where one single sunbeam steals in and reveals all the charms of cleanliness and neatness, are not exactly landscape pictures, but they approach so near to that branch of painting as to form a sort of transition to it. But as soon as one of these elements is entirely lost sight of, either that of history or that of the landscape, genre painting becomes flat or it approaches caricature.

The relation between genre painting and historical painting is clear, though the dividing line between them may sometimes be difficult to draw correctly. Historical painting represents historical reality; genre painting represents only the spirit of history. In an historical picture either the character or the situation must be real. One of them only can be fiction. In biblical representations the characters are invented, the events are real. In Paul Delaroche's *Cromwell at the Coffin of Charles I.* the situation is invented, the character is real; it is Cromwell's portrait. If both character and event are fiction, the picture may belong to what is called historical genre painting, but it is not an historical picture. In genre painting both character and situation may be invented, but, although without historical reality, they must have historical significance. Whether the subject be a popular custom, a procession, a ceremony, a festival, or a mere individual habit; whether it represent a business, sailors, soldiers, quack doctors, or merely an incident; whether it express passion, gambling, fighting, flirtation, or merely play,—whatever it may be, it must tell something about life in general, such as it is led in this country, by this class, in this age. The charm of the Dutch genre painting of the sixteenth and seventeenth centuries does not consist only in the marvellous accuracy and minuteness with which nature is observed and imitated, but one can see that these clumsy peasants become heroes on the dyke when the wall is broken and the waters come—that these tipsy soldiers are unconquerable when they fight for their freedom and their religion. One can study the climate and soil of the country, the character and history of the people, in these pictures; and were they all gathered together in one gallery, Homer would not be more eloquent or more complete than they are. But without any historical signification genre painting becomes utterly flat. It may still be interesting as imitation of nature, as a study, but it is not art. A smoked herring suspended on a wooden peg and dangling in the air, with a piece of board for its background, is not a genre picture.

Less clear but no less important is the relation between genre painting and landscape painting. Critics often overlook this relation entirely, in spite of the fact that genre painting originated from the introduction of the landscape into the historical picture. In the Netherlands, Joachim Patenier (1490–1550) first began to work out the background on which the Holy Family was placed, into an elaborate landscape; and this novelty found so much favor that in the next generation Henri de Bles could place an unbiblical event in the middle of the landscape and yet sell the picture. In Italy a similar transition took place at about the same time. In the pictures of Paul Veronese (1528–88), especially in the *Marriage at Cana* and the *Finding of Moses*, the accessories, the locality, the landscape are developed to an extent and with an independence hitherto unknown; and with Jacopo da Ponte (1510–92), like Veronese a disciple of Titian, genre painting was born with all its principal characteristics. Among these, critics often mention representation of low life, or, better, of the life of the lower classes. But this is as erroneous as if one should say that it is a characteristic of historical painting to represent kings. Historical painting describes the relations of man to his fellow-man, and in order to be interesting it must consequently paint powerful men. Genre painting describes the relations of man to nature, and in order to be true it must consequently paint men who converse intimately with nature. It is not low life, but life in nature, which is characteristic of genre painting. The intermixture of nature is as necessary as historical significance. If nature is too harshly shut out, genre painting approaches to caricature. It is well known that Hogarth did not exaggerate. On the contrary, he delineated the vices of his time with the accuracy of a sober realist. And yet he impressed most people as a caricaturist. The reason is, that in his anxiety for psychological precision and completeness he forgets that with the medium which he uses psychological precision and completeness are not enough to express psychological truths. According to its own nature, the medium asks for something which only the admission of nature into the composition can give—the picturesque. Without this element the medium is as sure to caricature any idea which is seen through it as a globular mirror is sure to distort any face which looks into it.

The origin of genre painting has been mentioned. Information concerning its development and brilliant culmination in the sixteenth and seventeenth centuries can be found in the biographies of the individual artists. After a somewhat irregular course through the last century, it has made a new departure in this, and seems destined to become once more a grand art. Almost every country has one or more excellent, and quite a number of able, genre painters. The most celebrated names in France are Gérôme, Hebert, and Jules Breton; in Germany, Adolph Schrödter, Jacob Becker, Karl Hübaer, Rudolph Jordan, and Henry Ritter, all belonging to the school of Düsseldorf, and evincing its faults in their art of coloring; in Spain, Escosura and Luis Ruiperez; in America, Winslow Homer; in Belgium, Alfred Stevens; in Denmark, Carl Block; in the Netherlands, Israels; in England, Thomas Faed; in Russia, Peroff. CLEMENS PETERSEN.

Gens. See TRIBE, by HON. L. H. MORGAN, LL.D.

Gens d'Armes, a title in France anciently applied to the whole body of men liable to military service. From the twelfth to the sixteenth century it designated the body of nobles and gentry serving under the kings of France. In the present century it denotes the armed and mounted rural police, generally soldiers detailed from the army.

Gen'seric, king of the Vandals, was the natural son of a Vandal king in Spain, and joint heir of the kingdom with Gonderic, his brother, whom he succeeded in 428 A. D.; crossed to Africa in 429 with 50,000 men, who were joined by the savage native tribes and the Donatists; sacked and burned Hippo in 431; banished the Catholic bishops 437; captured Carthage in 439, and dismantled all the African towns except Carthage; terrified the Mediterranean coasts; overran Sicily 440; took and sacked Rome for fourteen days and nights 455, carrying off the empress and her daughters, and robbing the city of its most valued treasures of art; remained master of Carthage and the terror of both the Eastern and the Western empire, successfully repelling all attacks. D. in 477. He was the most terrible of the barbarian invaders of Rome, an Arian, and a fierce persecutor of orthodoxy, an able general, and a cruel and rapacious man.

Gen'tian, a genus of plants of the natural order Gentianaceæ, of which the most important species is the yellow gentian (*Gentiana lutea*), growing on the mountainous meadows of Central and Southern Europe. This is a perennial plant, with a thick, long, branching root, erect stem three or four feet high, broad, ovate, bright-green leaves, and rather large, bright-yellow flowers. The name is said to be derived from Gentius, an ancient king of Illyria, who introduced yellow gentian into medicine. The dried root is an important drug. It is of spongy texture, faint odor, but intensely bitter taste. Its active principle is probably a bitter crystallizable neutral substance, the *gentiopicrin* of Ludwig and Kromayer, a body belonging chemically to the glucosides. This, like other simple vegetable bitters, when taken internally tends to increase the appetite and promote digestion by gentle irritation of the mucous membrane of the stomach. The root is accordingly used medicinally as a stomachic tonic in simple digestive debility, being given in the form of solid and fluid extract, compound infusion, or tincture. The roots of the several perennial species of the U. S. have similar medical prop-

erties. Many species have very beautiful flowers, as, for instance, our fringed gentian (*G. crinita*), an autumnal biennial. EDWARD CURTIS.

Gentiana'ceæ [from *Gentiana*, one of the genera], a natural order of exogenous herbs, rarely shrubs, with a watery, bitter juice, and mainly opposite and entire leaves, without stipules. They are found in nearly every part of the world, mainly, however, in the temperate and frigid zones. A few are climbing. They have, as a rule, the tonic properties alluded to in the article GENTIAN. Many have beautiful flowers. There are 60 genera and 450 species.

Gen'tile [from the Lat. *gens, gentis*, a "people;" Heb. *goyim;* Gr. ἔθνη, "nations"], one not a Jew; a name applied by the Jews to all who were not of their own nationality. Between Jews and Gentiles there was a profound mutual aversion, the intensity of which it is hard for us to conceive, although the feeling itself is not yet quite obsolete. The Mormons in recent times apply the term Gentile to those who are neither Mormons, Jews, nor aboriginal Indians, for they regard the latter as a remnant of the ten lost tribes of Israel.

Gentilly, a v. of France, in the department of Seine, is by the walls of Paris, divided into two parts, Great and Little Gentilly, and contains the famous hospital of Bicètre and numerous manufactories, of which those of chemicals are quite extensive. Pop. about 15,000.

Gen'tleman [Lat. *vir gentilis*, or *generosus;* that is, a "man of family," a "man of good birth"], in Great Britain, a man of a rank above that of yeoman. The term *gentry* in a large sense includes the nobility, but in popular use often excludes them. Thus, British society is divided into nobility, gentry, and yeomanry, and families are either *noble, gentle,* or *simple.* Some of the Plantagenet kings gave patents of gentility. Sir Thomas Smith (1514–77) says, ". . . Whosoever studieth the laws of the realm, who studieth in the universities, who professeth the liberal sciences, and (to be short) who can live idly and without manual labor, and will bear the port, charge, and countenance of a gentleman, he . . . shall be taken for a gentleman." Later authorities make the bearing of coat-armor the test of gentility, but Chaucer, an older authority than any we have cited, puts it on a better ground: "He is gentil that doeth gentil dedes." The French *gentilhomme* was properly a title belonging to those of noble birth.

Gen'tlemen-at-Arms (or, more fully, "Her Majesty's Body-Guard of the Hon. Corps of Gentlemen-at-Arms," formerly called "Gentlemen Pensioners"), in the court of Great Britain, one of the divisions of the royal body-guard, the others being the "Yeomen of the Guard" (Beef-eaters) and the Royal Archers (for Scotland). The Gentlemen-at-Arms consist of one captain (Gold Stick), one lieutenant (Silver Stick), one standard-bearer (Silver Stick), one clerk of the cheque, adjutant and harbinger, one sub-officer, and forty gentlemen, for the most part retired officers of the army. They are present only on occasions of state ceremony. Instituted 1509 by Henry VIII.; received the present name in 1834.

Gen'try, county of Missouri, in the N. W. part of the State. Area, 504 square miles. It is watered by Grand River and its numerous branches. Cattle, grain, wool, tobacco, and sawed lumber are the principal products. Cap. Albany. Pop. 11,607.

Gen'tryville, post-tp. of Gentry co., Mo. Pop. 255.

Genuflec'tion [Lat. *genu*, "knee," and *flecto*, to "bend"], the act of kneeling in prayer and worship. Kneeling has been the general attitude of supplication in all times and regions. Christ himself knelt in prayer. In the liturgies and rubrics of nearly every ritual there are directions given indicating the proper times for genuflection.

Ge'nus [Lat. *genus, generis*, a "kind"], plu. **Gen'era,** in zoology and botany, a group of closely-allied animals or plants, distinguished from others by the possession of numerous characters in common with each other, indicating a closer relationship than that of families, and yet not indicating identity of species. Some genera, such as *Felis* (the cats), *Quercus* (the oaks), etc., are so plainly marked as to be recognized in popular language by a common name: and yet in many instances generic distinctions are and must be partly arbitrary and artificial, because the genera often overlap and run into each other. The rule or statement laid down by high authorities, that the genus indicates ultimate structural identity, the various species being marked off by variations in the proportion of parts, is a very useful one, as affording a standard or ideal according to which to construct genera; but practically it is almost nowhere possible to apply this or any other absolute rule for the construction of the genus.

Genza'no, town of Italy, about 16 miles S. E. from Rome. Little is known of its history before the thirteenth century, after which it passed successively from the dominion of one great mediæval family to that of another. It contains some fine buildings, but it is chiefly known by its yearly festival of the Infiorata, on which occasion (the Sunday of the Corpus Domini) the streets are covered with flowers, so arranged as to produce a kind of floral mosaic—a show which attracts many strangers. Pop. about 5000. —Also, town in Southern Italy, in the province of Potenza.

Ge'ode, a roundish hollow concretion, sometimes having the cavity lined with crystals, sometimes filled with ochre, and sometimes quite empty.

Geod'esy [Gr. γεωδαισία, from γῆ, "earth," and δαίω, "I divide"]. Geodesy is the higher science of surveying, in which the magnitude and figure of the earth are taken into account. The size and form of the earth are such that no areas of any considerable extent can be correctly admeasured and mapped without due regard to its curvature. Due N. lines, ten miles apart, deemed parallel in plane surveying, have, in fact, such a convergence in middle latitudes as to approach each other 150 feet in ten miles. The operations of a geodetical survey divide, therefore, into two principal parts: First, the measurement of the distances and angles on the surface of the earth, to determine the geometrical figure of the area surveyed; secondly, the determination of the position of this figure with regard to the astronomical meridian, latitude, and longitude, or, in other words, its situation on the surface of the globe.

The first operation, which is that of trigonometrical surveying, requires the lineal measurement of base-lines and the observation of horizontal angles in the triangulation. The lineal measurement of a line consists in the continued repetition of some unit of length, which operation may be performed either by optical means or by actual contact. The optical mode of measurement consists in bringing into coincidence, side by side, lines drawn on two measuring-bars; or, where a greater degree of precision is desired, in the employment of a micrometric microscope, mounted on a very solid support, which is pointed on the forward end of one bar, and with which the rear end of the next bar is brought into coincidence; the ends being defined either by a fine line or other suitable optical means. In the method of measuring by contact care must be had not to disturb the position of the bar which remains in place, and against which the next succeeding one is made to abut. It is therefore admissible only to touch it with a very light pressure. To this end, Bessel used a slender glass wedge divided along its parallel sides, which was inserted between two bars purposely left a short distance apart, the width of the wedge at the points of contact being added each time to the length of the bar. Repsold's level of contact was first employed in the measurement of base-lines by Struve in Russia, and was subsequently adopted by Bache in the U. S. in a measuring apparatus which may be considered as the most perfect hitherto employed, and which will serve here to illustrate the principles involved in the delicate operation of the precise measurement of a distance of several miles. The apparatus consists of two measuring-bars, each supported on two massive tripod-stands, placed respectively at one quarter from each end, and provided with mechanical means for adjusting the bars sidewise, lengthwise, and in height. Each measuring-bar is a compensating combination of an iron and a brass bar, so adjusted as not only to have the same length at different temperatures, but also to preserve an invariable length through changes of temperature, by means of a suitable adaptation of the cross-sections of the bars to their respective specific heat and conductivity. These compound bars are protected from the direct influence of the sun by double tubes of tinned sheet iron, within which they are movable on rollers by means of a differential screw, admitting of the contacts being made within $\frac{1}{10000}$ of an inch. The abutting-piece acts upon a lever of contact which is attached to the fixed end of the compound bar, and carries a spirit-level of great sensibility, the horizontal position of which defines that length between the two contact-pieces of the measuring-bar, which has been compared with a standard iron bar of six mètres. By means of a circular abutting-piece it is made possible to use the apparatus at inclinations ranging to four degrees on each side of a level. (For complete description of this apparatus see the report of the U. S. Coast Survey for 1854.)

An accuracy within $\frac{1}{10}$ of an inch in ten miles, or the $\frac{1}{600000}$ of the whole length, is attainable by means of this apparatus. The length of each bar is six mètres, or nearly twenty feet. The average length of base-lines to which modern practice has settled is about 10,000 mètres, or six miles. The necessity for extreme accuracy in the measure of a base-line becomes apparent when we reflect that whatever be its errors, the same are constantly multi-

plied as the triangulation advances, and an error of a foot in ten miles would produce one of ten feet in a hundred miles.

From such a base-line the triangulation proceeds, by gradually-increasing steps, to sides of as great length as the nature of the country will admit of. The preferred system of enlargement from the base-line is that of forming equilateral triangles on each side of the base, which together compose a lozenge, the long diagonal of which, duly observed from both ends, forms the base for a similar system as the next step. In a country of moderate elevations, sides from 25 to 40 miles are usually attained. In mountainous regions, sides from 60 to 80 miles are common, while 100 miles is very rarely attained.* In work of the first order it is always desirable to obtain quadrilaterals, the diagonals of which are intervisible, which attains the object that each successive base can be derived from a preceding one by two different triangles, and thus affords a continual check upon the precision of the operations. The intervisibility of stations on long lines is effected by means of small mirrors reflecting the solar rays towards the observer, directed by means of an apparatus called a heliotrope, of which there are several forms, all effecting the same purpose with more or less simplicity. Such a signal may be seen in the telescope, showing like a star of the second magnitude, when the outline of the mountain from which it is seen is indistinguishable.

The horizontal angles subtended from the different points of the triangulation are measured by means of theodolites —instruments for angular measurement—the vertical axis of which is placed in the vertical of the station-point occupied, and by means of which are consequently measured the angles between the vertical planes passing through the station-points observed upon. The angles thus measured are, therefore, the spherical—or, more precisely speaking, the spheroidal—angles of the triangle; their sum should exceed two right angles by an amount dependent on the ratio of the area of the triangle to that of the whole sphere; and known as the spherical excess. In an equilateral triangle of sides of 40 miles this amounts to $9''.1$, or $1''$ to every 76 square miles. The formula for spherical excess is as follows: $E''=\frac{a\,b\,\sin\,C}{2r^2\,\sin\,1''}$, where a and b are two sides, C the included angle of the triangle, and r the radius of curvature of the earth at the triangle. This radius of curvature varies somewhat with the latitude, and if we call $E=\frac{1}{2r^2\,\sin\,1''}$, and express the distances in mètres, the following values will serve for accurate computation:

Lat. 25°	log E = 1.4060
30	1.4056
35	1.4051
40	1.4046
45	1.4041

The size of instruments used for the measurement of angles in geodetic work ranges from circles of 12 inches to 40 inches diameter, with telescopes of from 28 inches to 54 inches focal length, and corresponding apertures, the smaller instruments being of course applicable to the lesser length of sides. The accuracy attained in the mean result of the measurement of an angle should not be less than the nearest half second. When the largest class of instruments is employed the uncertainty of the result may be reduced to $0''.25$. Owing to the variability of the directions as seen through the atmosphere, it is necessary to measure each angle at least twenty-five times, employing five or more different positions of the circle in order to eliminate the accidental errors of graduation, which even in the best instruments frequently reach $2''$. The readings are usually taken with three micrometer microscopes, attached at equal intervals to the movable plate which carries the telescope. When the circle has been firmly mounted and carefully levelled, the telescope is pointed successively at each station, the corresponding readings on the circle being taken by means of the micrometers; the telescope is then reversed, and another series of observations is taken in the inverse order. The mean of these series forms a complete measure of the relative angles between the stations observed upon. From twenty-five to thirty such measures will generally yield all the accuracy attainable by the means employed.

When we have thus measured all the angles in a system of triangulation with the utmost attainable precision, and proceed to calculate the length of the sides, we shall be met by discrepancies in such lengths as may be independently derived through different series of steps, and by defects or excesses in the theoretical sum of the angles about a given point, or in the several triangles. These discrepancies, due to the residual errors in the angles, require adjustment in order to arrive at some definite geometrical figure. Such adjustment is effected by the application of the method of least squares, which demands that the geometrical conditions of the figure shall be satisfied with the least possible change of the observed angles. Illustrations of this method of adjustment will be found under the head of SQUARES, LEAST, METHOD OF.

Since the triangles are always small compared with the whole sphere, it is extremely convenient to compute the length of the sides as if they were plane triangles, each angle being diminished by one-third of the spherical excess —a method based upon the fact that small arcs are to each other as their sines.† An interesting example of the methods of computation and adjustment will be found in the Coast Survey Report for 1865, giving the results of the primary triangulation extending from the eastern boundary of Maine to New York, and involving three measured baselines.

All geodetic operations are reduced to the common level of the ocean, and represent the surface of equilibrium at that level—a surface which is affected by the varying densities of the earth's crust, and which therefore will differ in many localities from the closest approximation to an average geometrical figure. It is necessary, therefore, to reduce the length of each base-line to what it would be at the level of the sea, to which end it is only necessary to know its elevation above that level, and allow for the divergence of the radii passing through its ends. The angles of the triangulation, being measured in the horizontal plane of each station, are the same whatever altitude they are measured at. The elevation of each station above the level of the sea, although of no importance in the general plan of a geodetic survey, is nevertheless of great importance in topographical aspects. It is determined by the observation of zenith distances of the several stations as seen from each other; which observations should be reciprocal and simultaneous in order to avoid the great variability of atmospheric refraction. Owing to the uncertainties arising from the latter cause during these measures, the levelling with a spirit-level and at comparatively short sights yields an accuracy far superior to that attainable by trigonometrical levelling.

The computation of difference of height from reciprocal zenith distances observed at two stations is made as follows: Let z, z' be the observed zenith distances, d the distance between the two stations, R the radius of curvature of the arc joining them, c the angle subtended by that arc, expressed in seconds, $h-h'$ the difference of height; then $c=\frac{d}{R\sin 1''}$, $h-h'=\frac{d\sin\frac{1}{2}(z'-z)}{\cos\frac{1}{2}(z'-z+c)}$. The effect of refraction is indicated by the fact that the sum of the two zenith-distances exceeds two right angles by an angle less than c, the angle at the centre of curvature. Designating the ratio of that excess to c as the *coefficient of refraction*, m, we have $m=\frac{c-(z'+z-180°)}{2\,c}$. This coefficient of refraction is found to vary from 0.078 in moist localities to 0.070, and even less, in dry and elevated regions.

When the value of m may be assumed as known, the difference of elevation may be computed from the zenith-distance measured at one station only, by the formula $h-h'=\frac{d\cos(z+mc-\frac{1}{2}c)}{\sin(z+mc-c)}$.

The geometrical figure and dimensions of a system of triangulation having been determined by the methods heretofore sketched, the next step is to determine its position in azimuth and latitude. The azimuth is determined by observations on the pole-star, preferably at its elongations, when the accurate knowledge of time does not affect the result; by which means the meridian plane is referred to some point included in the system of horizontal angles of the triangulation. In order to check the accumulation of small errors in the measure of horizontal angles, and to take into account the local variations of the direction of gravity, it is now customary to determine the astronomical meridian with reference to the triangulation at a great number of stations, and to take an average of the whole for the orientation of the scheme of triangles. On similar considerations, the latitude is observed at a great number of stations, in order that from their comparison there may

* A convenient rule for the distance of visibility on account of the earth's curvature is this: The distance in miles is $1\frac{1}{3}$ times the square root of the height in feet. Thus, an elevation of 144 feet affords a visibility from the horizon 16 miles distant. This includes an average amount of refraction.

† With the angles so reduced, one side and the three angles being always given, the computation of the other two sides proceeds upon the principle that the sides are to each other in the same ratio as the sines of the opposite angles. It is customary to carry the expression of the angles to hundredths of seconds of arcs, and to employ eight places of decimals in the logarithmic computation.

be derived an average value of the earth's curvature in the meridian, less influenced by local attraction than the comparison to two terminal stations would probably be.

The azimuth is usually determined by means of the same theodolite which serves for the measurement of horizontal angles, using the mercurial horizon for direct and reflected observations of the pole-star in preference to the spirit-level on the transit-axis of the instrument. The determination of a meridian-mark by means of a transit-instrument, employing upper and lower passages of circumpolar stars, is to be specially commended.

The determination of latitude is primarily effected by the observation of the zenith-distances at upper and lower culminations of circumpolar stars, or else by the measurement of zenith-distances of stars the declinations of which have been well ascertained at fixed observatories. The most convenient practice for determination of latitude in the field, where the employment of instruments carrying circles of large size is extremely inconvenient, has been found to be that of equal zenith-distances, first suggested by Gauss, and put in practical shape by Talcott. This method consists in selecting from the great number of stars whose positions are now accurately determined, two that follow each other within a few minutes of time, and which have nearly the same zenith-distance at the place of observation, on opposite sides of the meridian. A telescope of considerable power, with attached level and micrometer, serves to measure the differences of zenith-distance. The method thus leaves to the permanent observatories, supplied with instruments of great power, the ascertainment of absolute declinations, and at the field-station we only concern ourselves to measure micrometrically the difference of zenith-distance, including, of course, the ascertainment of the level correction. It is evident that the mean of the declinations, corrected for half the difference of zenith-distance, will give the latitude of the place.* By these means it is found practicable to determine the latitude within 0.″1 by observing twenty-five pairs of stars on three nights, occupying about four hours on each.

Another method of determining the latitude is by observing the times of passage of stars which culminate near the zenith over the prime vertical on both sides of the meridian. The difference between the declination of each star and the latitude of the place is then deduced from the difference of time between its two prime vertical transits. This method, first employed by Bessel, is susceptible of great precision, but absorbs much time; having, however, the economical advantage of employing the same instrument which is used for observations of time, the astronomical transit. Observations have been made at the same station by the three different methods, to test their agreement with the following results:

Latitude of Station Mount Agamenticus, Me.

By differences of zenith distance...	43° 13′ 24.89″	±0.11″
By absolute zenith distances.........	25.07	±0.10
By transits in prime vertical........	24.97	±0.14

showing an accordance within the limits of the probable error.

While the astronomical latitude is referred to a determinate plane in space—viz. that of the equator—the longitude is merely relative to some assumed meridional plane of the globe, for which it is customary, for many historic reasons, to take that of the Greenwich Observatory in England. It is obvious that the difference of longitude between two stations can only be determined by corresponding observations at both places. Our only means of measuring such differences being by time, we must note at the outset that the unit employed and perceptible to our senses is much larger than that employed in the co-ordinate of latitude, the second of time being fifteen times as great as the second of arc. Hence the extreme difficulty of precise determinations. The essential mode of obtaining a difference of longitude is that of comparing the accurate local time of each place by means of some instantaneous phenomenon that can be simultaneously observed at both places. A flash of light visible from each station is the type of this mode of determination, but is applicable only for limited distances. Occultations of stars by the moon, although not strictly simultaneous, yet reducible to a common instant, are the next in order of accuracy, but fail in extreme precision, from the fact that the moon's edge presents very sensible inequalities. Solar eclipses have a somewhat greater degree of precision than occultations of stars, but occur at very rare intervals. The transportation of chronometers from one place to another for inter-comparison of local time affords another means of recognized value.†

By far the most precise method of determining differences of longitude is by means of the electric telegraph, by which astronomical clocks at different places are compared with each other chronographically with the utmost precision. The method of recording observations of time on a chronographic register, by means of a galvanic circuit, known in Europe as the *American method*, originated in the U. S. Coast Survey with the first attempts to determine longitude by means of the electro-magnetic telegraph. The *chronographic record* is made on a cylinder, revolving with nearly uniform velocity, covered with a sheet of paper, upon which a pen traces a line, interrupted or deflected for an instant, through the agency of an electro-magnet, every time the pendulum of the clock passes the vertical, and, in doing so, interrupts a galvanic circuit. The pen is at the same time slowly moving lengthwise, so that the line formed is a long spiral, which is thus graduated into spaces corresponding to seconds of time, and described with uniform velocity. When any instant of time is to be recorded the observer strikes a finger-key, which, like the pendulum, breaks the galvanic circuit, and causes a similar mark to be made on the record; the position of which, in reference to the adjacent seconds marks, can be read off with great precision. The method of determining longitudes by means of the electric telegraph is substantially as follows: A transit-instrument, astronomical clock, and chronograph are mounted at each station. After suitable observations for instrumental corrections at each station, which are recorded only at the place of observation, the clock at the eastern station is first put in connection with the circuit, so as to write on the chronographs at both stations. Next that at the western station is made to perform the same service. Now, since these records have been obtained at both stations, it will be easily seen that if there be any sensible interval of time consumed in the transmission of the signals, the difference of longitude obtained from the record at the eastern station will be too great by that interval, and that at the western station will be too small by the same amount. The mean result will give the longitude free from this error, and the difference measures double the time of transmission of the signals through the whole circuit. By this method the longitude of Harvard Observatory from Greenwich has been determined by the U. S. Coast Survey, on three different occasions, with the following highly accordant results:

1866, by Anglo-American cables.........	4*h.* 44*m.*	31.00*s.*
1870, by French cables to Duxbury.....		30.99
1872, by French cable to St. Pierre.....		30.96

Instructive examples of this method will be found in the Coast Survey Reports for 1848, 1856, 1866, 1867, and 1872.

When, by the operations heretofore indicated, the trigonometrical network of a country has been determined, and its situation in respect to the astronomical meridian, the equator, and the assumed first meridian has been ascertained, it remains to compute for each point of the triangulation its latitude and longitude, in order to project the same upon a map. The latitude and longitude of some point of departure being known, and the distance and azimuth of the next station, we proceed to compute the difference of latitude and longitude and the reverse azimuth by the following formulæ, which take into account the spheroidal figure of the earth, and are those used in the U. S. Coast Survey. Let a be the equatorial radius of the earth, or 6,378,206 mètres; b the polar semi-axis, or 6,356,584 mètres; then $e^2 = \frac{a^2 - b^2}{a^2}$, e being the eccentricity; the radius of curvature in the meridian for any latitude L is $R = \frac{a(1-e^2)}{(1-e^2\sin^2 L)^{\frac{3}{2}}}$; the normal to its intersection with the polar axis is $N = \frac{a}{(1-e^2\sin^2 L)^{\frac{1}{2}}}$. Let, further, K designate the distance between two trigonometrical stations, L, L' their latitude, M, M' their longitude, Z and Z' the azimuths of the line K, counted from S. around by W.; then we have, in the spheroidal triangle formed by the pole and the two stations, by development into series, $L - L' = \frac{K\cos Z}{R} + \frac{K^2\sin^2 Z\tan L}{R\,2N} + \frac{K^3\sin^2 Z\cos Z(1+3\tan^2 L)}{R\,6N^2} + \ldots + (\delta L)^2 D.$

The last term is a small correction due to the fact that the series is developed for the radius of curvature at the latitude of the given station, instead of the middle latitude, δL being an approximate value of the difference of latitude derived from the first and second terms, and $D = \frac{3Re^2\sin L\cos L}{2a(1-e^2)}$.

* A marked advantage of the method is that refraction enters only differentially into the results.

† Yet the degree of accordance in the results attainable by different timekeepers and by repeated transportation falls far short of what would be requisite to make the difference of longitude so obtained comparable in accuracy with differences of latitude.

We have further $M'-M=\frac{K\sin Z}{N'\cos L'}$, and $Z'-Z=180°-(M'-M)\frac{\sin\frac{1}{2}(L+L')}{\cos\frac{1}{2}(L-L')}$.

The use of these formulæ is made quite convenient by means of tables of coefficients depending on the latitude, which can be found in the Coast Survey Report for 1860.

With the determination of the latitude and longitude of each triangulation-point, and of their relative distances and bearings, the work of geodesy is concluded. The further operations requisite to the construction of a complete map of a country are set forth in our articles on TOPOGRAPHY and MAP. It remains now to show how the figure and magnitude of the earth may be derived from the results of the geodetic operations that have been reviewed.

The fundamental elements of the earth's magnitude and figure have long been a subject of the highest interest to philosophers. While measures approximating to precision have only been executed within the last 200 years, attempts were made to ascertain the diameter of the globe as early as 200 years before our present era. The sphericity of the earth was fully recognized by the Alexandrian school, and Eratosthenes, by a comparison of the angle of the shadow of a vertical style at Alexandria and at Syene, had estimated the circumference of the earth to be about 252,000 stadia; and, later, Posidonius, by a similar comparison of the altitude of the star Canopus at Rhodes and at Alexandria, derived a value of 240,000 stadia.* Under the auspices of Maimon, caliph of Bagdad, the length of a degree was determined to be between 56 and $56\frac{2}{3}$ Arabic miles, equivalent to 58,400 to 59,000 toises—a result only about $2\frac{1}{2}$ per cent. in excess. Meantime, the Western World had fallen into the night of the Middle Ages, during which the earth was again considered as flat; and it was not until 1800 years after Eratosthenes that Snellius and Musschenbroek, by measures near Leyden in Holland, between 1615 and 1629, determined the length of a degree to be 57,033 toises. Norwood (1633–35) found the length of a degree between London and York to be 57,300 toises.

But these attempts, as well as that of Fernel in France, while they are notable approximations, were not based upon methods of precision. The first application of accurate measurement was made in 1669 by Picard, who first applied telescopes to astronomical observation, between Malvoisin and Amiens, in France, which operation furnished to Newton the data for the demonstration of the law of gravitation. At that era, under the intelligent auspices of Louis XIV., the French continued to lead in geodetic operations, and in connection with the trigonometrical survey of France three arcs were measured by the two Cassinis (1683–1700) between Bourges, Paris, Amiens, and Dunkirk, by trigonometrical operations, avowedly for the purpose of determining the figure and magnitude of the earth. While such measurements, taken in middle latitudes, would well serve to determine the average diameter of the earth, they could throw but little light on the question of its ellipticity, which can be derived only from arcs measured in widely different latitudes. From theoretical considerations, supported by the pendulum observations of Huyghens and Richer, Newton had concluded the polar axis of the earth to be somewhere between $\frac{1}{180}$ and $\frac{1}{580}$ less than its equatorial diameter, while Cassini's measures indicated a slight excess of the polar axis. In order to settle this question, the French determined to measure arcs of the meridian near the equator and near the pole, in addition to those situated within their own country. Accordingly, about 1740 three degrees were measured in Peru, near the equator, by Bouguer and La Condamine, and a corresponding arc in Lapland, near Tornea, by Maupertuis and Clairaut. The results of these operations showed a flattening at the pole of between $\frac{1}{200}$ and $\frac{1}{300}$, and first established the fact of the spheroidicity of the earth.

Since that time all civilized nations have been engaged in making geodetical surveys of their territories, either with the direct object of measuring arcs of the meridian or of a parallel, with a view to the determination of the elements of the earth's figure, or in connection with a complete trigonometrical survey of their respective countries.

The French have covered their entire territory with a network of triangulation, and their meridional arc, of over ten degrees, from Dunkirk to Barcelona, forms a leading element among the existing data, having served, in connection with the arc measured by them in Peru, for the determination of the *mètre* as the ten-millionth part of a meridional quadrant. The value thus obtained has been found somewhat too small when more extended measurements are taken into account, as will be seen below. England has not only covered the British Isles by the geodetic operations of the Ordnance Survey, but has executed still more extensive surveys in India, besides extending at the Cape of Good Hope the arc first measured by Lacaille under French auspices. In Russia the geodetic operations carried on by the Struves cover a range of twenty-nine degrees of latitude. The Scandinavian and German states have contributed their share. In Italy and Spain great activity in the same direction has lately been developed; and an international organization for the complete junction of all European triangulations is actively engaged in bringing the whole network of Europe into one uniform system of geodetic measurement. North America early (*Phil. Trans.*, 1768) furnished a contribution to the general stock of information by Mason and Dixon's measurement of the line between Maryland and Pennsylvania, and the determination of latitude at its terminal points. But since the increase of precision demanded in the latter element this datum has lost its place among the valid measures. Trigonometrical operations of the U. S. Coast Survey have, however, furnished up to this time an addition of eight degrees of the meridian—namely, $3\frac{1}{2}°$ in New England and $4\frac{1}{2}°$ from the head of Chesapeake Bay to Ocracoke Inlet; and much larger contributions to the admeasurement of the earth's figure are accruing from the further prosecution of the work.

It will be readily seen, without going into mathematical developments, that the measure of the length of a degree in different latitudes on the same meridian will give us the measure of the earth's ellipticity; and if in different meridians we should find a different degree of ellipticity, the inference would obtain that the equator itself is not a circle, and the earth's figure therefore not precisely a spheroid of revolution about its polar axis, but more nearly an ellipsoid of three axes. There is a small preponderance of evidence in favor of the latter supposition; but as by far the larger proportion of meridional arcs have been measured in nearly the same longitude, while the total aggregate does not yet reach a quarter of a circle, the conclusion as to the ellipticity of the equator is at present within the uncertainties of the data.

It will not be out of place here to show the method of finding the semi-axis and ellipticity, when the lengths, amplitudes, and middle latitudes of two arcs are known. Let s, λ, m, and s', λ', m' represent those data respectively, and a, b, as heretofore, the equatorial and polar semi-axes; then,

$$\frac{a-b}{2}=\frac{1}{3}\frac{\frac{s}{\lambda}-\frac{s'}{\lambda'}}{\cos 2m'-\cos 2m}$$

$$\frac{a+b}{2}=\frac{\frac{s}{\lambda}\cos 2m'-\frac{s'}{\lambda'}\cos 2m}{\cos 2m'-\cos 2m};$$

from which a and b are readily found, as well as the ellipticity, which is $\epsilon=\frac{a-b}{a}$.

Bessel has shown how measurements made in different parts of the earth, comprising not only those of meridional arcs, but also arcs of the parallels or geodetic arcs measured in any direction, may be combined, by the method of least squares, to give the most probable elements of the earth's figure; and in 1841 (*Ast. Nach., No.* 438), he derived, from the data existing at that time, the following values: $a=$ 6,377,397 mètres, $b=$ 6,356,079 mètres, and hence $\epsilon=\frac{1}{299}$, and the length of a meridional quadrant = 10,000,856 mètres.

The latest general combination of the various meridional arcs with a view to the determination of the figure of the earth has been made by Clarke, of the British Ordnance Survey, published in 1866. It does not comprise the results of the American measures, which were only published in 1868, but these so closely agree with the general result that their introduction would not sensibly modify the elements. It is based, like all previous discussions, upon the supposition that the uncertainty of the measured lengths of the arcs is extremely small, compared with that of their amplitudes or differences of latitude; since the latitudes are affected by the irregularities of local attraction to an amount generally between one and two seconds of an arc, attaining in mountainous regions even ten seconds. Stations exhibiting extraordinary discrepancies in latitude are of course excluded from the discussion, which was preceded by a minute comparison of all the standards of length that had served in the several operations. The following arcs, entitled to equal consideration by their superior precision, have entered into the comparison: (1) The French arc, from Formentera (lat. 38° 40′) to Dunkirk (lat. 51° 2′), having an amplitude of 12° 22′, and comprising six latitude-stations. (2) The British arc, from Greenwich (lat.

* We lack the means of making an approximate comparison of these estimates with modern measures, but they show that the problem was well understood by the ancients.

51° 28′) to Saxavord (lat. 60° 49′); amplitude 9° 21′, with six latitude-stations. (3) The Indian arc, between Punnae (lat. 8° 10′) and Koliana (lat. 29° 31′); amplitude 21° 21′, with eight latitude-stations. (4) The Russian arc, from Staro Nekrassowska (lat. 45° 20′) to Fuglenoess (lat. 70° 40′); amplitude 25° 20′, thirteen latitude-stations. (5) The Cape of Good Hope arc, from North End (lat. 29° 44′) to Cape Point (lat. 34° 21′); amplitude 4° 37′; five latitude-stations. (6) The Peruvian arc, from N. lat. 0° 2′ to S. lat. 3° 4′; amplitude 3° 6′; two latitude-stations. These six groups, aggregating an arc of over 76°, and comprising 40 latitude-stations, when treated with reference to a spheroid of rotation, yield the following results:

Equatorial semi-axis = 20,926,060 feet = 6,378,206 mètres.
Polar semi-axis = 20,855,120 " = 6,356,584 "
Ellipticity = $\frac{1}{295}$.

When the latitudes of the several stations are computed from the mean of each arc upon these elements, the difference between the computed and observed latitudes is on the average ± 1″.8, a degree of discordance fairly ascribable to local deviations of the plumb-line. The same data, treated with reference to an ellipsoid of three axes, indicate an ellipticity of the equator of 1: 3270, while the average error of the latitudes is only reduced to ± 1″.4, which small improvement gives no great support to that assumption. A quadrant of the meridian on the spheroid (of rotation, the elements of which are above given) is equal to 10,001,887 mètres, showing that the mètre falls short of its presumed value by its $\frac{1}{5300}$th part.

It appears that this figure may be taken as the most probable that can be deduced from the geodetic measurements published at the present time; nor is it likely that it will be materially changed by the operations now in progress in Central Europe. The following table, derived from the same elements, embodies the data which are most likely to be useful to the American reader:

Latitude.	Length, in metres, of one degree— on the meridian.	on the parallel.
23°	110,739	102,524
24	110,753	101,754
25	110,768	100,952
26	110,783	100,119
27	110,799	99,257
28	110,815	98,364
29	110,831	97,441
30	110,848	96,488
31	110,865	95,506
32	110,883	94,495
33	110,901	93,455
34	110,919	92,387
35	110,937	91,291
36	110,956	90,166
37	110,975	89,014
38	110,994	87,835
39	111,013	86,629
40	111,033	85,396
41	111,052	84,137
42	111,072	82,853
43	111,091	81,543
44	111,111	80,208
45	111,131	78,849
46	111,151	77,466
47	111,170	76,058
48	111,190	74,627
49	111,210	73,174
50	111,229	71,698

Besides geometrical admeasurements of the earth, there are physical considerations which lead to an estimate of its form and ellipticity which it is of interest to compare here with the above results. Upon the hypothesis of the earth having the form which a fluid mass of its dimensions would assume rotating with the same velocity, it was shown by Clairaut in 1743 that the increase of gravity in passing from the equator to the poles varies as the square of the sine of the latitude, and that a certain relation must necessarily exist between the ellipticity and the amount of gravity—namely, that $\frac{g}{G} = 1 + (\frac{5}{2}m - \epsilon)\sin^2 L$, where G is the force of gravity at the equator, g that at any latitude L, m the ratio of centrifugal force at the equator to gravity, and ϵ the ellipticity.

The force of gravity has been determined at a great number of stations by pendulum experiments, an exhaustive discussion of which is to be found in Airy's treatise on the figure of the earth. (*Encyc. Metrop.*, 1830. See also PENDULUM EXPERIMENTS.) The general result of these observations is that the difference between the equatorial and polar diameters, or the ellipticity of the earth, is $\frac{1}{289}$ of the former. This is somewhat larger than the ellipticity deduced from the geodetic measures above recited—namely, $\frac{1}{295}$. The difference between the two results, partly attributable to the unequal distribution of land and water on the surface of the earth, is so small as to show that the distribution of the earth's mass is very nearly that which would result from the supposition that its form is due to an anterior fluid condition, or that if its interior be now fluid the hardened crust is very closely adapted to the form of fluid equilibrium.

The standard works to which the student of geodesy may be referred, in addition to those already cited, are Delambre and Méchain, *Base du Système Métrique;* Puissant, *Traité de Géodésie* (1842); Bessel's *Gradmessung;* Fischer's *Geodäsie;* James and Clarke, *Ordnance Trigonometrical Survey of Great Britain*, etc. (1858); Pratt, *Figure of the Earth* (1871). No systematic treatise on geodesy is at the present time (1875) extant in the English language.

J. E. HILGARD.

Geof′frey of Mon′mouth (JEFFREY AP ARTHUR), a Welsh chronicler, became bishop of St. Asaph in 1152, and probably d. in 1154. His most important work, *Chronicon sive Historia Britonum*, is probably a paraphrase of some older work, and so abounds in fables as to have small historic value.

Geoffroy St.-Hilaire (ÉTIENNE), b. Apr. 15, 1772, at Étampes, France; distinguished himself by his brave rescue of Haüy from the Terrorists 1792; became professor of zoology in the Jardin des Plantes 1793; was actively engaged in the Egyptian exploration 1798–1802; was chosen to the Legion of Honor, 1803, to the Institute, 1807; became professor of zoology in the Faculty of Sciences 1809. In 1829 his famous controversy with Cuvier broke out, regarding the unity of plan lying at the basis of the philosophic or transcendental system of comparative anatomy; the soundness of which system Cuvier denied. He wrote much and ably regarding philosophical anatomy and other biological subjects; was late in life blind and paralytic, and d. June 20, 1844.

Geoffroy St.-Hilaire (ISIDORE), M. D., son of the foregoing, b. at Paris Dec. 16, 1805; became his father's assistant 1824; took his degree 1829; entered the Institute 1833; became inspector in the Academy of Paris 1840; professor of zoology in the Museum 1841, and in the Faculty of Science 1854; professor in the Société d'Acclimatation 1854. D. Nov. 10, 1861. Author of the *Life* of his father, and of good treatises on teratology, acclimatization, hippophagy, and various biological subjects.

Geographical Distribution of Diseases. It has long been known that certain diseases are endemic, or peculiarly prevalent at all times, or at certain seasons of the year, in particular countries and regions. The ancients knew this, and recorded many interesting facts in relation to it; but the idea of a generalization of the known facts, and of a systematic and thorough search after new and unknown ones, is a thing originating in the present century. Scientific nosogeography is a newly-born and as yet a comparatively undeveloped branch of knowledge. The geographical distribution of disease is largely dependent upon the *physical conditions* of the various countries of the globe. The topics which physical geography considers are the great facts which bear upon the health of man and the lower animals. Latitude, elevation, surface of country, climatic zones and isothermal lines, variations of temperature, the geological and chemical character of soils, water-distribution in air and soil, the vital characters of different races, the injurious and salutary influences of vegetation,—these are some of the topics which nosogeography considers.

Latitude and Climatic Zones.—These are intimately associated in their influences upon disease. Thus, the intertropical zone is the home of the worst forms of malarious fevers, cholera, and hepatic diseases. Not alone the influences just indicated, but other conditions, tend to this result. Damp soils and the presence of decaying vegetation especially assist, particularly in low-lying regions like river-deltas. The yellow fevers of the Mexican Gulf, the dreadful remittent fevers of Western Africa, and the ever-present cholera of the lower Ganges are examples of the evil effects of a combination of unfavorable conditions. Farther N. and S. are the zones of typhus, typhoid, and intermittent fevers, scarlatina, and the like. These zones are nowhere clearly marked off from the tropical on the one hand or the cold zones on the other. Except intermittent fevers, few of their diseases are endemic. But they are peculiarly subject to epidemics or occasional severe visitations of some prevalent disease. If the intertropical region is the abode of dreadful endemic diseases, then is this the peculiar field of great epidemics, for many of the epidemic diseases are truly endemic in the intertropical regions. In this connection it may be noted that the plague, once the great epidemic scourge of Europe, is now strictly localized, and known only in the Levant. In the northern hemisphere we find northward of the zone last mentioned the great zone of catarrhal diseases of the air-passages—a zone which has no southern representative, for all the habitable land in the southern hemisphere is remarkably free from catarrhal diseases of any kind. Catarrhal diseases prevail also to a

great extent in portions of the intertropical and warm zones, but their seat is (though not exclusively) the alimentary canal, rather than the respiratory mucous surfaces. The zone of catarrhal disease extends northward as far as the human race is found. It is to be noted that certain diseases seem not to be affected by any of the conditions hitherto considered. Thus, leprosy is endemic in Greenland, Norway, and Iceland, as well as in the valleys of the Niger and the Amazon, in the high Deccan, the volcanic Sandwich Islands, and the low Philippines. Rheumatism prevails in the warm and dry Queensland and in the cold and wet Newfoundland.

Elevation above the sea-level is another important point to be considered. In cases of emphysema and heart disease it may have a direct effect upon the patient's comfort and the duration of his life. The barometrical pressure in cases of thoracic disease is a question little studied as yet, but most inviting to the student and the philanthropist. Hypsometrical conditions also affect health through the temperature, the vegetation, and the hygrometry of any region. Thus, in Italy the higher hills about the Maremma are comparatively free from the prevalent fevers. Some hill-regions, however, are habitually ravaged by fevers, while the intervening valleys are free from the endemic. Researches regarding geology, the character of soils, vegetation, and drainage may explain these apparent anomalies.

Drainage.—The importance of this topic, considered with relation to the prevalence of disease, is well illustrated in the history of the Campagna, the Maremma, and the Pontine Marshes. The destruction of the rude drainage systems of antiquity during the Gothic wars was a great blow to Rome and to Italy, for it reconverted the once fruitful region just indicated into an almost useless waste, whose exhalations infect a large area. Of late years, the relation of soil-moisture to the prevalence of consumption, enteric and other fevers, dysentery, and scarlatina has attracted much attention. Dry soils, it must be conceded, are the healthiest by far, other conditions being equal.

Geological and Chemical Characters of Soils.—That goitre, calculus, and cretinism prevail upon calcareous soils, and that the inhabitants of alluvial tracts are peculiarly liable to fevers, have long been known. But that a high and dry region with a porous soil, like that of Gibraltar, and in general the dry volcanic regions, should be the homes of acute diseases, such as fevers, is by no means easy to explain. It has been suggested that some dry soils may be peculiarly receptive and retentive of the organic germs upon the presence of which many diseases are supposed to depend. The subject is by no means well understood at present. It is certain that cultivation of the soil may favorably modify the character of malarial diseases, and even banish the endemic influence; but these effects are not universal, for some of the longest-settled and best-cultivated regions of Europe are subject to intermittent fevers.

Vegetation.—The influence of vegetation upon general health is sometimes injurious and sometimes beneficial. The belief that microscopic plant-germs are the direct cause of many diseases is becoming a general one, but the known facts with regard to the question are as yet few. On the one hand, the beneficial influence of trees and herbs in warding off diseases is clearly established. The destruction of large forests, especially in wet and warm countries, is often followed by deadly epidemics. On the other hand, it has been held that the mangrove-belts of tropical regions breed fevers, but the facts collected go to show that the fevers prevail in spite of the protection exercised by the mangroves; or, rather, that the flux and reflux of tides deposits decaying organic matter among the roots of the mangroves, and that this decaying matter is the source of the disease, for there is no question that if living vegetation wards off disease, decaying vegetation is a most fruitful source of it. Facts are not wanting which tend to show that the cholera may have its origin from minute vegetation. Certain it is that its worst ravages in the Ganges Valley have been in years when the rice was mildewed or rusted extensively; and there are observers who believe that the rust of barley-straw gives origin to the measles; but it is generally regarded as probable that neither cholera nor measles are originated in this way.

Animal life affects the distribution of disease much less directly than vegetable. Egypt has an endemic dysentery, and the Cape Colony an endemic hæmaturia due to entozoa. Guinea-worm prevails in the tropical parts of the Old World, and tape-worm about the Gulf of Bothnia, to an astonishing degree. Certain epizoötic diseases are also to some extent communicable to man.

Races, Acclimation.—That there is a difference in the vital character of the different races is now generally conceded. The Polynesian race seems dying out, not simply from degrading habits, but even in islands seldom visited by sailors, and in places where the former conditions of their life seem to be maintained. In many instances it appears that strong emotional excitement has caused the death of persons of this feeble race. The rapid destruction of the American Indians illustrates the same probable truth, that the vital force of some races is becoming exhausted. The mixed races, as seen in India, South America, South Africa, and the U. S., are generally inferior, physically, to both parent stocks. People of the different races generally thrive best upon their own soil. In Bengal it is declared that British troops never become acclimated, but become feebler the longer they stay. In Australia, however, the British emigrant is far healthier and stronger than the aboriginal native. The French have crossed the Mediterranean and settled Algeria, but, says Boudin, its colonization has been proved to be impossible. Nevertheless, the Phœnicians and Romans long ago colonized the same region with success. These points show that man's constitution is one of the factors in vital statistics.

The prevailing *personal habits* of any people materially affect the public health. Certain endemic diseases, like the *beri-beri* of Ceylon, appear to depend largely upon the widely-prevailing abuse of alcoholic stimulants. The avoidance of an unmixed fish-diet has extinguished the leprosy once endemic in the Faröe Islands, and the unhealthy Mauritius has a hardy peasantry of French descent whose poverty has kept them abstemious, and consequently healthy.

The Continents.—No part of the world seems so well adapted to human health and development as *Europe.* Here the conditions of temperature, soil, and moisture seem almost perfect; and with increased attention to public health the future will, it may be hoped, be far more free than the past from pestilences, famines, and the ravages of endemic disease. The diseases of *Asia* much resemble those of Europe, except that in the intertropical regions the diseases have that peculiar character already indicated. Japan and China have more cholera and remittent fevers than might be looked for. North-eastern Asia has a North American climate and disease-character. *Africa* is the home of acute and deadly diseases of the intertropical type, yet Morocco and the Cape of Good Hope are remarkably healthful. *Australia* has almost no widely-prevailing diseases, except rheumatism in the N. E. and fevers in the extreme N. *North America* appears less congenial to human health than Europe. In the U. S. fevers prevail in the S., pneumonia and ague in the central, and consumption in the N. E. portion. The Pacific coast and the Western plains and mountains are, however, exceptionally healthful. There is no civilized country where the conditions requisite to public health require more careful attention than ours. The tables of the vital statistics of the ninth U. S. census are prepared from the very imperfect death-returns of the U. S. census-takers. They are illustrated by carefully prepared maps, showing the relative proportion of deaths in the various parts of the U. S. from each of several important classes of disease. The general results of the investigation of the census returns may be stated as follows: (1) Other things being equal, there is more mortality from lung diseases in a northern than in a southern latitude; in a wet than in a dry region; at a low than at a high level, the pine regions of the South being, however, remarkably free from pulmonary disease, though low and having a large rainfall. (2) Malarial fevers are most fatal, *cæteris paribus,* in southern latitudes and in wet and low regions, but are also for the most part comparatively insignificant in the great pine forests. (3) The continued fevers and intestinal catarrhs are most deadly in the South, but prevail to a formidable degree throughout the land.

The science of the geography of disease requires, first, careful collection of more facts by competent observers, and, next, wise generalizations and thorough discussion of the gathered facts. No branch of science can be more important, and few will be found more difficult to master, than this. (See the treatises of Mühry and of Boudin on nosogeography, and Sir R. Martin *On the Influence of Tropical Climates.*) Chas. W. Greene.

Geog'raphy [Gr. γῆ, the "earth," and γράφω, to "write" or "describe"], literally, a description of the earth. A simple description, including the nature of the land and waters, of the climate and natural productions, of the various countries of the globe, together with an account of the people and nations inhabiting them, and of their social and political condition, was the substance of the first geographical writings transmitted to us by the ancients. Though our information on all parts of the earth is now far more extensive and reliable, geography has, to this day, necessarily retained its descriptive character; for an accurate description of the phenomena observed in nature and in human societies is the only foundation for a scientific knowledge of our planet. It is therefore quite natural that most of the geographical treatises confine themselves to the task of drawing such pic-

tures as will seem to most readers sufficient for practical purposes. This is *General Descriptive Geography.* But the great progress of physical and natural science, as well as of the science of man in all his conditions, has awakened a desire for a higher, more comprehensive, and intelligent knowledge of our earth. To describe without rising to the causes and descending to the consequences of the phenomena is not science. The reflective mind craves more. While studying the earth in its natural aspects, it wishes to learn *why* these natural phenomena are as they appear, *how* they are produced, and what *laws* govern them. It seeks to understand the relations of mutual dependence which bind them together, as causes and effects, into a vast system, into one great individual mechanism, which is the terrestrial globe itself, with all it contains. Such a science must endeavor to discover those incessant mutual actions of the different portions of physical nature upon each other, of inorganic nature upon organized beings—upon man in particular—and upon the successive development of human societies; in a word, to study the reciprocal action of all these forces, the perpetual play of which constitutes what might be called the life of the globe. This is *Scientific Geography,* which may be defined as the science of the general phenomena of the present life of the globe in reference to their connection and mutual dependence.

It may be asked whether a science which thus embraces the whole domain of nature and man has a claim to an individual existence; but when geology has taught us the composition of the earth's crust and the history of its gradual formation, physics, the laws which govern matter—when botany and zoology have classified the plants and animals according to their affinities and differences in a grand system of life; when ethnography and history have done their special work,—it still remains for geography to trace out the relations of these various orders of things to each other. Geography needs the results of all these sciences, but is not to be confounded with them.

Geography, as the science of the earth, is naturally divided into three great departments, corresponding to three orders of facts: the earth considered as a planet, a part of the solar system, or *Astronomical Geography;* the earth considered in itself, the *Geography of Nature,* or *Physical Geography;* the earth considered as the abode of man, the *Geography of Man.* These three departments are usually called *Mathematical, Physical,* and *Political* Geography.

Mathematical Geography embraces two distinct sciences, both of which need mathematics as their principal instrument: *a. Astronomical Geography,* which treats of the position of the earth in the solar system, of its general form, its movements of rotation and revolution around the sun as causes of the daily and annual changes in the distribution of solar light on the surface of our planet, or the succession of days and nights and seasons. *b. Mathematical Geography* proper includes Geodesy (from γῆ, the "earth," and δαίω, to "divide"—viz. in mathematical figures), which teaches the scientific methods of ascertaining the exact form of the earth, and of all portions of its surface, and their precise location in longitude and latitude; *Topography* (τόπος, a "place," and γράφω, to "describe"), which surveys the minor features of relief and position of land and water, the location of mountains, rivers, and places; and *Cartography,* which teaches how to represent the same on maps and globes.

Physical Geography is the geography of nature. Physics, or natural philosophy, is its principal helpmate. When it confines itself to a simple description of the natural features of the land, climate, plants, and animals, it is called *Physiography* (from φύσις, "nature," and γράφω, to "write"), a term which is fast coming into use. When applied to the waters, it is *Hydrography* (from ὕδωρ, "water," and γράφω, to "write").

Physical Geography proper, however, goes farther, and seeks by careful comparison to discover the laws which regulate the structure and distribution of the land-masses and oceans. It shows how the relief of the continents controls their drainage and shapes the vast river-systems, so useful and so characteristic of each of them; how the very forms of the lands, together with their size and relative situation, modify the climate, the productions, and therefore the capacity of each country for commerce and civilization. It not only describes the great marine currents which circulate in the bosom of the oceans, but seeks to discover their causes, trace their connection, and the vast influence they exert upon climate, either by heating or cooling the superincumbent atmosphere. It is not enough for it to find that the temperature is highest in the equatorial regions of our globe, and gradually decreases toward the poles; it inquires into the cause of that fundamental law of the distribution of heat. But, while this general law is well established, why is it that mountains which rise from the burning, tropical plains of the Amazon and the Ganges are capped with everlasting snow? that in January snow obstructs the streets in New York City, while in the same latitude the orange tree flourishes under a genial sun and in a mild atmosphere in Naples, and flowers and perpetual verdure grace the gardens in the islands of the Azores in the midst of the Atlantic? that on the E. of the American continent Labrador is but a frozen peninsula, where no tree can grow, no agriculture is possible, in the same latitude where in Europe, on the other side of the Atlantic, the cities of Christiania, Stockholm, St. Petersburg flourish in the midst of cultivated fields? Looking at the distribution of rain-water, that other element of climate indispensable for all that has life on earth, why is it that it is so unequal, varying from a complete or almost total absence in the deserts to an amount which would cover the ground with a layer of fifty feet of water? Why are the sunny regions of the tropics blessed with a quantity of rain-water several times greater than that which falls in our temperate regions, while the foggy regions toward the poles receive as many times less? Why are the rains periodical in the warm regions, and more and more equally distributed throughout the year as we recede from them toward the poles?

To answer all such questions, suggested at every step to the reflecting observer of nature's phenomena, physical geography has to find out the laws which govern the distribution of heat and of the rains. It has to study the course of the winds, which are the carriers of warm and cold air from one place to another, and of the rains from the common reservoir of the ocean to the interior of the continents. It thus shows that upon all these elements, properly combined, and modified in their action by the forms, extent, and situation of the land-masses and oceans, depend the distribution of life, vegetable and animal, on the surface of the globe, and the degree of usefulness to man of each portion of his domain.

The scientific treatment of every portion of this vast field of research expands into a science. The study of the globe as a unit, irrespective of its surface, involving that of its general form, as given by geodesy, its density, its magnetism, its specific temperature, forms a group to which may fitly be applied the name of *Physics of the Earth,* already much in use among French scientists, though in a less defined meaning. Taking up the surface, *Geomorphy* (from γῆ, the "earth," and μορφή, the "form") studies the forms, horizontal and vertical, the relief, of the solid land, including the basin of the oceans, and endeavors to find out the laws of their physical structure and peculiar arrangement; *Hydrology,* those which regulate the land and oceanic waters, and their movements. *Climatology,* or the science of climates, aided by meteorology, inquires into the nature and character of those combinations of physical agencies, especially of heat and moisture, which, acting through the atmosphere, foster nature's life. The *Geography of Plants,* raised by Humboldt's researches to the dignity of a science, and the *Geography of Animals,* treated in the same spirit, make it a special object to ascertain the mode of association of plants and animals, in each natural region, in characteristic groups called *floras* and *faunas,* and to discover their relation with the special climatic influences under which they are found and sustained.

The Geography of Man, Political Geography, or the globe as the abode of human races and societies, can be viewed under different aspects. It may be a simple description of the various races and nations of men as found in their present dwelling-places; *Ethnography* (ἔθνος, "nation," and γράφω, to "write"), the scientific form of which, inquiring into the principles underlying their nature, relations, and formation, is *Ethnology.* To give a description of the civilized nations, their characteristics, their boundaries and extent, their territories, an enumeration of their cities, an account of their constitution and government, of their population and resources, is the object of *Political Geography* proper, while *Statistics* gives the numerical data relating to these various branches of the subject.

But aside from this descriptive part, a multitude of questions arise. We see that each large portion of the earth is tenanted by a peculiar race—the black in Africa, the yellow in Eastern Asia, the white in Western Asia and Europe, the so-called red in both Americas, etc. Is there any physical peculiarity of relief or climate in each of these natural regions which can account for these deep modifications of the human type? What influence have these continents exerted, with their plateaus, plains, and mountains, on the formation of nations and languages—on the course of the migrations which have spread them over the whole face of the earth? The history of mankind shows that each individual continent has performed a different part in the progress of civilization. Asia, the great parent continent, is also the mother of the races and civilization; in Europe and North America man's development has attained its

highest pitch. Is there in their structure, climate, situation, and geographical properties anything which fits them better than others for such functions? Were there special geographical features which enabled Palestine, Greece, and Italy to play on the theatre of history the brilliant parts for which they have been conspicuous? All these and similar questions are to be answered by what we may call *Historical* or *Philosophical Geography*, the sister and indispensable handmaid of the Philosophy of History.

A. GUYOT.

Geo'logy [from the Gr. γῆ, the "earth," and λόγος, "discourse"] is that branch of natural science which treats of the structure of the crust of the earth and the mode of formation of its rocks, together with the history of physical changes and of life on our planet during the successive stages of its history. It depends upon mineralogy for its knowledge of the constituents of rocks, and upon chemistry and physics for its knowledge of the laws of change; and in its study of fossil remains it is closely connected with the sciences of zoology and botany. A knowledge of geology lies at the base of physical geography, and is essential to the skilful prosecution of mining and other useful arts. A subject so vast and so complicated in its relations requires a special treatise for its discussion. We shall merely attempt here to give a sketch of the results as yet attained by geological investigation, leaving the reader to consult such works as Dana's *Manual* for details and methods of research.

The geological history of the earth is ascertained by a study of the successive beds of rock which have been deposited on its surface, and of the masses which have been forced up in a liquid state from within its crust, together with the fossil remains of animals and plants which certain of the beds contain. As thus established, it is usually divided into four great periods, the names of which are taken from the progress of animal life, as this at present affords one of the best criteria for geological classification. They are—

I. The EOZOIC, or "period of the dawn of life."
II. The PALÆOZOIC, or "period of ancient life."
III. The MESOZOIC, or "middle period of life."
IV. The NEOZOIC, or "recent period of life."

Each of these admits of subdivisions; which may stand as follows, beginning with the oldest:

EOZOIC,	*Laurentian,*	MESOZOIC,	*Triassic,*
	Huronian.		*Jurassic,*
PALÆOZOIC,	*Cambrian, or Primordial,*		*Cretaceous.*
	Siluro-Cambrian,	NEOZOIC,	*Eocene,*
	Silurian,		*Miocene,*
	Devonian,		*Pliocene,*
	Carboniferous,		*Post-pliocene and Recent.*
	Permian.		

I. PRIMITIVE CONDITION OF THE EARTH.—In the oldest condition of the earth, shown by the most ancient of the rock-formations above referred to, its surface was covered with water more generally than at present, and sediments were then, as now, being deposited in the waters. The earth must, however, have an earlier history than this, though not represented by distinct geological monuments. This primitive condition of the earth is a subject of inference and speculation, rather than of actual knowledge; still, we may begin with a consideration of a fact bearing upon these questions which has long excited attention. It is the observed increase in temperature in descending into deep mines and in the water of deep artesian wells—an increase which may be stated in round numbers at 1 degree of heat of the centigrade scale for every 100 feet of depth from the surface. These observations apply, of course, to a very inconsiderable depth, and we have no certainty that this rate continues for any great distance towards the centre of the earth. If, however, we regard it as indicating the actual law of increase of temperature, it would result that the whole crust of the earth is a mere shell covering a molten mass of rocky matter. Thus, a very slight exercise of imagination would carry us back to a time when this slender crust had not yet been formed, and the earth rolled through space an incandescent globe, with all its water and other vaporizable matters in a gaseous state. Astronomical calculation has, however, shown that the earth, in its relation to the other heavenly bodies, obeys the laws of a rigid ball, and not of a fluid globe. Hence, it has been inferred that its actual crust must be very thick, perhaps not less than 2500 miles, and that its fluid portion must therefore be of smaller dimensions than has been inferred from the observed increase of temperature. Further, it seems to have been rendered probable, from the density of rock-matter in the solid and liquid states, that a molten globe would solidify at the centre as well as at the surface, and consequently that the earth must not only have a solid crust of great thickness, but also a solid nucleus, and that any liquid portions must be a sheet or detached masses intervening between these. Still, this would merely go to show that the earth has advanced far toward the entire loss of its original heat. Other considerations, based on the form of the earth and the distribution of variances, lead to similar conclusions. It must be observed, however, that, as Dr. Hunt has well shown, there are good reasons for the belief that the products of volcanoes arise chiefly from the fusion of portions of the stratified crusts. Such considerations, however, lead to the conclusion that the former watery condition of our planet was not its first state, and that we must trace it back to a previous reign of fire. The reasons which can be adduced in support of this are no doubt somewhat vague, and may in their details be variously interpreted, but at present we have no other interpretation to give of that chaos formless and void, that state in which "nor aught nor naught existed," which the sacred writings and the traditions and poetry of ancient nations concur with modern science in indicating as the primitive state of the earth.

II. EOZOIC TIME (ARCHÆAN OF DANA).—Here we have actual monuments to study. The Laurentian rocks, more especially, occupy a very wide space in the northern part of America, the name being derived from the vast belt of these rocks stretching across the northern part of Canada and constituting the Laurentide hills of the old French explorers. These rocks stretch along the N. side of the St. Lawrence River from Labrador to Lake Superior, and thence northwardly to an unknown distance, constituting a wild and rugged district, often rising into hills 4000 feet high, and in the deep gorge of the Saguenay forming cliffs 1500 feet in sheer height from the water's edge. S. of this great ridge the isolated mass of the Adirondack Mountains rises to the height of 6000 feet, rivalling the newer (though still very ancient) chain of the White Mountains. Along the eastern coast of North America a lower ridge of Laurentian rock, only appearing here and there from under the overlying sediments, is seen in Newfoundland, in New Brunswick, and perhaps in Nova Scotia, and farther S. in Massachusetts, and as far as Maryland. In the Old World rocks of this age do not, so far as known, appear so extensively. They have been recognized in Norway and Sweden, in the Hebrides, and in Bohemia, and may no doubt be yet discovered in other localities. Still, the grandest and most instructive development of these rocks is in North America, and it is there that we may best investigate their nature and endeavor to restore the conditions in which they were deposited. Though originally sedimentary, they are very different in their external aspect from the silt and mud, the sand and gravel, and the shell and coral rocks of the modern sea or of the more recent geological formations. Yet the difference is one in condition rather than in composition. Deeply buried in the earth under newer sediments, they have been baked until sandstones, gravels, and clays have become crystalline, as gneiss, mica-schist, hornblende-schist, and quartzite, showing at first sight no resemblance to the original material, except in the regularly stratified and bedded arrangement which serves to distinguish them from igneous or volcanic rocks. In like manner, certain finer calcareous sediments have been changed into Labrador feldspar, and what were once common limestones appear as crystalline marbles. If the evidence of such metamorphoses is asked for, this is twofold. In the first place, these rocks are similar in structure to more modern beds which have been partially metamorphosed, and in which the transition from the unaltered to the altered state can be observed. Secondly, there are limited areas in the Laurentian itself in which the metamorphism has been so imperfect as to permit traces of the original character of the rock to remain. In North America these Laurentian rocks attain to an enormous thickness. This has been estimated by Sir W. Logan at 30,000 feet, so that the beds would, if piled on each other horizontally, be as high as the highest mountains on the earth. They appear to consist of two great series, the Lower and the Upper Laurentian. Even if we suppose that in the earlier stages of the world's history erosion and deposition were somewhat more rapid than at present, the formation of such deposits, probably more widely spread than any which succeeded them, must have required an enormous length of time.

Geologists long looked in vain for evidences of life in the Laurentian period, but its probable existence was inferred from such considerations as the abundance of carbon, limestone, iron, etc.—materials known to be accumulated in the newer formations by the agency of life. In addition to this inferential evidence, however, one well-marked animal fossil has at length been found in the Laurentian of Canada—*Eozoön Canadense*, a gigantic representative of one of the lowest forms of animal life, that of the Protozoa, and of a type still extant in the ocean,

and remarkable for its power of collecting and secreting calcareous matter. The existence of such creatures sup-

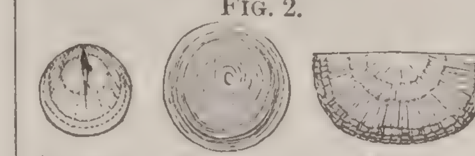
FIG. 1.

Eozoön Canadense.

poses that of other organisms, probably microscopic plants, on which they could feed. No traces of these have been observed, though the great quantity of carbon in the beds probably implies the existence of the larger sea-weeds. Of life on the Laurentian land we know nothing, unless the great beds of iron ore already referred to may be taken as a proof of land vegetation.

III. THE PALÆOZOIC TIME.—(1) *The Cambrian, or Primordial.*—Between the time when *Eozoön Canadense* flourished in the seas of the Laurentian period, and the age which we have been in the habit of calling Primordial, or Primordial Silurian, a great gap evidently exists in our knowledge of the succession of life on both the continents, representing a vast lapse of time, in which all the beds of the Upper Laurentian were deposited, in which the Laurentian sediments were altered, contorted, and upheaved, and in which another immense series of beds, the Huronian and Lower Cambrian, were formed in the bottom of the sea. The western hemisphere, where the Laurentian is so well represented, is especially unproductive in fossils of the immediately succeeding period. Worm-burrows and remains of *Eozoön*, however, occur in beds of this age in Canada. Here, however, the European series comes in to give us some small help. Gümbel has described in Bavaria a great series of gneissic rocks corresponding to the Laurentian, or at least to the lower part of it. Above these are what he calls the Hercynian mica-slate and primitive clay-slate, probably equivalent to the Huronian, in the latter of which he finds a peculiar species of *Eozoön*, which he names *Eozoön Bavaricum.* In England, also, the Longwynd group of rocks in Shropshire and in Wales, and their equivalents in Ireland, appear to be the immediate successors to the Huronian, and have afforded some obscure worm-burrows, or perhaps casts of sponges or fucoids, with a small shell of the genus *Lingulella,* and also fragments of crustaceans (*Palæopyge*). If these rocks are really the next in order to the Eozoic, they show, even in their few fossils, a marked advance in life immediately on the commencement of the Primordial period. In Ireland the curious *Oldhamia* appears to occur in rocks equally old. In the Middle Cambrian, however, various forms of marine life abound, for to this age we may refer the Menevian beds of Wales and the Acadian group of New Brunswick; and the Upper Cambrian may be held to include the rich lingula flags of Wales and the Potsdam and Calciferous groups of American geologists. The beds of the Middle and Upper Primordial are especially rich in crustaceans of the order Trilobites. The Primordial sediments must have at one time been very widely distributed, and must have filled up many of the inequalities produced by the rending and contortion of the Laurentian beds. Their thicker and more massive portions are, however, necessarily along the borders of the Laurentian continent; and as they in their turn were raised up into land, they became exposed to the denuding action first of the sea, and afterwards of the rain and rivers, and were so extensively wasted away that only in a few regions do large areas of them remain visible. That of Bohemia has afforded to Barrande a great number of most interesting fossils. The Shropshire districts in England, and those of Wicklow in Ireland, are also of great interest; and next to these in importance are perhaps the Acadian and Potsdam groups of North America, in which these formations, with characteristic fossils, occupy wide areas, and in some parts—as, for example, in Nova Scotia and in New England—there are extensive areas of old metamorphic rocks whose age has not been determined by fossils, but which may belong to this period.

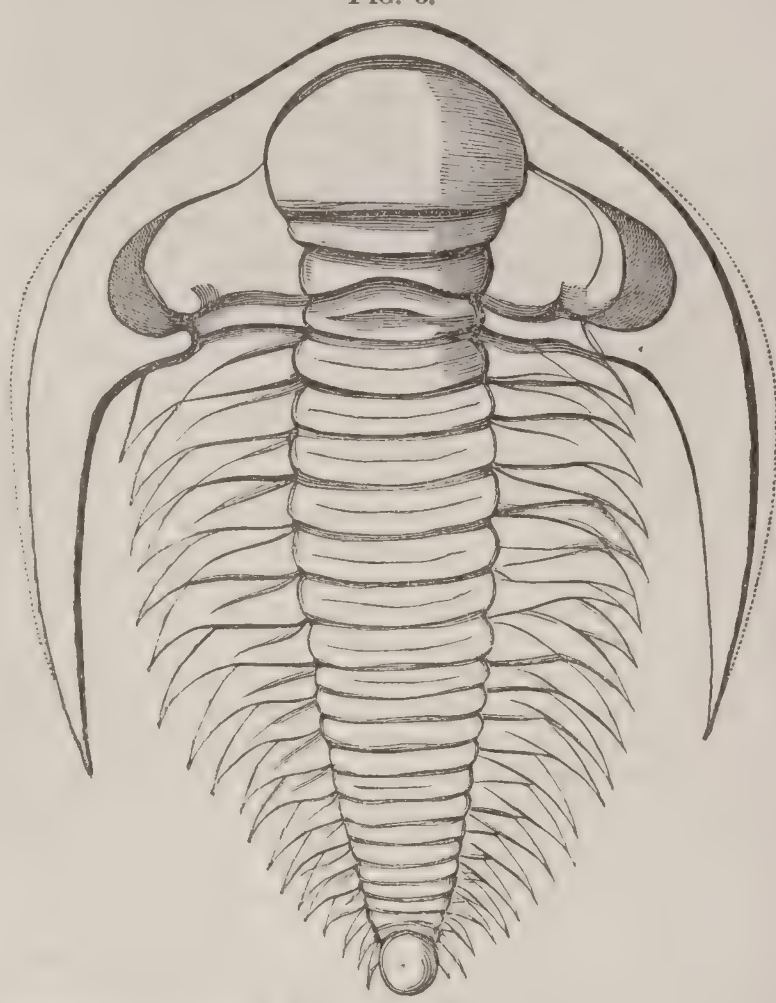
FIG. 2.



Lingula Matthewi. *Discina Acadica.* *Orthis Billingsi.*

Brachiopods from the Primordial of New Brunswick.

FIG. 3.



Paradoxides Micmac, a Primordial Trilobite from New Brunswick; restored by G. S. F. Matthew.

(2) *The Siluro-Cambrian, or Lower Silurian.*—In North America this is represented by the great Trenton group of limestones, with the Utica shale and Hudson River group above. In Britain the Bala and Caradoc groups are its representatives. In America it is remarkable for its extensive distribution and the thick limestones which it contains, and it exhibits a greatly increased and more varied marine fauna. The Trenton limestone in North America can be traced over forty degrees of longitude, and throughout this space it is composed almost entirely of comminuted corals, crinoids, and shells. The muddy and sandy deposits of the Utica and Hudson periods which succeed are almost as extensive. It will be convenient to notice under this head the leading marine animals of the Lower Palæozoic, so as to avoid repetition.

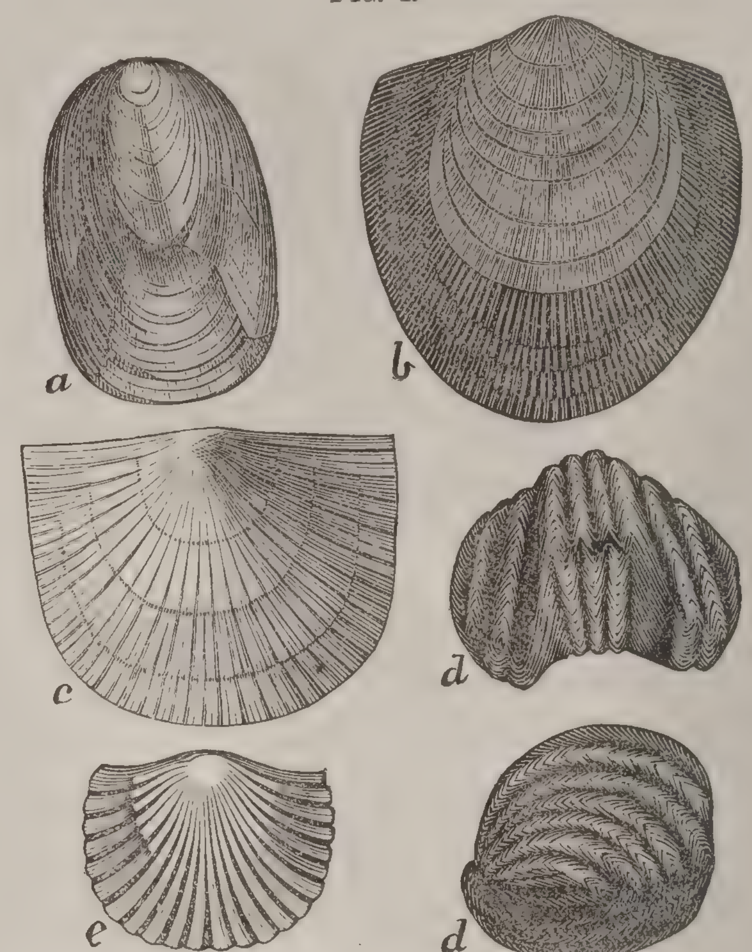
The Siluro-Cambrian presents us with a definite physical geography, for the northern hemisphere at least; and this physical geography is a key to the life-conditions of the time. The North American continent, from its great unbroken area, affords, as usual, the best means of appreciating this. In this period the northern currents, acting

perhaps in harmony with old Laurentian outcrops, had deposited in the sea two long submarine ridges running to the southward from the extreme ends of the Laurentian nucleus, and constituting the foundations of the present ridges of the Rocky Mountains and the Alleghanies. Between these the extensive triangular area now constituting the greater part of North America was a shallow oceanic plateau, sheltered from the cold polar currents by the Laurentian land on the N., and separated by the ridges already mentioned from the Atlantic and Pacific. It was on this great plateau of warm and sheltered ocean that what we call the Silurian fauna lived, while of the creatures that inhabited the depths of the great bounding oceans, whose abysses must have been far deeper and at a much lower temperature, we know little. During the long Silurian period, it is true, the great American plateau underwent many revolutions, sometimes being more deeply submerged, and having clear water tenanted by vast numbers of corals and shell-fishes; at others rising, so as to become shallow and to receive deposits of sand and mud; but it was always distinct from the oceanic area without. In Europe, in like manner, there seems to have been a great internal plateau bounded by the embryo hills of Western Europe on the W., and harboring a very similar assemblage of creatures to those existing in America. Further, during the two Silurian periods themselves there were great changes, from a fauna of somewhat Primordial type up to a new order of things in the Upper Silurian, tending towards the novelties which were introduced in the succeeding Devonian and Carboniferous. We may, in the first place, sketch these changes as they occurred on the two great continental plateaus, noting as we proceed such hints as can be obtained with reference to the more extensive oceanic spaces.

Previous to the beginning of the age both plateaus seem to have been invaded by sandy and muddy sediments, charged at some periods and places with magnesian limestone; and these circumstances were not favorable to the existence or preservation of organic remains. Such are the Potsdam and Calciferous beds of America and the Tremadoc Llandeilo beds of England. The Potsdam and Tremadoc should be included in the Cambrian, and the succeeding Chazy limestone may be regarded as the transition group to the Silurian. It is further to be observed, in the case of these beds, that if we begin at the W. side of Europe and proceed easterly, or at the E. side of America and proceed westerly, they become progressively thinner, the greater amount of material being deposited at the edges of the future continents, just as on the sides of a muddy tideway the flats are higher, and the more coarse sediment deposited near the margin of the channel, and fine mud is deposited at a greater distance and in thinner beds. The cause, however, on the great scale of the Atlantic was somewhat different, ancient ridges determining the border of the channel. This statement holds good not only of these older beds, but of the whole of the Silurian and of the succeeding Devonian and Carboniferous, all deposited on these same plateaus. Thus, in the case of the Silurian in England and Wales the whole series is more than 20,000 feet thick, but in Russia it is less than 1000 feet. In the eastern part of America the thickness is estimated at quite as great in amount as in Europe, while in the region of the Mississippi the Silurian rocks are scarcely thicker than in Russia, and consist in great part of limestones and fine sediments, the sandstones and conglomerates thinning out rapidly eastward of the Appalachian Mountains.

In the animal life of this period we may remark the vast abundance and variety of corals. The polyps were represented in the Silurian seas by a great number of allied yet different forms, equally effectual with those of the modern ocean in the great work of secreting carbonate of lime in stony masses, and therefore in the building up of continents. The animals themselves must have differed somewhat from their modern successors. This we gather from the structure of their stony cells, which present points of difference indicating corresponding difference of detail in the soft parts. Zoologists thus separate the rugose or wrinkled corals and the tabulate or floored corals of the Silurian from those of and prevailing in the modern seas. Next to the corals we may place the crinoids, or stone-lilies, creatures abounding throughout the Silurian seas, and realizing a new creative idea, to be expanded in subsequent geological time into all the multifarious types of the star-fishes and sea-urchins. A typical crinoid, such as the *Glyptocrinus* of the Lower Silurian, consists of a flexible jointed stem, sometimes several feet in length, composed of short cylindrical disks curiously articulated together, a box-like body on top, made up of polygonal sides attached to each other at the edges, and fine radiating jointed arms furnished with branches and branchlets, or fringes, all articulated and capable of being flexed in any direction. Such a creature has more the aspect of a flower than an animal; yet it is really an animal, and subsists by collecting with its arms and drifting into its mouth minute creatures floating in the water. Another group less typical, but abundantly represented in the Silurian seas, is that of the Cystideans, in which the body is sack-like and the arms few, and sometimes attached to the body. They resemble the young or larvæ of crinoids. Among shellfishes, of which vast multitudes of all grades existed in the Silurian, we may select the representatives of the highest group. In

FIG. 4.



Brachiopods from the Silurian: *a*, Lingula; *b*, Atrypa; *c*, Leptæna; *d*, Rhynconella; *e*, Orthis.

the Silurian period there were not only nautili like ours, but a peculiar kind of straight nautilus, the Orthoceratite, which sometimes attained to a gigantic size. The shells of these creatures may be compared to those of nautili straightened out, the chambers being placed in a direct line in front of each other. A great number of species have been discovered, many quite insignificant in size, but others as much as twelve feet in length and one foot in diameter at the larger end. Indeed, accounts have been given of individuals of much larger growth. These large Orthoceratites were the most powerful marine animals known to us in the Silurian, and must have been in those days the tyrants of the seas.

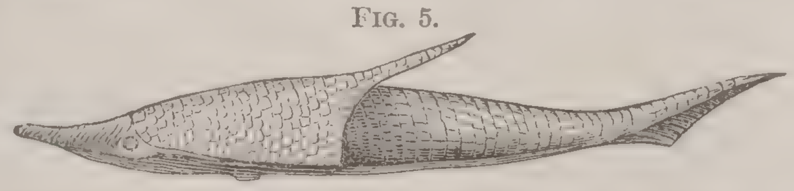
Among the crustaceans or soft shell-fishes of the Silurian we meet with the Trilobites, continued from the Primordial in great and increasing force, and represented by many and beautiful species; while an allied group of shell-fishes of low organization but gigantic size, the Eurypterids, came in with the Upper Silurian, and were provided with powerful limbs, long flexible bodies, and great eyes in the front of the head, and were sometimes several feet in length.

No remains found in the Silurian rocks have been more fertile sources of discussion than the so-called *Grapholites*, a name given long ago by Linnæus, in allusion to the resemblance of some species, having rows of cells on one side, to minute lines of writing. These little bodies, which are characteristic of some portions of the Siluro-Cambrian, usually appear as black coaly stains on the surface of the rock, showing a slender stem or stalk, with a row of little projecting cells at one side, or two rows, one at each side. The more perfect specimens show that in many of the species, at least, these fragments were branches of a complex organism spreading from a centre; and at this centre there is sometimes perceived a sort of membrane connecting the bases of the branches, and for which various uses have been conjectured.

(3) *The Silurian proper, or Upper Silurian.*—The central mass of this formation in Eastern America is the great Niagara limestone, almost equal to the Trenton in extent and thickness, and constituting by its outcropping edge the abrupt escarpment over which Niagara pours its waters. Under the Niagara limestone are the sandy and pebbly beds of the Medina and Oneida formations, and above it, in the typical New York regions, are shallow water sandstones, marls, and magnesian limestones, constituting the Salina group, supporting a mixed calcareous and argillaceous series, the Lower Helderberg group. The life of the Upper Silurian is not markedly distinct from that

of the Lower Silurian group, except in some general specific types, and we have already anticipated most of its great dynasties of life in describing the Siluro-Cambrian. In its upper member, however, we find the first appearance of fishes and of land-plants. The land-plants of the Upper Silurian as yet known are confined to a few species, representing members of the family of club-mosses, or Lycopodiaceæ. They belong to the genera *Lepidodendron* and *Psilophyton*, to be noticed in the sequel. In Great Britain the Wenlock limestone and shale, so rich in beautifully preserved marine organisms, are the equivalents of the Niagara of America, and the Ludlow formations represent the Lower Helderberg. As already stated, we find in the Upper Silurian the first vertebrate animals, represented by several species of shark-like fishes, which come in here as forerunners of the dynasty of the Vertebrates, which from that day to this have been the masters of the world. These earliest vertebrates are especially interesting as the first known examples of a plan of structure which culminates only in man himself. They appear to have had cartilaginous skeletons, and in this, and their shagreen-like skin, strong bony spines, and trenchant teeth, to have much resembled our modern sharks, or rather the dog-fishes, for they were of small size. One genus (*Pteraspis*), apparently the oldest of the whole, belongs, however, to a tribe of mailed fishes allied to some of those of the old red sandstone. In both cases the groups of fishes repre-

FIG. 5.



Pteraspis, a mailed fish of the Upper Silurian, as restored by Powrie and Lankaster.

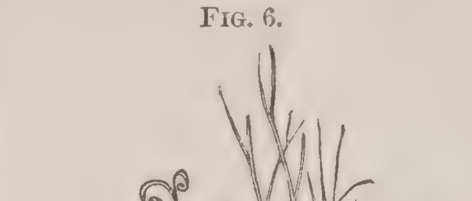
senting the first known appearance of vertebrates were allied to tribes of somewhat high organization in that class; and they asserted their claims to dominancy by being predaceous and carnivorous creatures, which must have rendered themselves formidable to their invertebrate contemporaries.

(4) *The Devonian, or Erian.**—In this age our knowledge of land-plants greatly increases, and we have evidence that our continents were more definitely assuming their present forms. The lowest Devonian beds in the Pennsylvania and New York series are sandy deposits, the Oriskany and Schoharie sandstones. These are succeeded by a great oceanic limestone rich in corals, and named, from its concretions of hornstone, an impure flint, the Corniferous limestone. Associated with it are the Hamilton and Genesee shales. Above these are the sandy and muddy beds known as the Portage and Chemung groups, still rich in marine fossils, but holding also many fossil plants. In the more eastern part of America, as along the Appalachian ridges and in Gaspé and New Brunswick, the great marine limestone is absent, and shallow water and littoral beds, in some places rich in land-plants, are alone developed. In like manner, in Europe the marine limestones of the Eifel and of Devonshire are represented in Central England and Scotland by the "old red sandstone," containing remains of fishes and of land-plants. When we read Hugh Miller's graphic descriptions of the old red sandstone of Scotland, with its numerous and wonderful fishes, we have before us a formation altogether distinct from that of Devonshire or the Eifel. But the one represents the shallow, and the other the deeper, seas of the same period. We learn this by careful tracing of the beds to their junction with the corresponding series, and by the occasional occurrence of the characteristic fishes of the Scottish strata in the English and German beds. In like manner a geologist who explores the Gaspé sandstones or the New Brunswick Devonian shales has under his consideration a group of beds very dissimilar from that which he would have to study on the shores of Lake Erie. But here, again, identity of relations to the Silurian below and the Carboniferous above shows the contemporaneousness of the beds; and this is confirmed by the occurrence in both series of some of the same plants and shells and fishes. It will further be observed that it is in the Middle that the greatest difference occurs. Sand and mud and pebble banks were almost universal over our two great continental plateaus in the Older and Newer Devonian. But in the Middle there were in some places oceanic areas with coral reefs; in others, shallow flats and swamps rich in vegetation. Herein we see the greater variety and richness of the Devonian. Had we lived in that age, we should not have seen great continents like those that now exist, but we could have roamed over lovely islands with breezy hills and dense lowland jungles, and we could have sailed over blue coral seas, glowing below with all the fanciful forms and brilliant colors of polyp-life, and filled with active and beautiful fishes. Especially did all these conditions culminate in the Middle Devonian, when what are now the continental areas of the northern hemisphere must have much resembled the present insular and oceanic regions of the South Pacific.

From the abundant life of the Devonian period we may select, as specially characteristic, its corals, its fishes, and its land-plants. The central limestones of the Devonian may be regarded as the head-quarters of the peculiar types of corals characteristic of the Palæozoic age. Here they were not only vastly numerous, but present some of their grandest and also of their most peculiar forms. Edwards and Hairne, in their *Monograph of British Fossil Corals* (1854), enumerate 150 well-developed species, and the number has since been largely increased. The reign of fishes began in the Upper Silurian, for in the rocks of this age, more especially in England, several species have been found. They occur, however, only in the newer beds of this formation, and are not of large size nor very abundant. It is to be observed that, in so far as the fragments discovered can be interpreted, they indicate the existence of two distinct types of fishes—the Ganoids, or gar-fishes, protected with bony plates and scales, and the Placoids, or shark-like fishes—and that in the existing world these fishes are regarded as occupying a high place in their class. Further, these two groups of fishes are those which through a large portion of geological time continue to prevail to the exclusion of other types, the ordinary bony fishes having been introduced only in comparatively recent periods. With the Devonian, however, there comes a vast increase to the finny armies; and so characteristic are these that the Devonian has been called the Age of Fishes *par excellence*. But we have not space here to give details as to these old inhabitants of the waters, and Agassiz, Hugh Miller, and Dr. Newberry have described all the more important forms in the Devonian of Europe and of the U. S.

We may now briefly sketch some of the more prominent features of the Devonian vegetation. The plants of the genus *Psilophyton*, of which there are several species, probably grew on swampy flats liable to inundation. They constitute the most characteristic and abundant members of the Lower Devonian flora, and appear to have been equally abundant in Europe as in America, though when occurring in fragments they have often been mistaken for Algæ and for roots. More distinctly allied to the modern club-mosses were the *Lepidodendra*, *Leptophlœa*, and similar plants of the Devonian, which may be defined to be gigantic arborescent club-mosses or Lycopodiums. These also are widely diffused in the Devonian of all parts of the world; and some of the genera, especially *Lepidodendron*, are still more abundant and attain to greater dimensions in the Carboniferous period. Still another feature of this ancient vegetation was the occurrence of dense brakes of *Calamites*, plants which were exaggerations of the modern Equisetums, attaining to a diameter of several inches, and to a great height, and in some cases with strong and woody stems. The Calamites of the Devonian much resemble those of the Carboniferous, and two of the species are found also in the latter system. Probably allied to the Calamites were the beautiful star-leaves of the genus *Asterophyllites*, which occur spread out on the Devonian shales of St. John, N. B., as if prepared by a careful botanist.

FIG. 6.



Psilophyton princeps, the oldest known plant of America, restored: *a*, fruit; *b*, stem; *c*, scalariform tissue of the axis, highly magnified. In the restoration one side is represented in vernation, and the other in fruit.

*The name *Erian* is derived from the Erie division of the State survey of New York, and from the extensive distribution of this formation around the shores of Lake Erie.

The ferns are among the most beautiful plants of the modern world in point of foliage, and they are very ancient in regard to geological time, making their appearance abundantly in the Middle Devonian. Of the Devonian species, few extend into the Carboniferous; and some forms, like that of the well-known *Cyclopterus* (*Archæopteris*) *Hibernicus* of the Upper Devonian of Ireland, are quite peculiar to that system. This type of ferns is represented in America by *Cyclopterus Jacksoni* and others.

There seems to have been in the Devonian a prevalence of forms of ferns allied to the modern genera *Hymenophyllum* and *Trichomanes*. There were also tree-ferns, large trunks of which, of the genera *Psaronius* and *Caulopteris*, have been found by Prof. Newberry in Ohio and by Prof. Hall in New York. Those of the former genus had the same habit found in the modern ferns, of sending out masses of aërial roots which, stretching into the soil like cords, supported the stem. In Scotland a small trunk, approaching to a tree-fern, has been found. It is the *Caulopteris Peachii* of Salter. Of all the plants of the Palæozoic forests, the most singular are the *Sigillariæ*.

FIG. 7.

Sigillariæ and *Lepidodendron*, restored. (*Dawson's Acadian Geology.*)

The head-quarters of this genus, or family, are in the Carboniferous, but several species occur in the Devonian, though they are of comparatively small stature, as far as yet known. The Sigillariæ had tall slender stems, with vertical rows of narrow two-nerved leaves, and their structures present remarkable points of resemblance to those of modern Gymnosperms, though there is reason to suspect that some trees included in the group may have been Cryptogams of high organization. The Sigillariæ were the trees most important in the accumulation of coal in the Carboniferous, but in the Devonian we have no evidence that their remains accumulated to so great an extent. In the Lower Devonian especially the rhizomata of *Psilophyton* appear to take the place which the stigmaria roots of *Sigillaria* hold in the Carboniferous. Rising still higher in the vegetable kingdom, we reach unquestionable Gymnosperms in the pine trees of the genus *Dadoxylon*, whose drifted trunks, preserved in stone by the infiltration of siliceous or calcareous matter, occur in the sandstones of New York, Ohio, and New Brunswick, and also in Scotland and Germany. The most noteworthy point with reference to these trees is that, while specifically distinct from those of the Carboniferous, they resemble them precisely in the structure of the woody fibres, and more especially in the beautiful bordered pores of the cell-walls—a structure fitted to promote the more free flow of the sap, and in which they agree with the fossil conifers of the coal formation, and also with the modern Araucarian pines of the southern hemisphere, but differ in detail from the modern pines of the northern hemisphere. With these Araucarian trunks are others showing structures which may have appertained to a rudimentary type of conifers, and which are known by the generic name *Prototaxetes*.

The oldest known remains of insects were found by Prof. Hartt in the Devonian rocks of New Brunswick, associated with some of the above-mentioned fossil plants.

(5) *The Carboniferous.*—That age of the world's history which, from its richness in accumulations of vegetable matter destined to be converted into coal, has been named the Carboniferous, is in relation to living beings the most complete and noble of the Palæozoic periods. In it those varied arrangements of land and water which had been increasing in perfection in the previous periods attained to their highest development. In it the forms of animal and plant life, that had been becoming more numerous and varied from the Eozoic onward, culminated. The Permian, which succeeded, was but the decadence of the Carboniferous, preparatory to the introduction of a new order of things. Thus, the Carboniferous was to the previous periods what the modern is to the preceding Tertiary and Mesozoic ages—the summation and completion of them all, and the embodiment of their highest excellence. We may take as a type of the Carboniferous the development of this system in Nova Scotia, where it attains a thickness and completeness in its several members not surpassed in any other part of the world. The complete Carboniferous series may be arranged in the following subordinate groups or formations, the limits of which are, however, in most cases not sharply defined: (1) *The Upper Coal Formation*, containing coal-formation plants, but not productive coals. (2) *The Middle Coal Formation*, or coal formation proper, containing the productive coal-beds. (3) *The Millstone-grit Series*, represented in Nova Scotia by red and gray sandstone, shale, and conglomerate, with a few fossil plants and thin coal-seams, not productive. (4) *The Carboniferous Limestone*, with the associated sandstones, marls, gypsum, etc., holding marine fossils, recognized by all palæontologists who have examined them as Carboniferous. (5) *The Lower Coal Measures*, holding some, but not all, of the fossils of the Middle Coal Formation, and thin coals not productive, but differing both in flora and fauna from the Upper Devonian, which they overlie unconformably. The most remarkable facts in connection with the Carboniferous period are the land-life of the period, the introduction of reptiles, and the culmination of the Palæozoic flora, accompanied with vast accumulations of vegetable matter in the form of coal.

In the Carboniferous, as in the Devonian age, insects existed, and in greater numbers. The winged insects of the period, so far as known, belong to three of the nine or ten orders into which modern insects are usually divided. Conspicuous among them are representatives of our well-known domestic pests the cockroaches, which thus belong geologically to a very old family. Another group, represented by many species in the coal forests, was that of the may-flies and shad-flies or ephemeras, which spend their earlier days under water, feeding on vegetable matter, and affording food to many fresh-water fishes—a use which they no doubt served in the coal period also. Another group of insects was that of the weevils, a family of beetles, whose grubs must have found plenty of nuts and fruits to devour, without attracting the wrathful attention of any gardener or orchardist. A curious and exceptional little group of creatures in the present world is that of the gally-worms or millipedes — wingless, many-jointed, and many-footed crawlers, resembling worms, but more allied to insects. These animals seem to have swarmed in the coal forests, and are represented by *Xylobius* and other genera. It is not wonderful that animals like these, feeding on decayed vegetable matter, should have flourished in the luxuriant Sigillaria swamps. A few species of scorpions and spiders, very like those of the modern world, have been found in the coal-measures both in Europe and America.

In the coal-measures we also meet, for the first time, in our ascending progress, the land-snails, so familiar now in every part of the world, and which are represented by two little species found in the coal formation of Nova Scotia.

Perhaps the most fish-like of the reptilian animals of the Carboniferous are the curious creatures from the coal-measures of Saarbrück, first found by Von Dechen, and which constitute the genus *Archegosaurus*. Their large heads, short necks, supports for permanent gills, feeble limbs, and long tails for swimming, show that they were aquatic creatures, presenting many points of resemblance

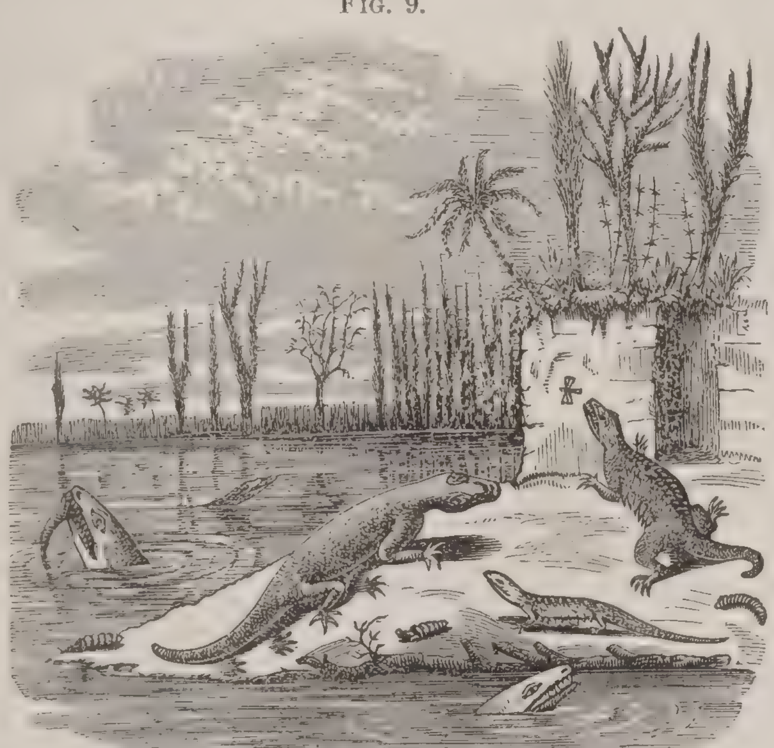
to the ganoid fishes with which they must have associated; still, they were higher than these in possessing lungs and

Fig. 8.

The two oldest Land-Snails, *Pupa Vetusta* and *Conulus priscus.*

true feet, though perhaps better adapted for swimming than even for creeping. From these creatures the other coal reptiles diverge, and ascend along two lines of progress, the one leading to gigantic crocodile-like animals, provided with powerful jaws and teeth, and probably haunting the margins of the waters and preying on fishes; the other leading to small and delicate lizard-like species, with well-developed limbs, large ribs, and ornate horny scales and spines, living on land and feeding on insects and similar creatures. In the first direction we have a considerable number of species found in the Jarrow coal-field in England, and described by Prof. Huxley. Some of them were like snakes in their general form, others more like lizards, and at the top stand such animals as *Baphetes* and *Eosaurus* from the Nova Scotia coal-field, and *Anthracosaurus* from that of Scotland. The style and habits of these creatures are easy to understand, however much haggling the comparative anatomists may make over their bones. They were animals of various size, varying from a foot to at least ten feet in length, the body generally lizard-like in form, with stout limbs and a flattened tail useful in swimming. Their heads were flat, stout, and massive, with large teeth strengthened by the insertion and convolution of plates of enamel.

Fig. 9.

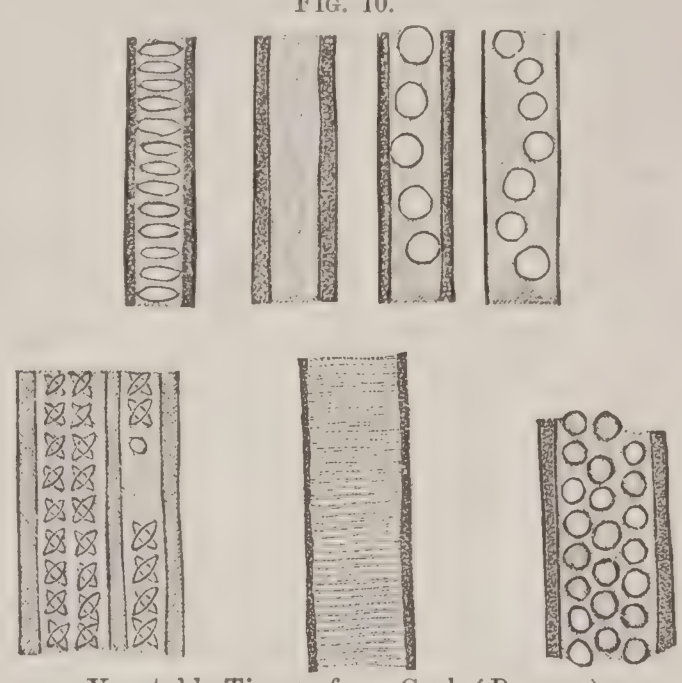


Reptiles of the Carboniferous Period, restored. Those on the land belong to the genera *Dendrerpeton* and *Hylonomus.*

The fore limbs were probably larger than the hind limbs, the better to enable them to raise themselves out of the water. The belly was strengthened by bony plates and closely imbricated scales, to resist, perhaps, the attacks of fishes from beneath, and to enable them without injury to drag their heavy bodies over trunks of trees and brushwood, whether in the water or on the land. In the other direction we find several animals of small size, but better developed limbs, leading to a group of graceful little animals quite as perplexing with regard to affinities as those first mentioned, but tending towards the smaller lizards of the modern world. At the top of these we may place the genus *Hylonomus* from hollow fossil trees of Nova Scotia.

In the present condition of our civilization, coal is the most important product which the bowels of the earth afford to man. And though there are productive beds of coal in most of the later geological formations, down to the peats of the modern period, which are only unconsolidated coals, yet the coal of the Carboniferous age is the earliest valuable coal in point of time, and by far the most important in point of quantity. Mineral coal may be defined to be vegetable matter which has been buried in the strata of the earth's crust, and there subjected to certain chemical and mechanical changes. The proof of its vegetable origin will grow upon us as we proceed. The chemical changes which it has undergone are not very material. Wood or bark, taken as an example of ordinary vegetable matter, consists of carbon or charcoal, with the gases hydrogen and oxygen. Coal has merely parted with a portion of these ingredients in the course of a slow and imperfect decay, so that it comes to have much less oxygen and considerably less hydrogen than wood, and it has been blackened by the disengagement of a quantity of free carbon. The more bituminous flaming coals have a larger amount of residual hydrogen. In the anthracite coals the process of carbonization has proceeded farther, and little remains but charcoal in a dense and compact form. In cannel coals and in certain bituminous shales, on the contrary, the process seems to have taken place entirely under water, by which decomposition has been modified, so that a larger proportion than usual of hydrogen has been retained. The mechanical change which the coal has experienced consists in the flattening and hardening effect of the immense pressure of thousands of feet of superincumbent rock, which has crushed together the cell-walls of the vegetable matter, and reduced what was originally a pulpy mass of cellular tissue to the condition of a hard laminated rock. To understand this, perhaps the simplest way is to compare under the microscope a transverse section of recent pine wood with a similar section of a pine trunk compressed into brown coal or jet. In the one the tissue appears as a series of meshes with thin woody walls and comparatively wide cavities for the transmission of the sap. In the other the walls of the cells have been forced into direct contact, and in some cases have altogether lost their separate forms, and have been consolidated into a perfectly compact, structureless mass. With regard to its mode of occurrence, coal is found in beds ranging in a vertical thickness from less than an inch to more than thirty feet, and of wide horizontal extent. Many such beds usually occur in the thickness of the coal formation, or "coal-measures," as the miners call them, separated from each other by beds of sandstone and compressed clay or shale. Very often the coal occurs in beds of several, somewhat close to each other, and separated from other groups by "barren measures" of considerable thickness. In examining a bed of coal where it is exposed in a cutting or shore cliff, we nearly always find that the bed below it, or the "under-clay," as it is termed by miners, is a sort of fossil soil, filled with roots and rootlets. On this rests the coal, which, when we examine it closely, is found to consist of successive thin layers of hard coal of different qualities as to lustre and purity, and with intervening laminæ of a dusty fibrous substance, like charcoal, called "mother coal" by miners, and sometimes mineral charcoal. Thin partings of dark shale also occur, and these usually present marks and impressions of the stems and leaves of plants. Above the coal is its "roof" of hardened clay, limestone, or sandstone, and this generally holds great quantities of remains of plants, and sometimes large stumps of trees with their bark converted into coal, and the hollow once occupied with wood filled with sandstone, while their roots spread over the surface of the coal. Such fossil forests of erect stumps are also found at various

Fig. 10.



Vegetable Tissues from Coal. (*Dawson.*)

levels in the coal-measures, resting directly on under-clays without any coals. A bed of coal would thus appear to be a fossil bog or swamp.

Of the trees of the Coal period, we may first notice that which is the most conspicuous and abundant tree in the swampy levels—the *Sigillaria*, or seal tree, so called from the stamp-like marks left by the fall of its leaves—a plant which has caused much discussion as to its affinities. Some regard it as a Gymnosperm, others as a Cryptogam. Most probably we have under this name trees allied in part to both groups, and which, when better known, may bridge over the interval between them. These trees present tall, pillar-like trunks, often ribbed vertically with raised bands, and marked with rows of scars left by the fallen leaves. They are sometimes branchless, or divide at top into a few thick limbs, covered with long, rigid, grass-like foliage. On their branches they bear long, slender spikes of fruit, and we may conjecture that quantities of nut-like seeds scattered over the ground around their trunks are their produce. If we approach one of these trees closely, more especially a young specimen not yet furrowed by age, we are amazed to observe the accurate regularity and curious forms of the leaf-scars, and the regular ribbing, so very different from that of our ordinary forest trees. If we cut into its stem, we are still further astonished at its singular structure. Externally it has a firm and hard rind. Within this is a great thickness of soft cellular inner bark, traversed by large bundles of tough fibres. In the centre is a core or axis of woody matter very slender in proportion to the thickness of the trunk, and still further reduced in strength by a large cellular pith. Thus, a great stem four or five feet in diameter is little else than a mass of cellular tissue, altogether unfit to form a mast or beam, but excellently adapted, when flattened and carbonized, to blaze upon our winter hearth as a flake of coal. The roots of these trees were perhaps more singular than their stems; spreading widely in the soft soil by regular bifurcation, they ran out in long snake-like cords, studded all over with thick cylindrical rootlets, which spread from them in every direction. They resembled in form, and probably in function, those cable-like root-stocks of the pond-lilies which run through the slime of lakes, but the structure of the rootlets was precisely that of those of some modern Cycads. It was long before these singular roots were known to belong to a tree. They were supposed to be the branches of some creeping aquatic plant. Along with the trees last mentioned we observe others of a more graceful and branching form, the successors of those Lepidodendra already noticed in the Devonian, and which still abound in the Carboniferous, and attain to larger dimensions than their older relations, though they are certainly more abundant and characteristic in the lower portions of the Carboniferous. Relatives, as already stated, of our modern club-mosses, now represented only by comparatively insignificant species, they constitute the culmination of that type, which thus had attained its acme very long ago, though it still continues to exist under pauperated forms. In the Coal period there were several generic forms of these plants, all attaining to the dimensions of trees. Like the Sigillariæ, they contributed to the materials of the coal; and one mode of this has recently attracted some attention. It is the accumulation of their spores and spore-cases, already referred to in speaking of the Devonian, and which was in the Carboniferous so considerable as to constitute an important feature locally in some beds of coal. A similar modern accumulation of spore-cases of tree-ferns occurs in Tasmania; but both in the modern and the Carboniferous such beds are exceptional, though wherever spore-cases exist as a considerable constituent of coal, from their composition they give to it a highly bituminous character—an effect, however, which is equally produced by the hard scales supporting the spores, and by the outer epidermal tissues of plants when these predominate in the coal, more especially by the thick, corky outer bark of *Sigillaria*. In the wide, open forest glades tree-ferns almost precisely similar to those of the modern tropics reared their leafy crowns. We have only time to glance at the vast brakes of tall Calamites which fringe the Sigillaria woods, and stretch far seaward over tidal flats. They were allied to modern mares-tails or Equisetums, but were of gigantic size, and much more woody structure of stem. The Calamites grew on wet mud and sand-flats, and also in swamps; and they appear to have been especially adapted to take root in, and clothe and mat together, soft, sludgy material recently deposited or in process of deposition. Rarely in the swampy flats, perhaps more frequently in the uplands, grew great pines of several kinds—trees capable of doing as good service for planks and beams as many of their modern successors, but which lived before their time, and do not appear to have aided much in the formation of coal.

(6) *The Permian.*—This formation does not occur in Eastern America, unless perhaps some of the upper beds of the Carboniferous of Nova Scotia should be referred to it. This period is, however, that when the greatest foldings and elevations of our rocks occurred, and in the West it is represented by limestones and sandstones of considerable thickness and extent. In Europe the magnesian limestone (the *Zechstein* of the Germans) is its principal deposit, though accompanied by sandstones and shales of considerable thickness. With respect to the first point above named, the earth's crust was subjected in the Permian period to some of the grandest movements which have occurred in the whole course of geologic time, and we can fix the limits of these, in Europe and America at least, with some distinctness. If we examine the Permian rocks in England and Germany, we shall find that everywhere they lie on the upturned edges of the preceding Carboniferous beds. In other words, the latter have been thrown into a series of folds, and the tops of these folds have been more or less worn away before the Permian beds were placed on them. But if we pass on to the eastward, in the great plain between the Volga and the Ural Mountains, where, in the "ancient kingdom of Perm," the greatest known area of these rocks is found—an area equal in extent to twice that of France, and which Sir R. I. Murchison, who first proposed the name, took as the typical district—we find, on the contrary, that the Permian and Carboniferous are conformable to one another. If, now, we cross the Atlantic and inquire how the case stands in America, we shall find it precisely the same. Here the great succession of earth-waves constituting the Appalachian Mountains rises abruptly at the eastern edge of the continent, and becomes flatter and flatter, until, in the broad plains W. of the Mississippi, the Permian beds appear, as in Russia, resting upon the Carboniferous, so quietly that it is not always easy to draw a line of separation between them. As Dana has remarked, we find at the western side of Europe and the eastern side of America great disturbances, inaugurating the Permian period; and in the interior of both, in the plains between the Volga and the Ural in one, and between the Mississippi and Rocky Mountains in the other, an entire absence of these disturbances. The Permian fauna may be, in the main, regarded as an imperfect continuation of that of the Carboniferous period.

The Palæozoic period includes the thickest and most widely distributed formations of our continents.

IV. The Mesozoic Time.—(1) *The Trias.*—The red sandstones and their associated beds, which in Prince Edward's Island, Nova Scotia, Connecticut, and Pennsylvania overlie unconformably the Carboniferous and all the older formations, are the best known American representatives of these rocks. They are remarkable for their fossil footprints of gigantic bird-like reptiles, and also for the ejections of volcanic or trappean rocks which have been poured through them, and of which the Palisades on the Hudson and the North Mountains of Cornwallis and Annapolis in Nova Scotia are eminent examples. In Virginia, and also in North Carolina, this formation includes plant-bearing shales and thick beds of coal, resembling those of the Carboniferous period, but the fossil plants are of different species. With reference to life, the Trias is remarkable for the introduction of many forms of reptilian life, heralding the Age of Reptiles, which culminates in the succeeding period, and for the first appearance of the Mammalia, or ordinary quadrupeds, of which one small species has been found in North Carolina and another in Germany. In Europe the Trias is more complete in its development than in America, and may be represented by the following table:

German Series.	French Series.	English Series.
Keuper sandstone and shale.	Marnes irisées	Saliferous and gypseous shales and sandstones.
Muschelkalk, limestone, and dolomite	Calcaire coquillier.	Wanting.
Bunter sandstone and conglomerate.	Grès bigarré	Sandstone and conglomerate.

(2) *The Jurassic*—The Trias is succeeded by a great and complex system of formations, usually known as the Jurassic from its admirable development and exposure in the range of the Jura, but which the English geologists often name the "Oolitic," from the occurrence in it of beds of oolite or roe-stone. This rock, of which the beautiful cream-colored limestone of Bath in England is an illustration, consists of an infinity of little spheres, like seeds or the roe of a fish. Under the microscope these are seen to present concentric layers, and often to have a minute grain of sand or fragment of shell in the centre. They are, in

short, miniature concretions, produced by the aggregation of the calcareous matter around centres by a process of molecular attraction to which fine sediments, and especially those containing much lime, are very prone. This style of limestone is very abundant in the Jurassic system, but it is not confined to it. The writer has seen very perfect oolites in the Silurian and the Carboniferous. The Jurassic series, as developed in England, may be divided into three triplets or cycles of beds, in the following way:

Upper Jurassic ...	Purbeck and Wealden, Portland limestone, Portland sand.
Middle Jurassic...	Kimmeridge clay, etc., Coral rag, limestone, Lower calcareous grit, Oxford clay.
Lower Jurassic* ..	Aenbrad and forest marble, Great and inferior oolite, limestone, Lias clays and limestones.

These rocks occupy a large space in England, and are also largely distributed over the continent of Europe and Asia, which had evidently three great and long-continued dips under water, indicated by the three great limestones. In America the case was different. The Jurassic has not been distinctly recognized in any part of the eastern coast of that continent, which then perhaps extended farther into the Atlantic than it does at present, so that no marine beds were formed on its eastern border. But in the West, along the base of the Rocky Mountains, and also in the Arctic area, there were Jurassic seas of large extent swarming with characteristic animals. The Jurassic was emphatically the Age of Reptiles. Among the most remarkable of these were the great terrestrial group of Dinosaurs, many of them huge in bulk, some of them biped, and combining the characters of the modern Reptilia with features now restricted to birds and mammals. The flying reptiles of the Pterodactyl group were not less marvellous. Species of these creatures from Western America, recently described by Cope, must have been bat-like reptiles, with wings more than twenty feet in expanse; and equally gigantic species occur in Europe, while others were no larger than pigeons or snipes. Some of these, like *Plesiosaurus,* had short bodies and long, swan-like necks; others, like *Ichthyosaurus,* had gigantic heads and long, flexible bodies; others, like *Mosasaurus,* rivalled the fabled sea-serpent in the immense extension of their bodies. Our limits do not permit us to attempt the description of these creatures, notices of which will be found in most books of geology. The Jurassic period also presents numerous small mammals allied to the humbler marsupials of New Holland, and one very remarkable type of bird, the *Archæopteryx,* which, with the feet and general form of a modern percher, combined peculiarities of tail and wings which tend toward the reptiles.

FIG. 11.

Plesiosaurus rostratus, from the Lower Lias of Charmouth, Dorset. (In the British Museum.)

FIG. 12.

Skeleton of *Hadrosaurus* (tallest figure in cut), a giant reptile found in Cretaceous strata in New Jersey, North Carolina, etc. From the Central Park Museum, New York.

The Jurassic shores were clothed with an abundant flora, which changed considerably in its form during the lapse of this long time; but yet it has a character of its own distinct from that of the previous Palæozoic and the succeeding Tertiary. Perhaps no feature of this period is more characteristic than the great abundance of those

* This last group is very complex, and might perhaps admit of subdivision, locally at least, into subordinate cycles.

singular plants, the Cycads, which in the modern flora are placed near to the pines, but in their appearance and habit more resemble palms, and which in the modern world are chiefly found in the tropical and warm temperate zones of Asia and America. No plants certainly of this order occur in the Carboniferous, where their nearest allies are perhaps some of the Sigillariæ; and in the modern time the Cycads are not so abundant, nor do they occur at all in climates where their predecessors appear to have abounded. In the quarries of the island of Portland we have a remarkable evidence of this in beds with numerous stems of Cycads still *in situ* in the soil in which they grew, and associated with stumps of pines which seem to have flourished along with them. In further illustration of this point, we may refer to the fact that Carruthers, in a recent paper, catalogues twenty-five British species belonging to eight genera —a fact which markedly characterizes the British flora of the Mesozoic period.

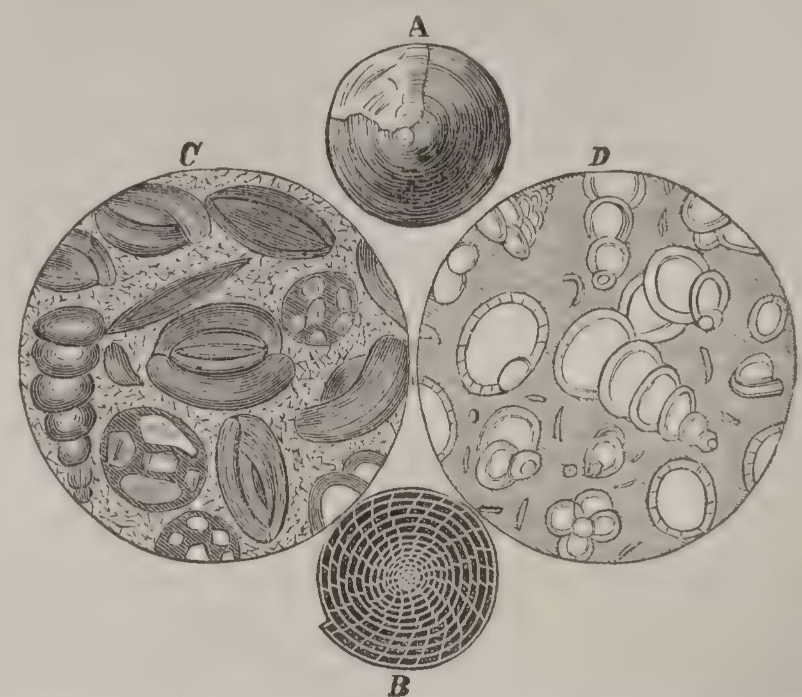
(3) *The Cretaceous.*—At the close of the Triassic the eastern and western continents seem to have been as extensive as at present. The Cretaceous began with a great subsidence, more complete in the eastern than in the western hemisphere, but very widespread in both. This led to the deposition over the Jurassic rocks of the chalk of Western Europe—a very remarkable rock, produced only in the abysmal depths of the ocean; and associated with this are extensive deposits of greensand, made up largely of grains of the mineral glauconite. In America pure chalk does not appear, but the greensand is extensively developed on the eastern coast, especially in New Jersey, and wide regions of the West are covered with limestones and marls of this period, while in Vancouver's Island it contains beds of coal and fossil plants, the latter presenting many generic forms still represented on the earth, as the oaks, plane trees, etc.

IV. Tertiary, or Neozoic Time.—Both in Europe and America there is evidence of great changes of level at the beginning of the Tertiary. In the west of Europe beds often of shallow water or even fresh-water origin fill the hollows in the bent Cretaceous strata. This is manifestly the case with the formations of the London and Paris basins, contemporaneous but detached deposits of the Tertiary age, lying in depressions of the chalk. Still, this does not imply much want of conformity, and, according to the best explorers of those alpine regions in which both the Mesozoic and Tertiary beds have been thrown up to great elevations, they are in the main conformable to one another. Something of the same kind occurs in America. On the Atlantic coast the marine beds of the Older Tertiary cover the Cretaceous, and little elevation seems to have occurred. Farther W. the elevation increases, and in the upper part of the Valley of the Mississippi it amounts to 1700 feet. Still farther W., in the regions of the Rocky Mountains, there is evidence of elevation to the extent of as much as 7000 feet. Throughout all these regions scarcely any disturbance of the old Cretaceous sea-bottom seems to have occurred until after the deposition of the Older Tertiary, so that there was first a slow and general elevation of the Cretaceous ocean-bottom, succeeded by gigantic folds and fractures, and extensive extravasations of the bowels of the earth in molten rocks in the course of the succeeding Tertiary age. These great physical changes inaugurated the new and higher life of the Tertiary, just as the similar changes in the Permian did that of the Mesozoic. The classification of the Tertiary given by Sir Charles Lyell is represented in the following table, the percentage of fossils being taken from marine forms, and mainly from mollusks, and the system having in some cases been modified by stratigraphical evidence:

Tertiary, or Neozoic Time.	Post-pliocene, including that which immediately precedes the Modern. In this the shells, etc., are recent, the Mammalia in part extinct.
	Pliocene, or more recent age. In this the majority of the shells found are recent in the upper beds. In the lower beds the extinct become predominant.
	Miocene, or less recent. In this the large majority of the shells found are extinct.
	Eocene, the dawn of the recent. In this only a few shells occur.

(1) *The Eocene.*—This has been very thoroughly studied in the Tertiary basins of Paris and London, and also in the Southern States of the Union, where it constitutes the Claiborne, Jackson, and Vicksburg groups of Dana. We may content ourselves with a review of its formations as exposed in the localities first mentioned. The London clay is Lower Eocene, but in the beds of the Isle of Wight and neighboring parts of the south of England we have the Middle and Upper members of the series. They are not, however, so largely developed as in the Paris basin, where, resting on the equivalent of the London clay, we have a thick marine limestone, the *calcaire grossier*, abounding in marine remains, and in some beds composed of shells of Foraminifera. The sea in which this lime-

Fig. 13.



Foraminiferal Rock-builders: A, *Nummulites lævigata*, Eocene; B, the same, showing chambered interior; C, Milioline limestone, magnified, Eocene, Paris; D, chalk, section magnified, Cretaceous.

stone was deposited, a portion, no doubt, of the great Atlantic area of the period, became shallow, so that beds of sand succeeded those of limestone, and finally it was dried up into lake-basins, in which gypsum, magnesian sediments, and siliceous limestone were deposited. These lakes or ponds must at some periods have resembled the American "salt-licks," and were no doubt resorted to by animals from all the surrounding country in search of the saline mud and water which they afforded. Hence there occur vast numbers of bones of Mammalia, and in some marly beds intervening between the layers of gypsum numerous footprints occur, exactly like those already noticed in the Trias. The mammals were largely pachyderms of extinct genera, but Carnivora and Marsupials are also represented.

(2) *The Miocene.*—In France and elsewhere on the continent of Europe marls and sands of this age succeed to the Eocene beds, and in America beds of similar age occur along the Atlantic coast from Gay Head southward, and they are extensively developed in the West. Confining ourselves mainly to the mammalian life of the Miocene, we find three remarkable points of difference as compared with the Eocene: (1) Whereas the Eocene mammals are remarkable for adherence to one general type—viz. that group of pachyderms most regular and complete in its dentition—we now find a great number of more specialized and peculiar forms. (2) We find in the latter period a far greater proportion of large carnivorous animals. (3) We find much greater variety of mammals than either in the Eocene or the Modern, and a remarkable abundance of species of gigantic size. The Miocene is thus apparently the culminating age of the Mammalia, in so far as physical development is concerned; and this, as we shall find, accords with its remarkably genial climate and exuberant vegetation. In Europe the beds of this age present for the first time examples of the monkeys, represented by two generic types, both of them apparently related to the modern long-armed species, or gibbons. Among carnivorous animals we have cat-like creatures, one of which is the terrible *Machairodus*, distinguished from all modern animals of its group by the long, sabre-shaped canines of its upper jaw, fitting it to pull down and destroy those large pachyderms which could have easily shaken off a lion or a tiger. Here also we have the elephants, represented by several species now extinct; the mastodon, a great, coarsely-built, hog-like elephant, some species of which had tusks both in the upper and lower jaw; the rhinoceros, the hippopotamus, and the horse, all of extinct species. We have also giraffes, stags, and antelopes, the first ruminants known to us, and a great variety of smaller and less noteworthy creatures. Here also, for the first time, we find the curious and exceptional group of Edentates, represented by a large ant-eater. Of all the animals of the European Miocene, the most wonderful and unlike any modern beast is the Dinothere, found in the Miocene of the Epplesheim in Germany, and described by Kaup. Some doubt rests on the form and affinities of the animal, but we may reasonably take it, as restored by its describer and currently reproduced in popular books, to have been a quadruped of somewhat elephan-

tine form. Some years ago, however, a huge haunch-bone, supposed to belong to this creature, was discovered in the south of France, and from this it was inferred that the Dinothere may have been a marsupial or pouched animal, perhaps allied in form and habit to the kangaroos. The skull is three feet four inches in length, and when provided with its soft parts, including a long snout or trunk in front, it must have been at least five or six feet long. Such a head, if it belonged to a quadruped of ordinary proportions, must represent an animal as large in proportion to our elephant as an elephant to an ox. In Asia the Siwalik Hills afforded to Falconer and Cautley one of the most remarkable exhibitions of Miocene animals in the world.

FIG. 14.

Sivatherium giganteum, Falconer, from the Miocene of India. (From a restoration by Dr. D. Murie of London.)

These hills form a ridge subordinate to the Himalayan chain, and rise to a height of 2000 to 3000 feet. In the Miocene period they were sandy and pebbly shores and banks lying at the foot of the then infant Himalayas, which, with the table-lands to the N., probably formed a somewhat narrow E. and W. continental mass or large island. As a mere example of the marvellous fauna which inhabited this Miocene land, it has afforded remains of seven species of elephants, mastodons, and allied animals—one of them, the *Elephas Ganesa*, with tusks ten feet and a half long and twenty-six inches in circumference at the base. Miocene America is scarcely behind the Old World in the development of its land animals. From one locality in Nebraska, Leidy described in 1852 fifteen species of large quadrupeds, and the number has since been considerably increased. Among these are species of *Rhinoceros*, *Palæotherium*, and *Machairodus;* and one animal, the *Titanotherium*, allied to the European Anoplothere, is said to have attained a length of eighteen feet and a height of nine, its jaws alone being five feet long.

The Miocene is also remarkable for its flora, which is of very modern type, but presents the remarkable peculiarity that plants now confined to the more temperate regions extended N. to Greenland and Spitzbergen. The Miocene flora of these Arctic regions, as described by Heer, constitutes one of the most marvellous revelations of modern geology. To this or to the Eocene belongs the remarkable accumulation of the siliceous crusts of the humble plants known as Diatoms, which extends through parts of Maryland and Virginia, with a thickness in some places of thirty feet, and is celebrated among microscopists as the "Richmond infusorial earth."

(3) *The Pliocene.*—Beds of this age occur along the coast of North and South Carolina, containing from 40 to 60 per cent. of living species of shells. It is probable that wide areas on the plains of the West are occupied by deposits of the same period, and the calcareous and sandy beds known in England as clay may be regarded as a representative in that country. With regard to animal life, the Pliocene continues the conditions of the last age, but with signs of decadence. Many of the old gigantic pachyderms have disappeared, and in their stead some familiar modern genera were introduced. The Pliocene was terminated by the cold or Glacial period, in which a remarkable lowering of temperature occurred over all the northern hemisphere, accompanied, at least in a portion of the time, by a very general and great subsidence, which laid all the lower parts of our continents under water. This terminated much of the life of the Pliocene, and replaced it with boreal and arctic forms, some of them, like the great hairy Siberian mammoth and the woolly rhinoceros, fit successors of the gigantic Miocene fauna. How it happened that such creatures were continued during the Post-pliocene cold we cannot understand till we have the Tertiary vegetation before us. It must suffice now to say that as the temperature was modified and the land rose, and the modern period was inaugurated, these animals passed away, and those of the present time remained. Perhaps the most remarkable fact connected with this change is that stated by Pictet, that all the modern European mammals are direct descendants of Post-pliocene species, but that in the Post-pliocene they were associated with many other species, and these often of great dimensions, now extinct. In other words, the time from the Pliocene to the Modern has been a time of diminution of species, while that from the Eocene to the Miocene was a time of rapid introduction of new species. Thus the Tertiary fauna culminated in the Miocene. Yet, strange though this may appear, man himself, the latest and noblest of all, would seem to have been a product of the later stages of the time of decadence. We propose, however, to return to the animals immediately preceding man and his contemporaries after we have noticed the Glacial period.

(4) *The Post-pliocene, or Glacial.*—The warm climate and rich vegetation of the Miocene extended far into the Pliocene, with characters very similar to those already stated; but as the Pliocene age went on, cold and frost settled down upon the northern hemisphere, and a remarkable change took place in its vegetable productions. For example, in the somewhat celebrated "forest bed" of Cromer, in Norfolk, which is regarded as Newer Pliocene, we have lost all the foreign and warm-climate plants of the Miocene, and find the familiar Scotch firs and other plants of the modern British flora. The animals, however, retain their former types; for two species of elephant, a hippopotamus, and a rhinoceros are found in connection with these plants. This is another evidence, in addition to those above referred to, that plants are better thermometers to indicate geological and climatal change than animals. This Pliocene refrigeration appears to have gone on increasing into the next or Post-pliocene age, and attained its maximum in the Glacial period, when, as many geologists think, our continents were, even in the temperate latitudes, covered with a sheet of ice like that which now clothes Greenland. Then occurred a very general subsidence, in which they were submerged under the waters of a cold icy sea, tenanted by marine animals now belonging to boreal and arctic regions. After this they rose to constitute the dry land of man and his contemporaries.

Our next topic for consideration is one of the most vexed questions among geologists—the Glacial period which immediately preceded the advent of man. In treating of this it will be safest first to sketch the actual appearances which present themselves, and then to draw such pictures as we can of the conditions which they represent. The most recent and superficial covering of the earth's crust is usually composed of rock-material more or less ground up and weathered. This may, with reference to its geological character and origin, be considered as of three kinds. It may be merely the rock weathered and decomposed to a certain extent *in situ;* or it may be alluvial matter carried or deposited by existing streams or tides or by the rains; or lastly, it may be material evidencing the operation of causes not now in action. This last constitutes what has been called drift or diluvial detritus, and is that with which we have now to do. Such drift, then, is very widely distributed on our continents in the higher latitudes. In the northern hemisphere it extends from the Arctic regions to about 50° N. lat. in Europe, and as low as 40° in North America; and it occurs S. of similar parallels in the southern hemisphere. Farther towards the equator than the latitudes indicated we do not find the proper drift deposits, but merely weathered rocks or alluvia, or old sea-bottoms raised up. This limitation of the drift at the very outset gives it the character of a deposit in some way connected with the polar cold. Besides this, the general transport of stones and other material in the northern regions has been to the S.; hence in the northern hemisphere this deposit may be called the *Northern* Drift. If now we take a typical locality of this formation—such, for instance, as we may find in Scotland, or Scandinavia, or Canada—we shall find it to consist of three members, as follows:

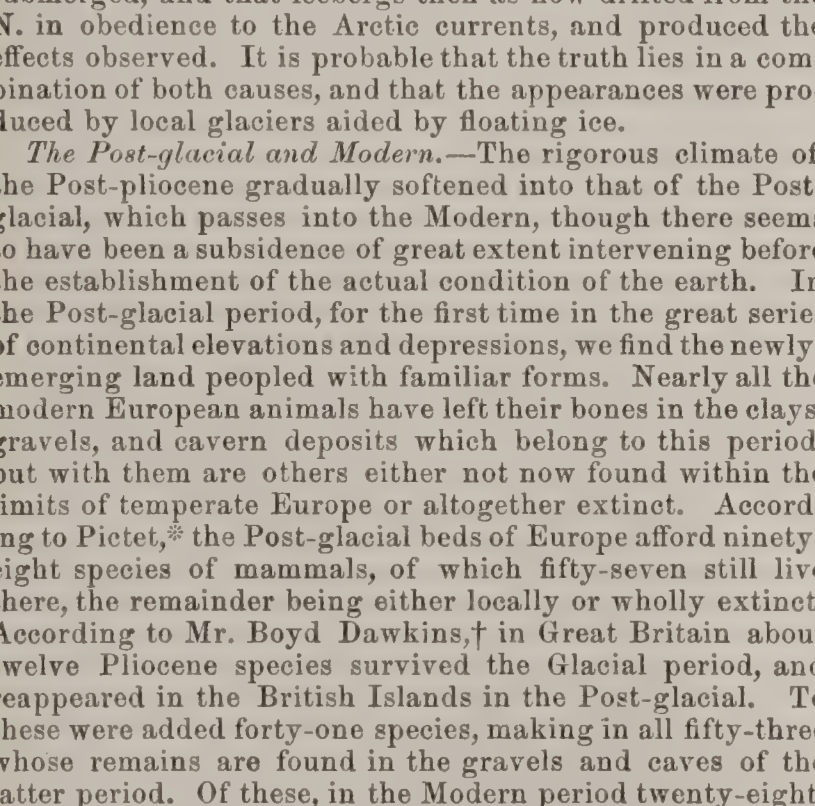
3, Superficial sands or gravels;
2, Stratified clays;
1, Till or boulder clay.

This arrangement may locally be more complicated, or it may be deficient in one of its members. The boulder clay may, for example, be underlaid by stratified sand or gravel, or even by peaty deposits. It may be intermixed with layers of clay or sand; the stratified clay or the boulder clay may be absent, or may be uncovered by any upper member. Still, we may take the typical series as above

stated, and inquire as to its characters and teaching. The lower member, or boulder clay, is a very remarkable kind of deposit, consisting of a paste which may graduate from tough clay to loose sand, and which holds large angular and rounded stones or boulders confusedly intermixed; these stones may be either from the rocks found in the immediate vicinity of their present position or at great distances. This mass is usually destitute of any lamination or subordinate stratification, whence it is often called *Unstratified* Drift, and is of very variable thickness, often occurring in very thick beds in valleys, and being comparatively thin or absent on intervening hills. Further, if we examine the stones contained in the boulder clay, we shall find that they are often scratched and striated and grooved; and when we remove the clay from the rock-surfaces on which it rests, we find these in like manner scratched and grooved and polished. These phenomena—viz. of polished and striated rocks and stones—are similar to those produced by those great sliding masses of ice, the glaciers of alpine regions, which in a small way and in narrow and elevated valleys act on the rocks and stones in this manner, though they cannot form deposits precisely analogous to the boulder clay, owing to the wasting away of much of the finer material by the torrents, and the heaping of the coarser detritus in ridges and piles. Further, we have in Greenland a continental mass with all its valleys thus filled with slowly-moving ice, and from this there drift off immense ice-islands, which continue at least the mud-and-stone-depositing process, and possibly also the grinding process, over the sea-bottom. So far, all geologists are agreed, but here they diverge into two schools. One of these, that of the Glacier theorists, holds that the boulder clay is the product of land-ice; and this requires the supposition that at the time when it was deposited the whole of our continent N. of 40° or 50° was in the condition of Greenland at present. This is, however, an hypothesis so inconvenient, not to say improbable, that many hesitate to accept it, and prefer to believe that in the so-called Glacial period the land was submerged, and that icebergs then as now drifted from the N. in obedience to the Arctic currents, and produced the effects observed. It is probable that the truth lies in a combination of both causes, and that the appearances were produced by local glaciers aided by floating ice.

The Post-glacial and Modern.—The rigorous climate of the Post-pliocene gradually softened into that of the Post-glacial, which passes into the Modern, though there seems to have been a subsidence of great extent intervening before the establishment of the actual condition of the earth. In the Post-glacial period, for the first time in the great series of continental elevations and depressions, we find the newly-emerging land peopled with familiar forms. Nearly all the modern European animals have left their bones in the clays, gravels, and cavern deposits which belong to this period, but with them are others either not now found within the limits of temperate Europe or altogether extinct. According to Pictet,* the Post-glacial beds of Europe afford ninety-eight species of mammals, of which fifty-seven still live there, the remainder being either locally or wholly extinct. According to Mr. Boyd Dawkins,† in Great Britain about twelve Pliocene species survived the Glacial period, and reappeared in the British Islands in the Post-glacial. To these were added forty-one species, making in all fifty-three whose remains are found in the gravels and caves of the latter period. Of these, in the Modern period twenty-eight, or rather more than one-half, survive, fourteen are wholly extinct, and eleven are locally extinct. Among the extinct animals are the mammoth, *Elephas primigenius;* the Tich-

Fig. 15.



Elephas primigenius (the Mammoth).

orine rhinoceros (*R. tichorhinus*), and the great hippopotamus, *H. major*, the *Machairodus*, and the cave bear. Among the locally extinct are the reindeer, the lion and the Cape hyæna.

In the Post-glacial and Modern deposits we have remains of man and his works, and in the Modern the geological ages pass into modern history.

(For the more full discussion of geological details and methods, and for the economic relations of the science, the reader is referred to the *Manuals* of Lyell and Dana, and that of Jukes, edited by Geikie.) J. W. Dawson.

Geology, Chemical. The science of geology is concerned not only with the structure or architecture of the earth, the arrangement and succession of the various rocks which compose its crust, and the physical agencies which have presided over its changes, but with the mineral composition of these rocks, and the chemical agencies which have been at work in past ages arranging from the elements of the globe their present combinations. Chemistry, therefore, finds a wide application in the investigation of the earth, the waters, and the air, and in considering the changes which these have undergone in past ages, and are still undergoing; and to this study we give the name of chemical geology. We may further distinguish between chemical geognosy, or the chemical composition and relations of the various bodies, and chemical geogeny, which concerns itself with the origin and changes of these bodies. Beginning with the rock-masses of the globe, we have to consider first, the mode of their generation, and second, their composition and the relations which they sustain to the atmosphere and the waters. Looking back into the past, we can discern a time when the oldest Palæozoic rocks were not yet deposited, and when the Eozoic rocks formed the surface, and by their subsequent disintegration and decay gave rise to the Palæozoic formations. Going still further, we may form some notion of the generation of the Eozoic rocks, and may speculate upon the condition of the earth when even these were not, and when water and air had not yet begun their action on the surface of the globe. The hypothesis of the igneous origin of the earth is now almost universally admitted, and we may fairly accept it as the basis of our sketch of chemical geogeny and geognosy. This hypothesis, as interpreted in the light of modern discoveries, supposes a liquid globe condensing from a vaporous mass in which, as in the sun, the various elements were at first in a state of chemical dissociation, but united, as the temperature of the mass became reduced, in the order of their affinities, and were successively precipitated. From this must have resulted a molten globe of oxidized materials, and an atmosphere in which the chlorine was presumably in the condition of chlorhydric acid, with carbon and sulphur in oxidized forms, watery vapor, nitrogen, and a probable excess of oxygen gas. Starting from this hypothetical condition of things, which is, however, strictly in accordance with what we know of chemical affinities at elevated temperatures, we have the basis of an intelligent scheme of chemical geogeny, which will enable us to understand clearly the order of things as we see it recorded in the earth's crust.

The conclusion now generally received as to the earth's interior is that it is solid to great depths, if not throughout, and there are good reasons for supposing that solidification may have commenced at the centre. The mean density of the earth, which is 5.3, water being unity, is about twice that of the known rocks taken as a whole, leading to a conjecture that denser compounds may have accumulated at the centre. Chemical geology has, however, only to do with the superficial portions, from which, with the elements of the air and the ocean, the whole of the known rocks have been derived. Analogies lead us to conclude that the primitive surface was irregular and accidented, and consisted of a compound of silicates of alumina, lime, magnesia, iron-oxide, and alkalies, besides the rarer bases, resembling perhaps some basic lavas in composition, and therefore very unlike granite, which is generally supposed to be the fundamental rock. Upon this, as cooling went on, there would, in accordance with our hypothesis, be precipitated the acid compounds of chlorine and sulphur from the primeval atmosphere, by which at an elevated temperature and under the pressure of a high barometric column, the silicates would be decomposed, with separation of silica and saturation of the acids by the bases of the primitive silicated mass. This process would soon terminate, and be succeeded by another reaction, the decomposition of portions of the silicates by waters holding in solution carbonic acid, which must have abounded in the early atmosphere. From this process (which still continues to operate on crystalline rocks) would result the separation of silicate of alumina as clay, free silica, and iron-oxide, and the formation of carbonates of lime, magnesia, and alkalies. These being carried down to the sea in solution, the alkaline carbonate would, from the dissolved chloride of calcium, precipitate carbonate of lime, with the production of chloride of sodium;

* *Palæontologie.*

† *Journal of Geological Society*, and Palæontographical Society's publications.

we thus get a conception of the process which may have given rise at once to the formation of limestone, clay, silica, and sea-salt. How near these decompositions, which are now going on, approach to the method of nature in the earlier times we can never determine, for our knowledge of the precise constitution of the primitive crust is too hypothetical. The elements therein may have been arranged in a manner very different from that of any compounds now known to us, and the mode of its decomposition consequently subject to conditions of which we can form but an imperfect notion. It will be found, however, that the above hypothesis gives us a starting-point in chemical geology, and is, moreover, in remarkable accordance with the facts to be made known farther on.

Coming now to the chemical composition of the rocks, we distinguish them into so-called crystalline and uncrystalline divisions—terms which are better defined by saying that the first consist chiefly of crystalline silicates, and the second, for the greater part, of the results of the decay of these. Granites, gneisses, and hornblende rocks may be taken as examples of the former, which includes most eruptive and Eozoic rocks, and sandstones and shales of the latter. In this grouping we have excluded such rocks as are composed of carbonate and sulphate of lime, carbon, metallic oxides, and sulphurets, which belong alike to the crystalline and uncrystalline divisions. The minerals of crystalline silicated rocks are, besides quartz, potash-feldspar or orthoclase, the lime and soda-feldspars albite, oligoclase, andesine, labradorite, and anorthite, leucite, nepheline, and other double aluminous silicates, both hydrous and anhydrous, which are related to the feldspars in composition; the various micas and chlorites, garnet, epidote, all of which are moreover double aluminous silicates, and such simple aluminous silicates as andalusite, kyanite, and pyrophyllite. No less important are those which are essentially protoxide-silicates, such as hornblende, pyroxene, chrysolite, chondrodite, serpentine, and tàlc; and if to these we add carbonates of lime and magnesia, iron-oxides and graphite, we shall have the chief mineralogical elements of the crystalline rocks. Granite consists essentially of quartz and orthoclase, sometimes accompanied by a triclinic feldspar (oligoclase or albite), and holding, as an accidental mineral, a small portion of mica or of hornblende, or both. Trachyte is closely related to granite in composition. The elements of granite, arranged in a banded or stratiform manner, make up gneiss, and this, by a predominance of mica, passes into mica-slate, which itself often includes, as accidental minerals, garnet, staurolite, andalusite, and kyanite, giving rise to compound rocks in which silicates of alumina without alkali replace orthoclase. Passing from the above classes of rocks, in which there is generally an excess of silica in the form of quartz, we come to those in which quartz is rarer or altogether wanting. Hornblende or pyroxene, either alone or mixed with a feldspar, generally labradorite, often accompanied by chrysolite, constitutes the compounds known as dolerite, diabase, diorite, and many related rocks, frequently containing chlorite, garnet, or epidote; while those composed chiefly of serpentine or steatite make up another and closely-related class.

To discuss the whole question of the varieties of rocks produced by the admixture of different minerals would exceed the limits of this sketch. It will, however, be necessary to give some notion of the different classes of crystalline silicated rocks, considered geognostically: 1. Those which, like gneiss, mica-slate, and serpentine, are evidently bedded and stratified rocks, are generally supposed to have been deposited from water, and are conveniently designated indigenous rocks. 2. Those which, like granites, traps, and lavas, have been forced in a more or less liquid form from beneath the surface, are regarded as of igneous origin, and are called eruptive or exotic rocks. 3. Those which have been deposited from solution in fissures of previously formed rocks, as the quartz of mineral veins, and likewise many granitic vein-stones, have been called endogenous rocks. Rock-masses of the same mineral constitution may belong to all of these classes; thus, a granitic gneiss, an eruptive granite-dyke, and a granitic vein-stone may be alike composed of orthoclase, quartz, and mica, and difficultly distinguished from each other unless their geognostical relations are taken into account.

The origin and mode of formation of the indigenous crystalline rocks, such as gneiss or hornblende, are involved in much obscurity. By one school they are supposed to be of plutonic origin—that is, to have been formed in some way from the cooling of the primitive crust of the earth, and to have acquired the stratiform arrangement observed in their constituent minerals from movements in the cooling mass. These ancient crystalline rocks are declared by this school to be neither stratified nor eruptive rocks in the accepted sense of these terms, but to partake of the nature of both of these classes. Granite would thus differ from gneiss only in the accident of structure.[1] To this view, which derives these rocks from the cooling mass of the globe, it is objected that the quartz which they contain is not, as far as known, a product of igneous action, but is, on the contrary, changed into a wholly unlike form of silica by a heat even below that required for its fusion, and in most cases is clearly shown by its associations to have been deposited from aqueous solution. Moreover, the microscopic study of the quartz, as well as of other minerals of granitic rocks, has shown them to contain in many cases small cavities partially filled with water or with saline solutions; and from the examination of these at elevated temperatures it has been calculated that the crystallization of such quartz has taken place at a heat much below that of redness. Such are some of the arguments advanced against the purely igneous origin of granite and granite-like rocks, and in favor of the notion that they have at one time been in a softened condition under the combined influence of water and heat, or in a condition of what may be defined as one of aqueo-igneous fusion. Reasons are given for supposing that the presence of a few hundredths of water may produce a softened and plastic condition of the rock at a temperature far below that required for the fusion of its elements. Granite, according to the views of this school, is a softened and modified gneiss which has lost the evidences of its aqueous stratification. The occurrence of the various minerals of granite in vein-stones which are pretty evidently of aqueous origin, gives a further support to this theory; and it has been suggested that the deposition of bedded gneiss at the earth's surface was a process closely analogous to that by which the granitic vein-stones were formed in fissures, in both cases from solutions. A similar view will then be extended to other feldspathic and hornblendic indigenous rocks, which must have been generated under conditions, both physical and chemical, very different from those which have in more recent times prevailed at the surface. A modification of this view is that which holds that the various mineral silicates, such as hornblende and feldspars, which enter into the composition of these rocks were deposited from watery solutions, not in a crystalline form, but as non-crystalline precipitates or magmas, which subsequently assumed a crystalline arrangement, as has evidently been the case in many limestone rocks. It is probable in the present state of our knowledge that each of these latter views is in certain instances true, and that in either case the minerals seen in our crystalline stratified rocks have been generated by aqueous agencies. It has been suggested above that granite is a softened and displaced gneiss from which the evidences of stratification have been obliterated, and a similar view should be extended to other eruptive or exotic rocks, with certain modifications to be considered farther on, in the discussion of volcanic phenomena. Eruptive rocks are seen in many cases to present local variations in their structure, which presents a banded arrangement simulating that of indigenous rocks—a fact which has lent support to the notion that all stratified rocks, such as gneisses, have been derived from granites, rather than all exotic granites from gneisses. Such a view, however, leaves unaccounted for the origin of the exotic rocks themselves, which is the very problem to be explained. These are by this school supposed to have had their origin in the original fluid mass of the globe, of which a portion at least is imagined to have separated into two strata, a lighter and a denser one, which arranged themselves in the order of their specific gravities, and being from time to time ejected, have given rise, the heavier and more basic stratum to the hornblende and pyroxenic rocks, and the lighter and more silicious to the granitic and trachytic rocks, all of which may assume in certain cases a stratiform structure. The variations in the chemical and mineralogical composition of the crystalline rocks are, however, so great as to require a supplementary hypothesis; which is that of a conversion or transmutation of almost any crystalline rock into any other. The rocks are supposed to be permeated by circulating liquids, through which one element may be removed and another substituted in its place, so as to effect a more or less complete transformation of the rock. Thus, in accordance with this view, we are told that granite or gneiss may be changed into serpentine, limestone, or dolomite, and, conversely, limestone may be converted into any one of these, hornblendic rocks being subject to not less remarkable changes; so that, given the two types of igneous rocks already mentioned, it is easy, in accordance with this view, to imagine the conversion of various parts of them into limestones, dolomites, serpentines, chloritic, talcose, and micaceous rocks. This hypothesis, based upon a small number of well-recognized facts as to the alteration of certain known species, and upon a much larger number of cases of association or blending of species which have been regarded as evidences of partial alteration, has been very generally

adopted as a means of explaining the origin of the great variety of crystalline rocks.

Related to this view, which supposes the plutonic origin and subsequent aqueous alteration of the crystalline rocks, is another which requires some notice, and which supposes that various crystalline stratified rocks have been formed from the uncrystalline sedimentary sands and clays (themselves the result of the decay of the older crystallines), through the agency of infiltrating waters, which have introduced alkalies, magnesia, etc., and thus effected changes analogous to those supposed to have taken place in the plutonic rocks. Such a process has doubtless in some cases operated on a limited scale, but is of no importance to the inquiry as to the origin of the ancient crystalline rocks themselves. These views of the generation of various crystalline rocks by the alteration either of plutonic rocks or of earthy sediments through the addition or subtraction of foreign matters in solution, are now being supplanted by that above defined, which supposes the direct aqueous origin of those rocks and their constituent minerals.

The relations of the internal heat of the earth, which has been found to increase at the rate of about 1° F. for every 50 feet of depth to more than 3000 feet, are very important in connection with geological chemistry. The earth is slowly cooling, and it can be shown that at an early period in its history, when this process was less advanced, the augmentation of heat in descending must have been much more rapid than it now is, so that atmospheric waters penetrating the crust to no great depth would attain a temperature at which their solvent power would be greatly increased. It has been found that water, either pure or impregnated with the saline matters often met with in mineral waters, such as alkaline carbonates and alkaline or earthy sulphides, has its solvent power greatly exalted when heated under pressure to temperatures above the ordinary boiling-point. Experiments thus conducted have shown that it is possible to crystallize quartz, pyroxene, zeolites, and many other mineral species, including the metallic sulphurets and sulpharseniets, which are our common metallic ores. Pressure alone, moreover, aids the solution of bodies in water by favoring that condensation which is one of the conditions of solution, as has been shown by the experiments of Sorby in operating under great degrees of pressure upon mixtures of water and soluble salts. A vast number of bodies generally classed as insoluble in water, or nearly so, are known to present modifications, often very unstable, under which they are readily soluble in water, and are the soluble forms of colloids. Water seems, in fact, under favorable conditions of temperature, pressure, and saline impregnation, to realize pretty nearly the conception of a universal solvent or menstruum, which, penetrating at considerable depths through highly-heated strata, dissolves from these great quantities of mineral matters. Coming towards the surface again, where both pressure and heat are diminished, it deposits these materials, and thus gives rise to the crystalline fillings of veins or to superficial deposits.

The Eozoic or crystalline stratified rocks consist of several distinct series, deposited, like the later formations, through long ages, and sustaining to each other such relations as to show that one series had been partially broken up or destroyed before the deposition of the succeeding one. Each in its turn consists of feldspathic, hornblendic, and micaceous silicates, with quartz rocks, limestones, iron ores, etc.; and in each series at present known we find some evidences of the destruction of a preceding series, so that the fundamental rock remains as yet undiscovered. The substratum of granite, in the sense generally understood of a first-formed rock, is nowhere known, and it is the granite-like gneiss of the Laurentian or oldest Eozoic series which has given rise to the notion of an underlying granite. A study of the elements of these crystalline rocks shows that essentially the same chemical agencies were at work in those earlier times as at present, and that the differences are rather in kind than in degree. Silicates of magnesia, like serpentine, have been found not only in the Silurian, but as late as the Cretaceous period; sepiolite is found in the Tertiary; triple silicates, related to chlorite, fill the pores of Palæozoic crinoids; and glauconite is found in similar conditions in more recent foraminifera; while the deposition of crystalline zeolites comes down to the historic period; all of which processes show the continuation, though under enfeebled conditions, of processes which were once very active at the earth's surface. Further illustrations of this will be given when we come to speak of mineral springs and of vein-stones.

The agencies of organic life are among the most important of those which from a very early age have contributed to changes in the chemistry of the earth. We have seen that there is reason to believe that the condition of the first-formed globe was one of general oxidation, and hence endeavored to show that after the affinities of the stronger acids were satisfied, the whole of the sulphur must have existed as sulphates, all of the carbon either as carbonates or free carbonic acid, all of the hydrogen as water, and all of the iron and other readily oxidable metals as oxides, either combined as silicates or set free by the partial decomposition of these. A great problem to be solved is that of the deoxidation of these elements as a condition preliminary to their entering into new combinations; and this, so far as we know, can be effected in one way only—namely, by the intervention of organic life. It is the function of vegetation under the stimulus of solar light and heat to decompose carbonic acid and water, setting free oxygen, and giving rise to hydrocarbonaceous bodies, both organized and unorganized, which in many cases, after having served the purposes of plants, become in turn a part of living animals. When in the course of nature plants and animals die, their remains, in a dead or disorganized form, constitute what is sometimes comprehensively spoken of as organic matter. This, by taking up oxygen either in the process of combustion or of slow decay, is again transformed into carbonic acid and water, not to speak of the nitrogen which is present in greater or less extent in organisms, and is again liberated either as gaseous nitrogen, as ammonia, or as nitrate. While living, the vegetable organism effects the reduction of carbonic acid and water (and to a less extent of sulphates), and is thus the source of carbon and hydrogen as they appear in the earth in the various forms of graphite, coal, petroleum, and hydrocarbon gases. In addition to this, growing plants and animals reduce sulphates, as appears from the sulphuretted compounds which occur in many of them. These organisms, moreover, by a process of selection, remove from the media in which they live certain mineral elements, which through this intervention become fixed and concentrated. Thus, the phosphates of the soil through vegetation are accumulated in the bones of vertebrate animals. Potash is removed in like manner both by terrestrial and marine vegetation, and by the latter also the metals found in the sea—silver, lead, and copper—are removed from its waters and fixed in the organic tissues, by which means they are removed from the oceanic circulation, and by the decay of these in contact with the ooze of the bottom or the mud of the shore are again restored to the earth, from which they are as constantly dissolved and taken down to the sea, the waters of which, but for the intervention of organic life, would become charged with these mineral elements. But the results of the decay of animal and vegetable organisms are not less important through their reducing action, due to their affinity for oxygen which is demanded in the retrograde metamorphosis by which the elements return to their original highly oxidized condition. In virtue of this power they reduce soluble sulphates, like those of the alkalies and the alkaline earths, to the condition of sulphides; the carbonic acid which results from the oxidation of carbon in this process in its turn decomposes these sulphides, liberating sulphuretted hydrogen gas, the partial oxidation of which, removing the hydrogen, produces deposits of sulphur. The soluble sulphides or the sulphuretted hydrogen resulting from this process of reduction give rise to the insoluble metallic sulphides which are so abundant in the rocks as metallic ores. Native metals like copper are also probably due to the reducing action, either directly or indirectly, of organic matters; and the power of these substances to reduce the insoluble peroxide of iron which abounds in the soils into a protoxide, which is soluble in solutions of carbonic acid or of certain organic acids, themselves the products of vegetable decay, permits the removal of this element from certain beds of rocks, and its accumulation in certain others in the shape of oxidized ores, such as limonite, hematite, or siderite, or, when the decomposition of sulphates concurs, of pyrites.

There is another agency which is not less important in its relations to the chemistry of the rocks, and that is the slow sub-aërial decomposition of the crystalline silicated rocks under the influence of atmospheric agents. In those regions of the earth from which comparatively recent changes have not removed the products of decay this process is seen to have attacked the feldspars, removing from them their protoxide bases, together with a portion of silica, leaving behind a hydrated silicate of alumina or clay. In like manner the protoxide silicates like hornblende and pyroxene have given up in a soluble form the lime and magnesia which they contained, together with a part of the silica, leaving behind with the remaining silica the oxides of iron and manganese raised to a higher degree of oxidation. The decomposition of other silicates, such as mica and chlorite, has been as yet but partially studied, but the quartz remains unchanged. This process of decay is seen to have penetrated to a depth of several hundred feet in many regions, and the beds and veins of metallic sulphides enclosed in the decayed crystalline rocks have

undergone a somewhat similar change, which has resulted in the loss of the sulphur, copper, and zinc in a soluble form, leaving behind a residue of hydrous peroxide of iron, which forms in many of these cases an ore of that metal. This process of decay has doubtless been effected by the action of the carbonic acid and oxygen of the air dissolved in atmospheric waters, which, while oxidizing iron and sulphur, have removed in the form of carbonates, the bases lime, magnesia, and the alkalies, together with a portion of silica, which was liberated from its compounds in a soluble form. Such a process as this was doubtless active from a very early period; and this decay was a preliminary to the process of denudation by the action of water, which removed the clay and separated it from the unchanged quartz; which latter, by its further attrition, gave rise to grains of sand. From the vast quantities of this decaying matter the clays of all the argillaceous strata of the various geological periods have been derived, while from the silica set free in a dissolved form during the process of decay have come the great deposits of flint, chert, hornstone, agate, etc. which abound at many different horizons, and also certain crystalline sands which appear to consist not of the quartz from the decay of ancient granite-like rocks, but rather of crystalline quartz directly deposited from solutions.

The carbonates which in a dissolved form have come from the decaying crystalline rocks, and have been conveyed to the sea, have played an important part in the chemistry of its waters. It would appear from *a priori* considerations, in accordance with the views already put forth, that the early sea must have contained a great predominance of lime and magnesia salts relatively to the soda salts; in other words, that a much larger part of the chlorine which the ocean must have from the first contained was combined with earthy bases, and a less portion consequently with sodium, than in the modern ocean. In strict accordance with this is the fact that the saline mineral waters of the older rocks, which may be looked upon as fossil sea-waters imprisoned since a very early date, contain a great predominance of chlorides of calcium and magnesium, while in modern sea-waters, as in the bitterns resulting from their evaporation, there is no chloride of calcium found, the sulphates of the sea being sufficient not only to convert into gypsum the whole of the lime present, but to yield, moreover, a large proportion of sulphate of magnesia. Now, as the proportion of sulphates in the sea has not been augmented in the course of ages, but, on the contrary, has diminished, not only by the gypsum deposited, but also by the sulphur reduced and separated either in a free state or as metallic sulphides, it follows that this changed condition of the sea-water as regards the proportion of the lime to the sulphate must have been brought about by the abstraction of lime in other forms than that of sulphate. No compounds of this base other than sulphate and carbonate being found in the rocks since the beginning of Palæozoic time, it follows that the lime must have been removed as carbonate from the sea in which it must have previously been present in a soluble form. In other words, the bicarbonates of soda and magnesia derived from decaying rocks have the power of decomposing chloride of calcium, with the formation of chloride of sodium and the separation of carbonate of lime which, either directly or indirectly, has been separated in the form of limestone.

Another not less important factor in the chemistry of the sea has been evaporation. Climatic conditions have over large areas favored the evaporation of waters, as is now the case in certain desert regions, and enclosed sea-basins have often been subject to this action. The result of this process of evaporation on sea-water is to cause the deposit of the sparingly soluble sulphate of lime; and if, as was the case in the early seas, the lime-salts were in excess, the whole, or very nearly the whole, of the sulphates would be removed, sulphate of lime being much less soluble in strong saline liquids than in pure water. A further continuation of the process of evaporation would give rise to the separation of rock-salt, and at a later stage to salts like carnallite, tachydrite, and karstenite, which are found in a solid form in certain saliferous formations, with all the evidences of a slow evaporation of sea-water. In connection with this process of evaporation an important reaction takes place between waters holding sulphate of magnesia and solutions of bicarbonate of lime. This latter compound is found in most river and spring waters, and is either derived from the direct decomposition of rocks containing silicate of lime, or from the solution, by means of atmospheric carbonic acid, of previously formed carbonate of lime. By the reaction between bicarbonate of lime and sulphate of magnesia there are formed sulphate of lime and bicarbonate of magnesia. The latter is much the more soluble of the two, pure water being capable of holding about nine parts of carbonate of magnesia as bicarbonate for one part of sulphate of lime. Thus, from an evaporating sea-basin fed with solutions of bicarbonate of lime, gypsum is deposited, while the more soluble magnesian carbonate, being subsequently thrown down mixed with a variable portion of carbonate of lime, furnishes the material for dolomite and magnesian carbonates of lime. This reaction, then, results in the elimination from the waters subjected to it of both the elements of the sulphate of magnesia. Another not less important reaction in connection with evaporating waters is of even greater significance as regards the formation of magnesian limestones. When waters, charged with carbonates of lime, magnesia, and soda from the decay of rocks, flow into the sea, the latter bases, replacing lime in the soluble salts of the water, give rise to carbonate of lime; but when, in a confined basin, the sulphate and chloride of calcium are at length decomposed, the carbonate of soda attacks the magnesium salts, giving rise to bicarbonate of magnesia, which, added to that accompanying the soda-salt, soon causes the accumulation in the basin of an abundance of magnesian carbonate, which by evaporation is deposited, mingled with lime-carbonate, and is itself a still more frequent source of magnesian limestones. These, resulting from the intervention of carbonate of soda, are distinguished from those produced by the previously described reaction by the absence of associated gypsum. In both cases, however, the great solubility of the magnesian carbonates is such that evaporation is an indispensable condition for the generation of these magnesian deposits, which, from their geological relations, are shown to have been formed in limited basins.

Closely related to this subject is that of saline and alkaline mineral waters: of these the first consist of the elements of the ocean-waters imprisoned in the ancient strata, sometimes as fossil sea-water, and at other times as the bitterns or the solid salts resulting from its evaporation. From these sources, which in fissured and dislocated strata are in communication with atmospheric waters, the saline matters, more or less diluted, are brought to the surface as mineral springs. The source of alkaline springs is to be sought in the slow subterranean decomposition of feldspathic sediments, which yield to infiltrating waters carbonated or silicated alkalies; and from the mingling of these with the saline waters already mentioned various intermediate kinds of waters are produced. The deoxidation of sulphates by organic matters, in the manner already explained by the intervention of decaying organic matters, aided in some cases by the action of carbonic acid, explains the origin of the sulphuretted hydrogen and the soluble sulphides which abound in many mineral waters. Alkaline mineral waters hold in solution large quantities of free silica, but besides that many of them contain dissolved silicates of lime and soda. The reaction of these upon magnesian salts in saline waters gives rise to a very insoluble silicate of magnesia, which in some uncrystalline formations is found accumulated in large beds under the name of sepiolite or magnesian marl. From analogous compounds formed in a like manner in earlier geological periods, it is probable that magnesian silicates like serpentine, chrysolite, and talc have originated. Many neutral and alkaline mineral waters contain, besides silica, a portion of alumina in a soluble form, from which may be generated aluminous silicates. In the deposits from mineral waters we find an explanation of the origin of the minerals of metalliferous and other vein-stones, which are accumulations in fissures that once were channels for aqueous solutions of mineral matters.

The origin of volcanic products is a problem of great interest in geology. The various molten rocks and lavas poured out from beneath the surface of the earth, sometimes imperfectly fused and enclosing crystalline mineral species, sometimes vitreous and homogeneous, embrace great varieties in chemical composition, and are moreover accompanied by watery vapor and several gaseous products, chiefly sulphuretted hydrogen, hydrochloric and carbonic gases. The origin of all these has been sought to be explained by different hypotheses, but the one which seems the most rational is that which ascribes them to the action of heat upon stratified rocks. Whether the source of this heat be conduction from the igneous centre, or, as supposed by others, due to mechanical movements in the earth's crust, or rather to the heat from the one source seconding and supplementing the other, we may conceive that its effect upon heterogeneous strata containing, besides siliceous and argillaceous matters, carbonates, chlorides, sulphates, and organic matters, the whole permeated with water, would be to generate both the gaseous and the stony products of volcanoes.

It is impossible within the limits here assigned to discuss all of the questions which arise in connection with the

chemistry of geology, but we have endeavored in the preceding pages to touch briefly upon some of the more important problems which it presents, and to offer such solutions as seem most in accordance with the present state of geological and chemical knowledge. T. STERRY HUNT.

Geomet′rical Mean, the second of three continued proportionals, or the second of the terms of a geometrical progression containing three terms. The geometrical mean of two numbers is equal to the square root of their product. If we assume two terms, and insert any number of terms, so that the whole forms a geometrical progression, all the inserted terms are called geometrical means to these two.

Geomet′rical Progres′sion is a series of numbers, each one of which is the product of the preceding one multiplied by a common and constant ratio. A geometrical progression may be increasing or decreasing, according as the constant ratio is greater or less than unity.

Geom′etry [Gr., from γῆ, the "earth," and μέτρον, "measure"], that branch of mathematics whose object is to investigate the properties and relations of geometrical magnitudes.

Subject-matter of Geometry.—The subjects treated of in geometry are *volumes, surfaces, lines,* and *angles.* A volume is a limited portion of space; it has three dimensions—length, breadth, and thickness or height. That which separates a volume from the rest of space is called a *surface;* a surface has length and breadth, but not thickness. If we conceive a surface to be made up of two parts, that which separates these parts is called a *line;* a line has length, but neither breadth nor thickness. If we conceive a line to be made up of two parts, that which separates these parts is called a *point;* a point has position, without length, breadth, or thickness. These are the fundamental concepts of geometry. Considered in a reverse order, we may conceive a line to be generated by a point moving according to some fixed law; a surface to be generated by a line moving according to some fixed law; and a volume to be generated by a surface moving according to some fixed law. (See FLUENTS AND FLUXIONS.) In taking this view of the subject we have the additional concept of *direction.* The difference of direction of two lines, or the inclination of one line to another, is called an *angle.*

Division of Geometry.—Geometry is divided into two branches—*elementary geometry,* and *higher* or *transcendental geometry.* 1. Elementary geometry treats of those magnitudes whose elements are the straight line and the circle. It embraces all propositions relating to plane figures whose elements, or bounding lines, consist of straight lines or arcs of circles; it also embraces all propositions relating to surfaces and volumes whose elements, or bounding surfaces, may be generated by the revolution of a straight line or of an arc of a circle; it also embraces all constructions that can be made by the aid of the straight line and circle. 2. Higher or transcendental geometry embraces those branches in which the elements are more complex than the straight line and circle; as, for example, conic sections, cycloids, and the like. In this branch are included those higher investigations of the ancients which are now more elegantly made by means of analytical geometry and the calculus.

Objects of Geometry.—The object of geometry is to deduce the properties and relations of geometrical magnitudes. A *property* of a geometrical magnitude is an attribute that is common to every individual of the class to which the magnitude belongs; thus, it is a property of a triangle that the sum of its three angles is equal to two right angles. A property may be *characteristic,* or *secondary.* A characteristic property is one that is peculiar to a particular class of magnitudes, but is not possessed by any other class; thus, it is a characteristic property of a triangle that it has but three angles. A secondary property is one that is shared by magnitudes of other classes; thus, it is a property of a square that its area is equal to the product of its perimeter by the radius of the inscribed circle. This property is secondary, because it is a property common to all regular polygons. The enunciation of a characteristic property is a sufficient definition of a magnitude. In fact, the definition of a magnitude usually consists of a statement of one or more of its characteristic properties; thus, we say that a triangle is a polygon having three angles: it might also be defined as a polygon of three sides. Since the same magnitude may have several characteristic properties, it follows that the same magnitude may have several definitions.

The *relations* deduced by geometrical reasoning are of two kinds: those of equality or inequality, and those of proportionality. As an example of the first kind of relation we may instance the following: any side of a triangle is less than the sum of the other two, and greater than their difference. As an example of the second kind of relation we may instance the following: similar triangles are to each other as the squares of their homologous sides.

Methods of Investigation.—The truths of geometry form a chain of dependent propositions which may be divided into three classes. The *first* class of truths are those implied in the definition; for example, when we say that a quadrilateral is a polygon of four sides, we imply that such a figure may exist. The *second* class of truths are self-evident or intuitive; these are called axioms; thus, the proposition that a whole is greater than any of its parts is self-evident—that is, its truth is universally admitted. The *third* class of truths are those which are inferred from definitions, axioms, and truths already established; these are called demonstrative truths. The train of reasoning by which a geometrical truth is inferred from truths already established is called a demonstration. Two methods of demonstration are employed—the *direct* and the *indirect.* The direct demonstration consists of a train of logical arguments in which the successive premises are definitions, axioms, and truths previously demonstrated, and in which the final conclusion is the truth to be established. Thus, the method of demonstrating Prop. v. book iii. *Davies' Legendre,* that "two triangles which have two sides, and the included angle of the one, equal to two sides, and the included angle of the other, each to each, are equal in all their parts," is direct. In the indirect method at least one of the premises is an hypothesis, that is, a supposed truth. There are two species of indirect demonstration. In the *first* species there may be several hypotheses, of which one, and only one, can be true; in this case we show that all of these hypotheses except one are false, and then we infer the truth of this one. This is the method by *exclusion.* The demonstration of Prop. xvii. book iii. *Davies' Legendre,* in which it is shown that "in equal circles, incommensurable angles at the centre are proportional to their intercepted arcs," belongs to this species. In the second species of indirect demonstration an hypothesis is made which is contradictory to the proposition to be demonstrated; this hypothesis is then treated as though it were true, and the reasoning is carried on, using no other propositions except those that are known to be true, until a conclusion is reached that contradicts some known truth; the contradictory of the assumed hypothesis is then inferred to be true. This species of demonstration is called the *reductio ad absurdum.* The demonstration of Prop. iv. book i. *Davies' Legendre,* in which it is shown that "if a line meets two other lines at a common point, making the sum of the contiguous angles equal to two right angles, the two lines met form one and the same straight line," belongs to this species of demonstration.

Besides the methods of investigation already given, there is a mode of demonstration which was much used by the ancients in their higher investigations, known as the *method of exhaustions.* This method is closely connected with the modern *method of limits.* As an example of this method we may instance the mode of determining the area of a circle in plane geometry. It is first shown that two regular polygons, having the same number of sides, can be constructed, the one inscribed within, and the other circumscribed about, a given circle whose areas differ from each other by less than a given area. By continually increasing the number of sides, this difference is continually diminished or *exhausted;* as the two polygons approach each other in area, each becomes more nearly equal to the circle; finally, when the number of sides is made infinitely great—that is, when the limit is reached—the two polygons become equal to each other and to the circle. This method of proceeding enables the geometer to find an approximate value for the area of the circle true to within any desired degree of accuracy. The ancients applied the method of exhaustions to a great variety of propositions both in elementary and in higher geometry.

History of Geometry.—The following sketch of the history of geometry has been compiled, mostly from Rouché and De Comberousse. Ideas of form and extension are as old as the human race, but the first attempts to co-ordinate and systematize them were made by the Egyptians and Chaldæans. Geometry, as a science, was introduced into Greece by Thales of Miletus (637–548 B. C.); he founded the Ionian school, and is said to have demonstrated many propositions which were afterwards incorporated with Euclid's *Elements.* It was Thales who discovered the properties of similar triangles. Pythagoras of Samos, a disciple of Thales (580 B. C.), founded in Italy the celebrated school which bore his name. He demonstrated the relation between the three sides of a right-angled triangle, and showed that the circle contains a greater area than any plane figure having the same perimeter, and that the sphere contains the greatest volume bounded by a given surface. He also investigated the properties of regular polyedrons, and established those

relations which formed so conspicuous an element in the cosmogonies of the Middle Ages. Plato (430–347 B. C.) laid the foundation of the analytical method; he investigated the nature of the conic sections and developed the fundamental principles of geometrical loci. It was in the school which he established that the noted problems of the *duplication of the cube* and the *trisection of an angle* were first discussed. It is said that Plato himself gave a solution of the first of these problems. Euclid, who belonged to the famous school of Alexandria, flourished about the year 285 B. C. He wrote on various mathematical subjects, but he is especially noted as the author of the *Elements of Geometry*, in which he collected and systematized all the truths and principles of elementary geometry that were known before his time, and to which he added many new ones. It is in Euclid's *Elements* that the method of proof known as the *reductio ad absurdum* first appears. Many of his works have been lost, the most important of which is his treatise on porisms. His *Elements of Geometry* have been translated into all civilized tongues, and to the present day form a favorite text-book for elementary instruction. Immediately after Euclid came Archimedes and Apollonius, two of the most distinguished geometers of the most brilliant era of the Alexandrian school. The attention of Archimedes (287–212 B. C.) was specially directed to metrical geometry. He determined the ratio of the diameter of a circle to its circumference, and also investigated the areas of the circle and parabola. He discussed the properties of spirals, the relation of the sphere to its circumscribed cylinder, and the cubature of spheroids and conoids. The writings of Apollonius (247 B. C.) relate to the geometry of form. He composed a treatise on conic sections, in which he developed the properties of asymptotes, foci, conjugate diameters, and normals. He also wrote on the subject of maxima and minima, and it is to him that we owe the theory of cycles and epicycles, which was employed for so long a time in explaining the apparent motion of the bodies of the solar system. The successors of Archimedes and Apollonius directed their studies towards those branches of geometry which have a particular bearing on the science of astronomy. Hipparchus (150 B. C.) discovered the method of projecting the sphere stereographically, also the properties of transversals in both rectilineal and spherical triangles. Pappus discovered the principle of the theorem now known as Guldin's; he also discovered the fundamental principle of the anharmonic relation and the properties of a hexagon inscribed in a conic section. The school of Alexandria was destroyed when that city was taken by the Arabs about 640 A. D. During the following centuries there sprung up in the school of Bagdad a few able commentators on those writings of the Greeks that had escaped the disasters incident to the Arabian conquest, but throughout the rest of the world a profound stagnation took place, which remained unbroken for nearly 1000 years, and clearly marked the line of division between ancient and modern geometry. The ancients were in full possession of the two great methods, geometrical synthesis and geometrical analysis, and by their aid "they built up a grand and symmetrical fabric of geometrical truth, which certainly may contest the palm with the achievements of any age, and whose positive value has only been surpassed by the acquisitions of our own." It was not till the middle of the sixteenth century that geometry showed any signs of revival. Vieta (1540–1603) developed the science of symbolical algebra, and applied it to the solution of problems in geometry. He constructed graphically the roots of equations of the second and third degrees, and was the first to solve the problem of drawing a circle tangent to three given circles. In the writings of Kepler (1571–1631) and of Fermat (1570–1633) we have the first germs of the method of infinitesimals. Pascal (1623–62) and Desargues (1593–1663) extended and improved the ancient methods of geometrical analysis, and laid the foundation of that new geometry which has received such a wonderful development during the present century. The ancients studied the properties of conic sections on the cone itself, and often made use of tedious demonstrations, differing in method for each of the three classes of curves. Desargues, whom Poncelet calls the Monge of his age, generalized the methods of investigation, and by an extension of the properties of the circle which forms the base of the cone he reached demonstrations that were equally applicable to all of the classes. Descartes (1586–1650) created the science of analytical geometry, which produced a complete revolution in the method of geometrical investigation, and for a time checked the progress of pure geometry. A few eminent writers, amongst whom may be named Huyghens and La Hire, resisted the change, and worthily sustained the character of the ancient methods. The discovery and development of the infinitesimal calculus by Newton and Leibnitz gave an additional check to the progress of pure geometry. The ease with which this new branch of mathematics could be applied to geometrical investigation and the study of natural phenomena caused it to absorb almost exclusively the labors of the most illustrious geometers of the age. There were, however, a few exceptions. Newton showed in the *Principia* that the ancient methods could be employed in researches of the highest order. Cotes and Maclaurin applied their methods to the study of geometric curves. Halley and Simpson also strove to revive a taste for the ancient geometry, but no decided advance was made till the time of Monge and Carnot. At the beginning of the nineteenth century the creation of descriptive geometry by Monge marked a new era. This new science was of immense assistance in studying the properties of bodies. It showed the intimate relation between plane figures and figures in space, and at once enriched the science of geometry by many new and elegant methods of investigation; by permitting the deduction of properties of figures of three dimensions from those of two dimensions, it contributed in no small degree to the revival of pure geometry. The appearance of Carnot's *Geometry of Position* and his essay on transversals still further directed the attention of mathematicians to the possibility of obtaining, by the principles of pure geometry, all the results that had been reached by the analytical methods of Descartes. To the labors of Carnot and Monge must be added those of Poncelet, who, in his treatise on the properties of projections of figures, was able, by a skilful employment of the principle of continuity and the beautiful theories of reciprocal polars and of homological figures, to deduce all the known properties of lines and surfaces of the second order. Passing over numerous writers on the recent geometry, mention must be made of Chasles, whose great works are his higher geometry, his treatise on porisms, and his memoir on duality and homography. These developments of the recent geometry are a continuation of the methods of geometrical analysis of the ancients, as revived by Pascal and Desargues, but they possess an immense advantage over those methods in their generality and systematic uniformity of proceeding. W. G. PECK.

Geoph'agism [Gr. γῆ, "earth," and φαγεῖν, to "eat"], or **Dirt-eating,** a habit which prevails in many parts of the earth among uncivilized nations, who often, even when the supply of food is good, resort to this habit. The Ottomacs of South America eat upon an average, we are informed, a pound and a half of ferruginous clay daily. Clay for eating is a regular article of merchandise in Bolivia; and the negroes and lower classes of whites in some of the U. S. have a similar practice. In Lapland and Northern Scandinavia bergmehl is mixed with flour in making bread, but it is by no means unlikely that the diatoms it contains are nutritious to some extent. From Lollhagysyön alone hundreds of cartloads of bergmehl are sold yearly. Dirt-eating is a common habit among the West Indian blacks, and in the Hudson's Bay country among the Indians, where a soft steatite is eaten, probably to allay hunger. Dirt-eating is also one of the forms of the *pica*, *malacia*, or depraved appetite, common among chlorotic young women, in whom it is not improbable that some stomachic uneasiness of local or reflex origin may be relieved by it.

George, duke of Saxony, the second son of the late King John of Saxony, was b. Aug. 8, 1832. He received a military education; entered early into the artillery, and gave the first proofs of his ability in the campaign of 1866, during which he commanded a brigade of cavalry as major-general. In the beginning of the Franco-German war of 1870 he commanded the first division of the Saxon army corps, but after the battle of Metz, when his elder brother was appointed commander-in-chief of the fourth army, he received the command of the whole army corps, and led it with distinction in the encounters of Nouart and Beaumont, in the battle of Sedan, and during the siege of Paris. After the war he retained his command, with the rank of general. AUGUST NIEMANN.

George I., the first Hanoverian king of Great Britain, b. at Osnabrück May 28, 1660, was the son of Ernst August, elector of Hanover, and great-grandson, on his mother's side, of James I. of England. In 1682 he married his cousin, known as Sophia of Zell, from whom in 1694 he was divorced on account of her adulterous intrigue with Philip, Count Königsmark. In 1698 he became elector; served against the Danes and Swedes 1700; and held a high command in the war of the Spanish succession 1701–09; succeeded Anne as sovereign of Great Britain in 1714 in consequence of the exclusion of the Stuarts; was never popular in England, which he in turn disliked, although he served British interests faithfully and (for a king) with more than ordinary ability; but his private character was thoroughly bad. Memorable events of his reign were the first Jacobite rebellion (1715–16); the failure of the South Sea Company (1720); the restoration of the Order of the Bath

(1725); the Spanish war of 1726. D. near Osnabrück June 10, 1727.

George I., king of Greece, with the title "king of the Hellenes," was b. at Copenhagen Dec. 24, 1845, second son of the king of Denmark. In 1863 he accepted his present position, King Otho having been deposed. The Cretan war (1866–69) and the troubles with brigands have caused some complications with foreign powers, but thus far (1875) his reign has been somewhat prosperous and tolerably quiet. In 1867 he married a niece of the Russian czar. His children are to be bred in the Greek faith, but the king is a Lutheran.

George II., of Great Britain, b. at Hanover Oct. 30, 1683; was throughout life an object of dislike to his father, in consequence of which his education was slighted, and his intellect, not naturally brilliant, suffered from this neglect; married in 1705 the princess Wilhelmina Carolina of Brandenburg-Anspach, whose remarkable abilities for many years made good the defects of her husband; fought with conspicuous valor at Oudenarde 1708; succeeded his father in 1727. His English reign was singularly adorned by men great in art, letters, war, and diplomacy. The king's fondness for war led him to take command at the battle of Dettingen (1743), where by good luck he won a victory in spite of tactical blunders. Other great events of his reign were the battle of Minden 1739; of Fontenoy 1745; the second Stuart invasion 1745–46; the wars of Clive in India; and the conquest of Canada. The king was a man of obstinate temper and of vicious habits, and was far more fond of Hanover than of Great Britain, where he was personally unpopular; but he advocated liberal public measures, by means of which England made great material and industrial progress. D. at Kensington Oct. 25, 1760.

George III., of Great Britain, son of Frederick, prince of Wales, was b. in London June 4, 1738, and succeeded his grandfather, George II., in 1760. He was the first Hanoverian king who had a British education and a deep regard for his country, but his patriotism proved a far worse thing for his subjects than the neglect and open dislike shown by his predecessors. He was a man of conscientious principles, and felt a high regard for religion and morals, which contrasted strangely with the lewdness of the two preceding as well as the two succeeding monarchs; but this was neutralized by his intellectual sluggishness, his blind obstinacy and craft, his revengeful and long-remembering hostility to those who opposed his reactionary policy, and his equally blind partiality to his political friends. The annals of his reign of sixty years, the longest in English history, are replete with great events, among which are the Spanish war of 1762–63; the Wilkes controversy 1762–82; the passage of the American Stamp Act 1765; the publication of the Junius letters 1769–72; the American Revolution 1775–83; the Fox and North coalition 1783; the French Revolution 1789 *seq.*; the Irish Rebellion 1798; and the Napoleonic wars. (See NAPOLEON I.) The king's mind was naturally infirm, and in 1810 a fifth attack of insanity came on and proved incurable. Blindness also supervened, and in 1811 the prince of Wales became regent. The Tory foreign policy of the king was continued until Napoleon's power was finally crushed. D. at Windsor Jan. 29, 1820. His reign is memorable as a time of great literary and industrial activity.

George IV., king of Great Britain, b. Aug. 12, 1762; received a careful training, but became early conspicuous for loose moral habits, which he never abandoned; in 1781 joined the Whig opposition to his father's public policy; in 1791, in consequence of misconduct on the turf, he got into trouble with his Whig friends, and then became, and ever after remained, a Tory; married Caroline Amelia of Brunswick 1795, and in 1796 separated from her on the ground of her supposed adultery, for which she was, however, not brought to trial until 1820, and was then acquitted. In 1811, George became regent, and in 1820 king. The wars with Napoleon, that of 1812–15 in North America, the Catholic emancipation, the conquest of Aracan and the Tenasserim provinces, the slow but healthy advance of liberal ideas in Great Britain, so vigorously and constantly opposed by able Tory leaders, and, above all, the progress of the physical sciences, pure and applied, in England, make the reign of George IV. one of the most interesting periods of British history. (See THACKERAY, *The Four Georges*, 1860; *The Greville Memoirs*, 1874.) D. at Windsor June 26, 1830.

George V., ex-king of Hanover. See CUMBERLAND AND TEVIOTDALE, DUKE OF.

George, SAINT, patron of England and of Russia, is reputed to have been b. in Palestine in the third century. According to the legend, he became a prince in Cappadocia, and was distinguished for his exploit of rescuing a king's daughter from a dragon. He was a Christian, and suffered martyrdom at Nicomedia Apr. 23, 303, for having torn down the edict of Diocletian against Christians, the emperor himself being then in the city. Saint George is venerated in the Eastern and Latin churches, and even by the Mohammedans is regarded with great reverence. Gibbon and others identify him with George of Cappadocia, a fuller, who in 356 A. D. was made bishop of Alexandria by the Arians, and in 361 was killed by the pagans, whom he grievously oppressed. But the latest authorities decide that Saint George is not identical with the Cappadocian fuller.

George (ENOCH), b. in Lancaster co., Va., in 1767; entered the Methodist Episcopal ministry as an itinerant in 1790, while residing in North Carolina; was made presiding elder in the Charleston (S. C.) district 1796, where his powerful eloquence and great zeal led to a large increase in the numbers and effectiveness of his denomination. In 1816 he was chosen a bishop, after which his usefulness was still more conspicuous. He was a man of rare native abilities, and was widely known and beloved. D. at Staunton, Va., Aug. 23, 1828. ABEL STEVENS.

George (WILLIAM S.), b. in Derby, Vt., Mar. 3, 1825; removed to New Hampshire, and attended the common schools; at thirteen years of age commenced learning the trade of a printer; at twenty removed to Massachusetts; became foreman, printer, and editor; in 1862 removed to Michigan; won his chief success in journalism on the Detroit *Tribune;* since 1868 has been publisher and editor of the Lansing *Republican*, and head of the firm of State printers and binders by contract.

George, Lake, a beautiful sheet of water in the State of New York, extending N. N. E. and S. S. W., and having Warren co. on the N. W. and Washington co. on the greater part of its S. E. border. Its length is 36 miles; its breadth, from 1 to 3 miles. Lake George was the scene of important military operations during the French-and-Indian war of 1755–59. Here stood Fort George, Fort William Henry, and other works. The lake is 310 feet above tide. Its outlet flows into Lake Champlain. The lake contains some 300 islands. Its waters are clear, and are, in some places, 400 feet deep. Steamboats ply upon it in summer. It is sometimes called Lake Horicon, but its Indian name was Caniaderioit.

Geor'ges, tp. of Fayette co., Pa., in an important coal and iron region. Pop. 2544.

George's Creek, tp. of Barnwell co., S. C. P. 1295.

Georgetown, the capital of British Guiana, at the mouth of the Demerara. It is neatly built, but very unhealthy. Its exports of sugar, rum, and coffee are considerable. It is the seat of an Anglican bishop. P. 25,508.

Georgetown, port of entry, cap. of King's co., Prince Edward's Island, on the eastern coast, has an excellent harbor and exports provisions. Shipbuilding is carried on. It has one weekly newspaper. Pop. 760.

Georgetown, post-v. of Equessing tp., Halton co., Ont., Canada, on the river Credit, has good water-power, large paper-mills, a brisk trade, and one weekly paper. Pop. of sub-district, 1282.

Georgetown, maritime county of South Carolina. Its surface is level, and mostly covered by pine forests and by swamps, where rice is produced. The Santee River flows along its S. W. border, and the Waccamaw traverses the county, and discharges its waters into Winyaw Bay. The county has suffered much in consequence of the civil war. Cap. Georgetown. Pop. 16,161.

Georgetown, post-tp. of El Dorado co., Cal. Pop. 1023. It contains rich gold-mines.

Georgetown, post-v. of Clear Creek co., Col., located in the heart of the Rocky Mountains in a beautiful valley. Two branches of Clear Creek run through the town. It has a national bank, a newspaper-office, a number of hotels, business-houses, and shops. It is the centre of the great silver-region, and contains several large reduction-works.
E. H. N. PATTERSON, ED. "MINER."

Georgetown, post-v., cap. of Sussex co., Del., on the line of the Junction and Breakwater R. R., and the northern terminus of the Breakwater and Frankford R. R. It has 1 bank, 1 newspaper, mills, shops, 4 churches, and 2 hotels. Pop. of v. 710; of hundred, 1863.
W. F. TOWNSEND, ED. "SUSSEX JOURNAL."

Georgetown, District of Columbia, situated at the head of navigation on the Potomac, 125 miles from its mouth, lies W. N. W. of Washington, from which it is separated by Rock Creek. In 1871 its autonomy was merged in the territorial form now governing the entire district; and as we write (first session 43d Congress) a bill is pending to abolish the name and designate it a part of Washington. Founded in 1751, or nearly half a century before

the seat of government was located on the left bank of the river, Georgetown has not advanced like the rest of the country; *e. g.* its population, which in 1830 was 8441, diminished in the next decade of years 1129; and, though the following census showed an increase over the preceding one of 1000, the generation between 1830 and 1860 augmented only 292 souls. Its business has also fallen away, the construction of railroads N. W. and S. W. having diverted its former brisk trade to other places. Georgetown is the terminus of the Chesapeake and Ohio Canal, which extends 185 miles to the bituminous coal-fields in the Alleghany Mountains, and divides with the Baltimore and Ohio R. R. the transportation of coal, an average of 600,000 tons being annually received and shipped on board vessels of from 300 to 400 tons each for Northern and Eastern markets. The flour manufactured here is of first quality and highly prized, it being of the "fancy" brand, and therefore outside the regular market quotations. Six large flour-mills operate constantly; there are besides 2 corn-mills, 1 bone-mill, 1 paper manufactory, several large lumber-yards, 1 saw-mill, 2 tanneries, 2 iron-foundries, 11 churches, 3 cemeteries, 3 hotels, 2 banks, 2 street railways, 2 breweries, 1 vinegar-factory, and 1 weekly paper. The facilities for education are nowhere excelled in places of the size, Georgetown College and the Academy of the Visitation, under Catholic auspices, antedating the present century, and having long enjoyed an enviable reputation for imparting knowledge of the higher branches of learning. This place also boasts of two seminaries for young ladies and several private academies for youth, while the public schools are in an excellent condition. The Peabody Library and Linthicum Institute (founded by former residents) are located in the N. wing of a large and elegant school-building. The Aged Women's Home, a new brick edifice, is maintained by voluntary contributions of the charitably disposed, as is the parochial school attached to Trinity (Catholic) church. Water is copiously supplied by a conduit from the Great Falls of the Potomac, 14 miles distant, the works, which are of a most enduring character, having cost the general government $3,500,000, and the authorities of the District cities $1,500,000 additional for mains, pipes, etc. Georgetown is situated on a succession of heights, and fine residences abound, the place being salubrious and commanding a prospect of the Capitol, the river, Arlington, and other interesting localities. Pop. 11,384.

J. D. McGill, Ed. "Georgetown Courier."

Georgetown, post-v., cap. of Quitman co., Ga., on the Chattahoochee River and on the South-western R. R., 142 miles S. W. of Macon and 2 miles E. of Eufaula, Ala. Pop. of tp. 263.

Georgetown, post-tp. of Vermilion co., Ill. Pop. 2237.

Georgetown, post-tp. of Floyd co., Ind. Pop. 1424.

Georgetown, post-v., cap. of Scott co., Ky., on the turnpike leading from Lexington, Ky., to Cincinnati, O., 12 miles N. of the former place, and on the proposed railroad from Cincinnati to Chattanooga. It has a college, 2 female seminaries, a number of private schools, 2 banks, 2 hotels, 1 newspaper, several stores, etc. It has a fine water-power, but no manufacturing establishments. Principal business of surrounding country, farming and stock-raising. Situated in the heart of the "Blue-grass country," it is admirably adapted to the latter purpose. Pop. 1570. John A. Bell, Ed. and Pub. "Times."

Georgetown, post-tp. of Sagadahoc co., Me., consisting of Parker's Island, E. of the mouth of the Kennebec River, and 12 miles S. of Bath. Pop. 1135.

Georgetown, post-v. and tp. of Essex co., Mass., on the Newburyport R. R., 31 miles N. of Boston. It has 3 churches, one of which was built by the late George Peabody of London, a fine library and building given to the town by the same benefactor, and is the seat of the Perley Institute. Boot and shoe making and agriculture are the chief industrial pursuits. Pop. 2088.

Georgetown, post-tp. of Ottawa co., Mich. Pop. 1474.

Georgetown, tp. and post-v. of Madison co., N. Y., has 3 churches and manufactures of leather, etc. Pop. 1423.

Georgetown, post-v., cap. of Brown co., O., 42 miles E. of Cincinnati and 7 miles from the Ohio River. It has 3 churches, a large school-house, a fine court-house, a woollen-factory, steam flour-mill, a bank, 2 newspapers, 2 hotels, and 17 stores. Agriculture, and especially tobacco-raising, are leading interests. Pop. 1037.

L. B. Leeds, Ed. "Brown Co. News."

Georgetown, v. of Clermont co., O. Pop. 65.

Georgetown, v. of Coleraine tp., Hamilton co., O. Pop. 172.

Georgetown, post-v. of Greene tp., Beaver co., Pa. Pop. 297.

Georgetown, post-v. and tp., cap. of Georgetown co., S. C., on Winyaw Bay. It has 3 lumber-mills, several rice-mills, 2 newspapers, about 35 stores, and a "Winyaw Indigo Society" hall. It is a great turpentine section. It has direct communication with New York by several lines of schooners. Pop. of v. 2080; of tp. 3520.

Josiah Doar & Co., Pubs. "The Times."

Georgetown, post-v. and tp., cap. of Williamson co., Tex., 25 miles N. of Austin, in a healthy section and surrounded by picturesque scenery. It is the seat of the "Texas University," has several churches, 2 schools, and 1 newspaper. Principal business, agriculture. Pop. of tp. 479. Wm. K. Foster, Ed. "Williamson Co. Record."

Georgetown College, D. C., founded in 1789, when the first building was erected; classes begun in 1792; chartered by Congress as a university 1815; medical department organized 1851; law department 1870; buildings were added from time to time, the last in 1854. Students can enter the college at any age, though young children are not admitted, and no previous scholastic attainments are required beyond the mere rudiments of knowledge. The applicant is examined, and placed in the class for which he is fitted by his previous course of study. For those who begin at the lowest point a seven years' course is required; this term may be shortened by extraordinary diligence or proficiency, but promotions are rarely made except at the close of the scholastic year. Each student undergoes a careful examination twice a year in all his studies. Marks are kept in each class; the general result is read publicly every month, and tickets of excellence are awarded to the most meritorious. Those who fall below a certain standard are punished by the withdrawal of certain privileges, or by being sent to a lower class, or, if persistently idle, they are dismissed from the college. Quarterly reports of each student's literary progress and moral conduct are sent to parents. Rewards are distributed in medals or books, or by honorable mention, at the close of the year. The studies of each class and the books used are prescribed in the annual catalogue. The class-titles used here are also explained by the class-titles employed in other colleges for the same grade. No departure from the regular course is permitted. At a future day the college may provide an extended commercial course and another course of science, but it has not been found expedient, or even possible, to inaugurate these departments as yet. The standard of the classes is rigorously kept up to the point the character of each class requires, so that the graduate of Georgetown is fully the equal in scholastic attainments of the graduate of any other American college. Graduates of these other colleges, owing to their more advanced age, may have more finish of literary culture, but can hardly be as deeply grounded in the studies which belong to their course as the students of Georgetown, owing to the close and constant supervision exercised here over every student in his studies, and the responsibility under which the student lies towards his teachers, individually and collectively. Nearly all the students board in the college. Those who do not, live with their parents. One-fourth or one-fifth of the students are non-Catholics. Students attend from all portions of the Union, but the greater portion are from the Southern States. The schools of law and medicine are conducted in Washington, and neither the professors nor the students of these schools live within the college or form any part of the community directed by its superiors. The college is, and always has been, directed by the Jesuits. It has no endowments, and is supported by the fees paid for tuition. No school of theology is carried on in connection with it.

J. S. Sumner.

Georgeville, port of entry of Stanstead tp. and co., Quebec, Canada, on the E. side of Lake Memphremagog, 13 miles from Derby Line, Vt. Pop. about 250.

George White, tp. of Blount co., Ala. Pop. 232.

Geor'gia [Russ. *Grusia*] has now no geographical signification, being divided into the Russian governments of Tiflis, Kutais, Elizabetopol, Baku, and Erivan; but it was formerly a kingdom, comprising the territory S. of the Caucasian Mountains, between the Black and the Caspian seas, and bounded S. by Asiatic Turkey and Persia. After the death of Alexander the Great the Georgians succeeded in establishing themselves as an independent people with a government of their own; and although they were conquered and made tributary several times by the Arabian caliphs, by Timoor, and by Persia, they maintained a political position as a state until the beginning of this century, when Georgia was merged into the Russian empire. Early in the fourth century (318 A. D.) the Georgians were converted to Christianity, but at present many of them are Mohammedans. Their language forms a very interesting intermediate link between the Aryan languages and the

monosyllabic ones of Eastern Asia. Georgian women are, like the Circassians, celebrated for their personal beauty.

Georgia, one of the Southern Atlantic States of the American Union, lying between the parallels of 30° 20′ and

Georgia Seal.

35° N. lat., and between the meridians of 80° 48′ and 85° 38′ W. lon. from Greenwich. It is bounded on the N. by North Carolina and Tennessee; on the E. by South Carolina, from which it is separated by the Savannah River and by the Atlantic Ocean; on the S. by Florida; and on the W. by Alabama. Its extreme length from N. to S. is 320 miles, and its extreme breadth from E. to W. 254 miles. Its area is estimated at 58,000 square miles, or 37,120,000 acres.

Face of the Country.—Georgia is well watered. The course of its rivers in the eastern half of the State is S. E., gradually turning to the S. The Savannah, which separates the State from South Carolina, is about 450 miles in length, and is navigable for large vessels to Savannah, 18 miles, and for steamboats to Augusta, 230 miles from its mouth. It has three or four considerable affluents—viz. the Brier and Broad rivers and Beaverdam Creek—and is itself formed by the union of the Tugaloo and Kiowee rivers. Like most of the rivers entering the Atlantic, it forms a considerable delta, and discharges its waters by several mouths. The Ogeechee, about 250 miles in length, rises in Greene co., and runs nearly parallel with the Savannah, discharging its waters into Ossabaw Sound; the Cannouchee is its principal affluent. The Altamaha is formed by the junction of the Oconee and the Ocmulgee: the former of these rises in Hall, and the latter in Gwinnett co., and after flowing in nearly parallel courses for about 250 miles, the latter turns eastward, and the two join to form the Altamaha. The Little Ocmulgee and the Appalachee are the principal branches of these rivers. The Ocmulgee is navigable for steamers to Macon, and the Oconee to Milledgeville. The Satilla and St. Mary's drain the south-eastern corner of the State. Between them lies the great Okefinokee Swamp. The Withalacoochee and the Allapaha, which unite in Florida to form the Suwanee, and the Ochlochonee, which falls into the Gulf in Florida, drain its southern counties. In the S. W. the Flint and the Chattahoochee, the former rising in Campbell co., and the latter in the Blue Mountains, are the principal streams. They unite at the Florida line to form the Appalachicola River. The Chattahoochee has a course of 550 miles to the Gulf, of which 350 are navigable; the Flint has a course of 300, and is navigable for steamboats to Albany in Dougherty co. In the N. W., to the N. of the Chattahoochee, which turns eastward at the 33d parallel, the Tallapoosa, one of the rivers which unite to form the Alabama; the Chattooga River and Chickamauga Creek, branches of the Coosa; and the Etowah and Oostenaula, which, uniting, form the Coosa, the other tributary of the Alabama; the Tacoah, Notley, and other affluents of the Hiawassee, and the Chattanooga, both tributaries of the Tennessee, are the principal streams which drain the hill-country. The sea-coast, extending in a direct line about 100 miles from St. Mary's to the mouth of the Savannah River, is bordered with islands, between which and the mainland are seven sounds, connected with the ocean by numerous inlets. These sounds are—St. Andrew's, St. Simon's, Altamaha, Doboy, Sapelo, St. Catharine's, and Ossabaw. The whole coast-line formed by the islands and sounds is said to be about 480 miles. The islands are of alluvial soil, very fertile, and yield considerable rice and sea-island cotton.

Surface.—The Atlantic coast, for a distance of about 20 miles inland, is low and swampy, spreading out in the extreme S. into the great Okefinokee Swamp. Where it is cleared, this land is adapted to the cultivation of rice. Where not cleared, this swampy lowland is covered with the saw-palmetto and some other semi-tropical trees. A little farther back, on the sandy lands and dunes, pines and scrub-oaks are the principal trees. About 20 miles inland the land suddenly rises, by a terrace formation, about 70 feet, and continues at the level of about 100 feet above the sea for nearly 20 miles farther, when another terrace, 70 or 75 feet high, appears, and a second table-land extends with a gradually ascending grade not far from 160 miles to the centre of the State, where, in Baldwin co., the elevation is about 575 feet above the level of the sea. At this point, about 200 miles from the sea, the foot-hills begin, and rise in the northern and north-western portions of the State to the height of 2500 to 4000 feet above the sea. These hills, which run in nearly parallel ranges to each other, though with outlying spurs, cover a breadth of nearly 150 miles. Between the eastern Appalachian chain and the Blue Mountains the country is broken up into valleys with a rocky, broken surface and short ranges of hills; between the Blue Mountains and the Cumberland the valleys are narrower, but less broken. This mountain-district covers 25 counties, lying mostly N. W. of the Chattahoochee River. Throughout this region, as well as in the counties of Middle Georgia, there are many cataracts and waterfalls of great beauty. Toccoa Falls and the cataracts of Tallulah in Habersham co., Estatoia Falls in Rabun co., Hiawassee Falls on the Hiawassee, the falls of Amicalula in Lumpkin co., and the falls of the Towalaga in Butts co., are the most celebrated.

Geology and Mineralogy.—In the varied surface of Georgia we have examples of almost every known geological formation. For about 20 miles from the coast, and including the great Okefinokee Swamp and the valley of the Savannah River for nearly 100 miles, we have alluvium rich in vegetation, but level, though with numerous sand-dunes, except where there are marshes. From the first terrace to a line running almost straight from Augusta on the Savannah River to Georgetown on the Chattahoochee, the Eocene, with its sands, clays, calcareous and siliceous strata, overlies the Metamorphic slates and gneiss. For a short distance in Jefferson co., on both sides of the Ogeechee, the Cretaceous formation appears at the surface, and seems to have pushed the Eocene rocks from their position. W. of the Eocene, beginning at Knoxville in Crawford co., running nearly due W. to and across the Chattahoochee, and along that river to Eufaula, and thence back to Knoxville, we have a Cretaceous deposit extending over a part of nine counties. N. of the Eocene and Chalk stretch the Metamorphic, Palæozoic, and Eozoic rocks of the Appalachian range, covering nearly half the territory of the State. On the Savannah River above Augusta, for a distance of 25 miles, the Silurian strata from North-western South Carolina come to the surface, and from the point in Union co. where the Notley River passes out of the State, to the foot of Dugdown Mountain in Haralson co., on the W. line of the State, the north-western counties are overlaid with Silurian rocks, with occasional outcrops of Devonian; while in the north-western corner the coal-measures belonging to that great coal deposit which occupies Central and North-eastern Alabama yield an excellent quality of bituminous coal. Immense deposits of iron ore are found at the junction of the limestone and metamorphic rocks in Bartow and Cherokee cos. In the N. W. part of the State, for 40 miles, a small mountain called Shinbone Mountain, which is simply a mass of fossiliferous iron ore, runs parallel with Lookout Mountain, less than a mile distant, in which are beds of coal. Every facility for the production of the best quality of iron at the cheapest possible rate, and under the most favorable circumstances, is found here. On the E. side of Taylor's Ridge this fossiliferous iron ore is so abundant and in such large blocks that the people near the ridges saw it into blocks to put in the backs of their chimneys, as it stands fire well. Gold is found in almost every county N. of the central line of the State. It was first discovered in Habersham co. in 1831, and is most plentiful in Cherokee, Carroll, Cobb, and Lumpkin cos. A branch mint was established at Dahlonega, Lumpkin co., in 1837, and coined in the next 24 years $6,121,919, mostly of Georgia gold. The mint was discontinued in 1861, and the buildings have been given by the government to the North Georgia Agricultural College. Efforts are now making to renew the gold-mining by the hydraulic process on a large scale. There are veins of copper ore in Gilmer co., a continuation of those which have been worked so productively in Polk co., Tenn. Silver is combined with the gold, and is also found with lead in the argentiferous galena. There is a very good building limestone in the central portion of the State, and marls and burrstones in the Eocene

region. The usual minerals found in connection with gold and silver—manganese, titanium, antimony, zinc, and graphite—also exist, but are not largely worked. Granite of good quality, marble (that of Cherokee co. being statuary marble of excellent quality), gypsum, sienite, talc, soapstone, asbestos, slate, shale, tripoli, petroleum, fluor-spar, barytes, and hydraulic cement in Bartow co., white in color and of excellent quality, are among the minerals of economic value; and among the choicer minerals and gems have been found the more precious varieties of the quartz-crystal, beryls, garnets, agates, and, it is asserted, diamonds, though not of clear water or perfect color. There are several deposits of fossils, mostly in the alluvium, which have enlisted much attention. Among the most remarkable of the fossil animals of these deposits are skeletons of the mastodon, mylodon, megatherium, one (if not two) extinct species of elephant, an extinct species of the ox, and numerous fossil species of turtles and mollusks. There are numerous mineral springs in the State, mostly chalybeate in the N. and sulphurous in the central portion of the State. The Indian Springs in the N. of Forsyth have a high reputation.

Vegetation.—The vegetation of the alluvial lands near the coast is semi-tropical. The cypress, cedar, live-oak, magnolias, the gum trees, liquidambar, sweet bay tree, palmetto, canes, etc. abound, and the orange grows wild. The live-oak timber exported from Brunswick and its vicinity is the most valuable grown in the U. S. On the sandy lands pines and scrub-oaks are plentiful. The Georgia yellow pine grows over a somewhat extensive but distinctly defined district, and commands a high price. The central and northern portions of the State have large tracts of forest, and among the trees of these sections are black walnut, chestnut, tulip tree, hickory, poplar, sycamore, beech, maple, ash, elm, fir, spruce, birch, and bay-laurel. The broad-leaved *Kalmia* adorns the wild lands with its beautiful blossoms, and other flowering shrubs are abundant. Still more varied are the cultivated agricultural products of the State. In South-eastern Georgia the orange, lemon, banana, olive, and other tropical fruits come to perfection, while rice, sugar-cane, sea-island and some short-staple cotton, sweet potatoes, and some corn are the principal crops. In the extensive flatlands of Southern Georgia there is considerable cotton, and rich and excellent grasses both for pasture and hay. Stock and swine are largely pastured in the pine woods. Middle Georgia is an admirable fruit-region. The peach tree is hardier, subject to fewer diseases, and yields more than almost anywhere in the U. S. Apples and pears of native seedling varieties are of excellent quality and yield abundantly. Cherries and some of the small fruits do not thrive so well in this section. The Catawba grape has been found a failure, but the scuppernong, herbemont, post-oak, and other Southern varieties more lately introduced, are proving successful. Melons of the finest quality abound, and the trade in market vegetables is growing rapidly, and has already become very large. This section is largely devoted to cotton, but clover, wheat, and Indian corn are also grown, as well as oats and a small amount of rye and barley. Tobacco is also a crop of some importance. Sorghum and pea-nuts (or ground-nuts, as they are called in the South) are grown in considerable quantity. The sweet potato and the Irish potato are both cultivated, the latter not so largely as in the northern counties. North-eastern Georgia is mountainous, some of the mountains being 5000 feet above the sea; its geological structure is Azoic; it has fine scenery, a healthy and delightful climate, heavy timber, and good crops of grass and grain in the creek and river lands, small farms; and in the uplands a thin, poor soil. North-western Georgia, the region N. and W. of the Chattahoochee, is a blue limestone region, has numerous fine navigable streams, and is the connecting link between the great West and the Atlantic ports of the South. This section has a rich and fertile soil in the river and valley lands, but requires manure and deeper ploughing to realize its full advantages. All the Northern fruits do well here, and are from four to five weeks earlier than in New York. The principal crops are wheat, Indian corn, clover and other grasses, and in the river-valleys, which contain sand, cotton. South-western Georgia is in the Tertiary formation. It is the great cotton-region of the State, and cotton is there a very sure crop. It is also well adapted to the culture of the sugar-cane and of rice in the bottom-lands. Sweet potatoes are grown in immense quantities by the freedmen, and a commencement has been made in the tea-culture. The climate of this portion of the State is sickly, and perilous to the unacclimated in summer, especially in the river-valleys, though the old inhabitants enjoy fair health. In the whole State 54.6 per cent. of its area was in forest woodland in 1870. A wide field of enterprise may be found in converting the products of these forests to economical uses.

Zoology.—The wild animals of the State are tolerably numerous, especially in the densely wooded portions. The black or dark-brown bear, and probably both, are not unfrequent in North-eastern and North-western Georgia. The panther and wild-cat are occasionally seen, and the fox, raccoon, opossum, and woodchuck (or ground hog) are tolerably plentiful; deer and smaller game, rabbits, squirrels, etc., abound. In the southern section alligators are to be found in the rivers, estuaries, and bayous, the sea-turtles on the coast and about the mouths of the rivers, and a variety of reptiles more displeasing to the sight than positively harmful. The only poisonous serpents are the cotton-mouth, the moccasin, and the rattlesnake. The insect pests are numerous in the lowlands, the most annoying being the chigoe or tick, the sandflies and mosquitoes. The northern portion of the State is comparatively free from these annoyances.

Climate.—Having spoken in general terms of the climate and healthfulness of the different sections when describing the vegetation of each, we now proceed to give the average monthly temperature, the maximum and minimum for each month, the monthly rainfall, and the yearly average and rainfall at Atlanta, lat. 33° 42′, W. lon. 84° 20′; Macon, lat. 32° 45′, W. lon. 83° 32′; and Berne about lat. 30° 55′, W. lon. 81° 45′:

Places.	January.			February.			March.			April.			May.		
	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.
	°	°	in.	°	°	in.	°	°	in.	°	°	in.	°	°	in.
Atlanta......	63	25	5.86	67	16	9.93	76	16	5.85	85	29	8.67	94	44	1.75
Macon.......	69	28	5.70	70	26	6.48	78	25	2.13	86	36	4.9	89	51	3.60
Berne........	..	..	....	..	..	....	..	..	....	83	38	4	95	53	2.21

Places.	June.			July.			August.			Sept.			October.		
	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.
	°	°	in.	°	°	in.	°	°	in.	°	°	in.	°	°	in.
Atlanta......	93	52	2.48	....	..	....	98	50	2.12	86	44	2.30	75	27	1.87
Macon.......	98	64	3.58	103	70	3.34	103	64	2.85	..	..	....	..	..	....
Berne........	92	65	6	93	70	9.17	92	64	3.90	84	58	4.50	80	36	....

Places.	November.			December.			Year.			Year.	Remarks.
	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Rainfall for month.	Highest temperature.	Lowest temperature.	Mean temperature.	Annual amount of rainfall.	
	°	°	in.	°	°	in.	°	°	°	in.	
Atlanta......	69	26	5.95	60	23	6.67	98	16	55.9	53.7	For 11 months.
Macon.......	75	31	0.51	69	13	5.32	103	13	61.3	38.45	For 10 months.
Berne........	76	29	0.75	76	27	4.99	93	27	60	35.53	For 9 months.

Agricultural Products.—The two great agricultural staples of Georgia are Indian corn and cotton. Previous to the late war cotton was its great crop, yielding in 1859–60, 701,840 bales, or more than one-sixth of the whole cotton crop. Since the war the cotton crop has never attained the same magnitude, and in 1873 there were nearly 100,000 acres more in corn than in cotton. The product of cotton in 1873 is officially reported at 614,039 bales, about 19,000 bales more than in 1872. The corn crop of 1873 was about 23,500,000 bushels, raised from about 2,000,000 acres. Its money value was about $20,410,000, or somewhat less than that of 1872. The wheat crop amounted to about 3,125,000 bushels, from 349,000 acres, and was estimated worth $5,490,000. The wheat of South-western Georgia is of remarkably fine quality, and averages 64 pounds to the bushel. The acreage of oats in 1873 was about 400,000, yielding over 5,000,000 bushels, valued at $4,160,000. Of rye only 190,000 bushels were raised in 1873, from 18,887 acres, value $285,000. Very little barley is raised, and not much tobacco—only 600 acres in 1873, yielding about 300,000 pounds, valued at $52,000. The sweet-potato crop occupied about 45,000 acres in 1873, yielding 4,050,000 bushels, worth nearly $4,000,000. There were only about 2500 acres of Irish potatoes, yielding perhaps 250,000 bushels. These are largely shipped North, and, being very early, bring a high price, reported in 1873 at $261,000. Over 20,000 acres

are devoted to the pea-nut or ground-nut; the greater part of the crop is sent North. There are over 100,000 acres of orchards, and the fruit crop is becoming very valuable. There were nearly 10,000 acres of sugar-cane, and almost 5000 of sorghum; the production of sugar increases with great rapidity, and may soon supply the southern counties. There were in 1873 about 30,000 acres in rice; the production of this staple in the State in 1870 was 22,277,380 pounds, worth about $1,650,000. The culture of the vine for wine is not extensive, the scuppernong, herbemont, Norton's Virginia, and post-oak being the varieties most cultivated. The number of acres of land in farms in 1870 was 23,647,941 acres, not quite two-thirds of the area of the State; the value of the farms, $94,559,468. In 1873 the number of acres of improved land in farms had increased to 27,762,445 acres, and the value to $99,125,591; of farming implements and machinery, $4,614,701; the amount of wages paid to farm-hands, including board, $19,787,086; the estimated value of farm products was $80,390,228; of orchard products, $352,926 (evidently an under-estimate); of the produce of market-gardens, $193,266; of forest products, $1,281,623; of home manufactures, $1,113,080; of animals slaughtered or sold for slaughter, $6,854,382. There were reported as produced that year 21,927 gallons of wine; 4,499,572 pounds of butter; 4292 pounds of cheese; 109,139 gallons of milk sold; 10,518 tons of hay; 31,233 pounds of beeswax and 610,877 pounds of honey. The census of 1870 reports but 846,947 pounds of wool as produced in Georgia in 1869–70, and 410,020 bushels of peas and beans. The numbers of live-stock, except horses, etc., do not seem to be increasing very rapidly. In 1870 there were 81,777 horses and 87,426 asses and mules in the State; in Jan., 1873, the Agricultural Department estimated the number of horses at 117,300, and of mules at 92,700; in Dec., 1873, the State comptroller, from incomplete returns, gave the number of horses and mules as 139,672, but stated that the real number was almost double. The census gave the number of cattle, including milch cows, working oxen, and other cattle, as 697,903; the Agricultural Department in Jan., 1873, makes the number 658,700, while the imperfect returns of the comptroller give 559,340. The census report is probably not far from the truth. Of sheep, the census reports 419,465; the Agricultural Department in Jan, 1873, 253,500—evidently a blunder; Rev. Mr. Howard in 1867 thought there were not less than 500,000, while the imperfect returns of the comptroller in Dec., 1873, give 369,012, with six important counties and parts of others omitted. The true estimate is probably not below 500,000. In 1870 the census reports 988,566 swine; the Agricultural Department in Jan., 1873, 1,559,400, and the comptroller's report, 758,935. There are probably not less than 1,200,000 in the State.

Manufactures.—The manufactories are increasing, both in numbers and extent. From 1860 to 1870, Georgia had more than doubled the number, and nearly doubled the product, of her manufacturing establishments, and since 1870 manufactures have received a new and powerful impetus. In 1870 there were 3836 manufacturing establishments, using 405 steam-engines of 10,826 aggregate horse-power, and 1729 water-wheels of 27,417 horse-power, employing 17,871 persons, of whom 15,078 were males over 16 years of age, 1498 females above 15, and 1295 children. The reported capital of these establishments was $13,930,125; the wages paid, $4,844,508; the raw material used, $18,583,781; the manufactured products were valued at $31,196,115. The most important of these were—cotton manufactures, of goods and yarns, which employed in 34 establishments, 2920 persons, and capital to the amount of $3,433,265; paid $611,868 in wages; used $2,504,758 worth of raw material; and produced goods to the amount of $3,648,973; flouring and grist-mill products had 1097 establishments, employing 17,887 persons, $3,103,918 capital, paid $337,864 wages, used $9,189,578 of raw material, and produced goods to the value of $11,202,029. Iron manufactures were produced in 30 establishments, employing 492 persons and $407,810 of capital, paying $389,896 wages, using raw material to the value of $705,598, and producing iron to the value of $1,346,365. The 187 carpentering and building establishments employed 624 hands, and produced buildings valued at $1,007,623; the 513 blacksmithing establishments, employing 1080 hands, produced articles valued at $630,445; boots and shoes, in 244 establishments, were produced to the value of $493,862; and brick, in 41 kilns, to the amount of $420,109; carriages and wagons in 178 factories were produced to the value of $664,512; leather tanned and curried, in 186 tanneries, was produced to the value of $572,306; lumber planed and sawed, in 557 saw and planing mills, was produced to the value of $4,615,575; machinery, in 42 machine-shops, to the value of $1,624,622; printing and publishing, in 45 printing-offices, was done to the value of $931,672; woollen goods were manufactured and dressed in 46 factories, employing 563 persons, $936,585 capital, and producing goods valued at $471,523 (in 1873 the number of these establishments had increased to 81); tobacco was manufactured in 20 factories to the amount of $465,874; car-building and car-repairing were prosecuted in 180 car-shops to the amount of $366,790; clothing, in 38 establishments, to the value of $213,072. The manufactures of cotton, wool, iron, and tobacco have increased materially since 1870. The consumption of cotton in the cotton-mills in the State in 1870 was 24,820 bales; in 1873, 39,122 bales.

Mining.—The census of 1870 reported 10 mining establishments, employing 126 hands and $145,800 capital, and producing $49,280. These, too, have since been greatly increased. The products of the fisheries were very imperfectly reported, only one fishing-station, yielding but $200, being noticed. The shad fisheries of the Savannah River and the Ogeechee, which send the first shad to the Northern markets, are very profitable, as are many of the fisheries of Brunswick, St. Mary's, and other points on the coast.

Railroads.—There were in Jan., 1874, 2388 miles of completed railroads in Georgia. The principal railroads are trunk roads, now or in the near future forming connecting links in some one or other of the great systems of N. and S. or E. and W. lines of the country. Lines radiate from Chattanooga, Tenn., just at the N. W. corner of the State, connecting Atlanta, and through other radiations Augusta, Savannah, and Brunswick, with Chicago, Cincinnati, Louisville, St. Louis, and Memphis. Other lines stretch toward Selma, Ala., Montgomery, Mobile, and New Orleans; and others still aim to connect with Pensacola and Cedar Keys, Fla., and thus secure outlets on the Gulf. From Brunswick and from Savannah railroads are pushing westward to make a connection with the proposed Pacific road on the 32d parallel, and furnish that future thoroughfare with eligible termini on the Atlantic coast. Numerous branches are also already built or projected to connect enterprising villages with these trunk roads. The Georgia, the Central of Georgia, the Atlantic and Gulf, and the new Atlanta and Richmond have leased many of the minor lines, and are running them as feeders to their main roads. The Central has, including its leased lines, 660 miles of road, the Atlantic and Gulf 347, and some of the others nearly as much. The cost of the railroads already constructed in the State exceeds $43,000,000, or one-sixth of the entire valuation of the State.

Finances.—The public debt of the State Jan. 1, 1874, was $8,342,500. This is entirely a bonded debt, all the bonds falling due within eighteen years, and most of them in annual sums which can readily be paid from the current revenues. There is besides this a contingent indebtedness arising from the endorsement of railroad bonds amounting to $7,033,400, most of which will be met by the railroads themselves, and for all of which the State holds securities more or less ample. The credit of the State is good and improving. The amount received into the treasury from all sources during the year 1873, including the proceeds of the sale of bonds and the balance on hand from the previous year, was $3,172,788.74. The disbursements for the same period, including the payment of $1,335,767.73 of the principal and interest of the public debt, were $2,250,232.49, leaving a balance in the treasury Jan. 1, 1874, of $922,556. The estimated receipts for 1874 from all sources (mainly from taxes) were $2,722,856, and the disbursements, after paying $823,460 on interest and principal of public debt, $1,563,660, leaving a balance in the treasury of $1,159,196, a part of which would be applied to a sinking fund to reduce the State debt. The bonds issued in 1873, $1,200,000, were taken at par, and mostly by citizens of the State. The assessors' valuation of real and personal property in the State in 1873 was $242,687,382. It is probable that the true valuation, which in 1870 was $268,169,207, now exceeds $300,000,000.

Commerce and Trade.—The assessed value of merchandise in the stores and warehouses of the State in 1873 was $14,781,024, the assessed value being probably from one-third to one-half the true, as is usual. The aggregate value of wild and improved land was $101,805,039, these also being assessed at much less than their true value; the amount of money and solvent debts, $26,585,350; and the assessed value of city and town property, $58,891,268. This last is probably on the basis of 40 to 50 per cent. of the true value. The capital reported as invested in shipping and tonnage in the State in 1873 was $207,895; in cotton manufactories, $1,908,095; in iron-works, $766,405; in mining, $22,770. All these amounts, being for assessment purposes, are probably less than half of actual values. The official report of the imports and exports from the three ports of the State, Savannah, Brunswick, and St. Mary's, for the year ending Dec. 31, 1873, does not fully represent the commerce of the State, since a considerable portion of the exports from the

north-eastern portion of the State are made through Charleston, those from the southern counties through Fernandina, Appalachicola, and Pensacola, Fla., and those from the W. and S. W. through Mobile, Ala.; yet the imports of the three ports were $845,693, and the exports, in which cotton was much the largest item, $31,199,183.

Banks.—In Jan., 1873, there had been 13 national banks organized in Georgia, of which two were closed or closing, and 11 in operation. The capital of these banks, paid in, was $2,620,000; the bonds on deposit, $2,356,400; the circulation issued, $2,340,050; the amount of actual circulation, $2,129,301.75. There were also the Georgia Railroad and Banking Co., operating under the State charter of the Georgia R. R., with $300,000 capital, and located at Augusta; the Central Georgia Bank, connected with the Central Georgia R. R., located at Macon, and having a capital of $200,000; and the Savannah Banking and Trust Co., at Savannah, with $100,000 capital. There are saving banks at Augusta and Macon, and about 40 private banking-houses, some of them very large.

Insurance.—In July, 1873, there were 5 fire insurance companies in the State, all stock companies except that at Athens, which is mutual. The capital of the stock companies was $825,000, and the assets of all in July, 1873, were $1,483,275. There were at the same date two life insurance companies, one having a capital of $150,000, assets, $542,302; and the other a capital of $120,000, assets not reported.

Population.—The following table exhibits the population of the State at each census, with its classification, until that of 1870, when slavery had ceased:

Census.	White.	Free Colored.	Slave.	Total.	Remarks.
1790	52,886	398	29,264	82,548	
1800	102,261	1,019	59,406	162,686	
1810	145,414	1,801	105,218	252,433	
1820	189,566	1,763	149,656	340,985	
1830	296,806	2,486	217,531	516,823	
1840	407,695	2,753	280,944	691,392	
1850	521,572	2,931	381,682	906,185	
1860	591,550	3,500	462,198	1,057,286	38 Indians.
1870	638,926	545,142	None	1,184,109	40 Indians, 1 Chinese.

The density of the population in 1850 was 15.62 to the square mile; in 1860, 18.23; in 1870, 20.42. The population of Georgia is almost wholly of native birth; of its 1,184,109 inhabitants in 1870, 1,172,982 were born in the U. S., and only 11,127 in foreign countries; of the native population, 572,126 were males and 600,856 females; of the foreign-born, 6829 were males and 4298 females; of the 638,926 whites, 311,171 were males and 327,755 females; of the 628,173 native whites, 304,562 were males and 323,611 females; of the 10,753 foreign-born whites, 6609 were males and 4144 females. Among the 545,142 colored (267,765 males and 277,377 females), there were but 372 (219 males, 153 females) of foreign birth. Of these people of color, 501,814 were blacks, and only 43,328 mulattoes; of the 40 Indians, 18 were males and 22 females. Of the population in 1870, 407,516 (namely, 206,026 males and 201,490 females) were of school age, or between 5 and 18 years; 202,573 males (of whom 108,711 were whites and 93,852 colored) were of the military age, from 18 to 45; and 237,640 males (of whom 129,665 were whites and 107,962 colored) were of the voting age, 21 years old and upward; of these 234,919 were male citizens.

Education.—According to the report of Hon. G. J. Orr, State school commissioner of Georgia, presented to the legislature in Jan., 1874, there were at that date 349,164 children of school age (between 6 and 18 years) in the State. Of these, 198,516 were white and 150,198 colored. By act of the legislature the benefit of the school moneys was also to be extended to all Confederate soldiers under 30 years of age who chose to avail themselves of this opportunity of acquiring an elementary education. Of these, there were 8704. According to the same report, there were in the State 1379 schools for white children and 356 for colored children, which were sustained wholly or in part by the school moneys. In the white schools there were 58,499 children (32,502 boys and 25,997 girls); in the colored schools there were 17,658 children (8945 boys and 8713 girls); in all, white and colored, 76,157 scholars, or about one-fifth of the school population. These were, however, divided somewhat unequally, two-sevenths of the white children and but little more than one-ninth of the colored being in school. The average attendance was but 32,224 in all. The monthly cost of tuition was $1.65. The schools of the cities of Savannah, Atlanta, Macon, and Brunswick, and of the counties in which they are situated, are organized under special laws. In these schools there are about 5000 children in attendance, though the number enrolled is somewhat more than 7000. In addition to these public schools there are 576 private elementary schools which have reported to the State commissioner, partially sustained by the Peabody and other charitable funds, having 713 teachers and instructing 23,597 children, of whom 22,363 were white and 1234 colored. There are thus about 107,000 children, white and colored, who attend the schools, public and private, some portion of the year, out of 358,000 of school age, though not more than 54,000 attend regularly. According to the census of 1870, 418,553 persons over ten years of age in the State could not read, and 468,593 over ten years of age could not write. There are also 101 high schools which have reported to the commissioner (the whole number of these schools is supposed to be about 140). The 101 reporting had 167 teachers and 5450 scholars (3228 males and 2222 females). They are mostly schools of really high grade, and some of them of established reputation. There are also 18 or 20 (so-called) female colleges, which are really only academies or seminaries of high grade, very few, if any of them, we believe, possessing the power of conferring degrees; these have 91 teachers or professors, 1476 students, and an average tuition fee of about $50 per annum. In the true sense of the term there are not more than one or perhaps two universities in the State. The University of Georgia, at Athens, which is now also the Agricultural and Scientific College, and has the North Georgia Agricultural College at Dahlonega as one of its branches, and a law department also, is an institution which under its present management may become a true university. Mercer University, at Macon, has a theological department. Oglethorpe University, at Atlanta, is simply a college. Atlanta University, for colored students preparing to become preachers, is rather a missionary theological school than either a college or university. The other colleges—Bowdon College, at Bowdon, Carroll co., Emory College, at Oxford, Newton co., the Masonic College, at Covington, Marshall College, at Griffin—have a fair measure of support. These universities and colleges have about 45 professors and 1446 students. The State University is scantily endowed, and the others need further endowment. In the matter of special education there is an academy for the blind at Macon, with 35 pupils and 8 instructors and employés, which receives about $10,000 annually from the State: an institution for the deaf and dumb at Cave Spring, with 5 instructors and 61 pupils, which receives $15,000 per annum from the State; but no normal school, no reformatory for either boys or girls, no asylum for idiots or inebriates, and but one hospital for the insane, that at Midway. The State-prison labor is farmed out, and the prison is certainly not abreast of the age in the character of its discipline. It had Jan. 1, 1874, 664 convicts, of whom 93 were white and 571 colored; there were 1 white and 19 colored females in the number.

Newspapers and Periodicals.—In 1870, Georgia had 110 newspapers and periodicals of all kinds, with an aggregate circulation of 150,987, and an annual issue of 15,539,724 copies. In 1872 the number had increased to 125, though the aggregate circulation was not greatly enlarged. There were 15 dailies, 5 tri-weeklies, 7 semi-weeklies, 86 weeklies, 2 semi-monthlies, 9 monthlies, 1 bi-monthly; of these, 6 were agricultural and horticultural; 8 literary and miscellaneous; 95 were political, embracing two-thirds of the entire circulation; 4 were religious; 3 technical and professional.

Churches.—There were in Georgia in 1870, 2873 churches of all denominations, 2698 church edifices, with 801,148 sittings, and church property valued at $3,561,955. Of these, the regular Baptists had 1364 churches, 1308 church edifices, 388,265 sittings, and $1,123,950 of church property. (At the close of 1873, according to the *Baptist Year-Book*, there were 2112 churches, 1217 ordained ministers, 7015 baptisms, and 149,636 communicants. There were also 500 Sunday schools and 28,125 teachers and scholars.) Of the minor Baptist denominations there were in 1870, 5 churches, 4 church edifices, 900 sittings, and $1700 church property. Of the Christian Connection there were in 1870, 34 churches, 33 church edifices, 10,285 sittings, $60,050 church property. In the census of 1870 there are reported (erroneously) 10 Congregationalist churches, 10 church edifices, 2800 sittings, $16,550 of church property. (The *Congregational Quarterly* in 1873 reports only 4 churches, 2 constituted that year, 6 ministers, and 420 members.) The census reported in 1870, 35 Protestant Episcopal churches, 27 church edifices, 8975 sittings, $246,850 of church property. (The *Protestant Episcopal Almanac* for 1874 reports 1 bishop, 28 churches, 33 parishes and missions, 37 clergymen, 3522 communicants, 379 confirmations, 3103 Sunday school teachers and scholars, $86,761 contributions for church support and benevolent institutions.) The census reports 6 Jewish congregations, 5 synagogues, 1400 sittings, $52,700 of church property. In 1870 there were 11 Lutheran churches, 10 church edifices,

3000 sittings, $57,100 of church property. (The *Lutheran Almanac* for 1874 reports that in 1873 there were in the synod of Georgia 9 ministers, 14 churches, 980 communicants.) In 1870 there were of Methodists of all descriptions 1248 organizations, 1158 church edifices, 327,343 sittings, $1,073,030 of church property. (There are so many kinds of Methodists in Georgia that it is impossible to obtain the statistics of all for 1873 or 1874, but there has undoubtedly been a considerable increase over the census figures.) There is one New Jerusalem (Swedenborgian) church in the State. There were in 1870, 121 regular Presbyterian (*i. e.* Presbyterian Church South) churches in Georgia, 114 church edifices, 45,275 sittings, $545,450 church property. (In 1872 this church reported but 75 ordained ministers in Georgia.) The other Presbyterian bodies had in 1870, 13 churches, 9 church edifices, 4300 sittings, and $8075 of church property. The Associate Reformed Synod of the South had in 1872, 1 presbytery, with 3 churches and 3 ministers in the State; and Cumberland Presbyterians had 4 ministers and 8 churches in the State in 1872. The Roman Catholic Church had in 1870, 14 congregations, 11 church edifices, 5500 sittings, $294,550 of church property. (In 1875 the *Catholic Directory* reports 14 churches and 7 others building, 30 chapels, and out-stations, 19 priests, 1 monastery, 5 convents, 4 academies, 6 free schools, 1 college.) The Roman Catholic population does not exceed 25,000. Of Universalists there were in 1870, 5 congregations, 3 church edifices, 900 sittings, and $900 of church property. (In 1873 their official *Register and Almanac* reported 16 parishes and 12 congregations, with 271 members.) There were also in 1870, 6 union congregations, with 6 church edifices, 1100 sittings, and $20,700 of church property.

Constitution, Courts, Representatives in Congress, etc.—The present constitution of the State was adopted in convention in Mar., 1868, and ratified by the people in April of the same year. It declares all citizens of the U. S. residing in the State to be citizens thereof, and that no laws shall be made or enforced which shall abridge the privileges or immunities of citizens of the U. S. or of the State, or deny to any person within its jurisdiction the equal protection of its laws. The governor is chosen by the people for four years; and for the same period are elected by the general assembly the following officers: the secretary of state, comptroller-general, treasurer, and surveyor-general. The senate consists of 44 members, one-half elected biennially for four years, and the house of representatives of 168 members, elected biennially for two years. The judiciary of the State comprises a supreme court, a superior court for each judicial district, courts in ordinary, and justices of the peace. The supreme court has appellate jurisdiction only. The superior courts have exclusive jurisdiction in cases of divorce, in criminal cases, where the penalty is death or confinement in the penitentiary, in cases respecting titles to land, and in equity cases. It has also power to correct errors in inferior judgments, and to issue writs that may be necessary for carrying into effect their powers. The judges of the supreme and superior courts, the attorney-general, solicitor-general, and the district judges and attorneys are appointed by the governor and confirmed by the senate. Under the apportionment of 1872, Georgia has 9 representatives in Congress (a gain of 2 on her previous representation).

Counties.—Georgia had in Jan., 1874, 136 counties, which had the following population in 1870: Appling, 5086; Baker, 6843; Baldwin, 10,618; Banks, 4973; Bartow (formerly Cass), 16,566; Berrien, 4518; Bibb, 21,255; Brooks, 8342; Bryan, 5252; Bullock, 5610; Burke, 17,679; Butts, 6941; Calhoun, 5503; Camden, 4615; Campbell, 9176; Carroll, 11,782; Catoosa, 4409; Charlton, 1897; Chatham, 41,279; Chattahoochee, 6059; Chattooga, 6902; Cherokee, 10,399; Clarke, 12,941; Clay, 5493; Clayton, 5477; Clinch, 3945; Cobb, 13,814; Coffee, 3192; Columbia, 13,529; Colquitt, 1654; Coweta, 15,875; Crawford, 7557; Dade, 3033; Dawson, 4369; Decatur, 15,183; DeKalb, 10,014; Dodge*; Dooly, 9790; Dougherty, 11,517; Douglass*; Early, 6998; Echols, 1978; Effingham, 4214; Elbert, 9249; Emanuel, 6134; Fannin, 5429; Fayette, 8221; Floyd, 17,230; Forsyth, 7983; Franklin, 7893; Fulton, 33,446; Gilmer, 6644; Glascock, 2736; Glynn, 5376; Gordon, 9268; Greene, 12,454; Gwinnett, 12,431; Habersham, 6322; Hall, 9607; Hancock, 11,317; Haralson, 4004; Harris, 13,284; Hart, 6783; Heard, 7866; Henry, 10,102; Houston, 20,406; Irwin, 1837; Jackson, 11,181; Jasper, 10,439; Jefferson, 12,190; Johnson, 2964; Jones, 9436; Laurens, 7834; Lee, 9567; Liberty, 7688; Lincoln, 5413; Lowndes, 8321; Lumpkin, 5161; Macon, 11,458; Madison, 5227; Marion, 8000; McDuffie*; McIntosh, 4491; Meriwether, 13,756; Miller, 3091; Milton, 4284; Mitchell, 6633; Monroe, 17,213; Montgomery, 3586; Morgan, 10,696; Murray, 6500; Muscogee, 16,663; Newton, 14,615; Oglethorpe, 11,782; Paulding, 7639; Pickens, 5317; Pierce, 2778; Pike, 10,905; Polk, 7822; Pulaski, 11,940; Putnam, 10,461; Quitman, 4150; Rabun, 3256; Randolph, 10,561; Richmond, 25,724; Rockdale*; Schley, 5129; Scriven, 9175; Spalding, 10,205; Stewart, 14,204; Sumter, 16,559; Talbot, 11,913; Taliaferro, 4796; Tatnall, 4860; Taylor, 7143; Telfair, 3245; Terrell, 9053; Thomas, 14,523; Towns, 2780; Troup, 17,632; Twiggs, 8545; Union, 5267; Upson, 9430; Walker, 9925; Walton, 11,038; Ware, 2286; Warren, 10,545; Washington, 15,842; Wayne, 2177; Webster, 4677; White, 4606; Whitfield, 10,117; Wilcox, 2439; Wilkes, 11,796; Wilkinson, 9383; Worth, 3778.

Principal Cities and Towns.—There are six cities in the State: Atlanta, the capital, pop. in 1870, 21,789, and rapidly growing; Augusta, county-seat of Richmond co., on the Savannah River, pop. in 1870, 15,389; Macon, county-seat of Bibb co., pop. in 1870, 10,810; Columbus, county-seat of Muscogee co., on the Chattahoochee, pop. in 1870, 7401; Athens, in Clarke co., on the Oconee, pop. in 1870, 4251; and Savannah on the Savannah River, county-seat of Chatham co., pop. in 1870, 28,235. Aside from these cities, the only towns having a population between 3000 and 5000 in 1870 were Griffin and Americus; between 2000 and 3000, Milledgeville, Cartersville, Cuthbert, Albany, and La Grange.

History.—Though one of the thirteen colonies which united in the Declaration of Independence in 1776, Georgia was settled much later than any of the rest. Before the year 1733 it was a wilderness, a doubtful border-land, claimed both by Great Britain and by Spain. By a patent dated June 9, 1732, George II., king of Great Britain, from whom the colony was subsequently named, granted the territory to a company designated as the "Trustees for settling the Colony of Georgia." Among the parties interested in obtaining this grant, were Gen. James E. Oglethorpe (who was subsequently the leader and governor of the colony), Whitefield, and the Wesleys, the founders of Methodism and the eloquent and noted preachers of that period. The objects of this colonization were twofold—to provide a refuge for the needy and destitute, especially for poor debtors, orphans and friendless children and youth, and to establish a barrier against Spanish and Indian encroachments and aggressions upon the British possessions in North and South Carolina. The charter and grant being duly executed, Gen. Oglethorpe sailed from Gravesend late in the autumn of 1732 with a colony of 120 persons, and landed at Charleston in Jan., 1733, and at once proceeded to the new territory, and shortly, after some explorations, founded the city of Savannah. The colony was at first a military one, the colonists holding the lands parcelled out to them on the condition of military service. This condition involved so many hardships that many of the emigrants deserted the new colony and settled in North Carolina, where the land was held in fee-simple. The trustees then changed their policy, offering 50 acres to each settler, and as a consequence a considerable number of immigrants, mostly Scotch and Germans, flocked to the colony. Mr. Whitefield was very active in establishing his home for orphans at Bethesda, near Savannah, and crossed the Atlantic many times for this purpose, bringing with him a considerable number of settlers at each voyage. In 1739 war was declared between Great Britain and Spain, and Gen. Oglethorpe was appointed to command the colonial troops of Georgia and South Carolina, and marched with 1000 troops and Indian allies into Florida, but this expedition proved a failure. In 1742 the Spaniards returned the compliment of Oglethorpe's visit with an expedition of 36 ships and 3000 men. The fleet appeared in the Altamaha River, took Fort Frederica, on St. Simon's Island, when, by a stratagem conceived by Oglethorpe, they became alarmed, retired to their ships, and sailed for Florida. Peace was subsequently restored. The people of Georgia became discontented on account of the prohibition of negro slavery, which was tolerated in other sections. In 1752 the trustees surrendered their charter to the Crown, and the colony became a part of the royal government, enjoying the same privileges as to land, trade, and negro slavery as the other colonies. The general assembly was established in 1755, and in 1763 all the land between the Altahama and St. Mary's rivers was added to the province. From this date the progress of the colony was rapid. The fertile lowlands were brought into cultivation as the immigration increased, and in the ten years from 1753 to 1763 the exports had risen from £3059 = $15,300, to £14,469 = $72,350. In 1773 they amounted to £85,391 = $426,955. The imports of 1773 were £62,932 = $314,660. In 1775 the population had increased to 75,000, the exports were £103,477 = $517,385, and the imports £113,777 = $568,885. Of all the colonies, Georgia was in the most prosperous condition, and had the fewest inducements to take part

* Those having no population specified are new counties organized since 1870.

with the other colonies in the Revolution. But the colonists felt that the cause was one, and they lost no time in manifesting their sympathy with the other colonies, and in preparing to take an active part in the coming struggle. In Mar., 1755, they appointed a delegate to Congress, and in July of the same year a convention of the colonists met and gave their sanction to the measures adopted by Congress. During the war which followed Georgia suffered severely. The State was overrun by British troops, and the principal citizens were compelled to fly for their lives. In 1768, Savannah was captured, and in 1779, Augusta and Sudbury. The Americans, aided by the French, attempted to retake Savannah in 1779, but without success. Georgia formed her first constitution in 1777, her second in 1785, and her third in 1798, which, with some amendments, continued in force till 1861. The constitution of the U. S. was ratified by the State Jan. 2, 1788. For some years after the close of the Revolutionary war the Creeks and Cherokees made frequent forays into the frontier settlements of Georgia, but in 1790 and 1791 treaties of peace were concluded with the chiefs of these nations, and the western boundaries of the State were established. In 1802, by the treaty of Fort Wilkinson, the Creeks ceded to the U. S. a large tract of land, which now comprises the rich and fertile counties of S. W. Georgia. These lands were subsequently assigned to Georgia, and the State in 1802 ceded to the U. S. all its claims to the lands W. of its present boundaries, now forming the greater part of the States of Alabama and Mississippi. From 1830 to 1838 there were constant collisions between the State government and the Cherokees, who occupied a large and valuable tract in N. W. Georgia. The citizens of the State were determined to drive out this intelligent and formidable tribe, and at one time there seemed a probability that the national and State governments would be arrayed in hostility against each other. In 1838 the removal of the Indians to the Indian Territory W. of Arkansas put an end to the strife, and the people of Georgia speedily entered into possession of their valuable lands. Growing rapidly in wealth and political influence, Georgia became within the next twenty years the leading State of the Southern tier. Her influence was naturally thrown in favor of slavery; and when South Carolina determined (Dec. 20, 1860) to secede, Georgia followed with an ordinance of secession Jan. 19, 1861, although a minority, strong in talent and influence, opposed it. Once enlisted in the Southern Confederacy, the State was very active in furnishing material aid to the war. At first, her citizens had but little personal experience of suffering from its ravages, though many of her sons had fallen in the field or had been taken prisoners; but in the autumn of 1863, beginning with the battle of Chickamauga Creek and the conflicts which followed, partly in East Tennessee and partly in Georgia, she first tasted its horrors on her own soil. Cavalry raids of considerable extent visited several of her cities and larger towns; but it was not until May, 1864, when Gen. Sherman set his face towards Atlanta, that there were any great number of severe conflicts on her soil. The campaign, of four months' duration, which culminated in the capture and occupation of Atlanta, was one of great losses, both of life and property; much of her territory was traversed more than once by the contending armies; this was followed in the autumn and winter of 1864–65 by Sherman's "march to the sea," his army spreading over a breadth of 50 miles, and finishing by the capture and occupation of Savannah. Humbled and helpless in the hands of the conquerors, the citizens of the State were not slow to accept the situation under the proclamation of Pres. Johnson. On Oct. 25, 1865, a convention elected by the people assembled, and on the 30th of that month they repealed the act of secession, repudiated the Confederate debt, and adopted a new constitution, in which slavery was for ever prohibited in the State. The legislature which soon after met under this new constitution also ratified the Thirteenth Amendment to the Constitution of the U. S. This new constitution of the State so made, with the entire State government so put in operation, was set aside by the Reconstruction act of Congress in Feb., 1867. All the State officers, executive, legislative, and judical, were deposed. Another provisional governor (Gen. Ruger, U. S. A.) was assigned to Georgia, and the State was included with Alabama and Florida in the third military district then created. A new election was ordered for another constitutional convention. At this election all persons were disfranchised who had ever held civil office of honor or profit in the State. Several thousand white men were thus excluded from the polls, while all colored male residents of twenty-one years of age and upward were permitted to vote. The second convention so ordered met in the winter of 1867–68, and formed the constitution under which the State is now organized. A legislature elected under it met early in July, 1868, and ratified the Fourteenth Amendment to the Constitution of the U. S., and the State thus passed out of military rule to self-government, and was admitted again to the Union. A Senator and several members of the House were permitted to take their seats in Congress, but on the failure of the legislature to ratify the Fifteenth Amendment the State was again put under military rule until this additional exaction was complied with. Since that period Georgia has been peaceful, and has occupied itself with the restoration of its material resources and its financial position, in which it has been in a marked degree successful. For a time there was a very general complaint of the maladministration of some of the State officers, but a peaceful political revolution seems to have resulted in an honest and well-administered government.

The *Governors* of the State since the adoption of the U. S. Constitution have been:

Governors.	Term of service.	Governors.	Term of service.	Governors.	Term of service.
George Walton	1789–90	David B. Mitchell	1815–17	George W. Crawford	1843–47
Edward Telfair	1790–93	William Rabun	1817–19	George W. B. Towns	1847–51
George Matthews	1793–96	Matthew Talbot (acting)	1819–19	Howell Cobb	1851–53
Jared Irwin	1796–98	John Clarke	1819–23	Herschell V. Johnson	1853–57
James Jackson	1798–1801	George M. Troup	1823–27	Joseph E. Brown	1857–65
David Emanuel (acting)	1801–1801	John Forsyth	1827–29	James Johnson (provisional)	1865–65
Josiah Tatnall	1801–02	George R. Gilmer	1829–31	Charles J. Jenkins	1865–67
John Milledge	1802–06	Wilson Lumpkin	1831–35	Gen. T. H. Ruger (provisional)	1867–68
Jared Irwin	1806–09	William Schley	1835–37	Rufus B. Bullock	1868–72
David B. Mitchell	1809–13	George R. Gilmer	1837–39	James Milton Smith	1872–
Peter Early	1813–15	Charles J. McDonald	1839–43		

Electoral and Popular Votes for President and Vice-President.—The vote for President and Vice-President in Georgia was cast by the legislature, who chose the Electoral College, until 1828. Since that time the presidential electors have been chosen by the people, so that there has been both an electoral and popular vote since that time, except in 1864, when the State was regarded as out of the Union.

Elect. Year.	Candidates voted for President and Vice-President.	Elect. Vote.
1788	P. George Washington	5
	V.-P. four candidates	5
1792	P. George Washington	4
	V.-P. Geo. Clinton, N. Y.	4
1796	P. Thomas Jefferson	4
	V.-P. George Clinton, N. Y.	4
1800	P. Thomas Jefferson	4
	V.-P. Aaron Burr, N. Y.	4
1804	P. Thomas Jefferson	6
	V.-P. George Clinton, N. Y.	6
1808	P. James Madison	6
	V.-P. George Clinton, N. Y.	6
1812	P. James Madison	8
	V.-P. Elbridge Gerry, Mass.	8
1816	P. James Monroe	8
	V.-P. D. D. Tompkins, N. Y.	8
1820	P. James Monroe	8
	V.-P. D. D. Tompkins, N. Y.	8
1824	P. William H. Crawford, Ga.	9
	V.-P. M. Van Buren, N. Y.	9
1828	P. Andrew Jackson	9
	V.-P. John C. Calhoun, S. C.	2
	V.-P. William Smith, S. C.	7

Elect. Year.	Candidates for President and Vice-President.	Elect. Vote.	Popular Vote.
1828	P. Andrew Jackson	....	18,709
1832	P. Andrew Jackson	11	20,750
	V.-P. Martin Van Buren	11	20,750
1836	P. Hugh L. White, Tenn.	11	24,930
	V.-P. John Tyler, Va.	11	24,930
	P. Martin Van Buren	....	22,126
	P. three other candidates	....	not reported.
1840	P. Wm. H. Harrison, O.	11	40,261
	V.-P. John Tyler, Va.	11	40,261
	P. Martin Van Buren	....	31,933
1844	P. James K. Polk	10	44,177
	V.-P. Geo. M. Dallas, Pa.	10	44,177
	P. Henry Clay, Ky.	....	42,100
1848	P. Zachary Taylor, La.	10	47,544
	V.-P. Millard Fillmore, N. Y.	....	47,544
	P. Lewis Cass, Mich.	....	44,802
	P. Martin Van Buren, N. Y.	10	not reported.
1852	P. Franklin Pierce, N. H.	10	34,705
	V.-P. William R. King, Ala.	10	34,705
	P. Winfield Scott, N. Y.		16,660
1856	P. James Buchanan, Pa.	10	56,578
	V. P. J. C. Breckenridge, Ky.	10	56,578
	P. Millard Fillmore	....	42,228
	P. John C. Fremont	....	not reported.

Elect. Year.	Candidates for President and Vice-President.	Elect. Vote.	Popular Vote.
1860	P. John C. Breckenridge	10	51,889
	V.-P. Joseph Lane, Or.	10	51,889
	P. Stephen A. Douglas, Ill.	....	11,590
	P. John Bell, Tenn.	....	42,886
	P. Abraham Lincoln, Ill.	....	not reported.
1864	No vote	....	no vote.
1868	P. Horatio Seymour, N. Y.	9	102,722
	V.-P. Francis P. Blair, Jr., Mo.	9	102,722
	P. Ulysses S. Grant, Ill.	....	57,134
1872	P. Horace Greeley, N. Y.	3	
	P. B. Gratz Brown, Mo.	6	76,356
	P. Charles J. Jenkins, Ga.	2	
	V.-P. B. Gratz Brown, Mo.	5	
	V.-P. Alfred Colquitt, Ga.	5	76,356
	V.-P. Nath'l P. Banks, Mass.	1	
	P. Ulysses S. Grant	....	62,550
	P. Charles O'Conor, N. Y.	....	4,004

We are indebted for statistical and other information to His Excellency James Milton Smith, governor of Georgia, to Rev. C. W. Howard of Kingston, Ga., and to the editors of the *South*, New York. L. P. BROCKETT.

Georgia, tp. of Limestone co., Ala. Pop. 958.

Georgia, tp. of Columbia co., Ark. Pop. 783.

Georgia, tp. of Jasper co., Mo. Pop. 948.

Georgia, tp. and post-v. of Franklin co., Vt., 52 miles N. W. of Montpelier, and on the Vermont Central R. R., has 3 churches and an academy. Pop. 1603.

Georgia, Gulf of, the body of water between the mainland of British Columbia and Vancouver Island. It may be regarded as a northward extension of Puget Sound. The Strait of San Juan de Fuca is the southern entrance to the gulf and to Puget Sound. Queen Charlotte's Sound is the northern entrance. The Gulf of Georgia is a sound or channel, rather than a gulf, is 100 miles long, and in some places 20 miles broad.

Georgia'na, post-v. of Butler co., Ala., on the Mobile and Montgomery R. R., 16 miles S. S. W. of Greenville, has a weekly newspaper.

Georgiana, tp. of Sacramento co., Cal. Pop. 1056.

Geor'gian Bay, the easternmost portion of Lake Huron, lying within the province of Ontario, Canada, and separated from the rest of the lake by the Great Manitoulin Island and by a peninsula (Cabot's Head) which extends N. from Bruce co., Ont. The bay was formerly called Lake Manitoulin. Length, 120 miles; breadth, 50 miles.

Geor'gian Lan'guage and Lit'erature. The Georgian language is placed by Latham in his Dioscurian group, which includes the other languages of the Caucasus, which have been variously classed as either Turanian or Dravidian, or as related to the monosyllabic tongues of South-eastern Asia, but some authorities state positively that it is quite distinct from the other languages of the Caucasus, and assign to it an Indo-European origin; and some make it a link between the monosyllabic and the Aryan tongues. Though harsh in sound, the language has many merits. The old alphabet of forty letters is giving place to the Russian. Some of the literature is of high antiquity. It consists chiefly of romances, histories, pseudo-histories, poetry, and church literature. The Georgian Bible is of the tenth century. The golden age of Georgian letters was the seventeenth and eighteenth centuries, but in 1807 the Russians carried to St. Petersburg an important part of the literature of the country, and a process of Russianization is now going on in the schools of Transcaucasia. (See BROSSET, *Éléments de la Langue Georgienne*, 1837, and the *Lexicon* of PRINCE SULKHAN SABA ORBELIAN.)

Geor'giaville, post-v. of Smithfield tp., Providence co., R. I., on the Providence and Springfield R. R., 9 miles N. W. of Providence.

Geor'giesville, post-v. of Pleasant tp., Franklin co., O., on the Columbus Springfield and Cincinnati R. R., 12 miles W. by S. of Columbus. Pop. 22.

Ge'ra, town of Germany, in Reuss, on the White Elster. It is neatly built and thriving. Its woollen and cotton manufactures are considerable. Pop. 10,036.

Gera'ce, old town of Italy, in the province of Reggio di Calabria, situated 4 or 5 miles from the sea. It has a fine Gothic church and other good buildings, and mines of iron, lead, and zinc are worked in the neighborhood. It is a bishop's see. Pop. 7200.—GERACE SICULO, small town in the province of Palermo, Sicily.

Gérando, de (JOSEPH MARIE), BARON, b. at Lyons, France, Feb. 29, 1772; studied for a priest, but served in the army and the civil service, and in 1812 was made a baron and governor of Catalonia; was 1828–42 professor of public law in the faculty at Paris; was made a peer in 1837. D. at Paris Nov. 11, 1842. Author of *Des signes et de l'art de penser* (4 vols., 1800), which was written while he was in the army, and gained the prize of the Institute; *Génération des connaissances* (1802); *Histoire comparée des systèmes de philosophie* (3 vols., 1803; 4th vol., 1847); *Du perfectionnement moral et l'éducation de soi-même* (1830); *Visiteur du pauvre* (1821); *De l'éducation des sourds-muets* (1827); *Institutes du droit administratif* (1829); *Cours normal des institutions judiciaires* (1839); *De la bienfaisance publique* (4 vols., 1839); and many other works upon philosophy, education, social questions, law, etc.

Gerania'ceæ, a natural order of exogenous plants, mostly herbs, having as many or twice as many stamens (including the sterile ones) as there are sepals; the one or few ovuled lobes of the ovary as many as the sepals; the flowers perfect, and very generally symmetrical; the axis of the dry fruit persisting. Some authorities separate the Limnantheæ, the Tropæoleæ, the Balsamineæ, and the Oxalideæ from the order, but they all possess very nearly the characters indicated above.

Gera'nium [Gr. γεράνιον, "cranesbill"] is the typical genus of the order Geraniaceæ. It has ten stamens with perfect anthers. Five are longer than the others, and have glands at the base alternate with the petals. The persistent sepals are imbricated, and the petals usually convolute in the bud, while the stamens are slightly monadelphous. The receptacle has a very long extension, which gives the name of "cranesbill" to the genus. The five carpels and the styles are adnate to this. When ripe and dry, the pods are torn off and carried away by the styles, which curve elastically and throw out the seeds. Our common wild *Geranium maculatum* well exhibits the characteristics of the genus. It flowers in April or May. The geraniums are herbaceous, with rose-colored, purplish, or white flowers, sometimes variegated. They generally have a strong odor—often agreeable, but sometimes offensive, as in *Geranium Robertianum*. They contain tannin, often in

Geranium Robertianum: 1, the stamens; 2, the ovary; 3, section of seed, showing the curved embryo.

large quantities, and from the astringency which this imparts are used in medicine. *Geranium maculatum* contains very large quantities of it, and is often called *alum-root*. It is used as a remedy for dysentery. The true geraniums are not much used in cultivation, the plants from the Cape of Good Hope, generally known by the name, in fact belonging to the kindred genus *Pelargonium*. Of these there are very many—some valued for their rich scarlet, pink, or white blossoms, and some for the fragrance of their leaves. There are no plants better known in floriculture, or more sought after for in-door or garden ornamentation. As they cross easily, many hybrids have been formed, and it is now often difficult to determine the parentage of an individual. The pelargoniums are mostly shrubby. While the flowers of the geraniums usually are purple or some related color, a species exists in the south of Europe (the *Geranium chrysanthum*) which has yellow flowers. Those used in cultivation are easily propagated by cuttings. The genus contains about 500 species, unequally distributed over the world. W. W. BAILEY.

Gérard (CÉCILE JULES BASILE), b. at Pignans, Var, France, June 14, 1817; went to Algeria as a *spahi* in 1842. His *La chasse au lion* (1855) and *Gérard le tueur des lions* (1856) made him widely known as "Gérard the Lion-killer." In 1863 he set out to explore parts of Western Africa, and after many misfortunes was drowned in the river Jong, Sept., 1864.

Gérard (ÉTIENNE MAURICE), COUNT, b. at Damvillers, France, Apr. 4, 1773; enlisted in the army 1791; had attained a colonelcy 1800; distinguished himself in many of Napoleon's principal battles; was made a general of division and count in 1813; commanded the army of the Moselle 1815, and was with Grouchy in that campaign; returned to France 1817; was made war-minister and marshal 1830; reduced Antwerp 1832; became a peer of France 1832, prime minister 1834; commander of the national guard 1838; senator 1852. D. at Paris Aug. 17, 1852.

Gérard (FRANÇOIS PASCAL SIMON), BARON, b. at Rome,

1770; began to study painting under David 1786; became the first French portrait-painter of his time; was patronized by Napoleon and made a baron by Louis XVIII. D. at Paris Jan. 11, 1837. Among his numerous historical paintings are *Belisarius*, 1795; *Cupid and Psyche*, 1797; *The Battle of Austerlitz*, 1810; *The Entrance of Henry IV. into Paris*, 1817, his *chef d'œuvre; Coronation of Charles X.*, 1830; *Thetis with Achilles' Armor*, 1822. His most famous portraits are those of the Napoleon family.

Gerarde (JOHN), b. at Nantwich, Cheshire, England, in 1545; became in 1577 head-gardener to Lord Burghley, and practised as a surgeon in London. Author of *Catalogus arborum*, etc. (1596), and of a very quaint and curious *Herbal*, 1597, which is based on the *Historiæ Stirpium* of Dodæus (Antwerp, 1583), which was translated by one Priest, whose MSS. Gerarde freely used. Plumier named the genus *Gerardia* in his honor. D. about 1607.

Gérardmer, Giromeix, or **Géromé,** town of the department of Vosges, France, on the beautiful Lake Gérardmer, 21 miles S. E. of Epinal. From this place comes the Géromé cheese. Pop. 5600.

Gerards'town, post-v. of Berkeley co., West Va., is situated in one of the most fertile portions of the Shenandoah Valley. It has 3 churches, 1 Masonic hall, 1 hotel, 1 weekly newspaper, 2 school-houses, stores, shops, etc. Pop. of tp. 1857. J. B. MORGAN, ED. "TIMES."

Ger'asa, the name of two places in Palestine: I. Also written **Ger'gesa** and **Ger'sa,** on the E. side of the Lake of Galilee, just opposite Magdala. At this point, and not at Gadara (which is more than three miles from the lake), the herd of swine perished (Matt. viii. 28–32). The ruins which now mark the spot are within a few rods of the shore, and the mountain just behind is pierced with ancient tombs. (See THOMSON'S *Land and Book*, ch. XXV.) II. (Arabic, *Jerash*), 20 miles E. of the Jordan, in a shallow valley about 5 miles N. of the Zerka (ancient *Jabbok*), and about the same distance N. E. of Dibbîn, or Dhibân, where the Moabite Stone was found in 1868. This place is not spoken of in the Bible. It is first mentioned by Josephus (*Jew. War*, 1, 4, 8) as captured by Alexander Jannæus (105–78 B. C.) about 85 B. C. It was one of the ten cities of *Decapolis*. Having been twice destroyed, it was rebuilt with great splendor in the time of the Antonines (138–180 A. D.). Its ruins are the most extensive and beautiful E. of the Jordan. Its walls, in places of the original height, with three of the ancient gateways nearly perfect, enclose a square of about a mile. Inside are ruins of a forum and of baths, theatres, and temples. More than 230 columns still remain upon their pedestals. Among the ruins are the remains of a Christian church. A bishop of Gerasa attended the Council of Seleucia, in 359, and another the Council of Chalcedon, in 451 A. D. R. D. HITCHCOCK.

Ger'bil (*Gerbillus*), a genus of rat-like rodents, found mostly in Asia, Africa, and Eastern Europe. They are all nocturnal, living in burrows, where they store away much grain. They generally secrete an offensive odor. They are elegant and active, and generally of a fawn color.

Gerboa. See JERBOA.

Gerfalcon. See GYR FALCON.

Ger'hard (EDUARD), b. at Posen, Prussia, Nov. 29, 1795; held a professorship at Breslau, where in 1816 he graduated; went to Rome 1822; was 1828–37 director of the Institute of Archæological Correspondence at Rome; was afterwards professor in the University of Berlin and archæologist of the Royal Museum. D. May 12, 1867. Author of works on Italian, Greek, and Etruscan archæology.

Gerhardt (CHARLES FRÉDÉRIC), b. at Strasburg, France, Aug. 18, 1816; studied chemistry under Liebig; was a professor at Montpellier 1844–48; pursued chemical investigations in Paris for some years, and was 1855–56 professor of chemistry and pharmacy at Strasburg. His *Traité de chimie organique* (4 vols., 1853–56) is a work of great value. Gerhardt's immortality rests upon the reform in chemical notation and theory inaugurated by him, but his early death left the work incomplete; and his doctrines, as he left them, contain some crudities which later observations and speculations have in a great degree removed. D. at Strasburg Aug. 19, 1856.

Ger'izim and **E'bal,** mountains of Western Palestine, about halfway between Jerusalem and Nazareth. They face each other across a narrow and exceedingly fertile valley, in which stands the town of Nablous, the ancient *Shechem* or *Sychar*. Gerizim, on the S. side of the valley, is 2650 feet above the sea; Ebal, on the N. side, about 2750. Jacob's Well and Joseph's Tomb are just at the mouth or E. end of the valley. Here was Abraham's first encampment W. of the Jordan. Here the Law was solemnly read in the hearing of the twelve tribes (Josh. viii. 30–35). Gerizim is the sacred mountain of the Samaritans, where the handful that survive (150 persons in all) still observe the three great festivals of the Mosaic ritual. The temple built there, by permission obtained of Alexander the Great in 330 B. C., was destroyed by John Hyrcanus (135–106 B. C.) about 129 B. C. The spot where it stood is now a platform of naked rock surrounded by slight traces of former walls. The massive ruins near by are probably the ruins of Justinian's fortress, built there about 529 A. D. (See ROBINSON'S *Biblical Researches*; also his *Physical Geography of the Holy Land*, 1865.) R. D. HITCHCOCK.

Ger'ki, town of Central Africa, in the dominion of Saccatoo, is situated in lat. 12° 26′ N., lon. 9° 16′ E., surrounded with walls. Pop. 15,000.

Germ [Lat. *germen*], or **Em'bryo,** is the essential part of the seed of a plant. All the other portions of the flower and fruit serve merely to develop or protect it. It possesses in a rudimentary condition all the essential portions of a mature plant, and varies greatly in size, position, and the quantity of nourishment it requires. Sometimes the embryo occupies the whole seed, but often it is surrounded by albumen or starch, or has similar nutritious matter stored away in its own tissue. It consists of the *cotyledons*, or seed-leaves; the *plumule*, or small leaves of the ordinary kind folded together between the cotyledons; and the *radicle*, or stem from which the true roots afterwards develop. It is from the number of cotyledons that the classes of phænerogamous plants take their names and leading character. The name *germ* is equally applied to any growing point, as of a bud. The embryo is the germ of a seed. Moreover, germ was the name applied by Linnæus and his contemporaries to what is now named the ovary or ovarium; but this use is now completely obsolete. (See OVULE.) The *embryo* must not be confounded with the ovule which contains it. W. W. BAILEY.

Ger'man, tp. of Bartholomew co., Ind. Pop. 1302.

German, tp. of Marshall co., Ind. Pop. 2233.

German, tp. of St. Joseph co., Ind. Pop. 551.

German, tp. of Vanderburg co., Ind. Pop. 1683.

German, tp. of Grundy co., Ia. Pop. 839.

German, tp. of Keokuk co., Ia. Pop. 1512.

German, tp. of Bollinger co., Mo. Pop. 1117.

German, tp. of Madison co., Mo. Pop. 868.

German, post-tp. of Chenango co., N. Y. Pop. 712.

German, tp. of Allen co., O. Pop. 1462.

German, tp. of Auglaize co., O. Pop. 1750.

German, tp. of Clark co., O. Pop. 1918.

German, post-tp. of Darke co., O. Pop. 1743.

German, tp. of Fulton co., O. Pop. 2479.

German, tp. of Harrison co., O. Pop. 1227.

German, tp. of Holmes co., O. Pop. 1408.

German, tp. of Montgomery co., O., contains the village of GERMANTOWN (which see). Pop. 3197.

German, tp. of Fayette co., Pa. Pop. 1911.

Ger'man Cath'olics, a sect in Germany which in 1844 seceded from the Roman Catholic Church in consequence of the exhibition of "the holy coat" at Treves. Two elements entered into the composition of the sect. The dominant element was rationalistic, represented by Johannes Ronge, a deposed Roman Catholic Silesian priest, then living in retirement, whose letter of Oct. 1, 1844, to Bishop Arnoldi of Treves inaugurated the whole movement. The weaker evangelical element was represented by Johann Czerski, another Roman Catholic priest of Posen, who had left the Church (Aug. 22) some five or six weeks before the appearance of Ronge's letter. These two men came together. The first congregation was that organized in 1844 by Czerski himself at Schneidemühl, under the name of "Christian Catholic." The first Creed put forth was the *Confession of Schneidemühl*, drawn up by Czerski, and differing but little from the Roman Catholic faith. It appealed to Scripture and accepted the Nicene Creed, rejecting indulgences, purgatory, invocation of saints, the Latin mass, communion in one kind, auricular confession, clerical celibacy, the papal supremacy, and some other points. The *Confession of Breslau*, drawn up by Ronge, was less conservative and orthodox. The Creed adopted by the council which met at Leipsic Mar. 22, 1845, was substantially Ronge's *Confession of Breslau*. At this time there were more than 100 congregations, and by the end of the year nearly 300. Meanwhile, another sect, called "Free Congregations" (*Freie Gemeinden*), composed of rankly rationalistic seceders from Protestant churches, and dating from 1841, had been making considerable headway in Germany. Both of these sects were strengthened by the revolution of 1848, and weakened by the reaction that fol-

lowed. They came together at Gotha in 1859, under the name of *Bund freiligiöser Gemeinden*, but the vitality of the movement was even then nearly spent. Since then, disintegration and decay have gone steadily on. Governmental hostility (from the start), internal divisions, and, more recently, "Old Catholicism," have worked together against a movement which will stand in history as one of very great promise and of very small performance. (See KAMPE'S *Geschichte der religiösen Bewegungen der neuern Zeit*, 4 vols., Leipsic, 1852–60.) R. D. HITCHCOCK.

German′der, a name given to various labiate herbs of the genus *Teucrium*. The U. S. have one species, *Teucrium Canadense*. Most of the Old World species have been employed in medicine. Of these, the cat thyme (*Teucrium marum*) has a powerful fragrance much liked by cats.

Ger′man Em′pire, established by treaties between the North German Confederation and the South German states in Dec., 1870, and enlarged by the annexation of Alsace and German Lorraine by the peace of Frankfort-on-the-Main, May 10, 1871, is situated in the centre of Europe, and bounded N. by the North Sea, Denmark (Jutland), and the Baltic; E. by Russian Poland and Galicia; S. by Austria from the Vistula to the Lake of Constance, and by Switzerland; and W. by France, Luxemburg, Belgium, and the Netherlands. (See Map of Europe in vol. i. of this work.) Its northernmost point is situated in lat. 55° 52′ 56″ N., at the village of Nimmersatt, N. of Memel; the easternmost in lon. 22° 25′ 25″ E. of Greenwich, at the town of Schirwindt in East Prussia; the southernmost in lat. 47° 15′ 48″ N., at the source of the Stillach in the Algauer Alps; and the westernmost in lon. 5° 24′ 50″ E. of Greenwich at the village of Isenbruch in Rhenish Prussia, only 2½ E. miles from the Meuse. The distance from Tilsit to Metz (from N. E. to S. W.) is 810.9 E. miles; that from Hadersleben to Kempten (from N. to S.), 535.6 E. m.; that from Swinemünde to Bautzen (between the Baltic and Austria), 195.7 E. m.; and that from Trier to Wunsiedel (between Luxemburg and Austria), 247.3 E. m. The total area of the empire amounts to 9896 German square miles (15 to one degree at the equator), or 210,396 English square miles. The area of the several states is given in the following table, with their absolute and relative populations:

	Area.		Population in 1871.	Population.	
	German square miles.	English square miles.		On one German sq. mile.	On one English sq. mile.
GERMAN EMPIRE	9896	210,396	41,060,695	4,149	195
Kingdoms.					
Prussia	6401.6	136,103	24,643,941	3,850	181
Prov. of Prussia	1179.3	25,074	3,137,545	2,661	125
" Brandenburg	724.5	15,403	2,863,229	3,952	186
" Pomerania	574.9	12,224	1,431,633	2,490	117
" Posen	525.8	11,179	1,583,843	3,012	142
" Silesia	731.7	15,556	3,707,167	5,067	238
" Saxony	458.4	9,738	2,103,174	4,588	216
" Sleswick-Holstein	320.5	6,814	995,873	3,107	146
" Hanover	699.0	14,862	1,963,618	2,809	132
" Westphalia	366.8	7,799	1,775,175	4,839	228
" Rhenish Prussia	489.9	10,415	3,579.347	7,306	344
" Hesse-Nassau	288.7	6,138	1,406,370	4,872	229
" Hohenzollern	20.7	441	65,558	3,161	149
" Lauenburg	21.3	453	49,556	2,327	109
Bavaria	1377.8	29,292	4,863,450	3,530	166
Saxony	272.2	5,788	2,556,244	9,391	442
Würtemberg	354.3	7,532	1,818,539	5,132	241
Grand Duchies.					
Baden	277.1	5,891	1,461,562	5,274	248
Hesse	139.4	2,964	852,894	6,117	288
Mecklenburg-Schwerin	241.6	5,138	557,897	2,309	109
Mecklenburg-Strelitz	53.2	1,131	96,982	1,823	86
Oldenburg	116.2	2,470	312,778	2,692	127
Saxe-Weimar Eisenach	65.8	1,399	286,183	4,349	205
Duchies.					
Saxe-Meiningen	44.8	953	187,957	4,195	197
Saxe-Coburg-Gotha	35.7	760	174,339	4,907	230
Saxe-Altenburg	24.0	510	142,122	5,922	279
Brunswick	67.2	1,428	311,764	4,739	218
Anhalt	42.6	906	203,437	4,772	224
Principalities.					
Schwarzburg-Rudolstadt	17.1	364	75,523	4,417	208
Schwarzburg-Sondershausen	15.7	333	67,191	4,238	202
Waldeck	20.4	433	56,224	2,761	129
Reuss—Elder line	5.0	106	45,094	9,037	425
Reuss—Younger line	15.1	320	89,032	5,912	278
Schaumburg-Lippe	8.0	171	32,059	3,982	187
Lippe-Detmold	20.6	438	111,135	5,395	254
Free Cities.					
Hamburg	7.4	157	338,974	45,931	2,160
Lubeck	5.1	109	52,158	10,167	478
Bremen	4.6	98	122,402	26,437	1,244
Imperial Lands.					
Alsace-Lorraine	263.2	5,596	1,549,587	5,887	277

Surface.—With respect to its surface, Germany consists of three different regions—the alpine region along the southern frontier, the mountain region of Central Germany, and the North German lowland. Of the Alps, only some smaller portions of the northern belt of the central and eastern Alps belong to the German empire: to Bavaria—namely, to the W. the Algauer and Bavarian Alps, and to the E. of the Inn, the Salzburger Alps. All these branches form parts of the northern limestone Alps, which extend to the S. into Tyrol to the Inn, from the entrance of the valley of the Stanzer to Schwaz. The northern spurs of the Alps terminate at the towns of Immenstadt on the Iller, Füssen on the Lech, Tölz on the Isar, Rosenheim on the Inn, and Traunstein on the Traun. The Algauer Alps surround the alpine region around the sources of the Iller, but extend beyond it to the E. as far as the Lech, and send their spurs to the W., through Tyrol (Vorarlberg), to the Lake of Constance. To the W. of the broad Iller valley extend the Rindalpen Horn (1850 mètres), at whose northern termination the Alp Lake is situated, near Immenstadt. Opposite this chain, on the eastern side of the Iller valley, the picturesque Grünten (1733 m.) forms the watchtower of the Alps towards the plateau. But these Alps are grandest near the sources of the Stillach and the Trettach, which form the Iller; here the Bavarian territory stretches far into Tyrol, and on the frontier the Mädeler-Gabel (2637 m.) and the Hoch Vogel (2588 m.) rise. The Bavarian Alps, at whose northern termination several lakes, such as those of Kochel and Tegern, are situated, extend between the Inn and the Lech, and are torn in a peculiar way by the Loisach and the Isar. The west-eastern chains are numerous. The most remarkable of them in the territory of the German empire extend on both sides of the Isar towards the frontier of Tyrol; to the W., the Wetterstein Mountains, whose western termination, the Zug Spitze, is the highest peak of the realm (2957 m.); to the E., the Karhwandel Mountains, which are followed into Tyrol by three parallel chains. Of the border-chains towards the northern plateau, the Benedikten Wand is especially noteworthy; it extends between the Kochel Lake and the Isar, and to the S. W. of it the Walchen Lake is situated, entirely encircled by the Alps. The Salzburger Alps, E. of the Inn, and within the boundaries of the German empire (Bavaria), are most remarkable at Reichenhall and Berchtesgaden, which two places are situated in the vicinity of Salzburg, among magnificent alpine surroundings. To the S. of Berchtesgaden, which lies 580 m. above the level of the sea, the King's Lake, the most beautiful lake of the empire, is situated, 604 m. above the sea, in the centre of a magnificent landscape, in which arise to the W. the Watzmann (2740 m.) and to the S., but within the Austrian frontier, the Stone Sea (2728 m.) and the mountain of Perpetual Snow (2938 m.). Those parts of the Alps which belong to Germany consist of Bunter sandstone, lime, lias, new red sandstone, Jurassic, chalk, and oligoclase. The Alps, lifted by tremendous forces from their originally horizontal position, pressed forward, and sometimes wholly overturned, rise often through perpendicular walls or steep precipices into jagged peaks covered with eternal snow or glaciers. The complete upsetting of the different strata, and the great difference between the Alps and the other mountains of Germany, make it very difficult to arrive at a correct view of their formation. But the principal cause of the immense disturbances in the Alps was no doubt the frequent great sinkings, which even affected the northern plateau. Bunter sandstone and lime are not found in large quantities; red sandstone forms the principal mass, and to it belong the dolomite and rock-salt formations of Berchtesgaden. Lias forms the chief element of the Algauer Alps, at least of the Bavarian part of them. Jurassic and chalk deposits are not very prominent. In the older Tertiary formations some iron ore is found; the Rindalpen Horn at Immenstadt belongs to the oligoclase formation.

Along the northern terminations of the Alps the Suabian-Bavarian plateau extends; to the S. W. it stretches beyond the boundaries of the empire into Switzerland, as far as the Lake of Geneva, and to the E., in Austria, it connects with the plain of the March and the Hungarian lowlands. It is broadest (80.8 E. m.) between Rosenheim, where the Inn issues from the Alps, and Ratisbon, where the Danube pushes farthest to the N. The southern side of the plateau is bounded by a belt of Alps belonging to the older Tertiary formation; the north-western, from the Lake of Geneva to Regensburg (in which region the Rhine-fall at Schaffhausen is found), by Jurassic mountains, and the north-eastern by the Bavarian and Bohemian mountains, consisting of granite and gneiss. Strata of the later Tertiary formation form the foundations of the plateau, on which diluvial strata have been deposited, and through these the volcanic cones of Hegau, consisting mostly of basalt, rise to the E. of Schaffhausen. A fine hilly landscape stretches along the feet of the Alps, dotted over with beautiful lakes (Ammer, Würm, and Chiem in Bavaria); to the S. of the Ammer Lake the Hohe Peissenberg (975 m.) offers a splendid prospect. The river-valleys of the plateau have first a northern and then a north-eastern direction. Otherwise the plateau is uniform, and even more monotonous than many parts of the North German lowland. Large, partly uncultivated swamps are found in several places; that below Munich, which stands 519 m. above the sea; the Da-

chau Swamp extends on the left, and the Erdinger Swamp on the right bank of the Isar; and between Ulm and Ingolstadt the intricate Danube swamps. The fertility of the plateau is very small in the centre, around Munich, where large forests abound, but very great between the Inn and the Danube, especially at Straubing, the granary of Bavaria. Those parts of the plateau which belong to Würtemberg are more varied with hills and vales, but even there the fertility of the soil is not great. The climate is generally rough, and vine-cultivation succeeds only on the opposite side of the plateau, at the Lake of Constance, which communicates with the vine-region of the Rhine, and along the Danube below Regensburg, which communicates with the vine-regions of Austria and Hungary.

The mountains of Central Germany are separated from the Alps by the Suabian-Bavarian plateau, but connected with the Carpathian Mountains between the sources of the Oder and the Vistula. They consist of three systems: the Rhenish-Westphalian slate mountains, or the Batavian system; the Rhenish system; and the Hercynian or Sudetic system. The Jura Mountains do not belong to any of these systems. (1) The Rhenish-Westphalian slate mountains, or the Batavian system, form a plateau of no considerable height, but in many ways torn by deep river-valleys. It occupies parts of Rhenish Prussia, Westphalia, and Hesse-Nassau, is traversed by the Rhine, which between Bingen and Bonn forms a deep and often very narrow valley. It consists chiefly of strata belonging to the Devonian formation, which, like those of the smaller hill-ranges in the vicinity, show an inclination from S. W. to N. E. To the W. of the Rhine the Moselle forms in the slate mountains a deep and very winding valley between Trier and Coblenz, separating Hunsrück from Eifel. S. of the Moselle, Hunsrück extends to the Saar, and contains some hill-ranges, such as Hochwald, with Erbeskopt (814 m.), the highest top of the slate mountains on the left side of the Rhine. The southern boundaries of the system are designated by the coal-hills of Saarbrück, at the southernmost point of Rhenish Prussia, and the beautiful group of the Donners Berg (689 m.) in Rhenish Bavaria. N. of the Moselle, the Eifel forms a plateau without hill-ranges. Especially the eastern part abounds in volcanic products, such as lava and mineral waters, and in extinct volcanoes, craters, and cones of basalt. The western part is very rough and barren. The highest point of Eifel is the Hohe Acht (760 m.). The valley of the Ahr is productive of wine, the districts around the Laacher Lake quite picturesque, and the millstone quarries at Niedermendig noteworthy. The northwestern part of Eifel, the Hohe Venn (695 m.), situated S. of Aix-la-Chapelle, is entirely bare, and constitutes the most inhospitable region of the empire. Rich collieries are situated at its northern termination, between Aix-la-Chapelle and Eschweiler. The Ardennes in Belgium form the western part of the slate mountains, but may be left out of consideration here. On the eastern side of the Rhine the hill-ranges of Hunsrück are continued by those of Taunus. They are rich in forests and mineral springs, slope rather abruptly to the S., towards the lowland of the upper Rhine, and to the E., towards the Wetterau, but rise in Great Feld Berg to the height of 881 m., and are celebrated for their magnificent vineyards, especially along the foot of the western part of them, the so-called Rhinegau, at Rüdesheim, Johannisberg, and Assmannshausen. To the N., Taunus slopes gently towards the fruitful valley of the Lahn, on whose northern side the plateau of Westerwald (657 m.) extends, which is strewn all over with basalt, and is rich in forests, iron, and brown-coal, and which sends forth at Königswinter the volcanic Sieben Gebirge as an outpost towards the Rhine and the lowland. Still farther to the N. the mountains of the Sauerland, differently named in their different parts, and traversed by the Lenne and the Ruhr, cover the southern part of Westphalia and extend into the neighboring districts. They are very rough in the plateau of Winterberg, around the sources of the Ruhr, the highest point, Astenberg (842 m.), being entirely barren. Along their northern boundary, bordering on the lowland, Haarstrang extends, connecting to the W. with the coal deposits along the Ruhr. (2) The Rhenish system shows an inclination from S. S. W. to N. N. E., and follows the course of the Rhine from Bâle to Mainz, whence it continues in the same direction, but to the E. of the slate mountains, to the Weser. With its two highest branches, the Vosges and the Black Forest, it encloses the low plain of the upper Rhine, which stretches on both sides of this river from Bâle to Mainz, and which must be considered as the finest region of Germany, on account of the fertility of the soil, the mild climate, the excellent fruit, and the superior wine. The Rhenish system consists in its middle chains and plateaus of sandstone; in its lower parts, which to the E. and to the W. extend towards the Jura Mountains, of lime and red sandstone; in its highest parts, in the S., as also in some points on the border of the low plain of the upper Rhine, of granite and gneiss; and in the northern parts, belonging to the region of the red sandstone, heavy masses of basalt are found. Although the Vosges in Alsace-Lorraine and France, and the Black Forest in Baden and Würtemberg, are separated by the low plain of the upper Rhine, in which the insulated volcanic mountain, the Kaiserstuhl, rises, yet they show many similarities: the same height—Sulzer Belchen in the Vosges is 1432 m., Feld Berg in the Black Forest, 1494 m.; the same abrupt descent towards the plain in the regions of the older formation, and the same gentle declivity in those of the later; the same extension to the S.—the Vosges to the gap at Belfort, the Black Forest to the Rhine at Waldshut; the same construction—granite, gneiss, and Devonian strata in the higher parts, though so that the latter are more prominent in the Black Forest, the former in the Vosges. In both groups small streams descend on the steep side, while large rivers have their sources on the opposite sides, the Moselle in the Vosges in France, and the Neckar and the Danube in the Black Forest. Also the beauties of nature, the traditions, and the ruins are similar, though they certainly are much richer in the Vosges. But the Vosges form a ridge on the watershed between the Moselle and the Ill, and the Black Forest has none; and while the Black Forest entirely disappears between Carlsruhe and Pfordsheim, the Vosges reach to the latitude of Strasburg in their full height, and continue then through lower formations of red sandstone into Rhenish Bavaria, where at Kaiserslauten a connection takes place with the slate mountains. To the E. of the low plain a small range of hills connects the Black Forest with Oden Wald, which, chiefly extending between the Neckar and the Main, encircles Heidelberg, and is separated from Spessart by the Main. Odenwald and Spessart are also very similar, being of the same height (about 620 m.) and same formation, sandstone prevailing, with granite and gneiss on the western side. On the northern sandstone plateau of the Hesse, Vogels Berg arises between Giessen and Hanau, consisting mostly of basalt, covered with forests and 772 m. high (the Taufstein). Along its western slope runs the railway from Frankfort to Bremen; along its eastern slope, that from Frankfort to Berlin. Just E. of Vogels Berg lies the High Rhön (Abtsrhön in Prussia, 950 m.; Kreuzberg in Bavaria, 930 m.), in which group basalt is very prominent. The higher parts, which are treeless and occupied by moorland and grass-fields, are covered during the winter with heavy snow-masses, and resemble the northern countries more than any other part of the empire. Near the point where the Fulda and the Werra unite and form the Weser are the Habichtswald; E. of Cassel, the Meisner; near the Werra, the Sollinger Wald, with its beautiful forests on the right side of the Weser; the Egge and the rather barren plateau of Paderborn W. of the Weser. E. of the sandstone formation follows, from Heidelberg to Nuremberg, a formation of shell-limestone and red sandstone, the Suabian-Franconian terraces, the most remarkable points of which are the Franconian Hills, between the Danube and the Rhine (Wörnitz and Tauber), the Steigerwald, and the beautiful Main valley in Lower Franconia. This region of terraces extends as far as the Jura Mountains, which rise very abruptly from it, while on the other side they slope gently down towards the Suabian-Bavarian plateau. The German Jura is a continuation of the Swiss Jura, but differs very much from it. It has not those parallel edges which characterize the Swiss Jura; it rises in elevated plats, traversed by valleys. At some elevations reigns a general scarcity of water, as the water sinks very rapidly through the Jurassic limestone, and forms rich springs at the foot of the mountains and in the deep valleys. Numerous caves are found, especially in Würtemberg and Franconia, among which that at Muggendorf is famous for the remains it contains of extinct animals. The German Jura is divided into the Suabian and Franconian Jura by a fertile basin, the Nördlinger Ries. The former, situated mostly in Würtemberg, is 1012 m. high, and runs from S. W. to N. E.; the latter, situated between the Danube and the Main, extends into the region of the Fichtel Gebirge, has from Coburg a direction S. and N., and is much lower. To the W. of the Rhine, beyond the shell-lime and red sandstone formation in Lorraine, on the Moselle, another Jura chain rises at Metz, which in Germany is very rich in iron ore, but which chiefly is situated in France. (3) The Hercynian or Sudetic system comprises the north-eastern part of the mountains of Central Germany, and has a general direction from S. E. to N. W. It consists of two well-marked mountain-lines. The southern contains Böhmer Wald, Fichtel Gebirge, Thüringer Wald, and Teutoburger Wald; the northern, the mountains of Silesia, the Harz, and the Weser Mountains. The ground between the two lines is occupied by the mountain-regions of Bohemia and Mo-

ravia, the Erz Gebirge, and the terraces of Thuringia. The largest part of this system, from the sources of the Danube and the Oder to the Thüringer Wald, consists chiefly of granite and gneiss; in the north-western parts influences from the other systems are apparent. The Böhmer Wald forms the boundary between Bohemia and Bavaria. To the S. E. its offshoots reach the Danube between Passau and Linz. It is chiefly composed of gneiss and granite, and consists of several chains, the principal one of which is on the frontier between the two countries, and is, like the chains belonging to Bohemia, entirely covered with forests. The highest points are in the principal chain, the Great Arber (1476 m.) and the Great Rachel (1458 m.); in the Bohemian chain, the Kubany (1357 m.), situated in a wilderness of forests; and in the treeless Bavarian chains on the Danube, the Dreitannen Riegel (1216 m.). On the Bavarian side the Böhmer Wald proper terminates in a deep basin, through which the railway runs from Regensburg to Prague. The Oberpfälzerwald forms the continuation to the N. W., and extends to the plain of Naab Wondreb; it is, in Bohemia, called the Czerkow Mountains. Beyond these rises the Fichtel Gebirge, forming the watershed between the Danube, Elbe, and Rhine. It forms the centre of the German mountains, those of German Austria included, and is about 280 E. miles distant from the beginning of the delta of the Rhine, the mouths of the Weser and Oder, and the cities of Presburg, Trent, Bâle, and Strasburg. From it the Eger flows eastward, and the Saale northward, both to the Elbe; the Main westward to the Rhine, and the Naab southward to the Danube. The highest points are the Schnee Berg (1063 m.) and the Ochsen Kopf (1026 m.). Granite and gneiss form the principal rocks of this group. Gneiss is found especially on the plateau of Frankenwald, which leads from Fichtel Gebirge to the Thüringer Wald, and is covered with magnificent forests. The Thüringer Wald, so important as the boundary which separates the Franconians in the S. from the Thuringians in the N., forms to the S. E. a broad plateau, but to the N. W. a real edge, terminating in a cone at Eisenach on the Werra. In the broader south-eastern part the rocks of the Silurian and Devonian formations are most prominent. The north-western part, beginning at the source of the Werra, consists of porphyry and different kinds of crystalline rocks. The highest points are the Great Beerberg (984 m.) and the Schnee-Kopf (978 m.), both situated on the Schmücke; farther to the N. W., the Inselsberg (914 m.), and at Eisenach the celebrated Wartburg. To the N. of the Thüringer Wald the Thuringian terraces extend to the Harz, the plateau of Eichsfeld forming the watershed between the Weser and the Elbe. The Harz is a group of mountains 56 E. miles long, situated between the Leine and Saale, and sloping abruptly to the N. towards the lowland. Its most beautiful points are found along its northern border, the Selke Valley, Bode Valley, Viktors Höhe, Ilse Valley, and the Brocken, the highest point (1141 m.), from which the plateau of the upper Harz stretches to the W., and that of the lower Harz to the E. The principal rocks of the Harz, along whose northern border chalk formations have assumed wonderful forms, are granite chiefly in Brocken, Silurian rocks in the upper Harz, red sandstone, melaphyre, and, as frame of the whole, zechstein. The north-western part of the Hercynian system, traversed by the Leine and the Weser, and extending nearly to the Ems, consists of numerous ranges, in which are found coal, Jurassic rocks, and chalk. The Teutoburger Wald, wholly to the W. of the Weser, and the Weser Mountains, with the gates of the Weser, beyond Minden, run in the same direction as the two principal lines of the system. Between the Weser and the Leine, Süntel, Deister, and Bückeberg are situated, containing considerable coal deposits; in the N. W., near the Ems, lies the small but important coal mountain of Ibbenbühren. None of all these ranges reaches the height of 500 m. From the Fichtel Gebirge, the Erz Gebirge stretches to the N. E., forming the boundary between Saxony and Bohemia. It is steep towards the valley of the Eger, but slopes gently towards the low plain in the N. along the Mulde. Keil Berg (1235 m.) and Fichtel Berg (1213 m.) are the highest points. The prevailing rocks are gneiss, granite, mica, and clay-slate, to which must be added porphyry and red sandstone, with the cave formations at Zwickau, Chemnitz, and Dresden (Potschappel). At the Elbe above Pirna we meet the sandstone mountains of the Elbe, which, under the name of Saxon Switzerland, have acquired a fame not quite deserved. They are continued to the E. along the boundary of Saxony and Bohemia by the Lausitzer mountains, while to the N. the granite plateau of Upper Lausitz, on which the Spree originates, extends from Dresden to Görlitz. E. of the Lausitzer mountains the Silesian mountains begin, which extend in a south-eastern direction, partly in Silesia, partly in Bohemia and Moravia, to the large basin of the upper Oder, through which the railway leads from Upper Silesia to Vienna, and beyond which the Carpathians begin. Within these boundaries the Silesian mountains are divided twice by cuts running from S. to N., once at the upper Bober, and once at Glatz, through which two depressions the railroads of Silesia connect with those of Austria. In the basin of the upper Bober rises the Riesen Gebirge, on the boundary between Silesia and Bohemia. This group contains the highest mountains of Central Germany, well-marked ridges, covered with forests and beautiful valleys. The highest point is Schneekoppe (1665 m.). Like their western continuation, the Isergebirge, they consist mostly of granite on the Silesian side, and of mica in Bohemia and the Schneekoppe. The beautiful Hirschberger Valley lies at their northern foot. The melaphyre and porphyry formations of the coal mountains of Lower Silesia at Waldenburg, lie to the E. of the upper Bober, and form the transition to the mountain-system of Glatz. This surrounds the kettle-shaped valley of Upper Glatz, and consists of several mountain-ranges, of which the Heuscheuer in the W., with its freestone, belongs to the chalk formation, while the Eulen Gebirge in the N. and on the border of the plain, as well as the Glatzer Schneegebirge (Great Schnee Berg, 1412 m.), consists mostly of gneiss. To the S. E. the Sudetic Mountains (Altvater, 1440 m.) are situated, wholly within the boundaries of Austria.

The North German lowland is only a small part of the great European lowland, which occupies almost the whole of Eastern Europe, and to the W. reaches as far as the Strait of Dover. In Germany that part of the lowland which lies to the W. of the Elbe differs very much from that which lies to the E. Fertile marshes extend along the North Sea, also on the eastern side of the Elbe, along the whole western coast of Sleswick-Holstein. They generally lie so low that they must be protected against the sea and the rivers by dykes. Here, in the western part of the German lowland, large swamps alternate with sand-fields, and real hill-ranges do not appear to any extent, except in the vicinity of the Elbe. The Lüneburger Heide, with their brown heath, can support only coarse sheep and bees. In the eastern part, on the contrary, hill-ranges appear, and stretch eastward to the Ural Mountains. Of special interest is the Baltic-Uralic ridge, which begins in Jutland, curves around the Baltic through Sleswick-Holstein, Mecklenburg, Brandenburg, Pomerania, and Prussia, is traversed by the Oder and the Vistula, and forms in Russia a most important watershed. It consists of a broad, undulating extension, is rich in lakes, and rises in Germany, in the province of Prussia, thrice to the height of 300 m. Another ridge, the Mark-Silesian, stretches through Brandenburg and Silesia from N. W. to S. E., and communicates in Poland with the Polish mountains. Between these two ridges large lowlands extend, especially in Brandenburg, along the Havel, the Spree, and the Oder, and these lowlands have made it easy to establish a communication by canals between the Elbe, Oder, and Vistula. Lowlands and beautiful hill-ranges are also found along the Baltic; as, for instance, on the island of Rügen. Dunes also appear; as, for instance, on the land-strip which separates the Kurische Haff from the Baltic, where they are more extensive than in any other place in Europe. The foundation of the whole North German lowland, at least to the E. of the Elbe, belongs to the Tertiary formation, which, however, is covered on the elevations with diluvial, and in the depressions with alluvial formations. The older rocks appear very seldom on the surface, except on Rügen and in Mecklenburg; chalk and even Jurassic rocks occur in Pomerania; shell-lime at Rüdersdorf, near Berlin; gypsum and extensive rock-salt deposits at Segeberg in Sleswick-Holstein, Sperenberg in Brandenburg, Inowraclau in Posen, and in Hanover. Also other rocks are found along the mountain-land; as, for instance, Devonian at Magdeburg, to the W. of the Elbe; granite and serpentine in the insulated Zobten (728 m.), near Breslau in Silesia; and large coal deposits appear in Upper Silesia, to the E. of the Oder, in spurs of the Carpathians.

Hydrography. — The German empire borders on two seas, the North Sea and the Baltic. In the North Sea the usual tide rises 3, the highest spring-flood 8, mètres. A number of islands are scattered along the coast from the Netherlands to Jutland, among which Borkum, Norderney, and Sylt belong to Germany. The sea between these islands and the mainland is called the Watten Sea, but in many places it is entirely dry at low tide. The Gulfs of Dollart and Jade cut deeply into the mainland; also the mouths of the Weser, Elbe, and Eider expand into a sort of gulfs. The Baltic, which has no tides, forms long, narrow, and deep gulfs in Sleswick-Holstein (Flensburg, Kiel). A remarkable feature are the Haffs, large fresh-water lakes or estuaries of rivers. The Pomeranian Haff in Pomerania is separated from the Baltic by the islands of Usedom and Wollin. In Prussia the Frische Haff, at the mouths of the

Vistula and the Pregel, and the Kurische Haff, at the mouth of the Memel, are separated from the Baltic by narrow land-strips covered with dunes. The German empire owns parts of seven river-valleys and three large coast-streams. Of the latter, the Pregel flows to the Baltic, and the Eider and Ems to the North Sea; of the former, the Memel, Vistula, and Oder flow to the Baltic, the Elbe, Weser, and Rhine to the North Sea, and the Danube to the Black Sea. Of all these rivers, the Weser is the only one which belongs entirely to the German empire—of the Elbe and Oder, the largest part; of the Rhine, the larger half. The Memel (in Russia called Niemen) flows through the north-eastern corner of the empire, and divides into two branches, the Russ and the Gilge, both of which fall into the Kurische Haff. It is 490 m. long, and connects with the Pregel by the Gilge and several canals. The Pregel, the principal river of East Prussia, is formed by the Inster, Pissa, and Angerapp, receives the Alle, sends the Deime to the Kurische Haff, and passes through the Frische Haff to the Baltic. The Vistula (652 E. miles) rises in Austrian Silesia in the Carpathians, and belongs, in a small part of its upper course, to Silesia; it then traverses Galicia and Poland in a great curve, and enters Prussia above Thorn, where in the fertile lowland it divides into several branches. Two of these branches, among which is the Nogat, flow to the Frische Haff—two directly to the Baltic, in the vicinity of Danzic. Its largest feeder in Poland is the Narew, with the Bug; its affluents in Prussia—the Drewenz from the right and the Brahe from the left—are less important, but they have a considerable fall, and form a system of canals, among which the Elbing-Oberländische in East Prussia leads from the Drewenz to the Elbing, which falls into the Frische Haff beside the Nogat, while the Bromberger Canal connects the Brahe with the Netze, an affluent of the Oder. Among the coast-rivers of Pomerania may be mentioned the Stolpe, Wipper, Persante, and Rega. The Oder (559 E. miles long) has its sources in Moravia, flows through Silesia, Brandenburg, and Pomerania, becomes navigable in Upper Silesia, forms the Pomeranian Haff, and falls into the Baltic through three branches—the Peene, Swine, and Dievenow. The only important among its affluents from the right side is the Warthe (442 E. miles), which receives from the right the Netze (211 E. miles), which again communicates with the Vistula through the Bromberger Canal. To the left it receives the Glatzer Neisse, the Bober, and the Lausitzer Neisse, which all originate in the Silesian Mountains, but contain very little water during the summer; in the Pomeranian plain it receives the Peene. The Oder is in Brandenburg connected with the Elbe by the Fr. Wilhelm Canal, which leads to the Spree, and the Finow Canal, which leads to the Havel. Between the Oder and the Elbe is a long line of coast-land which is cut at Rostock by the Warnow and at Lübeck by the Trave. The Elbe (721 E. miles long) rises in Bohemia in the Riesen Gebirge; flows in a curve through Northern Bohemia, where it receives the Moldau and the Eger; enters the German empire through the sandstone mountains of the Elbe and the lowland at Dresden; traverses the kingdom and the province of Saxony, Anhalt, Hanover, Mecklenburg, and Sleswick-Holstein, and falls into the North Sea 84 E. m. below Hamburg, having a breadth of 11 E. m. at its mouth. It is decidedly the most important river of Northern Germany; it opens a navigable water-road far into Bohemia; and through navigable affluents and canals it communicates with all the rivers of the eastern part of the country. Near its mouth stands the most important port of Germany, Hamburg. On the right, the Elbe receives, besides the Elde in Mecklenburg, the Havel (221 E. m.), through whose affluent, the Spree, on which Berlin stands, it connects by canals with the Oder. On the left it receives the Mulde from the Erz Gebirge, the Saale (226 E. m.), which gathers a part of the waters from the Fichtel Gebirge and the Thüringer Wald through the Ilm, on which Weimar stands; from the Thuringian terraces through the Unstrut; from the Harz through the Bode; and from the Erz Gebirge through the White Elster, on which Leipzig stands. The Weser (267 E. m.) is formed by the Werra from Thüringer Wald and the Fulda from the Hohe Rhön; receives on the right the Aller, through the Ocker, and Leine, on the left the Hunte, passes by Bremen, and falls into the North Sea below Bremer Hafen, having a breadth of 7 E. m. at its mouth. The Ems flows through sand-fields and moorlands, mostly uncultivated, in Westphalia and Hanover, and falls into the Dollart. The Rhine (948 E. m.), the principal water-road in Western Germany, and from Bâle to the boundaries of the Netherlands wholly within German territory, originates from several sources in the Swiss Alps, and divides in the Netherlands into numerous branches. That part of the Rhine which lies between the Lake of Constance and Bâle belongs partly to Switzerland and partly to Germany. From Bâle to Mainz the Rhine traverses the plain of the upper Rhine; from Bingen to Bonn it breaks through the slate mountains; and at Bonn, opposite the Sieben Gebirge, it enters into the North German lowland. On the right the Rhine receives first several small streams from the Black Forest, among which are the Kinzig and the Murg; then the Neckar (247 E. m.), the principal river of Würtemberg, originating on the eastern side of the Black Forest, and receiving from the left the Enz, and from the right the Kocher and the Jagst; and at last the Main (308 E. m.), which is formed by the White Main from the Fichtel Gebirge, and the Red Main from the Franconian Jura, and which flows through Franconia with a very winding course, joining the Rhine in the northern part of the plain of the upper Rhine, opposite Mainz, and receiving from the left the Regnitz and the Tauber—from the right the Franconian Saale; the Ludwigs Canal connects the Regnitz at Bamberg with the Altmühl, an affluent of the Danube. Other affluents of the Rhine on its right are the Lahn, Sieg, Ruhr, and Lippe. On its left it receives the Ill near Strasburg, the Nahe at Bingen, and at Coblenz the Moselle (314 E. m.), which rises on the French side of the Vosges, traverses Metz, and receives on the right side the Saar, which also comes from the Vosges. At Strasburg the Rhine-Rhône and the Rhine-Marne canals connect the Rhine and the Ill with the Rhône and the Marne. The Danube (1771 E. m.), the principal river of Southern Germany, is formed at Donaueschingen by the Brege and the Brigach, which both rise in the Black Forest. After breaking through the Jura, it flows along the northern border of the Suabian-Bavarian plateau, through Würtemberg and Bavaria, and enters Austria below Passau. It becomes navigable at Ulm, and receives from the left the Altmühl, the Naab, and the Regen, and from the right the Iller, Lech, Isar, and Inn. The last rises in Switzerland, is 317 E. m. long, the principal stream of the Northern Tyrol, and joins the Danube at Passau, after receiving from the right the Salza.

There are many lakes in Germany, but no great ones. Most of them are situated in the vicinity of the Alps and on the Baltic-Uralic ridge or near the Baltic. In the S. the lakes of Chiem, Würm, and Ammer are the most important; King's Lake is the most beautiful; of the Lake of Constance, parts belong to Austria and to Switzerland. In the N. the most noticeable lakes are Müritz and Schwerin in Mecklenburg, Leba in Pomerania, Geserich on the boundary between East and West Prussia, and Mauer, Löwentin, and Spirding in East Prussia.

Climate.—The German empire is situated in the happy temperate zone. Only a few peaks of the Alps on the southern boundary of Bavaria rise into the snow-region. In the other mountains there are also a few points where the snow may last into the summer, and sometimes the whole year round. But the whole country lies in the region in which the warm and moist winds still have power enough to resist the arctic currents, and in which rain may occur at every season. The lowest annual rainfall, between 12 and 16 inches, has been observed in the centre of the Silesian plain at Polnisch-Wartenberg and Breslau, at Würzburg on the Main, at Sigmaringen on the Danube, at Dürkheim in Rhenish Bavaria, and at Güstrow in Mecklenburg. The largest rainfall has been observed on the North Sea (27–35 in.), and in the mountains—in the Riesen Gebirge, 43; in the upper Harz, 59 in.; in the slate mountains, 40; in the Alps and the Black Forest, 55; and in the Vosges, 43 in. The annual average heat of Germany, exclusive of the mountains, varies from 43° to 51° F. Along the Baltic coast, or in the vicinity of it, the heat rises from 43° F. in the north-eastern part of East Prussia to 47° F. at Kiel, while the North German land-ridge, situated farther back, shows not 43° F. in the province of Prussia, and not 45° in the more elevated portions farther W. The highest annual average heat is found in the plain of the upper Rhine, where it slowly increases from Frankfort-on-Main to the Neckar, and then again decreases towards the S., according to the elevation. On the Main, at Strasburg and Bâle, the annual average heat is a little below 50°; on the lower Neckar and in the immediate surroundings on both sides of the Rhine, more than 51°.

The vine and the maize reach in Germany their northernmost boundary. The former demands, in order to be cultivated with success, an annual average heat of at least 7° R., and the latter even somewhat more. Thus, the maize still ripens in the south-western parts of the country, but in the districts around the Havel, where in Potsdam table-grapes are still produced, it is cultivated only as fodder. On the Rhine the vine stops at Bonn—on the Saale a little below the mouth of the Unstrut. The chestnut has its northernmost boundary between Coblenz and Cologne, but it is still found at Wernigerode in the Harz. The peach ripens still in the open air in Rhenish Prussia, but in Brandenburg only under shelter; the walnut, on the contrary, succeeds

even in West Prussia. The flowering of fruit trees takes place at Memel eight days later than at Königsberg, three weeks later than at Berlin, and four weeks later than on the Rhine. The beet-root succeeds well in the fertile regions between the Oder and the Weser, but in East Prussia it contains very little sugar. Of the forest trees, the red beech stops a little S. of Königsberg. The ice lies generally 26 days on the Rhine, 30 on the Weser, 62 on the Elbe, 70 on the Oder, 86 on the Vistula, and 116 on the Memel. Storms are more numerous and violent in the S. than in the N. Heavy earthquakes, such as occur in Southern Europe, have never been observed in Germany.

Although the climate generally is healthy, yet endemics and epidemics occur, such as fevers in the swamp districts and goitre in some mountain-regions; and among epidemics cholera and smallpox. Cholera appeared for the first time in Germany in 1831; from 1831 to 1874, 420,000 persons died by this disease.

Minerals.—The production of gold is very small, 640 pounds yearly; more important is that of silver, which is seldom found pure, but generally mixed with lead and copper ore; 228,000 pounds were produced in 1872, of which 162,553 pounds in Prussia, chiefly in the Harz, and over 62,000 pounds in the kingdom of Saxony, at Freiberg. At Freiberg and at Klausthal in the Harz are mining academies, of which the former is the centre of the whole science of metallurgy and mining. Lead ore to the amount of 2,500,000 cwts. is annually raised, especially at Aix-la-Chapelle, Oppeln, Wiesbaden, in Harz, and at Freiberg. In 1872 the smelting produced 1,160,000 cwts. of lead and litharge, of which 1,080,144 cwts. were in Prussia alone; one-half at Aix-la-Chapelle. About 5,000,000 cwts. of copper ore are annually raised, especially in the zechstein formations at Merseburg in the province of Saxony, in the eastern Harz, and at Arnsberg in Westphalia. The smelting produces annually about 150,000 cwts. of copper. Germany is very rich in iron ore. The most remarkable strata are found in the Jura Mountains, on the left side of the Moselle in Lorraine, connecting with the rich strata in Luxemburg; in the Lower Devonian, on the right side of the Rhine from the Wied, N. of Coblenz, to Siegen in Westphalia; in the Upper Devonian, on the Lahn in Wiesbaden; and in Fichtel Gebirge, Erz Gebirge, Upper Silesia, and Thüringer Wald. The production of iron ore amounts, at present, to more than 90,000,000 cwts. annually, of which, in 1872, 73,427,353 cwts. were produced in Prussia, and about 14,000,000 cwts. in Alsace-Lorraine. The production of pig iron, surpassed only by England and America, amounted in 1872 to about 36,000,000 cwts.—namely, 29,156,704 cwts. in Prussia, 4,441,401 in Alsace-Lorraine, 1,210,597 in Bavaria, and about 1,500,000 in the other states. At least 160,000 men are employed in Germany in the production of iron. More than 7,000,000 cwts. zinc ore (calamine and zinc-blende) are annually raised: calamine (nearly 6,000,000 cwts.) especially at Leuthen in Upper Silesia; zinc-blende in Westphalia and Rhenish Prussia. The production of zinc in 1872 amounted to 1,163,779 cwts. Manganese ore is chiefly raised at Wiesbaden on the Lahn and in the Thüringer Wald. Bismuth is found in the kingdom of Saxony; antimony in Thuringia and Westphalia; cobalt in the kingdom of Saxony and Hesse-Nassau; nickel and tin in Saxony; quicksilver in Westphalia, but only in small quantities. Coal is the most important mineral which Germany possesses. It is found in seven large and several minor deposits. Of the large deposits, five belong to Prussia, and two to the kingdom of Saxony. The largest of all coal deposits in Germany is that in Upper Silesia. It stretches into Austria and Russia, but is most powerfully developed in Germany in the districts of Tarnowitz, Beuthen, and Zabreg, from which it extends into the neighboring counties of Pless, Rybnik, Tost-Gleiwitz, and Ratibor, comprising an area of 532 E. sq. miles and reaching the surface on an area of 213–234 E. sq. miles. The working of this coal-field began in 1784; at the beginning of this century the production amounted to 400,000 cwts., in 1822 to 4,000,000, in 1864 to 75,000,000, in 1873 to 156,786,309 cwts. The second great coal deposit is situated in Lower Silesia, in the district of Waldenburg, but some of its strata extend into the county of Glatz, and through the district of Landshut into Bohemia. The production of this field amounted in 1787 to 800,000 cwts., in 1838 to 4,000,000, in 1864 to 21,000,000, and in 1872 to 42,351,118 cwts. The third great coal-field in Prussia stretches along the northern border of the slate mountains on the Ruhr, especially in the districts of Dortmund, Bochum, and Hagen in Westphalia, and Essen and Duisburg in Rhenish Prussia. It is 51 E. m. long, and extends on the left side of the Rhine below very recent layers of earth; that part which reaches the surface comprises 170 E. sq. miles, the whole 340. The production of the Westphalian division amounted in 1740 to 600,000 cwts., in 1800 to 4,000,000, in 1854 to 24,000,000, in 1864 to 76,500,000, and in 1872 to 175,710,249 cwts.; that of the Rhenish Prussian division amounted in 1827 to 3,500,000, in 1854 to 27,000,000, in 1864 to 65,500,000, and in 1872 to 105,604,763 cwts. About 200,000,000 cwts. are annually shipped from these coal-fields by rail, and 30,000,000 to 40,000,000 by the Rhine. The fourth coal-field is situated in two separate basins near Aix-la-Chapelle, to the N. of the Hohe Venn; they yielded 20,826,285 cwts. in 1872. The fifth coal-field, on the Saar, at the southern foot of the slate mountains, extends into Bavaria and Alsace-Lorraine; the productions of the Prussian part amounted in 1815 to 2,000,000, in 1854 to 24,000,000, in 1864 to 56,000,000, and in 1872 to 84,444,680 cwts., besides 3,577,278 cwts. in Bavaria and 5,804,110 cwts. in Alsace-Lorraine. Several other minor coal-fields are found in Prussia: at Ibbenbühren in Westphalia (3,074,373 cwts. in 1872), in Hanover and Hesse-Nassau (7,720,896 cwts. in 1872), and at Wettin on the Saale, N. of Halle. Of the two coal-basins in the kingdom of Saxony, the one is situated at Potschappel, near Dresden; the other, and more important, at Zwickau and Chemnitz. They yielded in 1845, 9,000,000, in 1858, 24,000,000, and in 1872, 58,925,228 cwts. Minor coal-fields are worked on the southern side of the Thüringer Wald, at Neuhaus in Meiningen, and at Rockhing in Bavaria, in the Black Forest in Baden, and in the Tertiary formations in Bavaria at the foot of the Alps. The total production of coal in Germany in 1872 was 666,000,000 cwts.—namely, in Prussia 590,475,512; in Saxony 58,925,229; in Bavaria 8,248,237; in Alsace-Lorraine 5,840,511; and in the other states, 2,600,000 cwts. In the same year 40,161,802 cwts. of coal and coke were imported to the German Zollverein; 81,670,481 cwts. exported. Coal is imported from England for the coast-regions, especially to those E. of the Elbe, and exported to Russia, Austria, the Netherlands, and France. The deposits of brown coal are still more extensive, and comprise a western and an eastern division. The western division consists of the basins of the lower Rhine, at the northern border of the slate mountains, and especially to the W. of Bonn and Cologne. The eastern division extends from the Thuringian terraces to the coast-regions of East Prussia, and is strongly developed, especially in the provinces of Saxony and Brandenburg. In 1872, 182,000,000 cwts. of brown coal were produced in Germany—namely, 148,992,730 cwts. in Prussia; 12,028,966 in Saxony; 9,000,000 in Anhalt; 4,500,000 in Thuringia, and 4,500,000 in Brunswick. In 1873, 29,781,435 cwts. were imported into the German Zollverein, especially from Bohemia; 381,393 cwts. were exported. Peat is raised in the extensive moorlands of the North German lowland and the Bavarian plateau. Amber is found on the coast of the Baltic, especially from Pillau to Memel.

Of precious stones only a few inferior species are found, such as the topaz in the kingdom of Saxony, the chrysoprase in Silesia, the agate in Silesia, and different species of rock-crystals. For larger articles of art, serpentine, alabaster, marble of various kinds are used; also the erratic blocks of the North German lowland and the granite from Weissenstadt in the Fichtel Gebirge. Gypsum is found in the zechstein formations, and in insulated spots in the North German lowland; it is of great importance as a fertilizer. Phosphorite, likewise used as a fertilizer, is raised at Wiesbaden; fluor-spar and heavy spar in the mountains of Central Germany; magnesite in Silesia. Limestone is found in many different deposits; building-stone and freestone everywhere. The sandstone of Saxon Switzerland, Sollinger Wald, and the Weser Mountains is sent even to the coast-regions. About 1,500,000,000 of brick and tiles are annually made of the clay and loam of the lowlands; fireproof brick is made of the clay of the coal formation. Millstones are raised in Eifel at Niedermendig; lithographic stones at Solnhofen on the Altmühl in the Franconian Jura; roofing slate in the slate mountains, but especially at Lahnstein and Gräfenthal in Thüringer Wald; table slate and grapholite in Thüringer Wald; chalk on Rügen; graphite in Böhmer Wald; kaolin especially in Thüringer Wald.

The production of salt increases every year. Many of the salines, however, have ceased to be worked since the discovery of the large strata of rock-salt. Among these, that in the Alps of Salzburg has been in operation for a long time. In 1816 the rock-salt layers were reached in Würtemberg by boring, in 1853 those at Stassfurth in the province of Saxony, and since that time many others in different places around the Thüringer Wald and the Harz. In the North German lowland rock-salt layers of immense volume were discovered by boring, in 1867 at Sperenberg in Brandenburg, in 1868 at Segeberg in Sleswick-Holstein, and in 1871 at Inowraclau in Posen. The total production of salt in Germany amounted in 1872 to 20,225,754 cwts.—namely, 9,441,664 in Prussia, 5,923,098 in Anhalt, 1,641,166

in Würtemberg, 942,290 in Bavaria, 716,187 in Alsace-Lorraine, 612,302 in Thuringia, 495,003 in Baden, and 307,809 in Hesse: 7,637,500 cwts. were crystallized salt; 2,796,418 rock-salt; and 9,789,836 potassic salts (only in Anhalt and Prussia). Iron pyrites are very frequently found, especially on the Linne in Westphalia; about 2,500,000 cwts. are annually raised. Alum is found in the brown-coal formations. Germany is very rich in mineral springs. The most important are Baden-Baden in Baden; Kissingen in Bavaria: Wiesbaden, Homburg, Ems, and Nieder-Selters in Hesse-Nassau; Aix-la-Chapelle in Rhenish Prussia; and Pyrmont in Waldeck.

Agriculture.—Of the total area of the German empire, fields and gardens occupy 48.5 per cent. (102,115 E. sq. miles), meadows and pastures 17.7 per cent. (37,227 E. sq. m.), forests 25.3 per cent. (53,109 sq. m.), and waste land 8.5 per cent. (17,944 E. sq. m.). In the Prussian provinces the largest proportions of fields are found in Sleswick-Holstein (64.1), Posen (59.6), Saxony (59.1), Pomerania (54.7), and Silesia (54.0). Forests are most frequent in the interior. Prussia possesses 23.1 per cent., Mecklenburg 13.3; of the Prussian provinces, Sleswick-Holstein possesses 4 per cent., Hanover, Pomerania, Prussia, and Silesia 18–20 per cent. The central and southern parts of the country, in which the mountain-regions are suited for forest cultivation only, possess 30 per cent., Hesse-Nassau, 40 per cent.

The annual average production of the more important kinds of bread-corn is—34,000,000 hectolitres wheat, 15,000,000 hectol. spelt, 94,000,000 hectol. rye, 30,000,000 hectol. barley, 87,000,000 hectol. oats, and 272,000,000 hectol. potatoes, of which in Prussia 19,000,000 hectol. wheat, 69,000,000 hectol. rye, 12,000,000 hectol. barley, 55,000,000 hectol. oats, and 176,000,000 hectol. potatoes. Agriculture stands highest in the Saxon countries, but on account of the greater proportion of fields, Mecklenburg and the Prussian provinces of Sleswick-Holstein, Prussia, Pomerania, Posen, and Silesia are the richest corn-lands. The cultivation of maize is insignificant; peas are found everywhere, the gray only in East Prussia; lupine is much cultivated on the poorer fields in Northern Germany as a fertilizer. The cultivation of fruit trees demands an annual average temperature of 6° R., and thus it can be carried on with success through the whole country with the exception of the more elevated tracts. It has its principal domain, however, in the south-western parts of Germany, especially in the Neckar Valley in Würtemberg, where, in the vicinity of Stuttgart, 15,200 fruit trees may be counted on one square mile. Apples, pears, plums, and cherries are found everywhere; in the S. W. also apricots, peaches, and in very favorable localities even almonds and figs. The vine-cultivation succeeds only in regions which have an annual average temperature of at least 48° F. Thus, the vineyards are found, together with the orchards, in the south-western part of the country, though most excellent wine is produced in Hesse-Nassau, under the shelter of Taunus and the Rheingau Mountains, and on the northern border of the plain of the upper Rhine (Rüdesheim and Johannisberg). The vineyards occupy in Germany an area of 303,900 acres; the production of wine amounts on an average to 3,800,000 hectol. a year; in Prussia, 49,400 acres, 378,000 hectol.; in Bavaria 54,600 acres, 612,000 hectol.; in Würtemberg, 43,800 acres, 414,000 hectol.; in Baden, 49,400 acres, 1,250,000 hectol.; in Alsace-Lorraine, 78,100 acres, 1,250,000 hectol.; in Hesse, 23,400 acres, 322,000 hectol. Vegetables are grown at Erfurt, Bamberg, and near all the large cities. Flowers are cultivated at Berlin, Potsdam, Erfurt, and Quedlinburg. Landscape-gardening is principally carried on at the princely palaces, with which large hot-houses are generally connected. The cultivation of oil-seeds has much decreased, on account of the large importation of petroleum from America, but a considerable quantity is still produced for exportation. Of dyestuffs are produced madder, safflower, etc., especially in the provinces of Silesia and Saxony. The cultivation of flax, which at one time was decreasing on account of the extensive use of cotton, is now increasing. It succeeds very well in mountain-regions of middle elevation, but also in the northern lowland. The best flax is raised at Bielefeld in Westphalia, where hemp is also cultivated. The cultivation of flax and hemp in Germany occupies at least 494,000 acres. Chicory is cultivated in Baden and the province of Saxony (14,800 acres). The beet-root, which since 1836 has been of some importance to Germany, is cultivated at present on more than 173,000 acres, especially in the fertile regions of the province of Saxony. From 2,000,000 to 3,000,000 cwts. of beet-root were consumed by the sugar-factories in 1837, but in 1874 no less than 70,000,000. Since the potato disease made its appearance beet-root has been much used as fodder. The tobacco cultivation is decreasing; it occupies about 50,700 acres, and succeeds best in the sandy loam of the plain of the upper Rhine; 900,000 cwts. are annually produced. The cultivation of hops occupies 62,000 acres: in Bavaria, 37,000 acres; in Würtemberg and Prussia, 9900. The annual production amounts to 375,000 cwts.

Besides the production of wood, the forests of a country have the office of regulating its climate. They are the keepers of the moisture, and the stand of the water-courses depends on them. The reckless destruction of the forests has had injurious consequences in many parts of the German empire. Thus, the dunes along the ocean, especially on the land-strips which separate the Baltic from the so-called haffs, have increased and covered with sand good agricultural grounds; in many rivers water has become scanty, and they have partly lost their importance for navigation; in others, the laying bare of the mountain-regions has caused frequent inundations. On the Eifel the devastation of the forests impoverished the inhabitants; on the Hohe Venn it turned meadows into swamps, as the absence of trees prevented a sufficient evaporation of the moisture of the ground. In the coast-regions it has been less injurious—with the exception of the increase of the dunes—than in the interior, on account of the moisture of the sea; and, as above mentioned, Germany has much more extensive forests in the interior than on the coast. The forests belonging to the state are generally managed with great care; the same may be said of those belonging to the communes, but not of the private forests. Of 2,017,000 acres of forests in Prussia, 30 per cent. belong to the state, 14 to the communes, 1 to different institutions, and 55 to private persons. In some of the minor principalities more than 50 per cent. belong to the state; in Bavaria 36, in Würtemberg and Saxony about 30. The principal forest trees are the pine, fir, beech, oak, elder, and birch.

The Animal Kingdom.—According to the account taken in 1873, the German empire possesses 3,360,000 horses, 15,800,000 head of horned cattle, 25,200,000 sheep, 7,300,000 swine, and 2,330,000 goats; that is, on 1 geographical square mile 340 horses, 1600 head of horned cattle, 2550 sheep, 740 swine, and 240 goats. Of these, Prussia possesses 2,278,724 horses, 8,612,150 head of horned cattle, 19,624,758 sheep, 4,278,531 swine, and 1,477,335 goats, or on 1 sq. m. 357 horses, 1350 head of horned cattle, 3076 sheep, 670 swine, and 230 goats. The breeding of horses is of importance in East Prussia, Sleswick-Holstein, Mecklenburg, Hanover, Brunswick, and several places in the South German states. For cattle-breeding the marshes along the North Sea (East Friesland, Oldenburg, Sleswick-Holstein) are of great importance; also all the South German states and the western part of the Prussian state, the Rhine region. In 1873, Bavaria possessed 3,066,263 head of horned cattle; Würtemberg, 943,934; Baden, 660,403; the kingdom of Saxony, 647,074. Sheep-breeding has for its purpose the production either of wool or of meat—the former in those parts of the country where there are estates with extensive grounds, in the eastern province of Prussia, and in Mecklenburg; the latter in the more densely-peopled regions. The genuine merino sheep, the Escorial breed, was introduced into Germany in the latter part of the eighteenth century; later on, another breed, also Spanish, the Negretti, spread into Silesia from Bohemia and Moravia; and in 1820 a crossing of these two breeds was effected, and the improved race, the Escorial-Negretti, was introduced generally. Nevertheless, sheep-breeding seems at present to have passed its point of culmination. The number of sheep is decreasing in many districts, on account of the heavy competition with wool imported from Australia and South America. The largest wool-markets in Germany are held at Berlin and Breslau, and in Southern Germany at Kirchheim on the Alb in Würtemberg. In 1873, Bavaria possessed 1,342,190 sheep; Mecklenburg-Schwerin, 1,100,048; the Thuringian states, 599,370; Würtemberg, 575,930; the kingdom of Saxony, 206,830 (in 1834, 604,950). Swine are numerous (1200–1500 on 1 sq. m.) in the province of Saxony, in Thuringia, Hesse, and the northern part of Baden; goats are kept by small householders in the mountain-regions. Of mules and asses there are only a very few. Of useful game, hares are numerous; the alpine hare is found in the eastern part of the country. The red deer does not go farther E. than the province of Prussia; it is raised, together with the fallow deer, all over the country in large parks. The elk is still found in the forest of Ibenhorst at the Kurische Haff. The roe is very frequent; the black roe is scarce, however, and the white roe is extinct since 1845. The chamois is found in the Bavarian Alps; the wild-boar in some of the extensive forests of Northern Germany. The breeding of rabbits is increasing. The marmot is found in some alpine regions; the beaver now and then on the Elbe; the seal at the sea. Among the beasts of prey, the wolf is the most dangerous; in large packs it is found only in the extensive forests to the W. of the Rhine and in the province of Prussia. The fox is very common, also the

marten, weasel, and fitchet. Great care is bestowed on the breeding of poultry; chickens, ducks, and geese are found everywhere; pheasants are also common. Swans are raised in large establishments on the Havel. Partridges are numerous, but grouse rare. Wild-ducks are caught in great number on the islands of the North Sea. Singing birds are protected by law. Fish cultivation, supported by establishments for artificial breeding at Munich in Bavaria and Hüningen in Upper Alsace, is steadily developing. The best fresh-water fishes are the carp, raised in numerous places; the sheat-fish, sometimes weighing 100 pounds, in the Lake of Constance; the bezola, especially found in Pomerania; and the trout in limpid mountain-brooks. Both in fresh and salt water live the perch, eel, pike, and rudd. Among the salt-water fishes the herring and the flounder are the most important; also the salmon in the Rhine, and the sturgeon. Crabs and oysters are consumed in great quantities. Bees are very extensively kept in Silesia; in 1873, Prussia possessed 1,443,764 beehives.

Of the total population, the female sex (50.92 per cent.) exceeds the male (49.08 per cent.); in some regions, however, the male sex exceeds the female; as, for instance, in Westphalia, Rhenish Prussia, and other mining or manufacturing districts. The increase of the population was, up to the year 1840, nearly uniform in all parts of the empire, and showed nearly the same proportions in city and country. But the building of railways and the general increase of manufacturing industry effected a change. Large numbers of the inhabitants left the agricultural districts, especially in the flat lowlands, and gathered in cities or districts favorably situated for manufacturing business. This movement was apparent even before 1867, and after that time it became still more striking. Berlin rose from 200,867 in 1819 to 920,000 in 1874; Breslau from 78,135 to 208,025; Dortmund from 4453 to 55,000; Essen from 4721 to 60,000. The annual average number of births in the German empire is 1,600,000; of deaths, 1,200,000; of marriages, 380,000. Thus, the births annually exceed the deaths by about 400,000. But a great part of this surplus is lost to Germany by emigration: 1,420,464 emigrants were transferred through Bremen from 1832 to 1873; 826,617 through Hamburg from 1836 to 1873; more than 100,000 a year from both places in the years 1854, 1866–69, 1871–73. Of the total number of emigrants, more than 1,700,000 were from the German states. If to this number are added the emigrants before 1832, and those transferred from other places, it appears that in this century more than 2,000,000 Germans have left their native country. Of the births in Prussia, more than 8 per cent. are illegitimate (in Brandenburg, 11.4; in Westphalia, more than 3); in Bavaria, 16 (1835–68, 21–22); in the kingdom of Saxony, 12.5; in Würtemberg, nearly 13; in Baden and Alsace-Lorraine, 9–10; in Thuringia, 16; in Anhalt, 11; in Mecklenburg-Schwerin, 17; in Hamburg, 12.5; and in Bremen, 7. The density of the population is very unequal in the different parts of the empire. The average was 195 on 1 E. sq. m. in 1871. In Prussia it reached 181—namely, in Rhenish Prussia, 344; in Silesia, 238; in Hesse-Nassau, 229; in Westphalia, 228; in Saxony, 216; in Brandenburg, 186; in Sleswick-Holstein, 146; in Posen, 142; in Hanover, 132; in Prussia, 125; and in Pomerania, 117. The density of the population is greatest in the districts of Düsseldorf (629) and Cologne (400); smallest in those of Hanover (102) and Lüneburg (85). The greatest density of population is in the kingdom of Saxony—namely, 442 on 1 sq. m. Of the other German states, it is in Hesse 288 on 1 sq. m.; in Alsace-Lorraine, 277; in Baden, 248; in Würtemberg, 241; in Thuringia, 224; in Anhalt, 224; in Brunswick, 218; in Oldenburg, 127; and in Mecklenburg-Schwerin, 109. The most scattered population is found in the alpine regions of the S., in the heath and moorlands of the N., and in districts with large estates; the densest population is found in regions with small estates and manufacturing industry. In general, however, such a concentration of the population as is found in England is foreign to Germany. Of the 2280 towns of the empire, none has yet 1,000,000 inhabitants; 8 have more than 100,000—namely, Berlin, 920,000; Hamburg, 240,251; Breslau, 207,997; Dresden, 177,089; Munich, 169,693; Cologne, 129,233; Königsberg, 112,092; and Leipzig, 106,925; 24 have between 50,000 and 100,000—namely, Frankfort-on-the-Main, 100,000; Stuttgart, 91,623; Danzig, 88,975; Hanover, 87,616; Strasburg, 85,529; Magdeburg, 84,401; Nuremberg, 83,214; Bremen, 82,969; Stettin, 76,280; Barmen, 74,449; Aix-la-Chapelle, 74,146; Altona, 74,102; Elberfeld, 71,384; Düsseldorf, 69,365; Chemnitz, 68,229; Brunswick, 57,883; Crefeld, 57,105; Posen, 56,374; Mainz, 53,902; Mülhausen, 52,825; Halle, 52,620; Essen, 51,513; and Augsburg, 51,220. Of the remaining towns, 28 have between 25,000 and 50,000 inhabitants; 160 between 10,000 and 25,000; 188 between 6000 and 10,000; 273 between 4000 and 6000; 819 between 2000 and 4000; and 780 below 2000.

With respect to the language, there were in 1871, according to an estimation, 37,832,000 Germans in Germany, and 3,226,000 not Germans—namely, 2,516,000 Poles in the provinces of Prussia, Posen, Silesia, and Pomerania; 136,000 Wends in Brandenburg, Silesia, and the kingdom of Saxony; 51,000 Bohemians in Silesia; 143,000 Lithuanians in the province of Prussia, along the Kurische Haff and the Memel; 150,000 Danes in Sleswick-Holstein; 230,000 Frenchmen in Alsace-Lorraine and Rhenish Prussia; 200 Kassubes in Pomerania, near the city of Stolp; and 400 Kures in the provinces of Prussia, along the Memel, the last remnants of the old Prussians.

Religion.—The Westphalian treaty of 1648 regulated the relations of the confessions, and in general these regulations have not changed, though, in consequence of the greater tolerance of our time, many Roman Catholic congregations have been formed in countries formerly Protestant, and *vice versâ.* In general, the Evangelical Church reigns in Northern Germany, and the Roman Catholic in Southern. According to the census of 1871, there were in the German empire 25,581,676 Evangelicals (62.30 per cent.), 14,867,698 Roman Catholics (36.21 per cent.), 82,156 Christians of other denominations, 512,160 Jews (1.25 per cent.), and 17,156 persons of other religions. There were in the Prussian state 15,987,927 Evangelicals (64.89 per cent.), 8,267,862 Roman Catholics (33.55 per cent.), and 325,540 Jews. Among the minor states of Northern Germany, Oldenburg is the only one which has a considerable Roman Catholic population—namely, 22.49 per cent.; in the other states the Roman Catholic element never exceeds 3 per cent., and in Mecklenburg and Lübeck it falls below 1. In the Thuringian states there are 1,047,941 Evangelicals, 13,041 Roman Catholics, and 3309 Jews. In the kingdom of Saxony, where the court is Roman Catholic since 1697, there were 2,493,556 Evangelicals (97 per cent.), 53,642 Roman Catholics (2.10 per cent.), and 3358 Jews. Of the South German states, Würtemberg and Hesse are principally Evangelical, the former with 68.67 per cent. (1,248,860), the latter with 68.6 per cent. (585,399). Bavaria, Baden, and Alsace-Lorraine are principally Roman Catholic countries; in Baden, however, the court is Evangelical. In 1871 there were in Bavaria 1,342,592 Protestants (27.61 per cent.), 3,464,364 Roman Catholics (71.23 per cent.), and 5066 Jews. In Baden the percentage of Evangelicals rose between 1852 and 1871 from 31.83 to 33.55; in Alsace-Lorraine, between 1866 and 1871, from 15.30 to 17.47. In the latter country the increase is due to immigration from other German countries, while many Roman Catholics have emigrated to France. In Baden there were 491,008 Evangelicals and 942,560 Roman Catholics (64.49 per cent.). In 1871 there were in Alsace-Lorraine 270,752 Evangelicals and 1,235,195 Roman Catholics (79.70 per cent.). In all the South German states, with the exception of Würtemberg, the Jews are very numerous, especially in the towns along the Rhine and in the villages which formerly belonged to the Knights of the Empire. In 1871 there were 50,662 Jews in Bavaria (mostly in Middle and Lower Franconia and in the Palatinate), 40,928 in Alsace-Lorraine, 25,703 in Baden, 25,373 in Hesse, and 12,245 in Würtemberg.

Manufactures.—The manufacturing industry of Germany has been subject to immense fluctuations during the last fifteen years. In 1860 it was influenced by the war in America; later it suffered much from the unsettled state of Europe; after the close of the war against France it rose at once to a height none had ever expected, but from which it fell in 1873, partly in consequence of fraudulent operations. In the territory of the empire there is liberty of carrying on any kind of trade or manufacture, and boards of trade are established to represent the manufacturing and trading interests. The manufacturing industry has its centres in the Prussian provinces of Rhenish Prussia, Westphalia, Brandenburg, Silesia, and Saxony; in the kingdoms of Saxony, Würtemberg, Alsace-Lorraine, and parts of Bavaria, Thuringia, and Baden. Of no consequence in this respect are Sleswick-Holstein, Posen, Mecklenburg, Oldenburg, and Lippe. (1) The manufacture of woollens employs about 250,000 hands. The raw material is partly imported from other countries, especially from Australia; 1,088,700 cwts. were imported in 1873; 249,000 cwts. were exported; 1,500,000 cwts. were worked up. Coarse woollen stuffs are still made by the country population in the north-eastern part of the empire as a secondary occupation, while the making of cloth, which once was very common, has now ceased almost entirely. To provide the cloth-factories with yarn, about 1,750,000 spindles are in operation in different spinning-factories, situated mostly in the cloth-manufacturing districts, but also in Upper Alsace and in the kingdom of Saxony. The


MAP OF THE
GERMAN EMPIRE
Scale of Eng Miles
0 50 100
NORTH SEA
BALTIC SEA
DENMARK
SWEDEN
GERMAN EMPIRE
PRUSSIA
HANOVER
WESTPHALIA
RHENISH PRUSSIA
MECKLENBURG-SCHWERIN
BRANDENBURG
POMERANIA
POSEN
SILESIA
SAXONY
HESSE
NASSAU
PALATINATE
BAVARIA
WURTEMBERG
BADEN
ALSACE LORRAINE
HOLLAND
BELGIUM
FRANCE
SWITZERLAND
TYROL
ITALY
BOHEMIA
MORAVIA
AUSTRIA
HUNGARY
GALICIA
POLAND
RUSSIA
GULF OF DANTZIC
BERLIN
HAMBURG
BREMEN
DRESDEN
MUNICH
VIENNA
PRAGUE
PARIS
Longitude East from Ferro

cloth-manufacturing industry has its principal centre in the government of Aix-la-Chapelle, in whose towns, Burtscheid, Düren, Eupen, and Aix-la-Chapelle, it has flourished for many years, and from which it has conquered a market for itself in almost every part of the world. America buys annually cloths and doeskins in Aix-la-Chapelle to the value of 5,000,000 marks. Another cloth-manufacturing region exists in Southern Brandenburg, and a third is found in the western part of the kingdom of Saxony. Here, and in the neighboring parts of Thuringia, the manufacture of other kinds of woollen stuffs is also very flourishing; in Greiz and Zeulenroda, the German Thibet (20,000,000 marks annually); in Apolda, hosiery; in Gera, fine woollens. Carpets and shawls are made in Berlin; Turkish carpets in Schmiedeberg in Silesia. (2) The industry in flax and hemp is increasing, but as yet it demands a considerable importation of raw material from Russia, and of yarn from Great Britain and Belgium. The centre of this industry is Bielefeld in Westphalia and its vicinity, where, besides the spinning and weaving factories, 4000 hands are employed in the manufacture of home-made linen. Other centres are at Zittau in the eastern part of the kingdom of Saxony and in the Silesian mountains. In the whole empire there are about 60 flax-spinning factories, with 280,000 spindles, and about 450,000 looms for the manufacture of linen, of which about 250,000 are found in the eastern provinces of the Prussian state, where linen is manufactured by the country population as a secondary occupation. Sailmaking is important in the seaports; cordage is made in Westphalia. (3) Cotton manufactures are important in Alsace-Lorraine (at Mülhausen, Colmar, and in the valleys of the Vosges); in the kingdom of Saxony, especially in the government of Zwickau (Chemnitz), and in Würtemberg, between Reutlingen and Geislingen. In 1872 there were 430 cotton-spinning factories with about 5,000,000 spindles in the empire; in 1834 there were only 600,000 spindles. At the same time the working capacity of the spindles has increased immensely. In 1836 a spindle consumed only 24 pounds daily; in 1870, nearly 70 pounds. The importation of raw cotton rose from 230,000 cwts. in 1836 to 3,578,500 cwts. in 1873; the exportation from 45,000 to 1,163,800 cwts.; the annual consumption from 185,000 cwts. to 2,412,700 cwts. Besides, in 1873 an importation took place of 426,400 cwts. of cotton yarn, and an exportation of 97,800 cwts. In 1836 the German spinning-factories produced only 29, but in 1871, 82 per cent. of the yarn demanded. Some years ago there were in the empire 1030 establishments for cotton weaving, with 48,000 mechanical looms. But the total number of cotton-looms in the empire now amounts to 225,000. (4) The silk and velvet manufactures have their centre in Rhenish Prussia, in the cities of Crefeld, Elberfeld, Barmen, and Viersen. In 1871 there were in Crefeld 32,000 looms, producing goods to the value of 76,000,000 marks, of which Great Britain received 26,000,000, and countries outside of Europe 13,000,000. Viersen manufactures especially velvet ribbons. In heavy, all-silk goods Germany cannot compete with France, but in lighter kinds of velvet it can, and its half-silk goods are superior to the French. (5) Among the other branches of the weaving industry of great importance are lace-making and embroidery in the kingdom of Saxony, where numerous power-looms are used; embroidery in Southern Würtemberg; the manufactures of galloons and fringes in Berlin and Barmen; of umbrellas in Berlin and Frankfort-on-the-Main; of ready-made clothes in all large cities; of corsets in Würtemberg; of oilcloth in Leipzig and Berlin. (6) Auxiliary branches of the yarn and cloth manufacturing industry are the dyeing and printing establishments. For silk-dyeing Crefeld is the most important place; for Turkey-red, Elberfeld and Barmen in the valley of the Wupper. For calico-printing there are celebrated establishments at Berlin and Mülhausen in Alsace, at Augsburg in Bavaria, at Säckingen, Lörrach, and Constance in Southern Baden, etc. (7) The manufacture of leather is important in the southern and western states. Excellent leather is produced at Mainz and Worms in Rhenish Hesse, at Malmédy in Rhenish Prussia, in the Siegensche Land in Westphalia, and at Eschwege in Hesse-Nassau. Fine boots are made for exportation in Rhenish Bavaria and at Mentz, and leather goods of excellent quality at Berlin, Nuremberg, Offenbach, Hanau, etc.; gloves for exportation in Würtemberg. (8) For the manufacture of paper there are 950 establishments in the empire, employing more than 25,000 hands. The most important are those in the districts of Düren and Jülich, near Aix-la-Chapelle in Rhenish Prussia, and on both sides of the Lenne in the government of Arnsberg in Westphalia, though many of the factories in these regions produce only wrapping and straw paper. In the other parts of the empire the paper-factories are more insulated. (9) Among the other branches of industry in animal and vegetable materials, the manufactures of straw goods in the Black Forest and the Vosges, and at Dippoldswalde in the kingdom of Saxony, are important, and of basket-work in Upper Franconia in Bavaria. There are 10,000 saw-mills in the empire; the largest are those at the Finow Canal in Brandenburg, and on the Memel in East Prussia, where they are worked by steam. The manufacture of furniture for exportation is also important, especially at Mainz, of turnery-ware in wood, amber, meerschaum, and mother-of-pearl; of carved work, both in wood and bone, in the Alps and at Nuremberg; of hats, which branch is steadily increasing; of gum and gutta-percha goods, especially at Harburg in Hanover and at Berlin. (10) The manufacture of tobacco and cigars is carried on in 3600 establishments, which employ about 70,000 hands. Bremen is its centre (200 establishments with 8000 hands), and it prevails in the adjacent Hanoverian districts. (11) For the manufacture of food there are 65,000 corn-mills in the empire, of which 1000 are worked by steam, 2500 by animal power, and the rest by water or wind. The number of beet-root sugar factories in the empire amounted in 1874 to 336, employing 55,000 hands; 5,640,700 cwts. of raw sugar were produced. Magdeburg is the principal sugar-market. There are besides 45 sugar-refineries in the empire, in Hamburg, Bremen, Cologne, Brunswick, and Magdeburg. Meat is salted in large establishments in Hamburg, Bremen, and Danzig, and preserved at Gütersloh in Westphalia and Gotha; famous are the *pâtés de foies gras* of Strasburg, the Westphalian hams, the smoked beef of Hamburg, and the Pomeranian goose-breasts. (12) In the manufacture of beverages, Bavaria occupies the first place in beer-brewing in the world; in 1872 it produced in 5127 establishments nearly 11,000,000 hectolitres of beer. The most important places are Munich, Regensburg, Nuremberg, Augsburg, Erlangen, Kulmbach, and Hof. Bavarian beer is now made throughout the whole of Northern Germany, but it cannot compete with the genuine Bavarian product. There are in Northern Germany 10,220 beer-breweries, and in Southern Germany, besides those of Bavaria and Alsace-Lorraine, 3490. The brandy-distilleries of Germany number 25,000, of which many, however, are only worked by the country population as a secondary occupation. The distilleries of Northern Germany consume annually 3,500,000 hectolitres of barley, 20,000,000 hectolitres of potatoes, 180 hectolitres of juniper-berries, 1,000,000 cwts. of molasses, and 230,000 hectolitres of fruit and grapes. Of special importance in this respect is Nordhausen in the province of Saxony. Sparkling wines are manufactured in the Rhine regions. Of vinegar-factories there are 1600 in the empire. (13) There are 650 factories for the manufacture of chemicals and dyestuffs. The former are principally situated at the large salt-works, and it is especially the potassic salts of Stassfurth in the province of Saxony, and of Leopoldshall in Anhalt, which have given rise to immense factories for chemicals which export their products to every country of Europe. There are color manufactories in Thuringia and in Bavaria, at Nuremberg, Schweinfurt, and Amberg; ultramarine is made at Nuremberg and in Rhenish Prussia; aniline at Elberfeld, Ludwigshafen, Mannheim, and Crefeld. There are 180 factories for perfumery, among the products of which is the eau de cologne; 7000 oil-mills and oil-refineries; 350 candle and soap factories; 1200 potash factories. (14) There are 18,000 brickkilns in Germany. They are largest and most frequent along the navigable streams of the province of Brandenburg (the Havel, Finow Canal), where they furnish the building materials for the rapidly growing capital of the empire. For the manufacture of pottery and other earthenware there are 600 establishments. There are 110 porcelain-factories; that of Meissen—now in the adjacent Triebsche Valley—is the oldest in Europe (1710). (15) For the manufacture of glass and glassware there are 300 establishments in the empire, employing 35,000 hands. They are numerous in the forest-regions of Eastern Bavaria, Thuringia, and Lorraine, and in the coal-regions on the Ruhr; in the North German lowland they are found only in remote forest districts, where a more profitable use of the wood seems impossible. (16) Of other manufactures of stone and earth, there are in Germany 5200 limekilns and 400 gypsum-mills; the manufacture of Portland cement is increasing. Slates and slate-pencils are made in Thüringer Wald and Franconia; marble articles in the Bavarian Alps, especially at Berchtesgaden, in the slate mountains in Westphalia, and in the Harz at Rübeland. (17) The first steam-engine in Germany was put in operation Apr. 4, 1788, at Friedrichshütte, near Tarnowitz, in Upper Silesia. Twenty-five years ago the most of the locomotives and machines were imported from foreign countries, but since that time the German machine-works have improved so much that they are capable not only of satisfying all domestic wants, but even of exporting. Since 1867 the exportation of machinery from the German Zollverein has

exceeded the importation. In the whole empire there are at present 750 machine-works, employing 90,000 hands. The most prominent places are Berlin (locomotives and sewing-machines), employing more than 15,000 hands; Chemnitz, with more than 10,000 workmen; Mülhausen in Alsace; and various towns in the kingdom of Saxony. (18) The manufacture of railway cars has large establishments at Berlin, Aix-la-Chapelle, Breslau, Görlitz, Cologne, Cassel, Munich, Stuttgart, Carlsruhe, Mainz, and Brunswick. The expulsion in 1870 of all Germans from France was advantageous to the manufacture of carriages. Shipbuilding is carried on in Hamburg, Bremen, at different places on the Oder below Stettin, at Danzig, and Lübeck. War vessels are built at Kiel, Danzig and Wilhelmshaven on the Jade. Large iron-clads, however, are bought from foreign countries, as also a considerable number of merchant vessels. (19) Pianofortes are made with great perfection at different places; organs at Dresden; harmoniums at Gera in Thuringia; string instruments of different kinds at Mittenwald in Upper Bavaria, Cassel, and Adorf in Saxony; musical boxes in the Black Forest. The manufacture of watches employs about 10,300 hands in the Black Forest. Munich is the centre for the manufacture of scientific and optical instruments; other important places are Nuremberg and Rathe, now in Brandenburg. (20) The manufacture of iron and steel goods is the chief industrial pursuit in large parts of Westphalia, Rhenish Prussia, and Lorraine. For the production of raw iron (more than 36,000,000 cwts. in 1872) there are large works in the coal-regions. The production of steel and rolled iron amounted in 1872 to 24,300,000 cwts. (in Prussia to 19,482,599 cwts.), of iron rails to 8,600,000 cwts. (in Prussia to 7,221,632 cwts.), of raw and cast steel of different kinds to 6,250,000 cwts. (in Prussia to 5,758,098 cwts.), of iron and steel plate to 2,300,000 cwts. (in Prussia to 2,180,408 cwts.), of iron and steel wire to 2,050,000 cwts. (in Prussia to 1,854,348 cwts.), and of castings to 8,500,000 cwts. (in Prussia to 6,479,529 cwts.). For iron and steel goods the Prussian governments of Düsseldorf (Rhenish Prussia) and Arnsberg (Westphalia) are the centres; for arms, Solingen; for cutlery, Remscheid. The largest establishment for the manufacture of cast steel, and generally the largest industrial establishment of the empire, is that of Krupp at Essen in Rhenish Prussia, celebrated for its cannon. It employs 16,000 hands, covers an area of 400 hectares, uses 270 boilers, 286 engines of 9230 horse-power, and 71 steam-hammers, weighing 4340 cwts. (21) The manufacture of other metals is important—of silver ware at Berlin; of gold and silver ware at Stuttgart, Pforzheim in Baden, and Hanau in Hesse-Nassau; of gold and silver thimbles at Schorndorf in Würtemberg; of gold and silver leafs and wire at Nuremberg and Fürth in Bavaria; of bronzes in Frankfort-on-the-Main; of brass, bronze, and German silver ware at Nuremberg, Fürth, and Augsburg in Bavaria, Gmünd and Ulm in Würtemberg, Pforzheim in Baden, Offenbach in Hesse, Iserlohn and Altena in Westphalia; and of tinware at Lüdenscheid in Westphalia.

Commerce.—The Zollverein, established in 1833 by the acceptance by Bavaria and Würtemberg of the commercial agreements existing between Prussia and the Hessian countries, and now comprising all the German states, has exercised a large and beneficial influence on the commerce of the empire by abrogating injurious restraints and destroying many unnatural barriers. To the Zollverein belong the grand duchy of Luxemburg and an Austrian parish to the S. of Kempten in Bavaria, but not the free ports of Hamburg, Altona, Bremen and Bremer Hafen, Geretemünde, and some districts in Southern Baden. The German custom law dates from July 1, 1869; a new tariff was introduced Oct. 1, 1873. All duties on export and transit are abolished, and the duty on imports is very reasonable. The value of goods imported to the German Zollverein in 1872 amounted to 3,468,480,000 marks; that of exports to 2,494,620,000 marks. The principal items of importation were—spinning materials, 588,900,000; timber and wood, 297,000,000; corn and milling products, 279,300,000; animals and animal food, 230,700,000; precious metals, 206,400,000; yarns, 194,700,000; felt, hair, feathers, hides, and leather, 193,500,000; sugar, coffee, and spices, 192,600,000; woven fabrics and cloths, 187,000,000; fats, oils, and soaps, 178,000,000; drugs, chemicals, and dyestuffs, 172,680,000; raw metals, 140,000,000. The principal items of exportation were—woven fabrics and cloths, 450,300,000; corn and milling products, 215,100,000; spinning materials, 199,900,000; precious metals, 174,000,000; animals and animal food, 173,400,000; timber and wood, 115,800,000. The value of the importations in 1872 through the two free ports Bremen and Hamburg was—for Hamburg, 2,017,222,875 marks (by sea, 1,297,722,805; by land, 720,500,070); for Bremen, 496,197,211 marks (by sea, 316,602,622; by land, 179,594,509).

The commercial fleet of Germany occupies the third place, and follows immediately after those of Great Britain and North America. It consisted in 1873 of 5082 vessels, of 1,308,988 tons burden; of these, 3401 vessels of 650,951 tons, belonged to Prussia; 257 vessels of 231,805 tons, to Bremen; 408 vessels of 199,839 tons, to Hamburg; 426 vessels of 142,954 tons, to Mecklenburg; 542 vessels of 71,547 tons, to Oldenburg; 48 vessels of 11,892 tons, to Lübeck; or to the North Sea fleet, 2672 vessels of 689,557 tons, and to the Baltic fleet, 2410 vessels of 619,431 tons. Of the vessels, 219 were steamers of 165,178 tons burden and 29,139 horse-power. In 1871 there entered 69,710 vessels of 8,542,000 tons; in 1872, 71,907 vessels of 8,994,000 tons. In 1871 there cleared 69,138 vessels of 8,447,000 tons; in 1872, 69,829 vessels of 8,855,000 tons. Among the seaports of the empire, Hamburg and Bremen occupy the first places. The tonnage of entering vessels rose in Hamburg, between 1841 and 1872, more than 500 per cent.—namely, from 520,000 to 2,775,000; and in Bremen, between 1847 and 1872, more than 350 per cent.—namely, from 312,000 to 1,136,000. It is principally these ports which carry on the traffic with England and the Transatlantic countries. They maintain numerous steamship lines, and the main stream of emigration passes through them. For inland navigation there are 16991.2 E. miles of water-roads, of which 8140 are in Prussia and 1155 in Bavaria. In 1872 there were 21,364 coasters, river-craft, and canal-boats in the empire, with a carrying capacity of 31,036,550 cwts.; of these, 20,901 were sailing vessels and 463 steamers.

The first railway in Germany, the Ludwigsbahn, from Nuremberg to Fürth, 3.7 E. m. long, was opened Dec. 7, 1835; the first long line was contracted for between 1837 and 1839, from Dresden to Leipzig. The total length of the railways in Germany was 3.7 E. m. in 1836, 13 in 1837, 86.4 in 1838, 149 in 1839, 291 in 1840, 1332 in 1845, 3638 in 1850, 4863 in 1855, 6890 in 1860, 8637 in 1865, 11,379 in 1870, and 15,158 in 1874; so that there is at present an average of 1.6 E. m. to each E. sq. m. In 1874, 6726 E. m. belonged to the government roads, 1598 E. m. to private roads managed under the superintendence of the state, and 6828 to other private roads. More than 5000 E. m. have double tracks. The total cost of construction amounted in 1874 to 5,000,000,000 marks. The cheapest were the Kottbus-Grossenhain and Nuremberg-Fürth lines, averaging 100,000 marks per mile; the most expensive were those of Rhine-Nahe and Zittau-Reichenberg, averaging more than 666,000 marks per mile, and those of Hausach-Villingen in the Black Forest and Cologne-Minden, averaging between 600,000 and 666,000 marks per mile. There are at present 65,200 miles of highways in the country.

The post and telegraphs are uniformly organized throughout the empire, though in Bavaria and Würtemberg they have separate administrations. Between the German empire and Austro-Hungary there exists a postal convention of May 7, 1872, and a telegraph convention of Oct. 5, 1871. In 1873 the number of post-offices amounted to 7600, of which 1600 were in Bavaria and Würtemberg. The entire length of the post-routes of the empire was in 1873—on railways, 11,903 m., on highways, 37,926 miles. There were delivered 454,554,920 letters, 26,948,267 postal cards, 69,056,824 printed articles, 248,154,482 newspapers, 49,004,406 packages (weighing 289,957,140 pounds, and valued at 4,016,149,326 thalers). In Bavaria and Würtemberg were delivered about 80,000,000 of letters and as many newspapers. At the end of 1872 the entire length of telegraph-lines in Germany was 23,345 m., of which 4265 m. were in Bavaria and 1380 m. in Würtemberg; that of the wires, 77,858 m. The number of stations was 4038; the number of despatches—private, 7,086,579; official, 451,403; international sent out, 1,894,402; international received, 2,022,329; transit, 711,241; total 12,165,954.

In the middle of 1874 there existed in Germany 195 stock institutions for deposits and industrial credit, with an issue of 2,180,000,000 and a capital of 1,700,000,000. There were also, for the same purpose, 40 state and communal institutions. The most important banking institution is the Bank of Prussia, founded in 1765, and in 1846 transformed into a stock institution. Very common are savings banks and the Deutsche Genossenschaftswesen, founded in 1850 by Schulze-Delitsch, and since 1873 existing in Austria and Luxemburg, and now (1874) numbering 1,300,000 members.

Education.—For general education the German people are deeply indebted to Pestalozzi and his disciples, who, aided by political circumstances during the early part of the present century, succeeded in reforming the whole school-system of Prussia. This reform received a hard blow, however, from the reaction which in Prussia began after 1840 with Eichhorn. The retrograde movement was at first hardly apparent; in many points it worked even beneficially, but it became very evident after the introduction of the new school regulation of 1854, and in 1872 it

was generally acknowledged that school matters in Germany had fallen into a sort of dissolution. The regulation of 1854 left the course of the national German development, and hoped to quench the ideas of the revolution and of modern times by an ecclesiastical reaction and a narrow patriotism. At the head of the ecclesiastical reaction stood the Ultramontane party, and it pursued its plans in every direction. But, fortunately, the successful wars of 1866 and 1870 and the foundation of a Protestant empire formed an effective opposition to the Ultramontane party, and made the mistakes of the reaction apparent. The normal schools suffered still more than the primary schools in this period, both from a vicious system and from insufficient teachers. Improvements have certainly taken place since 1872, but a thorough reform of the matter is demanded, and for it a liberal grant of money is necessary. The education is lowest in the eastern provinces, in which a not inconsiderable percentage of the annual levy of recruits appears to have received no school education at all; thus, in 1873 in the governments of Marienwerder, Posen, and Bromberg 18–20 per cent., in Gumbinnen and Danzig 10–13, and in Königsberg 9. According to the census of 1871, there were in Prussia (exclusive of Rhenish Prussia) 13,494,932 persons above ten years of age who could read and write, but 2,061,176 persons, or 13 per cent. of the whole population above ten years of age, had no school education at all. In other German states school matters have been subject to similar fluctuations. The period of reaction was generally shorter, however, and thus the schools of several countries—Baden, Würtemberg, and Saxony—are superior to those of Prussia. In 1873, 7.3 per cent. of the recruits from Bavaria had no school education. The primary schools are generally divided according to religion, but ecclesiastics have been removed as school directors in Prussia, Alsace-Lorraine, and several other countries. Germany has about 60,000 primary schools, with 75,000 teachers (male and female), and 6,000,000 pupils. The proportion between the number of inhabitants and that of school-attending children is as 1000 to 150. Each teacher has on an average 80 pupils. A transition from the primary schools to the higher is formed by the middle schools, institutions of different names and of various organization. The higher school institutions are divided into *Realschulen* and gymnasiums. The Realschulen, subdivided into a first and second order and higher burgher schools, give the foundation of a technical education. Among foreign languages, the living ones have the preference; in the Realschulen of the second order Latin is not taught. In 1874 there were in the empire 106 schools of the first, 42 of the second order, and 107 higher burgher schools, containing 82,000 pupils. The gymnasiums aim at the development of mental productivity (science and art), and prepare for the higher government offices and for the universities. Among foreign languages, the ancient have the preference. In 1874 there were 333 gymnasiums in the empire—183 Evangelical, 57 Roman Catholic, and 93 mixed. Together with the 170 progymnasiums, or so-called Latin schools, they contained 108,000 pupils. For the education of teachers for the primary schools there are 156 seminaries—110 Evangelical and 40 Roman Catholic; furthermore, 9 for teachers for the Latin schools in Prussia; 1 for preachers at Wittenberg; 4 for Evangelical theology in Würtemberg, and for Roman Catholic theology in the dioceses of the archbishops. The 22 universities consist, generally, of 4 faculties—divinity, law, medicine, and philosophy. The faculty of divinity is generally Evangelical; Roman Catholic in Munich, Würzburg, Freiburg, and Münster. The universities of Bonn, Breslau, and Tübingen have both an Evangelical and Roman Catholic faculty of divinity; the last university has seven faculties —namely, besides the five above mentioned, one of political economy and one of natural philosophy. The universities of Munich and Würzburg have also five faculties—namely, one of political economy, besides the four common ones. The academy of Münster ranks with universities, though it has only two faculties (Roman Catholic divinity and philosophy). The oldest university of the empire is that of Heidelberg, founded in 1386; the youngest, that of Strasburg, founded in 1872. These universities contained in the winter of 1873–74, 1675 professors and 17,737 students. As technical high schools are considered the Academy of Architecture in Berlin, the polytechnic schools of Aix-la-Chapelle, Darmstadt, Dresden, Hanover, Carlsruhe, Munich, and Stuttgart, and the Collegium Carolinum, in Brunswick. The number of special schools is very great: for architecture and mining, the mining academies at Berlin, at Freiberg in Saxony, and at Clausthal in the Harz; for forest cultivation, the academy at Neustadt-Eberswalde in Brandenburg, at Münden in Hanover, at Tharand in Saxony; for commerce and the science of war, the military academies at Berlin and Munich; for agriculture, music, and navigation. There are also 63 asylums for the deaf and dumb, and 28 for the blind; numerous learned societies and associations, libraries, museums, zoological and botanical gardens. In 1873 the total number of literary productions amounted to 11,315 (in 1871, 10,669)—namely, collected works, science of literature, bibliography, 258; theology, 1239; law, politics, statistics, 1051; medical and veterinary science, 514; natural philosophy, chemistry, pharmacy, 600; philosophy, 157; pedagogical science, German school-books, 1314; books for the young, 337; classical and Oriental languages, antiquities, mythology, 438; modern languages, Old German literature, 346; history, biography, memoirs, correspondence, 690; geography, travels, 339; mathematics, astronomy, 162; science of war, 314; science of commerce and trade, 402; building, machinery, railways, mining, navigation, 331; forest, hunting, 59; agriculture and horticulture, 310; romances, poems, theatre, 948; fine arts, 391; books for the people, 205; Freemasonry, 19; miscellaneous writings, 590; maps, 220. The German Zollverein imported 54,349 cwts. of books in 1873, and 107,000 cwts. were exported.

Church Matters.—The constitution of the Evangelical Church is different in the different states. In Prussia the highest church authority is the ecclesiastical council; a general synod for the eight old provinces is under consideration. The synodal system is developed in Bavaria, Saxony, Würtemberg, Baden, and Hesse. In most states a presbyterian system exists; in others, the constitution of the Evangelical Church rests on a consistorial system. The highest ecclesiastics are the general superintendents and the superintendents; in Alsace-Lorraine the church inspectors. The Evangelical Church in the German empire has 16,000 ecclesiastics. For the Roman Catholics there are 5 archbishoprics (Cologne, Gnesen-Posen, Munich-Freising, Bamberg, and Freiburg), 20 bishoprics, and 3 vicariates apostolic. There are in the whole empire about 20,000 Roman Catholic priests, and more than 800 monasteries. The Jesuits were excluded from the territory of the empire by the law of July 4, 1872.

Constitution.—The constitution of the empire dates from April 16, 1871, with some modifications made in 1873. It consists of 14 articles and 78 paragraphs. Article I. defines the territory of the confederation. Article II. treats of its government, which is exercised by the federal council, *Bundesrath*, and the diet, *Reichstag*. Article III. discourses on the federal council, which consists of delegates from the federal states—17 from Prussia, 6 from Bavaria, 4 from Saxony, 4 from Würtemberg, 3 from Baden, 3 from Hesse, 2 from Mecklenburg-Schwerin, 2 from Brunswick, and 1 from each of the other states, with the exception of Alsace-Lorraine. Article IV. confers the presidency of the confederation on the king of Prussia, who bears the title of *Deutscher Kaiser*. Article V. treats of the diet, which is constituted by general and direct election by ballot, and consists of 397 members (1 representative for every 100,000 inhabitants)—235 from Prussia, 1 from Lauenburg, 48 from Bavaria, 23 from Saxony, 17 from Würtemberg, 15 from Alsace-Lorraine, 14 from Baden, 9 from Hesse, 6 from Mecklenburg-Schwerin, 3 from Saxe-Weimar, 3 from Oldenburg, 3 from Brunswick, 3 from Hamburg, 2 from Saxe-Meiningen, 2 from Saxe-Coburg-Gotha, 2 from Anhalt, and 1 from each of the other states. The legislative period lasts three years when no dissolution of the diet takes place. All German states, except the two Mecklenburgs, in which feudality still exists, possess constitutions more or less in harmony with modern views; the controversy, however, between the old and the new is not yet closed at every point. The greater number of mediatized princes have seats in the upper houses of the southern states and in the Prussian *Herrenhaus*. At the head of the administration of the empire stands the chancellor of the realm, with offices for the post, telegraphs, railways, and statistics of the empire, and a separate office for the affairs of Alsace-Lorraine. The chancellorship is at present connected with the ministry of foreign affairs. Under the minister of foreign affairs stand the ambassadors and consuls of the empire. Besides the ambassadors of the empire, the different states may represent themselves at foreign courts by special ambassadors. For the whole empire there are furthermore a common school committee for all the higher schools, and a common board of trade in Leipzig, the highest authority in all matters of commerce or trade. The federal council forms standing committees for the army and fortresses, navigation, toll and taxes, commerce and trade, railways, post and telegraph, and for the affairs of Alsace-Lorraine. In the administration of justice the German empire exhibits still the same want of uniformity it formerly showed in political and military affairs. When smaller differences are overlooked, Germany consists of five different jurisdictions. The Prussian municipal law is valid in the largest part of those countries which belonged to Prussia before 1866 and before 1806. The Roman law is predominant in the new Prussian provinces, the Saxon

civil law in Saxe, the common law of Baden in Baden, and the French code on the left side of the Rhine, and on the right in the former grand duchy of Berg (the governments of Düsseldorf, Elberfeld, and Barmen).

Finances.—The revenues of the empire are derived from toll, excise of consumption, post, and telegraph, or, if necessary, they are levied from the several states according to the number of inhabitants. A common imperial income-tax will be introduced. In 1873 the receipts and expenses of the empire amounted to 444,470,325 marks. The receipts were — toll and excise, 198,716,150; stamp-tax, 4,969,800; post, 14,749,634; telegraph, 471,969; government railways in Alsace-Lorraine, 7,637,979; of the French war-indemnity, 57,594,876; surplus from 1872, 38,552,073; interest on capital, 4,201,200; levies from the states, 67,144,251. The standing expenses are — the imperial chancery, 4,114,764; the diet, 202,077; the ministry of foreign affairs, 4,980,495; the army, 278,499,627; the navy, 13,834,674; interest on the debt, 7,290,000; the court of accounts, 294,600; the supreme board of trade, 301,800; rent-allowance to the officers of the army and navy, 16,084,260, and to the officers of the imperial railways, 121,050; total, 363,720,225 marks. The extraordinary expenses amounted to 81,008,100 marks—namely, for the army, 28,989,966; for the navy, 39,534,510; the railway of St. Gotthard, 2,105,064; the mint, 8,400,000. The empire has now no debt. Paper money to the amount of 120,000,000 will be put into circulation in 1876, instead of the present paper money of the separate states.

Army and Navy.—The present military system of Germany was established by Articles IX. and XI. of the constitution of Apr. 16, 1871, by the law of Nov. 9, 1867, concerning the duty of military service, and by the laws of May 2, 1874, and Mar. 26, 1868. The armed power consists of the army, the navy, and the *Landsturm*. The army is divided into the standing army and the *Landwehr*. The navy consists of the fleet and the *Seewehr*. The standing army and the fleet are always ready for war. The Landwehr and Seewehr serve as their support. The Landsturm becomes active only when an enemy invades the territory of the empire. The duty of military service is universal throughout the empire, and substitution is not allowed. Only the members of the reigning or mediatized princely families are exempted from military service. The duty commences with the twentieth year, and lasts for three years at the standard, for four in the reserve, and for five in the Landwehr. To the Landsturm belong all between the seventeenth and the forty-second year who are capable of bearing arms. The volunteer who passes through a certain scientific examination, and proves himself in possession of a certain amount of knowledge, remains only one year at the standard, but pays for his equipment and provision. Teachers from the primary schools have only to go through an exercise of six weeks in an infantry regiment. The military nurses give an active service of eighteen months. The period of service in the active marine is one year for sailors and machinists. The commander-in-chief of the whole army is the emperor, though in times of peace with some restrictions from the side of Bavaria and Würtemberg. Officers are appointed in the different contingents by the different states; to the appointment of generals, however, the consent of the emperor is necessary, except in Bavaria. The emperor also appoints all commanders-in-chief of the contingents and of the fortresses, again with the exception of Bavaria; and he can build fortresses and declare any part of the empire in a state of siege. To a declaration of war in the name of the empire the consent of the federal council is necessary. By the law of May 2, 1874, which is valid to Dec. 31, 1881, the strength of the army of the empire in time of peace is determined to be—401,659 rank and file; 17,036 officers and 3647 physicians, farriers, etc.; in all, 422,342 men — namely, infantry and chasseurs, 280,824; cavalry, 68,922; artillery, 48,291; pioneers and railway troops, 10,137; train, 5354; special formations, 3565; guns, 1200. The war-force is as follows: infantry, 908,346; chasseurs, 42,224; cavalry, 111,839; artillery, 152,205; pioneers and railway troops, 34,649; train, 45,671; staff and administration, 19,114. The respective contingents of the different states are—Prussia, 961,280 men and 2064 guns; Bavaria, 149,307 men and 300 guns; Saxony, 75,762 men and 156 guns; Würtemberg, 62,914 men and 126 guns; in all, 1,249,263 men and 2646 guns.

The development of a navy first began in 1848 as a merely Prussian concern. It is now a force of the empire, under the command of the emperor. It has a flag in common with the merchant fleet—black, white, and red. It consists of 74 vessels, with 528 guns, of which 106 are in iron-clads, 257 in other steamships, and 165 in sailing vessels. It numbers in time of peace 8124 men; in time of war, more than 15,000.

History.—In pre-historic times Germany was inhabited by tribes belonging perhaps to the Celtic family. They built their houses on piles in the lakes, and possessed tools and instruments of stone—later, of bronze and iron. Comparatively late, not until a few centuries before Christ, did the German races, coming from the East, reach the present boundary of the empire, but in the fourth century A. D. they had driven the Celtic tribes over the western frontier into the Vosges Mountains. Meanwhile, they had also met with the Romans—the first time in 113 B. C. —in Noricum, which comprised the present Styria and the adjacent Austrian districts; and although the German tribes which appeared at this occasion—the Cimbrians from the Danish peninsula of Jütland, and the Teutons—were defeated and destroyed by Marius, still the danger which threatened Rome from the North was by no means removed. Cæsar, although he crossed the Rhine twice, did not attack the Germans, and when the emperor Augustus—or, rather, his general Varus—tried to bring the German race under the Roman yoke, the German tribes gathered together in large masses on the call of Hermann (Arminius), the chief of the Cherusci. The Roman legions, the best Rome ever had had, were trampled down in the battle of Teutoburger Wald (9 A. D.), and the liberty and independence of the German race were established for ever. The Romans tried repeatedly to subjugate the Germans, and Thusnelda, Hermann's wife, spent the last years of her life in Roman slavery; yet as a race the Germans remained free, and soon overthrew the fortresses which the Romans built on the frontier between the Rhine and the upper Danube. Their power grew as they united into large national formations, of which the Saxons lived between the Baltic and Harz, the Franks between the lower Rhine and Fichtel Gebirge, the Alemanni along the upper Rhine, and the Goths along the lower Danube. In those days of the first wars with Rome all Germany was covered with forests and swamps. The Hercynian forest spread over all the mountains and plateaus of Central Germany. The coasts of the North Sea were formed otherwise than at present. Large islands, which later floods have submerged, were situated at the mouths of the rivers and stretched along the coast. The climate was rougher than at present. Animals which are now found only in the northernmost regions roamed in the forests. The inhabitants, like all primitive people, were fond of hunting and war. Magnificent hospitality was their pride. Many vices, such as drunkenness and gambling, darkened their lives, but they were, on the other hand, possessed of many virtues which distinguished them above other races. They were chaste, they respected woman, and they kept their word. The Romans brought the vine and the finer sorts of fruit to the Rhine, but they could not withstand the pressure of the Germans. Soon after 300 A. D. the Alemanni pushed forward into Switzerland and Alsace, and although they were defeated in 357 at Strasburg by the Roman emperor Julian, they succeeded in settling in these regions. In 375 the Huns burst into Europe, and then began the migration of nations, which caused great changes in Germany. German tribes from the Vistula, Oder, and Elbe moved farther to the West, even to Africa (the Vandals), while Slavonian tribes (the Wends) advanced from the East into the depopulated regions. Other German tribes went to Italy and destroyed the West Roman empire in 476, while in Gaul, the present France, Clovis founded the powerful empire of the Franks, to which he added the dominions of the Alemanni after the battle of Zülpich in 496. Under the descendants of Clovis, the Merovingians, the strength of the empire was much impaired, however, by being divided, until at last the Carolingian family arose and grasped the reins under the hereditary title of *major-domus*. A member of this family, Pepin le Bref, dethroned the last Merovingian and declared himself king of the Franks in 752, with the consent of the pope. A contemporary of Pepin was the Anglo-Saxon Winfried (Bonifacius), the first archbishop of Mainz, who converted a large part of the German tribes E. of the Rhine to Christianity, but was killed in 755 by the Frisians. With Charlemagne (768–814) the empire of the Franks and the power of the Carolingians reached their highest point. Long wars with the pagan Saxon duke Wittekind, and in Italy, Spain, and Bavaria, extended the empire from the Ebro in Spain to the Raab in Hungary, and from the Eider in the N. to the Tiber in the S. But in spite of the imperial crown bestowed in 800 by Pope Leo III., and in spite of the wise policy pursued in the interior, these conquests caused a weakness which was generally felt even under Louis the Pious (814–840), and which led to the famous treaty of Verdun between his sons. Germany (Eastern Franconia) became now separated for ever from France (Western Franconia), and Lorraine (Middle Franconia) was thrown between them as the apple of discord. Ludwig the Child, the last Carolingian in Germany, died in 911. At

this time the Germans were threatened by the Norsemen from the N., by the Wends on the Elbe and the Havel, and especially by the Hungarians in the E., while in the interior a sort of national or tribal division became more prominent; so that at the extinction of the Carolingian house Germany was divided into five large dukedoms—Saxony (with Thuringia), Franconia, Suabia (formerly Alemannia), Bavaria, and Lorraine. The Franks elected their own duke, Conrad, king of Germany, and he was acknowledged by the other tribes with the exception of Lorraine, which fell to Western Franconia (France). Conrad, however, did not succeed in consolidating the empire internally or strengthening it outwardly, but after his death the Franks and the Saxons chose the mighty Saxon duke Henry for king. Henry I. (911–918) is the founder of the German empire. He vindicated the royal authority against the dukes; he acquired Lorraine for Germany; he fought with success against his foreign enemies, the Wends on the Havel and the Hungarians, whom he defeated at Merseburg in 933. In the interior he improved military affairs by developing a new system of cavalry; built numerous towns, and laid the foundation of the kingdoms of Saxony and Prussia by establishing against the Wends the margraviates of North Saxony and Meissen. Of still greater consequence was the reign of his son, Otho I. the Great (936–973). He crushed the rising opposition of the princely aristocracy; gave the dukedoms to friends and relatives; acquired the crown of the Lombards in 951; defeated the Hungarians at Augsburg on the Lech in 955; and assumed in 962—not to the advantage of Germany—the imperial title, which from that time, and up to 1806, remained with the German kings. After him followed three emperors of the Saxon house, Otho II., Otho III., and Henry II. But under them the royal authority lost very much; the princes and the ecclesiastical dignitaries became very bold; and the popes, hitherto always submitting to the strong emperor, began now to aspire to the empire of the world. With Conrad II. (1024–39) begins the Franconian or Salic dynasty, under which the royal power culminated in Germany; so that, if Henry III. (1039–56) had lived longer, not only would the imperial dignity have become hereditary in his family, but an end would have been put to the injurious interference of the pope in German affairs. His government was severe but just in the interior, and it was respected in foreign countries; in papal affairs he was generally referred to as arbiter. But he died only thirty-nine years old, and all the fruits of his policy were lost for centuries under his son Henry IV. (1056–1106). Henry was well gifted by nature, but having been educated by priests, he suffered very much from their influence. Under him the feudatory princes, the Church, and the Saxons took back what they had lost under his father, and the Church compelled him to perform the famous humiliation at Canossa (1077) by which he, in a manner, acknowledged the supremacy of the Church over the Crown. Henry, however, supported by the burghers, continued to struggle against the Church with various fortune. At one time he even expelled the pope, Gregory VII., from Rome. But his last days were much embittered by his own son, Henry V. (1106–25), who was won over to the papal party and rose against him. As soon, however, as Henry V. came to power himself, he followed the example of his ancestors, but was compelled by the papal party to conclude the concordat of Worms in 1122; with him the Franconian dynasty became extinct. The Saxon Lothaire followed (1125–37); he yielded to the princes and the Church, and by marrying his daughter to Henry the Proud, duke of Bavaria, he left his possessions to the house of the Guelphs. On his death the powerful house of Hohenstauffen ascended to the German crown (1138–1254). Conrad III. (1138–52) confined himself to German affairs, but his successor, Frederick I. Barbarossa (1152–90), tried to extend his power beyond the boundaries of the empire. In Italy he was not successful against the Lombard cities and the pope, but when his son married the heiress of the Norman empire in Lower Italy, he gained new influence, while in Germany he succeeded in curbing Henry the Lion of the powerful house of the Guelphs. He died in Asia on a crusade. His son, Henry VI. (1190–97), ruled with vigor and severity, but died very early; and on his death a contest began between Philip of Suabia, of the house of Hohenstauffen, and Otho, of the house of the Guelphs. The latter was supported by the pope, Innocent III., and Philip was killed; but when Otho IV. became sole emperor he could not satisfy the papal demands, and a son of Henry VI., Frederick II. (1212–50), was elected king by the papal party in opposition to him. Frederick gained the superiority, but as the popes soon became his most inveterate enemies, and were supported by the Lombard cities, he had to fight against the Church during his whole life; and although his adversaries did not succeed in placing another king of any power against him in Germany, still the empire suffered frightfully. During his reign the Germans succeeded in breaking the power of the Danes in the battle of Bornhöved (1227), and in 1230 the Teutonic Order conquered the country of Prussia to the E. of the Vistula. But after his death the house of Hohenstauffen declined rapidly. Conrad IV. died in 1254, and his son, Conradin, the last of the family, was beheaded at Naples in 1268, while trying to reconquer his heritage in Lower Italy from the invader, Charles of Anjou. In Germany, William of Holland reigned to 1256, but then followed an interregnum to 1273. Neither of the two foreign princes who were elected German emperors had any authority at all. On the election of Rodolph I. the house of Habsburg ascended the German throne. Rodolph restored general tranquillity to the empire, which during the interregnum had fallen under club-law, and by the battle on the March in 1278, in which Othokar II. of Bohemia was killed, he acquired the duchy of Austria, and laid the foundation of the Austrian state. After Adolph of Nassau (1292–98) followed Rodolph's son, Albert I. (1298–1308), under whose reign the Swiss Confederation was formed, which later was vindicated so gloriously against Austrian pretensions in the battles of Morgarten (1315) and Sempach (1386). With Henry VII. (1308–13) the house of Luxemburg acquired the German crown; its members held Bohemia, Moravia, and Silesia in their possession. After him, Ludwig of Bavaria (1314–47) and Frederick of Austria contended for the German crown. The former was victorious in the battle of Mühldorf (1322), and by the establishment of the electoral body of the empire in 1338 he made the election of the German emperor independent of the papal confirmation. With Charles IV. (1347–78) of the house of Luxemburg, Bohemia reached its point of culmination. He founded the University of Prague in 1348—the first university in Germany—and in 1356 published the Golden Bull, by which the election of the German king by seven electors (four secular and three ecclesiastical) became finally settled. His son, Wenceslaus (1378–1400), was too weak for the difficult circumstances. The mischief of club-law increased; associations of princes and lords originated; the Holy Fehme extended its authority beyond Westphalia; the Hansa, founded in 1241 by the maritime cities of the realm, acquired the dominion over the northern seas. Wenceslaus was deposed, and Ruprecht of the Palatinate was elected (1410–37). Then followed Wenceslaus' brother, Sigismund (1410–37), under whose reign the Councils of Constance (1414–18) and Bâle (1431–43) were held, in order to effect a reformation of the Church, which, however, did not take place. On the contrary, the result of the Council of Constance was the burning of Huss, and that of the Council of Bâle a compromise which ended the war of the Hussites. During the reign of Sigismund the house of Hohenzollern first came to Brandenburg in 1411. With Albert II. (1438–39) the house of Austria once more ascended the German throne, which it afterwards held till 1806, with a short interruption. Frederick III. (1440–93) was a feeble ruler. In his time Gütenberg invented the art of printing (1450), which exercised an immense influence on life in general, as the invention of gunpowder a century earlier (1350) by Berthold Schwartz had transformed the whole military system. Bohemia and Hungary were at this time governed by the celebrated kings George Podiebrad and Matthias Corvinus. Frederick's son, Maximilian I. (1493–1519), brought the period of club-law to an end by the declaration of the public peace of the country in 1495, and by the establishment of the imperial chamber or supreme court of the empire. By marriage he acquired Burgundy, to which the Netherlands belonged, and he witnessed the beginning of the Reformation by Martin Luther in Wittenberg (Oct. 31, 1517). The reign of his grandson, Charles V. (1519–56), was one of the most remarkable periods in the history of Germany, especially on account of the rapid development of the Reformation. At the Diet of Worms (1521) Luther defended himself with undaunted courage; at that of Speyer (1529) his adherents formally protested against decisions which were unfavorable to them; and at that of Augsburg (June 25, 1530) they publicly set forth their creed. Other remarkable events of his reign are the peasants' war (1524–25); the appearance of the Anabaptists at Münster (1535); the Schmalcaldian war (1546–47); the Agreement of Passau (1552); the Peace of Augsburg (1555); his several wars with France; and the counter-Reformation which took place within the Roman Catholic Church, partly through the establishment of the order of Jesuits, partly through the Council of Trent (1545–63), whose decisions have ruled the Roman Catholic Church up to our days. The empire of Charles V. comprised Germany, Austro-Hungary, the Netherlands, Belgium, Spain, and large portions of Italy. In 1556 he retired, leaving Spain and the Netherlands to his son Philip, and Germany and Austria

to his brother, Ferdinand I. (1556–64). Maximilian II. (1564–76) was rather indifferent with respect to religious matters, but under his son, Rudolph II. (1576–1612), the confusion increased, and under Matthias (1612–19) the Thirty Years' war broke out (1618–48). In the beginning the Roman Catholics gained such great advantage, through the emperor, Ferdinand II. (1619–37), the duke (later elector) Maximilian of Bavaria, and the generals Tilly and Wallenstein, that about 1630 it seemed as if the total fall of the Protestant cause was at hand. But the courageous interference of the Swedish king, Gustavus Adolphus, saved Protestant freedom in Germany; Tilly and Wallenstein died in 1632 and 1634, and the intermeddling of France after 1635 changed the whole character of the war, and transformed it from a religious to a merely political contest. By the Peace of Westphalia (1648) the Lutherans and the Reformed (adherents of the Swiss Reformers, Zwingli and Calvin) obtained free exercise of religion, but large tracts of land were lost to France and Sweden, the German countries were to a great extent withdrawn from the influence of the emperor, and Switzerland and the Netherlands were acknowledged as independent states. After Ferdinand III. (1637–57) followed the slow and hesitating Leopold I. (1657–1705), under whom Germany sank to the lowest stage of degradation. Louis XIV. of France pursued at that time a policy of aggrandizement. In the midst of peace he took (1687) the free imperial city of Strasburg, and with unheard-of cruelty devastated (1689) by fire and sword the Palatinate, the most beautiful part of Germany. And yet the Germans did not rise to resistance. At the diet, which from 1663 to 1806 was always held at Regensburg (Ratisbon), the princes were represented only by deputies. The most important business was delayed and procrastinated, while personal interests were pursued with great eagerness. The immorality and prodigality of the French court were imitated by every petty court in Germany; the French language was adopted in court circles; and German princes allied themselves with France against the emperor and the empire. And it was of very little comfort to the national feeling that the Turks, who in 1683 laid siege to Vienna, were thrown back by the Hungarians and vanquished by Prince Eugène of Savoy. Neither was the victory which the elector of Brandenburg, Frederick William, gained over the Swedes at Fehrbellin (June 28, 1675) so very impressive, though thereby he became the founder of the Prussian state. His country did not assume the name of Prussia, however, until Jan. 18, 1701, when Frederick I. was crowned king. At the same time as Prussia grew into a kingdom two great wars devastated Europe. The one, the Northern war, which raised Russia at the expense of Sweden, and introduced her among European states, touched the German empire only on its north-eastern boundary; while the other, the war of the Spanish succession (1701–14), was fought chiefly in Germany. As the English and the Germans, allied against France and led by Marlborough and Prince Eugène, won victory after victory (Hochstädt 1704, Turin 1706, Malplaquet 1709), it seemed as if Germany would rise again under the reign of Joseph I. (1705–11) and reconquer a large part of the territory which she had lost to France. But with the fall of Marlborough (1711) a reverse of fortune took place, and under the emperor Charles VI. (1711) she was compelled to make an unfavorable peace with France. While, at this time, the prodigality of most German courts had reached an unexampled height, and while Saxony had lost her prominent position among the Protestant states of Germany by the conversion of the dynasty to the Roman Catholic confession in 1697—in order to get possession of the crown of Poland—the king of Prussia, Frederick William I. (1713–40), laid a solid foundation by parsimony, careful administration, and the establishment of an excellent army; and on this foundation his son, Frederick the Great (1740–86), built up a state which soon ranked among the great powers. When, in 1740, the male line of the house of Habsburg became extinct, Frederick II. laid claim to some parts of Silesia. By the first Silesian war (1740–42) he took them; by the second (1744–45) he kept them. Also Bavaria, whose elector was emperor of Germany, under the name of Charles VII., from 1742 to 1745, demanded certain territories of the Austrian countries. Bavaria was supported by France, and the war of the Austrian succession began (1740–48). But Bavaria soon retired from the war; Saxony and the maritime powers allied themselves with Maria Theresa; and in 1747 the first Russian army, also in aid of Austria, reached the Rhine. By the Peace of Aix-la-Chapelle (1748) France gave up all her conquests in the Netherlands. Three years earlier the husband of Maria Theresa, Francis I. of Lorraine, had been elected emperor of Germany (1745–65). Meanwhile, Frederick the Great of Prussia had used the eleven years of peace to prepare himself for the Seven Years' war (1756–63), in which Austria, allied with Russia, France, Sweden, and most of the smaller German states, tried to humiliate Prussia, whose only ally was England, and make her an insignificant state. But Frederick proved himself superior in the field to all his enemies, and although he lost many battles, and more than once brought Prussia to the very verge of ruin, yet he was not to be crushed. The defeat at Kollin (June 18, 1757) was followed by the victories at Rossbach (Nov. 5, 1757) and at Leuthen (Dec. 5, 1757); the defeat at Kunersdorf (Aug. 12, 1759) was followed by a series of marches and strategical camps which reduced almost to nothing the advantages the enemy had gained over him. Russia, Sweden, and France retired from the field, one after the other, and at last Austria herself was compelled to make peace at Hubertsburg (Feb. 15, 1763). From that moment there existed in Germany a destructive dualism, until in 1866 Prussia acquired a decided superiority. The emperor, Joseph II. (1765–90), a son of Maria Theresa, tried by education, religious freedom, and political reforms to bring his people up to the standard of the age. But he was less successful in this respect than the Prussian king had been, partly because he introduced his reforms with some violence, partly because he was thwarted by the Roman Catholic clergy, but more especially because in Austria no preparations had been made by his ancestors. Nevertheless, his reforms were of great importance to Austria, and in spite of a violent reaction they still form the foundation of Austrian life. Both Frederick the Great and Joseph II. took part in the first division of Poland (1772), in which, however, as in the two following (1793 and 1795), Russia received the lion's share. But the attempts of Joseph II. to annex Bavaria to Austria were frustrated by Frederick the Great. In Prussia the weak Frederick William II. (1786–97) followed Frederick the Great, but, although the country was much enlarged by the division of Poland, yet it was brought near to ruin by interior mismanagement, by prodigality, intolerance, and false administrative measures. After the short reign of the emperor Leopold II. (1790–92), Austria, under the emperor Francis II. (1792–1835), and Prussia united into a war against France when the Revolution of 1789 had brought all the states of Europe into fermentation. Royalty, which was in danger in France, and which was to be helped by the allies, was finally overthrown by the first small successes of the Prussian arms. A republic was declared, and Louis XVI. was beheaded. In the field fortune changed. The Prussians had to leave France, the Austrians Belgium, and the jealousy between them prevented any energetic action. Meanwhile, the Reign of Terror in France had passed away, and Prussia made peace with the French republic, while Austria and England continued the war. But after the victories of Napoleon Bonaparte in Italy in 1796, which opened the way for him into Styria, Austria concluded peace at Campo Formio in 1797, and gave up Lombardy, for which it received Venice. In 1799, however, Austria again began war against France, this time in connection with Russia and England. The French were repeatedly defeated both in Italy and Germany, but, on account of a quarrel between Austria and Russia, the Russian troops under Suwaroff were withdrawn, and soon after Napoleon Bonaparte returned from Egypt and became first consul. By the battle of Marengo (June 14, 1800) Austria lost Italy, and after the disaster at Hohenlinden (Dec. 3, 1800) she was compelled to conclude the Peace of Lunéville (1801), by which the Rhine became the boundary of France. Several German princes lost their possessions on the left side of the Rhine, but they received ample indemnification on the right—together with some former Italian princes—by the mediatization of the ecclesiastical states and the imperial cities. In 1804, Napoleon became emperor of France. A third coalition against France was dissolved by the defeat of Russia and Austria at Austerlitz (Dec. 2, 1805), and Austria lost large territories by the Peace of Presburg; Bavaria and Würtemberg were made kingdoms. In 1806, Napoleon united all the South German states into the Rhenish Confederation, under his own protectorate. Numerous mediatizations of minor states took place, and (Aug. 6, 1806) the emperor Francis abdicated his dignity as chief of the empire and assumed the title of emperor of Austria. Prussia, under Frederick William III. (1797–1840), had hitherto lived in peace with France—not to her own advantage—but in 1806 she felt compelled to declare war, and before the Russians could come to her support she was completely defeated at Jena and Auerstädt (Oct. 14, 1806), and thoroughly subdued, owing to the unexampled cowardice and treachery of many of her generals. After the battles of Eylau and Friedland (Feb. 8 and June 14, 1807) peace was concluded at Tilsit, by which Prussia lost one-half of her possessions, and only kept the other half on very hard conditions. After the peace, however, Baron von Stein effected a thorough regeneration of social

and political life in Prussia, and Scharnhorst, supported by Blücher and Gneisenau, became the founder of a new military system. In 1809, Austria ventured once more on a war with France. The archduke Charles won the battle of Aspern (May 21, 1809), but at Wagram he was defeated (July 5, 1809), and by the Peace of Schönbrunn, Austria lost other territories and became totally excluded from the sea. In 1810, Napoleon incorporated the Hanseatic cities of Bremen, Hamburg, and Lübeck into his empire, but on the retreat from Russia, after the burning of Moscow, in 1812, he lost his whole army, and then began the German War of Deliverance. In the beginning, Prussia and Russia fought alone against Napoleon, and they were not successful. They lost the battles at Grossgörschen (May 2, 1813) and Bautzen (May 20, 1813), and Davoust maintained himself in the important city of Hamburg up to 1814. But during the armistice from June to Aug., 1813, Austria and Sweden joined the coalition of the three armies—the chief army, under the Austrian Schwarzenberg in Bohemia; the army of the North, under the Swedish crown prince, the former French marshal, Bernadotte; and the Silesian army, under Blücher in Silesia: the last, though the smallest, turned the fortune of the war. Silesia was delivered by the battle on the Katzbach (Aug. 26). The French force pushed towards Berlin was defeated by Bülow and Tauenzien at Grossbeeren (Aug. 23) and Dennevitz (Sept. 6), and on Oct. 3, Blücher crossed the Elbe at Wartenberg, following the movements of the army of the North, while the main army, after the defeat at Dresden (Aug. 26) and the victory of Kulm (Aug. 29), pushed forward from Bohemia towards Leipzig. The battle of Leipzig (Oct. 16–19, 1813) decided the destiny of Germany and Napoleon. The allies followed the fleeing emperor into France, and after entering Paris (Mar. 31, 1814) they compelled him to abdicate the crown of France and retire to the island of Elba. By the Treaty of Paris the Bourbons returned to France, and German affairs were regulated, after a plan of Metternich, by the Congress of Vienna (1814–15). From this time, and up to 1848, the influence of Metternich, the Austrian minister, was predominant in Europe. The German Confederation developed no life. The diet, sitting at Frankfort-on-the-Main, suppressed every free movement. The promised constitutions were never given. By the establishment, however, of the Zollverein in 1833, Prussia laid the foundation of united Germany, at least with respect to political economy. In Austria, Ferdinand I. ruled from 1835 to 1848. In Prussia, Frederick William IV. inaugurated a powerful ecclesiastical reaction, which, after the transient success of the revolution of 1848, extended also to political affairs, and placed Prussia under the influence of Russia and the Ultramontanes. In 1848, Prussia had become a constitutional state, but its constitution was later altered under the influence of the reaction. The national constitution of the German empire, which in 1849 was planned in Frankfort-on-the-Main, was never introduced into real life. Revolutions in several places of the empire in 1848 and 1849 were subdued by the aid of Prussia. The war with Denmark about Sleswick-Holstein ended favorably to Denmark. In 1851 it seemed as if Germany would glide quietly back into the old track. In Prussia, William I. governed from 1857 as prince-regent instead of his brother —from 1861 as king. He first tried to return to constitutional views, but when the government would not carry the army law, he appointed, in 1862, Bismarck minister of state, and a violent reaction took place in Prussia. In 1863, however, Bismarck found an opportunity of showing his foreign policy. When the Danish dynasty became extinct he disputed, together with Austria, the claims of Denmark on the duchies of Sleswick and Holstein, and by the war of 1864 he acquired these two countries for Germany. Then there arose a quarrel between Prussia and Austria, as Prussia wished to annex the two duchies, while Austria favored the claims of a collateral branch of the Danish dynasty (Augustenburg). In June, 1866, the war broke out, and after routing the Austrian army under Benedek at Königsgräz or Sadowa (July 3), the Prussian armies appeared before Vienna. By the Peace of Prague (Aug. 23, 1866) Austria retired altogether from the German Confederation, and acknowledged the changes and annexations which Prussia had made in Germany. Prussia now established the North German Confederation, whose constitution later was extended, with some modification, to the whole German empire, and concluded treaties with the South German states. But while in the interior the contest between the representation and the government became settled, the relations to France became every day more difficult. In July, 1870, France declared war (see FRANCO-GERMAN WAR), but the surprising success of the Prussian arms brought about, what the war from the French side was intended to prevent, the unity of Germany. In Dec., 1870, treaties were concluded between Northern and Southern Germany by which the new German empire was founded, and (Jan. 18, 1871) the king of Prussia, then residing at Versailles, was proclaimed emperor of Germany, under the name of William I.

GUSTAV NEUMANN.

Ger′man Flats, tp. of Herkimer co., N. Y., has 11 churches and 3 cheese-factories, and contains the important villages of ILION and MOHAWK (which see). It was settled by Germans in 1722. Pop. 5718.

Germa′nia was used by the Romans as the common name for the vast but half-unknown regions extending between the Rhine and the Vistula, and from the Danube to the North Sea and the Baltic. The first time they made any real acquaintance with the inhabitants of this territory was through Cæsar's campaign in Gaul. Several Germanic tribes, the Triboci, Nemetes, and Vangiones, had at that time crossed the Rhine and settled in the district between that river and the Vosges Mountains, while the Marcomanni, Tencteri, and Usipetes pushed forth through Belgium. Cæsar subdued the former, together with the Gauls, and the latter he drove back on the other side of the Rhine. The Usipetes, however, soon returned, followed from the E. by the Catti and Cherusci, and from the N. by the Frisii, Batavi, and Chauci. A new series of campaigns, directed solely against the Germanic tribes, was then undertaken by Drusus (from 16 to 9 B. C.), and the result was that the Roman conquests in Germania were extended N. to the Elbe and E. to the Taunus Mountains. Forts were erected, canals dug, roads constructed, bridges built, and Roman civilization began to make great strides into Germania; but when, a few years later, Varus tried to subject the inhabitants of these newly-conquered regions to the forms of Roman provincial administration, they rose at once in a terrific rebellion. Arminius, the chief of the Cherusci, defeated Varus and his legions at the Teutoburger forests, and the whole northern portion of the Roman possessions in Germania, from the Elbe to the Weser, made itself independent. Although Germanicus was very successful in his attempts at restoring the Roman authority in Germania, yet after the defeat of Varus, the Roman policy became defensive in Germania. The Germanic tribes began to associate, and the Marcomanni and Quadi of the second century, the Alemanni and Franks of the third, the Vandals, Suevi, and Heruli of the fourth, and the Goths and Longobards of the fifth, were not small tribes, but large nations. And when the Germanic tribes, pressed from the E. by the Slavi, went westward and southward, the Romans were incapable of withstanding them. The Roman empire was dissolved, and Germanic states established in its provinces. The ideas which the Romans had formed of these neighbors of theirs, whom they generally considered as mere barbarians, and which are known to us through the writings of Cæsar and Tacitus, seem to have been pretty nearly correct. Tacitus noticed that they erected no temples and had no idols, but believed in a future life and in eternal justice—that they built no cities, and had no manufactures or trade, but held their women and households in deep respect; and indeed these four points are the foundation of the character and history of the ancient inhabitants of Germania.

CLEMENS PETERSEN.

Germanic Union. See GERMAN EMPIRE, by G. NEUMANN; PRUSSIA.

Ger′man I′vy, a climbing plant often seen in parlor culture, and popular for its rapid growth and ivy-like leaves, is in reality not an ivy at all. It is the *Senecio scandens* (order Compositæ), a native of South Africa. Out of doors it is very handsome, but will not stand the lightest touch of frost. It occasionally puts forth clusters of yellow flowers.

Ger′man Lan′guage and Lit′erature. The German language belongs to the Teutonic branch of the Indo-European family, and is a sister of the Gothic, which possessed literary monuments in the fourth century, but died out entirely in the ninth; and of the Icelandic, whose oldest literary production, the elder Edda, dates from the end of the eleventh century, but which is still spoken in its original form in Iceland, and is the mother of modern Danish and Swedish. The German language consisted, and consists still, of two dialects—High German, spoken in Suabia, Bavaria, Austria, and parts of Franconia; and Low German, spoken in the northern and north-western parts of Germany. The latter, which developed into the Anglo-Saxon, the Dutch, the Flemish, etc., has produced one remarkable literary monument, the *Heliand* (*heiland*, "saviour"), a Christian epos from the ninth century, written in alliterative verses, and still existing in two manuscripts—one in Munich, and one in the British Museum. It was published in 1830 by A. Schmeller in Munich. But besides this one production, the Low German dialect has left only feeble traces of itself in the German literature. It had to submit very early to its nobler and more powerful brother-dialect,

the High German. High German, in its second form (known as Middle High German), was used by the Minnesingers in the twelfth and thirteenth centuries, by the Meistersingers in the fourteenth and fifteenth, and in the sixteenth century Luther's translation of the Bible (1534) made it, in its third form (known as New High German), the literary language of the German people, the medium of German civilization. In the oldest shape under which we know it, belonging to the period between the ninth and the twelfth centuries, it differs considerably from the Gothic and Icelandic, both in its grammatical forms and in its phonic method. It has no passive, no dual, and no vocative, but a bewildering exuberance of diphthongs. One of the most characteristic elements, however, of the phonic system of the German language, the famous *sch*, did not appear until the following period, between the twelfth century and the Reformation, when "slagen" became *schlagen*, and "swimmen," *schwimmen*. In the shape in which it was finally fixed by Luther and the other Reformers, it was not founded on any local or individual variety. Luther started from that form of the language which was used at the court of electoral Saxony and by the people of the district of Meissen, but to this he added from other sources whatever his great logical acuteness, powerful poetical intuition, and vivid musical sense told him could and would be generally understood. It was considered necessary to translate the translation into Low German, and in the first spurious reprints of the original edition many expressions are either altered or explained in notes. But hardly one hundred years elapsed before both the explanatory notes and the translation into Low German wholly disappeared. In its present shape the German language is exceedingly rich both in materials and in forms. In the latter respect it is perhaps somewhat encumbered, but with respect to materials it contains more words than either the English or the French language, and it possesses what those two languages have lost, or, at least, only retain in a very meagre state—the power of forming new words. A new idea must in French and English generally be expressed by a word borrowed from another language; a new shade of an old idea by a periphrasis. The German language can coin new words in its own mint, and be sure to have them accepted—that is, understood—by all its citizens. In its speech the German language is rather hard, but manly, energetic, and dignified. It has a great pathetic power, though it is somewhat liable to become harsh and guttural in the expression of passion, and sentimental or wailing when it tries to be sweet. Its style—although the German literature contains examples of style unsurpassed in any other literature, dead or living—is nevertheless, in its general standard, inferior to that of most other European languages. Its richness in grammatical forms makes an intricate and highly artificial construction of sentences possible; and that imitation of Latin eloquence which under Dr. Johnson's leadership passed through the English literature as a temporary aberration, seems in the German language to have become the fixed character of its style. Schiller's prose is often monstrous; Richter's is generally intolerable. And this false tendency was furthermore aided by the German philosophy. As a too pedantic application of the logical forms of thinking generally ends in the most ridiculous logical blunders, so a too minute reflection on the wording of an idea generally makes the expression vague and verbose. This fate has befallen the German style since it ceased to write in German words, and began to write in Latin definitions.

The history of the German literature begins with, or shortly after, the Reformation. Before that time there was a literature, but it had no history. It was produced by sporadic efforts, and it consisted of isolated attempts. During the first period, from Charlemagne to the house of Hohenstauffen—that is, from the ninth to the twelfth century—it was the Church that made the literature; during the second, from the twelfth to the fourteenth, it was the court; and during the third, before and under the Reformation, it was the middle class, the burghers, the workshop. But the literature of the Church had no influence on that of the court, and the literature of the court none on that of the shop. There is no continuity. The true literary spirit, which creates a literature because it has made a literature necessary, and which lives on uninterruptedly as long as the people live, did not awaken until the Reformation. Many of the preliminary attempts are interesting, however, at least in an historical respect, and so is the whole literary life which sprang up under the Reformation. Charlemagne took some interest in the popular songs and mythological lore of the German nations, and had a collection made. But his principal task was to introduce Christianity into the country, and to produce order by curbing that spirit of turbulence which had produced the songs he collected. And to his successors these remnants of paganism and barbarism were objects of utter abhorrence. It was translations of Latin prayers and hymns which were needed, and this literature the monks undertook to furnish. The highest they contrived to produce was a paraphrase in German verses by Ottfried of the Gospels, which is remarkable because the Old German versification, with alliteration, has here given place to the mediæval fashion of making verses with end-rhymes, which was a Roman invention. Much more original life was shown by the Minnesingers between the twelfth and fourteenth centuries. With them the national spirit of the German people breaks forth for the first time in spontaneous poetical inspiration. The personal characters of the emperors of the house of Hohenstauffen, proud, daring, and adventurous; their wars in Italy and the Orient, often victorious and always energetic; their magnificent court and their splendid hospitality, gathered around them the most gifted and most advanced spirits of the people, thus at once calling forth a common individual development and creating a widespread popular influence. The Crusades brought the German warriors into contact with foreign climates and countries more luxurious and dazzling than their own, and with foreign characters more refined in habits and ideas than they were themselves; and when they returned home they brought with them treasures of wonder and adventure which pressed on their hearts for utterance. In their intercourse with the Spanish, English, and French knights they learned the arts of chivalry, especially the art of poetry. How to lay a tune, how to form a strophe, how to build a verse, how by this means to give the utterance the same wonderful charm as had the inward vision,—this they learnt, and the result was a profusion of lyrical songs in praise of love, honor, and fidelity, and of ballads revealing the wonders which life contained. The subjects of these ballads, especially of those which assumed a more decidedly epic character, are the same that we find in the chivalrous poetry of Provence, of Flanders and Champagne, of Brittany, etc. It is the traditions of King Arthur and his knights, of Charlemagne and Roland, etc., but in the German treatment these subjects are most curiously mixed up with traditions coming from the North and originating from the old Teutonic paganism. The most celebrated of these knightly poets were Walter von der Vogelweide, Hartman von der Aue, Wolfram von Eschenbach, and Conrad von Würzburg. The highest production of the period is the *Niebelungenlied*. An excellent collection of minor songs and ballads is given by Lachmann and Haupt under the title *Des Minnesangs Frühling* (Leipsic, 1857). With the fall of the Hohenstauffen dynasty the vital nerve of the art of the Minnesingers was deadened; the composition of lyrical songs continued for some time, but the contents became sentimental and affected, and the form lost all charm in its utter artificiality. In the fourteenth century the art died out entirely. Meanwhile, the development of the cities had reached a considerable height; commercial and industrial associations or corporations had been formed. The guilds presented themselves to the government, to the other estates, to the world at large, not only as elements of order and progress, but as a power. Although vastly inferior, both in privileges and in institutions, to the nobility and the clergy, still the burghers were now acknowledged as the third estate, and two circumstances, both of the greatest consequence, made it possible for literature, after it died out in the Church and the chivalry, to plant itself among the burghers. In the fourteenth century the University of Prague was founded, and similar institutions were soon after established in other parts of Germany. But of all institutions, the university is that one through which the third estate has received its highest mental development and exercised its greatest social influence. In the fifteenth century the art of printing was invented. Books became cheap; literature was no longer a privilege of the rich. At last the historical movement made the decision. The Reformation originated from and addressed itself to the third estate principally, and thus literature became the business of the burghers. It did not, perhaps, gain so very much by this change. With the exception of certain books of edification and confession, which are as dear to Protestants as books can be, and of some hymns, which any man of religious feeling and poetical sense must bow to as among the highest inspirations of religious poetry, the rest of the literature of this period is rather tame (even its satires) and clumsy (even its chronicles). But it was eminently practical. It derived its authority not from its enthusiasm and power of charming, but from its purpose and power of instructing. Its character was thoroughly didactic, but its influence was very great and beneficial, both as a combatant in the religious controversy and in general as a propagator of civilization. It worked in two different forms—the dramatic and the lyric—but the productions of the first form were without comparison the most important.

The small religious drama, representing some biblical event, which used to be performed in the church and by the clergy on the great Christian festivals, had grown during the Middle Ages into the large mysteries and miracle-plays, which, containing many profane, even comical elements, were performed on the market-place by the guilds. To read these dramas is not very entertaining, but the picture of their performance is impressive—the immense scaffold, gorgeously ornamented and illuminated with fireworks and rockets; the deep earnestness and piety with which the actors entered into their parts; the devout fervor and enthusiasm with which thousands of spectators sat the whole day through before this stage as before a revelation. These mysteries were succeeded, during the period of the Reformation, by a much tamer sort of small dramas, which bore the same relation to them as the lyrics of the Meistersingers to the lyrics of the Minnesingers. The lyrical productions of the Meistersingers are extremely artificial expositions of dry and often narrow moral ideas, but they were held in very great esteem in their own time. Hans Sachs (1494–1576), a shoemaker in Nuremberg, the son of a tailor, and the master of all Meistersingers, wrote 4275 such pieces, which he published on fly-leaves. But his 208 dramas or dialogues in prose are much more interesting. They have sometimes humor, sometimes character, often a naïveté we must love, and often a naïveté irresistibly ludicrous; as when the God-Father takes Cain and Abel on his knees and examines them in Luther's Catechism. But from the German mysteries came no Shakspeare, from the German Fastnachtspiele, no Molière. All the germs which the period contained were first frost-nipped by the tyrannical and barren dogmatism into which the fresh passion of the first Protestantism very soon became petrified, and then entirely cut off by the horrors of the Thirty Years' war.

But before the war ended literature made a new start in Germany, and this time with success, so far as it has since moved on continuously through a natural evolution of action and reaction, steadily enlarging its principles, developing its ideas, perfecting its forms, and increasing its influence. Compared with the great political and social agents which during the three former periods stimulated the literary spirit into action, the present starting-point seems rather small. Literature now begins, under the shelter of the university, as the business of the learned and addressing itself only to the educated class. Of course, the principle inherent in this situation is too narrow, and it may be that for a time the progress of the German literature was somewhat impeded and its total character somewhat impaired thereby, but there was no other starting-point, and the issue is consequently exempt from all criticism. With Martin Opitz (b. 1597 at Bunzlau, and established in different positions at Liegnitz, Breslau, and other cities of Silesia until his death in 1639) the movement began. He was a man of solid learning, elegant education, much experience, and some talent. His *Comfort under the Miseries of War* is not without some strains of genuine warm feeling, and by his book on the *Art of German Poetry* (1624) he laid the foundation of this art. Originally, the German language was quantitative, like the Latin, but during the previous centuries the quantity of its syllables had been tampered with, the sense for it was lost, and the art of making verses was reduced to the mere counting of the syllables. This did very well as long as all verses were destined to be sung, but for verses without a tune the method was utterly insufficient. Opitz showed that the accent of the syllables would form as potent a principle of versification as their quantity, and thus he founded the metrical science of all modern Teutonic languages. A number of men, all of learning, some of talent—Paul Flemming (1609–40), Andreas Gryphius (1616–64), Philip von Zesen (1619–89)—gathered around him, and formed the so-called "first Silesian school." Literary societies were established at the universities and at the courts, and much was done for the purification of the language. Something, too, was done for the development of taste, but here was the weak point. The school could do nothing but imitate. Perhaps only a few people could feel that an imitation in unpolished German of the polished forms of the Italian and French languages, and an imitation in rough German elements of the refined ideas of Italian and French culture, resulted in caricature; but by degrees most people felt that it resulted in emptiness, and the reaction came in the form of the second Silesian school. At the head of this reaction stood Hofmann von Hofmannswaldau (1618–79) and Kaspar von Lohenstein (1635–83). The former wrote only lyrical poems, the latter romances and dramas. Neither of them possessed a truly creative imagination. The impression of life, reality, and truth which was missing with the poets of the first Silesian school they endeavored to produce by frivolities and crudities. Wild bombast took the place of the cold, flat tirade; violent reverses of fortune were substituted for the tame development of human destiny. Scream, grimace, murder, and blood filled the scene, but of character and passion there was none. Lohenstein's influence was enormous, however. Strolling bands of clowns and tragic howlers, who, instead of performing regular dramas, simply filled by improvisation a dramatic scheme, succeeded to the performance of mysteries and miracle-plays by the guilds, and found great favor. Lohenstein and his disciples furnished these bands with dramas, and the theatre actually made a step forward. Still greater was his success with his romance *Arminius and Thusnelda*, which called forth a flood of similar productions, and probably had the good effect that thereby people were allured to read books, and to seek in literature, if not an education, at least an entertainment. There was a correlation between the first Silesian school and the philosophy of Leibnitz, and between the second and the pietism of Spener and Franke, but only a very elaborate analysis could show the connection. The lines in which German civilization moved on were as yet widely separated from each other, and the literature proper, confined to that which concerns the general education, and exclusive of the special development of the sciences, was as yet only a feeble instrument of civilization, not the complete mirror of civilized life. That point it did not reach until the end of the next period, with Kant, Winckelmann, Lessing, and Herder. It had to make over again, but in a higher sphere and on an enlarged scale, the movement which it had performed already once through the first and second Silesian schools. The wildness, savagery, and confusion to which the second Silesian school had delivered over the German literature was tamed and reduced to order by Gottsched (1700–66), a disciple of the philosophy of Wolff. The theatre was his passion. By his *Cato*, the wonder and pride of its time, and by his numerous translations from Corneille, Racine, and Voltaire, he raised the theatre in public estimation, and helped the strolling bands to conquer a settled position as court-establishments; which of course was a circumstance of the utmost importance for the development of the theatre. But his influence extended far beyond these limits. By his handbooks and compendiums he made literature, criticism, and æsthetics interesting to people at large, and constituted himself a literary pope. He had no genius, however; he imported all his ideas from France. But without genius no literary standpoint can be vindicated. Jakob Bodmer (1698–1783), Jakob Breitinger (1701–76), and others formed the so-called Swiss Association in opposition to him. They considered the epos as the highest poetical form, and the English literature as containing the most perfect artistic types; and they were exceedingly positive in their views—the more so as they had as little genius as Gottsched. At last they attacked him, and a very hot controversy ensued. Several literary and critical periodicals were established, and the attention and interest of the public were roused. At the same time appeared Baumgarten's *Æsthetica*, by which that beautiful science which is called æsthetics was founded, and which gave to all literary and critical questions a deeper and broader signification. A quarrel, however, about whether the epos or the drama is the highest poetical form, or whether the French or the English literature contains the most perfect artistic types, can only end satisfactorily in one way. In disputes about æsthetical principles only *argumenta ad hominem* are decisive—that is to say, only creations of genius, which strike but argue not, can produce a true decision. And in this way ended the controversy between Gottsched and the Swiss Association. Two poets appeared —Klopstock (1724–1803) and Wieland (1733–1813). They did not belong to the two parties, but they represented pretty well the two principles at issue. Both of them had genius. Klopstock, heavy, but deep, obscure, but inspired, roused the enthusiasm for religion and Fatherland, and called forth ideas which elevated the mind and enlarged the heart. Wieland, light, but elegant, sometimes frivolous, but always brilliant, awakened a sense for clearness and gracefulness; and, flitting about from ancient Greece to mediæval Germany, he always brought brightness and joy along with him. They were great contrasts, these two men, but they did not contradict each other; it was possible to love them both. And this startling discovery found its full and brilliant explanation in the criticism of Lessing (1729–81). The first element of beauty is truth. All that is true to nature, whether its name is Klopstock or Wieland, is capable of impressing our imagination. But in order to produce an impression which is pure and full, the truth must be formed in accordance with the laws inherent in that special art which is to represent it. With merciless analysis he dissolved the praised forms of the French models into ridiculous conventionalities, and with an almost cruel irony he compared the ideas of Voltaire

with those of Shakspeare and Sophocles, and asked, Where is the truth? At this time the civilized class of the German people had reached a standpoint of taste superior to that occupied by any other nation. They displaced Voltaire, they reinstated Shakspeare; they infused new life in Greek art. And meanwhile the different agents of the German civilization drew nearer together and began to enter into communication. The battle of Rosbach and the *Kritik der reinen Vernunft* were not isolated influences any more. They met each other in the same consciousness, and began to work together. And thus the German public was not only capable of enjoying a great literature, but also able to produce it.

In the latter part of the eighteenth century an epoch begins in the German literature which may be compared with that of Pericles in Greece and Elizabeth in England, and which in the genuine excellence of its productions and their wonderful variety far surpasses that of Augustus in Rome and that of Louis XIV. in France. It is the period of Goethe (1749–1832). One of the most striking characteristics of the literary phenomena of this period is their great complexity. It was great in every respect. History (John von Müller, Schlosser, Ranke), philology (Wolff, Voss, Hermann, Lachmann, Böckh), theology (Schleiermacher, Neander), philosophy (Fichte, Schelling, Hegel), and the exact sciences (Alex. von Humboldt) were cultivated, not only with success, but with genius. New ideas broke forth everywhere. And with this brilliant state of the intellectual life the development of real life corresponded. In spite of long wars and great defeats, industrial and commercial business prospered, and in politics and religion and on every field of practical life new and powerful tendencies rose. Of this immense activity the literature of the epoch is a true mirror. There is a new moral system in Schiller's earlier dramas; there are politics and theology in the lyrical songs of the romantic school. The agencies of actual life and the results of scientific research, in all their diversity and singular intermixture, formed the ideas of the literature. But in spite of the great complexity which this circumstance gives to all literary phenomena of this period, still the whole epoch centres in Goethe, and all its productions may be classified with relation to him. The intimate co-operation of Goethe and Schiller (1759–1805) actually governed the German literature through several years. But while every one of Goethe's larger works formed a school, and became the starting-point of a new tendency, the direct influence of Schiller is comparatively small. They were very different, these two men, but they were not contrasts; by their differences they supplemented each other. In nature and history Schiller always searched after the law, while Goethe always looked at the life. The objective development of the necessary laws and their influence on human destinies form the fundamental construction of Schiller's dramas, all of which are historical in the strongest sense of the word, with exception of two of his earliest tragedies, in which the subject is not taken from history. In Goethe's two great historical dramas, *Götz von Berlichingen* and *Egmont*, it is the rich variety of circumstances, which like plants grow differently under a different sun and in a different soil, and their influence on human character, which form the centre. Both aspects found followers. The most prominent of Schiller's disciples are Christian Grabbe (1801–36), Friedrich Hebbel (1813–63), Friedrich Halm, and Heinrich Laube. With the two latter the conflict between the general law and the individual passion is generally somewhat tame—with the two former generally somewhat exaggerated. Among Goethe's followers there was one, Heinrich von Kleist (1776–1811), of eminent talent both as a dramatist and as a novelist. In one point Goethe's and Schiller's aspect of history coincided—namely, in their view of the antique world. It was impossible here to emphasize differently the working of the law or the splendor of the life, since the reconciliation of the objective law and the subjective passion to perfect harmony formed the fundamental idea of antique civilization. From Goethe's *Iphigenia*, and from his and Schiller's ballads, issued not only a poetical school, but a broad tendency of civilization, whose most eminent representative in the literature was Franz Grillparzer (1790–1871).

In strong opposition to Schiller, but in sympathy with Goethe, and actually inspired by several of his works, especially by *Faust*, developed the Romantic school, comprising a great number of highly gifted men—poets, critics, historians, philologists, and philosophers. Their intoxication with nature; their enthusiasm for all strongly marked traits of nationality, especially for the picturesque Middle Ages; their high respect for art as one of the principal forms of the human mind,—all the different elements of their creed they derived from Goethe, but he himself kept aloof from those exaggerations which made his ideas romantic. With him love of nature became a deep and patient study of natural philosophy; with the romanticists it grew into mysticism and demonism. To Goethe the Middle Ages were a rich mine of splendid poetical materials; to the romanticist they represented the highest type of social life. Many members of the romantic school turned Roman Catholics, and in politics they all favored reactionary tendencies. The idea of art as one of the principal forms in which the human mind lives and manifests itself they mixed up with Fichte's doctrines of the world-creating Ego, and the result was a deplorable contempt for all objective authority. Considered as a whole, the school was more critical than productive. Of the works of the two brothers Schlegel, August Wilhelm (1767–1845) and Friedrich (1772–1829), nothing has any interest now but their critical, historical, and philosophical essays. Of the works of Ludwig Tieck (1773–1853), the novels are still entertaining by their elegant irony, but his name is best known as a dramatic critic and as an excellent translator. Novalis (1772–1801), Clemens Brentano (1778–1842), E. T. A. Hoffmann (1776–1822), Lenau (1802–50), and others were more exclusively poets, but none of them possessed a very comprehensive or very intensive talent.

However brilliant this epoch is—and in philosophy, philology, theology, history, natural philosophy, almost in every field of intellectual life, it can show names corresponding to those of Goethe and Schiller—it always bears the character of being the literature of the educated class, not the literature of the people. It contains very few truly popular elements, such as those of Ludwig Uhland (1787–1862); those who try to be poets of the people become awkward, confused, and rough, like Ernst Moritz Arndt (1769–1860) and Friedrich Ludwig Jahn (1778–1852). So also think men like Ludwig Börne (1786–1837), Heinrich Heine (1799–1856), Julian Schmidt, and Wolfgang Mentzel; and the general tone of German criticism seems to indicate that this is felt and acknowledged in Germany, and a new starting-point, with a broader and truly popular principle, sought for. CLEMENS PETERSEN.

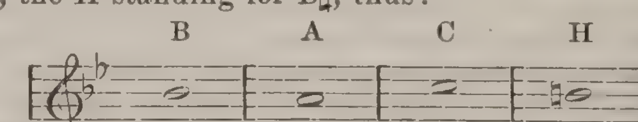
German Ocean. See NORTH SEA.

German Philosophy. See PHILOSOPHY, by HON. W. T. HARRIS, A. M., LL.D.

German Reformed Church. See REFORMED CHURCH IN THE U. S.

German Scale. With the Germans, the musical scale is represented by the letters A, *H*, C, D, E, F, G, not A, *B*, C, etc. It is customary with them to reserve the letter B for *B*♭, and its place is supplied by substituting the letter H. In German organ-music there are numerous fugues written in honor of the illustrious J. S. Bach, in which the leading theme or subject is formed from the four letters of his surname, the H standing for B♮, thus:

B A C H



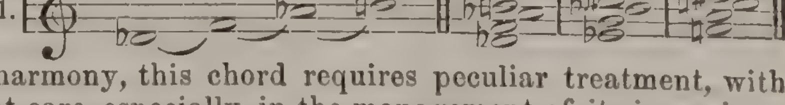
German Seventh-Day Baptists, a sect founded in 1728 at Ephrata, Pa., by Conrad Beisel, who led a secession from the so-called Dunkers. The members in 1732 entered a conventual life and adopted the Capuchin habit. Their principal settlement is at Snowhill, Franklin co., Pa. They take no monastic vows, hold property in common, keep the seventh day sacred, recommend celibacy, but do not forbid marriage. They are few in numbers.

German Silver, an alloy of variable constitution, designed as an imitation of silver. Eight parts of copper to three or four each of zinc and nickel make a very fair imitation; and the addition of 2 or 3 per cent. of iron renders it whiter, but less malleable. A very malleable sort has 10 parts of copper, 6 of zinc, and 4 of nickel. The Chinese *pakfong* is essentially the same as German silver. As the price of nickel has recently increased, various cheaper white alloys have to some extent superseded the use of German silver, which is, however, still extensively used in the arts.

German Sixth. In music, the augmented, superfluous, or extreme sharp sixth, comprising four whole tones of the scale, or one semitone more than the major sixth. It is the interval formed by D♭ and B♮, E♭ and C♯, F♮ and D♯, etc. Its elements, in harmony, are a major third, a minor third, and an augmented second, as in Ex. 1:

Maj. 3d. Min. 3d. Aug. 2d.

Ex. 1.

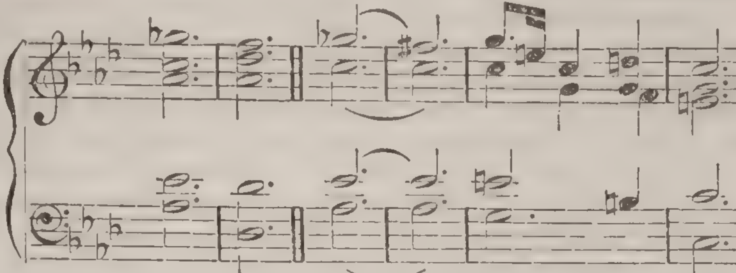


In harmony, this chord requires peculiar treatment, with great care, especially, in the management of its inversions. And as its form, when viewed apart from its grammatical relations, is precisely that of the ordinary dominant seventh, it may, by an enharmonic change (as of B♮ into C♭,

C♯ into D♭, D♯ into E♭, etc., or *vice versâ*), be made to produce the most surprising and beautiful effects. Thus, in Ex. 2, at *a* the *ordinary* progression of the dominant seventh on A♭ is given. But at *b*, by an enharmonic change of the seventh into the German sixth (by assuming G♭ to be F♯), a brilliant and unexpected transition is instantly made into the somewhat remote key of C major.

a *b* *Beethoven.*

Ex. 2.



WILLIAM STAUNTON.

German Theology. Thus far in its history, Protestantism has appeared under many different forms, which have generally presented themselves in separate churches. The principal among them have nevertheless a certain external unity, in that they have taken their rise especially among the Teutonic races and are the offspring of the Reformation. Nor do they lack a certain internal unity. As it was not a few individuals alone who accomplished the work of the Reformation, since the most influential Reformers would only be regarded as mere instruments for carrying out their modest share of the work of God, and they had been exalted almost against their will, through faithfulness in little things, to their far-reaching thoughts of reform; and as it was thus a comprehensive divine thought prepared in numberless places, and to be accomplished by the co-operation of the most favorable circumstances, that Christianity should be raised from its deep decline—yea, new chaos—to a higher stage in the appropriation of salvation and the building up of Christianity; so this one divine thought which created the Reformation has been the strong bond of union to all those who have attached themselves truly to the great reform movement of the sixteenth century, or would remain with it in unity of spirit, notwithstanding the manifold differences and divisions in Protestantism and its history. In spite of appearances to the contrary, there is to the present day a great family resemblance among all who call themselves Protestants. With good reason, therefore, may we speak of the unity of a Protestant or Evangelical Church, the more so as it is the common evangelical principle that the unity of the Church does not consist in the similarity of ceremonies or form of government of the Church, but in the preaching of the pure gospel and the administration of the sacraments in accordance with the principles of their institution. This one Evangelical Church, or Protestantism, has this distinguishing characteristic, that it would have the common features of Christianity apprehended by conscious personal appropriation, in the full sense of the word; that is to say, through the appropriation by the whole soul from centre to circumference, and indeed so that through the acceptance of the object of faith in our inmost souls the assurance of salvation is grounded in justification by faith in Christ, whereby immediate access to God is secured and enjoyed. And this assurance of salvation, as it opens up a new idea of God, of his acts, and of the destiny of mankind—thus a new conception of God and the world—contains no less a strong impulse of gratitude in order to the work of sanctification in one's self and for work in one's calling for the kingdom of God. This assurance of salvation is a knowledge which begets a new disposition, a new being, a new regenerate creature—which, recognizing itself, with a loving heart would engage in work. Christianity in Protestantism has advanced to a new stage in its appropriation by mankind, for it is not content either with a purely intellectual appropriation of Christianity, be it in a speculative form or more as a matter of memory, as is chiefly the case in the Greek Church, influenced by the Hellenic mind, or by a mere legal submission of the will to a system of doctrines, or even a practical ecclesiasticism, as in the Roman Catholic Church, influenced by the Jewish mind. Protestantism, on the other hand, as a unit, would be the personal expression of Christianity, above all as the religion of peace and reconciliation, and indeed of light and life from God.

Protestantism, so soon as the preparatory streams of the Middle Ages had worn for themselves deep beds and been combined in one channel, manifested itself in a twin form —the Lutheran, which on the whole prevailed in German Protestantism, and the Reformed. The one took possession of the eastern division of the German races, the other of the western. The difference is, that the Reformed confession carried out the evangelical principle more according to its realistic or practical side, or as a principle of the will, whilst the Lutheran confession, in accordance with the genius of the German people, unfolded it more according to the intellectual side. Thus, each has a relative advantage and a relative deficiency. If, in conformity with our task, we confine ourselves to German theology, and have to lay greater stress upon that which, within Protestantism as a whole, constitutes the peculiar strength of the German Church, it is not to exalt it above other confessions or to depreciate their superiority in other respects. We observe a prelude or type of German theology already in the Middle Ages in the German mysticism of Johann Eckart, Heinrich Suso, Ruysbroeck, Tauler, and the little book with the characteristic title *Ein Deutsche Theologey*, which Luther justly prized so highly. In the Middle Ages, indeed, men of the German race had distinguished themselves as scholastics, such as Albertus Magnus, Gabriel Biel, not to speak of Nicolaus Cusanus or Occam; but the Latin races then led the van in scholasticism. In analysis and the logical treatment of a subject they were in their element. The Teutonic (particularly the German) mind early tended to unite religious feeling or mysticism with speculation, together with a thoroughgoing reconciliation of faith and knowledge. The evangelical principle of faith unites faith and knowledge in the form of religious assurance; and in that it shows itself capable of establishing a Church, the soil is prepared upon which the peculiarity of the German mind may assert itself, and at the same time take up a position at the head of theology.

The evangelical principle ripened to its power of reform by satisfying the longing of the soul for immediate communion with God by the word of reconciliation through Christ and justification by faith; that is to say, in that the deep mystical tendency of the German mind attached itself in faith and faithfulness to historical Christianity, as it has its sources in the Holy Scriptures, thus possessing the truth no more outwardly as a law, but inwardly as an enlightening and quickening power. And so the principle of the Reformation reached its maturity in that faith and the Word, the Word and faith manifested and confirmed themselves in their necessary internal harmony. This is nothing else but what we now call the formal and material sides of the Protestant principle. The history of German theology is only to be understood from the movement of these constitutive factors. We distinguish in the following sketch a creative and formative period; a preservative and conservative period; and finally, in the last century, a critical or destructive period. The last, however, was only a purifying process in order to a regeneration which already announces itself in potent tokens.

I. The first creative period of the German Church and theology, embracing the period of the Reformation, is evidently characterized by the position which the doctrine of justification assumed in its critical and positive development. The prevailing church doctrine and order were critically measured by the word of God, contained in the Holy Scriptures, apprehended by faith. Faith in the Holy Scriptures was not based upon the authority of the Church, although historical tradition in other respects continued to be recognized. No more was the authority of the Church to decide respecting the canon (as the exclusion of the Apocrypha shows), or the interpretation of the Scriptures. The Holy Scriptures received their regulative place because the apostolic word about Christ, or because that which was recognized as the kernel of the Holy Scriptures, Christ accepted in faith, demonstrated to the soul its animating divine power. And so the real attestation of the Holy Scriptures was found in nothing else than Christ so far as He imparts to the soul through His Holy Spirit the assurance of divine salvation. Accordingly, whilst faith itself arises through the word of God, whether in the Holy Scriptures or in the preaching regulated by them, it is only through them as the specific means of grace. On the other hand, the Holy Scriptures are authority or norm for faith only through that which certifies them, through Christ their central theme. He is "the emperor over the Scriptures" ("der Kaiser über der Schrift"); a writing that "does not urge Christ" ("Christum nicht treibet") cannot claim canonical authority.

Faith in unison with the Holy Scriptures, and holding them in the hand as norm, now critically revised the whole ecclesiastical system of the Middle Ages, and established new religious views. The doctrinal type which resulted therefrom received its classical expression in the Augsburg Confession (1530), with its Apology, and in the two catechisms of Luther, with the Schmalkald Articles, which are essentially in unison with these writings of Melanchthon. These five symbols present the first formation of the Lutheran doctrine, the most systematic and summary being the Augsburg Confession; for justification by faith constitutes the centre from which all else is ruled (Art. IV.); its theological, anthropological, and Christological presupposi-

tions are given in the first three articles, while the fourth article contains the union of the free grace of God with the believing soul. It then proceeds to the doctrine of the origin and nature of this faith. Its origin is through the ecclesiastical office, which administers the word of God, and the sacraments, these being accompanied by the agency of the Holy Spirit (Art. V.). Faith grows into new obedience or love (Art. VI.). If this be the nature of evangelical faith in its origin and growth, it of necessity leads to the Church, which partly presupposes faith, partly supports it; therefore the Church is treated of at length in Arts. VII.–XVII. Art. VII. determines the fundamental idea of the Church as an everlasting communion of saints or believers, which is recognized externally by the pure doctrine of the gospel and the proper administration of the sacraments, and which preserves its unity even in the dissimilarity of human tradition. The Church in its realization is to a certain extent inconsistent with its idea, and hence there arises the distinction between the invisible and visible Church, which, however, does not find its expression in the Lutheran symbols. This inconsistency, however, on the side of the subjective factors of the Church does not go so far as to do away with the efficacy of the objective factors, the Word and sacraments. These objective factors, baptism and the Lord's Supper, were now positively stated (Arts. IX.–XII.) with silent polemic towards the Roman Catholic Church, and her apparently fuller doctrines of the sacraments (viz. penance, with confession and ordination); the *opus operatum* was rejected, because contrary to faith (Art. XIII.), and the evangelical idea of ordination was defined as the lawful call to the public administration of the means of grace, as opposed to anarchy as well as hierarchy, so that the balance is restored between church order and evangelical freedom. The principle of faith entirely unites the objective or necessary side with the subjective side, and transfigures both into evangelical freedom. On this very account the evangelical type of teaching is friendly to the state, which it acknowledges as a divine institution, and engages to serve with the cheerful obedience of love (Art. XVI.). Finally, Art. XVII. treats of the final destiny of the Church, excluding enthusiastic millenarianism. The remainder, for the most part, refutes misconceptions respecting evangelical doctrines, such as the supposed entire denial of free-will and the charging the divine causality with the origin of evil, the supposed despising of good works and the law; and closes with the rejection of the principal ecclesiastical abuses, such as withdrawal of the cup from the laity, the celibacy of the priests, the sacrifice of the mass, oral confession, laws about eating, monastic vows, as well as the unevangelical exaltation of episcopal power over against the laity and the state. That which has just been stated is the substance of the doctrines of the Lutheran Church—that which constituted the official doctrine until 1750. These Lutheran symbols contain in general an harmonious whole, and have shown themselves capable of establishing an evangelical Church and an independent evangelical literature and learning. Several important points, however, were either not discussed in this first confession, or were not clearly decided in harmony with the general evangelical type. Above all, the Holy Scriptures are indeed presupposed as authority, but are mentioned only as a means of grace; no doctrine respecting them as a norm is established, even though they are implicitly understood to be so as a matter of course. There is a marked difference in this respect in the Reformed confessions, since they very early presented the article respecting the Sacred Scriptures as a particular doctrine, some of them with a specification of the particular writings which were to be regarded as canonical. The Formula Concordiæ partly made up the deficiency. But it evidently proves that Luther's clear insight into the relation of faith to the word of God and the Holy Scriptures in the principles briefly mentioned above, as resulting from faith with respect to the canonicity and criticism of the Holy Scriptures, as well as their interpretation, had by no means become the general conviction of the Lutheran Church. The deficiency in the working out of this fundamental principle constitutes the mainspring of the theological movements of the two following centuries, which somewhat differ from the standpoint of the Lutheran Reformation. There are other inequalities or deficiencies, such as the following: Whilst the *opus operatum* is decidedly denied, owing to the fundamental principle that salvation must be apprehended by personal faith, yet regenerative power was ascribed to the baptism of infants even at the moment of its administration, not indeed by the Augsburg Confession, but by the common Lutheran doctrine. And notwithstanding Luther's attempts to escape the difficulty by the supposition that even infants who have been baptized have faith (analogous to Calvin's *fides seminalis*), another inconsistency threatened with the position decidedly taken against enthusiasts, that faith comes only through preaching. Luther hinted at a better solution in his Larger Catechism—namely, that baptism has not merely momentary significance as an act of the eternal God in His adopting grace, but is a revelation of His gracious will, which remains valid and efficient until human unbelief shall have destroyed the baptismal covenant. But this solution was not made use of by the Lutheran theologians.

There is another inequality with reference to the doctrine of predestination. It is indeed true that Luther never lost sight of the universality of the divine gracious will, and would found the consciousness of salvation not on the knowledge of everlasting election working through faith, but, on the contrary, on the gracious will revealed in the word and sacraments and apprehended by faith—maintaining likewise a possibility of a falling away from grace. Nevertheless, Melanchthon, in the first edition of his *Loci*, the earliest dogmatical work of the Reformation, as well as Luther's treatise *De servo arbitrio* (1525) against Erasmus, shows that in the beginning the leading men of the Lutheran Church, even up to 1550–62, as well as the so-called Gnesio-Lutherans, held fast to the doctrine of absolute predestination, with no essential difference from the Reformed Church. And indeed the Formula Concordiæ itself in the same way asserted an absolute predestination with reference to the elect. The German evangelical people, however, from the very beginning did not agree with the absolute denial of the freedom of the will, as is clear from the letters of the laity to the Reformers. Absolute *determinism*, even in the Augustinian form, did not please them, and they could not be contented with the mere *liberum arbitrium in civilibus* which the leaders of the Reformation early acknowledged. (*Conf. Aug. XVIII.*) This was in the interest of not letting the cause of evil, nor indeed the ruin of the descendants of Adam on account of original sin, fall back upon God. But since even the Reformers had been led by a religious motive to the denial of freedom towards the good—namely by the doctrine that all good cometh from above—it became a necessary as well as a difficult task to reconcile the apparent conflict in an harmonious, well-adjusted doctrine of sin and grace. Melanchthon attempted this in his so-called synergistic doctrine, which was repudiated by the Formula Concordiæ. But the Lutheran theologians of the Formula Concordiæ and subsequent times continued wavering and undecided in the effort to be rid of the double decree, and safely to preserve the assurance of salvation, without falling into doctrines of a Pelagian or synergistic tendency; whilst they, on the other hand, repudiated the exaggeration of Flacius, that evil had become of the substance of mankind. The Lutheran theology of the seventeenth century sought the solution by presupposing as necessary for conversion certain inevitable operations of grace, whereby the *liberum arbitrium* was restored, upon the use of which, then, our final fate depends. But it did not thereby escape the stumbling-block of the double decree, because they did not conceive the inevitable effects of grace to be universal, whether in this world or the next; and when in the eighteenth century the universal salvation of the heathen, even without Christ, was frequently acknowledged, nothing was gained thereby. It was not until the present times that the *universality of the call* by the gospel to faith and salvation was taught on the ground of 1 Pet. iii. 18.

With reference to Christology, finally, the Augsburg Confession and the other older symbols limited themselves to that which is common to Christianity, only that Christ as a conscious possession was placed in the centre, whilst he had hitherto been pushed into the background, and, as it were, "buried" by the doctrine of the saints and the merit of works. Nor did these symbols establish any doctrine in opposition to the Reformed Church. The germ of the conflict lay in Luther's doctrine of the Lord's Supper and his polemical writings against Zwinglius; yet this doctrine assumed only a subordinate position. Luther was concerned with reference to the Lord's Supper simply with the objectivity of the sacrament independent of faith, which did not make the sacrament, but only received it. To ensure this objectivity, he maintained that the body and blood of Christ were the divinely given pledge of the forgiveness of sins, which were imparted in, with, and under the bodily elements, so that whoever receives the elements, even though without faith, would likewise receive that pledge—the glorified body and blood of Christ. It was not clear, however, how far the objectivity of the sacrament depended upon the partaking of the body and blood on the part of unbelievers likewise, or why the equal objective *offer* did not suffice, as Brenz taught in the *Syngramma Suevicum*, which even Luther himself approved. On the other hand, it was not clear in what sense the invisible body and blood of Christ were to be a pledge, together with the visible pledges of bread and wine, of the invisible grace of the forgiveness of sins. It was not until the later Lutheran

theology since Hollaz that an especial significance was ascribed to the partaking of the former, in that, with Calvin and several Reformed confessions, the participation in the virtue of the glorified body of Christ was regarded as a blessing in itself, and no longer merely as a means of the assurance of the forgiveness of sins. It would not have been at all necessary for the Lutheran doctrine of the Lord's Supper to adopt the Lutheran Christology with reference to the *status exaltationis* and all its consequences, which threatened in a Docetic manner the true earthly humanity of Christ, his growth, learning, etc., unless it had already fully extended the *communicatio idiomatum* to the childhood of Jesus, instead of making a deep and real distinction between the state of humiliation and the state of exaltation. This course was considered necessary in order that the first Lord's Supper should become entirely identical with the subsequent ones; for which there was no real necessity, since the visible bodily presence of Christ afforded the disciples a complete compensatory pledge for that which the glorified body of Christ is said to veil behind the visible.

Melanchthon, whose native character was more ethical than religious, was the occasion of the controversies with reference to the relation of justification and sanctification to the law and good works, which were so decided by the Formula Concordiæ as more closely to define the Lutheran doctrine on this subject. Since Melanchthon ascribed such essential importance to the law for the origin of faith through repentance and the continuance of faith, George Major and others of his school asserted that good works were necessary to salvation. This doctrine was assaulted in many points by the Antinomianism of Johann Agricola. The law, he contended, belonged to the court-house, and not to the pulpit, true repentance originating entirely from the contemplation of the love of Christ. And, as Luther had shown that penitence and repentance presuppose a moral norm, he insisted at least that the believer no longer required the law, because the internal impulse of the Spirit works of itself that which is good. The Formula Concordiæ rightly decided that the law was of threefold necessity: (1) to secure civil order (*usus politicus*); (2) to work repentance (*usus elenchticus*); (3) to regulate even the life of the regenerate, who were still struggling with sin (*usus normativus*), whereby it was acknowledged that Christ alone, as the living Law, could lead to saving repentance as well as be the living mirror of holiness. On the other hand, the necessity of good works to salvation was truly recognized in the sense (contrary to Nicolaus of Amsdorf) that a good tree bringeth forth good fruit; but the opinion was repudiated that good works can in any way merit salvation; which would admit a depreciation of the justifying free grace of God.

In all these points the ethical spirit of Melanchthon was followed. It was otherwise with the controversy respecting the atonement and justification, which was raised by Andreas Osiander and Franz Stancarus of Mantua. The school of Melanchthon had been accustomed to base the atonement exclusively upon the expiatory sufferings of Christ, which led Stancarus to ascribe mediatorial significance *solely to the human nature* of Christ, which alone was able to suffer. Osiander thought it more frosty than ice to limit justification to deliverance from guilt and punishment, from which, indeed, we had been redeemed by the work of Christ 1500 years ago. It was rather the communication of the essential righteousness or divine nature of Christ, which is the archetype of humanity, eternally appointed for incarnation, and hence only the *divine nature can come into consideration with reference to salvation.* A *justitia forensis*, consisting merely in imputation, and indeed of the merit of Christ, blotting out guilt and punishment by His suffering, would not be sufficient to satisfy the divine good pleasure; but nothing less than the restitution of the divine image through the indwelling of the divine nature of Christ, which justifies in fact, and not merely in the way of imputation. Osiander in this appears to be ethically superior to Melanchthon; and indeed the Melanchthon type of doctrine did not attain the fervency and depth of the mysticism which, for instance, distinguished Luther's little book about the freedom of the Christian. But, on the other hand, the undervaluing of the atonement by Osiander, and of the blotting out of guilt and punishment, was not inspired by an ethical spirit; he leaps over the step of the appropriation of the forgiveness of sins, which in fact can only take place by a forensic act of God, and not merely on the ground of our habitual righteousness in faith; and he pays too little regard to the necessity of peace with God in order to sanctification. He would attain holiness immediately through the divine nature of Christ, which he does not conceive as sanctification. Moreover, he stops at *justitia essentialis*, and thus does not overcome an *unethical mysticism.* The Formula Concordiæ maintains the unity of the person of Christ in the work of salvation, the co-operation of the divine and human natures of Christ therein, and regards as Christ's work not only His passive suffering, but also His active obedience. And thus the imputation which it maintains against Andreas Osiander is so carried out that we are justified by faith because Christ represents us before God, having blessed us with His active obedience as well as His passive. Thus, Luther's doctrine is likewise preserved, that we enter by faith into union with Christ; and this opinion simply is rejected, that we receive forgiveness of sins or justification on account of the *justitia essentialis* which has become ours. Personal sanctification is first called forth by the love of God experienced in the forgiveness of sins, and appears in the form of responsive love. A remnant of ideas current before the Reformation pervades this doctrine of the Formula Concordiæ when it says that Christ, according to His divine nature, in which the human nature by virtue of the *communicatio idiomatum* participates, is the Lord of the law, and is not therefore obligated to it; and thus His double obedience produces disposable merit, which, by imputation, may be charged by grace to the account of believers. Thus, the fact is lost sight of that Christ by His entering into human life subjected himself (Gal. iv. 4) to its conditions and laws, therefore also to the divine law to which all men are bound. Finally, the internal goodness and necessity of the law is not regarded in this view, which does not admit that it should be conceived as depending for its validity on absolute power or arbitrary will.

II. The period of the Reformation was followed by an epoch of scholasticism which more and more fortified the doctrinal system of the symbolical books. In the place of the creative period which built up the doctrines of the Reformation, came a period of the cultivation and preservation of traditional doctrines; the sublime activity of the Reformation was followed by a period of slackness in spiritual things—the bold and yet well-regulated use of freedom by a kind of barrenness, anxiousness, and narrowness. The bravery and courage of the heroes in the spiritual battle of the sixteenth century remained as a model, but were exchanged for a hateful love of strife, which regarded the little things as great, and only too often the great ones as little. But just as we are not to despise or blame the generations subsequent to the apostles, however far below them they may have stood, inasmuch as they yet helped to conquer the world for the faith by their faithful testimony unto death, so our fathers in the epoch subsequent to the founding of the evangelical Church had to exhibit no trifling power of faith in the bloody conflicts which were excited and nourished by the counter-Reformation, especially by the Jesuits. It is enough that they accomplished something in true labor for the task which was laid upon them. The principle of the Reformation, in accordance with its great historical significance for the world, must first secure the firm establishment of Protestantism in the midst of the Old World. It was not of so much importance to bring forth new treasures out of the Holy Scriptures and the chambers of the believing spirit, as to carry out the Reformation's idea of the world through the consideration of the history of the Church. It was necessary to search into the entire sources of the revelation in the Old and New Testaments, to study them in the light of the newly-gained knowledge, and thus to take spiritual possession for the new Church of the whole previous world. It was necessary to find confirmation and proof for the truth of the Reformation in the Holy Scriptures and the history of the Church. The whole of theology under these circumstances became the servant of dogmatics—yea, almost became absorbed in it. What had been planted by the Reformation in the heart of the German people was taken possession of in the seventeenth century by the architectonic spirit, in order to build up a systematic structure for offence and defence. A well-organized method, equipped with logical power, endeavored to arm Protestant truth on all sides. The indefatigable diligence and acuteness of the great dogmatic writers of that century surrounded the district of evangelical truth on all sides with fortifications in order to present it as a great invincible citadel. In the beginning of the century, and indeed subsequently, there was no lack of the power of a spiritual life. It resounds with abundance of holy hymns and mighty chorals, and the people were edified by excellent evangelical preaching. But an abatement of spiritual power was soon manifest. The thought of the conquest of the world, Roman Catholic, heathen, and Jewish, was scarcely agitated, nor was there any great effort to carry out the Protestant principle in an ethical direction in the whole life of the Church. Rather with the one-sided effort to preserve that which had been won, the evangelical principle itself, in accordance with an internal law, changed in their very hands. This is shown in the treatment of the principle of the Reformation itself, which was for Luther the living soul and controlling centre of the whole, and which the *Augustana*

(see above) shows to be fruitful in the production of an entire system of doctrine, as well as in criticism and polemics. But now the principle became a single article of doctrine alongside of others, and in the scholastic treatment to which the doctrine of justification was likewise subjected can be traced, only too clearly, an internal uncertainty respecting important points in the principle itself, as well as in its systematic position.

There was an uncertainty respecting the time of the divine act of justification with reference to the individual; thus, whether justification is adjudicated to man only as subsequent to faith, either as coming into existence or confirmed, or whether, on the other hand, the declaration is made known to man by God that He *has* forgiven him for Christ's sake, and justification is thus offered in order that he may believe. Since faith and true repentance were more and more demanded in such a manner as a condition of justification that faith almost gained the significance of a meritorious or efficient cause of justification, the pious began to be doubtful whether they were in possession of true repentance and true faith, or not, as well as to doubt (in the eighteenth century) respecting the true evidences of genuine faith. Finally, these evidences were found in faith working by love, and the assurance of justification was drawn from good works as the evidences of true faith. And thus they had returned by a roundabout way to the boundaries of Rome. So likewise there appeared more and more uncertainty whether faith might be sure of eternal election or only of present grace, as Musäus claimed. It was of more importance to theology, however, that justification by faith was no longer treated as a principle, but only the Holy Scriptures. They were now brought forward in such a way that they were treated by the dogmatic writers as the only foundation of Christian truth. The doctrine of the Holy Scriptures was so wrought out that it should be clear that the evidence of the truth consisted solely and sufficiently in the fact that it could be proved to be contained in the sacred books. Accordingly, then, the theory of Philo respecting inspiration previous to the Christian era became almost the model for the Christian theory of inspiration. It was said that the contents and words of Scripture were dictated to their authors, and imparted *non ad sciendum sed ad scribendum*, whilst, on the other hand, it is the characteristic of the New Testament economy, by which it is essentially distinguished from the time before Christ, that the subject-matter of salvation no longer remained merely external to the spirit, but unites itself with its innermost convictions and knowledge of the truth. Whilst the significance of the gospel, according to Protestantism, consisted above all in the building up of free and conscious individuals, that theory made the pillars of the Church, the teachers of mankind, into mere machines, so that their personal faith and knowledge were not employed as co-operative factors in the preservation and transmission of the gospel. That theory passed rather lightly over the fact of the different individualities of the writers of the Holy Scriptures, as well as the various readings of the original text, the impossibility that believers in general should resort to the original sources, and the imperfections in the style and language of the various compositions. All the differences and lack of harmony in parallel historical statements were balanced, not unfrequently by an overstrained endeavor to harmonize them. Thus, there was a recoil from the critical principles of Luther with reference to the canonicity of particular writings, important as they were in religion and theology, as if they were something which was not to be followed, but rather pardoned in him. But they had nothing better to substitute for them than a renewal of the authority of the Church in constituting the canon, as indeed the view of Quenstedt was: that, granted the Gospel according to Matthew were spurious, it would nevertheless retain its authority if the Church should ascribe canonicity to it. In the same manner the difference between proto- and deutero-canonical writings of the New Testament, which was still recognized in the editions of the Bible of the sixteenth century, was abolished in the seventeenth. Yet they did not deviate so far from the standpoint of the Reformation as to treat mere historical faith (*fides historica*), or evidence of the same, as a substitute for the proper assurance of faith (*fides divina*). On the contrary, they laid great stress on the fact that a special operation of the Spirit accompanied the reading of the Scriptures to receptive souls, or that the Scriptures were the peculiar channel for the Holy Spirit, the Spirit of truth. This significance of the Scriptures as a means of grace—which characteristic they eternally possessed independent of all criticism—was, however, immediately inverted in the doctrine that the Holy Spirit gives immediately, and not only to true believers, divine assurance respecting their divine origin and the fact of their inspiration. Hence was derived their normal authority. Instead of their being acknowledged as the document and source of the knowledge of the genuine original Christianity, their contents, they were considered as likewise a sufficient attestation of the *truth* of these contents. Furthermore, it was granted that each individual could be enlightened and assured respecting the truth of the contents of the Scriptures through the working of the Holy Spirit in these Scriptures, without the necessity of the operation of the power of the gospel in changing the heart. This decline to the standpoint of intellectualism, with its latent Pelagianism, occurred in the so-called *Theologia irregenitorum*, which led the way to Pelagianism through the magical operation of the Scriptures and the Holy Spirit—a doing away of the difference between nature and grace, and between the regenerate and unregenerate.

Space does not permit us to go into details with reference to the deviations from the standpoint of the Reformation which are involved in the changes in the fundamental principle already described. However, we are not to suppose that all theologians took this direction of establishing a Protestant tradition as an external assurance of the redemptive power and truth of the gospel. The various universities (each of which had its peculiar type of theology) took up different positions with reference to this matter, and are represented by important theologians, the authors of remarkable dogmatical works. The strict Lutheran orthodoxy was especially represented in Wittenberg and Tübingen, subsequently also in Rostock. A freer tendency was represented by Calixtus and his school (called by their opponents, Calov, Hülsemann, etc., *Syncretists*) in Helmstädt, Königsberg, and the Nuremberg University of Altdorf. Jena assumed an intermediate position, with the great John Gerhard (author of the *Loci theologici* in 9 vols.; in the eighteenth century edited by Cotta—in the nineteenth century by Preuss), who with John Himmel and John Major, likewise Salomon Glassius (*Philologia sacra*, 1636–40), established the flourishing period of Jena, which was afterwards continued by the acute and philosophical John Musäus, and by W. Baier (*Compendium theologiæ*), as well as Buddeus (*Institutiones*). Leipsic also was more moderate in the seventeenth century, where Hoepfner (*De justificatione*), Scherzer (*Systema theologiæ*, in 29 definitions, not a few of which are prosy, 1667–83), and Rechenberg, the friend of Spener, flourished; Strasburg, where after Calvin, in the sixteenth century, Capito, Hedio, Bucer, P. Martyr, Zanchi, and even John Schmid, the teacher of Spener, later likewise Seb. Schmidt, taught. Subsequently, through the influence of Dorsche and Dannhauer, this university went over to the stricter Lutheranism. This was likewise the case with Rostock, where after Chytræus a prevailing practical theological tendency long maintained itself, united to some extent with mysticism. On the other hand, the chief representatives of the stricter Lutheran orthodoxy after Martin Chemnitz (*Examen concilii Tridentini*, 1552–1610) were Ægidius Hunnius in Marburg 1576–92 (subsequently in Wittenberg; d. 1603), who became the most influential in building up the Lutheran doctrine of predestination; Leonhard Hutter (d. 1616), who was the chief opponent of the Irenics of Melanchthon; the profound Hülsemann (1629–46 in Wittenberg and in Leipsic; d. 1661); the contentious Abraham Calov (in Königsberg, Rostock, Wittenberg; d. 1686; author of the *Biblia illustrata*, in 4 vols. fol., and the *Systema theologicum*, 12 vols. 4to); his father-in-law, Quenstedt (d. 1688), and his son-in-law, Deutschmann. In Tübingen, after Jacob Andreæ (d. 1590), and Heerbrand (d. 1600), flourished Hafenreffer (1502–1619), and Thumm (d. 1630), an advocate of *crypsis* in Christology. In the same university were also Lucas Osiander, called "Arndt's Scourge" (*Arndtomastix*), and John Adam Osiander (d. 1697; author of *Harmonia evangelica*). In Giessen were the advocates of *kenosis*, Balth. Menzer, and Just. Feuerborn.

III. But more and more complaints were raised against the scholastic bent of theology. On the one side, those of a humanitarian and freer tendency, who had been trained in philosophy, contended against the hostility to all philosophy which had been manifested in the Hofmann controversy. This we may regard as a revival of the Melanchthon school in the seventeenth century. It is the tendency of the great theologian of Helmstädt, George Calixtus, with his friends and pupils, Hornejus and Titius; in Königsberg of the same spirit were Behm, Dreier, Latermann; and in Altdorf, Hackspan, Saubert, and Dürr. But it was in vain that they attempted to stem the tide of polemical zeal; as so-called syncretists they only inflamed it the more, and were regarded with distrust on account of Reformed elements in their emphasizing of good works, and on account of Roman Catholic tendencies in their doctrine of the *consensus quinquesæcularis*, and their depreciation of the principle of justification. But still more weighty were the complaints on the part of vital piety in such men as John Arndt, Lütkemann, Valentin Andreä, Grossgebauer, Heinrich Müller, Tarnov,

Guistorp, Mayfahrt, and Schuppius, heralds of the pietistic movement of Spener. Already, previous to these, the mystical element, which in the Reformation ripened into an ecclesiastical form, had again separated itself and taken a position in hostility to the Church in Valentin Weigel, Jacob Bœhm, Rathmann in Dantzic, and others. But the severest blow against the orthodoxy of the seventeenth century was given by Philip Jacob Spener of Rappoltsweiler in Alsatia, through a thorough reform in theological study which he awakened, through a thorough revival of love for the Holy Scriptures, and through the foundation of the so-called *collegia pietatis*, which became *ecclesiolæ in ecclesia*. Whilst the Lutheran clergy, allied with the authority of the princes, held the so-called third class, *status œconomicus*, the laity and the congregation, in general in dependence, and made them into a mere *ecclesia audientium*, Spener again raised the banner of the universal priesthood of Christians, and trained by the study of the ecclesiastic order of the Reformed Church—for example, in Geneva—he demanded an analogous use of the presbyterian element. He would not deviate from orthodoxy in doctrines, but would simply modify the formula of subscription to the symbols. Yet his efforts for conscious faith, for regeneration and sanctification, were little in harmony with the prevailing spirit of the so-called orthodox, who persecuted him and his school in a conflict of more than thirty years. The orthodox, however, lost the confidence of the German people, by nothing so much as through their hostility to the school of Spener and its principles, by their boasting of a *theologia irregenitorum*, as well as the especial grace of the ecclesiastical office. As Calixtus, for instance, had permanently established the independence of ethics, so Spener on the practical side carried over the evangelical principle of faith into the ethical sphere; first of all, as was the case in the ancient Church, in the form that the idea of the Church of the future was fixed, and the way was paved to heathen missions; and thus the innermost vital impulses of the evangelical Church were awakened, and these from the centre were set in motion in an ethical direction. Moreover, Spener, by his ideas of church organization, exhibited a lively interest in the Church of his times. Yet the ethics of the Pietists were still much too negative, exaggerating the contrast between the Church and the world, and confining themselves for the most part to the sphere of personal and religious ethics. The North German pietism suffered likewise from a depreciation of the importance of scholarship, whilst on the other hand the South German branch, in the great theologian, critic, and exegete, John Albert Bengel (author of the *Gnomon Novi Testamenti*), gained a worthy representative of the harmony between scholarship and the Church, and thereby secured for the Church of his native land a powerful support, working even to the most recent times.

A long conflict was carried on by the orthodox theologians Carpzov, Schelwig, Neumeister, Edzard, and particularly Ernst Valentin Löscher, court-preacher in Dresden, against Spener and his disciples, August Herrmann Francke (founder of the orphan-house of Halle), George Anton, Breithaupt, Freylinghausen, Rambach, and the contentious Joachim Lange (*Œconomia salutis eaque moralis; Antibarbarus*, 1709). After this struggle had endured for a long time a kind of mediating school between orthodoxy and Pietism was formed—a gentler late summer of orthodoxy. To this belonged Hollaz (1713; *Examen theologicum acroamaticum*, 1707), Johann George Walch the Elder, the thoroughly learned and honest but unoriginal writer of the *Einleitung in die Religionsstreitigkeiten innerhalb und ausserhalb der Lutherischen Kirche je in* 5 *Baenden*, 1730, ff.; the very skilful and intellectual chancellor of Tübingen, Christoph Matthæus Pfaff, advocate of the union of Protestants; the historian Lorenz von Mosheim of Göttingen (d. 1755). These have especial merit with reference to historical theology, as likewise Solomon Cyprian Salig (*Vollstændige Geschichte der Augsburger Confession*) and Veit Ludwig von Seckendorf (*Historia Lutheranismi*). The Magdeburg Centuriators in the sixteenth century (1559–74), Matthias Flacius, Wiegand, and others, had employed their extensive historical material in such a manner that they regarded the ideal of the Church with reference to unity and purity of doctrine, especially of justification by grace, as realized in the most ancient times of Christianity, and from that time on they recognized no advance, but only a decline in the following centuries from the pure beginning, through the agency of the power of darkness concentrated in the papacy; thus the truth was regarded as having merely a history of suffering and not of progress; that is, a history of error, as if the truth were only to be maintained against it, and not unfolded. Gottfried Arnold, however, represented another method of treating history. In his *Kirchen und Ketzerhistorie* (1698–1700) he always takes the side of the heretics against the official doctrine and usages of the Church, by which it is true he did away with the claim that the Church was the unchangeable sanctuary of the truth, but still by no means found the true relation between the heretics or heterodox and the orthodox. It is true that Calixtus had not only claimed for the earliest beginnings of Christianity the possession of the pure doctrine, but had rather regarded the first five centuries as the ideal primitive time, and had thus distinguished the ancient Catholic Church from the papal period; but he found no sufficient grounds for the movements and changes in the system of doctrine. Whatever had been added to the common Christian doctrine given in the Apostles' Creed was to him indeed not necessarily erroneous or a decline, but a matter of indifference and subordinate, as then he did not reckon the doctrine of justification among the common Christian doctrines. The theologians subsequent to Calixtus, just mentioned, were, like him, characterized by a more objective historical spirit of investigation. It is true, they were in advance of Arnold, yet it was only through Arnold's exaggerations that their attention was directed to the importance of heretical movements; it was reserved for a subsequent period to recognize and show that it is by means of heretical movements that an advance in the Church is mediated, and to represent them not merely as an accidental swarm of opponents, but rather as those who stepped forth in opposition to a still unprepared Church doctrine in points where a further development was necessary, although with a one-sided or distorted emphasis of the elements that were still lacking.

The above-mentioned theologians, for the most part devoted to historical theology, in sympathy with the culture of the time, and in anticipation of approaching storms, desired to establish themselves on a good footing, and everywhere to break off the sharp edges of the old doctrines. Original sin became significant only after our consent to it; inspiration was merely assistance by the Holy Spirit; the *communicatio idiomatum* was more and more limited; the doctrine of justification was obscured by mixing it with sanctification. With reference to other doctrines, such as the Trinity, the incarnation, the work of atonement, the Lord's Supper, they avoided the difficulties of the Church form of doctrine by referring to their inconceivableness and mystery. A new regenerative principle was lacking. Yet they went back to the Holy Scriptures in distrust of the doctrinal development of the Church. Faith in the Holy Scriptures—which were identified, on their part, with revelation itself—was regarded in its way as Christian faith, so that they thought only of doctrines, especially of mysteries, in connection with it, and not of real vital communion with God in Christ, and of the assurance to be wrought by the Holy Spirit. In the seventeenth century, notwithstanding the systematic subordination of the material principle to the formal, it was still maintained that assurance was to be gained only through the Holy Spirit, whose testimony united itself to the reading of the Scriptures; whereby, to be sure, the contents of the testimony were more and more regarded to be not so much the power of the gospel unto salvation or the experience of salvation, as rather the divine origin of the Holy Scriptures (their inspiration), and through them the truth of Christian doctrines. In the eighteenth century the *testimonium Spiritus Sancti* was more and more abandoned, as in general the fervent sense of the active nearness of God and the presence of the Spirit in the Church vanished.

In order, now, to gain a substitute for the assurance of Christianity, the way of demonstration offered itself. To this path philosophy, which had begun its course since Leibnitz and Wolff with a strong feeling of self-consciousness, successfully invited. The school of Wolff, flourishing before the middle of the eighteenth century, undertook to establish Christianity by mathematical demonstration. Reusch, Schubert, Carpzov, Canz, Reinbeck, and particularly Sigmund Jacob Baumgarten of Halle, belong to this school. They began the proof for Christianity through a rational demonstration of the divine authority of the Holy Scriptures, which should be superior to what they regarded as the merely apparent proof from the experience of the operations of the Holy Spirit. The idea of God derived from the *lumen naturæ*, the righteousness, holiness, goodness, and power of God in the presence of sin and guilt, prove the necessity of the revelation of an atonement, if an atonement should in any way be possible or capable of being known. Its possibility is evident from the fact that the predicates ascribed to it are not contradictory; these predicates constitute at once the criteria whereby a true revelation may be known. Now, the Holy Scriptures correspond with these criteria, since they teach the way of peace, and contain mysteries which could not of themselves be derived from the reason. This method of proof goes no further into the consideration of the Scriptures, their origin, and the formation of the canon, whilst indeed these criteria

do not of themselves prove the divine authority of the Scriptures. About this time the science of biblical theology began, after Ernesti's *Institutio interpretis Novi Testamenti* (1761), through the labors of Büsching, Zachariä, Hufnagel, Ammon, G. Lorenz Bauer, and especially Gabler, who has the merit of having clearly stated the historical character of biblical theology (which has since been more thoroughly wrought out by Schmid and Œhler in Tübingen, Weiss in Kiel, Messner in Berlin, and others). From this circumstance, as well as the fact that Baumgarten's pupil, Semler, began the period of the criticism of the Holy Scriptures, it resulted that the elder Tübingen school, under Storr, Flatt, Süsskind, paved the way for the purely historical proof of the divine origin of the Sacred Scriptures, and thereby of Christianity. The apostles, and the scholars of the apostles, said they, composed the Scriptures of the New Testament canon (the proof of their authenticity and integrity); these Scriptures are historically worthy of confidence (*fides humana*); the apostles could, would, and must have spoken the truth. These writings describe, on the one side, Christ's sinless character—on the other side, His miraculous acts; both together attest the truth and full authenticity of His statements respecting himself and His divine mission. Now, Christ promised His disciples the gift of the Holy Spirit; and that He was able to fulfil this promise is proved by His miracles; and thus they were in possession of an inspiration corresponding with His veracity; consequently, whatever is contained in these writings is divinely attested (*fides divina*); and the authority of the Old Testament likewise rests on that of the New. That which is here called *fides divina* is thus by no means assurance of salvation or divine assurance, but is human assurance of divine things. This whole method of proof is based on the formal principle, and is a revival and improvement of the idea of Hugo Grotius; it is in an altogether intellectual form, and essentially changes the principle of faith of the Reformation. About the same time theological ethics were likewise more and more separated from their internal connection with the principle of faith, partly through the influence of the popular philosophy of Wolff (Steinbart, Eberhardt, Bahrdt) in the manner of eudæmonism, partly in earnest natures, under the influence of Kant, through the ethics of the reason.

The supernaturalism of the rational as well as the historical method formally maintained the supernatural character of Christianity—miracles, prophecy, etc.—but more and more tended to depreciate and weaken that which constituted the subject-matter of the doctrine. Thus, the doctrine of the Trinity (and this could not but be significant for Christology) was constituted by some in the form of subordination—*e. g.* by Töllner (who likewise denied the saving significance of the active obedience of Christ), by Döderlein, and by Flatt; by others, as Urlsperger, in the form of Sabellianism or a modal Trinity. In place of the Church doctrine of the atonement, it was supposed that there was a kind of *acceptilatio* of the obedience of Christ for the blotting out of our guilt; the Church was defined as a work of believing individuals uniting themselves together; and the doctrine of justification was placed almost at the end of the system. (Storr.)

The incongruity of the significance that was ascribed to the still remaining elements of Christianity with the supernatural form, now invited rationalism to advance with confidence of victory; so much the more as the first philosophic systems of Wolff, Kant, Jacobi, and Fichte gave systematic expression with ever-increasing boldness to the self-confidence of the newly-awakened subjectivity. Supernaturalism in vain sought to appropriate these systems and turn them in a direction favorable to itself. Thus, with reference to the system of Kant, Stäudlin, Süsskind, K. L. Nitsch, and Stapfer—to that of Jacobi, Vater, Steudel, Emmerich, Heydenreich. The rationalists of the school of Kant, Tieftrunk—subsequently likewise Ammon; furthermore Löffler, Henke, Schmid, Krug, Röhr, Paulus, Wegscheider (to a certain extent tinctured with the deism of the school of Wolff); likewise scholars of Jacobi, such as Heinrich Schmid, Köppen, Köhler, or of Jacobi and Fries, such as De Wette—forced back supernaturalism still farther from its standpoint, until that miserable abortion of a rational supernaturalism and supernatural rationalism threatened theology with self-destruction.

At first, the elements of Christian faith became rigid, and afterwards weakened; and this had the saddest consequences with reference to the Church, its constitution and laws. In the sixteenth and seventeenth centuries the clergy and civil authorities shared with one another in the management of ecclesiastical affairs; the people (*status œconomicus*) were excluded. The dangers of such a confederacy between the clergy and the autocratic power of the princes were observed by the declining orthodoxy of Johann Benedict Carpzov, who now sought, by an un-Lutheran enhancing of clerical authority (power of the keys), over against the state to secure independence for the Church; but it was in vain ("the *Apapa* had stepped in the place of the *papa*"—the popery of a Cæsar in the place of the cæsarism of a pope). Moreover, through Christian Thomasius the territorial system came into vogue, which handed over the Church entirely into the hands of the state, whose highest interest with reference to religion, according to him, was to see to it that the Church did not disturb the peace of the state. A more honorable position was assumed by the collegiate system of Pfaff, which at least guaranteed the Church its independence by presenting it as a collegium, as a society with the rights of a society. But then he regarded the Church as originating through the free inclination of the individual, and its relation to the state remained a purely accidental one. The territorial system, however, gained the supremacy until the nineteenth century, and it even reckoned the mode of worship as among the external things under the control of the state.

IV. Rationalism, under the influence of English deism and Voltaireism, more and more prevailed until the closing years of the eighteenth century. Among these we may mention Reimarus (author of the *Wolfenbüttel Fragments*), Nicolai (editor of the *Deutsche Bibliothek*), Biester, Gedike, Teller, Venturini (*Natürliche Geschichte des grossen Propheten von Nazareth*, 2d Aufl., 1806, 3 parts). Against these there was a significant reaction already in the second half of the last century, through distinguished men, who may be regarded as heralds of the theology of the nineteenth century. Among these were not only Klopstock and Claudius, who again turned with devotion and grateful love to the person of the Redeemer, but also Herder, who recognized and represented the indissoluble bond between poesy and religion, and sought to present Christianity as the religion of humanity. He had the special gift of discerning the true human element in the sacred documents, which is often misunderstood, as well as the noble and beautiful therein; and especially did he reconquer, so to say, the Old Testament for German literature. His highly cultivated mind, his large heart, attracted him to all that was great in the literature of all nations, especially of the Orient. He likewise conceived the idea of a philosophy of the history of humanity. Furthermore, we may mention Hamann, a man of profound mind, full of new ideas, although from lack of dialectic training he wrought out but little of the rich ore of his spiritual mine. A free, grand insight into the character of Christianity exalted him above the anxiety of the pious of his times, and, deeply rooted in evangelical Christianity, he could look with a humor that was sure of victory upon the efforts of the entire coterie of neologians who supposed they were capable of overthrowing Christianity. His favorite principle was *omnia divina et humana omnia*. He did not regard the eternal and the historical as being in irreconcilable contradiction, as the deistical Rationalists would have it; rather, history was to him the eternal becoming historical and embodied, and faith was the faculty of recognizing the facts of God in history and nature, of beholding the metaphysical, the eternal, and the historical in their unity by means of a mysticism which is not merely subjective, but objective, determined by the reality itself. Lessing was by no means, as many suppose, a mind hostile to Christianity. He issued the *Wolfenbüttel Fragments* in the conviction that Christianity was able to meet this assault, but that it needed an entirely different method of representation than the prevailing one of demonstration. He despised the enervating Rationalism, and preferred the muddy waters of orthodoxy to the dirty water of neology. But he was oppressed by the inconsistency between the eternal truths and history, and as he did not find the bridge, he offered, though in vain, a divine recompense to any one who would help him over the hideous chasm. And yet he had already in himself a presentiment that humanity needed something more than instruction in eternal truths, which still constituted the principal thing in his *Erziehung des Menschengeschlechtes*. There was likewise in him, notwithstanding all the power of his understanding, a deep mystical tendency. He ascribed to Christianity an internal truth, which, witnessing for itself, as the sun by its warming rays, makes all other testimony unnecessary. By emphasizing the *regula fidei* over against the criticism of the New Testament, he would give to susceptible Christians a secure position against assaults. At the same time, in contrast with that theology which makes the Holy Scriptures themselves a revelation, he would distinguish between Christianity as the foundation of revelation and the Bible as its record. He felt the need of a living God making himself known to the soul's experience, but remained shackled by the prevailing doctrines respecting God, which were held by deism as well as supernaturalism, which removed God too far away from history. This was all to be changed by the new philosophical movement which began with the nineteenth century.

The philosophical movement which originated in Germany after Kant and Fichte, through Schelling, Hegel, and Schleiermacher began to make up the acknowledged defects of the previous Christology and Soteriology with reference to the consideration of the being of God, as well as their mutual relation to one another. The fundamental tendency of these philosophers was the rejection of the barren deistical view; and although to some extent they approached too closely to the opposite extreme of pantheism, yet a more vital idea of God, and a more intimate relation between the being of God and man, were the common conviction of the more recent philosophies of religion, which could not but be of advantage to a series of doctrines; for, according to Schleiermacher, for instance, there is not merely a temporal interruption of the ordinary course of things in miracles or divine acts, which do away with the usual distance between God and the world, as was the view of supernaturalism, but an element of truth was now accepted from rationalism, which advocated immutable, eternal truths; and it was said that all things on earth are ordered according to a fixed, eternal decree of God, yet in this decree establishing a fixed order of nature he likewise regarded as included the eternal living presence and activity of God. Thus, the idea of the miracle as an abrupt act disturbing the order of nature was abandoned, and it was confined to its place as a part of the eternal decree. This does not mean that the entire contents of the eternal will of God are realized in every part alike. but that the temporal separation of the parts and the divine activity in different acts do not disturb the unity and continuity either of the decree or of the world; in that, rather, the new event attaches itself to that which already exists, which has developed so as to be capable of receiving and desiring it; yea, the new occurrence gains a permanent existence in the already existing one, or naturalizes itself in the world (*in der Welt sich naturire*). Schleiermacher, who among those above mentioned has had the most permanent influence on theology, referred the Trinity solely to the world, and did not sufficiently maintain the independence of the Divine Being in and for itself. On the other hand, through his doctrine of Christianity as a second creation, and of Christ as a second Adam, he made several great scriptural truths fruitful, so that they came into play in overcoming the opposition between supernaturalism and rationalism. For Jesus was to him not from the earth, as merely the product of the sinful race, but, although true man, yet of a supernatural nature through the "existence of God in Him in a manner peculiar to Him alone" (*einzigartiges Sein Gottes in ihm*). In order to make the work of redemption easier of apprehension, he conceived the entire life of Christ, His actions and sufferings, as Christ's manifestation of Himself; and especially, in order that Christ's salvation might be imparted and man delivered from the consciousness of guilt and punishment, Schleiermacher applied the efficacious sympathy of Christ as high priest, and His position as the head of humanity, in whom God beholds the believing as parts of Christ's manifestation of Himself, so that they are well-pleasing to God on account of their vital union to Christ, and may know that they are justified, as then God has resolved to impart all His grace to humanity in Christ. Furthermore, Schleiermacher was the first to make the idea of the Church a living one, and recognize it in its glory. The Church was to him not a work of subjective choice or agreement, but a work of the Holy Spirit, who is constantly active in it, distributing His gifts; always, however, taking of that which is Christ's (John xvi. 4). Schleiermacher likewise rendered great service to the Church by establishing the boundaries of truth, or by marking out the heretical points of the compass. He fixed in a scholarly manner the difference between heterodoxy and heresy, which the Moravian Brethren, among whom he had been trained, had practically carried out in the different types which it would embrace within itself. He thus defined the conditions of church membership, the limits of liberty in teaching. This led to the great service which he rendered for the union of the Reformed and Lutheran churches in Germany. His *Glaubenslehre*, returning to the principles of the Reformation, sought a reconciliation of the Reformed and Lutheran types of doctrine. Thus, in the doctrine of predestination he combined Lutheran universalism with the Reformed absolute decree; Lutheran mysticism and the demand that objective Christianity should be appropriated in the inmost soul, with the ethical tendency of the Reformed type of doctrine; and the personal assurance in one's self with the awakening of the sense for the practical problems of the Church and of Christian national and political life; and thus he became, although without high ecclesiastical office, a true prince of the Church in revived German Protestantism. He would not have the union itself to be a mere work of the state or politics; still less did he require for union that all differences of doctrine should be abandoned. According to the principle of individuality which he regarded as so important, there is no justice or necessity for blotting out any true peculiarities, whether they appear in individuals or in the uniform belief of great masses; but only of delivering them from morbid conditions, among which was especially to be reckoned a separatistic position towards other individualities. Thus, he did not demand a union which should dissolve differences, nor indeed a postponing of union until a reconciliation of the points of difference in the Lutheran and Reformed doctrines should be reached through a higher unity: what he demanded was simply the mutual granting of church communion, especially in the Lord's Supper, and that such a significance should not be given to doctrinal differences as to allow them to bring about a separation of churches. It appeared to him unprofitable to go back to doubtful doctrines. He considered that the unity of the Church was not only consistent with the existence of different branches living in mutual recognition of one another, but that it was likewise quickened and enriched thereby in the interchange of spiritual blessings on the part of each one of the branches, which, going on without interruption, was thus preparing that higher unity.

Thus, the Augsburg Confession (Art. VII.), together with its Apology and the Schmalkald Articles, had distinguished between the common evangelical foundation the *articulus principalis*, justification through faith in Christ, and other doctrines, respecting which pious and learned men might debate among themselves. Schleiermacher now gave this distinction its practical application in the Church to subordinate differences in doctrine, and thus pointed out in the future the ideal which the evangelical Church in its unity may realize. After that these principles had been established in law and in custom through the union in accordance with the ideas of the Reformation, we may speak in truth of a German evangelical Church, whose living members already exhibit a public spirit which asserts itself in manifold Christian works. Among these are the Gustavus Adolphus Association, Bible societies, foreign missionary societies, the central committee for domestic missions, the German Evangelical Church Diet, and the Eisenach conference of deputies of German church governments, which is even now about to constitute itself into a body representative likewise of those ecclesiastical bodies which have a synodical organization. Moreover, it is not a mere accident that in our days German Protestantism seeks and finds an increase of intercourse with Protestantism in other countries. But it is clear from this fact what a significant mission, with reference to the present condition of the Protestant Church and the combination of its members in the conflict with unbelief and superstition, the Evangelical Alliance will likewise have, since that it has had the mission, and has fulfilled it in North America, of affording the proof that different evangelical denominations, in spite of many not unimportant differences, may live together in unity of spirit, in prayer, and co-operation in the peaceful and profitable discussion of numberless scientific and practical questions. Isaac A. Dorner.

Ger'mantown, tp. of Livingston co., Ill. Pop. 369.

Germantown, a v. of Bracken co., Ky. Pop. 191.

Germantown, post-v. of Mason co., Ky. Pop. 160.

Germantown, tp. and post-v. of Columbia co., N. Y., on the Hudson River. It has valuable fisheries. The tp. was settled by German refugees in 1710. The town is on the Hudson River R. R., 10 miles S. of Hudson. Pop. 1393.

Germantown, post-v. of Montgomery co., O. It has 1 national bank and 1 weekly newspaper. Pop. 1440.

Germantown, a former borough, now included in the 22d ward of Philadelphia, Pa. It is 6 miles N. W. of the old State-house, and was settled by Germans in 1684, under Francis Daniel Pastorius. Here was fought (Oct. 4, 1777) the battle of Germantown, so unfortunate to the American cause. Germantown is connected by steam and street railroads with the city proper; is very pleasantly situated, and contains a large number of fine residences, churches, etc., good public schools, a bank, a weekly newspaper, a community of Vincentian Fathers, a Roman Catholic college and seminary, a parish school with 390 pupils, and various charitable institutions. Pop. of ward, 22,605. (See Philadelphia, by H. C. Sheafer.)

Germantown, post-v. of Shelby co., Tenn., on the Memphis and Charleston R. R., 15 miles E. by S. of Memphis. Pop. 197.

Germantown, post-tp. of Juneau co., Wis. Pop. 593.

Germantown, tp. of Washington co., Wis., on the Milwaukee and St. Paul R. R. Pop. 1954.

Germany. See GERMAN EMPIRE, by G. NEUMANN, Prussia.

Ger'many, tp. of Monroe co., Ala. Pop. 1537.

Germany, tp. of Richland co., Ill. Pop. 1040.

Germany, tp. of Adams co., Pa. Pop. 880.

Ger'mersheim, town of Bavaria, on the W. bank of the Rhine, 7 miles by rail S. S. W. of Spire, at the mouth of the Queich. It is strongly fortified, and has active business interests. Pop. 6223.

Germin'ation [Lat. *germinatio*, a "sprouting forth," from *germen*, a "sprout" or "bud"], in botany, is the term to denote the first steps of the development of the embryo or "germ" in the seed into the plant. It is naturally extended to the analogous development of any cryptogamous plant from its spore, which answers to seed. The embryo, originated in the ovule through its fertilization by a grain of pollen (see GERM and FERTILIZATION), completes its first stage of development in the seed while connected with the mother-plant; when the seed matures it has a period of rest; after which, when placed in favorable circumstances, germination takes place. Seeds vary greatly as to the length of time during which they preserve their vitality. Many seeds, especially oily ones, soon lose the power of germination unless they are committed to the ground soon after their ripening, although when in the ground they sometimes remain quiescent for two or three years. Others, especially leguminous seeds, when kept dry, may retain the power of germination for several, or even for many, years The same is true of many seeds when rather deeply buried in the soil; after long burial some of them germinate on being brought to the surface. But the accounts of "mummy-wheat," etc. growing after the lapse of 2000 or 3000 years may be wholly discredited. The conditions necessary to, or favorable for, germination are a congenial temperature, varying with the species, moisture, and darkness or a certain amount of obscurity. In the incipient process water is absorbed, and certain chemical changes set on foot, through which solid nourishing matter in the seed is gradually liquefied and made available for growth. In this a certain amount of carbonic acid gas is evolved and the temperature raised (which becomes very perceptible in bulk, as is seen in the malting of barley), showing that a portion of the store in the seed is consumed or decomposed to render the rest available. Sometimes this store of food is in the embryo itself, usually in the cotyledons, as in the bean and pea, when the germ makes the whole kernel of the seed; sometimes mainly outside of it, as in corn and other grain. The particular mode of development of the germ varies according to its conformation. Commonly, the radicle lengthens and projects from the seed, takes a vertical position, develops a root from its lower end, raises the cotyledons above the ground to expand as the seed-leaves, and above these develops the plumule or bud into the succeeding stem and leaves. In many cases the radicle does not lengthen, and the cotyledons remain under ground and within the coats of the seed; then the first foliage that appears belongs to the plumule, as in the pea and the oak. It is the same, with a certain difference, in corn and other grain. In any case, when the germ has developed into a plantlet, with root established in the soil and foliage in the air and light, so that it can provide its own nourishment, the process of germination is completed. REVISED BY A. GRAY.

1, section of seed of morning-glory, showing the embryo; 2, same embryo detached and straightened; 3, germination of the morning-glory; 4, same, further developed.

Germ-Theory of Disease, a theory which ascribes disease in general, and infectious diseases in particular, to the introduction into living organisms of minute parasitic forms of life, and their subsequent multiplication to the obstruction of the vital functions. Though this theory has, in recent years, attracted a great deal of attention, in consequence of the deserved celebrity of some of its advocates, it is not, as is commonly supposed, a theory which has originated in recent years. Traces of it appear in writings of very high antiquity, and more than 200 years ago it was brought distinctly forward by the celebrated Father Kircher, in his *Scrutinium Physico-Medicum Contagiosæ luis quæ pestis dicitur*, as an hypothesis to account for the infectious propagation of the plague. During the century which followed, moreover, it received the countenance of many other eminent men, among whom may be mentioned Lancisi, Vallisneri, Réaumur, and Linnæus. The discovery of the spermatozoa, which was made by Leeuwenhoek in 1677, soon after that of the infusoria by the same naturalist, gave a certain degree of plausibility to the doctrine; for, as these were generally regarded as real animals, the presence of microscopic living organisms within the bodies of men was supposed to be demonstrated; and it seemed to be quite reasonable to conclude that noxious as well as innocent organisms of this description might sometimes establish themselves there. But whatever plausibility this theory might at that early period have seemed to possess, it could then claim no higher rank than that of a bare hypothesis; and it has only been in times comparatively recent that observation has brought to light a sufficient number of facts apparently favoring it to justify our advancing it in the arena of scientific discussion to the higher dignity of a theory. Many of the most distinguished pathologists of the present day have, in fact, already declared themselves convinced of the substantial truth of the theory; and some idea of the progress which it has recently made, and of the light in which it is by many beginning to be regarded, may be gathered from the following passage, taken from the introduction to the monograph upon typhoid fever, by Liebermeister, recently published in Ziemssen's *Cyclopædia of Medicine*. The phrase *contagium vivum* in this extract will be understood to signify the propagation of disease by means of living organisms. "Within the last ten years a great revolution has taken place with regard to the popular signification of a *contagium vivum*. New investigations on the appearance, mode of propagation, and the significance of the low organisms, new facts in regard to the extension of national diseases, and also a number of quite positive discoveries by numerous investigators, have removed the old opposition to the theory, or even been the means of furnishing definite proof of its correctness. The prophecy which I believed myself justified in making in 1865—viz. that the theory of a *contagium vivum* would soon be the prevailing one, and that under its influence investigation would take directions that would probably lead to results of the greatest theoretical and practical importance,—this prophecy has actually been fulfilled, in part, during the last few years. A great number of the best experimentalists are the declared adherents of the theory. At any rate, it is now admitted, even by those who do not unreservedly acknowledge the theory of a *contagium vivum*, that it represents a view which points more clearly than any other to order in the chaos of facts."

The object of this article being to present in brief the evidence as yet gathered as to the important question to which it relates, it is proper to remark in the outset that it would be absurd to attribute all diseases to the invasion of the diseased system by microscopic parasites. From the laws of organic life, it is obvious that the causes of disease must be various. No living organism enjoys an existence of unlimited duration. Every such organism, under favorable circumstances, passes through three distinct stages, which are those of growth, vigorous maturity, and decline. The organism commences as a germ, and ends in dissolution and disintegration. Since the laws of life, as well as those of physics, are fixed and definite, there is reason to believe that all organisms of the same species, if placed in conditions equally favorable to their development, would be equally long lived; yet, in point of fact, those which pass through the regular stages constituting their normal life are comparatively few. In the large majority, the vital functions are, earlier or later, more or less disturbed, if not arrested, by an endless variety of causes tending to produce disease and premature death. In the human race, life is often shortened by ignorant or wilful disregard of the conditions necessary to the preservation of health. Accident, also, often exposes individuals to deleterious influences. Thus, in many cases, diseases arise from exposure to extremes of temperature or from excesses in eating and drinking persisted in until the organs of digestion become debilitated and fail to fulfil their proper functions. But besides these causes of disease, which may be classed under the head of "injurious conditions," there are other influences directly morbific which, whenever they come into play, cut short the duration of life. Poisons belong to this class, but the effects of these are felt only in occasional and accidental instances. Other noxious influences, of which the pernicious consequences are more widely spread, are those which produce the diseases called zymotic. Such are malaria, contagion, and infection, instrumentalities to which are owing the widespread ravages of epidemics. It may further be remarked

that there are many cases of disease in which the cause is not traceable directly to any of the sources above mentioned, but in which the disease has been transmitted by inheritance from a parent similarly affected. In such cases there is nevertheless every reason to believe that the disease in its first appearance was produced in a healthy organism by causes belonging to one or the other of the classes above named.

With all those varieties of disease which begin and end in the individual our present discussion has nothing to do. It is the propagation of disease only which concerns us; and this is a subject which has occupied more carefully the attention of physicians, and has led to more elaborate observation and experiment, and has given rise to more marked differences of opinion and more animated controversy, than almost any other in the science of pathology. That epidemics often arise from peculiar conditions of the atmosphere not in the least a yet understood, can hardly be doubted; and in this case the influence which excites disease simultaneously in many is not dissimilar to that by which contagious diseases are transmitted from individual to individual. It is, however, in this latter mode of transmission that, if the germ-theory is true, the evidence of its truth is most likely to be earliest detected; and hence, in the evidence which has hitherto been presented bearing upon the question under consideration, there is none which relates to diseases which are epidemic without being contagious. As to contagious diseases, the germ-theory does not stand alone. Opposed to it are two others—one of them commanding probably the largest number of suffrages and long familiar to the medical profession; and the other of recent origin, and as yet publicly advocated only by its distinguished author, Dr. Lionel S. Beale of London. The first of these may be properly called the chemical, and the second the vital or bioplasmic theory. The chemical theory is founded on a presumed analogy between the propagation of disease in living organisms and the process of fermentation in certain forms of organic matter without life. (See FERMENTATION.) This theory assumes a ferment to be an organized substance in a certain state of decay, which possesses the property of exciting the same decay in other organic substances with which it is in contact. Applying this theory to disease, it supposes that infection is communicated by the instrumentality of particles thrown from the person, or from substances proceeding from the person diseased, and borne by the air to other persons in full health, in whom they excite, probably by contact with the membranous linings of the lungs, or by absorption through the pores of the skin, the same diseased condition which exists in the patient.

The bioplasmic theory rests upon certain views entertained by Dr. Beale as to the nature of vitalized matter, and as to the distinction between those portions of the living organism which are really alive, and those other portions (constituting much the greater part) which are, as he expresses it, "formed tissue," and lifeless. This really living matter he calls *bioplasm*, and each separate portion of it a *bioplast*. Its simplest representative is the *Amœba* among the Protozoa. It is also present pure and simple as the white globule of the blood in all the mammifers. But it also forms the fluid or semi-fluid content of every animal and vegetable cell, the cell-wall being merely formed tissue which was originally a part of the bioplast which it encloses. Chemically considered, bioplasm is identical with the protoplasm with which Huxley has made all the world so familiar. Biologically, it is something more, in the respect that it possesses the property of contractility, which is characteristic of life in its lowest forms—a property which does not necessarily belong to protoplasm. According to Dr. Beale, the bioplasts of the blood multiply, like many of the Protozoa, by fissuration or self-division, or by gemmation or budding. The fact of such multiplication is demonstrated, as he asserts, by direct observation with the microscope. In a healthy state of the animal, the process of multiplication is balanced by that of assimilation, and the bioplasts attain certain normal and uniform dimensions. But occasionally, under conditions impossible to define, there occurs an abnormal acceleration of the process of gemmation, each parent bioplast throwing off an immensely numerous progeny, of which the individuals never attain the normal dimensions, though they themselves become immediately the parents of another generation still more degenerate, until the blood is overloaded with these excessively minute and infinitely numerous organisms, and the regularity of the vital functions is disturbed. These minute bioplasts, according to the author of this theory, escape from the diseased individual in countless numbers. Protected by a coating of formed tissue, they float through the air, retaining their vitality for an indefinite period; and if at length they are absorbed into the circulation of a healthy animal, they recommence there the process of morbid development of which they are themselves the offspring, and thus engender the same disease in which they originated. This theory, it will be seen, is entitled to be called, in a certain sense, a germ-theory, but it is not *the* germ-theory. Its germs, in other words, are not embryos out of which are developed more perfect organisms, having individual characteristics and specifically distinct from other organisms. Their analogies, on the other hand, are quite as close with the ferments as with the true germs.

The germ-theory proper, however, presumes that the diseased person is suffering from an invasion of his system by microscopic algoid or fungoid vegetative forms having, like the presumed bioplasts of Dr. Beale, the property of rapid self-multiplication, and that the spores which proceed from these fungi or the cells of the Algæ are wafted in like manner by the air from person to person, penetrating the systems of the healthy, and establishing new colonies to generate disease in them. A *prima facie* evidence, which, so far as it goes, is favorable to this theory, is found in the well-known fact that all the forms of cryptogamic vegetation are propagated by spores, which they shed freely abroad in all directions, and that these are borne in infinite numbers through the atmosphere, which they pervade near the surface of the earth in all places. The fact of their universal presence is made manifest by the promptness with which fungoid growths spring up in all circumstances in which the conditions favor their development. Such conditions embrace a congenial temperature, and the presence of some organic substance suitable to serve as a nidus and furnish for them their proper food. There are peculiar forms of fungus which appear on particular forms of organism and nowhere else. Thus, the hoofs of dead horses are overspread, when exposed at a moderate temperature to moisture, with a vigorous growth which is seen in no other situation, and some of the larger plants are infested by their own peculiar fungi.

This constant appearance of minute forms of vegetable life could not take place so invariably in all varying situations were not the spores of the fungi continually present in the air throughout its whole extent. We know that the numbers of these spores which all fungi produce are incalculable. The larger fungi give us evidence of this. The spores of a single puff-ball have been estimated to be more numerous than the entire human population of the globe. It is true that to ordinary observation the presence of foreign matters in the atmosphere is not perceptible, except when such foreign matters take the gross form of clouds of smoke or dust; but particles of smoke or dust, and in general of all inorganic substances, are so heavy that they soon subside; yet when the air is thus left apparently free from all foreign admixture, it is demonstrably full of organic particles so extremely light as not to subside for many hours, or even days, of perfect rest. The chemist, it is true, is unable to detect them by his tests, delicate as they are; for, being organic, and composed in general of but two or three elements—which elements are in great part those of the atmosphere itself—they produce no distinctive reactions under the ordinary processes of analysis. But there is a mode of analysis much more delicate than even that of the chemist. It is that which has been applied incidentally to this question by Prof. Tyndall, in his interesting investigation into the chemical effects of light upon vapors. Prof. Tyndall discovered that there are many substances of great volatility which, when in the state of vapor, are easily decomposed by light. He found that a perfectly transparent vapor, like steam, when traversed by a luminous beam, is absolutely invisible; while we all know that if we admit a beam of sunlight into a darkened room through an aperture in the shutter, the path of the beam through the apartment is as distinctly marked as if it were a solid bar. That this visibility of a beam of light in the air is not owing to the power of the aërial particles themselves to reflect light, is demonstrated by him by proofs entirely conclusive. A beam of light from an electric lamp was made in his experiments to pass through a large glass tube closed at both ends by plates of glass ground on. No light was permitted to escape into the room; and accordingly, when the tube was exhausted of air altogether, and no light from its interior was reflected to the eye, it was perfectly invisible. But if the air of the room were allowed to re-enter it, it immediately became brilliantly luminous, as in the case of a sunbeam admitted through the window-shutter. If, however, the air before being admitted into the empty tube had been passed through a red-hot tube of platinum, the tube thus filled remained as completely invisible as when it was a perfect vacuum. This experiment—which is but one of many employed by Prof. Tyndall to demonstrate the same proposition—shows not only that the air is full of foreign matters, but that these foreign matters are organic; for were they not so they could not be destroyed by fire. He proved also that these particles are so numerous that they

cannot be entirely arrested by passing the air through the most energetic chemical reagents, as sulphuric acid, caustic potash, and the like; but that, though these substances arrested a large portion of the organisms, they allowed still not a few to escape. He showed, however, that a filter of rather closely compacted cotton will shut off entirely, or almost entirely, the organic matters which the air contains; and he showed, finally, that absolute rest for a long period of time will cause these particles completely to subside. Thus, a large flask which had been standing in the store-room was found to be, as he expressed it, "optically empty;" that is to say, the rays of light passed through it without showing any more trace of their path than if it had been a vacuum. He also experimented to ascertain how long a time would be required to free the air by subsidence of its suspended particles in a space completely closed; and for this purpose he constructed such a closed space, cubical in form and several feet in lineal dimensions, glazed so as to permit him to pass through it a beam of light, and to observe the path of the beam. This small apartment was made absolutely air-tight and left to itself. On each succeeding day the brilliancy of the transmitted beam grew less and less, and at length, at the end of a week, it could no longer be perceived at all. The apartment was optically empty. These experiments, and others no less interesting, by Prof. Tyndall, thus prove in the most conclusive manner that the ordinary air at the surface of the earth is always completely filled with particles of organic matter. It is not necessary to suppose that all these particles are living germs of vegetable or animal organisms; but when we see how constantly such organisms spring up wherever the conditions favor germination, it is impossible to doubt that a vast many of them have this character, and that these are the source of those growths of minute cryptogams which thus seem to spring up spontaneously. There is no other mode of accounting for such growths except to suppose that they are actually spontaneous; and accordingly the view has been taken by some physiologists—perhaps, it should be said, many—that the true mode of accounting for the appearance of microscopic forms of life is to suppose that they originate without organic antecedents, or, as they express it, *de novo*. It is no part of our purpose to discuss this question here. The history of the controversy, which has long been in progress, regarding it, is given in the article GENERATION, SPONTANEOUS.

From what has been said, it is evident that, if disease is not produced by the invasion of the blood or viscera of the patient by a parasitic vegetation, it is not for want of the germs from which such vegetation might spring. It is therefore important to consider first what has been already ascertained of the effects of such parasitic growths infesting the animal organism. A simple form of fungus, called the *Sarcina ventriculi*, is often found in matters thrown up by persons laboring under disorder of the stomach. It has also been met with in other parts of the body when diseased. But it is likewise found, and not unfrequently, in the stomachs of persons in perfect health, and, as Dr. Carpenter says, may accumulate there in considerable quantities without causing inconvenience. This parasite, therefore, cannot be regarded as an inciting cause of disease. The stomachs of many worms and insects are found, moreover, to be frequently infested with fungi, which grow there in great luxuriance. Many of these have been examined and described by Dr. Leidy of Philadelphia. It does not appear that they occasion inconvenience to the animals within whose bodies they thus establish themselves. On the other hand, some of the dipterous and hymenopterous insects, and some caterpillars, are liable to invasion by fungoid growths, which speedily spread through their entire bodies and destroy their lives. In the West Indies, according to Dr. Carpenter, it is not at all uncommon to see individuals of a species of *Polistes* (corresponding to our wasp) flying about with plants of their own length projecting from some part of their surface, the germs of which have been introduced through the breathing-pores at their sides. This fungoid growth, however, soon kills the insect; and a similar effect follows a similar cause in the case of certain caterpillars in New Zealand, Australia, and China, of which the bodies become so thoroughly interpenetrated and, as it may be said, replaced, by the fungoid vegetation, that when dried they have almost the density of wood; so that, in the language of Dr. Carpenter, "these caterpillars come to present the appearance of twigs, with long slender stalks formed by the projections of the fungus itself." Our common house-fly is a not unfrequent victim of a similar parasitic visitation. A fungus called the *Empusa muscæ*, originating from the germination of a single spore brought in contact almost anywhere with the body of the insect, pervades after a time its whole interior, and, while leaving the surface uninjured, emphatically eats out its substance. When the animal's life is nearly exhausted he comes to rest, and fungoid shoots put forth from his body on all sides, clothing him apparently with a kind of fur, consisting of filaments each bearing a fructification of innumerable spores. The harvest of spores becomes very conspicuous when the unfortunate animal makes his last stand upon the window-pane, forming a thin film over the glass to a considerable distance around him; and if by any chance a healthy individual of the same species comes within the limit of this infected area, the disease which has destroyed his fellow will be sure to attack him also. There are some forms of parasitic disease affecting insects which have had consequences of serious importance to certain great industrial interests to which these humble forms of animal life are tributary. A fungus called the *Botrytis Bassiana* is the occasion of the disease in silk-worms known by the name of *muscardine*. The spores of this fungus, entering the breathing-pores of the worm, soon germinate, and death is the invariable consequence. It is only, or at least rarely, however, the case that the cause of the fatality is manifest until after death has occurred; but then the fungus shoots forth luxuriantly, especially at the junction of the rings of the body. A still more destructive epidemic among silk-worms is that which has received the name of *pébrine*, and which is caused by the multiplication of a parasitical organism called *Panhistophyton*, fungoid in its nature. This disease is the more difficult to deal with, in that it is transmissible by inheritance, the *Psorospermiæ* entering into the eggs of the diseased worm. It was thoroughly investigated by Mr. Pasteur, who pointed out the means by which it might be extirpated—means which have since been successfully applied. But there are diseases produced by invasions of parasitic fungi in animals of much higher grade than worms or insects. There are, for example, many cutaneous diseases among men, caused demonstrably by the presence and multiplication of microscopic forms of parasitic life, usually vegetable, but sometimes animal. The *Tinea favosa*, a disease of the scalp, happily rare, covers the head with yellow scales consisting almost wholly of a fungoid vegetation. The thrush in the mouths of children is made up of white patches of similar vegetable character. The itch is caused by the burrowing, beneath the cuticle, of a minute insect known as the *Acarus scabiei*. Of deeper-seated diseases, *Trichiniasis* owes its name to the animal, and *Mycosis intestinalis* to the vegetable, cause to which these diseases are severally owing. The widely prevalent and frequently fatal malady known as *Diphtheria* has been proved by the recent investigations of Cohn, Oertel, Eberth, Nassiloff, and others to proceed from a penetration of the tissues by particular forms of bacteria, one of them called the *Micrococcus* and another *Bacterium termo;* while still other analogous organisms appear in the false membranes which form in the mouth and fauces. The disease is readily communicated by inoculation; and when this experiment is made, "the point of inoculation," according to Oertel, "forms a centre from which the growth of these organisms radiates through the tissues; and the intensity of the infection is wholly proportionate to the degree in which the tissues are penetrated by these parasites. The mass of *Micrococci* developing in the body forms the criterion for the severity of the disease, and an exact indication of the virulence of the diphtheritic contagion." He adds: "There can be no longer a doubt that these vegetable organisms are not of accidental occurrence, but are inseparable from the diphtheritic process, just as the bacteria of decomposition are necessarily connected with decay and act as a ferment of it. *Without Micrococci there can be no diphtheria.*" Again, the epidemic among cattle called in England "the blood" is shown by the researches of Davaine to be occasioned by the presence in the blood of the diseased animals of innumerable living organisms resembling vibrios. This disease is communicable to man, producing what is called "malignant pustule," and this is attended with the development of the same organisms in the pustules thus produced. Prof. Lister, an eminent surgeon of Edinburgh, long ago observed that when a chronic abscess is discharged by means of a canula and trochar, the subsequent accumulations of fluid are frequently attended with putrefaction, though none had existed before. The putrid mass is also found to be swarming with vibrios, though none had been present in the first discharges. No explanation of this singular phenomenon, according to him, can be given, except that the germs of these organisms were introduced in the original operation with the canula and trochar. Another remarkable fact noticed by Prof. Lister seems strongly to corroborate the theory of inflammation and putrefaction above given. A wound in the chest producing effusion of blood in the pleural cavity is attended with great danger from the liability of the extravasated blood to putrefy. Yet when the lung is wounded by a broken rib, without any external opening, the blood, though escaping into the cavity

in quantity, undergoes no decomposition and excites in the surgeon no concern, even though air at the same time enters in such volume as to inflate the cellular tissue of the entire body. "These facts," says Prof. Lister, "involved to me a complete mystery until I heard of the germ-theory of putrefaction, when it at once occurred to me that it was only natural that the air should be filtered of germs by the air-passages" of the lungs. Now, what Prof. Lister conjectures *a priori*, Prof. Tyndall, interested by this remark, subsequently proved experimentally. Through the path of a beam of light made visible by his lantern in the dark room described above, he caused the air from his own lungs to pass by breathing through a tube. The current at first but slightly affected the brightness of the beam, but as the air from the larger passages passed away, and that from the deeper network of the lungs succeeded, the light progressively faded, and at length gave place to absolute blackness. The experiment fully confirmed the anticipation of Prof. Lister, that the air which passed through the lungs would no longer contain the germs of living things or any other suspended foreign matter. But what an idea does this give us of our liability, through our lungs, to absorb into our system anything noxious which the air may contain, no matter how minute in quantity or how finely divided! If the quantity in given volume is minute, it is to be remembered that the volume we inhale in a limited time is enormous, amounting to two or three thousand cubic feet a day; and the accumulation which must result from even the partial exhaustion of this great mass, of its impurities, must become very considerable.

Having spoken now of the cases in which disease, local or general, in animals, is manifestly occasioned by the presence of parasitic vegetation, it is proper to mention, briefly, similar examples in plants. The smut in wheat, the rust in cotton, the *Oidium* in grapes, and the *Botrytis* in potatoes are examples of fungi constantly concomitant with disease, and presumably, almost certainly in the last two instances, its cause. Neither in plants nor animals, however, is it to be supposed that the noxious effects observed are occasioned merely by the presence of these parasites, mechanically interfering with and obstructing the vital functions, or acting directly as poisons in the ordinary sense; but rather by their own vital activity decomposing the substance of the organisms they infest, and making them their food. The consequences of their extensive prevalence to the material interests of communities and peoples, and to their means of subsistence, have been occasionally of the gravest character. The *Oidium* may be said to have exterminated the vine from the island of Madeira; the *Panhistophyton* cut down the product of silk in France from 130,000,000 francs per annum to 30,000,000; and the *Botrytis* threatened to depopulate Ireland, by destroying the vegetable which constituted, for the common people, the staple article of their food.

Putting together, then, the known facts regarding this subject before proceeding to more doubtful cases, we may say that the germ-theory has an amount of *prima facie* evidence in its favor which entitles it to careful consideration. In certain instances, and in a certain sense, the evidence is complete that the germ-theory is true. But when we come to apply it to infectious diseases in general, we find the analogies which they present with the limited class of examples above enumerated, to be unexpectedly feeble, while the points of dissimilarity are numerous and marked. It is not even enough to discover that in such diseases there are actually present in the blood, or in the tissues, or in the secretions, or in the dejections of the suffering individuals, living forms of microscopic cryptogams, since the evidence is rarely conclusive either that these minute bodies are injurious to the patient or that they were present antecedently to the attack. And if, as to the first of these points, the evidence in some cases *is* satisfactory, as to the second it can hardly be pronounced to be so in any.

As to the constant presence of vegetable organisms in the blood of men or animals suffering under infectious diseases of whatever kind, it is impossible to entertain a doubt. The testimony of all the observers who have occupied themselves with this subject is concurrent to this effect. Coze and Feltz, Klebs, Burdon-Sanderson, Klein, and many others have found bacteria invariably in the blood of patients suffering under typhoid fever, smallpox, scarlet fever, puerperal fever, pyæmia, and septicæmia. Dr. J. H. Salisbury of Cleveland, O., affirms that in healthy as well as in diseased blood there are always present two species of cryptogams—the one algoid and the other fungoid. In the pustules of smallpox Dr. Salisbury claims further to have observed a cryptogam having both a fungoid and an algoid development, of which the spores are also found in the blood. The existence of the smallpox fungus is treated by the German pathologists as fully established by their own observations. Again, in typhoid fever, according to Salisbury, a peculiar algoid vegetation is developed upon the external surface of the entire body and upon the mucous membrane of the interior cavities, which is regarded as the efficient cause of the disease and the means by which it is propagated. And of typhus fever Lebert remarks: "All the later writers agree that the disease is spread by a typhus germ." Dr. Ernst Hallier of Jena, who has published largely on this subject, and has made himself prominent as an advocate of the germ-theory, has described a large variety of vegetable forms found by him in diseased men and animals, many of which he has subjected to systematic cultivation in order to study their modes of development. He claims to have demonstrated the existence in the rice-water discharges of cholera patients, and within the intestinal canal of such persons, of a new and peculiar fungus, as marvellous for the rapidity of its development as for its strange forms of growth, and its terribly fatal destruction of the epithelial tissue of the intestine. This has been called by Profs. Thorne and Klobe the *Cylindrotænium*, but is regarded by Dr. Simon and Dr. Harris as being an exotic member of the family to which belong the *Urocystic* and *Oidium* blights of cereals and fruits. Whether this parasite has been satisfactorily identified or not, however, the weight of medical opinion among the highest authorities on the continent of Europe, as will appear from citations given below, is decidedly in favor of the fungoid character of the choleratic contagion. It is proper, nevertheless, to remark that British authorities seem to lean in the other direction; and in the last and recently published edition of Dr. Parkes's *Manual of Practical Hygiene* we find the following explicit statement: "As regards cholera, the careful observations of Drs. Lewis and Cunningham in Calcutta seem to have disproved the possibility of either fungi or bacteria being the cause of cholera."

The disease which appeared in 1868 among the beef-cattle brought to New York from the West, and which is known as the Texas cattle disease, was attributed at the time to a peculiar species of fungus, of which the spores were said to have been found both in the blood and in the bile of the diseased animals. The epizootic which attacked all the horses of the country in 1872 was also marked by the presence of fungi in the blood and the urine of the animals affected. These examples will probably be thought sufficiently numerous to justify the generalization that in infectious diseases the presence of microscopic algoid or fungoid cryptogams is a fact of invariable occurrence. What is the significance of this fact? In all these cases we find that the fluid in which the cryptogams occur is itself diseased. Is not the disease of the blood the very condition that is necessary to the development of the plant? When mould makes its appearance on the surface of paste, is it the presence of the mould which causes the paste to putrefy, or is it the putrefaction of the paste which provides a congenial nidus for the mould?

About forty years ago the yeast-plant was discovered by Cagniard de la Tour, and almost simultaneously by Schwann. (See FERMENTATION.) Till that discovery the chemical theory of disease had a strong support in the imagined analogy of fermentation. To the suggestion, after the discovery, that fermentation is probably a consequence of the rapid growth of the plant, there was at first a very general and natural dissent; but when, in 1843, Helmholtz made a direct experimental test of the question, by placing a fermenting liquid side by side with one of the same kind not fermenting, both being contained in the same vessel, but separated by a membrane which permitted the mingling of the liquids, but prevented the passage of the plant, that analogy lost its force, for the fermenting liquid continued to ferment, while the quiescent liquid remained quiescent. The case of fermentation assumed now a significance quite the contrary of that which it had before seemed to possess, and it began to be considered quite as conclusive in favor of the germ-theory as it had been before in favor of the chemical. In the words of Liebermeister: "Since we know that those ferment processes which here alone can be taken into consideration are all associated with the presence and multiplication of low organisms, the theory of fermentation becomes virtually identical with the theory of a *contagium vivum*."

But independently of the argument derived from the detection, or supposed detection, in the body of the patient, of the microscopic parasites which are the presumed cause of his disease, there are some considerations of a general nature bearing upon the question, which must be admitted to favor strongly the truth of this theory. It is, in the first place, a material substance, and not merely a dynamic influence, by which the infection of disease is communicated from individual to individual. This is proved by the fact that it is conveyed in merchandise, in clothing, in letters, in books, etc.; and that, in these and similar ob-

jects, if they are closely packed and excluded from the air, it will preserve its energy for an indefinite length of time. Now, being a material substance, the fact is significant that we find in it a power of reproduction, or of self-multiplication, which is at once strikingly analogous to that of all low living organisms, and at the same time difficult to be explained on any theory of chemical combination or decomposition. On this point, Dr. Liebermeister, in the treatise already cited, expresses himself as follows: "*The poisons of infectious diseases can reproduce themselves, and that to an unlimited extent.* With a minimal quantity of vaccine virus we can vaccinate a child, and obtain vaccine matter from him. From this child ten, and even more, children can be successfully vaccinated; from each one of these children ten more in turn, and so on; so that what at first was a scarcely appreciable quantity of the virus of the disease is sufficient to produce the disease in 1, 10, 100, 1000, 10,000 children, and so on *ad infinitum*. There is no limit to the extension of the disease until there are no individuals left to whom the poison can be successfully conveyed; otherwise, the number of persons who could be infected by a minimal quantity would be unlimited in the strict mathematical sense of the word. As with the vaccine virus, so with variola, measles, scarlet fever, typhus fever, syphilis, malignant ulcers, blennorrhœas, etc.—the poison can be multiplied to an endless extent. In opposition to such facts as these, all hypotheses which refer these poisons to certain known or unknown chemical combinations—and such views are even now sometimes advanced—must be abandoned as thoroughly untenable."

Another consideration, pointing in the same direction, is the fact that every contagious disease preserves for ever the same invariable type. On this point we cannot do better than to quote once more from Liebermeister. "A peculiarity of the infectious diseases," observes this authority, "which they have in common with the poisons proper, or *intoxications*, but by which they also differ in the most marked manner from all other diseases, is their *specificness*, which shows itself in the fact that always, and under all circumstances, a given kind of disease is solely due to a given kind of morbid agent or cause. There is no such constancy in the relations between cause and manifestations in other diseases. Exposure to the same degree of cold will occasion different affections, varying with the individuality of the person attacked—in one person a coryza, in another bronchial catarrh, in the third an attack of colic or diarrhœa, toothache, facial paralysis, or any other lighter or more severe 'rheumatic' affection; or, *vice versâ*, a catarrh can originate from irritants affecting the mucous membrane of the nose, as irritating fumes, pungent snuff, mechanical injuries; or also from cold to which the feet have been exposed, or by poisoning—as, for instance, with iodine, or even by infection. On the other hand, vaccination with the virus of variola alone produces variola, if any disease at all is produced by it; vaccination with vaccine matter produces vaccinia only; infection from a patient with measles only produces measles, and never anything else." And further: "Various physiological conditions, and, indeed, other pre-existing affections, are influential only so far as they increase or diminish the susceptibility; the *kind* of disease will not be determined by it. Through the longest series of generations, diseases preserve their specific character with the utmost persistency; and if, at times, some of these characteristics are not brought into complete maturity, owing to an unfavorable field for their development, yet they assume them again so soon as they are planted in favorable soil. The weather, the period of the year, the climate, the condition of the soil, etc., conduce to or prevent the spread of an infectious disease, but they never change the nature of the disease—the diseases which in all climates, as cholera, smallpox, syphilis, exhibit the same essential characters everywhere. The kind of diet and all other physico-chemical influences act indifferently with regard to the nature of the affection. In fine, it may be said that no individual or external influence ever decides the nature of the affection, and one infectious disease is never under such conditions changed into another." There is here something so closely resembling the persistency of species in organic nature that we cannot but recognize in the analogy a strong argument in favor of identity of cause.

Still another consideration of no less interest in this discussion than those already presented is derived from the phenomena attending the propagation of the class of diseases distinguished as *miasmatically contagious*. These diseases are not communicated from individual to individual, yet they never make their appearance in any place to which a diseased individual, or objects which have been in contact with such an individual, or morbid matter proceeding from such an one, has not been conveyed. Cholera is an example of this kind, and yellow fever is another. The attendants on cholera patients are no more frequently attacked by the disease than persons who hold themselves aloof with the severest caution. Yet in a thousand instances it has been proved that an atmosphere contaminated by effluvia proceeding from choleratic dejections, or a source of water which has been even remotely polluted by them, become active agents in spreading the disease. This singular anomaly is in entire harmony with what we know of the modes of reproduction of sundry known forms of parasitic animal life. The embryos must pass through two stages of development—one within the body of the animal which they infest, and the other without. When the *Trichina spiralis* has become encysted in the muscle of a living animal, the animal, if it survives the crisis, is troubled no more. Reproduction will not take place unless the cyst shall afterwards pass into the stomach of another animal. The *Tænia*, or tapeworm, cannot pass directly from one person to another. An intermediate stage of development is necessary. Examples of this description furnish us with a key to the explanation of miasmatic contagious diseases, which is not only consistent with the theory of a *contagium vivum*, but forms a strong argument in support of that theory. On this point Dr. Liebermeister says: "If we think that a procedure similar to what we know with sufficient accuracy takes place in the development of the *Tænia* also takes place in the development of every disease-poison—that, for example, the organisms which are the root of cholera have, in their reproduction, to pass through two stages of development, the one outside the human body, and the other within—then the difficulty which envelops the affair is removed. The fresh discharges of cholera patients contain these organisms in the stage of their development in which, if introduced into the body of another, they do not reproduce themselves further, and can cause no infection with cholera; before they are again capable of it they must pass through another stage of development outside the body." The phenomena attending the propagation of the miasmatic contagious diseases are thus in strict harmony with what we know of the modes of reproduction of many low forms of organic life; while, upon the purely chemical theory, they present an enigma incapable of solution. In the words of Lebert, the distinguished pathological anatomist of Vevay, who has discussed this subject in Ziemssen, "the universally accepted specific cholera-germ must be either an organic poison or a living organism. But in the whole range of toxicology, a subject now so accurately understood, there is not a single observation that speaks even approximately in favor of the purely toxic character of the cholera-germ."

Yet notwithstanding the undeniable weight of these arguments, the germ-theory of disease, at least when stated in all its generality, cannot be said as yet to have obtained acceptance with a majority of the medical profession. Serious difficulties present themselves in connection with the subject, which as yet it fails to explain; and among these are the objections strongly put by Dr. Bastian, that the theory demands a belief in the existence of about twenty different kinds of organisms never known in their mature state, and whose existence is not demonstrated, but simply postulated; and that these germs, if they exist, are not the germs of any known organisms, because such germs have been experimentally shown to be incapable of producing the particular diseases these are assumed to cause. Moreover, feeding on putrid flesh, as is habitual among the Kalmucks, is followed by no injurious consequences, though such flesh swarms with bacteria; and, as the author just referred to affirms, the organisms of ordinary putrefactions may be introduced even into the blood of men and animals without producing any of these specific diseases. The same writer asserts that in sheep-pox the blood and the secretions are not infective, though this disease is allied to, and even more virulently contagious than, human smallpox.

What account shall we give, then, of the multiplication of fungi and Algæ in diseased blood, if these organisms are not the cause of the disease? Simply, that the diseased condition furnishes to the organisms the pabulum, which is not present in the healthy state. For the cause of the disease we must, on this supposition, look elsewhere, and we shall be compelled, perhaps, to fall back upon the chemical doctrine of sympathetic decomposition. Many causes, in fact, produce profound changes in the blood with which parasites have nothing to do. This is true of prussic acid and of the venom of serpents, both of which produce fatal effects with singular rapidity. Of "the black death," which raged in the fifteenth century, Bastian quotes from Hecker that "many were struck as if by lightning, and died on the spot;" and he cites the testimony of Dr. Aitken to the fact that, when the cholera reached Muscat, instances occurred in which only ten minutes elapsed from the first apparent seizure till life was extinct. These are cases for which the germ-theory affords no solution. On the other hand, we

have the numerous observations and experiments of Coze and Feltz, of Burdon-Sanderson and Klein, of Klebs, of Davaine, of Zahn and Tiegel, and others, in which rabbits and guinea-pigs were inoculated with bacterious blood drawn from patients laboring under a great variety of infectious diseases, including pyæmia, septicæmia, smallpox, measles, scarlet fever, typhoid fever, etc.—observations and experiments which seem to leave little room for doubt that these organisms are, in fact, in these cases, the vehicles of the infection and the causes of these several diseases. It was observed, for instance, that successive inoculations increase the intensity of the virus, and that along with the increase of toxic power the number of the organisms in the fluids manifesting it was correspondingly increased. It is true that the diseased fluid is itself necessarily introduced into the animal inoculated along with the contained bacteria, so as to leave the question still somewhat in doubt to which to ascribe the induced disease. Some light is thrown upon this question by certain experiments of Drs. Zahn and Tiegel, who in cases of septicæmia filtered the parasites from the liquid; and having done this, found that the clear liquid caused heavy but transient fever without suppuration, while the same fluid with the parasites produced suppuration extraordinarily widespread.

In view of the conflicting character of the evidence surrounding the vexed problem under consideration, it may be permitted us, perhaps, at present, to hold by the conclusion, that neither the germ-theory of contagious disease, nor the chemical theory, is exclusively true, but that each of these morbific influences has a range of action of its own; and that in some cases it is eminently probable that the disease in its inception is attributable to one of these causes, and that is the chemical, but owes its subsequent virulence mainly to the other—that is, to the presence of rapidly-multiplying vegetable organisms. By the proper application of this key we may succeed in solving most of the perplexing anomalies which particular examples have seemed to present, and shall find a common ground on which the champions of opposing views may meet and harmonize their differences.

As to the bearing of this question upon public hygiene and the principles which should govern sanitary legislation, it is to be observed that, if we accept the chemical theory of contagion as exclusively the true one, we can hardly avoid admitting the possibility that contagious disease may originate in a healthy individual without communication with a person already diseased. The causes, whatever they may be, will be found in surrounding conditions. It is certainly beyond question that the cholera in the Mississippi Valley during the summer of 1873 did not originate from without. Somewhere conditions must have existed which favored its origination *de novo* in our own country. In this view of the subject, the business of sanitary science is to discover the nature of the deleterious conditions tending to induce disease, and to prevent their occurrence.

If, on the other hand, infectious disease is propagated by living germs alone, what we have to aim at is to devise measures for promptly extirpating those germs the moment the disease appears. But as the necessary measures of precaution or extirpation will be substantially the same, whatever may be the theoretic views entertained as to the nature and the origin of the evil to be met, our legislation in any case is likely to be practically the same, however in its motive it may be logically different. Pure air, pure water, wholesome food, thorough drainage, rigidly-enforced cleanliness, the severe exclusion from towns and cities of industries which contaminate the air with noxious gases or offensive effluvia—especially such as arise from decaying organic matter—the prevention of overcrowding in dwellings, the prompt and complete disinfection of every spot where pestilence may lift its head, and of every article and substance, including the dejecta of the sick, which may serve as a vehicle of disease, and finally, a well-organized sanitary police and untiring vigilance on the part of its members,—these are the objects which the guardians of the public health must labor to secure, to whatever school of etiology that they may happen to belong. It is indeed a fortunate circumstance—a fact hardly observable in any other department of practical human effort—that here the champions of conflicting theories, however freely they may splinter lances in the area of controversy, are always found marching harmoniously side by side in the field of actual warfare and in the face of the common enemy.

The study of the laws of hygiene is assuming at the present day, in the estimation of the public and of the medical profession itself, an importance which places it above even the proper business of the profession—that of the science of therapeutics. Drugs, whether remedial or prophylactic, are falling more and more into disrepute; and it is felt that prophylactic action is infinitely better than prophylactic draughts. Such has been the success of modern measures for closing up all the insidious approaches by which disease has hitherto effected its entrance into the family, the community, or the individual organism, as to encourage a hope, even so seemingly wild and visionary, as that a time is coming in which disease itself shall be utterly extirpated, and men shall begin to live out the days which Heaven intended for them. F. A. P. Barnard.

Gérôme (Jean Léon), b. at Vésoul, France, May 11, 1824, son of a jeweller; became a student of painting with Paul Delaroche 1841; followed for a time the course at the École des Beaux Arts, and in 1844 went with his master to Italy. He exhibited paintings at the Salon in 1847, and since then has been a diligent contributor. A journey into Turkey and along the western banks of the Danube in 1853, and in 1856 a long excursion into Egypt, furnished him with rich materials for his art. In 1863 he was appointed professor of painting in the École des Beaux Arts; in 1865 was chosen member of the Academy; obtained a third-class medal in 1847, two second-class in 1848 and 1855, and a medal of honor at the Universal Exposition of 1867. In 1855 he was created a chevalier of the Legion of Honor; in 1867 he was made an officer; then two years later the decoration of the Red Eagle was conferred on him. Gérôme's pictures are well known through the photograph: *The Duel after the Masquerade, The Death of Cæsar, Cæsar and the Gladiators, King Candaules, Phryne, Cleopatra and Cæsar, Jerusalem,* are among the most familiar. The artist loves sombre and sinister themes, with a strong element of sensuous life in them. *The Age of Augustus, The Decay of the Empire, The Plague at Marseilles, The Death of St. Jerome,* are examples. His works are all powerfully imaginative and suggestive, though not often pleasantly so; a morbid taint runs through them, but they are clearly drawn and carefully studied; few of them are bright or glad, but few are destitute of a subtle and fascinating beauty. O. B. Frothingham.

Gero'na, province of Catalonia, Spain, bounded by France, the Mediterranean, and the provinces of Barcelona and Lerida. Area, 2413 square miles. Pop. 322,631. It is a romantic mountain-region, rich in wheat, wine, olives, walnuts, and all kinds of fruits, and traversed by the only highway which leads from Spain over the Pyrenees into France. Cattle are reared extensively, and along the coast the people are largely engaged in maritime pursuits. Cap. Gerona.

Gerona, fortified town of Spain, in the province of Gerona, on the Ter. Its cathedral is a fine Gothic building of the fourteenth century. It has been besieged twenty-eight times, and taken five times. Pop. 7661.

Geropi'ga, Geropig'ia, or **Jerupig'ia,** a factitious liquor exported from Portugal as brandy, and imported into the U. S. and Great Britain as wine. It is variable in composition, but generally consists of grape-juice, brandy, sugar, logwood-extract, and other ingredients. The U. S. is the principal market. It is used in making imitations of wine and other liquors. It is a villainous compound.

Ger'rish (Frederic Henry), A. M., M. D., b. at Portland, Me., Mar. 21, 1845; graduated at Bowdoin College 1866, and took his medical degree there in 1869; became in 1873 professor of materia medica and therapeutics in Bowdoin College, and in 1874 became also professor of physiology, therapeutics, and materia medica in the University of Michigan; is also pathologist to the Maine General Hospital since 1874. Residence, Portland, Me.

Ger'ry, post-tp. of Chautauqua co., N. Y., contains several sulphur springs and a spring of inflammable gas. Pop. 1096.

Gerry (Elbridge), b. at Marblehead, Mass., July 17, 1744; graduated at Harvard in 1762; became a successful merchant of his native town and a prominent provincial legislator and patriot; was specially interested in the naval operations of the Revolution, and was the founder of the Massachusetts admiralty court; in the Continental Congress 1776–85; signed the Declaration of Independence; one of the framers of the U. S. Constitution 1787, but refused to sign it; in Congress again 1789–93; was with Pinckney and Marshall a special minister to France 1797; chosen governor of Massachusetts (Anti-Federalist) 1810 and 1811, and defeated when running for that office in 1798, 1801, and 1812; chosen Vice-President of the U. S. in 1812; and d. at Washington, D. C., Nov. 23, 1814.

Gers, department of France, on the slope of the Pyrenees, ranges of which traverse it from S. to N., forming large, well-watered valleys. The soil, however, is only mediocre. Wine is the main produce, but it is of an inferior quality, and mostly transformed into Armagnac brandy. Many mules are reared for the Spanish market. Area, 2390 square miles. Cap. Auch. Pop. 284,717.

Gerson, de (JEAN CHARLIER), called DOCTOR CHRISTIANISSIMUS, b. at Gerson, near Rheims, France, Dec. 14, 1363. In 1377 he was sent to the College of Navarre, Paris, studied theology under D'Ailly (*Malleus hæreticorum*), from whose hands in 1392 he received the doctor's hat, having previously, while only a bachelor of divinity, been employed upon missions to the rival popes, with a view to ending the great schism then existing. In 1409 he went to the Council of Pisa, and in 1414 to that of Constance, in which he represented the Gallican Church, and in which he favored the superiority of the councils to the pope and the reform of the Church within itself. He zealously advocated the burning of Huss and Jerome of Prague. His opposition to the preaching friars (Dominicans), as rivals of the secular clergy, raised up so many enemies that he retired to Germany, where he lived until 1419, after which he went to the Celestine convent of Lyons and became a catechist of poor children. There he d. July 12, 1429. Gerson's chief aim was the reform of the Church from within itself. He was the great founder of Gallicanism. As a philosopher he hated the scholastic pedantry, and tried to substitute a practical and semi-mystical theology, opposing the mixture of divinity and human science then in vogue. He gave much attention to the subject of judicial astrology, which he combated with success. He was a voluminous writer, and many authorities (chiefly French or Benedictine) have claimed for him the authorship of *De Imitatione Christi*, usually ascribed to Thomas à Kempis.

Ger'stäcker (FRIEDRICH), b. in Hamburg, Germany, May 16, 1816. After a brief schooling he was apprenticed to a grocer, but ran away to Bremen, whence he shipped in 1837 as cabin-boy on a vessel bound for New York. After journeying through the U. S. and Canada, performing such work as he could get, being at different times a sailor, jeweller, hunter and trapper, and hotel-keeper, he returned to Germany in 1843, and published an account of his travels in several volumes (1843–49). He spent the years 1849–52 in making a journey around the world, and a narrative of his travels which he published on his return became very popular. In 1860–61 he made the tour of South America, and in 1862 accompanied Duke Ernest of Gotha on a tour through Africa; visited Central America in 1863, and in 1867 started upon another journey around the world, regarding which he wrote a number of interesting volumes. His works have been translated into English. D. at Vienna May 31, 1872. G. C. SIMMONS.

Ger'vas, a South American and West Indian shrub, *Stachytarpheta Jamaicensis* (order Verbenaceæ), whose leaves have valuable medicinal properties, and are used as a substitute for tea. Considerable amounts are used for adulterating tea in Europe.

Ger'vase of Til'bury, b. at Tilbury, Essex, England, was a reputed nephew of Henry II., and about 1208 was made marshal of the kingdom of Arles. Author of a remarkable *Otia Imperialia*, a medley of history, curious learning, fables, and the natural science of that day; and perhaps author of a *History of Britain*, which must not be confounded with the valuable *Chronicle* of Gervase of Canterbury, a monk probably contemporaneous with the foregoing, and author also of a history of the archbishops of Canterbury.

Gervi'nus (GEORG GOTTFRIED), b. at Darmstadt, Germany, May 20, 1805; studied at Heidelberg and in Italy; became in 1835 professor extraordinary at Heidelberg; was 1836–37 professor of history and literature at Göttingen, but lost his place for political reasons; became honorary professor at Heidelberg 1844, and d. there Mar. 18, 1871. His works include *Geschichte der Angelsachsen im Ueberblick*, 1830; *Geschichte der deutschen Dichtung* (1871); *Geschichte des neunzehnten Jahrhunderts* (8 vols., 1855–56); works on Shakspeare, etc. He was a prominent liberal politician and journalist. His history of the nineteenth century, written in admirable style, had a profound political influence in Germany, at once correcting the revolutionary tendencies of his time, and checking the opposing reaction of the conservative classes.

Gesells'ville, a v. of Fairchild co., O. Pop. 58.

Gese'nius (FRIEDRICH HEINRICH WILHELM), D. D., b. at Nordhausen Feb. 3, 1786; studied at Helmstädt and Göttingen, and taught in both universities; became in 1809 professor of ancient literature at Heiligenstadt, professor of theology at Halle in 1810, and d. Oct. 23, 1842. He was an outspoken rationalist, but gave a great impulse to Oriental learning by his philological works. The chief of these are *Hebräisches und Chaldäisches Handwörterbuch* (1810–12; many editions); *Hebräische Grammatik* (1813); *Kritische Geschichte der Hebr. Sprache* (1815); *De Pentateuchi Samaritani Origine* (1815); a translation and commentary on Isaiah (1820–21); the Hebrew and Chaldee *Thesaurus*, finished by Rödiger (1827–53); and *Scripturæ linguæque Phœniciæ monumenta quotquot supersunt* (1837).

Ges'ner (ABRAHAM), M. D., b. at Cornwallis, N. S., in 1797; studied medicine in England, and received his degree in 1827; acquired repute as a naturalist and chemist; was appointed to make a geological survey of the lower provinces of what is now the Dominion of Canada; patented a process for kerosene oil; author of *Mineralogy and Geology of Nova Scotia; Industrial Resources of Nova Scotia; New Brunswick* (1847); *Geology of New Brunswick, Nova Scotia, and Prince Edward's Island; Practical Treatise on Petroleum*, etc.; *Fisheries of the Provinces;* and other works. D. at Halifax, N. S., Apr. 29, 1864.

Gesner (JOHANN MATTHIAS), an eminent Latin scholar and editor, was b. at Roth, near Ansbach, Apr. 9, 1691; studied first in the gymnasium at Ansbach, and then in the University of Jena; was appointed associate rector in Weimar 1715; rector of the gymnasium in Ansbach 1728; removed to Leipsic as rector of the Thomas School in 1730, whence he was transferred, on the establishment of the University of Göttingen, to that institution as professor of philosophy in 1734. He founded the Seminarium Philologicum in the university, greatly improved the schools of Hanover, over which he had a general supervision, and was of great service to the university library. His literary productions were chiefly editions of the Latin authors and works in illustration of them—viz. *Scriptores Rei Rusticæ Latini* (the Latin agricultural writers), Leipsic, 1735, 2 vols. 4to (new edition by Ernesti, 1774); *Plinii Epistolæ; Claudianus; Horatii Eclogæ; Quintilian; Novus linguæ et eruditionis Romanæ Thesaurus*, Leipsic, 1749, 4 vols. fol.; *Primæ lineæ isagoges in eruditionem universam*, Leipsic, 1784, 2 vols. 8vo; *Opuscula*, Breslau, 1743–45, 8 vols. 8vo. A collection of his letters (*Thesaurus epistolarum Gesneri*) was published by Klotz, Halle, 1768. D. Aug. 4, 1761. (See CREUZER, *Gesch. der Class. Philologie; Narratio de J. M. Gesnero*, in ERNESTI'S *Opuscula.*) H. DRISLER.

Gesner, or **Gessner** (SALOMON), b. at Zürich Apr. 1, 1730; author of *Daphnis* (1754); *Inkle und Yarico; Idyls* (1756), and other poetical works; *Der Tod Abels* (1758, a prose poem), besides dramas, tales, etc. His etchings are for the most part very fine, and he had a good reputation as a landscape-painter. D. at Zürich Mar. 2, 1788.

Gesner, von (CONRAD), M. D., b. at Zürich, Switzerland, Mar. 26, 1516, of a family which subsequently produced many learned men; studied at the leading universities of Europe, and became a physician and professor in his native town; author of a very large number of learned works, of which *Bibliotheca Universalis* (1545–48), an important bibliographical treatise; *Catalogus Plantarum* (1542); *Historia Animalium* (5 books, 1551–87); *De Raris Herbis* (1554), are noteworthy. D. Dec. 13, 1565, and was for many years considered a high authority in botany, zoology, etc.—JOHANN VON GESNER, M. D. (b. at Zürich Mar. 28, 1709; d. Mar. 28, 1790), was also a prominent physician, and a leading writer upon botany, physics, and mathematics.

Gesneria'ceæ [from *Gesneria*, one of the genera], a natural order of exogenous herbs and shrubs, mainly tropical, often parasitic or epiphytic, and South American, although one sub-order or tribe is Asiatic and Polynesian. Some are handsome greenhouse plants, and a few yield useful dyes or fruits. Neither the U. S. nor Europe have any plants of the order.

Ges'ta Romano'rum, one of the oldest mediæval collections of pious legends, designed for the edification of the monks and clerks. It was compiled probably by one Elinandus at a very uncertain date, and moral reflections were interpolated by Peter Berchorius (d. 1362), a Benedictine of Poitou. It was written in Latin, but translated into most of the vulgar tongues of Europe, and down to the revival of learning was extensively read. Many of the legends are told with charming simplicity. Richard Robinson's translation (1577) is incomplete; Charles Swan's (1824, 2 vols.) has copious notes.

Gesta'tion [Lat. *gestatio*, from *gesto*, to "carry;" Fr. *gestation;* It. *gestazione;* Span. *gestacion;* Ger. *Trächtigkeit;* Gr. κύησις; syn. utero-gestation], the carrying of the young animal by the mother up to the time of its birth. This being effected by the uterus, or womb, occurs only in the MAMMALIA (which see), since the females of that class alone possess that organ. Gestation begins with conception, and is brought to an end by parturition, and includes the progress of the young animal in development throughout this period. Gravidity, or pregnancy, though of precisely corresponding duration, refers to the condition meanwhile of the mother alone. In birds and other oviparous animals the germ is expelled from the body of the female

as one of the constituents of the egg, and subsequently undergoes further development during incubation until the young is hatched. In the Mammalia the young animal—called the embryo in the human species during the first four months, and afterwards till birth the fœtus—is not separated from the mother till so far developed as to be capable of at once maintaining life independently of her.

The *fecundity* of animals, or their capability of bearing young, depends both on the frequency of gestation and the number produced at a birth; both of which factors vary inversely with the size of the animal and the duration of gestation, as a general rule. The elephant, camel, and horse very seldom produce more than one at a time; the lion, one, more often two or three, sometimes five or more. In these animals also gestation occurs only at comparatively long intervals, while by the dog, cat, and rabbit from six to ten or more are produced at a litter, and several times a year. Gestation, however, occurs far less frequently in animals still in the wild state than in the same when domesticated. Pigeons breed in the former state but twice a year; in the latter, six, and sometimes even nine, times. The fecundity of the domesticated rabbit (*Lepus cuniculus*) is truly astonishing. Since it begins to breed at six months, and has seven litters a year, each of from four to twelve, or even more, it was calculated by Pennant that the descendants of a single pair of rabbits would, without interference, amount in four years to 1,274,840. Fecundity increases within certain limits with the animal's age. The elk and bear produce but one at first, but afterwards two at a time, and lastly again but one. The young hamster produces only three to six at a litter—that of a more advanced age, eight to sixteen. The same is true of the sow. (*Burdach.*) In the human species the first is rarely a twin birth, especially if the mother be quite young; and although the maximum fecundity of woman is attained at twenty-five or twenty-six years, almost all the cases of triple, quadruple, and quintuple births have occurred after the age of thirty. In a remarkable instance which occurred in the city of New York the mother had twelve children within four years after her second marriage, at four births, there having been twins at the first, triplets at the second and third, and quadruplets at the fourth. The first (twin) birth occurred at the age of thirty-five; she had previously given birth to seven children, one only at a time. A still more remarkable case occurred in Mercer co., Pa., in 1816, ten children having been born within twelve months—five at each of two births. The mother died about a year after the second birth, but meantime gave birth to twins; or twelve children in twenty months. She was thirty-seven years old at her death. The *fertility* of animals refers to the actual number of births, independently of the capability of bearing, and is the product and measure of their fecundity.

The *duration* of gestation varies in different animals with their size and the degree of development of their young at birth, both of these influences being, however, modified by the animal's habits. It is shorter in carnivorous than in herbivorous animals of similar size, since the greater activity of the former would be essentially curtailed by a prolonged gestation and a corresponding increase of size and weight. Hence, also, their young are less developed at birth; the eyelids, for example, not being yet separated, and therefore the eyes not opening for several days afterwards. A very remarkable example of imperfect development at birth is presented by the kangaroo. The young animal is expelled from the uterus at the end of thirty-nine days, while still less than half an inch long, and in a gelatinous and embryonic condition, and then placed in a little pocket formed by a fold of skin in the inguinal region, where it remains, attached to a teat, until so far developed as to be capable of living when separated from the mother. The animals next to be named have the following periods of gestation: (1) *Herbivora.*—The elephant, 20 or 21 months; the giraffe, 14 months; dromedary, 12 months; buffalo, 12 months; ass, 12 months; mare, upwards of 11 months; the tapir, between 10 and 11 months; rhinoceros, 9 months; the cow, 9 months; many of the larger deer, over 8 months; reindeer, 8 months; sheep and goat, 5 months; the sow, 4 months. (2) *Rodentia.*—The beaver, 4 months; dormouse, 31 days; rabbit, 30 to 31 days; squirrel and rat, 28 days; guinea-pig, 21 days or less. (3) *Carnivora.*—The bear, 6 months; lion, 108 days (Van der Hoeven says 3 months); the puma, 79 days; the fox, wolf, and dog, 62 or 63 days; the cat, 55 or 56 days. (4) *Marsupialia.*—The kangaroo (the largest), only 39 days; the opossum, 26 days. (5) *Cetacea.*—The Greenland whale, about 10 months. (6) *Quadrumana.*—The most common duration for the varieties of monkeys is 7 months, and they produce one, and sometimes two, at a birth.

It was erroneously claimed by ancient writers that every animal has a fixed period of gestation except the human female. The duration now generally accepted for her is 280 days from the termination of the last preceding menstrual epoch, and 275 days after insemination. But the former is merely an average statement. The somewhat shorter duration of a first gestation has long been a popular idea, and has recently been proved by statistics, but in case only of young mothers. Its increase with the age probably does not, however, continue after twenty-seven to twenty-nine years. The length and weight (size) of the child is also found to increase with the mother's age up to the limits just mentioned, while the number of the birth after the first has no influence in this respect.

Gestation may terminate prematurely from violence or otherwise, such an accident being termed an abortion if occurring before the beginning of the fifth month, and premature delivery if later, but still before the average time. If parturition occurs after the end of seven months (or 210 days) the child will probably live, the probability increasing the more nearly the average term is completed. Children born previously to seven months have also lived, but only in a few well-authenticated instances. Dr. Carpenter (*Human Physiology*) quotes two cases occurring at 27 weeks and less, and one of even 22½ weeks. Dr. Barker of Dumfries gives a case of birth on the 158th day (22�4 weeks). The child grew to puberty. In the celebrated Kinghorn case the child was born 174 days (24⅚ weeks) after marriage, and lived more than eight months. The majority of the medical witnesses considered the child to have been begotten in wedlock. English law allows a child of seven months after marriage to be legitimate if former access can be denied; a circumstance that can seldom happen. According to the French code, a child is legitimate if born as late as 180 days after marriage.

The proposition that human gestation may be prolonged for several days, or even weeks, beyond the average duration, was by some of the older writers pronounced absurd; and a discussion was continued for a long time, and not without acrimony, between Bohn, Hebeinstreit, Bouvard, Mahon, Louis, and others on the negative side, and Zacchias, Alberti, Haller, Lieutaud, Bertin, Roussel, Vicq d'Azyr, A. Petit, and Lebas on the affirmative. (1) The presumption derived from comparative physiology is very decidedly in its favor. M. Tessier, whose observations were continued through a period of forty years with every precaution against inaccuracy, found that of 577 cows (the average term being 280 days), 20 calved beyond the 298th day, and some of these even as late as the 321st day—an excess of nearly six weeks. Of 447 mares (the average period being 335 days), 42 foaled between the 359th and the 419th day; the maximum protraction being 84 days, or one-fourth of the usual term. Of 912 sheep (average being about 151 days), 96 yeaned beyond the 153d day, and 7 of these went to the 157th day—an excess of 6 days. Of 161 rabbits (average about 30 days), 25 littered between the 32d and 35th day, the greatest protraction being one-sixth of the whole period, and occurring also in nearly one-sixth of the total number. Even in the incubation of the common hen, Tessier found not infrequently a prolongation of 3 days, or one-seventh of the whole period. Earl Spencer, accepting 284 or 285 days as the average term for the cow, found the two longest terms in 764 cows to be 306 and 313 days; and also that of 106 calves born between the 290th and the 300th day, 74 were males, while all born after the 300th day were females. He also found that in 75 instances of the offspring of a particular bull, the average of gestation was prolonged from 284 to 288½ days. Mr. C. N. Bement found the average in 62 cows to be for males 288 days, and for females 282 days, the longest period to be 336 days, and the shortest 213 days. (*Am. Journal of Med. Sciences*, Oct., 1845.) The extremes of duration for the cow being thus found by these independent observers to be 321, 313, and 336 days, it might be expected that a similar prolongation is possible in human gestation, which is so nearly of the same average duration. (2) And facts, though few in number up to the present time, demonstrate a possible prolongation at least beyond ten months. Instances frequently occur to obstetricians of parturition 300 days or more after the cessation of the last preceding menstrual flow. But such cases are of no value in the present inquiry, since it is insemination, and not menstruation, that determines the time of conception, and therefore the beginning of gestation; and that may have occurred even 20 days after the last monthly period, and just before the next was due; and gestation therefore may have been prolonged but slightly, or not at all. Obviously, the only reliable cases are those of pregnancy from a single coitus or from connection on a single day; and in such, all the time beyond 275 days is to be regarded as a prolongation beyond the average duration. Of 25 cases given by Dr. Reid, the maximum of duration was 293 days; and of 50 reported by Dr. Montgomery, it was 297 days. The last case would have been at least 302 days after the

end of the last menstruation, as the calculation is usually made, and might possibly have been even 20 more (317 days), as before explained. The writer can also add a case of birth 301 days after insemination by a single coitus. Dr. Hodge mentions a case of gestation certainly continuing 302 days, and probably not less than 322 to 327 days. The French code is therefore not too indulgent in admitting the legitimacy of children born within 300 days after the separation of the parents. The Scotch law does not declare a child a bastard unless born later than ten months after the death or departure of the husband. English law is still more complaisant in deciding that a child born within eleven months after the death or the possibility of access of the husband shall still be regarded as his. In the Gardner peerage case, however—which was tried in London in 1825–26—it was decided that a child born 311 days after separation from the husband was illegitimate; but mainly, if not entirely, on the ground that the mother had lived in open adultery after the separation. Twelve of the seventeen distinguished medical witnesses gave the opinion that natural gestation might have been prolonged to this extent. (*Lancet*, vol. x. p. 289, 1826.) It has been decided in this country that a child born 317 days after separation was legitimate. (*Commonwealth* vs. *Porter, Am. Journal of Med. Sciences*, 1845.) E. R. PEASLEE.

Get'æ [Gr. Γέται], the ancient name of the Dacians (*Daci*). (See DACIA.) The old belief, that the Getæ were of the same race as the GOTHS (which see), is not now generally received.

Gethsem'ane [Gr. Γεθσημανῆ; Heb. *Gath* and *Shemen*, "olive-press"], a garden, or orchard rather, at the foot of the Mount of Olives, where our Lord spent a part of the night preceding His crucifixion, and which had been a place of frequent resort for Him and His disciples (John xviii. 2). The spot now shown by Latin monks is a short half mile from Jerusalem, nearly opposite the Golden Gate, just across the Kedron, at the angle made by the two paths that lead up over Olivet. The garden is nearly square 160 feet from N. to S. and 150 from E. to W., contains eight large olive trees, which are believed to be at least 1200 or 1300 years old, and, since about 1840 or 1850, has been enclosed by a high stone wall. The actual spot, in Dr. Robinson's opinion (1838), may have been a little farther up the hill. Dr. Thomson (1858) pronounces in favor of a more secluded locality several hundred yards to the N. E. of the present Gethsemane. R. D. HITCHCOCK.

Get'ty, tp. of Stearns co., Minn. Pop. 366.

Getty (GEORGE WASHINGTON), b. in Georgetown, D. C., Oct. 2, 1819; graduated at West Point Military Academy July, 1840; entered the army as second lieutenant of artillery; promoted to be first lieutenant 1845, captain 1853, major 1863, colonel 37th Infantry 1866, and transferred to 3d Artillery 1871; served on the northern frontier during the Canada border disturbances 1840; in garrison 1841–46; in the war with Mexico 1847–48; engaged in the battles of Contreras (brevet captain), Molino del Rey, Chapultepec, and the capture of the city of Mexico; in Florida 1849–50 against hostile Seminole Indians; in garrison 1851–56; on frontier duty 1857–61. During the civil war he served with the Army of the Potomac in the Virginia Peninsula campaign, 1862, as lieutenant-colonel and A. D. C., being engaged at Yorktown, Gaines's Mill, Malvern Hill, etc., and in Maryland at South Mountain and Antietam; appointed brigadier-general of volunteers Sept. 25, 1862, and engaged in the battle of Fredericksburg, Dec., 1862. In the Richmond campaign of 1864 he was severely wounded in the battle of the Wilderness, May 5; called to aid in the defence of Washington (July, 1864) and pursuit of the Confederate forces to Shenandoah Valley, he was engaged in the battles of Opequan, Fisher's Hill, and Cedar Creek, and subsequently with the Army of the Potomac from the siege of Petersburg to the final surrender of Gen. Lee, Apr. 9, 1865. For gallant conduct in battles during the war he was brevetted lieutenant-colonel, colonel, brigadier-general, and major-general U. S. A., and commanded various military districts till mustered out of volunteer service Sept., 1866; at present is in command of his regiment, the 3d Artillery. G. C. SIMMONS.

Get'tysburg, a v. of Darke co., O. Pop. 228.

Gettysburg, post-b., cap. of Adams co., Pa., is situated on the southern border of the State, 8 miles from "Mason and Dixon's line," 28 miles W. by S. of York, and 25 E. by S. of Chambersburg. The Susquehanna Gettysburg and Potomac R. R. is completed to this place. Gettysburg is the seat of Pennsylvania College, a Lutheran theological seminary, and minor educational institutions; has an orphans' homestead, 7 churches, 2 national banks, 2 newspaper-offices, 7 hotels, and a number of stores. Carriage manufacturing is a leading business here, and two granite-yards also employ a considerable number of hands. A passenger railroad connects the town with the Gettysburg Springs Hotel and Katalysine Spring, 1¼ miles to the W. The battle of Gettysburg occurred in and around this town July 1, 2, and 3, 1863. The National Cemetery at Gettysburg contains the bodies of 3580 Union soldiers, with a central monument costing $50,000, and a bronze statue of Gen. Reynolds costing $13,000. The Confederate dead have nearly all been exhumed from the battle-field and taken to Southern cemeteries. Pop. 3074. (See GETTYSBURG, BATTLE OF.) H. J. STAHLE, ED. "GETTYSBURG COMPILER."

Gettysburg, Battle of. The campaign which culminated at Gettysburg was inaugurated at Chancellorsville, and its final result was due in no small degree to the loss of the flower of the Confederate infantry and the fall of one of their most formidable leaders—"Stonewall Jackson." The two armies after that drawn battle remained in position on the opposite shores of the Rappahannock during the ensuing month (May, 1863). By an able manœuvre, Gen. Lee succeeded in blinding his adversary, and gaining, practically, a week's march. His movement was only revealed, too late for opposition, when the cavalry of Pleasanton, on the 9th of June, struck the enemy's columns at Beverly Ford and Brandy Station. On the 13th of June the division of Ewell was before Winchester, routing, on the 15th, the defending force under Milroy, and crossing the Potomac at Williamsport. Traversing on the 21st and 22d the narrow territory of Maryland, and pushing forward into Pennsylvania, one of his brigades (Rode's) was before Harrisburg and another (Early's) opposite Columbia. The corps of Longstreet and Hill followed the movement of Ewell, crossing the Potomac on the 24th and 25th, reaching Chambersburg on the 27th.

On the 14th and 15th, Gen. Hooker moved towards Centreville, crossing the Potomac on the 26th and 27th near Edwards' Ferry, reaching Frederick City on the latter day. On the same day he relinquished to Gen. Meade the command of the army. His demands, the rejection of which led to his resignation, are believed by the writer to have been just and his plan of operations judicious. The issue at Gettysburg is believed to have been but a natural sequence of them, and he well deserved the expression of thanks subsequently voted by Congress "for the skill, energy, and endurance which first covered Washington and Baltimore from the meditated blow of the advancing and powerful army led by Gen. Robert E. Lee."

The command of the Army of the Potomac was assumed on the 28th by Maj.-Gen. George G. Meade. Such a change of commanders on the eve of a most momentous conflict has scarcely a parallel in the annals of war. Wherever anything similar had occurred (*e. g.* Borodino and Dennewitz) the experience presented no reassuring examples. The relative positions of the antagonistic forces at this critical moment of change in the command should be alluded to. Taking Gettysburg, the actual theatre of conflict from which radiated the roads on which the troops were advancing or moving, as a central pivot, the opposing forces were scattered and interlaced over an elliptical area whose longest diameter N. and S. was about 60 miles. Lee, with Longstreet and Hill, was about 25 miles to the W. N. W.; Ewell, about 30 miles N. N. W.; Early, 30 miles to the E. Stuart's cavalry crossed the Potomac at Seneca, near the same place where Hooker had passed, and pursuing a devious course—so much so that for a time the Union army was interposed between Lee and his cavalry—reached Hanover, about 20 miles E. of Gettysburg, on the 30th, where, to his surprise, were the cavalry of Pleasonton, which had moved up from Frederick on the 28th, and had no idea that the enemy were anywhere near them. Meanwhile, Gen. Buford (up to his death undeniably the best of our cavalry commanders proper), charged with the duty of covering the left of the Union army, first followed the track of Lee up the Franklin or Cumberland Valley, then turned sharp to the right, crossed the South Mountain by the Monterey Pass, and at daylight of June 30 fell upon another stray force of Pettigrew's Confederate infantry, near Fairfield, 10 miles S. E. of Gettysburg. Both combatants recoiled, the Confederate officer falling back on his superior, Heth, at the head of Lee's main column pushing down the Chambersburg pike beyond Cashtown, and within a few miles (perhaps five) of Gettysburg. Buford on his side retraced in some measure his steps, moved to Emmittsburg, and thence marched N. by E. to Gettysburg. The next morning (July 1) the two bodies which had collided at dawn of June 30, near Fairfield, met again towards noon on Willoughby's Run, some 3 miles N. W. of Gettysburg. Here, to Buford's tenacity in holding with 4000 cavalry over 30,000 of all arms, the country owes the battle-field of Gettysburg, and made Buford (said his superior, Pleasonton) "the true hero of that battle."

Neither Lee nor Meade intended to fight where they

fought, nor as they did. Lee had promised his lieutenants not to risk the offensive on loyal ground, while Meade had determined to take up a defensive position on Pipe or Big Pipe Creek. The "strategy of Providence," however, which, after all, determines the fate of wars, campaigns, and battles, had decided otherwise.

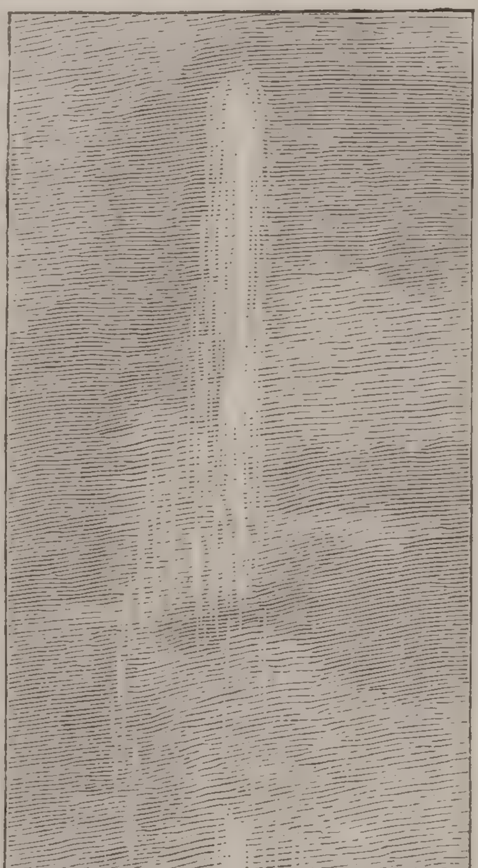
On June 30, Meade's plan, predicated on a defensive battle along Pipe or Big Pipe Creek, was being carried out. The 6th corps, forming the right wing of his army, was ordered N. E. to Manchester; the 2d corps, N. N. E. to Taneytown; the 12th and 5th corps, forming the centre, in a general direction due N.; the 1st, 3d, and 11th corps, composing the left wing, under Reynolds, likewise N., towards Gettysburg. Space prevents a more detailed consideration of the preliminary movements. Suffice it to say, that before noon of the 1st, about the same hour (11 A. M.) that the battle of Waterloo commenced, Buford was checking the first onset of the Confederates on Oak or Seminary Ridge, towards Willoughby Run, to the W. of Gettysburg. Gallantly coming to his support, while reconnoitering Reynolds was killed in a grove on Oak Ridge, where the bloodiest portion of the first day's collision was fought out. The 11th corps followed the 1st into action on its right to the N. of Gettysburg; and had it not been for the prescience of a subordinate, Howard's faulty dispositions would have lost us the magnificent position which enabled the Union forces to foil Lee. Summoned to the field of decision by the appealing voices of cannon, the columns of Early and Rodes, by a concentric movement from the N. and N. E., fell, while the corps of Hill was attacking from the N. W., upon the 1st and 11th corps, overlapping them, and forcing them back, after vain prodigies of valor, upon the position which became that of the battle—Cemetery Ridge. The afternoon brought Hancock, whose aid and personal influence gave stability to our new position and confidence to our forces. The Confederate commander, in arresting his attack, threw away his best chances of victory. Like Napoleon after Bautzen, he postponed until the morrow ("everything to-morrow") all that was the imperative question and duty of to-day. He himself actually neutralized all the advantages that his lieutenants had won. The battle of Willoughby Run, of Oak or Seminary Ridge, was over; the first day of Gettysburg had been fought out. The fighting had been disadvantageous to the Union forces, but darkness nevertheless found them established in an impregnable position. Night brought the 3d corps, under Sickles, and the 12th, under Slocum. They took position on the left of the 1st and right of the 11th corps, and the horseshoe form of Gettysburg was occupied. Considering this position in its similitude to a horseshoe, the Round Tops constituted a heel-calk to the left and S. W.; Wolf's Hill to the right and S. W. the toe-calk was at the Cemetery overlooking Gettysburg; the frog was Power's Hill. The opposing forces did not materially exceed 75,000 on either side. The preponderance of force was perhaps 5000 in favor of the Confederates. Both the Union and Confederate cavalry were on the wings. Longstreet's corps (Lee's right) faced the Union 3d and part of the 1st corps, reinforced in the course of the afternoon and towards night by the 5th and 6th. Hill's corps (Confederate centre) fronted the Union 2d and part of the 11th, Ewell's corps (the Confederate left) the right of the 11th, Wadsworth's division of the 1st, and the 11th.

A skirmish about noon for the possession of some cattle brought on the terrible engagement of the second day. It was doubtless the intention of the Confederate commander to turn the Union left. This movement, if successfully carried out, would have neutralized all the magnificent advantages of the Union position. To frustrate this attempt, Sickles advanced his line, so that it constituted a great salient angle, with its left in the Devil's Den, stretching even across Plum Run to the granite spur of the Round Top. Its apex was at the blood-drenched Peach Orchard, and its right in echelon to the front and left of the Union centre, whose batteries protected what has been erroneously styled a *gap*. This disposition, severely criticised by the Union commander, as well as by Gen. Halleck, was, after a personal examination of the ground, pronounced "right" by Gen. Grant; and the writer, after similar examination and review of the testimony, maintains, and has ever maintained, the same. The 3d corps, after heroism unsurpassed, as at Hazel Grove, on *the mighty* (third) day of Chancellorsville, was shattered and forced back, fighting grandly to the last. Sickles, holding his devoted men up to their terrible work, lost his right leg. Thanks to the prompt arrival and support of the 5th corps, Crawford leading, bearing the colors of the 1st Pennsylvania Reserves — like Milaradowitch and Grouchy at Nevi (1799) or the archduke Charles at Aspern (1809)—to the indomitableness of Humphrey's, and the unrivalled fighting qualities of the 3d corps, the Round Tops, the key of our position, was preserved. Meanwhile, there had been some hard fighting on the Union right. The Confederates had made a vain attempt to storm Cemetery Ridge, and had gained some slight advantage towards Rock Creek. The moon arose upon the fearful struggle, but nevertheless, when our men sank down to their rest the question was decided that if Lee counted upon victory, he had to win it by a grim aggressive, with no points in his favor. The morning of the 3d of July dawned upon a renewal of the struggle on the Union right, where the Confederates had gained a slight lodgment within the Union line of defence on Culp's Hill. This operation had commenced on the 2d, about 6 P. M., with a simultaneous attempt at this point and along the Baltimore turnpike. The fighting was still carried on by moonlight, and only ended with absolute darkness. Owing to the withdrawal of the greater part of the 12th corps, the Confederates, easily repulsed on Cemetery Ridge, made good a lodgment on Culp's Hill. With the return of that portion of the 12th corps which had been sent on the previous evening to strengthen the menaced Union left, commenced the process of recovering what had been lost. The consequent fighting was not very hot, and ended from 10 to 11 A. M. with the expulsion of the Confederates from every inch of ground which they had won. The last sputtering skirmish-fire at the base of Culp's Hill ceased about noon. Then came an hour's ominous silence, which had become positively oppressive when, about 1 P. M., 150 guns opened fire and tortured the air for the subsequent two hours. Neither this prolonged bombardment, nor the responsive 80 guns from the Union lines, produced any material effect. Doubtless supposing that this cannonade had swept away opposition, or shaken at least the *morale* of the Union defensive, Lee launched 15,000 to 18,000 of his best troops against the Union centre. These, in column, had for their indicative objective the umbrella-shaped clump (since become historically famous) of trees at the mid-centre of Cemetery Ridge, in the same way that Ney at Bautzen, by written order from Napoleon, directed his march upon the steeple of Hochkirch. Much has been said in praise of this advance of over a mile up a gentle slope, the very best ground for the defensive sweep of artillery. This assault failed, and the BATTLE OF GETTYSBURG had been fought. The writer is not permitted to venture upon debatable ground, nor to say whether Meade failed to gather, by a vigorous pursuit to the Potomac, the full fruits of the campaign. The lamented President Lincoln is said to have made one of his forcible comments, that "Providence had twice" (*i. e.* once after Antietam) "delivered the army of Northern Virginia into our hands, and with such opportunities neglected we ought scarcely to hope for a third chance." Gen. Lee entered Pennsylvania (according to the estimate of Gen. Humphreys) with 85,000 infantry, 8000 cavalry, and a due proportion of artillery. This is a low estimate, for there is reason to think he mustered over 100,000 men, not over 83,000 of which were in the actions of the 1st, 2d, and 3d. Straggling on both sides was enormous. Humphreys states that the Army of the Potomac comprised 70,000 infantry and 10,000 cavalry, with 300 guns. Meade certainly did not bring into action four-fifths of this force, and the 6th corps was comparatively fresh as to fighting on the 4th. Lee's losses were 18,000 killed and wounded, and 13,600 missing, a large part of the latter prisoners; making a total loss of 31,600. Our losses were 16,500 killed and wounded, and 6600 missing, chiefly prisoners captured on the first and second days (allowed to be carried off with the defeated army); making a total loss of not less than 23,000. J. WATTS DE PEYSTER.

Gey'er (HENRY SHEFFIE), b. at Frederick, Md., Dec. 9, 1790; was admitted to the bar 1811; an officer during the war of 1812–15; removed to St. Louis; was the first Speaker of the Missouri house, and twice re-elected; published *Statutes of Missouri*, 1818; one of the framers of the code of 1825; declined the secretaryship of war 1850; U. S. Senator 1851–57. D. at St. Louis Mar. 5, 1859.

Gey'ser [Icelandic, *geysa*, to "gush forth"] is the name given, generally, to a kind of water-volcanoes or springs of boiling water found in Iceland, but applied more especially to one single spring, the Great Geyser, situated 70 miles from Reikjavik, in the neighborhood of the volcano of Hekla. On a low plateau of trap formation, and of an area of half a square mile, a great multitude of these hot springs gush forth, as if a powerful subterranean river had been put over fire here and brought to boil. Many of them are small, and remind the spectator of the trickling of water from an overboiling tea-kettle, but two of them, the Strokr (the "Churn") and the Great Geyser, are phenomena of a most imposing character. The mouth of the Great Geyser consists of a mound 15 feet high, whose top contains a basin 4 feet deep and 72 feet in diameter, which is formed of a siliceous incrustation, a deposit of the silica contained in the water of the spring. This basin is generally filled with

hot water, 188° F. at the edge and 221° at the centre, where it wells up through a shaft 8 feet wide and 83 feet deep. When the spring is in a quiet state, the water ascends slowly up the shaft, is cooled off in the basin, and discharges itself through a small aperture in the incrustation, winding its way down the plateau. But every four or five hours a subterraneous noise is heard like the rumble of a train of artillery over a pavement. The noise increases rapidly, an ebullition takes place in the basin, and for some minutes jets of boiling water several feet high are thrown up through the shaft. Once a day, or about every 30 hours, these eruptions assume astonishing dimensions. The rumble becomes a terrific thundering, the jets ascend 100 feet, stones even are sometimes thrown up, and such volumes of vapors are discharged as to fill the whole atmosphere and form clouds which shut in the horizon on all sides. After such an eruption the basin is empty for several hours. The Strokr is only 100 yards distant from the Geyser. It is smaller, calmer, more easily accessible, and, although it is somewhat different from the geyser, both in form and manner of working, it bears the same general character. (For an explanation and a more detailed description of this remarkable phenomenon, see *Travels in Iceland*, by Sir George Mackenzie (1810); Bunsen in *Tracings of Iceland*, by R. Chambers (1855); *Island; Det 18 Aarhundrede*, by M. Stephenson (1808); *Island fra et lagevidenskabeligt Synspunkt*, by P. Schleissner (1849).) Outside of Iceland there are geyser-fields in New Zealand, Formosa, and the U. S. In this country the most important are in the National Park, and principally in Wyoming Territory; for the so-called geysers of California hardly deserve the name, while some of the National Park exceed in power and grandeur any elsewhere known, several of the springs occasionally throwing up streams of water over 200 feet high. (For a description see article Yellowstone Valley, by Prof. F. V. Hayden, M.D., M.N.A.S., in this work.) The principal geysers of New Zealand are those of the northern island. They are but little inferior to those of the U. S. Little is known of the geyser-fields of Formosa, but their springs would appear to be inferior in power to those previously noticed; but they are in principle the same—thermal springs whose waters are from time to time expelled in a jet by the action of superheated steam.


Giant Geyser, National Park, U. S.

Ghaut, or **Ghât** [Eng. *gate*], in India, (1) a pass through a mountain-range; (2) a landing-place or stairway for people to use in going on or off boats in the rivers of India. These ghauts are used also as bathing-houses, and as places of rest and recreation. Some of them are architecturally fine structures.

Ghauts, The, two chains of mountains in the peninsula of Hindostan, running respectively along the eastern and western coasts, joining each other in Cape Comorin, and enclosing on the two sides the table-land of the Deccan. The Western Ghauts form a distinct range, though interrupted by the gap of Palghatcheri, of a height varying between 4000 and 7000 feet. Their gold-mines have long been worked, but in 1874 gold-bearing strata of extraordinary richness were discovered. The W. side of these mountains is very steep, but towards the interior they slope in gentle undulations. The Eastern Ghauts are lower, their average height being only 1500 feet; they are often interrupted, and almost disappear before they reach Cape Comorin.

Ghazepoor′, town of British India and the capital of the province of Ghazipoor, is situated on the left bank of the Ganges. Rose-culture and the manufacture of rose-water and rose-oil furnish the most conspicuous articles in its bazaars. Pop. 38,573.

Ghee [Hindoo, *ghi*], a variety of butter prepared in India from the milk of the buffalo or the cow. The milk is boiled, then cooled, curdled with sour milk, churned, and after the butter comes it is put aside till it begins to grow rancid; then boiled, mixed with sour milk (*dhye*), salt, and sometimes with aromatics, and is then ready for use. It has a strong and disagreeable smell and flavor, but is very extensively used in India.

Gheel, town of Belgium, in the province of Antwerp. Since the seventh century this town and its surroundings have been inhabited by a great number of idiots and lunatics, who at first sought a cure here from the shrine of St. Dymphnea, and later from the peculiar and often advantageous treatment they underwent in the houses of the citizens and farmers. The establishment is now under government control. Pop. 11,614. The Gheel system of treatment for lunatics has of late attracted much attention elsewhere.

Ghent, or **Gand,** city of Belgium, and the capital of the province of East Flanders, is situated at the confluence of the Scheldt and the Lys, and traversed with numerous canals and branches of the rivers, which divide the city into twenty-six islands, connected with each other by about 300 larger and minor bridges. The general character of the city is that of a town of the Middle Ages which has partially become modern; dark and narrow streets, with singular houses towering like castles, alternate with open and beautiful quays lined with elegant edifices. The best view of the city may be had from the Belfry (Beffroi), which occupies a central position, is 396 feet high, built 1183–1339, and adorned on its highest point by a golden dragon, which the crusaders brought hither from the church of St. Sophia in Constantinople. Other interesting edifices are the cathedral, one of the most splendid church edifices of Belgium, the interior covered with marble, the doors cast in bronze, the crypt built 941, the choir and the chapels 1228; the church of St. Nicholas, a Gothic structure of the fifteenth century; the church of St. Michael, also of the fifteenth century, with an unfinished tower; the church of St. Peter, restored in 1720, and containing many fine pictures; and the ruins of the chapel of St. Macarius, belonging to the old citadel. A new citadel, built between 1822 and 1830, stands on the Blandinusberg, to the W. of the city. The town-house, standing near the Beffroi, is a very interesting structure; its front, finished in 1200, is very rich in its ornamentation; in the hall the Confederation of Ghent was signed in 1576. The university, situated on the other side of the Beffroi, was built in 1818 by Roelandt, and contains a magnificent commencement-hall, a rotunda with room for 1700 persons, and lighted from above through a cupola. The Bourse occupies the lower part of the Palace of Justice, built in 1844 by Roelandt, and presenting an elegant peristyle of the Corinthian order; opposite stands the beautiful theatre, built in 1848. The Beggynhof, at the Bruges gate, consists of 400 small houses, 18 convents, and 2 churches, and is inhabited by about 800 Beguines. Ghent also contains 20 monasteries. The penitentiary, an octagonal building, with nine inner yards, and cells for 2600 convicts, is a model establishment of its kind. The meat-market, built in the fourteenth century; the Prinzenhof, where Charles V. was born; the old Audeburg and the s'Gravencasteel (Château des Comtes) are also interesting buildings. Among the public places the most remarkable are—the Vrydag-markt, where the "Dulle Griete" ("Crazy Margaret") lies, a giant cannon from the fifteenth century, and where the executions under the duke of Alva took place; and the Kauter, a parade-ground and flower-market, where Van Eyck and Jacob van Artevelde lived. Ghent has a university, a celebrated library of 60,000 volumes, an excellent botanical garden, a conservatory of music, and numerous other scientific and benevolent institutions. With respect to its manufactures, Ghent does not occupy as prominent a place as it formerly did, yet its spinning, weaving, and cotton-printing industry, and its manufactures of leather, sugar, and machinery, are considerable, and its horticulture is carried on on an immense scale. Its commerce is extensive, and its harbor and shipping facilities excellent; vessels drawing 18 feet can get close to the city. Ghent is a bishop's see.

In historical respects Ghent is a famous place. In 949 the emperor Otto the Great built a castle in order to defend the city against the counts of Flanders; nevertheless, in 1000 the counts seized the city. In the fourteenth century Ghent, under Jacob van Artevelde, waged violent wars against Louis of Flanders and the dukes of Burgundy. It

was at that time at the culmination of its prosperity. It mustered an army of 50,000 men; the contingent of the wool-weavers alone was 18,000 men. In the fifteenth century it fought obstinately against Charles the Bold, but under the emperor Charles V. its splendor began to wane; it was conquered by the emperor in 1540, and heavily taxed. In 1576 the "Pacification de Gand" was concluded in Ghent, a confederation between Holland, Zealand, and the southern provinces of the Netherlands against Spain. It was conquered in 1584 by the duke of Parma, and in 1678 by Louis XIV. of France, who, however, restored it to Spain. In 1713 it fell to Austria. Several times it was taken by the French, but by the Peace of Paris in 1814 it was incorporated into the kingdom of the Netherlands; on the establishment of the kingdom of Belgium in 1830 it became a Belgian possession. Pop. 127,333. A. NIEMANN.

Ghent, post-v. of Carroll co., Ky., on the Ohio River opposite Vevay, Ind. Pop. 464.

Ghent, tp. and post-v. of Columbia co., N. Y., 125 miles N. of New York, on the Harlem and the Boston and Albany R. Rs. Pop. 2886.

Ghent, Treaty of. This treaty, between the U. S. and Great Britain, negotiated on our part by John Q. Adams, Henry Clay, Albert Gallatin, and two other envoys at Ghent, was concluded Dec. 24, 1814, and the ratifications were exchanged Feb. 17, 1815. It put an end to the war which was begun by an act of the two Houses of Congress, signed by the President June 18, 1812. The leading provisions were—1st, restoration of all territory, places, and possessions taken by either party from the other during the war, except certain islands mentioned below. Public property remaining in such places at the time of ratifying the treaty was not to be destroyed or carried away, and the same engagement was made as to slaves and other private property (Art. I.). 2d, Article IV. provides the appointment of a commission to decide to which of the two powers certain islands in and near Passamaquoddy Bay belong; and if the commission should fail to come to a decision, the subject is to be referred to some friendly sovereign or state. 3d, Articles V.–VIII. provide for several commissions to settle the line of boundary as described in the treaty of 1783—one commission to settle the line from the river St. Croix to where the 45th parallel cuts the river St. Lawrence (called the Iroquois or Cataraqua in the treaty); another to determine the middle of the water-communications from that point to Lake Superior; and a third to adjust the limits from "the water-communication between Lakes Huron and Superior to the most north-western point of the Lake of the Woods." If either of these commissions should not make a decision, the subject was to be referred to a friendly sovereign or state, as before. 4th, Article IX. binds both parties to use their best endeavors to abolish the slave-trade, as being "irreconcilable with the principles of humanity and justice." The Treaty of Ghent is remarkable for omitting to provide for some important interests. The impressment of seamen, one of the main causes of the war, and the claims of the U. S. still to participate in the fisheries according to the provisions of the treaty of 1783, were passed over in silence; and no conclusion was reached touching the naval forces to be maintained by the two parties on the northern lakes, which were common to both parties.
T. D. WOOLSEY.

Gherar'di (BANCROFT), U. S. N., b. Nov. 10, 1832, in Louisiana; entered the navy as a midshipman June 29, 1846; became a passed midshipman in 1852, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866. He commanded the steamers Chocura and Port Royal (West Gulf blockading squadron) during 1863 and 1864, taking part in the latter vessel in the battle of Mobile Bay. His services in this action are thus highly spoken of in the official report of Capt. Thornton A. Jenkins, commanding the steam sloop of war Richmond: "I have the honor to report that, in obedience to general orders and plan of battle for attacking Fort Morgan and the rebel fleet, Lieut.-Com. Bancroft Gherardi, commanding the U. S. steamer Port Royal, reported himself with his vessel to me, ready for action, a little before daylight this morning (Aug. 5, 1864). The Port Royal was lashed on the port side of this vessel, with her stern pivot-gun sufficiently far aft of the quarter of this ship to enable it to be used against the enemy as effectively as one of my own broadside guns. To Lieut.-Com. Gherardi I am greatly indebted for his cool and courageous conduct from the moment the attack commenced to the time that his vessel was cast off, by my order, to go in chase of the enemy's three wooden gunboats, the Morgan, Gaines, and Selma. My orders on board of this ship to the helmsman, and to the officer stationed at the engine-bell, were repeated by him on board of his own vessel, and the soundings passed from his vessel to this with a coolness and clearness of voice that could not but excite my admiration. The after pivot-gun of the Port Royal (the only one that could be brought to bear upon the enemy's batteries from that vessel) was worked most effectively." FOXHALL A. PARKER, U. S. N.

Ghibellines. See GUELPHS.

Ghiber'ti (LORENZO), an Italian goldsmith and sculptor, lived and wrought in Florence from 1378 to 1455. He came from a family of goldsmiths; his father, a skilful worker in the fine metals, taught his son the arts of drawing, modelling, and casting. He was still young (but twenty-three) when he competed with the most illustrious sculptors of his time, Donatello and Brunelleschi being among them, for the honor of designing and executing a bronze folding-door for the Baptistery of San Giovanni, one of the two having already been made by Andrea Pisano. Donatello and Brunelleschi were alone ranked with Ghiberti, and they voluntarily confessed his superiority and withdrew. Twenty-one years the artist devoted to his task, and the door when finished was so beautiful that he was commissioned to execute another as companion to it. About an equal length of time was spent on the second, which was declared superior to the first, and pronounced by Michael Angelo worthy to be a gate to Paradise. A description of these exquisitely wrought gates cannot be given here, nor is there need, for their general design can be understood from the familiar plaster-casts, and the delicacy of the modelling and decoration, the wonder of grouping and perspective, are recalled by the photograph. These bronze gates have made Ghiberti's renown, casting into the shade other lovely pieces—a statue of John the Baptist outside of Or San Michele, two bas-reliefs on the baptismal font in the cathedral of Siena, the St. Stephen, the St. Matthew, and even the sarcophagus of St. Zenobius, in the S. Maria del Fiore—which share with the gates the praise of being the finest works of their kind in Italy. Ghiberti was an architect also, deemed worthy to be associated with Brunelleschi, and an excellent painter on glass. He was, too, a man of letters, author of treatises on Italian art, on proportions, and on sculpture. The first was published entire in 1841. The last was published in part. Lübke calls Ghiberti "one of the greatest sculptors in all ages." O. B. FROTHINGHAM.

Ghi'ka, the name of a princely family of the Danubian principalities, over which several Ghikas ruled as hospodars, and in which many of them held very high state offices. In 1657, George Ghika was first appointed by Turkey hospodar of the principalities, and after him eight other members of that family held the same princely office in Moldavia or in Wallachia. Since the beginning of this century, Alexander, Constantin, Demetrius, and John have been the most celebrated and the most active members of the Ghika family. They took part in all the conspiracies and political measures which finally brought about the fusion of the two principalities of Moldavia and Wallachia into a single state, now called Roumania, and they hold a large influence over the affairs of that country. FÉLIX AUCAIGNE.

Ghilan', province of Persia, on the north-western slope of the Elbrooz and along the Caspian Sea. The coast is swampy and bordered by sandbanks and lagoons, but as soon as the ground rises a little large fields of rice and sugar-canes appear, the former being raised in such abundance as to be used as food for horses. With the hills begin the forests—fruit trees, especially figs and mulberries, of a most luxuriant growth and intertwined by vines to the very top. After the forests follow the pastures, and over the whole rise the naked, snow-clad peaks of the Elbrooz. But this beautiful land, whose fertility is equalled by the vales of Hindostan only, is very unhealthy; and neither its area nor the number of its inhabitants is known.

Ghirlanda'jo (DOMENICO BIGORDI, or, as some say, CORRADI), a Florentine painter, called GHIRLANDAJO after his father, who derived the name either from the manufacture or the sale of children's garlands—whether in metal or not is doubtful. He was a goldsmith, and under him his distinguished son learned drawing and designing. Domenico was b. in Florence probably in 1449, and d. probably in 1498; the dates vary. As a boy he was remarkable for correctness of eye and hand, and used, says Vasari, to catch the likenesses of people as they passed by the shop. The chapels and churches of Florence bear testimony still to the originality, freshness, and delicacy, as well as to the exuberance, of his genius. The accuracy of his portraits, the freshness of his nature, the liveliness of his grouping, the unconventional ease of his treatment, attracted attention from the beginning. He painted men and women in the costumes of their time, discarded tinsel ornaments, gilded scrollwork, and plaster borderings, substituting in their place honest brush-work. The aërial perspective was so wonderful that he is credited with having been the discoverer of its laws. He painted in oil, but

chiefly in fresco, and very much in places exposed to the weather; which explains the ruinous condition of many of his pictures. When about thirty years old, Pope Sixtus IV. invited him to Rome to assist in decorating his chapel. Of his two pictures there, but one, *Christ calling Peter and Andrew from their Nets*, is preserved. Ghirlandajo painted in Pisa, Lucca, and Siena, but his best work is seen in Florence, especially in the Tassetti chapel, in the church of the Trinità, and in the choir of Santa Maria Novella. In the first series portraits are introduced of Lorenzo de' Medici and other eminent Florentines, and in the last series, in the portion illustrating the life of the Virgin, is the celebrated portrait of Ginevra de' Renci, a young beauty of Florence. The altar-piece of the Tassetti chapel, in which the artist has introduced his own portrait as a shepherd, is in the gallery of the Academy. Ghirlandajo's influence on Italian art was very great. He was a man of ideas as well as of skill, of great facility and boldness of conception—an innovator and discoverer. Michael Angelo is said to have studied with him as an apprentice, for three years, when fourteen years old. O. B. FROTHINGHAM.

Ghirlandajo (RIDOLFO), son of the preceding, also an artist of very great talent. He was b. in 1482; d. in 1560. One of his best works represents St. Zenobius raising a dead boy to life. This extraordinary picture is in the Uffizi at Florence.

Ghiustendil′, or **Kostendil′,** town of European Turkey, in the province of Nissa, on the Strymon. It has warm sulphurous springs. Pop. 8000.

Ghi′zeh, or **Gizeh** [also written JEEZEH], in Egypt, on the left bank of the Nile, just above Cairo. It was formerly a large and splendid town, but now it is mostly in ruins. The principal pyramids are in its immediate neighborhood. (See PYRAMIDS.)

Ghiz′nevides, a famous dynasty of Afghan monarchs who reigned at Ghazni (Ghizni or Ghuznee) and at Lahore from 961 A. D. to 1184. At the time of the Sultan Mahmoud (d. 1030) the empire had its widest extent, occupying a great part of Persia, Western Tartary, a part of India, and the intermediate countries. These sultans were zealous orthodox Mohammedans.

Ghiz′ni, or **Ghuznee,** town of Afghanistan, on a river of the same name. It was formerly a strong fortress, but is now of little consequence. In the neighborhood are the ruins of Old Ghizni. Pop. from 3000 to 10,000.

Ghog′gra, or **Ghog′ra,** a river of Hindostan, one of the largest affluents of the Ganges, rises in lat. 30° 28′ N., lon. 80° 40′ E., at an elevation of between 17,000 and 18,000 feet, in the glaciers of the Himalayas; enters the plains of Hindostan in lat. 29° 6′ N., lon. 80° 13′ E., at an elevation of 798 feet, and joins the Ganges in lat. 25° 46′ N., lon. 84° 40′ E., 150 miles below Benares, after a course of about 600 miles. After its descent into the plains it is navigable for large boats in all seasons, though its navigation is somewhat difficult on account of shoals.

Ghost [Ang.-Sax. *gâst*, "spirit," "breath"], the spirit of a human being, or, in a more popular sense, an apparition, or a departed human spirit made visible. Belief in the occasional appearance of ghosts exists in all countries, and has existed in all ages. Among the more recent developments of this belief we may note the newer phases of the so-called spirit manifestations, which are (1873–74) being studied by Sir W. Crooke and his able coadjutors.

Artificial ghosts, such as are seen upon the stage, are easily made by means of glass plates which reflect only a faint outline of the person who personates the ghost. By equally simple means the ghosts may be magnified, distorted, decapitated, etc., in many surprising ways.

Ghost, Holy. See HOLY GHOST.

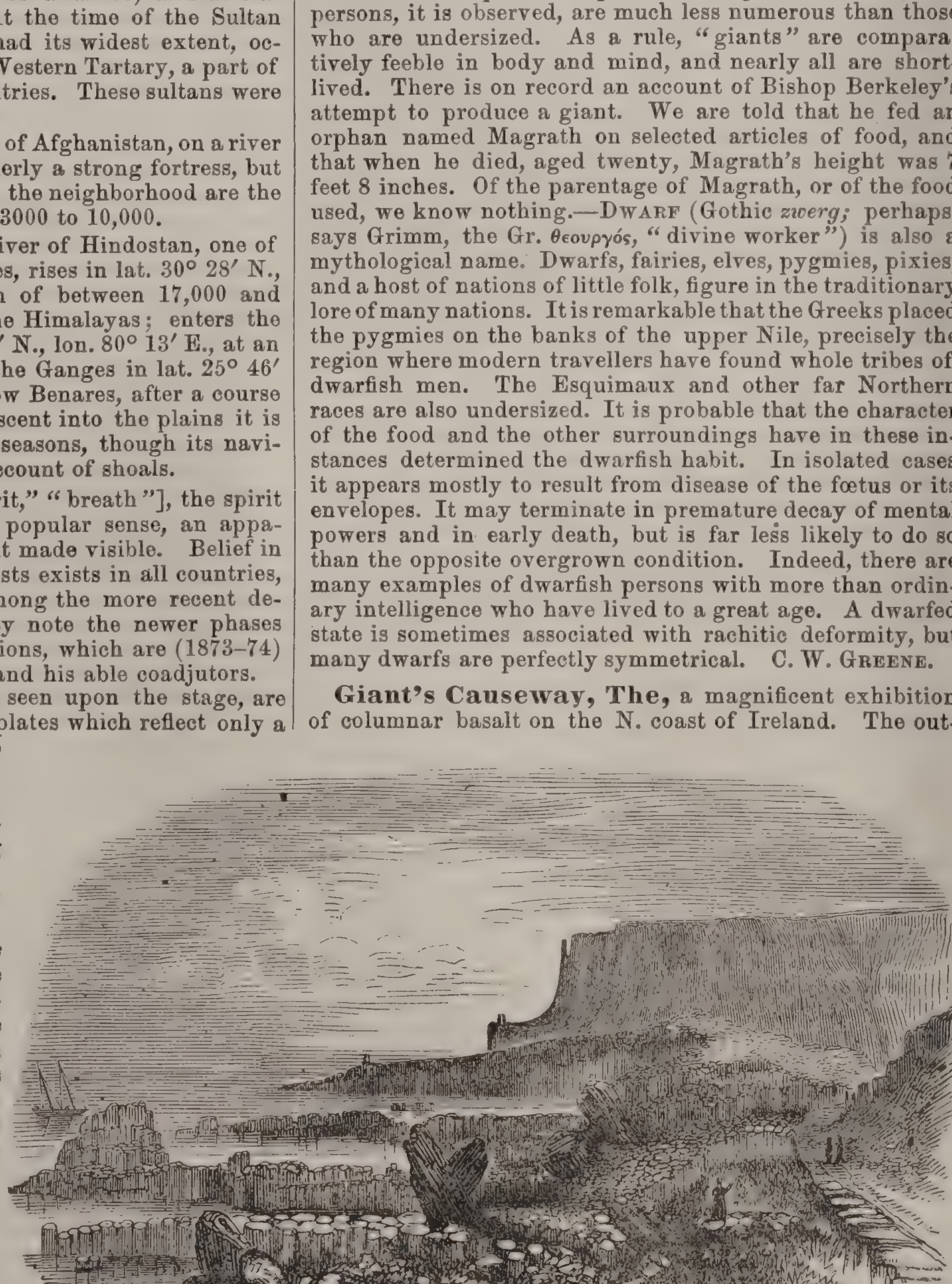
Ghost-Moth, the *Hepialus humuli*, a European moth of the family Bombycidæ, whose destructive larvæ, known as *otters*, bore in hop-vines and the stalks and roots of many plants. The moths are white below and brown above; and hence, as the upper surface is turned towards or away from the spectator in flight, the moth appears and disappears by turns. Hence the name. The genus is American also.

Ghumurdji′na, town of Roumelia, Turkey, 80 miles S. W. of Adrianople, and not far from the Ægean Sea. Pop. 8000.

Ghûr, Gaur, or **Ghore, Dynasty of,** descendants of an ancient race of Afghan princes, were the second line of Mohammedan rulers in Hindostan. Allah-ad-deen (d. 1160) almost destroyed the power of the Ghiznevides, and his successors conquered the whole country from the Caspian to the Bay of Bengal; but their power was short-lived. The period of their authority is usually given as from 1176 to 1206, after which their power was feeble and hardly more than nominal. They are also called GHÛRI and GOURIDES.

Gi′ant and **Dwarf.** The term *giant* [Gr. γίγας] is primarily a mythological one. The Greek giants were huge earth-born beings, who, according to the older writers, had the form of men (later writers made them hideous monsters), and who revolted against the gods, who finally slew them. The Norse mythology gives the giants (jotuns, frost-giants, etc.) a very prominent place. The giants are held by some writers to represent the adverse forces of nature—by others, human enemies of foreign race. Thus, English folk-lore abounds in traditions and nursery-tales of Cornish and Welsh giants, and Cæsar speaks of the huge stature of the ancient Germans and Gauls. But in authentic history there are accounts of races of men of very large size. The Hebrew Scriptures allude to giants (nephilim) before the Flood, and in and about Palestine there were, in Joshua's time, the Rephaim, Anakim, Emim, and Zamzummim, all men of great stature. The names of Og, two Goliaths, Ishbibenob, and Saph are preserved to us. In comparatively recent times there was a belief that the Patagonians and the men of Guayaquil were giants; and it is now unquestionable that the former do considerably exceed in stature the average of mankind. Scores of well-authenticated instances could be cited of persons exceeding $7\frac{1}{2}$ feet in height. Several are on record of men measuring 9 or even $9\frac{1}{2}$ feet, but these examples are open to some question. Very tall persons, it is observed, are much less numerous than those who are undersized. As a rule, "giants" are comparatively feeble in body and mind, and nearly all are short-lived. There is on record an account of Bishop Berkeley's attempt to produce a giant. We are told that he fed an orphan named Magrath on selected articles of food, and that when he died, aged twenty, Magrath's height was 7 feet 8 inches. Of the parentage of Magrath, or of the food used, we know nothing.—DWARF (Gothic *zwerg;* perhaps, says Grimm, the Gr. θεουργός, "divine worker") is also a mythological name. Dwarfs, fairies, elves, pygmies, pixies, and a host of nations of little folk, figure in the traditionary lore of many nations. It is remarkable that the Greeks placed the pygmies on the banks of the upper Nile, precisely the region where modern travellers have found whole tribes of dwarfish men. The Esquimaux and other far Northern races are also undersized. It is probable that the character of the food and the other surroundings have in these instances determined the dwarfish habit. In isolated cases it appears mostly to result from disease of the fœtus or its envelopes. It may terminate in premature decay of mental powers and in early death, but is far less likely to do so than the opposite overgrown condition. Indeed, there are many examples of dwarfish persons with more than ordinary intelligence who have lived to a great age. A dwarfed state is sometimes associated with rachitic deformity, but many dwarfs are perfectly symmetrical. C. W. GREENE.

Giant's Causeway, The, a magnificent exhibition of columnar basalt on the N. coast of Ireland. The out-



Giant's Causeway.

pouring of lava in Tertiary times that formed the beds of basalt of the islands of Mull and Staffa, off the Scotch coast, at the same period overwhelmed extensive tracts in what is now the county of Antrim, and the coast for some miles E. of Portrush is formed of dark volcanic rocks, which by their unequal decomposition give rise to a line of cliffs from 400 to 500 feet in height, remarkable for their boldness and wild picturesqueness. The transition from the snow-white chalk-rocks which it overlies to the almost black basalt gives additional variety and beauty to the scenery around the Causeway. The cliffs consist of thick sheets of basalt, with intervening beds of ochreous clay. The lower layers of basalt are rich in zeolitic and other minerals, and in certain beds the columnar structure is very strongly developed, and in places these are beautifully exposed. The Causeway itself is a promontory of columnar basalt that has been laid bare by the waves, but has itself resisted their action; and here the visitor can make his way for a long distance over an irregular floor formed of perfectly developed polygonal columns, which remarkably illustrate the peculiarities of this kind of rock-formation.

EDWARD C. H. DAY.

Giaour′ [Turkish; Persian *gawr*, "infidel"], a term applied by Turks and other Mohammedans to Christians and others not of their own faith. Its use is not always intended as a reproach, but very commonly has that character.

Giard, post-tp. of Clayton co., Ia., on the Milwaukee and St. Paul R. R. Pop. 1294.

Giar′re, a Sicilian town of considerable commerce, in the province of Catania. It lies near the sea-shore, and in its neighborhood, at Carpineta, are some of the largest chestnut trees known; among them the famous *castagno dei cento cavalli*. Pop. 17,414.

Giave′no, town of Italy, in the province of Turin, formerly possessing considerable silk manufactures, which have now declined. It has an ancient castle surrounded by walls, in which the old dukes of Savoy sometimes wintered with their court. Pop. 9683.

Gibbes (ROBERT WILSON), M. D., born at Columbia, S. C., July 8, 1809, graduated at South Carolina College in 1827, where he became assistant professor, and afterwards professor of chemistry; took his medical degree in Philadelphia; became distinguished as a palæontologist, ornithologist, ichthyologist, and antiquary, as well as a physician; was twice mayor of Columbia, and for some time editor of the *Daily South Carolinian* and the *Weekly Banner;* became in 1861 surgeon-general of South Carolina. In 1865, when Columbia was burned upon its occupation by Sherman, his mansion, with its treasures of art and literature and its valuable cabinets, was burned. Author of an excellent *Monograph of the Squalidæ;* one of great value on *Typhoid Pneumonia* (1842); *Memoir of James De Veaux* (1845); *Documentary History of South Carolina* (3 vols., 1853); *Sketch of Charles Fraser; Memoir on Mososaurus; Cuba for Invalids* (1860); and many scientific papers. Was a member of numerous learned societies in Europe and the U. S. D. at Columbia, S. C., Oct. 15, 1866.

Gibbes (ROBERT WILSON), M. D., son of the above, b. June 10, 1831; graduated at the South Carolina College 1850, and received the degree of M. D. at the Medical College of South Carolina in 1852, after which he spent two years abroad, continuing his professional education, chiefly in Paris and Dublin; since which time he has been in active duty as a physician and surgeon. Has contributed various articles to different medical journals, and also filled the chairs of anatomy and surgery in the University of South Carolina at Columbia until Oct., 1873, when he resigned in consequence of changes in the administration of the university.

Gib′bites, a fanatical sect of Scotland in the last part of the seventeenth century. They combined some of the doctrines of the Quakers with others of the strict Covenanters, and were never numerous. Imprisonment of the Gibbites in jail broke up the movement, and they soon ceased to exist as a separate body. Their leader was a sailor named John Gib.

Gib′bon, a name applied to the tailless monkeys of the East Indies, belonging to the genus *Hylobates*, and constituting, with the gorillas, chimpanzees, and orangs, the group called anthropomorphous apes. They are rather small, very long-armed, destitute of cheek-pouches, and provided with naked callosities upon the buttocks. They are of gentle disposition. They live among the branches of trees, and leap from branch to branch with great freedom. Among the rather numerous species may be mentioned the active gibbon (*Hylobates agilis*), the hooluck (*Hylobates huluk*), the lar (*Hylobates lar*), and the white-handed gibbon (*Hylobates albimana*).

Gibbon, post-v., cap. of Buffalo co., Neb., on the Union Pacific R. R., 193 miles W. by S. of Omaha.

Gibbon (EDWARD), b. at Putney, Surrey, Apr. 27, 1737; studied at Westminster and Oxford, and in 1753 declared himself a Roman Catholic; was placed under the instruction of a minister of Lausanne 1753–58, under whose training he renounced Roman Catholicism (1754), and acquired a vast knowledge of history and of Latin and French literature; returned to England, and pursued the reading of Greek authors with much zeal; entered Parliament in 1774 as a member for Liskeard; was a constant Tory, and in 1778 became a member of the board of trade; resided at Lausanne 1783–93, chiefly occupied with the completion of his *History of the Decline and Fall of the Roman Empire*, the production of which was first thought of at Rome in 1764, the first volume appearing in 1776 and the last in 1788. Besides this great work, he produced some other relatively unimportant writings. The best editions of the *History* are those of Milman and of William Smith (1855). The great merit of Gibbon's work is diminished by his lack of fairness towards Christianity, for he seems incapable of appreciating the nobler traits of the early Christians, while alive to all their faults. Recent ingenious attempts to show that Gibbon was a Christian have quite failed. In early life he was disappointed in a suit for the hand of the lady who became Mme. Necker and the mother of Mme. de Staël. He never married, and for many years enjoyed a large inherited fortune. D. in London Jan. 16, 1794.

Gibbon (JOHN), b. in Pennsylvania 1826; graduated at U. S. Military Academy July, 1847, and entered the army as brevet second lieutenant of artillery; promoted to be second lieutenant Sept., 1847, first lieutenant Sept., 1850, captain Nov., 1859, and colonel 36th Infantry July, 1866. Gibbon's first service was in the war with Mexico, being present at the city of Mexico; subsequently he was in garrison and on frontier duty against hostile Indians till the outbreak of the civil war in 1861. During this struggle he served as chief of artillery of Gen. McDowell's army till May, 1862, when he was appointed brigadier-general of volunteers, and assigned to the command of a brigade in the Army of the Potomac, participating in the second battle of Bull Run, of South Mountain, and Antietam; in Nov., 1862, he was placed in command of a division, which he led in the battle of Fredericksburg, where he was wounded. At the battle of Chancellorsville he was engaged in the storming of Marye's Heights; at the battle of Gettysburg he received severe wounds while in command of the 2d corps, and did not rejoin the army until Mar., 1864, when he was placed in command of a division of the 2d corps, and was engaged in Gen. Grant's Richmond campaign at the battles of the Wilderness, Spottsylvania, Cold Harbor, etc.: he subsequently commanded the 24th army corps, and was constantly engaged in the operations about Petersburg against the army of Gen. Lee, up to the surrender of the latter in Apr., 1865. For gallant services in battle he received the successive brevets from major to that of major-general U. S. A. In 1869 he was transferred to the command of the 7th Infantry. G. C. SIMMONS.

Gib′bons (ABBY HOPPER), b. in Philadelphia Dec. 7, 1801, daughter of Isaac T. and Sarah Hopper; was a teacher in Philadelphia and New York; was married in 1833 to James S. Gibbons of Wilmington, Del.; since 1836 their home has been in New York. In 1845, Mrs. Gibbons was an efficient co-worker with her father in the formation of the Women's Prison Association, and in founding the homes for discharged prisoners, since known as "The Isaac T. Hopper Home." In this interest she has been a frequent visitor to the Tombs, Blackwell's and Randall's Islands, and similar institutions. In 1861, Mrs. Gibbons visited the army hospitals at Washington, and throughout the war rendered efficient services in hospital and camp, often at great personal risk. The anti-slavery sympathies of her husband and herself were well known, and in the New York riots of 1863 their house was one of the first to be sacked. In 1871 she was actively interested in the establishment of the New York infant asylum, and is now one of its chief managers. In 1873 she took an active part in opening the New York diet kitchen, and is president of the association which supports it. SARAH S. THAYER.

Gibbons (CHARLES), fourth son of W. G., a distinguished member of the Philadelphia bar, was b. at Wilmington Mar. 30, 1814; studied law in the office of Charles Chauncey, Philadelphia, and was admitted to practice in 1838; was president of the National Whig Club in 1844; for several years a member of the State senate, and Speaker of that body in 1847; actively promoted the passage of a law to punish the kidnapping of negroes, to prevent the use of the State jails for the detention of fugitive slaves, and prohibiting the judges of the State courts and magistrates from issuing writs for the arrest of such fugitives; was chairman of the first Republican State committee, one of the founders of the Union League, the first organization of that

kind in the U. S., and the author of its constitution; represented the government under a special commission during the civil war in the argument of prize cases in the U. S. courts at Philadelphia, and is now a practising lawyer in that city. He is connected with a number of the most useful benevolent institutions in the city and State.

Gibbons (Edward), fifth son of W. G., was b. in Wilmington Dec. 7, 1817; studied law, and resided some time in Philadelphia; subsequently graduated in the Crosby Street Medical College of New York; removed to San Francisco in 1850, and became a successful physician. Is now a member of the California State legislature.

Gibbons (Grinling), a wood-carver, b. in Rotterdam in 1648; came to London after the Great Fire of 1666, and was taken into the employment of Charles II., and afterwards of George I. Several of the princely houses of England—Chatsworth, Petworth, and Burghley—contain specimens of his exquisite work in screens, sideboards, chimney-pieces, ornamental panels with flowers, fruit, birds, carved with a precision and delicacy that entitle them to the rank of works of very fine art. Gibbons d. at his house in Bow street, London, Aug. 3, 1721. O. B. Frothingham.

Gibbons (William), M. D., was one of the fifth in descent from the Quaker emigrants who accompanied William Penn and settled in Pennsylvania about 1673–80. He was b. in Philadelphia Aug. 10, 1781, and was educated with special care by his father, who was for some years a classical teacher of eminence in that city. William studied medicine, and obtained his degree in the medical school of the University of Pennsylvania in 1805, soon after which he settled in Wilmington, where he resided the rest of his life. To the duties of his profession he added the study of the natural sciences. He made excellent progress in philological studies and the acquisition of languages, and among them the Hebrew, in which he attained to a remarkable proficiency. In the earlier part of his professional career, while his medical practice was not yet arduous, he devoted much time to the culture of ornamental plants, and established a nursery of grafted fruit trees—a business which has been maintained, and is still prosecuted in that locality. He was among the earliest promoters in Wilmington of associated efforts for the spread of scientific knowledge, among which was the Delaware Academy of Natural Sciences, of which he was the first president, and to which he contributed many valuable essays. He was the first president of the Peace Society and also of the State temperance organization in Delaware. He was an active member of the society for preventing the kidnapping of colored people—a business which was promoted by the proximity of Wilmington to the Baltimore slave-market. About 1823–25 Wilmington became the head-quarters of a prolonged religious controversy originating in an attack by an eminent Presbyterian clergyman, under the signature of "Paul," on the principles and doctrines of the Society of Friends. The dispute soon enlarged, and grew into a general polemical war between the Unitarians and the Trinitarians. Dr. Gibbons, though deeply interested, did not appear in the controversy as a writer, but near the close of it, under the signature of "Vindex," he addressed a letter to the Presbyterians, entitled *Truth Vindicated*, an able and successful refutation of the charges preferred by "Paul," and one of the clearest expositions, and perhaps the best defence, of the doctrines of Friends which has been published in modern times. William Darlington.

Addenda.—The religious controversy noted above was soon followed by another, in which Dr. Gibbons took a leading part; this was between the two divisions of the Society of Friends which have been known since that time as "Friends" and "Orthodox Friends." The final separation of this long harmonious body was consummated in 1827. (See Quakers.) Dr. Gibbons established and maintained for several years, at his own expense, a religious periodical publication called *The Berean*, which in four volumes covering the period from Feb., 1824, to Sept., 1828, is esteemed by the Society of Friends as the best-accredited history extant of the events embraced by it.

Dr. Gibbons was himself one of thirteen children, and left a family of the same number, of which eleven still survive.—Henry Gibbons, the eldest, was b. in Wilmington Sept. 20, 1808; graduated in the medical department of the University of Pennsylvania in 1829; practised medicine some years in Philadelphia, and was widely known as a lecturer; removed to San Francisco in 1850. He is now professor of the principles and practice of medicine in the Medical College of the Pacific; president of the California State board of health, and senior editor of the *Pacific Medical and Surgical Journal.* He is the author of a prize essay on tobacco, and of many addresses and essays on scientific subjects.—His oldest son, Henry Gibbons, Jr., is also a graduate of medicine, associate editor of the *Medical and Surgical Journal*, and a successful practitioner in San Francisco. He entered the hospital service during the civil war, and became a skilful surgeon.—James Sloane Gibbons, the second son of William, was b. July 1, 1810; in early life removed to Philadelphia, where he engaged in mercantile business; became a resident of New York in 1835, and since that time has been connected with banks and finance. He is the author of a work on *The Banks of New York, the Clearing-House, and the Panic of 1857*, 350 pp.; also of a volume entitled *The Public Debt of the U. S., Taxation, and Liquidation*, 275 pp.; and contributor to various literary and financial periodicals.—William Peters Gibbons was b. in Wilmington Apr. 19, 1812; removed to Philadelphia, where he engaged in the printing business; established a scientific journal, of which he was the editor; removed, on invitation, to Poughkeepsie, N. Y., to take charge of a boarding-school for young ladies; in the mean time studied medicine, and graduated in the New York University; removed to San Francisco, where he is now a successful practitioner and an occasional writer on scientific subjects.

Gibbs (Alfred), b. in New York 1824; graduated at West Point, and entered the army as brevet second lieutenant mounted rifles, July, 1846. In the war with Mexico he was engaged in the siege of Vera Cruz, in the battles of Cerro Gordo (where he was wounded), Contreras, Churubusco, Chapultepec, and was present at the capture of the city of Mexico; brevet first lieutenant and captain for gallant conduct in battle. Promoted to be second lieutenant of rifles in 1847, and first lieutenant 1853. From 1848 to 1856 he was aide-de-camp to Gen. Persifer F. Smith, serving on the Pacific coast and in Texas; from 1856 to 1861 he was engaged mostly on frontier duty and against hostile Indians. In July, 1861, he was taken prisoner in New Mexico. Upon being paroled (Aug., 1862), he was appointed colonel of the 130th New York Vols., Sept., 1862, being engaged in operations about and defence of Suffolk, Va., till Aug., 1863, when his regiment was changed to be the 1st New York Dragoons, and for several months he was engaged in organizing it as a cavalry regiment, and stationed at Manassas, guarding the Orange and Alexandria R. R. During Gen. Grant's Richmond campaign (1864–65) he commanded a cavalry reserve brigade, participating in various actions till Aug., 1864, when he resumed command of his regiment in the Shenandoah campaign, leading it in the battles of Opequan, Fisher's Hill, Cedar Creek, besides numerous minor actions. Appointed a brigadier-general of volunteers Oct. 19, 1864, in the final conflict with, and pursuit of, the Confederate army of Northern Virginia, he commanded a brigade of cavalry, being engaged at Dinwiddie Court-house, Five Forks, Sailor's Creek, etc., and present at the surrender of Gen. Lee at Appomattox Court-house. He subsequently commanded a cavalry brigade and division in the division of the Gulf, and was mustered out of the volunteer service Feb., 1866. For gallant conduct during the war he received the various brevets from major to that of major-general U. S. A. Promoted in the army to be major 7th Cavalry in July, 1866, he served on frontier duty in Kansas. D. Dec. 26, 1868, at Fort Leavenworth, Kan. G. C. Simmons.

Gibbs (Josiah Willard), LL.D., b. at Salem, Mass., Apr. 30, 1790; graduated at Yale in 1809; was tutor there 1811–15; professor of sacred literature 1824–61; librarian of the college 1824–43. He published several philological works and many valuable papers. Among his works are a Hebrew lexicon, 1824; an abridgment of Gesenius's lexicon, 1828; *Philological Studies*, 1857; *Teutonic Etymology*, 1860, etc. D. at New Haven, Conn., Mar. 25, 1861.

Gibbs (Wolcott), M. D., LL.D, b. in New York City Feb. 21, 1822; after graduation at Columbia College, 1841, studied chemistry and physics in Giessen and Berlin. Shortly after his return from Germany, Dr. Gibbs was elected professor of physics and chemistry in the College of the City of New York 1849; in 1863 resigned this position, having been elected to fill the Rumford professorship in Harvard University. Dr. Gibbs is the author of many elaborate and valuable chemical researches; as, for example, on the platinum metals, on the ammonia-cobalt bases, on the equivalent of cobalt, on niobic acid, etc. Besides these he has made extensive contributions to analytical chemistry, both organic and inorganic. In the department of physics his contributions have been equally valuable and almost as numerous; among them we mention as examples his elaborate work on the wave-lengths of light, that on vapor densities, and his methods of avoiding the troublesome effects of temperature and pressure in gas analysis. His memoirs on these subjects, along with those on theoretical chemistry, are scattered among the volumes of the *American Journal of Science and Arts*, of which he has for many years been one of the editors.

Gib'el, or **Prussian Carp**, a small European fresh-

water fish, the *Cyprinus gibelio.* It is prized for the table, but is not very easy to catch, as it seldom takes the hook.

Gibelli'na, small town of Sicily, in the province of Trapani, near which (at Magione) are found very curious remains of troglodyte habitations—a large number of cells and niches excavated in the sides and on the top of a hill; thence called *Le Finestrelle.*

Gib'eon, town of Palestine, 5 miles N. W. of Jerusalem, is mentioned in Joshua x. 2, and in several other places in the Old Testament. Its site is now occupied by a small village, *El Jib,* and the surrounding district is well cultivated.

Gibral'tar, the southernmost promontory of Spain, is an insulated rock connected with the mainland only by a

Rock of Gibraltar. The signal-station from the south side.

low, sandy slip of land between the Bay of Gibraltar on the W. side and the Mediterranean on the E. side. This rock, together with that of Abyla, now Ceuta, on the African coast, formed the so-called Pillars of Hercules, which by the ancients were considered the western boundary of the earth. The Rock of Gibraltar is 1400 feet high, almost perpendicular on its southern and eastern sides, and sloping and accessible only on its northern and western sides. Here is situated the town of Gibraltar, containing a population (exclusive of the garrison) of 18,695, consisting of Englishmen, Spaniards, Jews, and Moors, and carrying on a considerable transit-trade. Its chief importance, however, Gibraltar has as a fortress. In 1704 it was taken by the English, and they have retained it since as the key to the Mediterranean, and have fortified it, especially on its western and northern sides, so as to make it impregnable. Gibraltar was named *Gebel al Tarik* ("Tarik's Mountain"), from Tarik ben Zeyad, a famous Saracen leader who landed here in 711. It remained a Moorish stronghold till 1309, when Ferdinand IV. took it. The Moors held it again 1333–1462, and it was surprised and taken by the English 1704; besieged 1704–05; ceded to Great Britain 1713; besieged again 1727; blockaded and besieged by the French and Spaniards 1779–83, when it made one of the most obstinate and famous defences recorded in history. It is the see of an Anglican and of a Roman Catholic bishop.

Gibraltar, tp. of Door co., Wis., on Green Bay, Lake Michigan. Pop. 466.

Gibraltar, Strait of, connects the Atlantic with the Mediterranean by a channel 15 miles wide and 900 fathoms deep, between Spain and Africa. The central current of the channel constantly sets from the Atlantic into the Mediterranean, and makes it very difficult for sailing vessels to pass through to the Atlantic unless aided by a brisk east wind. The lower level of water in the Mediterranean is caused by its greater evaporation.

Gib'son, county of S. W. Indiana, bounded on the N. W. by the White and Wabash rivers. Its surface is broken and well timbered, and its soil productive. Cattle, grain, tobacco, and wool are staple products. Carriages, wagons, and flour are manufactured. Coal of good quality abounds. The Evansville and Crawfordsville R. R. traverses the county. Cap. Princeton. Pop. 17,371.

Gibson, county of W. Tennessee. Area, 760 square miles. The soil is highly productive. Cattle, corn, wheat, cotton, and tobacco are produced. Lumber, wagons, brick, and flour are among the manufactures. The Mobile and Ohio and the Memphis and Ohio R. Rs. traverse the county. Cap. Trenton. Pop. 25,666.

Gibson, tp. of Morgan co., Ala. Pop. 1274.

Gibson, tp. of Sierra co., Cal. Pop. 520.

Gibson, a v., cap. of Glascock co., Ga.

Gibson, tp. of Washington co., Ind. Pop. 1525.

Gibson, Ill. See GIBSON CITY.

Gibson, post-v. of Corning tp., Steuben co., N. Y., 1 mile E. of Corning. Pop. 372.

Gibson, tp. of Mercer co., O. Pop. 1100.

Gibson, tp. of Cameron co., Pa. Pop. 1236.

Gibson, post-tp. of Susquehanna co., Pa. Pop. 1368.

Gibson, tp. of Manitowoc co., Wis. Pop. 1638.

Gibson (CHARLES BELL), M. D., son of the professor who so long occupied the chair of surgery in the University of Pennsylvania, was b. in Baltimore, Md., Feb., 1816; d. of a heart affection in Richmond, Va., Apr. 23, 1865, near the close of the war between the States. Soon after his birth the family moved to Philadelphia, where his father opposed his studying medicine, but finding him so accurate in a description of an operation then just performed, the parent at once changed his mind. Dr. C. B. Gibson soon commenced lecturing to private classes, and so successfully that he was invited to the chair of surgery in Washington Medical College, Baltimore; in 1848 to the same professorship in the Richmond Medical College, Va. When that State united with the seceding States, he was made surgeon-general. In Richmond he became the chief consulting surgeon and operator, and from excessive labor and fatigue heart disease was induced, of which he died. Like his renowned father, Dr. Gibson, Jr., was a gifted man, and gave promise of great usefulness when suddenly cut off in the prime of life. PAUL F. EVE.

Gibson (EDMUND), D. D., b. at Bampton, Westmoreland, England, 1669; passed M. A. at Queen's College, Oxford, 1694; became bishop of Lincoln 1715, of London 1723. D. at Bath Sept. 6, 1748. Gibson was a man of severe virtue and great learning, but of an intolerant spirit, for he advocated penal laws against the Quakers and caused Meade's edition of the *Restitution* of Servetus to be burned. His edition of the *Saxon Chronicle,* with notes (1692), and the *Codex juris ecclesiastici Anglicani* (1713), are very import-

ant. His polemical works, written against Romanism and infidelity, are highly esteemed. He translated Camden's *Britannia*, and wrote also upon archæological and biographical subjects.

Gibson (George), b. in Pennsylvania; entered the army as captain of infantry in 1808; served through the war with Great Britain 1812–15; appointed quartermaster-general, rank of colonel, 1816; commissary-general 1818; which latter position he held for upwards of forty years; brevet brigadier and major-general U. S. A. D. at Washington, D. C., Sept. 21, 1861.

Gibson (John), an English sculptor, b. July 19, 1790, at Gyffyn, near Conway, Wales, the son of a landscape-gardener; at the age of fourteen was apprenticed to a cabinetmaker, then to a wood-carver. He first studied sculpture under the Messrs. Francis, statuaries of Liverpool. Several gentlemen, attracted by his genius, which was revealed in models and figures, supplied him with money for a two years' residence in Rome. There, in 1817, Canova welcomed him, admitted him without charge to his studio and academy, and procured for him distinguished patronage. His first pieces, *Mars and Venus* and *Hero and Leander*, were executed for the duke of Devonshire. After Canova's death (in 1822) Gibson placed himself under Thorwaldsen. In Rome he lived, revisiting England but once in twenty-four years. The patronage of the rich and great was lavished on him. King Louis of Bavaria ordered from him several groups, the nobility both of Italy and England prized his works, and wealthy merchants were glad to own them. Liverpool boasts of many pieces by his chisel. He modelled the statues of the queen in Buckingham Palace and in the Princes' Chamber of the Houses of Parliament. His ideal pieces, mostly repetitions of classic themes and showing little originality, are familiar through copies of photographs. Gibson partially revived the ancient practice of tinting marble statues by adding color to the *Aurora*, the *Venus*, and the statue of the queen, but did not carry the questionable practice far. He was regularly an exhibitor at the Royal Academy in London, was chosen an associate in 1833, and made a member in 1836. He was also a member of the academies of Munich, St. Petersburg, Turin, and St. Luke in Rome. At the Paris Exposition of 1855, Gibson had four pieces—a hunter, a hunter and dog, a wounded Amazon, and *Hylas carried away by Nymphs*. D. in Rome Jan. 27, 1866. O. B. Frothingham.

Gibson (Tobias) was b. in Liberty co., S. C., in 1771; joined the Methodist ministry in 1792; labored with notable success in the South-east till 1800; went then to Natchez, and founded his denomination in Louisiana and the South-west generally. He endured extreme hardships in his pioneer ministry, and was a genuine hero and saint. D. at Natchez in 1804.

Gibson (William), M. D., LL.D., was b. in Baltimore, Md., 1784; d. in Savannah, Ga., 1868, whither he had gone in feeble health. He took his medical degree from the University of Edinburgh; was the pupil and associate of Sir Charles Bell; was at the siege of Corunna, 1809, and Waterloo, 1815, where he was slightly wounded; was intimate with Sir Astley Cooper, Velpeau, etc., and had met Napoleon Bonaparte, Lord Byron, Hastings, Abernethy, Halford, etc. In 1819 he succeeded Dr. Physick in the chair of surgery in Philadelphia. Dr. Gibson published a *System of Surgery*, in two vols., which passed through nine editions; was also the author of several lectures, of *Rambles in Europe*, 1839, containing biographical sketches of surgeons, etc. He resigned his professorship in 1855, which he had occupied thirty-six years. He was the first to perform the cæsarean operation twice on the same patient, successful to both mother and children. He was, too, honest enough to publish his unsuccessful cases. He was a man of indomitable energy, of astonishing memory, so that in old age he could repeat many poems, and left no superior as a lecturer. Paul F. Eve.

Gib′sonburg, post-b. of Luzerne co., Pa., on the Delaware and Hudson R. R., 11 miles N. E. from Scranton. It has mines of coal. Pop. 1156.

Gib′son City, post-v. of Ford co., Ill., on the Toledo Wabash and Western, at the crossing of the Gilman Clinton and Springfield and the Chicago and Paducah R. Rs. It has one weekly newspaper.

Gib′son Station, post-v. of the Creek Nation, Indian Territory, on the Missouri Kansas and Texas R. R., 108 miles S. of Parsons City (7 miles from Fort Gibson).

Gib′sonville, a v. of Hocking co., O. Pop. 67.

Gid′dings, post-v., cap. of Lee co., Texas.

Giddings (De Witt C.), b. in Susquehanna co., Pa., July 18, 1827; studied law, and removed to Texas in 1852, making Brenham his residence; opposed secession in 1861, but immediately after the withdrawal of that State from the Union entered the Confederate service as a private in the 21st Texas Cavalry, and rose to the rank of colonel. In 1866 was a member of the constitutional convention of that State, and subsequently became a member of the 42d and 43d Congresses. A. H. Stephens.

Giddings (Joshua Reed), an American statesman, was b. at Tioga Point, Pa., Oct. 6, 1795. His father removed from Lyme, Conn., to Pennsylvania in 1772. Six weeks after the birth of their child his parents removed to Canandaigua, N. Y. When he was about ten years old they removed to Ashtabula co., O., a part of the Connecticut Western Reserve. His youth was one of severe toil, yet he became a man of great size and strength, as well as of capacious mind and generous and enterprising spirit. After Hull's surrender in 1812 he enlisted as a volunteer in the U. S. service, and took part in a severe action near Sandusky Bay. After Proctor's retreat the troops with which Giddings served were sent home. His education was obtained by reading books, mostly borrowed, and read at night by the light of a hickory fire. He taught school, studied law with Elisha Whittlesey, a prominent lawyer, and was admitted to the bar in 1821. In 1826 he went as a representative to the State legislature; declined re-election in 1827; was defeated in running for State senator in 1828; devoted himself to his profession, in which he rose to the first rank In 1839 he was sent to Congress. He was not then, and was never, an abolitionist in the strict sense of the term. The men who claimed that title did not approve his views and seldom commended his action. His adhesion to the Whig party exposed him to their assaults. They labored for the abolition of slavery in the States, while he admitted that it was out of the reach of Federal enactments. He revered the Constitution which they denounced. He zealously labored to preserve the Union, which they were willing to divide. At the same time, he believed that Congress had no right to protect slavery in the States, that slavery was a great evil, and that it was wrong and unconstitutional to compel the free States or the general government to return fugitive slaves to their owners. He also believed it was the duty of Congress to prohibit slavery in the District of Columbia and the Territories, and to break up the coastwise slave-trade. At that time the U. S. government was thoroughly committed to the defence of slavery in the States, and it was not lawful to present petitions relating to it, all such petitions being laid at once on the table without debate. During his membership of Congress a large share of his attention was given to the tracing out of the constitutional relations of the government, the States, and the people to slavery, and the exposition of his views thereupon; but he also took a prominent part in questions of tariff and of appropriations and in other important affairs. He opposed the Florida war, on the ground that it was an attempt to recapture fugitive slaves at the expense of the U. S. In 1841 the Creole, a vessel laden with slaves, sailed from Norfolk, Va., for New Orleans. The slaves arose, seized the vessel, and finally found the British port of Nassau, N. P., where they were recognized as free. Mr. Webster, then secretary of state, having demanded compensation of the British government, Mr. Giddings introduced into the House resolutions declaring that the slaves upon the Creole were guilty of no crime in taking their freedom upon the high seas, inasmuch as they were outside of the jurisdiction of Virginia, that persons held in slavery cease to be slaves when upon the high seas, and that the demand for the slaves or for compensation for them was not warranted by the U. S. Constitution. For presenting these resolutions (which he temporarily withdrew at the earnest request of many friends) Mr. Giddings received the censure of the House, without being permitted to speak in his own defence. He thereupon resigned, but was at once re-elected without opposition. In his early years in Congress his views were shared by no member except his friend, John Quincy Adams. In 1843 he produced the famous "Pacificus" essays upon the slavery question. He zealously opposed the annexation of Texas. In 1844 he successfully opposed the bill to pay for the Amisted negroes. He resisted the joint occupation of Oregon with Great Britain, and asserted the right of the U. S. to the whole. He opposed the insertion of clauses in Indian treaties requiring the return of fugitive slaves. He strongly favored the Wilmot proviso. Upon the nomination of Gen. Taylor for the Presidency in 1848 he left the Whigs and joined the new Free-Soil party. He declined to vote for a Whig Speaker of the House in 1847 and 1849, and thus in the latter year caused the choice of a Democratic Speaker. In 1850 he opposed the new compromise, the fugitive slave bill, and the $10,000,000 Texas bill. He afterwards resisted Mr. Douglas's Kansas policy, and in 1855, as senior member of the House, administered the oath to Mr. Banks, the first Republican Speaker. In 1859, after twenty-one years' service, he closed his Congressional career. Twice during

this time he fell and became unconscious while addressing the House. He was twice assaulted in Congress by armed men, and was once set upon by a mob in Washington. He met such attacks with great courage. In 1853 he published a volume of speeches; in 1858 the *Exiles of Florida*, an historical sketch of much interest. In 1861 he was appointed consul-general to British North America. He wrote a Congressional history of slavery, and in 1864 published *The Rebellion, its Authors and Causes*. D. at Montreal May 27, 1864. He was a man of deep religious character, strong convictions, and great ability. A vigorous writer, a cogent reasoner, a ready and able debater, a bold, clear speaker, he often, especially when opposed, displayed great oratorical power. His services contributed largely to the great changes which have in recent years been made in the current of public opinion. A. G. RIDDLE.

Gid'dy Swamp, tp. of Lexington co., S. C. Pop. 358.

Gien, town of France, in the department of Loiret, on the Loire. Pop. 6528.

Gier Eagle, a bird mentioned in the Bible, is generally thought to be the "Pharaoh's hen" or EGYPTIAN VULTURE (which see); but some believe it is the *Pelecana onocratalus*, a pelican of the Levant.

Gie'seler (JOHANN KARL LUDWIG), b. at Petershagen, Germany, Mar. 3, 1792; studied and taught in the Halle Orphan-House 1803–13; served against Napoleon 1813–15; taught at Halle, Minden, and Cleves 1815–19; became professor of theology at Bonn 1819, and at Göttingen 1831; where he d. July 8, 1854. His great work on *Church History* (1824–57) is one of the most valuable and impartial works of the kind ever produced, but a somewhat rationalistic spirit has been remarked in it. The best English translation is that of H. B. Smith (New York, 4 vols., 1856).

Gies'sen, town of Germany, in the grand duchy of Hesse-Darmstadt, on the Lahn. It has a university (founded in 1607) and other educational institutions. Pop. 9331.

Giffard's Injector. See STEAM-ENGINE.

Gif'ford (ROBERT SWAIN), an American painter, b. on the island of Naushon, Gosnold, Mass., Dec. 23, 1840. His parents were poor laboring people. Living on the seashore (his father was a boatman), the boy's love for art early showed itself in marine studies, his removal, at the age of three years, to New Bedford and neighboring towns not withdrawing him from the associations of his childhood. His only education for the first ten years was derived from the public school, which ill-health forbade his attending regularly. From that time onward he was indebted to his own exertions for his mental acquirements. A natural taste for art, inherited, it would seem, from his mother, was developed by a German artist, who employed the lad in little services, and thus became interested in his genius. Subsequently, good friends, seeing his promise and attracted by his character, lent their aid. The youth rapidly rose in power and reputation, and at present stands in the front rank of the younger landscape-painters. His best pieces are from studies made in the East in 1870–71. At present (1874) he is making further æsthetic explorations in the same fruitful field. Mr. Gifford married a daughter of Hon. T. D. Eliot of New Bedford. His residence is in New York City. O. B. FROTHINGHAM.

Gifford (SANDFORD ROBINSON), an American artist, b. in Greenfield, Saratoga co., N. Y., July 10, 1823. His ancestors were among the earliest settlers in New England. His father was an iron-founder at Hudson on the Hudson. Mr. Gifford, the fourth of a large family, received, as all did, a fair education; was two years at Brown University (1842–44); came to New York in 1845, and studied drawing, perspective, and anatomy with John Rubens Smith; drew from casts and from life at the National Academy, and attended lectures on anatomy at the Crosby Street Medical College. At this time he painted portraits. His attention was directed to landscape-painting in 1846 by pedestrian tours among the Catskill Mountains and the Berkshire Hills. In 1851, Gifford was elected an associate of the National Academy, and in 1854 an academician. Two years and a half (1855–57) were spent in Europe in faithful art-work. At the breaking out of the civil war Gifford joined the 7th New York regiment, and saw six months of service. Eighteen months more in Europe (1868–69) added to his stores of material. Subsequently the artist visited Colorado and Utah, California, Oregon, British Columbia, and Alaska. The fruit of all these journeyings has been presented in forty or fifty oil-paintings of remarkable merit of design, sentiment, and execution. Mr. Gifford has his studio in New York, and is one of the most popular of American artists. His *Mansfield Mount, Shrewsbury River, San Giorgio, Tivoli, On the Nile, Venetian Sails, Baltimore in 1862,* are among the most characteristic of his pieces. O. B. FROTHINGHAM.

Gifford (WILLIAM), b. at Ashburton, Devon, England, Apr., 1757; went to sea in childhood, was apprenticed to a shoemaker in 1772, and afterwards, through the kindness of friends, was sent to Exeter College, Oxford, and received the patronage of Lord Grosvenor. His successful *Baviad* (1797), directed against the Della Cruscans, was followed by the *Mæviad* (1795) and the severe *Epistle to Peter Pindar*, which called forth an equally caustic reply. In 1797 he became editor of the *Anti-Jacobin*, and in 1809 of the *Quarterly Review*. His translations of Juvenal (1802) and of Persius are spirited and accurate, but his reputation is founded on his work as a critic and reviewer. He was a most bitter enemy of the Whigs, and was distinguished for his hostility to Hunt, Keats, and all the liberal authors of his day. His editions of the old English dramatists are noteworthy. Gifford was of small stature, very ugly in his appearance, but kind, says Southey, to every living thing except authors. The general voice of subsequent criticism has been adverse to his opinions on most questions of literary taste. D. in London Dec. 31, 1826.

Gift, in law, a voluntary or gratuitous transfer of personal property. It differs from a contract in not being based upon a consideration, which is essential to give a contract validity. But the correspondence between the principles relating to gifts and those appertaining to contracts is so very close—since in both cases there is contemplated a change of ownership by mutual consent—that the effect of the absence of all consideration upon a proposed transfer of lands or goods either by one mode or the other is the same. A promise to confer a gratuity in the future is virtually an executory contract without consideration, and the lack of this indispensable prerequisite renders the intended gift unenforceable, even though the actual purpose of the donor may have been to completely fulfil his offer, and the most confident expectations may have been excited in the intended donee. It is only the entire execution of a design to confer a gift that is regarded as an equivalent of a consideration, and in whatever other stages of fulfilment the purpose of the donor may be, no liability is fastened upon him, but he may recall his proffer when he will. A gift actually conferred is, therefore, in effect, an executed contract—one merely promised, an invalid executory contract. Gifts are divided into two classes—gifts *inter vivos*, or between living persons, and gifts *causa mortis* —*i. e.* bestowed in anticipation of the donor's death.

I. *Gifts inter vivos.*—Strictly speaking, this technical designation is incorrect, since all gifts must necessarily be made between living persons, but it has become firmly established as a legal term whose extent of application must be understood as limited to cases in which there is no immediate apprehension of death on the part of the giver, or, if there be such apprehension, where it is not given on that account. The real distinction is, that gifts of this class may be complete within the donor's lifetime, while gifts *causa mortis* only take absolute effect from his death, being, as long as life lasts, conditional and revocable. The capacity to confer gifts which shall be valid and irrevocable demands the same qualifications in the donor as to make binding contracts or to perform other legal acts. Coverture, infancy, insanity, and duress would be causes of disability, in consequence of which the gift might be retracted. When the donor is under no incompetency, the necessity that his intention be executed requires a delivery of the property conferred into the possession of the donee. The transfer of ownership must be in reality consummated. The delivery may be either actual, as by placing the very article intended to be given in the hands of the donee, or constructive. Giving the key of a warehouse in which the goods are deposited, or an order upon a bailee which the latter accepts, are instances of a sufficient constructive delivery. The thing given must have an actual existence. The promise of the donor, though in writing, cannot be the subject of such a gift. Thus, if a person give his own promissory note or a check drawn upon a banker to another, or an order upon a bailee who refuses to be bound by its directions, the donor's title is not in the least affected until the money is collected or the article demanded and received; and before that time the gift is revocable. The gift in such cases is but a promise without consideration. Even a court of equity will not enforce an inchoate gift, but will only lend its aid to require specific performance when some valuable consideration has been advanced, and a contract thereby established. After a complete and valid delivery of a gift has been made, the only remaining cause for which it may be avoided is that the donor's act was induced by fraudulent means, or that the gift would be prejudicial to the rights of creditors. Artifices practised to mislead any person to his injury invalidate a gift in the same manner as they would a contract. In protecting the rights of creditors the law has adopted the moral maxim that "a man must be just before he is generous," and will

not allow a debtor to expend in gratuities what he ought to use for the discharge of his just obligations. (A fuller discussion of this question will be found under the topic FRAUDULENT CONVEYANCE.)

II. *Gifts causa mortis.*—Gifts bestowed in anticipation of death differ, in several important respects, from gifts *inter vivos.* They are conferred only upon the presumed condition that they shall take effect in case the donor dies by his existing disorder. A recovery from the illness operates of itself as an avoidance of the gift, and no express revocation is necessary. Moreover, though delivery is an essential element to the validity of the donor's act to the same extent as in gifts *inter vivos,* and though it may, in the same manner, be either actual or constructive, it does not, nevertheless, have the same effect, at least until the donor's death. For as long as he continues to live he has power to revoke his gift, even though actual delivery may have been made.

But apart from these fundamental distinctions, there is a general resemblance between the two classes of gifts. The same rules as to legal capacity are applicable, and as to the effect of the donor's gratuitous promises. The doctrine of constructive delivery as applied to valid rights of action, such as mortgages, policies of life insurance, deposits in savings banks, etc., has been carried farther than in gifts *inter vivos,* in order to effectuate the donor's intent. Mere delivery in such cases is in general sufficient, even though there be no written assignment of the mortgage, policy of insurance, etc. Moreover, the same qualifications are applicable as to the effect of fraud upon the legality of the gift, and the rights of existing creditors receive the same protection. Questions concerning gifts *causa mortis* are frequently entertained by courts of equity, though this is by no means the invariable practice. The validity or invalidity of a pretended gift *causa mortis* is oftentimes difficult of proof, since the donor's testimony is of course unobtainable, and excellent opportunities are frequently afforded for the assertion of fraudulent claims by professed donees. On this account every claim of the kind is examined with careful scrutiny, and clear proof is required that the gift was actually made as maintained by the donee.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Gi'ger (GEORGE MUSGRAVE), D. D., b. in Philadelphia June 6, 1822; graduated at Princeton with honors in 1841, and studied divinity at that place; was a tutor there, and in 1846 became adjunct professor of mathematics; in 1847 adjunct professor of Greek; was professor of Latin 1854–65. D. in Philadelphia Oct. 11, 1865, and bequeathed his library and a large amount of money to the college.

Gignoux (FRANÇOIS RÉGIS), a landscape-painter, b. at Lyons, France, in 1816; educated at Fribourg; studied art in the Academy of St. Pierre at Lyons; entered later the School of Fine Arts in Paris, and afterwards was a pupil of Delaroche. He it was who confirmed his bent towards landscape-painting. In 1840 he came to America, married, and entered on an industrious career in New York and Brooklyn. His pictures are sincere studies of Nature, chiefly in her more cheerful aspects; they display a sympathetic feeling, a correct hand, an eye for picturesque effects, a rich sense of color, a healthy fondness for beauty, an absence of everything morbid, and a freedom from monotony and mannerism that indicates good training and well-poised faculties. His style is unambitious; his subjects commonly unobtrusive, as, for example, *Spring, The First Snow, The Indian Summer.* He is, however, bold at times, as in the *Niagara in Winter,* the *Bernese Alps at Sunrise,* and other large canvases placed in public exhibitions. The *Niagara by Moonlight,* in the Belmont collection, is a good example of his power. Mr. Gignoux has been a sincere servant of art in his adopted country. He was chosen the first president of the Brooklyn Art Academy.

O. B. FROTHINGHAM.

Gi'hon (ALBERT LEARY), M. D., b. 1833 in Philadelphia; graduated first in his class at the Philadelphia High School 1850; professor of chemistry in the Philadelphia Medical College 1853–54; entered the medical department of the U. S. navy 1855; has attained the rank of commander, and is medical inspector (1875). Author of *Practical Suggestions in Naval Hygiene* and various professional papers, and a large contributor to periodical literature.

Gijon', town of Spain, in the province of Asturias, on the Bay of Biscay. Its Instituto Asturiano, with professorships in mathematics, navigation, the English and French languages, its large cigar manufactures, and its considerable trade in fruit and coal, make Gijon quite a lively place. Pop. 10,378.

Gi'la, Ri'o, a river which rises in Socorro co., N. M., in the Sierra Madre, and flows first S. W., then S., and finally W., joining the Rio Colorado about 180 miles from its mouth. Its course is entirely within the Territories of New Mexico and Arizona. Its total length is not far from 500 miles. One-half its course is through mountain-cañons, but its lower half flows through a somewhat level but rather narrow valley, well wooded, and in some parts very fertile when irrigated. Its waters are utilized also in gold and silver mining. Its lower valley abounds in ruins, the relics of an ancient civilization represented at present by the Pima and Maricopa Indians, and a few other partly civilized tribes. In its lower course its depth averages 3 feet, its breadth 60 feet, and its current 2 miles per hour.

Gil'bert (NATHANIEL), a lawyer and Speaker in the house of assembly in Antigua, West Indies, is distinguished in the history of Methodism as the founder of that denomination in those islands. He was in England in 1758, when he and two of his slaves heard Wesley preach. Master and slaves became converts, the slaves being baptized by Wesley. On his return to the West Indies, Gilbert held religious meetings in his own house. He became a local preacher of Methodism, and founded a society, chiefly of blacks, which was the beginning of the extensive Wesleyan missions in the archipelago, by which many thousands of negroes have been Christianized. Methodism became one of the chief means of West India emancipation, and it now prevails through most of the islands.

ABEL STEVENS.

Gilbert, or **Gilberd** (WILLIAM), M. D., b. at Colchester, England, 1540; was educated at St. John's, Cambridge, and in 1573 settled in London. In 1603 he became first physician to James I. Author of *De magneti magneticisque corporibus* (1600) and *De mundo nostro Philosophia* (1651), works of surprising accuracy of statement and full of profound thoughts. He stood far in advance of his time as a scientific observer and theorist, and as a recorder of facts. D. Nov. 30, 1603.

Gil'bert Hol'low, tp. of Lexington co., S. C. P. 872.

Gil'bertines, an order of monks and nuns founded in England by St. Gilbert of Sempringham (1083–1189). It at first contained only nuns who were Benedictines, but in most of their houses were also monks who were canons regular of St. Augustine. There were also lay brothers, who followed the Cistercian rule. The rules of the order were very strict with regard to the separation of the monks and nuns. The order was extinguished by Henry VIII.

Gil'bert Isl'ands, or the **Kingsmill Group,** the south-easternmost group of Micronesia, containing sixteen inhabited islands of coral formation, situated in the Pacific, between lat. 1° S. and 2° 30′ N. and lon. 172° and 174° 30′ E., and belonging to the Mulgrave Archipelago. The islands are low, and covered only with a thin layer of vegetable mould. Cocoanuts, taro, and pandanus are cultivated. The inhabitants, who number about 60,000, and have some resemblance to the Malays, are very rude, and are occasional cannibals. Promising missions are maintained here by Hawaiian and American Congregationalists.

Gil'bertville, post-v. of Hardwick tp., Mass., on the Ware River and the Ware River R. R., 16 miles N. E. of Palmer. It has important manufactures.

Gil'boa, tp. of Benton co., Ind. Pop. 452.

Gilboa, mountainous tp. of Schoharie co., N. Y.—GILBOA, post-v. of this tp., is at the falls of the Schoharie Creek. Pop. of tp. 2227.

Gilboa, post-v. of Blanchard tp., Putnam co., O. Pop. 315.

Gil'christ, post-tp. of Pope co., Minn. Pop. 169.

Gil'das, a Welsh historian, b., according to Ussher, in 511 A. D., and said to be the brother of Aneurin, a famous bard. His *De Calamitate, Excidio et Conquestu Britanniæ* has been often printed. He is called "the Wise," and became a prominent ecclesiastic in Ireland, and later in Brittany. D. 570 (*Ussher*). It is, however, sharply questioned whether such a person ever lived.

Gil'der (WILLIAM H.) was b. in Philadelphia Sept. 17, 1812; was educated at the Wesleyan University, Conn., and entered the ministry in 1833. In 1840 he began a Methodist paper in Philadelphia called the *Depository.* He served during several years as principal of the female institute at Bordentown, N. J., and subsequently as president of the female college, St. Thomas's Hall, Flushing, L. I. For some time he was editor of the *Literary Register.* In 1862 he became chaplain in the army, and d. in hospital at Culpeper, Va., in 1864.

ABEL STEVENS.

Gild'ing, the application of a thin layer of gold upon the surface of another substance. There are various methods in use of effecting this. The ancient process, that of applying gold-leaf, is still the best for many kinds of work. Gold-leaf is made to adhere by the use of "gold-size," a tempera priming rendered adherent by an admixture of glue; or by "oil-size," a varnish of linseed oil and ochre,

the last chiefly used for work that is exposed to the weather. For gilding book-covers the leaf is made to adhere by heat and pressure (if the cover is of cloth), or by the use of albumen or gelatine for leather-work. Gold is often applied to metals by means of an amalgam (which is rubbed on and then heated) or a solution. A brass or copper wash affords the best surface for this kind of gilding. Whatever method is employed, the gilded surface has to be burnished afterwards. Much gilding is done by the electrotype process (see ELECTROTYPE), or even by simple immersion of the article to be gilded in a gold solution. Glass and porcelain are gilded by the encaustic method. For the gilding of particular kinds of goods there are innumerable special processes, many of them involving widely various chemical reactions. Most of them are comparatively recent inventions. Gilding can be applied in layers of incredible thinness by the newer methods, and at a small cost; but the old standard process by the use of gold-leaf is, where applicable, unsurpassed for durability and handsome appearance.

Gil'ead ("rocky region"), a district of Palestine, bounded W. by the Jordan, E. by the Arabian desert, N. by the Hieromax (*Yarmûk*), and S. by the Arnon (*Mojib*). Northern Gilead extended from the Hieromax to the Jabbok (*Zerka*), about 35 miles; in the time of Moses was under the dominion of Og, king of Bashan, and after its conquest was assigned to the half-tribe of Manasseh. Southern Gilead extended from the Jabbok to the Arnon, about 50 miles; in the time of Moses belonged to Sihon, king of the Amorites, and after its conquest was assigned to the tribes of Reuben and Gad. In this southern portion, which at one time belonged to the Moabites, were Nebo, Pisgah, and Peor. The whole district is wildly mountainous (the greatest elevation being about 4000 feet above the sea), but exceedingly picturesque, clad with noble forests, and very fertile. The streams, unlike those W. of the Jordan, are perennial. R. D. HITCHCOCK.

Gilead, post-tp. of Calhoun co., Ill. Pop. 498.

Gilead, post-v. and tp. of Oxford co., Me., on the Grand Trunk Railway, 80 miles N. W. of Portland. Pop. 329.

Gilead, post-tp. of Branch co., Mich. Pop. 794.

Gilead, tp. of Morrow co., O. Pop. 2017.

Gilead, Balm of, a product of Oriental lands, once highly valued as a vulnerary and cosmetic, and for its odor as well as for its medicinal properties. In the Levant it still sells for a very high price, and is now known as Mecca balsam. It is the product of *Amyris Gileadensis*, an evergreen shrub now found chiefly on the shores of the Red Sea. Some think that the ancient balm of Gilead was MASTIC (which see), the product of *Pistacia Lentiscus*.

The "balm of Gilead tree" of the U. S. is the *Populus balsamifera*, a tall poplar whose large buds are in spring covered with a strong-smelling, copious resin, which is used as a vulnerary and stimulant in domestic medicine.

Giles, county of Middle Tennessee, bordering on Alabama. Area, 600 square miles. The soil is remarkably fertile. Cattle, corn, cotton, tobacco, and wool are produced. Among the manufactured articles are lumber, brick, and building-stone. It is traversed by the Louisville Nashville and Great Southern R. R. Cap. Pulaski. Pop. 32,413.

Giles, county of S. W. Virginia, between the Appalachian ranges known as Peter's and Walker's Mountains. Area, 275 square miles. The surface is very rough. Grain, tobacco, and wool are produced. Cap. Pearisburg. Pop. 5875.

Giles, tp. of Van Buren co., Ark. Pop. 611.

Giles, tp. of Amelia co., Va. Pop. 3597.

Giles (HENRY), a clergyman, lecturer, and author, b. Nov. 1, 1809, in Craanford, Wexford co., Ireland; educated in Belfast, at the Royal Academy, in the Roman Catholic faith; this he departed from till he became a Unitarian. As a minister of this sect he preached in Greenock and in Liverpool; in the latter city he bore an able part in the controversy between the Unitarians and Episcopalians, in 1839, with Mr. Martineau and Mr. Thom. In 1840 he came to America, where his excellence as a preacher and lecturer made him known in every city as a man of brilliant gifts. He has published several volumes of essays, lectures, and discourses marked by ingenuity of thought, fulness of diction, and fervor of style. Their titles are—*Lectures and Essays* (2 vols., 1845); *Christian Thought on Life* (1850); *Illustrations of Genius* (1854); *Human Life in Shakspeare* (1868). For many years Mr. Giles has been withdrawn by illness from public view. His residence at present is at Hyde Park, Mass. O. B. FROTHINGHAM.

Giles (WILLIAM BRANCH), b. in Amelia co., Va., Aug. 12, 1762; was educated at Princeton, N. J.; became a lawyer of Petersburg, Va.; was in Congress 1790–98, 1801–02; in the U. S. Senate 1804–15; governor of Virginia 1827–30; Presidential elector 1801, 1805. D. Dec. 4, 1830. Mr. Giles entered public life as a Federalist, but very early left that party, and acted mainly with the Jeffersonians, but was often found outside of all party lines. He was one of the best debaters and parliamentarians of his time, and was prominent as a State legislator, and published several severe but effective political letters. A. H. STEPHENS.

Gilesville, a v. of Lafayette tp., McKean co., Pa., is the S. terminus of the Buffalo Bradford and Pittsburg R. R., 26 miles from Carrollton, N. Y. It is an important shipping-point.

Gilfil'lan (GEORGE), b. at Comrie, Perthshire, Scotland, 1813; was educated in Glasgow University; in 1835 became a minister of the United Presbyterian Church, and since 1836 has been settled at Dundee. Author of *Gallery of Literary Portraits* (1845–55, 3 series); *The Bards of the Bible* (1850); *Night*, a poem (1867); *Martyrs, etc. of the Scottish Covenant* (1852), and numerous other works, including an edition of the *British Poets* in 48 vols. His too ornate style has invited severe criticism, but his productions have had wide popularity.

Gil'ford, tp. of Tuscola co., Mich. Pop. 353.

Gilford, tp. of Belknap co., N. H., on Lake Winnepiseogee, contains LACONIA (which see), the capital of the county, and LAKE VILLAGE, an important manufacturing place, on the Boston Concord and Montreal R. R., 27 miles N. E. of Concord. Gilford has 5 churches, a savings bank, a large trade, and manufactures of hosiery, iron goods, machinery, shoes, etc. The scenery is charming. Pop. 3361.

Gill. See WEIGHTS AND MEASURES, by F. A. P. BARNARD.

Gill, tp. of Sullivan co., Ind. Pop. 2135.

Gill, post-tp. of Franklin co., Mass., on the W. side of the Connecticut River, 4 miles N. E. of Greenfield. It is a beautiful and fertile tract, and has a good town-hall and a public library. Pop. 653.

Gill (HENRY Z.), M. D., b. at Richborough, Bucks co., Pa.; took his medical degree at Jefferson Medical College, Philadelphia, 1857; practised at Columbus, O., until 1861; served 1861–65 as assistant surgeon and surgeon in the U. S. volunteer service, and received the brevet rank of lieutenant-colonel in 1865; studied medicine in Europe 1866–67; practised his profession in St. Louis until 1873, when he removed to Jerseyville, Ill.; was president of the St. Louis Microscopical Society, recording secretary of the St. Louis Medical Society, corresponding secretary of the Missouri Medical Association; was one of the publishers of the *St. Louis Medical and Surgical Journal* 1872–74; author of many professional papers.

Gill (JOHN), D. D., b. at Kettering, North Hants, England, 1697; became a Baptist pastor; settled at Horsleydown 1719, and d. there Oct. 14, 1771. He was profoundly versed in Latin, Greek, and Oriental biblical literature; was a high Calvinist. Author of a voluminous and very learned *Exposition of the Bible* (1746–66), a *Body of Divinity* (1769–70), sermons, treatises on baptism, etc.

Gill (THEODORE NICHOLAS), M. A., M. D., Ph. D., naturalist, resident at Washington, D. C., b. in the city of New York Mar. 21, 1837; received a classical education in private schools and under special tutors; honorary M. A., M. D., and Ph. D., and member of the National Academy of Sciences. His earlier contributions to science were chiefly on fishes, and later on mammals, but in the course of his investigations he has published articles on mollusks, crustaceans, and other departments of natural history, in all amounting to nearly 200 papers. The most noteworthy of these are *Arrangement of the Families of Mollusks* (1871), *Arrangement of the Families of Mammals* (1873), and *Arrangement of the Families of Fishes* (1873), all published by the Smithsonian Institution.

Gil'lam, tp. of Jasper co., Ind. Pop. 635.

Gil'lem (ALVAN C.), b. in Tennessee 1830; graduated at the U. S. Military Academy July, 1851, and entered the army as brevet second lieutenant of artillery; promoted to be second lieutenant Dec., 1851, first lieutenant 1855, captain and assistant quartermaster 1861, and colonel 24th Infantry July, 1866; served in garrison and on frontier duty 1851–61, and in the civil war in defence of Fort Taylor, Fla.; as brigade and chief quartermaster Jan., 1861, to June, 1862, being engaged in the battle of Shiloh and siege of Corinth; appointed colonel 10th Tennessee Volunteers May, 1862, and was provost-marshal of the city of Nashville Aug.–Dec., 1862; appointed brigadier-general of volunteers Aug., 1863, and participated and commanded in numerous engagements and expeditions in Tennessee. Upon the reorganization of the State government of Tennessee he was vice-president of the convention to revise the constitution and a member of

the State legislature; he subsequently commanded a cavalry division, and was engaged in various expeditions and combats in Tennessee and North Carolina. In Sept., 1866, he was mustered out of the volunteer service. For gallant conduct in the field he received the successive brevets from major to that of major-general U. S. A. In 1869 he was transferred to the command of the 11th Infantry, and in 1870 to that of the 1st Cavalry, which position he still retains. He was conspicuous in the pursuit of the Modoc Indians, which resulted in their capture. G. C. SIMMONS.

Gilles'pie, county of Western Texas. Area, 925 square miles. The surface is hilly, the valleys narrow, but very fertile. The inhabitants are principally Germans. Grain, wool, fruit, and pork are the chief products. The climate is dry and healthful. Coal, limestone, and iron have been found, but the extent and value of the mineral deposits are not known. Cap. Fredericksburg. Pop. 3566.

Gillespie, post-v. of Macoupin co., Ill., on the Indianapolis and St. Louis R. R., 45 miles E. of E. St. Louis.

Gillespie (WILLIAM MITCHELL), LL.D., b. in New York 1816; graduated at Columbia College 1834; studied in Europe; returned in 1845, and was professor of civil engineering in Union College 1845–68; author of *Rome as Seen by a New Yorker in 1843–44* (1845); *Roads and Railroads* (1845), a work which has passed through many editions; *Philosophy of Mathematics*, after Comte (1851); a treatise on *Land-Surveying* (1855); another on *Levelling, Topography, and the Higher Surveying* (1870). D. at New York Jan. 1, 1868.

Gil'let (RANSOM H.), b. in New Lebanon, N. Y., Jan. 27, 1800; removed first to Saratoga co., and in 1819 to St. Lawrence co., N. Y.; studied law with Silas Wright, and became a lawyer of Ogdensburg, where he was postmaster 1830–33; Democratic member of Congress 1833–37; an Indian commissioner 1837–39; register U. S. treasury 1845–47; solicitor U. S. treasury 1847–49; assistant U. S. attorney-general 1855–58; solicitor of the court of claims 1858–61. Author of a *History of the Democratic Party, The Federal Government* (1871), etc.

Gil'lett, post-tp. of Oconto co., Wis. Pop. 268.

Gillette (ABRAHAM DUNN), b. at Cambridge, N. Y., in 1809; became a Baptist minister; held the pastorate of Calvary church, New York, etc.; author of *Memoir of D. H. Gillette, Pastor's Last Gift*, etc., and became a large contributor to denominational literature.

Gil'leys, tp. of Dale co., Ala. Pop. 400.

Gil'lies (JOHN), LL.D., b. at Brechin, Scotland, Jan. 18, 1747; was educated at Glasgow, where he was some time Greek professor; became historiographer-royal for Scotland in 1793. D. at Clapham, London, Feb. 15, 1836. Author of a *History of Ancient Greece* (1786–1810); published translations from Aristotle, Lysias, and Isocrates, and was author of several other works. Of these his *History* is the only one ever of any value. Its style is faulty, and the works of Grote, Curtius, and other late students have entirely superseded it.

Gil'liflower [Fr. *girofle*, a "clove," alluding to the odor of some kinds; others say *July Flower*], a popular name for the cruciferous plants of the genus *Matthiola*, called also by the general name of stock or stock-gilliflower. They are herbaceous or partly shrubby. All the common kinds are European. *Matthiola annuus* includes the ten-weeks stocks; *Matthiola Græcus*, the Grecian stock; *Matthiola incanus*, the purple gilliflowers, Brompton stocks, etc.; and *Matthiola fenestralis*, the large window stocks. The varieties are many, and several species besides the above are recognized. Considerable skill is required in growing fine stocks, which are favorite flowers in cultivation, especially in Great Britain.

Gil'lis (JAMES H.), U. S. N., b. May 14, 1831, in Pennsylvania; entered the navy as a midshipman Oct. 12, 1848; became a passed midshipman in 1854, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866; commanded the little steamer Hale in Rhind's spirited engagement with a battery of two long 24-pounders on the Dawho River, S. C., and received the commendation of his superior officer for "skilful handling of his vessel" and "effective planting of his shells" in the action. In command of the steamer Commodore Morris (North Atlantic blockading squadron) in 1863 and the first part of 1864, during which period he was actively engaged afloat and ashore. Commanded the iron-clad Milwaukee at the time she was blown up by a torpedo off Spanish Fort, near Mobile, Mar. 28, 1865, from which date until Apr. 8, when the fort surrendered, he was in charge of the naval battery engaged in its reduction. Speaking of this battery, Rear-admiral Thatcher, in his official report of the capture of Fort Alexis and Spanish Fort, says: "These very strong works were heavily bombarded last evening, from five until seven o'clock, by army and navy. Our battery on shore, under command of Lieut.-Com. Gillis, late of the U. S. iron-clad Milwaukee, is highly spoken of by Gen. Canby for its efficiency in the attack." FOXHALL A. PARKER, U. S. N.

Gillis (JOHN P.), U. S. N., b. Sept. 6, 1803, in Wilmington, Del.; entered the navy as a midshipman Dec. 12, 1825; became a passed midshipman in 1831, a lieutenant in 1837, a commander in 1855, a captain in 1862; retired from active service, owing to physical disability, in 1864. Commanded the Monticello at the capture of Forts Hatteras and Clark, and the Seminole in the battle of Port Royal, and was commended by Rear-admiral Dupont, in his official despatch of Nov. 11, 1861, for "zeal and ability."

FOXHALL A. PARKER, U. S. N.

Gil'lis Bluff, tp. of Butler co., Mo. Pop. 203.

Gil'liss (JAMES MELVIN), b. in D. C. in 1810; midshipman U. S. navy 1827, captain 1862; organized one of the first astronomical observatories in the U. S. 1838; organized the naval observatory 1842–45; was put in charge of the national observatory 1861. D. at Washington Feb. 9, 1865. Published a volume of the *American Astronomical Observations* (1843), and a *Report of the U. S. Astronomical Expedition of 1849–52* (2 vols., 1855), besides many scientific papers of importance. He also introduced important improvements in the instruments employed in astronomical work.

Gill'more, tp. of Isabella co., Mich. Pop. 88.

Gillmore (QUINCY ADAMS), b. at Black River, Lorain co., O., Feb. 28, 1825; graduated at West Point at the head of the class of 1849, and entered the army as brevet second lieutenant of engineers; served three years as assistant engineer in construction of the defences of Hampton Roads, Va., returning to West Point in 1852 as instructor of military engineering. In July, 1856, he was promoted to be first lieutenant, and placed in charge of the engineer agency at New York. He was promoted to a captaincy Aug., 1861, and made chief engineer of the Port Royal expedition under Brig.-Gen. T. W. Sherman. After a careful reconnoissance of Fort Pulaski, Ga., Capt. Gillmore reported that he deemed the reduction of that work practicable by batteries of mortars and rifled guns established on Tybee Island, 1 mile distant from the fort; and he was at once placed in command of the troops engaged in the siege. After nearly two months of incessant labor, Fort Pulaski was completely invested and the Savannah River blockaded, and on the evening of Apr. 9, Gen. Gillmore (then acting brigadier-general) issued his order for the bombardment. On the 10th, the commandant of Fort Pulaski having refused to surrender, the bombardment was commenced at $8\frac{1}{4}$ A. M., continuing with little cessation till 2 P. M. of the 11th, when the white flag was raised from the fort, the surrender being consummated during that afternoon and evening. (See BOMBARDMENT.) In Aug., 1862, Gen. Gillmore was assigned to the command of a division of troops in Kentucky. In Jan., 1863, he was placed in command of the central district of Kentucky, defeating Gen. Pegram at the battle of Somerset, for which service he was brevetted colonel. In June, 1863, he was called to command the department of the South, and in July following the 10th army corps. It was while holding this command that he conducted the operations against Charleston, comprising the descent on Morris Island, the reduction and capture of Fort Wagner, and the bombardment and practical demolition of Fort Sumter from batteries 2 miles distant. The general-in-chief (Halleck), in speaking of this siege, said: "Gen. Gillmore's operations have been characterized by great professional skill and boldness. He has overcome difficulties almost unknown in modern sieges. Indeed, his operations on Morris Island constitute a new era in the science of engineering and gunnery." Transferred to the James River in 1864 in command of 10th army corps, he was engaged (May 13) in the assault in front of Drury's Bluff, and (May 16) at the battle of Drury's Bluff. Summoned to Washington in July, on the approach of Early, he commanded two divisions of the 19th army corps in the defence of that city and subsequent pursuit of Early's command, when he received severe injuries from the fall of his horse. From Nov., 1864, to Feb., 1865, he commanded the department of the South, resigning his volunteer commission Dec., 1865. After serving on various boards he was assigned to his present duty as engineer in charge of fortifications on Staten Island, N. Y., and South Atlantic coast, embracing North Carolina, South Carolina, Georgia, and Florida, being also entrusted with the improvement of Charleston harbor, the Savannah and St. John's rivers. In June, 1868, he was promoted to be major, and Jan., 1874, to be lieutenant-colonel of engineers. For gallant conduct at Morris Island, Forts Wagner and Sumter he was brevetted brigadier-general and major-general U. S. Army. Among his published works are the *Siege and Reduction of Fort Pulaski;*

A Practical Treatise on Limes, Hydraulic Cements, and Mortars; Engineer and Artillery Operations against the Defences of Charleston in 1863; Report on Béton Aggloméré, or Coignet-Béton. G. C. Simmons.

Gillott' (Joseph), b. in Warwickshire, Eng., 1800; became a knife-grinder of Sheffield, and began in early life the manufacture of steel pens at Birmingham in a very small way. But his improvements in steel pens gradually increased their popularity, and his establishment became by far the largest in the world in that line of manufacture. His acquired wealth was great, and he made a famous collection of paintings. D. at Birmingham Jan. 6, 1872.

Gill-over-the-Ground, or **Ground Ivy,** the *Nepeta Glechoma*, a strong-smelling, trailing plant naturalized in the U. S. from Europe, belongs to the Labiatæ. It was formerly used in medicine, chiefly as a domestic remedy for colds, coughs, etc.

Gill'ray (James), b. 1757 at Chelsea, Eng., the son of a pensioner; was a goldsmith's apprentice; ran away with a company of strolling actors; studied art at the Royal Academy; became a good engraver, chiefly distinguished as an unrivalled political caricaturist, in which line of art he produced some 1200 copper-plate etchings. His intemperate habits brought on insanity, and he d. of delirium tremens at London June 1, 1815. (See his *Life and Times* (1874), by T. Wright.)

Gills [Lat. *branchiæ*], the organs of respiration in fishes, batrachian larvæ, insects, crustaceans, mollusks, molluscoids, etc. In Bryozoans and Brachiopods the gills are fringes of tentacles around the mouth. These are hollow, and contain the circulatory fluid, which is aërated through their walls. The Lamellibranchiates are so named from the fact that their gills are thin lamellæ, two of these generally being within the mantle, one on each side of the body. The gills of the Gasteropods are extremely various, and the various groups are named according to the position of the gills. Cephalopods have two gills (Dibranchiata) or four (Tetrabranchiata). In most crustaceans the gills are fringes and expansions of the limbs. In the Decapods they are feather-shaped, and within the abdominal cavity. Many insects have gill-like breathing-organs, either external or internal. Batrachians have temporary fish-like gills, which disappear when the animal enters the adult condition. The gills of the fishes show many remarkable modifications, the object in all being to present a large surface to the external water, the substance of the gill-surfaces being charged with blood, which is kept supplied by gill-arteries, often contractile. (For an enumeration of these modifications see the article Comparative Anatomy.)

Gill's Creek, tp. of Lancaster co., S. C. Pop. 2040.

Gill's Creek, tp. of Franklin co., Va. Pop. 2453.

Gil'man, post-v. of Iroquois co., Ill., at the crossing of the Illinois Central and the Toledo Peoria and Warsaw R. Rs. It is also the N. E. terminus of the Gilman Clinton and Springfield R. R. It has 1 newspaper, 1 opera-house, a library building and a public library, 3 hotels, 2 schools, 2 churches, 1 bank, 2 public fountains flowing artesian water obtained by boring 90 feet; 1 nursery of 600 acres, and 20 small fruit-farms. The town derives its support from small fruit, corn, and cattle. It has fine pasturage and good water. Pop. about 1500. Ed. Rumley, Ed. "Star."

Gilman, post-v. of Marshall co., Ia. It has one weekly newspaper.

Gilman, tp. of Pierce co., Wis. Pop. 503.

Gilman (Arthur), b. in 1837 at Alton, Ill.; educated in New York, and was for a time engaged in business, but removed to Berkshire co., Mass,, where he engaged in literary pursuits and in labors in behalf of education and religious instruction. In 1871 he became editorially connected with the publications of the American Tract Society, Boston. He has contributed much to periodicals, and has published a popular manual of English literature.

Gilman (Caroline), b. in Boston, Mass., Oct. 8, 1794, was the daughter of Samuel Howard and the wife of Rev. Dr. Samuel Gilman (1791–1858). In youth her poems *Jephthah's Rash Vow* and *Jairus's Daughter* attracted much attention. In 1819 she married and removed to Charleston, S. C., and in 1832 began to edit *The Rosebud*, afterwards *The Southern Rose.* She is the author of numerous volumes of prose and verse.—Her daughter, Mrs. C. H. Glover (b. 1823), is also a gifted writer of poems and tales.

Gilman (Chandler Robbins), M. D., b. at Marietta, O., Sept. 6, 1802, received his medical degree at the University of Pennsylvania, his father having removed to Philadelphia several years before. Dr. Gilman for many years practised medicine in New York; was appointed in 1840 professor of obstetrics and diseases of women and children in the College of Physicians and Surgeons, and in 1851 assumed also the chair of medical jurisprudence. He wrote *Legends of a Log Cabin* (1835), *Life on the Lakes*, and a number of professional writings, besides some translations from the German, etc. D. at Middletown, Conn., Sept. 26, 1865.

Gilman (Daniel Coit), b. at Norwich, Conn., July 6, 1831; graduated at Yale in 1852; was superintendent of schools New Haven, Conn., 1856–60; professor of physical and political geography at Yale and college librarian 1856–72; superintendent of schools in Connecticut 1863–65; president of the University of California 1872–75; became in 1875 president of Johns Hopkins University, Baltimore, Md.; author of numerous reports, addresses, scientific, historical, and educational papers, etc.

Gilman (John Taylor), b. at Exeter, N. H., Dec. 19, 1753, joined the Revolutionary army at Cambridge, Mass., 1776; was prominent in State and national affairs; was in Congress 1782–83; treasurer of New Hampshire 1783–92; governor 1794–1805 and 1813–16. He was a strong Federalist. D. at Exeter, N. H., Sept. 1, 1828.

Gilman (Nicholas), a brother of J. T. Gilman (1753–1828), b. about 1762, was sent to Congress from New Hampshire in 1786; was one of the framers of the U. S. Constitution, and was again in Congress 1789–97, and U. S. Senator 1805–14. D. at Philadelphia May 2, 1814.

Gilman (Samuel), D. D., b. at Gloucester, Mass., Feb. 16, 1791; graduated at Harvard in 1811; was a mathematical tutor there 1817–19; pastor of the Unitarian church, Archdale street, Charleston, S. C., 1819–58; and was the author of several volumes of miscellaneous literature and many contributions in prose and verse to periodicals. His best known work is the *Memoirs of a New England Village Choir* (1829). D. at Kingston, Mass., Feb. 9, 1858.

Gil'manton, tp. of Benton co., Minn. Pop. 193.

Gilmanton, post-tp. of Belknap co., N. H., 20 miles N. E. of Concord, has an academy, five churches, and manufactures of farming implements, sash, blinds, etc. P. 1642.

Gilmanton, post-tp. of Buffalo co., Wis. Pop. 715.

Gil'mer, county of the N. of Georgia. Area, about 460 square miles. It is mountainous, and abounds in gold, marble, and iron. Tobacco, wool, and corn are staple products. Cap. Ellijay. Pop. 6644.

Gilmer, county of Central West Virginia. Area, about 230 square miles. Its surface is hilly, but fertile. Iron, salt, and coal are found. Corn and tobacco are staple products. Cap. Glenville. Pop. 4338.

Gilmer, tp. of Adams co., Ill. Pop. 1425.

Gilmer, tp. of Guilford co., N. C. Pop. 2311.

Gilmer, post-v., cap. of Upshur co., Tex., 40 miles W. of Jefferson.

Gilmer (George Rockingham), b. in what is now Oglethorpe co., Ga., Apr. 11, 1790; became a lawyer of Lexington, Ga.; was 1813–18 an officer of the 43d U. S. Infantry, and served against the Creeks; served in the State legislature; was governor of Georgia 1829–31, 1837–39; was in Congress 1821–23, 1827–29, 1833–35; a Presidential elector in 1836 and 1840; trustee of Georgia University for thirty years, and in his will left to it large benefactions D. at Lexington, Ga., Nov. 15, 1859. Author of *Georgians* (1855), a book containing much valuable information. A. H. Stephens.

Gilmer (Jeremy Francis), b. in Guilford co., N. C., Feb. 23, 1818; graduated at the U. S. Military Academy, and entered the army as second lieutenant of engineers July, 1829, and continued in the service of the U. S., in the construction of fortifications, surveys, improvements of rivers, etc., till 1861, being then captain of engineers, when he resigned and espoused the Southern cause, being appointed major of engineers C. S. A. Sept., 1861, and served as chief engineer on the staff of Gen. A. S. Johnston until the death of the latter on the field at Shiloh Apr. 6, 1862. In the battle of Shiloh, Gen. Gilmer himself was severely wounded. After his recovery he served a short time with the army of Northern Virginia, being assigned (Aug. 9, 1862) to the office of chief of engineer bureau at Richmond, Va., with the rank of colonel of engineers. This office he continued to fill till the close of the war, although not constantly in Richmond. Promoted to be major-general C. S. A. Aug. 20, 1863, he was ordered temporarily to Charleston, S. C., to direct the defences of that city; returning to Richmond in June, 1864, he resumed charge of the engineer bureau, continuing to perform this duty till the close of the war. In the fall of 1865, Gen. Gilmer was elected a director of the Georgia Central R. R., afterwards president *pro tem.;* in 1866 elected president of the Savannah Gas-Light Co., which office, together with that of director Georgia Central R. R., he now holds. G. C. Simmons.

Gilmer (John A.), b. in Guilford co., N. C., Nov. 4,

1805; was member of the State senate from 1846 to 1856; was then member of the 35th and 36th Congresses; from the latter he withdrew in 1861; was delegate to the national Union convention at Philadelphia in 1866. D. May 4, 1868. A. H. STEPHENS.

Gilmer (THOMAS WALKER), a native of Virginia; was often a member of the house of delegates, of which he was Speaker; held many positions of high character, was governor in 1840; and was member of Congress from 1841 to 1843, when he was appointed secretary of the navy by Pres. Tyler; was in this office when killed by the accident on the U. S. steamer Princeton, Feb. 28, 1844. A. H. STEPHENS.

Gil'more, post-tp. of Benzie co., Mich., on Lake Michigan. Pop. 169.

Gilmore, post-v. of Tuscarawas co., O. Pop. 133.

Gilmore, tp. of Greene co., Pa. Pop. 703.

Gilmore, tp. of Jackson co., W. Va. Pop. 2169.

Gilmore (JOHN R.), b. at Boston, Mass., in 1823; received a mercantile education; became the head of a successful shipping-firm in New York in the Southern coastwise trade; retired from business 1857; was one of the founders of the *Continental Monthly;* wrote much under the name of "Edmund Kirke;" author of *Among the Pines, My Southern Friends, Down in Tennessee, On the Border, Life of Jesus, Among the Guerrillas,* and other works, besides copious contributions in prose and verse to periodical literature.

Gilmore (JOHN TAYLOR), M. D., b. Dec. 7, 1835, in Lowndes co., Miss.; took the degree of A. M. at the University of North Carolina 1856; studied medicine under Prof. Thomas of New York City, and graduated M. D. in the Jefferson Medical College, Philadelphia, 1858; entered the Confederate army as surgeon to Barksdale's famous Mississippi regiment; was soon advanced to brigade, then to division surgeon; and at the close of the war was in charge of hospitals at Greenville, S. C. He became professor of anatomy in Mobile (Ala.) Medical College in 1868, and in 1871 was transferred to that of surgery. PAUL F. EVE.

Gilmore (JOSEPH ALBREE), b. in Weston, Vt., June 10, 1811; d. in Concord, N. H., Apr. 17, 1867. Went to Boston at a very early age, and engaged in mercantile pursuits; removed to Concord, N. H., in 1843, and continued in the same business for a time, but subsequently became superintendent of the Concord and Claremont, Manchester and Lawrence, Concord, Concord and Portsmouth, and other railroads; member of the State senate 1858–59; president of that body 1859; governor of New Hampshire 1863–65.

Gilmore (JOSEPH HENRY), b. at Boston, Mass., Apr. 29, 1834; graduated at Brown University 1858; studied theology at Newton Seminary, where he was instructor in Hebrew 1861–62; held pastorates of Baptist churches at Fisherville, N. H., and Rochester, N. Y., and became in 1868 professor of logic in Rochester University.

Gilo'lo, or **Halmahe'ra,** an island in the Malay Archipelago, belonging to the Moluccas or Spice Islands, and situated on the equator in lon. 128° E. It is separated from Celebes, which it resembles somewhat in shape, by the Molucca Passage, from Ceram by Pitt's Passage, and from New Guinea by the Gilolo Channel. It is mountainous, densely wooded, very fertile, and produces spices and fruits, horses and cattle, gold-dust and pearls. Edible birds' nests are one of its exports. Its area is estimated at 6500 square miles.

Gil'pen's, tp. of Fayette co., Ala. Pop. 411.

Gil'pin, the smallest, but one of the most prosperous of the counties of Colorado. Area, 150 square miles. It abounds in mineral wealth. Gold-mining is the chief industry. It is mountainous, and is traversed by the Colorado Central R. R. Cap. Central City. Pop. 5490.

Gilpin (BERNARD), "Apostle of the North" of England, b. at Kentmire, Westmoreland, in 1517, was a nephew of Tonstall, and was patronized by Wolsey; educated at Queen's College, Oxford, he was converted to Protestantism by discussions with Hooper and Peter Martyr; was protected during Mary's reign by Tonstall, and afterwards became rector of Houghton-le-Spring, archdeacon of Durham, and itinerant preacher in the Debatable Land; was famous for laborious benevolence, for large hospitality, and for beneficence towards poor students. D. Mar. 4, 1583. His *Life,* by Bishop Carleton, is an English classic. (See also *Life* by W. GILPIN.)

Gilpin (CHARLES), M. P., b. in Bristol, England, in 1815. He came from a Quaker family, and during his life remained attached to the Society of Friends; brought up to trade, he became, in the course of time, a man of wealth. He served for some years as a member of the common council of London, and during that period succeeded in abolishing street-tolls in the metropolis. In 1852 he was a candidate to Parliament from Perth, but was defeated; but in 1857 was elected in the Liberal interest for Northampton, and retained the representation of that borough in the House of Commons up to his decease. In 1859 he was appointed by Lord Palmerston secretary to the poor-law board, which position he resigned in 1865. Outside of his legislative position, Mr. Gilpin held many private offices of trust—viz. chairman of the National Freehold Land Society, director of the South-eastern Railway and of the National Provident Institution; also chairman of the Metropolitan and Provincial Bank. D. Sept. 9, 1874. G. C. SIMMONS.

Gil'roy, a city and tp. of Santa Clara co., Cal., on the line of the Southern Pacific R. R., 80 miles from San Francisco and 30 miles from San José, the county-seat. It contains 6 churches, a fine public school, 3 private schools, 1 newspaper, a flour-mill, a tobacco and cigar factory, 2 hotels, 1 bank, and the usual number of stores, etc. Water works supply the city with good water, and the town is lighted with gas. It is the second city in size in Santa Clara co., and the streets are wide, macadamized, and clean. It has a municipal government and 3 fire companies. Farming is the principal business, although dairying is quite extensively carried on. Tobacco is beginning to be extensively cultivated and cured by a patent process, which makes it equal to the best Havana. Pop. of city, 1625; of tp. 3195. H. COFFIN, ED. "ADVOCATE."

Gil'sum, post-tp. of Cheshire co., N. H., has manufactures of lumber, woollens, wooden ware, etc. It is 50 miles S. W. of Concord. Pop. 590.

Gilt-head, a name given to numerous fishes (Sparidæ) of the genus *Chrysophrys,* especially to the *Chrysophrys*

The Gilt-head.

aurata of the European and African coasts, and the *Chrysophrys aculeata* of the North American Atlantic waters. The former is very highly prized for the table. The name is given to several other marine fishes.

Gil Vicen'te, best of Portuguese dramatists, called "the Portuguese Plautus," was b. probably in Barcellos in 1485; became an actor, and was patronized by John III. Author of many comedies, tragedies, farces, and Christmas pieces. D. in 1557. He was one of the fathers of the modern drama. A good edition of his works is that published at Hamburg in 1834.

Gim'bals, pairs of brass or copper rings in which are mounted a ship's compasses, chronometers, or barometers. One of the rings turns on a horizontal axis; the second ring, within the first, turns upon an axis at right angles with that of the first. The object is to keep the instrument right side up in spite of the pitching and rolling of the ship. To this end the instrument is weighted heavily. The object is attained in a very satisfactory, though by no means perfect, manner.

Gin, or **Gene'va** [Fr. *genièvre*, D. *jenever*, "juniper-berry"], an alcoholic spirit distilled from grain and flavored with the volatile oil of juniper. A principal seat of its manufacture is Schiedam in the Netherlands, which has some 220 gin-distilleries, and hence the liquor sometimes bears the names of Hollands and Schiedam schnapps. One part by measure of barley-malt and two parts of the best rye are usually mashed together for gin, but buckwheat and other grains have a limited use. The mashing (at 165° F.) lasts until the grains are brought to a smooth paste, when, after resting the process two hours, the whole mash is cooled to 80° by adding the spent wash of a former distillation till the worts show 33 by Dicas' hydrometer. Good yeast is added, and the grains and worts ferment for two or three days. Grains and all ("whole worts") are then put into the still, and the low wines are taken off, which are very weak. These are then redistilled with about a pound of juniper-berries to every fifty gallons of low wines; a little

salt and a pugil of hops may be added. The resulting liquor is gin. It commonly stands about 17° below proof, and before it reaches the consumer its proof is still farther lowered. Ordinary British and American gin is made by rectifying corn-whisky with a little oil of juniper or oil of turpentine, while coriander, grains of paradise, orange-peel, etc. still further improve or modify the flavor. Gin is also made in Great Britain from a mash of malt, rye, and potatoes, and rectified with oil of turpentine. The oil of juniper or of turpentine present gives gin a diuretic quality which causes it to have a great popular reputation for the cure of diseases of the kidneys. It has also a limited use in regular practice, but is not officinal in the U. S. or Great Britain. Gin is a very popular stimulant in England. There is no question but that the abuse of gin in supposed kidney disease is a fruitful cause of diseases of the kind it is intended to cure; and the so-called cirrhosis of the liver ("gin-drinker's liver"), and the consequent ascites or dropsy of the abdomen, are often produced by it.

Gin'ger [Gr. ζιγγίβερις; Lat. *zingiber;* Sans. *sringawêra,* "horn-shaped"], the prepared rhizome of *Zingiber officinale* (order Zingiberaceæ), a plant native to India and Southern China, now extensively cultivated in tropical America and West Africa, as well as in its native lands. The plant has a biennial or perennial, creeping, somewhat tuberous root-stock, which is the part employed. This may be dug when the plant is one year old, and must soon be scalded to prevent sprouting. If it now be at once dried, it constitutes the *black* ginger of commerce, but if it be decorticated also, it is called *white* ginger, of which that from Jamaica has the best reputation. Bleaching is sometimes employed to bring the scraped root to the proper whiteness. Calcutta exports the principal part of the ginger of commerce. Canton supplies much preserved ginger-root, which is boiled, and then cured with sugar. The West African colonies ship considerable quantities of ginger. Ginger is used as a flavoring for food and medicines, and has valuable stimulant and carminative properties. Good ginger affords 5 per cent. of an oleo-resin (the piperoid of ginger of Beral), which possesses all its active properties, for the residuum is inert. A volatile oil and several resinoids are believed to be combined in the oleo-resin. Ginger in the root (before grinding) is known as race-ginger (*radix,* a "root"). Ginger generally reaches the consumer in the powdered state, and is liable to very considerable adulteration.

Ging'ham [a name of East Indian origin], a cotton fabric woven from colored yarn, either plain or in checks or figures. Ginghams were originally made in Asia by hand, but are now made very extensively in Europe and the U. S. by power-machinery. Great Britain is the principal seat of the manufacture, but it is also carried on successfully in the U. S.

Ging'ko Tree, a large tree of China and Japan, the *Salisburia adiantifolia* (order Coniferæ, sub-order Taxineæ), now rather common in Europe and the U. S. It is very remarkable for having wide flat leaves, a character possessed by very few trees of the order. They resemble those of the maiden-hair ferns, whence the specific name. It is prized for its excellent timber, which resembles that of pine. Leaves of extinct species of this genus are obtained in the Eocene of the U. S. and British America.

Gin'gras, county in the N. of Dakota. Area, 1512 square miles. The Rivière au Jacques, or Dakota River, rises here, and a fork of the Cheyenne traverses the N. W. portion.

Ginguené (Pierre Louis), b. at Rennes, France, Apr. 25, 1748; entered the public service at Paris 1778; was imprisoned by the Jacobins 1793–94; was chosen to the Institute in 1796; minister at Turin 1798. D. at Paris Nov. 16, 1816. Author of poems, reviews, and a great amount of miscellaneous writing; chiefly remembered for his *Histoire littéraire d'Italie* (9 vols., 1811–19), a work of high value.

Gin'seng [Chinese], the root of the *Aralia* (*Panax*) *Ginseng* of Asia, and of the *Aralia quinquefolia* of the U. S. These two plants resemble each other very much, and are perhaps identical. The root is exported from the U. S. to China, where it is highly prized as a medicine, though less esteemed than Asiatic ginseng. The prices it formerly brought were very high. It has a pleasant aromatic taste, but its medicinal qualities are not important. Ohio, Minnesota, and West Virginia chiefly export it.

Giober'ti (Vincenzo), a distinguished Italian philosopher and statesman, the prophet of the uprising of Italy, as was Mazzini its apostle; b. in Turin Apr. 5, 1801. Left an orphan in his boyhood, he was early trained to loneliness and want, and in his later years he used to say with David, "Pauper sum ego et in laboribus a juventute mea." And indeed he lived poor and died poor. At sixteen, having already decided upon the clerical profession, Gioberti obtained a place in the ecclesiastical household of the king of Sardinia. He became an earnest student of the Bible, of ecclesiastical history, and of the Latin and Italian classics, reading at the same time contemporaneous works with great avidity. Even then it was his habit to annotate the books he read, and after a third perusal to make copious extracts and summaries. When only eighteen he had already planned a work to be entitled *Della Scelleratezze dei pontifici,* for the purpose of showing that all the misdeeds of the popes had resulted from their temporal power, and all their virtues from their reverence of gospel precepts. The varied reading of Gioberti soon rendered his mind almost encyclopædic, and at the same time quick, elastic, and apt at everything, preparing him also for a tolerant and amiable writer. In 1823, Gioberti was made doctor of divinity, and two years later he took sacerdotal orders. His dissertations, *De Deo et religione naturali* and *De Christiana religione et theologicis virtutibus,* secured him the chair of theology in the University of Turin. In 1828 he went into Lombardy, where he made the acquaintance of Manzoni; and into Central Italy, where he became the friend of Giacomo Leopardi, who predicted great things of the young philosopher. In 1830 the work of Rosmini concerning *L'origine delle idée* was published at Rome, and Gioberti was the first to study, teach, and circulate it. He now gathered about him certain young priests and other ardent juvenile students, whom he endeavored, through the philosophic teachings of Pasquale Galuppi, to lead to free and independent habits of thought. Instigated by the Jesuits, the eyes of the police were soon upon him. Having received, as court-chaplain, a first admonition from the abbot of Bricherasio, Gioberti, feeling his dignity wounded and desirous of greater freedom, resigned his office. Twenty days after, while walking and philosophizing with some of his friends, he was arrested (May 31, 1833), was detained in prison four months, and then sent into banishment. His name was also cancelled from the list of doctors of the university on the charge of his being (*like Socrates*) *a corrupter of youth.*

Gioberti went to Paris, where he devoted himself entirely to the study of philosophy, and formed a friendship with his fellow-exiles, Carlo Botta, Pellegrino Rossi, Guglielmo Libri, Terenzio Mamiani, etc. Mazzini attempted to draw him to his own party, and reproached him for his independent attitude, but Gioberti, averse to *societies* and conspiracies, preferred to keep his freedom of action intact. After fifteen months in Paris he went to Brussels to teach philosophy in a private institution. There also he had the society of other distinguished refugees, and there he began the publication of his *Teorica del Soprannaturale,* dedicated to the Piedmontese Paolo Pallia, his companion in study, who died in exile, "victim of the cruel severity of an Italian prince." These words caused the work to be prohibited in Piedmont. Then followed the publication of the *Introduzione allo studio della Filosofia,* undoubtedly his greatest philosophical work. In 1842, Gioberti was offered the chair of philosophy in the University of Pisa, but the intrigues of a *Sanfedista* minister of the court of Sardinia rendered his election impossible. In 1843 his most popular work, entitled *Del primato morale e civile degli Italiani,* appeared at Brussels. This work, dedicated to Pellico, was a trumpet-call. Somewhat emphatic in style and exaggerated in sentiment, its object was to magnify the civil and national power of the papacy in Italy. The clergy were roused by it, and began to take part in the agitation in favor of Italian independence. The whole idea of the book was certainly utopian, but it kindled a zeal for the cause of Italy in many hearts before indifferent, and this enthusiasm hastened the fortunate crisis. The *Primato* was followed by *I Prolegomeni,* a still bolder work, in which he was very careful to distinguish between the Jesuits and the rest of the clergy, and earnestly insisted that the liberators of Italy should be the Italians themselves. The Jesuits were prompt to attack him, and he defended himself triumphantly in a work called *Il Gesuita Moderno,* which was the chief instrument in driving out the Jesuits from Piedmont, while it revealed the great polemic ability of Gioberti. One month after the glorious "five days" of Milan, and after fifteen years of exile, Gioberti, already proclaimed a prophet throughout Italy, left Paris for Turin, where he was most enthusiastically received. From thence he made a triumphal journey through Lombardy and Tuscany to Rome—where Pope Pius IX. was beginning to be alarmed by the uprising of Italy—and there preached the necessity of a Guelph confederacy of Italian princes, with the pope at their head. Wherever Gioberti appeared he was received with acclamations of joy. The Subalpine Parliament having opened, he was elected president of the chambers, and he and Collegno were afterwards named presidents of the

new ministry. After the defeat of Custozza (1848) the ministry was obliged to resign, and was succeeded by the Revel cabinet. This again having fallen, Gioberti was recalled, and he selected, from among the deputies of the opposition, Rattazzi as a colleague. It was this ministry that in the spring of 1849 advised the resumption of hostilities which were to end in the disaster of Novara. After that discomfiture the ministry of Pinelli was formed, and Gioberti was sent to Paris, as minister, to secure the good offices of French diplomacy in the negotiations for peace with Austria. He could obtain nothing, but, once there, he remained, and, although broken in health and crushed in spirit, he sought comfort in his studies. He wrote at that time his beautiful book, *Del Rinnovamento civile d'Italia*, in which he prophesied the greatness of Cavour; and he prepared his *Protologia*, published after his death, which occurred in Paris Oct. 25, 1852. On his bed were found two open volumes—the *Imitation of Christ* and *I Promessi Sposi*. His body reposes in the Campo Santo at Turin, where a monument has been erected to him by that city. The posthumous works of Gioberti have been published by Giuseppe Massari, who is also the author of *Studii sopra Gioberti*. F. A. P. BARNARD.

Gioj'a del Col'le, a handsome and wealthy commercial town of Italy, in the province of Bari, about halfway between Bari and Taranto. It is believed to have been founded in the sixth century, and in its neighborhood, especially at Monte Sannace and Santa Sophia, ancient vases of great value, as well as Greco-Roman coins, have been found. Pop. 13,094.

Giojo'sa, town of Southern Italy, province of Catanzaro, near the railway from Taranto to Reggio, and near the site of the ancient *Locri Epizephyrii*. Pop. 6899.—Another Giojosa is on the N. coast of Sicily. Pop. 4624.

Giorda'ni (PIETRO), b. at Piacenza in 1774; d. at Parma 1848. He left the Benedictines—which order he had joined in early youth to please his parents—and accepted at first civil employment, and afterwards a literary professorship at Bologna. Cardinal Gonsalvi deprived him of his office as secretary of the Academy of Fine Arts on account of his liberal opinions, and he afterwards suffered bitter persecution in Florence, in Piacenza, and in Parma, where he died, and where, in spite of the presence of the Austrians, his obsequies were magnificently celebrated. Giordani is regarded as the father of Italian epigraphy, and as the best prose-writer of his day, although he wrote no extensive work, but confined himself rather to inscriptions, eulogies, critical articles, etc. Gussali, in his edition of Giordani's most valuable *Epistolario*, has prefixed to the first volume a full life of the author. Giordani was the friend of almost all the distinguished scholars of his time, and it will be a lasting honor to him that he was the first to discover and encourage the wonderful genius of Giacomo Leopardi.

Giorda'no (LUCA), b. in 1632, became a famous painter, distinguished for the variety of his styles and the surprising amount of his work, which brought him wealth and fame. His works are very numerous, and of unequal merit. He had undoubted genius. His etchings are very spirited, and are of masterly execution. D. at Naples Jan. 12, 1705.

Giorgio'ne (GIORGIO BARBARELLI), called GIORGIONE, or "the big," from his great stature and noble aspect, an Italian artist, b. at Castelfranco about 1477, the same year with Titian, with whom he was a fellow-student in the school of Giovanni Bellini in Venice. Being gifted with original powers, he early departed from the traditions of the school, and, aided by the study of Leonardo da Vinci, acquired a freedom and breadth of treatment and a richness of color till then unknown in art. Much of his work was done in fresco on walls and façades, and consequently perished from time and weather. The panel-painting at which he was much employed was remarkable for warmth of tone. A tendency to realism, or the painting of objects as they were, will account perhaps for his preference of portrait-painting to historical or sacred subjects, and for his superiority therein. His portraits rank with the work of the greatest masters. The genuineness of pictures ascribed to Giorgione has been so much discussed that but few pieces can be mentioned as unquestionably his. One of undoubted genuineness, and of great beauty, *The Concert*, in the Pitti Palace at Florence, is a fine example of his best style. The galleries of Dresden, Vienna, Milan, and Venice contain pieces from his hand. His own portrait of himself, one of his finest, is in the gallery at Munich. Giorgione passed his life in Venice, and d. there in 1511, at the age of thirty-four—some say of the plague, others say of mental despondency and a broken heart, produced by the desertion of his mistress and the faithlessness of his friend. O. B. FROTHINGHAM.

Giotti'no (TOMMASO DI STEFANO), a painter and sculptor, b. in 1324; d. 1356; surnamed GIOTTINO from his devoted study of Giotto's works. He has left heads so like those of his great prototype as to create disputes among critics. An early death cut short his promising career. (See HORNER'S *Walks in Florence*.)

Giot'to, di (BORDONE), an eminent Italian painter, sculptor, and architect, b. at Vespignano in 1276; d. in 1336. He was a shepherd, and was discovered by Cimabue drawing figures on stones. To Cimabue he owed his introduction to art and his earliest instruction, but to his own genius was due his success. In composition, design, and color Giotto was a master and a creator. His works, which are very numerous, are found in all the chief galleries of Italy, but the most admired are in Padua, Bologna, and Florence. The beautiful bell-tower of the S. Maria del Fiore was his design, and in part his work. He died before it was finished, but left complete models of the whole, which, however, were departed from in the spire alone. The main structure in its details is his, and is regarded as a gem of the building art. The hand of the sculptor is seen in the decorations. Much of Giotto's work was in fresco. Of his oil-paintings, his crucifixions have a celebrity aside from their artistic execution, as inaugurating a new method of treating that painful subject by transferring the agony from the coarse muscles of the frame to the head and face, and spiritualizing the expression of suffering. His greatest work, on the whole, is in the S. Maria dell' Arena at Padua, the walls and vaults of which he covered with paintings representing the history of Christ and the Virgin, with the *Last Judgment* at the entrance. In the S. Francesco at Assisi is another great series. The large mosaic at the porch of St. Peter's at Rome, representing the ship on the stormy sea, was executed after his designs. The genius of Giotto was felt throughout Italy from Venice to Naples; the Italian art of his age felt in every department the influence of his commanding mind. Taddeo Gaddi, Spinello Aretino, and Niccolò da Pietro were his most famous pupils, but innumerable compositions in chapel and sacristy show how deep a mark he made on his time. Giotto was a contemporary and personal friend of Dante; his portrait of the great poet, on the wall of the palace of the Podestà in Florence, though defaced by time and marred by restorers, is still recognizable as a masterpiece. O. B. FROTHINGHAM.

Giovina'zzo, a rich commercial town of Italy, in the province of Bari, on the Adriatic. This city is very ancient, and the seaward portion of the wall, with which Trajan surrounded it, is still standing. It suffered severely during the wars of the Middle Ages. Pop. 9108.

Giraffe [Fr., from the Arabic-Egyptian *zorafeh*, "long-neck"], or **Camel'opard** [Lat. *camelopardalis*, the "camel-pard," because it was fancied to combine the characters of the camel with the spots of the panther or pard], the *Camelopardalis giraffa*, a ruminant mammal of Africa, whose habitat extends from the Cape of Good Hope almost to Egypt. It is the only species of its genus or of the family Giraffidæ. The shortness of its body, the length of its legs, the slope of its dorsal line, the excessive length of its neck, and the persistent, bony horns covered with skin, the extensile tongue, are all remarkable characteristics. The giraffe feeds chiefly upon the leaves of trees. It is gentle and inoffensive, but when it feels so disposed will kick dangerously. It runs with an awkward amble, and is not very swift. The greatest height reported is about eighteen feet, so that it is the tallest living animal. It is hunted for its skin, which makes good leather. The flesh of the young giraffe is very palatable.

Girard', tp. of Russell co., Ala. The village is pleasantly situated on the Chattahoochee, opposite Columbus, Ga., with which it is connected by a fine bridge. It is the N. W. terminus of the Mobile and Girard R. R., and is connected with Opelika by the Columbus and West Point R. R. Pop. 3984.

Girard, post-v. of Macoupin co., Ill., on the Chicago Alton and St. Louis R. R., 13 miles N. by E. of Carlinville.

Girard, post-v., cap. of Crawford co., Kan., 126 miles S. of Kansas City, on the Missouri River Fort Scott and Gulf R. R. It has a savings bank, a grain-elevator, a grist-mill, 2 weekly newspapers, 2 hotels, 5 churches, and about 30 stores and shops. Trade supported principally by farmers, stock-raisers, and dairymen. Pop. about 980. EDS. "GIRARD PRESS."

Girard, post-tp. of Branch co., Mich. Pop. 1230.

Girard, tp. of Clearfield co., Pa. Pop. 490.

Girard, post-b. and tp. of Erie co., Pa., 1½ miles from the Lake Shore and Michigan Southern R. R., in a belt of very rich farming land. It has a national bank, a broker's office, 25 stores, 1 newspaper, 5 churches, excellent graded schools, a wrench-factory, a furniture-factory, planing-mill, etc. Pop. of b. 704; of tp. 2018.

JACOB BENDER, ED. "COSMOPOLITE."

Girard (CHARLES), b. at Mulhouse (Mühlhausen), Alsace, in 1822; became Agassiz's pupil; attended him to America (1846); became a resident of Washington, D. C., 1850. Author of reports, memoirs, and papers, chiefly upon fishes and serpents, published by the Smithsonian Institution, in the government reports of scientific expeditions, etc.

Girard (STEPHEN), b. near Bordeaux, France, May 24, 1750; became a sailor, and before the Revolution engaged as the master of vessels in the American coasting and West India trade; and during the Revolution was a grocer, sutler, and liquor-seller in and near Philadelphia, where he had already married and separated from his wife. He was again in the West India and coastwise trade in successful partnership with John, his brother, in 1780–90; gained money by receiving valuables from the Haytian planters during the insurrection (1791–1804), for much of this property was never called for; and by leasing property in Philadelphia when business was dull at low rates, and then renting at high rates in times of industrial activity. In 1812 he became a private banker, and was later a director of the second U. S. bank. He was for years by far the wealthiest man in the U. S. He was very eccentric in his habits, a free thinker, ungracious in manner, ill-tempered, and lived and died without a friend; but was always a liberal benefactor of the public charities, and even of churches, which he despised. During several yellow-fever seasons in Philadelphia no citizen was more active in relieving distress by free expenditure of money or by personal care of the sick; and at his death nearly all his estate was bequeathed to various charitable and municipal institutions of Philadelphia and New Orleans, and to the founding of the Girard College for orphan boys. D. at Philadelphia Dec. 26, 1831.

Girard′ Col′lege, at Philadelphia, Pa., was founded by the bequest of more than $2,000,000, left by Stephen Girard, for the benefit of poor white male orphans, who are admitted between the ages of six and ten, and, according to the will of the founder, are to be apprenticed to some industrial occupation when between the ages of fourteen and eighteen. The buildings are situated 2 miles N. W. of the old State-house, in a fine enclosure of 41 acres. The principal building (169 feet long, 111 feet wide, and 97 feet high, with fine Corinthian columns each 55 feet high) is by far the best specimen of Greek architecture in America. It is built mainly of white marble, with no inflammable material, as nearly as possible in accordance with the minute directions left by Mr. Girard, according to whose will no minister or ecclesiastic of any sect or Church is allowed to visit the premises on any pretext, or to have any connection with the institution. The construction of the buildings was commenced in 1833, and finished in 1848. The greater part of the bequest would have been absorbed in the construction but for this delay in opening the establishment. It now accommodates some 500 boys, who are supported and educated by the institution.

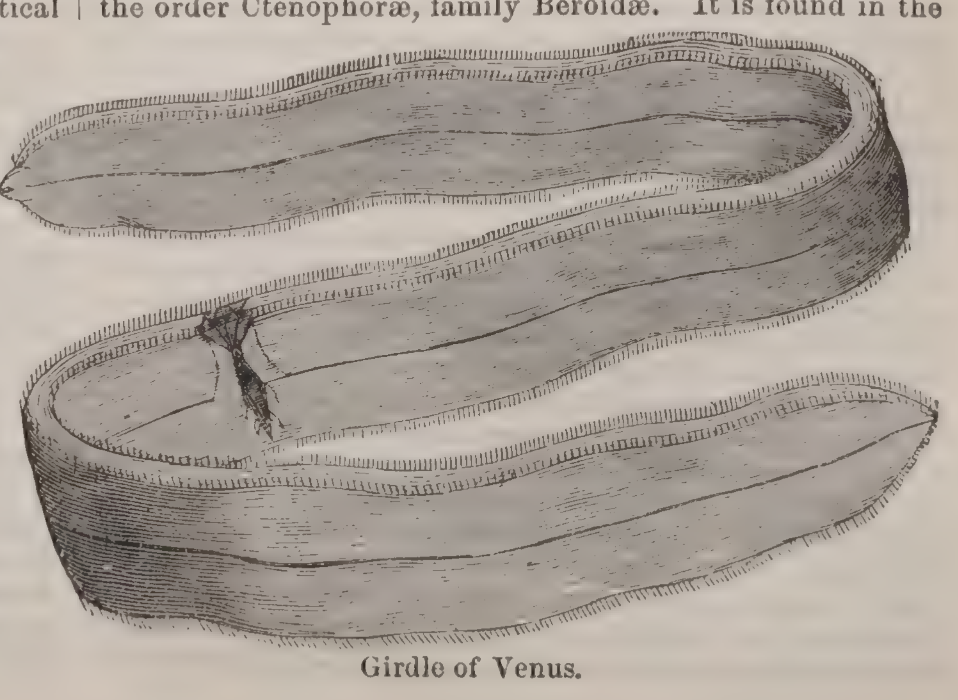
Girardin, de (ÉMILE), b. in Paris June 22, 1806, natural son of the count de Girardin: entered upon journalism as conductor of *Le Voleur*, a periodical compiled from other journals, and *La Mode*, a fashion-paper. His *Journal des Connaissances utiles* and *Journal des Instituteurs* won great success from their exceeding cheapness. He also was very influential in establishing savings banks and in issuing cheap and good literature and maps for the people. He was concerned also in *Le Musée des Familles*, *Le Journal des Gardes Nationales*, and *Le Gastronome*, a highly successful journal treating of food and cookery. His great distinction, however, was gained as conductor of the *Presse*, a cheap daily, which he edited most of the time from 1836 to 1856. This journal made him one of the great political powers of France. In 1848 he persuaded Louis Philippe to abdicate. Under Napoleon III. he was a vigorous member of the opposition, but in 1870 he was made a senator, although the decree to that effect was never published. He was (1866–70) editor and owner of *La Liberté*, and in 1872 became connected with the *Journal Officiel*. Among his published works are many political brochures; *Questions de mon temps* (12 vols., 1858, compiled from his political editorials); *L'Homme et la femme* (1872); and *Du droit de punir* (1871). De Girardin has never been constant to any political principle except hostility to Great Britain and friendship for Russia.—His first wife, DELPHINE (b. Jan. 26, 1804; d. June 29, 1855), was a daughter of the novelist Sophie Gay (1776–1852); married M. de Girardin in 1831; was a very talented poet, and author of many clever novels and highly successful plays, besides political essays and effective literary criticisms. Her *salon* was one of the social and political centres of Paris. Her beauty, cleverness, and charming manners contributed much to her husband's success.

Girardin (JEAN PIERRE LOUIS), b. at Paris Nov. 16, 1803; was chemical professor at Rouen 1838–58, and since then in other French towns. Author of numerous handbooks of science for popular use, besides *Leçons de chimie élémentaire* (1835), *Mélanges de agriculture, etc., et des sciences physiques appliqués* (1852), and other works.

Girardin (SAINT-MARC), generally called MARC GIRARDIN, one of the most celebrated and one of the noblest representatives of that singular class of people which modern civilization has created and designated with the somewhat vague title of *littérateurs*, was b. at Paris Feb. 12, 1801. He studied at first law; wrote in 1827 an article in the *Journal des Débats*, which made a great sensation, and after that time participated in politics, both as a journalist and as a member of the legislative assembly. He was not a politician, however. Very early he turned from the study of law to that of literature and philosophy. In 1822 he received a prize from the Academy for a paper on Lesage, in 1827 another for a paper on Bossuet, and in 1828 a third for his *Tableau de la littérature française au xvi. siècle*; in 1844 he became a member of the Academy. He was, nevertheless, not exactly an author. In 1831 he succeeded Guizot as professor in history at the Sorbonne, which chair he changed in 1834 for that of French literature and poetry; and for more than thirty years he delivered his lectures, often to an audience of 3000 or 4000 people. He also took a great interest in all questions concerning education, travelled through Germany to make himself acquainted with its schools, and filled at different times different positions in the ministry of public instruction. Yet he was not a teacher. In the newspaper and in the legislative assembly, in the Academy and in the committee-room, in his books and before the audience, he was always only a *littérateur*—that is, a man who interests himself more for the application of science than for its progress, unlike the scientific man; more for the educational power of literature than for its internal development, unlike the author; more for the elevating and harmonizing influence of art than for its ideal perfection, unlike the artist; and who, utterly unlike the teacher, takes people as they are, grieving with them when they are sorrowful and laughing with them when they are merry. His acquirements were enormous. He was thoroughly familiar with all the prominent languages and literatures; in philosophy he was one of the first, and one of the very few Frenchmen who ever understood Hegel; in history nothing was foreign, in science nothing was strange to him. His talent, great by nature and perfect by training, was that of comparative criticism. He would choose a certain subject—for instance, maternal love—and then run through all periods of all literatures, showing how maternal love has been represented by different nations and in different ages; and thus he would rise from a penetrating analysis of the various phenomena to an elevated and powerful conception of the idea. On this plan is written his principal work, *Cours de littérature dramatique* (5 vols., 1843–68). In 1869 he retired from his chair at the Sorbonne, but continued as editor of the *Journal des Savants*. D. Apr. 11, 1873.
CLEMENS PETERSEN.

Giraso′le [It., "sun-turning," because its finest tints appear only in a strong light], a precious stone of various colors and qualities, but all distinguished by a strong, deep reflected light. The fire-opal and quartz resinite are among its varieties. Fine specimens bring very high prices. This stone is found in many countries, but good specimens are rare. The same name is given to several other minerals which afford bright tints in a strong sunlight.

Gir′dle of Ve′nus, the *Cestus Veneris*, an acaleph of the order Ctenophoræ, family Beroidæ. It is found in the



Girdle of Venus.

Mediterranean, and is often five feet long by two feet wide; the breadth, however, typically representing the length of most other organisms. It is of a very delicate structure, moves with a graceful, waving motion, and is one of the most beautiful of natural objects when seen in the water. By night it often seems a band of fire. Its mouth is seen about midway of its length. It was named from the *cestus* or zone of Venus, which had the power of compelling all beholders to love the wearer of it.

Gird'letree Hill, post-v. of Worcester co., Md. P. 74.

Gir'geh, or **Geer'geh** [from *Girgis*, or *George*, the patron saint of the Coptic Church], an Egyptian town, of Christian origin, on the W. bank of the Nile, about 108 miles below Thebes and 12 miles from the ruins of Abydus. It was formerly the capital of Upper Egypt, and a town of fine appearance, with its palm trees, eight minarets, and Roman Catholic monastery (the oldest in Egypt), standing about a quarter of a mile from the river. The Nile is now rapidly washing it away. Pop. about 10,000.

R. D. Hitchcock.

Girgen'ti, province of Sicily, on the south-western coast. Area, 1377 square miles. Pop. 289,018. It is mountainous, but extremely fertile, and produces corn, oil, wine, salt, and sulphur in great abundance.

Girgenti [Lat. *Agrigentum;* Gr. Ἀκράγας], a maritime town of Sicily, in the province of Girgenti, in lat. 37° 17′ N., lon. 13° 28′ E. It was founded 584 B. C. by a Greek colony from Gela, at the foot of an older acropolis called Camicus. Through commerce with Carthage the new colony grew rapidly rich and powerful, though later it suffered greatly from wars with that city. In the days of its greatest prosperity Agrigentum contained 200,000 inhabitants within its walls, and including suburbs the population is said to have reached 800,000. The government, though sometimes in the hands of a tyrant, was generally free and independent till the time of the Punic wars, when the city became a Roman possession, and soon began to decline. In A. D. 826 it was taken by the Saracens, who held it nearly 300 years, since which time it has shared the changing fortunes of the island. Girgenti stands on a high, steep rock, commanding a glorious view of the Mediterranean, and overlooking rich olive-slopes and luxuriant gardens and vineyards, while, conspicuous everywhere, rise the vast temples, more or less in ruins, which bear such splendid witness to its former greatness. Among these are the temple of Concord, a beautiful Doric structure, and one of the best preserved of all the ancient temples; the temple of Juno, also in partial preservation; and the temple of Jupiter Olympius, the largest in Sicily, and still imposing in its ruins. Other striking remains of temples, towers, and tombs are seen on every side, and not a few precious objects of art, such as carved gems, etc., have been found in the vicinity. Notwithstanding its advantages of climate, soil, and situation, this town, though containing a very considerable population, was too miserable a few years since to shelter the traveller comfortably, even for a night. At present there are signs of returning life. In 1865 water was brought, by an expensive aqueduct, to the highest part of the town; elementary and normal schools have been established; its exports of oil, soda, sulphur, and fruit are on the increase; and works are now in progress for improving the harbor, which, though not good, is the most available on the southern coast of Sicily. Pop. 20,646.

Geo. P. Marsh.

Gironde, department of France, situated around the estuary of the Gironde, formed by the confluence of the Garonne and the Dordogne. Its western part is low and flat, consisting of lagoons and sand-dunes planted with pine forests; it is generally called *Les Landes*. The eastern part is hilly and calcareous, and produces the finest claret wines — 44,000,000 gallons annually. Area, 3714 square miles. Pop. 701,855.

Giron'dists [Fr. *Girondins*, from the Gironde, whence several of their leaders came], the conservative republican party of the French legislative assembly from Oct., 1791, to Oct., 1793. When the assembly was at first organized, the future Girondists, who were cultivated men, full of admiration for the spirit of ancient Grecian liberty, proposed severe measures against the priests and *émigrés*, and opposed the reactionary policy of the court. In Mar., 1792, the king selected four of them for his new ministers, but dismissed them June 13—an act which led to a popular insurrection. On Aug. 11 they were recalled. The party of the Mountain (1792) and the Jacobins (1793) violently opposed them, and the latter (June 2) procured the arrest of thirty of their leaders. Throughout the provinces there followed a series of popular uprisings in their favor, but the Convention had the advantage of previous organization and strong leadership, and the armed Girondists everywhere met a fearful overthrow. In October the leaders were arraigned before the revolutionary tribunal, but so strong was their eloquent self-defence, and so conspicuous their patriotism and their innocence, that not even that court could convict them. But by order of the Convention they were sent that very night to the guillotine (Oct. 31, 1793), chanting the *Marseillaise* while on the way. During the following year great numbers of other real and suspected Girondists perished. The Girondists were looked upon as *doctrinaires*, and were in part victims of the prejudice of the Parisian rabble against educated men; but their greatest offence was their opposition to the mad zeal of the ultra-republicans.

Gir'van, town of Scotland, in Ayrshire, on the Girvan. It has a lively trade with Belfast. Pop. 7047.

Gis'co, the name of many distinguished Carthaginians, of whom the most distinguished was a general who commanded at Lilybæum during a part of the First Punic war, in which he was exceedingly popular with the soldiers. The latter, during the mutiny known as the Inexpiable war, received Gisco at Tunis as a messenger from the government, but treacherously made him a prisoner, and put him, with 700 others, to a cruel death, about 239 B. C.

Giti'ades, a statuary, architect, and poet of Lacedæmon, flourished about Ol. 60 (O. Müller and C. F. Hermann), B. C. 536. He erected the temple and fashioned the statue of Athena Poliouchus ("city protector"), also called Chalciœcus ("of the brazen house"), in his native city. He composed a hymn in honor of the same goddess, with a few other poems in the Doric dialect. (See Sillig, *Dict. of Ancient Artists;* Müller, *Ancient Art and its Remains.*)

H. Drisler.

Git'schin, town of Bohemia, noted for the encounter which took place here (June 29, 1866) between Prince Frederick Charles of Prussia and the Austrian general Clam-Gallas. The prince marched the second army corps from Podol and the third from Turnan towards Gitschin, and attacked the Austrians, who occupied a favorable position on some hills, and had one-half of the Saxon army as reserve. Clam-Gallas was defeated, and retreated behind Gitschin, leaving the defence of the town to the Saxons; in the night it was taken by the Prussians. The Prussians lost 2000 men; the Austrians about 4000 men, besides 2000 prisoners. Pop. 6570. August Niemann.

Giudi'ci- [Emilia'ni], (Paolo), b. at Mussomeli, in Sicily, June 13, 1812. At the age of sixteen, and against his own will, he entered a Dominican convent, where he devoted himself to the study of design and of literature. These pursuits kindled his patriotism, and, as a first symptom of his love of freedom, he quitted the convent and applied for a chair in the University of Palermo. Not only was this refused, but he was put under *surveillance*, whereupon he fled from Sicily into Tuscany. There he formed a friendship with the poet Niccolini, and encouraged by him, began his principal work, *La Storia della Letteratura Italiana*, written from a critical and political point of view. About this time he received a handsome legacy from his friend Emiliani—whose name he then took—and was thus enabled to prosecute his studies at leisure. In 1849 he became professor in the University of Pisa; in 1851 he published his *Storia dei Municipii Italiani*, then *Storia delle Belle Arti in Italia*. In 1861 he succeeded Niccolini as secretary to the Academy of Fine Arts in Florence. In 1864 he resigned his professorship, and passed much of his remaining life in England. In 1867 he was elected to the Italian Parliament. D. at Hastings, in England, in 1872.

Giuglia'no, town of Italy, in the province of Naples. Pop. 11,772.

Giulia'ni (Giambattista), the most distinguished of living commentators on the *Divina Commedia*, was b. at Canelli, in Piedmont, in 1818. He entered the religious order of the Somaschi, and between 1837 and 1847 he held various professorships in different schools of learning, occupying himself at the same time with the profound study of Dante. In 1841 he published a much-approved *Treatise on Algebra;* in 1845 his celebrated *Saggio di un Nuovo Commento della Commedia di Dante Allighieri;* in 1846, before the Scientific Congress of Genoa, he declared that the *Divina Commedia* embodied the earliest and most authentic material for Italian history. In 1847–48, while professor in the University of Genoa, he was named, under the new liberal reforms, censor of the Press, the duties of which office he performed with great dignity and liberality. Among the works of Giuliani the volume entitled *Sul vivente Linguaggio della Toscana* should be mentioned as having contributed largely to his reputation. In 1856 appeared *Le Norme di Commentare la Divina Commedia, tratte dall'Epistole di Dante a Cangrande*, a most important work, which was followed by his *Metodo di commentare la Divina Commedia*, and afterwards by a new critical

and annotated edition of all the works of Dante, this last being still (1875) in course of publication at Florence.

Giu'lio Roma'no, an Italian painter and architect, b. at Rome in 1492; d. in Mantua in 1546. The family name was PIPPI. As a painter, much of his reputation has been due to his association with Raphael, who held him in high esteem, entrusted to him the execution of important works, placed him at the head of his scholars, made him one of his heirs, and, dying, confided to him, along with Gio. Fran. Penni, the finishing of his uncompleted pieces. The pupil did not justify the master's predilection. His pictures, while showing boldness of conception, learning, and mastery of materials, are destitute of harmony, grace, delicacy of sentiment, and refinement of expression. His success was greatest in battle-pieces. In sacred subjects he did not excel, though his most famous picture, in the church of S. Stefano at Genoa, was one of this kind—*The Martyrdom of St. Stephen*, an important work, and still regarded as a masterpiece of composition and drawing. His celebrated paintings, *The Apparition of the Cross to Constantine* and the *Battle between Constantine and Maxentius*, in the Hall of Constantine at the Vatican, and the *Fall of the Giants*, in the Palazzo del Tè at Mantua, are examples of his grandest manner. Giulio Romano's fame rests more on his capacities as an architect than on his genius as a painter, though his architecture had the same general characteristics with his painting. Leo X. and Clement VII. employed him on the Vatican, and when in Rome he erected two palaces, the church Madonna del Orto, and other buildings. Called to Mantua by its duke, he did an immense amount of work in construction and reconstruction, of which the Palazzo del Tè is the crowning achievement. The cardinal Gonzaga had a saying that Mantua belonged to Giulio Romano by right of creation. When the emperor Charles V. came to Mantua, the architect erected the triumphal arches in his honor. His renown became so great that the pope invited him to return to Rome and undertake the construction of St. Peter's, but death prevented. As a figure in the history of art, Giulio Romano occupies large room; as a creator in the world of art, the place assigned to him is not the highest. His has been styled "an evil art, founded on art, and at variance with nature."

O. B. FROTHINGHAM.

Giurge'vo, town of Wallachia, on the Danube, 40 miles S. W. of Bucharest. It is one of the principal trading-places on the Danube. Pop. 20,000.

Gius'ti (GIUSEPPE), b. at Monsummanno, near Pescia, 1809; d. in the house of the marquis Gino Capponi, Florence, Mar. 31, 1850. He studied first at Pistoja and Lucca, then in the University of Pisa. While still a student the manuscript poems of Giuseppi Giusti were greatly in vogue, but these early specimens were coarse and burlesque rather than satirical. The revolutionary attempts of 1831 roused the patriotic spirit of Giusti, and it found expression in his admirable satires, which, far from being imitations, are a new form of that branch of poetry—popular, graceful, and biting. He well merits the name of "the Tuscan Béranger," although, according to the judgment of Italians, and even of many foreigners, Giusti far surpasses the French poet in delicacy of taste, in elegance, and richness of thought. The satires of Giusti remained many years in manuscript, but immediately upon their publication, they obtained a wide circulation throughout Italy, and everywhere excited great enthusiasm. They were the noble precursors of the revolutionary movements of 1848—more noble even than that revolution itself; for Giusti, who had always hitherto been a republican, when he found himself in personal contact with furious demagogues, became a *moderate*, and adhered to the policy of Gino Capponi, whom he had already taken for his literary adviser. When the first Tuscan national assembly was convoked, Giusti was elected deputy, and by voting with the conservatives he naturally brought upon himself the hatred of the radicals, who abused him as a traitor. The grand duke being restored, Giusti saw his dearest hopes crushed, and, suffering partly from depressing hypochondria and partly from a pulmonary affection, he died a few months after. The unhappy life of this poet was in singular contrast with the apparent gayety of his verses, but in the smiles of Giusti there lurk bitterness and tears. No one better understood or better used the Tuscan speech than Giusti. Clear proofs of this are to be found in the collection of Tuscan proverbs completed and illustrated by Capponi after the death of his young friend, and also in his letters, among which are many models of the epistolary style.

Givet, town of France, in the department of Ardennes, on the Meuse, near the Belgian frontier. It is strongly fortified, and has famous leather manufactures. P. 6404.

Givors, town of France, in the department of Rhône, on the Rhône. It has large glass manufactures. P. 9352.

Giz'zard, in birds and some invertebrates, a portion of the alimentary canal, which is very muscular and strong, being fitted for grinding up the food, a function performed by the teeth of many animals. Some of the Bryozoa have such a gizzard between the œsophagus and the true stomach. Many Gasteropods have gizzards armed with teeth (*Aplysia*) or calcareous plates (*Bulla*), and some Cephalopods have both powerful jaws and strong gizzards between the crop and the first stomach. Many insects and crustaceans have gizzards, in some cases armed with strong teeth. Most birds have a true gizzard, excepting only those whose food is very soft and succulent. The food, unlike that of the invertebrates above alluded to, is acted upon by the gastric juice before it is ground up in the gizzard. This organ is the homologue of the pyloric portion of the stomach of most of the vertebrates. It is lined by a horny epithelium, the "gizzard-skin," and most birds swallow pieces of gravel to assist the gizzard in grinding food. The "gizzard-skin" of the pigeon was, and perhaps still is, a domestic remedy for indigestion—a curious example of a popular prescription whose merits have been confirmed by science, since it is only quite recently that the stomachs of sheep and swine have been in like manner exhibited as "pepsin" for the same purpose, and as the result of scientific observation.

Gla'brio, an important family of the Roman plebeian gens Acilia, of which the most distinguished name is that of MANIUS ACILIUS GLABRIO, who became tribune of the people 201 B. C., a decemvir of sacred rites 200; prætor 196, consul 191, conducted with success the war in Greece against Antiochus III. of Syria and his allies; triumphed in 190, and after 189 B. C. withdrew from public life.—Another of the same name was prætor urbanus B. C. 70, consul 67, proconsul in Cilicia 66, where, after an inglorious campaign against Mithridates, he was succeeded by Pompey; became a pontiff in 67 B. C. He was a grandson of P. Mucius Scævola, and had a high reputation as a jurist.

Glabrio (C. ACILIUS) filled the offices of quæstor B. C. 203, and tribune of the plebs, and acted as interpreter to the Athenian embassy, consisting of the three philosophers Carneades, Critolaus, and Diogenes, before the Roman senate, A. U. C. 599, B. C. 155. He wrote a history of Rome in Greek, translated by a certain Claudius into Latin, which translation was known to and used by Livy. The fragments are collected in KRAUSE, *Hist. Script. Frag.*, pp. 84–87. (See BÄHR, *Gesch. d. Röm. Lit.*, vol. ii. p. 31; G. C. LEWIS, *Credibility of Early Roman History*, vol. i. p. 33.)

H. DRISLER.

Glacier [Fr., from Lat. *glacies*, "ice"]. In every part of the world high mountains are more or less covered with permanent snow, extending from the topmost crests to the limit where the annual melting exceeds the annual supply, which forms what is called the *snow-line, or limit of perpetual snow*. Among mountains that rise far above that limit we usually find the upper ends of the higher valleys occupied by continuous masses of ice that originate in the region of perpetual snow, but extend far below the snow-line, often reaching the zone of forests, and sometimes descending into inhabited districts, in the midst of corn-fields and fruit trees. The ice is very different in appearance from what is commonly seen in winter on streams and lakes. The surface is rough and undulating, and not seldom scarred by deep clefts. Towards the lower end these ice-masses are usually strewn with sand and rough gravel and trains of large blocks that disguise the natural color. These ice-masses are called *glaciers*. In former conditions of the earth's surface they attained enormous dimensions, but, if we except those of Greenland, yet unexplored, none are known that exceed about 30 miles in length and 2 or 3 in breadth. The countries where glaciers have been found on a large scale are the Alps of Switzerland and Tyrol, the North-western Himalayas, the Rocky Mountains, North-western Scandinavia, and Greenland. In each of these regions all the important phenomena of glaciers may be studied, but it is in Switzerland and the adjoining districts of Tyrol, Savoy, and Piedmont that all the earlier investigators have pursued their inquiries into the origin, the motion, and the structure of glaciers. It was there also that the facts were first observed that proved the vast extension of glaciers at a very recent geological period, and the important share they have had in fashioning the surface of many large districts to the condition in which we now behold it. Hence the Alps have become the classic land of glacial phenomena, and in attempting to explain them it is necessary to refer to the observations that have been there made.

Origin of Glaciers.—A large part of the heat which the sun sends to the earth is expended in converting water into vapor and raising it into the atmosphere. Under given conditions of temperature and density the air can retain in suspension no more than a fixed quantity of aqueous vapor. When that limit, which is called the point of saturation, is

surpassed, the superfluous vapor is precipitated, at first in the form of cloud, and, if the process is continued, ultimately reaches the earth again in the form of rain or snow. Several causes, which need not be here discussed, concur to lower the temperature of the air as it is raised above the earth's surface, and at a sufficient height it becomes so cold that whatever vapor is condensed takes the form of snow or sleet. In falling to the earth this is usually reconverted into water, but on high mountains, where the temperature of the surface is also low, the greater part of the aqueous vapor returned from the atmosphere retains the form of snow. When the air is calm, the snow of the high Alps consists of regular crystalline forms of exquisite beauty, being wonderfully varied modifications of a six-rayed star. When the air is disturbed, the snow assumes a new condition, which is that of small frozen pellets, no larger than a pin's head. It is this that forms that blinding snow-dust well known to those who have ever experienced the *tourmente.* The snow that falls on the exposed ridges and steep slopes does not long remain there. A large portion is generally carried away by the wind; a further portion accumulates till the slope becomes too steep, when it slides down in an avalanche; and a small share is disposed of by melting and evaporation. The result is, that nearly the whole of the snow falling on high mountains is retained in the hollows or on the more level parts of the surface. If these hollows and plateaus are below the level of perpetual snow—or, in other words, if they are so situated that the annual melting equals the quantity of fresh snow annually supplied—no accumulation can take place. A certain quantity of snow is gathered into these storehouses every winter, and is removed during the following summer, the same process being renewed year after year. This condition of things is seen in the Carpathians, the ranges of Central Spain, and many other European mountains whose summits rise above the level of perpetual snow. The case is otherwise when the winter snows are gathered in hollows and plateaus where the amount annually melted is less than the fresh supply. The first impression of a person speculating on the subject would be that under such circumstances the accumulation would go on without limit, and that a layer of snow constantly increasing in thickness would be piled up. To understand what actually occurs, a little detail is necessary. The higher region of the Alps and other high mountains is subject to a constant alternation between heat and cold. In clear weather this takes place between each day and night; in clouded weather the intervals are longer. The sun shining upon the mass of snow-dust and minute crystals partially melts them, and ultimately fuses them together till they form grains of larger size, which are frozen together into compact particles of ice during the next interval of cold. At first this process is confined to the uppermost layer of the snow, but as the alternate melting and congelation are frequently renewed, a similar change extends through the mass, which is gradually converted into that peculiar condition that has been called *névé,* or in German *Firn.* The longer the exposure of a layer of snow has lasted, the more complete the change into *névé;* the sooner a fresh layer falls, the more imperfect will be the conversion of the older one. A section of the upper strata of the *névé,* here and there exposed on the sides of a crevasse, shows successive layers, whose upper surfaces are seen to be more near the condition of ice than the underlying portions. In the lapse of years the *névé* increases layer by layer, one of them corresponding to every considerable fall of snow, until a great weight presses on the lower and older portions of the mass. To understand what effects are produced by this pressure, we must bear in mind an important property of ice, to which the name of *regelation* has been given. Two surfaces of ice at or very near the melting-point, when brought into contact, freeze together so completely that no trace of the original separating surface remains. Adequate pressure applied to a mass of fragments of ice, by forcing them into positions where their surfaces come into contact, causes regelation, and the closer the contact the more completely will the separate portions be welded together. Such is the change that is effected in the reservoirs where the alpine snows are stored. Having been first brought to the condition of granular *névé* by the sun's action, these grains are more and more completely united in the deeper portions of the mass into nearly compact ice.

Glacier.

If the reservoirs of which we have spoken were closed basins of sufficient extent, they would become filled with stationary masses of ice. But such ice-lakes, if they exist, must be very uncommon. The reservoirs partake more or less of the general slope of the mountain, and each is connected with the lower level by a valley, glen, or ravine, through which the snow would quickly flow if it were converted into water. But the masses of imperfect ice that are accumulated on the flanks of the higher mountains possess a considerable degree of plasticity. When the accumulated mass, and the weight consequently pressing on the lower strata, are great enough, the whole begins to yield in the direction of least resistance, and with a slow, constant, imperceptible motion to crawl downward towards the lower region, where the ice, being exposed to a higher temperature, is rapidly consumed. In other words, the mass has become a glacier.

Motion of Glaciers.—It will now be understood that the essential attribute of glaciers is the fact of their progressive motion from the upper level where they are formed towards the lower valleys. There may possibly exist in the polar regions great accumulations of stationary ice, but these are not true glaciers. All the characteristic phenomena hereafter described are inseparably connected with glacier motion; and if usage permitted the use of *ice-stream* as an English equivalent, this would be the most correct and expressive name for these remarkable objects. The onward motion of the greater glaciers must have been known from a remote period to the herdsmen who in summer led their cattle to the pastures on the banks of these ice-rivers. Huge blocks of stone often rest on the surface of the ice, and it was a familiar fact that at the recurrence of each yearly visit the blocks were found to have advanced a considerable distance. But, though men of science had speculated on the cause, no one had undertaken such accurate observations as could alone supply a secure basis for physical reasoning.

Laws of Glacier Motion.—The first to undertake a regular system of observations with a view to ascertain the facts and investigate the causes of glacier phenomena was the late Prof. Agassiz. In company with several friends he established himself in 1840 on the Lower Aar Glacier, and with remarkable enterprise and perseverance persisted for several successive years in carrying on systematic observations, which are recorded in his work, *Nouvelles Etudes sur les Glaciers.* The previous studies of Prof. Agassiz and his companions had not given them a familiarity with the principles of physics, and it naturally followed that they did not at first devise the most effectual means of investigation; hence it happened that as to the most important results they were partly anticipated by better prepared competitors. In July, 1841, M. Arnold Escher von der Linth made the first well-devised attempt to determine the main facts of glacier motion, by planting on the surface of the great Aletsch Glacier two series of stakes at equal intervals of 100 mètres, the one carried in a direct line across the glacier, the other being parallel to the direction of its motion. Had he been aware of the rapid wasting of the surface of a glacier during summer, M. Escher would have doubtless been the first to determine the general laws of glacier motion. Returning after an absence of five weeks, he found that the surface of the glacier had lost fully three feet in thickness through melting and evaporation, and that not one of the stakes firmly planted in the ice still

remained standing. In Aug., 1842, the late Prof. J. D. Forbes, by well-devised observations, ascertained all the most important facts, and was thus enabled to establish the general laws of glacier motion in terms that, with slight modification, are accepted by all those who have followed him in this inquiry. Forbes judiciously reflected that the rate of the annual progress of the great glaciers, as then roughly known, was such that if the motion were continuous the rate would be measurable in very short periods, if instruments of sufficient accuracy were provided; and further, that if the rate of motion at a number of points suitably chosen on the surface were ascertained, the laws of glacier motion might thence be inferred. When the right question is put in the right way, nature is not slow to reply. In the course of a single week the chief facts of glacier motion were ascertained; but the late professor extended his observations to other questions connected with the phenomena of glaciers, and continued his observations during several subsequent journeys. The following conclusions were established: (1) The motion of glaciers is continuous, and sensibly uniform during short periods. (2) The rate of progress is somewhat retarded at night, and still more by prolonged cold weather. (3) The central part moves more rapidly than the sides in all parts of the glacier. (4) The rate of motion is not uniform throughout the length of the same glacier, but varies with the inclination of the bed and the width of the channel through which it moves. (5) The increase in the rate of motion in passing from the sides towards the centre of a glacier is regular and continuous, so that a series of points fixed in a straight line across the surface is gradually bent into a curved line by the onward motion of the glacier. (6) The upper surface advances more rapidly than the interior, and the interior more rapidly than the under surface. (7) The advance of a glacier is not suspended, but only retarded, during winter. To these main conclusions an addition was made some years later by Prof. Tyndall. He ascertained that when a glacier flows through a bend in the valley, the point of most rapid motion is shifted from the centre towards the convex side of the curve.

The inference to be drawn from these facts, established by repeated and multiplied observations, is unavoidable. A glacier *does not move* as a rigid body, slipping forward on its bed, whose parts retain their relative positions during its progress; it *does not move,* as some had conjectured, by dilatation, or the expansion of the substance of the ice in the direction of least resistance; it *does move* as a plastic substance, conforming to the laws that regulate the motion of imperfect fluids.

Cause of Plasticity of Glacier Ice.—Although the law of glacier motion was established by the observations and experiments of Forbes, no satisfactory explanation was given of the mode in which a substance so different in obvious properties from those known to possess plasticity is enabled to conform to the behavior of semi-fluids acted on by gravity. The most important step towards the solution of this seeming paradox was made by Prof. Tyndall, who showed that it is mainly owing to that peculiar property of ice, first observed by Faraday, which we have spoken of as *regelation,* that a glacier is enabled, without losing its continuity, to advance in a sinuous channel, not only changing its external form to suit the irregularities of its bed, but also suffering internal dislocations by the constant rearrangement of its parts. By actual experiment he showed that lake ice, much more compact than ordinary glacier ice, may by adequate pressure be moulded to any given form. The first effect of pressure is to cause fractures in the ice, and thus enable the fragments to assume new relative positions. Owing to the property of regelation the newly-formed surfaces, when brought into contact, reunite by freezing together; but if the pressure be continued, new fractures arise, and regelation again welds the parts together; and the process is repeated until a condition of equilibrium is attained. An identical experiment is performed on a great scale in the laboratory of nature when a glacier descends through a valley. The enormous weight of the mass is partially resisted by contact with the sides and the bottom of the valley, but acts with greater force, and encounters a less resistance, in the centre of the ice-stream. This force, not acting uniformly, but constantly shifting the point of greatest pressure, causes local yielding and fracture of the ice; and if it were not for the property of regelation the glacier might gradually be reduced to a mass of incoherent fragments. But at each step in the progress of the glacier the damage done to the continuity of the ice is repaired, and by the twofold process of fracture and regelation the whole mass moves onward, constantly changing its form, yet in appearance an almost continuous mass.

Objections Answered.—In the course of continued controversy to which the physical theory of glaciers has been exposed many objections have been taken to the explanation here given, and several rival theories have been propounded; but few of these now require notice. The most notable exceptions are the views advanced by Prof. James Thomson of Belfast and by Canon Moseley. Prof. Thomson derived from theoretical considerations first developed by Sadi Carnot the conclusion, since experimentally verified, that the freezing-point of water is lowered by pressure. It is well known that water when at or near to the freezing-point is denser than ice, as shown by the familiar fact that ice floats on the surface of cold water. Under the ordinary pressure of the air ice will remain solid at the temperature of 32° F., but if pressure be applied to it, the particles tend to assume a new molecular arrangement, in which they yield somewhat to the pressure by filling less space than they did before, or, in other words, to become water. The greater the pressure the more the melting-point will be depressed, but the whole effect is but slight. To lower the freezing-point by 1° F. requires a pressure of more than 74 atmospheres, or nearly half a ton per square inch. According to Prof. Thomson's theory, the pressure produced at various points in a glacier suffices to liquefy portions of the ice. The water finds its way into new positions where the pressure is less intense, and where it is consequently reconverted into ice. Hence, the virtual plasticity of glacier ice—the temporary assumption of the fluid state throughout successive points of the glacier—enables the parts to change their relative positions, while the speedy reconversion into ice of the liberated water maintains the general continuity of the mass. There can be no doubt that the process here described is physically possible, and it may be surmised that in some experiments where ice has been moulded under great pressure the change of form is partly effected in this way, and not exclusively by fracture and regelation. Further than this, it appears certain that some peculiarities of glacier structure, noticed hereafter, are due to partial liquefaction of ice submitted to extreme pressure. But as a general explanation of the process by which glaciers advance in conformity with the law of semi-fluid motion, the views of Prof. J. Thomson have not commanded general assent.

Canon Moseley, who had previously originated an ingenious theory of glacier motion, which has found little support amongst those who have observed the phenomena, has sought to prove that the descent of glaciers by their own weight is a mechanical impossibility, and hence that the explanation given above is untenable. The relative displacement of the particles of ice, which is a necessary consequence of the ascertained facts of glacier motion, however it may be caused, must overcome the cohesion of the substance, which is measured by what is called in mechanics the *shearing force.* Canon Moseley has sought to ascertain by experiment on a cylinder of ice the amount of this force —*i. e.* the force necessary to cause one portion to advance while the adjoining portion is forcibly retained in its place. From the mean of two experiments he concludes this to be equivalent to the pressure of 75 pounds per square inch. It is easy to show that on such slopes as we commonly find in the lower part of great glaciers the mere weight of the mass cannot produce a pressure nearly so great as this; and it is inferred that some other force, and not that of gravity, must be the efficient cause of motion. To this it may be answered that glacier ice is not usually nearly so solid a substance as that experimented on by Mr. Moseley, and that it is impossible to reason correctly on the assumption that a glacier is a uniform mass made up of parts that offer equal resistance in all directions to external force. It is still more important to note that although glacier motion undoubtedly involves the relative displacement of adjoining portions of the ice, the process is extremely slow, and has no real analogy with those involved in Mr. Moseley's experiment. He sought to measure a visible amount of displacement produced within a short time. But the displacements arising in the glacier would, within so short a period, elude the most accurate instruments. The greatest amount of relative displacement yet observed amounts to a difference of 1 inch in 24 hours between two points 16 feet apart. In other words, if we were able to measure accurately enough the motion of two points in the glacier 1 inch apart, we might find at the end of 28 minutes that one had advanced more rapidly than the other by $\frac{1}{10000}$th of an inch. There is great reason to believe that many seemingly rigid bodies as well as ice, especially when brought near to the temperature of liquefaction, are capable of slowly modifying their form under great pressure.

The most important facts bearing on the glacier-theory lately brought to light are due to observations made by Mr. W. Matthews of Birmingham. He found that a plank of ice $2\frac{3}{8}$ inches in thickness, supported on bearers 6 feet apart, and exposed at a temperature somewhat above the freezing-point, was rapidly deflected from its original form until in about

seven hours the centre had subsided as many inches below its original position. In a subsequent and more important experiment a plank 1¾ inch in thickness, supported in the same manner, but exposed to a temperature always some degrees lower than the freezing-point, was slowly bent from its original form to the extent of about 2½ inches in 24 hours, preserving meanwhile its optical continuity, and maintaining for a time its altered form when its position was reversed.

Glacier Crevasses.—It has been seen that under the influence of the forces called into play glacier ice possesses a virtual plasticity, and there is even reason to admit that it is really somewhat plastic—*i. e.* that it can be moulded to a different form without solution of continuity. Inasmuch as most plastic substances are also viscous, it not unnaturally happened that, in publishing his conclusions as to the laws of glacier motion, Forbes attributed to the glacier as a whole the quality of viscosity, as well as plasticity, and designated his own views as the *viscous theory* of glacier motion. The characteristic of viscous substances is that they yield to tension without a breach of continuity, or, in common language, can be more or less stretched without being broken. But, in point of fact, glacier ice is especially devoid of this quality, and can yield not at all, or only imperceptibly, to tension. When the general movement of the glacier tends to draw asunder adjoining portions of ice, this is unable to obey the strain, the mass is rent through, and in this manner are formed the *crevasses.* These are among the best known and most characteristic of glacier phenomena. They are most numerous and widest in summer, when the glacier moves most rapidly, and are partially or completely closed up in winter, when the onward flow of the ice is slackened. But the same causes recur year after year, subject to slight variation owing to the differences of seasons, and, as a general rule, crevasses reappear annually in the same places, though the ice in which the rent takes place may have been some hundreds of feet higher up the stream in the preceding season. Crevasses are at first narrow fissures, and are gradually enlarged by the onward motion of the glacier, increasing in width from a few inches to many feet, and sometimes reaching to a great depth. The positions in which crevasses usually oppose the most serious obstacle to the alpine traveller are those where the bed of the glacier suddenly changes its inclination from a gentle slope to a steeper declivity. The ice, as it bends over the convex surface of rock, is rent by transverse crevasses of great depth and width, which often cross the entire breadth of the ice-stream, and these are repeated as each successive portion arrives at the same point; so that the result is to form a series of deep parallel trenches, divided by massive walls or ramparts of ice, giving the glacier, when seen from a distance, the appearance of a gigantic staircase. It not unfrequently happens that in the same places where the ice is thus rent by one set of parallel crevasses, another system of crevasses may be formed running transversely across the first. In this way the whole of the surface is cut up into isolated tower-shaped masses. When first formed, the sides of crevasses are more or less vertical walls, with well-defined edges, but the exposed parts of the ice are rapidly attacked by the sun, and even by the air and by rain. In a short time the flat-topped ramparts and turrets have their upper edges eaten away, till the broad rampart becomes a sharp ridge and the tower a pointed pinnacle. This is the origin of those singular and beautiful forms that are often seen towards the lower part of an ice-fall in the greater glaciers, where the crevasses penetrate to a depth that must be reckoned by hundreds of feet.

The Bergschrund.—A peculiar sort of crevasse, somewhat different in its origin from the rest, is best known by the German name *Bergschrund.* This appears at the upper limit of a glacier, along the line of separation between the fields of *névé*, that partake more or less of the downward movement, and the upper snow-slopes, that remain attached to the rocky skeleton of the mountain. A continuous fissure, sometimes 20 or 30 feet in width, marks the separation, and sometimes interposes a formidable obstacle to the traveller who seeks to reach the higher peaks.

Séracs.—When an ice-fall occurs in the higher part of a glacier, where it is covered by a considerable depth of *névé*, the crevasses naturally cut through the *névé*, and expose sections showing the outcrop of the successive beds of snow from which it was originally formed. When it is cut up by the intersection of transverse crevasses, the *névé* often appears in the form of huge square blocks, known, since Saussure, by the name *séracs.*

Moulins.—A remarkable phenomenon, seen only on the greater glaciers, is that presented by the so-called *moulins.* During the summer, when the sun acts with great force, the melted ice forms rivulets on the surface. In portions of the glacier intersected by crevasses the superficial water is quickly carried off, but where the ice is compact, these rivulets, uniting together, may accumulate until they form a considerable stream. Sooner or later this encounters a crevice, perhaps at first very small, but this is enlarged by the action of the falling water till a vertical shaft is formed in the ice, through which the stream is poured in a waterfall that is lost to sight in the depths of the glacier.

Wasting of the Surface: Ablation.—Among other apparent objections to the above explanation of the origin of glaciers, it may occur to the reader that, as considerable pressure is necessary to account for the conversion of the *névé* into ice, the upper strata, which have not undergone this pressure, ought to continue in the state of *névé*, and hence that the upper surface of the glacier should consist of *névé*, and not of ice. This objection loses sight of the vast amount of *ablation*, or loss, which a glacier annually undergoes through the melting of the surface. By mounting high enough on each glacier, we do find the upper surface composed of *névé*, but as it descends to a lower level a fresh slice of the surface is annually cut away by melting, so that if we follow the stream, we find as we advance that the ice under our feet constantly becomes older and more compact, until we reach the point where the annual loss by melting equals the supply brought down by the progress of the glacier, and where, consequently, this comes to an end. The amount of ablation, or loss by melting, depends upon many different circumstances, and varies on different parts of the same glacier. The most frequent cause is the direct effect of the sun's rays, but exposure to warm winds is another important agent; and a still more efficient, though unfrequent one, is heavy rain at a temperature much above the freezing-point. The latter, by its rapid effects on the snow-fields and glaciers, is the main cause of those formidable inundations that sometimes visit the skirts of the Alps and other mountain-countries. If we possessed continuous series of observations on the rate of progress in different parts of a glacier, and of the corresponding amount of annual ablation, we might estimate pretty closely the depth of the ice in the upper part of the glacier where the main accumulation occurs. There is strong reason to believe that in the greater glaciers the depth is much in excess of what has been commonly supposed. During the summer months the surface of a glacier is by day usually seamed with tiny streamlets, produced by the melting of the ice, the sun is constantly eating away the edges and sides of the crevasses, and the air and the earth consume some small portion of the under surface. The water from all these sources finally makes its way to the rocky bed, where it flows under the ice, and finally issues from the foot of the glacier. When the form of the bed is favorable the waters unite into a single torrent, often of great volume, and then the overhanging ice commonly forms a dome-shaped vaulted arch, whose azure tints attract the admiration of travellers.

Glaciers of the Second Order.—The details hitherto given apply to true glaciers, which, as has been seen, are rivers of ice flowing through definite channels. But in high mountain-countries we find, along with the main glaciers, very numerous accumulations of *névé* lying in the lesser hollows and recesses of the surface, and giving birth to minor glaciers, that exhibit in a slight and imperfect manner the phenomena of the greater ice-streams. These are called *glaciers of the second order.* In these the accumulation of *névé* is smaller, and this is less completely converted into ice, and their downward motion, which is much less rapid than that of the great glaciers, is mainly effected by sliding on the underlying surface of rock.

Veined Structure of Glacier Ice.—Glacier ice, especially when examined some distance above the lower end, is usually of a nearly white color, and this tint is due to the multitude of minute air-bubbles contained in it. It very often happens, however, that the mass is seamed by countless parallel veins of the purer azure color characteristic of ordinary ice. On examination, this is found to arise from the fact that the blue veins are almost completely free from air-bubbles. This structure, seemingly noticed in the first instance by the late Sir David Brewster, and subsequently well described by M. Guyot in 1838, has furnished matter for much discussion by subsequent investigators, and may yet afford room for further inquiry. The most satisfactory explanation of its origin is that given by Prof. Tyndall in his work on the *Glaciers of the Alps.* He has established the fact that the blue veins are first developed in parts of the glacier that have been subjected to extreme pressure. A common instance of this occurs where two glaciers unite to form a single stream. It often happens that the bed of the united glacier is no wider than that of each separate affluent, and at the point of junction the ice, urged on by the weight of the advancing mass, is forcibly compressed and made to enter the relatively contracted channel. The blue veins are produced at right angles to the direction of

greatest pressure, but when once the structure is developed it is more or less retained throughout the subsequent progress of the ice. The exact nature of the process is perhaps not yet fully disclosed, but it is highly probable that a chief cause of the phenomenon is the fact brought to light by Prof. J. Thomson, that intense pressure causes portions of the compressed ice to be converted into water, thus facilitating the escape of the imprisoned air-bubbles.

Moraines.—One of the obvious differences between a glacier and an ordinary stream depends on the fact that earth and stones that fall on the surface rest there, instead of sinking to the bottom. Hence, it is not rare to find in the lower part of a glacier the natural appearance of the ice completely masked by fine sand and gravel, not to speak of blocks of various sizes borne down by the ice-stream. The traveller who chooses a commanding position for the purpose sees a great glacier stretch downward from the snow-covering that envelops the upper region of the mountain. He will observe that it is formed by the confluence of several smaller ice-streams, each of which issues from a lofty reservoir. As it descends the color is more and more soiled by superficial impurities. Along either bank will be seen a fringe of blocks that have fallen from the impending slopes, and one or more trains of blocks, forming conspicuous ridges on the surface, that extend along the middle of the stream parallel to its banks; while at the lower end an irregular accumulation of similar blocks, mixed with finer materials, often forms an unsightly termination to the view. These are the *lateral*, *medial*, and *terminal moraines.* In the lateral moraine we often find blocks that have fallen on the glacier at points much higher up in the stream that have slowly travelled along with it. As they are borne onward, and the ice is constantly wasted by the increasing temperature, some of these blocks are stranded on the banks; others slip down between the edge of the ice and the adjoining rocks; others, again, fall into the crevasses that often yawn near the sides of the glacier, but only in rare cases do they reach the lower end of the glacier. When two glaciers meet and unite to form a single stream, it is clear that the right-hand lateral moraine of one and the left-hand one of the other will be joined together, and form a single medial moraine somewhere about the centre of the united glacier. The same process will be repeated whenever a new affluent is added to the main stream, and hence some great glaciers have as many as eight or nine medial moraines. The blocks are often of great size, and as they protect the underlying ice from melting, the medial moraines often appear as an elevated ridge rising 50 feet or more above the general level of the glacier. As such ridges become steeper in the lower part of the glacier, the separate blocks sometimes slip or roll down the slope on either side, so that the original limits of the moraine become effaced, and the materials are then distributed irregularly over the tongue-shaped end of the glacier. It may be inferred from what has preceded that a large part of the solid materials borne downward on the surface of a glacier fails to reach the terminal moraine. Those of the lateral moraine are nearly altogether intercepted, and some part of the medial moraine also disappears in crevasses or reaches the sides of the ice-stream. Nevertheless, when a glacier remains for a long period stationary, a terminal moraine of great size may be accumulated. Whenever a gradual change in local meteoric conditions causes a diminished supply of material in the upper snow-fields—as has occurred in the Alps during the last twenty years—the effect is a gradual withdrawal of the glaciers towards their sources. A terminal moraine marks the limit reached during the period of expansion, and the materials that would have gone each year to add to its bulk if the glacier had remained stationary, are spread over the space between that limit and the present end of the glacier. In several instances in the Alps the space left by the retiring glaciers exceeded in 1873 a quarter of a mile. During a period when opposite conditions prevail the extremity of each of the great glaciers advances down the valley. A portion of the materials of the terminal moraine is shoved forward, while the rest is crushed beneath the advancing mass.

Glacial Mud.—A universal characteristic of the streams that issue from glaciers is their milky color. This is due to the quantity of fine mud carried in suspension—so much finer than ordinary mud that the water continues turbid at a distance of more than 50—nay, even 100—miles from its source. The origin of this mud is easily understood when we observe the processes carried on beneath the glacier. It has been already said that a considerable part of the materials of the moraines are intercepted before they reach the lower end, falling between the ice and the rocky bed of the glacier, either from the banks or through open crevasses. The fragments either get set into the under surface of the ice or lie between this and the bed. In this way a gigantic mill is formed in which all the surfaces exposed are slowly ground down. The harder blocks are reduced to flattened cakes, striated and polished on either side; most of the materials are reduced to sand and flakes of mineral matter; but a large part is crushed to a powder so fine that it is not completely deposited after resting for many days. The whole is gradually carried down by the streams that run under the glacier, till it reaches the main torrent, there to undergo further reduction, the finer matter being carried to great distances, and the coarser materials to intermediate stations, according to the force of the current. When a glacier retires, a certain portion of the materials here described is left on the surface of the rock, and constitutes what is known as *glacier mud.* By the practised eye this is easily recognized, but it is most certainly identified by the condition of the scored and striated pebbles scattered through it.

Action of a Glacier on its Bed: Glaciated Rocks.—The materials of the mud formed on the bed of the glacier are not exclusively derived from the rocks and gravel of the moraines: a considerable part of the finer matter is produced by the abrasion of the rocks forming the bed. Unmistakable evidence is found in the condition of those rocks. The general outline is always reduced to that of gentle curves, and the projecting ridges are worn down to the form of an inverted boat without a keel, or that of a sheep's back, whence they have been called in Switzerland *roches moutonnées.* The appearance of the surface, when examined near at hand, is no less characteristic, and entirely different from that produced by aqueous erosion. It is all covered with fine striæ, amongst which are seen coarser scratches, and at intervals deeper furrows, that may sometimes be traced for a long distance. These are usually exactly parallel, and always tend in the direction of the former motion of the glacier. Rocks that exhibit these characteristic appearances, which, so far as we know, can be produced only by the passage of ice, are called *glaciated rocks.*

Former Extension of Glaciers.—In describing, with what may appear too great detail, several of the phenomena of glaciers, there are others of a less essential kind which need not be here discussed. But it is necessary to advert to the important part which glaciers have played in periods historically very remote, but which are among the most recent in the geological chronicle, and to the nature of the evidence by which this page of the chronicle has been interpreted. The late Swiss geologist, M. de Charpentier, was the first to call attention to the facts by which the former extension of the Alpine glaciers is established. Having converted to these new views Agassiz—who in the first instance disputed their validity—along with many other vigorous adherents, Charpentier became the founder of a school which seems, in some respects, to have outrun his anticipations. For the last quarter of a century geologists have been divided between those who admit an amount of glacier extension compatible with a moderate change in climatic conditions, and those who believe in an extension so vast that the greater part of the temperate zones—nay, even large regions of the tropics—were covered with wide sheets of ice of such dimensions as to mask all but the most prominent mountain-summits; a state of things now existing only in some regions near the poles. It may be safely asserted that where subsequent changes have not effaced the record the former presence of a glacier in a valley is as completely proved as the existence of extinct animals by their bones, teeth, or scales. The entire surface over which the glacier moved exhibits the peculiar appearances already described as *glaciation.* The direction of the striæ and scorings preserves the general downward slope, though at particular spots portions of the glacier may have passed over convex masses, and the striæ may there slope upward. The stranded blocks left on either bank by the shrinking of the lateral moraines, known to Swiss geologists as *blocs perchés,* occur at intervals, resting on slopes so steep that no other known agency could have placed them there, and often so arranged that a contour-line carried through them would correspond with the slope of the glacier. Finally, the moraines which have been left by the extinct glacier differ in many respects from the other accumulations which are the results of subaërial denudations. They are characterized by the absence of arrangement among their contents; small angular gravel, glacial mud, blocks of all sizes, of which some may have the edges abraded, while others are unworn, are all mixed together without a trace of order. Especially characteristic are the small scored pebbles, of which a certain number may almost always be found in the terminal moraine. A further note of distinction between the moraines of ancient glaciers and other accumulations similar in general appearance arises from the regularity with which the materials of the moraines are distributed. The rocks belonging to each recess of the mountains wherein one of the tributaries of the main glacier has

originated will be preserved in the medial moraines flanking that particular part of the main stream, but will not be found elsewhere; and although some partial mingling may occur in the terminal moraines, it will be found that the distribution of the materials borne down by a glacier gives a correct key to the order of the rocks in the part of a mountain-chain whence it has flowed. A careful examination of the evidence leaves no room to doubt that in all the chief mountain-regions of both hemispheres the glaciers have, at a not very remote period, extended very far beyond their present limits, and were present in countries where they do not now exist.

Some scientific men are disposed to extend very much farther the supposed limit of the ancient glaciers, and to believe that extensive regions, even in the warmer temperate and tropical zones, were covered with a continuous ice-sheet. Others hold that the evidence for these wide conclusions is altogether insufficient. They point out that vast masses of floating ice, such as form the icebergs that descend annually from the polar lands through the Northern Atlantic, constantly grind against the sea-bottom down to depths of fully 800 feet, and that the markings on the rocks must be very similar in character to those made by glaciers. These icebergs are, in fact, detached fragments of the enormous glaciers of Greenland and other polar lands, that descend into the sea, and there break loose from the land ice. They bear on their surface portions of the moraines of the parent glaciers, and as they are floated southward into warmer latitudes these are deposited on the sea-bottom, either in isolated blocks when they break away in deep water, or in denser accumulations on shallow coasts, where, year after year, icebergs are stranded, and their remains are piled up and go to increase the size of the banks, as happens off the coast of Newfoundland. It is argued that if a portion of the bed of the Northern Atlantic were raised above the sea-level, it would exhibit most of the appearances that have been thought to prove the former existence of an ice-sheet covering the whole surface.

Erosion of Valleys and Lake-Basins.—The limits of this article permit but a brief allusion to the controversies that have arisen of late years as to the important part which some geologists attribute to glaciers in fashioning the earth's surface by excavating valleys and lake-basins. It is indeed generally admitted that glaciers have had a share in moulding the minor features of the surface in most mountain-countries; but there are wide differences of opinion as to the extent to which the erosive process has been carried, and especially as to its supposed action in scooping out extensive lake-basins. It may be safely said that a more complete acquaintance with facts is required before attempting to pass a final judgment on these controversies. Careful and prolonged observations are needed to determine the amount of abrasion performed by glaciers under various conditions. Some are disposed to rate this high; others believe that, save at comparatively few points, where the inclination of the bed undergoes rapid change, it is quite inconsiderable. In speculating on the origin of lakes, it is no less desirable to have exact information as to the form and dimensions of the lake-basins, as to which little is known, even approximately, except in a very few instances. It is equally necessary, in connection with the same problem, to ascertain the law of glacier motion when a glacier lies on an extensive level surface. If, as some have surmised, the motion of the glacier on its bed then disappears, or becomes quite insignificant, it would follow, *a fortiori*, that the larger lakes cannot have been excavated by glaciers. It is an interesting illustration of the close connection between all branches of natural knowledge—a connection daily more and more apparent—that geological problems so important and interesting should depend for their solution on the minute study of physical phenomena apparently so remote and so exceptional.

Bibliography.—A brief list of the more important works connected with the physics of glaciers and their relations to the recent geological history of the earth is here subjoined. Two or three only of the works of the earlier explorers of the Alps who were the first to speculate on these subjects have been included. Several valuable papers that have appeared within the last quarter of a century will be found in the *Bulletin de la Société Géologique de France*, the *London and Edinburgh Philosophical Magazine*, and many other scientific periodicals published on either side of the Atlantic, but are too numerous to be here cited. List of works connected with glaciers: SCHEUCHZER, *Itinera Alpina*, Leyden, 1723; GRUNER, *Die Eisgebirge des Schweizerlandes*, Berne, 1760; HUGI (J. J.), *Naturhistorische Alpenreisse*, Solothurn, 1830; DE SAUSSURE (H. B.), *Voyages dans les Alpes*, Neuchâtel, 1803–06; DE CHARPENTIER (J.), *Essai sur les Glaciers*, Lausanne, 1841; FORBES (J. D.), *Travels through the Alps of Savoy, etc.*, Edinburgh, 1843, and *Occasional Papers on the Theory of Glaciers*, Edinburgh, 1859; AGASSIZ (L.), *Système Glaciaire, etc.*, Paris, 1847; SCHLAGINTWEIT (H. and A.), *Untersuchungen über die physikalische Geographie der Alpen*, Leipsic, 1850, and *Neue Untersuchungen, etc.*, Leipsic, 1854; TYNDALL (J.), *The Glaciers of the Alps*, London, 1860; HUBER (W.), *Les Glaciers*, Paris, 1867; RÜTIMEYER (L.), *Ueber Thal-und Seebildung*, Bâle, 1869; DOLLFUSS-AUSSET, *Matériaux pour l'Étude des Glaciers*, a valuable collection of observations connected with the physics of the Alps, published at intervals; nine large volumes have appeared. J. BALL.

Glacis [Fr.], in fortification, the bank of earth which conceals the scarp-wall, itself forming the parapet of the counterscarp, and sloping gently from the main fortification. (See FORTIFICATION, by CAPT. O. H. ERNST, U.S. Army.)

Gladbach. See BERGISCH-GLADBACH and MÜNCHEN-GLADBACH.

Glad'den (ADLEY H.), b. in South Carolina; in the war with Mexico he served as major of Butler's regiment of South Carolina volunteers, which he commanded at Churubusco, where both his superior officers were killed; and at the conflict of Belen Gate, where he was himself severely wounded; in the civil war in America he was appointed a brigadier-general in the Confederate army in 1861; mortally wounded at the battle of Shiloh, Apr. 6, 1862.

Glad'den (WASHINGTON), b. at Pittsgrove, Pa., Feb. 11, 1836; graduated at Williams College, Mass., 1859; has held Congregational pastorates in Brooklyn and Morrisania, N. Y., and North Adams, Mass.; has been connected with the *Independent* and other journals of New York and Brooklyn, and is a successful lecturer. Author of *From the Hub to the Hudson*, and of contributions to periodical literature.

Glade, tp. of Warren co., Pa. Pop. 899.

Glade, tp. of Barbour co., West Va. Pop. 1302.

Glade, tp. of Webster co., West Va. Pop. 447.

Glade Creek, tp. of Alleghany co., N. C. Pop. 640.

Glade-net, a net made of fine thread, and set in glades of forests in Europe for fowling. The woodcock especially is taken in this way. The birds are driven towards the net, which is set in a place where they are known to be accustomed to pass, and at the proper time the net is dropped upon them by a fowler concealed near by.

Glade Spring, post-v. and tp. of Washington co., Va. The village is 14 miles E. by N. of Abingdon, on the Atlantic Mississippi and Ohio R. R., at the junction of the Saltville branch. Pop. of tp. 2898.

Gladeville, tp. of Wise co., Va. Pop. 1252.

Gladia'tor [Lat., from *gladius*, a "sword"], in ancient Rome a person who was employed to engage in combat at public shows. This custom was introduced into Rome in 264 B. C. It was of Etruscan origin, and is believed to have sprung from the old and once quite universal custom of slaughtering captives and slaves at the funerals of the great. Gladiatorial shows (*munera*) were at first exhibited chiefly at funerals, but later they were shown on the grandest scale as mere entertainments or as means of winning the popular favor. Gladiators were captives, slaves, criminals, or even free citizens. They were trained with great care, and carefully fed. The life of a vanquished gladiator might be spared or not according to the will of the spectators. The gladiators were regarded as a bad and dangerous class. Their number was very great, and at one time, under the lead of Spartacus, they threatened the existence of the Roman state.

Gladi'olus (a "little sword," alluding to the shape of the leaves), a genus of plants of the order Iridaceæ. Most of the species have bulbs, and are South African. The *Gladiolus segetum* and *communis* of Europe were formerly prized in medicine. The starchy bulbs of some African species are used as food. But the genus is chiefly noteworthy for its beautiful flowers, the ornament of almost every garden and greenhouse. Many splendid varieties have been produced by cultivation.

Glad'stone (Rt. Hon. WILLIAM EWART), D. C. L., b. at Liverpool, England, Dec. 29, 1809, fourth son of Sir John Gladstone, Bart., a Scottish merchant; was educated at Eton and Christ Church, Oxford, where he graduated double first-class in 1831; was made a fellow of All Souls' College; entered Parliament in 1832; became in 1834 a junior lord of the treasury, and in 1835 under-secretary for the colonies, under Peel; was sworn of the privy council 1841, and became vice-president of the board of trade and master of the mint; author of the revised tariff of 1842; president of the board of trade 1843–45; secretary of state for the colonies 1845–46; chancellor of the exchequer 1852–55, 1859–66, and 1873–74; high commissioner extraordinary to the Ionian Islands 1858–59; in 1868 he became first lord of the treasury and prime minister, retaining that

position until Feb. 17, 1874, when the ministry of Disraeli came into power. Mr. Gladstone's premiership was characterized by many important measures, such as the disestablishment of the Irish Church (1869), the Irish Land bill (1870), immense reforms in legal administration, the abolishment by royal warrant of the purchase of commissions in the army (1871), and the settlement of difficulties with the U. S. by the Geneva Conference. Gladstone entered public life a Tory and a High Churchman, but his political views have gradually changed, and since 1859 he has been a leader of the Liberal party. His literary abilities are great, and many of his Parliamentary speeches and financial papers are models of style and of argument. Author of *The State in its Relations with the Church* (1838); *Church Principles Considered* (1840); *Studies on Homer, etc.* (1858); *Essay on Ecce Homo* (1868); *A Chapter of Autobiography* (pamphlet, 1868); *Juventus Mundi* (1869); and of many published addresses, etc. His pamphlet on the *Vatican Decrees* (1874; enlarged by P. Schaff, New York, 1875) produced a profound sensation, and has called forth numerous replies, among which those of Dr. John H. Newman and Archbishop Manning are noteworthy.

Glad'win, county in the N. E. central region of the southern peninsula of Michigan. It is largely covered with forests. In the census of 1870 it was returned as being without inhabitants. Area, 484 square miles.

Gladwin, tp. of Midland co., Mich. Pop. 122.

Glagolit'ic Alphabet [Slavic *glagol*, a "word"], one of the South Slavic alphabets. According to Schafarik, it is older than the so-called Cyrillic, and was itself the invention of St. Cyril (see CYRILLIC ALPHABET), while the so-called Cyrillic is a corruption of this. Others make the Glagolitic much older than the time of Cyril. Still others regard the present Glagolitic as a corruption of the so-called Cyrillic. There is a small Glagolitic literature, chiefly ecclesiastical. A Glagolitic liturgy is used by some Dalmatian and Istrian Roman Catholic dioceses.

Glaish'er (JAMES), F. R. S., an aëronaut of Scottish parentage, b. about 1800; became F. R. S. in 1849, in consequence of his meteorological observations made in balloons; attained in 1862 the height of 37,000 feet above the earth's surface; became in 1865 president of the meteorological department of the British board of trade; has also been president and secretary of the Meteorological Society. Is one of the authors of *Travels in the Air* (1870).

Glamor'ganshire, the southernmost county of Wales, bounded S. and W. by the Bristol Channel, E. and N. by the counties of Monmouth and Brecknock. Area, 856 square miles. Pop. 396,010. The southern part, the "Vale of Glamorgan," is a plain, very fertile and well adapted to wheat-growing. The northern part is mountainous, and contains some of the richest coal-fields in the kingdom. Merthyr-Tydfil, Neath, Swansea, and Cardiff (the cap.) are the principal towns.

Glance, a name for several native metallic sulphides, arsenides, etc. Galena or lead-glance, argentite or silver-glance, copper-glance, gold-glance, etc. are all valuable ores.

Gland [Lat. *glans*, *glandis*, an "acorn"], in animal and vegetable anatomy, a name applied to certain organs, some of which produce secretions or eliminate excretions, while others do neither. In plants, glands are integumentary cell-masses sometimes found at the bottom of a pit or depression of the surface of the plant, and sometimes elevated above the surface, or even stalked. Some vegetable glands appear to secrete poisonous principles (the nettle), others to contain essential oils (orange-leaf), while still others have no known function. In animals, the glands are of two kinds: (1) the *ductless* glands, including the mesenteric and lymphatic glands; and (2) the secreting and excreting glands. The ductless glands proper are the spleen, the thymus, and the thyroid gland, the suprarenal capsules, and probably the pituitary body. (Each of these is described under its alphabetical head.) In general, these bodies are proportionately or even absolutely larger in the fœtus than in the adult. It is almost certain that their function is to assist in fitting the materials of the blood for the work of nutrition. This function appears to be shared, especially in the fœtus, by the liver and the marrow or soft material within the cavities of the long bones. The glycogenic function of the liver is of this general character. The lymphatic glands (situated along the course of the lymphatic vessels which pass through them), the mesenteric glands (similarly situated on the lacteals), and Peyer's glands (situated near the absorbent blood-vessels of the intestine) are all similarly concerned in preparing the materials in the lymph, chyle, or blood, and adapting it to the nutrition of the organism. That the character of the absorbent and the ductless glands is essentially similar is illustrated by the fact that diseased states of either class of organs may lead to leucocythæmia. The glands for secretion include the salivary glands, the liver, pancreas, kidneys, mammary glands, and many others. The true function of secretion is the product of a material partly derived from the blood and partly originating in the gland itself, like bile or milk; the function of removing effete matters already existing in the blood is excretion. The functions of secretion, and perhaps excretion, are shared by some of the simple epithelial cells; and indeed the epithelial cell may be considered the essential element of all the glands of this class. Next higher in the scale come the follicles, simple tubes lined with secreting cells; and the most complicated and perfect glands of all, such as the liver and the kidney, are ultimately but aggregations of such follicles. The ovaries and testes may be considered glands in typical structure, but they produce living cells (sperm-cell, germ-cell), and not lifeless secretions. C. W. GREENE.

Glan'ders (*equinia*, *malleus humidus*), a dangerous and very contagious disease of the horse, ass, and mule, communicable to man, but not, as far as is known, to other animals. It is characterized by an inflamed state of the nasal mucous membrane, upon which chancre-like sores appear, discharging a viscid humor. The lymphatic glands are secondarily affected. When the swelling of the lymphatics appears to supersede or exceed in importance the nasal affection, the disease is called FARCY (which see). Four types of the disease are recognized: acute glanders, acute farcy, chronic glanders, and chronic farcy. They are severe and fatal in the order named, but even chronic farcy, the mildest form, is seldom really cured. The farcy-buds, as the lymphatic tumors are called, are sometimes the seat of profuse or even gangrenous suppuration. Glanders has proved fatal to man in less than a week, but it has been known to last a year or more. A good constitution, a liberal diet, and perfect cleanliness may carry a patient through the disease and restore comparative health if the glanders be of the chronic type; but no remedy is known. Every glandered or farcy-budded horse should be killed at once, or reserved for experimental treatment by competent veterinarians.

Glan'vil, or **Glan'ville, de** (RANULPH or RALPH), an English jurist who in 1165 became sheriff of York; was custodian of Queen Eleanor at Winchester 1173–89; captured William the Lion at Alnwick 1174; justice itinerant 1175; was ambassador to the earl of Flanders 1177; led an army in Wales 1181; was connected with the English government in Ireland 1185; went with Richard Lion-heart to the Holy Land, and d. near Acre 1190. He is the reputed author of a valuable *Tractatus de legibus consuetudinibus*, often reprinted, and in 1812 translated by John Beames into English.

Gla'rus, canton of Switzerland, bounded by the cantons of St. Gall, the Grisons, Schwytz, and Uri. Area, 280 square miles. Pop. 35,150. It consists of three valleys enclosed by high mountains—namely, the Klönthal, the Serufthal, and the Linththal; which latter is the most important, being formed by the Linth, which from the foot of Tödiberg (11,880 feet high) runs through the whole length of the canton and falls into the Lake of Wallenstadt. The climate is very severe; agriculture inconsiderable; the rearing of cattle is more important, but manufactures of cotton, linen, silk, and paper are the chief business of the inhabitants.

Glarus, in Switzerland, the capital of the canton of Glarus, on the Linth, shut in by lofty mountains, has some breweries and manufactures of cloth and calicos. The Reformer Zwingli was pastor here from 1506 to 1516. On the night of May 10, 1861, more than 500 buildings, including the old parish church, were destroyed by fire. The inhabitants, most of whom are Protestants, are noted for the primitive simplicity of their manners. Pop. 5516.

Glas'co, post-v. of Saugerties tp., Ulster co., N. Y., on the Hudson River, 3 miles S. of Saugerties; has a large trade in brick and stone.

Glas'cock, county of the E. of Georgia. Area, about 160 square miles. Corn and cotton are staple products. Cap. Gibson. Pop. 2736.

Glascock (THOMAS), b. in Georgia; served as lieutenant at the siege of Savannah, under Count Pulaski, and exhibited great skill and valor; was appointed colonel of the troops ordered out by the legislature in defence of Georgia against the Indians, in the war of 1812, on the Western frontier; and was afterwards appointed general of militia; was a representative in Congress from Georgia from 1836–39, and highly respected for his talents and exemplary character. D. at Decatur, Ga., May 9, 1841.
A. H. STEPHENS.

Glas'gow, the commercial and industrial metropolis of Scotland, is situated in Lanarkshire, lat. 55° 51′ 32″ N.,

lon. 4° 17′ 54″ W., on both sides of the Clyde, which here is crossed by three elegant stone bridges and two suspension bridges, 21 miles from its mouth. The name of the city is of Celtic origin, and is said to signify "dark glen," referring to a ravine in the north-eastern part of the city formed by the Molendinar. Here stands on an eminence overlooking the whole city the cathedral, founded in 1187 by Bishop Jocelin, but not finished until the present century, and one of the finest buildings in the country. Close by stands the university, founded in 1451 by Bishop Turnbull, and from these two buildings as its nucleus the city gradually developed. In 1660 it had 12,000 inhabitants; in 1801, 83,769; in 1851, 347,001; in 1871, 547,538. When by the union between Scotland and England the trade with the American colonies was opened to Scotch enterprise, Glasgow became the centre of the tobacco-trade, and later of the sugar-trade with the West Indies, and thereby its prosperity was largely increased. Still more rapidly has it developed in this century, having become the centre of the cotton and iron manufacturing industries of Scotland. Situated as it is in a region rich in coal and iron, and provided with good shipping facilities, nature has given it the most splendid opportunities, and it has known how to use them. The Clyde has been made navigable for vessels of 2000 tons burden, and an excellent harbor has been formed on the Clyde and Forth Canal. Over 2,000,000 spindles, supplying 27,000 power-looms, and consuming annually 125,000 bales of cotton, are in operation. Nearly as extensive are the iron manufactures, especially the building of iron steamships, and the manufactures of chemicals. The chemical works of St. Rollox are the largest in the world, and employ more than 1000 hands. The dyeworks, calico-printing establishments, woollen manufactures, glass-works, and breweries are also very extensive. The value of the exports of 1871 amounted to £10,049,987; that of the imports to £6,577,575. The aspect of Glasgow is of course that of a great manufacturing place. Some parts of it—as, for instance, the former suburbs, Calton, Bridgeton, and Camlachie—are rather poor, but others again are very fine. The quays along the Clyde are open, lined with handsome buildings, and present many fine views. Buchanan street, with its magnificent shops, and Blythswood, Garret Hill, and Kelvin Grove, with their elegant residences, are also noticeable. In general, the streets are broad, straight, well paved, and well lighted. The city has three fine parks, beautifully laid out—the Green (140 acres) at the E. end, near the river; Queen's Park (100 acres) to the S.; and Kelvin Grove (40 acres) to the W. Besides the cathedral there are 175 churches and chapels: Established Church, 40; Free Church, 43; United Presbyterian, 37; Roman Catholic, 12; Independent, 9; Baptist, 7; Episcopalian, 5; Reformed Presbyterian, 4; other denominations, 18. A great number of elegant monuments are scattered throughout the city, among which the most noticeable are the statue of James Watt by Chantrey, that of Sir Robert Peel by John Mossman, and that of Sir John Moore by Flaxman; and it possesses a valuable collection of pictures, several good public libraries, and a large number of benevolent, educational, and scientific institutions. Among these is the Andersonian University, with schools of chemistry and medicine, and courses of gratuitous popular instruction. Glasgow sends three members to Parliament. It is the see of an Anglican bishop and the seat of a Roman Catholic delegate-apostolic, who has the rank of an archbishop *in partibus infidelium*. The Anglican see is united to that of Galloway.

Glasgow, University of, was founded in 1451, by Turnbull, bishop of Glasgow, by authority of Pope Nicholas V. Lord Hamilton gave it a building in 1480. Mary, queen of Scots, handsomely assisted the university in her day. Her son, James I. of Great Britain, gave it its present charter in 1577. In 1870 its new buildings were opened. The splendid Hunterian museum was presented to the university in 1781. Besides the regular academical course, there are law, divinity, medical, and scientific examinations, degrees, and professorships. Fine buildings have been lately erected. The university joins that of Aberdeen in sending a member to Parliament. The old University of Glasgow is not connected with the ANDERSONIAN UNIVERSITY (which see).

Glasgow, post-v., cap. of Barren co., Ky., on the Cumberland and Ohio R. R. (incomplete), and terminus of the Glasgow branch of the Louisville and Nashville R. R. It has 2 banks, 1 newspaper, a male and female college, 6 churches, several large mills and shops, 5 hotels, 1 carriage manufactory, 2 wagon manufactories, and 31 stores. It is only 3 miles from the flowing oil-wells of Kentucky. Pop. 733. E. Y. KILGORE, PUB. "TIMES."

Glasgow, post-tp. of Wabashaw co., Minn. P. 1769.

Glasgow, city of Chariton tp., Howard co., Mo., is in the N. E. part of the county, on the Missouri River, on the Keokuk and Kansas City R. R. It contains 2 banks, 1 newspaper, 2 large flouring-mills, 4 tobacco manufactories, 1 carriage and 1 wagon manufactory, 5 churches, a public library with 4000 volumes, and a large library building and hall, a city-hall, a city market-house, 2 colleges, a free public school, with a 2-story brick school-house, also a free public colored school, 3 hotels, and 9 stores. There are Masonic, Odd Fellows, and Good Templar lodges, also a German relief society. Glasgow is surrounded by a fine agricultural region, and is the centre of a great tobacco market. Pop. 1795. LUCIAN J. EASTIN, ED. "GLASGOW JOURNAL."

Glas'ites, the followers of John Glas (1695–1773), a Scottish minister. The sect is more generally known as the SANDEMANIANS (which see).

Glass [Saxon, *glaes*]. In the early stages of the Indo-Germanic tongues the word *glass* was applied to all shining bodies. The old Germans called amber *gles*, and the Swedes termed gold *glis* and *gläs*, while the Phrygians gave it the name of *gleros*. The word *glare* and the Latin *glacies*, French *glace*, "ice," all belong to the same family, in common with *glance*, *gold*, and *glitter*. The Sanscrit *las*, to "shine," also *kash*, probably indicate the general origin of the word. The name of glass is given, says Laboulaye, in its most general acceptation, to every transparent or translucid body which is brittle and sonorous at ordinary temperature, becomes soft and ductile, finally melting, under the influence of heat, and which presents when broken the peculiar appearance known as the vitreous fracture. In the arts the term is limited to compounds of silex, potash, or soda, sometimes with lime or oxide of lead, alone or mingled, giving by fusion a substance which is not soluble in water, nor, when well made, in any acid except hydrofluoric. Borax, oxide of manganese, litharge, red lead, and other materials are used in making glass, according to the kind wanted. Specifically, glass in its simplest form is composed of silica and an alkali. In order to aid the fusion together of its materials a flux is added to some kinds of glass; which flux is generally lead. An old story told by Pliny ascribes to the Phœnicians the invention of glass. Certain sailors of this nation, who had a cargo of soda, having landed by the Belus, a little river at the foot of Mount Carmel in Palestine, wanting stones to support their pots, used lumps of soda, which, being liquefied with the heat, formed with sand, which was also fused, glass. The possibility of this legend has been denied, but on insufficient data. It is certain that the Egyptians made glass at a very early period of their national existence. Paintings of the reign of Osirtasen I. at Beni-Hassan, representing glass-blowers making a very large vase, show that 3500 years ago, or before the Hebrew Exodus, the Egyptians were far advanced in this art; and the fact that glazing was applied to many objects about the same time indicates great skill not only in combining the materials of glass, but in its manipulation. The writer has observed in Egypt that the common blue glaze, such as was used in the earliest ages, is still made for inkstands, buttons, and other articles among the peasants. An Egyptian glass bead "of very advanced art," found at Thebes by Capt. Hervey, bears an inscription which indicates that it was made during the reign of Thothmes III. (1500 B. C.). The curious glass beads called *aggry*, which are valued in Ashantee like diamonds, and which are found deep in the ground in the Dinkira, Akim, Warsaw, Ashantee, and Fantee countries, are supposed to be of ancient Egyptian manufacture. If so, they prove that the Egyptians surpassed the moderns in some respects in making glass. "The variegated strata of the aggry beads are so firmly united, and so imperceptibly blended, that the perfection seems superior to art. The surfaces of some are covered with flowers and regular patterns so very minute, and the shades so delicately softened one into the other and into the ground of the bead, that nothing but the finest touch of the pencil could equal them. The agatized parts disclose flowers and patterns deep in the body of the bead; and thin shafts of opaque colors run from the centre to the surface." The recent Ashantee war has made the public in England somewhat familiar with these beautiful beads. There is observed in them different colored clays baked together without blending, as well as certain peculiarities of manufacture which cannot be well explained. It is remarkable that these beads bear some resemblance to the celebrated *glain neidyr*, or Druid holy snake beads of glass, found in Wales. The most beautiful specimens of *ancient* Egyptian glass in the British and other museums, which so closely resemble turquoise, jasper, and other stones, are nearly all opaque, and strictly speaking are a kind of smalt, such as was produced in great perfection by the ancient Romans and Venetians, and such as is made at present in Norway. Beckmann, however, declares that as regards the use of *cobalt*, smalt was invented about the beginning of the

sixteenth century, and that the blue glass of the ancients was colored with iron. However this may be, the Egyptian opaque glass was apparently thickened with earthy or aluminous matter. Under the Roman rule the Egyptians excelled in glass-making. Cæsar Augustus, having a great admiration for the glass of Egypt, when he had subdued that country (26 B. C.) ordered that it should form part of the annual tribute to be paid to the victors. This became a source of incredible wealth to Egypt, for the Romans, having thereby become familiar with Egyptian glass, ordered it in immense quantities, and the Egyptians devoted themselves to a very large export trade, of which they preserved the monopoly until the reign of Tiberius (14 A. D.), at which time, according to Pliny, this industry began to be cultivated at Rome. The Egyptians, to suit their customers, studied Roman (or rather Greek) patterns, and a beautiful fragment in the British Museum of Egyptian manufacture is of elegant Greek design. Long previous to this time the Sidonians and the Tyrians had made very elegant glassware. The only color which the Egyptians certainly originated is the *bleu de Nil*, a rich blue, which has of late, by a caprice of fashion, become the *mode* in Paris for glass beads. In the tombs of Thebes small solid pieces of turquoise-colored glass enamel have been found which were used for glazing beads and figures. The Egyptian glass of other colors is supposed to have been derived from the Greeks and Romans. The art of depriving glass of color and making it like crystal was a very late invention, but it would appear to have been Egyptian, since the vessels of pure transparent glass which the emperor Hadrian valued so highly were received by him at Alexandria. Glass had been made in Rome two centuries B. C., but under Nero Egyptian artists in Rome and the natural intelligence of the Romans, stimulated by the extravagant luxury of the court, developed the industry to such an extent that in a short time the Roman wares attained an elegance which is as yet one of the lost arts. Under Alexander Severus an entire and separate quarter of the city was filled with glassmakers (A. D. 210). From Rome the art spread to Gaul, Spain, and Britain. The Latin writers of the Augustan age make frequent mention of glass. Virgil compares it to the clearness of the Fucine Lake, and it would appear from Horace that it was very lustrous and transparent. Athenæus states that glass cups were made in his time imitating all the shapes of foreign potters. From the context it would appear that when Cassander founded his city he was very desirous that it should be distinguished by having its own peculiar pattern of wine-vases of glass, and that the statuary Lysippus gratified his wish. Glass continued for a long time to be imported from Egypt. The Phœnicians at a very early age had made and exported, even to Britain, much glass, and Alexander Nesbitt, a very high authority, thinks that the aggry beads are of Phœnician make—a theory which would account for their identity with the British *glain neidyr*. The analyses made by Prof. John of Berlin, given by Von Minutoli, show that Egyptian blue opaque glass owed its color to copper, or copper and iron; semi-transparent blue to cobalt, or the same with lime; violet to manganese; and black to iron. These processes were all employed by the Romans. Greenish glass was made in Abyssinia B. C. 722, but the colored glass discovered at Nineveh by Layard is probably Roman. According to Labarte, the beautiful little glass vases called Greek, so often found in tombs on the Mediterranean, are really Phœnician, though of Greek (or more rarely Egyptian) form. Those in the British Museum are very elegant. All forms and styles centred in Rome, where ere long glass was much more used than at the present time. Collectors soon sprung up; among these was the emperor Tacitus, of whom his biographer, Vopiscus, tells us that he was incredibly pleased with the elaborate adornment and variety of glass vases. The Portland Vase in the British Museum, which is made of two layers of glass, the surface being cut away by hand, is of such rich and firm material that four of the principal art-critics who have written on it believe it was cut from some stone, such as chalcedony or agate. It was in making glass of the texture and body peculiar to jasper and other stones that the Romans excelled. It bore cutting on the wheel and engraving better than any glass now made, took a gem-like polish, was less brittle, and did not display to any great degree the vitreous fracture. It partook, in fact, more of the character of *smalt*. These peculiarities explain more readily how it was that certain statues of antiquity, the so-called Holy Graal, etc., were mistaken as to their material for precious stones. Almost every means of decoration and manipulation of glass was known to the Romans, and every year brings forth new proofs of their astonishing knowledge. The largest collection in England of fragments of Roman glass, made by a lady some years ago, had in it every variety of whorls, spirals in sheets, strips, pipes, canes, rosettes, and threads of the Venetian style. As regards the rich stone-like quality of the glass, the writer has seen a specimen imitated to perfection under the direction of Sir William Drake in Murano. That gentleman says that while it is perfectly possible to imitate the peculiarities of the richer Roman colored glass, it would be impossible to do so at a profit, owing to the want of appreciation on the part of the public. The Romans excelled in working *glass within glass;* they also made singular combinations of glass and terra cotta, many of which would be almost impossible to workmen at present. But their skill was chiefly shown in the celebrated *diatreta* or bored work. This was done either by making a vase in two layers, the outer extremely thick, and then cutting away the latter in patterns of very bold relief, frequently of network and flowers, or else by applying the patterns with the ponty or with the blowpipe and other instruments, and then cutting the work when cold. The celebrated *diatreta* vase found at Strasburg in 1825, formerly belonging to the emperor Maximinian, was a fine specimen of the former process; some cheap vases found in Britain illustrate a mere imitation of the latter by *applied* glass. Very few Roman glass vessels of an ornamental character have been preserved, though urns of plain glass, used to contain the ashes of the dead, and bottles, are very common. But from the immense quantity of fragments it would appear that vases of singular elegance and great value were relatively much commoner than at present. It would also seem that during a long period there was a systematic destruction of these wares. The emperor Gallienus, it is true, drank from gold, and said of glass that nothing was more vulgar, but his subjects thought differently. The Romans made glass of transparent colors—blue, green, purple, and amethystine, amber, brown, and rose; of opaque, white, black, red, blue, yellow, green, and orange; and all these were remarkably good, the blue shades being extremely rich and varied, often closely resembling lapis-lazuli and turquoise. Their green, purple, and crimson are often very fine, and in the combinations, imitations of onyx, porphyry, granite, and agate are frequently produced which far surpass anything made at present. The analyses of this glass, as given by Von Minutoli, show the use of the oxides of lead, copper, or iron in combination with silica, alumina, and lime, these materials alone in different proportions forming opaque red, green, or transparent blue. They also used cobalt sparingly for blue, gold for rose-color, manganese for violet, and the oxides of tin and arsenic for white and orange. Two methods of working glass were highly developed—firstly, by combining rods or threads of glass of different colors, and joining them together in one rod or cane, which when cut transversely into slices gave as many duplicates of the pattern; and secondly, by spreading one color or coat over another. The former class includes the so-called mosaics and *millefiori*. This process was Egyptian, and as it is always found most perfect in objects of Egyptian character and design, there is reason to believe that to the last Egyptian workmen in Rome continued to excel the natives in this branch of the art. Very beautiful ornaments, representing such subjects as faces, flowers, and birds, are often met with, and these so astonishingly delicate and minute that feathers and hairs are accurately represented which are invisible to the naked eye. This was effected by making the pattern on a large scale or with large rods, which while hot were drawn out to any degree of fineness. In the British Museum there is a small bust in glass, with a lock of hair not broader than a horsehair, on the forehead; but when examined with a lens this lock is seen to be composed of nine threads alternately of transparent and opaque glass. Plaited bands and threads of glass, or rolled strips of many quaint patterns and of different colors, were embedded in transparent material with great skill. Glass in layers or strata, of which the outer was cut like a cameo, was the second class, and in this the Romans—or, what is more probable, the Greek artists who worked for them—have never been equalled. The Portland Vase, the amphora of the Museo Borbonico at Naples, and the Auldjo Vase of the British Museum are of this kind. The ground of these vases is generally transparent blue, lined with white, to "throw up" the color or opaque blue, while the *cut* outer layer is a rich opaque white. It should be remarked that some very elegant Roman glass is very light; one specimen is but little more than twice its weight of water—viz. specific gravity, 2049. Nearly all their colored glass *feels*, so to speak, differently from the modern. Some is heavier, but it is generally warmer. "The more a manufacturer gets acquainted with ancient fragments, the more firmly he appreciates the high state of perfection to which ancient workers in glass carried their art, but of which skill we find few records in ancient literature." The same author is of the opinion that the Romans used both lead and barytes to produce density and brilliancy. A very fine Roman goblet seen by him was much heavier than any

modern flint-glass. It had been blown in a mould, after the modern Bohemian manner, and cut on a wheel. *Krinkled* glass, as it is called, made by blowing bottles, etc., in cages of wire, was often made; "pillar-moulding" was also extensively practised, a process by which projecting ribs are formed on the sides. Houses were also ornamented, both as to walls and pavement, with glass slabs or mosaics; as these were generally cut with a wheel, they must have been enormously expensive. Roman window-glass has been found even in England, and in the House of the Faun at Pompeii a small pane remains in a bronze sash. The Roman *specularii*, spoken of A. D. 377, were no doubt glaziers. A beautiful industry in glass among the Romans consisted of imitating gems, seals, and cameos for jewelry. Those who could not afford cut gems on hard stone gladly purchased imitations in glass, which were so well made as to be but little inferior to the originals. These are found in immense quantities about Rome. It is probable that in them we have copies of almost every gem or statue or work of art of any great value known to antiquity. A part of these glass gems were cast, but many were cut by hand with great care.

After the fall of the Roman empire glass-making declined, but not so rapidly as other arts. Glass mosaics of good quality were made at Rome from the time of Constantine until that of Charlemagne. Window-glass for churches was made, according to Lactantius, in the fourth century; it is alluded to by St. Jerome early in the fifth, and by Gregory of Tours and Fortunatus in the sixth. In the seventh century workmen were sent from Rome to glaze a church in England. As the art declined in Rome it flourished in Constantinople, and there is every reason to believe that it was cultivated to a considerable extent among the pagan Saxons, the Picts, and Irish, as all had their own peculiarly formed goblets and ornaments of glass. Those of the Irish are very characteristic, their mosaics displaying considerable skill, as is shown on the crozier of Lismore, the cross of Coirg, the shrine of St. Mogne, and the Tara brooch. It is supposed that as several Irish illuminated MSS. present an analogy with Egyptian art, and as there is direct evidence in the *Leabhar Breac* of seven Egyptian monks having come to Ireland, it is possible that Ireland learned the art, like Rome, from Egypt. Beads were made by all the Celts, even in the earliest times, with great skill, after the style of the Egyptian or Phœnician aggry type. A large bead from an old Irish grave near the Giant's Causeway consists of terra-cotta with inlaid glass. Very little remains of early Byzantine art; the bacchanalian cup of Baron Lionel de Rothschild, the situlæ in Venice, and two specimens in the British Museum are among the few known. After the revival of Byzantine art which followed the decline caused by the Iconoclasts, glass-making produced a few beautiful works, such as the famous Sacro Catino at Genoa, long supposed to be cut from a single emerald, and the blue cup at Monza, which is so perfect that it is doubtful whether it be not really a sapphire. In the eleventh century glass-making was practised with great success in Persia and Alexandria, and in 1163 Benjamin of Tudela says there were at New Tyre 400 Jews, "ship-owners and manufacturers of the celebrated Syrian glass." From this time elegant cups, bowls, and lamps of Oriental manufacture became common, enamelling having been extensively developed and applied to glass. Many European kings obtained specimens of this ware—much of it made at Damascus—and prized it highly. Among these are the cup of St. Elizabeth of Hungary (d. 1231), now in the museum of the University of Breslau, the glass of Charlemagne, and the celebrated Luck of Edenhall. The treatises of Heraclius, a Frenchman, and of the monk Theophilus, a German, of the eleventh and twelfth centuries, contain full details for making glass in great variety, both for windows and vessels. Glass-making was never lost either in France or England. In the former country it was extensively practised in the seventh century, and the records of Colchester (England) show that three *verrers* or glass-makers were taxed in that town in 1300. The tomb of Edward the Confessor in Westminster Abbey is decorated with glass mosaic, probably Byzantine or Venetian. Glass for such mosaics was made in Ravenna to the sixth century, in Rome to the ninth, and again in the twelfth and thirteenth. "In the latter centuries it was much used in Central Italy in the decoration of monuments, etc., where it was inlaid in white marble." Glass-making in Venice is asserted to date from the seventh century, but "both monumental and documentary evidences are entirely wanting as regards the period antecedent to the thirteenth century, with the exception of the mosaics in the churches of Murano, Torcello, and St. Mark." The earliest of these was completed in A. D. 882, but these were probably Byzantine. The immense labor of covering the interior of St. Mark's with glass mosaic in the eleventh and twelfth centuries probably attracted to Venice skilled Byzantine workmen; and as fine sand and plants yielding good alkali abounded there, glass-making soon became a national art. It is evident that not only were the processes extant in the East speedily transferred to Venice, but that careful study of all the Roman devices of the millefiori, filigree, and ribbon work, never perhaps entirely lost, soon revived nearly all that was known of old. The taste for solid elegance had departed, but that for the light, flower-like, and even the frivolous, had increased; and in this direction Venice soon attained perfection. Millefiori was revived previous to 1400, and soon after the celebrated *vitro di trina* (lacework or reticulated glass) followed it. The millefiori or mosaic glass, made from sections of rods welded together, never equalled the old Roman in taste or success, but the filigree or reticulated far surpassed anything of the kind known to the ancients. The *latticino*-work is a variety containing milk-white threads, often running by hundreds in graceful spirals around a cup expanding from a common point, while on the other side another series spread in the contrary direction. In the fifteenth century Venetian glass attained incredible popularity. At this time porcelain was almost unknown, and, with the exception of gold and silver, glass furnished the only material for elegant ornament to gratify the inordinate luxury of an age in which all genius was devoted to ornament, and in which utility itself was despised unless equally developed with art. The Venetian glass is often strangely fantastic, and being made without lead is very light. The government guarded the secrets of the art with great jealousy, and when two Venetian glass-workmen went to Germany, they were followed up and murdered. The workmen still affect great mystery, but the real secrets of the craft have always consisted of extraordinary skill in manipulation or dexterity. In 1291 the glass-makers of Venice were all placed in the island of Murano, and the art, as a source of incredible profit to the state, was made highest in respectability, or, as it is generally claimed, all who practised it were held to be noblemen. At Murano six kinds of work were developed. In the sixteenth century the glasses were generally made so thin as not to bear enamelling. The *crackled* or *frozen* glass of the sixteenth century has since been successfully produced by Mr. A. Pellatt. *Avvanturino*, or smalt speckled with gold, was invented in the eighteenth century.


Venetian Drinking-glass.


Venetian Drinking-glass.

Of late years the Venetian glass-work of Murano has revived, and its goblets, vases, and chandeliers, are extensively sold in London.

About the year 1860 several persons interested in the development of the industries of the Venetian provinces attempted to revive the then dormant art of glass-making in the island of Murano, where its traditions still lingered, and where the descendants of the glass-blowers of the sixteenth century yet existed, though no longer holding the proud position assigned them in the palmy days of the republic. The persons to whom the merit of this attempt is due were Murenese; amongst them may be mentioned Bigaglia, who sought to reproduce the composition known as avventurino; Franchini, who revived the "millefiori;" Fuga, who directed his attention to the fabrication of mirrors of the old Venetian

Venetian Drinking-glasses.

type; and Radi, who applied himself to the production of enamels. Dr. Antonio Salviati, a native of Verona, availing himself of the practical knowledge and enterprise of the manufacturers, sought to give a commercial value to their product by establishing an emporium for its sale in England; where he also sought to introduce a taste for mural decoration in glass mosaic. He also established a furnace on a small scale at Murano for the production of blown glass, and then called to his aid two of the most apt workers. Dr. Salviati was in some respects well qualified for the speculation he had undertaken, but his efforts would have been unavailing for want of capital and commercial experience had he not succeeded in interesting in its manufacture a gentleman whose early youth was spent in Italy, and who throughout a remarkable career never faltered in his exertions to restore to that country the ancient prestige which attached to her art-production. Henry Austen Layard, the early explorer of Nineveh, took the work in hand which Dr. Salviati had initiated. By his influence, aided especially by Sir William R. Drake and W. L. M. Rate, a small private company was formed, and English capital and energy were called in. As is generally the case, the promoters of the new company, looking at the business too much from an art-loving point of view, paid far too dearly for it, and in a very short time the comparatively large capital subscribed was practically lost; but those who had undertaken the direction of the company refused to abandon it; and by providing fresh capital, and by perseverance under difficulties of no ordinary character, they have succeeded in making the business self-supporting, have established ateliers where boys learn to become mosaic artists; and have succeeded in producing works which vie in beauty of form and material with the most renowned specimens of the best period of the Venetian glass manufacture. Space would not admit of our particularizing the various methods employed in producing the artistic specimens which the company can show. Specimens of their Egypto-Roman glass are undistinguishable from the fragments found in the tombs of Egypt, Greece, and the Roman empire. The peculiarity of Venetian glass consists in its extreme lightness, the elegance of its forms, and the great variety of material used, added to the fact that it is, almost without exception, produced by the blowpipe, without the assistance of moulds; so that the accuracy of the shape depends entirely upon the correctness of eye and the dexterity of the artist. Thus it presents that indescribable charm which handiwork possesses as compared with the product of machinery.

Engraved Flagon (Clichy Glass works).

Glass was made during the Middle Ages, especially for windows, in all European countries. French specimens indicating skill and taste are not rare. The Germans produced an immense quantity of cylindrical drinking-cups, generally of greenish glass enamelled. These are called *Wiederkom* or "come-again." They generally bear the arms of the Roman empire, whence they were often called Römer, from which the English word rummer. They were made from 1553 to 1725, and are profusely imitated at the

Bohemian Glass.

present day. In the beginning of the seventeenth century the Bohemians began to produce fine crystal glass, and developed the art of engraving on it. Then Henry Schwanhard invented engraving with fluoric acid. In 1736, Bohemian goblets were made which cost £150 = $750. The gold ruby glass, though already made by Romans and Venetians, was perfected in Germany by Kunckel at Potsdam in 1679, both with gold and copper. Great efforts were made in Germany, not without success, to excel in glass-work. In elaborate work the Bohemians often equalled the Venetians. Bohemia has always been able to produce very cheap glass, and even when coarse it has a certain

odd character which commands a sale. At the present day more than 30,000 persons are engaged in its glass-works. In the seventeenth century the French made vigorous efforts to excel in the art, and introduced Venetian workmen. Oxide-of-lead flint-glass was made in 1784 at St.-Cloud, and other factories were soon after established. Glass-casting and plate-works had previously been established by Thévart. At the present day French plate-glass is the best known. In England glass-painting was practised by one Bristol in 1338, and by others at the same time, especially by John Thornton of Coventry. The splendid W. windows of York cathedral are by him. In 1485, English window-glass cost much more than any other. Yet the art greatly declined until the middle of the sixteenth century, when a revival took place, and in 1557 window and coach glass was produced nearly equal to the Venetian. Cornelius de Lauroy, Jean Quarie, and other Flemings established glass-works in London in 1567; Dollyne and Carye of Antwerp obtained a monopoly to make glass. In 1589 there were fifteen glass-houses in England, and about this time the manufacture rose to importance. Sir Robert Maunsell's monopoly, obtained in 1615, to make and import glass, seems to have been used principally to obtain it from abroad. About 1670 the duke of Buckingham established a factory with Venetian workmen at Lambeth; from this came the small mirrors with bevelled edges still found in old houses. The influx of French Huguenot glass-workers in 1685 gave an impulse to the manufacture, and in 1736 English glass was considered by Dr. Pococke to be superior to that of Bohemia, and only inferior to that made in Prussia, under royal patronage, at unlimited outlay. Plate-glass was made in 1771 at Prescot, Lancashire; the patent plate was introduced in 1840. At the present day perfectly pure glass, free from specks or striæ (lines), is made in England better than in any other European country; and with all the elegance and originality of Venetian patterns, its finest work is inferior to the English and French as regards mechanical accuracy. The French, however, at an early date made plate-glass very large and of good quality. Soon after 1688, Thévart at Paris and at St. Gobain, Picardy, cast plates 60 inches by 40. Blancourt in 1698 says that plate-glass was invented 200 years before by a workman, who while melting glass spilt some which ran under a flat flagstone; when taken out it had formed a perfect plate. But St. Jerome tells us that in his time glass was *cast* into plates for windows. In England glass-making suffered until within a few years from excise restraints which now seem incredible, every process requiring a permit from an official. It is a matter of astonishment, says Pellatt, how flint-glass works existed at all under such commercial and manufacturing hindrances as were imposed by the excise.

Optical glasses are probably almost as old as glass, for it is not likely that men who worked in this material would not almost at once observe the magnifying properties inherent in every piece thicker in the middle than at the sides. A lens was found in Nineveh, and the Chinese chronology of Père Gaubil states that the emperor Chan (2283 B. C.) observed the planets through an optical glass. Ptolemy is said to have had a telescope in Egypt. In 1303 a French surgeon, Gui de Chauliac, recommended spectacles as well known. A tombstone in Florence declares that they were invented by Salvino d'Armato, who died in 1317. Cornelis Drebbel (1572) and Zachary Janson (1590) invented the compound microscope, afterwards perfected by Dollond. Kepler (1571) is regarded as the modern inventor of the telescope. The telescope was invented, or rediscovered, in 1606 by Hans Lippershey of Middelburg, Holland; the states-general granted him a patent on condition that he should add a second tube to it, or make it *binocular*. The so-called Galileo's glass was invented by Metzu in 1609. Glass for optical instruments is the most difficult to make. According to Lardner, one of the most scientific opticians in London was unable during ten years to obtain a piece sufficiently free from defects to be used in a telescope. Great advances in the preparation of optical glass were made by M. Guinand, a Swiss, and by Fraunhofer of Munich. A single pot or a single fragment of pure glass has more than once stirred up an excitement among all the opticians in Europe, and caused a spirited competition to obtain it. The method by which Guinand was enabled to make larger and clearer lenses than any known before consisted in agitating the glass while in fusion and annealing it in the pot; a method which has been greatly improved of late years by Mr. Pellatt. From Guinand's son the secret was conveyed to Bontemps of Paris, by whom the glass was further improved and enlarged. In 1848, Bontemps transferred his work to the celebrated glass-factors, Messrs. Chance, who possess the largest works in England, and by whom lenses are now made of extraordinary size and purity.

Qualities of Glass.—Glass is a salt, every salt being the result of a combination of an acid with an alkaline base—*i. e.* an alkali or alkaloid of organic nature. In the case of glass the acid is silica or silicic acid, and the *base* a mixture of an alkaline with an earthy base, such as lime, or with the oxide of one of the heavy metals, such as lead. Silica exists in nature in such minerals as flint, agate, rock-crystal, or quartz. Its character as an *acid* was first clearly established by Berzelius. This does not appear until it is at a red heat, when it acts very powerfully, and, expelling other acids, combines with *bases* to form solid compounds or salts called silicates. Glass may be made by substituting boracic acid for silica. It is remarkable that while the silicates formed by nature crystallize, those made by art do not. Potash and soda are the most important ingredients, next to silica itself, in glass. They act as a flux, rendering the glass easy to melt. Lead renders glass brilliant, clear, and fusible, but in excess softens it. Lime increases the density, hardness, and lustre of glass. Carbon in the form of charcoal aids the fusion. Glauber's salt with lime is sometimes used instead of soda, and muriate of soda, or common salt, is extensively used as a flux for coarse ware. A small admixture of the black oxide of manganese is essential in making flint-glass, its property being to clear and purify the mass from the discoloration caused by particles of carbon and iron. For this reason it is called the "glass-maker's soap," as it appears to wash away all impurities. In excess, manganese causes reddish colors. This may be removed by agitating the glass. Coarse greenish glass is, however, made white by an *excess* of manganese. The purple-pink windows sometimes seen in dwelling-houses are made so with manganese. As a general principle, the glass is less fusible and offers greater resistance to the action of water and acids the larger its proportion of silica and alumina, while the contrary results from an excess of potash, soda, baryta, lime, magnesia, or oxide of lead. Lustre and the refractive power of glass are produced in the highest degree by lead-glass, next by baryta, next by potash, and least by soda-glass.

Toughened Glass.—A very recent and important invention has been made by M. de la Bastie, which has been fully tested and verified by scientific men in London and New York. It consists of plunging hot glass, manufactured in any form, into hot oil or a heated oleaginous compound. When cool it becomes almost as tough as metal, so that a cup or mirror made of it may be thrown violently many feet or dropped on a stone floor without receiving any injury. When very violently broken it separates into granulated fragments, without sharp edges, so that the danger of being cut by it is much diminished. The process does not affect the transparency or beauty of the glass in any way.

Frit or *batch* in glass-making consists of the ingredients needed for any kind of glass powdered, mixed, and carefully dried. The following are the ordinary glasses: Bottle-glass, sp. gr. 2.732, very infusible, from its excess of alumina over soda.—French: prepared from varec, 30 or 40 pounds; lixiviated ashes, 160–170; fresh ashes, 30–40; ferruginous clay, 80–100; cullet (old glass), 100; or from quartz sand, marl, wood-ashes, and salt. English: lixiviated ashes, 100 pounds; kelp, 40–90; wood-ashes, 30–40; clay, 80–100; cullet, 100. Apothecaries' and chemists' vials and glassware, hard, bearing changes of temperature well: common potash, 30–35 pounds; lime, 17; ashes, 110–120; binoxide of manganese, 0.35–0.50.

Window-Glass.—In France a mixture is used of 100 parts quartz sand with from 30 to 40 parts of dry carbonate of sodium (or as much sulphate with charcoal), and 30 to 40 parts of chalk. German window-glass consists of a double silicate of chalk and potassa; *e. g.* 100 parts of quartz sand, 50 parts of pearl-ash, from 25 to 30 parts of chalk, and 2 parts of nitre. In many mixtures common salt is an ingredient. According to A. F. Gehlen, it is prepared with 100 parts of quartz sand, 50 parts of dry Glauber's salt, 17.5 to 20 parts of lime, and 4 parts of charcoal. Peligot's formula: silica, 69.06; lime, 13.04; soda, 15.2; alumina, 1.18. An analysis of ancient window-glass from Pompeii gave—silica, 69.43; lime, 7.24; soda, 17.31; alumina, 3.55; oxide of iron, 1.15; oxide of manganese, 0.39, with traces of copper. No fixed proportions of materials can, however, be agreed upon, and the manufacturer has to determine the amount of real alkali in every fresh supply of ash.

Plate-Glass.—Silicic acid, 72; soda, 17; lime, 6; oxide of iron, 2; alumina, 2. This is similar to crown-glass, the only essential bases with silicic acid being soda and lime, but a larger proportion of alkali being used, the point of fusion is lower than in crown-glass, used for mirrors. Plate-glass, according to Dr. Knapp, differs from window-glass (including crown and cylinder sheet-glass) only by greater purity of the materials. The superiority of the French plate-glass, especially that of St. Gobain, to English, is

due to the fact that it is a true chemical compound, consisting of one atom of the trisilicate of soda and one of the trisilicate of lime, with a small percentage of alumina. The English plate-glass, on the contrary, consists of a mixture of two glasses of different densities, its inferiority being shown by an imperfect reflection. It is, however, harder than the French, and cheaper. Flint-glass contains more lead than the crystal, and is made of silicate of potash and oxide of lead. Analysis: silicic acid, 45; potash or soda, 12; oxide of lead, 43. Recipe: (Bontemps) white flint sand, 261; minium, 261; potash, first quality, 60; borax, 18. Guinand's: flint sand, 225; minium, 225; potash, best, 52; borax, 4; nitre, 3; manganese, 1; arsenious acid, 1; cullet, 89. *Crystal-Glass*, used for optical purposes: silica, 59.2 (or boracic acid); potash, 9, and lead, 28. Tomlinson: silicic acid, 61; potash or soda, 6; oxide of lead, 33. Newcastle crystal: silica, 0.514; potash, 0.094; aluminum, 0.012; oxide of lead, 0.374. Practical mixture, or frit: white sand, 100; minium, 55 to 65; potash, 25 to 30; nitre, 2 to 5; peroxide of manganese, 0.001; arsenious acid, 0.0005 to 0.001; cullet, 50 to 100 parts. In the experiments conducted by Herschel, Faraday, Dollond, and Roget in Pellatt's glass-house, an optical glass was formed of remarkable purity, consisting of silicate of lead and borate of lead, the materials being vitrified in a platinum crucible, and the air-bubbles disengaged with spongy platinum in powder. This glass is very pure, but decays gradually. *Strass*, a variety of flint-glass used for imitating precious stones: silica, 44; potash, 12; oxide of lead, 43; and colored by various metallic oxides. Recipes: rock-crystal ground, 4056 grains; red lead, 6300 grains; pure carbonate of potash, 2154 grains; borax, 276 grains; arsenic, 12 grains. Recipe No. 2: of same ingredients, 3456, 5328, 1944, 216, 6. *White Table-Glass for tumblers, tubes, etc.:* silica, 71.7; soda or potash, 15; lime, 10. Recipes: potash, 40; chalk, 11; sand, 76; manganese, ½; white cullet, 95. Bohemian table or plate-glass: quartz, 63; pure potash, 26; sifted slaked lime, 11; and some cullet. *Enamel* consists of silica, soda, and oxide of lead, rendered opaque by oxide of tin or antimony. The proportions vary greatly, according to the colors required. Enamel is for the most part a double silicate of lead and potassium, rendered opaque by stannic oxide. In one specimen Dumas found 8.3 per cent. of potash, 50.3 of oxide of lead, 9.8 of stannic acid, and 31.6 of silica. Arsenious acid produces a similar effect to the stannic oxide.

"The mirror above a mantelpiece can be made from the mantelpiece and the ashes and fire beneath; the stones furnish silex, the ashes potash, and the marble lime." The base of all glass is sand, and the quality of this is of great importance. Formerly calcined and powdered flints were used, but now in England sand from the Isle of Wight, Lynn, and Reigate is used. To fit it for use it is dried or burned, sifted and washed, the Isle of Wight sand requiring eight waters. Much fine sand is taken from New Jersey to France. The two principal modern inventions in glass-work are both entirely American. One of these is *pressing* glass into shape by machinery; the other is the process invented by Tilghman of Philadelphia, by means of which glass or stone may be cut or worked into any shape, or be engraved upon, by the simple process of a sand-blast, the sand being blown steadily upon the portions to be removed. The sand acts with great difficulty on organic or fibrous substances, but very promptly on hard and amorphous bodies, so that if a piece of lace be put on a pane of glass exposed to a sand-blast, the pattern will be cut on the glass without injuring the lace. In preparing the *frit*, saltpetre, binoxide of manganese, and arsenic are sometimes used to purify the melted metal. Red lead (minium, Pb_3O_4) has the same effect in the compound glasses, which renders it superior to litharge. Lime, soda, and potash are used in all their forms. Coal, wood, or peat is the common fuel, great care being taken to exclude the smoke or carbonaceous deposits, and to use only the best qualities. In some furnaces in America powdered resin is employed to great advantage.

Coloring or Staining Glass.—This is a very important part of the manufacture, involving much skill. At one time dark *massive-colored* glasses were generally used. By color *en masse* we mean that which is tinted all through. At present hues are conveyed by covering a body of pure flint glass with one or more thin coatings of intensely colored glass, whether of blue from cobalt, green from iron and copper, or ruby from gold. The more metallic coloring oxide is employed, the less lead must be used, so as to equalize the composition. Massive colors produce a shadowy blackness, which was, however, turned to account by the artists of the Middle Ages, by *leading* their tints of blue, red, yellow, amethyst, and green into windows, either thicker or thinner of solid or *cased* glass as the required effects suggested. The following are approved recipes: Prepare a very fine flint glass—*e. g.* carbonate of potash, 1 cwt.; minium or litharge, 2 cwt.; sand, washed and burned, 3 cwt.; saltpetre, 14–28 pounds; oxide of manganese, 4–12 ounces. Add to this for ruby red, to 6 cwt. of the batch or frit, 4 ounces of oxide of gold; ancient red, use protoxide of copper. The art of making this, though known to Neri and Kunckel, was entirely lost until revived in 1828 by Engelhart of Zinsweiler. Red schmelz, or smalt, is prepared by a very long and intricate process, given by Laboulaye. Azure blue: to 6 cwt. of batch add 6 pounds of oxide of copper; cobalt blue, by adding oxide of cobalt or smalt. The cobalt forms a transparent glass. Amethyst or purple: 6 cwt. of batch, 20 pounds of oxide of manganese (and a little nitre—*Laboulaye*). Yellow common topaz, add to the glass charcoal in powder. Common orange, 6 cwt. of batch, 12 pounds of iron ore, and 4 pounds of manganese. Gold topaz, 6 cwt. of batch, 3 pounds of oxide of uranium. Gold yellow, to a composition for dark violet (peroxide of manganese) add a little oxide of iron, giving a brown violet; increase the iron, it will become a fine yellow, such as is used to spin into gold threads in woven glass. Green (grass), protoxide of chrome, or a mixture of antimony glass and oxide of cobalt. Emerald, to 6 cwt. of batch add 12 pounds of copper scales and 12 of iron ore. A far more beautiful emerald is made with the oxides of nickel and uranium. Black, peroxide of manganese, oxide of copper and of cobalt, equal parts, or with a mixture of iron filings, peroxide of manganese and oxide of copper or of cobalt. Soft white enamel, opaque, to 6 cwt. of batch add 24 pounds of arsenic and 6 pounds of antimony. Hard white, 200 pounds of tin and lead-putty. Hyalith is a black glass, so hard that it may be used freely to contain boiling liquids. It is made from the slag of forges, added to the batch of common white glass, and charcoal dust in excess. Basalt or lava may be used for the scoria or slag. It may be made in different colors, but is always brilliant and susceptible of a high polish.

Manufacture.—There is perhaps no manufacture in which every successive stage requires so much care as glass, and none in which results on so large a scale involve such delicate skill. A puff of smoke or a sudden draught of air, imperceptible to an invalid, may ruin an immense quantity of "metal;" and when the wares are made they are, so to speak, in their infancy, and must be carefully conducted through the process of annealing or tempering by judicious cooling. There are six kinds of glass, each requiring a peculiar fabrication and a peculiar building and furnace. These are bottle, crown, sheet-window, plate, flint, and colored glass. As a rule, glass-houses are conical, from 60 to 100 feet high, and from 50 to 80 in diameter at the base. With the exception of the pot-rooms and cutting-shops, all the processes are conducted on one floor, the prompt removal of the glass in its different stages being a matter of the utmost importance. The whole should be so planned that the crude materials in the course of preparation shall always be moving upward to the fusing-furnace, and when manufactured be drawn downward to the warehouse or packing-shop. All furnaces are buildings of circular or rectangular form, four different kinds being needed, which are built together or separately. Of these one is the main furnace, employed for supplying the melted glass from the pots in which it is contained; of the others, one is the annealing furnace, in which the wares are annealed or tempered when made or while making; and the other is employed for baking the raw materials combined, and called frit or batch. Having to furnish a temperature between 1800° and 2700° F., these furnaces are entirely constructed of fire-brick made of infusible clay and a cement obtained from the fusion of old pots made from the same clay. In addition to these is the flashing-furnace, where articles being made are rewarmed or restored to sufficient softness as they cool. The furnace for baking and partly fusing the frit is called a calcar, and that for annealing, a leer. For window-glass there is also the spreading-furnace, in which cylinders while soft are expanded into plates, while in a crown-glass factory the blowing-furnace is the principal. A flint-glass furnace is between an air-furnace and an oven—*i. e.* it must not have too much draught, and yet must be very hot. A large cave extending through the subterranean area of the glass-house, connected with the open air at each end, under the bars of the furnace, receives the fallen cinders, and supplies the oxygen for the combustion of the fuel. At right angles from the large cave are smaller caves, communicating so as to catch the wind from as many aspects as possible. A flint-glass furnace is reverberatory—*i. e.* with no heat or flame issuing from its centre. If the furnace contains ten pots, it will have as many flues or chimneys, and the flames escape through "linnet-holes," of which there is one in each flue. The smoke passes into the outer brick dome of the building, and thence through the funnel and great chimney. The

bottom part of the furnace is called the *siege*, or seat. The fire never goes out in a glass-house; if a part of the arch or crown of the furnace is destroyed by heat, the repairs are made by cramming the entire furnace with coals and cinders, which stops the draught, and on this the workmen rebuild with arch-bricks and fireproof clay. A furnace in England lasts from three to ten years; in France, but one or two years. Between every two adjacent flues in the furnace is an aperture called the working-hole, opposite to and a little above each pot, for the purpose of putting in raw material or taking out melted glass. The pots are from 18 inches to 3 feet high, 2 or 3 inches thick, the bottom 4 inches. They are either round, oval, or rectangular. For crystal made at the coal-mine they are shaped like a retort with a very narrow neck, or are hooded—having a mouth in front. Large pots cost £10 = $50, each. When a pot wears away or splits in the furnace, it is repaired as it remains by different methods, and may thus be preserved for several weeks. The breaking away of an old pot and setting a new is a very difficult and sometimes dangerous process. After being kept for nearly a year free from change of air, the pot is annealed or tempered at a red heat for five days, and then carried to and placed in the main furnace. This requires much skill. Filling the pot with new glass is *founding*. It requires constant skimming —an operation only confided to a very skilful workman. The process of making up the hot glass or metal is called a journey (French, *journée*, a "day"). It is from 30 to 40 hours. The shorter the time for preparing the glass, the better. It is, if good, quite liquid. If by delay it becomes thick, it is spoiled, and must be turned into cold water and used as cullet. The men generally work in England from Monday to Friday, by piece-work. In France their labor is by the day.

Annealing is an important process with glass-ware. If not well done, the articles will, it may be months afterwards, break suddenly. An unannealed bottle will be shivered if grains of sand or a bit of flint are shaken within it, and the writer has seen a massy glass tube separate with light blows into evenly-divided rings. This results from a different arrangement of the molecules through the whole mass, caused by sudden cooling. The furnace for annealing is fed for *plate* with coke, and has different degrees of heat. The time required is from 6 to 60 hours, according to the size of the articles. Much depends upon the wind. Great losses result when a sudden contrary current drives back the heated air. Very large objects are annealed in heated sand.

Working.—The ordinary tools of the glass-house are nearly the same to-day as those described by Blancourt in 1699. They consist of the pucellas, which resembles a pair of wool-shears, but with dull edges. The spring tool is like sugar-tongs, but straight and without bowls. The shears are exactly what the name indicates. The battledore is a square trowel. The punty, ponty, or pontil is a solid rod used to support the glass while working, and the blowing-iron is a hollow tube about four feet long, which is enlarged at the end to be dipped into the metal. The marver (French, *marbre*, so called from the material once used) is an iron plate one inch thick, highly polished, on which the glass is rolled into even shape. Two kinds of ladles are used to transfer or skim the glass, and also a rake to stir the frit or metal. The chair on which the workman sits is a low flat seat, with two long projecting arms. These are faced with iron, on which the blowing-iron is rolled to give a rotatory motion, while the hand with the pucellas shapes the article. If the workman now wishes to make a wine-glass, he puts the blowing-iron through a working-hole, dipping the end into the liquid metal. It is removed with a ball of hot glass sticking to it, which is at once blown by the breath into a large bubble, which has one end flattened on the marver to make the bottom of the vessel. In this condition it resembles a bottle without a neck, stopped by an iron rod. On the middle of the flat surface, which is the bottom of the wine-glass, a small ball of hot glass is now put. From this soft ball the stem is shaped with the pucellas while the whole is rolling up and down on the arms of the glass-maker's chair. The moment the glass hardens by cooling the action of the pucellas must cease or the surface will be rough. Another bubble of glass is now blown and attached to the end of the stem, to make the flat disk or foot on which the glass rests. This second bubble or globe is now cut open and flattened out with the pucellas, while the whole is being turned as before on the arms of the chair. In this condition the whole resembles a champagne bottle without a neck, but stopped with the blowing-iron tube, while on its flat bottom are the stem and foot of a wine-glass, the other iron rod, a pontil, which has been used to make the foot, in a line with the blowing-iron and stem. The pontil from this time supports the glass, for with a touch and a tap from the cold pucellas a crack is made in and around the bottle or bubble at the place where the rim is to be. This at once makes of it a wine-glass, but with a bowl of the shape of a barrel. The rim is then sheared smooth, and the glass is *flashed*, or rewarmed, at a furnace made for this purpose, and rolled into the ordinary form on the marver or iron slab. When thus finished and ready for annealing, it is knocked off from the end of the pontil by a sharp blow. This process is, with few variations, exactly that which is followed in making all articles of blown glass, whether tumblers, pitchers, dishes, salts, lamp-shades, or jugs. Bottles, vials, and all objects covered with projections, bulbs, letters, ornaments, or, as it is called, "pillar-moulding," receive this from being pressed while soft into a mould. These moulds are made of metal in two or more pieces, and open and shut. By blowing the glass is pressed against the hollows which form the ornaments or mouldings. Workmen acquire great accuracy in taking out on the irons exactly the quantity of glass required—a very important matter in making articles to be of the same size. Tubes for thermometers, etc. are made by drawing out to an incredible length, sometimes 70 feet, the bubbles of glass. *Casing* glass is the laying one very thin coat of colored glass on another, generally white. It is simply effected by blowing a bubble, cutting off one-half of it, and capping it on the white ball of hot glass. The American invention of pressed glass consists in forcing hot metal into a mould, not by blowing, but by mechanical pressure. Great practice is required to determine the exact quantity of metal, and to keep the moulds at a regular temperature just short of red heat. Glass-cutting or grinding is simply effected on the lathe and wheel with sand and water, pumice, etc. Beads are made by cutting tubes into segments. The Venetians are still unrivalled in this branch of the manufacture, and supply the greater part of the markets of the world, though immense quantities are made in Germany. The tube is cut into bits, which are filled with a paste of ashes and sand. They are then put with sand into a cylinder which is heated and turned. The motion renders the soft beads globular, the sand keeps them from adhering, and the paste preserves the bore. The wonderful skill which the workmen attain is best shown in making crown-glass in sheets. In this so much as nine or ten pounds of melted glass are sometimes taken out at once on the blowing-pipe. This is blown into a long ball, and reheated to expand it. At this stage a solid iron rod charged with glass is made to adhere to the centre opposite the blowpipe, which is now detached, leaving an orifice. This orifice enlarges as the ball is *flashed* or heated and rapidly revolved, until it expands suddenly with a flap into a large round plate four or five feet in diameter, and of uniform thickness except at the centre, where it forms, of course, with the pipe a lump or "bull's eye." It is then cut into panes. When the workman's breath is insufficient to enlarge the glass, the growth is effected by blowing in water, which as vapor at once expands the ball, or sometimes by a blowing-machine. Plate-glass is simply made by pouring the metal on a table covered with copper. On either side is an iron rod or bar the thickness of the proposed sheet, and on these an iron roller passes, reducing the metal to the exact thickness required. In grinding plate-glass, two plates are ground, one on another; one, imbedded in plaster of Paris, lies on a table, while the other, also cased in the same substance and heavily weighted, is moved uniformly and rapidly over its surface. Sand and water, emery of different grades, and finally tripoli and putty, are employed to polish it. When blown, sheet-glass is expanded into cylinders, which are while warm cut along their entire length with a steel point or glazier's diamond, and thus made into sheets which are flattened. As such glass cannot be perfectly flat like plate, neither can it be polished to perfection, as it would break under pressure. To obviate this, Mr. James Chance invented the process of laying a sheet on soft leather, while it was polished with another sheet. The elasticity of the glass prevented its fracture. Every year now sees great improvements in manufacturing large sheets of glass, and some of the most important and recent are of American origin. As regards all glass-ware made by hand, success depends entirely on the skill of the individual workman, and the simple description which we have given of the making of a wine-glass applies to every object. The formation of the infinite variety of wares produced in flint-glass houses depends more upon skill, adroitness, and tact than upon the ingenuity of the tools; in truth, the perfection of the product of the furnace, as regards its workmanship, depends chiefly upon the tact and intuition of the glass-blower, avoiding as much as possible the use of tools. Iron tools should only be employed in the earlier processes to produce the crude form, and the wooden tool used but sparingly; whilst the finishing and intermediate shaping depend chiefly upon the application of centrifugal force by

rapid hand-rotation; upon the expansion given to air to widen the forms while reheating at the aperture of the furnace, technically termed "flashing;" and upon a skilful final throw.

Iridescent Glass.—Pieces or objects of ancient glass dug from the ground are often exquisitely beautiful. Sometimes they are like the richest and most varied wings of butterflies or the feathers of peacocks, presenting every shade of every color known, and at other times they resemble metal. The writer has found in the Palace of the Cæsars pieces of a cup which resembled intensely burnished silver, but with a pearl-like tint. This is caused by decay, or, more accurately speaking, by the action of ammonia. In fact, it has been imitated by using this agent. The rainbow-like film which is often seen in glass in stables indicates the beginning of the process. The iridescent scales are a mixture of silica and earthy silicates, the alkaline silicates having disappeared.

Soluble or water-glass is a simple silicate of soda which is perfectly soluble in hot water, but which becomes hard when exposed to the air. It may be obtained by dissolving pure silica, obtained by precipitation, in a boiling solution of caustic potash; but this process is too inconvenient and costly to be practised on a large scale. It may be made by mixing 30 pounds of pearl-ash, 45 of sand, and 12 of powdered charcoal, to be heated for five or six hours. It is then powdered and dissolved in boiling water; 1 part of glass requires 4 or 5 of water. It is boiled until no more glass dissolves. Carbonate of soda may be substituted for potash, and a better kind of glass results from mixing the two thus made. It is used for many purposes—as a glazing which resists water and fire, as a cement for glass, and as glue or isinglass in coloring. It requires to be mingled with aluminous or other bodies when used as a protective glazing.

Works on Glass.—*L'Arte Vetraria distinta in libri sette*, by ANTONIO NERI, Florence, 1612; German version, with additions, in the *Ars Vitraria experimentalis*, by J. KUNCKEL, Baron von Lowenstein, 1697; translated into English, with curious additions, by A. MERRET, in 1662; re-edited and privately printed by SIR T. PHILLIPPS, 1826; a French version, with very curious additions, by M. ZIMMERMAN, 1756; *De l'Art de la Verrerie*, by FRANÇOIS HANDICOURT DE BLANCOURT, Paris, 1697; the English translation of 1699 is full of useful information, and written in so quaint a style as to make it interesting to the most general reader; *Vitreous Art in the Art-Treasures of the United Kingdom, Manchester Exhibition 1848, and Exhibition of Works of Industry of All Nations 1851; Curiosities of Glass-Making*, by APSLEY PELLATT, 1849; *Marvels of Glass-Making in all Ages*, by A. DE SAUZAY; English translation, 1870; *L'Histoire des Arts industriels au Moyen Age et a l'époque de la Renaissance*, by M. J. LABURTE, Paris; *Inquiry into the Treaty of Commerce with England* (French), Paris, 1861; *La Manufacture de St. Gobain*, by M. A. COCHIN, Paris, 1866; PELIGOT, *Douze Leçons sur l'Art de la Verrerie*, Paris; *Il Museo di Murano*, Venice; HOWELLS' *Familiar Letters from Venice; Notes on the History of Glass-Making*, by ALEXANDER NESBITT; *An Introduction to the Catalogue of the Collection of Glass formed by Felix Slade and presented to the British Museum*, privately printed, 1871.

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Glass, American Manufacture of. The manufacture of glass was commenced in the American colonies at a very early period, though probably in a rude way, and confined to the manufacture of coarse black bottles. The production of crude potassa from the ashes of the forest trees felled by the early settlers, and the presence of a clean, sharp sand on or near the shores and river-banks, probably suggested this manufacture. We find in Howe's *Historical Collections of Virginia* a quotation from Capt. John Smith's *History of Virginia*, under date of 1615, in which he states that "the labor of the colony had been misdirected in the manufacture of ashes, soap, glass, and tar, in which they could by no means compete with Sweden and Russia." In 1622 a new building which had been commenced for glass-works in Jamestown, Va., was abandoned in consequence of the Indian invasion and massacre. Other glass-houses were undoubtedly established during the seventeenth century, and probably some along the Hudson River or its vicinity. In the eighteenth century there were a considerable number in existence, though all, we believe, confined to the manufacture of bottles and coarse hollow glass-ware. One of the earliest of which there is any definite or particular account was established about 1754 in Brooklyn, N. Y., by a wealthy Dutch gentleman by the name of Bamper. Stiles, in his *History of Brooklyn*, vol. i. p. 309, thus refers to it: "Mr. Bamper was largely interested in the establishment of a glass-factory on almost the identical spot lately occupied by the glass-works on State street. The first bottle ever made at this factory, having blown on it a seal bearing the name of Mr. Bamper and the date 1754, is still preserved among the curiosities of the Long Island Historical Society." A glass-factory of considerable extent, and remarkable for its employment of Hessians and Waldeckers who were deserters from the British army, was established 1779 or 1780 at Temple, N. H., by a Mr. Hewes of Boston, but was burned down in 1780–81, and was not rebuilt; some of its products, a glass plate, etc., are in Harvard University. There was a glass-factory established by Albert Gallatin and his associates at New Geneva, on the Monongahela River above Pittsburg, in 1787, and it is supposed one at New Haven, Conn., in 1789 or earlier. In 1795, the first glass-factory in Pittsburg, Pa., was erected by Gen. O'Hara and Major Craig, and the manufacture of window-glass commenced. This was the first manufactory which attempted the production of window-glass in this country. Soon after this other glass-works were established in Pittsburg and its vicinity, in Boston and elsewhere in Massachusetts, in Rensselaer co., N. Y., in New Jersey, in the vicinity of Philadelphia, and in Kings co., N. Y. In 1802, Gen. O'Hara added the manufacture of flint-glass in a separate establishment to his other works, and in 1807 a second flint-glass factory was erected at Pittsburg. In 1813 there were five glass-works at Pittsburg, producing glass to the value of $160,000, and probably about 25 in the entire country. We have not the statistics of the number in 1820, but in 1830 there were 21 furnaces for manufacturing crown-glass, having 140 pots, averaging 100 "tables" of crown-glass each every three days; of these, 6 were in Boston. There were also 23 flint-glass-works in the country, of which 10 were in Pennsylvania, 2 at Wheeling, Va., 2 in Maryland, 2 in New York, 2 in Ohio, and 1 each in Massachusetts, New Hampshire, Vermont, Connecticut, and the District of Columbia. The whole value of flint-glass produced annually was estimated at $1,350,000. Eight of the ten Pennsylvania factories were at Pittsburg, and their product was over $500,000 per annum. Of these, one-half were manufacturing flint-glass and the others window and green glass, or, as it was then called, crown-glass. In 1840 there were 81 glass-houses in the U. S., employing 3236 men and a capital of $2,014,100. The annual product is not stated, nor did the census report distinguish between the different kinds of glass. In 1850 there were 94 glass-works, employing 5571 men, with an estimated capital of $3,402,350, and producing to the value of $4,641,676 per annum. In 1860 the number of glass-works had increased to 112, the employés to 9116, the capital to $6,133,666, and the annual product to $8,775,155. Of these factories, 36 were credited to Pennsylvania (Pittsburg alone had 33 in 1857), 22 to New Jersey, 23 to New York, 18 to Ohio, 11 to Massachusetts, 3 to Connecticut, and the remainder were distributed among half a dozen other States. In 1870 the statistics of the glass manufacture were given much more minutely than in any previous census, though in this, as in the previous censuses, they were very imperfect, and far below the truth. According to the census, there were 201 glass-works of all descriptions, employing 15,822 hands (11,505 men, 715 women, 3602 children); the capital invested was $14,111,642; the wages paid $7,846,425; the raw material used, $6,133,168; and the annual product, $19,235,862. Of these, 35 establishments, producing annually $3,811,308, were devoted exclusively to window-glass; of which 11 were in New Jersey, 10 in Pennsylvania, 7 in New York, and the remainder in Massachusetts, Maryland, and Illinois. One hundred and fourteen establishments, producing annually $14,300,949, were devoted to glass-ware not specified, including bottles, vials, hollow-ware, lamp-chimneys, as well as table-ware, glass dishes, etc. Of these, 42 were credited to Pennsylvania, 32 to New York, 11 to Massachusetts, 8 to New Jersey, 6 to Ohio, 4 to Missouri, and the remainder to Connecticut, Indiana, Kentucky, New Hampshire, and West Virginia. Eighteen establishments were engaged in the manufacture of stained glass, producing wares to the value of $297,480. Of these, 4 each were in Pennsylvania and New York, 2 each in New Jersey, Kentucky, and Illinois, and 1 each in Ohio, Michigan, Maryland, and the District of Columbia. Twenty-nine establishments manufactured cut glass, producing $470,875. Of these, New York had 15, producing three-fifths of the whole amount; Massachusetts 8, producing $171,000; Pennsylvania and California, each 2, producing but a very small amount, and Illinois and Maryland, each 1. There were 5 plate-glass factories reported, with an annual product of $355,250, of which Ohio had 3, producing $332,000; New York and New Hampshire each 1. In all, 58 establishments were credited to Pennsylvania, with an annual product of $8,409,000; yet in 1869 Pittsburg alone had 71 glass-factories, producing annually a little more than $7,000,000 of glass; and the production was but 74 per cent. of that of the entire State; so that the entire product of the State in 1870 could not have been less

than $9,000,000, and the number of factories not far from 90. New York is credited with 44 glass-factories (aside from the cut-glass establishments, which are not properly glass-works), and a production of $2,121,000; yet in 1865 there were 34 factories, producing $1,664,000 of glass, and in the next five years the business almost doubled; Kings co., N. Y., now has 16 glass-factories, and the whole number in the State is not less than 70.

The processes of glass-making are much the same the world over; one of the largest of our American manufacturers asserts that there has been very little change in glass-blowing since the Syrians practised it 2500 years ago. These processes have been detailed with sufficient minuteness in the preceding pages. We shall notice, therefore, only such improvements as have been made by our American glass-houses in some of the details. The various departments or classes into which glass-making is divided are—*Green glass,* which may be subdivided into the coarse

Manufacture of Glass Bottles.

and ruder bottles usually known as black glass, and the better grades of vials, champagne bottles, etc., which are now of elegant forms and much stronger than any other glass-ware; *flint-glass,* which embraces a wide variety of articles, mostly of hollow and table ware, and differing widely in its composition, some of it containing oxide of lead or zinc, which would more properly be called metallic glass; *window-glass,* of which there are two varieties, crown and cylinder or sheet glass; *plate-glass,* which is cast instead of being blown and moulded, as are the other kinds; and *optical glass,* such as is used for lenses of telescopes, microscopes, cameras, etc., and to some extent for eye-glasses; this may be either flint or crown glass, or of a different composition from either. *Cut glass* is merely flint-glass of the best quality which has been either cast or blown, and then ground on emery-wheels or grindstones of fine grain till it assumes the desired form. The drops of chandeliers and many of the finer bottles or articles for table use are cut in this way. The German glass-makers have of late introduced cut glass made from the better qualities of their green glass, and which are blown rather than cast. These are not quite free from the greenish tint, but are a very fair substitute for the English cut-glass goods. Our American manufacturers of glass have preferred to improve as far as possible their processes of casting and moulding, and have brought these to such a state of perfection that the best qualities of pressed glass are scarcely distinguishable from cut glass. Glass is cut, however, in this country to a considerable extent, the principal establishments being in New York and Massachusetts, but this is done rather by the decorators of china and glass than at the glass-works. Colored or stained glass may be made at the glass-works, as is the case with the Bohemian glass and its imitations, where glass of a particular color being blown very thin, a mass of glass of another color or white glass is introduced and blown till it fills the cavity and unites with the first, so as to form a homogeneous mass. This process may be repeated, and the outer color removed at some points by grinding, and a very beautiful effect is produced. The more usual process, however, is to make a paste or coating of such metallic colors as are desired, and, covering plate or flint glass with it, expose it to a heat sufficient to vitrify it and incorporate it with the glass. By this process, which is conducted by the decorator rather than the glass-manufacturer, any design may be put upon glass, and in any required colors. Crown and sheet window-glass of the better qualities are made of different colors as required, the colors being always metallic, and as readily fusible as the glass itself. The second and third processes are those used exclusively for the stained glass windows of churches and other public buildings. While there has been no considerable change in the processes of glass-blowing, our American manufacturers have acquired a greater deftness and skill in some of the departments of the manufacture than any of the foreign glass-makers. While the methods vary but little from the English, French, or Bohemians in the production of green-glass or flint-glass bottles, vials, and other hollow-ware, and in the manufacture of pressed glass table-ware, the American goods of these descriptions are so perfect, and of such admirable quality and finish, that they are largely exported to England and to some of the continental countries.

The manufacture of window-glass, though conducted here for more than 70 years, was for many years conducted under difficulties from the alleged superiority of the English crown-glass. After a time such improvements in the manufacture of cylinder or sheet glass were made in England that it was regarded as equal in quality and brilliancy to the crown-glass, and could, of course, be made of larger sizes; but the Pittsburg manufacturers have far surpassed in size and in uniform thickness the English. The largest size of sheet-glass ordinarily made in England is 50 by 30, or possibly 35, inches. At Pittsburg sheets 70 by 40 inches, and of uniform thickness of 7 to the inch, are not uncommon. These are called "double strength," and so uniform is their thickness that they are commonly known as "American plate." In the dexterous handling of these immense cylinders, the process for making which has been described on a preceding page, and so managing them as to make them of uniform thickness and freedom from blemishes (a very difficult matter), the American manufacturers have been remarkably successful. They are said also to be free from the liability to rust or devitrification, caused by the excess of alkali in the glass, which has been so serious an objection to much of the German and some of the English window-glass. In the manufacture of plate-glass American glass-makers have not, at least till within the past five years, been very successful. One of the most famous of the American plate-glass factories (that of Lenox, Mass., originally at Cheshire, Mass.) has, after being in operation nearly twenty years, been given up. This establishment made what was called "rough plate" (used for domes, skylights, etc.), as well as the polished article. A similar factory in Brooklyn, N. Y., established in 1855, was also relinquished after three or four years. In 1870 there were but 5 plate-glass factories in the U. S., 3 of them in Ohio, and the only one of large size was in Cincinnati. The production of all at that time was about $355,000; the amount has since considerably increased. Some plate-glass is imported, mainly

for mirrors, from England, and a moderate quantity from Germany—the latter, however, having a greenish tinge which is unpopular—but the great bulk of the importation of plate-glass (which is the largest item of imported glass) is from France, the French plate being far superior to any other in quality. Having in this country the best possible material for making plate-glass, and fuel abundant and cheap, skilful workmen, and an almost limitless market, there


Manufacture of Window-Glass.

seems to be no good reason why this fragile luxury should be imported. The bending or rounding of plate-glass to adapt it to corner windows, etc. is done at Newark, N. J., and, we believe, also at Cincinnati. There are also several establishments in New York and elsewhere for cutting, drilling, and etching it by means of the newly-discovered sand-blast. Enamelled glass, of which there are two or three varieties, is now manufactured in Newark, N. J., by two or three of the Pittsburg glass-works, and by several other makers in Ohio, New York, and Massachusetts. It is largely used for the ornamentation of churches, school-houses, public halls, and private residences. The glass used for this purpose is usually the double-strength cylinder of the Pittsburg manufactories, which is well adapted for it. A paste of metallic powder is spread over the surface of the glass, which has been previously polished, the ornamental devices etched out by machinery or by hand, and the glass is then thrust into the reverberatory furnace till the enamel is thoroughly vitrified and incorporated with the glass, when it is withdrawn and put into the annealing oven, and kept there for a week, cooling very gradually. The flocked enamelled glass is prepared by a similar method, though the glass itself is previously rendered opaque by another process. A large demand has sprung up for these enamelled sheets of glass, which are not surpassed in beauty by any of the foreign manufactures.

The immense extension of the use of petroleum and coal-oils for illuminating purposes has given a great impulse to the manufacture of lamp-chimneys, which had previously been limited to argand gas-burners, argand, solar, and students' lamps. A number of glass-factories confine themselves to this specialty; others manufacture mainly ground-glass globes and lamp-shades.

The flint-glass factories use now feldspar, finely ground quartz, or the finest white sand, in the place of flint, for the silica, and some of the Pittsburg and Philadelphia factories at one time tried cryolite, a spar found native in large quantities in Greenland, to furnish the alkali, but it was found not to answer the purpose. Some years since an attempt was made to manufacture lamp-shades and chimneys, plates, dishes, vases, bisque figures, statuettes, etc. of a material called hot-cast porcelain, which was really an opaque glass, and for which the cryolite and certain earths found in New Jersey were used. The wares were very beautiful and offered at low prices, but the enterprise failed after a short time. The carbonate of soda used in the best glass-works is imported from England, being better adapted to the manufacture than that made elsewhere. The glass used for optical purposes is made here for the smaller lenses for cameras, microscopes, spy-glasses, and some of the opera and field glasses, but as yet our glass-makers have not attained to the homogeneousness of structure necessary for the largest telescopic lenses. These, as stated elsewhere, are produced in their perfection only in West Bromwich, near Birmingham, England. They are made both of crown and flint glass, but by peculiar processes and great care and skill. The two points of greatest importance seem to be constant stirring of the molten liquid at a high heat, to produce homogeneousness of structure, and the annealing in the same pot in which it is melted, to avoid the admission of air into the mass in pouring off. The mass of glass is subjected to subsequent very careful manipulation in grinding, shaping, and polishing to fit it for its purpose. The largest perfect lens yet produced by this enterprising house is, we believe, not quite thirty inches in diameter. Several of their larger lenses have been imported in the rough, and finished with immense and protracted labor by Messrs. Clark, the celebrated telescope-makers.

In conclusion, the present condition of the glass manufacture in the U. S. is as follows: the annual production of glass of all kinds is from $21,000,000 to $23,000,000; in articles of hollow-ware, except a few styles of fancy cologne bottles and cut-glass caster bottles, decanters, etc., there is not only no competition, but we are exporting largely to England, and to some extent to France, the druggists' ware, prescription bottles, stoppered bottles, and graduated bottles of several manufacturers being of better quality and greater perfection of finish than any produced in Europe. Of table-glass we are producing articles fully equal to the English and French, except in a few styles, and our best grades of pressed glass-ware vary so little from the finest foreign cut glass that, in the language of an eminent authority, "only experts in the trade can distinguish between them." In window-glass (not plate) the American manufacturers command the market, except where the old prejudice in favor of English crown-glass has not died out, and except also in the very cheapest styles of German window-glass. In plate-glass, glass for optical purposes, and in the specialties of Bohemian glass-ware our manufacturers acknowledge their present inferiority to European glass-makers; but this inferiority is fast disappearing. The statistics of the importation of glass of all descriptions for the fiscal years 1873 and 1874 are as follows: There was imported of cylinder, crown, and common window glass in the year ending June 30, 1873, the value of $2,759,728; in the year ending June 30, 1874, the importation had fallen off to $1,881,378; the importation of cylinder and crown polished glass in 1873 was $21,217; in 1874, $14,933. Of fluted, rolled, or rough plates of glass there were imported in 1873, $34,180; in 1874, $34,237. Of cast polished plate, not silvered, in 1873, $1,550,857; in 1874, $1,655,909. Of cast polished plate, silvered, in 1873, $823,076; in 1874, $961,512. Of other manufactures of glass in 1873, $2,230,986; in 1874, $1,710,009—a reduction in these branches of $520,000. The total importation of glass of all sorts in the year ending June 30, 1873, was $7,420,044; for the year ending June 30, 1874, $6,257,978—a reduction in a single year of $1,163,066.

The invention of the sand-blast and its value in carving, etching, and drilling glass has added greatly to the eco-

nomical uses of glass. Though easily manageable in its viscid condition, glass was very refractory in its solid and cold state; it could only be cut by a diamond or very hard steel point, and some of the choicest and heaviest plates would develop a crack or flaw which would render them worthless even under these agencies; but it can now be cut in any form, holes drilled in it, figures etched or carved on it in low or high relief, and it can be cut in any desired shape without difficulty. As a consequence, plate-glass from one-fourth to one-half an inch in thickness is largely introduced into our modern furniture and articles *de luxe*. We find it used for small shelves at the tellers', cashiers', and bookkeepers' desks in banks, insurance offices, and stores, in hand-mirrors, parlor summer-pieces, for covering the dial-plates of fine clocks, for library doors, vestibule floors, etc. The demand for the finer qualities of glass is thus very greatly increased, and we may expect a corresponding increase in its manufacture. (We acknowledge our obligations for many facts and statistics to R. Pearsall Smith of Philadelphia, and to Messrs. Barr and Myers's volume on *Pittsburg, its Industry and Commerce*.)
L. P. Brockett.

Glass (Henry), U. S. N., b. Jan. 7, 1844, in Kentucky; graduated at the Naval Academy in 1863; became a master in 1865, a lieutenant in 1866, a lieutenant-commander in 1868; served in the South Atlantic squadron from July, 1863, to the close of the civil war, where he was conspicuous for energy and gallantry. Commended by Lieut.-Com. Richard W. Meade in his report of Dec. 28, 1863, for "coolness and good service." F. A. Parker, U. S. N.

Glass-Blowing. See Glass, by Charles G. Leland, A. M.; and Glass, American Manufacture of, by L. P. Brockett, A. M., M. D.

Glass'borough, post-v. of Clayton tp., Gloucester co., N. J., on the West Jersey R. R., at the junction of the Bridgeton branch, 18 miles S. of Philadelphia. It has manufactories of glass, and is in a fertile region.

Glasschord. See Harmonica.

Glass-Cloth and **Glass-Paper** are prepared by sprinkling powdered glass upon paper or cloth, one side of which is moistened with thin glue. They are used like sand-paper.

Glass Crab, the name of several transparent crustaceans, but chiefly given to those of the genus *Phyllostoma*, family Phyllostomidæ and order Stomapoda. They are so perfectly transparent that as they float on the water only the eyes are visible. The carapace is flat, and formed of two bucklers. There are several species, found chiefly in warm seas. The name might well include the transparent Erichthidæ, which approach closely to the above.

Glass Slip'per. The fairy tale of Cinderella is known in all civilized countries. It is of French origin. The prince presents Cinderella with a pair of slippers lined with miniver or petit ver, a fur which was the prerogative of royalty, as ermine was that of the highest officer of the law. The story was translated into English, and "petit ver" was rendered "little glass." It was afterwards retranslated into French, and the "little glass" was retained. In the German version it is only the small size of the slipper which serves as a means of recognition; the glass is left out.
William Detmold.

Glass Snake, the *Ophisaurus ventralis*, a snake-like lizard of the U. S. It completely resembles a serpent at first sight, but has eyelids (which no snake possesses), and other anatomical peculiarities which associate it appropriately with the lizards. It is variously colored, and is often two or three feet long. It is harmless, and is found in woods, and especially in sweet-potato fields in the South. When smartly struck with a stick, it often breaks into several pieces, whence the name.

Glass, Soluble. See Water Glass.

Glass Snake.

Glass Sponge, a name of various sponges of the genera *Hyalonema*, *Holtenia*, *Rossella*, *Pheronema*, *Euplectella*, etc., of which the typical forms have the siliceous sponge-spicules prolonged into a flexible, loosely-twisted cable of glassy threads. Whether this cable serves to moor the sponge or not is a point on which various opinions have been expressed. The first-mentioned genus is remarkable for having upon the sponge a mass of horny elevations, by some considered as consisting of polyps parasitic upon the sponge; by others as a polyp-mass upon which the sponge is parasitic, and by still others as a part of the sponge itself.

Glass Staining and Painting. See Glass, by Charles G. Leland, A. M.

Glas'tenbury, tp. and post-v. of Hartford co., Conn., on the E. bank of the Connecticut River, 7 miles S. E. of Hartford. The township contains several villages, and has important manufactures. Pop. 3560.

Glastenbury, post-tp. of Bennington co., Vt. P. 119.

Glas'tonbury, town of England, in the county of Somerset, with some interesting remains of its once celebrated Benedictine abbey. Many writers believe that the mythical isle of Avalon was originally identical with the peninsula where Glastonbury stands; but this is doubtful. The river Brue flows by the old town, which was anciently an episcopal city. Pop. 3670.

Glatz, or **Glaz,** town of Prussia, in the province of Silesia, on the Neisse. It is a strong fortress, and has extensive manufactures of damask, linen, ribbons, and plush. Pop. 11,541.

Glau'ber's Salt [named from J. R. Glauber, its discoverer (1604–68)], called formerly *sal mirabile*, the neutral sulphate of soda ($SO_4Na_2 10OH_2$), a salt found native in sea-water, in mineral springs, and especially in the alkaline soils and waters of the Western plains and mountains of the U. S. It was formerly much used in medicine as a cathartic, but is now so employed chiefly in veterinary practice. In the arts its formation takes place on a very extensive scale during the production of carbonate of soda from common salt. The sulphate is converted into the carbonate of soda by various methods. (See Soda.)

Glau'chau, town of Saxony, on the Mulde. It is picturesquely situated, and has very extensive manufactures of cotton, paper, and different kinds of hardware. P. 22,036.

Glau'cias [Γλαυκίας], a statuary of Ægina, flourished about 490–476 B. C., celebrated for his statues of combatants in the games. He cast the chariot and a statue of Gelon, conqueror in the chariot-race Olympiad 73; made statues of the wrestlers Philo of Corcyra and Glaucus of Carystus, and also of Theagenes the Thasian, conqueror at the Olympic games Ol. 75. H. Drisler.

Glaucias [Γλαυκίας], a distinguished physician of the Empiric school, teacher of Heraclides of Tarentum, and one of the earliest interpreters of the writings of Hippocrates, to which he drew up a sort of lexicon of the difficult words in alphabetical order, but too much in detail, as Erotian implies in referring to the work in his own glossary, still extant. H. Drisler.

Glauco'ma [from the Gr. γλαυκός, "light-green," alluding to the greenish, bluish, or reddish tint sometimes seen upon the eye in this disease], a disease characterized by a general inflammatory action in the different parts of the eye, attended by increase in the bulk of the fluids contained, and marked by a gradual loss of sight and by pain, often very intense. It is acute or chronic. The ophthalmoscope affords the surest tests of its existence. It is a disease of advanced life, and very frequently leads to complete blindness. The best treatment begins in the early performance of iridectomy, which sometimes arrests, and almost always palliates, the symptoms.

Glau'conite, a mineral of green color occurring abundantly in Secondary and Tertiary greensands and chloritic marls, and composed of silica 46 to 56 per cent., ferrous oxide 20 to 25 per cent., potash 5 to 13 per cent., alumina 4 to 14 per cent., and water 0 to 10 per cent.

Glau'cus [Γλαῦκος], an artist of Chios, said to have invented the art of soldering metals. His most famous work was the celebrated iron base on which was placed a silver vase, dedicated by Alyattes II., king of Lydia (617–561), to the god at Delphi, spoken of with admiration by Herodotus, and so superior in workmanship as to have given rise to the proverb Γλαύκου τέχνη. (See Sellig, *Dict. Artists*, s. v.) H. Drisler.

Glaucus [Γλαῦκος], the name of several personages who figure in the Greek heroic traditions. The most important was a Bœotian fisherman, who by luck ate of a divine herb which made him immortal. He built the Argo, was helmsman for the Argonauts, and became a sea-god whose oracles were very famous.

Glaux [Gr.], a genus of primulaceous plants, represented on the North Atlantic shores of Europe and America by the *G. maritima*, a little fleshy perennial, which also grows beyond the Mississippi, to the north-westward. Its fleshy leaves make good pickles.

Glebe [Lat. *gleba*, "arable soil"], in English ecclesiastical law the land which belongs to a church. It constitutes a part of the revenue of a benefice, and is vested in the parson or vicar. By a recent statute certain commissioners have power to ascertain and define the boundaries of the glebe-lands of any benefice, or, with consent of the ordinary

or patron, to exchange them for other lands, either in the same or an adjoining parish.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Glede. A bird mentioned in the authorized English version of the Bible under this name is generally believed to be the common kite (*Milvus regalis*) of the Old World, though some authorities make it some species of vulture.

Gledit'schia [named from J. G. Gleditsch (1714–86)], a genus of trees of the order Leguminosæ, represented in the U. S. by the honey-locust (*G. triacanthos*) and the water-locust (*G. monosperma*). Although it shares the name of locust with the *Robinia Pseudacacia*, it differs widely from that tree, especially in its more compound leaves, small leaflets, compound thorns, large flat pods filled when ripe with a sweet honey-like substance, and its inconspicuous flowers. It is a good hedge-plant and an ornamental tree. Its timber is very heavy, resembling that of the common locust, but coarser. The water-locust is a small tree growing in swamps in the West and South-west. There are one or two North Asiatic species. (See LOCUST.)

Glee, a species of musical composition in three or four parts, and usually of two or more movements, originally written for voices without instrumental accompaniment. The term "glee" is supposed to be a modification of the Anglo-Saxon word *gligg*, signifying music generally, but popularly applied to those pieces which were ordinarily of a social, cheerful, and even convivial character, though at times glees were more grave and serious, both in the drift of the words and the style of the music. The glee is of English origin, and appears to have sprung from the old "part-songs" and madrigals which were furnished in abundance by the composers of the sixteenth and seventeenth centuries, and were commonly used on occasions of joy and festivity, as well as for social entertainment in private circles. By degrees, the distinctive marks of these several classes of compositions have been more or less obliterated, and the name *glee* is now given, in a broad sense, to almost any secular part-song of two or three movements. For the most part, also, the modern glee has an instrumental accompaniment, of equal importance with the voice-parts for the full expression of the composer's ideas. Among the most distinguished writers of glees may be named Dr. Arne, Dr. Cooke, Dr. Calcott, Dr. Hayes, Dr. Nares, Lord Mornington, Paxton, Danby, Spofforth, Stevens, and Webbe. WILLIAM STAUNTON.

Gleet. See GONORRHŒA.

Gleig (GEORGE ROBERT), M. A., b. at Sterling, Scotland, Apr. 20, 1796, son of the bishop of Brechin, was educated at Glasgow and Balliol College, Oxford; entered the army in 1812; served against Napoleon and in the U. S., and was badly wounded near Washington, D. C.; took orders in the Church, and after receiving several preferments was made chaplain-general of the British army in 1846, which position he still holds (1875). In 1848 he became a prebendary of St. Paul's. Author of many historical and other works, among which are *The Subaltern* (1825); *Hist. of British India* (4 vols., 1831–33); *Family Hist. of England* (3 vols., 1836–54); a 1 volume *Hist. of England;* a laudatory *Memoir of Warren Hastings* (1841); *Military Hist. of Great Britain* (1845); *Campaigns of Washington and New Orleans* (1847); *Life of Clive* (1848); and *Life of Wellington* (1859), besides tales, devotional and didactic works, sermons, etc.

Glei'witz, town of Prussia, in the province of Silesia, on the Klodnitz. It has large iron-foundries, breweries, and leather manufactories. Pop. 11,038.

Glen Ar'bor, post-tp. of Leelanaw co., Mich. P. 405.

Glen'burn, post-tp. of Penobscot co., Me. Pop. 720.

Glencoe', a valley of Scotland, in the county of Argyle, famous both for its wild scenery and for the massacre of the Macdonalds which took place here in 1692.

Glencoe, post-v. and tp., cap. of McLeod co., Minn., is situated on the Buffalo River, 60 miles W. of St. Paul, on the Hastings and Dakota R. R. It has several good hotels, 2 grain-elevators, 3 churches, 1 weekly newspaper, and a seminary. It is in the centre of a rich farming country, and has an abundance of timber and water. Pop. 487.

L. HALL, ED. "GLENCOE WEEKLY REGISTER.

Glencoe, post-tp. of Buffalo co., Wis. Pop. 676.

Glen Cove, post-v. of Oyster Bay tp., Queens co., N. Y., has a fire insurance company, a corn-starch factory, 3 churches, and 2 weekly newspapers. It is on the Locust Valley branch of the Long Island R. R.

Glen'dale, post-v. of Stockbridge tp., Berkshire co., Mass., on the Housatonic River and R. R., 18 miles S. W. of Pittsfield, has important manufactures of paper, woollens, etc.

Glendale, tp. of McLeod co., Minn. Pop. 527.

Glendale, tp. of Scott co., Minn. Pop. 387.

Glendale, a v. of Washoe co., Nev. Pop. 129.

Glendale, post-v. of Hamilton co., O., on the Cincinnati Hamilton and Dayton R. R., 15 miles from Cincinnati. It is the site of a female seminary. Pop. 1780.

Glendale, post-tp. of Monroe co., Wis. Pop. 679.

Glendale, Battle of. See FRAZIER'S FARM, BATTLE OF.

Glen'don, a b. of Northampton co., Pa., on the Lehigh River, 2 miles S. W. of Easton, on the Lehigh Valley R. R. and the Central R. R. of New Jersey. It has manufactures of iron. Pop. 707.

Glendora'do, tp. of Benton co., Minn. Pop. 139.

Glen'dower (Sir OWEN), (*Owain Glyndwr Du*), b. in Merionethshire, Wales, about 1350, great-grandson of Llewellyn, the last Welsh monarch; studied law, was made a barrister of London, became an esquire of Richard II.'s guard, and in 1387 was knighted. Suspected of disloyalty by Henry IV., a part of his estates were given to Lord Grey of Ruthin (1399), and having appealed in vain for redress to Parliament, he in 1400 took arms, declared himself monarch of Wales, and carried on war with general success, though opposed by Henry IV. in person, Lord Talbot, and other able leaders, among whom was Sir Edward Mortimer, whom he won to his side. He then entered into an alliance with the Percies, after whose final defeat he still carried on the war with varying fortunes, with the aid of the French. Henry V. finally offered him full pardon; shortly after which he d. at Monnington, Herefordshire, Sept. 20, 1415.

Glen El'der, post-tp. of Mitchell co., Kan. Pop. 25.

Glenelg', a river of Australia, in Victoria, where it rises in the Grampian Mountains. It passes into South Australia, and falls into the Southern Ocean E. of Cape Northumberland.

Glengar'ry, the most easterly county of Ontario, Canada, bounded on the S. E. by the St. Lawrence River, and on the E. by the province of Quebec. Area, about 440 square miles. It is judicially united with Stormont and Dundas cos. Cap. Cornwall, Stormont co. It is traversed by the Grand Trunk Railway. Pop. 20,524.

Glen'ham, post-v. of Fishkill tp., Dutchess co., N. Y., on the Dutchess and Columbia R. R., 5 miles E. of Newburg. It has important woollen manufactures. Pop. 924.

Glen Ha'ven, tp. and post-v. of Grant co., Wis., on the Mississippi, 20 miles S. of Prairie du Chien. Pop. of v. 163; of tp. 1177.

Glenmore, tp. of Brown co., Wis. Pop. 730.

Glenn, post-v. and tp. of Montgomery co., N. Y., on the S. side of the Mohawk. The village has a cheese-factory and other industrial interests. The tp. contains FULTONVILLE (which see) and other villages. P. 145; of tp. 2782.

Glenn Spring, post-tp. of Spartanburg co., S. C., 86 miles N. W. of Columbia, has saline sulphur springs, resorted to for the cure of dyspepsia and other complaints. The scenery is pleasant and the climate delightful. Pop. 1814.

Glenrock', tp. of Nemaha co., Neb. Pop. 582.

Glen Rock, post-v. of Shrewsbury tp., York co., Pa., on the Northern Central R. R., 15 miles S. of York. Has manufactures of cordage, woollen goods, etc., a national bank, and a weekly newspaper. Iron ore is found in the vicinity. Pop. 537.

Glenroy', a valley of Scotland, in the county of Inverness, along the Roy, which runs into the Spean. On each side of this valley, and at exactly the same elevation, appear three roads or shelves running parallel with each other, the first at an elevation of 1139½ feet above the level of the sea, the second 80 feet lower, and the third 212 feet lower than the second. This most remarkable phenomenon has been explained as caused either by the subsidence of a lake or by the rising of the land. The popular explanation declares the shelves to be the roads of the heroes of Ossian.

Glen Roy, post-v. of Howard co., Ia.

Glen's Falls, post-v. of Warren co., N. Y., is on the Rensselaer and Saratoga R. R., 50 miles by rail N. of Albany, on the Hudson between Saratoga Springs and Lake George, 9 miles from the latter. It is noted for its cave, water-power, mills, lime, block marble, canal, water-works, beautiful fountain, and handsome soldiers' monument. It has a large iron-foundry, machine-shop, gasworks, paper-mill, 2 grist-mills, 1 stone-sawing mill, 9 large saw mills run by water-power, with a total of 42 gates, 6 lath-mills, 2 steam saw and planing mills, 2 plaster-mills, 28 lime-kilns, which turn out over 480,000 barrels of lime annually, 3 carriage manufactories, a sewing-machine factory, 2 gun-shops, 3 banks, 2 weekly newspapers, a ladies' seminary,

academy, insurance company, 2 opera-houses, 7 churches. Pop. 4500. Ed. "Glens Falls Messenger."

Glen'ville, tp. of Russell co., Ala. Pop. 1712.

Glenville, tp. and post-v. of Schenectady co., N. Y., on the N. side of the Mohawk, here crossed by the iron railroad bridges of the New York Central and the Saratoga branch of the Rensselaer and Saratoga R. R., and by two other bridges. Pop. 2973.

Glenville, tp. and post-v., cap. of Gilmer co., West Va., 33 miles S. of West Union. Pop. 174; of tp. 1422.

Glen'wood, city and tp., cap. of Mills co., Ia., on the Burlington and Missouri River R. R., 20 miles S. of Council Bluffs. It has 1 national bank, 1 foundry, 1 soap-factory, 1 furniture manufactory, 4 churches, 2 newspapers, 2 hotels, 1 livery stable, and the usual number of stores, etc. Pop. of city, 1291; of tp., exclusive of city, 842.

G. M. McBride, Manager "Opinion" Office.

Glenwood, tp. of Winneshiek co., Ia. Pop. 1196.

Glenwood, post-tp. of Aroostook co., Me. Pop. 185.

Glenwood, post-v. and tp., cap. of Pope co., Minn., is situated in a beautiful wooded glen 100 feet below the level prairie, overlooking Lake Whipple. It has good hotel accommodations, excellent schools, stores, mill, shops, water-power, 1 weekly newspaper, and a substantial trade. Pop. of tp. 214. Ed. of "Eagle."

Glenwood, post-v. and tp. of Schuyler co., Mo., 120 miles N. of St. Louis, on St. Louis Kansas City and Northern R. R., 65 miles W. of the Mississippi River, on the Missouri Iowa and Nebraska R. R., and 2 miles from the county-seat. It has a woollen-factory, a foundry, a machine-shop, a flouring-mill, a hub and spoke factory, 2 wagon-factories, 2 churches, 2 hotels, 1 newspaper, a $10,000 school-house, 1 bank, etc. Principal business, manufacturing and shipping. Pop. of tp. 1101.

H. D. B. Cutler, Ed. "Criterion."

Gles'son, tp. of Duplin co., N. C. Pop. 481.

Gleyre (Gabriel Charles), a French painter, b. at Chevilly, canton de Vaud, Switzerland, in 1807; studied at Lyons and at Paris under Hersent; went to Italy, and made close study of Italian art; thence to the East, Egypt, Abyssinia, Turkey, Greece. His pictures are not numerous. *St. John at Patmos, Evening, The Departure of the Apostles, The Nymph Echo, Bacchantes, Pentecost, The Execution of Major Duval,* are the best known; but all his work is remarkable for the combination of severe study with strong imagination and freedom from conventional rules. An attack of ophthalmia which threatened loss of sight interrupted his activity, and perhaps gave to his later pieces the tone of melancholy which pervades them; but, though exhibiting less than becomes his fame, he still produces works which museums and churches are proud to obtain. Paul Delaroche, no longer able to teach himself, advised his pupils to pursue their studies in the studio of Gleyre, the "poet-painter," as he was called at the beginning of his career. O. B. Frothingham.

Glid'den, tp. and post-v. of Carroll co., Ia., on the Chicago and North-western R. R., 100 miles N. E. of Council Bluffs. Pop. of v. 177; of tp. 438.

Glid'den (George D. B.), U. S. N., b. Apr. 15, 1844, in Maine; graduated at the Naval Academy in 1863; became a master in 1866, a lieutenant in 1867, a lieutenant-commander in 1868: served in the Seminole at the battle of Mobile Bay (Aug. 5, 1864), and received the commendation of his commanding officer, Com. Edward Donaldson, for behaving "with the utmost coolness" during the action.

Foxhall A. Parker.

Glid'don (George Robins), b. in Devon, England, 1809, was the son of John Gliddon, the U. S. consul to Egypt, in which country the son lived twenty-three years, and was long U. S. vice-consul at Cairo; lectured in the U. S.; became agent of the Honduras Interoceanic Railway, and d. at Panama Nov. 16, 1857. Author of *Memoir on the Cotton of Egypt,* 1841; *Appeal to the Antiquaries on the Destruction of the Monuments of Egypt,* 1841; *Egyptian Archæology,* 1841; *Otia Ægyptiaca,* 1849; *Ancient Egypt,* 1850; and, with Dr. J. C. Nott, wrote *Types of Mankind* (1854) and *Indigenous Races of the Earth,* 1857, etc.

Glio'ma [Gr. γλία, "glue"], plu. Gliomata, a tumor of the brain-substance, believed to be produced by excessive growth of connective element of that substance at the expense of the proper nerve-elements. It consists of a finely reticulated material containing many roundish nuclei. It is not definitely circumscribed, and never involves the meninges. It was formerly confounded with cancer, from which it appears to be quite distinct. Its diagnosis is very obscure during life, and its treatment, when suspected to exist, can be only palliative of the symptoms, such as local or general paralysis, which may be present. It is a disease of youth, rather than of old age.

Glis'an (Rodney), M. D., b. Jan. 29, 1827, at Linganore, Frederick co., Md.; graduated in the medical department of the University of Maryland, Baltimore, Md., Mar., 1849; passed an examination before an army medical board in Nov., 1849; commissioned an assistant surgeon U. S. A. in May, 1850; ten years' service in the army—five being on Plains, and five in Oregon during her Territorial Indian wars; has been for fifteen years in successful practice of his profession at Portland, Or.; is president of the medical society of Multnomah co. Author of various articles on *Climate* and *Medical Topography,* and a *Journal of Army Life,* published in 1874.

Glis'son (Francis), M. D., b. at Rampisham, Dorsetshire, Eng., 1597; took the master's degree at both Cambridge and Oxford; took the degrees in medicine at Cambridge (M. D. 1634), and in the same year became professor of physic there; held the royal professorship of medicine in the College of Physicians, London, and in 1639 became professor of anatomy there. He wrote learned Latin treatises on the anatomy of the liver (1654), on rickets (1650), on the intestines (1676), and other works; practised at London and Colchester; had a wide fame as a subtle and profound philosopher and a skilful anatomist. His fame is perpetuated in "Glisson's capsule," a constituent of the liver first discovered by him. He was a royalist. D. in London 1677.

Glis'son (Oliver S.), b. Jan. 18, 1809, in Ohio; entered the navy as a midshipman Nov. 1, 1826; became a passed midshipman in 1832, a lieutenant in 1837, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1870; retired in 1871. He commanded the steamer Santiago de Cuba in both the Fort Fisher fights. Rear-admiral Porter, in his "commendatory letter" of Jan. 28, 1865, writes: "To Capt. O. H. Glisson, commanding the Santiago de Cuba, I am particularly indebted for his zeal in covering the troops, landing guns, and taking his division into action. I recommend him for promotion." Foxhall A. Parker.

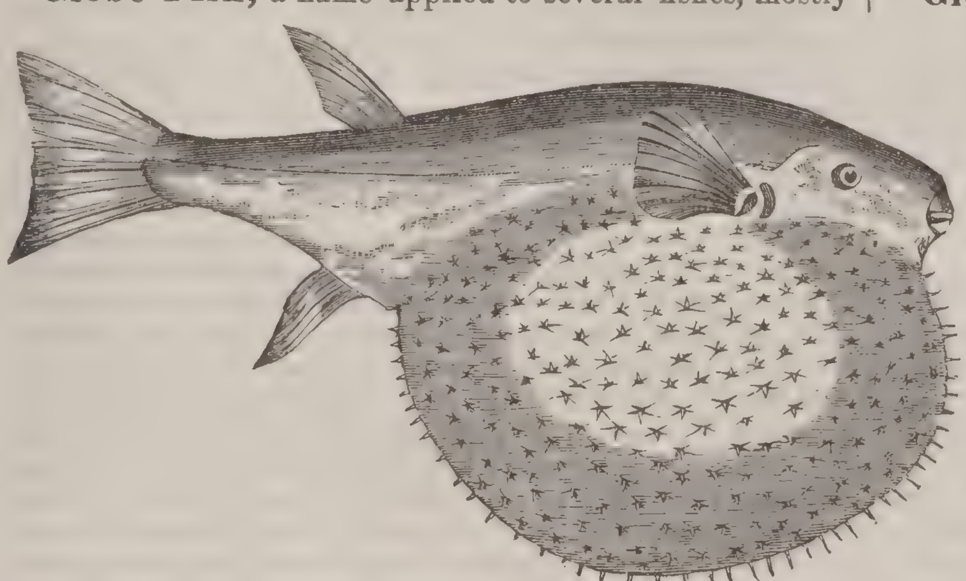
Globe, Artificial, a sphere on which is a map. Globes set forth the earth or heavens, and are called terrestrial or celestial. On the latter the stars appear as they would if seen from the centre of the earth, while the former is a literal copy of the earth itself, with the addition of lines or circles to enable us to determine the position of places and the movements of the sun and planets. The globe is thus, in reality, a spherical map, and is superior to an ordinary plane chart by giving more readily an understanding of the relative distances of places, especially as regards their position on the ball, and in determining problems in navigation and time. By its aid many important questions may be solved, if not very accurately, at least promptly, and well enough for most practical purposes. In schools, globes are invaluable as a step in "object teaching," since by familiarity with them the young obtain far better ideas of general geography than they can from plane charts, as appears from the spherical map. The oldest globe in existence is that in the Museum Borgia at Velletri, probably from the year 1225. Celestial globes of gold, on which the stars were represented by pearls, were made by the Arabs. But the impetus which the Arabs gave to astronomy and geography was discouraged by the Church, which opposed the theory that the world was round. The first modern globe-maker was Johann Schöner (b. 1477 at Karlstadt in Franconia), a distinguished mathematician and astronomer. Tycho Brahe also made many globes; one of these, 4 feet 7 inches in diameter, and made of copper, was seen by M. Picard at Copenhagen in 1671.

The process of making globes is simple, but requires great accuracy. A ball of iron or of wood, to serve as a base on which to make the globe, is first made, with stout wires projecting from the poles. It is covered with a coating of dry paper, and on this are laid as many sheets of coarse soft or hard paper, damped, as are necessary to the requisite thickness, which is generally half an inch, more or less, according to the size. This of course, when dry, makes a hollow ball of *papier-mâché* or thick pasteboard. When dry it is hung by the wires in sockets, and made to turn rapidly, and while so revolving the edge of a sharp knife cuts the globe into two hemispheres. A round stick for an axis and support is placed within, and a stout wire projecting from either end forms the poles. The two segments are then united and joined with glue. This is placed in a semicircular disk or band of steel, and being coated with whiting and size is made to revolve. The edge of the steel band removes any excess of size, the process being in fact turning. The equator and ecliptic and lines of latitude and longitude are then marked with great care. The two crossings of the equator and ecliptic, or the points of the

equinoxes, are usually the line of the first meridian, and from the point of the vernal equinox the degrees on the equator and ecliptic begin. The maps, which are generally made in twenty-four pieces, with two circular pieces for the poles, are now fitted and pasted on. They are then dried and highly sized before being varnished. The brass circle in which most globes hang by their poles is called the universal meridian, since any given place on the earth's surface may come within it. This brass meridian is held within the broad flat circle of wood called the horizon by sliding in two grooves. Of late years the horizon has in some globes been so constructed as to revolve with ease. This horizon is supported by two arms and a base forming a stand, on which it rests. By sliding the meridian the poles of the globe can of course assume any point from the horizon to the vertical. The brazen meridian is divided into 360 equal parts called degrees. On one side of the meridian, or the *lower semicircle*, they are numbered from 1 to 90 from the poles to the equator, to give the elevation of the former. In the upper semicircle the same numbers from the equator to the poles are used to ascertain the latitude of any point on the earth's surface. Excellent globes are made in London, but when ordered from a distance or for the colonies they are often faulty. A globe costing £18 was supplied in 1870 by one of the best makers in London, on which the city of Chicago was not to be found; and a very large one which is now by the writer contains an incredible number of similar errors in its American geography. Excellent globes are now made by several American manufacturers. Many of them are unexcelled by any produced abroad. CHARLES G. LELAND.

Globe Am′aranth, the *Gomphrena globosa*, a flowering plant well known in cultivation for its globose purple or white heads of imperishable flowers—one of the kinds known as *immortelles*. This species is East Indian. Many of the South American species (herbs or shrubs) are prized for their medicinal virtues, especially *Gomphrena officinalis* and *macrocephala*.

Globe Fish, a name applied to several fishes, mostly



Pennant's Globe Fish.

marine, and of the genus *Tetraodon*. Like other fishes of the family, they have the power of puffing themselves up by swallowing air. In this condition they sometimes lose their balance, and float in a helpless state upon the water. They are protected by sharp spines. The U. S. coasts have one species or more; the *T. Pennantii* is European.

Globe Flow′er [so named from the almost spherical shape of the blossom], a genus (*Trollius*) of perennial herbs of the order Ranunculaceæ. *Trollius Europæus* and *Asiaticus* are cultivated ornamental plants. *T. laxus* is a rather rare plant of the U. S., and the only American species.

Globe Vil′lage, post-v. of Southbridge tp., Worcester co., Mass., on the Boston Hartford and Erie R. R., has woollen-mills and mousseline de laine print-works.

Glob′ulin, (1) a semi-solid nitrogenous substance which constitutes a large proportion of the bulk of the red globules of the blood. It is coagulable by heat, insoluble in cold water, and is found intimately associated with a little fat and some inorganic salts. It is closely akin to albumen, and is called an albuminoid. Its composition is given in the art. ALBUMINOIDS (which see). But some late authorities question its existence as a distinct principle. (2) Globulin, fibrinogin, myosin, and vitellin are collectively called globulins—a name which is (3) also given to the granules ($\frac{1}{7500}$ of an inch in diameter) found in the lymph of the animal absorbent system, and regarded by some as a variety of leucocytes. From the threefold application of this word some confusion has arisen.

Globigeri′na, an interesting genus of microscopic foraminifers, each roughly globular; but masses of Globigerinæ are commonly found united in a somewhat raspberry-shaped lump, the parent organism from time to time forming new animals by budding. These creatures abound in deep-sea ooze over large areas of the ocean-bottom, where their shells are gradually forming new chalk strata.

Glocester, tp. of Providence co., R. I., contains a number of manufacturing villages. Pop. 2385.

Glogau, or **Gross-Glogau,** town of Prussia, in the province of Silesia, on the left bank of the Oder. It is strongly fortified, and has large breweries and manufactures of beet-root sugar, tobacco, woollen and linen fabrics, and paper. Pop. 18,265.

Glom′men, the largest river of Norway, rises in lat. 62° 40′ N. and lon. 11° 16′ E., at an elevation of 2419 feet. After joining the Vormen it is called the Stor-Elv, and falls into the Skagerack. Its course is about 400 miles long, and its volume of water very considerable, but its navigation is much impeded by falls, of which the Sarp, 10 miles from its mouth and 70 feet high, is the most remarkable.

Glonoine. See NITRO-GLYCERINE.

Glo′ria, in music, one of the principal divisions of a Catholic or liturgical mass, being the music to the words of the hymn "Gloria in excelsis Deo," etc. In masses of a diversified and elaborate character the Gloria frequently embraces several movements, consisting of solos, duets, etc., and choruses. The word is also used for the doxology Gloria Patri, "Glory be to the Father," etc., and the Gloria Tibi, "Glory be to Thee, O Lord."

Glo′ria in Excel′sis De′o [Lat. for "Glory be to God on high"], the title of the greater doxology, being the first words of that formula. It is also called the Angelic Hymn, because the first words were sung by the angels on the plains of Bethlehem (Luke ii. 14). With slight differences it is used by the Greek, Latin, Lutheran, Anglican, Wesleyan, Methodist Episcopal, and some other churches, being a part of the office for the Holy Communion. It dates from the second century, and was originally the morning hymn of the Greek Church.

Glo′ria Pa′tri ("Glory be to the Father"), the lesser doxology, a very ancient ascription of praise to the Holy Trinity—a brief hymn which is believed to have taken its present form about the time of the origin of the Arian controversy.

Glorio′sa, a genus of liliaceous flowering plants (remarkable for having the leaves tipped with a short tendril or hook), of which the best known is the *G. superba*, a tuberous East Indian perennial herb, with very fine red and yellow flowers, seen in greenhouse culture.

Gloss [γλῶσσα, the "tongue," "language," because it explains verbal difficulties], an explanation written upon a MS. writing between the lines, along the margins, or upon a separate parchment, designed to explain foreign, obsolete, provincial, or technical words or obscure phrases. The Greek, Hebrew, and Vulgate texts of the Bible and the canon and civil law were the subjects of many and often important glosses. Sometimes the gloss is more than a verbal explanation, and takes the form of a logical elucidation.

Glos′sop, town of England, in Derbyshire, has iron-foundries, paper-mills, dyeworks, bleaching-fields and manufactures of woollens. Pop. 17,046; with surroundings, 20,673.

Gloucester (glos′ter), city of England, the capital of the county of Gloucester, on the left bank of the Severn. It is well built and laid out, its four main thoroughfares crossing each other at right angles in its centre, and with its docks and wharves conveniently situated for a speedy communication between the harbor and the railways. Its cathedral, commenced in 1047, is one of the finest in England, especially its square tower, 223 feet high. Its steel and iron manufactures (railway fittings, agricultural implements, cutlery, pins, etc.) are very extensive. Gloucester, Worcester, and Hereford form together a choir which gives its celebrated annual concerts alternately in one of the three cities. The see of Gloucester has since 1842 been united with that of Bristol. The see-house is at Gloucester, but there are separate cathedral establishments. P. 18,330; of parliamentary borough, 31,804.

Gloucester, the north-easternmost county of New Brunswick, Dominion of Canada, bounded on the N. by the Bay of Chaleurs. It is mostly fertile, but is somewhat broken. Agriculture, shipbuilding, fishing, and lumbering are the chief pursuits. It is intersected by the Intercolonial Railway. Cap. Bathurst. Pop. 18,810.

Gloucester, county of Southern New Jersey, bounded on the N. W. by the Delaware River. The surface is generally level; the western part is very fertile. Area, 250

square miles. Grain, sweet potatoes, and garden products are the staple crops. Flour, carriages, iron, and glass are manufactured. It is intersected by the New Jersey Southern R. R. Cap. Woodbury. Pop. 21,562.

Gloucester, county of the peninsula of Virginia, bounded on the E. by Chesapeake and Mobjack bays, and on the S. by the York River. The surface is level and productive. Grain, firewood, fish, and oysters are exported. Area, 280 square miles. Cap. Gloucester C. H. P. 10,211.

Gloucester, city and seaport of Essex co., Mass., near the extremity of Cape Ann, 28 miles N. E. of Boston, with which it is connected by a branch of the Eastern R. R. It received its name from Gloucester, England, whence many of its early settlers came. It was settled in 1623, incorporated a town in 1642, and became a city in 1874. It contains a city hall, 13 churches, 21 school-houses, 3 national and 1 savings bank, a public library, 3 hotels, 6 post-offices, and 2 weekly newspapers. The business is mainly confined to the fisheries and the granite industry. It is also quite popular as a summer resort. In 1873 the valuation was $8,000,000, and the product of the fisheries for the year $4,000,000. It has a very fine harbor. Pop. in 1870, 15,389.

A. F. Stickney, Ed. "Gloucester Telegram."

Gloucester, tp. of Camden co., N. J. Pop. 2710.

Gloucester, tp. of Transylvania co., N. C. Pop. 372.

Gloucester City, post-v. of Newton tp., Camden co., N. J., on the Delaware, opposite the lower part of Philadelphia, and 4 miles below Camden, on the West Jersey R. R. It has several churches and manufactories. Pop. 3682.

Gloucester Court-house, post-v., cap. of Gloucester co., Va., $1\frac{1}{2}$ miles from Ware River. It has a flour-mill, a saw-mill, 1 newspaper, 2 coach manufactories, stores, etc.

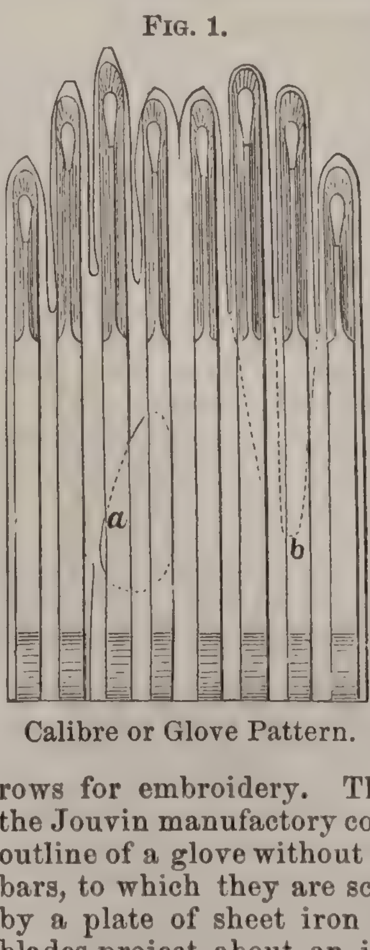
P. W. Page, Prop. "Gloucester Herald."

Gloucestershire, county of England, is situated around the estuary of the Severn. Area, 1258 square miles. Pop. 534,320. The eastern part is occupied by the Cotswold Hills. Here the soil covering the rocks is thin, yet affords excellent pastures, especially for sheep. The central part is a valley formed by the Severn, with very rich soil and a peculiar climate, which ripens all fruits very early. The western part is the Forest of Dean, of which about 20,000 acres belong to the Crown. Besides agriculture and dairying, many branches of manufacture, especially that of woollen goods, are pursued. Coal-mining and the iron industry are also extensively carried on.

Gloves [Ang-Sax. *glôf,* a covering for the hands, usually of leather or textile fabric, enclosing each digit separately, and sometimes extending up the arm] were worn in ancient times by the Persians as a protection from cold, but in Greece and Rome they were only used by husbandmen during the performance of certain kinds of field-labor as a protection from thorns. In the early Middle Ages they became quite common. Knights, priests, and ladies used them, and they received different symbolical significations of love, challenge, submission, etc. It was not, however, until the age of Louis XIV. that they became part of elegant dress in general, but after that time their use has become more and more common. During the reign of Louis XIV. the glovers of Paris became a very important community; the king renewed their statutes, dating from 1190; in these they were styled marchands-maîtres-gantiers-parfumeurs, and alone had the right to sell or prepare gloves. Between 1644 and 1680, Louis XIV. issued several edicts prohibiting the use of gloves embroidered with gold or silver. Gentlemen's gloves at this period were made with gauntlets; those worn by ladies covered the arm.

Gloves are made of leather, fur, and cloth, of silk, linen thread, cotton, and worsted, generally woven in the same manner as stockings. Leather, being most used of these materials, is of chief commercial importance. The principal kinds are doe, buck, and calf skin; reindeer skin; sheep skin, for military gloves; lamb skin, of which much so-called kid is manufactured; and veritable kid, used for the best and finest gloves. Dog skin is much used; and the skins of the rat and the kangaroo are reported to be employed as material for fine gloves. Calf skins are imported from the Baltic; lamb skins, from the south of France, Italy, Spain, Turkey, and Austria; kid skins from the south of France, Italy, Switzerland, Ireland, and the East Indies. Great care is required in tawing or preparing kid leather for gloves, and it is necessary that the animal shall be killed young, because so soon as it begins to feed on herbage its skin is injured for this purpose. The skin is cleaned in running water; then, having been slacked with cream of lime, or lime and orpiment, the hair is removed from it with pincers. It is next steeped for ten or fifteen days in lime-water, then washed in pure water, and soaked in fermented bran-liquor. Alum, salt, yolks of eggs, and flour are used to soften it, a larger proportion of salt being necessary in hot weather to prevent putrefaction. It has been calculated that over 60,000,000 eggs are used to prepare glove leather in France and England. The skin is next dried, worked upon the softening-iron, stretched, and rubbed with pumice to render it smooth. The best kid leather is manufactured at Armonay, 40 miles S. of Lyons. Lamb skins in great quantities are prepared at Yeovil in Somersetshire, England. The next process is dyeing the skins intended for colored gloves. In this the French excel, producing a great variety of delicate tints; their superiority is attributable partly to the quality of the water in certain places, partly to the clearness of the atmosphere in France. Before 1833 the method of cutting out gloves was extremely defective. It was done with long scissors by workmen who had no definite rules to guide them as to the size and shape of different hands, and who hardly calculated the stretching capacity of the leather. Half an inch more or less in length or breadth seems to have been regarded as a matter of little importance; and in a manual of glove-making, published about 1828, the workman is directed to use his own middle finger as a standard by which to cut the fingers of a glove. So much being left to the judgment, it is plain that careless or inexperienced operators must have wasted great quantities of kid, while the most skilful can seldom have succeeded in shaping two gloves exactly alike. In 1819, Vallet d'Artois, a French glove manufacturer, invented punches (*emporte-pièces*) in three sizes, each of which cut out two dozen gloves at once. But economy of labor was less needed than improvement in its result, and the idea of justly calculating the lateral and longitudinal extension of leather not having occurred to the inventor, his instruments, though ingeniously conceived, were practically of little value. In 1834, Xavier Jouvin turned his attention to inventing a new method of cutting out gloves. This young man, though brought up as a working glover, possessed not only an aptitude for mechanics, but also much self-acquired geometrical knowledge, and a patriotic desire to improve and extend the manufactures of his native town, Grenoble. He set to work on a scientific basis—first, to classify the various sizes and forms of hand; next, to determine the exact stretch of leather required to cover each of them; then, to draw up a list or scale in which by means of a letter and a figure the glove-wearer should find the exact size and shape of his own hand. By careful and ingenious application of certain geometrical rules, Jouvin succeeded in deciding the amount of any quality of kid required for any sized glove. He found that 32 sizes included all dimensions of hands, the various shapes of which he classed under five heads: very slender, slender, medium, broad, very broad. Having divided each type into two dimensions, he got 10 distinct glove-forms, and multiplying these by the original 32 sizes, obtained 320 different numbers of gloves. This great variety is more than sufficient, and many numbers are very rarely required. For each of the 32 sizes he made a *calibre,* or glove-pattern of sheet iron (Fig. 1), furnished on its inferior surface with diminutive points for marking upon the kid the place for the thumb-hole, *a*, and the lines for embroidery at the back of the hand, *b*. He also made small calibres for the thumbs, and punches (*emporte-pièces*) for cutting the thumb-hole and shaping the gussets. A piece of kid having been duly stretched, the calibre was pressed upon it, and it was cut to the shape of the pattern by means of a knife invented for the purpose. Jouvin got the idea of this method while watching a glover cut kid into strips for binding with a penknife drawn along a ruler. In 1838 he replaced the calibres with punches, which cut out at once the glove, thumb-hole, button-hole, and cleft at the wrist, and traced the three rows for embroidery. The punch (Fig. 2, X) still used in the Jouvin manufactory consists of steel blades forming the outline of a glove without its thumb, and connected by iron bars, to which they are screwed. These bars are covered by a plate of sheet iron (Fig. 2, Y), beyond which the blades project about an inch. The punch is forced by a lever through several layers of kid, and thus cuts out a number of gloves at a time. Punches are also employed for the thumbs and gussets. In order to cut out with the same instrument gloves for differently formed hands, skins

Fig. 1.

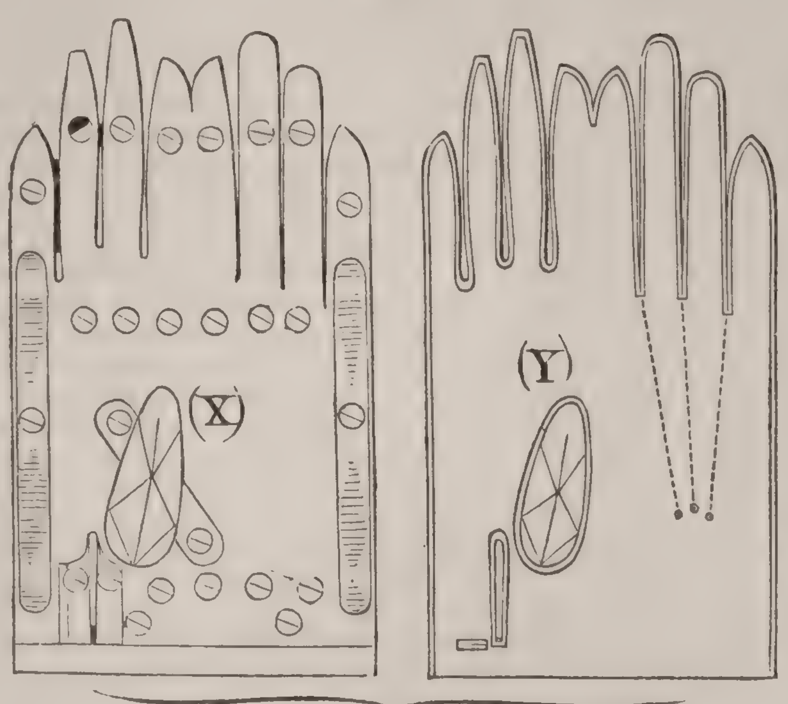


Calibre or Glove Pattern.

varying in elasticity are used, and each pair of Jouvin gloves has two marks—one, indicating the punch with which they were cut; the other, their degree of elasticity.

Glove-sewing is done by women, generally in their own homes. This work requires much care, as the kid is easily soiled, stretched out of shape, or torn by the use of too coarse a needle. Some manufacturers employ punches which, while shaping the gloves, prick places for the stitches, but a machine of English invention is commonly used in glove-sewing. It consists of an iron vice set in a stand which is screwed to the edge of a table. Each jaw of this vice has its extremity made of brass, and is tipped with a comb of the same metal, the teeth of which, about one-twelfth of an inch long, are perfectly even and regular. The spaces between the teeth, as also the shape of the comb, vary according to the kind of sewing required; therefore sets of vices are used provided with combs of different shapes and sizes. One jaw of the vice is made fast to its stand, but the other is movable by a hinge, and is kept in its place by a strong spring. The movable jaw is furnished with a lever connected by a wire with a pedal, upon which the workwoman presses her foot when it is necessary to separate the jaws. She inserts the seam to be sewed between the two brass combs, then lifts her foot, and the jaws, closing firmly upon the kid, hold it in position. She then passes her needle successively through all the teeth of the comb, and is sure to make an even seam if she lets it graze along the bottom of each notch. When one piece is sewn, she again presses the pedal, and repeats the above process with a fresh seam. The glove-sewer usually begins by putting in the thumb, with its gusset; she then sews the long seam from the wrist to the tip of the little finger, puts in the finger-gussets, and sews the fingers. In a variety of gloves called *Josephine* there is no long seam, but instead two short ones—from the thumb to the space between the first and second fingers, and from the lower part of the thumb to the wrist. The glove being sewn, the slit at the wrist is bound, the button-hole is completed, the button or other fastening added, and a binding of white kid or some other finish put round the wrist. It is then pressed and smoothed, the finger-gussets are folded back between the superior and inferior surfaces of the fingers, and the thumb is bent across the palm.

FIG. 2.



Punch (*Emporte-Pièce*).

Until 1825 a law existed prohibiting the importation of foreign gloves into England. Since its repeal the quality of English leather gloves has much improved; they are manufactured at London, Ludlow, Worcester, Yeovil, and Woodstock. Limerick, in Ireland, was formerly celebrated for gloves of a peculiarly delicate kind, a pair of which could easily be packed into a walnut-shell. This manufacture has fallen into decay. Very excellent gloves are made in Italy, principally at Naples; in Belgium, Sweden, Denmark, and Germany. Austria exports many gloves of the first quality. Gloversville, N. Y., has large manufactures of gloves of many grades of excellence. France, however, supplies the world with most of the finer and more expensive kinds. The chief seats of manufacture are Paris, Grenoble, Chaumont, Milhau, and Niort. About 2,000,000 dozen pairs of gloves, of first, second, and third quality, are made annually, their price being from 35 to 75 francs per dozen, and their aggregate value from 65,000,000 to 70,000,000 of francs. Of these, at least two-thirds are exported. The tanning and dyeing of glove-leather employ 20,000 persons; the manufacture and trade, 50,000. In the town of Grenoble there are 180 master-glovers, employing, in various branches of the business, 30,000 work-people, of whom 2000 are cutters. The annual manufacture amounts to 900,000 pairs of gloves, valued at 30,000,000 francs. St. Anne, mother of the Virgin, having, according to monkish legends, been accustomed to knit gloves, is the patroness of French glovers, who celebrate an annual holiday in her honor. In 1811 the glovers of Grenoble ordered a statue of their saint, represented knitting with a glove in her hand, and at her feet a basket containing several pairs of gloves.

Woollen gloves are made in Germany and England, the chief English manufactories being at Nottingham and Leicester. JANET TUCKEY.

Glov′er, tp. of Colleton co., S. C. Pop. 1102.

Glover, post-tp. of Orleans co., Vt., 35 miles N. E. of Montpelier. It has 4 churches, a liberal institute, and manufactures of lumber, leather, boxes, etc. The famous Runaway Pond, or Long Lake, which burst its banks June 6, 1810, was situated partly in this town. Pop. 1178.

Glover (JOSEPH), M. D., a physician and surgeon of Charleston, S. C.; graduated in the medical department of the University of Pennsylvania in 1806, when his thesis on digestion was published. He is reported to have performed lithotomy, tapped the head for hydrocephalus, and removed successfully a portion of the spleen and omentum. PAUL F. EVE.

Glov′ersville, post-v. of Johnstown tp., Fulton co., N. Y., 44 miles N. W. of Albany, and 9 miles N. of Fonda. It contains 2 national banks, 1 savings bank, 1 union school, 1 public library, 2 foundries, 3 large hotels, 3 newspapers, 7 church societies, 60 stores, and upwards of 150 glove manufactories. The latter is the principal business, and from it the place derives its name. It is connected with the New York Central R. R. by the Fonda Johnstown and Gloversville R. R. Companies are organized for the construction of a horse railroad and waterworks on the "Holly" plan. Pop. 4518.

J. R. ARROWSMITH, ED. "STANDARD."

Glow′worm, the wingless and nocturnally luminous female of *Lampyris noctiluca*, and other fireflies of Europe. The winged male emits a very feeble light, not at all comparable for brilliancy with the common fireflies of the U. S.; while the female has a pale bluish and rather faint luminosity, which, it is supposed, serves to attract the male. In the U. S. some luminous larvæ of various fireflies are named glowworms. (For an hypothesis as to the origin of the glowworm's light, see FIREFLY.)

Glu′chow, town of Russia, in the government of Tchernigow. In its neighborhood is found a fine sort of porcelain clay, which is sent to the imperial manufactories at St. Petersburg. Pop. 8856.

Glu′cic Ac′id, an acid prepared by the action of lime or baryta on cane or grape sugar; also by the action of baryta on gallotannic acid, as well as by sulphuric acid on cane-sugar; composition, $C_{12}H_{18}O_9$. Glucic acid is a colorless, amorphous body, very soluble in water and alcohol. It decomposes when dry on being heated to the temperature of boiling water. Boiled with acids, it forms apoglucic acid by absorption of oxygen, the solution turning brown. The basic lead salt is insoluble in water; the other salts, as far as studied, have been found to be soluble.

E. WALLER.

Gluci′num [Gr. γλυκύς, "sweet," from the taste of some of its salts], called also **Beryl′lium** (symbol, G; atomic weight, 9.3), an artiad (dyad) earth-metal, whose oxide (GO) is known as glucina, and is considered an earth. Glucinum in nature commonly occurs as a silicate of glucina, as in the beryl, of which gem this earth constitutes 14 per cent.; or as an aluminate, as in the chrysoberyl. The glucinum chloride (GCl_2), when vaporized and passed over melted sodium, yields metallic glucinum, a white malleable metal (sp. gr. 2.1) which cannot be burned, even in pure oxygen.

Gluck, von (CHRISTOPH WILIBALD), an eminent composer, b. at Waidenwang, near the borders of Bohemia, July 2, 1714; d. at Vienna Nov. 15, 1787. His father was a huntsman and forester in the service of Bohemian nobles. Besides receiving a good school education and part of a course at the University of Prague, the boy was well instructed in music under the direction of the Jesuits, who cultivated the art for religious purposes. At the age of eighteen, being forced to work for his support, he gave lessons in vocal and instrumental music, sang and played in church, and in leisure time entertained villagers with his accomplishments. At the age of twenty-two his ability had attracted the attention of a noble patron, who gave him opportunity to study music at Vienna under the most favorable auspices. A Lombard prince, hearing him there at his patron's house, took him to Milan and placed him under the tuition of the then celebrated Sammartini. He was but

twenty-six years old when he received an order to compose an opera for the court theatre. This was the *Artaserse*, and it was a triumph, in spite of the innovations of style which the author introduced; for the new spirit which later effected a complete reform in operatic compositions was already born in the young master. Other operas followed—*Demofoonte, Demetrio, Ipermnestra, Artamene, Siface, Fedra, Poro*—all for Italian cities. Invited to the Haymarket, London, he produced there, in 1746, *La Caduta dei Giganti*, which was not a flattering success. In London he became acquainted with English composers and with Handel. In Paris he was attracted to the works of Jean Philippe Rameau, then at the height of his fame. Full of new ideas, Gluck gave his whole mind to his new theory of opera, and after producing many pieces more or less significant at Paris, Vienna, Rome, Naples—two of which, *Il trionfo di Camillo* and *Antigono*, won for him from Pope Clement XIII. the order of Knight of the Golden Spur—he returned to Vienna and established himself as Capellmeister of the imperial opera. During the whole of this period, lasting till 1762, Gluck's genius, though copiously and variously productive and widely recognized, had not fully unfolded its powers or justified itself to its possessor. He was forty-eight years old when, from a libretto by a new author, Calzabigi, poet and statesman, he composed the *Orfeo ed Euridice*, which was first performed in Vienna Oct. 5, 1762. This opera marked a new era. The fame it acquired at once it has never lost. It was followed shortly by the *Alceste*, and in 1769 by the *Paride ed Elena*, the texts for the three being by the same author. Still, Gluck was not satisfied without the ratification of the judgment of Paris. This, after great effort, he was able to secure in 1774. On Apr. 19 of that year the *Iphigénie en Aulide*, finished at Vienna in 1772, was brought out in Paris under the direction of the composer himself, who had bestowed immense labor on all the details of its scenic production. A ferocious controversy raged over it between the champions of the old and new schools. Gluck carried the day, and five years later, he being then in his sixty-fifth year, he enjoyed the triumph of witnessing the successful representation of his great opera, the *Iphigénie en Tauride*, in the French capital. He was sixty-four when he wrote it, but it ranks among the foremost of his compositions; by many is deemed his very best, as being the most complete and splendid vindication of the new school. The aim of this school was to make music expressive of the emotions implied in the action of the drama. The opera, according to this theory, was to be a musical drama, not a concert in costume. The text must be descriptive of real passion, intense and elevated. The notes must voice fully the spirit of the text, giving to the poetry the light and shade and color by which the painter imparts life to his outlines. The instruments must be subservient to the voices, while sustaining and aiding them. The overture must foreshadow the sentiment of the piece, and a conscientious simplicity, forbidding useless decoration, discouraging vanity and affectation, and submitting sound to sense and soul, must be the composer's law. Gluck, though possessing immense industry, energy, and determination, the mind of a critic and the soul of a reformer, lacked the affluence of genius that distinguished his immortal successors in operatic composition, Mozart and Beethoven. His aims were lofty, his ambition was great. He demanded a theme of deep sentiment and elevated character. A tender dignity and pathos were native to his mind, and were enhanced by the simplicity and singular purity of his method. His greatest compositions are penetrated with a feeling religious in its character, yet his religious compositions are very few and of small account. Schiller, after witnessing a representation of the *Iphigénie en Tauride* at Weimar, wrote: "Never has any music affected me so purely, so supremely, as this; it is a world of harmony, piercing straight to the soul, and dissolving it in the sweetest, loftiest melancholy." Gluck was a man of attractive social qualities, but keen and somewhat acrid in controversy. His married life was childless, but otherwise happy. O. B. Frothingham.

Glück'stadt, town of the German empire, in the duchy of Holstein, on the Elbe. It has a school of navigation and a good harbor. Pop. 5752.

Glu'cose, the name applied to a class of sugars similar in chemical composition, but differing in some of their properties. The glucoses are thus classified: 1, ordinary glucose, dextro-glucose, or dextrose; 2, Lævulose or lævoglucose; 3, Maltose, produced by the limited action of diastase on starch, and having a high dextro-rotatory power on light; 4, Mannitose, from the oxidation of mannite by platinum black; 5, Galactose, the result of the action of acids on milk-sugar; 6, Inosite, existing in muscular flesh; 7, Sorbin, obtainable from mountain-ash berries; 8, Eucalyn, existing in Australian manna. The first four exhibit but little difference in their properties except in their action on polarized light. The last three are fermentable only under peculiar conditions. The others ferment readily when in contact with yeast.

Glucose in its more limited signification is applied to dextrose and lævulose, which occur naturally together in acid fruits of various kinds, in honey, and in diabetic urine. These sugars are known as fruit-sugar, grape-sugar, honey-sugar, diabetic-sugar, and, when produced in the laboratory or in commercial processes from other substances, as inverted sugar, starch-sugar, potato-sugar, rag-sugar, etc., according to the substances from which it is made. The various fruits contain them in the following proportions:

Peach	1.57 per cent.	Gooseberry	7.15 per cent.
Apricot	1.80 "	Cranberry	7.45 "
Plum	2.12 "	Pear	8.02 to 10.8 "
Raspberry	4.00 "	Apple	8.37 "
Blackberry	4.44 "	"	7.28 to 8.04 "
Strawberry	5.73 "	Sour cherry	8.77 "
Bilberry	5.78 "	Mulberry	9.19 "
Currant	6.10 "	Sweet cherry	10.79 "
Plum	6.26 "	Grape	14.93 "

Inverted sugar is produced by long boiling of solutions of cane-sugar, and hence is formed incidentally in the manufacture of refined sugar from the cane and beet, being found in considerable quantities in the molasses. It may also be more readily produced by adding a little acid to a solution of cane-sugar, and then boiling. From grape-juice glucose is obtained by neutralizing the free acid, principally tartaric, with some form of lime or baryta carbonate, allowing the precipitate to stand, clearing with blood (2 to 3 per cent. by volume), evaporating down, and crystallizing out: 1000 parts of grapes yield about 60 to 70 parts of pure glucose when thus treated.

By far the largest proportion of glucose used in the arts is made by boiling starch for some time with dilute sulphuric acid in lead or wooden pans. The starch is first converted into dextrine and glucose, the dextrine being then changed to glucose:

$$\underset{\text{Starch.}}{2C_6H_{10}O_5} + \underset{\text{Water.}}{H_2O} = \underset{\text{Dextrine.}}{C_6H_{10}O_5} + \underset{\text{Glucose.}}{C_6H_{12}O_6}$$

$$\underset{\text{Dextrine.}}{C_6H_{10}O_5} + \underset{\text{Water.}}{H_2O} = \underset{\text{Glucose.}}{C_6H_{12}O_6}$$

For this purpose one to two parts of sulphuric acid are diluted with three or four times their bulk of water, and 100 parts of starch are mixed with sufficient water to make a milky fluid. These two are then run into 300 to 400 parts of water heated to boiling, and the boiling is continued. When a portion of the mixture ceases to turn blue with iodine, the starch has all been converted into dextrine and glucose, which is the intermediate stage. The boiling is continued until a large amount of absolute alcohol fails to produce a precipitate of dextrine in a sample of the mixture, when the conversion into glucose is complete. The sulphuric acid is then neutralized by addition of lime or baryta carbonate in slight excess, and the insoluble lime or baryta sulphate is separated by settling and decantation; a portion is removed in the screens. The solution is then filtered through bone-black, concentrated by evaporation, and the sugar is crystallized out, which takes from 8 to 10 days, or concentrated to a certain point. It is put on the market under the name of starch syrup, corn syrup, or maltine. Sawdust and wood chippings from the refuse of wood-paper manufactories is sometimes treated in the same way, an inferior quality of glucose being thus obtained. The chemical formula for the different varieties of glucose above enumerated is $C_6H_{12}O_6$. Dextrose rotates the plane of a ray of polarized light to the right, while lævulose rotates the ray much more strongly to the left. Hence a mixture of equal parts of each has a left-handed rotation. Lævoglucose by itself is an uncrystallizable syrup. The glucoses, when heated in contact with metallic oxides, have the power of reducing many of them to lower degrees of oxidation or to the metallic form. They form compounds with various oxides. One part of cane-sugar sweetens as much as two or two and one-half parts of glucose. With alkalies and their carbonates, glucose alters to melassic acid, a brown substance which is used for artificial coloring of wines, brandies, and other liquors and beverages under the name of sucre-couleur. Glucose is also used in wine-making, either to sweeten wines or to give them a larger proportion of alcohol by fermentation. In brewing it is also used, as much as 1 hundredweight of sugar being sometimes used to 3 hundredweight of malt. It is also used in confectionery. The inferior qualities, such as are prepared from wood, are used for making alcohol.

Originally, cane-sugar and glucose were considered as identical. In 1792, however, Lowitz showed the difference

between them. Kirchhof was the first to prepare it from starch, and Bracconnot first showed that it could be obtained by boiling linen threads and other forms of cellulose with acids. Dubrunfaut investigated the difference in optical properties of the various kinds of glucose. (See LOWITZ, *Crells Ann.* vol. i. pp. 218 and 345; KIRCHHOF, *Schweigg. Journ.* vol. xiv. p. 389; BRACCONNOT, *Ann. de Chim. et de Phys.*, [2] vol. xii. p. 181; DUBRUNFAUT, *Comptes Rendus*, xvii. 228. Also articles BEER, BREAD, SUGAR, FERMENTATION, and DIASTASE.) E. WALLER.

Glu′cosides, a term applied to substances yielding when treated with dilute acids (or certain ferments) glucose or a sugar of similar composition, and another substance not belonging to the group of carbohydrates. They occur in various plants, most frequently in the bark. None have been formed artificially. A series of bodies, however, called artificial glucosides, has been prepared by heating glucose with some organic acid for several hours, but these yield glucosan, and not glucose, on being decomposed. Alkalies and some organic ferments also decompose some glucosides to glucose and some other body. Among the most important glucosides may be mentioned amygdalin from bitter almonds, chitin from the wing-cases of insects and from the carapaces of crustaceans, gallo-tannic acid from gall-nuts, myronic acid from the seed of black mustard, salicine from the leaves and bark of the willow and poplar, and solanin from the nightshade, tobacco, potato, tomato, and other plants of the family of Solanaceæ. (See ALMONDS, OIL OF.) E. WALLER.

Glue [Lat. *glus*], a hard, brittle, glassy form of dried gelatine, containing impurities which give it a brownish color. It is the most important of the animal cements, and is usually obtained from the scraps of hides, the hoofs of animals, etc., by first thoroughly cleansing with lime, then washing and airing so as to slake the remaining caustic lime, and then boiling in rain-water, by which the albuminoid elements of the animal matter are changed into gelatine. The latter is removed and carefully dried in nets, care being taken to avoid too much or too little heat, for the first will melt the glue, while cold may cause the pieces to crack. Bone-glue (bone-gelatine) is prepared from fresh bones, either by digesting them with superheated steam, or with dilute hydrochloric acid, followed by boiling, the latter process affording the best results. "Fish-glue" is an inferior isinglass made from the offal of the fisheries. Glue is used in joinery, cabinetmaking, in preparing size for dressing paper, silk goods, etc., in calico-printing, in making rollers for inking type, in fresco-painting, in paper-hanging, in stiffening hat-bodies, and for many other uses in the arts. For use as a cement, glue is generally dissolved with a gentle heat in a water-bath, and is then fit for use. "Prepared" or liquid glue is the ordinary solution kept liquid by the addition of a fluid ounce of strong nitric acid for every pound of dry glue; or commercial acetic acid, 3 parts to 1 of the dried and powdered glue is used, for this acid will dissolve the glue without heat. Six parts glue, 16 parts water, 1 part hydrochloric acid, and 1½ parts sulphate of zinc also give excellent results as an imputrescible liquid glue.

Glue, Marine, a cement formed by dissolving 1 pound of India-rubber in 5 gallons of oil of turpentine, or preferably in coal-naphtha, and then adding after some days a quantity of shellac equal, or sometimes much exceeding, the previous solution in weight. The mixture is heated over a gentle fire and thoroughly mixed by stirring. It is then run into plates and dried. When used, it is melted by heating. It is insoluble in water, and will hold pieces of tough wood together so strongly that they may be broken across the grain sooner than parted at the place where glued. Glass and metals may also be glued with it.

Glü′mer, von (ADOLF), Prussian lieutenant-general, b. June 6, 1814; became a lieutenant in 1832; served for some time on the staff and became commander in 1861 of the 1st West Prussian Grenadier regiment. He took part as major-general in the campaign of 1866 against Hesse, Hanover, and the South German States. At the beginning of the Franco-German war of 1870–71 he received the command of the 13th division of infantry, and he decided the battle of Saarbrücken, Aug. 6, 1870, by his circuitous manœuvre at Forbach. He took part in the battle of Metz, and received Sept. 30 the command of the division of Baden. He was wounded in the encounter at Nuits, Dec. 18, 1870, but continued to command, and he distinguished himself both in the encounter of Villersekel, Jan. 9, and in the battle of Bellefort, Jan. 15, 16, and 17, 1871.
AUGUST NIEMANN.

Glu′ten [Lat. for "glue"], a nitrogenous and highly nutritive substance found in many of the cereal grains in variable proportions. It is generally regarded as a mixture of vegetable fibrin with a small proportion of a very adhesive principle called gliadine or glutine, which imparts to the gluten some of its own adhesive quality; but the proportion of gliadine is extremely variable, it being almost entirely absent from rye-gluten. Caseine and a thick oil also exist in most gluten in small proportions. The gluten of wheat varies from 9 to more than 35 per cent. of the grain, according to the soil where grown, the manure used, and the other conditions of growth. The article FLOUR in the present work gives an instructive account of the structure of the gluten-coat of the wheat-grain, and conveys some impression of the great importance of this element in bread-making. Gluten is by most authorities stated to exist in rye, oats, and barley in proportions but little inferior to that in which it exists in wheat; while in maize and buckwheat, and especially in rice, its proportion is much smaller. But some of the best authorities give the name *vegetable fibrin* to the gluten of the grains other than wheat, because it lacks the *gliadine* or glutinous element of wheat-gluten. When wheat flour is kneaded under a gentle stream of water (which washes out the starch, sugar, mucilage, albumen, etc.) a pasty, grayish lump is left. This is gluten. It is a ferment, and is capable of turning starch into dextrine, and dextrine into sugar. It is so highly nutritious that animals can live upon it probably longer than upon any other single nutritive material. Gluten bread, made from carefully washed flour, has been found useful in some cases of *diabetes mellitus*, in which disease its use was suggested by the fact it is not capable of being converted into sugar.

Glut′ton (the **Wolverine** or **Carcajou** of the French Canadians). The genus *Gulo* belongs to the family of Mustelidæ, closely resembling its members in dentition and anatomical details, though differing so much from them in external appearance as to have been placed by many authors with the Ursidæ, or bears. The wolverine of North America, one of the greatest pests of the fur-regions, robbing the traps of the hunter with unceasing pertinacity, and the glutton of Europe and Siberia, belong to one far-ranging species, the *Gulo* (*Ursus*) *luscus* of Linnæus. EDWARD C. H. DAY.

Gly′cas [Γλυκᾶς], MICHAEL, a Byzantine historian who lived after A. D. 1118, but the precise time is not known. Composed a history of the world (βίβλος χρονική), in four books, comprising the period from the Creation to the year 1118. The work was first published in a Latin translation by Leunclavius, Bâle, 1572; then the first part in Greek by Meursius, 1618; the whole Greek text by Labbé, Paris, 1660; best edition by Bekker, Bonn, 1836. H. DRISLER.

Glyc′erine [Gr. γλυκύς, "sweet"], the propenyl alcohol; a sweet principle obtained by the action of alkalies upon fixed oils and fats, which are regarded as propenylic ethers of fatty acids. Thus, stearine (propenyl tristearate), $C_3H_5(OC_{18}H_{35}O)_3$, *plus* potash (3KOH), gives potassium-stearate or soap ($3KOC_{18}H_{35}O$), *plus* glycerine ($C_3H_5(OH)_3$). Pure glycerine is a colorless, syrupy liquid, unctuous to the touch, sweet to the taste, and without odor. Sp. gr. 1.27. It is very miscible with water (of which it always contains some), cannot be crystallized or evaporated (except when mixed with water and steam at a great heat and pressure), and when heated alone undergoes dehydration, and produces the pungent ACROLEIN (which see) and other compounds. Treated with strong nitric and sulphuric acids, nitro-glycerine or glonoine is produced. (See EXPLOSIVES and NITRO-GLYCERINE.) Glycerine was first discovered by Scheele in 1789. It was formerly obtained for pharmaceutical use by boiling lead plaster (a salt of fatty acids with lead), and then throwing down the lead with sulphydric acid, after which the solution was filtered and evaporated to a syrupy consistence. Large quantities of glycerine were wasted in the soap-manufacture; but at present it is utilized by first saponifying the fats with lime, and then distilling out the glycerine by means of superheated steam. Glycerine as prepared from soapmaker's waste is very liable to retain an offensive odor and an acrid quality (partly from the acrolein present), in spite of the observance of great care in refining and deodorizing it. In medicine, chemistry, and the arts glycerine has a wide range of uses. It is an important ingredient of cosmetics, toilet soaps, unguents, and pomades. Its solvent and antiseptic powers are great, and its non-drying quality adds much to its usefulness. It has nutrient qualities, and is useful in many diseases of the skin and the mouth. But its chief use in medicine is as an excipient, solvent, and preservative for more active medicines. It is used for filling gas-meters, for various purposes in brewing, calico-printing, photography, and in the preparation of objects for microscopic examination, and for innumerable purposes in chemical and pharmaceutical laboratories and in the other arts.

Gly′cogen ("sugar-producer"), a white, amorphous, starch-like, tasteless, odorless substance, found by Claude

Bernard in the liver of man and the lower animals, and now known to exist in other tissues, especially during fœtal life. It may be dissolved out of the tissues where it exists by water, and then precipitated with alcohol. The mere contact with blood or the secretions converts it into liver-sugar, which differs from glucose only in the fact that it is more readily fermented. The composition of glycogen is rather doubtful. (The glycogenic function of the liver is discussed in the article LIVER, which see.)

Gly'con [Γλύκων], a statuary of Athens (date unknown, but probably under the early Roman emperors), by whom the celebrated colossal statue of Hercules, known as the Farnese Hercules, was made. This was probably brought to Rome in the time of Caracalla, and placed in his baths, where it was discovered. The statue is supposed to be a copy from an original by Lysippus, and represents Hercules leaning on his club. (See OTF. MÜLLER, *Hist. Greek Art*, § 129, 2). H. DRISLER.

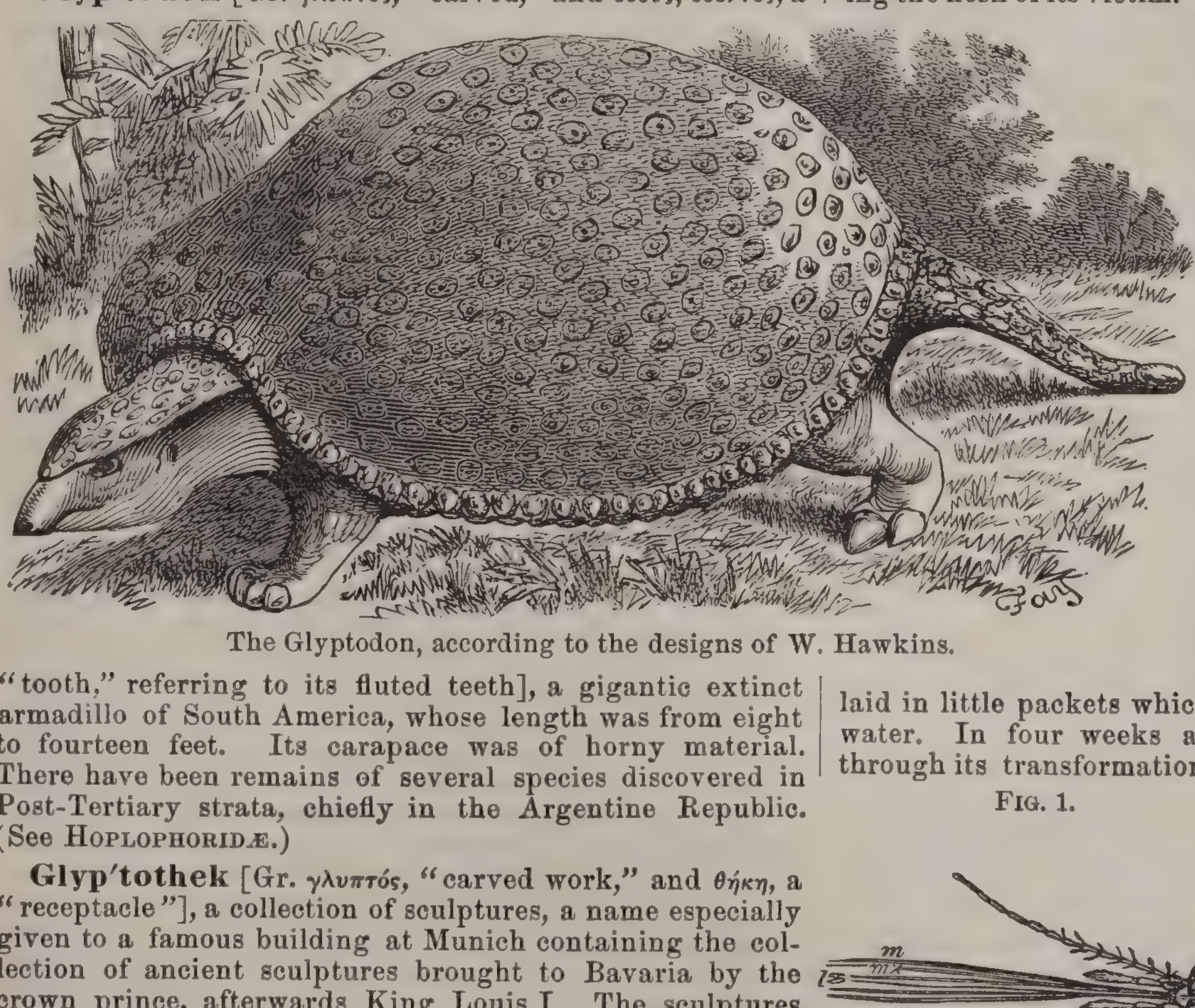
Glycyrrhiza. See LIQUORICE.

Glyn'don, post-v. of Clay co., Minn., at the junction of the St. Paul and Pacific R. R. with the Northern Pacific, 241 miles W. of Duluth and 10 miles E. of the Red River of the North. It is the head-quarters of the Red River Colony. It has a church, a public library, 3 hotels, round-house and machine-shops, a weekly newspaper, and a number of stores and shops. Pop. about 400.

E. B. CHAMBERS, ED. "GAZETTE."

Glynn, county of Georgia, bounded on the N. by the Altamaha, and on the E. by the ocean. Area, 280 square miles. It includes several of the sea-islands. Its surface is partly pine woods and partly marsh. Rice and lumber are exported. The county is traversed by the Brunswick and Albany and the Macon and Brunswick R. Rs. Cap. Brunswick. Pop. 5376.

Glyp'todon [Gr. γλυπτός, "carved," and ὀδούς, ὀδόντος, a



The Glyptodon, according to the designs of W. Hawkins.

"tooth," referring to its fluted teeth], a gigantic extinct armadillo of South America, whose length was from eight to fourteen feet. Its carapace was of horny material. There have been remains of several species discovered in Post-Tertiary strata, chiefly in the Argentine Republic. (See HOPLOPHORIDÆ.)

Glyp'tothek [Gr. γλυπτός, "carved work," and θήκη, a "receptacle"], a collection of sculptures, a name especially given to a famous building at Munich containing the collection of ancient sculptures brought to Bavaria by the crown prince, afterwards King Louis I. The sculptures are mostly Greek, partly Egyptian and Roman, and partly modern—the latter chiefly classic in style. The Glyptothek was built in 1816–30, and contains twelve halls, the sculptures in each illustrating a distinct epoch in the art.

Gme'lin (JOHANN GEORG), M. D., b. at Tübingen, Germany, June 12, 1709; was educated in the University of Tübingen, and took his medical degree in 1727; became professor of chemistry and natural science at St. Petersburg 1731; journeyed in Siberia 1733–43; was made professor of botany at Tübingen 1749; d. there May 20, 1755. Author of *Travels in Siberia* (4 vols. 1751–52) and *Flora Sibirica* (4 vols. 1749–70).—His nephew, JOHANN FRIEDRICH GMELIN, M. D., b. at Tübingen Aug. 8, 1746; graduated in medicine 1769; became professor of botany, etc. at Tübingen 1771, of medicine 1775; professor of medicine at Göttingen 1778. Author of many works on botany, chemistry, and toxicology. D. at Göttingen Nov. 1, 1804.—SAMUEL GOTTLIEB GMELIN, M. D., also a nephew of J. G. Gmelin, was b. at Tübingen June 23, 1745; took his medical degree 1766; became botanical professor at St. Petersburg, and travelled (1768–74) in S. and S. E. Russia; was taken prisoner in the Caucasus, and d. July 27, 1774, in consequence of the ill-treatment he received. His *Historia Fucorum* (1768) and some volumes of travels have been published.—LEOPOLD GMELIN, M. D. (son of J. F. Gmelin), b. at Göttingen Aug. 2, 1788; studied at Göttingen, Tübingen, Vienna, and in Italy; was chemical and medical professor (titular and ordinary) at Heidelberg 1817–51. Author of *Handbuch der Theoretischen Chemie* (3 vols. 1817–19) and a *Lehrbuch der Chemie* (1844), and also made famous experiments upon digestion. D. at Heidelberg Apr. 13, 1853.—Other distinguished members of this family were JOHANN CONRAD (1707–59), a physician, author, and pharmaceutist of Tübingen, elder brother of J. G. Gmelin; and PHILIPP FRIEDRICH, younger brother of the same (1721–68); held professorships of botany, chemistry, and medicine in Tübingen, and was author of many scientific monographs. The botanists of this name are commemorated by the Linnæan genus *Gmelina*, plants of the order Verbenaceæ.

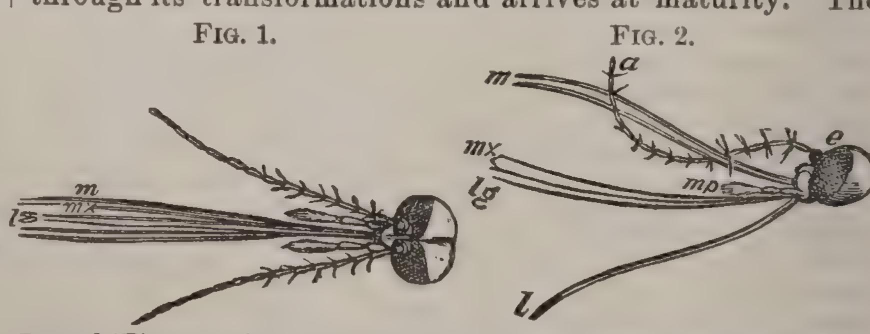
Gmünd, town of Würtemberg, on the Rems. It has an asylum for the blind and for deaf mutes, and celebrated manufactures of jewelry. Pop. 10,739.

Gmun'den, town of Austria, in the province of Upper Austria, is beautifully situated at the Lake of Traun or Gmunden, where the Traun issues from it, and is the seat of several civil, ecclesiastical, and educational institutions. The salt-works of the vicinity are important. Pop. 6533.

Gna'denhütten [Ger., "tents of grace"], a post-v. of Clay tp., Tuscarawas co., O., on the Pittsburg Cincinnati and St. Louis R. R. This was once a celebrated Moravian village of Christian Indians, of whom 100 were cruelly slain by the whites Mar. 8, 1782. Pop. 284.

Gnat. The gnat or mosquito differs from other two-winged flies (Diptera) by the long and slender mouth-parts (Figs. 1 and 2). These are adapted for probing and puncturing the flesh of its victim. The young, or larvæ (Fig. 3), are aquatic, living in pools. They are cylindrical, with the head and succeeding segment much enlarged, and breathe by means of a bunch of hairs radiating from a long tubercle situated at the end of the body, and connecting with the internal respiratory tubes (tracheæ). They remain most of the time at the bottom, feeding upon decaying matter, and are thus very beneficial as scavengers. In the pupa state they take no food, and breathe by a respiratory tube (Fig. 3, B, *d*) situated on the greatly enlarged thorax. They are very active in this state, jerking up and down in the water, aided by a pair of broad caudal leaves (Fig. 3, C). The long cylindrical eggs are laid in little packets which float on the surface of standing water. In four weeks after hatching the insect passes through its transformations and arrives at maturity. The

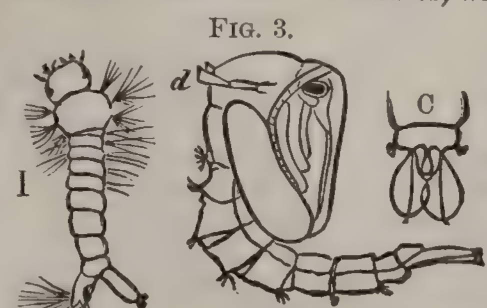
FIG. 1. FIG. 2.



Dorsal (Fig. 1) and side (Fig. 2) view of the head of the female, enlarged: *a*, antennæ; *m*, mandibles; *mx*, maxillæ; *lg*, lingua; *l*, labium, in which the other parts are ensheathed.

females alone bite. The males, which may be distinguished from the other sex by their bushy antennæ, seldom visit our houses, and do not bite. It is a question whether the bite of the mosquito is poisonous. No poison-gland has yet been found in the head, and it is generally thought that the inflammation and swelling following the bite of one of these insects are due to the irritation set up by the slightly barbed jaws, and perhaps the saliva is slightly acrid. About

FIG. 3.



A, larva; *c*, respiratory tube and radiating hairs; B, pupa; *d*, thoracic respiratory tube; C, lamellæ at end of body of the pupa, enlarged.

thirty American species of *Culex*, the genus to which the gnat belongs, are described in various works.

A. S. PACKARD, JR.

Gnei'senau, Neidhart von (AUGUST), COUNT, b. at Schilder, Saxony, Oct. 28, 1760; served with the German mercenaries in the American Revolutionary war; became in 1789 a captain of Prussian troops; defended Colberg against the French 1806; was dismissed in 1809 at the suggestion of Napoleon I.; was chief of staff and chief quartermaster to Blücher; conducted the retreat after Lützen 1813, and after the Leipsic campaign was made lieutenant-general; served in France 1814, and was made a count; contributed much to the final success at Waterloo by his strategic skill after the affair at Ligny; was made governor of Berlin 1818; general field-marshal 1825; led an army in Prussian Poland during the Polish insurrection of 1831. D. at Posen Aug. 24, 1831. He was an able officer and a man of liberal principles.

Gneiss, a metamorphic, stratified rock, crystalline-granular in texture and foliated in structure, composed essentially of quartz, feldspar, and mica; the latter ingredient is often replaced by hornblende, thus giving rise to hornblendic or syenitic gneiss.

Gne'sen, town of Prussia, in the province of Posen. It has a cathedral, and is the residence of the archbishop of Gnesen-Posen (Roman Catholic). Pop. 7995.

Gnome [Gr. γνώμων, "wise"], in the Rosicrucian and cabalistic doctrine, a spiritual being residing within the bowels of the earth, guarding mines of precious metals, gems, and hidden treasures. There were male and female gnomes, generally grotesque dwarfs, who were rarely seen by men.

Gnom'ic Poets [Gr. γνώμη, a "sentiment"], in Greek literature, a name applied to those didactic poets whose compositions are characterized by aphorisms and short, proverb-like moral precepts (*gnomai*). Pre-eminent among the gnomic poets are Theognis, Solon the lawgiver, Phocylides, and Simonides of Amorgos. Among the best-known editions of the gnomic poets (of some of whom considerable fragments remain) are those of Boissonade (1832), Bekker (1815), Brunck (1784), and Sylburg (1651).

Gnos'tics ("men of knowledge;" Gr. γνῶσις), a name applied to numerous schools of heretics in the early Christian Church. In the New Testament *gnosis* is simply (as in 1 Cor. xii. 8) the more profound apprehension of Christian truth. In Pseudo-Barnabas (107–120 A. D.) it means allegorical interpretation. Finally, it came to denote a system of excessive and fanciful religious speculation. As to its origin, it was in part a reaction of the freer pagan mind against the narrowness and poverty of Ebionism, but also, and more essentially, an inevitable product of the speculative genius of the Gentile world in its first exciting contact with the stupendous facts and doctrines of Christianity. Its elements were derived from three sources: Hellenistic idealism, Oriental pantheistic naturalism, and the Christian revelation. It did not begin as a heresy, but soon became such in undertaking to answer unanswerable questions. These questions are suggested by Tertullian (*De Præscriptione Hæreticorum*, § 7): "Unde malum, et quare? et unde homo, et quomodo? et quod proxime Valentinus proposuit, unde Deus?" Its grand leading question was in regard to the origin of evil: πόθεν τὸ κακὸν? But, as Niedner says, this question was only one of several. Its theme was really the whole "world-process." This process embraces the three problems of creation, sin, and redemption. The solutions offered were in form exceedingly diversified; the systems many and various. In classifying these systems the ingenuity of critics has been severely taxed. The more noted classifications are as follows:

I. GIESELER'S.—(1) The Alexandrian Gnostics: Basilides, Valentinus, Ophites, Antitactes, Prodiciani; (2) Syrian: Saturninus, Bardesanes, Tatian: (3) Marcion and his school. This geographical classification is not at all felicitous.

II. RITTER'S.—(1) Dualistic: Saturninus, Basilides, Hermogenes, and others; (2) Idealistic: Valentinus, Marcus, Ptolemæus, and others.

III. NEANDER'S.—Originally, (1) Judaistic; (2) Anti-Judaistic. Subsequently modified by subdividing No. 2, so as to stand, (1) Judaistic: Cerinthus, Basilides, Valentinus and his school, Heracleon, Ptolemæus, Marcus, and Bardesanes; (2) Anti-Judaistic: (*a*) in sympathy with Paganism, the Ophites, Pseudo-Basilidians, Cainites, Carpocratians, Prodicians, Antitactes, Nicolaitans, Simonians; (*b*) dissevered from all earlier systems, Saturninus, Tatian, the Encratites, Marcion and his school.

IV. BAUR'S.—(1) Those who brought Christianity into closer connection with Judaism and heathenism: Basilides, Valentinus, Saturninus, Bardesanes, the Ophites; (2) those who made a strict separation of Christianity from Judaism and heathenism: Marcion and his school; (3) those who identified Christianity with Judaism, and opposed both to heathenism in the form of gnosis: the Pseudo-Clementines.

V. NIEDNER'S.—(1) Those who gave Christianity at once a place, and the highest place, among the religions of the world: (*a*) in its original form, Basilides, the Ophites, and the closely-allied Cainites and Sethites; (*b*) in its perfected form, Valentinus, Heracleon, Ptolemæus, and Marcus; (2) those who separated Christianity from its historic connection, and made it the first true revelation of God: (*a*) Marcion and his school; (*b*) the Syrians, Saturninus, Bardesanes, Tatian, and Apelles; (3) those who identified Christianity (*a*) with heathenism, the Carpocratians, Antitactes, and Prodicians, all licentious; (*b*) with Judaism, the Pseudo-Clementines.

On four points these systems all, or nearly all, agree: (1) God is incomprehensible. (2) Matter is eternal and antagonistic to God; or, as Basilides taught, if created by God, still conditions and limits the divine efficiency. (3) Creation is the work of the Demiurge, according to some, only subordinate—according to others, totally opposed to God. (4) The human nature of Christ was a mere deceptive appearance. The most elaborate system was that of Valentinus. The historic order was as follows: (1) the Simonians, 37 A. D. (Acts viii.); (2) the Nicolaitans, 96 A. D. (Rev. ii. 6); (3) Cerinthus, near end of first century; (4) the Ophites, very early; (5) Basilides at Alexandria, 125–140 A. D.; (6) Valentinus, 138–160 A. D.; (7) Marcion, 150 A. D.; (8) Bardesanes, 170 A. D.; (9) Hermogenes, about 200 A. D. Gnosticism reached its highest bloom about 150 A. D. In the third century its creative energy was gone. In the fourth century it was powerless. And in the sixth century only remnants of it remained. Severe laws against the Gnostics were enacted in 530 A. D. (See *Cod. Just.* 1:5: 18, 19, 21.) The rapidity with which the system waxed and waned is explained by the fact that it was an aristocratic heresy. The masses neither relished nor understood it. It was only a speculation of the few, and the aim was not to found sects, but schools. Only the Marcionites organized separate churches. (The principal original sources of information are—IRENÆUS, *Adversus Hæreses*, 182–188 A. D.; TERTULLIAN, *Adv. Marcionem* and *Adv. Valentinianos*, c. 200 A. D.; HIPPOLYTUS, *Philosophoumena*, 222–235 A. D. (the greater part of it recently recovered); EPIPHANIUS, *Panarium*, c. 400 A. D.; also quotations in EUSEBIUS, and the *Pistis Sophia*, a recently (1853) discovered Gnostic poem. Able monographs on the subject have come from NEANDER (1818), BAUR (1835), MATTER (1828–45), ROSSEL (1847), LIPSIUS (1860), and others.) R. D. HITCHCOCK.

Gnu [a Hottentot word], or **Horned Horse,** the *Connochætes gnu*, the **Wildebeest** of the colonists, an antelope which approaches in character the ox tribe, and has a flowing mane and tail of white hair, resembling

The Gnu.

those of the horse. This species is found in South Africa but other species of the genus abound probably almost as far N. as the Great Desert. They have clumsy curved

horns and bristly hairs about the mouth. The name *wildebeest* is given on account of the habit the animal has of frantically rushing about in a most violent manner. It is very fleet and timid.

Go'a, the name of a territory of Hindostan, on the Malabar coast, situated between lat. 14° 54′ and 15° 45′ N., and belonging to Portugal. Area, 1066 sq. m. Pop. 313,262. It produces rice and pepper, but requires an annual support of £71,920 from Portugal. Cap. Panjim, or New Goa.

Goa, town of Hindostan, on the Malabar coast, in lat. 15° 30′ N. It was formerly the capital of the Portuguese dominions in India, and a magnificent city, but it is now decaying. In the beginning of the eighteenth century it was deserted on account of cholera. Pop. 4000.

New Goa, 6 miles W. of Goa, is the residence of the Portuguese governor-general and of the archbishop of Goa. It has handsome churches and other public buildings, and has been the capital since 1758. Pop. 10,000.

Goalpa'ra, a district of the Bengal presidency, British India, lying W. of Assam, N. of the Garrow Hills, S. of Bootan, and traversed by the river Brahmapootra. It has a hot, wet, and sickly climate and a productive soil. Area, 4430 square miles. Cap. Goalpara. Pop. 442,761.

Goat (*Capra*), a genus including the goats proper. It is characterized by hollow, annulated horns, which are directed upward and backward. There are eight cutting teeth in the lower jaw, and none in the upper. The chin is bearded in the male. This genus has no representative in America, though in the domestic state the goat is found in all parts of the world. The single American species which so long was regarded as the Rocky Mountain *goat* is properly an antelope. The wild goat (*C. ægragus* Gm.) roams in extensive herds on the Persian and other mountains of the eastern hemisphere; it is regarded as the parent-stock from whence all the domestic varieties have sprung. The ibex (*C. ibex*) is a notable example, distinguished by its large, square, and transversely ridged horns. The Caucasian ibex (*C. Caucasica*) has similarly large horns of a triangular form. The Cashmere goat of Thibet is the most valued; a delicate gray wool grows under the longer silky hair; about two ounces of this is obtained from one individual, and is the much-prized material of the cashmere shawls. The goat exhibits a striking difference of habit as compared with the sheep. Buffon has given a graphic description, in which he regards the former as being "superior both in sentiment and dexterity." The milk of the goat is sweet, nutritive, and is also esteemed as medicinal. In ancient times the skin was valued for clothing; at present it is a favorite and familiar item in the manufacture of the best turkey or morocco leather, and, in the young state, of the better class of gloves. J. B. Holder.

Goat Island, an island which divides the current of the Niagara River at the Falls. It belongs to Niagara tp., Niagara co., N. Y. Area, 70 acres. It is 900 feet distant from the American and 2000 from the Canadian shore. It is connected with the former shore by a substantial bridge.

Goat'sucker, the *Caprimulgus Europæus*, a passerine bird of the Old World, the type of the family Caprimulgidæ, to which belong the whip-poor-will, the chuck-wills-widow, the night-hawk, and several other birds of the U. S., all of which are sometimes collectively called goat-suckers. The first bird mentioned above gets his name from the popular belief that he sucks the cow's and the goat's milk, infecting the animal with a deadly disease. It is also called fern-owl, dor-hawk, night-jar, etc.; the latter name coming from a jarring or purring sound which it utters. It is the subject of many popular superstitions in the folk-lore of many nations.

Gobelins Tapestry, the most highly valued grade of carpet, manufactured only in the Gobelins factory, in the Faubourg St. Marcel, Paris, in the Rue Mouffetard. The carpets are all of rug-like make, and are works of art, not of artisanship. Many of the designs are pictured scenes in colors. The workmen (or rather artists) are about 120 in number. The colored silks and wools which they employ are passed into the work by means of wooden needles. The result is a faithful copy of the pictured pattern. Each artist averages less than 1¼ square yards per annum. Some Gobelins carpets cost from $30,000 to $40,000, and require from five to ten years for the completion. Since 1791 none have been sold. They are mostly presented by the French government to foreign courts. The Gobelins factory was first called *Gobelin's folly*. It was an unsightly structure, built by a Belgian wool-dyer of the fifteenth century, one Jehan Gobeelen. Here the brothers Cannaye, and afterwards others, carried on carpet-making with success. In 1662, Louis XIV. made it a royal manufactory. In 1826 another royal carpet-factory, La Savonnerie, established in 1615, was joined to it. May 24, 1871, the Communists burned a part of the factory.

Go'bi, Co'bi, or **Sha'mo,** is a wide tract in Central Asia, between lat. 40° and 50 N., and lon. 90° and 120° E. It forms a table-land 3000 feet above the level of the sea, between the mountain-ranges of Altai and Kuen-Lun, with only small depressions and elevations. Its western part is mostly covered with fine sand, drifting before the wind, and forming an undulating surface which reminds the traveller of the waves of the ocean. The eastern part is mostly naked rocks. It is a desolate region where the winter is nine months long; frost and snow may occur in July, and the short summer, with its intense heat, creates but an oppressive atmosphere. Extensive steppes, rising towards the mountainous borders, afford pasture for the flocks of the nomadic tribes of Mongolians who wander in these wilds.

Go'by (*Gobius*), a genus of small marine fishes of the

The Black Goby.

family Gobiidæ. They have no swim-bladder, and live mostly upon muddy bottoms, where they burrow in holes. Some of them build nests for their young. The *Gobius carolinensis* is a typical species found on our Atlantic coasts. The black goby (*Gobius niger*) and other European species are rather larger. These fishes are prized for the aquarium, in which their nesting can be readily observed. More than 100 species are known.

God. It is proposed to state briefly what is known of God under the following heads: (1) Definition of the term; (2) proofs of his existence; (3) his names; (4) attributes; (5) existence as Three Persons; (6) relation to the world; (7) works; (8) prevalent antitheistic theories.

I. In consequence of the predominance of Christian ideas in the literature of civilized nations for the last eighteen centuries, the word *God* has attained the permanent and definite sense of a self-existent, eternal, and absolutely perfect free personal Spirit, distinct from and sovereign over the world he has created.

II. Proofs of His Existence.—The word nevertheless continues to be used with a wide latitude of meaning. The full conception associated with it by Christians is of course largely the product of revelation. On the other hand, the general idea of God as a being upon whom we depend, and to whom we are responsible, and for whose communion we long, is innate in human nature—*i. e.* it is universally generated and sustained in human consciousness by the laws of our nature. This fact is by some attributed to a "God-consciousness" (*Schleiermacher*); by others to a direct intuition of God (*Schelling, Cousin*); and by others to an innate religious sentiment or instinct. It bears all the marks of an intuitive truth or first principle of reason—*e. g.* universality and necessity—since it reappears and persists in all normal conditions of consciousness. (See Cicero, *Natura Deorum*, and Gillett, *God in Human Thought*, etc.) This general idea of God, native to the human soul, has been moulded into various forms by tradition and speculation, and perfected by revelation. All the "arguments" for the being of God are intended either to quicken and confirm this innate idea, or to expand and render it definite by showing *what* God is, as well as proving *that* he is. (See Dr. McCosh's *Intuitions of the Mind*, pt. 3, b. 2, ch. 5, § 2.)

A. *The Ontological Argument* has been presented in various forms: 1. Anselm, archbishop of Canterbury (1093–1109), in his *Monologium and Proslogium*, states this argument thus: We have an idea of an infinitely perfect being. But real existence is a necessary element of infinite perfection. Therefore, an infinitely perfect being exists, otherwise the infinitely perfect as we conceive it would lack an essential element of perfection. 2. Descartes (1596–1650), in his *Meditationes de prima philosophia*, prop. 2, p. 89, states it thus: The idea of an infinitely perfect being which we possess could not have originated in a finite source, and therefore must have been communicated to us by an infinitely perfect being. He also, in other connections, claims that this idea represents an objective reality, because (1) it is pre-eminently clear, and ideas

carry conviction of correspondence to truth in proportion to their clearness; and (2) it is necessary. 3. Dr. Samuel Clarke in 1705 published his *Demonstration of the Being and Attributes of God.* He argues that time and space are infinite and necessarily existent, but they are not substances. Therefore, there must exist an eternal and infinite substance of which they are properties. 4. Cousin (*Elements of Psychology*) maintained that the idea of the finite implies the idea of the infinite as inevitably as the idea of the "me" implies that of the "not-me." (Dr. Shedd's *Hist. Christ. Doc.*)

B. *The Cosmological Argument* may be stated in the form of a syllogism: Every new thing and every change in a previously existing thing must have a cause sufficient and pre-existing. The universe consists of a system of changes. Therefore the universe must have a cause exterior and anterior to itself. It has been objected that our "causal judgment" rests solely on experience, which gives only invariable sequence, and not efficiency. (See MILL's *Logic*, p. 203, and HUME's *Treat. on Hum. Nature*, pt. 1, § 1.) On the contrary, the "causal judgment" is a self-evident or intuitive truth or law of reason, presupposed in all experience, bearing the marks of universality and necessity. Moreover, an endless series of effects supported by no absolute cause is infinitely less rational than any single uncaused effect. The mind can rest only when it has reached ultimately an uncaused first cause. (DR. MCCOSH's *Intui. of the Mind*, pt. 2, b. 3, ch. 2, § 8.)

That the universe is a system of changes is proved and illustrated by all the sciences, especially by geology, zoology, and anthropology. John Stuart Mill, in his *Essay on Theism*, argues that the conclusion from the recently established doctrine of the "conservation of force" is, that the matter and force of which the universe consists are a constant quantity, assuming various forms, but themselves without beginning or cause. But the fact is, that the theory of cosmical development from the days of Laplace to the present involves the constant dispersion of physical energy, the sun and planets passing from a state of heated gas to frozen and lifeless solidity; and since this dispersed and lost energy is finite, it must have commenced in a spontaneous cause—*i. e.* a personal volition.

C. *The Teleological Argument*, or argument from design or final causes, is as follows: Design, or the adaptation of means to effect an end, implies the exercise of intelligence and free choice. The universe is full of traces of design. Therefore, the "First Cause" must have been a Personal Spirit. This argument has been elaborated ever since the time of Socrates. (*Memorabilia*, b. 4.) Bacon says: "I had rather believe all the fables in the Legend, and the Talmud, and the Alkoran than that this universal frame is without a mind." "Final causes" have been repudiated as a principle of interpreting nature by Hume, and under his influence by a class of modern naturalists. He maintained (see *Dialogues on Nat. Relig.*) that the judgment which infers a designing cause from adjustments adapted to effect an end rests wholly upon experience; and as we have no experience of world-making, we have no right to infer a world-maker. But this judgment is intuitive, universal, and necessary. Its force is admitted by J. S. Mill. (*Essay on Theism.*)

The new doctrine of the "survival of the fittest" is urged by Herbert Spencer, Darwin, and many naturalists as an alternative more rational than that of "design." This at present is admitted by its advocates to be a bare hypothesis, demanding many postulates, and leaving many broken links; *e. g.* the "first germs," the introduction of sensation, the beginnings of organs, intelligence, volition, moral obligation, *necessary* ideas, etc. (See arts. A CRITICISM ON DARWINISM, by J. H. SEELYE, and EVOLUTION, by HENRY HARTSHORNE.) (See WALLACE, *Natural Selection;* MIVART, *Genesis of Species;* ULRICI, *Review of Strauss;* ALEX. WINCHELL, *Evolution;* J. W. DAWSON, *Earth and Man;* DR. MCCOSH, *Christ. and Positivism.*) The design everywhere manifest in the inorganic, organic, instinctive, and rational provinces of the universe has been fully demonstrated in the *Bridgewater Treatises*, Paley's *Nat. Theol.*, Butler's *Analogy*, McCosh's *Typical Forms*, etc., Buchanan's *Faith in God*, etc., Tulloch's *Theism*, etc.

D. *The Moral Argument* derived from the constitution and history of man, and his relations to the universe: 1. All our knowledge rests upon consciousness. We begin with the knowledge of self as a conscious, intelligent, spontaneous cause; and this is involved in every act of sense, perception, reflection, recollection, etc. From knowledge of self as (1) spontaneous cause, (2) intelligent, we come to recognize the absolute cause discovered by the "cosmological" and "teleological" arguments as a personal spirit. We are under the necessity of referring all the phenomena of the cosmos ultimately to mind. 2. The phenomena of conscience necessarily imply a sovereign personal will which binds ours. The hypothesis of the associationists (Spencer, Mill, etc.), that all our intellectual and moral judgments are transformed sensations, is absurd, because (1) they are universally the same, (2) incapable of analysis, (3) necessary, (4) sovereign over all impulses, etc. 3. Man is a religious being. The instinct of prayer and worship, the longing for and faith in divine love and help, are inseparable from human nature under normal conditions as known in history. 4. The entire history of the race, as far as known, discloses the presence and influence of a wise, righteous, and benevolent moral ruler and educator of men and nations. 5. The compact and mutually supporting system of divine interventions and culminating revelations recorded in the Christian Scripture, reaching through 2000 years, is the true vertebrate column of human history, upon which all human progress in civilization or science rests.

III. THE NAMES OF GOD: Goth. *Guth;* Ger. *Gott;* Per. *Choda;* Hind. *Khoda.* Some derive the English word from "good," from its similarity of form, and make it an expression of the divine goodness. Since, however, its various cognates could not have this origin, others derive it from the Persic *Choda—dominus,* "possessor." The Latin *Deus* and Greek Θεός have been commonly derived from the Sanscrit *div,* "to give light." But Curtius, Cremer, and others derive it from θεσ in θέσσασθαι, "to implore." Θεός, then, is "He to whom one prays." The Hebrew *El*, of pre-historic Semitic origin, is from אוּל, "to be strong." From this (or, as some say, from the obsolete אָלַהּ, "to worship") come *Elohim* (pluralis *excellentiæ*) and *Eloah* (poetic form), and Arabic *Al* or *Allah*. *Elohim* is used by Moses consistently as a general name for God, as the God of all nations, and applied to false gods, while *Jehovah* (of doubtful etymology, perhaps from הָוָה, "to be") is always used for the peculiar covenant God of Israel, the revealed God and Redeemer. In reading the Scriptures the Jews always substituted *Adonai, dominus,* κύριος, for *Jehovah.* Hence, the English Bibles always substitute for it LORD in capitals, and the French *L'Eternel,* and the German HERR. In the Christian Scriptures God also calls himself "Spirit" (John iv. 24), "Light" (1 John i. 5), "Love" (1 John iv. 8), and "Father" (Rom. viii. 15, 16).

IV. THE ATTRIBUTES OF GOD are to be distinguished (1) from "predicates" of God in the concrete, marking his relation to his creatures as Creator, Preserver, etc.; (2) from "properties," which belong to each divine Person in distinction from the others. The attributes are the modes of existence and of action of his substance. They are the very substance itself, existing and acting in the various modes determined by its nature. They differ among themselves, not as distinct things, but as distinct tendencies and modes of existence and action of the same thing.

The sources of our idea of God are found in his revelation of himself in the human soul, in physical nature, in history, and in the Scriptures. From these materials we construct our idea (1) by the way of negation, denying all imperfections; (2) by the way of eminence, affirming of him the possession of every excellence in absolute perfection; (3) by way of causation, attributing to him all the perfections discovered in his works. The attributes of God have been variously *classified:* (1) According to the order in which we arrive at the knowledge of them—*e. g.* by way of negation, or by way of eminence, or by way of causality, etc.; (2) according as they pertain to the substance, the intellect, or the will of God; (3) according to their nature as moral or natural (non-moral); (4) as communicable or incommunicable; (5) as absolute or relative.

1. *The Divine Unity.*—Monotheism, the primitive religion, traces of which are found in the Hindoo Veds, soon gave place through nature-worship to pantheism and polytheism. It has been recovered only imperfectly by philosophers of the first rank like Plato, and has been established as a popular faith only through the Mosaic and Christian revelations. It is proved (1) There can be but one necessarily existent being, and but one infinite and absolute of the same order. (2) The unity of the cosmos proves the unity of presiding intelligence. (3) Our moral consciousness testifies that the source of all moral authority must be single and unique.

2. God is an *infinite* and *absolute* being. The transcendentalists, on the one hand, and Sir W. Hamilton, Mansell, and H. Spencer, on the other, understand by these predicates a being including all being, and excluding all relation to other being. Hence, the infinite and the absolute can neither be a person, nor conscious, nor a cause nor an object of knowledge; all of which imply limitation and relation. But the true idea of the "absolute" is the finished, and that which exists in no relation to anything not determined by its own will. And the true idea of the "infinite" is that which admits of no increase after its kind. (SIR W. HAMILTON, *Discussions and Lectures;* MANSELL, *Lim. of Rel.*

Thought; McCosh, *Intuitions;* Mill, *Review of Hamilton;* Porter, *Human Intel.*, pt. 4, ch. 8; Hickok, *Creator and Creation*, ch. iii.) *Anthropomorphism* is right and necessary when limited to the application to God in an infinite degree of the spiritual excellencies of man. But it is used in a bad sense when we attribute to God any likeness of our bodily parts or passions, or conceive of him as subject to our imperfections or limitations.

3. God is an absolute, perfect, *personal* Spirit. This, as shown above, is the result of the whole convergent testimony which establishes the fact of his existence. If not this, we have no evidence that he is anything.

4. He is *eternal.* His existence transcends all the limits of time. Eternity conceived of by us, as either *a parte ante* or *a parte post*, is really *una, individua, et tota simul.*

5. Absolutely, God is infinite in his *immensity*, transcending all the limits of space; relatively, he is *omnipresent* in his essence, as well as his knowledge and power to all his creatures.

6. He is *immutable*, as to his essence, his perfections, and his will.

7. His *knowledge* has no limits. He knows himself and all things possible by the light of his pure reason. He knows all things actually existent, whether past, present, or future, in the light of his purpose. He knows all things in their essential being, and in all their relations, by one all-comprehensive, timeless intuition. Wisdom is the perfect use which he makes of his knowledge and his power to effect his ends.

8. He is *omnipotent*—that is, the causal efficiency of his will has no limit other than his own perfections. Second causes are necessary to him only relatively to his own purpose.

9. The *goodness* of God, existing in the forms (1) of benevolence to all sentient creatures, (2) love to persons, (3) mercy to the miserable, and (4) grace to the ill-deserving, has no limit outside of his own perfections. This is as good a world as was consistent with the end God had in view. (Pascal's *Thoughts;* Leibnitz, *Theodice.*) J. S. Mill in his *Essay on Theism* objects that if God is infinitely good, he cannot in consistency with facts be infinitely powerful. But he forgets (1) the glory of the Creator, and not the good of the creature, must be the last end; (2) the *ultimate* reasons of facts known to us lie out of our reach, except they are revealed; (3) the grand fact of sin, when once admitted, overthrows all his objections.

10. God is absolutely *true*—*i. e.* self-consistent and reliable.

11. He is absolutely *righteous.* This involves (1) holiness, or absolute subjective moral perfection; (2) justice, when he is regarded as standing to his intelligent creatures in the relation of moral governor. It is distinguished as rectoral and distributive, and is the immutable ground of rewards and punishment.

12. God's *will* is the organ of his infinite perfections. It is free, in the sense of being a rational spontaneity. It is sovereign, inasmuch as it is conditioned upon nothing save his own all-perfect nature. Hence, God is an absolute sovereign, having an unconditioned power to dispose of and command his creatures as his own perfections suggest. His will is to them an ultimate rule of right, in his "positive" commandments creating obligation, and with respect to essential morality expressing and giving effect to the law of absolute right resident in his own nature. (See Cumberland, *De Legibus Naturæ;* Cudworth's *Intellectual System.*)

V. The One God Exists as Three Hypostases or Persons.—Schelling says: "The philosophy of mythology proves that a trinity of divine potentialities is the root from which have grown the religious ideas of all nations of any importance;" *e. g.* the Hindoo Trimurti, Brahma, Vishnu, and Shiva. This shows that the Christian doctrine of the Trinity, however original and unique, has a basis in man's religious nature. Abstract Mohammedan and Unitarian monotheism conceives of an isolated, unsocial God, existing from eternity alone, whose urgent affections and infinite energies remain inactive until the advent of creation affords them an object. On the other hand, the Tripersonal God of Christian revelation has within the infinite depths of the Godhead been eternally exercising upon adequate objects those unbounded perfections which can have only an inadequate field of demonstration in a created universe. If God *is* love, he must have an eternal and infinite object to love. (Christlieb's *Modern Doubt.*)

A. *The Biblical Doctrine of the Trinity.*—1. *There is but One God.*—The monotheism of the Old and New Testaments is unquestionable (Deut. vi. 4; 1 Cor. viii. 4). This is expressed by saying the Three Persons are the same in substance, numerically. 2. Father, Son, and Holy Ghost are each that one God. To each divine names, attributes, works, and worship are applied (Jer. xxiii. 6; John ii. 24, etc.). 3. Nevertheless, they are always set forth in speech and action as distinct persons. They use reciprocally the personal pronouns (John xi. 41, etc.). They regard each other objectively, loving, speaking to, and acting through and upon each other as personal agents (John xiv. 31, and xvii.). 4. The Father is the fountain of Godhead, self-existent as person as well as substance. The Son is eternally springing from the person of the Father, and the Spirit from the persons of the Father and of the Son, in virtue of the spontaneous yet necessary constitution of their nature, whereby they receive the indivisible common nature in its fulness. (1) The terms Father and Son are reciprocal. The Son is eternally "begotten" by the Father, his "word," "image," "form," the "radiance of his glory." (2) The term "Spirit" expresses the personal, not the substantial, nature and relations of the Third Person. He is the personal Breath of the Father and of the Son, proceeding from and returning to both. (3) They eternally love one another, take mutual counsel, and act together, as the coexecutors of their common purpose, in a system of distributed yet correlated functions. 5. In the economies of creation, providence, and redemption the order of procedure is always *to* or *from* the Father, *through* the Son, *by* the Spirit. All actions *ad extra* may be affirmed of either person or of the Godhead absolutely. But by way of eminence creation is ascribed to the Father, redemption to the Son, and sanctification to the Spirit. The Father is the absolute from and to whom all movement originates and ends. The Son is the Revealer and Mediator, the Spirit is the Executive of God.

B. *The Historical Definition of the Trinity.*—The Ante-Nicene Church was united in believing that Father, Son, and Holy Ghost are each eternal, supernatural divine Beings, and yet the Son as decidedly inferior to the Father, and the Spirit to the Son. Origen admitted the eternal generation of the Son, but held he was different from and dependent upon the Father. Irenæus, the disciple of Polycarp, and the Western Church generally, followed more faithfully the doctrine of the apostle John. The two antagonist principles, (*a*) the unity of God and (*b*) the distinct personality and the perfect equality of the Three divine Hypostases, were never accurately adjusted and defined before the great œcumenical councils of Nice (325) and Constantinople (381 A. D.). Each principle determined a tendency, and developed heresies.

1. *The principle of the divine unity* was maintained at the expense of the denial of the complementary elements of the revealed doctrine: (1) By the Humanitarians, who held that Christ was a mere man—*e. g.* the Ebionites, an heretical Jewish-Christian sect; the Alogians; the Theodotians and the disciples of Paul of Samosata (260), who denied the personality of the Logos, or divine principle dwelling in the man Jesus. (2) By the Patripassians (Praxias, Noetus, etc.), whose doctrine was matured by Sabellius (268), who held that the Godhead, existing with no intrinsic distinctions, manifests itself externally and successively in different forms; as the Father under the old dispensation, the Son in the incarnation, and the Spirit in inspiration, etc.

2. *The principle of the distinct personality* of the divine Persons, at the expense of their unity and equality: (1) By the Arians (from Arius of Alexandria, 336), who held that the Son is the first and greatest being created by the will of the Father, and his instrument in creating the Spirit, and subsequently all other beings. They expressed this by saying the Son was *hetero-ousion*, of a different nature from the Father. (2) The Semi-Arians, or Eusebians, represented by Eusebius of Cæsarea (270–340), held that the Son was eternally begotten by the Father, but that he is of a different though similar essence—*homoi-ousion.*

3. *The principle of distinct personality and equality*, at the expense of the divine unity, was maintained by the Tritheists, John Philoponus and John Ascunages (about 550), and Dean Sherlock (1690) in his *Vind. Doc. Trin.*

The Council of Nice was convened by the emperor Constantine in 325 to settle these questions by a thorough analysis and definition of the doctrine. There were present three parties: The Arians, led by Arius, who maintained the difference of essence, *hetero-ousion;* the Semi-Arians, led by Eusebius, who maintained the likeness of essence, *homoi-ousion;* the orthodox, led by Athanasius the Great († 373), who successfully maintained that Father and Son were of the same numerical substance, *homo-ousion.* This decision was expressed in the Creed of Nice, afterwards completed at Constantinople (381) and Toledo (589). The points defined were: (1) There is but one numerical substance, *οὐσία, φύσις, substantia*, in the Godhead. (2) This substance eternally exists as three equal *hypostases, subsistentiæ, persons.* (3) Each person is distinguished from the others by a *character hypostaticus*, or personal property peculiar to himself. (4) The Father eternally begets the Son, and the Spirit eternally proceeds from the Father and the Son. The clauses relating to the Holy Ghost ("the Lord, the giver of life, who," etc.) were added by the Coun-

cil of Constantinople. The "Filioque" clause was added by the Western Church at the Council of Toledo, and rejected by the Eastern Church. The doctrine was restated with consummate skill in the Creed, "*Quicumque vult,*" falsely ascribed to Athanasius, and has been adopted by all historical churches. Through political intrigues, Arianism prevailed widely in the East, partially in the West, from 325 to the accession of Julian (361), and was finally expelled upon the accession of Theodosius I. (379). (See BISHOP BULL'S († 1710) *Defensio Fid. Nicænæ;* DORNER'S *Hist. Per. Christ.*, Clark, Edin.; NEANDER and SCHAFF'S *Church Histories;* DR. SHEDD'S *Hist. of Ch. Doc.;* BISHOP HEFELE'S *Hist. of Christian Councils to 325,* Clark, Edin.)

VI. GOD'S RELATION TO THE WORLD.—In opposition to the pantheistic and deistic false views (below defined), the Christian view of God's relation to the universe includes the following points: 1. That God is a free moral person, transcending the universe, and acting upon it *ab extra* in the exercise of his *potestas libera.* 2. God is nevertheless personally present to every atom of creation through each moment of duration, in his essence and in the free exercise of all his perfections, sustaining and co-working with every creature in every event in the exercise of his *potestas ordinata.* 3. The capital distinction is made between the physical and the moral order. The former, God administers in the mode of fixed laws and forces inherent in the things themselves. The latter he administers through ideas, motives, and other moral and spiritual influences, brought to bear on the moral natures and free wills of his subjects. 4. As an infinitely perfect intelligence, God has formed a plan from eternity, immutably determining in general and in particular the being, the attributes, and the relations of all creatures, and hence the fixed laws of the physical order, and the course of events in the moral order, and his own actions concurrent therewith. In this universal plan he has established a fixed subordination of parts to the whole, and of order to order. The end of the whole he has placed in the manifestation of his own glory. The end of the natural order is the perfect development of the moral order. "In him we live and move and have our being" (Acts xvii. 28); "Of him and through him and to him are all things" (Rom. xi. 36); "Thou madest man to have dominion over the works of thy hands; thou hast put all things under his feet" (Ps. viii. 6).

VII. THE WORKS OF GOD.—As an eternal, immutable Spirit, God is essentially active. His actions are distinguished as—

A. *Those which are Immanent.*—These are (1) his purposes, technically called "decrees," which relate to all events, and are infinitely wise, righteous, and certainly efficacious; and they subordinate all his works, and all their forces, laws, and historical development in time, to a purpose or final end. (2) The actions peculiar to each person of which the other persons are the objects—*e. g.* eternal generation, procession, etc.

B. *His Emanant Actions,* or those which terminate *ad extra.*—These are—1, *Creation,* which is a free act of God in time, executing an eternal purpose. Some, as Origen among theologians, and Cousin among philosophers, have held that creation is a necessary and eternal (timeless) act of God. The latter says (*Psychol.*, p. 44): "God is no more without a world than a world without God." The Church has always held otherwise. Creation is of two kinds: (1) *Creatio prima seu immediata,* the immediate creation by God of the elements of things *ex nihilo.* This was denied by all ancients and by pantheists, and first taught by revelation. (2) *Creatio secunda seu mediata,* or the origination by God, out of and by means of pre-existing material, of new genera and species—*e. g.* the body of man (Gen. ii. 7). This distinction was admitted by St. Augustine (*De Genesi ad Lit.*, v. 45), and by all theologians since. In the method of this "mediate creation" God has been evidently executing law, creating according to types in an ascending series. (ARGYLE'S *Reign of Law,* ch. 5; MCCOSH, *Typical Forms;* MIVART, *Gen. of Species,* ch. 12.)

2. *Providence,* which includes (1) *Preservation.* This some make identical with a continual creation. By some, as Strauss and other pantheists, preservation is regarded as a necessary unconscious eternal act. By others, as by Heidegger (*Corp. Theol.*, 7, 32) and by Pres. Edwards (*Orig. Sin,* pt. 4, ch. 3), the design of such language is only to emphasize the dependence of the creature. The Scriptures teach that while second causes have real being and efficiency, "they have their being in God." (2) *Government.* This (*a*) extends to all creatures and all their actions. (*b*) Its method is consistent with the perfections of God, and congruous to the nature of each creature and action concerned. (*c*) Its end is God's glory through the execution of purpose. (*d*) It comprehends every particular as a means to a general end; it is therefore for the same reason both general and special. (*e*) It extends to the sinful acts of men, to forbid, control, punish, and overrule them for good. (*f*) This universal government God accomplishes partly by means of the original properties of second causes and their primal adjustments, and partly by a present *concursus* of his own energy with them, guiding them in the direction predetermined by his purpose. Leibnitz (*New System of Nature*) taught the doctrine of pre-established harmony, whereby all events were predetermined from the creation by fixed sequences, alike in the separate spheres of the physical and spiritual. All theories of pantheistic tendency imply the sole agency of the Creator in all actions, the second cause being only the mode in which God appears, or the instrument by which his energy is immediately exerted. This is the tendency of Emmons, of the ultra-Calvinists of a former age, and of the extreme wing of the school of Schleiermacher.

3. *Redemption* of course involves from beginning to end supernatural intervention with the physical order for the sake of the moral order perverted by sin. It includes (1) the incarnation; (2) expiatory sacrifice; (3) resurrection; (4) dispensation of the Holy Ghost, including inspiration of Scripture, the regeneration and sanctification of individuals, and the preservation and historical development of his Church.

4. *Miracles.* (See art. MIRACLES.)

VIII. VARIOUS PREVALENT ANTI-THEISTIC THEORIES.—A. *Atheism,* according to its etymology, signifies the denial of the being of God. It was applied by the ancient Greeks to Socrates and other philosophers to indicate that they failed to conform to the popular religion. In the same sense it was applied to the early Christians. Since the usage of the term "theism" has been definitely fixed in all modern languages, "atheism" necessarily stands for the denial of the existence of a personal Creator and Moral Governor. Notwithstanding a belief in a personal God is intuitive, atheism is possible, as an abnormal state of consciousness induced by sophistical speculation or animal indulgence, as subjective idealism is possible. It exists in the following forms: 1, practical; 2, speculative. Again, speculative atheism may be—1, *Dogmatic,* as when the assertion is made either (1) that God does not exist, or (2) that the human faculties are positively incapable of ascertaining or of verifying his existence—*e. g.* Herbert Spencer. (*First Principles,* pt. 1.) 2, *Skeptical,* as when it simply doubts the existence of God, and denies the conclusiveness of arguments generally relied upon. 3, *Virtual,* as when (1) principles are maintained essentially inconsistent with the existence of God, or with the possibility of our knowing him—*e. g.* by materialists, positivists, absolute idealists; (2) when some of the essential attributes of the divine nature are denied, as by pantheists, and by Stuart Mill in his *Essays on Religion;* (3) when explanations of the universe are given which exclude (*a*) the agency of an intelligent creator and governor, and (*b*) the moral government of God and the moral freedom of man. Such explanations are made by Darwin, H. Spencer, and by necessitarians generally. In ancient times Epicurus (341–270 B. C.) and his school were really, though not professedly, atheists, and Lucretius (95–52 B. C.) was openly so. In modern times the deism of Voltaire and the Encyclopædists degenerated into the atheism of D'Holbach; at present, Moleschott, Feuerbach, the English secularist Holyoake, the disciples of Comte, and the extreme left of the Evolution school generally. (See ULRICI, *God and Nature* and *Review of Strauss;* STRAUSS, *Old and New;* BUCHANAN, *Modern Atheism;* TULLOCH, *Theism, etc.*)

B. *Dualism,* the opposite of *Monism* in philosophy, is the doctrine that there are two generically distinct essences, matter and spirit, in the universe. In this sense, the common doctrine of Christendom is dualistic. All the ancient pagan philosophers held the eternal independent self-existence of matter, and consequently all among them who were also theists were strictly cosmological dualists. The religion of Zoroaster was a mythological dualism designed to account for the existence of evil. Ormuzd and Ahriman, the personal principles of good and evil, sprang from a supreme, abstract divinity, Akerenes. Some of the sects of this religion held dualism in its absolute form, and referred all evil to ὕλη, self-existent matter. This principle dominated in the various spurious Christian Gnostic sects in the second century, and in the system of Manes in the third century, and its prevalence in the Oriental world is manifested in the ascetic tendencies of the early Christian Church. (See J. F. CLARKE, *Ten Religions;* HARDWICK, *Christ and other Masters;* NEANDER'S *Church Hist.;* PRESSENSÉ, *Early Years of Christianity;* TENNEMANN, *Manual Hist. Philos.*)

C. *Polytheism* (πολύς and θεός) distributes the perfections and functions of the infinite God among many limited gods. It sprang out of that nature-worship seen in the earliest Hindoo Veds, so soon and so generally supplanting

primitive monotheism. At first, as it long remained in Chaldæa and Arabia, it consisted in the worship of the elements, especially of the stars and of fire. Subsequently, it took special forms from the traditions, the genius, and the relative civilization of each nationality. Among the rudest savages it sank to fetichism, as in Western and Central Africa. Among the Greeks it was made the vehicle for the expression of their refined humanitarianism in the apotheosis of heroic men rather than the revelation of incarnate gods. In India, springing from a pantheistic philosophy, it has been carried to the most extravagant extreme, both in respect to the number and the character of its deities. Whenever polytheism has been connected with speculation it appears as the exoteric counterpart of pantheism. (CARLYLE'S *Hero-Worship;* KEIGHTLEY, *Mythol. Greece and Italy;* MAX MÜLLER, *Compar. Mythol.*, in *Oxford Essays*, 1856; PROF. TYLER, *Theology of Greek Poets.*)

D. *Deism* (from *deus*), although etymologically synonymous with theism, has been distinguished from it from the middle of the sixteenth century, and used to designate a system admitting the existence of a personal Creator, but denying his controlling presence in the world (*concursus*), his immediate moral government, and all supernatural intervention and revelation. The movement began with the English deists, Lord Herbert of Cherbury (1581–1648), Hobbes († 1680), John Toland († 1722), Woolston († 1733), Tindal († 1730), Shaftesbury, Bolingbroke (1678–1751), Thomas Paine († 1809). It passed over to France, and was represented by Voltaire and the Encyclopædists. It passed over into Germany, and was represented by Lessing and Reimarus (*Wolfenbüttel Fragmentist*), and, invading the Church and theology, it was essentially represented by the old school of the naturalistic rationalists, who admitted with it a low and inconsequent form of Socinianism—*e. g.* Eichhorn (1752–1827), Paulus (1761–1851), and Wegscheider (1771–1848). It has been represented in America by the late Theodore Parker and the extreme left of the party known as "Liberal Christians." In Germany mere deistical naturalism gave way to pantheism, as the latter has recently given way to materialistic atheism—*e. g.* Strauss. (See LELAND'S *View of Deistical Writers;* VAN MILDERT'S *Boyle Lectures;* FARRAR, *Crit. Hist. Free Thought;* DORNER, *Hist. Protest. Theol.;* HURST, *Hist. Rationalism;* BUTLER'S *Analogy*, admitted by J. S. Mill to be unanswerable as against deism.)

E. *Pantheism* (πᾶν, θεός) is absolute monism, maintaining that the entire phenomenal universe is the ever-changing existence-form of the one single universal substance, which is God. Thus, God is all, and all is God. God is τό ὄν, absolute being, of which every finite thing is a differentiated and transient form. This doctrine is of course capable of assuming very various forms. (1) The one-substance pantheism of Spinoza. He held that God is the one absolute substance of all things, possessing two attributes, thought and extension, from either of which respectively the physical and the intellectual world proceeds by an eternal, necessary, and unconscious evolution. (2) The material pantheism of STRAUSS'S *Old and New Faith.* (3) The idealistic pantheism of Schelling, which maintains the absolute identity of subject and object; and of Hegel, which maintains the absolute identity of thought and existence as determinations of the one absolute Spirit.

It is obvious that pantheism in all its forms must either deny the moral personality of God or that of man, or both. Logically, pantheism does render both impossible. God comes to self-consciousness only in man; the consciousness of free personal self-determination in man is a delusion; moral responsibility is a prejudice; the supernatural is impossible, and religion is superstition. Yet such is the flexibility of the system that in one form it puts on a mystical guise, representing God as the all-person absorbing the world into himself, and in an opposite form it puts on a purely naturalistic guise, representing the world as absorbing God, and the human race in its ever-culminating development the only object of reverence or devotion. The same Spinoza who was declared by Pascal and Bossuet to be an atheist is represented by Jacobi and Schleiermacher to be the most devout of mystics. The intense individuality and the material science of this century has reacted powerfully upon pantheism, substituting materialism for idealism, retiring God and elevating man, as is seen in the recent degeneration of pantheism into atheism in the case of Feuerbach and Strauss.

The most ancient, consistent, and prevalent pantheism of the world's history is that of India. As a religion, it has moulded the character, customs, and mythologies of that people for 4000 years. As a philosophy, it has appeared in three principal forms—the Sankhya, the Nyaya, and the Vedanta. In Greece, pantheistic modes of thought prevailed chiefly with the Stoic and New Platonic schools—Zeno (340–260 B. C.), Plotinus (205–270 A. D.), Porphyry (233–305), Jamblichus († 333). It reappears in John Scotus Erigena († 883) and with the Neo-Platonists of the Renaissance—*e. g.* Giordano Bruno, burnt at Rome in 1600. Modern pantheism began with Benedict Spinoza (1632–1677), and closes with the disciples of Schelling and Hegel.

Besides the pure pantheism above referred to, there has existed an infinite variety of impure forms of virtual pantheism. This is true of all systems that affirm the impersonality of the infinite and absolute, and which resolve all the divine attributes into modes of casuality. The same is true of all systems which represent providential preservation as a continued creation, deny the real efficiency of second causes, and make God the only agent in the universe—*e. g.* Edwards (in *Original Sin*, pt. 4, ch. 3) and Emmons. Under the same general category falls the fanciful doctrine of emanations which was the chief feature of Oriental theosophies, and the hylozoism of Averroes († 1217), which supposes the coeternity of matter and of an unconscious plastic *anima mundi.* (See HUNT'S *Essay on Pantheism*, London, 1866; SAISSET, *Modern Pantheism*, Edinburgh, T. T. Clark, 1863; COUSIN, *Hist. Modern Philos.;* MORELL, *Hist. Modern Philos.;* RITTER'S *Hist. Ancient Philos.;* BUCHANAN'S *Faith in God, etc.;* DÖLLINGER'S *Gentile and Jew*, London, 1863; MAX MÜLLER, *Hist. Anc. Sanscrit Lit.*)

A. A. HODGE.

Goda'very, the largest river of the Deccan, rises from the Western Ghauts, within 50 miles from the Arabian Sea, and crosses the Deccan in a south-eastern course of about 900 miles. After passing through the Eastern Ghauts it separates into several arms, in lat. 16° 57′ N. and lon. 73° 30′, forms a delta, and falls into the Bay of Bengal. It is navigable for some distance above its passage through the Eastern Ghauts.

God'dard (JOSIAH), a Baptist missionary, b. at Wendell, Mass., in 1813; graduated at Brown University in 1835, and at Newton Theological Institution in 1838; labored among the Chinese of Siam with success, and afterwards, for six years, at Ningpo, China, where he d. in 1854. His principal work was an excellent version of the New Testament in Chinese, but he also preached with much energy and effect, though in feeble health.

Go'derich, port of entry and cap. of Huron co., Ont., Canada, on Lake Huron, is the western terminus of the Buffalo and Goderich division of the Grand Trunk Railway. It has a good harbor, and has extensive communication by steam with the various lake-ports. It has a large elevator for wheat, extensive lake fisheries, 8 valuable salt-wells, and 2 weekly newspapers. It is rapidly increasing in importance. Pop. of town, 3954; of Goderich tp., outside the town limits, 3615.

Godfather, Godmother. See SPONSORS.

God'frey, post-v. of Monticello tp., Madison co., Ill., on the Mississippi River and the Chicago Alton and St. Louis R. R., 29 miles from St. Louis, at the junction of the Jacksonville branch. It is the seat of Monticello Seminary.

Godfrey of Bouillon, king of Jerusalem and the sixth duke Godfrey of Brabant, or the Lower Lorraine, b. at Nivelle, Lorraine, in 1061; became governor of Bouillon 1076; fought with conspicuous valor in Germany and Italy on behalf of Henry IV. against the pope; slew Rudolph, the rival emperor, with his own hand, and was the first to mount the walls of Rome on Henry's successful attack, 1084; succeeded as duke 1089; took the cross for the Holy Land 1095, in order to expiate his sin of fighting against the pope (first crusade); led 80,000 men to the East by way of Constantinople; captured Nicæa 1096; defeated Soliman at Dorylæum 1097; took Antioch 1098, and stormed and took Jerusalem July 15, 1099; was declared king of Jerusalem, but declined to wear a crown of gold where his Lord had worn a crown of thorns; defeated the Egyptians at Ascalon, conquered Galilee, promulgated the *Assize of Jerusalem*, a system of feudal law; d. at Jerusalem July 15, 1100, and was succeeded by Baldwin I. In 1244 the Carismians tore up and burned his remains. Godfrey's strength, valor, piety, and virtue were favorite themes of mediæval poetry. He is the central figure of TASSO'S *Jerusalem Delivered.*

Godi'va, The Lady, wife of Leofric, earl of Mercia and master of Coventry in England, who about 1040 imposed upon that town heavy exactions, by reason of which the people all complained. The lady Godiva entreated her lord to spare the town; and at last he consented on condition that she should ride naked by daylight through Coventry, to which proposal she readily agreed, notwithstanding her well-known and extreme modesty. The earl could do no less than order the people to keep within their houses, and not look out. This (so the story goes) they all did excepting one tailor, the Peeping Tom of Coventry (some say he was a baker), who looked out at a window as the lady rode by veiled with her flowing hair only; but the poor

tailor was at once struck blind, and, as some tell us, was shortly after hanged by the earl. A yearly pageant, in which a young woman enacted the part of Godiva, was long kept up at Coventry, and is still occasionally performed.

God'kin (Edwin Lawrence), b. at Moyne, county Wicklow, Ireland, Oct. 2, 1831; was educated at Queen's College, Belfast; was war-correspondent in Turkey and the Crimea for the London *Daily News* 1854–56; travelled in the U. S. as a correspondent of the same journal; was admitted to the New York bar 1858; corresponded with the *Daily News* and the New York *Times* in the late civil war; became editor of the *Nation* 1865, and its proprietor 1866.

God'man (John D.), M. D., the son of a Revolutionary soldier, was b. at Annapolis, Md., Dec. 30, 1794; d. Apr. 7, 1830, when (as has been said) there "fell from the firmament of the medical profession, before he had reached his meridian splendor, one of the brightest stars which ever rose above the horizon." At two years old he was motherless, then fatherless, friendless, homeless. He said himself, "I have eaten the bread of sorrow and drunk the cup of misery." At the bombardment of Fort McHenry he fought as a common sailor. When asked, as he applied to study medicine, if he could read Latin, he replied, "No, sir, but if I live I will make a Greek, Latin, and French scholar." After taking his first course of lectures in the University of Maryland, the professor of anatomy had his thigh fractured, and the faculty unanimously appointed young Godman to complete his course. But not only had he to contend with poverty all his life; his constitution was frail and health never robust. On the organization of the Ohio Medical College in Cincinnati he was its first professor of anatomy, 1824. Subsequently he was called to the same chair in Rutgers Medical College, N. Y., where he became the associate of Mott, Hosack, etc. Dr. Godman contributed largely to the *Western Quarterly Reporter*, Philadelphia *Journal of the Medical Sciences, Physical and Pathological Anatomy, Encyclopædia Americana*, etc. As a lecturer few were more gifted; he (almost alone in this country) has taught anatomy successfully with the scalpel in hand to the class in the amphitheatre. In his early death the profession lost one of its brightest ornaments. Author of *American Natural History* (3 vols., 1823–28); *Rambles of a Naturalist*, and other works. Paul F. Eve.

Gödölö, small town of Hungary, a few miles E. of Pesth. On the neighboring heights the Austrians under Windischgrätz were wholly defeated by the Hungarians under Görgei; which victory led to the famous declaration of independence issued by Gov. Kossuth Apr. 14, 1849.

Godol'phin (Sidney **Godolphin**), Earl of, b. in Cornwall (date unknown); took the master's degree at Oxford 1663; became a secretary of state 1664, and first commissioner of the treasury; was envoy to the Netherlands 1678; a lord of the treasury and one of the chief ministers 1679; a secretary of state 1684; chamberlain to the queen 1685; commissioner of the treasury 1686–90; first lord of the treasury 1690–97, 1700–01; lord high treasurer 1702–10; was made a baron 1684; K. G. 1704, Viscount Rialton and Earl Godolphin 1706. D. at St. Albans Sept. 15, 1712. Godolphin was a man of few words and decided talents for public business. Political or moral principles he had none. When chamberlain to James II.'s queen he conformed to the Roman Catholic rites; was in turn Tory or Whig as best served his interest in times when these party names carried meaning with them. His only conspicuous vices were gambling and inordinate fondness for the turf. In demeanor he was exceedingly modest and retiring.

Go'don (Sylvanus W.), U. S. N., b. June 18, 1810, in Pennsylvania; entered the navy as midshipman Mar. 1, 1819; became a passed midshipman in 1827, a lieutenant in 1836, a commander in 1855, a captain in 1861, a commodore in 1863, a rear-admiral in 1866; retired in 1871. He commanded the Powhatan at the battle of Port Royal, and the Susquehanna in both the Fort Fisher fights; commended by Rear-admiral Dupont for zeal and ability, and thus spoken of by Rear-admiral Porter in his "commendatory letter" of Jan. 28, 1865: "Com. S. W. Godon, commanding the Susquehanna, is an unusually intelligent officer, who does not need to be told a second time where to go in time of action. This is the second important affair in which he has been engaged during the war, in both of which he has acquitted himself in the most handsome manner. His ship was beautifully handled, and impressed me with her good discipline and accurate firing. To me personally he has given his warmest support, and I should fail in my duty if I did not give him the full credit he deserves. His conduct throughout this harassing affair has met my warmest approbation, and I think he is one of those who merit promotion." Foxhall A. Parker, U. S. N.

Godoy', de (Manuel), duke of Alcudia, Albufera, and Soto-Roma, and prince of the Peace, b. at Badajoz, Spain, May 12, 1747, of a noble but reduced family; entered the body-guard at Madrid 1787; became an officer 1790; major and adjutant-general and knight grand cross of Charles III. 1792. His beauty had by this time won him the favor of the queen and her ladies, and with the former he lived in most intimate relations under the very eyes of the king, who nevertheless loaded him with honors. In 1795 he was made a grandee of the first rank, having in 1792 been made first secretary of state, and in 1793 captain-general. His treaty of Bâle (1796) won him the title Prince of the Peace. In 1797 he married Maria Theresa, the king's niece, although he was already secretly married to another wife. In 1798 he was declared grand major-domo, and in 1799 grand admiral. In 1801 he reassumed the power which in 1798 the popular will had forced him to abdicate, and soon after, by the treaty of Badajoz, he agreed to divide Portugal between France and Spain, for which service he received a large sum from France. In 1804 he was declared generalissimo. He assisted Napoleon in gaining possession of Spain, and Napoleon in turn released him (1808) from the prison into which the nobles and people had thrown him. Godoy never again returned to power. Hated by nobles, priests, and people, all of whom he despised and had braved so long, he followed the fortunes of the king and queen, who still clung to him. In 1835 he went to Paris, where he lived a pensioner of the French government. In 1842 the Spanish government confirmed to him his former honors. D. at Paris Oct. 4, 1851.

God Save the King! (*Domine salvum fac Regem!*), a formula repeated upon occasions of solemnity and appended to state proclamations in Great Britain. The same words give name to a well-known British national air, the authorship of which was long ascribed to Dr. John Bull (1563–1622), but it is generally conceded that his "God save great James, our king!" was not the national anthem of the present day. The authorship of both words and music of this piece, nearly as it now stands, is now generally assigned to Henry Cary, who d. in 1743; but some antiquaries claim that it was adapted from Jacobitic words and melody of that day. The expression "God save the king!" occurs several times in the historical books of the Old Testament.

The "God save the king!" of the public proclamations has been changed to "God save the Commonwealth of Massachusetts!" in that State, and to "God save the Commonwealth!" in Pennsylvania.

God's Truce. See Truce of God.

Godt'haab, the first Danish colony in Greenland, established in 1721 by Hans Egede on Davis's Strait, in lat. 65° N. Pop. 740.

God'win (Mary **Wollstonecraft**), b. at Beverley, Yorkshire, England, Apr. 27, 1759. Driven from home by the unkindness of her father, she gained a living for a time by teaching school, and was then a governess. In 1787 she went to London. Her *Thoughts on the Education of Daughters* (1786), *Mary*, a tale, *Original Stories*, and some translations from Salzmann and Lavater, attracted much attention. Her famous *Vindication of the Rights of Woman* (1791), an able presentation of a then novel doctrine, was followed (1792–95) by a residence in Paris, prompted by her enthusiasm for the new political theories of the time. Here she became mistress to an American named Imlay, a connection quite justified by her avowed doctrines regarding the constitution of society. After the birth of a child Imlay left her in great distress. Mr. William Godwin, who fully sympathized with her levelling opinions, soon after became her protector, and in 1797 public opinion compelled their marriage. She d. in London Sept. 10, 1797, in giving birth to a daughter, the future Mrs. Shelley, and author of *Frankenstein*. Mrs. Godwin was a woman of attractive manners and of singular courage and independence. The irregularities of her life must be ascribed to the unfortunate circumstances of her early surroundings. Full justice to her character is done by her husband in her *Memoirs* (1798), in which, however, some details of her life are presented with unnecessary minuteness.

Godwin (Parke), b. at Paterson, N. J., Feb. 25, 1816; graduated at Princeton, N. J., 1834; was called to the bar in Kentucky. Since 1837 he has been for a great part of the time connected with the New York *Evening Post*, of which his father-in-law, Wm. C. Bryant, was so long the editor-in-chief. Of the *Post*, Mr. Godwin was at first a contributor, and then managing editor. In 1843 he for a time conducted the *Pathfinder*, a weekly; was a prominent contributor to the *Democratic Review*, and was for a time one of the editors of *Putnam's Magazine*. Under Mr. Polk he was deputy-collector in the New York custom-house; was an early member of the Republican party, but always an advocate of free trade. Author of a *Popular View of*

the Doctrines of Fourier (1844); *Democracy, Pacific and Constructive* (1844); *Vala*, a romance (1851); *Handbook of Universal Biography* (1851); *Political Essays* (1856); the first vol. of a *History of France* (1860); *Cyclopædia of Biography* (1865); *Out of the Past* (1870); and other works from his pen are announced. He has also translated tales from Zschokke, and a portion of Goethe's *Autobiography*.

Godwin (WILLIAM), b. at Wisbeach, Cambridgeshire, England, Mar. 3, 1756, son of a Presbyterian minister; studied at the Hoxton College; was a dissenting minister at Stowmarket 1778–83, when his new religious and political views led him to leave his profession. His *Sketches of History* (1784) was a pecuniary failure; but his *Political Justice* (1793), with its eloquent language and its generous though impracticable theory of universal benevolence, attracted wide attention, and in spite of its levelling doctrines was widely approved. The same doctrines are set forth in *Caleb Williams*, a novel (1794), his most powerful work. In 1797 he married Mary Wollstonecraft, whose memoirs he published in 1798. His other novels (*St. Leon, Fleetwood, Mandeville, Cloudesley, Deloraine*) and his tragedies (*Antonio, Faulkner*) are now forgotten. He wrote useful *Lives* of Chaucer, John and Edward Phillips, Chatham, and others; an *Essay on Sepulchres* (1808); a valuable *History of the Commonwealth* (4 vols., 1827–28); *On Population* (against Malthus, 1820); *Thoughts on Man* (1831); *Lives of the Necromancers* (1834), and many political pamphlets, besides several works for the young, published under the assumed name of "Edward Baldwin." His posthumous *Genius of Christianity Unveiled* (1873) and *Autobiography*, etc. (1874) have recently somewhat revived the public interest in him and his works. Mr. Godwin was for some time a bookseller of London. By a second marriage he had a son of brilliant talents, who died before him. He was always poor, but in old age was appointed yeoman-usher of the exchequer. Late in life his anti-marriage views were abandoned. D. in London Apr. 7, 1836.

God'wit, a popular name for various wading birds, having long bills, like those of snipes. They mostly belong to the genus *Limosa*. In the Old World are found the black-tailed and bar-tailed godwits (*L. melanura* and *rufa*), seashore birds which are good for the table. The great marbled godwit and Hudsonian godwit (*L. fedoa* and *Hudsonica*) are North American species; the tell-tale godwit is the *Gambetta melanoleuca* of the U. S.

Goe'ben, von (AUGUST), Prussian general of infantry, was b. at Stade, Hanover, Dec. 10, 1816, and entered the Prussian service in 1833 as a lieutenant. Of a restless and adventurous spirit, he soon resigned his position and went to Spain, where he took service with the Carlists in the corps of Cabrera. But fortune did not favor him much; he was wounded several times, taken prisoner, thrown into jail in Cadiz, thence carried to Saragossa, and treated so ill that his health, especially his eyes, suffered thereby. After the end of the Carlist war he was liberated, returned to Germany, wrote an able book on his Spanish experiences, and re-entered the Prussian army, where he served chiefly on the staff. He took part in 1849 in the campaign against the revolution in Baden; was on this occasion, and also on others in the subsequent years, attached to the staff of the prince of Prussia, the present emperor, and became in 1855 chief of the staff of the 6th army corps. In 1860 he was ordered, together with several other officers, to follow the army of the Spanish general O'Donnell in order to observe the campaign in Morocco, on which he published an able work. In 1863 he became commander of the 26th brigade of infantry; in 1864 he took part in the war against Denmark, and became commander of the 10th division; and in 1865 he became lieutenant-general and commander of the 13th division. At the head of this division he entered Hanover in 1866 and fought on several occasions with distinction. In the Franco-German war of 1870–71 he was appointed commander of the 8th army corps, and played an important and conspicuous part in the battles of Saarbrücken and Metz. When Gen. von Manteuffel received the command of the army of the South, in Jan., 1871, Goeben was appointed commander of the army of the North, and defeated Gen. Faidherbe in the decisive battle of St.-Quentin, Jan. 19. AUGUST NIEMANN.

Goes, or **Tergoes,** town of the Netherlands, in the province of Zealand, on the island of South Beveland, 15 miles by rail from Berg-op-zoom. It has considerable trade in corn, hops, and salt. Pop. 6313.

Goess'mann (CHARLES ANTHONY), PH. D., b. at Naumburg, Hesse-Cassel, Germany, June 13, 1827; was educated at Fritzlar and Göttingen, where he graduated in 1852; came to the U. S. in 1858; resided for a time at Syracuse, N. Y., and since 1867 has been professor of chemistry in the Massachusetts Agricultural College at Amherst, and in 1873 was appointed chemist to the State board of agriculture. Author of numerous and valuable papers upon chemical subjects, among which his nine articles upon salt and the chemistry of natural brines, those upon sugar and the sugar manufacture, and his reports upon commercial fertilizers, have special interest.

Goe'thals (HENRY), or HENRY OF GHENT (*Doctor Solemnis*), b. near Ghent 1217; studied under Albertus Magnus at Paris, and taught the scholastic philosophy with great applause at the Sorbonne. He was an acute and sagacious Realist, and qualified the Aristotelianism of his day by an attempt to blend with it some of the doctrines of Plato. He became archdeacon of Tournay, where he d. in 1293.

Goe'the, von (JOHANN WOLFGANG), was b. Aug. 28, 1749, at Frankfort-on-the-Main, of a rich and highly respected family, and enjoyed a careful and very varied education, rich in the acquisition of knowledge and rich in impressions. The father was a peremptory and somewhat pedantic character, proud of his family connections and personal acquirements; he held no office, but had an imperial title. The mother was a bright and quick-witted woman, with very decided opinions and very vivid sympathies; she stood greatly in awe of her husband, and Wolfgang and she formed a little group of their own within the family. Under the father's superintendence the boy was taught drawing, music, grammar, rhetoric, foreign languages—Latin, Italian, French, Hebrew—and natural history; from the mother he learned to judge characters as they presented themselves in social intercourse, to understand life as it appeared in the streets, and to make small excursions into Fairyland. But his religious impressions were defective; he knew the Bible very well, but it was, and always remained to him, an object of intellectual and æsthetic interest only. It had no authority over his heart, and when, in his great novel, *Wilhelm Meister*, he tried to bring the development of a human soul to a final and, so to speak, typical close, the hero was made to settle down in a sort of mystical Freemasonic institution, which, compared with what a truly religious spirit has proved itself able to work out both in individual and social life, appears very puerile and utterly disappointing. Much more genuine and truly productive of great ideas was the influence he received from the political events of the Seven Years' war—on the one side, the old idea of the emperor, so deeply rooted in the feeling and imagination of the German people, so magnificent, and at this moment represented by a beautiful young woman; on the other side, the new idea of the unity of the German nation, awakened by a young hero who stood unconquered among the heaviest calamities, and who had wrung from fate what Germany had not seen for centuries, a victory over a foreign nation, the battle of Rosbach. During one period of the war Frankfort was occupied by French troops, and young Goethe learned to speak French, to look at pictures, and to feel the strange charm of theatrical representations. In 1768, in the nineteenth year of his age, he went to the University of Leipsic, where he made the acquaintance of Gottsched and Gellert; in 1770 he moved to Strasburg, where he formed intimate friendships with Herder, Jung Stilling, and Lenz. After taking his degree in law at the latter university, he returned in 1771 to Frankfort and began to write lyrical poems and minor critical essays for periodicals, incited to do so by his intercourse with Merck. While in Leipsic he had written two dramas, *Die Laune des Verliebten* and *Die Mitschuldigen*, which were published then, but anonymously and without any effect. In the spring of 1772 he received a position at the imperial chancellery at Wetzlar, but returned home in the fall utterly disgusted with diplomatic affairs, and determined to concentrate himself on some poetical subject.

Personally, the young Goethe made a most extraordinary impression. His bearing was very reserved, even a little haughty; his manners were stiff, sometimes even a little awkward. But the beauty of his countenance was so irresistible, and the impression of courage, independence, nobleness, and kindness so powerful, that when he entered an inn conversation would stop and the guests look surprised at each other. And on nearer acquaintance, in spite of some occasional rashness and arrogance, he quite intoxicated people with the richness, originality, and grasp of his ideas, and with the wonderful freshness and enchanting enthusiasm of his feelings. Everybody expected that something great would come from him, and yet everybody was surprised when in 1773 he published his drama, *Götz von Berlichingen*, and in the following year his famous novel, *Werthers Leiden*. They not only opened a new period in the German literature, but they inaugurated a new epoch in the German civilization. The most striking quality of these two great works is their artistic truth, the magical vividness of their pictures, their objectivity. In order to represent any character or event with such perfect truth it is necessary that the poet shall paint nothing but that which

falls within his own consciousness, and which at least as a possibility, as a danger, forms part of his own soul. Goethe fulfilled this condition, and the secret of the immense success of his works was that in writing out of his own heart he wrote out of the heart of his time. Shakspeare has painted greater characters than Goethe, but the exuberance of his style, which was the style of his time, throws a veil over his characters which aggrandizes the figure, but weakens the outline. No poet has ever reached Goethe in the magic of his representations. Every sentence in his dramas is a portrait. But although the explanation of this excellency, of his method of production, of the relation between his personal life and his poetical creations, is a question of the highest interest, it requires too minute biographical and psychological researches to be treated here. The absolute objectivity of his descriptions raises other questions, however, which, through *Werthers Leiden*, became of historical consequence. Werther is a man who can do nothing ignoble, but the noble, that which is duty, he can only half do. Halfness, however, in the fulfilment of duties deprives a man as absolutely of his moral freedom and spiritual happiness as a total denial of duty through crime and vice. It only conceals the fact to the person himself by entangling his soul in a morbid feeling of being misunderstood and wronged by the world. Such halfness was the disease of the time, produced partly by an imperfect enlightenment which furnished no motives to the volition, partly by a sentimental pietism which represented resignation as the highest form of the will. Every one who reads *Werthers Leiden* reads something about himself, but only those in the first stage of the disease understand the poet. To them the book becomes a help, a cure. Napoleon read it over and over again. Those, on the contrary, who are very far advanced in the disease understand only the hero, and, like him, they blow out their brains. The book was prohibited by law in several countries, and although we now may laugh at such measures, the question still remains, Is objectivity the highest goal of art? or shall there be something behind the picture which shines through it and explains it?

In 1775 the duke of Saxe-Weimar, Charles Augustus, invited Goethe to take up his abode at his court. After some hesitation the invitation was accepted, and from 1776 Weimar became his residence. A warm and noble friendship sprang up between the duke and the poet; and as Goethe possessed much practical administrative talent and great business tact, he occupied at different times many different positions in the ducal government; at last that of a minister of state, which he held from 1815 to the death of the duke in 1828, when he resigned all his offices and retired into private life. A house was built for him, small enough according to the ideas of our times, but magnificent for those days, and containing an excellent library, a fine collection of scientific instruments, and many precious objects of art. During the first two years of his residence in Weimar the court-life seems to have occupied his whole time, but by degrees he began to take part in practical business and to engage in severe scientific studies of botany, comparative anatomy, mineralogy, and optics. Great men, such as Wieland, Herder, Fichte, Schelling, and Schlegel, gathered around the court of Weimar, and made it a German Athens. And in spite of all its easy grace and its somewhat Epicurean aspect, Goethe's life during this period contains both efforts and results. With respect to poetry, the results were small enough. For the twelve years after the publication of *Werthers Leiden* nothing but *Stella* (1776), *Clavigo* (1778), and some other still less important works were produced. But much was prepared, and after his journey to Italy (from 1786 to 1788) masterpiece followed after masterpiece in rapid succession: *Egmont* (1785), *Iphigenia* (1786), *Römische Elegien* (1788), *Tasso* (1789), *Faust I.* (1790), *Wilhelm Meister* and *Hermann und Dorothea* (1796). The variety of these works is not more astonishing than their perfection. In *Tasso* Goethe reached a simplicity and limpidity of form which makes the words disappear behind the ideas they convey, and transforms the metrical movement of the language into a melody of the thoughts; and thus he succeeded in representing the most refined and delicate movements of the human soul with perfect clearness and great dramatical impressiveness. In strong contrast to the antique harmony and classic repose which distinguishes *Iphigenia* and *Tasso*, stand the romantic exuberance and picturesque disorder of *Faust*. The wildest and coarsest outbursts of passion and the most sublime and touching innocence of the heart, the flattest and most trivial stages of intellect and the highest aspirations and innermost longings of the soul, combine in this drama, and form a picture of human nature to which probably no literature has an equal. In 1794 the intimate and noble friendship began between Goethe and Schiller which lasted to the death of the latter in 1805. The influence of this friendship on Goethe was hardly favorable to the full and free exertion of his powers; his poetical productivity stopped. But to Schiller his friendship with Goethe was the baptism of his genius, and Goethe was during the whole period very active. His studies were comprehensive and assiduous; his critical sallies on the extravagances of his own pupils were most effective; and through his direction of the ducal theatre in Weimar from 1790 to 1817 he exercised a lasting and ennobling influence on the theatrical art of Germany. After the death of Schiller, on the day of the battle of Jena (Oct. 19, 1806), he married Christiane Vulpius, by whom he previously had a son.

Goethe had now ceased to be merely an influence; he had become an authority. Civilized life in Germany—and in foreign countries too—was deeply indebted to him. He had unlocked the narrow ties of the old order, and in the wild fermentation of all the elements of civilization he had established a law which prevented chaos from breaking in. He had brought freedom into the German civilization. There was in German life and character a hardness and narrowness which, although intimately allied to energy and honesty, hindered the free movement of human nature, and constrained it within the boundaries of the most singular prejudices. These were melted down by Goethe's influence, and human nature breathed freer. Lessing had proclaimed in his criticism the right of nature against conventionalities, but it was Goethe who demonstrated the truth of the doctrine by his poetical creations. And with him it received a most important expansion. Lessing had said that truth to nature was the first condition of beauty, thus confining himself within the merely theoretical sphere. Goethe said that everything natural was true as far as it was beautiful, thus breaking into actual life with a new and almost revolutionary issue. This view of human life as composed merely of two agents—nature, giving the force, and beauty, giving the law—is the key to that grand phenomenon in the history of mankind which is called Goethe. It explains the vagaries of his pupils, the Romanticists; it explains the defects of certain of his works, *Wilhelm Meister's Wanderjahre* and *Faust II.*; it explains certain not amiable singularities in his life—why he did not marry Frederike Brion; why his first words on hearing that Charles Augustus had died were a scolding to the footman because he had not kept back the news till dinner was over. To us, in our days, it is apparent that such a view of human life is far from being exhaustive. We know that human nature contains elements which beauty is too weak to master—elements which even morality cannot bring to full development—elements which only religion can grapple with. But to the time of Goethe, curbed and almost mutilated under the tyrannical constraints of pedantic prejudices, this view was a gospel of freedom, progress, power, and happiness. It will hold a certain authority in every age, because it contains a certain proportion of truth. It was followed by Goethe himself with a sincerity and honesty on which there probably is not one spot, and which in many cases certainly cost him unspeakable sufferings. Its effect on civilized life was most wonderful; it gave much more than it promised. Thus, it was quite natural that the whole age bowed to its bringer with the deepest gratitude and reverence.

The most remarkable of Goethe's poetical productions during the last period of his life are—*Die Wahlverwandtschaften*, a romance (1808), *West-östlicher Divan*, a collection of lyrical poems (1813), *Faust II.* (1831), and the exceedingly interesting autobiography *Aus meinem Leben* (1830), which he calls a blending of facts and fiction. Most of his time, however, was given to practical business and scientific researches. In this last respect he has been very severely criticised by several scientific men of second rank, while all scientists of first rank have acknowledged that his discoveries in botany and comparative anatomy are valuable, and his studies and observations interesting and suggestive, even when the theories which he formed and endeavored to maintain proved untenable. He d. in Weimar Mar. 22, 1832, and lies interred in the ducal burial-vault beside the duke, Charles Augustus, his friend through many years. The best biography of him is that by G. H. Lewes, London, 1855; the fullest impression of his personal character is given by the numerous collections of his correspondence with Schiller, Mad. von Stein, Lavater, Herder, Merck, Humboldt, and others. CLEMENS PETERSEN.

Goettee′, tp. of Beaufort co., S. C. Pop. 2319.

Goet′tling (KARL WILHELM) was b. at Jena in 1793; began his studies in that place; served as a volunteer in the war with France 1814; finished his university course in Berlin; appointed in 1815 professor in the gymnasium at Rudolstadt; in 1819 director of the gymnasium at Neuwied; in 1822 professor extraordinary; and in 1832 pro-

fessor in the University of Jena; in 1826 was appointed also university librarian, and later associate director of the Philological Seminary. In 1828 he visited Italy and Sicily; in 1840, and again in 1852, Greece, in connection with historical and archæological studies. He wrote *Das Geschichtliche im Niebelungenliede* ("The Historical in the Niebelungenlied"), Rudolstadt, 1814; *Nibelungen u. Ghibellinen*, ib. 1817; *Lehre von Griech. Accent*, 5th ed., Jena, 1835; translated as *Elements of Greek Accentuation*, London, 1831; *Geschichte der römischen Staatsverfassung* ("History of the Roman Constitution from the Founding of the City to Cæsar's Death"), Halle, 1840; edited *Theodosii grammatica*, Leipsic, 1822; *Aristotelis Politica*, Jena, 1824; *Œconomica*, 1830; *Hesiodi Carmina*, Gotha, 1831; 2d ed. 1843; published *Gesammelte Abhandlungen aus dem Classischen Alterthum*, vol. i., Halle, 1851; vol. ii., Munich, 1863. His *Opuscula Academica* were collected and edited by Kuno Fischer, Leipsic, 1869, after his death, which took place Jan. 20, 1869. (See KUNO FISCHER'S *Charakteristik*, prefixed to the *Opuscula;* C. NIPPERDEY, *Memoria C. Goettlingii*, Jena, 1869.) H. DRISLER.

Goffe (WILLIAM), b. in England about 1605; was a devout Puritan and an able major-general in Cromwell's army, and with Whalley, his father-in-law, came to Boston, Mass., in 1660. Having been among the regicide judges, they were not included in the general amnesty at Charles II.'s restoration. From 1661 to 1664 they lived in concealment near New Haven, Conn., and were several times in very great danger of capture. In 1664 they went to Hadley, Mass., where, with Dixwell, another regicide, they were long residents in the family of the Rev. Mr. Russell. The narrative given by Dr. Dwight of Goffe's taking command of the men of Hadley, and repulsing the Indians in 1675, is now regarded as incorrect. Goffe d. at Hadley in 1679.

Goffs'town, post-tp. of Hillsborough co., N. H., on the Manchester and North Weare R. R., 8 miles W. by N. of Manchester. It contains 3 villages, has 2 post-offices, 2 churches, a town-hall, a fine central school-house, 2 large sash and blind factories, 2 hotels, a machine-shop, a flouring-mill, a large lumber and wood establishment, besides minor industrial enterprises. P. 1656. S. H. KEELER.

Gog and **Ma'gog** [of doubtful etymology, perhaps indicating something great or gigantic; in Arabic, *Yajuj* and *Majuj*]. In the Mosaic Table of Nations (Gen. x. 2), Magog is the second of the seven sons of Japhet, representing a people, probably the Scythians. In Ezekiel (xxxviii. 2 and xxxix. 1) Gog is the prince of the people Magog. In Revelation (xx. 8) both Gog and Magog are peoples, opposing, as in Ezekiel, the people of God, and doomed to destruction.—GOG and MAGOG are also two images of giants standing in the Guildhall, London. The present giants were made in 1708 by Richard Saunders, the old ones having been burned in the Great Fire. They are mentioned as early as 1415, and are probably much older. Many European towns have, or have had, their old corporation giants. The origin of the custom is obscure.

REVISED BY R. D. HITCHCOCK.

Gogra. See GHOGGRA.

Gohanuh, town of British India, in the Bengal presidency, on the Delhi Canal. Pop. 6668.

Go'ito, town of Italy, on the right bank of the Mincio, in the province of Mantua. From its position it frequently suffered from military operations during the Middle Ages, and in modern times has given name to two battles—one between the Austrians and Italians in 1814; the other between the Austrians and Piedmontese, 1848. Pop. 5274.

Goître (*gutter*, the "throat"); synonyms, **Bronchocele, Derbyshire Neck.** This is an enlargement of the thyroid gland, which lies across the front of the windpipe. It probably originates in hypertrophy of the natural gland-structure, and the concurrent formation of cysts in the interstices of the gland-tissue. These cysts are of varying size, and generally contain a more or less solid glairy matter, blood, earthy concretions, etc. The disease has been supposed to be due to the drinking of snow-water, but it occurs where there is no snow. Although manifesting itself to a greater or less extent in all parts of the world, it is more prevalent in the chalky parts of England, especially Derbyshire and Nottingham, and in mountainous districts, among which may be named the Himalayas, Andes, Alps, the Tyrol, and the valley of the Rhône. It is seen upon almost all cretins. Goître is also a symptom of a peculiar affection known as Grave's or Basedow's disease, which consists, besides the enlargement of the thyroid gland, of an unusual prominence of the eyeballs and a very rapid action of the heart. This tumor, called exophthalmic goître, is not goître at all, and usually disappears with the general disease. (*Niemeyer.*) Unless it be very large, goître causes but little inconvenience, but it often attains to such a size as to produce serious trouble by pressure on the neighboring important parts—the large veins, trachea, œsophagus, etc. The treatment usually adopted is iodine, both applied externally and administered internally, to cause absorption. Extirpation is sometimes performed. In India, powerful mercurial inunctions are successfully employed. EDWARD J. BERMINGHAM.

Golcon'da, town of Hindostan, in the dominion of the Nizam. It is famous for its diamonds, which, however, are only cut and polished here; but it was the treasury of the Nizam, and as such fortified and jealously guarded; which two circumstances have given it an almost fabulous fame. In its neighborhood are the mausolea of its former sovereigns, stupendous buildings of granite, with roofs of porcelain tiles of the most brilliant blue color.

Golconda, post-v., cap. of Pope co., Ill., on the Ohio River. It has 4 manufactories, 3 mills, 4 churches, 1 newspaper, 1 high school, a new court-house, a lead and a kaolin mine, and 4 hotels. Principal business, farming, mining, and manufacturing. Pop. 858.

M. GOWN & BRO., EDS. "HERALD."

Golconda, post-tp. of Humboldt co., Nev., on the Central Pacific R. R., 479 miles N. E. of San Francisco. P. 80.

Gold, one of the heaviest, softest, and the most malleable of metals, is widely distributed, being found in the metallic state in nearly all of the great mountain-chains of the globe, and in solution in minute quantity in sea-water. It was probably the earliest known metal, and it has been prized through all ages for its beauty and indestructible qualities. It is rarely found pure, it being alloyed with silver in varying quantities in different regions. The silver ranges from 0.16 to 16 per cent. of the native metal. California gold averages 88 per cent. of pure gold and 12 per cent. of silver. Australian gold contains on an average 92.5 of gold and 7.5 of silver. New Zealand gold has about the same average of fineness. The percentage of silver varies at different localities in the same gold-region. In Nova Scotia gold is found nearly pure. The gold found on the Chaudière in Canada contains from 10 to 15 per cent. of silver. Alloys are found, however, with a much larger quantity of silver. The *electrum* of the ancients contained from 26 to 36 per cent. of silver. A mass of this nature weighing 25 pounds was found at Vöröspatak, and contained 25 per cent. of silver. A pale yellow alloy occurs in the rich ores of the Comstock Lode in Nevada, and according to an analysis by Mr. Attwood contains 55.37 per cent. of gold and 42.87 of silver. In U. S. gold coin there are 90 parts of pure gold and 10 parts of alloy, which consists chiefly of copper, with a little silver. Silver gives a lighter yellow color or whiter shade to the gold, and copper imparts a reddish color. The red gold used for watch-chains and jewelry is alloyed with copper. The mixture, whether formed by the addition of silver or of copper, or of both, is harder than pure gold, which is too soft and easily worn away to be used for coin or ornaments. In jewelry the quantity of alloy added to the gold varies from 12 to 50 per cent., or even more. The ratio of the quantity of gold to the other metals, called the *fineness*, is usually expressed in "thousandths" or "carats." Pure gold is 1000 fine; half gold and half silver would be 500 fine. California gold as mined averages 880 thousandths, being 880 parts of gold in 1000. It ranges from 870 to 890 thousandths. U. S. gold coin is 900 fine. The expression of fineness by carats is an older form, and is still in general use by jewellers and at the British mint. Pure gold is said to be 24 carats fine. When there are equal parts of gold and of other metals the mixture is said to be 12 carats fine. Six parts of alloy give 18-carat gold, and so on. Common gold jewelry is often 14 carats fine, but the superior qualities are 18 carats. In Great Britain bullion accounts are rendered in carats, carat grains, and eighths or thirty-seconds of a carat, the carat being divided into thirty-two equal parts. One carat is equivalent to $41\frac{2}{3}$ thousandths. The U. S. standard gold, 900 fine, is equivalent to 21.6 carats. The British standard is 22 carats, equivalent to $916\frac{2}{3}$ thousandths. The range of gold above the standard is designated in England as "*betterness*," and below the standard as "*worseness*."

The specific gravity of native gold and of artificial alloys of the metal varies with the fineness. Native gold ranges from 15 to 19. When quite pure, and after pressure in a die, the gravity is 19.34. One cubic inch of pure gold weighs 10.12883 ounces troy, and is worth $209.38. In the calculation of tables of value 387 ounces troy are considered to be worth $8000; hence one ounce is worth $20.6718+. The metal is not so hard as silver, being from 2.5 to 3 upon the mineralogical scale, but its hardness is slightly increased by hammering. Its extreme malleability is best shown by the thinness of gold-leaf as used in gilding. One ounce of gold may be beaten out so as to cover 160 square

feet of surface, but the leaves are seldom made so thin, 100 square feet to the ounce troy being the usual extent. The average thickness of common leaf is $\frac{1}{282000}$th of an inch; thus 282,000 sheets would be required to make a pile one inch in height. When so thin, green light is transmitted. One grain will yield leaf sufficient to cover 56.75 square inches, or may be drawn into a wire 500 feet in length.

The value of gold in the arts for ornamentation and for money rests in great part upon its unalterability by any ordinary agencies. It cannot be easily rusted or dissolved, nor does it tarnish by exposure to the weather or to foul gases for ages. Gold ornaments found in Egyptian and other ancient tombs are unchanged. The proper solvent of gold is chlorine, and fluids containing free chlorine or evolving chlorine will dissolve it. The mixture of the two acids, nitric and hydrochloric, known as *aqua regia*, is commonly employed. Selenic acid acts upon it. Its solution in sea-water is referred to the presence of iodate of calcium. Experiments by Prat show that under certain conditions gold can be oxidized and salified by oxacids; that two oxides can be formed capable of giving a new series of salts; and that there is a carbonate and a sesqui-iodide. A sulphate may be formed by heating gold with solid permanganate of potash and concentrated sulphuric acid for a few minutes. Gold may be obtained in a powdered state by precipitating an aqueous solution of the chloride by green vitriol. Spongy gold, according to Dr. C. T. Jackson, is obtained by adding oxalic acid to a concentrated solution. Gold fuses at a temperature of 2016°. It may be volatilized by solar heat concentrated by a glass, or by the oxy-hydrogen jet, and rises in purple vapors. In solidifying from fusion it contracts greatly. The presence of $\frac{1}{2000}$th part of lead, bismuth, or antimony destroys the ductility of gold. It is also made brittle by sudden cooling. Its tenacity is next to that of silver. Atomic weight, 196.71. There are many interesting alloys of gold besides those already mentioned, as, for example, with palladium, and artificially with platinum, the latter giving a hard and highly elastic mixture. A native alloy of gold and palladium contains nearly 10 per cent. of the latter and 4 per cent. of silver.

As regards the nature of the rock-formations in which gold is found, it may be said, in general, that it occurs in formations of nearly all geological periods, from the earliest rocks to the latest Tertiary. It is chiefly, however, in the uplifted and partially altered slates and shales of the Middle Secondary and the Palæozoic periods that the great deposits occur. The principal veins and placers in California follow a belt of Jurassic and Triassic slates on the western slope of the Sierra Nevada. In all this region there are large areas of serpentine and magnesian slates. The metal also occurs in granite, syenite, limestone, and sandstone. Quartz is the almost universal veinstone, but the metal is sometimes found penetrating seams of calc-spar or dolomite in hornblendic slates without much quartz. Beautiful crystallizations of gold are occasionally found in cavities of the veinstone. They belong to the cubic system, and in California are generally distorted octahedra. In Australia dodecahedral crystals are more common. Very large irregular masses are sometimes taken from veins, but they are more common in placer-deposits, and are generally known as *nuggets*. The famous Blanch Barkly nugget in Australia weighed 146 pounds, and one from Ballarat weighed 184 pounds 8 ounces, and was worth over $41,000. A mass weighing about 160 pounds, consisting partly of quartz, was reported in the early days of California mining as having been taken from the quartz-vein on Carson Hill. A mass weighing 28 pounds, and about the size of a smoothing-iron, was found in Cabarrus co., N. C. A highly crystalline mass, weighing about 17 pounds, was dug up near Georgetown, Cal., in 1865, and was valued at $4000. A great number of masses of considerable weight have been found in California of which no special record has been kept, but the Australian placers appear to have afforded the largest number of heavy nuggets.

The almost universal distribution of gold is not so surprising when we consider its presence in sea-water. Sonstadt has shown that there is nearly one grain to each ton of water, and that it can be separated so as to be recognized from a quantity of water so small as 150 to 200 cubic centimètres; and as regards distribution in the soil, it is known, for example, that the ordinary brick-clay which underlies the city of Philadelphia contains gold.

The suitability of gold for money rests not only on the general estimation in which it is held, its unalterability, and its beauty, but from the fact that while so generally distributed over the globe, it cannot be obtained without labor. To extract an ounce of the metal from the earth requires a certain amount of work which differs somewhat in different places, but is approximately the same in all great gold-fields. The average quantity which a man can wash out in a day appears to determine the price of a day's labor for that locality. Thus, when a man can conveniently wash out half an ounce of gold per day for himself, he will not work for less than its value. But placer-deposits are soon exhausted, and such exceptional yields do not last long. Vein-mines are not subject to such sudden fluctuations. The tenor of auriferous quartz and the force required to extract the gold are about the same in all countries. Hence, gold is an excellent measure of labor performed, and represents labor. It is at once the measure and the reward of labor.

The value of gold relatively to silver has varied in time and in locality according to their relative abundance and the estimation in which they have been held. In the year 1546 in England, and all countries where values have been more or less equalized by commerce, the ratio was as 10 to 1; in 1849, as 15.63 to 1; in 1874, as 15 to 1. This is probably the simplest and the most convenient ratio, but it is constantly changing, having increased in 1875 to nearly 16 to 1, from various causes. (See SILVER.) In the far East, however, there has been a long-established preference for silver. When Japan was forced open by Com. Perry the relative value there of gold to silver was much below the European standard, and advantage was soon taken of it by traders, who exchanged silver for gold and depleted the empire of millions. Enormous quantities of gold are consumed annually in the arts and are lost by wear of coin and jewelry. The consumption for gilding alone is very large, for although the films are exceedingly thin, they are spread upon a variety of manufactures, such as frames, furniture, signs, pottery, jewelry, books, etc., to a far greater extent than is generally supposed. Electro-gilding has increased the waste. Since the discovery of gold in California in 1848 the annual production of the metal has greatly increased. The average product of the California mines up to 1870 was about $45,000,000 annually. The discovery was followed by the opening of new fields in Australia, in New Zealand, and other regions. At the date of the discovery in California the aggregate annual production of the metal, exclusive of Asia, was not over $30,000,000 in value. In 1853 the aggregate annual production reached its maximum, and was valued at $160,000,000. The production in California alone for that year was about $60,000,000. The total production of gold in the U. S. from 1847 to 1873 inclusive was approximately $1,240,000,000. The yield in California for 1873 is estimated as worth $17,000,000. The aggregate value of the gold of domestic production deposited at the mints and assay-offices of the U. S. from their organization to July, 1874, was $871,265,517. The greater part of the gold of the world is obtained by washing from detrital deposits in and along the beds of rivers. (See GOLD-MINES and MINING.) A smaller quantity is obtained from veins by crushing and washing the quartz. W. P. BLAKE.

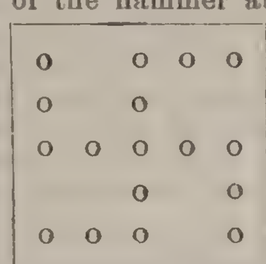
Gold, tp. of Bureau co., Ill. Pop. 392.

Gol'dau, village in Switzerland, in the canton of Schwytz, was buried on Sept. 2, 1806, by a tremendous landslip, together with the villages of Busingen and Rothen. A part of the southern side of the Rossberg, consisting of rock resting on light soil, became detached from the ground by rain, and rushed down into the Lake of Lauerz, burying three villages and killing 400 persons.

Goldbeaters' Skin, a thin material prepared from the peritoneal coat of the large intestines of the ox. The mucous coat is scraped away, and the remaining part undergoes a long and complicated process of preparation before it is fit for use. It is tanned with alum and softened with isinglass and white of egg, and after thorough beating, and drying under pressure between sheets of paper, it is ready for use. It is very costly, and is used by goldbeaters and sometimes in surgery.

Gold-Beating. The thin leaves of gold used in gilding and by dentists in filling teeth are prepared by beating thin sheets of the metal placed between the leaves of what is technically called a "book." The first step in the process is to prepare the gold. For dentists' use this must be perfectly pure—1000 fine. Common mint gold is dissolved in aqua regia, separated from the copper and silver it contains, precipitated by iron salt, and melted. For gilders' use alloys are prepared of silver and gold for the pale shades, and of copper and gold for the darker tints. "Light gold" contains from 2 to 12 pennyweights of silver to the ounce. "Extra deep gold" has 10 grains of copper and 12 grains of silver to the ounce, and "double extra deep gold" has 16 grains of copper to the ounce. In addition to these, leaf is made which has gold on one side and silver on the other. It is made by casting one metal upon the other in a mould, and subjecting the ingot to the processes described below. The gold is cast in an ingot usually of about 1000 grains weight, and rolled to a ribbon a little more than 1⅛

inches wide, and so thin that about 700 would go to the inch. In this form it is delivered to the beater, who receives 50 pennyweights, which he cuts up, after annealing, into squares a little more than an inch wide. These are placed in a book called the "kutch." Kutch is a kind of parchment-paper made in Germany, and possessing great toughness combined with evenness of surface. The kutch is about $3\frac{3}{4}$ inches square. One ribbon of 50 pennyweights weight makes about 170 squares, the number depending upon the "number" or thickness of the leaf which is to be made from it—a detail which is determined by the master in rolling the ribbon. The squares are laid precisely in the centre of the kutch, and with their edges in an exact vertical line. Two envelopes, also of kutch, are drawn over the book in opposite directions, so as to enclose it on all four sides. It is then placed on a solid stone anvil, and the workman beats it with a sixteen-pound, round hammer with a broad and slightly rounded face. At first the blows are all directed toward the centre, but as the gold flattens out the hammer is first struck upon the centre and then a little toward the edge which is farthest from the workman. The book is then turned one-fourth round; the centre is struck again, and then the second blow towards the farther edge follows. This is repeated, turning the kutch one-fourth round, until eight blows have been struck—four on the centre and four toward the edge. The book is then turned over, and the same process is repeated on the other face. When the gold has spread so as nearly to fill the whole book, the workman strikes one blow on the centre, one between the centre and the edge, one on the edge in its middle line, one on the edge toward the right, and finally one on the upper right-hand corner. These five blows are repeated at each one-fourth turn, and the other face of the book is treated in the same way. The circles in the accompanying diagram indicate the position of the hammer at each blow. Sometimes a different succession is chosen, but whatever system is pursued must be continued until the book is finished, or the expansion of the gold between the leaves of kutch will not be uniform. The workman is careful not to strike on the extreme margin, and also to moderate the force of the blow as he nears the margin, the object being to keep the centre of the leaf thinner than the edge. In the final operation of "booking" the edge is cut off and returned by the beater as scrap. If he has carelessly made the edge thin and the centre thick, the result may be the loss of his week's wages in "short gold." Every three minutes the book is taken out of its covers and "riffled." Riffling consists in shaking up the leaves, so as to loosen the whole and prevent the gold from clinging to the parchment, which would cause an uneven spread of the metal. The kutch is beaten about half an hour, and is then "skewed." This consists in taking out the gold, and lasts another half hour. The leaves are then cut into quarters and laid in a "shodar." The shodar is a book made up of leaves prepared from the cæcum (one of the intestines) of the ox. This is stretched and cleaned, and the two mucous surfaces are pressed together, adhering strongly. It is then treated with some preparation which, so far as the best makers are concerned, is a secret, though isinglass, white of egg, and similar substances have been mentioned as dressings of more or less excellence. It is then cut into leaves five inches square, and made up into moulds of 900 leaves. The cæca of nearly 600 oxen are required to form one mould, which is of course very expensive, costing in New York (1873) about $71 in gold. These membranes have a perfectly smooth, even surface, free from veins and knots, and their fineness is indicated by the fact that a "mould" of 900 membranes, containing also 900 sheets of gold-leaf, is only one inch in thickness. The membranes become dry and stiff by use, and are also sensitive to the hygrometric condition of the atmosphere. When too dry, they are moistened; when too moist, they are heated to dry them, both operations requiring great care. The shodar, which is four inches square, is not made of fresh membranes, but of old moulds cut down. The filling of the shodar requires one hour, and it is then beaten two hours with a lighter hammer, say 7 pounds in weight, and with the same precision as before. The leaves of gold are then cut into quarters and transferred to the "mould," which is made of new membranes in good condition. The leaves have now only $\frac{1}{16}$th the thickness of the ribbon, are partially transparent, and very fragile. The succeeding operations must consequently be performed with great care. The filling of the mould occupies two hours, and it is then beaten one hour with a five-pound hammer, after which it is annealed. Annealing is performed in a small screw-press of iron which is heated on a fire. After its removal from the fire the mould is placed between two plates, shoved into the hot press, and screwed down. It is evident that the least excess of temperature will ruin the delicate membranes of the mould, and this is the most hazardous part of the beater's work, for the mould is far more costly than the gold it contains. Beating, annealing, and cooling are performed four times in all. The whole operation of reducing 50 pennyweights of gold to leaf occupies 24–30 hours, average 27, or nearly three working days. After the last beating the gold is taken from the mould by girls and "booked," while the membranes are rubbed with "brime" or burnt talc, laid on with a hare's foot, to preserve their smoothness. Booking is the operation of placing the gold-leaf in books of tissue-paper, the leaves of which are rubbed with red ochre to keep the gold from sticking. The girl lifts the leaf by means of light wood pincers, lays it on a leather cushion, and blows it flat with her breath. She then cuts a piece $3\frac{1}{4}$ inches square from the centre, by pressing down a wooden frame with sharp edges, and transfers the leaf to the book. Each of these holds 25 leaves or $5\frac{1}{2}$ grains of gold. In this extremely attenuated condition gold exhibits the phenomenon of malleability in the cold. Torn leaves are mended by laying a second torn leaf on top of the first and cutting them in two near the centre by means of a thin and sharpened strip of reed. The leaves unite perfectly along the line of the cut, the scrap is removed, the double leaf blown out flat, and the centre is cut out as usual. Sometimes no trace of the welding is visible. Holes are patched by merely pressing a bit of scrap on them. The malleability of the ordinary leaf is not, however, sufficiently perfect for the purposes of dentistry. Dentists' foil is accordingly annealed by floating the leaf for an instant over the flame of an alcohol lamp. A gas-flame will not answer, as it lessens rather than heightens the malleability of the leaf, probably by depositing a film of sulphur over it. After this process the leaves unite with the slightest touch, and adhere to any rough substance, as the finger.



It costs about $500 to stock a workman, of which not more than $150 is represented by gold, and the rest by his tools, books, etc. He must account by weight for all the gold he receives, the books of 25 leaves being taken at $5\frac{1}{2}$ grains, and all the scrap cut from his leaves being returned to him for melting down. Allowing that he cuts his ribbon into 170 pieces, this number is increased by 4, or to 680 leaves, in the shodar, and this again to 2720 in the mould. Were he able to return this number of whole leaves, his pay would be very good, but the waste is such that the rate of wages is based upon the return of 2000 whole leaves, or 80 books of the standard weight of 17 pennyweights. This is really under the average return of a good hand. If he beats his leaves beyond the standard thinness, he will of course have an excess of gold, for which he receives pay as scrap. Workmen earn from $14 to $22 a week. By the census of 1870 there are in the U. S. 23 establishments of goldbeaters, employing 226 hands. The capital invested amounts to $140,000, the materials cost $300,000, and $78,000 is paid in wages. The finished product has a value of $481,000. The system of gold-beating here described is that pursued by Mr. W. Valleau, Jr., New York. Slight variations are found in different establishments and different countries, but the art appears to have been practised in a very similar way to that given above for thousands of years. Even the more peculiar details, such as the use of the cæca of oxen, have been in use so long that the date of their introduction is not known. Gold-leaf is found in ancient monuments of Egypt and other countries. An increasing skill appears to have been used in its manufacture, for the thinnest leaf mentioned by the ancients was fully three times the thickness of what is now ordinary leaf. The reduction of the gold from a foil $\frac{1}{700}$th of an inch thick to a leaf $\frac{1}{254248}$th of an inch thick is the common work of the goldbeater. But this is by no means the limit of his skill, for sheets have been made of which 367,500 would go to the inch. Though the goldbeater receives credit for $5\frac{1}{2}$ grains on every 25 leaves he turns in, the real weight is not more than $5\frac{1}{10}$ grains; and as the book contains 264 square inches of leaf, 1 grain of gold has been beaten out to a surface of 52 square inches. Though gold-beating as an art remains almost as simple as it was centuries ago, the modern use of gold by dentists has given rise to a number of patented articles which are prepared by goldbeaters. "Carbonized foil" is one of these. It is made by interleaving gold-foil of more than usual thickness with coarse-grained paper, and setting fire to the latter while the book is placed in a press. In burning it contracts, and gives the gold a peculiar and very beautiful corrugated appearance. "Pack's crystal pellets" are made of ordinary leaf made into a mash by stirring the leaves in alcohol, and pouring them lightly into a mould. The alcohol remaining on the gold is then fired, and the heat causes the whole to weld to a very porous mass, which is cut into small square blocks. "Kiersing's blocks" are made of carbonized gold, the sheets

being piled one above the other and the mass then cut into blocks. Dentists' gold is known by the name of "foil," which is heavier than the leaf. Machines have been invented to take the goldbeater's place, but they have not come into use. Simple as the work appears, it requires the exercise of discretion. Other metals than gold are beaten, as silver, aluminum, and certain alloys of the baser metals made in imitation of gold. Silver-leaf is about four times as thick as gold-leaf. The price of labor hardly permits the beating of silver in the U. S., while aluminum and the alloys cannot be beaten at all with a profit in this country. Aluminum-foil is used by hat-makers for the stamp on the inside of the hat, where the vapors rising from the head would tarnish silver. JOHN A. CHURCH.

Gold'beck (ANNA MARY FREEMAN), a miniature-painter, the daughter of George Freeman, also a miniature-painter, b. in New York in 1833; d. in New York Feb. 17, 1874. About the year 1857 she married R. W. Goldbeck, a musical composer, by whom she had a son.

Gold'berg, town of Prussia, in the province of Silesia, on the Katzbach. In ancient times it was famous for its gold-mines, from which it has its name; it now thrives by its manufactures and its trade. Pop. 6716.

Gold Branch, tp. of Tallapoosa co. Ala. Pop. 680.

Gold Coast, a part of UPPER GUINEA (which see), Western Africa, from the river Volta to the river Assinie. It receives its name from the gold sand which is found often in considerable quantities, not only along the coast, but also along the shores of the Ashantee. In 1846, 100,000 ounces of gold were exported. The British have a colony known as the Gold Coast Settlements, of which Cape Coast Castle is the capital. In 1872, Elmina and Dutch Guinea on the same coast were also transferred to the British crown, the Danish forts having been ceded in 1850. The area of the whole is said to be 16,626 square miles, and the pop. 408,070, mostly uncivilized natives, over whom the British exercise protection rather than government.

Gold-crested Wren, a name given in Great Britain to the *Regulus atricapillus*, and in the U. S. to the *R. satrapa*, the former the smallest British bird, but neither of them wrens. Both are extremely active and playful, and take their names from the yellow feathers upon their heads.

Gol'den, post-v., cap. of Jefferson co., Col., the initial point of the Colorado Central R. R., main line to Denver, 17 miles; the Julesburg branch, completed to Longmont, 42 miles; the mountain division, narrow gauge, completed to Black Hawk, 22 miles; the Georgetown branch, narrow gauge, completed to Floyd Hill, 16 miles; and the Golden and South Platte R. R., narrow gauge, graded to the junction with the Denver and Rio Grande R. R., 21 miles. It has 2 banks, 2 newspapers, 5 churches, 1 college, public schools, 3 flour-mills, 1 paper-mill, 1 iron-foundry, 2 smelting-works, 2 coal-mines, good hotels, stores, etc. It is in a good farming country. Pop. about 2500.
GEORGE WEST, ED. AND PUB. "TRANSCRIPT."

Golden, tp. of Oceana co., Mich. Pop. 335.

Gol'den Age, in the traditions of many nations, the supposed period of primæval happiness and innocence, from which mankind have departed. The ancients referred this time to the reign of Saturn. A favorite dream of some modern reformers is that the golden age is in the future instead of in the past. The "golden age" of Roman literature is reckoned from the time of Livius Andronicus, about 250 B. C., to the time of Augustus Cæsar's death, A. D. 14. Plautus, Terence, Lucretius, Catullus, Cæsar, Cicero, Sallust, Propertius, Virgil, Tibullus, Livy, Ovid, and Horace are the principal writers of the golden age.

Gol'den Bull. See BULL, GOLDEN.

Gol'den Calf, a golden image of a bullock formed for idolatrous worship by the Israelites at Mt. Sinai. It was of cast metal, and is believed to have stood for Mnevis or Apis, the Egyptian god. It was destroyed by Moses, but in later times golden calves were set up by King Jeroboam at Bethel and Dan, where they became favorite objects of popular worship.

Gol'den Ea'gle, the *Aquila chrysaëtos* of Europe and Asia, and the *A. Canadensis* of North America, now regarded by most authorities as mere varieties of a single species. It is the typical eagle, the imperial emblem of ancient Persia and Rome. It is chiefly of a brown color, and about thirty-five inches long. (See EAGLE.)

Gol'den Eye, the *Fuligula clangula*, a wild-duck of Europe and North America, nineteen inches long. It builds in hollow trees near the water or on the ground. The Laplanders place boxes near the water, and the golden eye lays her eggs in them. The hunters visit the boxes day after day and abstract the eggs.

Gol'den-eyed Fly, a name applied to the troublesome horse-flies of the genus *Chrysops;* also to the neuropterous insects of the genus *Chrysopa*, important as an active destroyer of plant-lice.

Gol'den Fleece, in Greek mythology, the golden wool produced by the ram Chrysomallus. The fleece was suspended in an oak tree in the grove of Ares in Colchis, and was guarded by a dragon. When the ARGONAUTS (which see) came to Colchis for the fleece, being sent thither by Pelias, Medea put the dragon to sleep and Jason carried the fleece away. Various attempts have been made at explaining the origin of this legend, which probably arose from accounts of the commercial enterprises of the early Greeks on the coasts of the Black Sea.

Golden Fleece (*Toison d'Or*), **Order of the,** a famous order of knighthood, reckoned, next to that of the Garter, the most illustrious in Europe. It was founded at Bruges in 1429 by Philip III. of Burgundy. Charles VI., emperor of Germany, as possessor of the Netherlands, transferred the seat of the order to Vienna, as the Spanish monarchs had already done to Madrid. Thus there arose two branches, a Spanish and an Austrian, the latter having the original archives, but the former being the more exclusive. Neither order recognizes the other's existence.

Gol'den Grove, tp. of Barton co., Mo. Pop. 405.

Gol'den Horde, a band of Tartars who appeared at Khipsali in 1235; in 1240 invaded Russia and burnt Moscow and Kiov; destroyed Lublin and Cracow 1240, burnt Breslau in 1241, and defeated Henry, duke of Silesia, at Liegnitz; ravaged Moravia and Hungary, and massacred the Magyar army 1241. A crusade was preached against them in that year; their siege of Neustadt was unsuccessful; they crossed to the S. of the Danube 1242; marched eastward in 1243; made Russia tributary 1243–1477; made Alexander Newski grand duke in 1252; were attacked by Timour in 1392; and were overthrown by Ivan III. and the Nogay Tartars at Bielawesch 1481. Their first leader, Batou, was a grandson of Genghis Khan, and their invasion was ordered by Octai, the great khan.

Gol'den Le'gend (*Aurea Legenda*), a celebrated work composed in the thirteenth century by James de Voragine, archbishop of Genoa. It is a collection of legends concerning the saints, and for many years maintained a wonderful popularity. It was translated from the original Latin into most of the vulgar tongues.

Gol'den Num'ber, the number of the year in the Metonic cycle, otherwise called the lunar cycle. (See CYCLE.) As the times of holding the Grecian games were dependent on the state of the moon, this number was of prominent importance in the Grecian calendar; and hence is said by some to have been inscribed in characters of gold on the columns of the temple of Minerva at Athens; whence its name. Others say that it is thus called because it was written in gold in the calendar tables publicly suspended in the Grecian cities; and later in the portable calendars in use among the early Christians. At present, the golden number is only useful in finding the day upon which Easter (and consequently the other movable feasts of the Church) will fall. (For the explanation of this, and also of the mode of finding the golden number, see EASTER.)
F. A. P. BARNARD.

Gol'den Rod, a popular name originally belonging to the *Solidago Virga aurea*, an extremely variable plant of North America and Europe, once in repute as a vulnerary. The name is in this country extended to the very numerous herbs of the same genus (order Compositæ), which are mostly tall, stiff annuals with yellow flowers. They are chiefly American. One species, the *S. odora*, is often fragrant, abounding in a volatile oil. It has a limited use in medicine, being carminative, aromatic, and diaphoretic.

Gol'den Rose, a rose made of gold and set with precious stones which is blessed by the pope annually on the fourth Sunday in Lent, and then presented to some prince or other dignitary (usually to a lady). Pope Innocent IV. has the credit of originating the Golden Rose about 1250, and Pope Urban V. in 1366 first sent one as a present, Joanna I., queen of Naples, being the recipient. The Golden Rose seems to refer to Christ, the "Rose of Sharon."

Gol'den Val'ley, tp. of Rutherford co., N. C. P. 1122.

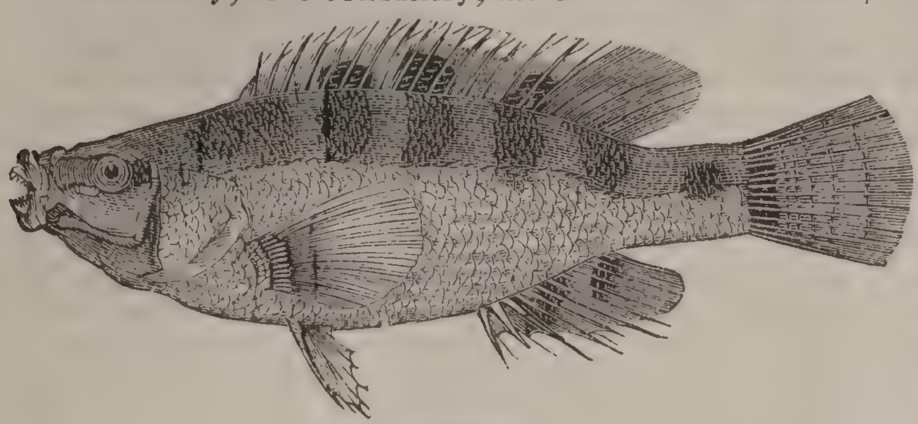
Gol'denville, Guysborough co., N. S., is the most productive gold-region in the extensive mining districts of Nova Scotia. The greatest annual yield has been nearly $200,000. Pop. about 900.

Gold Eye, the name of certain North American freshwater fishes of the genus *Hyodon*, family Hyodontidæ, having teeth on the jaws, palate, and tongue. The fishes are small, and will rise to a fly like the trout or grayling.

Gold'finch, the *Carduelis elegans*, a favorite European

song-bird, beautifully colored with yellow, white, black, and red. It is readily domesticated, sings very well, and is intelligent and affectionate. It breeds freely with the linnet, canary, and other finches, and the mules or hybrids are prized for their song. The *Chrysomitris tristis*, American goldfinch or yellow-bird, has more yellow in its plumage. It much resembles the foregoing. The green goldfinch is the *Fringilla melba*, from Brazil.

Gold′finny, or **Goldsinny**, the *Crenilabrus Cornubi-*


Goldfinny.

lus, Norvegicus and others of the genus, small European fishes of the family Labridæ. They are generally yellowish, and have a large back fin.

Gold Fish, the *Cyprinus auratus* or golden carp, a Chinese fish now naturalized in many streams and lakes of Europe and the U. S. From its beautiful orange color and its tenacity of life it is often kept in glass globes and aquaria. When very young its color is dark, and when very old it sometimes fades to a silvery hue. It is of fair quality for the table.

Gold Hill, an incorporated town of Storey co., Nev., 328 miles by rail from San Francisco, Cal., and 1 mile S. of Virginia City, at the head of Gold Cañon, a large ravine 8 miles in length emptying into Carson River. The famous Comstock Lode, passing through Virginia City along the eastern slope of Mt. Davidson, passes also through Gold Hill. Beneath the town lie some of the richest mines known, including the Belcher and Crown Point, which yield about $2,000,000 in silver and gold bullion monthly. Within the limits of the town are about a dozen large quartz-mills, but most of the ore is transported some 15 miles over the Virginia and Truckee R. R., which runs through the town, to still more extensive and powerful mills on Carson River. Gold Hill contains 3 churches, excellent public schools, and 1 newspaper. It received its name from a small rocky hill at that point rich in gold, which was soon discovered to be merely a prominent portion of the surface croppings of the now world-renowned Comstock Lode. The mines have been worked to a depth of 1900 feet, and show no signs of failing. Mining is the chief occupation. Pop. 4311.

Alf. Doten, Ed. "Daily News."

Gold Hill, post-tp. of Rowan co., N. C. Pop. 959.

Gold Lace, a material used for decorating the uniforms of officers in armies and navies, and for other similar purposes. The best gold lace is made by winding extremely thin gilded and flattened silver wire around threads of silk. There are other but quite inferior methods of making the gilded thread of which this expensive lace is woven.

Gold-Mines and Mining. Gold mines may be grouped in two broadly marked divisions: (1) vein mines, and (2) placer mines. Gold-bearing veins are generally of quartz, and they penetrate solid rocks to considerable depths. Placer mines are the comparatively superficial detrital deposits formed by the action of rivers and floods upon the veins. In veins the gold is firmly fixed in the gangue or veinstone, and is in irregular, ragged masses or crystalline particles; but in placers the gold is detached from the gangue, and is worn and rounded by attrition, having been rolled and tumbled in the beds of creeks and torrents together with pebbles and boulders until all the asperities have been removed. Placer gold can thus be easily distinguished from vein gold. The gold so broken out from veins is distributed through the gravel and sand, but, owing to its high specific gravity, it gradually finds its way down to the lowest layers of gravel, and accumulates upon the surface of the underlying rock, generally known among miners as the "bed-rock." There is thus a kind of concentration of the gold in a layer under the gravel and soil, having more or less lateral extension, and comparatively near the surface; while in veins the gold is distributed through a layer of quartz traversing the rocks in a vertical or nearly vertical plane to great depths. This great difference in the mode of occurrence of the metal of course necessitates a great difference in the methods of mining. The operation of collecting the gold is in both cases essentially a mechanical one, based upon the superior gravity of the gold, which permits it to be readily separated from the rocky and earthy substances in which it is found.

Gold-bearing veins are found in rocks of various ages and kinds: argillaceous, talcose, and chloritic slates appear, however, to be peculiarly favorable to the occurrence of the metal. In some regions hornblendic slates are more highly auriferous than the other rocks. Veins vary in width from a few inches or less to several feet. As a general rule, veins are larger, broader, and more extensive in slate regions than in granite or the hard rocks. This seems to result from the fact that slates are more readily and deeply fissured in one direction than in any other. This direction is the plane of stratification or of highly developed cleavage, and veins generally conform to it in their direction and depth. There is a remarkable uniformity in the characteristics of gold-bearing veins all over the world. The veinstone is generally the opaque or translucent, milky-white variety of quartz, without distinct crystallization or cleavage. In some veins, however, it is very much harder than in other veins, and requires great labor and much powder to break it out. Sometimes it is readily excavated by the pickaxe; as, for example, in some parts of the great Comstock Lode in Nevada, yielding silver and gold, the white quartz is in a fragmentary or powdered condition. It is usually, in all veins, much softer at considerable depths and when freshly mined than at the outcrops or after it has been exposed to the air for a long time. In some veins the bulk of the quartz exists in hard, rounded, nodular masses, surrounded more or less by softer cellular quartz, in which the gold is chiefly found associated with pyritous minerals, while the hard boulder-like masses of quartz are comparatively barren. These veins are known in California as "boulder-veins." A distinctly marked, banded structure, with a more or less crystalline medial plane, is not uncommon where veins traverse a hard, homogeneous rock, such as granite or syenite. This is a structural arrangement of the gangue which is regarded as one of the characteristics of true fissure veins. A banded structure, due chiefly to the parallel arrangement of the pyrites or to enclosed films of slate, is often seen in veins traversing slates. Such veinstone is often known as "ribbon-quartz," and is considered by miners as favorable to the richness of the ore. There is a class of veins known as "slate-veins," in which a belt of slates is traversed by thin seams of quartz so much divided up into films and mixed with the layers of slate as scarcely to be recognized. Such seams, perhaps not thicker than a card or knife-blade, are sometimes highly charged with gold. It is very rare to find gold in rocks without quartz, but it sometimes occurs in seams of calc-spar, dolomite, or steatite. The decomposition of such minerals would leave the gold in the rock apparently without gangue. Large amounts of gold have frequently been taken out of such seams in the rocks in a short time, and without finding any distinct evidence of the existence of a vein.

The gold in almost all veins is associated with pyritous minerals, varying in quantity from 1 to 3 per cent. Sulphuret of iron is most common, though yellow copper ore, galena, and arsenical pyrites are common. Tellurium and telluret of bismuth are also abundant in some veins. Such minerals in the upper portions of veins, where exposed to air and moisture, become decomposed by oxidation, and impart a rusty, ochery condition to the veinstone. As a general rule, all of the upper portions of veins above the line of the permanent level of the subterranean water have lost their pyritous minerals by decomposition, and present a very different appearance from the portions protected by water from the access of air. By such decomposition any gold that was enclosed or covered by pyrites is left free and in a condition to be easily collected. The extraction of gold from such ores is therefore more simple and less costly than from the unchanged ore obtained at greater depths. The difference is so great that many mines are abandoned so soon as the naturally decomposed or "rotten ores" are worked out. The rusted vein-stuff is not only more easily worked, but it is likewise mined with more ease, than the undecomposed ores below the water-level. In many veins the gold is not visible to the naked eye, except where the pyrites is decomposed. The distribution of gold in the mass of the veinstone is a very important matter practically. Many quartz veins exist even in gold-regions without gold having been found in them; and in those known to be gold-bearing there are extensive portions without gold. The metal is thus not equally distributed along the vein; it is more abundant in some places than in others. Sometimes one side of a vein contains gold, while the other side is quite barren. Each vein has some distinctive peculiarity, which only becomes known to those who work it after long experience and observation. The metal, it is to

be remembered, is not always visible, and to an unpractised eye the quartz from all parts of a vein may appear of equal value. Gold conforms to the general law of distribution of ores in veins. It is found in "chutes" or "chimneys," so called, having a vertical rather than a horizontal extension upon the plane of the vein. The gold-bearing portion may thus be only a few feet in length horizontally, but may extend downward hundreds of feet. The length of the chute is the distance it extends horizontally along the vein; its depth is the distance it extends downward; and its breadth or thickness is at right angles, horizontally, to its length. The vein may continue unchanged in size for some distance beyond the paying ground, but be too poor to be worked, or be absolutely free of gold. The length of a vein does not therefore determine its value; it is the length and thickness of the ore-chute which are of the greatest consequence. Several chutes often occur in succession, separated by barren vein-stuff. Such chutes generally maintain an approximate parallelism in depth. They are rarely exactly vertical, being generally inclined upon the plane of the vein, partaking in inclination not only of the dip of the vein in the rocks, but having an independent inclination or "pitch" upon that dip.

The origin of these chutes of "pay-quartz" is explained on the theory of the ascent, along certain channels, of the thermal waters or vapors by which the gold was deposited as soot is deposited in a chimney. Such a distribution of the precious metal of necessity affects the position and extent of the operations for mining it. The shafts and levels must be located with reference to the extent and pitch of the chutes as well as the dip of the vein. Mining upon gold-bearing veins does not differ materially from mining on veins of ores of the ordinary metals. The same kind of machinery for drilling, hoisting, pumping, and tramming is brought into use. The great value of the metal, compared with its bulk, often permits extremely narrow veins to be followed with profit, although necessitating the excavation of a large amount of wall-rock on one side or the other. On the other hand, in some large veins only one side of the veinstone contains gold enough to pay for extraction. In general, it is difficult or impossible to determine the value of the quartz by mere inspection, and it is therefore not safe to select the paying portions too closely. The extraction of gold from the quartz veinstone is in the main a mechanical operation, but requires great special skill, and the details of the work vary with the condition in which the gold occurs, whether in coarse or fine grains, in thick or thin particles, or whether associated with much or little heavy pyrites or other minerals. The bulk or weight in all cases is extremely small compared with the veinstone. The pyritous minerals associated with it, generally known as "sulphurets," rarely exceed 3 per cent. of the mass; the gold is but a fraction of this amount. An ounce to a ton, equivalent to .0034 per cent., is a large yield. If it were not for the high gravity of gold compared with quartz, about as 16.5 to 2.5, satisfactory mechanical separation would be impossible. The operation consists in crushing the quartz to a fine powder, so as to detach every particle of gold, and in washing away the quartz with water, leaving the gold behind. Quicksilver is used to aid in arresting the fine particles of gold by uniting them in an amalgam. The crushing to powder is effected in stamp-mills (see STAMP BATTERIES), the large masses being first broken up in a rock-breaker, so that no mass larger than the fist is thrown under the stamps. Quicksilver is used either in the battery mortars, or only outside in riffles or on amalgamated metal plates which present a broad surface, over which all the gold coming from the batteries must pass. A great advantage in using quicksilver in the mortars is the immediate amalgamation of the coarse particles of gold when broken out from the quartz, thus removing them from the action of the stamps and preventing their being further reduced in size. Amalgamated copper plates placed inside the mortars serve to catch and retain the amalgam, which accumulates to a thickness of half an inch or more. In cleaning up, such amalgam has to be removed by chisels; it is dissolved or softened in quicksilver to separate all impurities. The excess of quicksilver is then removed by straining through a cloth or buckskin, leaving balls of pasty amalgam. The residue of the quicksilver is expelled by heating the amalgam in an iron retort, from which the gold is taken in a spongy, cavernous condition, known as "retorted gold." It is then fused and cast into ingots.

The sulphurets, which enclose more or less gold, are usually saved by concentrating machinery or by thick woollen blankets with a long hairy nap made expressly for the purpose. The battery sand in passing over such a surface deposits the greater part of the sulphurets, which are removed from the blankets by rinsing in water at short intervals. Such concentrated sand is usually worked by the chlorination process, which consists in dissolving out the gold by chlorine after a preliminary roasting to remove all of the sulphur, arsenic, etc. The value of sulphurets varies with the richness of the ore and at different mines. It ranges ordinarily between $50 and $250 per ton. The average value during the year 1873 at the Eureka mine, Grass Valley, Cal., was $80.57 per ton. This is one of the most noted and typical gold-mines of California, and a few facts regarding it and other prominent mines will fairly illustrate vein gold-mining generally. The thickness of the Eureka quartz-vein is about 4 feet, and the length of the pay-chute about 1000 feet. The main shaft has been sunk to a depth of 1250 feet. There are eight levels, with an aggregate length of 9000 feet. From Oct. 1, 1865, to Sept. 30, 1874, gold bullion valued at $4,273,148 was taken out, and an aggregate of $2,054,000 was paid in dividends. The quartz in the bottom levels is not as rich as it was above, and explorations in search of better ore are in progress. The cost of sinking in exploring is $65 per foot; of drifting, $25; and of stoping, about $10.50 per ton of quartz. Quantity extracted, 8130 tons; average yield of gold, $25; percentage of sulphurets, 1.5. The cost of milling the ore is $2.61 per ton. In 1873 it averaged $2.70. The Idaho mine is another good example of a first-class mine. It adjoins the Eureka, but is not worked to so great a depth. In five years fifty-three dividends, aggregating $1,284,950, were paid. In 1873, 27,624¾ tons of ore were worked, and averaged $37.91½ per ton. The average cost of mining and milling is $8.61½ per ton. At the Empire mine, worked to a depth of 1250 feet, 11,000 tons were extracted in 1874 from a vein averaging only 15 inches in thickness. The cost of extraction is stated at $8, and of milling $1.75 per ton; average yield, $16.75; percentage of sulphurets, 2½. With the exception of the last-mentioned mine the yield is above the average in gold-mines. Some of the most profitable mines pay much less per ton. At the Sierra Buttes, in Sierra co., Cal., the average value per ton of 40,035 tons worked in 1873 was $9; cost of mining, $3.60; and of milling, only 80 cents. Favorable conditions for mining, and the use of water-power instead of steam, make a great difference in the expense of working a mine and extracting the gold. At the Benton mills, run by water, on the Merced River, Mariposas estate, quartz can be crushed and stamped for less than 60 cents a ton, and the total cost of milling is about $1. At Hayward's Eureka mine, in Amador co., worked to a depth of nearly 1700 feet (1874), 22,465 tons were worked in 1873, and yielded an average of $17.91 per ton. The vein in some places was found to be not less than 55 feet thick, and in others only 8 feet and 4 feet. Some portions are quite barren. The cost of extraction averaged $2.50 per ton for the higher levels. The famous Princeton mine on the Mariposas estate yielded from $13 to $25 per ton at different times, the average, generally, being about $16. In the year 1872 there were over 311 gold quartz-mills in California, crushing about 573,000 tons of quartz annually.

Gold-bearing veins are often found by tracing the placer gold up the valleys to the side of the vein. When rough and ragged masses of gold are found in placers, it is good evidence that they have not been transported far from the original source. There are frequent examples of detrital deposits being barren of gold above certain veins, and rich in gold below them. Quartz veins which appear to be perfectly barren sometimes seem to have been the source from which large stream-deposits of the metal have been supplied. In seeking an explanation, the unequal distribution of gold in the mass of the veinstone is to be considered, as well as the enormous amount of erosion which most veins have undergone. The wearing away and natural mining by rivers and floods through long ages of time far exceed in extent any human efforts. Valleys in California transverse to the direction of gold-bearing veins are from 1000 to 3000 feet deep, and all of the gold which existed in the veins eroded to that depth is collected in the detrital deposit of the valley below. Nature has performed on a gigantic scale the very operations required to obtain the gold from veins. The quartz is mined, crushed, and the gold is rudely separated and concentrated on the bed-rock of rivers and alluvial deposits. Placer mining may thus be considered a *collecting* operation, and it affords a more rapid and abundant harvest of gold for a short time than can be expected from veins. The rivers and brooks of a gold-region are in fact natural sluices, in which the gold broken from the vein is gradually concentrated; but the distribution of the metal in such valleys is extremely irregular, depending upon the supply, the nature of the current and of the bed-rock. As a general rule, where the bed of a stream is hard and the current is swift the bed-rock is swept clean, and no gold remains, except perhaps in deep holes and crevices, where it accumulates out of reach of the force of the water. In the process of ages streams cut their channels to greater depths, and the drain-

age of the country changes; valleys are drained and terrace-like deposits are left upon the hills. These deposits are generally rich in gold, and are more accessible to the miner than the beds of rivers. Placer mining is thus conducted not only in the beds of existing but of ancient streams. Such stream-deposits have been traced for long distances, apparently across the existing drainage of the mountain-region of California, and have been mined with great profit. The gravel in many places, being deeply buried and excluded from the air, has a bluish color, due to the presence of protoxide of iron, contrasting strongly with the ordinary deposits. This blue gravel, wherever found in the higher parts of the gold-region, is generally regarded as the deposit of one great river which formerly flowed in a south-easterly direction. It is known as the "blue lead." But there may have been, and probably were, several ancient streams, each leaving deposits having a general similarity.

There are other classes of deposits than those mentioned. Some appear to have been formed in lakes, inasmuch as the coarser materials at the bottom carrying the gold are overlaid by horizontal beds of clay and sand hundreds of feet in thickness. Other extensive deposits of enormous boulders seem to have resulted from ice-action, and may be the medial or terminal moraines of ancient glaciers. This variety in the conditions of occurrence necessitates a variety of methods for securing the precious metal.

In placer gold-washing, as in collecting the gold from crushed quartz, the separation from earthy substances is effected by a current of water flowing over inclined surfaces. The materials presenting the greatest surface and having the least gravity are swept forwards most rapidly, while the heavier and smaller objects are left behind at or near the upper part of the incline. All apparatus and methods are based upon this principle; the difference is in degree, not in kind. Formerly, nearly all auriferous earth and gravel was washed by throwing it into "rockers" or "long toms," so called, which were essentially inclined troughs made of boards and set at such an angle that the current of water flowing through would be strong enough to sweep away the earth and gravel and leave the gold. A coarsely perforated plate or grating at the lower end allowed the water and gold to fall through into a box provided with riffles and charged with quicksilver. The coarse gravel was removed by shovelling. Such apparatus, with the pick and shovel and a pan, is sufficient for operations on a small scale in ordinary alluvial deposits, where the upper and barren layers of sand and gravel are shovelled off, and only the comparatively small amount of pay gravel at the bottom is washed. For such operations only one or two men are necessary, and but little or no capital, but for the more extensive deposits hundreds of feet below the surface, and overlaid, perhaps, by thick outflows of basaltic lava, extensive mining operations requiring combined effort and large capital are necessary. The great bulk of the gold of California and Australia is now obtained from the deep placers worked by associated capital on a stupendous scale. A large portion of the richest gravel deposits are found in trough-like channels or basin-shaped depressions with a rocky rim, which must be pierced to reach the paying substratum and to afford the requisite drainage for successful working. This piercing is effected by running a tunnel from some adjoining valley, so as to reach the lowest depression of the deposit and give an outlet for the flood of water used in washing. The grade or "fall" must be such as to convey away the earth, gravel, and boulders, and there must be room enough at the final outlet for the accumulation of tailings. In some cases the pay gravel on the bed-rock is removed by mining, in the same manner as a coal-bed is taken out, and is washed in sluices outside of the mine; but the most economical and expeditious method of excavation, when water can be had under pressure, is what is known as "hydraulic mining." This is a process which originated in California in 1852, and has since been greatly improved. Water is conveyed in ditches for many miles to the hills above the deposits, and is carried down in iron pipes and delivered in large streams, under a pressure of from 100 to 300 or even 500 feet of height of column, against the base of the gravel deposit to be washed. The end of the pipe is furnished with a nozzle from 5 to 8 inches in diameter. A 6-inch nozzle, under a pressure of 275 to 300 feet of column, will deliver 1579 cubic feet of water in one minute with a velocity of 140 feet per second. This mass of water striking in a solid column against the base of a bank of gravel excavates it with great rapidity. Boulders weighing hundreds of pounds are tossed right and left. The upper portion of the bank is soon undermined, and caves in. This brings down huge masses of the overlying deposits, which, under the continuous force of the jet, are in their turn broken up and carried off in the currents of water flowing in sluiceways converging to the tunnel leading through the rim-rock. When the gravel-bank is so hard that it will not yield readily to the force of the jet, it is broken up or loosened by blasting. From 100 to 600 kegs of powder are used at a time, and as much as 2000 kegs in one instance.

The iron used for the pipes varies in thickness from No. 16 to No. 11, and the diameter of the pipes ranges from 22 inches to 30 inches. Specially-constructed nozzles, with goose-necks or universal joints, and moved by levers and strong tackle, are requisite to control the jets. They are usually placed at a distance of 200 feet from the bank. Danger from caving usually prevents a nearer approach. The grade or "fall" should be about 6 inches in 12 feet. Sluice-boxes are laid in the tunnel, and are from 4 to 6 feet in breadth, and 36 to 40 inches high. These are paved with hard flat stones set on edge, so as to catch the gold and to prevent the wear of the bottom by the rapidly-moving gravel and boulders. Blocks of wood, set with narrow spaces between them, are also used. At the lower end of the sluice iron gratings are so arranged as to separate the large boulders from the gravel and water. Large derricks are required at the upper end for moving the heavier rocks which cannot be washed down the sluice. An invention known as the "under-current sluice" is largely used to withdraw the finer portions of the gravel with the gold from the main current, and spread them over a broader and less inclined surface, so that they move in a shallower current. These conditions are more favorable to the deposition of the gold than a deep and rapidly flowing stream, such as the coarse materials require.

The operation of hydraulic washing is a continuous one, and requires very little manual labor compared with the amount of material disintegrated and moved. The washing continues for months, and no gold is seen until the cleaning-up, which in one of the large sluices is an operation of considerable magnitude. Some of the bed-rock tunnels are thousands of feet in length, and require several years for their completion. The works of the North Bloomfield Co., in Nevada co., Cal., may be cited as an example. Ditches and reservoirs for the water-supply have been constructed at an expense of over $1,250,000, and with an aggregate length of more than 100 miles. The pay channel is supposed to be half a mile in width, and to reach and work it a tunnel nearly 8000 feet is required. This tunnel is for part of the distance 6 by 6½ feet, and for the remainder 8 feet by 8 feet. Nozzles 8 inches in diameter will be used, delivering a stream of water of that size under a pressure of 500 feet. It is estimated that there is material enough to furnish work in this way for many years. W. P. Blake.

Gold of Pleasure, or **False Flax,** the *Camelina sativa,* an annual herb of the order Cruciferæ. It grows in Europe and Asia, and has been sparingly naturalized in the U. S., where it is a worthless weed. But in some parts of Europe it is cultivated for the oil obtained from its seed. This oil is of rather poor quality. The oil-cake is acrid, and not much relished by cattle. The green plant is sometimes ploughed in for manure. It has the advantage of growing well and rapidly on sandy land.

Goldo'ni (Carlo), father of the modern Italian comedy, was b. at Venice in 1707. From his father and grandfather he inherited a strong passion for theatricals, but as he was unfit for the stage, he studied law, and he had even commenced practising as a lawyer in his native city when the success of a play he wrote for a troop of strolling actors induced him to give up his business and become a playwriter. In 1761 he went to Paris to write for the Italian theatre in that city. He was appointed teacher in the Italian language to the three daughters of Louis XV., and received a pension of 4000 francs yearly, which was taken from him at the outbreak of the Revolution, but restored to him by the efforts of André Chenier. He d. in 1795. He wrote about 200 comedies, of which a few—for instance, *Le Bourru Bienfaisant,* as well as his *Mémoires pour servir à l'Histoire de sa vie et à cette de son Théâtre*—are written in French; the rest are written in Italian, often in the Venetian dialect, which makes them difficult to enjoy, at least to foreigners; but the liveliness, gracefulness, and wit of his dialogue, especially in pieces picturing low life in his native city, are still highly appreciated by his countrymen, and his influence on the history of the Italian theatre was very great. From his time the *commedia dell' arte* disappeared from the stage. In his earlier plays—for instance, in *The Servant of Two Masters*—he still employed the stock characters, the so-called masks of *commedia dell' arte,* Harlequin, Pierrot, Pantaleon, etc., and the interest of the play centred in the comicality of the situations. But the improvisation ceased, the dialogue was written out in full, and the clown became an artist. In his later plays—for instance, in *A Curious Accident*—he discarded even the masks; and as his observation of human character

such as reveals itself in every-day life, was as acute and lively as his power of representing it in dialogues was brilliant and charming, the transformation from the *commedia dell' arte* to the present form of modern comedy was happily achieved. In Italy his plays are still given very often, and enjoyed very much, and many of them—as, for instance, the three mentioned in this article—would be seen with great pleasure on any stage. CLEMENS PETERSEN.

Gold-purple, known as the precipitate of Cassius, was described by Andreas Cassius and his son in 1685. It is used chiefly for giving a pink or violet color to glass and enamels. It is formed by adding a dilute mixture of protochloride and perchloride of tin, drop by drop, to a dilute neutral solution of terchloride of gold; a purple precipitate is formed. Its separation from the liquid is promoted by adding a little salt and boiling it. W. P. BLAKE.

Golds'berry, post-tp. of Howell co., Mo. Pop. 349.

Golds'boro', post-v. and tp., cap. of Wayne co., N. C., on the great southern thoroughfare of travel, 142 miles S. of Petersburg, Va., at the junction of the Central R. R., leading from the sea-coast through the mountains of North Carolina westward. It has 2 newspapers, 5 churches for white and 2 for colored, a large female college, a bank, a free school, a fine hotel, and several manufacturing enterprises. Its railways make it a very important town. Agriculture is its chief support. Pop. of v. 1134; of tp. 3886.
JULIUS A. BONITZ, ED. "CAROLINA MESSENGER."

Golds'borough, borough of York co., Pa., on the Northern Central R. R., 16 miles N. of York, on the W. bank of the Susquehanna. Pop. 310.

Goldsborough (LOUIS M.), U. S. N., b. Feb. 18, 1805, in Washington, D. C.; entered the navy as a midshipman June 18, 1812; became a lieutenant in 1825, a commander in 1841, a captain in 1855, a rear-admiral in 1862; retired in 1873. In 1827, while serving in the Mediterranean on board the schooner Porpoise, Lieut. Goldsborough was given the command of the boats of that vessel with orders to rescue an English brig called the Comet, captured by Greek pirates at night in the Doro Passage, while one of a convoy in charge of the Porpoise. The pirates numbered 200, while Goldsborough's little band, all told, did not exceed 40; yet, notwithstanding this disparity of force, the Comet was boarded without hesitation, many of the pirates slain, and the rest forced to take to their boats, and the English restored to liberty. This gallant affair was particularly mentioned by the Liverpool *Advertiser* as reflecting great credit upon Goldsborough and the American navy. After long years of faithful service this experienced officer had risen to the rank of captain when the government conferred upon him the command of the North Atlantic blockading squadron. This was in Sept., 1861, and he had hardly hoisted his flag as commander-in-chief when from a report sent to him by Lieut.-Com. (now Capt.) W. N. Jeffers, commanding a gunboat off Hatteras Inlet, he inferred that possession of the sounds of North Carolina might be obtained by a joint army and navy expedition, the objective point to be the stronghold of Roanoke Island. His views being approved by the navy department, he was summoned to Washington to hold a conference with Gen. McClellan, Assistant Secretary of the Navy, Fox, and the superintendent of the Coast Survey, Prof. A. D. Bache, as to the best means of carrying them into execution. The parties met one night just after dark at Goldsborough's house on K street, and remained together until midnight, by which time every point involved had been thoroughly canvassed and discussed, and it was agreed that Gen. Burnside's division, then unemployed, should be detailed to cooperate with the naval force under the command of the acting rear-admiral. When the combined forces were almost ready to start another meeting took place at night at the quarters of Gen. McClellan, the President, the secretary of state, the acting secretary of war, Gens. McClellan and Burnside, Mr. Fox, and the acting rear-admiral being present. Here the whole subject was again entertained and most carefully examined, and the conclusion arrived at was that success was certain to attend the Union arms. Goldsborough was closely questioned by Mr. Lincoln and Mr. Seward, but having well studied the whole matter, he answered all questions without difficulty, and confidently expressed the opinion that the end in view would be accomplished. The event justified his most sanguine anticipations, for it was not long afterward when the "Burnside expedition" (as it was popularly styled) was in possession of not only Roanoke Island and the sounds, but of many important positions in North Carolina. Goldsborough was now made a full rear-admiral, and received the thanks of Congress, and at the close of the civil war was complimented by the navy department with the command of the European squadron. Up to his retirement in 1873 no officer in the navy had had a more varied experience of naval life than the rear-admiral; and he is universally regarded as a man of the highest intelligence and attainments, and an undoubted authority on all matters relating to the naval profession. FOXHALL A. PARKER, U. S. N.

Gold'schmidt (HERMANN), b. of Jewish stock at Frankfort, Germany, June 17, 1802; studied painting under Cornelius, and practised that art with some success at Paris 1836–47; then devoted himself to astronomy, and discovered (1852–61) fourteen asteroids; the names and dates of discovery of these are given in the art. ASTEROIDS in this work. He also detected thousands of stars not given on the best atlases before his time, and announced the discovery of several new companion stars revolving around Sirius. D. at Fontainebleau Sept. 11, 1866.

Goldschmidt (JENNY **Lind**), b. at Stockholm, Sweden, Oct. 6, 1821; displayed in very early life a fine talent for singing, and even went upon the stage when ten years old, to the delight of all Stockholm; but her voice failing to some extent, she was withdrawn from the stage for three or four years, when, having taken some inferior part in an opera during the absence of one of the company, it was found that her voice had more than regained its former power and sweetness. She was for some years after a favorite singer, not heard of out of Sweden until in 1841 she became a pupil of Garcia in Paris. She soon became well known throughout Europe. She appeared in Berlin in 1844, in London in 1847, and in New York in 1850; married Mr. Otto Goldschmidt in 1851; returned to Europe in 1852, having won all hearts, not only by the sweetness of her voice and the great versatility of her dramatic powers, but also by the simplicity and excellence of her character. She has long been distinguished by liberal benefactions to the poor classes. Since her marriage she has seldom appeared as a singer, and then only for charitable purposes. She resides principally in London.

Goldschmidt (MEYER AARON), an eminent Danish novelist, was b. at Vordingborg, a small town of the island of Seeland, in 1819. He received a careful education, and studied at the University of Copenhagen. In 1840 he founded a weekly journal, *The Corsair*, which made a great sensation in sedate and somewhat old-fashioned Copenhagen by its brilliant wit and audacious satire. In 1848 he founded another weekly paper, *North and South*, which was well patronized on account of the criticism, generally sound and always fine and elegant, which it exercised both in the literary and the social and political fields. But, although a very able and successful journalist, it was as a novelist that M. A. Goldschmidt became dear to his countrymen. Danish life—how in its smallness and quietness it receives and develops in its own manner the greatest historical impulses—he describes with truth and exquisite fineness. His style has sparkling wit and considerable pathetic power, but its highest excellence is its wonderful simplicity, as fit for the description of nature and character as for the expression of sentiment and ideas. What Goldschmidt's eyes see is generally seen with love, and what his lips tell is always told with grace. Some of his novels are well known to English readers—*A Jew, The Homeless One, The Heir,* and *The Raven.*
CLEMENS PETERSEN.

Gold'smith (OLIVER), M. B., b. at Pallas, co. Longford, Ireland, Nov. 10, 1728, the son of a poor Anglican minister; graduated A. B. at Trinity College, Dublin, after five years as a sizar, during which he was subject to most humiliating indignities and much distress, partly the result of his own characteristic improvidence. A rejected applicant for holy orders, he tried the study of law, but having wasted his scanty means in gaming, he (1752–54) spent eighteen months as a medical student in Edinburgh, out of which town he was hunted by creditors; lived abroad 1754–56, chiefly at Leyden, and afterwards wandered over a large part of France, Germany, and Italy, taking his medical degree at Padua, and supporting himself by his musical talents, which entertained the kind peasants, and by the gratuities given by the universities to wandering students. In 1756 he went to London, where, after some years of hard experience as a chemist's assistant and practitioner of medicine, he became a proof-reader for the novelist Richardson. Still later, as usher in a school and as hack-writer for various journals, he earned a scanty living. His *Inquiry into the Present State of Polite Literature in Europe* (1759) was chiefly important as leading to opportunities for better work. The admirable *Citizen of the World* (1760) won him the friendship of Johnson and a membership in his Literary Club. The *Life of Beau Nash* was followed by the *History of England* (1761; revised ed. 1771), a work still read, for, though not of high critical value, its style is delightful. *The Traveller* (1764) established his place as a poet. *The Vicar of Wakefield* (1766), his only novel, is one of the choicest treasures of literature.

The Good-natured Man (a comedy, 1767), *Roman History* (1768), *The Deserted Village* (1770), his best poem, *She Stoops to Conquer* (1773), his best comedy, were followed by the *Grecian History* (1774), one of the least meritorious of his works, though long highly popular. The rest of his quite numerous works we need not enumerate. The highest and emptiest of the honors received by Goldsmith (1770) was the professorship of ancient history in the Royal Academy, which brought him no pay. The unfinished *Animated Nature* (1774) was his last undertaking, a well-written and pleasing work, but one without any scientific value. Goldsmith d. at London Apr. 4, 1774. His last days were rendered miserable by the pressure of debt, incurred partly at the gaming-table, partly by his thoughtless improvidence, and in no small degree by his liberal benefactions to the poor; for this awkward man, ugly in features, ludicrously uncouth in manners, so self-conscious and so sensitive that he could hardly talk for fear of being ridiculous, was nevertheless the kindest and most affectionate of men, and his death was as truly lamented by the poor and unlettered as by those who knew and appreciated the charms of his books. For style, his writings take place in the first rank, and their gentle humor and the indescribable charm of his genius win the heart of every reader. His own character was not without serious moral defects, but there was in him much more to love and respect than to condemn. Forster's *Life of Goldsmith* is the best, but that of Irving is good and appreciative. C. W. GREENE.

Gold Stick, a title given to colonels of the British Life Guards, and to the captain of the Gentlemen-at-arms, so called from the gilded bâtons which they carry on state occasions. (See SILVER STICK.)

Gold'thwaite (GEORGE), b. at Boston, Mass., Dec. 10, 1809; removed to Alabama at an early age, where he studied law and followed the practice of his profession; was judge of circuit court and of supreme court, and of the latter chief-justice for several years; adjutant-general of Alabama during the civil war; elected to the U. S. Senate Dec. 7, 1870.

Goldthwaite (HENRY), b. in Boston, Mass., was liberally educated, and became a law-partner of Gov. Fitzpatrick at Montgomery, Ala., a journalist, and a State legislator; became soon after the acknowledged leader of the Mobile bar. He was for some eight years a judge of the supreme court of Alabama. D. in 1847.

Golf [Dutch, *kolf*, a "club"], a game of skill played chiefly in Scotland. It is played upon a piece of grassy ground (called a *link*). Upon this a ball is driven by blows of a club through a "round" or succession of holes arranged in a circle. The object is to put the ball into each of the holes successively with the smallest possible number of strokes of the golf-club, a heavy curved bat.

Gol'fo Dul'ce, a lake of Central America, in the republic of Costa Rica, is 25 miles long, 10 miles broad, and communicates with the Gulf of Honduras by a small stream. The entrance into the river is impeded by sandbars, but the river itself and the lake are deep, and promise to be a road of commercial importance.

Golgotha. See CALVARY.

Goliad', county in the W. of Texas. Area, 900 square miles. The climate is dry and healthful. Cattle and wool are the principal products. The county is traversed by the San Antonio River. Timber is rather scanty, but building-stone abounds. Cap. Goliad. Pop. 3628.

Goliad, post-v., cap. of Goliad co., Tex., is situated on the San Antonio River opposite La Bahia, where Fannin and his followers were massacred in 1835. It has good schools, several churches, a salubrious climate, rich lands, and plenty of water-power. It is the seat of Aranama College (Presbyterian), and has one weekly newspaper. It is 28 miles from a railroad. PUBLISHERS "GUARD."

Goli'ath Bee'tles, a name given to a group of immense beetles from Western Africa, belonging to the Scarabæidæ, and living in the tops of trees, where they suck the juice of succulent stalks and devour the blossoms. The *Goliathus Goliathus* is considered the largest of all Coleoptera. It is sometimes four inches long. Some of these insects are most gorgeously colored.

Go'lius (JACOBUS), b. in 1596 at The Hague; was educated at Leyden, and was for a time Greek professor of La Rochelle; was attached to the Dutch embassy in Morocco 1622, and in 1624 became professor of Arabic at Leyden; was in the East 1625–29; became professor of mathematics at Leyden 1629; d. there Sept. 28, 1667. Published many translations from the Arabic, and a folio *Lexicon Arabico-Latinum* (1653), and left a MS. Persian dictionary and other works.—His brother PETER, a learned Orientalist, joined the Barefooted Carmelites, went as a missionary to the East, and founded the Carmelite convent of Mt. Sinai.

Göll'nitz, town of Northern Hungary, has important iron and copper mines, and manufactures of nails, wire, and cutlery. Pop. 5200.

Goll'now, town of Prussia, in Pomerania, on the Ihna, has manufactures of ribbons, paper, and tobacco. P. 7273.

Golomyn'ka, the *Comephorus Baikalensis*, a fish of the family Comephoridæ, caught in Lake Baikal for its abundant oil, which is extracted by pressure. It is one foot long, without scales, and is not edible.

Golosh'es [Fr. *galoche;* Sp. *galocha*, a "wooden shoe"], a name applied in Great Britain to overshoes, and especially, at present, to India-rubber or gum-elastic overshoes. (See INDIA-RUBBER, by PROF. C. F. CHANDLER, PH. D., LL.D.)

Golov'nin, or **Golownin** (VASILI or BASIL), b. in the Riazan government, Russia, 1776; became distinguished as a naval officer; was sent in 1807 to survey the shores of Asiatic and American Russia in command of the Diana sloop of war; was engaged in this work until 1811, when, having been driven by lack of food and water to land upon the Japanese island of Kunashir, he was seized and imprisoned (1811–13), but finally set at liberty. He afterwards led an exploring expedition around the world (1817–19), and was promoted to be vice-admiral and general overseer of the navy. D. at St. Petersburg, of cholera, in 1832. His *Observations upon Japan* and *Memoirs of a Captivity in Japan* have been translated into most modern languages, and were long the most valuable sources of knowledge regarding that country. He also wrote *A Voyage Round the World* (in Russian, 1822), and a book giving accounts of remarkable shipwrecks, etc.

Go'marists, or **Contra-Remonstrants,** the followers of Francis Gomar (1563–1641), a former ultra-Calvinistic party in the Dutch national Church, distinguished by their opposition to the Remonstrants or Arminian party, whose expulsion their leader secured at the Synod of Dort. (See DORT, SYNOD OF.)

Gombroon', or **Ben'der Abbas',** town on the Persian coast, at the Strait of Ormuz, belonging to the imamat of Muscat, in Arabia. On the island of Ormuz existed a flourishing town of the same name, established by the Portuguese. In 1622 the Persian Shah Abbas and the English disturbed this town, thereby transferring its commerce to Gombroon on the opposite shore. Gombroon rose immediately, and is said to have had 30,000 inhabitants. But under Persian rule it soon lost its commerce; the Europeans went away, the factories fell into decay, and the place is now insignificant.

Go'mer, tp. of Caldwell co., Mo. Pop. 558.

Gom'era, one of the Canaries, 12 miles long, 9 miles broad, and with a pop. of 11,742. It has two towns—St. Sebastian and Villa Hermosa.

Gomm (Field-Marshal Sir WILLIAM MAYNARD), G. C. B., D. C. L., b. about 1782; entered the English army as ensign in 1794; served in Holland in 1799; in the Peninsula; at the battle of Waterloo was quartermaster-general of a division. At the close of the latter campaign for distinguished services he was made a K. C. B., transferred from the line to the Guards, and commanded the troops in Jamaica. In 1842 he was appointed governor and commander-in-chief of Mauritius, which post he held till 1851, when he succeeded Sir Charles Napier as commander-in-chief of India. In 1859 he was made a G. C. B., and in 1868 was created a field-marshal. He held the colonelcy of the Coldstream Guards, and in 1872 he succeeded Field-Marshal Sir G. Pollock as constable of the Tower of London, a post of honor reserved for distinguished veteran soldiers. D. Mar. 15, 1875.

Gomu'ti Palm, the *Saguerus saccharifer*, a very valuable palm tree of Anam and the Malay Islands. It produces sago, palm wine, palm cabbage, sugar, *baru* (a substance used in caulking ships), and especially a large amount of COIR (which see), more durable than that of the cocoanut, but less flexible and not so good for the manufacture of running rigging for ships. Cables of the gomuti coir are very strong indeed, but rough and stiff, so that sailors dislike to handle them.

Gonaives, or **Les Gonaives,** town of Hayti, on the bay of the same name. It has an excellent harbor and a good trade. Pop. 4000.

Gon'dar (properly *Guendar*), city of Abyssinia, is situated in lat. 12° 35′ N. and lon. 37° 31′ 57″ E., on the ridge and slope of a southern spur of the Wogara Mountains, at an elevation of about 7000 feet above the sea and 1200 feet above Lake Tsana. In the beginning of the seventeenth century, under the government of the negus Fasilidas, whose name as king was Aslem-Seged, Gondar was made the capital, and is said to have had 50,000 inhabitants, while in the period between 1852 and 1862 Th. von Heuglin estimates its population at 6000 or 7000 only.

It consists of several extensive quarters, separated from each other by barren commons and mounds of rubbish, but at a distance it presents from all sides an imposing and wonderful aspect, with its picturesque groups of trees, its churches with their high conical roofs, and its royal palace, built, according to the Portuguese taste of the Middle Ages, with high walls, pinnacles, and towers. Limpid mountain-streams flow down the slopes. The northernmost quarter of the city, called Abun-Bed, contains the residence of the patriarch (*abuna*), and is separated by a brook flowing westward from the politically free state, Etsege-Bed, where the higher clergy and the religious orders live. A church, called by Rüppell, Telout, and containing two bells, which the Dutch presented to the negus Adjans Seged, stands to the E. of both these quarters on an elevated place. The quarter of Debra Birhan (the "church of the light"), with a church of the same name, extends to the S. and E.; and that of Gempsa-Bed (the palace-quarter) meets Etsege-Bed to the N. W. and Debra Birhan to the E. Here the royal palace, Gemp, arises among miserable huts thatched with straw, a high, towering castle, encircled with walls surmounted by towers and pinnacles. The main building is quadrangular, two stories high, with flat roof and stone ramparts. A tower with a cupola arises at each corner, and in the centre of the western façade another still higher, with tall pinnacles instead of the cupola. Several halls, galleries, chapels, bridges, and kiosks are connected with the main building. The material employed is chiefly basalt, with frames for windows and doors of red sandstone, and those parts of the main building in which these materials are used are in good repair, while the rest is generally crumbling and overrun with briers. A small citadel with tower and flat, crenellated roof, called Michaël-Gemp, lies to the N. W. of Gemp. At some distance, and to the S. W. of Gempsa-Bed, the large market-place is situated; on the slope to the S. the Mohammedan quarter, Islam-Bed; and directly S. W. the Jewish suburb, Felasa-Bed. The streets are narrow and crooked, partly paved with basalt, but partly covered with dirt and rubbish. The finer dwellings are low circular houses of two stories, built of unhewn stones, cemented with lime. The widely projecting, conical roof rests on a wooden framework, and consists of thatch covered with a thick layer of long grass. The lower story is not inhabited, but serves as store-room; the upper story is entered by a flight of stairs on the outside. Except the bed, some drinking-horns, and wooden pegs on which to hang arms and saddles, no furniture is found in the interior. Leopards, hyænas, foxes, genets, and ichneumons appear not unfrequently in the city. At some distance several other interesting buildings are situated, as, for instance, the church Fasilidas, a small temple with a cupola and a frieze, erected in the midst of a beautiful park, and a Portuguese church. Gondar contains 44 churches, with 1200 ecclesiastics. AUGUST NIEMANN.

Gon'dola [diminutive of It. *gonda*, a kind of boat], a boat about 30 feet long and 4 feet wide, used on the canals of Venice and in other parts of Italy. The Venetian gondolas have pointed ends, which rise out of the water. The gondola is propelled by from one to four rowers, who stand at their oars. In parts of the U. S. flat boats used for heavy merchandise are called gondolas (vulgarly pronounced *gundelo*).

Gonds [*Gônd*], a non-Aryan or Dravidian race of Central India, whose name is seen in Gundwana, the principal district where they dwell. They are small, strong, hardy, and brave, totally distinct from the Hindoos in language, religion, and habits; have no caste, except so far as they have adopted Hindoo customs, for the Raj-Gonds are partly of Rajpoot descent, and have some elements of Hindoo civilization, and some Gonds have attached themselves as pariahs to Hindoo society. The name appears to be identical with that of the Khonds, a Dravidian people of Orissa. The Gonds number 1,134,578.

Gon'falon, or **Gon'fanon** [It. *gonfalone, gonfanone*], in mediæval Italy the banner or standard of a city, a monastery, or a church. The bearer of this, and in some cases the chief magistrate of a town, was called a gonfalonier.

Gong [Javanese], an East Indian and Chinese instrument, a sort of cymbal, which emits a loud sound on percussion. A bronze with 78 parts of copper and 22 of tin (*Klaproth*) is a common material for gongs. It is stated that gongs are at first brittle, and have to be annealed and then hardened before use. A leather-covered wooden mallet is used for striking the gong.

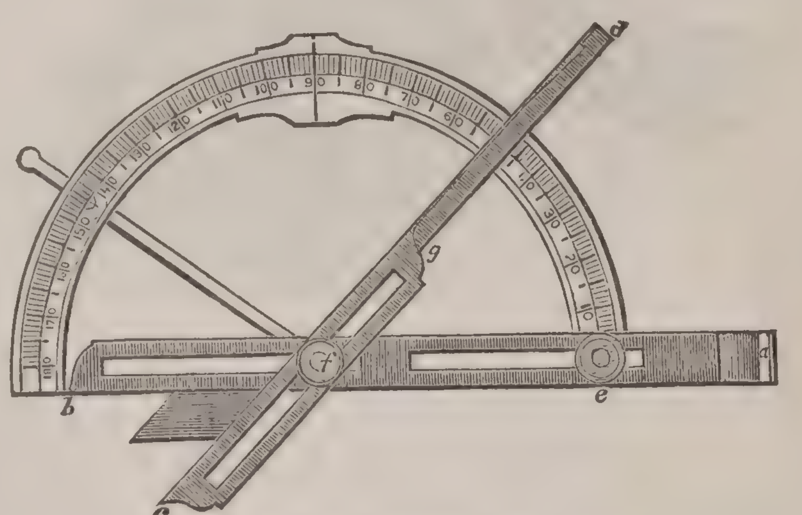
Goniati'tes [Gr. γωνία, an "angle"], a genus of fossil cephalopods of the family Ammonitidæ. Some 150 species are described from Palæozoic strata.

Gon'ic, post-v. of Strafford co., N. H. It is in Rochester township, on the Dover and Winnipiseogee R. R., 8 miles N. W. of Dover, and has a national bank.

Gonid'ia [pl., from the Gr. γονή, "generation," and εἶδος, "appearance"], in some of the cryptogamous plants a cell-mass which serves to reproduce the plant, not, like the true spores, as the consequence of a generative act, but, it is believed, by a process analogous to the budding of the higher plants, or the gemmiparous reproduction of many of the lower animals. The term is somewhat vaguely applied to bodies of this supposed character.

Goniom'eter [from the Gr. γωνία, an "angle," and μέτρον, a "measure"] was originally the instrument for measuring angles. Its use is now almost entirely restricted to those instruments used in measuring the angles of crystals. Goniometers are divided into two classes—goniometers of application and goniometers of reflection. The first consist of two strips of steel, which can be applied to the faces of the crystal. The second are constructed so as to make use of the reflection of an image seen successively in different faces of a crystal. The first application goniometer was invented by Caringeau in 1783. It was the one used by Haüy in his researches, and afterwards received the name of "Haüy's goniometer." It is founded upon the principle that if any two straight lines cut one another, the opposite angles are equal. This instrument (Fig. 1), as Caringeau

FIG. 1.



Caringeau's Goniometer.

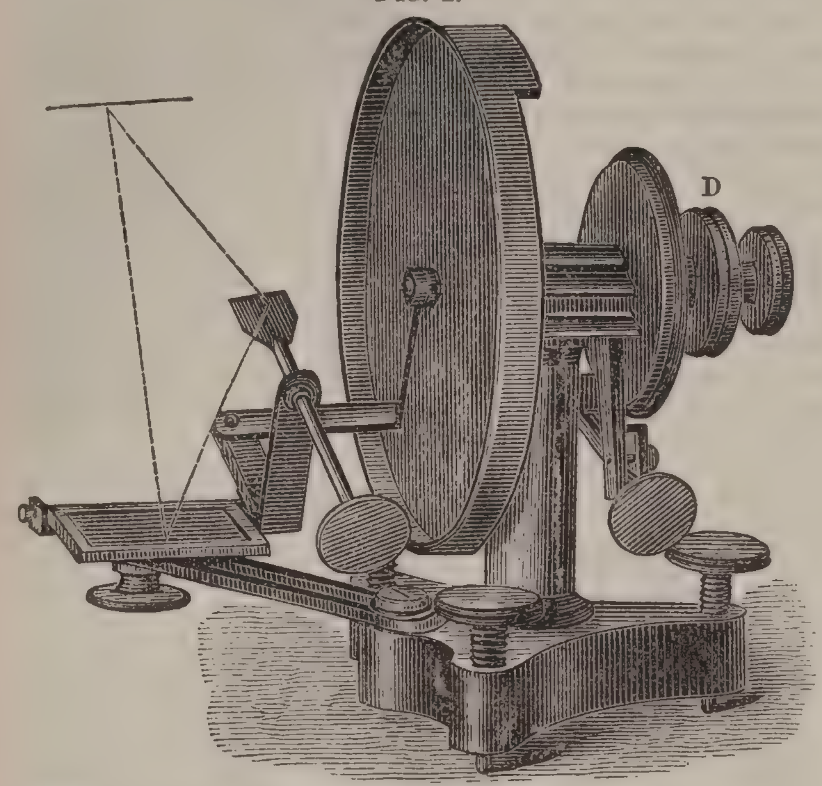
constructed it, is composed of a semicircle hinged at 90°, to which two arms of steel are attached, which are applied directly to the angle to be measured. One of these has no movement of rotation, but moves horizontally on the pins *e* and *f*, its upper edge always remaining at zero. The other is movable on the pin *f*, and can be made to assume any angle with the horizontal arm. One of its edges is bevelled to facilitate reading the angle. The arms can be lengthened or shortened at will. The operation of measurement consists in applying one end of the arms to the faces of the crystal, and reading the angle shown on the circle by the other. When the crystal is engaged in a gangue, and the extremity of the semicircle prevents the application of the arms, it can be turned back on its hinge. The instrument so arranged is heavy, and requires great skill in use. For this reason Brogniart proposed to have the arms detached from the semicircle, so that they can be applied independently of the circle, and the instrument so constructed is called "Brogniart's goniometer," and is the modification in general use. This goniometer gives rapidly an approximation to the real angle when it is necessary to determine it within half a degree. The defect of such an instrument is, that it is impossible to verify whether it has been well adjusted. It requires great skill to place the plane of the arms perpendicular to the surface of the crystal, and the edge parallel to it. Sometimes the nature of the crystal prevents it, as when the faces are rough or are unequally laminated. Generally, the crystals to be measured are quite small, and the surfaces too small to obtain an exact measurement of the angle, so that any imperfection of manipulation is necessarily magnified. In most cases approximate measurements are sufficient both to recognize the nature of the mineral and to describe it. But when its physical properties are to be studied, these values are not sufficiently exact, and a reflecting goniometer must be used.

The idea of using the reflecting property of the faces for measuring angles was first suggested by Malus, but Dr. Wollaston first applied it. His goniometer was first called the reflecting goniometer, but afterwards, when several based upon the same principle had been invented, "Wollaston's goniometer." It gives measurements within a few minutes; its use is quite as easy as that of the application goniometer, and the errors which a skilled person may commit are very much less. But it is necessary to its applicability that the faces of the crystal should be brilliant, and when that is the case their small size is no obstacle, as crystals can be measured which are only a millimètre square. An angle is measured with these in-

struments by causing the crystal to rotate around the edge of the angle, from a given position of one of the faces, until the other has taken the same position; which position is determined by the coincidence of images observed in each of the two faces successively, the eye remaining fixed. The value of the rotation is measured upon a graduated circle placed perpendicularly to the edge of the crystal, which gives the complement of its angle.

Wollaston's goniometer (Fig. 2) is the simplest, and for

FIG. 2.

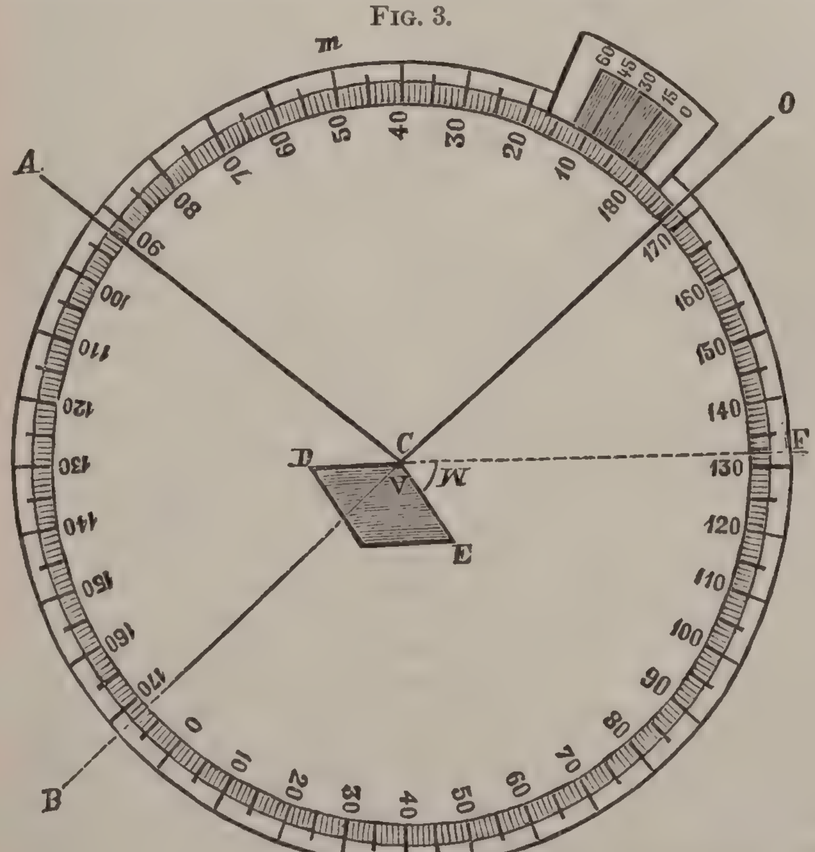


Wollaston's Goniometer.

many reasons the best. It will give within a minute the inclination of planes which are almost invisible. It is composed of a vertical graduated circle, divided upon its edge to half degrees. Through its centre two arms are arranged, supported in a fixed upright. One of them carries the circle, and is made to turn both the circle and crystal-holder. This arm is hollow, and carries in its interior another arm, which moves independently of the circle, and upon which the support for the crystal is placed, which consists of two arms with a joint which allows a rotation of 180°. The whole arm has a rotation of 360°. Through one end, at right angles to it, a piece of round steel is passed, which is slit to receive a plate of thin brass, on which the crystal is placed. Attached to the fixed support of the circle is a vernier.

The instrument is placed for use on a table five to six mètres from an open window, so that two horizontal lines A B of some distant building may be seen, or two window-bars, or lines drawn for the purpose. The circle is made vertical. To facilitate adjustment the foot of the instrument is provided with thumb-screws and small glass levels. The crystal is then fixed on its support with wax, so that one of the faces D C (Fig. 3) of the angle D C E, and

FIG. 3.



Wollaston's Goniometer.

their edge, is at right angles to the plane of the circle, and as near as possible in the prolongation of the axis of the instrument. The eye is now brought so near the crystal that the reflection of the lines A and B may be seen, and the image of the upper line is brought, by turning the crystal, to the lower line as seen directly, with which, by proper adjustment, it must be made to coincide. The crystal is then turned until the reflection of the image at A is seen in the second face C E, and a similar adjustment is made with this. The 0 of the circle and vernier are then brought together by turning the large thumb-screw D (Fig. 2); when the circle is at zero the small thumb-screw is turned until the line is seen as before in the first face. The eye remaining fixed, the circle and crystal are turned together until a new coincidence is observed in the second face. The number of degrees and minutes which measure the rotation of the crystal is then read. It is essential that the eye should remain fixed—a condition which is easily fulfilled, since the faces of the crystal are usually very small, and it sometimes happens that they are not distinctly visible, although the reflected line is.

Dr. Kupfer published in Berlin in 1825 a treatise on the theory of Wollaston's goniometer, in which he details the possible causes of error attending its use. He shows that the conditions necessary for exact measurement are—(1) That the crystal must be small, and that its edge must be as near the axis as possible, and parallel to it, and if possible in its prolongation, or at least must have a very small eccentricity. (2) That the reflected lines shall both be as far as possible from the instrument, and at exactly the same distance from the crystal. As this can seldom be, the instrument must be so placed that the plane of the circle shall cut the reflected lines at right angles. (3) The axis of rotation of the circle must be in the plane which divides the angle to be measured into two equal parts. Thus, the two normals of the faces start from a point of the axis, turn round their point of intersection, and are brought so that the two faces occupy successively the same position. If the axis is at a distance from the bisecting plane, the normals drawn from a point of this axis to the faces will be unequal, and one of the faces will not take the place of the other. It can only become parallel to it. The error which this may occasion will be less in proportion as the fixed lines are more distant, and by taking them far enough off may be practically eliminated.

By numerous repetitions made by turning back the crystal after each observation without turning back the circle, personal errors or the errors of graduation may be nearly or quite eliminated, and a result reached within a minute of the truth. When observations are repeated, though with great care and under the most favorable circumstances, variations in the readings are observed, which may attain the value of some minutes. It is only by taking the mean of many that it is possible to get the exact value of the angle.

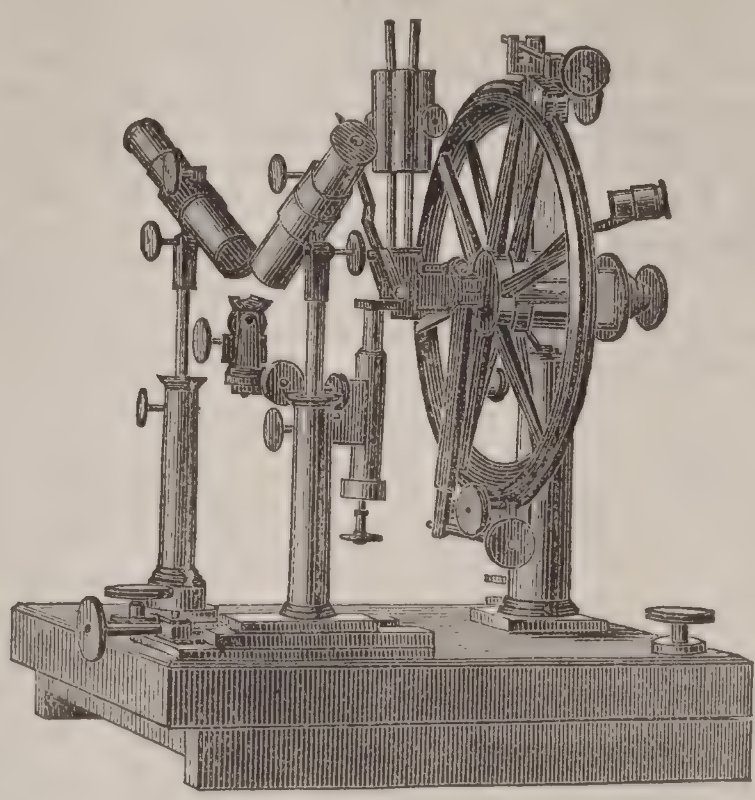
As it is difficult to find two lines at exactly the same distance, most crystallographers choose only one, and have this reflected in a mirror attached to the foot of the instrument. This mirror reproduces the image of the upper line at the same distance below that the line itself is above, and with this the one reflected from the crystal is made to coincide. In this way the equality of the distances of the two lines with regard to the crystal is fulfilled. The cross-hairs of a telescope would answer equally well. The telescope has the advantage of giving very exact results, but it is difficult to use when the reflecting power of the crystal is small. Sometimes a single point, instead of a line, is taken, and its image, reflected, is made to coincide with the intersection of two cross-hairs of a telescope.

The principal mistakes which can arise in using Wollaston's goniometer are—(1) The errors of adjustment of the crystal, caused by the eccentricity of the edge. This may be eliminated by two readings, turning the instrument so that they are made alternately on the right and left hand. Besides this error, others arise from the imperfection of the instrument, both as to its divisions and its centering, and from the fact that the position of the observer is not absolutely fixed. These may be made exceedingly small by repeating the measurement.

Mitscherlich's Goniometer.—Mitscherlich has avoided the inconvenience of keeping the eye fixed by adding a telescope to the instrument. The graduation of the circle is so fine that readings can be made within 10″. The light falls on the vernier and on the graduations of the circle through a screen of oiled paper. The microscopes are fixed to a movable support, so that the whole line of the vernier can be overlooked. The hollow axis, as in Wollaston's, carries the circle. The inner solid axis carries the crystal and the apparatus for holding it. The instrument carries a telescope of very small magnifying power, with cross-hairs, which moves in a vertical plane on pivots. It has also a movement of rotation to the right and left, on the rod which fits into the pillar. The pillar has a lateral motion by means of the slide upon which it rests. Mitscherlich recommended the

use of an eye-piece and objective whose foci are about 33 mm., both of them alike or very nearly so. In order to

Fig. 4.



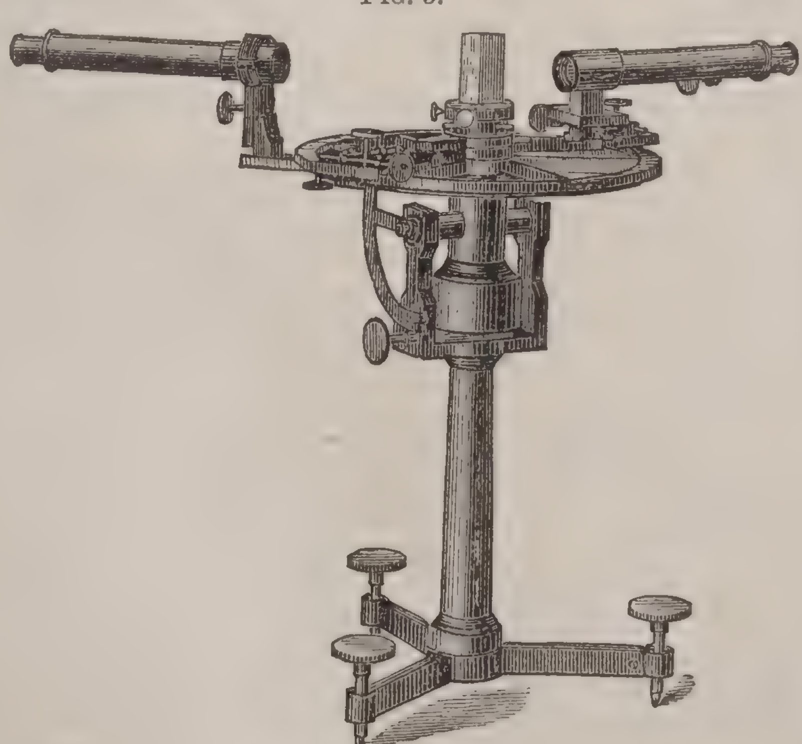
Mitscherlich's Goniometer.

eliminate parallactic errors the cross-hairs must be made to coincide with the reflected image seen through the objective. The adjustments must be such that the movement of the observing telescope shall be in a plane parallel to that of the graduated circle. As, during observation, the movements of the hand are apt to be brusque, it is difficult to bring the image of the reflected line into perfect contact with the line seen directly. The support for the crystal carries for this reason a number of adjusting screws, and a knife-edge which is in the exact prolongation of the axis, and so arranged that after the edge of the angle has been brought into contact with it, it can be turned back out of the way. The crystal is fixed with wax on the small plate. It can then be raised or lowered, or rotated to the right or left, or vertically and horizontally, by the adjusting screws.

In measuring with Mitscherlich's goniometer exactly the same conditions are to be fulfilled as in using Wollaston's. The telescope allows, however, of using a single point, which is made to coincide with the point of intersection of the cross-hairs of the telescope. The instrument as constructed by Mitscherlich had only a single telescope. Recently, a second has been added. The objective of the second telescope is turned towards the crystal, and its cross-hairs serve as an object whose reflection is seen by the first. When it is used in a dark room the light of the sun is directed through a small aperture on to the eye-piece, or a light is placed before it, to illuminate the cross-hairs. When these are in the focus of the objective they answer the purpose of a line at an infinite distance. The instrument is really only a perfected Wollaston goniometer.

Babinet's Goniometer. — Babinet's goniometer was invented to measure indices of refraction, but can be used quite as well for the measurement of angles. It is founded

Fig. 5.



Babinet's Goniometer.

upon the same principles as that of Wollaston. The plane of the circle may be either horizontal, inclined, or vertical. The direction of the lines of reference is determined by the inclination of the circle. The circle carries two movable telescopes, and a movable arm, with a vernier attached. Both telescopes are movable, but one of them is fixed at the commencement, and the other during the observation. This last one carries a vernier. The lines are cross-hairs at right angles to each other in the foci of the eye-pieces of the telescopes. One of these lines in the fixed telescope is parallel to the plane of the circle; the other, consequently, perpendicular. The telescope is arranged to see at a distance. The light which is to illuminate the lines is placed beyond its eye-piece, at a distance greater than its focus. The light may be either that of the clouds or of a lamp. With this disposition all the light by which the lines are illuminated leaves the telescope through the objective in parallel rays, and a point or line is obtained which produces exactly the same effect as if it were really at an infinite distance. In the Wollaston goniometer we judge that the two faces of the angle are perpendicular to the plane of the circle when each of them shows reflected lines parallel to the real ones. The same is true in the Babinet goniometer, but here the image seen directly is the intersection of the lines of the movable telescope, and is only a point. The image observed by reflection on the crystal is the reflection of the horizontal line in the fixed telescope. If the face under observation is perpendicular to the circle, the image of the point will appear to move parallel to the horizontal line when the movable telescope is made to change its position. For further details as to the adjustments and use of this instrument, the reader must consult systematic treatises on optical instruments or on mineralogy. It is convenient in use, but has the disadvantage of all instruments requiring the use of lenses, that the sharpness of the images is diminished, which renders its use impossible when the crystals are very small or their faces not very brilliant. It is therefore impossible for the mineralogist to do away with the Wollaston goniometer, which, having been arranged for almost microscopic crystals, is the one most applicable to general cases.

Moh's Goniometer. — Moh's goniometer has a horizontal circle, and is really Wollaston's goniometer in a different position. It is used in the centre of a room in which four perpendicular lines equally distant from the crystal, and at the same height, can be seen. Those usually selected are the bars of two windows upon different sides of a room. By turning the back to the two windows successively, the lines upon the opposite sides can be made to coincide. The methods of adjustment and verification are the same, and the instrument does not seem to offer any advantage over the usual form of Wollaston's goniometer. It sometimes carries a telescope with cross-hairs, when it requires only a single line. Thomas Egleston.

Gonorrhœ'a [Gr. γονή, "semen," and ῥέω, to "flow," a misnomer], acute catarrh of the urethra, a disease which is usually of impure venereal origin. It is a painful disease, and may result in the chronic catarrh called *gleet*, or may lead to stricture, epididymitis, enlarged prostate, and other serious evils. Its treatment should be entrusted only to practitioners of the highest character. Quacks extort large sums of money from persons suffering from this disorder and its consequences.

Gonsal'vo de Cór'dova (*Gonzalo Hernandez de Córdova y Aguilar*), duke of St. Angelo and of Sessa, "the Great Captain," b. at Montilla, Spain, Mar. 16, 1453; became one of the brightest ornaments of the court of Ferdinand and Isabella; was distinguished in the Portuguese war of 1479 and the Moorish war in 1481–92; took command in Italy 1495; drove the French from Naples 1496; suppressed the Moorish rebellion 1500; commanded with success against the Turks 1500–01; was made lieutenant-general of Calabria and Apulia 1501; served against the French in Italy 1502–07; was besieged by Bayard and the duke de Nemours at Barletta 1502–03, but destroyed the French army in a great battle (Apr. 28, 1503); won the great victories on the Garigliano (Nov. 6, Dec. 28–29, 1503); soon after which Gaeta fell and the French gave up their claim upon Naples. He was viceroy in Italy until 1507; retired to his estates at Loxa, and there lived in great state, venerated by the people, but hated by the king, who was jealous of his fame. D. at Granada Dec. 2, 1515.

Gonza'ga, town of Italy, about 22 miles from Mantua, in which province it lies. It was formerly well fortified and possessed a strong castle, but is chiefly remarkable as the cradle of the Gonzaga family, who ruled Mantua from 1328 to 1707. Pop. 17,526.

Gonzaga, a famous Italian family, to which belonged the captaincy of Mantua 1328–1433; the marquisate of Mantua 1433–1530; the dukedom of the same city 1530–1708; the duchy of Guastalla 1539–1729; the duchy of Montferrat 1536–1707; and that of Nevers 1565–1659; other honors held at various periods by the heads or cadet

lines of the house being the duchy of Solferino, the duchy of Rethel, the county of Torelli, the duchy of Sabbionetta, the principality of Bozollo, the marquisate of Medola, etc. Many illustrious generals, statesmen, churchmen, and men of letters sprang from this stock.

Gonza'les, county in S. W. Central Texas. Area, 1026 square miles. The country is fertile, well watered, and well timbered. Cattle, maize, and cotton are leading products. Coal and iron are reported to exist abundantly. Cap. Gonzales. Pop. 8951.

Gonzales, one of the oldest towns of Texas, cap. of Gonzales co., is on the Guadalupe River, 70 miles S. by W. of Austin. It is the seat of Guadalupe College, and has 2 weekly newspapers. Pop. 1255.

Gooch'land, county of E. Central Virginia. Area, 260 square miles. It is bounded on the S. by the James River. The soil is productive. Tobacco and grain are leading products, and flour is manufactured. Good Triassic coal abounds, and some gold has been found. Cap. Goochland Court-house. Pop. 10,313.

Goochland Court-house, post-v., county-seat of Goochland co., Va., 28 miles W. of Richmond, has commodious public buildings.

Good (John Mason), M. D., b. at Epping, Eng., May 25, 1764; was apprenticed to a surgeon of Gosport; began surgical practice at Sudbury in 1784, in London 1793; received the medical degree from Aberdeen 1820; d. at Shepperton, Middlesex, Jan., 1827. Dr. Good was an able and successful practitioner and an accomplished linguist and literary critic. He compiled and edited the "Junius" letters, and among his numerous works are poems (*Triumph of Britain*, 1803, etc.), translations of Canticles (1803), Job (1812), Lucretius's *De Natura Rerum* (1805–07), besides a translation of the *Basia* of Johannes Secundus, made in his youth and not recognized by him in his maturer years. His chief professional works were *Diseases of Prisons*, etc. (1785), a *Hist. of Medicine*, etc. (1795), *System of Nosology* (1817), *The Study of Medicine* (4 vols., 1822). His *Book of Nature* (3 vols., 1826) is also noteworthy. (See his *Life* by Olinthus Gregory, 1828.)

Good'ale (George Lincoln), M. D., b. Aug. 3, 1839, at Saco, Me.; graduated at Amherst College in 1860, and at the Harvard Medical School in 1863; practised medicine in Portland after receiving his degree, and was a lecturer on anatomy in the medical school of that city until 1869, when he was appointed lecturer on materia medica in the medical school of Maine, and professor of natural sciences in Bowdoin College. He is now assistant professor of vegetable physiology in Harvard University.

Good'by's, tp. of Orangeburg co., S. C. Pop. 719.

Goodell' (William), D. D., b. at Templeton, Mass., Feb. 14, 1792; graduated at Dartmouth in 1817, and at Andover Seminary 1820; labored for the American Board as a collecting agent, and in 1822 went to Syria as a missionary, having (1822) been ordained to the Congregational ministry; labored 1823–31 at Beiroot, Syria, and 1831–55 at Constantinople; returned in 1855 to the U. S., worn out with toil. D. at Philadelphia Feb. 18, 1867. His great work was the translation of the entire Bible into Armeno-Turkish.

Goodell (William), M. D., b. Oct. 17, 1829, in the island of Malta; graduated at Williams College in 1851, and at Jefferson Medical College in 1854. For several years he practised his profession in Constantinople, Turkey, and afterwards in West Chester, Pa. In 1865 he was appointed physician in charge of the Preston Retreat, Philadelphia. In 1874 he was elected president of the Obstetrical Society of Philadelphia, and in 1875 president of the Philadelphia County Medical Society. After lecturing for three years in the medical department of the University of Pennsylvania, he received in 1874 the appointment of clinical professor of the diseases of women and children. On these subjects he has been a prolific writer.

Good'farm, tp. of Grundy co., Ill. Pop. 803.

Good Friday, the Friday before Easter Sunday, celebrated by many Christian churches as a fast in commemoration of the passion and death of our Lord. It is preceded by Holy Thursday and followed by Holy Saturday.

Good Ground, post-v. of Southampton tp., Suffolk co., N. Y., on Shinnecock Bay and on the Long Island R. R. Pop. 504.

Good Hope, post-v. of Fayette co., O. Pop. 118.

Good Hope, tp. of Hocking co., O. Pop. 986.

Good'hue, county of Minnesota, separated from Wisconsin by the Mississippi River. Area, about 690 square miles. The surface is somewhat uneven, and is productive. Cattle, grain, and wool are leading products. It is crossed by the Milwaukee and St. Paul R. R. Cap. Red Wing. Pop. 22,618.

Goodhue, tp. of Goodhue co., Minn. Pop. 750.

Good'land, post-tp. of Lapeer co., Mich. Pop. 811.

Goodland, tp. of Orangeburg co., S. C. Pop. 955.

Good'man, post-v. of Holmes co., Miss., on the Mississippi Central R. R., has 1 church, 1 Masonic lodge, and 10 stores. It ships 8000 bales of cotton annually.

R. Walpole, Prop. "The Weekly Central Star."

Goodman (John), A. M., M. D., b. at Frankfort, Ky., July 22, 1837; graduated at Georgetown College 1856, and took his medical degree in the University of Louisiana 1859; became in 1868 professor of obstetrics in the Louisville Medical College, and in 1875 took in addition the professorship of obstetrics in the Kentucky School of Medicine; author of many professional papers.

Good'rich (Charles Augustus), brother of S. G. Goodrich, b. at Ridgefield, Conn., 1790; graduated at Yale 1812; pastor of the First Congregational church, Worcester, Mass., 1816–20, and afterwards was settled in Berlin and Hartford, Conn. Chiefly known by his books: *History of the U. S., Lives of the Signers, Universal Traveller, Geography, Family Encyclopædia*, and others. D. at Hartford, Conn., Jan. 4, 1862.

Goodrich (Chauncey Allen), D. D., b. at New Haven, Conn., Oct. 23, 1790; graduated at Yale in 1810; was college tutor 1812–14; pastor of a Congregational church at Middletown, Conn., 1816–17; professor of rhetoric at Yale College 1817–39; became in 1839 professor of the pastoral charge in Yale Divinity School. Published a Greek grammar (1814), and Latin and Greek lessons (1832); *British Eloquence* (1852); was editor of the *Quarterly Spectator* (1829–38); was largely engaged from 1828 till his death upon the dictionaries of Noah Webster, his father-in-law. D. at New Haven Feb. 25, 1860.

Goodrich (Elizur), D. D., grandfather of Dr. C. A. Goodrich, b. at Wethersfield, Conn., Oct. 26, 1734; graduated at Yale in 1752; was tutor there in 1755; pastor of the Congregational church 1756–97; was for many years also an instructor of youth; was an able astronomer and mathematician. D. at Norfolk, Conn., Nov. 22, 1797.

Goodrich (Elizur), LL.D., father of C. A. Goodrich, was b. at Durham, Conn., Mar. 24, 1761; graduated at Yale in 1779; was tutor there two years; became a lawyer 1783; was in Congress 1799–1801; was long a judge in the county and probate courts, mayor of New Haven, and law-professor in Yale College. D. at New Haven Nov. 1, 1849.

Goodrich (Frank Boot), son of S. G. Goodrich, was born in Boston, Mass., Dec. 14, 1826; graduated at Harvard in 1845; was Paris correspondent ("Dick Tinto") of the New York *Times* for some years; author of *Tri-colored Sketches* (1854); *Court of Napoleon* (1857); *Man upon the Sea* (1858); *Women of Beauty* (1859).

Goodrich (Samuel Griswold), the famous "Peter Parley," a brother of Dr. C. A. Goodrich, b. at Ridgefield, Conn., Aug. 19, 1793; became in 1824 a book-publisher of Hartford, Conn.; removed to Boston, Mass., and edited 1828–42 *The Token*, and 1841–54 *Merry's Museum;* wrote, edited, and compiled 170 volumes, of which 116 bear the name of "Peter Parley;" was consul in Paris under Mr. Fillmore. His works are histories, geographies, and tales, mostly for children, besides *Recollections of a Lifetime* (1857); *Fireside Education* (1838); *Sketches from a Student's Window* (1841), and other works. The most extensive and valuable of all his writings is *Johnson's Natural History*, published by A. J. Johnson & Son, New York, in two vols. 8vo, finely illustrated. D. in New York May 9, 1860.

Goodrich (William Henry), D. D., son of Dr. Chauncey A. Goodrich, b. at New Haven, Conn., Jan. 19, 1823; graduated at Yale 1843; studied in the Yale Divinity School 1844–47; tutor in the college 1847–48; pastor of a Congregational church at Bristol, Conn., 1850–54; of a Presbyterian church in Binghamton, N. Y., 1854–58; of the First Presbyterian church, Cleveland, O., 1858–74; lived in Europe for some time on account of poor health, and d. at Lausanne, Switzerland, July, 1874.

Goods and Chattels, a comprehensive phrase used in law to designate every variety of personal property, as distinguished from real estate, which is also often referred to by the corresponding phrase *lands and tenements*. The expression is, in fact, tautological, since the single word "chattels" has a sufficiently broad import to denote everything indicated by both terms; but as a consequence of long usage it is generally employed in legal instruments in preference to either word by itself. The term "goods" has the narrower meaning, since it has no application to such forms of personal property as estates for years in land, which are known as chattels real, nor is "goods"

generally considered to include animals; and by some writers it is still further restricted in signification, since it is by them held to apply not even to all inanimate movables, but rather to articles of merchandise. This, however, is not the general legal acceptation of the word. In criminal statutes and indictments the phrase "goods and chattels" is employed generally with a different extent of signification from that which it possesses in deeds and wills. It is held in such cases not to include choses in action, as promissory notes, mortgage deeds, etc., nor, according to some authorities, anything which circulates as money. But with this exception it would embrace everything of a personal nature. (See PROPERTY.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Good'son, tp. of Washington co., Va. Pop. 3835.

Good Springs, tp. of Clarke co., Ala. Pop. 559.

Good-will, the advantage which a business establishment engaged in a particular kind of trade or existing in a particular locality, possesses, on account of the natural tendency of former customers to continue their dealings there. The probability is that former customers will continue to seek an accustomed place to make their purchases, and to deal under methods with which they are familiar; and from this circumstance the value of the business there established may be much enhanced. The good-will of a trade therefore constitutes a valuable right of property, intangible it is true, and depending largely upon mere expectancy, but capable of having its worth determined, at least approximately, upon the theory of probabilities. It is consequently often made the subject of bargain and sale, its value being usually estimated at so many years' purchase upon the amount of the profits of the business. But unless there be some specific agreement to the contrary the sale of a good-will in connection with his previous business does not prevent a vendor from carrying on a precisely similar trade in the immediate vicinity, so long as he does not profess to continue the identical business sold. Great injury may thus be done to the purchaser by the detraction of custom, and all his expectations may be unrealized; but a contingency of this nature must be guarded against by previous arrangement. When a shop or store is conveyed to another, and no reference is made to the good-will of the trade, it nevertheless vests in the purchaser as accessory to the interest thereby acquired in the premises. Questions concerning good-will frequently arise in relation to partnerships. In adjudicating upon the opposing rights and mutual claims of partners when one or more separate from the others, or a controversy arises as to their respective interests, courts of equity will generally take into consideration the value of the good-will. If one of the partners dies, it appears to be now the established rule, though after much diversity of opinion in this country, that the good-will of the business does not survive exclusively for the advantage of the remaining partner or partners, but that the estate of the deceased participates in its value. If the partnership assets be sold and the proceeds divided, each partner must be allowed his proportionate share in the price which was received for the good-will, as well as for the more tangible articles of property. The doctrines of good-will are frequently connected with a right to the *name* under which the business has been carried on, and a class of legal questions comes into consideration closely analogous to those presented in the law of trade marks. (See TRADE MARKS.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Good'win, tp. of Plumas co., Cal. Pop. 639.

Goodwin (DANIEL RAYNES), D. D., LL.D., b. at North Berwick, Me., Apr. 12, 1811; graduated at Bowdoin College in 1832; entered the Protestant Episcopal ministry; was professor of modern languages in Bowdoin College 1835–53; president of Trinity College, Hartford, Conn., 1853–60; provost of the University of Pennsylvania 1860–68; and in 1865 became professor of systematic divinity in the Divinity School of the Protestant Episcopal Church, Philadelphia; which position he still holds (1875).

Goodwin (WILLIAM W.), PH. D., b. in Plymouth, Mass.; graduated at Harvard University 1851, and is Eliot professor of Greek in Harvard University. Has been president of the American Philological Society, and published *Moods and Tenses of the Greek Verb*, and revised a translation of Plutarch's *Morals* (1871, 5 vols.).

Goodwin Sands, a range of very dangerous sandbanks in the Strait of Dover, 10 miles long and 5½ miles distant from the coast. The lighthouses of North and South Foreland and lightships stationed on the shoals guide passing ships, yet wrecks, often fearful in their details, are recorded every year.

Good'year (CHARLES), b. at New Haven, Conn., Dec. 29, 1800; became a partner with his father, a hardware manufacturer of Philadelphia. After the failure of his firm in 1830 he began to experiment on the employment of gum-elastic or caoutchouc in the arts. His nitric-acid process (1836) was in a great degree successful in fitting this material for the manufacture of shoes. It was not until 1839 that he perfected the idea of vulcanizing or ebonizing India-rubber by means of sulphur. Others have claimed priority in this discovery, and his associate, Nathaniel Hayward, certainly shares the honor of the invention. Many other improvements followed, so that over sixty U. S. patents bore the name of Goodyear. In France and Great Britain he was deprived of the fruits of his labors, and the number of infringements in the U. S. has been very great, so that Goodyear's profits were small when compared to the importance of his labors. He received numerous medals and distinctions, including the cross of the Legion of Honor. D. at New York July 1, 1860.

Gookin (Col. CHARLES), deputy governor of Pennsylvania under William Penn 1709–17. His administration was much disturbed by difficulties with the colonists. He was a man of erratic conduct and grave manners, and was subject to attacks of insanity.

Goole, town of England, in Yorkshire (West Riding), on the Ouse. Since the opening of the Knottingley and Goole Canal and the railways, which afford a direct communication with Leeds, Hull, and Manchester, Goole has sprung into consequence, and does now a considerable business. Pop., with surroundings, 17,215.

Goor'khas, the race who with the Newars occupy the dominant place in Nepaul. They are Mongols by blood, small in stature, full of courage, and were very faithful to the British in the Sepoy war of 1857–58; but they are not physically strong. In religion they are Hindoos.

Goosan'der, called also **Dun Diver, Buff-breasted Sheldrake,** and **Saw-Bill,** the *Mergus merganser*, a bird intermediate between the duck and the diver families, and common to both continents, though some regard the American bird as of a distinct species, *Mergus Americanus*. The bill is notched into numerous tooth-like processes in both mandibles. Its flesh is rank and inedible. This bird, with the mergansers, is usually assigned to the duck family.

Goose (*Anser*), a genus of anserine birds which in the arrangement of Linnæus belonged to the third order. It is now systematically placed in the order Natatores (*swimmers*) and sub-order Anseres, having the bill with transverse lamellæ, and in the family Anatidæ, which is characterized by the bill having an obtuse rounded nail on the end of the upper mandible, and a groove along the jaws to the nail. The wild-goose, or the gray lag (*Anser ferus*), as it is called in Europe, is the most interesting example of this genus, as it is supposed to be the species that gave origin to our domestic goose. It is the largest of its kind, often weighing ten pounds. Every part of the world seems to be visited by geese, but their breeding-places are in the swampy regions of the most northern latitudes, whither they migrate in the early summer. A familiar sight is the annual flight of these birds in their regular battalion-like progress to and from their breeding-places. The Canada goose (*A. Canadensis*) is a notable example, confined to the American continent. Like the gray lag, it is known as the "wild-goose," and its curious habits of flight and peculiar cry (honk! honk!) have made it familiar and easily recognizable. Wilson was of the opinion that the range of the Canada goose "extends to the utmost polar point, amid the silent desolation of unknown countries, shut out from the prying eye of man by everlasting and insuperable barriers of ice." Its weight is the same as that of the gray lag. The snow goose (*A. hyperboreus*) is nearly as large as the preceding. It is common to both continents. The swan goose (*A. cygnoides*) and bean goose (*A. segetum*) are well-known species of the Old World. Several smaller species, not so familiar, are found in the western portions of North America. A few examples are known, having less weight and size than many of the ducks. Many modern systematists divide the old genus *Anser* into several genera. J. B. HOLDER.

Gooseberry [probably from *gorse*, *goss*, a prickly shrub, and *berry*], the common name of those shrubs and their fruit which belong to the section Grossularia of the genus *Ribes* (order Saxifragaceæ), distinguished from the currants by the presence of thorns and bristly prickles on the stalk, and especially near the bases of the leaf-stalks; while in most the flower-stalks have only from one to three flowers each, though in some species the flowers are in racemes, like those of the currants, but smaller. Some gooseberries have also prickly fruit, which currants never have, though a few species of currants have hairy fruit. Thus, the distinction between gooseberries and currants is not strongly marked. North America has quite a number of wild species. Of these, *R. niveum*, with beautiful white flowers, is cultivated for ornamental purposes, and is worthy of attention

for its fruit. Of our other species, *R. rotundifolium* is the parent of "Houghton's seedling," a very good and hardy variety for garden culture; and several of the Pacific coast species have attracted some, though insufficient, attention as fruit-bearers. The Old World has also a number of species, some of them common also to our continent. The cultivated gooseberries are principally assignable to *R. uva-crispa*, an Old World species, of which some 150 varieties have been named. In Europe, and particularly in Great Britain, great attention is paid to their culture, and some of the sorts bear fruit of surprising size and excellence. The fruit is used when unripe for making tarts and pies, and when ripe is a good dessert fruit, and is also made into jams and preserves. A pleasant drink called gooseberry wine is also produced from it, and gooseberry vinegar is prized. The European sorts almost uniformly fail in the U. S. from mildew, but our native gooseberries, with proper culture, will probably in time afford sorts as fine as any.

Goose Creek, tp. of Piatt co., Ill. Pop. 1120.

Goose Creek, tp. of Union co., N. C. Pop. 2207.

Goose Fish. See ANGLER.

Goose Lake, in Jackson co., Or., and Siskiyou co., Cal., is 30 miles long and 10 miles wide. Its waters have no outlet. It lies W. of the Warner Mountains.

Go'pher [corrupted from the French *gaufre*, "honeycomb," and applied originally by French settlers to animals burrowing into and "honeycombing," as it were, the earth], the vernacular designation of various species of burrowing rodent mammals, land-tortoises, and a snake in different portions of the U. S. The only feature in common between these forms is the habit of burrowing excavations into the earth for habitations and other purposes, and the natural inference is therefore that the name has been applied on account of preconceptions based upon the similarity of the dwelling, the connection with the indwellers themselves being an afterthought. The name is specifically restricted in different regions, and the diverse applications are characteristic of distinct sections; and thus, if the residence of the speaker is known, the animal intended may be inferred. In the extreme Southern States the name is used for the land-tortoises (*Testudo, Xerobates*, or *Gopherus Carolinus* and *Berlandieri*) which are peculiar to them, but in Georgia it is applied to a colubroid snake. In the Western States it is given to certain rodents, chiefly those of the family Geomyidæ and genera *Geomys* and *Thomomys*, but also (at least in some parts of Illinois and Wisconsin) to species of the genus *Spermophilus*. On the other hand, in the Southern States the species of Geomyidæ are termed salamanders (a name originally given to certain batrachians), although other names are conferred, as "hamster," "pouched rat," "muloes," etc. (For further information see SPERMOPHILE and TORTOISE.) THEODORE GILL.

Go'pher-wood, mentioned in the Bible as the material of Noah's ark, is generally thought to be the CYPRESS (which see).

Göp'pingen, a well-built and handsome town of Würtemberg, on the Fils, with mineral baths. Pop. 8649.

Go'ral, the *Nemorrhedus Goral*, a large antelope of Nepaul, inhabiting rocky heights and lofty table-lands. It is also called the Nepaul bouquetin, and is hunted for its excellent flesh.

Gordian Knot. See GORDIUS.

Gordia'nus Africa'nus (M. ANTONIUS), known as the elder Gordian, a Roman emperor, a descendant of the Gracchi and Trajan, b. 158 A. D., was consul 213 and 231; proconsul in Africa 232; and when eighty years old was invested with the purple at Tisdrus, without his consent, in place of Maximinus, but in less than two months was compelled by the victories of Capellianus to commit suicide (238 A. D.). He was a man of venerable character, and his death caused widespread grief.—His son, M. ANTONIUS GORDIANUS (b. 192), was declared Augustus jointly with his father, and fell in battle just before his father's death. He was a man of loose morality, but was a popular favorite, an able magistrate, and the author of writings in prose and verse, none of which are extant.

Gordianus (M. ANTONIUS), a grandson of the elder Gordian, b. about 226; was declared emperor in 238, after the death of Balbinus and Pupienus; set out for the East (242), where he won important advantages over the Persians and others, but in consequence of the machinations of Philip the Arab he was murdered by his own soldiers in Mesopotamia in 244 A. D. The younger Gordian was highly popular throughout the empire, and possessed many engaging qualities.

Gor'dius [Γόρδιος], a half-mythical king of Phrygia, father of Midas, was a peasant upon whose oxen an eagle alighted as he was ploughing. He repaired to Telmissus to consult the soothsayers regarding the occurrence, and was instructed by a prophetess whom he took to wife. Years after the oracles told the Phrygians that they should find a king in a cart. Soon afterwards Gordius, with his wife and son, rode up drawn by oxen, and Gordius (or, as some say, Midas) was declared king. Gordius's cart was placed in the acropolis of Gordium, a Phrygian city, and dedicated to Zeus Basileus; and the oracle declared that he who was able to untie the knot ("Gordian knot") by which the yoke was tied to the pole of the cart should be master of all Asia. In 333 B. C., Alexander tried to untie the knot, and, failing, cut it with his sword.

Gordius [so named from the knotted appearance these worms often assume—a reference to the Gordian knot], the typical genus of the family Gordiidæ, nematode worms of very simple structure and hair-like form. They are popularly called hair-worms, hair-snakes, and hair-eels. They are vulgarly regarded as transformed hairs. In reality, they are the adult forms of which the larvæ inhabit the bodies of insects and spiders. The adult worms chiefly inhabit fresh water and mud, are the subjects of many popular superstitions, and remarkable for tenacity of life.

Gor'do, post-tp. of Pickens co., Ala. Pop. 517.

Gor'don, county in the N. W. of Georgia. Area, 330 square miles. The soil is fertile and calcareous. Grain and tobacco are leading products. It is traversed by the Atlantic and Western and the Selma Rome and Dalton R. Rs. Cap. Calhoun. Pop. 9268.

Gordon, post-tp. of Henry co., Ala. Pop. 1823.

Gordon, post-v. of Wilkinson co., Ga., at the junction of the Eatonton branch with the Central R. R. of Georgia, 22 miles E. of Macon.

Gordon, tp. of Todd co., Minn. Pop. 195.

Gordon, post-v. of Darke co., O. Pop. 87.

Gordon, tp. of Orange co., Va. Pop. 1343.

Gordon (Lieut.-Col. CHARLES GEORGE), C. B., R. E., b. 1833; entered the Royal Engineers as second lieutenant in 1852; promoted to be first lieutenant in 1854; served during the Crimean war, and was wounded in the trenches before Sebastopol; in surveying and settling the Turkish and Russian frontier in Asia; and in the English expedition against Peking, remaining on service in China after the termination of difficulties. Entering the service of the emperor of China, he was made in 1863 commander of the "ever-victorious army," and was prominent in suppressing the Tai-Ping rebellion (1863–64), and recovering the great cities and silk districts from the insurgents. He was promoted captain Royal Engineers in 1859, major in 1862, and lieutenant-colonel in 1864. In Dec., 1864, he was nominated a companion of the Bath, and was afterwards appointed British consul for the Danube delta; resigned 1874, and accepted control of the force designed to continue the work (under the khedive) of Sir S. Baker's expedition in Egypt.

Gordon (Lord GEORGE), third son of the duke of Gordon, was a lord by courtesy only. B. in London Sept. 19, 1750, he served for some years in the navy, which he left in 1772; entered Parliament in 1774; became distinguished as a noisy opponent of both Whigs and Tories; was made president of the Protestant Association 1779; became at once leader of the large and turbulent No-Popery party; presented a petition (signed by 120,000 persons) for the repeal of Saville's Roman Catholic Relief bill 1780, arriving at the Parliament House at the head of 60,000 rioters, who (June 2–9) sacked the Roman Catholic chapels and the houses of papists and others, broke open the prisons, and fired London in many places. The military finally dispersed the rioters, but not till 450 were killed and wounded. Many more were afterwards hung. Gordon was tried for high treason and acquitted 1781; declared himself a Jew in religion 1786, but was without question insane; was fined and imprisoned for libel 1788, and d. in Newgate prison Nov. 1, 1793.

Gordon (JOHN B.) was b. Feb. 6, 1832, in Upson co., Ga.; graduated at the State University; studied law, and was admitted to the bar; in 1861 entered the Confederate service as captain of infantry, and rose to the ranks of major, lieutenant-colonel, colonel, brigadier-general, major-general, and lieutenant-general. At the surrender of Gen. Lee, Gordon commanded one wing of the army. During the war he was wounded eight times in battle. In 1868 he was the Democratic candidate for governor of his native State, and, as was believed, was elected by a large majority, but his opponent, Rufus B. Bullock, was awarded the office. He was a member of the national Democratic conventions in New York 1868 and at Baltimore 1872; was Presidential elector for the State at large at the elections in 1868 and 1872; was elected to the U. S. Senate in Jan., 1873, for six years, and took his seat in that body on Mar. 4, 1873, where he is recognized as an eloquent and leading member of the Democratic party. A. H. STEPHENS.

Gordon (Patrick), b. 1664, was governor of Pennsylvania 1726–36. He was reputed a good soldier, and his administration was highly popular. D. at Philadelphia Aug. 5, 1736.

Gordon (Thomas Winslow), M. D., b. at Warren, Trumbull co., O., Sept. 23, 1819; was educated at Warren Academy and at Western Reserve College, where he took his medical degree in 1846; became in 1857 professor of materia medica and botany in the Cincinnati College of Medicine and Surgery, and in 1858 professor of chemistry and pharmacy; served 1861–64 as regimental and brigade surgeon in the U. S. service; was wounded at Missionary Ridge, and in 1865 became military surgeon for Brown co., O., and from 1862 to the present (1875) has been U. S. examining surgeon. Author of many professional and other papers, and has had experience as a journalist, lecturer, politician, and artist. Resides at Georgetown, O.

Gordo'nia [named from two James Gordons, one of London, the other of Aberdeen], a genus of beautiful trees and shrubs of the order Camelliaceæ. The U. S. have two species. The *G. Lasianthus,* called loblolly bay, is a beautiful Southern tree, from 50 to 70 feet high (often a shrub in cultivation), growing in "bay swamps" in barren regions. Its bark is useful for tanning leather. Its mahogany-colored wood is extremely light, fragile, and perishable, but is recommended for some kinds of joiner-work, being quite handsome. The *Gordonia pubescens* of the Southern States is cultivated as a garden-shrub, and has large white and richly fragrant flowers. In Florida it sometimes becomes a good-sized tree.

Gor'donsville, post-v. of Orange co., Va., at the junction of the Chesapeake and Ohio with the Great Southern Railway.

Gore, tp. of Huron co., Mich. Pop. 173.

Gore, tp. of Hampshire co., W. Va. Pop. 1895.

Gore (Christopher), LL.D., b. in Boston, Mass., Sept. 21, 1758; graduated at Harvard 1776; was appointed U. S. district attorney for Massachusetts 1789, the first to hold the office; was with W. Pinckney a commissioner to England 1796–1804; chargé d'affaires at London 1803–04; governor of Massachusetts 1809; U. S. Senator 1814–17. D. at Waltham, Mass., Mar. 1, 1827. Left a considerable legacy to Harvard University, and was one of the legal instructors of Daniel Webster.

Gore (Catharine Grace), b. in Nottingham, England, 1799, the daughter of a Mr. Francis; was married to Capt. Charles Gore 1822. Author of about seventy works, mostly novels depicting English aristocratic life. She wrote also several dramas. D. Jan. 29, 1861.

Gorée, an island in the Atlantic Ocean near the western coast of Africa, belongs to France, and is situated 1½ miles S. E. of Cape Verde. It is only 3 miles in circumference, and deficient in wood and water, but it contains a well-built and fortified town, with a good harbor, from which large quantities of gold-dust, gums, resins, and ivory are exported. Lat. 14° 40′ N., lon. 17° 25′ W. Pop. about 5000, of whom 150 are Europeans.

Gor'gas (Ferdinand J. S.), A. M., D. D. S., M. D., b. July 27, 1834, at Winchester, Va.; graduated at Dickinson College in 1854, at the Baltimore College of Dental Surgery 1855, and at the University of Maryland School of Medicine in 1868. In 1864 revised Harris's *Medical and Dental Dictionary,* and in 1872 edited the operative part of Harris's *Dental Surgery;* has been since 1866 the editor of the *American Journal of Dental Science,* and has filled his present chair, that of dental surgery and therapeutics in the Baltimore College of Dental Surgery, since 1860. Author of *Lectures on Dental Science and Therapeutics.*

Gorgas (Josiah), A. M., b. in Dauphin co., Pa., July 1, 1818; graduated at West Point Military Academy 1841; was brigadier-general and chief of ordnance in the Confederate service 1861–65; became in 1872 vice-chancellor of the University of the South, Sewanee, Tenn.

Görgei (Arthur), General, b. at Topporcz, in Hungary, Feb. 5, 1818; educated at the military school of Tuln, and appointed to the Hungarian body-guard; promoted to be first lieutenant in the Palatinal Hussars. He resigned from the army to pursue the study of chemistry, but on the news of the rising in Hungary reaching him he hastened to place his services at the disposal of the Hungarian ministry. His conduct attracted the attention of Kossuth, and after the battle of Schwechat he assumed command of the Hungarian army. Unable to maintain himself at Raab, he was driven out by Windischgrätz; was again repulsed at Windschacht, saving his army by a bold retreat over the Sturecz Mountains. Difficulties arising between Görgei and the civil authorities, he was twice superseded in command. On the resignation of the governor and council in 1849, Kossuth made Görgei dictator in his place. Soon after this the Hungarian forces laid down their arms. Görgei was stigmatized as a traitor for this, and in 1851 he published a volume narrating his connection with the insurrection, entitled *My Life and Acts in Hungary.* Since that time he has lived in retirement.

Gor'ges (Sir Ferdinando), a native of Somersetshire, England, was a fellow-conspirator with the earl of Essex, against whom he was a witness, 1601; served in the British navy, and in 1604 became governor of Plymouth; was one of the leading spirits in the original Plymouth Company, sent a number of unsuccessful expeditions to the New England coast, and in 1620 obtained a charter "for the governing of New England," which was held to extend westward to the Pacific. He was also one of the original proprietors of Laconia, which was to extend from the Kennebec to the Merrimack, and in 1623 his son Robert was named general governor for New England. Gorges was soon after appointed lord-proprietary of Maine, the office to be hereditary in his family; and in 1642 he chartered the city of Gorgiana (now York, Me.). Gorges served against the Puritan armies in England, and d. in 1647. His grandson, Ferdinando (1629–1718), sold his rights in Maine to Massachusetts (1677) for £1250, and was author of *America Painted to the Life* (1659).

Gor'gias, a Greek orator, b. at Leontini, Sicily, about 485 B. C.; in 427 was sent to Athens to invoke aid in repelling the Syracusans, but remained in Athens, and attained great fame as a rhetorician and an instructor in eloquence. His style was elaborate and exceedingly artificial. Of his somewhat numerous writings fragments have been preserved, chiefly of the work on nature, in which he sets forth the dogma of the non-existence of things by arguments based upon the Eleatic philosophy. There are also two extant declamations ascribed to him, but there is no evidence of their genuineness. It is stated that he lived to be 105 years old or more.

Gor'gon [Γοργώ], the common name of three monsters of the Greek mythology, Stheno, Euryale, and Medusa, daughters of Phorcys and Ceto. Their myth is variously told. Medusa was the most dreadful of their number. They had but one eye, which each employed in turn. They wore girdles of living serpents and had serpents in place of hair. Medusa, the only mortal one, had the power of turning into stone every mortal who beheld her, but Perseus (which see) cut off her head, which was thenceforth fastened to the ægis of Pallas, but retaining the same dreadful power which it possessed in life.

Gorgo'nia, a genus of zoophytes in which the polypi-

Gorgonia or Sea-Fan.

doms are frequently arranged in a fan-like, branching, flat growth (sea-fan). Sometimes the axis is horny, sometimes calcareous, as in the corals. *Gorgonia flabellum,* a West Indian species, is often dried and preserved as a curiosity, and is called the sea-fan.

Gor'ham, tp. and post-v. of Cumberland co., Me., on the Portland and Rochester R. R., 10 miles W. of Portland, has 6 churches, a savings bank, 2 fire insurance companies, manufactures of woollens, powder, carpets, leather, etc. P. 3351.

Gorham, post-tp. of Coos co., N. H., on the Grand Trunk Railway, 91 miles N. W. of Portland. It is the northern gate to the White Mountains, and is a favorite place of summer resort. The scenery is admirable and the hotel accommodations ample. Considerable lumber is manufactured here. Pop. 1167.

Gorham, post-tp. of Ontario co., N. Y., on the E. side of Canandaigua Lake. The town has five churches and some manufactures. Pop. 2389.

Gorham, a v. of Seneca tp., Ontario co., N. Y., at the junction of the Northern Central with the Sodus Point and Southern R. R., 11 miles S. E. of Canandaigua.

Gorham, tp. of Fulton co., O. Pop. 1655.

Gorham Controversy, The. A controversy in the Church of England touching baptismal regeneration, which grew out of the case of *Gorham* vs. *The Bishop of Exeter.* In 1847 the Queen presented the Rev. G. C. Gorham, then holding a cure in the diocese of Exeter, to the vicarage of Brampford Speke in the same diocese. When application was made for institution the bishop (Philpot) felt it to be his duty to ascertain by examination whether Mr. Gorham was sound in doctrine, and after examination he refused to institute. The reverend gentleman brought suit in the Arches Court of Canterbury, and the judge having pronounced that the bishop had shown sufficient cause for his refusal, an appeal was taken. The case was heard before the judicial committee of privy council. The charge against Mr. Gorham was that "he held, and persisted in holding, that spiritual regeneration is not given in baptism—in particular, that infants are not made therein members of Christ and children of God—contrary to the teaching of the Church of England in her Articles and Liturgy, and especially contrary to the divers offices of baptism, the office of confirmation, and the Catechism." The bishop did not state what, in his view, is the true doctrine of the Church of England, nor did Mr. Gorham state the particular doctrine he maintained. The only evidence presented was a report of his examination, published by Mr. Gorham. From this report it appeared to the court that the appellant held "that baptism is a sacrament generally necessary to salvation, but that the grace of regeneration does not so necessarily accompany the act of baptism that regeneration invariably takes place in baptism; that baptism is an effectual sign of grace, by which God works in us, but only in such as worthily receive it—in them alone it has wholesome effect; and that, without reference to the qualification of the recipient, it is not in itself an effectual sign of grace; that infants baptized and dying before actual sin are certainly saved; but that in no case is regeneration in baptism unconditional." To this statement of the court may be added the words of Mr. Gorham: "If baptized infants die before they commit actual sin, the Church holds, and I hold, that they are undoubtedly saved; and therefore they must have been regenerated by an act of grace prevenient to their baptism in order to make them worthy recipients of that sacrament." The court held that the doctrine as stated by him is not contrary to the Church of England as by law established, and cannot afford a legal ground for refusing institution. The sentence of the Court of Arches was reversed. This judgment was based on these considerations: α, The Article on baptism speaks only of the blessings conferred by it on those who receive it rightly, and it does not determine what is signified by right reception. β, The Articles constitute the code of faith, from which any differences are prohibited, and yet they contain expressions which unavoidably admit of different constructions. Much more must differences of opinion be allowable in the interpretation of services which were framed, not for determining points of faith, but for establishing a uniform order of prayer, etc. γ, The strong expressions touching baptism in the services and in the Catechism cannot be considered as unconditionally true in all cases. Even the form for private baptism, which contains no expressed conditions, and which yet speaks of the infant "now baptized" as regenerate, must be supposed to imply all that is more fully stated in the public service. δ, Eminent men in the Church have differed as to the efficacy of baptism. This decision of the committee of privy council was followed by the abandonment of the Church of England by not a few, on the ground that the Church did not maintain the Catholic faith. Without entering fully on the question controverted, it may be said here that the language of the Book of Common Prayer is that of the older Church. Very frequently in ancient Church writers baptism and regeneration are used as equivalent terms. In the sense of such writers regeneration is not final salvation, but the placing man in a state in which he may work out salvation—the rehabilitation of fallen man. There was no confusion consequent on the use of the term until it was taught that only those who shall be finally saved can be rightly said to have been born again. It may be also said that the line of argument on which is based the decision in the Gorham case no longer satisfies those who hold the views held by Mr. Gorham; they demand the omission of the disputed terms from the services.

WM. F. BRAND.

Goril'la (*Troglodytes gorilla*), a species of anthropoid ape which now occupies the first place among the quadrumanous mammals. Though more bestial in appearance, especially in the extraordinary prominence seen in the cranial ridges, and in the extremely carnivorous aspect of its produced snout, it nevertheless has essential characters of superiority. In the light of modern research an old narrative of the Carthaginian navigator, Hanno, respecting the great apes becomes in a measure verified. Five hundred years before the Christian era this voyager records the discovery on the western coast of Africa of "an island full of wild men," "much the greater part of them," the text continues, "being females with hairy bodies, whom the interpreter termed *gorilloi.* The males were pursued, but not captured. Three females, who bit and scratched those who led them, were not willing to follow; however, having killed and flayed them, we conveyed the skins to Carthage." The history also relates that these skins were preserved in the temple of Astarte, where they remained until the taking of that city in the year 146 B. C., as stated by Pliny, who calls them *gorgones.* It is scarcely to be doubted that this short record refers to the great manlike apes that have until recently remained almost unknown to science. In 1589 an English sailor, during a detention as prisoner in Western Africa, observed two kinds of ape—one evidently being the chimpanzee, and the other, which he learned was called *pongo,* was undoubtedly a gorilla. "The pongo," he says, "is in all its proportions like a man, except the legs, which have no calves. But he is of gigantic height," etc. A minute and circumstantial account is given by this observer, the accuracy of which has been confirmed by subsequent travellers. Buffon had a clear conviction that there existed such a creature, inclining to regard it as a large species of orang. Cuvier was so entirely incredulous, and met the subject with so much ridicule, that for a long period it was again wellnigh regarded as a myth. In 1847 the gorilla was first made known to science, and its characteristics made out by Dr. Thomas Savage (who, with Dr. Wilson, another American missionary, may be said to have rediscovered it) and Prof. Jeffries Wyman, the distinguished comparative anatomist. Their paper, in which the scientific name was first given, was published in the summer of 1847, and was followed in Feb., 1848, by a memoir by Prof. Owen. In 1849 a complete specimen, preserved in alcohol, was obtained by a surgeon of the French navy. Later yet, very perfect crania and other portions were brought to this country by Du Chaillu. Figures now extant are mostly taken from the famous stuffed specimen in the British Museum.

Considerable information of a reliable character has been recorded of late concerning the habits of the gorilla. Its food consists of the fruit of several species of palm, the "cabbage" portion of the same, the banana, and other succulent vegetables of similar character. The teeth of the animal indicate an omnivorous nature; its diet is therefore supposed to include to a moderate extent animal food; *e. g.* the eggs and the young of birds, if not that of more solid matter. It forms for itself a sleeping-place not unlike the ordinary grass hammock; the long, slender, tough and flexible stems of the climbing plants that ascend the tall trees of the forest are used very effectively by interweaving them with the thicker foliage, whereby a rude mat is formed, which they retain as a resting-place—in truth, a home, occupied, according to some observers, by pairs. It is not gregarious. The young are seen in company with the parents until they attain adult size. In walking, the natural position is on all-fours, the enormously long arms facilitating such locomotion very materially. When it chances to stand or progress as a biped, it is with an unsteadiness that betokens a lack of power and ability, and, as in the case of the spider monkey (*Ateles*), the surest-footed in bipedal movements, throws its arms back over its head to preserve a balance. All accounts agree in awarding to the gorilla a ferocity that is unmatched in the animal kingdom. The negroes fear it above all creatures of the forest. Its hideous aspect; its green eyes flashing with rage; the skin over the enormous orbital ridges rapidly moved in diabolical menace; the hair erect, and the whole body poised like a very demon, afford a full exposition of its attributes. Its strength is enormous; instances are known of its extending its long arm down upon the head of a passing negro, seizing him by the neck, and after lifting him to the branches, strangling him before any adequate resistance can be made. The male is much more formidable in appearance than his mate, his large canine teeth being a characteristic feature. It is a redeeming quality in the history of this strange creature that the male exhibits great affection in the care of his family; and the female's devotion to its young is almost heroic. In two instances only has the gorilla been taken away alive from its native wilds: a small one was shipped to Havre, but died almost immediately on landing. More recently, a young individ-

ual was kept in a menagerie in the N. of England for a few months, where it was regarded as the young of the chimpanzee; it is now preserved at Walton Hall, Wakefield. It became quite tame and tractable. J. B. HOLDER.

Go'ritz [Ger. *Görz*], town of Austria, in the duchy of Görz, 22 miles N. W. from Trieste, on the Izonzo. Its manufactures of leather, silk, and rosoglio are extensive, and its trade very lively. Charles X., the ex-king of France, d. here, in the monastery of Castagnavizza, in 1836. Pop. 11,300.

Gorkhas. See GOORKHAS.

Gor'kum [Dutch *Gorinchem*], town of the Netherlands, in the province of South Holland, on the Merwede. It is strongly fortified, has large salmon fisheries, and a very lively transit trade. Pop. 8943.

Gör'litz, town of Prussia, in the province of Silesia, on the Neisse, which here is crossed by a viaduct 1500 feet long, 115 feet high, and resting on 34 arches. It is fortified, and has large weaving and bleaching establishments and considerable manufactures of cloth and leather. Among its buildings is the church of St. Peter and St. Paul, built in the fifteenth century, a remarkable specimen of Gothic architecture. It has five naves, of which the principal one is formed by twenty-four palm-shaped pillars 77 feet high; and a bell weighing 12½ tons. Pop. 25,254.

Görlitz Process, a trial held at Darmstadt Mar., 1850, made famous by the discussion which it involved of the question whether the death of a human being can occur by the spontaneous combustion of the body. The case derives its name from the countess Von Görlitz, who was strangled by her servant, Johann Stauff, and afterwards partially burned, in the sitting-room of her own house. The eminent physician Von Liebold favored the doctrine, while the no less eminent chemists Liebig and Bischoff opposed it. It may at present be regarded as exploded.

Gor'man (JOHN BERRY), M. D., was b. in Newberry district, S. C., Feb. 22, 1793; received his degree in medicine from the University of Pennsylvania about the year 1821. In twenty years he realized a large fortune from the practice of his profession at the towns of Milledgeville and Talboton. He was a contributor to magazines and journals, including the *North American*, and in 1845 published a work in Philadelphia styled *The Philosophy of Animated Existence*. Being fond of painting, he left a remarkable production which he called the representation of the nightmare. His library embraced works in Greek, Latin, French, and English. His correspondence was also quite extensive. D. Nov. 12, 1864, in Talbot co., Ga. PAUL F. EVE.

Gorman (WILLIS A.), b. in Kentucky Jan. 12, 1814; studied law and practised at Bloomington, Ind.; for several years member of the State legislature; major of Gen. Lane's regiment of Indiana volunteers in the Mexican war; at Buena Vista in command of the rifle battalion, and severely wounded; subsequently in command of the 4th Indiana Vols., and distinguished at Huamantla; civil and military governor of Puebla 1848; member of Congress 1849–53; governor of Minnesota Territory 1853–57. In the civil war, colonel of the 1st Minnesota Vols., and Sept., 1861, appointed brigadier-general of U. S. volunteers; distinguished in the Peninsular campaign, at Antietam, etc.

Gör'res, von (JAKOB JOSEPH), was b. at Coblentz Jan. 25, 1776. From his early youth he was an eager student, a close observer, rich in sympathy, broad and bold in his views, but his education was somewhat diffuse, and so became his life and his ideas. Inspired by the French Revolution, he began as a radical, carrying his radicalism into all the spheres of human life, but soon felt discouraged at the development of affairs, became entangled in the dream-life and mysticism of the romantic school, was driven into bitterness and obscurity by its retrograde ideas, and ended by serving the reaction which after the fall of Napoleon pressed on Europe during a whole generation. In 1797 he founded a periodical, *The Red Paper*, which in 1798 was succeeded by *Rubezahl in Blue Garment*, both of which were suppressed on account of their radical views. In 1799 he went to Paris at the head of a deputation from the Rhenish provinces, with the purpose of effecting the incorporation of these districts with France. He arrived a few days after the revolution of 18th Brumaire, and stayed a couple of months. But the First Consul declined to receive the deputation, and the result of his own individual observations was, that he predicted for France and Europe a despotism under the rule of Napoleon such as the world had not seen since the days of the Roman empire. In despair he retired from politics, became a teacher at the college of Coblentz, studied natural science—to which he had always felt a great inclination—fell in with the writings of Schelling, and became wholly enticed by that singular scientific *fata morgana* which at that time charmed all people in Germany under the name of the philosophy of nature. In 1806 he removed to Heidelberg, where he resided for two years. Here he made the acquaintance of Brentano and Achim von Arnim, and adopted all the Oriental and mediæval—that is, quietistic and reactionary—tendencies of the romantic school. In 1807 he published *Die deutschen Volkesbücher;* in 1810, *Mythengeschichte der Asiatichen Welt;* in 1813, *Lohengrin*. Once more he was allured back into politics. Under the general rising against Napoleon which followed his disaster in Russia and his defeat at Leipsic, Görres established a new periodical, the *Rhenish Mercury*, whose success was so great that Napoleon called it the fifth grand power. He was not radical now; he advocated the establishment of a German confederation of constitutional monarchies under an emperor; nevertheless in 1816 the paper was suppressed. For Görres was always a noble-hearted man, and his anger and scorn were tremendous when he saw how coolly, and even maliciously, the German princes broke those promises of liberal constitutions which in the days of their troubles they had given to their people. His book, *Deutschland und die Revolution* (1820), even occasioned the Prussian king to order his imprisonment in some fortress. He fled to Switzerland, where he lived till 1827, when he was appointed professor of history at the University of Munich. During his residence in Switzerland he published *Das Heldenbuch von Ivan* (1820); *Europa und die Revolution* (1822); *Emanuel Swedenborg* (1827), etc. A new change took place with him. He had once believed in the spontaneous development of the people itself towards civilization and freedom, but that idea he had given up in despair. He next hoped to find in constitutional government a guarantee for the happiness of the people, but this confidence he now lost. He looked down on all government with contempt, and considered the Church, the Roman Catholic Church, as the only means left of salvation. In this spirit are all his later books written —*Athanasius* (1838); *Die christliche Mystik* (1842); *Die Wallfahrt nach Trier* (1845), etc. They are still of a high character, interesting and suggestive, but they are essentially reactionary. D. at Munich Jan. 27, 1848.

CLEMENS PETERSEN.

Gor'ton (SAMUEL), b. at Gorton, England, about 1600, was a linen-draper of London; went in 1636 to Boston, Mass., whence he was soon expelled for heresy; was banished from Plymouth in the following winter; went to Aquidneck (now Newport, R. I.), where he was publicly whipped for saying that the magistrates were "just asses;" removed to Pawtuxet, R. I., and was involved in lawsuits about land; went (1642) to Shawomet (now Warwick, R. I.), whence he with ten of his followers, "Gortonians," were abducted by forty soldiers from Massachusetts, and were tried at Boston as "damnable heretics," and sentenced to hard labor in irons, but in 1644 the sentence was commuted to banishment; returned to Warwick, R. I., and became a preacher, a magistrate, and a person of much consideration. Author of several religious works. D. in Rhode Island in 1677. His sect survived for many years, and his followers were called "Nothingarians," because they repudiated religious forms of every kind and recognized no ministry.

Gort'schakoff (ALEXANDER MICHAELOWITSCH), PRINCE, chancellor of the Russian empire, and generally considered as one of the ablest statesmen of Europe, was b. in 1799, and belongs to one of the oldest and most celebrated families among the Russian nobility. He was educated at the Academy of Tsarskoe-Selo, and entered the diplomatic service in 1824 as secretary to the Russian ambassador in London. In different diplomatic positions at Vienna, Florence, Stuttgart, and other cities he acquired a large experience and showed considerable dexterity, but it was his eminent success in keeping Austria neutral during the Oriental war, at which time he represented Russia at the court of Vienna, which first made him conspicuous as a diplomate. In 1856 he succeeded Count Nesselrode as minister of foreign affairs, and his notes to the Western powers during the Polish insurrection in 1863 made a most decisive impression in Europe, and no doubt prevented foreign interference. Since 1862 he has the title of chancellor.

Goruckpoor', town of British India, in the presidency of Agra, on the Raptee. It is the capital of a district of the same name, which is situated between Nepaul and Oude and contains an area of 7346 square miles, with 2,376,000 inhabitants. The city has a pop. of 54,529; most of its houses are built of clay.

Go'ry Dew, a reddish slime sometimes seen on cellar-walls and in other dark, shady places. It is caused by the growth of *Palmella cruenta* and other confervaceous plants, allied to those which produce the so-called red snow.

Gösch'en (RT. HON. GEORGE JOACHIM), b. in London

in 1831 of German parentage; was educated at Rugby and Oriel College, Oxford; entered mercantile life in 1853; was returned to Parliament for London (1863) as a Liberal; vice-president of the board of trade and director of the Bank of England 1865–66; was sworn of the privy council 1865; chancellor of the duchy of Lancaster 1866; president of the poor-law board 1868–71; first lord of the admiralty 1871–74. Author of *The Theory of Foreign Exchange,* 1863.

Gos'hawk (*i. e.* "goose-hawk"), properly, the *Astur palumbarius* of Europe, a bird much employed in ancient falconry, though not reckoned one of the "noble" falcons, because it flies near the ground and overtakes its prey, while the noble falcons fly aloft and stoop downward upon their victims. It is represented in America by the nearly-related species *Astur atricapillus,* called also goshawk. Many other species are known. The chief distinguishing mark is the festoon at the end of the upper mandible. The young of the goshawk is the *falcon gentle* of former days.

Go'shen is the name of the district of Lower Egypt in which Jacob and his family settled, and where his descendants were kept in thraldom by the Egyptians until delivered by Moses. The exact site of the district has not yet been ascertained. It is certain, however, that it lay between the eastern branch of the Nile and the Red Sea.

Goshen, post-tp. of Litchfield co., Conn., 20 miles W. of Hartford. It contains the highest land in the State. Its soil is fertile, and there are manufactures of leather, doors, sash, blinds, soap, etc. Pop. 1223.

Goshen, tp. of Stark co., Ill. Pop. 1270.

Goshen, city, cap. of Elkhart co., Ind., halfway between Toledo and Chicago, on the Lake Shore and Michigan Southern R. R. It has an elegant court-house, 7 churches, a national and 2 private banks, 2 newspapers, 2 large flouring-mills, 2 saw-mills, 2 machine-shops, a woollen-mill, an oil-mill, wagon, furniture, sash and blind, and plough factories, stores, etc. The lumber-trade of the place is over 5,000,000 feet annually. The water-power is very great, and is afforded by the Elkhart River. Pop. 3133.

MURRAY & BEANE, PROPS. "GOSHEN DEMOCRAT."

Goshen, tp. of Muscatine co., Ia. Pop. 1381.

Goshen, post-tp. of Hampshire co., Mass., 12 miles N. W. of Northampton, has quarries of granite and flagging-stone, and manufactures of lumber. It affords many interesting minerals. Pop. 368.

Goshen, post-tp. of Sullivan co., N. H., 47 miles W. of Concord. It has 3 churches, and manufactures of leather, lumber, wooden wares, etc. Pop. 507.

Goshen, post-v. and tp. of Orange co., N. Y., on the Erie R. R., 60 miles from New York. It is half-shire town, with court-house, clerk's and surrogate's offices. First settled in 1772, and incorporated in 1809. It has 2 banks, 1 savings institution, 4 churches, schools for both sexes, 2 newspapers, 3 hotels, foundry, carriage, and sash and blind factories, drain-tile and brick works, dry-goods, grocery, hardware, jewelry, and drug stores, with all the minor branches of trade, and waterworks supplying an abundance of pure water. It has two branch railroads, the Goshen and Deckertown, 12 miles, and the Walkill Valley, running N. to Kingston, 43 miles. Principal business, dairying. Pop. of v. 2205; of tp. 3903.

CHAS. MEAD, ED. "DEMOCRAT."

Goshen, tp. of Auglaize co., O. Pop. 524.

Goshen, tp. of Belmont co., O. Pop. 2163.

Goshen, tp. of Champaign co., O. Pop. 1965.

Goshen, post-v. of Clermont co., O., is the seat of a female seminary. It is 24 miles E. by N. of Cincinnati. Pop. 274; of Goshen tp. 1876.

Goshen, tp. of Hardin co., O. Pop. 928.

Goshen, tp. of Mahoning co., O. Pop. 1475.

Goshen, tp. of Tuscarawas co., O., on the Lake Shore and Tuscarawas Valley R. R. It contains the village of NEW PHILADELPHIA (which see). Pop. 4650.

Goshen, tp. of Clearfield co., Pa. Pop. 468.

Goshen, tp. of Addison co., Vt., 6 miles N. E. of Brandon. It has manufactures of lumber. Pop. 330.

Goshen Hill, tp. of Pike co., Ala. Pop. 1268.

Goshen Hill, post-tp. of Union co., S. C. Pop. 1431.

Gos'lar, town of the German empire, in Hanover, on the Gose. It is a very old town, dating back to the time of Henry the Fowler (922), but most of its old splendor is now lost. Of its fortifications only one tower, *Der Zwinger,* remains. Of its cathedral only the porch is left. The imperial palace is now a corn magazine. It derives its present importance mostly from the neighboring mines. Pop. 7730.

Gos'nold, tp. of Dukes co., Mass., comprising the ELIZABETH ISLANDS (which see). The islands were settled in 1602 by a colony under Bartholomew Gosnold, but were soon abandoned. The Penikese school of natural science is in this town. Pop. 99.

Gosnold (BARTHOLOMEW), an English mariner, who first appears as an associate of Raleigh in his unsuccessful attempt to found a colony in Virginia. In 1602 he sailed in a ship containing twenty colonists for New England; steered directly across the Atlantic, instead of taking the circuitous southern course previously chosen by navigators. He entered Massachusetts Bay, named Cape Cod, discovered No Man's Land, and named it Martha's Vineyard (a name since given to a much more important neighboring island), and planted his colony on Cuttyhunk (now in the township of Gosnold, Mass.); but the settlers became discouraged and soon returned. In 1606 he led another colony to Virginia, which settled at Jamestown. D. in Virginia Aug. 22, 1607.

Gos'pel and **Gospels.** Gospel [Ang.-Sax. *god-spell,* "good spell"] is the English equivalent for the Greek εὐαγγέλιον (from εὖ, "well," "good," and ἀγγέλλω, to "bear message," to "bring tidings," εὐαγγελίζω, to "announce good news") and the Latin *evangelium.* It means (1) good news, glad tidings (originally a thanksgiving or sacrifice for good news); (2) glad tidings of salvation by Christ; (3) the historical records of this salvation, or of the life, death, and resurrection of Christ for the salvation of the world, or the gospel history, which we have in a fourfold form.

1. *The Canonical Gospels.*—They are properly only one and the same gospel, in its fourfold aspect and relation to the human race ("the fourfold gospel," τετράμορφον εὐαγγέλιον, according to Irenæus). Hence they are styled in ancient MSS. the Gospel *according to* (not *of*) Matthew, Mark, Luke, and John. The first and fourth are by apostles; the second and third by pupils of the apostles, and thus indirectly apostolical. Mark is closely connected with Peter (as his "interpreter"), Luke with Paul (as his companion in missionary travel and work). The first three were written between A. D. 60 and 70, certainly before the destruction of Jerusalem, to which they point as a future event. The last was probably written towards the close of the first century, at Ephesus. Before the end of the second century they were generally received and used in the churches as one collection. This is confirmed by the independent testimonies of the Ante-Nicene Fathers (Justin Martyr, Tatian, Irenæus, Tertullian, Origen, etc.), by the Gnostics, and other heretics. They are not complete biographies of Jesus, but selections of characteristic features as they seemed most important to each evangelist for the purpose of leading his readers to the faith that Jesus of Nazareth is the promised Messiah and Saviour of men.

Each Gospel has a marked individuality, corresponding to the author's education, talent, taste, and mission. Matthew wrote in Palestine and for Jews, to show them that Jesus is the fulfiller of prophecy and the true King and Lawgiver of Israel; Mark in Rome, for Roman readers, to exhibit Jesus as the mighty Wonder-worker and Son of God; Luke, for Greeks and Gentiles, to set Him forth as the univeral Saviour of all men; John, for Jewish and Gentile Christians combined, and for all future ages. Matthew (formerly a tax-gatherer and accustomed to keeping accounts) follows the topical and rubrical order; Luke (an educated Hellenist and a physician), the chronological order; John (the trusted bosom friend of Christ) combines both with an internal development of the growing antagonism between Christ and carnal Judaism; Mark gives, as from the first impressions of his master, the impulsive Peter, fresh, rapid, graphic sketches. The first three evangelists agree much in matter and language, and are, consequently, called *Synoptists* (their Gospels the *synoptic* Gospels); John stands alone, as the ideal and spiritual evangelist who introduces us into the holy of holies; his Gospel is the purest, deepest, and sublimest of all literary compositions, the Gospel of Gospels, "the one, true, tender, main Gospel," "the heart of Christ." (See Schaff's special introduction to LANGE's *Com. on John.*) Yet the first three are just as necessary, and give the historical basis, the divine humanity of Christ, while John, going back to the eternal Logos, presents to us the incarnate divinity of Christ.

The discrepancies among the Gospels in minor details confirm the independence and credibility of the authors. The genuineness and truthfulness of these books rest on stronger evidence than that of any other historical records, ancient or modern. This has been acknowledged by eminent writers who are free from all doctrinal or sectarian bias. Goethe says: "I regard the Gospels as thoroughly genuine, for we see in them the reflection of a majesty which proceeded from the Person of Christ—a majesty which is as divine as anything that ever appeared on earth." Rousseau remarks that "the gospel history can be no fiction, else

the inventor would be greater than the hero (*l'inventeur en seroit plus étonnant que le héros*);" or (as Theodore Parker says) it would take more than a Jesus to forge a Jesus. And yet the Jesus of the Gospels is admitted to be the purest and highest character conceivable. If there is no truth and reality in Him, it is nowhere else to be found. Take away the historical Christ, the Life and Light of the world, and human life and history are as dark as midnight, an inscrutable enigma. (For details see arts. HARMONY OF THE GOSPELS, MATTHEW, MARK, LUKE, and JOHN.)

Literature.—This has immensely increased within the last thirty years, in connection with the very numerous *Lives* of Jesus by Schleiermacher, Strauss, Neander, Ewald, Lange, Keim, Ellicott, Andrews, Farrar, etc. See the critical introductions to the New Testament by De Wette, Reuss, Bleek, Davidson, Guerike, Wescott (*Introd. to the Gospels*); the commentaries on the Gospels by Olshausen, De Wette, Lücke, Tholuck (on John only), Bleek, Meyer, Lange, Nast, Alford, and Wordsworth; and monographs on the several Gospels, especially that of John, too numerous to be mentioned here. Tischendorf: *When were our Gospels composed?* (4th ed. 1866, translated into several languages, even the Russian and Turkish) makes an able plea for the genuineness of the Gospels from historical evidence. Compare the careful bibliographical lists of Hase, in his *Leben Jesu*, 5th ed. 1865, p. 22 *seq.*, and of Ezra Abbot, in Smith's *Bibl. Dictionary* (Abbot's and Hackett's ed.), vol. ii. pp. 959–961.

2. *Apocryphal Gospels.*—A number of biographies of Jesus and the holy family, purporting to come from apostles or their pupils, but written in the second, third, and later centuries by unknown authors, to fill out, for the satisfaction of an idle and morbid curiosity, the vacancies left by the chaste modesty and veracity of the evangelists, especially in the history of the infancy of Christ and His descent into Hades. They are the first specimens of religious novels, replete with extravagant fancies and unnatural miracles which the boy Jesus is said to have performed for ostentation and amusement. They are also glorifications of Mary and the holy family. They are related to the canonical Gospels as the counterfeit to the genuine coin, as caricatures to the original. They furnish indirectly a strong argument for the historical Gospels, and enable us to trace some of the traditions and superstitions of the mediæval Church to their proper source. This is their only use. They have no historical or doctrinal or literary value whatever. The principal of these apocryphal productions are the *Gospel of James* (*Protevangelium*); the *Gospel of Pseudo-Matthew on the Infancy of Mary and Jesus;* the *Gospel of the Nativity of Mary;* the *Gospel of Joseph the Carpenter;* the *Gospel of Thomas;* the *Gospel of Nicodemus;* the *Acts of Pontius Pilate;* and his *Letter to Tiberius* on the death of Christ. The references in the Koran to the gospel history are from these apocryphal sources.

Literature.—THILO, *Codex Apocryphus Nov. Test.*, Leipsic, 1832; TISCHENDORF, *Evangelia apocrypha*, Leipsic, 1853; the same, *De Evang. apocr. origine et usu*, 1851; COWPER, *The Apocryphal Gospels*, London, 1867; R. HOFMANN, *Das Leben Jesu nach den Apokryphen*, Leipsic, 1851.

PHILIP SCHAFF.

Gos'port, town in England in the county of Hants, directly opposite Portsmouth. It is the seat of the Royal Clarence victualling-yard, with its breweries and bakeries, and has large iron-foundries for the manufacture of anchors and iron cables, and extensive storehouses for every kind of naval provisions. Pop., including Alverstoke, 22,638.

Gosport, post-tp. of Clarke co., Ala., on the Alabama River, 100 miles N. by E. of Mobile. Pop. 600.

Gosport, post-v. of Wayne tp., Owen co., Ind., on the W. fork of White River, at the crossing of the Louisville New Albany and Chicago and the Indianapolis and Vincennes R. Rs., 44 miles S. W. of Indianapolis. It has one weekly newspaper. Pop. 860.

Gosport, post-v. of Washington tp. Marion co., Ia. Pop. 108.

Gosport, tp. of Rockingham co., N. H., consists of Star, White, and Londoner's islands, belonging to the ISLES OF SHOALS (which see). The remaining four islands of the group are in Maine.—Gosport Village, on Star Island, is a fishing-town, 9 miles S. E. of Portsmouth. White Island light is in lat. 42° 58′ N., lon. 70° 37′ 30″ W. Pop. 94.

Gosport, suburb of Portsmouth, Va., on the Elizabeth River, 2 miles S. of Norfolk, has a large and excellent government dry dock and navy-yard. It is in Norfolk co.

Gos'samer, the long light filaments spun by certain small spiders. Some of these float in the air and carry the spider with them, perhaps in search of prey. Others are stretched upon the ground, and are believed to serve to collect the dew, of which many spiders have been observed to drink very frequently. In the folk-lore of various nations they are regarded as shreds of the Virgin Mary's neck-cloth, which she cast away at the time of her assumption.

Gosse (PHILIP HENRY), F. R. S., b. in Worcester, England, Apr. 6, 1810; lived in Newfoundland 1827–35, in Canada 1835–38, and in Alabama 1838–39, when he returned to England. Author of *Letters from Alabama; The Canadian Naturalist*, 1840; *Birds of Jamaica*, 1847 (he was in Jamaica 1844–45), an *Atlas of Illustrations* for the foregoing work; *Naturalist's Sojourn in Jamaica*, 1851; *Natural History*, 4 vols., 1848–51; *Ocean Described; Rivers of the Bible*, 1850; *History of the Jews*, 1851; *Textbook of Zoology*, 1851; *Assyria*, 1852; *A Naturalist's Rambles*, 1853; *The Aquarium*, 1854, *Handbook of Marine Aquarium*, 1855; *Marine Zoology*, 1856; *Omphalos*, 1857; *Evenings at the Microscope*, 1859; *Romance of Natural History*, 1860–62; *Land and Sea*, 1865; and other works.

Gosselies, town of Belgium, in the province of Hainaut. The neighboring coal-mines are important. Pop. 6757.

Gossellin (PASCAL FRANÇOIS JOSEPH), b. at Lille, France, Dec. 6, 1751; made extensive journeys (1772–80) for the observation of facts regarding ancient geography; and after this time carried on his studies for some years at the public expense. In 1790 he was chosen to the Academy. In 1799 he was made director and keeper of medals for the National Library. In 1816 he became one of the chief editors of the *Journal des Savants*. D. at Paris Feb. 7, 1830. Among his most important works are *Geographie des Grecs analysée* (1790); *Recherches sur la geographie des anciens* (1798–1818), besides a large number of valuable monographs upon ancient geography, and an *Atlas des Cartes*, with 75 maps.

Go'ta [Swed. *Göta-elf*], a large river in Southern Sweden, carrying the water from Lake Wener to the Cattegat. It is celebrated for the romantic beauty of its shores and for its magnificent cataracts, of which Trollhätta ("the witch's cap") is one of the most brilliant and imposing in the world. To make the river navigable, and to connect it with the Baltic through Lakes Wener and Wetter, a system of locks and canals (Trollhätta and Gota Canal) has been constructed, which is an admirable work of engineering art, and very costly.

Gotama. See GAUTAMA.

Go'tama, an East Indian logician, the reputed author of the *Nyâya Sûtra*, which in its present form is, however, in part the work of commentators. The time of Gotama's life is quite unknown, but most scholars assign him a high antiquity. The related events of his life are purely fabulous. It was believed by Sir William Jones that Aristotle borrowed the syllogism from Gotama's writings; but this opinion is now rejected by most critics, as is also the belief that Gotama was indebted to the Greeks.

Go'tha, town of Germany, the capital of the duchy of Saxe-Coburg-Gotha, on the left bank of the Leine. Its old walls and fortifications have been transformed into boulevards and promenades, and the whole city has a modern and elegant appearance. The ducal palace, Friedenstein, is a considerable building, and contains, besides a library of 150,000 volumes, a very fine collection of coins and medals. Gotha is the seat of much literary enterprise (the *Gotha Almanac*, the geographical establishment of Justus Perthes, etc.) and considerable industry and trade. Pop. 20,591.

Go'tha Al'manac (*Almanach de Gotha*), an annual register containing lists of government officials, genealogies of German princely families, necrology, diplomatic intelligence, statistics, etc. It is, especially of late years, a work of very great value. It is published at Gotha, in Germany. From 1764 to 1804 it was published in the German language. From that time till the present it has been published both in French and German.

Go'tham (*Goteham*), a parish of Notts, England, whose people have been (according to Thoroton) famous ever since King John's time for their stupidity; so that "a wise man of Gotham" became a synonym for a fool. Irving in his *Salmagundi* applied the name Gotham to New York, and the appellation is still a familiar one in the U. S. (For traditional explanations of the origin of the phrase "wise men of Gotham," see W. A. WHEELER's *Dict. of Noted Names of Fiction.*)

Goth'ic Arch'itecture has been treated of in the article on ARCHITECTURE, so far as regards its æsthetical character, and its connection with that period of modern civilization during which it originated, and whose artistic representative it is. We add here a few items of its system of construction and of its history. With the introduction of the pointed arch, which is the most prominent feature of the Gothic style and the leading principle in

its architectonic system, that somewhat heavy and gloomy aspect disappeared which still hovered over the buildings of the Romanesque style, and the organization of the dead masses was carried through with such a minuteness and harmony that the whole building looked like a living being. On entering the Gothic cathedral, with its vaults floating aloft on delicate ribs branching off from the top of its stately pillars, the modern critic feels himself so strongly reminded of the dome of the forest that he declares the building to be an imitation of nature; but, however that may be, a closer study shows that this audacious construction rests on the most subtle calculations. The first advantage which the pointed arch offered over the semicircular, and that one which probably led to its adoption, lay in the circumstance that it allowed arches of different span to be combined into the same system, as by constructing them on different radii they could be carried to the same height. Thus, it became as easy to vault an oblong as a square place, and a much greater freedom was attained for the ground-plan. But there was another circumstance which proved of still greater consequence. The tunnel-vault pressed with equal force along the whole line of its abutment, and the thrust was lateral. It consequently demanded very strong and solid side-walls to rest on. The pressure of the pointed arch was more perpendicular, and by developing the groin-ribs its whole force was gathered into the four points of abutment, which it now became sufficient to support, while the intermediate wall might be broken almost at pleasure. The nave-pier was folded together and formed into a pillar which, like a bundle of columns, arose to the sustaining point, each shaft receiving there its part of the vault to carry. And thus room was made for the large windows which, filled with stained glass, a contemporary invention, flooded the vaults with a soft, subdued light, that actually touched the sense of sight like the shadow of the forest. Also, the exterior of the building underwent characteristic changes consequent upon the introduction of the pointed arch. As the pressure became more and more concentrated in single points, it became more and more difficult to support and secure these points, especially to enable them to resist the thrust of the wall. Buttresses were carried along the exterior of the side-wall to the height of the sustaining point, but as the nave rose considerably above the aisles, the buttresses had to be carried considerably above the height of the wall of the aisle, and to be connected by arches with the wall of the nave. These flying buttresses and flying arches were highly ornamented and covered with exquisite stone carvings, which at some distance gave the building an aspect as if a veil of elegant lace had been thrown over it.

An ogival window of the last part of the fifteenth century.

The Gothic style which flourished from the middle of the twelfth to the middle of the fourteenth century, originated in Paris under the influence of the rich architectural monuments of Normandy, Burgundy, and Provence, and spread very rapidly to England, Germany, Italy, Spain, and the Scandinavian countries. The first fully-developed example is the cathedral of St. Denis, near Paris, consecrated in 1144, but it was soon followed by others more magnificent and more characteristic. The cathedral of Notre Dame in Paris was begun in 1163, Pope Alexander III. laying the first stone. In 1182 the high altar was consecrated; in 1223 the W. front was finished; in 1257 the southern transept; in 1312 the northern. The length of the interior is 390 feet; the width of the transepts, 144 feet; the height of the vaults, 105 feet; and of the towers, 224 feet. In both these buildings, however, as well as in the beautiful cathedral of Chartres, built 1195–1260, there are still some traces left of the Romanesque style, but in the cathedral of Rheims, begun in 1212, the Gothic style is carried through to the smallest detail, and the cathedral of Amiens, built 1220–88, is generally considered as representing the highest degree of perfection which the style ever reached. Its dimensions are—length of the whole edifice, 415 feet; width of the transepts, 182 feet; height of spire, 420 feet. But although it was impossible to attain any higher degree of refinement and elegance in the details without losing something of the nobleness of the general character, the French architects, in their restless eagerness after progress and improvement, pushed the audacity of their constructions farther and farther. The breadth and height of the nave of the cathedral of Amiens are respectively 42 and 132 feet; those of the cathedral of Beauvais were 45 and 146, but twelve years after its erection (in 1284) it fell, and had to be rebuilt on another plan. Stopped in this line, and yet passionately fond of novelties, the architects now subjected the details to arbitrary modifications, and the decay of the Gothic style began in France with that style of decoration which is called *Flamboyant*, and which is most conspicuous in the tracework of the windows.

In England the Gothic style was introduced by William of Sens, who built the cathedral of Canterbury in 1174. Then followed Westminster Abbey in London, built 1245–69, and the cathedral of Salisbury, built 1220–58, and generally considered the most perfect example of the *Early English* style. In the fourteenth century a movement took place somewhat similar to the Flamboyant, and the most celebrated of this, the *Decorated* style, are the cathedral of Exeter, built 1327–69, and that of York, built a little later. In the fifteenth century the Decorated style was succeeded by the *Perpendicular;* and with this movement begins the decline of the Gothic style. But Gothic architecture in England was by no means a repetition of French models; it was an independent adoption and followed an independent course of development. Not only is the general character of the French and English buildings of this style very different, but also their plan and construction show striking differences. The English cathedral is square-ended, the French semicircular; the English has large transepts, the French almost none; the English is long and low, the French short and high. The cathedral of Salisbury is 430 feet long, but its nave is only 33 feet wide and 78 feet high. Less original, and consequently less interesting, is the development of the Gothic style in Germany, though it is represented by several fine buildings, of which the cathedral of Cologne and the church of St. Stephen in Vienna are the most celebrated. The interior of the latter makes a somewhat peculiar impression, as the nave and the aisles are nearly equally high, and the nave without windows; but the exterior is very richly decorated, and the spire, 435 feet high, magnificent; finished in 1433. CLEMENS PETERSEN.

Gothic Language and Literature. See ULFILAS, by PROF. C. PETERSEN, A. M.

Goth'land, or Gottland [Swed. *Götartke*], the southernmost province of Sweden. Area, 37,000 square miles. Pop. 2,445,376. The northern part is mountainous, rich in iron, copper, alum, and nickel, and covered with forests of pine. The southern part is very fertile and well suited for agriculture. (See GOTTLAND.)

Goths, The, occupied originally the regions along the northern and north-eastern shores of the Black Sea, from the mouth of the Danube to that of the Don. Several centuries before our era one or more swarms of these Goths crossed through Central and Northern Europe, one portion of them invading and conquering Scandinavia, and the others settling S. of the Baltic, between the Oder and the Vistula. Here Pytheas from Marseilles, who calls them *Guttones*, visited them in the time of Alexander the Great; and they still lived here when Tacitus, who calls them *Gothones*, wrote his *Germania*. It was not until the third century of our era, however, that the original Goths became known to the Romans, who generally confounded or even identified them with their neighbors, the Getæ. Several modern historians believe that those Goths whom the Romans met at the Black Sea descended either from the Scandinavian or from the Germanic Goths; but the truth is that they were the original stem from which those two other tribes branched off. It is certain that the Scandinavian and Germanic Goths came from the Black Sea, and there is not the least proof of any one of them ever returning. On the contrary, such a movement of a people from W. to E. would at that time have been extremely difficult, not to say impossible, as it would have compelled them to face and fight the innumerable swarms which poured into Europe from Asia, all moving from E. to W. The Goths of the Black Sea never saw the Baltic, but their brothers did.

During the reign of Alexander Severus (222–235 A. D.) the Goths began to invade the Roman province of Dacia. In 250 they met and defeated the emperor Decius at Philippopolis, and the following year they defeated him a second

time, and killed him. In 258 they had procured a fleet and took Trebizond, and in 262 they came with 500 vessels before the Piræus, and took and plundered Athens. They now began to threaten Italy, but in 269 the emperor Claudius, the successor of Gallienus, defeated them, sunk their fleet, and pursued them into Mt. Hæmus, in whose ravines as many of them are said to have died of famine as had fallen in the battle. In spite of this heavy reverse, they compelled (in 272) the successor of Claudius, Aurelian, to give them the province of Dacia, where they settled, and where they kept comparatively quiet for nearly a century; indeed, one part of them, the so-called Mœsogoths, who settled in Mœsia, gave up war altogether and became an agricultural people. During this period of quiet life the Goths were converted to Christianity by Bishop Ulfilas, who translated the Bible into their language, and it was also during this period that the division sprang up between the *Ostrogoths*, living along the shores of the Black Sea, and the *Visigoths*, on the banks of the Danube in the Dacian provinces—a division which maintained itself through the rest of their history. When Theodosius the Great died in 395, and the Roman empire was divided between Arcadius and Honorius, the Visigoths rose and began to wander. They first invaded Greece, then Italy. In 410 their famous king, Alaric, conquered and sacked Rome, but his successor, Athaulf, after marrying Honorius's sister, Placidia, left Italy and went into Gaul. In 412 the Visigoths crossed the Pyrenees and established a large and flourishing empire, comprising the southern part of France and the northern part of Spain, with Toulouse for its capital. Their possessions N. of the Pyrenees they lost in the beginning of the sixth century, being compelled to cede them to Clovis, the king of the Franks. But in Spain they prospered till the beginning of the eighth century, when (in 711) they were routed by the Saracens at Xeres de la Frontera, their empire broken up, and their name as a people wiped out of the map. In 386 the Ostrogoths tried to cross the Danube, but were completely routed by the Romans, and had to retreat into Lydia and Phrygia. Hence they went with Attila on his campaign into Gaul, where they fought (452) at Châlons-sur-Marne against their own brethren, the Visigoths. After the battle they settled for some time in Pannonia, where they grew strong and exacted a handsome yearly tribute from the emperor of Constantinople. But their greatest success they achieved under Theodoric, who ruled over them from 475 to 526. First he conquered Bosnia, Servia, Wallachia, Transylvania, and Dalmatia from the East Roman empire, and then (in 486) he descended into Italy, defeated Odoacer, and formed a large kingdom, bounded N. W. and N. by the Rhône and the Danube, and with Ravenna for its capital. Theodoric was not only a man with a natural talent as a general and statesman, but also a man of culture. Italy was better governed under him and his successors than it had been for the previous two centuries; but soon after his death the East Roman generals, Belisarius and Narses, succeeded in breaking down the Ostrogothic empire in Italy, and with the death of Teias, the last king (in 553), even the name of the nation vanished from history. CLEMENS PETERSEN.

Got'tenburg [Swed. *Götaborg*], town of Sweden, in the province of Gothland, on the Gota, near its mouth. It has an excellent harbor and a considerable trade, exporting iron, copper, timber, tar, and fish. Also as a manufacturing place it is rising; its shipbuilding and manufactures of sailcloth are important. Pop. 59,329.

Got'teschalk, or **Godescalc** (*Gotheschalcus Fulgentius*), b. at Mentz, Germany, about 806; became a Benedictine of Fulda, where, wishing (829) to return to the world, he was restrained by the abbot Raban; studied at Paris and Orbais; devoted himself to the study of Augustine and the propagation of the predestinarian doctrines; was everywhere opposed, especially by Nothingus, bishop of Verona, and by his old master Raban, now archbishop of Mentz; condemned by the Council of Mentz 848; tried by Hincmar of Rheims and Charles the Bald at Quiercy (849 A. D.); flogged in presence of the king and bishops, and imprisoned for life in the abbey of Hautvilliers, where he d. Oct. 30, 867, Hincmar denying him the consolations of the Church in his last hours. Remigius of Lyons, Fulgentius of Troyes, and Ratramn of Corby were among his defenders, and Scotus Erigena wrote a treatise against him. A *Life* of Gotteschalk by Archbishop Ussher appeared in 1631, and Mauguin in 1650 published the existing fragments of his works.

Gott'land, or **Gothland,** an island in the Baltic belonging to Sweden, and situated in lat. 56° 55′ N. and lon. 18° 10′ E. Area, 1227 square miles. Pop. 41,575. Wisby, its principal town, was once a most flourishing city belonging to the Hanseatic League; now it is in ruins. (See GOTHLAND.)

Göt'tingen, town of Prussia, in the province of Hanover, on the Leine. It has a neat and quiet appearance, and some manufactures of woollens, tobacco, and leather, but it depends chiefly on its university, with which are connected an excellent library of 400,000 vols., a museum, a botanical garden, an observatory, an anatomical theatre, a chemical laboratory, and other scientific institutions. It was founded in 1737 by George II., king of England and elector of Hanover, and the magnificent scale on which it was established and maintained made it soon one of the most celebrated universities of Germany. In this century the University of Berlin, founded in 1810, has thrown it somewhat into the shade. Its number of students, which in 1823 amounted to 1547, fell in 1831 to 1123, and in 1834 to 860. In 1837 five of its most celebrated professors—among them the two Grimms and Gervinus—were expelled for political reasons, and in 1864 the number of students amounted only to 737. It is nevertheless still an institution of great repute and influence. Pop. of town, 15,841.

Gotts'chalk (LOUIS MOREAU), an American pianist and composer, b. in New Orleans, La., May 18, 1829; d. at Tijuca, near Rio Janeiro, Brazil, Dec. 18, 1869. When but seven years old he gave a concert. At twelve his father sent him to Paris, where he had instruction in the science and art of music from the best masters. He gave concerts in France, Switzerland, and Spain, and achieved a high reputation before his countrymen knew him. Afterwards he was heard in the chief cities of the Union, in Mexico, South America, and even in Australia. His pianoforte compositions, which are numerous and peculiar, are characterized by passion, often tumultuous, but often subtle, dreamy, and tender. His own style combined dash and pathos with brilliant effect. Gottschalk was popular as a man and admired as an artist. Among other decorations, he received that of the Legion of Honor and the order of Isabella the Catholic. His death caused great lamentation and excitement, and he was buried with distinguished honors. O. B. FROTHINGHAM.

Gott'sched (JOHANN CHRISTOPH) was b. Feb. 2, 1700, at Judithenkirch, near Königsberg, Prussia; studied the languages and literature, and was professor first in eloquence and poetry, then in logic and metaphysics in Leipsic, where he d. Dec. 12, 1766. At one time he was supreme lawgiver in Germany in matters of taste, and exercised a great influence. He attacked the second Silesian school of poets, among whom Lohenstein was the most remarkable, and whose characteristic was a wild and chaotic bombast. He was himself a representative of French taste, of its order, correctness, and elegance; and although he was a poor poet (his great tragedy, *The Dying Cato*, is a miserable production), both he and his wife possessed great mastery of language, and translated with ease, and not without taste, one piece after the other from the French. His intimate connection with Mrs. Neuber, the manager of the best troop of actors at that time in Germany, afforded him a very efficacious means of inculcating his ideas on the public, and he was moreover supported by all the German courts, which acknowledged or even noticed nothing unless it came from Versailles. He actually crushed the second Silesian school, and stood for several years as the dictator of the German literature. Then he had himself to experience opposition. The Swiss school arose, headed by Bodmer. Bodmer was a man of small poetical gift, but of considerable critical talent. His taste was English, and nationality in literature was with him more than an idea; it was a principle. He attacked Gottsched very severely in a long series of criticisms, and when, shortly after, Klopstock and Lessing came forth and gave practical evidence of the soundness and correctness of Bodmer's principles, poor Gottsched tumbled from his throne, and became the laughing-stock of all Germany. CLEMENS PETERSEN.

Gou'da, or **Ter'gouw,** town of the Netherlands, in the province of South Holland, on the Yssel. Its church of St. John is celebrated for its glass-stained windows of the sixteenth century. Gouda has large manufactures of bricks, cheese, tiles, pottery, and clay pipes. Pop. 15,776.

Gough (Rt. Hon. HUGH), VISCOUNT, b. at Woodstown, Ireland, Nov. 3, 1779; joined the army 1794; served with distinction at the Cape of Good Hope 1795, and in Spain 1809–13, where he was thrice wounded; became a major-general 1830; went to India 1837; led the land-forces in the Chinese opium war 1841; was made a baronet and G. C. B. 1842; and commanded the British forces against the Mahrattas 1843, and the Sikhs 1845; was made a baron 1846; commanded in the second Sikh war 1846–49, but in consequence of the terrible losses inflicted upon the British by the Sikhs his generalship began to be criticised, although all his battles were victories; and Sir Charles Napier in 1849 took his place. Gough was created viscount and handsomely pensioned (1849), made colonel of the horse-guards 1854, K. P. 1857, privy councillor 1859, G. C. S. I.

1861, field-marshal 1862. D. Mar. 2, 1869, and was succeeded as viscount by his son, Lord GEORGE STEPHENS GOUGH (b. Jan 18, 1815).

Gough (JOHN B.), b. at Sandgate, Kent, England, Aug. 22, 1817; came in 1829 to the U. S.; became a bookbinder, and after some years of poverty, caused by intemperance, he reformed, and in 1843 became a temperance lecturer, and labored with great zeal and success in the U. S. and in England (1853). He also attained great reputation as an orator upon other themes. Resides in West Boylston, Mass. (See his *Autobiography*, 1848; enlarged, 1870.)

Goulard's Cerate; Goulard's Extract. See LIME, MEDICINAL USES OF.

Goul'burn, city, cap. of Argyle co., New South Wales, Australia, 120 miles by rail S. W. of Sidney. It has an Anglican and a Roman Catholic bishop. Pop. 3500.

Gould (AUGUSTUS ADDISON), M. D., son of N. D. Gould, a famous teacher of music and writing, b. at New Ipswich, N. H., Apr. 23, 1805; graduated at Harvard 1825; was for some time scientific instructor in Harvard University, and in 1856 became one of the physicians of the Massachusetts General Hospital, Boston. Author of many scientific papers; of a *System of Natural History*, 1833; *Report on the Invertebrate Animals of Massachusetts*, 1841; reports on mollusks collected by the Wilkes and the Ringgold and Rogers expeditions; *Otia Conchologica*, 1863; translated works of Gall and Lamarck; with L. Agassiz published *Principles of Zoology*, 1848. D. at Boston Sept. 15, 1866.

Gould (BENJAMIN APTHORP), b. at Lancaster, Mass., June 15, 1787, was the son of Capt. Benjamin Gould, an officer in the war of Independence, who had borne a prominent part in the battles of Lexington, Bunker Hill, and Saratoga, as well as in the detection of the treachery of Arnold. After graduating at Harvard College in 1814, he was appointed to the charge of the Public Latin School of Boston, which soon assumed, and long maintained, the highest position of any institution in the country for thoroughness in classical teaching. He was the first American editor of any classical author, and besides his improved and revised Latin grammar, which was a novelty in America, and long remained a textbook, he prepared critical editions of Horace, Ovid, and Virgil, which, although intended as textbooks for the Boston Latin School only, found at once an extensive circulation through the country. He continued in charge of the Latin School till 1828, when his health compelled him to abandon prolonged literary occupations. He subsequently filled many important public positions in his native State, and d. Oct. 24, 1859.

Gould (BENJAMIN APTHORP), PH. D., LL.D., son of the foregoing, was b. in Boston Sept. 27, 1824. After graduating at Harvard College in 1844, he devoted himself to the study of astronomy, prosecuting this at the observatories of Greenwich, Paris, Berlin, Göttingen, and Altona, and returning home in Dec., 1848. In 1849 he established at Cambridge the *Astronomical Journal*, a periodical dedicated solely to original investigations, which he maintained, chiefly at his own expense, until 1861, when the war rendered its suspension necessary. In 1851 he took charge of the longitude operations of the Coast Survey, to which Bache and Walker had just begun the application of the electric telegraph. This method he extended and perfected, until in 1866 about twenty longitudes had been determined in the U. S. with the highest precision yet attainable by modern science. Immediately on the successful completion of the Transatlantic cable in that year, he established an observatory at Valentia in Ireland, and established its longitude from Newfoundland on the one hand and Greenwich on the other, thus completing a series of telegraphic longitude measurements from the Royal Observatory to New Orleans, and connecting these with the new European series from Greenwich to the Ural Mountains. In 1855, the Dudley Observatory at Albany having been organized, its management was committed to a scientific council consisting of Messrs. Bache, Henry, Peirce, and Gould, and its directorship was confided to Dr. Gould, who accepted it without remuneration, planning the principal instruments and superintending their construction. Here, for the first time, a normal clock, placed in a position as free as possible from atmospheric influences, gave its time telegraphically to dials in the observing-rooms. Important modifications, almost universally adopted since that time, were introduced in the meridian instruments, and the now celebrated difference-engine of Scheutz was procured, and used in calculating astronomical tables. A uranometry, containing the magnitudes to tenths of a unit for all stars visible to the naked eye between 60° N. and 2° S., was also prepared as preliminary to the sharp determination of the positions of the stars which it contained. The conflict between the trustees of the institution and the scientific council belongs to the history of American science. In addition to the management of the construction and equipment of the observatory for more than three years without remuneration, he had incurred a very large personal indebtedness for the expense of its equipment, etc., which entailed upon him the necessity of some years of subsequent labor in non-scientific avocations, and seriously interfered with the *Astronomical Journal*. In 1863, the Sanitary Commission having requested Dr. Gould to take charge of their statistics, he organized in connection with these an elaborate system of anthropological measurements, which were subsequently computed and tabulated. From the discussion of the ages of our soldiers in connection with the census, he deduced the curious formula which seems to control the distribution of a population according to ages, and which has been singularly verified by subsequent censuses of this and other countries. The law of growth in human stature was also elicited by these researches, as also the normal relation between height and weight, and the typical proportions of the human body. In 1870 he went to South America to establish a national observatory for the Argentine Republic at Cordova and complete the catalogue of the southern stars—a work which was nearly accomplished in Apr., 1874; at which date he had likewise organized a national meteorological office, and made various telegraphic determinations of longitude, and also prepared for publication a uranometry and charts of the southern heavens.

Gould (HANNAH FLAGG), b. at Lancaster, Mass., 1789. Her poems, published in 1832–36 and 1841, were much admired both in England and America. Author of *Gathered Leaves, The Diosma*, etc. D. at Newburyport Sept. 5, 1865.

Gould (JAMES), LL.D., b. at Branford, Conn., 1770; graduated from Yale College in 1791, and became justice of the supreme court of Connecticut; for 40 years associated with Judge Tapping Reeve as a professor in Litchfield Law School. He published *Principles of Pleading in Civil Actions* (1832). D. in Litchfield, Conn., May 11, 1838.

Goulds'borough, post-tp. of Hancock co., Me., on the Atlantic coast, 22 miles S. E. of Ellsworth. It has some excellent harbors, and has lobster and other fisheries, and manufactures of lumber, boats, etc. Pop. 1709.

Gou'ley (JOHN WILLIAM SEVERIN), M. D., b. at New Orleans, La., Mar. 11, 1832; received a classical education, and in 1853 took his medical degree at the College of Physicians and Surgeons, New York; in 1856 became professor of anatomy at the Medical College, Woodstock, Vt.; one of the surgeons of Bellevue Hospital New York, since 1859; demonstrator of anatomy in the University of New York 1859–61, 1864–66; in the U. S. army service 1861–64; professor of clinical surgery in the University of New York 1866–71. Author of *Diseases of the Urinary Organs*, 1873, and of professional papers; member of various scientific societies. Resides in New York.

Gounod (CHARLES FRANÇOIS), b. in Paris June 17, 1818. His early passion was for sacred music; his first great success was a mass performed at the church of St. Eustache in 1849. He began to write for the operatic stage in 1850, and persevered in it, in spite of the unpopularity of much of his work and the impulses of a deeply religious temperament, which, it has been remarked, has more than once nearly prevailed to make him a recluse. His compositions show a mastery of musical science, uncommon resources of melody, and affluence of ideas. The best known of them all is *Faust*, which was performed as first written nearly 200 times at the Théâtre Lyrique, and for ten years has been a general favorite. Other operas are—*La Nonne Sanglante, Le Médécin malgré lui* (comic), *La Colombe, Philémon et Baucis, Mireille, La Reine de Saba, Romeo et Juliette*, the last the most celebrated after the *Faust*. Gounod has written a lyric drama (*Sappho*), three symphonies, and a cantata. He is a member of the Academy of Fine Arts, was decorated with the Legion of Honor Aug. 15, 1857, and was made an officer Aug. 13, 1866. In May, 1866, he was elected a member of the French Institute.

O. B. FROTHINGHAM.

Gou'ra, or **Crowned Pigeon** (*Goura coronata*), the largest living species of the pigeon family, is about the size of the turkey. It is a native of the Eastern Archipelago, and is domesticated in Java, but in America and Europe it has failed to breed. Its flesh is highly prized.

Goura'mi, or **Goramy,** the *Osphromenus olfax*, a valuable fresh-water food-fish of Eastern Asia, introduced in the West Indies, the Mauritius, and Guiana with great success. It belongs to the Labyrinthibranchidæ, is a nest-builder, and protects its young fry with great care.

Gourd. In Great Britain this name is applied indiscriminately to any member of the natural order Cucurbitaceæ, but in America it is restricted to the genus *Lagenaria*. This name is derived from the Latin *lagena*, a "bottle,"

and refers to a frequent shape of the fruit, of which the shell is used not only for bottles, but, after soaking to remove the bitter principle, for dishes, cups, and especially for dippers, for which the natural handles especially adapt it. At the South a gourd is almost always found suspended at a spring for the use of travellers. The *Lagenaria* climbs extensively over walls and shrubbery by means of its compound tendrils. The clammy-pubescent herbage has a powerful odor of musk. It has rounded leaves, long-stalked flowers greenish-white in color, and fruit differing greatly in size and shape. Hence the great variety of purposes to which it can be applied by cutting the rind and removing the contents. The sterile flowers are on a long peduncle, the fertile on a short one, and are musk-scented like the leaves. The name *gourd* is from the French *gourde*, signifying a "swelling." The plant is a native of Africa and Asia, perhaps also of America. Pumpkins, squashes, cucumbers, and melons belong to the order Cucurbitaceæ, and are valued for their useful and often delicious fruit. The vegetable marrow, a variety of squash, is largely cultivated in England for its delicate fruit. The orange gourd (*Cucurbita orifera*) grows wild in Texas, and is cultivated for its ornamental fruit. W. W. BAILEY.

Gourdon, town of France, in the department of Lot, on the Bleu, manufactures woollen fabrics and trades in wine, nuts, and truffles. Pop. 5099.

Gout [*goutte*, a "drop"], an inflammation of the fibrous and ligamentous parts of the joints, and is dependent upon mal-assimilation. It derives its name from having been thought to be produced by a liquid falling (*goutte à goutte*), "drop by drop," into the joints, and, although this theory has long since been proved to be erroneous, it still retains the name. We generally find an hereditary predisposition to this affection. It can be traced through many generations, and is found in about two-thirds of the cases. Next frequently we find it in persons enjoying the luxuries of the table, drinking wine and beer, and taking but little exercise. It was formerly considered a disease of high life, but is now just as common among the poorest people in England as among the rich. It was not so in Sydenham's time. The ballast-heavers of London have more gout than any other class in the world. They work in the water, and drink on the average four gallons each of porter daily. The principal change observed in the blood is a great excess of uric acid, and the deposit in the affected joints is made up almost entirely of urates. But "we neither know whether the uric-acid diathesis be the primary and chief anomaly in gout, and whether it be not accompanied by other and more important changes in the composition of the blood, nor do we know the disturbances of nutrition by which one of the constant products of normal nutrition, uric acid, is formed in excess." (*Niemeyer.*) We have certain symptoms premonitory to an attack of gout. The digestive apparatus is disturbed, and we find that the patient loses his appetite; he will also suffer from pain and a sense of weight or fulness in the region of the stomach, accompanied by acid eructations, heartburn, irregularity of the bowels, and flatulence. Sometimes he will vomit a phlegmy material. The patient now complains of a dull headache, and feels indisposed for any work, and becomes irascible. This last symptom is well known among the laity as a premonition of gout. The urine becomes highly concentrated; the specific gravity runs up to 1025–1030; it is of a deep amber or red color, and deposits on cooling large quantities of uric acid and the urates, which are commonly known as the "brickdust deposit." This concentrated urine often causes a burning and pain as it passes along the urethra, and has even been known to excite a muco-purulent discharge. Dr. Graves speaks of an unavoidable desire in these patients to grind the teeth, which is caused by painful sensations in the genital organs, and which seems to be relieved in no other way. To such an extent is this sometimes practised that we find gouty individuals with the teeth worn almost entirely away. The next symptom noticed is small sharp pains throughout the whole economy; this precedes the attack of gout but a few days. Now the attack begins, generally during the night, by a burning, piercing pain in the great toe, generally the metatarso-phalangeal articulation. The patients have different modes of expressing this variety of pain—some simulating it to the driving of a nail into the foot, others to the teeth of a dog crushing the bones or to having the toe squeezed in a vice. The patient tumbles and tosses from one side of the bed to the other, seeking a position in which he may get some rest; but this is denied by his visitor, who never lets go his grip for more than a couple of seconds at a time. At the end of three or four hours the pain has become almost intolerable, and is so severe that the patient cannot bear even the weight of the bed-clothes upon the affected part. Towards morning the pain diminishes, and the patient breaks out in a perspiration and falls asleep. The following day the affected joints are found to be red and swollen, but the pain is a great relief from that of the previous night; they continue in this way until evening, when the scene of the previous night is re-enacted. After a week of this suffering the patient is generally temporarily freed from his trouble; the redness and swelling gradually subside, and the upper layer of the skin peels off and itches greatly. The patient now feels better than he did before the attack. After repeated attacks the disease may degenerate into chronic gout, in which the attacks are quite frequent; there is a purplish appearance of the affected joints, and, owing to synovial effusions and deposits of lithate of soda, they are œdematous and deformed. Abscesses frequently form in or about the joints, and concretions of urate of soda may escape from them when opened.

Nervous gout, also called atonic, anomalous, or irregular gout, is a name given to a variety which occurs in persons of hereditary gouty tendencies, in whom the debilitated constitution is not in a condition to develop a normal attack of gout. It generally occurs in nervous and poorly-nourished individuals, and appears as dyspepsia, cough, etc., accompanied by palpitation of the heart, irregular pulse, dizziness, syncope, etc. It is this variety which sometimes proves fatal.

The only disease with which gout could be confounded is rheumatism, but it differs from it in the following points: "(1) Rheumatism affects chiefly the young or middle-aged; gout, the elderly. (2) Rheumatism prefers the larger joints; gout, the smaller, and especially the feet and hands. (3) Gout is attended with more obvious disorder of the digestive organs; the pain is of a more burning character, and the swelling greater and more vividly red."

The treatment may be divided into two stages—viz. that during the paroxysm, and that during the interval between the paroxysms. In speaking of the treatment during the paroxysm, Trousseau asks the question, "Should we treat it?" and comes to the conclusion that we should not use any medicinal agents if we wish to do full justice to our patient. Colchicum is the favorite drug used to cut short the attack, and it has obtained a well-deserved reputation for it; but when the paroxysm has been brought to a premature termination by the use of this drug, it invariably returns sooner and with renewed violence; whereas otherwise the intervals between the paroxysms increase and the severity decreases. Should we, then, do nothing for the sufferer? Yes: we can regulate his diet and keep his bowels open, and if the pain is excessive, it may be relieved by opiates. By this method of treatment we shall accomplish more in the long run than if we had resorted to stringent measures to cut short the paroxysm. In the treatment during the interval between the paroxysms we should likewise discard all drugs. Attention should be paid to the diet and regimen of the patient; he should take his meals regularly; should eat plenty of vegetables, meat but once a day, and should abstain from alcoholic drinks, especially ale and beer, and take a certain amount of exercise in the open air daily. Particular attention should be taken to keep the bowels regular. EDWARD J. BERMINGHAM.

Gouverneur, post-v. and tp. of St. Lawrence co., N. Y., 34 miles S. E. from Ogdensburg, on the Rome Watertown and Ogdensburg R. R. It has a bank, 2 newspapers, a seminary, several large mills and shops, 5 churches, 3 hotels, 9 stores, etc. Pop. of v. 1627; of tp. 3539. F. E. MERRITT, PUB. "TIMES."

Gov'an, town of Scotland, in Lanarkshire, on the Clyde, 2 miles distant from Glasgow, of which it almost forms a suburb, and on which all its business depends. Pop. 7636.

Gove, county in the W. of Kansas. Area, 900 square miles. It is watered by the Smoky Hill and its tributaries, and traversed by the Kansas Pacific R. R.

Gov'ernment. The first proper step in all philosophical inquiry, as well as in all discourse, of whatever character, undertaken for the elucidation of truth, is to set forth as clearly and distinctly as possible the meaning of the words and terms used in the expression of the views presented, from which successive conclusions are to be logically drawn. This is the work of definition, and it is no less essential in moral and political investigations than it is in mathematical. It is indeed the beginning of progress in every department of learning, whether moral, intellectual, or material. Government, then, in its true and most comprehensive sense, may be said to be the operation of laws. Law, in its most general and comprehensive sense, according to very high authority (Blackstone), "signifies a rule of action, and is applied indiscriminately to all kinds of action, whether animate or inanimate, rational or irrational. Thus, we say the laws of motion, of gravitation, of optics or mechanics, as well as the laws of nature and of nations."

In a like general sense, with equal correctness, we speak of the government of the mind, of the passions, of a church or a state, as well as of the government of the universe. It is in each case the operation of those laws by which action, in its every sphere whether moral, intellectual, or material, is controlled. In the restricted sense in which it is proposed in this article to treat of government, and of the laws which shape its form as well as control its action, the term is intended to be applied only to the government of men in their relations, conduct, and intercourse with each other in organized society.

By government in this restricted sense, therefore, is meant the exercise of that inherent, absolute power existing in every distinct and separate organized society or state, of self-determination and self-control for self-preservation which springs by nature from its own social forces, and the laws which control their action.

Every single individual person is a complete living organism within itself, endowed by nature with vital functions and powers of self-determination for its own preservation. But man, by nature, is less capable of self-preservation singly, by himself, than jointly, with others. Mutual protection and mutual interests, therefore, form the natural and only just basis for all organized associations of individuals of the character named. An organization when so formed constitutes a separate community, properly denominated a state, nation, commonwealth, or kingdom. It is to all intents and purposes an organism composed of the individual organisms that enter into it. It becomes a political and moral person, subject not only to its own special laws, but also to the general moral law to which all human action is subject, and which prescribes the limitations of natural justice. As each single organism in its powers of self-determination is controlled by its own internal laws respectively, so the aggregate organism is controlled in its powers of self-determination by those social forces or laws which give existence and life to the separate commonwealth, state, or kingdom so constituted. The operation of these laws in such a political organism, in its origin as well as in its after-growth and development, physically, intellectually, and morally, is what is understood by the government of such state. The controlling power—the paramount authority, the "*jus summi imperii*"—in each state so organized, is what is known as the sovereignty thereof.

Sovereignty, then, may be defined to be that inherent, absolute power of self-determination in every distinct political body, commonwealth, state, or kingdom coming into existence by virtue of its own social forces, which, in pursuit of the well-being of its own organism, under the universal moral law, cannot be rightfully interfered with by any other similar body without its consent. Sovereignty, in every such body politic, organized society, or state, is that innate attribute of the commonwealth or aggregate organism which corresponds with the will and power of self-action in the personal organisms so constituting it; and by its very nature is indivisible: just as much so as the *mind* is in the individual organisms respectively. The limitations of natural justice prescribed by the universal moral law apply as well to the political persons of organized societies as to separate individuals in a supposed state of nature. In the organization of single societies, whatever may be the form assumed, the act itself is known as the social compact. The type or form of government so instituted, at first, and in its after developments, in all cases depends upon the nature and character and relative power of the social forces from which its existence springs. These forces are threefold, to wit: moral (or religious), intellectual, and physical. As these forces relatively predominate in the formation of society, so will be the character of its organic structure. This organic structure is what in all cases is known as the *constitution* of each particular state or kingdom, whether it be written or unwritten; and the sovereign power is exercised through the channels established for it by this constitutional structure, which becomes the fundamental law of the organization until changed by the same social forces which brought it into existence. In the beginning, when the physical predominates, a monarchical form of government is almost the necessary development. When the intellectual and moral predominate or are equally balanced, mixed forms of government of some sort are the consequent development. The study of these laws and the various forms of government springing from them has occupied the attention of the profoundest thinkers from the earliest times. The subject constitutes a science of the utmost importance, as nothing of an earthly character more deeply involves the interests of every people than the government under which they live. From this chiefly spring all those institutions, moral, intellectual, and material, which mark the progress of their civilization.

It is not the purpose of this article to do more, after the foregoing premise, than briefly to set forth, (1) some general views on what should be the objects of all governments of whatever form; (2) to present some of the essential principles of governments constituted for such objects, without reference to their forms; and (3) to present an outline view of the different forms of government heretofore and now existing, with their defects so far as concerns the achievement of the proper objects of their institution.

1. It having been shown that all organized societies, and the governments resulting therefrom, are founded upon the basis of the better protection and enjoyment of the individual rights of their constituent members, the conclusion clearly follows that the chief object in every case should be the security and maintenance of all "those absolute rights which were vested in them by the immutable laws of nature." These consist of the rights of things as well as the rights of persons—the right of property as well as the rights of life and liberty.

Many writers maintain that individuals, upon entering into society, give up or surrender a portion of their natural rights. This seems to be a manifest error. In forming single societies or states men only enter into a compact with each other—a social compact—either expressed or implied, as before stated,—for their mutual protection in the enjoyment by each of all their natural rights. The chief object of all good governments, therefore, should be the protection of all the natural rights of their constituent members; or, in other words, the object in all cases should be the establishment of what may be styled civil liberty, which is nothing more nor less than natural liberty secured by the guarantee of all the powers of organized society. No person has any natural right wantonly to hurt or injure another. The object of society and government is to prevent and redress injuries of this sort: for, in a state of nature, without the superior restraining power of government, the strong would viciously impose upon the weak. Wrongs upon rights could not be so efficiently prevented nor so adequately redressed. Upon entering into society, however, for the purpose of having their natural rights secured and protected, or properly redressed, the weak do not give up or surrender any portion of their priceless heritage in any government constituted and organized as it should be.

A succinct view may here be pertinently presented of what should be the correct understanding of what is termed civil liberty. There are few themes upon which more has been said and written than this, and few, it is believed, upon which less has been distinctly and correctly stated. Many definitions have been given to the terms liberty, natural liberty, civil liberty, and political liberty. Many of these definitions, put forth by learned men, seem to be exceedingly erroneous, many more exceedingly confused, while only a few, rightly understood, express the truth. The erudite Mr. Markham, archbishop of York, for instance, defines or states his idea upon the subject in these words:

"Civil or legal liberty is that which consists in a freedom from all restraints, except such as established law imposes for the good of the community, to which the partial good of each individual is obliged to give place."

This definition conveys the idea that upon the formation of organized societies individuals give up some of their natural rights, and that the main object of such societies and governments should be the security of the greatest good to the greatest number. It clearly implies at least that the good of some must, occasionally, be sacrificed to the greater good of the greater number. Few heresies or dogmas in the science of government are more erroneous or more mischievous in their tendencies than this very specious doctrine, which to most minds seems to be so well founded. The great object of government, properly stated, should be to secure the greatest good to every member of society which can possibly be accomplished without injury to any. No ninety-nine persons whatever have any natural right to advance their interest or good by inflicting an uncompensated injury upon the hundredth, nor in any other proportion.

Another learned writer on this subject, Dr. Paley, changes the language somewhat, but gives in effect the same definition of civil liberty as that given by the archbishop of York.

Paley says: "Civil liberty is the not being restrained by any law but what conduces in a greater degree to the public welfare."

This implies that the state may, by just enactment, inflict a positive, unrequited injury upon one or more of the community, if the general "public welfare" can be promoted thereby. This definition, therefore, from what has been just stated, requires no further notice here.

Judge Blackstone's definition is in these words:

"Political, therefore, or civil liberty, which is that of a member of society, is no other than natural liberty so far restrained by human laws (and no further) as is necessary

and expedient to the general advantage of the public." This definition more nearly approximates the truth than either of the others; and yet it is defective, not only in this, that it embraces the same erroneous implication, but also confounds political and civil liberty, or treats them as the same. These words, when accurately applied, express very different and distinct ideas, which should ever be kept in mind in all investigations or reflections upon the subject. A member of society may be in full possession of perfect civil liberty, and yet without any political right whatever in the proper sense of that term; as is the case with women and minors generally, as well as mere denizens in most free states. This error of the great commentator on the laws of England, in his definition of civil liberty, by leaving in it the implication stated, seems to have crept in more from an indisposition on his part openly to assail or depart from authority, than from his own deliberate judgment. For it is inconsistent with what he affirms should be the principal aim of all governments. This, he says, "is to protect individuals in the enjoyment of those absolute rights which were vested in them by the immutable laws of nature." Of course no human laws can rightfully be set up for any purpose against any of the "immutable laws of nature." The error of this definition is also not a little remarkable from the fact that the author cites, as authority for it, what is given as the substance of the definition set forth in the Justinian or Roman code. That definition, as it stands in a foot-note to the author's text, certainly excludes the implication referred to, when rightly construed. As it there stands it is in these words: "*Facultas ejus, quod cuique facere libet, nisi quid jure prohibitur:*" the proper meaning of which clearly is, "the faculty of each one to do what each one pleases except what is rightfully prohibited." Dr. Paley and those of his school seem to construe *jure* in this definition, as if the Latin word had been *lege*, hence their ideas that civil liberty consists in all the members of society doing what they please except in so far as they may be restrained by any law of the commonwealth that "conduces in a greater degree to the public welfare," whether such law be founded upon natural justice or not. This yields the whole question of right to might. *Jure* in Latin has a very different meaning from *lege*. If the draftsman of the definition under consideration had had the same idea of it which Dr. Paley and others seem to have entertained, he would doubtless have used the word *lege* instead of *jure*. As it stands the definition was evidently intended to convey the idea that where civil liberty is enjoyed every member of society is permitted to do everything which he or she pleases, except what is "rightly prohibited;" and, by the laws of nature, most manifestly no one can be rightly prohibited from doing anything except what interferes with the rights of others. Burlamaqui's definition of liberty, in the sense in which it is now treated, seems fully to cover the whole ground with clearness as well as accuracy. He says, "Moral or natural liberty is the right which nature gives to all mankind for disposing of their persons and property after the manner they judge most consonant to their happiness, on condition of their acting within the limits of the law of nature, and that they do not any way abuse it to the prejudice of any other men."

The great truth that all men are created equal must ever be borne in mind in investigations upon this subject. This equality, as is manifest, does not consist in size, form, or any personal characteristics, in a physical, moral, or intellectual view. It does, however, consist in an equal right in the administration of justice. Justice is the great regulator in the government of human affairs, as gravitation is in the government of the material universe. The same simple law of gravitation which moulds an atom also shapes a world. To the silent but potent influence of the same magic principle are due that harmony and concord which pervade the planetary and stellar spheres. In like manner, justice, rightly administered, stays discord and produces peace, quiet, order, and happiness in communities, states, and kingdoms. The rule of justice is the divine injunction, applicable alike to all: "As ye would that men should do to you, do ye also to them likewise."

An inquiry into what particulars certain classes, such as are to be found in all communities, from want of sufficient mental and moral development can be rightly and therefore justly restrained in their volitions and actions for their own good as well as that of the rest of society, and which their natural rights in point of fact require (as in the case with children, to say nothing of others), would lead to the gravest problems which ever engaged the attention of philanthropists, lawgivers, and statesmen. That, however, lies not within the scope of this article. The *principle* which should govern in every case is all that is at present intended to be set forth.

II. In considering the essential principles upon which all governments should be founded, with a view to the objects of their formation, as before stated, and without regard to their peculiar or specific types, the following may be set forth as a few of the most prominent of them to which attention should be directed: 1st, The basis should be the fundamental principle or truth that the sovereignty or governing power is an attribute of the entire aggregate organism where it existed in the beginning and ever remains in every case, and can never be justly assumed to become vested in any one or more of its constituent members. 2d. From this follows another essential principle or truth, that all governments derive their "just powers from the consent of the governed." 3d. These principles or truths being established, it further follows that all exercise of governmental power is a trust, and can be justly exercised only for the benefit of the governed.

The exercise of all powers with which any rulers are clothed or vested are held by delegation from the ruled, either tacitly given or formally expressed. Office so called therefore in all cases in kingdoms or republics is matter of trust and not of inherent right on the part of any one who performs its functions. 4th. Another of the essential principles or truths referred to, and the only remaining one which will be here mentioned, is this, that while sovereignty itself is indivisible, as has been shown, yet its powers are divisible. It is a point of no inconsiderable importance in discussions of this kind to bear constantly in mind the difference between the powers of sovereignty and the great source itself from which these powers emanate. The three chief powers of sovereignty when properly divided may by appropriate classification be termed the law-making power, the law-expounding power, and the law-executing power. In all properly constituted governments the exercise of these powers should be confided to distinct, separate, independent, coequal, and co-ordinate departments, known as the legislative, judicial, and executive. The powers exercised by each of these separate and distinct departments are equally sovereign, and when so divided and exercised they constitute the trinity in unity of organized society and present the grandest feature in governmental structures.

III. In the last view proposed to be taken of the subject in this article it is not intended to go into minute details concerning the different forms and various types of governments as exhibited in the history of mankind. An outline sketch of their general character only is intended. The most marked differences between them are those which indicate the propriety of their being arranged generically into two classes—single and confederated. A single government is that of a separate and distinct state or kingdom founded upon the social compact. A confederated government is that of a union of two or more single governments founded upon what is known as the federal compact. Writers usually divide single governments into five general kinds—to wit, monarchies, aristocracies, or oligarchies, as they are sometimes styled, democracies, republics, and mixed governments, or those partaking of the qualities of several of the others respectively. Monarchies are usually subdivided into various kinds, such as absolute, limited, hereditary, and elective. Democracies are also subdivided into several kinds. Two only of these kinds of the latter will be here mentioned—pure and representative. (See DEMOCRACY.) A pure democracy is where all questions pertaining to public affairs are decided by the body of the people in general assembly convened. A representative democracy is where the functions of government are performed by agents, deputies, or delegates selected by such electors from the body of the people as may be empowered to make the choice by the fundamental law or constitution. The power of choosing such deputies is what is known as the franchise. It is an office conferred by organized society, and therefore a matter of trust and not a matter of natural right.

Republics are but a species of democracy, and may be subdivided into various kinds. The two most general of these kinds are those which distinguish all governments—single and confederated. The great and leading object of confederation of any sort, applicable alike to republics and all other forms of government, is the better to protect and maintain the great inherent right of self-government or self-determination possessed by each of the parties entering into it, just as the great and leading object of all single governments formed by the social compact is the better to protect and maintain inviolate the innate, absolute, and indestructible rights of the individuals entering into organized society. What is known as the natural rights of individuals corresponds with what may be characterized as the sovereign rights of states or kingdoms.

Confederated republics, of some kind, organized for these purposes, have existed from the earliest times of which history has taken any notice. A characteristic feature of all of them, until recently, was that under the federal com-

pact no power was conferred, by the parties to it, upon the conventional state thereby created, to act directly in the execution of the powers that were conferred, upon the individual members of society or citizens of the several republics so confederating respectively. This was left to the good faith of each of the parties severally, and it was found to be a great defect in the workings of this kind of confederations. This form of confederation is what, by the German publicists, is styled a Statenbund or States' union. To remedy these defects in some degree, another form of confederation has been resorted to, characterized by the same writers as a Bundeestaat, or federative union, in which the entire sovereignty of the separate states is merged in the new and conventional state so created. It was reserved for American statesmen in the latter part of the last century to remedy the evils of both the Statenbund and Bundeestaat systems, under what is known as the federal constitution of 1787, with the amendments subsequently ratified in pursuance of its provisions. Space will not allow any extensive consideration of the striking and wonderful new features in this model of federal republics. Suffice it to say that, anterior to 1789, when the new constitution of 1787 went into operation, the U. S. of America, after the declaration of their independence, was a confederated republic upon the model of that set forth by Montesquieu, Vattel, and others; or, in other words, they constituted what the Germans style the Statenbund. The defect or "vice" of this system was the want on the part of the general government of the power to execute, by its own functions and machinery, the many other specific powers which had been conferred upon it under the first Articles of Confederation. The great fundamental changes made in the constitution of 1787 or 1789 were the clothing of the Federal government with this additional power; and the creation of the necessary machinery for its execution. This required a subdivision of all powers conferred upon the general government, limited and specific as they were, into legislative, judicial, and executive departments, and by the arrangement the Federal government is now empowered within its limited sphere to act as directly upon the citizens of the States respectively as the States are on all other matters reserved to themselves and not confided to the general government. Another peculiarity of the American systems, applicable alike to the general and State governments, is that in the subdivision of the sovereign powers before referred to, the judicial power is co-ordinate and coequal with the others. No one of them, in its assigned sphere, is superior to the other, in either the Federal or State governments. This is another new feature in American politics. In all other countries where a judiciary exists it is held to be subordinate to what is called the political power of the state. This is not so under American institutions. (See CONSTITUTION, Vol. I.)

In conclusion of this article, suffice it to say in reference to the new American model of a confederated republic that it is far in advance of anything ever before developed in the annals of history. It presents an entirely new species of confederated republics. It rests, as the French philosopher, De Tocqueville, said, upon "a wholly novel theory, which may be considered as a great discovery in modern political science," and for which there is as yet no specific name. His language is:

"This constitution, which may at first be confounded with the federal constitutions which have preceded it, rests, in truth, upon a wholly novel theory, which may be considered as a great discovery in modern political science. In all the confederations which preceded the American constitution of 1789, the allied states, for a common object, agreed to obey the injunctions of a federal government; but they reserved to themselves the right of ordaining and enforcing the execution of the laws of the Union. The American States which combined in 1789 agreed that the Federal government should not only dictate but should execute its own enactments. In both cases the right is the same, but the exercise of the right is different; and this difference produced the most momentous consequences." "The new word," said he, "which ought to express this novel thing does not yet exist. The human understanding more easily invents new things than new words, and we are hence constrained to employ many improper and inadequate expressions." (See CONSTITUTION U. S., Vol. I.)

Lord Brougham seems to have been similarly impressed with the novel character of our confederate republic in its specific differences from all others which had preceded it, when in speaking of it he said: "It is not at all a refinement that a federal union should be formed; this is the natural result of men's joint operations in a very rude state of society. But the regulation of such a union upon pre-established principles, the formation of a system of government and legislation in which the different subjects shall be, not individuals, but States, the application of legislative principles to such a body of States, and the devising means for keeping its integrity as a federacy, while the rights and powers of the individual States are maintained entire, is the very greatest refinement in social policy to which any state of circumstances has ever given rise, or to which any age has ever given birth." (See idem.)

From this exposition very clearly appears the proper solution of the vexed question whether the U. S. constitute a nation or not. It is clearly seen not only that they do constitute a nation, but also what sort of a nation it is. It is not a nation of individuals blended in a common mass, with a common sovereignty springing from the whole, but a nation, the constituent elements or members of which are separate and distinct political organizations or States united under a federal compact, on a model never before exhibited. It is a nation of States, or what is the same thing, a nation of nations—a nation of the highest and grandest type ever before known among men.

Among the works upon this subject which readers can consult with profit may be cited—Aristotle's *Politics;* Plato's *Republic;* Cicero *On the Commonwealth;* Grotius on the *Rights of War and Peace;* Puffendorf on the *Elements of Universal Jurisprudence;* Montesquieu's *Spirit of Laws;* Rutherford's *Institutes of Natural Law;* Machiavelli, and the works of Filmer, Locke, Mackenzie, and Sidney on government; Rousseau on the *Social Compact;* Vattel on the *Law of Nations;* Guizot on *Representative Government* and his *History of Civilization;* Hallam and Creasy and De Lolme on the *British Constitution;* De Tocqueville's *American Democracy;* Lord Brougham's *Philosophy of Government;* William Smith O'Brien and John Stuart Mill on *Representative Government;* Tucker's and Sharswood's editions of Blackstone; John Taylor, in a work entitled *Constructor Construed;* Calhoun on *Government;* Calhoun's, Webster's, and Hayne's speeches in the Senate of the U. S. in 1830 and 1832; Stephens's *Constitutional View of the Late War between the States;* Dawson's edition of the *Federalist;* the *Madison Papers;* Elliott's *Debates on the Ratification of the Constitution in the Several States;* and Jamison's *Constitutional Convention.* ALEX. H. STEPHENS.

Gov′ernment's Isl′and, properly **Rock Island,** an island in the Mississippi River, lying between Rock Island, Ill., and Davenport, Ia. The island belongs to the U. S. government and contains splendid U. S. armories and arsenals. It was used as a military prison during the civil war. The island is reached by several excellent bridges. It is 3 miles long, and has a very fertile soil. Area, 960 acres. It is in Rock Island co., Ill. Pop. 165.

Gov′ernors. 1. Governors [Ger. *der Regulator, der Gouvernator, der Moderator;* Fr. *moderateur,* m., *regulateur,* m.) are instruments attached to prime movers for the purpose of preserving regularity of motion by adjusting the amount of power exerted to the resistance to be overcome, where the latter is variable. They are a more economical class of regulators than brakes, which accomplish a similar result by absorbing and wasting an excess of power, which must always exist where the speed is intended to remain invariable under a variable load.

2. Governors differ, as regulators, from fly-wheels in preserving uniformity of motion without necessarily permitting change of mean speed. The latter form of regulator necessarily permits variation, which becomes greater as the weight and speed of the wheel are smaller in proportion to the changes of energy, and is rarely so small as to make the governor unnecessary.

3. Governors are usually intended to produce, as nearly as possible, absolutely uniform speed. None do so perfectly, but the approximation to uniformity is frequently very close. A good governor should not permit a variation of 5 per cent., even when the load is entirely thrown off, and 10 per cent. is generally considered the maximum range. Marine-engine governors are usually intended to prevent very sudden and very great fluctuations of velocity, rather than to preserve an exact rate of speed. Rankine designates the latter class "fly governors," to distinguish them from the other forms called *governors proper.*

4. Governors proper are divided into three classes—*position governors, disengagement governors,* and *differential governors.* Position governors are those in which the position of the regulating valve or regulating piece is determined by rigid connection with the governor; as, for example, the common fly-ball governor used upon the steam-engine. Disengagement governors are those which, when the speed rises above a certain fixed maximum, throw into gear a train of mechanism which shuts off the supply of impelling fluid, and causes a diminution of speed; and, when the speed falls below a stated minimum, it throws into gear another train producing the reverse effect. When at proper speed, neither train is in operation. The usual forms of water-wheel governors are examples of this class.

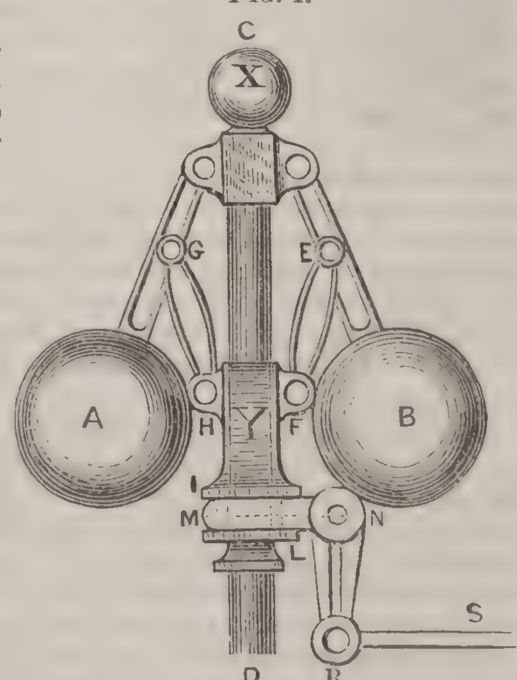
Differential governors are those which move the regulating mechanisms with a speed proportional to the difference between the actual and the proper speed of the engine.

5. A second classification divides governors into gravity governors—in which gravity and centrifugal force are opposed—and balanced governors, in which centrifugal force is balanced by a spring or by other force than gravity.

6. Pendulum governors are the oldest and most common class of governors. The conical pendulum, the centrifugal governor, or the fly-ball governor, as it is variously called, was invented by Huyghens about 1650, and applied by him to the regulation of horological mechanism. It was subsequently (1789) applied by Hooper to control the motion of windmills, and Watt about the same time (1784) applied it to the regulation of the steam-engine.

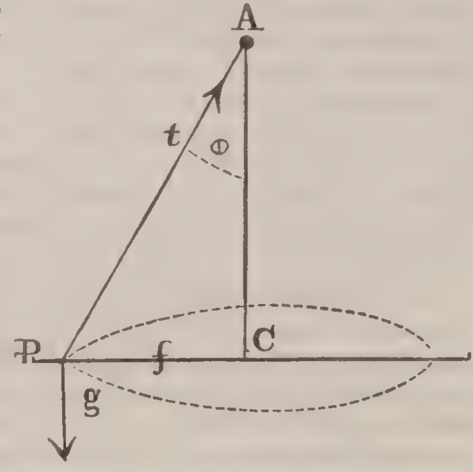
7. The pendulum governor consists of two heavy balls (A B, Fig. 1) suspended by short links from the spindle C D. Other links, E F and G H, connect with a sleeve H F in such a manner that any movement of the balls will produce a vertical movement of this sleeve, which is attached to an arm M N, forming part of the train of mechanism, M N R S, through which the adjustment of power is effected. In the case of the steam-engine the rod R S is attached to the "throttle-valve" or to the expansion gear; in the water-wheel it connects with the mechanism operating the "gate" by means of which the supply of water is adjusted; in the windmill this train of mechanism changes the pressure existing between the millstones, or it changes the position or the area of the "sails."

Fig. 1.



Pendulum Governor.

Fig. 2.



8. In this governor there exists at every position, with uniform motion, an exact equilibrium of the vertical component of the force acting along the suspending arm B C, the force of gravity, and centrifugal force. The height of the point at which the line of the arm crosses the spindle—the virtual point of suspension—above the plane of revolution of the balls bears a ratio to the radius of the circle in which the centres of the balls move that is equal to the ratio of the weight of the balls to the centrifugal force—*i. e.* Fig. 2.

$$t \sin \theta - \frac{m v^2}{r} = 0,$$

$$t \cos \theta - m g = 0,$$

$$v^2 = \frac{g r \sin \theta}{\cos \theta} = g.\ A P \frac{\sin^2 \theta}{\cos \theta},$$

$$\text{and } t = \frac{2 \pi v}{U} = 2 \pi \sqrt{\frac{A P \cos \theta}{g}} = 2 \pi \sqrt{\frac{A.C}{g}}.$$

The number of revolutions per second $N = \sqrt{\frac{0.815}{H}}$, and the height of the point of vertical suspension above the plane of revolution of the balls $A\ C = H = \frac{0.815}{N^2}$ foot $= \frac{9.748}{N^2}$ inches $= \frac{0.248}{N^2}$ mètres. Also $H = \frac{35186}{R^2}$, where H = height in inches and R = number of revolutions per minute, and $\frac{187.5}{\sqrt{H}} = R$.

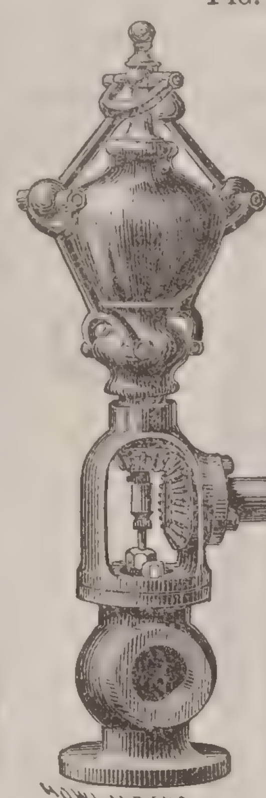
9. The speed of the governor should be carefully determined, either by experiment or by calculation, when first designed, in order that the transmitting mechanism which determines the velocity-ratio of governor and driving-shaft may be precisely proportioned to its work.

10. The weight of balls is determined by the character of the resistance to be overcome. It is proportional to the resistance to be overcome, but can seldom be calculated, and is usually determined by experiment.

The simple pendulum governor has comparatively little power, and does not give truly isochronous motion. Being rigidly connected with the regulating valve, the speed can only be precisely maintained under one set of conditions. Any variation of load or of steam-pressure will produce a limited but unavoidable change of speed. The limits of variation are determinable by the arrangement of the connecting mechanism, and are usually but slightly removed from the proper speed.

11. To secure greater sensitiveness and strength in action a weight is sometimes mounted upon, or suspended from, the collar I L (Fig. 1), which enables the speed of the governor to be greatly increased with the same height of suspension and with a smaller size of balls, giving, at the same time, quickness and much greater strength of action. This form was introduced by Charles T. Porter of New York, and has been extensively adopted both in the U. S. and Europe. It is shown in Fig. 3. In this case the effect of gravity is increased, while the effect of centrifugal force, at the same speed of revolution, remains unchanged, and the height $A\ C$ is increased in the ratio $A + \frac{A\ W}{W'}$ to 1; A representing the ratio of increase of the action of gravity, W the weight of balls, and W' the total weight of balls and the increased action of gravity produced by the added load. Then, $H = \frac{9.7848}{N^2} \times \frac{W + W'}{W'}$. A change of speed in the engine causes a greater change of position of balls than in the unloaded governor, in the proportion of W' to $W' + A\ W$. The governor is thus rendered more sensitive in this proportion. The suspending arms of this governor are forked, and the pins are thus made double. This construction is no less an essential feature than the preceding. It enables sudden variations of speed to produce change of altitude without serious retardation due to friction on the joints. Another important advantage possessed by this instrument is the comparatively slight resistance to change of speed, which is a consequence of the comparatively small weight of balls and of their small orbit. Strain upon the connecting gearing, or slipping of the governor-belt, is thus avoided, and the governor is enabled to act promptly and effectively where the ordinary form would be slow in action, or where it might break its belt and cease to act.

Fig. 3.



12. Approximate isochronism is secured in the governor of Farcot of Paris by crossing the arms, thus carrying the points of suspension of each ball to the opposite side of the vertical spindle from the ball, and thus causing the trajectory of the ball, as it rises and falls in its circular orbit, to coincide with the paraboloid of which the subnormal is equal to the altitude A C (Fig. 1). This form of governor is used to some extent in Europe. In the Farcot governor minor adjustments are secured, to eliminate faults in its action due to the arrangement of the mechanism transmitting movement of the controlling valves. The links connecting the ball-rods to the collar on the main spindle are crossed, and a helical spring on the spindle resists slightly the tendency of the balls to rise, its tension increasing as the balls separate.

Precise isochronism is obtained by the parabolic governors, in which the height H remains constant in all positions. In these governors the path of the balls in the vertical plane is such that they describe the arc of a parabola. The height A C (Fig. 1) is then the subnormal of this parabola. The subnormal is of constant magnitude, and only at that speed which gives a height H equal to this quantity is a position of equilibrium held. It consequently follows that any change of speed from that due the height A C will destroy equilibrium, and it can only be restored by a return to the proper speed. These governors therefore continue their action upon the connecting mechanism until normal speed is obtained or until the extreme of their range is reached. An altitude of the points of suspension above the plane of motion of the balls equal to twice the focal distance of the par-

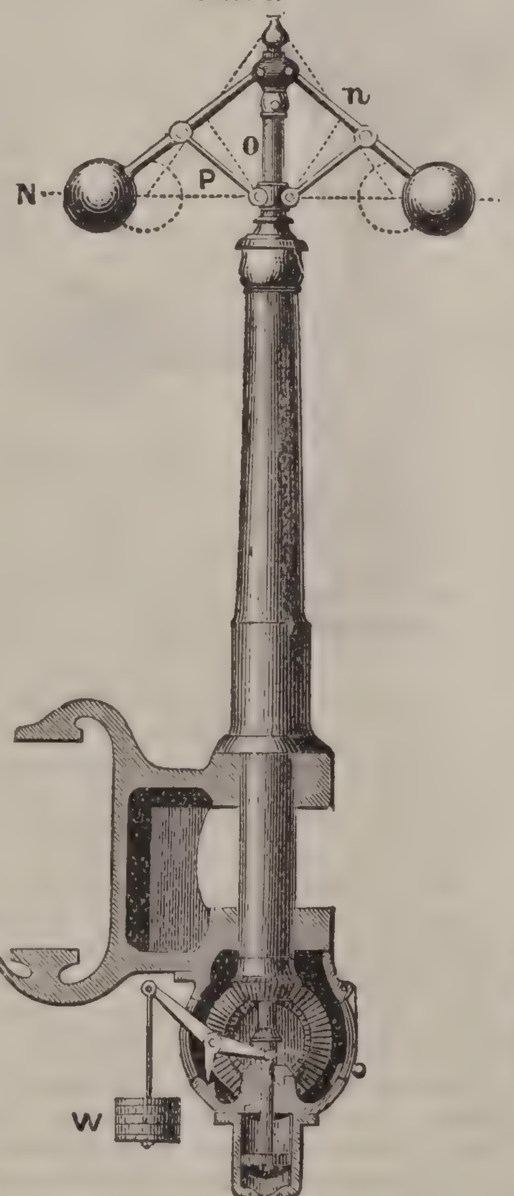
abola is the only one in which the balls can remain steady. The force with which the balls tend to move is proportional approximately to $\frac{W\delta}{N}$, in which W is the aggregate weight of balls, δ is the amount of deviation of speed, and N the proper speed of revolution.

The balls are given their parabolic path in Davey's governor by suspending them from a spindle by steel springs, which, as they diverge, unwrap from the edge of a guide-cheek having the form of the evolute of the parabola. The balls may also be carried on a guide-curve, as in Madden's governor.

The parabolic governor may be loaded, like Porter's governor, to obtain higher speed of rotation, and increased strength and sensitiveness. This will produce an increase of altitude in the proportion of the aggregate new weight to the original weight, and the speeds of revolution will be increased as the square root of those quantities. The added load gives a means of adjustment of speed by varying the amount of that load. A common method of applying it is by means of a sliding weight upon a lever, thus making the load upon the governor easily and accurately adjustable. By causing the balls to move in a high portion of the parabolic arc, also, increased strength of action and sensitiveness may be secured. Since the centrifugal force varies inversely as the square of the periodic times, the greater the speed of revolution thus secured, the greater the power of the governor. Smaller balls can thus be used with higher speed, as in the loaded pendulum governor, and their less weight gives greater sensitiveness, in consequence of their slight inertia, as well as because of their greater speed of revolution.

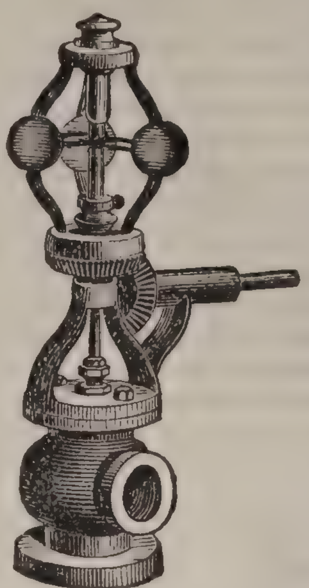
In the Babcock & Wilcox governor the balls always move in a horizontal plane, as shown in Fig. 4; the ball-rods, n n, being jointed to a spindle, o, which slides vertically within a hollow driving-spindle, and which is counterbalanced by weights at w, carried in a scale-pan on the end of a lever, through which they act upon the lower ends of the sliding spindle. The ball-rods are jointed at the middle to links P, which are secured at their opposite ends to the main driving-spindle, which takes its motion, through bevel gearing and intermediate shafting, from the main shaft of the engine. A dash-pot, seen at the foot of the sliding spindle, prevents sudden fluctuations of speed from throwing the governor beyond the proper position for adjusting speed, and prevents the oscillation of speed which attends the use of very sensitive governors not thus controlled. When the engine is precisely at speed the action of centrifugal force is equilibriated in every position by the action of the weight. At any other speed this equilibrium is destroyed, and the action of the governor is similar to those just described. It continues acting until the proper speed is resumed, or until it reaches the extremity of its range. Adjustment of speed is obtained by varying the weight upon the scale-pan.

Fig. 4.



Pickering's governor (Fig. 5) is the invention of Mr. T. R. Pickering of New York. In this governor the balls are carried upon flat springs which are curved in the form of a double cyma, and are attached at one extremity to the vertical driving-spindle, and at the upper end to a sliding collar which supports the stem of a balanced throttle-valve. The peculiar form of spring employed keeps the parts in proper relative position, and permits the use of steel so thin that it is not liable to "set" or break. Where an increase of centrifugal force is required, it is obtained by increasing the number of springs, using two or more together for each ball. Three balls are generally used. This governor has the sensitiveness and strength of the loaded pendulum governor, and is cheap in construction. It has come into extensive use in the U. S.

Fig. 5.



Silver's marine governor in its earlier form consisted of two crossed arms carrying balls at each extremity, and balancing about the pin by which they were carried on the spindle. The action of centrifugal force was balanced by a helical spring coiled upon the spindle. It was designed to regulate the engines of steam vessels, and was one of the earliest introduced.

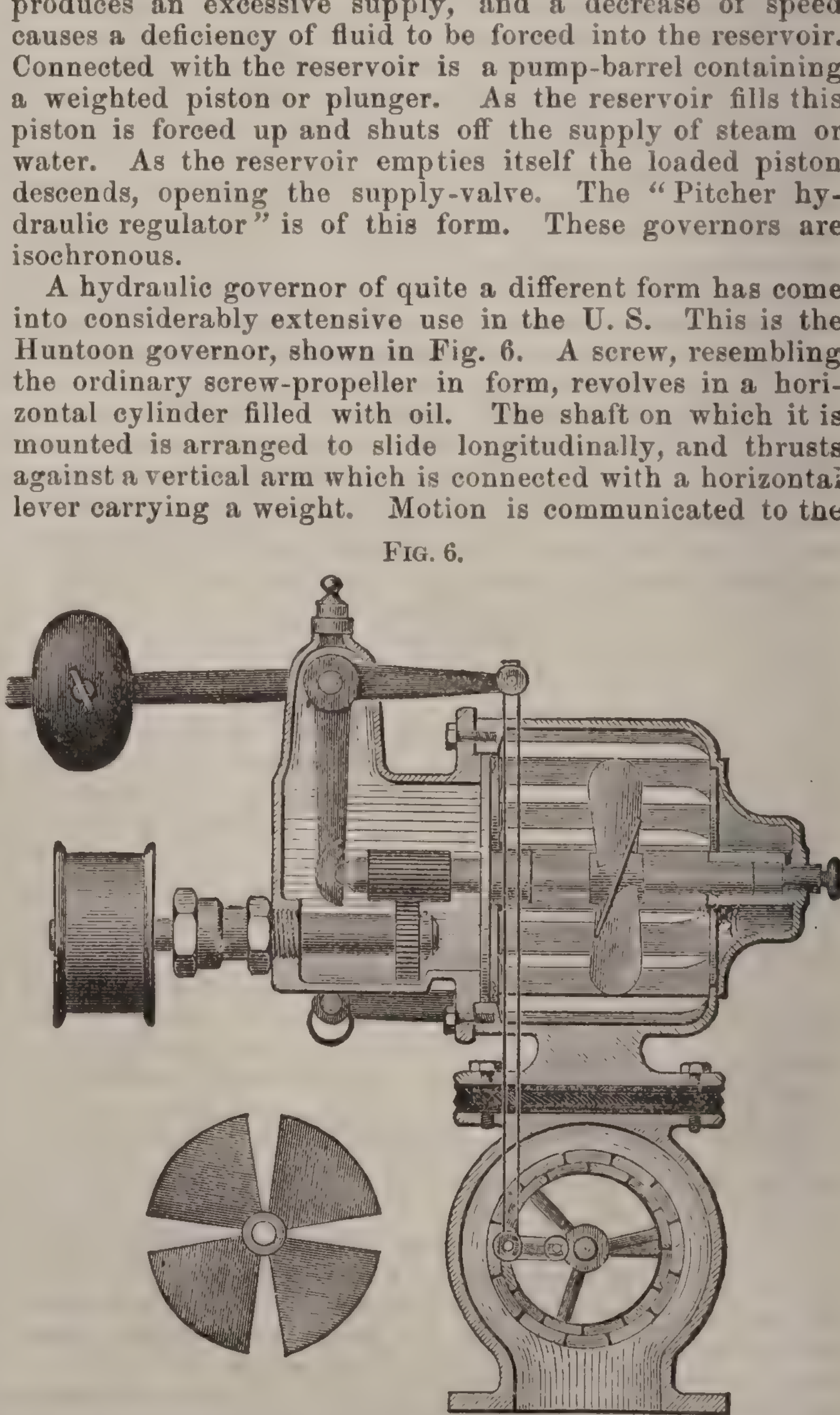
In the chronometric governor a train of gearing is driven by a clock or other uniformly moving apparatus. Another train is driven by the engine or machine to be regulated. The two trains are connected by intermediate mechanism in such a manner that, so long as both move at the same speed, no motion of the intermediate gearing occurs. A difference of velocity in the two trains being produced by a change of speed of the engine, a motion of the intermediate gear takes place, adjusting the regulating apparatus to restore the proper speed. This arrangement evidently gives isochronism.

In Siemens' differential pendulum governor the balls of a pendulum governor are suspended within a cylinder, and their friction against its interior surface produces a resistance which, acting through a "dynamometer train," moves the valve. In the governor of Prof. Sir Wm. Thomson the principles illustrated in Siemens' governor are applied to a governor attached to physical apparatus.

Hydraulic governors are of several forms. They usually consist of a pump or bellows which forces water or oil into a reservoir, from which it issues at a uniform rate by an orifice the size of which is adjustable. At the proper speed the liquid is pumped into the reservoir at precisely the speed at which it issues from it. An increase of speed produces an excessive supply, and a decrease of speed causes a deficiency of fluid to be forced into the reservoir. Connected with the reservoir is a pump-barrel containing a weighted piston or plunger. As the reservoir fills this piston is forced up and shuts off the supply of steam or water. As the reservoir empties itself the loaded piston descends, opening the supply-valve. The "Pitcher hydraulic regulator" is of this form. These governors are isochronous.

A hydraulic governor of quite a different form has come into considerably extensive use in the U. S. This is the Huntoon governor, shown in Fig. 6. A screw, resembling the ordinary screw-propeller in form, revolves in a horizontal cylinder filled with oil. The shaft on which it is mounted is arranged to slide longitudinally, and thrusts against a vertical arm which is connected with a horizontal lever carrying a weight. Motion is communicated to the screw through a pulley-shaft which gears into a pinion on the screw-shaft. As the screw revolves it tends to traverse

Fig. 6.



the cylinder in the axial line, and this tendency becomes greater or less as the resistance of the liquid increases or diminishes with changes of speed. At the proper speed this resistance is just sufficient to counterbalance the weight. A greater speed raises the weight, and a slower speed allows it to fall. These movements are transmitted by a vertical link to the arm of a register throttle-valve, by means of which the supply of steam is adjusted to the requirements of the engine. Fig. 6 exhibits a sectional view of this governor, accompanied by a separate sketch of the screw. This governor is theoretically perfectly isochronous. So long as the engine does not run at speed, the valve will be kept moving, and it will either bring the engine to speed or will reach the extremity of its range. Practically, isochronism is somewhat interfered with by the friction of the parts. In another form of this governor a paddle-wheel takes the place of the screw; both forms are in use.

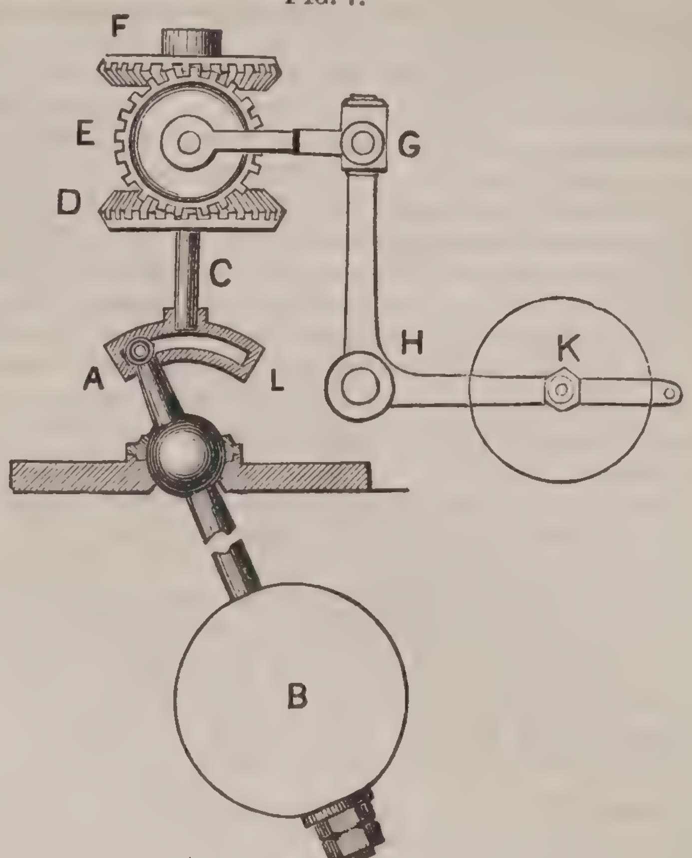
Pneumatic governors, in which the resistance of air is made useful in producing an equilibrium with the force exerted by a weight or spring, are of several forms. The best known form consists of several hemispherical cups carried at the outer ends of radial arms revolving about a central spindle, as in the anemometer. At the proper speed the resistance of the air is just sufficient to counterpoise a weight attached to the apparatus, while at higher or lower speed the rise or fall of the weight moves the mechanism connecting the governor with the supply-valve.

The marine steam-engine requires a governor of somewhat different qualities from those demanded in the regulation of the stationary engine. The motion of the marine engine when the vessel is in smooth water is uniform so long as the pressure of steam remains constant, as there is then a perfect uniformity in impelling power and of resistance, and no governor is required. At sea, however, in rough weather, the vessel is tossed about by the waves, and meets with a varying resistance. Frequently, all resistance to the motion of the engine is removed by the pitching of the ship and consequent lifting of the propeller out of the water. At such times the engine, if uncontrolled, starts off with great velocity, causing danger of accident and a wasteful expenditure of steam. While revolving at this high velocity the engine is next suddenly checked by the return of the vessel to a position in which the propeller is again immersed, and the resulting shock is even more dangerous than that due to the effect of inertia at the higher speed. This is the kind of fluctuation of speed which the marine governor is intended to prevent. No governor in which gravity acts can be used at sea, on account of the motion of the vessel. The ordinary forms of balanced governors are not usually satisfactory, because the inertia of the heavy parts, which must be suddenly made to move at higher velocity when a "jump" of the engine occurs, is liable either to prevent their prompt action or to strain and break the connecting mechanism.

Momentum governors have been usually found most satisfactory. Silver's momentum-wheel governor is an illustration of this class. This consists of a fly-wheel fitted loosely upon a shaft driven by the engine. The wheel carries flat vanes, so set that the resistance of the air when they are turning at the proper speed shall just equilibriate the effort of a helical spring by which the wheel is connected to the shaft, and through which it is driven. Any sudden increase of speed taking place, the inertia of the wheel prevents a proportional increase of its velocity. The shaft "running ahead" of the wheel, the spring is coiled up; and this change is made, by suitable mechanism, to change the position of the throttle-valve. A sudden decrease of the speed of the engine occurring, the inertia of the fly-wheel causes it to overrun the shaft, and the spring is uncoiled and the throttle-valve opened. This governor has been very considerably used. It is sensitive and quick in action.

In Siemens' pendulum governor (Fig. 7) the arrangement of the epicyclic train DEF, through which the suspended ball B is moved, is such that E may move around the vertical spindle C between limits which are determined by stops fixed on either side. In this movement the arms G and K participate, and the throttle-valve is controlled by the movement of the rock-shaft E, which may be made a continuation of the valve spindle. The motion of the vertical spindle C produces rotation of the pendulum A B by means of the slotted curved link on crosshead A L. When the speed of the system is uniform, the resistance of the revolving pendulum produces a tendency in the intermediate wheel E to move in the direction G E, raising the weight K, and holding it counterpoised in a position which is determined for every case. When so running in equilibrium the slightest change of speed in the engine and the driving mechanism produces a change of relative position of C and D, in consequence of the inertia of the pendulum, which cannot change its rate without exerting a

Fig. 7.



Siemens' Governor.

resistance which moves the weight K from the ordinary position of equilibrum, opening or closing the valve promptly and effectively regulating the engine. This regulator is used in the Greenwich Observatory, England, for regulating a chronograph. It is extremely sensitive, and very powerful under sudden changes of velocity incurred by sudden, even although moderate, changes of speed.

The governor is used in steam-engines of the best class to determine the point of "cut-off," instead of moving the throttle-valve, which latter method produces loss of efficiency by "throttling" the steam and diminishing the gain due to higher pressure and greater expansion. In some cases the governor changes the position of the "eccentric" which moves the valve-gear. In other cases it adjusts the "link-motion," producing a similar change of action in the valve, and consequently in the distribution of steam. The attachment of a governor to a "detachable cut-off valve-gear"—with which arrangement the grade of expansion of steam is determined without necessarily demanding from the governor the employment of any considerable moving force—is the most generally satisfactory method of regulation of steam-engines. It has been suggested by Bourne that in condensing steam-engines it would be advantageous to so arrange the governor connections as to automatically adjust the supply of condensing water.

The force required in the regulation of water-wheels is so great that water-wheel governors are arranged to simply throw trains of mechanism connected with the motor into gear with the water-wheel gate, opening or closing it as required. R. H. Thurston.

Gov′ernor's Isl′and, an island of Suffolk co., Mass., in Boston harbor, directly N. of Castle Island and of the main ship-channel or President Roads. It is occupied by fortifications (of which Fort Winthrop is the *keep* or réduit), forming part of the system of defence of Boston harbor and its maritime approaches.

Governor's Island, a small island in New York harbor, three-fourths of a mile S. of the southern extremity (now occupied by the esplanade known as the Battery) of the site of New York City (Manhattan Island), separated from Southern Brooklyn (Long Island) by a narrow (the Buttermilk) channel. A mile and a half westward are the small islands Ellis' and Bedloe's on the eastern margin of the extensive shoals known as the Jersey Flats, which constitute the western margin of the ship-channel to New York City, which passes between it and Governor's Island. The prominent position of Governor's Island marked it out in early days as the key to the maritime defence, and it was occupied for such purposes by the Dutch. In 1614 they built their first rude fort on Manhattan Island, probably where the Battery now is, and doubtless, as their settlement increased, occupied Governor's Island. The English took possession in 1674, and under them the first regular fort, on the site of what is now Fort Columbus, was built, and the island (probably through the residence of the early governors, who were also military commanders) became known as Governor's Island. The present Fort Columbus (which has, however, since undergone extensive repairs and modifications), occupying the centre of the island, and Castle Williams, on the western point, were built in 1807–10

(as also Fort Clinton (Castle Garden) and Fort Gansevoort, 3 miles higher up) by Col. Jon. Williams, the first chief engineer of the U. S. army—an officer whose services have since been in a measure lost sight of, but who has many claims to the title, since given to the late Gen. Thayer, "father of the U. S. Military Academy." Castle Williams was the first "casemated" battery erected in this country, and was planned after the system of Montalembert, with which Col. Williams had made himself acquainted in France. This and other works of Col. Williams, though they have been superficially and ignorantly criticised, were really meritorious, and do not suffer by comparison with European structures of the same or even much more recent dates. Besides the fortifications and small garrison, the ordnance department has one of its dépôts here, and the island is also a rendezvous of the general recruiting service of the U. S. army. J. G. BARNARD, *U. S. Army*.

Gow'an (Col. OGLE R.), b. about 1800 at Wexford, Ireland, was well educated, and became editor of the *Antidote*, a newspaper of Dublin; removed in 1829 to Canada; resided for a time in Escott, Leeds co., Ont., and afterwards in Toronto; was the founder of the Orange lodges of North America, and for twenty years their grand-master; sat 1834–41 in the Canadian Parliament; served against the insurrectionists of 1837–38; was for a time a post-office inspector, and afterwards a license-officer at Toronto.

Gowan'da, post-v. of Cattaraugus and Erie cos., N. Y., separated by the Cattaraugus Creek, 30 miles S. of Buffalo, on the Buffalo and Jamestown R. R. It contains a bank, a newspaper, a large agricultural implement and machine works, 2 tanneries, 3 hotels, 2 flouring-mills, 3 churches, 4 carriage-factories, a cheesebox-factory, 3 saw-mills, a planing-mill, a sash and blind factory, 27 stores, and many other smaller branches of business. It has splendid water-privileges. Principal business, farming and dairying. Pop. 994. JOHN S. FIDLER, ED. AND PROP. "GAZETTE."

Gow'deysville, post-tp. of Union co., S. C. Pop. 2647.

Gow'er, tp. of Cedar co., Ia. Pop. 957.

Gower (JOHN), an English poet, b. about 1327. The place of his birth is variously given as having been in Wales, Kent, and Yorkshire. He was probably a man of property, and it is said that he became chief-justice of the common pleas, and some state that he was knighted. He was a friend of Chaucer, who calls him "the moral Gower." His poetry was written in English, French, and Latin, the latter versified according to quantity. His principal work, undertaken by command of Richard II., who directed him to "book some new thing," was in 3 parts: the *Speculum Meditantis*, now lost; the *Vox Clamantis* (Latin), never printed entire, but existing in MS.; and the *Confessio Amantis*, completed 1394, first printed by Caxton (1483), best edition by Pauli, 1857. The Roxburghe Club in 1818 published his *Cinquante Balades*. He became blind in 1400, d. in Oct., 1408, and was buried in St. Saviour's Church, London, where his old monument still stands.

Gow'rie Conspir'acy, an attempt made (Aug. 5, 1600) by John Ruthven, earl of Gowrie, and others, either to assassinate the king, James VI. of Scotland (afterwards James I. of Great Britain), or much more probably to make him prisoner, for the purpose of permitting the government to be administered in a manner more thoroughly in the interest of Presbyterianism. The affair took place at Gowrie House, Perth, and the earl and his brother Alexander were both killed in the affray. It is possible that Gowrie's motive in this affair was revenge for the death of his father, who was executed as a traitor in 1584, but this is not generally believed to have been the cause.

Go'ya, town of Corrientes, a province of the Argentine Republic, on the river Goya, 100 miles S. of Corrientes, and near the Paraná. Its site is flat and low. The cattle-trade and the accessory industries are important. Pop. 10,907.

Goyan'na, town of Brazil, in the province of Pernambuco, on a river of the same name. Pop. 12,000.

Goy'az, an inland province of Brazil, extending between the Tocantins and the Araguay, two affluents of the Amazon, comprises an area of 275,000 square miles, but has only 151,000 inhabitants, most of whom are Indians. The gold-mines were formerly the principal source of wealth in this province, but they seem to have become exhausted. Rearing of cattle and agriculture are the principal occupations, but as the means of exportation are very poor, nothing more is produced than necessary for home consumption; and even this poor industry is carried on in so backward and slovenly a manner that famines occur, though the land is one of the most fertile regions on our globe.

Goyaz, town of Brazil, the capital of the province of Goyaz, on the Vermelho, has 8000 inhabitants.

Go'zo, or **Gozzo,** one of the Maltese Islands, in the Mediterranean, belonging to Great Britain. Area, 20 square miles. Pop. 16,000. It is beautiful and fertile, and has two good harbors. The remains of the cyclopean wall called the "Giant's Tower" are interesting. Principal town, Rabato.

Go'zzi (CARLO), COUNT, Italian dramatist and competitor of Goldoni, was b. in Venice in 1722. His *Useless Memoirs of his Own Life*, in connection with Goldoni's memoirs, give a very interesting and instructive picture of the state of the Italian theatre at that time. It was his idea that improvisation is a natural talent with the Italians, and for this reason he left open certain parts of his dramas, especially the comical parts, to be filled out by the momentary inspiration of the actors. But, although it is very true that the Italians often display a brilliant talent for improvisation, still there is in all improvisation something contradictory to the idea of modern art. Gozzi did not succeed in his opposition to Goldoni. His dramas have disappeared from the stage, though they bear evidence of a talent of a higher and finer order than that of Goldoni. There is a tenderness and romance in his imagination which would attract attention in any literature, and which are very seldom met with in the Italian art, cast as it is in the old classical forms. The two best of his dramas are *The Three Oranges*, and *The Princess Turandot*. D. Apr. 4, 1806. CLEMENS PETERSEN.

Go'zzoli (BENOZZO), (BENOZZO DI LESE DI SANDRO was his real name), an Italian artist who lived between 1424 and 1496, a pupil of Fra Angelico, remarkable for his love of nature and the introduction of landscape, natural objects, animals, and picturesque beauty into his paintings. His most famous and best-preserved work is in the Campo Santo at Pisa. His own tomb, directly under these frescoes, was presented to him by the Pisans. O. B. FROTHINGHAM.

Graaf'ian Ves'icles, or **O'visacs,** are numerous small globular transparent follicles found in the ovaries of mammals, probably representing the inner part of the calyx of oviparous animals. They are named from Regnier de Graaf, their discoverer (1641–73). They are filled with a transparent albuminous liquid. Very small at first and deeply bedded in the ovary, they gradually approach the surface, and finally burst and discharge the OVUM (which see).

Graal, or **Grail.** See SANGREAL.

Graccha'nus (M. JUNIUS) lived in the time of C. Gracchus (B. C. 123), enjoyed his friendship, and from this circumstance, according to Pliny, derived his cognomen. He was the author of a treatise *De Potestatibus*, addressed to Pomponius, the father of Pomponius Atticus, in which he gave a history of the constitution and the great offices of state from the time of the kings, which is highly commended by Niebuhr (*Hist. Rome*, vol. ii. p. 10–11). The original work is lost, but it is often referred to by Cicero, Varro, and others, and a portion of it is preserved in the Greek treatise of Joannes Lydus (*De Magistratibus*). (See GERLACH, *Geschichtschreiber der Römer*, p. 84 *seq.*; L. MERCKLIN, *De Junio Gracchano*, Dorpat, 1840–41.) H. DRISLER.

Grac'chus, the name of a family of illustrious Romans, plebeians of the gens Sempronia. The most noteworthy members were TIBERIUS SEMPRONIUS GRACCHUS, consul 238 B. C., and a victorious general; another TIBERIUS, who in 216 B. C. was curule ædile and magister equitum to M. Junius Pera, the dictator; consul 215 and 213; served against Hannibal and defeated Hanno at Beneventum 214; was betrayed to the Carthaginians and slain by Mago 212 B. C. He was a man of noble magnanimity.—A third TIBERIUS was early distinguished for valor; became tribune of the people 187 B. C.; married the noble Cornelia, daughter of Scipio Africanus; was prætor in Hither Spain 181–178; conquered all the Celtiberians and took hundreds of towns, and by his justice and magnanimity won the veneration of the subjected people; triumphed 178; consul 177; triumphed over the Sardinians 175; censor 169, when he brought about important political reforms; consul again 163 B. C. The time of his death is not known. He was the father of twelve children, among whom were Tiberius and Caius, the "Gracchi" *par excellence*.—TIBERIUS SEMPRONIUS GRACCHUS, eldest son of the foregoing, b. (according to Plutarch) 164 B. C.; went with the younger Scipio Africanus in 146 to the destruction of Carthage, and, according to Fannius, was the first Roman to mount the wall of that town; as quæstor (137) concluded an unpopular but highly advantageous treaty with the Numantines; became tribune of the people 134 B. C. At that time the Roman people were enduring most grievous hardships, kept out of their lands and many lawful rights by the senatorial party, headed by the Scipios; and Gracchus, with the advice of his mother Cornelia, his father-in-law Appius Clau-

dius, and the wisest leaders of the patricians, decided to bring forward anew, with slight modifications, the Licinian law, which had never been repealed. The party which opposed him was small but influential, and he felt compelled to resort to measures which, though perfectly just, were impolitic; and some additional measures, by which he sought to improve the condition of the poor, were so artfully misrepresented that the ignorant rabble began to clamor against him, and a mob led by Scipio Nasica set upon him and his followers with sticks and stones, and murdered him 133 B. C. He was a man of most amiable and noble character, and his worst fault was a certain lack of prudence in the conduct of his praiseworthy undertaking.—CAIUS SEMPRONIUS GRACCHUS, his brother, nine years younger, was serving in Spain at the time of his brother's murder; was quæstor in Sardinia 126 B. C., where his valor, wisdom, and justice made him very popular, but caused him to be regarded with suspicion at Rome. In 124 he went without leave to Rome, but so defended himself before the censors that his conduct was declared justifiable. Filled with a noble but almost hopeless enthusiasm for Roman liberty, now nearly extinct, he entered upon the tribuneship in 124 B. C., and was twice re-elected; renewed the Agrarian law in 123 B. C.; but, deserted by the ungrateful equites and by the misguided people, and a price having been put upon his head by Opimius, thousands of his friends were killed in an insurrection 121 B. C., and Gracchus himself was killed by his own slave, who thereupon killed himself. His greatest offence was the proposal to enfranchise the Italian allies. His eloquence was remarkable, and, viewed in the light of modern ideas, his character seems one of the noblest in all antiquity. Nearly all the Roman writers vilify the reputation of the Gracchi, but their virtue was too conspicuous to be thus obscured.

Grace [Gr. χάρις; Lat. *gratia*]. I. *In General*, is used (1) of *external form*, as elegance or gracefulness; thus Homer (*Od.* 2, 12), "She poured upon him an unspeakable grace;" and of *discourse* (Luke iv. 22), "They wondered at his words of grace." But mainly (2) it involves an *inward feeling* or *disposition*. It may refer (*a*) to favor *obtained* from another. From *man* (Gen. xxxix. 21, Sept.): Joseph obtained favor with the keeper of the prison; from *God*: "Thou hast found grace in my sight;" "Thou hast found favor with God" (Gen. xxxiii. 17, and Luke i. 30). For the most part, however, (*b*) its reference is to favor *cherished* or *bestowed*; in Scripture, the *Divine favor towards men.*

II. *Evangelical Import.*—This, its most important signification, denoting *God's favor manifest in Jesus Christ*, is to be derived from the New Testament, which warrants the following positions:

1. *Grace is a Peculiar Expression of the Divine Glory.*—The work of redemption is referred to God's own good pleasure, and is to be to the praise of the glory of His grace (Eph. i. 5, 6). The abundant grace is to redound to the glory of God (2 Cor. iv. 15). To the same import are the words of our Lord himself: "I have glorified Thee on the earth" (John xvii. 4).

2. *Grace, though manifest in Christ, is attributed to the One God and to each of the Persons.*—To the *One* without distinction: "To testify the gospel of the grace of *God*;" "This is the true grace of *God* wherein ye stand" (Acts xx. 24; 1 Pet. v. 12). To the *First* Person, as in the common introduction to Paul's Epistles: "Grace from God the *Father*;" less frequently to the *Third*: "Despite to the *Spirit* of grace" (Heb. x. 29). Grace is the Father's, as He is the *source* of redemption; the Spirit's, as He *applies* it; but, since *provided in the Son*, the doctrine of grace connects itself with the *Second* Person in a special manner. The grace of God is *given* in Christ Jesus (1 Cor. i. 4); "We believe that through the grace of our *Lord Jesus Christ* we shall be saved" (Acts xv. 11).

3. *Men are Saved by Grace.*—The condensed argument of Paul is this: All having sinned and being under a just condemnation, are, on the one hand, unable to save themselves. Hence, on the other, if saved, it must be by the free—*i. e.* undeserved—grace of God. It is this which *brings* salvation (Tit. ii. 11): "The grace of God and the *gift by grace*, which is by one man, Jesus Christ, hath abounded unto many" as their salvation (Rom. v. 15). (*a*) *By grace, not by the law.* An attempt to be justified by the law is a falling from grace (Gal. v. 4). The assurance of being delivered from sin lies in this, that we are *not* under the law, but are under grace (Rom. vi. 14). (*b*) *By grace rather than works.* Men by the deeds of the law cannot be justified before God, but, justified freely by His grace, are made heirs according to the hope of eternal life (see Rom. iii. 20; Eph. ii. 9; Tit. iii. 7). (*c*) *By grace through faith.* This, the receptive faculty of the soul, *takes* the offered gift by which believers are made heirs of the *grace of Christ* (comp. Rom. v. 1, 2, and Gal. ii. 16).

4. *Grace is to the Church the Source of Peculiar Gifts (charisms), and to Believers of Success in Life and Labor.*—There are diversities of gifts (χαρισμάτων), but they are all by the one Spirit, and are due to that *grace* which is according to the measure of the gift of Christ (comp. 1 Cor. xii. 4, and Eph. iv. 7). Paul's mission to the Gentiles he counts one of grace (Eph. iii. 8). He and his works are nothing: "By the grace of God I am what I am. I labored more abundantly. . . . Yet not I, but the grace of God which was with me" (1 Cor. xv. 10). This is the common source of satisfaction and success: "God is able to make all grace abound towards you, that ye always, having all sufficiency in all things, may abound in every good work" (2 Cor. ix. 8).

5. *The Gospel Dispensation is one of Grace, and to be carefully distinguished from the Reign of Mere Law.*—The thought is contained in John i. 17: "The law was given by Moses, but grace and truth came by Jesus Christ." It is the underlying argument of the Pauline Epistles, the antithesis being strongly stated in Galatians; but the *new* dispensation is most fully *contrasted* with the *old* in the Epistle to the Hebrews, according to which the law—even God's revealed will—proving inadequate to save, He caused the former to give place to the latter, bringing in a better hope through the one offering of His Son. And this method of grace, *being adequate, is not to pass away.* (See Heb. *passim*, especially ch. ix.)

III. *Theological Terms.*—1. *Special or efficacious grace (gratia efficax)*, that divine influence which, in the soul, changes it from sin to holiness—held by Augustinians and Calvinists, who refer the *initial* of man's salvation *to God;* rejected by Pelagians, who make *individual choice the initial.* Arminians, though affirming grace to be initial or "prevenient" (enabling), admit no special grace—only one common to all. (See ARMINIANISM and CALVINISM.) 2. *Irresistible grace*, used to denote that grace, spite all opposition, realizes its purpose. The conception being too mechanical, most would prefer *is not resisted* (*irresistita*), as indicating the work wrought *within* the sphere of moral freedom and in harmony with it. 3. *Gratia antecedens*, the divine work prior to regeneration; *gratia operans*, the same *in* the soul's renewal; *gratia co-operans*, the Spirit's work subsequently, in which the creature-will, renewed, concurs. 4. *Sovereign grace*, grace provided when not deserved, and applied as God wills. 5. *Covenant of grace*, that the Father accepts the mission and work of the Son, for satisfaction to Himself and His law, on the one hand, and on the other, as pledge of salvation, through and in Him, of all believers, or the elect. J. R. HERRICK.

Gra'ces, or **Grace Notes**, certain short notes in music, generally written in small characters, and introduced occasionally by way of ornament before some of the principal notes of a melody. The name is a very general one, referring to appogiaturas, trills, turns, beats, half-beats, springing notes, and similar embellishments, which are inserted for the purpose of developing or intensifying the effect of some particular notes in an air.

Gra'ces, The (*Charites, Gratiæ*), in Greek and Roman mythology, the female personifications of beauty and grace. Their names and number and their whole mythus are variously given. Hesiod makes them daughters of Zeus and Eurynome, and names them Euphrosyne, Aglaia, and Thalia. In art, they were once represented as draped, but afterwards as nude figures, in the bloom of early youth.

Gracio'sa, one of the AZORES (which see), received its name from its beautiful aspect. Pop. 11,500. Principal town, Santa Cruz.

Gradien'tia [plu., from the Lat. *gradior*, to "walk"], a name given by Laurenti in 1768 to the tailed amphibians (Urodela), as well as the lizard-like reptiles, but first limited as an ordinal designation to the group now to be defined by Merrem in 1821. It combines in one order all living forms of ambulatory amphibians—*i. e.* salamanders and kindred types—or those which are adapted for progression by running on the ground; and thus contrast with the Salientia or Anura (frogs, toads, etc.) and the Pseudophidia (*Cœcilia*, etc.). The forms associated under this head (1) are more or less elongated, and always provided with a long tail; (2) the vertebræ are ossified; (3) the frontal bones are distinct; (4) ethmoids are two lateral pieces; (5) the hyoid apparatus has a narrow or small distinct basihyal, and the ceratohyals or cornua, in part at least, retain their original form or are little modified, and remain connected with the suspensorium of the lower jaw; (6) the gills of the tadpole are external; (7) the pelvic elements are not confluent; (8) the sacral vertebræ (when differentiated) are normal; (9) when limbs are developed, the fore ones precede the hind ones in order of appearance; and (10) the bones of the fore arm remain separated through life, and the hind feet have the tarsal bones abbreviated (the

astragalus and calcaneum not being elongated). In other respects they exhibit great differences among themselves. The degree to which these various characters are carried, and the combinations in which they occur, are exhibited in the following table, in which groups assumed are analyzed with reference to various features in their economy:

1*a*. Branchiæ retained through life: Trachystomata, Proteida (and *Siredon?*).
1*b*. Branchiæ absorbed before maturity: Amphiumoidea, Protonopsoidea, and Salamandroidea.
2*a*. Epibranchials three: Proteida.
2*b*. Epibranchials four: Trachystomata, Amphiumoidea, Protonopsoidea.
2*c*. Epibranchials one (the last three pairs being atrophied): Salamandroidea (adults).
3*a*. Ceratobranchials in contact with basi-branchials, one: Proteida, Amphiumoidea.
3*b*. Ceratobranchials in contact with basi-branchials, two: Trachystomata, Protonopsoidea (*Sieboldia*), Salamandroidea.
4*a*. Branchial clefts retained through life: Trachystomata, Proteida, Protonopsoidea (*Protonopsis*), (and *Siredon?*).
4*b*. Branchial clefts closed at maturity: Protonopsoidea (*Sieboldia*), Salamandroidea.
5*a*. Skull narrowed: Trachystomata, Proteida, Amphiumoidea.
5*b*. Skull broad: Protonopsoidea, Salamandroidea.
6*a*. Pterygoids absent: Trachystomata and Salamandroidea, Plethodontidæ, Desmognathidæ.
6*b*. Pterygoids present: Proteida, Amphiumoidea, Protonopsoidea, and Salamandroidea (fam. sup. excl.).
7*a*. Palatine bones developed: Trachystomata, Proteida.
7*b*. Palatine bones undeveloped: Amphiumoidea, Protonopsoidea?
7*c*. Palatine bones metamorphosed: Salamandroidea.
8*a*. Prefrontals absent: Trachystomata, Proteida, Salamandroidea (Desmognathidæ).
8*b*. Prefrontals present: Amphiumoidea (Protonopsoidea), Salamandroidea (Desmognathidæ excluded).
9*a*. Nasal bones not developed; nasal sacs elongated and uncovered by bones or cartilages: Trachystomata, Proteida.
9*b*. Nasal bones developed; nasal sacs abbreviated and covered by bones or cartilages: Amphiumoidea, Protonopsoidea, Salamandroidea.
10*a*. Premaxillaries and dentaries with horny plates: Trachystomata.
10*b*. Premaxillaries and dentaries without horny plates: Proteida, Amphiumoidea, Protonopsoidea, Salamandroidea.
11*a*. Vertebræ differentiated into four regions or kinds—viz. cervical (one), dorsal, sacral, and caudal, a sacrum being developed, with which are connected posterior limbs: Proteida, Amphiumoidea, Protonopsoidea, Salamandroidea.
11*b*. Vertebræ differentiated into two regions or kinds only—viz. cervical and post-cervical, no sacrum or posterior limbs being developed: Trachystomata.
12*a*. Sternum developed: Amphiumoidea, Protonopsoidea, Salamandroidea.
12*b*. Sternum not developed: Trachystomata, Protonopsoidea.
13*a*. Hind members developed: Proteida, Amphiumoidea, Protonopsoidea, Salamandroidea.
13*b*. Hind members not developed: Trachystomata.

Divisions.—Weighing these several characters, and checking our observations by reference to their functional or developmental relations, we are led to the combinations embodied in the following arrangement:

The Trachystomata have no pterygoid nor palatine bones; the ethmoid is represented by two bones which extend forward and form a part of the palate; no prefrontal or maxillary bones are distinguishable; but nasals are present, and embraced by spines of the premaxillaries; the mandible is destitute of teeth, but is covered with a horny plate; the hind members are wanting; apparently no sternum is developed; the gills are retained through life. To this group belongs a single family (the Sirenidæ), whose species are confined chiefly to ponds and ditches of the Southern U. S.

The Proteida have pterygoid and palatine bones approximated to each other; the ethmoid is represented by two vertical plates (one on each side of the cerebral lobes), which are elongated, and do not enter into the palate; no pre-frontal, maxillary, or nasal bones are developed; the mandible has no horny plate, but carries teeth; the sternum is wanting; the gills are persistent; a sacrum and hind limbs exist. To this group belong the Proteidæ, the celebrated slender, salamander-like animal of the caves of Carniola, in Austria; and the Necturidæ, represented by a single genus (*Necturus* or *Menobranchus*), found in American lakes and rivers.

The Salamandroidea, Amphiumoidea, and Protonopsoidea agree together in many characters and form one group, combined under the name Caducibranchiata by Cope; they are provided with palatine and in many with independent pterygoid bones; with ethmoids (two in number) of large size, but not extending to the palatal surface; with prefrontal bones (except in Desmognathidæ, etc.); and with maxillary and nasal bones; the mandible is without a horny plate, and always carries teeth; a sternum is always developed; the gills are deciduous, and disappear generally before maturity is attained, but, exceptionally, are retained through life. To this group belong the vast majority of the species of the order; these are popularly known under the names newts, tritons, mud-eels, etc. They are naturally segregated into the three primary groups above designated as Amphiumoidea, Protonopsoidea, and Salamandroidea.

The Amphiumoidea are very elongated animals with very weak limbs; the cranium is broad, and has anterior axial bones; the anterior dorsal vertebræ only are rib-bearing, and in the skin are imbedded minute scales, and the branchial fissures remain through life.

The Protonopsoidea have moderately elongated bodies; well-developed limbs; the cranium broad, and with no anterior axial-cranial bones; the branchial fissures are in one form (*Protonopsis*) retained through life, and in another (*Sieboldia*) become closed.

The Salamandroidea also have moderately elongated bodies and well-developed limbs; a broad skull with no anterior axial-cranial bones, and, except in *Siredon*, the branchial fissures disappear with the gills before maturity. The Salamandroidea offer peculiarities in the relations of the dentigerous bones, which differentiate the members into two groups: in one (to which the name Lechriodonta has been applied) the vomero-palatine bones are truncated or produced backward towards the medial line, and on their posterior margins the teeth are developed, in two more or less converging series; in the other (which has been named Mecodonta) the corresponding bones are extended backward, diverge from each other, and bear teeth on the inner margins, which therefore form two diverging series. To the Lechriodonta belong the families Amblystomidæ, Plethodontidæ, Desmognathidæ, Thoriidæ, and Hynobiidæ: the Mecodonta include the typical salamanders, constituting the families Salamandridæ and Pleurodelidæ.

Development.—The characters distinguishing the several groups above defined, as well as those distinctive of the families of Caducibranchiata, are remarkably correspondent to those exhibited in the successive stages of development of the higher types; and so strongly are these characteristics marked that they have furnished the best basis for the hypothesis of the evolution of animal types, and their assumption of characters by acceleration or retardation in the development of parts. The older naturalists associated in one group all those forms of the sub-order which possessed branchiæ throughout life, and these were contrasted with all the other members of the class—*i. e.* salamanders, frogs, toads, etc.—or at least with all of the European types. Inasmuch as with these modifications of the branchiæ were associated other characters not found in the adult—at least of the European salamanders—such as the fish-like or amphicœlian vertebral column, imperfectly developed skull, etc., there seemed to be some good reason, independent of the retention of the branchiæ, in favor of at least the later of the views alluded to.

All the members of this sub-order come from the egg with slits upon each side behind the head, and through these the branchial apparatus sends forth shoots provided with filaments. The skeleton is then imperfectly developed, and contrasts remarkably with that of the adult animal. Among the commonest North American salamanders are certain black or blue species with grayish or yellowish spots, which belong to a peculiar genus known as *Amblystoma*. In Mexico, likewise, a common form of this great group is found, and is known to the natives under the name of *Axolotl*. It attains a size about equal to the largest of the North American Amblystomas, and resembles them in external appearance, except that on each side of the neck are slits through which project branchiæ. No form without branchiæ having been found in its native country, it was quite naturally assumed that this form was mature, and never underwent further development, although suspicions had been entertained by several naturalists that it was merely a larval condition of some unknown species. This opinion, however, seemed again to be falsified by the fact that it matured eggs in this condition. M. Duméril of Paris having finally obtained specimens, found that although in many of the individuals the young underwent no further development, but brought forth young in the condition noted, a few in one season lost their branchiæ and assumed all the

characteristics of the genus *Amblystoma*. And still more remarkable was the fact that although he repeated his experiment often and under all conditions, he was unable to breed any young from these amblystomoid forms, although he had no difficulty in obtaining progeny from the branchiferous individuals. It is quite possible, therefore, that the typical *Axolotl* of Mexico may be arrested permanently in its development, and not pass beyond the larval stage in its native country. The species of the genus *Amblystoma* are numerous, and exhibit much variation in the loss of their branchiæ, some shedding them when very small, others retaining them till they have attained their full size. The families of the order also exhibit characteristics which are expressive of different stages of development, some, *e. g.*, retaining their fish-like or amphicœlous vertebræ, while others towards maturity becoming opisthocœlous. This has been regarded as a very important character, but is merely dependent on the ossification and union of the intervertebral capsules with the vertebræ which they precede; and whatever may be the adult condition, are amphicœlous in the larval stage. It may be finally remarked that *Necturus* is very similar to the larval stage of *Spelerpes*, a plethodont salamander, but as it appears never to assume the characters of the adults of that genus, it is retained by all naturalists in an independent group next to *Proteus*.

Geographical Distribution.—The range of this order is exceptional. It is nearly confined to the temperate regions. In the entire temperate zone species are found, but the genera are mostly limited in their distribution: only two genera (*Triton* and *Spelerpes*) are common to the North American and European faunas. About 100 species (according to Strauch in 1870, 84) are known; of these America has the greatest proportion. The Sirenidæ, Necturidæ, Amphiumidæ, and Desmognathidæ are peculiar to it; and, with the exception of one or two species, the Amblystomidæ and Plethodontidæ also. On the other hand, the Salamandridæ and Pleurodelidæ are chiefly confined to the Old World; the Hynobiidæ are represented by a single genus, confined to Japan. The Protonopsidæ have one genus in North America, and another in Japan and China, and the Proteidæ are confined to certain caves in Carniola and Carinthia. The Salamandroidea known to Strauch were apportioned by him in the following manner:

I. *Eastern Hemisphere, with 28 species.*
- A. Circummediterranean District, with 19 species.
  - 1. European Province, with 15 species.
  - 2. African Province, with 3 species.
  - 3. Asiatic Province, with 5 species.
- B. Asiatic District, with 9 species.
  - 1. Western Siberia, with 1 species.
  - 2. Eastern Siberia, with 2 species.
  - 3. Japan, China, Siam, with 6 species.

II. *Western Hemisphere, with 57 species.*
- A. Pacific District, with 25 species.
  - 1. Northern Province, with 15 species.
  - 2. Southern Province (from Mexico southward), with 10 species.
- B. Atlantic District, with 32 species.
  - 1. Province W. of Mississippi, with 13 species.
  - 2. Province E. of Mississippi, with 28 species.

Geological Range.—The first appearance of representatives of this order has been until recently ascribed to the Tertiary epoch, but Dr. Newberry has obtained remains of an amphibian in the coal-measures of Ohio which have been identified by Prof. Cope as representing a type of this order, and constituting a new genus (*Cocytinus*, and family Cocytinidæ), related to the Amphiumidæ and Protonopsidæ. In the schistose beds of Oeningen, Switzerland (which belong to the Miocene Tertiary), remains are found of a gigantic salamander (named *Andrias Scheuchzeri*) related to our hell-bender (*Protonopsis*) and the great salamander of Japan (*Sieboldia*): these were supposed by some early naturalists (*e. g.* Scheuchzer) to have belonged to man. In the earliest geological ages the several forms of this order appear to have had analogous representatives in members of the order of Labyrinthodonts. THEODORE GILL.

Grad′ual [from *gradus*, a "step," because it is chanted from the steps of the pulpit], in the office of the mass that portion of Scripture which follows the Epistle and precedes the Gospel. It is generally a part of a psalm. The name is also given to the music, and to the book containing the music, for the Gradual.

Gradua′tion is the art of accurate division as applied to instruments of a mathematical character or those used in all kinds of measurement, as in astronomy, or of indication, as the surveyor's or mariner's compass. In its most extended sense graduation is the determination of equal distances as used in art or science. The distance of objects in every relation, and their size in measurement, depend entirely upon the accuracy of the graduation of the instrument employed. The importance of graduation is best illustrated by the fact that an error of $\frac{1}{100}$th of an inch in the divisions of a sextant or quadrant would cause a corresponding error of *four miles* as to the spot occupied by the observer. (*Chambers.*) Those who have attempted by means of the dividing compass alone to set off equal spaces, as in architectural drawings, have invariably realized the great difficulty of doing this with perfect accuracy; but it is not generally known that graduation is really the most delicate and difficult branch of mechanical art, and that the very few who have excelled in it are as well known by name to men of science as Bacon or Kepler. The difficulties are simply mechanical, as may be inferred from what was said by Troughton, a distinguished graduator (1809), who declared that with a steady hand and good eye he was much disappointed to find that after making two points, neat and small, he could not possibly bisect the distance between them without enlarging, displacing, or deforming them with the points of the compasses. Even with the beam-compass, vernier, and other hand instruments, accuracy can only be attained by a surprising talent for practical mechanism. Yet, notwithstanding the immense number of curious machines dividing surfaces with surprising accuracy, the processes of *original graduation* are still conducted in this manner. The other kinds are the so-called *common* and *engine graduation*. The difficulty with which graduation contends is "the accumulation of minute errors." (*Simms.*) Common graduation consists of copying from a scale already prepared by a higher process, and is only used where extreme correctness is not needed. It is effected by means of a *dividing-plate*, which is a disk of metal not more than 30 inches in diameter. Around its inner edge is a series of circles containing all the divisions and numbers requisite, with Gunter's and other logarithmic lines; also tangents in $\frac{1}{10}$th part of the radius, and the difference of the hypothenuse and base as applied to the theodolite; also the equation of time for dialling the points of the compass, etc. (*Tomlinson.*) In the centre is a hole, through which passes a pin or arbor. An index, a very straight, long, narrow plate of fine steel, passes to the centre, but so that the line of one of its sides shall be in a line with the centre of the pin. Its end in the centre is supplied with a brass plate which diverges to one side, and in it is a notch into which the pin or arbor fits exactly. This directs the straight edge to the centre. It will be understood from this that if a certain number of divisions are marked on the extreme edge of the disk, and one or more smaller circles be drawn within it, even to the minutest circle possible in the centre, the index, as moved from one of the outer graduated distances to another, must describe corresponding but smaller distances on the inner circles. If now a compass-plate, to be marked with the proper divisions, with a hole in its centre just fitted to receive the centre pin of the disk, be properly placed, we can easily mark the lines required, simply by moving the index from one to the other on the disk. As it moves it moves over the compass-plate also, and the lines are marked with a kind of knife made for the purpose. In doing this a draw-cut is used, instead of pushing the tool, as in engraving. In common dividing straight lines are ruled with a *dividing* square. It is like a carpenter's right-angle or square, and is simply pushed along over the pattern, while the distances thus given are marked off on the new plate. The beam-compass, the vernier, and spring dividers are essential in graduating, and with them alone much work is done.

Engine Graduation.—Henry Hindley of York was the first inventor of a *machine* for graduating, and in 1768 the duke de Chaulnes published two able works on the subject, which gave to Ramsden the basis for an engine which, though far from perfect, exceeded anything before known. This he subsequently improved. In 1778 the celebrated John Troughton completed a graduating engine which soon became popular. He was succeeded by his brother Edward, who invented an improved method of graduation, which was rewarded by a medal from the Royal Society. In 1788, John Stancliffe also made a dividing engine. Since their time the works of Andrew Ross and Simms in England, of Reichenbach in Germany, and of Gambey and Froment in France, have raised *engine graduation* to a high pitch of perfection. Ramsden's engine, as Tomlinson suggests, has supplied the principle on which later and far more elaborate graduating machines have been constructed; and this is, in effect, simple enough. "A horizontal circle 4 feet in diameter turns on a vertical axis, its outer edge being ratched by an endless screw, one revolution of which carries the circle round 10′, the screw being worked by pressure with the foot." The circle to be divided is fixed upon the dividing engine, and made concentric with it, and a division is cut with each pressure of the foot. The engine of Edward Troughton was one of the most complicated and ingenious machines ever made. A very com-

plete description of it, written by himself, may be found in the *Edinburgh Cyclopædia* (art. "Graduation"). With it the operator could cut twenty-four strokes in a minute, but it required a skilled operator, who was obliged to labor incessantly. Simms's engine (see *Memoirs of the Royal Astronomical Society*, vol. xv., 1846) was intended to make Troughton's self-acting and self-regulating, "and having performed its work, to throw itself out of gear." This he effected in his self-acting circular dividing engine, which is one of the greatest triumphs of the century, and which has justly been classed with Babbage's analytical machine and those elaborate inventions which seem to spare man not merely manual, but also brain labor. In 1831, Andrew Ross received from the Society of Arts 50 guineas and the gold Isis medal for an improved method of dividing instruments and for a circular dividing engine. This machine, which is not less complicated and elaborate than those of Simms and Troughton, may be found fully described and illustrated by the author in the 48th vol. of the society's *Transactions*. Its main object was to correct the errors caused by the ratched cylinder and screw in Ramsden's and Troughton's engine, and ensure greater ease and delicacy in action. He effected this by substituting for the driving motion of the screw that of an independent apparatus. Ross's engine excelled its predecessors in an improved method of stopping the circle at its *precise* angular position by giving it a steadier motion, and so adjusting its details that much wear and tear is prevented.

Original graduation is, as the name indicates, the art of preparing the original standards by which common and engine graduation are determined. The engine simply multiplies copies, more or less correct, but the *original* must be as nearly as possible absolutely correct. The principal methods recorded are those of Hooke, Romer, Hindley, Graham, the duke de Chaulnes, Ramsden, and Troughton. That of Hooke consisted in racking the edge of his quadrant with an endless screw (*Tomlinson*), using its revolutions and parts as divisions. This was ingenious, but impracticable without *independent* divisions. Of the two general methods recognized in original graduation, one, *bisection*, is effected by dividing the space into halves, and these again into halves, until the unit of measurement is reached. The other process, *stepping*, consists of several successive steps, in any of which errors may occur, although in the whole they generally balance one another. Hindley's method (1748) consisted of taking a long plate, 1 inch broad by 8 feet in length. He then bent double a long flat plate of steel, so as to make its ends press flat together. In these ends he bored two small holes, the units' distance apart, one to receive a small pin, the other a drill. The plate was then put at right angles between the chaps of the steel press, and a hole was bored carefully through the plate, into which the pin was placed. The next hole covering the plate served as guide to bore a second hole, and the steel chaps were now moved one hole forward, the pin placed in the second hole, and a third hole was bored. The plate was then advanced a second time, the pin placed in the third hole, and a fourth was bored; and this operation was repeated as often as necessary. By making the plate again into a hoop the circle was obtained to measure the required disk. Graham's method was the extremely simple one of bisection, leaving intentionally a small space between two arcs drawn with a beam-compass. The space between these arcs can be accurately marked with the aid of a lens. The duke de Chaulnes invented a highly ingenious and simple method of actual dividing by means of two micrometer microscopes. Ramsden also employed the microscope, and Troughton successfully combined Graham's method of perpetual bisections with the duke de Chaulnes' method of reading off the divisions of astronomical instruments. Troughton's method was, in fact, exactly Graham's principle of perpetual bisection, only using an *optical* beam-compass instead of one with points, and registering the errors of the dots instead of cutting actual divisions. (*Tomlinson.*) A full description of his method may be found in the article on graduation in the *Penny Magazine*. The celebrated engineer Smeaton says that one Abram Sharp, assistant to Flamsteed in 1689, was the first who accurately cut divisions on astronomical instruments. (See *Observations on the Gradation of Astronomical Instruments, with an Explanation of the Method Invented by the late Mr. Henry Hindley of York, Clockmaker, to divide Circles into any given Number of Parts*, by Mr. JOHN SMEATON, F. R. S., communicated by Henry Cavendish, Esq., F. R. S., and S. A. Read, Nov. 17, 1783.) Rowley and the Sissons graduated large instruments with great accuracy; and about the same time Bird, who had as a country-boy manifested a strange natural talent for correcting clock-dials, distinguished himself by his ingenuity in graduation. He received from Parliament a handsome reward for making known certain methods which he had invented. Among recent modern inventions is the electro-dividing machine of Froment, by which spaces from one inch to the $\frac{1}{25000}$th part of an inch are marked off. This is, however, nothing, as regards minuteness, to the *standard bar-measurer* of Mr. Whitworth, on which, by means of a metallic frame provided with two micrometers, and a simple combination of a screw, tangent screw, wheel, and circle, a division is reached on the circle which corresponds to the threads and teeth of the screws, as to the tenth of the four hundredth of the two hundred and fiftieth part of an inch—*i. e.* to the $\frac{1}{1000000}$th of an inch. By this machine the distances are of course determined by *touch*, and not by sight.

CHARLES G. LELAND.

Gra'dyville, post-v. of Adair co., Ky. Pop. 1713.

Grä'fe, von (ALBRECHT), M. D., b. in Berlin in May, 1828; was skilled in natural science and mathematics; studied medicine at the leading schools of continental Europe, and became (1856) professor of ophthalmology at Berlin; acquired a world-wide fame as an operator upon the eye; author of many valuable papers upon his specialty, chiefly published in the *Archiv für Ophthalmologie*, conducted in his name. D. at Berlin July 18, 1870.

Gräfe, von (ALFRED KARL), nephew of Albrecht, b. Nov. 23, 1830; graduated at Halle 1858; became an assistant to his uncle; founded a very successful ophthalmological institute at Halle; and became to some extent heir to his uncle's fame as an operator in diseases of the eye. Author of professional works.

Gräfe, von (KARL FERDINAND), M. D., b. at Warsaw, Poland, Mar. 8, 1787; graduated at Leipsic 1807; became professor of surgery at Berlin 1811; a staff-surgeon of the army 1815; was one of the restorers of rhinoplasty and a famous eye-surgeon, in which branch of his profession his son Albrecht became even more famous. D. at Hanover July 4, 1840. Author of *Angiektasie* (1808); *Normen für die Ablösung grösser Gliedmassen* (1812); *Rhinoplastik* (1818); and was 1820–40 one of the editors of the *Journal für Chirurgie und Augenheilkunde*.

Grä'fenberg, a hamlet of Austrian Silesia, where in 1826 Priessnitz opened the first water-cure establishment. It is 37 miles N. of Hohenstadt. The water-cure is still carried on.

Graffi'ti [It., "scratches"], the rude inscriptions found upon ancient buildings and stones, chiefly in Italy. The fact that they are in the Latin, Greek, or old Italian languages proves their great antiquity. They are of rude and almost always intrinsically worthless character, and are evidently in many cases the work of idle scribblers. Except in the case of those found in the Catacombs their antiquity confers upon them the only interest they possess. Several collections have been published, from which a little archæological knowledge has been gained.

Gräf'rath, town of Rhenish Prussia, on the Itter, has breweries and manufactures of cotton and silk fabrics, chemicals, and ribbons. Pop. 5003.

Grafting. See ENGRAFTING.

Graf'ton, county of New Hampshire, bounded on the W. by Vermont. Its area is 1463 square miles. Its surface is hilly, and the N. E. portion contains a part of the White and Franconia mountains. Much of the soil is very fertile. Cattle, grain, wool, potatoes, and dairy products are the staples. Lumber, starch, harnesses, wagons, metallic wares, woollens, gloves, and leather are among the leading manufactures. The county is traversed by the Boston Concord and Montreal and the Northern R. Rs. Caps. Plymouth and Haverhill. Pop. 39,103.

Grafton, post-tp. of Yolo co., Cal. It contains the village of Knight's Landing, on the Sacramento River and the California Pacific R. R., 90 miles N. of San Francisco. Pop. 1861.

Grafton, tp. of McHenry co., Ill. Pop. 1361.

Grafton, post-tp. of Oxford co., Me., 22 miles N. W. of Bethel. Pop. 94.

Grafton, thriving manufacturing town of Worcester co., Mass., on the Boston and Albany R. R., 6 miles E. of Worcester, at the junction of the Millbury branch. The township contains several flourishing villages, has 7 cotton-mills, important manufactures of boots, shoes, leather, and other goods; contains 2 national and 1 savings bank, a public library, 8 churches, a weekly newspaper, and a beautiful soldiers' monument. The cotton-mills run, in all, 34,422 spindles. The Blackstone and Quinsigamond rivers furnish power. Pop. 4594.

Grafton, post-tp. of Grafton co., N. H., on the Northern R. R., 40 miles N. W. of Concord. Pop. 907.

Grafton, tp. of Rensselaer co., N. Y. Pop. 1599.

Grafton, tp. and post-v. of Lorain co., O., at the cross-

ing of the Lake Shore and Tuscarawas Valley and the Cleveland Columbus and Cincinnati R. Rs. Pop. 960.

Grafton, post-tp. of Windham co., Vt., 12 miles N. W. of Bellows Falls. It has manufactures of lumber, cassimeres, etc. Pop. 1008.

Grafton, post-tp. of York co., Va. Pop. 1431.

Grafton, post-v. and tp. of Taylor co., W. Va., on the Valley River, at the junction of the Baltimore and Ohio and North-western Virginia R. Rs., 100 miles from Wheeling and the same distance from Cumberland, Md. It has a bank, 1 newspaper, large railroad-shops, 2 foundries, 7 wholesale and 23 retail stores, 7 churches, 6 hotels, 2 building associations, 3 planing-mills, several flouring and saw mills, and a large number of small shops of various kinds. Principal business, lumber, coal, etc. Pop. of tp. 1987.
HOLT & GARNER, EDS. "GRAFTON SENTINEL."

Grafton, post-tp. of Ozaukee co., Wis. Pop. 1864.

Gragna'no, town of Italy, near Castellamare di Stabia, in the province of Naples, celebrated for its superior wines. Is a bishop's see. Pop. 12,278.

Gra'ham, county of N. W. Kansas. Area, 900 square miles. It is mostly drained by the S. fork of Solomon River and its tributaries.

Graham, county in the S. W. of North Carolina, formed since the census of 1870. Its surface is mountainous, and abounds in unexploited mineral wealth. Cap. Robbinsville.

Graham, post-tp. of Jefferson co., Ind. Pop. 1408.

Graham, tp. of Johnson co., Ia. Pop. 1019.

Graham, post-v., county-seat of Alamance co., N. C., on the North Carolina R. R., 67 miles W. N. W. of Raleigh. Pop. 502; of Graham tp. 2332.

Graham, tp. of Clearfield co., Pa. Pop. 638.

Graham, tp. of Mason co., W. Va. Pop. 2325.

Graham (CHARLES K.), b. in New York City in 1824; received a liberal education, and entered the U. S. navy as midshipman. Soon after his enrolment the Mexican war broke out, and the vessel to which he was attached was ordered to the Gulf of Mexico to take part in the war. During this contest young Graham had abundant opportunities to witness the engineering operations, and to the study of engineering science he devoted himself. At the close of the war he returned to New York, and after continuing his studies for several years under the most competent engineers, commenced private practice. About 1857 he was appointed constructing engineer of the Brooklyn navy-yard, the dry dock and landing-ways being constructed under his supervision. On the outbreak of the civil war (1861) he announced his intention of volunteering his services to defend the government, upon which upwards of 400 men in his employ at the navy-yard followed his example, and the Excelsior Guard was organized, of which Graham was elected major subsequently. Throughout the early part of the war Col. Graham was actively engaged with his command in the various contests of the Army of the Potomac. At Gettysburg (July, 1863) Graham (now brigadier-general) was seriously wounded; recovering from his wounds, he again proffered his services, and was ordered by the secretary of war to report to Gen. Butler, who assigned Graham to the command of a gunboat flotilla, with orders to proceed to Bermuda Hundred, James River, and hold the place till the navy came up; which he did. During the remainder of the war he was actively engaged in the field, having attained the rank of brigadier-general and brevet major-general of volunteers. Soon after the close of the war he returned to New York and resumed the practice of his profession. Among other important duties, he has been engineer of the Broadway Pavement Co., of the Beach Pneumatic Transit Co., besides being connected with various surveys for the boards of public works and of public parks. In 1873, he was appointed chief engineer of the department of docks.
G. C. SIMMONS.

Graham (ISABELLA), b. in Lanarkshire, Scotland, July 29, 1742. Her maiden name was MARSHALL. In 1789 she came to New York and established a seminary for young ladies. Before leaving Scotland she founded the Penny Society, now known as the Society for the Relief of the Destitute Sick. After reaching New York she was instrumental in starting several benevolent societies. D. in New York July 27, 1814.

Graham (JAMES D.), b. in Prince William co., Virginia, in 1799; graduated at the U. S. Military Academy, and entered the U. S. army as third lieutenant of artillery July, 1817; promoted to be second lieutenant Oct., 1817, first lieutenant Sept., 1819; adjutant at the Military Academy till Feb., 1819; accompanied Major Long on his Western exploration 1819–21; on topographical duty 1822–29, when transferred as assistant topographical engineer, and continued on railroad and military surveys 1829–38, when promoted to be major Topographical Engineers; from 1838 to 1850 engaged as astronomer to determine the boundary between the U. S. and the republic of Texas; commissioner in survey of the north-eastern boundary of the U. S.; head of the scientific corps and principal astronomer to determine the boundary between the U. S. and the British provinces; on survey of "Mason's and Dixon's line," and of the boundary between the U. S. and Mexico. Promoted to be lieutenant-colonel 1861, and colonel of engineers 1863, and engaged in the survey of the lakes, lighthouse duty, and in charge of harbors on the North Atlantic coast. D. at Boston, Mass., Dec. 28, 1865. G. C. SIMMONS.

Graham (JOHN ANDREW), LL.D., b. at Southbury, Conn., June 10, 1764; was admitted to the Connecticut bar in 1785, and removed immediately to Rutland, Vt.; was sent to England as agent of the diocese to make application to the English bishops for the consecration of the Rev. Samuel Peters; was unsuccessful. In 1797 he published his *Descriptive Sketch of the Present State of Vermount.* A small volume of his ablest speeches was published in 1812. D. in New York Aug. 29, 1841.

Graham (LAWRENCE P.), b. in Virginia; entered the U. S. army in 1837 as lieutenant of dragoons, serving against the Seminole Indians in Florida, and in Louisiana and Texas till 1846. During the war with Mexico he was engaged in the battles of Palo Alto, Resaca de la Palma, and Monterey, being brevetted major for gallantry. From 1848 to 1852 he was on duty in California, New Mexico, and on expeditions against the Navajo Indians; promoted to be major in 1858, and on recruiting service, the Utah expedition, and superintendent of cavalry recruiting till 1861. Appointed brigadier-general of volunteers Aug., 1861, he organized and commanded the cavalry brigade till Apr., 1862; served on various courts-martial and examining boards, and was promoted to be colonel 4th U. S. Cavalry 1864; retired from active service May, 1864.
G. C. SIMMONS.

Graham (SYLVESTER), an advocate of the vegetarian dietetic theory, b. in Suffield, Conn., in 1794; entered Amherst College in 1823, to prepare for the ministry, but did not graduate. He began to preach in 1826, but soon left this for the work of temperance and dietetic reform. In 1832 he published his *Essay on Cholera,* and later, in 1839, delivered a course of lectures entitled *Graham Lectures of the Science of Human Life.* He wrote *Bread and Bread-making,* etc. D. in Northampton, Mass., Sept. 11, 1851.

Graham (THOMAS), D. C. L., F. R. S., b. at Glasgow, Scotland, Dec. 21, 1805; was educated at Glasgow High School and the universities of Glasgow and Edinburgh; passed M. A. in 1826; professor of chemistry in the Andersonian University 1830–37; announced the discovery of the law of the diffusion of gases 1834; became F. R. S. 1836; professor of chemistry in the London University 1837–55; master of the mint 1855; was the first president of the Chemical Society 1840; president of the Cavendish Society 1846; was the recipient of many honors and distinctions. D. at London Sept. 16, 1869. He first fully developed the theory of liquid diffusion; made numerous and important discoveries in theoretical and applied chemistry, and became widely known by his excellent *Elements of Chemistry* (1842).

Graham (WILLIAM ALEXANDER), b. in Lincoln co., N. C., Sept. 5, 1804; studied law, and entered in 1833 public life as a member of the lower branch of the State legislature, of which he was several times chosen Speaker; was a member of the U. S. Senate 1841–43, and governor of the State 1845–49; was secretary of the navy under Pres. Fillmore until 1852; in 1852 candidate for the Vice-Presidency on the ticket with Gen. Scott; was a member of the Confederate Senate. D. at Saratoga Aug. 11, 1875.

Graham (WILLIAM M.), brother of James D., b. in Prince William co., Va., 1798; graduated at West Point July, 1817, and entered the army as third lieutenant of artillery; second lieutenant Sept., 1817; first lieutenant 1819; captain 4th Infantry 1832; major 2d Infantry Feb., 1847; lieutenant-colonel 11th Infantry Apr., 1847; served on recruiting service, constructing military roads in Mississippi and Florida, and in garrison till 1835; engaged against Seminole Indians in Florida 1835–38 and 1841–42, being severely wounded at the battle of Withlacoochee, Dec., 1835. In the Mexican war he was engaged in the battles of Palo Alto, Resaca de la Palma, Monterey, siege of Vera Cruz, Contreras, Churubusco, and Molino del Rey, where he was killed while gallantly engaged in assaulting the enemy's works, Sept. 8, 1847.

Gra'hame (JAMES), LL.D., b. in Glasgow. Scotland, Dec. 21, 1790; was admitted as advocate to the Scottish bar in 1812. Published in 1827 a history of the U. S., 2 vols., but

its American spirit prevented a large circulation. He subsequently (1842) brought out *Who is to Blame? or, Cursory Review of the American Apology for American Accession to Negro Slavery*. D. in London July 3, 1842. He was a graduate of St. John's College, Cambridge.

Gra'hame's Isl'and, an island in the Mediterranean, 30 miles off the coast of Sicily. It appeared in July, 1831, and disappeared in August. It was built of material thrown up by a submarine volcano, and it was washed away by the waves. It reappeared for a short time in 1863.

Gra'ham's Land, an island in the Antarctic Ocean, discovered in 1832 by Biscao, and situated in lat. 64° 45' S. and lon. 63° 51 W.

Gra'ham's Town, town in the eastern part of Cape Colony, South Africa, cap. of Albany district. Bishops of the Church of Rome and the Church of England reside here. Pop. about 5000.

Grain, the unit of the system of weights prevailing in the U. S. and Great Britain. A statute of Henry III. (1266) enacted that 32 grains of wheat from the middle of the ear, well dried, should weigh a pennyweight, of which 20 should go to the ounce; but finally (as noted in the art. GALLON) the pennyweight came to be divided into 24 grains. At present in the U. S. the troy and apothecaries' pound each contain 5760 grains, or 12 ounces of 480 grains each; while the avoirdupois pound has 16 ounces of 437½ grains each, or 7000 grains to the pound. There are 15.43234874 grains in the gramme of the French or metric system of weights, according to Miller's determination made in 1844.

Grain. See CEREALIA, and the names of particular kinds of grain.

Grain Coast, the former name of the coast of what is now Liberia, in Africa, so named from the grains of paradise, formerly an important article of trade in that region.

Grain Elevator, an American invention by which grain is loaded in railroad cars, ships, etc. at a very great saving of labor and cost. The principle is very simple—an endless belt carrying up tin buckets or scoops, each containing a small quantity of grain, which is deposited in an elevated receptacle, whence it is discharged by spouts or chutes into the holds of vessels or into railroad cars, which are thus loaded in a very rapid manner and at small expense. Similar elevators are employed in Northern Michigan in loading vessels with iron ore, but the force of the falling ore must be broken by suitable appliances; for if allowed to fall directly into a ship, there would be danger of breaking holes in her bottom. *Elevators* for goods or persons are employed in the hoistways of warehouses, hotels, and manufactories, and are worked by power in various ways. They are entirely different in principle and construction from the elevators of the class above noticed. (See HYDRAULIC ELEVATOR, by F. A. P. BARNARD.)

Grain'ger, county of the N. E. of Tennessee. Area, 330 square miles. The county is hilly and mountainous. The low lands are fertile, the hills rich in mineral wealth. Iron ores abound. Cattle, grain, tobacco, and wool are leading products. Cap. Rutledge. Pop. 12,421.

Grain'ing, the *Leuciscus Lancastriensis* of England and continental Europe, a fresh-water fish of the dace family. It is prized for the table, and makes good sport for the angler, rising well at a fly. In habits it resembles the trout.

Grains of Par'adise, the seeds of the Malaguetta pepper (*Amomum Meleguetta*), a scitamінaceous plant of West Africa, cultivated to some extent in Guiana and Trinidad. The name is also given to other similar seeds. They are of a hot, fiery quality, and are used in giving apparent strength to watered spirits, beer, and wine. They are used in farriery, and their alcoholic tincture makes a good stimulant in some cases of neuralgia.

Gra'kle, or **Grack'le** (*Gracula*), a genus of birds of the starling family. The paradise grakle (*Gracula gryllivora*) is celebrated as a devourer of insects. The *Gracula religiosa* of the Eastern Archipelago is often trained to talk. Several blackbirds of the genus *Quiscalus* are called grakles in the U. S. They are allied to the true grakles in habits and structure.

Grallato'res [Lat. *grallæ*, "stilts"], the wading birds, an order of birds having very long necks, legs, and bills, and short tails. They are mostly found about marshes and shores, occasionally in dry regions. Cranes, storks, herons, the ibis, plovers, rails, and snipes afford examples.

Graminaceæ. See GRASSES, by W. W. BAILEY, A. M.

Gram'mar [Gr. ἡ γραμματική, from γράμμα, a "letter"], the science of language, or the art of using words correctly for the expression of thought. As a science, grammar investigates the relations between words and ideas, examines the structure of speech in general, and treats of the essential principles common to all tongues; in this broad signification, it is distinguished as philosophical, general, or universal grammar. As a science, also, it places side by side the words of different tongues, with their inflections, and, allowing for the changes of form due to phonetic corruption, seeks by the coincidences it detects to discover the genealogical relationship of languages; such is the province of comparative grammar. As an art, grammar has to do with the words and structure of some particular tongue; analyzes its sentences into their elements in order to show how those elements may properly be put together; and, furnishing the principles which regulate its use, teaches how to speak and write it correctly. The grammar of a language is generally considered under four heads: orthography, which considers letters, syllables, and spelling; etymology, which treats of the "parts of speech," and the changes of form that words undergo to express different relations; syntax, which deals with the relation, agreement, government, and arrangement of words in sentences; and prosody, which has for its province the accent and quantity of syllables and the laws of versification. To these is sometimes added a fifth division, orthoepy, which treats of pronunciation.

Thought is communicated by words, and words are the signs of ideas. Now, our first ideas are those of sensation; therefore names for the objects that make an impression on the senses must, from the very necessities of man, have been elements of the first language, and must constitute a fundamental part of every language whatsoever. Whether such names were at first arbitrary inventions, or had logical connection with the things named, it is clear that they are indispensable to speech, and as "substantives" they enter into the grammar of every language. Now, every substance thus named is endowed with some attribute of quality, quantity, action, or passion; and to express these attributes is needed a second class of words, which may be called "attributives." Again, the object of speaking is to assert something respecting the subject of discourse. Unless the attributive itself affirms the attribute, which in some cases it does (as "birds *sing*," "grass *grows*"), a third word, whose function it is to affirm, is required ("birds *are* singing," "grass *is* green"); such words may be distinguished as "affirmatives." Here, then, we have all that is absolutely essential to speech—the substantive, attributive, and affirmative, or *noun*, *adjective*, and *verb*—round which, as the chief parts of the sentence, cluster less important elements introduced for the sake of convenience or ornament. With these three alone may be formed the PROPOSITION, or affirmation of a thought in words—consisting of a SUBJECT, or that of which something is affirmed, and a PREDICATE, or that which is affirmed of the subject.

It is obvious that for the purpose of extended communication, as well as for improving and beautifying discourse, other classes of words besides the three enumerated above would soon be found necessary. The substantive would require "definitives," to limit its signification; "substitutes," to prevent its too frequent repetition; and "relationals," either used separately or coalescing with it, to express various relations of cause and effect, position, duration, and the like; hence what are called in English *articles*, *pronouns*, and *prepositions*. The attributive and affirmative must have "modifiers," which we distinguish as *adverbs*. As the graces of style are cultivated, and the brief modes of expression give way to elaborate periods, "connectives," or *conjunctions*, become necessary to combine propositions into sentences. Finally, *interjections*, or exclamations expressing strong and sudden emotions, find a place in every tongue. Constituting the chief element of that natural language which belongs to man in common with other animals, they have been regarded by some as the earliest part of speech, and are still used when the suddenness or violence of some mental emotion, surprising men into a forgetfulness of their more cultivated forms of discourse, brings them back to their natural state.

Such are the different classes of words, or "parts of speech," current in language, and which it is the province of grammar to consider. The most polished tongue requires no more for the expression of every conceivable shade of thought with perspicuity and strength; and the rudest can ill dispense with any of these classes if it is to be the vehicle of connected discourse.

A natural distinction of objects endowed with life is sex; and to this corresponds a modification of the substantive to denote what is technically called GENDER (which see).

The use of a distinct class of words (*prepositions*) to indicate the relations in which one object may stand to another, has been alluded to above. In some languages such relations are also indicated by terminations appended to the noun, which is then said to be *inflected*. Hence, the modification known as *case*. (See DECLENSION.) The terminations which mark the different cases of nouns are not accidental outgrowths or conventional contrivances for the

expression of certain relations, but they were originally independent words, capable of separate use, and each having a signification which gives to the word in that special case its peculiar force. In proof of this we are pointed to Chinese, in which the relational term is not disguised at all, but is added to the root unchanged, forming a compound whose elements are recognized at once, and are seen to retain their original meaning. In the agglutinative languages, the root, as in Chinese, remains unchanged, and stands out in bold relief from the relational appendage, which, however, having lost its primitive form and etymological meaning, has come to be regarded as a mere termination. But in the Aryan or Indo-European languages (including ancient Sanscrit, Greek, and Latin, and our own English), the elements, put together as before, coalesced into a word in which neither root nor relational retained its original form, or could be at a glance detected, the appended term dwindling in many cases to a syllable, or even a single letter.

To facilitate the expression of thought, modifications are as necessary in the case of the verb as of the noun. It may be desired to affirm the action or state expressed by the verb positively, or as a condition or supposition, or as a thing possible, necessary, wished for, or commanded; also, to affirm it as present, past, or future, either absolutely, or relatively to some other specified time, present, past, or future. Here again, as in the case of the noun, recourse is had either to terminations or auxiliary words, and these may in their turn be varied to denote that the action or state is affirmed of one or more than one,—of a person or persons speaking, spoken to, or spoken of. In some languages a termination is also appended to certain adjectives and adverbs, to make them denote the higher of two degrees compared, or the highest of more than two. Whenever such a termination, or indeed any other, is used, comparative grammar teaches that it is not a mere meaningless form, but the relic of a root whose original force still adheres to the insignificant appendage to which it has become reduced.

Comparative grammar as a science had no existence till the commencement of the present century. At that time Sanscrit began to be critically studied, and its remarkable affinities with the other Indo-European languages were soon perceived and thoroughly investigated. The study of philology received a new impulse; and the researches of several distinguished English scholars, but particularly of the Germans Bopp, Schlegel, Grimm, Pott, Bunsen, and Müller, have within the last three-quarters of a century thrown a flood of light on this whole subject. The various languages of which there is sufficient knowledge have been grouped according to their grammatical analogies into families, and made to reveal the relationship, and measurably the social condition, of nations during ages respecting which history is silent. These discoveries Humboldt pronounces "one of the most brilliant results of modern study."

Though the science of comparative grammar is of so recent an origin, the art of grammar may lay claim to great antiquity. As far as is known, the first attempts at systematic technical grammar were made in Sanscrit. The early language of the Vêdas had already given place to later dialects, but its purity was jealously guarded by the Brahmans, who from time to time accompanied the sacred text with critical observations on its pronunciation and constructions. These Bráhmanas, or commentaries, supposed to have been written from 700 to 800 B. C., formed the foundation of that great Sanscrit Grammar of Pânini which Max Müller pronounces "the perfection of a merely empirical analysis of language, unsurpassed—nay, even unapproached—by anything in the grammatical literature of other nations." The records of his countrymen assign Pânini to a remote antiquity; we may safely assume that this masterpiece of grammar was composed at least a century before Plato taught.

Among the Greeks, technical grammar was of later origin. With them what was not Greek was barbarian; and, if we except itinerant traders, and philosophers who sought foreign lands in quest of knowledge, they had little desire to become acquainted with other languages than their own, and little need of a formal grammar. Plato and Aristotle, indeed, both used the term ἡ γραμματική, and distinguished certain of the parts of speech. The latter, also, recognized number and case as modifications of the noun, and wrote a treatise, embraced in his *Organon*, on the expression of thought by means of speech. But the philosophers just named viewed these things as logicians rather than grammarians; they dealt with the thought rather than the word, and were deficient in grammatical terminology. Not till fifty years after Aristotle's time, when Alexandria became a great seat of learning, do we find much progress made in grammar. At that time the revision and explanation of the texts of Homer and the early dramatists and philosophers led to the cultivation of this art among the Greeks, just as the study of the Vêdas had done among the Brahmans. A rich crop of critics and scholiasts was the result. Zenodotus, the first superintendent of the Alexandrian library (280 B. C.); Aristophanes of Byzantium, who introduced accents into the Greek language; and Aristarchus, author of 800 commentaries,—are deserving of special mention as having prepared the way for a practical grammar of the language. Their labors, however, had chiefly in view the restoration and exposition of the text of Homer and other ancient Greek authors; it was reserved for Dionysius the Thracian, who established himself as a teacher at Rome about B. C. 80, to construct, out of the materials which had been accumulating for generations in the works of philosophers and commentators, and were specially valuable in those of his master Aristarchus, the first systematic grammar of the Greek language. The study of Greek had for years been regarded at Rome as a necessary part of a liberal education; indeed, the young patricians were often taught the Greek language before their own. How thoroughly their teachers, who were for the most part slaves or freedmen, may have drilled them orally in the details of declension and conjugation and the niceties of syntax, we cannot tell; but there is no evidence that any of these *grammatici* attempted to reduce their lessons to a systematic form and embody them in a manual of instruction. The first attempt of this kind of which we have any knowledge was made by Dionysius in his Τέχνη γραμματική, which has come down to us, and which was a standard school-book for centuries.

But even before the appearance of Dionysius at Rome, a taste for the study of grammar had prevailed in that metropolis. It originated with the lectures of the distinguished grammarian, Crates of Pergamus, who, sent as an ambassador to Rome about 157 B. C., and detained there by an accident, delivered a series of discourses on his favorite art. The study of grammar at once became fashionable, and it was not long before the scholars of Rome sought to apply its principles practically to the teaching of their own language. We read of Stilo writing on etymology and lecturing on his native tongue. His pupil Varro, "the most learned of the Romans," composed a comprehensive treatise, *De lingua Latina*, the first part of which was devoted to etymological investigations, the second to the inflections of words, and the third to syntax. Nor must we forget Julius Cæsar, who, amid the labors of the Gallic war, found time to prepare an essay on the analogies of the Latin language. Many grammarians followed; we may name Quintilian, who flourished near the close of the first century after Christ, and Priscian, one of the bright ornaments of Justinian's reign, whose treatise on the *Eight Parts of Speech* maintained its authority as a text-book for many centuries.

The labors of later grammarians have consisted chiefly in simplifying, illustrating, adapting, and carrying out the work of their predecessors; as regards the great principles of the art, they have added little that was really new. What is to-day taught in our schools as grammar, whether English, Latin, or Greek, has substantially the same framework that Priscian used, and Dionysius and Pânini constructed, centuries ago. There has been little change; from the very nature of things little could be expected. Much as our present systems of grammar have been decried, much as has been said in favor of banishing them from the schools, and letting the young learn to speak and write by imitation or by so-called natural processes, there yet remains to be found a royal road to the learning of language, which can dispense with the classification of words, the formal array of declensions and conjugations, verbal and sentential analysis, and syntactical rules based on the usage of standard writers. G. P. QUACKENBOS.

Gramme, commonly in English written *Gram* [Gr. γράμμα, a letter] the unit of weight in the Metric System of Weights and Measures. Theoretically it is the weight in vacuo of a cubic centimètre of distilled water at the temperature of maximum density, assumed to be 4° C. or 39°.1 F. Practically it is the one thousandth part of the weight of the standard kilogramme in platinum, deposited on the 22d June, 1799, in the Palace of the Archives in Paris, by the international commission appointed to fix the standards, who on that day completed their work. (See METRIC SYSTEM.) The original determination of this standard was made in 1795 with great care, by Mr. Lefèvre Gineau, a member of the commission. It was adopted as representing exactly the weight in vacuo of one cubic decimètre of water under the conditions above named. Its weight in British grains has since been carefully ascertained on three occasions, viz.; by Hassler, Chief of the U. S. Coast Survey, in 1832; by Kupffer of St. Petersburgh, in 1841; and by Miller of London, in 1844. These determinations are severally as follows:—Hassler, 15,433.1669; Kupffer, 15,432.36186; Miller, 15,432.34874. Miller's determination has been officially adopted by the British Standards Bureau, and is hence generally accepted. But

as the officially adopted length of the mètre in England is 39.37079 inches, and the officially adopted weight of the cubic inch of distilled water in vacuo, at 62° F. (252.724 grains) reduced by Miller's coefficient to 39.°1 F. is 253.00452 grains, it results from the combination of these numbers that the standard kilogramme of the Archives is 7.77118 grains too light. Kupffer on the other hand found the weight of the cubic inch of water in vacuo at 13°⅓ R. = 16.°67 C = 62° F., to be only 252.598 grains; and taking this with his determination of the weight of the standard kilogramme (which exceeds that of Miller only by the minute fraction 0.01312 gr.), a cubic centimètre of water at maximum density weighs in vacuo 1000.0115 grammes, or only about one sixth part of a grain more than the standard kilogramme. On this Mr. Chisholm, Warden of the Standards to the British Government, remarks (Second Report of the British Standards Commission, 1869) that "if Capt. Clarke's more recent valuation of the mètre = 39.370432 English inches, be taken as the base, a cubic decimètre of water at its maximum density weighs 0.015 gramme or 0.23145 grains *less* than a kilogramme," and that "If the mean of these two computations be taken, the weight of a cubic decimètre of water at its maximum density will be only 0.00175 grammes, or 0.027 grains less than a kilogramme." Capt. Clarke, the authority above referred to, is the eminent geodesist connected with the Royal Ordnance Survey of the British Islands.

It is still unsettled what is the true weight in British grains of a cubic inch or of any other given volume of water; and hence it is for the present equally uncertain what is the amount of discrepancy, if any, between the actual or legal and the theoretic weight of the standard kilogramme. A pretty full summary of the results of investigation up to 1832 on the weight of the cubic inch of water, may be found in Hassler's first and large Report on Weights and Measures made in that year to the Secretary of the Treasury of the United States. This document will probably at present be found only in libraries, public or private. The substance of Kupffer's results is given in the Sixth Appendix to the Second Report of the British Standards Commission, made in 1869 and published as a blue book. A pretty full discussion of the whole subject may be found in the essay on the Metric System, Appendix B, by the writer of this article, published in 1872.

The gramme = 15.43 grains though the unit base of the system of metric weights, is the practical unit only where small quantities are concerned, as in medicine, chemistry, coinage, &c. The usual commercial unit is the kilogramme = 2.20462 pounds avoirdupois. It should be observed that this equivalent of the kilogramme, which is commonly received, is a weight in vacuo, and involves consequently for ordinary uses a trivial error, which is however of no practical importance. F. A. P. BARNARD.

Grammont, town of Belgium, in the province of East Flanders, on the Dender. It has manufactures of damasks, linen, cotton, and black laces. Pop. 9362.

Grammont, Order of, called also **Grandmontains,** an order of monastics established at Muret, near Limoges, in France, in 1076, by Stephen of Thiers, who wore a shirt of steel rings and slept in a coffin. He took the title of corrector. Gregory VII. imposed the rule of St. Benedict. In 1124, after Stephen's death, the order was removed to Grandmont, whence it took its name. It had a verbal or traditional rule, derived from its founder and afterwards reduced to writing. The Grandmontains were afterwards very numerous and much respected. They were at first allowed to hold no lands or churches. This was one of the orders whose members were known as Bons Hommes. The order perished at the Revolution, having at last become degenerated.

Gramont, de (PHILIBERT), COUNT, b. in 1621; served in the French armies in Germany, Burgundy, and Spain, but is chiefly famous for his scandalous intrigues at the French and English courts; but having seduced Eliza Hamilton, a Scottish lady, he was compelled by her brother, afterwards Count Anthony Hamilton, to marry her (1664). He re-entered the French service in the Low Countries, and d. Jan. 10, 1707. Count Anthony Hamilton published in French his *Mémoires* (1713), a brilliant narrative of Gramont's exploits in love and at the gaming-table, well known in the English translation.

Gram'pians is the name of a range of mountains in the western part of Victoria, Australia, stretching from N. to S. in a curve around the basin of Glenelg and its affluents. Mount William, the highest peak, is 4500 feet above the sea.

Grampians is the name of a range, or rather system, of mountains which traverse Scotland from N. E. to S. W., from the Atlantic to the North Sea, and form the highlands of Aberdeenshire, Kincardineshire, Forfarshire, and Perthshire. The highest point is Ben Nevis, 4408 feet; the general height is from 2000 to 3000 feet. Towards the N. the Grampians send forth ranges of wild mountains, forming extensive highlands; towards the S. they slope more gently.

Gram'pus [from the Fr. *grand poisson*, "great fish"], a name applied to various cetaceans of the family Delphinidæ and of the genera *Grampus, Globicephalus, Orca,* etc. It has been also appropriated as a scientific name for a genus of Globicephalinæ, distinguished by the complete want of teeth in the upper jaw and the few of the lower jaw.

Gran, town of Hungary, on the right bank of the Danube. It is one of the oldest towns of Hungary, being the birthplace and residence of St. Stephen, the first king, and it is still a handsome and lively place. It is the see of the primate of all Hungary, an archbishop of the Latin rite, and has a most beautiful though yet unfinished cathedral. Its trade in wine is considerable. Pop. 8780. It is called Esztergom by the Magyars.

Grana'da was the name of one of the largest and richest kingdoms which the Moors established in Spain. It comprised the three modern provinces of Malaga, Granada, and Almeria, and had an area of 11,063 square miles of the most diversified and fertile land, bordering S. on the Mediterranean, and traversed by the Sierra Nevada, from whose lofty snow-clad peaks the ground gradually sinks, through beautiful terraces, into the low and hot plain of Andalusia. In the time of the Romans this territory belonged to the province of Bætica. After the invasion of the Moors it formed part of the kingdom of Cordova until 1235, when it rose into an independent kingdom, with Granada as its capital. Here the genius of the Moorish people seems to have had its finest and happiest inspirations. The land was densely peopled, the soil most excellently cultivated, and the kingdom covered with works of the most wonderful architecture and engineering. The most delicate products of art and industry passed from here to all the markets of the world, and a considerable influence was exercised on the civilization of Europe—on its science, its morals, and its customs. But in 1492 the kingdom of Granada was conquered by Ferdinand and Isabella, and in 1510 the Moors were expelled from Spain. The works of irrigation stopped operation, the plantations withered away, the gloom of the Inquisition fell like a frost on the sciences and arts, and the splendor of Granada was gone. The present province of Granada has an area of 4937 square miles. Pop. 485,346.

Granada, town of Nicaragua, in Central America, on the north-western shore of Lake Nicaragua. It is an old Spanish settlement founded 1522, and once a very thriving town, but in 1854 and 1855 it suffered very much during the civil wars, and is still mostly in ruins. It is said to have about 8000 inhabitants.

Granada, city of Spain, the capital of the province of Granada. It is built on two spurs of the northern range of the Sierra Nevada, at an elevation of 2445 feet above the level of the sea, and has a most delightful climate, the atmosphere being refreshed by the breezes from the snowy peaks behind it. Below it stretches the Vega, the plain of Granada, watered by the Jenil and the Darro, and once a wonder of cultivation and the scene of the most romantic valor and gayety. Granada is the see of an archbishop, and has a university founded in 1531, and yearly attended by several hundred students, and a large cathedral, most gorgeously decorated with variegated marble and containing the monuments of Ferdinand and Isabella. But its chief interest it derives from its historical remains. It was founded by the Moors in the eighth century, and became in 1248 the capital of the kingdom of Granada. As such it was one of the most splendid cities the world ever saw. It had 400,000 inhabitants, and was surrounded by a strong wall crowned by 1030 towers; and in spite of centuries of decay, not only the ALHAMBRA (which see), but many other buildings, fascinate the traveller. Pop. 61,993.

Granada, post-tp. of Nemaha co., Kan. Pop. 893.

Granadil'la [Sp., dim. of *granada*, a "pomegranate"], the fruit of several tropical species of passion-flower. The great granadilla is the fragrant, gratefully sub-acid fruit of *Passiflora quadrangularis*, whose root is emetic and narcotic. *P. laurifolia* (water-lemon), *P. maliformis, filamentosa, edulis,* and many other species bear edible fruits. They are all natives of America. (See PASSION-FLOWER.)

Gran'bury, post-v., cap. of Hood co., Tex., on the river Brazos. It has one weekly newspaper.

Gran'by, tp. and post-v. of Shefford co., Quebec, Canada, on the Stanstead Shefford and Chambly Railway, has an academy and 2 weekly papers. Pop. of v. 876; of tp., exclusive of v., 2225.

Granby, post-v. and tp. of Hartford co., Conn., on the New Haven and Northampton R. R., 47 miles N. of New Haven; has considerable manufacturing interests. The township contains the villages of West and North Granby. Pop. 1517.

Granby, post-tp. of Hampshire co., Mass., 5 miles E. of Holyoke. It has one insurance company, and is an excellent agricultural town. Pop. 863.

Granby, post-tp. of Nicollet co., Minn. Pop. 566.

Granby, post-tp. of Newton co., Mo., on the Atlantic and Pacific R. R., 8 miles N. E. of Neosho. It has lead-mines and one weekly newspaper. Pop. 1889.

Granby, tp. of Oswego co., N. Y., contains the village of OSWEGO FALLS (which see). It has extensive manufactures of lumber, cheese, leather, and wooden-ware. P. 3972.

Granby, post-tp. of Essex co., Vt., 58 miles N. E. of Montpelier. It has manufactures of boots, shoes, and lumber. Pop. 174.

Gran'by (JOHN **Manners**), MARQUIS OF, b. Jan. 2, 1721, was the son of the duke of Rutland; was educated at Eton and Cambridge; raised a foot regiment in 1745; was chosen to Parliament 1754, 1761, and 1768; became colonel of the horse-guards in 1758; lieutenant-general in 1759, and at the battle of Minden was greatly distinguished; commanded the British troops in the Seven Years' war 1760–63; was distinguished at Warburg 1760, at Kirchdenken 1761, at Gräbenstein and Homburg 1762; became master-general of ordnance 1763; had chief command of the British army 1766–70. D. at Scarborough Oct. 19, 1770. Granby had during life an immense popularity and a brilliant fame as a general, but the sentence of military critics has found nothing to commend in his generalship. He was, however, a brave, honest, and humane officer.

Gran Chaco. See CHACO, EL GRAN.

Grand, the north-westernmost county of Colorado, formed since the census of 1870.

Grand, tp. of Marion co., O. Pop. 403.

Grand Bank, the subaqueous plateau in the Northern Atlantic which extends eastward from Newfoundland towards Europe. Its limits are not at present accurately known. It is believed that its existence is largely due to the melting of icebergs by means of the warm waters of the Gulf Stream. The icebergs bring great amounts of gravel, earth, and stone from the parent-glaciers of Greenland, and as they melt this matter is deposited upon the sea-bottom. The Grand Bank is the most extensive and important of the known resorts of the codfish, and French, British, American, and colonial fishing vessels visit it in great numbers.

Grand Bank, port of entry and fishing-town on the S. side of Fortune Bay, Burin district, N. F. It has a good trade with St. Pierre. Pop. 740.

Grand Bay, or **Ha-Ha Bay,** a beautiful inlet from the river Saguenay in Chicoutimi co., Quebec, Canada, averaging 1 mile in breadth, with water 600 feet deep. At its head the largest ships load with lumber. Pop. of v. about 300; of sub-district, 1304.

Grand Blanc, post-tp. of Genesee co., Mich. P. 1367.

Grand Chute, tp. of Outagamie co., Wis., contains APPLETON (which see). Pop. exclusive of Appleton, 1390.

Grand Combe, La, town of France, department of Gard, has important coal, zinc, and lead mines. Pop. 8706.

Grand Coteau, post-v. of St. Landry parish, La. It is the seat of St. Charles College, a Jesuit institution, and has a convent of ladies of the Sacred Heart. Pop. 470.

Grand Coutumier, a name applied to each of two collections of ancient French laws. One, known also as the *Coutumier de France*, is a collection of the customs, usages, and forms of practice which had been in use from time immemorial in the kingdom of France. The work was first planned by Charles VII. in 1453, but was not finished until 1609. The other collection, which is more specifically designated as the *Coutumier de Normandie*, embodies the laws and customs of Normandy, and is much more ancient, having been made about the year 1229, in the reign of Henry III. of England. The great similarity between this latter collection and the ancient laws of England has been regarded as indicating that the Norman laws were in great measure derived from the English.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Grand Days, the days of social festivity appointed by the English Benchers for the entertainment of judges, barristers, and students of the Inns. These were formerly great occasions, and were celebrated four times a year with much revelry.

Grand Détour, post-tp. of Ogle co., Ill., at the Great Bend of Rock River, 166 miles N. N. E. of Springfield. Pop. 605.

Grandee' [Sp. *grande*, "great"], in the kingdom of Castile, and afterwards in Spain, a nobleman of the most highly privileged class. The privileges of the grandees, always greater than those of the merely titled nobility, have been subject to great variations. Originally feudal magnates, their privileges latterly have degenerated to childish matters of punctilio.

Grande Ligne, post-v. of St. John's co., Quebec, Canada, near the Richelieu River, and on the Montreal St. John's and Rouse's Point R. R., 17 miles N. of Rouse's Point, N. Y., has an academy, and is the seat of the celebrated Baptist mission established by the late Mme. Feller among the Canadian French. Pop. about 400.

Grande Ronde, The, a beautiful valley of Union co., Or., near the N. E. corner of the State. It is drained by the Grande Ronde River. It lies E. of the Blue Mountains and W. of Snake River. It has 275,000 acres of fertile arable land, and timber abounds on the mountains around it. La Grand is the principal town.

Grand Forks, county of Dakota, separated from Minnesota on the E. by the Red River of the North. Area, about 4200 square miles.

Grand Glauze, tp. of Jackson co., Ark., on the Cairo and Fulton R. R. Pop. 447.

Grand Gulf, post-v. of Claiborne co., Miss., on the Mississippi River, 2 miles below the mouth of the Big Black. It is on a high bluff, and has a hospital, a theatre, and trade in cotton and lumber. Pop. 190.

Grand Ha'ven, city and tp., cap. of Ottawa co., Mich., on Lake Michigan, opposite Milwaukee, Wis. It is connected with Milwaukee, Chicago, and ports N. and S. by 5 daily lines of large steamers. It is the terminus of the Detroit and Milwaukee R. R., and is the transfer-station of the Lake Shore R. R. It has a national bank, 2 newspapers, a high school, 8 churches, a public library, magnetic mineral springs, a fine hotel, 2 shipyards, and several manufactories. It is a summer resort. Pop. of city, 3147; of tp., exclusive of city, 558.

JOHN H. MITCHELL, SR. ED. AND PROP. "NEWS."

Grand Isl'and, post-tp. of Colusa co., Cal. Pop. 702.

Grand Island, city, cap. of Hall co., Neb., situated in the Great Platte Valley, 153 miles W. of the Missouri River, on the Union Pacific R. R. It is the end of the eastern division of the road, and also the initial point of the Grand Island Hastings and St. Joseph and the Central Nebraska and Montana R. Rs., running S. from the city, and the eastern terminus of the Grand Island and Nebraska R. R., on all of which work has already been commenced. It has a large flouring-mill, 3 public halls, 2 churches, 1 public-school building, 2 newspapers, 4 hotels, and 16 stores, and is growing rapidly. Principal business, handling and shipping grain. Pop. about 1600.

S. P. MOBLEY, ED. "INDEPENDENT."

Grand Island, tp. of Erie co., N. Y., consisting of Grand, Beaver, and Buckhorn islands in Niagara River, above the Falls. Here (1810–25) Maj. M. M. Noah vainly attempted to found a Jewish city of refuge. Pop. 1126.

Grand Isle, the north-westernmost county of Vermont, consisting of North and South Hero, and other islands in Lake Champlain, and of a part of a peninsula extending S. from Canada into the lake. The soil is fertile. Cattle, grain, fruit, and wool are leading products. It is crossed by the Central Vermont R. R. Cap. North Hero. P. 4082.

Grand Isle, post-tp. of Grand Isle co., Vt., consisting principally of the N. part of South Hero Island, in Lake Champlain. It is 46 miles N. W. of Montpelier. P. 682.

Grand Junc'tion, post-v. of Greene co., Ia., at the junction of the Keokuk and Des Moines and the Chicago and North-western R. Rs., 50 miles N. of Des Moines and 80 miles E. of the Missouri River. It has a bank, a newspaper, a graded school, a large steam flouring-mill, 2 large hotels, and the usual number of stores and shops. Principal business, farming and stock-raising. Pop. 444.

S. C. MAYNARD, ED. "HEAD-LIGHT."

Grand Junction, post-v. of Van Buren co., Mich., at the crossing of the Chicago and Michigan Lake Shore R. R. and the S. Haven division of the Michigan Central.

Grand Junction, post-v., cap. of Bell co., Tenn., at the crossing of the Mississippi Central and the Memphis and Charleston R. Rs., 52 miles E. by S. of Memphis.

Grand Ju'ry, a jury whose province it is to determine whether indictments shall be brought against alleged criminal offenders. The origin of the custom making the trial of any person for a crime entirely dependent upon the decision of his fellow-citizens must be referred to a very ancient period of English history; and its importance as a safeguard for the due protection of civil liberty, by prevent-

ing vexatious and vindictive prosecutions has caused its scrupulous maintenance down to the present day as a cardinal principle in English jurisprudence. In the U. S. the continuance of the practice has been deemed so essential to public welfare that provisions have been inserted in the national Constitution, and, for the most part, in the State constitutions as well, prohibiting criminal prosecutions for all but an inferior class of offences, or such as occur among the military or naval forces, except upon the presentment or indictment of a grand jury. The power of the government to prosecute on account of political or partisan reasons receives by this institution a salutary restriction.

As constituted under the common law, a grand jury must consist of not more than twenty-four members nor less than twelve, but in practice not more than twenty-three are ever sworn, in order that twelve may form a majority, for the concurrence of at least this number is always required that a bill of indictment may be found. The grand jury receives its name from its size, to distinguish it from the petit (*i. e.* "little") jury, which consists of only twelve men. There is also a diversity between them in another important respect, since it is a rule in regard to a petit jury that unanimity is required, instead of the agreement of a mere majority. In a few of the American States the number of members composing a grand jury has been altered by statute. In New York, for example, it varies from sixteen to twenty-three, in Massachusetts from thirteen to twenty-three, but the rule that twelve only need concur seems to have been uniformly retained. The proper number of jurors is returned by the sheriff or marshal at every session of a court for the trial of criminal causes, in pursuance of a writ termed a "venire," which directs him to summon a jury to be present at the appointed time. The names of those to be summoned are determined by lot from among the whole number of citizens liable to jury duty. After the appearance of those selected a foreman is either chosen by themselves or appointed by the court, and they are severally required to take an oath to perform their duties faithfully and impartially. This organization of the jury is termed an "impanelling." In performing their duties of investigation they sit in secret, and may either consider and pass upon bills of indictment presented by the attorney-general or other officer representing the government, or they may make presentments by themselves independently. By a "presentment" is meant an accusation made by the grand jury upon their own observation and knowledge or upon evidence laid before them, and without any introduction of a bill at the instance of the governmental officer. Much the larger proportion of business transacted, however, is regularly brought forward by the prosecuting attorney, and even when there is a jury presentment the proper officer of the court must frame an indictment upon which the party accused may be brought to trial. The proceedings before a grand jury are entirely *ex parte.* Only witnesses in support of the prosecution are examined, and no evidence is admitted in favor of the accused. The effect of a conclusion that an indictment shall be brought is not to determine the guilt of the alleged offender conclusively, but only presumptively. The decision of the jury merely indicates that in their opinion the evidence against him is of sufficient weight to justify his being brought to trial; the introduction of his defence may establish his perfect innocence. The sound rule is, that the evidence before the grand jury should be sufficient to convict him, unless he offer evidence in his defence, at the trial. The rule requiring the preservation of secresy in the conduct of the deliberations of a grand jury is very stringent. No spectators are allowed to be present, but only the officers presenting the accusation and the necessary witnesses. The jurors, moreover, are not permitted, on grounds of public policy, to disclose in a court of justice what occurs in the jury-room. The enforcement of this rule is necessary in order that the consultation may be free and unbiassed, that no fear of animosity or hostile acts on the part of those against whom accusations are brought may deter the jurors from agreeing upon an indictment if they deem it proper and requisite, and that those indicted may not receive intelligence of the fact, and be thus enabled to make their escape. But in some instances a grand juror may by statute be compelled to serve as a witness upon the actual trial of the cause, to establish, as a part of the requisite testimony, what occurred before him. A case of this kind might arise when the evidence of a witness upon the trial was directly contrary to that given before the grand jury, and it became necessary to prove the variance, that his testimony might be impeached or a prosecution for perjury brought against him. If the requisite number of members of a grand jury are satisfied, from the evidence presented to them, of the truth of the accusation, they write upon the back of the indictment the words, "A true bill;" but if they are convinced of the groundlessness of the charge, the indorsement is "Not a true bill" or "Not found." Formerly they used in this latter case the word *Ignoramus*, "we are ignorant." This is the origin of the common expression, "that the bill of indictment has been *ignored.*" After all the accusations laid before the jury are considered, and indictments found or denied, their labors are ended, and the causes are ready for trial before a petit jury. (See JURY.) GEORGE CHASE. REV. BY T. W. DWIGHT.

Grand Lake, in Maine. This name sometimes designates the great SCHOODIC LAKE, between Maine and New Brunswick, but it is more properly restricted to a large lake lying some 30 miles S. of the former. It is mostly in Washington co. Its waters are discharged into the St. Croix. Both these lakes are famous for trout and land-locked salmon.

Grand Lake, a large sheet of water in Iberia, St. Martin's, and St. Mary's parishes, La. It is often called Lake Chetimaches. It is connected with Atchafalaya Bayou, is very shallow, and scarcely navigable.

Grand Ledge, post-v. of Eaton co., Mich., 12½ miles from Lansing. It has 4 hotels, 1 newspaper, a good improved water-power, and 4 mineral wells. It is a resort for invalids. Pop. about 1200.

SAUNDERS & WESTLAND, PUBS. "INDEPENDENT."

Grand Manan′ [*manan* signifies "island" in the Passamaquoddy language], an island in the Bay of Fundy, belonging to Charlotte co., N. B. Lat. of N. E. head, 44° 45′ N., lon. 66° 45′ W.; lat. of S. W. head, 44° 34′ N., lon. 66° 53′ W. It is 22 miles long, and from 3 to 6 miles in breadth. It is fertile and well timbered, and its coast abounds in good harbors. Its shores are bold and high, but the general surface is not greatly elevated. The herring, haddock, and cod fisheries are important. Grand Harbor is the principal settlement. The island is a favorite summer resort. Total pop. 1867.

Grand Mead′ow, tp. of Clayton co., Ia. Pop. 945.

Grand Meadow, post-tp. of Mower co., Minn. P. 444.

Grand Monad′nock, or **Monadnock,** an isolated mountain-peak in Jaffrey tp., Cheshire co., N. H. It is 3718 feet high, and is visible for many miles in every direction. The view from its top is very fine. It is regarded as an outlying member of the White Mountain group.

Grand Pass, tp. of Saline co., Mo. Pop. 1956.

Grand Pen′sionary, in the former Dutch republic, the state secretary for the province of Holland. He was originally also advocate-general for the same province. In later times he was, by virtue of his position, an official of the states-general, a kind of premier in that body, and a virtual minister of foreign affairs. His term of office was five years. The syndic, or paid consellor, of any important Dutch town was called a pensionary.

Grand-Pierre (JEAN HENRI), D. D., was b. at Neuchâtel, Switzerland, in 1799. He was educated in his native city and at the University of Tübingen in Germany. He was licensed to preach by the consistory of Neuchâtel, and was called to be an assistant pastor at Bâle, Switzerland, in 1823. Here he was associated with the eloquent and pious Vinet, and his success was so remarkable that his reputation extended beyond his own country to France. In 1827 he was called to Paris to take charge of the House of Missions, which is a theological seminary for training young men for the work of foreign missions. He was not only president of this institution, but also professor of theology, of languages, etc., and became known as one of the most eloquent and successful preachers in the city of Paris. The place in which he preached was repeatedly changed in consequence of the numbers that flocked to hear him. It was at the time of the revolution of July, 1830, that a remarkable revival of religion occurred among the Protestants of Paris, and M. Grand-Pierre was one of the most eminent ministers engaged in it. He did not join in the movement for an independent Church, which was one of the results of this revival, but remained in connection with the national Church. For some years he was at Batignolles, a suburb of Paris, but during nearly the last twenty years of his life he was pastor of l'Oratoire, the most important Protestant church in Paris, and for a number of years was president of the consistory of Paris. After the death of his colleague, M. Adolphe Monod, he was the acknowledged leader of the orthodox party in the Reformed Church, and possessed great influence not only in the Church, but upon the public at large. Under Louis Philippe the government gave him "grand letters of naturalization for his distinguished services to France." This was an unusual honor to be conferred upon a Protestant minister, and for services essentially religious. Under Napoleon III. he was made a member of the Legion of Honor. In 1838 the College of New Jersey conferred upon him the degree of doctor of

divinity. He twice visited America, publishing an account of his first visit in his *Glance at America* in 1850. He was in this country in 1870, when the Franco-German war broke out, but hastened home, and reached Paris just as the empire fell and the republic was proclaimed. With his wife he passed through the privations of the siege and the horrors of the Commune. In consequence of feeble health he resigned his position in 1872, and retired to Lausanne in Switzerland. D. at Arlesheim, near Bâle, when visiting friends, July 10, 1874. As a preacher he was styled "the Bourdaloue of the French revival." For many years he was editor of *L'Espérance*, the principal religious paper of the orthodox Protestants in France. An easy, graceful, and learned writer, he published a number of works, almost entirely of a religious character. The principal of these are a series of sermons entitled *Doctrine Chrétienne, Vie Chrétienne, Unité et Variété, Tristesse et Consolation;* also *Séjour aux États-Unis d'Amérique, Le Guide du Fidèle, Essai sur le Pentateuque,* and *Souvenirs d'un Ancien Pasteur,* besides numerous reports, pamphlets, and occasional sermons.

Grand Prai'rie, tp. of Marion co., O. Pop. 370.

Grand Pré (post-o. Lower Horton), a beautiful village on the Basin of Minas, Horton tp., Kings co., N. S., on the Windsor and Annapolis Railway, 15 miles from Windsor, is the scene of Longfellow's *Evangeline.* It was settled by the French under De Monts in 1604, but they were expelled by the Virginia colonists in 1613. The Pré is a fertile tract of dyked land. Area, 10 square miles. Grand Pré is the seat of a seminary. Pop. about 600.

Grand Rap'ids, tp. of La Salle co., Ill. Pop. 1148.

Grand Rapids, city and tp., cap. of Kent co., Mich., at the head of navigation on Grand River, 30 miles E. of Lake Michigan. Six railroads enter the city, connecting it with all important points. It is in the midst of an excellent agricultural and fruit-growing region, and is a place of great manufacturing and commercial importance. It is an important distributing point for pine and hard-wood lumber. Its manufactures of furniture, wooden-ware, agricultural implements, brushes, and machinery are extensive, upwards of $2,000,000 being invested in the manufacture of furniture alone. Extensive quarries of gypsum are operated near the city, from which the product amounts to 100,000 barrels of stucco and 100,000 tons of land-plaster annually. The city has 2 public parks, 2 street railways, a paid fire department, and a reservoir system of waterworks. It is the place for holding the U. S. circuit and district courts for the Western district of Michigan. It has 3 daily and 6 weekly newspapers, one of the latter printed in the Dutch language; 2 national, 3 private, and 1 savings bank, and a public library of 7000 volumes. Grand River at this point has a fall of 17 feet in a distance of 2 miles, affording an excellent water-power, which is used for manufacturing and milling purposes. Pop. of city, 16,507; of tp., exclusive of city, 1650. Ed. "Daily Eagle."

Grand Rapids, post-v. of Wood co., O.

Grand Rapids, city and tp., cap. of Wood co., Wis., on the Wisconsin River and the Wisconsin Valley and Green Bay and Minnesota R. Rs., 200 miles N. W. of Milwaukee. It has a national bank, 2 newspapers, a large machine-shop and foundry, several lumber-mills, 3 churches, 5 hotels, and a number of stores. Large beds of pure kaolin are found in close proximity. Principal business, lumbering and agriculture. Pop. of city, 1115; of tp. 1661.

H. B. Philleo, Ed. "Wood Co. Reporter."

Grand Riv'er, in Michigan, is formed by the union of various streams in the southern peninsula, and flows in a devious course to Lake Michigan. At its mouth is Grand Haven. The river is navigable 40 miles to Grand Rapids, and boats ply upon it 50 miles above that point.

Grand River, in Missouri, an affluent of the Missouri River. Its head-streams rise in Iowa. With its numerous forks it drains a large part of Northern Missouri. Its mouth is at Brunswick in Chariton co.—Another Grand River is a north-western fork of the Osage.

Grand River, in Ohio, flows into Lake Erie at Fairport, Lake co. Its course is generally westward, through a pleasant region.

Grand River, in Utah, becomes, after its union with Green River, the Rio Colorado of the West. It is formed in Colorado by the union of the Blue and Gunnison rivers.

Grand River, tp. of Adair co., Ia. Pop. 235.

Grand River, tp. of Decatur co., Ia. Pop. 345.

Grand River, tp. of Madison co., Ia. Pop. 598.

Grand River, tp. of Wayne co., Ia. Pop. 833.

Grand River, tp. of Bates co., Mo. Pop. 1024.

Grand River, tp. of Carroll co., Mo. Pop. 3802.

Grand River, tp. of Cass co., Mo. It includes Harrisonville, the county-seat. Pop. 3978.

Grand River, tp. of Daviess co., Mo. Pop. 1093.

Grand River, tp. of De Kalb co., Mo. Pop. 959.

Grand River, tp. of Henry co., Mo. It includes Clinton, the county-seat. Pop. 5450.

Grand River, tp. of Livingston co., Mo. Pop. 1160.

Grand Sergeanty. See Tenure, by Prof. T. W. Dwight, LL.D.

Grand Tactics. See Tactics.

Grand Tower, post-v. and tp. of Jackson co., Ill., on the Mississippi, 120 miles below St. Louis, is the W. terminus of the Grand Tower and Carbondale R. R. It ships coal by the river, and has 1 weekly newspaper, large iron-works and an active trade. It takes its name from a huge rock in the river. Pop. of tp. 2181.

Grand Trav'erse, county of the N. part of the southern peninsula of Michigan, having Grand Traverse Bay to the N. Area, 500 square miles. It has numerous lakes and hard-wood forests, and its climate is far less severe than might be supposed from its latitude, 45° N. Grain is raised considerably. Cap. Traverse City. Pop. 4443.

Grand Traverse Bay, in Michigan, extends S. from Lake Michigan. Its southern part is divided by Preogenise Point into the E. and W. arms. Leelenaw co. lies on the W., Antrim co. on the E., Grand Traverse co. on the S.

Grandview', post-tp. of Edgar co., Ill. Pop. 1899.

Grand View, post-v. of Hammond tp., Spencer co., Ind., on the Ohio River, 5 miles N. E. of Rockport. It has 1 weekly newspaper.

Grandview, post-v. of Louisa co., Ia. Pop. 422; of Grandview tp. 1635.

Grand View, post-v. of Washington co., O., on the Ohio River, 15 miles above Marietta. Pop. 193; of Grand View tp. 2273.

Grane, or **Quade,** town of Arabia, on the Persian Gulf, in lat. 29° 23′ N. It has a very extensive trade on the Red Sea and with India. Pop. 8000.

Grange, an old English word derived from the Latin *granum,* through the Spanish, Portuguese, and Provençal *granja,* and the French *grange.* We find the word used by most of the poets from Spenser, Shakspeare, and Milton down to our own time, and occasionally by eminent prose-writers, but in slightly different significations. Primarily, it seems to have signified a granary or storehouse for grain; from this it passed to comprise the outhouses of the farm generally, as the stables, poultry-house, etc., and at an early period it was also used to designate an isolated farmhouse of the better class, a sort of semi-castle with its moat, drawbridge, portcullis, etc. Both in England and the U. S. the word has been frequently used as a proper name to designate an estate, with or without a prefix; as, The Grange, Suffolk, or Belair Grange.

Since 1867 the word has been extensively used with a still different meaning. The order of Patrons of Husbandry (see Patrons of Husbandry) in that year selected it as the name of their national, State, and subordinate organizations. The National Grange, which holds an annual session, is composed of the masters or presiding officers, past-masters of the State granges, and the wives of each; the founders of the order; and the present and past officers of the National Grange. The State granges are composed of the masters and past-masters of the subordinate granges, with their wives, who are members of the order, and the deputies or organizing officers, as well as the previous and current officers of the State grange. The subordinate granges are composed of the officers and lay members, male and female, within a given territory, or in a city those who from acquaintance or other causes most naturally affiliate with each other. All the members of the granges must be "interested in husbandry," and not connected with any interest which is in conflict with it. Every fully organized grange, whether subordinate, State, or national, should have thirteen officers, having the following titles: master, overseer, lecturer, steward, assistant steward, chaplain, treasurer, secretary, gate-keeper, Ceres, Pomona, Flora, and lady assistant steward. The last four are women. The room or hall in which the meetings of the grange are held is designated as the grange-room. The exercises of the grange at its meetings are, aside from those connected with its ritual, social, intellectual, politico-economical, and moral. The effect of these frequent gatherings (the granges usually meeting weekly or fortnightly), with their music, their libraries and periodicals, their discussions, and their financial aid and co-operation, has been very salutary upon the farmers of the North-west, West, and South, where they are most numerous. They have become more intelligent,

thoughtful, and successful farmers, and better citizens. There were in Aug., 1874, over 25,000 subordinate granges in the U. S., having a membership of about 2,000,000. (For the origin, history, and purposes of the order, see PATRONS OF HUSBANDRY.) L. P. BROCKETT.

Grang'er, post-tp. of Allegany co., N. Y. Pop. 1050.

Granger, post-tp. of Medina co., O. Pop. 987.

Granger (FRANCIS), b. at Suffield, Conn., Dec. 1, 1792; from 1826–31 was a member of the general assembly of New York; member of Congress 1835–37, 1839–40 from New York; appointed in Mar., 1841, U. S. postmaster-general; delegate to the peace convention in Feb., 1861. D. in Canandaigua, N. Y., Aug. 28, 1868. He was a son of Gideon Granger.

Granger (GIDEON), b. in Suffield, Conn., July 19, 1767; graduated at Yale College in 1787, and, being admitted to the bar, rapidly rose to distinction; was a member of the legislature of Connecticut; one of the originators of the Connecticut school fund; postmaster-general 1801–14; in the State senate in 1819. Author of several essays on the school fund, etc. D. in Canandaigua, N. Y., Dec. 31, 1822.

Granger (GORDON), b. in New York in 1821; graduated at the U. S. Military Academy; entered the army as brevet second lieutenant of infantry July, 1845; transferred to the mounted rifles in July, 1846, and in May, 1847, attained a full second lieutenancy. In the war with Mexico he was actively engaged at the siege of Vera Cruz, in the battles of Cerro Gordo, Contreras, Churubusco, Chapultepec, and the final attack and capture of the capital; promoted to be first lieutenant in 1852, captain May, 1861; transferred to 3d Cavalry Aug., 1861. From 1848 to 1861 he was almost constantly on active duty on the frontier against hostile Indians. When the civil war commenced he was in June assigned to duty on the staff of Gen. Sturgis, and participated in the battles of Dug Spring and Wilson's Creek. In September he was appointed colonel 2d Michigan Cavalry, and in Mar., 1862, brigadier-general U. S. volunteers. In the movement on New Madrid he commanded a brigade, and at the capture of Island No. 10; in command of cavalry in the advance on Corinth and subsequent pursuit of Beauregard's army. Promoted to be major-general of volunteers Sept., 1862, he commanded various districts in Kentucky and Tennessee, and at the defence of Franklin successfully repulsed the attack of Gen. Van Dorn; at the battle of Chickamauga he arrived in time to drive back the columns of Longstreet. At the battle of Missionary Ridge he commanded the 4th army corps; in the South-west the 13th corps, being engaged in the siege of Fort Morgan and Spanish Fort, the storming and capture of Blakely, and final occupation of Mobile; subsequently commanded the district of Texas and department of Kentucky. For gallant conduct in the Mexican war he was brevetted first lieutenant and captain, and for similar services in the civil war he received the successive brevets from major to that of major-general U. S. A. In July, 1866, he was appointed colonel 25th Infantry; transferred to 15th Infantry in 1870, which command he now holds (1875). G. C. SIMMONS.

Granger (MILES TOBEY), b. at New Marlboro', Mass., Aug. 12, 1817; graduated at the Wesleyan University, Conn., in 1842; taught in Louisiana; was admitted to the bar in Wilkinson co., Miss., in 1845; removed in 1847 to Canaan, Conn., where he was seventeen years a judge of probate; judge of the Connecticut superior court 1867–75, residing at North Canaan, Conn.

Granger (ROBERT S.), b. in Ohio in 1816; graduated at the U. S. Military Academy; entered the army as second lieutenant of infantry July, 1838; promoted to be first lieutenant 1839, captain 1847, and major 1861. His first service was in Florida, where he was engaged in the war against the Seminole Indians till 1841, when he was transferred to the northern frontier. With the exception of a year at the Military Academy as instructor of infantry tactics, he remained on frontier duty up to 1861, at which date he was captain 1st Infantry, stationed in Texas, where he was captured Apr. 27. He was subsequently paroled, and not exchanged till Aug., 1862. In Sept., 1862, he was appointed brigadier-general Kentucky vols., and acting brigadier-general U. S. vols. Assuming command of State troops Sept. 1, he was engaged in a skirmish at Lebanon and at the battle of Lawrenceburg, Ky.; subsequently commanded a division of the army of the Cumberland and various districts in Tennessee and Alabama; captured Gen. Roddy's camp near Courtland, and was engaged in driving the command of Gen. Wheeler from Middle Tennessee; defence against raids of Gen. Forrest; defence of Decatur, Ala., and assault upon the Confederate siege-works at that place. Brevetted colonel, brigadier-general, and major-general for gallant conduct; mustered out of volunteer service Jan., 1866. In June, 1865, he was promoted to be lieutenant-colonel 11th Infantry, and colonel 21st Infantry Aug., 1871. Retired from active service Dec., 1873. G. C. SIMMONS.

Grani'cus, the ancient name of the Kodshasu, a small river of Asia Minor, which rises in Mount Ida and runs into the Sea of Marmora. Here Alexander the Great won his first great victory over the Persians, in 334 B. C.

Granier de Cassagnac (ADOLPHE), b. at Bergelles in 1808. As early as 1832 he was one of the editors of the *Journal des Débats* and the *Revue de Paris*. After a voyage to the French West Indies, where he was married, he advocated the maintenance of slavery in the French colonies, and started many papers in Paris. In 1852 he was elected deputy to the Corps Législatif, of which he remained a member until the fall of the empire. He was chief editor of *Le Pays*, an imperialist paper. He wrote a *History of the Laboring and Bourgeois Classes, History of the Causes of the Revolution, Voyage to the French West Indies*, etc.

Granier de Cassagnac (PAUL), son of Adolphe, b. about 1841; became assistant to his father on *Le Pays* 1866, and afterwards chief editor, a position he still retains (1875). He has become widely notorious as the champion of imperialism, less by his pen than by his sword, employed in numerous "affairs of honor," of which the most celebrated were those with Gustave de Flourens, Lockroy, and Ranc. He served as a volunteer in the Franco-German war, and was taken prisoner at Sedan. During 1875 he was brought prominently into notice by his philippics against Gen. Wimpffen and Henri Rochefort.

Gran'ite, a crystalline granular rock essentially composed of quartz, feldspar, and mica, but often containing other minerals, such as hornblende, talc, etc., in such quantities as to modify its structure and produce varieties which have received distinct names, as syenite, in which the mica is chiefly replaced by hornblende, and protogine, in which the mica is largely replaced by talc. Granite is the most widely diffused of all known rocks, and as it is usually strong and durable, and may be quarried in blocks of any desired size or form, it has always been largely employed for architectural purposes. From its density and granular structure it works with difficulty under the chisel, and is rarely employed for ornamental work where elaborate carving is required, but it receives a high polish, and is therefore well adapted to the construction of columns, obelisks, etc. From the qualities mentioned, granite is more especially suited to heavy work, such as the construction of docks, bridges, foundations, and the more massive kinds of buildings. The prevailing colors of granite are gray and red, a difference occasioned by the presence or absence of iron in the feldspar. This feldspar is usually orthoclase, in which the alkali is potash, but it is frequently albite or soda-feldspar. In strength granite exceeds all other building-stones in common use. Its resistance to a crushing force varies, according to trials reported, from 2300 to 13,400 pounds to the square inch. Its weight is about 166 pounds to the cubic foot; hence, a cubic yard weighs about two tons. The specific gravity of ordinary granite is 2.66. It usually contains nearly 1 per cent. of water. Granite has been largely employed for architectural purposes from the most ancient times. Many of the monuments of Egypt are constructed from syenitic granite quarried at Syene in Upper Egypt, and where not marred by violence some blocks of this stone which have been exposed to the action of the weather for more than 4000 years show little deterioration. Granite has, however, this peculiarity, that, owing to the unequal expansion of its parts, it cracks, and sometimes explodes, when exposed to the action of fire, and it is therefore more easily destroyed by this agent than sandstone, brick, or even marble.

The granites used in the U. S. are obtained from many sources, the larger part being derived from quarries on the coast of New England, where granite forms a conspicuous feature among the crystalline rocks by which this region is generally underlaid. The islands off the coast of Maine are chiefly composed of granite, and on Dix Island and Mt. Desert gray granites of excellent quality are found, which are extensively quarried to supply the demand in the cities on the Atlantic slope of the U. S. The granite used in the construction of several public buildings at Washington comes from Maine. The gray granite quarried at Quincy, Mass., is one of the best known and highly esteemed varieties used in this country. A granite of similar quality, but of lighter color, and on that account sometimes preferred, is brought from Concord, N. H. The red granite now so much used for monumental purposes in this country is brought from Peterhead, near Aberdeen, Scotland. This is composed of red orthoclase, albite, black mica, and quartz, and is justly esteemed for its beauty, closeness of texture, and homogeneousness. A gray granite is imported from Aberdeen. This also takes a high

polish, and is much used for monuments and columns. A red granite resembling that brought from Scotland is found at St. George, New Brunswick, on the Bay of Fundy. In beauty and durability it is scarcely inferior to its foreign rival. In all the mountain-chains of our country granitic rocks abound, and excellent stone of red or gray color may be obtained from a great number of localities. In the Laurentian area back of Marquette, Lake Superior, a red syenite occurs which is fully equal in beauty and durability to the Aberdeen granite. This will hereafter undoubtedly be used in the great cities which are growing up on the lakes, but at present the wants of their inhabitants are so well supplied with handsome and excellent freestones that granite is very little used. In the Rocky Mountains both red and gray granites abound, and in the southern portion of this chain the granite which forms the core or centre of many of the ranges is red, and resembles the Scotch granite. In the Sierra Nevada the granites are generally gray, and sometimes nearly white, from the albite of which they are chiefly composed.

The origin of granite has been much discussed among lithologists. It is popularly regarded as the oldest of rocks, but is in fact of all ages, some of it being, geologically speaking, very modern. Granite is generally classed as a plutonic igneous rock—*i. e.* one that has been completely fused, but has solidified at great depths, and hence under great pressure. That it has formed slowly is shown by its coarse crystallization. Most granites are, however, probably metamorphic — *i. e.* are sedimentary deposits changed and made crystalline by long-continued but not necessarily very high heat, and especially through the influence of steam. Sorby and Zirkel have found cavities partially filled with water in the crystals of some granites. These they consider as evidence of the presence of steam during their formation. By measuring the relative quantity of water in the crystal cavities of different granites, Sorby has attempted to determine the relative pressure under which they consolidated. By observations of this kind he has been led to the conclusion that some granites have solidified at a depth of 28,700 feet greater than others. That some granites have been completely fused is shown by the fact that they have been injected into fissures which ramify through other rock, such as slate, and even limestone. When granite is distinctly stratified—like most of that of New England and the Alleghany belt—it is called gneiss. Granite is often found decomposed to a considerable depth by atmospheric action; this is specially marked in the granites of the tropics, and is also well shown in the southern portion of the Alleghanies. This disintegration was called by Dolomieux *la maladie du granite,* and he attributes it to the action of carbonic acid on the feldspar. Granite veins are often found decomposed in this way. In such cases the feldspar is changed to kaolin, and a large part of the kaolin of commerce is derived from these decomposed veins. J. S. Newberry.

Granite, tp. of Sacramento co., Cal. Pop. 1579.

Granite, post-v., cap. of Lake co., Col., on the Arkansas, 50 miles S. W. of Fairplay. It has important gold-mines.

Gran'ite Falls, post-tp. of Chippewa co., Minn. Pop. 373.

Gran'iteville, post-v. of Westford tp., Middlesex co., Mass., on the Stony Brook R. R., has extensive granite-quarries.

Graniteville, post-v. of Aiken co., S. C., at the junction of the Charlotte Columbia and Augusta and the South Carolina R. Rs., 12 miles N. E. of Augusta, Ga. It has prosperous manufactures, running 600 cotton-looms.

Gran Miche'le, or **Grammiche'le,** town of Sicily, in the province of Catania, near which are found interesting remains of the Græco-Sicilian period. Pop. 10,192.

Grant. In its most comprehensive sense the term *grant* denotes a transfer of any kind of property from one person to another, but it acquired at common law a specific technical signification, being confined in its application to a conveyance of such intangible interests in real property as reversions, rents, franchises, and other kinds of incorporeal hereditaments. In the early history of the English law feoffment and grant constituted the only modes of conveyance unconnected with judicial proceedings, the former being employed in the transfer of freehold estates of a tangible nature, of which an actual delivery of possession, termed in law, "livery of seizin," could be made (see Feoffment); while the latter was adopted when, from the necessity of the case, an actual transfer of possession would have been impossible, either on account of the unsubstantial nature of the interest conveyed or because the estate to be created was future and reversionary in its nature. Therefore, corporeal hereditaments were said to "lie in livery" —those incorporeal to "lie in grant." The grant was evidenced by a deed containing appropriate words of transfer, as *dedi et concessi* ("I have given and granted"), and corresponding terms have been retained in conveyances by deed until the present day. But the old system of feoffment has gone out of use, and it has been declared by statute in England that the distinction between corporeal and incorporeal forms of real property shall be abolished, and that transfer by grant shall be sufficient for both these classes of estates. In the U. S. also the ancient and distinctive meaning of the word has received important modifications. Still, in a majority of the States it would be generally employed, if used at all, with particular reference to the conveyance of incorporeal interests, as formerly. But in New York a special statutory provision has been enacted by which every mode of transfer of a freehold has been declared a grant, so that though deeds of bargain and sale and of lease and release may continue to be used, they are to be deemed grants. In Maine, New Hampshire, and Massachusetts nearly every form of conveyance is in actual practice denominated a grant, so that the old peculiar meaning of the word seems effectually abolished.

Besides "private grant," which is a transfer by a private person, there is a mode of conveyance known in law as "office grant," which consists in a transfer of land made by some officer of the law where the owner is either unwilling or unable to execute the necessary deeds to pass the title. An example would be the conveyance of lands sold by a government official for the payment of taxes, or by an administrator under license of the court for the payment of the debts of the deceased. The phrase "public grant" is employed to designate the mode of creating a title in an individual to lands which had previously belonged to the government. Conveyances of this kind are also termed "letters patent."

George Chase. Revised by T. W. Dwight.

Grant, county of S. Central Arkansas. Area, about 615 square miles. Its surface is rolling and somewhat broken; the valleys fertile, the mineral wealth great, but unexploited. Corn and cotton are leading products. Cap. Sheridan. Pop. 3943.

Grant, county of Dakota, bounded E. and N. E. by Minnesota, and having Big Stone Lake on the N. E. border. It is not included in the returns of the census of 1870. Area, about 700 square miles.

Grant, county of N. E. Central Indiana. Area, 420 square miles. It is level and fertile, producing wool, grain, and cattle in abundance. Lumber is sawed and carriages and wagons manufactured. The county is traversed by the Pittsburg Cincinnati and St. Louis R. R. Cap. Marion. Pop. 18,487.

Grant, county in the S. W. of Kansas. Area, 720 square miles. It is traversed by the Arkansas River. It is open prairie for the most part.

Grant, county in the N. of Kentucky, occupying a part of the watershed between the Kentucky and the Licking rivers. Much of the soil is very fertile. Cattle, grain, tobacco, and wool are leading products. Area, 200 square miles. Cap. Williamstown. Pop. 9529.

Grant, parish of Central Louisiana, bounded on the W. by the Rigolet de Bon Dieu, and on the E. by Bayou Saline. Area, about 500 square miles. It is well watered and fertile. Cotton is the leading product. Cap. Colfax. Pop. 4517.

Grant, county of W. Central Minnesota. Area, 576 square miles. It is traversed by the St. Paul and Pacific R. R., and is fertile, and diversified with hills and small lakes. Cap. Herman. Pop. 340.

Grant, county of Nebraska. Pop. 484. Since the U. S. census this county has been broken up and parceled out to other counties.

Grant, the south-westernmost county of New Mexico, bordering on Mexico and Arizona. Area, about 8430 square miles. It contains great mineral wealth. Copper, gold, silver, iron, and lead are abundant. The surface is in many parts elevated, broken, and dry. Cap. Silver City. Pop. 1143.

Grant, large county of Eastern Oregon, containing 20,020 square miles. Towards the N. it is mountainous. The southern part is a basin containing numerous lakes with no outlets. The climate is dry and healthful. The soil is finely adapted to grazing, and the mineral wealth is probably great. Some grain is produced. Cap. Cañon City. Pop. 2251.

Grant, county of the N. E. of West Virginia. Area, about 375 square miles. It is bounded on the N. W. by Maryland. The surface is mountainous, with smooth plateaus and valleys. Wool is a leading product. Coal and iron are found. Cap. Grant. Pop. 4467.

Grant, the south-westernmost county of Wisconsin. Area, about 1100 square miles. The surface is diversified, the soil fertile. Lead and zinc are abundant, and the former is extensively mined. Cattle, grain, and wool are staple products. Flour and wagons are leading manufactures. Cap. Lancaster. Pop. 37,979.

Grant, tp. of Johnson co., Ark. Pop. 960.

Grant, tp. of Lake co., Ill. Pop. 572.

Grant, tp. of Vermilion co., Ill. Pop. 1204.

Grant, tp. of Benton co., Ind. Pop. 835.

Grant, tp. of Greene co., Ind. Pop. 532.

Grant, tp. of Newton co., Ind. Pop. 699.

Grant, tp. of Cerro Gordo co., Ia. Pop. 95.

Grant, tp. of Dallas co., Ia. Pop. 382.

Grant, tp. of Franklin co., Ia. Pop. 156.

Grant, tp. of Grundy co., Ia. Pop. 436.

Grant, tp. of Guthrie co., Ia. Pop. 104.

Grant, tp. of Hardin co., Ia. Pop. 148.

Grant, tp. of Monona co., Ia. Pop. 252.

Grant, post-tp. of Montgomery co., Ia. Pop. 351.

Grant, tp. of Page co., Ia. Pop. 201.

Grant, tp. of Ringgold co., Ia. Pop. 290.

Grant, tp. of Story co., Ia. Pop. 406.

Grant, tp. of Tama co., Ia. Pop. 211.

Grant, tp. of Taylor co., Ia. Pop. 173.

Grant, tp. of Crawford co., Kan. Pop. 421.

Grant, tp. of Dickinson co., Kan. Pop. 849.

Grant, tp. of Douglas co., Kan. Pop. 583.

Grant, tp. of Republic co., Kan. Pop. 292.

Grant, tp. of Riley co., Kan. Pop. 616.

Grant, tp. of Clare co., Mich. Pop. 147.

Grant, tp. of Grand Traverse co., Mich. Pop. 293.

Grant, tp. of Huron co., Mich. Pop. 309.

Grant, tp. of Iosco co., Mich. Pop. 107.

Grant, tp. of Keweenaw co., Mich. Pop. 152.

Grant, tp. of Mason co., Mich. Pop. 125.

Grant, tp. of Mecosta co., Mich. Pop. 144.

Grant, tp. of Newaygo co., Mich. Pop. 77.

Grant, tp. of Oceana co., Mich. Pop. 208.

Grant, tp. of St. Clair co., Mich. Pop. 1143.

Grant, tp. of Goodhue co., Minn. Pop. 338.

Grant, tp. of Washington co., Minn. Pop. 309.

Grant, tp. of Caldwell co., Mo. Pop. 909.

Grant, tp. of Clarke co., Mo. Pop. 756.

Grant, tp. of Dade co., Mo. Pop. 279.

Grant, tp. of Dallas co., Mo. Pop. 1002.

Grant, tp. of Daviess co., Mo. Pop. 784.

Grant, tp. of De Kalb co., Mo. Pop. 956.

Grant, tp. of Nodaway co., Mo. Pop. 1105.

Grant, tp. of Putnam co., Mo. Pop. 638.

Grant, tp. of Richardson co., Neb. Pop. 515.

Grant, tp. of Washington co., Neb. Pop. 479.

Grant (or **Booth**), post-v. of Russia tp., Herkimer co., N. Y. Pop. 71.

Grant, tp. of New Hanover co., N. C. Pop. 1119.

Grant, tp. of Randolph co., N. C. Pop. 949.

Grant, post-tp. of Indiana co., Pa. Pop. 999.

Grant, tp. of Darlington co., S. C. Pop. 2172.

Grant, tp. of Edgefield co., S. C. Pop. 1116.

Grant, tp. of Cabell co., West Va. Pop. 980.

Grant, tp. of Doddridge co., West Va. Pop. 1128.

Grant, post-v., the county-seat of Grant co., West Va., 30 miles S. W. of New Creek Station. Pop. of Grant tp. 1598.

Grant, tp. of Hancock co., West Va. Pop. 1005.

Grant, tp. of Harrison co., West Va. Pop. 1547.

Grant, tp. of Jackson co., West Va. Pop. 2031.

Grant, tp. of Jefferson co., West Va. It contains the village of Charlestown. Pop. 4571.

Grant, tp. of Marion co., West Va. Pop. 530.

Grant, tp. of Monongalia co., West Va. Pop. 2216.

Grant, tp. of Nicholas co., West Va. Pop. 729.

Grant, tp. of Pleasants co., West Va. Pop. 601.

Grant, tp. of Pocahontas co., West Va. Pop. 837.

Grant, tp. of Preston co., West Va. Pop. 1733.

Grant, tp. of Putnam co., West Va. Pop. 1146.

Grant, tp. of Ritchie co., West Va. Pop. 2552.

Grant, tp. of Wayne co., West Va. Pop. 1314.

Grant, tp. of Wetzel co., West Va. Pop. 1021.

Grant, tp. of Clark co., Wis. Pop. 386.

Grant, tp. of Dunn co., Wis. Pop. 588.

Grant, post-tp. of Portage co., Wis. Pop. 240.

Grant, tp. of Shawanaw co., Wis. Pop. 226.

Grant (Sir Alexander), Bart., LL.D., eighth baronet of his line, b. in 1826; was educated at Harrow and Balliol College, Oxford; became a fellow of Oriel 1849; an examiner for the Indian civil service 1855; came to the baronetcy 1856; was a public examiner at Oxford; appointed inspector of schools in the Madras presidency 1858; professor of history and political economy in Elphinstone College, Madras, 1860, and its principal 1862; vice-chancellor of the University of Bombay 1863; director of public instruction, Bombay presidency, 1865; vice-chancellor and principal of the University of Edinburgh 1868. Has published an edition, with notes, of Aristotle's *Ethics* and a summary of the works of Xenophon; is a son-in-law of the late Prof. Ferrier of St. Andrew's.

Grant (Anne), b. at Glasgow, Scotland, Feb. 21, 1755, the daughter of a British army-officer named McVicar, whose estate in Vermont (where she for some years lived) was confiscated during the American Revolution. She married in 1779 the Rev. Mr. Grant of Laggan, and became the mother of a large family. He d. in 1801, and the stress of poverty forced her into literary work. *The Highlanders*, a successful volume of verses (1803), *Letters from the Mountains* (1806–07), *Memoirs of an American Lady* (Mrs. Schuyler of Albany, 1808), *On the Superstitions of the Highlanders* (1811), *Eighteen Hundred and Thirteen* (a poem, 1814), are her principal works. D. at Edinburgh Nov. 7, 1838. Her *Life*, by J. P. Grant, her son, but partly autobiographical, was published in 1844.

Grant (James), b. at Edinburgh, Scotland, Aug. 1, 1822; at the age of ten he accompanied his father, who was a British officer, to Newfoundland, and his education was principally acquired in barracks in British North America. In 1839 he returned to England, and was appointed ensign in the 62d; retiring from the army, however, the following year, he turned his attention to literature, his first work, *The Romance of War, or Highlanders in Spain*, appearing in 1846, since when he has published many romances, principally of a military character, all of which have been well received, and many of them republished in America and translated into French and German. He is also a frequent contributor to periodicals. G. C. Simmons.

Grant (James Augustus), C. B., C. S. I., b. at Nairn in 1827; educated at the grammar school and at the Marischal College, Aberdeen. In 1845 he was appointed to the Indian army, and served at both sieges of Mooltan; was present at the battle of Goojerat, for which he received a medal, and did duty with the 78th Highlanders at the relief of Lucknow, where he was wounded. In 1863 he accompanied the late Capt. Speke on his exploration of the source of the Nile, a joint account of their travels being published in 1864, and was made a C. B. in 1866; accompanied the Abyssinian expedition under Lord Napier in 1868, and for his services was nominated a companion of the order of the Star of India, and afterwards went upon the retired list.

Grant (Gen. Sir James Hope), G. C. B., b. in 1808; entered the army in 1826 as cornet in the 9th Lancers; served with distinction in China as brigade major; served with his regiment at Sobraon, commanding it in the battles of Chillianwallah and Goojerat; in 1854 he became brevet colonel, and in 1858 was made a major-general and nominated a K. C. B. for his eminent services in command of the cavalry division at the siege of Delhi, at the relief of Lucknow, and in subsequent operations at Cawnpore. In the campaign in China terminating with the capture of Pekin he commanded the British forces throughout, for which he received the thanks of Parliament and was nominated a G. C. B.; appointed commander-in-chief at Madras in 1861, with the rank of lieutenant-general; appointed colonel 4th Hussars in 1861, and transferred to the 9th Lancers (his old regiment) in 1865. In 1872 he was promoted to be general. Author of *Incidents of the Sepoy War* (1874). D. Mar. 7, 1875.

Grant (Gen. Sir Patrick), G. C. B., G. C. M. G., b. at Duthill, Elginshire, Scotland, in 1804, and entered the military service of the East India Company in 1819; served for many years with distinction in India, and took part in the battles of Maharajpore, Moodkee, and Sobraon. In 1856 he was appointed commander-in-chief of the Madras army, and in 1857 of the army in India at the period of the mutiny; for his services during this period he was made a

G. C. B. and aide-de-camp to the queen; was made governor of Malta 1867–72, general in 1870, and colonel of the 78th Highlanders.

Grant (ULYSSES S.) was b. Apr. 27, 1822, at Point Pleasant, Clermont co., O. His father was of Scotch descent, and a dealer in leather. At the age of seventeen he entered the Military Academy at West Point, and four years later graduated twenty-first in a class of thirty-nine, receiving the commission of brevet second lieutenant. He was assigned to the 4th Infantry, and remained in the army eleven years; was engaged in every battle of the Mexican war except that of Buena Vista, and received two brevets for gallantry. In 1848 he married Julia, daughter of Frederick Dent, a prominent merchant of St. Louis, and in 1854, having reached the grade of captain, he resigned his commission in the army. For several years he was engaged in farming near St. Louis, but met with small success, and in 1860 he entered the leather-trade with his father at Galena, Ill.

When the civil war broke out in 1861, Grant was thirty-nine years of age, but entirely unknown to public men, and without any personal acquaintance with great affairs. Pres. Lincoln's first call for troops was made on the 15th of April, and on the 19th Grant was drilling a company of volunteers at Galena. He also offered his services to the adjutant-general of the army, but received no reply. The governor of Illinois, however, employed him in the organization of volunteer troops, and at the end of five weeks he was appointed colonel of the 21st Illinois Infantry. He took command of his regiment in June, and reported first to Gen. Pope, in Missouri. On Aug. 7 he was commissioned a brigadier-general of volunteers, the appointment having been made without his knowledge. He had been unanimously recommended by the Congressmen from Illinois, not one of whom had been his personal acquaintance. For a few weeks he was occupied in watching the movements of partisan forces in Missouri.

On Sept. 1 he was placed in command of the district of South-east Missouri, with head-quarters at Cairo, and on the 6th, without orders, he seized Paducah, at the mouth of the Tennessee River, and commanding the navigation both of that stream and of the Ohio. This stroke secured Kentucky to the Union, for the State legislature, which had until then affected to be neutral, at once declared in favor of the government. Early in November he was ordered to make a demonstration in the direction of Belmont, a point on the W. bank of the Mississippi about 18 miles below Cairo; it was not only in possession of the Confederates, but commanded by the guns of Columbus on the opposite shore. The object of the demonstration was to prevent the crossing of hostile troops into Missouri. Grant got his orders on the 5th, and moved on the 6th, with 3100 men on transports. On the 7th he landed at Belmont, broke up and destroyed the camp under a heavy fire from Columbus, and was returning to his transports when large reinforcements arrived from the eastern bank to intercept him. His troops were raw, and even the officers were greatly disturbed at the idea of being surrounded. But Grant soon rallied the force, and charging the enemy cut his way out, reached the steamers, and returned to Cairo, having fully obeyed his orders and accomplished the object of the expedition. If any reinforcements had been intended for Missouri, they were by this operation detained. In the affair of Belmont the Confederates had 7000 men engaged against Grant's 3000. Their loss was 642, and his 485. Grant carried off two pieces of artillery and 200 prisoners.

Early in Feb., 1862, after repeated applications to Gen. Halleck, his immediate superior, he was finally allowed to move up the Tennessee River against Fort Henry, in conjunction with a naval force. The gunboats silenced the fort, which surrendered on the 4th, before the troops arrived. Grant immediately made preparations to attack Fort Donelson, about 12 miles off, on the Cumberland River. Without waiting for orders, he moved his troops to the latter point, and on the 12th with 15,000 men began the siege. This position was extremely strong, and the garrison numbered 21,000. There was hard fighting on three successive days, and on the 15th Grant carried by assault the works which were the key to the place. On the 16th the Confederates surrendered unconditionally 65 cannon, 17,600 small-arms, and 14,623 soldiers. About 4000 more had escaped in the night, and 2500 were killed or wounded. Grant's entire loss was less than 2000. On the last day of fighting his numbers amounted to 21,000. This was the first important success won by the national troops during the war. Its strategic results were marked; the entire States of Kentucky and Tennessee at once fell into the national hands, and the navigation of the Mississippi, the Tennessee, and the Cumberland rivers was opened for hundreds of miles. Grant was made a major-general of volunteers, and placed in command of the district of West Tennessee. In March he was ordered to move up the Tennessee River towards Corinth, where the Confederates were concentrating a large army; he was directed, however, not to attack. His forces, numbering 38,000, were accordingly encamped near Shiloh, or Pittsburg Landing, on the W. bank of the Tennessee, waiting the arrival of Gen. Buell with 40,000 more; but on Apr. 6 the Confederates came out from Corinth, 50,000 strong, and attacked Grant violently, hoping to overwhelm him before Buell could arrive; 5000 of his troops were beyond supporting distance, so that he was largely outnumbered. Both sides fought fiercely, but the national forces were pushed back to the river. There, however, Grant held out till dark, when the head of Buell's column came upon the field. There was no more heavy fighting that night, but on the 7th the combined national armies attacked and drove the hostile force, who retreated as far as Corinth, 19 miles. Grant was senior in rank to Buell, and commanded on both days. His entire loss was 12,217; that of Beauregard, the Confederate commander, was 10,617; but the ground remained in the hands of Grant, and the object of the attack was unattained. Two days afterwards Halleck arrived at the front and assumed command of the army, Grant remaining at the head of the right wing and the reserve. On May 30, Corinth was evacuated by the Confederates, although no fighting had occurred since Shiloh. In July, Halleck was made general-in-chief, and Grant succeeded him in command of the department of the Tennessee. On Sept. 19 he fought the battle of Iuka, where, owing to the failure of Gen. Rosecrans to carry out his orders, only an incomplete victory was obtained. The national loss was 736, that of the Confederates 1438. The strategy of this battle was Grant's, the tactics were those of Rosecrans and Ord. Subsequently, Grant fortified Corinth, and directed the operations which resulted in the repulse of the Confederates from that place on the 3d and 4th of October, and in the battle of the Hatchie on the 5th, the commanders under him being again Rosecrans and Ord. At the battle of Corinth the entire national loss was 2359, that of the Confederates more than twice as large.

Immediately after the victory of Corinth, Grant proposed to the general-in-chief the capture of Vicksburg, and, receiving no answer, on Nov. 2 he began a movement into the interior of Mississippi. While he threatened Vicksburg from the rear with 30,000 men, Sherman was sent by way of the Mississippi River with 40,000, to attack it in front. Grant advanced without opposition as far as Oxford, 50 miles, when Holly Springs, his principal base of supplies, was surrendered by Col. Murphy, who was dismissed from the army in consequence. This compelled the abandonment of the campaign, and Grant returned to the neighborhood of Corinth. Sherman's assault on Vicksburg failed at about the same time. In Jan., 1863, Grant took command in person of all the troops in the Mississippi Valley, and moved by the river to a point opposite Vicksburg. There he spent several months in fruitless efforts to turn the place; one plan was to build a canal in sight of Vicksburg, but out of reach of its guns, through which the army could pass to a point below; another, to divert the Mississippi River from its course; a third, to find or make a circuitous passage to the rear of the town through the tortuous streams on the N. and E. But all these failed, and in April Grant marched his army through the swamps on the western bank to a place below Vicksburg, while the gunboats and the transport fleet ran the batteries under a terrific fire. On Apr. 30 he crossed the river, and landed at Bruinsburg, 30 miles S. of Vicksburg. There were now two armies opposed to him. Pemberton, with 52,000 men, defended Vicksburg, and Johnston, with a smaller but rapidly increasing force, was at Jackson, 50 miles farther E. Grant's column was 43,000 strong. He at once abandoned all communication with the river, and pushed into the interior between the two hostile armies. On the 1st of May he met and defeated a portion of Pemberton's command at Port Gibson; then advancing eastward, on the 12th he fell upon and destroyed a force coming out from Jackson to resist him; and on the 14th he captured Jackson and scattered Johnston's army. Turning the same day to the Mississippi, on the 16th he utterly routed Pemberton's entire force at Champion's Hill; on the 17th, pursuing hotly, he came up with the enemy and beat him again at Black River Bridge; and on the 18th drove him into Vicksburg, encamping in its rear, with his own base once more on the Mississippi. On the 19th and 22d he made unsuccessful assaults, and on the 23d began a regular siege. On the 4th of July the place surrendered with 31,600 men and 172 cannon, at that time the largest capture of men and material ever made in war. During the entire campaign the Confederates had lost 40,000 prisoners, besides 12,000 in killed and wounded and about 8000 by disease and straggling; altogether, an army of

60,000 men. Grant's entire loss was 8873. The great river was thus opened to the sea, and no more important fighting occurred in the Mississippi Valley. Grant was made a major-general in the regular army. On Oct. 16 he was placed in command of the military division of the Mississippi, which included the armies of the Ohio and the Cumberland, as well as that of the Tennessee, with which he had been so long associated. Chattanooga was at this time beleaguered and almost surrounded by hostile forces, and the army of the Cumberland, which defended it, was in imminent danger of starvation or capture. On Oct. 23, Grant reached this place, and on the 27th the battle of Lookout Valley, fought under his direction, relieved the army of the Cumberland. On Nov. 23, 24, and 25 he fought the battle of Chattanooga, utterly defeating Bragg, driving him from positions that seemed impregnable, and capturing in the open field over 5000 prisoners and 40 pieces of artillery. His own losses were 6616; the Confederates reported 2500 killed and wounded, besides prisoners. Grant's force in this battle was 60,000; that of Bragg, 45,000; but the enemy enjoyed advantages of position which more than counterbalanced the disparity. The victory of Chattanooga overthrew the last important hostile force W. of the Alleghanies, and opened the way for the national armies into Georgia.

The remarkable series of successes which Grant had now achieved pointed him out as the appropriate leader of the national armies. In Feb., 1864, the rank of lieutenant-general was created for him by Congress, and on Mar. 17 he assumed command of the armies of the U. S. Having beaten all the other important hostile commanders, and broken in pieces every other great opposing force, he now prepared to encounter in person the army of Northern Virginia, under Lee, and at the same time, by his subordinates, to occupy all the remaining forces of the enemy, so that no Confederate army could in any emergency or by any possibility support another. Accordingly, while he sent Sherman into Georgia, and directed Sigel to penetrate the Valley of Virginia, and Butler to capture Richmond, he fought his own way from the Rapidan to the James. On May 4 he could put into battle 110,000 soldiers; Lee confronted him with 75,000; while 30,000 under Butler were opposed by the same number at Richmond, and Sigel with 7000 fought Breckenridge with 5000 or 6000. Before Grant reached the James he had lost 6000 men killed, 26,000 wounded, and nearly 7000 missing. The losses of Lee's troops can never be known, as their records were destroyed by their own hands; but Grant captured in this period 10,000 men (4000 more than Lee), and it is probable that the entire loss of the enemy was little if any less than his, although Lee fought constantly on the defensive, and therefore with immense advantage and security. The battles of the Wilderness, Spottsylvania, North Anna, and Cold Harbor were the hardest Grant ever fought, but after each he advanced and Lee withdrew. They cost the national commander dear, but they inflicted losses on Lee from which he never recovered, and thus accomplished the object at which Grant was aiming. He was more anxious to annihilate Lee's army than to effect any purely strategic result, or even to capture Richmond, for he believed that only by the annihilation of Lee could the Confederacy be overthrown. With this view and for this purpose the campaign of the Wilderness was planned and fought. When Grant arrived in front of Richmond he crossed the James, in pursuance of the design formed months before. Butler had failed to take the city, and his army was now joined to that which had fought its way from the Rapidan; and in June the siege of Richmond was begun. Sherman, meanwhile, was marching and fighting daily in Georgia, and steadily advancing towards Atlanta; but Sigel had been defeated in the Valley of Virginia, and was superseded by Hunter, who made his way as far as Lynchburg, and was then in his turn repelled. Hunter's retreat left open a road to Washington, and Lee sent Early to threaten the national capital; whereupon Grant gathered up a force which he placed under Sheridan, and that commander rapidly drove Early, in a succession of battles, through the Valley of Virginia, and destroyed his army as an organized force. But the siege of Richmond still went on. The Confederates were gallant and stubborn, and though Grant made numerous attacks, he was only partially successful. His army reached out on the right and left on both sides of the James, but for many months he was unable to get possession of the railroads by which Richmond was supplied. The government advised him to abandon the attempt, and the country was sometimes impatient and distrustful, but Grant never wavered.

By September, Sherman had made his way to Atlanta, and Grant then sent him on his famous march to the sea, a route which the chief had designed for himself six months before. He made Sherman's success possible, not only by holding Lee in front of Richmond, but by sending reinforcements to Thomas, who then drew off and defeated the only army which could have confronted Sherman. Sherman by this strategy was left unopposed. Thus Thomas, Sheridan, and Sherman were all used in furtherance of Grant's plans; each executing his part in the great design, and contributing his share to the result at which Grant was aiming. Sherman finally reached Savannah, Schofield beat the enemy at Franklin, Thomas at Nashville, and Sheridan wherever he met him; and all the while Lee was held near Richmond, unable to send to any part of the theatre of war to reinforce any army, no matter how threatened or assailed. Schofield was now brought from the West, and Fort Fisher and Wilmington on the sea-coast were captured, so as to afford him a foothold; from here he was sent into the interior of North Carolina, and Sherman was ordered to move northward to join him. When all this was effected, and Sheridan could find no one else to fight in the Valley, Grant brought the great cavalry leader to the army in front of Richmond, and, making a last effort, drove Lee from his intrenchments and captured Richmond.

When the final campaign began, Lee had collected 73,000 fighting men in the lines at Richmond, besides the local militia and the gunboat crews, amounting to 5000 more. Including Sheridan's force, Grant had 110,000 men in the works before Petersburg and Richmond. Petersburg fell on the 2d of April, and Richmond on the 3d, and Lee fled in the direction of Lynchburg. Grant pursued with remorseless energy, only stopping to strike fresh blows, and Lee at last found himself not only out-fought, but out-marched and out-generalled. He was completely surrounded, and on Apr. 9, 1865, he surrendered at Appomattox Court-house, in the open field, 27,000 men, all that remained of his army. In ten days Grant had captured Petersburg and Richmond, fought, by his subordinates, the battles of Five Forks and Sailor's Creek, besides numerous smaller ones, captured 20,000 men in actual battle, received the surrender of 27,000 more at Appomattox, absolutely annihilating an army of 70,000 soldiers. During the year Grant's entire loss among the troops immediately under his command, including those in Butler's army, amounted to 12,663 killed, 49,559 wounded, and 20,498 missing; total, 82,720. He captured in the same time 66,512 soldiers; of the Confederate killed and wounded no return was ever made. He had destroyed every army opposed to him—those of Lee, Early, and Beauregard, besides the reinforcements sent to Lee from all quarters of the South, leaving at the last not a living man of all those armies who was not a prisoner. His forces had never been more than one-third greater than those of his antagonist, and he had constantly fought on the offensive. The terms granted to Lee at Appomattox were so magnanimous that the whole population of the South at once sought to share their benefits. All the other Confederate armies offered to surrender, and the greatest civil war in history was at an end.

Grant returned at once to Washington to superintend the disbandment of his armies. This work was scarcely begun when Pres. Lincoln was assassinated. It had doubtless been intended to inflict the same fate on Grant, but he, fortunately, on account of leaving Washington early in the evening, declined an invitation to accompany the President to the theatre where the murder was committed. This event made Andrew Johnson President, but left Grant by far the most conspicuous figure in the public life of the country. He became the object of an enthusiasm greater than had ever been known in America. Every possible honor was heaped upon him; the grade of general was created for him by Congress; houses were presented to him by citizens; towns were illuminated because he entered them. Pres. Johnson soon took such a position in politics as threw most of those who had supported the war into open hostility to him. At first he had been so bitter towards the defeated South that Gen. Lee asked Grant's interposition in his behalf, and it was given. Grant saved Lee from prosecution for treason when Andrew Johnson was eager for it. But Mr. Johnson soon became the ardent friend of the former Confederates, and was believed by many to be plotting their return to power. In this conjunction all parties turned to Grant. Congress passed laws to restrain the President and giving Grant an amount of power unknown before to any subordinate. His position was extremely delicate. He was a soldier, and it was his duty to be subordinate to the President. Yet the President was in direct opposition to Congress, the law-making power. Grant, however, for a long time was able to comply with the directions of Congress without offending the President. Johnson, indeed, sought to obtain the sanction of Grant's name for his policy. He suspended the secretary of war, and placed Grant in his stead, and the soldier for some months was a member of Mr. Johnson's cabinet. Finally, however, it became necessary for him either to

break with the President, or by compliance, as he thought, to disobey the law; and he refused to do the latter. From this time Pres. Johnson was his political and personal enemy. Grant's popularity, however, remained unshaken with those who had supported the war, and in 1868 he was elected President by large majorities. He was inaugurated on Mar. 4, 1869. His first administration was distinguished by a cessation of the strifes which sprang from the war, by a large reduction of the national debt, and by a settlement of the difficulties with England which had grown out of the depredations committed by privateers fitted out in England during the war. These difficulties threatened at one time to embroil the two nations, but they were referred to arbitration, and the result was a large award of damages, which were paid by England to the U. S., on account of the injuries she had occasioned or allowed. During the latter half of his administration a violent opposition arose to Grant, led by men in his own party, who were dissatisfied with his course. He was, however, re-elected to the Presidency in 1872 by a larger vote and a larger majority than any candidate had received since the U. S. became a nation. (The figures in this article are, without exception, taken from the official returns now on file at Washington.) ADAM BADEAU.

Grant City, cap. of Worth co., Mo. It has 1 bank, 2 real-estate offices, 2 newspapers, 2 schools, lumber and wagon yard, 2 churches, 2 hotels, 9 stores, etc. Pop. about 800. PUB. "WORTH CO. TIMES."

Gran'tham, town of England, in the county of Lincoln, on the left bank of the Witham. Its church is an interesting building of the thirteenth century, with a fine spire 273 feet high. In its grammar school Newton received his first education. Pop. of town, 5028; of parliamentary borough, 13,248.

Grantham, post-tp. of Sullivan co., N. H., 40 miles N. W. of Concord. It has manufactures of lumber, etc. Pop. 608.

Grantham, tp. of Wayne co., N. C. Pop. 1823.

Grant Isle, post-tp. of Aroostook co., Me., 90 miles N. of Houlton, on the St. John's River. Pop. 688.

Gran'ton, post-v. of Biddulph tp., Middlesex co., Ont., Canada, on the Grand Trunk Railway, 18 miles from London. It has 1 weekly newspaper. Pop. about 350.

Grants'burg, post-v., cap. of Burnett co., Wis. Pop. of Grantsburg tp. 706.

Grants'ville, post-tp. of Alleghany co., Md. P. 1786.

Grantsville, post-v., cap. of Calhoun co., West Va.

Grant'ville, tp. and v. of Baker co., Ala. Pop. of v. 1761; of tp. 1859.

Grantville, post-v. of Needham tp., Norfolk co., Mass., on the Boston and Albany R. R., 13 miles W. of Boston. It is one of the most attractive villages in the vicinity of Boston.

Granvelle (or **Granvella**), **de** (ANTOINE **de Perrenot**), CARDINAL, b. at Besançon Aug. 20, 1517, was the son of the Sieur de Granvelle, prime minister to Charles V.; studied at Dôle, Paris, Louvain, and Padua; became bishop of Arras 1540; attended the Diets of Worms and Ratisbon 1540, and in 1545 was sent to the Council of Trent; became a prominent state councillor under Charles V., and in 1550 took the chancellorship of the empire after his father's death; negotiated the treaty of Passau 1552; arranged the marriage between Philip II. and Mary of England 1553; concluded the treaty of Cateau-Cambrésis 1559; was minister to the duchess of Parma in the Low Countries 1559–64; became archbishop of Mechlin 1560, cardinal 1561, and in 1564 retired to Besançon, compelled to leave his office by the clamors of nobles and people, led by Horn, Egmont, and the prince of Orange, for Granvelle's tyranny was of the most odious type; Spanish envoy at Rome 1570; viceroy of Naples 1570–75; became president of the supreme council of Italy and Castile 1575; was translated to the archbishopric of Besançon 1584. D. at Madrid Sept. 21, 1586. He was a man of learning and ability. Of his vast correspondence a large part has been printed, and forms a valuable mass of material for the historian.

Granville, town of France, in the department of La Manche, on the English Channel. It is fortified, and has manufactures of laces and considerable oyster and cod fisheries. Pop. 17,180.

Gran'ville, county of North Carolina, bordering on Virginia. Area, 750 square miles. Its surface is undulating, the soil productive, yielding large crops of tobacco and grain. The former product is manufactured for market. The county contains slate and sandstone. Cap. Oxford. Pop. 24,831.

Granville, tp. of Jasper co., Ill. Pop. 1260.

Granville, post-tp. of Putnam co., Ill. Pop. 1668.

Granville, post-tp. of Hampden co., Mass. It has 4 churches, and manufactures of cheese, kegs, drums, etc. Pop. 1293.

Granville, a v. of Monroe co., Mo. Pop. 71.

Granville, post-v. and tp. of Washington co., N. Y., on the Rutland and Washington division of the Delaware and Hudson Canal Co. R. R., 65 miles N. of Albany. Within the limits of the township are 6 villages, 5 post-offices, 12 churches, 3 hotels, 15 stores, 1 bank, and several cheese-factories. Granville Female Seminary is located in the village of North Granville. Principal business of the town, agriculture and the quarrying and manufacturing of roofing slate, mantels, and all articles of marbleized slate. Pop. 4003. WM. HASWELL, ED. "GRANVILLE REPORTER."

Granville, a post-v. and tp. of Licking co., O., 6 miles W. of Newark and 3 miles N. of the Central Ohio R. R. It has a national bank, a newspaper, 2 hotels, 12 stores, 2 female colleges, is the seat of Dennison University, and has several mills and shops. Pop. of v. 1109; of tp. 2127. GEO. W. EVANS, ED. "LICKING MONITOR."

Granville, tp. of Mercer co., O. Pop. 1234.

Granville, tp. of Bradford co., Pa. Pop. 1375.

Granville, post-tp. of Mifflin co., Pa. Pop. 1297.

Granville, post-tp. of Addison co., Vt., 23 miles S. W. of Montpelier. It has manufactures of lumber, wooden-ware, charcoal, and pyroligneous acid. Pop. 726.

Granville, post-tp. of Milwaukee co., Wis., on the Milwaukee and St. Paul R. R., 15 miles N. W. of Milwaukee. Pop. 2401.

Granville (GRANVILLE GEORGE **Leveson-Gower**), EARL, K. G., D. C. L., F. R. S., the second earl of the present line, b. in London May 11, 1815; was educated at Eton and Christ Church, Oxford; entered Parliament 1836; was under-secretary for foreign affairs 1840–41; master of the buckhounds 1846–48; vice-president of the board of trade 1848–51; foreign secretary 1851–52; chancellor of the duchy of Lancaster 1855; ambassador extraordinary to Moscow 1856; lord president of the council 1855–58 and 1859–66; colonial secretary 1868–70; secretary for foreign affairs 1870–74; also chancellor of London University, constable of Dover Castle, and lord warden of the Cinque Ports; is an able and distinguished Liberal politician; succeeded to the peerage in 1846, and in the same year was sworn of the privy council.

Grape, the fruit of the vine; the berry (one to four seeded) of the climbing shrubs of the genus *Vitis* (order Vitaceæ), of which species are found in the warm and temperate regions of both hemispheres. The Old-World cultivated grapes are the fruit of *Vitis vinifera*, which is believed by Regel to be the hybrid offspring of *V. Labrusca* and *V. vulpina*, both natives of the U. S. and of Eastern Asia. *V. vinifera* does not thrive in the U. S. east of the Rocky Mountains, except under glass, but in California its varieties yield a very large proportion of the vineyard products of that State; but numerous varieties have been produced by Rogers and others which are considered hybrids of *V. vinifera* and *Labrusca*. There are in the U. S., east of the Mississippi, nine recognized species, besides innumerable varieties, of many of which the proper species is hard to determine. Of these species we need notice only—(1) *V. Labrusca*, which ranges from Canada southward to North Carolina, and indefinitely westward, the parent of a very great number of cultivated sorts, of which the Isabella, Catawba, Concord, and most other kinds raised in the Northern U. S. in open air are examples. (2) *V. vulpina*, the Southern fox, muscadine, or bullace grape, not found N. of Maryland; of this the scuppernong is a variety, and perhaps also the mustang grape (*V. mustangiensis*) of Texas. The Mish, Thomas, and other Southern varieties are of this species. (3) *V. æstivalis*, or summer grape, the parent of the Delaware, Herbemont, Rulander, and other favorite kinds. (4) *V. cordifolia*, the frost grape, which has fragrant flowers. From this stock have sprung the Clinton, the Taylor, the Franklin, and a few other cultivated sorts, not generally of high excellence.—The vine is important, not only as affording a copious supply of excellent fruit, but it is the source from which are derived all genuine wines, brandies, and the cream of tartar; all of which are of such commercial value that they are everywhere subject to large adulterations. Raisins, vinegar, and currants are also products of the vine. The grapes of the *vinifera* class are readily distinguished by the fact that (as a rule) the skins do not readily slip from the pulp within, and that the pulp itself is not so tough as in most native kinds. They are with us reared only in cold graperies or in forcing-houses. The rules for grape-culture must vary with peculiarities of soil, climate, variety, exposure of land,

etc. (The reader is referred to the treatises of Strong, Fuller, Hussmann, Haraszthy, Chorlton, and other specialists.)

The culture of the vine is very ancient, as is shown by the narrative of Noah and by abundant references in all the ancient literatures. In the U. S. grape-culture is of very recent origin, the foreign grape not succeeding well except on the Pacific slope; but the readiness with which our native species can be made to afford valuable varieties for cultivation has caused a wonderful development of this industry. California, Ohio, New York, Missouri, Illinois, and Pennsylvania are, in the order named, the principal grape-growing States, but grape-culture is fast developing in other States, especially southward. Cryptogamous vegetable parasites (*Peronospora*, *Oidium*, etc., called mildew) and many insect enemies (notably the *Phylloxera vastatrix*) attack the grapevine, and of late have completely paralyzed the vine-growing industry over large areas; but their effect has not been very seriously felt as yet in the U. S.

Grape Grove, tp. of Ray co., Mo. Pop. 2660.

Grapeshot [Fr. *mitraille*], a name applied to several kinds of artillery missiles, but especially to a cluster of iron balls grouped together about a spindle and held in place by iron disks, through which the spindle passes. Grapeshot is very effective against infantry in masses at short range.

Grape-Sugar. See GLUCOSE.

Graph'ite [Gr. γράφω, "I write," from its property of leaving a distinct trace on paper], a form of carbon, usually classed as a mineral, but supposed to be of organic origin and the ultimate product of the destructive distillation of vegetable or animal tissue. When pure it crystallizes in flat hexagonal tables. Its specific gravity is 1.81, and its hardness from 0.5 to 2. As it occurs in nature, graphite is usually mixed with more or less foreign matter, consisting of silica, alumina, lime, magnesia, etc. The purest known variety of natural graphite, found at Ticonderoga, N. Y., consists of 99.9 carbon. The best Ceylon graphite contains 99 per cent., and that from the famous Borrowdale mine in Cumberland, England, 87 per cent. of carbon. The inferior varieties of graphite frequently contain 50 to 60 per cent. of foreign matter. Graphite usually occurs in metamorphic rocks, such as gneiss, granite, slate, crystalline limestone, etc., but it also is sometimes found in trap. It is often produced in iron furnaces, crystallizing in flat, specular flakes in cavities in the cast iron. In many instances it is seen to be the direct product of metamorphism on coal, as at Craigman, Ayrshire, Scotland, where coal is altered by trap, and at Newport, R. I., where the coal, highly metamorphosed in mass, varies from anthracite to graphite, and may be classed as graphitic anthracite. Still more direct evidence of the conversion of vegetable tissue into graphite is seen in the coating of graphite which sometimes covers the impressions of fossil plants in metamorphosed carboniferous strata. Here it is plain that the graphite is the residual product of the distillation to which the vegetable tissue has been subjected. Graphite occurs most abundantly in somewhat irregular sheets or in detached masses, occupying nearly the same plane in gneiss, slate, and other metamorphic rocks. In these instances it apparently represents collections of vegetable matter, like those which in more recent deposits form beds of coal. Graphite also occurs as a more or less abundant constituent of graphitic schist, which is probably but the metamorphic condition of bituminous shale. Usually, these stratified deposits of graphite contain much earthy matter. Graphite also frequently occurs in detached grains, crystals, lumps, or masses, sometimes of remarkable purity. In this category should be included the specks and grains found in crystalline limestone at Amity, Orange co., N. Y., the flattened crystals of Ticonderoga, N. Y., the larger masses found in trap at the Borrowdale mine, England, and perhaps those of the no less famous Alibert mine, Siberia. In some of these cases the graphite is almost chemically pure, and it seems to have crystallized out of its associations, as it does in cast iron. The detached masses or particles of graphite which occur in limestone probably represent the carbon of the soft parts of the animals of which the shells and bones have supplied the calcareous matter. Many unchanged limestones contain asphalt and petroleum, and these, in the process of metamorphism, may, by the loss of their hydrogen, be left as masses or specks of nearly pure carbon. The graphite which is sometimes found filling fissures in crystalline rocks is perhaps the product of the metamorphism of asphaltic veins or asphaltic coals like albertite, grahamite, chapapote, etc.

The uses of graphite in the arts are very varied. It is a good conductor of electricity, and is frequently employed for coating moulds in electrotyping. It is also an excellent lubricant, and is frequently added to the compositions applied to the bearings of machinery to reduce friction. The great consumption of graphite, however, is for the manufacture of crucibles and pencils. Although in certain circumstances graphite will burn, producing carbonic acid, yet it is practicably infusible. When mixed with clay and moulded into crucibles, it forms one of the most refractory substances known, and supplies the material from which the best crucibles used in chemistry and metallurgy are made. For the manufacture of pencils only the finer varieties of graphite are used. Where it occurs in blocks of considerable size and great purity, it is sawed in sheets, and these are again cut into rods which are inserted in wooden holders. The graphite obtained from the Borrowdale mine was largely used in this way, and the pencils made from it were in such repute that the material was sometimes sold at $40 the pound. The Siberian graphite from the Alibert mine is also used in the same way for the manufacture of pencils, the monopoly of which has been enjoyed by A. W. Faber of Stein, Germany. This house has consumed nearly 100 tons of Siberian graphite, brought by a long and expensive overland route from the frontier of China. Although the pencils made from the purest natural graphite are most highly esteemed, nearly all those used at the present day are manufactured from graphite which is washed free from its impurities, ground to an impalpable powder, and then consolidated by pressure, with or without cement. For the harder pencils a considerable quantity of fine clay is mixed with the powdered graphite.

The great source of supply of graphite to commerce and the arts at the present time is Ceylon. Most of the product of this island is carried to England for distribution or manufacture. It varies much in purity, some being almost entirely free from foreign matter—being second only to the Ticonderoga graphite in purity—while other varieties contain large quantities of earthy matter. These different grades are applied to different uses, the finer qualities serving for the manufacture of pencils, the coarser for crucibles, etc. Graphite is also produced in considerable abundance from Harnon, Sweden; from Passau, Bavaria; Schwarzbach, Bohemia; Stiermark, etc. It has also been recently discovered in the province of Nelson, New Zealand. In the U. S. graphite occurs at innumerable localities, but is mined only at Sturbridge, Mass., Ticonderoga and Fishkill, N. Y., Brandon, Vt., Wake, N. C., and at the Eureka mine, Sonora, Cal.; the latter, it is said, can yield 1000 tons per month. Important deposits of graphite are also known to exist in Canada, the most considerable of which is perhaps that of Buckingham on the Ottawa River, 16 miles above Ottawa City. This, like most of the New England and New York graphite, occurs in gneiss and crystalline limestone, and is mixed with much foreign matter, from which it needs to be freed by crushing and washing. The impurities contained in or associated with graphite are of two kinds—(1) the foreign matter of the rock which contains it; and (2) earthy material intimately blended with it. From the former it may often be easily separated by washing. The latter is an inherent impurity, like the ash in coal, and its character and quantity determine the value and uses of the material. Sometimes it exists as a mere trace, as in the Ticonderoga graphite, or it may amount to more than 50 per cent. of the mass. The market-value of graphite is, however, not directly proportioned to the earthy matter or ash it contains, as even when this is in large amount, if very fine and equally diffused, it may not forbid the employment of the material for the manufacture of pencils and other uses for which a kind is demanded that commands a high price. For the manufacture of crucibles, graphite may contain much ash, provided the quantity of lime, magnesia, etc. is small. Much of the alkalies or alkaline earths renders the substance fusible. The market-price of graphite has varied much within a few years, but the average commercial quality applicable chiefly to the manufacture of crucibles is worth, at wholesale, from $150 to $300 per ton. J. S. NEWBERRY.

Graph'otype, a process by which prints are made without engraving. A tablet of prepared and compressed chalk is used, and upon it the draughtsman makes his drawing with a peculiar ink. The tablet is gone over with a brush in such a way as to leave the inked parts in relief. The chalk is now hardened by an appropriate process, and from it electrotypes may be taken. Well-made graphotype plates sometimes afford prints of much merit.

Grap'tolite, a name given to fossil acalephs of the genus *Graptolithus* and its allied genera; named "written stone" from the slender black tracings left by the fossils upon the slates where they occur. They first appear in very early Lower Silurian rocks, and finally disappear in the Clinton group of the Upper Silurian. They were somewhat closely allied to the living sertularians, and some have found in them bryozoan affinities.

Gras'litz, town of Bohemia, near the frontier of Sax-

ony. It has manufactures of musical and mathematical instruments and of looking-glasses. Pop. 5786.

Grass, tp. of Spencer co., Ind. Pop. 1871.

Grass-Cloth, a popular name for fabrics made of the fibre of the RAMIE (which see), the *Bœhmeria nivea,* manufactured chiefly in Asia, but of late to some extent in Europe. The grass-cloths are extremely durable, and often very beautiful.

Grasse, town of France, in the department of Alpes-Maritimes. Its main industry is the manufacture of essences and perfumes from odoriferous flowers, for which it is very celebrated. Pop. 12,015.

Gräs'se (JOHANN GEORG THEODOR), b. at Grimma, Germany, Jan. 13, 1814; studied philology and literary history at Leipsic and Halle; became collaborator in the Kreuzschule at Dresden, and in 1843 private librarian to the king of Saxony; in 1848 inspector of the cabinet of coins and medals, in 1852 director of the collection of porcelain, in 1853 Hofrath, and in 1864 director of the Green Vaults at Dresden. Author of *Lehrbuch der Allgemeinen Literaturgeschichte* (4 vols., 1851–59); a *Handbuch* of the same (4 vols., 1844–50); *Die Sage vom Ewigen Juden* (1844); *Bibliotheca Psychologica* (1845); *Die Sage vom Ritter Tannhäuser* (1846); *Beiträge zur Literatur und Sage des Mittelalters* (1850); *Handbuch der Altennumismatik* (1852); *Beiträge zur Geschichte der Gefässbildnerei* (1853); *Orbis Pictus* (1861); a translation of *Gesta Romanorum* (1842); *Sagenbuch des Preussischen Staates; Trésor de livres rares et précieux* (7 vols., 1858–67, with subsequent supplementary volumes).

Grasse, de (FRANÇOIS JOSEPH PAUL), COUNT, and Marquis de Grasse-Tilly, b. at Valette, Provence, in 1723; entered a galley of the Knights of Malta in 1734, and served against the Moors and Turks; was transferred in 1749 to the French navy; became a lieutenant in 1754, captain in 1762, rear-admiral in 1778, *chef d'escadre* in 1779. Having long been one of the most renowned of French captains, and having an equal reputation for skill and valor, he sailed for America in 1781; contributed essentially to the reduction of Yorktown, and afterwards served with great distinction in the West Indies; but was surprised by the superior force of the British admiral Rodney, and utterly defeated Apr. 12, 1782. D. at Paris Jan. 11, 1788, while holding the rank of lieutenant-general of the naval forces.

Gras'ses. 1. The grasses or Graminaceæ form one of the largest natural orders in the vegetable kingdom, and are distributed over the whole earth. The albumen of the seeds and the nutritious herbage form the chief part of the food of man and the herbivorous animals. None of the family are known to be deleterious, although the darnel (*Lolium temulentum*) has until recently been so regarded. The stems of grasses often contain large quantities of sugar, as in the maize, sorghum, and sugar-cane. The latter is the well-known source of supply for the greater part of the sugar known in commerce. Besides these uses, certain members of the order are applied in the regions where they grow to a multiplicity of purposes. It is doubtful whether the natives of the East could survive without the bamboo, which they use in constructing their dwellings, in making mats, cordage, rafts, boats, sails, masts, musical instruments, and weapons. Man, by observing the processes of nature, has in some cases usefully applied certain species of grasses to prevent the encroachments of the sea, the fibrous and interlacing roots serving admirably to bind the shifting sands. Our own *Calamagrostis arenaria* is used in this way on the coasts both by individuals and by the government. Much land is thus reclaimed which would else be given over to the ocean. The grasses are eminently social plants, in cool climates usually growing together and forming a green sward. Often, however, they are tufted and scattered in little groups, as in the case of the *Aira flexuosa,* or hair-grass. There is no kind of soil apparently that is not adapted for some grass. They flourish in meadows and alluvial bottoms, on the banks of rivers and streams, by the seaside, and often in the water. Again, other species live in the clefts of rocks, on dry lands, or even in deserts. They range through all climates. The extreme alpine and arctic regions see them thriving, and in the tropics they are everywhere abundant. It is a waste indeed where there is no form of grass. Some of them are annual in habit and some perennial. They have fibrous roots, and often runners, as in the case of the quick-grass (*Triticum repens*), which, spreading by its vigorous root-stocks, takes entire possession of a field, and is a great pest to the agriculturist. The stem of grasses is called a *culm.* It is often hollow and jointed, with a siliceous coating, closed and swollen at the joints. The leaves are two-ranked, having many fine veins running parallel to the midrib; this and the stem-structure of course shows them to be endogenous in character. The leaves, which are sheathing, often have the sheaths prolonged into an appendage called the *ligule.* The flowers are arranged in spikes, as in the timothy (*Phleum pratense*), or in panicles, as in the bent-grass (*Agrostis*). These spikes and panicles differ greatly as to their degree of concentration or diffusion, and the flowers themselves as to their appendages. Some are armed with long awns or bristles, as in the barley. The stamens are usually three, with anthers attached only by one point, or what is called *versatile.* The styles are two, with feathery stigmas. The flowers are enclosed by two-ranked, imbricated bracts. The outer ones are called *glumes,* and the inner ones, or *palets,* are known as *paleæ.* The perianth if present consists of very small membranous hypogynous scales, one to three in number, distinct or united. They are termed *squamulæ.* The fruit is a *caryopsis,* or fruit in which the seed completely fills the cell and adheres to the pericarp. Embryo small, on the outside and at the base of the floury albumen. These humble plants, which form our out-door carpet, are, in their way, as beautiful as any of their prouder associates. They are often used for dry bouquets and in-door ornamentation, when their grace of form and varying shades of color make them highly valued. The prairie and herd grasses are especially lovely, both in the fields, which some of them tinge with their ruddy smoke, and in parlor vases. W. W. BAILEY.

Phleum pratense: a detached spikelet, magnified, showing the flower with its palets raised above the glumes.

Grass'hopper, a term popularly and very loosely applied in America to all sorts of saltatorial Orthoptera. It is particularly used to designate the Rocky Mountain locust (*Caloptenus spretus*), which in certain years proves such a scourge in much of the country lying W. of the Mississippi. (See LOCUST.) Popular misapplication of terms is often extremely confusing, and should not be encouraged. The above insect, which is so generally miscalled "grasshopper," is in reality a locust, belonging to the very same family as the locust of Scripture, the well-known migratory locust of Asia. In order to properly restrict the term "grasshopper" as it is restricted entomologically, it will be best to follow Harris, the father of popular entomology in America, and briefly characterize the three principal divisions of the saltatorial Orthoptera, as follows: CRICKETS (Achetidæ of Westwood) are distinguishable from the others by invariably having the wing-covers placed horizontally on the back. They have, with few exceptions, but three joints to the tarsi or feet, and as they usually live in holes away from the light, their organs of hearing and feeling, the antennæ, are very long, while those of sight are generally small. GRASSHOPPERS (Gryllidæ of Westwood) may be distinguished by having four joints to the feet. The wing-covers are roofed, and slope downward at the sides of the body; they are long and wide, and those of the male are furnished at the base with a talc-like plate, which produces the usual chirrup as the wings are rubbed sharply over one another. The female is distinguished by having an exserted or sabre-shaped ovipositor. Most grasshoppers are green, and their legs, though longer, are not so muscular as those of locusts. They are mostly nocturnal insects, and their antennæ are consequently long and tapering. They are also more solitary, never migrating in multitudes, like locusts. A few of the larger, tree-inhabiting species are called katydids, well-known insects peculiar to America. LOCUSTS (Locustidæ of Westwood) are distinguished from the above insects by having much shorter, thread-shaped antennæ, which terminate abruptly, or are sometimes even club-shaped. The feet appear on the under side five-jointed, but are in reality only three-jointed, the basal joint being long, with two impressions underneath. They nearly all agree in having straight, narrow wing-covers, lapping over and forming a ridge on the back. The female has, instead of the projecting piercer of the grasshopper, four short horny, cuneiform projections, placed in pairs, and opening and shutting opposite to each other. Their stridulation is produced by rubbing the posterior femora or thighs against the prominent nerves of the wings while resting on the fore legs. They are more robust, more muscular, than grasshoppers, are essentially social and diurnal insects, and their wing-covers, being so much narrower, do not so impede their passage through the air. C. V. RILEY.

Grasshopper, tp. of Atchison co., Kan. Pop. 1145.

Grass'hopper Falls, post-v. and tp. of Jefferson co., Kan., is centrally located in a fine agricultural region, 25 to 30 miles distant from Leavenworth, Lawrence, Topeka,

and Atchison, the four principal cities of the State, at the crossing of the Kansas Central and the Atchison Topeka and Santa Fé R. R. It has 2 newspapers, 2 banks, a graded school of five departments, 2 fine mills, a large woollen-factory, 3 hotels, 5 churches, and the usual number of stores and shops. It is situated on the Grasshopper River, and has an excellent water-power. Pop. of v. 603; of tp. 1943.

S. WEAVER, ED. "NEW ERA."

Grass Lake, post-tp. of Jackson co., Mich., on the Central R. R., 66 miles W. of Detroit. Pop. 2042.

Grass'mann (HERMANN GÜNTHER), b. at Stettin, Prussia, Apr. 15, 1809; was an instructor in Stettin 1834–52; took his father's professorship of mathematics in the gymnasium of Stettin 1852. Has published philological works of importance, but is chiefly distinguished for his profound treatises upon the theory of mathematics.

Grass-Moth, a name applied to the lepidopterous insects of the genus *Crambus* and family Pyralidæ. They are extremely abundant in this country in the summer in pastures and hay-fields. *C. mutabilis* is a common species.

Grass of Parnas'sus, the popular title of the genus *Parnassia* of smooth herbs, now generally referred to the order Saxifragaceæ, growing mostly in cold regions of both continents. The U. S. has five or six species, of which one, *P. palustris*, rare in this country, is the common grass of Parnassus of Europe.

Grass Oil, a volatile oil extensively distilled in the East Indies from *Andropogon Schœnanthus*, *A. muricatus*, *A. nardus*, *A. Iwarancusa*, and other grasses. It is used in scenting honey soap and in adulterating oils of geranium and roses; in perfumery it is called oil of citronella. Ceylon exports tons of this oil annually.

Grass Tree [so called from the long grass-like leaves], a genus (*Xanthorrhœa*) of long-lived, tree-like, liliaceous plants, somewhat resembling the *Yucca* in habit. They grow in Tasmania and Australia. Their leaves are not stiff and sharp like the leaves of *Yucca*, but are gathered as food for cattle. The tender base of the leaves is edible and agreeable. The tree abounds in a balsamic gum which has been used in medicine. There are several species, of which *X. hastilis* and *humilis* are best known. The "grass tree gum" is obtainable in inexhaustible quantities, and has been recommended as a source of illuminating gas and of picric acid.

Grass Valley, in Humboldt co., Nev., 10 miles S. E. of Winnemucca, contains 50,000 acres of fertile land, but is deficient in surface-water. Elevation, 4300 feet.—GRASS VALLEY, a v. of Austin tp., Humboldt co., Nev. Pop. 27.

Grass Valley, post-v. and tp. of Nevada co., Cal., is the centre of the chief gold quartz-mining district of the State, from which source it derives the principal part of its business. It has 6 churches, 2 orphan asylums, high, intermediate, and preparatory public schools, 3 banks, a number of hotels, 1 daily and 1 weekly newspaper, 2 foundries, 1 planing-mill, quartz-mills, etc. It is 12 miles distant from the Central Pacific R. R. at Colfax, with which it will be shortly connected by rail. Grass Valley is the seat of a Roman Catholic bishop. Pop. 7063.

CHAS. H. MITCHELL, PROP. "DAILY UNION."

Grass Valley, tp. of Lander co., Nev. Pop. 26.

Grass-wrack, called **Eel-grass** in the U. S., the *Zostera marina*, a salt-water plant of the order Naiadaceæ, growing in coves and sea-ditches, always under water. It grows upon both continents, and is used to weave into the coverings of flasks, as a material for stuffing paillaisses and cushions, and as packing for glass and queensware. In the U. S. it is gathered like sea-weed, chiefly as a manure. Several other species of the genus are described.

Gras'sy Creek, tp. of Mitchell co., N. C. Pop. 514.

Gras'sy Fork, tp. of Jackson co., Ind. Pop. 1188.

Gras'sy Moun'tain, tp. of Greenville co., S. C. P. 1335.

Gra'tian, or **Gratia'nus,** the founder of the science of canon law, was b. in the latter part of the eleventh century, and entered the convent of Classe, near Ravenna, whence he removed to that of St. Felix de Bologna. Here he wrote his *Decretum*, and sent it to the pope, Alexander III., who in reward appointed him bishop of Chiusi. The *Decretum* is a complete and systematized collection of all the canons issued by the popes and councils. It is divided into three parts: (1) *De Ministeriis*, subdivided into 101 *distinctiones;* (2) *De Negotiis*, subdivided into 36 *causæ;* (3) *De Sacramentis*, subdivided into five *distinctiones*. There existed earlier collections of this kind, but they were vastly inferior to that made by Gratian, and the science of canon law was not taught in the theological schools until after the publication of the *Decretum*. As Gratian never doubted the authority of the False Decretals, and as his collection was used and referred to for more than three centuries without comment or reservation, it contributed very much to the establishment of the doctrine of the pope's authority as above the canon law, absolute and unrestrained; of the exemption of the clergy from the secular jurisdiction, etc. In 1580, under Pope Gregory XIII., a critically revised and corrected edition of the *Decretum* was published in Rome, forming the first part of the whole *Corpus Juris Canonici*.

Gra'tian (GRATIANUS AUGUSTUS), Roman emperor, son of Valentinian I. and grandson of Gratianus Funarius, a soldier of humble origin, chiefly distinguished for his strength. The grandson was b. at Sirmium, in Pannonia, Apr. 19, 359 A. D.; was declared consul 366, and Augustus in 367; was educated by Ausonius the poet; succeeded his father in 375, jointly with Valentinian II., his half-brother, his uncle Valens also reigning in the East until 378, when Gratian succeeded him, but in 379 gave the dominion of the East to Theodosius I. He was a Christian, and, though he persecuted heathenism, was a man of justice and virtue, but of somewhat feeble and luxurious character. His wars against the barbarians were measurably successful. He lived chiefly at Treves, and was murdered Aug. 23, 383 A. D., by Andragathius, a follower of Maximus, who succeeded him as emperor.

Grati'ola [once called *Gratia Dei*, "God's grace," from its supposed medicinal virtues], a genus of herbs of the order Scrophulariaceæ. The U. S. have numerous species, none of them important. The hedge hyssop (*G. officinalis*) of Europe and some South American species have been used in medicine.

Gra'tiot, county of Michigan, near the centre of the southern peninsula. Area, 576 square miles. The soil is productive, and is well timbered with pine. Wool, grain, and lumber are the chief products. Cap. Ithaca. Pop. 11,810.

Gratiot, post-v. of Licking and Muskingum cos., O. Pop. 228.

Gratiot, post-tp. of La Fayette co., Wis., on the Mineral Point R. R., and on the Illinois State line. Pop. 1718.

Gratiot (CHARLES), b. in Missouri in 1788; graduated at the U. S. Military Academy in 1806, and entered the army as second lieutenant of engineers; promoted to be captain in 1808, major 1815, lieutenant-colonel 1819, and colonel and chief engineer U. S. A. (brevet brigadier-general) 1828. In the war with Great Britain (1812–15) he served with distinction as chief engineer of the N. W. army; subsequently in the construction of fortifications to 1838, when placed in command of the corps of engineers, which position he held till Dec., 1838, when he was dismissed by the President for having failed to pay into the treasury certain balances of money placed in his hands for public purposes, etc. Gen. Gratiot memorialized the U. S. Senate in 1852 for an expression of opinion as to the legality of his dismissal, which petition was referred to the committee on the judiciary, who, deeming such expression inconsistent with their duty, asked to be, and were, discharged from the further consideration of the subject; but in their report they say, "The career of the petitioner during a long period of nearly forty years is a matter of history that may justly excite the pride and admiration of every American citizen. Brave in battle, he presided for a long time, with distinguished honor and ability, at the head of one of the most difficult and arduous bureaus of the military department, and has left to the country lasting monuments of his skill and science in the construction of various magnificent fortifications." . . . "While thus honorably and usefully employed he was constantly confided in by his country, and never abused her confidence in the disbursement of immense sums of money, and lived honored and respected by all classes of men, with no taint of suspicion attaching to his name." In support of his plea that the power exercised by the President in summarily dismissing him was arbitrary and illegal, Gen. Gratiot exhibited a mass of testimony which the committee said was entitled to be "calmly weighed and measured;" and in support of his second plea, he denied totally the truth of the charge of defalcation, and contended "that a just and legal adjustment of his accounts will bring the U. S. in debt to him—that he was then, and is now, prepared for an equitable settlement." In conclusion, the committee reported, "It seems to the committee that both the pleas are reasonable, and should receive attention, urged as they are with the earnestness of conscious rectitude by a gallant soldier, who has acquired a right to be heard from the blood he has spilled in battle." The case of Gen. Gratiot was never afterwards reopened, and after holding a clerkship in the land office at Washington from 1840 to 1855, he died in destitute circumstances at St. Louis, Mo., May 18, 1855.

G. C. SIMMONS.

Grat'is, post-tp. of Preble co., O. Pop. 2023.

Gra'tius Falis'cus, a Roman poet of whom nothing is known but the three following circumstances: he was a contemporary of Virgil (see Ovid, *Epistles from Pontus IV.*, 16, 33); he wrote a poem upon the chase entitled *Cynegeticon Liber;* and this poem was so entirely forgotten at the time of Numerianus (283 A. D.) that Nemesianus, writing on the same subject, could assert that he entered on a hitherto untrodden path. The poem, consisting of 540 hexameters, has come down to us through one single MS., discovered in France in the beginning of the sixteenth century, printed in Venice in 1534, translated into English verse by Christopher Wase in 1654, and into German verse by Perlet in 1826.

Gratry (AUGUSTE JOSEPH ALPHONSE), b. at Lille, France, Mar. 30, 1805; studied at the École Polytechnique; became in 1841 director of the College Ste. Barbe, Paris; almoner of the higher normal school 1846–51; was one of the reorganizers of the Oratory of the Immaculate Conception, and became an instructor of youth; vicar-general of the diocese of Orleans 1861; professor of moral theology in the Sorbonne 1863; was chosen to the French Academy 1867; left the Oratory 1869. D. at Montreaux, Switzerland, Feb. 6, 1872. Author of *La Connaissance de Dieu* (1855); *Cours de philosophie* (1855–57); *Logique* (1856); *Paix : méditations historiques et religieuses* (1862); *Les Sources, conseils pour la conduite de l'esprit* (1861–62); *Philosophie du Credo* (1861); *Commentaries* on St. Matthew (1863); *Jésus Christ* (addressed to Renan, 1864); *Les sophistes et la critique* (1864); *La morale et la loi de l'histoire* (1868), and other works. Shortly before his death he accepted the definitions of the Vatican Council, which he had hitherto opposed.

Grat'tan, post-tp. of Kent co., Mich. Pop. 1297.

Grattan (HENRY), b. at Dublin, Ireland, July 3, 1746; graduated at Trinity College in 1767; studied at the Middle Temple, London, and was admitted to the Irish bar in 1772; was a member of the Irish Parliament in 1775 from Charlton; brought forward in 1780 and 1782 the famous Bill of Rights, asserting the right of Ireland to self-government, and for his earnestness was presented with a valuable estate by the Parliament; was in 1790 returned from Dublin; opposed alike the rebellious schemes of the United Irishmen and the union with Great Britain; entered the imperial Parliament in 1805; advocated Catholic emancipation with great zeal, and wore himself out with labors in behalf of Ireland. D. in London May 14, 1820. Personally, Grattan was small and of unprepossessing appearance; his private character was pure and noble.

Grätz, city of Austria, the capital of Styria, situated on both sides of the Mur at an elevation of 1047 feet above the level of the sea, and forming the principal station on the route from Vienna to Trieste. It is an old town, with narrow and crooked streets, but its surroundings are very picturesque, and it contains many interesting buildings. The cathedral of St. Agidi was built in 1462; the church of St. Leonhard in 1283; the mausoleum of Ferdinand II. in 1615. Besides these buildings is the old ducal palace, a structure of great interest. Grätz has a university and many good educational institutions. Its manufactures of steel and iron wares and saltpetre are large, and its trade very extensive. Pop. 80,732.

Gratz, post-b. of Dauphin co., Pa. Pop. 386.

Grau'denz, town of Prussia, in the province of West Prussia, on the right bank of the Vistula. It has manufactures of cotton and wool, and close by lies the fortress of Graudenz, constructed by Frederick II., and commanding the course of the Vistula. Pop. 15,559.

Grau'wacke [Ger., "gray flint"], often half Anglicised as **Graywacke,** a sort of conglomerate found in various strata, chiefly Cambrian and Silurian. The term is not often used in this country.

Grave Creek, W. Va. See MOUNDSVILLE.

Grav'el, a collection of small pieces of stone, of which the constituents are larger than those of sand and smaller than those of shingle. Gravel is a deposit usually made by currents of water. In all but the more recent formations it is frequently found cemented into a mass called conglomerate, lime, iron, or siliceous matter constituting the cement.

Gravel, a disease manifested by the formation of small concretions either in the kidneys or bladder, and their expulsion with the urine. They are generally composed of some of the salts of urine, and are deposited either on account of being in abnormal abundance, or in consequence of the urine not being of the proper reaction to hold them in solution. When they form in the kidneys, they sometimes cause the most excruciating pain when passing along the ureter to the bladder, giving rise to what is commonly known as renal colic. Gravel may be divided into three varieties, according to its composition—viz. (1) uric acid or red gravel (see LITHIC-ACID DIATHESIS); (2) oxalate of lime (see OXALURIA); (3) phosphatic deposits (see PHOSPHATIC-ACID DIATHESIS). Other rare varieties are mentioned in the art. CALCULUS (which see).

EDWARD J. BERMINGHAM.

Gravelines, town of France, in the department of Nord, on the Aa, where it falls into the English Channel. It is fortified, but most famous from the battle in which the count Egmont defeated the French in 1558. Pop. 6428.

Grav'elly Springs, post-tp. of Lauderdale co., Ala. Pop. 862.

Gravelotte, Battle of, Aug. 18, 1870, also called the BATTLE OF REZONVILLE, or, by the French, the BATTLE OF ST. PRIVAT, was the greatest and bloodiest battle of the Franco-German war of 1870–71. By the battle of Vionville (Aug. 16) the French army was prevented from marching to Verdun, and Bazaine concentrated his forces nearer Metz, and occupied, with his front facing W., a favorable defensive position, marked by the points of St. Privat, Amanvillers, Verneville, and Rozerieulles. On the morning of the 18th the Germans were still in doubt whether the enemy would march towards the N. or whether he would keep his ground. An attack was expected on the day before, but none took place. King William then ordered that the whole army should make a great circuitous movement to the right, so that the left wing would fall in with the enemy if he tried to march off, while the right wing and the centre kept him where he was. Soon reports came from the outposts that the French had not marched off, but were before Metz; and at 10 o'clock orders were given that the army corps as they came in should wheel round to the right, against the front of the enemy. The centre of the French army was first attacked, the 9th corps planting its batteries at noon on the hill of Verneville, and opening a violent fire on the French batteries at Ste. Marie, St. Privat, and Amanvillers. But it was 7 o'clock P. M. when St. Privat was taken, and it was completely dark when the battle was finally decided by the failure of the attempt at breaking through the German lines at Gravelotte; the French army was now shut up in Metz, and could not escape. The Germans, numbering 211,000, lost 904 officers and 19,658 men; the French, numbering 140,000, lost 609 officers and 11,605 men. AUGUST NIEMANN.

Gravel Walls, so called, are composed of a mortar of cement or lime filled in with gravel, stones of considerable size, pieces of slag, and the like. The mass is laid up in a casing of boards, kept from spreading by means of slips of wood passing from the inside to the outside tier of boards. These slips may be left in. The material should be well rammed, and kept covered from rain until dry. Door and window frames can be set in as the wall goes up. An octagonal ground-plan is a favorite one for this material, which is, however, not as much employed as formerly.

Graves, county in the W. of Kentucky, bordering on Tennessee. Area, 515 square miles. It is level and fertile. Cattle, tobacco, grain, and wool are leading products. It is traversed by the New Orleans and Ohio R. R. Cap. Mayfield. Pop. 19,398.

Gravesand. See 'S GRAVESAND.

Gravesend, town of England, in the county of Kent, on the right bank of the Thames, 20 miles below London, to whose inhabitants it affords a pleasant holiday resort, on account of its fresh air and beautiful scenery. Pop. of town, 21,183; of b. 27,451.

Gravesend, post-v. and tp. of Kings co., N. Y., on the lower bay of New York. The tp. includes Coney Island, and is on the Brooklyn Bath and Coney Island R. R. Pop. 2131.

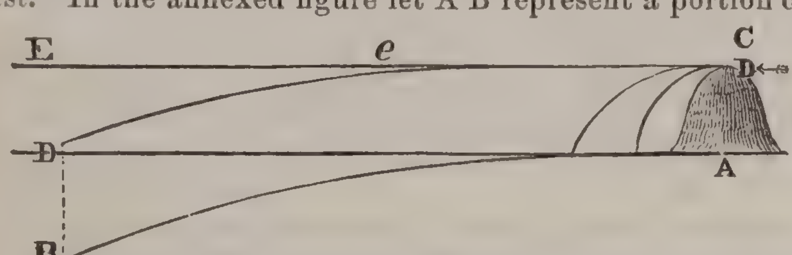
Gravesville, post-v. of Herkimer co., N. Y., in Russia tp. Pop. 67.

Gravi'na, town of Italy, in the province of Bari delle Puglia, situated in a very fertile district, with considerable commerce and industry. It is a bishop's see. Pop. 14,443.

Gravita'tion is, in its widest sense, the tendency which all bodies exhibit to approach each other with a force directly as their masses, and inversely proportional to the square of the distance between them. Two misapprehensions respecting this force are so widely prevalent, even among men of intelligence, that it is worth while to present such a view of the subject as shall remove them. They are (1) that gravitation was first discovered by Sir Isaac Newton; and (2) that it is simply a theory to account for the celestial motions, which may be hereafter disproved and superseded by some other theory. Neither of these views is strictly correct. The word "gravitation," derived from the Latin *gravitas*, literally means heaviness or weightiness, or, more exactly, the act or quality of being

heavy. That bodies in general tend to fall toward the earth is known to all even from earliest infancy; and as this tendency is gravitation, gravitation has been known to all men in all times. What Newton did was to show that the same force which causes a stone to fall extends to the moon and holds her in her orbit, and is only a special case of a force which extends through the entire solar system. He showed that the planets tend to fall toward the sun, the satellites toward the planets, and the moon toward the earth, according to the same law by which an apple falls to the ground. With this view of gravitation, the correction of the second misapprehension becomes easy. If gravitation is to be entirely disproved, we must begin by disproving the theory that heavy bodies tend to fall; and this no one thinks of doing. If any one supposes that the general fact that it extends to the heavens may, at some time, be disproved, we have only to say that the gravitation of the satellites to their planets and of the planets toward the sun is seen by the astronomer as clearly as the falling of raindrops is seen by the ordinary spectator. The only point in which the evidence in the one case falls short of that in the other is that the astronomer must depend on sight alone, and cannot feel the heavenly bodies as men can feel a stone. The evidence of sight is, however, so clear that that of touch is entirely unnecessary.

To the mathematician the passage from the gravitation of an apple to that of the moon is quite simple and easy, but the non-mathematical reader may not at first sight see how the moon can be constantly falling toward the earth without ever coming any nearer. The following illustration will make the matter clear. Any one can understand the law of falling bodies, by which a body falls 16 feet the first second, 3 times that distance the next, 5 times the third second, and so on. If, in place of falling, the body is projected horizontally—like a cannon-ball, for example—it will fall 16 feet out of the straight line in which it is projected during the first second, 3 times that distance the next, and so on, the same as if dropped from a state of rest. In the annexed figure let A B represent a portion of



the curved surface of the earth, and A D a straigh line, horizontal at A, or the line along which an observer at A would sight if he set a small telescope in a horizontal position. Then, owing to the curvature of the earth, the surface will fall away from this line of sight at the rate of about 8 inches in the first mile, 24 inches more in the second mile, and so on. In 5 miles the fall will amount to 16 feet, in 10 miles, in addition to this sixteen feet, three times that distance will be added, and so on, the law being the same with that of a falling body. Now, let A C be a high steep mountain from the summit of which a cannon-ball is fired in the horizontal direction C E. The greater the velocity with which the shot is fired, the farther it will go before it reaches the ground. Suppose, at length, that we should fire it with a velocity of 5 miles a second, and that it should meet with no resistance from the air. Suppose *e* to be the point on the line 5 miles from C. Since it would reach this point in one second, it follows from the law of falling bodies just cited that it will have dropped 16 feet below *e*. But we have just seen that the earth itself curves away 16 feet at this distance. Hence, the shot is no nearer the earth than when it was fired. During the next second, while the ball would go to E, it would fall 48 feet more, or 64 feet in all. But here, again, the earth has still been rounding off, so the distance D B is 64 feet. Hence, the ball is still no nearer the earth than when it was fired, although it has been dropping away from the line in which it was fired exactly like a falling body. Moreover, meeting with no resistance, it is going on with undiminished velocity. And just as it has been falling for two seconds without getting any nearer the earth, so it can get no nearer in the third second, nor the fourth, nor any subsequent second; but the earth will constantly curve away as fast as the ball can drop. Thus, the latter will pass clear round the earth, and come back to the point C from which it started, in the direction of the arrow, without any loss of velocity. The time of revolution will be about an hour and twenty-four minutes, and the ball will thus keep on revolving round the earth in this space of time. In other words, the ball will be a satellite of the earth, just like the moon, only much nearer and revolving much faster.

The ball we have just described is deflected from a straight line 16 feet in a second. The way in which Newton proceeded to find whether the moon was held in its orbit by the gravitation of the earth, was to calculate the amount by which the moon was deflected from a straight line every second, and compare this with the gravitation of the earth. It was already known from observations of the moon's parallax that her mean distance was 30 diameters of the earth. But the diameter of the earth itself was not known with any accuracy, and the value first used by him was one-half too small. The consequence was, that the distance of the moon he used in his calculations was also too small, and the result did not agree with the theory of gravitation. But a few years later a new determination of the magnitude of the earth was made by the French geodesists, which enabled Newton to repeat his calculation with exact data. He now found that the moon actually dropped $\frac{1}{15}$th of an inch in a second, or $\frac{1}{3600}$th as far as a stone at the earth's surface. The number 3600 being the square of 60, the distance of the moon in radii of the earth, he was enabled to announce that the force which held the moon in her orbit was the same which made the stone fall, only diminished in the ratio of the square of the moon's distance.

The next step in the demonstration was to show that the planets were held in their orbits by a force directed toward the sun, and inversely as the square of the distance from it. This demonstration was the great object of the *Principia*, and the data from which Newton set out were the laws of Kepler. From the law that equal areas were described around the sun in equal times it was easy to show that the force in question must be directed toward the sun; and from the relation between the distances of the planets and their times of revolution, the law of a force proportioned to the inverse square of the distance followed by a very simple demonstration. It remained to prove that the same law held true for the different distances of one and the same planet from the sun; in other words, that a planet revolving around the sun under the influence of gravitation would describe an ellipse having the sun in its focus. This demonstration occupied the attention of other mathematicians, as well as of Newton, but the latter first succeeded in it, and in doing so completed the theory of the gravitation of the planets toward the sun.

The next step was to apply to the moon the combined gravitation of the sun and earth. It was known that this body in its movement showed deviations from Kepler's laws, and Newton succeeded in showing that most of these deviations could be traced to the attractive force of the sun. But his mathematics were insufficient to enable him to calculate all the inequalities, or to give the exact values of those which he did calculate. Nevertheless, his success was sufficient to justify the enunciation of the greatest law of nature ever discovered: ***Every body in nature attracts every other body with a force directly as its mass, and inversely as the square of its distance.*** If this law is true in all its generality, then each planet must be attracted by every other planet, as well as by the sun, and its motion must be slightly altered by these attractions. To compute the effect of these attractions is a problem which has occupied the attention of most of the great mathematicians since Newton, and the result has been that the most complicated motions of the heavenly bodies can thus be predicted years in advance with a degree of accuracy limited only by the mathematician's power of calculating and the practical astronomer's power of observing.

Nor has the demonstration of gravitation been limited to the sun, moon, and planets. Nearly a century ago Maskelyne determined the attraction of a mountain, and this attraction is now shown whenever accurate observations for latitude and longitude are made in the neighborhood of great mountain-chains. Not only so, but Cavendish and Bailly succeeded in measuring the attraction of balls of lead upon very delicately balanced weights, and thus found the mean density of the earth to be about six times that of water. Passing from the smallest things to the greatest, Herschel found that many double stars revolve around each other, and by carefully observing those motions his successors have found that these also attract each other according to the law of gravitation. The gravitation of widely distant stars has not yet been seen, but the distances of these bodies from us and from each other are so immense that thousands and perhaps millions of years would be required before any motion due to gravitation could be perceived. From all the evidence we are justified in considering the mutual gravitation of bodies to be a universal law of nature, connecting the smallest masses as well as the largest. S. NEWCOMB.

Gravity, Specific—relative weight. Absolute weight is the weight of a body as measured by the units of ordinary metrology. Relative weight is the weight of a body as measured by the absolute weight of some other body equal to it in bulk taken as unity. Specific gravity is such relative weight when the measure is one which has been

adopted by common consent to be a *standard of comparison.* Water is the universally accepted standard for all solids and liquids; air, for all gases and vapors. But as the dimensions of bodies change with temperature, and in some cases with pressure also, and as the buoyant power of the air depends on the same conditions, it is necessary that comparisons for determining specific gravities should be made at certain determinate temperatures and states of barometric pressure, or that the results should be reduced to such. In regard to the standard temperature there has been no general agreement. In England, 62° F. has been used by many experimenters. Others both in England and the U. S. have used 60° F. Of recent years there has been a tendency to adopt the freezing-point of water = 32° F. = 0° C. or the temperature of the maximum density of water, which is 4° C. = 39.1° F. Every table of specific gravities should state the temperature to which the determinations have been referred. As to the standard pressure, no such difference of usage has prevailed. This is always taken at 30 inches of mercury, or 760 millimètres.

To ascertain the specific gravity of a liquid, the expedient which naturally suggests itself is to fill with water any convenient vessel up to a certain point and weigh it; and afterwards to weigh the same vessel filled to the same point with the liquid. The weight of the vessel having been deducted in both cases, the specific gravity is equal to the second weight divided by the first; and it will be greater or less than unity according as the liquid is more or less dense than water. For convenience in actual practice, a light vessel is constructed for these determinations, in the form of a bottle with a narrow neck (Fig. 1) capa-

FIG. 1.

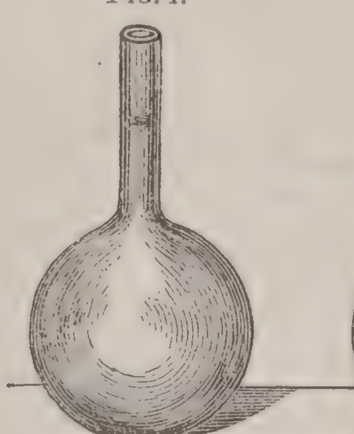


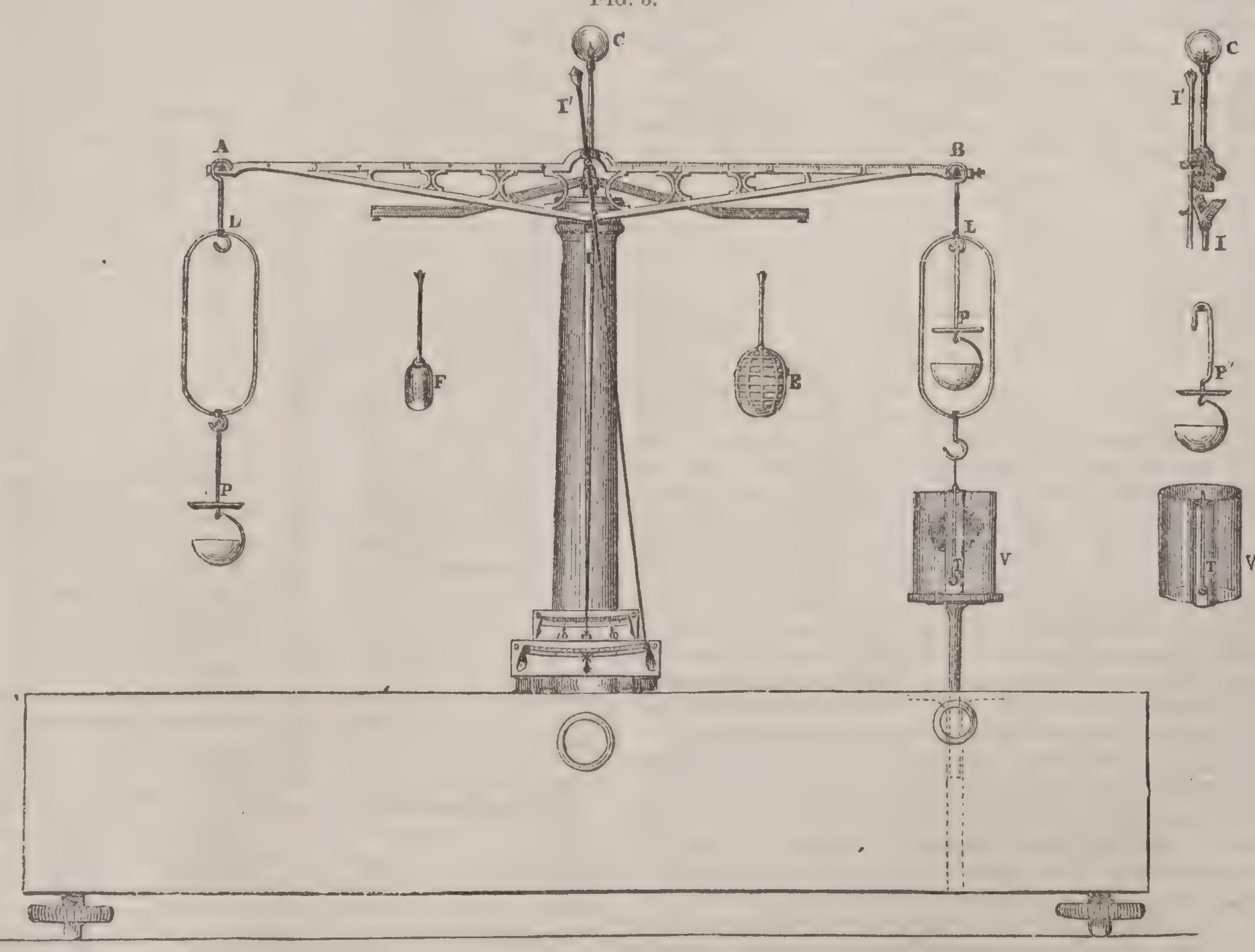
FIG. 2.

ble of containing 1000 grains or 100 grammes of water at the standard temperature. The weight of the liquid in grains or grammes then directly expresses the specific gravity, the decimal point being suitably placed. A mark on the neck shows exactly to what point the bottle is to be filled. Two marks are sometimes made to indicate the ends and the middle point of the curve in the surface of the fluid, produced by capillarity. In some instances also the bottle is made with a perforated stopper (Fig. 2), and after being entirely filled to the lip, is closed by putting in the stopper, the excess of fluid overflowing. The exterior must then be carefully dried before weighing. With every specific-gravity bottle a counterpoise weight is furnished by the maker, which exactly balances the weight of the bottle when empty. Placing this in the opposite scale, the additional weights necessary will be only the weight of the contents. The specific gravities of liquids may also be determined expeditiously by instruments constructed expressly for the purpose, called generally hydrometers, but variously named according to the nature of the liquid for which they are specially intended. (See HYDROMETER.)

The specific gravity of a solid could be ascertained by giving to a portion of the solid such regular shape as to allow an accurate determination of its dimensions, and then dividing its weight by the weight of an equal bulk of water. But this would be in general practically impossible; and it is not necessary. Advantage is taken of the Archimedean principle, that a solid body immersed in a liquid is buoyed up, or made apparently lighter, by an amount equal to the weight of the liquid it displaces. Hence, to ascertain the specific gravity of a solid, it is first carefully weighed in the air, and then, being suspended by a slender thread, is immersed in water and weighed again. The difference between these two weights is made the divisor, and the total weight of the solid, the dividend; the quotient being the specific gravity sought. If the temperature and pressure at the time of making the determination are not those adopted as standard, the result must be corrected, or reduced to standard; a process for which rules will be found in systematic treatises on physics. Should the solid be too light to sink, a sinker is attached to it, and the water-weight [weight of equal bulk of water] of the two together is ascertained as above. From this is afterwards deducted the water-weight of the sinker alone, and the remainder is the water-weight of the solid itself, which is to be used as the divisor.

The arithmetical operations necessary in computing and reducing specific gravities, involving generally divisors and factors of several places of figures, are troublesome. They may be avoided by the use of a balance constructed on a plan devised by the writer of this article, and represented in Fig. 3, which gives specific gravities by simple inspec-

FIG. 3.



tion. This balance differs from ordinary balances only in having the beam A B divided to units, tenths, and hundredths of length, and two index-needles, I and I′, the first for determining the position of horizontality, as in the common balance, and the other movable about a pivot of which the centre is coincident with the bearing knife-edge of the beam. Moreover, as the graduated edge of the beam is in a line with the bearing points, the ball C is placed above the middle point to prevent the centre of gravity from falling too low. These modifications do not in any manner

interfere with the usefulness of the balance for the ordinary purposes of weighing. When employed for determining specific gravities, the scale pans commonly used are removed, and two open loops of wire L, L, about two and a half or three inches long, are suspended from the ends of the beam, which still maintains its equilibrium after their attachment. The body under examination is fastened by a slender thread to the right-hand loop, and beneath it; while to the left-hand loop is suspended a pendent P designed to receive the weights which are to serve as a counterpoise. This pendent is itself a part of the counterpoise, and is so constructed as separately to weigh one gramme. It consists of a stem curved into a hook at top as shown at P′ on the right, provided below with a disk, through the centre of which it passes (designed to hold the weights), and carrying at bottom a small cup, into which may be introduced fine sand instead of small weights, to complete the counterpoise. The weights are disks, notched to the centre, in order that they may be placed on the disk of the pendent without being interfered with by the suspending wire. They are of different values, from twenty grammes to one centigramme. For smaller fractions, fine sand is used, the object being not to find out how much the body weighs, but to obtain a weight which is its exact equipoise. After a true equilibrium has been established, the beam is lifted, and the water vase V which stands beneath the suspended body is raised till the body is completely immersed. This vase is furnished with a thermometer, T, to show the temperature of the contained water. A pendent, exactly similar to that used in the first weighing, is now placed within the right-hand loop, over the immersed body, and weights are added to this until the equilibrium destroyed by the immersion is once more established. The total weight is the weight of the water displaced. The beam is now lifted again, the vase depressed, and the body removed. From a little table of numbers, with temperatures from 10° to 25° C., at the top, and cubic centimètres (represented for this purpose by gramme weights) at the side, is taken a correction for the reduction from the temperature of observation to 4° C. (the temperature of the maximum density of water), and this amount is added to the pendent in the loop. The left-hand pendent is then removed from the extremity of its arm, and placed at the unit division on the same arm; and the right-hand pendent is suspended on the right arm at such a distance from the point of support as to produce as nearly as possible an equipoise. The divisions of the arm being only to hundredths, perfect equipoise will not, in general, be in this manner secured. The nearest division short of equipoise will give the specific gravity to the second place of decimals. For the third and fourth places, the movable index needle above referred to must be used. This needle, which is made as light as possible, has its centre of gravity exactly coincident with its centre of motion; so that the equilibrium of the balance is not at all affected by its change of position when without a load. But at a distance from the centre equal to one-tenth of its entire length, it has a pin standing at right angles to itself, upon which may be placed weights which are made disk-shaped, with a hole through them at the centre. The construction is better seen in the perspective view on the right. A set of weights for the needle is provided, each being one-tenth part of the corresponding weight used with the pendents; and the load placed on the needle is one-tenth of that of the right-hand pendent, including the pendent itself. The needle, thus loaded, is then moved on its pivot toward the right, far enough to make the equilibrium, which had been previously almost attained, quite perfect; and when in this position the reading of its scale will give the third and fourth places of decimals in the specific gravity sought. It will be observed that, as no weights are used smaller than a centigramme in weighing the body immersed, the completion of the equipoise being effected by the use of fine sand, the load of the needle, which is in theory one-tenth of the weight of the pendent, must be a trifle deficient, no account being taken of the sand. The extreme deficiency, however, would not be so much as a milligramme; and this would usually affect only the sixth decimal, and would never affect the fifth by more than a single unit.

The beam A B is forty centimètres long, each arm being twenty centimètres. There are four unit divisions on each arm. For specific gravities exceeding *four*, the right-hand pendent is placed, when sinking the immersed body, at half-arm's length. The specific gravity found in this case, by proceeding as before, must be doubled to give the true result. If the pendent be in like manner placed at the quarter-arm's length, the observed specific gravity must be quadrupled. This carries the determinations up to *sixteen;* and by placing the *left*-hand pendent at *one-half* the unit distance from the middle, instead of the entire unit distance, they may be advanced to thirty-two, which is far beyond the actual specific gravity of any known substance.

For bodies lighter than water, a loaded cage E is provided, which confines and sinks them by its superior weight. When this is used, a counterpoise F is suspended within the left-hand loop, to balance it during the weighing in the air; and there is a second one to be used for the same purpose in weighing during immersion. For the specific gravity of liquids, a plunger is employed having an ascertained displacement in standard water of ten or one hundred cubic centimètres; and this is counterpoised by an exactly equal weight upon the left-hand arm. Accordingly when this plunger, thus counterpoised, is immersed in a liquid presented for examination, the figures expressing the metric weight required to re-establish equilibrium are themselves a direct expression of the specific gravity.

For determining the specific gravities of aëriform bodies, the principle of buoyancy is practically unavailable, though not so theoretically. Suppose the weight of a bulky solid weighed in vacuo to be P, and the apparent weight of the same solid weighed in air at standard density, to be W. Then if p be the weight of the air displaced by the solid, and w that of the air displaced by the counterpoising weights, we shall have for the actual weight of the air displaced by the solid,

$$p = \mathrm{P} - \mathrm{W} + w.$$

And if the same solid be weighed in a different aëriform medium, we shall have (using the same letters accented for the corresponding quantities)

$$p' = \mathrm{P} - \mathrm{W}' + w'.$$

Hence, putting S for specific gravity,

$$\mathrm{S} = \frac{\mathrm{P} - \mathrm{W}' + w'}{\mathrm{P} - \mathrm{W} + w}.$$

If the weighings are made with platinum weights, the terms w and w' may be neglected, since they could in no case affect the value of S more than a unit in the fifth decimal place. This method is however inapplicable, on account of the difficulty of conducting weighings in different atmospheres. There are moreover many gases to which the apparatus could not be exposed without injury. The method actually employed in making these determinations, is to fill a large and light glass globe (previously exhausted of its air) with the gas which is the subject of experiment, and to weigh it thus filled. The difference between this weight and that of the exhausted globe is the weight of the contained gas; and this divided by the weight of the equal bulk of air similarly ascertained, gives the specific gravity.

TABLE OF SPECIFIC GRAVITIES.

	Specific gravity.	Weight per cubic inch in pounds.
Metals.		
Platinum	21.150	.775
Gold	19.258	.697
Mercury, solid	14.391	.566
" liquid	13.588	.489
Lead	11.330	.408
Silver	10.472	.377
Bismuth	9.822	.353
Copper	8.878	.316
Iron	7.778	.280
Tin	7.291	.262
Zinc	6.862	.252
Antimony	6.712	.242
Arsenic	5.763	.208
Aluminum	2.670	.096
Rocks and Minerals.		
Topaz, Oriental	4.011	.145
Emery	4.000	.144
Diamond	3.520	.127
Limestone, white	3.156	.114
Glass, flint	3.078	.111
" crown	2.520	.091
" com. green	2.520	.091
" plate	2.760	.099
Alabaster	2.730	.098
Marble, statuary	2.718	.098
Coral	2.700	.097
Slate	2.672	.096
Chalk	2.620	.094
Granite, Ab. red	2.620	.095
Gypsum	2.286	.082
Salt	2.130	.077
Clay	1.900	.068
Sand, river	1.880	.067
" quartz	2.750	.099
Coal, anthracite	1.530	.055
" bituminous	1.270	.046
Woods.		
Lignumvitæ	1.333	.048
Box	1.280	.046
Ebony	1.187	.043
Mahogany, Span.	0.852	.031
Oak, Am. white	0.779	.028
" English	0.777	.028
Beech	0.696	.025
Ash	0.690	.025
Maple	0.675	.025
Pine, red	0.657	.024
" white	0.553	.020
Chestnut	0.606	.022
Cedar, American	0.554	.020
Elm, English	0.553	.020
Fir, spruce	0.512	.018
Cork	0.240	.008
Miscellaneous.		
Acid, phosphoric	1.880	.056
" sulphuric	1.842	.066
" nitric	1.552	.044
" hydrochlor.	1.270	.043
" acetic	1.062	.038
Asphalt	2.500	.090
Ivory	1.822	.065
Sugar	1.605	.058
Blood	1.054	.038
Beer, lager	1.034	.037
Milk	1.032	.037
Cider	1.018	.036
Water	1.000	.036
Camphor	0.988	.035
Beeswax	0.965	.034
Lard	0.947	.034
Butter	0.942	.034
Oil, linseed	0.940	.034
" whale	0.923	.033
Tallow	0.934	.034
India-rubber	0.933	.033
Alcohol, absolute	0.792	.028
" proof	0.916	.033
Ether	0.716	.026
Gases and Vapors.		
Steam	0.00880	.000317
Carb. acid	0.00197	.000071
Oxygen	0.00143	.000051
Atmos. air	0.00129	.000046
Olefiant gas	0.00127	.000046
Nitrogen	0.00125	.000045
Hydrogen	0.0000895	.0000032

F. A. P. BARNARD.

Gray, town of France, in the department of Haute-Saône, on the Saône. It has a brisk trade in corn, wine, and fruits. Pop. 7051.

Gray, tp. of White co., Ark. Pop. 2252.

Gray, post-tp. of Cumberland co., Me., 16 miles N. of Portland. It has 3 churches and some manufactures. Pop. 1738.

Gray, tp. of Edgefield co., S. C. Pop. 2533.

Gray (Alonzo), LL.D., b. at Townshend, Windham co., Vt., in 1808; graduated from Amherst College in 1834; was professor of chemistry and natural philosophy at Andover Academy 1837–43; professor of chemistry in Maryland College; principal of Brooklyn Seminary. Author of *Elements of Chemistry* (1853), *Elements of Natural Philosophy* (1851), etc. D. in Brooklyn, N. Y., Mar. 10, 1860.

Gray (Asa), M. D., LL.D., b. at Paris, Oneida co., N. Y., Nov. 18, 1810; received in 1831 his medical degree at the Fairfield College of Physicians and Surgeons, Herkimer co., N. Y.; studied botany with the late Prof. Torrey of New York; was appointed in 1834 botanist to the Wilkes expedition, but declined the post; became in 1842 Fisher professor of natural history in Harvard University, from the more active duties of which position he retired in 1873; became in 1874 a regent of the Smithsonian Institution. Dr. Gray has long been recognized throughout the scientific world as one of the ablest and most philosophic of botanists. Among his numerous writings are *Elements of Botany* (1836); *Manual of Botany* (1848); the unfinished *Flora of North America,* by himself and Dr. Torrey, the publication of which was commenced in 1838; *Genera Boreali-Americana,* also incomplete (1848); *Botany of the U. S. Pacific Exploring Expedition* (1854); numerous important and elaborate papers on the botany of the West and Southwest, published in the *Smithsonian Contributions, Memoirs,* etc. of the American Academy of Arts and Sciences, of which he was for ten years president, and in various government reports; also *How Plants Grow, Lessons in Botany,* and other works, forming a series of admirable textbooks upon this subject. In 1861 appeared his *Free Examination of Darwin's Treatise.* He is editorially connected with the *American Journal of Science and Arts,* and is a frequent contributor to that and other scientific journals in Europe and the U. S.

Gray (David) was b. in Edinburgh, Scotland, Nov. 9, 1836; emigrated with his family to the U. S. in May, 1849, and settled in Marquette co., Wis., as backwoodsman and farmer. In 1856 he went to Buffalo, N. Y., and three years later became connected with the *Buffalo Courier* as reporter. In 1868 he became managing and general editor of the same paper, a position which he now holds. J. B. Bishop.

Gray (Francis Calley), LL.D., son of Lieut.-Gov. William Gray, b. at Salem, Essex co., Mass., Sept. 19, 1790; graduated from Harvard University in 1809; was bred a lawyer; was private secretary to J. Q. Adams while U. S. minister to Russia; was often in the legislature; was corresponding secretary of the Academy of Arts and Sciences. He was an early contributor to the *North American Review;* was the author of *Prison Discipline* in 1848. He bequeathed $50,000 for the establishment and maintenance of a museum of comparative zoology in connection with Harvard University; and also a collection of engravings made during his life, probably the largest and most valuable of any in the U. S. He left, in addition, a sum of money the interest of which is to be expended for the increase and care of the collection, and provided for the publication of a catalogue of the engravings. This catalogue has since been prepared by Mr. Louis Thies, the first curator of the collection. It is a work of great thoroughness and accuracy. D. at Boston, Mass., Dec. 29, 1856.

Gray (George Robert), F. R. S., a brother of J. E. Gray, was b. at Little Chelsea, England, July 8, 1808. From 1821 till his death was connected with the British Museum as a zoologist, but gave especial attention to entomology and ornithology. Author of the entomological part of the English edition of Cuvier's *Animal Kingdom,* of *Genera of Birds* (1837–49), *Hand List of the Species of Birds* (1870), and other valuable treatises. D. May 6, 1872.

Gray (Henry Peters), b. in New York City June 23, 1819; began his art-studies with Daniel Huntington in 1838, but after a year's practice he went to Europe to study the masterpieces of foreign art. In 1843 he returned to New York, but for a short time. In 1846 he went abroad again for a few months, after which he lived in New York till the winter of 1872, when he went to Italy and stayed two years. Gray has been an industrious painter; his portraits number some 300. But his reputation rests mainly on his composition pictures, the subjects of which are biblical, classical, and romantic. As a draughtsman and a colorist he stands high. His best pictures are in private galleries of New York. Mr. Gray was for several years president of the National Academy of Design. O. B. Frothingham.

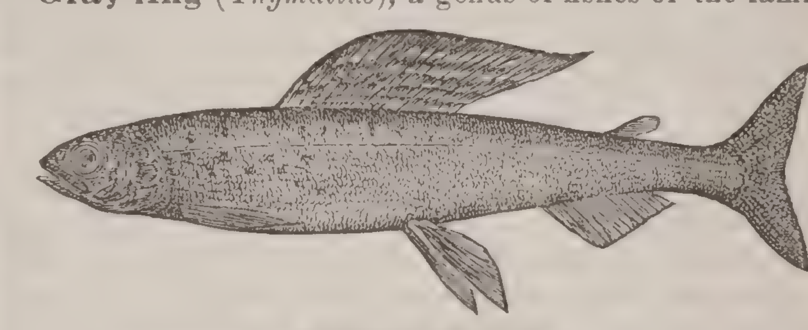
Gray (John Edward), Ph. D., F. R. S. (the son of S. F. Gray, a savant and author), was b. in 1800 at Walsall, England, and educated as a physician. His father's *Arrangement of British Plants* (1821), a valuable treatise, was mainly the work of J. E. Gray. From 1824 to 1875 he was prominently connected with the British Museum; was one of the most laborious of naturalists, a member of many learned societies, and the author of hundreds of scientific papers and of many valuable catalogues. He published zoological reports of the expeditions of the Erebus, Terror, Sulphur, and other historic British exploring ships; edited Turton's *Manual of Land and Fresh-Water Shells;* wrote *Illustrations of Indian Zoology,* etc.; and took a prominent part in favor of sanitary and social reforms. D. Mar. 7, 1875.

Gray (Robert), b. at Tiverton, R. I., in 1755. On Sept. 30, 1787, the sloop Washington, Capt. Gray, sailed from Boston to trade with the natives of the north-west coast. Returning in 1790, viâ Canton (China), Capt. Gray was the first man to carry the stars and stripes around the globe. He made a second voyage, and May 11, 1791, discovered the river which is now called Columbia. D. at Charleston, S. C., in 1806.

Gray (Thomas), LL.B., b. in Cornhill, London, Dec. 26, 1716, the son of a scrivener of brutal temper and habits; was educated at Eton and the Peterhouse, Cambridge; travelled in Italy and France (1739–41) with Horace Walpole; took his legal degree at Cambridge 1742, and afterwards lived at the university, in which he was appointed professor of modern history in 1768, but never actively engaged in the duties of that position. D. at Cambridge July 24, 1771. Gray's fame rests almost entirely upon his *Elegy written in a Country Churchyard* (1749), which has given him a high position in English literature. He was a man of delicate and refined tastes, retiring and sensitive, fond of learning, art, and philosophic studies, almost effeminate in manners, and of constitutionally infirm health. His published *Letters* are admirable in style and matter, and his Latin verse is good. The *Ode on a Distant Prospect of Eton College* (1747), *Progress of Poesy,* and the *Hymn to Adversity* (1742) are noteworthy among his other poems. Mitford's edition of his works (1814, often reprinted), with a memoir and notes, is one of the best.

Gray (William), b. at Lynn, Mass., June 27, 1750; became engaged in shipping, in which pursuit he amassed great wealth, having at one time 60 square-rigged vessels on the ocean; was lieutenant-governor of Massachusetts in 1810, having before this been a State senator. D. at Boston Nov. 4, 1825.

Gray'ling (*Thymallus*), a genus of fishes of the family



Michigan Grayling.

Salmonidæ, resembling the trout in habits and character. It is one of the best of the game-fishes, an order of aquatic nobility to which some authorities admit only the trout, salmon, and grayling. The *T. vulgaris* is the common grayling of Europe. It is in great request for the table. The *T. tricolor* is found in some streams of Michigan and in the head-waters of the Yellowstone. Its discovery has been hailed as a great acquisition to the anglers of the U. S. It is perhaps identical with *T. signifer,* a splendid inhabitant of the far northern waters of British America. There are other species, chiefly European and Asiatic.

Gray Powders. See Mercury, Medicinal Uses of.

Gray'son, county of W. Central Kentucky. Area, 700 square miles. Its surface is undulating. Coal, iron, limestone, and mineral springs abound. Cattle, tobacco, grain, and wool are leading products. Cap. Litchfield. P. 11,580.

Grayson, county of Texas, bounded on the N. by the Red River. Area, 950 square miles. Cattle, grain, pork, and cotton are staple products. The soil is fertile and well timbered. It is intersected by the Missouri Kansas and Texas R. R. Cap. Sherman. Pop. 14,387.

Grayson, county of Virginia, bordering on North Carolina, and included between the two easternmost ranges of the Appalachian Mountains. It abounds in iron and other mineral wealth, and is a good grazing region. Grain and wool are leading products. Area, 340 square miles. Cap. Independence. Pop. 9587.

Grayson, post-v., county-seat of Carter co., Kentucky. Pop. 152.

Grayson (John Breckenridge), b. in Kentucky in 1806; graduated from the U. S. Military Academy, and was appointed second lieutenant of artillery July, 1826, first lieutenant 1834; transferred to the subsistence department in 1838, with the rank of captain, and promoted to be major 1852; as an artillery officer he served in garrison and on special duty until 1836, with the exception of a period (1835) when on active duty in the field in Florida against the Seminole Indians; he served throughout the Mexican war as Gen. Scott's chief commissary, and for gallant conduct at Contreras, Churubusco, and Chapultepec was brevetted major and lieutenant-colonel. On the outbreak of the civil war he resigned his commission, and was appointed a brigadier-general in the Confederate service. D. in Florida in 1861. G. C. Simmons.

Grayson (William), b. in Prince William co., Va., graduated at the University of Oxford; studied law, and settled at Dumfries. He was chosen as aide-de-camp to Washington in 1776; also as colonel of a Virginia regiment in 1777. He was eminent throughout the Revolution as an officer of intrinsic worth and undaunted courage. He was one of the first U. S. Senators from Virginia in 1789. D. at Dumfries Mar. 12, 1790.

Grayson (William), b. in Maryland 1786; served with distinction in both houses of the Maryland Assembly; also took an eminent part in the struggle to acquire a new and more liberal constitution for the State in 1838; was governor 1838–41. D. July 9, 1868.

Grayson (William J.), b. at Beaufort, S. C., in Nov., 1788; graduated at South Carolina College in 1809; was educated for the law; occupied the office of commissioner in equity of South Carolina; became a member of the State legislature (1813); a State Senator (1831); held the position of M. C. 1833–37, and in 1841 was appointed collector of customs at Charleston, S. C., by Pres. Taylor. He contributed many articles to the *Southern Review;* was the author of *The Hireling and the Slave* (1856), *Chicora*, and other works. D. at Newbern Oct. 4, 1863.

Gray's Peak, on the Rocky Mountains, is in Summit and Clear Creek cos., Col., 12 miles W. of Georgetown. It is 14,466 feet in height. Named in honor of Dr. Asa Gray, and is the twin of Torrey's Peak, of the same height.

Grays'ville, post-v. of Monroe co., O. Pop. 199.

Gray'ville, post-v. and tp. of White co., Ill., on the Wabash River at the mouth of the Bonpas River, on the Cairo and Vincennes R. R. A portion of the town lies in Edwards co. It has 2 weekly newspapers, 1 bi-monthly religious paper, a literary society, good schools, 2 flouring and 3 saw mills, 1 stave and 2 furniture factories, 2 planing mills, and 3 hotels. Pork is packed and grain shipped at this point. It is surrounded by a fertile region. Pop. of tp. 1925. Jonathan Stuart, Ed. "Republican."

Grazale'ma, town of Spain, in the province of Cadiz. It is very peculiarly situated behind Sierra de Ronda and Cerro de St. Christoval, approachable only through a very narrow pass. Smuggling is largely carried on. Pop. 6600.

Grease [akin to the Lat. *crassus*, "thick"], the popular name of many inferior fats, or oils which are solid or semi-solid. They are used as lubricants for wagon-wheels (in which case a little tar or soda increases their durability) and in dressing some sorts of leather. "Mare's grease" is the oil of horses, imported from South America and used as a lubricant. Many kinds of grease are employed in making soap, candles, and glycerine.

Grease-Wood, the *Sarcobatus vermiculatus*, a plant of the order Chenopodiaceæ, very abundant in the Far West in barren places which are charged with alkaline salts. It is one of the characteristic plants of that region.

Great Barrington, post-v. and tp. of Berkshire co., Mass., on the Housatonic River and R. R. It is a prominent and pleasantly situated town, surrounded by beautiful hills. It contains manufactures of woollens, cotton goods, paper, flocks, pig iron, brick, and saw-mill products. It has a national and a savings bank, a weekly newspaper, 18 public schools (including a high school), and 7 churches. The post-villages of Van Deusenville and Housatonic are within the town limits. It is a popular resort in summer, has several first-class hotels, is supplied with gas and pure spring water, and the main street is lined with grand old elms. The town was settled in 1730, incorporated in 1761, and until 1787 was the county-seat. The territory was purchased from the Indians, and originally bore the name of the Housatonic Propriety. Pop. of tp. 4320.
Marcus H. Rogers, Ed. "Courier."

Great Basin, or **Fremont's Basin,** the great area extending westward from the Wahsatch Mountains to the Sierra Nevada, measuring some 300 miles N. and S., and 350 E. and W., and including nearly all of Nevada, a great part of Utah, a large area in California, and small parts of Wyoming, Idaho, and Oregon. Its waters do not reach the sea, hence it is called a basin. It is, however, in reality, a series of basins, mostly long, broken N.-and-S. valleys lying between rugged mountain-ranges. Across these ridges and valleys the valley of the Humboldt River strikes diagonally, affording the only practicable railroad route from E. to W.—the route of the Central Pacific R. R. The climate is very dry, and agriculture is not practicable without irrigation. The streams are small, and important only for irrigation and mining purposes. The Humboldt, Carson, Bear, Jordan, Provo, Beaver, Sevier, and Weber rivers are the largest. Great Salt Lake is the largest body of water, and Utah Lake is the principal fresh-water lake. The other lakes, some of them mere "sinks" or marshy places, are partly salt and partly fresh, while some are composed of highly complex chemical solutions, like Mono Lake in California. The climate is generally healthful. "White-pine" timber is cut on some of the mountains. There is a considerable grazing industry. Gold, silver, lead, borax, salt, sulphur, and soda-salts are abundant, and the mining interest is important. The basin is peculiarly exposed to the ravages of the "hateful grasshopper" (*Caloptenus spretus*).

Great Bear Lake, in British America, under the Arctic Circle, between lon. 117° and 123° W. It has an irregular outline, is very deep and clear, abounds in fish, and is frozen over for half the year. Area, 14,000 square miles.

Great Bend, post-v., cap. of Barton co., Kan., on the Arkansas River and the Atchison Topeka and Santa Fé R. R., near the centre of the State. It has a bank, a newspaper, a large brick court-house, a graded school building, 2 churches, 2 hotels, 15 stores, and a large trade.
A. J. Hoisington, Ed. "Register."

Great Bend, post-b. and tp. of Susquehanna co., Pa., 14 miles S. E. of Binghamton, N. Y., on the Susquehanna, at the junction of the Erie and the Delaware Lackawanna and Western R. Rs. Pop. of b. 855; of tp. 1431.

Great Britain [Gr. Ἀλουίων νῆσος, Βρεττανικὴ νῆσος; Lat. *Albion, Anglia, Britannia*]. Under this head we propose to notice the United Kingdom of Great Britain generally, and refer to the articles on England, Wales, Scotland, Ireland, the Isle of Man, and the Channel Islands for further particulars. Great Britain, thus called to distinguish it from Lesser Britain or the Bretagne, is the largest island in Europe, and, next to Greenland, New Guinea, Borneo, Madagascar, and Sumatra, the largest in the world. It is separated from the continent of Europe by the British Channel (La Manche of the French), the narrowest portion of which is called the Strait of Dover (Pas de Calais), and by the German Ocean or North Sea, and from Ireland by the Irish Channel or Sea, which communicates with the open Atlantic through the North and St. George's channels. The island of Great Britain comprises England, Wales, and Scotland, and lies between lat. 49° 57′ 30″ and 58° 40′ 24″ N., and between lon. 1° 46′ E. and 6° 13′ W. of Greenwich. Its most southerly point is Lizard Point in Cornwall; its most northerly, Dunnet Head in Caithness; its most easterly, Lowestoft Ness in Norfolk, and its most westerly, Ardnamurchan Point in Argyleshire. Its greatest length is 608 miles; its greatest breadth, between the Land's End and the North Foreland in Kent, 325. Farther N. the island is narrow. Near the frontier of Scotland it is only 64 miles across, and the distance between the Friths of the Forth and Clyde hardly exceeds 30 miles. The area of Great Britain is 84,392 square miles, and that of the 931 smaller islands along its coasts 4614 square miles. Of these smaller islands, 224 are inhabited. The more important among them are the Orkneys (320 square miles), the Shetlands (615 square miles), the Hebrides or Western Islands (3141 square miles), Anglesey (192 square miles), the Scilly Islands (6 square miles), and the Isle of Wight (156 square miles).

Great Britain, Ireland, the Isle of Man in the Irish Sea, and the smaller islands in the British seas are spoken of generally as the *British islands.* Their area is as follows:

Great Britain, mainland	84,392	square miles.
" " lesser islands	4,614	"
Ireland, mainland	32,285	"
" lesser islands	246	"
Man, Isle of	227	"
Total British islands	121,764	"

The "United Kingdom" includes Great Britain and Ireland, but neither the Isle of Man nor the Channel Islands near the French coast, which are not represented in Parliament, in spite of their vicinity to the seat of the central government. These islands are in the enjoyment of ancient institutions; and although, in statistical documents,

they figure occasionally as if they formed integral parts of the United Kingdom, they are in reality merely British dependencies.

The area of the whole British empire, including colonies, dependencies, etc., is as follows:

	Area.	Population.
Europe:		
United Kingdom	121,537	32,412,000
Isle of Man	227	54,042
Channel Islands	76	90,596
Heligoland	$\frac{1}{5}$	1,913
Gibraltar	2	25,216
Malta	143	149,084
Asia:		
British India	943,406	193,223,418
Native states (feudatory)	202,531	14,270,315
Ceylon	24,454	2,405,287
Straits settlements	1,206	308,097
Keeling Islands	8	400
Aden and Perim	12	29,730
Labuan	45	4,898
Hongkong	32	124,198
Africa:		
Cape Colony	200,616	566,158
Basuto Land	8,000	75,000
Griqualand, West	16,632	25,477
Griqualand, East	3,400	35,000
Natal	17,801	293,832
West African settlements	17,000	633,400
St. Helena	47	6,241
Ascension	34	27
Tristan da Cunha	45	53
Mauritius	739	317,069
Dependencies of do	350	13,391
Australia:		
New South Wales	308,560	584,273
Queensland	668,259	146,690
Victoria	88,451	790,492
South Australia	380,602	198,257
Northern Territory	523,531	55,000
West Australia	975,824	26,209
Tasmania	26,215	104,217
New Zealand	106,259	378,000
Chatham Islands	520	132
Norfolk Island	17	481
Fiji Islands	8,034	100,000
America:		
Dominion of Canada	3,513,325	3,718,745
Newfoundland	40,200	146,536
Bermuda	41	15,309
West India Islands	13,754	1,063,886
Honduras	13,500	24,710
British Guiana	85,425	215,200
Falkland Islands	4,741	803
Summary:		
Europe	121,985	32,732,851
Asia	1,171,694	210,366,343
Africa	264,658	1,865,648
Australia	3,086,274	2,383,751
America	3,670,986	5,185,189
Total	8,315,597	252,533,782

In addition to the territories enumerated above, Great Britain has taken possession at various times of a number of islands, not at present under British administration. Amongst these may be mentioned the Kuria Muria Islands on the coast of Arabia, Kamaran in the Red Sea, New Amsterdam and St. Paul in the Indian Ocean, the Auckland Islands, Lord Howe's Island, Fanning, Malden, Starbuck, and Caroline in the Pacific.

Physical Geography.—The British islands rise on a submarine plateau joined to Denmark, Germany, the Netherlands, and France, but separated from Norway by a deep channel exceeding 200 fathoms in depth. A fall of the sea to the extent of only 102 feet would cause the appearance of an isthmus joining the Netherlands to Norfolk and Lincoln, and the Dogger Bank, at present one of the most productive fishing-grounds, would rise to the surface, a huge flat island, in the middle of the German Ocean. A further fall of 18 feet would cut off the communication between the British Channel and the German Ocean and render superfluous any scheme for bridging or tunnelling the Strait of Dover. A total fall of the level of the sea of 180 feet would convert nearly the whole of the southern half of the German Ocean and a considerable portion of the British Channel into dry land. A fall of 240 feet would join Ireland to Great Britain. The depth of the sea increases rapidly at a distance of from 20 to 50 miles to the W. and N. W. of Ireland, the Hebrides, and Shetland Islands. The wide channel between the latter and the Faroe Islands attains a depth of 640 fathoms (3840 feet), and that of the Atlantic between Ireland and Rockall (a rock 70 feet high in lat. 57° 32′ N., lon. 13° 42′ W., and the centre of a productive fishing-bank) exceeds 1600 fathoms.

Coast-line.—The coast-line of Great Britain has a development of 2900 miles; that of Ireland of 1400 miles, minor indentations excluded. On the former island no point is at a greater distance from the sea than 75 miles; on the latter, this distance is only 50 miles. The eastern coast of Great Britain is unbroken, and there are only a few bays and natural harbors affording shelter to shipping, a deficiency compensated for to some extent by the existence of several estuaries of rivers, such as the Thames and Humber in England and the Forth and Tay in Scotland. The safest harbor along the whole of this coast is that formed by the Cromarty Frith, one of the two arms of the Moray Frith, though it is of small importance commercially. A considerable portion of this coast is flat, especially that of Norfolk and adjoining the sand-choked bay called the "Wash," where the Fens form an extensive marshland. In many parts the sea has encroached upon the land, but elsewhere considerable tracts of country have been conquered from the sea, and are defended against its ravages by dikes and embankments. The northern coast of Scotland, between Duncansby Head and Cape Wrath, is steep throughout, and the W. coast, as far S. as the mouth of the Clyde, is intersected by numerous narrow sea-lochs bounded by steep hills and of considerable depth. Narrow "sounds" separate the mainland from Skye, Mull, and others of the Hebrides, and a broad strait, the Minch, separates it from the Outer Hebrides. Amongst the numerous peninsulas of that part of Scotland, that of Cantire is the most considerable. It is nearly 60 miles in length, and terminates in the Mull of Cantire. The eastern coast of the Frith of Clyde is generally level, whilst that of the peninsula of Galloway, further S., is generally steep, and juts out in the bold Mull of Galloway, the most southerly point of Scotland, in lat. 54° 38′ N. The eastern portion of the Irish Sea forms a vast bay, bounded on the N. by Galloway, on the E. by the English counties of Cumberland and Lancashire, and on the S. by Wales. Its centre is occupied by the Isle of Man. Three subsidiary bays open into it—viz. those of the Solway Frith, Morecambe Bay, and Liverpool Bay (with the estuaries of Mersey and Dee). They all abound in sandbanks, which render navigation exceedingly intricate. The peninsula of Wales has generally bold and rugged coasts. Menai Strait, hardly 600 feet in width, separates it from the island of Anglesey. The wide sweep of Cardigan Bay opens here towards the W., and Milford Haven penetrates far inland towards the S. W. This is one of the most secure harbors of the British islands, though, owing to its geographical position, it is but little used. Bristol Channel and the estuary of the Severn separate South Wales from the counties of Somerset and Devon. The most important bays along it are those of Caernarvon and Swansea on the coast of Wales, and of Barnstaple on the coast of Devonshire. The navigation of its upper portion is obstructed by sandbanks. Devon and Cornwall form a peninsula, terminating in the Land's End (50° 4′ N., 5° 42′ W.), the most westerly point of England. The Scilly Islands lie off this cape, and have proved fatal to many a homeward-bound merchantman. The coasts of this peninsula are generally steep and celebrated for their picturesqueness. There are several excellent harbors, amongst which we may mention Mount's Bay, the harbor of Falmouth, and that of Plymouth; the latter is protected by a magnificent breakwater, and the celebrated Eddystone lighthouse points out the way to it. The remainder of the S. coast of England is generally level. The Bill of Portland, a rocky promontory joined to the mainland by the Chesil Bank, bounds the roadstead of that name to the W. The only other secure harbors on the S. coast are those of Southampton and of Portsmouth, opposite the Isle of Wight, the latter the most important naval station of Great Britain. Spithead is a secure roadstead between it and the Isle of Wight. Farther to the E. the South Downs gradually approach the coast and form the bold Beachy Head (532 feet). The coast then again becomes level and, at Dungeness, marshy, but from Sandgate to the North Foreland it is formed of white chalk cliffs. These "white cliffs of Old England" have become proverbial, though their extent is very limited. They owe their prominence in the popular estimation principally to the fact of their first meeting the eye of a traveller coming from the Continent.* There are no natural harbors along this coast (that of Dover has been created artificially), but the roadstead called the "Downs," lying between the land and the Goodwin Sands, offers some shelter to shipping. The estuary of the Thames is bounded by low coasts, and sandbanks render its navigation exceedingly intricate. The estuary of the Medway, which opens into it, forms one of the most secure harbors, and has been strongly fortified (Chatham).

Relief.—The British islands cannot vie with other European countries in the height of their mountains, but they nevertheless possess a variety of relief which removes them

* The name Albion, which is bestowed sometimes upon Great Britain, is derived frequently from *albus*, "white," with reference to these cliffs. A more correct derivation, however, appears to be that from the Gaelic words *alb* and *inn*, which mean "high land."

far from the monotonous low plains of Northern Europe. England, speaking generally, is a level country, especially towards the E., where the marshy district of the Fens offers an analogue to that we meet with on the opposite coast of the Continent, but it is traversed by table-lands and ridges of varying elevations, and which in the N. assume the height of veritable mountains. Wales, and also Scotland, may fitly be described as mountainous countries, whilst Ireland presents itself as a vast lowland dotted over by isolated mountain-groups. The culminating point of the whole country, Ben Nevis, attains an elevation of 4406 feet, and its mean height does not probably exceed 700 feet. The Highlands of Scotland are intersected by a long and narrow valley, the Great Glen (Glenmore), extending from Loch Eil to the Beauly Loch. This valley is occupied by a chain of lakes connected by the Caledonian Canal, and its highest point is only 94 feet above the level of the sea. The mountain-region to the N. of it consists of irregular groups, for the most part sterile and inhospitable and very thinly populated. There are extensive moors, and the mountain-summits rise above them to a height of about 4000 feet (Ben Derag 3235 feet, Ben Wyvis 3422 feet, Ben Attow 4000 feet). Towards the N. E. it merges into the undulating sandstone plains of Caithness, which form bold and striking headlands on the coast. The mountain-region to the S. of the Glenmore is known as the Grampians. In its arrangement it is much more linear than the northern Highlands. A central chain may be traced from Ben Nevis (4406 feet) in the S. W. to the coast of Aberdeen. The Pass of Drumouchter, on the confines of Perthshire and Inverness, crosses this chain at an elevation of 1488 feet. The northern Grampians branch off from this central chain near the head-waters of the Dee, and attain an elevation of 4295 feet in Mac Dhui. The southern Grampians culminate in Ben Lawers, 3984 feet. The Grampians are hardly inferior to the northern Highlands in sterility, and moors abound, but there are likewise excellent pastures in the valleys; and where these open out towards the N. E. and S. E. they offer every facility for a successful pursuit of agriculture. The western coast of the Highlands is generally steep and rugged, and sea-lochs penetrate far into the land; their interior abounds in picturesque lakes. Strathmore (the great vale) extends along the foot of the Highlands from Loch Lomond, in the S. W., to Stonehaven, in the N. E. It is separated from the sea and the great central plain extending between the Forth and the Clyde by a range of hills broken through by the Forth and Tay, and known as the Campsie Fells, the Sidlaw (1700 feet), and Ochill Hills (2352 feet). Southern Scotland consists of an extensive hilly region stretching from St. Abb's Head in the German Ocean to the Stranraer on the Irish Sea, and culminating in the Broad-Law (2754 feet). The valleys of the Tweed and Clyde almost cut off from the main mass the outlying ranges of the Lammermoor and Pentland towards the N. The range forming the boundary towards England is known as the Cheviots (2669 feet). The hills of Southern Scotland are generally broad and flattened; they are intersected by deep pastoral glens, which open out into fertile valleys and plains. Amongst the latter that called the Merse, at the mouth of the Tweed, is the most considerable.

Northern England, from the foot of the Cheviots to the middle of Stafford and Derbyshire, is intersected by a range of mountains forming the water-parting between the German Ocean and the Irish Sea. To geographers these mountains are known as the Pennine chain; locally they are known by a great variety of designations. The depression which separates this hilly region from the Cheviots is marked by the line of the old Roman wall which extended from Carlisle to Newcastle, and only rises 445 feet above the level of the sea. They naturally divide themselves into two groups, separated by a depression at the heads of the rivers Ribble and Aire, where the Liverpool and Leeds Canal crosses them at an elevation of 500 feet. The northernmost of these groups culminates in the Cross Fell (2928 feet), and is but loosely connected with the picturesque Cumbrian Mountains towards the W., which abound in lakes, shady woods, and rich pastures. Scafell (3230 feet), the highest summit of the Cumbrian Mountains, is at the same time the culminating point of all England. The southern group of the Pennine chain is far less elevated than the northern, and the Peak of Derbyshire, its culminating point, only rises to a height of 1981 feet. It terminates with the Weaver Hill, in lat. 53° N. (1154 feet). The region of the Pennine Mountains is one of the most sterile of England, and the moorlands are of great extent. In the rest of England there are no hill-ranges equal in importance with the Pennine chain, and the general level of the central portions of the country even but rarely exceeds 500 feet in height. The bands of Lias and Oolite which extend from Yorkshire to Dorset form a series of hills, interrupted by table-lands or plains, and having generally a steep escarpment to the W., and sloping down gently towards the E. Amongst these may be mentioned the North York moors (1864 feet), to the N. of the Ouse; the Lincoln Heights, to the S. of it; the Cotswold Hills (1134 feet), to the E. of the Severn; and the Dorset Heights. The valley of the Thames is bounded on the N. and S. by chalk hills, affording generally excellent pasturage. Those on the N. extend from Wiltshire into Suffolk, and attain an elevation of 905 feet in Wendower Hill. The southern chalk hills are known as the Downs, and attain nowhere an elevation of 1000 feet; Inkpen Beacon, on the boundary of Hants and Berks, is their culminating point. The northern Downs (Leith Hill, 967 feet) extend from it to the coast of Kent, at Dover, where they form white cliffs; the southern Downs terminate in the Beachy Head (532 feet), on the coast of Sussex. These two ranges bound a fertile district called the Weald, formerly a forest of oak, at present one of the most productive agricultural districts of the country. Geologists describe the Weald as a valley of denudation, and frequently refer to it in illustration of that kind of geological action. The Mendip Hills (979 feet), near the mouth of the Severn, are already beyond the chalk region of Southern England, for they consist of mountain limestone, and the Exmoor (1706 feet), a range on the southern shore of the Bristol Channel, consists of Devonian rocks, which, with members of the Carboniferous series, occupy the greater portion of Devonshire and Cornwall, and are intruded by granite and other igneous rocks. To this intrusion is due the origin of the so-called "Dartmoor Forest," a desolate moor region rising in Yeo Tor to a height of 2050 feet. The fertile plain of Cheshire and the valley of the Severn form the natural boundary between England and the mountain-region of Wales, next to Scotland the most considerable in the British islands. It is frequently distinguished as the "Cambrian Mountains," though "Welsh Hills" is the more popular designation. The highest summit is the Snowdon (3590 feet), close to Menai Strait. A natural depression at the head of the Severn divides North from South Wales, and the hills of the latter are particularly distinguished by their barrenness, their highest range being known as Black Mountains (Brecknock Beacon, 2863 feet), from the color of the heather which covers them. The Welsh Hills, towards the E., merge into the table-lands of Salop, Hereford, and Gloucester, where several outlying hill-ranges rise, amongst which may be mentioned the Malvern Hills (1444 feet), the Clee Hills (1805 feet), and the isolated Wrekin (1320 feet) in the centre of Shropshire. Several of the valleys of this Cambrian region are distinguished for their loveliness, and amongst these that of the Wye in the S. and of the upper Dee in the N. carry off the palm for beauty. The Isle of Man, in the Irish Sea, rises to a height of 2024 feet. The western islands of Scotland are generally of considerable height (Ben More, on Mull, 3185 feet); the Orkneys and Shetlands, though they present bold cliffs towards the sea and are much broken up by intricate channels, only rise to a height of 1556 and 1476 feet respectively.

Hydrography.—The rivers of the British islands are small if we compare them with those of the Continent; but as they all carry an abundant supply of water throughout the year, and many of them are navigable for considerable distances, they are nevertheless of considerable importance to commerce and industry. The following drain a basin of more than 1500 square miles:

Great Britain.	Length in miles.	Basin, sq. m.	Ireland.	Length in miles.	Basin, sq. m.
Thames	201	5255	Suir	114	3555
Ouse	143	2766	Shannon	160	6060
Humber	185	9293	Corib	64	1689
Tweed	96	1870	Erne	64	1689
Tay	103	2250	Bann	85	2242
Clyde	48	1580			
Mersey	85	1722			
Severn	186	8119			

The Thames rises at Thameshead, 376 feet above the level of the sea, and enters the German Ocean at the Nore Light, between Shoeburyness and Sheerness. At its mouth it is 5 miles, at London bridge, 46 miles above it, 692 feet, and as far as the latter it is navigable for vessels of 300 tons. Its most important tributary is the Medway, which forms an excellent harbor. The Ouse rises in Northamptonshire, and is navigable from Retford, 46 miles above its mouth. It enters the Wash at King's Lynn. The Humber, properly speaking, is an arm of the sea, into which the Trent and Yorkshire Ouse pour their waters, and extends 37 miles inland. Kingston-upon-Hull, an important commercial town, is situated on its N. coast at the mouth of the small river Hull. The Trent rises in the moorlands of Staffordshire, intersects an exceedingly fertile district, and becomes navigable at Burton-upon-Trent. Small sea-

going vessels can ascend it as high up as Gainsborough. The Ouse rises in Yorkshire, is navigable for small sea-going craft as far as York, and for barges to Linton. The Tweed is a rapid stream, forming, in its lower course, the boundary between England and Scotland, and entering the German Ocean at Berwick. The Forth, though an inconsiderable stream, deserves to be mentioned because Edinburgh (Leith) lies near its frith. It is navigable to Stirling. The Tay is the most important river of Scotland. It rises to the N. of Loch Lomond, flows through Loch Tay, leaves the mountains at Dunkeld, intersects the Strathmore, and finally enters the Frith of Tay. It is navigable as far as Perth. The remaining rivers of Scotland, with the exception of the Clyde, are of little use to navigation, for their fall is generally very rapid, but they abound in fish. The Clyde rises in a small lake on the southern confines of Lanarkshire, and enters the Frith of Clyde below Glasgow. Like other Scotch rivers, its current is very rapid, and it forms several waterfalls, but at a vast expense for dredging it has been made navigable for large vessels as far as Glasgow. The Mersey rises on the confines of Cheshire and Derbyshire, and forms a wide estuary at its mouth, on which is situated Liverpool, the first shipping-port of the world. Its tributary, the Irwell, is navigable for barges as far as Manchester, and canals connect it with the principal rivers of the rest of England. The Severn rises on the slope of Plinlimmon in Wales, and becomes navigable at Welshpool, 170 miles above its mouth. It traverses the fertile plain of Shrewsbury and the vale of Gloucester, and enters the Bristol Channel below the town of that name. The tides at its mouth are of tremendous height (60–70 feet), and the country is protected against them by embankments. Its most important tributaries are the Wye and the Avon. Bristol is situated on the latter.

Scotland abounds in lakes, in most of which productive fisheries are carried on. They are, almost without exception, in the Highlands. The more considerable amongst them are Loch Lomond (45 square miles), Lochs Awe and Ness (30 square miles each), Loch Shin (25 square miles), Loch Maree (24 square miles), and Loch Tay (20 square miles). England may boast of numerous lakes in the Cumbrian Mountains, the so-called "Lake District," but, though they are distinguished for picturesque beauty, the largest amongst them, the Windermere, covers an area of only 4 square miles. Wales is even poorer in lakes.

Climate.—The climate of Great Britain is mainly determined by the insular position of the country, to which it owes its mildness and equability, and that absence of extremes which distinguishes it from the climate of continental countries under the same latitude. The Gulf Stream, above all, by sending its warm waters towards the British islands, most potently influences their temperature, which it raises above that of the sea-board countries on the western shores of the Atlantic having the same latitude. The difference between the annual temperature of Penzance (52.17° F.) and Unst (44.99°), the former in lat. 50° 11′ N., the latter in lat. 60° 42′ N., only amounts to 7.18°. In spring it is only 5.76°; in autumn it rises to 10.38° F. The potent influence of the Gulf Stream is exhibited, moreover, by the fact of the temperature of places on the W. coast of Great Britain being about 1° in excess of that of places on the E. coast having the same latitude. The mean annual temperature of England has been estimated at 49.5°, that of Scotland at 47.5°, and that of Ireland at 50°, these figures being the means observed at a large number of meteorological stations. S. W. winds are the most prevalent throughout the year, and are generally attended with rain. The rainfall varies exceedingly according to locality. In the greater portion of England and Scotland it does not exceed 30 inches a year, but towards the W. and in Ireland this amount is much exceeded, and in some of the hill districts which catch the clouds as they drift eastward the amount of rain is only equalled in tropical countries. (At the Style Pass in Cumberland 189½ inches fell in a single year.) The maximum rainfall in South-western Ireland and England takes place in winter, but the greater portion of the country lies within the region of winter rains. Snow falls but rarely, except in the hills, where it remains on the ground frequently for three or more months.

Geology.—The geological features of Great Britain are distinguished by the presence of the whole series of recognized stratified rocks, which were first studied here systematically, and in most instances have become typical of similar series met with in other parts of the world. As a rule, the oldest stratified rocks occupy the W. and N. of Ireland, and in going to the E. or S. E. we pass in succession over the more recent formations until we reach the most recent of all, which form the marshland along some parts of the E. coast. The Palæozoic strata occupy about one-third of the entire superficies. Their comparative sterility is compensated for, in part, by the existence of mineral treasures, constituting one of the principal sources of Great Britain's eminence as a manufacturing country. The oldest rocks of this series are met with in the Outer Hebrides and on the coast of Ross and Sutherland. They consist principally of crystalline gneiss, and have been recognized as being equivalent to Sir W. Logan's Laurentian rocks of North America. The *Cambrian rocks* of Northern Scotland, Cumberland, and North Wales are superimposed upon them. In Scotland they consist of red sandstone and conglomerate, in England and Wales of sandstone, gritstone, and slates. To these succeed the *Silurian rocks*, most fully developed in South Wales, in the Cumbrian Mountains, and, above all, in Scotland, where they constitute nearly the whole of the southern hills and of the region of the Grampians, the broad belt separating them, and including Strathmore and the central plain, being occupied by members of the Devonian and Carboniferous series. The *Devonian* is most fully developed in Devonshire, but also occurs in Central Scotland. The *Carboniferous series* occupies a broad tract extending from the Bristol Channel to the foot of the Cheviots, and extends thence into Scotland. Within these limits there are no less than fourteen detached coal-fields. Scotland is equally well provided with coal, and five distinct fields occur between the foot of the Grampians and the southern hills. The Permian strata, consisting of magnesian limestone and red sandstone, occupy a considerable area in Durham; and though traceable thence as far as Devon and Cornwall, they are nowhere of great extent. Fine marbles, and in the two latter counties tin and lead, are found in it. The *Triassic measures* are represented by sandstones and variegated marls. They may be traced as a ribbon from Hartlepool in the N. to the mouth of the Exe in the S., but are most fully developed in the counties of Leicester, Staffordshire, Warwickshire, Shropshire, and Cheshire. Beds of rock-salt occur in them in the latter. The *Lias* extends from Yorkshire to the Dorset coast, and detached tracts of it are met to the W. of this line and in Scotland. Jet and alum are found in the rocks near Whitby, on the coast of Yorkshire. The *Oolites* constitute one of the most important amongst the geological formations, for they yield the best of all building materials. They occupy a belt of country in places thirty miles wide, and extending from Yorkshire to Dorsetshire. In Scotland the Oolites of Brora contain coal. The *Cretaceous rocks*, principally chalk with intercalated sands and clays, exceedingly rich in fossils, occupy a considerable portion of South-eastern England, and altogether surround the *Wealden* clays and sands of Kent and Sussex. The chalk hills can be traced from Flamborough Head in Yorkshire to Hants, and extend thence on the one hand into Wilts, Dorset, and Devon, and on the other, through the counties to the N. and S. of the Thames, to the shores of the German Ocean and of the British Channel, where they form chalk cliffs. The *Tertiary formations* are limited to a portion of the S. coast, of which Hants forms the centre, to the valley of the Thames and the coast of Essex and Suffolk, to the low lands surrounding the Wash and the basin of the Humber. On the E. coast of England they occur on the Solway Frith, on the coast of Lancashire, and on the Bristol Channel. They consist of Eocene clays, sands, and marls, of Pliocene ferruginous sands and marl, and of Pleistocene deposits. The Miocene is apparently not represented. *Eruptive rocks*, such as granites, porphyries, syenite, and basalt, are met with principally in the hills of Devon and Cornwall, in Wales, in the Cumbrian Mountains, in the Cheviots, and throughout Northern Scotland. There are several hot springs in England (Bath, Bristol, Buxton, and others), but none in Scotland or Ireland. Cold mineral waters, however, occur in all these countries.

The *Natural History* of Great Britain corresponds generally with that of continental Europe, and there are only a few species which are peculiar to it. The flora is represented by 1600 species of phænerogamous and 4800 of cryptogamous plants. The flora of by far the greatest portion of the island resembles that of Germany; that of the mountains in Western Ireland corresponds more or less to that of the Pyrenees; that of Devon and Cornwall agrees in many respects with the flora of North-western France; the flora of Northern France is most fully represented in South-western England, particularly in the chalk hills; whilst the vegetation of the mountains of Wales, North England, and Scotland has many affinities with that of the Alps or of Scandinavia. Perhaps the most remarkable example of a plant of one of the continental countries named not being likewise indigenous to Great Britain is that of the Norway spruce. The lemming offers a similar instance amongst animals. Only one species of fir (*Pinus sylvestris*) is indigenous to the British islands, and together with the yew and juniper it is the only representative of the coniferous family. Of other trees there are the oak, elm, beech, birch,

poplar, willow, ash, alder, hornbeam, and hazelnut, but numerous others have been acclimated, such as the cedar, maple, sycamore, and chestnut. The indigenous fruit trees yield plums, cherries, apples, sloes, pears, medlars, and nuts, and several others have been introduced, but generally require the protection of a wall to arrive at maturity. There is likewise a great variety of edible berries. Wheat, oats, barley, and rye are the cereals which are cultivated. The summers are not hot enough for maize. In the S. of England and Ireland many sub-tropical plants thrive in the open air.

With respect to the animal world, it may be stated that the bones of elephants, tigers, rhinoceroses, hippopotamuses, and alligators have been discovered in the rocks of Great Britain. But this is the only record that they once existed. The hyæna disappeared more recently, and there is documentary evidence to prove that wild oxen (the urus), wild boars, bears, beavers, and wolves were numerous in early times. All these have now disappeared, the wolf as recently as 1710. Irrespective of domesticated animals, there are 52 species of mammals—viz. 7 bats, the hedgehog, 2 shrews, the badger, the mole, the weasel, the polecat, the stoat, the beech and pine marten, the otter, the fox, the wildcat, the common and the bearded seal, 8 species of mice and rats, the squirrel, the hare, the alpine hare, the rabbit, the stag, the fallow deer, and the roe, besides 16 species of whale. There are 274 species of birds—viz. 22 birds of prey, 101 perching birds, 14 gallinaceous birds, 59 wading birds, and 78 swimming birds. There are about 170 salt and fresh water fish, including the pilchard, the herring, the salmon, and trout. Much has lately been done for the promotion of fisheries by establishing a close time and purifying the rivers, and the results are already showing themselves in a more plentiful supply of salmon. The number of reptiles is exceedingly small. These are—a lizard (very rare), 3 species of eft, and 4 of snake, including the poisonous viper. The Amphibia are represented by the frog, toad, and watterjack, all harmless. There are perhaps 500 species of Testacea, amongst which are the oyster and the muscle. Scotland in former times was celebrated for its pearl fishery.

Population.—The following table conveys information on the population of the United Kingdom, inclusive of the Channel Islands and the soldiers and seamen abroad, for the years 1811, 1831, 1851, and 1871:

	1811.	1831.	1851.	1871.
England and Wales..	10,164,256	13,896,797	17,927,609	22,712,266
Scotland.................	1,805,864	2,364,386	2,888,742	3,360,018
Ireland..................	5,956,460	7,767,401	6,574,278	5,412,377
Islands in the British seas...............	80,000	103,710	143,126	144,638
Army and seamen abroad................	502,536	260,191	212,194	216,080
Total...............	18,509,116	24,392,485	27,745,949	31,845,379

For the middle of 1874 the population is estimated as follows: England and Wales, 23,648,609; Scotland, 3,462,619; Ireland, 5,300,485; total, 32,412,010. At the time of the census (in 1871) there resided in foreign countries no less than 3,181,199 natives of the United Kingdom, and in British colonies about 1,730,000. Taken as a whole, the population of the United Kingdom has not retrograded during any period for which we possess trustworthy census returns. Its increase between 1801 and 1871 amounted to 96.12 per cent., or 0.97 per cent. annually. This increase, however, has varied considerably during different periods. It was most rapid in 1811–21, immediately after the termination of the great wars, and least in 1841–51, when the potato disease, combined with cholera, took away many lives, and gave an immense impulse to emigration. During the former period the annual increase amounted to 1.40 per cent., during the latter to 0.26 per cent. only. But whilst the population of the kingdom increased as a whole, that of particular districts has exhibited a decrease, and the increase in the remainder has been very unequal, having been most considerable in the manufacturing districts, the large towns of which absorb an increasing proportion of the rural population, very much to the detriment of the *physique* of the people. During 1861–71 the population of England and Wales increased 1.31 per cent. annually, that of Scotland 1.01 per cent., but that of Ireland decreased at the rate of 0.47. In Ireland the decrease has been almost universal, extending even to the large towns, Belfast alone excepted. In Scotland a considerable decrease took place in the northern and southern counties, but was more than compensated for by an increase in the population of the central manufacturing districts. Emigration has at all times, and particularly since 1840, considerably interfered with the increase of the population. If we assume that the emigrants had remained in the country, without themselves contributing towards the number of births, the decennial increase between the years 1860–71 would have amounted to 14.32 per cent., instead of 8.6 per cent. Some idea of the extent of this emigration may be gathered from the fact that from the beginning of 1825 to the close of 1873 no less than 7,505,781 persons left the United Kingdom in order to seek a home elsewhere. The details of this emigration are as follows:

Years.	No. of emigrants.
1825–30............	72,485
1831–41............	717,913
1841–51............	1,692,063
1851–61............	2,249,355
1861–71 (3 months)............	1,978,800
1871 (9 months)............	189,335
1872............	295,213
1873............	310,617

This vast emigration has been compensated for only to a small extent, for it is estimated that the number of immigrants between 1863–72 did not exceed 242,000 persons. Amongst the emigrants who left the country 1851–73 there were, according to nationality, about 1,613,000 English, 397,700 Scotch, 2,321,000 Irish, and 692,000 foreigners. Within the last few years the Irish emigration is on the decrease, and out of 310,613 emigrants who departed in 1873 they numbered only 83,693.

Taken as a whole, the United Kingdom is one of the most densely populated countries of the world, though there are extensive mountain-tracts and waste lands which support only a small population. The density in 1871 was as follows:

	Area, sq. m.	Population, 1871.	Density.
England...........................	50,933	21,495,131	422
Wales...............................	7,378	1,217,135	165
Scotland............................	30,695	3,360,018	109
Ireland..............................	32,531	5,412,377	166
Man..................................	227	54,042	238
Channel Islands................	76	90,596	1192
Total............................	121,840	31,629,299	260

A remarkable feature in the distribution of the population consists in the large number of populous towns. The town-population is more numerous, proportionately, than in any other country of which we have trustworthy returns. The number of towns of 2000 inhabitants and their population in 1871 were as follows:

	No. of towns.	Inhabitants.	Percentage of total population.
England and Wales......	938	14,041,404	62
Scotland......................	161	1,919,528	57
Ireland........................	127	1,197,344	22
Total.....................	1226	17,157,276	54

The following are the towns having more than 100,000 inhabitants, arranged according to magnitude: London, 3,254,260; Glasgow, 547,538; Liverpool, 493,405; Manchester, 351,189; Birmingham, 343,787; Leeds, 259,212; Dublin, 246,326; Sheffield, 239,946; Edinburgh, 197,587; Bristol, 182,552; Belfast, 174,412; Bradford (Yorkshire), 145,830; Newcastle-upon-Tyne, 128,443; Salford, 124,801; Hull, 121,892; Dundee, 119,141; Portsmouth, 113,569; Oldham (Lancashire), 113,100. There are thus 18 towns of over 100,000 inhabitants, or 4,156,989 inhabitants in all, which is 24.2 per cent. of the total town-population of the United Kingdom. In most of the towns the population increases rapidly, but there are several, such as Bath, Coventry, and Canterbury, which have either no manufactures at all or where they are in a state of decay, and these have decreased in population during the last ten years.

The annual number of births and deaths to 1000 living has been as follows during 1861–71:

	Birth-rate.	Death-rate.
England and Wales............................	35.06	22.41
Scotland..	34.90	21.99
Ireland..	25.99	16.38
United Kingdom............................	33.36	21.25

It should, however, be stated that the registration in Ireland is exceedingly defective, and that no dependence can therefore be placed upon the above figures. To every 1000 males there were, in 1871, 1058 females in the United Kingdom, 1056 in England, 1013 in Wales, 1096 in Scotland, 1050 in Ireland. This disparity between the sexes is due to the larger proportion of men who emigrate or who are abroad as soldiers or mariners. The following table furnishes information with respect to the ages of the population. It gives the percentage of persons under 20 years of age for the three portions of the United Kingdom:

	1821.	1841.	1871.
England and Wales....................	49.00	46.02	45.90
Scotland..	48.30	47.07	46.67
Ireland..	53.20	49.04	43.36

Nationalities.—According to place of birth the population of the United Kingdom is distributed as follows (1871):

	English.	Scotch.	Irish.	Natives of British Colonies.	For'ners and born at sea.
England and Wales..	21,692,165	213,254	566,540	96,467	143,840
Scotland.................	70,482	3,061,531	207,770	10,469	9,766
Ireland..................	67,881	20,318	5,306,757	8,367	9,054
	21,830,528	3,295,103	6,081,067	115,303	162,660

This table does not exhibit the composition of the population according to nationality, but merely illustrates the changes which are going on at the present time.

English is spoken by the educated classes throughout the British islands. Cymric has maintained itself in Wales, Gaelic in the Highlands of Scotland, on the Isle of Man, and in Ireland, particularly in Connaught and Munster. These Celtic dialects, however, are gradually dying out, in spite of the efforts made to keep them alive. It is supposed that about 77,000 persons in Wales do not understand English, and that about 300,000 in Scotland still speak Gaelic. In Ireland the number of persons able to speak Irish only was 103,562 in 1871, and there were 714,313 who spoke English in addition to Irish. In 1861 these numbers were 163,275 and 942,261 respectively.

Occupations of the People.—The census returns for the year 1871 contain most elaborate statements with respect to the occupations of the inhabitants of the British islands. Unfortunately, the facts obtained have not been published on identical principles for each of the three kingdoms, and the classification of occupation is open, moreover, to serious objections. We have carefully gone through these voluminous returns, and the following is the result obtained:

Occupations.	England and Wales.	Scotland.	Ireland.	Percentage. Eng. & Wales.	Scotland.	Ireland.
1. General and local government	106,286	11,407	25,728	0.4	0.3	0.5
2. Army and navy	136,491	8,198	36,686	0.6	0.3	0.7
3. Learned professions, literature, art, science	299,693	33,508	44,971	1.3	1.0	0.8
4. Agriculture	1,559,037	236,745	1,047,347	6.8	7.0	19.4
5. Engaged about animals	98,101	35,458	18,422	0.4	1.1	0.3
6. Laborers and indefinite	802,303	98,239	386,504	3.5	2.9	7.1
7. Miners and working in minerals	1,156,621	168,168	44,746	5.1	5.0	0.8
8. Art and mechanical productions in which matters of various kinds are used in combination	1,144,571	158,500	77,738	5.0	4.7	1.4
9. Textile fabrics and dress	2,150,791	333,210	399,075	9.5	9.9	7.4
10. Working and dealing in food and drink	464,051	62,523	56,253	2.0	1.9	1.4
11. Working and dealing in animal substances	56,351	5,863	3,881	0.2	0.2	0.1
12. Working and dealing in vegetable substances	165,340	27,441	15,854	0.7	0.8	0.3
13. Commerce	287,164	42,858	55,283	1.3	1.3	1.0
14. Transportation	528,260	72,873	54,039	2.3	2.2	1.0
15. Persons of rank and property	168,895	37,197	15,715	0.8	1.1	0.3
16. Wives and women engaged generally in household duties	4,271,657	699,173	910,925	18.8	20.8	16.8
17. Entertaining and performing personal duties for man	1,633,514	161,460	386,983	7.2	4.8	7.2
18. Students, scholars, and children under 15, not engaged in productive occupations	7,683,137	1,167,208	1,832,227	33.9	34.7	33.9
Total	22,712,266	3,360,018	5,412,377	100	100	100

Agriculture.—The soil of Great Britain is almost exclusively devoted to the production of breadstuffs and of grasses, roots, etc. as food for cattle. The principal cereals cultivated are wheat, barley, and oats. Beans and peas are of some importance; turnips and swedes are the principal green crops. Potatoes are most extensively cultivated in Ireland, where they constitute the principal food of the laboring population. The cultivation of hops (64,000 acres) is confined to England, that of flax almost entirely to Ireland. Orchards are most extensive in the S. W. and S. of England. Amongst other objects of cultivation may be mentioned rape, saffron, coriander, caraway, teasel, madder and woad, mustard, liquorice, chamomile, peppermint, and other medicinal plants, but none of these occupies a considerable area. The beet, which is used on the Continent largely for the manufacture of sugar, is used in Great Britain almost entirely as food for cattle, as there are no protective duties which enable home-made sugar to compete with colonial produce. The land of the United Kingdom available for agricultural purposes is almost entirely in the hands of a small number of landed proprietors, from whom it is leased by the actual cultivators of the soil. Until quite recently the latter were almost entirely at the mercy of their landlords; their tenure was of a very uncertain nature, and they could claim nothing for permanent improvements. In this respect a change for the better has taken place, particularly in Ireland; and although Great Britain even now stands at the head of agricultural countries, there is no doubt that recent legislation will contribute to a more rational and exhaustive cultivation of the land.

The following are the leading agricultural statistics of the United Kingdom for 1874 (in thousands of acres):

	England and Wales. Acres.	Per cent.	Scotland. Acres.	Per cent.	Ireland. Acres.	Per cent.	Man. Acres.	British Islands. Acres.	Per cent.
Under crops and fallow	14,616	39	3,474	18	5,280	25	73	23,443	30
Permanent pasture	12,072	33	1,106	6	10,472	51	21	23,671	30
Orchards	149	0.4	2	...	....	...	...	151	
Woods	1,453	4	734	4	325	1.5	...	2,512	3
Waste and sheepwalks	8,029	21	13,729	69	4,249	9.5	49	26,056	34
Water	1,009	3	600	3	494	3	2	2,396	3
Total area	37,319	100	19,645	100	20,820	100	145	77,929	100
Horses	1,924,000		296,000		526,000		6,000	3,752,000	
Cattle	4,971,000		1,155,000		4.118,000		20,000	10,264,000	
Sheep	22,925,000		7,389,000		4,438,000		84,000	34,836,000	
Pigs	2,272,000		150,000		1,096,000		4,000	3,522,000	
Number of occupiers	480,178		81,007		600,000				
Average size of holdings, acres	56		57		26				

It would appear from this table that only 63 per cent. of the superficies of the British islands is cultivated or planted with woods. Making every allowance for buildings and roads, and for the barren moorlands of Wales, England, and Scotland, there ought still to be a considerable extent of land capable of cultivation. The waste given above actually includes the sheep-drifts in Great Britain as well as the "commons," the latter covering 2,632,772 acres, of which 883,989 are capable of cultivation. The bogs of Ireland, however, which are included above amongst waste lands, we are told are incapable of being utilized even for pasturing purposes. A thorough utilization of the agricultural resources of Great Britain is demanded all the more as great quantities of food are now imported annually. During the years 1866–74 the wheat crops of the United Kingdom averaged 12,105,000 quarters, and no less than 9,286,000 quarters had to be imported annually to meet the deficiency. The case is more favorable as respects cattle. It was estimated in 1870 that the live-stock of the United Kingdom furnished 1,220,625 tons of meat, to which had to be added 114,693 tons of foreign meat to meet the demands for home consumption. It would appear from this that the annual consumption of meat amounts to 52 pounds per head—an amount by no means large if measured by an American standard, though very considerable if we compare it with the nations of continental Europe.

Fisheries.—The rivers and the seas surrounding the British islands abound in fish, and the fisheries give occupation to a large number of the population. In 1871 there were enumerated 58,967 fishermen, and the sea-fisheries in 1873 employed 40,928 boats, having a tonnage of about 294,000 tons (Scotland 16,765, England and Wales, 15,331, Ireland 8450, and the Isle of Man 375 vessels). Salmon are caught almost exclusively in the rivers of Scotland and Ireland; the herring fisheries are carried on principally from the Scotch ports; the pilchard is caught on the coasts of Cornwall and Devonshire, and England (Essex and Kent) rejoices in the possession of the best oysters. In former times, up to 1830, it was sought to encourage the fisheries by the payment of premiums. This system, however, proved fal-

lacious, and whilst in 1830 only 329,557 barrels of herrings were cured throughout Great Britain, the Scotch fisheries alone produced 681,193 barrels in 1860 and 938,000 in 1874.

Mining and Metallurgical Industries.—Amongst the valuable minerals which from immemorial times have been worked in Great Britain coal occupies at the present day the foremost rank. The position of the coal-basins has already been indicated. They cover an area of about 12,000 square miles, and if worked to the depth of 4000 feet they will be exhausted in the course of 700 years if the present rate of consumption continues. The coal raised in 1873 amounted to 127,012,767 tons (in 1874 it was only 126,590,108 tons). Of this amount 28 per cent. is used in smelting iron and other metals, 21 per cent. for steam-power in factories, 16 per cent. for domestic purposes, 10 per cent. is exported, 8 per cent. is used in mines and collieries, 6 per cent. on railways and in steamers, 5 per cent. in potteries, chemical works, etc., and 5 per cent. for the manufacture of gas. The iron industry is the most important next to that of coal. It has assumed gigantic proportions since 1740, when coal was first used for smelting the ore. Then the produce of pig iron only amounted to 17,350 tons; in 1806 it was 250,000, in 1823 443,066, in 1860 3,826,752, and in 1873 6,566,451 tons. There is just now some depression in the trade, owing to over-production and to disputes with the workmen, but it will no doubt soon pass away. The iron ores of Great Britain are generally associated with the coal-beds, which enhances their value. In 1871 there were 851 blast and 6805 puddling furnaces in Great Britain (none in Ireland), employing 127,618 hands. Copper is raised principally in Cornwall and Devon, as well as in Scotland and Ireland. Lead has been worked in Derbyshire from the time of the Romans, but has since been discovered in other parts of the island, including Cornwall and Devon, the only counties furnishing tin, and celebrated on that account amongst the Phœnicians. All other ores are of subordinate importance. They include zinc, arsenic, manganese, antimony, nickel, silver, gold, etc. The quantity and value of metals produced from British ores in 1873 were as follows:

Pig iron	6,566,451 tons.	£18,057,739
Fine copper	5,240 "	502,822
Metallic lead	54,235 "	1,263,375
White tin	9,972 "	1,329,706
Zinc	4,471 "	120,099
Silver (from lead ore)	537,707 ounces.	131,077
Other metals	....	5,000
Total		£21,409,818

In addition to these, 1,442,218 tons of foreign ores were smelted in Great Britain. If we add to the above the value of 1,785,000 tons of rock-salt, of 1,785,000 tons of clay and shale, of the coals not used in smelting or in mines (say £30,000,000), of clays and slate and building-stones, it will be found that the value of the mineral produce of the United Kingdom amounted to about £57,580,000 in 1873.

Manufactures.—Amongst the great textile industries of the country, that of woollens is the oldest. It was carried on already under the dominion of the Romans, but in spite of protective duties and other well-meant laws enforcing the use of woollen stuffs, it was only after the immigration of Flemish weavers (1668) that really good cloth was produced. At the present time English broadcloth enjoys a deserved reputation. The cotton industry has been of some importance since the invention of the spinning-jenny in 1767, and has since assumed astounding proportions. In 1766 the value of all cotton goods was estimated at £600,000, in 1846 at £36,000,000, and in 1874 at £100,500,000. The progress of this industry (which depends for its raw material mainly upon the U. S.) is shown in the following table:

Years.	Cotton consumed.		Total value of goods produced in millions of pounds.	Weight of yarns and cloth in millions of pounds.	
	Weight in millions of pounds.	Cost in millions of pounds.		Total.	Exported.
1858	907	24.8	63.1	810	652
1860	1,079	28.9	80.6	913	740
1862	449	26.7	42.7	514	412
1864	561	52.5	76.4	513	403
1866	800	51.9	102.7	770	625
1868	996	41.0	91.7	883	723
1872	1,175	48.0	102.3	1055	910
1874	1,266	40.2	100.5	1120	946

The linen manufacture has only recently become of importance. Its principal seats are in Scotland and Protestant Ireland. The manufacture of silk was introduced in the fourteenth century, and was subsequently much improved by Huguenot French emigrants (1665). The following is a summary of the textile industries of the United Kingdom for 1871:

	Factories.	Spindles.	Power-looms.	Hands.
Cotton	2,483	37,719,759	450,676	449,087
Wool	1,829	2,692,771	45,140	125,130
Shoddy and worsted	750	2,265,245	67,346	113,363
Flax, hemp, and jute	598	1,861,906	39,727	144,496
Silk	696	1,130,441	12,376	48,124
	6,356	45,670,122	615,265	880,200

To these should be added 234 lace-factories (8370 workmen), besides 129 hosiery-factories (9692 hands), 61 elastic-factories (4623 hands), 37 horsehair-factories (2339 hands), 149 print-works (30,308 hands), 439 bleaching-works (31,427 hands), 150 calendering and finishing works (3902 hands), etc.

Next to the textile industries the most important are the metal manufactures, ranging from the production of rails to that of steam-engines, iron ships, and of the finest cutlery and silversmith's work. There were in 1871, 18,291 metal-factories, employing 634,035 hands. The English potteries supply goods appreciated throughout the civilized world. They number 541, and employ 45,029 hands. The breweries are of great importance, for beer is the national beverage of England, whilst spirits are more highly prized by the Scotch and Irish. The breweries (in 1873) consumed 59,194,089 bushels of malt, the distilleries produced 31,862,472 gallons of spirits, of which 29,322,087 were retained for home consumption.

We add to these notes a list of some of the leading industries, together with the number of persons employed in them. These figures are from the census of 1871, and do not in all cases agree with the factory returns given above:

Occupations.	England and Wales.	Scotland.	Ireland.
Wool and worsted manufacture	253,490	42,217	15,698
Silk manufacture	82,053	2,546	785
Cotton and flax manufacture	562,015	97,863	57,318
Manufacture of mixed materials	116,913	62,736	87,733
Lace (incl. above under cotton)	49,370	181	787
Tanners and curriers	23.334	2,127	1,327
Sugar-refiners	2,843	951	36
Brewers	25,831	1,330	646
Iron manufacture	180,207	30,393	1,720
Nailsmiths	23,231	941	3,532
Steelworkers	5,789	34	10
Cutlers	17,903	——	196
Engine and machine makers	106,680	15,555	3,379
Gunsmiths	11.576	237	222
Goldsmiths, etc	22,038	1,237	475
Watch and clockmakers	21,273	2,007	1,075
Philosophical instrument makers	3,242	247	54
Shipbuilders	40,627	14,298	2,139
Coachmakers and wheelwrights	53.408	2,037	2,973
Cabinetmakers	56,945	6,724	2,987
Musical instrument makers	7,339	302	142
Earthenware manufacture	45,119	3,305	279
Glass manufacture	20,081	2,020	356
Paper-makers	16,772	6,274	627
Printers	44,814	5.589	3,420
Manufacturing chemists	11,328	2,978	159

The importance of these manufactures to the country can only be appreciated if we bear in mind that they not only supply the home market almost exclusively, but likewise furnish the bulk of the exports.

Transportation.—The roads of the United Kingdom have been constructed to a small extent only by government (in Wales, Scotland, and Ireland). The majority of them are maintained from local rates and managed by highway boards. The old turnpike roads, which were constructed by private speculators on condition of their being permitted to levy a toll, are gradually passing into the hands of the local authorities, their builders in many instances having suffered serious losses. We have already alluded to the importance of the rivers as navigable highways. They are connected with each other by an extensive system of canals, the whole of them being constructed since 1755, for the greater part by private companies. The railways have to a great extent superseded canals and roads. Tramways have been in use in some of the mining districts since 1797, but the first locomotive railway was opened in 1830, and since that time they have rapidly increased in extent. They are without exception the property of private companies. Their total length in 1862 was 10,870 miles; in 1873, 16,082. The following statistics refer to the latter year: Total capital, including loans, £588,320,380; number of passengers conveyed, 455,634,767, or 28,332 per mile; total traffic receipts, £55,674,421; miles run, 197,354,749; working expenses, £30,752,848; average dividend, 4.35 per cent.; railway servants, 274,535.

The shipping of the United Kingdom holds the first rank amongst the commercial marines of the world, for it has been calculated that no less than 57 per cent. of all steam-vessels and 37 per cent. of all sailing-vessels belong to it. In the foreign as well as home trade of the United Kingdom the British flag by far exceeds the flags of all other nations combined, and this result is achieved without differential duties, for even the coasting trade is open to for-

eigners on equal terms with the natives. The mercantile marine of the British islands included in 1800, 15,724 vessels of 1,698,515 tons; in 1845, 23,472 vessels of 3,004,398 tons; in 1860, 27,663 vessels of 5,758,687 tons; and in the beginning of 1874, 25,561 vessels of 5,805,162 tons. There has consequently been no appreciable increase in the tonnage since 1860, but the number of steamers has increased from 2000 to 3863, and their tonnage from 454,327 to 1,713,783. To this fleet must be added the colonial marines (about 11,000 vessels of 2,900,000 tons), and it will be seen that the British flag is now represented on the ocean by a total of about 36,000 vessels of 8,700,000 tons. The lighthouses and lightships encircling the British islands with a ring of light are managed by the Trinity board and two boards for Scotland and Ireland. There are now 360 shore-lights and 50 lightships, besides 250 lifeboat stations supported by a private association. The tonnage of the vessels which entered the ports of the United Kingdom in the foreign and colonial trade in 1873 was 21,864,957 (including 14,541,028 British); that of the vessels which cleared was 22,575,029 (including 15,106,316 British). The tonnage of vessels which entered coastwise with cargoes was 21,494,297 (including 21,369,167 British).

The post-office in England, as in most other states, enjoys the monopoly of carrying letters, and since 1870 it has managed the telegraph-lines, which were purchased by government for about £9,000,000. It likewise manages numerous savings banks, and grants life-annuities in behalf of the state. Some idea of the extent of its business may be conceived from the following figures, which refer to 1873: 907,000,000 of letters and postal-cards and 254,000,000 of newspapers and book-parcels were delivered; 15,180,369 money orders for £25,820,124 were issued, and 17,294,335 telegraphic messages forwarded; £8,433,591 were received by the post-office savings banks, and £6,584,181 were paid by them. The number of depositors was 1,556,645, and the capital deposited at the end of the year, £21,167,749.

Commerce.—There are neither export nor protective duties, for the customs duties levied upon articles which are likewise manufactured in the United Kingdom are balanced by corresponding excise or stamp duties. No tariff is probably as simple as that of the United Kingdom. It includes cocoa, coffee, chicory, tea, tobacco, wine, dried fruit, beer and ale, malt, vinegar, spirits, plate, and playing cards. Commercial activity has assumed now most gigantic proportions, for England not only exchanges her own products for those of foreign countries, but likewise acts as the agent for continental and other foreign markets. The extent of the commercial movement, for a number of years, will be appreciated from the following tabular statement:

Year.	Total imports.	Total exports.	Exports of British produce.	Bullion and specie. Imports.	Bullion and specie. Exports.
1854	£152,389,053	£115,821,092	£97,184,726	Not known.	£22,586,568
1860	210,530,873	164,521,351	135,891,227	£22,978,196	15,641,578
1866	295,290,274	238,905,682	188,917,536	34,287,139	12,742,059
1872	354,693,624	314,588,834	256,257,347	29,608,012	19,748,916
1873	371,287,372	310,994,765	255,164,603	33,599,231	19,071,220
1874	370,225,345	297,500,000	239,436,207	30,435,000	20,439,000

These figures do not include the value of the merchandise transhipped in British ports, which was £5,136,652 in 1860, and £13,764,400 in 1873. When we analyze the commercial returns we find that a vast proportion of the imports consists of articles of food, condiments, and stimulants (41 per cent.), and of raw materials to be used in manufactures (41 per cent.). Manufactured goods only constitute about 9 per cent. of the total imports. The exports of British produce, on the other hand, include 82 per cent. of manufactured goods. The value of some of the principal articles imported in 1874 was as follows: cotton, £50,937,000; wool, £22,640,000; silk, £15,713,000; ores of metals, £11,109,000; sugar and molasses, £16,083,000; grain and meal, £50,753,000; provisions, £25,868,000; tea, £11,573,000; coffee, £7,103,000; wines, £6,868,000; spirits, £2,612,000. The exports of British produce and manufactures included —cotton yarn and manufactures, £74,232,000; woollen do., £28,354,000; linen do., £8,845,000; silk do., £3,130,000; apparel, haberdashery, and millinery, £9,328,000; earthenware and glass, £3,152,000; iron, £31,225,000; coals and culm, £11,954,000; hardware, £4,413,000; machinery, £9,771,000; leather manufacture, £3,547,000; beer and ale, £2,451,000; soda, £2,602,000; books and stationery, £1,587,000, etc. In the foregoing table we give the imports and exports from and to the principal countries for 1860 and 1874, in pounds sterling.

	Total imports.		British exports.	
	1860.	1874.	1860.	1874.
Russia	16,201,498	21,403,554	3,268,479	8,787,300
Scandinavia	6,930,257	14,833,527	1,775,879	7,915,258
Germany, Nether-l'ds, & Belgium	27,780,504	49,344,791	21,216,519	45,049,057
France	17,774,031	46,545,585	5,249,980	16,376,690
Spain & Portugal	5,874,679	12,921,592	4,170,378	6,787,532
Italy	2,748.525	3,598,846	4,514,287	6,368,096
Turkey	3,253,246	3,552,804	5,064,233	4,634,164
Rest of Europe	5,580,548	3,942,791	4,462,147	6,099.335
Total Europe	86,143,288	156,143,490	49,721,902	102,017,432
Brit. India & Ceyl.	18,435,284	37,477,836	19,306,674	27,927,783
Dutch E. Indies	361,866	1,308,860	1,432,657	1,282,329
China (& Hongk.).	9,323,764	11,961,258	5,318,036	8,394,238
Japan	167,511	578,098	....	1,283,079
Rest of Asia	820,707	4,300,545	769,849	2,931,161
Total Asia	29,109,132	55,626,597	26,827,216	41,818,590
Egypt	10,352,574	10,467,598	2,479,737	3,559,791
Cape and Natal	1,713,502	4,291,646	2,065,523	4,302,622
Rest of Africa	4,143,724	5,892,465	2,336,403	3,810,198
Total Africa	16,209,800	20,651,709	6,881,663	11,672,611
Australia	6,025,001	14,971,506	9,138,195	14,662,645
New Zealand	445,244	3,547,564	569,066	4,408,886
Pacific	298	69,668	33,967	37,728
Total Australasia	6,470,543	18,588,738	9,741,228	19.109,259
United States	44,724,312	74,108,807	21,667,065	28,034,564
Brit. N. America	6,826,551	11,771,934	3,727,350	9,413.315
Mex. & Cen. Amer.	1,024,321	1,856,440	787,430	1,529,748
West Indies	7,887,223	8,736,253	4,990,867	5,189,996
Brazil	2,269,130	7,019,831	4,446,776	7,689,137
Rest of S. Amer	9,721,283	15,600,737	7,099,623	12,961,561
Northern Whale Fisheries	145,284	120,807	105	
Total, America	72,598,104	119,144,809	42,719,216	64,818,315
Grand total	210,530,867	370,225,343	135,891,225	239,437,207

The details of the trade with the U. S. for a number of years are as follows:

Year.	Total imports from U. S.	Total exports to U. S.
1854	£29,795,302	£22,333,403
1856	36,047,773	22,616,877
1858	34,257,515	15,793,701
1861	49,389,584	11,025,683
1864	17,923,678	20,183,566
1866	46,854,218	31,843,836
1868	43,062,299	23,801,851
1870	49,804,681	31,306,089
1871	61,134,463	38,692,837
1872	54,663,948	45,907,998
1873	71,471,593	36,698,424
1874	74,108,807	32,300,000

Religion, and Provision for its Support.—Great Britain is a Protestant country, but all other religions, as long as they do not offend against public or private morals, may be practised. In England and Scotland there are established churches, that of the former being Episcopal, that of the latter Presbyterian. Ireland has no longer an established Church. (See IRELAND.) The number of persons professing different religions may be estimated as follows (1871):

	Established churches and Epis. Church of Ireland.		Roman Catholics.		All others.	
	Number.	Per cent.	Number.	Per cent.	Number.	Per cent.
England and Wales	19,223,000	82.44	913,000	4.02	3,076,266	13.54
Scotland	1,505,000	44.76	298.600	8.89	1,556,418	46.35
Ireland	667,998	12.10	4,150,867	76.68	583,512	11.22
United Kingdom	21,395,998	67	5,362,467	17	5,216,196	16

Amongst "all others" are included about 51,000 Jews (48,000 in England, 3000 in Scotland, 285 in Ireland), but the bulk of them consists of Protestant dissenters. Those persons who in England dispensed with a religious marriage ceremony have been apportioned by us amongst the churchmen and dissenters. They included 9.67 per

cent. of the English population. The number of Roman Catholics in England steadily increased until 1853, and in Scotland until 1865, owing almost exclusively to the Irish immigration. Since that time the number of Catholics, proportionately to the general population of the country, is on the decline, and we have endeavored to show elsewhere (*Geographical Mag.*, 1874) that many of these Catholic immigrants must have deserted the faith of their fathers. The established churches of England and Scotland, and particularly the former, are in possession of valuable endowments. All other denominations are dependent upon voluntary contributions, and several amongst them have succeeded in accumulating large funds. Some idea of the activity of religious life may be gathered from the fact that the income of 58 of the principal religious societies of England exceeded £2,000,000 in 1874–75, most of which was expended in the distribution of "good" books and in missions to the heathen. The number of ministers of religion, etc., according to the census of 1871, was as follows:

	England and Wales.	Scotland.	Ireland.
Protestant ministers	29,958	4,105	3,243
Roman priests and monks	1,620	224	3,505
Missionaries, Scripture readers, etc.	3,261	252	24
Nuns	2,474	243	3,719

Education.—Not many years ago Great Britain might fairly have been accused of not providing sufficiently for the elementary education of the growing population. Scotland already had a school law since 1696; in Ireland a system of national education was inaugurated in 1845; but in England government contented itself with making *pro rata* allowances to such among the schools as chose to submit to certain regulations. A further step in advance was taken in 1870, when the formation of school boards was sanctioned in all places not sufficiently provided with schools. The illiterateness of the population of the United Kingdom, however, has frequently been exaggerated, as is proved by the following statement, referring to the year 1871:

		England and Wales.	Scotland.	Ireland.
Teachers	male	32,901	6,368	8,995
	female	94,239	6,059	9,929
Medical students		4,528	1,138	1,292
Law students		1,543	204	248
Theological students		1,438	209	633
Scholars or students over 15	male	56,358	11,297	23,378
	female	77,762	9,462	21,526
Scholars under 15	males	1,821,046	283,420	318,776
	females	1,742,842	268,690	287,151
Total at school		3,705,517	574,321	653,054

It would appear thus that 15.7 per cent. of the total population attend school—viz. 16.3 in England, 17.1 in Scotland, 12.1 in Ireland. This proportion is satisfactory, for in Germany only 14.5 per cent. go to school. At the same time, it must be admitted that the British schools leave much to be desired, for in 1873 those amongst them (including Irish national schools) which admitted the government inspectors were attended by only 2,615,000 scholars, or not quite one-half the number of those put down above as being under fifteen years of age. There are undoubtedly many excellent private schools and educational establishments supported by private associations, who claim no government subsidy, and do not therefore admit government inspectors; but it is nevertheless satisfactory to know that the school boards are making rapid progress throughout the country. The salaries of certificated teachers average £103 in England, £110 in Scotland, and £57 in Ireland; those of schoolmistresses, £62, £59, and £46 respectively. About half of them receive a house in addition. Scotland is certainly the best educated amongst the three kingdoms, for in 1871 out of 100 men only 10.27 per cent., and out of 100 women, 19.54 per cent., could not sign the marriage register. In England this percentage was 19.4 and 26.8 per cent. respectively. In Ireland about 35 per cent. of the population 5 years of age and upwards were illiterate. Amongst Roman Catholics the proportion was 43 per cent. Indeed, the Roman Catholics throughout the kingdom are the least educated portion of the population, and they furnish the largest contingent of criminal prisoners. This is clearly exhibited by the following table:

	Catholics amongst general population. Per cent.	Catholics amongst prisoners. Per cent.
England and Wales	4.04	24.3
Scotland	8.9	31.4
Ireland	76.7	84.5
United Kingdom	17.0	34.2

Amongst the higher educational establishments, the universities of Oxford, Cambridge, Durham, and London, the Scotch universities of Edinburgh, Glasgow, Aberdeen, and St. Andrew's, and the Irish Trinity College and Queen's University, occupy the first rank. The latter, as well as the London University, are, strictly speaking, mere boards of examiners, and have a number of colleges throughout the country affiliated to them. There are numerous medical schools in connection with the leading hospitals throughout the kingdom; and the establishment of a law school by the inns of court has been advocated. Comparatively little has been done hitherto for systematic and technical education, considering the industrial character of the country, and neither the School of Mines nor the schools of design and "science" established by the authorities of the Industrial Museum can rival similar continental institutions. Owens's College at Manchester, a private institution, is perhaps the nearest approach to them. Art is promoted by a Royal Academy and by numerous art unions. A musical education may be obtained at the Royal Academy of Music and the recently established National School of Music. There are numerous musical societies, but no English opera company has succeeded hitherto in establishing itself permanently. Scientific societies cultivate every branch of science. Foremost amongst them is the Royal Society, founded in 1660.

The newspaper press occupies a prominent and respected position, and its influence upon public opinion is undoubted. In the present year (1875) there appear 1609 political journals and 643 magazines. Of the former, 308 are published in London, 939 in the rest of England, 58 in Wales, 149 in Scotland, 137 in Ireland, and 18 on the smaller islands; 133 are published daily. The publishing trade concentrates itself in London and Edinburgh; 3463 new works were published in 1873, and 3351 in 1874.

Social Condition and Provident Institutions.—There is perhaps no better standard for measuring the well-being of a population than the quantity of food consumed by it in the course of a year. Our data in this respect are unfortunately incomplete, but they nevertheless allow us to form some idea of the manner in which the bulk of the population live. The annual consumption per head is about as follows: wheat, 5.5 bushels; potatoes, 950 pounds; rice, 11.37 pounds; meat, 52 pounds; currants and raisins, 4.29 pounds; sugar, 51.59 pounds; tea, 4.11 pounds; coffee, 0.99 pound; cocoa, 0.26 pound; spirits, 1.23 gallons; wine, 0.56 gallon; malt, 1.98 bushels; tobacco, 1.41 pounds. The wages of the industrial classes are sufficiently high, as a rule, to enable them to live in comfort, but the agricultural class is barely able to exist, for in many parts of the country the wages do not exceed 12*s.* to 15*s.* ($3 to $3.75) a week. An "Agricultural Laborers' Union," in imitation of the trades-unions of the industrial classes, has lately been established, but its efforts have hitherto not proved very fruitful in results. The trades-unions exercise considerable power, and they have certainly succeeded in forcing up the rate of wages; 104 of these societies which had registered their rules numbered 264,357 members, and their funds amounted to £215,479. Of far greater importance are the "friendly societies:" 21,659 were on the register in 1873 for England and Wales, and 11,926 of these sent in returns. These latter numbered 1,787,291 members, and had funds amounting to £8,630,525. Most important amongst these societies are the Odd Fellows and the Foresters, which jointly number 860,000 members, have accumulated a capital of £5,100,000, and paid in one single year £771,000 to sick members and in cases of death. Their lodges and courts are scattered throughout the kingdom. 790 co-operative industrial societies had 340,930 members in 1873, and a capital of £3,334,104. They sold goods to the value of £13,651,127. In Ireland none of these societies have taken root. The money deposited in savings banks likewise furnishes a criterion of prosperity amongst the working classes. In 1863 there were 27,080,402 depositors, whose deposits amounted to £4,187,401; in 1873, the depositors had increased to 3,002,567, their deposits to £63,471,412.

But whilst the majority of the working classes are thus intent upon doing something to secure themselves against poverty in old age, there are many unable to sustain the struggle against adversity with success, or who from the prostration of trade become a burden to their fellow-citizens. The present poor law of England dates from the year 1834, and those of Scotland and Ireland are modelled upon it. Each poor union, consisting, as a rule, of several parishes, is bound to provide for its own poor by granting either outdoor or indoor relief. Schools and infirmaries are connected with each work or union house. The following is the number of paupers who were in receipt of relief on the 1st of January of each year named:

	England and Wales.	Scotland.	Ireland.
1849	934,419	82,357	620,747
1853	798,822	75,437	141,822
1858	908,186	79,199	50,582
1861	890,423	117,113	50,683
1863	1,142,624	120,284	66,220
1871	1,081,926	123,570	74,692
1874	829,281	111,996	79,633

MAP OF
GREAT BRITAIN
AND
IRELAND
8 Longitude West 6 from Greenwich 4
Scale of Miles
50
100
ATLANTIC OCEAN
NORTH SEA
IRISH SEA
ST. GEORGES CHANNEL
ENGLISH CHANNEL
SHETLAND ISLANDS
ORKNEY ISLANDS
HEBRIDES OR WESTERN ISLANDS
SCOTLAND
ENGLAND
WALES
IRELAND
ULSTER
LEINSTER
MUNSTER
CONNAUGHT
BRISTOL CHANNEL
STRAIT
THE CHANNEL ISLANDS
Scale same as main map.

In the year 1873 there were expended in the relief and management of the poor £7,692,169 in England, £873,076 in Scotland, and £930,240 in Ireland. The number of inmates living in charitable institutions, as far as ascertained by the census of 1871, was as follows:

	England and Wales. No.	Inmates.	Scotland. No.	Inmates.	Ireland. No.	Inmates.
Workhouses...	730	148,291	66	8651	166	48,926
Hospitals.......	407	19,585	49	2682	91	2,894
Lunatic asylums...........	166	39,246	53	6027	26	7,116
Orphan, blind, etc. asylums.	559	33,420	135	6587	100	4,876

The total number of blind is 30,956; of deaf and dumb, 18,072; of idiots, 40,815; and of lunatics, 34,701.

Political Institutions and Government.—The government of Great Britain is that of a so-called constitutional monarchy. The sovereign represents the executive, whilst the legislature is exercised by the imperial Parliament. The "act of settlement" settles the succession upon the descendants of Sophia of Brunswick, and no change in the act can be made except by consent of Parliament. The heir-apparent since Edward III. assumes the title of prince of Wales. The civil list granted to the queen amounts to £363,760 a year, in addition to which she enjoys the revenues of the duchy of Lancaster (£37,000 net). The members of the royal family enjoy annuities amounting to £132,000, and the prince of Wales, in addition, receives the revenues of the duchy of Cornwall (£63,000 net). The royal palaces are Buckingham, St. James's, and Kensington Palace in London, Windsor Castle, Balmoral (Scotland), and Osborne House (Isle of Wight). The royal arms are quartered, and exhibit three lions in red in the first and fourth quarters for England; a red lion in gold for Scotland, and a golden harp in blue for Ireland. The shield is supported by a lion and a unicorn. The motto is *Dieu et Mon Droit*. The king or queen is the fountain of honor. There are orders of chivalry—viz. that of the Garter (founded 1347), that of the Thistle (819?), that of St. Patrick (1782), that of the Star of India (1861), the order of the Bath (1399), and of St. Michael and George (the Maltese cross). The Victoria Cross is bestowed for deeds of valor performed in the field. Parliament consists of the sovereign, the House of Lords, and the House of Commons, and no act obtains the force of law until it has been passed by all three. The House of Lords is hereditary, and numbers 492 members, including the 2 archbishops and 24 bishops of the established Church of England. More than two-thirds of the peerages are of recent creation; only 14 go back to the fifteenth century. The lord chancellor presides over the sessions of the House of Lords. The House of Commons consists of 654 members (487 for England and Wales, 62 for Scotland, and 105 for Ireland). Of these, 360 are the representatives of 355 boroughs, 283 represent the counties, and 11 the universities. In boroughs the right of voting is restricted to householders and to lodgers paying a rent of £20 a year; in counties, to householders paying £10 rent. In 1874 there were 1,078,180 voters in counties, 1,647,596 in boroughs, and 23,209 in the universities. Members of Parliament are not paid for their services, nor are they able to compensate themselves by an exercise of patronage, as all government appointments in England are made for life. The king appoints the members of the privy council, the lord mayor of London being the only *ex-officio* member, but public business is in reality conducted by a cabinet council, whose members are likewise appointed by the king, but are responsible to Parliament. Their appointment is consequently virtually made by the party enjoying the majority. The members of the cabinet are the first lord of the treasury (generally prime minister), the lord high chancellor (the highest legal official and president of the House of Lords), the chancellor of the exchequer, secretaries of state for the home department, foreign affairs, the colonies, war, and India, a first lord of the admiralty, the postmaster-general, and two others. There are likewise a president of the board of trade, a chief secretary for Ireland, a president of the local government board, a vice-president of the council of education, and a chancellor of the duchy of Lancaster. The legal advisers of the Crown are an attorney-general and a solicitor-general, who both go out with the cabinet. In Ireland the Crown is represented by a lord lieutenant.

For purposes of local government the United Kingdom is divided into a great variety of divisions which are puzzling even to the inhabitants of the country. There are, *inter alias*, 117 counties, 1141 hundreds, wapentakes, wards, and similar divisions of counties, 316 municipal boroughs, 1451 petty sessional divisions of counties, 906 police districts, 404 highway districts, 18,258 civil parishes, 14 military districts, 2164 excise divisions and rides, 789 registration districts, etc.

The gross revenue and expenditure have been as follows:

Years, ending Mar. 31.	Revenue.	Expenditure.	Per head of population.
1859	£65,477,284	£64,663,882	45*s.* 8*d.*
1862	69,674,479	71,116,485	49*s.* 11*d.*
1866	67,812,292	65,914,357	44*s.* 2*d.*
1869	72,591,991	74,972,816	48*s.* 6*d.*
1872	74,768,314	71,490,020	45*s.* 0*d.*
1874	77,335,657	76,466,510	47*s.* 7*d.*

The local receipts in 1871–72 amounted to £38,691,328, of which £26,444,136 was raised by taxation, or at the rate of 16*s.* 9*d.* per head of the population. If the amounts raised for imperial and local purposes be added together, the taxation in the United Kingdom would be about 64*s.* 4*d.* per head of the population. The sources of revenue in 1874 were—customs, £20,339,000; excise and licenses, £27,172,000; stamps, £10,550,000; land-tax and house-duty, £2,324,000; income-tax, £5,691,000; post-office revenue, £5,792,000; telegraph service, £1,210,000; crown-lands (net), £375,000; miscellaneous receipts, £3,882,657; total, £77,335,657. The expenditure included—interest and management of national debt, £26,706,726; civil list and civil charges of all kinds (including £3,196,875 for "Alabama claims"), £17,067,609; army and navy, £26,220,864; charges of collection, £6,471,311; total, £76,466,510. The charges for collection include £4,934,767 for the post-office and telegraph services, which yielded consequently a profit of over £2,000,000. The annual value of the property and profits upon which the income-tax was assessed during the last few years amounted to £485,000,000. The English national debt has rapidly increased after each war, and not very much has been done hitherto towards its redemption. It has now, however, been proposed to devote annually £28,000,000 a year to the payment of interest and reduction of the debt, as well as any surplus that may arise; and it is hoped by these means to reduce the debt in the course of thirty years to the extent of £232,000,000. The national debt and the charges for interest, etc. have been as follows:

	Debt.	Interest, etc.
1689	£664,263	£39,855
1702	16,394,702	1,810,945
1714	54,145,363	3,351,853
1763	138,865,480	4,852,051
1773	123,583,635	4,471,571
1793	239,350,148	9,311,630
1817	840,850,491	32,015,941
1853	771,335,801	27,804,844
1859	830,757,193	28,673,381
1868	806,572,884	26,571,750
1874	779,283,245	26,706,726

Administration of Justice.—The judicial system of England very much resembles that of the U. S. The courts of justice may be classified into two grand divisions, those of common law and those of equity. The former include the courts of queen's bench, common pleas, and exchequer, and the courts of probate, divorce, and matrimonial causes; and the latter those of the lord chancellor, the lords justices of appeal, the master of the rolls, and the three vice-chancellors, and the court of appeal in chancery of the county palatine of Lancaster. The new Judicature Act (1874) combines these courts into a "high court of justice," from which an appeal lies to a newly constituted "court of appeal." The House of Lords and the judicial committee of the privy council retain their appellate jurisdiction as regards Scotch, Irish, colonial, ecclesiastical, and admiralty cases. In addition to the above there are courts of bankruptcy, three ecclesiastical courts, the lord mayor's court, the sheriffs' courts, and sixty county courts. The number of judges in the superior courts, including the lord chancellor and the lord chief-justice of England, is about 46, including "masters." The inferior jurisdiction is carried on by justices of the peace in petty and quarter sessions, and by stipendiary magistrates in the larger towns. In Scotland the court of sessions is the highest court for civil, the court of justiciary for criminal cases. The Irish courts resemble those of England, and there is in addition a landed estates court. The sessions of the justices of the peace are presided over by a salaried barrister. The number of salaried judges throughout the United Kingdom is about 450, and their joint salaries amount to about £550,000. They are appointed for life, in most instances by the lord chancellor.

The police (28,550 in England and Wales, 3200 in Scotland, and 12,000 in Ireland) are maintained by the local authorities, excepting that of the metropolis (exclusive of the city police), which depends upon the home secretary. The prison population of the United Kingdom numbers 35,526 persons, and there are in reformatories (for youthful criminals) 6709 inmates; in industrial schools (for young vagrants), 16,151. The number of criminal offenders convicted was in 1873—England and Wales, 11,089; Scotland, 2230; Ireland, 2542.

Army.—There is a law which renders service in the militia compulsory, but this law is at present in abeyance, and the whole of the military forces of the United Kingdom are at present recruited by voluntary enlistment. These forces include the following categories: (1) A regular standing army, consisting of men who enlist for at least three years. Desertions are numerous. The strength of the army has varied considerably during different periods. In 1792 it was 57,252 men; in 1815, 250,314; in 1834, 108,672; in 1862, 222,839; in 1870, 180,444; in 1874, 190,459 men, including the troops in India. (2) The militia, which is trained annually during four weeks, and is recruited by enlistment. (3) Enrolled pensioners and the army reserve force, consisting of old soldiers, who are trained annually for twelve to fourteen days. (4) Yeomanry cavalry and volunteer corps—the former an ancient institution, the latter formed since 1859. (5) The Irish police force (constabulary), which is organized and armed as a military body. (6) Local troops in India and colonial militia and volunteer corps. In 1874 these forces were approximately as follows:

Regular standing army at home and in colonies	128,995
Regular standing army in India	62,840
Militia United Kingdom	133,952
Enrolled pensioners and army reserve	33,000
Yeomanry	15,378
Volunteer corps	153,538
Irish constabulary	12,400
Native troops in India	132,542
Total	672,645

The available colonial militia and volunteer corps do not probably exceed 100,000.

Navy.—The navy has at all times been the pet of the nation, which looks upon it as the chief bulwark against foreign invasion. It is, comparatively speaking, a creation of modern times. Queen Elizabeth had the command of only 42 vessels of 17,000 tons; Cromwell left 150 vessels. In 1863 there were 567 steamers (including 29 iron-clads) and 267 sailing vessels. In 1874 there were 57 iron-clads, 300 steamers, and 170 sailing vessels, of which 25 iron-clads, 145 steamers, and 69 sailing vessels were in commission. Amongst the iron-clads there were 5 of over 10,000 tons, 10 of from 8000 to 10,000 tons, 20 of from 6000 to 8000 tons, 5 of from 4000 to 6000 tons, 10 of from 2000 to 3000, and 7 of from 1000 to 2000 tons. The ships in commission are manned by 33,500 seamen, 7000 boys, and 14,000 marines, but there are in addition 21,000 men of the naval reserve (merchant sailors, who are drilled annually on a man-of-war), 4300 coast-guardsmen, and 1200 men on Indian vessels.

History.—On the 1st of May, 1707, the union between England and Scotland was finally established, and though the Scotch, at first, were highly indignant at this event, they soon became reconciled to it, and now look upon it as a great blessing. For years after the union intrigues for the restoration of the Pretender (the representative of the exiled Stuarts) disturbed the peace of the country. Queen Anne was succeeded in 1713 by the elector of Hanover, who took the title of George I. The Whigs, led by Walpole, now regained the ascendency, and a rising in favor of the Pretender, led on by the earl of Mar in Scotland and the earl of Derwentwater in England, was speedily crushed (1715). Five years later a commercial crisis, brought about by the South Sea Bubble, wrought ruin in thousands of households. George II. succeeded in 1727, Walpole continuing in power as prime minister. He was forced into a war with Spain (1739), who had given offence to British merchants by checking the illicit trade carried on by them in South America. This war terminated ingloriously. Soon afterwards England became involved in the Austrian war of succession. The battle of Dettingen was won, but the victory of the French at Fontenoy paralyzed the efforts of England during the rest of the campaign, and the Peace of Aix-la-Chapelle (1748) left both nations, as far as territories were concerned, in the position they held before the war. Meanwhile, a second attempt had been made by Prince Charles Edward Stuart to win back the throne of his ancestors, but was crushed at Culloden (1746). During the Seven Years' war England sided with Prussia, and though 40,000 men, under the duke of Cumberland, surrendered in Hanover, Clive drove the French from India, while Wolfe conquered Canada. George III. reigned 1760–18—, a most eventful period. A war with France and Spain largely added to the extent of the colonial empire (1783). The government of the Tories caused much dissatisfaction throughout the country, but it was allayed by the appointment of Pitt, earl of Chatham, as prime minister. An attempt to tax the Americans drove them into rebellion, and led to the formation of the U. S. (1783). Fox, Burke, and Sheridan were the leading Whig statesmen during this epoch, but the foremost position must be assigned to the younger Pitt, who held office until his death in 1806. In 1793 he declared war against France without any real cause, but simply because his sympathies were anti-republican, and this war can be said to have terminated only with the battle of Waterloo (1815), where Wellington and Blücher shattered the forces of Napoleon. An Irish rebellion, assisted by a French force, was one of the incidents of these wars, but Great Britain, though suffering occasional defeats on land, finally proved victorious. Amongst the naval battles were those of Cape St. Vincent, Aboukir, Trafalgar (1805), whilst Vittoria and Waterloo proved great victories on land. These wars had increased the English national debt to an immense amount, and led to great distress amongst the working classes, whose discontent it was endeavored to suppress by severe measures. With George IV. an era of reform set in. Commercial reforms were introduced by Huskisson and Canning, and an act emancipating the Irish Catholics was passed in 1829. After the accession of William IV. (1830) the British reformers gained in strength, and a Whig ministry under Earl Grey again came into office, after an exclusion of more than fifty years. This ministry passed the first Parliamentary reform bill, decreed the abolition of slavery (1834), and reformed the poor law. William IV. died in 1837, and was succeeded by the present sovereign, Queen Victoria. Amongst the statesmen who have swayed the destinies of the country since her accession, the most prominent are Sir Robert Peel, Lord John Russell, the earl of Derby, Lord Palmerston, Gladstone, and Disraeli. The principles of free trade had their most able advocates in Cobden and Bright, who succeeded in abolishing the corn laws (1846) and in carrying other measures for the removal of restrictions on trade and commerce. Amongst the more recent acts of Parliament the Irish land act (1870), the act disestablishing the Protestant Episcopal Church in Ireland (1874), and that creating school boards are the most important. In 1854–55 Great Britain went to war with Russia (siege of Sevastopol) in order to stop Russian encroachments in the East; in 1857 an Indian mutiny was suppressed, and there have besides been minor wars in China, Abyssinia, and Ashantee. E. G. Ravenstein.

Great-Cir′cle Sail′ing. A great circle is one the plane of which, extended through the globe, passes through its centre, dividing it into equal sections or hemispheres. The equator and the meridian are such circles. To sail on an arc or part of a great circle which joins any two points on the earth's surface is to sail on the shortest possible line between them. This might be demonstrated on mathematical principles. It may be made apparent by measurement on a globe; for any one may satisfy himself of its truth by stretching a thread between two places in nearly the same latitude and considerably distant in longitude. Theoretically, then, this is the true line of sailing for ships. The foundation of their course must be the track which the spherical nature of the globe points out as the shortest distance between two given harbors. But a mere inspection of the globe shows at once that this rule, based on its spherical form, is modified by geographical considerations—by the natural projections of the continents and by islands and rocks which lie across or near the great-circle arcs. The experience of the navigator has further taught him the prevalence in different quarters of the world of constant and powerful winds and currents, by making use of which on one course, or avoiding them on another, he gains more than by following rigorously the great-circle arc. The navigator's rule, therefore, must be that he sail his vessel on a great circle wherever the land, rocks, or shoals do not intervene or where the prevalence of powerful currents or adverse winds will not lessen his speed more than the difference between the distance on a great circle and that of another route more favored in these respects. When compelled to deviate from a rigorous following of this shortest line, he may gain time by resorting to composite sailing; that is to say, to sailing on successive arcs of great circles between intermediate points selected to suit the winds, currents, and projections of land. His inquiry will be which course will be the shortest, taking into view all the impediments in his way.

The idea of sailing on the arc of a great circle must have occurred to many as soon as the earth was known to be a sphere. Sebastian Cabot planned his voyages on this true idea. The earliest English systems adopted it. Until the invention of Mercator's chart (in 1569) distant voyages were thus made in preference to sailing on what is known to mariners as the rhumb or spiral curve, which cuts all the meridians at the same angle. The progress of navigation up to Mercator's day may be thus briefly stated: When the invention of the compass first gave to ships their unfailing guide and covered the seas with commerce, the cross-staff and the astrolabe gave the latitude approximately by observations of the sun and stars. But the gross distortions

of the sea-charts in use, especially in voyages remote from the equator, misrepresented the sphere and misled the mariner. His next recourse was to globes, of which some famous pairs were made, having on them the tracks of distant voyages. Yet the plane chart, being more easy and convenient for daily use, kept its place until Gerard Mercator of East Flanders supplied his improvement. The directions of the compass or "compass courses" on his charts are straight lines; and, as the mariner works most easily on a plane surface, he could lay down his courses with a parallel rule on this chart, on which he found the meridians parallel, and yet proportional to the parallels of latitude. Mercator's method at once found favor, and brought great-circle sailing into comparative disuse. For, besides the advantages we have named for the eye which could see the whole track and determine how far it could be followed, there were other practical reasons against great-circle sailing. There was the very severe labor of calculations in an age before the invention of logarithms, and a yet greater difficulty in determining the ship's position in longitude, until the precise places of the heavenly bodies were given in nautical almanacs, and until the subsequent introduction of the lunar method. The usual mode of navigation was to steer on a line which would bring the ship to the latitude of her destination, when she would be about midway, and then to sail on that parallel until the port was reached—a method even now frequently practised.

For the reasons which have been given, and because the great circle projected on Mercator's chart appears not as a straight course, but as a curve, and *seemingly* a *longer* course than the rhumb, the latter idea until recently has continued to prevail, notwithstanding the greater distance which it is known the ship must go over. Within the last few years, however, intelligent navigators have begun to substitute the great-circle route wherever practicable. The improvements in the aids to navigation have removed the old difficulties. In addition to the use of logarithms, the tables furnished by the astronomer-royal for sweeping an arc of a circle on Mercator's chart approaching the projection of a great circle, and such methods as those found in the tables of Towson and others, have relieved the navigator of the old tedious processes. The accuracy of the star-places in our nautical almanacs, and the perfection of the chronometers of our day, aid in determining a ship's longitude as closely as her latitude, and our increasing knowledge of ocean meteorology lends a most valuable assistance in regard to the winds and currents. Beyond all this, the introduction of ocean steamers has changed the whole aspect of navigation. It is an age in which, as the late eminent hydrographer, Fitzroy, remarked, "to steer on the arc of a great circle is much required since steamers compete so keenly on the ocean," valuing even an hour's gain in voyages of great length. The routes recommended by Capt. Maury between a number of prominent ports are chiefly great-circle routes. The great steam-packets adopt this method. For the introduction of steam has enabled the mariner to shape his course and lay the ship's head whichever way he pleases, independently, in a great measure, of winds or of deflecting currents. In the case of distant voyages, as from England to Australia, the great-circle route may abridge the distance more than 1000 miles, and in shorter distances, where the gain in distance is small, the gain in time may be important. Even for sailing vessels a knowledge of great-circle sailing will often greatly aid the navigator in shaping his course. A striking illustration is offered in the extreme case of a ship sailing from a point in high latitude to another on the same parallel, 180° distant in longitude. The great-circle route is across the Pole, while the rhumb-line is along the small circle, the parallel of latitude E. or W., the two courses differing 90°. Since any arc of a small circle drawn between the two points, and lying between the Pole and the parallel, is less than the arc of the parallel, a ship sailing on one of these small circles nearly W. would make a less distance than on the Mercator's rhumb or parallel due E.

What seems most needed for great-circle sailing is an improvement in the construction of charts. The present sea-charts, constructed almost without exception on Mercator's projection, do not show great circles to the eye directly. The mariner wishing to sail on one has to lay down the arc on which he usually sails on short courses. His method is to compute the great-circle course at least once a day, making allowance in the intervals for the change of azimuth. But these constructions and computations constitute a task too tedious for the ordinary navigator. A partial remedy for this is supplied by Chauvenet's great circle protractor; the complete remedy would be the construction of charts on the gnomonic projection. On this projection the eye is supposed to be at the centre of the sphere. The arcs on the circumference are on planes which are tangents to that centre. Thus, the great circles are projected as straight lines. Charts on this projection are as conveniently used by the navigator as those on Mercator's projection. The government of the U. S. has very recently ordered the preparation of such sea-charts, under the direction of its hydrographic office. (For full information on great circle see MAURY'S and COFFIN'S *Navigation;* GODFRAY and FITZROY'S pamphlets; AIRY in *Monthly Notices Roy. Astron. Soc.*, vol. xviii.; TOWSON'S *Tables; Nautical Magazine* for 1847.) CHARLES H. DAVIS.

Great Cy'press, tp. of Barnwell co., S. C. Pop. 1620.

Great East'ern, the largest ship in the world, was built at Millwall on the Thames by Mr. Scott Russell for the Eastern Steam Navigation Co., from plans by Mr. I. K. Brunel, who had sole charge of the work. Her construction commenced May 1, 1854. She was launched with her broadside towards the stream. Owing to the flat pitch of her ways, the launching process lasted from Nov. 3, 1857, to Jan. 31, 1858, at a cost of £60,000, hydraulic pressure being employed. Her weight when launched was 12,000 tons. Her extreme length is 680 feet, breadth (exclusive of paddle-boxes), 82½ feet; inclusive, 118 feet; height, 58 feet, or 70 to top of bulwarks. She has no keel. Her frame is of iron ribs and cross-ribs covered inside and out with iron plates, 10,000 in total number. She has eight engines—four for her screws and four for her side-wheels—capable in the actual work of 11,000 horse-power, and has besides 20 auxiliary engines. She has ten anchors, a mile of chain-cables, five iron masts and one of wood, with iron spars, shrouds, and standing rigging, and 7000 yards of sail. The electric telegraph conveyed her commander's orders. She carried two large steam-launches and twenty other large boats. On her trial-trip some of her steam-pipes exploded, killing seven men and wounding seven. Mr. Brunel died soon after hearing of this disaster. In 1860–61 she made several trips to New York, at a cost far exceeding the profits. In 1861 she was sent with troops to Canada after the Trent affair. She was sold in 1864 for £25,000, and was employed with good success in 1864–66 as a cable-laying vessel. In 1867 she made a trip to New York and Havre with passengers, running at a heavy pecuniary loss. It is stated that she can carry 20,000 tons of coal and merchandise, or 5000 troops, besides her crew of 400. Since 1867 she has been most of the time lying in the Mersey, a source of serious pecuniary loss to all who ever were concerned with her. She behaved admirably at sea, is remarkably comfortable for passengers, and possesses fair capabilities for speed.

Great Falls, post-v. of Strafford co., N. H., on the Salmon Falls River and Portsmouth, Great Falls and Conway, and the Boston and Maine R. Rs., 74 miles from Boston. It has 6 churches, 2 national banks, a savings bank, a newspaper, 7 large cotton-mills, a woollen-mill, a bleachery, a foundry, 3 hotels, and a village library. It is the centre of business for a large part of York co., Me. It derives its prosperity chiefly from the cotton-mills. Pop. about 4500. EDWIN FERNALD, ED. "JOURNAL."

Great Fish River, in British America, is a large stream, flowing some 500 miles in a N. E. course to Cockburn Bay, an arm of the Arctic Ocean. It is not navigable. Its mouth is in lat. 67° 8′ N., lon. 94° 40′ W.

Great Green Island, an island belonging to Knox co., Me., in the Atlantic, off the entrance to Penobscot Bay. Pop. 14.

Great Grim'sby, town of England, in the county of Lincoln, on the estuary of the Humber. It has a good harbor, which, with the exception of that of Hull, is the only good harbor on the E. side of England. It carries on an immense fishing-trade, sends one member to Parliament, and has 20,328 inhabitants.

Great Kanaw'ha Riv'er, in West Virginia, is formed by the junction of Gauley and New rivers. It is navigable from its mouth at Point Pleasant on the Ohio River to the Falls, 2 miles below its origin, but only for narrow vessels. The stream itself is swift and narrow, flowing through a rich and picturesque region, abounding in coal, salt, and iron. The Great Kanawha Navigation Co. have rendered it navigable throughout most of its course for the entire year.

Great Mar'low, town of England, in Buckinghamshire, on the Thames. It is a municipal and parliamentary borough, returning two members to Parliament, and has manufactures of paper, silk, and lace. Pop. 6619.

Great Nem'aha A'gency, an Indian agency in Richardson co., Neb., for the Iowa and a part of the Sac and Fox tribes. Pop. 33.

Great Oak, tp. of Palo Alto co., Ia. Pop. 240.

Great Pedee' Riv'er is formed in North Carolina by the union of the Rocky and the Yadkin rivers. It flows S. S. E. into South Carolina, and reaches Winyaw Bay. In

its lower course it is often called the *Waccamaw*, which is properly the name of an affluent. The principal tributary is the Little Pedee, which rises by two main forks in North Carolina. It is navigable 150 miles to the falls at Cheraw.

Great St. Law'rence, a port of entry in Burin district, W. side of Placentia Bay, Newfoundland, has a good harbor. Pop. 270.

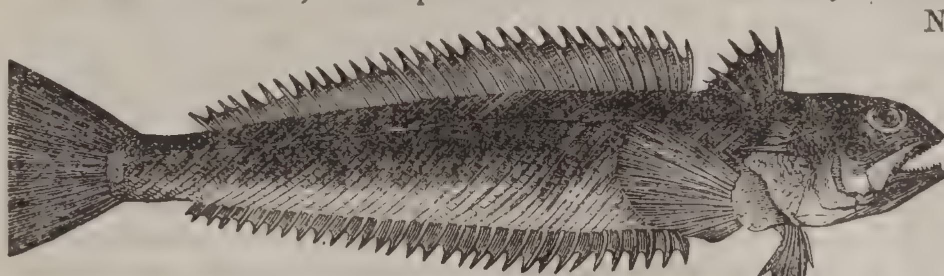
Great Salt Lake, in Northern Utah, the principal body of water in the Great Fremont Basin, and one of the most remarkable lakes on the globe. It is 70 miles long, 45 miles broad, and 4250 feet above the sea-level, and is slowly rising. It contains numerous rocky islands, some seven of which are of considerable size. Its maximum depth is 60 feet; mean depth, 12 feet. Some of the islands are used as sheep-pastures. The lake is doubtless much smaller than formerly. It is navigated by a line of steamers from Corinne to Black Rock, on the S. shore. Its water contains 20.196 per cent. of common salt, 1.834 of sodic sulphate, 0.252 of magnesium chloride, and a trace of calcium-chloride. Its specific gravity is 1.170, almost exactly that of the Dead Sea; but, unlike that sea, it abounds in animal life. The *Artemia fertilis*, a brine shrimp, is exceedingly abundant, as are the larvæ of *Ephydra gracilis*, various species of *Chironomus, Corixa*, and other insects. Hence, the probable success of the attempts of the U. S. fish commission to stock the lake with food-fishes. Its area is 1900 square miles. Bear River is its principal tributary, but is too small for navigation, except near its mouth. The Weber, the Jordan, and several small creeks also discharge their waters into the lake. Great Salt Lake will eventually become an important source of supply for salt. Antelope Island, its largest island, is 15 miles long.

Great Slave Lake, in British America, lies between 60° 40′ and 63° N. lat., and 109° 30′ and 117° 30′ W. lon. It is very irregular in outline, is 300 miles in greatest length, 5 miles in breadth, abounds in islands, is frozen over for half the year, and has in part high woody and rugged shores. The rivers Hay, Peace, Athabaska, English, Slave, Linah, and other large streams swell its waters, which are discharged into the Mackenzie River.

The Great Slave River flows 300 miles from Lake Athabaska to Great Slave Lake. Its shores are in part alluvial and fertile. Its upper course is broken by rapids.

Great Val'ley, post-tp. of Cattaraugus co., N. Y., on the Erie R. R., 49 miles S. E. of Dunkirk. It has manufactures of lumber, chairs, etc. Pop. 1641.

Great Wee'ver, a European marine fish of the family



Great Weever.

Trachinidæ, the *Trachinus draco*, a small fish, dreaded for the serious wounds its spines inflict. Its flesh is very good.

Greaves (John), M. A. (*Gravius*), b. at Collmore, Hants, England, in 1602; became a fellow of Merton College, Oxford, 1624, M. A. 1628; was professor of geometry in Gresham College, London, 1630–43; travelled extensively in the East, making archæological and scientific collections, 1637–40; was Savilian professor of astronomy at Oxford 1643–48, but was ejected by the Puritans. D. in London Oct. 8, 1652. Among his works are *Pyramidologia* (1646); *Discourse on the Roman Foot and Denarius* (1647); *Elementa Linguæ Persicæ* (1649); *Epochæ celebriores* (1650); *Astronomica quædam* (1652), and miscellaneous papers.

Grebe, or **Dip'per,** a name applied to various aquatic birds of the genus *Podiceps*. The U. S. have nine species, frequenting lakes, rivers, and sea-coasts. The crested or satin grebe of both continents (*P. cristatus*) is much hunted for its coat of silvery feathers, which is used in trimming ladies' dresses and in making muffs. It is rare and costly. The *P. cornutus* (horned or Slavonian grebe) is common to both continents. The smaller species are called dabchicks. They are awkward on land, but are expert divers, having the power of remaining long under water and thrusting up the bill for a supply of air. It is asserted that the little grebe (*P. minor*) builds a floating nest, which she removes at the approach of danger, paddling it with one foot.

Gre'ble (John Trout), b. in Philadelphia Jan. 19, 1834; acquired his preliminary education at the grammar and high schools of his native city, receiving his bachelor's degree at the latter; entered West Point in 1850, graduated in 1854, and was promoted to be brevet second lieutenant 2d Artillery; served in Florida against the Seminole Indians 1854–56; was appointed acting assistant professor of ethics at the Military Academy Dec., 1856, performing his duties with great credit to himself; in Oct., 1860, he was assigned to active duty at Fortress Monroe at the artillery school, and in defence of the fortress 1861; in May, 1861, he was placed on ordnance duty at Newport News, and in June following was detailed to accompany the expedition to Big Bethel in charge of the artillery (two pieces). After the repulse of the U. S. forces at this place, he by skilful management protected their rear and saved them from complete destruction. He had given orders to withdraw from the field when he was struck by a cannon-ball and instantly killed, June 10, 1861.

Grecian Architecture. See Architecture. By Clarence Cook.

Gre'cian Games. Public games were instituted in Greece at a very early period, but it is not easy to determine in what they originated or what was their more particular design. It is evident that they arrived gradually at the state of complete organization and splendor in which they appear in historic times. Their beginnings go back, doubtless, to the days of Homer, who describes sundry amusements and athletic exercises in which the Greeks then already took delight. These probably constituted the rudiments of those great games which are so celebrated, but the development and systematic arrangement of which may be regarded as a natural outgrowth of the genius of that wonderful people, of their admiration of the beautiful, of ease and grace in motion and action, their early cultivation of skill in the use of arms, and of their constant desire to furnish models to painters and sculptors. But it cannot be doubted that their situation in the midst of hostile movements, which required them to be always ready and skilled in the use of arms, and the rivalries which existed among themselves, also contributed greatly to this result. Thus, these games were designed to cultivate personal courage, to foster a love of arms, to create a martial spirit, to promote fearlessness in danger and contempt of pain, but also to excite and cherish a love of that country which they tended to glorify. Thus, they were a school of patriotism and public spirit, besides affording frequent opportunities for the cultivation of kindly feelings and of a sense of common interests by so often bringing the different tribes together, and impressing upon them, through their use of the same language, and their possession of the same religion and of similar institutions, the conviction of their being essentially one and the same people.

National games have a general interest, because they are more or less indicative of national character. Thus, the Olympic and other games of the Greeks exhibit in a striking light the higher culture and the superior refinement of that people as compared with the ruder tastes, the less-refined culture, and the more vulgar—or rather the brutal—amusements of the Romans. Games were celebrated in Greece at different localities and under different names; but while they differ from each other in some particulars, and require to be separately noticed, they are very much alike in their general character. They present themselves under the four grand divisions of the Olympic, the Pythian, the Isthmian, and the Nemean, which will now be considered in order.

I. *The Olympic Games.*—These were, in several respects, the most important. Celebrated at Olympia in Elis, they preceded all others in the order of time, and served as a model for all those which were subsequently instituted. These circumstances invest them with paramount importance in Grecian affairs, which is still more increased by the greater solemnity which belonged to them, and especially by the fact that the Grecian method of reckoning time was based upon them and their regular occurrence. We shall therefore more particularly and fully consider the Olympic games; but ere we proceed to set forth their nature it will be necessary to describe the locality at which they were celebrated, and then to trace, as far as possible, their origin. Olympia in Elis was not a city or a town, but a small plain in the district of Pisatis, with beautiful environs, nearly surrounded by lofty hills, and bounded on the S. by the river Alpheus. On this plain was the sacred grove, called Altis, adorned with divers beautiful structures and works of art, with the Olympieum, the temple of Zeus Olympius, and with altars, statues, and monuments in great number. According to a legend greatly adorned by Pindar, this Altis was laid out by Hercules. Within it grew many wild olive trees, among which was that which furnished the wreaths or crowns for the victors in the various contests. The most important and beautiful edifice erected here was the temple of Zeus, which closely resembled the Parthenon at Athens. In it stood that most magnificent production of Hellenic plastic art, the chryselephantine statue of Zeus

Olympius by Phidias, around which were grouped a great many other beautiful statues, etc. In the western part of the plain, between the Altis, Mount Kronos, and the Cladeus, which empties into the Alpheus, lay the Hippodromus for hippic contests; in another part of it was the Gymnasium, with race-courses and palæstra for the preliminary practice of the athletes; and near it was the Stadium, in which the gymnic contests were held. At the passage from the Stadium into the Hippodromus the Hellanodicæ, or judges of the contests, had their seats. The history of the Olympic games must be divided into the pre-historic or mythical, which represents the Idæan Hercules as having founded them during the reign of Kronos, and into the historic or authentic, which begins with Iphitus and his associate Lycurgus, and which is alone entitled to consideration in an article like the present. Iphitus was a noble Elean, called king of Elis by some, and a reputed descendant of that Oxylus who led the Heraclidæ into the Peloponnesus. When Hellas was distracted by the dissensions of its tribes and states, Iphitus inquired of the Delphic Oracle how this unhappy condition of affairs could be remedied. The response was that he should, in conjunction with the Eleans, revive the Olympic games. He obeyed the oracle, reinstituted the games, establishing, at the very beginning, the Pentaëteris—*i. e.* their regular return after every four years. His most important enactment regarding these games was the ἐκεχειρία—*i. e.* the cessation of all hostilities throughout Greece during the continuance of these festivities. It was the duty of the Elean σπονδοφόροι, the peace-heralds, who published the ἐκεχειρία, or universal truce, to proclaim, first in Elis, and thereupon in the other states of Greece, the commencement of the sacred month (ἱερομηνία), from the first day of which those who proposed to take part in the contests and all spectators could travel to Olympia in perfect safety. Some instances occurred, however, in which this truce was violated. Although the Olympiads require a separate article, it may be mentioned here that the first of these, that with which Grecian chronology begins, is dated from the victory of Corœbus in the Stadium, which is placed in the 3938th year of the Julian era, or 776 B. C. It is probable that at first but few of the Peloponnesian states took part in the Olympic contests, and that it was only after the 15th Olympiad that participation in them became more general; but in the 30th the lists were thrown open to all Hellas, and in the 40th to the Greeks of Asia Minor, Sicily, Magna Græcia, and other Hellenic communities. With the 50th Olympiad began the most brilliant period of these great national games, but their classical period extends down nearly to the 85th Olympiad. This period is designated as the classical, because to this belong the most celebrated of the Hellenic athletes. Among these may be mentioned Milo of Crotona, Diagoras of Rhodes, Theagenes of Thasos, and the Locrian Euthymus. The privilege of taking part in these exercises was, until the Roman conquerors introduced innovations, confined to candidates of pure Hellenic descent; so that, when Alexander the Great proposed to enter the lists, it was required that he should first prove his descent from a Hellenic family of Argos. Even after the expiration of the classical period these great national assemblies maintained their importance; and, although the Romans were, during the republic, not favorable to numerous meetings of this kind in conquered countries, they did not materially alter, or impose any restrictions upon, these great Grecian festivities. Under the empire the victors in any of the four great Grecian games, and such combatants as had, by authority of the emperors, received the title of ἱερός, enjoyed sundry important privileges, and both Tiberius and Nero achieved victories at Olympia. These great national celebrations did not lose their importance until Christianity became the religion of the empire, and after the 293d Olympiad (A. D. 394), in the tenth year of the reign of Theodosius, the Olympic games were finally abolished.

We come now to consider the nature of these games, the gradual introduction and regular succession of the different contests, and the arrangement of the several festivities. For a long time after their reinstitution by Iphitus there was no other contest besides the single foot-race; but the recollection of the earlier varieties induced the Eleans gradually to reintroduce these, and, after a while, to add others. Thus, the double foot-race was introduced in the 14th Olympiad, the Dolichos (the long course) in the 15th, wrestling and the Pentathlum, which consisted of five exercises, in the 18th, and in the 25th the chariot-race with four full-grown horses, as practised in the early heroic age, was revived. In this the Theban Pagondas was the first to win the prize. In the 33d Olympiad followed the Pancratium, an athletic game which called into exercise all the powers of the combatant, as it combined all the arts of boxing and wrestling; also in this Olympiad, the horse-race (ἵππος κέλης). In the 37th, boys obtained permission to engage in wrestling and in the foot-race, and in the 38th they were admitted to the Pentathlum, which was, however, very soon again prohibited, because there was in this exercise no chance for any but Laconian boys to win the crown. In the 41st, boys were for the first time permitted to contend with the cœstus—that is, to engage in boxing with fists armed with thongs which were loaded with lumps of lead to render their blows more powerful. In the 65th the foot-race in a full suit of armor was first introduced. This was probably at first a single foot-race once through the course (στάδιον), but became subsequently a δίαυλος, a foot-race in which the stadium was traversed twice—that is, to the goal and back again. In the 70th the chariot-race with mules, and in the 71st the horse-race with mares, were introduced, but discontinued in the 84th. The 94th brought the chariot-race with two full-grown horses, and the 96th the contests of heralds and trumpeters. In the 99th Olympiad the Eleans introduced the chariot-race with four foals, in the 128th that with two foals, and in the 131st single foals were first ridden in the race-course. In the 145th Olympiad the Pancratium for boys was instituted, and it appears from Pausanias that boys were also permitted to ride in the single horse-race. If, as Pausanias asserts, these games lasted at first only one day, this arrangement could not have remained in force after the number of exercises had been greatly increased; for, whenever new contests were introduced, a day was added to the festivities, and it is very probable that these were as early as the 80th Olympiad kept up for five days.

The whole panegyric festival was divided into two parts: (1) into the contests, designated as ἀγὼν Ὀλυμπιακὸς, ἀέθλων ἅμιλλαι, κρίσις ἀέθλων, τεθμὸς ἀέθλων, νικαφορίαι; (2) into the sacrifices, the processions, and the banquets given to the victors in the games. The first day was devoted to initiatory sacrifices, and the classification and arrangement of all the competitors by the judges; the fifth to sacrifices, processions, and the banquets; and the intermediate days to the different contests. The sacrifices were either those instituted and offered in the name of entire states, or such as were brought by individual contestants, and they were of course offered to different divinities, and even to several heroes, such as Pelops and Hercules.

Among the visitors from other Grecian states, the θεωροί who represented them contributed greatly to the splendor of the festivities. Such θεωροί were sent by every Hellenic state interested in the great games, to attend the celebrations as its deputies, who were charged to take part in the sacrifices offered to Zeus Olympius, and in the processions, and to omit nothing that could reflect credit upon the state which they represented. It is likely that, for this reason, the richest citizens were appointed to this service, as the deputies were expected to make as splendid a display as possible.

Order of Exercises.—The gymnic contests began with the στάδιον, that is, the single foot-race, and then followed the δίαυλος and the δόλιχος, which have been explained already. According to Plutarch, the contests of the boys preceded those of the men, which was probably a later innovation. Before the 77th Olympiad the Pentathlon, or the contest of the five exercises, ἅλμα, δίσκος, δρόμος, πάλη, πυγμή—*i. e.* leaping, throwing the quoit, running, wrestling, boxing—preceded the Pancration, a union of the boxing and wrestling matches; an arrangement which was reversed during this Olympiad. After the Dolichos followed the wrestling, and next the boxing matches; but before the 142d Olympiad the Pancration was placed after the boxing contests. The contest of the ὁπλιτοδρόμοι, the runners in armor, completed the series of the gymnic contests. The order in which the contestants followed each other was determined by the drawing of lots, and, as this might decide the success or failure of different candidates, it was a matter of the utmost importance to all.

Qualifications.—From these games all ἄτιμοι, persons punished with civil degradation, all persons notoriously ἀσεβεῖς, impious, all ἐναγεῖς, persons polluted, especially blood-guilty, were strictly excluded. Hence, all applicants were subjected, before the commencement of the exercises, to a rigorous examination. Punctuality in appearing in the lists was peremptorily required of all who had their names entered as candidates, in default of which the delinquents were excluded from the exercises. There were other stringent regulations, always rigidly enforced, which cannot be mentioned here.

Ἑλλανοδίκαι, the Hellanodicæ—that is, the judges who awarded the prizes and fixed the time within which the combatants were required to give in their names. It was their duty to ascertain, by a rigid investigation, whether the candidates were Hellenes and free-born; whether they had ever incurred ἀτιμία, the loss of civil rights, or been guilty of ἀσέβεια, impiety; and whether their age ranked them as παῖδες (boys) or as ἄνδρες (men). To those who proved to be in all respects duly qualified they now admin-

istered an oath which bound them to act honorably; they arranged all the details of the contests, investigated all charges which might be brought against any of the candidates, paired the combatants by lot, and took care that all the regulations of the games were strictly enforced. In the performance of these duties they were assisted by subordinates called ἀλύται, who were subject to an ἀλυτάρχης.

Rewards of the Victors, Processions, Feasts, etc.—At Olympia the prize bestowed upon the victors in the contests was not one that possessed any material value. As every contest was simply an ἀγὼν στεφανηφόρος or στεφανίτης, conferring honor or distinction, the prize consisted of a wreath or crown made of twigs taken from the wild olive tree which grew in the Altis. It may here be mentioned, incidentally, that at the Pythian games the chaplet was made of laurel; at the Isthmian, of twigs of the pine tree; at the Nemean, of ivy or parsley. At first the rewards were prizes which possessed intrinsic value, but after the 6th Olympiad the victors were, in obedience to an oracular response, simply crowned with wreaths or chaplets. The Hellenes regarded the Olympic crown as bestowing the very maximum of human felicity. In all the four great games the crowned victor received also a palm-branch, which he is always represented as carrying in his right hand. But in the ἀγὼν στεφανίτης no inferior prizes could be won; he who did not win the highest, the crown, won nothing, whereas in contests for prizes of material value there might be second and third grades. With the crowning of the victor was combined the loud proclamation, by a herald, of his name, of that of his father, and of his native city or state. He had, besides, the privilege of erecting a statue on the scene of his triumph at a particular place in the sacred Altis, and rich victors in the hippic contests had themselves, their charioteers, horses, and chariots represented there in bronze. The processions (πομπαί) were connected with the sacrifices, and probably marched at first around the altars while the offerings were ablaze; but doubtless they touched in later times at all the consecrated spots of the sacred Altis where the feasts were held. Ἐπινίκια, triumphal odes composed by celebrated poets, were sung at the feasts. Rich victors, like Alcibiades, sometimes invited to a feast all who were present at the games. The other distinctions and material advantages which were conferred upon the victor in the Olympic games in his native country or throughout Hellas were very great. He was honored with a solemn entry into his native city, or into any other as a citizen of which he had had himself inscribed in the list of contestants; and in order to make the triumphal procession more distinguished, it was customary to throw down a part of the city wall and gate. Statues were erected in honor of him in his native city, and sometimes in other cities where he had friends or to which he had rendered some important service. In later times he was, at Athens, maintained in the Prytaneum at the public expense, but long before this Solon had allotted to him a prize of 500 drachmæ, about $90. At Sparta the victors enjoyed the distinction of fighting in battle near the person of the king, and throughout all Greece they were invested with valuable privileges.

Discourses, Recitations (ἐπιδείξεις), etc.—From the 80th Olympiad it became customary at Olympia to engage in sundry intellectual exercises, to perform dramatic pieces, to deliver discourses, to make recitations and to read poetic productions in the presence of the vast assembly. Artists also exhibited their works here. Here Herodotus read his great historical work to a profoundly interested auditory; and this is said to have inspired Thucydides, who was present, with that enthusiasm for compositions of this kind which afterwards made of him also an eminent historian; but there is no satisfactory evidence of the truth of the tradition that he read his admirable narrative of the Peloponnesian war at Olympia. The spectators submitted to a great deal of inconvenience, and even suffering, for the sake of obtaining good seats from which to witness the contests, arriving at the stadium or the hippodromus generally before sunrise, often even at midnight, and remaining in their places till the hot hours of the afternoon, in order to be present when the minor contests were to be decided. As the celebration took place at the hottest season, and the spectators were required to have their heads uncovered, it cannot be a matter of surprise that the philosopher Thales, when he attended the games at a very advanced age, should have died from the effects of the sun's heat and the pressure of the crowd.

Minor Olympic games were celebrated, in imitation of the greater, in several Hellenic states and foreign cities, which cannot, however, be mentioned here.

II. *Pythian Games.*—Of the other great Grecian games which have already been named, the Pythian are next in importance. Of these there were two kinds—the greater and the less. The great Pythian games were celebrated on the Crissæan Plain, which, lying N. of Crissa, was, in accordance with a response of the Delphic Oracle and a consequent decree of the Amphictyonic Council, to remain for ever uncultivated and uninhabited. There was here a hippodromus, a dromos for foot-races, and a theatre for musical contests. As regards their history, the mythical account represents Apollo as the founder and protector of this great festival. This will account for the contests having originally been exclusively musical, and also for the earliest performance of this kind having consisted in singing a hymn to the Pythian god. The historical period begins with the third year of the 48th Olympiad, when the Amphictyons, after the close of the Crissæan war, assumed the control of these contests; whence also the first celebration under their direction is counted as the first Pythiad. The celebration was originally an Ennæteris, occurring regularly after every eight years; but after the third year of the 48th Olympiad it became a Pentaëteris, taking place every four years, regularly in the third year of each Olympiad. The musical contests comprised those of the performers who played on the cithara and sang to its accompaniment, of those who played on the flute, and of those who sang to the accompaniment of the flute. In the first Pythiad the gymnic and hippic contests, copied after the Olympic, were introduced. The nature and arrangement of the Pythian games, the prizes, the regulations, the sacrifices, the splendid processions, the display made by the official visitors (θεωροί) sent by different states, were all so very similar to those of the Olympic games, after which they were modelled, that they require no detailed description here. As they were sacred to Apollo, the god of divination, whose favor was coveted by all, the number of spectators was doubtless always very large, and the celebration exceedingly magnificent. The minor Pythian were, like the lesser Olympic games, simply imitations of the greater, celebrated at divers places where Apollo was worshipped.

III. *The Isthmian Games* are next in distinction and importance. It is rather surprising that they never attained to the highest rank, as the locality in which they were celebrated was far better adapted to the purpose than any other. The scene of the contests on the Corinthian isthmus was enclosed by a sacred grove of pine trees (Ποσειδάνιον τέμενος), and here was also the sanctuary of the Isthmian Poseidon. Here, as elsewhere, the principal parts of the arena were the hippodromus for the hippic and the stadium for the foot-races. The prescribed preparatory exercises of the athletes took place in the Kraneion, a spacious gymnasium in a grove of cypress trees which bore the same name. As regards the origin and organization of this great festival, we have, in this instance also, to distinguish between a mythical or pre-historic and an historical period. The legends are quite numerous and singularly attractive and interesting. The principal one represents the institution of this festival to have been commanded by Poseidon as a funeral celebration in honor of Melicertes, a son of Athamas (king of Orchomenus) and Ino, who threw herself into the sea with her son. The different beautiful myths relating to this Melicertes cannot be repeated here; they are all intimately interwoven with the worship of Poseidon, and one of the latest represents Theseus, the majestic descendant of the great sea-god, as having instituted these games to express his gratitude for the victory which he had gained over, and the destruction with which he visited, the wretch Sinis Pityocamptes. But as Sinis was himself a scion of Poseidon's, this institution of Theseus may perhaps be more correctly described as an expiatory celebration. As respects the historical period of these games, there is no reason to doubt that they commenced very early, and that a degree of rivalry between the Corinthians and the Eleans had considerable influence in promoting their celebration and their unquestionable splendor. There is positive evidence of their great antiquity in the fact that Solon awarded to each Attic victor in these contests a reward of 100 drachmæ, about $18. This great festival, at first an octaëteris—*i. e.* occurring every eight years—became, it is not precisely known when, a trieteris, a biennial celebration, which it remained ever after, taking place in the first and the third year of each Olympiad. The Isthmian games consisted of the same gymnic and hippic contests as those of Olympia, to which musical contests were subsequently added. In all these the names of many distinguished victors occur. The customary truce in connection with these games was sometimes violated, and on one occasion so rudely by Agesilaus, king of Sparta, with a powerful army, as to prevent their celebration. Among the theoriæ which came, by sea and by land, from all parts of Greece to witness this great spectacle, those of Attica were doubtless the most splendid. The prize obtained at the Isthmian games was, for a long time, a wreath of parsley, until at last the Isthmionicæ were rewarded with crowns made of twigs of the pine tree.

Among the intellectual or literary performances which

formed a prominent part of this festival were recitations, discourses of various kinds, rhetorical and poetical productions, and, as many Sophists assembled here about the temple of Poseidon, loud declamations, and sometimes rude and boisterous demonstrations between rival Sophists, supported by their respective pupils. These celebrations were numerously attended by spectators from many parts of Europe and Asia, and among them Socrates, Æschylus, and Ion are named. As in the case of the other great games, imitations of the Isthmian were celebrated in several Hellenic states.

IV. *The Nemean Games.*—Nemea is a name which was applied to a valley in Argolis, between Cleonæ and Phlius, in which Argus is said to have kept watch over Io, and Hercules to have slain the famous Nemean lion. In the historical period there was here a splendid sanctuary of Zeus Nemeios, with a grove (ἄλσος) in which the games were celebrated. The pre-historic period of the Nemean games is connected with the legend of the war of the Seven Captains against Thebes; which seven heroes are said to have instituted them in honor of Archemorus. Some connect these games with Archemorus as the son of Nemea, the daughter of Asopus. The commencement of their historical period is uncertain. For a long time mere local contests, they did not become common to all the Hellenes until many Olympiads had passed. The first-reckoned Nemead began with the 51st Olympiad. They were, like the Isthmian, trieteric, recurring ordinarily after every two years, in the second and fourth years of each Olympiad. Besides the usual gymnic and hippic, they comprised also musical contests, especially vocal performances to the accompaniment of the cithara. In the customary contests, which correspond with those at Olympia, men and boys participated. As these constituted, like the others, an ἀγὼν στεφανίτης, it is a matter of course that the victors could win no other prizes than wreaths or crowns, which consisted, according to some authorities, of twigs of the olive tree, according to others of ivy or of parsley. In connection with these games, the Spartans sometimes violated the truce, but they were attended, like the others, by theori from most Hellenic states. These games were, as well as the three great festivals already described, imitated, on a smaller scale, in other Grecian states; as, for example, at Ætna in Sicily.

(For further and very full particulars the reader is referred to the exceedingly elaborate articles by Prof. Dr. I. H. Krause of Halle in Pauly's *Real-Encyclopädie der classischen Alterthumswissenschaft*, etc., from which work the materials for this article have mainly been derived.)

H. I. Schmidt.

Gre′cian Mythol′ogy was so closely interwoven with Grecian civilization in general that there is hardly any Greek author from whose writings something may not be learned concerning the Greek gods. Poets and philosophers, historians and orators, mathematicians and astronomers,—they all have something to say about their gods, and thus the whole Greek literature may be mentioned as the first source for the study of Grecian mythology. Another source, as important and almost as rich, is the Greek art. It is hardly too much to say that without the aid of the Greek sculptors we should never have arrived at a true appreciation of the manner in which the Greeks conceived of their gods. The love-stories of Zeus are of a character so light and frivolous that, in spite of their bright beauty and the brilliant symbolization to which they invite, they seem altogether incompatible with the idea of the Father and Ruler of the world. But after seeing the head of Zeus as modelled by Phidias we understand that although these stories kept the Greek and Latin poets pretty busy, they form, nevertheless, only a subordinate element of the Greek idea of the king of the gods. A more direct source of information are the writings of the old Greek and Latin mythographers, who collected, systematized, and interpreted the myths. The most important among the Greeks are Apollodorus, *Bibliotheca;* Conon, *Narrationes*, an epitome of which is preserved by Photius; Ptolemæus, *Nova historia;* Parthenius, *Narrationes Amatoriæ;* Antoninus Liberalis, *Transformationes;* Joannes Pediasimus, *De Herculis laboribus;* and Nicetas, *Deorum cognomina;* among the Latins, Hyginus, *Fabulæ;* Fulgentius, *Mythologiarum Libri Tres.*

With Hesiod and Homer the formation of the myths is finished; the ideas are individualized into perfectly plastic figures and perfectly epic actions. With Euripides and Plato the dissolution of the myths has begun; the forms are broken asunder and considered only as symbols of the ideas. On being transferred from Athens to Rome the Greek myths hardly underwent any other changes than that of names: Cronos was called Saturnus; Zeus, Jupiter; Poseidon, Neptunus; Ares, Mars; Hephæstos, Vulcanus; Hermes, Mercurius; Hera, Juno; Athene, Minerva; Artemis, Diana; Aphrodite, Venus; Hestia, Vesta; Demeter, Ceres; Dionysus, Bacchus; Leto, Latona; Persephone, Proserpina; Selene, Luna; Eros, Amor, etc.

Two of the most interesting points of a mythology are its cosmogony and its eschatology, or its doctrines concerning that which goes before and that which follows after life on earth. The ideas which the Greek mythology contains of the origin of the world are very remarkable, and their symbolizations very suggestive. Uranos (heaven) and Gæa (earth) arose out of chaos, and their children were the wild and unruly powers of nature, the Titans. One of the Titans, Cronos (time), who eats his own children, slew his father and ruled the world for some time. But Uranos had cursed his sons, and the curse was fulfilled. Zeus, a son of Cronos, rose against his father, and, after a horrible contest which convulsed the whole world, he confined him and the other Titans in Tartaros, and raised his throne in Olympos, in the light-region above the sky. Much weaker are the ideas of the Greek mythology concerning that which will take place after death, though in course of time they become very elaborate. To the dying man Hermes came and led him to Hades, the realm of shadows, where the deceased live for ever, but live a bloodless life. Achilles said of it that he would rather be a swineherd on earth than the king of Hades. Later, the poets and philosophers tried to bring some life into this dead, monotonous, shadowy region. When the deceased had paid his obolos, a small coin which his children or friends had placed in his mouth, Charon would ferry him over the Styx, which flowed between life and death and surrounded Hades. Arrived at the other side of the Styx, he had to pass by Cerberus in order to gain the large plain where Minos sat to judge the coming. According as the judgment read, he then turned either to the left into Tartaros, where Tantalos, Ixion, and others were tortured, or to the right into the Elysian Fields, where there was a never-setting sun and spring twice a year. But these ideas of a final judgment and an eternal punishment or reward never obtained a fast hold of the conscience of the Greek people. They were a dream, not a conviction.

From Olympos, Zeus reigns over the world and mankind. After the fall of Cronos his three sons divided the realm. Zeus chose the upper region, the heaven; Poseidon, the ocean; and Pluton, Hades: the earth was common to them all. But, in spite of this division, Zeus is the highest ruler, the king and father of the gods. What the myths have to tell of him is mostly love-affairs, but in these stories courtship seems only to be a form by which different ideas, generally physical, are symbolically represented. Thus, he falls in love with Io, the wanderer, the moon. But his wife, Hera, the earth, being jealous, transforms Io into a cow, the crescent resembling a pair of cow's horns, and puts Argos with the thousand eyes, the stars, to watch her. Hermes, the god of the dawn which makes the stars wane, kills Argos, and Io escapes in the embraces of Zeus, as the moon vanishes in the resplendent light of the sun. Around the throne of Zeus stand Poseidon, Apollon, Ares, Hephæstos, Hermes, Hera, Pallas Athene, Artemis, Aphrodite, Hestia, and Demeter; in a somewhat lower sphere, Pluton, Hecate, Helios, Selene, Dionysus, Leto, Persephone, Themis, and Æolus; still lower, the Graces, Muses, Oceanids, Nereids, Nymphs, Dryads, and Hamadryads; and at last, on the outskirts of divinity, the monsters, Cerberus, the Gorgons, the Harpies, Pegasus, Chimæra, the Sphinx, the Centaurs, and the Sirens. Such deities as Ate, Adrastea, the Eumenides, and Nemesis occupy a peculiar position. They all refer to the feeling of justice. Nemesis does not occur in Homer. She is first mentioned by Hesiod, but later poets and philosophers developed the idea with a mystic grandeur which overawed Olympos itself. From Nemesis, the just measure, the inevitable consequence, the iron connection between cause and effect, no one was exempted, not even Zeus himself. It is also very remarkable that a principle of evil, such as Siva in the Indian, Ahriman in the Persian, and Loke in the Scandinavian mythology, is not found in the Grecian. Clemens Petersen.

Greece. Greece is the southern part of the most eastern of the three peninsulas of Europe which project into the Mediterranean Sea. The ancient Greeks called their country *Hellas*, and styled themselves *Hellenes;* and these names prevail among the modern Greeks. We have received the designations Greece and Greeks from the Romans, who gave the name *Græcia* to the country and *Græci* to its inhabitants from the name of a small tribe (*Graïkoi*) in Epirus, with whom they first came in contact as they approached Hellas. Aristotle (*Meteor.*, i. 14) is the first Greek author who applies the term Græci to designate the Hellenes. The term Hellas originally designated only a small district in Thessaly, and was subsequently used to denote the entire country settled by the Hellenes.

Ancient Greece proper extended from 40° N. lat. to 36°

23′. It was bounded on the N. by the Cambunian Mountains, which separate it from Macedonia. The Ægean Sea was upon the E., the Cretan upon the S., and on the W. were the Ionian and the Adriatic. Its greatest length was about 250 miles, its greatest breadth 180 miles. Its area, exclusive of Epirus (4690 square miles), but including Eubœa (1410 square miles), was 21,121 square miles. (Clinton, *F. H.* ii. 385.) Heeren, however, makes its superficial extent (including all the islands) 29,600 square miles. Modern Greece is more limited in extent. Contrary to the wishes of the Greek people, the great powers of Europe allowed not only Epirus and Macedonia (which did not belong to ancient Hellas), but Thessaly and a part of Acarnania, or more than one-third of the whole country, to remain under Turkish control. In 1834 the N. boundary was fixed on a line 137 miles long, following mainly the summit of the range of Mount Othrys from 39° 11′ N. and 22° 42′ E., on the Gulf of Volo (Pagasæ) to Menidhi at 39° 3′ N. and 21° 5′ E., on the Gulf of Arta (Ambracia) in the W. The Ionian Islands were also placed under the protection of Great Britain, and were not annexed to Greece until 1864. Modern Greece is about 200 miles long from N. to S., and about 180 miles in breadth from E. to W. Its area is 19,353 square miles, of which 7500 are N. of the Isthmus of Corinth, 8500 in the Morea (Peloponnesus) S. of the isthmus, and the islands (the Ionian Isles, Eubœa, and others) make up the remainder, or nearly 3500.

Greece is triangular in shape, and is almost surrounded by water. It is divided near the middle by the Corinthian and the Saronic gulfs, which are separated by the Isthmus of Corinth, only 3½ miles wide. The three natural divisions of ancient Greece were—Northern Greece, extending from the Cambunian Mountains to the Ambracian and Malian gulfs; Central Greece, between these gulfs and the Isthmus of Corinth; and the Peloponnesus (now the Morea), which lies S. of the isthmus. There were anciently seventeen states, varying greatly in extent and importance. In the N. were Thessaly on the E. and Epirus on the W. (which do not belong to modern Greece); in the centre were Locris E., and W. Phocis, Bœotia, Ætolia, Acarnania, Megaris, and Attica; in the Peloponnesus were Corinth, Sicyonia, Argolis, Achaia, Arcadia, Elis, Megaris, and Laconia. The islands are of three classes: (1) Those near the coast, as the Ionian Isles, Eubœa (Negropont), Cythera, Ægina, Salamis, etc.; (2) the Cyclades, around Delos, and the Sporades, scattered in the Ægean Sea; and (3) the large separate islands, as Crete and Cyprus. Ancient Greece had many colonies and dependencies on the coasts of Asia, Europe, and Africa, and the neighboring islands; modern Greece has none.

Greece is now divided into nomes (νόμοι), which correspond in names, and often in extent, to the states of ancient Greece. These nomes are divided into eparchies (ἐπαρχίαι), which are subdivided into demes (δῆμοι). There are now 13 nomes, 59 eparchies, and 353 demes. The devastation of the Greek revolution reduced the population to 612,608 in 1832; in 1853 it was 1,042,529, while the Ionian Isles had 230,000. In 1870 the total population was 1,457,894, while in European Turkey there were 6,000,000 Greeks.

Divisions and Population of Greece.

Nomes.	1860.	1870.
1. Attica and Viotia (Bœotia)................ Capital, Athens.	116,024	136,804
2. Evoia (Eubœa)................................ Capital, Chalcis.	72,368	82,541
3. Phthiotis and Phocis...................... Capital, Lamia.	102,291	108,421
4. Acarnania and Ætolia...................... Capital, Mesolonghi.	109,392	121,693
5. Achaia and Elis............................. Capital, Patras.	138,249	149,561
6. Arcadia...................................... Capital, Tripolitza.	113,719	131,740
7. Laconia...................................... Capital, Sparta.	96,546	105,857
8. Messenia.................................... Capital, Kalamæ.	117,181	130,417
9. Argolis and Corinthia...................... Capital, Nauplia.	127,370	127,820
10. Cyclades.................................... Capital, Hermopolis (Syra).	118,130	123,293
11. Corcyra...................................... Capital, Corcyra.	99,533	96,940
12. Kephallinia................................. Capital, Argostoli.	92,929	77,382
13. Zacynthus................................... Capital, Zacynthus.	44,760	44,557

Army, 12,420; navy, 1315; sailors abroad, 7133. The males were 754,176; females, 703,718; total, 1,457,894.

Greece is exceedingly irregular in form. Its surface is greatly diversified by mountains, and its coast-line is very extensive in comparison with its surface. It has in this last respect the same characteristic among European countries that Europe has among the continents. Less than Portugal in extent, it has more extent of coast than "the whole Pyrenean peninsula." (Thirl., *H. of G.* i. 1.) Its mountain-system divided the country like a checker-board, and gave character to its people and their civilization. The Cambunian Mountains were the boundary between Macedonia and Greece; Pindus, a lofty chain running S., separated Thessaly (*Trikhala*) from Epirus (*Albania*), and at 39° sent off Othrys (*Gura*), now, in part, the N. boundary of Greece, and Œta (*Katavothra*), which ran S. E., and reached the sea at the noted pass of Thermopylæ; Pelion and Ossa are on the E. coast of Thessaly. The main chain, under the successive names of Parnassus, Helicon, Cithæron, and Hymettus, runs S. E. through Phocis, Bœotia, and Attica to Simium, and Parnes separates Bœotia from Attica, joins Cithæron, and the united range extends nearly to the isthmus. The mountains of the Peloponnesus are sent forth from the central state, Arcadia. The highest are Cyllene (7788 feet) in the N. E. of the Peloponnesus, Erymanthus (7297 feet) in the W., Parnon (*Malevo*), (6355 feet), extending along the E. coast to Malea, Taygetus (*Pentedactylon*), (rising to 7902 feet), which separates Laconia and Messenia, and extends to Tænarum (*Matapan*). The Geranean Mountains are in Megaris; the other states and the islands are mountainous. Cithæron is 4630 feet high, Helicon 4963, and Parnassus 8000, while Olympus rises to the height of 9700 feet. The noted fortified hills of Greece were the Acrocorinthus (1886 feet high), Ithome at Messene (2631 feet), Larissa at Argos (900 feet), while the celebrated Acropolis at Athens is only 150 feet high. The valleys are generally very narrow. The plains are mostly small, and situated on the seashore and at the mouths of rivers or enclosed by mountains. Those of Thessaly, Bœotia, Messenia, Argos, and Marathon were the most celebrated, and are very fertile. Numerous lakes form in the spring, but they either dry up in the summer or degenerate into stagnant marshes. Copais in Bœotia, Trichonis in Ætolia, Stymphalus and Lycuria in Arcadia, and Ambracia (*Valto*) in Acarnania are the largest of the permanent lakes. There are no navigable rivers in Greece, and very few are perennial. The most important is the Achelous (*Aspropotamo*), which rises in Mount Pindus, flows S., and empties into the Ionian Sea. It is 130 miles long. The Cephissus and Ilissus, flowing past Athens, are exhausted in summer before they reach the Saronic Gulf. The Spercheus flows E. 60 miles from Pindus, between Othrys and Œta, to the Malian Gulf. The Cephissus bursts forth from the base of Parnassus, and flows E. through the fertile plain of Bœotia into Lake Copais. The Eurotas (*Vasilipotamo*) and the Alpheus (*Rofia*) are the chief streams in the Peloponnesus. The Peneus (*Salamoria*), which waters the fertile plains of Thessaly, and flows through the beautiful Vale of Tempe, is now in Turkey. The numerous gulfs running into the land supply the place of rivers.

The Pindus range is composed of primitive and metamorphic rocks, such as granite, mica-schist, serpentine, etc., while Parnassus, Helicon, etc. are mainly of a hard gray limestone, the characteristic rock of Greece, which often assumes the form of the most beautiful marble. There are no volcanoes, but traces of volcanic action are everywhere manifest in the forms of the mountains, fissures, caverns, mineral springs, etc. The hot springs of Thermopylæ and the mephitic vapors that inspired the priestess at Delphi are famous in history. Copper, lead, iron, silver, and even gold, are found. The silver-mines at Laurium in the S. of Attica were formerly quite valuable. Antimony, cobalt, manganese, and sulphur exist, and also salt. Gypsum and porphyry are quarried, but the most beautiful products of the quarries are the white marble of Mount Pentelicus and the green and red marbles of the Peloponnesus and some of the islands.

The climate of Greece was more salubrious in ancient than in modern times. It varies according to location, and the heat of summer may be found in the S., the warmth of spring in Laconia, and the severity of winter in Arcadia in March. Near the coast snow is rare; on some of the mountains it lies nearly the entire year. The cold N. wind prevails even in summer. The sirocco often sweeps over the southern portions, and the S. E. wind brings the rains of spring and autumn. But even in these rainy seasons the atmosphere is fresh and clear, except in Bœotia, the land of fogs and malaria, which affect body and mind. Attica has a pure, dry atmosphere, a sky of deep and beautiful blue; hence Athens is a most pleasant place of residence.

In ancient as in modern times the domestic animals of Greece were the horse, ass, mule, ox, sheep, goat, hog, and dog. Oxen are used for agriculture; sheep and goats con-

stitute the wealth of the rural population. In ancient times swine's flesh was the favorite meat; now it is mutton. The bear, wolf, boar, lynx, wild-cat, jackal, deer, etc. are found in the mountains; eagles, vultures, hawks, owls, etc. are numerous, and game is abundant. Many of the mountains have been stripped of their forests, so that the fertility of the soil and the climate have been unfavorably affected. Taygetus, Parnassus, Helicon, and others have not been denuded. The pine is the most common tree; the beech, chestnut, cypress, and oak are found. The soil is thin, and agriculture is backward. Irrigation is practised, but the implements generally are as primitive as in the days of Hesiod. Mountains and marshes occupy one-half of the land, and only one-fifth of the remainder is cultivated. The state owns more than three-fourths of this, renting it on the "metayer" system, the oxen and seed being furnished by the proprietor, who receives a large percentage of the crop. Wheat, barley, and maize are raised; rice is produced in the plains of Argos and Marathon, and in the marshy regions. Cotton and tobacco grow in the plain of Argos and elsewhere. Vineyards are numerous, but the wine is poor. In Laconia, Messenia, and the islands the mulberry is cultivated for the sake of the silkworm. Almonds, figs, oranges, lemons, and other fruits abound. Olives are produced in all parts of Greece; the oil is used for light and instead of butter. The currant, or small Corinthian grape, is raised in large quantities along the shores of the Gulf of Corinth and on the islands. The figs of Attica and the honey of Hymettus are proverbially excellent. Manufactures are unimportant. In the towns they are of cutlery, earthenware, hardware, articles in leather, silk, hats, cotton and woollen cloths, brandy, vinegar, etc.; in the country cotton and woollen cloths are woven. Shipbuilding is carried on at the seaports, and salt is made in a few places.

The position of Greece, the conformation of the country, its numerous bays and islands, all tend to make the Greeks a seafaring people. For centuries it was in the pathway of commerce. Its exports have always been the simple products of the country. The imports are manufactured goods from Western Europe, such as cloths, hardware, and fancy articles; coffee, rice, drugs, and spices from Turkey. The grain-trade of the Black and the Mediterranean seas is almost exclusively in the hands of Greek merchants. The principal ports are Hermopolis (*Syra*), the centre of steam navigation in the Levant; Hydra, Spezia, Corcyra (*Corfù*), Zacynthus (*Zante*) on the islands; Piræus (the port of Athens), Patras, Mesolonghi, Nauplia, etc. They trade with Constantinople and Smyrna, Trieste, Palermo, Leghorn, Marseilles, and Liverpool. In 1821, Greece had 440 vessels, measuring 61,450 tons, most of which were destroyed in her revolution, when her navy became so distinguished. In 1871 her commercial marine amounted to 6135 vessels, with a capacity of 419,350 tons, and manned by 35,144 sailors. Imports are nearly $25,000,000; exports, $15,000,000. There are several lines of steamers, both Greek and foreign. The ports have been improved and lighthouses erected. There are no canals, but the Euripus between Bœotia and Eubœa has been rendered navigable, and since the success of the Suez Canal a contract has been made to pierce the Isthmus of Corinth, and thus complete within four years what was begun 1800 years ago. There are but few roads practicable for carriages in Greece, that from Athens to Thebes being the longest. In Jan., 1869, the first railroad was opened in Greece. It extends 7 miles from Athens to Piræus. Another of the same length stretches from the mines of Laurium to the port, and a third is projected from Piræus to Lamia, nearly 140 miles. There are about 1000 miles of telegraph lines, all owned by the government. The postal service is good. Horses, mules, asses, and even camels, are used for the transportation of merchandise and for travel.

The debt of Greece in 1870 was $60,000,000, contracted mainly in achieving her independence. Revenue in 1873, estimated at $6,000,000, expenditures at a little less. The revenue is derived from duties on imports, a tithe of the gross product of the farming-lands, and a royalty of 25 per cent. as rent for the lands belonging to the state.

The *Government* is a constitutional hereditary monarchy. King Otho governed the country from 1833 to 1843 without a constitution. The liberty-loving Greeks effected a bloodless revolution on Sept. 14, 1843, and a national assembly was called, which framed a constitution that was approved by the king Mar. 16, 1844. It established hereditary monarchy—the Holy Orthodox Catholic and Apostolic Church, while tolerating others, but forbidding proselytism. All persons are equal before the law; personal liberty is inviolate; titles of nobility and slavery are forbidden; the right of petition, trial by jury, the freedom of the press, the public administration of justice, the independence of the judiciary, the security of letters and domicile, are all guaranteed. The king appoints his ministers, seven in number, who are responsible to the legislature and take part in its deliberations. At first there were a senate (Γερουσία), named by the king for life, and a house of representatives (Βουλή), elected by the people for four years. But in 1864, after the expulsion of Otho and the accession of George I., the senate was abolished and the legislative power was vested in the *boule*, to consist of not less than 150 members; there are now 190. The suffrage is universal, and elections are by ballot. A council of state examines all bills, and may offer amendments to the boule within a certain time. The king must be a member of the Greek Church, and so must the heir-apparent. The king receives about $250,000 per annum, and has a palace in Athens and a summer residence in Corcyra (*Corfù*). The present king is George I., second son of Christian IX., king of Denmark, b. Dec. 24, 1845. He accepted the crown from the national assembly June 5, 1863. He married Olga, daughter of the grand duke Constantine of Russia, Oct. 27, 1867. The crown prince, Constantine, was b. Aug. 2, 1868, and received the title duke of Sparta. There are two other sons and one daughter.

Administration of Justice.—The supreme court of Greece is called the Areopagus. The kingdom is divided into four judicial districts, each having a royal court of appeal; there are 13 primary courts of appeal, and 120 justices of the peace. The judicial legislation is excellent, and is based mainly on the Code Napoléon. Criminal cases and offences of the press are tried by jury. Judges and advocates must have received the degree of LL.D. from the University of Athens or from one of the universities of Europe, and must have passed a satisfactory examination before a special commission. The judges are appointed by the king, and removable, but they are noted for their independence and integrity. Punishments are fines, imprisonment, and in capital cases death by guillotine. The prisons are rather defective in construction and administration. Brigandage is only too common, and murder not infrequent, but drunkenness and immorality are rare.

The *Religion* established is the Holy Orthodox Catholic and Apostolical Church, to which nearly all the population belong. All religions are tolerated, but there are only 12,535 members of other Christian churches and 3499 Jews, Mohammedans, etc. The Church in Greece became virtually independent of the patriarchate of Constantinople at the time of the revolution (1821), and was organized by decree July 15 (27), 1833, upon the model of the Russo-Greek Church, but its independence was not acknowledged by the patriarch until 1850. Its supreme council is the Holy Synod of five members, appointed annually by the king. The metropolitan archbishop of Athens is *ex-officio* the president, and a majority must be archbishops or bishops. Two royal officials may assist in the deliberations of this body, which elects archbishops and bishops, who must be approved by the Crown. There are 16 archbishops and 13 bishops—one for each nome. There are four ecclesiastical seminaries, containing 115 students. A certain degree of instruction is now prescribed for all priests, and the higher dignitaries are selected only from those of the highest culture and blameless lives. The priest is generally married, but must have married while a deacon, and cannot marry a second time without demitting his office. The priests do not preach, but certain well-qualified persons appointed by the bishops. The archbishops and bishops are paid small salaries by the state, but the priests depend upon their flocks, and receive only a meagre support. The monks who inhabit the numerous monasteries are ignorant and degraded.

Education.—Popular education is widely diffused in Greece. "While her villages were burning and her fields were running blood her national assembly discussed under the orange trees of Epidaurus a law to systematize public instruction." Under Otho primary schools were established by law in every deme. Education is free even in the university. In 1835 there were 71 primary schools, with 6721 pupils; 21 Hellenic, with 2528 pupils; 3 incomplete gymnasia, and 1 inchoate university; now there are 1141 demotic schools, with 60,634 pupils (nearly 200 of which, containing 11,000 pupils, are for girls); 114 Hellenic schools, with 5000 pupils; 15 gymnasia, with 1800; universities at Athens and Corfù, the former with 1205 students; 4 ecclesiastical seminaries, with 115 students; 6 normal schools, with 83 students; and 12 private schools, containing 1000 girls; total, 69,837. Many pupils are in private schools. The demotic schools afford elementary instruction, the Hellenic schools prepare students for the ordinary pursuits of life or for the gymnasia, which are nearly equal to our colleges, and are manned by about 100 professors, each of whom must be at least a Ph. D. To enter the University of Athens, Greek students must have completed the course of the gymnasium. It opened in 1835 with 52 students; it now has 1205, of whom about one-half are from Greece. There are the four facul-

ties of theology, law, philosophy (literature and science), and medicine. There are 51 professors and 12 fellows. The course of studies requires three or four years, and the degrees are those of licentiate and doctor, and are essential for those who contemplate a profession. The university has a library of 100,000 vols. and valuable museums. Baron Sinna, a wealthy Greek of Vienna, erected an astronomical observatory on the Hill of the Nymphs at Athens. He and other Greeks have founded various other public institutions. Polytechnic schools exist in several places; archæological, medical, natural history, and other societies exist at Athens.

The press is free in Greece. There are 40 printing-presses in Athens, and as many more in other parts of the country. Upward of 30 newspapers are published in Athens, some of them daily, and there is not an important town without its journal. The political, literary, and religious newspapers are more than 120 in number. Only since her regeneration could Greece cultivate literature. Art is not much cultivated, and time alone can determine whether the Greeks have inherited the æsthetic nature of their ancestors.

All able-bodied men in Greece are held to military service for twelve years, three of which must be in the regular army. In 1873 this consisted of 12,397 men, all others in the service being styled national guards. The officers are chiefly graduates of the military school at Athens. The navy consists of 2 plated frigates, 8 screw-steamers, and a number of sailing vessels. There are 1315 sailors, who are obtained by conscription among the seafaring people. The police or gensdarmerie often need the assistance of the regular army against the brigands. Brigandage is a relic of the war of independence, for which the government is often unjustly blamed. H. C. CAMERON.

Greece, Ancient History of. The early history of Greece is enveloped in the clouds of fable. In the exploits of imaginary heroes are presented the movements of nations, and the events of an era are shadowed forth in the traditions of a people.

The earliest inhabitants of Greece were probably the Pelasgi, an Aryan nation who came from the high tableland of Asia, passed around the Caspian Sea into Europe, and settled in Greece and Italy. They have left traces of their existence in the religion of the Greeks, in the names of places, and in the walls composed of huge stones found in various places. They were composed of various tribes, among whom the Hellenes were the most powerful, and before whom the others disappeared. Their original seat, according to Aristotle (*Meteor.*, i. 14), was near Dodona in Epirus, but they first appear in the southern part of Thessaly about B. C. 1384. The Hellenes represented themselves as the descendants of a common ancestor, Hellen, son of Deucalion and Pyrrha. The name Pelasgia was supplanted by that of Hellas, denoting at first a small district, and subsequently the entire land inhabited by the Hellenes. The names Greece and Greeks are derived from the Romans. The Hellenes were divided into Dorians, Æolians, Ionians, and Achæans, descended respectively from Dorus and Æolus, sons of Hellen, and Ion and Achæus, sons of Xuthus, the third son of Hellen. Hellen and his sons were purely mythical persons. These four divisions of the Hellenic people were distinguished from one another by their institutions, and even the peculiarities of their language. The physical features of the country exerted a powerful influence upon the people, determining their character, giving form to their political institutions, and assisting in the development of a peculiar type of civilization. High mountains and small enclosed plains open to the sea tended to produce a bold, adventurous people, who loved individual liberty, who were jealous of the rights of their little states or cities, but who could rarely unite for a grand purpose except under a conqueror or a pressing necessity. There are traces of Oriental influence in Greece, and tradition attributes the first elements of civilization to colonies from the East. To Cecrops, a native of Sais in Egypt, Attica is said to have owed the institution of marriage, religion, and the foundation of Athens. Argos is said to have been founded by Danaus, an Egyptian, and the Peloponnesus owes its name to Pelops, a Phrygian, son of Tantalus, who by his wealth and influence became king of Mycenæ. Cadmus, a Phœnician, is said to have built Cadmea, afterwards the citadel of Thebes, in Bœotia. The earliest forms of the Greek letters, and especially their names, show their Phœnician origin; weights and measures, and shipbuilding also, the Greeks probably received from the Phœnicians.

From the appearance of the Hellenes in Greece, about B. C. 1384, to the siege of Troy, B. C. 1184, is called *the heroic age*. These heroes were represented as of divine descent—superior to ordinary men in qualities of mind and body. Hercules was the national hero of Greece, and his labors represented in mythical form the triumph over physical and moral evil, the attainment of wealth and power. Theseus represented the establishment of civil government in Attica, and Minos the triumph of law and social order. So the expedition of the Argonauts under Jason presents the progress of commerce; and the Trojan war, the greatest of the heroic achievements, as sung by Homer in the *Iliad* and the *Odyssey*, gives not only a vivid picture of the manners and institutions of early Greek society, but also exhibits the contest between Greek and Oriental civilization. Although the Greeks were divided into many small communities, yet there were bonds of union in their community of blood and language, of religious rites and festivals, of manners and character. In these respects they were distinguished from all other people, whom they styled barbarians. Their most celebrated oracles were at Dodona and at Delphi, and public games (see GAMES) were held in honor of different gods at stated intervals. Thus, the Greeks were brought together and reminded of their common origin and mutual interests. The state of society in Greece in the earlier ages was not unlike that of the feudal ages in Europe. Each state had its own king, whose authority was not limited by laws, but was partially restrained by the council of chiefs, or *boule*. The *agora*, or assembly of the people, merely met to hear the decision of the kings and chiefs. There were three classes of persons—the nobles, powerful and wealthy; the freemen, some of whom possessed estates; and the slaves. The manners even of the highest class were simple; nobles were proud of their skill in the manual arts, and their wives and daughters discharged the various household duties. The Greeks dwelt in fortified towns adorned with palaces and temples, and the poems of Homer attest alike their skill in war and their culture in poetry and in art. War was their delight, and even piracy was honorable. Æolus, son of Hellen, succeeded his father, and his descendants occupied Central Greece, and even the W. coast of the Peloponnesus. The Æolians were widely scattered, and became a seafaring people. The Achæans in the heroic age were the most warlike of the Greeks, and their chiefs were the most distinguished in the Trojan war. At that time they dwelt in Thessaly, and also possessed Mycenæ, Argos, and Sparta in the Peloponnesus. The Dorians and Ionians were of small importance in the earlier history. The former were confined to Doris, a small mountainous district between Thessaly and Phocis; the latter were settled on the N. coast of the Peloponnesus and in Attica. In historical times these became the leading races of Greece, the Dorians being represented by Sparta, the Ionians by Athens. Thucydides (i. 12) speaks of the migrations that occurred among the Greeks. The Dorians overran the Peloponnesus B. C. 1104. This invasion was styled the "return of the Heraclidæ," because led by the descendants of Hercules, who had long been fugitives from Argos. The country was divided among the leaders, and the defeated Achæans drove out the Ionians from the N. coast of the Peloponnesus, which portion was henceforth called Achaia. The Ionians went to Attica, and thence to Asia Minor. The earliest migration from Greece was in B. C. 1124, when the Æolian clans proceeded from Thessaly and Bœotia to the N. part of Asia Minor and the islands of Lesbos and Tenedos. The Ionians followed B. C. 1040, and settled on the coast of Lydia and the islands of Chios and Samos. The Dorians soon after settled the S. part of the coast and the islands of Rhodes and Cos. Cumæ was founded B. C. 1050 by a colony from Cyme in Asia and Chalcis in Eubœa. Colonies were subsequently planted in the S. of Italy and in Sicily. So numerous and important were the colonies in Southern Italy that it was called Magna Græcia. Colonies were also planted at Cyrene in Africa, Massilia (Marseilles) in Gaul, and along the coast from Greece to the mouth of the Danube, at Selymbria, Byzantium, and many other places. These colonies show the hardy and adventurous spirit of the Greeks. The most noted in Asia were Smyrna, Ephesus, and Miletus; in Italy, Sybaris, Croton, and Tarentum; in the island Corcyra (Corfu); and Syracuse and Agrigentum in Sicily.

The two most important states of Greece were Attica and Laconia, generally designated as Athens and Sparta from the names of their capitals. The other states, as Arcadia, Bœotia, Locris, Phocis, etc., consisted simply of small independent cities. Sparta had supplanted Argos as the chief state in the Peloponnesus soon after the Dorian conquest. She owed her supremacy to the military and political institutions of Lycurgus, who flourished between B. C. 850 and 776. The Spartans were a mere handful of people surrounded by enemies, and hence were compelled to be soldiers. The ordinances of Lycurgus, and the severe gymnastic and military training to which the Spartans were subjected, changed their government and society, and made them almost irresistible. This discipline enabled Sparta to conquer Messenia, Arcadia, and Argos. Lycurgus, having obtained from his countrymen an oath to observe his

institutions until his return, disappeared, and the Spartans worshipped him as a god. (See LYCURGUS.) The Spartans were descendants of the Dorians, and alone had political rights. The Periœci were descended from the old Achæan population, and engaged in trade, while the Helots were the slaves. Sparta was nominally a monarchy under two kings, but was really an oligarchy in the hands of five ephori. The other states or cities of Greece became democratic. The change from monarchy to democracy usually pursued a regular course. An oligarchy of nobles would overthrow the monarchy, and then some one of the nobles would espouse the cause of the people and overthrow the oligarchy. He was styled a *tyrannus*—*i. e.* a "usurper"—in allusion to his mode of obtaining power, and not to his manner of exercising it. Resistance to his government incited violence on his part, and he became really a tyrant. His power was rarely transmitted to the third generation, and a democracy usually succeeded. Sparta was the type of an oligarchy; Athens, her great rival, the example of a democracy. Corinth was under the tyrants Cypselus and his son Periander from B. C. 655–585.

The early history of Athens is involved in obscurity. Tradition says that Cecrops divided Attica into twelve states, which were consolidated, with Athens as the capital, under Theseus, the national hero. The Dorians invaded Attica, and the Delphic oracle promised them victory if they spared the life of the Athenian king. Codrus entered their camp in disguise and provoked a quarrel with one of the soldiers, who killed him. The Dorians, learning the fact, withdrew, and the Athenians, from respect to the memory and patriotism of Codrus, abolished the title of king and instituted that of archon. (See ARCHON.) The people were divided into three classes—*eupatridæ*, or nobles, *geomori*, or husbandmen, and *demiurgi*, or artisans. The government of the eupatridæ was so oppressive that in B. C. 624, Draco was appointed to draw up a code of laws. They were so severe that they were said to have been written in blood. Cylon attempted a revolution B. C. 612, but failed. Some of his followers were murdered at the altar of the Eumenides or Furies, and this sacrilege was the source of constant trouble to Athens. Megacles, the archon, was of the family of the Alcmæonidæ, and they were afterwards banished because tainted with sacrilege. The people of Attica were divided into three factions—the *Pedieis*, or wealthy nobles of the plain; the *Diacrii*, or poor inhabitants of the hills; and the *Parali*, or merchants along the shore. The poorer classes were in poverty, their lands and persons being pledged to their creditors; many were reduced to slavery. Amid their dissensions the people turned to Solon, a man of great wisdom and patriotism. Solon became archon B. C. 594, with unlimited power. His legislation relieved the poor and repealed the laws of Draco, except those against murder, and divided the people into four classes, according to their income. The kind of military service and the right to hold office were alike determined by income. (See SOLON.) Solon bound the Athenians by an oath to observe his laws for ten years, and set out upon his travels. In his absence the old local dissensions broke out again, and the result was the triumph of Pisistratus, the leader of the party of the Mountain, in B. C. 560. Twice driven out, he became tyrannus again in B. C. 537, and at his death (B. C. 527) left his power to his sons, Hippias and Hipparchus. He did much for the culture of art and literature at Athens. In consequence of a private quarrel, Harmodius and Aristogeiton slew Hipparchus, and the character of Hippias was completely changed. Clisthenes, of the family of the Alcmæonidæ, secured the Delphic oracle, which induced the Spartans to overthrow Hippias. Clisthenes returned, but controlled the state only by making the constitution more democratic. Athens now defeated Thebes, conquered a part of Eubœa, and, despite the opposition of Sparta, entered upon her glorious career.

We have already alluded to the migrations of the Greeks, which occurred shortly after the Trojan war. Colonies were of two classes—the one sent out under chosen leaders with religious ceremonies, and were really independent; the other were merely garrisons. The Greek settlements in Asia Minor and the adjacent islands consisted of Æolians in the N., Ionians in the middle, and Dorians and Achæans in the S. These colonies were conquered by Crœsus, king of Lydia, who ascended the throne B. C. 560. Cyrus, king of Persia, overthrew him B. C. 546, and also subdued the Greek cities except Samos. The Ionians revolted against the Persians B. C. 500, and the Athenians sent twenty ships and the Eretrians sent five to assist them. The combined forces entered, plundered, and accidentally burned Sardis. Great numbers were slain in the retreat. The Athenians returned home, and the enraged Darius, king of Persia, vowed vengeance upon them. He crushed the rebellion, and then sent Mardonius, his son-in-law, to punish the Athenians and Eretrians. He crossed the Hellespont, conquered Thrace and Macedonia, but losing 300 ships and 20,000 men in a hurricane at Mount Athos, he led his forces back to Asia (B. C. 492). Datis and Artaphernes were now sent with 600 galleys, besides transports, and 110,000 men. They captured Eretria, and landed on the plain of Marathon, under the guidance of Hippias. Sparta, the leading state of Greece, through superstition, did not send aid in time. Only the little town of Platæa sent 1000 heavy-armed soldiers to assist the 10,000 Athenians, and a few slaves as light-armed troops. Under the skilful leadership of Miltiades, assisted by Callimachus, Aristides, and Themistocles, the Athenians gained a most brilliant victory (B. C. 490). The Persians lost 6400, the Athenians only 192, who were buried on the field, and the mound over their remains still exists. The Persians sailed back to Asia. Athens had saved Greece and gained immortal glory. The conduct of Ægina in favoring Persia led to a war between her and Athens. This war and the foresight of Themistocles, the leading statesman of Athens, made her a maritime power. She prepared a fleet of 200 ships, to which 20 were annually added. In B. C. 480, Xerxes, the son of Darius, led an immense army against Greece. He threw a bridge over the Hellespont and cut a canal through Mount Athos. When he reached the pass of Thermopylæ his land and sea forces amounted to 2,641,610, and the attendants swelled the number to 5,283,220. So great was the terror inspired by this vast army that only a few cities of the Greeks took part in the congress which Athens and Sparta summoned to meet at Corinth. A stand was made at THERMOPYLÆ (which see). Xerxes conquered Greece, except Delphi, as far as Athens, which was burned. The Persian fleet sustained heavy losses in storms on the Greek coast and in battle at Artemisium, but after the battle at Thermopylæ the Greek fleet retreated to Salamis. It was prevented from dispersing only by the skill and policy of Themistocles. The Persians had about 1200 vessels; the Greeks had less than 400, of which 200 were Athenian. The battle took place in the narrow strait between Attica and Salamis. Xerxes from his throne on the shore beheld the defeat of his fleet and the loss of 200 vessels. Becoming alarmed, he returned to Asia, leaving Mardonius with 350,000 men in Thessaly to conclude the war. He again invaded Attica, and the Athenians again abandoned their city. Their patriotism, and their intimation to Sparta that they might not continue this course, at last alarmed and aroused the Spartans. A Greek army of 110,000 defeated the Persians at Platæa (B. C. 479), and Mardonius was slain. On the same day the Persian army was defeated and their fleet burned at Mycale in Asia. The patriotism and sacrifices of Athens had made her the leader of Greece, and the treachery of Pausanias, the Spartan commander, confirmed her position. The confederacy of Delos was now formed against Persia, and delegates from the different states met regularly in the temple of Apollo and Artemis on that island. Aristides the Just, who had been ostracised, but returned to take part in the battle of Salamis, fixed the assessment in ships or money on the different states. The yearly amount was 460 talents, nearly $500,000, and the treasury was in Delos. Athens was now rebuilt, and through the energy and diplomacy of Themistocles was surrounded with walls, and Piræus became its port. From the battle of Marathon (B. C. 490) to the beginning of the Peloponnesian war (B. C. 431) was the most brilliant period of Athenian history. Themistocles had created her navy, Aristides had conciliated her allies, Cimon increased her reputation, and Pericles enlarged her resources, formed alliances, and conquered her enemies. The prosperity of Athens excited the jealousy of Sparta, and her treatment of her allies produced great dissatisfaction. She had freed the Greek cities in Asia Minor from taxation, but the death of Cimon, who had been recalled, brought an end to the Persian war (B. C. 448). Athenian power culminated in the defeat of the Thebans at Œnophyta (B. C. 456). Pericles revolutionized the Athenian constitution amid many struggles, making it completely democratic, impairing the power of the Areopagus or supreme court, and of the senate of five hundred. He endeavored to consolidate Athenian power, and but for her arrogance and unwise conduct she might have continued much longer to exercise the hegemony or leadership of Greece. A revolution in Bœotia and her defeat by the Thebans at Chæronea (B. C. 447) were the beginning of her reverses. She soon lost her control of Central Greece, and Pericles reconquered only Eubœa. By the thirty years' truce (B. C. 445) she abandoned all her acquisitions in the Peloponnesus. Pericles now devoted himself to the internal affairs of the city. He erected the Propylæa, the Parthenon, and the temple of Victory on the Acropolis, the Theseum and other buildings in the city. He built the long walls to the Piræus

and sent out colonies. Athens became the centre of art and literature. Architecture and sculpture reached their highest excellence. The greatest names in Greek literature adorn this century: in tragedy, Æschylus, Sophocles, and Euripides; in comedy, Aristophanes; in history, Herodotus and Thucydides; all of whom, except Herodotus, were Athenians, and even he resided at Athens.

Athens had lost her empire on land, and her allies in the confederacy of Delos were dissatisfied with the heavy tribute (now 600 talents) exacted by Athens, her misapplication of it, and the oppression of the members. Samos revolted, but was subdued and punished. Nearly all, however, waited only an opportunity to free themselves. A dispute between two Corinthian colonies led to the war that overthrew Athens. Corinth had sent a colony to Corcyra (Corfu), and Corcyra had established a colony at Epidamnus in Illyria, taking, however, a leader from Corinth. A war of factions broke out at Epidamnus, those in the city being assisted by the Corcyræans, those who had been driven out being aided by the Corinthians. The Corcyræans defeated the Corinthians in a naval battle (B. C. 435). The latter prepared to revenge their defeat, and as they were in alliance with the Lacedæmonians, the Corcyræans applied to the Athenians for help. To avoid breaking the truce the Athenians made only a defensive alliance. In the next battle the Corinthians were victorious, and a small Athenian squadron interfered to save the Corcyræans. A renewal of the battle was about to take place when twenty more Athenian vessels appeared. Thinking these to be the advanced guard of a large fleet, the Corinthians retired, and, although not attacked, returned home. These events occurred B. C. 432. The Corinthians, with Perdiccas of Macedonia, induced Potidæa, a tributary of Athens, to revolt. The Megarians also complained that Athens excluded them from her ports. The Lacedæmonians were urged by their allies to declare war against Athens. War was determined upon at Sparta B. C. 431, although it was precipitated by a treacherous attack of Thebes upon Platæa. This war was one of races and of principles; Athens represented the Ionian tribes, democracy, and progress; Sparta, the Dorians, aristocracy, and conservatism. Athens was a maritime power, and controlled Eastern and Asiatic Greece and most of the islands; Sparta was a land power, and controlled Western Greece, Southern Italy, and Sicily. The states with Athens were mainly subject allies; those with Sparta constituted a voluntary confederacy. Athens had great financial resources; Sparta depended upon occasional contributions. The Peloponnesians, except Argos and Achaia, were with Sparta, hence the name of the Peloponnesian war. It may be divided into three periods: (1) From its beginning to the Peace of Nicias (B. C. 431–421); (2) from the peace to its rupture by the Spartans (421–413); (3) from this rupture to the capture of Athens (413–404). Pericles pursued a defensive policy, and induced the rural population to retire within the walls of Athens while Archidamus, the Spartan king, ravaged the country. The Athenians sent out expeditions to retaliate, and made preparations for a long war. The invasion of Attica was repeated in 430 B. C., and a plague carried off one-fourth of the people in Athens. The people became dissatisfied with Pericles, but soon restored him to power. The epidemic carried off many of his friends and members of his own family. Depressed by his afflictions and weakened by the disease, he died of a lingering fever. Athens thus lost her greatest statesman and orator (B. C. 429). Nicias became the military leader, and was, upon the whole, successful, although the Peloponnesians invaded Attica five times in seven years. In B. C. 429 the memorable siege of Platæa began. It was taken in 427, and the Lacedæmonians put every prisoner to death. The town was transferred to the Thebans, who utterly destroyed it. Mitylene in Lesbos revolted from the Athenians, and domestic dissensions led to its surrender to the Athenians. It narrowly escaped the fate of Platæa proposed for it by the low Athenian demagogue Cleon. Scenes of horror were enacted by the popular party at Corcyra about this time. In B. C. 425 bad weather detained an Athenian fleet at Pylus in Messenia. Demosthenes, an active officer, threw up a rude fortification, and remained there with five ships and 200 hoplites. A large Lacedæmonian fleet and army were unable to dislodge him; and while preparing for a second attack an Athenian fleet appeared, defeated the Lacedæmonian fleet, and blockaded their army on the island of Sphacteria. The Spartans at last proposed a peace, but Cleon induced the Athenians to demand extravagant terms. Hostilities were renewed, and the Athenians made but little progress. Demosthenes made unfavorable reports, and the Athenians blamed Cleon for preventing them from making peace. He made boasts of what he would do if he were general, was taken at his word, and through ridicule was compelled to lead the force sent to assist Demosthenes. Cleon promised to take Sphacteria in twenty days, and either kill or bring all the Lacedæmonians to Athens. Fortune favored him. Demosthenes had prepared all things for the attack, and Cleon arrived in time to share the glory. Of the 420 Spartans, 292 surrendered, and the prestige of Sparta was destroyed. Cleon literally fulfilled his promise. Pylus was garrisoned with Messenians, and the Spartans repeatedly proposed peace, but the elated Athenians declined. In B. C. 424 they were defeated at Delium in Bœotia, and met with severe losses in Thrace. Brasidas, the Lacedæmonian, was very successful in Macedonia and Chalcidice. He gained Amphipolis before Thucydides could bring assistance from Thasos, and hence the latter was banished. Cleon was disgracefully defeated by Brasidas before Amphipolis (B. C. 422), when both commanders fell. Pleistoanax, the Spartan king, and Nicias in B. C. 421 concluded a peace for fifty years, called the "Peace of Nicias." The hatred of Corinth to Athens, and the influence of the brilliant but profligate Alcibiades at Athens prevented a sincere peace, and led to the renewal of the war. The Athenians assisted Argos, and (B. C. 418) Argives and Athenians were defeated at Mantinea by the Spartans without rupturing the peace. In B. C. 416 the Athenians conquered Melos and practised horrible cruelties. In B. C. 416, Segesta and Selinus in Sicily had a quarrel; Syracuse assisted Selinus, and Segesta appealed to Athens for aid. Alcibiades favored the appeal, and an armament was prepared. The mutilation of the Hermæ or marble statues of Hermes in the streets of Athens aroused the superstitious terrors of the Athenians, and arrested the sailing of the fleet. Alcibiades was charged with this crime and the profanation of the Eleusinian mysteries. He denied the crime, but was refused the immediate investigation he demanded. The fleet sailed under Nicias, Alcibiades, and Lamachus, and was intended to extend Athenian influence in Sicily. Alcibiades was recalled to stand his trial, but escaped to Sparta and revealed the plan of the Athenians. He was condemned to death in his absence. Lamachus and Nicias had been partly successful in Sicily, having taken Catana and Naxos and defeated the Syracusans. The siege of Syracuse took place the next year, reinforcements having arrived from Athens. Lamachus died, and Nicias seemed on the point of success when affairs were changed by the arrival of Gylippus, the Spartan commander, and the Athenians were really the besieged party. Reinforcements were sent to Nicias under Demosthenes and Eurymedon. The Spartans openly broke the peace (B. C. 413) by invading Attica. Disaster and disease overtook the Athenians at Syracuse. They prepared to abandon their position, when an eclipse of the moon occurred and deterred them. In a battle by land they were victorious, but at sea they were defeated and Eurymedon was slain. In a second naval battle in the harbor they were again defeated. The army of 40,000 men now attempted to retreat, but they were pursued, scattered, and at last compelled to surrender at discretion. Nicias and Demosthenes were put to death, and the soldiers were reduced to slavery. This disaster was a terrible blow to Athens. Her allies in Asia and the islands, except Samos, threw off the yoke. For a time the Spartan fleet was successful, but again the tide turned in favor of the Athenians. Alcibiades had lost the confidence of the Lacedæmonians and escaped to the Persians. He separated the Peloponnesians and the Persians, and secured his own restoration and a change of government through hope of Persian aid. An oligarchy of 400 was established at Athens B. C. 411, but they retained the power only four months, and the old constitution was restored. The Athenian fleet gained several victories—one at Abydos by the help of Alcibiades. Tissaphernes, the Persian satrap, changed his views and arrested Alcibiades, but he managed to escape. He joined the Athenian fleet, which defeated the Lacedæmonians and Persians at Cyzicus (B. C. 410). Thus masters of the Propontis, they could send provisions to Athens, although the Lacedæmonians held Decelea and ravaged the fields of Attica. The Athenians rejected the Lacedæmonian offers of peace, and soon after recovered Selymbria and Byzantium, chiefly through Alcibiades, who was recalled to Athens and magnificently received. Cyrus, the younger son of Darius II., now became Persian satrap, and Lysander, an able and energetic officer, commanded the Lacedæmonian fleet. Alcibiades took command of the Athenian fleet, but accomplished little. Conon, his successor, was defeated by Callicratidas. Reinforcements arrived from Athens, and the Athenian fleet was successful in a desperate battle at Arginusæ (B. C. 405). Lysander now became the real although not the nominal navarchus of the Lacedæmonians, and captured nearly the entire Athenian fleet at Ægospotami (B. C. 405). Conon escaped with a few vessels, but 3000 or 4000 prisoners and

the generals were put to death. This victory really closed the war. Lysander devastated Salamis and blockaded the Piræus, while the Peloponnesian army encamped at the gates of Athens. Famine compelled her to surrender in Mar., B. C. 404. She was completely humbled; her walls were demolished to the music of the flute, her ships were surrendered, and she was stripped of all her foreign possessions. Oligarchical principles triumphed with Sparta, and decarchies with a Spartan harmost were appointed in the Athenian cities. At Athens a committee of thirty, known as the Thirty Tyrants, supported by a Lacedæmonian garrison, supplanted the democracy, and a reign of terror ensued. Throughout Greece the rule of Sparta became more cruel than that of Athens had ever been, and a revulsion of feeling occurred in reference to Sparta and Lysander. Thrasybulus and other exiles seized Phyle on Mount Parnes, took the Piræus, defeated the force of the Thirty, and killed their leader, Critias. The Thirty were deposed and a committee of ten was appointed. Lysander came with a Lacedæmonian force, but was superseded by King Pausanias. Matters were finally arranged; a general amnesty was proclaimed, the obnoxious laws were changed, Thrasybulus and the exiles entered Athens, and the democracy was restored (B. C. 403).

It was at this time that Socrates, the wisest and best of the Greeks, a martyr for the truth, was put to death upon the false charge of infidelity and corrupting the youth. The Anabasis, or expedition of Cyrus the Younger to dethrone his brother, Artaxerxes, occurred B. C. 401. Xenophon led back from Cunaxa to the sea the 10,000 Greeks who were a part of the army. The weakness of Persia was thus revealed to the Greeks. A war ensued between Sparta and Persia. Agesilaus was called home from Asia by the troubles in Greece, which were aided by Persia. The Thebans defeated the Spartans and slew Lysander at Haliartus (B. C. 395), and compelled Pausanias to retreat. Athens, Corinth, Argos, and other states formed an alliance with Thebes against Sparta. Agesilaus defeated the allies at Coronea (B. C. 394), but Conon and Pharnabazus destroyed the Lacedæmonian fleet at Cnidus, and the Spartans lost their maritime supremacy. The combined fleet came to Greece, and Conon rebuilt the fortifications of the Piræus and the long walls. The war continued with varying success in Greece and in Asia until Sparta induced Persia to impose a disgraceful peace on the Greeks (B. C. 387). Sparta now attacked Bœotia, seized the citadel of Thebes by treachery, and conquered Olynthus. Her power on land was at its height B. C. 379, and her unpopularity was commensurate. Pelopidas and other exiles recovered Thebes; Athens and Thebes organized a confederacy of seventy cities against Sparta. A war of seven years ensued, and through Athenian jealousy of Theban success the Peace of Callias was made (B. C. 371). Thebes refused to sign the peace unless acknowledged as the head of Bœotia. In the war that ensued, Epaminondas, the great Theban commander, utterly defeated the Spartans at Leuctra (B. C. 370). This event electrified Greece. Epaminondas next ravaged Laconia, established an Arcadian confederation at the new city, Megalopolis, and restored the Messenians. Sparta fell at once from her high position, and even asked the aid of Athens. Pelopidas settled disturbances in Thessaly and in Macedonia, and Epaminondas again successfully invaded the Peloponnesus. Pelopidas with other deputies went to the king of Persia, who declared Thebes to be the head of Greece (B. C. 366). Pelopidas was slain in an expedition into Thessaly. A war broke out between Elis and Arcadia, the Mantineans and Spartans supporting the former. Epaminondas marched into the Peloponnesus to assist the Arcadians. He gained a decisive victory over the combined force at Mantinea (B. C. 362), but himself fell mortally wounded. The greatness of Thebes began and ended with this able man. Peace was now made, according to his dying advice. Greece was now completely exhausted by these struggles. Athens regained some of her former prosperity, but lost much in every way by a war with her allies, whose independence Persia compelled her to acknowledge (B. C. 355). A new power was now rising in the neighborhood of Greece. Macedonia lay N. of Thessaly: its people were despised as barbarous; its kings claimed to be of Hellenic descent. Philip, the youngest son of Amyntas II., became king of Macedon B. C. 359, at the age of twenty-three. He took Amphipolis and defeated the Illyrians. He conquered Pydna, Potidæa, and Thrace as far as the Nestus, thus gaining control of the gold-mines of Pangæus, which yielded him 1000 talents annually. The Sacred war, between Thebes and Phocis, prepared the way for Philip's supremacy. The Amphictyonic Council imposed a heavy fine on the Phocians for cultivating sacred soil. Driven to desperation, they seized Delphi and appropriated the sacred treasure. Philip appeared as champion of the Delphic god, slew the Phocian leader, and became master of Thessaly. An Athenian army prevented him from passing Thermopylæ. Demosthenes, the great Athenian orator, now appeared as the opponent of Philip. When Philip threatened Olynthus, Demosthenes infused more energy into the Athenians. His *Olynthiacs* and his *Philippics* are among his most celebrated orations. Olynthus was taken B. C. 347, and many other towns fell into Philip's hands. By deceit and bribery he gained as much as by war. He induced the Athenians to make peace, but excluded the Phocians, who soon surrendered. They were ruined, and the Amphictyonic Council at Delphi gave him the seat of which the Phocians were deprived. He shared in the honor of presiding at the Pythian games, and in B. C. 346, Macedon became the leading state of Greece. His attempts on Byzantium, Perinthus, and the Chersonesus were successfully resisted by aid of the Athenians. He came into Greece to conduct a sacred war against Amphissa, but seized Elatea, showing that he aimed at Bœotia and Attica. Demosthenes aroused the Athenians to resistance. They united with the Thebans, and on Aug. 7, B. C. 338, was fought the battle of Chæronea, which crushed the liberties of Greece. Philip treated Thebes with severity, but offered advantageous terms of peace to Athens. A congress of Greek states, except Sparta, met at Corinth, declared war against Persia, and appointed Philip commander-in-chief. While making preparations for the expedition he was assassinated, and his son Alexander, then twenty years old, succeeded him. He was thoroughly educated in every respect. The courage and energy he displayed secured his appointment as leader of the expedition against Persia. He suppressed disturbances in Thrace and Illyria. Thebes revolted, and was utterly destroyed, save Pindar's house, and the inhabitants reduced to slavery. Greece was terror-struck, and leaving Antipater as regent he set out for Asia with 35,000 soldiers (B. C. 334). He marched along the coast of the Propontis, and defeated the Persians at the river Granicus. Turning S., he took Sardis, then Ephesus, Magnesia, Miletus, and many other places. In the spring he received reinforcements at Gordium, marched E. without resistance until he reached Issus, where he defeated the immense army of Darius, 600,000 strong. He conquered Phœnicia and Egypt in twenty months. With 47,000 troops he marched towards the centre of the empire, and encountered and defeated the immense army of Darius about 20 miles from Arbela. The capitals, Babylon, Susa, and Persepolis, with their enormous treasures, surrendered. Three years were spent in conquering the N. E. provinces of the Persian empire, and then Alexander advanced into India, conquered Porus, and overran what is now called the Punjaub. His army refused to go farther than the Hyphasis (Sutlej), and he then descended the Indus, and after terrible sufferings returned to Persepolis. At the height of his power, he now meditated the conquest of Arabia. After a banquet given in connection with the preparations he was seized with a fever and died (June 28, B. C. 323). His plans perished with him, and his empire was divided among his generals. Philip Arrhidæus, his half-brother, was proclaimed king, reserving, however, to Alexander's child by Roxana (whom he had also married), if a son, a share in the empire. Perdiccas eventually became the guardian of Philip, Roxana, and her son Alexander, but was murdered in Egypt. Antipater now became regent; Ptolemy received Egypt; Seleucus took the satrapy of Babylon; and Antigonus had Susiana, Phrygia, Lycia, and Pamphylia. Harpalus had wasted the royal treasures at Ecbatana, and fled when Alexander returned from the East. Demosthenes was falsely accused of receiving a bribe from Harpalus at Athens, and was fined and imprisoned, but managed to escape. Upon the death of Alexander, Hyperides in Athens and Demosthenes in exile endeavored to arouse the Greeks to revolt, but only the smaller states joined Athens. Antipater took refuge in Lamia, but was reinforced, and defeated the allies at Crannon in Thessaly (B. C. 322). Demosthenes had been recalled to Athens, but was now demanded as one of the conditions of peace. He escaped to Calaurea, and in the temple of Poseidon took poison and died. Antipater died soon after, leaving the regency to Polysperchon, and not to his son Cassander. He, however, shortly became regent, and murdered Olympias, and finally Roxana and her son. Various changes occurred in the East. After the death of Cassander, Macedonia changed rulers repeatedly and rapidly, until Antigonus Gonatas gained control of nearly all Greece. His oppression caused the revival of the Achæan league (251 B. C.). It was originally for religious purposes; it now embraced Athens, Corinth, Megara, Ægina, Salamis, and the Peloponnesus, except Sparta, Elis, and a few others. In B. C. 221, Sparta opposed the league, but by the assistance of the Macedonians was completely defeated. An Ætolian league had been formed in Central Greece which

defeated the Achæans, and Philip, king of Macedonia, was called in by the latter. He gained several victories, but soon made peace. Siding with Carthage in her struggle, he was defeated by the Romans. Philopœmen led the Achæans and defeated the Lacedæmonians, allies of Rome. The Romans made peace and retired, but at the close of the Second Punic war they declared war against Philip, and both the Ætolian and the Achæan leagues joined them. He was defeated at Cynoscephalæ (B. C. 197), and his supremacy was destroyed. Flaminius proclaimed the freedom of Greece (B. C. 196). The Ætolian league was crushed (B. C. 189). Perseus succeeded Philip (B. C. 179). War broke out, and L. Æmilius Paulus defeated Perseus at Pydna (B. C. 168), and led him to Rome to adorn his triumph. Thus ended the Macedonian empire, and Macedon became a Roman province. Sparta appealed to Rome against the Achæans, and in B. C. 147, Roman commissioners decided that Sparta, Corinth, and all the cities except those in Achaia should be independent. Riots ensued in Corinth, and the commissioners barely escaped. A second embassy was insulted, and Rome declared war. Metellus defeated the Corinthian leader, Critolaus, and Mummius overthrew his successor, Diæus, near Corinth. The inhabitants of the city were reduced to slavery, its priceless treasures of art were carried away, and the city was consigned to the flames. Greece perished B. C. 146, and henceforth was only a province of the Roman empire under the name of *Achaia*. Greece was conquered, but her civilization and culture conquered Rome:

Græcia capta ferum victorem cepit, et artes
Intulit agresti Latio.

HENRY C. CAMERON.

Greece, Modern, continued to form a part of the Byzantine Empire until the time of the fourth crusade (A. D. 1203). The old empire was then broken up, and its provinces divided among the Frankish princes. The dukedom of Athens belonged successively to several different families, from A. D. 1205 to 1453, when, on the fall of Constantinople, Greece came under the Moslem yoke. After the signal defeat of the Turks at Vienna (A. D. 1684) the Venetians joined the Christian league, and with a powerful fleet, under the command of Francesco Morosini, invaded Greece, conquered the Peloponnesus, and took possession of Athens (A. D. 1687). It was during the bombardment of the citadel by the Venetians at this time that the Parthenon, in which the Turkish garrison had stored their powder, was shattered by an explosion. But the Venetians did not take much trouble to keep what they had won. It was scarcely a dozen years ere they abandoned Athens, and by A. D. 1718 the whole of Greece was again in the power of the Turks. For a century longer the Greeks groaned under this cruel despotism. But in the spring of 1821 the war of independence began. The first battle, fought on June 19, was disastrous for the Greeks. Prince Alexander Ypselantes was defeated, with the loss of 400 men, most of whom were among the noblest and bravest youth of the country. In Jan., 1822, the first national assembly met at Epidaurus and framed a provisional constitution. In the same year occurred the terrible massacre in Scio, by which the population of that beautiful island was reduced, in less than twelve months, from 120,000 to not more than 16,000 souls. This year was also marked by several gallant and successful exploits of the little Greek navy, especially by the burning of the flagship of the Turkish commander by the fireships of Admiral Canares. The slaughter of Scio was thus at least partly avenged, for the Turkish admiral, who perished in dreadful agonies in this engagement, was the same who had led the bloody expedition against that ill-fated island. The next year (1823) witnessed the bold and successful midnight attack upon the Turkish camp at Carpenesion, in which 800 Turks were slain, with a loss of only 50 on the part of the assailants. But among these 50 was the heroic Suliote chief himself, Marcos Botzares. It was in this year also that Lord Byron arrived in Greece, or rather in the Ionian Islands, where he spent five or six months in correspondence and preparations. He arrived in Missolonghi on Jan. 5, 1824, and d. there on the 19th of the following April. It was there that he wrote, on Jan. 22, his thirty-sixth birthday, those melancholy lines beginning with "My days are in the yellow leaf," and ending with what seems like a presentiment of his approaching death. The funeral services were held in the same church where the body of the brave Botzares was resting, and an eloquent oration was pronounced by Mr. Tricoupes, the historian of the Greek revolution, and for many years the representative of Greece at the court of St. James. In Apr., 1825, this important fortress fell before the army of Ibrahim Pasha after a gallant defence and many instances of heroic valor worthy of Marathon and Thermopylæ. Nearly the whole of Greece was now at the mercy of the Turks. In July of this year they laid siege to Athens, which after an obstinate resistance fell into their hands in June of the following year. The cause of Greek independence seemed now hopeless, unless the Christian powers of Europe should interpose in her behalf. After many unsuccessful embassies on the part of Greece, and much fruitless correspondence between the courts of England, France, and Russia, a treaty was at last signed in London on July 6, 1827, by the plenipotentiaries of these three powers, providing that an immediate armistice should be established between Turkey and Greece, and proposing to place Greece on the footing of a tributary province, with the right to choose her own governors. Greece was in no condition to reject these humiliating terms; but, happily for her, the Porte was too proud or too obstinate to accede to them. The sultan's government indignantly resented any interference, and even refused to receive a written communication from the allied powers. These last now perceived that they must either adopt more rigorous measures or else stand before the world in a very humiliating position. They at once augmented their fleets in the Mediterranean, and instructed Admiral Codrington, who was chief in command, to prevent the landing of any more hostile troops upon the soil of Greece. Ibrahim Pasha, the commander of the Turco-Egyptian fleet, refused to comply with this demand. His force, consisting of 120 vessels, including 79 ships of war, and carrying more than 2000 guns, was lying in the harbor of Navarino. On Oct. 20 the allied fleets consisting of only 26 vessels, and carrying about 1300 guns, entered the harbor, but without intending to make an immediate attack. This was brought on, however, by the enemy, who fired upon a boat sent with a flag of truce, and killed several persons. After a bloody action of three or four hours the allies gained a complete victory. The Turkish squadron was almost annihilated. Not more than twenty or thirty vessels remained in a sailing condition: the rest were either burned or driven ashore. This was a decisive blow; the freedom of Greece was now secure. But the triumph was embarrassing to the victors. It was not their policy—at least not that of France and England—to weaken so fatally the Ottoman power. The king of England, in his address to his Parliament, expressed his regret at "this unfortunate collision with an ancient ally." The duke of Wellington spoke of it as an "untoward event." But Greece was exultant. It was nearly two years, however, before hostilities entirely ceased, the last battle having been fought in Bœotia on Oct. 7, 1829. In this engagement Prince Demetrius Ypselantes, the brother of him who was so disastrously defeated in the first battle of the war, gained a brilliant victory over a Turkish force of 7000 men.

What was to be done with the liberated territory? At the close of the war the government was in the hands of the Count Capo d'Istria, who had left the Russian service and assumed the presidency of Greece at the beginning of the year 1828. When the protecting powers had at last come to an agreement to erect Greece into an independent kingdom, Prince John of Saxony, a scholar and a poet, had the first offer of the throne. Upon his refusal, Prince Leopold of Saxe-Coburg was the next choice of the guardians of Greece. He accepted the crown on certain conditions, but some of these conditions being unacceptable to the allies, and other difficulties arising, he soon resigned the honor. He was nominally king of Greece only from Feb. 11 to May 22, 1830. Both these princes afterwards enjoyed prosperous and peaceful reigns, the former as king of Saxony (1854–73), and the latter as king of Belgium (1831–65). In October of the following year the president, Capo d'Istria, was assassinated at Nauplia. This event accelerated the negotiations of the protecting powers, and their third choice fell on Otho, second son of Louis, king of Bavaria. This choice was solemnly ratified by the national assembly of the Greek people, and in Feb., 1833, the young prince, then not quite eighteen years of age, arrived at Nauplia, then the seat of government. A Bavarian regency managed the government until 1835, in which year Otho, now twenty years of age, assumed the reins of government and transferred the capital to Athens. For ten years Greece was governed by the house of Bavaria without a constitution. The Greeks have never been lovers of despotism, and during all the stormy period of the revolution the forms of constitutional government had been generally observed. After much discontent and several unsuccessful insurrections the will of the people at last expressed itself in a manner not to be resisted. On the night of Sept. 14, 1843, the palace of Otho was surrounded by the entire garrison of the capital and a crowd of excited citizens. Gen. Kalerges, who commanded the military force, informed His Majesty that they had come to demand a constitution, and that they should remain until their demand was granted. There was no alternative; the king promised to call a national assembly at once to frame a constitution; and thus in one autumn night, without a drop

of bloodshed or an act of violence, Greece became a constitutional kingdom. The national assembly met on Nov. 20; its discussions on the articles of the constitution continued until Mar. 14, 1844; and on the 16th of the same month the constitution was definitively adopted and received the royal signature. Amid frequent complaints and several conspiracies Otho administered the government under—perhaps sometimes *over*—this constitution for twenty years longer. But in Oct., 1862, while the king and queen were indulging themselves in a short excursion in the royal yacht among the beautiful islands of the Ægean, Greece decided to change her master; and when their Majesties returned after about ten days they were met in the harbor of Salamis by a deputation, who informed them that the throne of Greece had been declared vacant, and that the provisional government would not allow them to come on shore. The royal pair were obliged to exchange their yacht for a British man-of-mar, which bore them safely to Venice, whence they proceeded to the capital of Bavaria. Otho had no son to whom he could bequeath his reserved rights to the throne. On Dec. 1, the provisional government issued a decree ordering the election, by universal suffrage, of a new constitutional king. The vote resulted in the almost unanimous choice of Prince Alfred, second son of Victoria, queen of England. Out of 241,202 votes he received 230,016. Out of every 44 votes, 43 were polled for him. He was accordingly officially proclaimed the constitutional king of Greece, elected by the sovereign will of the Greek people. But former treaty stipulations between the three protecting powers forbade that any member of the royal family of either should ever wear the crown of Greece. A joint protocol of the three powers, dated May 27, 1863, declared the throne of Greece still vacant, and on June 5 another similar protocol offered the crown to Prince George of Denmark, second son of King Christian IX., and younger brother of Alexandra, princess of Wales. He accepted the offer on condition that the Ionian Islands, which had been since 1814 a nominal republic under the protection of the British crown, should be annexed to the kingdom of Greece. The protecting powers assented to this condition, and the national assembly of Greece ratified the whole proceeding, and declared the prince already of age, though he yet wanted six months of having completed his eighteenth year. Near the end of Oct., 1863, King George I. arrived in Athens, and took possession of his throne. On Oct. 27, 1867, he was married to Her Royal Highness the princess Olga, daughter of the grand duke Constantine and niece of Alexander II., emperor of Russia. Four children, three sons and one daughter, give good security that no future trouble will arise in regard to the succession to the throne.

A. N. Arnold.

Greece, post-v. and tp. of Monroe co., N. Y., on Lake Ontario. The township contains Charlotte, the port of Rochester, and numerous other villages. Pop. of Greece v. 737; of tp. 4314.

Greece City, post-v. of Butler co., Pa., 5 miles from Butler, at the extreme end of the lower oil-region. It has 1 school, a church, a bank, 2 hotels, 1 temperance paper, and 31 operating oil-wells. Pop. about 400. Ed. "Review."

Greek Church. I. *Name and Extent.*—The full title is the *Holy Oriental* (or *Eastern*) *Orthodox Catholic Apostolic Church.* The words *Holy Catholic Apostolic* are derived from the Nicene Creed, and are also claimed by the Roman Church in an exclusive sense. *Oriental* or *Eastern* designates the origin and geographical territory. The greatest stress is laid on the title *Orthodox*, and a special festival is devoted to its celebration—viz. "Orthodoxy Sunday," at the beginning of Lent, when a dramatic representation of the œcumenical councils is given in the churches, and anathemas are pronounced against heresies. The popular designation *Greek* Church, though not strictly correct, refers to the prevailing nationality and language in which most of its creeds, liturgies, and theological and ascetic literature are composed and its worship mainly conducted.* The Greek Church embraces, however, also the Russian and other Slavonic nationalities. It has its seat in Western Asia and Eastern Europe, chiefly in Turkey, Greece, Russia, and some parts of Austria. It never spread southward and westward except in a few isolated congregations of Greek merchants and colonists, or in connection with the Russian embassy (at Vienna, Trieste, Geneva, Berlin, Paris, London, New York). The numerical strength of the Greek Church is estimated at eighty millions, which is about one-half of the Roman Catholic membership, and nearly equal to the Protestant population. She is behind both in intelligence, activity, and influence upon the course of history, but has an unconquerable tenacity, and may have an important future through the immense political power of Russia.

II. *Division.*—The Greek Church is divided into three great branches: 1. The Orthodox Church in Turkey, under the patriarch of Constantinople, with the subordinate patriarchates of Alexandria, Jerusalem, and Antioch. Constantinople, the city of the first Christian emperor (New Rome), though now in the hands of the Turk, is still the natural centre of the whole Greek Church, and may become for the Eastern world, at some future day, in Christian hands what Gregory Nazianzen eloquently described it to be in the fourth century, "the eye of the world, the strongest by sea and land, the bond of union between East and West, to which the most distant extremes from all sides come together, and to which they look up as to a common centre and emporium of the faith." 2. The Orthodox Church in Russia, under the permanent Holy Synod of St. Petersburg and the czar, whose dominion now stretches in unbroken line across the two continents of Europe and Asia. The czar is the personal, as Constantinople is the local, centre of the whole Greek Church, and he keeps a lustful eye upon the city of the Bosphorus as his future capital, where at no distant day there must be a tremendous reckoning with Mohammedanism. 3. The National Church of the kingdom of Greece, which since 1833 is governed likewise by a permanent holy synod, but less dependent upon the state than the Russian Church. 4. Distinct from these, and belonging to the Roman Church, are the United Greeks, scattered through Turkey, Hungary, Galicia, Transylvania, and Russia. They acknowledge the authority of the pope, and adopt the dogma of the double procession of the Holy Spirit, but are otherwise allowed to hold to their ancient discipline, marriage of the lower clergy, *communio sub utraque*, leavened bread, their liturgy, and the use of the Greek language. 5. The Greek, or rather Oriental Schismatics, Nestorians, Jacobites, Armenians, Maronites, etc., are separated from the Greek and Latin Catholic Church mostly on the dogma of Christ's person, and have independent organizations, which rise up as the broken fragments of ancient national churches from surrounding Mohammedanism and heathenism in Western Asia and Africa.

III. *Historical Survey.*—The Greek Church has no continuous history like the Latin or the Protestant. She has long periods of monotony and stagnation; she is isolated from the main current of progressive Christendom; her languages and literature are little known among Western scholars; she has more interest for the antiquarian and traveller than for the historian and philosopher. Yet this Church is the oldest in Christendom, and for several centuries she was the chief bearer of our religion. She still occupies the sacred territory of primitive Christianity, and claims most of the apostolic sees, as Jerusalem, Antioch, Ephesus, and the churches founded by Paul and John in Asia Minor and Greece. All the apostles, with the exception of Peter and Paul, labored and died in the East. From the old Greeks she inherited the language and certain national traits of character, while she incorporated into herself also much of Jewish and Oriental piety. She produced the first Christian literature, apologies of the Christian faith, refutations of heretics, commentaries of the Bible, sermons, homilies, and ascetic treatises. The great majority of the early Fathers, like the apostles themselves, used the Greek language.‡ Polycarp, Ignatius, Clement of Alexandria, Origen, Eusebius, Athanasius, Basil, Gregory of Nazianzen, Gregory of Nyssa, Chrysostom, Cyril of Jerusalem, and Cyril of Alexandria, the first Christian emperors from Constantine the Great, together with a host of martyrs and confessors, belong to the Greek communion. She elaborated the œcumenical dogmas of the Trinity and Christology, and ruled the first seven œcumenical councils, which were all held in Constantinople or its immediate neighborhood (Nicæa, Chalcedon, Ephesus). Her palmy period during the first five centuries will ever claim the grateful respect of the whole Christian world, and her great teachers still live in their writings far beyond the confines —nay, even more outside of her communion, as the books of Moses and the prophets are more studied and better

*Owing to the long connection with the East Roman empire of Byzantium (New Rome) the Greek language is now known in the East as "Romaic," not as "Hellenic," and till recently the Greeks distinguished themselves as "Romans" from the surrounding Turks. The term Γραικός (used by Polybius as equivalent to the Latin *Græcus*) was by the Greeks themselves always regarded as an exotic. They called themselves *Hellenes.*

†The Jews were indeed converted before the Greeks (Ἕλληνες), but the Jewish Christian churches passed over into the Greek, and the majority of the original Jewish converts were Greekish Jews or Hellenists.

‡Even Clement of Rome, Hermas, Irenæus, Hippolytus, and others who belong to the Western Church, wrote in Greek. The early popes were Greeks. The very name of pope is Greek, and belongs to every pastor in the East. The Roman congregation itself was originally a colony of Greek Christians, Hellenes, and Jewish Hellenists. In this sense, too, the maxim of Horace holds good: "*Græcia capta ferum victorem cepit.*"

understood among Christians than among the Jews for whom they wrote. But she never materially progressed beyond the standpoint occupied in the fifth and sixth centuries. She has no proper middle age, and no Reformation, like Western Christendom.

IV. We may distinguish three periods in the history of the Greek Church.

1. The *classical* or *productive* period, the first five or six centuries, which has just been characterized. The last great divine of the East is John of Damascus (about 730), who summed up the scattered results of the labors of the preceding Fathers into a tolerably complete system of theology. But he is an isolated phenomenon. The process of degeneracy and stagnation had already set in, and the former life and vigor gave way to idle speculations, distracting controversies, dead formalism, and traditionalism.

2. The *Byzantine* period, corresponding to the Middle Ages of the Latin Church, from the rise of Mohammedanism to the fall of Constantinople (A. D. 650–1453). Here we have the gradual separation from the West and from all progressive movements; dependence on the imperial court at Constantinople; continuation of a certain literary activity; philological and biblical studies in slavish dependence on the Fathers; commentaries of Œcumenius (A. D. 1000), Theophylact († 1107), Euthymius Zigabenus († about 1120); large literary collections, classical and Christian, of Photius (about 890), Balsamon, Zonaras, Suidas, and Simeon Metaphrastes; the liturgical works of Maximus, Sophronius, Simeon of Thessalonica; the Byzantine historians; the image-controversy (726–842); inroads and conquests of Mohammedanism (since 630) in Syria, Persia, Egypt, North Africa; temporary suspension of the patriarchates of Alexandria, Antioch, Jerusalem; finally, the conquest of Constantinople by the Turks and the extinction of the Greek empire (1453), which led to the emigration of Greek scholars (Chalcondylas, Chrysoloras, Pletho, Michael Apostolius, Theodore Gaza, George of Trebizond, etc.) to the West, the revival of letters, the study of the Greek Testament, and, aided thereby, the preparation for the Reformation. Yet during this period of decline in her original home the Greek Church made a great conquest in the conversion of the Slavonians—namely, the Bulgarians and Russians (in the ninth and tenth centuries), while the Latin Church converted the Celtic and Teutonic races.

3. The *modern* period, which may be dated from the downfall of the Greek empire (1453). It presents in Asia stagnation and slavery under the tyranny of the Turks, but with great tenacity and independence as to all internal affairs; in Europe rapid external growth through the rising power of Russia, with some reforms in manners, customs, and the introduction of Western culture; protests against Romanizing and evangelical movements; the orthodox Confession of Peter Mogilas (1642); the Synod of Jerusalem (1672); the Russian Church; the patriarchate of Moscow; the reforms of patriarch Nicon († 1681), and of the czar Peter the Great († 1725); the reaction of the "Old Believers" (Raskolniki); the Holy Synod of St. Petersburg (since 1721); the New Greek Church in Hellas (since 1827); modern influences from the West; prospects for the future.

V. *Doctrine and Theology.*—The Greek Church is in doctrine substantially agreed with the Roman, but upon the whole more simple and less developed, though in some respects more subtle and metaphysical. The only serious doctrinal difference is that on the PROCESSION OF THE HOLY GHOST (which see). She holds to the leading principles, but rejects many of the consequences or results, of Roman Catholicism. She adheres to the theology of the Fathers, and ignores the succeeding scholastic theology of the Schoolmen, who completed the Roman system. The Eastern theology is not properly systematized. It remains rigidly in the fragmentary state of the old councils. The resistance to the Western clause *filioque* implied a protest against all further progress both in truth and in error, and meant stagnation, as well as faithful adherence to the venerable symbol of the first and most important of the œcumenical councils. The Greek theology is most full on the doctrine of God and of Christ, but very defective on the doctrine of man and the order of salvation. The East went into all sorts of theological and Christological subtleties, especially during the long and tedious Monophysite controversies, which found little or no response in the West; but it ignored the Pelagian controversies, the development of the Augustinian and later evangelical theology. It took the most intense interest in the difference between *usia* and *hypostasis*, the *homo-ousion*, the relations of the persons in the Trinity, the *perichoresis*, the relation of the two natures in Christ, the Nestorian, Eutychian, and Monophysite heresies, but was never seriously troubled with the questions about predestination and election, total depravity and freedom, vicarious atonement, justification and imputation, conversion and regeneration, faith and good works, merit and demerit, vital union to Christ, and cognate doctrines which absorbed the attention of Western Christendom. The cause for this difference must be sought in the prevailing metaphysical, rhetorical, and objective character of the Eastern Church, inherited partly from Asia, partly from Greece, as distinct from the practical, logical, and subjective tendency of the Western churches, which is derived from the Roman and the Teutonic nationalities. The difference is illustrated already by the Nicene Creed, with its metaphysical terms about the Son, as compared with the more simple and popular Apostles' Creed, which originated in the West and is very little used in the East.

VI. *Government.*—The Greek Church is a patriarchal oligarchy, in distinction from the papal monarchy. The episcopal hierarchy is retained, the papacy rejected. The Vatican decrees of 1870 have intensified the separation between the two churches. Centralization is unknown in the East. The patriarchs of Constantinople, Alexandria, Antioch, and Jerusalem are equal in rights, though the first has a primacy of honor. The Eastern hierarchy resembles the Jewish type. The Greek priest within the veil of the sanctuary is concealed from the eyes of the people, but in social respects he is nearer the people than the Romish priest. He is allowed, and even compelled, to marry once, but forbidden to marry twice. Celibacy is confined to bishops and monks. Absolution is given only in the form of a prayer, "May the Lord absolve thee!" instead of the positive form "I absolve thee." The confessional exists, but in a milder form, with less influence and abuse, than in Romanism. The laity are more independent, and the Russian czar, like the Byzantine emperor of old, is the head of the Church in his dominion. The unction of confirmation is made to symbolize the royal priesthood of every believer. The monastic orders, though including many clergy, are not clerical institutions; the community of Athos is a lay corporation with chaplains.

The administration of the churches as developed in the Byzantine empire is most complicated, and involves, besides the regular clergy, an army of higher and lower ecclesiastical offices, from the first administrator of the church property (ὁ μέγας οἰκόνομος), the superintendent of the sacristy (ὁ σκευοφύλαξ), the chancellor or keeper of ecclesiastical archives (ὁ χαρτοφύλαξ), down to the cleaners of the lamps (οἱ λαμπαδάριοι), the bearer of the images of saints (ὁ βασταγάριος). These half-clerical officers are divided into two groups—one on the right, the other on the left; each is subdivided into three classes, and each class has again five persons. Leo Allatius and Heineccius enumerate fifteen officials of the right group, and even more of the left. But many of these offices have either ceased altogether or retain only a nominal existence.

VII. The *cultus* is much like the Roman Catholic, with the celebration of the sacrifice of the mass as its centre, with an equal and even greater neglect of the sermon, and is addressed more to the senses and imagination than to the intellect and the heart. It is strongly Oriental, unintelligibly symbolical and mystical, and excessively formalistic. The Greeks reject organs, musical instruments, and sculpture, and make less use of the fine arts in their churches than the Romanists; but they have even a more complicated system of ritualism, with gorgeous display, semi-barbaric pomp, and endless changes of sacerdotal dress, crossings, gestures, genuflexions, prostrations, washings, processions, which so absorb the attention of the senses that there is little room left for intellectual and spiritual worship.* They use the liturgy of St. Chrysostom, which is an abridgment of that of St. Basil, yet very lengthy, and contains, with many old and venerable prayers, later additions from different sources to an excess of liturgical refinement.

The most characteristic features of Greek worship, as distinct from the Roman, are—the threefold immersion in baptism, with the repudiation of any other mode as essentially invalid; the simultaneous performance of the act of confirmation and the act of baptism, which in the West have been separated; the anointing with oil in cases of dangerous illness, which Rome has changed into extreme unction of the dying; infant communion, which the Latin Church has not only abandoned, but forbidden; the communion under two kinds (κατὰ τὰ δυοειδῆ, *sub utraque*); the use of leavened instead of unleavened bread in the Eucharist; the standing and eastward posture in prayer; the stricter separation of the sexes; the use of the screen or veil before the altar, and the withdrawal of the performance of the mysteries from the eyes of the people.

The worship of saints, relics, flat images, and the cross is carried as far as, or even farther than, in the Roman

* Stanley (*Eastern Church*, p. 32) characterizes the Greek worship as "a union of barbaric rudeness and elaborate ceremonialism."

Church, but statues, bas-reliefs, and crucifixes are forbidden. The ruder the art the more intense is the superstition. In Russia especially, the veneration for pictures is carried to the utmost extent, and takes the place of the Protestant veneration for the Bible. The picture with the lamp burning before it is found and worshipped in the corner (the sacred place) of every room, in the street, over gateways, in offices, taverns, steamers, railway and telegraph-stations, in the knapsack of every soldier—not as a work of art, but as an emblem, a lesson of instruction, an aid to devotion. The vernacular languages are used in worship—the Greek in Turkey and Greece, the Slavonic in Russia—but they have to a considerable extent become unintelligible to the people. The Oriental sects hold to their native dialects, the Syriac, Armenian, etc. The old Greek calendar, which is eleven days behind the new style introduced by Gregory XIII., is still retained in distinction from the Roman and Protestant churches.

VIII. As to Christian *life*, the Greeks and Russians are very religious in outward observances and devotions, but almost destitute of what Protestants mean by subjective, experimental piety and personal direct communion of the soul with the Saviour. They are liberal and deceitful in unmeaning compliments. The Greek Christians surpass their Mohammedan neighbors in chastity, but are behind them in honesty. What St. Paul says of the Cretans (Κρῆτες ἀεὶ ψεῦσται) is still characteristic of the whole race. In Russia there is the same divorce between religion and morality. The towns are adorned with churches and convents; every public event is celebrated by the building of a church; every house has an altar and sacred pictures; every child his guardian angel and baptismal cross; a Russian fasts every Wednesday and Friday, prays early and late, regularly attends mass, confesses his sins, pays devout respect to sacred places and things, makes pilgrimages to the tombs and shrines of saints, and has the phrase *Slava Boga* ("Glory to God") continually on his lips. And yet even the priests are grossly intemperate, and public officials even to the highest dignitaries are said to be open to bribery.

IX. *The Greek Church and the Bible.*—Concerning the extent of the canon of the Scriptures the Eastern Church is not quite consistent, and stands midway between the Roman and the Protestant view concerning the Jewish Apocrypha. The "Orthodox Confession" repeatedly quotes the Apocrypha as authority, and the Synod of Jerusalem mentions several apocryphal books (The Wisdom of Solomon, Judith, Tobit, the History of Bel and the Dragon, the History of Susannah, The Maccabees, and The Wisdom of Sirach) as parts of the Holy Scriptures. On the other hand, Metrophanes enumerates only twenty-two books of the Old Testament (according to the division of Josephus, who counts the twelve minor prophets as one, and combines several historical books), and eleven books of the New Testament (counting fourteen Epistles of Paul as one book, and so the two Epistles of Peter and the three of John), and then speaks of the Jewish Apocrypha as not being received by the Church among the canonical and authentic books, and hence not to be used in proof of dogmas. The Longer Catechism of Philaret likewise enumerates (with Josephus, St. Cyril, and St. Athanasius) only twenty-two books of the Old Testament and twenty-seven books of the New, and says that "the Wisdom of the Son of Sirach and certain other books" are ignored in the list of the books of the Old Testament "because they do not exist in the Hebrew." The use of the Apocryphal books is founded in this, that "they have been appointed by the Fathers to be read by proselytes who are preparing for admission into the Church."

As to the *circulation* of the Scriptures among the laity, it is not encouraged, and certain portions, especially of the Old Testament, are declared to be unfit for general use. But the Greek Church has never expressly prohibited the reading of the Bible to the people, like the Roman; and the Orthodox Church of Russia has always had a popular version of the Bible, first in the old Slavic, and now in modern. Alexander I., by a ukase of Jan. 14, 1813, allowed even the British and Foreign Bible Society to establish a branch in St. Petersburg. Through the labors of this society nearly 500,000 copies of the New Testament and the Psalms were scattered in thirty-two languages all over the empire, and read with great avidity. A recent traveller says: "Except in New England and in Scotland, no people in the world, so far as they can read at all, are greater Bible-readers than the Russians." (Hepworth Dixon, *Free Russia*, p. 290.) A priest told him, "Love for the Bible and love for Russia go with us hand in hand. A patriotic government gives us the Bible, a monastic government (Nicholas) takes it away." But it should be remembered that not more than one out of ten Russians can read at all. The Bible drove the Jesuits from Russia, who opposed it with all their might. In 1825, Nicholas, under the influence of the monks, or the black clergy, placed the book under arrest, and replaced it by an official "Book of Saints." But the present emperor, Alexander II., the emancipator of the serfs, has also emancipated the Bible, and restored in part, at least, the liberty of the Bible Society, but restricted it to the Protestant population. The printing and circulating of the Bible in the Russian language and within the Orthodox Greek Church is under the exclusive control of the Holy Synod of St. Petersburg.

X. *Missions.*—The Eastern Church spreads, through Russian influence, in Siberia, the Aleutian Islands, and wherever the civil and military power of the czar prepares the way. But, apart from the aid of government, she has little or no missionary spirit, and is content to keep her own. Her greatest mission-work was the conversion of Russia, and this was effected not by preaching, but by the marriage of a Byzantine princess and the despotic order of the ruler. In the midst of the Mohammedan East the Greek populations remain like islands in the barren sea, and the Bedouin tribes have wandered for twelve centuries round the Greek convent of Mount Sinai probably without one instance of conversion to the creed of men whom they yet acknowledge with almost religious veneration as beings from a higher world. (*Stanley*, p. 34.) If the Turks are ever to be converted to Christianity, it must be done by other churches. Mohammedans regard the Greek and Roman Christians as idolaters, and cannot but despise the monks who annually disgrace by their fights the traditional spot of the crucifixion, and have to be kept in order by Turkish soldiers.

The want of missionary spirit, however, accounts also for greater freedom from the curse of proselytism and persecuting intolerance. The history of the Greek Church is not disfigured by bloody tribunals of orthodoxy, like the Spanish Inquisition, or systematic and long-continued persecutions, like the crusades against the Waldenses, Albigenses, Huguenots, with the infernal scenes of St. Bartholomew's massacre. Yet the Greek Church of old has mercilessly expelled and exiled Arian, Nestorian, Eutychian, and other heretics, persecuted the Paulicians (835); and modern Russia rigidly prohibits secession from the orthodox national Church. Nobody can be converted in Russia from one religion or sect to another except to the national orthodox Church, and all the children of mixed marriages, where one parent belongs to it, must be baptized and educated in it.

Literature.—The chief sources are the acts of the first seven œcumenical synods (from the first of Nicæa, 325, to the second of Nicæa, 787); above all the creeds and canons of the Council of Nicæa, 321, and the Council of Chalcedon, 451. The writings of the Greek Fathers, especially Athanasius, Chrysostom, and John of Damascus. The Confession of Gennadius, patriarch of Constantinople (delivered to the Turkish sultan, Mahomet II., 1453); the Orthodox Confession of Peter Mogilas, metropolitan of Kief (1643); the eighteen decrees of the Synod of Jerusalem and the Confession of Dositheus (1672, mainly directed against the Patriarch Cyril Lucar and his attempt to Protestantize the Greek Church); the Russian catechisms of Platon, and especially of Philaret (metropolitan of Moscow, d. 1867). The Longer Catechism of Philaret, issued by authority of the Holy Synod of St. Petersburg, 1839, is used in all the churches and schools of the Russian empire, and is by far the best modern exposition of the orthodox doctrine of the Eastern Church. It contains in questions and answers a commentary of the Nicene Creed, the Lord's Prayer, the Nine Beatitudes, and the Ten Commandments. Modern works: Leo Allatius, on the consent of the Greek and Latin churches (Col., 1648); Le Quien, *Oriens Christianus*, 1740; Jac. Goar, *Euchologium, s. Rituale Græcum*, 1667; John King, *Rites and Ceremonies of the Greek Church in Russia*, London, 1772; John Mason Neale, *History of the Holy Eastern Church*, London, 1850; Dean Stanley, *Lectures on the Eastern Church*, London and New York, 1861 (3d ed. 1866); Gass, *Symbolik der Griech. Kirche*, 1872. On the Russo-Greek Church see also the works of Strahl, Mouravieff, Pinkerton, Blackmore (*The Doctrine of the Russian Ch.*, 1865), Haxthausen, Philaret (*Geschichte Russlands*, 1872), Basaroff, Boissard (*L'église de Russie*, 1867, 2 vols.), and Lect. 11th and 12th of Dean Stanley's work on the *Eastern Church*. Philip Schaff.

Greek Fire, a highly inflammable compound, probably made of naphtha, saltpetre, and sulphur, and much used by the Byzantine Greeks in defensive and offensive warfare; but there is much doubt as to its composition. It was thrown by means of a copper tube upon the enemy, or pledgets of tow were dipped in it and attached to arrows, which were discharged at hostile ships or towns. This material was also used in Western Europe and in Asia to some extent in the Middle Ages. Its invention was ascribed to Callinicus of Heliopolis, in Egypt, in 668 A. D.; and it was first used by Constantine Pogonatus against the

fleet of the caliph Moawia at the siege of Constantinople in 673, with the most complete success. It is, however, generally considered an Arabian or an East Indian invention. The use of similar compounds called by the name has been attempted in modern times, without much success, the new plan being to throw it in shells or grenades.

Greek Language. The Greek belongs to the South European branch of the Indo-European family of languages, its nearest relations being with the Italic tongues—Latin, Oscan, Umbrian, etc. The admirable genius of the Greeks built up their language to a surprising degree of perfection, its chief excellences being copiousness of inflection and vocabulary, and consequent capacity for fine distinctions, wonderful power of self-development, great vivacity, flexibility of expression, and freedom from arbitrary rules. Most noteworthy, however, is it that this rich development is hardly at all the result of literary culture and the conscious reflection of scholars; its growth was complete in all essential particulars long before the time of the Homeric poems; it was unconsciously formed in the mouths of a people, gifted, but of rude manners and utterly ignorant of the art of writing.

PERIODS.—We may distinguish two chief periods in the history of ancient Greek: (1) The classic period, of growth, from the earliest times to 330 B. C.; (2) the post-classic period, of decay, from this date to about 800 A. D.; with the end of the eighth century may be said to begin (3) the modern Greek period.

DIALECTS.—There must have been a time when the Greeks were one undivided people and spoke exactly the same language, of which original Greek the Doric of later times preserved a better likeness than the Attic familiar to us. But the time and place of this Hellenic unity is matter of conjecture. In historic times the language was by no means uniform. Though all Greeks felt their community of speech, and seem to have understood one another without difficulty, yet the dialectic variations were considerable; they are largely phonetic, following fixed rules, but affect also vocabulary and syntax. Most of these dialects were little cultivated by literary use, and though they are of the greatest importance to the linguist, it is only recently that by effective researches their true relations have been brought to light. Unfortunately, our knowledge of them is incomplete. Only two, Ionic and Attic, do we know through copious literary monuments; of all the others (aside from scanty literary remains handed down in a corrupt state) our knowledge depends chiefly on inscriptions. The number of these has greatly increased of late years, and new discoveries are constantly bringing more to light the astonishing multiformity of the Greek tongue. The primary division of the dialects, as of the people itself, is a twofold one—into an eastern (Ionic) and a western (Æolo-Doric) branch. This dualism, which is sharply defined, arose, if we accept E. Curtius's theory, in that at a very early period, while both stems dwelt together in Asia Minor, the western Greeks separated themselves from the eastern, and migrated through Thrace into the peninsula of Greece, the Ionians remaining on the Asiatic coast, and only sporadically and much later coming across by sea and gaining a foothold in Greece proper; thus the Ionians would be essentially Asiatic, and the Æolo-Dorians European Greeks. This theory cannot yet be considered as established. According to the common belief, which assumes the peninsula as the common home of all Greeks, the deep cleft between Ionians and western Greeks must be otherwise (though less easily) accounted for. The western branch further divides itself into Æolic and Doric; so arises the common threefold division into Ionic, Doric, and Æolic. The western dialects are far more conservative than the Ionic. Common to all Æolo-Dorians is long α in most words for Ionic η, the better preservation of the *w*-sound (digamma or vau), and the particle κα = ἄν. The following are the chief individual dialects, with some characteristics of each.

A. ÆOLIC.—The dialects classed as Æolic lack that unity which the Doric have; the tribes speaking them seem to have been early dispersed over all Greece. They possess in common a certain instability of the vowel sounds, including a love for close vowels (ι, υ), and a preference for the μι-form of conjugation. There are two groups of Æolic dialects. The first includes—

1. *Asiatic Æolian* (Lesbian) of Lesbos and the neighboring coast. 'Απύ = ἀπό, κρέτος = κράτος; αις οις from ανς ονς, thus accus. μοίσαις = μούσας, λόγοις = λόγους (the Lesb. datives being μοίσαισι, λόγοισι); fondness for doubled consonants, βόλλα = βουλή, ἔνεμμα = ἔνειμα; general retraction of the accent, and dislike for the rough breathing, ὔμμες = ὑμεῖς. This is the language of Alcæus and Sappho, often called simply Æolic.

2. *Arcadian.*—'Ες for ἐξ, κάν for κα (= ἄν), κατύ, ἀπύ, for κατά, ἀπό; ζέλλω, δέλλω for βάλλω; subjunct. 3 pl. in -ωνσι; genitive of 1st decl. in αυ, ζαμίαυ = ζημίας.

3. *Cyprian.*—'Ιν, ἰπέρ for ἐν, ὑπέρ; κίν for ξύν, ἔρ for ἄρα, θόρα for θύρα.

The second group comprises—

4. *Thessalian.*—Δαύχνα = δάφνη, ὄν = ἀνά; ου for ω, as τοῦν πολιτάουν = τῶν πολιτῶν, γνούμας = γνώμης; genitive of 2d decl. in οί, λόγοι = λόγου, and dative in ου, τοῦ κοινοῦ = τῷ κοινῷ; iota subscript omitted, τᾶ ἀρχᾶ τᾶ ἑαυτοῖ = τῇ ἀρχῇ τῇ ἑαυτοῦ.

5. *Bœotian.*—βανά, βανῆκος = γυνή, γυναικός; δ for ζ, as δυγόν, γραμματίδδω = ζυγόν, γραμματίζω; 3 pers. pl. in νθι, as ἔχωνθι = ἔχωσι; a very peculiar vowel-system by which many of the long vowels and diphthongs are replaced by others, ει standing for η and ῃ, η for αι and ᾳ, ι for ει; in the later stage υ stands for οι and ῳ, ου for long and sometimes for short υ; examples, 'Ηολεῖα = Αἰολῆα, Ϝελατιήυ = 'Ελατειαίῳ, τούχα = τύχῃ, τραγα Ϝυδός = τραγῳδός (-αοιδός). E often becomes ι, Ϝέτια = ἔτεα. The dative sg. of 1st and 2d decl. ends in earlier times in αι and οι (ταῖ ὁδοῖ = τῇ ὁδῷ), but sometimes in the Latin-like diphthongs αε and οε (Πλαύχαε, Διωνύσοε); in later times in η and υ (τῆ ὀδῦ). Σαυκράτεις stands for Σωκράτης.

6. *Elean.*—Fondness for α-sound; ἄδειρεν, Ϝάργον, πάρ, Ϝράτρα, μά, ἔα = ἔδειρεν, ἔργον, περί, ῥήτρα, μή, εἴη, words in which even the Doric has ε, η.

B. DORIC.—All Doric dialects have μες for μεν in 1st pers. pl.; ντι in 3d pers. pl. (λέγοντι for λέγουσι); future in σιω for σω; gen. pl. 1st decl. in ᾶν, gen. sg. masc. in ᾶ, πολίτα πολιτᾶν = πολίτου, πολιτῶν; all contract αε to η. The Doric dialects divide themselves into strict and mild; the strict having η and ω for Attic ει and ου in certain cases, as μῶσα, δάμω, τιθῆσα, ἦχον = μοῦσα, δῆμον, τιθεῖσα, εἶχον; the mild agreeing with the Attic.

1. *Strict Doric*, spoken in Crete. Magna Græcia, Laconia, Cyrene. Best known from the celebrated Heraclean tables, showing the dialect of Heraclea in Italy. The Laconian and Cretan dialects had much that was peculiar, the former σ for θ, ου for υ, and ρ or the rough breathing for σ (σιόρ = θεός, πᾶἀ = πᾶσα, μουσίδδει = μυθίζει), the latter θθ for σθ, ττ for ζ, νς preserved (Ϝειπάθθω = εἰπάσθω, Ττῆνα = Ζῆνα, τὸνς πρειγευτάνς = τοὺς πρεσβευτάς).

2. *Mild Doric*, spoken in Rhodes, Melos, and some other islands, in Megara, Argos, Corinth, Corcyra, and Sicily. The Megarian had χρήδδω = χρήζω, etc. The Argive preserved νς like the Cretan.

3. A special group is the *Northern Doric* of Phocis, Locris, etc. This, though counted among the mild dialects, approaches the strict in some points. Peculiar is the use of ἐν for εἰς with accus. of -οις in dat. pl. 3d decl., as Ϝετέοις = ἔτεσι. The Locrian has ἐ = ἐκ, στ for σθ in verbal forms (χρήστω = χρήσθω), πατάρα, ἀμάρα for πατέρα, ἡμέρα.

C. IONIC, including Attic, which is but a branch of Ionic. Characteristic of the Ionic is the wholesale change of long α into η, the particle ἄ = κα, κε, and the ν loss of digamma.

1. *Attic*, the chief literary dialect. It retains long α in certain positions (πράσσω, σοφία), and admits contraction freely, verging thus toward the Doric, but avoiding the monotonous frequency of the *a*-sound (πλατειασμός) in that dialect, as well as the Ionic predominance of the *e*. It was by holding this middle position the better fitted to become the universal Greek language.

2. *Ionic of the Asiatic coast*, often called simply Ionic, distinguished by dislike of contraction and tolerance of successive vowel-sounds (δηϊόῳεν), including—

(*a*) *Old Ionic* of the Homeric poems and all later epics, a partly conventional and artificial language, containing much that is extremely ancient (genitive in οιο, endings μι σι in subjunctive, futures and aorists with σσ, traces of digamma), side by side with forms of a later stage.

(*b*) The so-called *New Ionic*, the spoken language of the Asiatic Ionians; its local variations are no longer traceable. It is known to us by the writings of Herodotus and Hippocrates. It has κ for π in interrogatives. The predominance of vowels gives it a soft, effeminate character.

ALPHABET.—Though not strictly a part of the language, the alphabet may receive some notice here. The Greeks received their letters from the Phœnicians, at what time is uncertain, but our earliest, very rude and primitive inscriptions are not older than 650 B. C., and the Homeric poems make no mention of writing. The Phœnician alphabet of 22 signs, ending with T, was increased by a new vowel-sign Y at the end, and later by the letters Φ, X, Ψ, but these last two were differently employed, the western Greeks using the sign X for the sound *x* (so too the Latins), and Ψ for *ch*, while with the eastern Greeks the X was *ch* and Ψ *ps*. The letter Ξ was employed by the eastern Greeks as *x*, but dropped by the western. The Phœnician alphabet furnished two signs for *s*; after some fluctuation one of these was dropped. The original forms of the letters were by no means those familiar to us; they varied much with times and places, and became fixed about as we know them in the fourth century B. C. The letters at first were turned (Ǝ, Ʀ), and the writing proceeded from right to left; this, however,

was early reversed. E and O stood originally for the long as well as the short *e* and *o* sounds, H representing the rough breathing *h*. The Ionians first began the practice of using H for the long *ē*, and invented the sign Ω for the long *ō*. This mode of writing, and with it the complete Ionic alphabet, became general about 400 B. C., superseding the older alphabets. Breathings and accents were unused till long afterwards. Capitals only were known to the ancients; the cursive letters familiar to us developed themselves in the mediæval period.

PRONUNCIATION.—The vowels in the classical period were sounded as in Italian or German, except that υ had early assumed in most dialects the sound of the French *u*; the diphthongs, αι, ει, οι, αυ, ευ, υι sounded as in *ay*, r*ei*n, b*oi*l, h*ow*, f*ew*, *we*; the ι in ᾳ ῃ ῳ was distinctly heard; ου assumed early a simple sound, as in y*ou*th = Roman *u*. The guttural nasal (*n* in *ink*) was expressed by γ, but sometimes by ν. The aspirates φ, ϑ, χ were at first tenues with following breathing, as in ha*ph*azard, po*th*ook, bloc*kh*ead; later they came to be merely spirants (*f*, Eng. *th*; Ger. *ch*), probably through the intermediate stage of *affricates* (tenues with following spirants), *pf*, *tth* (as heard in *eighth*), and *kch* (as in Ger. *häkchen*). F where pronounced sounded like Eng. *w*, ζ was like *dz*.

PHONETIC RELATIONS TO PARENT LANGUAGE.—The original Indo-European tongue had but three vowels, *a*, *i*, *u*. *E* and *o* were later developed as variations of *a*. Hence, Greek ε, ο, ᾰ all respond to original *ă*, and η, ω, ᾱ to original *ā*. Compare ἀπό, ἐπί with Sanscrit *apa*, *api*, ἕᾱδα, ἡδύς, ὠκύς with Sans. *svād*, *svādus*, *āçus*. In some cases, however, Greek ο = original *ā* as contrasted with ε = original *ă*, thus φόρος = Sans. *bhāras* as opposed to φέρω = *bharāmi*. This interchange of ε, ο, α in root-syllables (τρέπω, ἔτραπον, τρόπος) plays an important part in Greek. Greek η is mostly of late origin, having been developed from α since the separation of the dialects; the Doric and Æolic dialects have mostly retained α, as ἁδύς for ἡδύς, yet not always, for ϑήρ, μή, μήδομαι, and many similar are Doric. Greek ι, υ come chiefly from original *i*, *u*, τίς, ἴ-μεν = *kis*, *i-masi*; ζυγόν = *jugam*; but in rare instances they are merely further attenuations of ε, ο, Ionic ἱστίη = ἑστία; νύξ = Lat. *nox*, orig. *naktis*; so Æol. ἰν, ἀπύ = ἐν, ἀπό. The diphthongs αι, ει, οι all correspond to original *ai*; αυ, ευ, ου to original *au*. They have to a large extent arisen from amplification of the simple *i* and *u* by the process known to the Sanscrit grammarians as *guna*; *e. g.* Fοῖδα, εἶμι (origin. *vaida*, *aimi*, Sans. *vēda*, *ēmi*), from roots *vid*, *i*; πεύϑεται (Sans. *bōdhatē*—*i. e. baudhatai*). Elsewhere the diphthongs have arisen from the accidental concurrence of two vowels, as γένει from γενε(σ)ι, by the dropping of σ. From the above rule of correspondence must be excepted the spurious diphthongs ει and ου, to be spoken of below. The so-called *improper* diphthongs, ᾳ, ῃ, ῳ, ηυ, ωυ, are specifically Greek and of secondary origin, the result of contraction. Of consonants, σ, κ, γ, τ, δ, π, β answer in general to the same sounds in the parent language; the aspirates χ, ϑ, φ to original *gh*, *dh*, *bh*; compare ἐ-λαχύς, τίϑημι, φημί with Sans. *laghus*, *dadhāmi*, *bhāmi*. The nasals μ, ν = Indo-European *m*, *n*, but ν final often represents an *m*; ζυγό-ν = Lat. *jugu-m*. Greek ρ = original *r*; λ responds to either *l* or *r* of cognate languages, though it is now mostly held that all *l*'s were originally *r*'s. To the semi-vowels *v* (*w*) and *j* (*y*) of the cognate tongues answer in Greek F and *j*; this last, though never written, was a Greek sound in the pre-historic period; it was afterwards partly vocalized to ι, partly lost, but has left many traces of itself. It should be noted that these two semi-vowels interchange freely with their related close vowels *i* and *u*. The double sounds ξ, ψ arose in various ways too complicated to be here detailed. Z is mostly the product of a union of δ or γ with following ι (*j*); when initial it responds to *j* of other languages; ζυγόν = *jugum*. The Greek rough breathing is (except where of secondary origin) a remnant of a lost consonant (σ, F, *j*), and never corresponds to Latin or Sanscrit *h*.

PRINCIPAL PHONETIC TENDENCIES.—1. *Disappearance of Consonants* was the most prolific cause of changes of form in Greek.—*J* was lost in the earliest times; F disappeared entirely in the Ionic branch, and to a great extent in the others; it remained most persistently when initial. Σ falls out between two vowels and at the beginning of a word; γένεος from γενεσ-ος (Lat. *gener-is* for *genes-is*), ῥόος from σροFος. The rough breathing over initial ρ is usually a trace left of a lost σ or F. Many words have lost initial σF, as ἡδύς from σFαδυς (Lat. *sva(d)vis*, Eng. *sweet*). Other consonants than these do not fall out when standing alone, but difficult combinations of consonants may be lightened; τ, δ, ϑ regularly disappear before σ. The combination νς is especially disliked, and is got rid of by nearly all dialects, usually by dropping the ν. 2. *Changes of Consonants.*—I often turns a preceding τ to σ, though not in all dialects: εἴκοσι, πλούσιος (from πλοῦτος), φησί; but Doric Fίκατι, πλούτιος, φατί. Less often υ exerts the same influence: Doric τύ (Lat. *tu*) becomes σύ. T, δ, ϑ before μ become σ, but not universally; Ionic ἴδμεν, Doric ϑεϑμός or τεϑμός for Attic ἴσμεν, ϑεσμός. Assimilation, either total, as ὄμμα (Æol. ὄππα) for ὄπ-μα, or partial, as ἐμβαλεῖν γέγραπται for ἐν-βαλεῖν, γέγραφ-ται, is frequent. Metathesis (transposition of a vowel and consonant) occurs in root-syllables, chiefly affecting liquids and nasals: ἔ-ϑαν-ον, ϑνή-σκω. Noteworthy is the spontaneous generation of β between μρ, μλ, and δ between νρ, νλ; ἀνδρός for ἀν(ε)ρός, μέμβλωκα for μέμλωκα; so French *chambre*, *cendres* from *cam(e)ra*, *cin(e)res*: when initial the μ, ν are dropped; (μ)βλώσκω, (μ)βροτός for μλω-σκω, μρο-τος, roots μολ, μορ. A tenuis occasionally develops aspiration without special reason; Ionic δέκομαι becomes in Attic δέχομαι; to these secondary aspirates the Attic is most partial. Not infrequent change of organ in mutes is seen in the comparison of the dialects or of kindred languages: ποῦ, Ionic κοῦ; βάλλω, Arc. δέλλω; πέσσω (*i. e.* πεκ-*j*ω) Lat. *coqu-o*; πέντε, Æol. πέμπε, Lat. *quinque*; τίς Lat. *quis*, etc. This is the result of the operation of *parasitic j* and *v* on the gutturals. In such cases the guttural is always the original sound, changed by *v* into a labial (*k*—*kv*(*qu*)—*p*) and by *j* into a dental (*k*—*kj*—*t*). The middle stage is often retained in Lat. *qu*; λείπω = *li(n)quo*; other examples above; and a trace of it is seen in the doubled π and τ in Homeric ὅππως, ὅττι (ὁκFως, ὁκ*j*ι); cf. ἵππος (ἰκFος, *equus*). The vowel ι or its consonant form *j* unites with preceding δ or γ to form ζ, with κ, τ, χ, ϑ to form σσ or ττ. This is regularly the origin of σσ (= ττ) and ζ in Greek; πεζός = πεδ-ιος, ἐλάσσων = ἐλαχ-ιων; so Æol. κόρζα, ζά for καρδία, διά. The process is the same as in Italian *mezzo* (*medius*), French *face* (*facies*). *J* has furthermore the power of generating a δ-sound before itself, with which it unites to form a ζ; so ζ comes to stand for *j*, as ζυγόν = *jugum*, verbs in -αζω and -ιζω from α-*j*ω, ι-*j*ω. So Italian *già* from *d-ja*; Lat. *jam*. The Bœotians and others dropped here the *j*, and said δυγόν, -αδδω. In the same manner the δ at the end of such feminine noun-stems as Ἑλλα-δ, ἐρι-δ represents an added *j*. 3. *Contraction of vowels*, which are brought together mostly by the loss of intervening consonants. The rules for Attic can be found in any Greek grammar, but the usage of the dialects differed much; thus, αε gave in Doric η, ἐνίκη = Att. ἐνίκα; εε, οο gave in strict Doric η and ω; ἁγῆται, ἵππω = Att. ἡγεῖται, ἵππου. The contraction of unlike vowels seems to have been preceded by assimilation, and the epic dialect sometimes preserves these intermediate forms, as ὁρόω, αἰτιάασϑε, from ὁράω, αἰτιάεσϑε. Contraction is only one means of avoiding hiatus (concurrence of vowels); others are synizesis (a forcible utterance of the two vowels in one syllable) and transfer of quantity, as νεώς for ναός; these last afford only a partial relief. At the end of a word hiatus may be removed by elision. 4. *Rejection of vowels.*—Besides the loss of vowels between consonants (syncopation), common in all languages, the Greek especially drops the close vowels ι, υ between other vowels, changing them first into the semi-vowels F, *j*: Ἀϑηναία, Ἀϑηνάα; βασιλευ-ος, βασιλεF-ος, βασιλέος. 5. *Vicarious lengthening of a vowel* in compensation for an omitted consonant, an important process but imperfectly understood till recently. There are two very different cases of it. (*a*) When μ, ν, ρ, λ (rarely σ) are dropped *before another consonant*, the preceding vowel is lengthened to compensate for its loss of position: the commonest case is (ν)σ. The dialects differ widely in respect of this process. The Lesbian often avoids it, contenting itself with assimilation of the consonants. Otherwise it replaces omitted ν by ι. Examples are—ἐσ-μι, Lesb. ἔμμι, strict Doric, ἠμί; Ionic and mild Dor. εἰμί; Aorist ἐμεν-σα, Lesb. ἔμεννα, str. Dor. ἔμηνα, mild Dor. Ion. ἔμεινα; ξεν- ος, Lesb. ξέννος, Ionic ξεῖνος, Attic and other dialects ξένος; παν-σα, Lesb. παῖσα, other dial. πᾶσα; ϑεν-σα, str. Dor. ϑῆσα, other dial. ϑεῖσα; μον-σα, Lesb. μοῖσα, str. Dor. μῶσα, mild Dor. Ion. μοῦσα; τόνς retained by Cretans and Argives, other Dorians τώς τός and τούς, Ionic τούς, Lesb. τοίς. The Ionic, Attic, and mild Doric lengthen ε and ο to the false diphthongs ει, ου, which must be carefully distinguished from the genuine ει and ου, as they were, in early times at least, neither written nor sounded as diphthongs. The same is true of the ει and ου which arise from the contraction of εε, οε, οο, εο. (*b*) When F or *j* disappears *between two vowels*, the former vowel may be lengthened, ε and ο becoming η and ω, never ει or ου; βασιλεF-ος becomes βασιλῆος. The length thus attained is inconstant, it often shifts to the other vowel (βασιλέως) or disappears altogether (βασιλέος). 6. *Transposition of Iota.*—I (or *j*) has the power of springing over a consonant and intruding itself into the previous syllable: τείν-ω for τεν-*j*ω. So the verbal forms λέγεις and λέγει(τ) come from λεγε-σι, λεγε-τι. 7. *Prothesis* of vowel at beginning of a word, to assist in the enunciation of a difficult consonant or combination; so in Italian, *i-scrivere*; French, *e-sprit* (*spiritus*); χϑές or ἔχϑες; often before F, where it remains after the latter's disappearance, ἄεϑλον, ἐείκοσι for ἀ-Fεϑλον, ἐ-Fεικοσι; even before a

simple liquid ἐ-ρυθρός = *ruber*. 8. *At the end of a word* vowels and consonants crumble away as in other languages; peculiar is the law that no consonant but ν, ρ, σ can end a word. The others mostly drop off: γάλα for γαλακτ; τ, δ, θ may become σ; δός for δοθ(ι). A ν, sometimes fixed, sometimes movable, attaches itself to some final syllables: 1st pers. pl. -με-ν, Dor. -μες, Lat. *-mus;* dat. pl. -σι or -σι-ν.

Inflection.—1. *Of Nouns.*—The eight cases of the Indo-European language are in Greek reduced to five (nominative, accusative, genitive, dative, vocative). The lost ones, ablative, locative, and instrumental, are preserved only in adverbial forms, though the Greek dative sing. of 3d declension and the dative plur. of all declensions are the original locative forms. Other locatives are οἴκοι, χαμαί (*humi*); instrumentals are κρυφῇ, ἅμα. The ablative is preserved in the common adverbs in -ως; σοφῶς, originally σοφωτ, like Latin *bonō(d)*. The Greek nominal stems end in long α (original *ā*) 1st declension, ο (orig. *ă*) 2d declension, and in close vowels diphthongs and consonants, 3d declension. The case-endings show the closest relation to those of the Sanscrit and the parent language. They are, in the oldest authenticated Greek forms, as follows: For ο and α stems; nom. sg. ς, gen. (σ)ιο, dat. αι, acc. ν, nom. plur. ι, gen. ων or (σ)ων, dat. ισι, acc. νς. For consonant and close-vowel stems; nom. sg. ς, gen. ος, dat. ι, acc. ν or α(ν), nom. plur. ες, gen. ων, dat. σι or ασσι, acc. νς or ας. Neuters in nom. acc. pl. have the ending α; in nom. acc. sg. they have in the consonant declension no ending, but the ο stems take the accusative ending ν. The Greek has retained the dual number more fully than most of the related languages, though only in two case forms; its endings are ε, οιν. Vocative cases proper have no ending. The union of stems and endings gives rise to many phonetic changes in accordance with principles explained above. 2. *Of Pronouns.*—The flexion of pronouns differs in many points from that of nouns, and is too complicated to be discussed here. The relations of the personal pronouns to those of the parent language may be seen thus: ἐγώ = orig. *agham;* μέ, σέ (Dor. τέ), (σϜ)ἕ = orig. *ma-m, tva-m, sva-m;* ἡμέες, ὑμέες = *asmajas, jusmajas*, etc. The Greek ὁ, ἡ, τό = orig. (Sans.) *sa, sā, tat;* τοῖο = *tasja*, τόν = *tam*, τήν (Dor. τάν) = *tām*, etc. The Dorians and most Æolians had τοί, ταί in the nom. pl., not οἱ, αἱ. The relative pronoun ὅς, ἥ, ὅ is the Sans. *ja-s, jā, ja-t*, and has nothing to do with the Lat. *qui*. The interrogative τίς is Sans. *ki-s*, Lat. *quis*. 3. *Of Verbs.*—In no respect can the language claim greater pre-eminence than in the structure of the verb. First, in copiousness of significant variations of form; G. Curtius computes that the Greek finite verb (excluding infinitives, participles, and all periphrastic forms) has 249 different forms, in contrast with 94 of the Latin, 38 of the Gothic, 243 of the Sanscrit; the Sanscrit, though nearly as copious, being far inferior in the practical use of the inflections to express fine distinctions of sense. Secondly, the Greek alone of all Indo-European languages has preserved intact the original distinction of the tenses. It never allows the perfect to become a mere preterite, and it has, in its use of present and aorist, carefully kept up the distinction between continued and momentary action, which enables it, for example, to express directly such differences as "be ill" and "fall ill," "weep" and "burst into tears," which we accomplish only by circumlocutions. The Greek finite verb has three voices; besides the active and the passive, the *middle* voice, representing the subject as acting upon, for, or with himself; this is made the means of many fine distinctions. The middle and passive are distinguished in form only in future and aorist, and here the distinction is not very old, and not uniformly kept up. Besides the indicative and imperative moods, there are two oblique moods—subjunctive (conjunctive) and optative. The tenses fall into three groups, representing continued, momentary, and completed action. The distinction of time belongs to the indicative only; its seven tenses being thus classified:

	Continued.	*Momentary.*	*Completed.*
Present,	Present,	...	Perfect.
Past,	Imperfect,	Aorist,	Pluperfect.
Future,	Future,	...	Future Perfect.

The oblique moods do not distinguish time, and have three tenses only, the (wrongly-named) present for continued, the aorist for momentary, the perfect for completed action. The structure of most of these tenses is inherited from the parent language. The present and imperfect are often distinguished by some amplification of the stem of the verb; this is of several sorts, and furnishes the best ground for a classification of verbs. The so-called second aorist lacks this, and is thus distinguished from the present. The perfect and pluperfect have for their characteristic the reduplication, primarily a repetition of the initial syllable. All these tenses exist in two forms (called respectively the ω-conjugation and the μι-conjugation), as they are with or without a certain vowel (thematic or connecting vowel) appended to the stem: most verbs follow the former. The future and the so-called first aorist are composite tenses, formed by adding to the stem an old future and an old preterite of the substantive verb: these have in Greek the form of -σjω and -σα, originally *as-jāmi* and *as-am*. The future perfect is peculiarly a Greek formation; the same is true of the passive aorist and future, but their origin is less plain. The Greek has preserved dual forms of the verb in the 2d and 3d persons. The personal endings of the verb vary for the different moods and tenses, being more or less fully retained, but are reducible to the following oldest Greek forms: 1. For pres., perf., fut., and subj.; active sing. μι, σι, τι; plur. μες, τε, (α)ντι; dual τον; passive sing. μαι, σαι, ται; plur. μεσθα, στε, (α)νται; dual στον. 2. For past tenses and optative, active sg. ν, ς, τ; plur. μες, τε, ν; dual τον, ταν; passive sing. μαν, σο, το; plur. μεσθα, στε, (α)ντο; dual στον, σταν. The imperative has separate endings. Participles and infinitives, the latter being the dative of a verbal noun, are formed from present, aorist, perfect, and future. There is also a rare future optative, a special Greek development.

Formation of Words.—The suffixes by which nominal stems are formed from roots are part of the inheritance from the parent language. The chief ones are—α, ο, ι, υ; κο, το, μο, νο, ρο, λο, Ϝο, ιο (and the corresponding κα, etc.), ες, ας, εν, ον, τηρ, τορ, and various compounds of these. Nouns derived from verb-stems are called primary; those derived from other noun-stems are called secondary; thus, δό-σι-ς, κρι-τή-ς πρεσβευ-τή-ς are primary, but δίκα-ιο-ς, πρεσβύ-της are secondary, derived from δίκη, πρεσβύ-ς. The commonest secondary suffix is ιο (ια); before it ο is dropped; ἵππ-ιος from ἵππο-ς. Another is Ϝεντ (χαρι-Ϝεντ, nom. χαρί-εις), signifying "abounding in." The comparative suffixes ιον or ιος, τερο, and the superlative ιστο, τατο, deserve mention. To few of these suffixes can a uniform meaning be attached, as that of the *doer* to τηρ. In compound words two stems are united; the latter only is inflected, ἱππό-κομο-ς. The Greek is rich in compounds, but they rarely contain more than two members, avoiding the unwieldy and obscure combinations of the Sanscrit. Verbs (called denominative) are freely formed from nouns; they end mostly in αω, εω, οω, originally α-jω(μι), etc., the first vowel belonging to the noun-stem; φιλέ-ω from φίλο-ς, with ο changed to ε. A variation of αω is αζω; just so ιζω makes verbs from ι-stems. From the stems of denominative verbs other nouns may be formed in the same manner as from roots.

Accent.—The accent of the Greeks was not, like ours, a stress on a particular syllable, so much as an elevation in pitch. It is confined to the last three syllables of words. The ordinary tone of accented syllables is called *acute* (marked ´), and when it falls on long vowels extends to the end of the same. But long vowels in either of the two final syllables have sometimes the high tone restricted to the first half, the voice descending on the last half; this kind of accent is called *circumflex* (marked ^). If the final syllable of a word be long, the tone can in no case stand farther back than the end of the penultimate vowel; that is, the circumflex cannot stand on the penult nor the acute on the antepenult—ἀνθρώποις, not ἄνθρωποις or ἀνθρῶποις. The accent of most words is *recessive*, going as far back as this rule will allow; but in some words it adheres to the ultimate or penult. An acute at the end of a word is lowered in pitch if other words follow in close connection; so arises a third variety of tone, called *grave* and marked `. Some short words (enclitics and proclitics) have no accent of their own, leaning on the preceding or following word.

Syntax.—The structure of Greek sentences is natural and unfettered, giving rise to many colloquial idioms, and admitting many slight inconsistencies which are not looked upon as blemishes. The rules are singularly flexible, the variety of possible constructions very great. As peculiarities of Greek syntax might be named the frequency of *attraction* of case in connection with relative clauses, the wide development of the *inner* accusative in its different varieties, the particle ἄν which plays an important part in the syntax of the verb. The genitive and dative cases have a complex office, the former having taken on itself, in addition to its own, most of the functions of the lost ablative; the dative in like manner those of the old locative and instrumental cases. To explain the Greek uses of these cases from a single fundamental notion is at present unscientific. The Greek is the only language of the Indo-European family which, retaining both the subjunctive and optative formations, has kept them distinct, and made them the basis of different shades of modality. They have each two uses—a primary use, in which they have the force of a modified future (opt. of wishing, subj. of request, and in protasis and apodosis of future conditions); and a secondary use, in general conditions only, in which they refer to indefinite frequency in present and past time respectively, the idea of futurity being given up: ἐὰν τοῦτο ποιῇ, εἰ τοῦτο ποιοίη = "if he (ever) does

(or did) this." The optative has yet another use in indirect quotations.

LATER HISTORY OF THE LANGUAGE.—From the time of Alexander (330 B. C.) on, literary and political influences gave the Attic dialect ascendency over all others; it became the language of the whole Greek world. The national dialects gradually disappear, first in public life and educated circles, last of all among the masses. The new universal speech takes the name of *common* (κοινή) *dialect*. It is a slightly modified Attic; thus, for οἶσθα, ἴσμεν, δείκνυμι, are said οἶδας, οἴδαμεν, δεικνύω; besides οὐδείς, οὐθείς comes into use. Outside of Greece, in Syria, Macedonia, Alexandria, the language was spoken with less purity, and many corruptions crept in, the blunders of foreigners using the Greek language, Ἑλληνισταί. The language of the New Testament and the Septuagint is tinctured with such peculiarities. So arose, besides the κοινή of the educated, many vulgar dialects. That of Alexandria, for instance, had ἤλθωσαν for ἦλθον, ἔλιπαν for ἔλιπον. The literary language resisted these vulgarisms, and kept itself comparatively pure. The pronunciation altered even more than the form of words. Among the earliest changes was that of ει to that of simple ι, and of ζ from *dz* to simple *z*. In the first centuries of the Christian era the same corrupting influences are yet more actively at work. Β is softened to our *v*, and η yields to the prevailing *itacism*, and takes the sound of ι; these two corruptions are first detected in Alexandria. The diphthong οι came to coincide in sound with υ; much later both were attenuated to ι. Αι took the simple sound of ε. The diphthongs with υ modify or lose their second vowel. Δ and γ are softened in sound. The quantity of vowels is confused. The inscriptions of this period abound in singular misspellings —ἧτος (ἔτος), Εἶσις (Ἶσις), ἐπύησεν (ἐποίησεν), πρεσβοίτεροι (πρεσβύτεροι), κῖτε (κεῖται), καταδουλιζμός (-ισμός), ἀτός (αὐτός), ἐπισκεάζειν (-σκευάζειν). Many of these phonetic corruptions had taken place in the Bœotian language long before. Peculiar forms of this period are -ις and -ιν for -ιος, -ιον (Δημήτρις, μαρτύριν), such accusatives as ἄνδραν, γυναῖκαν, confusion of cases (παραμεινάτω παρὰ τὸν πατέρα, σύν with genitive). The cleft between the vulgar tongue and the language of the *literati* widens. The Attic revival of the time of Hadrian affected of course very few. Roman words are largely adopted—ὀσπίτιον, πρίνκιψ, παλάτιον. The process of decay went rapidly on after Byzantium was made the head of the Hellenic world. The written language, though clinging stoutly to ancient models, cannot hold its own, and the spoken tongue verges gradually toward the Romaic or modern Greek. The use of diminutives for primitives, of the accusative for the dative, of ἵνα and subjunctive for infinitive, of εἰς for ἐν, of auxiliary verbs θέλω, ἔχω, are among the characteristics of this transitional stage. Long and short vowels are no longer distinguished, and word-accent is made the basis of versification. Inscriptions of the ninth century show the wildest confusion in orthography, as παναγήα Θεοτώκε = παναγία Θεοτόκε, ἐπὴ τôν ὑκιακôν = ἐπὶ τῶν οἰκειακῶν.

The completest Greek grammar is that of Kühner (*Ausführliche Grammatik*, 2 vols.; 2d ed. Hanover, 1870). No full exposition of Greek historical grammar yet exists, but Curtius's work, *Das Griechische Verbum* (1st vol., Leipsic, 1873), will partly supply this lack. The Greek portion of Schleicher's *Compendium of Comparative Grammar* covers the ground in outline. The works of Krüger, Madvig, and Goodwin are important for the syntax. On dialects the standard work is Ahrens' (Göttingen, 1839–42), and on etymology, G. Curtius's (4th ed. Leipsic, 1873). The best defining lexicon is Liddell and Scott's (6th ed. Oxford, 1871). F. D. ALLEN.

Greek Language, Modern. The language of Greece has undergone no *revolution* since the time of the Attic historians, philosophers, orators, and poets. Through all the successive invasions and conquests of the country, by the Romans, the Goths, the Huns, the Slavonians, the Crusaders, the Venetians, and the Turks, the basis of the population and the substance of the language have survived unchanged. The gradual decline which began from the Macedonian conquest continued down to near the end of the last century. In times of ignorance, such as prevailed during the four centuries of Turkish oppression, the language suffered, indeed, much corruption, not only in its syntax, but also in its vocabulary. Many foreign words were introduced. But there has never been a period when there were not some who wrote Greek with a fair approach to Attic purity. The impulse given by Christianity to the Hellenic mind arrested for centuries the degeneracy that had already begun. The Christian Fathers enriched their native tongue with many new and striking words and expressions, born of the sublime doctrines and conceptions of the new religion. Since the time of Homer the Greek has never been a dead language. Western Europe by that libel only proclaimed her own ignorance and shame. If there has been a time when even Athenians spoke a wretched patois, there were even at that time educated men and women in Constantinople who spoke and wrote the language in a style which would have been quite intelligible not only to Plutarch and Pausanias, but also to Pericles and Plato. There was never any very extensive introduction of foreign elements into the language of the educated Greek: its vocabulary was always essentially that of the ancient language. But its grammatical forms became vulgarized, and its syntactical construction was still more extensively modified. In the conjugation of the verb the dual number was soon dropped altogether (as it was also in the declension of nouns and adjectives); the optative mood, and to a great extent the infinitive also, was supplanted by the subjunctive; the future and perfect tenses were commonly expressed by auxiliaries; and other minor etymological changes took place. The personal pronouns were changed, chiefly by the addition of new syllables; the relative pronoun, so brief in the ancient Greek, was exchanged for an awkward trisyllable, with the article prefixed; the prepositions, such of them as remained in use, were nearly all construed with the accusative case; the old particles, which added so much to the delicacy and flexibility of the language, were either wholly dropped or else lengthened. The nouns and adjectives suffered less change; but the nouns very generally took on the *diminutive* neuter form—a sadly significant change. The syntax was materially modified, the nicer rules of the ancients in regard to the *arrangement* of words being very generally ignored, and the simple order of most modern languages being followed. Of these languages, the French is the only one that has in any very perceptible degree influenced the Greek. As to pronunciation and accentuation, there was no important change, except that the rough breathing is no longer heard at the beginning of words. In the written language, indeed, whatever barbarisms or provincialisms may have prevailed in the speech of the vulgar, there has been no change in accentuation since the time when the accent began to be used in writing. The pronunciation, too, as the most ancient manuscripts plainly testify, has remained what it was in the first centuries of the Christian era. The same consonants, vowels, and diphthongs which are confounded with each other in writing by an illiterate Greek of the present day were confounded in just the same way by illiterate or careless transcribers, copying from dictation, in the fourth and fifth centuries. The niceties of pronunciation, by which similar sounds were no doubt accurately distinguished by the Attic voice and ear, must have been lost very early. The sound of the continental *i* is now expressed, without the slightest variation, by six different written signs—the vowels η, ι, and υ, and the diphthongs ει, οι, and υι. The sounds of β and υ, when the latter is preceded by α, ε, or η, are also identical, except as the latter has, in certain cases, the sound of *f* instead of *v*.

Towards the close of the last century there commenced a systematic attempt to purify the Greek language from its foreign admixtures, to recall the ancient forms of words and the ancient syntax, so far as these had been abandoned or corrupted, and to restore the obsolete words of the classic Greek, not only to supplant the barbarisms that had crept in, especially from the Turkish and the Venetian Italian, but also to enrich the scanty vocabulary of the common speech, resulting naturally from popular ignorance. This movement was connected with the establishment of schools and other methods of arousing the Greek mind from its comparative torpor, and preparing the way for the civil regeneration of the nation. The leading spirit in this patriotic enterprise was Adamantios Koraes. (See under GREEK LITERATURE.) From that time there has been a constant and rapid improvement in the Greek language; and this improvement has been greatly accelerated since the independence of Greece was established. The style of the best writers of the present day is such as to justify the claim on which they proudly insist, that there is but *one* Greek language. This fact would soon be universally admitted if we would only concede to the Greeks, what is granted to every other nation, the right to regulate the pronunciation of their own language. When this educational reform, already happily inaugurated, shall have been accomplished, the educated foreigner who visits Greece will be able to converse with the people in their own still beautiful tongue.

It may help to show how far the Greek language has advanced in its progress of return to the ancient models if we subjoin an analysis of a passage from one of the best of the modern Greek writers. For this purpose let us take the last paragraph of the Olympian Oration delivered by Prof. Philippos Joannou on the second anniversary of the modern Olympiads, A. D. 1870. The subject of the oration is, "The Intellectual Progress of the Greek Nation from the War of Independence to the Present Time." In the clos-

ing paragraph, embracing about a page and a half of closely-printed octavo, there are about fifty verbs, every one of which is found in Liddell and Scott's ancient Greek lexicon; and the only departures from the regular forms of the ancient Greek are these four: first, the future tense, which occurs nine or ten times, is always expressed by the aid of the auxiliary θέλει; secondly, the form εἶναι of the substantive verb is used, not as the infinitive, but as the third person singular of the indicative; thirdly, the imperative is expressed by the subjunctive preceded by the sign ἄς (a contraction for ἄφες); and fourthly, the infinitive is resolved into the subjunctive, preceded by νὰ, an abbreviation of ἵνα. Of seventy-five or eighty nouns, all but one are found in the above-named lexicon, and this one is simply a modification of a well-known root familiar to Greek scholars, and represented by several cognate words (παγιωτής). The common word, μέσον, is also used in the sense of the English word, "means," a sense not justified by ancient usage. Of about fifty adjectives, all but one are found in the lexicon, and of this one the corresponding adverb is found. Indeed, the adjective itself is found in Pickering's lexicon. All the nouns and adjectives, without the slightest exception, are declined as in the ancient grammars. Among eight or ten different pronouns, personal, relative, demonstrative, and compound, occurring in all about twenty-five times, there is but one instance of departure from ancient usage. The enclitic του is three times used instead of αὐτοῦ. Of ten adverbs, the only one not belonging to the ancient language is the negative δέν (contract for οὐδέν), instead of οὐ or οὐκ. This modern form is used twice; and the ancient form οὐχί also occurs twice. The only particles not known to the ancient Greek are two, both already noticed as signs of the imperative and infinitive moods, and both obviously contracted from ancient Greek forms. So slight is the difference between the Greek language of B. C. 400 and that of A. D. 1870. A. N. Arnold.

Greek Literature. The literature of the Greeks is distinguished above all for freshness, originality, and perfection of form. While itself a spontaneous national outgrowth and independent of outside influences, it furnished an intellectual impulse which spread to other people, the force of which has never spent itself, and of which modern European literature is the result. Greek literature, the creation of a people gifted with wonderful artistic sense and productive force, has in one sense no infancy: that is, no period of unsatisfactory first efforts; each new type appears at once in full vigor. We distinguish four periods: (1) The ancient or classical literature, ending with Aristotle at the time of Alexander the Great; (2) The Alexandrine period, till the subjection of Egypt to Rome, 30 B. C.; (3) The Roman period, till the division of the empire, 330 A. D.; (4) The Byzantine period, till the capture of Constantinople, 1453. The last three are of subordinate importance.

I. The National Classical Literature. — 1. *Epic Poetry.*—Before Homer, the Greeks must have had popular poetry and poets, for in the *Iliad* and *Odyssey* the bard and his art are no strangers. The hymn, the epic song, the dirge, the bridal-song must all have existed in these early days, the epic element certainly predominating in all these. In this pre-Homeric period the oldest national poetical measure, the dactylic hexameter, gradually formed itself out of a ruder metre, and multitudes of epithets and poetical formulæ fixed themselves in use as part of the stock of the professional bard. But of this period we have no direct knowledge; even the names (Orpheus, etc.) referred to it are certainly mythical. Greek literature begins with the Homeric poems, the *Iliad* and *Odyssey*, in which are found the vividest word-painting, most musical flow of language, great wealth of expression, with an inimitable childlike simplicity. The *Iliad*, Achilles its central figure, describes portions of the siege of Troy; the *Odyssey*, the adventures of Odysseus on his return home from the siege. The origin of these poems has been in recent times the subject of a sharp controversy. In 1795 appeared Wolf's *Prolegomena ad Homerum*, in which, maintaining that the poems were not reduced to writing before 600 B. C., he denied the possibility that a poem of such length, composed for oral recitation, could have previously existed as a whole; and thus opened the way for disbelief in the personality of any Homer. Since then much investigation has been directed to the subject, and inquiry into the nature and origin of unwritten ballad poetry as found among other people has played a conspicuous part in the discussion. Wolf's line of argument has been adopted and carried further by Lachmann, Köchly, Sengebusch, Kirchhoff, and others; the first named went so far as to attempt the separation of the *Iliad* into its component ballads. The doctrine of this school is, in outline, that the poems are aggregations of ballads relating to the favorite subject of the Trojan war; that they came into form in the hands of a guild of professional singers (Homeridæ of Chios), to whom Homer was a mythical *heros eponymos*, and were thus handed down from generation to generation; that different parts are of different ages; and that the present form of the poems, with what unity of plan they show, was given them at the time of Pisistratus by men employed by him to collect the scattered portions, and that they were first reduced to writing then or shortly before that time. Opposed to this skeptical tendency, many scholars—among them Nitzsch, Bergk, Mure, Gladstone—hold fast to the old view of the unity of the poems and a single author, their strongest ground being the undeniable evidences of systematic plan, especially in the *Odyssey*, and the uniformity of style and language. The question must yet be considered an open one, but it is not unlikely that the truth lies between these extremes. So much must, at any rate, be conceded to the Lachmann party, that even if the poems do bear the impress of one master-mind, and that a Homer's, this Homer used much material already on hand, both of matter and expression (many stereotyped formulæ show evidence of having arisen when the language was in a very different phonetic state from any known in the historic period), and that in the subsequent transmission of his work there was every likelihood of its being further changed in form. The poems have in any case passed through different phases, and the personal Homer, if there was one, is only one of several factors. The traditions of the ancients respecting the person of the poet are in every respect contradictory, and rest apparently on nothing but conjecture. Certain it is, however, that the poems originated among the sea-loving Ionians of the Asiatic coast. It should not be overlooked that doubts respecting the Homeric poetry existed even in antiquity; some of the Alexandrines referred the *Iliad* and *Odyssey* to different authors. Besides the *Iliad* and *Odyssey*, there are handed down, under the name of Homer, several hymns, which are certainly of later origin, although old. The *Batrachomyomachia*, or "Battle of the Frogs and Mice," a burlesque, is the product of an uncertain but very late age. Down to the time of Pisistratus epic poetry was widely cultivated, and a series of poems, known as the "Epic Cyclus," arose, clustering around the Homeric works, and aiming to embody in song the rest of these and similar myths. Though these works are now lost, they were only inferior to the *Iliad* and *Odyssey* in merit and popularity, and exercised great influence on subsequent literature, furnishing materials for the dramatists, Virgil, etc. The authorship of part of these poems is known. The *Cypria* of Stasinus introduced the *Iliad*, while the *Æthiopis* and *Sack of Troy* of Arctinus and the *Little Iliad* of Lesches continued it; the *Nosti* and *Telegonia* were connected with the *Odyssey*. Besides these there were the *Œdipodea*, *Thebais*, and others.

2. Hesiod, author of *Works and Days*, a didactic poem on husbandry and the calendar, is the first undoubted personality in Greek literature; he lived at Ascra in Bœotia, at what time is uncertain. The tone, subdued and of sententious brevity, differs greatly from the Homeric; the dialect is a modification of epic Ionic. The *Theogony* ascribed to Hesiod is, probably, as many of the ancients suspected, of different authorship, though of the same school.

3. *Elegiac and Iambic Poetry.*—During the decline of epic poetry these two new creations appeared simultaneously, both doubtless developments of germs already existing in the unwritten popular poetry. Like the epos, the new forms have their rise among the Ionians, at these early times the most intellectual of the Greeks. From 700 to 500 B. C. is the flourishing period for these types. The elegy is of a serious, reflective, but by no means always mournful tone, the didactic and moralizing element prevailing; its range of subjects was great; its metre is a modification of the epic hexameter. It stands in connection with the spirit of the times, the age of the "Seven Wise Men," and of the first beginnings of philosophic thought. The iambic verse, at first the medium of personal invective, is lively and epigrammatic in style. Of all these poems only scanty fragments have been preserved to us. Archilochus of Paros (about 700) was at once the inventor and the most famous author of iambi; some represent him as the earliest elegiac poet, while others assign that honor to Callinus the Ephesian. Nor were the verses of Archilochus confined to these two forms; he used trochees and dactylotrochees as well. A poet of great inventive powers and the most versatile talents, he gave an impetus to the new style which lasted centuries after. Distinguished as authors of elegies are Tyrtæus the Athenian and adopted Spartan (the lame schoolmaster of the popular fable), Mimnermus of Colophon, the famous Solon, and Theognis the Megarian. Of the last there has come down to us a collection of extracts, in all some 1700 verses. As iambic poets next to Archilochus, Simonides of Amorgus and Hipponax are distinguished, the latter the inventor of the choliamb,

or *limping* iambic verse, in which a humorous effect was produced by an unexpected rhythmic turn at the end.

4. *The Subjective Lyric.*—Hitherto every fresh impulse in literature had come from the Ionians of Asia Minor. Now the Æolians of Lesbos took the initiative in the cultivation of the *melos*, or song expressly composed for and inseparable from music. The former styles of poetry, though perhaps originally chanted in musical tones, had early emancipated themselves from such connection. The lyric poem, on the other hand, was always essentially musical. The way was prepared for it by great improvements made in music by the Lesbian composer Terpander, about 700. In Alcæus and the poetess Sappho, both Lesbians (about 600), the expression of individual thought and passion is predominant. The song is for a single voice with cithara accompaniment; the form, that of the short stanza, mostly of four lines; the subjects, erotic, convivial, even political; the dialect, their native Lesbian. The Rhegian Ibycus and Anacreon of Teos later continued this style of composition; the latter, known as an erotic poet, had a playful vein unknown to the earlier lyric poets; he lived in Samos and Athens in the sixth century. Little besides fragments of these has reached us; the extant ditties bearing the name of Anacreon are spurious compositions of many centuries later.

5. *The Choral Lyric* was first brought to perfection among the Dorians, who hitherto had taken no creative share in literature. Hence, the dialect of choral poetry was always Doric. The first impulses came even here from Æolians—Terpander, who came to Sparta about 700, and Arion, who flourished at Corinth a century later; both were Lesbians, chiefly musicians, and made great advances in the outward form of the lyric. As thus developed, choral poetry existed in a great variety of forms, all of which combined voices with instrumental music and orchestic action, and were often exceedingly complicated in their metrical and melodic structure. Important among the many forms was the dithyramb, a feature of Bacchic worship, performed by 50 singers round an altar, and early admitting a mimetic element which was the germ of the future tragedy. Arion was especially famous as the perfecter of this style. Other sorts were pæans, hyporchemata or ballets, various marching-songs for religious and military occasions, marriage-songs, dirges, and the like. Most of these took the character of a public spectacle. The subject-matter was quite varied; they were often narrative, often responsive or in dialogue form. The earliest names of importance are Alcman and Stesichorus; the former was a Spartan of the seventh century; the latter, of Sicilian birth, flourished about 580. Stesichorus was especially fond of mythical subjects, as the titles of his compositions show; they thus stood in an intimate relation to the epos. Later (556–467) Simonides of Ceos attained the highest distinction in choral composition; his life was passed mainly in Athens. The pathos of his dirges was particularly admired. Outside the limits of choral poetry he became famous for elegies and epigrams. Passing over names of less note, the list of famous choral poets closes with Pindar, the only one from whom any complete poems have come down to us. He was about forty years younger than Simonides, and a native of Thebes. We possess from him forty-five *epinicia*, or poems celebrating victors at the four national festivals. Loftiness of diction is Pindar's chief characteristic; he is deeply religious, always of a dignified earnestness; often obscure, yet abounding in poetical beauties. Besides these, his compositions embraced many other species, but nothing of them is preserved but fragments.

6. *Tragedy.*—The dithyramb contained, as we have seen, a mimetic trait, and this was little by little developed, first by introducing a disguised personage apart from the chorus, who personated a character (at first doubtless Dionysus himself), and narrated in the first person instead of the third, and sustained a dialogue with the chorus; then by introducing this action at intervals in different characters (episodes), by extending the representations to other than Bacchic myths, by erecting at first a platform, and then a regular theatre for the spectacles, and improving the costumes and masks; lastly, by increasing the number of actors to two, and then to three, so that more than one character could appear on the stage at once, and the action thus progress without the chorus, the latter being diminished in numbers (to fifteen or twelve) and importance. This took place at Athens, and Athens remained the home of the tragedy; it was exotic elsewhere. Tragedy remained essentially a Bacchic solemnity, and was performed only at the Dionysiac festivals; it was sustained at the public expense, and partook of the nature of a contest, three poets contending together (each with three or four pieces) for the prize. The theatre was of immense size and uncovered, the stage narrow; the chorus moved in the orchestra below it. Stage machinery and scenery reached a certain degree of perfection. The chorus was an essential part, though its office became less and less important. The lyrical parts were sung with instrumental accompaniment and orchestic action, the dialogue recited, or probably intoned or chanted. The materials of plays were taken almost without exception from the national myths, the action simple, the conceptions highly ideal. The fifth century B. C. is the flourishing period of tragedy, marked by the three great names of Æschylus, Sophocles, and Euripides. Æschylus (525–456), after his predecessors, Thespis, Phrynichus, and others had made many advances, first gave the tragedy its complete form. A man of stern and serious nature, thoroughly penetrated with religious feeling, his plays abound in lofty ethical conceptions and powerful but sometimes stilted diction. Seven of them are preserved, the *Prometheus* and *Agamemnon* the best. Sophocles (495–405), if less lofty, has finer feeling for human nature, more dramatic life, greater versatility and power of affecting the sympathies. Both ancient and modern critics rank him highest of the three. We possess seven of his plays, of which the most powerful are the *Antigone*, *Œdipus Tyrannus*, and *Electra*. A marked decline from this high standard is seen in Euripides (480–405), who, though a poet of great talent, shows glaring faults, too little ideality, want of symmetry and unity in plot, too much moralizing, a reliance on single passages of brilliancy for effect. The sophistical tendencies of the age were unfavorable to poetry, and a great falling off in poetical taste begins from this time. Euripides was very popular in subsequent ages, and we possess eighteen plays of his, besides many fragments; a nineteenth, *Rhesus*, is spurious. We have no plays of the lesser tragedians, and all mention of them may be omitted. Their number was immense.

7. *Comedy* arose, like tragedy, from the Bacchic festivities; not, however, from the dithyramb, but from the *comus* or procession of licensed revellers at the country Dionysia, which mingled invocations of the deity with gibes at the bystanders. Its early history is obscure; it never received so large a share of public patronage as tragedy. It passed through three phases, known as Old, Middle, and New Comedy. Old Comedy flourished from 450 to 400; the chief poets were Cratinus, Crates, Eupolis, and Aristophanes. Only of the latter have plays, eleven in number, been preserved. Farcical extravagance and the utmost license in personal satire are the characteristics of the Old Comedy; with this the most brilliant though often the coarsest wit. Aristophanes, with all his buffoonery, yet shows always an earnest trait; each piece is written for a purpose. His fertility in the invention of the ludicrous is inexhaustible. In the *Parabasis*, a part where the action stopped and the chorus addressed the audience directly, the Old Comedy preserved the image of the original *Comus*. With the end of the Peloponnesian war the spirit of comedy changes; its farcical merriment is given up; political satire is now less its motive than the delineation of types of character and scenes of daily life. The Middle Comedy (400–338) was a transitional stage. The latest piece of Aristophanes, *Plutus*, properly belongs to it. The chief poet was Antiphanes. The New Comedy belongs chronologically in the next period, but in spirit in this, being the last phase of the national poetry. It has no chorus, its characters are types of every-day society; it stands very near the modern comedy. Menander (342–290) has the first place among the sixty-four authors of New Comedy; his works must have been masterpieces of their class. Others were Philemon, Diphilus, Posidippus. Literature has suffered a great loss in that no plays of these have been preserved. We can form some judgment of their merit from the imitations of Plautus and Terence. Separate from the Athenian comedy was the Sicilian, which attained some eminence in the hands of Epicharmus about 475, and Sophron somewhat later.

8. *History.*—As in every literature, so among the Greeks, prose began long after poetry. The first beginnings were made by the Asiatic Ionians—attempts merely at preserving current reminiscences, without as yet any idea of independent investigation or criticism. They were confined at first to local traditions, then took a wider range. The language had still a poetical coloring, and much fable was mixed with facts. Such early prose-writers were Cadmus and Hecatæus of Miletus, Hellanicus of Mitylene, and others. The dialect was Ionic even when the writer was not. The chief of these Ionic historians, and the only one whose works have come down to us, is Herodotus of Halicarnassus (b. 484), who undertook from the love of knowledge extensive journeys, and embodied the results of his inquiries in nine books of history, our chief source of information for the Persian wars and preceding periods, treating of almost all the known nations of the earth, and giving geographical and ethnological information, as well as historical. The style is of charming simplicity and the utmost vividness. His credibility has often been questioned; cer-

tain it is that, though sincerely aiming at truth and exercising far more criticism than any of his predecessors, his superstition and love of the marvellous have influenced his work in many ways. Especially is he unreliable in the past history of foreign nations. A genuine piety pervades his work; his conception of the Persian invasions and their causes is a religious and ethical one. Thucydides, the greatest historian of Greece, was an Athenian (470–396), and, no longer following in the hitherto beaten track, wrote in his native dialect. His work in eight books, treating of the Peloponnesian war down to 410, is a model of impartiality and conscientious research. Scorning the charm of mere style, he aims at the utmost brevity, and writes in a fashion obscure and crabbed, but which yet has a singular force. Speeches, partly imaginary, form an important part of the work, serving to set forth motives and the inner connection of events. The military career of Thucydides was unfortunate, and his work was written in banishment. A continuation of Thucydides' history is furnished by Xenophon (about 444–355), whose seven books of Grecian history (*Hellenica*) extend to 362 B. C. Superior to this work in style is his *Anabasis*, a simple and graphic account of the adventures of the body of Greek mercenaries who joined the ill-fated expedition of the younger Cyrus against Artaxerxes—adventures in which Xenophon himself had an important share. Xenophon is a plain, soldierly, and straightforward man, fond of the practical, but lacking in that intellectual grasp needful for a historian; a devoted adherent of Socrates, and inclined to favor Spartan rather than Athenian polity. Much of his life was spent abroad, partly in banishment. His literary labors were not confined to history; we possess the *Cyropædia* (a life of the elder Cyrus, a sort of historical romance) and the *Memorabilia* of Socrates, a collection of personal reminiscences of the great teacher, besides several smaller works, some of doubtful genuineness. Lost historians of this time are Ctesias, a Cnidian physician long employed at the Persian court, and the author of Persian annals, and Philistus, the historian of Sicily, both contemporary with Xenophon. Later were Ephorus and Theopompus, scholars of Isocrates, the former the founder of the general history.

9. *Philosophy.*—No philosophical writings before Plato have been preserved, though the two preceding centuries had been prolific of such. The first beginnings of philosophy are contemporary with those of history, and the Ionians, as in history, took the initiative. The Ionic philosophers occupied themselves with speculations on the physical universe; Thales, Anaximander, Anaximenes were the earliest of these. A little apart from these stood Heraclitus (500), and later Anaxagoras of Clazomenæ (500–428), the most advanced philosophic thinker before Socrates, long a resident of Athens, and exercising the most powerful influence on the great men of that day. Special schools, offshoots of the Ionic, were formed by Pythagoras, a Samian who emigrated to Croton in Italy, and Xenophanes of Colophon, the founder of the Eleatic school in Elea; both of the sixth century. The former, though eminent in mathematics, did not get beyond a vague mysticism in speculation; his followers were numerous and wrote in Doric, Philolaus and Archytas being noted among them. The Eleatics pursued the metaphysical tendency farther; they reverted to the poetical form in their writings; so Xenophanes, Parmenides, and Empedocles, the latter again busied with speculations in physics. Entirely new ground for philosophic thought was obtained by the fearless thinker and uncompromising moralist Socrates (d. 399), who, though he wrote nothing, gave that direction to speculation which resulted in the establishment of several schools. The first of these, the Academy, was founded by the celebrated Plato (429–347) of Athens, an enthusiastic, imaginative, almost visionary nature, educated by extensive travel, master of dialectics. His works are in the dialogue form, always with Socrates as chief speaker. As works of art they are unsurpassed; though ranging over the whole field of ethics, politics, and metaphysics, they possess a dramatic vivacity which never flags and a constant freshness of thought. Probably all are preserved; besides the longer works, *Republic* (10 books) and *Laws* (12 books), there are some forty shorter compositions, many of doubtful genuineness. The numerous works of Heraclides Ponticus, the scholar of Plato, are lost. The founders of the other Socratic schools, Euclid (Megarian school), Aristippus (Cyrenian school), and Antisthenes (Cynic school), were of little importance for literature. Aristotle (384–322), the founder of the Peripatetic school in the Lyceum, was a pupil of Plato, but very unlike him. His voluminous works were of less importance for literature than for science. Of clear judgment, great acumen and memory, he was pre-eminently a man of facts; his eagerness for knowledge extended into every part of the physical and metaphysical universe. Recognition of the importance of inductive research, as opposed to mere speculation, exactness of method and completeness of system, the introduction of accurate technical terms, are among his merits. About one-half his numerous writings are preserved, composed in a clear, pragmatic style, devoid of all ornament, often bald and compendious. Among the completest of these are the *Nicomachean Ethics*, the *Politics*, the *Logic;* besides these, his extant writings extend over literature, rhetoric, psychology, zoology, botany, mathematics, physics, and other departments. It may be said of Aristotle that he embraced in himself all the science of his age. Though contemporary with Demosthenes, he stands on the border of two periods, and in spirit belongs quite as much to the latter as to the former.

10. *Rhetoric and Oratory.*—The nursery of Grecian eloquence was Athens, and its flourishing period the fourth century, though the study of rhetoric as an art had been previously pursued during the period of the Peloponnesian war, especially under the influence of the class of men called Sophists. The Sophists were a peculiar product of that age, rhetoricians rather than philosophers, loose thinkers, though professedly teachers of philosophy and morals. Their province was words, not thoughts; their whole art, persuasion; their aim, rather outward semblance than inward reality. Athens was their chief field, though most of them were from abroad. The principal Sophists were Gorgias a Sicilian, Hippias of Elis, Protagoras of Abdera, Polus of Agrigentum, and Prodicus the Cean. Under the instructions of these men the art of oratory grew to maturity. The famous Attic orators are ten in number. The first department cultivated was the judicial; in this field distinguished themselves Antiphon (479–411) and Andocides. Of the former we have seventeen orations preserved, of the latter four, many of these written for others to speak. To a somewhat later period belong Lysias and Isocrates; their style shows more freedom and elegance. The latter brought to perfection the epideictic style, or speech of display. We possess of the one thirty-four speeches, of the other twenty-one. A little later flourished Isæus and Lycurgus. With Demosthenes (384–322) is reached the highest point in oratory. It was he who developed the political style, demanding not only the orator, but the statesman. Demosthenes, perhaps the greatest orator of all times, and, next to Pericles, the greatest statesman of Athens, attained his eminence, without great natural endowments, by the most unremitting diligence. Though he lacks the ease of some, his style is forcible beyond description, free from rhetorical trickery, although carefully studied, weighty, and earnest. Sixty orations of his are preserved. His contemporaries, Æschines, Hyperides, and Dinarchus, though able orators, are his inferiors in power. The famous contest on the Crown between Æschines and Demosthenes (330 B. C.) gave occasion for the masterpieces of the two orators.

11. *Medicine.*—The only works of a technical professional nature which have reached us from this period are the writings of Hippocrates of Cos (460–370), the founder of the science of medicine. They are in the Ionic dialect, brief and plain in language; parts are of doubtful authenticity.

II. ALEXANDRINE PERIOD (330–30 B. C.).—Its characteristics are great diminution of originality, the cultivation of science at the expense of literature, the study and dissemination of previous works. The boundaries of the Hellenic world were greatly enlarged, and foreign influences made themselves felt. The two centres of literary activity were Alexandria and Athens.

1. *Poetry* became secondary to prose. Besides the New Comedy, already described, the only new type produced is the bucolic, the germ of which existed among the Sicilian peasantry; it was artistically developed by Theocritus, a Syracusan, about 270. These poems, called *idyls* (a word of uncertain meaning), were primarily pictures of rural life, many in dialogue form, in Sicilian Doric and the dactylic metre; the tone is tender and sportive; a feeling for nature not very common among the ancients pervades them. We have, besides thirty pieces of Theocritus, several by Bion and Moschus of a similar nature. The remaining poetry of this period is artificial in the extreme. The epic compositions are labored and learned imitations of Homer; the *Argonautica* of Apollonius, a grammarian of Alexandria (200), is preserved, but has little merit. Still less interesting are the didactic poems on astronomy and medicine of Aratus and Nicander; the latter wrote *Georgics* and *Metamorphoses* (now lost), imitated afterwards by Virgil and Ovid. The epigram is cultivated with more success; the *Anthology* contains many good ones of this period. Callimachus, the first Alexandrine librarian, distinguished himself in this style; we have also hymns of some little merit from him. Both the elegy and the tragedy received some attention, but all productions are lost. The *sillos*, or satiric poem, came also into vogue.

2. *Philosophy* was chiefly pursued at Athens, where, besides the Academy and the Lyceum, the Epicurean and Stoic schools (the latter, outgrowths of the Cyrenian and Cynic schools respectively) flourished, attracting pupils from all parts of the civilized world. Of the teachers the most important in a literary point of view are Theophrastus, pupil and successor of Aristotle, a man of most varied learning, from among whose many works a book on botany and an essay on types of character have reached us, and Chrysippus and Panætius the Stoics, both prolific writers on ethics. The latter's work on *Duties* was the model for Cicero's book on the same subject.

3. *Grammar*, in its widest sense, including the study of literature, was ardently pursued, especially at Alexandria under the Ptolemies. The famous libraries there collected, and the Museum, a kind of academy of sciences, were important means. The collection, cataloguing, criticism, and annotation of the literary relics of the classical period was the chief task; later came the systematic treatment of grammar. Scanty as are the remnants of these grammarians' works, whatever we possess of the classic literature has passed through their hands, and modern philology is greatly indebted to them. The greatest of these critics were Aristophanes of Byzantium (200) and Aristarchus (150); the former busied himself chiefly with the drama, the latter with Homer. A small grammatical textbook of Dionysius Thrax (110) has come down to us, also a short treatise on mythology by Apollodorus. A rival of the Alexandrine school was the Pergamenian, its representative scholar Crates.

4. *Other Sciences.*—The advances made, especially at Alexandria, in astronomy, mathematics, and geography were remarkable. In mathematics were distinguished Euclid, whose *Elements of Geometry* hold their place even yet, and who lived in Alexandria in the last part of the fourth and first part of the third century B. C.; and later Archimedes of Syracuse and Apollonius. Of others, Eratosthenes, a man of universal learning, the first scientific geographer (d. 194), and Hipparchus, the astronomer, may be mentioned. In Athens the Peripatetics and other philosophers also cultivated the sciences.

5. *History* is singularly neglected in this period; the only name of importance is Polybius (204–122), of whose history of Roman conquests only five books (out of forty) are preserved complete.

III. ROMAN PERIOD (30 B. C.–330 A. D.).—Literature centres at Rome, the ancient seats of learning losing their importance. The scientific spirit decreases, but there is returning taste for rhetoric and regard for form and style in composition, which had been singularly neglected in the preceding period; so results a remarkable revival of Attic prose, especially history. To the first century of this period belong Diodorus Siculus, only a small portion of whose *Universal History* is preserved; Plutarch, the biographer and essayist; Flavius Josephus, the Jewish historian; and Strabo, the descriptive geographer. From the rhetorician Dionysius of Halicarnassus we have a history of early Rome, as well as works on rhetoric and literature. Later were Arrian, Appian, Herodian, and Dio Cassius (the last three writers of Roman history), and Pausanias, the traveller, from whom we have a *Description of Greece*. Of rhetoricians, Dio Chrysostom, and later Longinus, deserve mention, but especially the witty satirist Lucian, whose works are of the most varied character. Less valuable are the writings of the two Philostrati and those of Ælian, the latter a collection of anecdotes. The *Deipnosophistæ* of Athenæus consists of table conversation; though a tasteless melange, it contains important material. The writing of imaginary letters ascribed to noted personages came into vogue, and was cultivated by Alciphron and others. The grammarians of this time are divided into Technicists and Atticists. Of the former were the Alexandrian Apollonius Dyscolus and his son Herodian, the last of the great ancient grammarians; of the latter, mere Attic purists, Phrynichus and Julius Pollux. The astronomer and geographer Ptolemy and the physician Galen are the chief names in physical science. The study of philosophy languished, and the Athenian schools died out; Epictetus the Stoic is the most eminent teacher. Philosophy degenerated on the one hand into the fantastic superstition of Neo-Platonism, whose chief apostle was Plotinus (third century), or the skepticism of Sextus Empiricus (about 200 A. D.). From Diogenes Laertius (about 200) we have a history of philosophy. In poetry this period is utterly barren; Babrius, the author of Æsopian fables in choliambs, is the only name worth mentioning.

IV. BYZANTINE PERIOD (330–1453 A. D.).—The literary centre is Constantinople. A brief renaissance in poetry and rhetoric is followed by a long decline, in which every spark of good taste and originality dies out. Learning grows less and less; many works of antiquity are forgotten and lost; careless compilations and excerpts replace original works. The writers of this period are for the most part devoid of literary merit, and of no importance except as sources of contemporary history, or from the fragments of older monuments which they may contain. It will suffice to mention a few: Nonnus (about 400), author of the voluminous *Dionysiaca*, not without originality and a certain merit, and Quintus Smyrnæus, are the best of a large number of poets. Anthologies, or collections of epigrams of various ages, are compiled. Rhetoric flourished under Julian, and the works of Libanius are no mean specimens of oratory. The romance was cultivated by Heliodorus and others. Stobæus' *Florilegium* and *Eclogæ*, collections of choice extracts, contain much that is valuable. In grammar and erudition, Chœroboscus, Eustathius, the commentator of Homer (bishop of Thessalonica, 1160), Photius, and the lexicographers Hesychius and Suidas may be mentioned. Zosimus, Procopius, Zonaras, Nicephorus Gregoras, are among the historians. Eusebius, the chronologist and Church historian, was contemporary with Constantine; Stephanus Byzantius, the geographer, lived some two centuries later. Of ecclesiastical writers, the most eminent are Justin Martyr, Clement of Alexandria, Origen, Gregory, John Chrysostom, Synesius, Socrates; the first three belong chronologically to the preceding period.

The study of Greek literature was revived in the West during the fifteenth century, chiefly through the influence of the learned Greeks who fled in considerable numbers to Italy, and labored there, favored by such men as Lorenzo de' Medici; among these were Theodore Gaza, Constantine and Janus Lascaris, and Marcus Musurus. Since then these literary relics have been studied with ever-increasing zeal. Among the many modern scholars whose labors in this field have been fruitful are prominent, Reuchlin, Erasmus (sixteenth century), and later (eighteenth century) Hemsterhuis and Valckenaer in Holland; in England, Bentley (d. 1742), and afterwards Porson and Elmsley; in Germany during the present century, Heyne, Wolf, Hermann, Böckh, Bekker, Dindorf, Müller, and Welcker. The principal histories of Greek literature are, in English, Mure's and Müller's (completed by Donaldson); in German, Bernhardy's, Nicolai's, and Bergk's, the last now (1875) just begun.

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Greek Literature, Modern. Prof. Sophocles, in his *Greek Lexicon of the Roman and Byzantine Periods*, divides what he calls the Byzantine Period into three epochs, the first extending from A. D. 330 to A. D. 622; the second, from A. D. 622 to A. D. 1099; and the third, from A. D. 1099 to A. D. 1453. It is only the writers of the last of these periods that can be considered as belonging, in any sense, to *modern* Greek literature. Most of these, indeed, wrote in the scholastic or would-be Attic style, rather than in the modern Greek.

Anna Comnena, distinguished alike for the graces of person and of intellect, was the daughter of Alexis I., emperor of Constantinople. Born in 1083, and educated with the greatest care, she was early married to Nicephorus Bryennius, descended from one of the noblest families in the empire, and renowned as a warrior, an historian, and a statesman. He was the author of a history of the empire in four books, modestly entitled *Materials for History*. It covers only about twenty years, from 1057 to 1078, and was left unfinished at his death, which occurred in 1137. His beautiful widow never ceased to mourn his loss. There is no parallel in the European history of those times to the uninterrupted domestic happiness, for more than forty years, of two such eminent and noble authors. Anna survived her husband eleven years, dying in 1148. She wrote a biography of her father, entitled *Alexiad*, a work of great historic value, but somewhat disfigured by a pedantic style. In this respect it is a striking contrast to her husband's modest history. George Gemistus, surnamed by himself *Plethon*, was one of the most remarkable men of his age. He was born in Sparta about the middle of the fourteenth century, and lived till near the middle of the fifteenth. A passionate admirer of Plato, he formed the bold design of establishing the supremacy of his philosophy, thereby supplanting not only the system of Aristotle, but also the religion of Christ. Visiting Florence, he lectured on the Platonic philosophy before Cosmo de' Medici the Elder, and he inspired that distinguished patron of learning with such enthusiasm for the great Grecian that he afterwards founded an academy at Florence for the purpose of teaching the Platonic philosophy. Gemistus wrote nearly forty different treatises, embracing a wide range of subjects—geographical, historical, astronomical, mathematical, philosophical, moral, and theological, including several poems. His most important works are those relating to the Platonic philosophy, especially that on the difference between the philosophy of Plato and that of Aristotle. He was so confident of the speedy success of his scheme of enthroning Plato as the

sovereign of human thought that he is said to have predicted that not many years would elapse before all the world would be of one religion; and that not Mohammedanism, not Christianity, but Platonism. His admiration of Plato was probably the reason of his adopting the surname of Plethon as a synonym of Gemistus, and a near approach in sound to the name of his great master. Whether or not we assent fully to the verdict of his modern Greek biographer, that he was "the most learned man of the fifteenth century," there is no doubt that his learning was very extensive, and his influence in exalting Plato above Aristotle very efficacious. George Scholarius (1400–60) was one of the learned Greek ecclesiastics who took part in the Council of Florence, and was made the first patriarch of Constantinople after its conquest by the Turks. He was the author of between sixty and seventy theological works, mostly of a polemical character. Laonicus Chalcondylas (or Chalcocondylas) was an eminent statesman and historian in the last half of the fifteenth century. Little is known of the incidents of his life, nor is the year of his birth or of his death ascertained. We know that Athens was his birthplace, and that he was sent by the emperor John Palæologus VII. in the year 1446 as ambassador to Amurath (or Murad) II., and that he wrote a history of the Turks in ten books, from their origin to the year 1463. This history is regarded as high authority, and, in spite of its affectation of the classical style, has considerable literary merit. His account of the fall of Constantinople, of which he seems to have been an eye-witness, is pronounced by Prof. Felton far more graphic and affecting than the stately picture of Gibbon. Theodore Gazes (1370–1478) was one of the earliest and most influential of those Greek scholars who did so much to revive in Western Europe the study of the ancient Greek literature. Born in Thessalonica, he was already nearly sixty years of age when, on the subjection of his native city to the Turkish power (A. D. 1429), he migrated into Italy, made himself master of the Latin language, taught Greek first in Sienna, afterwards in Ferrara, where he was chosen professor of Greek in the Gymnasium, and in the year 1455 went to Rome on the invitation of Pope Nicholas V. Here he translated the works of Aristotle into Latin, and carried on a controversy with George Scholarius and other disciples of Gemistus, defending Aristotle against the attacks of the admirers of Plato. Besides translating the works of Aristotle into Latin, he translated from Latin into Greek Cicero's *Cato Major*, or *De Senectute*. He was also the author of an excellent Greek grammar. He lived to be more than 100 years of age, dying, according to the most probable account, in 1478, though others state that he survived till 1484. Constantine Lascaris, descended from a royal race, was born in Constantinople near the beginning of the fifteenth century. On the conquest of that city by the Turks he took refuge in Italy, teaching Greek first in Milan, and afterwards in Rome, Naples, and Messina, in which last city he died in 1493. He is the author of between thirty and forty different works, including several translations from Greek into Latin. He wrote largely on grammatical subjects, and his Greek grammar, published in 1476, is said to have been the first book printed in Greek letters, as it was probably the first book issued from the celebrated Aldine press in Venice. Lascaris was the intimate friend of the cardinals Bessarion and Bembo and of other distinguished Italian literati; and he too was among the foremost of those Greek refugees who contributed to the revival of Greek learning in Europe. He bequeathed his library, comprising many valuable manuscripts, to the city of Messina. It was afterwards removed to Spain and deposited in the Escurial.

The Greek writers thus far mentioned wrote in the scholastic style, and not in the common language of the Greek people of their time. Their works, therefore, though entitled to be ranked as belonging to the literature of modern Greece, had only an indirect, yet not inconsiderable, influence upon the development of the modern Greek language. We must now go back a little, to notice the earliest writers who composed their works in the popular dialect. Theodore Prodromos, nicknamed *Ptochoprodromos*, a learned monk of the twelfth century (1143–80), is regarded as the father of modern Greek as preserved in literature. He wrote some popular verses on the poverty of learned men, which he addressed to the emperor Manuel Comnenus. They have been preserved by Koraes in the first volume of his *Atakta*. An extract of thirty or forty lines from this poem, with a spirited English translation, may be found in *Geldart*, pp. 110–113. There appeared in the fourteenth century a remarkable poetical romance, entitled *Belthandros and Chrysantza*. Its author is unknown, but good judges have assigned it a place in the highest order of poetry, not unworthy to be compared with the productions of Dante and Goethe. "Did the modern Greek language," says Geldart, "possess but this single epic, to say that it is destitute of literature were a calumny indeed." We must pass over, with only the briefest mention, Maximus Margunius (1530–87) of Crete, the Venetian publisher, Anacreonic poet, and elegant letter-writer; and Cyril Lucar (1572–1638), the Protestant patriarch of Constantinople and martyr to his religious convictions. Leo Allatius (1586–1669), the Sciote scholar and poet, claims a somewhat more extended notice. Going to Rome at the age of sixteen, he studied philosophy, theology, and medicine. After having been appointed professor of Greek by Pius V., he was made librarian of the Vatican in 1661 by Alexander VII. He abandoned the Greek faith and accepted the doctrines of Rome, but the precise period when this change took place is not known. He was renowned for his extensive learning, his untiring industry, and his tenacious memory. His writings, more than 100 in number, treat of a great variety of subjects, and are composed in the Latin, Greek, French, and Italian languages, and in poetry as well as in prose. He was unquestionably one of the greatest scholars of the seventeenth century, and was in regular correspondence with most of the distinguished literary men of his time. George Chortakes, a Cretan poet of the seventeenth century, was the author of a tragedy entitled *Erophile*. It is chiefly remarkable for the abundance and vividness of its imagery. Franciscus Scuphos, also a Cretan, wrote a valuable work on rhetoric, published in 1681. Elias Meniates (1669–1714), a Cephaloniote, combined in himself the qualities of a successful teacher, an eloquent preacher, and an able diplomatist. He exercised his gifts in the two former directions simultaneously for many years in Venice and the Ionian Islands, until he was made bishop of Calavrita in 1711; after which he confined himself, for the few remaining years of his life, to his ecclesiastical duties. He left only two works, one entitled *The Rock of Offence*, an exposition of the causes of the breach between the Eastern and Western churches. This work has passed through many editions, and been translated into both Latin and German. His other work is a volume of discourses, of which five editions were printed in Venice between 1727 and 1800, and many others more recently. These discourses are characterized by force of argument, copiousness of expression, ardor of feeling, and aptness of illustration. As a preacher he had probably no superior in the Greek Church in the time in which he lived, and many were led to repentance and a religious life by his earnest and pungent sermons. Vincentius Kornaros, the Cretan poet, is generally assigned to the eighteenth century, for his single extant poem was first printed in 1756. But he appears to have been born about A. D. 1620. Very little is known of him, but his *Erotocritos* has gone through many editions, and he has been called the Homer of modern Greece. Kosmas the Ætolian (1714–79) was renowned for his bold earnestness as a preacher, whereby he made many enemies among the aristocracy; and for his zeal in the cause of popular education, whereby he made many friends among the common people. As the founder, directly or indirectly, of more than 200 schools in various parts of Greece, he is reckoned among the prominent harbingers and promoters of Grecian independence. Accused by his enemies of seditious plots, he at last suffered martyrdom at the hands of the Turkish authorities in Epirus. Still more prominent in the list of those who prepared the way for the national regeneration was Rhegas Pherraios. Born about the middle of the eighteenth century, he early devoted his life to the liberation of his country from Turkish oppression. By a secret society which he formed, by his stirring appeals to the European powers, and most of all by his patriotic songs, he kindled the love of country and of liberty in the hearts of the Greeks, and well earned the name of the modern Tyrtæus. Arrested by the Austrian authorities at Trieste in 1798, and delivered up to the Turks, he died a martyr to liberty. Eugenios Bulgaris (1716–1806) was born in Corfù, educated in Padua, and after teaching a while in Yannina, at Mt. Athos, and in Constantinople, he travelled in Germany, was ordained a priest in 1775, and the next year was appointed archbishop of Slavonia and Cherson. In 1787 he resigned his office, and passed the remainder of his days in private life. His works are numerous and various—scientific, didactic, polemical, and religious. Among them are a treatise on logic and a Greek translation of Virgil. He was well acquainted with the philosophy of Locke and Leibnitz. His scientific treatises are written in the scholastic language, and his more popular and practical works in the common dialect; for he wrote with equal facility in both. Nicephorus Theotokes (1736–1800) studied under the best masters—and there were at that time some of wide renown—in his native island of Corfù, and afterwards in the universities of Bologna and Padua. Returning to his birthplace, he preached and taught with such success that he was soon invited to Constantinople. After a short stay there he

removed to Jassy, and thence, in 1765, to Leipsic, chiefly for the purpose of publishing his writings. He succeeded Eugene Bulgares in the see of Slavonia, and was afterwards transferred to Astrakhan. He was a man of great learning, and wrote treatises on metaphysics and natural philosophy, besides many theological works, polemical and practical. Two of his most useful practical works bear the title *Kyriakodromion*, or expository homilies on the Sabbath lessons of the Greek Church, from the Gospels and from the Acts. There is no name in the history of modern Greek literature worthy of more honor than that of Adamantios Koraes (or Coray, as his name is often written). Born in Smyrna in 1748, he was destined by his father to be a merchant. After six or eight years spent in this business, he succeeded in obtaining his father's consent to devote himself to study. In 1788, after six years' study at Montpellier, he obtained his degree as doctor of medicine. Thrown upon his own resources, soon after he arrived at Montpellier, by the death of his father, he earned his livelihood by translating into French, German and English works on medicine. Shortly after taking his degree he removed to Paris, where he remained for nearly half a century, until his death in 1833. Patriotism was his ruling passion. Three things seemed to him indispensable to the liberation of his countrymen: first, to make known to all Europe their oppressed condition; secondly, to keep before their minds the glorious achievements of their ancestors; and thirdly, to purify and elevate their language. From these aims he never swerved. To the *Fatherly Advice* of the patriarch of Constantinople, published after the martyrdom of Rhegas, and exhorting the Greeks to bear meekly the Turkish yoke, he replied by his *Brotherly Advice*, summoning them to break that yoke. When Napoleon invaded Egypt in 1803, he published his *Salpisma Polemisterion*, which was indeed a trumpet battle-call to every true Greek. About this time also he began that series of editions of the classics, amounting in all to fifteen or twenty volumes, to which he prefixed soul-stirring prefaces, which had great effect in developing the sentiments of nationality and the passion for freedom. In 1803 or 1804 he was commissioned by the government of Napoleon, in connection with two French savants, to translate Strabo's *Geography* into French, and he performed his part in so satisfactory a manner that a pension of 3000 francs a year was settled on him for life. In 1828 he began to publish his *Atakta* (or "Miscellanies"). The last of his publications was entitled *Synekdemos Hieratikos* (or "The Priest's Vade-mecum"), an excellent practical commentary on the Pastoral Epistles, still valued and used by biblical scholars. He wrote also an autobiography, published in 1833, the year of his death. Geldart styles Koraes "the second Leo Allatius of Greece." "No country, certainly," he adds, "except Germany, can show such a literary Hercules as Adamantios Koraes." No one, perhaps not all others together up to the time of his death, did so much to improve and enrich the Greek language or to elevate the Greek race, and make it free and worthy of freedom, as Adamantios Koraes. Demetrius Galanos (1760–1833), an Athenian by birth, after studying eight or ten years at Patmos and Constantinople under the most celebrated teachers, went to Calcutta in 1786 as private tutor to the children of several wealthy Greek families. Here he studied English, Sanscrit, Persian, and several other Oriental languages, and not only acquired great reputation for learning and wisdom, but contrived at the same time to amass a handsome fortune. Having determined to devote the remainder of his life to the study of philosophy, he invested his property in a way to secure an adequate income from it, and betook himself to Benares, the sacred city of the Brahmans. Assuming their dress and mode of life, and studying under their most renowned teachers, he was initiated into all their mysteries, yet without renouncing—so the Greek writers tell us—the Christian faith, and became distinguished among the Brahmans and the people of India as not inferior to their most illustrious doctors. Such was the life of this extraordinary man for nearly forty years, until his death in 1833. After he had become thoroughly versed in the Brahmanical theosophy he undertook the Herculean task of translating the selectest works of the Indian philosophers and poets into Greek. At his death he bequeathed his manuscripts, his library, and nearly half his fortune to the National University at Athens. Of his translations, seven volumes were published between 1845 and 1853, including the *Mahabharata* and the *Gita Govinda*. Besides these, he translated the *Vhagavata*, and compiled a Brahmanic lexicon and two tri-glott lexicons—one of Persian, Brahmanic, and Greek, and the other of Brahmanic, English, and Greek. Among the dead of the year 1833 there was no European scholar superior to Koraes, and no Oriental scholar equal to Galanos. Anthimos Gazes (1764–1837) translated Benjamin Martin's *Philosophical Grammar* from English into Greek (Vienna, 1799, 2 vols.), edited a scientific periodical entitled *Lógios Hermes*, devoted mainly to philology, and compiled a valuable dictionary of ancient Greek, with definitions in modern Greek (Venice, 1809–16, in 3 4to vols.). He was also active in the cause of his country during the war of independence, being a member of nearly all the successive congresses and national assemblies of that period. Athanasius Christopulos (1772–1847) was the author of a grammar and a lexicon of the modern Greek, but is best known as a lyric poet. He has been called the modern Anacreon, but he was no imitator. The name is appropriate only as expressing the subject and character of too many of his songs. Some, however, are devoted to the tender passion rather than to the wine-bottle, and these are exquisitely delicate and beautiful. His *Nightingale* is believed to have suggested Tennyson's *Swallow*, and is pronounced by a competent critic superior to the laureate's imitation. Neophytus Bambas (1770–1855), a Sciote by birth, after having studied in several of the best Greek schools, went to Paris in 1807, and there pursued mathematical and scientific studies under the best masters for about eight years. He held successively the positions of teacher of an academy in Scio (1815 to 1821), in Hydra, and in Cephalonia, professor of philosophy in the Ionian University in Corfù, rector of the Theological Seminary in the same island, principal of the Hellenic School in Syra (1834–37), and professor of theology in the National University at Athens for the last eighteen years of his life. He published many educational works on rhetoric, elements of moral science, elements of philosophy, internal evidences of the inspiration of the Scriptures, manual of pulpit eloquence, syntax of ancient Greek, notes on the orations of Demosthenes, discourses, etc. He was a hearty and efficient co-worker with the English and American missionaries in translating the Scriptures into modern Greek, incurring thereby no little odium from the more bigoted of his countrymen, both priestly and laic. Constantine Œconomos (1780–1857) was a Thessalian by birth, and, like the last named, a priest. He taught a philological gymnasium in Smyrna (1810–19), resided successively in Athens, Odessa, St. Petersburg, Germany, and Italy; and coming again to Athens in 1834, remained there until his death. He is the author of several volumes of sermons, a treatise on Greek pronunciation, a work on the three orders of the ministry, in opposition to what he regarded as the presbyterian tendency of some of his countrymen, and various funeral discourses. But his principal work was on the Septuagint version of the Old Testament, in 4 vols. 8vo (Athens, 1849), the most scholarly work that has been written on the wrong side of the controversy as to the credibility of the story of Aristeas, that the Seventy, being secluded in so many separate cells, each one of them translated the entire Old Testament, and when they came together to compare their work the translations were all found to be alike *ad literam*. Œconomos was a zealous polemic, an elegant writer, an able preacher, but of the opposite school from Bambas, as conservative as the latter was progressive. Theoclytus Pharmakides (1784–1862), also a priest, was an active participant in the revolutionary struggle, and was prominently connected with several educational enterprises. For two years (1825–27) he held the office of editor of the government journal and superintendent of the government press. In 1833 he was entrusted with the ecclesiastical organization of the new kingdom, in which service he showed great zeal for the independence of the Greek Church, in opposition to the assumptions of the patriarch of Constantinople. He was appointed secretary of the Holy Synod in 1833, removed from that office in 1839 by means of intrigue, but soon reinstated in it. He continued to hold it till his death. Pharmakides was one of the most vigorous of the modern Greek writers, formidable as a polemic and wielding a sarcastic pen. He wrote a work entitled *Apologia*, a severe attack on Œconomos, to whose influence he attributed his removal from the office of secretary of the Holy Synod, a series of commentaries on all the books of the New Testament, and a controversial work entitled *The Synodical Tomos*, in which he deals some heavy blows upon the rescript of the patriarch of Constantinople acknowledging the independence of the Greek Church.

We have now brought down these notices of the leading scholars and authors of modern Greece to our own times. It would enlarge this article beyond proper limits to notice in detail even the most eminent of the lately deceased and the still surviving peers of those whom we have commemorated. We can barely refer to such historians as Trikoupes and Paparregopulos, to such metaphysicians as Damalas and Braila, such philologians as Asopius, such antiquarians as Mustoxidi, and such poets as Salomos and the brothers Soutsos, among the lately deceased, and Rangabes, Zampelios, Zalacostas, and Valaorites among the living.

A list of the most important works on the subject of

modern Greek literature is here appended: SOPHOCLES' *Greek Lexicon of the Roman and Byzantine Periods* (Boston, 1870); FABRICIUS, *Bibliotheca Græca;* GELDART'S *Modern Greek Language* (Oxford, 1870); FELTON'S *Lowell Lectures on Ancient and Modern Greece*, vol. ii. (Boston, 1867); KORAES, *Atakta;* CONSTANTINE SATHA'S *Neoellenike Philologia* (Athens, 1868); PHILIPPOS IOANNOU'S *Logos Olympiakos* (Athens, 1870). (The last three are in modern Greek.)

A. N. ARNOLD.

Gree'ley, county in the E. of Dakota, on the Coteau des Prairies. Area, 850 square miles. It is mainly unsettled.

Greeley, county in E. Central Nebraska, in the Valley of the Pawnee Loup. Area, 576 sq. m. Cap. Lamartine.

Greeley, post-v. of Weld co., Col., on the Denver Pacific R. R., halfway between Denver and Cheyenne, at the crossing of the Colorado branch of the Union Pacific, on the Cache la Poudre above its junction with the Platte, and 20 miles from the Rocky Mountains. Founded in 1870. It has 4 churches, 2 banks, 3 hotels, 2 saw-mills, 1 grist-mill, 20 stores, 2 newspapers, a school building that cost $30,000, 3 tanneries, mechanic shops, etc. In all deeds there is a forfeiture clause in case liquor is sold or given away, and one fence 45 miles long encloses the town and 50,000 acres of farming land (made legal by the legislature). It includes 5000 acres in cultivation. The town is a centre for trade and education for Northern Colorado. Pop. 480.

N. C. MEEKER, ED. "THE GREELEY TRIBUNE."

Greeley, post-v. of Walker tp., Anderson co., Kan. Pop. 145.

Greeley (HORACE) was born in Amherst, N. H., Feb. 3, 1811. His father was a farmer in humble circumstances, and while yet a child Horace took an active part in the labors of the farm. It was his task to ride the horse to plough, to assist in the spring planting, to pick up stones from the field, and in the frosty autumn mornings to watch the oxen as they fed on the grass beside the corn-field before they were yoked up for their day's work. At an early age he gave tokens of remarkable intelligence, and a singular love of learning. He could read before he was two years old, and had scarcely reached the age of ten before he had devoured every book that he could borrow within seven miles of his father's house. As soon as he was up in the morning he rushed to his book, and devoted to it every minute of the day which he could snatch from the work of the farm. He would read when he was sent to the cellar or the wood-pile, and, having despatched his errand, would take the book from his pocket, where it had been placed for the moment, and again fall to reading with increased zest. His third winter was spent at the house of his maternal grandfather in Londonderry, where he attended a district school for the first time. He at once attracted notice by the excellence of his recitations, and especially by his skill in spelling. When he was about ten years old his father removed with the family to Westhaven, Vt., where for about five years he was assisted by Horace in clearing up wild land and other severe manual labor. At the end of that time, in the spring of 1826, he became an apprentice to the printer of a weekly newspaper in East Poultney, Vt. This was a position which he had long coveted, having early set his heart on following the trade of Benjamin Franklin. He soon learned the art of setting type, and even before the first week was over his skill was superior to that of many an apprentice who had been in practice a month. After remaining in this situation about four years he had become master of the trade, and rendered valuable assistance in conducting the newspaper. In June, 1830, the paper was discontinued, and young Greeley, after spending a few weeks with his parents, who had removed to Erie co., Pa., obtained employment in some of the printing-offices in that vicinity. The work was hard and the pay poor, and he at length made up his mind to seek his fortune in New York. He arrived in that city on Aug. 17, 1831, with only ten dollars in his pocket, and a scanty stock of clothing in his bundle. After much difficulty he found employment as a journeyman printer. In this capacity he worked in several different offices until Jan. 1, 1833, when he entered into a partnership with Francis Story, and commenced the publication of the *Morning Post*, the first daily penny paper ever printed. The enterprise was unsuccessful, and the paper failed in about three weeks. The partnership, however, went on in the job-printing business until July, when it was dissolved by the sudden death of Mr. Story. His place was supplied by Mr. Jonas Winchester, and on Mar. 22, 1834, the new firm issued the first number of the *New Yorker*, a weekly journal devoted to literature, politics, and news. This was edited almost exclusively by Mr. Greeley, and published under his immediate supervision. It was considered at that time the best newspaper of its kind ever attempted in this country. In spite of its high character, it never gained financial success, and Mr. Greeley was obliged to engage in other labors. He supplied the *Daily Whig* with its leading articles for some months, and in 1838 undertook the editorial charge of the *Jeffersonian*, a political weekly newspaper, devoted to the interests of the Whig party, and published in the city of Albany. This journal, according to its original plan, continued in existence but one year, and in May, 1840, Mr. Greeley devoted himself to the editorship of the *Log Cabin*, a campaign journal established in the interest of Gen. W. H. Harrison, the Whig candidate for the Presidency. It obtained a large circulation, but in the autumn of 1841 was merged, together with the *New Yorker*, in the *Tribune*, with which Mr. Greeley's name is completely identified, and for which his previous newspaper enterprises had served as a preparation.

The first number of this celebrated journal was issued on Apr. 10, 1841. It was a small sheet, retailing for one cent, with no presses, no capital, and with only 500 subscribers. For the first week the expenses exceeded the income, but in the course of six months it was established on a sound financial basis, when Mr. Thomas McElrath became a partner and undertook the sole charge of the business of publication, leaving Mr. Greeley the exclusive care of the editorial department. In 1848, Mr. Greeley was elected to fill a vacancy as a member of the House of Representatives in the national Congress, and served in that body from Dec. 1 of that year to Mar. 4, 1849. He took an active part against the abuses of the mileage system and in favor of the establishment of homesteads in the public lands. In 1851 he visited Europe, and served as one of the jurors of the World's Fair in the Crystal Palace in London. He also appeared before the parliamentary committee on newspaper taxes, and gave full and important details concerning the newspaper press of this country. His letters during his absence are among his most interesting productions. In 1855 he made a second visit to Europe, chiefly for the purpose of attending the French exhibition, remaining abroad about three months. In 1859 he made a journey across the Plains to California, and was honored with a public reception at Sacramento and San Francisco. After having exerted himself for the prevention of civil war between the South and the North at the national Republican convention which met in Chicago in May, 1860, he took a decided stand in favor of its vigorous prosecution subsequent to the actual commencement of hostilities. In 1864 he made an attempt at reconciliation on a plan of adjustment proposed to Pres. Lincoln, which proved unsuccessful. In the same year Mr. Greeley was a presidential elector for the State of New York, and a delegate to the Loyalist convention at Philadelphia.

Upon the close of the war in the spring of 1865, Mr. Greeley became a strenuous advocate for complete pacification based on the conditions of impartial suffrage and universal amnesty. In pursuance of this end he consented to be one of the bondsmen for Mr. Jefferson Davis, the late President of the Confederacy, who was imprisoned by the Federal government on the charge of treason. In 1867, Mr. Greeley was a delegate to the New York State convention for the revision of the constitution, and in 1869 was brought forward as a candidate for the office of State comptroller, but was defeated in the canvass. In 1870 he stood for Congress as a candidate for the sixth New York district, and was again defeated, though receiving an exceptionally large number of votes.

The Liberal convention for the nomination of a candidate for the Presidency, which met in Cincinnati on May 1, 1872, after the fifth ballot gave a majority of votes for Mr. Greeley. He accepted the nomination, and in the month of July following was nominated for the same office by the Democratic convention at Baltimore. He was thus presented to the country as the candidate of two great parties for the highest office in the government, and an impassioned contest ensued; and he lost the election by a large majority. During the canvass Mr. Greeley performed an incredible amount of mental and physical labor. He constantly spoke, and in all parts of the country, to numerous and eager audiences, frankly discussing the great question at issue, and expressing his convictions with equal boldness and candor. His strong constitution at length became impaired by excessive toil and intense excitement. The loss of his wife, who had been a hopeless invalid for many years, and upon whose deathbed he attended during the last weeks of the canvass, served to complete the fatal work. He was attacked with inflammation of the brain, and, sinking under the disease, died on Nov. 29, at the residence of his physician, two or three miles from his own country-home at Chappaqua.

In addition to his labors as a journalist and public speaker, Mr. Greeley was the author of several works, the principal of which are the following: *Hints towards Reforms* (1850); *Glances at Europe* (1851); *History of the*

Struggle for Slavery Extension (1856); *Overland Journey to San Francisco* (1860); *The American Conflict* (1864); *Recollections of a Busy Life* (1869); Mr. Greeley was also the writer of the sketch of Henry Clay and of other articles in the *New American Cyclopædia*, and of the CONFEDERATE STATES and several other valuable papers in the present work, of which he was one of the original editors. The *Life* of Mr. Greeley has been written by James Parton (Boston, 1855; new ed. 1868), and a *Memorial* volume was issued by the *Tribune* Association in 1873. GEO. RIPLEY.

Green, county of Central Kentucky. Area 525 square miles. It is undulating and fertile. Limestone and salt-springs abound. Live-stock, tobacco, grain, and wool are leading products. Cap. Greensburg. Pop. 9379.

Green, county of Wisconsin, bordering on Illinois. Area, 576 square miles. It is partly prairie and partly wooded hills, and is very fertile. There is good water-power. Cattle, grain, and wool are staple products. Carriages, harnesses, lumber, clothing, and metallic wares are manufactured. The county is traversed by a branch of the Chicago St. Paul and Milwaukee R. Rs. Cap. Monroe. Pop. 23,611.

Green, tp. of Mercer co., Ill. Pop. 1326.

Green, tp. of Woodford co., Ill. Pop. 933.

Green, tp. of Grant co., Ind. Pop. 1115.

Green, tp. of Hancock co., Ind. Pop. 1117.

Green, tp. of Jay co., Ind. Pop. 1115.

Green, tp. of Madison co., Ind. Pop. 954.

Green, tp. of Marshall co., Ind. Pop. 1097.

Green, tp. of Morgan co., Ind. Pop. 1345.

Green, tp. of Noble co., Ind. Pop. 1106.

Green, tp. of St. Josephs co., Ind. Pop. 964.

Green, tp. of Wayne co., Ind. Pop. 1293.

Green, tp. of Mecosta co., Mich. Pop. 616.

Green, tp. of Hickory co., Mo. Pop. 1217.

Green, tp. of Lawrence co., Mo. Pop. 1434.

Green, tp. of Livingston co., Mo. Pop. 903.

Green, tp. of Nodaway co., Mo. Pop. 1613.

Green, tp. of Polk co., Mo. Pop. 1074.

Green, tp. of Worth co., Mo. Pop. 703.

Green, tp. of Guilford co., N. C. Pop. 1119.

Green, tp. of Adams co., O. Pop. 1833.

Green, tp. of Ashland co., O. Pop. 1818.

Green, tp. of Brown co., O. Pop. 1490.

Green, tp. of Clinton co., O. Pop. 2492.

Green, tp. of Hamilton co., O. Pop. 4356.

Green, tp. and v. of Mahoning co., O. Pop. of v. 146; of tp. 1733.

Green, tp. of Monroe co., O. Pop. 1282.

Green, tp. of Ross co., O. Pop. 1898.

Green, tp. of Scioto co., O. Pop. 1882.

Green, tp. of Shelby co., O. Pop. 1254.

Green, tp. of Summit co., O., has beds of valuable coal. Pop. 1740.

Green, tp. of Wayne co., O. Pop. 2715.

Green, tp. of Erie co., Pa. Pop. 1395.

Green, tp. of Forest co., Pa. Pop. 226.

Green, tp. of Greene co., Pa. Pop. 739.

Green, tp. of Indiana co., Pa. Pop. 2160.

Green, tp. of Mercer co., Pa. Pop. 832.

Green, tp. of Pike co., Pa. Pop. 919.

Green, tp. of Randolph co., West Va. Pop. 893.

Green, tp. of Wetzel co., West Va. Pop. 931.

Green, tp. of Wapello co., Ia. Pop. 1252.

Green (ALEXANDER L. P.), D. D., b. in Sevier co., Tenn., June 26, 1807. He filled with success many of the most important offices of the Methodist Episcopal Church. He took a prominent part in the General Conference in New York in 1844, where measures were adopted for the division of the Church, and in the organization of the M. E. Church South; was one of the commissioners in the adjustment of the Church property question consequent upon the division; was one of the principal originators of the publishing house at Nashville and of the Vanderbilt University; was chairman of the book committee which supervised the interests of the publishing house; and for many years was a trustee of the Nashville University. He was noted as a preacher, platform speaker, and conference debater. He rose to the highest eminence in the Tennessee conference, which he joined in 1824; wrote largely for periodicals, and was well versed in Indian traditions and in piscatory matters, and at the time of his death was preparing a work on the fishes of North America, etc. He was a very useful minister, and d. in Nashville, Tenn., July 15, 1874, much lamented. T. O. SUMMERS.

Green (ASHBEL), D. D., LL.D., b. at Hanover, Morris co., N. J., July 6, 1762; entered the Revolutionary army 1778; graduated from New Jersey College in 1783 with the highest honors. Soon after leaving college he was appointed tutor, which office he held for two years; was 1785 chosen professor of mathematics and natural philosophy in New Jersey College; commenced preaching in 1786; was elected a member of the American Philosophical Society in 1787; pastor of the Second Presbyterian church, Philadelphia, 1787–1812; became president of Princeton College in 1812, and soon after received the degree of LL.D. from the Univ. of North Carolina. Author of *A History of Presbyterian Missions*, *Lectures on the Shorter Catechism*, and other works. Edited and largely wrote the *Christian Advocate* (1822–34), a periodical of great influence; was an able orator, and one of the leaders of Old School Presbyterianism for many years. D. at Philadelphia May 19, 1848.

Green (BARTHOLOMEW), b. at Cambridge, Mass., Oct. 12, 1666; is famous as being the first newspaper printer in North America. In the spring of 1704 he published the first number of the *Boston Newsletter*, which he edited until his death; was the publisher of the *Weekly Newsletter*, which he afterwards combined with his *Boston Newsletter*, calling the whole *The Boston Weekly Newsletter*. D. in Boston Dec. 28, 1732.

Green (DUFF), a distinguished lawyer, journalist, and politician, who edited the opposition organ at Washington during the presidency of Mr. J. Q. Adams and the administration organ (the *United States Telegraph*) during Gen. Jackson's first term. He exercised an immense power within his party, and was believed to influence very much the policy of the executive. D. June 10, 1875.

Green (HENRY WOODHULL), LL.D., an eminent jurist, was b. at Maidenhead (now Lawrence), N. J., Sept. 20, 1804; graduated at the College of New Jersey in 1820; was admitted to the bar in 1825, and practised law at Trenton, N. J., until 1846, when he was appointed chief-justice of the supreme court of the State; which office (after reappointment in 1853) he resigned in 1860 to accept the appointment of chancellor. This office he resigned in 1866 on account of impaired health, and travelled in Europe. In 1867 he was one of a commission to revise the laws of the State relative to taxation. He now (1875) resides at Trenton; has since 1860 been president of the board of trustees of Princeton Theological Seminary, and takes an active part in the religious and educational movements of the day. R. D. HITCHCOCK.

Green (HORACE), M. D., LL.D., b. at Chittenden, Vt., Dec. 24, 1802; graduated at the University of Pennsylvania and at Middlebury College, studying medicine afterwards in Paris. He was professor in the medical college at Castleton, Vt., 1840–43; was instrumental in starting the New York Medical College (1850), in which he was afterwards chosen president of the faculty, and professor of the theory and practice of medicine. Author of several medical works, among them *Treatise on the Diseases of the Air-Passages* (1846); also *Pathology and Treatment of Croup* (1849), and others. D. at Greenmount, Sing-Sing, N. Y., Nov. 29, 1866.

Green (JACOB), b. at Malden, Mass., Jan. 22, 1722; graduated from Harvard University 1744, and from New Jersey College in 1749; was ordained at Hanover, Mass.; appointed vice-president of New Jersey College in 1757; was a member of Congress from Providence, R. I., in 1775; also chairman of the committee which drafted the State constitution. Author of several books, one of them, *A View of a Christian Church and Church Government*, being very popular. D. at Hanover, Mass., May 24, 1790.

Green (JACOB), M. D., b. at Philadelphia July 26, 1790; graduated at the University of Pennsylvania 1806. Soon after his departure from the university, he, in company with a friend, issued a treatise on electricity and galvanism, which gave him considerable reputation. He accepted in 1818 the professorship of chemistry, experimental philosophy, and natural history at the College of New Jersey. He held this chair four years, at the end of which time he was appointed professor of chemistry in Jefferson College, Philadelphia (1822), which office he held until his death. Published scientific works, among them *Chemical Philosophy* (1829), *Treatise on Electro-Magnetism*, *Astronomical Recreations*, etc. Was also an able botanist, palæontologist, and student of physics, etc. D. in Philadelphia Feb. 1, 1841; was a son of Ashbel Green.

Green (JOHN ORNE), A. M., M. D., b. at Lowell, Mass., June 7, 1841; was educated at Phillips Academy, Exeter, N. H., and at Harvard College, where he graduated 1863;

took his medical degree there in 1866; studied in Vienna; is (1875) aural surgeon in Boston City Hospital and lecturer on otology in Harvard University.

Green (Lewis Warner), D. D., b. 1806; graduated from Transylvania University; commenced preaching about 1825; became president of Centre College and of Hanover and Alleghany seminaries; also president of Washington College and Transylvania College at Lexington, Ky., from 1857 to his demise. D. at Danville, Ky., May 26, 1863.

Green (Nathaniel), U. S. N., b. Jan. 22, 1836, in Pennsylvania; graduated at the Naval Academy in 1856; became a lieutenant in 1861, a lieutenant-commander in 1863; d. in 1873 at Reading, Penn. He served as executive officer of the gunboat Katahdin at the passage of Forts Jackson and St. Philip and capture of New Orleans, and is thus honorably mentioned by Lieut.-commanding George H. Preble in his official report of Apr. 30, 1862: "While exposed to the iron hail rained over us from both forts, and the simultaneous fire of the enemy's gunboats on the 24th, not a man flinched from his gun or hesitated in the cool performance of his duty. Where all performed so well, it is perhaps invidious to particularize. I may mention, however, as coming under my immediate notice, the deliberate way in which the first lieutenant, Mr. Green, gave his general superintendence to the serving and supplying the guns and the other duties assigned him."

Foxhall A. Parker.

Green (Seth), b. in Rochester, N. Y., Mar. 19, 1817. He received only a common-school education, but early manifested a taste for hunting, fishing, and woodcraft, which as he matured became a passion and determined his career. Almost constantly engaged with the rod and gun, he used his eyes as well, and became a careful observer. Determining to adopt these pursuits as the business of his life, he was for a number of years the proprietor of the only fish and game market near his home. His business increased from year to year, until he found himself the head of a large concern, with scores of agents scattered along the lakes and water-courses of the State. In 1838, being in Canada, his attention was arrested by the appearance of a number of salmon, and from their movements he judged that they were about to prepare a nest for their spawn. Perched in the branches of a tree, he carefully watched them continuously for forty-eight hours. He observed that as soon as the spawn was cast the male salmon and other fish ate all they could find, and that there were but a very few eggs unconsumed, and these the female was sedulously covering with gravel for concealment. He had never read upon the subject, but from what he there observed he became convinced that fish could be artificially hatched. From this time he devoted his entire attention to methods of improving the yield of fish from spawn. He found that 25 per cent. was the largest product of trout or salmon attained by artificial means, and he determined to increase this by avoiding defects which existed in the system then in vogue. He began in 1864 by gradually diminishing the proportion of water to milt, finding larger results from each diminution, until, by using the least possible quantity, he had raised the product to 95 per cent. In 1867, by invitation of the fish commissioners of four of the New England States, he experimented in the hatching of shad at Holyoke on the Connecticut River, and after many discouragements, and much opposition from fishermen, ascertained the precise position in the stream which the hatching-boxes invented by him should preserve in order to secure the largest result. He thus reduced the loss to a merely nominal amount, and in a fortnight hatched at this time 15,000,000, the next year 40,000,000. Similar results have since been reached by him in the Hudson, Potomac, Susquehanna, and other important rivers, where he has succeeded in artificially propagating fifteen of the more common species, and in introducing a largely increased product. In 1868 he was appointed one of the fish commissioners of his native State, but, shortly afterwards resigning, was made superintendent of fisheries therein. In the prosecution of this trust he has been untiring in his efforts to arouse public attention to the vast importance of the work in which he is engaged. He is in constant correspondence with eminent European fish-breeders, and has been decorated with two gold medals by the *Société d'acclimatation* of Paris. It may be safely said that to him, more than to any living man, are due the great advances of ten years past in pisciculture.

Fred. A. Whittlesey.

Green (William Henry), D. D., LL.D., b. at Groveville, Burlington co., N. J., Jan. 27, 1825; graduated at Lafayette College, Easton, Pa., 1840; studied at the Princeton Theological Seminary; became teacher of Hebrew there 1846; was ordained to the Presbyterian ministry 1848; became pastor of the Central Presbyterian church, Philadelphia, 1849; has held the professorship of Hebrew and Old Testament literature in Princeton Seminary since 1851; has taken a prominent part in the work of revising the authorized version of the Bible; is chairman of the "Old Testament Company," one of the two sections of the American committee of revision; declined the presidency of the College of New Jersey 1868. Author of a *Hebrew Grammar, Hebrew Chrestomathy, The Pentateuch Vindicated* (against Colenso), and *The Argument of the Book of Job Unfolded.*

Green (William Mercer), D. D., LL.D., b. in Wilmington, N. C., May 2, 1798; graduated at the university of that State June 3, 1818; was ordained deacon in the Protestant Episcopal Church in 1820, and priest in 1821, by the Rt. Rev. Richard Channing Moore of Virginia. He was the first pastor of St. John's church, Williamsborough, and afterwards of St. Matthew's church, Hillsborough. In 1837 he was called to the chair of English literature in his alma mater, and in 1849 was elected the first bishop of Mississippi. His published works comprise little more than a brief *Memoir of Bishop Ravenscroft* and a few sermons, chiefly on the subject of ministerial authority and baptismal regeneration.

Green'back, a popular name designating the paper money of the U. S., first issued by the treasury department in 1862. Sometimes the term is used also to include the national bank-notes. (See Currency, Money, Finance.)

Green Bay, in the N. W. part of Lake Michigan, extends 140 miles from N. N. E. to S. S. W., and is nearly 30 miles in average breadth. Its waters are about 500 feet deep, and of a green color. To the N. E. the Great and Little Bays de Noquet are its continuations. It is a beautiful sheet of water. Its shores are densely covered with pine.

Green Bay, post-tp. of Clarke co., Ia. Pop. 507.

Green Bay, tp. of Lee co., Ia. Pop. 664.

Green Bay, city and tp., cap. of Brown co., Wis., on the Milwaukee and Northern and the Green Bay and Lake Pepin R. Rs., on the E. bank of Fox River, about a mile from the mouth, and therefore at the terminus of the proposed navigable connection between the lakes and the Mississippi by the Fox and Wisconsin rivers. It has 3 national banks, a savings bank, 1 daily and 3 weekly newspapers, gasworks, street omnibus line, wooden pavements, 5 public school buildings, 2 steam fire-engines, 4 hand companies, an iron furnace, 2 sash and planing mills, a large tannery, foundry, machine-shops, breweries, etc., 3 lines of railway, shipping, and lake steamers. It is one of the largest primary shingle-markets in the country, also a large exporter of staves, heading, and other hard-wood products. It is largely engaged in the fisheries, principally of white-fish and trout. It has some dozen different churches, and is the see of a Roman Catholic bishop. Great improvements have been made in the public thoroughfares and in public and private buildings. It is provided with numerous excellent hotels, and is becoming a place of summer resort. Pop. of city, 4666; of tp., exclusive of city, 1073.

Geo. E. Hoskinson, Ed. "Daily State Gazette."

Green Bri'ar, tp. of Independence co., Ark. P. 1369.

Green'brier, county of West Virginia, bordering on Virginia. Area, 725 square miles. Its surface is composed of mountains, valleys, and plateaus, all fertile and having a delightful climate. Mineral springs abound. Grain, wool, and live-stock are leading products. Salt-springs exist at several points. The county is traversed by the Chesapeake and Ohio R. R. Cap. Lewisburg. Pop. 11,417, but its area has been reduced since the census.

Green Bri'er Moun'tains, in West Virginia, a ridge parallel to the main Alleghanies, and lying N. W. of them, continuous southward with the Great Flat Top, and northward with Shaver Mountains.

Green'brier Riv'er, in West Virginia, rises in lat. 38° 40′, and flows S. W. parallel to the main ridge of the Alleghanies, on the western slope of which its valley lies between that ridge and the secondary ridge of the Greenbrier Mountains. It unites with New River in about lat. 37° 40′, which, running nearly northward, unites with the Gauley and forms the Great Kanawha. These rivers and their valleys constitute the trans-Alleghany portion of the James River and Kanawha Canal route of the proposed connection between tide-water and the great valley of the Mississippi.

Green'burg, tp. of Westchester co., N. Y., lying between the Hudson and the Bronx rivers. It contains Tarrytown, Irvington, Hastings, Dobb's Ferry (which is now called Greenburg), and other villages; has a fertile soil, numerous manufactures, and quarries of marble. P. 10,790.

Green'bush, post-tp. of Warren co., Ill., contains beds of coal. Pop. 1270.

Greenbush, a v. of Greenfield tp., Warren co., Ia. Pop. 129.

Greenbush, post-tp. of Penobscot co., Me., on the E. bank of the Penobscot and on the European and North American R. R., 23 miles N. of Bangor. Pop. 621.

Greenbush, post-tp. of Alcona co., Mich. Pop. 86.

Greenbush, tp. of Clinton co., Mich. Pop. 1486.

Greenbush, tp. of Mille Lac co., Minn. Pop. 294.

Greenbush, tp. of Rensselaer co., N. Y., on the Hudson River, opposite Albany, and including East Albany and the post-village of Greenbush. It is on the Boston and Albany, the Troy and Greenbush, and the Hudson River R. Rs., has two weekly newspapers, active manufactures, and contains the mother-house of the Sisters of Mercy for the Roman Catholic diocese of Albany. The schools of this establishment have some 350 pupils. Pop. 6202.

Greenbush, a v. of Brown co., O. Pop. 42.

Greenbush, a v. of Preble tp., Preble co., O. P. 53.

Greenbush, post-tp. of Sheboygan co., Wis. P. 1939.

Green Camp, post-tp. of Marion co., O., on the Atlantic and Great Western R. R. Pop. 999.

Green Castle, tp. of Madison co., Ill. Pop. 120.

Green'castle, city and tp., cap. of Putnam co., Ind., is beautifully situated on a high table-land between two of the principal E.-and-W. lines of railroad—the Vandalia on the S. and the Indianapolis and St. Louis on the N. It also has one N.-and-S. line—the Louisville New Albany and Chicago. Eight miles to the W. is the celebrated block coal-region of Indiana. Adjacent to the city are fine bodies of timber, with sandstone and limestone, and some iron ore; also Big Walnut, a branch of Eel River. It has the best of facilities for the cheap and easy collection of materials for the manufacture of iron, glass, and articles of wood. The public schools are among the best in the State. Indiana Asbury University, with 450 students, is located here, also the Indiana Female College, a Presbyterian institution with over 100 students. The city has a street railway, 2 banks, 6 churches, 3 school-houses, and 2 weekly newspapers, an iron and nail mill, and many other manufactories. Pop. of city, 3227; of tp., exclusive of city, 1716.

G. J. Langsdale, Ed. "Greencastle Banner."

Greencastle, tp. of Marshall co., Ia. Pop. 764.

Greencastle, post-v. of Bloom tp., Fairfield co., O. Pop. 59.

Greencastle, post-b. of Franklin co., Pa., on the Cumberland Valley R. R., 63 miles S. of Harrisburg. It has a national bank, a newspaper, 2 high schools, 5 churches, agricultural works, 3 hotels, 1 woollen mill, a town-hall, etc. Principal business, agriculture and huckstering. Pop. 1650. Geo. E. Haller, Ed. "Valley Echo."

Green City, post-v., county-seat of Platte co., Col., on the river Platte, 25 miles E. of Evans. Settled in 1872 by the "South-western Colony" from Memphis, Tenn.

Green Cove Springs, post-v., county-seat of Clay co., Fla., on the W. bank of the river St. Johns, 30 miles above Jacksonville. It has a large sulphur spring, resorted to for the cure of rheumatic troubles, and believed to be the "Fountain of Youth" of Spanish and Indian legends.

Green Creek, tp. of Sandusky co., O. It contains the village of Clyde. Pop. of tp. 3666.

Green Dyes. See Dyestuffs and Dyeing, by Prof. C. F. Chandler, Ph. D., LL.D.

Greene, county in the W. of Alabama, bounded on the E. by the Black Warrior and on the S. W. by the Tombigbee River. Its surface is undulating, and well timbered with pine. Corn and cotton are leading products. It is intersected by the Alabama and Chattanooga R. R. Area, 500 square miles. Cap. Eutaw. Pop. 18,399.

Greene, county in the N. E. of Arkansas, bounded on the N. and E. by Missouri. The surface is rolling, the soil very rich, producing grain, tobacco, cotton, and other crops. The county is well timbered. Area, about 820 square miles. Cap. Gainesville. Pop. 7573.

Greene, county of N. Central Georgia. Area, 374 square miles. The surface is hilly, the soil productive. Grain and cotton are leading products. It is traversed by the Georgia R. R. Cap. Greenesborough. Pop. 12,454.

Greene, county of the W. of Illinois, extending eastward from the Illinois River. The surface is well timbered and undulating, the soil very rich. Area, 500 square miles. It contains beds of coal. Cattle, grain, tobacco, and wool are staple products. Carriages and wagons are leading articles of manufacture. It is traversed by the Jacksonville and Alton and the Rockford Rock Island and St. Louis R. Rs. Cap. Carrollton. Pop. 20,277.

Greene, county of the S. W. of Indiana. Area, 540 square miles. It is intersected by the W. fork of White River. The surface is very rich prairie and timber land. Cattle, grain, tobacco, wool, and lumber are leading products. There are mines of good coal. The county is traversed by the Indianapolis and Vincennes R. R. Cap. Bloomfield. Pop. 19,514.

Greene, county of W. Central Iowa. Area, 625 square miles. It is a rolling prairie region, of which grain is the leading product. It is traversed by the Chicago and Northwestern and the Des Moines Valley R. Rs. Cap. Jefferson. Pop. 4627.

Greene, county of the S. of Mississippi, bordering on Alabama. Area, 864 square miles. It is in the great pine-region, and abounds in excellent timber. Corn and rice are produced. It is watered by the head-streams of the Pascagoula. Cap. Leakesville. Pop. 2038.

Greene, county in the S. W. of Missouri. Area, 660 square miles. It contains timber and prairie, is fertile, and has limestone and ores of lead. Cattle, grain, tobacco, and wool are leading products. The county is traversed by the Atlantic and Pacific R. R. Cap. Springfield. Pop. 21,549.

Greene, county of New York, extending westward from the Hudson River. Area, 686 square miles. Its surface is broken by the Catskill Mountains and by deep ravines called "cloves," but the soil is generally productive. Grain, cattle, wool, hay, and especially dairy products, are the staples. Metallic wares, brick, carriages, leather, and paper are leading manufactures. Stone and ice are extensively produced. Cap. Catskill. Pop. 31,832.

Greene, county of E. Central North Carolina, in the great pine-region. Area, 280 square miles. It is level and fertile. Marl is found. Grain, cotton, and forest products are the staples. Cap. Snow Hill. Pop. 8687.

Greene, county in the S. W. of Ohio. Area, 432 square miles. Its soil is very fertile. Limestone and marble are found. Cattle, grain, tobacco, and wool are important products. The manufactures include carriages, clothing, flour, etc. The county is traversed by the Cleveland Columbus and Cincinnati and other railroads. Cap. Xenia. Pop. 28,038.

Greene, the south-westernmost county of Pennsylvania, having West Virginia on the W. and S. Area, 600 square miles. It is well watered, hilly, and fertile. Bituminous coal and fictile clay are found. Cattle, grain, and wool are important products. Saddlery, iron, pottery, etc. are manufactured. Cap. Waynesburg. Pop. 25,887.

Greene, county in the N. E. of Tennessee, bounded S. E. by North Carolina. Area, 750 square miles. The surface is broken, well timbered, and fertile. Iron ores abound. Cattle, grain, tobacco, and wool are leading products. Leather is manufactured. The county is traversed by the Atlantic and Mississippi R. R. Cap. Greenville. Pop. 21,668.

Greene, county of Virginia, bordered on the N. W. by the Blue Ridge. The surface is uneven, the soil partly fertile. Tobacco is the principal crop. Area, 230 square miles. Cap. Stannardsville. Pop. 4634.

Greene, tp. of Parke co., Ind. Pop. 1122.

Greene, tp. of Randolph co., Ind. Pop. 1034.

Greene, post-v. of Butler co., Ia., on the Burlington Cedar Rapids and Minnesota R. R., 35 miles N. W. of Cedar Falls; has 1 weekly newspaper.

Greene, tp. of Iowa co., Ia. Pop. 1040.

Greene, post-tp. of Androscoggin co., Me., on the Maine Central R. R., 7 miles N. N. E. of Lewiston; has 3 churches, and manufactures of shoes and leather. P. 1094.

Greene, tp. of Platte co., Mo. Pop. 2245.

Greene, tp. of Sussex co., N. J. Pop. 868.

Greene, post-v. and tp. of Chenango co., N. Y., 19 miles from Binghamton, on the Chenango River and the Utica division of the Delaware Lackawanna and Western R. R. It has a bank, a foundry and machine-shop, a newspaper, 4 churches, a flourishing union school, hotels, mills, shops, stores, etc. Pop. of v. 1025; of tp. 3537.

Denison & Roberts, Eds. "Chenango American."

Greene, tp. of Clarke co., O. Pop. 1464.

Greene, tp. of Fayette co., O. Pop. 879.

Greene, tp. of Gallia co., O. Pop. 1577.

Greene, tp. of Harrison co., O. Pop. 1547.

Greene, tp. of Hocking co., O. Pop. 1513.

Greene, tp. of Trumbull co., O. Pop. 915.

Greene, tp. of Beaver co., Pa. Pop. 1836.

Greene, tp. of Clinton co., Pa. Pop. 1102.

Greene, tp. of Franklin co., Pa. Pop. 3357.

Greene (Albert Collins), b. at East Greenwich, R. I.,

1792; became a member of the Rhode Island assembly in 1815; he also represented his native State in the U. S. Senate, and was Speaker of the house of representatives; was major-general of the State militia two years; became attorney-general in 1825–43, and U. S. Senator in 1845–51. D. at Providence Jan. 8, 1863.

Greene (ALBERT GORTON), b. at Providence, R. I., Feb. 10, 1802; graduated at Brown University 1820; held for many years the office of clerk of the municipal court of Providence, also clerk of common council. Published the popular ballad *Canonchet*, also *History of the Narragansett Church*, and others. He became judge of probate, and was for many years president of the Rhode Island Historical Society. D. at Cleveland, O., Jan. 3, 1868.

Greene (CHARLES GORDON), b. at Boscawen, N. H., July 1, 1804. At the age of nine he was assigned to the care of his brother Nathaniel, then manager of the *Patriot* at Haverhill, Mass., who sent him to the Bradford Academy near by, of which Benj. Greenleaf was then the principal; he was subsequently apprenticed in his brother's printing-office, and continued his apprenticeship in Exeter, N. H.; in 1822 he removed to Boston, and entered the office of the Boston *Statesman*; in 1825 he undertook the management for a year of the *Free Press* at Taunton, and was for a portion of the time its editor. Returning to Boston, he published *The Spectator*, a literary journal, which, however, he soon abandoned, and resumed his place in the *Statesman* office; in 1827 he removed to Philadelphia and published the *National Palladium*, which advocated the election of Andrew Jackson to the Presidency; and in 1828 went to Washington and was engaged upon the *United States Telegraph* until after Jackson was elected, when he returned to Boston and acquired a joint ownership in the *Statesman*, of which he became sole owner in a few years. In Nov., 1831, he established the Boston *Post*, which he continues to publish. He has been a member of the legislature, and Democratic candidate for various public offices; was naval officer of the port of Boston 1853–57.
G. C. SIMMONS.

Greene (CHARLES WARREN), A. M., M. D., b. at Belchertown, Mass., Aug. 17, 1840; educated at Phillips Academy, Andover, Waterville College (Me.), and Brown University; studied medicine at Harvard Medical School, Berkshire Medical College, Pittsfield, and the medical department of Dartmouth College, where he graduated M. D. in 1867; entered the U. S. volunteer service by enlistment July 19, 1862, and served in the army three years, attaining the rank of captain of volunteers, which he held for one year; practised his profession in Massachusetts 1868–72; in 1872 devoted himself to literary pursuits, having already for several years been an occasional contributor to periodicals.

Greene (CHRISTOPHER), b. at Warwick, R. I., 1737; served in Canada as colonel under Arnold and Montgomery; was taken prisoner at Quebec 1775; repelled the Hessians under Donop at Red Bank, N. J., 1777; was killed in an encounter with Tories in Westchester co., N. Y., May 13, 1781.

Greene (GEORGE S.), b. at Warwick, R. I., May 6, 1801; graduated at the U. S. Military Academy, second in his class, and entered the army as second lieutenant of artillery in 1834; from this date he was on duty at West Point, as professor of mathematics, in garrison, and on ordnance duty till 1836, when he resigned from the army and adopted the profession of civil engineer. As such he was employed on various public works in different parts of the U. S. till 1860, when he was appointed engineer of Croton waterworks and of Croton reservoir. He resumed his sword on the outbreak of civil war; was appointed colonel 60th N. Y. Vols., and brigadier-general of volunteers in the following April, participating in the battles of Cedar Mountain and Antietam, the defence of Harper's Ferry, and the battles of Chancellorsville and Gettysburg; transferred to the Army of the Cumberland in 1863, he was severely wounded at Wauhatchie, and disabled from duty in the field till 1865, when he joined the army of Gen. Sherman, and was engaged at Kinston, Goldsboro', etc., N. C. In Apr., 1866, he was mustered out of the volunteer service and resumed charge of the Croton waterworks, and in addition the construction of reserve reservoir in Putnam co., N. Y., besides being engaged on many other important public works.
G. C. SIMMONS.

Greene (GEORGE WASHINGTON), b. in East Greenwich, R. I., Apr. 8, 1811, a grandson of Gen. Nathaniel Greene; was educated at Brown University; lived in Europe 1827–47; U. S. consul at Rome 1837–45; was for some years instructor in modern languages in Brown University; became in 1872 professor of history (non-resident) at Cornell University. Author of *Historical Studies*, 1850; *History and Geography of the Middle Ages*, 1851; *Historical View of the American Revolution*, 1865; *Biographical Studies*, 1866; *Life of Nathaniel Greene*, 1867–68; and other works.

Greene (NATHANIEL), b. at Warwick, R. I., of Quaker parents, May 27, 1742. In early youth, chiefly by his own perseverance, he acquired a more than ordinary knowledge of many branches of education, the perusal of military history occupying much of his attention. In 1770 he was chosen a member of the assembly of Rhode Island, and from this date took an active part in the affairs of his country till the close of the war. The battle of Lexington excited his military ardor, and on receiving (in May, 1775) the appointment of brigadier-general and the command of the Rhode Island contingent army, he led them to Cambridge; for this he was formally excommunicated from the religious body of which he was a member. On the arrival of Washington at Cambridge, Greene expressed to his commander his satisfaction in his appointment, and soon won his confidence and esteem. In Aug., 1776, he was appointed by Congress a major-general. In the battle of Trenton he led a division, and bore an equally important part in the following battle of Princeton. At the Brandywine, where he commanded a division, he distinguished himself, and contributed largely towards saving the army from destruction by a rapid march and the firm stand he made against the enemy. At the battle of Germantown he commanded the left wing of the army. In Mar., 1778, he was appointed quartermaster-general, which office he accepted, at the urgent solicitation of Washington, on condition that his rank in the army should not be affected and that in time of action he should retain his command. This right he exercised at Monmouth, where he commanded the right wing, as also at the battle of Tiverton Heights. During Gen. Washington's visit to Hartford in 1780 Greene was in command of the army; was president of the court of inquiry upon Major André. After the disasters to the American arms in South Carolina he was assigned to the command of the southern department to supersede Gen. Gates. He found the army reduced by defeat and desertion, and greatly disorganized and in want. Having recruited his army and repaired its wants, he sent out a detachment under Gen. Morgan, which resulted in the victory of the Cowpens, Jan. 17, 1781. Greene effected a junction with Morgan Feb. 7, but finding his numbers altogether greatly inferior to the army of Cornwallis, he retreated with great skill to Virginia, where, being reinforced, he returned to North Carolina, and the battle of Guilford was fought, in which, though Greene was defeated, the loss of the British was the greater, and in a few days Cornwallis began a retreat towards Wilmington, followed by Greene; but changing his plan, Greene marched directly to South Carolina, where on Apr. 28 he engaged Lord Rawdon at Camden, and was defeated, but again with the results of success; on May 22 he commenced the siege of Fort Ninety-six, which was raised by the approach of Lord Rawdon. To the suggestion now made, that he had better retire to Virginia, Greene replied, "I will recover South Carolina or die in the attempt." Awaiting a favorable opportunity, he in turn pursued the forces of Lord Rawdon, resulting in the battle of Eutaw Springs, the hardest fought battle of the war, and the advance upon Dorchester. For his conduct at Eutaw Springs, Congress presented him with a gold medal and a British standard. During the remainder of his command he struggled successfully against the greatest difficulties in suppressing mutiny among his troops, who were insufficiently fed and clothed. North and South Carolina and Georgia made him valuable grants of property, and after spending a year in Rhode Island upon the return of peace, he sailed with his family to his estate near Savannah, where he d. June 19, 1786, from inflammation of the brain, occasioned by a stroke of the sun.
GEO. C. SIMMONS.

Greene (NATHANIEL), b. at Boscawen, N. H., May 20, 1797. Left dependent upon his own resources at an early age, he entered the office of the *New Hampshire Patriot* at Concord in 1809, and in 1812 became editor of the Concord *Gazette*; removed to Portsmouth in 1814, and for a year managed the *New Hampshire Gazette*; thence he removed to Haverhill, Mass., where for two years he conducted the Haverhill *Gazette*; in 1817 he started the Essex *Patriot*, which he continued until 1821, when by invitation he removed to Boston and established the Boston *Statesman*, at first a semi-weekly, but finally it became the leading Democratic daily in the State; in 1829 he was appointed postmaster of Boston, which office he held until 1840, and again from 1845 to 1849. In 1836 he published a translation of Sforzosi's *History of Italy*, *Tales from the German* in 1837, and *Tales and Sketches from the German, Italian, and French* in 1843.
G. C. SIMMONS.

Greene (ROBERT), M. A., b. at Ipswich (or, as some

say, Norwich), England, in 1550 (according to others, about 1560); took degrees at St. John's College (1578) and Clare Hall (1583), Cambridge; travelled in Italy and Spain; studied at Oxford, and (as some say) took holy orders in 1584. He soon went to London, where he was a dramatist and poet, one of the associates of Lodge, Peele, and Marlowe, all famous for their profligate debaucheries. He d. of a surfeit at London Sept. 3, 1592. His plays are mostly forgotten, but his pamphlets, tracts, poems, and tales show good abilities; but his style is often more euphuistic than that of Lyly, whom he imitated.

Greene (S. Dana), U. S. N., b. Feb. 11, 1840, in Cumberland, Md.; graduated at the Naval Academy in 1859; became a lieutenant in 1861, a lieutenant-commander in 1865, a commander in 1872. True to a name famous in the annals of the Revolution, Lieut. Greene, in Jan., 1862, *volunteered* to serve as the executive officer of the Monitor (the first of an untried type of vessels), which the majority of seamen, not without reason, as was afterwards proved, believed to be utterly unseaworthy. His services in fitting out the vessel, in her encounter with the Merrimack, etc., are fully narrated by Commander (now Rear-admiral) Worden in an unpublished report on the files of the navy department, dated Jan. 5, 1868, from which we extract the following: "I was ordered to the Monitor on the 13th of Jan., 1862, when she was still on the stocks. Prior to that date Lieut. S. D. Greene had interested himself in her, thoroughly examined her construction and design, and informed himself as to her qualities; and, notwithstanding the many gloomy predictions of naval officers and officers of the mercantile marine as to the great probability of her sinking at sea, volunteered to go in her, and at my request was ordered. From the date of his orders he applied himself unremittingly and intelligently to the study of her peculiar qualities, and to her fitting and equipment." . . . "Lieut. Greene, the executive officer, had charge in the turret, and handled the guns with great courage, coolness, and skill, and throughout the engagement, as in the equipment of the vessel and on her passage to Hampton Roads, exhibited an earnest devotion to duty unsurpassed in my experience; and for which I had the honor in person to recommend him to the department and to the board of admirals (some three years since) for advancement, in accordance with the precedent established in the case of Lieut.-Com. Thornton, the executive officer of the Kearsarge. I beg leave now, most respectfully and earnestly, to reiterate that recommendation." Toward the close of the engagement between the Monitor and the Merrimack a shell, striking the pilot-house of the Monitor, near the "lookout hole," through which Capt. Worden was then looking, exploded, "filling his face and eyes with powder, utterly blinding, and in a degree stunning him." By this casualty Lieut. Greene became the commanding officer of the vessel, and, taking his place in the pilot-house, gave orders to turn her head in the direction of the Merrimack, with the design of coming to close quarters with his antagonist. As he steered toward her, however, she declined the combat, and, "crippled and discomfited," retired to Norfolk, whither Lieut. Greene had the good judgment not to attempt to follow her, for had he done so, and met with disaster from the enemy's batteries or by grounding on one of the many shoals of the intricate channel leading to that city, he would have imperilled not only the vast amount of shipping at Hampton Roads and in Chesapeake Bay—more than half of which must have shared the fate of the Congress and Cumberland—but also Mansfield's army at Newport News, and perhaps even Fortress Monroe, the key to the Chesapeake and the James and Elizabeth rivers. Lieut. Greene had the good sense to perceive all this, and to resist the temptation, which must have been very great to a young and gallant officer, to pursue the retreating foe. Lieut. Greene remained in the Monitor until she foundered off Hatteras on Dec. 31, 1862, with a loss of four officers and twelve men. His conduct on this trying occasion is thus highly spoken of by his commanding officer, Com. J. P. Bankhead, in his official report of Jan. 1, 1863: "I would beg leave to call the attention of the admiral and of the department to the particular good conduct of Lieut. Greene and Acting Master L. N. Stodder, who remained with me until the last, and by their example and bearing did much towards inspiring confidence and obedience on the part of others." Thus we see that in tempest as in battle Lieut. S. Dana Greene displayed the highest qualities of the American officer—coolness, decision of character, prudence. There are many brave men, but not many who, like him, unite bravery with discretion and sound judgment. Foxhall A. Parker.

Greene (Samuel Stillman), LL.D., b. at Belchertown, Mass., May 3, 1810; graduated at Brown University 1837; superintendent of schools Springfield, Mass., 1840–42; instructor in the grammar and English high schools, Boston, 1842–49; agent for the Massachusetts board of education 1849–51; superintendent of public schools Providence, R. I., 1851–55, and at the same time professor of didactics in Brown University; professor of mathematics and civil engineering in Brown University 1855–64; of mechanics and astronomy since 1864; has been president of the Rhode Island State Institute, of the American Institute of Instruction, and of other educational societies. Author of *The Analysis of Sentences*, 1848, and of a series of English grammars and other works.

Greene (William), b. in 1732; was Speaker of the assembly of Rhode Island; chief-justice of the colony; governor of the State 1788–86; and d. at Warwick, R. I., Nov. 30, 1809.—Another William Greene became deputy governor of Rhode Island in 1740; was governor 1743–58; and long was the clerk of the county court at Providence. D. Feb. 23, 1758.

Green Ebony (*Jacaranda ovalifolia*), a South American tree of the order Bignoniaceæ. Its wood is quite hard and is olive-green in color. It is used by dyers, and gives yellows, browns, and greenish tints. It is also used in turnery and joiner-work to some extent. Other species of the genus yield medicinal agents.

Greeneville, post-v., cap. of Greene co., Tenn., on the East Tennessee Virginia and Georgia R. R., 75 miles N. E. of Knoxville. It has a good system of public schools and 2 newspapers. There are two furnaces in active operation, and Greeneville and Tusculum College is a few miles from the town. It is the home of Ex-Pres. Andrew Johnson. The narrow-gauge railroad leading to North Carolina terminates here. P. 1039. J. B. R. Lyon, Ed. "New Era."

Green'field, tp. of Poinsett co., Ark. Pop. 261.

Greenfield, post-v. of Greene co., Ill., 55 miles from St. Louis, on the line of the Rockford Rock Island and St. Louis R. R. It has 4 churches, 1 large brick seminary, 1 private academy, 6 dry-goods houses, 8 grocery, 2 drug, 2 hardware, 1 jewelry, and 1 furniture store, 1 banking-house, 1 newspaper, 2 hotels, 2 harness-shops, 1 steam flouring-mill, 3 large warehouses, 1 planing-mill, 2 lumber-yards, 1 gunsmith-shop, a commodious town-hall, etc. It exports large quantities of grain, cattle, hogs, horses, and other produce. W. E. Milton, Pub. "Locomotive."

Greenfield, tp. of Grundy co., Ill. Pop. 1645.

Greenfield, post-v., cap. of Hancock co., Ind., on the Pittsburg Cincinnati and St. Louis R. R., 21 miles E. of Indianapolis. It has a bank, a printing-office and newspaper, 2 large flouring-mills, 1 furniture-factory, 3 very fine churches, a large number of fine stores, groceries, shops, etc., 2 hardware stores, 2 planing-mills, and a commodious school-house costing $25,000. Pop. 1203. William Mitchell, Ed. "Hancock Democrat."

Greenfield, tp. of La Grange co., Ind. Pop. 1078.

Greenfield, tp. of Orange co., Ind. Pop. 1439.

Greenfield, post-tp. of Adair co., Ia. Pop. 197.

Greenfield, tp. of Jones co., Ia. Pop. 1083.

Greenfield, tp. of Warren co., Ia. Pop. 1514.

Greenfield, post-tp. of Penobscot co., Me., 20 miles N. E. of Bangor. Pop. 317.

Greenfield, a post-v. and tp., cap. of Franklin co., Mass., 36 miles N. of Springfield, in the valley of the Connecticut River and on the Vermont and Massachusetts and the Connecticut River R. Rs. It derives its principal prosperity from the farming interests which surround it, being the main market for butter, cattle, sheep, etc. in the N. W. section of the State. Its manufactures are children's carriages, planes, bolt-cutting machines, and other small articles. There are 2 national and 2 savings banks, 6 churches, a young ladies' seminary, and a large library. It has a fine court-house, a well-constructed high-school building, a beautiful soldiers' monument, and 2 weekly newspapers. Pop. 3589. E. A. Hall, Ed. "Gazette and Courier."

Greenfield, post-tp. of Wayne co., Mich. Pop. 2406.

Greenfield, tp. of Wabashaw co., Minn. Pop. 590.

Greenfield, post-v. of Centre tp., cap. of Dade co., Mo., 40 miles N. W. of Springfield, near the Turnback River, on the line of the Kansas City and Memphis R. R. It has a bank, 2 newspapers, 15 stores, 2 hotels, and 3 churches. P. 364. C. W. Griffith, Prop. "Vidette."

Greenfield, post-tp. of Hillsborough co., N. H., 30 miles S. W. of Concord. Pop. 527.

Greenfield, tp. of Saratoga co., N. Y., 6 miles N. of Saratoga, on the Adirondack R. R. It has manufactures of brick, paper, glass, etc., and quarries of limestone. P. 2698.

Greenfield, tp. of Fairfield co., O. Pop. 1944.

Greenfield, tp. of Gallia co., O. Pop. 1386.

Greenfield, post-v. of Madison tp., Highland co., O., on the Marietta and Cincinnati R. R. It has 2 newspapers, and 1 national bank. Pop. 1712.

Greenfield, tp. of Huron co., O. Pop. 954.

Greenfield, tp. of Blair co., Pa. Pop. 1233.

Greenfield, post-tp. of Erie co., Pa. Pop. 1039.

Greenfield, tp. of Luzerne co., Pa. Pop. 823.

Greenfield, b. of Washington co., Pa. Pop. 386.

Greenfield, tp. of La Crosse co., Wis. Pop. 676.

Greenfield, post-tp. of Milwaukee co., Wis. P. 2281.

Greenfield, tp. of Monroe co., Wis., on the Milwaukee and St. Paul R. R. Pop. 519.

Greenfield, tp. of Sauk co., Wis. Pop. 746.

Green Finch, or **Green Linnet,** the *Coccothraustes chloris*, a bird of the family Fringillidæ, found throughout a large part of the eastern hemisphere. It is often kept as a cage-bird, but is a poor songster. It is also called the green grosbeak. It feeds on both seeds and insects.

Green Garden, post-tp. of Will co., Ill. Pop. 1202.

Green'heart, the very valuable timber of the *Nectandra Rodiæi* (order Lauraceæ), the same tree which yields the bebeeru bark, a valuable medicine. Its seeds also yield starch, which is used as food by the natives. The timber is imported from Guiana. It is very heavy and durable, takes a high polish, and is used in turnery. In Guiana it is used as ship-timber. It resembles lignum-vitæ, and is much employed in making fishing-rods.

Green Hill, post-tp. of Rutherford co., N. C. P. 1186.

Green'house, a glass structure designed to afford an artificial climate in which tender plants may be grown in countries too cold for their unprotected growth. The simplest structures of this kind are the cold-frames used by market-gardeners for forcing the early maturity of vegetables. Cold graperies, conservatories, orchard-houses, bark-stoves, etc. are among the varieties; but gardeners apply the name *greenhouse* more especially to those whose winter temperature is just high enough to keep tender plants alive, or perhaps to produce from the flowering kinds some blossoms, but not enough to stimulate growth. When a greater heat than this is kept up in winter (say over 65° F. by day or 42° by night), the structure is called a stove or hothouse. The glass serves for the imprisonment of a portion of the solar heat, and currents of cold air are excluded; but in order equably to maintain this temperature, it is necessary to employ artificial heat in some form. For the ruder cold-frames the fermentation of horse-dung mixed with dead leaves or other suitable organic matter is sufficient; and in the bark-stove very delicate plants may be forced by the fermentation of ground tan-bark and horse-dung, which affords not only a suitable heat, but a copious supply of moisture, which is another very favorable condition for plant-growth. But, ordinarily, flues or steam-pipes are employed for this purpose. The construction and management of greenhouses are the subject of many published works, and the business requires special training, and calls for no ordinary degree of intelligence and faithfulness on the part of those entrusted with its management. The regulation of temperature, light, air, moisture in air and soil, economy in the use of materials, the detection and destruction of the peculiar insect enemies and fungoid growths which attack greenhouse plants, are points which require diligent attention.

Green Isl'and, post-v. of Watervliet tp., Albany co., N. Y., is situated on an island in the Hudson River, between Troy and West Troy, and on the Rensselaer and Saratoga R. R. It is connected by bridges with these towns, and has 4 churches and extensive manufactures of railroad cars, machinery, castings, iron, and other goods. It is connected with Troy and Cohoes by a street railroad. Pop. 3135.

Green Isle, post-tp. of Sibley co., Minn. Pop. 437.

Green Lake, a small lake of Clear Creek co., Col., 3 miles S. W. of Georgetown. It is 10,000 feet above the level of the sea; is half a mile long and one-fourth of a mile wide. It is a pleasant resort.

Green Lake, county of S. E. Central Wisconsin. Area 380 square miles. It is fertile, and has an uneven surface. Cattle, grain, and wool are staple products; carriages and flour are leading manufactures. Cap. Dartford. Pop. 13,195.

Green Lake, tp. of Monongalia co., Minn. Pop. 234.

Green Lake, post-tp. of Green Lake co., Wis., on the Sheboygan and Fond du Lac R. R., 26 miles W. of Fond du Lac. Pop. 1102.

Green'land [Dan. *Grönland*], an island of vast but unknown extent, stretching from Cape Farewell, its southern extremity, in lat. 59° 49′ N., towards the north pole, separated by Davis's Strait, Baffin's Bay, and Smith's Sound from continental America on the W., and bounded on the S. and E. by the Atlantic and Arctic oceans. On account of the vast extent of land, the climate of these regions is much colder than that of corresponding latitudes farther E. In lat. 60° N. the mean temperature is lower than that of Lapland in lat. 72° N. In the two summer months, June and July, during which the sun is always above the horizon, the temperature rises to 53°; the snow melts; the icebergs detach themselves from the glaciers of both coasts, and float with the currents from the Arctic Ocean down into the Atlantic; and in the vales of the W. coast, along the fiords, vegetation begins its short and feeble life. The pine never becomes a tree, it remains a shrub, and the blubber of the whale and the oil of the seal must be used for fuel. Potatoes and a few other vegetables may be raised. A few herbs, flowers, and berries will grow. But the principal plant is the moss, which lives under the snow, and on which the reindeer feeds. During the winter the temperature sinks to —69° F. The eastern coast, which is the most inhospitable, was explored in 1822 by Capt. Scoresby, in 1823 by Capt. Clavering, in 1830 by Capt. Graah up to lat. 74° 30′ N., and in 1868–70 by German expeditions. It presents a range of precipitous cliffs from 2000 to 3000 feet high, covered with eternal snow and ice, over which the huge glaciers of the much higher mountains of the interior descend to the ocean. The western coast, along which most of the settlements have been made, was explored in 1853 by Dr. Kane up to lat. 81° 22′ N. The land was discovered in the ninth century by an Icelander, Gunbjörn, and shortly after it was visited by another Icelander, Erik the Red, who called it Greenland, and gave a very flattering report of it, which occasioned two Icelandic settlements to be made—West Bygd and East Bygd. These two settlements seem to have been quite flourishing, but in the middle of the fourteenth century both of them were utterly destroyed by the plague, by attacks of the natives, and by a foreign fleet. In the sixteenth and seventeenth centuries the western coast was visited by the English, by Frobisher, Davis, and Baffin, but the first regular European settlement was made in 1721 by the Norwegian clergyman, Hans Egede, who, with the support of the Danish government, removed himself, his family, and a few friends to GODTHAAB (which see), and began preaching Christianity among the native inhabitants, the ESQUIMAUX (which see). Hans Egede's report of the land and the people is a very interesting and touching little book; and since his time the Danes have founded and supported 13 colonies, of which Godthaab, Julianeshaab, and Upernavik are the most important, and in which about 10,000 people (in 1871, 9825) are gathered—about 300 of them Danes, and the rest Esquimaux. Life in these colonies depends upon hunting and fishing, and the natives exhibit great skill in these occupations, though of late it has become the steady complaint of the Danish officers that the foreign fishing-fleets which come to these places introduce habits among the natives which make them unfit for the kind of life which alone can be led here; the consequences of which are often utter wretchedness and misery. Though vegetation is feeble in this climate, animal life is quite vigorous. The dog is the only domesticated animal, but reindeer, bears, foxes, and wild-fowl—among which is the eider-duck—whales, seals, and cod-fish abound. Great quantities of fish-oil, fur, and eider-down are exported, and lately cryolite and other minerals have become important items of exportation. Miocene lignitic coal of good quality exists. But the seal is the chief resource of the Greenlander's life. Its skin is his dress, his boat, his bed; its oil is his lamp and his stove during the long winter when the sun never rises; its flesh is almost the only kind of meat which gives his body a sufficient vital heat. When the Greenlander ceases to catch the seal, he must die; when for a bottle of whisky (the sale of which is prohibited) or a red ribbon he sells too much of his harvest, he must starve. The Lutherans and Moravians each maintain missions in Greenland. CLEMENS PETERSEN.

Greenland, post-tp. of Ontonagon co., Mich., has mines of copper. Pop. 548.

Greenland, post-tp. of Rockingham co., N. H., on the Concord and Portsmouth and the Eastern R. Rs., 6 miles W. of Portsmouth. Pop. 695.

Greenleaf, tp. of Sanilac co., Mich. Pop. 336.

Greenleaf, post-v. and tp. of Meeker co., Minn. Pop. of v. 54; of tp. 392.

Greenleaf (BENJAMIN), b. at Haverhill, Mass., Sept. 25, 1786; graduated at Dartmouth College 1813; was principal of Bradford Academy 1814–36, and of the Bradford Teachers' Seminary, 1839–48; represented Bradford in the legislature of Massachusetts in 1837–39. Published a series of *Arithmetics*, an *Algebra*, and *A System of Practical Surveying*. D. at Bradford, Mass., Oct. 29, 1864.

Greenleaf (Moses), LL.D., b. at Newburyport, Mass., 1778. Author of *Statistical View of Maine* (1816), *Survey of Maine* (1829). D. in Williamsburg, Me., Mar. 20, 1834.

Greenleaf (Simon), LL.D., b. at Newburyport, Mass., Dec. 5, 1783; studied law, and, after being admitted to the bar, commenced practice at Standish, Me., in 1806, removing to Gray soon after, and in 1818 to Portland. From 1820 to 1832 he was reporter of the supreme court in Maine, and published nine volumes of reports. In 1833 was appointed Royall professor of law at Harvard University, through the influence of Judge Story, whom he succeeded as Dane professor of law in 1846. Having resigned in 1848 his professorship, he was made emeritus professor. He was for many years president of the Massachusetts Bible Society. His most important work was a *Treatise on the Law of Evidence*, in 3 vols. (1842–53). A volume of *Overruled, Denied, and Doubted Decisions and Dicta* was published in 1840, and subsequently expanded to three volumes. In 1849 he edited Cruise's *Digest of the Law of Real Property*. He also published an *Examination of the Testimony of the Four Evangelists by the Rules of Evidence as administered in Courts of Justice, with an Account of the Trial of Jesus* (1846), and *Remarks on the Exclusion of Atheists as Witnesses*. His style is remarkably clear and elegant. D. at Cambridge, Mass., Oct. 6, 1853.

Green Moun'tain, a high grass-covered peak in Jefferson co., Col., composed of coal-bearing rocks. Near it are important mines of lignitic coal of good quality.

Green Moun'tains, a part of the Appalachian system of mountains, found in Vermont and Massachusetts, and continued southward in the hills of Western Connecticut and the Highlands of New York. The Taconic range of Massachusetts, New York, and Connecticut is an outlying western parallel range. North-eastward the Green Mountains pass into the Notre Dame Hills of Canada, and are traceable at least as far as the Gulf of St. Lawrence. The highest points are Mt. Mansfield, 4400 feet, Camel's Hump, 4188 feet, and Killington Peak, 4221 feet in height. The range contains marble, iron, slate, and some copper and gold. The country is generally a rich pastoral region, with valuable water-power and abundant forests.

Green Oak, post-tp. of Livingston co., Mich. P. 994.

Gree'nock, a young but rapidly developing town of Scotland, in the county of Renfrew, on the Frith of Clyde. It has excellent harbors and docks, extensive establishments for sugar-refining, shipbuilding, and the manufacture of iron-work, and a very brisk trade with North America and the West and East Indies. Pop. 57,138.

Green'ough (Horatio), b. in Boston, Mass., Sept. 6, 1805. His father was a merchant of character and consideration; his mother, a native of Massachusetts, was a woman of great intelligence and sensibility. Horatio was one of several children. He received the best education the times afforded at public and private schools, and enjoyed early the society of cultivated people. At the age of sixteen he entered Harvard College, prepared to improve his advantages. The artistic bent appeared in him early and decidedly. The schoolboy's propensity to cut, carve, design, and model attracted attention, and secured for him interest and admiration. His high social position, his enthusiasm, his evident genius, and his winning manners won for him encouragement and help. At Cambridge he found in Washington Allston a stimulating and wise friend; his gratitude to Allston never diminished. Young Greenough was too much interested in studies connected with his chosen art to strive after academic honors; still, he was a faithful scholar, if not distinguished, and on leaving college was furnished with literary stores and culture far beyond other lads of his years. His sonnets, written while an undergraduate, sketches with the pencil, plaster casts, models, and designs—particularly one for a monument on Bunker's Hill—attest a remarkable creative power. Before the day of graduation Greenough went to Italy for serious study of the ancient masterpieces, repairing at once to Rome, the centre of art. There were the Academy, the Vatican, the gardens, and galleries; there Thorwaldsen was his friend. His studies impaired his health, and he spent a few months at home, executing portrait-busts of J. Q. Adams, Chief-Justice Marshall, and others. Already he had a reputation for talent. At Paris, whither he went for the purpose, he made the bust of La Fayette, by none admired more than by La Fayette himself. Returning to Italy, Greenough, after some stay at Carrara among the marble-quarries, took up his residence in Florence as a sculptor. He was the pioneer of the great company who since have found fortune there. Powers, two months his senior, joined him in 1837. American travellers in Italy were then comparatively few; of American residents the number was very small. American art had no fame, its works were unknown and unpurchased. Solitary, unpatronized, unvisited, the artist knew poverty and depression. However, the patrons came; among the first, Cooper the novelist, who gave him not only the cheer of his presence and the encouragement of his praise, but a commission which proved to be the beginning of his larger renown. The group, two nude cherubs, came to Boston, and excited great admiration in influential quarters just at the time when the government was thinking of a statue to George Washington. The poet Dana, his friend Mr. Cooper, Allston, then at the summit of his fame, Edward Everett, who had known the artist in Italy, spoke effective words for him, and secured for him the commission. The statue is well known to all the visitors at the national capital. It was a work of great study, labor, and feeling, wrought in the poetical, not the historical spirit, and by those who thus approached it it was greatly admired. Edward Everett regarded it as "one of the greatest works of sculpture of modern times." His brother, Mr. Alexander H. Everett, declared that it surpassed his expectations, high as they were: "It is truly sublime." The work was not designed for the open air, and the placing of it was a disappointment to the artist, who was in consequence of that exposed to what he considered unjust criticism. Had Greenough designed a statue for a public square, he would have modelled a very different one; for although trained in antique schools, among the masterpieces of classic art, he was a modern man, and understood as well as anybody the conditions of living art. He gave his whole mind and nearly eight years of life to the execution of the statue, but to place it finally was not given to him.

Greenough was a man of ideas, imaginative, poetical. He loved ideal work. He made a bust of the Christ which was greatly praised. One of his earliest works was a statue of Abel. One of his latest, *The Rescue*, representing, under the design of an American settler grappling an Indian, the superiority of the Anglo-American to the savage, was executed between 1837 and 1851 on an order from the government. Greenough excelled in small pieces of sentiment and fancy—groups of children at play, portraits of children. These were never commonplace, and often were strikingly original. They belong to private families. He was a man of genius—not a sculptor merely, but a lover of art in general, an observer of nature, a student of man. Everything that concerned the conditions of human life interested him—social arrangements, modes of existence, building, government. His literary talent was remarkable, though exhibited only in fragments of prose and verse. R. W. Emerson pronounced his conversation "both brilliant and deep; and his writing so remarkable for its realism and its occasional splendor that I conceived the highest hope of what he should do, and cause others to do, by his speech and pen as well as by his chisel." Mr. Greenough passed the last year of his life in the U. S. The disturbed state of Italy made his home there disagreeable, and he came away in the autumn of 1851 on the pretext of erecting his group of *The Rescue* in Washington, but he never returned. It is thought that the excited condition of life, social and political, in America was too much for a sensitive man who had passed his best years in the world of the past; the transition from the serene atmosphere of Italy to the intellectual tumult of the New World was too sudden to be borne. In the winter of 1852 he was attacked at his home in Newport with brain fever. A removal to Somerville, near Boston, for medical treatment proved unavailing, and he d. there on Dec. 18. Among the best known works of Horatio Greenough are the *Venus Victrix*, the *Angel Abdiel*, the *Medora*. His smaller but most attractive pieces were numerous. O. B. Frothingham.

Greenough (Richard S.), brother of Horatio, was b. at Jamaica Plain, Mass., Apr. 27, 1819, and educated at the Boston Latin School 1829–32. The habit of drawing acquired in childhood and practised diligently took a decided bent from the sculptor Clevenger, under whose eye he finished a small bust, which gave so much promise that friends decided he should go to Florence and work with his brother. The winter of 1840–41 was spent in Venice, Ferrara, Bologna, and Florence, but ill-health compelled him to return to Boston. A portrait-bust of William H. Prescott, executed in 1843, brought him orders for similar work, which kept him occupied till 1850, when he returned to Italy and worked, chiefly in Rome, on imaginative subjects—a head of Christ, *Moses and the Daughter of Pharaoh*, *Cupid Warming an Icicle*, *Night Watching a Young Mother*. His best known work of this period is the bronze group, *The Shepherd Boy and the Eagle*, now in the Boston Athenæum. The bronze statue of Franklin in School street, Boston, executed in 1853 in Boston, and the marble statue of Gov. Winthrop in the chapel at Mount Auburn Cemetery, finished in Florence 1855–56, are the best known of Mr. Greenough's works. The period from 1856–68, spent in Paris, was full of industry, the busts, bas-reliefs, and imag-

inative pieces indicating much poetic feeling and delicacy of taste. For the past four years the artist has resided at Newport, R. I. Here he has done *Victory*, a memorial statue in honor of the Boston Latin School graduates who fell in the civil war, ideal heads of Beatrice and Portia, and a colossal statue of Gov. Winthrop, ordered by the State of Massachusetts for the Capitol at Washington.

O. B. FROTHINGHAM.

Green Pig'ments. In painting, the mixture of yellow and blue pigments in suitable proportions will afford the various shades of green. Among the most prominent of the pigments which directly afford green colors is *chrome green*, the sesquioxide of chromium, made by firing the chromate of mercury, and affording a very permanent and full-bodied opaque green paint. *Terre verte* or green earth, a native mineral, affords a neutral green, permanent and delicate, much used by artists. *Scheele's green*, the arsenite of copper, is a cheap and good green paint. *Schweinfurth's green* is the double arsenite and acetate of copper; it affords a very handsome color. *Sap green*, prepared from buckthorn-berries, is employed by artists. Many of the salts of copper are employed as green pigments. (See PAINTS and PIGMENTS.)

Green'point, now the 17th ward of the city of Brooklyn, N. Y., into which it was incorporated in 1852, has 13 churches, 2 banks, a daily and a weekly newspaper, shipbuilding, and other important manufacturing and business interests. Pop. of ward 17,353. (See BROOKLYN.)

H. G. LAMBERT, ED. "BROOKLYN DAILY POST."

Green'port, tp. of Columbia co., N. Y., on the Hudson River, has much fertile soil and extensive limestone-quarries. Pop., exclusive of HUDSON (which see), 1325.

Greenport, post-v. of Suffolk co., N. Y., on Shelter Island Sound, between Peconic and Gardiner's bays, 95 miles from Brooklyn, is the eastern terminus of the Long Island R. R. It has 5 churches, 5 hotels, 2 newspapers, 1 national bank, 20 stores, a good fire department, 2 shipyards, 3 sets of marine railways, a stereotype-foundry, and numerous minor branches of industry. Principal business, coasting and fishing. Pop. 1819.

WM. R. DUVALL, ED. "SUFFOLK TIMES."

Green Prai'rie, post-tp. of Morrison co., Minn. Pop. 201.

Green Riv'er, in Kentucky, rises in Lincoln co., and pursues a devious north-westerly course, uniting with the Ohio 6 miles above Evansville, Ind. It is navigable at high water 200 miles by means of locks and dams. The mouth of the Mammoth Cave, at an elevation of 225 feet above, is about a quarter of a mile from this river, a subterranean communication from which constitutes the famous "river" of that cave. A recent barometrical observation showed its level to be the same as that of Green River, while it is known to rise and fall with that of the latter.

Green River, of Massachusetts, rises in Windham co., Vt., and joins the Deerfield River at Greenfield. It affords good water-power, and there is fine scenery on its banks.—Another Green River flows from Hancock, Mass., through Williamstown, into the Hoosac.—Still a third rises on the borders of Massachusetts and New York, flows southward through West Stockbridge, Alford, and Great Barrington, and joins the Housatonic River near the northern boundary of Sheffield. It is this which forms the theme of the poet Bryant in his lines "To Green River" (written when he was a resident of Great Barrington).

Green River, of Utah, rises in Western Wyoming, and flows in a generally southward course into Utah. With Grand River it constitutes the Rio Colorado of the West. It drains a large portion of Utah E. of the Wahsatch Mountains, and a large area in North-western Colorado.

Green River, tp. of Henderson co., N. C. Pop. 709.

Green'sand, a term used by geologists to describe a sand that contains a large proportion of glauconite in the form of green grains. (See GLAUCONITE.)

Greensand, The, a term applied to a subdivision or subdivisions of the Cretaceous series of rocks. The (Cretaceous) greensand of America belongs to the Upper Cretaceous series, while the greensand of Europe is divisible into the Upper Greensand, belonging to the Upper Cretaceous, and the Lower Greensand, belonging to the Lower Cretaceous or Neocomian period. Lithologically alike, the Upper and Lower Greensands are palæontologically very distinct; the presence of the fault between them also evidencing the difference of their "horizons."

Greens'boro', post-v. and tp., cap. of Hale co., Ala., a few miles N. of the canebrake-region, which was famous before the war for its productiveness. The Southern University, under the auspices of the Alabama Conference of the Methodist Episcopal Church, South, is located here, and is in quite a flourishing condition. The place is well supplied with merchants and professional men, and has 4 church edifices. The Selma Marion and Memphis R. R. passes through the suburbs of the place. Pop. of v. 1760; of tp. 2400. JOHN G. HARVEY, PUB. "ALABAMA BEACON."

Greensboro', post-v., cap. of Greene co., Ga., on the Georgia R. R., 87 miles from Augusta and 85 from Atlanta. It has a fine brick court-house, 4 churches for whites and 2 for colored, a number of brick stores and residences, male and female schools for whites and 1 for colored, a bank, 1 weekly newspaper, several hotels, a large tanyard, and beautiful fair-grounds and buildings. Pop. 913.

J. IRVING WESTERVELT, ED. "HERALD."

Greensboro', post-tp. of Henry co., Ind. Pop. 1488.

Greensboro', post-v., cap. of Guilford co., N. C., on the North Carolina R. R., 82 miles from Raleigh, and the terminus of the Richmond and Danville R. R., 188 miles from Richmond. It has 4 churches, 2 banks, 2 political and 1 religious paper, about 30 stores, 2 spoke and handle manufactories, employing about 400 men, 1 spoke-factory, 1 saw-mill, a planing-mill, a foundry, an agricultural-machine works, 2 splendid hotels, a Methodist female college with accommodations for 400 pupils, and several smaller schools. The products of the surrounding country are wheat, oats, corn, and fruit. Large quantities of the latter are dried and shipped South. Its mineral products are copper and iron, both being worked profitably. Pop. 497.

P. F. DUFFY, ED. "GREENSBORO' PATRIOT."

Greensboro', post-tp. of Orleans co., Vt., 28 miles N. W. of St. Johnsbury, on the Portland and Ogdensburg R. R. Pop. 1027.

Greens'borough, post-v. and tp. of Caroline co., Md., on the Maryland and Delaware R. R., 61 miles S. S. W. of Wilmington, Del. Pop. of v. 561; of tp. 2473.

Greensborough, post-v., county-seat of Choctaw co., Miss., 110 miles N. by E. of Jackson.

Greensborough, post-v. of Greene co., Pa., in Monongahela tp., has extensive potteries, beds of excellent potters' clay, and remarkable deposits of coal. It is on the W. bank of the Monongahela River.

Greens'burg, post-v., cap. of Decatur co., Ind., 47 miles S. E. of Indianapolis, on the Indianapolis Cincinnati and Lafayette R. R. It has a furniture-factory, a pork-packing establishment, several flouring-mills, 2 carriage-factories, a woollen-mill, a foundry and machine-shop, 2 national banks, 1 fine hotel, and numerous mercantile business-houses. It contains fine stone-quarries, and extensive shipments of stone for business purposes are made. It is the shipping-point for a large agricultural district. It has 2 weekly newspapers. Pop. about 3700.

JAS. C. MCKEE, ED. "STANDARD."

Greensburg, post-v., county-seat of Greene co., Ky., on Green River, here navigable at high water some 200 miles from its mouth. Pop. 351.

Greensburg, post-v., cap. of St. Helena parish, La. It has a Masonic lodge, a temperance hall, and Methodist and Baptist churches. Pop. 160.

R. W. READ, OFFICE MANAGER OF "STAR AND JOURNAL."

Greensburg, tp. and post-v. of Knox co., Mo., 10 miles N. of Edina. Pop. 994.

Greensburg, tp. of Putnam co., O. Pop. 779.

Greensburg, post-b., cap. of Westmoreland co., Pa., 31 miles E. of Pittsburg, on the Pennsylvania R. R. at its junction with the South-western R. R. It has 4 weekly newspapers, 1 national and 2 deposit banks, hotels, stores, churches, etc. Principal business, merchandizing, including shipping grain, wool, coke, and agricultural products generally. It is in a rich agricultural region. Pop. 1642.

J. M. LAIRD & SONS, PUBS. "PENN. ARGUS."

Green Sea, tp. of Horry co., S. C. Pop. 1043.

Green's Fork, tp. of Randolph co., Ind. Pop. 2043.

Green's Grant, a tract of land in Coos co., N. H. Pop. 71.

Green'shank, the *Totanus glottis*, a wading bird of the group known as tatlers, is remarkable for its wide geographic range, being found in Asia, Europe, and North America, but rather rare in the U. S. It is as large as a woodcock, and has a much longer bill and legs.

Green's Mills, tp. of Henry co., Ala. Pop. 816.

Green Snake, a name applied to several harmless serpents of the U. S. *Cyclophis vernalis* is the little green or grass snake, very common throughout a large part of the U. S. *Cyclophis æstivus* is a long, slender tree-snake, of the Southern States, golden-green above, whitish-yellow beneath; the genus to which these belong is rather closely related to *Coluber*.

Greens'pond, a port of entry on an island of the same name N. of the entrance to Bonavista Bay on the N. E. coast of Newfoundland. The island is utterly barren, and soil for gardens has been brought from the mainland. The harbor is small, but safe, and the town is important as a fishing and sealing station. Pop. 1073.

Greens'port, tp. of St. Clair co., Ala. Pop. 548.

Green Spring, a v. of Seneca and Sandusky cos. (p. o. in Seneca co.), O., on the Cincinnati Sandusky and Cleveland R. R., 22 miles S. of Sandusky City. It has a national bank, a newspaper, water-cure, diabetic-cure, a planing-mill, a grist-mill, a hub and spoke factory, and the usual number of stores. Principal business, pork-packing and lumbering. G. E. SWEETLAND, PROP. "GAZETTE."

Green Spring, tp. of Louisa co., Va. Pop. 2018.

Green'stone (*diorite*), a granitoid rock of the hornblende series. In appearance and texture it is much like syenite. It is very tough and of a greenish hue. It is composed of hornblende, mixed with albite or with oligoclase, which are varieties of feldspar.

Green'up, county in the N. E. of Kentucky, bounded on the N. by the Ohio River. Area, 480 square miles. Its surface is broken, but fertile and well timbered. It abounds in excellent coal and in iron ores. Some grain is produced, and iron is manufactured. The county is traversed by a branch of the Lexington and Big Sandy R. R. Cap. Greenup. Pop. 11,463.

Greenup, post-v. and tp. of Cumberland co., Ill., on the St. Louis Vandalia Terre Haute and the Indianapolis R. Rs., about midway between St. Louis and Indianapolis, on the most elevated point of land between the two places. It has 1 weekly newspaper, 3 hotels, 20 places of business, a grist-mill, a woollen-factory, and a well of excellent mineral water. Pop. of v. 535; of tp. 2128.

OZIER & COOPER, PUBS. "MAIL."

Greenup, post-v., cap. of Greenup co., Ky., on the Ohio River, at the terminus of the Eastern Kentucky R. R. It has a bank, a newspaper, mills, an academy, fine public buildings, 4 churches, 9 stores, and 3 hotels. It is situated in an iron manufacturing country, and there are several iron furnaces a short distance from the village. Pop. about 870. G. A. CERUM, OF "INDEPENDENT."

Greenup (COL. CHRISTOPHER), b. in Virginia in 1750; governor of Kentucky 1804–8; was at different times a member of the legislature, and M. C. 1793–97; appointed to the office of clerk of the State senate; an able lawyer. D. at Frankfort, Ky., Apr. 27, 1818.

Green'vale, tp. of Dakota co., Minn. Pop. 725.

Green Val'ley, tp. of Solano co., Cal. Pop. 592.

Green'view, post-tp. of Menard co., Ill., on the Chicago and Alton R. R., 8 miles W. by S. of Mason City. Pop. 373.

Green'ville, county in the N. W. of South Carolina, bounded on the N. by North Carolina. Area, 800 square miles. Its surface is diversified, the soil productive. Cattle, grain, cotton, and wool are the leading products. The county is traversed by the Greenville and Columbia R. R. Cap. Greenville. Pop. 22,262.

Greenville, county in the S. E. of Virginia, bounded S. by North Carolina. Area, 300 square miles. The surface is generally level and well wooded. Tobacco and grain are produced. The county is traversed by the Petersburg and Weldon and the Roanoke Valley R. Rs. Cap. Hicksford. Pop. 6362.

Greenville, post-v., cap. of Butler co., Ala., on the Mobile and Montgomery R. R., 45 miles S. of Montgomery, the capital of the State. It has 2 private banks, 2 colleges (male and female), 6 churches, several large mills, a shingle factory, a boot and shoe factory, 3 hotels, a theatre, numerous business-houses, and 2 newspapers. Principal business, cotton and timber. Pop. 2856.

J. R. THAMES, ED. "SOUTH ALABAMIAN."

Greenville, tp. of Clarke co., Ark. Pop. 749.

Greenville, post-v., cap. of Meriwether co., Ga., 30 miles S. W. of Griffin. It has 12 stores, 3 churches, 2 schools, a female college, and a weekly newspaper. It was founded in 1828, and is noted for the intelligence of its citizens and the wealth of the surrounding country.

W. T. REVILL, ED. "VINDICATOR."

Greenville, post-v. and tp., cap. of Bond co., Ill., 50 miles N. of E. of St. Louis, Mo., on the Vandalia R. R. It has 1 national and 2 private banks, Almira Female College, 4 churches, library association, Masonic, Odd Fellows, and Good Templars' lodges, 1 weekly newspaper, hotels, mills, shops, stores, grain warehouses, hay-presses, etc. Pop. of tp. 1989.

GEO. M. TATHAM, PUB. "GREENVILLE ADVOCATE."

Greenville, tp. of Bureau co., Ill. Pop. 901.

Greenville, post-tp. of Floyd co., Ind. Pop. 1814.

Greenville, post-v., cap. of Muhlenburg co., Ky., on the Louisville Paducah and South-western R. R., 92 miles E. of Paducah.

Greenville, post-tp. of Piscataquis co., Me., at the S. extremity of Moosehead Lake, 32 miles N. W. of Dover. It has good hotels, and manufactures of lumber. Pop. 369.

Greenville, city of Montcalm co., Mich., on the Flat River and the Detroit Lansing and Lake Michigan R. R., 144 miles from Detroit, and the Grand Rapids and Newaygo R. R., 34 miles from Grand Rapids. It has excellent water-power, Flat River being dammed at two points within the city limits, 2 large flouring-mills, 4 saw-mills, 3 planing-mills, 1 woollen-mill, 2 machine-shops, 1 tannery, 2 shingle-mills, 4 churches, 1 national and 1 private bank, 2 weekly newspapers, and public library. It is surrounded by a good farming country, and is a base of supplies for the Flat River lumbering. Pop. 1807.

E. F. GRABILL, ED. "GREENVILLE INDEPENDENT."

Greenville, post-v., county-seat of Washington co., Miss., is 100 miles N. N. W. of Jackson, and on the Mississippi River. It has 1 weekly newspaper and an active trade. Pop. 890.

Greenville, post-v., county-seat of Wayne co., Mo., 150 miles S. E. from Jefferson City, and on the river St. Francis. It has 1 weekly newspaper.

Greenville, former post-tp. of Hudson co., N. J., now merged into Jersey City. Pop. 2789.

Greenville, tp. and post-v. of Greene co., N. Y., is the seat of Greenville Academy. Pop. 2084.

Greenville, tp. of Orange co., N. Y. Pop. 1123.

Greenville, post-v. and tp., cap. of Pitt co., N. C. Pop. of v. 601; of tp. 3838.

Greenville, post-v. and tp., cap. of Darke co., O., on the E. bank of the Greenville Creek, at the crossing of the Dayton and Union and the Pittsburg Cincinnati and St. Louis R. Rs. It has 1 national and 1 private bank, 3 newspapers, 8 churches, a very large union school-house, 1 large furniture manufactory, 2 planing-mills, 3 hotels, 4 clothing stores, 2 book stores, 4 jewelry stores, 5 dry-goods stores, 3 drug stores, 1 brewery, 3 hardware stores, 3 stove and tin stores, and 10 or 12 groceries. Greenville was built as a fort in 1793 by Gen. Wayne, who concluded an important treaty with the Indians here, Aug. 3, 1795, at which 1130 Indians were present. Pop. of v. 2520; of tp. 5688. E. W. OTWELL, ED. AND PROP. "JOURNAL."

Greenville, post-b. of Mercer co., Pa., on the Erie and Pittsburg R. R., at the crossing of the Atlantic and Great Western. It is the terminus of the Shenango and Alleghany R. R., which leads to the coal and oil fields of Western Pennsylvania. It is at the head of the Shenango Valley, and is surrounded by a rich and fertile farming country. It has a rolling-mill and coalworks, and 2 newspapers. Thiel College of the Evangelical Lutheran Church is located here. The town lies on both sides of the Shenango River, which affords abundant water-power. Pop. 1848. HARRY WATSON, ED. "ARGUS."

Greenville, tp. of Somerset co., Pa. Pop. 494.

Greenville, post-v. of Smithfield tp., Providence co., R. I., 12 miles N. W. of Providence. It has 1 national bank and several cotton-factories.

Greenville, post-v. and tp., cap. of Greenville co., S. C., at the terminus of the Greenville and Columbia R. R., and on the Atlanta and Richmond Air-line R. R. It is the seat of the Southern Baptist Theological Seminary, Furman University (which latter institution is to be free of tuition), and a female college. The U. S. court meets annually in Greenville. It is the third city in population and advancement in the State. It contains a large carriage and wagon manufactory, a national bank, 2 weekly newspapers, and 6 churches. Pop. of v. 2757; of tp. 3135.

J. C. BAILEY, ED. "ENTERPRISE AND MOUNTAINEER."

Greenville, post-v., cap. of Hunt co., Tex. It has 1 newspaper.

Greenville, tp. of Outagamie co., Wis. Pop. 1460.

Green'way, tp. of Clark co., Va. Pop. 1570.

Green'wich, parliamentary borough of England, in the county of Kent, is situated on the right bank of the Thames, and contains several establishments for the building of iron steamers and the manufacture of machinery. The two objects of greatest interest, however, are the Royal Observatory, from which the longitude of a place is reckoned on all English charts, and the hospital for old seamen, a splendid building erected by Christopher Wren, and containing 2400 beds. Pop. 167,632.

Greenwich, tp. and post-b. of Fairfield co., Conn. It is the most south-westerly township in the State. The town is finely situated on Long Island Sound and on the New York and New Haven R. R., 31 miles N. E. of New York. It has a savings bank, an insurance company, and is a favorite country residence. Gen. Putnam's daring ride at Horseneck in 1779 took place in this town. Pop. 7644.

Greenwich, post-tp. of Hampshire co., Mass., on the Athol and Enfield R. R., 17 miles S. of Athol. Pop. 665.

Greenwich, post-tp. of Cumberland co., N. J., on Delaware Bay, contains the village of Bay Side, the S. terminus of the New Jersey Southern R. R., 10 miles W. by S. of Bridgeton. Pop. 1262.

Greenwich, tp. of Gloucester co., N. J., on the Delaware River. Pop. 2342.

Greenwich, tp. of Warren co., N. J., on the Central R. R., 5 miles S. E. of Easton, Pa. The township contains several villages. Pop. 2587.

Greenwich, post-v. and tp. of Washington co., N. Y., on the Battenkill River, about 30 miles N. E. of Troy, at the terminus of the Greenwich and Johnsonville R. R. It has a national bank, a newspaper, a union graded school, a foundry, a japanned-ware factory, a knitting-mill, 2 machine-shops, a thread-mill, 5 churches, 3 hotels, several grist and saw mills. Principal business, manufacturing and farming. Pop. of tp. 4030. Ed. "People's Journal."

Greenwich, tp. of Huron co., O. Pop. 881.

Greenwich, tp. of Berks co., Pa. Pop. 2151.

Green'wich Hos'pital, a refuge for old and disabled seamen at Greenwich, England, was founded by William and Mary in 1694, upon the site of a former royal palace. The buildings are very fine, and extend from the Thames to Greenwich Park. It is now under an entirely different phase of existence from that it previously had. A large portion of the pensioners formerly resident there now live with their friends, receiving their pensions for their personal use.

Greenwich Observatory. See Observatory.

Green'wood, county of Colorado, bounded on the E. by Kansas. Area, 6300 square miles. It is a great plain, better adapted to grazing than agriculture, except where irrigation is practicable. It is reported to contain good lignite. The county is traversed by the Kansas Pacific R. R. Cap. Kit Carson. Pop. 510.

Greenwood, county of S. E. Central Kansas. Area, 1155 square miles. It is a rolling and well-watered region. It has an excellent soil and abundance of timber, coal, and building-stone. Grain is the leading product. Cap. Eureka. Pop. 3484.

Greenwood, tp. of Bullock co., Ala. Pop. 3396.

Greenwood, post-v., cap. of Sebastian co., Ark. It has 2 weekly newspapers.

Greenwood, post-tp. of El Dorado co., Cal. P. 557.

Greenwood, tp. of Christian co., Ill. Pop. 776.

Greenwood, post-tp. of McHenry co., Ill. Pop. 925.

Greenwood, tp. of Kossuth co., Ia. Pop. 280.

Greenwood, tp. of Franklin co., Kan. Pop. 1115.

Greenwood, post-tp. of Oxford co., Me., on the Grand Trunk Railway, 10 miles N. W. of Paris. Pop. 845.

Greenwood, tp. of Oceana co., Mich. Pop. 249.

Greenwood, tp. of St. Clair co., Mich. Pop. 898.

Greenwood, post-tp. of Hennepin co., Minn. P. 425.

Greenwood, post-v., cap. of Leflore co., Miss., on the right bank of the river Yazoo, 3 miles below the confluence of the Tallahatchie and Yallabusha rivers. It has 2 churches, a Masonic hall, court-house, jail, 2 hotels, a weekly newspaper, several stores, and a large business in cotton and merchandise. H. T. Martin, Ed. "Valley Sentinel."

Greenwood, post-v. of Jackson co., Mo., on the Missouri Pacific R. R., 18 miles S. E. of Independence. It is the seat of Lincoln College (United Presbyterian).

Greenwood, post-tp. of Steuben co., N. Y., has 4 churches and some manufactures. Pop. 1394.

Greenwood, tp. of Moore co., N. C. Pop. 1523.

Greenwood, post-tp. of Columbia co., Pa. Pop. 1588.

Greenwood, tp. of Crawford co., Pa. Pop. 1782.

Greenwood, tp. of Juniata co., Pa. Pop. 744.

Greenwood, tp. of Perry co., Pa. Pop. 1080.

Greenwood, post-v. and tp. of Abbeville co., S. C., on the Greenville and Columbia R. R., 85 miles W. N. W. of Columbia. Pop. 700; of tp. 2817.

Greenwood, tp. of Vernon co., Wis. Pop. 744.

Greenwood (Francis William Pitt), D. D., b. in Boston Feb. 5, 1797. He grew up under the religious care and teaching of Dr. Freeman, under whose charge the King's Chapel passed over from Trinitarianism to Unitarianism, and on graduating at Harvard College in 1814 studied theology with Dr. Henry Ware, Hollis professor in Cambridge. Immediately after finishing his studies he began his ministry in the New South church in Boston, but remained in it but a single year, a pulmonary attack forcing him to desist. The year of 1820–21 was passed abroad, chiefly in Devonshire, England. Two years after his return were passed in Baltimore. In 1824 he accepted an invitation to become colleague pastor with Dr. Freeman of King's Chapel. Three years later, in 1827, Dr. Freeman retiring from the active ministry, Mr. Greenwood became sole pastor, and, as far as his health would allow, discharged all the duties. In 1837 an attack of hæmorrhage compelled him to make a voyage to Cuba, but his strength was never restored. After a lingering illness, he d. Aug. 2, 1843, in Boston. Dr. Greenwood was a man of refined taste and pure evangelical spirit. He had a strong love for the natural sciences, especially for botany and conchology, and was one of the earliest members of the Boston Society of Natural History. He was a frequent writer for the Unitarian magazines and a contributor to the *North American Review* and the *Journal of Natural History*. His religious writings were pervaded by a spirit of deep piety. His *Sermons of Consolation* and *Sermons to Children* had a great popularity within the sect. He published, besides, *Lives of the Twelve Apostles*, less known, and a *History of King's Chapel*. Two volumes of sermons, prefaced with a memoir by Hon. S. A. Eliot, and a volume of *Miscellanies*, edited by his son in 1846, though not distinguished by intellectual originality, are productions of a beautiful and cultivated mind. O. B. Frothingham.

Greenwood (Miles), b. in Jersey City, N. J., Mar. 19, 1807; emigrated in 1832 to the West, and started upon the Miami Canal the Eagle Iron-works, which soon developed itself into the largest factory of the West. He was one of the originators of the Mechanics' Institute of Ohio, and one of the first to bring the steam fire-engine into use.

Green'wood Cem'etery, in the southern part of Brooklyn, N. Y. (partly in Flatbush), comprises 413 acres, having a surface varied with valleys, lakes, and hills, and is in large part covered with forest trees of natural growth. It was incorporated in 1838. Some of the eminences command extensive and interesting views, and many of the monuments are interesting as works of art. Few enclosures of this character excel Greenwood in size or natural beauty; and the additional charms which landscape-gardening, floral decoration, and costly monumental structures have bestowed combine to render it one of the most beautiful cemeteries in the world.

Green'wood Cen'tre, post-v., county-seat of Crocker co., Ia., on the E fork of Des Moines River.

Greenwood Centre, a v. of Greenwood tp., Steuben co., N. Y. Pop. 100.

Green'wood Planta'tion, tp. of Aroostook co., Me. Pop. 47.

Greer, an unorganized county in the extreme N. of Texas. Area, 3480 square miles. It lies between the forks of the Red River, and doubts have been expressed as to whether it is really a part of Texas, the boundary-line being unsettled. It is reported to be nearly destitute of timber.

Greer, tp. of Warrick co., Ind. Pop. 864.

Greer (James A.), U. S. N., b. in Ohio; entered the navy as a midshipman Jan. 10, 1848; became a passed midshipman in 1854, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866. He commanded the iron-clad Benton at the passage of the Vicksburg batteries on the night of Apr. 16, 1863, where "the squadron was under fire two hours and thirty minutes," and "the enemy lighted up the river on both sides;" in the heavy engagement of five hours' duration with the Grand Gulf batteries on Apr. 27 of the same year; and in all the succeeding operations on the Mississippi River until the fall of Vicksburg, July 4, 1863. In many of the above fights the Benton carried the flag of Rear-admiral Porter, which made her a conspicuous target, and in all of them, according to the official reports, Lieut.-Com. Greer distinguished himself; so that when in 1873 he was chosen by the department to command the Tigress in the search for the missing Polaris, the navy concurred in the wisdom of the selection. Foxhall A. Parker.

Greers'ville, a v. of Knox co., O. Pop. 73.

Gregarin'idæ [from *Gregarina*, the typical genus], a family of microscopic Protozoa, considered, however, by many as extremely low forms of Vermes, or as possibly

Protophytes. They were described and named in 1828 by Léon Dufour. The simple Gregarina seems to be a cell, usually ovate and entozoic, but they are often seen to consist of more than one cell. These examples, however, are considered to be Gregarinæ conjugated for reproductive purposes. They have neither mouth nor intestine, but often have a beak, furnished sometimes with one, two, or many hooklets. The locomotive power is not conspicuous. The reproduction is by the bursting of the conjugated cells and the escape of vesicles sometimes called pseudo-naviculæ; these by alternate generation give rise to pseudo-amœbæ, which finally become Gregarinidæ.

Gregg, county in the N. E. of Texas, bounded S. by Sabine River. It is diversified and very fertile. The county ha been formed since the U. S. census. Cap. Longview.

Gregg, tp. of Morgan co., Ind. Pop. 1041.

Gregg, tp. of Centre co., Pa. Pop. 1636.

Gregg, tp. of Union co., Pa. Pop. 821.

Gregg, tp. of Edgefield co., S. C. Pop. 3200.

Gregg (Andrew), b. at Carlisle, Pa., June 10, 1755; obtained a classical education, and was a tutor in the University of Pennsylvania; became a member of Congress in 1791–1807, and afterwards held the office of U. S. Senator 1807–13; was secretary of state of Pennsylvania in 1820. D. at Bellefonte May 20, 1835.

Gregg (David McM.), b. in Pennsylvania 1833; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of dragoons July, 1855, receiving his full appointment as second lieutenant in September following. After serving a brief time in Jefferson Barracks, Mo., Gregg was ordered to New Mexico, and thence to California, marching there with his command, and continued on frontier duty against hostile Indians, being engaged in numerous actions, up to the outbreak of the civil war. In Mar., 1861, he was promoted to be first lieutenant, and in May following captain 6th Cavalry. In Jan., 1862, he was appointed colonel 8th Pennsylvania Cavalry, which command he led in the Virginia Peninsular campaign (1862), being engaged at Fair Oaks, Seven Pines, and the "Seven Days'" fight. Appointed brigadier-general U. S. volunteers Nov., 1862, he commanded a division of cavalry in the Rappahannock campaign in the raid toward Richmond under Gen. Stoneman; participated in the battle of Gettysburg and subsequent pursuit of Lee's army. In Gen. Grant's Richmond campaign (1864–65) he was actively engaged, and in command of the cavalry corps of that army from Aug., 1864, till Feb., 1865, when he resigned from the army. Brevetted major-general of volunteers for highly meritorious conduct. G. C. Simmons.

Gregg (John I.), b. in Pennsylvania; entered the U. S. Army as first lieutenant 11th Infantry 1847; promoted to be captain, and served during the Mexican war; disbanded Aug., 1848. On the outbreak of the civil war he was chosen colonel of the 5th Pa. Vols., which commission he resigned May, 1861, to accept a captaincy in the 6th U. S. Cavalry; was engaged in various actions in the Virginia Peninsular campaign 1862; appointed colonel 16th Pa. Vols. Oct., 1862, and in command of a cavalry brigade 1863–65, during which time he was engaged in the battles of Gettysburg, Cold Harbor, Deep Bottom (wounded), and the various actions of the Army of the Potomac up to the final surrender of Lee. Three days prior he was taken prisoner, and held till the surrender. For gallant conduct in battle he was brevetted major, lieutenant-colonel, colonel, and brigadier-general U. S. A. and major-general of volunteers; promoted to be colonel 8th U. S. Cavalry July, 1866.
G. C. Simmons.

Gregg (Maxcy), b. at Columbia, S. C., 1814; studied law and admitted to the bar in 1839, arriving at prominence in his profession; in the war with Mexico he served as major 12th Infantry; was a member of the South Carolina State convention in 1860, and of the committee to prepare the ordinance of secession. In the civil war he commanded the 1st S. C. Vols., which on the expiration of its term of service he reorganized; was subsequently made brigadier-general, and constantly and conspicuously in service. Killed at Fredericksburg, Va., Dec., 1862. At the time of his death he was governor-elect of S. C. G. C. Simmons.

Gregg's, tp. of St. Francis co., Ark. Pop. 160.

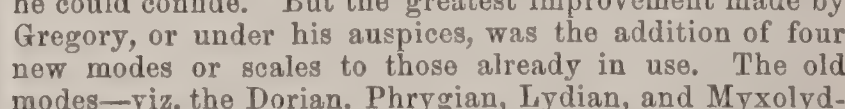
Greg'oras Niceph'orus, b. at Heraclea, in Pontus, probably in 1295; became a priest in Constantinople; went in 1326 as ambassador to the kral (the king of Servia); proposed the reform of the calendar in a treatise (*Paschalium correctum*) still extant, and highly prized for its scientific accuracy; lost his estate on the accession of Andronicus III. (1328); pronounced the eloquent funeral oration of Andronicus I., 1332; opposed Barlaam's theories and Pope John XXII.'s plan of uniting the Eastern and Western churches; and late in life was involved in serious troubles arising from the new doctrines taught by Barlaam. He was alive in 1359, but the time of his death is not known. He was the author of many treatises on many subjects, but the most important of his works is the *Historia Byzantina,* written in a very diffuse style and in a strongly partisan spirit, but valued for the great number of facts it preserves. Not all his works have been printed.

Gregorian Calendar. See Calendar, by F. A. P. Barnard.

Grego'rian Mu'sic. The customary designation of the ancient music of the Church as regulated and improved by St. Gregory the Great, bishop of Rome, in the latter part of the sixth century and the beginning of the seventh. The information which has reached us relative to the music of St. Gregory's times is not only scanty, but obscure and perplexing. The art was then in its infancy. So far as we know, melody existed only in a rude and vague inflection of the voice through the range of a few intervals, while harmony, as now understood, was utterly undeveloped, and was probably confined to an irregular and unsystematic use of the octave, fifth, and third as occasion served. The ancients—as we have incontestable reasons for believing—had no accurate and intelligible system of notation; and for that reason the fragments of their music which we possess are almost as difficult to interpret as the strange and bewildering signs of a newly-discovered language. It has been thought by some that in the early days of the Church the Hebrew chant was brought in by the numerous Jewish converts, and that it became the basis or ruling form of the Church's songs. It is more probable, however, that, as the Church spread far and wide among other races and nations, this element gave way to the adoption of the musical system of the Greeks, as having more affinity with the languages of the Christian liturgies and the musical habits of a people largely composed of Gentiles. Whatever the system was, Jewish, Greek, or a blending of both, it is certain that St. Ambrose, bishop of Milan in the fourth century, found it in so confused and disorderly a condition as to render his interference desirable in the capacity of a musical reformer. Ambrose—who is described as an accomplished musician for his times—appears to have entered upon this work with energy and good judgment, and soon moulded into a more consistent shape the various and conflicting forms which music had assumed in the Church. In doing this he retained and made use of the four original Greek modes or scales—viz. the Dorian, or scale of D, the Phrygian, or scale of E, the Lydian, or scale of F, and the Myxolydian, or scale of G (all formed of the natural notes as they stand, without flats or sharps). These were known as the *authentic* modes, and the chant or ritual-song of the Church was based upon or composed of the elements forming these scales. The ecclesiastical music thus purified and systematized in the Church of Milan obtained the name of the "Ambrosian" chant, and was soon brought into extensive use.

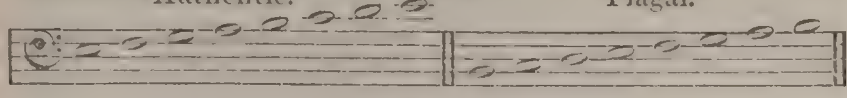
Two centuries later, St. Gregory, who then occupied the papal throne, entered upon a further reform in the music of the Church. It appears that the simplicity and plainness of the Ambrosian chants had been overlaid in the course of time with embellishments of too frivolous, ambitious, and fanciful a character to be congruous with the solemnity of divine worship. These innovations were promptly denounced by St. Gregory, who seems to have had little sympathy with the promoters of what was called figured song, or with the early experimenters in the florid style. He also collected and arranged in a methodical form such fragments of psalmody and ecclesiastical hymns as had been approved by former bishops in whose judgment he could confide. But the greatest improvement made by Gregory, or under his auspices, was the addition of four new modes or scales to those already in use. The old modes—viz. the Dorian, Phrygian, Lydian, and Myxolydian—were called the authentic modes, as already stated; and those now derived from or added to them received the name of *plagal,* relative, or collateral. Each plagal scale was formed by commencing on *the fourth degree below the lowest note* of the corresponding authentic. Thus, as the first authentic mode or scale consisted of D, E, F, G, A, B, C, and D, the octave, its plagal mode would be formed of A, B, C, D, E, F, G, and A. The three other authentic modes were in like manner attended by their respective plagal derivatives—the fourth note of the plagal always corresponding with the first note of the authentic, thus:

Dorian.



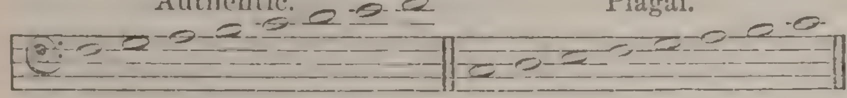
PHRYGIAN.

Authentic. Plagal.



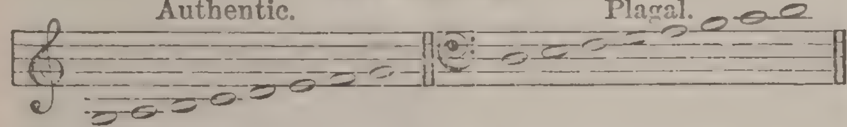
LYDIAN.

Authentic. Plagal.



MYXOLYDIAN.

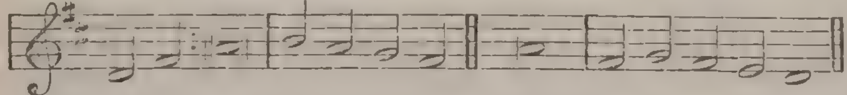
Authentic. Plagal.



These modes, composed of the natural intervals of the diatonic scale, without reference to the position of whole tones and semitones, are (with one exception) more or less imperfect, being neither major nor minor, but each having its own distinctive character as the result, indeed, of that imperfection. Thus, the Dorian has neither F♯ and C♯ to render it a true *major* scale, nor B♭ to form the true *minor*. Melodies, therefore, written on such scales differ considerably in their fitness to express various shades of feeling and sentiment. The Phrygian, *e. g.*, so far resembles our modern minor mode as to possess a certain plaintive and mournful character; the Dorian, though strongly minor in its general cast, is expressive of dignity, grandeur, and solemnity; the Myxolydian, closely approaching our G major, suggests peace, serenity, and joy; while the Lydian, with its irregular fourth occasionally corrected, has the gentle and soothing tranquillity of many modern pieces in F major. These various qualities may, however, be in part attributed to other causes. It has been thought very probable by several modern writers "that as these modes have their names from some Grecian nations, part of the very great effects ascribed to them may have depended on the particular melodies of those nations and their rhythms, more than on the mode in which they were composed; in the same manner as still the national dance-tunes of different countries—*e. g.* a Scotch reel, a polonaise, a Siciliano, etc.—are strongly characteristic merely by their rhythms." (*Kollmann.*)

The music of the Church, as thus modified and settled by St. Gregory, came into general use in the Western Church, and is commonly known as the "Gregorian." In each of the modes, scales, or gamuts (to which another has been added, under the name of irregular or peregrine) short chants or melodies for the psalms were prepared. These are commonly styled Gregorian *tones*, and are distinguished or spoken of as the first, second, or third tone, etc. These psalm-chants consist of two strains each; and the latter of these strains has frequently several terminations, which are called "endings." Of these endings, the first tone has six; the third tone, four; the fourth tone, four; the fifth tone, two; the seventh tone, six; and the eighth tone, two; while the second and sixth tones have each only one ending. Hence, in designating a psalm-chant we say, *e. g.*, "First tone, third ending," etc. In each of these tones or chants a certain note called the *dominant* is more frequently used than the others, and is the reciting note in chanting. Preceding the dominant are two or more short introductory notes called the *intonation*, to be sung by the minister or precentor with the first division of the first verse of a psalm or hymn. The other portions of each strain are the *recitation*, *mediation*, and *cadence*, as in the following example:

Inton. 1st Recit. Mediat. 2d Recit. Cadence.



Gregorian music is still frequently written or printed in ancient character on the old stave of only four lines. Two *clefs* are used—viz. the F clef and the C clef. These are not permanently fixed on certain lines, like the clefs of modern music, but are placed on such lines as will bring the notes of the melody within the compass of the stave, and thus avoid the resort to ledger lines. The notes in use are chiefly three: 1st, the long, a black square (or oblong figure) with a stem; 2d, the breve, a black square without a stem; 3d, the semibreve, a black diamond-shaped note. These notes do not express exact measures of duration, as the ratios of 4, 2, and 1, but are very much dependent for their times on the sentiment and accent of the words sung. In most cases they are simply signs to express in an indefinite way the relations of long, shorter, and shortest. From this it will be readily understood that *rhythm* (as now understood) has no place in Gregorian music. There is no division into bars or measures; nor can music of this kind be brought, without great difficulty, within the limits and form of any regular musical movement.

In an adapted form the psalm-chants or tones (with some other music of the Gregorian school) are in common use in the Anglican Church, modernized, however, so much by the addition of harmony and more or less of rhythmical order, as to be recognizable only by the crudeness of their melodic phrases and the quaintness of not a few of their cadences. WILLIAM STAUNTON.

Gregoro'vius (FERDINAND) was b. at Neidenburg, in the province of Prussia, Jan. 19, 1821; studied theology and philosophy at the University of Königsberg 1838; and began his public career as a literary critic with *Wladislaw aus der Wüste Romantik* (1845), and *Goethe's Wilhelm Meister in seinen socialistichen Elementen* (1849). In 1848 and 1849 he published two minor works in favor of Poland —*Die Idée des Polenthums* and *Polen und Magyarenlieder;* and in 1851 his tragedy, *Der Tod des Tiberius*, and his first historical work, *Geschichte de Römischen Kaisers Hadrian und seiner Zeit.* In 1852 he went to Italy, of whose history, literature, and political and social circumstances he made a comprehensive and penetrating study, and on which he has written several works of great merit—*Corsica* (2 vols., 1854); *Wanderjahre in Italien*, a collection of several minor works (4 vols., 1874); *Die Grabmäler der Römischen Päpste* (1857); and his two most important works—*Geschichte der Stadt Rom in Mittelalter* (8 vols., 1859–72) and *Geschichte der Lucrezia Borgia* (2 vols., 1874).

Greg'ory, county of Dakota, separated from Nebraska on the S. by the rivers Keya Paha and Niobrara, and having the Missouri on the N. E. Area, about 1150 square miles.

Gregory I., POPE, a saint and doctor of the Roman Catholic Church, called GREGORY THE GREAT, a great-grandson of Pope Felix II., was b. at Rome about 540; became a senator, and in 573 a prætor, and soon after entered a monastery and devoted his great wealth to the founding of religious establishments; went as nuncio to Constantinople, and reconciled the emperor to the pope, and in 590 became pope himself; sent missionaries to Sicily, Sardinia, Lombardy, England, etc.; attempted the union of the Eastern and Western churches; strengthened and reformed the papal see; confirmed the celibacy of the clergy; extended greatly the monastic system; was confirmed in his primacy over the other patriarchs by the emperor Phocas; and reformed the liturgy. He has been called the father of the mediæval Church, the inventor of the mass and of the doctrines of purgatory and transubstantiation. Author of numerous works, of which his *Magna Moralia*, his *Homilies*, his *Pastoral*, and the liturgical treatises are the most important. D. Mar. 12, 604.—GREGORY II., SAINT, a Roman of high birth, became a Benedictine, and in 715 became pope; sent Corbinian and Boniface as missionaries to Germany; assumed the government of Rome in 726, and did much to establish the temporal power of the popes; engaged in a famous contest with Leo the Isaurian and the Iconoclasts, whom he anathematized. D. Feb. 10, 731.—GREGORY III., a Syrian, became pope in 731; opposed the Iconoclasts and the Byzantine emperors; assumed the rulership of the exarchate of Ravenna; exacted homage from Charles Martel, and contended with the Lombards. D. Nov. 28, 741.—GREGORY IV., a Roman, became pope in 827, succeeding Pope Valentine; was a grasping and tyrannical prelate; made the feast of All Saints a general one. D. Jan. 27, 844.—GREGORY V., a German, and nephew of King Otho III. His name was Bruno; became pope in 996, when twenty-four years old; treated with great brutality the antipope John XVI.; put Robert, king of France, under a terrible interdict for marrying within the forbidden degrees of consanguinity. D. Feb. 18, 999.—GREGORY VI., ANTIPOPE, assumed the papal title in June, 1012; expelled Benedict VIII., and was himself expelled (Dec. 25, 1012) by the emperor Henry II.—GREGORY VI. (*Johannes Gratianus*), POPE, an arch-priest at Rome, purchased the papal chair in 1044 of Benedict IX., but the latter revived his claim, and Sylvester III. and John XX. were also elected (1044); but Henry III., the emperor, caused all to be deposed, and Clement II. to be elected, 1046. D. at Cologne in the summer of 1048.—GREGORY VII. (*Hildebrand*) was b. at Soana, in Tuscany, probably before 1020, and was a carpenter's son; became a monk at Cluny; was called to the priory of St. Paul, *extra muros*, at Rome, and was the chief adviser of Leo IX., who made him cardinal. Hildebrand assumed at once a commanding position in the affairs of Italy and the Church; repressed the interference of the laity and of the emperors in ecclesiastical affairs; punished simony and licentiousness, and stopped the marriage of the clergy; reformed the convents; restrained the progress of Berengarius's doctrine regarding the Eucharist, with which, nevertheless, it has been thought that Hildebrand sympathized; improved the manner of papal elections so as to prevent bribery (1058); engaged in a quarrel with St. Peter Damian; and in 1073 succeeded Alex-

ander II. as pope, after which he still more actively engaged in his reforms; forbade in 1074 all marriage and concubinage in the clerical ranks; in 1075 summoned a council at Rome which prohibited all lay investitures, although the princes (and in some places the people) had almost universally exercised a suffrage, more or less complete, in this matter. Thus, Gregory, by one of the boldest strokes recorded in history, attempted to cut the Church free from the domination of the German emperors, which a few years before had been absolute and almost unquestioned. Henry IV. thereupon called a diet at Worms, and declared the pope deposed; and in 1076, Gregory retaliated by excommunicating and deposing Henry and plunging Germany and Italy into terrible civil wars. Henry, everywhere overcome, humiliated himself to the earth, and received the papal absolution at Canossa (1077). But when the emperor had recovered sufficient strength, he shut up the pope in the castle of St. Angelo, whence he was released by Robert Guiscard; and Gregory, having for the fourth time excommunicated the emperor, retired to Salerno, where he d. May 25, 1085. Gregory planted the seed which grew into the tree of ultramontanism and overshadowed the whole Church. He was a man of excellent abilities, and his character is in many respects admirable. In its bearing on the destinies of Europe no pontificate was more important than that of Gregory.—GREGORY VIII., ANTIPOPE (*Maurice Bourdin*), a Frenchman, bishop of Coimbra, archbishop of Braga 1110; became papal legate to Henry V. of Germany 1111; was chosen by the emperor in 1118 as pope in opposition to Gelasius II., but was imprisoned, and d. at Fumona in 1122.—GREGORY VIII., POPE (*Alberto de Mora*), was b. at Benevento; became a cardinal in 1135; as papal legate absolved Henry II. for the murder of Becket 1172; elected pope Oct. 21, 1187. D. at Pisa Dec. 17, 1187.—GREGORY IX. (*Count Ugolino* of Legni), a relative of Innocent III., succeeded Honorius III. Mar. 20, 1277. His reign is remarkable for his long and bloody wars with Frederick II. of Germany, whom he four times excommunicated. His *Decretals*, published in 1234, are an important compilation of the canon law. D. Aug. 21, 1241.—GREGORY X. (*Tebaldo Visconti* of Piacenza), chosen pope in 1271; promoted the Crusades; convened the Council of Lyons (1274), and reformed the conclave. D. at Arezzo Jan. 10, 1276.—GREGORY XI. (*Pierre Roger de Montroux*), was b. at Maumont, Limoges, in 1329, of a noble family; became cardinal in 1348, and pope at Avignon Dec. 30, 1370; removed to Rome in 1377; was a pacificator of princes, a violent persecutor of heretics, and a reformer of monasteries; but his pontificate was disgraced by nepotism. D. Mar. 28, 1378.—GREGORY XII. (*Angelo Cornaro*), b. at Venice about 1325; became a cardinal-priest 1405; was elected pope in opposition to Benedict XIII. Nov. 30, 1406; deposed by the Council of Pisa 1409; abdicated his claim at the Council of Constance 1415. D. Oct. 18, 1417.—GREGORY XIII. (*Ugo Buoncompagno*), b. at Bologna Feb. 7, 1502; was a learned doctor of the university, and instructed Alexander Farnese, St. Charles Borromeo, and other eminent men in the law; became cardinal-priest in 1565; succeeded Pius V. May 13, 1572. The great events of this pontificate were the reform of the calendar, the *Te Deum* sung and medal struck in honor of the massacre of St. Bartholomew, the efforts made to spread the Church by missionary operations, and the publication of the *Decretum Gratiani*, with notes by the pope. Gregory was a man of convivial habits, and left a natural son. D. Apr. 10, 1585.—GREGORY XIV. (*Niccolò Sfondrate*), b. at Cremona 1535; became a cardinal 1583; succeeded Urban VII. Dec. 5, 1590. D. Oct. 15, 1591.—GREGORY XV. (*Alessandro Ludovisio*), b. at Bologna Jan. 9, 1554; became a cardinal in 1616; succeeded Paul V. Feb. 9, 1621; reformed the conclave 1621; established the Propaganda 1622; and zealously pushed forward the missionary work. D. July 8, 1623.—GREGORY XVI. (*Mauro* or *Bartolommeo Alberto Capellari*), b. at Belluno Sept. 18, 1765; became in 1814 vicar-general of the Camaldules; cardinal-priest and prefect of the Propaganda 1826; succeeded Pius VIII. Feb. 2, 1831; was active in extending the sway of his Church and in promulgating what are called Ultramontane principles. D. at Rome June 1, 1846, and was succeeded by Pius IX.

Gregory (FRANCIS H.), b. at Norwalk, Conn., Oct. 9, 1789; became a mariner, and in 1809 a midshipman U. S. N., a lieutenant in 1814, a commander in 1828, a captain in 1838, and in 1862 was retired with the rank of rear-admiral. D. at Brooklyn, N. Y., Oct. 4, 1866. He served with distinction under Chauncey in 1812–14 on the lakes; was distinguished in several contests with pirates in the Gulf and in the West Indies; commanded the frigate Raritan during the Mexican war; and was engaged in constructing iron-clads during the war of 1861–65.

Gregory (JAMES), F. R. S., b. at Drumoak, Aberdeenshire, Scotland, 1638; studied at Marischal College, Aberdeen; invented the Gregorian reflecting telescope (see TELESCOPE) when twenty-four years old; published *Optica Promota* in 1663; studied at Padua, and while there published *Vera Circuli et Hyperbolæ Quadratura* (1667), *Geometriæ Pars Universalis* (1668), and *Exercitationes Geometricæ* (1668); was professor of mathematics at St. Andrew's 1668–74, and at Edinburgh 1674–75, where he d. Oct., 1675, at the age of thirty-six. He was the inventor of many new and important mathematical processes, and the correspondent of Newton, Wallis, Huyghens, and other mathematicians of the first order of ability.—His grandson, Prof. JOHN GREGORY, M. D. (1724–1773), was a brilliant author; and Prof. JAMES GREGORY, M. D. (1753–1821), son of the latter, was a professional writer of high authority.—DAVID GREGORY, M. D., F. R. S. (1661–1701), nephew of the first mentioned, was successively mathematical professor at Edinburgh and Savilian professor of astronomy at Oxford. He published able mathematical treatises, and was the friend and associate of Newton.

Gregory (OLINTHUS GILBERT), LL.D., b. at Yaxley, Hunts, Eng., Jan. 29, 1774; became in 1798 a bookseller of Cambridge; in 1801 a master, and 1806–38 professor of mathematics at the Royal Military Academy, Woolwich. D. Feb. 2, 1841. His *Lessons, Astronomical and Philosophical* (1793), was published when he was but nineteen years old. He was also author of several mathematical textbooks, *Letters on the Evidences of Christianity* (1810), *Lives* of J. M. Good and Robert Hall, and was a man of devout religious character.

Greg′ory Nazian′zen, SAINT (*Gregorius Nazianzenus*), one of the Greek Fathers, and a doctor of both the Eastern and Western churches, b. at or near Nazianzus, in Cappadocia, probably about 330 A. D. He was a son of Gregory, bishop of Nazianzus, and of the devout St. Nonna; completed his school-studies at Athens, where he became the associate of St. Basil, his lifelong friend. In 361 A. D. he was ordained a presbyter by his father, but without his consent. After nine years of labor at Nazianzus, varied by retreats with St. Basil to the desert for devotional purposes, by contests with the Arians and with Julian the emperor his school-fellow at Athens, pressed by Basil, he accepted in 372 A. D. the bishopric of Sasima, but remained at Nazianzus his father's coadjutor, and after the latter's death (374) as administrator of the see. He lived (375–379) in retirement at Seleucia, and then went to Constantinople to contend with the Arians and other heretics; and there his eloquence created the most profound effects, and contributed much to the restoration of orthodoxy, then unpopular at the capital. In 380 A. D. Theodosius made him bishop of Constantinople, and in 381 the first œcumenical council of Constantinople confirmed the appointment, although translations from one see to another were then uncanonical; and in consequence of the opposition thus excited he soon resigned and retired to his native town, and in 389 d. at Nazianzus. Gregory was a man of sensitive, retiring disposition, averse by nature to active life, into which, however, he was impelled by conscientious motives. His honesty and piety were perfectly sincere, and in that sincerity lay his power, rather than in great mental qualities. His earnestness often led him to the use of severe language. His learning was great. His sermons, letters, poems, etc. have been often printed. The Benedictine edition of Clemencet (1 vol., 1778; 2d vol., edited by Caillau, 1842) is the best. (See ULLMANN'S *Gregorius von Nazianz*, 1825.)

Greg′ory Nys′sen, SAINT, b. at Cæsarea, in Cappadocia, probably about 331 A. D., a younger brother of St. Basil the Great; was carefully educated, and became a teacher of rhetoric, but a letter (*Epist.* 43) from Gregory Nazianzen caused his return to a clerical life, and in 372 he was consecrated bishop of Nyssa in Cappadocia, and afterwards became one of the pillars of the Eastern Church. D. after 394 A. D. His writings, which fill three volumes, are doctrinal and practical religious treatises, sermons and other addresses, biographies, letters, etc. He is one of the ablest and most learned of the Greek Fathers. A good complete edition of his works is much needed. (See RUPP'S monograph, 1834, and MÖLLER'S essay, 1835.)

Gregory of Tours [originally *Georgius Florentius*], SAINT, b. at Averna (now Clermont), chief city of Auvergne, about 540. He was of a noble Roman family, and after his conversion took the name of Gregory out of regard to his mother's grandfather, the bishop of Langres. About 573 he became bishop of Tours, and d. there Nov. 17, 594 (some say 595). His principal work is *A History of the Franks*, in 10 books, which has earned for him the title of "Father of French history." Other works of his are *Miraculorum Libri Duo*, *Liber de Gloria Confessorum*, *Vitæ Patrum*, *De Miraculis S. Martini*, and *Fragmenta Commentarii in Psalmos*. His Latin is barbarous, and his honesty

is equalled only by his credulity. The best edition of his works is by RUINART, Paris, 1699; reproduced in MIGNE's *Patrologiæ Latinæ*, vol. lxxi., 1858. Of monographs we have, in German, LÖBELL (1839) and KRIES (1839); and in French, DUPUY (1854). (See *Gregor von Tours und Seine Zeit*, J. W. LÖBELL, 2d ed. Leipsic, 1869.)

R. D. HITCHCOCK.

Greg'ory Thaumatur'gus, SAINT, and "wonder-worker," of heathen parentage, and originally called THEODORE, was b. at Neocæsarea, in Pontus, about 210 A. D.; when fourteen years of age lost his father, and became a Christian; in 231 fell under the influence of Origen at Cæsarea, in Palestine, and in 235 went with him from there to Alexandria; was made bishop of Neocæsarea in 244, when there were only seventeen Christians in the place, and d. there in 270, when, as it was said, there were only seventeen persons in the place who were *not* Christians. His biographer, Gregory of Nyssa, relates, in a legendary way, the miracles (chiefly of exorcism) which he was said to have performed. His principal literary work is *A Panegyrical Oration on Origen*, whose peculiar theological opinions he labored to establish in Pontus and Cappadocia. He also wrote *A Metaphrase on the Book of Ecclesiastes*, an important *Confession of Faith*, and some other pieces. The best edition of his works is in MIGNE's *Patrologiæ Græcæ*, vol. x.

R. D. HITCHCOCK.

Greg'ory the Illu'minator [in Armenian, *Lusavoritch*], SAINT, and apostle of Armenia, in regard to whom the old authorities are hardly to be trusted. The story is, that he belonged to the royal family of the Arsacidæ, who nominally ruled Armenia from 149 B. C. to 428 A. D.; that he was born about 258 A. D.; that his father Anak, having assassinated the king, Chosroes I., was put to death with all his family except Gregory, who, when two years old, was taken to Cæsarea, in Cappadocia, where he was brought up in the Christian faith, and whence he returned as a missionary to Armenia about 286 A. D.; that he baptized the king, Tiridates, in 289; that in 302, Leontius of Cæsarea ordained him patriarch of the Armenian Church; that in 331 he retired to a cave, and lived on some years longer, perhaps till 442 A. D. His *Homilies* were published at Constantinople in 1737, and again by the Mechitarists of San Lazaro at Venice in 1837. Many *Prayers* in the Armenian liturgy and thirty *Canons* are also ascribed to him. (See *Hist. of Armenia*, by MOSES CHORENENSIS, written about the middle of the fifth century; *Acta Sanctorum*, Sept. viii. pp. 295–413; and REV. S. C. MALAN's *Life and Times of S. Gregory the Illuminator, translated from the Armenian*, 1868.)

R. D. HITCHCOCK.

Greifen'berg, town of Prussia, in the province of Pomerania, on the Rega. It has manufactures of linen and leather. Pop. 5617.

Greif'enhagen, town of Prussia, in the province of Pomerania, on the Regliz. It has large cloth manufactures and distilleries. Pop. 6134.

Greifs'wald, town of Prussia, in the province of Pomerania, on the Ryk, near its mouth. It has a university and several other educational institutions, large salt-works, and manufactures of soap, oil, leather, and paper. Pop. 17,208.

Greig, post-tp. of Lewis co., N. Y., has manufactures of leather, lumber, paper, paper-pulp, and other articles. It has a wooden railroad 7 miles long, and abundant water-power. Pop. 2638.

Grei'ner (JOHN), b. at Philadelphia, Pa., Sept. 14, 1810; removed to Ohio; became distinguished as a temperance orator, and wrote popular Whig electioneering songs; State librarian 1845–51; Indian agent 1851–52; acting governor of New Mexico 1852; was a successful journalist of Columbus and Zanesville, O.; receiver in the U. S. land-office, Santa Fé, N. M., 1861–62; sub-treasurer there 1862–66. D. at Toledo, O., May 13, 1871.

Greiz, a town of Central Germany, the capital of the principality of Reuss-Greiz, on the White Elster. It is the residence of the sovereign prince, and has a fine palace surrounded by beautiful gardens. It has considerable manufactures of woollens, and large breweries and distilleries. Pop. 11,582.

Grena'da, an island in the West Indies, a colony of Great Britain, situated between lat. 11° 58′ and 12° 30′ N., and lon. 61° 20′ and 61° 35′ W. Area, 133 square miles. It is 21 miles long and 12 broad. Pop. 37,684. It is of volcanic origin and very mountainous, the highest peaks rising to an elevation of 3000 feet; but it is very beautiful and fertile; cotton and sugar are the principal productions. The chief towns are St. George (the cap.) and St. Mark.

Grenada, county of N. Central Mississippi. Area, 375 square miles. The soil is fertile. Corn and cotton are produced. The county is traversed by the Mississippi Central and the Mississippi and Tennessee R. Rs. Cap. Grenada. Pop. 10,571.

Grenada, city, cap. of Grenada co., Miss., at the former head of navigation of the Yallabusha River, and at the junction of the New Orleans St. Louis and Chicago and the Mississippi and Tennessee R. Rs., the latter extending to Memphis. It has 6 churches, 2 hotels, 2 newspapers, 50 stores, grist, flour, planing, lumber, and rolling mills, and is an important business centre. It is compactly built, and the population has greatly increased since the census. Pop. 1887. J. A. SIGNAIGO, ED. "SENTINEL."

Grenade [Sp. *granada*, a "pomegranate"], a small shell, usually of iron, charged with powder and thrown into a mass of attacking troops by the garrison. They have a straight fuze, and are thrown by hand or rolled into the trench by a wooden trough or spout. They were formerly fired from a musketoon.

Grenadier' [once the name of a soldier who hurled grenades], in some armies a soldier of the first company of a battalion of foot-troops. Grenadiers are chosen for their tall stature and fine appearance. The first regiment of British foot-guards is called the Grenadier Guards.

Grenadines, or **Grenadilles,** a group of small islands in the West Indies, belonging to Great Britain and extending from Grenada to St. Vincent. The largest are Carriacou and Beguia. Total pop. 3000.

Grenard', tp. of Iroquois co., Ill. Pop. 541.

Gren'nell (GEORGE), LL.D., b. at Greenfield, Mass., Dec. 25, 1786; graduated at Dartmouth 1808; became a lawyer 1811; prosecuting attorney of Franklin co., Mass., 1820–28; State senator 1824–27; in Congress 1829–39; probate judge 1849–53; and afterwards clerk of the courts at Greenfield. He was the first to propose in Congress the recognition of the independence of Hayti.

Grenoble [anc. *Gratianopolis*], town of France, in the department of Isère, on both sides of the Isère, which is crossed by two beautiful bridges and confined within elegant quays. Grenoble is fortified, and celebrated for its manufactures of gloves, liqueurs, brandies, and perfumes. It is a bishop's see. Pop. 42,660.

Gren'ville, county of Ontario, Canada, bordering on the St. Lawrence, and for judicial purposes united with Leeds co. Area, about 500 square miles. It is traversed by the Grand Trunk and the St. Lawrence and Ottawa Railways. Chief town, Prescott. Pop. of Leeds and Grenville cos., including Brockville, 57,912.

Grenville, post-v. and tp. of Argenteuil co., Quebec, Canada, on the Ottawa River, at the head of the Longue Sault Rapids and the Grenville Canal. (See CANALS OF CANADA, by A. J. RUSSELL, C. E.) Pop. of sub-district, 2223.

Grenville (GEORGE), b. Oct. 14, 1712; went first to Parliament in 1741; treasurer of the navy 1754; was a secretary of state 1762; first lord of the admiralty 1762; first lord of the treasury and chancellor of the exchequer 1763–65; introduced the plan for taxing the colonies, and is reputed the author of the Stamp Act; was an able statesman, but, according to Whig authorities, was the head of the worst administration Great Britain ever knew. Author of *Considerations on Commerce and Finances* (1767) and other writings. D. Nov. 24, 1770.

Grenville, or **Granville** (Sir RICHARD), a relative of Sir W. Raleigh, b. 1540; went in 1556 to fight the Turks in Hungary; entered Parliament, was knighted, and made high sheriff of Cornwall 1571; assisted Raleigh in planting the Roanoke colony 1585; vice-admiral 1591; attacked a Spanish fleet of 53 vessels with only 5 ships; sunk 4 ships, and after being twice wounded was taken prisoner, and d. soon after (1591).

Greppo (LOUIS), b. at Pouilly, near Lyons, Jan. 8, 1810, was brought up as a silk-weaver, and elected a representative for Lyons in 1848, in the national assembly, where he was the advocate of the most ultra-socialist doctrines. He was arrested on the *coup d'état* of Dec. 2, 1851, and banished from France, but he returned after the proclamation of a general amnesty in 1860. Greppo was elected again after the fall of the empire.

FÉLIX AUCAIGNE.

Gresh'am (Sir THOMAS), b. in London 1519; was apprenticed to his uncle, a wealthy mercer, and then studied at Gonville Hall, Cambridge; succeeded his father as manager of Henry VIII.'s finances; became king's factor at Antwerp 1552; was knighted 1559; founded the Royal Exchange, London (opened 1570), and the Gresham College, London, which has lectureships on physic, divinity, geometry, astronomy, music, law, and rhetoric. He also founded eight almshouses and many other charities. D. in London Nov. 21, 1579.

Gret'na Green, a v., or rather a farmstead, in Dumfries-

shire in Scotland, near the English frontier, acquired at one time quite a curious celebrity. The English law acknowledges the validity of a marriage if it is contracted in accordance with the laws of the country in which it has taken place. Now, the Scotch law simply demanded that the mutual declaration of marriage shall be exchanged in presence of a witness, and thus it became fashionable for young couples in England, to whom it was not convenient to await the consent of their parents, the publication of banns, etc., to run away to Gretna Green, and declare their marriage in the presence of the owner of the farm, who was a blacksmith. On account of later changes in the English and Scotch marriage laws this custom has now died out.

Greuze (Jean Baptiste), b. at Tournus, in Burgundy, Aug. 21, 1725; studied first with Graudon (or Gromdon) at Lyons; afterwards at Paris and at Rome. He was a genre-painter of domestic scenes or incidents of affection, and as such became an associate of the French Academy in 1755; but being elected a member in 1769 as a genre-painter, his single historical piece, *Severus Reprimanding his son Caracalla* (now in the Louvre), being disregarded, he resented the insult and retired from the Academy. D. in Paris, Mar. 21, 1805. The best known works of Greuze are *The Village Bride, The Broken Pitcher, The Little Girl with the Dog,* which engravings have made familiar. His pictures are in great demand with connoisseurs, and command high prices, the *Girl and Dog* having been sold in London in 1832 for $3125. The charm of his pieces is in their color, the grace of the grouping, the naturalness of the expression, and their sensibility.

O. B. Frothingham.

Greville (Robert Kaye), b. at Durham, England, in 1794; became renowned as a cryptogamic botanist. Author of *Scottish Cryptogamic Flora* (6 vols., 1822–28), a work of the first authority; *Flora Edinensis* (1824); *Algæ Britannicæ* (1830); and was joint author with W. J. Hooker of the splendid *Icones Filicum* (1829–31). D. at Edinburgh June 4, 1866.

Grévy (François Paul Jules), b. at Mont-sous-Vaudrez, department of Jura, Aug. 15, 1813; was a student in law when he took an active part in the three days' fight of the revolution in 1830. During the reign of Louis Philippe he often pleaded in political cases, especially for two friends of Barbas in 1839. Grévy was elected representative to the national assembly in 1848, and, without acting with the ultra-radicals, still sat on the benches of the Montagne. Under the empire, he was elected *bâtonnier* or president of the lawyers' corporation of Paris, and was sent as deputy to the Corps Législatif by the department of Jura. He acted there as a moderate republican, which character he maintained after the revolution of 1870, when he was elected again to the national assembly. Félix Aucaigne.

Grey, county of Ontario, Canada, S. of Georgian Bay. Area, 2321 square miles. Cattle, grain, and timber are produced. There are North and South ridings. Cap. Owen Sound. Pop. 59,395.

Grey, tp. of Pulaski co., Ark. Pop. 704.

Grey (Charles), second earl, b. at Fallowden, Northumberland, England, Mar. 13, 1764; was educated at King's College, Cambridge; entered Parliament as a Whig 1789; was one of the managers of the Hastings trial; was an early friend of parliamentary reform; opposed the Irish union 1799; became (as Lord Howick) first lord of the admiralty 1806, and soon succeeded Fox as secretary of foreign affairs; carried the bill for abolishing the slave-trade 1806; and being defeated in the measure for abolishing the oath which kept Roman Catholics from the holding of commissions in the army and navy, he dissolved the cabinet; took the title of Earl Grey 1807; long led the Reform party in opposition; was again premier in 1830–32 and 1832–34. The great event of his last administration was the passage of the Reform Bill of 1832. D. at Howick House, Northumberland, July 17, 1845.

Grey (Sir George), D. C. L., LL.D., K. C. B., b. at Lisburn, Ireland, in 1812; educated at Sandhurst Military College, and entered the army, from which he soon after retired, and in 1839 accompanied an exploring expedition to Australia, receiving the appointment of governor of South Australia in 1841, which position he held till appointed governor of New Zealand in 1846; his abilities in this capacity being acknowledged in 1848 by the bestowal of the title of K. C. B., and in 1854 by his advancement to the governorship of the Cape of Good Hope, returning, however, at the request of his government, to New Zealand in 1861, where he contributed to the suppression of the insurrection. In 1867 he returned to England. Among his published works are *Journals of Discovery in Australia* (1841); *Polynesian Mythology and Traditions of New Zealand* (1855); *Proverbial Sayings of the Ancestors of the New Zealand Race* (1858). G. C. Simmons.

Grey (Sir George), Bart., G. C. B., M. A., b. at Gibraltar May 11, 1799; graduated with honors at Oriel, Oxford; was called to the bar at Lincoln's Inn 1826, and came to the baronetcy 1828; entered Parliament 1832; under-secretary for the colonies 1834 and 1835–39; judge-advocate-general 1839–41; chancellor of the duchy of Lancaster 1841 and 1859–61; home secretary 1846–52, 1855–58, and 1861–66; colonial secretary 1854–55; was made privy councillor 1839, and G. C. B. 1849.

Grey (Henry George), third earl, b. Dec. 28, 1802; was educated at Cambridge; entered Parliament 1826, and in the same year was called to the bar; was under-secretary for the colonies 1830–33; under-secretary for the home department 1834; was sworn of the privy council 1835; secretary at war 1835–39; came to his title 1845; colonial secretary 1846–52; has been lord lieutenant of Northumberland since 1847; received the Garter in 1863, and the grand cross of SS. Michael and George 1869. Author of *The Colonial Policy of Russell's Administration* (1853), *Essay on Parliamentary Government* (1858).

Grey (Lady Jane), daughter of Henry Grey, duke of Suffolk, and great-granddaughter of Henry VII. in the female line, b. at Bradgate, Leicestershire, 1537; married Lord Guildford Dudley, son of the duke of Northumberland, in 1553, having already, under the tutelage of Ascham and Aylmer, bishop of London, acquired a good knowledge of Greek, Latin, French, and Italian, and such proficiency in the Oriental languages as caused her to be regarded as a prodigy of learning, while her piety and excellence of disposition were equally remarkable. Edward VI., persuaded by Lady Jane's father and father-in-law, had set aside the claims of his sisters and declared Lady Jane his successor. Accordingly, after much persuasion, she reluctantly assented, and was proclaimed queen July 10, 1553. Ten days later Queen Mary was proclaimed, and Lady Jane and her husband were confined in the Tower. Nov. 30 she was tried for treason at the Guildhall, and pleaded guilty, and on Feb. 12, 1554, she and her husband were beheaded, chiefly, it is believed, on account of the fact that Suffolk had rashly taken arms against Queen Mary in his daughter's behalf.

Grey (Zachary), LL.D., b. in Yorkshire, England, 1687; was educated at Jesus College and Trinity Hall, Cambridge; became an Anglican clergyman; d. at Ampthill Nov. 25, 1766. Chiefly remembered for his edition of *Hudibras*, with copious notes (1744–52), and his valuable *Examination of Neal's History of the Puritans* (1736–39). He also wrote a *Defence of Ancient and Modern Historians* (1725–30), *The Ministry of Dissenters Null and Void* (1725), and many smaller works, chiefly violent polemics.

Greyfriars. See Franciscans.

Grey'hound, a remarkable variety, or group of varieties, of the domestic dog, distinguished chiefly by slender, graceful build, quick sight, and great speed in the chase. In other points there is much lack of uniformity. For example, in India there are long-haired and even shaggy greyhounds, while China and Turkey have breeds with no hair, or next to none. Scotland, Ireland, and Russia have stocks of the greyhound which are keen of scent, but most greyhounds are very deficient in this respect, and follow the game by sight alone. Some strains are of very large size and treacherous disposition, while the little Italian greyhound is a gentle household pet. While the celebrated dog Gelert, a greyhound whose mythus is found in the folk-lore of several nations, was a most faithful servant, with but few exceptions his modern representatives are unintelligent, and do not attach themselves strongly to any master. The greyhounds of the present day are descendants of a long line of clearly-marked ancestry. Celtic, Teutonic, Latin, Greek, Persian, Indian, Egyptian, and Chinese literature and tradition testify to the antiquity of the race, which has of late been much modified by crossing with other breeds.

Grey'lock, the highest point of land in Massachusetts, is in the town of Adams, Berkshire co. It is the principal eminence of Saddle Mountain. Its height is 3505 feet. The sides of Greylock are covered with forests.

Grey Nuns. See Charity, Sisters of.

Grey'town, or **San Juan de Nicaragua,** a seaport of the Mosquito Territory, Nicaragua, Central America, on the river San Juan; lat. 10° 55′ N., lon. 83° 43′ W.

Grid'ley, post-v. and tp. of McLean co., Ill., on the Toledo Peoria and Warsaw R. R. It has 3 churches, 2 elevators, 1 school-house, primary and grammar school, 8 stores, and 12 other places of business of various kinds, and 2 weekly newspapers. Pop. of tp. 1709.

Geo. W. Kent, Ed. "Gridley Monitor."

Gridley (Charles V.), U. S. N., b. in Indiana; graduated at the Naval Academy in 1863; became a master in 1866, a lieutenant in 1867, a lieutenant-commander in 1868; served in the Oneida at the battle of Mobile Bay (Aug. 5, 1864), and is thus favorably mentioned in the official report of the executive officer of that vessel: "The conduct of Acting Ensign Charles V. Gridley is beyond all praise. He had charge of the master's division, and assisted in conning the ship from the top-gallant forecastle."

Foxhall A. Parker.

Gridley (Jeremy), brother of Richard, b. at Boston, Mass., Mar. 10, 1702; graduated 1725 at Harvard; became distinguished as a lawyer, scholar, and occasional preacher; was attorney-general of Massachusetts, distinguished for his opposition to James Otis; was nevertheless highly respected for his patriotism and virtue. D. at Brookline, Mass., Sept. 10, 1767.

Gridley (Maj.-Gen. Richard), b. at Canton, Mass., 1711. He was chief of the corps of engineers in the reduction of Louisburg in 1745; was raised to the position of colonel of infantry in 1755; was instrumental in planning the fortifications around Lake George. In compensation for his services rendered at the taking of Quebec, the British government presented him Magdalen Island, with half-pay, which remained permanent through life; was wounded at Bunker's Hill, and appointed major-general by the provincial Congress Sept. 20, 1775. D. at Stoughton, Mass., June 20, 1796.

Grier (Robert), b. in Columbia co., Ga., 1779, was famous in Georgia, South Carolina, North Carolina, and Alabama as an almanac-maker for nearly half a century. The *Grier Almanac* is still published. D. May 4, 1848.

Grier (Robert Cooper), b. in Cumberland co., Pa., Mar. 5, 1794; graduated from Dickinson College in 1812; was taught classics by his father, who was a thorough scholar and clergyman; commenced the study of law in 1815; was the recipient soon of a large practice. In 1846 Pres. Polk appointed him one of the justices of the U. S. Supreme Court. D. at Philadelphia Sept. 26, 1870.

Grier (William N.), b. in Pennsylvania in 1813; graduated at the U. S. Military Academy 1835, and appointed a brevet second lieutenant of dragoons in the army, receiving his full commission the following year. Prior to the civil war his service was almost constant with his regiment on the frontier, being frequently engaged with hostile Indians. On the outbreak of war, Grier, then a major, was assigned to duty with the Army of the Potomac as acting inspector-general, but in the Virginia Peninsula campaign of 1862 commanded his regiment. In 1863 he was appointed chief mustering and disbursing officer of the State of Iowa, on which duty he continued till 1865, when he was appointed to similar duty in Pennsylvania. In 1870 he retired from active service. G. C. Simmons.

Gri'erson (Benjamin H.), b. at Pittsburg, Pa., July, 1837; removed at an early age to Ohio, and subsequently to Illinois. During the civil war he served on the staff of Gen. Prentiss; was major, subsequently colonel, 6th Illinois Cavalry; appointed brigadier-general of volunteers in 1863, and major-general 1865. His services as a cavalry leader were conspicuous, as such conducting many important and successful operations, raids, expeditions, etc. In July, 1866, he was selected as colonel of the 10th U. S. Cavalry, which position he still retains. G. C. Simmons.

Gries'bach (Johann Jakob), was b. at Butzbach Jan. 4, 1745; studied theology at the universities of Tübingen, Halle, and Leipsic; travelled in 1769 and 1770 through Holland, England, and France, and was appointed professor in theology at the University of Jena in 1776; which office he held till his death, Mar. 24, 1812. After finishing the ordinary course of theology, he devoted himself almost exclusively for many years to critical researches concerning the texts of the books of the New Testament, the result of which was his edition of the New Testament (Halle, 1775–77), which, properly speaking, was the first critical edition ever given, and which has been reprinted since in many editions. His works on other theological subjects are of less importance, though his *Populäre Dogmatik* (1779) reached four editions.

Grif'fenfeld (Peter) was born at Copenhagen, Denmark, in 1635. He was the son of a wine-dealer, and his family name was Schumacher. He early came into the service of Bishop Swane as private secretary; and as Swane played a very conspicuous part in the Danish revolution of 1660, by which the power of the nobility was broken and the constitution of the kingdom changed into an absolute monarchy, a way was thus opened for the talent and ambition of the young Schumacher. The bishop recommended him to the king, Frederick III., who employed him in several responsible positions in the government offices. He was the author of *Lex Regia Danica*, promulgated Nov. 17, 1665. On his deathbed Frederick III. said to his son and successor, concerning Schumacher: "Give him power, but do it slowly;" but it was not in the character of Christian V. to do anything slowly. In the same year he became king (1670) Schumacher was ennobled under the name of Griffenfeld; in 1673 he was made a count and chancellor of the realm; in 1674, president of the supreme court and chancellor of the university. The king had great confidence in him, and his talents were noticed and respected at the courts of France and England. But his policy was in utter opposition to that of the court, and even to that of the king. The dynasty of Oldenburg, descending from Germany, always marrying into German families, and often holding German possessions, or at least claims of succession, never became truly Danish. It wished to take rank among German sovereigns and to make Denmark a German power. The personal sympathy of the individuals and the traditional ambition of the family centred in Germany. Now, the king wished to wage a war, for war belonged to the dignity of a king, as hunting to that of a nobleman; and the war had to be made in close alliance with the German powers, and against Sweden. Griffenfeld objected that Denmark was too exhausted to carry on a war with any degree of vigor; that Sweden was Denmark's only natural ally, with which it would be foolish to quarrel; and finally, that at this moment Sweden was too powerful, on account of its alliance with France, to be attacked with any prospect of success. He was overruled, and war was declared against Sweden. He then proposed to attack those provinces on the other side of the Sound which Sweden had taken from Denmark in 1660, and whose population still clung to Denmark with great affection; while the king and the court liked better to attack Pomerania and the other possessions which Sweden had held in Germany since the Thirty Years' war. He was overruled in this too; and it was easy to foresee that a minister so utterly in opposition to the instincts and traditions of an absolute monarch would not keep his place for a long while, the more as he was himself rather haughty and incautious. One day in 1676 he fell out with the king, and the courtiers hastened to have him bereft of his honors and put in prison. Some days after the king missed him badly, and the alarmed courtiers had him sent 1000 miles away, to Munkholm, a lonely rock-fortress in the fiord of Trondhjem. The king soon forgot him, and he remained imprisoned for twenty-three years. D. May 11, 1699, a martyr for common sense, the victim of a whim. Clemens Petersen.

Grif'fin [Gr. γρύψ], a fabulous monster, having the body and legs of a lion, joined to the back, wings, and often the feet of the eagle. It was believed, indeed, to be the offspring of the eagle and the lion. Learned writers, even after the revival of European learning, asserted its existence. Aristeas, a very ancient Greek poet, is credited with being the first to mention the griffin. Watchfulness, swiftness, and strength were its most marked characters. It is a common heraldic bearing.

Griffin, tp. of Conway co., Ark. Pop. 458.

Griffin, tp. of Pope co., Ark. Pop. 479.

Griffin, post-v., cap. of Spalding co., Ga., 40 miles S. of Atlanta, on the Macon and Western division of the Central R. R. It has 1 national bank, 2 savings banks, 2 daily newspapers, 7 churches, male and female colleges, free schools, 1 furniture-factory, and 1 carriage manufactory. A mineral spring of sulphur water has recently been discovered. It is a summer resort for planters of South-western Georgia. Principal business, cotton. The annual receipts vary from 25,000 to 45,000 bales. Pop. of district, 3421. A. M. Speights, Ed. "Daily News."

Griffin (Charles), b. in Ohio 1826; graduated at West Point 1847; entered the army as brevet second lieutenant of artillery, and served in the war with Mexico 1847–48; became a second lieutenant in Oct., 1847, and first lieutenant June, 1849, serving on frontier duty and against hostile Indians. Appointed captain in 1861, he served during the civil war at the first battle of Bull Run, being brevetted major for gallant conduct. Promoted to be brigadier-general of volunteers June, 1862, he commanded a brigade in the Virginia Peninsular campaign, and distinguished himself at Yorktown, Gaines's Mill, Malvern Hill, etc., and subsequently in the second battle of Bull Run and at Antietam. In the Rappahannock campaign he commanded a division at the battle of Fredericksburg, Dec., 1862, at Chancellorsville, May, 1863, and at Spottsylvania, assault and siege of Petersburg, and the various battles of the final campaign, 1864–65. For conspicuous gallantry in this latter campaign he was brevetted major-general of volunteers. Placed in command of the 5th army corps Apr. 1, 1865, he was appointed one of the commissioners to carry out the terms of the surrender of Gen. Lee at Ap-

pomattox Court-house Apr. 9, 1865. Being mustered out of the volunteer service Mar., 1866, he was in July following appointed colonel 35th Infantry, and commanded military districts in Texas and Louisiana. D. at Galveston, Tex., Sept. 15, 1867. G. C. SIMMONS.

Griffin (CYRUS), b. in Virginia 1749; educated in England, and became connected with a noble family there by marriage; a member of the Virginia legislature; member of the old Congress in 1778–81 and 1787–88, and became its president in 1788; elected president of the supreme court of admiralty; held the office of judge of the U. S. district court for Virginia from 1789 until his death, which occurred at Yorktown, Va., Dec. 14, 1810.

Griffin (EDWARD DORR), D. D., a pulpit-orator of commanding power, was b. at East Haddam, Conn., Jan. 6, 1770; graduated at Yale 1790; was settled at New Hartford, Conn., from 1795 to 1801, at Newark, N. J., from 1801 to 1809; was professor of sacred rhetoric in Andover Seminary from 1809 to 1811; was settled in Boston, Mass. (Park Street church), from 1811 to 1815; at Newark again from 1815 to 1821; was president of Williams College from 1821 to 1836; and d. at Newark, N. J., Nov. 8, 1837. He published several works, the most noted of which is a *Course of Lectures in Park Street Church* (1813). Sixty of his sermons, with a biography prefixed, were published in 2 vols. by Dr. William B. Sprague in 1838. R. D. HITCHCOCK.

Griffin (EZRA LEONARD), M. D., b. at Hillsboro', N. H., Sept. 21, 1821; educated at Dartmouth College; took his medical degree (1848) at Berkshire Medical College, Pittsfield, Mass.; removed to Fond du Lac, Wis.; became in 1875 pres. of Fond du Lac County Medical Society, and in 1873 vice-president of the State Medical Association. Author of professional papers, biographical memoirs, etc.

Griffin (GERALD JOSEPH), b. at Limerick, Ireland, Dec. 12, 1803; went in 1823 to London with a view of becoming a dramatist, but the failure to dispose of his tragedies *Aguire* and *Gisippus* obliged him to become a writer for periodicals. His *Holland Tide* (1826); *Tales of the Munster Festivals* (1827); *The Colleen Bawn* (1828); *The Invasion; The Rivals; The Duke of Monmouth,* and other novels were very successful and meritorious works. He also published some good poetry. In 1838 he became a postulant of the Christian Brothers, and took the name of Brother Joseph. D. at the North Cork monastery, Ireland, June 12, 1840. His *Life* has been written by his brother.

Griffin (GILDEROY W.), A. M., PH. D., b. in Louisville, Ky., Mar. 6, 1840; was educated at the University of Louisville; and in 1861 was admitted to the practice of law, and after some years of professional labor became one of the editors of the Louisville *Industrial and Commercial Gazette,* and was for a time literary and dramatic critic on the staff of the Louisville *Journal.* Mr. Griffin published in 1869 a biographical sketch of G. D. Prentice; edited the subsequent revised edition of *Prenticeana,* in which he wrote the *Life* of Prentice, which he afterwards rewrote and enlarged; was U. S. consul at Copenhagen 1871–74. Author of a *Life of C. S. Todd* (1873); *Danish Days* (1874); *A Visit to Stratford* (1875); has contributed largely to periodical literature, and delivered a lecture upon literary and other subjects; is a fellow of the Royal Society of Antiquaries, Copenhagen.

Griffin (HAMILTON), M. D., b. at Louisville, Ky., Sept. 21, 1832; was educated at South Hanover College, and took his medical degree at the University of Louisville, 1857; became a fellow of the College of Physicians and Surgeons 1858; professor of materia medica and therapeutics in Baker University, Leavenworth, Kan., 1859; surgeon in the Confederate service 1862–65; resumed practice at Louisville 1865; became in 1873 one of the physicians of the city hospital. Author of *Lectures on Materia Medica and Therapeutics* and many scientific papers.

Griffith (WALTER SCOTT), b. in New York City July 22, 1808; removed in early youth to Western New York; entered business-life in Rochester, where he became a successful wholesale merchant; assumed in 1842 the extensive but embarrassed forwarding business of his father, and removed to New York; was the founder and first president (1860–72) of the Home Life Insurance Co. of Brooklyn, N. Y.; director in various savings banks of Brooklyn; was for some years secretary of the Prospect Park commission; a useful and influential member of the State legislature and the New York Chamber of Commerce, of which in 1870 he became second vice-president; was prominent in the work of the Christian Commission, the American Board of Commissioners for Foreign Missions, and various other benevolent and business enterprises. D. at Brooklyn, N. Y., Nov. 23, 1872.

Grif'fith (WILLIAM), b. in England in 1810; studied at the London University; went to India in 1832 as an assistant surgeon; was a government collector of plants and birds in Tenasserim, Assam, Bootan, Afghanistan, and Malacca, where he d. Feb. 9, 1845. The name *Griffithia* has been given to a genus of rubiaceous plants.

Grif'fitts (SAMUEL POWELL), M. D., b. at Philadelphia, Pa., July 21, 1759; graduated from the College of Philadelphia, and pursued the study of medicine abroad for three years; returned to Philadelphia and commenced practice; was chosen vice-president of the College of Physicians in 1817, and held that office until his death; became professor of materia medica in the University of Pennsylvania from 1792–96. He rendered efficient aid during the terrible pestilence of 1793 and the epidemics of 1797–99, 1802, and 1805; and was instrumental in relieving the suffering and wants of the French immigrants from St. Domingo in 1793–94. Author of several articles on hygiene, etc. D. at Philadelphia May 12, 1826.

Griggs, tp. of Van Buren co., Ark. Pop. 593.

Griggs'ville, post-v. and tp. of Pike co., Ill., 30 miles E. of Hannibal, 4 miles W. of the Illinois River, on the Hannibal and Naples R. R. It has a national bank, a newspaper, a public library of about 2000 volumes, a carriage and wagon manufactory, 1 large flouring-mill, 1 harrow and 1 plough manufactory, 3 churches, 2 large hotels, 1 wholesale dry-goods house, 15 stores, a good school, and a silver-plating manufactory. Pop. of v. 1456; of tp. 2645.
B. L. STROTHER, ED. "THE GRIGGSVILLE REFLECTOR."

Grigorio'pol, town of Russia, in the government of Kherson, on the Dniester, was founded by a colony of Armenian settlers in 1793, who are mostly engaged in the cultivation and manufacture of silk. Pop. 6477.

Grig'sby (HUGH BLAIR), LL.D., b. at Norfolk, Va., 1806; became chancellor of William and Mary College in 1871. He held the position of member of the Virginia Convention of 1829–30, respecting which he delivered an address in 1853 before the Virginia Historical Society, was a contributor to the *Southern Literary Messenger,* etc.

Grill'parzer (FRANZ), b. at Vienna Jan. 15, 1791; spent his life in a quiet way in his native city, where for many years he held a position in the imperial archives. D. Jan. 20, 1872. In 1816 he brought his famous tragedy *Die Ahnfrau* ("The Grandmother") on the stage, and at once he became the hero of the German theatre, a rival of Kotzebue. *Die Ahnfrau* is one of the wildest, most absurd, and most disgusting productions of the romantic school. It was the delight of the stupid mass of theatre-goers, who in this piece saw their own crude and senseless superstitions treated as deep, philosophical ideas. But among people of culture and taste it threw such a disgrace on the author's name that fifty years had to pass by before the eminent merits of his later works became fully acknowledged. He himself must have felt that he had made a mistake, for, although there still linger some faint vestiges of his early infatuations in *König Ottokar's Glück und Ende* (1825) and *Melusina* (1833), in all his chief works, *Sappho* (1819), *Medea* (1822), *Des Meeres und der Liebe Wellen* ("Hero and Leander") (1840), and *Esther* (a fragment), he threw off all allegiance to the ideas of the romantic school, and pursued an almost opposite direction. Goethe's *Iphigenie* became his model. For Grillparzer was not an original genius. He has created no types. But he had a talent of great power and perfect education, and the vein which Goethe had found he worked out with eminent success. There is in Goethe's *Iphigenie* a repose in the representation even of the strongest passions, and a simplicity in the expression even of the profoundest thoughts, which Grillparzer never has attained; but he understood how to communicate to the Greek statue, without hurting its antique character, a life whose warm pulsations charm us and excite our deepest sympathy, and the perfect clearness and sweet gracefulness of his diction make us forget the intricacies and subtleties of his ideas.
CLEMENS PETERSEN.

Grimal'di, an old Guelphic family of Italy, whose principal seat was at Genoa. They traced their origin to one Grimoald (d. 714), major-domo to Childebert III. (683–711), Merovingian king of Neustria and Burgundy. The Grimaldi were long (980–1731) princes of Monaco, but on the extinction of the male line of the princely house the title passed to the Goyen-Matignon line; and at present (1875) the princes of Monaco still bear the name Grimaldi, though not of the direct male line. The name became a common one in Italy, as well as France and Spain; and many poets, artists, scholars, churchmen, nobles, generals, and admirals bore this name in the Middle Ages.

Grimes, county of S. E. Central Texas. Area, 902 square miles. It is extremely fertile, consisting partly of prairie and partly of timber land. Live-stock, corn, cotton, and lumber are staple products. It is traversed by the Texas Central R. R. Cap. Anderson. Pop. 13,218.

Grimes (JAMES WILSON), LL.D., b. in Deering, Hillsboro' co., N. H., Oct. 20, 1816; d. at Burlington, Ia., Feb. 7, 1872. The youngest of eight children, and of Scotch-Irish extraction, he entered Dartmouth College Aug., 1832; commenced the study of law in Feb., 1835, with James Walker at Peterboro', N. H.; settled at Burlington (now in Iowa, then in the "Black Hawk Purchase," which was attached to the Territory of Michigan) May, 1836, and engaged in the practice of law, in which he was highly successful; for twelve years (1841–53) was partner with Henry W. Starr. His first public service was as secretary to an Indian commission held at Rock Island, Sept. 27, 1836, at which the Sacs and Foxes relinquished by treaty to the U. S. the lands lying between the then W. boundary-line of the State of Missouri and the Missouri River, which were subsequently added to that State. He was a representative of Des Moines county in 1838 and in 1843 in the legislative assembly of the Territory of Iowa, and in 1852 in the general assembly of the State. Reared among the Whigs, and sustaining their general principles, he earnestly opposed the repeal of the Missouri Compromise, and was one of the founders of the Republican party, while his whole career was marked by freedom from party bias. On several occasions he canvassed nearly the whole of Iowa and addressed the people upon public questions. He was chosen governor Aug., 1854, for the term of four years, having been nominated for the office at the last State convention of the Whig party ever held in Iowa, Feb. 22, 1854, and also by the Free-Soil Democracy. One of the commissioners for founding a hospital for the insane at Mt. Pleasant, he gave careful attention to that trust. He convened the general assembly in special session July, 1856, to act upon land-grants made to the State by Congress for the purpose of aiding in the construction of railroads, by which the material development of the State has been greatly promoted. In Aug., 1856, he addressed a remonstrance to Pres. Pierce against outrages perpetrated in Kansas upon former citizens of Iowa. By the effect of a new constitution his tenure of office terminated Jan., 1858, when he was chosen U. S. Senator for the term of six years from Mar. 4, 1859. In Jan., 1864, he was chosen for a second term. He resigned in consequence of a failure of health Aug., 1869. In the Senate a ready and vigorous debater, but rarely making a set speech, he gave close attention to public business, especially to subjects entrusted to committees of which he was a member, particularly pensions, the affairs of the District of Columbia, and naval affairs. He initiated the first practical act of emancipation after the outbreak of the civil war by securing an order from the secretary of war which set free a large number of escaped slaves confined in the jail of the District of Columbia July 4, 1861. His principal speeches in Congress were on the achievements of the Western naval flotilla Mar. 13, 1862, and on the surrender of slaves by the army Apr. 14, 1862. He became a recognized authority in all matters pertaining to the navy. He first suggested in the Senate the introduction of iron-clad vessels into the navy, July 19, 1861. The establishment of a navy-yard at League Island, the return of the Naval Academy to Annapolis from Newport, and the establishment of a national armory at Rock Island were largely due to his advocacy. In the impeachment trial of Pres. Johnson he regarded himself as acting, not in a representative capacity but as a judge, and gave his opinion that the President was not guilty of an impeachable offence by reason of anything alleged in the articles preferred against him. During that trial he was stricken down by an attack of paralysis, and came into the Senate chamber and recorded his vote as an act of public duty and in the exercise of severe fortitude and a determined moral energy. With reference to the obloquy cast upon him for this vote he said in a letter of Jan. 29, 1869, "Neither the honors nor the wealth of the world could have induced me to act otherwise than I did; and I have never for a moment regretted that I voted as I did. I shall always thank God that He gave me courage to stand firm in the midst of the clamor, and by my vote not only to save the Republican party, but prevent such a precedent being established as would in the end have converted ours into a sort of South American republic, in which there would be a revolution whenever there happened to be an adverse majority in Congress to the President for the time being." After long and painful prostration, and a residence of two years in Europe, with temporary intervals of improved health, he d. suddenly of heart disease. JOSEPH HENRY.

Grimes's, tp. of Pike co., Ala. Pop. 1600.

Grimké (FREDERICK), b. at Charleston, S. C., Sept. 1, 1791; graduated at Yale College (1810); judge of the Ohio supreme court 1836–41. Author of *Nature and Tendencies of Free Institutions*, also of an essay on *Ancient and Modern Literature*. D. at Chillicothe, O., Mar. 8, 1863.

Grimké (JOHN FAUCHERAUD), LL.D., a judge of the supreme court of South Carolina; was elected to the office of colonel in the Revolutionary war. Author of a *Revised Edition of the Laws of South Carolina to 1789, A Probate Directory*, etc. D. in 1819.

Grimké (THOMAS SMITH), LL.D., b. at Charleston, S. C., Sept. 26, 1786; graduated from Yale College in the class of 1807, and at once took up the study of law in Charleston, S. C., where he soon rose to eminence as a lawyer. In 1828 he delivered a speech in the State senate on the tariff question in favor of the general government, and an argument on the constitutionality of the South Carolina Test act of 1834. He became one of the best classical scholars in the country, yet maintained that neither classics nor mathematics should enter the list of studies for general education in this country. Author of several addresses before Sunday-schools, peace societies, etc.; *Reflections on the Character and Objects of all Science and Literature* (3 addresses with notes and appendix, New Haven, 1831). D. near Columbus, O., Oct. 11, 1834.

Grimm (FRIEDRICH MELCHIOR), BARON, a literary adventurer of more ambition than talent, and more shrewdness than character, a German by birth and education, but a Frenchman by residence, was b. at Ratisbon, Bavaria, Dec. 25, 1723, and studied at the University of Leipsic. Having failed sadly with his tragedy *Banise*, he went to Paris as tutor in a noble family, and here he succeeded. Rousseau made him acquainted with Diderot, D'Alembert, D'Holbach, and other literary celebrities. Count Friesen, to whom he had become private secretary, introduced him in the most elegant salons. Voltaire made him famous by exclaiming, after reading his pamphlet *Le petit prophète de Boemishbroda* (1753): "De quoi s'avise donc ce Bohémien d'avoir plus d'esprit que nous?" He now became the regular correspondent of Catharine II. of Russia, Gustavus III. of Sweden, Stanislas of Poland, and other sovereigns, and his letters give a minute chronicle of French literature from 1753 to 1790. In 1776 he was made a baron and ambassador from the duke of Saxe-Gotha to the French court, but in 1792 he had to leave France with the rest of the foreign diplomats. He retired to Germany, where Catharine II. gave him a pension and some shadow of a diplomatic position. D. Dec. 19, 1807. A complete edition of his *Correspondance littéraire, philosophique, et critique* was published in 15 vols. in Paris in 1829; the Germans have felt satisfied with an abridgment in 2 vols., 1823. It is very common to find this *Correspondance* praised both by French and German critics, but it is very rare to find it used. The reason of this last peculiarity is that it does not contain anything which cannot be had easier and better from other sources. The most interesting thing connected with Grimm is the picture which Rousseau gives of him in his *Confessions*, greatly exaggerated, but nevertheless strikingly true. CLEMENS PETERSEN.

Grimm (JAKOB LUDWIG), a celebrated German philologist and archæologist, was b. at Hanau Jan. 4, 1785; studied law at Marburg 1802; received in 1805 an office in the war department of Hesse; accompanied in 1814 the Hessian ambassador to the Congress of Vienna; went in 1815, under Prussian authority, to Paris to reclaim such manuscripts as Napoleon had carried away from German libraries; became in 1816 librarian at Cassel, and in 1830 professor at Göttingen. When in 1837 the Hanoverian king abolished arbitrarily the constitution, Grimm signed a protest against the measure, and was dismissed, but in 1841 received a chair at the University of Berlin, which he filled till his death, Sept. 20, 1863. He began his literary career in 1811 with *Ueber den altdeutschen Meistergesang*, which in 1819 was followed by his *Deutsche Grammatik* (unfinished), in 1828 by his *Deutsche Rechtsalterthümer*, in 1840 by his *Weisthümer*, and in 1844 by his *Deutsche Mythologie*. Each of these works was a new departure in its respective field, and exercised powerful influence not only over science, but on the people. But besides these, and a great number of minor essays and archæological researches and collections undertaken in connection with his brother, his two principal works are *Geschichte der Deutschen Sprache* (1848) and *Deutsche Wörterbuch* (1852). The former, a history of the German language, is not only a comprehensive, almost exhaustive, representation of its subject, but it is of paramount importance for all linguistical study on account of the brilliant discoveries it contains, by which some of the fundamental laws for the development of a language are established. The latter, a dictionary of the German language, is arranged on a broader plan than any other dictionary, and is executed with infallible correctness and an astonishing learning. Only the first volumes, to the word *Garten*, were finished when death overtook him, but very rich materials were left to his successors.

Grimm (Karl Wilhelm), brother of Jakob Ludwig, was b. at Hanau Feb. 24, 1786; studied law at Marburg, and followed his elder brother as librarian and professor at Cassel, Göttingen, and Berlin, where he d. Dec. 16, 1859. Although a philologist and archæologist like his brother, and taking part with him in all his studies, and dividing the labor, he seems to have been more attracted to the poetical side of the questions which the two brothers raised and answered. The most important of his independent works are *Altdänische Heldenleider, Balladen und Märchen* (1811); *Ueber die Deutschen Runen* (1821); *Die Deutschen Heldensage* (1829), his principal work; *Der Grosse Rosengarten* (1834); *Das Rolandslied* (1838); *Konrade von Würzburg* (1849); *Altdeutsche Gespräche* (1851). In connection with his brother he edited *Kinder- und Hausmärchen* (1812), one of the loveliest collections of fairy and other popular tales; *Altdeutsche Wälder* (1813–16); *Deutsche Sagen* (1816–18); and he took part with all his strength in the preparation of the dictionary.

Grim'ma, town of Germany, in the kingdom of Saxony, on the Mulde, has extensive manufactures of shoes and linens, and a trade in wood and yarn. Pop. 5879.

Grimm's Law, the principle laid down by J. L. Grimm that appears to regulate the interchange of consonants of the mute species among the Indo-European languages. For example, the consonants *p, b,* and *f* in (1) Latin, Greek, and Sanscrit become in (2) Gothic *f, p,* and *b;* and in (3) old High German, *b, f,* and *p.* So the dentals *t, d, th* (1) become (2) *th, t, d;* and (3) *d, z, t;* while (1) *k, g,* and *ch* become (2) *k, k,* and *g,* and (3) *g, ch,* and *k.* This rule, though useful, is far from being infallible.

Grims'by, a post-v. and tp. of Lincoln co., Ont., Canada, on Lake Ontario and on the Great Western Railway, 19 miles E. S. E. of Hamilton. Fruit-culture and the wine-manufacture are important industries. Pop. about 800.

Grin'delwald, a v. of the canton of Berne, Switzerland, 35 miles S. E. of Berne, in a valley just N. W. of the great mountains Eiger, Mettenberg, and the Wetterhorn, between which descend the upper and lower glaciers of Grindelwald. The manufacture of kirschwasser and the herding of cattle are the chief industries of Grindelwald, which is an interesting point for the tourist, and is therefore much visited in summer. Pop. 3135.

Grind'ing and Crush'ing Machi'nery. Grinding and crushing (or pulverizing) processes and apparatus are used in nearly every branch of industry, and a large variety of machinery belonging to these classes has been designed and constructed. The reduction of large masses to the state of powder usually involves the use both of crushing and of grinding apparatus. Crushing machinery usually reduces the size of masses or breaks up fragments by simple pressure. Such action is best in the reduction of hard, brittle, non-fibrous substances. Grinding machinery acts by compression, combined with a lateral action. Such attrition is better adapted to produce extreme fineness of division than simple crushing; and where the material to be ground is organic, particularly if fibrous and tenacious, this is the only satisfactorily efficient method. Pulverization of hard substances is also frequently effected by percussive action.

In breaking up hard materials existing naturally in masses—as, for example, minerals and the metallic ores—the first operation is usually that of blasting. Holes are drilled to a depth of from a few inches to twenty feet, according to the nature of the material and the scale upon which the work is prosecuted. For this work drills worked by steam or by compressed air are now frequently used, effecting very great economy over hand-labor. These holes are charged with explosive materials, which being fired, the mass is rent into fragments. The larger pieces are blasted again, and all, when sufficiently reduced in size to permit it, are broken up by the workmen with blows of heavy hammers or by crushing machinery. The *stamp-mill,* shown in Fig. 1, is one of the oldest and most generally known forms of crushing apparatus. A heavy mass of chilled cast iron B is secured upon the lower end of a strong vertical beam E, which also carries, near the upper extremity, a bracket K, which is engaged by a cam D, which lifts it to the required height. This beam is guided by a suitable frame F G, and the lifting is done by a cam or by a series of cams which

Fig. 1.

Stamp-mill.

are keyed upon and revolve with a horizontal shaft A, driven by a steam-engine or other prime mover. A shield C of wood or metal protects the workmen against injury by flying fragments. D represents the ore flowing under the stamp-heads, which crush it against the floor H. A stream of water I usually flows over the minerals, carrying off the fine particles, and also preventing the rising of dust. Usually, a series of such stamps are placed side by side, all operated by a single shaft, and forming what is called a "battery." In this case they are so arranged, by the adjustment of the elevating cams upon the shaft, as to make their combined action in resisting the driving power as uniform as possible. Where two are worked by one shaft, their cams are set opposite each other; where three or four or six form a battery, their cams are so set as to make angles of 120°, 90°, or 60° with each other. The stamps are also sometimes arranged in a circle about a central vertical shaft carrying a single lifting-cam which operates all. This form of stamp-mill is becoming very generally used in the U. S. Its advantages are obviously compactness, less cost with equal efficiency, and rather less driving power.

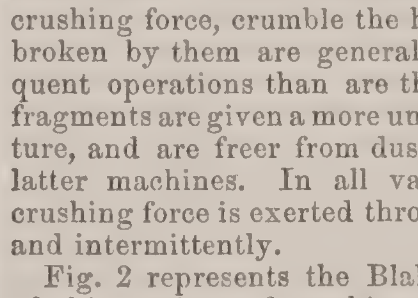
A modification of the steam-hammer, resembling somewhat that used in forging iron, is sometimes used as a steam-stamp. When properly designed it is very effective in breaking up boulders and masses too small to be cheaply broken by the use of gunpowder, and too large and too hard to be crushed by ordinary stamps or other breaking apparatus. The stamp-heads, in the ordinary form, are often made to revolve, so as to change their positions with each blow. A battery of five stamps, running on quartz, crushes about 200 bushels in ten hours. The pestles, or stamp-heads, weigh 250 to 500 pounds. They are mounted on white oak or hickory beams 6 inches square in section, and making 100 blows per minute, with a fall of 10 or 12 inches. As an average, two-horse power is required per head.

Cornish Crushers, or rolls, somewhat similar to those used in iron-works, are sometimes used for crushing ores and stones.

Where it is not essential that the material shall be completely powdered, or in the reduction to small pieces of masses already broken to moderate size, as in the breaking up of large pebbles in road-making, or in metallurgy in the preparation of coarse material for the more complete comminution effected by stamps or by mills, *stone-breakers* are much used. These machines, by the exertion of immense crushing force, crumble the hardest known rocks, and ores broken by them are generally better prepared for subsequent operations than are those treated by stamps. The fragments are given a more uniform size, have a cleaner fracture, and are freer from dust, than when produced by the latter machines. In all varieties of stone-breakers, the crushing force is exerted through an extremely small range, and intermittently.

Fig. 2 represents the Blake stone-crusher, an example of this variety of machinery, the drawing exhibiting a longitudinal section, such as would be obtained by removing one side of the main frame A A. The circle at D exhibits a section of the driving-shaft, with the eccentric which actuates the pitman or connecting-rod F, giving it a vertical motion, and, through it, working the toggle-joint C C. This elbow, or toggle-joint, acting against the movable jaw J on the one side, and the fixed abutment, or frame of the machine, on the other, forces the former toward the fixed jaw H, crushing any material which may have been thrown into the intervening space from above. N is a wedge which by means of the screw attached can be raised or lowered to diminish or to increase the size of product. B represents the fly-wheel, and C the driving-pulley. The faces of the jaws are protected by removable plates, which sustain all of the wear produced by abrasion. A spring of rubber, L, withdraws the swinging jaw when it has made its forward movement, and the toggle releases it. The action of the machine is as follows: The material, being already broken to a size which admits of its being placed between the jaws, is thrown into the machine, and the movable jaw, swinging through a small arc at each revolution of the fly-wheel shaft, fractures the pieces, and they drop until caught in the narrower space below, and the next approach of the pendent jaw produces new fractures, and again it releases them. The pieces finally become sufficiently small to fall out through the opening at the bottom, which is adjusted by the wedge O to the proper width

Fig. 2.



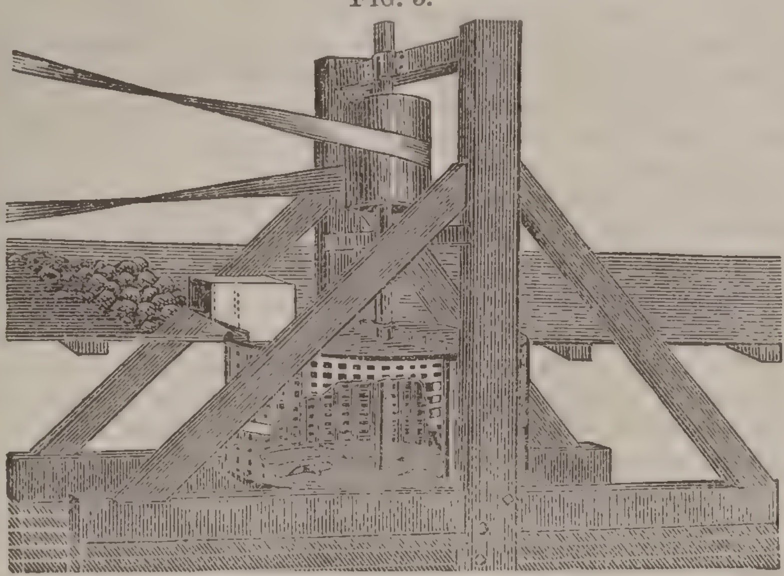
Blake Stone-breaker.

to suit the individual case. The momentum of the fly-wheel, which makes from 100 to 250 revolutions per minute, and the great leverage obtained by the use of the knee-joint, enable such a machine to exert a crushing force which is only limited by the strength of the frame. With argillaceous minerals water is used to ensure free discharge.

Various forms of rock-breaking machines have been designed, all of which embody the principles illustrated by the machine just described as a typical example of the class. The work done varies from a half ton per hour, in the smallest machines reducing to coarse sand, up to twelve or fifteen tons with the larger sizes doing less complete work. The power required varies from one-half to one and a half horse-power per ton of product per hour.

Fig. 3 represents an example of that class of machinery

FIG. 3.

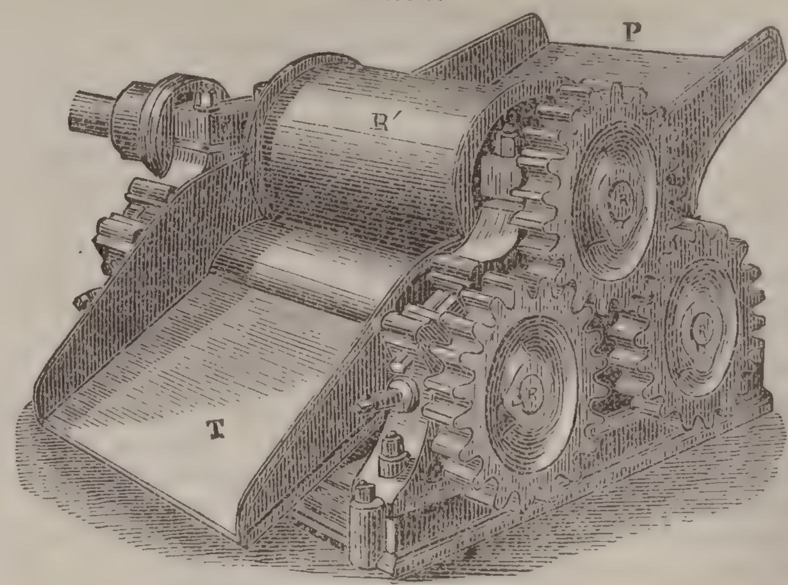


Whelpley & Storer Crusher.

in which crushing is produced by percussive action—the Whelpley & Storer crusher. It consists of a cylinder or tub-shaped vessel 30 or 40 inches in diameter, made in sections of heavy iron plates, and perforated with holes of three-fourths of an inch in diameter, or larger, as may be determined by the nature of the material and the fineness of division desired. The top of the cylinder is of thick cast iron, and contains an opening through which the material to be broken falls from a hopper placed above. The bottom of the cylinder is detached, and revolves about a vertical shaft, which is supported by a step-bearing below. It extends upward through the top of the cylinder, and is driven by a belt running upon a pulley at the upper end. On this cylinder bottom or table are bolted several heavy blocks of iron faced with steel. The cylinder just described is surrounded by an enclosure which receives and retains the crushed material thrown out by the machine. When in operation the table carrying the blocks or "hammers," and which forms the bottom of the cylinder, is set in motion, revolving at the rate of from 1000 to 1500 turns per minute. The material to be crushed is fed into the hopper, and, falling into the cylinders, meets the whirling hammers, and is at once broken up by collision with their edges and faces and by mutual impact, and is then thrown out, through the perforations in the sides of the cylinder, into the surrounding chamber. The size of the pieces is determined by the diameter of the holes in the cylinder. The larger proportion usually are of about two-thirds the diameter of these holes. The hammers and their steel faces are so attached that they may be readily removed when the former are broken or when the latter become worn out, and new ones may be put in their places. From 5 to 10 tons of material are crushed per hour by these machines in average work, when the entering pieces average between 4 and 5 inches in diameter. The power required to drive these machines is stated to average one and a half horse-power for each ton of broken material.

Materials requiring to be more thoroughly comminuted, or to be reduced to the state of fine powder or of flour, are usually ground in mills such as are hereafter to be described. Fibrous substances and organic materials generally are not readily crushed by the machinery above sketched. For simply crushing sugar-cane and similar substances, where the cellular or porous mass is to be compressed and broken to expel the contained liquid, a set of rolls such as are shown in Fig. 4 is used. These rolls are of cast iron, and are from one and a half to three feet in diameter, arranged as shown in the sketch, one being placed above and between the two others. The cane is fed between the rolls R R^1 from an apron P. Passing under the rolls, it is guided by a plate arranged for that purpose, between R and R^2, and then, the juice being thoroughly expressed, the crushed cane (or "bagasse," as it is called) falls clear, led by the tail-trough T. The effect of the action of the first pair of rolls R R^1 is to crush the cane, and the succeeding heavy pressure exerted by R^1 and R^2 expresses the juice very completely. The juice falls into a trough below, which

FIG. 4.

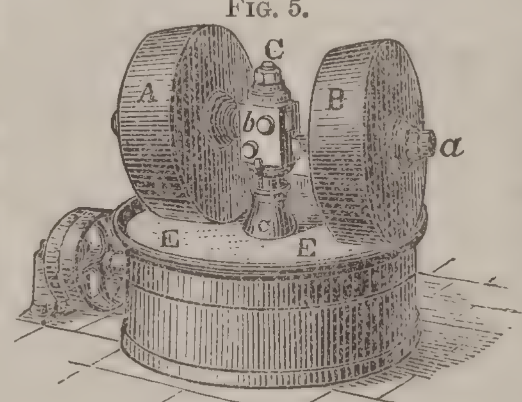


Rolls for crushing sugar-cane.

leads it to a reservoir conveniently situated to receive it. The heavier mills, which are made for large plantations, do the best work. A good mill expresses from 70 to 75 per cent. of the juice of the cane. The larger the rolls, the slower their speed, and the heavier the pressure exerted by them, the more perfectly is the work done. They are often made very large and immensely strong. A mill having rolls 40 inches in diameter and 6 feet long, making three revolutions per minute, requires a driving power of 60 or 70 horses, and expresses 20 tons of cane-juice per day.

Fig. 5 represents a form of mill which is also used principally for crushing organic materials, for expressing oil from seeds, and for similar work. It is also used in grinding chocolate, in mixing mortar, and in kneading clay for brick or porcelain manufacture. A and B are two millstones revolving on horizontal axes *a b*, which are held in position by bearings fastened by bolts to the framework of the machine. The vertical shaft C revolves in bearings steadied by the framework above, and its weight, with that of its appurtenances, is carried by a step at its lower end. Keyed upon this shaft is a strong cast-iron disk, having a high flange around its edge. Fitted to this disk, and well bedded upon it, is a thick stone E E, upon which the mill-stones A B rest. The vertical shaft C is driven by a bevel-wheel at its lower extremity, and carries with it the horizontal table E E. The material to be crushed is thrown upon the table, and as the latter revolves the former is carried under the millstones, which revolve by contact, and is crushed and ground by the weight of the stones and by the slight twisting action arising from the combination of the relative motion of the two sets of stones in the vertical and the horizontal plane. In a better form of this mill the bed or table is fixed, and the axle carrying the vertical stones is attached to the vertical spindle and revolves with it. Where the stones are small and their orbit is of large diameter, the action is almost purely that of crushing, but where, as is customary, the millstones are of large diameter and revolve in small orbits, the action combines grinding with crushing. The hydraulic press is often used as a substitute for this form of mill. In crushing and kneading soft materials, as paints or chocolate, the stones have a diameter of 24 or 30 inches, but when designed for breaking ore or for crushing seeds containing oil, they are given a diameter of 5 feet. They make from three to five or six revolutions per minute. The stones are made of some hard rock, as granite, gneiss, or trap, or occasionally of cast iron. Making five revolutions per minute, the heavier stones require about five horse-power to drive them over materials offering moderate resistance.

FIG. 5.

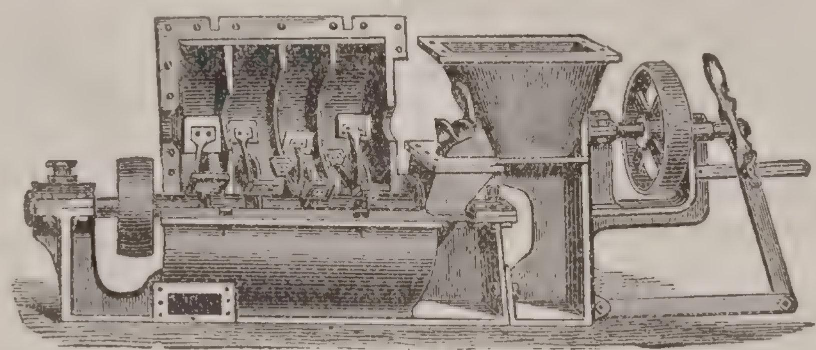


Vertical Seed-mill.

When a thorough pulverization of materials is desired mills of various kinds, in which the action is purely that of grinding, are generally used. An exception to the general rule exists in the pulverizer of Whelpley & Storer, shown in Fig. 6. This machine is only intended for the reduction to fine powder or to dust of such materials as sand, gravel, or crushed ore. The material is fed regularly and automatically into the machine from the hopper above, and, entering the cylinder, encounters the swiftly revolving

"paddles," and, becoming entangled among the accompanying and surrounding eddies and whirlwinds of air,

FIG. 6.

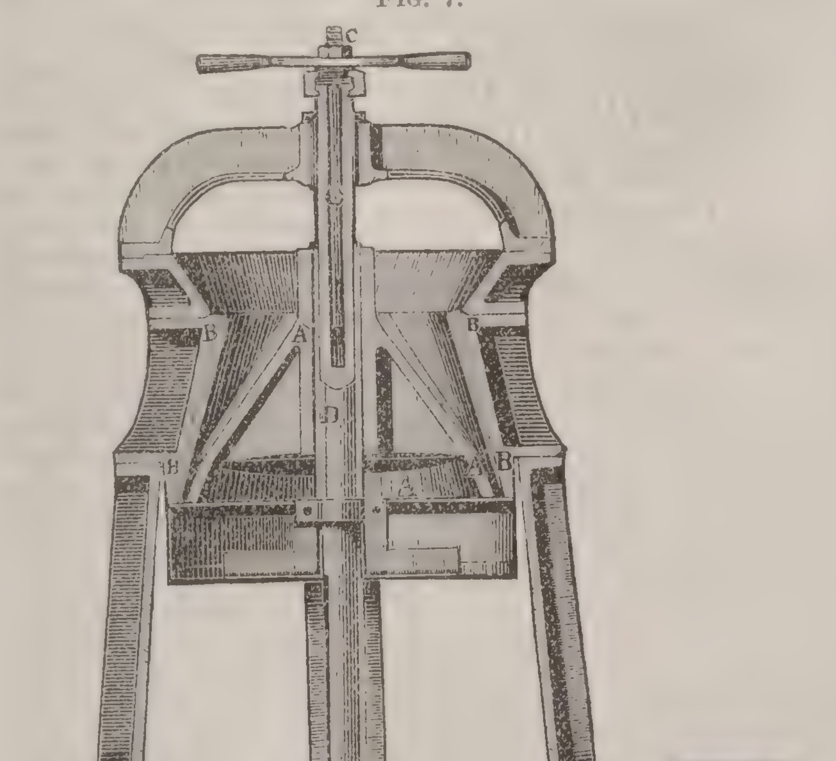


Whelpley & Storer Pulverizer.

the particles are, by mutual attrition and collision, ground into sometimes impalpable powder. The coarser particles thrown out are found to have rounded surfaces, instead of broken faces and sharp edges, as would be the case were they simply crushed. The velocity of the paddles is about two miles per minute. The dust is drawn out by a suction-fan or blower at the end of the cylinder opposite the feed apparatus. One of these machines, one foot in diameter, requires a power of three horses. Those of two feet, two and a half, and three and a half feet diameter are rated at nine, twelve, and eighteen horse-power respectively. The weight of the product and its fineness are determined by the rate of feeding and the speed of the blowing-fan. It may be given any degree of pulverization, from that of fine sand to that of an impalpable powder.

For grinding coffee and spices, dry paints, soft ores, solid chemicals, and easily crushed substances in general, mills with grinding surfaces of cast iron are commonly used. In these mills the rubbing faces of the metal are usually corrugated or ribbed in a manner and to a degree which is determined by the nature of the work to be done. Fig. 7 exhibits a mill of this class, such as is designed specially

FIG. 7.

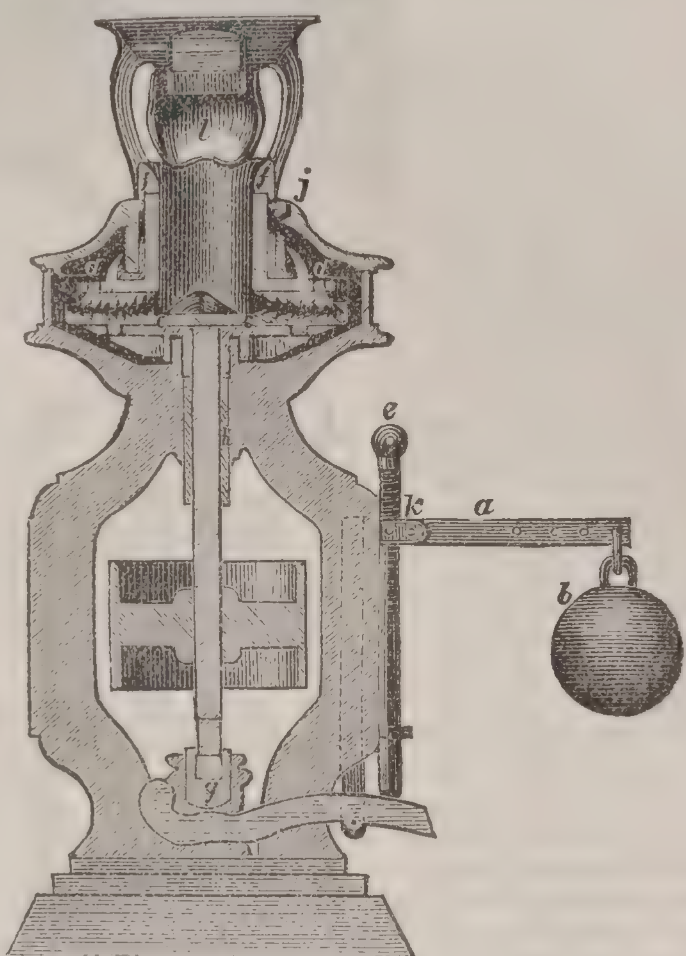


Salt and Spice Mill.

for grinding salt and soft ores. The cone-shaped grinding portion, or "stone," A A, is of chilled iron, and the surrounding casing B B is of the same material. The form given both surfaces is such that the actions of gravity and of centrifugal force combine to urge the ground material downward and into closer contact with those surfaces. The grinding cone is capable of adjustment vertically by means of the screwed bar C carried in the hollow portion of the vertical shaft D, and turned by means of the horizontal handle at the top. The connection between this bar and the cone is made by means of a "cotter" passing through a slot cut in the shaft, which has the necessary length to permit the vertical motion. The bevel-gear E on the horizontal driving-shaft is not keyed in its place, but is secured by taper keys which hold only by friction. Should too heavy a strain come upon the machine, it slips on the shaft, and thus prevents injury of the mill.

Another form of mill which has been extensively used in the U. S. is that of Bogardus. This is shown in section in Fig. 8, where *c c* is the lower plate driven by a vertical shaft revolving in the bearing *h*, and supported by the step *g*, and counterbalanced by the weighted lever *a b*, by means of which the required pressure is applied with steadiness and uniformity. The upper plate, similar in form to the lower, is capable of taking up a motion of revolution, also,

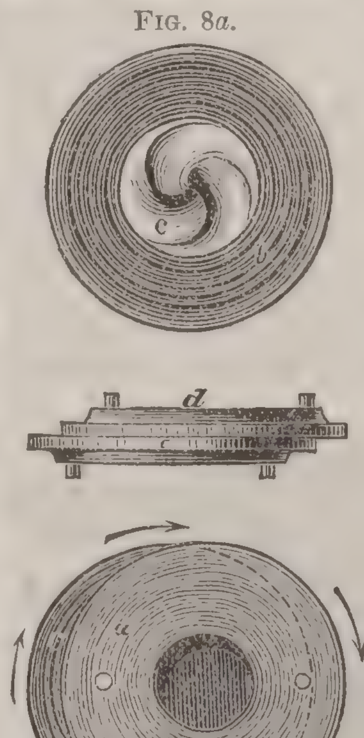
FIG. 8.



Section of Bogardus Mill.

about a centre out of line with the axis of the lower plate, being screwed by bolts *a a* to the loose collar *f f*. A shoe *l*, acting upon the collar, causes a vibration which shakes the material in the hopper, and sends it downward as rapidly as it can be ground. A screw *e* is so arranged as to prevent the weighted lever from forcing the grinding plates into actual contact when the supply of material to be ground has been nearly or quite exhausted. The counterbalance also acts as a safety attachment, allowing any foreign material too hard to be ground to separate the plates, and to leave the mill uninjured, should such substance by any accident enter it. Fig. 8*a* following shows the form of the plates used and their relative position when in place. They should be made of carefully selected and strong chilled iron. Their centres being out of line with each other, their peculiar form gives them a relative motion which is admirably adapted to grinding. These mills are driven from 600 to 800 revolutions per minute. The weight of material ground varies greatly with its character and with the degree of fineness of the product. Two tons of black lead, one to two tons of dry bones, three to four tons of iron ore, one and a half tons of white lead in oil, half a ton of bark, four to five tons of oil-cake, and twenty barrels of sugar per hour are said to represent the average work of a mill sixteen inches in diameter. The power required is stated at from three-quarters to one and a quarter horse-power. The peculiar form of the plates and their eccentricity of position cause an unusual rapidity of discharge and freedom from liability to choke, thus permitting the grinding of adhesive substances which would

FIG. 8*a*.

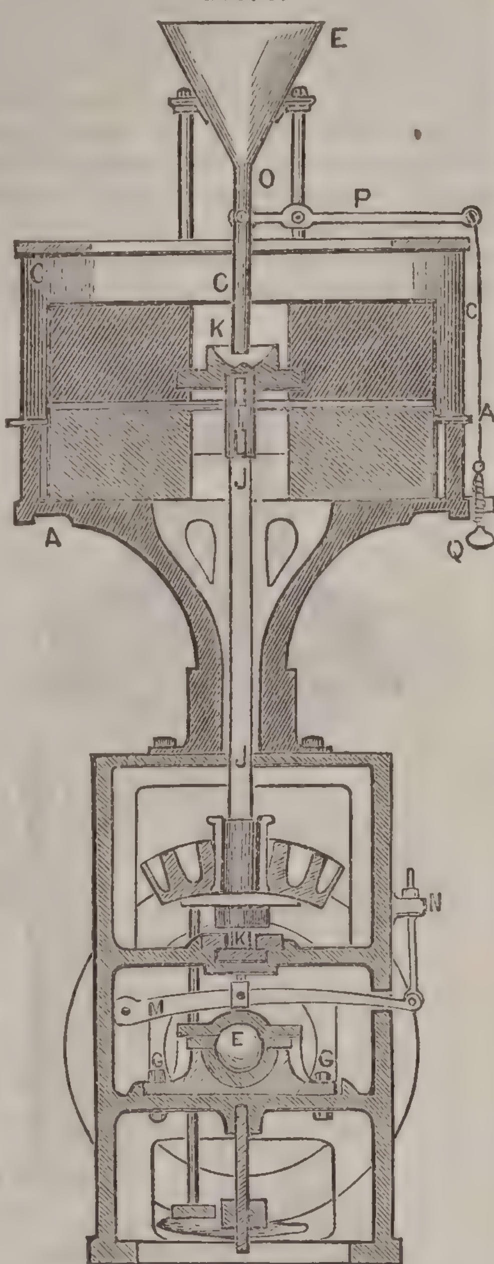


Plates of Bogardus Mill.

obstruct ordinary mills. These peculiarities produce also a uniform action over all portions of the grinding surfaces, and consequent durability.

For grinding grain the standard mill is shown in Fig. 9. The grinding surfaces are the faces of two stones, one of which is secured to the frame A which supports the hopper E, and carries the bearing C of the driving-shaft. The other stone revolves, in close proximity to the first, upon a spindle J, which receives its motion from the driving-shaft. The stones are surrounded by a cylindrical casing C C, which supports the hopper above. This casing is divided at the middle, in order that the upper portion may be removed to allow of the adjustment or repair of the top stone. The upper portion is made lighter than the lower, and frequently of thin sheet iron. The top is open to allow free access of air. The shaft F drives the spindle J by bevel gearing, as shown, or frequently the spindle is driven directly by means of belting. The upper stone is balanced upon the spindle, instead of being rigidly attached, in order that it may adjust itself freely to the slightly irregular distribution of grain between it and the lower stone. The spindle J rests upon a "step" of bronze or other alloy well adapted for machinery bearings. It is so fitted as to be capable of adjustment in all directions, and is supported by a lever M, which is raised or depressed by the screw and nut N, thus determining the pressure upon the substance passing through the mill and the degree of fineness to which it is ground. The hopper E receives the grain, and, falling downward, it passes through the tube O, flows over the "rhind" K—the piece of metal by which the upper stone is supported upon the spindle—and enters between the stones. The pipe O is supported by a lever P, and its height above the rhind can be adjusted by the screw Q upon the side of the standard above N, that screw being connected with the end of the lever by a chain or cord. The pipe being lowered upon the rhind, the flow of grain is stopped; being raised, it allows the feeding to go on with greater and greater rapidity as it rises clear of K.

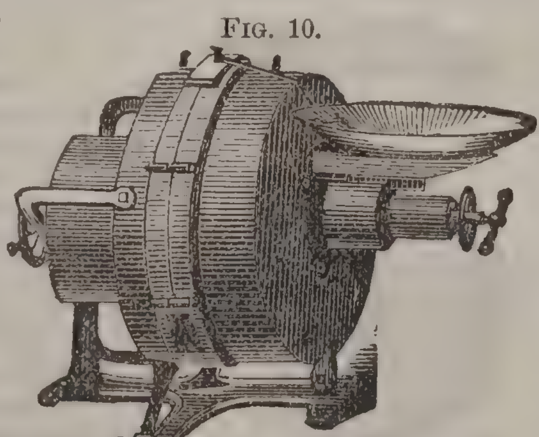
Fig. 9.



Corn Mill.

Many other forms of mill are in use, all, however, containing the essential details of the standard mill just described, and shown in Fig. 9. The framing and the hopper and feed-spouts were formerly, and are still frequently, made of wood. The feeding apparatus is often of different form, and the sizes of stones and speed of mill vary greatly. In some cases, as shown in Fig. 10, mills are constructed having the stones set with their axes horizontal, the special advantages being the convenience with which pressure may be adjusted, and the more rapid feed and delivery secured, which permits higher speed and reduces liability of choking. In other mills the spindle is vertical, as in Fig. 9, but the upper stone is stationary, and secured firmly in the casing, while the lower revolves. This gives somewhat more stability, and therefore increased speed and steadiness of motion. In both the latter forms the stones being less liable to strike and dull each other than in the preceding style of mill, they may be expected to wear longer. Their frames are light, yet strong; they occupy comparatively small space; their spindles are short; and the mill with horizontal spindles may be very conveniently driven from the line shafting. The journals of mills running at high speed should always be made long, to ensure freedom from heating. The bearings of the mills with horizontal spindles are often made eight or ten inches long.

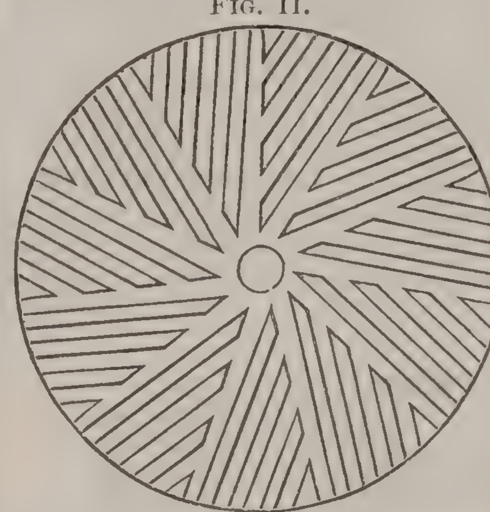
Fig. 10.



Forsman Vertical Mill.

The stones of the mill Fig. 9 are frequently four, or even four and a half feet, in diameter, and a foot in thickness. They are "built up," the lower half of the top stone being of pieces of French burr-stone, cut to fit well and cemented firmly together. The upper half is of plaster of Paris. The lower stone is of French burr also, the pieces firmly cemented and bedded upon the frame. In the other forms of mill the stones are usually smaller and are often made in a single piece. Where not of one piece, they are strongly cemented and surrounded by a strong iron band to prevent liability of being ruptured by the centrifugal force due to their high velocity of revolution. The fixed stone has usually a perfectly flat grinding face; the moving stone is hollowed towards the centre to allow the material ground to flow freely between the grinding surfaces, and in order that a more thorough comminution may be secured during its passage towards the circumference. The faces of both stones are cut, as shown in Fig. 11, with straight grooves, of wedge-formed section, and in directions inclined to the radii. The edges of the grooves are thus given a cutting action somewhat resembling that of scissor blades, and also a tendency to force the grain outward towards the circumference is secured, and thus the feeding is accelerated and choking is avoided. These grooves are usually cut by hand. Machines have been designed to do this work, but none have been generally introduced. They usually consist of a revolving horizontal shaft carrying diamond cutters, and capable of being adjusted and fed automatically along the proper lines.

Fig. 11.



Plan of Millstone.

The stone used in mills of the class just described are usually of French burr, a siliceous rock containing many small rough cavities, by which the grains are caught and retained until crushed. The stone is very hard, and wears very slowly. It therefore does not injure the flour or meal by mingling with it in fragments or powder. It is quarried of finest quality near La Ferté-sous-Jouarre, in the geological district known as the "Paris basin," where it forms a bed of from ten to fifteen feet in thickness. Great difficulty is found in getting out stones of large size, for which reason the stones of large mills are generally built up of fragments. Quarries of very good stone of the quality desired for millstones are worked near Andernach on the Rhine. This is supposed to be a kind of lava from a neighboring and now extinct volcano. In the U. S. there are several deposits of stone suitable for use in mills, but they are usually inferior to imported stones. A quarry has been worked many years in the valley of the Savannah River, about 100 miles above the city of Savannah, which has been stated to be nearly or quite equal in quality to the French stone. It has been extensively used from the time of Oliver Evans, who was one of the first to make use of it.

Mills, such as are illustrated in Fig. 9, with stones four feet in diameter, driven at the rate of 200 revolutions per minute, grind from seven to ten bushels per hour, the quantity varying with the degree of fineness. The power required is usually not far from one horse-power per hour for each bushel ground. In later styles, with smaller stones running at higher speed, the yield is greater and the power is less. With "twenty-inch stones," making 700 revolutions per minute, the power required varies from five to eight, and the product is from six to twelve bushels per hour. A stone two and a half feet in diameter, making 500 revolutions, grinds from fifteen to twenty bushels an hour with an expenditure of from ten to twenty horse-power, the meal produced being in the first case very coarse, and in the latter very fine.

R. H. Thurston.

Grind'stone, a thick circular disk of stone, usually sandstone, used for bringing dull cutting instruments of steel to an edge, the blade being applied to the edge of the stone, which revolves around a central axis. The best

grindstones in the U. S. are brought from Berea, O., and from Nova Scotia. Various forms and materials are also used in making grindstones for cutting glass, gems, etc.

Grindstone Island, a small island near the head of the Bay of Fundy, in Albert co., N. B., has a lighthouse and grindstone-quarries, of which the products are sent to the U. S.—Another GRINDSTONE ISLAND is one of the Magdalen group, in the Gulf of St. Lawrence.

Grindstone Island, one of the Thousand Islands in the St. Lawrence, belongs to Clayton tp., Jefferson co., N. Y. Pop. 330.

Grinnell′, post-v. and tp. of Poweshiek co., Ia., 120 miles W. of the Mississippi River, on the Chicago Rock Island and Pacific R. R., also on the Central R. R. of Iowa. It is the seat of Iowa College, has 5 churches, good public schools, a newspaper, a national bank, 2 hotels, several large flouring-mills, a foundry, a glove manufactory, and good stores. It is located in the midst of a thriving farming community. Pop. of v. 1482; of tp. 2389.

S. F. COOPER, ED. OF "HERALD."

Grinnell, tp. of Trego co., Kan. Pop. 40.

Grinnell (HENRY), b. at New Bedford, Mass., Feb. 13, 1799, son of Cornelius Grinnell and brother of M. H. Grinnell; was a partner in the firm of Grinnell, Minturn & Co., whale-oil shippers of New York, 1819–49, and after that time retired from business, but retained connection with several insurance companies and with the Seamen's Savings Bank, in which he was greatly interested; fitted out the "Grinnell expeditions" (1850, 1854, etc.) in search of Sir John Franklin; and was throughout life a most generous advocate of the interests of sailors. He was the first president of the American Geographical Society. D. June, 1874.

Grinnell (MOSES H.), b. at New Bedford, Mass., Mar. 3, 1803; obtained his early education at private schools and Friends' academy. He was influential in sending out Dr. Kane upon his Arctic expedition (1853–55); collector of the port of New York 1869–71; was elected M. C. 1839–41.

Grinnell Land, in the Arctic Ocean, the northernmost land on the globe hitherto discovered, was first seen in 1850, and mapped in 1854 as far as lat. 82° 30′ N. in lon. 76° W. An open polar sea, entirely free of ice and abounding in animal life, is reported to extend 125 miles N. of its shores. High mountains were seen in the interior.

Grinnell's Island, one of the Thousand Islands in the St. Lawrence. It belongs to Clayton tp., Jefferson co., N. Y. Pop. 3.

Grippe. See INFLUENZA.

Gri′quas (called BASTAARDS by the Boers), a mixed race in South Africa, the offspring of Hottentot and Bushwomen by the Boers, or colonists of Dutch descent. Many of them are well-to-do breeders of cattle, and have adopted the habits and religion of Europeans, while others prefer the savage life. A large part of their territory (Griqualand) was in 1874 annexed to the Cape Colony against the wish of the people.

Gris′com (JOHN), LL.D., b. at Hancock's Bridge, N. J., Sept. 27, 1774; became principal of the Friends' monthly meeting school in Burlington, N. J., which office he held thirteen years. Taking up the study of chemistry, he pursued this branch of learning for many years, often giving representations of his proficiency before the public; in 1806 was elected professor of chemistry in Rutgers College, N. J. He published *A Year in Europe* after his return home in 1823 from a foreign tour; was instrumental in forming the society for the prevention of pauperism (1817), of which he issued the constitution and first report on the various causes and remedies of pauperism. D. at Burlington, N. J., Feb. 26, 1852.

Griscom (JOHN HOSKINS), M. D., b. in New York City Aug. 14, 1809; graduated from the University of Pennsylvania in 1832; studied medicine under Profs. Godman and Valentine Mott; became professor of chemistry in New York College of Pharmacy 1836–40, and has held the office of visiting physician of the New York Hospital since 1843. Author of *Animal Mechanism and Physiology* (1839), *Uses and Abuses of Air, and the Means for the Ventilation of Buildings* (1850), etc.

Gri′si (GIULIA), daughter of a topographical officer of the French empire, b. at Milan May 22, 1812; d. at Berlin Nov. 29, 1869. She studied at Milan and Bologna, where at the age of sixteen she made her first public appearance as Zelmira, and carried the audience away by the charm of her voice, manner, and person. Subsequently she achieved triumphs at Florence, Pisa, and Milan. At the Scala she first appeared as Norma. Her efforts to overcome defects of training were so successful that she ranked with Pasta and Malibran, and was admitted to the musical friendship of Lablache, Tamburini, and Rubini. For her the opera *Puritani* was written. In 1836 Grisi married a Frenchman, M. Gérard de Meley, but the union was unhappy and was legally dissolved. She was afterwards united to Signor Mario, the tenor, and had several children by him. In Aug., 1854, they visited the U. S. together, and sang in the principal cities. In later years her residence was in England. She appeared at Covent Garden as late as 1864. Before that time her popularity in Italy and France had been on the wane. O. B. FROTHINGHAM.

Grisons [Ger. *Graubünden*] is the easternmost and largest, but at the same time the most thinly peopled, canton of Switzerland, bounded E. by Tyrol, S. by Lombardy, W. and N. by the cantons of Uri, Glarus, and St. Gall. Area, 2673 square miles. Pop. 91,782, of whom one-third speak German, and the rest peculiar Romanic dialects. The whole canton consists of a system of high and wild mountains, containing 240 glaciers, from which rise the Rhine, Inn, Ticino, and Adda; these rivers form valleys, and thereby give the country its geographical physiognomy. The southern valleys are fertile; wheat, vines, and figs are grown. But the highlands yield only pasturage, and dairying and cattle-rearing are the main sources of wealth. The name Grisons (Graubünden), "the gray league," is derived from the plain gray garment worn by the Swiss farmers who in the beginning of the fifteenth century formed a league and broke the yoke under which the nobility held them. The principal town is Chur (It. *Coira;* Fr. *Coire*), with about 5000 inhabitants.

Gris′wold, post-v. and tp. of New London co., Conn. The township contains Jewett City and other manufacturing villages. Pop. 2575.

Griswold (ALEXANDER VIETS), D. D., b. at Simsbury, Conn., Apr. 22, 1766; appointed rector of St. Michael's church at Bristol, R. I. The eastern diocese of the Protestant Episcopal Church was organized in 1810, and in May, 1811, Dr. Griswold was ordained its first bishop. Soon after he was elected chancellor of Brown University. He published *On the Reformation and the Apostolic Office* (1843), sermons, etc. D. at Boston, Mass., Feb. 15, 1843. (See *Memoirs*, by JOHN S. STONE.)

Griswold (JOHN A.), b. at Nassau, in Rensselaer co., N. Y., in 1822; was M. C. from New York 1863–69, and was mayor of Troy 1856. It was through his efforts that Ericsson's famous Monitor was built. He was an iron manufacturer; was Republican candidate for governor of New York 1868. D. at Troy, N. Y., Oct. 31, 1872.

Griswold (MATTHEW), LL.D., b. at Lyme, Conn., 1716; held the office of lieutenant-governor of Connecticut for several years; governor 1784–85; also judge of the supreme court; president of the convention which ratified the Federal Constitution, 1788. D. at Lyme, Conn., Apr., 1799.

Griswold (ROGER), LL.D., b. at Lyme, Conn., May 21, 1762; graduated from Yale College in 1780. He was admitted to the bar in 1783; became M. C. from 1795 to 1805; appointed judge of the supreme court of Connecticut in 1807, and was lieutenant-governor from 1809–11; governor 1811–13; was regarded as a man of great talents and great legal ability. D. at Norwich, Conn., Oct. 25, 1812.

Griswold (RUFUS WILMOT), D. D., b. at Benson, Vt., Feb. 15, 1815; spent much of his early life in travel, and at the age of twenty-one had visited the most interesting places of his own land and those of Central and Southern Europe; became a printer, then a Baptist preacher, and afterwards a journalist. In 1841 he brought out an anonymous volume of poems and a volume of sermons. Became the chief editor of *Graham's Magazine* in 1842–43, and of the *International Magazine* of New York in 1850–52. Author of *Poets and Poetry of America, Washington and the Generals of the Revolution, Curiosities of American Literature, Prose Writers of America, The Republican Court,* and other works, and published the first edition of Milton's prose works in America. He was also engaged as one of the editors of the works of Edgar A. Poe. D. in New York City Aug. 27, 1857.

Griswold (STANLEY), b. at Torringford, Conn., Nov. 14, 1763; graduated from Yale College in 1786; studied theology, and was settled to preach at New Milford, Conn., from 1790–1802, but resigned, owing to the animosity occasioned by his Democratic views. In 1804 he edited a Democratic paper at Walpole, N. H., with marked ability. Became U. S. Senator in 1809 from Ohio, and afterwards U. S. judge for the North-west Territory; appointed secretary of Michigan Territory by Jefferson in 1805. D. at Shawneetown, Ill., Aug. 21, 1815.

Gris′woldville, post-v. of Jones co., Ga., 12 miles E. by N. of Macon, on the Central R. R. leading to Savannah, noted before the war for its extensive cotton-gin manufac-

tory, and during the war for a pistol-factory. Here was fought on Nov. 22, 1864, a bloody battle between a portion of Gen. William T. Sherman's command, under Gen. Walcott, and a number of the Georgia reserves, under Gen. Howell Cobb, in which several hundred on both sides were killed and wounded, and among the latter Gen. Walcott.

Griswoldville, post-v. of Coleraine tp., Franklin co., Mass., has valuable water-power and active manufactures of cotton goods. It is on North River, 4 miles N. of Shelburne Falls, and on the unfinished Deerfield Valley R. R.

Grivegnée, town of Belgium, in the province of Liege, on the Ourthe, has large coal-mines and extensive manufactures of nails, wire, cutlery, and iron tools. Pop. 6234.

Gro'dek, town of Austro-Hungary, in Galicia, has 7381 inhabitants, mostly engaged in the cultivation of flax.

Grod'no, government of European Russia, bounded S. and W. by Volhynia and Poland, and N. and E. by the governments of Wilna and Minsk. Area, 14,700 square miles. Pop. 958,582. The ground is low and level; in the northern part, in the basin of the Niemen, of a light, sandy soil, covered with immense forests of pine and beech; in the southern part, in the basin of the Dnieper, of a swampy and marshy character. Rye, flax, hemp, and timber are exported in great quantities; cattle and bees are reared; wolves, bears, elks, and roebucks abound in the forests.

Grodno, town of Russia, cap. of the government of Grodno, on the right bank of the Niemen. Many of the palaces formerly belonging to Lithuanian noblemen are now decaying, though one built by Augustus III. is still in good repair, and is a magnificent structure. Grodno has extensive manufactures of weapons, silk, and cloth, and a lively trade. Pop. 26,187, of whom two-thirds are Jews.

Groes'beck, post-v. of Limestone co., Tex., on the Houston and Texas Central R. R. It has a weekly newspaper.

Gron'ingen, the northernmost province of the Netherlands, is flat and low, and protected against the inundations of the sea by dykes. It is fertile and well cultivated. Its south-eastern part is marshy, but affords good pasturage. Grass-culture, dairying, fishing, and shipbuilding are the main pursuits of the population. Its area is 896 square miles, with 230,357 inhabitants, of the Frisian race and belonging to the Reformed Church.

Groningen, town of the Netherlands, the capital of the province of Groningen, on the Hunse, which here forms a good port, accessible for large vessels, and communicating by canals with the Dollart and the Zuyder-Zee. Groningen is fortified, has a university founded in 1614, a public library, and a botanic garden. Pop. 39,015.

Grono'vius, or **Gro'nov,** the name of a distinguished Dutch family which produced many learned men. Johan Frederik Gronovius, b. in Hamburg, Germany, Sept. 8, 1611; was educated at Leipsic, Jena, and Altorf, and in 1643 became professor of history and eloquence at Deventer; in 1658 professor of the Greek language and history at Leyden; published texts of ancient authors with notes, and wrote philological and archæological treatises. D. at Leyden Dec. 28, 1671.—His son, Jacobus, b. at Deventer Oct. 20, 1645, went in 1688 to study in the English universities; was attached in 1672 to the Dutch embassy at Madrid; was professor of polite literature at Pisa, and in 1679 took the corresponding chair at Leyden. Published annotated texts, and wrote *Thesaurus Antiquitatum Græcarum* (13 vols., 1697–1702). D. at Leyden Oct. 21, 1716.—His son, Abraham (1694–1775), a distinguished physician, was editor of several ancient authors and author of learned works.—His brother, Johan Frederik (1690–1762), was a distinguished jurist, botanist, and author.—Laurentius Theodorus (1730–78), a learned zoologist and author.—His grand-uncle of the same name was a distinguished student of the civil law, and author of a volume of corrections for the Pandects and of several archæological treatises.

Groo'te Ey'landt, the largest island in the Gulf of Carpentaria, North Australia. It is mountainous in the interior, with flat and barren coasts. Its diameter is about 40 miles.

Gros (Antoine Jean), b. at Paris in 1771; d. there in 1835. He was a pupil in the school of David; was patronized by Napoleon, whose portrait, full length, he painted in Italy, and the most impressive events in whose career—the battles of Aboukir, of the Pyramids, of Eylau, Napoleon visiting the sick at Jaffa, among them—he depicted by order of the government. These pieces are strong, but coarse. His miniature portraits are delicate and beautiful. The cupola of St. Génevieve at Paris shows his skill as a decorator. Gros was a member of the Legion of Honor and the order of St. Michael, and professor at the Institute and the School of Fine Arts. He drowned himself in a fit of melancholy. O. B. Frothingham.

Gros'beak [so named from their large bill], a popular name of several birds, principally belonging to the family Fringillidæ. The U. S. have the evening grosbeak (*Hesperiphona vespertina*), the pine grosbeak (*Pinicola Canadensis*), the rose-breasted grosbeak (*Guiraca ludoviciana*), the blue grosbeak (*Guiraca cœrulea*), and others of that genus. The cardinal grosbeak (*Cardinalis Virginianus*) is the Virginia red-bird, a fine songster, often seen in cages. The social grosbeak (*Loxia socia*) of South Africa builds a huge roof in some large tree, beneath which sometimes as many as 300 pairs of birds are lodged.

Grose (Francis), b. at Greenford, Middlesex, England, 1731; resigned his office of Richmond herald 1763; was a paymaster of militia whose convivial habits are immortalized by Burns, who was for a time his associate. Grose published several freely illustrated antiquarian works, which are not of high value, but his *Classical Dictionary of the Vulgar Tongue* (1785) and his *Provincial Glossary* (1787) are of some merit. D. at Dublin May 6, 1791.

Gross (Samuel D.), M. D., LL.D., D. C. L., was b. in Pennsylvania July 8, 1805; studied medicine under Dr. George McClellan, and graduated in the Jefferson Medical College, Philadelphia, 1828; in 1835 was elected professor of pathological anatomy in the medical department of Cincinnati College, O., and in 1840 to the professorship of surgery in the University of Louisville, Ky. In 1850 he was selected to become Dr. Mott's successor in the University of New York, and in 1856 he succeeded Dr. Mütter in his alma mater, a position which he still occupies. In 1862, Dr. Gross was made a member of the Royal Medical Society of Vienna; in 1868, of the Royal Medico-Chirurgical Society of London, and of the British Medical Association. He has also been honored with the degree of LL.D. in this country, and with that of D. C. L. in Great Britain. In 1867 he was elected president of the American Medical Association. He commenced in early life to contribute to our medical literature, and is the well-known author of several professional works; above all, his *System of Surgery*, which in 1872 reached its fifth edition in two large volumes of about 2500 pages, closely printed and elegantly illustrated. It is a cyclopædia of this department of medicine.

Paul F. Eve.

Grosse Isle, an island in the river St. Lawrence, 29 miles below Quebec, is $2\frac{1}{2}$ miles long and 1 mile wide. It is the property of the province, and is used as a quarantine-ground.

Gros'senhain, town of Germany, in the kingdom of Saxony, on the Röder, has large manufactures of cloth and different kinds of woollen fabrics. Pop. 10,438.

Grosse Point, post-tp. of Wayne co., Mich. P. 2230.

Grosseteste (Robert), bishop of Lincoln (probably named *Grosseteste*, "great head," from his learning and ability), was b. at Stradbrooke, Suffolk, about 1175; studied law, physic, and divinity at Oxford and Paris, and is reputed to have held a professorship at Paris; was made archdeacon of Wilts in 1214; received other preferments, and in 1214 received the doctorate of theology and became *magister scholarum* at Oxford; defended (1232) the Jews against the king and people; became bishop of Lincoln 1235; reformed with vigor his large diocese; opposed successfully alike the intrusions of king, nobles, and the pope in local ecclesiastical affairs; was involved in a long controversy with Innocent IV., who strove to fill the richest places in all the Church with Italians and Provençals; was one of the most learned and popular preachers of his day, a voluminous author, and a successful instructor, Roger Bacon being among his pupils. In 1253 he was excommunicated by Innocent IV. D. at Buckden Oct. 9, 1253. He is one of the central figures in the history of the thirteenth century.

Grosse'to, province of Tuscany, Italy, on the Mediterranean. Area, 1710 square miles. Barren mountains and unhealthy and unproductive marshes occupy much of its surface. Cap. Grosseto. Pop. 107,457.

Grosseto, town of Italy, in the province of Grosseto, on the Maremmana railway, about halfway between Florence and Rome. It is surrounded by marshes, and suffers greatly from miasmata and bad water, though the recent efforts of the Italian government to improve the drainage of the Maremma have somewhat reduced its mortality. Promising indications of coal have been recently discovered in this vicinity. It is a bishop's see. Pop. 6310.

Gross-Glogau. See Glogau.

Gros'si (Tommaso) was b. at Belluno, on the Lake of Como, in 1791, and passed his whole life as a notary in Milan, where he d. in 1853, greatly lamented by his friends, among whom most intimate was Alessandro Manzoni. He began his literary career by a poem in the Milanese dia-

lect, *La Principe*, which nearly cost him his life. In 1816 followed two short poems in the same dialect, *La Fuggitiva* and *La Pioggia d'Oro*, the first of which is a model of pathetic poetry. His *Ildegonda*, a romance in verse (1820), made that species of writing fashionable in Italy, and its success led Grossi to try to restore the epic, neglected since the time of Tasso, by his poem, *I Lombardi alla Prima Crociata.* But this poem, printed in 1826 by a generous subscription, did not equal public expectation, and was soon forgotten. In 1834, Grossi published his *Marco Visconti*, which soon became very popular, and three years later his *Ulrico e Lida.*

Grosswar'dein, town of Upper Hungary, on the Körös, 130 miles E. by S. by rail from Pesth. It consists of the town proper, which was formerly a fortress, and eight suburbs. Its cathedral is a magnificent building. It carries on a considerable trade in pottery, cattle, and wine, and has two Roman Catholic bishops—one of the Latin and one of the Roumanian rite. Pop. 22,443.

Gros Ventre Indians [Fr. "big bellies"], a tribe living with the Blackfeet and other tribes in the Milk River agency of Montana. They number 1100. They are hostile to the Sioux, are usually friendly to the whites, and are becoming quite industrious. They are called also Prairie Gros Ventres, and are a branch of the Arapahoes. The MINNETARIE INDIANS (which see) are also called Gros Ventres.

Grote (GEORGE), D. C. L., F. R. S., b. at Clayhill, Kent, Nov. 17, 1794, of German ancestry, studied at the Charterhouse, and in 1809 entered his father's banking-house as a clerk; became a liberal political writer, and sat in Parliament for London 1832–41, and was distinguished by efforts in favor of the use of the ballot in elections. In 1823 he began to devote much attention to Greek history, and the fruit of his labors was his noble *History of Greece* (12 vols., 1846–56; new ed., 8 vols., 1862), written from a democratic standpoint, and enriched with the products of novel and important researches. His other principal works are *Plato and the other Companions of Socrates* (3 vols., 1865); *Aristotle* (2 vols., 1872); *Minor Works*, containing essays and reviews (1873). In 1860 he became vice-chancellor of the London University, and in 1869 president of University College. D. in London June 18, 1871. (See *Character and Writings of G. Grote*, by ALEX. BAIN, prefixed to *Minor Works*, and *Memoirs*, by Mrs. GROTE, London, 1873.)

Gro'tefend (GEORG FRIEDRICH), b. at Münden, Germany, June 9, 1775; studied at Göttingen 1795–97; announced his discovery (in 1802) of the meaning of certain Pehlevi inscriptions near Persepolis; was director of the Lyceum, Hanover, 1821–49; d. there Dec. 15, 1853. Among his publications are *Rudimenta linguæ Umbricæ* (1835–38); *Neue Beiträge zur Erläuterung der persepolitanischen Keilschrift* (1837); *Zur Erläuterung der babylonischen Keilschrift* (1840); *Zur Geographie und Geschichte von alt-Italien* (1840–42).

Gro'tius, or **De Groot** (HUGO), b. at Delft in 1583, where his learned father was the burgomaster, was sent to Leyden at the age of eleven, and after three years' residence at the university, under Joseph Scaliger and other eminent professors, accompanied the ambassadors of the states-general into France. Here he received notice on account of his precocious learning even from the king, Henry of Navarre. Returning to his native town in 1599, he was in the same year admitted to the bar at the Hague, and soon gained distinction by works in various departments of learning, such as editions of the classics, and by original compositions. In 1601 he was appointed historiographer of Holland; in 1607 he was made advocate-general of the fisc for Holland and Zealand; and in 1610 the office of pensionary (paid counsellor) of Rotterdam was conferred upon him. By virtue of this office he had a seat in the States of Holland, and afterwards in the states-general. In these years he gave several works to the world—in 1608, his *Mare liberum*, in defence of the freedom of the seas against the pretensions of Portugal and England; in 1610, his treatise in Latin—in which language nearly all his works were written—on the antiquity of the Batavian republic; and in 1612 he finished his annals and history of Belgian affairs, which, however, did not see the light until after his death. All the time from his first visit to France he had enjoyed the friendship of John of Barneveldt, the grand pensionary of Holland, the head of the states' rights party, and a favorer of Arminian opinions in theology. Grotius shared his opinions in theology and politics; and when, about the time of the meeting of the synod at Dort, the stadtholder Maurice, the head of the national party, with whom the Calvinists sided, caused the arrest of Barneveldt on unfounded charges of secretly plotting for the Spaniards, Grotius also was arrested and imprisoned. The result is well known. Barneveldt was put to death, Grotius was held in confinement, first at the Hague, then in the castle of Lowenstein near Gorkum, until Mar. 21, 1624, when he was conveyed, by a stratagem of his wife, in an empty book chest, to Gorkum, whence he escaped to Antwerp, and from there found his way to Paris. In his imprisonment he was not idle. He translated the *Phœnissæ* of Euripides into Latin verse, wrote an introduction to the jurisprudence of Holland, and composed his important commentaries on the New Testament, together with the treatise on the truth of Christianity. In France he had a pension from the king of 3600 florins. Here he published his treatise *De jure belli et pacis*, to which modern international law owes its first development. Experiencing some disgusts during his stay in France, he left that country and visited Holland in 1631, but finding his enemies still able and willing to make him trouble, he chose Hamburg for his residence in 1632, and ere long (*i. e.* in 1634), in compliance with the solicitations of Chancellor Oxenstiern, entered the service of Queen Christina of Sweden. He was made a privy councillor and the queen's ambassador in France. His diplomatic life becoming uncomfortable to him, in 1645 he asked for a recall. The queen offered him honorable employment, but he was unwilling to engage longer in the service of courts. He took ship for Germany, encountered a violent storm on the Baltic, and reached Rostock spent with fatigue, to die Aug. 28, 1645, in his sixty-third year.

Grotius was perhaps the most universal scholar of his age. His editions of several of the classics, with his elegant translations into Latin verse of choice flowers from the Greek poets, gave him a place of eminence among classical scholars; his notes on the New Testament, marked by their purely philological character, and removed from theological biasses, would alone have given him a high reputation; his historical and legal writings were the occasional works of a great man; his original poems in Latin show his versatility, although they are forgotten; his treatise on the truth of Christianity was long a classic; his theological works prove him to be a believer in the atoning death of Christ for the sins of men upon an explanation of the doctrine different from that commonly received at the time, and they remove him from the doctrines both of Pelagius and of Socinus. But he will be remembered longest as having first brought system into the law of nature in his preface to the *De jure belli*, and into the law of nations in the body of that work. His mild Christian humanity led him to attempt to bring better principles than those of his age into the intercourse of nations, especially into the laws of war. His thorough knowledge of Roman law furnished the basis of the system, and his great familiarity with ancient history supplied him with copious, in fact with too copious and sometimes inapposite, illustrations. T. D. WOOLSEY.

Grot'on, post-v. and tp. of New London co., Conn., on the E. side of the river Thames, opposite New London, and on the Shore Line R. R. It has important manufactures. It has a fine monument to the memory of the patriots massacred here Sept. 6, 1781, by British and Tory troops after the surrender of Fort Griswold. Pop. 5124.

Groton, a pleasant post-v. and tp. of Middlesex co., Mass., traversed by the Worcester and Nashua, the Nashua and Acton, and the Peterboro' and Shirley R. Rs. It is the seat of Lawrence Academy (a thriving institution), and has several paper-mills. Pop., before the separation of the town of Ayer, 3584.

Groton, post-tp. of Grafton co., N. H., 45 miles N. W. of Concord, has manufactures of wooden wares, etc. P. 583.

Groton, post-v. and tp. of Tompkins co., N. Y., 26 miles S. of Auburn, 40 S. of Owego, on the Southern Central R. R. It has a national bank, 4 churches, a union graded school, 1 newspaper, a hotel, several large machine-shops and other manufactories, including an immense cooperage and extensive carriage-shops. Pop. of v. 863; of tp. 3512. L. N. CHAPIN, ED. "GROTON JOURNAL."

Groton, tp. of Erie co., O. Pop. 910.

Groton, post-tp. of Caledonia co., Vt., 28 miles E. of Montpelier. It has a literary institute, and manufactures of leather, lumber, and starch. Pop. 811.

Grot'ta del Ca'ne ("Grotto of the Dog") is the name of a small cave, 10 feet deep, 4 feet wide, and 7 feet high, in Southern Italy, between Naples and Pozzuoli, remarkable for its exhalations of carbonic acid gas, in which a candle is instantaneously extinguished and small animals stifled. It received its name from the circumstance that small dogs are generally used to show the experiment. It is mentioned by Pliny, and the exhalations seem at his time to have been more powerful than now.

Grotta'glie, town of Italy, in the province of Lecce, on the high-road between Taranto and Brindisi. It has some cotton-factories. Pop. 8747.

Grot′te, town of Sicily, in the province of Girgenti, about 12 miles E. of the ancient Agrigentum. It has a considerable sulphur-trade. Pop. 7306.

Grouchy, de (Emmanuel), Marquis, marshal and peer of France, was b. at Paris Oct. 23, 1766, and entered the artillery in 1781. In 1793, on the outbreak of the Revolution, he was colonel of a regiment of dragoons, advanced to brigadier-general, and fought in 1794 in La Vendée, but was discharged, like all officers of the nobility. After the fall of Robespierre he was reinstated in his former place, and fought with distinction under Joubert and Moreau in Italy and on the Rhine in 1799 and 1800, but was treated somewhat coldly by Napoleon on account of his sympathy for Moreau. On Oct. 26, 1806, he defeated the Prussian cavalry at Zehdenik, and after that time he was much and successfully employed in the campaigns in Prussia, Spain, Austria, and Russia; on the retreat from Moscow he led the body-guard of the emperor, a legion consisting of officers only. On the restoration of the Bourbons in 1814 he was banished from France, and although he was allowed to return in 1815, he was treated with suspicion. He joined Napoleon immediately on his return from Elba, received command, fought successfully in Northern France, and was made a marshal of France. After the battle of June 17, 1815, he was ordered to pursue Blücher with an army of 34,000 men and 100 guns, and although, on the 18th, he heard the cannonade from Waterloo, and was entreated by his staff to march in that direction, he adhered to his orders and pushed forward towards Wavre. As Napoleon sent no orders to recall him, it seems utterly unjust to lay the burden of the defeat on him. After the battle he collected the scattered remnants of the army and led it back to France, but resigned his command when the negotiations began between the allies and the provisional government. The Bourbons banished him a second time, but after residing for five years in the U. S., he was permitted to return to his estate near Caen. After the revolution of 1830 his rank of marshal was acknowledged, and he was created a peer of France. D. May 29, 1847. Besides a number of pamphlets, he published *Fragments historiques*, in vindication of his conduct in 1815, military and diplomatic.

Ground is in the idea what cause is in reality. That which actually causes the movement of the wings of a windmill is theoretically the ground of the phenomenon. Thus, *ground* and *sequence* express in one sphere exactly the same correlation as *cause* and *effect* in another. Ground and reason are so far identical as they belong to the same sphere, but a different field is ascribed to them. Reason is objective, and refers to a process; ground is subjective, and refers to the volition. Reason is scientific, ground is moral. The grounds for which I believe that a thing is so or so are reasons; the reasons why I act so or so are grounds.

Ground, or **Ground Bass,** in music, a given bass on which the student is required to write several original melodies or descants in succession, the whole forming a set of variations in different styles.

Ground Dove, a general name for those species of pigeon which seldom fly, but walk or run, often quite rapidly, upon the ground. The ground dove of the Southern United States (*Chamæpelia passerina*) is less than seven inches long. The genus comprises the smallest pigeons known.

Ground Ice, or **Anchor Ice** (called *ground gru* in parts of England), is the ice which forms in crystals at the bottom of streams. Its formation is probably due (1) to the current of the stream, which mixes the lighter cold water of the surface with the rest of the water, and brings the whole down nearly to the freezing-point; (2) to the asperities at the bottom, which favor the forming of crystals; and (3) to the comparative stillness of the water at the bottom.

Ground-nut, or **Pea-nut,** the fruit of the *Arachis hypogæa*, an annual plant of the order Leguminosæ, a native of Africa or of South America. In these countries it has long been cultivated for food. In the U. S. it is cultivated extensively for its oil also. The pods generally have two seeds, and have the remarkable habit of thrusting themselves under the soil and there ripening. The seeds ("nuts") when roasted are extensively eaten, and are liked by many. The oil is prepared by grinding, heating, and pressing the kernels, which yield over 20 per cent. of fixed, non-drying oil, useful as a lubricant, as soap-stock, and in woollen factories. Its specific gravity is .918. In lamps it is better than sperm oil, except in cold weather, when it thickens. When deodorized it is used for adulterating olive oil. France and Belgium manufacture large amounts of this oil from African nuts, and use the oil as a lubricant.

Ground Par′rakeet, a name applied to several beautiful Australian parrots, which live almost entirely upon the ground—such as the *Pezoporus formosus* and the *Nymphilus Novæ Hollandiæ*. The latter is of a yellow color, and is extremely abundant in parts of Australia.

Ground-Rent. See Rent, by Prof. T. W. Dwight, LL.D.

Ground Squirrel, a name applied to various rodents intermediate in character between the true squirrels and the marmots. They are of the genera *Tamias, Spermophilus*, etc. (See Chipmunk and Gopher.)

Ground′sel Tree, a name given in the U. S. to *Baccharis halimifolia, angustifolia*, and *glomeruliflora*, handsome resinous shrubs of the order Compositæ. They grow chiefly near the sea-coast.

Grouse, the common name for birds of the order Rasores and family Tetraonidæ. The species are numerous, and many are American. Of these the spruce partridge or Canada grouse (*Tetrao Canadensis*), the *Centrocercus urophasianus*, or cock of the plains, the *Cupidonia cupido*, prairie chicken or pinnated grouse, the *Bonasa umbellus*, ruffed grouse (incorrectly called "partridge" and "pheasant" in some places), and others, are well-known game birds. Of these the more important are described under their alphabetical heads.

Grouse Creek, tp. of Cowley co., Kan. Pop. 153.

Grouse Valley, in Elko co., Nev., N. of Toano Station, is a good grazing region. Its elevation is 5600 feet.

Grousset (Paschal), b. in Corsica about 1845; became a journalist of Paris and the associate of Rochefort; wrote the articles in the *Marseillaise* against Pierre Bonaparte which led to the murder (by the latter) of Victor Noir. Grousset was for a time imprisoned; was afterwards editor first of the *Marseillaise*, and then of *La Bouche de Fer;* was prominent among the Parisian Communists, who made him their foreign minister; was sent to New Caledonia in 1872, but made his escape in 1874.

Grove, tp. of Jasper co., Ill. Pop. 1094.

Grove, tp. of Adair co., Ia. Pop. 437.

Grove, tp. of Davis co., Ia. Pop. 1230.

Grove, tp. of Pottawattamie co., Ia. Pop. 356.

Grove, tp. of Stearns co., Minn. Pop. 424.

Grove, tp. of Allegany co., N. Y. Pop. 1056.

Grove, tp. of Harnett co., N. C. Pop. 1093.

Grove, tp. of Cameron co., Pa. Pop. 440.

Grove, tp. of Greenville co., S. C. Pop. 1089.

Grove (Sir William Robert), Q. C., F. R. S., b. at Swansea July 14, 1811; was educated at Brasenose, Oxford, and at Lincoln's Inn, and came to the bar in 1835; gave special attention to experimental physics, and invented valuable electrical appliances; was one of the first to advance as an hypothesis the doctrine of the correlation of forces; was professor of experimental philosophy in the London Institution 1840–47; became Q. C. 1853; a royal medallist 1847; president of the British Association 1866; a justice of the common pleas 1871; and knight bachelor in 1872. Author of many valuable scientific papers, and of an essay *On the Correlation of the Physical Forces* (1846).

Grove City, post-v. of Franklin co., O. Pop. 143.

Grove Hill, post-v., county-seat of Clarke co., Ala. It has 1 weekly newspaper. Pop. 200; of Grove Hill tp. 1360.

Grove Lake, post-tp. of Pope co., Minn. Pop. 292.

Groveland, tp. of La Salle co., Ill. Pop. 1561.

Groveland, tp. and post-v. of Tazewell co., Ill., on the Chicago Pekin and South-western R. R., 8 miles N. E. of Pekin. Pop. 1323.

Groveland, post-v. of Putnam co., Ind. Pop. 67.

Groveland, post-v. and tp. of Essex co., Mass., on the Merrimack River, opposite Haverhill, and on a branch of the Newburyport R. R., 43 miles N. of Boston. It has a savings bank and manufactures of shoes and woollen goods. It is a beautiful place, and has an iron bridge connecting it with Haverhill. Pop. 1776.

Groveland, post-tp. of Oakland co., Mich. Pop. 1180.

Groveland, post-tp. of Livingston co., N. Y. It contains a Shaker village. Pop. 1455.

Groveport, post-v. of Addison tp., Franklin co., O., on the Columbus and Hocking Valley R. R., 12 miles S. E. of Columbus. Pop. 627.

Gro′ver, tp. of Johnson co., Mo. Pop. 1233.

Grover (Cuvier), b. in Bethel, Me., July 24, 1829; graduated at the U. S. Military Academy July, 1850, and entered the army as brevet second lieutenant of artillery; promoted to be second lieutenant Sept., 1850; first lieutenant of infantry Mar., 1855; captain Sept., 1858; major Aug.,

1863; lieutenant-colonel July, 1866. His services prior to the civil war were principally on the frontier, being engaged on the Northern Pacific R. R. exploration 1853–54, and the Utah expedition 1857–58. On the outbreak of the civil war he was a captain of the 10th Infantry, and with his command in New Mexico. Returning E., he was (Apr., 1862) appointed a brigadier-general of volunteers, and assigned to duty with the Army of the Potomac, participating in the various battles of the Peninsular campaign in Virginia and in the second battle of Bull Run. In Dec., 1862, he was in command of a division of the 19th Corps in the department of the Gulf, and engaged at Baton Rouge, Port Hudson, and various actions. In Aug., 1864, he was raised to the command of the 19th Corps, and in the Shenandoah campaign was engaged in the battles of Opequan, Fisher's Hill, and Cedar Creek, in the latter of which he was wounded; he subsequently commanded the district of Savannah, Ga., and was mustered out of the volunteer service Aug., 1865. Brevet lieutenant-colonel, colonel, brigadier-general, and major-general U. S. A. for gallant conduct. Since the close of the civil war, Col. Grover has been engaged on duty on the frontier. In 1870 he was transferred to the 3d Cavalry, of which regiment he is (1875) lieutenant-colonel. G. C. SIMMONS.

Gro'vertown, tp. of Starke co., Ind. Pop. 71.

Groveton, Battle of. See BULL RUN, SECOND BATTLE OF.

Grow, tp. of Anoka co., Minn. Pop. 396.

Grow (GALUSHA AARON), b. at Ashford, Conn., Aug. 31, 1823; graduated from Amherst College in 1844; studied law, and was admitted to the bar in 1847; was M. C. from Pennsylvania in 1851–53, 1855–57, and 1859–63; he was chairman of the committee on territories 1859–61; was Speaker of the House of Representatives in the 37th Congress (1861–63); and was appointed delegate to the Baltimore convention in 1864. He is now (1875) president of a railway company, and resides in Houston, Tex.

Grow'ler, the *Micropterus nigricans*, or black bass, a good table-fish of the lakes and rivers of the U. S.

Groy'nn (WILLIAM M.), M. D., b. at Londonderry, Ireland, Oct. 21, 1835; was educated at Pompey Academy, N. Y., and at the State Normal School, Albany; received his medical degree in 1867 from the Homœopathic Medical College, Philadelphia; was president of the Cayuga County (N. Y.) Homœopathic Medical Society 1871–72, vice-president of the Central New York Homœopathic Medical Society 1874–75. Residence, Throopsville, N. Y.

Grub, the larva of a coleopterous insect. Larvæ of dipterous insects are called *maggots;* those of Lepidoptera are *caterpillars.* Larvæ of the other orders of insects have no special popular names.

Grubbs (JOHN CLOUD), A. M., M. D., b. at Pittsburg, Pa., May 24, 1836; graduated at Willamette University, Or., 1861; was an officer of the 5th Pennsylvania Cavalry 1864; graduated M. D. in 1868 at the University of Michigan; has held the professorship of chemistry in Willamette University, and been editor of the *Medical and Surgical Reporter* of Oregon. Resides at Dallas, Or.

Gru'ber (JOHANN GOTTFRIED), a German writer of some note, was b. at Naumburg, Prussian Saxony, Nov. 29, 1774, and made from 1792 to 1797 extensive studies, though of a somewhat miscellaneous character, at the University of Leipsic. From 1803 to 1810 he resided in Weimar, where he became very intimate with Wieland, of whom he has written a good biography (2 vols., 1815). In 1815 he was appointed professor of philosophy at the University of Halle, and in 1818 he began, together with Ersch, the publication of the great *Allgemeine Encyklopädie der Wissenschaften und Künste,* which after the death of Ersch he conducted alone for many years. D. Aug. 7, 1851.

Gruet'li, post-v. of Grundy co., Tenn.

Gru'gan, tp. of Clinton co., Pa. Pop. 295.

Gru'mo Ap'pula, an old town of Italy, in the province of Bari. It has considerable trade in wine, oil, and grain. Pop. 8132.

Grün (ANASTASIUS). See AUERSPERG.

Grün'berg, town of Prussia, in the province of Silesia. It is famous for its wine, and has some manufactures of cloth and leather. Pop. 10,324.

Grundt'vig (NICOLAI FREDERIK SEVERIN), the Danish reformer, was b. Sept. 8, 1783, at Udby parsonage, in the island of Seeland, and studied language, history, and theology at the University of Copenhagen. In 1808 he attracted some attention by his book on the Scandinavian mythology (much enlarged in 1839), and still more in 1802 by a large and powerful picture in dramatic form of the contest between Christianity and heathenism in Denmark. His *World's Chronicle* (1812, much enlarged in 1837), which was written from a positive Christian standpoint, considering all events as divine rewards or punishment, involved him in a warm contest with A. S. Oersted, the jurist, who defended a more speculative view. His first large religious work was *Kirkens Gjenmale* (1825), in which he attacked the rationalistic views then reigning in the Danish Church. The dispute was more than bitter, and brought Grundtvig under ecclesiastical ban; but afterwards he partly gave up his polemical standpoint, and confined himself to positive teaching and preaching. His *True Christianity,* his *Sunday-book,* and many minor essays and papers are principally of practical tendency. He possessed eminent gifts as a preacher, and filled the office of a minister in Copenhagen from 1838 till his death, Sept. 2, 1872; and he deeply touched the hearts of his countrymen by his sublime hymns and beautiful patriotic ballads. His party developed gradually into a school, and his school became a reform of the whole Danish civilization. (See DANISH LANGUAGE AND LITERATURE.) CLEMENS PETERSEN.

Grun'dy, county in the N. E. of Illinois. Area, 432 square miles. It is level and fertile. It contains little timber, but produces much bituminous coal. Cattle, grain, and wool are leading products. It is traversed by the Illinois River and by the Chicago and Alton and the Chicago Rock Island and Pacific R. Rs. Cap. Morris. Pop. 14,938.

Grundy, county in Central Iowa. Area, 504 square miles. It is undulating and fertile. Grain is the leading product. Cap. Grundy Centre. Pop. 6399.

Grundy, county in the N. of Missouri, in the valley of the Grand River. Area, 420 square miles. It is generally productive prairie-land. Cattle, grain, tobacco, and wool are staple products. It is traversed by the south-western division of the Chicago Rock Island and Pacific R. R. Cap. Trenton. Pop. 10,567.

Grundy, county of S. E. Central Tennessee. It has a broken surface; the soil is fertile. Some grain is produced. Bituminous coal of good quality is found. Area, 225 square miles. Cap. Altamont. Pop. 3250.

Grundy, tp. and post-v., county-seat of Buchanan co., Va. Pop. 1152.

Grundy Centre, post-v., cap. of Grundy co., Ia., is the only town in the county. It has 2 hotels, a new school building, a weekly newspaper, stores, etc. It is the centre of a rapidly-growing agricultural district. Pop. about 500.
REA & MOFFETT, EDS. OF GRUNDY COUNTY "ATLAS."

Grundy (FELIX), b. in Berkeley co., Va., Sept. 11, 1777; was educated at the Bardstown Academy by Priestley; studied law and became famous in criminal cases; was chosen a member of the convention to revise the constitution in 1799; was elected to the legislature in the same year; upon the resignation of Judge Todd was appointed chief-justice of Kentucky. Removed to Nashville, Tenn.; was in Congress 1811–15; U. S. Senator 1829–38. President Van Buren in 1838 selected him as attorney-general of the U. S.; in 1840 he resigned his office, and was re-elected to the Senate. D. at Nashville, Tenn., Dec. 19, 1840.

Grup'pe (OTTO FRIEDRICH), a German philosopher, archæologist, and poet of some note, was b. at Dantzic Apr. 15, 1804, and entered in 1825 the University of Berlin. In 1830 he became a contributor, especially of criticisms on literature and art, to the *Allgemeine Preussische Staatszeitung,* and his *Antæus* (1831), containing an open attack on the philosophy of Hegel, attracted some attention. In 1844 he was appointed extraordinary professor of philosophy at the University of Berlin. The most noteworthy of his poetical works are his tragedies, *Otto von Wittelsbach* (1860) and *Demetrius* (1861), the latter a completion of a fragment by Schiller. His archæological writings are very numerous and not without merit, but they are not distinguished by any decided originality.

Grüt'li, or **Rüt'li,** a small plateau on the western shore of the Lake of Lucerne, in the canton of Uri, Switzerland, renowned as the place where Stauffacher, Fürst, Melchthal, and thirty other confederates met on the night of Nov. 7, 1307, and started the insurrection against Austria which resulted in the independence of Switzerland.

Gruyère, or **Gruyères,** a small town in the canton of Freyburg, Switzerland. The cheese manufactured in its surroundings and bearing its name is the most famous cheese manufactured in Switzerland.

Grymes (JOHN R.), b. in Orange co., Va., 1786. He served at times as U. S. district attorney and attorney-general, also held a position in the State legislature and constitutional convention of Louisiana. He was a man of thorough learning and great eloquence. D. at New Orleans, La., Dec. 4, 1854.

Grys-bok [Dutch for "gray buck"], the *Calotragus*

melanotis, a small reddish gray antelope of the wooded mountains of South Africa. It is extremely active and timid, and its flesh is good.

Gua'ca, or **Hua'ca,** according to Herrera, is an ancient Peruvian word meaning "temple;" but Pedro de Cieza de Leon says, "It is the appellation of the devil, to whom an infinite number of temples are dedicated in Peru, having burial-places attached to or near them." The word is now in common use in Central and South America to designate an Indian grave, and from it comes *huacal*, an Indian cemetery. In 1859 great excitement was produced in the U. S. and Europe by the announcement that several *huacas* had been discovered at Chiriqui in the state of Panama, from which a number of golden images etc. had been extracted; and it was generally believed, by those who investigated the matter, that the unearthed treasures were the works of a people who preceded the Indians, and whose civilization greatly exceeded theirs. The Panama *Star and Herald*, one of whose editors had made an especial study of Indian antiquities, etc., and whose views were acquiesced in by antiquaries generally, published Sept. 10, 1859, the following: "In that portion of the state of Panama comprising the former provinces of Ayuero, Veraguas, and Chiriqui, Indian burial-places are of very common occurrence, but they appear to be most numerous in the district of Chiriqui. As far as we have been able to ascertain, they abound principally on the Pacific slope of the Cordilleras, and from their vast numbers prove that at one period this country must have been very densely inhabited by a race of people whose knowledge of the arts of working in metals and clay is evidence of a certain degree of civilization. That they preceded the people whom the first Spanish discoverers found in possession of the country is, we think, clearly proved by the images that have been brought to light; for whilst we find most of the animals of this part of the continent, such as jaguars, tapirs, deer, monkeys, bats, alligators, etc., skilfully represented, there has been nothing as yet discovered bearing any resemblance to the animals introduced from the Old World, such as horses, cows, pigs, etc.; neither in any instance that has come to our knowledge have there been found any of the toys and beads which the Spaniards bartered with the natives for gold; nor has any iron-work been met with; and it seems only reasonable to suppose that had they possessed such articles they would have been deposited along with the other treasures in the sepulchres of their deceased owners. Another instance of the great antiquity of these graves consists in the fact that in none of them has a body been found; and though, in some instances, portions of bones have been distinguished when the grave was first opened, they immediately crumbled to dust on exposure to the atmosphere. At most a few teeth and some fragments of bones have resisted the hand of time."

Now, the above statements, plausible as they seem, I cannot but consider as at variance with all history; for, according to the early Spanish historians, many of the tribes of Central and South America showed considerable skill "in carving emeralds and other hard stones, and were well acquainted with the art of casting and sculpturing metallic substances." Bernal Diaz, speaking of the Mexican Indians residing on the banks of the Grijalva, says: "On the last day of Mar., 1519, there came to us many chiefs and principal men bringing presents of gold, consisting of four diadems, a number of figures of little lizards, two resembling little dogs (*dos como perrillos*), five ducks, etc." In the province of Zenu vast numbers of graves were rifled by the Spaniards, which contained articles similar to those which were found in the burial-grounds of Chiriqui. In the land of Duytama, Gonzalo Ximenez fell in with several *adoratorios* or temples, which he plundered of $40,000 worth of gold and emeralds, "much of the gold being in the form of crowns, eagles, and other birds and animals." Columbus himself, as early as 1502, in his fourth voyage to the New World, "discovered many tombs in the houses of the Indians of Portobello, where were deposited dead bodies, dry and perfumed with myrrh, without any bad smell, and wrapped in blankets or cotton sheets; and over the tombs were boards, on some of which were placed the sculptured figures of animals, and on others the effigies of those who were buried there, together with the most precious jewels they possessed."

All these sepulchres, as well as those in Zenu, and some thousands of others in Mexico, Central America, and Peru, which were unscrupulously robbed by the Conquistadores, were spoken of by the Indians as the last resting-places of their great chieftains, whose treasures, consisting of vessels and images of gold, stone, and earthenware (*the work of their ingenious dependants*), as also their household servants and the most beloved of their wives, were almost invariably buried with them; "the devil," says the quaint old chronicler Herrera, "in all parts of the Indies, appearing to the natives, and giving them to understand that they would live in the next world exactly as they had lived in this."

The facts I have cited show conclusively, it seems to me, that the graves excavated at Chiriqui are of Indian origin; and if nothing was discovered in them "bearing any resemblance to the animals introduced from the Old World," it follows simply that the Indians, beholding their "mansions of the dead" everywhere desecrated by the Spaniards in their unhallowed search for gold, relinquished, *after the Conquest, their ancient mode of burial.*

That throughout the whole of this continent are to be found unmistakable traces of a highly-civilized people who preceded the Indians, as is so often asserted, I very much doubt; but, granting this, to reckon the *huacales* of Chiriqui among their monuments is absurd. *They* are unquestionably the work of the Indians; and when we consider that they may be fifty, *and must be three and a half, centuries old*, it will not appear surprising that "in none of them has a body been found, and that at most a few teeth and some fragments of bones have resisted the hand of time."

Taken in connection with what I have said, the subjoined accounts of Indian burials, translated from the Spanish, will not be found uninteresting perhaps to those who are studying the history, etc. of the unfortunate races inhabiting this continent at the time of its discovery: "When a chief of Darien died, his wives and servants committed suicide, in order that they might serve him in the next world, fully believing that the souls of those who did not kill themselves on the decease of their lords died with their bodies or were converted into air. As soon as the cacique expired his followers seated him on a stone, and, kindling a fire about him, they dried him until nothing but his skin and bones remained; after which they hung him up or fastened him against the wall of a room set apart for this purpose, adorning him with feathers and jewels of gold, and placing him by the side of his father or predecessor deceased. Thus, by his corpse was his memory preserved among his kindred; and when a chief was killed in battle the fame of his prowess was handed down to posterity in the songs which accompanied their *areitos* or dances." "When a chieftain of Uraba departed this life his friends and domestics met at his house, and in the dark drank strong liquor, weeping for the dead; and after many sorceries and ceremonies they placed him in the grave, with his wives, treasure, jars of wine, arms, and food; the demon giving his subjects to understand that he had to take provisions for his journey to another kingdom, which he had provided for him." "In Castilla del Oro they clothed a deceased ruler in his richest armor, and hung him over a fire to dry, the grease which dripped from him being caught in large vases appropriated to this purpose. While this process of drying was going on, twelve of the principal men of his house, enveloped from head to foot in black blankets, sat round the corpse, and from time to time one of their number struck a hoarse drum (*as we beat for a funeral*), commencing a low chant in the intervals of the beating, which his companions took up in regular succession, *after the manner of the responsory.* A little before daylight on each night of their vigil they gave a piercing yell, after which they relapsed into silence, while the drum was tapped quickly and lightly, *as one rings the passing-bell.* All the people of the house drank and made merry, save the twelve, who left not the corpse by day nor by night, unless compelled by some necessity to do so, when they kept closely veiled from the vulgar gaze. Pasqual de Andagoya, being present at the burning of the lord of Pocorosa in the province of Cuebra, asked what was said by the mourners in their chants. 'They sing,' replied an old Indian of the mountain, 'the history of the deeds of our great chieftain.' After the lapse of a year the mummified chief was carried to the great square of the town or village in which he had lived, and after the food which he had most liked in life had been placed before him, and his favorite wives slain, he was placed upon a large fire and entirely consumed, the Indians thinking that the smoke went to the abode of his soul in the other world; and being asked 'Where?' they pointed, without speaking, toward the skies." "In El Reino Misteco, when a great lord was taken sick, the priests made vows to make pilgrimages and observe fasts, which were conscientiously fulfilled; and if he recovered they had grand dances, both at his house and in the monastery. If he died, the funeral procession was very grand, the dead being surrounded by the whole body of the priesthood, and followed by thousands of his dusky warriors, while a slave, royally attired, preceded him, who with the chieftain's three best-beloved wives (previously made drunk and strangled), and two other slaves, was interred with him. He was buried at midnight in a vault above ground, with a mask on his face, golden earrings in his

ears, rings on his fingers, and a mitre on his head, and enshrouded in many cotton blankets." F. A. PARKER.

Guacha'ro Bird [so called from the Guacharo cave, near Cumana, one of its chief abodes], the *Steatornis Caripensis*, called also **Oil-Bird** and **Trinidad Goatsucker,** a bird usually referred to the goatsucker family, but differing from the goatsuckers in its food, which consists of fruits entirely, while the goatsuckers feed upon insects only. It lives in the northern parts of South America and the Southern West Indies, inhabiting caves and coming out only in the night. The birds become excessively fat, and are caught in great numbers by the Indians, who try out their oil, which is sweet and limpid and used as food. The flesh is also eaten. It is probable that their caves will become important sources of the guano supply.

Guachinan'go, town of Mexico, in the state of Puebla, celebrated for the excellent vanilla which is raised in its vicinity. Pop. 6000.

Gua'chos, or **Gau'chos,** a class of mestizoes, descending from the earliest Spanish colonists and native Indians, and inhabiting the Pampas of South America, chiefly in the Argentine Republic. Their lives, led in miserable mud huts, and occupied solely in tending the immense herds of wild cattle and horses which roam over the Pampas, are, like their characters, rude and wild, but not without a peculiar romantic interest. Their skill in riding on horseback and catching wild cattle is marvellous, and their knowledge of the vast regions they inhabit most wonderful. They are very hospitable and courteous.

Guadalaja'ra, or **Guadalaxa'ra,** province of Spain, the northernmost part of New Castile. It is mountainous, fertile, without trees, but rich in minerals. Much wheat is raised here. Area, 4870 square miles. Cap. Guadalajara. Pop. 208,638.

Guadalajara, or **Guadalaxara,** town of Spain, the capital of the province of the same name, on the left bank of the Henares. It is picturesquely situated, well built, and contains the magnificent palace of the dukes del Infantado. Pop. 6533.

Guadalajara, or **Guadalaxara,** city of Mexico, the capital of the state of Jalisco, near the river Santiago. It is a large and handsome city, with fourteen public squares, and twelve large fountains provided with water from Cerro del Col by an aqueduct 3 miles long. Its cathedral is a magnificent building, though its appearance has been impaired by the destruction of the cupolas of its two towers by the earthquake in 1818. Its alameda or public walk is a beautiful promenade, and its manufactures of leather, earthenware, and shawls are quite considerable. It is a bishop's see. Pop. 19,500 in 1820; 46,804 in 1841; 68,000 in 1855.

Guadalaviar', or **Tu'ria,** a river of Spain, rises in the Sierra Albarracin, in South-western Aragon, near the sources of the Tagus, and after a south-eastern course of 130 miles, through the gardens of Valencia, it falls into the Mediterranean.

Guadalquivir' [Arab. *Wad-al-Kebir,* "the great river"], a river of Spain, rises in the Sierra de Cazorla, in the province of Jaen, and after a south-western course of 260 miles through the provinces of Jaen, Cordova, and Seville, it falls into the Atlantic 18 miles N. of Cadiz. It is navigable to Seville, 12 miles below which it separates and forms two islands. Its lower course is sluggish, through a marshy, unhealthy, but fertile tract. Its affluents are—on the right, the Guadalamar and the Jandula; on the left, the Guadajoz and the Xenil.

Guadalu'pe, county of S. W. Central Texas. Area, 807 square miles. The surface is beautifully undulating, and is well timbered. Live-stock and corn are leading products. Lignite is found. Cap. Seguin. Pop. 7282.

Guadalu'pe Moun'tains, a range of N. W. Texas and of New Mexico, lying between the Rio Grande and the Pecos. They are a long spur of the Rocky Mountain system.

Guadalu'pe Riv'er, a branch of the San Antonio, rises in Edwards co., Tex., and after a course of 200 miles falls into the San Antonio 13 miles from its mouth, in Espiritu Santo Bay. It flows for the most part through a beautiful region.

Guadalu'pe-y-Cal'vo, town of Mexico, in the state of Chihuahua. In its vicinity are rich silver-mines worked by an English company. Pop. 10,000.

Guadeloupe, one of the Lesser Antilles, in the West Indies, situated in lat. 16° N. and lon. 61° 45' W., belonging to France, and connected with the neighboring islets Désirade, Marie Galante, and St. Martin under the same administration. Area, 534 square miles. Pop. 152,910. By Salt River, a narrow strait, it is divided into two parts. The western part, Guadeloupe proper, is of volcanic origin and mountainous, its highest peak, La Souffrière, an active volcano, being 5108 feet high. The eastern part, called Grande Terre, is a coral formation, low and flat. The soil is fertile. Sugar, rum, coffee, dyestuffs, cabinet-woods, and tobacco are exported. Cap. Basse-Terre.

Guadia'na, a river of Spain, rises in the Sierra Alcaraz, in La Mancha, runs for a distance of 30 miles under ground, passes through La Mancha and Estremadura, enters the Portuguese province of Alemtejo, and falls into the Atlantic after a course of 420 miles. It is navigable only for about 35 miles. Its chief affluents are—on the right, the Giguela; on the left, the Javalon and the Ardila.

Guadix, town of Spain, in the province of Granada, on the river Guadix, is an old town, but well built, and contains a fine cathedral, a Moorish castle, and other handsome buildings. In the vicinity are several hot mineral springs. It is a bishop's see. Pop. 10,151.

Gua'duas, town of Colombia, South America, in Cundinamarca, is 8700 feet above the sea, among the Andes, near the Magdalena. Pop. 9000.

Guai'acum, a genus of trees, natural order Zygophyllaceæ, of which the important species are *G. officinale* and *G. sanctum*, small evergreen trees, with blue flowers, growing in the West Indies and adjacent mainland. The wood, commonly called *lignumvitæ*, is exceedingly hard and heavy, sinking in water, and is much used in manufactures, as for ship-blocks, ten-pin balls, etc. It is imported from the West Indies in logs or billets, of which the sap-wood is yellow and the heart-wood greenish-brown. It has a peculiar odor when rubbed or heated. *Guaiac resin*, or *guaiac*, is the concrete juice of the same tree, obtained from the wood, and also imported from the West Indies. It comes in deep greenish-brown or olive-colored brittle resinous masses, of feeble fragrant odor, and, after melting in the mouth, of a hot, pungent taste. It is a complex body, containing three acids, a peculiar resin and other substances. It is completely soluble in alcohol, forming a deep-brown tincture. Guaiac readily oxidizes on exposure, turning green, and from the change of color produced by contact with some animal and vegetable substances is useful as a chemical test, as for detection of blood in stains. It is used sometimes in medicine as a so-called "alterative" in rheumatism and syphilis, and as an emmenagogue and sudorific, but its virtues are very feeble. *G. sanctum* grows in Florida. EDWARD CURTIS.

Guaicurú Indians, found in the valley of the Paraguay, in Brazil. They live by horse-breeding, have some simple manufactures, despise agriculture, have a sort of caste, keep slaves, and are mostly heathens.

Guala'la, post-v. of Punta Arenas tp., Mendocino co., Cal. Pop. 236.

Gual'do-Tadi'no, town of Italy, in the province of Perugia, once fortified, and governing itself under the protectorate of Perugia; then it passed under that of Rome. In 1833 it was honored with the title of "the city of Pope Gregory XVI." Pop. 7799.

Gualeguaychú, thriving city of the province of Entre Rios, Argentine Republic, on a river of the same name. Beef, salted and dried, wool, superphosphate of lime, tallow, horns, etc. are largely exported. Pop. 25,000.

Gualeyguay', town of the Argentine Republic, in Entre Rios, on a navigable river of the same name, a branch of the Paraná. It has an active trade in wool, timber, and hides, and is very prosperous. Pop. 8000.

Gualtie'ri, town of Italy, in the province of Reggio nell' Emilia, on the left bank of the Po, near Parma. There is a tunnel of some interest in the neighborhood, constructed by a Bentivoglio in the sixteenth century for the purpose of draining the Vallis Putrida. Pop. 5684.

Gu'an, a name applied to various gallinaceous birds of the family Cracidæ, all natives of warm parts of America. One of these, the *Penelope cristata* of Brazil and Guiana, is domesticated in those countries and in Holland, and prized as food. The Texas guan of Mexico and Texas is the *Ortallida Maccalli*, a large bird, the only one of the family reported in the U. S. The *Ortallida motmot* of Guiana is there called the pheasant.

Guanabaco'a, an eastern suburb of Havana, Cuba, on the seashore, has fine residences, sea-bathing establishments, hospitals, convents, schools, etc., and a railway connects with the city proper. Pop. 7000.

Guana'co (*Auchenia Guanacas*), a South American animal of the camel family, regarded by many as a distinct species, by others as merely a wild variety of the llama (*Auchenia glama*), a species of which the alpaca is also by some regarded as a variety. The guanaco is especially abundant in Patagonia and Chili, where it forms

large flocks. This beast is about three feet high at the shoulders, and is extremely swift. In domestication it is ill-tempered, and has a disagreeable habit of ejecting saliva upon unwelcome visitors. In its wild state it seldom drinks water. Its flesh is edible, and its skin is of considerable value.

Guanaha'ni, Cat Island, or **San Salva'dor,** one of the Bahamas, is a small island with 2378 inhabitants. It is fertile, but poorly cultivated. It was formerly generally believed to be identical with Columbus's San Salvador, but recent criticism seems to point out Watling's Island as his first discovery, and the latter has now received the official name San Salvador.

Guanajua'to, or **Guanaxua'to,** a state of Mexico, between lat. 20° and 22° N. and lon. 99° 40′ and 102° 40′ W. It is very high, partly a lofty plateau 6000 feet above the level of the sea, partly traversed by chains of mountains whose peaks reach a height of more than 11,000 feet. Area, 12,619 square miles. Pop. 874,043. It is very fertile. Maize and wheat are raised in great quantities; also red pepper, vines, and olives. But most important among its products are its minerals—gold, silver, copper, and lead; its silver-mines are considered the richest in the world.

Guanajua'to, or **Guanaxuato,** town of Mexico and the capital of the state of the same name. It has some manufactures of soap, linen, and tobacco, but its chief importance it derives from the silver-mines in its vicinity. It is situated at an elevation of 6017 feet above the sea, and curiously built with steep and tortuous streets, but many of its houses are very handsome. Pop. 63,000.

Guana're, city of Venezuela, in Barinas, near the river Guanare, exports hides, coffee, cacao, etc. It is some 220 miles S. W. of Caracas. Pop. 12,000.

Guan'ches, the aboriginal race of the Canary Islands, now extinct, though the chief families of the group boast of their Guanche blood. Conquered by Bethencourt (1402–05), they were compelled to embrace Christianity. They possessed some noble traits of character. A short vocabulary of their words indicates a Berber origin, but this has been questioned. Catacombs where they placed the embalmed and dried bodies of their dead are still shown.

Gua'nine ($C_5H_5N_5O$). This substance was discovered in guano by Unger in 1844; it does not occur in fresh excrement of birds. It is found in excrements of garden spiders, in the green organ of the river-crab, in the Bojanian organ of the pond-mussel, in the pancreas of horses, in the scales of the bleak, and in concretions of pork diseased with the guanine gout. Guanine is a white, amorphous powder, insoluble in water, alcohol, and ether. It combines with acids, bases, and salts, forming well-crystallized compounds. By digestion with hydrochloric acid and chlorate of potassa it yields guanidine and parabanic acid, with some other substances in lesser quantities. Guanidine has the formula CH_5N_3, is crystalline and alkaline, with a caustic taste. It combines with acids, forming crystalline salts.

W. H. Chandler.

Gua'no [from the Peruvian word *huano*, "dung"]. One of the oldest mentions of the word "guano" occurs in *The Natural and Moral History of Indies*, written by Father Acosta, a Jesuit priest, and published in Seville in 1590. The passage reads as follows: "On some islands near the coast of Peru may be seen, from a great distance, large hills of a white color, which look as if covered with snow; yet are they nothing but heaps of sea-fowls' dung, in so great a quantity that it rises yards and even lances in height, to an extent that would seem fabulous. Vessels go to these islands for no other purpose than to load this dung, for no other kind of produce is found on them. This dung is so efficient that the land manured with it will yield an abundant return of grain and fruit. This dung is called guano." Of still older date are the *Commentaries of the Incas*, written by Garcilaso de la Vega, who died in 1568. His mother was an Indian princess, and his father a Spaniard of good family. Garcilaso gives a very interesting account of the manner in which the birds producing the guano were protected by the laws of the Incas, by which it was made a crime punishable by death to kill the sea-fowl, gather their eggs, or even to visit the islands during the breeding-season. The writer then goes on to say how each island was divided by landmarks, apportioning it among the different provinces of the kingdom, to each of which was assigned the amount of guano to be used during the season. He greatly extols the fertilizing properties of guano, but does not call it by this or any other special name. The Peruvians to this day continue to employ guano as a fertilizer, and in fact it is the only manure they use. The government, to whom all guano deposits belong, allows those requiring it for home consumption to take what they may need free of any charges; yet even then the agriculturists in many localities in the interior have to pay as high a price for this fertilizer as it commands in New York, in consequence of the expense of transportation from the coast, which is generally effected on the backs of llamas or on donkeys. Humboldt called attention to the great value of guano, and the sample analyzed by Fourcroy and Vauquelin was sent to France by that savant in 1805. He stated that "the guano is deposited in layers 50 to 60 feet thick upon the granite of many of the South Sea islands, off the coast of Peru. During 300 years the coast-birds have deposited guano only a few lines in thickness. This shows how great must have been the number of birds, and how many centuries must have passed over, in order to form the present guano-beds."

About thirty years ago a quantity of guano was sent to England from Peru to test its worth as a merchantable article. It was consigned to a commission-merchant, by whom it was placed in the care of a broker, who advertised it and put it up at auction. Being unknown in the market, it found no bidders, and the commission-merchant, acting in the interest of his consignor, ordered the entire lot to be thrown into the Thames to avoid storage and other expenses. Another sample of guano was sent to England. On this occasion, however, it was not offered for sale, but was placed in the hands of agriculturists to test its merits as a manure. The result may be easily imagined. Wherever used it gave the most ample proofs of its fertilizing qualities, and a demand immediately sprung up, purchasers being found to take it at £20 (or $100 gold) per ton. The parties who thus became aware of the commercial value of guano purchased from the Peruvian government for the sum of $40,000 the exclusive right of taking it from the islands and exporting it to Europe; but they were not long allowed to enjoy this privilege, the government claiming the benefit of a law which authorizes the recession of any contract or sale when the value of the thing sold is greatly in excess of the consideration given for it. After this the government began to export guano on its own account through the agency of the house of Gibbs & Sons of London. This was in 1842, and from a few thousand tons that were at first imported annually the amount rapidly increased to its present figure—viz. from 400,000 to 500,000 tons per annum. Before the late war the importation of Peruvian guano into the U. S. had reached 80,000 tons per annum, the greater portion being consumed in the Southern States. At the commencement of the war this demand ceased, but at its close the trade at once revived, though it has not yet reached the former maximum quantity. Some few years since the right of exporting guano was granted, for certain considerations, to a stock company, who still hold this right, and whose agents are located in various guano-markets and manage this business. The high price which guano commanded soon led to the search for and the discovery of similar deposits in other parts of the world. Large deposits were found on the coast of Chili and Bolivia, in South Africa, and on numerous islands in the Pacific Ocean and Caribbean Sea; and the importation of them into England caused the price to fall to £9 10*s.* per ton. Yet the consumption increased, and the superior quality of the Peruvian over the other varieties being established, its price advanced, and Chincha Island guano was sold in Europe for £13 10*s.* per ton of 2240 pounds, and in this country for $67.50 gold. Excellent guano was formerly obtained from Ichaboe, an island off the W. coast of Africa, whose climate is much like that of the Peruvian coast. Guano of low grade is supplied by many islands of the Pacific. (See art. Guano Islands of the Pacific Ocean.) Quite recently attention has been called to extensive cave-deposits of "bat-guano," consisting of the dung of bats and birds. This substance is formed in the caves of many warm countries, and may yet become important. The so-called "fish-guano" is the refuse of fishes caught for their oil. It has a high but unequal value as a fertilizer, and is prepared chiefly in Norway and on the Atlantic coast of the U. S.

Composition of Guano.—The composition of guano varies, as may be seen by inspecting the subjoined tables of analyses. The first table represents the composition of guanos containing more or less ammonia-producing compounds, and the second the composition of guanos in which these compounds are quite wanting. Of the former class, the Guañape and Ballista only are found in our markets to any extent; and of the latter class, the South Carolina phosphates have quite usurped the market by reason of their cheapness. Extensive deposits of this latter class occur in various portions of the world, and are largely used in the manufacture of the class of fertilizers termed superphosphates. The Guañape Islands are situated a few miles off the coast of Peru, in lat. 8° 27′ S., and the Chinchas about 300 miles farther S. These islands, as well as Ballistas, Lobos, and Macabi Islands, all of which are situated off the same coast, are the property of the Peruvian government.

Ammoniacal Guanos.

	Chincha Islands. 1.	2.	3.	4.	5.	Guanape Islands. 6.	7.	8.	Ballistas Isl. 9.	Elide. 10.
Date of shipment	1804	1852	1853	1857	1870	1869	1870	1870	1870	1858
Ammonia	10.54	15.24	16.25	16.39	15.97	11.24	13.18	11.92	10.74	10.03
Phosphoric acid, soluble	11.35	9.70		4.17	5.02	13.58	6.09	3.35	2.95	5.19
" " insoluble		10.00	8.11	10.37	7.90		8.24	13.18	13.59	6.35
Potash	2.96	3.24								5.52
Water		8.50		12.68	14.35		19.72	19.32	12.85	27.47

1. Carried to Europe by Humboldt, and analyzed by Fourcroy and Vauquelin. 2, 3. Imported into England, and analyzed by Dr. Andrew Ure. 4. Average of analyses of four lots of guano imported into this country, analyzed by Prof. S. W. Johnson. 5. Average of analyses of two cargoes imported into New York, analyzed by Prof. C. F. Chandler and F. A. Cairns. 6. Analyzed by Prof. S. W. Johnson. 7. Average of analyses of nine cargoes imported into New York, analyzed by Prof. C. F. Chandler and F. A. Cairns. 8. Average of analyses of six cargoes imported into Savannah, Ga., analyzed by Dr. A. Means and F. Bruckman, E. M. 9. Imported into Savannah, Ga., analyzed by Dr. A. Means and F. Bruckman, E. M. 10. From the coast of California, analyzed by S. W. Johnson. Analysis of Lobos Island guano shows 13 per cent. of ammonia.

Phosphatic Guanos.

	Sombrero Isl. 1.	Swan Island. 2.	3.	4.	Redonda Isl. 5.	So. Carolina. 6.	Baker's Isl. 7.
Lime	49.82	44.77	19.46	0.61	0.57	35.71	42.74
Magnesia		0.70	1.57	0.14			2.54
Sesquioxide of iron		1.42	5.17	9.04	14.40	15.01	
Alumina		1.91	10.12	14.04	16.60		
Phosphoric acid	37.83	33.38	25.39	31.05	43.20	24.95	39.70
Sulphuric "		0.12	0.03			2.40	1.30
Carbonic "	5.04	3.08	0.38	0.10		2.55	
Silica and insoluble matter	0.40	5.68	21.16	24.80	1.60	11.67	
Water expelled at 212° F.	2.62	2.58	2.87	3.62	24.00	9.15	2.92
" " above 212° F.	3.50	2.70	8.30	13.81			8.32
Organic matter		2.57	5.02	1.74			
Undetermined matter	0.79	1.09	0.53	1.05			2.48
	100.00	100.00	100.00	100.00	100.37	101.44	100.00

1. From Sombrero Island, West Indies, lat. 18° 36′ N., lon. 63° 27′ W. from Greenwich, imported into this country in 1859, analyzed by S. W. Johnson. 2, 3, 4. From Swan Island, West Indies, lat. 17° 22′ N., lon. 83° W., imported in 1866, analyzed by C. F. Chandler and F. A. Cairns. 5. From Redonda Island, West Indies, imported in 1869, analyzed by C. U. Shepard. 6. From Ashley River, S. C., analyzed by C. U. Shepard in 1868. 7. Baker's Island, lat. 0° 13′ N., lon. 176° 22′ W., analyzed by J. D. Hague, 1862.

Navassa guano belongs to this class, and has yielded as high as 37 per cent. of insoluble phosphoric acid. This island is situated in the West Indies, E. of Jamaica, lat. 18° 25′ N., lon. 75° 5′ E.

In the tables of analyses the ammonia is calculated as dry ammonia gas (NH_3), the phosphoric acid as phosphoric anhydride (P_2O_5), and the potash as oxide of potassium (K_2O).

Origin of Guano.—It is generally conceded that guano is the accumulated droppings of birds, which in numberless flocks frequent at the present time secluded localities. These deposits were formerly supposed to belong to a previous geological epoch, but recent study has brought to light, deeply imbedded in the guano, well-preserved remains of aquatic birds and other animals of the present epoch. The phosphatic character of these deposits is due to the fact that these animals feed largely upon fish. The ammoniacal compounds are most abundant in the guanos found in situations where the rainfall is very light and the subsoil of a compact, clayey nature, conditions which exist at the Peruvian islands. When the rainfall is abundant, these substances are decomposed and leached out, and the earthy constituents remain. Such is the condition of the West Indian deposits, where ammonia-producing compounds are mostly wanting. Between these extremes the various grades of guano range.

Valuation of Guano.—The constituents in guano of value to the agriculturist are ammonia and ammonia-forming compounds, soluble and insoluble phosphoric acid, and potash. By considering the various commercial supplies of these materials, the following values may be assigned to them per pound:

Ammonia	25	cents.
Soluble phosphoric acid	12	"
Insoluble " "	4	"
Potash	7	"

To calculate from these figures the value of a guano, take, for example, Analysis No. 8 of Guañape guano, per ton of 2240 pounds:

Ammonia	11.92 per cent.,	265 lbs.	at 25 cts. =	$66.25
Sol. phos. acid...	3.35 " "	75 "	" 12 "	9.00
Insol. " "	...13.18 " "	295 "	" 4 "	11.80
				$87.05

Giving thus $87.05 as the commercial value of a long ton of this guano, as compared with other sources of the same constituents.

Adulteration of Guano.—This practice is by no means uncommon, and consists in adding to a genuine guano of established reputation earth which resembles the original guano in appearance. Sophistication of Peruvian guano is frequent, this article being the best-reputed article in the market. Guañape Island guano, which is the variety of Peruvian guano now in the market, is sold at wholesale by the cargo for $60 gold for 2240 pounds; Chincha Island guano, now quite exhausted, brought $67.50 gold. This material has by some jobbers been adulterated with worthless yellow earth and the less valuable West Indian or South Carolina phosphates, and thrown upon the market as genuine. South Carolina phosphates have been sold as low as $12.50 per ton. The advantage to the jobbers is thus evident, and the disadvantage to the agriculturist is appreciable on inspecting the paragraph upon the *Valuation of Guano*. In a recent examination of eleven samples of so-called Peruvian guano, bought of as many dealers, the composition varied from ammonia 4.54 per cent. and phosphoric acid 6.04 per cent. to ammonia 11.19, phosphoric acid 15.85 per cent., the tests being made by Mr. Habirshaw, chemist of the New York Board of Trade. In purchasing guano, therefore, one must patronize reliable dealers, as it is not possible by any examination within the scope of a practical farmer to distinguish the genuine from the adulterated article. Any good chemist, however, can easily determine the percentage contents of ammonia and phosphoric acid, soluble and insoluble, and from these data the farmer may, by use of the system of valuation explained in this article, and by comparison with the table of analyses, determine its value.

Application of Guano.—No definite rules can be given for guano as to what soils will be most benefited, or the necessary quantity. This must be determined by experiment. Peruvian guano should not be applied to crops in its pure state, but should be previously mixed with four times its weight of good soil, thus avoiding the danger of injury to the seed. For wheat, grass, oats, and similar crops from 1000 to 1500 pounds of the above mixture should be sowed broadcast in the early spring; this is equivalent to from 200 to 300 pounds of guano. For corn, cotton, beans, peas, etc. the above mixture is placed in the hill, covered slightly with earth, and the seed dropped upon it and covered as usual. The equivalent of guano per acre varies up to 250 pounds per acre. The guano is best applied in all cases in damp weather. For application to flowering plants it is sometimes suspended in water and sprinkled around the roots.

The Guano Trade.—The exportation of Chincha Island guano to Europe commenced in 1841, and has amounted some years to nearly 500,000 tons, of which Great Britain was the largest consumer. At the present time the consumption in the U. S. of this quality of guano is about 35,000 tons. The Chincha Islands, after yielding from 12,000,000 to 15,000,000 tons of guano, are now quite exhausted. In 1868, when the exportation from the Guañape Islands began, the amount of guano upon these and the other Peruvian islands was estimated at 5,000,000 tons. It is probable, therefore, that in the year 1880 these sources of guano will be exhausted. In various localities upon the W. coast of South America, in Bolivia and Chili, there are extensive deposits of guano, but of a quality inferior to that obtained from the Peruvian islands. In 1870 there were exported from the Peruvian islands 461,299 tons, as follows:

Great Britain	178,870
France	100,186
Belgium	68,837
Germany	36,412
Spain	34,366
United States	30,798
Holland	6,524
Italy	5,306

In regard to the trade in the phosphatic guanos, these have been obtained from many localities in all parts of the world. The South Carolina deposits were first mined in 1867, and on July 1, 1872, there had been mined a total of 242,415 tons, valued at $1,700,000. During the last named year nearly 100,000 tons were mined. The South Carolina phosphate, from its cheapness and abundance, has quite usurped the market for this quality of guano.

An act of Congress, passed in 1856, granted protection to Americans who should occupy and operate unclaimed deposits of guano, and in 1859 no less than 48 islands had been thus secured by citizens of this country.

W. H. Chandler.

Guano, or **Villa Guano,** town of Ecuador, 100 miles S. W. of Quito, on the Rio Guano, province of Chimborazo. It has varied manufactures and some trade. Pop. 9000.

Guano Islands of the Pacific Ocean. By this designation must be understood those small low islands of the far western Pacific upon which within twenty years past the valuable fertilizer known as guano has been discovered and worked. These islands must therefore not be confounded with the guano islands upon the coast of Peru, as the Chinchas, Guañape, and the Macabis, which contain guano of an entirely different character from that found upon the low coral islands which form the subject-matter of this article. The principal guano-producing islands of the western Pacific are ten in number, and may be classified as follows:

Worked Out and Abandoned.

(1) McKean Island, lat. 3° 35′ S., lon. 174° 17′ W.
(2) Phœnix Island, " 3° 47′ S., " 170° 43′ W.

Worked at the Present Time (1874).

(3) Jarvis Island, lat. 0° 23′ S., lon. 159° 54′ W.
(4) Baker Island, " 0° 13′ 30″ N., " 176° 29′ 30″ W.
(5) Howland Isl., " 0° 49′ N., " 176° 40′ W.
(6) Enderbury Isl., " 3° 09′ S., " 171° 08′ W.
(7) Starbuck Isl., " 5° 37′ S., " 155° 56′ W.
(8) Malden Island, " 4° S., " 155° W.

Occupied, but not Worked yet.

(9) Christmas Isl. (Company's station), lat. 1° 57′ 16.8″ N., lon. 157° 26′ 49.5″ W.

Not Occupied as yet, in consequence of the Guano being deemed of Inferior Quality.

(10) Canton or Mary Island, North Pt., lat. 2° 44′ 35″ S., lon. 171° 42′ W.

To describe one of these islands is to describe nearly all of them; therefore a brief description of those best known, as Baker, Howland, Jarvis, Enderbury, and Starbuck, may be deemed sufficient for the purpose of conveying a c ear idea of their general character. All are low and of coral formation; all but Christmas and Canton islands, which are large atolls, are very small (say, 3 miles long by ¾ to 1 mile wide); all contain phosphatic guano, and numerous vessels are annually chartered by the various companies referred to to load at the several islands which have been mentioned as in working condition. The *climate* of these islands is similar and very equable; the trade-winds are almost constant, and blow in the summer from E. by S. to S. E., and in the winter from E. by N. to N. E. Westerly winds are rare except at Baker and Howland, and even there only in the winter, which lasts from November to March, at which season Baker Island is dangerous to ships loading, and in fact many wrecks have taken place there. The sky is generally clear and cloudless, and the temperature quite even, ranging from 76° at sunrise to 88° F. at the hottest period of the day in the shade. In the sun at noon, the thermometer frequently rises to 100° F. Broad-brimmed straw hats, very light clothing, and green goggles (to protect the eyes from the blinding glare of the dazzling white coral sand) are absolute necessities to the white occupants of the islands. Rain falls in light showers not unfrequently, but generally at the full and change of the moon. Heavy showers are rare, and rainy days unknown except (at long intervals) at Baker Island. During an observation of four winter months at the latter island rain fell 23 times, generally in light showers or squalls: the least of these showers, as shown by a conical rain-gauge, was 0.005 inch on a level; the greatest was 0.258 inch. The greatest rainfall noted occurred in 1859. Between the 14th and 20th of December of that year inclusive, the total rainfall was 0.65 inch, and the total amount in five months was 1.849 inches, of which 0.85 inch fell in December. At the other islands the rainfall is not nearly so great. Although the rainfall in the summer is very much less than in the winter, there are occasional days even in summer on which showers have fallen as heavily as at any other season of the year. Rain falls most frequently in the night and just before daybreak; sometimes also by day (especially if the sky has been much overcast) a raincloud will pass over the island. At all the islands may be seen the remarkable phenomenon of a rainsquall approaching with great rapidity, and then just before reaching the windward side of the island separating into two parts, one of which passes N. and the other S., not a drop of rain reaching the island, the nimbus having been cleft by the column of heated air rising from the white coral sand. In many instances the two portions of the rainsquall have been observed to reunite when several miles to leeward of the island. The position of these islands, being so near the equator, and remote from any high land, makes them exceedingly favorable for studying the meteorology of this region. The Equatorial Current is also a matter of great interest. Its general direction is to the W. and W. by S., its average velocity about 2 knots (nautical miles) per hour. In the vicinity of Christmas Island it varies between 1½ and 3½ nautical miles per hour. It is least in the vicinity of Malden and Starbuck islands, they being farther removed from the equator. In the neighborhood of Starbuck Island the velocity is rarely greater than 1 nautical mile per hour. At all the islands, especially during the winter months, the swell and surf is very heavy on the windward side. During the summer there is little or no surf on the lee side, and the water is very smooth, and landing is therefore easy. Enderbury and Howland islands are the only ones on which even passable fresh water is to be found, and all the islands are comparatively destitute of vegetation.

About fifteen or twenty varieties of birds may be distinguished as frequenting these islands, of which the principal are gannets, boobies, frigate-birds, tern, noddies, petrels, and tropic-birds, both white and red-tailed. On some of the islands game birds are found, as the curlew, snipe, and plover. All these birds are, however, much scarcer than formerly, when the islands were unoccupied, though even at this time they may be reckoned by myriads, at times absolutely darkening the air, and at the season of incubation literally covering the ground. Rats are found on all the islands, especially at Enderbury and Howland, where they are astonishingly numerous, and prey upon the birds and their eggs when they cannot get access to the stores of the guano company. There is no anchorage at any of these islands except Christmas and Canton, and the general features of the coral reef are common to all. None are over 28 feet, or less than 8 feet, above the sea; the highest is Enderbury, the lowest Christmas Island. Their surface generally contains a growth of coarse grass, portulacca, mesembryanthemum, and a few other species of plants. On a few of the islands are found some cocoanut trees, and low coarse, spongy wood bushes. Fish are numerous, some being of excellent quality, but the sea swarms with a voracious race of sharks, which haunt the vicinity of every ship with greedy and persistent devotion. Strange to say, the dark-skinned Polynesian has no fear of these monsters, but will fearlessly plunge into the sea and swim unmolested with a line in his teeth to a mooring-buoy, returning unharmed.

The vicinity of these islands was thirty years since the great rendezvous of the sperm-whalers, and the discovery of the guano or phosphate on Baker (then known as New Nantucket) Island was the result of an accident: a sailor from a whale-ship dying in the vicinity of the island, was buried upon it; the upturning of the soil to make the grave revealed the presence of the guano. When the American company was first formed to work Baker Island, the U. S. ship Independence (64), Commodore Mervine, was sent to examine the locality, but the report was unfavorable, it being alleged that the guano on the island could be of no value in consequence of the rains prevailing at the period of the vessel's visit; that if good, it could not be boated off through the surf; and that if boated off, the enterprise would not pay for the extra cost; while, there being no anchorage, the ships loading must lie "off and on" while awaiting cargoes. Consequently, the enterprise was inaugurated under rather unfavorable auspices, as some of these statements were undeniably true, though the deductions (especially as regards the value of the guano) were erroneous. In 1856 the Congress of the U. S. passed an act, which was approved Aug. 18th of the same year by Pres. Pierce, in consequence of which Commander (now Rear-admiral) C. H. Davis of the U. S. sloop St. Mary's (20) took formal possession of Jarvis and Baker islands Aug., 1857. This was the virtual inauguration of the guano enterprises of the western Pacific, and since this occurrence many hundreds of thousands of dollars of American and English capital have been invested in working the several islands.

The practical difficulties in the way of procuring and shipping the guano will be understood by what follows. All of these islands are surrounded by a double ledge or shelf of coral rock called "the fringing platform." The first or shallow ledge extends from high-water mark some

200 or 300 feet, and has usually from 3 to 5 feet water on it. The second ledge pitches abruptly downward from the first, and extends out about 300 feet, with a depth ranging from 50 to 200 fathoms. The downward trend of this ledge is so great (frequently 45°) that an anchor let go from a ship will not grapple the bottom, but falls away from the ledge into unfathomable depths, and of course, as no ship could anchor on the first ledge, it became necessary to devise some method of mooring the ships coming to load at these islands; and this is the arrangement practised with little variation at all of them: A large anchor is imbedded as firmly as possible in the shore above high-water mark, and has a very strong chain attached to it, this chain being long enough to allow another and a heavier anchor to be carefully lowered down on the second ledge in a depth of 70 fathoms. Of course the first anchor effectually prevents the second one from sliding off the steep ledge into deeper water. To the ring of the second anchor is secured a chain to which is attached a large mooring-buoy, so that ships can make fast with perfect safety. One or more of these moorings are laid down at each island, and the wind being fresh and almost constant from the eastward, and the moorings on the lee side of the island, of course a vessel cannot (except in a calm or westerly wind) swing in toward the dangerous first ledge unless the master and officers of the vessel are grossly negligent of their duty. A number of vessels, however, have been lost at Baker Island, which is the most dangerous of all the guano islands, in consequence of its "trending" in such manner as to give a less perfect lee for ships; but in the majority of these cases a little prudence or vigilance would have averted disaster. Yet when a vessel once swings round and strikes the hard coral ledge, she goes to pieces in the surf very speedily, and in most cases slides down the reef into deep water, and carries the company's moorings with her. A dangerous change of wind is almost always preceded by a dense dark mass of clouds appearing on the western horizon, and the aneroid barometer is also an unfailing guide. No prudent shipmaster who avails himself of the signs of the glass and sky need ever lose a ship at these islands; and in fact with moderate care a vessel is safe at any of them all the year through, with the single exception of Baker Island, which is undeniably dangerous in the winter months.

At Howland, Jarvis, Enderbury, Malden, and Starbuck islands there are fixed wharves or jetties for convenience of loading, but at Baker no fixed wharf is possible on account of the heavy surf. So there is a movable one on rollers, which is run to the beach and placed in position whenever it is necessary and the surf is favorable. These fixed wharves or jetties are light and strong, the framework being supported by iron piles screwed into the coral ledge. The wharf extends beyond the line of rollers, and a tramway is laid from the guano-beds to its termination, upon which platform cars convey the guano. At Starbuck Island these "trollies," as they are called, are propelled from the beds to the wharf to leeward by means of sails. The guano is transferred in bags to the lighters which convey it to the ship secured to the mooring-buoy. If the weather is favorable a ship will load rapidly, taking in an average of 100 tons per day. In many instances 125, and even 150 tons, have been taken in in a single day.

The guano is free from odor, and resembles brown dust in appearance, in this particular presenting a strong contrast to the Peruvian and African guano. Enderbury Island is the most remarkable of those now occupied, and though in its general features it resembles the others, it has some points of difference. It once contained a lagoon of considerable size, which has in a long course of years gradually filled up, while the entire island seems to have undergone some elevation. Immense slabs of coral rock lie piled in great masses here and there, especially at the northern end of the island; all this being evidently the result of upheaval combined with the long-continued action of the sea. The interior of this island (and Jarvis also) presents a shallow basin-like appearance as one views it from the highest point, the surface being much depressed from the outer edge of the coral wall towards the centre. On the eastern side of the island the first shelf is more abrupt than on the western or leeward side, and some distance beyond high-water mark the beach is very steep, with many ridges and deep furrows, all parallel to each other, and all evidently ancient beach-lines or water-marks. Great quantities of shells, beautiful fragments of coral of different colors, and some pebbles are found on the windward shores of these islands. With reference to the guano itself at Enderbury, it is best when discovered below a light layer of coral sand and shells. At Howland and Baker the guano rests solidly on a hard coral rock-base. At Jarvis Island, in the central and lower parts, the surface is composed of sulphate of lime, and on this foundation it is that most of the Jarvis guano rests. This feature in Jarvis is important to consider in studying the difference between the guano found on it and that at Baker and other islands, for it explains the appearance of the sulphate of lime remarked by those who have investigated the Jarvis guano, while the unequal mechanical mixture of its guano with this underlying sulphate accounts for the lack of uniformity in the samples. At Baker and Howland, on the contrary, the guano, resting on a hard rock-foundation, has undergone only such changes as the climate has produced. Of the origin of this sulphate of lime at Jarvis there can be little doubt. While the lagoon was filling up there was a gradual elevation of the island, and thus the communication between the outer ocean and the inner lake became constantly less easy, and large quantities of sea-water must have been evaporated in the basin. (This process is even now going on on a large scale at Christmas and Canton islands.) By this means deposits were probably formed containing common salt, gypsum, and other salts peculiar to sea-water. From these the more soluble parts were doubtless washed out by the occasional rains, leaving the less soluble sulphate of lime as it is found here. In fact, on Jarvis Island, as a proof of this process having gone on, there is a crescent-shaped bed 600 feet long by 200 feet wide, having a surface very slightly depressed from the outer edge towards the middle. On its border are incrustations of crystallized gypsum and common salt, ripple-marks, and similar evidences of the gradually disappearing lake. The whole is composed of a crystalline deposit of sulphate of lime, which around the borders is mixed with common salt, while near the centre, where rain-water sometimes collects after a heavy shower, the salt is almost entirely washed out, leaving the gypsum by itself, closely but not hard packed, and very wet. There is on Enderbury Island a description of guano or phosphate called "rock guano;" the best of this has yielded 86 per cent. of pure phosphate of lime.

At several of these islands, and at Enderbury and Jarvis in particular, there can be no doubt that the deposit of the birds has only partially contributed to the formation of the guano, the gradual evaporation in the lagoon and the slow decomposition of the coral rock having had as much to do with the formation of the phosphate as the excrement of birds. None of these guano islands resemble the Ichaboe islands of the W. coast of Africa or the guano islands on the coast of Peru. They are as different in their character as the deposits found on them. While the Peruvian and African islands are comparatively high, those of the western Pacific are low. The Peruvian and African guano has been produced almost wholly by the sea-fowl, and is white and pungent in odor; the guano of the western Pacific islands is brown and entirely inodorous.

The following is the report of the analytical chemists of the Smithsonian Institution on the Baker and Jarvis islands guano:

Percentage on Specimens from Baker Island.

Specimen.	Water.	Organic matter.	Residue of fixed salts.
A	21.07	6.6	72.33
B	28.30	6.7	65.00
C	33.04	6.0	61.00
D	30.40	6.5	63.00
E	28.80	6.5	64.70
F	27.30	6.4	66.30
G	28.00	6.9	65.00
H	25.80	7.4	67.00
I	27.94	7.7	64.36
Average	27.87	6.744	65.41*

The Howland Island guano is about the same as the above; the Enderbury rather better.

Percentage on Specimens from Jarvis Island.

Specimen.	Water.	Organic matter.	Residue of fixed salts.
K	17.20	11.80	71.00
L	23.60	7.70	68.70
M	18.00	11.20	71.00
N	14.88	9.90	75.00
O	13.50	12.00	74.50
P	18.00	11.40	70.60
R	21.00	10.25	69.75
S	21.04	6.80	72.00
Average	18.2775	10.156	71.57†

These specimens contained a larger percentage of lime than bones contain, and had also rather more phosphoric acid than bone-earth, and were in a finely divided condition, so that the useful matter could be readily taken up when applied to crops. Of course, phosphate of lime, being an important constituent of all cereals, is a most desirable addition to the soil. This will be the better understood when it is remembered that nearly the whole of the

* This residue consists of from 80 to 90 per cent. of phosphate of lime (tribasic), and from 10 to 20 per cent. of other phosphates.

† This residue consists of from 64 to 72 per cent. of tribasic phosphate of lime, the remainder being sulphate of lime and of other bases, chloride of sodium, and carbonate of lime.

bone of all animals is originally derived from the bone-earth in vegetable food.

On all the occupied islands roughly built but comfortable houses have been erected for the accommodation of the employés of the company, who consist of four or five white men, and from 30 to 60 Polynesian laborers. There is a superintendent (generally the ex-master of some whale-ship), a mooring-master, a carpenter, and on some of the islands an analytical chemist. The laborers work ten hours a day, and receive good food and fair pay and treatment. They are generally enlisted for a specific term, usually one year, at the end of which time the relief vessel carries them back to their native island. Water and provisions are supplied by relief vessels, which touch at the island regularly every three months. A large supply of water and provisions is always kept on hand, however, and at some of the stations, as at Baker, there are fresh-water distillers in use. About 140,000 tons of guano have been shipped from Baker Island since the inauguration of these guano enterprises, and about 20,000 tons of fair guano still remain on that island. Enderbury still contains about 140,000 tons of good phosphate, and Howland about 25,000 tons. On the other islands the amounts vary from 20,000 to 50,000 tons.

RICHARD W. MEADE, U. S. N.

Guara'na, a substance prepared from the seeds of *Paullinia sorbilis*, a climbing shrub of Brazil, order Sapindaceæ. The seeds are dried, powdered, then moistened and made into a paste; this, mixed with more of the seeds, either whole or merely bruised, is rolled into cylinders, which on drying form a strong, hard, mottled, reddish-brown mass. The essential ingredient of guarana is a crystallizable principle apparently identical with caffeine. Guarana is habitually consumed by the South American Indians, mixed with their food or made into a drink, and has lately been introduced into medicine, principally as a remedy for "sick headache." Like all remedies for neuralgic diseases, it often cures and often fails utterly. EDWARD CURTIS.

Guar'anty, a special promise to be responsible for the payment of some debt or the performance of some obligation or duty in case of the failure of another person, who is primarily liable to such payment or performance. It is less broad in its meaning than SURETYSHIP (which see), as that term includes implied as well as express promises. It requires all the elements essential to give contracts validity. The party promising must labor under no legal disability, and there must not only be a proposal upon his part, but a sufficient acceptance of the offer by the promisee. It is not necessary that acceptance be expressed in a positive declaration, since it may be presumed from acts evincing a readiness to comply with the request or demand upon which the promise was based, as if a shopkeeper should deliver goods to some person through faith in the guarantor's assertion that he would be responsible for the payment if the receiver of the goods were guilty of default. But unless the offer of the guarantor be absolute in its terms, there must generally be notice of acceptance given him, that he may know that the liability which he was ready to assume has become fixed and definite. The promise must be founded upon a valid and sufficient consideration. This may be of but trifling amount, but must have been operative as the inducement to the guarantor's action. If indebtedness had already been incurred, an engagement to pay it in case it were not satisfied by the one primarily liable would be nugatory, on account of the lack of consideration. In such a case as this, a new and independent consideration would be necessary. It would be sufficient if the creditor should agree to postpone the collection of the debt for a specified or a reasonable time. If the giving of the guaranty were contemporaneous with the formation of the contract for which the guarantor proposed to be answerable, the consideration which supported the principal agreement would support the collateral one also. It is not requisite that any benefit be received by the party giving the guaranty. It is sufficient that the person in whose favor it is given receive a benefit, or if the person to whom it is given put himself to some inconvenience, or part with some property, or undertake some obligation on the faith of the guarantor's promise. If a person in the form of a guaranty assume an obligation for a claim which would not be enforceable against the original debtor, as if he should promise to be responsible for articles, other than necessaries, supplied to married women or infants, he becomes himself a debtor. The reason is, that as the promise of the infant, etc. is void, there is but one valid promise, and that is his own. A guaranty may be resorted to not only as a means of ensuring the satisfaction of pecuniary liabilities, but also to secure the faithful performance of duty on the part of public officials, private agents, etc.

After a valid guaranty has been given the rights and obligations of the guarantor are determined upon somewhat peculiar principles. As his engagement is undertaken for the benefit of others, rather than his own, the law is scrupulous in protecting his interests. Hence, if any attempt be made to materially change the nature or extent of his liability by subsequent agreement between his principal and the party to whom the guaranty was given, he is, in general, relieved from liability. An instance of this kind would occur if he should guarantee a contract with certain stipulations in which an alteration was afterwards made by agreement between the debtor and creditor. Upon a similar principle, a guaranty of the good conduct of a clerk to a partnership would ordinarily be extinguished by an introduction of new members into the firm as to all subsequent acts performed by the clerk. But a guarantor might consent to any change which might be desired by the principal parties, and his liability would then continue.

The contract of guaranty does not impose a primary, but only a secondary, liability; and it is a just and reasonable requirement that diligent efforts be made to collect the sum due of the principal debtor. A mere delay or indulgence to his principal would not necessarily be sufficient for the guarantor's discharge, since he might not be injuriously affected in consequence. He might, if he desired, discharge the debt himself, and bring an action against the debtor at any time. There is in this connection an important distinction between a guaranty of *payment* and of *collection* of a debt or claim. In the case of a guaranty of payment the creditor may proceed at once against the guarantor without any reference to the principal debtor. In a guaranty of collection he must, as the term imports, strive to *collect* the debt from the debtor before resorting to the guarantor, and will be bound to proceed with diligence in his efforts to make such collection. If there should be in any case a valid agreement, without the guarantor's assent, between the creditor and the debtor for indulgence, preventing a resort to legal proceedings for a certain length of time, the guarantor would be discharged. If a guarantor should at any time pay the debt, he would be entitled to be substituted in the creditor's place as to the right to retain any property which the latter held in pledge to secure the claim. This is called in law the doctrine of SUBROGATION (which see). Sometimes a guaranty is extinguished or discharged because the creditor gives no due notification to the guarantor that the debtor has refused to pay on demand. The rule requiring notice is not, however, so strict as in the case of indorsers of negotiable paper, and the guarantor would not be discharged unless there was an unreasonable delay. The general principle would be the same as that which has been stated as applying to notice of acceptance of the guaranty by the creditor. If the guarantor had made a positive categorical promise, no notice would, in general, be necessary to bind him, but otherwise he ought to be speedily informed, in order that he might be enabled to take advantage of every available means to secure reimbursement from his principal. On this matter of notice the law of the various States is, however, not uniform.

The English Statute of Frauds, which has been substantially re-enacted throughout the U. S., requires that "upon any special promise to answer for the debt, default, or miscarriage of another person, the agreement, or some memorandum or note thereof, must be in writing and signed by the party to be charged therewith, or some other person thereunto by him lawfully authorized." A contract of guaranty must accordingly be in writing to be of any legal validity. But in the determination of the question whether certain promises are to be deemed guaranties or original engagements, which might be enforced even though made orally, very nice distinctions have been taken. The form of the undertaking here becomes important. There must of necessity be two promises—one of the principal debtor; the other, of the guarantor. If the transaction results in only one promise, the apparent guarantor will be in fact the true debtor, and no writing will be necessary. If A should say to B, "Let C have so many goods, and I will pay you," there will be but one promise (that of A), and writing will not be required. If A had said, "Charge the goods to C, and if he does not pay you I will," his promise would be void, as it would be collateral to that of C, who would be the true debtor, and would need to be in writing. It is a further rule that the promise need not be in writing unless it is made to the creditor himself. So it has been considered that a promise apparently collateral is not within the statute whenever the leading object of the promisor is not to discharge the debtor, but to subserve some interest of his own distinct from a payment of the debt. An instance of this kind would occur if any person, A, should pay his creditor, B, by an order upon his (A's) debtor, C, with a guaranty that the latter should discharge the debt. This would be, in effect, but a peculiar method adopted by A of discharging his own obligation. This rule, however, has been sharply criticised in some of its aspects by able jurists as

working, in many instances, a practical evasion of the Statute of Frauds. (Consult FELL on *Guaranties;* PARSONS on *Contracts;* CHITTY on *Contracts;* KENT'S *Commentaries,* etc.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Guaranty. In international law it has been more or less the practice for a third power to add its guaranty to a treaty between friends, but the term has special application where such third power promises its aid in the event that certain specific promises made in the treaty by one of the powers are violated. Such a guaranty may refer to the promise to pay a sum of money or to cede territory, to one relating to the integrity of a state, the right of succession, religious franchises, etc. (See WOOLSEY'S *Introduction,* § 105.) A guaranty requires the party making it to give the kind and amount of aid promised in a case to which, in his judgment, the promise applies. If the promisee declines his aid, he is under no obligation to give it; but general guaranties are dangerous, because they furnish pretexts for interference. If a debt is guarantied, and is not paid, Vattel holds that the promiser is not bound to make it good, but only to do his best to induce the party owing the debt to fulfil his engagement. A *surety* would be obliged, says the same author, to do what the principal party has failed to do, but not the guarantying party. In the Middle Ages vassals or towns sometimes attached their seals to a political engagement of their sovereign, and persons watched over the execution of treaties, called conservators. Out of these usages modern political guaranties have grown. T. D. WOOLSEY.

Guaratinguetá, town of the province of São Paulo, Brazil, 120 miles W. of Rio de Janeiro, and on the Parahyba. Pop. 7000.

Guardiagre'le, an old town of Southern Italy, in the province of Chieti. Belisarius surrounded it with a turreted wall as a defence against the Goths. It was often besieged during the Middle Ages, and in 1799 was mercilessly sacked and burned by the French. Some interesting old churches, however, escaped the flames, and the town has partially recovered its prosperity. Pop. 8776.

Guar'dian. The custodian of any one who is unable to take care of himself is sometimes called a guardian, but the term as usually employed designates a person who has the care and control of the person, property, or both, of a minor child during either a portion or the whole of his minority. Guardians are of various kinds, and may be divided into two general classes: I. Those who become so by operation of law, without the need of any specific appointment. II. Those who are appointed by courts or by a parent, either in pursuance of some inherent power residing in the appointing tribunal or in accordance with the provisions of particular statutes.

I. The first class includes those kinds of guardians existing at common law, which were four in number: (1) guardian by nature; (2) guardian by nurture; (3) guardian in socage; (4) guardian by estoppel. These forms of guardianship still have a recognized existence in England, and also in the U. S., so far as the fundamental changes which have been made in the laws of inheritance render them admissible in the latter country. (1) A *guardian by nature* was originally one who had charge of the person, but not of the property, of an heir-apparent until he became twenty-one years of age. This authority was vested primarily in the father, but in case of his death could be exercised by the mother. As in the U. S. all the children of a family inherit equally, guardianship by nature appertains to no particular one among them, but includes the whole number, and, as regards a parent's authority and duties, constitutes the same legal relation that is usually considered in law under the topic of PARENT AND CHILD (see this title). (2) A *guardian by nurture* had charge of the persons of the younger children, who were not heirs-apparent, but his authority terminated when a child reached the age of fourteen. The laws of equal inheritance in this country cause guardianship by nurture to be identical with guardianship by nature, so that, as a distinct relation, it has virtually become obsolete. (3) A *guardian in socage* had custody not only of an infant's person, but also of his lands. Whenever a child under the age of fourteen acquired socage lands by descent, that one of his relatives who could by no possibility inherit the estate had the right to undertake the control of his person and the management of his inheritance until that age was reached. If the child possessed personal property, the guardian might take charge of this also as incidental to his principal trust. The infant upon reaching the age of fourteen had the right to choose a new guardian, but if he failed to exercise this privilege the previous guardianship continued. In the U. S. this form of guardianship is generally superseded by the appointment of guardians by will or action of the courts, though in default of such appointment it is sometimes retained, with important modifications. Thus, capacity to inherit the lands would no longer be regarded as a disqualification in the guardian. (4) *Guardianship by estoppel* takes place when a stranger or a wrong-doer interferes with the management or disposition of a minor's property, as by receiving to himself the rents and profits of land. He will then be compelled in a court of equity to account as a guardian, and will be *estopped* from denying a fiduciary relation to the minor's estate. (See ESTOPPEL.)

II. Guardians who are appointed by courts or parents are much more frequently met with than those just described. When the appointment is made by virtue of an inherent power residing in a particular court, the guardian is either (1) a guardian in chancery or (2) a guardian *ad litem.* Other guardians are selected by virtue of statutory provisions, and when appointed by courts are either (3) guardians appointed by probate or surrogate courts, or (4) those appointed by other courts under special statutes. Statutory guardians appointed by parents are termed (5) testamentary guardians.

(1) The English court of chancery assumed the power to appoint guardians as incidental to its general jurisdiction over minors and their estates, and this has long constituted one of its important prerogatives. In the U. S., courts exercising equity powers have generally retained the same authority, though in some instances the right has been defined anew by statute or in some degree qualified. The guardianship continues until the ward reaches the age of twenty-one. If the appointment is made when he is over fourteen, his selection is commonly allowed to guide the decision of the court, but when he is under that age the court exercises an independent discretion. The wishes of parents and friends will, however, be considered. The guardian is required to give bonds for the faithful management of the ward's estate. (2) Every court in which an infant is one of the parties to a particular suit has a special and necessary power to appoint a guardian *ad litem* (*i. e.* "for the litigation"), to protect the infant's interest during the course of the proceeding. A general guardian will not be permitted to act in such a capacity unless he receives a particular appointment for the purpose. An attorney-at-law is frequently selected, particularly in cases before courts of equity. (3) The ecclesiastical courts of England, which correspond with the probate or surrogate courts of this country, had no inherent power to appoint general guardians, and it was therefore necessary for the authority to be conferred by statute. Powers of this kind have been quite generally created throughout this country. The surrogate's jurisdiction is confined to the county or other locality of which he is an officer. The same principles generally apply to appointments when the infant is above or under fourteen as have been stated in reference to chancery guardians. Courts of equity often exercise a supervisory control over the action of surrogates or probate officers, and may remove guardians appointed by them if good cause be shown, as well as those appointed in other modes. (4) In some States statutes have been passed giving particular courts designated the power to appoint guardians in special instances. Reference must be made to the statutes themselves, and the fact need only be alluded to here for the sake of completeness. (5) Testamentary guardianships are created by the last will of a father, and give the appointee rights superior to the claims of other guardians, and continue until the ward arrives at majority. They are, however, under the control of the court of chancery, may be held to account there, and may be removed if unfaithful. They were introduced by statute in the reign of Charles II. to remedy a defect in the law growing out of the abolition of military tenures whereby children were permitted to enter upon their estates at the early age of fourteen. Statutes have been generally enacted in this country containing substantially the same provisions. The right of appointment is personal to the father, and cannot be delegated. It is sometimes qualified, as in New York, by a requirement of the consent of the mother. Testamentary guardians are under the control of courts of chancery in the same manner as other guardians.

The authority of a guardian over the person of his ward is in many respects the same as that which a parent possesses. He has a right to direct the child's education, both in the common branches of learning and in religious training. He may, moreover, act as a parent in changing the child's domicile. If a ward marries, the guardianship of the person terminates, and in the case of a female child the same has been held true of the property. In the management and disposal of personal property, a guardian has very extensive powers, but his only right in the control of a ward's real estate is to receive the rents and profits accruing, and to place the land upon lease so that it may continue profitable. All additions to the infant's personal

property, as legacies and distributive shares, pass into the guardian's control, and he possesses power to sell chattels without obtaining the consent of the court, but must at the same time exercise prudence and a wise discretion. The erection of buildings or other improvements upon the ward's land with the ward's money is not allowable at the guardian's discretion; and if the guardian uses his own money for the purpose he can have no claim for its recovery. Authority to perform such acts must be derived from the court of chancery. At common law there was no power to sell the infant's land. A special act of Parliament was necessary. But by statute enacted generally in this country, authority has been conferred upon the proper court to grant permission of sale upon petition when it appears by judicial investigation that the ward's interests demand such a course. The subject is regulated in detail by statute and by rules of court. The power of a guardian, in all cases, is local, being confined within the jurisdiction of the court by which he is appointed.

The duties of a guardian are the same in nature as those of all trustees, since guardianship is in reality a personal trust. His action must be guided by a constant purpose to subserve the interests of his ward, and not to promote his own advantage. He cannot act for his own benefit in any proceedings which he undertakes to enforce his ward's rights or to increase the value of his ward's property, and if he should, in such cases, receive personal emolument, it would enure entirely to the advantage of the infant. Property must be kept in a productive condition, and if money is received it must not be suffered to lie idle, but should be profitably invested. Rules of court are sometimes established or statutes enacted pointing out the kinds of securities in which a ward's money may be invested, and these requirements must be strictly followed. If the guardian is guilty of undue neglect in employing the funds received as his duty demands, he will be charged with simple interest, and in cases of gross delinquency with compound interest. The court of chancery has power to enforce an accounting by a guardian at reasonable intervals in order to exhibit the condition of the estate, and he may also be called to account by the ward when the latter deems it necessary or when he attains majority. Dealings between a guardian and his ward are very carefully scrutinized by the courts, on account of the position of authority which the former possesses and his power to coerce his ward into unreasonable and imprudent bargains. Hence, even after the relation has terminated the guardian is permitted to derive no advantage from contracts made with his ward, unless so long an interval has elapsed that the presumption can reasonably be entertained that no unfair advantage was taken. The amount of compensation which a guardian shall receive for his services is usually determined by statute, and is estimated at a certain percentage upon moneys received and paid out.

George Chase. Revised by T. W. Dwight.

Guards, in the British army, the household troops, whose nominal duty it is to guard the person of the monarch. The cavalry guards are two regiments of "Life Guards," one of "Horse Guards," and seven of "Dragoon Guards." These, like the foot guards, have better pay and their officers higher relative rank than those of other regiments. There are also three regiments of foot guards —the "Grenadier Guards," the "Coldstream Guards," and the "Scots Fusileer Guards." The "Body Guards" for special ceremonial occasions are the "Yeomen of the Guard," the "Gentlemen at Arms," and the "Royal Archers." The actual guard of the British sovereign's person is detailed from one of the first three regiments of heavy cavalry.

Guard National (French). See National Guard.

Guarne'rius, or **Guarne'ri,** the family name of certain violin-makers of Cremona in the seventeenth and eighteenth centuries. The most famous of the family was Giuseppe Antonio (1683–1745), known as Guarneri del Gesù, whose best works rank with the finest Amati and Stradivari instruments. The other Guarneri hardly attained the first rank as violin-makers.

Guastal'la, town of Italy, in the province of Reggio nell' Emilia, which, together with several large villages—so near as to be almost suburbs—formed the little duchy of Guastalla. This duchy was given in dower by Napoleon I. to his sister Paulina. Afterwards it was adjudged by the allied powers in 1815 to the ex-empress Maria Theresa, and in 1860 it annexed itself to the new kingdom of Italy. Pop. 10,618.

Guastal'lines, called also the **Angelic Order,** a congregation of nuns founded in 1534 by the countess Torelli of Guastalla.

Guatema'la, or **Guatimala,** republic of Central America, situated between lat. 13° 45′ and 17° 45′ N., and between lon. 88° 10′ and 93° 12′ W., and bounded by the Pacific, Mexico, the Caribbean Sea, Honduras, and San Salvador. Area, 44,800 square miles, with 1,180,000 inhabitants, of which 900,000 are Indians, 260,000 mestizoes, and 20,000 white men. The country is high and the surface very varied, the Andes traversing it in its whole extension. The main range runs along the Pacific, containing many active volcanoes (Sapotitlan, 13,050 feet high, and Atitlan, 12,500 feet high), and sending out branches towards the Caribbean Sea which form plateaus and valleys. The climate, different according to the differing elevation, is generally healthful and beautiful, and the soil exceedingly fertile. Maize, wheat, and rice of a superior quality are produced, besides cotton, sugar, vanilla, and tobacco; but the most important article among the products of the country is cochineal. The government of the state is an oligarchy, in which a few leading families are actually in possession of the whole power. The president is chosen for four years. The Roman Catholic religion is the only one tolerated, but since 1872 Jesuits have been excluded. Liberty of the press is also established.

Guatemala (New), the capital of the republic of Guatemala, situated at an elevation of 4961 feet above the sea, on a rich and spacious plain. It is a well-built town, very extensive, as the houses are generally only one story high, on account of the frequent earthquakes, but often handsome. It has manufactures of muslin, silver-ware, etc., and a lively trade, and is the see of an archbishop. Pop. 40,000.

Guatemala (Old), formerly cap. of Guatemala, stands about 30 miles W. of the new town. Founded by the Spanish in 1524, its frequent calamities from earthquakes and the eruptions of the neighboring volcanoes have from time to time almost depopulated it; but its beautiful site and the fitness of its vicinage for the production of cochineal has caused it to be rebuilt. Pop. 18,000.

Guatu'so In'dians, a brave and unconquered tribe of Central American native Indians, of supposed Aztec race, living S. of Lake Nicaragua. They are heathens, and are vulgarly reputed to have red hair and pale complexions. They dwell near the Rio Frio.

Gua'va, the fruits of *Psidium pyriferum, pomiferum, Cattleyanum, pygmæum, albidum,* and other species of the genus, which consists of trees and shrubs of both Indies, mostly natives of the New World, though cultivated in nearly all warm climates, where they yield important dessert fruits, that of *P. pyriferum* (white guava) being the best. From this the guava jelly is made, a conserve extensively exported, and highly prized for its flavor. It is cultivated to a considerable extent in Florida. The guavas belong to the Myrtaceæ.

Guayaquil', department of the republic of Ecuador, South America, bounded W. by the Pacific and E. by the Andes, which here recede from the coast and leave a broad belt of low, level land, fertile and well cultivated. Area, 14,400 square miles. Pop. 92,696.

Guayaquil, city of Ecuador, South America, the capital of the department of the same name, is situated in lat. 2° 20′ S., at the mouth of the river Guayaquil, which is navigable here, and forms a good port, the best on the W. coast of South America. The city is not healthy, as it lies very low, and is not well provided with good drinking-water; neither is it beautiful, most of its buildings, with the exception of the cathedral, the two hospitals, and the two colleges, being insignificant wooden structures. But it is a very lively trading-place. In 1866 its exports were valued at £669,420, its imports at £430,000. Cacao, India-rubber, timber, and tobacco are exported; cottons, wine, and hardware are imported. It is a bishop's see. Pop. 20,000.

Guay'as, province of Ecuador, bounded W. by the Pacific Ocean. It has a hot, wet, and sickly climate, a fertile soil, and dense forests. Cap. Guayaquil. Pop. 35,000.

Guay'mas, a port of entry of Mexico, in Sonora, on Yaqui Bay, an arm of the Gulf of California, has a fine harbor, a good trade, and profitable fisheries, but is unhealthy. Pop. 2500.

Gub'bio [anc. *Iguvium*], town of Italy, in the province of Perugia, about 27 miles from Urbino. It was an Umbrian city anterior to Rome, by which it was ultimately conquered. During the Middle Ages it was for a time a small independent republic of 50,000 inhabitants, then fell into the hands of the dukes of Urbino. Dante found refuge here between 1316 and 1318. Interesting remains of the ancient fortress, of the theatre, and of Etruscan tombs still exist. There are some remarkable old churches, and the municipal palace, of the fourteenth century, is one of the finest existing examples of Renaissance architecture. This palace contains the famous *Tavole Eugubine,* consisting of seven bronze tablets covered with inscriptions in a very ancient Umbrian character. These tablets were found in a temple of Jupiter not far from Gubbio, and their interpretation

has been the subject of much discussion among archæologists. (See LEPSIUS, *Inscriptiones Umbricæ et Oscæ*, Leipsic, 1841.) In the same building are a valuable library and many fine pictures, including examples of almost every great master from Giotto to Titian; also a collection of antique vases, coins, etc., together with specimens of the beautiful ware decorated by Maestro Georgio da Gubbio and known to connoisseurs as the "Gubbio majolica." The modern town is supplied with good water by an aqueduct, with a very large and strongly-built reservoir called the Bottacione. It has some commerce, and is a bishop's see. Pop. 22,757.

Gu'ben, town of Prussia, in Brandenburg, on the Neisse. It has extensive manufactures of woollen and linen hosiery and yarn, and a very brisk shipping trade on the Neisse, whose banks here are planted with vines, and produce a very good red wine. Pop. 21,423.

Guberna'tis, de (ANGELO), was b. of an old and noble family in Turin in 1840. He passed through the academic grades in the University of Turin, and in 1862 was sent by the Italian government to perfect himself in philological studies at Berlin. In 1863 he was appointed professor extraordinary of Sanscrit in the superior institute at Florence. In 1865 he associated himself with the Russian revolutionist, Michael Bakunin, but after two months separated from him and returned to his professorship. In 1869 he was appointed to a full professorship of Sanscrit, and having edited the *Rivista Contemporanea* of Turin during the previous year, he now purchased it and founded the *Rivista Europea*. Prof. de Gubernatis is the Italian correspondent of many foreign literary journals, among others of the London *Athenæum*, the New York *International Review*, and also of literary periodicals in Leipsic, Berlin, St. Petersburg, etc. Besides numerous critical essays published by him in *Il Diritto*, in *L'Italia Letteraria*, in the *Rivista Contemporanea*, *Il Politecnico*, the *Perseveranza*, the *Rivista Orientale* (founded by him in 1869), the *Rivista Europea*, etc., he is the author of *Life of Santorre Santarosa; Il Re Nala* (Trilogia drammatica in versi), *La Morte del Re Dassarata* (dramma in versi), *Cenni sul Sanscrito; I primi venti Inni del Rigveda* (tradotti ed annotati, etc.); *Piccola Encyclopedia Indiana; Zoological Mythology* (in English); *Letture sopra la Mitologia Vedica*, and other literary and philological works of value.

Gud'geon, the *Gobio fluviatilis*, a very common freshwater fish of Europe. It is of the carp family, is a bold biter, and is taken in large quantities with nets. It seldom exceeds eight inches in length, and is marketed alive, being kept in water until sold. The Niagara gudgeon (*Gobio cataractæ*) is caught in the Niagara River, and is only five inches long.

Gudgeon, or **Journal,** the metallic end of a revolving shaft in machinery, or a piece attached to the end of a shaft to receive the wear and tear of friction. Gudgeons ply in journal-boxes, or upon brass, Babbitt metal, lignumvitæ, or other bearings, and receive various lubricating applications. (See FRICTION, by PROF. R. H. THURSTON, C. E.)

Guebres. See PARSEES.

Guebwiller. See GEBWEILER.

Guelder Rose. See SNOWBALL.

Guelph, post-town, cap. of Wellington co., Ont., Canada, on the river Speed and the Grand Trunk and the Buffalo and Guelph branch of the Great Western Railway, is 47 miles W. of Toronto. It has a large trade, fine water-power, and first-class manufactories of many kinds of goods, such as woollens, farmers' tools, sewing-machines, lime, and musical instruments. There are 2 daily and 3 weekly newspapers. Excellent building-stone is quarried. Pop. of town 6878; of tp. 2955.

Guelph and **Ghib'elline.** There is still much obscurity in regard to the origin of the names of these two mediæval factions. It is known that these distinctive appellations were first employed in the twelfth century, and that in the contest between the empire and the Church the name of Guelph was equivalent to a partisan of the Church, and the name of Ghibelline to a partisan of the empire. The vulgar tradition says that Guelph and Gibel (called Gibel and Gualef in the chronicle of Pietro Azario in the collection of Muratori) were two brothers who lived in Pistoia, one of whom took the side of the pope, the other that of the emperor, and that hence were formed two great parties in Italy which assumed the names of their separate founders. But this tradition has no historical value. Another states that in the battle near Weinsberg, fought in Germany in 1140 between the troops of Conrad III. of Suabia and those of the duke of Bavaria, Welf VI. (Guelfus), the former took for their war-cry *Hie Gieblingen* (Gieblingen or Waiblingen was a Suabian fortress, and the Hohenstaufens and their followers were called Waiblingen); and the latter, on the other hand, had for their cry, *Hie Welf!* It is probable, then, that these two designations may have passed into Italy, or at least made their way towards it, with the Hohenstaufen Suabians, or Waiblingen, against whom the Italians fought under the guidance or the inspiration of Alexander III. and his successors. The German followers of the Suabians, Waiblingen or Ghibellini, having come into Italy, may themselves have given the name of Guelphs to their new enemies; and the rather as a branch of the Bavarian family of the Guelphs, the last heir of those princes, had married a descendant of the Italian house of Este, at that time very powerful in Padua. It would seem, then, that this might somewhat explain the reason why *the name* and *the thing*—that is, the party names and the contests of Ghibellines and Guelphs—especially prevailed in Upper Italy, and more particularly in Lombardy and in Venetia, where the Ezzelini had become all powerful as vicars of the Suabian emperors. The fury of partisanship was such that simply to call one's self Guelph or Ghibelline became perilous, and Pope Benedict XII. in 1334 found it necessary to prohibit, under pain of banishment, the employment of these epithets, which excited such furious indignation and such sanguinary conflicts. The Guelphs took for their device an eagle tearing a blue dragon, which, in place of a crown, wore upon its head a red or yellow lily, the badge of the Ghibellines; this lily was sometimes exchanged for the red rose. The towers of a palace indicated the party of the owner: if a Guelph, the battlements were *square;* if a Ghibelline, they were *swallow-tailed.* Even in Tuscany the factions of the Guelphs and Ghibellines became very violent, and as in Northern Italy the house of Este had taken to itself a descendant of the Guelph house of Bavaria, so in Tuscany a Guelph (Welf V.) had married the famous countess Matilda, the powerful supporter of the papacy against the emperor Henry IV. The occasion of the new party-appellations as bestowed on the imperialists and the papists in Italy may have been, either that the partisans of the pope in Tuscany from the time of the countess Matilda called themselves Guelphs in honor of the Guelphian husband of the countess, and that this epithet was still more firmly fixed upon them on the arrival in Italy of those Suabians (Waiblingen) who in Germany had already fought against the Bavarian Guelphs; or, on the other hand, that, being once in Italy, the Waiblingen, meeting with opposition from the Italians devoted to the pope, called them Guelphs in memory of the Guelphs against whom they had already contended in Bavaria. Whoever wishes to form an idea of the fury with which the Guelph and Ghibelline factions combatted each other may read with much profit, among other things, the Bergamasc *Chronicle* of Castello Castelli, extending from 1378 to 1407, and the *Cronica anonima of Bergamo*, from 1402 to 1448, both which were published by Canon Giov. Finazzi at Bergamo in 1870. Muratori, in the preface to the *Chronicle* of the Ghibelline Castelli, inserted in the 16th vol. of his *Scriptores Rerum Italicarum*, speaking of the Guelphs and the Ghibellines, wrote: "Fortasse Bergomates, si Brixiensem populum excipias, precæteris in vesana et infelici hac animorum dissolutione ac furore excelluerunt." It is to Bergamo that the pulpit-orator, afterwards St. Bernadino di Siena, alluded when he wrote, "Here more than elsewhere the greatest cruelties are practised; and so attached are our citizens to the superstitions of party spirit that, having for the most trifling cause taken their banners into their houses and fixed them over their doors, suspended them from their walls, raised them upon their towers, upon their palaces, over the city gates, and upon their country-houses, they have come at last to carry them even into the churches; they stamp their devices upon the holy vessels, upon the sacred pavements, upon the altars, and upon the sepulchres. Some foolishly think that the Church is Guelph, and they suppose that there was a certain St. *Guelph;* others, that it is Ghibelline, etc.; there are some, even, who are so impious and insane that they have ventured to make a partisan of the Divine Majesty itself, the King of Glory and of Eternal Peace!" It will be remembered that two of the streets of Florence are still named from these factions, Via Guelfa, Via Ghibellina. In Florence the Bianchi united themselves with the Guelph party, and the Neri with the Ghibellines: notwithstanding this, the Neri repossessed themselves of Florence by the aid of Pope Boniface VIII., and the Bianchi, being driven out of Florence, became Ghibellines. The names Guelph and Ghibelline were afterwards generally used to indicate two hostile factions in whose mutual quarrels the person of the pope or the emperor had little concern. They were, for the most part, rivalries between family and family, quarter and quarter, village and village, town and town, and in order to give a specious pretext for their sackings, their plunderings, and their assassinations, they invoked in their defence the imperial cause or the rights of the Church. While the

latter had manifested a fierce zeal in the wars against the Suabians in the thirteenth century, now, having taken refuge in Avignon, she showed herself entirely indifferent to the conflicts of the Italian partisans who affected to fight either for or against her. The chronicler Pietro Azario, confessing that he had seen "pejores Guelfos inter se quam contra Gibelinos," throws a very sinister light upon the character of these factions, which, far from contending for an idea, were incited by the most vulgar interests and the most savage passions. Matteo Villani, who was a Guelph, suggesting a strange etymology, says that this word was equivalent to *guardatori di fe* (guardian of the faith); and that in the name Ghibelline might be read the words *guida belli*, as much as to say, *guidatore di battaglie* (leader of strifes). But it would be difficult to show which of the two factions had caused, not the most benefit, but the most mischief to Italy and to civilization; both were certainly very fatal. The Guelphs formed the first *Company of the People* to oppose the tyranny of the Ghibellines; but when the Guelph party had obtained the ascendency it showed itself even worse than the Ghibellines, by favoring those Guelph princes who desired to acquire dominion over certain towns; by creating plebeian governments, which are the least durable because they are the worst; by converting the political question into a social question; and by often calling in against dangerous nobles a fatal foreign intervention. Dante Allighieri, himself in his youth first with the Guelphs and afterwards with the Ghibellines, when verging upon old age boasts in his *Paradiso* "that he had made a party for himself," and declares "the Guelphs and the Ghibellines to be the cause of all the miseries of Italy."

> Omai puoi giudicar di que'cotali
> Che io accusai di sopra, e de'lor falli
> Che son cagion di tutti i nostri mali.
> L'uno al publico segno i gigli gialli
> Oppone, e quel s' appropria l' altra parte,
> Si che è forte a veder qual piu si falli.

(See Longfellow's translation of *Il Paradiso*, canto vi. lines 97 to 102.) The word Guelph has been revived in our century by the institution of the order of the Guelphs, founded Aug. 12, 1815, on the anniversary of the birth of the prince regent of England, in order to celebrate the new reign of the Guelphs in Hanover. F. A. P. BARNARD.

Guelphs, Order of (usually but incorrectly called the **Guelphic Order**), an order of knighthood founded in 1815 by George IV. of England, as regent of Hanover, for his German subjects, but conferred upon many British subjects by George IV. and William IV. Its members are not reckoned as knights in Great Britain, and since the extinction of Hanover the Prussian government does not recognize its existence.

Gue'mal, the *Furcifer Huamel*, a deer found in South America near the eastern coast. It has been called "the cloven-footed horse."

Guérande, town of France, in the department of Loire-Inférieure, on the Loire. It has large linen manufactures. Pop. 8524.

Guerara, town of Algeria, in the oasis of Wady-Mzab, in lat. 32° 45′ N., and lon. 5° E. It is the rendezvous for all the neighboring tribes, and horses, asses, ivory, gold-dust, and ostrich feathers are exchanged for cottons, woollens, silk, and cutlery. Pop. estimated at 12,000.

Guerci'no (GIOVANNI FRANCESCO BARBIERI), called GUERCINO from a squint he had, an Italian painter, b. at Cento, near Bologna, in 1590; d. 1666. His finest works, the *S. Petronilla*, the *Aurora*, the *St. Philip Neri*, are in Rome. His style varied much at different periods. His best pictures belong to the second period; they are distinguished by dignity of design and striking effects of color. His large pictures numbered 250; of smaller works in oil and frescoes he painted very many, and he left a vast collection of drawings. O. B. FROTHINGHAM.

Guêret, town of France, the capital of the department of Creuse. It carries on a large trade in cattle. Pop. 5139.

Gue'ricke (HEINRICH ERNST FERDINAND), PH. D., D. D., a staunch champion of old Lutheranism, was b. at Wettin, Prussia, Feb. 23, 1803, and since 1829, with an intermission of five years (1835–40), has been a professor in the University of Halle. He has published *De Schola quæ Alexandriæ floruit* (2 vols., 1824–25); *Handbuch der Kirchengeschichte* (3 vols., 1833; 9th ed. 1866–67), admirably translated by Prof. Shedd (2 vols., 1857–70); *Allgemeine christliche Symbolik* (1839; 3d ed. 1861); *Historisch-kritische Einleitung in das Neue Testament* (1843); *Isagogik* (1854; 3d ed. 1868); *Lehrbuch der christlichen Archäologie* (1847; 2d ed. 1859), translated by MORRISON (1851), and some minor works. R. D. HITCHCOCK.

Guericke, von (OTTO), b. at Magdeburg, Germany, Nov. 20, 1602; was burgomaster of that town 1646–81; invented the air-pump 1650; also first constructed the "Magdeburg hemispheres," and made a rude barometer. His principal works are upon physics, etc. Of these, the *Experimenta Nova* (1672) is the most noteworthy. D. at Hamburg May 11, 1686.

Guérin, de (EUGÉNIE), sister of Maurice, b. in 1805 at Cayla, Languedoc; devoted her life mainly to the care of her brother. She was a woman of saintly life and of fine intelligence. D. May 31, 1848. Her *Journal and Letters* (1862) are remarkable for the rare genius displayed, as well as for the delightful style and devout spirit in which they are written.

Guérin, de (MAURICE **du Cayla**), b. in 1810 in Languedoc, France, and d. in 1839. He was a poet of rare power and of great original talent. His *Reliquiæ* (2 vols., 1860, with a life by Sainte-Beuve) contain his poetical fragments, letters, etc. He was the friend and associate of Lamennais.

Guern'sey, the westernmost and (except Jersey) the largest of the Channel Islands. It has a varied, fertile surface, a fine healthful climate, and a thrifty population, who speak a Norman-French dialect, and, though subject to Great Britain, have their own legislature. Cap. St. Peter Port. Pop. in 1871 (including the isles of Herm and Jethou), 30,667.

Guernsey, county in the E. of Ohio, in the Muskingum Valley. Area, 460 square miles. It is hilly, but fertile, producing cattle, grain, tobacco, and wool. Bituminous coal is mined. Saddlery and carriages are the leading manufactures. The county is traversed by the Ohio Central and the Marietta and Pittsburg R. Rs. Cap. Cambridge. Pop. 23,838.

Guernsey (HENRY NEWELL), M. D., b. at Rochester, Vt., Feb. 10, 1817; was educated at Royalton, Vt., and in New York, where he took his medical degree in 1844; professor of obstetrics and diseases of women and children in the Homœopathic Medical College of Pennsylvania 1861–68, of materia medica in the Hahnemann College of Philadelphia 1872–74, and dean of both the above faculties. Author of a treatise on *Obstetrics and the Diseases of Women and Young Children*, and of many professional brochures; member of several American and foreign professional societies, etc.

Guernsey (WILLIAM NOAH), M. D., b. at Litchfield, Conn., Jan. 30, 1849; graduated at the University Medical College, New York, 1870; took the degree of master of obstetrics at Vienna; was chosen in 1874 lecturer upon the diseases of children in the New York Homœopathic Medical College, and professor of diseases of the throat and lungs in the New York Medical College for Women; member of various societies, and author of professional papers.

Guéroult (ADOLPHE), b. at Radepont, France, Jan. 29, 1810; entered the St. Simonian society 1830; was for years a foreign correspondent of the *Journal des Débats* and writer on social and political economy; French consul at Mazatlan 1842–47, at Jassy 1847–48; became one of the editors of *L'Industrie* 1851; sub-chief of the *Crédit foncier* 1852; founded the *Opinion Nationale* 1859; was in the Corps Législatif 1863–69, and was a distinguished opponent of Ultramontanism. D. at Paris July 22, 1872. Author of *Lettres sur l'Espagne* (1838), *De la question coloniale* (1842), *Discours prononcés au corps législatif* (1869), etc.

Guerra'zzi (FRANCESCO DOMENICO) was b. at Leghorn in 1804. While studying law at Pisa he made the acquaintance of Byron, who produced a strong impression upon him. His eulogy of *Cosimo del Fante* showed the lion's claws; and the police restricted Guerrazzi to Montepulciano, where Giuseppe Mazzini went to visit him and gave him a new political impulse, as Byron had already given him a poetical one. At the age of twenty-two Guerrazzi published his *Battaglia di Benevento*, an imaginative romance glowing with a sinister light and filled with protests against tyranny. His turbulent restlessness kept the eyes of the police upon him; he was imprisoned in 1831, and banished to Portoferraio, in the island of Elba, in 1834. There he wrote his masterpiece, *L'Assedio di Firenze*, which reveals in a remarkable degree all the good and all the bad qualities of Guerrazzi's genius. It is written as if in the heat of battle, and it powerfully incited the Italian youth to rise against the *foreigner*. *Isabella Orsini*, *Veronica Cybo*, and the *Nuove Tartufi* followed; then his *Autobiographical Letter* to Giuseppe Mazzini. In 1848 he was elected deputy, and finally, on the overthrow of the Capponi ministry, he was chosen triumvir with Giuseppe Montanelli and Giuseppe Mazzini; afterwards, on the flight of the grand duke, he was proclaimed republican dictator. As a statesman he failed; his violence irritated the people, who on the restoration of the grand duke turned against the ex-dictator. He was illegally arrested, iniquitously prosecuted, and, in spite of his admirable *Apology*, was finally condemned to per-

petual exile. He went first to Corsica, where, in a state of hypochondria, he wrote the terrible *Beatrice Cenci;* afterwards followed the *Torre di Nonza* and *Fides*. After some time he returned to Genoa, where he wrote *Il Buco nel Muro*, a most graceful and humorous little work, the *Asino*, a bitter political and social satire, and several other smaller stories. After the proclamation of the kingdom of Italy, Guerrazzi was several times elected to Parliament, and he had just finished his romance entitled *Il Secolo che muove*, now in course of publication, when he d. suddenly, on Sept. 25, 1873. The city of Leghorn decreed him a magnificent funeral, and is about to erect a monument in his honor. F. A. P. Barnard.

Guerre′ro, state of the republic of Mexico, organized in 1849. It borders on the Pacific, and its southern part consists of the declivities of the Mexican plateau, well watered, hot only in the deep valleys, but mostly covered with primitive forests. Its northern part belongs to the Sierra Madre, and is a wild, mountainous region. The soil throughout the whole state is described as very fertile, but the land is yet very thinly peopled. Mining, which formerly was a flourishing industry in these regions, has now nearly ceased, though the country abounds in useful metals, and there are silver-mines of some importance. Area, 32,000 square miles. Pop. 300,029. Cap. Guerrero.

Guerrero, or **Tixtlan,** city, cap. of the Mexican state of Guerrero. It has some rude industrial and mining interests. It is in a hot, unhealthy mountain-valley, 150 miles S. W. of the city of Mexico. Pop. 6501.

Guerrero (Vicente), b. at Guerrero, Mexico, of mixed negro and Spanish stock, was a slave; took part in an insurrection 1809; became in 1818 leader of patriotic troops, and in 1827 was candidate of the *Yorkino* or liberal party for president, but was not elected. Civil war thereupon broke out, but Mr. Poinsett, the U. S. minister, succeeded in effecting a compromise, by which in 1829 Guerrero was declared president. The Spanish troops soon invaded Mexico, and Guerrero was declared dictator. The invaders were totally defeated and slavery abolished, but Bustamente, the vice-president, marched against Guerrero with an army because Guerrero was regarded as not disposed to give up the dictatorship. Accordingly (1830), Guerrero resigned his office, which Bustamente assumed. After an unsuccessful attempt at revolution, Guerrero was captured and shot at Cailapa Feb. 14, 1831.

Guerri′lla [Sp., literally, a "little war"], properly the name of partisan warfare, but now applied to men serving in a war in an irregular, unauthorized manner. The name was first given to an irregular partisan soldiery of Spain, especially to that which opposed Napoleon's armies between 1808 and 1815. From Spain the name was brought to Spanish America, and thence to the U. S. In the late civil war guerrilla-parties were common at various times and places in the Border States. Though often a great annoyance to an invading army, they seldom are of much real service to their own side. In Napoleon's wars in Spain, however, his armies met for a time with much serious trouble from guerrilla-parties, who were favored by the mountainous nature of the country, which gave them great advantages.

Guerrilla-Party [Sp. *guerra*, "war;" *guerrilla*, "a little war"]. In military law this is defined as a self-constituted set of armed men in time of war, who form no part of the organized army, take up arms and lay them down at their own will, and carry on an independent, irregular, unauthorized warfare. If guerrilla-men are taken captive in open warfare, they should be treated with the privileges of war, unless they are proved guilty of such special crimes as murder, or the killing of prisoners, or the sacking of places, in which cases they are deemed to have forfeited such privilege. G. Chase. Rev. by T. W. Dwight.

Guess (George or **Sequoyah**), a Cherokee half-breed, inventor of the syllabic Cherokee alphabet, b. about 1770; was known as an ingenious silversmith previous to his invention of the Cherokee alphabet in 1826. The alphabet contains 85 characters, all of which are applied to writing and printing with complete success. D. at San Fernando, Northern Mexico, in Aug., 1843.

Guest, in law, a transient lodger at an inn or hotel. It frequently becomes important in legal practice to determine whether a person remaining at an inn is a guest or a boarder, as the legal rights of the parties are not the same. Thus, a guest may insist that as to him the innkeeper is an insurer, while the boarder can only claim that he is to exercise ordinary care. So the innkeeper has a lien for his compensation upon the goods of a guest, but has no such lien, except by statute, upon the effects of a boarder. The legal distinctions between the two classes of persons will be noticed under the topic Innkeepers. T. W. Dwight.

Guest (John), U. S. N., b. in Missouri; entered the navy as a midshipman Dec. 16, 1837; became a passed midshipman in 1843, a lieutenant in 1850, a commander in 1862, a captain in 1866, a commodore in 1873; served on the E. coast of Mexico during our war with that republic, and participated in several sharp engagements with the enemy on shore; in 1854 was second in command of the seamen and marines of the U. S. S. Plymouth in a severe but victorious fight with the Chinese "rebels" at Shanghai, who threatened to plunder the foreign residents of that city. Commanded the Owasco of Porter's mortar flotilla in the bombardment of Forts Jackson and St. Philip prior to and during the passage of Farragut's fleet by the forts on its way to New Orleans (Apr. 24, 1862), and afterward at the bombardment of Vicksburg in the summer of the same year, and received the commendation of his superior officer. In command of the Itasca took part in both the Fort Fisher fights. Foxhall A. Parker, U. S. N.

Gueux [Fr., "beggars"], a name applied by the count of Barlaimont in 1566 to the confederated nobles and others of the Low Countries who opposed the tyrannies of Philip II. The malcontents at once adopted the title, and calling themselves *Gueux*, they for many years opposed the Spanish king by sea and land with varying success.

Gue′vei, a name applied to quite a number of African antelopes, mostly of the genus *Cephalopus*.

Gug′genbühl (Louis), M. D., b. at Zürich 1816; graduated in medicine 1836; devoted himself to the study of cretinism; purchased the Abendberg, a mountain near Interlaken, and in 1841 started a school for the instruction and treatment of cretins, which had noteworthy success. Author of a volume (1851) and some pamphlets on cretinism. D. Feb. 2, 1863.

Guglione′si, town of Southern Italy, in the province of Campobasso. Pop. 5286.

Guia′na [Fr. *Guyane;* Sp. *Guayana*] is the name of a large territory of the north-eastern part of South America, situated between lat. 8° 40′ N. and 3° 30′ S., and between lon. 50° and 68° W., and bounded by the Atlantic and the rivers Amazon and Orinoco. Politically, this territory is divided between Brazil, Venezuela, Great Britain, France, and the Netherlands, of which powers the two former have incorporated their portions as provinces, while the three latter keep theirs as colonial dependencies. Along the Atlantic, Guiana presents a belt from 10 to 40 miles broad of low, flat coast-land, consisting of shallows which stretch far into the sea, and mudbanks which at high tide are only at a level with the water. This dreary-looking flat has been formed by the rivers which in great number enter the Atlantic, such as the Essequibo, Demerara, Berbice, Corentin (which forms the boundary between English and Dutch Guiana), the Maroni (between Dutch and French Guiana), and the Oyapok (between French Guiana and Brazil), and consists of a bluish clay mixed with decayed vegetable matter and impregnated with marine salts. This soil is exceedingly fertile, but the ground, when drained and consolidated, sinks nearly a foot, and must be protected against the ocean by dykes. Back from this alluvial flat stretches a range of low sandhills, behind which the interior gradually rises until in the south-western part of the territory the ground swells into a wild mountainous region, the Sierra Parime and the Sierra Pacaraima. These mountains consist mainly of granite and gneiss, but sometimes of white quartzose rock, which, from the great quantity of mica contained in it, shines like gold. In former days they were a geographical fable-land. Here lay El Dorado, to which Ulrich von Hutten and Sir Walter Raleigh made their expeditions. But recently they have lost all their mythical splendor by the researches of Robert Schomburgk, published in Leipsic in 1848. They are rather barren.

The climate of Guiana is hot (the mean temperature being 81°) and moist, but it is more equable and less dangerous to the European race than that of the West Indies; the enormous death-rate of these regions is probably caused not so much by the climate as by the irregular habits of the colonists. There are two wet and two dry seasons, the former reigning during the months of June, July, August, and December, January, February; and the change of season is generally accompanied by violent thunderstorms, but without hurricanes. Among the various products of Guiana, sugar, rum, and molasses are the principal. Cotton and coffee were formerly grown to some extent, but improvements in method and in machinery have made sugar production much more profitable. Next in importance range the different kinds of woods, of which Guiana possesses a great variety and an enormous quantity. Much timber is exported, and many kinds are ranked among the finest and most valuable in commerce. The mira tree is a giant among trees, attaining the height of 150 feet, and looking at a distance like a forest-covered hill; its

timber is said to equal that of the teak. Fine fruits (among which are the banana, pineapple, guava, etc.) and gorgeous flowers (among which is the *Victoria regia*, one of the largest of the water-lilies) abound. Among the animals of the country are specially noteworthy the tapir, the ant-eaters, and different kinds of turtles; the parrots, humming-birds, and flamingoes; several kinds of poisonous snakes, anacondas, alligators, iguanas, and a multitude of gorgeous but annoying insects; finally, a great variety of excellent fish.

British Guiana occupies the westernmost part of Guiana, between Venezuela and Dutch Guiana, from which it is separated by the river Corentin. Its boundaries are not well defined. Its area is about 76,000 square miles, with 193,491 inhabitants, of whom 11,488 are white, about 10,000 aboriginal Indians, and the rest negroes, Chinese and East Indian coolies, and persons of numerous mixed races. It is divided into three counties—Essequibo, Demerara, and Berbice. The principal towns are Georgetown and New Amsterdam.

Dutch Guiana, or *Surinam*, lies between British and French Guiana, and between the rivers Corentin and Maroni. It is called Surinam after the main river flowing through it. Area, 45,000 square miles. Pop. 50,310, of whom 6000 or 7000 are white, and about 40,000 negroes, without reckoning the 1000 aborigines and the Maroons, descendants of runaway slaves, 7500 in number. Cap. Paramaribo.

French Guiana lies between Dutch Guiana and Brazil, and between the rivers Maroni and Oyapok. Area, 18,000 square miles. Pop. 25,151. French Guiana differs somewhat from the rest of Guiana. It has only two seasons—the rainy season lasting from November to June, and the heat is less oppressive on account of the trade-winds. On the island of Cayenne, just off the coast, lies the capital of the whole colony, of the same name as the island. France uses this colony as a penal settlement.

Guib Antelope, or **Harnessed Antelope,** the *Tragelaphus scriptus*, a fine antelope found in great herds in Western Africa. Its reddish sides are marked with white stripes, which make it appear as if harnessed.

Guicciardi'ni (Francesco), b. at Florence, Italy, Mar. 6, 1482; became professor of jurisprudence there in 1505; ambassador to Spain 1512; to Leo X. 1513; governor of Modena 1518; defended Parma, as the pope's lieutenant-general, against the French 1521; was made president of the Romagna 1523; governor of Bologna 1531–34; was a partisan of the Medici family. D. at Arcetri May, 1540. Left much correspondence and other writings, portions of which have been published, but is chiefly memorable for his *History of Italy* (1561–64; best edition, 10 vols., Pisa, 1819–20), which by common consent occupies the first place among Italian histories; but it lacks spirit, and is too diffuse. It has been translated into English by Sir G. Fenton (1579) and by A. P. Goddard (10 vols., 1755–59).

Gui'ccioli (Teresa), Countess, b. in Italy in 1801, daughter of Count Gamba; married the Count Guiccioli 1817, she being only sixteen and he over sixty, his wealth and her beauty being the motives to the match. In 1819 she fell in with Lord Byron, who from this time till 1822 was her constant associate. In 1851 she married the marquis de Boissy (1798–1866), who often spoke of her as "my wife, formerly Lord Byron's mistress." She d. at Rome Mar. 26, 1873. Her *Recollections of Lord Byron* (1869) is of very small value.

Gui'cowar's Ter'ritory, or **Baroda,** state of Hindostan, lying between lat. 20° 40′ and 24° N., and between lon. 69° and 74° E., in the province of Guzerat. It is an independent dominion belonging to the native ruler called the Guicowar, but subsidiary to British India and subordinate to the presidency of Bombay. Area, 4399 square miles, with 325,526 inhabitants, consisting of Hindoos, Mohammedans, and wild aboriginal tribes. In 1874 the Guicowar was deposed, and in 1875 tried by a court of inquiry on a charge of having poisoned Col. Phayre, resident at Baroda. It is a most fertile region, producing cotton, indigo, grain, tobacco, and flax. Cap. Baroda.

Guide, or **Direct',** in music a mark (𝆖) placed at the end of a stave (as an assistance to the eye), to indicate the position of the first note in the stave succeeding, or over the leaf.

Guido d'Arezzo. See Gamut, by Rev. William Staunton, S. T. D.

Gui'do Re'ni, b. at Bologna in 1575. He was the son of a musician, who, finding him uninterested in his own art, placed him in the school of Denis Calvart, whom he left to become a pupil of the Caracci. Here, in opposition to Caravaggio, then becoming famous for his vehement mannerisms, Guido learned the gentle, sweet, harmonious style to which he owes his reputation. The extraordinary talents of the young man, his quickness, brilliancy, and ambition, exciting the jealousy of his masters, he was dismissed from their school. His fame having reached Rome, Guido was invited there, and went with his friend Albano. His first picture, *The Martyrdom of St. Cecilia*, raised high expectations, but awoke new jealousies among his rivals. Decorations for the private chapel in the palace of Monte Cavallo, done by order of Pope Paul V., added to his reputation; but being disappointed in the price he expected to receive, he returned to his native city, where he painted several pictures, the most celebrated of which are *The Murder of the Innocents*, in the church of St. Domenico, and the *Repentance of St. Peter*, for the Casa Sampieri. Again he went to Rome at the solicitation of the pope, who wished to employ him in decorating the chapel of S. Maria Maggiore. His most eminent works of this period are the *Aurora*, the *Fortune*, the *Rape of Helen*, and the *Magdalen*, in the Barberini palace. A short visit to Naples, whence he was driven by his enemies, intervened between his second stay in Rome and his final return to Bologna, where he passed the remainder of his years, till his death in 1642. Guido was an artist of immense productiveness, but of unequal merit. The productions of his pencil are found in all the principal collections in Europe. There are several in the English National Gallery. In the latter portion of his life his popularity was such that even his fertility could not meet the orders that came in. He did a great deal of poor work, and it is said, in order to raise money to supply his gambling propensities, retouched paintings of his pupils and sold them as his own. His manner changed in different periods. His earliest works were done in the style of Caravaggio, with strong effects of light and shade. The productions of the second period were marked by gentleness, grace, and beauty, by sweetness of tone and harmony of color. The last period was loose and careless. He excelled in the treatment of pathetic and devout subjects, and in treating others brought their more gracious aspects into prominence. Even in his best works there is some lack of vigor in drawing and color; his average work is tame, monotonous, at times insipid, however redeemed by elegance of tone and delicacy of touch. His numerous *Madonnas* have a sameness of expression that is wearisome. Guido, besides painting on canvas and in fresco, modelled in clay, and is said to have executed statues. He amused himself also with making etchings, of which a considerable number remain. Many of his pictures are familiar in engravings. The *Magdalene*, the *Aurora*, the *Michael vanquishing Satan*, are known to all frequenters of print-shops. The portrait of Beatrice Cenci, one of the most remarkable of his paintings, must be seen to be appreciated, the so-called copies of it being fancy pieces, with hardly the faintest semblance to the original. O. B. Frothingham.

Guienne, or **Guyenne,** one of the old provinces of France, lying N. of Gascony, with which it formed the ancient Roman province of Aquitania, of which its name is supposed to be a corruption. (For its history see Gascony.) It is divided into the departments of Gironde, Lot-et-Garonne, Dordogne, and Aveyron, and includes parts of Tarn-et-Garonne and of Landes.

Guignes, de (Joseph), F. R. S., b. at Pontoise, France, Oct. 19, 1721; obtained early distinction as a Chinese scholar; became F. R. S. (London) 1752; was chosen to the Academy of Inscriptions 1754; became Syriac professor in the Collége de France 1757; keeper of the antiques in the Louvre 1769. D. at Paris Mar. 22, 1800. The *Histoire générale* (of the Huns, Turks, Mongols, etc.) is his principal work. The elder De Guignes was a man of noble and exalted character. This cannot be said of his son, Chrétien Louis Joseph (1759–1845), a distinguished Sinologist, who published as his own a Chinese, French, and Latin dictionary, taken mainly from the manuscripts of Father Basile de Glemona, a Franciscan missionary, whose papers were deposited in the Vatican library.

Guigniaut (Joseph Daniel), b. at Paray-le-Monial, France, May 15, 1794; studied at the Lycée Impérial, at the École Normale (1811–13), and the Lycée Charlemagne (1813–17); was *maître des conférences* in history at the Normal School 1818–22; held the corresponding chair in Greek letters 1826–28, and then became director of the same school and professor of Greek in the faculty of letters. In 1835 he left the Normal School, and became professor of geography in the faculty; was chosen to the Academy of Inscriptions 1837, and in 1847 received the cross of an officer of the Legion of Honor; was secretary-general of the council of the university 1845. Wrote much upon Greek literature and antiquities; published text and variations of the *Prometheus Bound* of Æschylus (1829), and *Les Religions de l'antiquité* (1825–51, 10 vols.), based

upon the *Symbolik* of F. Creuzer. In 1862 he became honorary professor of history, commander of the Legion of Honor, and perpetual secretary of the Academy of Inscriptions.

Guijar′, or **Guixar′,** a lake of Central America, in San Salvador. It is 60 miles in circumference, receives several affluents, among which is the Mitlan, and sends its water to the Pacific through the Lempa. On a large island, called by the natives Zacualpa ("the old city"), are ruins of large buildings.

Guild [Ang.-Sax., *gild,* "tribute," since the members contributed to the common fund], among the English Saxons, appears to have been either a mutual-relief society, or more probably an association to meet the expense of the frank-pledge system; but some authors believe that it sprang directly from the *collegia,* or guilds of the ancient Roman artisans. Religious guilds, precisely similar to the modern Roman Catholic confraternities and sodalities, were also organized at an early date. The property of the religious guilds was sequestrated by Henry VIII. The laws of Athelstane mention trade-guilds as early as 939. The Steelyard Merchants' Guild dates from before 967, and the Saddlers' from about that time. Trade-guilds were early called livery companies. Mercantile guilds followed soon after. The guilds originally had something of the character of trades' unions, but they were unions of master craftsmen who carried on business for themselves, not of journeymen to protect themselves against the tyranny of capital. As the guilds grew in importance, they were frequently united into one general guild or corporation. Hence arose the power of the burgess class, the great bulwark of freedom in mediæval times. Hence, as in the towns of Scotland at the present day, the dean of a guild became a municipal magistrate. Many of the old guilds still exist, as in London, but their old exclusive privileges have been abolished, and trade and manufacturing have been perfectly free since 1835. A similar system of guilds existed throughout a great part of Europe, and some archæologists hold that the original lodges of Freemasons were simply guilds, whose members were *free* from the taxation which bore so heavily upon most of the guilds.

Guild (Reuben Aldridge), LL.D., b. at West Dedham, Mass., May 4, 1822; graduated at Brown University 1847, and became its librarian in 1848. He has published *The Librarian's Manual* (1858), *Life, Times, and Correspondence of James Manning, and the Early History of Brown University* (1864), *A Biographical Introduction to the Writings of Roger Williams* (1866), *History of Brown University, with Illustrative Documents* (1867), etc.

Guil′derland, post-tp. of Albany co., N. Y., on the Albany and Susquehanna R. R., 14 miles N. W. of Albany. It has 5 churches and some manufactories. Pop. 3132.

Guild′hall, the town-hall of London, and the place of meeting of several municipal courts. It was built in 1411; was nearly destroyed by the Great Fire 1666; rebuilt in its present form 1789, its main hall being 153 feet long, 48 broad, and 55 high. Noteworthy are the lord mayor's and other civic feasts held here since 1500. In 1873 a public library was opened here.

Guild′hall, post-v. and tp., cap. of Essex co., Vt., 72 miles N. E. from Montpelier, on the Connecticut River, opposite Northumberland, N. H. It has 1 hotel, 2 stores, 2 churches, 1 weekly newspaper, an academy, mills, etc. Principal business, lumber-trade and farming. Pop. of tp. 483. Osmon B. Boyce, Ed. "Essex Co. Herald."

Guild′ford, town of England, cap. of co. Surrey, on the Wey. It is a quaint old town, but it has a considerable trade in grain. It is a municipal and parliamentary borough, and sends one member to Parliament. Pop. 9801.

Guil′ford, county in N. W. Central North Carolina. Area, about 625 square miles. It is an undulating, fertile, and well-wooded region, producing large quantities of grain, tobacco, wool, and live-stock. Flour and leather are manufactured. Gold is found, and copper and iron are abundant. The county is traversed by the North Carolina and other railroads. Cap. Greensboro'. Pop. 21,736.

Guilford, post-tp. and b. of New Haven co., Conn., on the Shore Line R. R., 16 miles E. of New Haven, and on Long Island Sound. It is a beautiful place, and has a fine stone school-house and 5 churches. Pop. 2576.

Guilford, post-tp. of Jo Daviess co., Ill. Pop. 1079.

Guilford, tp. of Winnebago co., Ill. Pop. 1062.

Guilford, tp. of Hendricks co., Ind. Pop. 2193.

Guilford, tp. of Monroe co., Ia. Pop. 873.

Guilford, post-tp. of Wilson co., Kan. Pop. 604.

Guilford, post-v. and tp. of Piscataquis co., Me., 8 miles W. of Dover, has 3 churches, and manufactures of lumber, woollens, etc. Pop. 818.

Guilford, tp. of Wabashaw co., Minn. Pop. 812.

Guilford, tp. and post-v. of Chenango co., N. Y. The township contains a number of manufacturing villages. Guilford Village has some mills, a machine-shop, foundry, etc. It is on the Midland R. R., 115 miles S. E. of Oswego. Pop. 331; of tp. 2806.

Guilford, post-tp. of Medina co., O. Pop. 1809.

Guilford, tp. of Franklin co., Pa. Pop. 3097.

Guilford, post-v. and tp. of Windham co., Vt., 5 miles W. of Brattleboro', has a mineral spring, large and valuable quarries of roofing-slate, and manufactures of children's carriages and other articles. Pop. 1277.

Guilford, tp. of Surry co., Va. Pop. 2240.

Guilford Court-house, Guilford co., N. C., some 5 miles from Greensboro', famous as the locality of a battle fought between the armies of Gen. Greene and Lord Cornwallis. The army of Gen. Greene, to which he had succeeded a short time previous, had been reinforced by militia from Virginia and North Carolina, until it numbered nearly 4500 men, of whom nearly 3000 were inexperienced militia. With this force he started in pursuit of Cornwallis, whose army comprised some 2500 veteran British troops, and whom he came up with in the vicinity of Guilford Court-house, where, on Mar. 15, 1781, the battle of this name was fought. The North Carolina militia were the first to receive the charge of the British troops, before which they gave way; the Virginia troops, next in line, held out for a time, and did effective service, but in turn fell back. The pursuing British were now met by the Continentals in the third line, and before a destructive fire of the 1st Maryland, followed by a charge of the cavalry, were in turn repulsed. Not wishing to risk another attack with his disorganized militia, Greene withdrew his army, but such was the damage inflicted upon the British army that Cornwallis not only did not pursue, but himself fell back upon Wilmington.

Guillaume (or **William**) **de Champeaux,** Doctor Venerabilis, b. at Champeaux, near Melun, in France; studied dialectics under Anselm of Laon (1030–1117); became archdeacon of Notre Dame; founded in 1113 the abbey of St. Victor, which became a famous scholastic centre; was made bishop of Châlons-sur-Marne in 1113; was a realist, and the instructor, and afterwards the adversary, of Abelard. He wrote a number of treatises, several of which exist in MS., and a few have been printed.

Guillemin (Jean Antoine), b. at Pouilly-sur-Saône, France, Jan. 20, 1796; studied botany with P. de Candolle; made important collections of plants, woods, fruits, gums, and other vegetable products in Brazil 1838–39. Author of many valued papers and several volumes upon his favorite science. D. at Montpellier Jan., 1842. The genus *Guilleminia* (Amarantaceæ) was named in his honor by Kunth.

Guil′lemot, a name applied to various sea-birds of the auk family, chiefly of the genera *Uria* and *Brachyrhamphus.* The former are common to both shores of the North Atlantic, where their feathers and eggs are extensively gathered. The other genus comprises six species of the short-billed guillemots of the North Pacific. The foolish guillemot (*Uria troile*) and the black guillemot (*Uria grylle*) are among the best known.

Guil′lim (John), b. in Herefordshire, England, 1565; was a student of Oxford; rouge croix pursuivant 1617–21; and d. in London May 7, 1621. In 1610 he published the famous *Display of Heraldry,* which was, however, according to Anthony Wood, mainly the work of John Barcham (1572–1642), a divine and antiquary, some time student of Exeter College, Oxford.

Guillotine [Fr., from *Dr. J. I. Guillotin* (1738–1814), its reputed inventor], a machine for inflicting capital punishment by decapitation, which acquired a terrible fame during the first French revolution. A very similar instrument had, however, been employed at times in various parts of Europe (Naples, Germany, Holland, Scotland) for more than 500 years. In Scotland it was called the "maiden," in France the "demoiselle." In this machine a heavy blade of steel falls in a grooved frame upon the neck of the victim. The inclined edge of the blade constitutes mainly the superiority of the *guillotine* over its predecessors. As a *machine,* the guillotine does its work with more certainty than the axe of the headsman. √

Guimarães, town of Portugal, in the province of Entre Douro e Minho. It is one of the oldest and most beautiful cities of Portugal, as interesting for its architectural monuments as for the beauty of its surroundings. Its most remarkable buildings are a church dating from the fourteenth and the palace or castle from the twelfth cen-

tury. In the neighborhood are several warm springs much used for bathing. Pop. 8000.

Guinand (François), a noted mechanic, b. in Neufchatel, Switzerland, in 1745; distinguished as the inventor of the best-known process for preparing glass for telescopic lenses. This process is still a secret one, the Messrs. Chance of England, the famous lens-makers, being among the possessors of the secret. Guinand furnished lenses for Fraunhofer and other distinguished makers; had previously made telescopes as an amusement. D. about 1840.

Guin'ea, a former coin of Great Britain, originally coined of gold brought from the Gold Coast of Guinea, whence the name. It was first struck in 1664 in Charles II.'s time, and in 1817 it ceased to be coined. Subscriptions, professional fees, and the like are still estimated in guineas. It was coined for 20 shillings, but passed for 21 up to 28 shillings, the value varying considerably.

Guinea is the common name of a large tract of coast-country of Western Africa, from Cape Verga in lat. 10° 18′ N. to Cape Negro in lat. 15° 45′ S., along the Atlantic and the Gulf of Guinea. The coasts are low, forming a belt of well-watered and very fertile land of varying breadth; among the rivers are the Niger or Quorra, the Calabar, the Zaire or Congo, and the Coanza. In the interior rise lofty ranges of mountains, among which the Kong Mountains in the N. are the best known. These mountains are covered with forests of immense trees, stocked with wild animals —elephants, lions, leopards, and serpents. But the exuberance of the animal and vegetable life in the mountain-forests increases when we descend toward the coast. Sugar, cotton, indigo, pepper, and other spices, oranges, lemons, grapes, and other fruits abound, and in the animal kingdom cattle, antelopes, turtles, pheasants, and birds of beautiful plumage. But the land is very unhealthy, and its relations with the civilized world, though very famous (consisting as they formerly did mainly in the slave-trade), are comparatively small. It is divided into Upper and Lower Guinea. The former lies N., the latter E., of the Gulf of Guinea. Upper Guinea contains a great number of native states, among which are the kingdoms of Ashantee, Dahomey, and Benin (which see), and the principal European settlements, among which are Accra, Cape Coast Castle, Elmina, and Dixcove. It is divided, in commercial language, into the Grain Coast (*Liberia*), Ivory Coast, Gold Coast, Slave Coast, and Calabar Coast. The principal states of Lower Guinea are Loango, Congo, Angola, and Benguela, a Portuguese possession.

Guinea-Fowl, the *Numida maleagris*, a gallinaceous bird, a native of Africa, so completely naturalized in parts of tropical America as to have become wild. The birds are mostly of a blue-gray color, spotted with white. They are often kept as domestic fowls in the U. S. and Europe, and are thought to protect other poultry from the attacks of the hawks. Their eggs are very good, and so is their flesh when young. Their cry is harsh and disagreeable. There are other species of the genus, all African.

Guinea, Gulf of, a part of the Atlantic Ocean, washing the western coast of Africa between lat. 4° N. and 1° S.

Guinea Pig, the "restless cavy" (see Cavy), the *Cavia aperea* of Linnæus; or, more strictly, the domesticated variety of the same species, known to some systematists as *C. cobaya*. It is a rodent, and has no affinity with the pig, which it very faintly resembles in its grunting voice. Neither is it a native of Guinea, but is found wild only in South America, where its range is extensive. It is bred for its gentleness and for the pretty coloring of some examples. It is quite defenceless, and seems too stupid to fear anything, but its unpleasant odor may protect it to some slight degree, although its chief defence against extermination lies in its marvellous fecundity. The time of gestation is three weeks; there may be a dozen young at a birth, and in about six weeks the young may be fecundated. There is an incorrect belief that the guinea pig kills or drives away rats. Its flesh and fur are useless, and the principal use thus far found for guinea pigs is as subjects for vivisection; for this they are extensively used, being cheap and non-resistant; and it is probable that their sufferings under the knife are small, since during and after extensive mutilation they commonly give little evidence of pain.

Guinea-Worm (*Dracunculus*), the female of *Filaria medinensis*, a nematode entozoic worm inhabiting the flesh of men and other animals, as dogs and horses. It is from six inches to four feet in length, and about one-ninth of an inch in diameter. It is found to prevail in many parts of Africa, India, Sumatra, Persia, Arabia, and the island of Curaçoa. It is believed to enter the flesh through the skin, and there live till its young are matured, which takes from eight weeks to two years. Then it appears to approach the surface, causing a small ulcer, from which, if let alone, it will eject its young; after which it is quite easily drawn out. As many as fifty have been reported in a single person. In some cases they cause much pain and inconvenience, in others none. Death has sometimes resulted from them. The little tank-worm of East Indian fresh waters and of wet soils is believed to be the larval form of the Guinea-worm.

Guingamp, a very picturesque town of France, in the department of Côtes-du-Nord, on the Trieux. It has tanneries and manufactures of yarn. Pop. 7350.

Guipuz'coa, the smallest but one of the most densely peopled provinces of Spain, bordering on the Bay of Biscay, and traversed by several branches of the Pyrenees. It is one of the Basque provinces, is rich in minerals, and mining and fruit-culture are the chief pursuits of the inhabitants. Area, 891 square miles. Cap. San Sebastian. Pop. 180,743.

Guiscard (Robert), sixth son of Tancred of Hauteville, a Norman baron with twelve sons. Robert was b. about 1015; went about 1053 to the Norman county of Apulia in Italy, where several of his brothers had already attained distinction; captured Pope Leo IX. at Civitella 1053, and in 1057 succeeded his brother Humphrey as count. In 1059 his new title of duke of Apulia and Calabria was confirmed by Pope Nicholas II., who also appointed him gonfalonier of the Church, and gave him leave to become master of such parts of Italy as were in the hands of the Greeks and Saracens. He also assisted his younger brother Roger (1031–1101), afterwards grand count of Sicily, in his conquests. In 1074, Gregory VII. excommunicated him for trespassing upon the papal rights in Benevento, but in 1080 the pope was reconciled by Robert's submission. He next (1081–82) gained a series of victories in the Epirus over the Byzantines, but led the forces by which (1082–84) the pope resisted Henry IV., the emperor; delivered the pope from the castle of St. Angelo and sacked Rome 1084; carried the pope to Salerno 1084; defeated the combined Greek and Venetian fleet and raised the siege of Corfù 1084. D. at Cephalonia July 17, 1085. Robert and his brother Roger were the founders of the kingdoms of Naples and Sicily. Their most important part in history was their share in the expulsion of the Saracens from Italy. Scarcely less noteworthy is Robert's successful championship of the pope at one of the most important junctures of the long controversy between the popes and emperors.

Guise, a fortified town of the department of Aisne, France, on the river Oise, 23 miles N. of Laon. It has manufacturing interests. Pop. 5099.

Guise, Cardinals of, or **Cardinals of Lorraine.** The well-known devotion of the Guise family to the Roman Catholic religion caused the promotion of several of its members to the cardinalate. Prominent among them were Charles of Guise, b. at Joinville Feb. 17, 1524; became archbishop of Rheims in 1538, and cardinal in 1547; went to the Council of Trent in 1562; was learned, affable, and politic, but cowardly, hypocritical, and licentious. His great ambition was to become pope, and to make his brother, the second duke of Guise, king of France. He founded the University of Rheims, and d. at Avignon Dec. 26, 1574.—Jean of Guise, b. in 1498, was made cardinal in 1518, and d. May 18, 1550. He held three archbishoprics, six bishoprics, and many abbeys, and was famous for his large charities and his many amours; and when a beggar in those days received large alms, he would say to the giver, "Thou art either Christ or the cardinal."—Louis I., brother of Cardinal Charles (1524–74), was b. Oct. 21, 1527; d. at Paris Mar. 24, 1578. He became cardinal in 1553, and was chiefly noted for convivial habits; and the people called him "the bottle cardinal," but he possessed fine natural abilities.—Louis II., a brother of the third duke of Guise, b. at Dampierre July 6, 1555; became archbishop of Rheims in 1574 and cardinal in 1578. He was put to death by order of Henry III. (who feared his power) on the same day that the duke of Guise, his brother, was murdered, Dec. 24, 1588. The cardinal left a natural son, Louis de Guise, prince of Falzburg.—Louis III., brother of the fourth duke, was b. Jan. 22, 1575; became duke-archbishop of Rheims without consecration, and was made a cardinal in 1615; was fond of military pursuits, and once attempted to settle a difficulty about an investiture by a duel, but was arrested on the field, and sent for a time to the Bastile. He left five children by the countess of Romorantin, mistress of Henry IV. D. at Saintes June 21, 1621.

Guise, Dukes of, a cadet branch of the house of Lorraine. The first duke was Charles, duke of Aumale, b. Oct. 20, 1496; married Antoinette de Bourbon 1513; wounded at Marignano 1515; became count of Guise 1520

(the first count was Charles of Anjou, 1414); fought the Germans under Charles V. successfully, and became duke of Guise 1528; conquered Luxemburg in 1542, and d. at Joinville Apr. 14, 1550.—FRANCIS, second duke, b. Feb. 17, 1519, at Bar, an able general, rose by his own abilities and the aid of his niece Mary, afterwards queen of Scots, to a high place in public affairs; became lieutenant-general in 1552, and won renown by his defence of Metz 1552–53, and by his conduct at Renti 1554; unsuccessfully commanded in Italy 1557; served brilliantly in command against the English and Germans 1557–58, taking Calais, Guisnes, Ham, and Thionville; exercised the chief power under Francis II.; renewed the war with the Protestants by the massacre of Vassy, Mar. 1, 1562; defeated and captured Condé at Dreux Dec. 19, 1562; and was assassinated by a Huguenot named Poltrot de Méré, dying Feb. 24, 1563.—HENRY (*Le Balafré*), third duke and prince de Joinville, b. Dec. 31, 1550, gained great distinction in the service against the Turks and the Huguenots; was the leading spirit in the massacre of St. Bartholomew, and was afterwards "head and soul" of the League; was forbidden to come to Paris by Henry III., who well knew the ambition of Guise, but entered Paris in triumph, virtually imprisoned the king in the Louvre, and demanded of the states-general the office of constable; but was assassinated by order of the king Dec. 23, 1588, and on the same day the cardinal Guise, brother of the duke, was also murdered by the king's command.—CHARLES, the fourth duke, prince de Joinville and duc de Joyeuse, b. Aug. 20, 1571, became governor of Provence, and was an able general; banished by Richelieu in 1631; d. at Cuna, near Siena, 1640.—HENRY, fifth duke, prince de Joinville and comte d'Eu, b. at Blois Apr. 4, 1614, became archbishop of Rheims when fifteen years old; entered upon a life of almost unexampled licentiousness; abandoned in 1640 the Church, and in 1641 was banished as a conspirator by Richelieu; married and became a soldier of fortune, distinguished for reckless valor. In 1647 he made himself generalissimo of Naples, but was given up to the Spaniards, and kept a prisoner four years; in 1655 he became grand chamberlain of France. D. at Paris June 2, 1664.—LOUIS JOSEPH, sixth duke, was b. Aug. 7, 1630, and d. July 30, 1671.—FRANCIS JOSEPH, seventh and last duke, prince de Joinville, duke of Guise, Alençon, Joyeuse, Augoulême, and count of Aleth, was b. Aug. 28, 1670, and d. Mar. 16, 1675. CHAS. W. GREENE.

Guitar′ [Gr. *κιθάρα*; Lat. *cithara;* Fr. *guitarre*], a stringed instrument in size between the violin and the violoncello, and in shape similar to them. Its construction is simple: a hollow body like a violin, but flat in floor and cover, the latter having in the centre a large round hole for resonance; a long wide neck, which serves as a keyboard; and six strings of wire and catgut, that are attached to a low wooden bridge below the sound-hole, are stretched along the instrument, and slackened or tightened by screws at the end of the keyboard. Across the neck, beneath the strings, are ridges of metal at unequal distances, pressure on which modulates the tone. The instrument is played with the fingers, the right hand touching the strings, the left making the modulations. As an instrument by itself, the guitar is not interesting, though finished performers execute difficult pieces on it; but as an accompaniment to the voice it has been, and still is, much used. In 1788 the duchess Amalia of Weimar introduced it in Germany as a new Italian instrument. The Italians had it from the Spaniards; the Spaniards had it from the Moors; and they brought it from the East, where it, or something very much like it, had been known from a great antiquity. Instrument-makers have attempted improvements on the guitar. A German artist in London invented a method of keys by which the instrument could be played more easily and be made to produce a fuller and steadier tone. Staufer of Vienna devised the guitarrencello and the guitarre d'amour; Birnbach tried to combine the guitar and violin by substituting a bow for the twanging of the strings. Other modifications have been suggested and applied, but none have met with favor, and the instrument remains essentially unchanged. As a distinct instrument it is now seldom used, and as an accompaniment to the voice it has been generally superseded by the pianoforte. O. B. FROTHINGHAM.

Guit′land, tp. of Marshall co., Kan. Pop. 707.

Guizot (ÉLISABETH CHARLOTTE PAULINE DE MEULAN), b. in Paris Nov. 2, 1773. Thrown upon her own resources by the death of her father, she developed considerable literary ability. She published in 1800 a popular novel entitled *The Contradictions*, and subsequently became editor of Suard's journal called *Le Publiciste,* and gained distinction as a critic and moralist. During a temporary illness she was relieved of her editorial duties by an anonymous substitute, who afterwards became known to her as the young M. Guizot. The acquaintance thus formed led to her marriage in 1812. She subsequently gave assistance to her husband in his historical labors, and published several works for the moral improvement of the young. Her book on domestic education won a prize from the Academy, and is esteemed her best work. D. Aug. 1, 1827. A. L. CHAPIN.

Guizot (FRANÇOIS PIERRE GUILLAUME), b. at Nîmes Oct. 4, 1787. His father, an eminent lawyer, fell a victim of the Revolution in 1794. His mother had him educated in the Protestant faith and classical learning at Geneva. He established himself at Paris in 1805, and commenced writing for the public in 1809. In 1812 he married Mlle. Pauline de Meulan, noted above, and the same year was appointed assistant professor of history at the Sorbonne. His political career began with the fall of Napoleon in 1814, when he was appointed secretary-general of the interior. The next year he was transferred to the department of justice, was made master of requests in 1816, and councillor of state in 1817. He belonged to the constitutional party, and in his writings represented the views of the Doctrinaires, so called. On the fall of the Decazes cabinet in 1820 he resigned the position of director-general of the communal and departmental administration, and having lost his seat in the council of state, resumed his historical lectures at the Sorbonne. In 1822 his lectures were suppressed on account of their liberal views. He then gave himself to literary work, and in 1828 established the *Revue Française.* The same year he married his second wife, a niece of the first, and also an authoress, by whom he had one son, who survived him. In that year also he was restored to his chair at the Sorbonne and to his seat in the council of state. His lectures during the next two years were received with great favor, and gained for him his highest distinction. In Jan., 1830, he became a member of the Chamber of Deputies, and favored the measures which led to the revolution of July. Louis Philippe called him into his first cabinet as minister of the interior, but he soon resigned and resumed his place in the Chamber. In 1832 he took the department of instruction in Marshal Soult's ministry, and for four years did much to organize the system of primary education. On the dissolution of that ministry in 1836 he retired, and except for a few months, when he again occupied his post in connection with the ministry of Molé, acted with the opposition party. In Feb., 1840, he was sent as ambassador to England, where he was received with marked attention on account of the favor with which in his lectures he had spoken of the English constitution. In October of the same year he entered the cabinet again as minister of foreign affairs, and for more than seven years was really the head of the government. In that position he maintained steadily and persistently the policy of resisting the revolutionary spirit prevalent in the country, and establishing on a secure basis a constitutional monarchy like that of England. His wise and able administration did much to form a healthy political sentiment in the nation, and to secure the largest liberty compatible with a stable government. But his policy favored peace with all other European states. This was interpreted by the opposition as involving a subordination to the influence of England and Russia, and the party which had inherited the ideas and spirit of the Great Revolution, restless and active, though comparatively small in numbers, used this plea effectively to make the ministry unpopular, especially in Paris. Yet M. Guizot had the full confidence of the king, and was sustained by the Chamber of Deputies to the end.

In the latter part of the year 1847 an earnest agitation for electoral reform created a feverish excitement throughout France; so-called reform-banquets were organized to discuss the proposed measures. In these the government was insulted and defied, and the city press fired the popular mind to intense excitement. Guizot proposed to the king that the cabinet should retire and open the way for a change of policy. But to this the king objected so long as the administration had the support of the Chamber of Deputies. The attempt subsequently made to suppress the banquets brought on the revolution of 1848, when Louis Philippe was dethroned and Guizot took refuge in England. After about a year's absence he returned, and as a candidate for the Chamber of Deputies was defeated. The remainder of his life was passed in retirement from direct concern with politics. He was, however, an interested observer of passing events, and occasionally gave public expression to his opinions. Thus, in 1861 he startled his Protestant friends by declaring himself in favor of continuing the pope's temporal power; and in 1870 he sustained the administration of Ollivier. During his later years his pen was continually busy, and he published many volumes on religious and historical subjects which embodied his mature judgments. He d. peacefully at his villa in Valricher, near Paris, on Sept. 13, 1874, within three weeks of completing his eighty-seventh year.

As a statesman, M. Guizot must be ranked among the

great and good men of France. He was a consistent advocate of constitutional monarchy, but the nation, especially as represented by the population of the capital, was not prepared to adopt his views. His highest and most enduring reputation rests on his historical writings, in which he evinced accurate knowledge of facts, clear discernment of causes and governing principles, and great power for comprehensive and well-balanced generalization. The purity of his private life and the simplicity and strength of his Christian faith add a crown of solid worth and shining grace to his noble character. He was honored by membership in three of the five academies which make up the Institut de France. He was elected to the Academy of Moral and Political Science in 1832, to that of Inscriptions and Belles-Lettres in 1833, and to the French Academy in 1836. In 1872 he received the chief prize of the Academy.

The following is a list of M. Guizot's most important published writings: *A Dictionary of French Synonyms* (1809); *Annals of Education* and *The State of the Fine Arts in France* (1810); an annotated translation of *Gibbon's Decline and Fall of the Roman Empire, Lives of the French Poets of the Age of Louis XIV.* (1813); an *Essay on Representative Government* (1816); *Conspiracies and Political Justice, Means of Government in France* (1821); *History of Representative Government* (lectures at the Sorbonne, 1822); *An Introduction to a Revised Translation of Shakspeare, Essays on the History of France from the Fifteenth to the Eighteenth Centuries, Notes to Memoirs respecting the English Revolution, Notes to Memoirs respecting the History of France down to the Thirteenth Century; History of the English Revolution* (1827); *General History of Civilization in Europe* (1828); *General History of Civilization in France* (1830); *Fall of the Republic and Restoration of Monarchy in England* (1850); *Corneille and his Times, Shakspeare and his Times* (1852); *History of the English Republic and the Protectorate of Cromwell* (1854); *History of the Protectorate of Richard Cromwell and the Restoration of the Stuarts* (1856); *Memoirs on the History of my Own Time* (1856–68); *The Church and Christian Society* (1861); *Meditations on the Essence of the Christian Religion* (1864); *Meditations on the Present State of the Christian Religion* (1865); *History of France, for my Grandchildren* (1870 *seq.*); *History of Four Great French Christians* (1873–4). His *Study of Washington,* written as a preface to the life and writings of Washington, is a charming monograph. Most of his works have been translated into English. A. L. CHAPIN.

Gules [from the Pers. *gul*, a "rose," or perhaps from the Late Lat. *gula*, the color of the mucous membrane of the mouth], in heraldry, red, the most honorable of the colors, ranking next to the metals, *or* and *argent.* In engravings and drawings it is shown by fine perpendicular lines upon the escutcheon.

Gulf, tp. of Chatham co., N. C. Pop. 1786.

Gulf Stream, The. The great current of the Atlantic Ocean known as the Gulf Stream issues from the Gulf of Mexico, through the narrow strait between the mainland of Florida and the Bahama Banks, and extends in a northerly and easterly course, parallel to the coast of the U. S., to the vicinity of Nantucket Shoals. Here its course changes still more to the eastward, extending quite across the North Atlantic in the direction of the British Islands, a portion of the stream penetrating far into the Arctic seas of Northern Europe. The edge of the stream next to the Atlantic coast is well defined, the separation of the warm waters of the stream from the cool waters of the counter-current from Baffin's Bay, which skirts the coast of North America, being well marked. The outer edge, on the other hand, is not so well defined, on account of the overflow or dispersion of the waters along the eastern limits. The width of the stream between Cape Florida and the island of Bimini is less than 40 miles, but its breadth gradually increases as it flows onward, being estimated at 300 to 400 miles on a line from the island of Bermuda to Halifax.

This great ocean-current forms but a part of the general system of circulation of the waters of the globe, although it is induced chiefly, without doubt, by the trade-winds of the equatorial regions of the Atlantic, which blow continually towards the shores of the continent of America. While, therefore, the rapidity of the current in the narrow Strait of Florida gives rise to the impression that this point is the origin of the stream, these local features of narrow breadth and great velocity are to a great extent accidental, and are due to the configuration of the coast and the outlying ranges of islands of the Caribbean Sea. The great circuit of motion given to the waters along the shores of the western continent would doubtless still exist were a barrier to be thrown across the Strait of Florida, although the stream would be greatly modified in its general characteristics. The waters which now are driven into the Caribbean Sea and Gulf of Mexico through the passages between the Windward Islands find an outlet mainly through the Strait of Florida, where, according to well-known laws of hydraulics, the channel being contracted, increased velocity is required to preserve continuity of flow.

The Gulf Stream, on account of its influences on the climates of the countries of the Old World, to the shores of which its warm waters find their way, and its effects on the meteorology of the North Atlantic, as well as on the commerce between the eastern and western continents, may be regarded as one of the most important phenomena connected with the physical geography of the globe. In this connection may be included what are known as its counter-currents, the most noted of which is that which comes from Baffin's Bay, and continues along the coast of America, depositing cooler water along the coast even as far S. as the Florida Strait. This cool water, skirting the coast, modifies in a remarkable degree the climates of the shores along which it passes. It is hardly possible to conceive the effects which would be produced along the temperate regions of the coast of the U. S. were the hot waters of the Gulf Stream to be thrown directly on our shores. They are now kept at a distance by the inner cool counter-current, which gives a well-defined inner wall or bank at a distance of 20 to 100 miles; and the influences of the Gulf Stream are felt more through the medium of the atmosphere than through direct contact of its waters.

Such being the general facts in regard to the Gulf Stream and its important influences, a brief history of exploration and discovery in connection with it may not be without some interest. Its influences were detected and observed along the coast of Europe many years before the discovery of America, and, according to some historians, it is apparently well authenticated that the discovery of objects from some unknown land cast ashore on the Azores, or floating in the sea to the westward, furnished evidence which was eagerly seized upon by Columbus as proof of his theory of the existence of a western continent; and while he was lingering in Spain, disappointed and almost discouraged in his efforts to obtain assistance in his great undertaking, the intelligence of this character that reached him from time to time served to renew his courage and strengthen his belief in the correctness of his views.

A venturous Portuguese pilot, Martin Vicenzo, who had sailed far out to sea, had seen floating upon the waves a piece of wood ingeniously carved with some rude instrument; another pilot, Pietro Correa, found a similar piece of carved wood on the island of Porto Santo. Stalks of cane, "each joint of which would hold several quarts," were found on the same shores; and some of the inhabitants of the islands reported that pine trees not belonging there had been driven ashore by the W. winds; at Cape de Verde two large canoes had been found which were supposed to have been forced to sea while going from one island to another; and finally the bodies of two men, differing in their features and color from the Christians, were cast upon the island of Flores.

These floating objects were supposed to have been driven about by the winds and waves until they were thrown by chance upon the coast of Europe; and this idea seems to have impressed Columbus with the belief that the new continent was much nearer to that of Europe than it is; and in his voyage he was obliged to conceal from his companions what surprised himself—the great distance which he found separating him from the Old World, without any signs of the New.

The continual discovery of trees, fruits, seeds, and other objects on the coasts of Norway, Ireland, and Scotland years after the continent of America had become known, led to the conjecture that these objects were brought from other lands by the more rapid agency of currents; and these conjectures have finally been confirmed by closer observations and by actual experiments upon the drifting of bodies thrown into the Gulf Stream. The molucca-beans found on the shores of the Hebrides, and regarded by the common people as curious productions of the sea, were pronounced by Sir George Mackenzie in the year 1675 to belong to a tropical climate, and he indulges in some speculations with regard to their having been brought through the North-west passage. In 1696 these beans were identified by another observer as belonging to the island of Jamaica, where he had seen and described them in a work on the natural history of that island. On the coast of Norway similar curiosities were found; and the fishermen of the western coast of Ireland and Scotland often discovered trees of cotton-wood and other unknown productions of the tropical forests. The exact route by which the seed or tree was carried was in a great degree conjectural until the general course of the Gulf Stream became known. Later evidences of the flow of this great current from the Gulf of Mexico to the coasts of Europe have been derived from

numerous observations on the drifting of bottles and pieces of wrecks, which have been carried in a few months from the western to the eastern continent; and also in the higher temperature of the western coast of Ireland, caused by the waters of the stream, which retain sufficient warmth to reproduce there some of the Algæ of the Florida coast.

In connection with the discovery of America, this agency of the Gulf Stream in transporting through several thousand miles of the ocean objects belonging to a new and unknown continent was the more important on account of the extravagant ideas which were then entertained of the sea beyond the visible horizon. It was generally regarded as a vast region of darkness, which the minds of the common people filled with imaginary horrors; even the more learned thought it impossible for a vessel to return after reaching the opposite point of the globe, on account of the tendency of the sea to the antipodes by the force of gravity. A mysterious dread pervaded the minds of seamen with regard to those unknown regions of the earth; an expedition which had secretly departed from Lisbon with the design of robbing Columbus of the glory of the discovery of the New World returned in dismay at the horrors with which their imaginations filled the expanse which seemed to stretch infinitely to the West. The simple incidents therefore of familiar objects borne quietly along from the vast unknown sea, while they were proofs of the existence of inhabited lands to the West, tended also to remove from the minds of the superstitious seamen the prevailing ideas of the intermediate ocean.

It is difficult to assign a precise date to the discovery of the Gulf Stream as a continuous current of the ocean. The early Spanish navigators did not fail to notice those currents of the Caribbean and Mexican seas in which the Gulf Stream current has its origin. In his last voyage Columbus sailed from the Canary Islands to Hispaniola in sixteen days "with prosperous wind, and by the swift fall of the ocean from the E. to the W.;" and in his voyage from Paria along the coast of South America towards Carthagena, it is stated that the "swift course of the water deceived both Johannes Sarranus, the chief pilot of the governor's ship, and all others, although they made their boast that they knew the nature thereof;" "for they affirm that in one night they were carried fifty leagues beyond their estimations." "The Strait of Florida was discovered in 1512 by Ponce de Leon. He first came upon the island of Bimini, and soon afterwards discovered the mainland, which he called Florida. To find a haven he kept sight of the shore, but his ships met with so strong a current that notwithstanding they were favored by a fresh gale of wind, yet they could not stem it, and one of the vessels was carried out to sea out of sight."

In 1519, Cortez, after having been three months in Mexico, sent messengers to inform the king of Spain of his conquests; he selected for their pilot Antonio Alaminos, who was already famous for the boldness of his navigation in the waters of the New World, and familiar with the coast of Florida and the adjacent islands. Alaminos resolved to sail through the Strait of Florida and take his course thence to Spain. He "took this resolution, concluding that those currents must lead somewhere," "and accordingly stood northward; and it proved well, for, being got safe out of the channel, he came into the open sea, and arrived safe at San Lucar in October, having sailed from Mexico on the 26th of July." Thus, Alaminos was the first navigator who followed the Gulf Stream to Europe; whether he recognized its influence throughout his entire voyage or not, it is impossible to determine.

Curious and interesting speculations on the currents of the Caribbean Sea and Gulf of Mexico, written by Peter Martyr, in his *Decades of the Ocean*, were translated into English, and published in Hakluyt's *Collection of Voyages*. It appears from these historical accounts that not only were the early Spanish navigators acquainted to some extent with the currents of the West Indian seas, but Sebastian Cabot discovered the counter-current which flows from the Arctic seas southward along the coast of America. From the accounts of these navigators, Peter Martyr concluded that the waters of the globe were "driven about by the incessant moving and impulsion of the heavens, and were not swallowed up and cast out again by the breathing of Demogorgon, as some imagined because they saw the seas increase and decrease, flow and reflow."

The first delineation of the Gulf Stream on a chart of the Atlantic of which we have any knowledge was made by Dr. Franklin in 1769–70, from the information communicated by Capt. Folger of Nantucket, commanding a whaling vessel from that port. In his account of this map he writes, "Vessels are sometimes retarded and sometimes forwarded in their voyages by currents at sea which are often not perceived." "About the year 1769–70 there was an application made by the board of customs at Boston to the lords of the treasury in London, complaining that the packets between Falmouth and New York were generally a fortnight longer in their passage than merchant-ships from London to Rhode Island, and proposing that instead of New York for the future they should be ordered to Newport. Being then concerned in the management of the American post-office, I happened to be consulted on the occasion; and it appearing strange to me that there should be such a difference between the places scarce a day's run asunder, especially when the merchant-ships are generally deeper laden and more weakly manned than the packets, and had from London the whole length of the river and channel to run before they left the land of England, while the packets had only to go from Falmouth, I could not but think the fact misunderstood or misrepresented. There happened then to be in London a Nantucket sea-captain of my acquaintance, to whom I communicated the affair. He told me he believed the fact to be true; but the difference was owing to this, that the Rhode Island captains were acquainted with the Gulf Stream, which those of the English packets were not. 'We are well acquainted with that stream,' said he, 'because in our pursuit of whales, which keep near the sides of it, but are not to be met with in it, we run down along the side; and frequently cross it to change our side; and in crossing it have sometimes met and spoke with those packets who were in the midst of it and stemming it. We have informed them that they were stemming a current that was against them to the value of three miles an hour, and advised them to cross it and get out of it, but they were too wise to be counselled by simple American fishermen. When the winds are light,' he added, 'they are carried back by the current more than they are forwarded by the wind; and if the wind be good, the subtraction of seventy miles a day from their course is of some importance.' I then observed that it was a pity that no notice was taken of this current upon the charts, and requested him to mark it out for me, which he readily complied with, adding directions for avoiding it in sailing from Europe to North America. I procured it to be engraved, by order from the general post-office, on the old chart of the Atlantic, at Mount and Page's, Town Hill, and copies were sent to Falmouth for the captains of the packets, who slighted it, however; but it has since been printed in France, of which edition I hereto annex a copy.

"This stream is probably generated by the great accumulation of water on the eastern coast of America, between the tropics, by the trade-winds which constantly blow there. It is known that a large stream of water ten miles broad, and generally only three feet deep, has, by a strong wind, had its water driven to one side and sustained, so as to become six feet deep while the windward side was laid dry. This may give some idea of the quantity heaped upon the American coast, and the reason of its running down in a strong current through the islands into the Bay of Mexico, and from thence issuing through the Gulf of Florida, and proceeding along the coasts to the Banks of Newfoundland, where it turns off towards and runs down through the Western Islands. Having since crossed the stream several times in passing between America and Europe, I have been attentive to sundry circumstances relating to it, by which to know when one is in it; and beside the gulf-weed with which it is interspersed, I find that it is always warmer than the sea each side of it, and that it does not sparkle in the night. I annex hereto the observations made in two voyages, and may possibly add a third. It will appear from them that the thermometer may be a useful instrument to the navigator, since currents coming from the northward into southern seas will probably be found colder than the water of those seas, as the currents from southern seas into northern are apt to be warmer." * The chart drawn by Franklin expresses exceedingly well the inner limits of the Gulf Stream as we now know them.

The second volume of the *American Philosophical Transactions* (old series, published in 1786) contains, besides a copy of the chart referred to, tables of the observations made during those voyages; the first is entitled "Observations of the warmth of sea-water, etc. by Fahrenheit's thermometer, in crossing the Gulf Stream, with other remarks, made on board the Pennsylvania packet, Capt. Osborne, bound from London to Philadelphia in April and May, 1775." The second table is entitled "Observations of the warmth of sea-water, etc. by Fahrenheit's thermometer, with other remarks, made on board the Reprisal, Capt. Wycks, bound from Philadelphia to France in October and November, 1776." And the third, "A journal of a voyage from the channel between France and England towards America, 1785." The temperatures observed were surface temperatures, and were noted daily, as well as the direction and course of the wind. On the last voyage an experi-

* *Am. Phil. Transactions*, vol. ii., old series.

ment was made to obtain the temperature at moderate depths by bringing up water in a bottle and a cask with valves. The first attempt, with a bottle at twenty fathoms, was unsuccessful, the bottle coming up empty; in the second attempt, at thirty-five fathoms, the bottle came up full, and the water it contained was found to be six degrees colder than at the surface. On soundings off the Delaware, in eighteen fathoms, a cask, with a valve in the bottom opening inward and another in the top opening outward, was sunk to the bottom and then drawn to the surface, and the water it contained was found to be at 58°, which was twelve degrees colder than at the surface. In the first voyage Franklin sailed near the axis of the Gulf Stream, from lon. 60° 38′ and lat. 37° (the latitude of Cape Henry) to a point off the capes of the Delaware. In the second voyage his vessel seems to have kept S. of the axis, and finally crossed the stream in a direction nearly perpendicular to the coast at Cape May. The highest surface temperature recorded was 80°. On the voyage from Philadelphia to France the Reprisal struck the axis of the stream off the capes of the Delaware, and seems to have followed the middle of the stream nearly, the temperature of the water ranging for several days ten degrees above that of the air. The uncertainty with regard to the determinations of longitude in these voyages renders it difficult to trace the tracks of the vessels with accuracy.

The journal of Dr. Franklin on his last voyage was kept for him by Mr. Jonathan Williams, afterwards colonel and chief engineer of the U. S. A. The interest awakened in this subject by these experiments led Col. Williams to continue the investigations in subsequent voyages. Journals of four voyages between England and America, made by him, were published in the *Transactions of the American Philosophical Society* in 1790. Without defining the limits of the Gulf Stream, Col. Williams presented his observations as a foundation for a theory of thermometrical navigation, supposing that the temperature of sea-water, even at the surface, depended directly upon the depth, and that "the passage from deep to shoal water could be discovered by a regular use of the thermometer before a navigator could see the land," and that it would be "an easy thing to make a general survey of the coast under water, more particularly than could be done by sounding." In 1800 a paper was read before the Philosophical Society by Mr. William Strickland *On the Use of the Thermometer in Navigation*, giving the results of observations made by him during two voyages across the Atlantic. He kept a daily and sometimes hourly record of the temperature of the air and water, chiefly with a view of testing or confirming the theory of Col. Williams, which had come to his knowledge through the *Philosophical Transactions*. Mr. Strickland remarks that "in the outward voyage the subject appearing most worthy of attention is the probability of a branch striking off from the Gulf Stream in a northerly or northeasterly direction, flowing to the E. of and somewhat parallel to the Banks of Newfoundland;" and that "it is probably continued in about a N. E. direction, and extends entirely across the Atlantic till it ultimately strikes the coasts of Ireland and the Hebrides, after having lost in its long course in those northern latitudes much of its heat, and at last being reduced to the temperature of the sea through which it flows." He recommends the employment of a vessel especially to explore this northern branch of the Gulf Stream between lat. 47° and 60°, using the thermometer to detect its limits. The remaining part of the paper of Mr. Strickland is an attempt to prove the "accuracy of the thermometer in ascertaining a navigator's position at sea," in which he fell into the error of Col. Williams in taking the phenomena of the temperature of the Gulf Stream waters along the coast of America as general phenomena applicable to any part of the globe, and supposing that the thermometer might with safety be used by mariners to indicate the approach to dangerous coasts.

Tables of observations on the winds, the currents, the Gulf Stream, the comparative temperature of the air and water, etc., made in the North Atlantic during twenty-six voyages to and from Europe (principally between Philadelphia and Liverpool), between the years 1799 and 1817, inclusive, by John Hamilton, were published in the *American Philosophical Transactions* in 1825 (vol. ii. new series). In these tables the direction of the wind and the direction and velocity of the currents are given for the different months in the year, and also the temperature of the air and water near the axis of the stream. The average temperature of the water on soundings off the capes of the Delaware, St. George's Bank, and on the coast of Ireland for the different months of the year, were also given. The conclusions to which Capt. Hamilton arrived were, that it was impossible to define the limits of the current of the Gulf Stream, owing to the variable influence of the wind; that after it passes the tail of the Grand Bank of Newfoundland the main stream proceeds to the southward, while several ramifications, generally not very strong in their currents, branch off to the N. E., and from that to the E., with counter-currents in the intermediate spaces; that "on both sides of the Gulf Stream a counter-current running in the opposite direction is met with;" that "by the frequent use of the thermometer the navigator may always discern when he touches upon the Gulf Stream, and take advantage of its current or show its influence." Capt. Hamilton further remarks: "I was for a long time almost induced to conclude that some of these currents, particularly those which prevail between the coast of Newfoundland and Europe, were periodically running half the time in one direction and half the time in the other, and the foregoing tables seem to strengthen this conclusion, except the counter-currents near the edge of the Gulf Stream. In February and March the set seems to be southerly, with a single exception, from lat. 41° to 48°. In April, on the parallels between 48° and 50° and longitudes 13° and 26°, its direction was northerly, while at other times, from lat. 48° to 52°, lon. 14° and 29°, it set to the southward. In May, between lat. 49° and lon. 16° and 24° the set was invariably to the northward. In June always southerly, and always strong; in July, August, and September southerly. When the current from the northward prevailed to any great extent, a set in the opposite direction near the Bank of Newfoundland, and on the W. coast of Ireland," was always observed. "On the N. side of the Gulf Stream the temperature of the water is 10° higher than the surrounding ocean. On the S. side, 5°; the difference is greater in the winter than in summer. On the coast of Ireland the thermometer is of very little use in indicating soundings, the water seldom falling over 3°." The difference in the temperature of the water in the Gulf Stream and its counter-currents was considered to be very small, if there was any at all, and the breadth of the latter, particularly on the southern edge of the Gulf Stream, inconsiderable.

"The gulf-weed is no mark by which the stream can be distinguished, as it is met with in great quantities throughout the middle latitudes, to the westward of the Azores and N. of the Bermudas. It will be found uniformly the case that the water is much colder on banks than on soundings shelving gradually from the land. In summer the difference of temperature of the water on and off soundings on the coast of America is not so great as at other seasons of the year; and on the edge of soundings it will mostly be found to be colder than in shoaler water. The irregularity of the courses the Gulf Stream pursues, together with its undefined limits, all of which are considerably changed by the prevailing wind, renders it impossible for a person to know when he is in it unless the thermometer be used."

The publication of the chart of the Gulf Stream by Franklin in England led to numerous observations on its extent, velocity, and temperature by both public and private vessels of Great Britain; the results of which were collected and digested by Major James Rennell, F. R. S., and published after his death by his daughter, Lady Rodel, in 1832, in a work entitled *An Investigation of the Currents of the Atlantic Ocean, and of those which prevail between the Indian Ocean and the Atlantic.* This work is accompanied by an atlas containing elaborate charts of the currents of the North Atlantic, and representing the observations of different navigators, chiefly in the service of the British admiralty. Notwithstanding the great number of observations placed at his disposal, Major Rennell concludes that from a want of system in the observations, which form a collection for the most part of isolated and unconnected facts or statements, made by different observers at different seasons, and from errors in the determination of longitudes where the greater part of the stream from America to Europe lies E. and W., it was impossible in the state of knowledge at that time to say where the borders of the Gulf Stream were; and notwithstanding all attempts to arrange a line of passage from Europe to America, a ship might have the current against her during nearly half of her voyage. That part of the stream lying between the Strait of Florida and Cape Hatteras was better determined, but "no portion was less known, and which ought to have been better known, than that lying between Cape Hatteras and the Banks of New York and St. George." The observations discussed by Major Rennell were surface observations, and the apparent course and breadth of the stream were influenced by the winds and other causes prevailing at the time of observation. The central line or axis was wholly undetermined E. of Cape Hatteras, and the borders only approximately ascertained. Major Rennell suggested the method of bringing up water from different depths in determining the temperatures, for the purpose of ascertaining the thickness of the stratum of warm water; but the possibility of tracing the axis of the stream and its real course and breadth by cross-sections of deep temperatures does not

seem to have impressed him nor the various navigators from whom he derives his information. His work, however, was the most valuable collection of results that had yet been made, and his general conclusions and deductions, the result of many years' labor, and derived from a great mass and variety of observations, furnished the most reliable information we possessed of the Gulf Stream beyond the limits of our own coast. Accepting the explanation of Dr. Franklin with regard to the cause of the Gulf Stream, Major Rennell cites many instances to prove the effect of wind constantly blowing in one direction in producing a surface drift, which on meeting with the resistance of a coast causes a heaping up of the waters. The most noted instance is that of the Gulf of Guinea, where, according to frequent observations of Capt. Lawson, the water in the Bight of Benin is elevated five or six feet above its ordinary level by the S. W. winds. In support of this theory concerning the origin of the Gulf Stream, he states that there is an inset through every passage into the Caribbean Sea, caused by the trade-winds, except that between Cuba and Yucatan, where the current flows into the Gulf of Mexico. This current is divided—one, the main branch, flowing around the Gulf to the westward, and the other flowing directly to the outlet between Florida and the Bahamas.

The Gulf Stream is thus described by Major Rennell: "The Florida Gulf Stream is well known to issue from the Gulf of Mexico, whose waters, acquiring a higher level by accumulation, are discharged with great force and velocity through the channel between the southern cape of Florida and the island of Cuba, and being subsequently opposed in front by the Bahama Archipelago, and its banks and shoals, turns northward along the coast of North America, following it at no great distance, until it is again opposed by the banks of Nantucket and St. George, which advance far into the ocean from the shores of New York and New England. These turn it so decidedly from the coast that it never returns to it, but perseveres in its newly-acquired eastwardly course through the Atlantic, passing over or near the tail of the Great Bank of Newfoundland, and to a point several degrees beyond it, when the stream from the Hudson's and Davis's Straits appears to give it a cast to the southward. At this point, although it has made a course of more than 2000 miles, it still preserves a velocity of one mile and a quarter per hour, as also a temperature of seven to ten degrees of Fahrenheit's thermometer above the summer temperature of the surrounding ocean." The stream was supposed by Major Rennell, though from what he acknowledged to be insufficient data, to *follow the coast* between Cape Hatteras and Nantucket in the same manner that it does along the coast of Georgia and the Carolinas. The axis of the stream he supposed to lie towards the western side rather than in the middle. The velocity, according to his deductions, varies with the seasons, depending on the prevalence and strength of the trade-winds, and is greatest in the Strait of Florida in the months of July, August, and September, the maximum being 90 to 120 miles per day. The mean rate above the narrowest part of the strait is 44 miles per day; and between the narrowest part of the strait and the opening into the ocean the mean rate of motion in those months is 100 miles, and 82 miles per day for 180 miles northward; and at a distance of 1100 miles from the strait, or at a point where a line from Bermuda to Halifax crosses the stream, its velocity is commonly 48 miles per day. At its outlet from the Strait of Florida, the breadth of the stream is 40 miles; off the coast of Georgia, 60, and opposite Cape Hatteras, 75 miles; its inner edge at Cape Hatteras is reported to be 24 miles to the S. E. of the cape and in 60 fathoms depth of water. The mean velocity is understood to be from $2\frac{1}{2}$ to 3 miles per hour from the straits to Cape Hatteras. "At Cape Hatteras the coast falls back suddenly from the N. E. to the W. of N., and the western border of the stream expands on that side, and takes a more northerly direction, whilst the main body continues its former course to a considerable distance, but, meeting the Nantucket and St. George's Bank, it is turned off to seaward, and never afterwards approaches any land."

When first turned from the coast the central part of the stream takes a direct eastwardly course, and finally to the southward of E., at the same time expanding to a vast breadth. After passing the Banks of Nantucket and St. George it continues through the Atlantic in an E. northerly course to the distance of 1500 miles, or to lon. 43°–44°, lat. 41°–44°. From this point its course changes from E., northerly, to E. and S. E., and finally southward. This latter part of its course embraces about 570 miles, completing a course of 3060 miles from the Gulf of Mexico. No trace of the current S. of the Azores has been found, but the observations of Franklin and others show the existence at times of warm water which may be traced to the Gulf Stream. A part of the Gulf Stream 500 miles in extent, between 50° and 61° lon., is almost wholly unknown; neither its direction, velocity, nor temperature having been observed. The width of the stream at any point is variable; on a line from Bermuda to Halifax the variation is from 140 to 320 miles, according to numerous surface observations made by Mr. Napier and others in the passage along this line. These variations appear also to be sudden. Ten crossings of the stream between lon. 63° and 72° W. are reported by Major Rennell, in all of which except one the surface temperatures were recorded in detail. Five of these crossings were made by Mr. James Napier in H. M. ship Newcastle in the years 1820 and 1821, and by Mr. B—— during the same years nearly on the same meridian, giving good opportunities for determining the breadth of the warm water. The least breadth found on the line from Bermuda to Halifax was 140 miles, and the greatest 320—the northern limit changing generally less than the southern.

In crossing the stream in 1821, Mr. Napier noticed that after passing through Gulf water with a temperature of 70° for a distance of 36 miles, he came into water of 66° temperature, which continued 32 miles, where the temperature again rose to 70°. He observed that the water of the higher temperature was very much agitated, having every appearance of a current, but in the "cooler vein" the water was smooth. Three traverses of the stream were made in the month of May, 1821, along this line: viz. the above traverse of Mr. Napier and two by Mr. B——, all within 20 miles of longitude: the variation in breadth was 62 miles, and warm water was found in a higher latitude than at any other period. From these results Maj. Rennell estimates the extreme breadth of the stream at this point to be 390 miles. This extreme breadth is attributed to the overflowings of the stream, which are to be traced to the irregularities in velocity at the origin rather than to the seasons.

The general results of the inquiries of Maj. Rennell in regard to temperatures may be summed up as follows: The maximum temperature of the Gulf of Mexico is 86° at the entrance to the Strait of Florida, which is 8° higher than the ocean temperature in the same latitude. From this point to Cape Hatteras the mean velocity in summer is 77 miles per day. The difference in latitude is 11°, and the Gulf water loses in its passage 3° F. The ocean water is 6° F. lower at Cape Hatteras than in the latitude of Cape Florida. From Cape Hatteras to the point where a line from Bermuda to Halifax crosses the Gulf Stream, a distance of 600 miles, the loss of temperature is 2° F., and the difference of latitude 4°, the mean velocity being 50 miles per day. From the latter point to lat. $43\frac{1}{2}$, lon. $43\frac{1}{2}$, a distance of 950 miles, the velocity is about 40 miles per day, the increase in latitude 4°, and the loss of temperature $5\frac{1}{2}$° F.; and finally to the neighborhood of the Azores, a distance of 570 miles, the temperature diminishes 3°, the velocity diminishes to 20 miles per day; the latitude in this last interval diminishes $2\frac{1}{2}$°. Thus in running about 3000 miles, from the parallel of 24° to 43°, the temperature is diminished about $13\frac{1}{2}$°, from 86° to $72\frac{1}{2}$° F., and the time occupied is about 78 days. The data upon which the time is calculated are the mean velocities of the stream in summer between the different points. About five and a half months are required for the waters of the Gulf Stream to reach the coast of France.

The observations of the U. S. Coast Survey having furnished the means of calculating not only the volume of warm water which is carried by the Gulf Stream from the tropics to the North Atlantic and the Arctic regions, but also the amount of heat which is thereby transferred, Mr. James Croll estimates that 133,816,320,000,000 cubic feet of water are daily conveyed, and the quantity of heat in foot-pounds transferred amounts *per day* to 154,959,300,000,000,000,000—a quantity of heat sufficient to melt daily a mass of cast iron as large as Mount Washington. This heat is distributed over Western Europe and a portion of the Arctic regions, producing the marked differences in climate and temperature which are there observed as compared with points of the same latitudes on the American continent.

Explorations of the Coast Survey.—From the preceding brief history of the progress of discovery with regard to the Gulf Stream, it will be perceived that even for the purposes of navigation it was but imperfectly known as late as 1842, especially that part lying along our coast from the Gulf of Mexico to Nantucket. It is this portion of the stream to which the name of *Gulf Stream* properly belongs; and having the swiftest current, and lying as it does in such a manner that all the commerce of our country must cross it or sail within its influence, a thorough knowledge of its limits and characteristics is of the first importance. When the explorations were commenced in 1844–45, this part of the Gulf Stream was imperfectly known, while the

interests of commerce, of science, and every consideration for the safety and welfare of navigators called for its thorough and systematic investigation. A report urging the lords of the admiralty to undertake the work was made by Admiral Sir Francis Beaufort in 1842, in which it was stated that to make a complete or even creditable exploration would require "very powerful means, considerable time, and conspicuous talents." The importance of an examination of the great rivers emptying into the Atlantic, to whose influence the Gulf Stream was attributed, was suggested, and a detailed plan given for the survey of the stream from the Gulf of Mexico to the shores of Europe. This plan proposed the employment of three steam vessels and one sailing vessel; one of the steamers to remain in the Gulf of Florida for the purpose of keeping a constant record of the velocity and temperature at that point, the sailing vessel to drift along the axis of the stream, and the other two steamers to operate from the centre to the edges in conjunction with the sailing vessel. The report suggested that, should their lordships be inclined to adopt the undertaking, they should invite the Royal Society and other learned bodies to suggest any inquiries which might seem to be connected with this great problem, and expresses the conviction that an enterprise of such magnitude and importance, if undertaken with less ample means, would end in disappointment and bootless expense. The work here suggested was undertaken along that portion of the stream adjacent to the coast of the U. S. by Prof. A. D. Bache on his accession to the control of the U. S. Coast Survey in 1844. To his conspicuous talents and untiring industry and perseverance we are indebted for the development of the most interesting characteristics of this part of the stream. The work extended over a period of nearly sixteen years, the explorations being conducted under his direction by officers of the U. S. navy, among whom may be mentioned, as distinguished in this as well as in other fields of duty, Bache, Davis, Sands, Berryman, Craven, Febiger, Murray, and Wainwright.

The plan of exploration of Prof. Bache was to run sections for soundings and deep-sea temperatures across the stream at various points, by which not only the limits of the warm waters of the stream would be defined at the surface and at various depths, but also the form of the bottom of the sea along its path. Numerous sections were run in this manner, which resulted in the discovery that the stream is divided from its initial point in the Strait of Florida, throughout its whole extent along the coast of the U. S., into alternating bands of warm and cool water; and further, that the bands of cool water are produced by the forcing to the surface of the cool underlying water of the ocean by submarine ranges of mountains running in lines generally parallel to the coast. The inner edge of the stream occurs where there is an abrupt descent of the bottom from soundings of moderate depths to the deep waters of the ocean, this feature being so marked as to be called the *cold wall*. The published reports of the Coast Survey give maps of the stream indicating the bands and the courses of these ranges of submarine elevations. It was found impracticable to determine the depths across the stream except near its origin, owing to the great depth and the velocity of the current; and it is a somewhat remarkable fact that the existence of the depressions and elevations at the bottom of the sea, determined in these explorations by the deep-sea thermometer, furnished the first evidence of the existence of such inequalities in advance of the sounding-line and plummet. These explorations of the Gulf Stream by Prof. Bache constitute one of the most important contributions to the physical geography of the sea of modern times. For the first time during these explorations specimens from the deep sea-bottom were procured and examined.

A notice of the Gulf Stream would be incomplete without some reference to its meteorological characteristics. The effect of the transfer of warm water in a continuous stream from the tropics to the poles makes its path a region of violent storms. It may indeed be said that there is an aërial band of cloud and mist continually overhanging the stream, in which the electric and other changes due to the changes of heat play a conspicuous part, making it a region of violent gales and heavy seas, from which ships seldom escape without damage, and in which many annually founder, while others are driven far from their courses. Its influences in modifying the climate of the western coast of Europe are in marked contrast with the effects on the N. E. coast of America of the cold current from the Arctic regions which flows from Baffin's Bay. W. P. TROWBRIDGE.

Gulf-weed (*Sargassum vulgare* and *bacciferum*), seaweeds found floating in great areas in various parts of the ocean, especially in what are called the Sargasso seas, of which the most extensive is near the Azores. It is also found floating in the Gulf Stream, whence the popular name.

Gu'lich, tp. of Clearfield co., Pa. Pop. 601.

Gull, a name given to many web-footed sea-birds of the family Laridæ and of the genera *Larus*, *Blasipus*, *Chroicocephalus*, *Rissa*, *Papophila*, *Lestris*, etc. The terns, too, are popularly known as gulls, which they resemble in habits and appearance. On the N. E. coasts of British America great numbers of young gulls are salted down for food. Their feathers and eggs also are extensively gathered. The species are very numerous. The *Larus camis* is the most common in Europe. The *L. marinus*, or great black-backed gull, is one of the very largest of the species. In the U. S. many gulls visit the lakes and rivers far inland, and often breed there.

Gull (Sir WILLIAM WITHEY), BART., M. D., D. C. L., F. R. S., b. in Thorpe-le-Soken, Essex, Eng., Dec. 31, 1816, passed M. B. in 1841 and M. D. in 1846 at the University of London; was professor of physiology at the Royal Institution 1847–49, and for many years was a lecturer at Guy's Hospital; won a baronetcy by his skill in attending the prince of Wales in a fever. Author of works on cholera, paralysis, hypochondriasis, and abscess of the brain.

Gul'ledges, tp. of Anson co., N. C. Pop. 1519.

Gul'liver (JOHN PUTNAM), D. D., b. in Boston, Mass., May 12, 1819; graduated at Yale in 1840; held a Congregational pastorate at Norwich, Conn., 1846–65; pastor of the New England church, Chicago, 1865–68; president of Knox College, Galesburg, Ill., 1868–72; became in 1872 pastor of the First Presbyterian church, Binghamton, N. Y.

Gum [Lat. *gummi*], a name somewhat vaguely applied to many concrete vegetable juices, chiefly to such as are neither oily nor resinous. The gums proper consist (according to Guérin) essentially of arabin ($C_{12}H_{22}O_{11}$, found in gums arabic and senegal), of cerasin (cherry, plum, and peach gum), of bassorin (the mucilaginous principle of Bassora gum and of tragacanth). *Arabin* has mildly acid properties; is soluble in hot or cold water, forming mucilage; is precipitated by alcohol or subacetate of lead; is coagulated by borax; and is believed to exist in gum arabic in combination with small proportions of alkalies and alkaline earths. It is isomeric with cane-sugar. *Bassorin* swells, but does not perfectly dissolve, in water, with which, however, it may be rubbed into a very adhesive paste, which cannot be called a solution. *Cerasin* much resembles it, but has somewhat different chemical reactions. The principal gums are the following: GUM ARABIC is mainly the product of *Acacia Verek*, but is in part the product of *A. Nilotica* and of other thorny trees and shrubs of the genus, found throughout a very large part of Africa and in portions of Asia. That from the Nile valley is the Turkey gum of commerce; Barbary gum comes mostly from Mogadore, and is of two kinds—one (identical with Turkey gum) grows in Morocco, etc., and the other is brought from the Soudan by caravans. GUM SENEGAL is closely allied in character to the above, is identical in its uses, and is the product of several trees of the genus *Acacia*, growing in Western Africa. *Galam gum* is a name given to some of the best varieties of gum senegal. Much of the gum arabic of commerce is really from Senegal. *India gum* is mostly produced in Africa and Arabia, and finds its way to Bombay in Arab vessels. *Cape gum* was formerly brought from South Africa, and Australia has supplied some of the gum of commerce. GUM MEZQUITE, from *Algarobia glandulosa*, a thorny leguminous shrub of the dry regions of Mexico and the adjacent parts of the U. S., is closely analogous to gum arabic, but its principle is not precipitated by borax. TRAGACANTH is the gummy exudation which appears spontaneously or upon the incised bark of *Astragalus verus* and other species of that genus, order Leguminosæ. (See TRAGACANTH.) BASSORA GUM, from Persia, combines the principles arabin and bassorin. The plant which produces it is not known, but is supposed to be an *Astragalus*. Besides the true gums, many other somewhat similar products are popularly known as gums. (See GUM-RESINS.)

Uses.—The true gums above enumerated are used in the arts as sources of MUCILAGE (which see); in medicine they are demulcent; they are employed in pharmacy in making troches and pills; in confectionery, for the basis of many pastes and confections; in calico-printing, in preparing inks, in making sizes, and other stiffening preparations, they have also an extended use; but DEXTRINE (which see), or British gum, has in part taken their place. Most experimenters have concluded that the gums are entirely innutritious, but this conclusion is perhaps open to some question. CHAS. W. GREENE.

Gumbin'nen, town of Prussia, in the province of East Prussia, on the Pissa. It was founded in 1732 by Frederick the Great, who received and settled here the Protestants from Salzburg who emigrated on account of religious persecutions. Pop. 9085.

Gum'bo (*Gombaud, Okra*), the *Hibiscus esculentus*, a plant of the order Malvaceæ, native of the West Indies, and largely cultivated in the Southern States and in most warm countries for its mucilaginous pods, which are excellent in soup, and are often cooked and served up with butter or pickled. The *Gombo musqué* is the *Hibiscus moschatus*, cultivated in many warm countries, and prized for its reputed medical virtues. Its seed, known as ambrette, is employed by perfumers.

Gum-lac. See LAC, by PROF. C. F. CHANDLER, PH. D., LL.D.

Gum Log, tp. of Pope co., Ark. Pop. 646.

Gum Neck, post-tp. of Tyrrell co., N. C. Pop. 1068.

Gum-Resins, a class of vegetable products long recognized in pharmacy, obtained by drying the milky juice which exudes from incisions made in the stems, branches, or roots of some plants. These juices consist chiefly of a resin and an essential oil, held in suspension in water, containing considerable quantities of gum or mucilage. The gum-resins are opaque, brittle solids, heavier than water, generally possessing a bitter taste and a strong smell, and more or less colored. The resinous portion is soluble in alcohol, the gum in water. They are principally used in medicine. The principal gum-resins are gamboge, frankincense, scammony, asafœtida, aloes, euphorbium, galbanum, myrrh, olibanum, opopanax, gum-ammoniac, sagapenum, and bdellium. The following analysis of asafœtida will sufficiently illustrate the character of this class of bodies:

Resin	48.5
Gum, with traces of saline matter	19.0
Bassorin	6.4
Volatile oil	4.5
Extractive, with saline matter	1.4
Sulphate and carbonate of lime	9.3
Alumina and oxide of iron	0.4
Sand and vegetable fibre	4.5
Water	6.
	100.

C. F. CHANDLER.

Gumri. See ALEXANDROPOL.

Gum'ti, a river of British India, an affluent of the Ganges, passes by the cities of Lucknow and Jounpoor.

Gum'town, post-v. of Lee co., Miss., on the Mobile and Ohio R. R., 35 miles S. of Corinth. Pop. 240.

Gum Tree, a name given in the U. S. to several trees: (1) The black or sour gum, pepperidge, or tupelo (*Nyssa multiflora*), a large tree growing in most of the States E. of the Mississippi, produces a firm, unwedgable timber, used for bowls, hat-blocks, windmill shafts, hubs, cart-lining boards, etc. It is grown in Europe. *Nyssa uniflora* and *aquatica*, the water-tupelos of the South, have soft light wood, and their roots have been recommended as substitutes for corks. The *Nyssa capitata* of the Gulf States bears a sour edible fruit, the Ogeechee lime. The above trees belong to the order Cornaceæ. (2) The sweet gum, bilsted, or liquidambar (*Liquidambar styraciflua*), of the order Hamamelaceæ, grows from New England to Mexico. It is a fine large tree, well known by its star-like leaves and furrowed bark. Its wood is soft, but firm and fine-grained, and used in making furniture. In the warmer latitudes it yields an abundant balsamic resin, called American storax. Its bark is very useful in the treatment of diarrhœa and dysentery. This tree grows well in Europe. *L. orientale* of the Levant yields styrax or storax, and so does *L. Altingia*, a very lofty tree of farther India, having a very hard, heavy, fragrant red timber. (3) Very different from either of the foregoing are the *Eucalyptus*, or gum trees of Australia (see EUCALYPTUS); (4) in different British colonies still other trees with gummy or viscid juice are called by this name.

Gun. See ARTILLERY, by GEN. W. F. BARRY, U. S. Army, and SMALL-ARMS, by GEN. P. V. HAGNER, U. S. Army.

Gun'boat, a war-vessel of relatively small dimensions, usually propelled by steam and carrying a small number of guns, often of heavy calibre. Gunboats are of especial service on rivers and for in-shore duty, such as blockading service and the like. They are of late constructed by nearly every naval power of any importance. (See NAVAL ARCHITECTURE, by COM. T. D. WILSON, U. S. N.)

Gun-Cotton. See EXPLOSIVES, by GEN. H. L. ABBOTT, U. S. Army. For chemical properties, see PYROXYLIN.

Gunduck', a river of Hindostan, rises at the foot of the Dhwalagiri, and flows into the Ganges opposite Patna.

Gundwa'na, a former province of Central India, now mostly contained in the Nágpur or Nagpore district. It takes its name from the GONDS (which see), one of the most important of the native races. Their portion of this highland region is almost entirely a wild jungle. (See NAGPORE.)

Gun-Making. See ORDNANCE, by CAPT. R. P. PARROTT, U. S. Army.

Gun'nel, or **But'terfish,** a name given to certain small

The Spotted (European) Gunnel.

eel-like marine fishes of the blenny family, found often in tide-pools and under seaweed along the shore. Among the species are *Murænoides mucronatus* of the Atlantic coast of the U. S., and the *Murænoides Gunnellus* of Europe. They are covered with a surprising quantity of mucus, and are caught for fish-bait. They are very active in their movements.

Gun'nery, as a science, treats of the motion of projectiles from firearms. An eminent foreign writer divides the subject into interior and exterior ballistics, the former relating to the motion inside of the piece, the latter outside of it. This article refers to the latter division of the subject.

The line described by a projectile in motion is called its *trajectory*. The earliest idea of a trajectory was, that it was composed of two straight lines and an intermediate curve, supposed to be a circle. In 1537, Nicholas Tartaglia published in Venice a work called *Nova Scientia*, in which he claimed that no portion of a trajectory was a straight line. He invented the gunner's quadrant for measuring the angle of elevation of a firearm, and showed that the elevation corresponding to the greatest range is 45°. One hundred years later Galileo claimed from the law of falling bodies that a trajectory was a parabola. One hundred years after Galileo, Newton showed that when the resistance of the air was considered, a trajectory was far from being a parabola; that its two branches were dissimilar; and that the descending branch, if prolonged, would be a straight line. In 1742, Robins published his *New Principles of Gunnery*, and was the first person to place the subject on a scientific basis. He determined by actual experiment the density of gases in a firearm, and the pressure which they exert on a projectile. He invented the ballistic pendulum, and by means of it measured the velocity with which a projectile leaves its piece; and in this way showed the great disparity between a parabola and the real trajectory. He also showed by experiment that the revolution of a projectile around one of its points, combined with the resistance of the air, caused it to deviate from its true path; and finally, he pointed out the great advantage to be derived from using the rifle with oblong projectiles, thereby foreshadowing the great improvements of modern gunnery. Hutton and certain distinguished French artillerists improved the ballistic pendulum, and used it with the gun pendulum to develop a true knowledge of gunnery, particularly that relating to the laws governing that most important element, the resistance of the air.

The spiral grooves of the rifle, which contribute so much to increase the range and accuracy of projectiles by enabling us to use oblong projectiles, were first used in the sixteenth century, but it is only within the past thirty or forty years that their true value has been realized, and that they have been brought into general use for military purposes. At the present day the U. S. is the only nation of any military importance that employs smooth-bored cannon. The forces which act on a projectile to determine the form of its trajectory, are—the propelling force of the powder, which acts to move it in a straight line; the force of gravity, which draws it toward the earth; and the resistance of the air, which impedes its motion and diminishes its range. If the first and second of these forces only are considered, the trajectory *in vacuo*, from the well-known laws of mechanics, is a parabola, and its equation is $y = x \tan \phi - \frac{g}{2} \cdot \frac{x^2}{V^2 \cos^2 \phi}$. In this equation y is the height of any point of the curve above a horizontal line drawn through the muzzle of the piece; x is the horizontal distance of the same point from a vertical line drawn through the muzzle; ϕ the angle which the axis of the bore makes with the horizon, or angle of fire; V the initial velocity; and g the force of gravity. When the resistance of the air is introduced into this equation, it becomes of such form that the ablest mathematicians have been unable to solve it perfectly. Capt. Didion, formerly professor of gunnery of the artillery school at Metz, gives the trajectory in air as follows—

viz.: $y = x \tan \phi - \frac{g}{2} \cdot \frac{x^2}{V^2 \cos^2 \phi} \cdot B$, which differs from the equation of a parabola by the quantity B, which is a function of the velocity of the projectile and the resistance of the air to it. Values of B for all resistances and velocities likely to arise in practice may be found in tabulated form in the course of ordnance and gunnery as taught at the U. S. Military Academy, and in Capt. Didion's work, *Traité Ballistique*, to which the student is referred for a full exposition of the subject.

The things to be considered in the movement of projectiles are the *initial velocity*, or velocity at the muzzle of the piece; the *remaining velocity*, or velocity at any point of flight; the *terminal velocity*, or velocity with which it strikes the object; the *final velocity*, or velocity which a projectile will finally have when allowed to drop freely in the air until the resistance of the air and the accelerating force of gravity become equal; the *range*, or distance passed over; the *angle of fire*, or angle which the axis of the piece makes with the horizon; and the *angle of fall*, or the angle which the tangent to the trajectory makes with the horizon at the point of fall. The following general deductions are made from the equation *in vacuo*, and to a certain extent are applicable to movements in air:

1st. *The greatest range is obtained with an angle of 45°; any other range can be obtained with two angles of fire; and variations in the angles of fire produce less variation in range as the former approaches 45°.*

2d. *With the same angle of fire the ranges are proportional to the squares of the velocities, and, reciprocally, the velocities are proportional to the square roots of the ranges.*

3d. *The velocity of a projectile varies in different points in its flight, depending on its height above the muzzle of the piece. It is least at the highest point or summit, and equal at any other two points cut by the same horizontal plane.*

4th. *The time of flight for an angle of fire of 45° is equal to the square root of the quotient of the range divided by one-half the force of gravity;* or for a practical rule, it may be said *to be equal to one-fourth of the square root of the range expressed in feet.*

5th. *The angle of fall is equal to the angle of fire measured in opposite directions.*

The *velocity* of a projectile is determined experimentally by ascertaining the time it takes for it to pass between two points a short distance apart, and dividing this distance by the ascertained time. The distance generally selected is 100 feet, and the time is measured by the rupture by the projectile of an electric current passing through each point and connecting with a delicate time-keeper. For this simple application of electricity the science of gunnery is indebted to Wheatstone. The delicacy of the numerous instruments using electricity now employed is so great that the velocity of the projectile at different points of its passage along the bore of a gun has been accurately measured. The following table of initial velocities has been obtained by this means for the various firearms in use in the U. S. service:

	Charge.		Initial velocity, feet in seconds.	
	Powder, grains.	Projectile, pounds.		
Army revolver	30 grs.	250 grs.	650 ft.	United States.
Army carbine	55 grs.	405 grs.	1120 ft.	
Army musket	70 grs.	405 grs.	1350 ft.	
3-in. field-gun (rifle)	1 lb.	9 lbs.	1232 ft.	
4½-in. siege-gun (rifle)	3¼ lbs.	25¼ lbs.	1303 ft.	
15-in. Rodman gun (smooth)	100 lbs.	460 lbs.	1520 ft.	
12-in. rifle gun (Krupp)	130 lbs.	666 lbs.	1460 ft.	

It is found in practice that the initial velocity is affected by a change in the diameter and length of the bore, by the weight of the projectile and its windage, by the weight of the powder, and the size, form, and density of its grains, and the quality and proportion of the materials of which they are made. The form of the chamber and position of the vent are also found to have a certain effect on the velocity.

Everything else being equal, the initial velocities from two different charges of powder and weights of projectile will vary nearly in direct proportion to the square root of the weights of the powder, and indirectly in proportion to the square root of the weights of the projectiles. Knowing, therefore, the velocity for any particular charge of powder and weight of projectile, as in the foregoing table, the velocity for any other charge and projectile in the same gun may be determined by simple proportion. If the length of bore varies, it is found that the velocity will vary nearly directly as the fourth root of the length. These laws are empirical, and are only true within certain limits, which limits embrace most of the cases likely to arise in practice. More accurate but elaborate formulas for initial velocity may be found in special treatises on gunnery.

Resistance of the Air.—The resistance of the air varies with the form, size, and velocity of the projectile, and to a certain extent with the state of the atmosphere. Were air incompressible like water, it would offer a resistance to a projectile in proportion to the square of the velocity; being a compressible medium, it offers a resistance which increases in a ratio depending on both the square and cube of the velocity. The following formula, deduced by Piobert from the experiments of Hutton, has been found to give the resistance of the air with great accuracy—viz.: $\rho = A\pi R^2 \left(1 + \frac{v}{r}\right) v^2$; in which ρ is the resistance of the air in pounds; A is the resistance in pounds on a square foot of the cross-section of a projectile moving with a velocity of one foot; v is the velocity; and r is a linear quantity depending on the velocity, and for ordinary velocities is 1427 feet. For spherical projectiles $A = 0.000514$; for the ordinary oblong projectile with the ogival point, according to the careful experiments of Capt. Prince, U. S. ordnance department, $A = 0.0004192$. In other words, *the pressure of the air is about one-fourth greater on the spherical than on the pointed form of projectile.* The pressure of the air on a 15-inch shot moving with a velocity of 1500 feet is found by this formula to be 2865 pounds. The power of a projectile in motion to overcome the resistance of the air is directly in proportion to its weight, divided by the cross-section opposed to the air. Let $2c$ represent this power in any projectile; we have $2c = \frac{P}{A\pi R^2}$, in which P is the weight, and R the radius of the cross-section. The value of c is an important element in all equations of trajectories in air, and the study of it shows that large and dense projectiles will have a greater range than small and light ones, and that oblong projectiles will have a greater range than those of spherical form.

The expression for calculating the remaining velocity of a projectile after passing over a certain distance is $v = \frac{Vr}{(V+r)e^{\frac{x}{2c}} - V}$, in which v is the remaining velocity at the distance x; V the initial velocity; $e = 2.718$; and $r = 1427$, and c as before given. The loss of velocity in a 15-inch round shot and a 12-inch rifle shot will be as follows:

Distance.	15-inch round shot.	12-inch oblong shot.
500 yards.	185 feet.	46 feet.
1000 yards.	335 feet.	90 feet.
2000 yards.	571 feet.	172 feet.

The shape of the forward part of an oblong projectile exercises a certain influence in modifying the resistance of the air. The form found to experience the least resistance, and the one now generally employed for all rifle projectiles, is known as the ogival. In profile it is made up of the arcs of two circles tangent to the sides of the projectile and meeting in a point. The point may be very considerably rounded or flattened without materially increasing the resistance of the air. Oblong solid shot are now made about two and a half calibres or diameters long, and shells are about three calibres long.

That a projectile may not deviate from its true path, the resultant of the resistance of the air upon it must pass through its centre of inertia, and be constantly tangent to the trajectory throughout the flight. These conditions can only be fulfilled by a perfectly homogeneous spherical projectile that moves through the air without rotation, and are such as will seldom if ever occur in practice. This fact explains the general want of accuracy in the flight of round projectiles. The question is frequently asked, "Why do rifle projectiles have greater range and accuracy of flight than those from smooth-bored guns?" There are two reasons for this: (1) By means of the spiral or rifle grooves in the gun the projectile, if oblong, has a rapid rotary motion around its long axis, and is thus given the necessary stability to pass through the air in the direction of its least resistance from the air. (2) The rifle motion distributes the deviating forces symmetrically around the direction of flight, and thereby neutralizes their effects. A rifle musket bullet revolves at the start about 736 times per second, while a 12-inch rifle cannon projectile revolves about 300 times per second. The force expended in giving a projectile its rifle motion will be measured by the velocity of the centre of gyration. In the present .45-calibre service rifle the forces of translation and rotation are to each other as 1400 to 60. A round projectile from a smooth-bored gun rotates from two causes—viz. by bounding along the bore in consequence of windage, and by taking up motion around its centre of gravity when that centre does not coincide

with the centre of force. Having rotation, it is easy to see that the portions of the surface moving in the direction of flight impinge on the air with greater force than those on the opposite side, which are moving in an opposite direction, and that the projectile will be deviated from the side which moves the more rapidly. In the case of an eccentric spherical projectile the movement of the front surface will be towards the side on which the centre of gravity is situated, and the deviation will be in the same direction. In other words, the deviation of eccentric spherical projectiles will be in the direction of the position of the centre of gravity in the gun, and its amount will be in a certain proportion to the distance of the centre of gravity from the axis of the bore. If the centre of gravity is above the axis and in the plane of fire, the range will be increased; if below the axis, it will be shortened. This law of deviation has been confirmed by numerous experiments.

An oblong rifle projectile moves through the air with its long axis parallel to itself. The trajectory, however, being curved, the under surface of the projectile is brought in contact with the air in the descending branch, and there is an effort to raise the point and depress the base of the projectile, or, in other words, to rotate it around a short axis. The result of the efforts to rotate the projectile around the long and short axis at the same time will be to deviate the point to the right or left, as the rifle motion is with or contrary to the hands of a watch as seen by the person firing the gun. (On this subject see GYROSCOPE, by J. G. BARNARD.)

Guns both large and small are usually grooved to the right, or in the direction of the hands of a watch. The point of the projectile in these cases will move to the right, bringing the left side slightly oblique to the air, and consequently produce a deviation to the right. This peculiar deviation is called "drift," and increases in a greater ratio than the distance which distinguishes it from the deviation produced by an error in sighting a gun. Two rifles with opposite twists have been fired at the Springfield Armory at a distance of 500 yards in calm weather, and the shots carefully noted. The musket with a right-hand twist gave a mean drift to the right of 18 inches, while the one with a left-hand twist gave a mean drift to the left of 19 inches. At 100 yards the drift of a musket projectile will not exceed 2 inches, while that at 1000 yards exceeds 16 feet.

The deviating effect of the wind is an important element to be considered in the movement of projectiles, more particularly on account of its varying and uncertain character. The effect will be the least on heavy projectiles moving with high velocities. A fresh wind blowing across the range of a rifle musket bullet will cause it to deviate from 1½ to 7 feet in a distance of 500 yards, and in a distance of 1000 yards from 14 to 28 feet. The rotation of the earth has the effect to make all projectiles fired in the northern hemisphere deviate to the right of the point aimed at, and those fired in the southern hemisphere to deviate to the left. This cause of deviation is only appreciable in very long ranges, and is never considered in practice.

To aim or point a firearm is to give it such elevation and direction that the projectile shall strike its object. The *line of sight* joins the front and rear sights of the piece and the object; the *line of fire* is the axis of the bore prolonged; the *angle of sight* is the angle included between the line of sight and the horizon; the *angle of fire* is the angle which the line of fire makes with the horizon; the *plane of sight* is the vertical plane containing the line of sight; the *plane of fire* is the vertical plane containing the line of fire. The most distant point where the lowest or fixed line of sight on a firearm intersects the trajectory is called the *natural point blank*, and the distance from the muzzle to this point is called the *natural point blank distance*. The English definition of point blank is that point where the projectile strikes the ground, the axis of the piece being laid horizontally and at the usual height above the ground. Having by means of the lines, etc. here described given the proper direction in aiming, it is necessary to give more or less elevation to the piece to strike the object. This information can be obtained from a *table of fire*, which gives the range, time of flight, etc. for each degree and part of a degree of the elevations likely to be required in service. These tables may be made from direct experiment, or be calculated by Didion's formulæ, which are found to answer well for the purpose.

Rapidity of fire depends on the size of the gun, the manner of loading, as at the muzzle or breech, the construction of the carriage, etc. A magazine small-arm can be fired, but without careful aim, about one shot per second for the number of cartridges contained in the magazine. A single breech-loader can be fired about one shot in three seconds. The Gatling gun can be fired about 400 shots per minute. Field guns can be discharged from two to four times per minute; heavy sea-coast guns require from one to two minutes for each discharge.

All artillery firing is divided into *horizontal* fire and *vertical* fire, the former being at low and the latter at high angles of elevation. A fire is said to be *direct* when it hits its object at the first impact; it is a *ricochet* fire when it strikes the object after one or more rebounds on land or water. A *rolling* fire is a particular case of ricochet fire when the axis of the piece is placed nearly parallel to the ground; and a *plunging* fire when the object is situated much below the level of the piece. A direct fire is important when great penetration is required, as against armor-clad vessels, and in cases where the nature of the intermediate surface does not ensure a regular rebound. The greatest angle under which a round projectile will ricochet depends upon the penetrability of the surface struck. On ordinary ground this angle will not exceed 15°, and on smooth water it will not much exceed 8°. If the water be rough, very little dependence can be placed on the regularity of the rebound. Artillerists divide ricochet firing into the *flattened*, when the angle of fall is between 2° and 4°, and *curvated*, when it is between 6° and 15°.

The projectile which has the flattest trajectory and least deviation from the true trajectory has the greatest chance of hitting its object if the piece be properly aimed. The mean deviation of the service rifle bullet at distances of 500 and 1000 yards is about one and three feet respectively. Rifle cannon projectiles preserve their accuracy at greater distances, increasing with their size and velocity. Accuracy of fire is properly determined by firing a certain number of shots with an unvarying aim at a target placed at the given distance. The mean distance of the shot-holes from the centre of the group is termed the *mean deviation* for that distance. For sporting rifles, however, accuracy of fire is generally measured by the *string* or sum of the distances of each shot-hole from the point aimed at. In military small-arm firing accuracy of fire is measured by the number of shots which strike in certain portions of the target; for instance, a certain space around the centre point of the target is called the "*bull's eye*," and each shot that hits in this space counts 4 points; a certain space around the bull's eye is called the "*centre*," and each shot that strikes in it counts 3 points; the remaining portion of the target is called the "*outer*," and each shot-hole made in it counts 2 points. A shot missing the target counts 0. The maximum number of points is when all are in the bull's eye.

Before a firearm can be properly aimed at a distant object its distance must be approximately known. Various instruments, known as "telemètres," plane tables, etc., have been devised for measuring distances for the military service, some of them very simple and accurate in their operation. The most reliable plan, however, is to cultivate the judgment through the eye.

Military projectiles are either *solid shot, shells*, or *case shot*. Solid shot are now but little employed in warfare, except in large smooth-bored cannon, when they are invariably of spherical form. Shells contain more or less powder as a bursting charge. When employed against armor-plates they are made of cast steel or chilled cast iron, and have very thick sides. As the heat generated on striking the object is sufficient to ignite the bursting charge, these projectiles have no fuze, and are known as "blind shells." A "live shell," not being intended to penetrate very resisting objects, is longer than a blind shell, and has thin sides, which give it capacity for a large bursting charge, which is ignited by a time or percussion fuze. *Shrapnel* are a species of case shot, or thin shells, containing a small bursting charge and a large number of small round projectiles made of iron or lead. By means of a properly regulated time-fuze the shrapnel is made to burst in front of and near its object. The contained projectiles, being but slightly dispersed by the bursting charge, are carried forward against the object with a velocity which the shrapnel had when it burst. *Canister* and *grape* shot are species of case shot which begin to disperse at the muzzle of the piece. They are effective at short distances only, while shrapnel are effective at nearly all distances. (Consult DIDION, *Traité de Balistique;* HÉLIE, *Traité de Balistique;* BENTON, *Ordnance and Gunnery*.)

J. G. BENTON.

Gun'ny [Bengalee] **Bag**, a sack made of jute, and used for covering cotton-bales and as bags for wheat, rice, coffee, pepper, saltpetre, and many other commodities. Gunny cloth is manufactured chiefly in South-eastern Bengal. But little machinery is used in the business, which employs vast numbers of people during their leisure from other employments. The work is very largely domestic in character. Immense quantities are exported to all parts of the globe. When worn out, the material makes a good stock for wrapping-paper.

Gunplain', tp. of Allegan co., Mich. Pop. 2238.

Gun'powder is an explosive substance formed by the intimate mechanical mixture of nitre, sulphur, and charcoal. It is principally used in firearms and for mining; for the latter purpose, however, it has of late years been superseded to a considerable extent by gun-cotton, dynamite, and other substances of very great explosive power. The knowledge of the combustible nature of a mixture of nitre, sulphur, and charcoal is of very great antiquity; some writers place it antecedent to the Christian era. Gunpowder is known to have been employed in China in the ninth century to propel rockets; and in the early part of the fourteenth century it was first employed in firearms. The idea of employing gunpowder as a propelling power for projectiles is popularly ascribed to an accident which occurred to Berthold Schwartz, a monk of Fribourg, in 1330, but it was not until the sixteenth century that it came into general use in warfare. The earliest known proportion of the ingredients of gunpowder corresponds nearly to those of the best powders of the present day, as well as those called for by the theory of combining equivalents—viz.:

By atomic theory............	74.64 nitre,	13.51 charcoal,	11.85 sulphur.
For U. S. military service.	76. "	14. "	10. "
For sporting..................	78. "	12. "	10. "
For blasting..................	62. "	18. "	20. "

In blasting powder the proportion of nitre is reduced, to make it cheap; the residuum from the incomplete combustion that follows a variation of the proportions from those called for by the atomic theory being not so objectionable in mining as in firearms. A very strong and cheap powder can be made by substituting nitrate of soda for nitrate of potassa or nitre, but as it has a strong affinity for moisture, it will not retain its strength for a length of time.

The most important ingredient in powder is the *nitre*, or *saltpetre*, a substance composed of nitric acid and potassa. The principal source of the supply of this mineral is the East Indies, where it occurs as an efflorescence on the surface of the ground. In the condition in which it is imported it is called *rough saltpetre*, and contains a considerable quantity of the chlorides of potassium and sodium or common salt. These are separated at the powder-mills by the process of refining. Nations whose supplies of nitre are cut off during war are mainly dependent on artificial *nitre-beds*, as was the case during the French Revolution and in the Confederacy during the late war in this country. These beds are formed of a collection of earth, calcareous matter, mortar from stables, and animal products, such as blood, urine, etc. It may also be made from the nitrate of soda, an extensive natural product of this continent, and the chloride of potassium.

Charcoal for gunpowder is obtained by distilling the lighter kinds of wood in iron retorts. The woods most in use in this country are *willow* and *poplar;* in Europe the *common* and *black alder*, with the exception of Russia, where the *white birch* is the principal wood. The sticks should be of small size, about one inch in thickness for military powder, while still smaller sticks or twigs are employed in sporting powders. The wood should be cut in the spring when filled with sap, that the bark may be peeled off easily, and it should be well seasoned before charring. The quality of charcoal for powder depends on the heat of distillation. If it be about 1800° F., or sufficient to drive off all the volatile matters in six hours, the result is *black* charcoal. If the heat be about 500° F., or only sufficient to drive off the volatile matters in twelve hours, the result is a *brown* charcoal. Brown charcoal makes a stronger and more inflammable powder than black charcoal, but it is a powder more liable to absorb moisture, and cannot be so well preserved. Black charcoal is generally employed for military powders in Europe, and brown in this country.

Sulphur is mostly obtained from Sicily, where it occurs as a volcanic product. It is imported in a crude state, containing some 6 or 8 per cent. of earthy matter. It may be obtained, but not so cheaply, in this country from metallic ores. For powder, crude sulphur is purified by distillation and afterwards pulverized in a mill. The flowers of sulphur produced by sublimation contain more or less sulphurous and sulphuric acids, and are consequently not suited to the manufacture of powder. The tests for sulphur as a suitable ingredient for gunpowder are—1st, burning a small quantity on porcelain, when the amount of residuum should not exceed 0.25 per cent.; 2d, boiling with water and testing with blue litmus-paper, which it should only very feebly redden. Prof. Bloxam states "that sulphur is valuable as an ingredient in gunpowder on account of the low temperature (560° F.) at which it inflames, thus facilitating the ignition of the powder. Its oxidation by saltpetre appears also to be attended with the production of a higher temperature than is obtained with charcoal, which would have the effect of accelerating the combustion, and of increasing by expansion the volume of gas evolved."

The necessary operations in making gunpowder are—(1) *Refining* and *pulverizing* the ingredients. The charcoal and sulphur are first broken up in mills of peculiar construction. The nitre is generally sufficiently pulverized as it comes from the refinery. The charcoal is pulverized by rolling it in cast-iron barrels with zinc balls. The same method is pursued with sulphur, except that the barrel is made of leather stretched over a wooden frame.

(2) The second operation is *incorporation*, the object of which is to bring each particle of ingredient into close contact with the others. The process consists of two parts—mixing the pulverized materials in a rolling barrel, and then grinding them under heavy cast-iron wheels, following each other in a circular cast-iron trough. Each wheel weighs from four to eight tons, and both are joined to a vertical shaft by a horizontal axle around which they turn. The amount of mixture varies with the size of the wheel and duration of the operation. In England the charge is 50 pounds, in this country about 150 pounds; and the time varies from three to four hours. In the case of certain fine sporting powders the operation is continued as long as twelve hours. This operation is one of the most important in the making of powder, as the more thoroughly the ingredients are mixed the more complete will be their combustion.

(3) *Compressing*, to give the necessary density to the mass and strength to resist the shocks of transportation. The fragments of cake as they come from the wheel-mill are broken down under rollers, and then spread out into layers about four inches thick, and separated by brass plates. These are brought under a powerful hydraulic press, which compresses the layers to a thickness of one inch.

(4) *Graining* is the operation of breaking up the pressed cake into small fragments or grains for the purpose of increasing and regulating the combustion. It is performed by passing the cake between fluted rollers, and separating the fragments thus produced by sieves.

(5) *Glazing* is done by rolling the grains in a barrel for a certain length of time. The attrition of the grains on each other and against the sides of the barrel wears away the sharp corners and hardens the surfaces, thereby preventing the formation of dust in transportation. A high polish is sometimes given to powder by adding powdered blacklead to the charge, but this is objectionable.

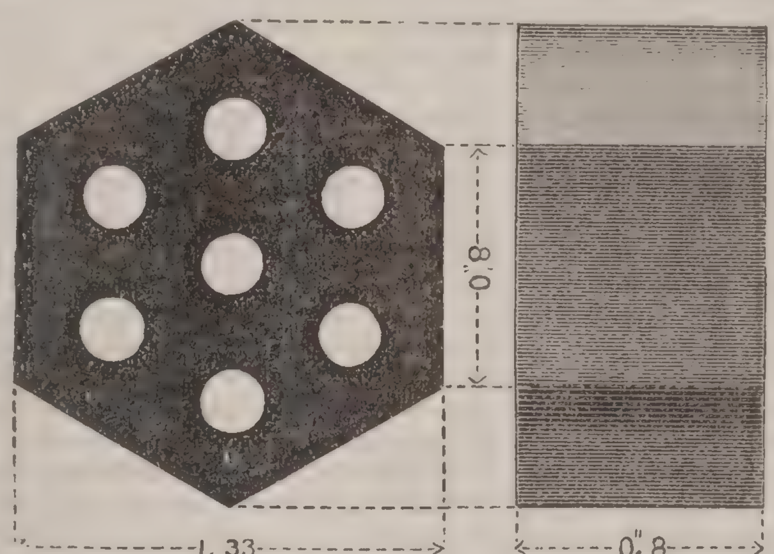
(6) *Drying* has for its object to remove the moisture that is purposely introduced in the several stages of manufacture. It is done by spreading out the powder on shelves in a room heated by steam to a temperature of 140° to 180° F.

(7) *Dusting* has for its object to remove the dust and fine grains which would otherwise fill up the interstices and retard inflammation. It is done by means of fine sieves and bolting-cloths.

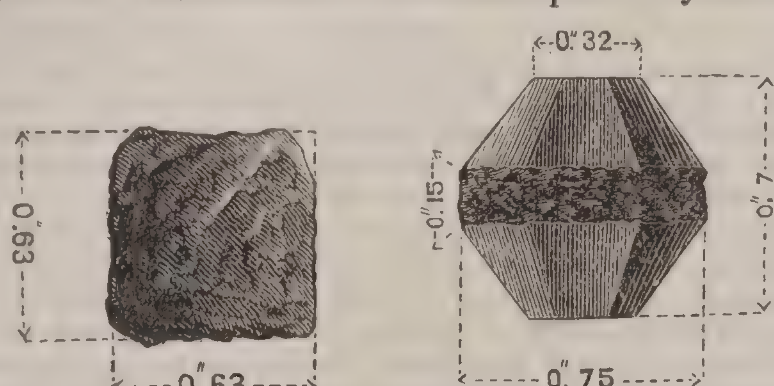
The *explosion* of a charge of powder may be divided into three distinct parts—viz. *ignition, inflammation*, and *combustion*. Ignition is the setting on fire of a particular grain; inflammation is the spread of ignition from one grain to another; and combustion is the burning up of the body of each grain. The heat required to ignite gunpowder is about 572° F. The friction and percussion of metals against each other or against wood will ignite powder, and so will the electric spark. The velocity with which the inflamed gases from gunpowder move in a resisting tube like a gun-barrel was determined by Robbins to be about 7000 feet per second. When forced to pass through the interstices of a charge of powder, Piobert concludes that their velocity is reduced to some 33 feet, depending on the size and form of the grains, which regulate the size of the interstices. The rate of inflammation is found to be greater for large than small charges, and for light than for heavy powders. Too much compression or ramming of a charge of powder retards the inflammation. If compression be carried to the extent of reducing the charge to a single mass, the inflammation will be entirely destroyed, and the case becomes one of simple combustion. When the inflammation has spread to all of the grains of a charge of powder, each grain burns progressively from its surface to its centre. The rate with which the burning surface approaches the centre is called the *velocity of combustion*, and is the same for the same composition and manufacture of powder, whatever may be the shape of the grain and the surrounding pressure. For English and American military powders the velocity of combustion is about 0.4 inch per second. The nature and condition of the ingredients, together with their proportions and the trituration which they undergo in manufacture, will cause the velocity of combustion to vary. The density of the grains has also an important influence on it. *The Handbook of the Manufacture and Proof of Gunpowder at the Royal Powder-Mills at Waltham Abbey* states that a difference of 0.05 in density of the powder may affect the initial velocity of a 12-pound shot, fired with a 1-pound

charge, to the extent of 50 feet per second. Piobert shows by experiment and calculation that each grain of a charge of powder of the size of American mortar powder will be entirely consumed in 0.1 of a second, and that by far the largest portion will be consumed in the first $\frac{1}{50}$th part of a second. The force which accompanies this evolution of gas is exerted on the projectile before it has sensibly moved from its seat in the gun, and a corresponding strain is brought to bear on that part of the gun which surrounds the charge. In the case of large projectiles, and especially rifle projectiles, this strain is so great that it is necessary to moderate it to save the piece from rupture; and this is done by diminishing the surface of combustion of the grains which compose the charge, so that less gas shall be given off in the first instants. The total surface of combustion of a given charge of powder may be diminished by increasing the size of the grains which compose it.

Gen. Rodman, late of the U. S. ordnance department, was the first person to suggest the idea that the most suitable powder for any firearm would be one in which the grain burned from the centre to the surface, developing gas in increasing amount with the space behind the projectile as it moved along the bore. It being impracticable to carry out this idea fully with ordinary grains, he proposed instead cakes with holes running through them, for the spread of the flame. That the cakes might fit each other in the charge without loss of space, he proposed to make them of hexagonal form. This idea has been tested



by experiment in this country, and has been very generally adopted by the continental nations of Europe for making powder for heavy rifle cannon. Prism powder, as the foregoing is now called, was first made on a large scale in Russia, and in the form and dimensions given in the accompanying figure. Each cake is 0″.8 thick, and has seven holes, each 0″.2 diameter, extending through it in the direction of its axis. The powder now used in England for heavy guns, is known as "pebble powder." Its normal shape is that of a cube about 0″.63 on the side. In breaking down the cake to form the grains the edges of the cube are left in a more or less broken condition, as shown in the accompanying figure. The large grain powder heretofore employed in this country for heavy guns is known as mammoth powder, the grains of which are of irregular size and shape, varying from 0″.6 to 0″.9. Lately, a very great improvement has been made in mammoth powder by making



the grains of uniform size. In shape they are composed of the frustra of two hexagonal pyramids, separated at their bases by a prismatic space 0″.15 in height. (See accompanying figure.) The figures represent the full size of the grain in each case.

To obtain uniform results from charges of powder of the same weight, it is essential that they occupy the same space in the gun; hence it is important that the grains be of the same size, and of such shape that their volume shall not vary in handling or ramming the cartridge. It is principally for this reason that uniform results are obtained with the three kinds of powders just described for heavy guns.

Gunpowder when fired in a confined space exerts a pressure which bears a certain relationship to the density of the charge; which density is equal to the weight of the charge divided by the space occupied by the gases evolved. This relation, as determined by the experiments of Rumford, is $p = 1.841\ (905d)^{1+0.362d}$, in which p is the pressure in atmospheres, and d the density of the gases. The pressures of charges, the densities of which are $\frac{1}{20}$, $\frac{1}{10}$, and $\frac{1}{2}$, are 1290, 2900, and 3700 pounds per square inch respectively. The results given by the formula of Rumford are considered reliable up to a density of $\frac{6}{10}$, which includes all the densities likely to occur in practice. The absolute force of fired gunpowder, or the force which it exerts when it exactly fills the space in which it is confined, has never been satisfactorily ascertained. It has been variously estimated, however, at from 1000 to 100,000 atmospheres. The later experiments of Gen. Rodman show that it is *at least* 200,000 pounds per square inch.

Rules for the inspection and proof of powder for the military service require that the grains should be rounded and of uniform size—that they should be hard, have a certain density, and be free from dust. The size of the grains is determined by passing a certain quantity through the holes of sieves made of a certain diameter. The density is ascertained by the "densimeter," an instrument for determining specific gravity by means of mercury. The strength of powder is best determined by firing service charges in guns in which the powder is intended to be used in service, and determining the initial velocity by one of the many reliable velocimeters now used for such purposes. The strain on the gun, if of large calibre, is important, and is determined by a pressure-gauge which may be inserted with the charge or affixed to the gun. The sizes of the holes of inspecting sieves are as follows, viz.: mammoth powder, 0″.9 and 0″.6; cannon, 0″.31 and 0″.27; mortar, 0″.1 and 0″.07; musket, 0″.06 and 0″.035.

The following table gives the standard initial velocities and pressures for military powders:

Powder.	Gun.	Weight of charge.	Initial velocity, feet per second.	Pressure, pounds per sq. inch.
Mammoth	8-in. Rodman	10 lbs.	Not less than 1050	Not more than 10,000
Cannon	8-in. Rodman	10 lbs.	" 1225	" 40,000
Mortar	3-in. rifle....	1 lb.	" 1000	" 50,000
Musket.......	Rifle	70 grs.	" 1300	

The new hexagonal powder has lately given in the 15-inch Rodman gun pressures as low as 18,000 pounds, with initial velocity of 1600 feet, with a service charge of 100 pounds, and a shot weighing 450 pounds.

Sporting powders and blasting powders in this country and in England are designated by a name indicative of use or peculiar quality or manufacture, as "mining powder," "duck-shooting powder," "electric powder," etc. Each particular kind is again subdivided according to the size of the grain, as No. 1, No. 2, No. 3, etc., or as F, FF, FFF, and C, CC, CCC, etc. J. G. BENTON, *U. S. Army.*

Gunpowder Plot, a conspiracy entered upon in 1604 by several Roman Catholics to blow up King James I. of Great Britain, the ministers, and the Houses of Parliament by gunpowder, which was stored by them in the vaults under the Parliament House. The plot was to be executed Nov. 5, 1605, but was detected on the preceding day by means which are not now well understood. It is probable that some one of the conspirators revealed the plot. The famous Guy Fawkes was to be the immediate agent of the conspirators. The 5th of November is celebrated in many English, and in some New England, towns by the burning in effigy of Fawkes.

Güns, town of Western Hungary, on the Güns, famous for the persistent and successful defence of its fortifications against the Turks in 1532. Pop. 6915.

Gun'shot Wounds, wounds produced by balls or other projectiles propelled by the force of an explosive, such as gunpowder, gun-cotton, or the like. They differ in some essential points from other wounds; they are generally accompanied by shock, and complicated by the presence of foreign bodies in the wound, such as the ball or projectile itself and pieces of clothing or accoutrements which the ball has carried with it and before it. Another element of their danger consists in the fact that they generally occur in large numbers—*i. e.* in war—when the accumulation of a large number of suppurating wounds gives rise to dangerous complications, such as erysipelas, pyæmia, and hospital gangrene; add to that, that in protracted wars the constitution of the men has already suffered by camp-life, bad diet, and exposure, producing typhus, dysentery, scurvy, etc. When, after the discovery of gunpowder, gunshot wounds first became known, surgery being then in its infancy, these wounds were looked upon as the result of some supernatural and malificent agency, and were therefore often treated by incantations and the like, or they were looked upon as poisoned either by the powder or the ball, and were treated with a view to destroy the poison—for

instance, by pouring boiling oil into the wound. At the present day the treatment of gunshot wounds has become more simple and rational; even the extraction of the ball is no longer looked upon as of such absolute necessity as formerly. Still, some erroneous notions have prevailed till very recently. Thus, it was maintained that the wound of exit of the ball was always larger than that of entrance—a question which might be of importance in a legal point of view. Recent investigations have shown that the above is not true, and that the wound of entrance is often larger than that of exit. Another mistaken idea has prevailed with regard to what was called the "wind of the ball." A round shot will not unfrequently crush the parts under the skin without wounding the skin; this was ascribed by some writers to the compression of the air, by others to the vacuum which the ball leaves behind it in its passage, and again by others to electricity, thought to be acquired by the ball by friction through the gun and its rapid passage through the air. Recent investigations have done away with these erroneous notions, and have proved that a spent round shot may roll over a part of the body when it touches at an obtuse angle like a wheel, crushing everything beneath the skin, without breaking or wounding the skin itself.

Taking a statistical view of gunshot wounds and their fatality on a large scale, we find that on an average the number of those killed outright on the field of battle to those wounded is about in the proportion of 1 to 5, and that of the wounded about 14 to 15 per cent. will die of their wounds. Thus, the number of killed in battle in the U. S. army during the civil war was 59,850. The number of gunshot wounds from May 1, 1861, to June 30, 1865, was 235,585; of the latter, 33,653, or 14.2 per cent., died of their wounds. The Confederate army lost 57,425 killed in battle, and had 227,871 wounded. In spite of these formidable numbers of killed and wounded, it must not be overlooked that in protracted wars internal diseases incidental to, and as yet unavoidable in warfare carry off a by far larger number of men than all the hostile engines of death. WM. DETMOLD.

Gun'ter (EDMUND), b. in 1581 in Herts, England; was educated at Westminster and Christ Church, Oxford, where he passed M. A. in 1606; in the same year invented the sector; took orders in the Church, and in 1619 became professor of astronomy in Gresham College, London; made use of a logarithmic scale before 1624, and d. in London Dec. 10, 1626. His works best known are *Canon triangulorum* (1620); *Of the Sector, Cross-staff*, etc. (1624); *Description of His Majesty's Dial* (1624). Is best known by the chain, scale, line, and quadrant which bear his name.

Gun'ter's Chain, the invention of Edmund Gunter, is 66 feet in length, and is used in land-measuring. It is composed of 100 links; consequently, 10 square chains, or 100,000 square links, are contained in an acre.

Gunter's Scale. See GUNTER (E.).

Gun'tersville, post-v., the county-seat of Marshall co., Ala., on the S. bank of the Tennessee River, at its southernmost point. It has 1 weekly newspaper. Pop. 244.

Gün'ther (ALBERT CHARLES LEWIS GOTTHILF), M. D., F. R. S., b. at Esslingen, Würtemberg, Oct. 3, 1830; was educated at Tübingen, Berlin, and Bonn, and in 1858 became connected with the zoological department of the British Museum. Author of several valuable works on fishes, reptiles, and batrachians, of which the most important is the noble catalogue of the fishes in the British Museum (8 vols. 8vo, 1859–70), and edited (1864–70) the *Record of Zoological Literature.*

Guntoor', district of the presidency of Madras, British India, bordering N. on the Kistna and S. on the Bay of Bengal. The coast is so low that it cannot be seen at a small distance. It is consequently dangerous and little visited. Area, 4960 square miles, with 570,089 inhabitants.

Guntoor, the capital of the Kistna collectorate, presidency of Madras, British India, is in the Guntoor district, 252 miles N. of Madras and 40 miles W. of the Bay of Bengal. Pop. 26,000.

Gu'ra Spring, tp. of Etowah co., Ala. Pop. 722.

Gurhwal', an independent dominion of India, under the protection of the British. It is situated on the southwestern slope of the Himalayas, and consists of mountains, some of which rise to the height of 23,000 feet. It contains the sources of the Ganges, for which reason it is yearly visited by thousands of pilgrims. Area, 4500 square miles. Cap. Serinagur. Pop. 309,947.

Guriev', town of Russia, on a delta-island of the river Ural, near its mouth; peopled by Cossacks, who maintain considerable trade and some manufactures. It is 188 miles E. N. E. of Astrakhan. Pop. 16,462.

Gur'ley (JOHN A.), b. at East Hartford, Conn., Dec. 9, 1813; was a Universalist minister of Methuen, Mass., 1834–37, and for fifteen years edited the *Star of the West* in Cincinnati, O. He was a member of Congress from Ohio 1858–62, and was the first governor of Arizona (1862–63). D. at Cincinnati, O., Aug. 19, 1863.

Gurley (RALPH RANDOLPH), b. at Lebanon, Conn., May 26, 1797; graduated at Yale 1818; removed to Washington, D. C., and became a licensed preacher (Presbyterian); was (1822–72) agent of the American Colonization Society, and one of the founders of Liberia. Author of *Lives* of J. Ashmun and S. Larned, and of a narrative of his *Mission to England* in behalf of colonization; was long editor of the *African Repository.* D. at Washington, D. C., July 30, 1872.

Gur'nard, a name given to some marine fishes of the family Triglidæ and of the genera *Trigla*, DACTYLOPTERUS (which see), *Peristethus, Prionotus,* etc. The number of genera in the family is about thirty. Several species, called grunters, sea-robins, sea-swallows, cuckoos, etc., are found in American waters. These fishes have the head, or in some genera the whole body, covered with hard plates. They often have numerous sharp spines and fantastic-looking appendages, which give them a singular appearance, but their flesh is generally very good. The red gurnard, found on both sides of the Atlantic (*Trigla enculus*), and the sapphirine gurnard of Europe (*T. hirundo*), are among the most important species.

Gur'ney (Sir GOLDSWORTHY), KNT., b. in England in 1793; educated for the medical profession, he became early absorbed in the study of practical chemistry, and in 1822 delivered a course of lectures on chemical science at the Surrey Institution, which were published in 1823; was the inventor of the "lime light," the "magnesium light," the Bude and the oil-gas lights; also of the high-pressure steam-jet and the tubular boiler; and in 1829 drove a steam carriage from London to Bath over the turnpike road at a speed of 14 miles per hour. By means of his high-pressure steam-jet, first applied to locomotives Oct., 1830, the rate of speed was increased from 12 to 30 miles an hour; it was subsequently successfully used to ventilate and extinguish fires in coal-mines; it was further applied in 1849 to the exhaustion and consumption of the poisonous gases from the sewers of London. In 1852 he was appointed to assume charge of lighting and ventilating the new Houses of Parliament, which he accomplished by a method of his own. In his early lectures he claimed to have been the first to observe the deflection of the magnetic needle, the basis of the electric telegraph; knighted in 1863. D. Mar., 1875.

Gurney (JOSEPH JOHN), b. at Earlham, near Norwich, England, Aug. 2, 1788; was educated at Oxford without formally entering the university, and in 1818 became a preacher of the Society of Friends. He was distinguished for labors in behalf of prisoners, which he carried on in conjunction with his sister, Mrs. Fry, and was also an active friend of the abolition of slavery. His ample wealth was freely used in benevolent causes. He travelled extensively in the U. S., the West Indies, continental Europe, etc. while prosecuting his charitable enterprises. D. at Earlham Jan. 4, 1847. His biography was written by Bernard Barton (*Memorial*, etc., 1847) and by J. B. Braithwaite (2 vols., 1854). Among his quite numerous works are *Notes on Prison Discipline* (1819), *On the Religious Peculiarities of the Society of Friends* (1824), *Portable Evidences of Christianity* (1827), *Sabbatical Verses* (1837), *A Winter in the West Indies*, and other books of much value. Mr. Gurney's doctrinal views called forth some opposition in the U. S., and the resulting controversy led to the separation of the party called Wilburites from the main body of Orthodox Friends in 1843.

Gurow'ski, de (ADAM), COUNT, b. at Kalisz Sept. 10, 1805. In youth his ardent and expressed sympathy with the Polish cause resulted in his expulsion from school, and in 1820 he went to Germany, where he pursued his studies for the next five years. Returning to Poland, he was on several occasions imprisoned for his active sympathy with the opponents of Russia. He was a prominent instigator of the revolution of 1830, and acted agent of the republicans in France, where he remained in exile after the insurrection was suppressed. In 1835 he published a work (*La vérité sur la Russie*) advocating Panslavism, and was in consequence recalled to Russia and employed in the service of the emperor. Here he remained till 1844, when he secretly left Russia on account of troubles at court, and went to Berlin; here and at Heidelberg he pursued his studies, delivering lectures in the mean time at the University of Berne, Switzerland, on political economy. In 1849 he came to the U. S., and was for a time professor of languages; from 1861 to 1863 he was a translator in the department of state at Washington. He was the author of numerous works in various languages. Among his published works in this

country are *Russia as it Is; America and Europe;* and *My Diary.* D. at Washington, D. C., May 4, 1866.

Guspi'ni, town of Sardinia, in the province of Cagliari. In its neighborhood are the ruins of Neapolis, an ancient and important town mentioned by Ptolemy, which was destroyed by the Saracens. Other antiquities exist in the vicinity, among them several *nuraghi*, or round towers of a peculiar construction, the origin and purpose of which are doubtful. Pop. in 1872, 5716.

Gusta'vus, post-tp. of Trumbull co., O. Pop. 938.

Gusta'vus I. Va'sa, king of Sweden, the son of Eric, duke of Gripsholm, was b. at Lindholm May 12, 1496, and was descended lineally from the old Swedish kings; educated at Upsala, he entered the public service (1514) at a time of general discontent with the Danish domination, a large party having openly pronounced for independence. Vasa was one of the hostages sent in 1518 to warrant the safety of the Danish king, and was treacherously sent in irons to Denmark; escaped in 1519; listened to Luther's preaching, and became his correspondent; returned to Sweden, where his father was killed in 1520; headed an insurrection of Dalecarlians in 1521, whom his eloquence aroused from apathy to patriotic fervor; gained the battle of Westeraas (1521); was made administrator of Sweden, of which he became king in 1523; openly professed Lutheranism in 1527; and in 1528 made it the state religion. His reign was disturbed by domestic wars with the peasants and with the reactionary party, and by contests with Russia. D. at Stockholm Sept. 29, 1560. Though a man of noble moral qualities and excellent ability, Vasa was a somewhat arbitrary ruler, but his reign was a great blessing to Sweden.

Gusta'vus II. Adol'phus, grandson of Gustavus Vasa, was b. at Stockholm Dec. 9, 1594 (old style); succeeded Charles IX., his father, Nov. 8, 1611; found the nation at war with Denmark, Poland, and Russia, the king of Poland, Sigismund, his cousin and the lawful heir of the Swedish crown, having been set aside for being a Roman Catholic; detached Denmark from the alliance by a treaty in 1613; gained great advantages over Russia, and forced the czar to a disadvantageous peace in 1617; overran Polish Prussia, and was wounded at Dantzic; and though the Poles were sustained by the emperor Ferdinand, who put Gustavus under the ban and let loose Wallenstein upon him, he made an advantageous truce of six years; landed again at Usedom in 1630, and joined issue with the emperor in the great THIRTY YEARS' WAR (which see); and the last two years of Gustavus's life were the most glorious of all. The great battle of Leipsic, Sept. 7, 1631, Tilly's first defeat, established the fame of Gustavus; the victories of Würzburg and the Lech (Apr. 10, 1632), where Tilly received his death-wound, added to that fame. The generalship of Wallenstein drew him into Saxony, and the foes met at Lützen Nov. 16, 1632, where Wallenstein was defeated and Gustavus fell covered with wounds. The first tactician and the first disciplinarian of his age, a man of large ambition for military glory, his most marked trait was nevertheless his profoundly religious spirit. As a ruler he showed what he might have been by the improvements introduced in the industrial, commercial, and mining interests of Sweden, and by the valuable changes he made in the internal economy of his government. Few names are held in more reverent esteem by the entire Protestant world than that of Gustavus Adolphus.

Gustavus III. of Sweden, b. at Stockholm Jan. 24, 1746, succeeded his father, Adolphus Frederick, in 1771. His reign was much disturbed by conspiracies, the machinations of the Hat and Cap factions, and wars with Denmark and Russia. Gustavus was a man of ability and ambition, but his vacillating and perhaps treacherous disposition, and his disregard of the constitutional limits of his power, bred much discontent, and he was shot by Ankarstroem at a masked ball, and d. of the wound Mar. 29, 1792.—His son, GUSTAVUS IV., b. Nov. 1, 1778, succeeded to the crown in 1792; was robbed of Pomerania by Napoleon, and of Finland by the czar Alexander; was forced to abdicate in 1809, was succeeded by Bernardotte (Charles XIV.), and d. at St. Gall Feb. 7, 1837. He was a vain, incompetent, and tyrannical man.

Gustavus Adolphus Society, a society of German Protestants, organized in 1832 in consequence of resolutions adopted on the two hundredth anniversary of the death of Gustavus Adolphus (which occurred Nov. 16, 1632, new style). This society is very popular in Germany, and also in the Netherlands and Sweden. Its object is the assistance of weak congregations of evangelical Protestants in all parts of the world. Its annual receipts are now about $150,000, which are distributed among more than 900 congregations.

Güs'trow, town of Mecklenburg-Schwerin, on the left bank of the Nebel. It has a fine cathedral and considerable breweries and distilleries. Pop. 10,575.

Gu'tenberg (HENNE or JOHANN), b. at Mainz, Germany, about 1400, was the son of one Gänsfleisch, and probably took his mother's name; removed in 1420 to Strasburg, where in 1436 he took several partners for the practice of wonderful secret arts by him invented. Of these arts, that of printing with movable types was the most important. Books printed before this time are all of the class called block-books, printed from engraved plates of wood or metal. It is certain that Gutenberg and his associates had a printing-press, with other essential apparatus for practising the new art, as early as 1438, but it is not known that any books were printed until after the formation of his partnership with Faust and Schöffer at Mainz in 1450. (See FAUST.) In 1465, Gutenberg, who had for some years been carrying on printing by himself, left the business and entered the court of the elector of Nassau. D. at Mainz Feb. 24, 1478.

Guth'rie, county of S. W. Central Iowa. Area, 576 sq. m. It is a fertile prairie region. Grain and wool are staple products. Cap. Panora. Pop. 7061.

Guthrie, tp. of Lawrence co., Ind. Pop. 1292.

Guthrie, post-v. of Guthrie co., Ia., on the Chicago Rock Island and Pacific R. R., 90 miles E. of Omaha.

Guthrie, tp. of Faribault co., Minn. Pop. 550.

Guthrie (JAMES), LL.D., b. near Bardstown, Ky., Dec. 5, 1792, of Scotch origin. He acquired an education at the academy at Bardstown, and at once commenced the study of law; admitted to the bar in Louisville, Ky., where he soon built up a lucrative practice; represented Louisville several times in the legislature with marked ability; chosen presiding officer of the convention which formed the new constitution of Kentucky 1850; appointed secretary of the treasury by Pres. Pierce 1853–57; elected to the U. S. Senate (1865), but resigned on account of ill-health. D. at Louisville, Ky., Mar. 13, 1869.

Guthrie (THOMAS), D. D., son of a banker, was b. at Brechin, Forfarshire, Scotland, July 12, 1803; graduated at the University of Edinburgh; studied medicine in Paris; was settled at Arbirlot, in his native county, in 1830; in 1837 removed to Old Grey Friars church in Edinburgh, and in 1840 to St. John's, a new church built for him in the same city; in 1843 took a prominent part in the establishment of the Free Church; encouraged the building of manses; inaugurated in 1847 the Ragged School system; was moderator of the General Assembly in 1862; was compelled to give up public speaking in 1864, when he began to edit the *Sunday Magazine;* and d. at St. Leonard's, Fifeshire. Feb. 24, 1873. He was an ardent Christian, an earnest philanthropist and social reformer, and a very brilliant orator. Among his humanitarian publications may be named *A Plea for Ragged Schools* (1847), *A Plea for Drunkards* (1856), *The City, its Sins and Sorrows* (1857). He published also *The Gospel in Ezekiel* (1855), *Christ and the Inheritance of the Saints* (1858), and *The Way to Life* (1862). His sons issued his *Autobiography and Memoir* in 1874. R. D. HITCHCOCK.

Guthrie Centre, post-v., cap. of Guthrie co., Ia., 50 miles W. of Des Moines. It has a newspaper, 2 churches, 2 school-houses, 1 hotel, 1 mill. Principal business, farming. HESS & KAUTZMAN, EDS. "JOURNAL."

Gut Manufacture. See CATGUT, GOLDBEATERS' SKIN.

Guts-Muths (JOHANN CHRISTOPH FRIEDRICH), b. at Quedlinburg, Germany, Aug. 9, 1759; was educated at Halle; studied divinity, and in 1786 became overseer in gymnastics at Schnepfenthal, where he d. May 21, 1839. He was one of the founders of modern German gymnastics; published a series of textbooks on gymnastics and other athletic exercises, and some school geographies and other educational books.

Gut'ta Per'cha is the hardened milky juice of the *Isonandra Percha* or *I. Gutta*, a large tree, which grows in Malacca, Borneo, and other islands of the Indian Archipelago, and also, according to Bleekrode, procured from *Sapota Mulleri.* The milky juice exudes from incisions in the bark made after the tree is cut down, and is inspissated by boiling. Crude gutta percha is purified either by rasping in water to remove soluble impurities, and then heating to 230° F. to reduce to a compact mass; or by dissolving in bisulphide of carbon and evaporating the filtered solution. The purified gutta percha has a brownish-red color, and a specific gravity of 0.979. It becomes electrical by friction, and is a very poor conductor of electricity; hence it is used for forming insulating supports for electrical apparatus and for covering telegraph-wires which are to be immersed in water. At about 115° F. it softens and becomes pasty, without losing its tenacity. At

104° F. it may be easily spread out in sheets, drawn into tubes, applied to any surface, or worked into any desired form. It will take the finest impressions from a mould. It is used for water-pipes, mouldings, and, mixed with linseed oil, for the moulds employed in making electrotypes. It is insoluble in water, and but slightly soluble in alcohol and ether. Boiling olive oil dissolves a little of it, but deposits it again on cooling. It is readily soluble in bisulphide of carbon, benzol, chloroform, and oil of turpentine, especially when heat is applied. Alkalies and hydrofluoric acid have no action upon it. Bottles and other vessels for the latter acid are made from it. Oil of vitriol carbonizes it, and strong nitric acid converts it into a yellow resin. It yields volatile oils by dry distillation. Gutta percha consists of—

1, Pure gutta..........	$C_{10}H_{16}$	75 to 82 per cent.
2, Fluanil................	$(C_{10}H_{16})2O$	6 " 4 "
3, Alban	$C_{10}H_{16}O$	19 " 14 "

The fluanil and alban are products of the oxidation of the gutta. The fluanil is a yellow resinous body, soluble in cold alcohol; the alban, a crystalline substance, insoluble in cold, but soluble in boiling alcohol. The gutta is insoluble even in boiling alcohol. Pure gutta is obtained by exhausting gutta percha with water and hydrochloric acid, dissolving in boiling ether, pressing the substance which separates on cooling, repeating the operation as long as anything is taken up by the ether. The pure gutta is perfectly white, cakes together at 212° F., begins to melt at 300° F. Gutta percha is strongly attacked by ozonized oxygen and by strong hydrochloric acid. It rapidly deteriorates by oxidation when exposed to the air, especially in warm climates. It loses its flexibility, tenacity, and extensibility, and becomes very brittle and entirely useless for industrial purposes. Mixed with sulphur or certain sulphides, and heated to 260° or 300° F., the gutta percha undergoes a change similar to that which occurs during the vulcanizing of caoutchouc. (See INDIA-RUBBER.) Gutta percha is chiefly employed for coating submarine telegraph-wires. For this purpose it will probably be replaced by *kerite*, a preparation of India-rubber which is not affected by the air. (For further details see URE'S *Dict.*, MUSPRATT'S *Chemistry*, and articles by T. M. BLOSSOM, E. M., in the *American Chemist*, vol. ii., 1871, p. 81 *seq.*) C. F. CHANDLER.

Gut'ta Ro'sea ("rosy drop"), a name somewhat vaguely applied to skin diseases in which some of the sebaceous glands of the nose and face become the seat of inflammatory action, often of a very obstinate kind. The name includes often those cases of *acne* so common among young persons of either sex just as they are coming to years of maturity. The whelks or tubercles which appear upon the faces of hard drinkers come under the same general name. Regulation of the habits in any case is the most essential condition of cure. Mild lead lotions, with iron, are useful.

Gut'ta Sere'na [Lat. "the clear drop," so called in distinction from *gutta opaca*, or cataract; it being the belief of the ancients that drops of some humor of untoward quality fell into the eye and quenched the sight], an old synonym for AMAUROSIS (which see); the "drop serene" of Milton.

Gut'tenberg, post-v. of Clayton co., Ia., on the W. bank of the Mississippi, 40 miles above Dubuque. It has mines of lead, and is in a beautiful locality. Pop. 1040.

Guttif'eræ, a synonym for the Clusiaceæ, a natural order of exogenous trees and shrubs, all tropical or subtropical, and sometimes epiphytic. Many of them have resinous and balsamic juices, and the fruits of some species are prized as food. The timber of some of these trees is of great value. Gamboge and tacamahac are products of the order, which has one representative species in Florida.

Gutzkow (KARL FERDINAND), b. in Berlin, Germany, Mar. 17, 1811; studied philosophy and theology; became an acknowledged head of the "Young Germany" party. His *Wally die Zweiflerin* (a novel, 1835) caused his imprisonment for three months, its tendency being considered atheistical and destructive to social order; and this opinion was confirmed by his *Nero* (1835), a dramatic piece. He has since attained very great popularity as a novelist, dramatist, and journalist, but has been subject to occasional attacks of insanity. He has lived in various German capitals, and since 1870 at Berlin. Noteworthy among his works are *Zur Philosophie der Geschichte* (1836, written against Hegel); *Blasedow*, a satirical tale (1838–39); *Zopf und Schwerdt* (1844) and *Urbild des Tartufe* (1847), comedies; *Uriel Acosta* (a tragedy, 1847); *Die Ritter vom Geiste* (1850–52); *Der Zauberer von Rom* (1859–61); *Fritz Ellrodt* (1872), and many other novels. Notwithstanding the popularity of his works, his influence is regarded as deplorable by many thoughtful critics.

Gütz'laff (KARL FRIEDRICH AUGUST), b. near Stettin July 8, 1803; went in 1823 as a missionary of the Dutch Church to Singapore, and showed wonderful proficiency in the acquisition of languages; went to Java in 1826, to Siam in 1828, and to China in 1831; became in 1834 interpreter and secretary of the British legation; sustained himself without connection with any missionary society, and was beloved by the Chinese, among whom he practised medicine with great success. D. at Hong-Kong Aug. 9, 1851. Among his works are *Journal* (1834); *Chinese History* (in English, 1834; in German, 1847); *China Opened* (1838); *Life of Tao-Kwang* (1852); and numerous papers on the geography, social life, and religion of the Chinese, into whose language he translated the New Testament.

Guy (THOMAS), founder of Guy's Hospital, Southwark, London, b. at Horseleydown in 1644; carried on business first as a bookseller, importing English Bibles from Holland; then as a financier, buying the prize-tickets of seamen at a large discount and investing the money in stocks. By this means he amassed a fortune of nearly £500,000, which, at his death in 1724, he bequeathed to charitable purposes. He founded the Stationers' Company, and different charitable institutions at Tamworth, his mother's birthplace, received large grants.

Guy'an, tp. of Gallia co., O. Pop. 1279.

Guyandotte, tp. and post-v. of Cabell co., West W., on the Ohio, at the mouth of the Guyandotte River, and on the Chesapeake and Ohio R. R., 4 miles above Huntingdon. It has 1 weekly newspaper. Pop. 427; of tp. 2095.

Guyon (Mme. JEANNE MARIE BOUVIER DE LA MOTHE), b. at Montargis, France, Apr. 13, 1648, and in 1664 married the wealthy but uncongenial M. Guyon, a tyrannical and irreligious man, who late in life was converted to her own religious views. He d. in 1676, leaving his wife free to foster that state of spiritual exaltation to which from infancy she had been inclined. Severe penances, untiring labors for the spiritual good of others, the abandonment of her property for the use of her children, the guardianship of whom she surrendered, led her to a state in which she believed herself to be the bride of Christ, united in soul with God, having daily and hourly communication with Heaven, being invested with what she termed the apostolical state, in which she could discern the spiritual state of those whom she met. She was much with one Lacombe, a Barnabite of mystical views, a devout man who was long her confessor, and who d. insane; and Mme. Guyon's enemies spread many scandalous rumors regarding this relationship, but no one who knew her ever believed any of these reports. She was (1688–89) confined as a Quietist in the Visitation convent of Paris, her brother, a monk, being the chief instigator of her imprisonment, for the pope in 1687 had condemned Quietism, and most of the French bishops now condemned Mme. Guyon's books; and Fénelon, for defending her, was involved in the persecutions which fell upon her. She was liberated through the agency of Madame de Maintenon, and for a time lived at the French court. She was (1695–1700) confined at Vincennes and in the Bastile, where she suffered many indignities. When released she retired to her daughter's house at Blois, where the rest of her life was spent in works of charity; and there she d. June 9, 1717, in full fellowship with the Roman Catholic Church, which she had never forsaken. But the leading divines of that Church suspected her of heresies, and her most appreciative admirers have been Protestants. John Wesley especially, while disapproving strongly of some of her teachings, cannot withhold from her his hearty praise. She left a considerable number of volumes containing hymns, letters upon spiritual questions, and devotional treatises, some of them of a highly mystical character. The best *Life* is that by Upham (2 vols., 1848–50). The so-called autobiography is probably not altogether her own.

Guyon (RICHARD DEBAUFRE), a general in the Hungarian army during the revolution of 1848–49, was of English descent, b. at Wolcott, near Bath, in England, Mar. 3, 1813. In 1832 he entered the Austrian service, but after marrying the countess Splényi in 1838, he lived as a private citizen on his estates near Comorn. As soon as the revolution broke out he offered his services to the national government, and accompanied Görgei as a brigadier-general on his victorious march to Buda and on his unfortunate retreat to Temeswar. On many occasions Guyon distinguished himself by his audacity and inexhaustible energy. After the battle of Temeswar (Aug. 9, 1849) he escaped to Turkey, and entered the service of the sultan. Under the name of Kourshid Pasha he was governor of Damascus, and during the Crimean war he organized the army of Anatolia. D. at Constantinople 1856.

Guyot (ARNOLD HENRY), PH. D., LL.D., M. N. A. S., b. near Neuchâtel, Switzerland, Sept. 28, 1807; was educated at Neuchâtel, Stuttgart, Carlsruhe, and the University of Berlin, where he graduated Ph. D. in 1835; continued his studies in Paris 1835–39. Though at first a student of theology, he gave especial attention to the natural and physical sciences. With Agassiz, his early associate, he accepted 1839 a professorship in the Academy of Neuchâtel, just founded, to carry on a post-graduate course of higher studies, and filled the chair of universal history and physical geography from 1839 to 1848. During these ten years he studied the structure and physics of the modern and the extent of the ancient glaciers of the Alps. He discovered the laminated character of the ice of glaciers, and the fact that the movement of the glacier is due to molecular displacement, mainly under the action of gravity, explaining thereby the principal laws of glacier motion which he had found and pointed out. He then investigated the subject of the transportation of Alpine boulders around the Central Alps, determined for the first time the real limits of each erratic region in Switzerland, Savoy, and Lombardy, as well as the vertical limits of the phenomenon, and demonstrated the identity of the laws of the distribution of erratic débris with those of moraines of glaciers. His observations were to have been published in full in the *Système Glaciaire* of Agassiz, Guyot, and Desor (Paris, 1848), of which, however, only the first volume was printed; but the most important results are found in the *Bulletin of the Society of Natural Sciences* of Neuchâtel, and in *D'Archiac Histoire de la Géologie*, vol. ii., Paris, 1848. He removed in 1848 to the U. S.; delivered (1849) the lectures in French, translated by Pres. Felton of Harvard College, and published as the *Earth and Man* (1849). These lectures inaugurated the movement of reform in geographical teaching which has been since going on, and to foster which he was employed for six years by the Massachusetts board of education as a lecturer on physical geography. He organized for the Smithsonian Institution a system of meteorological observations, superintended the construction of the improved instruments now in use; published *Directions for Meteorological Observations* (1850), and a volume of *Meteorological and Physical Tables* (1851–59); travelled extensively in the U. S., and made numerous and important hypsometrical observations, especially in the Appalachian Mountain system, from Maine to Georgia, partly published in a paper on the *Physical Structure of the Appalachian Mountains* in *Silliman's Journal of Science* (1861); became in 1855 professor of geology and physical geography in the College of New Jersey, Princeton; is author of the treatise on physical geography in *Johnson's Family Atlas of the World*, and of a series of school geographies (1866–75); has also published a series of wall-maps for schools. In 1873 his geographical works received the medal of progress at the Vienna Exposition; has also written numerous scientific lectures and papers. He received the honorary degree of LL.D. from Union College; was one of the original members of the National Academy of Sciences created by Congress; is associate member of the Royal Academy of Turin; honorary correspondent of the Royal Geographical Society of London, and of the Geographical Society of Paris; member of the American Academy of Boston, American Philosophical Society of Philadelphia, and other learned societies.

Guys'borough, the north-easternmost county of the mainland of Nova Scotia. Its surface is partly rough and broken. It abounds in mineral wealth, especially in gold. Its coast-line is broken by many bays and harbors. Cap. Guysborough. Pop. 16,555.

Guysborough, port of entry and cap. of Guysborough co., N. S., on the W. side of Milford Haven. It was settled in 1783. Its harbor is commodious. Fishing and gold-mining are important industries. Guysborough is the seat of a large academy. Pop. about 1000.

Guy's Hospital, a great charitable institution of Southwark, London, named from its founder, Thomas Guy, who began its erection in 1722, and at his death most liberally endowed it. In 1829 it received large benefactions from a Mr. Hunt. It was first opened in 1725.

Guyton-Morveau (LOUIS BERNARD) was b. at Dijon Jan. 4, 1737. He studied first law, and had become an attorney when he determined to devote himself exclusively to the study of natural science, especially chemistry. At his instigation chairs of chemistry, mineralogy, and medicine were erected at the Academy of Dijon, and he filled the first-mentioned one till 1790. During the Revolution he was active as a politician, and voted for the immediate execution of Louis XVI. He contributed much to the erection of l'École polytechnique in Paris, at which he became a professor. From 1800 to 1814 he was director of the mint. D. in Paris Jan. 2, 1816. His chief merits as a chemist are his discovery of the disinfecting qualities of chlorine, made in 1773, and since that time extensively utilized, and his establishment of a new and simpler chemical terminology, the idea of which he conceived in 1783, and in the execution of which he was aided by Lavoisier. But his experiments and researches have also been of great influence in the manufacture of saltpetre, gunpowder, prussian blue, etc., in the employment of cement for building under water, and in many other instances of practical application of chemical science. His principal works are *Dictionnaire de Chimie* (1786), *Methode d'une Nomenclature chimique* (1787), *Traité des moyens de desinfecter l'air* (1801), *Rapport sur la restauration d'un tableau de Raphael* (1802).

Gu'zerat, an old province of Hindostan, consisting of the peninsula of Kattywar, projecting into the Arabian Sea between the Gulfs of Cutch and Cambay, and an irregularly shaped territory on the mainland between Baroda, Gwalior, and British India, between which powers Guzerat, containing 40,000 square miles, with about 6,000,000 inhabitants, is now divided, parts of it forming the northern districts of the presidency of Bombay, and part belonging to the Guicowar.

Gwa'lior, a region of Central Hindostan, formerly belonging to the family of Scindia, but now governed by a maharajah who is tributary to the British government. Its northern part is low, occupying the basin of the Jumna; the middle part is hilly, and the southern covered with branches of the Vindhyan and Santpoora mountains. Area, 33,119 square miles. Pop. 3,228,000.

Gwalior, capital of the state of Gwalior, on the Subanrika, an affluent of the Jumna, but with very little water in the dry season. In the midst of the city rises a rock, perpendicular, 300 feet high, 1½ miles long, and 300 yards broad. This rock has been used as a fortress for more than 1000 years; but leaving the natural advantages of the position out of sight, the fortifications are picturesque, and nothing more. At the foot of the rock stretches the city, built in the ancient Hindoo style, hot, squalid, uninviting. Pop. 30,000.

Gwin (WILLIAM MCKENDRY), b. in Sumner co., Tenn., Oct. 9, 1805; was educated at Transylvania University; studied medicine, and removed to Vicksburg, Miss.; became U. S. marshal 1833; was in Congress 1841–43; as commissioner of public buildings supervised the construction of the New Orleans custom-house 1847; went in 1848 to California; was in the constitutional convention 1849; U. S. Senator 1850–61; was imprisoned for disloyalty 1861–63; took part in a scheme for colonizing Sonora with people of Southern birth 1864–65; and, according to a report (officially denied by the imperial representative), was appointed prefect of Northern Mexico under the short-lived empire of Maximilian.

Gwin'iad [Welsh, "white fish"], or fresh-water herring, a lake-fish of Northern Europe, the *Coregonas fora*, of the salmon family, closely resembling the white-fish of the American lakes, though greatly inferior to it as food. It is caught in England and Wales in large quantities, and salted, and sold to the poor at very cheap rates.

Gwin'nett, county in the N. of Georgia. Area, 550 square miles. It is hilly, but fertile. Granite, gold, antimony, and iron have been found here. Grain, tobacco, cotton, and wool are produced. It is traversed by the Atlanta and Richmond Air-line R. R. Cap. Laurenceville. Pop. 12,431.

Gwinnett (BUTTON), b. in England about 1732; emigrated to Charleston, S. C., in 1770, and became engaged in agriculture (1772). He took an active part in the political questions of the time during the Revolution, was elected by the general assembly of the province a representative to the general Congress, and was a signer of the Declaration of Independence. He was killed in a duel by Gen. McIntosh May 27, 1777.

Gwynn (NELL) was b. about 1650 in London, in the most abject poverty. Nor was her career upward to the top of society very enviable. She sold oranges in the taverns, and sang and danced for money, and became the mistress of the actors Hart and Lacy. In her sixteenth year she went upon the stage, and made a great hit in humorous and lascivious rôles; after which she became the mistress of Lord Buckhurst. In 1669, Lord Buckhurst sold her to the king, and in 1671 she was appointed a lady of the privy chamber to Queen Catharine, and received the name of Madam Ellen. But once arrived at this station, her behavior made her rather popular. She was coarse, but kind, generous, witty, and pleasant. She helped her old friends among the actors and poets with great liberality, and did harm to none. She gave the first idea of the erection of Chelsea Hospital for disabled soldiers, and she was generally believed to exert herself in support of the Protestant

cause at court. She bore two sons to the king, of whom the one died early, and the other was created duke of St. Albans. After the death of Charles II. she lived in retirement, and when she died (about 1690) her funeral sermon was preached by Dr. Tenison, afterwards archbishop of Canterbury. Two memoirs have been published of her—one by John Seymour in 1752, and another by Peter Cunningham in 1850.

Gwyn'edd, post-tp. of Montgomery co., Pa. Pop. 2094.

Gyarmat-Balassa. See BALASSA-GYARMAT.

Gy'aros [Γύαρος], one of the Cyclades, now uninhabited and employed as a sheep-pasture. It lies S. W. of Andros; was anciently proverbial for the poverty of its people; and was a place of banishment for the Romans. It is very small and rocky.

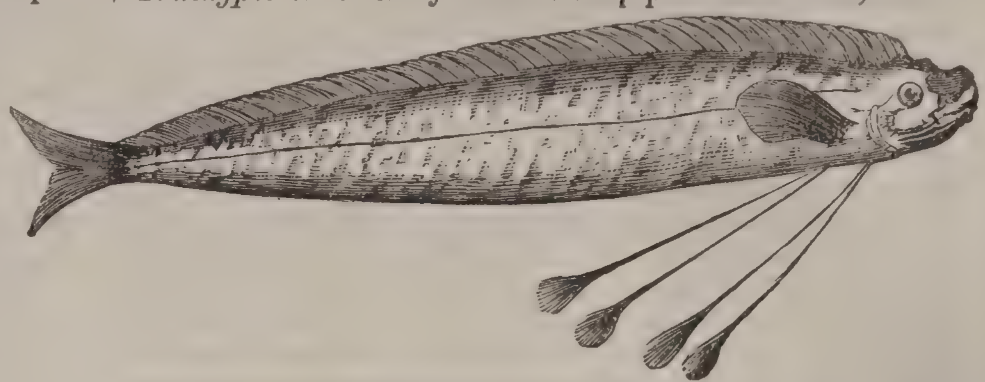
Gy'ges, the founder of the dynasty of the Mermnadæ in the kingdom of Lydia, was the favorite of King Candaules, and in possession of a ring by means of which he could make himself invisible. Urged by the king, who boasted of the beauty of his wife, Gyges concealed himself in the bed-chamber of the queen in order to see her naked, but was discovered. The queen, indignant at the affront offered her, gave him the choice of being put to death himself or of killing her husband. He chose the last, and became king about 716 B. C. D. 678 B. C. The Delphic oracle confirmed him in his new position, and he acquired great wealth. The story of the ring is told by Plato, and the ring of Gyges was with the ancient Greeks a symbol of extraordinary good luck, like the lamp of Aladdin with the Arabs.

Gylip'pus [Γύλιππος], son of the exiled Spartan general Cleandridas; commanded two Spartan galleys for the relief of Syracuse, then (414 B. C.) besieged by the Athenians; took command of the Sicilian land forces, by the aid of which (413) the siege was broken up. In 412 he returned to Sparta; for the Syracusans, notwithstanding his brilliant and successful efforts in their behalf, seem to have despised him and treated him with open insult. (PLUTARCH, *Nicias*, 19, 21, 28.) He was afterwards banished from Sparta for having stolen a part of the treasure sent from Athens by Lysander, and probably d. in exile. Ælian states that he was a *Mothax*—that is, a man of Helot birth, brought up as a Spartan, and allowed a part of a citizen's privileges, but there is reason to doubt the truth of the statement.

Gymna'sium [Gr. γυμνάσιον, from γυμνός, "naked"] properly designates a place for athletic exercise, but in ancient Greece the great gymnastic schools became also places for lounging, for conversation, for study, and for oral instruction. Thus, the gymnasium finally became a school. But except in Germany and some other European countries the name has reverted to its original sense. (See GYMNASTICS.) In Germany, the gymnasia are the schools where young men are fitted for the universities. Latterly, most of the instruction in practical studies, mathematics, foreign languages, and the like, for those who do not intend to enter the universities, are taught in the REALSCHULEN (which see).

Gymnas'tics [Gr. ἡ γυμναστική (τέχνη), from γυμνός, "naked"], the systematic exercise of the muscles for the preservation or restoration of health and the development of the physical powers. Among no nation was the gymnastic art ever so thoroughly put in practice as among the ancient Greeks. They knew that much of the enjoyment of life depends upon the possession of a vigorous physical constitution. All free-born youths were exercised systematically in the gymnasium; in the Doric states even young women took part in the exercises. The Greek physicians often prescribed gymnastics as a means for the recovery of health. To the thorough physical culture of the Greeks we must undoubtedly give much of the credit for their intellectual and artistic successes. Gracefulness and strength in movement and sanity of mind and body were national characteristics, for which the Greeks owed much to the gymnasium. Rome borrowed the Grecian physical culture, but only in her later days. In the Middle Ages knightly and rustic pastimes, tourneys, and feats of arms on the one part, and wrestling, boxing, archery, and other exercises of strength on the other, took, to some extent, the place of the old physical culture; and it was not till a comparatively late time that interest in these things began to die out. Modern gymnastics originated early in the nineteenth century in Prussia. Germany, Scandinavia, and France adopted them for schools and for the soldiery, and in all these countries private enthusiasm did much for the cause. Basedow, Jahn, Guts-Muths, and Salzmann were the great promoters of this reform. Great Britain's upper and middle classes, always fond of manly exercises, have given an important but not a prominent place to gymnastics. In the U. S., chiefly through the influence of the colleges, the Caledonian societies, and of the German Turners, there has been of late an awakening of interest in the subject.

Gymne'trus, a remarkable genus of fishes of the family *Trachypteridæ*. They inhabit deep parts of the sea, and are



Hawken's Gymnetrus.

seldom seen. *G.* or *Regalecus Banksii* and *G. Hawkenii* are found in the Atlantic waters. They are board-like in form, very much compressed, and from six to twenty feet in length. Their ventral fins are reduced to the form of oar-like filaments. These fishes are very delicate and fragile, and when found some of their parts are usually wanting.

Gymnoc'ladus [γυμνός, "naked," and κλάδος, a "branch," referring to the absence of small boughs], a genus of the order Leguminosæ, of a single species, the *G. Canadensis*, called coffee tree, stump tree, and chicot. It is a handsome tree, with peculiar and very compound leaves, but in winter it appears as if dead, from the absence of small branches. Its wood is valuable to the joiner and furniture-maker, and the very hard seeds have been used for coffee.

Gymnodon'tes [from γυμνός, "naked," and ὀδούς, "tooth"] are a sub-order of Plectognath fishes, distinguished by a complete union of the bones of the upper jaw and the consolidation of their dental armature, as well as that of the lower jaw, in exposed, beak-like masses, with or without median sutures; the scapular arch is also characterized by the atrophy of one of its bones (the hypercoracoid). The various species are distinguishable by a greater or less eccentricity of form and deviation from the fish-like type, some having sac-like bodies, with the belly more or less distensible, and others by a truncation of the body behind, and a consequent absence of the caudal peduncle and true fin. Three families belong to this group—viz. Orthagoriscidæ, Tetrodontidæ, and Triodontidæ, whose representatives are known popularly as salt-water sun-fishes, swell-fishes, porcupine-fishes, etc. THEODORE GILL.

Gym'nogens, a synonym for GYMNOSPERMÆ (which see).

Gymnono'ti [from γυμνός, "naked," and νῶτος, "back"] are a sub-order of Teleocephalous fishes, distinguished by the brain-case of the skull produced forward; symplectic bones present; pterotic normal; opercular all present; branchiæ normal; four anterior vertebræ, much modified and united in a single mass, with which are connected the ossicula auditus; air-bladder connected by a duct with the intestinal canal; and an anus far in front and in advance of the scapular arch, or even behind the symphysis of the lower jaw of a prolonged snout; the body is elongated and finless on the back, but with a long anal continued far forward. To this sub-order belong two families of South American fishes: (1) Gymnonotidæ, which includes a number of genera and species, and (2) Electrophoridæ, of which the only well-determined representative is the famous electrical eel. THEODORE GILL.

Gymnoso'mata [Gr. plu. for "naked-bodied"], a name applied to those pteropod mollusks which are naked, having neither mantle nor shell (except sometimes a rudimentary one); the head distinct; fins upon the sides of the neck, and the gill not often distinctly developed. They constitute one family, the Cliidæ, which some divide into three or more. The number of known species is small. All are marine, and the right whale feeds largely upon some of the species, engulfing great numbers in its open mouth, and straining them from the water by means of its baleen.

Gymnos'ophists [Gr. γυμνοσοφισταί, "naked philosophers"], a name given by the Greeks of Alexander's time to the Fakirs of India. (See FAKIR.)

Gymnosper'mæ [from the Gr. γυμνός, "naked," and σπέρμα, "seed"], a sub-class of exogenous plants, including the Coniferæ, the Cycadaceæ, and the Gnetaceæ or joint-firs. They have either no pistil or an open leaf or scale serving as a pistil, the seeds and ovules being therefore naked (that is, destitute of a pericarp), the ovules being fertilized by the direct contact of the pollen. They have been called polycotyledonous plants, because there are sometimes (not always) more than two cotyledons to the embryo.

Gymnotus Electricus. See ELECTRICAL FISHES.

Gyo'ma, town of Hungary, on the Körös, is celebrated for its excellent wine. Pop. 8587.

Gyöngyös', a well-built and beautifully situated town of Central Hungary. It has a considerable trade in corn, fruit, wine, cattle, and horses. Pop. 15,830.

Gyp'sies. *First Appearance in Europe.*—It is generally assumed, on the authority of M. H. M. G. Grellman (*Die Zigeuner*, Leipsic, 1783), that the gypsies first appeared near the North Sea in 1417, and that this must have been shortly after their migration from their fatherland, India; but more recent research indicates that small bands of them had long before this date been found in Europe, and that great numbers of them had been living in Greece and those countries where Greek is spoken, in all probability as early as the eleventh century. Little now, however, is known with regard to their presence in Eastern Europe previous to the year 1417, except that, although held as serfs, they were inveterate vagabonds, and in all respects, as to appearance and manners, the same as those of every country in the world at present. In 1417 they suddenly appeared in Germany in hordes of hundreds, which in a few years swelled to thousands. In that year, says Herman Korner, "a strange multitude of Oriental vagabonds came into Germany, . . . appearing at first by the sea, beginning at Lunenburg, whence, coming into Prussia, they went through Hamburg, Lubeck, and other cities. They went afoot, camped by night afield, being thieves and fearing arrest in cities. They were about 300 in number, ugly, black as Tartars, and called themselves *Secani*. They had leaders, a duke and count, whose judgments they obeyed. They were great thieves, especially the women; many of them were in many places arrested and slain. They bore letters of commendation from princes, especially from the Roman emperor Sigismund, through which they were admitted to cities, princes, castles, towns, bishops, and prelates, by whom they were kindly treated. Some of them rode." Another contemporary writer shrewdly observes that those who rode changed their horses very frequently. "They said that the cause of their wanderings and pilgrimage was a penance for having relapsed to Paganism after being converted to Christianity, and this penance of wandering had been enjoined on them by their bishops for seven years." Rufus, a Low German writer between 1400 and 1430, observed them very closely, and states that they were called Tartars by the common people, but *Ciani* in Italy. He utterly disbelieved their story of the penitential pilgrimage by which his contemporaries were deceived, declaring it to be his conviction that they were born vagabonds and thieves, "*nullam agnoscentes patriam*"—knowing no country. They care for no religion, he adds, and live but for the day. "A wonderful rabble (*colluvies hominum*), skilled in all languages, but dire for the rustics." Another writer of that period says they appeared as "baptized heathens" in Switzerland, at Bâle, Zurich, and other places. They appear to have been the same party seen at Hamburg with the duke and count, "who wore silver girdles and rode," bearing the imperial letter. In 1422 they appeared in Bologna, headed by a "duke of Egypt," named Duke Andrew. Inspired by the success of the (probably forged) letter from the emperor Sigismund in Germany, they added to the old story of their being renegades and penitents by declaring that Hungary was their original country, the king of which having conquered them in battle, had sent them on a seven years' penitential pilgrimage, and had granted them a decree which they showed, "authorizing them to rob and steal without being amenable to justice." They remained in Bologna fifteen days, stealing freely. It would appear that faith and respect attached to their "license," since the authorities did not arrest them, but decreed that any one whom they had robbed might steal to an equal amount from them; and the Bolognese availed themselves of this to such an extent that the gypsies were glad to escape to Rome. They were "*la più brutta genia*"—"the most beastly people ever seen in those parts. Black and lean, they ate like pigs. The women went in chemises." From a description of their hair, color, and ornaments they were evidently low-caste Hindoos.

Name and Origin.—The first gypsies did not profess to come from Egypt, but the name Egyptian having been applied to them, it was soon corrupted to gypsies. That some of them came *through* Egypt is likely from several Coptic words, and in Egypt to-day Copts call themselves *Gipti*. But from the beginning they were universally called Cingari or Chingani, varied in Italy to Zingari, in Spain to Zincali, in Germany to Zigeuner. An immense amount of learning and research has been devoted to the origin of this word. But as it is given among the gypsies of Persia to a large class among themselves, the saddle-makers, or Zingari, which has given its name in turn to the Zinganeh, a Kurd tribe, supposed to be of gypsy origin, this is possibly the true root. Among themselves they never say gypsy, but always *Rommany*. There exist in India several kinds of wandering pariahs or outcasts, which are identical in all respects with gypsies, the latter, however, uniting in one the peculiarities which in India attach to different bodies. Prominent among them are the Doms, whose name, it is probable, is identical with that of *Rom*, by which gypsies distinguish themselves all the world over. The Hindoo *d* generally changes to *r* in the Rommany or gypsy language —*e. g. doi*, a "spoon," into *roi*; and as the words Dom, Domni, and Domnipana mean in Hindoo, a Dom, a female Dom, and "the being a Dom," so Rom, Romni, and Romnipen have precisely the same signification, and in common use as applied to a gypsy, his wife, and gypsydom. The antiquity of the Doms is indisputable, as they are mentioned in the Shasters, where they are called Sopuckh, or "dog-eaters." At the present day in India they roam about, living in tents, eat swine which have died a natural death, carry out corpses, etc., and flay animals; all of which are habits or pursuits peculiar to gypsies, or were so when they first appeared in Europe. The Doms of India, like gypsies, make baskets and mats, which they sell while roaming about. Their women sing, play on musical instruments, and frequent weddings, as did the gypsy-women of Italy and Spain. Unlike all other Hindoos, the Doms are madly addicted to intoxication, being "so fond of drinking that they spend nearly the whole of their earnings on spirits." Even in Germany the excessive fondness of gypsies for spirits was observed in early times. The name Dom was probably the first type of that of Rom, but other causes may have helped to form it. In Hindoo, as well as English, a similar word signifies roaming. Many gypsies passed through Egypt on their way westward, and in Coptic—which was more generally spoken in the eleventh century than at present—*Romi* means, as in gypsy, a "man;" and it is also probable that from their long sojourn in Roumania and among Greeks, who are generally called Rūmi in the East, being confounded at an early period with *Romans*, they spoke of themselves as Romani when they first appeared in Hungary. There is, however, in India another body of outcasts which probably contributed largely to the gypsies, but at a *later* period, the first immigrants being Doms. These are the Nāts, which all European residents in India call simply gypsies, so identical are they with them. The Nāts "are noted thieves, wander about, are addicted to conjuring, legerdemain, and theatrical pursuits." It may here be remarked that there is probably *not one* theatre or circus in England or America in which there are not one or more performers of more or less mixed gypsy blood. The Nāts tell fortunes by chiromancy, and live, like English gypsies, in tents of dark blanket-stuff. Many of the men are skilful blacksmiths. Their women sell love-potions and charms against the evil eye, just as in Europe. The personal appearance of these tribes is peculiar, and so identical with that of gypsies that any one who is familiar with the one cannot fail to recognize the other. This is especially seen in a very singular and characteristic glitter of the eye, and an expression not to be seen in any other kind of Easterns, excepting perhaps Persians, who often resemble gypsies. Like North American Indians, the gypsies all walk with the feet *straight*; so that, as a gypsy once informed the writer, he could tell the track of one of his own people among a hundred *gorgios* (or non-gypsies). There are in India two or three other roaming castes which have strongly marked gypsy traits. The use of a secret language among most of these wanderers, and especially by the Nāts, also identifies them with gypsies. Nothing is as yet known which explains the fact why at one period there was apparently a vast and sudden migration of them from India. The pariahs or outcasts of that country have in their ranks many men of genius, and it is to the writings of members of the Poorrachchameiyan and Vallooran sects of pariahs and similar heretics that India owes its best literature in a literal sense. It is probable that the first leaders of the gypsies into Europe, who are described as men of rank and knowledge, were of this class, and that, owing to the free thought which sprang from Booddhism, the ranks of the intellectual pariahs were at one time largely augmented, the result being an effort to deliver themselves by emigration from the extreme tyranny to which they were subjected. The only history of their early migration is contained in their language. We shall speak more in detail of one group of European gypsies.

English and Scottish Gypsies—Their dialect contains Greek, Slavonian, Magyar, and German words. To these Miklosich adds French, but the 10 "French" words given by five different writers are not all French, and the rest are either not gypsy or are doubtful. The immense number of Indian and Persian words collected among English gypsies by the writer, and not as yet found on the Conti-

nent, renders it possible that the English branch are of a separate migration; which seems the more likely from the fact that many of these so-called Greek, etc. words are also of Indian origin. The first Gypsies slipped over into England very quietly. An anonymous writer in 1612 states that they first began to gather to a head in the south of England about 1512. They had a king named Giles Hather, and a queen, "Calot." They roamed about in some state, cheating poor country-girls of everything, and stealing. The vagabond element seems to have been developed and perfected in England by gypsies, and the *old* Cant, or early thieves' slang, was founded on Rommany. In 1522 they were described as an outlandish people calling themselves Egyptians, exercising no craft but palmistry and robbery, etc. In 1549 they were included in a search made through Sussex for all "vagabonds, gypsies, conspirators, prophesiers, players, and such like." From some cause it would appear that gypsies during the reign of Henry VIII. were imported into England. A fine of £40—a large sum for those days—was imposed in consequence on every gypsy entering England; and at one time a great number were reshipped to France. Yet in 1563 there were fully 10,000 of them in England. At this time they taught their language freely to recruits. Acts for their suppression being useless, it was made felony without benefit of clergy for any person above fourteen years of age to keep company with them; and Judge Hale remarks that at one assize a few years before the Restoration 13 gypsies were executed—*i. e.* simply for being gypsies. It should be remembered that the outrages and evils committed by them were incredible, and even at the present day the *Rommany* is the life of the entire vagabond population of the roads in England, it being almost impossible to find a tinker or petty hawker who is not part gypsy. There are now but a few hundred full-blooded *tent*-gypsy persons in England (1874), but of *kairengroes*, or house-dwellers, who keep their gypsy blood a secret, and of half-breeds (*churedi* or *posh an posh*), or of those affiliated by blood—all of whom possess the great secret of the Rommany language to a greater or less degree—there are perhaps 20,000. As the tinkers in England are all gypsies, and as they were probably the same in the time of Shakspeare, since he speaks of "their own language," it is thought by some that John Bunyan was of gypsy origin, as his father was a tinker, and as he himself speaks of being of the most despised *race* in the land. The old class of gypsies in England occasionally speak Rommany very purely, and mourn for the dead, as in Germany, by abstaining from some peculiar food for years, or from some pursuit or pleasure. They also refrain from mentioning the name of the dead, and otherwise manifest great respect for them. Gypsydom in England received its first blow at the period of the American Revolution, when great numbers were forced into the fleets and armies serving in America. Most of these deserted, finding America a congenial home. Another great blow to English gypsyism was the railroads, and of late years the Enclosure Act, which by enclosing all commons and wastelands has deprived them of places to camp. At present (1874) they are being driven with great severity from all their old camping-grounds. In an outskirt of London called the Potteries about 1000 live in small houses, especially during the winter. Dr. R. Bright in 1818 first gave the world some account of the English gypsy language, followed by John Hoyland in 1816. Hoyland was an English Quaker who married a gypsy girl. The gypsies of the present day are by no means so dishonest as is generally supposed, though, like all childish, ignorant, and very poor people, they yield to temptation. When implicitly trusted they are very honorable, and are grateful for *kindness*. They are all strong of body, are good rough-riders, and box well. They are very quarrelsome, continually fighting, and even murdering, among themselves, but very seldom trouble *gorgios*. When one is arrested for crime, his friends make incredible efforts to obtain his release. Of late years the works of George Borrow have attracted much attention towards them. They burn the clothes of their dead, and sometimes other valuables. The writer knows of a young gypsy who recently (1874), because he had been jilted and disgraced by his bride's not coming to the wedding, broke his watch to pieces and burned his wagon. Their favorite food is the hedgehog, stewed or roasted. It should be known that gypsies among themselves ridicule fortune-telling as being mere *hockerben* or lying, as the writer has learned from frequent conversations with them on the subject.

Tradition asserts that gypsies were in Scotland in 1460. In 1506 James IV. granted them a letter of favor, deluded by the old story of their being penitents. For many years their true character was not suspected. When it was intimated to the gypsy king that it was time for him to leave the kingdom and end his pilgrimage, "commanded by the pope," he declared that he had been robbed by some of his subjects, and obtained the aid of government. It is said that James V., while travelling in disguise, was cruelly treated by two gypsies of a band of three, in consequence of which he made a law that whenever three tinkers or gypsies were found together, two should be hanged and the third set at liberty. This order was in force only one year, and with this exception the gypsies were unmolested. They multiplied prodigiously, and married well among the natives, their thieving habits, as Simson (himself a Scotchman) asserts, proving no bar to such connections, "as the Scottish people were accustomed to thieving of all kinds." After a period of peace was established severe edicts against the gypsies appeared in 1592, 1600, 1603, 1609, etc. But though to be a gypsy was a capital crime, and they were hunted down with excessive severity, they remained in great numbers; and it was only after the persecution ceased that they rapidly diminished. Until a very recent period the Scottish gypsies were generally robbers and villains of the worst kind, availing themselves of the popular weakness for romance and boldness to outrage law, as they appear, according to Simson, to have always been popular. Until within fifty years, Scotch gypsies divorced themselves by killing a horse with several Hindoo ceremonies; and the writer has found English gypsies who preserved the tradition of such a custom. In Scotland gypsies call themselves *Nawken*. A small town (Kirkyetholm) was at one time peopled by them, in consequence of a gypsy, by his bravery at the siege of Namur, having obtained a grant authorizing his descendants to dwell there. At present very few remain in it, great numbers of Scotch gypsies having gone to America, where they generally become at once house-dwellers, and are lost to view. At one time, English gypsies buried their dead in remote places, but at present they are careful to secure Christian burial. Their ordinary weddings generally consist of nothing but an announcement and a feast, but of late years the better class obtain the aid of a clergyman. They have several Hindoo superstitions not known to the English, such as the evil eye and a belief that the blind-worm sees for half the year out of his right eye, and half with his left. Like the Hindoos, they send cooked food for three days to the family of a deceased person, and call it by nearly the same words (*kair hăbben;* in Hindoo, *karwá khana*). Their children are very beautiful, and the old people are distinguished by a peculiarity which is also observed among their ancestors, the doms of India. Their hair seldom turns gray, even in advanced age, unless there be "white" blood in their veins. During the summer the gypsies frequent races, where they set up cocoanuts or toys to be thrown at at a halfpenny a throw, or keep "Aunt Sallies" (a similar game), while their women beg and tell fortunes. They also frequent fairs, where they sell horses, and haunt pic-nics with their games or music. In the autumn, during a period of three days, hundreds of them may be seen in London crowding one or two favorite shops (of which Belrose's is the chief), and buying baskets, brooms, clothes-lines, etc.; after which they wander all over England, selling them. Formerly, they made their baskets, but of late years they purchase the French, on which they make a profit of over 200 per cent. As winter advances the men begin to manufacture clothes-pins and butchers' skewers, by which they earn two shillings a day. Chair-mending with split rattan is in England exclusively followed by quarter-blood gypsies or those more remotely allied to them; no one can walk far in London without seeing one or more seated on the curbstone hard at work. This class speak very little Rommany. Gypsies are in England industrious; the women, however, earn more than the men. On the whole, they earn twice as much as farm-laborers, and lead much happier lives. They are very fond of tea and beer, and always live well. The men greatly prize a coat or other garment from a gentleman, particularly from a patron, far above its value. This is also characteristic of Hindoos. There are nearly 100 English gypsy family-names, most of which are represented in America.

It has been asserted that there are no gypsies in America, but there are in reality more than in Great Britain, and in fact those of other countries are here in great numbers. Mr. Simson says (in his *History of the Gypsies*, London, 1865) that he met in America with French, Hungarian, German, and English gypsies, and speaks of a village in Pennsylvania and of one in New England originally established by gypsies, and in which Rommany is still secretly spoken. Many peddlers in America are gypsies, and many of the smaller tin, crockery, and basket "stores" in New York are kept by half or quarter blood gypsies. The tinware which they sell is of a plain, coarse kind, so that a gypsy tin-store is easily known. A very large proportion of the itinerant cutlers and tinkers in American cities are German, Hungarian, or French gypsies. Hungarian gypsies are sometimes to be found in negro-minstrel and other

bands. There are a number of gypsy musicians in Baltimore. Many of the fortune-telling women in our cities are half-blood gypsies. Within a few years the number of wandering tent-gypsies has largely increased in America; many of them roam from Canada to Texas; the writer is well acquainted with one who did this. They are, like all gypsies, very reticent as to their language. Yet very few among the wanderers possess a large vocabulary or speak Rommany well, and the reader who will devote a very few weeks to either Dr. B. Smart's vocabulary, to G. Borrow's *Romano Lavo Lil*, or C. G. Leland's *English Gypsies* (London, 1872), can in a few weeks speak the language better than most English or American gypsies. CHARLES G. LELAND.

Gyp'sum [from the Greek γύψος]. Gypsum is a mineral, the natural bihydrated calcium sulphate, $CaSO_4 + 2H_2O$, crystallizing in the monoclinic system. The translucent crystalline varieties are known as selenite (from selene, the "moon," in allusion to the characteristic soft lustre); the ordinary massive forms and opaque crystals as gypsum; the finer granular sub-translucent massive kinds, as alabaster, and fibrous varieties, as satin-spar. In hardness gypsum varies from 1.5 to 2.0, and the specific gravity of pure crystals is from 2.314 to 2.328. Heated, this mineral gives off its contained water, and becoming opaque falls to a powder, which has the power, if moistened, of rapidly "setting" or assuming again the solid form. Upon this property depends the most extensive application of this mineral in the arts, as plaster of Paris is made from it by heating and subsequently grinding it to a fine powder. It is also used as a fertilizer and in the manufacture of glass and porcelain. Alabaster, being of great beauty and easily carved on account of its softness, is extensively used for ornamental purposes. Extensive deposits of gypsum are worked in England, France, and other countries of Europe, and also in the U. S. and Nova Scotia. The latter occur in the Palæozoic series of rocks, but this mineral occurs most abundantly in the Mesozoic or Secondary formations, especially in association with deposits of rock-salt. Gypsum is also found generally in volcanic regions. In the U. S. gypsum is recorded from a great number of localities, more or less extensive beds having been met with in Virginia, Tennessee, Michigan, etc., and in imitative forms of scrolls, vines, flowers, shrubbery, etc., it constitutes one of the wonders of the Mammoth Cave, Ky. Perhaps the most celebrated gypsum-beds in the world are those of Montmartre, near Paris, which have given rise to the name "plaster of Paris," and which are rich in the remains of Tertiary mammals. These quarries are classical ground in science, as they furnished to the great Cuvier the materials upon which he based his observations on the philosophic history of life on the earth. EDWARD C. H. DAY.

Gypsum Creek, post-tp. McPherson co., Kan. P. 117.

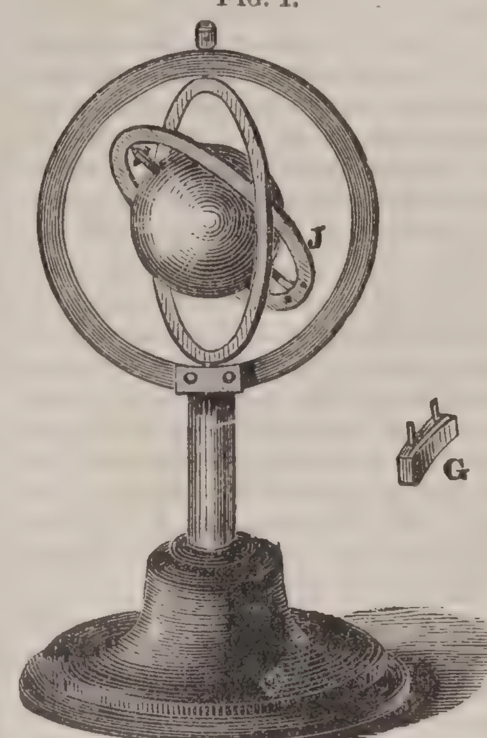
Gyrenceph'ala [from γυρόω, to "bend" or "wind," and ἐγκέφαλος, "brain"] are those mammals in which the superficies of the cerebrum is folded into gyri or convolutions (as implied by the name), and the cerebrum itself extends over more or less of the cerebellum, and generally over the olfactory lobes: they were considered by Owen as a "sub-class," and in the group were included the quadrumanous Primates, Carnivores, Ungulates, Proboscidians, Toxodonts, Sirenians, and Cetaceans. Man was excluded, through a peculiar interpretation of certain characters, as the sole representative of a corresponding group called Archencephala. This sub-class has not received the approbation of original investigators, although it has found considerable currency in popular and semi-popular works. The Gyrencephala and Archencephala had been combined long previously in a group named (by Bonaparte) Educabilia, for more valid reasons. THEODORE GILL.

Gyr'falcon, the *Falco gyrfalco* of Iceland, Scandinavia, Asia, and North America, one of the most highly esteemed of the noble falcons used in hawking, was trained with great difficulty, and commanded a very high price. It is about two feet long, and has mostly white plumage, especially when full grown. Some writers distinguish a second species of gyrfalcon, *Falco candicans*. The name is also spelled *gerfalcon* and *jerfalcon*.

Gyro-Pigeon. See PIGEON, GYRO.

Gy'roscope [Gr. γῦρος, a "ring" or "circle," and σκοπεῖν, to "view"], a word first applied, as is believed, by Foucault to that form of the instrument designed by him to show ocularly the rotation of the earth; it became thereafter the received name for the curious instrument sometimes known as the "mechanical paradox." It illustrates "a particular case of the rotational motion of ponderable bodies," viz. that case in which such a body is a rapidly rotating solid of revolution, held by, but free to move about, a fixed point in its axis of figure and rotation. Poisson (*Méc. Analytique* and *Journal de l'école Polytechnique*, cah. 16), at the conclusion of his analytical investigation of this "particular case," remarks: "There is to be seen in many philosophical cabinets a machine of Bohnenberger which exhibits with fidelity all the circumstances of this rotational motion, just as Atwood's machine gives ocular illustration of all the circumstances of the motion of falling bodies." This (Bohnenberger) machine (Fig. 1) was first described in the *Tübingen blätter für Naturwissenschaft*, etc., 1817, and also in Gilbert's *Annalen*, vol. lx., p. 60, and is the oldest, the prototype, of gyroscopic instruments. Designed, probably, to illustrate the precession of the equinoxes, and consisting merely of a spherical or spheroidal body so balanced in gimbals that its axis is free to take any direction, it is well fitted to illustrate—*first*, the *stability of direction* of the axis of rotation of a solid of revolution possessing high rotary velocity (this may be done by placing the instrument on the revolving disk of a centrifugal machine; the axis of the rotating sphere will continue invariable, or nearly so, in direction); *second*, by attaching the small weight G to the inner ring J near one of the extremities of the axis of the rotating spheroid, a preponderance is established *tending* to tilt (or pull down) that extremity, but *actually* causing a slow horizontal gyration or *precessional* motion.

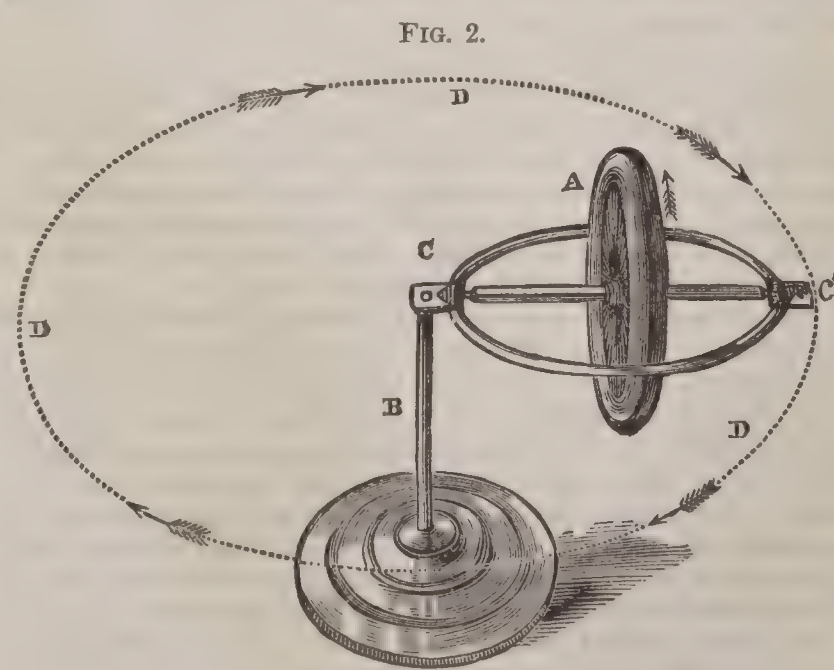
FIG. 1.



Bohnenberger Machine.

In 1831 (see *Am. Jour. Sci.*, vol. xxi., 1832), Prof. Walter R. Johnson of the University of Pennsylvania invented a machine to which he gave the name of "rotascope," and which, possessing all the qualities comprised within the narrow scope of the Bohnenberger machine, afforded the means for curiously illustrative experiments in which it has not really been equalled in any subsequent invention. It is not within the compass of this paper to enumerate these experiments, or even minutely to describe the instrument. Reference must be made to the volume just cited, and to an interesting lecture by Prof. Snell printed in the *Annual Report of the Regents of the Smithsonian Institution* for 1855. It is sufficient to remark that with the combined wheel and inner ring, disconnected from the other parts, all the characteristic experiments of the *common* and popularly known "gyroscope" were exhibited by Prof. Johnson.* By this latter instrument (Fig. 2) we have the phenomena which, "though so directly due to the fundamental laws of mechanics, seem to exhibit so utter a violation of them," presented in their paradoxical form; whereas there is in the exactly balanced or slightly overpoised spheroid of the Bohnenberger machine nothing of this *apparent* violation of fundamental laws—nothing which so perplexes, and, even to scientific observers, seems at first sight to invoke "some

FIG. 2.



Rotascope.

* At a later date the instrument in the more familiar form was brought out by Mr. J. H. Lane (now of the U. S. Coast Survey), and named by Prof. Olmstead the "Mechanical Paradox."

new and hitherto unknown mechanical principle, or some modification of those already admitted." The rotascope of Prof. Johnson seems to have remained for many years as little known as had been the Bohnenberger machine: something was needed to make it an object of general attention, which seems to have been found in the novel and startling applications, by Foucault, of the Bohnenberger machine and the pendulum, to the ocular exhibition of the diurnal rotation of the earth. Neither Poisson, who, in his solution, already referred to, of "a particular case of rotational motion, etc.," prepared the way to a complete analysis of the gyroscope, and who in reference to the pendulum investigated the motions of bodies near the surface of the rotating earth, nor Laplace, who, in the remarkable words, "Though the rotation of the earth is now established with all the certainty that belongs to the physical sciences, nevertheless a *direct proof* of the phenomena could not fail to be highly interesting to geometricians and astronomers," seemed to desiderate some ocular demonstration—neither of these great analysts caught the clue which their own researches offer to the invention of such an ocular exhibition. It was reserved for the greatest genius in this sphere of invention of modern times, the late Léon Foucault, to furnish to the eye the "direct proof" desiderated by Laplace, by means of the "freely suspended" pendulum, and again, and independently, by means of the gyroscope.

Nearly contemporaneous with these inventions of Foucault was the invention of oblong projectiles for rifled arms, by aid of which the rifled weapon, whether of small-arms or of cannon, speedily superseded the smooth-bore; and the phenomena of "deviation" which these rapidly rotating projectiles exhibited gave rise to the invention of Prof. Magnus of Berlin (*Poggendorf Annalen*, vol. xc. pp. 175 and 371, and vol. lxxxviii. p. 18) of a gyroscopic instrument ("rotations-apparate") designed to illustrate his theoretical deduction that this "deviation" had a common origin with that of the already familiar gyroscopic phenomena.

The gyroscope in its common form, and the phenomena which it exhibits (Fig. 2), are now so familiar to every one as to need but few descriptive words. The wheel or circular disk A of the instrument having, by well-known means, been put in motion with very great velocity, the bearing-point C of the ring in which the disk and axis are mounted is placed on the point of an upright support B. Not only does the rotating disk (with its ring) *not* fall, as would happen were there no rotation, but, preserving the angular elevation of its axis, it takes up a slow horizontal angular motion (gyration) in the reverse direction to that in which, by rotating, the upper periphery of the disk is moving—*e. g.* the disk in the figure revolves as marked by the arrow near its top; its *gyration* is as the arrows along the indicated horizontal circle D. If the direction of disk-rotation be reversed, so will be that of the gyration. It will be found also that the *rate of gyration* is the same for all elevations of the axle, and that the greater the rotating velocity of A the *slower* will be the gyration—that as (by friction and the resistance of the air) rotatory velocity is lost, the *gyratory* velocity increases simultaneously, with a gradual drooping of the outer extremity of the axis, which, with continually accelerated gyratory velocity, falls in a descending spiral (or helix), until finally the bearing C, if not prevented, escapes (slips off) from its point of support. Still more puzzling, still more paradoxical, is that phase presented by placing the wheel (rotating with *very* great velocity) on the point of support with axis considerably elevated. Instead of falling (as it gyrates), the axis will *rise.*

A full analytical exposition of these phenomena cannot be attempted here. Every student of mechanics (and the analysis which follows will be intelligible to none other) is familiar with the principle of *moments* or "areas," by virtue of the latter of which the sum of the areas described by the radius vector of bodies acted on by central forces remains constant. Expressed in terms of "moments of the quantity of motion," it affirms, among other things, that the sum of these moments with respect to any axis cannot be altered by forces acting *parallel to that axis.* For the purpose of analysis, we must suppose an imaginary gyroscope in which (Fig. 2) the rotating wheel or disk A alone *has mass,* the axis (the ring excluded) being an immaterial rigid line resting and held at a fixed point at O. Let C be the "moment of inertia" of the solid referred to its axis of rotation, and A the common value of that moment with respect to all other "principal" axes though the *point of support.*

M = the mass.

γ = the distance from the centre of gravity to the point of support.

ψ = the *azimuth* angle (counted positively in the reverse direction to that in which the disk by its rotation n would roll as a wheel) made by the axis with any arbitrarily chosen horizontal line of direction through the point of support.

θ = the *vertical* angle made by the axis at any instant, with the *inferior* vertical drawn through the point of support.

α = the *initial* value of the same vertical angle.

n = the *angular velocity* of rotation of the disk.

g = the force of gravity.

The wheel being put in rotation with the velocity n, Cn will represent the moment of the quantity of motion about its axis *of figure;* and Cn multiplied by $\cos\alpha$ the moment of that same quantity of motion referred to the inferior vertical. If, by the action of gravity, the disk is pulled down to any angle of elevation denoted by θ, Cn multiplied by $\cos\theta$ will then be the expression, and hence an increment in the sum of "moments" $Cn(\cos\alpha - \cos\theta)$ will have resulted.

Suppose that, in falling, *the axis of figure,* motionless at first, has *acquired* azimuthal angular motion $\frac{d\psi}{dt}$; this implies rotation, about, as an instantaneous axis, a principal axis of A in the same vertical plane, of angular velocity $\sin\theta\frac{d\psi}{dt}$, and the sum of the moments with respect to this axis will be $A\sin\theta\frac{d\psi}{dt}$. This sum, referred to the inferior vertical as an axis, becomes $A\sin^2\theta\frac{d\psi}{dt}$.

But since these effects are due to a force (gravity) acting parallel to the axis about which they are measured, the "principle" of moments (or of "areas") demands that these acquisitions neutralize each other, or that $A\sin^2\theta\frac{d\psi}{dt} + Cn(\cos\alpha - \cos\theta) = 0$;

which may be put in the form

$$(1) \qquad \text{Sin}^2\theta\frac{d\psi}{dt} = \frac{Cn}{A}(\cos\theta - \cos\alpha).$$

If λ be the length of the simple pendulum which would swing at the same angular velocity as the disk (considered as suspended at O), the *total* angular velocity acquired must be that due to the action of gravity *through the total fall,* which will be $\lambda(\cos\theta - \cos\alpha)$. We have attributed already a horizontal angular component $\sin\theta\frac{d\psi}{dt}$; let there be also a vertical one, $\frac{d\theta}{dt}$. These two components make up a resultant angular velocity, the square of which is $\sin^2\theta\frac{d\psi^2}{dt^2} + \frac{d\theta^2}{dt^2}$, and *by the law of living forces* (as it exhibits itself in the case of the pendulum) we have,

$$\lambda^2(\sin^2\theta\frac{d\psi}{dt} + \frac{d\theta^2}{dt^2}) = 2g\lambda(\cos\theta - \cos\alpha).$$

But $\lambda = \frac{A}{M\gamma}$, and the foregoing becomes,

$$(2)^* \qquad \text{Sin}^2\theta\frac{d\psi^2}{dt^2} + \frac{d\theta^2}{dt^2} = \frac{2Mg\gamma}{A}(\cos\theta - \cos\alpha).$$

If we eliminate $\frac{d\psi}{dt}$ between the equations (1) and (2), and abbreviate by putting λ for $\frac{A}{M\gamma}$, and β for $\frac{Cn}{2A}\sqrt{\frac{\lambda}{g}}$, we shall get

$$(3)\ \text{Sin}^2\theta\frac{d\theta^2}{dt^2} = \frac{2g}{\lambda}\Big[\sin^2\theta - 2\beta^2(\cos\theta - \cos\alpha)\Big](\cos\theta - \cos\alpha).$$

The equation (3) expresses a relation between the angle θ and the angular velocity $\frac{d\theta}{dt}$. When that angle is *maximum* or *minimum*—that is, when, in its motions, the axis of the disk reaches its *greatest* or *least* inclination—the differential coefficient $\frac{d\theta}{dt}$ (*or* the vertical angular velocity) is zero. This will be the case when either of the factors of the second member of (3) becomes zero; that is, when $\cos\theta = \cos\alpha$, *or*

$$(4) \qquad \text{Cos}\,\theta = -\beta^2 + \sqrt{1 + 2\beta^2\cos\alpha + \beta^4}.$$

The first value corresponds to a *maximum,* and shows that the axis *never rises higher than its initial position.*

The second of the above equations gives the *minimum* value of θ; and this minimum cannot be zero (that is, $\cos\theta$ cannot $= +1$) so long as β is not zero; that is, so long as n, the rotary velocity, is not zero. Make n zero (that is, deprive the disk of rotation) and equation (3) becomes that of the simple pendulum of length λ, and the motion is accordingly such. But if n be *not* zero—*i. e.* if there be ro-

* These equations (1) and (2) are usually derived from the general (Eulerian) equations for rotary motion; as they are in the writer's work on *The Gyroscope.* This *direct* derivation from certain fundamental mechanical principles is here preferred.

tation, however slow—this motion is modified *in this,* that the axis in swinging cannot pass *through* the inferior vertical, as does the pendulum.

The self-sustaining power of the gyroscope when very great velocities are given *is but an extreme case of this law.* For if β be *very great,* the small quantity $1 - \cos^2 \alpha$ may be subtracted from the quantity under the radical without sensibly altering its value, and therefore the equation is equivalent to $\cos\theta = \cos\alpha$ (*nearly*). Hence in this case the minimum of the angle θ differs very minutely from the maximum α.

Here, then, is the result, analytically found, which so surprises the observer, and for which an explanation has been so much sought and so variously given. The revolving body, though solicited by gravity, *does not sensibly fall.*

Knowing this fact, we may, assuming that the impressed velocity n is very great, introduce a new variable u (equal to $\alpha - \theta$), which will always be minute; and deducing the values of $d\theta$ and (by development) of $\sin^2\theta$ and $\cos\theta$ in terms of u (neglecting its higher powers), and substituting in (1) and (3) (as abbreviated), they become (omitting, as relatively small, $\cos\alpha$ in the factor $\cos\alpha + 4\beta^2$),

$$(5)\qquad \sqrt{\frac{g}{\lambda}}\,dt = \frac{du}{\sqrt{2u\sin\alpha - 4\beta^2u^2}},$$

$$(6)\qquad \frac{d\psi}{dt} = 2\beta\left(\frac{g}{\lambda}\right)^{\frac{1}{2}}\frac{u}{\sin\alpha}.$$

Equation (5) gives by integration and putting $\beta\left(\frac{g}{\lambda}\right)^{\frac{1}{2}} = k,$

$$(7)\qquad u = \frac{1}{2\beta^2}\sin\alpha\sin^2 kt,$$

which substituted in (6) gives

$$(8)\qquad \frac{d\psi}{dt} = \frac{1}{\beta^2}k\sin^2 kt,$$

$$(9)\qquad \psi = \frac{1}{2\beta^2}kt - \frac{1}{4\beta^2}\sin 2kt.$$

If we make $\alpha = 90°$, $\sin\alpha = 1$, in equation (6), deduce the value of dt, and substitute in (5) we get

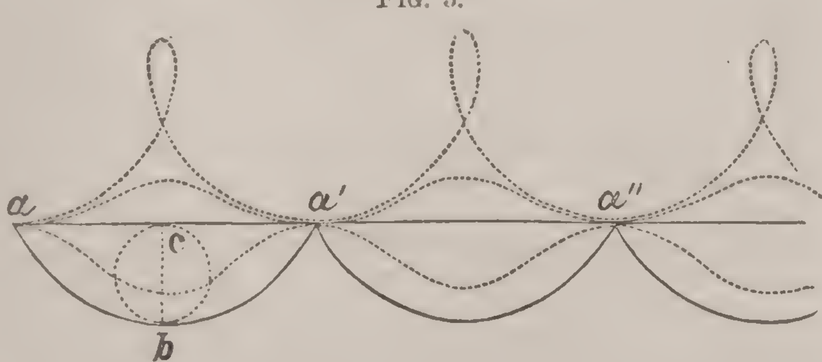
$$(10)\qquad d\psi = \frac{u\,du}{\sqrt{\frac{1}{2\beta^2}u - u^2}},$$

the differential equation of the cycloid, generated by a circle of which the diameter is $\frac{1}{2\beta^2}$, and having a chord $\frac{\pi}{2\beta^2}$.

If the value of α is not 90°, the diameter of this circle will be $\frac{1}{2\beta^2}\sin\alpha$; but the quantity $\frac{\pi}{2\beta^2}$ then measures an angle of an arc of a small circle having a radius $= \sin\alpha$; and the chord of the curve is reduced in the same proportion as its sagitta, and the curve is still a cycloid.

The *theoretical* character of the motion of a point of the axis would therefore be represented by the cycloid (Fig. 3, *full line*) generated by the rolling of the circle of which the diameter cb (exceedingly minute) is $\frac{\sin\alpha}{2\beta^2}$.

FIG. 3.

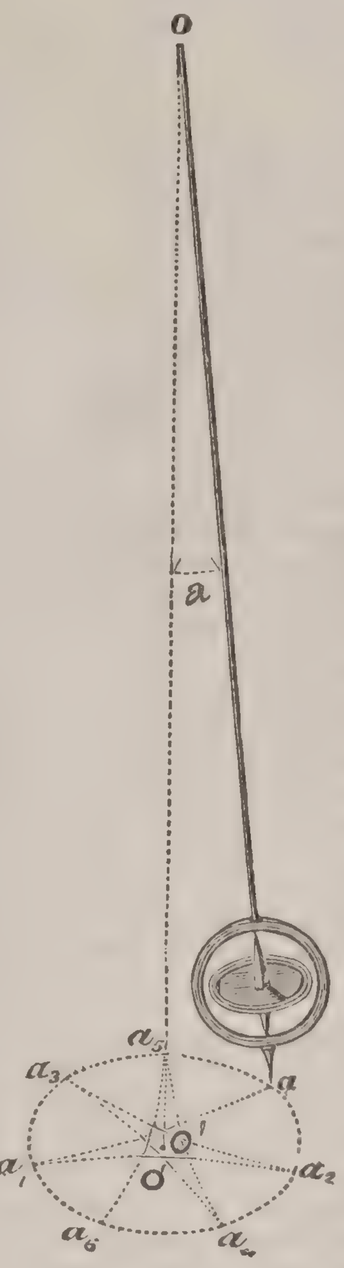


The above demonstration of the intrinsic character of the gyroscopic motion was first given (as is believed) by the writer of this in the *Am. Jour. of Science* in 1857, and in *Barnard's Am. Jour. of Ed.*, No. 9, of same year.*

In the foregoing it is assumed that at the instant of starting the rotary disk has *no other* motion than its rotation. If there be given, at that instant, an *initial* gyration, such as may be imparted by a push or shock, the resulting cycloid will be (cf. works above cited) (according to its intensity) of the species known as *prolate* (Fig. 3, *broken line*) or *curtate* (Fig. 3, *dotted line*).

The "gyroscopic pendulum" (Fig. 4) is one of which the pendulum-bob is a rotating gyroscope. It offers a particular case of the problem, in which the initial angle α is very small, and β (owing to the length of the pendulum arm, and hence great value of γ) much less than for the ordinary gyroscope. If the pendulum starts from a position of rest at a, and O O′ is a vertical dropped from the point of suspension, the foot of the pendulum will not swing through O′ but, passing near it, be deviated in a curve $a\,a_1$ convex towards O′, till it attains a departure at a equal to the initial angle α, where, coming to rest, it commences (making a *cusp* at a_1) another swing to a_2; and so on. If propelled from a state of rest *in* O′, the curves of vibration will all pass *through* the centre O′, and the extremities a_1, a_2, a_3, etc. will be loops instead of cusps. The special analysis of the motion is identically the same as that of the "freely suspended pendulum," which reveals by the progressive azimuthal displacement of its plane of vibration the rotation of the earth; though in the case in hand this azimuthal motion is far more rapid. (See *Smithsonian Contributions*, vol. xix., "Problems of Rotary Motion," by the writer.)

FIG. 4.



In the foregoing we have given in a very condensed form the *mathematical theory* of the gyroscope. But to the unmathematical reader the "why" of the phenomena will be still unanswered; and even the student who has mastered the analysis will yet ask for some other rationale than the ineloquent logic of "operations" upon abstract symbols. Verbal explanation is difficult, *mainly* in consequence of the imperfection of ordinary language for the conveying of ideas on such subjects; hence circumlocutions, in themselves confusing, and perplexities of terms where clearness is the first requisite. Let the inquirer take in his hands the combined wheel and ring of the common gyroscope (Fig. 2); the wheel having been put in rapid motion by the usual means. Holding the extremities C and C′ by the thumb and forefinger of the two hands, let him give a rapid angular motion (*i. e.* change of direction) to the axle C C′. He will become sensible that *a force* which he did not anticipate is, through this motion, exerted. It does not directly *oppose* the motion; it is *lateral*—sideways—to it.† In scientific language it is a force acting "normal to the plane of the angular motion of the axis." It is this force, addressing without symbols or words the very *senses* of the inquirer, which is the unknown cause—the *deus ex machinâ*—of the gyroscopic phenomena. But *why* is this force developed? The answer in its simplest form is, "In giving *angular* motion to the axis of a rotating body, *change of direction of the motion* of every material point of the body is compelled." Now, it is fundamental to mechanics, and obvious to the senses, that a moving body cannot be deviated from its direction without the exertion of *force* normal *to that direction.* Bodies describing curved paths undergo a continual diversion of *direction,* and *hence* require the incessant action of normal forces. The familiarly known "centrifugal force" is but an expression for the force necessarily applied to constrain to curvature of path.

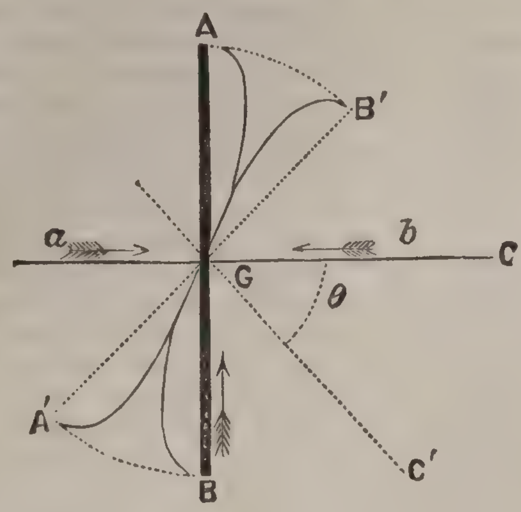
For the purpose of showing the connection of this law with the case in hand, conceive the mass of the revolving disk concentrated in a single ring of matter, and, for simplicity, suppose the angular motion of the axis to take place around the centre of figure and gravity G. "Let A

* Poisson terminates his analysis with eq. (5), (6), (7), and deduces no other results than this, that "when the rotary velocity is very great the axis preserves a nearly constant inclination, at the same time taking a nearly uniform but very slow azimuthal motion, the rate of which will be independent of the initial angle α, etc. etc." Jullien (*Problèmes de Mécanique rationelle*, Paris, 1852) does indeed deduce the *circular* motion, relatively to the "instantaneous axis" of the axis of figure; but he fails to show that a *common* cycloidal path results; and indeed makes the blunder of confounding this minute nutation with the astronomical "nutation" of the earth's axis due to the inclination to the ecliptic of the moon's orbit.

† "The use of a fly-wheel to regulate the motion of machinery in a steamboat was formerly very common, and some of our boats still retain it. In describing a curve, as in rounding to near a wharf, a close inspection of the wheel will show that a powerful effort is made by it to depress one and elevate the other of its gudgeons; and that a correspondent effect in racking the boat or causing it to careen is produced."—*W. R. Johnson, Am. Jour. Sci.* (Jan., 1832).

B be the projection of such a ring revolving about its axis of figure G C, while the axis turns in the plane of the

FIG. 5.



paper about a point G to the position G C′. Let the rotary velocity n be such that the visible portion of the disk moves upward through the semi-circumference from B to A, while the axis moves downward through the angle θ to the position G C′. The point B, by its axial rotation *alone*, would be carried to A, but the plane of the disk, by the simultaneous angular movement of the axis, is carried to the position A′ B′, and the point B arrives at B′ instead of A, through the curve projected in B G B′. The equation of the projection, in circular functions, is easily made; but its general character is readily perceived, and it is sufficient to say that it passes through the point G; that its tangents at B and B′ are perpendicular to A B and A′ B′; and that its concavity, throughout its whole length, turned to *the right*. The point A descends on the other or remote side of the disk, and makes an exactly similar curve A G A′ with its concavity reversed."

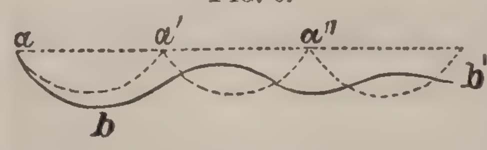
Thus, instead of describing circles in the plane of rotation A B (in which the centrifugal forces exactly balance each other), all the particles are diverted in their motion by the angular motion imparted to the axis, describing in front curves projected with concavities *to the right*—in rear of the plane of the axis, curves projected with reverse concavity. Hence, the opposite (in direction) forces necessary to *compel* this curvature, and hence the force tending to turn the axis normally to the plane of its *imparted* angular motion; hence, in short, the strange *force* felt by the hands under the circumstances mentioned.

This force (consult works already cited) has been computed,* and shown to be precisely that which, necessarily attending, is *required* to produce the phenomena of the gyroscope. That it does not directly *oppose* the falling of the axis at the first instant can be proved by any arrangement which will *prevent* azimuthal motion. Thus, if the extremity of the axis of rotation were confined in a vertical circular groove in which it could move without friction, or if (Fig. 8) the spindle J be clamped, and gyration thus prevented, the gyroscope falls just as if (in both cases) no rotation existed.

Let us see now how such a force can produce the theoretical effects. The rotation-axis being assumed, *ab initio*, motionless, it is self-evident that the first *tendency*, the first *effect* of gravity, is to cause it to *fall*, generating *vertical angular velocity*. But with this angular velocity the *deflecting* force proportional to its rate and normal to its direction is generated, which pushes aside the descending axis from its vertical path. But as the direction of motion changes, so with it does the direction of this force. It finally acquires an upward component of intensity equal to that of gravity; but the *acquired* downward velocity still exists, and the axis *still* descends, at the same time acquiring a constantly increasing horizontal component, and with it a still increasing upward deflecting force. At length the descending component of velocity is entirely destroyed—the path of the axis is horizontal; the deflecting force due to it acts directly contrary to gravity, which it exceeds in intensity, and hence causes the axis to commence rising. This is the state of things at the point b (Fig. 3). The axis has described the curve $a\ b$, and has acquired a velocity due to its actual height of fall $c\ b$; but this velocity has been deflected to *a horizontal direction*. The *ascent* of the branch $b\ a'$ is precisely the converse of its descent. The acquired horizontal velocity impels the axis horizontally, while the deflecting force due to it (now at its maximum) causes it to commence ascending. As the curve bends upward, the normal direction of this force opposes itself more and more to the horizontal, while gravity is equally counteracting the vertical, velocity. As the horizontal velocity at b was due to a fall through the height $a\ d$, so, through the medium of this deflecting force, it is just as capable of restoring the *work* gravity had expended, and *lifting* the axis back to its original elevation at a', and the cycloidal undulation is completed, to be again and again repeated, and the axis of our *theoretical* gyroscope, performing these rapid and minute undulations, moves slowly around its point of support.†

But, as already intimated, the phenomena of the gyroscope, as actually constructed, are not apparently in complete harmony with these theoretical results. No appearance of the minute cycloidal motion can be detected in the common gyroscope:‡ moreover, as already stated, the common gyroscope not only does not sensibly fall, but under certain circumstances, in actual violation of the foregoing theory, *rises*. The violation is only *apparent*, however. The actual gyroscope is *loaded* with the heavy ring by which its axle finds points of support, and there is always *friction* at these points, which (together with the resistance of the air) gradually destroys the rotary velocity, or converts it into azimuthal motion *of the whole mass*. On the other hand, owing to loss of rotary velocity in the disk, the deflecting force which depends on it is gradually impaired, and cannot, even for a single cycloidal arc, bring back the axis to the level a' (Fig. 3) from which it started; hence, instead of the cycloid $a\ a'\ a''$, etc., we would have a curve shown by the full line $a\ b\ b'$ (Fig. 6), which would speedily lose all undulatory character; the axis moving horizontally with such an *angular velocity as will generate an upward deflecting force adequate to oppose gravity and prevent sensible falling.*

FIG. 6.



Let, now, the rotary velocity be *very* great, and the axis be placed, at the commencement, with considerable *upward* inclination; the friction of the axle extremities on the sustaining ring tends to impart rotation to the ring, and this tendency will be converted (through the impossibility of the ring turning about any other than the *vertical* standard on which it rests) into azimuthal motion of the whole mass about that standard—that is, the *gyratory* velocity is thereby accelerated—and the resulting upward deflecting force becomes thereby *greater* than gravity, and the axis rises.

The phenomenon may be best illustrated in the following manner: Let the outer extremity of the common gyroscope, having its axis inclined *above* the horizontal, be held by a thread attached to some fixed point vertically above the point of the standard. Here gravity is eliminated, and the axes of our theoretical solid of revolution would remain perfectly motionless; but the gyroscope *starts off, of itself*, to gyrate in *the same direction* that it would were its extremity *free*. This gyration increases (if the rotary velocity be great) until the deflecting force due to it lifts the outer extremity from its support on the thread, and causes it indefinitely to rise. Try the same experiment with the axis *below* the horizontal. The gyration will commence spontaneously as before, but in the *reverse direction*;§ it will increase until the *inner extremity is lifted from the point of support on the standard* (the action of the deflecting force being here reversed), the instrument supporting itself *on the thread alone*. If the experiment is tried with the axis perfectly horizontal, *no gyration takes place*, for the component of rotation about the standard produced in the ring by friction is, in this position, zero.

The TOP (which, childish toy as we usually regard it, is called by Sir John Herschel in his *Treatise on Astronomy* a "philosophical instrument") is but a gyroscope of which a point of its rotary axis rests not on a fixed point, but on a horizontal plane. The theory is analogous. As in the gyroscope, a *deflecting force* is generated by any angular motion of the axis of the rotating top; and it is this

* The "couple" developed or *moment* of this force is $\frac{W}{g}k^2 n v$ in which W is the weight of the ring, k its "radius of gyration," and v the *angular velocity* given to its axis *G C*. (See *Van Nostrand's Mag.*, Apr., 1875.)

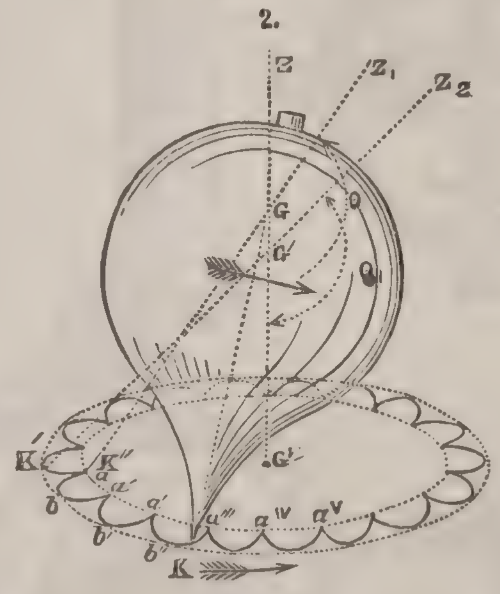
† By means of the apparatus of Dr. Franz Heinen of Brunswick (Germany) curtate cycloids can be manifested.

‡ I have thus, with the precision of mathematical analysis developed, and with detail described, this theoretical motion to show, *first*, the inaccuracy of speech, and even violation of *fundamental mechanical principles*, by which in even scientific explanations (by composition of rotations) pure horizontal gyration is affirmed to result *directly* from the action of gravity (as if gravity could produce motion *at all*, unaccompanied with that of *falling*); *second*, that the modifying causes of the *observed phenomena* may be better understood; and, finally, because in the astronomic phenomena (precession, etc.) the theory (the earth's crust considered rigid) absolutely applies, though even they have been subjected to the same objectionable reasoning.

§ Were it not for the thread support, the *natural* gyration would be *in the same* direction; clearly showing that the gyration *now* observed is due to friction of the axle on its point of support in the ring.

force which supports it. Did the axles of the top terminate in a mathematical point, and were the horizontal surface on which it spins a true plane, and *perfectly* hard and smooth, the centre of gravity of the top would be ever in the same vertical line, and its point would *gyrate*, describing on the surface an epicycloid; that is, the minute cycloidal arcs of Fig. 3 would be superposed externally on the periphery of a circle described round the projection G″ on the surface, of the centre of gravity. This is never the

FIG. 7.

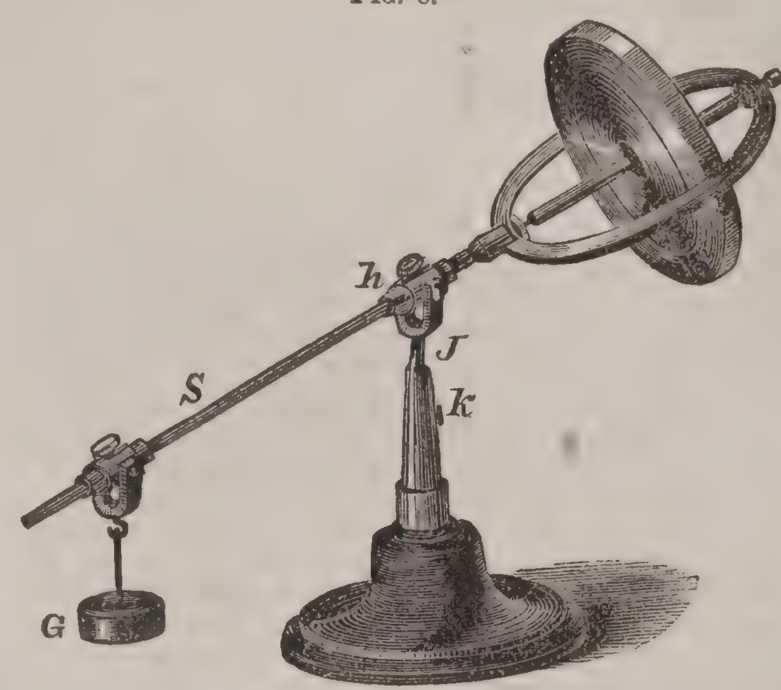


case of reality. It will be found, however, that the more perfectly pointed the top is, and the harder and smoother the surface, the less will be the tendency to *rise*. This rising is due to the (more or less) *rounded* point rolling (with friction) on the surface, and thus increasing the angular motion of the axle, by which the upward *deflecting force* is made greater than the downward force of gravity, and the top gradually rises to a motionless spinning in a vertical position.

From the minute motions of this child's toy, or of the *gyroscope*, to the grand phenomena exhibited in the heavens —the "precession of the equinoxes"—there seems an *incommensurable* stride; yet as mechanical phenomena they are essentially identical. The earth is a rotating solid of revolution. It is *oblate*—that is, flattened—at the poles, and protuberant around the equator. The ring of protuberant matter is more strongly attracted on the side nearest the sun or moon than on the more remote side; hence, the tendency of solar or lunar attraction to *tilt* or pull down the equator into the plane of the sun's (or moon's) orbit. The result is, just as in the case of the gyroscope, *gyration* around the direction of the disturbing force. But these directions are, owing to the orbital motions of the sun and moon, constantly changing, and hence, also, the direction of the resulting gyrations. Regarding the earth as a solid of revolution rotating about its axis, the fixed point of which is the centre of inertia, and acted upon by the disturbing or tilting action of the sun or moon, and integrating the elementary gyrations for each momentary direction of the tilting force (*Smithsonian Contributions*, vol. xix.), I obtain the known formulæ for "precession" and "nutation." The latter term (as understood in astronomy) is the "nodding" or undulatory motion of the "precession" produced by the moon, and is due to the slight obliquity of the moon's orbit to the plane of the ecliptic, to the revolution of the nodes of which its "period" ($18\frac{2}{3}$ years) corresponds. In this connection it is interesting to remark that if there were a solid ring having the mean radius of the moon's orbit, and having the same inclination to the ecliptic (about 5°) as the actual orbit, and did this ring revolve about the earth (at its centre) with the mean velocity of the moon's orbital motion, the attraction of the sun would cause *gyration* of the plane of the ring, or, in other words, regressive motion of its nodes. Calculated in this way, the period would be about $17\frac{4}{5}$ years. It is actually (as just stated) $18\frac{2}{3}$ years. Nevertheless, the actual and the hypothetical phenomena are not identical in their *rationale*—a remark the more necessary since a gyroscopic ring has been invented to illustrate and explain mechanically the regression of the moon's nodes; and on the other hand a solid "girdle of moons" "clasping" the earth has been invoked (*Cyclo. of Phys. Science*) to explain the earth's precession.

Before closing this article a brief allusion will be made to some of the forms and applications of gyroscopic instruments. The original Bohnenberger machine (Fig. 1) has been already depicted, and mention made of the more complex instrument called the rotascope invented by Prof. Johnson. Another form (Fig. 8) is the apparatus introduced by Fessel (*Pogg. Ann.*, vol. xc. pp. 175 and 351). The prolonged stem S, and the movable counterweight G (with both of which we are familiar in our common instruments) serve only to vary the experiments. If the counterweight

FIG. 8.



is placed so near the fulcrum that the weight of the disk and ring preponderate, gyration will ensue, as in the case of Fig. 2; but slower, since the weight of the latter is partly counterbalanced. If the weight is so far removed as to preponderate, gyration in the reverse direction will ensue, since, through the preponderating counterweight, gravity tends to *lift* (instead of to pull down) the rotating disk. Let, now, the weight be placed so as exactly to balance the disk and ring; no gyration will be observed. The weight and a portion of the prolonged stem S can be removed, and then we have *essentially* the gyroscope of Fig. 2; with this difference, however, that instead of a mere pointed end to the standard B, there is introduced the fork J (Fig. 8), the vertical stem of which turns freely in the standard, while the prongs hold the trunnions of the band or socket *h* through which the stem S is introduced and clamped. By this arrangement free angular motion is permitted, while at the same time the disk and ring are always firmly connected with the standard, and cannot "fly off," as they often, and damagingly to surrounding objects, do, from the common gyroscope. The machine illustrates (as already mentioned) another property, which has been announced as a discovery of experiment, but which theoretical investigation without experiment affirmed—viz. that by simply *preventing gyration* (by means of the clamp-screw *k* which fixes the axle J) the disk and ring *fall* "as if no rotary motion existed." An improvement on this instrument—a much more complicated and elaborate apparatus—is that of Dr. Franz Heinen of Brunswick (1857). As, however, all the essential properties are sufficiently exemplified by the instruments mentioned, the description and diagram are omitted. As before remarked, this instrument illustrates the exhibition under certain conditions of the *curtate* cycloid of Fig. 3.

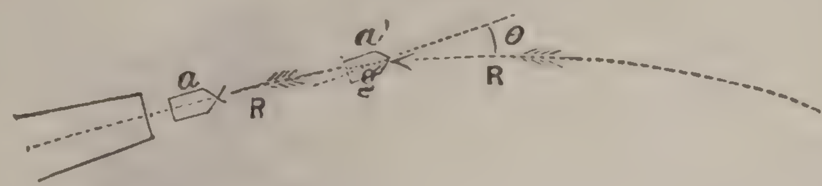
Another form of gyroscope is that designed by Dr. Magnus of Berlin to illustrate the causes of the "deviation" of oblong rifle projectiles.* It is a familiar fact that the rotation given to the projectile by the rifling or grooves of the barrel is indispensable to the maintenance of axial direction in the projectile; without it the oblong shot *tumbles* and flies wildly. But it has also been shown that this stability against disturbing forces is not absolute, but is necessarily accompanied with a slow gyratory motion. The elongated projectile is discharged from the piece with its axis coinciding with its trajectory, but, through the action of gravity, the trajectory deflects from its original direction and from that of the axis. In consequence of this, the resistance of the air acts obliquely to the axis, and, with the ordinary forms of elongated projectiles, its resultant passes above the centre of inertia, tending to raise the point; and from this results the angular motion of the axis to the right if the rotation is to the right—to the *left* in the contrary case.

The machine of Dr. Magnus is merely a Bohnenberger with a solid of revolution, in the general form of a rifle projectile, substituted for the spheroid. By directing upon it, obliquely to the direction of the axis of rotating body, a current of air, a pressure results, the resultant of which will not in general pass through the centre of gravity. Instead of the tilting which would ensue were there no

* Dr. Magnus also designed what he called a "polytrope," having two rotating disks. All that is *essential* to the gyroscope is illustrated by instruments described, and, as in the case of the far more interesting machine of Prof. Johnson, particular description is here out of place.

rotation, a slow horizontal gyration will be observed. In the real projectile (Fig. 9) we have, likewise, the essential

FIG. 9.



conditions of gyration—viz. a solid of revolution revolving rapidly about its axis, and a dynamic "couple" (*i. e.* the inertia of the projectile's motion of translation acting through its centre of gravity, and the resistance of the air acting through a point of the axis more or less distant from g), tending to turn the projectile upward about a horizontal axis through g; and this produces instead an elementary gyration about a line through g, parallel to R (the atmospheric resistance). If this line retained an invariable direction, the integral effect of these elementary gyrations would be to revolve *down* the axis of the projectile, and we should ultimately find it assuming horizontal and even sub-horizontal directions. But such cannot be the case; the direction of the axis is no sooner deviated, *laterally*, from its original direction than a (nearly) corresponding change takes place in the direction of the resistance R (since from the elongated form of the projectile the direction of its motion follows pretty nearly that of its axis), and in that of the line (parallel to R) about which gyration takes place. The integral of such a series of elementary gyrations is angular motion about a line perpendicular to the plane in which that line shifts direction—that is, about a vertical. Hence, the vertical direction (or "elevation") of the axis of the projectile remains constant, or nearly so, while its horizontal direction undergoes a small progressive azimuthal motion.

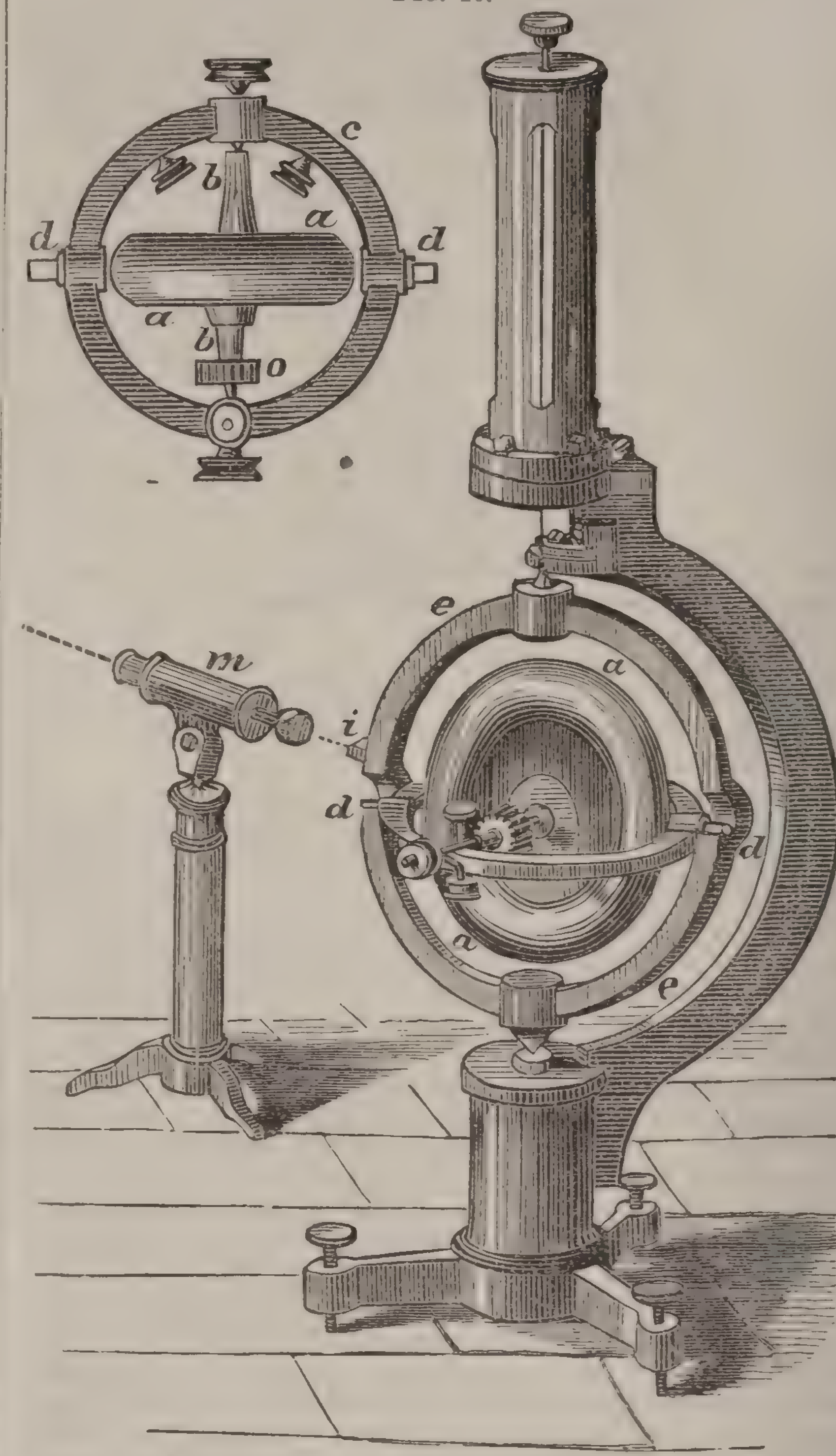
Friction of the air is sometimes assigned as the cause of deviation. It has influence, doubtless; but "deviation" sometimes is the contrary of what would be produced by it; *e. g.* Dr. Magnus states that a cylindrical projectile is found to deviate *to the left*, when, the twist being to the right, the deviation due to friction *should* be to the right. In the want of accurate observation, and in the diversity with which the problem presents itself with different forms of projectile,* no precise statement of actual results can be ventured upon. Dr. Magnus asserts that the axis of the projectile is generally found to be in direction of the tangent to the trajectory. Proof is wanting,† and, however deviated from original direction, it is little probable that the dictum is precisely exact. Possibly, the downward gyration may sometimes be more rapid than the horizontal shifting of the line of direction, and greater or less depression may ensue. The material fact is, that, by Dr. Magnus's apparatus and by theory, deviation *is accounted for*. His paper (translated by Rieffel, Paris, 1863) amounts to little more than this. The theory herein given is believed to be a nearly true expression of the main features of the phenomena.

A more interesting—the *most* interesting—application of the gyroscope is that into which the Bohnenberger machine was modified by the late M. Foucault, and (in allusion to its functions) named the GYROSCOPE. It depends on the principle that the plane of a rapidly-rotating disk, perfectly free to take any position about its centre of inertia, will retain uniformity of direction however that *centre* may move or be moved; that the otherwise sensible effects of slight disturbing forces (friction, etc.) will be transformed into comparatively insensible *gyration*, and thus minimized.

"The tall figure shows the gyroscope in supposed action, the frame $e\ e$ being suspended at the top by a simple thread passing through the upright cylinder, and resting at its bottom on a very fine point placed in an agate cup. Within the frame e the detached frame $c\ c$ may be laid at any time, so that the knife-edges $d\ d$ rest on hard plates; the rotation-disk $a\ a$ may be put into rapid rotation by a separate machine, and placed in that state of rapid motion within $e\ e$, where, by the suspension, and by the knife-edge bearings, it will have perfect freedom of motion."

"Suppose, now, that a graduated slip on the edge of the apparatus is examined through the telescope m; it is clear that if the earth be at rest, the same graduated line will continue under the spectator's eye at the telescope. But if the earth is rotating, and carrying the gyroscope along with it, the revolving ring cannot remain in its original relation to the telescope, just because its displacement by the

FIG. 10.



earth would, if it did so, *change the direction of the plane in space in which the ring revolves*. The graduated slip will therefore move in the telescope; and the observer will discern the different lines of graduation passing regularly under his eye, exactly as a star moves across the field of view of a transit instrument."

The same ingenious inventor had previously applied the pendulum to the same effect—*i. e.* the ocular exhibition of the earth's rotation. Widely different as these two experiments seem to be, their radical identity has been demonstrated by the writer in vol. xix. *Smithsonian Contributions* ("The Pendulum and Gyroscope as exhibiting the Rotation of the Earth"). By these experiments the "direct proof" desiderated by Laplace has been furnished, and the earth's rotation, long since taken from the category of "admirable hypotheses," has become not only an established, but an *observed* fact.

Of *practical* applications, other than to these illustrative experiments, the gyroscope as yet has none; unless indeed the successful application of rotation to elongated projectiles, which has been the means of the greatest stride of advance in the effectiveness of modern firearms, be considered such. An attempt to utilize it to giving steadiness to the telescope in observing the eclipses of Jupiter's satellites was made in 1855 by Prof. C. Piazzi Smyth (astronomer-royal of Scotland); and the Russian government has made some researches in this way, with no successful result. It is as a beautiful illustration of the truth (just where it *seems* to our senses to be contradicted) of the received law of mechanics, that the gyroscope asserts its claim to consideration; and it would require a useless array of words to explain why more "practical" uses need not be anticipated.‡ J. G. BARNARD, *U. S. Army*.

Gyula, town of Hungary, on the White Körös, which divides it into German and Magyar parts. It is a handsome old town, with considerable trade in cattle. Pop. 18,495.

*Col. Benton, U. S. ordnance corps, observed with a Magnus instrument that when the air impinged with less than about 10° obliquity (rotation being right-handed) the deviation was to the right—greater than 10° to the left; the reason being that the different presentations of the model to the current caused a shifting of the resultant resistance from *above* to *below* the centre of gravity. Similar *apparent* anomalies may present themselves with actual projectiles. (*See next note.*)

†The theory of Thiroux assumes the axis of the ball is depressed below the trajectory; that of Panot, that the direction is unchanged.

‡Concerning an "invention" of Mr. Bessemer (and the proposed modifications) of a gyroscopic machine to regulate the controlling valves of his "suspended saloon," see *Engineering*, Oct. 9 and 30, 1874, and *Van Nostrand's Eng. Mag.*, Apr., 1875.

H.

H, a consonant, the eighth in order of the letters of our alphabet. Ordinarily, it is a simple aspiration or rough breathing in our language. In some words it is quite silent. With *t* it forms two digraphs, *th* soft and hard. With *c* it forms three such digraphs, and with *g* one; *gh* being, however, in English ordinarily a *g* pronounced as if hard, when from position, without the *h*, it would be soft. H in chemistry stands for hydrogen.

H, in German music, is used as the designation of B natural. H dur, when indicating a key, is the major key of B natural; and H moll is B natural minor.

Haar'lem, city of the Netherlands, in the province of North Holland, on the Spaarne. It is a well-built and extremely neat city, with several interesting buildings, as, for instance, St. Bavon's Kerk, with its world-famous organ. It has many collections of consequence to science and art, good educational institutions, and considerable manufactures of velvet, silk, linen, carpet, and lace. It is the centre of the trade in flowers, bulbs, and flower-seeds, which is a great specialty of Dutch enterprise, and which here has assumed astonishing dimensions. Close by is the beautiful Haarlem-Hout, with the royal palace, Welgeleque, which is a much frequented summer resort for people from Haarlem and Amsterdam. It has a Roman Catholic and a Jansenist bishop. Pop. 32,156.

Haarlem Lake, Holland (no longer existing), was contiguous to the city of that name. A map of the date of 1531 shows within the area afterwards covered by it, which was traversed by two highways, four small lakes and three flourishing villages; the combined area of the lakes was about 6000 hectares (15,000 acres). In 1591 one of these villages had disappeared, and so in 1647 had the other two, and the four lakes had united into one, to which the name which had belonged to that one nearest the city of Haarlem attached, and which thus gained its ultimate fame. But its dimensions continued to increase by encroachment on the bordering land, particularly towards the N. and E., and in the early part of the century had acquired an area of 18,000 hectares (45,000 acres). All this process seems to have been due to want of adequate means of artificial drainage, the surface, as is that of so much of Holland, being lower than the sea-level. With such an area, and a perimeter of more than 30 miles, every tempest caused new encroachments, and the danger to some of the adjacent regions became very great. Long before, projects of drainage had been proposed and discussed. The realization grew more and more urgent, and in 1839 the Dutch government inaugurated the great work, finally completed in 1852, the history of which forms one of the most interesting narratives of engineering works of that kind. It has been described in various professional works. Reference may be made to *Civil Engineer and Architect's Journal* (1851–52); *Journal des Ponts et Chaussées* (1842, 1846, 1863); more especially to the work of M. Gevers d'Eude-geest, *Du Dessechement du Lac de Haarlem.*

J. G. Barnard, *U. S. Army.*

Hab'akkuk [Heb., "loving embrace" or "embracer"], the eighth of the twelve minor prophets of the Old Testament. Apparently (iii. 19), he was a Lévite, and he is thought to have prophesied during the reign of Josiah (639–609 B. C.), Delitzsch supposes about the year 630 or 629 B. C. As Nahum denounces the Assyrians, who had already crushed the kingdom of Israel, so Habakkuk denounces the Chaldeans, who are about to crush the kingdom of Judah. The third chapter, which has been called a "Pindaric ode," is one of the sublimest compositions ever penned. *The History of Bel and the Dragon*, an apocryphal addition to the book of Daniel, is, in the Septuagint, ascribed to "Habakkuk, the son of Joshua, of the tribe of Levi," thought by some to be identical with the prophet.

R. D. Hitchcock.

Habeas Corpus [Lat. "You may have the body"], in law, a writ issuing out of a court of justice, or awarded by a judge in vacation, with the view of bringing a person before the court or judge to be dealt with according to law. There are several writs passing by this name with words added, more specifically to denote their application, such as: (1) *Habeas corpus ad faciendum et recipiendum;* (2) *ad prosequendum;* (3) *ad respondendum;* (4) *ad satisfaciendum;* (5) *ad subjiciendum;* (6) *ad testificandum.* The office of the first of these is to remove, on the application of a defendant, a cause from an inferior to a superior court; of the second, to remove a prisoner to be tried within the jurisdiction where an alleged act was committed; of the third, on the part of a suitor, to remove a cause of action to a higher court; of the fourth, after judgment, to charge a person in a superior court, with process of execution; of the fifth, to bring up a person detained by another, with a view of inquiring into the cause of detention; and of the sixth, to bring a witness who is in custody at the time of a trial into court. Of these the last two are much the most important. The fifth, as above enumerated, is the great writ of *habeas corpus,* of so much importance to the liberty of the individual both in England and in this country. The residue of this article will be confined to this writ, with the exception of a few words as to the *habeas corpus ad testificandum.*

The writ of habeas corpus is called in the English law a "writ of right." By this is meant that the party in confinement, on making a proper case, is entitled to it. It is, accordingly, only issued on a proper foundation of proof. It is necessary that there should be an affidavit and motion for an allowance of the writ. When these steps are taken, the right of the prisoner is fixed. The writ is said by some jurists to be based on the well-known clause in Magna Charta that "no freeman is to be deprived of his life, liberty, and property except by the judgment of his peers and the law of the land." The subject will be treated under the following principal divisions: I. History of the writ and of the statutes affecting it; II. Its general effect; III. Procedure; IV. Relation of the States to the U. S. courts; V. Power of U. S. courts to issue the writ.

I. At the common law the writ issued from the court of king's (or queen's) bench, not only while the court was in session (or in "term-time"), but also in the vacation, by an order from one of the justices. In the latter case it was made returnable either before the judge who issued it or before the full court. The other great common-law courts (viz. the common pleas and exchequer) did not originally have general power to issue the writ, but only in special cases. It was supposed at one time that the lord chancellor had no power to grant the writ in vacation, though the law is now settled to the contrary. A serious controversy arose in England in the reign of Charles I. upon the point whether a return to a writ of *habeas corpus* by the warden of the Fleet prison was legally sufficient, which set forth that the prisoners were detained by a warrant from the privy council, setting forth no particular cause of imprisonment, but that they were committed by the special command of the king. The counsel for the prisoners insisted that the council was bound as much as any petty magistrate to assign a sufficient cause for commitment. The decision of the judges was in favor of the legality of the warrant. The effect of this decision was that every statute from the time of Magna Charta designed to protect personal liberty was practically nullified, since it was only necessary, in order to avoid their effect, to insert in the warrant the words "by the special mandate of the king." This servile action of the bench so aroused the nation that an act affecting the subject was passed in the same reign, the famous "petition of right," 16 Charles I. ch. 10, sec. 8. This statute, among other things, provided that where a person was committed by the king or his privy council, he should have a writ of *habeas corpus* upon demand or motion made to the *court* of king's bench or common pleas. A close construction was put upon this statute by the judges, who declined to award the writ (*ad subjiciendum*) in vacation. At a later day, for the purpose of furnishing a more complete remedy, the famous *habeas corpus* act was passed (31 Car. II. c. 2). This act is frequently termed "Lord Shaftesbury's act," its enactment having been due largely to the exertions of that distinguished statesman. It is said to have been carried through the House of Lords by a mere artifice. Bishop Burnet gives the following account of it in his *History of his Own Times:* "Lords Gray and Norreys were named to be the tellers. Lord Norreys, being a man subject to vapors, was not at all times attentive to what he was doing, so, a very fat lord coming in, Lord Gray counted him for ten, as a jest at first; but seeing Lord Norreys had not observed it, he went on with this misreckoning of ten, so it was reported to the house, and declared that they who were for the bill were the majority, though it indeed went on the other side." (Vol. ii. p. 256, Oxford ed., 1833.) This story is corroborated by a note by Speaker

Onslow and adopted by Lord Mahon in his *History of England* (ed. 1858, Murray, Lond., vol. iv. p. 125. See also Cooke's *Life of Shaftesbury*, 220, ed. 1836). The last-named work adds that when the numbers were reported from the wool-sack, the ministry, who knew their strength, were surprised; and whilst they were whispering to one another, Lord Shaftesbury, who found there was a mistake and guessed their intentions, immediately started up and spoke upon the first thing that occurred to him almost an hour. Whilst he was speaking several lords went out and others came in, so that it was impracticable to retell the house, and by this means the bill was carried. This great act was an important contribution to English constitutional law, as it tended to render more effectual rights whose existence had long been recognized, but which had hitherto been imperfectly vindicated. This statute has had much influence upon American legislation, and the substance of it will be briefly stated. It is applicable to persons committed and charged with *crime*, and therefore does not embrace all the cases in which there may be an unlawful detention. The act provides that, with certain exceptions, when any person is charged with crime, a judge, in vacation, on viewing a copy of the warrant, shall award the writ, returnable either before himself or any other of the judges, and if the case is bailable shall discharge the prisoner on proper security being given. The prisoner is required to be brought up within a limited time, not exceeding twenty days. Heavy fines are imposed upon the judge for refusing to award the writ upon a proper case being made, as well as upon the officer or keeper of the prisoner neglecting to make return or evading the mandate of the judge; similar provisions are made for punishment of one causing, after discharge, a recommitment of the prisoner for the same offence. The writ was made to run into all counties palatine and privileged places. There are also clauses providing for the prisoner's discharge unless he is speedily indicted and tried after indictment. There is also a heavy penalty imposed upon any one sending a person as a prisoner out of England, unless in cases of transportation for crime, etc. The *habeas corpus* act of Charles II. was seriously defective in one respect: it only applied to persons arrested on *criminal* charge. In the year 1757 an instance occurred of a gentleman being by some mistake pressed as a foot-soldier, whereupon his friends, on applying for the writ, found that the case did not come within the act. This led to the introduction of a bill into Parliament extending the act to other cases of confinement besides those resulting from a charge of crime. Though the bill passed the House of Commons, it was defeated in the House of Lords under the lead of the great Lord Hardwicke, and it was not until the year 1816 (56 Geo. III. c. 108) that this obvious defect in the law was supplied and the writ in other respects made more effective.

Legislation in general in the U. S., while following the spirit of the English act, is not confined to commitments on criminal charges, but is more comprehensive in its character, and extends beneficial provisions to all arrests and detentions on any grounds or pretexts whatsoever. There is a clause in the U. S. Constitution and in State constitutions to the effect that "the privilege of the writ of *habeas corpus* shall not be suspended unless when, in cases of rebellion or invasion, the public safety may require it." The effect of this clause was much discussed in the late civil war, the President of the U. S. having on the 27th of Apr., 1861, addressed to Lieutenant-General Scott an order authorizing him, under certain contingencies, to suspend the writ. Other orders of a similar nature were issued. One Merryman having been arrested on May 25, 1867, charged with various acts of treason, the general having him in charge refused to comply with the writ, as well as to yield to an attachment issued for its enforcement, on the ground of its suspension by the President. Chief-justice Taney, who had issued the writ, filed an opinion denying the President's authority, and insisting that the power of suspension was vested solely in Congress. (9 Am. Law Register, N. S., 527.) This view is supported by the opinion of Deady in the case of *McCall* v. *McDowell*, 1 Abb. U. S. 112, and of Smalley in *Ex parte Field*, 5 Blatchford 63. These views of the judges referred to have been distinctly controverted by able jurists in pamphlets and professional opinions. Among these may be mentioned the venerable Horace Binney of Philadelphia, Reverdy Johnson, Prof. Theophilus Parsons, etc. Congress passed an act upon this subject Mar. 3, 1863, authorizing the President to suspend the writ. (12 U. S. Statutes at Large, 282. See also ch. 22 Laws of 1871, sec. 4; 17 U. S. Stat. 15.) A proclamation by the President, issued Oct. 17, 1871, under the last-named act, will be found in 17 U. S. Stat. Appendix No. 4, and another in Appendix No. 7, issued Nov. 10, 1871. It would seem that the current of judicial and professional opinion is in favor of the view that the power of suspension under this constitutional provision is vested in Congress rather than in the President.

II. The general scope and office of the writ is to bring before a court or judge the question whether the person in whose behalf it is issued is lawfully detained. The cases coming before the court, etc. will be divisible into two principal classes, one where the person is simply detained without any legal process, and the other where he is in custody under such process. The first class of cases is illustrated by that of a contest between a father and a mother as to the custody of a child. There being no legal process in such a case, there must be an inquiry embracing the merits of the whole controversy for the sake of determining to whom the custody of the child shall be awarded. Wholly different considerations occur when the detention is upon legal process. The point then may be whether the legal proceedings were not wholly void because the court instituting them had no jurisdiction, or whether, assuming that the tribunal had jurisdiction, it was proceeding irregularly, or if all the proceedings were regular whether the merits of the controversy can be considered. There will thus be three principal points to be examined: (1) The right upon a writ of habeas corpus to relieve from detention where the process is issued by a court or magistrate having no jurisdiction; (2) where jurisdiction exists, but the proceedings are irregular; and (3) cases where there is an entire regularity of proceeding and the claim is made that the merits of the case shall be considered.

(1) Where the court or magistrate has no jurisdiction over the subject matter or the person, the prisoner may be relieved by this writ even though there may have been a final judgment, and though the court may have been one of high jurisdiction. So, if it had no power to dispose of the particular question in the mode that it pursued, its judgment is a mere nullity. In the eye of reason there has been no decision and no judgment, no matter though legal forms may have been pursued. Thus, if a court had only power to sentence to imprisonment, and it rendered judgment of death, a writ of *habeas corpus* might be resorted to. It may be said that this is a dangerous doctrine. While this is readily conceded, its soundness cannot be denied. Judicial as well as administrative power has its limits. If these are exceeded by a court, its pretended decision is no judgment; it is but waste paper, and may be disregarded. Great caution should be observed in reaching a conclusion that the judgment is a nullity. If, however, it be clear that jurisdiction is exceeded, there is no more reason why a prisoner held under such a void judgment should be detained than that property seized under a similar void proceeding should be sacrificed. The writ of *habeas corpus* is a legitimate mode of showing the nullity of the judgment and of relieving from the false imprisonment. This subject has recently been extensively considered by the Supreme Court of the U. S. in the case of *Ex parte Lange*, 18 Wallace's Reports, 163.

(2) In the second class of cases (where the court has jurisdiction over the subject in the way that it is presented for its action, but it is proceeding in an irregular manner), it will not necessarily follow that a prisoner will be discharged by the writ. If the proceedings be of a summary nature, and it appears upon the face of them that some essential step or form has been omitted, they will be void and the prisoner will be discharged. Thus, if a fugitive from justice were demanded by way of extradition (see EXTRADITION), the regularity of the proceedings might be tested by means of a writ of *habeas corpus*. It has, however, been maintained by some jurists that if the warrant or other process is sufficient to protect the officer who executes it from an action of false imprisonment, a discharge will not be made. In many cases where a court has jurisdiction over the subject-matter and of the person, the only mode of taking advantage of an irregularity in the proceedings is by a motion addressed to the court itself in the very proceeding complained of. In other words, the writ of *habeas corpus*, an independent method of review, is not to be resorted to, but the mode of correcting the irregularity is to be found in addressing the very tribunal before which it takes place, and asking it so to mould and correct its own procedure as to make it conform to the rules of law; and if such correction is refused, resort may perhaps be had to an appellate court.

(3) Where the case is regularly before a court, the writ under consideration cannot be used to determine the merits of the controversy. This point will only be considered in detail in connection with the administration of criminal law. When a prisoner is charged with crime, the common practice is to bring him before a magistrate, *e. g.*, a justice of the peace, and to make an inquiry into the circumstances which are supposed to establish his guilt. This is not a trial, but a preliminary proceeding devised for the purpose of securing his attendance at the trial. The testimony of

witnesses is taken down in writing by the magistrate; on this he proceeds in making his commitment. The writ of *habeas corpus* may be resorted to with the view of testing its validity, and the court may, in connection with a *certiorari*, consider whether the testimony, as shown in the depositions, supplied a sufficient basis for the action of the magistrate, as well as whether the commitment itself is sufficient in point of legal form. No inquiry can be had even at this stage as to the guilt or innocence of the prisoner. To do that would be to examine the case on its merits. Let it now be assumed that an indictment (see INDICTMENT) has been found. The writ of *habeas corpus* cannot be used to inquire into the depositions before the committing magistrate. These are shut out of view by the indictment; the prisoner is now held upon that. The only question that can be examined is, whether the indictment itself is sufficient in point of form. If that be regular, the court or judge will not go beyond the indictment to inquire into the merits; if it would, trial by jury might be practically abolished. The writ of *habeas corpus* accomplishes its beneficent purposes by securing the prisoner so far that he is not to be held without *apparent* cause. Whether he is in fact guilty or innocent can only be determined by a regular course of trial. The prisoner may be allowed, in certain cases, to go at large on bail, notwithstanding that the proceedings are valid. The statutes of the respective States must be consulted upon this point. (See BAIL.)

III. *Procedure.*—Application for the writ must be made by petition signed by the party or some one in his behalf. In the well-known case of *Ashby* v. *White*, in Parliament, it was resolved "that every Englishman who is imprisoned by any authority whatsoever has an undoubted right, by his agents or *friends*, to apply for and obtain a writ of *habeas corpus* in order to procure his liberty by due course of law." A father claiming the custody of an infant child may himself apply for the writ. Statutory provisions in some States lead to the view that if the petition is properly drawn, the writ must be granted, even though there is good reason to believe that it would be without practical effect; in other words, it must be granted where there is but slight apparent ground for asking for it. The form of petition is also in some States prescribed by statute. It may be directed to any one who has the prisoner in custody or who has participated in the illegal detention. The writ is made returnable at a specified time and place, either before the officer who issues it, at chambers (see CHAMBERS), or to the court as such. The person to whom the writ is directed is expected at the appointed time to make a "return," or a statement of the grounds on which the detention is made. This must be distinct and unequivocal. It would not be enough, for example, to state that the prisoner is not in the defendant's *custody*, but it must be made to appear that he is not under his control, so that he could respond to the requirements of the writ. If the return be evasive or otherwise imperfect, an amendment of it may be allowed. Formerly, the prisoner could make no denial of the truth of the matters alleged in the return. If that furnished a sufficient excuse for the imprisonment, though it were wholly unfounded in point of fact, the prisoner must be remanded. The only remedy of the prisoner was to bring an action for damages for any injury sustained by him for the false return. In some cases criminal proceedings might be instituted. This serious defect in the administration of justice has been remedied by modern statutes, and the prisoner has been allowed to deny the statements of his custodian, or, in legal phrase, to "traverse the return," and also to set up any facts arising subsequently which may make in his favor. The judge or court disposing of the writ may thus have to consider both questions of fact and of law, the matters of fact being presented by way of affidavit or affirmation. If the return is not made or is evasive, the party to whom it is addressed may be regarded as having committed a contempt of court, and will be liable to be placed in close custody until he obeys the writ. On the hearing of the case, the prisoner, if the circumstances require it, may be discharged, or may be remanded to the original custody. The decision does not, as it would seem, necessarily prevent the hearing of the matter again upon a new writ, particularly where the circumstances of the case have changed. Thus, if the custody of a child were awarded to one of its parents at a given time, the facts might be so changed as to make it proper that, on a new application, it should be awarded to the other. Severe penalties are imposed by law upon a ministerial officer who knowingly recommits a prisoner for the same cause as that on account of which he was discharged. Allusion may be made in this connection to another writ existing at common law in favor of personal liberty, *de homine replegiando* (replevying a man). This raises a question to be tried by a jury; while the proceedings in a *habeas corpus* take place before a judge or court. The former writ has become practically obsolete.

IV. Conflicts of jurisdiction have arisen frequently in executing writs of *habeas corpus* between the State and the Federal courts. The principles that should apply to the subject have recently been expounded by the final interpreter of the U. S. Constitution, the supreme court (*Tarble's Case*, 13 Wallace Reports, 397). It is there said that no State judge has a right to issue a writ of *habeas corpus* for the discharge of a person held under the authority of the Federal government. If it do not appear, upon application for such a writ, that the person is so held, the State judge may inquire into the circumstances of the case as to how the prisoner is held, and the marshal in whose custody the party is should give the requisite information. These principles were applied to a case in which the commissioner of a State court issued a warrant to a recruiting officer of the U. S. to discharge a minor who had enlisted in the service of the U. S. It was decided that the commissioner had no jurisdiction, the prisoner being detained under the authority of the Federal government. The proper course in such a case is that the U. S. officer upon whom the writ is served should produce the body of the prisoner before the State court and set forth in what manner he holds him under the authority of the U. S. The State court or judge should go no farther. By this decision the relations of the two governments as to this writ must be regarded as authoritatively settled.

V. The power of the U. S. courts to issue the writ is more limited than that of the State courts, being confined to the exercise of such authority as is either expressly or by implication conferred by the U. S. Constitution and the laws made under its provisions. The courts and judges of the U. S. are authorized to issue the writ in cases coming within Federal jurisdiction. The *circuit* court may inquire into the cause of a commitment, and except when the privilege of the writ is suspended may determine the question whether the prisoner is entitled to be discharged. Thus, this court may by this means, where the circumstances of the case require it, discharge a prisoner held under a warrant of extradition (see EXTRADITION) issued by the governor of a State. The writ, however, cannot be issued to bring up any person *confined in jail* unless held under or by color of the authority of the U. S., or unless such person is required to testify in a cause depending in a court of the U. S. Neither a court of the U. S., nor any judge thereof, under these rules can issue the writ to bring up a prisoner in custody under a sentence or execution of a State court for any other purpose than to be used as a witness. When a prisoner is taken by an order of a U. S. court from a State court to be used as a witness, its authority continues so as to send him back, after his testimony is taken, to the place from which he was brought. In cases coming within the purview of the U. S. Constitution and the laws of Congress it has been said that relief may be granted not only to those held under legal process, but also to such as are confined without any formal appearance of authority; as, for example, where the prisoner and the defendant are citizens of different States, or where a master, before the abolition of slavery, demanded the return of slaves taken from him by force. The *Supreme* Court of the U. S. has not the same power to issue the writ in question as the circuit court. It can only exercise the power in an appellate form, as its original jurisdiction is limited to specific cases. (See JURISDICTION.) It may accordingly issue the writ, where the circumstances of the case require it, when a person is imprisoned under the order or warrant of a court of the U. S. It does not by this means review decisions made at chambers (see CHAMBERS) by a justice of the court.

Further information upon the general subject of the writ will be found in Hurd's treatise on *Habeas Corpus*, and in an elaborate note written by the late Nicholas Hill of Albany and published in vol. iii. of his *Reports*, pp. 647–676; also in Blackstone's Kent's *Commentaries*, Story, Rawle, Paschal, and Pomeroy on the *U. S. Constitution*, and in the digests and decisions of the Federal and State courts. (See also Hallam's *Constitutional History* for historical information.)

A word is added as to the writ *ad testificandum*. This is resorted to for the purpose of bringing up a person who is in custody to testify in some cause or other matter pending judicially. When his testimony is given in, he is returned to the custody from which he is taken. The writ is obtained upon motion based upon an affidavit setting forth the facts upon which the application is founded. A legislative body, *e. g.*, the House of Representatives, desiring the attendance of a witness at the time in custody, simply executes its will by the warrant of its Speaker, giving authority to its sergeant-at-arms to produce the prisoner. The writ of *habeas corpus ad testificandum* cannot in such a case be resorted to.

T. W. DWIGHT.

Haber'geon, a coat of chain-mail without sleeves, or in later times a suit of plate armor worn over the hauberk.

Hab'ersham, county in the N. E. of Georgia, bordering on South Carolina. Area, 450 square miles. It is mountainous and well watered. Gold and iron are found abundantly, and rubies, diamonds, and other precious stones have been found. The scenery is generally fine. The staple products are corn and tobacco. Cap. Clarkesville. Pop. 6322.

Habersham (Col. Joseph), b. at Savannah, Ga., July 28, 1751; was eminent throughout the Revolutionary war, and at its close held the rank of lieutenant-colonel. He became Speaker of the assembly in 1785, and again in 1790. He was appointed postmaster-general by Washington in 1795. D. at Savannah, Ga., Nov. 17, 1815.

Habersham (Joseph Clay), M. D., was b. in Savannah, Ga., Nov. 18, 1790; d. there Nov. 2, 1855. He took his literary diploma at Princeton, N. J., and his professional from the University of Pennsylvania in 1814. Commencing the practice of medicine in Savannah in 1815, he continued to the date of his death in active business. He was at one time health officer of Savannah, president of the Medical Society of Georgia, and well known for his benevolence and love of science. Paul F. Eve.

Habersham (Richard W.), b. in Savannah, Ga., in 1786; graduated at Princeton, N. J., in 1805; rose to distinction at the bar in his native city; occupied many positions of high official trust in the State; was member of Congress 1839–43; was greatly lauded for resigning the office of U. S. district attorney in 1825, when there was a threatened collision between the Federal administration of John Quincy Adams and the State administration of George M. Troup. D. in Habersham co., Ga., Dec. 2, 1846. A. H. Stephens.

Hab'ington (William), b. at Hindlip, Worcestershire, England, Nov. 5, 1605, of an old Roman Catholic family; was educated at St. Omer in France; married Lucy Herbert ("Castara"), the daughter of Lord Powis, and lived chiefly on his ancestral estate at Hindlip, where he d. Nov. 13, 1645. He is chiefly remembered for his *Castara* (1634), a collection of poems addressed mostly to his wife, and remarkable for their pure and elevated sentiment and for their occasional quaint and far-fetched conceits. The *History of Edward IV.* is believed to have been his father's work. He wrote also the *Queene of Aragon*, a play.

Hab'it [Lat. *habitus*, a "condition;" Gr. ἕξις], a constitution or state of mind or body which disposes one to certain acts or conditions, mental or physical. A habit is of more fixed character than a *disposition*, but is generically the same. There are habits intellectual and moral, acquired and inherited, active and passive. Habits are originally the results of voluntary acts, but the control of them may become impossible to the will. A wise and skilful formation of habits may be of the greatest moral and intellectual advantage, whilst habits injudiciously formed may be destructive of mind, character, body, and estate. The question of habit is intimately connected with that of the Association of Ideas (which see).

Hack'berry, Sugar-berry, or **Nettle Tree,** the *Celtis occidentalis*, a North American tree of considerable height and much beauty, but singularly variable in its mode of growth. Its wood is quite tough, but is not much used in the arts. It makes good charcoal, and when young is used for barrel hoops, and sometimes called hoop-ash. The genus (*Celtis*, order Ulmaceæ) contains several foreign trees of considerable importance.

Hackberry, tp. of Labette co., Kan. Pop. 637.

Häck'el, or **Hæckel** (Ernst Heinrich), M. D., b. at Potsdam, Germany, Feb. 16, 1834; studied medicine and botany; was the pupil of Kölliker, Leydig, Virchow, and Johannes Müller; became a medical practitioner of Berlin 1858; devoted much attention to biological questions; became zoological professor extraordinary at Jena 1862, and in 1865 received the regular professorship of zoology there, which he has since retained, his lectures having rendered that university a very famous school for biological science. Häckel was one of the first German savants to recognize and accept Darwinism, a theory towards which his own researches had long been leading him. He has published many remarkable monographs. Among his principal works are *Generelle Morphologie der Organismen* (2 vols., 1866); *Natürliche Schöpfungsgeschichte* (1868); *Biologische Studien* (1870); and *Die Kalkschwämme* (3 vols., 1872). He has propounded many novel and suggestive biological theories, and the general drift of his recent writings is toward the confirmation of Darwinism, in support of which theory he has brought forward many interesting facts.

Hack'ensack, post-v. and tp., cap. of Bergen co., N. J., on the Hackensack River, the Erie R. R., and the New Jersey Midland R. R., 13 miles from New York and 6 miles from Paterson. It has several churches, 3 newspapers, public and private schools, 2 banks, gas and water companies, and a number of small factories. Pop. of tp. 8038. H. D. Winton, Ed. "The Bergen Co. Democrat."

Hackensack River rises in Haverstraw, Rockland co., N. Y., and flows S. through Bergen and Hudson cos., N. J., falling into Newark Bay, and draining a beautiful and fertile region.

Hack'ett (Horatio Balch), D. D., LL.D., b. at Salisbury, Mass., Dec. 27, 1808; graduated from Amherst College in 1830; studied theology at the Andover Seminary until 1834, and afterwards at Halle and Berlin in Germany; was professor of Latin in Brown University four years, also a tutor in Amherst College; was elected to the chair of biblical literature in the Newton Theological Institution (Baptist) in 1839; became professor of New Testament Greek in Rochester Theological Seminary 1870. Published Plutarch's *De Sera Numinis Vindicta*, with notes (1844); translated and enlarged Winer's Chaldee grammar (1845); published a Hebrew grammar and reader (1847); *Commentary on Acts* (1851); *Illustrations of Scripture* (1855); *Philemon*, newly translated, with notes (1860); *Christian Men in the War* (1864); translated (for Lange's *Commentary*) Van Oosterzee on Philemon (1868), and Braum on Philippians (1870); was one of the editors of the enlarged American edition of Smith's *Dictionary of the Bible;* edited also Rawlinson's *Historical Illustrations of the Old Testament* (American reprint, 1873).

Hackett (James Henry), b. in New York Mar. 15, 1800; d. at Jamaica, L. I., Dec. 28, 1871; studied a year at Columbia College; applied himself a little while to the study of law; tried business without success, and in 1826 attempted the stage, appearing first at the Park Theatre. For twenty-five years he was popular in England and the U. S. In 1849 he was joint manager with William Niblo of the Astor Place Opera-house, and in 1854 took part in the management of the Grisi and Mario opera troupe in their visit to America. Mr. Hackett was a comedian of much versatility. He introduced Yankee characters with great effect, but his highest excellence was shown in the humorous characters of Shakspeare, especially in Falstaff, which he made his own. His talent, however, was not for comic parts exclusively, as his admirable performance of King Lear proved. In his later years Mr. Hackett seldom appeared before the public. O. B. Frothingham.

Hack'ettstown, post-v. and tp. of Warren co., N. J., on the Musconetcong River, half a mile from the highest point in New Jersey. The Morris Canal and the Morris and Essex and Delaware Lackawanna and Western R. Rs. pass through it. It is liberally supplied with water by an aqueduct, and the streets are lighted at night with kerosene. It contains 4 churches, 3 academies, the Newark M. E. Conference Seminary, 2 weekly newspapers (one run by steam-power), 1 bank, 2 steam saw and planing mills, 1 car manufactory, 2 foundries, 4 harness manufactories, 30 stores of various kinds, 2 lumber and 3 coal yards, 3 grist-mills, and 9 carriage-factories, the latter being the leading industry. Pop. 2202. E. W. Osmun, Ed. "Hackettstown Gazette."

Hack'länder, von (Friedrich Wilhelm), was b. at Bertscheid, near Aix-la-Chapelle, Nov. 1, 1816. He learned the dry-goods business in Elberfeld; entered the Prussian artillery; returned again to his commercial occupations, and succeeded at last in 1841 in making for himself a literary name by the publication of his *Bildern aus dem Soldatenleben* in a Stuttgart paper, and shortly after of his *Wachtstubenabenteuer.* He then accompanied Baron von Taubenheim on a trip to Arabia to buy horses, and published in 1842 *Daguerreotypes taken in the Orient*, which also was well received, and which recommended him to the crown prince of Würtemberg, whom he accompanied on a journey through Italy, France, and Russia. New travelling sketches and small humorous tales followed, and the king of Würtemberg gave the author an office and a pension. In 1850 he published a large novel or romance, *Handel und Wandel* (2 vols.), and in 1854 another, *Europäisches Sklavenleben* (4 vols.), both of which made some sensation. But his quick observation, his talent of humorous sketching, his easy-flowing style, which are sufficient to entertain in a travelling sketch or small tale, are utterly insufficient in a large composition. Of his dramas, *Der geheime Agent*, a comedy in five acts, and two or three one-act pieces, *Schuldiz, Unten im Haupe*, etc., have been played with success in all the German theatres; they are a sort of mosaics, dexterously put together and pleasant to look at. In 1857 he founded, in connection with Zoller, *Ueber Land und Meer*, an illustrated paper, which has become very popular, and deserves its popularity.

Hack'le, Hat'chel, or **Hetchel,** the comb with long steel teeth by means of which the tow is removed from flax, hemp, or jute, and the fibres fitted for spinning or other

uses by straightening and laying them parallel to each other. The long, tapering, polished teeth are affixed to a wooden or metallic block, and are arranged in two, or more frequently in many, rows. Their adjustment for effective use requires considerable skill.

Hack'leman (Pleasant Adam), b. in Franklin co., Ind., about 1817; studied law, and attained prominence in his profession in his State. About 1840 he assumed the editorship of the Rushville *Republican*, which he retained till the outbreak of the civil war in 1861; was elected to the State legislature in 1841; member of the Republican national convention 1860, and of the Peace Conference at Washington in 1861; appointed colonel 10th Indiana Vols. in 1861, he served with distinction under Gen. Banks in Virginia; was promoted to be brigadier-general of volunteers Apr., 1862, and ordered to the army of the South-west, under Gen. Grant, being engaged in the battle of Iuka, Miss., Sept. 19–20, 1862, and at Corinth, where he was killed, Oct. 4, 1862. G. C. Simmons.

Hack'ley (Charles E.), A. M., M. D., b. at Unadilla, N. Y., Feb. 22, 1836; graduated at the University of Pennsylvania; A. B. in 1856, M. D. in 1860; surgeon 2d U. S. Cavalry 1861–64; surgeon-in-chief to the 3d cavalry division Army of the Potomac; appointed physician to New York Hospital 1867; surgeon to New York Eye and Ear Infirmary; clinical professor of diseases of eye and ear Woman's Medical College, New York, etc. Translator of Stellwag on the eye and Billroth's *Surgical Pathology;* one of the translators of Niemeyer's *Practical Medicine*, etc.

Hackley (Charles W.), b. in Herkimer co., N. Y., Mar. 9, 1809; graduated from the U. S. Military Academy in 1829; appointed second lieutenant of artillery; retained at the Academy as assistant professor of mathematics until 1833, when he resigned from the army. Was ordained in 1839 in the Protestant Episcopal Church. Professor of mathematics at the University of New York from 1833 to 1839, when he was appointed president of Jefferson College, Miss.; subsequently professor of mathematics in Columbia College 1843–57, and of astronomy from the latter date to his death in New York City Jan. 10, 1861. He published *A Treatise on Algebra, Elementary Course of Geometry, Elements of Trigonometry*, etc., and was a frequent contributor to the scientific and literary journals of the day. G. C. Simmons.

Hack'matack, Tam'arack, or **American Larch** (*Larix Americana*), a forest tree of the U. S., growing frequently in wet places, and attaining a noble size, except in the far north, where it is a stunted shrub. It is our only native coniferous tree whose leaves fall off in winter. Its wood is of excellent quality. It is prized in the West for poles and rafters: in shipbuilding it is used for ship's knees, top-timbers, and spars; and if fastened with square iron is far better than oak for such uses.

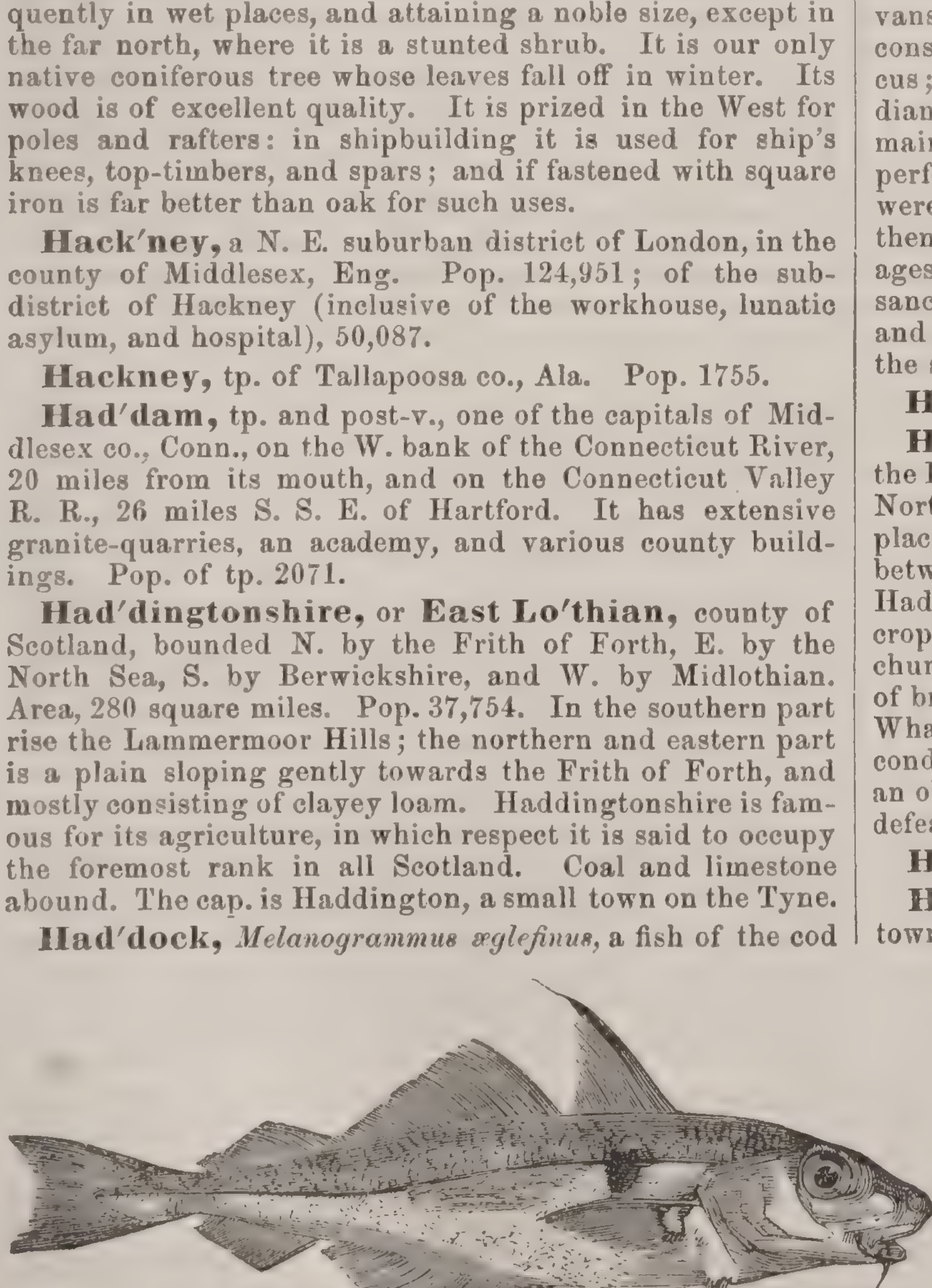
Hack'ney, a N. E. suburban district of London, in the county of Middlesex, Eng. Pop. 124,951; of the sub-district of Hackney (inclusive of the workhouse, lunatic asylum, and hospital), 50,087.

Hackney, tp. of Tallapoosa co., Ala. Pop. 1755.

Had'dam, tp. and post-v., one of the capitals of Middlesex co., Conn., on the W. bank of the Connecticut River, 20 miles from its mouth, and on the Connecticut Valley R. R., 26 miles S. S. E. of Hartford. It has extensive granite-quarries, an academy, and various county buildings. Pop. of tp. 2071.

Had'dingtonshire, or **East Lo'thian,** county of Scotland, bounded N. by the Frith of Forth, E. by the North Sea, S. by Berwickshire, and W. by Midlothian. Area, 280 square miles. Pop. 37,754. In the southern part rise the Lammermoor Hills; the northern and eastern part is a plain sloping gently towards the Frith of Forth, and mostly consisting of clayey loam. Haddingtonshire is famous for its agriculture, in which respect it is said to occupy the foremost rank in all Scotland. Coal and limestone abound. The cap. is Haddington, a small town on the Tyne.

Had'dock, *Melanogrammus æglefinus*, a fish of the cod family, captured in large quantities on both sides of the Atlantic for food. It is generally eaten fresh, but is sometimes smoked or salted and dried. It resembles the cod, but is easily distinguished by the black line along its side, that of the cod being white.



The Haddock.

Haddock (Charles Brickett), D. D., b. at Franklin, N. H., June 20, 1796; graduated from Dartmouth College in 1816, and from Andover Seminary in 1819. Held the chair of rhetoric and belles-lettres at Dartmouth College from 1819–38, also that of intellectual philosophy and political economy at same college 1838–54. Was *chargé d'affaires* to Portugal 1851–55; was a member of the legislature in his native State for four years, where he introduced and carried through the present common-school system of the State; was the originator of the railroad system in New Hampshire. He was well versed in public law, etc. Author of several addresses, essays, etc. D. at West Lebanon, N. H., Jan. 15, 1861.

Had'don, tp. of Sullivan co., Ind. Pop. 2750.

Haddon, tp. of Camden co., N. J. Pop. 1926.

Had'donfield, post-v. in Haddon tp., Camden co., N. J., on the Camden and Atlantic R. R., 7 miles S. E. of Philadelphia. It has a public library and several churches. Pop. 1075.

Had'ersleben [Dan. *Haderslev*], town of Prussia, in the duchy of Sleswick, with a good harbor on the Haderslev Fjord, an inlet of the Little Belt. Pop. 8259.

Ha'des [Gr. Ἀιδης, ᾅδης], in the Homeric writings (as in *Il.* xv. 188), is used as the name of the god of the lower or invisible world, and is the equivalent of Pluto. In later Greek writings it is used to designate the place of departed spirits. The corresponding Hebrew word is *Sheol*, which in our English version is sometimes rendered "grave," sometimes "pit," and sometimes "hell." *Hades* is almost always employed by the LXX. in translating *Sheol*. It occurs eleven times in the New Testament, and in our English version is rendered "hell," except in 1 Cor. xv. 55, where it is rendered "grave." R. D. Hitchcock.

Hadház, one of the Haiduk towns of Hungary, in the county of Szabolcs. Pop. 7024.

Hadj [Arab., "pilgrimage"], the pilgrimage to Mecca which every Mohammedan is under obligation to perform at least once, unless poverty or sickness forbid. The hadji or pilgrims from distant lands often perform a great part of the journey by ship; other persons travel in great caravans, of which there are four regular ones—one from Cairo, consisting largely of Berbers; one of Turks from Damascus; one of Persians from Babylon; and a fourth of Indians, Arabs, and others from Zibith. Strict discipline is maintained. Arrived at Mecca, a routine of ceremonies is performed. These ceremonies, and the pilgrimage itself, were adopted by Mohammed from the old Arabian heathenish customs, which had become thoroughly established ages before his time. These he adopted, partly to gain the sanction of rites so immemorial and so sacredly esteemed, and partly because their rejection would have endangered the success of his own system.

Had'ley, tp. of Pike co., Ill. Pop. 1309.

Hadley, tp. and post-v. of Hampshire co., Mass., on the E. side of the Connecticut River, which separates it from Northampton and Hatfield. The village is a beautiful place, embowered in ancient trees. Mount Holyoke lies between this town and South Hadley. The greater part of Hadley is a very fertile alluvial plain, producing luxuriant crops of tobacco, broom-corn, hay, and grain. There are 3 churches, an academy, a public library, and manufactures of brooms. Hadley was long the place of refuge of Goffe, Whalley, and Dixwell, three of the regicide judges who condemned Charles I. Here on Sept. 1, 1675, according to an old tradition now discredited, the colonists, led by Goffe, defeated the Indians after a sharp encounter. Pop. 2301.

Hadley, tp. and post-v. of Lapeer co., Mich. P. 1461.

Hadley, tp. and post-v. of Saratoga co., N. Y. The township lies on the Hudson River. It is mountainous, and has manufactures of leather, lumber, etc. There is abundant water-power, and gneiss is extensively quarried. Large quantities of this stone have been used in the construction of the new State capitol at Albany. The town has 4 churches, and is on the Adirondack R. R., 22 miles N. of Saratoga. P. 1039.

Hadley (James), LL.D., was b. at Fairfield, Herkimer co., N. Y., Mar. 30, 1821. His father was professor of chemistry in a medical institution established there. Entering the junior class in Yale College, he graduated in 1842. From 1843 to 1845 he was a theological student in New Haven, serving as tutor in Middlebury College meanwhile (from Sept., 1844, to Apr., 1845); was tutor at Yale from

1845 to 1848, when he was appointed associate professor of Greek; succeeded Dr. Woolsey as full professor in 1851; and d. Nov. 14, 1872. At first he gave great promise of distinction in mathematics, but circumstances turned his genius and industry in a different direction. Few men in either hemisphere have made such attainments. In addition to his mastery of the Greek language, he was well versed in Hebrew, Arabic, Armenian, Sanscrit, Welsh, Gaelic, Irish, and the principal modern languages, including Swedish. Keen as a Damascus blade, he had the gentleness of a child and a simple, steady Christian faith. His *Greek Grammar*, based on that of Curtius, was published in 1860. In 1873 a posthumous volume of twelve lectures on *Roman Law* was edited by Ex-President Woolsey; and in the same year another volume of twenty *Philological and Critical Essays* was edited by Prof. Whitney. (See President PORTER's art. in the *New Englander*, Jan., 1873.)—His brother, HENRY HAMILTON HADLEY, who graduated at Yale in 1847, at Andover in 1851, was appointed teacher of Hebrew in Union Theological Seminary, N. Y., in 1862, and d. at Washington, D. C., in the service of the Sanitary Commission, Aug. 1, 1864, at the age of thirty-eight, was a scholar of kindred spirit. R. D. HITCHCOCK.

Had'lyme, post-v. of Lyme tp., Middlesex co., Conn., 30 miles S. S. E. from Hartford.

Hadramaut' [the *Adramitæ* of Strabo], in a narrow sense designates the S. W. portion of Arabia Felix, but in a large sense it includes nearly all that part of Arabia S. and S. E. of the central desert of the peninsula. The coast-land is low, the interior dry, and broken with ranges of mountains and hills. In the valleys there are some torrents, which are often dry. Its people are of many tribes, subject to various local sultans. As a rule, they are not nomadic. The country affords fine horses, camels, wool, dates, gums, and grain. Copper, coal, and bitumen exist. Chief seaport, Makallah.

Ha'drian, or **A'drian** (PUBLIUS ÆLIUS HADRIANUS), the fourteenth Roman emperor, b. at Rome Jan. 24, 76 A. D., the son of a senator, a kinsman of Trajan (afterwards emperor), who became his guardian in youth. Young Hadrian was a zealous student of Greek letters; entered the army in Spain when fifteen years old; became a military tribune in Mœsia 95 A. D.; was made quæstor in 101; married Trajan's grand-niece; tribune of the people 105; prætor 107; prætorian legate in Lower Pannonia 108, where his military renown, already great, was much increased; was consul suffectus 109; archon at Athens 112; legate in the Parthian war 114–117; was chosen consul 117; was proclaimed emperor after Trajan's death 117; gave up the country E. of the Euphrates to the Parthians, and made Armenia independent; appeased the discontent of the people consequent upon the bloody suppression of a formidable conspiracy by the remission of all arrears in taxes and debts due the state, and by large gifts of money to the people; passed a large part of his reign in travels throughout the empire, redressing wrongs, confirming disputed privileges, inspecting the troops and the fortifications. During one of these famous progresses the wall of Hadrian from the Tyne to the Solway was constructed (119 A. D.). In 132 the bloody revolt of the Jews broke out, which lasted for several years, and was not ended till Palestine was almost depopulated. Athens was a favorite residence of the emperor. He rebuilt Jerusalem (134), returned finally to Rome in 135, spending a great part of his declining years in his splendid villa near Tibur. He d. at Baiæ July 10, 138 A. D. Hadrian's name is one of the most illustrious in the imperial annals. He was the first emperor, almost the first Roman, who cared for any part of the empire except Italy. He fostered peace and promoted the welfare of his people. He reformed the system of jurisprudence, and punished severely injustice and crime. But his private character was not free from stains, and late in his reign he was guilty of many acts of tyranny. He affected to be a poet, architect, painter, philosopher, orator, and musician. Six Latin and six Greek epigrams, and some quotations from his history of his own life, are all that remain to us of his written works. He was succeeded by Antoninus Pius.

Hadrosau'rus [Gr. ἁδρός, "thick," "stout," and σαῦρος, a "lizard"], a genus of fossil reptiles from the American Cretaceous, belonging to the order Dinosauria. This order included animals now extinct, mostly of very large size, some of them being the largest of land animals, and, although true reptiles, they possessed also many characters of birds and mammals. Their affinities with the birds, as Huxley has shown, are especially seen in the large medullary cavities of the long bones, and in the structure of the pelvic arch and hind limbs. Thus, the sacrum consists of four to six vertebræ; the ilium extends far in advance of the acetabulum, and furnishes only a widely arched roof for that cavity; the ischium is greatly elongated, and often presents the obturator process characteristic of birds; and the *os pubis*, in many genera at least, is slender and elongated, and directed downward and backward. The femur has, usually, a strong inner trochanter, and its distal end is particularly bird-like in the presence of a strong ridge between the tibia and fibula. The tibia closely resembles that of a bird, and in many genera the astragalus is ankylosed with its distal end. The latter bone is very similar to that of a bird, and has a stout ascending process. The metatarsals are elongate and closely fitted together; the inner and outer digits are short or rudimentary; and the third digit is the longest, as in the birds. The hind legs were usually much larger than the fore legs, and ordinarily supported the body in walking. The so-called "bird tracks" in the Connecticut River sandstone were probably all made by Dinosaurs. The cervical vertebræ, as in many mammals, were convex in front and concave behind—a character possessed also by the dorsals, but in a less degree posteriorly. The teeth in the herbivorous genera present broad grinding surfaces, and the articulation of the jaw admitted of lateral motion, as in herbivorous mammals. Other genera were, however, carnivorous, and furnished with sharp, recurved, serrated teeth. The latter are implanted in various ways, but never ankylosed with the jaws. In their manner of life Dinosaurs seem to have resembled ordinary terrestrial mammals. Their remains are found throughout the Mesozoic or Reptilian Age, at the close of which they appear to have become entirely extinct. The present genus (*Hadrosaurus*) is the principal American representative of the herbivorous group of this order. Its existence was first made known in 1858 by Dr. Leidy, who described portions of a skeleton found at Haddonfield, N. J., under the name of *Hadrosaurus Foulkii*. It is closely related to the *Iguanodon* from the Wealden and Cretaceous of Europe. The teeth of *Hadrosaurus* are small, set in alveolar grooves separated by narrow intervening ridges, and present the same general characters as those of *Iguanodon*. They appear to have been crowded together, both those in actual use and the successional teeth, in a quincuncial arrangement. In the upper teeth the layer of enamel seems to have been upon the outer side, so that the series of teeth at the border of the jaw, as worn down by use, formed a continuous pavement sloping inward and downward, and presenting triturating points and facets of various sizes and patterns, according to the portion of the tooth that had reached the grinding surface. In the lower teeth the inner side of the crown only is covered with enamel, and forms a lozenge-shaped surface, divided by a prominent median keel. The upper angle or apex of each tooth is rounded, the lower angle notched. This structure and disposition of teeth indicate a vegetable feeder that masticated its food like the herbivorous mammals. The skull is little known. The cervical vertebræ are convex in front, concave behind. The caudals are biconcave. The humerus resembles that of *Iguanodon*. It is twenty-two and a half inches long, and has a large medullary cavity. The bones of the fore arm are similar to those of the living iguana. Their interior is occupied by a coarse, spongy substance. The bones of the hind limbs are of very large size in comparison with those of the fore limbs—larger than in *Iguanodon*. The femur is four and a half feet in length. It has a quadrilateral shaft, with the head and trochanter on the same line as the condyles. The medullary cavity is large in this bone, as well as in the tibia, which is slender, twisted, and about three feet long. The entire length of this animal is estimated at more than twenty-five feet. It moved usually upon its hind legs, and used its large tail as an additional support while it browsed upon the vegetation growing near the ocean where it lived. Two smaller species of *Hadrosaurus* have since been found, also in the Cretaceous—*H. minor* from New Jersey, and *H. agilis* from Kansas.

O. C. MARSH.

Hæm'atine [Gr. αἷμα, "blood"], a substance ($C_{96}H_{102}N_{12}Fe_3O_{18}$) which may be obtained from blood long extravasated. It was long supposed to be the coloring-matter of the blood, and to be essential to health. It was believed to be associated with globulin in the red blood-corpuscles, but at present most chemists recognize but one definite compound, hæmoglobin, instead of two associated compounds.

Hæm'atite, or **Specular Iron Ore,** one of the most common ores of iron, distinguished by its color into red and brown hæmatite. It does not attract the magnet. These ores are composed chiefly of peroxide of iron, and are very important sources of metallic iron. They occur largely in metamorphic strata, and are found sometimes crystallized in various forms. (See IRON, ORES OF.)

Hæmatox'ylin, a crystalline yellow principle obtained by digesting the aqueous extract of logwood (*Hæmatoxylon Campeachianum*) in ether or alcohol, and carefully evapo-

rating it; then adding a little water and allowing the hæmatoxylin to form crystals. When pure, it is sweet to the taste. Its formula is $C_{16}H_{14}O_6 + 6Aq$. It does not have the power of dyeing cloths, but with alkaline bases fine reds, blues, and purples are produced. It exists already formed in the logwood.

Hæmatozo'a [Gr. αἷμα, "blood," and ζῷον, an "animal"] are those Entozoa or intestinal worms which are found in the blood-vessels of other animals. This habit is not confined to any one natural group, but is manifested in representatives of several widely separated types, some belonging to the order of Nematoids, some to the Trematodes, and others to the Gregarinidæ or Protozoa. One or more species occur under certain conditions in the several species of mammals, birds, reptiles, and fishes, as well as in some invertebrates. They are of course small, and generally of microscopic size, but a few reach comparatively large dimensions. They are generally (when in the blood-vessels) in an undeveloped stage—*i. e.* without generative organs—but in the larger forms these organs are sometimes found developed. The only examples of this group which it is necessary to specifically name are a "fluke" found in the abdominal venous system of man (called *Distoma hæmatobium*), and a thread-worm found in the vascular system of man lately discovered (*Filaria sanguinis hominis*). These are generally confined to the specific portions mentioned, but in other animals the species infesting them may be met with in other specific parts of the vascular system, the several species always, however, being limited to certain parts thereof. The source of these animals is not yet definitely known. It has been supposed that they may be transmitted in mammals through the vessels of the placenta from generation to generation, but the researches of several naturalists have militated against this view. The parasites do not generally cause much inconvenience to their hosts, but occasionally they seem to be the origin of grave disorders, and even derangements of the nervous system have been attributed to them. The occasional occurrence in the blood-vessels of man of the common liver-fluke (*Distoma hepaticum*) has been verified by several observers, who have found individuals in the veins of different parts of the body (neck, feet, and abdominal veins), and in each case the presence of the parasite was indicated externally by a tumor. In these several cases death was apparently caused or hastened by the parasite. The *Filaria sanguinis hominis* has recently (1874) been claimed to be associated with chyluria and the elephantoid condition of the tissues in man in India, and has been made the subject of special investigation by Dr. T. R. Lewis. THEODORE GILL.

Hæmoglo'bin, Hæm'ato-glob'ulin, or **Hæm'atocrys'tallin,** a substance which forms the principal part of the red corpuscles of the blood of vertebrates. It was formerly supposed to consist of hæmatin, intimately associated with globulin. Its composition is given as 54.2 parts of carbon, 7.2 of hydrogen, .42 of iron, .16 of nitrogen, 21.5 of oxygen, and .7 of sulphur. From the blood of certain animals it can be obtained in the form of crystals, which vary in character according to the animal whence they are obtained.

Hæmop'tysis [Gr. αἷμα, "blood," and πτύσις, "spitting"], the expectoration of blood from the vessels of the lungs or from the mucous membrane of the thoracic air-passages. Hæmoptysis occurs in pulmonary consumption, in heart disease, etc. It is sometimes vicarious in cases of suppressed menses. The significance of hæmoptysis in any case can only be estimated by the trained diagnostician. A distinction is to be observed between hæmoptysis from the congested mucous membrane of the air-passages (the blood issuing from many points in the congested surface, which is not lacerated), and the far more formidable *pneumorrhagia*, when the flow is from a vessel opened in the course of pulmonary disease. It is believed by some good observers that cases of consumption which are characterized by a decided tendency to hæmoptysis are as a rule slower in progress and less rapidly fatal than other cases are. The remedies usually administered for hæmoptysis are dilute sulphuric acid, ergot, gallic acid, lead-acetate, opium, turpentine, common salt, and other hæmostatics. Perfect quiet of mind and body is to be sought. Sometimes obstinate hæmorrhage is stayed by the free opening of a vein in the arm, which seems marvellously to divert the flow from its former course. Ice to the chest and the swallowing of lumps of ice is often effective.
REVISED BY WILLARD PARKER.

Hæmorrhage. See BLEEDING.

Hæmorrhoids. See PILES.

Hæ'res [Lat., "an heir"], in Roman law one who is the universal successor to all the property and all the rights of a person deceased, and who is bound to acquit all the charges and burdens of the said property. The term *hæres* in civil law has a much more comprehensive signification than the word *heir* in English law. For the *hæres* succeeds immediately to all the property of the deceased, and not merely to some specific portion, as the real estate; and even though devises or legacies have been made to third persons, these cannot be obtained by the donees except at the hands of the *hæres*, who is charged with the fulfilment of the trust which the gift imposes. Moreover, a person was called *hæres* even when appointed by will and having no natural claim to the inheritance. The *hæres* therefore corresponded partly with the heir or devisee, and partly with the executor or trustee under the common-law system. Sometimes *hæredes* received the property entirely for their own personal benefit, and then they occupied simply the position of heirs or donees, but more commonly duties of a fiduciary character were devolved upon them to carry out the intentions of the deceased; and the discharge of trusts thus created might constitute their entire functions, so that they would act merely as executors. There were two kinds of *hæredes*—those who were appointed by a testament, who were called testamentary *hæredes;* and those to whom the law gave the inheritance on account of their connection by blood with the deceased, who were therefore called *hæredes* at law. All persons might act in this capacity except persons not Roman citizens, slaves of such persons, persons not in being at the death of the testator, corporations unless specially privileged, and a few less important classes. If a person appointed *hæres* was a slave of the testator, or was under the testator's authority at his death, he was obliged to accept the position, but in other cases acceptance was discretionary.
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Háfiz (SHEMS UD DÍN MOHAMMED), better known by his *takhallus* or poetical *nom de plume* of HÁFIZ—*i. e.* "one who knows the Kor'án by heart"—was b. at Shiraz in the beginning of the fourteenth century. Like many other great poets, the historical notices of his life are very scanty; indeed, one or two unimportant incidents are all that have come down to us. One of the most authentic of these is that one of the kings of the Deccan, admiring Háfiz's genius, endeavored to tempt him by splendid presents to his court. Háfiz set out from Shiraz, and reached Ormuzd in safety, but no sooner had he embarked on board ship there than a storm arose which forced the ship to return to port. The poet was so dreadfully seasick that he refused to trust himself again on the ocean, and sent an ode to his royal friend as an apology for not coming in person. Another incident related by the Persian historians is the following: When the Teimur Lang (Tamerlane) had subjugated the province of Fars, he is said to have sent for the poet, and called him to account for having made free with his (the conqueror's) dominions in a well-known verse which says, "For the black mole on thy cheek I would give Samarcand and Bokhara." Háfiz replied, "Yes, sire, and it is such reckless extravagance that has made me poor as I am." Tamerlane was so pleased with his ready wit that he bestowed on him a magnificent mark of his favor. Unfortunately for the truth of the story, Tamerlane did not take Shiraz till at least four years after the poet's death. Here and there a few records of his life and times may be extracted from various passages in his works; as, for instance, the tragical end of Abu Ishák, the usurping prince of Shiraz; but his personal biography is little better than a blank. Háfiz d. in 1389, and was buried in a garden near Shiraz; a white marble monument was erected over the tomb, which is still an object of veneration to numerous pilgrims who visit the spot. The anacreontic and free-thinking expressions which abound in Háfiz's poems appear to have brought him into disfavor with the clerical party, who hesitated about according him Muslem burial. A *fál* or omen was, however, taken from his poems, after the fashion of the *Sortes Virgilianæ*, and the following verse being indicated,

"Shun not Háfiz's bier, for, though sunk in sin, he will yet go straight to heaven,"

the coincidence was considered sufficiently remarkable to overcome the scruples of the mollahs. The works of Háfiz are frequently used for a similar superstitious purpose at the present day. The poems of Háfiz consist for the most part of *ghazals*—that is to say, of short odes consisting of from five to fifteen verses each, with the same rhyme throughout. They were not published in a collected form until after his death. Such a collection of poems, arranged in alphabetical order of the rhymes, is called a *díván*, and the *Díván i Háfiz* is the name under which his works are generally known. Háfiz is justly esteemed the greatest lyrical poet which Persia has ever produced. His language is singularly idiomatic and beautiful; his verse is exquisitely smooth and flowing; and his thoughts and allusions are eminently national. European writers have

for the most part disputed whether the odes of Háfiz are to be considered anacreontic and erotic, as they at first sight appear, or whether they are mystical and religious, as native readers and critics deem them. The fact is, that both views are correct. Háfiz, in common with nearly all his compatriot poets, belonged to the religious order of dervishes called Súfis. This sect profess doctrines which may be fairly called the esoteric creed of Islam; steering a middle course between the pantheism of India on the one hand, and the monotheism of the Koran on the other, the Súfis' cult is a religion of beauty, where heavenly perfection is considered under the imperfect type of earthly loveliness. He aims at elevating mankind by the contemplation of spiritual things through the medium of the most impressionable feelings. The charms of visible objects are enthusiastically described by him, but as he refers all love and beauty to the Deity, it is easy to extract an allegorical meaning from the most passionate of his utterances. This is the real secret of understanding Háfiz's poetry; his utterances are fresh and natural, and, as he was no ascetic, it is probable that many of the passages in which he describes the pleasures of love and wine are actual records of his own experience. But the sorrows and yearnings to which he gives expression may also have been real; but, for all that, they may be read—nay more, may have been written—in an allegorical sense. As a true poet, Háfiz poured his soul into his verse; as a true mystic, he saw God reflected in the human soul. To a person who desires to study the thoughts, manners, or language of Persia, Háfiz is the best guide. The native editions of his *Diván* are so numerous that it would be difficult to make a selection, but for general use an edition lithographed at Lucknow by Munshí Nowel Kishore, proprietor of the *Audh Akhbár* newspaper, may be recommended. It is easily obtainable through the munshi's agents, Messrs. Trübner & Co. of London, and is furnished with a concise and useful commentary in Persian. Of European editions, etc., there are *Die Lieder des Hafiz, Persisch mit dem Commentar des Sudi*, v. H. Brockhaus, Leipsic, 1857–59; *Der Diwan des grossen Lyrischen Dichters Hafiz, in Persischen Original herausgegeben ins Deutsch metrisch übersetzt, und mit Anmerkungen versehen*, v. Vincenz Ritter von Rosensveig-Schvannan, Wien, 1858; *Der Diwan v. Mohammed Schems eddin Hafis aus dem Persischen zum erstenmal ganz übersetzt*, v. J. V. Hammer, Stuttgart and Tübingen, 1813; *A Specimen of Persian Poetry*, or *Odes of Hafiz*, with an English translation and notes by J. Richardson, London, 1774; do. second ed., by Rousseau, London, 1802; *Persian Lyrics, or Scattered Poems from the Diwan Hafiz*, with paraphrases in verse and prose, by J. Haddon Hindley, London, 1800; *Select Odes from the Persian Poet Hafiz*, translated into English verse, with notes critical and explanatory, by J. Nott, London, 1787; *The Persian Poet Hafiz*, by Prof. Cowell, *Macmillan's Magazine* for Aug., 1874, No. 177, p. 251; *A Translation into English Verse of the Principal Poems in the Collection*, by Mr. Biknel of London, is also in the press. E. H. Palmer.

Hag, a very low form of cyclostome fishes, including the *Myxine glutinosa* of European seas and the *Myxine limosa* of the American Atlantic waters, found abundantly about Grand Manan Island. They were formerly classed as worms, which they much resemble. The former is believed to live sometimes within the stomachs of other fishes. They have a remarkable power of secreting slime. There are no eyes, and the ears are but little superior to the molluscan type. The six pairs of gill-sacs receive water from the gullet, and discharge it from an opening upon the ventral aspect of the fish. There are no bones, and the dorsal chord is of embryonic type. There is a portal heart. The mouth is a sucking organ, and is surrounded with barbules.

Ha'gar, post-tp. of Berrien co., Mich., on Lake Michigan. Pop. 834.

Ha'geman's Mills, post-v. of Amsterdam tp., Montgomery co., N. Y. It has manufactures of woollen goods. Pop. 250.

Ha'gen, town of Westphalia, Prussia, on the river Volme and the Dortmund-Düsseldorf Railway, has extensive manufactures of metallic wares, steel, cloth, papers, etc. Pop. 13,445.

Hagen (Hermann August), M. D., Ph. D., was b. in Königsberg, Prussia, May 30, 1817; graduated at Königsberg 1836; received the degree of M. D. in 1840, and practised medicine and surgery from 1843 to 1867. Since then he has been assistant in the entomological department of the Cambridge Museum at Harvard University, Mass., and has published many articles, chiefly on entomology, in French, English, Danish, Russian, and North American scientific periodicals.

Ha'genbach (Karl Rudolph), D. D., the son of a professor in the University of Bâle, was b. May 4, 1801; studied at Bâle, Bonn, and Berlin; in 1823 became adjunct professor of theology, and in 1828 full professor, at Bâle; and d. there June 7, 1874. He was a firm Protestant, but a man of catholic temper. Of the long list of his publications, the most important are *Encyklopädie und Methodologie der theologischen Wissenschaften* (1833; 8th ed. 1869); *Lehrbuch der Dogmengeschichte* (1841; 5th ed. 1867), translated by Buch (Edinburgh, 1846; 3d ed. 1858), revised and enlarged by Prof. Henry B. Smith (New York, 1861–62); and *Vorlesungen über die Kirchengeschichte von der ältesten Zeit bis zum 19 Jahrhundert* (thoroughly revised, 1868–72). The first part of this last work was published in 1853. *German Rationalism* is a translation by Gage and Stuckenburg (Edinburgh, 1865).—His father and his two brothers, Johann Jakob and Eduard, were distinguished naturalists. R. D. Hitchcock.

Ha'genau, town of the German empire, in the province of Lower Alsace, on the Moder. It was founded by Frederick Barbarossa in 1164, and was formerly a fortress which played a conspicuous part in the wars between France and Austria. It is now chiefly a town of manufacturing interest. Pop. 11,331.

Ha'gerstown, post-v. of Jefferson tp., Wayne co., Ind., at the junction of the White Water Valley R. R. with the Pittsburg Cincinnati and St. Louis R. R. It has 1 weekly newspaper. Pop. 830.

Hagerstown, city and tp., cap. of Washington co., Md., 20 miles N. W. of Harper's Ferry and 6 miles N. of the Potomac River. It has 2 daily and 3 weekly newspapers, 3 banks, 2 savings institutions, and 3 machine-shops. There are 8 turnpikes leading into the city, and 3 railroads passing through. Pop. of city, 5779; of tp. 6471. Bell & Heikes, Eds. "Hagerstown Mail."

Hag'gada [Heb. "narration"], a name applied to the great body of Hebrew and Chaldee legends, often poetical, and designed to be expository of the Scriptures or of human duty. The Haggadoth are not regarded as authoritative in their teachings. Their total amount is very great, and they have never been entirely printed.

Hag'gai [Heb. *Chaggai*, "the festal one," from *chag*, "festival"], in the Apocrypha and Vulgate Aggeus, the tenth of the twelve minor prophets of the Old Testament, and the first after the Babylonian captivity. Chronologically, he follows Jeremiah, Ezekiel, and Daniel. The rebuilding of the temple, which began under Zerubbabel in 535 B. C., had been arrested by the hostility of the Samaritans. In 520 B. C., the second year of Darius Hystaspis (521–486 B. C.), Haggai roused his disheartened and sluggish countrymen to a resumption of the work. His three messages were delivered in the sixth, seventh, and ninth months (Sept., Oct., and Dec.) of that year. His third message contains a striking Messianic prediction, which is referred to in Heb. xii. 26. Haggai is supposed by some critics to have written also a part of the book of Ezra. In the Roman martyrology Hosea and Haggai are reckoned among the saints, and commemorated (see Acta Sanctorum) on the 4th of July. R. D. Hitchcock.

Hag'gerty (John), b. in Prince George co., Md., in 1747. He joined the Methodists about 1771, and was distinguished in the early history of his denomination; as a local preacher labored extensively under the Methodist founders Strawbridge, Rankin, and King till 1779, when he joined the conference and became a regular and most effective itinerant. In 1792 he settled in Baltimore, where he continued to preach successfully down to his death in 1823. He was one of the original elders or presbyters of his Church, ordained by Bishop Coke at its organization. He preached in German as well as in English. A. Stevens.

Hagiographa. See Bible, by Prof. W. G. Sumner, A. B.

Hag'ner (Peter), b. at Philadelphia Oct. 1, 1772; d. at Washington July 16, 1850. Appointed a clerk in the treasury by Gen. Washington in 1793, and third auditor by Mr. Monroe upon the creation of that office in 1817, he served under every administration for fifty-six years, with high approbation and esteem, resigning his office to Gen. Taylor in 1849. Congress repeatedly devolved on him the settlement of large and important claims, and twice, by direct votes, expressed their appreciation of his valuable services. The office of third auditor, before the institution of the present court of claims, became at one time so prominent, from the calls made upon its chief by Congress, that John Randolph of Roanoke, once pausing in debate for an apt phrase to express his sense of the influence of the emperor Nicholas in the affairs of Europe, styled him "the great *third auditor of nations*." In the *Union* of Oct. 24, 1849, its editor, the late Thomas Ritchie, commenting upon the

retirement of Mr. Hagner, said: "No government could ever boast of a more able, honest, and efficient officer. He has been the model of what a public servant should be; no higher compliment can be paid to a public officer than to say of him, 'He is as virtuous as Peter Hagner.'"

G. C. Simmons.

Hagner (Peter V.), b. Aug., 1815, at Washington, D. C.; graduated at the Military Academy in 1836, and was assigned to 1st Artillery. He served in the Florida war during Gen. Jesup's campaign of 1836–37 with a field-battery and on ordnance duty, and on the Niagara frontier until July, 1838, when he was transferred to the ordnance corps. In the war with Mexico he was attached to the "siege-train company of ordnance" of Gen. Scott's army; was brevetted captain Apr. 18, 1847, "battle of Cerro Gordo," and major Sept. 13, 1847, "assault and capture of the city of Mexico." Visited European arsenals and laboratories, under orders of the secretary of war, in 1848–49 (report published with Ex. Doc., 1850); member of the ordnance board from 1854 to 1860; in May, 1861, was assigned to the duty of ordering, inspecting, and purchasing arms and ordnance stores; and in Mar., 1862, was appointed by Secretary Stanton member of commission on ordnance and ordnance stores. He was inspector of all factories making small-arms for the government under contract from July, 1862, to Dec., 1863; since which time he has been in command of Watervliet Arsenal. Member of ordnance boards in 1863, 1868, and 1870, of board for the trial of breech-loading small-arms in 1866, and of the board for selecting a breech-system for muskets and carbines 1872–73. Was promoted colonel of ordnance Mar. 7, 1867, having received brevets of colonel and brigadier-general Mar. 13, 1865.

G. C. Simmons.

Hague, or **The Hague** [Dutch, *s'Gravenshage*], city of the Netherlands, the capital of the province of South Holland, and the residence of the king and seat of the states-general, in lat. 52° 4′ N. and lon. 4° 18′ E. It is a very handsome city, but, as it has no trade and no manufactures of any consequence, it is somewhat dull. Many of its streets are intersected by canals, with rows of linden trees planted on both sides, and spanned by elegant bridges. Among its most notable buildings are the church of St. James, built in 1308, and famous for its hexagonal tower with a chime of thirty-eight bells; the national museum and the palace of the prince of Orange, containing large collections of the most excellent works of the Dutch school of painting; the Gevangenpoort, the Binnenhof, and the Buitenhof, old places of striking architecture, and interesting on account of their connection with the history of the country. A short distance from the city lies, to the N., the Huis in 't Bosch, a royal summer-palace, containing some of the finest frescoes and paintings by Rubens, and to the S., the castle of Ryswick, where the treaty was signed in 1697. Pop. 92,785.

Hague, a mountainous tp. and post-v. of Warren co., N. Y., on Lake George. It is a place of summer resort. Iron ore has been mined in this township. Pop. 637.

Hague (William), D. D., b. in New York about 1805; graduated from Hamilton College, N. Y., in 1826 with high honors; studied theology, became a Baptist minister, and has preached in New York, Boston, Mass., Providence, R. I., etc.; now settled at Orange, N. J. Published *The Baptist Church Transplanted from the Old World* (1846), *Home Life* (1855), *Christianity and Statesmanship* (1855), etc.

Hahn (Michael), b. in Bavaria, Germany, Nov., 1830; obtained his education at New Orleans; he studied law, was M. C. 1862–64, and governor of Louisiana 1864–68. The degree of LL.B. was conferred upon him by the University of Louisiana.

Hah′naman, tp. of Whitesides co., Ill. Pop. 624.

Hah′nemann (Samuel Christian Frederic), M. D., b. at Meissen, in Saxony, Apr. 10, 1755. His father, a painter of porcelain in the royal manufactory, discouraged the eager desire of the son for a high education. The schoolmaster of the parish, however, gave the young man such efficient instruction as enabled him to enter the University of Leipsic at twenty years of age. After reaching Leipsic with what was left of twenty thalers, his sole patrimony, he supported himself by teaching English, French, and Italian, and by making translations from those languages. The following year he went to Vienna, where he obtained more lucrative employment, and was able to prosecute his studies with fewer privations. Afterwards he received the appointment of librarian to the governor of Transylvania, a position which enabled him to graduate as doctor of medicine at Erlangen in 1779. He returned to Saxony and settled as a physician, first at the little village of Hettstadt, and afterwards at Dessau, but finding little employment in either place, he was forced to accept a government appointment as "district physician" at Gommern, where, as he himself admits, "no physician had ever been before, nor did the people have any desire for one." He remained three years at Gommern, where the lack of professional employment left him abundant leisure to cultivate the sciences. At length he removed to Dresden, where his genius and learning were appreciated, and where his already numerous contributions to scientific literature were recognized. He served for a year as physician to the hospital, and soon attained a liberal patronage. He assiduously continued, however, his investigations in general science, especially in chemistry and toxicology, upon both of which he wrote several works of acknowledged value. One, on arsenical poisoning, is still referred to as authority. From Dresden he removed to Leipsic for the better prosecution of his studies.

Among the English works which he was at this time engaged in translating was Cullen's *Materia Medica.* The ingenious but unsatisfactory explanation proposed by that author of the therapeutic action of Peruvian bark in certain fevers, then a subject of much controversy, induced Hahnemann to undertake a series of experiments with that drug upon himself and others, with the hope of ascertaining the true principle of its operation. The result of these trials, a full record of which he published, was the confirmation of an opinion which previous observations had already led him to entertain of the existence of a general law of drug-action, which, if established, would give a scientific basis for therapeutics. This principle, which he afterwards expanded into a system which he called Homœopathy, is aptly expressed by the maxim, *Similia similibus curantur* (or similars are cured by similars), and constitutes, as is well known, the fundamental doctrine of the Homœopathic method. Similar experiments to those above referred to with Peruvian bark were made with various other substances, and records of medical experience were searched for whatever evidence they might yield upon the same point. No public declaration was made by Hahnemann of his new views until three or four years later, the interval being occupied with his investigations. In 1792 he was appointed physician to a hospital for the insane at Görgenthal in the Thuringian Forest, where he was afforded an opportunity of making a partial application of his principles. The complete and unexpected recovery of the Hanoverian minister, who was in the institution, made him the object of no little congratulation, while his courageous inauguration of an entire reform in the physical management of his patients deserves to be mentioned with that of Pinel, who in the very same year removed the chains from the unhappy lunatics in the Bicètre. In 1796 he published in *Huffeland's Journal* the first partial exposition of his doctrine, in an essay "On a New Principle for ascertaining the Remedial Powers of Medicinal Substances." This was followed by other contributions to the same journal. The extraordinary nature of these opinions attracted no little hostile criticism and ridicule from the profession. Several physicians of character and repute, however, adopted his views, and afterwards greatly assisted him in his further experiments and by collecting the results of Homœopathic clinical experience. The controversy aroused by the publications of Hahnemann and his friends was carried on with earnestness on both sides, but gradually new accessions were made to the number of his professional and non-professional adherents. In 1810, Hahnemann published an elaborate exposition of his system (*Organon of Homœopathic Medicine*), of which numerous editions in various languages have since appeared. The following year he put forth the first volume of the *Materia Medica Pura,* containing the collated results of his observations and experiences. Additional volumes of the same work were published in the course of the next few years.

A singular feature in the history of Hahnemann was the persistent opposition he experienced from the apothecaries, on the ground that his habit of preparing his medicines himself was an infringement of their prerogative. As the law was found to be in their favor, and as he could not yield a point that he considered of vital importance, he was several times forced to escape their prosecutions by removal. In 1821 he was relieved from further annoyances of this kind by accepting the protection of the duke of Anhalt-Cœthen, who made him state councillor and court physician. By this time his reputation had extended throughout Germany, and great numbers of patients from different parts of Europe sought his advice and treatment. In 1835, when eighty years of age, he married his second wife, a French lady, Mademoiselle d'Hervilly, who had gone to Cœthen to consult him regarding her health. By her persuasion he was induced to remove to Paris. In that capital he met with great success, and for eight years continued with great activity the exercise of his profession. He d. July 2, 1843. He lived to see the system he had founded adopted by considerable numbers of physicians in

most countries of Europe and America. He was a prolific and forcible writer on medical and other scientific subjects, and most of his later works have been translated into several languages. (For a more particular account of his system, see HOMŒOPATHY.) H. D. PAINE.

Hahn-Hahn (IDA MARIA LOUISA FREDERIKA GUSTAVA), COUNTESS, b. at Tressow, Mecklenburg-Schwerin, June 22, 1805 (the daughter of the count von Hahn, a devotée to the drama); was married in 1826 to another count von Hahn, and divorced in 1829. Author of numerous volumes of poetry, fiction, and travels. Became an ardent Roman Catholic, and since 1851 has published a number of religious works.

Hahn'ville, post-v. of St. Charles parish, La., 28 miles above New Orleans, on the W. bank of the Mississippi River. It has a church, a public school, several stores, a newspaper, a concert-hall, a machine-shop, and several minor manufactories. It is about half a mile from the parish court-house, and is the centre of a sugar, rice, and orange-producing country.

HORACE VALLAS, ED. "ST. CHARLES HERALD."

Hai'duk, Hajduk, or **Hayduk,** the Magyar inhabitants of the district of Hajdu Kerület in Eastern Hungary. They are Calvinists, and descendants of Bockskay's soldiers. From 1605 to about 1700 they were free from taxation and had the privileges of nobles. They are chiefly agriculturists, and are estimated to number 70,000. The name signifies "shepherds;" sometimes designates the militia of the country; and not unfrequently is incorrectly applied to menial attendants at German courts.

Haight (Rev. BENJAMIN I.), S. T. D., LL.D., b. in the city of New York Oct. 16, 1809; graduated at Columbia College 1828, and at the General Theological Seminary 1831; ordained same year, and became first rector of St. Peter's church in New York; from 1834 to 1837 was rector of St. Paul's church, Cincinnati; in 1837 accepted the rectorship of All Saints' church, New York, which he retained for nearly nine years; from 1837 to 1855 acted as professor of pastoral theology and pulpit eloquence in the General Theological Seminary. His connection with Trinity parish commenced in 1855, and in 1874 he was elected assistant rector. He was appointed a delegate from the diocese of New York to the General Conventions of 1868, 1871, and 1874. In 1873 he was elected bishop of the diocese of Massachusetts, but was obliged, from failing health, to decline that high honor. He was secretary of the diocese of New York for twenty years, and for more than ten years a member of the standing committee of that diocese. He has held the office of trustee of Columbia College since 1843.

Haight (HENRY HUNTLEY), governor of California 1867–71, b. at Rochester, Monroe co., N. Y., May 20, 1825; graduated from Yale College in 1844; studied law, and began practising in San Francisco, Cal., 1850. He was appointed U. S. district judge of California by Pres. Lincoln.

Hail. The precipitation of the vapor in the atmosphere, when it occurs at a low temperature, takes place in a solid form, and assumes the shape of snow, sleet, or hail. No very precise distinction is drawn between the terms hail and sleet, other than that the latter word is applied to the smallest hailstones, comparable in size to drops of water, and generally falling at the close of a rain or snow storm. While snow descends in crystalline flakes whose weight is at the most but a few grains, hail, on the contrary, frequently occurs weighing an ounce, and in exceptional cases one or two pounds. Such hailstones are formed of crystalline and amorphous masses of ice, the latter generally of lenticular or spherical shape. Their structure, as revealed by the microscope (see FLOGEL in *Pogg. Ann.*, 1871, Band 146, seite 482) and by the polariscope (see MULLER in *Pogg. Ann.*, 1871, Band 144, seite 333), suggests that they have been formed by a process of rapid crystallization and accretion at temperatures a little below the freezing-point—a process precisely similar to the formation of crystals from ordinary liquid solutions. We are indeed warranted in the general statement that as snowflakes are smallest when formed slowly at very low temperatures, and largest when formed rapidly at temperatures near the freezing-point, so hailstones are largest when formed most rapidly, and have in general as their origin large snowflakes or snowballs; these latter being carried upward by the violent ascending currents attending summer thunderstorms (and to whose mechanical cooling the precipitation is originally due), begin their fall, in the course of which the snowball is converted into a semi-crystalline mass of ice enclosing many air-bubbles, and, rotating rapidly, grow by the addition of such particles of vapor as lie near their path. In large lenticular-shaped hailstones this additional formation was found by Abich (see MORITZ, *Klimatologie der Kaukasus*) on the equatorial portions of the central mass, and in the shape of more or less definite crystals imbedded slightly in the surface of the spheroid. In the case, however, of conical hailstones, Flogel found the accretionary ice confined to the base of the cone, and composed of closely packed crystals, that would have been indistinguishable from each other except for the fact that their respective optical axes were inclined to each other at all possible angles; within each crystal he also found cavities, each of which contained liquid water and a minute bubble of air. It has also been by Reinsch shown that these bubbles of air are confined under a pressure of many atmospheres. (See *Pogg. Ann.*, 1871; Band 144.)

The origin of the cold necessary to the formation of hail in the midst of warm weather was first properly explained by Espy (1835) as the result of the mechanical cooling of ascending expanding currents of air. The development of this principle by William Thomson (*Memoirs of Manchester Lit. and Phil. Soc.*, 1862), Hirn (*Introduction à la Météorologie de l'Alsace*), Reye (*Die Wirbelsturme*, 1872), Peslin (*Bull. Hebd.*, 1868), Hann (*Zeitschrift für Meteorologie*, 1874), offers a complete explanation of the fact that hail falls usually on the advancing side of a thunderstorm or tornado, and of its dependence upon local topography. These vertical currents can, in fact, rarely occur except when the surface of the ground has been heated by the sun so rapidly that, so far as temperature is concerned, the upper and lower portions of the atmosphere are in a condition of unstable equilibrium. As a consequence, the upper colder layers descend, pushing the warmer ones up; and although in its descent the air is warmed at the rate of 0.99° C. for every 100 mètres descent, it still reaches the earth as cool air compared with that which it displaces; the latter in its ascent cools at a rate from 0.99° C. to 0.0° C., varying with its humidity. In accordance with these principles, it is found that hailstorms are usually of small dimensions, and confined to the central portions of more extensive rainstorms; they deposit their hail in narrow bands, sensibly parallel to the general track of the storm; they are usually preceded by a notable rise in the temperature, and occur especially in the springtime or early summer, and during the hottest portions of the day; the duration of the fall rarely exceeds a few minutes, within which period, however, enormous quantities sometimes fall over quite limited areas, resembling in this respect the floods of water or cloud-bursts that occur in some localities. Although hailstorms are usually accompanied by intense lightning, yet there is no reason to believe that electricity is essential to the formation of hail, at least not in any such way as was suggested by Volta; on the other hand, it is plausible that the electrification of minute particles of vapor or ice may hinder the process of accretion, and that the formation of large crystals may take place rapidly immediately after a discharge of lightning. The geographical distribution of hailstorms is in complete accordance with the previous explanations; thus, Prettner has shown that in Carinthia hailstorms occur most frequently in broad, open valleys, and least frequently in those that are closely shut in by mountains. Humboldt first called attention to the fact that in the tropics hail never occurs with any severity above 5000 feet, and rarely occurs near the level of the sea. France and portions of Northern Germany are visited with more frequent, severe, and destructive hailstorms than are recorded in any other country except India, and in these portions of Europe the statistics relating thereto are made the basis of numerous flourishing hail-insurance companies. CLEVELAND ABBE.

Hailes (Sir DAVID **Dalrymple**), LORD, b. at Edinburgh Oct. 28, 1726, grandson of Viscount Stair; was educated at Eton, Edinburgh, and Leyden; became a Scottish advocate 1748; a judge of the court of session 1766, and as such assumed the title of Lord Hailes, but was never a peer; became a lord of justiciary 1776. D. Nov. 29, 1792. Author of many highly valued works, among which are *Canons of the Scottish Church* (1769); *Annals of Scotland* (1776–79); *Remains of Christian Antiquity* (1776–80); a translation of Lactantius's *De justicia*, etc.

Hailesborough, post-v. of Fowler tp., St. Lawrence co., N. Y., on the Oswegatchie River. Pop. 177.

Haimu'ra, a large and excellent food-fish of the upper parts of the rivers of Guiana. It is the *Erythrinus macrodon*, of the family Erythrinidæ. Its bite is very severe.

Hainan, island of China, belonging to the province of Quang-Tong, in the China Sea, just outside the Gulf of Tonquin, between lat. 18° and 20° N., and between lon. 108° and 111° E. Its area is estimated at 12,000 square miles, its population at 1,500,000 Chinese, besides wild tribes in the interior. The western coast is low and surrounded by shoals and banks, but fertile and productive of rice, sugar, and indigo. The interior is mountainous, mostly covered with extensive forests, from which much

timber is exported. The southern coast is rocky, but has good harbors. Here is situated Kiang-Choo, the capital and the southernmost Chinese port open to foreigners. It is a very populous town, said to have 200,000 inhabitants.

Hainaut (formerly **Hainault**), province of Belgium, bounded W. and S. by France, E. and N. by the provinces of Brabant and Flanders. Area, 1430 square miles. Pop. 896,285. The southern and eastern parts are hilly, occupied by the Ardennes; the northern and western parts are flat, but exceedingly fertile. The region around Mons contains very extensive coal-fields, and coal, together with porcelain, flax, hemp, tobacco, and linen, forms the main export. The old province of Hainault comprised also a territory which in 1678 was ceded to France, and now forms the department of Nord.

Hain'burg, town of Austria, in the province of Lower Austria, on the Danube, 27 miles S. E. of Vienna, contains many interesting remains of antiquity, among which are a Roman aqueduct which still provides the town-market with water, and the so-called Roman tower with the statue of Attila; and has an imperial manufactory of tobacco, the largest in the country, employing 1300 men, and a needle-factory, which annually produces more than 60,000,000 needles. Pop. 4325.

Haines, tp. of Centre co., Pa. Pop. 1354.

Hainesville, post-v. in Clinton co., Mo. Pop. 248.

Hair. See Histology.

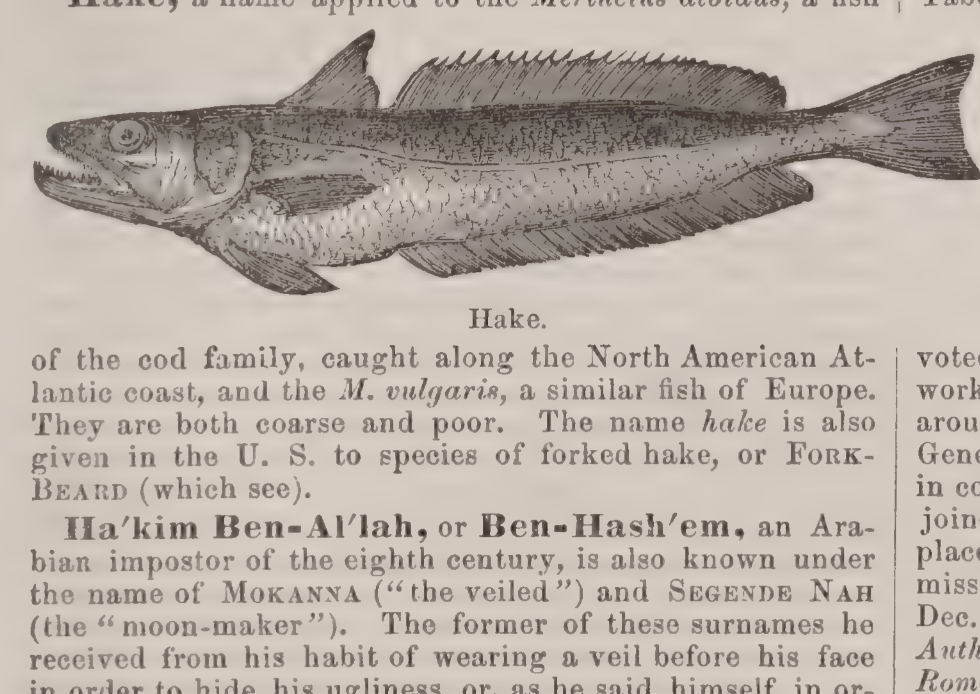
Hair-Spring, in a watch, the delicate spiral steel spring, the outer extremity of which is attached to the frame of the watch, the inner to the "verge" (or axle) of the balance-wheel, supplying the force for resisting the successive impulses given by the teeth of the escapement-wheel, and converting them into isochronous vibrations. The perfect manufacture (*tempering* included) of these (slighter than hair) springs (the combined weight of 4000 being required to make an ounce) is one of the essentials to producing correct timepieces, and is now successfully performed by American watchmakers. (See Watchmaking.)

Hair'tail (*Trichiurus*), a genus of fishes of the family Cepolidæ. The silvery hairtail, *T. lepturus* (ribbon-fish, sword-fish), is from two to four feet long, of a shining, silvery color, and is caught along the Atlantic shores of the U. S.

Hair-worm. See Gordius.

Hajji. See Hadj.

Hake, a name applied to the *Merlucius albidus*, a fish



Hake.

of the cod family, caught along the North American Atlantic coast, and the *M. vulgaris*, a similar fish of Europe. They are both coarse and poor. The name *hake* is also given in the U. S. to species of forked hake, or Fork-Beard (which see).

Ha'kim Ben-Al'lah, or **Ben-Hash'em,** an Arabian impostor of the eighth century, is also known under the name of Mokanna ("the veiled") and Segende Nah (the "moon-maker"). The former of these surnames he received from his habit of wearing a veil before his face in order to hide his ugliness, or, as he said himself, in order to conceal the radiance of his eyes; the latter from a trick of legerdemain he once performed, causing a moon to issue from a deep well and remain visible for a whole week. He succeeded in gathering a number of adherents, with whom he seized several strong places near Nekshib and Kish. The caliph Mahadi marched against him, and soon all his strongholds were taken. Shut up in the last of his fortresses, he poisoned his soldiers by wine at a banquet, and burned himself up, in order to make people believe that he had ascended bodily to heaven. Moore has used the story of his life for the episode of "The Veiled Prophet of Khorassan" in *Lalla Rookh*.

Hak'luyt (Richard), b. in London in 1553; studied at Oxford. He was master of arts and professor of divinity when in 1584 he accompanied the English ambassador to Paris, and here he published in 1587 an account of a voyage to Florida by Laudonnière, which he found in the library, and also Peter Martyr's work, *De Novo Orbe*. But the greater part of his reputation he owes to his *Principal Navigations, Voyages, Traffiques, and Discoveries of the English Nation* (3 vols., 1598–1600), in which are found accounts of 220 voyages, accompanied with many curious documents. D. in London in 1616, a prebendary of Bristol and Westminster. The Hakluyt Society was established in London in 1846 for the purpose of preserving and editing accounts of geographical or historical interest.

Hakoda'di, town of Japan, on the island of Jesso, at the foot of the southernmost promontory Tzagar, in lat. 41° 40′ N. and lon. 141° 15′ E. It is not a large place, but it has a good harbor, and has become important as one of the Japanese ports opened to foreigners. Hakodadi is much visited by whalers. Pop. 50,000.

Hal'acha [Heb., the "rule"], the Hebrew oral and traditional law, handed down, as Jews conceive, from Moses and the other eminent teachers of antiquity, and first reduced to writing in the early centuries of the Christian era. The general code is called Mishna (which see), but the Halacha is much more extensive.

Halas, town of Hungary, about 80 miles S. E. of Pesth. It has a considerable trade in wine. Pop. 13,339.

Hal'berd [originally *helmbart*, "helmet-axe," that is, an axe to split helmets with], a form of the battle-axe, combining the hooked blade of the bill or gisarme with the head of the lance. It was once borne by bodies of troops called halberdiers and by various non-commissioned officers. Its use is now limited to ceremonial occasions. In Great Britain the partisan, one form of the halberd, is borne by the Yeomen of the Guard.

Hal'berstadt, town of Prussia, in the province of Saxony, on the Holzemme. It is an old town; many of its houses are ornamented with curious wood carvings. Its cathedral, built in the thirteenth century, is in the finest Gothic style; the church of Our Lady, built in the eleventh century, is in the Byzantine style. Halberstadt has considerable manufactures of soap, oil, leather, gloves, etc. Pop. 25,419.

Hal'bert, tp. of Martin co., Ind. Pop. 1336.

Hal'cott, mountainous tp. of Greene co., N. Y., containing extensive forests. Pop. 426.

Halcyon. See Kingfisher.

Hal'dane, tp. of Ogle co., Ill. Pop. 1265.

Hal'dane (James Alexander), brother of Robert, b. at Dundee, Scotland, July 14, 1768; became a mariner, and master in 1793 of the Melville Castle, an East India Company's ship; retired in 1794 from business with a considerable estate; was for more than fifty years minister of the Tabernacle, a Baptist chapel, Leith Walk, Edinburgh; travelled extensively in Scotland, and engaged in religious labors. D. at Edinburgh Feb. 8, 1851. Author of *The Social Worship of the First Christians* (1805), *Man's Responsibility and the Atonement* (1842), *Exposition of Galatians* (1848), *Inspiration of the Scriptures* (1845), and controversial tracts.

Haldane (Robert), b. of Scottish parents in London Feb. 28, 1764; served 1780–83 in the royal navy; was converted to Christianity, of the divine origin of which he had entertained doubts, and devoted his life and large fortune thenceforth to missionary-work. Forbidden to labor in India, his field-preaching aroused great religious feeling in Scotland, but in 1800 the General Assembly interfered with his work, and Haldane in consequence left the National Church, and after a time joined the Baptists. He built many "tabernacles" or places of worship, did much for the African and French missions, and for the Bible and continental societies. D. Dec. 12, 1842. Among his works are *Evidence and Authority of Revelation* (2 vols., 1816), *Exposition of Romans* (2 vols., 1835), *Verbal Inspiration* (1830), etc. (See *Memoirs of R. and J. A. Haldane*, by Alex. Haldane, 1852.)

Hal'deman (Samuel Stehman), A. M., b. near Columbia, Pa., in 1812, pursued his studies at Dickinson College until 1830; was chosen an assistant in the New Jersey geological survey (1836), and held the same office the ensuing year in the Pennsylvania geological survey. While engaged in this capacity there he discovered the oldest fossil known at that time—viz. *Scolithus linearis*; occupied the chair of natural history in the University of Pennsylvania (1851–55); took the corresponding professorship in Delaware College 1855, and in the same year became professor of geology and chemistry at the Agricultural College of Pennsylvania; is now professor of comparative philology in the University of Pennsylvania. Author of numerous articles on conchology, entomology, and palæontology, published in various scientific magazines. His work entitled *Analytic Orthography*, which consists of investigations into the philosophy of language, obtained for him in England the highest Trevellyan prize over 18 competitors (1858).

Hal'dimand, fertile county of Ontario, Canada, on the N. shore of Lake Erie. Cap. Cayuga. Pop. 20,091.

Hale, county in the W. of Alabama. Area, 520 square miles. It has an undulating surface and an excellent soil. Cotton, corn, tobacco, and wool are staple products. The Black Warrior River is its western boundary. Cap. Greensborough. Pop. 21,792.

Hale, tp. of Warren co., Ill. Pop. 1212.

Hale, tp. of Jones co., Ia. Pop. 997.

Hale, post-tp. of McLeod co., Minn. Pop. 399.

Hale, tp. of Hardin co., O. Pop. 1254.

Hale, post-tp. of Trempealeau co., Wis. Pop. 616.

Hale (Benjamin), D. D., b. at Newbury, Mass., Nov. 23, 1797; graduated from Bowdoin College (1818) with high honors, and was selected at once as principal of the Saco Academy; studied theology at Andover Seminary, and began preaching in 1822; was elected tutor at Bowdoin College 1823, and principal of the Gardiner Lyceum 1822–27; in 1827 became professor of chemistry and mineralogy at Dartmouth College, Hanover, N. H., in which office he remained until it was abolished by the trustees in 1835; took orders in the Protestant Episcopal Church; was chosen president of Geneva (now Hobart Free) College in 1837. Author of *Scriptural Illustrations of the Liturgy* and other works. D. July 15, 1863, at Newbury, Mass.

Hale (Charles), brother of E. E. Hale, was b. at Boston, Mass., June 7, 1831; graduated at Harvard 1850; has been editorially connected with *To-day*, a journal, and with the Boston *Advertiser*, of which his father, Nathan Hale, was long responsible editor; U. S. consul in Egypt 1864–70. Author of pamphlets, review articles, etc.

Hale (David), b. at Lisbon, Conn., Apr. 25, 1791; went to Boston in 1809, and engaged in mercantile business in 1815; in 1827 became associate editor of the New York *Journal of Commerce*, and in 1828 became associated with Gerard Hallock as proprietor of that journal, long thereafter one of the most influential in the U. S. He was a prominent Democratic politician, and a most liberal benefactor of the religious enterprises sustained by the Congregational denomination, of which he was an active member. D. at Fredericksburg, Va., Jan. 20, 1849. (See his *Memoir* by J. P. Thompson, 1845.)

Hale (Edward Everett), A. M., b. in Boston, Mass., Apr. 3, 1822; was educated at the Boston Latin School and at Harvard College; studied divinity in private; entered the ministry of the Unitarian sect; was settled at Worcester, Mass., in 1846; became minister of the South Congregational church of Boston in 1856. In his profession Mr. Hale is eminent for his interest in social and philanthropic movements, for pastoral activity, denominational zeal, and power of organization. To the general public he is best known through his writings—*The Rosary, Margaret Percival in America, Sketches of Christian History, Kansas and Nebraska, Letters on Irish Emigration, Ninety Days' Worth of Europe, If, Yes, and Perhaps, Ingham Papers, Sybaris and other Homes, How to Do it, Ten Times One is Ten, Reformation, Level Best and other Stories, Ups and Downs, Christmas Eve and Christmas Day, In His Name, Our New Crusade, Workingmen's Homes.* In addition to these volumes he edited the Boston edition of Lingard's *History of England*, was editor of the *Christian Examiner*, the organ of the Unitarian body, and founded in 1869 *Old and New*, a monthly magazine semi-theological in its character, whereof he has been the sole editor. Mr. Hale has contributed largely to the papers, is a popular lecturer, a man of extensive information, of extraordinary energy, and large influence. O. B. Frothingham.

Hale (Edwin M.), M. D., b. at Newport, N. H., Feb. 2, 1826; became a printer and *littérateur* of Newark, O.; graduated at the Cleveland Homœopathic Medical College; practised twelve years at Jonesville, Mich.; became in 1864 professor of materia medica in the Hahnemann Medical College, Chicago; in 1870 professor of medical botany and pharmacology; and in 1871 became also special lecturer on diseases of the heart in the same institution. Has long been editorially connected with professional journals. Author of many monographs, etc., and of a treatise on *New Remedies* (1862; 3d ed. 1867); *On Sterility* (1868); *Pocket Manual of Domestic Practice* (1870); *Lectures on Diseases of the Heart* (1871); *Treatise on Cerebro-Spinal Meningitis* (1875), and other professional works.

Hale (Enoch), M. D., b. at Westhampton, Mass., Jan. 19, 1790; took his medical degree at Harvard University 1813; practised until 1816 at Gardiner, Me.; then removed to Boston, where he was long a very prominent physician and public-spirited citizen. Author of many professional dissertations of value. D. at Boston Nov. 12, 1848.

Hale (Eugene), b. at Turner, Me., June 9, 1836; was admitted to the bar in 1857; was for nine years attorney for Hancock co., Me.; was in the legislature 1867–68; was elected to Congress 1868, and has been thrice re-elected; has taken a prominent part in national affairs, and in 1874 declined the postmaster-generalship. Resides at Ellsworth, Me.

Hale (John Parker), b. at Rochester, N. H., Mar. 31, 1806; graduated from Bowdoin College, Me., 1827; studied law, and was admitted to the bar in 1830; became a member of the New Hampshire legislature 1832; M. C. 1843–45; occupied the chair of U. S. Senator 1847–53 and 1855–65, and was U. S. minister to Spain 1865–69. Candidate of the Free-Soil party for President in 1852, receiving 157,680 votes. D. at Dover, N. H., Nov. 19, 1873.

Hale (Sir Matthew), b. at Alderley, Gloucestershire, England, Nov. 1, 1609; was bred a Puritan, but while at Oxford University (1626–29) fell into wild habits, which he soon abandoned; read law 1629–36, and was called to the bar at Lincoln's Inn; entered Parliament 1654, and was 1654–58 a judge of common pleas under Cromwell; was in the Convention Parliament 1660; was knighted and made chief baron of the exchequer 1660; was chief-justice of the king's bench 1671–76. D. at Alderley Dec. 25, 1676. Among his legal works are the *History of the Pleas of the Crown* (1678), *History of the Common Law* (1713), *Analysis of the Law* (1739); among his religious works, *An Abstract of the Christian Religion, A Discourse of Religion, Contemplations* (1676), *The Knowledge of Christ*, and some minor works. He was the last English judge who condemned persons accused of witchcraft. He was nevertheless a man of justice, moderation, wisdom, and wide and thorough learning, as well as of devout religious character.

Hale (Nathan), b. in Coventry, Conn., June 6, 1755; graduated at Yale College 1773; intended for the ministry, he yet devoted a time to teaching at East Haddam and at New London; after the battle of Lexington he joined the army as lieutenant, and was soon after appointed captain. Among his exploits the capture of a British sloop, in Sept., 1776, loaded with provisions, from under the guns of a frigate in New York harbor, is worthy of record. After the defeat of our army on Long Island and its subsequent retreat therefrom, Washington was extremely anxious to obtain information of the strength, plans, and situation of the enemy, and Hale volunteered to undertake the perilous task. He crossed safely, and possessed himself of full knowledge of the situation, but on returning was discovered by the enemy, with his notes upon his person, and being recognized, was hanged as a spy, by order of Sir William Howe, on the morning of Sept. 22, 1776. His last words were, "I only regret that I have but one life to lose for my country." His virtues have been extolled in verse and prose by Dwight. His *Life* was published by Stuart in 1856. G. C. Simmons.

Hale (Nathan), b. at Westhampton, Mass., Aug. 16, 1784; graduated at Williams College 1804; began the study of law, but devoted two years as instructor in the academy at Exeter, N. H., when he removed to Boston, and in 1810 was admitted to the bar; after practising his profession four years, during which time he was also an editor of the *Weekly Messenger*, he purchased (Mar., 1814) the Boston *Daily Advertiser*, the pioneer daily in New England; Federal in politics at first, it subsequently became an advocate of the Whig and Republican parties, Mr. Hale remaining at the editorial helm during his life. During the discussion of the Missouri (1820) and Nebraska (1854) bills the journal took a decided and influential stand in opposition, but was the first to advocate the free colonization of Kansas. Actively interested in internal and local improvements, he was the first president of the Boston and Worcester R. R., which position he held nineteen years; was influential in promoting the introduction of water into the city of Boston, and at the head of the commission for that object; was one of the founders of the *North American Review*, also of the *Christian Examiner;* at various times elected to the Massachusetts legislature; member of the Academy of Arts and Sciences, Massachusetts Historical Society, etc. Mr. Hale was a nephew of the Revolutionary patriot who was executed as a spy in 1776, and father of the Rev. E. E. Hale. G. C. Simmons.

Hale (Salma), b. at Alstead, N. H., Mar. 7, 1787; studied law, and held the office of clerk of the superior and county courts of Cheshire for twenty-two years; was M. C. in 1817–19, and a member of the legislature 1823–25. Author of several works, as *History of the U. S.* (1825), *Annals of Keene*, etc. D. at Keene, N. H., Nov. 19, 1866.

Hale (Sarah Josepha Buell), b. at Newport, N. H., in 1795. She issued in 1823 her first work, entitled *Genius of Oblivion, and Other Original Poems.* She became editress of the *Ladies' Magazine* (1828), which was united with *Godey's Lady's Book* in 1837. She also published *Traits of*

American Life (1852), *Dictionary of Poetical Quotations* (1852), *Woman's Record, or Biographical Sketches of all Distinguished Women from the Creation to the Present Time* (1853), *New Household Receipt Book* (1853), *Letters of Lady Mary Wortley Montagu* (1856), and many others.

Hales (Alexander of), surnamed *Doctor Irrefragabilis*, was b. probably (date not known) at Hales, in Gloucestershire, England. Hence his name, Alexander *Halensis*. He cannot have belonged to the famous abbey there, which, according to Tanner, was not founded till the year after his death. After studying a while at Oxford, he went to Paris in 1222, and joined the Franciscans. In 1230 he was made professor in the university, and d. Aug. 27, 1245. Bonaventura, and perhaps Aquinas, were among his pupils. He was the first of the Schoolmen to make a thorough use of Aristotle. Only the *Organon*, translated by Boethius, had previously been in the hands of Occidental theologians. After the fall of Constantinople (in 1204) all the Greek originals, with the Arabian commentaries, were accessible. Very shortly Aristotle supplanted Plato. Alexander of Hales commented on Aristotle, as also on the Psalms and the Apocalypse. But his great work was the *Summa Universæ Theologiæ*, in four books (God, Creation, Redemption, Sacraments), based on the *Sentences* of Lombard. The arguments on each side were arranged in a syllogistic form. He first developed the doctrine of a *Thesaurus Meritorum*. The earliest edition of his *Summa* was that of Venice (1475; again, and improved, 1576). Other editions are those of Nuremberg (1482) and Cologne (1622). R. D. Hitchcock.

Hales (John), M. A., "the ever-memorable," b. at Bath, England, Apr., 1584; was entered of Corpus Christi College, Oxford, 1597; became a fellow of Merton 1606, of Eton 1613; professor of Greek at Oxford 1612; went to the Synod of Dort 1618, and was then converted to Arminianism; canon of Windsor 1630; was an irenic or latitudinarian, and one of the oldest of what is now called the Broad Church school, hence denounced in his own time as a trimmer; chiefly remembered for his *Golden Remains*, written in a quaint and vigorous style, but hardly worthy of his great fame for learning and ability. D. in great poverty at Eton May 19, 1656.

Hales (William), D. D., an Irish divine who became fellow of Trinity, Dublin, in 1769; professor of Oriental languages 1782; rector of Killeshandra 1787, and d. Jan. 30, 1831. Among his scientific works are *Sonorum doctrina rationalis* (1778), *Analysis æquationum* (1784), *Analysis fluxionum* (1800), *New Analysis of Chronology* (1809–14). Among his other writings are *Prophecies regarding our Lord* (1708), *The Holy Trinity, Primitive British Church* (1819), etc.

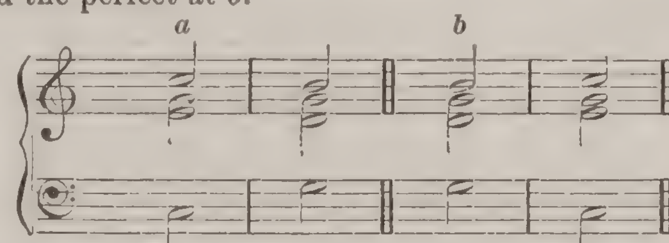
Hale's Location, an unincorporated tract in the White Mountain region of New Hampshire, is in Carroll co. It contains much romantic scenery. Pop. 4.

Halévy (Jacques François Élie Fromental), b. in Paris May 27, 1799; d. at Nice Mar. 17, 1862. He was of Jewish parentage; studied successfully at the Conservatoire, and was a favorite pupil of Cherubini; was enabled to spend two years in Italy, having won a first prize for composition. There his opera *Pygmalion* was written; this was followed by others, *Phidias, The Artisan*, which had a local reputation. The opera *La Juive* was the foundation of his fame; it was first produced in 1835. Other well-known works are *The Queen of Cyprus, Charles VI., The Queen's Musketeers, The Wandering Jew, The Tempest, Valentine d'Aubigné*, and *The Sorceress*. He produced some thirty operas in all, tragic and comic. He was a talented and cultivated composer, painstaking and scholarly, but without the gift of genius. He was a writer besides on musical topics. Except in Paris, Halévy is little known, though once he was highly honored. Louis Philippe and his family conferred distinction on him; he was made "professeur de haute composition" at the Conservatoire, member and perpetual secretary of the Academy of Fine Arts, officer of the Legion of Honor.
O. B. Frothingham.

Halévy (Léon), son of Jacques Fromental Halévy, b. in Paris Jan. 14, 1832, author of many works on literature, philosophy, history, foreign languages, etc. One of these works appeared with the remarkable epigraph: "The golden age, which a blindfold tradition has placed behind us, is in front of us." His principal books are—*Literary, Philosophical, and Industrial Opinions, The Barcelona Plague, Summary of the History of the Hebrews, Summary of the History of French Literature.* He gave also many plays to different Paris theatres: *The Spy, Czar Demetrius, Indiana, Beaumarchais at Madrid, The Golden Broomstick, Electra*, etc. Félix Aucaigne.

Halévy (Ludovic), son of Jacques Fromental Halévy, b. in Paris in 1834. He is one of the most popular authors of light plays or vaudevilles of the French stage. He has also written nearly all the librettos of the opéra bouffe composer, Offenbach. Among the works of Halévy the following are the best known: *Ba-ta-Clan, Orphée aux Enfers, Métella's Key, The Brazilian, La Belle Hélène, Blue Beard, La Vie Parisienne, La Grande Duchesse de Gérolstein, Fanny Lear, The Brigands, Frou-frou.* In many of his plays he had the collaboration of H. Meilhac. Félix Aucaigne.

Half Cadence, in music, the name sometimes applied to a cadence on the dominant, otherwise called the "imperfect" cadence, as contradistinguished from the perfect on the tonic. In the example see the half (or imperfect) cadence at *a*, and the perfect at *b:*



William Staunton.

Half Moon, post-tp. of Saratoga co., N. Y., extending from the Hudson to the Mohawk River. Many thousand tons of moulding-sand are annually shipped from this town, which is traversed by the Erie Canal and the Rensselaer and Saratoga R. R. Pop. 3093.

Half Moon, post-tp. of Centre co., Pa. Pop. 698.

Half Moon Bay, post-tp. of San Mateo co., Cal. Pop. 1665.

Half Note, a term popularly, though incorrectly, used for half *tone* or semitone, such as the progression from B to C, or from F to F sharp; also, the designation of a minim, as having half the duration of a semibreve, the latter being regarded, in modern music, as the standard of time, and hence called a *whole* note.

Hal'ford (Sir Henry), Bart., M. D., b. at Leicester, England, Oct. 2, 1766 (named Vaughan in youth); was educated at Rugby and Oxford; M. A. 1778, M. D. 1791; settled in London 1794; was made a baronet 1809; took the name Halford with an inherited estate 1815: was a court-physician throughout nearly all his professional career, and one of the most popular physicians in London; was made knight commander of the order of Guelphs 1825. D. in London Mar. 9, 1844. Among his works are *Essays and Orations* (1831), *The Death of Some Eminent Persons* (1835), *Nugæ Metricæ* (1842).

Half-pay [Fr. *demi-solde*], the money-allowance made to officers of armies and navies when not engaged in active professional duties. Half-pay is unknown in the U. S. In the British navy half-pay is the regular stipend of every officer except when afloat or performing certain specified duties. In the British army half-pay is ordinarily given to officers temporarily thrown out of employment by sickness or by the reduction in size of the corps to which they belong. There are also some officers *retired* upon half-pay, but as a rule retired officers have full pay. Half-pay was first granted by William III. in 1698.

Hal'iburton (Thomas Chandler), D. C. L., b. at Windsor, Hants co., Nova Scotia, in 1797; was educated at King's College, Windsor, and after studying law was called to the bar in 1820; practised for a number of years in Nova Scotia, and became subsequently judge of the court of common pleas. He issued 1837 his work entitled *The Clockmaker, or Sayings and Doings of Samuel Slick of Slickville*, which became very popular in the U. S. and England; also published *Traits of American Humor* (1852) and other works. D. at Isleworth, England, Aug. 27, 1865.

Hal'ibut, the *Hippoglossus vulgaris*, a large fish of the family Pleuronectidæ, sometimes found to weigh more than 600 pounds. It is caught on both sides of the Atlantic, and especially on the Banks of Newfoundland in the winter

Halibut.

season. Its flesh is justly prized. Its upper side is dark, its lower white, the eyes being both upon the upper side, as in the other Pleuronectidæ.

Halicarnas'sus (Ἁλικαρνασσός, now *Boudroum*), a Greek city of Caria, on the Ceramian Gulf, was colonized from Trœzene, and once belonged to the Dorian Hexapolis, but afterwards became the great centre of Persian influence, and fell under the power of a line of Carian princes, vassals of the Persians, of whom Mausolus was the most celebrated. Though Greek in language and culture, it was Persian in politics. Alexander was unable to take its citadel, Salmacis, but destroyed the rest of the town. It never afterwards regained its greatness. The village of *Boudroum* occupies its site, and recent excavations have revealed abundant relics of its former splendor. Boudroum has an outer and an inner harbor; lat. 37° 2′ 21″ N., lon. 27° 25′ 18″ E.

Hal'ifax, town of England, in the county of York, on the Hebble. It is a flourishing and rapidly growing town of very large manufacturing interests. Its carpet-works are the largest in the world, and its manufactures of woollen and worsted rank next to those of Leeds and Bradford. Pop. 65,124.

Halifax, county of Nova Scotia, bounded on the S. E. by the Atlantic. Its surface is broken, and in part not very productive. Its coast is broken by deep bays and harbors, and is sheltered by numerous small islands. Ores of gold and lead are among the minerals found. Shipbuilding, commerce, and the fisheries are important industries. It is intersected by the Intercolonial Railway. Cap. Halifax. Pop. 56,963.

Halifax, the metropolis of Nova Scotia, and the principal naval station and arsenal held by England in British America, was founded by Gov. Cornwallis in 1749. It is

New Provincial Building.

beautifully situated on the W. side of Chebucto Bay, one of the best harbors in the world. Commanded by a hill on which is a strong fort, the town is protected seaward by many batteries armed with guns of the newest pattern and heaviest calibre. The garrison consists at present of two regiments of foot, several companies of artillery and engineers, while the local forces are in a very efficient state. The principal streets are laid out parallel with the water, crossed by others at right angles; they are wide and commodious, with sidewalks having heavy granite curbings and crossings. As usual with all towns on the seaboard of British North America, the houses were constructed of wood, though, in consequence of repeated and disastrous fires, these have been in a great measure replaced by really beautiful buildings of stone or brick. Many of the stores and public edifices may vie in external appearance with any on this continent. The salubrity of the air—devoid in summer of the relaxing effects of extreme heat, tempered by bracing winds from the ocean; the beautiful drives into the surrounding country; the well-known hospitality of its citizens; its easy accessibility by means of the Intercolonial Railway, render it one of the most desirable of watering-places; and there are several hotels which, without much pretension, are really comfortable, not to say luxurious. Halifax is supplied with pure water from two beautiful lakes a few miles distant, brought in pipes twenty inches in diameter, ample for a population of 100,000. The fire department is in a most efficient state, served by three steam and several hand engines, and the pressure from the lakes is such that, by means of hose, the water can be thrown in heavy streams to a considerable height in any part of the city. There are 26 places of worship, 4 convents, a Presbyterian theological school, 2 public libraries, 1 university and 2 colleges, 1 grammar school, 17 public schools, and many private seminaries, attended by nearly 7000 pupils; the public schools are free to all, and compare very favorably with similar establishments elsewhere. There are three orphans' homes, an asylum for the poor, one for the blind, and one for the deaf and dumb, all of which are in successful working order and are generously sustained. The 6 daily and 4 weekly papers have a large circulation. Four breweries, 2 steam-bakeries, a carriage and skate factory,

foundries, establishments for machinery, for canning lobsters and fish, tobacco, piano, and furniture manufactories, and an extensive gasworks have been for some years in active operation, and command extensive business, while 7 banks possess ample capital. Halifax carries on an increasing trade, particularly with the West Indies. The exports are fish and lumber in very large quantities. The return cargoes consist of sugar, molasses, rum, and other West Indian produce, while from England and the U. S. are imported all kinds of manufactured goods. Imports for the year ending Dec. 31, 1873, $9,116,798; exports, $4,120,155; duties collected, $1,044,470. Pop. 29,582. It has an Anglican bishop and a Roman Catholic archbishop. Lat. 44° 39′ 42″ N., lon. 63° 35′ 30″ W. J. R. WILLIS.

Halifax, county in the N. N. E. of North Carolina. Area, 680 square miles. The Roanoke River is its N. E. boundary. It is intersected by the Wilmington and Weldon R. R. The chief products are cotton, corn, and swine. Cap. Halifax. Pop. 20,408.

Halifax, county of Virginia, bounded S. by North Carolina. Area, 960 square miles. It is bounded N. E. by the Roanoke River, and is traversed by the Richmond and Danville R. R. It has a fertile soil, producing grain and large amounts of tobacco. Plumbago is found. Cap. Halifax Court-house. Pop. 27,828.

Halifax, post-tp. of Plymouth co., Mass., on the Old Colony R. R., 28 miles S. E. of Boston. Pop. 619.

Halifax, post-v., county-seat of Halifax co., N. C., on the Wilmington and Weldon R. R., 8 miles S. of Weldon, and on the W. bank of the navigable Roanoke River. It is finely situated, and has a good trade. Pop. 429.

Halifax, tp. and post-v. of Dauphin co., Pa., on the Northern Central R. R., 20 miles N. of Harrisburg, and on the E. bank of the Susquehanna. Pop. 568; of tp. 1905.

Halifax, post-tp. of Windham co., Vt., on the Massachusetts line, and 15 miles W. of Brattleborough. It has manufactures of lumber, maple-sugar, leather, chair-stuff, and other articles. Pop. 1029.

Halifax (CHARLES **Montague**), EARL OF, b. Apr. 16, 1661, at Horton, Northamptonshire, and educated at Cambridge. He entered the House of Commons as member for Malden during the Convention Parliament, and was appointed a commissioner of the treasury in 1692, and first lord of the treasury in 1698. His two most famous measures were the foundation of the English national debt in 1694 and the establishment of the Bank of England in 1695, both of which plans were devised with great insight and carried out with immense success. In 1699 he was made Baron Halifax, but in 1701, and again in 1703, he was impeached by the House of Commons, and escaped only by the protection of the House of Lords. During the reign of Queen Anne he was without office, but he took part very actively in the negotiations for the union between Scotland and England and for the succession of the House of Brunswick. On the accession of George I. he was made premier, earl of Halifax, knight of the Garter, etc., but d. soon after (May 19, 1715). His personal character was mean and probably dishonest, a mixture of baseness and arrogance, but his talents and his taste were superior. In his youth he had dabbled a little in literature, and when he came into power he patronized authors and artists.

Halifax (GEORGE **Saville**), MARQUIS OF, b. in 1630; d. in 1695. During three reigns he held the highest offices and played a most conspicuous part in politics. In 1668 he was made Baron Saville and Viscount Halifax for his participation in the Restoration, and in 1680 it was due to his eloquence that the House of Lords rejected the bill excluding the duke of York from the succession. Nevertheless, it was he who presented the crown to William and Mary on their accession, and he was for several years their prime minister; when he retired he entered into negotiations with the Jacobites. His party was contemptuously called the *Trimmers*, which name, however, he adopted and defended. He wrote *Character of a Trimmer, Anatomy of an Equivalent, Maxims of State*, etc.

Halifax Court-house, post-v., cap. of Halifax co., Va., on the Banister River, 6 miles from S. Boston. It has 3 churches, 1 newspaper, a good water-power, grist and flouring-mills, and some stores. Tobacco is the chief crop of the surrounding country. Pop. about 600.

P. H. CARPENTER, ED. "THE HALIFAX RECORD."

Halifax River, in Volusia co., Fla., is a salt-water tidal channel, running N. 30 miles. It is 1 mile wide throughout, and communicates with the sea through Mosquito Inlet. It is sometimes called Mosquito North Lagoon. It is continuous southward with Hillsborough River. It is navigable, and abounds in fish and oysters. Its W. bank is a mass of oyster-shells.

Halite. See ROCK-SALT.

Hall, at the English universities of Oxford and Cambridge, an institution differing from a college chiefly in being unendowed, or nearly so, and in having no corporate existence. In former times the halls were very numerous, Oxford alone having had at one time over 500, according to Anthony à Wood. At present they are few at either university; and in 1874, Magdalen Hall, Oxford, was absorbed by (the restored) Hertford College. It is, however, allowable for any M. A. to open a new hall, but the few that have been recently instituted on this plan have been, on the whole, unsuccessful.

Hall, town of Austria, in the province of Tyrol, 10 miles from Innspruck, and on the Inn, has many good educational and benevolent institutions, and large manufactures of salt and chemicals. Pop. 5022.

Hall, town of Würtemberg, on both sides of the Kocher. It is a picturesquely situated town, with large salt-works and sugar-refineries. Pop. 7793.

Hall, county in the N. E. of Georgia. Area, 540 square miles. It has rich mineral wealth, gold, silver, and lead, and several diamonds, rubies, and other rare precious stones have been found. Corn and tobacco are staple products. The county is traversed by the Atlanta and Richmond R. R. Cap. Gainesville. Pop. 9607.

Hall, county of E. Central Nebraska, bounded S. by the Platte River, and intersected by the Union Pacific R. R. Area, 414 square miles. The interval-lands are very productive; the higher lands need irrigation, but afford good pasturage. Cap. Grand Island. Pop. 1057.

Hall, tp. of Bureau co., Ill. Pop. 1059.

Hall, tp. of Dubois co., Ind. Pop. 2046.

Hall, tp. of Gates co., N. C. Pop. 778.

Hall, tp. of Anderson co., S. C. Pop. 1240.

Hall (BASIL), F. R. S., F. R. S. E., b. in Edinburgh, Scotland, 1788; entered the royal navy 1802; become post-captain 1817; d. in the insane hospital at Haslar, near Gosport, Sept. 11, 1844. His principal works are *A Voyage to the West Coast of Corea and the Great Loo-Choo Island* (1818); *Extracts from a Journal* (written on the Pacific coast of America, pub. in *Constable's Miscellany*); *Travels in North America* (3 vols., 1829, a work which excited no small indignation in the U. S.); *Fragments of Voyages* (9 vols., 1831–40, his best work), and several other volumes of travels.

Hall (CHARLES FRANCIS) was b. in 1821 at Rochester, N. H.; became a blacksmith, but removed to Cincinnati, where he was a stationer and journalist. He for a time paid great attention to the subject of caloric engines. He afterwards became deeply interested in the fate of Sir John Franklin, and in 1860 sailed from New London in the ship George Henry, Capt. James Buddington, the expedition being fitted out chiefly at the expense of Henry Grinnell of New York. Hall remained two years with the Esquimaux, and in 1862 returned. He published his *Arctic Researches* in 1864, and soon sailed again for the N. in the Monticello, Capt. James Buddington, again at the expense of Mr. Grinnell. He remained in the polar regions until 1869, when he returned, bringing many undoubted relics of the Franklin party. In 1871 he sailed on his third expedition in the steamer Polaris, fitted up by the U. S. government for polar exploration. Capt. Hall d. Oct. 10, 1871, in Greenland, and after great privations and many dangers the Polaris was abandoned, a portion of her crew under Capt. Tyson having drifted away on floating ice, from which they were rescued by the steamer Tigress Apr. 30, 1873, after floating 195 days. The remainder of the crew constructed boats, put to sea, and were picked up June 23, 1873, by a whaler, and carried to Dundee, Scotland.

Hall (Rev. CHARLES H.), b. in North Carolina Apr. 18, 1831; d. in Virginia Aug. 22, 1872. He graduated with high distinction at Randolph-Macon College, and joined the Virginia conference of the Methodist Episcopal Church, South in 1853. He was rarely gifted as a preacher, and occupied high positions in Virginia, and for three years was pastor of Trinity church, Baltimore. T. O. SUMMERS.

Hall (CHARLES HENRY), D. D., b. at Augusta, Ga., Nov. 5, 1820; studied at Phillips Academy, Andover, Mass., and graduated at Yale in 1842; entered the Protestant Episcopal ministry. Author of *Commentaries on the Gospels* (2 vols.), *Protestant Ritualism, Spina Christi*. Received the degree of D. D. from Hobart and Columbia colleges.

Hall (DOMINICK AUGUSTINE), b. in South Carolina in 1765; became U. S. judge of the State of Louisiana after its admission into the Union in 1812; is prominent as being interested with Gen. Jackson in a violent controversy 1815. D. at New Orleans, La., Dec. 19, 1820.

Hall (Frederick), M. D., LL.D., b. at Grafton, Vt., 1780; graduated at Dartmouth 1803; was a tutor there 1804–05; tutor in Middlebury College 1805–06; professor of natural philosophy and mathematics 1806–24; held the chemical professorship in Trinity College, Conn., and Columbian College, D. C., and the presidency of Mt. Hope College, Md. D. at Peru, Ill., July 27, 1843.

Hall (Gordon), one of the first missionaries of the A. B. C. F. M., was b. in Tolland, Hampden co., Mass., Apr. 8, 1784, and graduated at Williams College in 1808 with the first honors. He studied theology at Andover; was ordained, and set apart to the foreign missionary work with his brethren and colleagues, Messrs. Nott, Rice, Judson, and Newell, Feb. 6, 1812, at Salem, and in the same month sailed on his mission to India. He reached Calcutta in August of the same year, but the East India Co. refused to allow him and his fellow-missionaries to remain. After having been subjected to the greatest embarrassments through the arbitrary measures of the government, during all of which he never lost his self-possession and dignity, he succeeded in getting a foothold in Bombay, where he labored for thirteen years with absorbing devotion and great success. D. of cholera Mar. 20, 1826. He published several tracts and volumes on the missionary work, and revised the Mahratta New Testament.

Hall (Gordon), D. D., b. at Bombay, India, Nov. 4, 1823; graduated at Yale College in 1843, and at Yale Divinity School in 1847; was a tutor in Yale College 1846–48; was ordained at Wilton, Conn., in 1848, and in 1852 became pastor of the Edwards church (Congregational) in Northampton, Mass.

Hall (Hiland), LL.D., was b. at Bennington, Vt., July 20, 1795, the son of a farmer. He was admitted to the bar in 1819; served in the Vermont legislature, and became State's attorney; was a member of Congress 1833–43; a judge of the supreme court of Vermont four years; second comptroller of the U. S. treasury 1850; land commissioner of California 1851–54; governor of Vermont 1858–60. Published *History of Vermont* (1868), and has held various prominent offices.

Hall (James), b. at Philadelphia Aug. 19, 1793; served 1812–18 in the army on duty on the northern frontier, and in the expedition of Decatur against Algiers; became in 1820 a lawyer and editor at Shawneetown, Ill.; was four years public prosecutor, and three years judge of a State circuit court; removed to Vandalia; was four years State treasurer, and was also a successful lawyer and editor there; went in 1833 to Cincinnati, where he edited the *Western Monthly Magazine* 1833–37; was a bank president 1853–65. D. at Cincinnati July 5, 1868. Author of *Letters from the West* (1829), *Legends of the West* (1832), *The Soldier's Bride*, etc. (1832), *The Harpe's Head* (1833), *Tales of the Border* (1835), *Statistics of the West* (1836), *Life of W. H. Harrison* (1836), *History of the Indian Tribes* (3 folio vols., 1838, written jointly with T. L. McKenny; original price $120), *Notes on the Western States* (1839), *The Wilderness and the Warpath* (1845), *Life of Thomas Posey* (1846), *Romance of Western History* (1857), *Works* (4 vols., 1853–56).

Hall (James), LL.D., b. at Hingham, Mass., Sept. 12, 1811; studied under Amos Eaton in the Polytechnic Institute of Troy, N. Y., 1831–36; became in 1837 one of the State geologists of New York, and in 1843 was appointed State palæontologist, a position which he holds in 1875; has long been professor of geology in the Polytechnic Institute of Troy, N. Y. Among his published works are annual reports (1838–41) upon the State geological survey; a volume (1843) of the *Natural History of New York*, published by the State; five large volumes (1847–75) upon the *Palæontology of New York* (to be finished in 7 vols.), besides many papers, reports, etc. upon geology (dynamical and descriptive) and palæontology. He was appointed in 1855 State geologist of Iowa, and afterwards served upon the State survey of Wisconsin, and has done much work upon the U. S. surveys in the far West. Is a member of many learned societies at home and abroad.

Hall (James Crowhill), M. D., was b. in Alexandria, Va., Jan. 10, 1805; graduated M. D. in the University of Pennsylvania 1827, and opened an office next year in Washington, D. C. In 1832 he was elected professor of surgery in the Columbian Medical College. He has not written much professionally, but has long held connection with the charitable institutions of the district, of which he is one of the leading practitioners. Paul F. Eve.

Hall (John), D.D., of Scottish descent, b. in the county of Armagh, Ireland, July 31, 1829; entered Belfast College at the age of thirteen; repeatedly won the Hebrew prize; was licensed to preach in 1849, going as a missionary into the W. of Ireland; in 1852 became pastor of the First Presbyterian church in Armagh, and in 1858 was called to the church of St. Mary's Abbey, now Rutland Square, in Dublin. By royal appointment he was commissioner of education for Ireland. In 1867 he came as a delegate from the Presbyterian Church in Ireland to the Presbyterian churches in the U. S., and soon after returning to his native land was summoned by cable telegram to take charge of the Fifth Avenue (19th street) Presbyterian church in New York, over which he was installed Nov. 3, 1867. In 1875 a splendid church edifice was erected for him on the corner of Fifth Avenue and 55th street. As a clergyman he magnifies his office and emphasizes the great facts and doctrines of the gospel. His habit is carefully to write his sermon, and then leave the manuscript behind him. He has published *Family Prayers for Four Weeks* (1868), *Papers for Home Reading* (1871), *Questions of the Day* (1873), and *God's Word through Preaching* (1875). This last volume comprises the lectures on the Lyman Beecher foundation delivered before the students in the theological department of Yale College. R. D. Hitchcock.

Hall (John E.), brother of James (1793–1868), b. 1783; was educated at Princeton, N. J.; became in 1805 a lawyer of Baltimore, and soon was made professor of rhetoric, etc. in the University of Maryland; was a Federalist; edited the *Am. Law Journal* 1808–17; the *Portfolio*, Philadelphia, 1816–27; the *Philadelphia Souvenir* 1827. Author of *Memoirs of Anacreon*, *Memoirs of Eminent Persons* (1827), *Practice and Jurisdiction of the Court of Admiralty* (1809), etc. D. June 11, 1829.

Hall (Joseph), D. D., "the Christian Seneca," b. at Ashby-de-la-Zouch, Leicestershire, July 1, 1574; became a fellow of Emmanuel College, Cambridge, 1595; dean of Worcester 1617; went in 1618 to the Synod of Dort; was consecrated bishop of Exeter 1627; translated to Norwich 1641; was imprisoned for six months in the Tower by the Puritans 1642; and d. at Heighham, Norfolk, Sept. 8, 1656. He was a man of great wisdom, piety, and moderation. His principal works are *Mundus alter et idem* (1607), *Contemplations* (1612–15, on the Old and New Testaments), *Virgidemiarum Liber* (1597–98, a collection of satires), *Epistles* (1608–11), *Explication of Hard Texts* (1633–34), *Christian Meditations* (1640), one of his best works; also an autobiography and other writings.

Hall (Dr. Lyman), a signer of the Declaration of Independence, b. in Connecticut 1725, graduated at Yale College 1747; settled near Sunbury, Ga., in 1752; was elected a delegate, and then a member, to Congress from Georgia 1775–79, and in 1783 made governor of that State. He was in person tall and well-proportioned, with easy manners and dignified deportment, and by nature was of a warm and enthusiastic disposition. D. in Burke co., Ga., Oct. 19, 1790. Paul F. Eve.

Hall (Marshall), M. D., b. at Basford, Notts, in 1790; passed M. D. at Edinburgh in 1812; studied on the Continent; settled at Nottingham in 1815, and attained a large practice, and removed in 1826 to London. D. at Brighton Aug. 11, 1857. Dr. Hall's observations in clinical medicine and the physiology of the nervous system, and his well-known method for the restoration of asphyxiated patients, placed him in the front rank of the medical men of the present century. Author of *Diagnosis* (1817); *Medical Essays* (1824); *The Circulation of the Blood* (1831); *The Nervous System* (1836); *Theory and Practice of Medicine* (1837); *Theory of Convulsive Diseases* (1848); and various scientific and other papers.

Hall (Nathaniel), b. in Medford, Mass., Aug. 13, 1805; was destined for a business-life; entered a store in Boston at the age of sixteen, then an insurance office as secretary; at twenty-four devoted two years to preparation for the study of divinity; entered the school at Cambridge 1831; graduated in 1834; was ordained Unitarian minister of the First parish in Dorchester 1835, and still remains there. Mr. Hall is the author of about thirty published discourses. He has been an earnest abolitionist, a warm philanthropist, a broad thinker, and a devoted pastor. He received from Harvard College the honorary degree of A. M.

O. B. Frothingham.

Hall (Nathan K.) was b. at Marcellus, Onondaga co., N. Y., Mar. 28, 1810; studied law with Millard Fillmore, and in 1832 became his partner at Buffalo, N. Y.; held various important State offices; was a member of Congress 1847–49; U. S. postmaster-general 1850–54; and a judge of the U. S. district court for Western New York. D. Mar. 2, 1874.

Hall (Rev. Newman), LL.B., b. in 1816; graduated B. A. and LL.B. at the University of London, winning a law-scholarship; was 1842–54 a Congregational pastor in Hull, and in 1854 became minister of Surrey chapel, Blackfriars' road, London; after the war of 1861–65 visited the

U. S. for the purpose of allaying the popular bitterness towards Great Britain; author of *Homeward Bound, Notes of a Journey from Liverpool to St. Louis, Pilgrim Songs,* and other works.

Hall (Robert), M. A., b. at Arnsby, Leicestershire, England, May 2, 1764, the son of a Baptist preacher, was distinguished in childhood for precocity of intellect; was educated at the Bristol College and at King's College, Aberdeen, where he passed M. A. with first honors 1784. He served as a tutor in the Bristol Academy, and was also assistant pastor of the Broadmead Baptist chapel; took a pastorate at Cambridge 1791; was several times between 1804 and 1807 temporarily insane by reason of his severe sufferings, for he had a large renal calculus; was pastor of a church in Leicester 1807–26; and then again pastor of the Broadmead chapel, Bristol, until his death, Feb. 21, 1831. Mr. Hall was one of the first of English preachers, a man of thorough sincerity, broad and generous principles, and active charity. He published political tracts of liberal tendencies; opposed Socinianism and the so-called close communion; and published many sermons, reviews, lectures, etc. His *Works*, with a memoir by Olinthus Gregory, were published in 6 vols., 1831–33.

Hall (Samuel Carter), b. at Topsham, Devonshire, in 1800; studied law and entered upon his literary career as a parliamentary reporter for the London *Times*. In 1824 he established the *Amulet*, an illustrated annual, and has since edited many illustrated books; as, for instance, *Book of Gems, British Ballads, Baronial Halls, Ireland,* etc. He has been the editor of the London *Art Journal* since 1839. His *Trials of Sir Jasper* (1873), a temperance poem, proved very popular.—In 1824 he married Anna Maria Fielding, b. at Dublin in 1805, who, besides assisting him in many of his literary undertakings, has achieved a literary name of her own by her *Sketches of Irish Character* (1828), *Lights and Shadows of Irish Character* (1838), *Stories of Irish Peasantry* (1840), *The Buccaneer* (1832), *Uncle Horace* (1838), etc. She has also written two dramas—*The French Refugee* and *The Groves of Blarney.*

Hall (Samuel Read) was b. at Croydon, N. H., Oct. 27, 1795; began in 1814 to teach at Rumford, Me., and in 1822 at Fitchburg, Mass. From 1823 to 1830, at Concord, Vt., where he was a Congregational missionary, he conducted a school for teachers, founded by himself, the first school of the kind in the U. S. In 1827 he assisted in organizing the American Institute of Instruction. In 1830 he became principal of the English department of Phillips Academy, Andover; taught in a teachers' seminary at Plymouth, N. H., 1837–40; at Craftsbury, Vt., 1840–46; and afterwards removed to Bennington, Vt. He has published several works, chiefly educational.

Hall (Willard) was b. at Westford, Mass., Dec. 24, 1780, and graduated at Harvard in 1799. In 1803 he was admitted to the New Hampshire bar, but soon removed to Dover, Del.; was secretary of state for Delaware 1811–14, and again in 1821; was a member of Congress 1817–21; and in 1823 became U. S. district judge for Delaware. He also held other prominent public offices. In 1829 he published the revised statutes of the State. D. May 10, 1875.

Hall (William W.), M. D., b. at Paris, Ky., in 1810; graduated at Centre College 1830, and took his medical degree at Transylvania University 1836; practised medicine fifteen years in the South; removed to New York; began in 1854 to publish *Hall's Journal of Health*, which has had a wide circulation. Author of *Health by Good Living* and other popular works on hygiene; a treatise on *Cholera, Bronchitis, and Kindred Diseases* (1853), etc.

Hall (Willis), b. at Granville, N. Y., Apr. 1, 1801; graduated at Yale 1824; studied law in New York and at Litchfield, Conn.; was admitted to the bar 1827; practised in Mobile, Ala., 1827–31, in New York 1831–38; was in the assembly 1837 and 1842; attorney-general of New York 1838; was for a time lecturer in the Saratoga Law School; resumed practice in New York; retired in 1848 from professional and political life. D. July 14, 1868.

Hal'lam (Arthur Henry), son of the historian Hallam, b. in London Feb. 1, 1811; was educated at Eton and Trinity, Cambridge, where he passed B. A. in 1832; studied law in the Inner Temple in 1832; went to Germany for his health, and d. at Vienna Sept. 15, 1833. He is memorable as the subject of Tennyson's *In Memoriam*. A volume of his writings in prose and verse appeared in 1862.

Hallam (Henry), LL.D., D. C. L., F. R. S., b. at Windsor, Eng., in 1777; was educated at Eton and Oxford, and studied law. His early contributions to the *Edinburgh Review* (1802 *seq.*) gave him a wide fame as a liberal thinker and able writer. His principal works are *Europe during the Middle Ages* (1818); *Constitutional History of England* (1827); *Introduction to the Literature of Europe* (1837–39); *Literary Essays and Characters* (1852). D. at Penshurst Jan. 21, 1859.

Hal'le, town of Prussia, in the province of Saxony, on the Saale. It has some manufactures of hardware, woollens, and starch, and very extensive salt-works. The vicinity is rich in salt-springs, and the inhabitants around these springs (the so-called Halloren), who are employed in the manufacture of salt, form a peculiar race in features, character, and customs; they are supposed to be of Wendish or Celtic origin. Händel, the composer, was b. in Halle in 1685. The university (founded in 1694), with which that of Wittenberg (founded in 1502) was united in 1817, has ranked high, especially in theology. Gesenius was one of its professors from 1810 to 1842. In his time there were 1300 students, subsequently less than 600; and now again (1875) more than 1000. Pop. 52,639.

Hal'leck (Fitzgreene), an American poet, was b. at Guilford, Conn., July 8, 1790. His mother was a descendant of the missionary John Eliot. He studied in the academy of his native town, and in 1811 became, and long remained, a clerk in the house of Jacob Barker of New York. Was afterwards (1824–49) employed by J. J. Astor, who named him a trustee of the Astor Library. In 1849 returned to Guilford, Conn., where he d. Nov. 19, 1867. He was never married, and in the latter part of his life was a Roman Catholic. The best known of his poems are *Twilight*, first printed in 1818 in the New York *Evening Post;* that on the death of his friend, J. R. Drake, which appeared in 1820; *Fanny* (1819; enlarged 1821), his longest production; *Alnwick Castle, Marco Bozzaris,* and *Burns* (1827). His *Young America* appeared in 1864. The *Croaker Papers* (1819), by himself and his friend Drake, were first published in a complete edition in 1860. (See his *Life* by J. G. Wilson, 1869.)

Halleck (Henry Wager), LL.D., b. at Waterville, Oneida co., N. Y., Jan. 16, 1815; graduated at West Point Military Academy July 1, 1839, entered the army as second lieutenant of engineers, being retained at West Point as assistant professor of engineering till June, 1840, and for a year subsequently was assistant to a board of engineers at Washington, D. C., during which time he prepared a work on *Bitumen, its Varieties, Properties, and Uses.* From Washington he was transferred as assistant in charge of the construction of fortifications in New York harbor, where he remained till 1846, except while absent in 1845 on a tour of examination of public works in Europe. On his return he delivered a course of twelve lectures on the science of war before the Lowell Institute at Boston, which were published in 1846 under the title of *Elements of Military Art and Science*, a second edition of which, with large additions, including notes on the Mexican and Crimean wars, was issued in 1861, and largely used as a manual during the civil war. Early in the Mexican war he was sent to the Pacific coast, where he bore an influential part in military operations and in the civil government there up to the time that California was admitted as a State of the Union. Becoming deeply interested in the fortunes of that new State, he left the army by resignation in Aug., 1854, and devoted himself to the practice of law, continuing as director-general of the New Almaden quicksilver-mine, which position he had held since 1850. Early in 1861, at the solicitation of Lieut.-Gen. Scott, Gen. Halleck was appointed major-general of the regular army, and assigned to the command of the department of the Missouri, embracing the States of Missouri, Iowa, Minnesota, Wisconsin, Illinois, Arkansas, and Western Kentucky. On assuming this command he immediately applied his military knowledge and administrative powers to the organization of the chaotic masses in his department and to the reform of existing abuses. In Mar., 1862, the departments of Kansas and Ohio were added to Halleck's command, the whole constituting the department of the Mississippi, including the territory between the Alleghany and the Rocky Mountains. After the battle of Shiloh, Halleck took the field, and after reorganizing and recruiting his forces moved on Corinth by slow and regular approaches, so that it was not until May 27 that his army appeared before that fortified city, to which stronghold the army of Gen. Beauregard had fallen back. Active preparations were made by Halleck on the 28th and 29th for an attack, but on the morning of the 30th it was found that Beauregard had evacuated this stronghold during the previous night, and Corinth was occupied without resistance. After the campaign of Corinth, Halleck was called to Washington as general-in-chief, and exercised that command until the grade of lieutenant-general was revived. He then continued under assignment as chief of staff of the army until transferred to the command of the military division of the James in Apr., 1865. Upon the termination of the war, Halleck was ordered to the military division of the Pacific, assuming command

Aug., 1865, and Mar., 1869, was transferred to that of the South, which he retained till his death, which occurred at Louisville, Ky., Jan. 9, 1872. Degrees of A. M. and LL.D. conferred by Union College, N. Y. Among the more important of Gen. Halleck's published works may be mentioned his great treatise on *International Law, or Rules Regulating the Intercourse of States in Peace and War,* and a translation of Jomini's *Vie Politique et Militaire de Napoléon.*
G. C. SIMMONS.

Hallelu'jah [Heb., "Praise ye the Lord!"], also written *Alleluia* (from the Gr. Ἀλληλούϊα), an ancient formula of praise, universally adopted by the Christian churches as a doxology.

Hal'ler, von (ALBRECHT), M. D., F. R. S., the father of the science of physiology, was b. at Berne Oct. 18, 1708; studied divinity at Tübingen, medicine under Boerhaave at Leyden, and mathematics with the Bernoulli family at Bâle; made a botanical exploration of the Alps with Gesner; practised medicine with great applause at Berne 1729–36; held important professorships at Göttingen 1736–53, declining calls to several of the most renowned universities of Europe; became physician to the king of England 1729; retired to private life in Berne 1753. D. Dec. 12, 1774. He was a voluminous writer on physiology, anatomy, botany, surgery, and practical medicine; author of several romances and poems, and of an almost incredible number of reviews and scientific papers. His hypotheses were often short-lived and inadequate, but admirable for their scientific spirit, and for the great stimulus which they gave to physiological study throughout Europe.

Hal'lettsville, post-v., cap. of Lavaca co., Tex. It has 1 weekly newspaper. Pop. 431.

Hal'ley (EDMUND), LL.D., F. R. S., an eminent astronomer, b. at Haggerston, near London, Nov. 8, 1656; was educated at Queen's College, Oxford, where he chiefly studied mathematics, physics, and astronomy; published in 1675 a method for finding aphelia and planetary eccentricities; was in St. Helena 1676–78, cataloguing the southern stars; discovered in 1680 the great comet which bears his name while travelling on the Continent; became a captain in the royal navy 1699, and conducted expeditions to observe the variations of the magnetic needle; became Savilian professor at Oxford 1703, a position which had previously been refused him on account of his alleged infidelity; was made secretary of the Royal Society 1713, and astronomer-royal 1720. Halley was a friend and collaborator of the great Newton, and a member of many learned societies, and one of the ablest physicists of his time. D. near Greenwich Jan. 25, 1742.

Halley's Comet. See COMET.

Hal'liwell (JAMES ORCHARD), F. R. S., b. at Chelsea, England, June 21, 1820; studied for a time in Cambridge, and in 1839 began his great work of the editing and publication of old English authors and MS. texts. He has produced an incredible number of works, many of them original. Among these are *Shakspeariana* (1841); *A History of Freemasonry* (1842); *Dictionary of Provincial and Archaic Words* (1844–45); and many volumes of Shakspearian literature, including a *Life of Shakspeare* (1845).

Hal'lock, post-tp. of Peoria co., Ill. Pop. 1094.

Hallock (GERARD), a son of Rev. Moses Hallock, was b. at Plainfield, Mass., Mar. 18, 1800, and graduated in 1819 at Williams College. He was for a time a teacher of German and Hebrew. In 1824 he founded the Boston *Telegraph;* in 1827 became one of the proprietors of the New York *Observer;* and from 1828 to 1861 was one of the owners and editors of the New York *Journal of Commerce.* This paper in 1828 stationed a vessel off Sandy Hook so as to get the earliest European news from inward-bound vessels, and in 1828 its proprietors established a horse-express from Philadelphia, which enabled them to give the Congressional news a day sooner than any other New York newspaper. Mr. Hallock was liberal in the support of religious and benevolent institutions, was strongly conservative in politics, and was one of the founders of the Southern Aid Society, a home-missionary organization.

Hallock (MOSES), b. at Brookhaven, L. I., Feb. 16, 1760; graduated at Yale in 1788. He was in 1792 settled over a Congregational church in Plainfield, Mass., where he remained till his death. He was a man of nobly pure character, and was distinguished as an instructor of young men for the ministry. One of his students was the afterwards famous John Brown of Ossawatomie. D. July 17, 1837. (See his *Life* by W. A. HALLOCK, D. D.)—His brother, JEREMIAH HALLOCK (b. Mar. 13, 1738; d. June 23, 1826), was a famous minister of West Simsbury, Conn. His *Life,* by CYRUS YALE, was published in 1838.

Hallock (WILLIAM ALLEN), D. D., b. in 1794 at Plainfield, Mass., a son of Rev. Moses Hallock. He graduated at Williams College in 1819 with the highest honors, and studied theology at Andover. In 1822 he became agent for the New England Tract Society, and in 1825, when the American Tract Society of New York was organized, he became its corresponding secretary. His life-work has been that of the society itself, thousands of whose publications he has carried through the press, a work of peculiarly arduous character from the varied theological opinions of the supporters of the society. In addition, besides his laborious work as secretary, he has published *Lives* of Harlan Page, Justin Edwards, and Moses Hallock; also the *Mountain Miller* and other well-known tracts and sketches.—MRS. M. A. HALLOCK, wife of the preceding, was b. in 1810 at Rowe, Mass., and early removed with her father, a Mr. Ray, to Norwich, N. Y. Her first husband, a Mr. Lathrop, d. in 1854, and she afterwards commenced authorship to obtain means for the support of her children. Her writings for the young are highly esteemed. They are published by the American Tract Society, of whose secretary she subsequently became the wife.

Halloween', or **All Hal'lows' Eve,** the night of Oct. 31—*i. e.* the *eve* of All Saints' or All Hallows' Day, which is the first day of November. The word *hallow* is the Anglo-Saxon *halig* and the German *heilige* ("holy," "sacred," etc.), nearly equivalent to the Latin *sanctus,* from whence comes our word *saint.* All Saints' (All Hallows' or All Hallow Tide) Day takes its origin from the conversion in the seventh century of the Pantheon at Rome into a Christian place of worship, and its dedication to the Virgin and all the martyrs. First celebrated on the 1st of May, the date was subsequently changed to November 1st, and under the designation of "Feast of All Saints" set apart as a general commemoration in their honor, and as such retained by the Anglican and American Episcopal churches, the collect for which supplicates for "grace so to follow Thy blessed *saints* in all virtuous and godly living," etc. On that day it is a custom of Roman Catholic countries (still practised in Louisiana) to visit the cemeteries for devotions or for laying floral tributes on the graves of relatives. But the "Halloween" has nothing churchly about it, and seems to be a relic of pagan times, or perhaps of mediæval superstitions, which regard it as the time of all others when supernatural influences prevail, and which set apart the night for a universal walking abroad of spirits both of the visible and invisible world; for on this mystic evening it was believed that even the human spirit might detach itself from the body and wander abroad. Halloween seems clearly allied to the "Walpurgis Night" of the Germans, the witch-festival or assembling of evil spirits on the summit of the Brocken in the Hartz Mountains on the eve of the 1st of May—the day, as already noticed, dedicated to the Christian martyrs or saints. The Walpurgis legend being almost coeval and early associated with the latter day, it is probable that in England the transference of the festival-day to the 1st of November carried with it the superstitions attributed to its preceding night. Practically, so far as it is recognized at all, as it is still in Great Britain and in some of our own States where church usages and traditions survive (*e. g.* Maryland and Virginia), it is devoted to sports and practical jokes. Nuts and apples are in requisition, the former giving the name "Nutcrack Night" to Halloween in the S. of England. They are not only cracked and eaten, but are made the means of vaticination in love-affairs.

> "The old guidwife's well-hoordit nits
> Are round and round divided,
> And mony lads' and lassies' fates
> Are there that night decided." (BURNS: *Halloween.*)

But the grand sport is that of "ducking" or "bobbing" for apples set afloat in a tub of water. It is believed to be yet practised in Maryland, and perhaps elsewhere in the U. S.
J. G. BARNARD.

Hal'lowell, city of Kennebec co., Me., beautifully situated on the W. bank of the navigable Kennebec River, 2 miles below Augusta, and on the Kennebec and Portland R. R., 58 miles from Portland. It has 3 national and 1 savings bank, 6 churches, and manufactures of cotton goods, oil-cloth, soap, candles, carriages, etc. It was formerly distinguished for its shipbuilding, which has now declined. It has of late an active trade in granite of superior quality, which is here extensively quarried. Except in winter, it has a line of steamers running to Boston and the ports on the Kennebec. Pop. 3007.

Halls, tp. of Sampson co., N. C. Pop. 1010.

Hall's Cross-Roads, tp. of Harford co., Md. It includes the village of Havre de Grace. Pop. 3805.

Halls'ville, post-tp. of Duplin co., N. C. Pop. 381.

Hallsville, tp. of Chester co., S. C. Pop. 1416.

Halluc, a small river of Northern France, which enters

the Somme from the right above Amiens, is noticeable on account of the battle which took place here Dec. 23, 1870, between the German general Von Manteuffel and the French general Faidherbe. The latter came from Lille with the purpose of advancing on the besieging army around Paris, and rested on the Halluc, Dec. 20; the former proceeded from Rouen with the purpose of arresting his advance. The French took up a position along the river, the 22d corps, under Gen. Lecointe, occupying the ground from Daours to Beaucourt, and the 23d, under Gen. Paulze d'Yvog, Corbie, its vicinity, and the villages to the S. W. of Albert; they numbered 40,000 men with 78 guns. On the 23d, Manteuffel attacked with 20,000 men, chiefly consisting of the 8th army corps under Gen. von Goeben. The German attack was directed from Amiens against the French front, but as the judiciously selected position made it impossible to get into the rear of the wings of the enemy, the attack was very difficult. From the right bank the French were soon driven back, but in their main position on the left bank they continued the resistance with great stubbornness. The battle was chiefly concentrated around Daours on the German right wing, and around Pont Noyelles in the centre; on the left German wing, however, a sally was made against Fréchencourt. The French succeeded in taking these places, but a further success was not achieved. At 4 P. M., when it began to darken, the situation of the battle was this: the Germans held the right bank, and on the left bank all places in the valley; the French, the heights on the left bank. In the dusk Faidherbe tried to take the offensive, but without success. After some fighting, during which several villages changed occupants, yet finally remained in the hands of the Germans, both armies occupied their respective positions and awaited the next day. No contest, however, took place on the 24th: in the afternoon Faidherbe drew off towards Arras and Douay. He lost 141 dead, 905 wounded, several hundred prisoners, and 1000 missing; the German army lost 38 officers, 834 men, dead and wounded, and 93 missing.

A. NIEMANN.

Hallucination. See INSANITY, by PROF. W. A. HAMMOND.

Hall'ville, a station of the Union Pacific R. R., in Sweetwater co., Wy., 225 miles by rail W. of Laramie. It has mines of good lignitic coal. It is on Bitter Creek.

Halm (FRIEDRICH) is a pseudonym under which ELIGIUS FRANZ JOSEPH, Baron von Münch-Bellinghausen, wrote his dramas, and under which he is best known and most often spoken of in German literature. He was b. at Cracow Apr. 2, 1806; studied law, and held different government offices in Vienna at the imperial library, the Burg theatre, etc. In 1834 his first drama, *Griseldis*, was performed at the Burg theatre, and had a great success. Then followed in 1836 *The Adept*, in 1837 *Camoens*, in 1838 *Imelda Lambertazzi*, in 1843 *Der Sohn der Wildniss* ("Ingomar"), in 1844 *Sampiero*, in 1847 *Maria de Molina*, in 1854 *The Gladiator from Ravenna*, etc. The last-mentioned is his best work; his subsequent ones are rather weak. As a dramatist, Friedrich Halm belongs to the school of Schiller. He starts from an idea which he finds represented in some historical event, and in the development of this idea through strong contrasts he is often very successful; as, for instance, in the *Gladiator* and *Ingomar*. But outside of these contrasts there is no picture in his dramas either of history or character; and as his words generally are bigger than his thoughts, and his situations much more powerful than his passion, it often causes a sad disappointment to read his dramas after seeing them well performed. He has also written some lyrical poems, but of inferior quality. His collected works were published at Vienna in 8 vols. (1857–64). CLEMENS PETERSEN.

Halma (NICOLAS), ABBÉ, b. Dec. 31, 1755, at Sedan; studied theology, language, mathematics, and geography at the colleges of Lemoine and Sainte-Barbe in Paris; took holy orders, and was in 1791 appointed director of the College of Sedan. In 1794 he was made secretary at the École Polytechnique and teacher in the engineering school in Paris, but as he refused to accept the title of captain he was discharged. He served for a time as an army-surgeon. Later he held different offices, such as professor of geography at the military school of Fontainebleau, as librarian of Sainte-Geneviève in Paris, etc. D. in Paris June 4, 1828. He was a very prolific writer, and published a great number of handbooks and essays on mathematics, geography, education, archæology, chronology, and other subjects, but his principal work is his translation of Ptolemy's *Almagest*. He worked for more than ten years on this translation, but when finished it was found admirable both in linguistic and astronomical respects. Halma was an excellent linguist, and a man of marvellous knowledge and exceedingly varied accomplishments.

Ha'lo, the popular term applied to bright circles and attendant optical phenomena seen when the sun or moon shines through or upon fog, haze, or cloud. For the purposes of scientific description in meteorology, halos are classified as greater or lesser halos; the former are the halos proper, while under the lesser halos are included the small rings, aureolæ, or glories known as coronæ and anthelia. Huygens and Sir Isaac Newton explained the process of the formation of the ordinary rainbows and halos; the principal steps in the further elucidation of the subject are due to Fraunhofer (*Theorie der Hofen*, 1825), Brandes (art. "Hof" in Gehler's *Wörterbuch*, 1829), Kämtz (*Meteorology*, vol. iii., 1836), Galle (*Ueber Höfe, etc., Pogg. Ann.*, 1840, bd. 49). For a careful investigation of a remarkable halo see Clausen (Dorpat, 1849), and for a general description see Loomis (*Meteorology*, New York, 1874). According to the numerous physicists who have contributed to the explanation of the phenomena in question, these are all the result of certain modifications which light undergoes by reflection, refraction, dispersion, diffraction, and interference when it falls upon the crystals of ice, the raindrops, or the minute particles that constitute fog and clouds. The phenomena and their explanations may be considered under the following heads:

(1) A *corona* is a simple ring or concentric rings of light surrounding the sun or other luminary. These rings are generally tinged with colors, the inner being blue or purple, and the outer red; several series of such rings, separated by white spaces, are included within a distance of from one to five degrees from the sun. Fraunhofer first explained the origin of these rings as being the result of the diffraction of the rays of light in passing between the particles of a cloud or fog; by careful experiments upon coronæ artificially produced he rendered his explanation perfectly acceptable; and the undulatory theory of light enables us to conclude the average diameter of the drops of vapor from the measured diameter of the colored rings. The results of this investigation have been carefully collated by Kämtz, who has shown that the higher the temperature of the air the smaller is the diameter of the vapor-particles, so that, for instance, in winter, the average diameter is 0.00095 of an inch, but in summer 0.00061. Some physicists, following Halley and Leibnitz, have maintained that fog-particles are hollow vesicles of vapor, but Bravais has shown that if the thickness of the shell of the vesicle is greater than one-third the exterior diameter of the particle, the latter will then produce halos closely resembling, if not identical with, those of a solid drop. The internal structure of vapor-particles need not be considered in the explanation of coronæ, which, being due to diffraction only, depend simply upon the exterior diameter; but is, on the other hand, of importance in explaining the phenomena of aureolas or glories.

(2) *Aureolas* or *Glories*.—This term includes the bows, circles, etc. surrounding the shadow of the observer when it is projected upon a cloud or fog-bank or dew-covered grass. These colored rings are observed upon the upper surface of clouds by aëronauts, and have been well described by Flammarion. (See GLAISHER, *Travels in the Air*, London, 1871.) The phenomena in question are doubtless produced by the diffraction of the light reflected at a nearly perpendicular incidence from the surfaces of the particles of vapor. Aureolas and coronæ are seen in greatest perfection when the vapor-particles are of comparatively large and regular dimensions; the smaller the diameter, and the less of uniformity in the size of the particles, the larger is the breadth of the colored rings, and the more perfectly do they overlap, thereby producing a more perfect commingling of the individual colors, resulting in a simple white and faint fog-bow. The existence of this bow, in connection with the absence of colored bands, is held to be an argument against the existence of vesicles. (For an account of the arguments for and against the vesicular theory, see KOBER in *Pogg. Ann.*, 1871, bd. 144.)

(3) *Halos proper* consist of more or less complicated arrangements of arcs and circles of light surrounding the sun or moon, accompanied by others tangent to or intersecting them; near the points of tangency and intersection there appear spots of special brightness, known as parhelia, paraselenæ, sun-dogs, etc. Of these arcs of light, some are colorless, while others are composed of parallel colored bands; the light of some arcs is polarized, while that of others is not. The very various appearances of these halos can only be properly appreciated by means of colored drawings; in general they are due to reflection and refraction from crystals of ice floating in the air; and of those features, the origin of which has been satisfactorily explained, the following may be noted: (1) A circle of 22° radius, the inner edge well defined red, the outer edge ill defined blue; the light polarized in the direction of a tangent to the circumference. This halo is formed by light

passing through the alternate faces of hexagonal prismatic ice-crystals in the direction of minimum deviation. (2) A circle of 46° radius, the inner edge red, and the outer edge pale blue. This is formed by the rays passing in the direction of minimum deviation through the base and sides of right prisms of ice. (3) A circle of about 90° radius, of white light. This is probably due to rays that after entering an ice-prism are totally reflected, and emerge through an opposite face of the prism. (4) The parhelic circle. This is a colorless arc extending from the sun to the right and left, parallel to the horizon, and is produced by simple reflection of the sun's light from the outer vertical surfaces of such ice-prisms as are slowly settling down through tranquil air. (5) A vertical arc is similarly produced by the reflections from the horizontal surfaces of ice-crystals. The arc extends to a distance of 5° to 20° above and below the sun. (6) The parhelia and paraselenæ. These are spots of special brightness that are seen at the mutual intersections of the circular arcs; it is a sufficient explanation of these to consider that at these points two causes are combining to turn towards the eye a double portion of the solar rays, thereby producing the increased apparent brightness. This at least suffices to explain the parhelia that are distant 22° and 46° from the sun's centre. Anthelion (Ger. *Gegensonne*) would be a term properly applicable to the parhelion that is seen at a point on the parhelic circle directly opposite the sun, and which is probably sometimes due to the combination of reflections from sets of surfaces oblique to the horizon. (7) Tangential arcs. Of these, which are numerous and have variable positions, the most brilliant is that which touches the halo of 46° at its summit; this arc is only seen when the sun's altitude is between 12° and 30°, and is due to the refraction of the sun's light through prisms whose refracting edges are horizontal. (8) The rainbow may be very properly considered as a halo due to the action upon the sun's light of large drops of water, instead of smaller drops or of crystals of ice, and differs from a corona in that it is not due to diffraction. The rainbow phenomena consist principally of one, two, or three main arches of prismatic colors, known as the primary, secondary, and tertiary bows, whose radii, reckoned from the point opposite the sun, are respectively 41½°, 82¼°, and 136¼°, and which are respectively formed by those rays that experience a minimum deviation after one, two, or three total reflections within the drop. The secondary bow is sometimes erroneously spoken of as a reflection of the primary. These arches are, especially near their summits, fringed on their concave sides by narrow supernumerary belts of color, due, as was first explained by Dr. Thomas Young (1804), to the interferences of those rays that enter and leave the drops very nearly at the angle of minimum deviation. CLEVELAND ABBE.

Hal'ogen ("salt-producer"), a name formerly given by some chemists to those elementary substances which by combination with a metal produced those compounds which Berzelius called haloid salts. The halogens are chlorine, bromine, iodine, and fluorine (simple halogens), while cyanogen was called a compound halogen. The simple halogens form a very natural and strongly marked group. All are perissad (monad) elements, and cyanogen is strongly analogous to them in its character.

Ha'loid Salts [ἅλς, "salt," so called because they are analogous in composition to common salt], a name given by Berzelius to compounds of some halogen with a metal. Common salt and iodide of potassium are familiar examples. The metallic chlorides, iodides, bromides, and fluorides are haloid salts, and to these the metallic cyanides have a close relationship.

Hal'pine (CHARLES G.), b. at Oldcastle, co. Meath, Ireland, in Nov., 1829, graduated at the University of Dublin in 1846. His father was a Protestant clergyman, and editor of the Dublin *Evening Mail*. The young Halpine entered upon the life of a journalist, and in 1847 came with his wife to New York, without money or friends. He was for a long time connected with the New York *Herald*, *Times*, and other papers. For the *Tribune* he wrote that famous piece, "Tear Down the Flaunting Lie." He also wrote for the Boston *Post*, and was for a time one of the editors of the *Carpet Bag* in that city. In 1861 he enlisted in the Union army, in which he speedily rose, reaching in 1864 a brigadier-generalship of volunteers. He was also a major in the regular army and brevet major-general. He resigned his army commissions in 1864. It was while in the army that he wrote the humorous pieces in prose and verse, under the name of "Private Miles O'Reilly," which were universal favorites. In 1864 he became editor, and then proprietor, of the *Citizen* newspaper. He was afterwards register of the county of New York. D. Aug. 3, 1868, in consequence of an overdose of chloroform. He was a brilliant and versatile writer, and a man fond of convivial life. He published two volumes of poetry, chiefly humorous, besides the *Miles O'Reilly* papers, in 2 vols.

Halsey Valley, post-v. of Tioga tp., Tioga co., N. Y. Pop. 103.

Hal'stead, town of England, in Essex, on the Colne, has manufactures of silk, satin, and velvet. Pop. 6749.

Hal'stead (MURAT), b. in Butler co., O., Sept. 2, 1829; graduated at Farmers' College, College Hill, O., in 1851, and in the fall of the same year went to Cincinnati, where he adopted writing for the newspapers as an occupation, furnishing tales and stories mostly. In 1853 he obtained a situation on the Cincinnati *Commercial*, and in May, 1854, became one of its proprietors. He was married in 1857, and has eight children. J. B. BISHOP.

Hal'ton, fertile county of Ontario, Canada. Area, about 362 square miles. It extends N. W. from Lake Ontario. It is traversed by the Great Western and Grand Trunk Railways. Cap. Milton. Pop. 22,606.

Ha'lys ("Αλυς, now *Kizil-Irmak*, "red river"), the largest stream in Asia Minor, rises in the mountains between the ancient Pontus and Armenia Minor, and flows S. W., N., and N. E., and finally discharges its waters by several mouths into the Black Sea. It was once the boundary between the Lydian and Persian empires. Length, 520 miles.

Ham, the cured and smoked thigh of the domestic swine; also sometimes applied to the corresponding part of the sheep, the ox, or the calf treated in a similar manner. There are many recipes for the curing of hams, and much appears to depend also on the breed and feeding of swine, and perhaps on the climate. Westphalia and many of the English counties have high repute for the excellence of their hams. No finer hams are seen in the U. S. than those of the Piedmont region of Virginia. For smoking hams the wood of the sugar-maple, hickory, and sometimes oak, is preferred. In Westphalia juniper-twigs are employed. Peat is used in parts of England, and hams are sometimes hung in the chimney of the cottage. In the U. S. many prefer the smoke of corn-cobs, which impart a fine flavor, but require much care in the burning, for if they burst into flame there is but little smoke, and the hams are injured by the heat. Many dispense entirely with smoking.

Ham, town of France, in the department of Somme, on the Somme. Its old fortress, built in 1470, is now used as a state prison. Louis Napoleon was kept there from 1840 to 1846. Pop. 2836.

Ham, a son of the patriarch Noah and the brother of Shem and Japheth, was, according to Genesis, the father of those nations which inhabited the southern countries, Egypt, Libya, etc. The Coptic or native name of Egypt is *Kem*, Χήμια with Plutarch, *Chemê* in the Rosetta inscription, which signifies "hot" or "burnt;" and this circumstance has occasioned a very strange piece of reasoning. By supposing that the Hebrew name *Ham* is derived from the Hebrew root *hamam*, to be "hot," to be "burnt," and by supposing that this name of "hot," "burnt," "sunburnt," was given to the son of Noah prophetically with reference to his descendants, Gesenius has tried to establish an agreement between the biblical record and the historical fact. It must be remembered that the descendants of Ham were not all African. The Canaanites and Phœnicians, the Cushites of the Euphrates Valley, a South Arabian race of importance, all were Hamitic. Some of these peoples were closely associated with the Semitic races, and made use of languages essentially Semitic.

Hamadan', the ancient *Ecbatana*, town of Persia, in the province of Irak-Ajemee, in lat. 34° 50′ N. and lon. 48° 32′ E. Its location on one of the routes from Bagdad to Erivan, Teheran, and Ispahan, makes it a trading-place of considerable importance: it has many caravanseries and extensive bazaars. The beautiful gardens and orchards which surround it diminish somewhat the dreary aspect of the ruins which cover the ground in the vicinity. Among its most remarkable monuments are the reputed tomb of Mordecai and Esther, and that of Avicenna, yearly visited by crowds of pilgrims. Pop. 50,000.

Hamadry'ads, or **Adry'ads** [plu., Gr. ἁμαδρυάς, ἁμαδρυάδες, or ἀδρυάς, ἀδρυάδες, from δρῦς, an "oak" or any lofty tree], in Greek mythology, the nymphs who were attached to particular trees, with which they came into existence and died. (See DRYADS.) They differed from most other nymphs in not possessing immortality.

Ha'mah, modern Arabic name of HAMATH (which see).

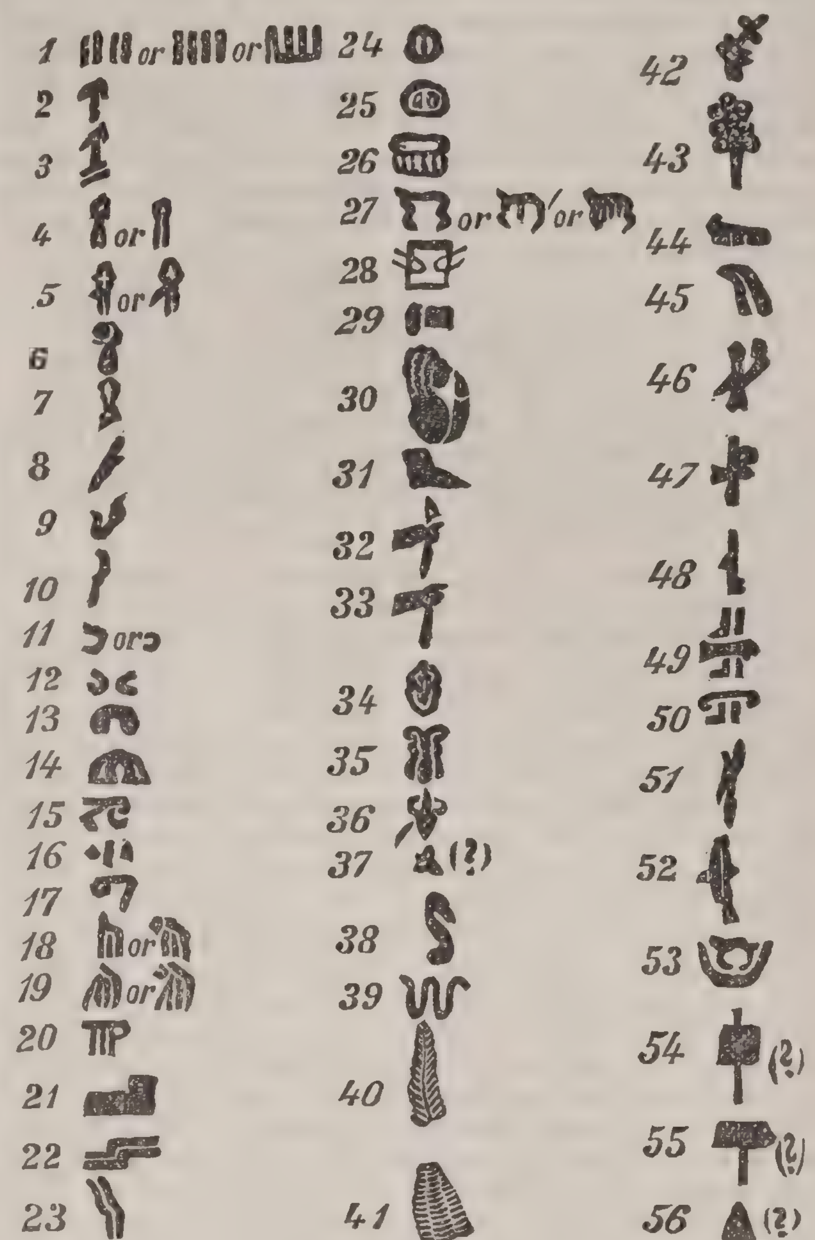
Ha'maker (HENDRIK ARENS), b. at Amsterdam Feb. 25, 1789; studied first the classic languages, then Oriental philology, and was in 1815 appointed professor in Arabic, Chaldæan, and Syriac at the Academy of Franeker, whence he removed in 1817 to the University of Leyden. Here he

d. Oct. 10, 1835. He was a very prolific writer and a man of original ideas, but his knowledge was more multifarious than exhaustive, and his representation more striking than accurate. One of his principal works is *Specimen catalogi codicum MSS. orientalium Bibliothecæ academicæ Lugduno-Batavæ* (1820), in which he gives a description of each volume, a *résumé* of its contents, the biography of its author, the manner in which it was acquired, etc. Specially noteworthy among his many other writings are his Punic researches, *Diatribe philologica-critica* (1822), *Lettre à M. Raoul Rochette* (1825), *Miscellanea Phœnicia* (1828).

Ha'mann (JOHANN GEORG), b. at Königsberg Aug. 27, 1730. He studied theology, law, philosophy, poetry, and philology in a miscellaneous manner; accepted in 1752 a place as tutor in a noble family in Livonia; changed it next year for another position of the same kind in Courland; entered in 1755 into the service of a commercial house in Riga, and visited on business Berlin, Lübeck, Holland, and England, in which latter country he spent about a year. After 1759 he lived for several years in his father's house in Königsberg in leisure, studying theology and philosophy, but from 1763 to 1787 he held various small offices in the tax department in his native city. In 1787 he was discharged. He then lived alternately in Düsseldorf and Münster, where he d. June 21, 1788, and was buried in the garden of the princess Gallitzin, who resembled him somewhat in mental qualities, and who was brought by him to a belief in Christianity, which became the ruling principle of her life. Their personal acquaintance was but short. In some of his writings, which consisted of small pamphlets or essays published on fly-leaves, he calls himself the "Northern magian," and this has now generally become his title. The public at large took no notice of him. He was in strong opposition to the reigning fashion of enlightenment. The depth of his religious intuitions, the eccentricity of his humor, and the numerous allusions which crowd his pages made him unintelligible to the general reader, but upon men like Herder, Goethe, and F. H. Jacobi he exercised great attraction, and in the subsequent generations all the most prominent minds have studied him with great attention. His writings were collected and published in 8 vols. in Berlin (1821–43) by Roth. (For a description of the character of his mind see the article on GERMAN THEOLOGY.) CLEMENS PETERSEN.

Ha'math [the *Epiphaneia* of the Greeks and Romans, now called *Hamah*], in Upper Syria, about halfway between Baalbek and Antioch, one of the oldest cities in the world, founded by the youngest (or last-named) of the eleven sons of Canaan (Gen. x. 18). The "entrance of Hamath" (Num. xxxiv. 8), named at first as the northern boundary of the Promised Land, was probably the low screen of hills between the sources of the Leontes (*Litany*) and the sources of the Orontes. The small kingdom or province of which Hamath was the capital was in alliance with David and tributary to Solomon, but regained its independence after the revolt of the ten tribes (975 B. C.). Hamath was reconquered and dismantled by Jeroboam II. (823–772 B. C.), and not long afterwards fell under the power of Sennacherib (702–680 B. C.) of Assyria. In 638 A. D. it was taken by the Saracens, and in 1517 came into the hands of the Turks. Under the Arabs it was a place of considerable importance. Aboolfeda, the Arab geographer and historian, was b. there in 1273. The city now has some 40,000 inhabitants, one-fourth of whom are Greek and Jacobite Christians, and the rest Mohammedans, noted for their bigotry and fanaticism. The Orontes (*el-Asy*), spanned at this point by four bridges, divides the city into two parts. Huge Persian water-wheels (*nâ-ûrah*), 70 or 80 feet in diameter, turned by the current, supply the houses and gardens with water. The houses are built of sun-dried bricks and wood. The city keeps up a lively trade with the Bedaween. Recent archæological discoveries have made Hamath famous. In 1812, Burckhardt saw a stone there with "a kind of hieroglyphical inscription" upon it. In 1870 this stone and three others, all of black basalt and similarly inscribed (in relief), were found and examined by the Hon. J. Augustus Johnson, American consul-general at Beiroot, and the Rev. Samuel Jessup, American missionary in Syria. Three years later these stones, by order of the Turkish government, were carried to Constantinople. But while in Beiroot, on their way to the capital, casts and squeezes of the inscriptions (five in all) were very carefully taken by Lieut. Steever and Prof. Paine, and fac-similes of the same were published by the American Palestine Exploration Society in 1873. The writing appears to be alphabetic mainly, but no clue has yet been found either to its meaning or its age. (See ROBINSON'S *Later Biblical Researches* (1856); BURTON and DRAKE'S *Unexplored Syria* (1872); and the Palestine Exploration Society's *Second Statement* (Sept., 1873).) R. D. HITCHCOCK.

Ha'math Inscrip'tions, The. A peculiar kind of hieroglyphic writing has been found at Hamath, Syria, on four inscribed stones, forming what are called the Hamath Inscriptions. They were first mentioned by Burckhardt, but attracted no further attention until Mr. J. A. Johnson, the American consul at Beiroot, rediscovered them in 1870,



Hamath Alphabet.

and obtained imperfect copies. These copies, being published, attracted considerable attention, and two years later the stones, which were built into walls and houses in Hamath, were taken possession of by the Turkish government for the museum in Constantinople. Casts were taken by Prof. J. A. Paine at Beiroot, as stated in the article HAMATH (which see). On three of these stones the inscription, containing about sixty characters, is the same, except that in two places there are three or four variants, perhaps the names of kings. One of the three stones has the end of the lines broken off. The fourth stone begins with very nearly the same inscription, but continues it to a length eight or ten times as great. The characters are arranged in horizontal lines, in tiers of two or three over each other. The lines read *boustrophedon*, the characters being reversed as the direction of the line is reversed. The characters are of various conventional sorts, with some whose forms can be referred to portions of the human body or to weapons. They are about fifty-five in number, and entirely different from any other known hieroglyphic. Besides these Hamath stones another is known to be in Aleppo, not yet correctly copied, and there are in the British Museum a few seals from Nineveh with the same characters. Thus far, no clue has been discovered to their decipherment. The paucity of characters might suggest that they are syllabic, but even this is uncertain. No relation has been established with the Cypriote, Lycian, Assyrian, or any other character. The Hamath character must have had currency over a considerable territory before it was displaced by derivatives of the Phœnician alphabet. How early it was introduced we do not know, but it probably ceased to be employed about the seventh century B. C., when the kingdom of Hamath was destroyed. The seals probably belonged to the later kings of Hamath, of whom we know two, and from their names Lenormant has tried in vain to identify two or three characters. WM. HAYES WARD.

Hamba'to, town of Ecuador, South America, situated on a plateau 8860 feet above the sea. It has a lively trade in wheat, which under the equator can be grown at this elevation, and other products. Pop. 10,000.

Ham'blen, county of East Tennessee, organized since the census of 1870. Area, 130 square miles. It is bounded on the N. W. by Holston River, and is intersected by the

Virginia Tennessee and Georgia and the Cincinnati Cumberland Gap and Charleston R. Rs. Cap. Morristown.

Ham'blin, tp. of Brown co., Ind. Pop. 2011.

Ham'burg, a free city, one of the principal members of the old Hanseatic League, and the most important commercial port of the German empire, is situated on the Elbe, near its entrance into the North Sea. With its district it comprises an area of 158 square miles, with 338,974 inhabitants, of whom 240,251 live in the city and suburbs. Its present constitution dates from Sept. 28, 1860. The legislative power rests with a senate consisting of 18 members, and a municipal council consisting of 192 members; the executive power with the senate alone. The state of finances is as follows:

	Revenues.	Expenses.
1870	5,462,464	5,575,962
1871	5,348,044	5,575,600
1872	5,750,000	6,200,000
1873	6,550,000	6,839,000

At the end of 1871 the public debt amounted to 40,349,223 thalers. The commerce shows importations over sea of the value of 432,240,000 thalers in 1872, against 375,890,000 in 1871, mainly from

	1871.	1872.
Great Britain	243,480,000	255,590,000
United States	20,080,000	27,480,000
West coast of America	15,090,000	19,030,000
Brazil	10,470,000	14,300,000
France	9,870,000	14,700,000
The Netherlands	8,510,000	14,070,000

The value of the importations over land amounted in 1871 to 227,360,000 thalers; that of the total importation in 1871 to 603,450,000 thalers, against 369,640,000 in 1870; 427,860,000 in 1869; 409,020,000 in 1868. The exportations comprised 13,573,284 cwts. in 1872, chiefly to Great Britain, the U. S., the west coast of America, Brazil, and the Netherlands. Of the exportations, 4,928,344 cwts. were in German vessels; 8,644,940 in foreign. In 1872, 5913 sea-going vessels, of 1,387,275 tons burden, arrived, of which 778 vessels, of 327,048 tons burden, belonged to Hamburg. In the same year 5872 sea-going vessels, of 1,383,648 tons burden, cleared, of which 837 vessels, of 322,683 tons burden, belonged to the city. With Lübeck and Bremen, Hamburg furnishes as its military contingent the 75th and 76th (Hanseatic) regiments of infantry.

The city stands in a semicircle on the right bank of the Elbe, the depth of whose waters at high tide allows sea-going vessels not drawing more than 5.5 m. to enter the harbor, while an extensive river-traffic establishes a lively communication with the interior. Hamburg, which formerly was fortified, consists of the old and the new city, the former suburb of St. Georg, situated to the N. E., and the suburb of St. Pauli, situated to the W. Besides the Elbe, it has another small river, the Alster, which, coming from the N., forms within the city a small basin, called Binnen-Alster, and outside of it a larger one, called Aussen-Alster; it traverses the city by two main branches, which communicate by canals with the numerous branches of the Elbe. The harbor presents a grand and interesting aspect. It has recently been considerably enlarged, and is now 5500 m. wide, affording room for 400 sea-going vessels and 400 large and several hundreds of small river-craft. The westernmost part of the harbor is chiefly occupied by English coal-ships and the steamers of the Hamburg-American Steamship Co.; the lower harbor, situated more to the E., and safe against drifting ice, is especially intended for sailing vessels; farther to the E. stretch the Sandthorhafen and the Grasbrookhafen, with fine quays for steamboats. The easternmost part, the Brookthorhafen, the upper harbor and the lumber harbor, consist of shallow basins, and are occupied by lumber-craft and other small vessels coming down the river. The great dépôt belonging to the railway line destined to run through Bremen, Osnabrück, Wesel, and Maestricht to Paris, is situated between the Brookthorhafen and the upper harbor. The railway crosses a branch of the Elbe by an iron bridge above the dépôt, and turns then to the S., towards Harburg, crossing another branch of the Elbe on a second bridge. The Berlin dépôt is situated in the eastern part of the old town, Altstadt. ✓

The best view of the city and the river is from the Elbe Hill, near the harbor. The finest part of the city is the Binnen-Alster, generally called the Alster Basin, and its surroundings. The quadrangular basin, 1750 m. in circumference, is on three sides lined with elegant buildings, among which are the best hotels, and has fine quays planted with trees—Jungfernstieg and Alsterdamm. Boats and small steamers cover the water, and all around is stirring with life. The Alster Pavilion and the Bazar, a trading-hall roofed over with glass, are situated on the Jungfernstieg. The northern side of the basin is formed by a dyke which separates the Binnen-Alster from the Aussen-Alster. Only in the middle is an opening through which the water flows, and which is crossed by the Lombard Bridge. A column with the bust of Prof. Büsch stands to the W. of the bridge; to the E. a statue of Schiller by Lippelt. At the N. E. corner of the Alster Basin, on the Alster Hill, the art-gallery is situated, finished in 1869 after the plans of Schirrmacher and Von der Hude, in Italian renaissance style. The lower story contains sculptures; the upper contains pictures by Calame, Camphausen, Verbockhoven, Vautier, Delaroche, Brendel, and others. The fortifications, extending from the art-gallery to the Berlin dépôt, have been transformed into promenades, and here an iron monument was erected in 1821 in honor of Count Adolph IV. of Holstein. Similar promenades stretch from the other end of the Lombard Bridge to the Elbe Hill and the harbor, separating the city proper from the suburb of St. Pauli, and connecting with the botanical garden, one of the richest in Germany, and with the zoological garden, also a magnificent institution. The new Zollverein dépôt is situated opposite to the zoological garden, an immense structure, covering 50,000 square mètres, and containing storerooms of all kinds, post-office, railway and telegraph stations, etc. Other remarkable buildings are the Bourse, where every noon more than 5000 men gather together, and which contains a commercial library of 40,000 volumes; the bank; the Nicolai church, built in 1842 after the plan of Gilbert Scott of London; the Catharine church, containing a remarkable altar and fine glass paintings; the Grosse Michaelis church, built in the middle of the eighteenth century; the Johanneum, containing a library of 250,000 volumes and 5000 manuscripts; and the Thalia theatre, built in 1842, in the renaissance style. The vicinity of Hamburg, especially the right bank of the Elbe, is covered with fine villas, beautiful promenades, and charming villages, such as Blankenese, Flottbeck, and others. ✓

It is probable that Hamburg originated from one of the castles which Charlemagne built against the Slavi, and more especially from the so-called Gammerburg. In 831 it was made a bishopric, and in 834 an archbishopric, although at that time it was only a miserable fishing-village. In 980 it had grown into a small town, but in that year it was destroyed by the Obotrites. In 1215 it was made a free city by the emperor Otho IV., but in 1223 it was taken by the Danish king Knut VI. His son Waldemar sold it for 700 marks silver to the count of Schaumburg-Orlamunde, and he sold it again for 1500 marks silver to the citizens. Thus, Hamburg again became a free city. It chose Count Adolph IV. of Holstein for its patron, and he protected it successfully against the Danes, leaving it all its rights and conferring many benefits on it. In 1242 it made a covenant with Lübeck, by which the foundation was laid for the Hanseatic League, to which Hamburg owes much of its commercial importance and all of its political influence. After the fall of the league it still increased, and it lived through the Thirty Years' war without seeing a foreign soldier within its walls. After a series of internal disturbances, caused by the jealousy between the senate and the citizens, it formed a new constitution in 1712, and in 1770 it acquired a vote in the German diet. Its commerce increased immensely during the North American war of independence, as Great Britain allowed neutral vessels free entrance to the colonies. On Dec. 13, 1810, it was incorporated into France; and suffered very much during the sieges of 1813 and 1814. In 1842, by a terrible conflagration, 4219 houses were burnt. In 1867, Hamburg became a member of the North German Confederation, and in 1871 of the German empire.

August Niemann.

Hamburg, post-v., county-seat of Ashley co., Ark.

Hamburg, tp. and post-v. of Calhoun co., Ill., on the Mississippi River, 90 miles S. W. of Springfield. Pop. 707.

Hamburg, post-v. of Fremont co., Ia., on the Chicago Burlington and Quincy and the Kansas City St. Joseph and Council Bluffs R. Rs. It has 2 newspapers, 2 flour-mills, 1 foundry, 5 churches, 7 schools. Pop. 1431.

W. A. Putney, Ed. "Times."

Hamburg, tp. and post-v. of Livingston co., Mich. Pop. of v. 81; of tp. 907.

Hamburg, post-b. of Berks co., Pa., on the Philadelphia and Reading R. R., the E. bank of the Schuylkill River, and at the foot of the Blue Mountain. It has 1 rolling-mill that turns out 300 tons of iron per week, 1 building and savings association, 2 savings banks, 2 foundries, 2 steam-mills, 5 churches, 1 high and several graded schools, 1 German newspaper, 1 broom-factory, 6 hotels. The South Mountain R. R., now in course of construction, will pass through the town. Pop. 1590.

M. P. Doering, Ed. "Hamburger Schnellpost."

Hamburg, tp. of Edgefield co., S. C. Pop. 1120.

Hamburg, tp. of Vernon co., Wis. Pop. 1208.

Ham'burgh, post-tp. of Erie co., N. Y., on Lake Erie,

and on the Lake Shore R. R., 10 miles S. of Buffalo, N. Y. It contains several villages, and has important manufactures. Pop. of tp. 2934.

Ham'den, post-tp. of New Haven co., Conn., the next town N. of New Haven. It is bounded on the E. by Quinnipiac River, and contains several manufacturing villages. It is traversed by the New Haven and Northampton R. R. Pop. 3028.

Hamden, tp. and post-v. of Delaware co., N. Y., on the Delaware River and on the Delhi branch of the New York and Oswego Midland R. R. The township is mountainous, but has important manufactures. Pop. of v. 133; of tp. 1762.

Hamden, a v. of Clinton tp., Vinton co., O., on the Marietta and Cincinnati R. R., at the junction of the Portsmouth branch, 127 miles E. of Cincinnati. (P. O. Reed's Mill, Vinton co., O.) Pop. 364.

Ha'meln, town of the German empire, in Hanover, on the Weser, which here is crossed by a chain bridge 780 feet long. It has a very interesting aspect of antiquity with its walls and towers, and with its houses ornamented with wood-carving and their gables turned towards the streets. It has large breweries and tobacco manufactures. P. 8530.

Ha'mer, tp. of Highland co., O. Pop. 959.

Hamer (Thomas L.), b. in Pennsylvania; removed at an early age to Ohio, where he studied and practised law, and was elected a member and Speaker of the State legislature; also member of the House of Representatives 1833–39. During the war with Mexico he served as major of Ohio volunteers until appointed brigadier-general, July 1, 1846, distinguishing himself at Monterey, where he succeeded to the command of Butler's division after that officer was wounded. D. at Monterey Dec. 2, 1846. To communicate its regret at his loss, Congress voted a sword to be presented to his nearest male relative. G. C. Simmons.

Ha'mersville, post-v. of Brown co., O., in Clark tp. Pop. 151.

Ham'erton (Philip Gilbert), b. at Manchester, England, Sept. 10, 1834, of an old family of the N. of England; devoted himself to landscape-painting, living much in the wildest parts of Scotland; married a French lady in 1859, and has since lived chiefly at Autun; has brought forward a new process for etching; but his devotion to literature has interfered with his success as an artist. Author of *Observations on Heraldry* (1851); *Isles of Loch Awe* (poems, 1855); *Painter's Camp in the Highlands* (1862); *Thoughts about Art* (1862); *Etching and Etchers* (1866); *Contemporary French Painters* (1867); *Etcher's Handbook* (1868); *Wenderholme* (a novel, 1869); *The Unknown River* (1870); *The Intellectual Life* (1873); *Chapters on Animals* (1873); and several other volumes, besides many fugitive pieces, etc.

Hamil'car was the name of several Carthaginian generals, but the most celebrated of them was Hamilcar Barca ("lightning"), the father of Hannibal. While yet very young he was appointed commander of the Carthaginian army in Sicily (247 B. C.) during the first Punic war. At this time the Romans had nearly succeeded in driving the Carthaginians from the island, but when Hamilcar received the command fortune turned. He took up his position first at Mount Hercte, then at Mount Eryx, and from these points he steadily extended his sway. But in 241 B. C. the Carthaginian fleet was totally defeated off the Ægates Islands. Hamilcar was called back to Africa to defend the mother-city; peace was concluded shortly after, and Carthage lost Sardinia and Sicily. In order to procure for his native city another empire as profitable, and form a basis of operations from which Rome herself could be attacked, he entered upon his Spanish campaigns in 236 B. C. He was eminently successful, and had brought the whole southern and eastern part of Spain under Carthaginian rule when he was killed in a battle against the Vettones, in 228 B. C.

Ham'ilton, town of Scotland, in the county of Lanark, on the Clyde, 11 miles S. E. of Glasgow. Close by is Hamilton Palace, a fine building in the midst of extensive pleasure-grounds and containing a fine collection of pictures. Pop. 11,496.

Hamilton, a flourishing city and port of entry, cap. of Wentworth co., Ontario, Dominion of Canada, on the Great Western Railway, 40 miles S. W. of Toronto and 43 miles W. N. W. of the Suspension Bridge, on Burlington Bay, the western extremity of Lake Ontario. The bay constitutes a noble and capacious harbor, connected with the main lake by Burlington Bay Canal. The Desjardins Canal, a deepened channel, leads to the thriving town of Dundas. Hamilton has 5 branch banks, a board of trade, 25 churches, 10 athletic and sporting clubs, a fine system of public schools, Roman Catholic schools, a business college, an industrial school, a public library, a female college, a grammar school, a convent, a mechanics' institute, 8 Masonic bodies, 6 Odd Fellows' lodges, 2 daily, 3 weekly, and 3 monthly periodicals, 1 agricultural and 1 horticultural society, 6 benevolent associations, 2 literary societies, a hospital, a deaf and dumb asylum, a female home, 2 orphan asylums, a house of refuge, 2 Christian associations, and a Bible society. The city has excellent water and gas works, a large trade, and manufactures of machinery, iron goods, paper, sewing-machines, carriages, brushes, glass, gunpowder, soap, lumber, etc. It is called the "Ambitious City," and is a place of great enterprise and thrift. It is divided into five wards, and has a Roman Catholic bishop. Pop. in 1871, 26,716.

Hamilton, county of Florida, bounded on the N. by Georgia. Area, 400 square miles. It has extensive forests of pine timber and large swamps. Cotton and corn are staple products. It is intersected by the Florida division of the Atlantic and Gulf R. R. Cap. Jasper. Pop. 5749.

Hamilton, county in the S. E. of Illinois. Area, 432 square miles. It contains both timber and prairie land, and is fertile. Cattle, grain, tobacco, and wool are staple products. Woollen goods and carriages are leading manufactures. The county is traversed by the St. Louis and South-eastern R. R. Cap. McLeansboro'. Pop. 13,014.

Hamilton, county of Central Indiana. Area, 400 square miles. It is very fertile, and is partly level and partly undulating. Cattle, grain, and wool are staple products. Flour, lumber, carriages, and brick are leading articles of manufacture. It is traversed by the Indianapolis Peru and Chicago R. R. Cap. Noblesville. Pop. 20,882.

Hamilton, county in N. Central Iowa. Area, 576 square miles. It is undulating and fertile. Grain is the leading product. Coal is mined in the county. It is traversed by the Iowa division of the Illinois Central R. R. Cap. Webster City. Pop. 6055.

Hamilton, county of S. Central Nebraska. Area, 576 square miles. The surface is rolling and adapted to pasturage. The N. W. part is traversed by the river Platte and the Union Pacific R. R. Cap. Orville. Pop. 130.

Hamilton, county of N. E. Central New York. Area, 1745 square miles. It is a part of the great northern wilderness of New York, is rocky and mountainous, and chiefly covered by forests. It abounds in lakes and streams. Some of the valleys are productive. Peat, iron ore, limestone, sandstone, and graphite are found. Cap. Sageville. Pop. 2960.

Hamilton, the south-westernmost county of Ohio. Area, 390 square miles. It is the most populous county in the State. It is undulating, fertile, and well cultivated. Grain, fruits, dairy products, and live-stock are the great staples. The manufactures are very extensive and embrace nearly all kinds of goods. (See art. Cincinnati.) The county has extensive commerce by rail and river. It is traversed by numerous railroads. Capital, Cincinnati. Pop. 260,370.

Hamilton, county of Tennessee, bounded S. by Georgia. Area, 520 square miles. The surface is in part broken by spurs of the Cumberland Mountains. The soil is productive. Wheat and corn are staple products. Coal and iron abound, and iron is manufactured. The county is traversed by the navigable Tennessee River and by the railroads centring at Chattanooga, the capital. Pop. 17,241.

Hamilton, county of N. W. Central Texas. Area, 825 square miles. It is a fine rolling prairie region, well watered and timbered, and abounding in good building-stone. The soil is fertile. The chief products are live-stock, wool, and hides. Cap. Hamilton. Pop. 733.

Hamilton, tp. of Prairie co., Ark. Pop. 582.

Hamilton, tp. of Butte co., Cal., on Feather River. Pop. 1130.

Hamilton, post-v., cap. of Harris co., Ga., 22 miles N. of Columbus and 3 miles from the North and South R. R. It has an academy, a female college, a newspaper, 2 churches, and a hotel. P. 359. D. W. D. Boully, Pub. "Visitor."

Hamilton, tp. and post-v. of Hancock co., Ill., on the Mississippi River, opposite Keokuk, Ia., and at the foot of the Des Moines Rapids, is on the Toledo Peoria and Warsaw and the Keokuk branch of the Toledo Wabash and Western R. Rs. It has a monthly paper, 4 churches, good common schools, a flouring and a saw mill, a basket-factory, wagon and plough factories, and an immense water-power, unimproved. The river is here crossed by a railroad bridge. In the midst of an excellent fruit-region. Pop. of tp. 1019. Th. Gregg, Ed. "Dollar Monthly."

Hamilton, tp. of Lee co., Ill. Pop. 186.

Hamilton, tp. of Delaware co., Ind. Pop. 1129.

Hamilton, tp. of Jackson co., Ind. Pop. 1565.

Hamilton, tp. of Sullivan co., Ind. It contains Sullivan, the county-seat. Pop. 3759.

Hamilton, tp. of Decatur co., Ia. Pop. 846.

Hamilton, tp. of Hamilton co., Ia. Pop. 546.

Hamilton, post-v. of Liberty tp., Marion co., Ia. P. 133.

Hamilton, post-tp. of Essex co., Mass., on the Eastern R. R., 24 miles N. E. of Boston. It is a good agricultural town, has manufactures of woollen goods, and a celebrated camp-meeting ground, known as Asbury Grove, owned by members of the Methodist Episcopal Church. Pop. 790.

Hamilton, tp. of Gratiot co., Mich. Pop. 294.

Hamilton, tp. of Van Buren co., Mich. Pop. 1172.

Hamilton, a v. of Houston co., Minn. Pop. 50.

Hamilton, post-v. and tp. of Caldwell co., Mo., 50 miles E. of St. Joseph, on the Hannibal and St. Joseph R. R. It has a bank, a newspaper, 5 churches, 3 hotels, stores, machine-shops, flouring-mills, etc. It is the centre of a fine agricultural section, and is an important point for shipping cattle, horses, hogs, and grain. Pop. of v. 975; of tp. 1658.
M. A. Low, Ed. "News."

Hamilton, post-v., cap. of White Pine co., Nev., 120 miles S. of Palisade, which is on the Central Pacific R. R. It has a bank, a Wells, Fargo & Co. express office, and 1 newspaper. Principal business, quartz silver-mining, in connection with which there are 7 mills, containing 122 stamps, and capable of crushing 150 tons of rock per day of 24 hours. The product of silver bullion during four years ending Jan. 1, 1874, has been nearly $9,000,000 in value. In the immediate vicinity are numerous "ranches" or farms, which produce hay and grain. Immense herds of live-stock are dispersed over the valleys during summer and winter, finding abundant feed the entire year. Pop. of tp. 3913. Fred. Elliott, Ed. "White Pine News."

Hamilton, tp. of Atlantic co., N. J. It contains May's Landing, the county-seat. Pop. 1271.

Hamilton, tp. of Mercer co., N. J., on the Delaware River, just below Trenton. It is traversed by several divisions of the Pennsylvania R. R., and has a very fertile soil. Pop. 5417.

Hamilton, post-v. and tp. of Madison co., N. Y., about 30 miles from Utica, on the Chenango Canal and the Utica Chenango and Binghamton R. R. It is the seat of Madison University, Hamilton Theological Seminary (Baptist), Colgate Academy, Hamilton Female Seminary, and a union graded school. It has a very fine park, 5 churches, 1 national bank, 2 weekly newspapers and a semi-monthly college paper, 1 foundry, a large coffin and burial-casket manufactory, a large wagon-works, a sash, blind, and door manufactory, etc. The tp. also contains Earlville, East Hamilton, Hubbardsville, and Poolville (which see). Pop. of v. 1529; of tp. 3687. Ed. "Democratic Republican."

Hamilton, tp. and post-v. of Martin co., N. C., on the S. bank of the Roanoke River. Large vessels can ascend to this point. Pop. of v. 200; of tp. 3957.

Hamilton, city, cap. of Butler co., O., on either bank of the Great Miami River, 25 miles N. of Cincinnati. The Cincinnati Hamilton and Dayton, Cincinnati and Indianapolis, Cincinnati Richmond and Chicago, and the Atlantic and Great Western R. Rs. and the Miami and Erie Canal pass through it. The river and canal afford unlimited water-power for manufacturing purposes. A railroad to connect the Cincinnati and Indianapolis road at this point with the Little Miami road at Morrow will soon be built, which will bring this city within easy reach of the Ohio coal-fields. The city is a large manufacturing centre, and one of the largest exhibitors at the Industrial Exposition annually held at Cincinnati. Among its industries is a manufactory of railroad supplies; 1 of punches, reapers, mowers, etc.; 1 of engines, threshers, etc.; 1 of wood-working machinery, a plough company, and the variety works. A large capital is invested in sash, wood-bending, brandurster, coinage, and other factories. There are 6 paper-mills, each representing about $50,000 capital; 1 woollen and 5 flouring mills, 2 national banks, 1 local insurance company and 32 agencies, a board of trade, a paid fire department and an electric fire-alarm telegraph, a projected street railway, 7 building associations with a capital of $2,225,000, 4 weekly newspapers, 21 corporations, 12 churches, 13 benevolent societies, and 2 parks. Pop. 11,081. F. H. Scobey, Ed. "Telegraph."

Hamilton, tp. of Franklin co., O. Pop. 1827.

Hamilton, tp. of Jackson co., O. Pop. 1108.

Hamilton, tp. of Lawrence co., O. Pop. 1108.

Hamilton, tp. of Warren co., O., on the Little Miami River and R. R. Pop. 2466.

Hamilton, tp. of Adams co., Pa. Pop. 1118.

Hamilton, tp. of Franklin co., Pa. Pop. 1630.

Hamilton, tp. of McKean co., Pa. Pop. 120.

Hamilton, tp. of Monroe co., Pa. Pop. 1892.

Hamilton, tp. of Tioga co., Pa., contains the villages of Blossburg and Morris Run, is traversed by the Tioga R. R., and has important mines of semi-bituminous coal.

Hamilton, tp. of Darlington co., S. C. Pop. 1814.

Hamilton, tp. of Cumberland co., Va. Pop. 2990.

Hamilton, post-v. of Loudoun co., Va., is the present terminus of the Washington and Ohio R. R., 40 miles W. from Washington City. It contains the usual number of stores and manufacturing establishments, has 2 weekly newspapers, a fine Masonic hall, the Virginia Normal Institute, and there are several churches in the town and immediate vicinity. It is a great resort for visitors from Washington during the summer months. Principal business, farming and dairying. Pop. about 500.
S. B. Mercier, Ed. "Loudoun Enterprise."

Hamilton (Alexander), b. in Nevis, an island of the West Indies, Jan. 11, 1757. His father was from Scotland; his mother, whose maiden name was Faucette, was of Huguenot stock. His father failed in business, and his mother died while her son was but a child. He was sent to the mother's relatives in Santa Cruz, where in 1769 he became a counting-house clerk of Mr. Nicholas Cruger; but on his discovering some literary taste, he was sent in 1772 to a grammar school at Elizabethtown, N. J. In 1773 he entered King's (now Columbia) College. In 1774 his speeches, pamphlets, and newspaper articles on the political affairs of the day won the applause of the people. In 1776 he received a captain's commission in the artillery, and served with honor in the army of Washington, whose aide-de-camp he became in 1777 with the rank of lieutenant-colonel. In this capacity he was employed by the commander in the most delicate and important trusts. In 1780 he married Eliza, a daughter of Gen. Schuyler. In 1781 he resigned his commission in consequence of a rebuke received from Gen. Washington. He next received command of a New York battalion of light infantry, of which he was lieutenant-colonel, and at the battle of Yorktown he served at its head with much distinction. He afterwards studied law, was a member of Congress (1782–83 and 1787–88), and served in the convention which drew up the Federal Constitution. He was the principal author of the papers afterwards called collectively *The Federalist;* was (1789–95) the first secretary of the U. S. treasury, and as such was the author of the funding system, the founder of the U. S. bank, and restorer of public credit. He afterwards had some share in the preparation of Washington's farewell address. He was at about this time involved in personal and political controversies with Jefferson and Monroe; but subsequently, when the House of Representatives was called upon to choose between Jefferson and Burr for the Presidency, he used his powerful influence for the former. In 1798, during the troubles with France, he was made inspector-general of the army with the rank of major-general, and was for a short time in 1799 commander-in-chief. In 1800 he was chosen president-general of the Cincinnati. He declined the chief-justiceship of the U. S. In 1804, when Aaron Burr unsuccessfully sought the governorship of New York, he was opposed earnestly, though not actively, by Hamilton, to whose influence Burr ascribed his defeat. Burr, smarting under his supposed injuries, challenged Hamilton; and the latter, though repudiating the code as barbarous and wrong in principle, accepted the challenge. The parties met at Weehawken, N. J., July 11, 1804. Hamilton declined to fire at his adversary, but at Burr's first fire was mortally wounded, and died on the following day. In person, Hamilton was thin, small, and erect, graceful and courtly in manners, aristocratic and reserved in social habits. Exceedingly able and industrious in public affairs, a ready and pleasing speaker, a strong and influential writer, his share in the settlement of the financial and other difficulties which early beset the republic was great and important. Far enough was he removed in his opinions and tastes from the democratic spirit of Jefferson and Madison; and it is probable that the antagonism of the two principles was necessary to the growth of a good government — one neither a central despotic power, nor a loose and weak association of separate communities, with no powers at all as a whole. (See his *Life,* by J. Renwick (1841); by his son, John C. Hamilton (1834–40); Hamilton's complete *Works* (7 vols., 1851).)
Chas. W. Greene.

Hamilton (Andrew), a merchant of Edinburgh; became deputy governor of New Jersey in 1686; was taken prisoner by the French in 1689; became deputy postmaster for the colonies in 1692; governor of East and West Jersey 1692–98 and 1699–1701; deputy governor of Pennsylvania

1701–03. D. at his residence, Amboy, N. J., Apr. 20, 1703. He was one of the proprietors of East Jersey.

Hamilton (ANDREW JACKSON), b. in Madison co., Ala., Jan. 28, 1815, the son of a farmer. He became clerk of the circuit court for the county, subsequently merchant, and then a lawyer. In 1846 he removed to Texas, where he was made attorney-general, besides holding other public positions. He was (1859–61) a member of Congress, and during the civil war actively supported the Federal government, and was made a brigadier-general of volunteers; was military governor of Texas 1862–65; provisional governor 1865–66; and afterwards one of the associate justices of the State supreme court. D. Apr. 11, 1875.

Hamilton (CHARLES S.), b. in New York Nov. 16, 1822; graduated at West Point, entered the army as brevet second lieutenant of infantry 1843, second lieutenant 1845, first lieutenant 1847; served with distinction in the Mexican war; brevetted captain for Contreras and Churubusco; severely wounded at Molino del Rey; subsequently on frontier duty till 1853, when he resigned and engaged in farming in Wisconsin. On the outbreak of the civil war he was appointed (May 11, 1861) colonel 3d Wisconsin Vols.; promoted to be brigadier-general of volunteers six days later, and major-general Sept., 1862. Served in Virginia during the siege of Yorktown, May, 1862, when he was transferred to Mississippi and commanded a division at Iuka and Corinth; subsequently in command of the left wing of the Army of Tennessee and of the 16th corps. Resigned Apr., 1863, since which time he has been engaged as a manufacturer at Fond du Lac, Wis. G. C. SIMMONS.

Hamilton (ELIZABETH), b. at Belfast, Ireland, July 25, 1758; was long a governess in Scotland. Author of *Letters of a Hindoo Rajah* (2 vols., 1796), *Memoirs of Modern Philosophers* (3 vols., 1800), *Letters on the Elementary Principles of Education* (2 vols., 1801–02), *Letters on the Formation of Religious and Moral Principles* (2 vols., 1806), *Cottagers of Glenburnie* (1808), *Rules of the Annuity Fund* (1808), *Exercises in Religious Knowledge* (1809), *Life of Agrippina* (2 vols., 1811), *Popular Essays on the Understanding*, etc. (2 vols., 1813), *Hints to Patrons of Schools* (1815). D. at Harrowgate July 25, 1816. (See her *Life*, by MISS BENGER, 2 vols., 1818.)

Hamilton (JAMES), b. about 1710, was a son of Andrew Hamilton of Philadelphia (d. 1741); was deputy governor of Pennsylvania for the proprietors 1748–54 and 1759–63; president of the council and acting-governor in 1771; was an able officer and royalist. D. in New York Aug. 14, 1783.

Hamilton (JAMES), b. at Charleston, S. C., May 8, 1786, was the son of Maj. James Hamilton of Washington's staff. The younger Hamilton received a good education, became a lawyer, served as a major in the war of 1812, and was for some years mayor of Charleston, besides holding other public offices. In 1822 he detected the conspiracy of Denmark Vesey. As a member of Congress (1822–29) he earnestly advocated State rights, free trade, direct taxes, and armed resistance to the tariff of 1828. As governor of South Carolina (1830–32) he recommended the passage of the Nullification act. He was afterwards made major-general commanding the State troops, and was later the minister plenipotentiary from Texas to the European powers. He was in 1857 elected from Texas to the U. S. Senate. On Oct. 15, 1857, he was drowned off the coast of Texas by the collision of the steamers Opelousas and Galveston, giving up, with characteristic manliness, his only chance of safety to a lady he had never seen before. He was active in commercial and literary enterprises, and declined the secretaryship of war and the post of U. S. minister to Mexico, both tendered him by Gen. Jackson.

Hamilton (JEFFERSON), D. D., b. in Ward, Worcester co., Mass., Aug. 23, 1805; educated and brought into the ministry of the Methodist Episcopal Church by Wilbur Fisk, D. D.; joined the New England conference May, 1831; preached four years in Hull, Randolph, Salem, and Boston; was transferred in 1836 to New Orleans on account of asthma, and in 1839 to the Alabama conference, in which he labored with almost unexampled zeal and success at Mobile, Montgomery, Tuscaloosa, and other places as pastor and presiding elder; acted as secretary of the Tract Society of the Methodist Episcopal Church, South, 1855–58. He was a member of the General Conference in 1844, in which measures were taken for the division of the Church; was a member of the Louisville convention at which the Methodist Episcopal Church, South, was organized, and of every General Conference till his death, Dec. 16, 1874, at Opelika, Ala. T. O. SUMMERS.

Hamilton (JOHN CHURCH), b. in Philadelphia in 1792, was a son of Alexander Hamilton; graduated at Columbia College; became a lawyer; was an aide on the staff of Gen. Harrison in the war of 1812–15. Author of *Memoirs of Alexander Hamilton* (2 vols., 1834–40), *History of the Republic as traced in the Writings of Alexander Hamilton* (2 vols., 1850–58), and edited his father's *Works* (7 vols., 1851).

Hamilton (SCHUYLER), a son of John Church Hamilton (b. 1792), and a grandson of Gen. Alexander Hamilton. Schuyler Hamilton was b. at New York July 25, 1822, and graduated at West Point in 1841. In the Mexican war he was twice wounded—once at Monterey, and again near Milflores, while in command of a scouting-party, with which he fought desperately a superior force. He was (1847–54) an officer on the staff of Gen. Scott. In 1855 he resigned and removed to Branford, Conn. In 1861 he enlisted as a private in the 7th New York, but soon received a commission; became in 1861 a colonel and afterwards a brigadier-general of volunteers; in 1862 major-general of volunteers. He took a prominent part in the actions at New Madrid, Mo., and Island No. 10. He resigned from the service in 1863. He published in 1853 a *History of the National Flag.*

Hamilton (Sir WILLIAM), BART., b. in Glasgow, Scotland, Mar. 8, 1788. He was the elder of two sons of Dr. William Hamilton, professor of anatomy and botany in the University of Glasgow. The only brother of Sir William was Capt. Thomas Hamilton, who served for a time in the British army. Having been severely wounded in the Peninsular war, Capt. Hamilton retired on half-pay and became a literary man. He was a frequent contributor to periodical literature. He was author of *Cyril Thornton*, a novel, and a book of travels in America. Sir William Hamilton belonged to an ancient Scotch family, several members of which are distinguished either in Church or State. One of these, Sir Robert Hamilton, was the commander of the Covenanters at Drumclog and Bothwell Bridge. (See Scott's notes to *Old Mortality*.) In 1603 the head of the family was made a baronet, but the family estate having been lost, the title had been in abeyance for nearly a century before Sir William's time, no one caring to claim the title. In 1816, Sir William made good his claim to it in the Scottish courts. From 1803 to 1806, Hamilton attended the yearly sessions of the University of Glasgow. In 1807 he entered Balliol College, Oxford, on the Snell foundation. This endowment was made for the education of students of Scottish birth, and it is worthy of remark that it secured the intellectual training (in addition to many others) of Adam Smith and Sir William Hamilton. Hamilton graduated at Oxford in 1810 with unprecedented honor, both for the extent of his reading and the difficulty of the authors which he presented for examination. Up to the time of his leaving Oxford he had been destined for the medical profession, and had made considerable progress in anatomical and physiological studies. Soon after this time, however, he decided upon the study of law, and in 1813 passed his examination as an advocate. In 1817 he visited Germany, and again in 1820. These visits seem to have laid the foundation of his taste for German literature. He does not seem to have been eminently successful as an advocate, and in 1820 he became a candidate for the chair of moral philosophy in the University of Edinburgh, made vacant by the death of Dr. Thomas Brown. Dugald Stewart up to that time had been the legal occupant of the chair, but by an arrangement between the two, Dr. Brown had for some time discharged its duties, on account of the age and infirmities of Mr. Stewart. At the death of Dr. Brown, Stewart resigned. The selection of the candidate was in the hands of the town council of Edinburgh. The rival candidate of Hamilton was John Wilson, author of the *Isle of Palms* and the dashing Tory editor of *Blackwood's Magazine.* There was no question of the immense superiority of Hamilton's learning and philosophical capacity, but the town council had a Tory majority, and the author of the *Noctes Ambrosianæ* was elected to the chair. Mar. 7, 1821, Hamilton was elected by the Faculty of Advocates professor of civil history in the University of Edinburgh. The salary attached to the chair was £100 a year, and as this was dependent upon a local duty on ale and beer, it was irregularly paid. As attendance upon this chair was not required for an academic degree, no previous occupant had formed a regular class. Hamilton, however, prepared a course of lectures on the modern history of Europe down to the period of the French Revolution, and secured classes from thirty to fifty in number. The topics which he discussed are strikingly analogous to those selected by Guizot in his lectures on European civilization. In 1826 he read a paper before the Royal Society of Edinburgh on phrenology, which had found strenuous advocates in Scotland under the leadership of George Combe. This was followed by another paper in 1827, and by a controversial correspondence with Mr. Combe, on the subject. In preparation for these papers he dissected a great number of brains, and made detailed examinations of the whole

subject, which he published from 1831 to 1850. Sir William says that his tables gave the results of an examination extended to 1000 brains of 50 species of animals—a wider examination "than had hitherto been instituted by any professional physiologist." In Oct., 1829, he wrote for the *Edinburgh Review* his celebrated criticism of Cousin's *Cours de Philosophie*, under the general title of the "Philosophy of the Unconditioned." This was followed in 1830 by his criticism of Brown; in 1831 by his discussion of the authorship of the *Epistolæ Obscurorum Virorum*, and by two articles on the state of the English universities. In 1832 he wrote his articles on the revolutions of medicine and on Johnson's translation of Tennemann. From 1833 to 1836 he wrote five articles upon general and professional education. In 1836 the chair of logic in the University of Edinburgh became vacant, and Hamilton presented himself as a candidate. His two principal opponents were Isaac Taylor, the author of the *Natural History of Enthusiasm*, and George Combe, the phrenologist. After an exciting canvass he was elected by a majority of two. In 1846 he published his edition of the works of Reid. In 1856 he completed his edition of the works of Dugald Stewart. It was his intention to add to this edition a memoir of Stewart, but he did not live to complete it. He continued to lecture till Apr., 1856. Although he had been struck by paralysis in 1844, his intellectual capacity continued unabated to the last. He d. May 6, 1856. M. B. ANDERSON.

Hamilton's (Sir William) Philosophy. For a man of so much practical power, the life of Hamilton was singularly quiet and unmixed with public life. Though he lost his election to the chair of moral philosophy by his unwillingness to avow himself a Tory, he never seems to have obtained any status among the Whig littérateurs of Edinburgh, or to have ever rendered any service to the party. His life was pre-eminently that of a scholar. The type of his scholarship was analogous to that of Erasmus and the Scaligers. He was so accurately trained in those languages which contain the world's thought that his industry was made in the highest degree available for the accumulation of knowledge. The range of his reading in literature was enormous. But beyond the subjects of anatomy and physiology his knowledge of physical science was not remarkable. But in all those branches of literature in any way connected with education, logic, or metaphysics his learning was equal, if not superior, to that of any man of his time; and he attempted minute investigation in every subject he undertook to study. This was his weakness, for upon so great variety of subjects special and minute learning is simply impossible for any human mind. He was unfortunately excitable and dogmatic, and when aroused by controversy, of which he was naturally fond, he was sometimes betrayed into statements which were erroneous or not well considered. The exaggerated estimate of his learning made by partial friends exposed him to the criticism of specialists, which was the more severe because of the extravagant claims made on his behalf. To sustain his arguments against religious tests in Oxford, he was led incidentally to attack Luther as having authorized in his speech and writings much of the heterodoxy of modern Germany. In the heat of this controversy his remarks were sweeping, bitter, and intense to such a degree that they furnished a presumption against their justice. The criticism of J. C. Hare, first published in his notes to the work entitled *The Mission of the Comforter*, met Sir William in all his weak points. He evidently trusted to his own general knowledge and to isolated extracts made by Luther's enemies as authority for assertions which a careful study and fair interpretation of Luther's works failed to justify. This controversy seems to have led Sir William to the detailed study of Luther's writings and the history of his times, with the view to the publication of a life of the great Reformer. Although much valuable time was spent upon the subject, and an immense amount of material accumulated, the life of Luther was never finished, and he appears to have left nothing among his papers in a condition fit for publication. This leads us to note another peculiarity of Sir William's mind. He seems never to have been willing to give the results of his own reflection upon any subject in a systematic form without previously studying the entire literature of the subject. He often exhausted his powers of production in the process of accumulating materials, and as a consequence has left no coherent systematic treatises which adequately represent either his learning or his power of thought. His mind was critical and dialectic, rather than constructive. He approached every subject from the point of view of an intellectual gladiator. This attitude of mind, connected with great power for clear and vigorous expression, renders his writings stimulating and suggestive almost without parallel. For the same reason they do not furnish safe guidance to a learner or to a person untrained in the processes and history of speculative thought. He manifestly had a constitutional dislike to regular and systematic composition. His works are all comparatively incomplete and fragmentary. In fact, with a partial exception in favor of his lectures on logic, his works are a series of magnificent torsos, grandly suggestive of range of learning and intellectual power. Like the unfinished statues of *Day* and *Night* by the great Florentine sculptor, Hamilton's works excite in the mind profound regret that they were never finished. Even his edition of Reid breaks off in the middle of a sentence. Though this unfinished work was published many years before his death, he could never be induced to complete it. An insatiable curiosity led him continually into the byways of literature, and caused him to waste valuable time in the critical reading of books whose contents had ceased, by the growth of thought, to have any present value. An illustration of this is found in his extensive study of modern Latin poetry, and his critical and out-of-the-way reading of the controversial literature of the period of the Reformation. His monograph upon the authorship of the *Epistolæ Obscurorum Virorum* is a proof of his accomplishments in this literature. His controversial tracts on education show a marvellous familiarity with the university system of modern Europe.

In the department of logic he awakened an interest which has steadily increased to the present time. In the reaction against the authority of Aristotle which marked the period of the Renaissance a prejudice was excited against the works of that great thinker which was unintelligent and undiscriminating. In Scotland this reaction took the form of opposition to the study of logic in any vigorous or systematic form. Though it formed a part of the Oxford curriculum, the subject was studied through meagre and inadequate manuals totally deficient in breadth of view and range of application. Whately's *Elements of Logic* was published in 1826, ten years before Hamilton's accession to his chair in the University of Edinburgh. This work furnished an intelligible, though not a profound, manual for instruction, but it aroused no deep and powerful interest in the subject. Hamilton's review articles and his lectures to his classes created a new epoch in the study of logic in Great Britain. The publication of his lectures since his death opened up an immense range of logical literature, illustrated the history of the science, and vindicated its uses as a means of academic discipline and as a test of right thinking in all departments of human inquiry. The actual advances in logical science due to Hamilton are not easily estimated. He never fully developed the doctrines which he claimed as new, and possibly overrated their importance. He certainly simplified logical processes by his quantification of the predicate and extending the possible significance of the copula. This has enabled teachers of logic to dispense with the cumbrous apparatus of figures and the complicated terminology which they involved. It is in great part due to the impulse which he communicated and left behind him that so many able and vigorous works have been written on the subject since his death. It may be safely said that in knowledge of the literature of the subject, in grasp of its principles, and in the impulse which his instructions gave to its study, Hamilton stands without a peer in the literature of Great Britain, and possibly in that of modern Europe.

The relations of Sir William Hamilton to psychology also are not easily defined. In his lectures and in the supplementary dissertations to his edition of Reid and his review articles he has left on record a great amount of acute discussion and profound remark, illustrated by an immense range of philosophical learning. These hold a distinguished place among the contributions which the present century has made to psychological science. But he has left no logically developed and coherent system. He commenced his philosophical career as a critic of the fundamental principles of Schelling so far as they had been expounded and adopted by Cousin. The celebrated article in the *Edinburgh Review* which contains this criticism was written hurriedly, under pressure, with a distinctly polemical aim. His object was to annihilate by one crushing blow that philosophy of the absolute which had seized the control of continental thinking. For the purposes of this discussion he availed himself of the methods and formulas of Kant. In his anxiety for a victory that should be complete he denied to man all knowledge of the infinite whatever, and set aside as untrustworthy those facts in the human consciousness which impose upon us the belief in an infinity of real existence, which quantitatively the same consciousness affirms itself unable to define and measure. In his anxiety to show the inability of our powers to comprehend or "go around" the infinite in the form of time, space, or power, he was led to a positive denial of the existence of the notion as an ineradicable element in the human consciousness. Hamilton failed to give simplicity and

clearness to his discussion of the doctrine in question by using the word "infinite" exclusively as a general term, including everything of which the word is used as a predicate. Had he denied to the human mind any notion of the infinite as applied to a right line in space, or to any of the specific infinite quantities of the mathematician, he could hardly have spoken with so much confidence. By using the phrase "the infinite" he shifts the discussion from specific cases to a concept of extreme generality, including within itself at the same time all conceivable infinite quantities, forces, and powers. Two points in space situated each in the same right line may be proved capable of approaching each other for ever without the possibility of meeting. So two points may be shown capable of receding from each other without limit in time or space. Now, the process by which the existence of these conditions is proved possible, involves the positive affirmation in thought of the infinitely great and the infinitely small in the domain of quantity. The denial implied in the term is not in any sense a denial of the existence of the infinitely great or the infinitely small, in fact or in thought, but it is the denial of our power to apply to them known units of measure. So far from the infinitely great or small being "the negation of thought," they are among the most positive affirmations of the human mind. They are named by appropriate terms in all cultivated languages, and are equally familiar in the symbols of the mathematician. The whole discussion of Hamilton, as well as that of Cousin, involves a want of discrimination between qualitative and quantitative thought. Cousin was right in affirming the positive nature and actual existence of the idea of infinitude, and wrong in the statement that it is essentially comprehensible or measurable. Hamilton was right in denying our capacity to apply units of measure, in fact or imagination, to infinite quantities, but wrong in defining them as the "negations of thought," and sharply limiting the sphere of mental activity to the finite in quantity or quality. It is, however, perfectly clear that infinite forces and quantities do become the subject-matter of thought, both subjectively as capacity and objectively in mathematical quantities. There are in the notion of the infinite two elements—one positive, the other negative. The positive side of the notion affirms the existence of the infinite in time and space, while the negative side of the notion is the denial of our power to subject them to a quantitative measurement or imaginative presentation. The denial of our power to measure the infinite is virtually a concession that the notion is actually present as an object of thought. As the necessary correlate of all thinking upon finite quantities, we are compelled to believe in its objective reality. All that was demanded of Sir William in his controversy with Cousin and the absolutists was to show the impotence of the human mind to comprehend or measure the infinite. But he went farther, and denied the existence of a notorious psychological fact.

Hamilton sought also, through his doctrine of the Unconditioned, to explain the origin and nature of the causal judgment. He makes the causal judgment the mere inability to think an absolute beginning. This statement is purely negative. The causal judgment comes into the mind in the presence of a change in what already exists. It is a change, a manifestation of power. No new existence appears. It affirms the event or the change to have had a cause. This affirmation is positive, both as a law of thought and a law of the objective change which calls out the affirmation from the mind of the observer. This effort on the part of Hamilton to account for the positive causal judgment by referring it to the impotence of the human mind, purely negative in its character, must be admitted to be a failure. The causal judgment is in the most emphatic sense positive, and no acuteness of psychological analysis can resolve it into a "fasciculus of negations."

In like manner, the doctrine of the "relativity of knowledge" which plays so large a part in Hamilton's discussions is a distinctly Kantian doctrine, and entirely foreign from the teachings, spirit, and aims of Scottish philosophy properly so called. It is equally irreconcilable with that doctrine of "natural realism" which, in his lectures and his celebrated criticism of Brown, Hamilton so emphatically taught. This word "relativity," as connected with the theory of knowledge, is used in different senses. If by "relativity" we mean that the knowledge of any object is impossible unless that object comes into relation with the mind, the term is simple and contains an intelligible idea. But if by "the relativity of knowledge" is meant that the external object as existing, and the internal percept which that object has determined in the mind, are different from each other in such a sense that our knowledge of it is untrustworthy, the notion strikes at the foundation of all evidence and all knowledge. It is, besides, an assumption purely gratuitous. For if it be a fact that our mental apprehension of external objects is different from the objects themselves, and that the "thing in itself" is for ever shut out from our knowledge, how can we ever know the fact? How can we legitimately affirm that the form of our percept is unlike that of the object, which by its relation to our minds has marked out and determined our knowledge? By the conditions of the hypothesis the "thing in itself" is unknowable, consequently a comparison between it and the percept is impossible. No dialectic skill can harmonize this Kantian "relativity" with "natural realism" in any proper sense of the term.

There are few facts in the history of philosophy more remarkable than the attempt of Hamilton to combine into one system the Kantian doctrine of "relativity" and the direct and immediate knowledge of the external world which Hamilton taught with so much earnestness and zeal. The truth seems to be, that the criticism on Cousin in the *Edinburgh Review* was so able, so learned, and so profound that it startled the British public into admiration, and made Hamilton famous all over the Continent. When he had once taken a position he was as incapable as any one of his old Covenanting ancestors of receding from it. When he took the position against Brown of a defender of the Scottish philosophy of Reid, he was called upon to defend a system in many essential particulars entirely foreign from that which furnished him with his weapons in his battle with the absolutists. He was publicly committed to the defence of two antagonistic systems. Instead of rejecting either, he attempted to hold to both and reconcile them. In this he failed, for the task was simply impossible. The Kantian portion of Hamilton's philosophy, formulated as the Philosophy of the Unconditioned, has been adopted by Spencer and Mill, for it harmonizes with the "reasoned" materialism which is the basis of the psychology which they hold in common with their masters, Hobbes and James Mill. It was accepted also by Mansel as the foundation-principle of his *Limits of Religious Thought*, but it has been very generally repudiated by cautious psychologists, who are as earnest as Hamilton in repudiating the extravagant claims for the human capacities which distinguished the system of Cousin and the earlier teachings of Schelling.

Hamilton's effort to clarify, supplement, and give systematic form to the doctrine of immediate perception, somewhat vaguely set forth by Reid, is a clear contribution to psychological science. For this purpose he revived and defended that doctrine of the relation of the soul to the body which the mediæval philosophers adopted from Aristotle, and which has since then been adopted by Stahl and Berard, and is now known under the designation of Animism. Unfortunately, Hamilton failed to perceive that the analysis of the qualities of body into primary and secondary is unnecessary in a system which recognizes sensible knowledge as the result of a face-to-face relation established between the different human senses and the various forms of matter. This analysis, to the history of which he gave great time and attention, had its origin in an incorrect apprehension of the nature of those attenuated forms of matter which reach and affect only the more delicate human senses. It was perpetuated by the failure to subject the complex phenomena which are the gifts of the several senses into their constituent elements. When we bear in mind that the nerves of the eye have been so delicately differentiated as to detect and recognize the presence of rays of light, the olfactory nerves to detect odors, and the nerves of the ear to recognize the pulsations of the sound-wave, it becomes evident that all our senses are in fact but so many modifications of touch. This being the case, the elaborate analysis of Hamilton of the qualities of body into primary, secondary, and secundo-primary has no place in a system of psychology which accepts the doctrine of immediate knowledge through the senses. This discussion of Hamilton, which has been so much admired by his unquestioning followers, is also defective in confounding facts of physics and facts of psychology. The "natural realism" which in one part of his *Psychology* Hamilton so rigorously taught, requires and receives no aid from such an analysis of the qualities of body. Sound-waves are directly apprehended. The instrumentality which sets them in motion is, so far as the ear is concerned, a matter of inference. A similar statement may be made regarding the senses of smell and sight. In vindicating the doctrine of synchronous perception, and making clear the analysis of the formula of consciousness, as a condition of all forms of perception, Hamilton's labors are beyond all praise. It is true that he has limited the application of this formula to the case of perception of what he calls the primary qualities of body. In this limited range of application he has discussed it with great clearness and power. It is a fruitful principle, and we believe that it is capable of application in all forms of per-

ception and in all processes of thought. Properly apprehended and clearly stated, it forms an impregnable basis of argument against all the modifications of the so-called associational psychology. Although the formula of consciousness is implicated with greater or less clearness in all psychological systems, and in all analyses of the elements necessary in the construction of sentences in every human language, we know of no writer who has discussed this formula so successfully as Hamilton. He has failed only in limiting its application to the most obtrusive and emphatic forms of perception. We have not the space to give the reasons for considering it to be the universal condition of all acquisition of human knowledge and of every process of human thought. Herbert Spencer, in his *First Principles*, has taken notice of this limited application of the formula by Hamilton, and for this reason has set aside as valueless the argument which Hamilton founded upon it for the real existence of the conscious self as distinct from all forms of matter.

In respect to the doctrine of consciousness, Hamilton departed somewhat from his immediate Scotch predecessors. With him consciousness is not a distinct faculty of the soul, but that fundamental fact of which all powers of the mind are so many different modifications. He affirmed also, as a consequence, the direct and immediate consciousness of all forms of matter coming into relation with their appropriate senses. For the history of philosophical opinions Hamilton's labors are invaluable. Perhaps no literature, as a whole, is less satisfactory than the history of philosophy. This is due to the very general failure in the simple and exact analysis and statement of the processes of thought gone through, and conclusions arrived at, by the philosophers of the past, which it is the function of the historian to give us. Though Hamilton's labors in this field are scattered and fragmentary, they are valuable in the extreme. He sometimes makes errors in quotations, he sometimes is inaccurate in interpretation, but he gives the history of an author's thought upon special topics with a precision and clearness without a parallel. He gave to his generation a new exposition and proof of the value of learning in psychological inquiry. He made it clear to the careful student of his writings that, after making full allowance for all the vagaries of philosophical thought, there has been from the dawn of speculation a steady though not uniform progress towards truth—that there is a great body of philosophical doctrine which has been under various forms and disguises accepted and held for true by the ablest philosophers among all cultivated nations. He has helped, beyond most other men, to illustrate the great truth that all the conflicts of opinion in the past have wrought the "steady gain of man;" he has illustrated also with equal clearness that the errors and false systems of our own times are but reproductions of old foes to truth, which have been a thousand times met and a thousand times vanquished. Even his doctrine of the Unconditioned, exaggerated and without requisite limitations as we believe it to be, has called attention anew to the limitations of the human understanding, and to the vast number of insoluble problems which lie around us on every hand. None but minds of the very highest order have been able to make an appreciable impression upon the abstract thought of their time. The mass of thinkers receive and transmit the products of the past without essential modification. Very few have made additions to its volume or essentially modified its form. There may be comparatively little of addition to the sum-total of philosophical thought which will be left after Hamilton's works have been subjected to the winnowing processes of time. But that little will be sufficient to place him among the foremost scholars and thinkers of his time. In the impulse which his vast learning, his intense nature, and his mastery of expression gave to the thinking of his time, he can hardly be overrated. Whether we accept or reject his doctrines, no better gymnastic for the mind can be found than the best discussions of Sir William Hamilton. (See VEITCH'S *Memoir of Hamilton* (ed. 1869); *Ed. Essays Art*, by T. S. BAYNES.) M. B. ANDERSON.

Hamilton (Sir WILLIAM ROWAN), LL.D., b. in Dublin Aug. 5, 1805; educated at the Dublin University, graduating with high mathematical honors; became professor of astronomy and astronomer-royal for Ireland in 1827; was knighted in 1835; became president of the Royal Irish Academy in 1837. D. at Dublin Sept. 2, 1865. Author of very valuable papers on physics and mathematics, but his fame rests upon his great invention, the calculus of quaternions. His principal works are *Lectures on Quaternions* (1853) and *Elements of Quaternions* (1866). (See QUATERNIONS.)

Hamiltonban', tp. of Adams co., Pa. Pop. 1418.

Ham'ilton Col'lege, an institution of learning situated in Clinton, Oneida co., N. Y. It grew out of the Hamilton Oneida Academy, which was established in the same place in 1793 by the energy and liberality of Rev. Samuel Kirkland, for many years a missionary to the Indians of Central New York. The college received its charter from the State in 1812. The first class graduated in 1814. The whole number of its alumni up to the present time (1875) is 1538, of whom nearly 1200 are still living. A law school has been connected with the college since 1854, from which 86 students have been graduated. A valuable law library, numbering about 5000 volumes, was bequeathed to the college by William Curtis Noyes of New York. The general library of the college contains upward of 12,000 volumes. The public buildings consist of a chapel, three halls with rooms mainly for students, a library and memorial hall, an observatory, a chemical laboratory, and a hall of natural history. The observatory, endowed by Edwin C. Litchfield of New York, and bearing his name, contains an equatorial telescope with an object-glass of 13.5 inches in diameter and a focal length of nearly 16 feet; a smaller portable telescope (made by Steinheil Sons, Munich) with an object-glass of 4 (French) inches diameter and a focal length of 5 feet; a transit instrument, an astronomical clock, and a Bond's chronograph. The longitude of the observatory has been accurately determined by exchanging star-signals with the Harvard College observatory, and in turn this observatory has become the basis for determining the longitudes of Buffalo, Syracuse, Elmira, and Ogdensburg, of the western boundary of the State of New York, and of the observatory at Ann Arbor, Mich.; which latter forms the fundamental point for the longitudes of the lake survey. Twenty asteroids have been first discovered at the Litchfield observatory up to the present date (Jan., 1875) by the director and professor of astronomy, Dr. C. H. F. Peters. The cabinets contain upward of 17,000 specimens in geology, mineralogy, and natural history, besides a valuable herbarium of 8000 samples of plants carefully labelled and classified. The college grounds contain in all about 40 acres. The campus proper, of about 17 acres, is laid out with taste and planted with trees and hardy shrubs.

The faculty of the college consists of a president and twelve resident professors. The presidents of the college have been—Rev. Azel Backus, D. D., 1812–16; Rev. Henry Davis, D. D., 1817–33; Rev. Sereno Edwards Dwight, D. D., 1833–35; Rev. Joseph Penney, D. D., 1835–39; Rev. Simeon North, D. D., LL.D., 1839–57; Rev. Samuel Ware Fisher, D. D., LL.D., 1858–66; Rev. Samuel Gilman Brown, D. D., LL.D., 1866. S. G. BROWN.

Ham'ilton's, tp. of Catawba co., N. C. Pop. 1562.

Ham'let, post-v. of Starke co., Ind., on the Pittsburg Fort Wayne and Chicago R. R. Pop. 47.

Hamlet (called also OMAR), post-v. of Villenova tp., Chautauqua co., N. Y. Pop. 155.

Hamlet, the hero of Shakspeare's famous tragedy, was a prince who belonged to the mythical period of Danish history, but who, for many centuries, was the subject of a very vivid tradition among the Danish people; his grave is still shown near Elsinore, and the part of Jütland's Heath where was fought the battle between him and Viglet is still called Hamlet's Heath. His life has been told at some length by Saxo Grammaticus, a Danish historian of the latter part of the twelfth century, but there is no direct connection between Saxo's story and Shakspeare's tragedy, nor between Shakspeare's tragedy and Belleforest's novel, a French compilation of the middle of the sixteenth century. That which is common between Saxo and Shakspeare is very little, and is most probably derived from an older play which Shakspeare rewrote. But it is an interesting fact that Shakspeare's deviations from Saxo—the scene of Elsinore, the wanderings of the ghost, Hamlet's studying at Wittenberg, the drunkenness of the king, etc.—are neither loose vagaries nor deep speculations. They all relate, in a very simple manner, to actual circumstances in Denmark during the latter half of the sixteenth century, and it is not altogether impossible to trace the run of the gossip from the ramparts of Elsinore to the taverns of London. CLEMENS PETERSEN.

Ham'lin, county in the E. of Dakota. Area, 720 square miles. The Big Sioux River traverses the N. E. portion. It is not yet settled to any extent.

Hamlin, tp. of Mason co., Mich., on Lake Michigan. Pop. 124.

Hamlin, post-tp. of Monroe co., N. Y., on Lake Ontario. It has 5 churches. Pop. 2304.

Hamlin, tp. of McKean co., Pa. Pop. 121.

Hamlin, post-v., county-seat of Lincoln co., W. Va.

Hamlin (AUGUSTUS C.), A. M., M. D., b. at Columbia, Me., Aug. 28, 1829; graduated at Bowdoin College 1851; studied medicine in Boston and Paris; took his medical degree 1854; was surgeon in the army service 1861–65; became medical director of the 11th corps and medical inspec-

tor U. S. A.; removed to Bangor, Me., 1865. Author of a *Treatise on the Tourmaline;* of brochures on *The Salmonidæ,* and on medical and scientific subjects; is preparing works on the diamond, sapphire, emerald, etc., and on alimentation, ventilation, etc. Is a member of several American and European learned societies; general secretary of the American Association for the Advancement of Sciences, etc.

Ham'lin (Hannibal), b. at Paris, Me., Aug. 27, 1809. He was for a time a printer; was admitted to the bar in 1833, and several times was elected Speaker of the Maine house of representatives. He was (1843–47) a Democratic representative in Congress; U. S. Senator 1848–57, 1857–61, and 1869–75; governor of Maine in 1857, to which position he was chosen as a Republican, but resigned on his re-election to the U. S. Senate. He was (1861–64) Vice-President of the U. S. during Mr. Lincoln's first term, and in 1865 was for a time collector of the port of Boston.

Ham'line (Leonidas Lent), D. D., b. in Burlington, Conn., May 10, 1797. Removing to the West, he was admitted to the bar in Ohio, but joined the Methodists in 1828, and entered their ministry in 1832. After editing the *Western Christian Advocate* and *Ladies' Repository,* he was bishop from 1844 to 1852, when he resigned. D. Feb. 22, 1867. His *Works* were published in New York in 1869.

Ham'linPlanta'tion, tp. of Aroostook co., Me. P. 558.

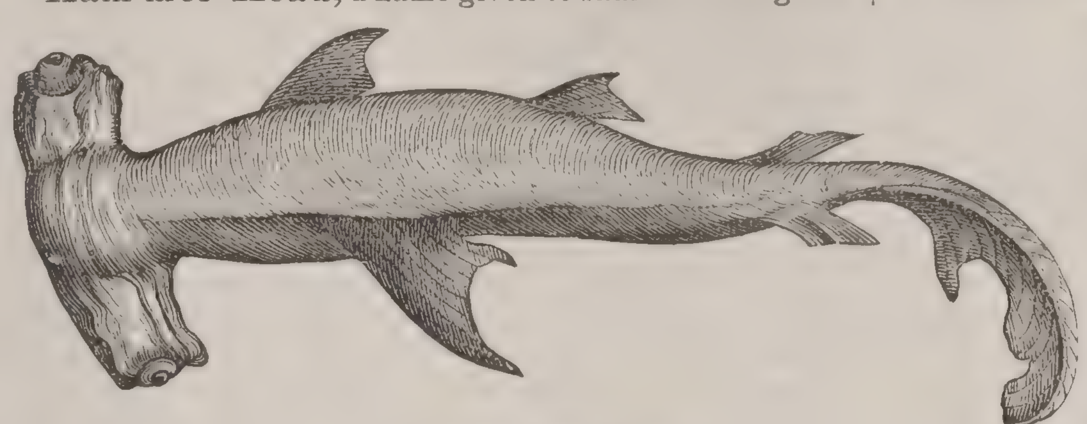
Hamlin's Grant, tract in Oxford co., Me. Pop. 95.

Hamm, town of Prussia, in the province of Westphalia, on the Lippe. It has considerable manufactures of linen and leather. Pop. 16,914.

Hamme, town of Belgium, in the province of West Flanders. It has manufactures of linen and lace and a great trade in flax and hemp. Pop. 10,143.

Hammer, Steam. See Steam-Hammer, by Coleman Sellers.

Ham'mer-Head, a name given to sharks of the genus



Hammer-head Shark.

Zygæna or *Sphyrnias,* having, in the adult, the two sides of the head produced laterally till the head has somewhat the shape of a double-headed hammer. There is an eye on each end of the head. These fishes are very voracious, and extremely prolific, especially in warm seas. The *Z. malleus,* a man-eating shark, has been often caught on both sides of the North Atlantic. The *Z. laticeps* has the widest development of the hammer-shaped head.

Ham'merich (Martin Johannes), b. in Copenhagen Dec. 4, 1811; studied philology and mythology; travelled much; was director of the gymnasium of Christianshavn 1842; and retired in 1868 to his estate, Islinge, in the southern part of the island of Seeland. His principal works are—*On the Myth of Ragnarokr* (1836), an excellent translation of the *Sakuntala* (1845), *Life of Thorwaldsen* (1870), besides a great number of minor essays relating to the Danish language and literature, and distinguished as much by their sound and broad views as by their elegant form.—His elder brother, Peter Frederik Adolph Hammerich, b. in Copenagen Aug. 9, 1809, studied theology, and became a minister in 1845, and in 1858 professor in theology at the University of Copenhagen, where he represents the ideas of Grundtvig. He has published several works relating to the history of Denmark and Scandinavia—*Danmark under Waldemarerne* (1847), *Danmark under Adelsvælden* (1854), *Den hellige Birgitta* (1863), distinguished alike for their novel ideas and for their vigorous style.

Clemens Petersen.

Ham'mer-Purg'stall, von (Joseph), Baron, b. at Grätz, Austria, June 9, 1774; studied the Eastern languages at the Oriental Academy, Vienna; became in 1799 interpreter to the internuncio at the Porte; inspector of consulates 1800; secretary-dragoman in the Anglo-Turkish army 1801; secretary of Austrian legation in Turkey 1802; consular agent at Jassy 1806; court-interpreter at Vienna 1816; aulic counsellor 1817; baron 1837; president of the Academy of Vienna 1847–49; grand officer of the Medjidie 1855. D. at Vienna Nov. 24, 1856. He was a man of great wealth and an earnest lover of Oriental learning. He published a very large number of learned works on Eastern history, etc., still valuable, although their reputation has of late declined. Of these we may note *Encyklopädische Uebersicht der Wissenschaften des Orients* (1804); *Die Staatsverfassung und Staatsverwaltung des Osmanischen Reichs* (1815–16); *Geschichte der schönen Redekünste Persiens* (1818); *Umblick auf einer Reise von Konstantinopel nach dem Olympos* (1818); *Geschichte der Assassinen* (1818); *Montenebbi* (1824); *Geschichte des Osmanischen Reichs* (1827–34, 10 vols.); *Gesch. der Osmanischen Dichtkunst* (1836–38, 4 vols.); *Gesch. der goldenen Horde* (1840); *Literaturgeschichte der Araber* (7 vols., 1850–56); *Denkwürdigkeiten aus meinem Leben* (1858).

Ham'mersfest, town of Norway, in Finmark. It is the northernmost town in Europe, situated in lat. 70° 40′ N. In the two summer months, in which the weather is quite hot, the harbor of Hammersfest is the rendezvous of more than 200 fishing-vessels; the fishing can be carried on, however, the whole year round. Pop. 1125.

Ham'mersmith, town of England, in Middlesex, on the Thames, 4 miles above London, in the Kensington district. Its kitchen and flower gardens are famous. Pop. 24,520.

Ham'mertown, a v. of Pine Plains tp., Dutchess co., N. Y. (P. O. Pine Plains.) It has a large scythe-factory, employing about 50 operatives.

Ham'mock [a word of West Indian origin], a netting used as a suspended bed on shipboard and in houses, especially in warm countries. Sisal hammocks, made from agave fibre in Yucatan, are especially prized.

Ham'mond, tp. of Spencer co., Ind. Pop. 2626.

Hammond, a v. of Tangipahoa parish, La., on the Mississippi Central R. R., 54 miles N. of New Orleans.

Hammond, post-tp. of St. Lawrence co., N. Y., on the St. Lawrence River, includes a part of the Thousand Islands. Pop. 1757.

Hammond, tp. of Edgefield co., S. C. Pop. 2560.

Hammond, tp. and post-v. of St. Croix co., Wis., on the W. Wisconsin R. R., 37 m. E. of St. Paul, Minn. Pop. 895.

Hammond (Dudley Whitlock), M. D., was b. in Pickens co., S. C., May 12, 1809. In early life he went to Georgia, and received his diploma from the Medical College of that State in Augusta. After practising medicine for twenty years in Munroe co., he removed to Macon, where he now resides, and ranks high as a surgeon and physician. He has operated eighteen times for urinary calculus without losing a case, and in one instance the stone weighed six ounces. He originated a new method of removing gravel or foreign bodies lodged in the urethra. He has contributed valuable articles to medical journals.

Paul F. Eve.

Hammond (Jabez D.), LL.D., was b. at New Bedford, Mass., Aug. 2, 1778. In 1799 he was a practising physician at Reading, Vt. In 1805 he became a lawyer at Cherry Valley, N. Y.; was a Democratic member of Congress 1815–17; a State senator 1817–21; a commissioner to settle State claims against the U. S. government 1825–26; a county judge in 1838; and one of the regents of the university 1845–55. He was the author of *James Melbourne* (1851), *Political History of New York* (1849 *seq.*, 3 vols.), and a *Life of Silas Wright* (1848). D. Aug. 18, 1855.

Hammond (James Hamilton), b. in Newbury district, S. C., Nov. 15, 1807, was a son of Pres. Elisha Hammond of South Carolina College, at which the son graduated in 1825. In 1828 he became a lawyer and an editor, and as an advocate of State rights served on the governor's staff as an officer of the nullification forces raised in 1833; was a member of Congress 1835–37; a general of State militia 1841; governor of South Carolina 1842–44; U. S. Senator 1857–60; president of South Carolina College in 1861. (His father, Pres. Elisha Hammond, was a native of Rochester, Mass.) Governor Hammond was the reputed author of the expression "Cotton is king," and originated the epithet "mudsills" as applied to the laboring classes. In his later life he abandoned his extreme nullification views. He possessed a large fortune, acquired by marriage. He was the author of numerous papers on agriculture, manufactures, politics, etc. His papers on slavery were republished in a volume as *The Proslavery Argument* (1853). D. at Beach's Island, S. C., Nov. 13, 1864.

Hammond (Samuel) was b. in Richmond co., Va., Sept. 11, 1757; was well educated, and served in his youth in the Indian wars. During the Revolution he served with the greatest honor as an officer, mostly of cavalry, finally

holding a colonel's commission under Greene. He was present upon nearly every battle-field in the South, and received several wounds; removed after the war to Savannah, Ga.; became surveyor-general, and was at one time governor of the State; fought in the Creek war of 1793; was a member of Congress from Georgia 1803–05; civil and military commandant of Upper Louisiana 1805–24; also receiver of public moneys and president of a bank at St. Louis (now in Missouri). In 1827 he became surveyor-general of South Carolina, and (1831–35) secretary of state. D. at Horse Creek, Ga., Sept. 11, 1842.

Hammond (William A.), M. D., b. at Annapolis, Md., Aug. 28, 1828; graduated M. D. at the New York University in 1848, and entered the U. S. army as assistant surgeon in 1849, in which he remained till Oct., 1860, when he resigned and accepted the appointment of professor of anatomy and physiology in the University of Maryland at Baltimore, where he also obtained a large practice. At the outbreak of the civil war he offered his services to the government, and was reappointed assistant surgeon May, 1861; on the reorganization of the medical department in 1862 he was appointed surgeon-general of the army, in which capacity he displayed great energy and ability. In the midst of these official duties he prepared and published *Physiological Memoirs* (1863) and *Lectures on Venereal Diseases* (1864). Leaving the service, he became a professor in Bellevue Hospital Medical College, New York, where he now resides. Author of *Military Hygiene* (1863); *Sleep and its Nervous Derangements* (1869); *The Physics and Physiology of Spiritualism* (1870); *A Treatise on Diseases of the Nervous System* (1871); *Insanity in its Relations to Crime* (1873). Geo. C. Simmons.

Ham'mondsburg, post-v. of Warren co., Ia. Pop. 59.

Ham'mondsport, post-v. of Urbana tp., Steuben co., N. Y., at the head of Keuka Lake, has a box-factory, 4 churches, and a foundry, and is a great centre of grape-culture and wine-manufacture. It has a line of steamers to Penn Yan. Pop. 602.

Ham'mondsville, post-v. of Saline tp., Jefferson co., O., on the Cleveland and Pittsburg R. R. Pop. 504.

Ham'monton, post-v. of Atlantic co., N. J., 30 miles from Philadelphia, on the Camden and Atlantic R. R., just halfway to Atlantic City. It has 2 newspapers, 4 churches, a hall used by two religious societies, a boarding-school for both sexes, 1 hotel, 6 shoe-factories, a cotton and woollen mill, and several other mills and shops. It is noted for its luscious fruits, wheat, corn, and root-crops, especially Irish and sweet potatoes. Pop. 1404.

H. E. Bowles, Pub. "Republican" and "Item."

Hamon (Jean Louis), b. at Plouha May 5, 1821; studied in Paris under Paul Delaroche, and afterwards with G. C. Gleyre; exhibited first in 1848. He worked for a time in the porcelain manufactory at Sèvres, and while there distinguished himself by designs for vases. An enamelled casket of his gained a medal at the London Exposition of 1851. The following year he returned to his painting, and produced rapidly pictures, since familiar through engravings, of an idyllic character, representing classical fancies—*My Sister is Not at Home, Love and his Cortège, The Captive Butterfly, Aurora, Love on a Visit, It is Not I, The Muses at Pompeii,* and many others. M. Hamon has received third and second medals for his work, and in 1855 was created chevalier of the Legion of Honor. Hamon's pieces are esteemed for poetic sentiment and technical grace. D. May 29, 1874.

O. B. Frothingham.

Hamoon', a lake of Afghanistan. It is shallow, overgrown with reeds, and surrounded with forests of tamarisks. Its water is salt.

Hamp'den, county of Massachusetts, bounded on the S. by Connecticut, and intersected by the Connecticut River. Area, 670 square miles. The soil along the river is very fertile. Tobacco, hay, and dairy products are the staples. The manufacturing interests are important. Cotton, woollen, and metallic goods, whips, firearms, paper, leather, wooden wares, furniture, machinery, and building-stone are a few of the leading manufactures. Springfield, Holyoke, Chicopee, Westfield, and Palmer are the largest towns. The county is traversed by the Boston and Albany, the Connecticut River, the New York New Haven and Springfield, the New Haven and Northampton, the New London Northern, and other R. Rs. Cap. Springfield. Pop. 78,409.

Hampden, tp. and v. of Marengo co., Ala. Pop. of v. 40; of tp. 742.

Hampden, tp. and post-v. of Penobscot co., Me., on the W. bank of the Penobscot River, 5 miles below Bangor, has 2 paper-mills, an academy, 4 churches, and considerable shipping interests. Pop. 3068.

Hampden, post-tp. of Geauga co., O. Pop. 767.

Hampden, tp. of Cumberland co., Pa. Pop. 1199.

Hampden, tp. of Columbia co., Wis. Pop. 1000.

Hampden (John) was b. in London in 1594. His father, William Hampden of Hampden, Buckinghamshire, belonged to an old Saxon family; his mother, Elizabeth Cromwell of Hinchingbrooke, Huntingdonshire, was the aunt of Oliver Cromwell. When he was three years old his father died and left him an immense fortune, consisting chiefly of landed property. He entered the University of Oxford in 1609, where he pursued his classical studies with earnestness and success, and in 1613 the Inner Temple, where he studied law. His life in London was gay and somewhat irregular, but in 1619 he married Elizabeth Symeon, retired to his estates, and settled down in steady and noble habits; she bore him three sons and six daughters. In Jan., 1621, he took his seat in the House of Commons as member for Grampound. He sat for Wendover in the first three Parliaments of Charles I. (June, 1625, Feb., 1626, and Mar., 1628), and for Buckingham in the last two (Apr., 1640, and Nov., 1640, the Long Parliament). He allied himself with the party in opposition, and took part, under James I., in the protest against the marriage of Prince Charles with a Spanish princess, in the impeachment of Bacon, etc.; and under Charles I. in all the measures which Parliament took against the encroachments and arbitrary rule of the Crown. But his position was in the beginning obscure, and later, although always respectable, still in the second rank, until in the spring of 1637 he at once became the most popular man in England. He had no brilliant talents, and achieved no dazzling feat which gathered people around him. But his ideas were those of the majority of the English people, and his character, strong, consistent, and noble of itself, was typical of the largest and most influential class of English citizens. He thus became the turning-point of the course of the history of England. He was no republican; he considered royalty as the natural, consequently as the best, form of government. But the royal power, whether more or less circumscribed, must be clearly defined and strictly kept within its legal boundaries. If the Crown encroached on the rights of the subjects, he considered it their duty to resist such encroachments, first by what legal means they might possess, and if this proved ineffectual, then by rebellion. These ideas he adhered to with unconquerable firmness, and when attacked he defended them with undaunted courage, and even with fierceness. The king was very much in need of money, and Parliament, which alone could vote him a subsidy, he would not convoke, or perhaps he dared not. He then undertook to levy a tax on his own authority, the so-called "ship-money." Such a tax had been levied previously without any special vote of Parliament, but only in the sea-towns and coast-districts, and only in time of war; it was simply another form of the old duty resting on this part of the country of furnishing ships for the navy. In 1636 the king arbitrarily extended this tax to the inland counties and to times of peace. Hampden was taxed twenty shillings, but refused to pay, and asked for a decision by the courts. In May, 1637, process was opened, and lasted for thirteen days; but, although Hampden was condemned to pay, the impression which the procedure produced on the English people was fatal to the king; he bought Hampden's twenty shillings with his crown and his head. It now became apparent that private property was not safe in England, and when, shortly after, the revolution broke out in Edinburgh, it found in England too the popular mind prepared for armed resistance against the king. It has been told that shortly after the condemnation of Hampden he, as well as Pym, Haslerig, Cromwell, and other patriots, determined to emigrate to America, and even had hired a ship, when they were detained by royal order; but the story has been doubted of late. In the Parliament of May, 1640, and in the Long Parliament of November of the same year, he stands as one of the most prominent leaders of the opposition; and he was one of the five members of the House of Commons whom the king accused of high treason (Jan. 3, 1642), but whom the House refused to deliver up for imprisonment. The king gave order to break by force into the House of Commons and arrest the five members in their seats, but they were warned by the French ambassador and the countess of Carlisle, and they kept themselves concealed. Meanwhile, insurrection arose in London, and the king was compelled to leave the city. Several months were spent in negotiations between the king and Parliament, but in August both parties took up arms, and the civil war began. Hampden now developed the greatest energy and activity in raising the militia and organizing an army; and after the brilliant success of the encounters at Edgehill and Brentford, in which he took part as leader of the cavalry, the House of Commons thought of making him commander-in-chief of the whole army, instead of the slow and hesitating Essex. But on June 17, 1643, in an

encounter at Chalgrove Field between the royal cavalry under Prince Rupert and that of Parliament under Hampden, the latter was mortally wounded, two balls entering his body at the first charge. He was brought to the house of one of his friends at Thame, and d. there six days after (June 24, 1643). The king rejoiced, but all England mourned. CLEMENS PETERSEN.

Hampden (RENN DICKSON), D. D., b. 1793 in Barbadoes; graduated B. A. as double first at Oriel College, Oxford, 1813; became a fellow of Oriel 1814; public examiner 1830; delivered 1832 the Bampton lecture on *The Scholastic Philosophy in its Relation to Christianity*, the orthodoxy of which was sharply assailed; principal of St. Mary's Hall, Oxford, 1833; professor of moral philosophy 1834; regius professor of divinity 1836, greatly to the discontent of the Anglo-Catholic party, then dominant at the university, the convocation of which in the same year passed a vote of censure upon him, High and Low Church parties uniting in the vote; but in 1842 he was unanimously chosen to the theological examining board, and in 1847, after a bitter controversy, he was consecrated bishop of Hereford. D. in London Apr. 23, 1868. He contributed very able philosophical and biographical matter to the *Encyclopædia Britannica* and the *Encyclopædia Metropolitana;* was author of a *Lecture on Tradition* (1839); *The Fathers of Greek Philosophy* (1862); *Philosophical Evidences of Christianity* (1827); *Lectures on Moral Philosophy* (1836); *Sermons* (1836, 1847).

Hampden-Sidney College is in Prince Edward co., Va., 7 miles from Farmville, in a district rapidly filling up with immigrants from the British Isles and the Northern States. The college was founded in 1775. The spirit of its founders is exhibited in the very name of the college, and still more significant is the following provision of its charter (1784): "In order to preserve in the minds of the students that sacred love and attachment which they should ever bear to the principles of the present glorious Revolution, the greatest care and caution shall be used in electing professors and masters, to the end that no person shall be so elected unless the uniform tenor of his conduct manifest to the world a sincere affection for the liberty and independence of the U. S. of America." In the list of the first trustees appointed under this charter occur the names of James Madison and Patrick Henry. The first president of Hampden-Sidney was the Rev. Samuel Stanhope Smith, D. D., afterwards president of Nassau Hall, Princeton, N. J. Dr. Smith was succeeded in his office by his brother, Rev. John Blair Smith, after whom came in succession Rev. Archibald Alexander and Rev. Dr. Moses Hoge. Among the alumni of the college are numbered many of the most distinguished men of our country, and its influence in the dissemination of knowledge and sound piety throughout the century of its existence can scarcely be estimated too highly.

It is strictly a college, sharply distinguished on the one hand from the university, and on the other from the mere classical school. It retains the old curriculum, and gives no diploma to any who have not passed through the full course of study prescribed. It includes no professional school, the Union Theological Seminary, though only a few hundred yards distant, being governed by a different corporation. Nor is there a preparatory school connected with the college, it being held by its authorities that the ends of discipline are more perfectly subserved by the separation of the youths attending the college classes from pupils of an inferior grade of study. The examinations are searching and rigid, and no one is allowed to pass to a higher class who does not evince a competent knowledge of the studies with which he has been engaged. J. M. P. ATKINSON.

Hamp'shire, Southamp'ton, or **Hants,** county of England, bordering S. on the English Channel, comprises, together with the Isle of Wight, which belongs to it, an area of 1625 square miles, with 543,837 inhabitants. It is traversed by the North and South Downs, but the soil is in most parts sandy or gravelly, and not very fertile. Hops are extensively cultivated, and a fine breed of sheep is reared. The south-western portion is covered with the New Forest, from which the dockyards of the English navy are supplied with oak and beech timber.

Hampshire, county of W. Central Massachusetts. Area, 524 square miles. The county is intersected by the Connecticut River. The soil along this river is remarkably fertile, and the scenery beautiful. Mounts Holyoke and Tom, and the Green Mountains in the W. part of the county, are the principal elevations. The county has fine water-power, which is well utilized. Tobacco, live-stock, and dairy products are the agricultural staples. Cotton and woollen goods, paper, brooms, lumber, wooden and metallic wares, straw goods, carriages, flour, brick, etc. are manufactured. The county is traversed by the New London Northern, the Massachusetts Central, the Connecticut River, the New Haven and Northampton, the Athol and Enfield, and the Ware River R. Rs. Cap. Northampton. Pop. 44,388.

Hampshire, county of West Virginia, having Maryland on the N. and Virginia on the E. Area, 540 square miles. It has high mountains and broad fertile valley-lands, well cultivated. Grain, stock, and wool are leading products. The N. part is traversed by the Baltimore and Ohio R. R. Cap. Romney. Pop. 7643.

Hampshire, post-tp. of Kane co., Ill. Pop. 1049.

Hampshire, tp. of Clinton co., Ia. Pop. 1030.

Hamp'stead, town of England, in the county of Middlesex, 4 miles N. W. of London. Its mineral springs were formerly much frequented, and the town still enjoys a high reputation for the beauty of its surroundings. Pop. 32,271.

Hampstead, tp. and post-v. of Carroll co., Md. Pop. of v. 235; of tp. 1742.

Hampstead, post-tp. of Rockingham co., N. H., 30 miles S. E. of Concord. It has manufactures of lumber, boxes, etc. Pop. 935.

Hamp'ton, a v. of England, in the county of Middlesex, on the left bank of the Thames. A mile from the village lie the palace and park of Hampton Court, originally erected by Cardinal Wolsey, and containing an interesting collection of pictures, among which are seven cartoons by Raphael. Pop. 6122; with surroundings, 10,175.

Hampton, post-v., cap. of Kings co., N. B., on the river Kennebecasis and the European and North American Railway, 23 miles N. of St. Johns. Pop. about 250.

Hampton, post-v., cap. of Calhoun co., Ark. Pop. 138.

Hampton, tp. of Marion co., Ark. Pop. 217.

Hampton, tp. of Monroe co., Ark. Pop. 794.

Hampton, post-tp. of Windham co., Conn., 35 miles E. of Hartford. It has manufactures of woollens, etc. Pop. 891.

Hampton, tp. and post-v. of Rock Island co., Ill., at the rapids of the Mississippi River, and on the Western Union R. R., 10 miles N. E. of Rock Island. Pop. 2006.

Hampton, post-v., cap. of Franklin co., Ia., on the Central R. R. of Iowa and the Iowa Pacific R. R. It has 3 churches, 2 weekly newspapers, a court-house, a school-house, fine business-blocks, and elegant residences. All kinds of mercantile business are represented. Pop. 588.
WHITNEY & HARWOOD, PUBS. "FRANKLIN RECORDER."

Hampton, tp. of Bay co., Mich., at the head of Saginaw Bay. Pop. 946.

Hampton, post-tp. of Dakota co., Minn. Pop. 930.

Hampton, post-tp. of Rockingham co., N. H., on the Atlantic coast and on the Eastern R. R., 10 miles N. of Newburyport, Mass. Hampton Beach is a fine summer resort. There are 3 churches and 8 well-kept hotels. The Boar's Head, a rocky promontory, is a picturesque object. Hampton has an academy, and manufactures of shoes, lumber, etc. Pop. 1177.

Hampton, tp. of Sussex co., N. J. Pop. 1023.

Hampton (P. O. WESTMORELAND), a v. of Westmoreland tp., Oneida co., N. Y., has several manufactories and 3 churches. Pop. 444.

Hampton, post-tp. of Washington co., N. Y., on the Vermont line. It is a fine farming township, and has manufactures of cheese, gunpowder, and woollens, and quarries of roofing-slate. Pop. 955.

Hampton, tp. of Allegheny co., Pa. Pop. 938.

Hampton, post-v., cap. of Elizabeth City co., Va., 3 miles from Fortress Monroe and 18 miles from Norfolk. It has 1 newspaper, 1 normal and agricultural institute for colored youth, a good harbor for small craft opening into Hampton Roads, a national cemetery and asylum for disabled soldiers in the suburbs, and 8 churches, 4 of them for colored people. Principal trade in fish, oysters, and garden-produce. Pop. 2300.
S. W. ARMISTEAD, *for Editor of* "SOUTHERN WORKMAN."

Hampton, tp. of Prince Edward co., Va. Pop. 2702.

Hampton, tp. of Rappahannock co., Va. Pop. 1934.

Hampton (WADE), b. in South Carolina in 1754; served under Sumter and Marion; was a member of Congress 1795–97 and 1803–05; became a colonel U. S. army in 1808, a brigadier-general in 1809, and was major-general 1813–14; commanded (1809–12) at New Orleans, and (1813–14) on the Canadian frontier. He resigned in 1814, and afterwards acquired great wealth, at one time owning 3000 slaves. D. at Columbia, S. C., Feb. 4, 1835.

Hampton (WADE), grandson of the preceding, b. at Columbia, S. C., 1818; graduated at South Carolina Col-

lege; has served as member of both houses of the legislature of South Carolina. Commanded the Hampton Legion at the first battle of Bull Run, July, 1861, where he was wounded; promoted to be brigadier-general, and in command of a brigade at Seven Pines, May 31, 1862, where he was again wounded; engaged at the battle of Antietam, Sept., 1862, and upon the raid into Pennsylvania the following month; at Gettysburg, July, 1863, and a third time wounded; promoted to be lieutenant-general, and in command of body of cavalry in Lee's army during campaign of 1864, being frequently engaged; subsequently transferred to South Carolina, where in 1865 he commanded the cavalry forming the rear-guard of the Confederate army retiring before Gen. Sherman's advance northward; a spirited correspondence regarding the destruction of the city of Columbia by fire established the fact that it was not ordered by either Gens. Hampton or Sherman, but was owing to the vast quantity of cotton and other combustibles which had been accumulated here, and ordered to be destroyed before the evacuation of the city. He acted a prominent part in the Democratic national convention in New York City in 1868, that nominated Seymour and Blair for the Presidency and Vice-Presidency in that year.

Hamp'tonburg, tp. of Orange co., N. Y., traversed by the Walkill Valley R. R. Pop. 1224.

Hamp'ton Falls, tp. and post-v. of Rockingham co., N. H., on the Atlantic coast, and on the Eastern R. R., 8 miles N. of Newburyport, Mass. It has 3 churches and some manufactures. Pop. 679.

Hamp'ton Roads, the broad and deep channel leading from Chesapeake Bay into the James, Nansemond, and Elizabeth rivers. Its name is derived from Hampton, Va., a village situated on Hampton Creek, an arm of the roads. Forts Monroe and Wool serve for defence. Lat. of Thimble Shoal light, N. side of entrance, 37° 42′ N., lon. 76° 14′ 5″ W. Hampton Roads was Mar. 8 and 9, 1862, the scene of important naval operations—the sinking of U. S. frigates Congress and Cumberland, and the contest between the iron-clads Monitor and Virginia.

Ham'ster, a name applied to certain rodent mammals of Europe and Asia of the rat family and of the genus *Cricetus*. *C. frumentarius* is the best known, but there are a number of other species. They all have large cheek-pouches, and all are very destructive to grain, which they store away in great quantities in their holes. They are vigorously hunted, not only for their skins, which are valuable, but for the grain they have buried. They are ill-tempered and pugnacious, but are extremely prolific. The full-grown hamster has a body nine inches long.

Ham'tranck, post-tp. of Wayne co., Mich. Pop. 2998.

Ha'nau, town of Germany, in Hesse-Cassel, at the confluence of the Kinzig and the Main. It is celebrated for its jewelry, and has extensive manufactures of cotton, silk, carpets, leather, gloves, and paper. Pop. 20,278.

Hancock, county in N. E. Central Georgia. Area, 500 square miles. The N. part has a clay soil; the S. part is sandy and covered with pine forests. Cotton and corn are leading products. Gold, lead, iron, and several kinds of precious stones have been found in the county, which is traversed by the Macon and Augusta R. R. Cap. Sparta. Pop. 11,317.

Hancock, county of Illinois, bounded W. by Missouri and Iowa. Area, 720 square miles. The soil is very fertile. Coal and limestone abound. Cattle, grain, and wool are staple products. Carriages, ploughs, metallic wares, harness, etc. are the leading manufactures. The county is traversed by several railroads. Cap. Carthage. P. 35,935.

Hancock, county of E. Central Indiana. Area, 312 square miles. It is level and fertile. Cattle, grain, and wool are staple products. Carriages and lumber are leading manufactures. The county is traversed by the Indiana Central and other railroads. Cap. Greenfield. P. 15,123.

Hancock, county in the N. of Iowa. Area, 625 square miles. The surface is rolling, the soil is good. It is traversed by the Iowa and Dakota division of the Milwaukee and St. Paul R. R. Grain and wool are staple products. Cap. Concord. Pop. 999.

Hancock, county of Kentucky, separated from Indiana by the Ohio River. Area, 500 square miles. The soil is very fertile, especially along the river. Tobacco and corn are staple crops. Coal is mined in this county. Cap. Hawesville. Pop. 6591.

Hancock, county in the S. E. of Maine, bounded S. by the Atlantic Ocean. It includes Mt. Desert and many smaller islands. Area, 1800 square miles. A part of the soil is quite fertile. Live-stock and wool are staple products. Lumber, cooperage, and bricks are leading manufactures. The fisheries and coasting-trade are of much importance, and there is some shipbuilding. Cap. Ellsworth. Pop. 36,495.

Hancock, county of Mississippi, bounded on the W. by the navigable Pearl River, which separates it from Louisiana, and on the S. by Mississippi Sound. The county is a part of the great pine region, and has a light soil. Area, 900 sq. m. It is intersected by the New Orleans Mobile and Texas R. R. Cap. Shieldsborough. P. 4239.

Hancock, county in N. W. Central Ohio. Area, 531 square miles. It has a fine fertile limestone soil. Cattle, grain, and wool are staple products. Lumber, flour, carriages, etc., are manufactured. It is traversed by the Lake Erie and Louisville and other railroads. Cap. Findlay. Pop. 23,847.

Hancock, county of Tennessee, bounded on the N. by Virginia. Area, 220 square miles. The surface is mountainous. Iron ore is found. The county is traversed by Clinch River. Corn is the principal product. Cap. Sneedsville. Pop. 7148.

Hancock, the northernmost county of West Virginia, at the extremity of the "Pan Handle," having the Ohio River and the State of Ohio on the W. and N., and Pennsylvania on the E. Area, 100 square miles. The surface is broken, but fertile and well cultivated. The county is famous for its excellent wool. Coal is mined, and brick is manufactured from fire-clay, which abounds. Cap. Fairview. Pop. 4363.

Hancock, tp. of Hancock co., Ill. Pop. 926.

Hancock, post-tp. on Frenchman's Bay, in Hancock co., Me., 9 miles E. of Ellsworth. It has four churches and some manufactures. Pop. 974.

Hancock, post-v. in Washington co., Md., on the Potomac River, opposite Hancock Station, Morgan co., West Va., on the Baltimore and Ohio R.R. It has several churches, and is traversed by the Chesapeake and Ohio Canal. Pop. of v. 860; of tp. 2139.

Hancock, a long and narrow post-tp. of Berkshire co., Mass., on the New York line, 158 miles W. of Boston. It has some manufactures of woollen and other goods, and is an excellent agricultural township, though mountainous. It has a settlement of Shakers in the S. part. There are many striking and picturesque views in this town. Pop. 882.

Hancock, tp. and post-v. of Houghton co., Mich., in the Lake Superior copper-region, is on Portage Lake, opposite Houghton. Pop. of tp. 2700.

Hancock, tp. of Carver co., Minn. Pop. 632.

Hancock, post-tp. of Hillsborough co., N. H., 36 miles S. W. of Concord. Pop. 692.

Hancock, post-v. and tp. of Delaware co., N. Y., on the Erie R. R., and near the Midland and Oswego R. R., 40 miles from Delhi. It has 2 newspapers, a graded school, 4 churches, 3 hotels, flouring-mills, shops, 12 stores, etc. Principal business, lumbering. Pop. of tp. 3069.

Ed. "Hancock Times."

Hancock, post-tp. of Addison co., Vt., 38 miles S. W. of Montpelier. Pop. 430.

Hancock, post-tp. of Waushara co., Wis. Pop. 438.

Hancock (John), LL.D., b. at Quincy, Mass., Jan. 12, 1737, was the son of the Rev. John Hancock. He graduated at Harvard in 1754, and in 1764 inherited the business and the greater part of the large fortune of Thomas, his uncle, in whose counting-house he had been trained to business. The young Hancock was present in 1760 at the coronation of George III. In 1768 his sloop Liberty was seized for evading the laws of commerce, and a riot followed; and in 1770 he delivered a fearless and eloquent address at the funeral of those slain at the Boston massacre. In 1774 he was president of the Provincial Congress. From 1775 to 1777 he was president of the General Congress at Philadelphia. He was the first of the signers of the Declaration of Independence. He was made in 1778 major-general of militia, and served in Rhode Island under Sullivan. He was governor of Massachusetts 1780–85; member of Congress 1785–86; again governor 1787–93, and held at times various other offices of honor. He was a man of strong and decided character, and dignified, courtly, and pleasing manners, and made a liberal use of his large fortune for benevolent purposes. D. Oct. 8, 1793.

Hancock (John), b. in Alabama Oct. 29, 1824; admitted to the bar in 1846; settled in Texas; elected judge of the district court in 1851; resigned in 1855; was in the legislature of 1860–61, when he was excluded for refusing to take the oath to support the Confederate constitution; was in the constitutional convention of Texas in 1866, and elected to the 42d, 43d, and 44th Congresses. Resides in Austin, Tex.

Hancock (Winfield Scott), b. in Montgomery co., Pa., Feb. 14, 1824; received his early education at the Morristown (Pa.) Academy, and in 1840 was appointed a cadet at the U. S. Military Academy, from whence he was graduated, and promoted in the army to be brevet second lieutenant of infantry July 1, 1844, receiving his full commission of second lieutenant in 1846; promoted to be first lieutenant 1853; in 1855 he was transferred to the quartermaster's department with the rank of captain; promoted to be major in same department 1863. For more than two years subsequent to his graduation he served on frontier duty; in the war with Mexico (1847–48) he served with his regiment at San Antonio, Churubusco, Molino del Rey, and the assault and capture of the city of Mexico, where he displayed conspicuous gallantry, receiving the brevet of first lieutenant for Contreras and Churubusco. From 1848 to 1855 he served with his regiment in the West, as quartermaster 1848–49, and adjutant 1849–55, when he was transferred to the quartermaster's department, on which duty he served in Florida during the Seminole hostilities, in Kansas during the disturbances of 1857, and in California, at Los Angeles, as chief quartermaster of the southern district, where we find him at the outbreak of the civil war in 1861, and where he exerted a powerful influence during that eventful period. Relieved from duty in California at his own request, he repaired to Washington and applied for active duty in the field; was assigned to Kentucky as chief quartermaster of Gen. Anderson's command, but before entering on that duty he was (Sept. 23, 1861) appointed a brigadier-general of volunteers; his subsequent history during the war is substantially that of the Army of the Potomac. During the fall and winter of 1861–62 he commanded a brigade at Lewinsville, Va.; in Mar., 1862, he accompanied Gen. McClellan's army to the Peninsula, being actively engaged with his command at the siege of Yorktown and the subsequent pursuit which resulted in the battle of Williamsburg, where he led the brilliant charge which captured Fort Magruder and gained the day. His services at the battles of Golding's Farm, Garnett's Hill, Savage's Station, and White Oak Swamp, and during the retreat to Harrison's Landing, were conspicuous and valuable; and the brevets of major, lieutenant-colonel, and colonel U. S. A. were conferred upon him, and he was recommended by General McClellan for promotion to major-general. He took part in the movement to Centreville, Va., Aug.–Sept., 1862; in the Maryland campaign he led his brigade at Crampton's Pass, South Mountain, and at Antietam, where he was placed in command of the 1st division 2d corps on the death of Gen. Richardson; Oct. 10–11, 1862, he conducted an important reconnaissance from Harper's Ferry to Charlestown, Va. Promoted to be major-general of volunteers Nov. 29, 1862, he continued in command of 1st division 2d corps, which he led at Fredericksburg, Dec., 1862, in the assault on Marye's Heights, and at Chancellorsville, May, 1863; in the following month he was placed in command of the 2d corps. At Gettysburg (July 1, 1863), after Reynolds had fallen, Hancock was sent forward from Taneytown by Gen. Meade to assume command; arriving on the field just as the rear of the beaten Union army was coming through Gettysburg, he at once made his presence felt, and after staying the retreat, extended the Union lines to Culp's Hill, when it was enabled to check the enemy's further advance. Perceiving its advantages, Gen. Hancock sent Gen. Meade such a report of the nature of the vicinity of Gettysburg as determined him to fight his battle there. On the following days (July 2–3), Hancock commanded the left centre, repulsing the grand final assault of Lee's army, July 3, himself falling severely wounded at the moment of victory. For his conspicuous services at Gettysburg, Gen. Hancock received the thanks of Congress. Because of his wounds he was disabled from resuming active duty till Dec., 1863, when he returned to the command of his corps; the army, however, being in winter-quarters and inactive, Gen. Hancock was requested to proceed to the North for the purpose of stimulating the recruiting of volunteers, much needed to fill the diminished ranks of his corps. His great reputation and popularity made his mission eminently successful, and at New York, Philadelphia, Boston, Albany, and other places visited he was tendered public receptions and the freedom of the cities. In Mar., 1864, he returned to his command, and in the campaign of that year, though still suffering from his wound, he bore a prominent part; in the battle of the Wilderness (May 5–7) his command amounted to more than 50,000 men; at the battle of the Po (May 10) he commanded the 2d and 5th corps, as well as in the assault near Spotsylvania Court-house, May 12; at Spotsylvania he led his corps in its famous assault on the enemy's works, capturing upwards of 4000 prisoners, 20 pieces of artillery, and thousands of small-arms; in the subsequent operations of the army, including Cold Harbor and the assault of the lines before Petersburg, Gen. Hancock was conspicuous and indefatigable until compelled (June 17) by the outbreaking of his Gettysburg wound to relinquish his command for ten days, when he returned to the command of his corps in front of Petersburg. On Aug. 12 he was appointed a brigadier-general in the regular army. During the months of July and August the battles of Deep Bottom and Ream's Station, and of Boydton Plank-road (Oct. 27), were fought under his direction and command. In Nov., 1864, he was selected to organize the 1st army corps of veterans, remaining in Washington on that duty until Feb., 1865, when he was assigned to the command of the middle military division, and in July to that of the middle department; which latter he held until Aug., 1866, when he was transferred to the command of the department of Missouri, having in the mean time (July 26) relinquished his volunteer commission and been promoted to be major-general in the regular army. While commanding this department he conducted an expedition against hostile Indians on the Plains. From Sept., 1867, to Mar., 1868, he commanded the department of the Gulf; the military division of the Atlantic, Mar., 1868, to Mar., 1869; the department of Dakota 1869–72, when he was assigned the command of the division of the Atlantic, which he holds at this date. Although not an aspirant for political honors, Gen. Hancock's name was freely mentioned in 1868 and 1872 as a desirable Democratic candidate for President of the U. S., and in 1869 the Democratic nomination for governor of Pennsylvania was tendered him, but declined. Geo. C. Simmons.

Hand, county of S. E. Central Dakota. Area, 1008 square miles. It is as yet unorganized, and is not settled to any extent by white inhabitants.

Händel (Georg Friedrich) was b. in Halle, Saxony, Feb. 23, 1685; d. in London Apr. 14, 1759. His father, designing to educate him as a doctor, kept him from the public schools; he forbade him any instrument, and took every other means to suppress his uncommon love of music. Händel, however, secretly taught himself to play on an old spinnet hidden in his garret. At eight years of age he was so proficient that when on a visit at the court of Saxe-Weissenfels, the duke, who overheard him playing on the chapel organ, exacted from the surprised father a promise that the boy should be educated as a musician. He commenced his studies at once under Zachau, organist of Halle. During the five years spent there he analyzed all the most important German and Italian compositions of that epoch, passed the severe ordeal of fugue and counterpoint, and finally composed every week a motet or a cantata for the church of Halle. At thirteen (1699) he was sent to study the operatic school in Berlin, where he remained but a short time with the amiable Ariosti and the vain Bononcini, who was already jealous of his genius. He next entered as a violinist the opera-house at Hamburg. His playing was poor, and for a while he won little else than sneers from his fellows: but at nineteen (1704) he one day assumed the direction of the orchestra during the absence of the leader, and displayed such ability that he was at once advanced to that position. He was invited to be organist of Lübeck, on condition that he would marry the daughter of the retiring organist, but he refused both the maid and the place. As composer he came into rivalry with Mattheson, his best friend. In a trifling professional dispute Händel's temper led them to fight a duel; Mattheson's sword broke on a button upon Händel's breast; they were then reconciled, and soon after reunited in friendship closer than ever before.

He now determined to visit Italy. With uncommon independence he refused money offered to aid his development, and preferred to earn his own privileges by giving lessons and practising economy. At twenty-one (1706) he came to Florence. At this age he was eminent as an organist and learned in the severe, scientific style of composition. But his early works are somewhat dull, lacking melody and sentiment. During two years he lived in Florence, Vienna, Rome, and Naples, composing operas which earned him some reputation, but little money. Failing to obtain an engagement, he returned to Germany. At twenty-five (1710) he was made chapel-master to the elector of Hanover—afterwards King George I. of England—and given a salary of $1500. While there he gained in grace and melody from association with the elegant Italian composer Steffani. The elector twice gave him leave to visit London. On his second visit (1712) he received a pension of $1000 from Queen Anne, and unceremoniously prolonged his absence to a permanent residence. In 1714 the elector ascended the throne of England, and, naturally being angry with Händel, forbade him the court. But London was full of Händel's music, and it was not easy to ignore him. He wrote his *Water Music* for a royal festival on the Thames, and it so

charmed the king that he forgave his truant chapel-master and raised his pension to $2000. For a few years he lived under the roofs of Lord Burlington and of the duke of Chandos, enjoying the patronage of the nobles, the society of wits and poets, and a quiet, studious life. At thirty-five (1720) he was appointed director of the Royal Academy of Music at the Haymarket Theatre. Then commenced a period of twenty years in which he passed through the severest trials of party warfare. His haughty, irritable manner soon created enemies amongst his patrons and his singers, who formed a rival opera-troupe, in which Bononcini and other celebrated composers led the most eminent artists of the day. He poured from his fertile brain scores of mediocre Italian operas, generally lacking the charming qualities of the Italian school, which just then were the demand of the times. Some of these works had a short run on the stage, but most of them fell dead. An occasional performance of an oratorio or of sacred music upon the organ brought the people eagerly about him, but notwithstanding this hint he obstinately continued to follow opera, the success of his youth, the failure of his vigorous manhood. He gradually lost his noble patrons, social position, health, fortune, passed twice through bankruptcy, and finally sank into neglect, almost oblivion. Not till he was fifty-five years old (1741) did Händel give himself entirely to oratorio, his true work. He had written up to this time about 100 large works, only a few of which are now alive, and he wrote afterwards but a few, each of which is now a familiar masterpiece. Händel, more than any other composer, was made of sturdy Saxon strength, for which only the solemn, grand oratorio was a complete expression. It is therefore equally surprising and unfortunate that he passed the best twenty years of his life in fruitless efforts to become an Italian. The people of Dublin, for whom he wrote his greatest work, *The Messiah*, were the first to believe and prove the full height of his genius. By this and other oratorios he suddenly rose to the pinnacle of fame, and before his death became the idol of the English. He was stricken blind in 1751, but notwithstanding this calamity his closing years were prosperous and happy. He was buried in Westminster Abbey with the grandest ceremonies that could be devised.

Händel's industry was extraordinary. After his first years in London he refused to be a member of any household, established himself in his own rooms, and declined all invitations. The time not used in his theatrical duties he passed in writing with prodigious rapidity or in playing on his clavecin, the keys of which were worn out like spoons. He wrote *Israel* in twenty-seven days. He associated with only three friends—Smith, his copyist, Goupy, a painter, and Hurter, a dyer. It is believed that he never loved a woman, and was a strict celibate. He was economical in his personal expenses, but not parsimonious. There is no doubt of his honesty. The concerts given him during the last years of his life enabled him to pay his debts, leave $5000 to the Foundling Hospital of London, and $100,000 to his poor relatives in Germany. He was very fond of pictures, which were his only interest besides music. He was uncommonly isolated in his profession, having no companionship with musicians, and but little interest in their productions. Excepting a smattering of Latin, he knew almost nothing but music and the Italian language. Even his long residence in London did not teach him good English. His speech was a strange and often a comical mixture of German and Italian idioms. Though at times haughty and irritable, he was not ill-natured or unkind, and in his prosperous days he was even a genial companion, whose conversation flowed freely, in form grotesque, but vigorous with good sense and sparkling with humorous satire. His only dissipation was an occasional excess in wine. His figure was large and imposing, having considerable embonpoint, which made his walk and other movements heavy and ungraceful. His constitution, physical, mental, and moral, must have been of the strongest type to withstand so well his harassing and exhausting life. His massive face preserved its pleasant expression to the last, despite his outer and inner wars. His violent temper at times knew no restraint. When Cuzzoni once refused to sing a certain song, he seized her by the arm and attempted to throw her out of a window. The orchestra on one occasion took their places, unconscious that their instruments were not tuned; they commenced, of course, with a frightful discord. He rushed through their ranks, snatched up the kettledrum and threw it at the head of the leader, jumped upon the stage, losing his wig, and there, in the blaze of the footlights, stamped and choked with rage till the prince of Wales finally calmed him to his senses.

The prominent characteristics of Händel's music are sublimity and strength. Around these, grouped in secondary importance, are other qualities equally precious. He excelled all other composers in writing choruses, in which vigor of thought and clearness of form unite to carry the interest in crescendo through the most colossal effects. Mozart reverenced Händel, and declared it impossible to increase the power of these pieces. Beethoven bowed before his grandeur, which was attained by means he considered marvellous in simplicity. His most remarkable works are the oratorios *The Messiah, Judas Maccabæus, Israel in Egypt,* and *Samson.* He wrote no fewer than 52 operas, 23 oratorios, 22 compositions for the church, 13 for chamber-music, and 3 collections for organ and piano—in all 113. This amount is enormous when it is known that most of the works are colossal in conception and proportion.

C. H. Farnham.

Hand'icapping, in horse-racing, yachting, and other sporting contests, is the attempt to place all competitors upon equal terms. Thus, of two horses the one which has been found superior is made to carry such extra weight as it is thought will give his competitor a fair chance of winning the race.

Hand'ley (George) was b. near Sheffield, England, Feb. 9, 1752; emigrated to Savannah, Ga., in 1775; served actively throughout the Revolutionary war as an officer on the side of the colonies: afterwards held many public offices; was governor of Georgia in 1788, and collector of the port of Brunswick 1789–93. D. at Rae's Hill, Ga., Sept. 17, 1793.

Hands'boro', post-v. of Harrison co., Miss., 1 mile N. of the Gulf of Mexico, on Bayou Bernard, near its confluence with Biloxi Bay, and within 1 mile of the New Orleans Mobile and Texas R. R., midway between New Orleans and Mobile; lat. 30° 28′ 25″ N., lon. 89° 6′ 13″ W. It has 5 churches, 6 schools, 1 printing, 1 book-bindery, and 1 job office, 1 literary society, 3 large saw-mills, 3 planing-mills, 5 large stores, 1 machine-shop, a carriage-shop, 1 ship-yard, 1 newspaper, etc. It is a watering-place. Exports about 100,000 pounds of wool and 10,000,000 feet of lumber annually. Pop. 459. P. K. Mayers, Ed. "Democrat."

Hand, Structure of the. *In Mammals.*—The hand (*manus*) in mammals is the foremost extremity, and always present, though often very much modified. When contrasted with the foot in size, there is much variety. The kangaroo has a small hand and a large foot. In the mole there is a broad shovel-shaped hand and a delicate foot. The sloth has an immensely long hand. The foot of the beaver and seal is much larger than the hand. The differences between the hand and foot usually consist in greater delicacy and slenderness of the fingers, with corresponding refinement of function, since the hand has the more to do in protection, defence, nourishment, and delicate operations than has the foot, which is mainly of use in propelling and maintaining the attitudes of the body.

The hand presents the carpus, metacarpus, and phalanges for study, corresponding in general plan of structure to the tarsus, metatarsus, and phalanges of the foot. The relative dimensions of these parts vary exceedingly. The hoofed animals, the elephant, and those animals which use the fore legs mainly for support, have short and robust bones. On the other hand, the bat and pterodactyl have enormously developed fingers to support the web which gives them the wing. Climbing animals have the whole hand developed into slender and delicate manipulating organs. And in general, animals which do not enjoy *free lateral movements* of the fore legs have small and diminutively modified hands. The typical idea of the hand is so nearly the same with the foot that reference is made for information to the article on Foot, Structure of the.

The Human Hand.—The human hand is probably the most remarkable organ, not vital, in the whole animal kingdom. Its mechanism is somewhat complicated, and quite unlike human machinery, and its sensitiveness, suppleness, delicacy of movement, and beauty of form are marvellous in the range of animal organisms. "The consummation of all perfection as an instrument," says Sir Charles Bell. The hand bears a very close relation in its plan of structure to the foot, or is the analogue of the foot. Thus, the foot has a tarsus of seven bones, a metatarsus of five, and phalanges numbering fourteen. The hand has its carpus of eight bones, its metacarpus of five bones, and fourteen phalanges. And each of these members is joined to the two bones of the limb above it. The ideal structure of the hand is well shown by the diagram devised by Dr. G. M. Humphry of Cambridge, England, and the exact framework of the hand is seen in the cut from Holden's *Osteology.* The carpus is united to the radius and ulna by its peculiar articulations, which permit the motions of the hand as a whole in all directions, and almost as perfectly as the ball-and-socket joint. The eight bones of the carpus are arranged in two more or less complete rows running across the hand. The peculiar arrangement of the two

rows, and four segments in each row as represented in the eight bones, is designed to give flexibility, suppleness, and

Fig. 1.

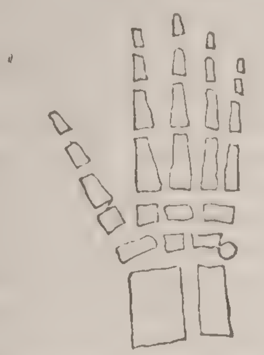


Diagram of the Human Hand.

Fig. 2.

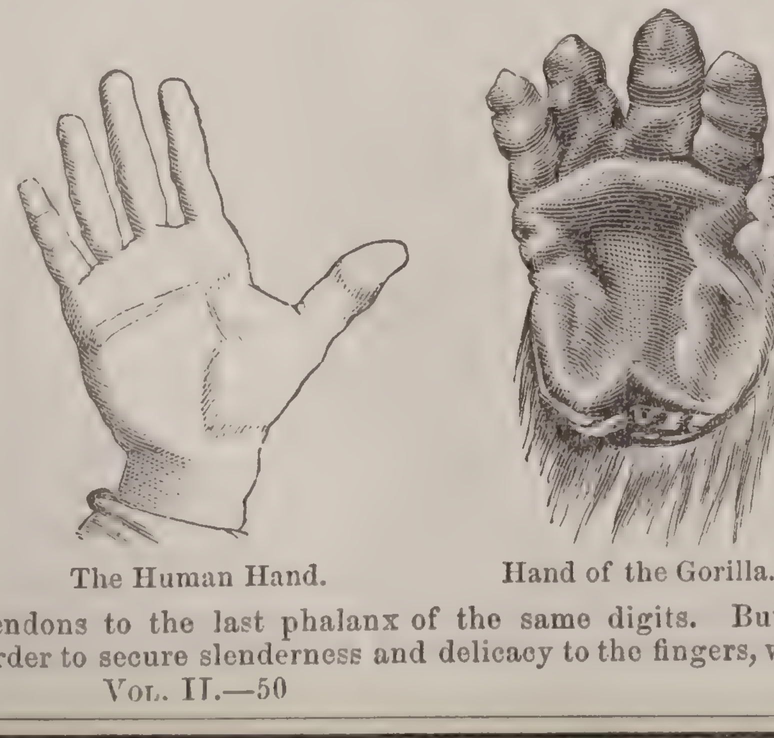
Bones of the Hand.

the peculiar strength to resist violent blows which the hand must so often receive. The long metacarpals, five in number, give the back and palm of the hand, which furnish a broad and firm surface for the apposition of the fingers in grasping anything and delicately manipulating minute and multiform objects. The slenderness and delicacy of the fingers are what give the elegant and beautiful proportions to the hand. To which, if we add the extensive mobility of the various parts, the flexion, extension, pronation, supination, adduction, and abduction of the organ and its parts, we see where all human machinery falls far short of the divine. The supination and pronation, or the turning of it on i s longitudinal axis, is a prominent characteristic of the human hand. No animal equals or nearly approaches man in this respect. And the muscles which enable him to *point with the index-finger* are supplied to man alone, thus indicating a superior grade of being in him, as this movement could only be required for higher purposes than mere sense-gratification or means of gaining a subsistence or self-protection.

Why are the fingers of different lengths? Regarding it in a typical sense, Prof. Owen says it is in obedience to the law of "simplification of the digits" (see Foot, Structure of the), or that the longest digit is the most permanent one, and the shortest the first to disappear. Thus, the thumb (*pollex*), or first digit, is the shortest, the fourth finger, or fifth digit, the second in length, the second digit the next, the fourth next, and the third digit, or second finger, the longest of all. Another reason of the unequal lengths of the fingers is shown by placing a small rod—say, a Faber's lead-pencil—across the palm of the hand, and bending the fingers' ends down upon it. In this experiment we shall see that all the tips of the fingers reach the pencil at the same instant and press upon it with nearly equal force. This shows us that the lengths of the digits and the muscles controlling them are so arranged as to make the hand most effective in grasping even small objects.

Each hand with its fingers is moved directly by thirty-one pairs of muscles, which are located between the elbow-joint and the tips of the fingers. They vary in length from about 18 inches to 1 inch in length, and many of them are provided with very long tendons. Those of peculiar interest are the two used in flexing the fingers. These have their origin near to the elbow-joint, their fleshy portions lie one above the other in the fore arm, and their tendons are attached to the inner surface of the base of a part of the phalanges. The most superficial one sends its tendons to the second phalanx of the first, second, third, and fourth digits, and the other (deepest one) sends corresponding

Fig. 3.



The Human Hand. Hand of the Gorilla.

tendons to the last phalanx of the same digits. But in order to secure slenderness and delicacy to the fingers, with strength also, a peculiar mechanical arrangement is devised. The tendon supplying the second phalanges is split just above its point of attachment, so as to allow the tendon sent to the third phalanx not only perfect facility of motion, but also to supply the place of ligaments to keep it in place as it passes by the joint. Thus, both of these sets of tendons can act singly or conjointly; and not only does each set act by itself, but each division of the muscle may act on its own finger if the will only so directs. The relative lengths of the fingers of man and the gorilla are shown in Fig. 3.

Another interesting point in the muscles of the hand is, that the thumb and little finger are the most abundantly supplied with muscles, and hence muscular power. This is so arranged in order that the hand may more firmly grasp any object, and be especially efficient in the acts of pronation and supination; and peculiar care is always exercised by the surgeon in treating a mutilated hand to save, if possible, one or both of the extreme digits, as they are of much more relative importance in manipulation than are the other digits.

The sensitiveness of the skin of the hand to external impressions is one of the most important characteristics of this organ. This property resides in minute elevations of the skin, called *papillæ*. These measure from the $\frac{1}{100}$th to the $\frac{1}{200}$th of an inch in height, and contain always a lymphatic, blood-vessels, and nerves. They are the most numerous on the palm of the hand and at the tips of the fingers, rather than at the other joints. Thus, on a square line of the palmar surface of the tip of the last joint of the fore finger are 108 papillæ; on the second joint, same space, 40; and on the first phalanx, 15. It has been assumed that each nerve-fibre ends in a pencil of delicate filaments which gives sensibility over a circular or oval area of the hand covering $\frac{1}{400}$th of a square inch; and on many of the terminal nerve-fibres of the hand and foot, in addition to the simple filaments, there are minute oval bodies found somewhat sparsely, and very small, called "Pacinian bodies," which doubtless aid the sense of touch. The theory of touch is that pressure gives the sensation. But if this be the case, why does tickling with a feather or a speck in the eye produce so marked an impression? The sense of touch is more improvable by education than any other of the senses. This is well seen in blind people, who use their fingers as eyes with great delicacy of perception; the Bengalese throwsters are able to detect by touch twenty degrees of fineness in the fibres of the cocoon. Edward Hitchcock.

Hand Tree [Sp. *manita*], the *Cheirostemon platanoïdes*, a tree of Central America, rarely found in Mexico, where it was anciently worshipped. It is one of the order Sterculiaceæ. It resembles the plane and buttonwood tree in appearance. Its flower has no corolla, but its large calyx has five curved anthers, bearing some resemblance to a hand, whence the name.

Han'dy, tp. of Livingston co., Mich., traversed by the Detroit Lansing and Lake Michigan R. R. Pop. 1306.

Ha'ney, tp. of Crawford co., Wis. Pop. 489.

Hang-Chow-Foo, city of China, the capital of the province of Che-Kiang, on the Tsien-Tang-Kiang, 20 miles from its mouth in the bay of Hang-Chow-Foo, at the beginning of the Great Canal. It is one of the largest, most important, and most elegant cities of China, built in the true Chinese style, with narrow streets and only one-story houses, but with many rich and magnificent temples and other public buildings. Its manufactures of silks and satins are very celebrated, and its trade extensive. Its population is estimated at 800,000.

Hanging. See Capital Punishment, Execution, Gallows.

Hanging Gardens of Babylon, one of the Seven Wonders of the World (according to an ancient estimate), consisting of a succession of terraces supported by columns, and containing an area of about four acres, covered with groves, gardens, and fountains, and having a great reservoir at the top, supplied with water from the Euphrates. The mound El Kasr in the ruins of Babylon is thought to represent them. The hanging gardens were ascribed variously to Nebuchadnezzar, Semiramis, and others.

Hanging Grove, tp. of Jasper co., Ind. Pop. 393.

Han-Keoo, or **Han-Kow,** city of China, the capital of the province of Hoope, in the centre of China proper, at the confluence of the Han and the Yang-tze-Kiang, which here is navigable for large vessels. It has recently been opened to foreigners, and seems destined to become one of the great commercial centres of the world. Properly, it consists of several cities, Han-Yong and Woo-Chang, on opposite sides of the Han River. Pop. estimated at 800,000.

Han'ley, town of England, in the co. of Stafford, in the district called "The Potteries," forms, together with Shel-

ton, one town, and has 39,942 inhabitants, who are mostly engaged in the manufacture of earthenware and china.

Han'na, tp. of Henry co., Ill. Pop. 964.

Hanna, tp. of La Porte co., Ind. Pop. 486.

Han'nah (JOHN), D. D., b. in Lincoln, England, Nov. 30, 1792; joined the Wesleyan conference in 1814, and became theological professor in Didsbury College in 1842. He was president of the Wesleyan conference in 1842 and 1851. He twice represented the Wesleyan Church before the General Conference of the American Methodist Episcopal Church, and d. at Didsbury Dec. 29, 1867.

Han'nahsville, tp. of Tucker co., W. Va. Pop. 433.

Han'nibal, city of Marion co., Mo., on the W. bank of the Mississippi River, 150 miles above St. Louis (by river), on the lines of the Hannibal and St. Joseph, the Missouri Kansas and Texas, the Toledo Wabash and Western, and the Mississippi Valley and Western R. Rs. It has 15 churches, 1 college, 7 public and several private schools, 1 daily and 2 weekly newspapers, 4 banks, 1 iron-foundry with machine-shops, extensive car-works, about 300 business establishments of all kinds, and a paid steam fire department. The extensive machine-shops and general offices of the Hannibal and St. Joseph R. R. are located here, and the Toledo Wabash and Western R. R. crosses the Mississippi River at this point upon a splendid iron bridge built in 1872. It has a very large lumber-trade with Missouri, Kansas, and Texas, the annual sales of this article reaching about 150,000,000 feet. The city is handsomely located and substantially built, with many fine residences upon the surrounding hills. Pop. 10,125.

J. R. WINCHELL, ED. "DAILY COURIER."

Hannibal, post-v. and tp. of Oswego co., N. Y., 11 miles S. of Oswego, on the Lake Ontario Shore R. R. It has 3 churches, a graded school, a weekly newspaper, 1 stave and 2 barrel factories, mills, tanneries, and 5 stores. Pop. 454; of tp. 3234. A. N. BRADT, ED. "REVEILLE."

Hannibal, one of the greatest generals and one of the most interesting characters of antiquity, was b. at Carthage 247 B. C. Carthage was at that time the largest and most opulent city on the Mediterranean. It had about 700,000 inhabitants, large dependencies in Africa, Sicily, Sardinia, Corsica, and Spain, and it could boast of an enterprise which never had been equalled; it worked the silver-mines of Spain and the tin-mines of Britain; it sent its vessels into the Baltic and its caravans to the Nile and the Niger. But it was only a commercial community. With the exception of a few inscriptions and a number of coins, the only monument it has left of itself is the name of Hannibal, and his history has been written by foreigners. The principal source is Polybius, who travelled over the route Hannibal had taken from Spain to Italy, and who conversed in Italy with many who had been eye-witnesses to his exploits. The next in importance is Livy; Plutarch and Cornelius Nepos have also interest. The first encounter between Rome and Carthage took place in Sicily. Both wished to come into sole possession of this beautiful island —the one for the sake of power, the other for the sake of gain. But after a protracted contest (the first Punic war, 264–241) Carthage had to sue for peace and give up all its possessions in the islands of the Mediterranean. Hamilcar Barca, the father of Hannibal, who had fought with great success against the Romans, and who at once saw his own fame destroyed and an enormous loss inflicted on his native city by the disaster of Hanno at the Ægates Isles, made his son swear on the altar eternal hatred to Rome; and the fulfilment of this oath became the object of Hannibal's life. He had only one passion—hatred to Rome; and all the glowing enthusiasm of his soul, all the great virtues of his character, all the wonderful fertility of his mind, were concentrated in this hatred. He grew up in his father's camp in Spain, but when Hamilcar died (in 229) he returned to Carthage, where he lived for four years. In 224 he returned to the army, and by Hasdrubal, his brother-in-law, was appointed commander of the cavalry. In 221, Hasdrubal was killed, and by acclamation the army chose the young Hannibal for its commander-in-chief. He accepted, and, feeling himself strong enough to act without the sanction of his government, he immediately turned the war from a war for gain into a war of hatred—from a war against Spain into a war against Rome. Saguntum was in alliance with Rome. With an army of 150,000 men Hannibal laid siege to it, and after a desperate resistance of eight months it was taken and razed. Rome demanded the surrender of the young general, and when the Carthaginian government hesitated and sought evasions, probably on account of the army, war was declared (the second Punic war, 219–201).

It was the plan of the Roman generals to carry on the war in Spain, and P. Cornelius Scipio the Elder was on the way thither with an army. But Hannibal wished to strike a deadly blow, and he thought that Rome would be much stronger in Spain than in Italy, partly because its Italian allies would cling more closely to it on a foreign soil, partly because the least reverse of fortune would give his own Spanish allies a chance of choice. He immediately broke up with his army, crossed the Pyrenees, the Rhone, and the Alps, and stood, after a march of five months, in the middle of Nov., 218, on the plains of Lombardy, at the Ticinus. It is uncertain at which point he crossed the Alps, but Polybius, who had seen the Alps himself, and who knew something about what it means to move an army, has a just appreciation of the tremendous magnitude of the undertaking, and gives a short but impressive description of the difficulties which Hannibal met with, and the ingenuity with which he encountered them. The crossing took fifteen days—the ascent nine, the descent three, and three were spent on the top in making some passages of the descent practicable. The army numbered 50,000 foot, 9000 horse, and 37 elephants when it encamped at the northern foot of the Alps; 20,000 foot, 6000 horse, and 1 elephant when it reached the southern. Here stood Scipio, who waited for them. He was defeated, however, in the battle of the Ticinus, chiefly by the superiority of the Numidian cavalry, and shortly after Sempronius was totally routed in the battle of the Trebia; thus the first year of the campaign ended. Next year (217) two new Roman armies under the two consuls, Servilius and Flaminius, stood ready to take up the contest with the invader; but Hannibal, after a long and perilous march through the marshy regions of the Upper Arno, succeeded in bringing the army of Flaminius in such a position between Cortona and Lake Thrasymenus that he could attack it at once in the front and in the rear. The victory was complete; half of the Roman army perished, and the rest were taken prisoners; even a part of Servilius's army, which was sent to the support of Flaminius, was lost. In this emergency Rome proclaimed Q. Fabius Maximus dictator, and the manner in which this prudent and sagacious man carried on the war contributed very much to save the republic. He never gave battle, but he followed Hannibal from place to place like his shadow, and thus he at once procured time for Rome to complete its fortifications and armament, and deterred its allies from deserting it. Once he even succeeded in surrounding the enemy at Callicula in Campania, but in the night Hannibal let loose on the enemy 2000 oxen with bundles of burning hay tied to their horns, and in the consternation and bewilderment thus caused he escaped. In Rome, however, this manner of carrying on the war was not much appreciated. Fabius received the surname *Cunctator*, and the two consuls of the next year (216), C. Terentius Varro and L. Æmilius Paulus, felt themselves obliged to give battle. They commanded an army of 80,000 men, while that of the enemy numbered hardly 50,000, and in courage, fortitude, and military training the Roman soldiers were second to none. But the talents of the respective commanders were so unequal that in the battle of Cannæ, Hannibal not only won a decided victory, but completely destroyed the Roman army; between 40,000 and 50,000 men were killed, and the rest were scattered. This battle was his greatest exploit, and it became the turning-point of his fortune.

All people, statesmen as well as generals, have wondered at the manner in which Hannibal used this victory. Why did he not march upon Rome? Why did he go to Capua? But Hannibal was not a hero; he was only a calculator. His genius was far-sightedness, his talent was shrewdness. As far as his calculation reached his courage and ingenuity were inexhaustible, but at the point where the calculation stopped the whole man stopped. He saw that Rome would be weaker in Italy than in Spain, and he crossed the Alps in order to make the war in Italy. He saw that Rome would fall when all its allies deserted it, and with a shrewdness which is so much the more admirable as it was not mixed up with falsehood he alienated one after the other of the allies. But he could not see—nay, he could not even understand—that Rome could be taken in any other way—for instance, by attacking it in a moment of panic—and instead of marching directly on its gates after the battle of Cannæ, he went into winter-quarters in Capua. New elements came into play which were far beyond any calculation. His soldiers grew tired of the war, and during a few months' rest in Capua they lost their discipline. Reverses followed—not many nor great, but still reverses. He lost Capua (212), Tarentum (210), etc. The mere circumstance that the campaign had lasted three years, and Rome was still unconquered, made the allies very cautious, and the only moment in which they perhaps could have been gathered in a siege around Rome was neglected. Furthermore, when he asked for reinforcements from home, a cold answer was returned, for his countrymen could not

understand how he could need reinforcements after such victories; and when at last his brother Hasdrubal was sent with an army to his support, this army was surprised, defeated, and destroyed on the Metaurus (207). Thus, while we begin to read his history with admiration for the young hero who is going to conquer Rome, we finish it with admiration for the old calculator whom Rome could not conquer. For the most striking proof of the talent of the man is the circumstance that he maintained himself in Italy for sixteen years. In 203 he was recalled. Scipio had landed in Africa, Masinissa, king of Numidia, had allied himself with Rome, and the situation of Carthage was extremely hazardous. In a short time Hannibal organized a new army and defeated Masinissa, but he saw the danger of encountering Scipio with his young, inexperienced force, and tried to avoid him. Pressed, however, by his countrymen, he had to give battle, and was defeated at Zama (202). Peace was now necessary, and although the Roman demands were heavy and humiliating, Carthage had to submit. But Hannibal did not give up the aim of his life. As the chief magistrate of his native city he commenced a thorough restoration of its corrupted and depraved society. With unrelenting vigor he pursued the shameless ringleaders who monopolized the offices in order to embezzle the revenues, and soon Carthage was rising once more. But the diplomatic negotiations which he carried on with Antiochus the Great, king of Syria, gave Rome an opportunity of interfering. It demanded his surrender, and the enmity which his reforms had created against him in Carthage was so great that he had to flee. Thus baffled a second time in his plans against Rome, he found a new chance to try his fortune. A combined action of Carthage and Syria, which might have been the ruin of Rome, he could not bring about, but he succeeded in instigating Antiochus to begin the war alone. Antiochus was defeated, however, and the Romans demanded the surrender of Hannibal. Hannibal fled, and was received by Prusias, king of Bithynia. Shortly after Bithynia began war against Rome. But Prusias was defeated, and the Romans again demanded the surrender of Hannibal. There was now not one more point along the whole horizon from which an operation against Rome could be started with any prospect of success. Hannibal gave up; he opened the bead on his ring and swallowed the poison it contained (183 B. C.). CLEMENS PETERSEN.

Han'no, the name of many historic Carthaginians, among whom the following are especially noteworthy: HANNO, a navigator who (probably in 570 B. C.) set sail with sixty ships and a large number of intended colonists, and coasted southward along the shores of the African continent, founding several towns on the way. On his return he set up in a temple a tablet containing an account of his voyage. Of this tablet a Greek version, the *Periplus*, is still extant.—HANNO THE GREAT, in the third century B. C., was the leader of the aristocratic party and the chief opponent of Hamilcar Barca and of Hannibal his son. Hanno was himself an able general.

Hannon, tp. of Mason co., West Va. Pop. 1551.

Han'over, formerly an independent kingdom, since 1866 a province of Prussia, bounded N. by the German Ocean and the Elbe, E. by Mecklenburg and Prussian Saxony, S. by Hesse-Cassel and Westphalia, and W. by the Netherlands. Its area is 14.672 square miles. Pop. 1,963,618, of which 1,713,711 are Protestants, 233,809 Catholics, and 12,799 Jews, and distributed as follows:

Landdrosteien.	Area, sq. m.	Pop. in 1871.	Chief towns.	Pop. in 1871.
Hanover	2300	404,968	Hanover	104,243
Hildesheim	1708	407,585	Hildesheim	20,801
Lüneburg	4293	384,205	Lüneburg	14,411
Stade	2595	302,801	Stade	8,269
Osnabrück	2388	268,665	Osnabrück	23,308
Aurich	1144	195,394	Aurich	4,712
Clausthal	241	33,981	Clausthal	9,052

With exception of the inhabitants of the districts bordering on the German Ocean and the Netherlands, who are of Frisian descent, the Hanoverians are Saxons. The lower classes speak Platt-Deutsch (Low German), and in the districts bordering on the Netherlands, Dutch and Frisian. The southern part of Hanover is covered with hills and low mountains, branches of the Hartz, which here seldom rise to the height of 3000 feet. They are covered with dense forests, and are very rich in minerals—gold, silver, lead, iron, coal, and salt. In 1860, 191 coal-mines were worked, employing 6463 men, and 124 iron-mines, and the works are steadily increasing. In 1853 the produce of the coal-mines was 1,750,000 cwt.; in 1860 it was 6,550,000 cwt. The produce of the salt-works in 1849 was 517,300 cwt.; in 1860, 719,831 cwt. The northern part of the country is a low plain. The basins of the rivers Elbe, Weser (with its affluent Leine), and Ems, all of which run to the German Ocean, are fertile, and the soil is well suited to agriculture. Rye and flax are grown in great quantities. In 1861 the products of the Hanoverian linen manufactures were 14,410,010 yards, worth 1,419,442 thalers. Along the German Ocean are extensive marshes and peat-moors. Wherever these marshes have been well drained, they afford excellent pasturage, and the trade in cattle is considerable; in 1860, 52,954 oxen were exported. A large portion of Central Hanover is occupied by the Lüneburg Heath, a sandy and unproductive tract, with no other resources than the rearing of sheep and bees, which latter forms an important industry.

The territory which forms the present province of Hanover belonged from ancient times to the family of Brunswick-Lüneburg, though it at some times was divided up very much between the different lines of the family. In 1692 it was made an electorate, and when in 1714 its elector, George Lewis, came to the English throne, it began to play quite a conspicuous part in the history of Europe. In 1814 it was made a kingdom by the Congress of Vienna, and in 1837, at the death of William IV., it fell to Ernest August, duke of Cumberland, as the Salic law, which excludes heirs female, prevented Queen Victoria from inheriting it. In 1866 it was conquered by Prussia, and incorporated by that kingdom as a province.

Hanover, capital of the Prussian province of Hanover, contains, together with the suburb Linden, 104,234 inhabitants. The Ihme, a tributary of the Leine, separates Linden, which has 16,617 inhabitants, from the city proper. The old city, irregular and partly old-fashioned, is surrounded to the N. and E. by new and elegant quarters which have arisen since 1840, and, steadily increasing, group themselves around the railway station. Magnificent promenades, due to the sovereign, who formerly resided here, extend to the N. W. of the city, and to the N., E., and S. a large forest, the Eileriede, surrounds it in a semicircle. The new quarters, of which Georg street, Theatre street, Schiller street, Dépôt street, and King street are especially noticeable, are distinguished by the original architecture of many of their buildings. The materials are brick; the style is consistent, grave, and dignified. A row of interesting villas in pure Pompeian style has recently arisen on the Schiffgraben, parallel with King street. The most remarkable public places are —the Bahnhofsplatz, surrounded with large hotels, and containing the equestrian statue of King Ernst August, 10 m. high, cast in bronze after a model by Woiff, and raised on a pedestal of granite; the Theatre Platz, in the centre of which stands the theatre, one of the largest and most beautiful in Germany, containing seats for 1800 persons, and built 1845–52 by Laves; the Georgs Platz, with the statue of Schiller by Engelhardt; the Markt, in the centre of the old city; and the Waterloo Platz, a parade-ground, with the Waterloo column, 46 m. high. The most remarkable buildings are—the Museum, in Sophie street, finished in the round style by Hase in 1856, and containing collections of art, history, and natural science; the Polytechnic School, in Georg street; the Lyceum, on Georgs Platz; the former town-house, in the market-place, a Gothic structure of the middle of the fifteenth century; the royal palace, an extensive building of the eighteenth century, situated on the Leine, and containing a chapel with a celebrated altar-piece by Lucas Cranach. The palace overlooks the Waterloo Platz, containing large barracks and a fine arsenal. On going from the palace to the Waterloo Platz, the statue of Gen. Count von Alten, who commanded the Hanoverians at Waterloo, stands to the right, and behind it the library building arises, containing 170,000 volumes and 3000 MSS., among which are the literary bequests of Leibnitz. A monument to Leibnitz, consisting of a circular temple containing his bust, stands on a hill near the library, on the Waterloo Platz. The most remarkable churches are—the Market church, of the fourteenth century, restored in 1855, with a quadrangular tower 90 m. high, and containing some beautiful glass-paintings and an altar carved in oak wood; Christ church, built of brick and finished in 1864 by Hase, also containing fine glass-paintings. Hanover has not many churches, and, with exception of the above mentioned, they are not beautiful. In the vicinity of Hanover stands the palace, Herrenhausen. It is situated in an extensive park laid out in French style by Le Nôtre, and containing a fountain more than 35 m. high and fine hothouses. Connected with the palace is an art-gallery with a collection of antique and modern sculptures. An avenue of linden trees, one of the most beautiful avenues which exist, two kilomètres long, 36 mètres broad, planted with four rows of old trees and provided with excellent drives, rides, and pathways, stretches from Hanover to Herrenhausen, and is on both sides surrounded with magnificent promenades, which on

the western side extend to Georgs Park. To the E. of the avenue the colossal Welfenschloss arises, in the round style, with five towers; the interior, however, has remained unfinished since the annexation to Prussia. The Eilenriede contains a zoological garden, with many tasteful buildings.

Hanover is first mentioned in history in 1163. It was at that time the residence of Henry the Lion, and with a few interruptions it remained in the possession of the Guelphs up to the present century. In 1481 it entered the Hanseatic League, and soon its commerce and wealth arose considerably. It suffered, however, very much from internal disturbances, brought on by the introduction of the Reformation. In 1837 it became the residence of the king of Hanover, and from that time it has made steady progress; especially since its annexation to Prussia it has increased both in size and splendor. AUGUST NIEMANN.

Hanover, county in the E. of Virginia. Area, 400 square miles. The soil and surface are varied, a portion being very fertile. Tobacco and grain are staple products. Flour is the leading article of manufacture. The county is traversed by the Chesapeake and Ohio and the Richmond and Fredericksburg R. Rs. Cap. Hanover Court-house. Pop. 16,455.

Hanover, post-tp. of Coosa co., Ala. Pop. 545.

Hanover, a v. of Clinton co., Ill., 45 miles E. of St. Louis. (P. O. name, GERMANTOWN.) It is inhabited by Germans. Pop. 391.

Hanover, tp. of Cook co., Ill. Pop. 1098.

Hanover, tp. of Jo Daviess co., Ill., on the Mississippi River. Pop. 1191.

Hanover, tp. of Jefferson co., Ind., on the Ohio River. Pop. of Hanover post-v. 564; of tp. 1399.

Hanover, tp. of Lake co., Ind. Pop. 973.

Hanover, tp. of Shelby co., Ind. Pop. 1572.

Hanover, tp. of Allamakee co., Ia. Pop. 550.

Hanover, tp. and post-v. of Oxford co., Me., on the Androscoggin River, has manufactures of woollens, flour, lumber, leather, furniture, and other goods. Pop. 188.

Hanover, post-tp. of Plymouth co., Mass., 26 miles from Boston, on the Hanover branch of the Old Colony R. R. It has 4 churches, an academy, a high school, and manufactures of iron, boots and shoes, lumber, etc. Here the first cast-iron ploughs were made, and the anchors of the frigate Constitution were forged. This town is fertile and pleasant. There was formerly considerable shipbuilding on the navigable North River. Pop. 1628.

Hanover, tp. and post-v. of Jackson co., Mich., on the Fort Wayne Jackson and Saginaw R. R., 14 miles S. S. W. of Jackson. Pop. 1093.

Hanover, tp. of Wexford co., Mich. Pop. 112.

Hanover, post-v. and tp. of Grafton co., N. H., on the Connecticut River, 73 miles from Portsmouth and 59 from Concord by railroad. It has 4 churches, 1 national and 1 savings bank, 1 weekly newspaper, and 1 hotel. It is also the seat of DARTMOUTH COLLEGE (which see). Lumber is manufactured to a considerable extent. Principal business, farming. Pop. of tp. 2085.

Hanover, tp. and post-v. of Morris co., N. J. The township contains numerous villages. Pop. of tp. 3623.

Hanover, tp. of Chautauqua co., N. Y., on Lake Erie, is a fertile tract, and contains several manufacturing villages, among which are Forestville, Irving, and Silver Creek. Pop. 4037.

Hanover, tp. of Ashland co., O. Pop. 1832.

Hanover, tp. of Butler co., O., on the Cincinnati and Indianapolis R. R. Pop. 1460.

Hanover (P. O. MAYSVILLE), tp. and v. of Columbiana co., O., on the Cleveland and Pittsburg R. R., 75 miles from both Cleveland and Pittsburg. P. of v. 481; tp. 2310.

Hanover, tp. and post-v. of Licking co., O., on the Pittsburg Cincinnati and St. Louis R. R. Pop. of v. 322; of tp. 1165.

Hanover, tp. of Beaver co., Pa., on the Ohio line. Pop. 1500.

Hanover, tp. of Luzerne co., Pa., on the Susquehanna River and the Lehigh and Susquehanna R. R. It has mines of coal. Pop. 3035.

Hanover, tp. of Northampton co., Pa., on the Lehigh River, opposite Allentown. Pop. 499.

Hanover, tp. of Washington co., Pa., on the West Virginia line. Pop. 1898.

Hanover, post-b. of York co., Pa., 18 miles S. W. of York, 42 miles N. W. of Baltimore, Md., on the lines of the Hanover branch, the Gettysburg, and the Littlestown R. Rs., and the S. terminus of the Hanover and York R. R., now building. It has 2 banks, 3 English and 1 German newspaper, 1 monthly journal, 6 churches, 2 academies, 6 hotels, gas and water works, and a public fountain in Centre Square. The surrounding country abounds in iron ore. Principal business, manufacturing of flavine, leather, cigars, and carriages. Pop. 1839. M. O. SMITH, ED. "HERALD."

Hanover Court-house, the county-seat of Hanover co., Va., 20 miles N. of Richmond, was the birthplace of Henry Clay, the place of Patrick Henry's greatest forensic triumphs, and was the scene, on May 27, 1862, of a smart action, resulting in an advantage to the national arms.

Han′overton, post-v. of Hanover tp., Columbiana co., O.

Hanseat′ic League, or **Hanse Towns** [Old Ger. *Hansa*, a "union"]. These are names applied to an association of free cities of Northern Europe formed in the thirteenth century to protect their common commercial interests. The rude barbarians of the Teutonic race, after the old Roman empire gave way under their irruptions, gradually organized society anew. The new wants of settled life set on manufacturing industry and gave rise to trade and commerce. Thus, cities sprung up in Northern Europe as centres of the developing civilization. But the whole social organization was cast in the forms of feudalism under the controlling principle that "might makes right." The cities were subject to heavy exactions from their feudal lords; the avenues to each city were beset by armed bands, watching to plunder the passing merchant-trains; piracy was considered a legitimate business, and the seas were covered with the cruisers of the bold vikings of the North. Trade was altogether insecure, and the accumulating wealth of the cities was constantly exposed to pillage. Yet the profits of trade, being proportioned to its risks, were sufficient to stimulate activity and to prompt means of defence. The first attempt to relieve this state of things was the movement which is called the insurrection or affranchisement of the cities. The burgesses armed themselves; each made his house strong as a fort, and all joined to throw walls around the city. Then all rose together to resist the exactions of the feudal lord, and the war went on till a treaty of peace in the form of a charter defined the privileges and rights of each party. This was a general movement, but was carried on without concert of action between the different cities.

The Crusades carried the rude warriors of the West and North by thousands into contact with the higher civilization of the East and South, and created among them a demand for the luxuries of Asia and the beautiful products of Italian taste and skill. This gave fresh stimulus and a wider range to commerce. The merchants of Venice and others of the older cities on the Mediterranean gladly entered the new market thus opened for their goods, and established mercantile relations with the cities of the North. But this expansion of legitimate trade occasioned also a revival of piracy and systematic robbery. Sovereigns saw no benefit from commerce beyond the opportunity it offered for levying revenues for themselves; petty lords for nominal protection made severe exactions; swarms of pirates watched the straits into the Baltic Sea and the mouths of the Rhine, the Elbe, and the Trave. This condition of things gave rise to the Hanseatic League. There are traces of some joint defensive action of the cities as early as the middle of the twelfth century. In 1239, Hamburg, Ditsmarsh, and Hadeln joined in measures to keep the Elbe and the sea at its mouth clear of marauders. In 1241, Lübeck and Hamburg concluded a formal treaty to provide ships and soldiers to make trade secure between the Elbe and the Trave, and on the waters from Hamburg to the ocean, and to promote their common interests. This is usually regarded as the date of the organization of the league. Six years later Brunswick joined the compact. In 1252 deputies from the three cities met at Lübeck and took steps for establishing factories at London, Bruges, and Novgorod in Russia. Later, a factory was also established at Bergen. The door was open for other cities to enter the association, and its manifest advantages inclined them rapidly to seek admission, till at its height it embraced 85 cities. Many other cities, not regular members, came into commercial relations with the league, to their own advantage, while they added also to its influence and power. In 1260 its affairs were regulated by a convention which ordained a diet of delegates to assemble triennially, and an extraordinary meeting every ten years to renew the league. Lübeck was made the capital of the Hansa and the depository of its treasury and archives. The meetings were generally held at Lübeck, but occasionally at Hamburg, Cologne, and other places. For the details of administration the cities were distributed into four classes: (1) The Vandalic or Wendish towns of the Baltic, with Lübeck as capital. (2) The Westphalian, Rhenish, and

Netherland towns, capital Cologne. (3) The Saxon and Brandenburg towns, capital Brunswick. (4) The Prussian and Livonian towns, capital Dantzic. The magistrates at the head of each circle were charged with sovereign power to carry out the decrees of the league.

In the outset the league aimed simply to resist the extortions of feudal lords and sovereigns, to prevent robbery and piracy, to regulate and expand commerce, and to stimulate production, especially in the four departments of agriculture, fisheries, mines, and manufactures. It did much to define general principles of mercantile law, and to enlarge the scope and ennoble the spirit of commercial enterprise, by uniting many petty, narrow interests in a great common cause. It served greatly to increase the wealth of the cities themselves, and to develop in their populations taste, refinement, and genius for both the practical and the fine arts. By the stimulus which it imparted to agricultural industry it also waked a spirit of enterprise and a love of liberty in the breasts of the oppressed tillers of the soil, and thus joined with other influences to prepare the way for the emancipation of the serfs. The league thus touched the springs of social life and activity universally, to the advantage of all classes. In its leading ideas and policy, though crude and only partially developed, we find the germs of that law of reciprocity and freedom which is now so generally recognized as the basis of modern commerce.

The four principal factories of the league, at London, Bruges, Bergen, and Novgorod, were endowed by the sovereigns of those cities with special privileges, to which every merchant belonging to a Hanseatic town was entitled. These factories were set up as distinct establishments, with some features of the monastic order, under officers who were bound to celibacy and a common table. Through its organized association and system, with the privileges secured, the league to a great extent monopolized the trade of Northern Europe. By concessions from Henry III. and the sovereigns who succeeded him the London factory gained command of both the import and export trade of England, and engrossed the carrying trade almost to the exclusion of British merchants. Similar advantages were gained in each of its great centres. The power of the league was thus rapidly and strongly developed. It reached its culmination in the latter half of the fourteenth century. But now its aims and policy were changed. It had sought at first only protection for common interests and special favors for a great public good. Then it had established itself as an organization independent of other authorities. Now it abused the power gained for the maintenance of separate interests of its own, and the exercise of sovereign authority to perpetuate an oppressive monopoly. So it maintained armies and navies; by a victory over the kings of Denmark, Sweden, and Norway gained control of the passage of the Sound; assumed to depose the king of Sweden; carried on war against Denmark; and by a declaration of war compelled Edward IV. of England to grant larger concessions. Through the fifteenth century it thus maintained its power with growing haughtiness and arrogance, till it became intolerable and declined as rapidly as it rose.

Among the causes of its dissolution may be mentioned—(1) the general development of commercial activity, and the security gained for it through the agency of the league. This at the same time created competition and awakened jealousy of the exclusive privileges enjoyed by the league. (2) The centralization of national life on the decay of feudalism, and the consequent desire of both sovereign and people that each nation should control its own commerce and reap its benefits, now fully appreciated. This led to the repeal of the concessions which had been granted, and broke up the monopolies enjoyed. Thus, England in 1597 revoked all special privileges of the Hanseatic merchants. (3) In desperate efforts to resist these tendencies and retain its power money was freely expended, and the Hanse towns were heavily taxed to meet the cost. This caused disaffection, and the maritime cities of the Baltic withdrew when trade was opened for them directly with the Dutch and English. (4) The new direction and the new impulse and methods given to the commerce of the world by opening the passage to India by the Cape of Good Hope and the discovery of America, reduced the trade of the league to comparative insignificance. It had fulfilled its office, and there was no longer necessity for its existence. In 1630 a last general assembly was summoned to meet at Lübeck, but the deputies from the remaining towns came only to notify their withdrawal. Thus, after nearly 400 years, this confederacy was dissolved. Then the cities of Hamburg, Lübeck, and Bremen formed a new association called the Free Hanse Towns. Frankfort-on-the-Main was subsequently added. The four were recognized as the free cities of Germany, each exercising independent and sovereign jurisdiction till 1810, when Napoleon I. incorporated them with the French empire. In 1813 they became free members of the German confederation. In 1866 Frankfort-on-the-Main fell to Prussia. Bremen, Hamburg, and Lübeck are still independent, and perpetuate the name of Hanse Towns. A. L. Chapin.

Han′si, town of British India, in the N. W. Provinces, 90 miles N. W. of Delhi. It has a fort and some commercial importance. Pop. 9112.

Han′son, county in the S. E. of Dakota, established since the census of 1870. Its surface is diversified. It contains a part of the Coteau de Missouri, an elevated and broken plateau.

Hanson, post-v. and tp. of Plymouth co., Mass., on the Old Colony R. R., 25 miles S. E. of Boston. The chief pursuits are agriculture and the manufacture of lumber, shingles, boxes, tacks, nails, straw-braid, boots, shoes, etc. Iron ore and building-stone are found. Pop. 1219.

Han′steen (Christopher), b. at Christiania, Norway, Sept. 25, 1784; studied mathematics at the University of Copenhagen, and was appointed teacher at the Latin school of Frederiksborg, in Seeland. While here he commenced his researches concerning the terrestrial magnetism, and a paper he prepared on this subject received a prize from the Academy of Science in Copenhagen. In 1814 he received a chair as professor of mathematics at the newly-established University of Christiania, where he still continued his scientific labors, the result of which he published in 1819 in Christiania. The book (*Researches concerning the Terrestrial Magnetism*), of which, however, only the first volume, with atlas, appeared, attracted much attention, and after a journey to London, Paris, and Berlin, Hansteen travelled from 1828 to 1830 through Western Siberia at the expense of the government. He published in 1863 *Magnetical, Astronomical, and Meteorological Observations on a Journey through Siberia.* Besides his strictly scientific labors, he also developed a great activity in a practical direction. In 1833 an observatory was erected at Christiania under his superintendence. In 1835 he published a manual of geometry, and in 1836 one of mechanics. He was also president of a committee for the regulation of weights and measures, and had chief charge of the triangulation of the country. After 1823 he edited, in connection with Mashmann and Sandh, a *Magazine for Natural Science.* D. in Christiania in 1873.

Hants, county of Nova Scotia, having Cobequid Bay and the Basin of Minas on the N. W. The surface is broken, the soil fertile. Gypsum abounds, and coal is found to some extent. The county is traversed by the Nova Scotia and the Windsor and Annapolis Railways. There are considerable manufacturing interests. Area, 1176 square miles. Cap. Windsor. Pop. 21,302.

Hants, England. See Hampshire.

Hants Har′bor, port of entry and fishing-town of Trinity district, Newfoundland. It has some shipbuilding. Pop. 730.

Haplo′mi [from ἁπλόος, "simple," and ὦμος, "shoulder"], a sub-order of fishes, belonging to the order Teleocephali, which have the brain-case confined behind the orbits; symplectic bones developed; pterotics normal; the usual opercular bones all present; lower pharyngeal bones distinct and sub-triangular; upper in three or four pairs; anterior as well as other dorsal vertebræ normal and distinct; shoulder-girdle with the meso-coracoid atrophied (whence, probably, the name); and the air-bladder communicating through a duct with the intestinal canal. The fishes embraced in this group vary in form and general appearance, and to it belong the pikes, killy-fishes or minnows, and kindred types; these have been arranged under the families Esocidæ, Umbridæ, and Cyprinodontidæ. The Cyprinodontidæ were referred, by the older naturalists, near the Cyprinidæ, but they have no real relations with those fishes. Theodore Gill.

Hap′py Camp, post-tp. of Del Norte co., Cal. P. 382.

Haps′burg, or **Habs′burg, House of,** named from the old castle of Habsburg (Habichtsburg), near Brugg, in Aargau, Switzerland, which was erected by Count Radbod von Altenburg about 1020 A. D. The castle is now in ruins, only the walls of the tower remaining. The first count was Werner of Habsburg, who d. 1096, and was descended from an ancient Suabian family of distinction, probably related to the Guelphs. Gontran the Rich, count of Alsace (eighth century), was the earliest ancestor of whom we are certain. In 1233 the line parted into two branches—Hapsburg-Hapsburg and Hapsburg-Lauffenburg. The latter parted again into two lines—Hapsburg-Lauffenburg proper (extinct in the male line 1408, but still represented by the Feilding family in England), and the Hapsburg-Kyburg line (of which the last count d. 1415). The first German emperor of this family was Rudolph I., who founded the Austrian house, which from 1438 to 1806

held the German imperial crown, and since that time has held that of Austria. In Spain, Burgundy, Tuscany, and Modena, Hapsburg monarchs have also borne sway.

Harafo'ra, Arafoo'ra, or **Alfoo'roo,** a name applied to an aboriginal or non-Malay race of the Spice Islands, Celebes, Papua, etc., according to some ethnologists embracing the native race of Australia, and indeed all the Melanesian tribes, including the extinct Tasmanians and the black forest tribes (Negrillos) of Malacca and the Philippines. These peoples are all exceedingly rude, have black or very dark skins, and for the most part crisp or woolly hair; but from the character of their languages they are considered quite distinct from the black races of Africa. From this people the sea N. of Australia and S. of the Malay Archipelago is called the Arafura Sea. The name is of Portuguese origin, and originally meant "foreigners."

Har'alson, county in the N. W. of Georgia, bounded on the W. by Alabama. Area, 390 square miles. The surface is hilly. Grain is the leading product. Cap. Buchanan. Pop. 4004.

Haralson (Hugh A.), b. Nov. 13, 1805, in Greene co., Ga.; graduated at the State University in 1825; was admitted to the bar and rose rapidly in the legal profession; was many years a member of the State legislature, and was member of Congress from Georgia 1843–51; was a major-general in the State militia; and d. in La Grange, where he had resided for many years, in Oct., 1854.

Har'baugh (Henry), D. D., a divine of the (German) Reformed Church in America, was b. near Waynesborough, Pa., Oct. 24, 1817. He was the descendant of a Swiss immigrant named Herbach, who came to this country in 1736. Young Harbaugh worked upon a farm, then became a carpenter, then a mill-operative, and next a teacher. In 1840 he entered Marshall College at Mercersburg, Pa., and after a partial course in academical and theological studies was ordained in 1843. He held pastorates in Lewisburg, Lancaster, and Lebanon, Pa., and in 1864 became professor of theology at Mercersburg, where he d. Dec. 28, 1867, in consequence of overwork. He was during the last year of his life editor of the *Mercersburg Review*, and had been for sixteen years previous to this editor of the *Guardian*. He was an advocate of the "Mercersburg theology," and belonged to the High Church school of his denomination. He was an indefatigable worker, and besides his numerous and highly popular religious books published some excellent poems in the so-called "Pennsylvania Dutch" dialect of the German language. Among his most important works are *Heaven* (1848), *The Heavenly Recognition* (1851), *Heavenly Home* (1853), *Life of Michael Schlatter* (1857), *The Fathers of the German Reformed Church* (3 vols., 1857–58), *Christological Theology* (1854), a volume of *Poems* (1860), and an illustrated work on the *Birds of the Bible* (1854).

Har'bison, tp. of Dubois co., Ind. Pop. 1590.

Har'bor. The word is by Webster derived from the O. H. German *heriberga* (*here*, "host," "army;" *bergan*, to "shelter," to "protect," and allied with the French *auberge*, an "inn"), and in its naval signification is defined "a refuge for ships; a port or haven."

A *natural* harbor may be more precisely defined as "a bay, recess, or inlet of the sea, or the mouth of a river, which affords good anchorage and a safe station for ships." The two great requisites (adequate *depth* both of entrance and interior area being assumed) are *shelter* from wave-violence and *accessibility*.* That there should be shelter it is necessary that the communication with the ocean should be as nearly as possible reduced to a channel of entrance of adequate width—*i. e.* that the waters of the harbor be, in expressive nautical phrase, "landlocked," and that the entrance should be, from the configuration and character of the adjacent coast, considered in conjunction with prevailing winds, safely and easily *accessible*. Natural harbors are ranked according as they possess more or less perfectly the combination of these qualities. Sea-waves owe their origin to the wind, and their most violent line of action is that of its direction. Hence, a mere indentation in the shore-line may afford a quite adequate harbor if it be in a windward shore, but in general the quality of being "landlocked" is essential. The harbors of Queenstown (Ireland), of Portland, Me., of New York, may be mentioned as possessing in a high degree the essentials. The qualities of a natural harbor are easily recognized; as well, also, as lack of these qualities. As an engineering problem, it is the supplying to natural harbors of such essentials as may be lacking, or the *creation* of a harbor where all essentials are absent, that is to be solved. The violence of the ocean waves being that against which protection is needed, it becomes important, especially in considering the strength of works erected to protect against their violence, to have some measure of its action. The following observations have been made (see also article Breakwater): "In Loch Awe (Scotland), where the fetch is under 14 miles, a stone weighing a quarter of a ton was torn out of the masonry of the landing-slip and overturned. . . . In Nov., 1817, the waves of the German Ocean overturned, just after it had been finished, a column of freestone 36 feet high and 17 feet base. We know of a block of 50 tons weight being moved by the sea at Barrahead, one of the Hebrides; and, what is far more extraordinary, we know, and can vouch for the fact, that blocks of 6 tons weight have been quarried or broken out of their beds *in situ*, on the top of the Bound Skerry of Whalsey in Zetland, elevated 17 feet above high-water spring tides. The Bound Skerry and neighboring rocks, which are in the German Ocean, certainly furnish by far the most wonderful proof that has yet been discovered of the great force which is developed by the billows of the ocean when suddenly checked by opposing rocks." (Mr. Thos. Stevenson's "Harbor," *Encyc. Brit.*) At the Skerryvore lighthouse Mr. Alan Stevenson observed the following: . . . "2d. Stones, some of which weighed as much as 5 tons, were swept by the waves over the top of the rock; and much floating wreck-timber has been seen to pass close to it. 3d. The force of the waves, as indicated by the marine dynamometer, has amounted to 6000 pounds per square foot. 4th. Two iron beacons were successively destroyed on the Bopheg Rock in Hynish Bay, 12 miles landward of the Skerryvore Rock, one of which was of a pillar form, and the other was a cone of iron plates like that proposed by Mr. Gordon, having the lower part of the void filled. Before the plate-beacon was carried away a hole of two feet in diameter was broken through one of the plates, most probably by a heavy spar urged end on by the waves." "At the Alguada Reef (India), Col. Fraser, R. E., states that he has seen stones over two tons in weight driven along the rocks by a summer sea; and that in the S. W. monsoon similar stones have been whipped out of the foundation-pit of the lighthouse 5 feet below the surface of the rocks, and swept along the rocks."

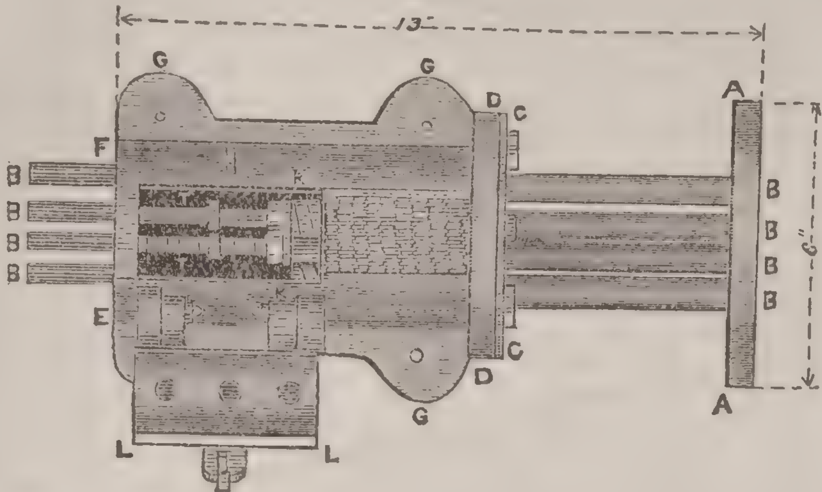
At the mouth of the Loire (*Annales des Ponts et Chaussées*, Apr., 1869) a beacon-tower of circular base (11 feet in diameter), 21 feet high, of excellent stone masonry, founded upon a rock ("*Du Petit Charpentier*"), the surface of which is $11\frac{1}{2}$ feet above extreme low and $7\frac{1}{2}$ *below* extreme high tides, was fractured through and through a few feet above its base and the upper part weighing about 50 tons, moved an inch or more. The engineer of *Ponts et Chaussées*, La Ferme, calculated that the average pressure per square foot was at least 6000 pounds. The vertical *range* of this determination had for its inferior limit the position of the line of fracture, and for its superior the top of the beacon; the extent was nearly 16 feet, commencing at a level of 3 feet below extreme high tides. The French example proves a large vertical range to this pressure, but does not determine its limits, though it does determine that it extends undiminished to over 12 feet above high tide. Smeaton built the Eddystone lighthouse solid to 27 feet above high tide, assuming that to be the extreme limit of violent wave-force. At Cherbourg it is found that the lower limit of violent wave-action is 5 mètres (nearly 17 feet) below extreme low tide. As all storms producing violent wave-action on any coast speedily heap up the water, it is fair to assume that powerful wave-action extends to *more* than 17 feet below the *actual* water-surface. In default of more definite information, we must assume, therefore, the vertical range of powerful action to be from 17 feet below low tide to 27 feet above the water-surface.

For the direct measurement of wave-force Mr. Thos. Stevenson invented the marine dynamometer (see *Trans. R. S. of Ed.* and *Encyc. Brit.*), which the following diagram and description will make intelligible. D E F D is a cast-iron cylinder which is firmly bolted at the projecting flanges G to the rock where the experiments are to be made. This cylinder has a circular flange at D. L is a door which is opened when the observation is to be read off. A is a circular disk on which the waves impinge. Fastened to the disk are four guide-rods B, which pass through a circular plate C, which is screwed down to the flange D, and also through holes in the bottom E F. Within the cylinder there is attached to the plate C a powerful steel spring, to the other or free end of which is fastened the small circular plate K, which again is secured to the guide-rods B. There are also rings of leather T, which slide on the guide-rods, and serve as indices for registering how far the rods have been pushed through the holes in the bottom, or, in other words, how far the spring has been drawn out by the action

*In this relation more than one entrance with different exposures to the wind is desirable, but seldom attainable, even in purely artificial harbors.

of the waves against the disk A. With this instrument the inventor "found the force of the waves of the German Ocean during hard gales to be $1\frac{1}{2}$ tons per superficial foot at the Bell Rock, and of the Atlantic Ocean 3 tons per superficial foot at the Skerryvore lighthouse. But," he adds, "these results may still be far short of the maxima." *

Fig. 1.



The element most influential in developing wave-force (the generative winds supposed the same) is the line of maximum exposure, or, in other words, the greatest reach of open sea. According to Mr. Thomas Stevenson, the limited observations as to this matter seem to indicate that the height of waves increases in the ratio of the square root of their distances from the windward shore. But *action* upon a certain shore will depend also on the angle of incidence of the waves on the walls of the harbor. Mr. Stevenson utters the following dictum: Let x = the greatest force that can assail a pier, h = height of waves which produce (after being corrected for obliquity) the maximum effect, and which are due to the line of maximum effective exposure. Sin a = sine of azimuthal angle formed between directions of pier and line of maximum effective exposure, radius being unity. Then x is proportional to $h \sin^2 a$ when the force is resolved normal to the line of the pier; but if the force is resolved again in the direction of the waves themselves, the expression becomes $x \propto h \sin^3 a$.

Tidal currents are also influential in the development of wave-force, and Mr. Stevenson mentions the effect of three successive waves carrying away in Peterhead harbor a bulwark wall 315 feet long, founded $9\frac{1}{2}$ feet above high spring tides, one piece of which, weighing 13 tons, was moved 50 feet, and the extreme violence of which he attributes to tidal influence.

Another circumstance affecting the exposure of any marine work is the depth of water in front of it. The great mountainous billows so commonly met with in the Atlantic Ocean cannot be generated in shallow seas. It becomes, therefore, of great consequence to ascertain the maximum possible wave in a given depth of water. Mr. Scott Russell has stated that if waves be propagated in a channel whose depth diminishes uniformly, the waves will break when their height above the surface of the level fluid becomes equal to the depth of the bottom below the surface. (For a more full exposition of Waves, see that heading; also *Revue Maritime et Coloniale*, Jan., 1873, which summarizes the recent Italian work *Sul Moto Ondoloso dal Mare*, by Cialdi; also *Naval Science*, Jan., 1873; also Airy's "Tides and Waves," *Ency. Metrop.*)

The foregoing facts sufficiently prove that sea-waves act, under certain circumstances, with enormous destructive force against opposed barriers. Inasmuch as wave-motion is (at least in its simplest form) merely an orbital motion of individual particles in closed curves, without resultant motion of translation (illustrated by the superficial wave produced by the wind in the tops of wheat in a large field or the wave of *form* translated along a shaken carpet), it is contended that a vertical wall descending to considerable depth in the ocean would merely reflect the sea-wave, suffering no shock; † and hence that vertical barriers are best adapted to resist waves. (Refer also to article Breakwater.) Against this postulate is, however, to be offered the fact that the sea-bottom, sloping up and shoaling shoreward, *does* generate motions of translation, and with them the destructive wave-forces; and that sea-walls in general are exposed to such already generated forces. Col. Emy (*Mouvement des Ondes*, Paris, 1831), developing this view, deduced the proposition that the exposed profile of a sea-wall or barrier should be a *curve* commencing tangentially with the bottom. On the other hand, advocates of the "long slope" and the "vertical" wall have based their contending arguments on their differing views as to the causes which develop wave-violence. Were other things equal, there can be no doubt that a long slope would be preferable, *but* a long slope requires corresponding extent of base, and hence an immense amount of material. Moreover, it is not practicable to unite this material into the same homogeneous and mutually sustaining mass as that which the vertical wall may be made to form. "It therefore appears," says Mr. Thomas Stevenson, "that the method generally resorted to, of forming deep-water harbors of masses of rubble-stone with long slopes, so as to form an artificial beach for the waves to spend themselves on, is, in most circumstances, the best and cheapest kind of construction. We incline, however, to the adoption of an upright wall, founded on the rubble as a basis, in preference to long paved slopes, etc., etc. . . . Much, however, depends on local peculiarities in selecting the best design for any work; and the nature of the bottom is all important. Where the bottom is soft, a vertical wall can hardly, if ever, be attempted. In making these remarks we must not be understood as condemning the adoption of vertical walls in cases where the foundation is good. All that we assert is the opinion that waves of translation do exist in deep water, and therefore that harbors of refuge will prove failures unless they are built in such a manner as to resist the impact of those waves of translation. . . .

The ultimate object of constructing harbors is by lowering the height of the waves to preserve the tranquillity of the area of water enclosed by the piers. Hence it is desirable to be able to predict, with some approximation to accuracy, to what extent such an effect will be produced by the proposed structure. The only formula attempted is that of Mr. Thos. Stevenson. (*Edin. New Phil.*, July, 1843, and *Encyc. Brit.*, art. "Harbors.")

When the piers are high enough to screen the inner area from the wind, where the depth is uniform, the width of entrance not very great in comparison with the width of the wave, and when the quay-walls are vertical, and the distance not less than 50 feet, let

H = height of waves in the open sea.
x = reduced height of waves in feet at place of observation in the interior of the harbor.
b = breadth of entrance to harbor, in feet.
B = breadth of harbor at place of observation, in feet.
D = distance from mouth of harbor to place of observation, in feet.

$$x = H\left\{\sqrt{\frac{b}{B}} - \frac{1}{50}\left(1+\sqrt{\frac{b}{B}}\right)\sqrt[4]{D}\right\}.$$

This formula has been found to give good approximations at several harbors where the heights of the waves were registered. When H is assumed as unity, x will represent the *reductive power* of the harbor; or, in other words, $\frac{x}{H}$ measures that reductive power. In situations where the highest waves cross the harbor-mouth at an oblique angle, a further reduction is due to this cause, but data are wanting for determination of its amount. (For an application of the above formula to a projected harbor, see *Prof. Papers, Corps of Engrs., U. S. A.*, No. 22, "North Sea Canal of Holland.")

In the providing of harbors of refuge, and more especially in the improvement of ports, the problem usually is to supply some lacking element. Thus a natural bay or deep indentation in the coast may, by artificial construction partially closing its mouth, be made to possess the qualities of a landlocked harbor. It is thus that at Cherbourg and Plymouth and (with some modification of phraseology) at Portland, Holyhead, etc. (England), and at our own Delaware breakwater, harbors of refuge have been formed. (See art. Breakwater.) But it sometimes happens that the *creation* of a harbor is needed where no natural element of one is found in the configuration of the shore. The most important examples are the harbor of Port Saïd to the Suez Canal, and that where the North Sea Canal of Holland connects with the North Sea. In both cases the coast and sea-bottom are of sand, and the shore-lines rectilinear and wholly destitute of harbor qualities.

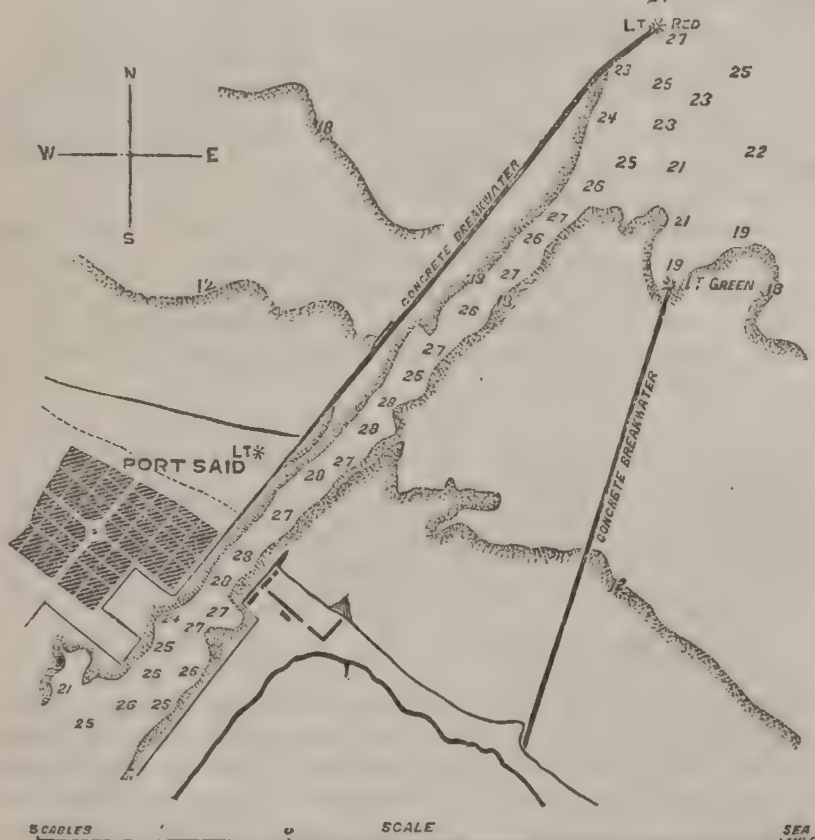
"Port Saïd, though affording sufficiently good anchorage for small vessels, cannot be considered a harbor, either in respect of extent or depth, for vessels of large tonnage and great draught of water. It is formed by two rough, narrow, and low breakwaters of unfinished appearance, enclosing an area of some 450 acres, with an average depth of only 13 or 14 feet of water, except in the ship-channel leading to the inner basins, where the depth is from 25 to 28 feet. The western breakwater, which extends for 6940 feet at right angles to the shore, and is slightly curved to the

* At the Delaware breakwater stones of 6000 pounds have been moved several feet. This is, however, far from being an open ocean exposure.

† Col. D. C. Houston, corps of engineers U. S. A., sets forth in the *Report of the Chief of Engineers* for 1872 some interesting views on this subject. It is certain that powerful wave-force is sometimes developed in mid-ocean, of which fact the terrific blows received by ships furnish proof.

eastward towards its extremity, was commenced in 1860, and carried out about 1300 feet, beyond which point, and at a short distance from it, was deposited a heap of stones that was surrounded by iron piles, and from its detached position was called 'the island.' The work was then left untouched till 1866, when the breakwater was joined to the island, and it was continued to its present length, and finished in 1868. From the mainland to the island the breakwater is formed, on its inner side, of a bank of rubble-stone, surmounted by a promenade, over which the spray breaks with a very moderate N. W. wind, and on the outer or sea-front of concrete blocks; but beyond the island to its termination it is entirely constructed of large blocks of artificial stone, composed of 1 part of French hydraulic lime with 2 parts of sand, and some of which were transferred to it from the eastern breakwater. This latter, which is also constructed of large masses of concrete, is of more recent construction; it extends about 6020 feet, and converges towards the western breakwater." (*Report of Messrs. Richards and Clarke*, 1869.) These concrete blocks are made from sand and lime from Theil; two months of exposure to the air suffices to harden them, and their subsequent immersion in water adds to their hardness. Each block weighs 25,000 kilogrammes. Steam-cranes lift them up and put them in their places. The joints between the artificial blocks are filled in with small pebbles, which, assisted by the action of the sea, form a compact and solid mass. "Both structures," says the report before cited, "are deficient in width, and from the rough way in which the blocks are deposited some amount of silt finds its way through the interstices, while from their slight elevation the sea, during fresh N. W. winds, washes over them, bringing with it a certain quantity of sand." Recent statements represent the entrance to be "shallowing so rapidly as to call loudly for an immediate extension of the west pier."

FIG. 2.



The canal now in progress, to furnish to the port of Amsterdam direct communication with the North Sea, has its sea-entrance and artificial harbor on a coast of sand "dunes," the trend of which is about N. by E. The axis of the harbor projected from the coast into the North Sea is nearly normal to the coast-line. The width of this entrance is 260 mètres. The two piers are to be extended to the depth of 8 mètres below the level of low water, corresponding with about 9.50 mètres below daily high water, and 8.50 mètres below A. P. (*i. e.* the established Amsterdam level). The roots of these piers, at the foot of the downs on the beach, are 1200 mètres distant one from another. Their directions converge, so as to make an angle of about 77° with their base-line. At 1200 mètres from their origin the piers, distant 660 mètres from one another, commence to converge more rapidly; so that, with an increment of length of 345 mètres (1545 in all), they terminate 260 mètres (868 feet) apart at the harbor-mouth. To obtain the requisite depth the area between these piers is to be dredged to an elliptic form for a width of 650 mètres, and to a depth of 8.50 m. below A. P. at the entrance, 7.50 m. on the land side, the *harbor* area being 55 hectares (135 acres); while the total area enclosed by the piers is fully 100 hectares.

The method of construction in this case is, forming on the sand a "rip-rap" foundation of small stone, and to lay regularly, from a huge derrick working from the built-up end of the pier itself, a wall of concrete blocks, as represented in the section (Fig. 4). (For a more detailed account see *Prof. Papers, Corps of Engrs.*, No. 22.)

FIG. 3.

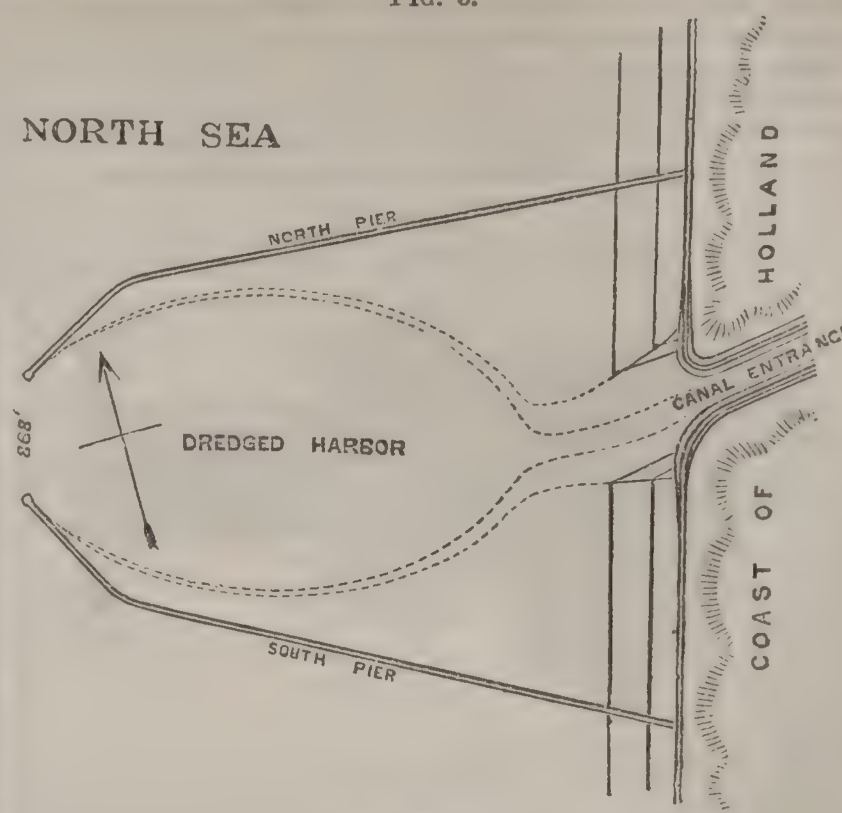
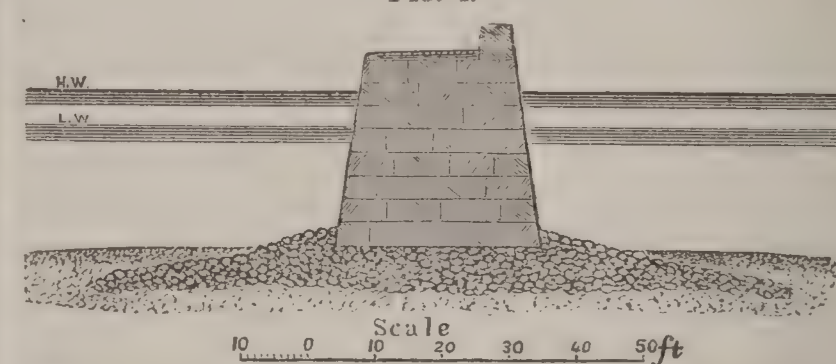


FIG. 4.



The last official report (for 1873) reports 1273 mètres length of the northern and 1165 mètres of the southern pier completed at the end of that year.* Serious damage had been caused by the autumnal storms, by which 470 mètres of the northern and 340 mètres (length) of the southern pier were greatly damaged by shattering and (in part) carrying away of the béton blocks; and, experience proving their resistance inadequate, the Dutch parliament proposes (Dec., 1874) to apply 3,340,000 guilders to reinforcing externally these piers with huge concrete blocks.

Mouths of great rivers not only constitute, in many cases, natural harbors, but seaports of cities, the marts of commerce for the products of the tributary territory. These mouths are most commonly obstructed by "bars," and offer the most interesting as well as the most difficult engineering problems of harbor improvement. One of the most interesting works of this character is that recently executed in Holland for the navigable communication of Rotterdam with the sea. Naught but a map can exhibit the relations of that city to the remarkable reticulation of fluvial channels by which the waters of the Rhine, the Meuse, and the Scheldt mutually communicate and discharge themselves into the North Sea. The shortest and most natural route is to follow the Nieuwe Maas to its outlet between the Hook of Holland and the island of Voorne; and this channel, formerly much used, becoming deteriorated, ships of modern large dimensions have been compelled of late years, by circuitous channels 60 or more miles in length, to reach the Brouwershaven Inlet. The direct communication, just alluded to, 15 miles in length, the Nieuwe Maas,† is deflected, near its mouth, from its course by the Hook of Holland, and discharges itself over extensive shoals; whereas, the Brouwershaven Inlet has ample depth of water. In former years the "Voorne Canal" had been made in order to reach the Goeree Inlet; but through various causes‡ had ceased to subserve fully its object. Another ship-canal by which to reach the Brouwershaven was projected, but was rejected not only in consequence of (in the language of the Dutch commission) the *admitted inferiority of canal to open river navigation*, but

* On May 20, 1871, these lengths were 651 and 477 mètres respectively; the advance of each pier was 500 mètres, about, in the ensuing nine months, or an average of 27 mètres (90 feet) per month. The year 1873 was very unfavorable, and the mean advance of the N. and S. piers was but 10 and 12 mètres per month.

† The main body of the Rhine River flows by Rotterdam, bearing this name, the ancient arm which, through the Netherlands, alone bears the name of "Rhine," having long since ceased to be an outlet.

‡ The locks were 294 by 46¼ feet: the draught could be made 23 feet, and was considered adequate; but the Goeree Inlet had deficiency of depth on its bar and shoals.

in consequence of the existence of river-shoals in the route, "the removal of which was by no means assured."

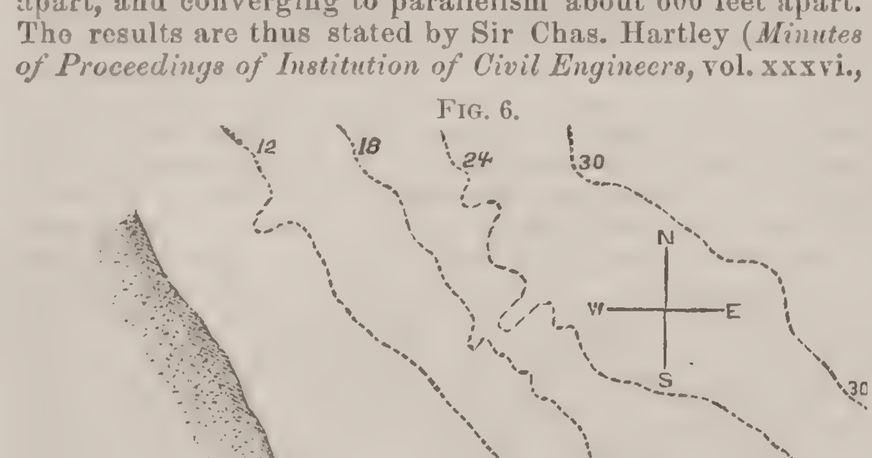
The project finally adopted by the commission, and successfully executed, was to cut a new outlet to the Nieuwe Maas through the Hook of Holland, and to prolong it into deep-sea water by parallel piers (jetties). These two jetties in the North Sea constitute the proper river-mouth, consist of fascine-work with stone, and have a total length of 2800 mètres, the northern pier reaching to 6.50 m. below mean low (8.20 m. below mean high) water,* and the southern one so much shorter that a tide-catching form is given to the entrance. (This latter arrangement, however, is found unsatisfactory, and the southern pier is to be lengthened by 1200 mètres in 1875 and 1876.)

Fig. 5.

These works have proved completely successful, though their ultimate results are not yet fully attained. There are now 18 feet depth (at ordinary high tides), which is constantly increasing. The entire commerce of Rotterdam with the sea now passes this channel, averaging 600 vessels per month. The autumnal storms of 1874 inflicted no serious injury, nor has any been experienced during the prosecution of the work. A report of the second legislative chamber of Holland announces: "the doubts formerly expressed as to the possibility of making piers at sea on our coast are entirely removed by the full success of the works at the Hook of Holland." The engineer, Mr. P. Caland, has been promoted to be "Inspector" of the Waterstaat in recognition of his success. For an account of the work see (by the writer) *Prof. Papers, Corps of Engrs.*, No. 22. The peculiar *construction* will be found described in article JETTY.

A more celebrated instance of the improvement of a river-mouth by the use of "parallel piers" or jetties is that of the Sulina mouth of the Danube. The piers as designed were of "rip-rap" thrown in from a staging of piles, subsequently reinforced and made permanent by covering with large blocks of concrete. As designed, the piers were 5850 and 4310 feet long, starting at points on shore 2500 feet apart, and converging to parallelism about 600 feet apart. The results are thus stated by Sir Chas. Hartley (*Minutes of Proceedings of Institution of Civil Engineers*, vol. xxxvi.,

Fig. 6.



Sulina Mouth of the Danube.

pp. 208, 209): 1. That when the European commission of the Danube began its labors in 1856, the entrance to the Sulina branch was a wild, open seaboard stream, with wrecks, the hulls and masts of which, sticking out of submerged sandbanks, gave to mariners the only guide where the deepest channel was to be found. 2. That the depth of channel varied from 7 feet to 11 feet, and was rarely more than 9 feet. . . . 5. That on the completion of the provisional piers (in 1861) the depth on the bar increased to 17 feet, and Sulina, instead of being the worst harbor, at once took the highest rank among the best commercial harbors in the Black Sea. Finally, by prolonging the south pier, consolidating and rendering *permanent* the work at an expense equal to the first cost of the temporary structure, and by other improvements, an effective depth of 20 feet was attained in 1872, and since maintained.

The Danube bears a proportion by volume of sediment of $\frac{1}{1723}$, nearly the same as for the Mississippi. The case was cited by the writer (*Ex. Docs.* 113, H. R. p. 98, and No. 220, p. 112, 43d Cong., 1st Sess.), not as a *proof*, but as an example, that to the great river of the West, the Mississippi, instead of abandoning the mouths and resorting to canal—inadequate at best, and of doubtful success—a navigable "open mouth" might be given.*

The subject of "tidal harbors," so important in England, is of slight importance in this country, natural harbors of superabundant depth being superfluously numerous in the limited portions of the North American continent where the range of tide is great; and space will not allow more ample description than has been given of artificial harbor-construction. Of recent and interesting works not described reference may be made to the following: that of Oamara, New Zealand, *Engineering*, Apr. 25, 1873; of Kurrachee, India, *Engineering*, June 6, 1873 (the Manora breakwater, which belongs to it, is described in art. BREAKWATER); Holyhead, *Engineering*, Sept. 26, 1873; Alexandria (new harbor), *Van Nostrand's Eng. Mag.*, Feb., 1873. In *Engineering*, Mar., 1873, will be found a novel project for an "island harbor" at Boulogne, by Col. A. Clarke, Royal Engineers. J. G. BARNARD.

Harbors of American Lakes. The great lakes of North America—viz. Lakes Superior, Michigan, Huron, Erie, and Ontario—discharging their waters into the Atlantic by the St. Lawrence River, constitute one of the most important features in the geography of the continent, and the one which has been predominant in the development of the great grain-producing section of the U. S. Navigated from the earliest discovery of the country, they now bear a commerce which rivals that of the ocean. Owing to their great size, navigation on them is almost as dangerous as on the high seas,† rendering good harbors as necessary as on the sea-coast. There is on these lakes a great deficiency of natural harbors, especially in those portions where the principal cities have been located, and where harbors are most needed for the purposes of commerce. The principal natural harbors are formed by islands, by indentations in the coast, or by the straits connecting the great lakes; but, with the exception of Detroit, there is no port of importance which possesses a harbor that is not to a great extent artificial.

The watershed of these lakes is comparatively small, and we find no large streams emptying into them. Proceeding but a short distance from the shores, the drainage on the N. is into Hudson's Bay, on the W. into the Mississippi River, and on the S. into the Ohio, Susquehanna, and Delaware rivers. Most of the cities and towns are located at the mouths of small streams, which would naturally be selected in early times when vessels of light draft were used. These are generally so insignificant that the discharge, except in times of freshets, is insufficient to maintain an adequate navigable channel over their bars, and for many years the commerce at large cities, like Chicago and Milwaukee, was carried on at open piers built out into the lake on piles. During storms, vessels were obliged to anchor in the lake where the bottom was favorable for the purpose. Such a state of things could not meet the increasing demands of commerce, and attention was directed to making harbors of the streams by works at the mouths, and dredging to obtain the requisite width and depth.

The principal port on the lakes is Chicago, Ill., where the annual number of arrivals and departures of vessels is about 25,000, with a tonnage of over 6,000,000. The Chicago River, as it is called, was originally an insignificant stream, with but a few feet of water on the bar, and wholly unsuited for commercial purposes. The stream has two

* In the article which follows (by Col. Houston, U. S. Engs.) will be found some theoretical considerations concerning the effect of jetties at river-mouths.

† The wave-violence is very great. Mr. D. Stevenson (*Engineering of North America*) describes the harbors on Lake Erie as reminding him of those of the British Isles, and mentions having seen a stone weighing more than half a ton which had been torn from its bed in the pier at Buffalo, moved several feet, and overturned.

branches—one running N., and the other S. These branches join and form the main stream, running E. a distance of about 1 mile to the lake. Most of the harbor improvements on the lakes are of the same general character as those at Chicago; and they consist in widening and deepening the channel out to the deep water of the lake, and in revetting the sides of the excavated channel. It is generally found that immediately inside of the mouth these streams have considerable depth, but this is separated from the deep water of the lake by what is known as the bar. This is composed generally of sand or shingle. The existence of bars is sometimes ascribed to the deposit of sediment brought down by rivers, but this is not the case with bars at the mouths of rivers emptying into the lakes, as far as the writer's observation has extended. The streams are generally free from sedimentary matter, and when, as in some instances, they hold such matter in suspension, it is not found on the bar, but is diffused by the action of the waves. The idea of these bars can best be formed by imagining a new stream suddenly finding an outlet into the lake. If we suppose a stream suddenly projected into the lake in a direction perpendicular to the coast when the latter is straight, it is evident that a direct channel will be excavated by the current. It is also evident that immediately after the current passes the line of the shore its force will be diminished as it meets the resistance of the water of the lake and spreads out, so that the depth of the channel produced by it will diminish from the shore outward. The consequence is, that there will be a bank of sand or shingle extending from shore to shore in a semicircular form, which is called the "bar." This supposes the lake to be without storms or currents. The bar, therefore, is not caused by the river, but is the material composing the natural bottom of the lake or sea which the river-current in its diminished force is unable to disturb.

The depth and width of the channel over the bar depend on the strength of the current. This bar, however, is subject to various modifications in form and extent by the action of the lake storms and currents, especially in the case of streams where the depth on the bar is small. The effect of waves is to stir up to a certain limited depth the material on the bottom, and this material, being held temporarily in suspension, is moved about by the current.

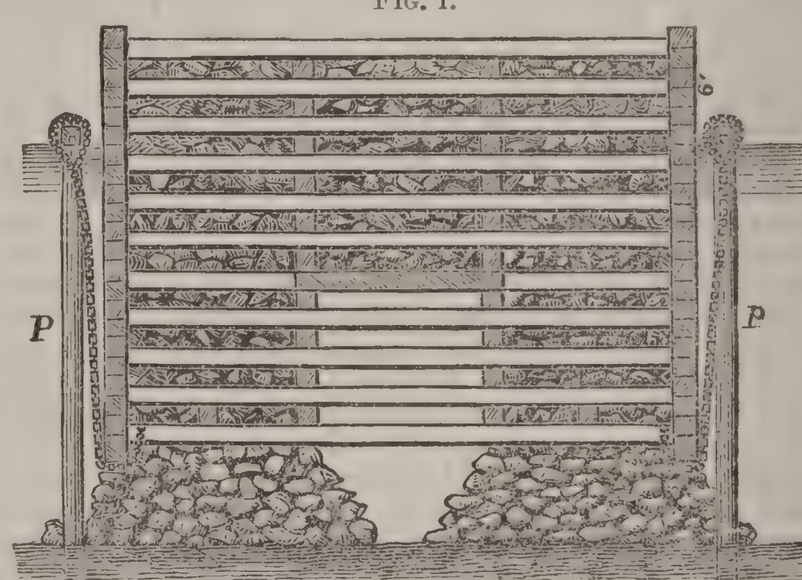
The southern portion of the W. side of Lake Michigan is a good example of the effects of waves and currents. The principal storms affecting this portion of the lake are from the N. E. The waves constantly strike the shore at an angle of about 45°, and produce a strong littoral current in a southerly direction. The material on or near the shore out to a varying depth, according to the height of the waves, is stirred up and moved to the S. When it meets the mouth of a stream, it is carried out and deposited on the N. side of the channel, so that the channel of the river is forced to the S. As stated above, the discharge from these streams is small, and insufficient to maintain a channel suited for navigation. What natural channels do exist are crooked and changing by the action of storms. It is evident from the foregoing that if a channel were dredged through the bar, it would speedily fill up unless some means were taken to prevent it. This is done by revetting the banks of the channel, and extending the revetment out to a depth of water beyond which the waves will not disturb the bottom. This depth may be practically assumed at from 18 to 24 feet in Lake Michigan. The class of harbor improvements which we are considering may be stated, then, to consist in making a channel of proper width and depth from the deep water of the great lake to the deep water of the river, lake, or artificial basin inside, and the construction of works for the maintenance of this channel. This is generally the ultimate plan of these improvements, but in their progress we may so place our works as to get the benefit of the river-current in making a better channel, especially during freshets.

In making the channel through the bar we are to consider, *first*, its width and depth; *second*, its direction; *third*, the character of the works for its maintenance. Its width should be, in the first place, sufficient to allow a free discharge of the river-water during freshets; and, secondly, to accommodate the necessities of commerce. The direction given to the channel has generally been perpendicular to the shore, and this is perhaps the best, except in special cases. The works executed for the protection of the channel are generally parallel piers extending from the shore at a distance apart equal to the width of the channel. The piers and breakwaters in the lakes are constructed either of cribs of timber and iron filled with stone, or of pile-work. The details of these methods of construction are too well known to require description here. But it should be remarked that they are in a certain sense temporary structures, requiring frequent repairs.

The work under water, if put together so as to resist the forces to which it is subjected, may be considered permanent, as timber under fresh water will last indefinitely. Above water the timber-work will last from ten to fifteen years, when it must be renewed. This portion of the work, known as the "superstructure," may be replaced by masonry when substantial cribs are used. It is impossible, except under the most favorable circumstances, to make cribs remain in their places on the ordinary lake-bottom without preparing a substantial foundation of loose stone. The bottom is generally clay overlaid with a stratum of sand of varying thickness. If a storm occurs after the crib is placed, it has the effect of washing out the sand underneath the crib, causing the latter to tip over, and in some instances to move it bodily from its place. In order to remedy this difficulty, a trench is sometimes excavated to make a bed for the crib, but this is an expensive and uncertain process. The frequent recurrence of storms causes the trench to fill up, in whole or part, before the crib can be placed, causing either delays in the work or an uneven bottom for the crib to rest on. Another remedy which has been adopted is to make the bottom of the crib a grillage of timber, with openings from two to three feet square. These openings are designed to admit stone through them to fill up the space below, and thus form a foundation. This remedy is but partial, and it has happened that severe gales, occurring soon after the crib was placed, have so shaken it up as to cause all the stone-filling to pass through, and the consequent loss of the crib.

It would be an improvement on the present system if the centre part of the crib, dividing it lengthwise into three equal parts, were made with a close bottom, and partitions put in to hold the stone over this portion. The object of the grillage would be secured by permitting the stone to pass through next to the sides, while we would have a large immovable mass in the centre, sufficient of itself to hold the crib under ordinary circumstances. This plan has been successfully tried at Chicago. (See Fig. 1.) Six

FIG. 1.



double or pairs of piles P P are driven on each side of the site of the crib. The piles are capped with a stick of oak timber running the whole length of the crib. The crib is built in three compartments by partitions running lengthwise. The middle compartment has a close bottom, about thirteen courses below the top. The outer compartments have entirely open bottoms, or may have a single longitudinal stick, as shown in the drawing. Chains are attached to the lower cross-timbers of the crib, three on each side. The chains are made of sufficient length to enable them to be securely fastened to the oak timber between each pair of piles when the crib is lowered to its required position. The piles having been driven and capped, and the crib framed, the latter is lowered to its position and weighed down with stone until its bottom is (say) four feet above the bottom of the lake. The chains are then secured to the oak timbers in the manner described. The filling then proceeds, care being taken not to put too much stone in the middle compartment, to bring too great a strain on the chains until the outer compartments are filled. These outer compartments, having open bottoms, allow the stone to pass through freely. Foundations are thus formed on which the crib rests. In case of any undermining the stone passes down without taking the crib with it, and thus prevents any displacement or settlement of the crib. The stone in the middle compartment, which has a close bottom, does not move, and is sufficient to secure the crib in its place in case of storms, and prevents the possibility of the crib rising by the sifting of the stone through the grillage bottom, as has sometimes occurred. It is considered that the bottom of this middle compartment may be nearer to the top of the crib. It is believed that the Holland method of combining fascines and stone for such struc-

tures (described by Gen. Barnard, *Prof. Papers, Corps of Eng's.*, No. 22) might be advantageously used on the lakes.

As commerce increases it is found that in many cases the streams do not afford all the harbor facilities needed. The Chicago River is not generally more than 200 feet wide, and in many places less. This has led to the construction of breakwaters in the lake parallel to the shore, so as to make a safe anchorage for vessels inside the breakwater, and to permit the construction of wharves on the lake-shore. Examples of these are found at Chicago, Buffalo, Dunkirk, and Oswego. Harbors formed in this way afford ample space and depth of water, whereas in constructing harbors of streams passing through large cities dredging must be constantly resorted to, collisions are frequent, and the public is put to expense and inconvenience by the use of drawbridges. A "harbor of refuge" is now in process of construction at Sand Beach on the W. coast of Lake Huron, consisting of a breakwater parallel to the shore, and connected with the latter at its northern end by a pier.

There are two essential differences in the problem of harbor improvements on the lakes and on the sea-shore. First, the fresh water of the lakes, which permits the use of timber for permanent work under water; second, the absence of the tides. The lake surface, however, is in a constant state of oscillation, due to various causes, of such extent and frequency as to give to the lower portions of the streams emptying into them the character of tidal rivers. These oscillations are sometimes as great as three feet, but they are irregular as to extent and time of occurrence. They frequently take place several times a day, causing an alternate ebb and flood current at the river-mouth much in excess of the volume due to the discharge proper of the river. An oscillation of a foot is quite frequent. When we find, as is frequently the case, small lakes or "lagoons" separated from the great lakes only by narrow strips of sand, the outlet of these lakes is maintained by this ebb and flow, as on the sea-shore.

Among the natural harbors on the lakes are—on Lake Ontario, Sackett's harbor and Toronto harbor; on Lake Erie, the bay formed by Long-Tailed Point and the roadsteads formed by the islands at its western end; on Lake Huron, Ottawa Bay, Thunder Bay, Middle Island, False Presque Isle, Hammond's Bay, the mouth of the St. Mary's River, the Duck Islands, and Michael Bay; on Lake Michigan, which is entirely destitute of natural harbors except at its northern end, the Porte des Morts, Grand Traverse Bay, and the roadsteads formed by the Beaver and Manitou groups of islands; on Lake Superior, Grand Island, L'Anse, and Bayfield harbors. There are about seventy harbors on the great lakes, wholly or in part artificial, and examinations have been made at many other points for the purpose of making plans and estimates for improvements. The multiplicity of these harbors tends directly to the safety of navigation. These improvements have nearly all been conducted under the supervision of the corps of engineers of the U. S. army. It is only, however, since the year 1865 that Congress has made large and continuous appropriations for this purpose, and these have not been commensurate with the necessities of commerce. There is no branch of the public service in which the benefits to the public are more evident than in that of river and harbor improvement, by which commerce is fostered, transportation cheapened, and a great saving in life and property secured. D. C. HOUSTON.

Har'bor Brit'on, a port of entry, cap. of Fortune Bay district, Newfoundland, has a fine and beautiful harbor. It has a jail. Pop. 360.

Har'bor Creek, tp. and post-v. of Erie co., Pa., on Lake Erie and the Lake Shore R. R., 1 mile E. of Erie. Pop. 1974.

Har'bor Grace, next to St. John's the most important town of Newfoundland, is the capital of Harbor Grace district. Lat. 47° 41′ 28″ N., lon. 53° 12′ 33″ W. Its harbor is large, and the inner port is very secure. Harbor Grace has a court-house, jail, and a fine cathedral. It is the seat of a Roman Catholic bishop. Has an extensive trade, 1 weekly newspaper, a government savings bank, a fire company, gasworks, a water-supply, a convent, schools, literary institute, and various benevolent societies. Pop. 6770.

Har'bor Main, the capital of Harbor Main district, Newfoundland, is a fishing-town at the head of Conception Bay. It has a convent and Roman Catholic school. P. 670.

Har'burg, town of Hanover, on the southern branch of the Elbe, 4 miles S. of Hamburg. It has large tanneries and extensive manufactures of woollens and linens, and its transit trade with Hamburg is of importance. Pop. 16,506.

Har'by (ISAAC), the grandson of a Moorish Jew, was b. at Charleston, S. C., in 1788. He was editor of various journals, and the author of several plays and numerous essays, orations, and critiques. D. in New York Nov. 14, 1828. A sketch of his life, with selections from his writings, by H. L. Pinckney and A. Moise, was published in 1829.

Har'court (Sir WILLIAM GEORGE GRANVILLE VENABLES VERNON), LL.D., Q. C., known as SIR VERNON HARCOURT, b. Oct. 14, 1827; graduated M. A. at Trinity College, Cambridge, with high distinction; came to the bar 1854; became Q. C. 1866; professor of international law at Cambridge 1869; knight bachelor 1873; solicitor-general 1873–74; entered Parliament for Oxford city 1868. Author of pamphlets and papers in the *Saturday Review* and London *Times*, signed "Historicus," etc.

Har'dee (WILLIAM J.), b. in Georgia about 1819; graduated at West Point 1838, and appointed a second lieutenant of dragoons; promoted to be first lieutenant 1839, and captain 1844. For gallant conduct in the Mexican war he was brevetted major and lieutenant-colonel. In 1855 he was promoted to be major 2d Cavalry, and in 1856 was appointed commandant of cadets at West Point, with local rank of lieutenant-colonel, performing at the same time the duties of instructor in cavalry, infantry, and artillery tactics. Promoted to be lieutenant-colonel of cavalry in 1860, he resigned his commission Jan. 31, 1861, and joined the Confederate cause, being appointed a brigadier-general C. S. A. the following June. For bravery at the battle of Shiloh he was promoted to be major-general, and placed in command of a division in Gen. Bragg's army. At the battle of Chaplin's Hills (Perryville) he commanded the left wing of Bragg's army, and was promoted for gallantry to the rank of lieutenant-general. He also took part in the battle of Murfreesboro'. After the fall of Vicksburg he commanded a camp of paroled prisoners in Alabama. Engaged at battle of Chattanooga Nov. 23–25, 1863, and subsequent operations, up to and including siege and fall of Atlanta, when he was transferred to the command at Savannah, Ga., which place he evacuated Dec. 20, 1864, as he did Charleston Feb. 17, 1865, finally surrendering with Johnston's army at Durham Station, N. C., Apr. 26, 1865. Author of *Hardee's Tactics*, adopted for use in the U. S. army and for the militia. D. at Wytheville, Va., Nov. 6, 1873.

Har'deman, county in the S. W. of Tennessee. Area, 644 sq. m. It is traversed by the Big Hatchie River and the Mobile and Ohio R. R. It is very fertile. Cattle, maize, and cotton are staple products. Cap. Bolivar. Pop. 18,074.

Hardeman, an unorganized county in the N. W. of Texas. Area, 1650 square miles. It has steep ridges, and is adapted to pasturage rather than agriculture.

Hardeman (THOMAS, JR.), b. in Eatonton, Putnam co., Ga., Jan. 12, 1825; was member of Congress from Georgia 1859–61; resigned on the passage by his State of the ordinance of secession, and energetically supported the Confederate cause; has been often a member of the State legislature, and repeatedly Speaker of the house. A. H. STEPHENS.

Har'den (JOHN MCPHERSON BERRIEN), M. D., b. in 1810; d. near Tallahassee, Fla., Feb. 16, 1848. He graduated M. D. at the University of Pennsylvania, and practised his profession in Liberty co., Ga. His contributions to the *American Journal of the Medical Sciences* and the *Southern Medical and Surgical Journal*, especially his researches on isopathia or the parallelism of diseases, stamped him an indefatigable student and one of decided ability. He sank into an early grave from consumption. PAUL F. EVE.

Har'denburg, post-tp. of Ulster co., N. Y., in a wild, mountainous region. Pop. 628.

Har'derwyk, or **Harderwijk,** town of the Netherlands, in the province of Geldern, on the Zuyder-Zee. It is much engaged in herring fishing. Pop. 6586.

Hardicanute (*Harthacnut*), king of England, was a son of Canute by Emma, widow of Ethelred II.; was chosen king of the West Saxons in 1035, while Harold, his reputed half-brother, ruled the rest of England. In 1036 he became king of Denmark, where he was already viceroy; was deposed as king of Wessex 1037, "because he was too long in Denmark;" made preparations for invading England, when he heard of Harold's death; was unanimously chosen king of England at the Witenagemote. Hardicanute's reign was short, but stained with dreadful crimes. D. at Lambeth June 8, 1042.

Har'die (JAMES ALLEN), b. in the city of New York May 5, 1823; graduated from the U. S. Military Academy July 1, 1843, entering the army in the artillery service; served as assistant professor at West Point, and as company officer in garrison, frontier, and Indian service till 1861, being, during a portion of the time, aide-de-camp to Gen. Wool. Served during the civil war as aide-de-camp to Maj.-Gen. McClellan during his campaigns with the Army of the Potomac, before Richmond, in the Maryland campaign, etc.; on the staff of Maj.-Gen. Burnside in the Rappahannock campaign; judge-advocate-general of the Army

of the Potomac, staff of Maj.-Gen. Hooker; brigadier-general of volunteers Nov. 29, 1862; appointed assistant adjutant-general (rank of major) Feb. 19, 1863; assigned to special duty in the war department till 1866; assistant to Mr. Secretary Stanton until he vacated office; thereafter with Gens. Grant, Schofield, and Rawlins, as acting secretary of war; appointed inspector-general (rank of colonel) Mar. 24, 1834; brevet brigadier-general and brevet-major-general U. S. A. Mar. 13, 1865; in 1866 senior member of commission to inspect the ordnance and ordnance stores in forts and arsenals of the U. S., with reference to the disposition of munitions, the accumulation of the war; commissioner to audit the military claims of Kansas, Montana, Dakota, California and Oregon. Writer of various contributions to the press; author of numerous military reports. G. C. SIMMONS.

Har'din, county of Illinois, bounded on the E. and S. by the Ohio River. Area, 200 square miles. It has a fertile soil, and grain is the leading product. Coal is found in the N. E. part. Cap. Elizabethtown. Pop. 5113.

Hardin, county of N. E. Central Iowa. Area, 576 square miles. It is a rolling prairie, with fertile soil. Grain is the chief product. There are important coal-mines. It is traversed by the Iowa Central and the Dubuque and Sioux City R. Rs. Cap. Eldora. Pop. 13,684.

Hardin, county of N. W. Central Kentucky. Area, 500 square miles. Its surface is diversified, with a productive soil. Cattle, grain, tobacco, and wool are leading products. It is traversed by the Louisville and Nashville R. R. Cap. Elizabethtown. Pop. 15,705.

Hardin, county of N. W. Central Ohio. Area, 476 square miles. It is level and fertile, but some parts are marshy. Cattle, grain, wool, and lumber are leading products. The county is traversed by the Cincinnati Sandusky and Cleveland and other R. Rs. Cap. Kenton. P. 18,714.

Hardin, county of Tennessee, bounded on the S. by Mississippi and Alabama. Area, 650 square miles. It is divided by the navigable Tennessee River. Iron ore is found. The soil is fertile. Cattle, wool, corn, and cotton are staple products. Cap. Savannah. Pop. 11,768.

Hardin, county in the S. E. of Texas, bounded on the E. by the Neches River. It is well watered, and heavily timbered with pine. Some cotton, rice, and tobacco is produced. Area, 1832 sq. m. Cap. Hardin. Pop. 1460.

Hardin, tp. of Conway co., Ark. Pop. 730.

Hardin, post-v. and tp., cap. of Calhoun co., Ill., on the Illinois River, 50 miles N. of St. Louis. It has a church, a school, 2 weekly newspapers, 3 hotels, a mill, and a machine-shop. It is a good shipping-point. Pop. of tp. 650.

ALBERT G. ANSELL, ED. "CALHOUN CO. DEMOCRAT."

Hardin, tp. of Pike co., Ill. Pop. 1468.

Hardin, tp. of Greene co., Ia. Pop. 195.

Hardin, tp. of Hardin co., Ia. Pop. 2013.

Hardin, tp. of Johnson co., Ia. Pop. 737.

Hardin, tp. of Webster co., Ia. Pop. 432.

Hardin, tp. of Clinton co., Mo. Pop. 1925.

Hardin, post-v. of Shelby co., O. Pop. 87.

Hardin, post-v., cap. of Hardin co., Tex., 78 miles E. N. E. of Houston.

Hardin (JOHN), b. in Fauquier co., Va., Oct. 1, 1753; served as lieutenant in the Revolutionary war in Morgan's rifle corps, and as lieutenant-colonel of Kentucky militia commanded detachment under Gen. Harmar in his fight with the Miami Indians in 1790; commanded advance of a successful expedition in 1791 against the Indians on the Wabash; served under Gen. Wilkinson in Ohio, and was killed (1792) by Indians while advancing under a flag of truce.

Hardin (JOHN J.), son of Major M. D. Hardin, b. at Frankfort, Ky., in 1810; educated at Transylvania University; studied and practised law at Jacksonville, Ill.; member of the Illinois State legislature 1836–42, and representative in Congress 1843–45; in the war with Mexico he served as colonel of the 1st Ill. Vols., which regiment he led at Buena Vista, where, on the second day, while heading a charge, he was killed, Feb. 23, 1847.

Hardin (MARTIN D.), a son of Col. John Hardin (1753–92), a famous Indian fighter and Revolutionary patriot of Virginia and Kentucky. The younger Hardin was b. June 21, 1780, in Western Pennsylvania; settled with his father in Kentucky in 1786; became a lawyer; was secretary of State for Kentucky 1812; served with distinction under Harrison as major in that year; was U. S. Senator 1816–17. Author of a vol. of legal reports, 1810. Was a lawyer of great ability. D. in Franklin co., Ky., Oct. 8, 1823.

Har'ding, tp. of Pottawattomie co., Ia. Pop. 122.

Harding (CHESTER), b. in Conway, Mass., Sept. 1, 1793; d. in Boston Apr. 1, 1866; began his art-life as a sign-painter; had his enthusiasm for higher art awakened by a man of no repute, who painted likenesses of himself and his wife. Without instruction or encouragement, he took up the profession, painted a hundred portraits in six months at $25 each; went to Philadelphia to study; thence to St. Louis, where he resided for some years; then established himself in Boston and became at once the fashion. In 1823, Harding went to Liverpool, and remained abroad three years, studying and painting. The dukes of Sussex, Hamilton, and Norfolk, the historian Alison, and the poet Rogers sat to him. On his return home success awaited him. Among the eminent persons who sat to him were Daniel Webster, Madison, Monroe, J. Q. Adams, Chief-Justice Marshall, Henry Clay, and J. C. Calhoun. Mr. Harding was a tall, robust man, of frank, social disposition and genial manners. His presence was very attractive, and his company delightful. To his personal qualities he probably owed much of his extraordinary popularity, for, though sometimes excellent as likenesses, his portraits lacked the accuracy of drawing and the color that distinguish the best works of art. O. B. FROTHINGHAM.

Har'dinge (CHARLES STEWART), second viscount, b. Sept. 12, 1822; studied at Eton and Christ Church, Oxford; B. A. 1844; served in the Sikh wars, and as secretary to his father in India; in Parliament for Downpatrick 1851–56; succeeded to the peerage 1856; under-secretary of state for war 1858–59. Author of *Views in India* (1847), a costly work, illustrated by himself.

Hardinge (HENRY), VISCOUNT, b. at Wrotham, Kent, Eng., Mar. 30, 1785; entered the army 1798; made lieutenant 1802, captain 1804; served in the Peninsula 1808–14; deputy quartermaster-general 1809–13; wounded at Vimeira, Vittoria, and Ligny, where he lost an arm while commanding a German brigade; K. C. B. 1815; entered Parliament for Durham 1820; married a daughter of Lord Castlereagh 1821; privy councillor, secretary at war 1828; chief secretary for Ireland 1830, 1834–35, and 1841–44; governor-general of India 1844–48, and performed the duties of that office with ability. In 1845 he gained a victory over the Sikhs at Ferozeshah, and fought in that bloody campaign, chiefly as a volunteer under Gough. In 1846 he was made Viscount Hardinge; master-general of ordnance 1852; commander-in-chief 1852; field-marshal 1855. D. at Southport Sept. 24, 1856.

Har'dinsburg, post-v. of Washington co., Ind. P. 199.

Hardinsburg, post-v., county-seat of Breckenridge co., Ky., 120 miles S. W. of Frankfort, has a seminary and several public buildings. Pop. 455.

Har'dinsville, a v. of Shelby co., Ky. Pop. 88.

Hard'ness, Scale of. In comparing the hardness of minerals, the mineralogist uses an arbitrary scale composed of ten minerals, representing from one to ten gradually increasing degrees of hardness. The minerals generally selected, and forming what is known as "Moh's scale," are—1, talc; 2, gypsum (we prefer rock-salt); 3, calcite; 4, fluorite; 5, apatite; 6, feldspar; 7, quartz; 8, topaz; 9, corundum; 10, diamond. Transparent crystalline varieties are chosen. A simple scale may be extemporized by use of the thumb-nail, of an old-fashioned copper-coin (which exactly equals No. 3), of a piece of glass, and of a hard steel file, which will give approximately all the degrees below 8. By a little practice, however, the student will learn to readily recognize the degrees below 8 by simply passing the file over the mineral and noting the resulting sound. EDWARD C. H. DAY.

Hardouin (JEAN), b. at Quimper, in Brittany, 1646; was appointed in 1683 librarian of the Collége Louis-le-Grande; devoted himself to the study of Greek and Latin, philosophy, theology, and numismatology. He maintained in his *Chronologia ex nummis antiquis restituta* (1697), and in his *Prolegomena ad Censuram veterum Scriptorum*, that the works ascribed to the Greek and Latin authors, with the exception of Cicero, Pliny the Elder, the *Georgics* of Virgil, and the *Satires* and *Epistles* of Horace, were the productions of the monks of the thirteenth century, and that most of the so-called ancient coins were of recent origin. Virgil's *Æneid* he considered an allegorical representation of St. Peter's journey to Rome. He also disputed the genuineness of the proceedings of the Church councils before that of Trent. Hardouin was one of the editors of the *Scriptores Latini in usum Delphini*, for which collection he prepared, with valuable notes and a copious index, *Plinii Historia Naturalis* (Paris, 1685, 5 vols. 4to; reissued 1723, 3 vols. fol.). He also published a *Conciliorum Collectio* (12 vols. fol., Paris, 1715), which was suppressed by authority of Parliament. D. Sept. 3, 1729. H. DRISLER.

Hard'ware, a term applied to those articles of common use made of iron, copper, brass, or bronze. A general assortment of hardware comprises an almost infinite variety of articles manufactured wholly or in part from the metals or alloys named above. For the convenience of both dealers and customers, this assortment is divided into several classes, and the wholesale dealers or jobbers usually confine themselves to a single class. Thus, *builders' hardware* includes locks, keys, bolts of all sorts, door and other knobs, hinges, springs, latches, hooks, staples, window-fasteners, window-weights, spikes, nails, brads, tacks, clothes-hooks, screws, nuts, anchors (for fastening brick walls), and perhaps also crowbars and jackscrews. *Carpenters'* or *joiners' hardware* includes not only all descriptions of carpenters' tools, a great variety of saws, planes, bitts and bitt-stocks, augers, gimlets, chisels, mortising tools, screwdrivers, hammers, hatchets, adzes, broad-axes, etc., but also the smaller articles, nails, screws, locks, and the like of builders' hardware. *Housekeepers' hardware* is a still larger department, embracing every kitchen utensil either wholly or in part of iron, steel, copper, brass, bronze, or block-tin, and, as generally construed, all articles of table cutlery and every description of tinned or galvanized-iron ware. It is often also made to include plated goods for household use, and many wooden articles, such as pails, tubs, boxes, etc., more appropriately belonging to wooden-ware, as well as the cheaper forms of glass-and-metal wares for domestic use, such as cans for fruit, preserve-jars, etc. An ordinary stock of housekeeping hardware may include as many as 10,000 different articles.

These are the principal divisions, but there are others of considerable importance in large cities, such as *saddlers', harness and trunk makers' hardware*, which comprises a considerable number of items; *miners' and contractors' hardware*, including picks, crowbars, spades, shovels, etc.; *machinists' hardware*, including those descriptions used by stove, range, heater, furnace, and boiler makers, plumbers and gasfitters, tinsmiths, etc.; *stationers' hardware*, including copying-presses, cash-boxes, fine cutlery, ink-standishes, match-safes, cigar-holders, etc.; *car-builders' hardware*, which includes all the metallic fixtures of a railway car; *furniture and house-furnishing hardware*, a large department of the business; and, finally, *fancy and toy hardware*, which includes a great variety of fanciful goods belonging rather to the realm of luxury than of mere utility. Many of these articles are treated under their specific names, but the general term, *hardware*, applying to them all, is too important to be overlooked. The amount of goods appropriately belonging to this title produced in a year is enormous: in 1871 the amount reported to the British government from the great hardware marts exceeded £12,000,000 = $60,000,000. In the U. S. in 1870, according to the census, the different branches of the hardware trade produced $142,836,272. L. P. BROCKETT.

Hard'wick, post-tp. of Worcester co., Mass., 75 miles W. of Boston, on the Ware River R. R. It is hilly, but fertile, and has abundant water-power and manufactures of paper and woollen goods. Pop. 2219.

Hardwick, post-tp. of Warren co., N. J. Pop. 638.

Hardwick, post-tp. of Caledonia co., Vt., 24 miles N. E. of Montpelier, is on the Portland and Ogdensburg R. R. It has an academy, 3 churches, and manufactures of sash, doors, blinds, furniture, woollens, carriages, leather, and other goods. Pop. 1519.

Hardwick (CHARLES), b. at Slingsby, Yorkshire, Sept. 22, 1821; lost his life by a fall in climbing the Pyrenees Aug. 19, 1859, and was buried in the Protestant cemetery of Luchon. Apparently of humble parentage, he made his way at the University of Cambridge by his talents and industry. In 1853 he was appointed professor of divinity in Queen's College, Birmingham, and in 1855 lecturer on divinity in King's College, Cambridge. He had been ordained deacon in 1846 and priest in 1847, and only a few months before his untimely death was made archdeacon of Ely. His scholarship was both broad and accurate, and he was a versatile and rapid worker. He published other books, but his fame will rest on these four: *History of the Articles of Religion* (1851; 2d ed. 1859), *History of the Middle Age of the Church* (1853), *History of the Reformation* (1856), *Christ and Other Masters* (in 4 parts, 1855–58; 3d ed. by Francis Procter, 1874). R. D. HITCHCOCK.

Hard'wicke, EARLS OF. (1) PHILIP **Yorke,** b. at Dover, Eng., Dec. 1, 1690; was a merchant's son; called to the bar at the Middle Temple 1715; M. P. for Lewes 1719; became solicitor-general 1720; was attorney-general 1723–33; lord chief-justice 1733–37; Baron Hardwicke 1733; lord high chancellor 1737–56; Viscount Royston and earl of Hardwicke 1754. D. in London Mar. 6, 1764. He was one of the ablest jurists that ever occupied the woolsack. (2) PHILIP, second earl, b. Dec. 9, 1720; was educated at Cambridge, where he took the doctorate of laws, and in 1762 became chancellor of the university. D. May 16, 1790; contributed to *Athenian Letters* (1741–43). His other principal works are *Miscellaneous State Papers* and *Walpoliana*. (3) CHARLES PHILIP, fifth earl, b. Apr. 23, 1836; succeeded to the peerage 1873.

Har'dy, county of West Virginia, bounded on the S. E. by Virginia. It is a fertile and romantic mountain-region, with broad and rich valleys. Grain and live-stock are leading products. Coal and iron are found. Area, about 480 square miles. Cap. Moorefield. Pop. 5518.

Hardy, tp. of Holmes co., O. Pop. 2857.

Hardy, tp. of Isle of Wight co., Va. Pop. 3171.

Hardy, tp. of Logan co., W. Va. Pop. 1472.

Hardy (JAMES WARD), a minister of the Methodist Episcopal Church, South, b. in Georgia Jan. 19, 1815; d. in Alabama Aug. 14, 1853: graduated with distinction at Randolph-Macon College, Va., in 1837, and was elected in 1838 to the chair of natural science in that institution. He was several years a professor of mathematics, and afterward president of La Grange College, Ala. He was a profound scholar and an eloquent preacher. T. O. SUMMERS.

Hardy (ROBERT SPENCE), b. at Preston, Lancashire, England, July 1, 1803; joined the Wesleyan conference in 1825, and went as missionary to Ceylon, laboring there for twenty-three years, and then returning to England. *The British Government and the Idolatry of Ceylon* (1841), *Eastern Monachism* (1850), *A Manual of Buddhism in its Modern Developments, translated from Singhalese MSS.* (1853), *Legends and Theories of the Buddhists compared with History and Science* (1867), were published by him. D. at Headingly, Yorkshire, Apr. 16, 1868. His writings have thrown much light upon Booddhism, and he was regarded as one of the best of recent Pali scholars.

Hardy (Sir THOMAS DUFFUS), D. C. L., b. in 1804 at Port Royal, Jamaica; became in 1819 a clerk in the Tower of London, and in 1861 deputy keeper of the public records; won great distinction by his editions of ancient MSS., old public records, and rolls, catalogues of state papers, a *Life* of Lord Langdale (1852), and other works of much historical value.

Har'dyston, tp. of Sussex co., N. J. Pop. 1668.

Har'dyville, post-v. of Mohave co., Ar., on the E. bank of the Colorado River, above Mohave City. Pop. 20.

Hardyville, post-v. of Hart co., Ky. Pop. 68.

Hare, a name properly belonging to those rodent mammals of the family Leporidæ which are in the main solitary in their habits, and which construct forms or nests upon the surface of the ground, but do not have burrows; for the social and burrowing Leporidæ are rabbits. According to this distinction, it is probable that there are no true rabbits in America, except the descendants of those brought from Europe. Our wild rabbits are therefore hares. With the exception of the calling hares (*Lagomys*, of which genus the U. S. have one species, the little chief hare, *L. princeps* of the Rocky Mountains), the hares and rabbits are all of the genus *Lepus*. Of more than forty known species, nearly half are North American. The more important are the common gray rabbit (*L. sylvaticus*), so extensively taken as food by traps, snares, and firearms; the great white hare (*L. Americanus*); the jackass rabbits (*L. callotis* and *Texanus*) of the Far West; Baird's hare (*L. Bairdii*), remarkable from the fact that the males as well as females give milk and suckle their young; and the water-hares of the South (*L. palustris* and *aquaticus*), both good swimmers and inhabitants of swamps. The most common of the European hares is the *L. timidus*, so extensively coursed by greyhounds and pursued by harriers and beagles. The hares have been considered partial ruminants; but it is stated by good authorities that the apparent rumination is performed for the purpose of grinding down the teeth and fitting them for gnawing. Their progression is by a series of leaps. Most of them are very swift, their only defence from enemies being in escape. It having been discovered in France that the European hare and rabbit breed freely together, and that the hybrid offspring, called *leporides*, are unusually good for the table, quite an industry in the breeding of them is reported to have sprung up.

Hare (AUGUSTUS JULIUS CHARLES), b. at Rome Mar. 13, 1834. Author of *Epitaphs for Country Churchyards* (1856); *Winter at Mentone* (1862); *Walks in Rome* (1871); *Memorials of a Quiet Life* (1872), which relate to the Hare family; *Wanderings in Spain* (1873); *Days near Rome* (2 vols., 1874).

Hare (EDWARD), b. at Hull in 1774; served in the British navy, and entered the Wesleyan ministry in 1798. D. in 1818. *A Treatise on the Scriptural Doctrine of Justi-*

fication (1839) and *Sermons* (the latter from his MSS., with his memoir, written by Joseph Benson) were his productions.

Hare (George Emlen), D. D., LL.D., b. at Philadelphia Sept. 4, 1808; graduated at Union College 1825; entered the Protestant Episcopal ministry; rector of St. John's, Carlisle, Pa., 1830–34; of Trinity church, Princeton, N. J., 1834–43; became in 1844 rector of St. Matthew's, Philadelphia, and in 1858 professor of biblical learning in the Divinity School, Philadelphia. Author of *Christ to Return;* received the degree of D. D. from Columbia College, of LL.D. from the University of Pennsylvania.

Hare (John Innes Clark), son of Prof. Robert Hare, b. at Philadelphia 1817; became a lawyer; associate judge of the district court of Philadelphia 1851; was afterwards chosen presiding judge of that court; with H. B. Wallace author of *American Leading Cases* (2 vols., 1847), and has ably edited and annotated several important reprints of English law-treatises.

Hare (Julius Charles), M. A., b. at Herstmonceux, Sussex, Eng., 1796; took his master's degree 1819, and a fellowship at Trinity College, Cambridge; became vicar of Herstmonceux 1832, archdeacon of Lewes 1840, a prebendary of Chichester 1851, chaplain to the queen 1853. D. at Herstmonceux Jan. 23, 1855. With his brother, A. W. Hare, wrote *Guesses at Truth* (1827, 1848); with Thirlwall translated Niebuhr's *History of Rome* (1828); author of *Mission of the Comforter* (1846); *Memoir of John Sterling* (1848); *Vindication of Luther* (1854), and other works.—His brother, Augustus William (b. 1793), became a fellow of New College, Oxford; rector of Alton-Barnes 1829. D. at Rome Feb. 18, 1834. Joint author of *Guesses at Truth* (see above); author of *Sermons to a Country Congregation* (2 vols., 1837).

Hare (Robert), A. M., M. D., b. in Philadelphia, Pa., Jan. 17, 1781, was the son of an English brewer, and early turned his attention to scientific experiments. In 1802 he invented the oxyhydrogen blow-pipe, which won for him the Rumford medal of the American Academy. In 1806 he received the degree of M. D. from Yale, *honoris causa*, and from Harvard also in 1816, in which year he brought forward the calorimotor, a form of galvanic battery by which intense heat may be generated. In 1831 he made successful experiments in subaqueous blasting by means of the galvanic current. Among his other inventions are the gallows-screw and several improved processes in chemistry, toxicology, and pharmacy. In 1818 he was called to the chair of chemistry in William and Mary College, and he held the chemical professorship in the University of Pennsylvania from 1818 to 1847. Late in life he became a believer in Spiritualism. He published *Brief Views of the Policy of the U. S.* (1811); *Chemical Apparatus* (1836); *Spiritual Manifestations Scientifically Demonstrated* (1855), and other works, besides an immense number of scientific papers. He was a member of various learned societies. His excellent and ingenious apparatus he gave to the Smithsonian Institution, in which he felt a deep interest. Dr. Hare excelled as an instructor in his favorite sciences. D. at Philadelphia May 15, 1858.

Harebell. See Bluebell.

Har'eld, Old'wife, or **Long-Tailed Duck,** the *Harelda glacialis*, a beautiful wild-duck of the oceanic group, common in both hemispheres. Its summer residence is in the sub-arctic regions, but in winter it flies as far S. as Texas. Its nest is lined with choice down, as good as eider-down. It is a very lively bird, a good diver, and of rapid flight. Its flesh is good.

Hare Lip, a congenital deformity of the human upper lip, characterized by a fissure (rarely median, like that normal in the hare or the cat), usually a little to one side, and more frequently on the left, but sometimes occurring on both sides at once. When simple and uncomplicated with cleft palate (a frequent accompaniment), a simple surgical operation will commonly cure it perfectly, and infancy is the proper time for operation; but the operation for cleft palate (staphyloraphy) should usually be deferred to a maturer age. The fissure itself normally exists in the fœtal state; by arrest of development it remains open after birth. When two fissures exist, it is not unusual to find the incisor segment (intermaxillary bone) of the upper jaw detached from, or rather ununited to, the jaw, and the deformity may amount to a double cleft palate. The rare case of median hare-lip is quite analogous to *spina bifida*, for the intermaxillary bone is the representative of the spinous process of the first cephalic vertebra.

Revised by Willard Parker.

Ha'rem [Arab., a "sanctuary"], a word properly applicable to any sacred place, but in European usage limited entirely to the apartments where Oriental women are kept. A harem does not necessarily include more than one wife with her attendant women and eunuchs. By Mohammedan law no man can have more than four wives, but there is no such restriction as to the number of his concubines and slave-women. As to the practical workings of the system, accounts differ. Many Frankish ladies have been freely admitted to visit the harems (from which all men but the husband and near relatives are jealously excluded). Some of these ladies have reported a most unhappy and altogether debased condition as that generally prevalent in the harems; others have found the Turkish and other women remarkably happy, and quite refined in their tastes. Considerable liberty is often allowed the inmates of the harem, but they must always go out closely veiled and suitably attended.

Har'ford, county of Maryland, bounded on the N. by Pennsylvania, and on the E. and S. E. by the Susquehanna and Chesapeake Bay. Area, 480 square miles. The surface and soil are various, but highly productive. Cattle, grain, wool, fruit, hay, and dairy products are important staples. There are some manufactures and important fisheries. Iron, chrome, building-stone, and kaolin are found. The county is traversed by the Philadelphia Wilmington and Baltimore R. R. Cap. Belair. Pop. 22,605.

Harford, tp. and post-v. of Cortland co., N. Y., on the Southern Central R. R., 41 miles S. by E. of Auburn. It has a large lumber-trade. Pop. 997.

Harford, tp. and post-v. of Susquehanna co., Pa. P. 1595.

Har'graves (Edmund Hammond), b. at Gosport, England, about 1815; went to sea at an early age, and for a time was settled in Australia; subsequently embarked for California (1849), and upon his arrival at the gold-fields was so impressed with the similarity of the country to that he had just left that on his return he entered upon explorations which resulted in the discovery of the valuable gold-fields of Australia. Disclosing his discovery to the colonial secretary at Sydney, he was subsequently appointed commissioner of crown-lands, receiving also many valuable testimonials, among which was a grant of £10,000 by the authorities of New South Wales; in 1854 he returned to England, and published the following year an account of his discoveries, entitled *Australia and its Gold-Fields.*

Har'greaves (James), inventor of a carding-machine (1760), and of the spinning-jenny (1764, 1767), was an unlettered hand-spinner and weaver, b. at Stanhill, near Blackburn, England. He had tried in vain to spin several cotton threads at one and the same time, but failed. One day his little child overturned his spinning-wheel, and as he saw the spindle revolving vertically, he resolved to construct a machine with several vertical spindles. This proved a success, and was kept a secret; but his neighbors, seeing how much yarn he and his family produced, broke into the house and destroyed the machine. In 1778 he went to Nottingham and set up as a machine-spinner, but never had much success. He got a patent on his invention, but it was set aside by the courts, and he d. (a poor man) Apr., 1778.

Ha'ri-ka'ri [Chinese for "happy despatch"], a form of suicide performed in Japan by cutting open the abdomen by two crosswise cuts with the sword. Officials who are guilty of misdemeanors are often commanded to perform hari-kari. If they comply, their children inherit the father's property and position, but not so if the suicide has taken place unbidden. Persons who have suffered unendurable affront, which cannot otherwise be satisfied, sometimes accomplish suicide in this way.

Har'ington (Sir John), K. B., b. at Kelston, near Bath, England, 1561, son of John Harington (author of the excellent *Verses made on Isabella Markhame*) by an illegitimate daughter of Henry VIII. Queen Elizabeth stood sponsor at his christening, and he studied at Eton and Cambridge. He went in command of some horse to Ireland with Essex, who as lord lieutenant knighted him on the field, to the great dissatisfaction of Elizabeth, who in 1596 excluded Harington from court on account of the publication of his *Metamorphosis of Ajax*, a poem. The queen had, however, a great liking for her godson, and soon recalled him. James I. made him a knight of the Bath 1603. D. 1612. His other chief works are a translation of *Orlando Furioso* (in heroic verse, 1591); *Epigrams* (1615); *The Englishman's Doctor* (1609); *History of Polindor, etc.* (1651); *Briefe View of the State of the Church of England* (1653); *Nugæ Antiquæ* (with memoir, compiled by Henry Harington, 3 vols., 1769–79).

Harîri, Al [Arab., "the silk-mercer"], a name of Abu Mohammed al Kâsim, b. at Bassora in 1054. Author of *Makamat* ("The Assemblies"), an Arabian classic of the first importance, written in prose and verse; also of *Molhat-*

al-Irab, a grammar, and *Dorrat-al-Gawas* ("The Diver's Pearl"), a treatise on the Arabic language, and other works. D. 1121. The best and completest English version is that of Prof. Thomas Chenery of Oxford (1867). Theodore Preston of Cambridge (1850) translated twenty of the pieces. The spirited free translation into German by F. Rückert (1826) should be mentioned.

Harivan'sa, a kind of epic written in Sanscrit, regarded as a supplement to the *Mahabhârata*. Its critical character is not high. It treats of Vishnu in his avatar as Krishna, of cosmogony, and of ancient history.

Har'ker (CHARLES G.), b. in New Jersey Dec. 2, 1837; graduated at the U. S. Military Academy July, 1858, and entered the army as brevet second lieutenant of infantry, receiving his full commission as second lieutenant in September following; promoted to be first lieutenant May, 1861, and captain Oct., 1861. Prior to the civil war he served on frontier duty, and on the outbreak of the war was assigned to the organization and drill of volunteers in Ohio; in Nov., 1861, he was appointed colonel 65th Ohio Vols., and led his regiment in the battle of Shiloh and the subsequent advance upon Corinth; assigned to command of a brigade in June, 1862, he participated in the battles of Stone River and Chickamauga. He was appointed brigadier-general of volunteers Sept. 20, 1863, for gallant conduct at Chickamauga, and engaged at the battles of Missionary Ridge, Resaca, Dallas, and Kenesaw Mountain. In the latter engagement he fell, at the head of his command, June 27, 1864.

Hark'ness (WILLIAM), A. M., LL.D., b. in Ecclefechan, Dumfriesshire, Scotland, Dec. 17, 1837; graduated at Rochester University, N. Y., in 1858, and was appointed professor of mathematics U. S. N. Aug. 24, 1863. Author of several astronomical and physical papers published by the U. S. naval observatory and the Smithsonian Institution. Was in charge of U. S. Transit of Venus expedition in 1874, at Hobart Town, Tasmania.

Har'lan, county of Kentucky, bounded on the S. E. by Virginia. Area, 600 square miles. It is a mountain-region, containing beds of iron ore and coal. Corn and pork are the principal agricultural products. There are extensive forests. Cap. Harlan. Pop. 4415.

Harlan, county in the W. of Nebraska, bounded on the S. by Kansas. It is drained by the Republican River and its branches, and is a fine grazing country. Area, 576 square miles. Cap. Orleans. Pop. not given in census of 1870.

Harlan, tp. of Fayette co., Ia. Pop. 312.

Harlan, tp. of Page co., Ia. Pop. 756.

Harlan, post-v. and tp., cap. of Shelby co., Ia., in the beautiful valley of the Nishnabatona, 40 miles N. E. of Council Bluffs. It has 2 churches, a graded school, a newspaper, a large flouring-mill, and a hotel. It has a good trade from the fine agricultural region surrounding. Pop. of v. 128; of tp. 466. A. F. HOLCOMB, ED. "RECORD."

Harlan, post-v., county-seat of Harlan co., Ky.

Harlan, tp. of Warren co., O. Pop. 2396.

Harlan (JAMES), b. in Clarke co., Ill., Aug. 25, 1820; graduated at Indiana Asbury University 1845; became a lawyer; superintendent of public instruction in Iowa 1847; president of Iowa Wesleyan University 1853; U. S. Senator from Iowa 1855–65; secretary of the interior 1865–66; again U. S. Senator 1866–73.

Harlan (RICHARD), M. D., b. in Philadelphia Sept. 19, 1796; made a voyage as ship's surgeon to Calcutta, and in 1817 graduated M. D., and became a practitioner in Philadelphia, whence in 1838 he removed to New Orleans, La., where he d. Sept. 30, 1843. He published *Fauna Americana* (1825); *Medical and Physical Researches* (1835); *On the Genus Salamandra* (1824); *American Herpetology* (1827).

Harlay, de (ACHILLE), b. at Paris Mar. 7, 1536; d. there Oct. 21, 1616. Appointed first president of the Parliament, the highest judicial court in France, by Henry III. in 1582, he remained faithful to him during the civil war of the League, and made this Puritan-like answer to those who threatened him: "It is a great pity when the servant puts his master out; but my soul belongs to God, my heart to the king, and my body is in the hands of the wicked; let them do with it what they please." He was left untouched for some time, but was thrown afterwards into the Bastile, after the surrender of Paris to Henry IV., who maintained Harlay at the head of the Parliament. He used his power to counteract the manœuvres of the Ultramontanes, and caused the condemnation of the books of Bellarmin and Mariana. Author of *La Coutume d'Orléans*, 1583. He was very witty, and the collection of his *bons-mots* was published under the title of *Harleana*.

Harlay de Sancy (NICOLAS), b. in 1546; d. in 1629, is principally known as having been the owner of the celebrated diamond, named after him the Sancy diamond, the largest in Europe, and which belonged afterwards to the crown of France. Harlay de Sancy was ambassador and superintendent of finances under Henry III. and Henry IV. He was a kind of free-thinker, and he changed his creed so often that the famous Protestant writer D'Aubigné published about him a bitter satire under the name of *Catholic Confession of Sancy*. FÉLIX AUCAIGNE.

Har'leeville, tp. of Marion co., S. C. Pop. 1314.

Har'leian Collec'tion, a mass of MSS. collected by Robert Harley, earl of Oxford (1661–1724), and by Edward, his son. In 1723 it was purchased by the British government for £10,000, and the documents are now in the British Museum. There are some 8000 MSS., many of them of very great value, and there were originally above 400,000 pamphlets. Volumes of *Harleian Miscellanies* have been from time to time published, being compilations from the collected documents. Harley's printed books were sold to a private person.

Har'lem, tp. of Stephenson co., Ill., on the Illinois Central R. R. Pop. 1243.

Harlem, tp. and post-v. of Winnebago co., Ill., on the Chicago and North-western R. R. Pop. 781.

Harlem, that part of New York City above 106th street, and between the East River and 8th avenue. It was once a distinct corporation. (See NEW YORK.)

Harlem, tp. and post-v. of Delaware co., O. Pop. 1149.

Har'lem Riv'er, the channel which extends northward from the East River at Hell Gate, forming a portion of the eastern boundary of Manhattan Island, upon which New York City is mainly situated. Harlem River is, throughout a large part of its extent, navigable for large vessels. It is connected with the Hudson River to the N. by the Spuyten Duyvil Creek, a shallow and tortuous passage.

Harlem Springs, post-v. of Carroll co., O., is the seat of Harlem Springs College.

Har'lequin, in mediæval and modern pantomime, the lover of Columbine, and her protector from the machinations of Pantaloon and the Clown. He wears tight-fitting garments covered with spangles, and often has the assistance of good fairies. (See PANTOMIME.)

Harlequin Duck (*Histrionicus torquatus*), a small and very beautiful wild-duck of Northern North America, rarely seen in Europe. It is often seen swimming in rapids and rough waters. Its color is blackish, but it is finely mottled with other colors.

Harles (GOTTLIEB CHRISTOPH, or THEOPHILUS CHRISTOPHORUS), a learned bibliographer and classical editor, b. at Culmbach June 21, 1738; studied philology in the University of Erlangen; was made professor of Greek and Hebrew in the gymnasium at Coburg 1765; professor of poetry and eloquence 1770 in the University of Erlangen; in 1776 university librarian; and in 1777 founded the philological seminary. Edited with notes the *Plutus* of Aristophanes, Aristotle's *Poetics*, Cicero's *De Oratore* and *Verrine Orations*, Cornelius Nepos, Theocritus Bion and Moschus, and other classic authors. Wrote numerous works on Greek and Latin literary history and bibliography, especially *Introductio in historiam Græcæ linguæ* (2d ed., 2 vols., Altenburg, 1792–95); *Supplementa* (2 vols., Jena, 1804–06); *Introductio in notitiam literaturæ Romanæ* (2d ed., Leipsic, 1794); *Brevior notitia lit. Rom.* (Leipsic, 1789); *Supplementa* (completed by Klügling, 3 vols., Leipsic, 1799–1817); published also *Vitæ philologorum* (4 vols., Bremen, 1764–72). His chief work was the new and enlarged edition of *Fabricii Bibliotheca Græca* (12 vols. 4to, Hamburg, 1790–1809). D. Nov. 2, 1815. H. DRISLER.

Har'less, von (GOTTLIEB CHRISTOPH ADOLF), D. D., b. at Nuremberg, Bavaria, Nov. 21, 1806; studied at Erlangen and Halle; held (1829–45) a theological professorship at Erlangen, and afterwards one at Leipsic; and in 1852 became an ecclesiastical councillor to the Bavarian government and president of the superior consistory of Munich. Author of a commentary on *Ephesians* (1834; 2d ed. 1858); *Theological Encyclopædia* (1837); *Christian Ethics* (1842); *Jacob Böhme and the Alchemists* (1870); and other valuable works.

Harley (ROBERT). See OXFORD, EARL OF.

Har'lingen, town of the Netherlands, in the province of West Friesland, on the Zuyder-Zee. It has a very lively trade with England, especially in butter. Pop. 9968.

Har'mar (Gen. JOSIAH), b. at Philadelphia in 1753, where he was educated; in 1776 he was made captain 1st Pennsylvania regiment, and lieutenant-colonel in 1777, which command he retained until the close of the Revolution, serving with Gen. Washington in his campaigns 1778–80; in the South with Gen. Greene 1781–82; bre-

vet colonel 1st U. S. regiment 1783; in 1784 was selected to bear the ratification of the definitive treaty to France, and in the following year was present as Indian agent at the treaty at Fort Mackintosh; appointed (Aug., 1784) lieutenant-colonel of infantry under the Confederation; brevet brigadier-general by resolution of Congress 1787, and general-in-chief of the army Sept. 29, 1789, which post he held until 1792, when he resigned. Adjutant-general of Pennsylvania 1793–99. D. at Philadelphia Aug. 20, 1813.

Harmat'tan [Arabic], a hot, dry wind which blows westward from the Great Desert of Africa. It is of the same character with the sirocco of the Mediterranean, but is represented as more severe in its effects upon the human system. It prevails in the winter months.

Har'mer, post-v. of Washington co., O., in Marietta tp., is on the Ohio River, and on the S. side of the navigable Muskingum River, at its mouth, opposite Marietta. It has steamboat-building and manufactures of cooperage, iron, brick, and other goods. Pop. 1511.

Harmo'dius, a beautiful youth of Athens, who was warmly attached to a citizen named ARISTOGITON, his remote kinsman, both belonging to the Gephyræi. It appears that Hipparchus, brother of the tyrant Hippias, desired to sever the relationship which existed between the friends, and to attach Harmodius to himself, and, failing, put repeated insults upon the two friends. Accordingly, they determined to put to death not only Hipparchus, but his brother the tyrant. On the feast of the great Panathenæa (514 B. C.) Hipparchus was assaulted and slain, but Harmodius was at once killed by the guards. Aristogiton, put to the torture, named the chief friends of Hippias as his accomplices, and they were accordingly put to death. After the expulsion of Hippias (510 B. C.), Harmodius and Aristogiton came to be highly honored as martyrs for the cause of liberty. They were, however, doubtless quite unworthy of the immortality which their supposed patriotism has conferred upon them.

Har'mon, post-tp. of Lee co., Ill., 8 miles S. W. of Dixon. Pop. 542.

Harmon (OSCAR F.), b. at Wheatland, N. Y., May 31, 1827; studied law, and in 1853 removed to Danville, Ill., where he practised his profession with great success. In 1862 he was appointed colonel 125th Illinois Vols., which regiment he led with ability. At the battle of Kenesaw Mountain, Gen. McCook being wounded, the command of the brigade fell upon Harmon, and while at the head of his command he was killed June 27, 1864.

Harmo'nia, the fabled daughter of Ares and Aphrodite, or of Zeus and Electra, and wife of Cadmus. She is chiefly remembered for the fatal necklace which her husband bestowed upon her on her wedding-day. This necklace brought bad luck to all its owners, and after several generations of heirs had been cursed with it, it was dedicated to Athena in her temple at Delphi, whence it was stolen by Phayllus as a gift for his paramour, whom it brought to utter ruin.

Harmon'ica, a musical instrument improved by Dr. Franklin (but known long before his time) consisting of a series of revolving glass cups, which upon being pressed by the tip of the finger or a suitable bow give forth musical tones of a peculiarly fine quality. Though much admired, the instrument soon passed out of notice. Various harmonicas have been since brought forward. The "chemical harmonica" is a long, straight, open tube of glass, one end of which is held over a flaming jet of hydrogen. A musical sound is given out, varying in pitch and other qualities with the proportions of the tube. The phenomenon is caused by a series of minute explosions produced by the burning gas, which communicate a vibration to the tube.

Harmon'ic Mo'tion, in mechanics. If a point move uniformly in a circle, its *projection* on any diameter changes by a simple *harmonic motion*. If a planet or satellite, moving uniformly in a circular orbit about its primary, be viewed from a very distant position in the plane of its orbit, it will appear to move backward and forward in a straight line with a simple harmonic motion—*e. g.* the satellites of Jupiter seen from the earth. Such motion as we describe is approximately that of the simplest species of *vibrations* of a sounding body, a tuning-fork or pianoforte wire, whence the name; it is also that of the various media in which waves of sound, light, heat, etc. are propagated, and it enters extensively into the theories of these phenomena, as well as into those of astronomy and mechanics. The *amplitude* is the range on one side or the other of the middle point of the course. The *argument* is the circular arc described by the projected point, and measured from any arbitrary fixed point. It is proportional of course to the time measured from period of passage through that arbitrary point. The distance of a point moving with simple harmonic motion from the middle of its course is a *simple harmonic function of the time*, the *argument* of which has just been defined. The *period* of such motion is the time of a complete course to and fro. The *phase* at any instant is the fraction of the whole period elapsed since the moving point passed through its middle position in a positive direction. The *epoch* is the time from the era of reckoning to the reaching of greatest elongation, in the direction reckoned as positive, from its mean position or middle of the course. (For HARMONIC ANALYSIS ("spherical"), see LAPLACE'S *Coefficients.*) J. G. BARNARD.

Harmon'ic Ra'tio, in mathematics. "If a pencil of four right lines meeting in a point O, be intersected by a fifth right line in the four points A, P, P', B, then the ratio $\frac{AP.P'B}{AP'.PB}$ is constant, no matter how the intersecting line be drawn." This ratio is called the *anharmonic ratio* of the pencil; and if it be *minus unity*, it is a *harmonic ratio* and the pencil is a *harmonic pencil*. In this case the angle AOB will be divided internally and externally into parts of which the sines are in the same ratio; and the line $P'P$ will be harmonically divided by the points A and B—one *on* it and the other on its prolongation, and AB is a harmonic mean between $P'B$ and PB. If B is at an infinite distance—that is, if the intersecting line be parallel to AB (and the pencil *harmonic*)—PP' is bisected at the point A. The division of a musical string into lengths denoted by the reciprocals of the numerical series 1, 2, 3, 4, 5, 6, etc. produces a great many of the essential sounds of our musical system. Hence, such a progression, or more generally that of reciprocals of any series in arithmetical progression, is called *harmonic*. If from four points taken on a conic section a pencil be drawn to any variable fifth point of the curve, the anharmonic ratio of the pencil thus formed will be constant. So, too, will that formed by the four tangents which can be drawn to a curve of the 3d degree from any point *on* the curve. Hence, it may be inferred that the harmonic and anharmonic properties of conic sections admit of many applications in the theory of these curves, and form an important branch of modern geometry. The name "anharmonic" is due to Chasles. (See his *Histoire de Géométrie;* also SALMON'S *Conic Sections.*)
J. G. BARNARD.

Harmon'ics, in music, certain secondary or accessory sounds which are given out by sonorous bodies, besides the principal sound, and different from it, but bearing also to such sound a determinate harmonic relation. It is probable that no musical sound is absolutely pure and simple, but that every well-defined sound is the generator or root of several other sounds, which are more or less audible to our ears. A single string, or monochord, produces not only its own proper sound, but also its octave, twelfth, fifteenth, seventeenth, nineteenth, etc., or the sounds belonging to one-half, one-third, one-fourth, one-fifth, one-sixth, etc. of its length. These secondary sounds, in combination with the principal one, are found to be the elements of the perfect *major-triad*—*i. e.* the root or fundamental tone—with its third and fifth, or their octaves and double octaves. A musical ear readily detects several of these in the sound of a large church-bell (the larger the better), and these harmonics are more or less perfect in proportion as the bell is regularly formed, well cast, free from cracks or flaws, and of uniform density. Sounding bodies not only give out primary tones and accompanying harmonics from their own substance, but also, under certain conditions, induce similar sounds in other bodies within reach of their vibrations. A string vibrating at a certain rate—*e. g.* 120 times in a second—will by "sympathy" cause equivalent vibrations in another contiguous string of the same length, thickness, and tension, and will also excite the more rapid vibrations of strings tuned to sound its octaves, thirds, and fifths; the vibrations or undulations on which sound depends meeting, coalescing, or touching each other at certain regular distances, longer or shorter, and thus producing the harmonic intervals just named. A long-continued note on an open string of a violin will thus cause vibrations in the corresponding string of another violin hanging against the wall. A tuning-fork forcibly struck, and set on the sounding-board of a pianoforte, will occasion all the strings in harmonic relation with it to vibrate in sympathy. The jarring of window-sashes, the jingling of glass vessels, and the rattling of loose articles of furniture, when musical notes *of a certain pitch* (and not otherwise) are sounded, are facts easily explainable on the same principle. Telegraph wires also, during a brisk wind, often give out harmonic tones, though the proper sound of the wire is inaudible. These derived or sympathetic vibrations are, in very large strings, sensible to the touch, and may even be visible to the eye (especially when aided by a magnifying-

glass), though the sounds produced are too faint to be appreciated by the ear when the experiment is confined to a single string. But when *several* strings are struck simultaneously, the sympathetic vibrations of a large number of other strings contiguous to them become distinctly audible to any ear by the manifest access of power thus given to the original sound. When a full chord, for example, is forcibly struck on a pianoforte, with *the dampers raised* by using the loud pedal, the quantity of sound produced is much greater than otherwise, because, the strings being now all free, every octave, fifth, and major third, with their octaves and double octaves, throughout the whole instrument, respond by sympathy to the notes actually struck, and the general effect is quite sensible to the ear. Composers of pianoforte music often avail themselves of this fact when they wish to give to certain chords the highest degree of force, richness, and brilliance. In the following example the chords at *a* and *b* are precisely the same, but the latter will far exceed the former in power, because the use of the pedal on each note sets the strings free to contribute their harmonics, and thus to intensify the notes under the fingers:

In the large pipes of an organ (chiefly the stopped diapason and bourdon) the harmonic or accessory sounds are often disagreeably perceptible, sometimes causing an indistinctness or uncertainty as to the real tonal pitch of the pipe. In such cases the organist hears distinctly the harmonic fifth or twelfth, while the proper sound of the pipe is barely appreciable. A pipe may also, by an over pressure of wind, be made to sound one or other of its harmonics *instead* of, or in union with, its own proper tone, as in the quintaton stop of German organs, where the pipes are so "overblown" as to yield a piercing quality of tone many degrees higher than that proper to their length or capacity.

Under harmonics, or those below the natural sound, are frequently heard from large bells, forming a booming or deep humming sound. It has also been found that two pipes of moderate size, under certain relations of length and diameter, if sounded simultaneously, will generate a third sound far deeper than their own, and this foreign sound will so predominate as to substitute itself for the proper sounds of the two pipes. Advantage of this curious fact has been taken by modern organ-builders, in obtaining from two pipes—*e. g.* one of them eight feet long, and the other only about five—a derived or harmonic tone equivalent to that of a pipe sixteen feet in length, thereby economizing both space and expense. It is obvious that an organ of moderate size may thus be made to produce tones similar in depth to those for which pipes of the largest class are commonly required. William Staunton.

Harmon'ic Stops, in a large organ, certain stops consisting of two, three, four, or more ranks of pipes, tuned in octaves, double octaves, and double or triple thirds and fifths above the natural pitch of the keys. These are the cornet, sesquialtera, mixture, furniture, etc.; but, comprehensively, the term may also include those stops having only a single rank of pipes, which are tuned in thirds, fifths, and their octaves above the pitch represented on the keyboard. These latter are known as "mutation stops," among which are the quint, twelfth, tierce, larigot, and several others. The use of these stops is not only to add power to the "foundation stops" of the instrument—*i. e.* those which give the primary or *true* sound and its octaves —but also to produce clearness, variety, and greater or less degrees of brilliance, according to the character and requirements of the music under performance. Hence, these stops are found in largest number on the keyboard or "manual" designated as the "great organ," though several of them have place also on the "choir organ," the "swell," and the "pedal organ."

In considering the peculiar *effects* of these harmonic stops, we arrive at some very curious and singular results, arising from the discovery that much of the sound produced by such stops must, in the nature of things, be utterly discordant and contradictory to the harmony under performance by the organist. Taking the diapasons as the standard (because tuned to the true and natural pitch), it is easy to understand that no ill effects of this kind would ensue by connecting with them another stop (*e. g.* the principal), sounding simply an octave higher, or still another (the fifteenth), sounding a *double* octave above each note on the keyboard. The effect would be only an increase of force and brilliancy, as in the addition of female to male voices. But when we add to the diapason such a stop as the twelfth, which makes *a perfect fifth* (in the octave above) to *every note* under the organist's fingers, we perceive that contradictory elements are now introduced, and more or less of discord must inevitably be the result. To a person not familiar with the organ, it seems incredible that a stop whose pipes are tuned a fifth or double fifth above the proper pitch should be admissible, inasmuch as such a stop must necessarily deliver in the key of the *dominant* that which the organist plays in the *tonic* or proper key.

The natural conclusion from this would be, that an organ provided with mutation and compound stops must be the most discordant of all instruments; and yet it is a known fact that these very stops contribute largely to the richness, majesty, and roundness of pure organ-tones. Experience proves that in their absence the diapasons, with mere duplicates in unison, octaves, and double octaves (as the principal, fifteenth, twenty-second, etc.), yield but a thin, meagre, and disagreeably harsh quality of tone—a tone unsatisfactory to the ear for want of an infusion of some other element to give it substance and body. The explanation of the enriching effect of the twelfth, tierce, sesquialtera, and similar stops, though seemingly difficult, is not so in reality, as it is nothing more than the carrying out of the laws of *harmonics*, by applying them to each individual note on the keyboard of the organ. (See Harmonics.) As a sounding body naturally gives forth not only its own proper tone, but also several accessory sounds (as the 8th, 12th, 15th, 17th, etc.), so the organ-builder seeks to strengthen the diapasons and other "foundation stops" by adding to them certain other stops or ranks of pipes, which are tuned (not as duplicates, but) in *imitation of the harmonic or secondary sounds* which are already faintly produced by the standard or fundamental stops. Each note of a complete organ, therefore, carries and exhibits all these harmonic elements in their perfection; and the ordinary ear recognizes *not the several constituents* of the sound, but *the whole blended together* in unity, as if produced by a single pipe. Hence it is that in playing a scale movement on the full organ the consecutive fifths and major thirds of the mutation and compound stops are not offensively apparent; and even in full chords the clashing of contradictory harmonics with their primaries is overborne and neutralized by the greater power of the stops sounding the root-tones, with octaves and double octaves superadded, and coming in *the same region with* the harmonics. Bad effects can ensue only when harmonic stops are drawn *without* those stops which are their foundation or correctives, as when we use the sesquialtera, etc. *without* the diapasons, principal, and fifteenth, at the least, as the basis from which they spring and the source of their meaning. William Staunton.

Har'monist, in music, one who is familiar with the principles and laws of musical harmony; more popularly, one who, in addition to a theoretical acquaintance with harmony, is also a practical composer or arranger of music. There are many harmonists who are not composers, as there are many composers who are very indifferent harmonists.

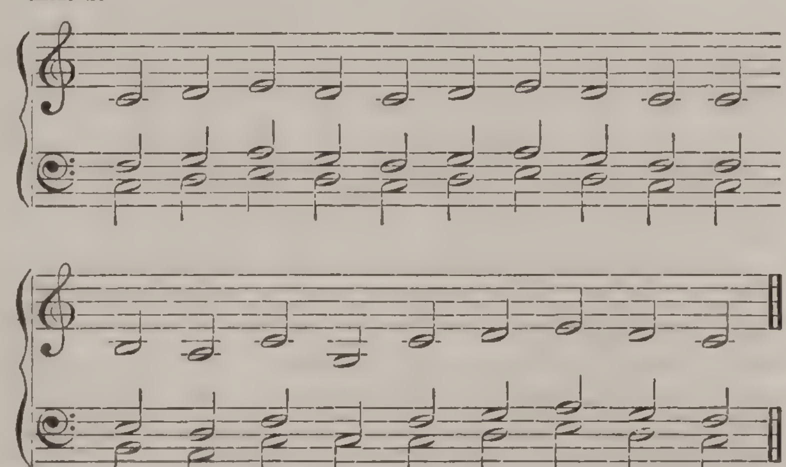
Har'monists, the followers of George Rapp (1770–1847), a German of Würtemberg, who, believing that he was divinely called to restore Christianity to its primitive purity, organized a community which held their goods in common. Disturbed by the authorities, they removed in 1803 to the U. S.; settled in 1805 at Harmony, Butler co., Pa., and removed in 1815 to New Harmony, Ind., which in 1824 they sold to Robert Owen. They then removed to Economy, Pa., 17 miles N. W. of Pittsburg. They own 3500 acres of land, and have important manufactures. They do not marry, lead strictly moral lives, and number some 1300 persons.

Har'mony [Gr. ἁρμονία, a "fitting" together, from ἁρμόζω, to "join"]. Music is commonly viewed as consisting of melody and harmony, the former being a varied *succession* of single or simple tones, and the latter the union of two or more such melodies, or the combination of several tones in one *simultaneous* utterance in accordance with certain regulating principles. Harmony, as now understood and practised, is a science of comparatively modern times, having risen from its rudest form to its present perfection within the last three or four centuries. There is no evidence that the ancients had any acquaintance with the laws indicating the relations of combined musical sounds, or any conception of the rich and beautiful effects resulting from those combinations under scientific and æsthetic treatment. The speculations of Greek writers concerning the origin,

relations, and proportions of intervals, and their theory of the diatonic, chromatic, and enharmonic genera, contributed nothing of consequence to the development of harmony, and possibly as little to the improvement of melody. It is also very certain that for the discovery and cultivation of harmony all abstruse and independent reasoning is fruitless *in the absence of instruments* of such compass, perfection, and regularity of scale as are requisite for the production, adjustment, and testing of chords in their great variety of relation and form. Ancient instruments, however elegant in figure and rich in workmanship, were of very limited range, and too imperfect and defective in their scales to suggest even the first principles of regular harmony. It is capable of proof that contrapuntal science made little advance till the invention of the more perfect classes of instruments, such as the keyed organ and the precursors of the harpsichord and pianoforte. When these instruments came into existence it became possible, for the first time, to reduce to experiment and proof all kinds of musical combinations, and to deduce from actual test some fundamental rules on which chords might be classified, and their progressions determined in an orderly and scientific manner.

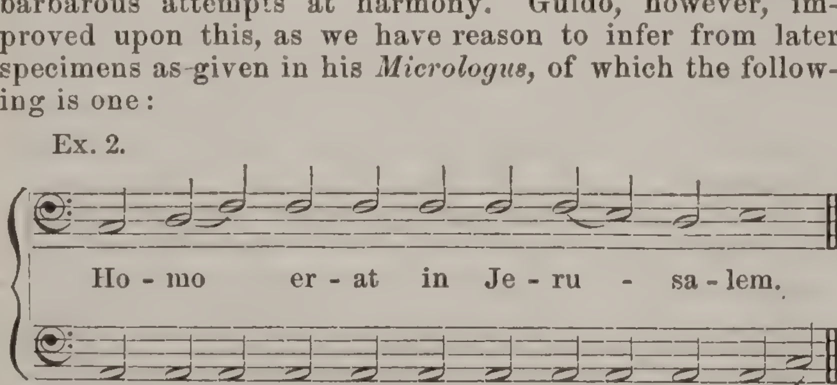
Even as late as the eleventh century we find that the music of the Church—chiefly Gregorian plain-song—was but a simple melody, more or less inflected, without any accompanying harmony, except such as might be supplied by a rude and arbitrary use of occasional octaves, fifths, and fourths. It is questionable, indeed, whether even the term "melody," as now understood, can with justice be applied to those successions of notes which seem to us so bald and unmeaning, but which, nevertheless, constituted what our forefathers regarded as "music," and extolled as consonant with their own ideas of perfection. Of the music of that age Dr. Burney gives some curious relics, which will illustrate what we have here said. "Guido," he remarks, "speaks of *diaphonia*, which means *discant*, or, as he calls it, '*organum*.' This consisted in singing a part *under* the plain-song or chant. Some used only *fourths* for this purpose, but it was allowable to double either the plain-song or the 'organum' by octaves *ad libitum*." The following is an example quoted from Guido by Dr. Burney. For greater convenience we give it in modern notation; and the reader will be able to judge of the condition of musical science and sensibility at a time when so hideous a succession of fourths, fifths, and octaves could be tolerated in divine service or anywhere else:

Ex. 1.



By such writing, Guido, though learned enough in such matters as tetrachords and the ordinary plain-song, proves himself ignorant of the simplest principles of counterpoint, and utterly insensible to the pain created by such semi-barbarous attempts at harmony. Guido, however, improved upon this, as we have reason to infer from later specimens as given in his *Micrologus*, of which the following is one:

Ex. 2.



In all the examples extant of that age the same wretched poverty of thought appears. The writers of music were groping in the dark, without rule, and without any apparent inward feeling to indicate the direction which such rule should take. Some ideas they had about simple intervals, but none concerning their use and relations. Fourths, fifths, and sixths succeed each other without order or reason; and it is remarkable that the fourth seems to have been a rather favorite interval. What further advances the musicians of that period made it is not easy to determine, but it is inconceivable that either Guido or his fellow-laborers ever produced anything which modern ears would tolerate, except for the satisfaction of a not unreasonable curiosity.

The first attempts at harmony seem to have been in the line of *extemporizing* a secondary part to any well-known melody, by running under it a parallel train of notes in fourths, fifths, or octaves (as is often done by ignorant people at the present day). For the sake of variety, as in the last example, the accompanying part would sometimes form a kind of ground-bass, *not* following the movement of the melody, and ending with a clumsily-formed cadence. This two-part or "double singing," as it was called, was common in the twelfth century, and even earlier. The constant hearing of the ecclesiastical chant rendered that chant familiar to the people, and its scales and inflections had a general influence over the style even of the secular songs of that day. By a kind of natural instinct, some diversity would be sought by those who were weary of a dry uniformity of song either in the church or the field, and with very little effort one singer might invent a free and artless under-strain to enliven or improve upon the song of his companion and neighbor. It is said that even at the present day the peasantry of Wales "may commonly be heard singing unwritten three-part music." And "the Rev. Sir Frederick A. G. Ouseley has recently shown that the untaught practice of extempore part-singing prevails among the Russian peasantry; and there is plentiful authority for the assertion that this exists in all Northern lands, and has existed since the utmost range of man's memory or its records." This part-singing was also much favored and promoted in and after the twelfth century by the facility which the organs then coming into use afforded for sounding two or more notes at once. The ear was thus in some degree trained to perceive the effect of perfect and imperfect intervals, and very gradually some rules were arrived at to regulate their succession. Some evidences of such improvement are discernible at this era, as will appear from the following harmonies of Marchetto da Padova:

Ex. 3.

The organs of that age, however, though important as *suggestive* of harmony, were of small dimensions and of clumsy construction, containing but an octave or two of pipes, sufficiently harsh and noisy to be heard at a great distance, and played by keys requiring the force of the hand rather than the mere pressure of the fingers. But by the end of the fourteenth century these instruments had reached a far higher degree of perfection, having regular keyboards, numerous stops, and a compass of several octaves with the semitones. In consequence of this, a new stimulus was given to the study of harmonious combinations and progressions, but still the advance in this direction continued to be slow and uncertain. Even as late as the middle of the fourteenth century, according to the statement of Dr. Burney, "the rules in use were of the rudest kind, and the ordinary ear in church service was not offended, probably, by any number of fifths and octaves in succession." From this to the time when Palestrina flourished (b. 1529; d. 1594) was a period when counterpoint was first successfully developed, its true principles discovered, carefully applied, and cast into a scientific form. The works of that renowned writer, though deficient in melody and the elegance and refined sentiment of modern music, abound with proofs of a profound acquaintance with counterpoint, even in its most subtle and intricate departments, and of wonderful skill in the most elaborate kinds of composition. Of the steps by which this great advance was reached, through a period of two centuries before Palestrina—an advance comparatively sudden, after more than 4000 years of almost total darkness on the subject of musical science—we have no full and accurate account. But it is certain that within that time the leading principles of harmony had been discovered, and applied with singular unanimity; compositions showing an exact knowledge of counterpoint had been produced; and already the nature and structure of *fugue* and *canon* had become familiar to musical writers.

The masters of the sixteenth and seventeenth centuries appear to little advantage as originators or students of *melody*, but their devotion to *harmony*, even in the most abstruse forms of canon, fugue, imitation, musical enigmas, etc., was all-absorbing, and almost marvellous in its results. Their successors, however, with less pedantry and more regard for the beautiful and imaginative, advanced the art by adding to their studies the cultivation of this further department of melody. And thus was completed the labor of centuries, by bringing into combination all the resources of pure *harmony*, and the glowing beauty and deep expressiveness of its *melodious counterpart*.

When we bring these two great elements of music into

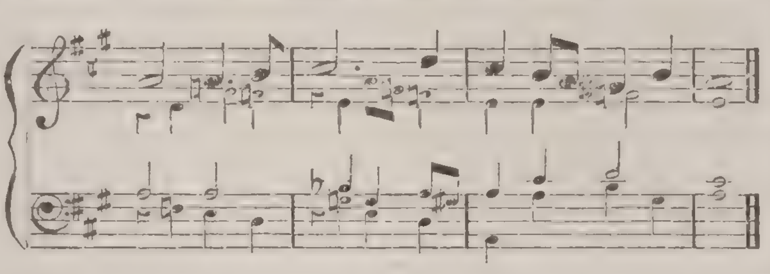
comparison, it will be found that harmony has a certain controlling power over melody—*i. e.* the sentiment or mental effect of a given melody is largely dependent on the harmony affixed to it. A change of the harmony, either within the same key or by digression into another key or mode, may alter and even reverse the whole drift and spirit of a melody. Thus, without the variation of a single note, the character of a given melody may be alternately joyful, sad, or otherwise, according to the relations impressed upon it by diversified and skilful harmony. The following example will be sufficient to show how an air may be affected in sentiment by changes in the quality of its accompaniment:

Ex. 4.

No. 1.

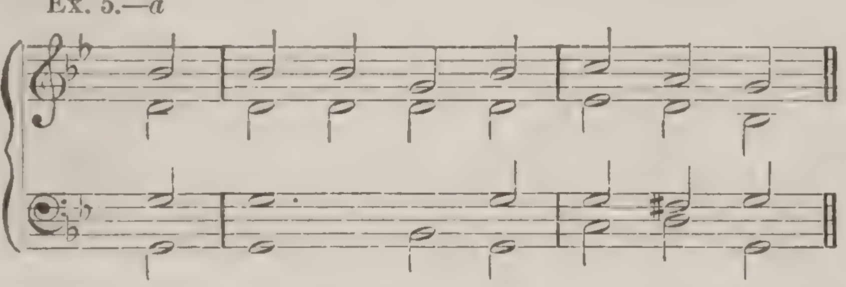
No. 2.

No. 3.

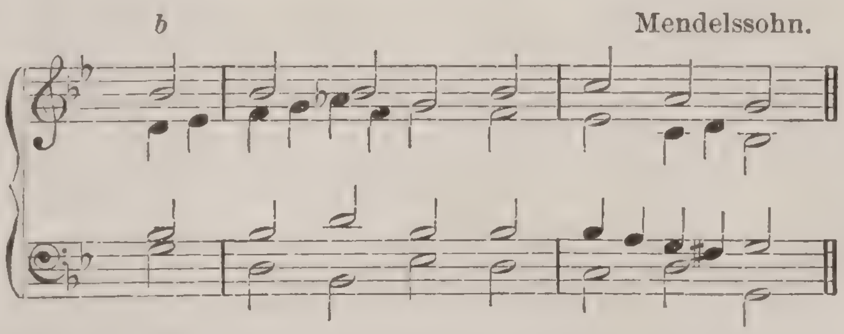


Very plain and even unmeaning melodies may also be impressed with a new beauty by the sole effect of a pleasing accompaniment. In the following example this is illustrated, the refined harmony at *b* giving the melody a far higher interest than it could have under the common treatment, as shown at *a*:

Ex. 5.—*a*



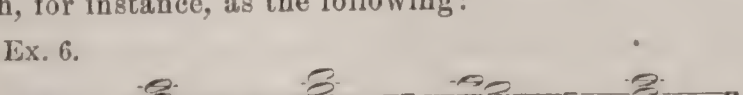
b Mendelssohn.



Hence it is that, as a general rule, the mind of a composer naturally associates some definite harmony with his conception of a new melody. Whether conscious of it or not, certain harmonious forms and progressions, key-relations, modulations, and even particularities of counterpoint, are in the background of his thoughts, and quietly determine the spirit and significance of the melodic strain. And for this reason it becomes impossible to have a just conception of the sentiment intended to be expressed by a given melody till we see or hear the very harmony in which it was invested by the composer.

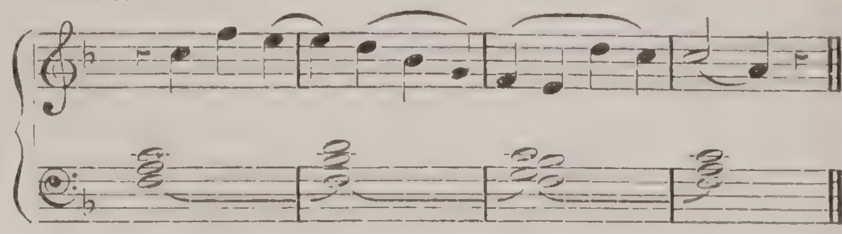
There is one aspect also in which *melody* may be viewed as holding a similar directive influence over *harmony*, or at least the power of conferring beauty on masses of chords which would otherwise be void of color and expression. A series of chords, quite regular in progression, may easily be written in which the ear detects nothing attractive or descriptive of any peculiar line of thought and feeling—such, for instance, as the following:

Ex. 6.



But let a distinctly marked and flowing melody be added, and these naked chords will acquire a meaning and connection which the ear recognizes at once, though due entirely to the suggestions of the melody. See this illustrated in Ex. 7:

Ex. 7.



This office of melody, as an element capable of throwing an air of ideal beauty over a train of dull and apparently aimless harmonies, is often lost sight of by young composers. The charm of chromatic and involved masses of chords obscures their sense of design, outline, rhythm, and breadth and symmetry of structure. And for this reason their early compositions are often overlaid and deformed with crude attempts at what they regard as "scientific" harmony, a superfluity of dissonant combinations and extravagant transitions into remote keys. Harmony may thus be abused till it becomes unmeaning and tiresome, like patches of color thrown at random on canvas, with an absence of all distinctly marked objects and graceful forms.

The various schools of harmony, German, Italian, French, and English, while differing much in matters of detail in the classification of chords, the nomenclature of their respective systems, and their mode of analyzing and explaining certain combinations and progressions, agree, notwithstanding, in the leading principles of contrapuntal science. The position that all musical harmony is an outgrowth of two fundamental chords with their inversions, supplemented by a few anomalous chords and musical idioms, is very generally received, as simpler and more satisfactory than the cumbrous systems which have become antiquated by the advances of modern art.

Into the systematic treatment of harmony as a science we shall not enter in the present article, as our design has been only to give such a general and historical view of the subject as might prepare the way for a full discussion under the head of MUSIC (which see). WILLIAM STAUNTON.

Harmony, tp. of Hancock co., Ill. Pop. 1457.

Harmony, post-v. of Van Buren tp., Clay co., Ind., on the St. Louis Vandalia Terre Haute and Indianapolis R. R. Pop. 597.

Harmony, tp. of Posey co., Ind. Pop. 2231.

Harmony, tp. of Union co., Ind. Pop. 734.

Harmony, post-tp. of Somerset co., Me., 25 miles N. by E. of Norridgewock. Pop. 978.

Harmony, tp. of Caroline co., Md. Pop. 2527.

Harmony, post-tp. of Fillmore co., Minn. Pop. 890.

Harmony, post-tp. of Washington co., Mo. Pop. 1485.

Harmony, post-tp. of Warren co., N. J. Pop. 1405.

Harmony, post-tp. of Chautauqua co., N. Y., bounded on the N. E. by Chautauqua Lake. It has 10 churches, several manufacturing villages, and fine sandstone-quarries, and is traversed by the Atlantic and Great Western R. R. Pop. 3416.

Harmony, tp. of Clark co., O. Pop. 1821.

Harmony, tp. of Morrow co., O. Pop. 773.

Harmony, tp. of Beaver co., Pa., on the right (E.) bank of the Ohio River. It contains Economy, an abode of the Harmonists, followers of George Rapp. Pop. 225.

Harmony, post-b. of Jackson tp., Butler co., Pa. It was once an abode of the Harmonists. Pop. 414.

Harmony, tp. of Forest co., Pa., in the oil-region, and on the W. bank of the Allegheny River. Pop. 1226.

Harmony, tp. of Susquehanna co., Pa. Pop. 1212.

Harmony, tp. of Clarendon co., S. C. Pop. 480.

Harmony, tp. of Rock co., Wis. Pop. 1214.

Harmony, post-tp. of Vernon co., Wis. Pop. 781.

Harmony (DAVID B.), U. S. N., b. Sept. 3, 1832, in Easton, Pa.; entered the navy as a midshipman Apr. 7, 1847; became a passed midshipman in 1853, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866; served on board the Iroquois at the passage of Forts Jackson and St. Philip and capture of New Orleans, and in many severe engagements with the batteries at Vicksburg and Grand Gulf; was executive officer of the iron-clad Nahant in the first attack upon Fort Sumter, Apr. 7, 1863, and in the engagement with the ram Atlanta, June 17, 1863; is honorably mentioned in the reports of Coms. De Camp, Palmer, and Downs. FOXHALL A. PARKER.

Harmony of the Gospels. There being four separate narratives of the life of our Lord, Christians from the earliest times have attempted to arrange them in such a way as to present at one view all their facts and teachings. The earliest efforts to accomplish this have perished, but appear to have been of the nature of a *diatessaron*, or a continuous narrative embracing all that is contained in the four Gospels, rather than of a "harmony," strictly so called. Tatian (about A. D. 170) prepared such a work, of which a spurious Latin translation still exists. In the earlier part of the third century, Ammonius of Alexandria prepared a harmony, traces of which remain in the so-called *Ammonian Sections*, combined with the *Canons* of Eusebius. These are of great importance, having been placed in the margin of nearly all manuscripts of the Gospels since the middle of the fourth century. They are simply tables of reference by which may be found any passage in one Gospel either parallel or similar to a passage in one or more of the others. Each Gospel is divided into sections; the sections of St. Matthew being arranged in a column in the order of their numbers, the numbers of the sections corresponding to this in the other Gospels are placed opposite. Thus, the first table, or *canon*, is formed of parallel passages in the four Gospels. There are ten such canons, containing the parallel passages in three Gospels, in two, and those found only in one. In the margins of manuscripts the number of the section is written above, and that of the canon by which the similar passages may be found, below in the form of a fraction. Since Eusebius every age has abounded in harmonies constructed on a variety of principles.

On the most cursory examination of the Gospels it is plain that the same events are not related in them all in the same order. Some of them, at least, must have arranged the details of the narrative on some other principle than that of chronological sequence. It is generally agreed that St. John, who gives minute notes of time, has carefully observed the chronological order of the history; but comparatively few facts are common to this Gospel and the others. Assuming in regard to these points the order of St. John, how shall the remaining events be grouped around them? St. Luke, in his introduction (i. 3), expresses his purpose to write "in order." Does this mean in chronological order? Some harmonists, and among them Tischendorf, have so understood it; but on examining the index of his *Synopsis Evangelica* it is plain that he has found himself obliged to disturb the order of St. Luke quite as much as is ordinarily done. It seems more probable that St. Luke's "in order" is equivalent to "systematically." He is remarkable for relating each event and discourse in careful connection with the circumstances under which it occurred; but it would be impossible to observe the order of St. Luke without violating that of all the other Evangelists, and at the same time, what would seem to be the most probable succession of events. The same things may be said with even more force of the first Gospel; indeed, it is soon evident to the student that exact chronological order was no part of the purpose of St. Matthew. St. Mark remains; and on comparing the points common to him and to St. John, it will be found that they exactly agree. On further arranging events in what seemed on the whole the most probable sequence, several harmonists (notably Robinson; see his *Introduction*) have found that they had hit upon the order of St. Mark. There has come, therefore, to be a general disposition to adopt the order of St. John as more fully carried out by St. Mark. On this plan the order of two of the Gospels is preserved intact, which cannot be accomplished in any other way.

Another debated question, which somewhat affects the structure of a harmony, is the length of our Lord's public ministry. Three theories have been proposed, severally known as the *Bi-paschal*, the *Tri-paschal*, and the *Quadri-paschal* schemes, according as they suppose that ministry to have included two, three, or four Passovers, and thus to have continued, in addition to the first half year, one, two, or three years. Until the time of Eusebius opinions on this point were very vague and various, and do not seem to have really been definitely formed at all. He investigated the subject carefully, and decided in favor of the quadri-paschal scheme; and this view was adopted on his authority for many ages without much further investigation. In modern times much research has been devoted to the point with varying results. The bi-paschal scheme has been generally abandoned, but in Germany the tri-paschal has found great favor, having been adopted by such men as Wieseler and Tischendorf. In England also it has some eminent advocates, as well as in this country; but the balance of opinion, both there and here, is decidedly in favor of the quadri-paschal. A weighty argument for this has been found in the reading of the *Codex Sinaiticus* in John v. 1, which renders it in the highest degree probable that the feast there mentioned must have been a Passover, and there are three other Passovers distinctly mentioned. Independently of that reading, however, and before it was known, the argument of Robinson to show that it was really the passover has never been satisfactorily met.

When all doubtful questions have been determined, there will still remain a certain number of passages whose chronological position cannot be fixed with certainty, because they contain no notes of time. These, however, are comparatively few and of secondary importance. On comparing the harmonies published in Germany, England, and America within the last fifty years, it will be found there is a general and striking agreement in the order of all the main points of the Gospel history, even among those who differ in regard to the whole length of our Lord's ministry. There is more difference of opinion as to whether miracles of a similar character, yet narrated with certain circumstantial differences in the different Gospels, should be considered as the same or as actually different. The tendency of the earlier harmonists was to consider such events different when the circumstances were at all differently narrated, as, *e. g.*, when the healing was of one demoniac or two, when the blind was cured as Jesus was entering into or departing from Jericho; later harmonists make more allowance for individual differences of narration, and in such cases identify the events, whether the data can be found (as they generally can) to explain these differences or not.

There is still greater difference in regard to the longer discourses of our Lord as given in the first Evangelist, such as the Sermon on the Mount and the charge to the Twelve (ch. x.), parts of which are given by the other synoptic Evangelists at other times and under different circumstances. Were these repetitions, or are the discourses as given in St. Matthew groupings together of several discourses uttered at different times? In most cases the other Evangelists give parts of the discourses in the same connection with St. Matthew, and other parts in connection with events or circumstances, especially the Perean journey of our Lord, of which St. Matthew makes no mention. (See the subject discussed in the *Bibliotheca Sacra* for July, 1874.)

The uses of a harmony are very obvious. It enables the critical scholar to compare readily the language of the several writers in the narration of the same things; it gives to the exegetical student the fullest material for the interpretation of our Lord's acts and words; and to every Christian it affords a ready and convenient method of seeing at once all that is recorded of each scene and event and discourse. FREDERIC GARDINER.

Harmony of the Spheres, a kind of music which the ancients imagined was produced by the motions of the heavenly bodies. This sound, said they, we do not hear, because we have always heard it, and cannot contrast it with absolute silence, of which we know nothing. Others thought the sound too powerful for our hearing, or that our senses are too gross to perceive it.

Harms (CLAUS), b. May 25, 1778, at Fahrstedt, Holstein; was educated at Kiel, and became in 1816 an archdeacon in that town. His work, *Das sind die 95 Theses*, published in orthodox spirit, and just at the time of the jubilee of the Reformation, made a great sensation. He published six collections of sermons between 1808 and 1847, which became very extensively used in Germany as means of edification. D. Feb. 1, 1855.

Harms (LUDWIG), (*Pastor Harms*), b. in 1809 at Hermannsburg, on the Lüneberger Heath, in Hanover, was the son of a Lutheran parish minister; was educated at Celle and Göttingen; became awakened to a new religious life, and in 1844 became assistant pastor in his native village. Here he built a large missionary college, trusting to Providence for funds; organized his great parish into a home and foreign missionary society; founded in 1854 an extensive printing establishment, where he published a missionary journal and many books. Pastor Harms was a prodigiously active man, and an admirable manager of the business affairs of his vast enterprises, for he supported missionaries in Africa, Asia, America, and Australia at an expense of not less than $40,000 per annum. A man of profound spirituality, he was tenderly beloved by his parishioners, and was their adviser in business, their confessor, and their ruler. He was also a man of considerable learning, of strong and eccentric character; in many respects one of the grandest figures of his time. Beggars feared him, and he hated beggars, since, as he said, he never asked any man for anything, but his novel missionary enterprise and his spirited journal appealed far more effectively for help than any direct solicitation could do. D. Nov. 14, 1866.

Harnett′, county of Central North Carolina. Area, 675 square miles. It is traversed by the Cape Fear River. Its surface is varied, its soil generally good. Corn, tobacco,

and pork are the chief products. Cap. Harnett Court-house. Pop. 8895.

Harnett, tp. of New Hanover co., N. C. Pop. 1543.

Harnett (Cornelius), b. in England Apr. 30, 1723; became owner of a large estate near Wilmington, N. C., and was early interested in the cause of American liberty. He was (1770–71) an active member of the provincial assembly; in 1775 president of the provincial council, and afterward acting governor; in 1776 a member of the provincial Congress at Halifax, in which he used his active influence in favor of independence, and was one of a committee to draft a State constitution and bill of rights, in which he procured the insertion of the clause declaring for religious freedom. In 1777–80 he was in Congress, and signed the Articles of Confederation. D. at Wilmington, N. C., Apr. 20, 1781.

Harnett Court-house, post-v., cap. of Harnett co., N. C., on Cape Fear River, 26 miles S. by W. of Raleigh.

Har'ney (William Selby), b. in Louisiana in 1798; appointed second lieutenant of infantry U. S. army Feb., 1818; in 1833 appointed paymaster with rank of major, and in 1836 was transferred to the 2d Dragoons as lieutenant-colonel, taking an active part in the Florida war against the Indians; brevet colonel Dec., 1840, for gallant conduct; appointed colonel 1846; served with distinction in the war with Mexico (brevetted brigadier-general), and in 1858 was promoted to be brigadier-general. While in command on the Pacific coast he took possession of the then neutral territory of San Juan Island, Puget's Sound, which was, however, soon evacuated by the U. S. In the early days of the civil war he commanded in Missouri, but for an unauthorized truce with Gen. Price was soon relieved, and in 1863 retired from active service.

Ha'ro, town of Spain, in the province of Logroño, on the Ebro. It carries on a considerable trade in wine and fruits. Pop. 5928.

Haro, de (Alonzo Muñez), S. T. D., b. at Villagarcia, Spain, Oct. 31, 1729; studied in the Royal University and at Bologna, in each university receiving the doctorate, and in the latter becoming rector and professor of sacred literature. He was appointed about 1770 archbishop of Mexico, and was there distinguished by eloquence, charities, and love of learning. He founded a free Roman Catholic school in New York City, and presented to St. Peter's church, New York, some paintings and gifts of money. D. May 26, 1800.

Har'old I. (Harefoot, so named from his swiftness), king of England, was the reputed son of Canute by Ælgifa of Northampton, who was either wife or concubine of the king; but whether Harold was really their offspring is doubtful. In 1035, Harold was chosen as Canute's successor by the Danish party, and began to reign N. of the Thames; but Hardicanute (*Harthacnut*), the late king's recognized heir, was preferred by the English party. Before this time it is believed that Harold had ruled Denmark for Canute. Hardicanute was chosen king of Wessex, and Emma, his mother, was his regent, he being then absent in Denmark. Harold soon rid the kingdom of the Anglo-Saxon princes (Æthelings), and in 1037 he was chosen king of all England. He banished Queen Emma, and d. at Oxford Mar. 17, 1040. The history of his reign is obscure.

Harold II., king of England, the last sovereign of the Anglo-Saxon race, was second son of Godwin, the great earl of the West Saxons, by Gytha, a Danish lady, and was consequently not of the royal line of England; assisted his father in his quarrels with Edward the Confessor, with whom he became reconciled 1052; with Tostig, his brother, conquered Wales 1063; was shipwrecked at the mouth of the Somme, Normandy, made prisoner, and compelled to swear to give support to Duke William's claim to the English crown, 1065; caused himself to be proclaimed king, and was crowned Jan. 10, 1066; defeated and slew Harold Hardrada, who supported the claims of Tostig, Harold's brother, Sept. 25, 1066; fought William the Conqueror at the bloody battle of Hastings, and was killed there Oct. 14, 1066.

Har'old (or **Har'ald**) **I. Haar'fager** (the "fair-haired"), first king of Norway in the historic period. He loved Gyfa, a jarl's daughter, who refused to marry him until he had conquered all Norway; and accordingly in 865 he took a vow never to comb or cut his hair till all the jarls submitted to his sway. His great sea-fight at Hafursfiord (885) released him from his twenty-years' vow. D. at Trondjem 933, and was succeeded by Eric I.

Har'old (or **Har'ald**) **III. Hardra'da** (Hardraade, "hard ruler"), king of Norway, b. about 1016; became a kind of knight-errant in the East; served in the Byzantine armies 1038–40, and was distinguished by his exploits in Sicily and at Jerusalem; became sole king of Norway on the death of Magnus the Good, his nephew, 1047; invaded England 1066 to avenge the supposed wrongs of Tostig, brother to Harold II. of England; gained the battle of Fulford (Sept. 20), but was defeated and killed in the battle of Stamford Bridge, Sept. 25, 1066.

Haroun' al Rash'id (*Aaron the Just*), caliph of Bagdad, the fifth of the Abbasides, was a son of the caliph Mohammed Mahadi by a slave-woman, and was b. at Rei in 765 A. D. (148 A. H.); invaded the Greek empire 781; encamped opposite Constantinople, and compelled the empress Irene to pay yearly 70,000 dinars in gold; succeeded Mousa al Hadi, his brother, in 786; raised the caliphate to its greatest pitch of splendor, chiefly by the aid of Jahia and Jiaffar the Barmecides, whom he treacherously murdered (803); sent an embassy with presents to Charlemagne (probably in 801); was frequently and with almost uniform success engaged in fierce wars with the Byzantines; made Bagdad a centre of learning, commerce, and industry. D. in Khorassan Apr. 2, 809.

Harp [Lat. *harpa*], a musical instrument highly esteemed by the ancients, and used by Egyptians, Hebrews, Greeks, and in Celtic nations, particularly in Wales and Ireland, as well as among the Teutonic nations of antiquity. In modern times its power and sweetness have been much improved, especially by Sébastien Érard. The harp is generally of a somewhat triangular outline, and has strings of wire or catgut.

Harp, tp. of De Witt co., Ill. Pop. 1164.

Har'palus, a nephew of Philip of Macedon, and a close associate of the youthful Alexander; was banished 337 B. C. by Philip for intriguing to bring about Alexander's marriage with the daughter of Pixodarus; was recalled by Alexander, and set out with his master into Asia, acting as superintendent of the treasury; but, having stolen a part of the king's treasure, was compelled to flee (333 B. C.); was pardoned by Alexander 331, and received his former office; became satrap of Babylon 326, and was guilty of disgraceful excesses; fled to Athens 325; was imprisoned, but escaped, and went with some troops to Crete, where he was murdered, probably in 324 B. C.

Harpe, La. See La Harpe.

Har'per, county of Kansas, bounded on the S. by the Indian Territory. Area, 1188 square miles. It is about equidistant from the E. and S. borders of the State, and is a good grazing region. Cap. Bluff City.

Harper, tp. of Roane co., West Va. Pop. 955.

Harper (Robert Goodloe), LL.D., was b. in 1765 near Fredericksburg, Va., and while young removed with his parents to Granville, N. C. He joined the Revolutionary army when fifteen years old. He graduated at Princeton in 1785, and was (1794–1801) a Federalist member of Congress from South Carolina. He married a daughter of Charles Carroll of Carrollton, and became a leading lawyer of Baltimore. He was (1815–16) U. S. Senator from Maryland, and a major-general of militia in the war of 1812. He was an active supporter of the Colonization Society, and the town of Harper, near Cape Palmas, was named in his honor. He published numerous letters, speeches, pamphlets, etc., and a volume of his select writings appeared in 1814. D. at Baltimore Jan. 15, 1825.

Harper (William), b. in Antigua Jan. 17, 1790; studied at Baltimore, and in 1802 settled with his father in Columbia, S. C. He graduated at South Carolina College in 1808, and became a lawyer; in 1818 removed to Missouri, and held several public offices. In 1823 he returned to Columbia, where he published a volume of legal reports. He was (1826) a U. S. Senator; in 1828 Speaker of the South Carolina house of representatives; became in 1831 judge of the court of appeals; and was (1834–47) chancellor of the State. He was a zealous State rights man and an able jurist. D. Oct. 10, 1847.

Harper & Brothers, the name of a firm of brothers, originally comprising James (b. 1795), John (b. 1797), Joseph Wesley (b. 1801), and Fletcher (b. 1806) Harper, universally known as American publishers. They were b. at Newtown, Long Island, their father being a farmer. The founders of the present extensive house were James and John, who, having concluded an apprenticeship at the printer's trade, commenced the printing business on their own account, and subsequently engaged in publishing under the firm-name of J. & J. Harper, which style was maintained until about 1825, when Joseph Wesley and Fletcher, both having served a term of apprenticeship to their brothers, were admitted to the business, and the name of the firm changed to Harper & Brothers. From small beginnings the firm constantly increased in importance until it became the leading publishing-house in America. In Dec., 1853, their extensive publishing-house was destroyed by fire, and a loss of nearly $1,000,000 sustained.

Their present fireproof establishment was erected on the old site. Besides their extensive catalogue of books, they publish *Harper's Magazine*, a monthly; *Harper's Weekly*, an illustrated journal; *Harper's Bazar*, a weekly journal devoted to fashion and domestic life. In 1844, James Harper was elected mayor of the city of New York, the only public office held by him. In Mar., 1869, while driving with his daughter, he was thrown from his carriage and killed. Wesley d. the following year. Soon after John retired from active participation, and d. Apr. 22, 1875. The firm is now composed of Fletcher of the original house, and of sons of the original firm, all well-educated and capable business-men.

Har'per's Fer'ry, post-v. of Jefferson co., W. Va., picturesquely situated at the confluence of the Potomac and Shenandoah rivers, and in the basin formed by the steep heights known as Maryland, Loudoun, and Bolivar Heights, which tower high above the village. The scenery at this point, where the combined streams break through the Blue Ridge, is grand and beautiful. Jefferson declared "the passage of the Potomac through the Blue Ridge one of the most stupendous scenes in nature, and well worth a voyage across the Atlantic to witness." An unusual historic interest also attaches to this locality. In Oct., 1859, the place was entered by John Brown and his followers, and the U. S. arsenal and national armory seized and held for upwards of twenty-four hours. During the civil strife it was among the first to feel the ravages of war. In Apr., 1861, the small party of regulars guarding the public buildings evacuated the place before an approaching body of insurgents, and the town was occupied and held by the Confederates until the following June, when it was in turn evacuated by them, after destroying the arsenal and armory, and the bridge across the Potomac. Again in Sept., 1862, during Lee's invasion of Maryland, the place was invested by the Confederates, and after a futile defence, the heights not having been fortified, was surrendered by Col. Miles, who was himself shot dead while bearing the white flag betokening surrender; 12,000 prisoners, 73 guns, and upwards of 13,000 small-arms, besides a large quantity of stores, thus fell into the hands of the Confederates. The place was reoccupied by Gen. McClellan after the battle of Antietam, and was not again out of possession of the U. S. The Baltimore and Ohio and the Winchester and Potomac R. Rs. unite here. The Chesapeake and Ohio Canal also passes by on the Maryland shore. Harper's Ferry is the seat of Stover College. Pop. about 2500.

Har'persfield, tp. and post-v. of Delaware co., N. Y. It has 5 churches, and is one of the best grazing towns in the State. Pop. 1485.

Harpersfield, post-tp. of Ashtabula co., O. P. 1120.

Har'persville, tp. of Shelby co., Ala. Pop. 1334.

Harpersville, post-v. of Colesville tp., Broome co., N. Y., on the Susquehanna River. It has 3 churches, and is on the Albany and Susquehanna R. R., 22 miles from Binghamton. Pop. 218.

Har'peth Riv'er rises in Williamson co., Tenn., flows N. W. in Cheatham and Dickson counties, and after a course of 100 miles falls into the Cumberland. It affords abundant water-power.

Harpeth Shoals, a shallow part of the Cumberland River, 40 miles below Nashville, Tenn., which during low water seriously obstructs steamboat navigation.

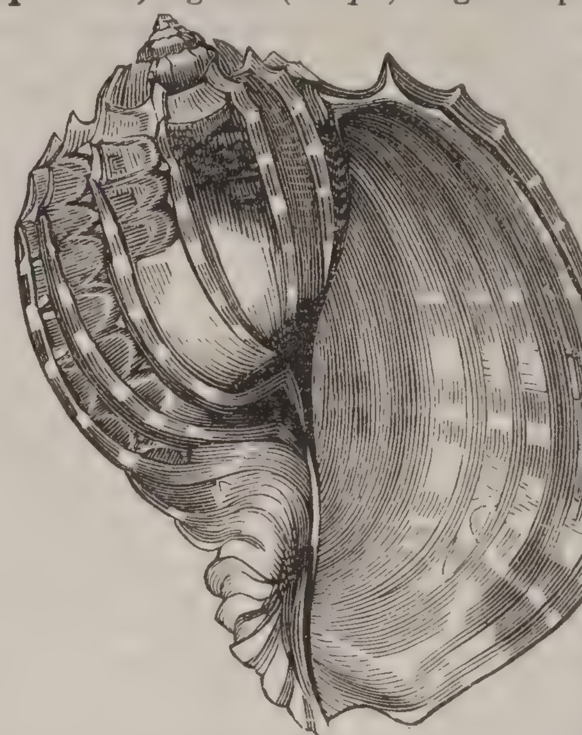
Har'pies [Gr. Ἅρπυιαι, the "swift spoilers"], in Greek mythology, certain hideous monsters of the female sex, often described as birds with the heads of women and having huge claws. Their number and all the circumstances of their mythus are variously related. They were commonly said to reside at the isles called Strophades. Some writers make them symbolical of storm-winds—others, of the forms of death.

Harpoc'rates [Egyptian *Harpa Khrut*, "Horus the child"], the Younger Horus, a divinity of the ancient Egyptians, son of Osiris and Isis, worshipped in later times in Greece and Rome as the god of silence, but not so esteemed by the Egyptians. His sculptures show him as a child placing his finger upon his lips—an infantile act which the Greeks incorrectly thought to be expressive of a command to preserve silence. The Romans honored him as the sender of prophetic dreams. He seems to have originally symbolized the feeble vegetal life of the winter months.

Harpocra'tion (Ἁρποκρατίων), with the Roman surname VALERIUS, a Greek rhetorician and lexicographer who flourished at Alexandria, but of whose life no particulars are preserved. Even the period when he flourished is uncertain. An important work for the explanation of legal and political terms is ascribed to him, entitled λεξικὸν τῶν δέκα ῥητόρων, containing in somewhat irregular alphabetical order an explanation of peculiarities of expression and of proper names in the ten chief Attic orators. Suidas and the *Etymologicon Magnum* have borrowed much from him. The best editions are that of Bekker (Berlin, 1833) and that of G. Dindorf (Oxford, 1855). H. DRISLER.

Harp Seal, the *Pagophilus grœnlandicus*, commercially the most important of the seal family. It inhabits the coasts of Greenland, Labrador, and Newfoundland; also found in the N. of Europe and of Asia. It is the most extensively caught of all the seals sought in the Newfoundland fisheries, many steamers as well as sailing vessels being employed in its pursuit. It yields great quantities of excellent oil, and its skin is also valuable. It takes its name from the rudely harp-shaped markings upon its back.

Harp-shell, a genus (*Harpa*) of gasteropod mollusks



The Harp-shell.

of the whelk family, natives of the Indian and Pacific oceans. There are several species, of which *H. ventricosa* is best known. It is caught as food at the Mauritius, and the shells are highly valued.

Harp'sichord, a keyed musical instrument, in form resembling the grand piano, but smaller, and strung with steel and brass wires, two to each note, which are struck by *jacks* furnished with quill plectrums. Stops, swells, and double rows of keys were sometimes employed to affect the power of the wires. When skilfully played upon, the instrument gave forth a feeble but not unpleasing tone, which was susceptible of delicate modulations. The harpsichord was in common use in the twelfth and thirteenth centuries; it was brought to England in the seventeenth, but is now wholly superseded by the pianoforte, of which it was the rude suggestion, and is probably nowhere manufactured at present.

Harps'well, post-tp. of Cumberland co., Me., comprising many islands in the E. part of Casco Bay. It is some 14 miles E. of Portland by water. It has 5 churches and a fire insurance company, and is interesting as the scene of many traditions of much interest. Pop. 1749.

Harquebus. See ARQUEBUS.

Harpy Eagle. See EAGLE.

Har'rel's, tp. of Mitchell co., N. C. Pop. 479.

Har'rell's Cross-Roads, tp. of Dallas co., Ala. Pop. 3778.

Har'rellsville, tp. of Hertford co., N. C. Pop. 1743.

Har'rier, a small fox-hound, bred and trained to follow the hare. It is chiefly used in the British Islands, where several breeds are distinguished.

Harrier, a general name for the hawks of the genus *Circus*. Of some fifteen species, only one (*Circus hudsonicus*), the marsh-hawk, is a native of the U. S. Like the goshawks, they fly along the ground in search of prey. In this genus feathers radiate from the eyes, giving the bird a rather owl-like appearance. Many of the species are European.

Har'rietstown, tp. of Franklin co., N. Y., in the Adirondacks, contains many lakes and mountains. Pop. 416.

Har'riman (WALTER), b. in Warner, N. H., about 1817. As a teacher, Universalist preacher, Democratic politician, and orator he won much renown; was 1862–65 the commander of the 11th New Hampshire Vols. in the civil war; secretary of state in New Hampshire 1865–67; Republican governor of New Hampshire 1867–69; and was then appointed naval officer of the port of Boston, Mass.

Har'rington, post-v. of Kent co., Del., at the union of the Junction and Breakwater R. R. with the Delaware R. R., 16 miles S. of Dover.

Harrington, post-tp. of Washington co., Me., on the sea-coast, 20 miles W. of Machias. Shipbuilding is an important interest. Pop. 1142.

Harrington, tp. of Bergen co., N. J., having the Hudson River on the E. and the New York State line on the N. E. Pop. 2664.

Harrington (JAMES), b. at Upton, North Hants, England, Jan., 1611; was educated at Trinity College, Oxford; served in the Low Countries, and became groom of the bedchamber to Charles I., to whom he was faithful, though an enthusiastic republican. His chief work, *Oceana* (1656), a description of an ideal republic, was dedicated to Cromwell, upon whom, however, it contained severe reflections. Soon after Charles II.'s restoration, Harrington was confined in the Tower as a traitor, and became insane during his imprisonment. His minor works are mostly upon the theory of government, but among them is a translation of four books of the *Æneid* into English verse. D. at Westminster Sept. 11, 1677.

Harrington (PURNELL F.), U. S. N., b. June 6, 1844, in Delaware; graduated at the Naval Academy in 1863; became a master in 1866, a lieutenant in 1867, a lieutenant-commander in 1868; served on board the Monongahela at the battle of Mobile Bay, Aug. 6, 1864, and was commended for gallant conduct by Com. James H. Strong.
FOXHALL A. PARKER.

Harrington (SAMUEL MAXWELL), LL.D., b. at Dover, Del., Feb. 5, 1803; graduated at Washington College, Md., 1823; secretary of state for Delaware in 1829; chief-justice of the State supreme court 1831; and afterwards was an associate judge of the superior court; again chief-justice 1855; chancellor of Delaware 1857–65. D. at Philadelphia Nov. 28, 1865. Author of three volumes of law reports (1837–44), and was at the head of the commission of 1849 for codifying the laws of his State.

Har'riott (THOMAS), b. at Oxford, England, 1560; studied at St. Mary's Hall, Oxford; graduated B. A. 1579; went with his patron, Raleigh, to Virginia 1584–85; published a *Briefe and True Report of the New Found Land of Virginia* (1588, republished in Hakluyt's 3d vol.); became a pensioner of the earl of Northumberland; made very important algebraical improvements; greatly simplified the theory of equations, and was the first to conceive the possibility of putting all the terms of the equation into the same side. He was also an able observer of the phenomena of physics. D. in London July 2, 1621. The posthumous *Artis analyticæ Praxis nova ad æquationes resolvendas* (1631) is his most important work.

Har'ris, county of Georgia, separated from Alabama by the Chattahoochee River. Area, 500 square miles. The surface is varied, the soil generally good. The county contains extensive forests. Cotton and corn are staple products. Cap. Hamilton. Pop. 13,284.

Harris, county in the S. E. of Texas. Area, 1832 square miles. It has mostly a light soil, but is profitably cultivated from its proximity to markets, and there are extensive tracts of high fertility. Cotton, lumber, and corn are leading products. The surface is mostly level, and only one-sixth is timber-land. The county is traversed by several navigable bayous flowing into Galveston Bay, and by the various railroads which centre at Houston, the capital. The manufacturing interests are quite important. Pop. 17,375.

Harris, tp. of Izard co., Ark. Pop. 122.

Harris, tp. of Fulton co., Ill. Pop. 1029.

Harris, tp. of St. Joseph co., Ind. Pop. 408.

Harris, tp. of Ripley co., Mo. Pop. 160.

Harris, tp. of Franklin co., N. C. Pop. 1266.

Harris, tp. of Stanley co., N. C. Pop. 924.

Harris, tp. of Ottawa co., O. Pop. 2190.

Harris, tp. of Centre co., Pa. Here the State Agricultural College is situated (AGRICULTURAL COLLEGE P. O.). Pop. 1999.

Harris, tp. of Wood co., West Va. Pop. 1699.

Harris, tp. of Marquette co., Wis. Pop. 498.

Harris (CHAPIN A.), A. M., M. D., D. D. S., b. in Pompey, N. Y., 1806; d. in Baltimore in 1860. He organized the Baltimore Dental College in 1839—the first of the kind. He established the *American Journal and Library of Dental Science;* published the *Dental Art;* the *Principles and Practice of Dental Surgery;* and the *Dental Dictionary* —works which have immortalized his name. A worthy contemporary, the venerable Dr. Parmley, said of him: "He has labored more assiduously as a practitioner, more untiringly as a writer, and more devotedly as a teacher of the principles and practice of dental surgery than any person who has in any way or in any country been connected with our professional art." He was for many years a prominent member of the Methodist Episcopal Church. He founded the first dental college in the world, and his publications on this art still remain unrivalled. P. F. EVE.

Harris (CHARLES), b. in England in 1772; educated in France; migrated to Georgia 1788; studied law in Savannah, where he was admitted to the bar, and rose to the highest distinction in his profession; was twice elected to the judgeship of his circuit, and twice declined; on the retirement of Gov. Milledge from the U. S. Senate (1809), the position was tendered him by both parties; this he also declined. D. Mar., 1827, lamented by all classes of people. It was in honor of him that the county of Harris in his State was named. "Mr. Harris was of a highly respectable family. His father was William Harris, barrister, who was first cousin of Lord Malmesbury. His mother was the sister of the hereditary champion of England, Charles Dymock, who attended at the coronation of George III., and his father was one of the two squires of the champion who attended the coronation. The Dymocks were a branch of the De Bergs, who had been champions of England from the accession of the Norman family." (See WHITE'S *Statistics of Georgia.*) A. H. STEPHENS.

Harris (DAVID BULLOCK), b. at Frederick's Hall, Louisa co., Va., Sept. 28, 1814; graduated at the U. S. Military Academy at West Point in 1833, and entered the army as a brevet second lieutenant of the 1st Artillery; served a year with that regiment in the field, and was assigned to duty as assistant professor of engineering at West Point, a position which he filled until Aug. 30, 1835, when he resigned from the army. For several years thereafter he was employed as a civil engineer on important works, such as the James River and Kanawha Canal; but subsequently for some years was largely and successfully engaged in Kentucky, and London, England, where he resided for a time, and in Virginia as an exporter of tobacco to Europe and of flour to South America. Residing on his plantation in Virginia when that State seceded from the Union in Apr., 1861, he re-entered the military career as a captain of engineers of the Virginia forces, and was at once put on duty at Culpeper Court-house. It was Capt. Harris who first reconnoitred the line of Bull Run, and determined its defensive and strategic value; and when the position of Manassas Junction was occupied in force late in May, 1861, he laid out and constructed the works for its defence. Having soon acquired the complete confidence of Gen. Beauregard, he was ever after associated with that commander. In the battle of Bull Run, attached specially to the staff of Gen. Philip St. George Cocke, Capt. Harris was not less conspicuous for his cool courage than for his skill at several critical moments in the disposition of the Confederate troops, notably in their encounter with Sherman's brigade. He accompanied Beauregard early in 1862 to the West, and there planned and constructed the works at Island 10 and Fort Pillow on the Mississippi River, and subsequently the river-defences at Vicksburg. When Gen. Beauregard was transferred to Charleston in Oct., 1862, Capt. Harris was also called there, and charged with the direction of the engineer operations of that remarkable defence. In 1864 (meanwhile promoted to the grade of colonel of engineers and second in rank in his corps) he went back with Gen. Beauregard to Virginia, where he gave signal evidence of his rare capacities as an engineer on the Confederate lines before Petersburg. But it having been thought best for him to return to Charleston, Capt. Harris was attacked with the yellow fever, and d. in the vicinity of that city on Oct. 10, 1864, just as he had been tardily commissioned a brigadier-general in a service of which he was among the very ablest soldiers. THOMAS JORDAN.

Harris (HENRY R.), b. in Sparta, Ga., Feb. 2, 1828; graduated at Emory College 1847; settled in Greenville, Meriwether co.; by profession a planter; was a member of the Georgia secession convention 1861, and a member of the 43d and 44th Congresses from his native State.

Harris (HOWELL), b. at Trevecca, Wales, in 1714; studied at Oxford, and on returning to Wales took the field as an evangelist and open-air preacher, founding societies and awakening the whole principality by his zealous labors. Though, like Wesley and Whitefield, a churchman, he received little or no sympathy from the clergy, but the two great evangelists heartily recognized him. In a few years he had formed no less than 300 societies. Wesley and Whitefield frequently traversed the principality in his company, preaching daily. Wesley describes Harris as a "powerful orator." He may be considered the chief founder of "Calvinistic Methodism," now the most prevalent form of dissent in Wales. Harris raised and commanded a regiment, mostly of his own people, during the French war, when the invasion of England was expected.

For about three years he preached in his camps and in the market-places whenever his troops moved. D. at Trevecca July 21, 1773. A. STEVENS.

Harris (IRA), b. in Charleston, Montgomery co., N. Y., May 31, 1802; graduated at Union College in 1824; became a lawyer in Albany; served in the legislature 1844–46, and in the constitutional conventions of 1845 and 1867; was a judge of the State supreme court 1847–60; U. S. Senator 1862–68. He is an able and successful lawyer.

Harris (IRA), U. S. N., b. May 4, 1843, in New York; graduated at the Naval Academy in 1863; became a lieutenant in 1866, a lieutenant-commander in 1868; served with gallantry in the assault upon Fort Fisher, Jan. 13, 1865, and was severely wounded in the right leg. Resigned Mar. 21, 1871. FOXHALL A. PARKER.

Harris (ISHAM G.), a distinguished Tennessee politician; was a member of Congress from 1849 to 1853; was governor of the State 1857–61; was an ardent advocate of secession, and after the war became a merchant of Liverpool, England. He now resides at Memphis, Tenn.

Harris (IVERSON L.), b. at Watkinsville, Ga., Jan. 7, 1805; graduated at State University 1823; studied law; admitted to the bar; settled in Milledgeville; was elevated to the circuit and then to the supreme court bench of the State, retiring in 1868; was trustee of the State University, but resigned in 1872 on account of ill-health. A. H. STEPHENS.

Harris (JAMES), nephew of Lord Shaftesbury, was b. at Salisbury July 20, 1709; was educated at Wadham College, Oxford, and at Lincoln's Inn; entered parliament for Christchurch 1761; a lord of the admiralty 1762; a lord of the treasury 1763; secretary and comptroller to the queen 1774. D. Dec. 22, 1780. Author of *Three Treatises* on art, music, etc., and on happiness (1744); *Hermes* (1751), a work on language and general grammar, still highly valued. His later works are *Spring*, a pastoral (1762), *Philosophical Arrangements* (1775, part of an unfinished work on Aristotle's *Logic*), and *Philological Inquiries* (1780).—His son, JAMES (1746–1820), became in 1788 a baron, and in 1800 was created earl of Malmesbury.

Harris (JOHN), D. D., b. at Ugborough, Devon, England, Mar. 8, 1802; was educated at Hoxton College, and in 1827 became an independent minister of Epsom: president of Cheshunt College 1837; principal and professor of theology in New College, St. John's Wood, near London, 1850, where he d. Dec. 21, 1856. Author of *The Great Teacher* (1835); *Mammon* (1836); *Britannia* (1837); *The Great Commission* (1842); *Pre-Adamite Earth* (1847); *Man Primeval* (1849); *Patriarchy* (1855), and other works.

Harris (SAMUEL), the "apostle of Virginia," so called, was b. in Hanover co., Va., Jan. 12, 1724. He became a colonel of militia in Pittsylvania co., and held important public offices. In 1769 he was ordained a Baptist minister, having for years zealously preached in the Baptist churches with great power. He gave a large share of his property to charitable causes, and underwent much persecution from the then Established Church of Virginia. In 1774 he was ordained an "apostle" by the General Association of Separate Baptists. Date of death uncertain.

Harris (SAMUEL), D. D., LL.D., b. in East Machias, Me., June 14, 1814; graduated at Bowdoin College in 1833, and at Andover Theological Seminary in 1838. He was a teacher at Limerick, Me., 1833–34, and at East Machias 1834–35 and 1838–41. He was pastor of the Congregational church in Conway, Mass., 1841–51, and of the South Congregational church in Pittsfield, Mass., 1851–55. From 1855 to 1867 he was professor of systematic theology in the Theological Seminary in Bangor, Me.; president of Bowdoin College 1867–71; and in 1871 took the chair of systematic theology in the theological department of Yale College. He received the degree of D. D. from Williams College in 1855, and the degree of LL.D. from Bowdoin College in 1871. He has published *Zaccheus, or the Scriptural Plan of Benevolence* (1850), *Christ's Prayer for His Redeemed* (1862), *The Kingdom of Christ on Earth* (1874), and several minor works. R. D. HITCHCOCK.

Harris (THADDEUS MASON), D. D., a Unitarian divine, b. at Charlestown (now Boston), Mass., July 17, 1768; graduated at Harvard in 1787; was appointed private secretary to Gen. Washington, but sickness prevented his acceptance. In 1790 he delivered the Phi Beta Kappa address at Cambridge, where he studied divinity; was librarian of Harvard University 1791–93; pastor of the First church, Dorchester, 1793–1839; d. at Dorchester, Mass., Apr. 3, 1842. He was the author of many works, among which are *The Minor Encyclopædia* (1803, 4 vols.); *Journal of a Tour into the North-west Territory* (1803); *Natural History of the Bible* (1820), an admirable work for its day; and *Memoirs of Oglethorpe* (1841).

Harris (THADDEUS WILLIAM), M. D., a son of Dr. T. M. Harris (1768–1842), was b. at Dorchester, Mass., Nov. 12, 1795; graduated at Harvard in 1815, and studied medicine, which he practised at Milton, Mass. He was (1831–56) librarian of Harvard College, and for a time was instructor in botany and natural history, and won especial distinction as an entomologist, being one of the pioneers of that science in North America. D. at Cambridge, Mass., Jan. 16, 1856. His most important works are a *Systematic Catalogue of the Insects of Massachusetts*; and a valuable treatise *On Insects Injurious to Vegetation* (1841; enlarged eds. 1842, 1852, 1862). He also published many scientific and antiquarian papers.—His sons, WILLIAM THADDEUS (1826–54) and EDWARD D. HARRIS, have attained distinction as genealogists and historical students.

Harris (THOMAS C.), U. S. N., b. Nov. 18, 1825, in Philadelphia, Pa.; entered the navy as a midshipman Sept. 9, 1841; became a passed midshipman in 1847, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866, a captain in 1872. During the civil war he commanded the Chippewa and the Yantic, in the former participating in several attacks on Fort Wagner, and in the latter taking part in both engagements with Fort Fisher. For cool performance of duty in action recommended for promotion by Rear-admiral Porter, Jan. 28, 1865. FOXHALL A. PARKER.

Harris (THOMAS L.), b. at Norwich, Conn., Oct. 29, 1816; graduated at Trinity College, Hartford, in 1841; became a lawyer in Virginia in 1842, but removed to Petersburg, Ill., in that year; was a State senator in 1846; as major commanding the 4th Illinois Volunteers in Mexico was distinguished at Vera Cruz and Cerro Gordo; was a member of Congress 1849–55. D. at Petersburg, Ill., Nov. 24, 1858.

Harris (THOMAS LAKE), b. May 15, 1823, at Fenny Stratford, England, and when four years old came to America with his parents, who settled at Utica, N. Y. He early attained some distinction as a writer, and became a minister of the Universalist faith in New York City and elsewhere. From 1850 to 1855 he labored as a lecturer upon Spiritualism, in which he became an earnest believer. He preached in Great Britain 1858–61, winning many followers to his system, which appears to combine the Swedenborgian theology and the Platonic philosophy with some of the doctrines of Fourier. His followers, "The Brotherhood of the New Life," are found in Great Britain, the U. S., India, and Japan. Their chief establishment, co-operative, but not communistic, was at Wassaic, Dutchess co., N. Y., from 1861 to 1867, when it was removed to Brocton, Chautauqua co., N. Y., where it still remains. The Scriptures and the marriage relation are esteemed sacred by them; proselytism is repudiated; and self-renunciation is regarded as one of the supreme duties of man. Mr. Harris is the author of numerous poetical and prose works, explaining and illustrating his mystical philosophy.

Harris (WILLIAM), S. T. D., b. at Springfield, Mass., Apr. 29, 1765; graduated at Harvard in 1786; was rector of an Episcopal church in Marblehead, Mass., and at the same time instructor in an academy 1791–1802; rector of St. Mark's, New York City, 1802–16; and the founder of an excellent classical school. From 1811 to 1829 he was president of Columbia College. D. Oct. 18, 1829. In early life he was a licensed preacher of the Congregationalist denomination.

Harris (WILLIAM L.), D. D., b. Nov. 4, 1817, in Ohio; he joined the Michigan conference in 1837, and after travelling some ten years as an itinerant preacher, was elected principal of the Baldwin Institute; he subsequently served some ten years as professor in the Ohio Wesleyan University. In 1860 he was elected assistant secretary to the Missionary Society of the Methodist Episcopal Church. At the General Conference of his Church in 1872 he was elected bishop. He has been energetically devoted to his denomination in her greatest enterprises, and was especially eminent in her anti-slavery struggle.

Harris (WILLIAM TORREY), A. M., LL.D., b. at Killingly, Conn., Sept. 10, 1835; entered Yale College in 1854; became a teacher in St. Louis, Mo., 1857; became superintendent of public schools there 1867; was in 1866 one of the founders of the Philosophical Society at St. Louis; founded the *Journal of Speculative Philosophy* 1867, which he has since edited, and in which he has published many translations and original articles upon philosophical questions. It is the only journal of the kind in the English language. His school reports are widely sought for and read both in this country and Europe, and large extracts from them have been republished in England and Germany.

Har'risburg, post-v., county-seat of Poinsett co., Ark., 55 miles N. W. of Memphis, Tenn.

Harrisburg, post-v. and tp., cap. of Saline co., Ill., on the Cairo and Vincennes R. R. It has 2 churches, a high school, 2 flouring-mills, an agricultural implement manufactory, 1 weekly newspaper, and is in the centre of a country abounding in coal, iron, lead, and salt. Pop. of v. 590; of tp. 1710. F. M. PICKETT, ED. "CHRONICLE."

Harrisburg, tp. of Van Buren co., Ia. Pop. 1089.

Harrisburg, post-tp. of Lewis co., N. Y., has 6 cheese-factories, and is a fine dairy tract. Pop. 1090.

Harrisburg, post-v. of Franklin co., O. Pop. 153.

Harrisburg, city, cap. of Dauphin co. and of the State of Pennsylvania, situated on the E. bank of the Susquehanna River, 60 miles from its mouth. It is 106 miles from Philadelphia, and 121 miles from Washington City; lat. 40° 15′ N., lon. 76° 12′ W., and stands chiefly on a plateau from 26 to 50 feet above low water in the river. The Cumberland Valley, Northern Central, Pennsylvania, and Philadelphia and Reading R. Rs. all centre here, while the Pennsylvania Canal, with its outlets and feeders, adds much to its facilities for trade. It is an extensive dépôt for lumber *viâ* the Susquehanna River. Four bridges, each over a mile in length—three for railroads and one a carriage bridge—span the river at this point. The State Capitol buildings,

State Capitol, Harrisburg, Pa., west front.

embracing offices for the different departments of the State government, are located in the midst of a beautiful park of ten acres on a gentle rise of ground. They are plain brick edifices; the Capitol proper has large porticoes on the E. and W. fronts, and a spacious rotunda surmounted by a dome which commands a fine view of the picturesque Susquehanna. The State Library comprises 40,000 volumes, and a monument erected to the memory of the soldiers who fell in the Mexican war adorns the Capitol park. Harrisburg has 38 churches, and 2 national and 7 banks of discount. It contains the court-house and county prison, and has 3 daily and 6 weekly newspapers, besides several monthly publications. Besides the Harrisburg Academy and Institute, St. Genevieve's Academy, and a young ladies' seminary, it has 15 large and a number of small public school buildings, accommodating 41 schools and 5000 scholars. Its local charities are a house for the friendless, city hospital, and the Pennsylvania Lunatic Asylum, a State institution. Harrisburg has a well-regulated fire department, an electric fire-alarm telegraph, and a horse railway. The new waterworks are extensive, and, with the old, cost $750,000. The streets are macadamized and supplied with gas. It has a fine opera-house, with a seating capacity of 1600. The prosperity of Harrisburg does not depend upon its being the capital of the State, but upon its railway and canal communication with the coal and iron resources of the State; and it is these remarkable resources that have invited the large manufacturing establishments of iron, steel, boilers, galvanized iron cornices, brick, and tile. Among these we may specify the Pennsylvania Bessemer steel-works, the Lochiel, Franklin, Central, and Pennsylvania Car Co.'s iron-works, the Chesapeake nail-works, the McCormick's, Wistar's, Price's, and Dock's blast-furnaces, the Harrisburg cotton-mill, the Eagle, the Harrisburg, and other machine-works. It has, besides, 5 carriage, 1 shoe, and 2 broom factories, file-works, 3 large flouring-mills, and 7 extensive saw and planing establishments, with numerous smaller manufacturing interests, employing a capital of $12,000,000. It is the fifth city in the State. It is the seat of a Roman Catholic bishop. Pop. 23,104.

WILLIAM H. EGLE, *Author of History of Pa.*

Harrisburg, post-v. of Harris co., Tex., 44 miles N. of Galveston, at the junction of the Galveston Houston and Henderson and the Galveston Harrisburg and San Antonio R. Rs. It is on Buffalo Bayou. Pop. 571.

Harris Gore, tp. of Washington co., Vt. Pop. 12.

Har'rison, county of Indiana, bounded on the S. by the Ohio River. Area, 475 square miles. The surface is finely diversified, the soil calcareous and fertile. There are several caverns. Cattle, grain, and wool are staple products; flour, cooperage, and lumber are leading manufactures. Cap. Corydon. Pop. 19,913.

Harrison, county of Iowa, bounded on the W. by the

Missouri River, which separates it from Nebraska. The soil is productive. Cattle, grain, and wool are the staples. It is traversed by the Chicago and North-western and the Sioux City and Pacific R. Rs. Cap. Magnolia. Pop. 8931.

Harrison, county of N. E. Central Kentucky. Area, 357 square miles. Its surface is varied, its soil mostly fertile. Cattle, grain, tobacco, and wool are staple products; distilled liquors and wagons are the leading articles of manufacture. It is traversed by the Kentucky Central R. R. Cap. Cynthiana. Pop. 12,993.

Harrison, county of Mississippi, bounded on the S. by the Gulf of Mexico (Mississippi Sound). Area, 970 square miles. The soil is light, and generally covered with pine forests. Rice and lumber are the principal products. The county is traversed by the New Orleans Mobile and Texas R. R. Cap. Mississippi City. Pop. 5795.

Harrison, county in the N. N. W. of Missouri, bounded on the N. by Iowa. Area, 720 square miles. It is chiefly prairie, most of which is fertile. Cattle, grain, tobacco, and wool are the staples. Cap. Bethany. Pop. 14,635.

Harrison, former county of Nebraska, parcelled out to other counties since the U. S. census. Pop. in 1870, 631.

Harrison, county in the E. of Ohio. Area, 400 square miles. It is hilly, but very fertile. Coal and limestone abound. Cattle, grain, and especially wool, are the staple products. The county is traversed by the Pittsburg Cincinnati and St. Louis R. R. Cap. Cadiz. Pop. 18,682.

Harrison, county of Texas, bounded E. by Louisiana, N. E. by Caddo Lake, and S. W. by the navigable Sabine River. Area, 964 square miles. Cotton, corn, fruit, and pork are extensively produced. The county is fertile, well watered, well timbered, and healthful. Leather, lumber, etc. are manufactured. The county is traversed by the Texas Pacific R. R. Cap. Marshall. Pop. 13,241.

Harrison, county in the N. of West Virginia. Area, 440 square miles. It is a hilly and rolling country, with broad valleys and a very rich soil. Timber, coal, iron, and salt are among its resources; cattle, grain, tobacco, and wool are the staple products. It is traversed by the Baltimore and Ohio R. R. Cap. Clarksburg. Pop. 16,714.

Harrison, tp. of Hale co., Ala. Pop. 800.

Harrison, post-v. and tp., cap. of Boone co., Ark., in Crooked Creek Valley. It has the U. S. land-office, a fine school-building, 5 general stores, 2 drug-stores, and 1 newspaper. Principal business, farming. Pop. of tp. 826.
THOMAS NEWMAN, ED. "HIGHLANDER."

Harrison, tp. of Columbia co., Ark. Pop. 960.

Harrison, tp. of Union co., Ark. Pop. 729.

Harrison, tp. of White co., Ark. Pop. 972.

Harrison, post-tp. of Winnebago co., Ill. Pop. 725.

Harrison, tp. of Bartholomew co., Ind. Pop. 1228.

Harrison, tp. of Blackford co., Ind. Pop. 1680.

Harrison, tp. of Boone co., Ind. Pop. 1209.

Harrison, tp. of Cass co., Ind. Pop. 1171.

Harrison, tp. of Clay co., Ind. Pop. 2241.

Harrison, tp. of Daviess co., Ind. Pop. 1084.

Harrison, tp. of Dearborn co., Ind. Pop. 1086.

Harrison, tp. of Delaware co., Ind. Pop. 1400.

Harrison, tp. of Elkhart co., Ind. Pop. 1655.

Harrison, tp. of Fayette co., Ind. Pop. 867.

Harrison, tp. of Harrison co., Ind. Pop. 3462. It contains the town of CORYDON (which see).

Harrison, tp. of Henry co., Ind. Pop. 1888.

Harrison, tp. of Howard co., Ind. Pop. 807.

Harrison, tp. of Knox co., Ind. Pop. 2812.

Harrison, tp. of Kosciusko co., Ind. Pop. 1745.

Harrison, tp. of Miami co., Ind. Pop. 1202.

Harrison, tp. of Morgan co., Ind. Pop. 378.

Harrison, tp. of Owen co., Ind. Pop. 451.

Harrison, tp. of Pulaski co., Ind. Pop. 753.

Harrison, tp. of Spencer co., Ind. Pop. 1977.

Harrison, tp. of Union co., Ind. Pop. 759.

Harrison, tp. of Vigo co., Ind. Pop. 870.

Harrison, tp. of Wayne co., Ind. Pop. 580.

Harrison, tp. of Wells co., Ind. Pop. 2961.

Harrison, tp. of Adair co., Ia. Pop. 434.

Harrison, tp. of Benton co., Ia. Pop. 502.

Harrison, tp. of Harrison co., Ia. Pop. 830.

Harrison, tp. of Lee co., Ia. Pop. 988.

Harrison, tp. of Mahaska co., Ia. Pop. 1270.

Harrison, tp. of Franklin co., Kan. Pop. 923.

Harrison, tp. and post-v. of Cumberland co., Me., 35 miles N. W. of Portland. It has a fire insurance company and manufactures of woollens, wire, agricultural machines, etc. Pop. 1219.

Harrison, tp. of Macomb co., Mich. Pop. 605.

Harrison, tp. of Monongalia co., Minn. Pop. 356.

Harrison, tp. of Daviess co., Mo. Pop. 831.

Harrison, tp. of Mercer co., Mo. Pop. 914.

Harrison, tp. of Moniteau co., Mo. Pop. 1585.

Harrison, tp. of Scotland co., Mo. Pop. 1491.

Harrison, tp. of Vernon co., Mo. Pop. 415.

Harrison, tp. of Gloucester co., N. J. Pop. 3038.

Harrison, city of Hudson co., N. J., on the Passaic River, opposite Newark. It has 2 weekly newspapers. Pop. 4129.

Harrison, tp. and post-v. of Westchester co., N. Y., on the New York and New Haven R. R. Pop. 787.

Harrison, tp. of Carroll co., O. Pop. 1024.

Harrison, tp. of Champaign co., O. Pop. 944.

Harrison, tp. of Darke co., O. Pop. 2007.

Harrison, tp. of Gallia co., O. Pop. 1329.

Harrison, tp. of Hamilton co., O. Pop. 758.

Harrison, post-v. of Hamilton co., O., on the Cincinnati and Whitewater R. R., 25 miles W. N. W. from Cincinnati, in a picturesque and agricultural district. It contains 6 churches, 2 schools, 3 flouring-mills, 2 tanneries, 2 brush-factories, 1 corn-drill factory, 1 woollen and 1 furniture factory, a sash and door factory, railroad-shops, etc. It has 1 weekly newspaper. Pop. 1417.
WILL R. HARTPENCE, ED. "HARRISON NEWS."

Harrison, tp. of Henry co., O. Pop. 1295.

Harrison, tp. of Knox co., O. Pop. 687.

Harrison, tp. of Licking co., O. Pop. 1242.

Harrison, tp. of Logan co., O. Pop. 994.

Harrison, tp. of Montgomery co., O. Pop. 2116.

Harrison, tp. of Muskingum co., O. Pop. 1197.

Harrison, tp. of Paulding co., O. Pop. 304.

Harrison, tp. of Perry co., O. Pop. 1202.

Harrison, tp. of Pickaway co., O. Pop. 1271.

Harrison, tp. of Preble co., O. Pop. 2294.

Harrison, tp. of Ross co., O. Pop. 1150.

Harrison, tp. of Scioto co., O. Pop. 1032.

Harrison, tp. of Van Wert co., O. Pop. 1319.

Harrison, tp. of Vinton co., O. Pop. 782.

Harrison, tp. of Allegheny co., Pa. Pop. 1870.

Harrison, tp. of Bedford co., Pa. Pop. 783.

Harrison, tp. of Potter co., Pa. Pop. 1052.

Harrison, post-v., cap. of James co., Tenn., on the E. bank of the Tennessee River, 12 miles above Chattanooga.

Harrison, tp. of Charles City co., Va. Pop. 1684.

Harrison, tp. of Calumet co., Wis., at the N. extremity of Lake Winnebago. Pop. 1562.

Harrison, tp. of Grant co., Wis. Pop. 1045.

Harrison (BENJAMIN), one of the signers of the Declaration of Independence, b. about 1740 at Berkeley, Charles co., Va.; was educated at William and Mary College. He took an early and prominent part in public affairs, and in 1764 was Speaker of the house of burgesses, and again 1777–82. He was a member of the General Congress from 1774–77, and governor of Virginia 1782–85. — He was the brother of Gen. CHARLES HARRISON, a Revolutionary officer, and President W. H. HARRISON was a son of Gov. Harrison, who d. in Apr., 1791.

Harrison (JOHN), b. at Faulby, Yorkshire, England, 1693; was bred a carpenter; produced a new escapement for clocks and watches and a compensation (gridiron) pendulum 1725; went to London 1735; invented the nautical chronometer 1736, and perfected it in 1759; received in consequence (1767) a prize of £20,000 offered in 1714 for the invention of means by which mariners could tell their longitude within thirty miles. He made various improvements in clocks and watches. D. in London Mar., 1776.

Harrison (JOHN HOFFMAN), M. D., b. in Washington City, D. C., Aug. 30, 1808; d. in New Orleans Mar. 19, 1849, of consumption. He received his diploma from the University of Maryland, was resident surgeon of its charity hospital 1833–36; was the founder of the *New Orleans Medical and Surgical Journal* in 1845, and edited it for four years. He published a valuable and elaborate work on the nervous system in 1849, and contributed several

important articles to the medical journals. His experiments in reference to the yellow fever are noticed by Dr. Drake in his elaborate work on the *Diseases of the Mississippi Valley*. PAUL F. EVE.

Harrison (NAPOLEON B.), U. S. N., b. Feb. 19, 1823, in Virginia; entered the navy as a midshipman Feb. 26, 1838; became a passed midshipman in 1844, a lieutenant in 1853, a commander in 1862, a captain in 1868. D. while in command of the Congress, Oct. 27, 1870. Capt. Harrison was a man of fine character, and greatly beloved by his brother officers. He had had the distinguished honor of leading the starboard column of the fleet by Forts Jackson and St. Philip on its way to New Orleans (Apr. 24, 1862), and "displayed masterly ability in steering his vessel under a hurricane of shot and shell, and afterward in manœuvring and fighting her." His death was universally regretted. FOXHALL A. PARKER.

Harrison (ROBERT A.), Q. C., D. C. L., Canadian barrister, was b. at Montreal Aug. 13, 1833, was called to the bar in 1855, and became a prominent lawyer of Toronto. He is the author of several standard works upon the law of Upper Canada, and has held important public offices.

Harrison (WILLIAM HENRY), the ninth President of the U. S., was b. Feb. 9, 1773, in Charles co., Va., at Berkeley, the residence of his father, Gov. Benjamin Harrison. He studied at Hampden-Sidney College with a view to entering the profession of medicine. In 1791 he became an ensign in the army, and in 1792 a lieutenant on Wayne's staff. In 1795 he was made captain and commandant of Fort Washington, now Cincinnati, O. In 1797–98 he was secretary of the North-west Territory, and in 1799–1800 its delegate in Congress. He was (1801–13) governor of Indiana Territory and superintendent of Indian affairs, and as such concluded thirteen important treaties and gained the battle of Tippecanoe, Nov. 7, 1811. In 1812 he was made major-general of Kentucky militia and brigadier-general in the army, with the command of the north-west frontier. In 1813 he was made major-general, and as such won much renown by the defence of Fort Meigs and the battle of the Thames, Oct. 5, 1813. In 1814 he left the army, and was employed in Indian affairs by the government. He was a member of Congress from Ohio 1816–19; State senator 1819–21; U. S. Senator 1825–28; Presidential elector 1821 and 1825; U. S. minister to Colombia 1828–29; after which he retired to his farm at North Bend, Hamilton co., O., 16 miles below Cincinnati, where for twelve years he was clerk of the county court. In 1839 he was nominated for the Presidency by the Whigs at Harrisburg, Pa., Mr. Van Buren being the Democratic candidate, and Gen. Harrison received 234 electoral votes against 60 for his opponent. This election is memorable chiefly for the then extraordinary means employed during the canvass for popular votes. Mass meetings and processions were introduced, and the watchwords "log cabin" and "hard cider" (referring to statements of his political adversaries as to the general's habitation and his favorite drink) were effectively used by the Whigs, and aroused a wonderful popular enthusiasm. Pres. Harrison d. Apr. 4, 1841, just thirty-one days after his inauguration. He published in 1838 a small work on the Indians of the Ohio Valley. (See his *Life* by MOSES DAWSON, 1824; by JAMES HALL, 1836; by R. HILDRETH, 1839; by S. J. BURR, 1840; by ISAAC R. JACKSON, and others.)

Har'risonburg, post-v., cap. of Catahoula parish, La., on the navigable Ouachita River. It has 1 weekly newspaper. Pop. 217.

Harrisonburg, post-v. and tp., cap. of Rockingham co., Va., in the Shenandoah Valley, on the Baltimore and Ohio and the Valley R. Rs., and on the Washington and St. Louis narrow-gauge R. R., which will connect it with the iron and coal fields of West Virginia. It has a national bank, about 30 stores of various kinds, 2 weekly newspapers, and 5 white and 2 colored schools. Rawley Springs are 12 miles E. of Harrisonburg. Pop. of v. 2036; of tp. 2828. JNO. H. WARTMANN, ED. "REGISTER."

Har'rison Square, post-v. of Suffolk co., Mass., now included in Boston, is on the Old Colony R. R., Shawmut and Milton branch.

Har'risonville, tp. and post-v. of Monroe co., Ill., on the Mississippi River, 28 miles below St. Louis, in a fertile region. Pop. 478.

Harrisonville, post-v., cap. of Cass co., Mo., 45 miles S. S. E. of Kansas City, on the Osage division of the Missouri Kansas and Texas R. R. It has 1 private bank, 1 newspaper, a high school, a steam flouring-mill, stores and shops. Pop. 1032. J. E. PAYNE, ED. "COURIER."

Harrisonville, post-v. of Meigs co., O., in Scipio tp. Pop. 160.

Har'ristown, tp. and post-v. of Macon co., Ill., on the Toledo Wabash and Western R. R., 7 miles W. of Decatur Pop. 984.

Har'risville, post-v., county-seat of Alcona co., Mich., on Lake Huron. Pop. 464.

Harrisville, tp. and post-v. of Cheshire co., N. H., 42 miles S. W. of Concord. It has manufactures of woollen goods, lumber, and wooden ware.

Harrisville, thriving post-v. of Diana tp., Lewis co., N. Y., has manufactures of lumber, chairs, leather, etc.

Harrisville, post-v. of Short Creek tp., Harrison co., O. Pop. 258.

Harrisville, tp. of Medina co., O. Pop. 1182.

Harrisville, post-b. of Mercer tp., Butler co., Pa., on the Shenango and Allegheny R. R., 33 miles S. E. of Greenville. Pop. 352.

Harrisville, manufacturing village of Burrillville tp., Providence co., R. I., on the Providence and Springfield R. R., 21 miles from Providence.

Harrisville (P. O., RITCHIE C. H.), cap. of Ritchie co., W. Va., 3 miles S. of the Baltimore and Ohio R. R. It has 1 weekly newspaper. Pop. 140.

Har'rodsburg, post-v., cap. of Mercer co., Ky., is 3 miles from the line of the Cincinnati Southern R. R. It has 6 churches for white and 2 for colored people, Daughters' College, common schools, 2 banks, 1 weekly newspaper, a hemp-factory, and a barrel-factory. It has good mineral waters, and fertile land around it. Pop. 2205.
JAMES B. CLARK, ED. and PROP. "KENTUCKY PEOPLE."

Har'rogate, or **Har'rowgate,** town in Yorkshire, England. Its sulphurous springs are much frequented during summer, and have very beneficial effects in diseases of the skin, scrofula, dyspepsia, and gout. Pop. with surroundings, 10,829.

Har'row (ON-THE-HILL), town and parish of Middlesex, England, on the London-Birmingham Railway, 12 miles N. W. of London, chiefly famous for its school, founded in 1571 by John Lyon, a yeoman, as a free school for poor boys. It is at present one of the most exclusive of English schools, few youth of the middle classes attending it. It has thirty-three masters and sub-masters, and special attention is given to Greek and Latin classics. Pop., with surroundings, 10,867.

Hart. See STAG.

Hart, county in the N. E. of Georgia, bounded on the N. E. by the Savannah River, which separates it from South Carolina. Area, 330 square miles. The surface is varied. Cotton, corn, and tobacco are the staple products. Cap. Hartwell. Pop. 6783.

Hart, county in the so-called "Barrens" of W. Central Kentucky. Area, 425 square miles. It is hilly, and generally productive. Limestone abounds. There are numerous caves. Live-stock, tobacco, grain, and wool are the staple products. The county is traversed by Green River and by the Louisville and Nashville R. R. Cap. Mumfordsville. Pop. 13,687.

Hart, tp. of Warrick co., Ind. Pop. 1892.

Hart, post-v. and tp., cap. of Oceana co., Mich., about 8 miles from Lake Michigan. It has 2 churches, a union school-building, a court-house, 7 stores, a good water-power, 3 mills, 1 weekly newspaper, and a factory. Pop. of tp. 1004. J. PALMITER, ED. "OCEANA COUNTY JOURNAL."

Hart, tp. of Winona co., Minn. Pop. 859.

Hart (JAMES MCDOUGAL), b. at Kilmarnock, Scotland, in 1828; came when a child to America, and lived at Albany, N. Y.; went to Düsseldorf, Germany, in 1851, and studied landscape-painting about a year; returned to Albany in 1852; removed to New York in 1856; was made an academician in 1859. His pictures are admired for their harmony of color and the quiet peacefulness of their tone. *Woods in Autumn, Moonrise in the Adirondacks, Peaceful Homes,* are best known. O. B. FROTHINGHAM.

Hart (JOEL T.), b. in Clarke co., Ky., 1810; was bred a mason, and learned to read by the light of a wood-fire. While working in 1830 at Lexington, Ky., as a stone-cutter, he began modelling in clay, and soon won reputation. His famous statue of Henry Clay, on which he began to work in 1846, owing to a shipwreck and other causes of delay, was not set up for many years. The *Angelina, Woman Triumphant,* and *Il Penseroso* are among his best works. He excels in portrait-busts, and has much facility and taste as a poet; has long been a resident of Florence.

Hart (JOHN), one of the signers of the Declaration of Independence, was b. at Hopewell, N. J., in 1708. He was a farmer, and a man of noble simplicity and purity of character, often sent to the provincial legislature, and known as "honest John Hart." He was in the Continental Con-

gress 1774–77, and was until after the battle of Trenton much persecuted by the Tories, who hunted their patriotic neighbor for a long time from place to place. D. at Hopewell, N. J., in 1780.

Hart (John Seely), LL.D., b. in Stockbridge, Mass., Jan. 28, 1810, and in 1812 removed with his family to Luzerne co., Pa. He graduated in 1830 at Princeton with the first honors; was principal of Natchez Academy, Miss., 1830–31; became in 1832 tutor, and in 1834 adjunct professor of ancient languages, at Princeton; taught in the Edgehill School, Princeton, 1836–41; was principal of the Philadelphia High School 1842–59; teacher and principal of the New Jersey Normal School, Trenton, 1862–71; and in 1872 became professor of rhetoric and the English language and literature in Princeton College. Author of a large number of educational and religious works, and has written many reviews and reports. Has been editorially connected with a number of periodicals, and an active promoter of the Sunday-school cause.

Hart (Nancy), a noted heroine of Revolutionary fame in the annals of Georgia. Though ignorant of letters and the civilities of life, yet she was a zealous lover of liberty and the "Liberty boys," as she called the Whigs, and did many valorous acts in support of their cause which rendered her name illustrious. On one occasion, by her own prowess and strategy, she overcame a party of five of the enemy who came to her humble cabin for the purpose of insult, outrage, and plunder: one she killed outright, another she put *hors de combat*, and compelled the other three to surrender as prisoners at her discretion to avoid a similar fate. (See Mrs. Ellet's *Heroic Women of the American Revolution*, and White's *Statistics of Georgia.*) In honor of this courageous woman the county of Hart in this State, embracing the place of her residence, was named.

Hart (Col. Ossian B.), a native of Florida, fought during the civil war on the side of the Union, and after the return of peace became a judge of the supreme court of the State. In 1870 he was sent to the U. S. Senate by the Republicans, but rejected by the Senate. In 1872 he was chosen governor of Florida for a term of four years. D. at Jacksonville, Fla., May 18, 1874.

Hart (William), elder brother of J. M. Hart, b. at Paisley, Scotland, in 1823; came to the U. S. in 1831; was bred a mechanic, and apprenticed to a coach-maker at Albany, but, exhibiting talent and taste for art, left the ornamental painting of carriages for the painting of canvas. His first publicly exhibited landscape picture in 1848 gained favorable notice. In 1850 the generosity of a friend enabled him to revisit his native land, and three years spent abroad in study advanced him greatly in his art. He has been from the first a frequent exhibitor at the National Academy, and became an academician in 1858. Mr. Hart has done very good work in water-color. The Water-Color Society owed its existence in large measure to him; for three years he was its president. O. B. Frothingham.

Harte (Francis Bret), b. Aug. 25, 1839, at Albany, N. Y. In 1854 he went to California, digged gold, taught school, engaged in the express business, set type in the office of the *Golden Era*, became editor of the *Californian*, a literary weekly, and was appointed secretary of the U. S. branch mint in San Francisco in 1864. Some of the poems which he published in San Francisco papers during the following years—*The Society upon the Stanislaw, The Pliocene Skull, John Burns of Gettysburg*, etc.—attracted great attention, and in 1868 he started a new magazine, the *Overland Monthly*. The two sketches which he contributed to this paper, *The Luck of Roaring Camp* and *The Outcasts of Poker Flat*, made quite a sensation, and with the publication in 1870 of his poem, *The Heathen Chinee*, his popularity culminated. In the same year he was appointed professor in modern literature at the University of California, but in 1871 he resigned his chair and returned to the Eastern States, settling in the city of New York. He has a decided talent for the description of life, as it appears when for some reason or other it falls outside of civilized society and has to start anew. The latent despair which is likely to be found at the bottom of such a form of life is perceptible in Bret Harte's pictures, without making them sentimental or painful; and the rudeness and harshness both of characters and events which are necessarily connected with it are painted with an astonishing realism, without becoming offensive or disagreeable. His style and his language help him. His style is sketchy and abrupt, but it is forcible, insinuating, and makes the impression that it always skips the worst and tells the best. His language is slang, but it is always characteristic, often witty, and now and then set off by an almost sublime simplicity. By this means he has succeeded in giving short but powerful glimpses of human nature, and the novelty and freshness of his productions have produced a great impression. But he has sometimes attempted to use other means, another language, another style, another subject, and has then been less successful. Within its proper limit his talent is a very delightful one. Clemens Petersen.

Harte-Beest [Dutch], or **Caama,** *Alcelaphus caama*, a large antelope of S. Africa, which goes in great herds, is extremely swift, and is hunted for its flesh, which resembles beef. It is often domesticated. The bastaard hartebeest, or sassaby (*Antilope lunata*), also lives in S. Africa, towards the tropic. It runs in small herds, and has excellent flesh.

Hart'enstein (Gustav), b. at Plauen, Germany, Mar. 18, 1808; became in 1834 extraordinary, and in 1836 regular, professor of philosophy at Leipsic; is of Herbart's school of thought, and has done much to make his master's teachings understood. Among his works are *Probleme und Grundlehren der Allgemeinen Metaphysik* (1836), *Die Grundbegriffe der ethischen Wissenschaften* (1844), *Historisch-philosophische Abhandlungen* (1870); has edited Herbart's and Kant's complete *Works*.

Har'ter, tp. of Clay co., Ill. Pop. 2785.

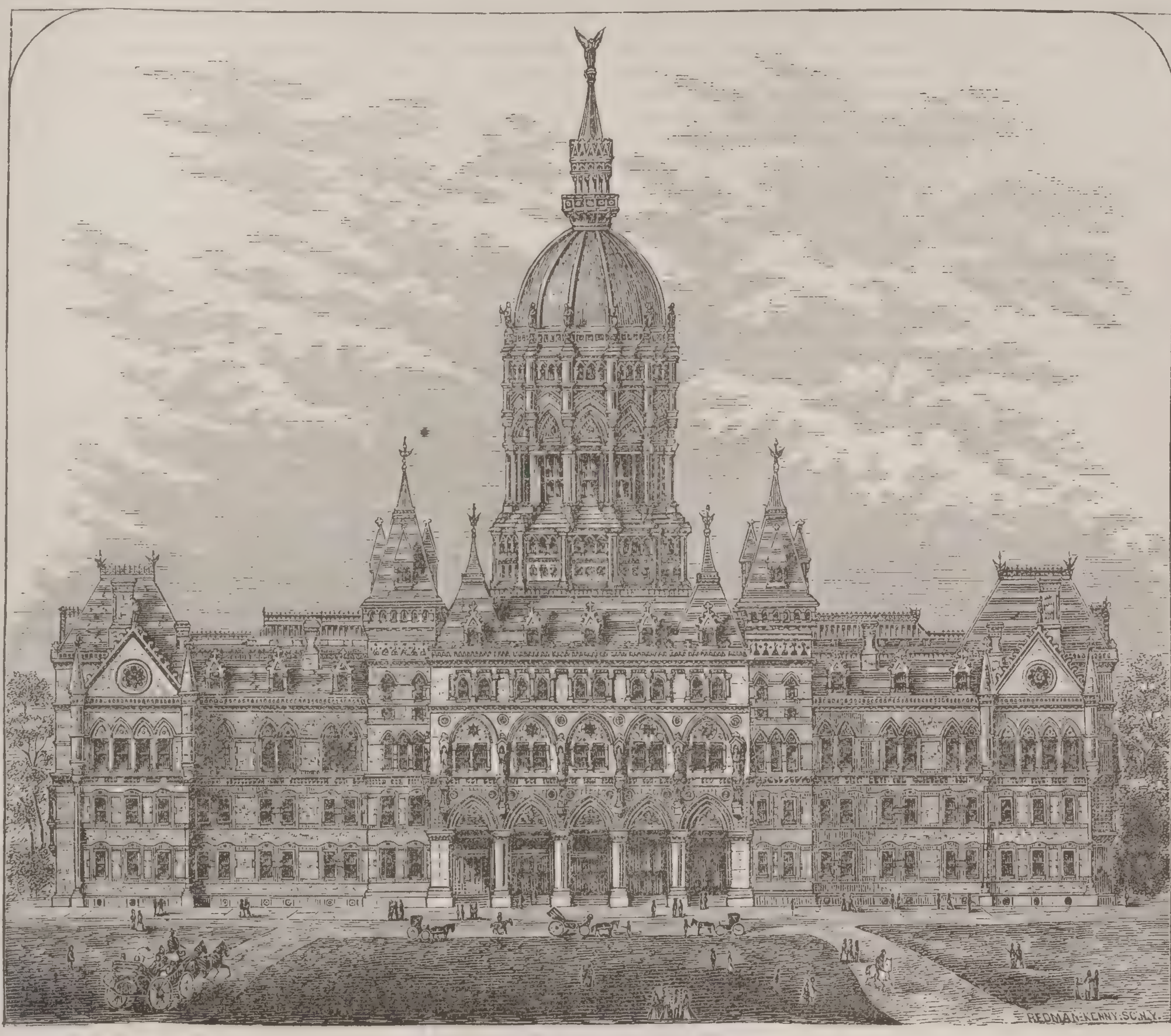
Hart'field, post-v. of Chautauqua tp. and co., N. Y. Pop. 59.

Hart'ford, county of Connecticut, bounded on the N. by Massachusetts, and intersected by the navigable Connecticut River. Area, 807 square miles. The surface is varied, the soil generally productive, especially along the Connecticut River. Tobacco, grain, fruit, live-stock, and wool are produced extensively. There are important manufactures of metallic wares, firearms, brick, flour, lumber, machinery, carriages, harnesses, woollens, furniture, and many other kinds of goods. The county is traversed by the New York New Haven and Hartford, the Hartford Providence and Fishkill, the New Haven and Northampton, and other R. Rs. Cap. Hartford. Pop. 109,007.

Hartford, the capital of Connecticut and the county-seat of Hartford co., is on the W. side of Connecticut River, 60 miles from its mouth, and the head of navigation except for small boats; lat. 41° 45′ 59″ N., lon. 72° 40′ 45″ W. It is on the New York New Haven and Hartford R. R., 111 miles from New York and 124 from Boston; is the eastern terminus of the Connecticut Western R. R., connecting W. with Albany, Poughkeepsie, and Fishkill; the northern terminus of the Connecticut Valley R. R., extending to Long Island Sound at Saybrook, 44 miles. The Hartford Providence and Fishkill R. R., a part of the New York and New England line, connects for Boston *viâ* Willimantic, and extends E. to Providence and W. to Waterbury, and is projected to the Hudson River at Fishkill. The city invested $1,250,000 in stock to secure the facilities furnished by the Connecticut Western and Valley roads. It has a daily steamboat line to New York, and freight lines to Philadelphia, Baltimore, and Albany, besides 150 to 200 sailing craft in the coasting-trade.

Hartford was settled in 1635 by emigrants from Newtown (now Cambridge, Mass.). The Indian name for the locality was *Luckiaug*, and the settlers secured a deed in 1636 from Sunckquassen (or Sequassen), chief of the Luckiaug tribe, but to secure a certain title the lands were repurchased in 1670. The settlement was first named Newtown, but changed to Hartford, after Hertford, England, said to have been the birthplace of Rev. Samuel Stone, teacher of the church. The Dutch built a fort on the river in 1633, but were dispossessed by the general court in 1654. Among the early settlers were men who had been eminent in England and in the Massachusetts colony. Emigrants from Hartford settled Farmington in 1645, Middletown and Norwalk in 1650, and Hadley, Mass., in 1659. In 1637, 42 of its 90 men went to the Pequot war. In 1775 a small committee of gentlemen met in Hartford and made arrangements for men and money which resulted in the memorable capture of Ticonderoga by Col. Ethan Allen. The first school was established in 1638, and the same year Ludlow, Haynes, Wolcott, Hopkins, and Hooker formed a written constitution, completed in 1639, which was the first framed in America, and embodied the main points of all subsequent State and of the Federal Constitution. The first code of laws was drawn up by Ludlow in 1650, reducing the capital offences from 160 (in England) to 15. The first mission was started in 1650 for the Christianization of the Indians. A prominent event in the history of the town was the effort of Sir Edmund Andros, governor-general of New England in 1687, to secure the charter granted to the colonists in 1662 by King Charles II. Andros made formal demand for the instrument in the general court, and while discussion was in progress Capt. Joseph Wadsworth carried off the charter and secreted it in the famous "charter oak;" or perhaps the original charter was secreted in the oak in June, 1687, and Wadsworth carried off the duplicate. The historic tree survived till 1856, when it was blown

down. It was an object of interest to every visitor to the city, and gave a name to the "Charter Oak City," as well as to a street and to numerous societies and business corporations, and furnishes a "trade-mark" for many industrial productions. Its wood has been worked and carved into innumerable relics. A young tree from the old oak is now growing in the park. The charter remained concealed until 1689. It is now preserved in the State-house, framed in wood of the "charter oak." The remains of the duplicate are in the Connecticut Historical Society. The State-house also contains a full-length portrait of Washington by Stuart, and portraits of most of the governors of the colony and State to the present time. Hartford was the sole capital of the Connecticut colony until 1701, made so by the vote of the freemen. In 1701 the October sessions of the general court were, by legislative act, ordered to be held at New Haven, while the May session was held at Hartford. The adoption of the constitution of 1818, though it did away with the October session, legally established the double-capital system. In 1873, after years of controversy, a constitutional amendment was adopted making Hartford again the sole capital. The State had previously appropriated $500,000, and Hartford $500,000, for the erection of a new State-house. Hartford purchased the Trinity



New State Capitol (Hartford, Conn.).

College grounds for $600,000, and presented the site to the State, and in 1873 the State appropriated $500,000 more towards the edifice. Subsequent appropriations make the entire cost about $2,500,000. It is of white marble, and occupies a commanding position in the West Park, visible from trains on railroads passing through the city. The park, with the State-house grounds, contains 46 acres, is tastefully laid out with walks, drives, fountains, etc., and has bronze statues of Gen. Israel Putnam and of Dr. Horace Wells, discoverer of anæsthesia, whose home was here. An agricultural park and fair-grounds border on the railroad S. of the city. A horse railroad runs from the northern limit of the city through Main street to Wethersfield, 4 miles S., and from the river on the E. to the city line W. The prominent business interest of the city is insurance. Its underwriters have a wide and honorable reputation. The capital of its 10 fire companies (including one steam-boiler and two mutual) is $6,500,000, and their gross assets in July, 1874, $14,420,411. Hartford companies paid $12,000,000 in losses by the great Chicago and Boston fires (1871–72) alone. The capital of its 11 life insurance companies (including 3 mutual and 1 partially and 2 wholly accident) is $2,300,000, and their assets in July, 1874, $90,741,400. It has 10 national and 2 State banks, with capital and surplus of $10,594,072; 5 savings banks, with deposits of $10,825,887; 3 trust companies, with deposits of $1,737,603 in 1874. There are 7 Congregational, 3 Baptist, 2 Methodist, 7 Episcopal, 1 Presbyterian, 3 Catholic, 1 Universalist, and 1 Hebrew church edifice, besides several chapels and some religious organizations which have no church buildings. It is the seat of a Roman Catholic bishop. The first church organization was brought from Cambridge by the settlers, with their ministers, Rev. Thomas Hooker, pastor, Rev. Samuel Stone, reader, and William Goodwin, ruling elder, and is now the First or Centre Congregational church. The Second or South Congregational church was organized in 1669–70. The first church edifice was built in 1638. The educational institutions are—Trinity College (Episcopal), founded in 1823 as Washington College, and now (1874) preparing to erect new buildings, models of scholastic architecture; Hartford Theological Institute; Hartford High and Grammar School, the latter the oldest educational institution in the State (the high school building cost $160,000); a thorough system of public schools, with fine buildings, one costing with land $185,000, and another $150,000; Hartford Female Seminary; 2 nunneries and 2 free Catholic schools. Its libraries are the Watkinson library of reference, 25,000 vols.; Young Men's Institute, 25,000; Trinity College, 13,500; Theological Institute, 7000; the Historical Society's library; and the State law library, which is very complete. In this library are preserved many letters from English kings to the colonial governors. Wadsworth Athenæum contains the Watkinson, Young Men's Institute, and Historical libraries; the rooms of the Historical Society, filled with relics and records covering the whole history of the country, open to the public free; a statuary-room, containing the works of Edward S. Bartholomew, a deceased Hartford sculptor, and others; a picture-gallery, containing 150 paintings, among them the historical war-pictures of Trumbull, and a full-length portrait of Benjamin West by Sir Thomas Lawrence.

There are a few extensive manufactories in the city, and Hartford capital is largely invested in manufacturing in other towns. The Hartford Carpet Co., works at Thompsonville, capital $1,500,000; Collins Co., edge tools, Collins-

ville, capital $1,000,000; Willimantic Linen Co., capital $1,000,000; Cheney Bros., silk-works, here and at South Manchester, capital $1,000,000; Connecticut Screw Co., Tariffville, capital $500,000,—all have their principal offices here, and much of the stock of the Holyoke, Mass., Water-Power Co. is owned here. The Colt Firearms Co.'s works, capital $1,000,000, are built within a dyke over 1½ miles long, 32½ feet high, and 30 to 50 wide, reclaiming 123 acres of land from overflow by the river. Col. Colt, the patentee of the famous revolver, built the dyke at a cost of over $80,000. The beautiful memorial church of the Good Shepherd and many private residences stand within this enclosure, and "Armsmear," the elegant residence of Mrs. Colt, overlooks it. Other manufactories are the Weed Sewing Machine Co., National Screw Co., Hartford Foundry and Machine Co., Woodruff iron-works and foundry, Geo. S. Lincoln & Co.'s iron-works and foundry, Pitkin Bros., machinists and boiler-works, Beach & Co., boiler-works, Roper Arms Co. and Sharp Rifle-works, Pratt, Whitney & Co., machinery, and large printing and lithographing establishments, railroad car and repair shops, car-wheel works, lumber and flouring-mills, marble-works, carriage manufactories, pump-works, and various other establishments. The corporations located here, but some having their factories elsewhere, represent a capital of about $17,000,000. The publication of subscription books is a prominent interest. The mercantile business, wholesale and retail, is extensive. The city has a paid fire department and electric fire-alarm telegraph. It has a water-supply from the Connecticut River by powerful pumping engines, and also from large reservoirs in West Hartford, storing the water of mountain-streams. The entire works have cost $1,500,000, and the rents now pay interest and expenses. An artesian well 1584 feet deep upon the Colt estate supplies 50 gallons a minute. Hartford is a central market for Connecticut seed-leaf tobacco, the principal crop cultivated in the fertile Connecticut Valley. Wadsworth's Tower, on Talcott Mountain, W., affords one of the finest views in New England. The Governor's Foot Guard was organized in 1771, and the Horse Guards in 1778—both now in existence. The first steam locomotive was run in Hartford streets in 1797–99, invented by A. Kinsley, who also invented the first brick-pressing machine. The first patent for a lever printing-press was issued to John I. Wells in 1819. The first printing-office in the city was started in 1764 by Thomas Green, who the same year established the *Connecticut Courant,* which has been published regularly to the present time. The American Asylum for Deaf and Dumb, started here by Rev. Thomas H. Gallaudet in 1816, who brought Laurent Clerc from Paris to assist him, is the oldest institution of the kind in the country. There is a retreat for the insane, the Hartford Hospital, the Hartford Orphan Asylum, and an almshouse. City missionaries, supported mainly by individuals, but in part by churches, take watchful care of the deserving poor. A woman's Christian association seeks to aid working women. The Union for Home-work, an association of benevolent women, systematically manages a wide range of practical charities. Hartford has 3 daily, 7 weekly, and 3 monthly journals, besides 5 advertising sheets. The city has been the home of many persons noted in politics, art, or literature. Besides the buildings already named, there are the State arsenal, a jail, a government building containing the post-office, U. S. courts, pension and revenue offices; 2 granite insurance buildings costing $750,000 each; and many fine residences and business blocks. Pop. 37,180; of tp. and city, 37,743. S. A. HUBBARD, ED. "COURANT."

Hartford, tp. of Adams co., Ind. Pop. 935.

Hartford, tp. of Iowa co., Ia. Pop. 1234.

Hartford, post-v. of Warren co., Ia. Pop. 295.

Hartford, post-v., cap. of Ohio co., Ky., situated on Rough Creek, 12 miles above its confluence with Green River, and 4 miles from the Louisville Paducah and Southwestern R. R. It has 1 wagon manufactory, 2 machine, repair, and blacksmith shops, and a common school. Extensive coal-mines are in operation within 5 miles from here. Pop. 511. JOHN O'FLAHERTY, ED. OF "JOURNAL."

Hartford, tp. of Oxford co., Me., on the Portland and Oxford Central R. R., 60 miles N. of Portland. It has manufactures of leather. Pop. 996.

Hartford, post-v. of Van-Buren co., Mich., 19 miles N. E. of St. Joseph, on the Chicago and Michigan Lake Shore R. R. It has a fine union school, 2 churches, 1 newspaper, 4 dry-goods and 2 hardware stores, 2 hotels, 1 large stove-factory. It is in a great fruit and agricultural region. Pop. 1709. O. D. HADSELL, ED. "DAY SPRING."

Hartford, post-tp. of Todd co., Minn. Pop. 269.

Hartford, tp. of Pike co., Mo. Pop. 1583.

Hartford, post-tp. of Washington co., N. Y. It has excellent slate and limestone, and contains several caves and mineral springs. Pop. 1989.

Hartford, a v. of Valley tp., Guernsey co., O. P. 98.

Hartford (CROTON P. O.), post-v. and tp. of Licking co., O. Pop. of v. 229; of tp. 1017.

Hartford, post-tp. of Trumbull co., O. Pop. 1314.

Hartford, post-tp. of Windsor co., Vt., 42 miles S. E. of Montpelier, on the Connecticut and White rivers, and on the various railroads centring at WHITE RIVER JUNCTION (which see), which is a village in this township. Hartford has great water-power, and has manufactures of carriages, sleighs, furniture, lumber, agricultural tools, paper, boxes, woollen goods, shoes, and other commodities. Pop. 2480.

Hartford, tp. and post-v. of Washington co., Wis., on the Milwaukee and St. Paul R. R., 37 miles N. W. of Milwaukee. Pop. 2685.

Hartford City, a v. of Blackford co., Ind., 40 miles S. of Fort Wayne and 34 miles from the Ohio line, on the Pittsburg Cincinnati and St. Louis and the Fort Wayne Muncie and Cincinnati R. Rs. It has 3 churches, 2 newspapers, good public schools, an extensive hub and spoke factory, a heading-factory, a stave-factory, a first-class flouring-mill, a saw-mill, and several stores. Pop. 878. J. M. RUCKMAN, ED. "NEWS."

Hartford City, or **Hartford,** post-v. of Mason co., W. Va., has manufactures of salt from wells. Pop. 918.

Hartford Convention. This convention, celebrated in the political history of the U. S., met at Hartford, Conn., Dec. 15, 1814, and adjourned without day Jan. 5, 1815. It consisted of 12 delegates from Massachusetts, 7 from Connecticut, 3 from Rhode Island (appointed by the legislatures of those States respectively), of 2 representing certain portions of New Hampshire, and of 1 from the county of Windham, Vt. The president, George Cabot of Massachusetts, and all the members, belonged to the Federal party, which had opposed the war then existing and the other leading measures of the administration. The members were among the worthiest political men whom the U. S. have produced, the objects contemplated were not in violation of the Constitution, and yet the greatest obloquy was heaped upon the delegates, and upon the party through the Union to which they belonged, and which, outside of New England, gave no unanimous or decided approval of the plan of such an assembly. It was falsely charged upon them that their meeting looked towards a dissolution of the Union; the party became obnoxious to censure as endeavoring to weaken the hands of the government during the war of 1812–15 with Great Britain. Soon after the convention met, the repulse of the British army at New Orleans brought fresh credit to the administration, and its adjournment was speedily followed in February by the Peace of Ghent. Federalism was already on the wane, and the appearance of disloyalty during war, of separating the interests of New England, where the Federalists were strongest, from those of the country as a whole, did more than anything else to give the deathblow to that honest and intelligent party, at the head of which, when it arose, stood Washington and the other principal leaders of the Revolution.

The journal of the convention, together with the acts of the States calling it together, and a sketch of the times, was published by Theodore Dwight, secretary of the convention, in 1833. With the light of the documents we may say—(1) that the New England States felt that the measures of the administration in regard to the militia were a great grievance, as well as unconstitutional, and that, while part of the coast, from Castine eastward, was in the military occupation of the enemy, they were left to themselves for their defence. (2) They, or the coast States at least, thought that a state of war had disclosed defects in the Federal Constitution, so that some check by new guaranties to the States needed to be put on the powers of the general government. (3) In the acts of the three States calling the convention there was care taken to declare, that the means of security and defence, to be devised by that body for the eastern section of the U. S., were to be "not repugnant to their obligations as members of the Union." Such was the language of Massachusetts. In the resolution of the general assembly of Connecticut the convention was to meet "for the purpose of devising and recommending such measures for the safety and welfare of these States as might consist with their obligations as members of the national Union." Rhode Island used similar words. There cannot be a doubt that nothing disloyal to the Union was intended.

When the convention met, it sat with closed doors, the members were bound to secresy, and the journal, which at the close of the sessions was put into the hands of Mr. Cabot, the president, was not open to inspection until some time after the adjournment. This gave room to all sorts

of false reports respecting its proceedings and intentions. When the report and resolutions were made public, these stories had done their work, and an almost ineradicable persuasion, that there was an evil design in this meeting of Federalists, was spread far and wide. As we examine the documents, however, while a strong party feeling is shown in it, and a fear that the "Union may be destined to dissolution by reason of the multiplied abuses of bad administrations," nothing beyond this is discoverable, except the recommendation of certain measures, important indeed, but such as any State legislature or any other body of men might propose. These propositions are of several kinds: *First*, to recommend to the legislatures of the States represented in the convention, to protect the citizens of these States from the operation of all acts of Congress "subjecting the militia or other citizens to forcible drafts, conscriptions, or impressments not authorized by the Constitution of the U. S." *Again*, that the general government should be requested to consent to some arrangement by which the States, separately or in concert, should be empowered to assume the defence of their territory against the enemy, they receiving into their treasuries for such service a reasonable portion of the taxes collected within their borders. *Further*, it was recommended that the legislatures of the three States should authorize the governors, etc. to make detachments from the militia, or to form voluntary corps, which should be ready for service within the State, and, on application of the governor of one of the other States, be sent there also in order to repel invasions made or attempted by the enemy. Besides these three measures the convention recommended the following amendments of the Constitution: that representatives and direct taxes should be apportioned among the States of the Union according to the number of *free persons* within the same; that new States should be admitted only by a vote of two-thirds of both houses; that Congress should lay no embargo on vessels belonging to citizens of the U. S. for more than sixty days, nor, except by vote of two-thirds, interdict commercial intercourse between the U. S. and foreign nations, nor declare war without a vote of two-thirds, except in case of actual invasion of our territory; that no person hereafter naturalized should be eligible into either house of Congress or capable of holding any civil office under the authority of the U. S.; and, finally, that the same person should not be elected President of the U. S. a second time, and that the same State should not furnish a President for two terms in succession.

The convention contemplated the possibility of another similar convention being appointed by the legislatures, in case peace should not be concluded and the defence of the States be neglected. It also empowered three of its members to call another meeting of their own body to be held at Boston, if in their judgment the situation of the country should urgently require it. T. D. WOOLSEY.

Hart'land, post-v. and tp. of Hartford, Conn., 21 miles N. W. from Hartford. Pop. 789.

Hartland, tp. of McHenry co., Ill. Pop. 1037.

Hartland, post-tp. of Worth co., Ia. Pop. 575.

Hartland, post-tp. of Somerset co., Me., 25 miles N. E. of Skowhegan. It has manufactures of woollens and other goods. Pop. 1120.

Hartland, post-tp. of Livingston co., Mich. P. 1159.

Hartland, post-tp. of Freeborn co., Minn. Pop. 485.

Hartland, post-tp. of Niagara co., N. Y., is one of the best agricultural towns in the State. Pop. 3226.

Hartland, post-tp. of Huron co., O. Pop. 953.

Hartland, post-tp. of Windsor co., Vt., on the Connecticut River and the Vermont Central R. R., 10 miles S. of White River Junction. It has manufactures of lumber, sash, blinds, castings, and wooden wares. Pop. 1710.

Hartland, tp. of Pierce co., Wis. Pop. 574.

Hartland, tp. of Shawano co., Wis. Pop. 541.

Har'tlepool, town of England, in the county of Durham. It is situated on a peninsula projecting into the North Sea, and has a good harbor. It was formerly a well-frequented bathing place, but is now chiefly engaged in the coal-trade. Pop. 13,164; of the parliamentary borough, including West Hartlepool, etc., 38,302.

Hartlepool, West, a young but rapidly growing town of England, in the county of Durham, 1 mile from Hartlepool. It was founded in 1847, in which year its port was visited by 460 vessels, and it shipped 54,202 tons of coal; in 1861 the number of vessels visiting its harbor was 5964, and it shipped 975,319 tons of coal. Pop. 13,601.

Har'tleton, post-v. of Lewis tp., Union co., Pa. P. 292.

Hart'ley, tp. of Union co., Pa. It contains iron-works. Pop. 1143.

Hart'ley (Sir CHARLES AUGUSTUS), F. R. S. E., b. at Heworth, Durham, in 1825; at the age of twenty he became engaged in the construction of railways in Scotland, where he continued until 1848, when he was appointed resident engineer on harbor works at Plymouth and Devon, under the late Joseph Locke, M. P., C. E. On June 22, 1855, he received the queen's commission as captain in the Turkish contingent engineers, and served at Kertch with that force until the conclusion of the Crimean war. He was appointed Jan. 1, 1857, engineer-in-chief to the European commission of the Danube, and, "as a mark of Her Majesty's approbation of his services" here, he received in 1862 the honor of knighthood from the queen. During his engagement with the Danube commission he has also been employed by the Austrian government to report on the respective merits of various schemes for improving the port of Trieste; by the Turkish government to report on dock accommodation at Constantinople; by the Russian government to inspect and report on the mouths of the Don; by the British government to report on the nature of certain proposed works on the Scheldt; by the Indian government to report on the improvement of the Hooghly; and by the Roumanian government to prepare detailed plans and estimates for harbor accommodation on the Roumanian coast. He has received the imperial order of the Medjidie and the Turkish war-medal from the sultan of Turkey; the Stephenson prize, the Telford medal, the Telford premium, and the Manby premium from the Institution of Civil Engineers; and in 1867 the emperor of Russia's grand competition prize of 8000 silver roubles, by a special commission of experts, for his plans for improving the harbor of Odessa. He is a member of the Institution of Civil Engineers, London; a fellow of the Royal Society, Edinburgh, and consulting engineer to the European commission of the Danube, with his residences at the Sulina mouth of the Danube, Turkey, and at London. J. G. BARNARD.

Hartley (DAVID), M. D., b. at Armley, Yorkshire, Aug. 30, 1705; became a fellow of Jesus College, Cambridge, where he graduated M. A. in 1729; was designed for the Church, but on account of conscientious scruples chose rather the profession of medicine; practised at Newark, Bury St. Edmund's, London, and Bath, where he d. Aug. 28, 1757. He was a man of simple and benevolent character and virtuous life; wrote some medical works, but is chiefly remembered for his *Theory of the Human Mind* (1775) and his *Observations on Man* (1749), which gave him a brilliant though transient fame. He was a firm necessitarian, and was perhaps the first philosopher who attempted to explain psychological phenomena by reasoning based mainly upon physiological data. He nevertheless repelled the charge of materialism. He made some valuable observations, especially upon the theory of the association of ideas, anticipating certain very recent theories.

Hart'mann, von (EDUARD), b. in Berlin Feb. 23, 1840. He was educated at the School of Artillery, and became an officer in 1861. But in 1862 he accidentally hurt his foot, and an incurable disease which set in has since that time confined him almost without interruption to his bed, where he occupies himself with literary and philosophical studies. In 1868 he published *Ueber die dialektische Methode;* in 1869, *Schelling's Positive Philosophie;* in 1871, *Das Ding an sich und seine Beschaffenheit;* but his principal work is his *Philosophie des Unbewussten* (1869). His idea is to connect the results of the abstract philosophy with those of the concrete inductions of natural science. The point in which these two lines of research meet each other and prove each other is the unconscious. The unconscious in nature has a will—not a merely blind, irrational will (*Schopenhauer*), but one which can determine itself to prototypal ideas; and an idea—not a merely logical idea (*Hegel*), but one which can reach reality by will. In the mind this will and this idea become conscious by means of brain and nerves, but the unconscious is still at work in the instincts, in love, in the formation of language, etc., and in the unconscious the "first principles" are to be found. The execution of this idea is very ingenious, and has attracted great attention in Germany, in spite of the sad coloring of pessimism which pervades it.

Hartmann, von (JACOB), BARON, was b. a French citizen Feb. 4, 1795, in the Bavarian palatinate; received his education in the military institutions of Bonn and St. Cyr; and entered Dec. 1, 1811, as a lieutenant the 1st regiment of the grand duchy of Berg. He fought 1813–15 under French colors in the 27th regiment of the line. At Waterloo he saved the eagle of the regiment, and was made a knight of the Legion of Honor. After the peace of Paris (1815) he left the French service and entered the 10th Bavarian regiment of infantry. In the topographical department and by travels in foreign countries he extended his knowledge, and was attached to the staff in 1824. In 1842 he

was appointed adjutant to the crown prince Maximilian, and in 1848 he became major-general and adjutant to the king. In this position he exerted himself for the improvement of the Bavarian army, its organization, and its fighting capacity, but he encountered great difficulties from the political situation of the kingdom. In 1854 he visited France, especially Paris, and published later an excellent military work, based partly on French experience, partly on his own studies, on the Italian war in 1859. In 1861 he became lieutenant-general and commander of the 4th division of infantry, and as such he took part in the war of 1866. In 1869 he became a general of infantry, and led the 2d Bavarian army corps against France in 1870 and 1871. He took part with great distinction in the encounter at Weissenburg, contributed considerably to the victory in the battle of Wörth by his energetic advance on the French left wing and line of retreat, took the fortress of Marsal, fought at Sedan, and kept, during the siege of Paris, the plateau of Chatillon occupied. D. Feb. 22, 1873.
A. Niemann.

Hartmann, von (Julius), was b. Mar. 2, 1817, at Hanover, in whose military school he received his education. In 1834 he entered the 10th Prussian regiment of hussars, and in 1848 he was attached to the staff. He was often employed in diplomatic missions on account of his elegant education and address; thus, he was sent in 1850 to Sleswick-Holstein, and later to Austria and Saxony, to represent Prussian interests. After various occupations in the ministry of war and in the staff, he was made a major-general in 1865, and commander of Coblentz. In 1866 he commanded a division of cavalry, and took part in the encounters of Zwithau, Tobitschau, and Rokeinitz. In 1867 he was given the difficult task of reorganizing the Bavarian army in harmony with the army organization of Prussia; which task he fulfilled with great success. In the Franco-German war he received the command of the 1st division of cavalry, and fought at Courcelles and Gravelotte. On Jan. 6, 1871, he was appointed commander of a larger detachment, comprising all arms, with which he operated in the region between the Loire and the Loir, and took Tours Jan. 13. After the peace he became governor of Strasburg, a position of great political importance, and in 1874 he was made a general of cavalry. A. Niemann.

Hartmann (Moritz), b. of Jewish stock at Duschnik, in Bohemia, Oct. 15, 1821; was educated at Prague and Vienna; left the empire on account of his political liberalism 1844; published *Kelch und Schwert* (1845), a volume of poems expressive of his opinions, followed by *Neuere Gedichte* (1847). He was in the Frankfort Parliament of 1848; went to Vienna, and escaped thence with some difficulty; lived for a time in the East, and then in Paris; began in 1860 to lecture on German history and letters in the Academy at Geneva; went to Stuttgart 1863, to Vienna 1868. Besides the above works he has written *Reimchronik des Pfaffen Maricius* (1849), a brilliant political satire, and the novels *Der Krieg um den Wald* (1850), *Der Gefangene von Chillon* (1863), *Die letzen Tage eines Königs* (1866), *Nach der Natur* (1866), *Die Diamanten der Baronin* (1868), and others. Among his works are *Schatten* (1851), *Tagebuch aus der Provence und Languedoc* (1853), *Briefe aus Irland*, and the idyllic poem *Adam und Eva* (1851).

Har'tranft (John Frederic), b. in New Hanover tp., Montgomery co., Pa., Dec. 16, 1830; graduated at Union College, N. Y., 1853; admitted to the bar of Montgomery co., Pa., 1859. At the outbreak of the civil war he was colonel of militia, and among the first to tender his services to the governor. As commander of the 4th Pennsylvania he served during the three months' term, and as volunteer aide to Gen. Franklin in the first battle of Bull Run. Commissioned colonel 51st Pennsylvania Vols. July 27, 1861, and with it accompanied the "Burnside expedition," leading it in the attack on Roanoke Island, Feb. 7, and in the battle near Newbern, N. C., Mar. 13, 1862; in temporary command of a brigade covering the rear of Pope's retreating army, was engaged in the second battle of Bull Run and Chantilly, and in the Maryland campaign at South Mountain and Antietam, in which latter battle he led his regiment in the brilliant charge which carried the bridge after repeated unsuccessful attempts by superior numbers. At Fredericksburg he led his regiment against the intrenchments, and with Burnside's transfer to the department of the Ohio was ordered to Kentucky. In June, 1863, he commanded a brigade before Vicksburg, and subsequently accompanied Gen. Sherman in his advance to Jackson, Miss. In command of a division which fought the battle of Campbell's Station, Nov., 1863, and participated in the repulse of Longstreet from before Knoxville, continuing in command of the division until his regiment was ordered home on veteran furlough. In the Richmond campaign of 1864 he commanded a brigade in the battles of the Wilderness and Spotsylvania; commissioned brigadier-general May 12, 1864, and engaged in all the army movements to and before Petersburg, and brevetted major-general for conspicuous gallantry in recapturing Fort Steadman, Mar. 25, 1865. In Oct., 1865, he was elected auditor-general of Pennsylvania, and re-elected in 1868. In Oct., 1872, he was elected governor of that Commonwealth, and inaugurated Jan. 21, 1873. G. C. Simmons.

Hart's Creek, tp. of Lincoln co., West Va. Pop. 858.

Hart'sell's, tp. of Morgan co., Ala. Pop. 317.

Hart's Falls, or **Schaghticoke Point,** post-v. in Schaghticoke tp., Rensselaer co., N. Y. Pop. 1111.

Harts'grove, post-tp. of Ashtabula co., O. Pop. 799.

Hartshorn. See Ammonia, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Hart'shorne (Edward), A. M., M. D., son of Dr. Joseph Hartshorne, was b. in Philadelphia in 1818; graduated at Princeton A. B. in 1837, A. M. in 1840, and M. D. at the University of Pennsylvania in 1840; was elected assistant physician to the new hospital for the insane of the Pennsylvania Hospital on its opening, Jan. 1, 1841; was elected resident surgeon to the Pennsylvania Hospital in Apr., 1841, and after two years' service there was elected physician to the Eastern State Penitentiary of Pennsylvania. A residence of fifteen months in the medical charge of this penitentiary, and constant observation of the working of the "separate system of prison discipline," led him to prepare two reports (1843 and 1844) in favor of the innocuous sanitary influence of the system when properly administered, which attracted much attention in Europe and this country as the first evidence of the kind derived from practical experience upon the spot. He engaged in general practice in Philadelphia after more than two years' travel and study among the hospitals, asylums, and prisons of Europe, and subsequently among those of the Northern Atlantic States of this country; was soon elected one of the attending surgeons of Wills' (eye) Hospital, and subsequently one of the attending surgeons of the Pennsylvania Hospital; served throughout the civil war as consulting surgeon and in other professional capacities in the U. S. army medical service, chiefly in Philadelphia U. S. army hospitals; also as active member and secretary of the executive committee of the U. S. Sanitary Commission in Philadelphia. During many years he has been an active member of the board of managers of the Episcopal Hospital of Philadelphia. He served as secretary to the first prison discipline convention in Philadelphia (1847), and to the first sanitary convention in the U. S. (Philadelphia, 1857), also as secretary for several years of the College of Physicians of Philadelphia, and subsequently one of the censors of the college and secretary and chairman of the building and hall committee. Among other offices of trust, the most important held by him were those of president of the Pathological Society of Philadelphia (two terms); chairman of the executive committee of the society of the medical alumni of the University of Pennsylvania, and for one year vice-president of that society; and chairman of the committee of arrangements for the meeting of the American Medical Association at Philadelphia in 1872. During many years he was a frequent contributor to the *American Journal of the Medical Sciences*, the *North American Medico-Chirurgical Review*, and the *Medical Examiner* of Philadelphia, chiefly in their review departments. He was editor for a few months of the *Journal of Prison Discipline and Philanthropy*. His most important book-work was the editing, under the permission of the editor, of two successive editions of Taylor's *Manual of Medical Jurisprudence*, with American notes and references, the most of which were incorporated, with acknowledgment, by the author in subsequent original editions. His longest continuous service in a professional position is that of medical adviser and examiner to the Penn Mutual Life Insurance Company since its origin in 1847. Although descended from Quaker ancestors on both sides through at least seven generations in this country, he became a communicant of the Protestant Episcopal Church in 1852.

Hartshorne (Henry), A. M., M. D., son of Dr. Joseph Hartshorne, was b. in Philadelphia in 1823; graduated B. A. at Haverford College in 1839, and M. D. in the medical department of the University of Pennsylvania in 1845. After a two years' residence in the Pennsylvania Hospital, he was appointed in 1859 professor of the practice of medicine in the medical department of Pennsylvania College. In 1865 he was elected the first professor of hygiene in the University of Pennsylvania, on the institution of this, with several other chairs, in the medical department, under an endowment for the purpose by Dr. George B. Wood. He has held also successively a number of other professorships, the most important of which were at Haver-

ford College and in the Woman's Medical College of Pennsylvania, besides the office of attending physician, held for several years, in the Episcopal Hospital of Philadelphia. He is the author of several works, chiefly medical: a *Monograph on Glycerine, Essay on Cholera, Guide to the Medicine-Chest, Conspectus of the Medical Sciences*, and *Essentials of the Principles and Practice of Medicine*. The last-named reached its fourth edition in 1874. For several years he was a frequent contributor to the *American Journal of the Medical Sciences* and to other medical journals; also, more rarely, to the *American Naturalist* and *Lippincott's Magazine*. He published a small volume of poems, *Summer Songs*, in 1865, and became editor of the *Friends' Review* in 1874. He has contributed several articles to this *Cyclopædia*, of which the most important is that on EVOLUTION.

Hartshorne (JOSEPH), M. D., b. near Alexandria, Va., in 1779; became a resident pupil at the Pennsylvania Hospital and a medical student in the University of Pennsylvania in 1800, and graduated M. D. in 1805, after a five years' training under Rush, Wistar, Physick, and others. After two voyages to the East Indies and a three months' residence in Batavia, he settled in Philadelphia, and gradually engaged in a very extensive practice. He was elected a colleague of Physick as one of the attending surgeons of the Pennsylvania Hospital, and served also in other similar posts. He continued in active private and consulting practice until broken down by the fatigues of the cholera epidemic of 1849, and d. in Aug., 1850. The few papers contributed by him to the medical journals of his day were brief and strictly practical. His only other publication was an appendix, with illustrations, to an American edition of a London translation of Boyer's work on *Diseases and Injuries of the Bones*, in which he reports a number of important cases, and describes a dressing for fractured clavicle and a new apparatus for the treatment of fractured thigh, afterwards popular for many years as Hartshorne's splints. He was, by descent and conviction, a member of the religious Society of Friends, his paternal ancestor, Richard Hartshorne, having emigrated from Leicestershire, England, in 1669, to escape from persecution as a follower of George Fox, and settled in New Jersey on land bought from the natives, and still held by his descendants; being afterwards associated with William Penn as one of the proprietary rulers of the province of East Jersey. Few members of his profession have left a better reputation for upright manliness of character and for practical experience and ability, as well as independent and original habits of thought and action.

Hart's Island (or **Spectacle Island**), an island in Long Island Sound, belongs to Rye tp., Westchester co., N. Y. It is the property of New York City, and was used for military purposes by the U. S. government during the late civil war.

Hart's Location, a tract of land in the White Mountain region of Carroll co., N. H., is a place of summer resort. Pop. 26.

Harts'town, a post-b. of West Fallowfield tp., Crawford co., Pa. Pop. 188.

Hart'suff (GEORGE L.), b. at Tyre, Seneca co., N. Y., May 28, 1830; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of artillery July 1, 1852, in which capacity he did duty in garrison and on the Texas frontier till 1853, when he was promoted to be second lieutenant and engaged in Florida (1854–56) on topographical duty, where, in a skirmish with the Seminoles, he was severely wounded, one ball remaining in his chest till his death. From 1856 to 1859 he was on duty at West Point as assistant instructor of artillery tactics. From 1859 to 1860 he served on frontier duty at Fort Mackinac. While in execution of his duty he was a passenger on the steamer Lady Elgin, which was wrecked on Lake Michigan, Hartsuff escaping by seizing a piece of floating timber, on which he was washed ashore. In Mar., 1861, he was appointed a captain and assistant adjutant-general, and in April sent to Fort Pickens with the secret expedition under Gen. Brown. In July he became chief of staff to Gen. Rosecrans in Western Virginia, participating in the action at Carnifex Ferry, Sept. 10, and subsequent operations of the campaign. In Apr., 1862, he was appointed a brigadier-general of volunteers, and assigned to special duty in the war department. In May he took command of a brigade, and was engaged at the battles of Cedar Mountain and Manassas. He also bore a conspicuous part in the battles of South Mountain and Antietam, being severely wounded in the last-named action, and incapacitated from duty in the field till Apr., 1863; serving in the mean time, upon his convalescence, as member of a board to revise the rules and articles of war, and to prepare a code for the government of armies in the field. Having been promoted to be major-general of volunteers Nov., 1862, he commanded the 23d army corps in the West from April to Nov., 1863, when he was compelled to relinquish this command from incapacity arising from his Antietam wound, and was employed on bureau duty till Mar., 1865, when he commanded the Bermuda front of the siege-works before Petersburg, assuming command of that city on its capture, and subsequently of the district of Nottoway, which command he held till he was mustered out of the volunteer service, Aug., 1865. He afterwards resumed duty in the adjutant-general's department, with the rank of lieutenant-colonel, serving in various military districts and divisions till June, 1871, when, still suffering from his wound, he was retired from active service on the full rank of major-general U. S. A. After some time he went abroad, and interested himself in bringing American improvements in artillery to European attention. D. at New York May 16, 1874. GEORGE C. SIMMONS.

Hart'suggs, tp. of Van Buren co., Ark. Pop. 297.

Harts'ville, post-v. of Bartholomew co., Ind., on Clifty Creek, 40 miles S. S. E. of Indianapolis, in Haw Creek tp. It contains Hartsville University, and a theological school of the United Brethren, connected with the university. Pop. 433.

Hartsville, tp. of Steuben co., N. Y. Pop. 993.

Hartsville, post-v., cap. of Trousdale co., Tenn., 42 miles N. E. of Nashville. It has a Masonic hall, a male and female institute, 3 churches, 2 hotels, 1 newspaper. Large deposits of lead ore, and siliceous sand suitable for glass manufacture, exist. Principal business, farming. Pop. about 500. A. C. WELCH, ED. "SENTINEL."

Hartt (CHARLES FREDERICK), b. about 1838 in Nova Scotia; educated at the Wolfville Institute, N. S.; became in 1862 a pupil of Agassiz; accompanied the latter on his Brazilian expedition, in which he had the charge of the exploration of Southern Brazil; has made several subsequent visits to that empire; is professor of geology and physical geography in Cornell University. His principal work is *Geology and Physical Geography of Brazil* (1870).

Hart'ville, post-v. of Wright co., Mo., on the Gasconade River, in a fine agricultural country. It has a high school, a newspaper, a good steam saw and grist mill, a carding-mill, 1 hotel. P. about 500. F. A. MASON, ED. "NEWS."

Hart'well, post-v., county-seat of Hart co., Ga., 50 miles N. E. from Augusta. Pop. 154.

Hartwell, post-v. of Springfield tp., Hamilton co., O., on the Cincinnati Hamilton and Dayton R. R., N. of Cincinnati. Pop. 67.

Hart'wick, tp. of Osceola co., Mich. Pop. 47.

Hartwick, post-tp. of Otsego co., N. Y., on the Cooperstown and Susquehanna Valley R. R., and on the Susquehanna River, contains several cotton manufacturing villages, and is the seat of Hartwick Theological and Classical Seminary (Lutheran). Pop. 2339.

Hart'wig (JOHN CHRISTOPHER), a German Lutheran minister, b. in 1716; came to America as a chaplain in the British army; was a member of the first Lutheran synod in America (1748); held pastorates in New Jersey, Pennsylvania, and New York, and founded the Hartwick Theological Seminary at Hartwick, Otsego co., N. Y., which was opened in 1815. He received in 1761 a patent of 21,500 acres of land, comprising the greater part of the present town of Hartwick. D. in 1796, on his eightieth birthday, having forty years before predicted the day and hour of his death. He was a man of eccentric but noble character.

Hart'wood, tp. and p. v. of Stafford co., Va. P. 1536.

Hartz, or **Harz,** an insulated group of mountains in North-western Germany, or, rather, an elevated plateau, intersected with deep valleys and rising in different places into high peaks. These mountains, which cover an area of about 800 square miles, occupying Brunswick and parts of Hanover and Prussian Saxony, are covered with forests, and are exceedingly rich in minerals—gold, silver, lead, iron, marble, and alabaster. The highest peak is the Brocken, 3740 feet high, which is the birthplace of numerous superstitions and fairy-tales, mostly of a hideous and humorous turn.

Haruga'ri is the name of a German order in the U. S., established in 1847, and numbering about 20,000 members. The word, derived from *haruc*, a "forest," denoted with the ancient Teutons a priest. The aim of this order is principally benevolent and social, though the introduction to the constitution also sets forth, as a general purpose, the preservation and extension of the German language in the U. S. The organization comprises 235 subordinate lodges, which in the different States combine into great State lodges, and these again into one national lodge. Since

1869 the order has its own organ, called *Deutschen Eiche* ("German Oaks"). Most of the lodges possess libraries, and lectures are often given in the lodge-rooms.

Haruspices. See ARUSPICES.

Har'vard, post-v., cap. of McHenry co., Ill., 63 miles N. W. of Chicago, at the junction of the Green Bay, the St. Paul, and the Kenosha and Rockford divisions of the Chicago and North-western R. R. It has 4 churches, 1 newspaper, a private bank, 3 hotels, several large mills and shops. Pop. 1120. A. M. LELAND, ED. "INDEPENDENT."

Harvard, tp. and post-v. of Worcester co., Mass., 38 miles N. W. of Boston. The township is very fertile, and is traversed by the Worcester and Nashua R. R. It has 3 churches and a public library, and is the seat of a flourishing community of Shakers. Pop. 1341.

Harvard, post-v. of Clay co., Neb., on the Burlington and Missouri River R. R., 81 miles W. of Lincoln, the State capital. It has 3 organized church societies, a lodge of Good Templars, 1 of Freemasons, 1 hotel. It is the centre of a thriving agricultural community. Pop. about 400.
WM. A. CONNELL, ED. "ADVOCATE."

Harvard (JOHN), M. A., the founder of Harvard College, was b. in England about 1608, probably in Middlesex, and was educated at Emanuel College, Cambridge. He came to New England, and in 1637 became a freeman of the Massachusetts colony. In 1638 some land was set off for him in Charlestown, where he performed the duties of minister. In that year he was one of a committee to consider matters "tending towards a body of laws." D. Sept. 14, 1638, and left half his estate, or £779 17*s.* 2*d.*, towards the founding of a college, besides more than 300 volumes of books from his library. Mr. Everett delivered the address at the dedication of his monument at Charlestown in 1828. But little is known of Mr. Harvard's life.

Harvard University. In the year 1636, less than sixteen years after the landing of the Pilgrims at Plymouth, the general court of the colony of Massachusetts Bay voted to give the sum of "four hundred pounds towards a school or college," one-half to be paid the following year, and the remainder when the work was done. Preliminary steps towards the establishment of a college at Newtown (afterwards Cambridge) were taken the following year. In 1638, John Harvard, a non-conforming clergyman of England, who had been in the colony about one year, left at his death half of his whole property and his entire library (about 300 volumes) to the institution. The value of this bequest was more than double the sum originally voted by the court, and it was resolved to open the college at once, and to give it the name of Harvard. The first class was formed in the same year, and graduated, nine in number, in 1642. From that date to the present there has been, with five exceptions—all occurring during the first fifty years of the existence of the college—no year without a graduating class. The last triennial catalogue (1872) contains the names of 12,175 persons who have received degrees from the university, nearly 7000 of whom are still living. The invested funds of the university amounted Sept. 1, 1873, to over $2,750,000, exclusive of the grounds, libraries, and buildings occupied for purposes of instruction, which, yielding no direct income, have no place in the treasurer's accounts. The government of the college was at first confided to a board of overseers, established and empowered by an act of the general court; but in 1650 a charter was granted, by which the college was made a *corporation*, consisting of the president, five fellows, and a treasurer, to be called by the name of "President and Fellows of Harvard College." This corporation had the power to fill vacancies in its numbers with the approval of the overseers, and continues to the present day in its original form as the *corporation*, acting under the original charter as first issued in 1650, and with its rights and privileges confirmed by a special section in the constitution of the commonwealth of Massachusetts, framed in 1780. The board of overseers has also continued in existence to the present day, but not without important changes in its constitution and modifications of its powers. At the outset the magistrates of the colony and certain preachers formed, *ex-officio*, the board, and it was not until the year 1810 that steps were taken to make a part of the number elective. The State government retained a more or less direct control over the constitution of this board until the year 1865, when all official connection between the college and the State was broken by the passage of a legislative act, according to which vacancies in the board of overseers were to be filled thereafter by the alumni of the college "voting on commencement day in the city of Cambridge." By this transfer of power to the graduates, the college was freed from any dependence upon political bodies, as it had been previously freed from the influences of sectarianism. The property of the university is held and managed entirely by the corporation, the board of overseers having ordinarily no voice in the investment or other disposition of university funds; but in all matters relating to statutes and regulations, the appointment of professors and other instructors, and in general the internal administration of college affairs, the consent of the overseers is necessary. That board consists, at present, of the president and treasurer of the university, *ex-officio*, and of thirty other persons elected for terms of six years, five retiring each year. The teaching force of the university consists now of 46 professors, 25 assistant professors, 23 tutors and instructors, and 35 other officers engaged in the duties of instruction or government. The number of students in all the departments is about 1200.

The central department of the university is Harvard College, in the restricted sense of the term. The number of undergraduates has risen from scarcely 400 in 1857 to over 700 in 1874. This increase is very largely due to the introduction of the "elective system." It is no longer required that every student pursue the same course of study and pass the same examinations as the condition of obtaining the degree of bachelor of arts. After the freshman year, in which the studies are all prescribed, the student is practically at liberty to mark out his own course of study. There are this year (1875) 91 elective courses, giving in the aggregate 232 hours of recitation or lecture per week during the year, from which the student has to choose. About one-seventh part of the instruction provided is all that it is possible for any one college student to pursue during his whole residence. The elective courses are classified under the heads of ancient languages, classics, modern languages, philosophy, history, mathematics, physics, chemistry, natural history, music, and the fine arts. In these groups the courses are in general so arranged that there shall be a regular gradation from the simpler to the more difficult, and a student is thus enabled at the end of his freshman year to lay out a progressive course of study for the remaining three years. An incidental advantage of the system is that the sections are, as a rule, much smaller than in former years, and each student receives a larger amount of personal instruction from the professor, especially in the more advanced courses. The requisitions for admission have been raised gradually as circumstances would allow, and as rapidly as the preparatory schools could follow; the result of which has been that the average age of students entering the college is nearly a year greater than it was a few years ago.

The buildings of the college proper at Cambridge comprise nine dormitories (containing over 400 rooms), five buildings for recitations and examinations or for laboratories and collections, the library, the chapel, and Memorial Hall, erected in 1874 by subscriptions from the alumni. The rooms are rented to students at prices varying according to position and desirableness, a sufficiently large number being held at a merely nominal price to satisfy the wants of the poorer students. The college has also received large gifts of money to be applied in aiding poor but capable students in meeting their necessary expenses. This aid is given partly in the form of scholarships, of which there have been 92 established in the college, with an income of about $250 apiece on the average, and partly through beneficiary and loan funds. There are daily devotional services in the chapel at which the undergraduates are required to be present; on Sundays those who do not spend the day with their families must attend public worship at least once, but each student may select his own place of worship if he be of age. In 1782 the first steps were taken by the corporation towards the establishment of professional schools in connection with the college by the appointment of professors in medical subjects, but it was not till about thirty years later that a separate college was built for the medical department. The medical college was erected in Boston for the sake of the advantages of the hospitals. Its funds amount to $50,000, and 9 professors, 5 assistant professors, 7 instructors, 7 lecturers, and 1 assistant demonstrator are engaged in giving instruction. The library of the school, although not large, is valuable, and the anatomical museum is recognized as the best in the country. In the year 1868 a new department of this school was established in Boston for the purpose of giving instruction in the art of dentistry, in which 4 professors and 6 other instructors are engaged, besides the teachers of the medical school, whose instruction students of dentistry attend.

Until the year 1812 the college government and students had united in public worship with the first parish in Cambridge, but in that year the opinion was expressed by the overseers that religious instruction should be given on the Sabbath within the walls of the university. The discussions thus begun led in a few years to the founding of a

theological school. The organization of this school has suffered many material changes during the sixty years of its existence, but the peculiar feature insisted upon by its founders, "that no assent to the peculiarities of any denomination of Christians shall be required either of the instructors or students," has not been altered. The school has a valuable library of nearly 16,000 volumes, which is kept in Divinity Hall. Instruction is given in all the subjects usually included in a system of theological education, and the full course occupies three years. Those students who complete the course and sustain the required examinations receive the degree of bachelor of divinity. There are now 5 professors and a librarian attached to the school.

The law school was established in 1817, but the number of students in law was small until after the reorganization of the school in 1829. Since that time the law school has been one of the most flourishing departments of the university, and there are now over 1700 names on the list of its graduates. The law library in Dane Hall is one of the most complete and extensive in America, containing about 15,000 volumes. There are now 3 professors, 1 assistant professor, and a librarian in the school.

The Lawrence Scientific School takes its name from Abbott Lawrence of Boston, who in 1847 made a gift of $50,000 to the corporation, with which to establish a school "for the purpose of teaching the practical sciences." The three professorships at first created were those of chemistry, engineering, and zoology and geology. This last professorship was held by Louis Agassiz from its foundation till the time of his death in 1873. Connected with this school is the School of Mining and Practical Geology, founded in 1865.

The Museum of Comparative Zoology, more popularly known as the Agassiz Museum, is not a constituent part of the university, although it is directed by a faculty appointed by the corporation. The property of the museum is held by an independent board of trustees. There is, however, such an intimate connection between the museum and the college that a large part of the college instruction in natural history is given at the museum. The institution was founded in 1859, and continued under the direction of Prof. Agassiz until his death. Its library now contains 12,000 volumes. The Botanic Garden of the university and the Herbarium afford facilities for the study of botany which are unsurpassed in America. Funds for a professorship of natural history were raised as early as 1805, and a site for the garden was selected shortly afterwards. Nearly opposite the Botanic Garden stands the Astronomical Observatory, erected in 1846, and equipped throughout with the best of instruments.

The Bussey Institution is a school of agriculture and horticulture, established as a department of the university according to the terms of the will of Benjamin Bussey, who left, at his death in 1842, a large bequest in money and land (Bussey Farm) for the purpose. The Peabody Museum of American Archæology and Ethnology possesses a rapidly accumulating collection of objects illustrating the habits and customs of the early races inhabiting this country, but the erection of a museum building will be deferred until the funds set aside for that object shall amount to $100,000.

Besides the libraries of the professional schools, there is the general library for the use of the whole university, kept in Gore Hall, and containing 150,000 volumes, exclusive of pamphlets (of which there are about 100,000) and unbound serial publications. WILLIAM H. PETTEE.

Harvest-Fly. See CICADA.

Harvest Moon, the full moon nearest the autumnal equinox. In Great Britain and Northern Europe, owing to the latitude, the harvest moon rises for several evenings in succession near the time of sunset; an irregularity which is less observable in the U. S., on account of our lower latitude. At the equator no such anomaly is observable. The southern hemisphere has a harvest moon in March. The name is given from the fact that it enables farmers to lengthen the day's work during the haste of the autumnal ingathering of the crops.

Har'vey, county of S. Central Kansas. Area, 468 square miles. It is a good agricultural region, and is traversed by the Atchison Topeka and Santa Fé R. R. Cap. Newton.

Harvey, tp. of Meeker co., Minn. Pop. 364.

Harvey (Sir JOHN), K. C. B., b. in 1778; entered the British army in 1794; served in the wars against Napoleon, and in South Africa, India, and Canada, and was distinguished at Stony Creek, Chrystler's Farm, Lundy's Lane, and Fort Erie, where he was severely wounded; was aide-de-camp to Wellington in the Waterloo campaign; was governor of New Brunswick 1837–41, of Newfoundland 1841–46, and of Nova Scotia 1846–52. D. at Halifax Mar. 22, 1852. He attained the rank of lieutenant-general, became a commander of the Legion of Honor, and married a daughter of Lord Lake.

Harvey (LOUIS P.), b. at East Haddam, Conn., July 22, 1820; removed at the age of eight with his parents to Ohio; educated at Western Reserve College; removed to Kenosha, Wis., in 1840, and devoted himself for a time as teacher, subsequently as editor of the Whig paper of that city. He was a member of the State senate from 1855 to 1857, when he was elected secretary of state, and governor Nov., 1861. After battle of Shiloh repaired to the field with supplies for relief of the wounded, and on his return from the battlefield, he was drowned at Savannah, Tenn., Apr. 19, 1862.

Harvey (MATTHEW), LL.D., b. at Sutton, N. H., June 21, 1781; graduated at Dartmouth in 1806; became a lawyer 1809; was a prominent State legislator; Speaker of the New Hampshire house 1818–20; president of New Hampshire senate 1824–28; State councillor 1828–30; in Congress 1821–25; governor 1830–31; a justice of the U. S. district court 1831–66. D. at Concord Apr. 7, 1866.

Harvey (WILLIAM), M. D., b. at Folkestone, Kent, Apr. 1, 1578, was the son of a substantial yeoman, and was educated at Caius College, Cambridge, and at Padua, where he studied under Fabricius and took his doctor's degree; returned to England in 1602; became physician to Bartholomew's Hospital, London; Lumleian lecturer on anatomy and surgery 1615; was physician to James I. and Charles I.; was attached to the court of the latter, followed his fortunes in the civil war, and became warden of Merton College, Oxford, probably in 1643. D. June 3, 1658. Harvey's great discovery of the circulation of the blood seems to have been suggested by him in 1616, announced in 1619, and published in the *Exercitatio de motu cordis et sanguinis* (1628). Other *Exercitationes* on the subject appeared in 1649. His later years were occupied in observations upon generation, upon which he published a treatise in 1651. Servetus, Paolo Sarpi, Cæsalpinus, and perhaps Fabricius, Harvey's tutor, would appear to have believed in the circulation of the blood, but Harvey first established the truth of the doctrine.

Har'veysburg, post-v. of Warren co., O., in Massie tp. Pop. 388.

Har'ville, tp. of Winston co., Ala. Pop. 365.

Har'wich, town of England, in the county of Essex, at the mouth of the Stour. Its harbor is safe, spacious, fortified, and one of the best on the E. coast of England, but its entrance is difficult. Harwich has manufactures of cement and artificial manure. Pop. 6107.

Harwich, post-v. and tp. of Barnstable co., Mass., on the S. side of Cape Cod, about 70 miles S. E. of Boston. It has 4 miles of sea-coast, but no good harbor. The Cape Cod R. R. passes through the town. The fishing and coasting business is carried on to some extent. It has a national bank, a newspaper and printing office, 8 churches, several large halls, etc. Pop. of tp. 3080.

JOSIAH PAINE, ED. "INDEPENDENT."

Har'winton, post-tp. of Litchfield co., Conn., 23 miles W. of Hartford. It has an insurance company and some manufacturing interests. Pop. 1044.

Har'wood, tp. of Champaign co., Ill. Pop. 779.

Harwood (EDWARD), D. D., b. in Lancashire, England, 1729; appointed master of Congleton school 1754; became Unitarian pastor at Bristol 1765; received the doctor's degree from Edinburgh 1768; went to London 1770 on account of injurious but false rumors about him, and engaged in teaching and authorship. D. there, very poor, Jan. 14, 1794. His principal works are a *Liberal Translation of the N. T.* (1797), which was severely criticised; *Introduction to the Study of the N. T.* (1767–71, 2 vols.); *View of Various Editions of Greek and Latin Classics* (1775), a learned and able work; *The N. T. Collated with the most approved MSS., with Select Notes* (1776); *Biographia Classica* (2d ed. 1778).

Has'drubal, or **As'drubal** ("Baal is his help"), the name of many famous Carthaginians, among whom we may notice—(1) a son-in-law of Hamilcar Barca, went to Spain and there founded New Carthage (242 B. C.), and by shrewd diplomacy brought nearly all Spain under the rule of Carthage; was murdered by a slave 221 B. C. (2) Son of Hamilcar Barca and brother of Hannibal; was defeated by the Scipios in a great battle on the Iberus, 216 B. C.; reduced the Numidians to quietness, 213 B. C.; defeated and slew Cn. Scipio in battle, in Spain, 212 B. C.; was defeated by P. Scipio the Younger at Bæcula, 209; invaded Italy through Gaul, and was defeated and slain on the Metaurus by Livius and Nero, 207 B. C. (3) A son of Gisco, who served in Spain in the second Punic war; was totally defeated by Scipio at Silpia, 206 B. C.; was twice

defeated before Carthage by Scipio, 204 B. C., and committed suicide by poison. (4) A general in the last Punic war; was defeated by Masinissa and forced to capitulate 150 B. C.; served against the Romans before Carthage 149–147; commanded against Scipio in the defence of Carthage (147–146 B. C.), and after the destruction of that town lived a captive in Italy.

Ha′se (KARL AUGUST), b. at Steinbach, Saxony, Aug. 25, 1800; was imprisoned in 1819 for belonging to the Burschenschaft; was made a private tutor in divinity at Tübingen 1823; graduated at Leipsic 1828; became in 1829 professor of philosophy there; professor of theology at Jena 1830; has long been a prominent rationalist, and in 1844 became an editor of the *Protestantische Kirchenzeitung*. Author of *Evangelische Dogmatik* (1825), *Gnosis* (3 vols., 1826–28), *Hutterus Redivivus* (1829), *Leben Jesu* (1829; in English by J. F. Clarke, 1859), *Kirchengeschichte* (1834; English trans. by Blumenthal and Wing, 1856), *Neue Propheten* (1851), *Das geistliche Schauspiel* (1858), *Handbuch der Polemik gegen die römisch-katholische Kirche* (1862), *Franz von Assisi* (1856), *Katharina von Siena* (1862), *Wormser Lutherbuch* (2d ed. 1868), *Ideale und Irrthümer* (1872), and many other works.

Hase (KARL BENEDICT), b. May 11, 1780, at Sulza, in Saxony; went in 1801 to Paris, was appointed 1805 to a place in the Royal Library in the MS. department; in 1816 professor of modern Greek and of palæography in the School of Oriental Languages; afterwards director of the same; member of the Academy of Inscriptions 1824; professor of the German language and literature in the Polytechnic 1830; professor of comparative grammar at the Sorbonne 1852; besides other honorable appointments. Contributed many valuable articles on philology to the *Journal des Savants, Journal Asiatique, Revue Archéologique*, etc. Edited *Laurentius Lydus de Ostentis*, Paris, 1823; wrote an introduction (*commentarius*) to the edition of *Lydus de Magist. Rom.* by Fuss; edited *Leo Diaconus* (in *Byz. Script.*), Bonn., 1828; was principal editor of the new edition of *Stephani Thesaurus Linguæ Græcæ*, aided by De Sinner and Fix, afterwards by W. and L. Dindorf, who continued the work after his death. D. Mar. 21, 1864. (See GUIGNIAUT, *Notice historique sur la vie et les travaux de C. B. Hase*, Paris, 1867.) H. DRISLER.

Hashish′ [Arabic], a variety of *Cannabis sativa* (hemp), is cultivated in districts N. of Calcutta for the production of (1) *bhang* (Hindostani), *hashish* (Arabic), the dark-green stalks and green leaves used in smoking, or as a constituent of a sweetmeat (*majun*); (2) *ganja*, the flowering shoots brought into the London drug-market under the name of *guaza;* (3) *charas*, or *churrus*, the resin which exudes from the branches and leaves of the plant. It has been shown that an extract of the hemp grown in the U. S. shares the qualities of that of India, but doubtless in a less degree, for the hemp of hot countries has more of the active resin (*churrus*) than the hemp of temperate climates. Hashish has long been employed in medicine in Asia. Arabs, Persians, Indians, Chinese, and South Africans esteem it for its intoxicating powers; but there are many people of European race who are scarcely influenced by it; and upon those who are intoxicated by its use the effects are extremely varied. This uncertainty of effect greatly limits its use in medicine. Upon some persons its influences as an anodyne and hypnotic in certain diseases are very happy.

Has′kell, county in the N. W. of Texas. Area, 1275 square miles. It is unorganized, and consists chiefly of a high, level table-land, reported to afford good pasturage and abundance of game.

Has′kins, post-v. of Middletown tp., Wood co., O. on the Dayton and Michigan R. R. Pop. 243.

Has′lett's, tp. of Gates co., N. C. Pop. 946.

Has′lingden, town of England, in the county of Lancaster. It is situated in a mountainous region rich in coal-mines and stone-quarries, and carries on extensive manufactures of woollen and cotton. Pop. 12,201.

Has′san, post-tp. of Hennepin co., Minn. Pop. 551.

Has′sard (JOHN R. G.), b. in New York City in 1836; graduated at St. John's College, Fordham, N. Y., in 1855. He assisted in preparing the *New American Encyclopædia;* was editor of the *Catholic World* in 1865, and was engaged on the *Chicago Republican* in 1865–66. Since 1866 he has been on the editorial staff of the New York *Tribune*, of which, since the death of Horace Greeley in 1872, he has been assistant editor. He published a *Life of Archbishop Hughes* in 1866. J. B. BISHOP.

Has′saurek (FRIEDRICH), b. at Vienna Oct. 9, 1832; served in the student legion in the revolution of 1848, and was twice wounded; came in 1849 to the U. S., and became a journalist, lawyer, and politician of Cincinnati; was U. S. minister to Ecuador 1861–65, and in the latter year became editor of the Cincinnati *Volksblatt*. Author of *Four Years among the Spanish Americans* (1868).

Has′sell's, tp. of Tuscaloosa co., Ala. Pop. 355.

Has′selt, town of Belgium, the capital of the province of Limbourg, on the Demer. It has large distilleries, salt-refineries, and manufactures of linen and lace. Pop. 10,448.

Hass′ler (FERDINAND AUGUSTUS), M. D., b. at Norfolk, Va., Mar. 6, 1844; took his medical degree at the University of Pennsylvania 1866; professor of materia medica in Lincoln University. One of the authors of the *Medical Register and Directory of the U. S.;* has published various papers upon natural science and on professional subjects.

Hassler (FERDINAND RUDOLPH), b. at Aernen, Switzerland, Oct. 6, 1770; was brought to notice in the U. S. by Albert Gallatin; professor of mathematics at West Point Military Academy 1807–10; was sent as scientific ambassador to Europe, with the salary of a foreign minister; was the first superintendent of the U. S. Coast Survey, which he conducted 1816–18 and 1832–43 (for an account of his work in this great enterprise, see art. COAST SURVEY); was for years chief of the bureau of weights and measures. D. at Philadelphia Nov. 20, 1843. Author of textbooks on mathematics; of a *System of the Universe*, in 2 vols.; and of many valuable scientific reports, including *Report to the U. S. Senate on Weights and Measures* (1832), and another to the secretary of the treasury on the same subject (1842).

Hassler Expedition. The U. S. Coast Survey having found it necessary to provide a new steamer for hydrographic purposes on the Pacific coast, the Hassler (so named from the first superintendent of the Coast Survey) was built in Philadelphia, and sent out by way of the Straits of Magellan. To render the voyage profitable to science, Prof. Peirce, the superintendent, offered to Prof. Agassiz the privilege of making the voyage in her with a limited number of assistants, which he gladly accepted. The steamer, an iron screw vessel of about 350 tons, was placed under the orders of Com. P. C. Johnson, U. S. N. Mr. L. F. Pourtalès of the Coast Survey was assigned to take charge of the dredging operations. The rest of the scientific corps consisted of Dr. F. Steindachner of Vienna, ichthyologist; Dr. Th. Hill of Cambridge, as botanist and photographer; Dr. White of Philadelphia, as chemist and photographer; Mr. J. H. Blake of Cambridge, as draughtsman and collector. Mrs. Agassiz accompanied her husband, as usual, in his travels. The steamer sailed from Boston Dec. 4, 1871, after considerable delay, which somewhat curtailed the time which would otherwise have been devoted to deep-sea dredging in the Atlantic. Therefore, only surface observations were made on the passage to St. Thomas. The next stopping-place was Barbadoes, where very rich dredgings were made in 100 to 120 fathoms. The rough sea caused by the trade-winds prevented any work being done from that port to Pernambuco, but along the coast of Brazil the dredge was used with success whenever the weather permitted. Rio Janeiro was reached Jan. 23, 1872, where three weeks were spent for various repairs to the vessel. Montevideo was next visited for coaling, but the ship was placed under quarantine; only a short visit to the mount was allowed, where Prof. Agassiz found unmistakable proofs of glacial action. The next halting-place was San Matias Bay, Patagonia, where the bluffs showed fine sections of the strata underlying the Patagonian plains. In the Straits of Magellan stoppages were made every night, and occasionally a day or two spent in interesting localities. Thus, at Possession Bay an excursion inland was made by some members of the party as far as Mount Aymon, which was found to be an extinct volcano, and the easternmost of a chain of similar ones extending in a westerly direction. Elizabeth and Magdalen islands, great breeding-places of birds; Sandy Point, a Chilian penal settlement, with a promising coal-mine; Glacier Bay, with a very interesting glacier reaching nearly to the sea-level; and Sholl Bay, were other stopping-places, where abundant collections were made and interesting observations on the former and present state of the glaciers recorded by Prof. Agassiz. The channels of internal navigation were followed through Smyth's Channel to the Gulf of Penas. On the coast of Chili, San Carlos, Lota, and Talcahuano were visited. The steamer went from the latter place to Juan Fernandez, while Prof. Agassiz went by land to Valparaiso. Some deep soundings were taken in the neighborhood of that island, but the dredging-rope having been injured by dampness in the hold, failed to give the results which were expected from it. Valparaiso, Caldera, Pisco, Callao, Payta, and the Galápagos Islands were next visited, and finally San Francisco was reached in Aug., 1872, after touching at Panama, Acapulco, Magdalena Bay, and San Diego. Some of the zoological results of the expedition have been published by Messrs. A. Agassiz, Lyman, and

Pourtalès, but the death of Prof. Agassiz has prevented the publication of his numerous observations, except in the preliminary form of letters to Prof. Peirce.

L. F. Pourtalès.

Hass'loch, town of Rhenish Bavaria, which carries on considerable coal-mining and trade in grain. Pop. 5090.

Has'tings, town of England, in the county of Sussex, on the English Channel. Here William the Conqueror landed, and the decisive battle was fought in 1066 in the vicinity. The excellent harbor was ruined in the time of Elizabeth by a storm, and Hastings is now best known as an elegant and much-frequented bathing-place. Pop. 29,289.

Hastings, county of Ontario, Canada, extending N. by W. from the Bay of Quinté, Lake Ontario. It contains many lakes and streams, and much fertile land. It has 3 ridings. Cap. Belleville. Pop. 48,364.

Hastings, post-v. of Peterborough and Northumberland cos., Ontario, Canada, on the river Trent, has a good water-power, and cotton, woollen, and flour mills.

Hastings, city and tp., cap. of Barry co., Mich., on the Thornapple River, 30 miles from its junction with Grand River, and 32 miles S. E. of Grand Rapids. It has a national bank, a union school-house that cost $50,000, 2 newspapers, 4 churches, 33 stores, 2 hotels, 2 large flouring-mills, a large foundry, 2 sash, blind, and door manufactories, 3 saw-mills, and several smaller manufacturing establishments. Pop. of city, 1793; of tp. 2919.

Geo. M. Dewey, Ed. "Republican Banner."

Hastings, city, cap. of Dakota co., Minn., on the W. bank of the Mississippi River, opposite the mouth of St. Croix Lake, 20 miles below St. Paul. It is on the Milwaukee and St. Paul R. R., river division, and the Hastings and Dakota R. R. It is noted as a wheat and lumber market, having 4 large flouring-mills, 3 saw-mills, 9 grain-elevators, carriage-shops, furniture-factories, foundry, machine-shop, 9 churches, 2 national and 1 private bank, 2 weekly newspapers, 12 hotels, a public library, an academy for ladies, and a well-conducted public school. Pop. 3458. Irving Todd, Ed. "Hastings Gazette."

Hastings, city of Adams co., Neb., on the Burlington and Missouri River R. R. and the St. Joseph and Denver City R. R. It is incorporated as a city of the second class. The region about Hastings is well adapted to agriculture. Pop. about 700. It has 1 weekly newspaper.

A. L. Wigton, Ed. "Journal."

Hastings, tp. and post-v. of Oswego co., N. Y., on the Syracuse Northern R. R., 24 miles N. of Syracuse. The township is also traversed by the New York and Oswego Midland R. R., and contains 5 churches and several villages. Pop. 3058.

Hastings (Thomas), Mus. Dr., b. in Washington, Conn., in 1784; removed to Clinton, N. Y., with his father when twelve years of age; was editor of a religious journal of Utica, N. Y., 1824–32; became a musical instructor and composer of sacred music in New York City. Author of *Spiritual Songs* (1832), *Christian Psalmist* (1836), of several volumes of poems, hymns, etc., and compiler of many collections of church music. Many of his compositions are widely known, and have attained enduring popularity.

Hastings (Warren), LL.D., b. at Daylesford, Worcestershire, Dec. 6, 1732; was educated at Westminster, and went to Bengal in 1750; was taken prisoner by Surajah Dowlah 1756; served under Clive 1757; was resident at the court of Meer Jaffier 1757–61; became a member of the council at Calcutta 1761; returned to England in 1764, and expended the considerable fortune he had acquired for the relief of his poor relatives; returned in 1769 to India, where he had hitherto been a general favorite, but more remarkable for industry and studious habits than for ability; was second in the Madras council 1769; became president of the supreme council of Bengal 1772; assisted the nabob of Oude against the Rohillas 1773–74; was the first governor-general of India 1774–85; quarrelled with the councillors 1774; procured the execution of his enemy Nuncomar 1776, in which year the government attempted unsuccessfully to displace him; received notice in 1778 that his resignation was accepted, but disavowed the resignation and refused to give up the office; married as his second wife the divorced baroness Imhoff 1778, to whom he had for nine years been avowedly attached; sent an expedition against the French in 1778; fought a duel with Philip Francis 1780; accepted bribes from the rajah of Benares 1780; made Sir Elijah Impey judge of the court of appeal 1781; compelled the Madras government to give up the revenues of the Carnatic to the nabob 1783, in disobedience of the orders of the directors; made the conquest of Benares 1784, and concluded the treaty of Chunar; resigned and went to England 1785. Articles of impeachment for high crimes and misdemeanors were presented by Burke against Mr. Hastings in Feb., 1786. In his famous trial, which began Feb. 13, 1788, and ended Apr. 23, 1795, the ability and eloquence of Burke, Sheridan, and Fox failed to convict him, it having been conclusively shown that India had improved greatly under his rule, and that Hastings was extremely popular with the natives and with the majority of the Europeans of his government. Hastings' faults were those of the English system in India. Personally, he was a kindly man, who made warm friends everywhere. As a ruler he was one of the ablest India ever had; but being a man of positive character, he could not fail to make enemies; and there is no doubt that his quarrel with Francis in India made the latter his bitter opponent. Hastings expended his fortune in defending himself in the great trial, and was afterwards supported by a large yearly allowance from the East India Company. D. at Daylesford Aug. 22, 1818.

Hastings-upon-Hudson, post-v. of Greenburg tp., Westchester co., N. Y., on the Hudson River and the Hudson River R. R., 19 miles N. of New York. It has a sugar-refinery and other manufactures.

Hat. See Hat-Making, by C. G. Leland.

Hat'boro', post-v. of Montgomery co., Pa., 15 miles N. E. of Philadelphia, on the North Pennsylvania R. R. It has 3 educational institutions, a public library of 9000 vols. founded 1755, 2 churches, 1 bank, 2 hotels, 10 grist-mills, and 1 newspaper.

Dr. W. T. Robinson, Ed. "Public Spirit."

Hatch (Edward), b. in Maine; removed to Iowa, and became captain 2d Iowa Cavalry Sept., 1861, rising to be colonel of the regiment June, 1862, and in command at New Madrid, Island No. 10, and Corinth; commanded a brigade at Iuka, and subsequently a division of cavalry in Army of the Tennessee. Appointed brigadier-general of volunteers May 30, 1864, and commanded a cavalry division at the battles of Franklin and Nashville and the subsequent pursuit of Hood's army. Brevet brigadier and major-general for the last two battles. In July, 1866, was appointed colonel of the 9th U. S. Cavalry, which command he still holds (1875).

Hatch (Horace), M. D., b. at Trowbridge, Vt., 1788; graduated at Dartmouth College 1815; practised medicine at Norwich, Vt., until 1837, and for twenty years thereafter practised at Burlington, Vt.; was employed in the U. S. treasury department, Washington, D. C., 1861–65, and then removed to New York; was distinguished for benevolent and generous disposition, and occupied a high place as a practitioner. D. in New York Oct. 28, 1873.

Hatch (John P.), b. in New York in 1822; graduated from the U. S. Military Academy, and appointed brevet second lieutenant of infantry July 1, 1845, rising through successive grades to be lieutenant-colonel of cavalry, 1873; in the Mexican war he took part in various engagements from Palo Alto to the final capture of the city of Mexico, and brevetted first lieutenant and captain for gallantry in battle; subsequently in garrison and on frontier duty; engaged on frequent expeditions against hostile Indians up to 1861. In the civil war he was appointed brigadier-general of volunteers Sept., 1861, and commanded a cavalry brigade in the Shenandoah Valley and Northern Virginia; engaged at second battle of Bull Run and Chantilly; at the battle of South Mountain Sept. 14, 1862, commanded a division and was severely wounded; subsequently commanded various districts in the South; brevetted from major to major-general for gallant services; at present (1875) serving with his regiment (4th cavalry) on the S. W. frontier. G. C. Simmons.

Hatch'ie River rises in the N. E. of Mississippi, flows N. into Tennessee, and then W. N. W. to the Mississippi River. Its mouth is 25 miles N. of Memphis. Small steamboats can run for half the year as far up as Bolivar, Tenn., 150 miles from its mouth. Its valley is very fertile. Its lower portion is often called the *Big Hatchie.*

Hatch'ing, the development of the young of an oviparous animal from the egg. In a narrower sense the term is applied to this development as a result of the process of incubation, or the sitting of the mother-bird upon her eggs. A few fishes and reptiles perform a kind of incubation, but they probably do this only to guard their eggs. A few birds, like the ostrich, leave the eggs in the hot sand during the heat of the day, the heat of the mother's body not being necessary. Other birds, like the Megapodidæ, place their eggs in heaps of rotting organic matter, the heat of which hatches out the young. In Egypt and China millions of eggs are hatched by artificial heat, and a machine called Eccaleobion (which see) has been employed for the same purpose.

Hatch'ment, or **Atchievement,** a funeral tablet set-

ting forth the arms, and sometimes the descent, of a deceased person. The construction of the hatchment is based upon nice heraldic rules, by a knowledge of which the observer can tell whether the deceased was male or female; married, single, or widowed; what was his or her rank; whether heirs survive; if a wife, whether she were an heiress or not, etc. In different countries there are varying rules for the decoration of hatchments, every circumstance of which is significant of some fact with regard to the deceased. It is very commonly placed upon the house-front for a season. (See HERALDRY, by REV. B. R. BETTS, A. M.)

Hat'field, tp. and post-v. of Hampshire co., Mass., on the W. bank of the Connecticut River, and on the Connecticut River R. R., 5 miles N. of Northampton. Hatfield village is one of the most thriving and beautiful places in the State. The greater part of the soil is very fertile, producing fine tobacco, broom-corn, grain, and hay. Hatfield has considerable manufactures of lumber, etc., and is the seat of an academy. It was during colonial times much exposed to Indian attacks, and spirited fights occurred here May 30 and Oct. 19, 1675. On Sept. 19, 1677, the Indians made a bloody assault upon the settlement. Pop. 1594.

Hatfield, tp. of Montgomery co., Pa. Pop. 1512.

Hatfield (CHESTER M.), U. S. N., b. Feb. 21, 1837, in Massachusetts; graduated at the Naval Academy in 1856; became a master in 1859, a lieutenant in 1860, a lieutenant-commander in 1862, a commander in 1870; served as executive officer of the Owasco, one of the vessels of Porter's mortar flotilla, during the bombardment of Forts Jackson and St. Philip in Apr., 1862, and is thus spoken of in the report of his commanding officer: "Lieut. Chester Hatfield, in action, and in the very heavy duties which have devolved upon him for weeks past, has proved himself a brave and capable officer." FOXHALL A. PARKER.

Hatfield (EDWIN FRANCIS), D.D., b. in Elizabethtown, N. J., Jan 9, 1807; graduated at Middlebury College, Vt., in 1829; spent two years (1829–31) in Andover Theological Seminary; was ordained by the third Presbytery of New York May 14, 1832; was pastor of the Second Presbyterian church of St. Louis, Mo., 1832–35; of the Seventh Presbyterian church of New York City 1835–56; and of the North Presbyterian church 1856–63, when he was compelled by loss of health to give up the pastoral work. After resting a year he became special agent of the Union Theological Seminary in New York 1864–66, and again 1870–73, raising a large sum of money for its endowment. Since 1846 he has been stated clerk of the General Assembly. In 1850 he received the degree of D.D. from Marietta College, O. While pastor of the Seventh church in New York 1556 persons were admitted to the fellowship of the church on profession of their faith. Dr. Hatfield has also done a large amount of literary work. He has published *Universalism as it Is* (1841), *Memoir of Elihu W. Baldwin, D.D.* (1843), *St. Helena and the Cape of Good Hope* (1852), *The History of Elizabeth, N. J.* (1868), *The Church Hymn-Book, with Tunes* (1872), *The Chapel Hymn-Book* (1873). He also edited *The New York Observer Year-Book* for 1871, 1872, and 1873. R. D. HITCHCOCK.

Hat-Making. The hats in general use at the present day among all civilized people are of two kinds only—those made entirely of *felt*, and the so-called *covered* hats, of silk or cotton, which are coated with a long nap or plush resembling the fur which it was originally intended to imitate. Felt, which was known to the Romans, is formed on the principle that hairs of any kind when subjected to constant motion and pressure have a tendency to closely fasten together until a compact mass is formed. This is due to the fact that every hair, although it may appear smooth under the strongest microscope, is made up of *lamellæ* or extremely fine plates or scales. If a hair of any kind be taken between the thumb and finger, and the two are gently pressed and rubbed together, the larger or root-end of the hair will always work away, until it escapes, owing to the gradually diminishing size of the protecting lamellæ. If two or more hairs of a single kind are worked or beaten together, the lamellæ will of course, acting like barbs, cause them to adhere closely. St. Clement, whose day occurs on the 23d of November, is the patron saint of hat-makers, because it is narrated that he accidentally discovered felt. Having gone on a pilgrimage, he put some wool between the soles of his feet and his sandals, to make his journey easier. The wool in time was converted into felt. Felt was really known long before it was rediscovered by St. Clement, but the legend illustrates the simple manner in which this material may be made; as it indeed is, even by cows when they swallow their own hair licked from their bodies, forming the well-known *ægagropila*, or felt balls, so often found in their stomachs. Ordinary felt hats are made either of wool or wool and hair, thickened with size. A better quality are the so-called *plated* hats (or *plates*), which are covered with a coating of finer material; and superior to these are the *short naps*, in which different qualities of fur—*e. g.* of rabbits or hares, muskrat, and nutria—are mixed in the wool. This kind of hat is invariably waterproof and stiffened. The old-fashioned apparatus for making felt hats by hand embraced the *bow*, a stick formerly of ash, but sometimes of other wood, with a very strong catgut cord; a *hurdle*, or a flat surface of wood or a table with three enclosed sides to keep in the light material; a *basket*, of straight wicker rods from 20 to 25 inches in length; and the *battery*, which consists of a *kettle* and the *plank*, half of lead and half of mahogany. The different kinds of fur and wool being combined, the first step by this process is to intimately mix them; and this is effected by *bowing*, or by causing the bowstring "to strike and play upon the fur, so as to scatter the fibres in all directions," while the dust and lumps in the fur fall through the *grids*, or holes between the woodwork or wires of the hurdle. The object of the workman now is to mould this material or felt as if it were putty, first into one piece which is to make half a *cap*, then make another, and unite the two. The fur, driven about by the bowstring, forms a lump, enough for one side or half of the hat. This is shaped partly by the bow and partly with the *basket*, by a process called *gathering*, into a conical form called a *bat*. With the aid of a piece of leather called a *hardening skin* and a wet cloth this is worked more and more into *felt*. Another conically-shaped piece, precisely similar, is now prepared. These are made into shape by folding and joining the edges over a stiff piece of triangular or conically-folded paper, which serves as a guide. The first bat is laid upon a second, so that the joining of the one rests upon the other, and the two by a process of wetting and manipulation are worked into one between folds of linen cloth. After being folded it is taken to the *battery*, where it is immersed in a liquor of sulphuric acid diluted with water, and worked with a roller or with the hands during four hours. If thin places are detected in the body of the hat, they are supplied with fresh felt, while lumps are picked out. If beaver is used, it is applied at the end, and in this case beer is added to the liquor. With this the hat is again brushed and worked with a roller till it is firm and no longer sticky. When dry a waterproofing varnish is applied, more to the inside than the outer surface, while the brim is specially thickened. If the hat is to be covered or napped, a coat of beaver or other fur is laid upon it, and patted on with a brush; moistened with the hot liquor until it gets incorporated, the *cut* ends of the hairs towards their roots being those which spontaneously fasten themselves into the felt. These ends are firmly worked in by wetting the hat with the liquor and squeezing it in a haircloth. *Napping*, it should be observed, depends entirely upon the curious tendency of the *cut* ends, and not the *points* of hairs, to root themselves into the felt. This working the beaver in is called *rolling off* and *ruffing*, or roughing. A brim is prepared and napped by the same process, and united to the whole. In this rough shape the hat is called a *hood* (Ger. *Hut*—*i. e.* "hat"). It is now cut to the proper size, and the crown is shaped by rewetting and working on a block, the brim being for the present neglected. Great care is taken to reduce the conical top to a flat surface. A *suit* or six dozen hats are now put, on *blocks*, into the dye-kettle, which contains a mixture of copperas and verdigris. They are alternately steeped in this and dried, and then washed clean. The nap is now raised, or caused to rise, by being carefully combed with a card, and further improved with pumice-stone and soft rubbing. The hat receives its final shape by being steamed and pressed on a block or mould with hot irons. By means of a knife fixed in a gauge which presses against the crown the brim is cut so as to correspond to the latter. The brim, in order to turn it, is cut through the stiff part, leaving the outer fur untouched. Many variations are made both as regards materials and manipulation, especially for silk hats, but the processes here described, although they have been generally superseded, especially in America, by machinery, set forth the principles of hat-making as usually practised till within a few years. At present the hat-maker generally obtains the bodies of the hats of some large manufacturer, and shapes and finishes them to suit his customers. By machinery the processes of mixing and cleaning the fur is effected with much greater rapidity than by the old method. The fur, being passed into a picking machine, is tossed and separated on revolving teeth, which, acting with great rapidity, cause a current of air which aids in agitating the material. It is then carried on an endless band to another similar machine, where it undergoes the same process, and is now considered as *mixed*, the different kinds of fur, wool, or cotton being thoroughly amalgamated. Lumps, long hairs, and other extraneous matters are, however, still to be removed, and this is effected by the process of *blowing*. Being passed upon rollers, it is now conveyed to a

cylindrical picker which revolves with incredible rapidity, retaining only the finest hairs and rejecting all impurities and coarse matter. This process is repeated until the fur is perfectly cleaned and reduced to a proper fineness. The felt from which the body is to be shaped is now formed by a very simple and ingenious process. A cone of thin plate copper, perforated with so many holes that it resembles wire gauze, turns slowly around, while within it a fan which revolves with great rapidity exhausts the air which is drawn into it through the perforations. The fur having been fed into a cylindrical case, passes through an opening or slit the exact height of the revolving cone, and about one inch wide at the top, and three at the bottom, in order that the lower part, or brim, may receive more stuff. This is of course *sucked* towards, and upon, the revolving copper cone. The *cap* is thus made of felt almost immediately, great care being, however, taken to remove any lumps or superfluous felt. The cone is now removed, the cap is wrapped up in a wet felt or cloth, and covered with a brass case and set in hot water. It is then *sized* and made up. By machinery 100 hats are made in the time which was formerly taken for one, and the price has accordingly been much reduced, though, as it would appear, not in the retail trade in proportion to the saving which has been effected for the manufacturer.

Silk hats of cylindrical shape are made by finishing the body with various applications of shellac, glue, and seedlac. A covering of fine silk plush, the best of which comes from Paris, carefully cut and sewn, is exactly fitted to the body, and the whole is pressed with a heated iron, which by softening the varnish causes the plush to adhere. Those from the best makers in Paris are very light and elegant in shape, but are not durable; the London-made are very strong, as the climate demands, and last well. The American hats combine lightness and durability to a remarkable extent, but are expensive in due proportion to their excellence. Of late years simple felt hats have again become, if not fashionable, at least very general for ordinary wear in all countries. The *chapeau mécanique*, invented about thirty-five years ago by a Paris hat-maker named Gibus, is made of thin cloth or strong crape upon a body consisting simply of a wire coil, and may be pressed quite flat and retained in this shape by means of a spring. The etiquette which demands that a hat shall be carried in crowded assemblies has kept this singular combination of machinery and head-covering in fashion. In England many hats are made of such light materials as felt, cork, and white linen for India.

Straw hats were known to the Romans and probably to many wild races since the earliest times. The most elegant have always been made in Italy; those of Leghorn, being the best, have given the name to all from the whole kingdom. The single straws for this manufacture are split by a fine iron comb, steeped in water, braided, and flattened between rollers. The plait is then sewn into shape on a block. Coarse hats made of whole straw are often worn. Very pretty hats for both men and women are made, especially in the Southern States, of the inner husk of the maize. Palm-leaf hats of the split leaf of the date and other palms are imported from China and Manila, and extensively made by machinery in the U. S. The *jipi-japa*, otherwise known as the Panama, is, however, the best of all these hats woven from vegetable fibres. One of the best quality costs from $50 to even $100. A coarse imitation of these South American hats, from the China Straits, is sold in London as Panama. The writer has seen a plain cigar-case, made from the finest quality of Panama reed, the cost of which was £7. Hats for sailors, cabmen, and others much exposed to the weather are made of oiled and glazed cloth or glazed leather.

Hat-making in France is at present principally confined to Anduze, Lyons, and Paris. Few persons are aware of the extent to which old hats are remade for the colonies, and in Paris it is common for street-dealers to cry, "A new hat for four francs and your old one." In the old days of beaver hats, when La Rochelle was at the head of this industry in France, it was shown (1692) by a M. de Guénégand that beaver skins passed from Canada to La Rochelle, and thence to Russia, where much of the fur was removed. Passing again to La Rochelle, the skins became hats of a new pattern, and when worn out in France were remade for Spain, where, hardened, gummed, and without fur—as the Spanish fashion required—they were again renewed and worn out. They then went to Portugal, where the same process of remaking and exhausting was again experienced, and then passed to Brazil, as of the latest style. Full of holes, the hats at last were forwarded to Guinea, and thence passed along the coast until, as thorough veterans, they were thrown away in Sofula and Mozambique. The last that is seen of a London hat at the present day is when, after sundry transitions, it passes to Ireland, and is finally thrown into New York harbor by the newly-arrived emigrant at the end of his voyage.

CHARLES G. LELAND.

Hato'ka, tp. of Nottoway co., Va. Pop. 3428.

Hatras', town of the N. W. Provinces, British India, 90 miles S. E. of Delhi. It has a fort and a large cotton-trade. Pop. 25,000.

Hat'temists, the followers of one Pontianus van Hattem, a Dutch minister of the eighteenth century who was excommunicated for Spinozism. They were fatalists and Antinomians, and taught that the whole duty of the elect was to be patient and to maintain tranquillity of mind. They denied the existence of moral evil and the corruption of the nature of man.

Hat'teras, tp. of Dare co., N. C. Pop. 673. (See CAPE HATTERAS.)

Hatz'feld, town of Hungary, in the Temesvar banat, has 6889 inhabitants, mostly engaged in raising wheat and breeding horses.

Hau'berk, a coat of mail covering the body, and often the neck, arms, and even the hands, and frequently covering also the head, except the face. It was of ring-mail or of true chain-mail.

Hauch (JOHAN CARSTEN) was b. at Frederikshald, Norway, May 12, 1790, and studied at the University of Copenhagen, where in 1821 he took the degree of Ph. D.; 1821–27 travelled through Germany, France, and Italy, studying zoology and botany; 1827–46 lectured on physics at the Academy of Sorö; 1846–48 held the professorship of Scandinavian literature and language at the University of Kiel, but on the outbreak of the rebellion he returned to Denmark, and became (1851) Oehlenshlager's successor as professor of æsthetics at the University of Copenhagen. He d. Mar. 4, 1872. His lyrical poems are comparatively few, and not very prominent, though some of his ballads and elegies are beautiful. Of his dramas several have been represented in the Scandinavian theatres and in Germany with great success, such as *The Two Sisters from Kinnacliff* (1849); *Honor Lost and Regained* (1851); *The Young Tycho Brahe* (1854); *The King's Favorite* (1858), etc.; but the largest and most interesting of his dramatic works—his tragedies *Tiberius* (1836); *Svend Grathe* (1841); *Mark Stig* (1850), and others—were not intended, and are hardly fit, for theatrical representation. He attracted most attention, however, by his excellent novels, *Wilhelm Zabern* (1834); *The Alchymist* (1836); *A Polish Family* (1839); *The Castle on the Rhine* (1845); *Robert Fulton* (1853); *Charles de la Bussière* (1860), etc. As a poet, Hauch was a disciple of Oehlenshlæger, though with individual character and independent development. His genius was of slow growth and inclined to mysticism. But he possessed considerable power of reflection, and has drawn many very intricate characters with great precision and clearness, and depicted many very complex social states with great vividness and impressiveness. In his old age his tendency to mysticism turned into a sublime pathos, which sometimes became monotonous, but which often was allied with a crushing satire.

CLEMENS PETERSEN.

Hauff (WILHELM), b. in Stuttgart, Germany, Nov. 29, 1802; studied divinity at Tübingen 1820–24; became editor of *Das Morgenblatt* (Stuttgart, 1827), and d. there Nov. 18, 1827. He was a writer of romance and poems in the manner of Hoffmann, whose inferior he was in imaginative power, although his style is more finished. Among his works are *Lichtenstein* (1826); *Die Bettlerin vom Pont des Arts*; *Das Bild des Kaisers*; *Märchen* (1842); *Mittheilungen aus den Memoiren des Satans* (1827); *Der Mann im Monde*, a satire on Clauren (1827); *Phantasien im Bremer Rathskeller* (1827), etc.

Hau'gians, the followers of Hans Nielsen Hauge (1771–1824), a reformer, b. in Norway. He opposed the Creeds, advocated the idea that all should share in the work of the ministry, believing that ordination and clerical education are not necessary, and laid great stress upon faith and upon strict church discipline. His labors led to a great religious revival, but he was imprisoned, heavily fined, and compelled to cease from his labors. At present the Haugians are a large and influential evangelical party in the Norwegian Church, but in Denmark Hauge's preaching was without success.

Haupt (HERMAN), A. M., b. in Philadelphia Mar. 26, 1817; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July 1, 1835. In September following he resigned from the army and adopted the profession of civil engineering. After serving as assistant engineer on railroads in Pennsylvania, he was in 1844 appointed professor of civil engineering and mathematics in Pennsylvania College, which position he held till 1847, when he was appointed principal assistant engineer of the Pennsylvania Railroad. From 1849 to 1854

he was general superintendent, and subsequently became chief engineer and director of that company. For many years he was engaged upon the Hoosac Tunnel, Mass., as chief engineer and contractor. During the civil war in America he was aide to Gen. McDowell, with the rank of colonel, and chief of bureau of U. S. military railroads in charge of construction and operation. In Sept., 1862, he was promoted to be brigadier-general U. S. volunteers, which appointment he declined. He is at present (1875) general manager of the Piedmont Air-Line Railway from Richmond, Va., to Atlanta, Ga.

Haupt (MORITZ), a distinguished philologist, b. in Zittau July 27, 1808; pursued his university course at Leipsic 1826–30, under Hermann; privat-docent 1837; appointed professor extraordinary 1838, and professor of the German language and literature 1843; in consequence of his participation in the political movements of 1848–49 was removed; called, however, in 1853 to take Lachmann's place in the University of Berlin as professor of classical literature; in 1861 secretary of the Academy of Sciences. Like his predecessor, Lachmann, he devoted himself to both classical philology and the Old German. He edited with Hoffmann *Altdeutsche Blätter* (1836–40, 2 vols.); founded in 1841 *Zeitschrift für deutsches Alterthum* (Leipsic); published a new edition of Lachmann's *Nibelungen* (Berlin, 1852); in same year *Poems of Walter von der Vogelweide; Armen Heinrich* (1842), and other old German works; his classical publications were editions of *Catullus Tibullus* and *Propertius*, Ovid's *Halieutica* and *Metamorphoses*, the *Cynegetica* of Gratius and Nemesianus, Avianus; also, from Hermann's unpublished remains, *Bion and Moschus* (1849), and *Æschyli Tragœdiæ cum Commentariis* (2 vols., Leipsic, 1852; 2d ed. 1859). He contributed largely to the principal critical journals. D. in 1874. H. DRISLER.

Hauran [Heb. *Hauran*, from *hur*, "cave"], the present Arabic, as well as English name of a district in Syria S. of Damascus and E. of the Jordan, mentioned by Ezekiel (xlvii. 16, 18), and nowhere else in the Old Testament, as the appointed N. E. boundary of the Holy Land after the captivity in Babylon. Its dimensions are not indicated. In the Greek and Roman period, Hauran (Gr. Ἀυρανῖτις) was one of the four provinces of BASHAN (which see). The Arabian geographers make it embrace the greater part of ancient Bashan; and so do some modern travellers, who say the natives regard it as consisting of three parts—*en-Nŭkrah, el-Lejah*, and *Jebel Hauran*. This whole region is volcanic, very fertile, and contains hundreds of deserted or ruined towns, with many Greek inscriptions, referred mostly to the Roman period. Druses, Bedouin, and a few Christians now inhabit the region. Others restrict the application of the name to the more level part of the district (the ancient *Auranitis*), which has a gently undulating surface and slopes strongly westward. It yields great crops of grain. (See ROBINSON, PORTER, and WETZSTEIN.)

R. D. HITCHCOCK.

Hauréau (JEAN BARTHÉLEMY), b. in Paris Nov. 9, 1812; began as a journalist in the provinces, and was sent by the department of La Sarthe as representative to the constituent assembly of 1848. Under the empire he resigned his functions of keeper of the manuscripts at the National Library, but was chosen librarian for the lawyers' corporation of Paris. He was elected member of the Academy of Inscriptions and Belles-Lettres. Hauréau published many works of erudition, the elements of which he nearly monopolized on account of his being the librarian of the National and other large libraries of France, and contributed largely, in Louis Philippe's reign, to *Le Droit*, a judicial paper, to *Le Journal du Peuple, Le National*, and other opposition papers. He has written a *History of Poland, Criticism of Palasgus's Metaphysical Hypothesis*, the 14th, 15th, and 16th vols. of the great compilation *Gallia Christiana, Francis I. and his Court, Charlemagne and his Court*, etc. FÉLIX AUCAIGNE.

Hau'ser (KASPER), b. Oct. 7, 1812, at some unknown place, and kept for sixteen years in some other place in a dark cellar, fed upon bread and water, and learning nothing, not even to walk. On May 26, 1828, he was found in the streets of Nuremberg. His helplessness—he could at that time walk a little, speak a little, and write his name—excited sympathy, the more so as he was a fine-looking youth; and the mystery which surrounded him made him and his history the subject of intense curiosity. He was placed under good circumstances, and his education began, but different attempts to assassinate him were made in a most mysterious manner, and at last he was actually stabbed in the royal garden at Anspach, and d. Dec. 17, 1833. Very different views have been propounded in explanation of this story. Julius Meyer (*Authentische Mittheilungens über Kaspar Hauser*, 1872) considers him an impostor. Prof. Daumer (*Kaspar Hauser, sein Wesen, seine Unschuld, seine Erduldungen und sein Ursprung*, 1873) considers him a son of the grand duke Charles of Baden and his wife Stephanie, pushed aside in some criminal way in order to secure the succession to the children of the grand duke Charles Frederick and the countess of Hochberg. This part of the story has comparatively little interest, however, but his education presented many curious psychological observations, which have been much and variously expounded by modern philosophers.

Haussmann (Baron GEORGES EUGÈNE), b. at Paris Mar. 27, 1809; educated at Paris; studied law, and became an advocate; was sub-prefect of various departments, and prefect under the presidency of Louis Napoleon. In 1853 the latter appointed him prefect of the Seine, and under his administration the various beautiful and costly improvements were conducted. Much opposition was made to his enormous expenditures, and charges of mismanagement were freely made against him. In 1870 he was relieved by the Ollivier administration. He was made officer of the Legion of Honor 1856, and in 1862 received the grand cross.

Hautboy. See OBOE.

Haute-Garonne, department of France, on the frontiers of Spain. Area, 2529 square miles. Pop. 479,362. The southern part is high, occupied by the Pyrenees, and rich in minerals; lead, copper, iron, and zinc are mined; excellent marble is quarried. In the northern part much wine and corn are raised. The transit-trade with Spain is very considerable. Cap. Toulouse.

Haute-Loire, department of Central France, on the upper part of the Loire. Area, 1900 square miles. Pop. 308,732. It is mountainous, mostly occupied by the Margerides, which connect the Cevennes with the mountains of Auvergne, and whose lofty peaks are covered with snow half the year. Wheat and wine are raised, cattle and silkworms reared, and coal mined. Cap. Le Puy.

Haute-Marne, department of North-eastern France, on the upper part of the Marne. Area, 2385 square miles. Pop. 251,196. It is hilly and mountainous, rich in vines and forests. Its chief product is iron; numerous mines and furnaces are worked throughout the whole department. Cap. Chaumont.

Haute-Saône, department of North-eastern France, on the upper part of the Saône. Area, 2028 square miles. Pop. 303,088. It is mountainous, traversed by numerous branches of the Vosges Mountains, which here are covered with splendid forests, and are rich in coal and iron. Besides agriculture and the timber-trade, a considerable industry is carried on in mining and in the manufacture of glass and china. Cap. Vésoul.

Haute-Savoie, department of France, separated in part from Switzerland by the Lake of Geneva, which extends along the N. border. It is also bounded E. by Switzerland. Area, 1667 square miles. It contains Mont Blanc, and its surface is elevated and not very productive. Forest products, cattle, wool, and cheese are the leading articles exported. Cap. Annecy. Pop. 273,027.

Hautes-Alpes, department of South-eastern France. Area, 2114 square miles. Pop. 118,898. It is entirely covered by the Alps, whose lofty summit, Des Écrines, is situated here, and rises 13,442 feet above the level of the sea. Numerous sheep are reared, and some mining industry is carried on. Cap. Gap.

Hautes-Pyrénées, department of France, on the frontier of Spain. Area, 1730 square miles. Pop. 235,156. Branches of the Pyrenees traverse it, and form beautiful valleys watered by the Adour, the Arros, and the Gave-de-Pau. The mineral springs, especially those of Bagnères, Barèges, and Cauterets, are celebrated and much frequented. The well-known woollen stuff called barège is made here. Cap. Tarbes.

Haute-Vienne, department of North-western France. Area, 2118 square miles. Pop. 323,447. It is covered with low mountains, the highest point of which is Le Puy de Vieux, 3200 feet high, and which are rich in minerals—copper, lead, tin, and porcelain clay. The soil is not very fertile. Horses, cattle, and sheep are reared in great numbers. Cap. Limoges.

Hautpoul, the name of an ancient family of Languedoc, which since the eighth century has produced many eminent men. JEAN JOSEPH D'HAUTPOUL SALETTE (1754–1807) was a brilliant general of cavalry, who fell at Eylau at the head of the cuirassiers.—MARIE CONSTANT FIDÈLE HENRI AMAND, MARQUIS D'HAUTPOUL (1780–1854), a distinguished officer of Napoleon's horse-artillery and cavalry; refused to serve the emperor during the Hundred Days; was made a field-marshal in 1819, and governor to the young duke of Bordeaux.—ALPHONSE HENRI, MARQUIS

D', brother of the preceding, b. at Versailles Jan. 4, 1789; entered the military school of Fontainebleau 1805; officer of the 59th infantry 1806; was badly wounded at Arapiles 1812; colonel 1815; brevet field-marshal 1829; minister of war 1830; lieutenant-general 1841; peer of France 1846; commander-in-chief of the army at Rome and minister to the Holy See, and, later, minister of war 1849; governor-general of Algeria 1850; senator 1852; became marquis in 1854. D. July 28, 1865.

Hau'vers, tp. of Frederick co., Md. Pop. 1384.

Haüy (René Just), Abbé, b. of humble parents at St. Just, Picardy, Feb. 28, 1743; became a church singer at Paris, and a teacher in the College of Navarre 1764; laid before the Academy of Sciences in 1781 his new and brilliant discovery of the geometrical law of crystallization; was chosen to the Academy 1783; took orders in the Church; was imprisoned in 1792, and escaped death at the hands of the revolutionists through the exertions of Geoffroy St.-Hilaire, his pupil; became keeper of the cabinet in the School of Mines 1794, a member of the Institute 1795, professor of mineralogy in the Museum of Natural History in 1802, officer of the Legion of Honor in 1815. D. at Paris June 3, 1822. His principal works are an *Exposition de la théorie de l'électricité et du magnetisme* (1787); *Traité de minéralogie* (1801); *Traité élémentaire de physique* (1803); *Traité de crystallographie* (1822).

Haüy (Valentin), Abbé, a brother of the mineralogist Haüy, b. at St. Just Nov. 13, 1745. Becoming acquainted with Mlle. Paradis, a blind pianist, he resolved to devote his time to the instruction of the blind, and invented the art of printing with raised letters for the blind. The schools of this philanthropist were everywhere failures, owing to his lack of judgment, yet he is universally recognized as the "apostle of the blind." Though a cleric of the Roman Catholic Church, he was twice married, the second time to an ignorant market-woman. He was also for a time, it appears, a sub-priest of the Theophilanthropists. He had, says Dr. Howe, "genius, generosity, and zeal, but lacked common sense." D. at Paris June 3, 1822. Was author of *Essai sur l'éducation des aveugles* (1786) and *Mémoire historique sur les télégraphes* (1810).

Hava'na [Sp. *La Habana*], cap. of the island of Cuba, the most important city of the West Indies, and one of the principal commercial marts of the world, is situated on the northern shore of the island, on an inlet of the Gulf of Mexico, in lat. 23° 8′ N., lon. 82° 22′ W. Its harbor is one of the finest in the world, entered through a narrow, strongly fortified channel, three-eighths of a mile long, and then opening into a large basin, capable of accommodating 1000 vessels of any size, lined with commodious, mostly covered wharves, and provided with a capacious dry dock. In the older part of the city the streets are generally very narrow, and not remarkable for cleanliness, but the more modern portion contains many spacious and beautiful avenues, with a broad macadamized drive in the centre and lined with palm trees. The architecture of the city is mostly that of Southern Spain—the houses low, one or two stories, massive, with flat roofs, the large windows provided with iron shutters and wooden blinds, but not glazed, and the walls gayly painted with red, blue, and yellow. The most prominent among the public buildings are—the opera-house, one of the largest in the world; the cathedral, built in 1724, and containing the ashes of Christopher Columbus, transferred hither from St. Domingo in 1796; the palace of the governor-general, with apartments for the different government officers, etc. None of these buildings, however, are very remarkable, but with respect to its public parks and promenades, Havana perhaps surpasses all other cities in the world. The Plaza de Armas, in front of the governor's palace; the Alameda de Paula, along the bay; the Parque de Isabel; the Paseo de Tacon, a magnificent drive with double rows of trees; and other promenades traverse and surround the city, charming the visitor not less with their liveliness and gayety than with their trees, flowers, fountains, and statues. The city is well provided with water from the Chorrera by an aqueduct about 7 miles long, and has about 50 public fountains. It has a university, an excellent botanical garden, many scientific, educational, and benevolent institutions, and is the seat of the government of Cuba and of a Roman Catholic bishop. Its manufactures are not important, with the exception of those of tobacco; in 1872 the exportation of this one article amounted to 18,210,800 pounds of leaf-tobacco, 229,087,545 cigars, and 19,344,707 packages of cigarettes. But its commerce is very extensive. Besides tobacco, one of the principal items of exportation is sugar; in 1872 were exported 252,271 tons of sugar, 2,606,125 gallons of rum, 12,000 gallons of molasses; also, honey, wax, oranges, pineapples, preserved fruits, etc. are largely exported. Havana communicates by weekly lines of steamers with Spain, France, England, and the U. S.; by telegraph with Key West, Kingston, and Aspinwall; and by rail with all the most important points of the island. Pop. 205,676—138,895 white, 66,781 colored, 29,013 of the latter being slaves.

Havana, tp. of Hale co., Ala. Pop. 1440.

Havana, post-v. and tp., cap. of Mason co., Ill., on the E. bank of the Illinois River, opposite the mouth of Spoon River, and on the Peoria Pekin and Jacksonville, the Indianapolis Bloomington and Western, and the Springfield and North-western R. Rs. It has a public park, 4 churches, 2 newspapers, 8 dry-goods and 7 grocery stores, 1 plough and wagon factory, 3 hotels, and 1 bank. A toll wagon-bridge spans the Illinois River, and a railroad bridge is in course of construction. Pop. of v. 1785; of tp. 2933. S. Wheadon, Ed. "Democratic Clarion."

Havana, post-v. of Schuyler co., N. Y., is beautifully situated 3 miles from the head of Seneca Lake, 18 miles from Elmira, on the Northern Central R. R. and the Chemung Canal. It has 1 national and 1 State bank, 2 newspapers, 3 foundries and machine-shops, 2 flouring-mills, 5 churches, 2 hotels, 2 woollen-mills, 2 plaster-mills, 1 pottery, a sash and blind factory, and the usual number of dry-goods and grocery stores. It is in close proximity to Havana Glen, and about 2½ miles from Watkins Glen. Pop. 1273. A. G. Ball, Ed. "Havana Journal."

Havan'na, tp. of Steele co., Minn. Pop. 636.

Havelock (Hargrave P. O.), a v., cap. of Pontiac co., Quebec, Canada, 8 miles from the river Ottawa, and 70 miles W. N. W. of Ottawa. It has manufactures of lumber, sash, doors, etc. Pop. about 200.

Havelock (Sir Henry), Bart., K. C. B., b. at Bishop-Wearmouth, England, Apr. 5, 1795; studied at the Charterhouse, and read law in the Middle Temple and under Chitty; entered the army in 1815; went to India in 1823; met with a great change in his religious views on the voyage, after which he joined to his military duties the religious instruction of the men under him; became a preacher of the Baptist denomination; served with distinction in Burmah 1824–26, in Afghanistan 1839 *seq.;* became adjutant-general for the queen's troops in India 1851; served in Persia 1856–57; became a brigadier 1857; gained over Nana Sahib the brilliant victories of Cawnpore, Bithoor, etc.; relieved and reinforced Lucknow Sept. 25, 1857; was made K. C. B. and baronet, the patent for the latter title being sealed the day after his death, but the title was confirmed to his eldest son. D. at Alum-Bagh Nov. 25, 1857.

Hav'emeyer (William F.), b. in New York City Feb. 12, 1804, the son of a German immigrant; graduated at Columbia College 1823; was successfully engaged as a sugar-refiner 1828–42; presidential elector 1844; was chosen mayor of New York in 1845, and again in 1848; was the first president of the commissioners of emigration 1846–47, an office which with that of mayor he filled with great acceptance; president of the Bank of North America 1851–61; was again elected mayor by the Reform party in 1872, and d. Dec. 7, 1874, before the close of his official term of service. Mr. Havemeyer was a man of the highest personal integrity.

Ha'ven (Alice Bradley), b. in Hudson, N. Y., Sept. 13, 1828. Her name at first was Emily Bradley. While at school she sent many pleasing sketches signed "Alice G. Lee" to the *Saturday Gazette* of Philadelphia, to whose editor, Joseph C. Neal, she was married in 1846, assuming at his request the name of Alice. After his death (in 1847) she conducted the *Gazette.* In 1853 she was married to a Mr. Haven. She published numerous sketches, tales, and poems, mostly designed for the young, under the name of "Cousin Alice." These were highly popular and of admirable moral tone. She d. at Mamaroneck, N. Y., Aug. 23, 1863. (See *Cousin Alice, a Memoir of Alice B. Haven,* 1865.)

Haven (Erastus Otis), D. D., LL.D., b. at Boston, Mass., Nov. 1, 1820; graduated at Wesleyan University 1842; was for some years an instructor at Sudbury, Mass., and principal (1846–48) of the Amenia Seminary, N. Y.; entered the Methodist Episcopal ministry 1848; stationed in New York until 1853, when he became professor of Latin in the University of Michigan; in 1854 took the professorship of English language, literature, and history; editor of *Zion's Herald,* Boston, 1856–63; member of the Massachusetts board of education 1858–63; member of the State senate 1862–63; president of the University of Michigan 1863–69; president of North-western University, Evanston, Ill., 1869–72; corresponding secretary of the board of education of his Church 1872–74; became chancellor of the Syracuse University 1874. Has published *Young Man Advised* (1856); *Pillars of Truth* (1866); *Rhetoric* (1869).

Haven (Gilbert), D. D., b. in Malden, Mass., Sept. 21, 1821; graduated at Wesleyan University, Conn., in

1846; was appointed the same year professor of Greek and Latin in Amenia Seminary, N. Y., and principal of the same institution in 1848. In 1851 he joined the New England conference of his denomination, and occupied several important pulpits. In the civil war he was the first commissioned chaplain (Apr. 18, 1861), and served in Butler's regiment. In 1862 he travelled in Europe. In 1865 he was appointed to special service in Mississippi; he subsequently became editor of *Zion's Herald*, Boston, and in 1872 was elected bishop. Author of the *Pilgrim's Wallet*, a sketch of his travels in Europe, and of a volume of sermons, chiefly relating to slavery and the war. ABEL STEVENS.

Haven (JOSEPH), D. D., LL.D., b. in Dennis, Mass., Jan. 4, 1816; graduated at Amherst College 1835; ordained pastor of the Congregational church in Ashland, Mass., 1840; pastor at Brookline, Mass., 1846–50; professor of mental and moral philosophy in Amherst College 1850–58; professor of systematic theology in the Chicago Theological Seminary 1858–70; resigned this place on account of ill-health in 1870, and after a tour in Europe and the East devoted himself to preaching and lecturing upon ancient and modern philosophy and the English classics. In 1873 he became acting professor of mental and moral philosophy in the Chicago University; and d. May 23, 1874. In addition to numerous sermons and articles in the religious journals and reviews, Dr. Haven published *Mental Philosophy* (1857), *Moral Philosophy* (1859), and a collection of essays entitled *Studies in Philosophy and Theology* (1869). J. H. SEELYE.

Haven (SOLOMON G.) was in a partnership in the practice of law with Millard Fillmore at Buffalo, N. Y., when the latter was elected to the Vice-Presidency in 1848. Mr. Haven was a leading member of Congress from 1851 to 1857. D. at Buffalo Dec. 24, 1861.

Ha'vens (JAMES) was b. in Mason co., Ky., Dec. 25, 1763; licensed to preach in 1781, and joined the itinerant ministry in 1820; was one of the founders of Methodism in the North-west, especially in Indiana. D. Nov., 1864.

Ha'vensport, a v. of Fairfield co., O. Pop. 83.

Hav'erford, post-tp. in Delaware co., Pa., on the Pennsylvania R. R., 10 miles W. of Philadelphia. Haverford College is situated near, but not within, this tp. Pop. 1338.

Hav'ercamp (SIGEBERT), b. at Utrecht 1683; became a Protestant parish minister, and in 1721 Greek professor at Leyden, and afterwards professor of history and eloquence. D. Apr. 25, 1742. He was the author of many learned works, and was a man of profound knowledge, but of limited critical sagacity. Among his works are editions of Josephus, Sallust, Tertullian, and Lucretius; *Introductio in Antiquitates Romanas* (1730), *Thesaurus Morellianus* (1734), and many other works on numismatics; *Introductio in historiam Patriæ* (1739), and other works.

Hav'erford Col'lege, in Delaware co., Pa., was founded in 1832 by members of the religious Society of Friends. Its purpose was to furnish an advanced and yet guarded collegiate education to young men belonging to that society. Taking the name at first of "Haverford School," it was made a college, with authority to grant degrees, about 1850. It possesses a farm of over 100 acres, and also a very beautifully laid out shaded lawn of 60 acres. The plan of the institution limits the number of resident students to about 60. Since 1849 others besides the sons of "Friends" have been admitted. In addition to the main college building, there is a picturesque and commodious "library and alumni hall," with a constantly increasing and admirably selected library. The reputation of the college, although not widely extended, has always been high, especially for thoroughness in the instruction of all its students, and a *balanced* or many-sided training and culture. The elective system has been, as yet, but very partially introduced. The presidents (during part of the time called principals) have been the following: Samuel Hilles, John Gummere, Isaac Davis, Daniel B. Smith, Jonathan Richards, Joseph Harlan, Timothy Nicholson, William F. Mitchell, Samuel J. Gummere, and Thomas Chase. Haverford College was the first collegiate institution founded and conducted entirely within the Society of Friends, and its influence in promoting intellectual culture among the members of that denomination has been large and important. HENRY HARTSHORNE.

Hav'erfordwest', town of Pembrokeshire, Wales, picturesquely situated on the Cleddy, carries on some export trade in cattle, butter, cheese, and corn, and is the cap. of the county. Pop. 6622.

Ha'verhill, city of Essex co., Mass., on the Merrimack, at the head of tidewater, 18 miles from its mouth, 32 miles by rail N. of Boston, with which it is connected by the Boston and Maine and the Newburyport R. Rs. On the opposite (S.) side of the river are the fine towns Bradford and Groveland. Railroad communication also extends to Portland (78 miles distant) and to Newburyport, while works are in progress which are intended to render the river navigable above this point. The shoe manufacture and the collateral industries are the leading employments, and in late years the manufacture closely approximates $10,000,000 in annual value of products. Few or no coarse or heavy boots and shoes are here manufactured. Woollen goods, hats, and other articles are also produced. Haverhill has 47 public schools, 17 churches, a public library, 3 weekly, 1 tri-weekly, and 1 daily newspaper, 1 street-railway, 4 national and 2 savings banks, a fine Masonic temple, a commodious city-hall, a high school, and many fine private buildings. It was first settled in 1640, incorporated as a town 1645, and as a city 1870. An exposed frontier settlement, it was for many years liable to Indian attacks. Ayer's Village and Rock's Village are outlying places, though within the city limits. Pop. 13,092.

Haverhill, tp. of Olmsted co., Minn. Pop. 650.

Haverhill, post-v., one of the capitals of Grafton co., N. H., is on the E. bank of the Connecticut River, and on the Boston Concord and Montreal R. R., 84 miles N. N. W. of Concord. The township has several villages, and manufactures of leather, lumber, starch, paper, whetstones, boxes, etc. It has also an academy, 3 churches, and a fine park, around which the public buildings stand. Pop. of tp. 2271.

Hav'ersack [Ger. *Habersack*, an "oat-sack"], a stout bag of canvas in which a soldier carries his rations on the march. Also, the leather bag in which ammunition is carried from a magazine to the guns.

Haver'sian Canals' [named from *Clopton Havers*, their discoverer] are passages in the compact substance of bone for the blood-vessels upon which the nutrition of the bone depends. They are round, oval, or angular in section, and are from $\frac{1}{200}$ to $\frac{1}{2000}$ of an inch in diameter. The largest contain several vessels surrounded by marrow. All are lined by a delicate membrane continuous with the periosteum or endosteum. Each Haversian canal is surrounded by from eight to fifteen concentric rings of bone called *lamellæ*. Each canal with its surrounding lamellæ makes up an Haversian system or Haversian rod. The general direction of the canals is usually nearly parallel to the long axis of the bone.

Hav'erstraw, post-v. and tp. of Rockland co., N. Y., on the Hudson River, 38 miles from New York. It has 8 churches, good schools, 1 newspaper, a bank of deposit and a savings bank, 3 hotels, the usual number of stores, etc., a large print-works, employing about 1000 hands, a rolling-mill for copper, and a paper-mill for making paper bags. Principal business, brickmaking. Pop. of tp. 6412.
ROBERT SMITH, PROP. "ROCKLAND CO. MESSENGER."

Hav'ilah, post-v., cap. of Kern co., Cal., 100 miles N. of Los Angeles. It has 1 weekly newspaper.

Havre, or **Havre de Grâce,** town of France, in the department of Seine Inférieure, at the mouth of the Seine. It is beautifully situated at the foot of a range of hills whose tops are lined with elegant villas and present some beautiful views. But the city itself is not handsome, though the new city-hall and barracks are magnificent buildings. Its harbor, consisting of seven spacious basins, capable of accommodating 600 vessels, and well provided with wet and dry docks, is one of the best harbors of France, and, next to Marseilles, Havre is the most important commercial place of the country. One-fifth of the foreign commerce of France is transacted in this city. The total value of the imports and exports amounts to about $250,000,000 annually. In 1870, 8458 vessels, with a tonnage of 2,516,898, entered its harbor. The port itself possessed about 500 vessels. It communicates directly with New York, Havana, Rio Janeiro, Calcutta, and all the chief commercial places in Europe, exporting wine, brandy, oil, and different kinds of French manufactures, and importing cotton (464,985 bales in 1870), sugar, coffee, tea, and spices. Pop. 86,825.

Havre de Grace, post-v. and tp. of Harford co., Md., 36 miles N. E. of Baltimore, on the line of the Philadelphia Wilmington and Baltimore R. R., on the S. bank of the Susquehanna River, near where it empties into the Chesapeake Bay. It is located at the natural outlet to tide-water, through the Pennsylvania and Susquehanna Canal, for the anthracite coal of the Wyoming and Shamokin regions, and for the bituminous coal of the Juniata, as well as the lumber, minerals, manufactures, and agricultural products from the valleys of the Susquehanna and its tributaries. It has 1 weekly newspaper, churches, schools, stores, flour-mills, breweries, shipyards, saw and planing mills, fruit-canning establishments, etc. It has a fine harbor, and an extensive trade in coal and lumber; also extensive shad and alewive fisheries, and in this vicinity are secured, in large numbers, the celebrated canvas-back ducks. Pop. 2281. A. P. McCOMBS, ED. "HAVRE REPUBLICAN."

Hawaiian Islands. *Origin of the Hawaiian Race.*—There are two theories of the origin of the Hawaiians—one pointing to the East, the other to the West. The former claims their relationship with the Toltec branch of the great Nahoa family of Mexico, and presents certain slight physiological and psychological similarities in proof thereof. This hypothesis makes the Hawaiians the oldest Polynesian colony, from which the other branches of the family originated. It is supported by the prevailing direction of the winds and ocean-currents. The other theory, carefully tracing the relationship of all the island-nations of Oceanica, supports the hypothesis, based mainly upon philological research and analogies in customs and implements, that all the Pacific archipelagoes and islands were colonized by successive migrations from Southern Asia; that the family which includes the Hawaiians, New Zealanders, Samoans, Marquesans, Tahitians, Tongans, the Austral islanders, and the natives of Madagascar, was an extremely ancient and primitive member of the great Malay race; and that the Malay Archipelago was the starting-point of their distinct migration. This theory is consistent with the evidence from language, race, manners, and customs, and has the additional support of Hawaiian tradition. A junk from the W., with survivors on board, has drifted ashore at the Hawaiian Islands in recent times.

History.—The Hawaiian Islands were discovered by Gaetano, a Spanish navigator, in 1542. Mendana, another Spanish discoverer, ascertained the correct position of the island of Kauai in 1567. Long before these dates (probably about 1527) one or two Spanish vessels were wrecked on the coast of Hawaii, and the few survivors intermarried with the natives. Their descendants are known at the present day by a light skin, which is liable to freckle, and by a Caucasian facial contour, and are designated as *Kekea.* Capt. Cook visited the Hawaiian Islands in 1778, sighting the islands of Oahu and Kauai on Jan. 18, and anchoring at Waimea, Kauai, on the 19th. After visiting the island of Nühau, he sailed for the American coast, and, returning, arrived at the island of Maui on Nov. 20, when he met Kamehameha I., then a young man. Capt. Cook afterwards spent some time with his vessels at the island of Hawaii, where, by his abuse of the unbounded hospitality and reverence of the natives, he lost their friendship, and was killed by them in a quarrel at Kealakekua Bay on Feb. 14, 1779.

The Hawaiians at this time supported an elaborate feudal system, closely analogous to that of Europe in the Middle Ages. Physical and religious forces were the controlling influences, each allying itself with the other as the necessary condition of its own permanence. From a collection of savage tribes, each led by its own chief, the movement from generation to generation, through incessant fighting, had been toward centralization, until, at the time of Capt. Cook's visit, under the sovereignty of five or six independent dukes or kings, they had reached a fair degree of barbaric civilization. The administration of these kings was absolute and their persons were sacred. High chiefs did fealty to the king, supplying food or forces for military service according to royal demands, while lower chiefs in like manner supported them, and were themselves served by the *konohikia*—middlemen between chiefs and people—who were the last representatives of kingly power, and who oppressed the common people with great severity. The status of the latter was that of vassals, tenants, and serfs, who, with all they possessed, belonged to the chiefs and were under their protection. In 1790, Kamehameha, then king of a portion of Hawaii, was attacked by Keoua, king of the other part, whom he defeated and captured, thus obtaining possession of the whole island. Inspired with this success, he invaded the neighboring islands, and after several years of hard fighting conquered them all except Kauai and Nühau, which were under the sway of Kaumualü, with whom Kamehameha, after one or two futile attempts at invasion, made a treaty, under which the possessions of Kaumualü were to vest in Kamehameha upon the death of the former.

In 1792 and the two following years Vancouver visited the Hawaiian Islands, and introduced cattle on May 8, 1819. Kamehameha died at Kailua, Hawaii, after a long and most successful reign, in which he had firmly established his kingdom over the whole group. His eldest son, Liholiho, succeeded him under the title of Kamehameha II., with Kaahumanu, widow of Kamehameha I., as premier, and who in influence and power was the real sovereign. Under her sagacious leadership, aided by the bold recklessness of the king, the mighty taboo system of centuries was overthrown, and the conservative party totally routed in a sanguinary battle which lasted for six hours. The universal destruction of the idols followed. Shortly after, on Apr. 4, 1820, the first American missionaries arrived—seven men, with their wives. They immediately began to reduce the language to writing, adopting an alphabet of twelve letters—*a, e, i, o, u, h, k, l, m, n, p, w*—the vowels pronounced as in Europe, and the consonants *hay, kay, lah, mu, nu, pe, way.* The first printing was done in 1822. In 1823 the king and Kamamalu, his queen, visited England, where they both died the year following; whereupon Kaahumanu, the premier, became regent, and governed until the majority of Kanikeaouli, brother of the late king, a period of nine years. In 1824, George, the son of Kaumualü, late king of Kauai and Nühau, headed a rebellion on Kauai, which after some successes was summarily crushed. In 1825 the Ten Commandments were adopted as laws by the government, and a few criminal laws were enacted in 1827 and 1829. The first Roman Catholic missionaries arrived July 7, 1827. The priests with their converts were from time to time exposed to severe persecutions by the government until 1839, when Commander Laplace of the French frigate L'Artemise obtained, under threats of war, civil and religious privileges for Roman Catholics. Kanikeaouli assumed the government in 1833 as Kamehameha III. In 1840, Kamehameha III. and the chiefs promulgated a constitution granting civil rights to the people. On Feb. 25, 1843, the provisional cession of the islands to England, in consequence of the harsh demands of Lord George Paulet, occurred; which arrangement was terminated and the Hawaiian flag restored by Admiral Thomas on July 31 in the same year. In 1846, Kamehameha III. approved of the famous Land Act, by which he released the royal right to a large portion of the lands of the kingdom and provided for their conveyance to the people. In 1849 the temporary occupation and embargo of the port of Honolulu by the French took place. In 1852 the constitution was revised by the king and legislature, by which free suffrage was established as a civil right. Kamehameha III. died on Dec. 15, 1854, and was succeeded by Alexander Liholiho (son of Kinau, the daughter of Kamehameha I.), who reigned as Kamehameha IV. The chief monument of his reign is the Queen's Hospital. In 1856 he married Emma Naea (adopted daughter of Dr. Rooke), who in 1858 gave birth to a boy who lived but little over four years. After a quiet and prosperous reign of nine years, he died on Nov. 30, 1863. In 1862 an English Reformed Catholic mission arrived. Lot Kamehameha, brother of the late king, succeeded him as Kamehameha V., and was noted for his forcible abrogation of the national constitution and promulgation of a new one limiting the right of suffrage by a property qualification. His reign was commercially prosperous, and Honolulu, the capital, was beautified with fine public buildings. He died Dec. 11, 1872, without issue, leaving the Kamehameha dynasty extinct. After a four weeks' interregnum under the regency of the cabinet, Lunalilo, a high chief, upon the unanimous nomination by the people, was elected king by the legislature. His short reign of one year was noted for the institution of measures for the restoration of the liberal principles of the old constitution, for the unpopular ministerial effort for commercial reciprocity with the U. S. on the basis of the cession of the Pearl River Lagoon, and for the bloodless mutiny of troops at the barracks in Honolulu. Lunalilo died Feb. 4, 1874, and left no issue. On Feb. 12, Kalakaua was elected king by the legislature, with the determined opposition of Queen-dowager Emma, which culminated at the election in a riot by her supporters, in which many of the representatives were severely injured and the legislative hall partially demolished. Order was restored by armed forces from American and English war-ships in the harbor.

The independence of the Hawaiian Islands was recognized by the U. S. in 1829, and more formally in 1843; by Belgium in 1844; and by England and France later in the same year.

Population.—From the time of Captain Cook's visit to the arrival of the missionaries in 1820 the decrease of population through war and disease was immense; a pestilence in 1804, called *ahulan okun*, the character of which is not known, decimated the nation fearfully. Cook's estimate of a population of 400,000 in his time was probably too great by 100,000. In 1823 the population was estimated at 142,000. In 1832 the first census was taken, making the number 130,313; the census of 1836 gave 108,579; that of 1850, 84,165; that of 1853, 73,137, the last interval including the smallpox year; the census of 1860 gave 69,700; that of 1866, 62,959; and that of 1872, 56,897. The last census shows 31,650 males and 25,247 females, of whom 13,077 males and 12,682 females are married. It also shows 889 resident Americans, of whom 240 are females; 619 English, of whom 178 are females; 224 Germans, of whom 47 are females; 88 French, of whom 19 are females; 395 Portuguese, of whom 28 are females; and 1938 Chinese, of whom 107 are females; besides 364 other foreigners, of whom 21 are females; and 849 Hawaiian-born, but of foreign parentage, of whom 431 are females; showing a total of 5366 foreigners and their descendants, of

whom 1071 are females—showing an increase over the census of 1866 of 1172.

Geological and Geographical Features.—The Hawaiian Islands are situated in the North Pacific Ocean between lat. 18° 50′ and 22° 50′ N., and lon. 154° 50′ and 161° 40′ W. They are twelve in number, with a total area of about 6400 square miles: Hawaii, 4000 sq. m.; Maui, 800 sq. m.; Kahoolawe, 65 sq. m.; Lanai, 100 sq. m.; Molokai, 200 sq. m.; Oahu, 500 sq. m.; Kauai, 640 sq. m.; Nühau, 95 sq. m.—habitable; and Molokini, Lehua, Kaula, and Nihoa, barren rocks. The group extends in a N. N. W. direction from Hawaii. The islands are all high, increasing in size and altitude toward the S. E. The rock of the whole group is volcanic, with the exception of the ancient elevated coral reef and the resulting sandstone. No true fossiliferous rocks are found, although the tufa contains fossilized shells and corals of recent species. On the tops and in the interior of the mountains a variety of trachyte is found, and the bulk of the mountains seem to be composed of phonolites and graystones, forming a complete series from basalt to trachyte. The following are some of the minerals that have been noticed: sulphur, pyrites, common salt, sal-ammoniac, limonite, quartz, augite, chrysolite, garnet, labradorite, feldspar, gypsum, soda-alum, copperas, glauber salt, nitre, and calcite. There are two active volcanoes on Hawaii—viz. Kilauea and Mauna Loa. The following eruptions are known to history: (1) In 1789, from Kilauea, accompanied by earthquakes and the discharge of poisonous gases, by which nearly 100 persons were killed; (2) in 1801, from Mount Kualalai, the third in height on Hawaii; (3) in 1823, from Kilauea; (4) in 1832, from Kilauea and Mauna Loa; (5) in 1840, from Kilauea; (6) in 1843, from new craters and fissures near the summit of Mauna Loa; (7) in 1852, from a fissure on the N. side of Mauna Loa; (8) in 1855, from the same place, continuing thirteen months; (9) in 1859, from Mauna Loa; (10) in 1866, from Mauna Loa; (11) in 1868, from a new fissure, nearly three miles long, in the slope of Mauna Loa, ten miles from the sea, accompanied with violent earthquakes and irruption of great sea-waves upon the land, by which 200 houses and 79 persons were destroyed. The craters of Mokuaweoweo (on Mauna Loa) and Kilauea are now active. The altitude of Mauna Kea, the highest point on Hawaii, is 13,805 feet; of Kaleakala, the highest point on Maui, 10,030 feet. The extinct crater of Kaleakala is 7 miles long, 3 wide, and 19 in circumference, and is from 700 to 2000 feet deep. Kaala, the highest point on Oahu, is 3850 above the sea; the altitude of Kauai is about 6500 feet. The soil is fertile and well adapted to planting and grazing. It is estimated that there are nearly 2,000,000 acres of grazing land, besides 290,000 acres of arable land. The mountain-sides abound in forests, in which there is a plenty of ship-timber and ornamental woods. Numerous streams, many of them large, flow down the mountains to the sea.

Agriculture.—Sugar is the principal product. There are between thirty and forty plantations which raise and manufacture an aggregate of about 10,000 tons of sugar per annum, besides molasses; wool, tallow, hides, rice, pulu, and bananas are exported in considerable quantities, their production being generally profitable. Nearly all the crops of temperate climates can be successfully grown, but are not profitable for want of markets.

Exports and Imports.—The total exports for 1873 were valued at $1,661,407.78, and the imports for the same period were estimated at $1,349,448.51.

Meteorology.—The climate is much affected by locality, and varies from cool, frosty weather to a high average of heat the year through. The N. E. trades blow the greater part of the year, and prevent the heat from becoming oppressive. Certain leeward portions of the islands are cut off from the trades by the mountains, and are consequently oppressed with sultry weather, which, however, is tempered by the sea-breezes which in such places almost invariably blow through the day. Showers are frequent in the summer, and in the winter severe southerly and westerly rain-storms, lasting for days and even weeks, are liable to occur. Thunderstorms are rare, but severe. At Honolulu the average height of the barometer is 30.054 inches. The thermometer at the same place ranges from 62° F. at sunrise to 89° at 3 P. M., with an average of 75.7°. At Waimea, Hawaii, at an elevation of 4500 feet, the average is 64°, the lowest 48°. The average rainfall at Waikiki, near Honolulu, is 48 inches per annum; on the hill, 1 mile back of the town, 56 inches; at Kalaea plantation, on the opposite side of the island, 61 inches. The rainfall in Honolulu for the year 1837 was 21.1 inches; for 1838, was 46.8 inches, 12 of which fell in October. The former year had 295 days of trade-winds, 44 of S. winds, and 26 variable; and 285 fine, 37 rainy, and 43 variable days; while the latter had 258 days of trade-winds, 71 of southerly winds, and 36 variable, and 275 fine days, 41 rainy, and 49 variable weather.

Fauna.—By far the greater proportion of animals peculiar to the Hawaiian Islands are birds, which number over 70 species, of which nearly 50 have been catalogued and partially described. The larger part of these consist of water-fowl, beach and sea birds. The difficulty with which the forest birds can be observed and procured has rendered progress in describing them necessarily slow. David Malo, the native historian, enumerates as native, hogs of several varieties, dogs, mice, the domestic hen, dragon-flies, two kinds of butterflies, millers, moths, flies, wasps, grasshoppers, cockroaches, winged ants, two kinds of spiders, and two kinds of lizards.

Plants.—The vegetable kingdom is rich in interesting forms. Many new species and varieties have been discovered, and much work has been done in their description and classification. ✓ S. B. DOLE.

I endorse the above article by Mr. Dole,
ELISHA H. ALLEN, *Chief-Justice of Hawaiian Islands.*

Haw Creek, tp. of Knox co., Ill. Pop. 1056.

Haw Creek, tp. of Bartholomew co., Ind. Pop. 2634.

Haw Creek, tp. of Morgan co., Mo. Pop. 1731.

Hawes (JOEL), D. D., b. at Medway, Mass., Dec. 22, 1789; graduated at Brown University in 1813; studied theology at Andover, and in 1818 became pastor of the First Congregational church in Hartford, Conn. He won great fame as an author and preacher. Among his numerous works are *Lectures to Young Men* (1828), which had a great sale; *Memoir of Normand Smith* (1839); *The Religion of the East* (1845); and *An Offering to Home Missionaries* (1865). D. at Gilead, Conn., June 5, 1867.

Hawesville, post-v., cap. of Hancock co., Ky., 120 miles W. S. W. of Louisville, on the Ohio River. It is the centre of the Kentucky coal system, 8 mines being in successful operation in the vicinity. There are several good schools, 4 churches, 2 hotels, 1 furniture-factory, 1 hub and spoke factory, and 1 newspaper. Principal occupation, coal-mining and tobacco-raising. Pop. 855.
DAVID R. MURRAY, ED. "PLAINDEALER."

Haw′finch, the common grosbeak of Europe and Asia, *Coccothraustes vulgaris.* It is a shy forest bird, but is quite destructive of small fruits, seeds, and the like. It is variegated with black, white, brown, and gray of various tints, and is seven inches long.

Haw′ick, town of Scotland, in the county of Roxburgh, at the confluence of the Teviot and the Slitrig. It is the centre of the Scotch manufactures of stockings, plaids, shawls, and blankets. Pop. 11,355.

Hawk, a popular name for many birds of prey of the family Falconidæ, mostly smaller than those known as eagles, and having, as a rule, shorter wings than the true or noble falcons. The term is, however, a very vague one. For instance, the black hawk of the U. S., called also rough-legged falcon, is the *Archibuteo sancti-johannis;* others are of the genera *Poliornis, Geranospiza, Micrastur, Melierax,* and many other genera. The genus *Accipiter* is, however, regarded as the typical one. The more important species are described under their alphabetical heads.

Hawk′bit, the *Leontodon autumnale* of Linnæus, called also fall-dandelion, a composite perennial plant from Europe, naturalized in parts of the U. S. Its heads of yellow flowers resemble those of the dandelion, and in New England are very abundant from July to October.

Hawk Creek, tp. of Renville co., Minn. Pop. 353.

Hawkers. See PEDDLERS, by PROF. T. W. DWIGHT, LL.D.

Hawkesbury, a river of East Australia, in New South Wales. It enters the Pacific at Broken Bay, 20 miles N. E. of Sidney. Its course is only 50 miles, but it is navigable up to Windsor. It is remarkable for its inundations, the water sometimes rising 20 feet in a few hours.

Hawkesbury, a v. of Prescott co., Ontario, Canada, on the river Ottawa, opposite Grenville, with which it is connected by ferry. It has manufactures of lumber. P. 1671.

Hawkesworth (JOHN,) LL.D., b. in London 1715 or 1719; was a clockmaker's apprentice; read law, and in 1744 became compiler of parliamentary debates for the *Gentleman's Magazine,* for which periodical he was critic 1765–72; was the author of 70 of the 140 papers published in the *Adventurer* (1752–54), in consequence of which he received the doctorate from the archbishop of Canterbury. Author of *Zimri,* a good oratorio (1760); *Edgar and Emeline,* a drama (1761); *Almoran and Hamet,* a tale (1761); prepared for the government an account of the first voyage of Cook, with some account of the voyages of Byron, Wallis, and Carteret (3 vols., 1773), a work which called forth severe criticisms; translated Fénelon's *Télémaque* (1768); prepared a good *Life of Swift,* etc. D. Nov. 17, 1773.

Hawking. See FALCONRY, by PROF. A. DE GUBERNATIS.

Haw'kins, county of Tennessee, bounded on the N. by Virginia. Area, 300 square miles. It is mountainous, with wide fertile valleys. Cattle, grain, tobacco, and wool are staple products. Cap. Rogersville. Pop. 15,837.

Hawkins (Benjamin), b. in North Carolina Aug. 15, 1754; educated at Princeton; was an excellent French scholar; became Washington's interpreter in his intercourse with the French officers of his army; was with him at the battle of Monmouth. In 1780 was chosen commercial agent of North Carolina, and 1781–84 and 1786–87 was a delegate to Congress; 1789–95 was a Senator from the same State under the new Constitution. In the latter year he was appointed by Washington agent for superintending all the Indians S. of the Ohio; this office he retained until his death, making his head-quarters most of the time at a station in Georgia which is now known as the city of Hawkinsville, named in honor of his memory. To each successive President from Washington to Madison he tendered his resignation, which was not accepted. He was a man of superior abilities, great variety of learning, and of lofty character. He left some valuable writings on topography and the Indian character. D. June 6, 1816, universally lamented by both the white men and the red men from the Ohio to the Gulf, whose mutual interests and intercourse he had so humanely and beneficently conducted for upwards of a quarter of a century. (See Chappell's *Historical Miscellanies of Georgia.*) A. H. Stephens.

Hawkins (Benjamin Waterhouse), F. G. S., F. L. S., b. in London Feb. 8, 1807; was educated at St. Aloysius' College; studied art under William Behnes, the sculptor; began the pursuit of natural science in 1827, and in 1852 began the restoration of extinct animals in model, his previous labors (1842–47) in studying living forms of animal life at Knowsley Park having fitted him for the work. In 1868 he removed to the U. S. His lectures in the United Kingdom and the U. S. have done much to popularize science. His thirty-three restorations of fossil animals for the Crystal Palace Park, near London, are famous examples of his skill in modelling. Author of *Popular Comparative Anatomy* (1840); *Elements of Form* (1842); *Comparative View of the Human and Animal Frame* (1860); *Atlas of Comp. Osteology* (with Huxley, 1864); *Artistic Anatomy of the Horse, Cattle, and Sheep,* etc.

Hawkins (Sir John), b. about 1520 at Plymouth, England; became a mariner, and in 1562, 1564, and 1567 took cargoes of slaves from Guinea to Spanish America; was attacked (1567) on the Mexican coast by a Spanish fleet, and lost several ships from the squadron in his command; was made treasurer of the English navy 1573; knight and rear-admiral 1588, and served with distinction against the Armada; went with Frobisher to cut off the plate-fleet 1590, but failed to accomplish that result; led with Drake an expedition against the Spanish West Indies, and d. at sea Nov. 21, 1595.

Hawkins (Sir John), b. in London Mar., 1719; was bred an attorney, but devoted much time to music and literature; joined the Madrigal Society 1741, and in 1749 became a member of Dr. Johnson's literary club; magistrate for Middlesex 1761; suppressed the riots at Brentford 1768, at Spitalfields 1769; was knighted 1772, and d. in London May 21, 1789. Chiefly remembered for his *General Hist. of Music* (1776), an important work; wrote also a *Life of Johnson* (1787), and published an edition of Walton's *Angler* (1760), and of Johnson's *Works,* besides several minor works of his own.

Hawkins (William George), b. at Baltimore, Md., Oct. 22, 1823, a son of John H. W. Hawkins (1797–1858), the Washingtonian temperance lecturer. The son graduated at Wesleyan University, Middletown, Conn., 1848; studied divinity at Fairfax Seminary, Va., 1848–51; entered the Protestant Episcopal ministry 1851; has held rectorships in Maryland, Massachusetts, Pennsylvania, etc.; edited the *National Freedman,* etc., 1863–66, and has been much engaged in domestic missions; in 1874 became chaplain in the asylum at Binghamton, N. Y. Author of a *Life* of his father (1859); *Lunsford Lane* (1863); *History of the Freedman's Commission* (1866), etc.

Haw'kinsville, city, cap. of Pulaski co., Ga., 40 miles S. of Macon, on the Macon and Brunswick R. R. It has 4 good schools, 5 churches, 1 bank and trust company, 1 newspaper, 2 carriage and wagon factories, a large cotton-factory, 3 cotton warehouses, 1 steam grist-mill, a Masonic and an Odd Fellows lodge, and the usual number of stores. Pop. 813. John H. Marten, *Mayor.*

Haw'kinsville, post-v. of Boonville tp., Oneida co., N. Y., has several manufactories. Pop. 150.

Hawk Moths, the Sphingidæ, a family of lepidopterous insects, of which there are more than 300 known species, quite largely from tropical America. Among them are some of the largest of the Lepidoptera. They have short bodies and narrow, strong wings, which make their flight swift and powerful. They often stand poised in the air like humming-birds, and in general obtain their food from flowers after the manner of humming-birds. At rest, the wings usually form a roof or tent over the insect, and in flight the hind wing is attached by a hook to the forward wing. The larvæ have sixteen legs, and are remarkable for their large size and their habit of elevating the fore part in a manner fancied to resemble the position of the sphinx (hence the name *Sphinx* for the typical genus). The larvæ are mostly destructive plant-feeders. The U. S. have many species.

Hawks (Cicero Stephen), D. D., LL.D., Protestant Episcopal bishop of Missouri, was b. at New Berne, N. C., May 26, 1812, and graduated at the University of North Carolina in 1830; studied law; was ordained in 1834; rector of Trinity church, Buffalo, N. Y., 1837–43, of Christ church, St. Louis, 1843–44, and was consecrated bishop of Missouri in 1844. During the cholera season of 1849 he was conspicuous for his care for the physical and spiritual good of the sufferers. He was the author of several works, chiefly for the young. D. Apr. 19, 1868.

Hawks (Francis Lister), D. D., LL.D., b. at New Berne, N. C., June 10, 1798, and was an elder brother of Bishop C. S. Hawks. He graduated at the University of North Carolina in 1815, and became a successful lawyer, but in 1827 was ordained to the ministry of the Protestant Episcopal Church. Was for a time assistant minister in New Haven, Conn., and in Philadelphia; in 1830 was chosen professor of divinity in Washington—now Trinity—College, Hartford, Conn.; in 1831 was rector of St. Stephen's, New York City, and of St. Thomas's, 1832–43. In 1835 he declined the missionary bishopric of the South-west. In 1837 he became one of the founders of the *New York Review,* and in 1839 established St. Thomas's Hall, a school at Flushing, N. Y., by which he was heavily involved in debt. He was (1840–42) editor of the *Church Record.* In 1843–44 he resided in Mississippi, of which diocese he declined the bishopric. He was (1844–49) rector of Christ church, New Orleans, and was chosen first president of the University of Louisiana. He held (1849–61) rectorships in New York City, where $15,000 was presented to him for the relief of his pecuniary embarrassments. In 1854 he declined the bishopric of Rhode Island. Sympathizing with the South during the civil war, he held (1861–65) the rectorship of Christ church, Baltimore. In 1865 he accepted the ministry of the chapel of the Holy Saviour, N. Y. D. Sept. 27, 1866. When in the practice of law he published several volumes of legal reports and a digest, and afterwards *Contributions to the Ecclesiastical Hist. of the U. S.* (1836–41); *Narrative of Com. Perry's Expedition* (1856); *History of North Carolina* (1857–68); *Documentary Hist. of the Prot. Episcopal Church* (1863), and a large number of other works, among them the "Uncle Philip" series for the young. He was alike eminent for learning, piety, and eloquence.

Hawks'bee, or **Hauksbee** (Francis), F. R. S., was chosen to the Royal Society in 1705; became curator of experiments, and in 1723 assistant secretary. Author of 43 papers in the *Philos. Transactions* between 1704 and 1713, and of *Physio-Mechanical Experiments* (1709). He was one of the founders of electrical science, and made improvements in electrical machines, air-pumps, and other apparatus. The times and places of his birth and death are not known.

Hawk'shaw (John), F. R. S., b. at Leeds, England, in 1811, where he was educated; pupil under Mr. Chas. Fowler; engaged in the construction of turnpike roads; subsequently he became assistant to Mr. Alexander Nimmo, government engineer of public works. On the death of Mr. Nimmo, Mr. Hawkshaw went to South America and assumed charge of the Bolivar copper-mines. Returning to England, he became engineer of the Manchester and Bolton Canal and Railway, and subsequently constructed the Lancashire and Yorkshire Railway and several others in various parts of England. His name is intimately connected with many great engineering achievements throughout Europe. In Russia he constructed the Riga and Dunaberg and the Dunaberg and Witepsk railways; in Wales, the Penarth harbor and dock in Cardiff Roads; the Londonderry bridge in Ireland; the Charing Cross and Cannon Street railways, besides other public works in London; the new docks at Hull; the government railways in Mauritius; was engineer-in-chief of the great ship-canal from Amsterdam to the North Sea, planning the North Sea harbor, the actual construction of which involves but slight deviation from his original designs; constructed the new West India docks in London, etc.; was consulting engineer to the Madras and Eastern Bengal railways; engineer of the magnificent harbor of refuge at Holyhead, and of the foundations of the new fortifications at Spit-

head; and is frequently called upon by the British government as consulting engineer on works of a professional character. On the failure of the great sluice at St. Germains, by which the tide-waters of the river Ouse poured into the *Middle Level* Drain, bursting its banks at various points and inundating 6000 acres of land, Mr. Hawkshaw's services were called upon to remedy the disaster, which he did successfully, substituting for the first time large siphons for the fallen sluice; was one of the metropolitan commissioners of sewers, and in 1860 was appointed royal commissioner to decide between the various schemes proposed for supplying the city of Dublin with water. In 1874 he sailed for Brazil, on invitation of the emperor, to examine and report on all the principal harbors of the 3000 miles of sea-coast. Author of many professional papers and works, and has been president of the Institution of Civil Engineers. G. C. Simmons.

Hawks' Springs, tp. of Jackson co., Ala. Pop. 386.

Haw'ley, post-tp. of Franklin co., Mass. It is mountainous, but well adapted to grazing, and contains iron ore and a mineral spring. Pop. 672.

Hawley, post-v. of Palmyra tp., Wayne co., Pa., on the Honesdale branch of the Erie R. R., 8 miles S. E. of Honesdale, and on the Pennsylvania Coal Co.'s R. R.

Hawley (Bostwick), D. D., b. at Camillus, N. Y., Apr. 8, 1814; graduated in 1838 at Wesleyan University; taught in seminary, Cazenovia, N. Y., 1838–42; has held numerous pastorates in the Methodist Episcopal Church. Author of *Manual of Methodism*, and various reviews, tracts, etc.

Hawley (Joseph), b. at Northampton, Mass., 1724; graduated at Yale College 1742. Starting life in the ministry, he became a lawyer, in which profession he achieved a great reputation through many years of practice. From 1764 to 1776 he occupied a seat in the house of representatives, where his eloquence was exerted in the cause of American liberty, of which he was one of the ablest advocates during this eventful period. Owing to the condition of his health he retired from public life in 1776. Although for a time an active opponent of Jonathan Edwards, whose removal he attempted to effect, he yet in 1760, on becoming convinced of his error, in a characteristic letter to Mr. Edwards deplored his action in the matter. D. Mar. 10, 1788.

Hawley (Gen. Joseph Roswell), b. at Stewartsville, N. C., Oct. 31, 1826. His father was a native of Farmington, Conn., and to that State the family returned in 1837, and afterwards removed to Cazenovia, N. Y. Gen. Hawley received his early education in the schools of Farmington and Hartford, Conn., and Cazenovia, N. Y., and was graduated at Hamilton College, N. Y., in 1847. He studied law at Cazenovia and Farmington, and in Sept., 1850, commenced practice in Hartford, where he was for a time the law-partner of John Hooker, Esq. He very early took a deep interest in the politics of the country, and was an active opponent of slavery, especially of its extension to the U. S. Territories. He was an earnest, forcible, and vigorous platform-speaker in the days of the Free-Soil agitation. In his law-office, and by his invitation, Hon. Gideon Welles, Hon. John M. Niles, and a few other prominent Hartford men met Feb. 4, 1856, and took steps which led to the organization of the Republican party in Connecticut. In Feb., 1857, he left the practice of the law and became editor of the Hartford *Evening Press*, a journal established in 1856 as the organ of the newly-formed Republican party, his associate being William Faxon, Esq., afterwards assistant secretary of the navy. As an editor and platform-speaker he was prominent in his State in the exciting political times from 1856 to 1861. Upon the outbreak of the war of 1861–65 he enlisted in the army (Apr. 15, 1861), being the first man in Connecticut to enroll his name for the volunteer service. He went to the field as captain in the 1st Regiment Connecticut Vols.; was in the battle of Bull Run, his company and regiment being among the forces which preserved their discipline through that rout, returning to Washington in good order, and saving much property that had been abandoned. At the close of the three months' campaign he immediately engaged in recruiting for the 7th Connecticut Vols., in which he was commissioned lieutenant-colonel. He served in a campaign before Charleston, S. C., aided in the bombardment of Fort Pulaski, his regiment being the first to occupy the fort after its surrender; was in the battles of Morris Island, Fort Wagner, James Island, Pocotaligo, and Olustee, commanding a brigade in the latter engagement. He was commissioned a colonel in 1862, and a brigadier-general in 1864, though he had commanded a brigade for a long time previous to this promotion. He served in the Army of the James before Richmond and Petersburg, and with his command participated in many of the hardest battles of that siege. He was military governor at Wilmington, N. C., on the occupation of that city by the Federal troops. He was brevetted major-general in 1865, was Gen. Terry's chief of staff at Richmond after the surrender of Lee, and was mustered out of service in Jan., 1866. He was elected governor of Connecticut in Apr., 1866, holding the office one year. He returned to journalism as editor of the Hartford *Courant*, with which the *Press* had been consolidated. He was president of the Republican national convention at Chicago in 1868, and his brief speech on taking the chair was an eloquent declaration of the high and pure ideas which have guided his political life. Such sentiments as the following in that speech furnished keynotes for the campaign in some degree: "For every dollar of the national debt the blood of a soldier is pledged. Every bond, in letter and in spirit, must be held as sacred as a soldier's grave." "The power of a nation of forty millions must be behind the just claims of the poorest workingman, of whatever race, to even a day's wages; its majesty must be felt wherever the humblest loyal man appeals against personal violence and oppression." He was elected to the 42d Congress from the First Connecticut district Nov. 5, 1872, to fill the vacancy caused by the death of Hon. Julius L. Strong, receiving the largest Republican vote ever cast in the district. He was re-elected to the 43d Congress Apr., 1873. On the organization of the Centennial commission to arrange for the celebration of the one hundredth anniversary of American Independence, he was chosen its president. Gen. Hawley is a good type of the self-made men of America. His progress in the army was due to a noble courage and constant devotion to his soldierly duties; his distinction in other fields has been worthily won—a sound integrity, high purposes, earnest advocacy of what he believed to be right, and fearless opposition to wrong everywhere, having been characteristics of his social, journalistic, and political life. S. A. Hubbard.

Haw'leyville, post-v. of Newtown tp., Fairfield co., Conn., on the Housatonic R. R., at its junction with the Shepaug Valley R. R., 23 miles N. by W. from Bridgeport, Conn.

Hawleyville, post-v. of Page co., Ia. Pop. 200.

Hawthorn. See Cratægus.

Haw'thorne (Julian), a son of Nathaniel Hawthorne, b. in Boston June 22, 1846; studied in Harvard College and Scientific School, and in Dresden, Germany, where he has resided since 1872. He was 1870–72 an engineer in New York. He has published the novels *Bressant* (1873) and *Idolatry* (1874), and many contributions to periodical literature.

Hawthorne (Nathaniel), b. July 4, 1804, at Salem, Mass. In early youth he was sent, on account of feeble health, to live upon a farm at Raymond, Me. He graduated at Bowdoin College in 1825, in the same class with H. W. Longfellow and G. B. Cheever. He then returned to Salem, where resided his widowed mother, who had ever since 1808 been a constant mourner for the loss of her husband. While here he published occasional articles, mostly tales, in different periodicals. In 1828 he published *Fanshawe*, an unsuccessful romance. He went to Boston in 1836 and edited the *American Magazine*, an illustrated periodical, which was soon bankrupt. In 1837 appeared *Twice-told Tales*, which was made up from his previous contributions to periodicals. This work gradually drew the attention of cultivated persons to the wonderful powers of its author, and in 1842 another series appeared. He was (1838–41) employed in the Boston custom-house, in which the historian Bancroft was then collector. In 1842 he joined for a time in the Brook Farm experiment. In 1843 he married and went to Concord, Mass., where he lived in the old parsonage, afterwards immortalized by him in *Mosses from an Old Manse* (1846). While here he was the associate of Emerson, Thoreau, Ellery Channing, and other congenial friends. He was (1846–50) surveyor of the port of Salem. While here he wrote that powerful tale *The Scarlet Letter* (1850), his most successful romance. He lived (1850–52) in Lenox, Mass., and here he produced the *House of the Seven Gables* (1851), and *The Blithedale Romance* (1852), and in the latter year published a *Life of Franklin Pierce*, who was a college-friend to whom Hawthorne was warmly attached. He was U. S. consul at Liverpool 1853–57, and afterwards spent some years in Italy. He lived (1860–64) in Concord, Mass., and while journeying for his health with Mr. Pierce he d. at Plymouth, N. H., May 19, 1864. Besides the works mentioned above are *True Stories from History, etc.* (1851), *The Wonderbook* (1851), *The Snow Image, etc.* (1852), *Tanglewood Tales* (1853), *The Marble Faun* (1860, in some respects his best effort), and *Our Old Home* (1863). After his death appeared a series of *Notebooks* (1868–72), *Septimius Felton* (1872), and parts of the unfinished *Dolliver Romance.* In person he was tall, large, and imposing, but he was as

shy, sensitive, and impressible as any woman. In his peculiar vein of romance his genius is unapproachable.—Mr. Hawthorne's wife, SOPHIA PEABODY (1810–71), a lady of artistic tastes, illustrated one of his stories before their acquaintance, and after his death edited the *Notebooks*, and published a volume of *Notes* of her own (1868).—His daughter UNA edited her father's *Septimius Felton*.

Haw Tree, tp. of Warren co., N. C. Pop. 1540.

Hax'all (ROBERT WILLIAM), M. D., b. in Petersburg, Va., Aug. 1, 1802; d. in Richmond Mar. 26, 1872; graduated at Yale College 1823; attended his first course of medical lectures in the University of Pennsylvania, and received his degree from the University of Maryland in 1826. He volunteered to meet the cholera in New York City in 1832, enjoyed the advantages of the schools and hospitals of Europe, and returning thence settled in Richmond, where for years he enjoyed a large practice. He obtained two Boylston prizes—one for an essay on fistula lachrymalis, the other for exploration of the internal organs by external means. He was also a frequent contributor to a monthly medical journal called the *Stethoscope*. He was president of the Medical Society of Virginia in 1841, and again in 1850, and took a very active interest in the organization of the American Medical Association—was in fact one of its founders. PAUL F. EVE.

Haxo (FRANÇOIS BENOÎT), BARON, b. June 24, 1774; a general of French engineers, and one of the most able military engineers of modern times. Distinguished himself at the siege of Lerida, Mequenenza, and Tarragona under Suchet; directed the construction of fortifications at Belfort, Sedan, Grenoble, and L'Écluse; also the operations at the siege of Antwerp, 1830; published no system of fortification, but introduced new features and made important modifications. (See *Encyc. Brit.*, "Fortification.") Best known out of France by what is called the "Haxo casemate," formed *in* the parapet, and, though arched over, covered with earth, and open behind to the terreplein; the guns fire through embrasures formed in an extension of the parapet beyond its ordinarily retired position in his system, and are not only secured from the enemy's fire, but may be hidden by masking the embrasures. D. June 25, 1838.

Hay, forage-plants cut for fodder and cured for storage. The plants commonly used for making hay are many kinds of grasses, several leguminous plants, particularly the clovers, and a few plants of other natural families. As a rule, plants are in the best state to be cut for fodder when in blossom or just out of blossom, because during the development of the seeds great drafts are made upon the plant to supply phosphates and other valuable nutritive substances which are needed for their perfection. The seed is thus formed more or less at the expense of the haulm and leaves, and at the same time the stems become woody and stiff, preparatory to sustaining the weight of the heads. This woody fibre is formed at the expense of the starch, gum, sugar, and soluble cellulose contained in the cells and juices of the stem and leaves.

The manner of curing is no less important than the time of cutting. If exposed to the sun, turned often, and dried rapidly and thoroughly, grass and clover will be found to be harsh and brittle, the leaves will fall off, the sweet odor will be gone, and a great part of the value of the hay lost. The object sought is not to *dry* hay so that it will keep, but to *cure* it so that it will make the most nutritious fodder and be dry enough for storing. Slow drying, with sufficient exposure to the air to prevent fermentation, causes the juices of the plants to become thickened, and when such a degree of inspissation is reached that the hay will not heat and mould when placed in stacks or in the mow—a point not difficult to determine with sufficient accuracy—the process is complete. Such hay will be found green, fragrant, and tough, the leaves even of clover not breaking and falling off. A greater weight of hay will be obtained, and it will prove more nutritious and be better relished by animals. The cutting of grass for hay is done by hand-scythes or by horse-power mowing-machines. The swaths as cut are shaken out and turned to expose all to the action of the sun and air, either by hand or by machines called "spreaders" or "tedders." It is raked together when somewhat dry, either by hand or horse rakes, into long heaps, called "windrows," extending in parallel lines across the field. The hay in the windrows is divided by the eye, and formed into symmetrical, compact conical heaps called "cocks," which are of greater or less size according to convenience, and according to the condition of the hay, small cocks heating less readily than large ones. Hay-caps, which are pieces of cotton cloth four to six feet square, with loops of cord sewed in at the corners, whereby they are pinned with wooden pins or forks to the hay, are not unfrequently used to cover the tops of these cocks in threatening weather to prevent the hay getting wet. Thus protected, or indeed unprotected, hay will go on curing in the cock for several days. There is no hay superior to that cured in this way, but there is danger of overheating and mildewing. When sufficiently and freshly aired, hay will have a slightly harsh feel when grasped in the hands; no semblance of moisture will be perceived when a lock is wrung and hard twisted in the hands, and the stems will not feel cool or moist when pressed against the dry lips. It is stored either under cover in barns or barracks, or in stacks. It may be salted when mowed away, four quarts to a peck of salt being used to the ton. This gives it a fresher color, and it is more relished by the cattle. Salt is, moreover, a great preventive of injury from heating, in case hay is housed or stacked too green. In addition to the tools already mentioned, horse hay-forks of various kinds are an important aid. They are arranged so that by a system of ropes, blocks, and rods the hay is lifted from the load upon the fork, and delivered in any section of the barn.

Brown Hay.—In some parts of Europe the fermentation of hay housed in a half-cured state or only well wilted before housing is so regulated that the mass becomes both cured and *cooked* by the operation. The result is a very compact mass, in which the plants lose to a degree their individuality, and which is of a dark-brown color, and so compact that it may be cut with an axe, though it can be broken up by hand. This is fragrant, and highly relished by stock, possessing at the same time a higher nutritive value than the best common hay. The fermentation causes a considerable loss in weight from the dissipation of moisture, and from the consumption of a part of the carbonaceous matter. Coarse grass and plants hardly regarded as fit for fodder, if mingled with grass of a better quality, are thus made to contribute largely to the store of winter forage.

Hay varies greatly in composition and nutritive value according to the plants from which it is made, the growth and period of cutting, the method of, and the good or ill fortune attending, its curing. Exposure to a single heavy dew causes fermentations and decompositions within the substance of the moistened stems and leaves, both fragrance and flavor are lost, and the nutritious quality of the hay seriously injured. The average composition of meadow hay of medium quality, as given by Wolff and Knop (quoted by Johnson), is in 100 parts—water, 14.3; combustible matter, 79.5; ash, 6.2. The organic or combustible matter consists approximately of albumenoids (gluten, etc.), 8 parts; carbohydrates (starch, sugar, and gum), 40; fat, 2; and crude fibre, 30. Except for the amount of crude fibre which it contains, good hay compares favorably with the different kinds of grain as nutritious feed, and it is its bulk, caused by the woody fibre, which particularly adapts it to the use of cattle and horses as a general diet. The money-value of the hay-crop in all countries where cattle cannot graze during the winter and spring is fully equal to any other farm-crop, as generally estimated. Its intrinsic value is really greater, for the value of farm-crops in money is fixed chiefly by the convenience and expense of marketing, and this places hay at a disadvantage. To be marketed at a distance it must be pressed into as small compass as possible by hay-presses worked either by hand or power; and even in this form hay is a bulky article and expensive to transport and to market. Ordinary bales measure 2 feet to 2 feet 6 inches across the ends, and 4 to 5 feet in length, and usually weigh from 200 to 350 pounds; while those made by the most powerful presses, though of the same size, weigh 400 to 500 pounds.

The kinds of grasses and forage-plants most valued for hay, and which are generally cultivated for that purpose in this country, are the following: (1) Timothy (*Phleum pratense*), called Herds-grass in New England, a well-known grass growing to the height of 2 to 4 feet, flowers in July, yields abundantly for the first cutting—little for the aftermath. (2) Orchard grass (*Dactylis glomerata*), called also Cock's-foot, a rough, rather coarse, leafy grass, flowering in June, at the same time with red clover, yields a heavy crop of hay very early, escaping late droughts, which it survives well; makes afterwards a great growth of root-leaves, useful for fall pasturage. (3) Red-top (*Agrostis vulgaris*), called Herds-grass S. and W. of New York, a grass known under many names, and assuming different forms and colors in different soils. It usually matures rather late, but grows wiry before it fairly flowers in July; is most valuable with other grasses, which it is apt gradually to crowd out; makes good hay—not so much as those previously named. (4) Fowl-meadow (*Poa serotina*), an admirable grass for moist meadows, making an abundance of nutritious, fine, soft hay—better for consumption than for market—and good aftermath. (5) June-grass or blue-grass (*Poa pratensis*) is hardly worthy of being included among hay-grasses, yet, as it finds its way into almost all permanent meadows, and makes good sweet hay,

excellent pasture, and a close sward, it is here named as one of our best grasses. Besides these, a long list of less valuable grasses might be named, but those who buy seed for hay-meadows will generally confine themselves to these and to the clovers. The rye-grasses are good, but not equal to timothy and orchard-grass for hay. Sweet-scented vernal-grass is present in almost all soils of the Northern and Eastern States. It gives the odor to new-mown hay so much admired, which is not noticed in Western hay, on account of the absence of this grass. In addition to these proper grasses, the clovers are most important, as already mentioned. The most valuable is the common red clover (*Trifolium pratense*), which we have in two principal varieties—the mammoth and medium. The latter is preferable for hay, and may be used alone, or, better, in connection with orchard-grass or timothy, or with timothy, orchard-grass, and red-top mixed. Alsike, or Swedish clover (*Trifolium hibridum*), is partially procumbent in its growth, but with grass to sustain it makes excellent hay. Lucerne, or alfalfa (*Medicago sativa*), is sowed by itself, and after becoming established, where it does well yields at least three heavy crops of hay or green fodder each year.

The great consumption of hay is of course in those parts of the country where the winter is long and severe. Grasses adapted to the soil throughout these colder portions of the temperate zone afford rich and abundant summer pasturage, but for winter fodder the chief dependence is hay, and in this country corn-fodder, which, though properly included in our general definition of hay, is never reckoned as such by the farmers. The amount of hay cured in the U. S., and its distribution, as given in the census for 1870, may be roughly stated as follows: The total is placed at 27,316,000 tons; of this, New York produced 5,614,000, Pennsylvania 2,848,000, Illinois 2,747,000, Ohio 2,289,000, Iowa 1,777,000, Michigan 1,290,000, Wisconsin 1,287,000, Indiana 1,076,000, Maine 1,053,000, Vermont 1,020,000, Minnesota 695,000, Missouri 615,000, New Hampshire 612,000, Massachusetts 597,000, Connecticut 563,000, California 551,770, and New Jersey 521,000. This embraces all those States the hay-crop of which is reported at more than 500,000 tons, and it will be observed that the great stock-growing sections of Kentucky, Virginia, Tennessee, Kansas, and Texas are not included, the winters being so mild as to make hay of secondary consideration, its place being supplied by corn-fodder and the straw of grain, peas, etc. M. C. Weld.

Hay (Sir James Douglas Hamilton), Bart., a Canadian statesman, b. Dec. 28, 1800, son of Sir Thomas, fifth baronet; succeeded to his title 1833; resided at Quebec and at Ottawa, where he was on duty at the adjutant-general's office, and where he d. July 30, 1873. The family was raised to the Scottish baronetage in 1703. His mother was Anna, daughter of Mr. Sheffield Howard of New York.—His son, the present baronet, Sir Hector Maclean Hay, was b. in 1821, and resides in Quebec.

Hay (John), b. at Salem, Ind., Oct. 8, 1839; graduated at Brown University in 1858; studied law at Springfield, Ill., and was admitted to the bar in 1861. Immediately afterwards he went to Washington with Pres. Lincoln, serving him as assistant secretary, and subsequently as adjutant and aide-de-camp. During the war of 1861–65 he served for several months under Gens. Hunter and Gillmore, attaining the ranks of colonel and assistant adjutant-general. He was appointed secretary of legation at Paris in 1865, and remained in that position till 1867, when he became *chargé d'affaires* at Vienna by the withdrawal of Mr. Motley, remaining in the latter place till 1868. In 1869 he was appointed secretary of legation at Madrid, and held that position till 1870, when he returned to the U. S. and accepted a situation upon the editorial staff of the New York *Tribune*, where he still remains. Soon after this he became widely known by his dialect poems of "Little Breeches," "Jim Bludsoe," "Banty Tim," etc., which were afterwards published in book-form under the title of *Pike County Ballads*. He also published about the same time his most enduring work, *Castilian Days*, a series of brilliant sketches of Spanish life, character, and politics. J. B. Bishop.

Hay (Sir John Charles Dalrymple), Bart., F. R. S., F. R. G. S., b. Feb. 11, 1821; educated at Rugby; entered the navy, and as midshipman served on the coast of Syria, and as flag-lieutenant off the coast of Borneo; senior officer of the Columbine in 1849 in China, and promoted for the destruction of pirate vessels; commanded the Hannibal during the Crimean war, participating in the capture of Kertch and Kinburn and the bombardment and capture of Sebastopol; in command of the Indus 1857–59; on Greenwich Hospital commission 1860–61; and 1861–64 chairman of the iron-plate committee; succeeded to the baronetcy on the death of his father in 1861; elected to Parliament 1862, and again in 1866, in which year he was promoted to be rear-admiral, and retired as such 1870; was a lord of the admiralty 1866–68. Author of the *Flag List and its Prospects*, *Our Naval Defences*, *Remarks on the Loss of the Captain*, etc.

Hay (Thomas), M. D., b. Feb. 7, 1837, at York, Pa.; was educated at the Pennsylvania College, Gettysburg, Pa., and the College of New Jersey; in 1861 took his degree of M. D. from the University of Pennsylvania, commenced practice in Philadelphia, and very soon obtained a lucrative and extended business. Gynæcology attracted his especial attention, and among many successful operations he removed, in 1871, an inverted uterus, complicated with a large intramural fibrous tumor. Previous to this time the most eminent surgeons had held that this operation was not to be resorted to unless death were certain to take place without it. But since then Dr. Gross, in a new edition of his *System of Surgery*, as well as other distinguished writers, has accorded him due credit for this achievement. His operations have extended to almost every branch of surgery. In 1869 a paper of his upon the use of the long tube in intestinal obstruction was published in the medical journals, and in 1871 another upon the removal of an inverted uterus by écrasement. Various other contributions have been made by him to professional literature. In 1865 he became a member of the Philadelphia County Medical Society; in 1866 a permanent member of the American Medical Association and of the Medical Society of Pennsylvania; in 1872 a corresponding member of the Gynæcological Society of Boston; and in 1874 a member of the American Public Health Association.

Hay (Walter), M. D., b. at Georgetown, D. C., June 13, 1830; was educated in the Georgetown College and in the medical department of Columbian College, D. C.; studied for an engineer, and for five years was employed in the U. S. Coast Survey; since 1857 has been a practitioner in Chicago; editor of the Chicago *Medical Journal* since 1868; adjunct professor of the theory and practice of medicine in Rush Medical College since 1870; in 1872 was for six months attached as surgeon to the staff of Gen. Sheridan.

Hay As'thma, Hay Fe'ver, or **Autum'nal Catarrh',** a disease recurring in certain individuals at certain seasons every year, as in June (rose cold), in the hay-making season (hay fever), or (in this country especially) in the autumn, whence the name autumnal catarrh. It is a catarrhal affection of the nasal (and sometimes of the bronchial) passages, often with some fever and more or less asthmatic spasm. Sometimes incessant sneezing and coryza are the only prominent symptoms. It is not observed in very hot or very cold countries, on the sea, or at considerable heights in some mountain-regions. It is very probably caused by pollen from some plants, but it is by no means certain of what species they are. Helmholtz has found vibriones in the nasal mucus in this affection, and recommends the topical employment of quinine, which seems to destroy the vibriones. Removal from districts where the disease prevails is the only means of cure, but the usual palliatives may be employed. (See Morrill Wyman, *Autumnal Catarrh*, 1872.) Rev. by Willard Parker.

Hay'cock, tp. of Bucks co., Pa. Pop. 1250.

Hay Creek, tp. of Goodhue co., Minn. Pop. 901.

Hay'den (Ferdinand Vandeveer), M. D., Ph. D., b. in Westfield, Mass., Sept. 7, 1829. At an early age he emigrated to Ohio; graduated at Oberlin in 1850, and took his degree as doctor of medicine at Albany, N. Y., in 1853. He did not practice medicine, but commenced his explorations of the Western Territories in 1853. He was a surgeon of volunteers during the civil war, and was brevetted lieutenant-colonel for meritorious services at its close; was appointed professor of mineralogy and geology in the University of Pennsylvania at Philadelphia in 1865, and resigned in 1872; commenced the geological survey of the Territories in 1867 under the auspices of the general government, with an appropriation of \$5000; continued in 1868 with \$5000; 1869, \$10,000; 1870, \$25,000; 1871, \$40,000; 1872, \$85,000; 1873, \$115,000; 1874, \$95,000. Seven annual reports have been published, with abundant illustrations; also some volumes of miscellaneous memoirs octavo, and a number of volumes quarto. Besides the reports of the survey, Dr. Hayden has written about 50 memoirs, some of them good-sized volumes. His reports of the explorations of the famous Yellowstone region in 1870 and 1871 induced Congress to set apart by law, as a national park, 3575 square miles of the public domain, containing within its limits most of the geysers, hot springs, and other wonders of that region. Dr. Hayden is a member of the National Academy of Sciences, and of nearly all the other scientific societies of America; honorary and corresponding member of a large number of scientific bodies in foreign

countries. Dr. Hayden has occupied more than twenty years in the exploration of our great West, and has extended his investigations over the greater portion of Kansas, Nebraska, Colorado, New Mexico, Dakota, Montana, Idaho, and Utah.

Hay'den (Joel), a prominent manufacturer of Williamsburg, Mass., b. Apr. 7, 1798. He founded the village of Haydenville, where he was successfully engaged in cotton manufacturing and the making of gold pens, and where he afterwards established a large brass-foundry. He was (1861–62) a member of the governor's council, and (1863–65) lieutenant-governor of Massachusetts, besides holding other important offices. D. in New York Nov. 10, 1873.

Hay'denville, an important manufacturing post-v. of Williamsburg tp., Hampshire co., Mass., on the New Haven and Northampton R. R., 7 miles N. W. of Northampton. It has a savings bank and a good water-power, which is well improved. In 1874 it was nearly destroyed by the bursting of the Williamsburg reservoir, when the loss of life here was very great.

Haydenville, post-v. of Green tp., Hocking co., O., on the Columbus and Hocking Valley R. R., 57 miles from Columbus, has extensive mines of coal.

Haydn (Franz Joseph), b. in Rohrau, near Vienna, Mar. 31, 1732; d. in Vienna May 26, 1809, seventy-seven years of age. When a mere child he assisted the family music by playing on two sticks as violin and bow with so much expression that at five years of age a schoolmaster named Frank took him to Hamburg for education. During the three years spent with Frank he learned reading and writing, something of Latin, and the elements of music and of the art of singing. He also commenced to play on the violin and several other instruments, besides the drum, of which he was very fond. At eight years of age his fine voice and his intelligence attracted the attention of Reuter, who took him to Vienna as chorister for the cathedral of St. Stephen. There he diligently followed his art, learning what he could from his associates and from observations in the course of his work. At thirteen he made his first effort at composing by writing a mass, which was so crude that Reuter laughed him to shame. But not disheartened, Haydn set to work with characteristic patience and industry, teaching himself the art of composition from the dry and obscure works of the period. When by the natural change his fine soprano voice was lost, Reuter turned him into the street penniless. A poor barber named Keller gave him a bed in his garret. There, with a worm-eaten harpsichord, a few books, and some scores, he worked in tranquillity, occasionally having a bout down stairs with the wigs, or with Anne Keller, to whom, in an evil hour, he proposed marriage. After a while his lessons and playing on the violin and the organ gave him a support. In these early years he was so attracted by the sonatas of Karl Philipp Emanuel Bach as to study closely his style, and he mastered it so well that Bach recognized the complete success of his effort. Sammartini, a prolific Italian composer of clear and graceful style, exerted the only other influence which affected his early work. He was introduced to Porpora, one of the greatest masters of that day, and knowing what inestimable benefits might be derived from such a source, Haydn devoted himself to Porpora as valet, brushed his boots, dressed his wig to perfection, ran on his errands, and steadily labored to overcome that master's ill-humor and repulses. Finally, Porpora received him fully, made him his accompanyist, his companion, and gave him invaluable knowledge of the art of Italian singing and of correct, elegant composition. His productions improved much after this, and brought him some personal attention. But, although publishers issued many of his works, he derived little or no benefit from them, being either ignorant of their publication or too retiring to enforce his claims.

The precarious period of his life ended at twenty-eight years of age in 1760, when he became chapel-master to Prince Esterhazy and a member of his household, receiving a salary of 400 florins, which was later raised to 1000. Rarely do circumstances harmonize so completely with character as in Haydn's life from 1760 till 1790. He was the intimate friend of his beloved Prince Nicholas till death severed the bond. The prince played the violoncello, and fully appreciated Haydn's genius. What more charming offering of friendship than Haydn's fresh compositions, 150 of which were written for his patron's instrument? The monotony of the country-life at the court of Eisenstadt was varied by the most healthful recreations—mountain-rambles, hunting, fishing, occasional visits to Vienna, musical evenings, and friendly, affectionate intercourse with intelligent men and beautiful women. Haydn, the greatest figure in that little world, and unconsciously one of the greatest in the great world, lived in his calm retirement, contented, laborious, and unambitious. But one misfortune crossed his path. In his prosperity, remembering his gratitude to the barber, he married Anne Keller. Her exasperating nature was too much for even the serenity of Haydn. They lived together but a short time before he left her, sharing his means generously for her support. His affectionate but dispassionate heart found consolation in Mademoiselle Boselli, a singer of the court, as well as in the friendship of other congenial and appreciative people about him. By the death of the prince the tie was broken which made Haydn unwilling to travel. In 1790, at the age of sixty, he visited London, where his enthusiastic reception was a proof of his renown surprising to him. At this time his accumulated fortune was $5000. In 1795, after a second voyage to London and some of the continental cities, having amassed $100,000, he retired from the Esterhazy service, and bought a house and garden near Vienna. There he remained till his death, modestly receiving the greatest honors from all parts of Europe. The nobility of Vienna vied with one another in tendering him every affectionate attention to render his last years happy—a striking contrast to their treatment of Beethoven, who died in abject poverty but eighteen years afterward.

Haydn was small and slight in stature, and of so dark a complexion that he was nicknamed "the Moor." But his face was kind and unaffected, expressing a placid, healthy, genial nature. He was extremely generous in his recognition of other musicians. The love between young Mozart and his "papa Haydn" is one of the sweetest passages in the history of art. He was deeply devout, taking every accomplished work as from God. At the beginning of every MS. are the words "In nomine Domini" or "Soli Deo gloria;" at the end of each, "Laus Deo." When, in the midst of a composition, he was arrested by a difficulty or by the cooling of his imagination, he recited his rosary, which he said invariably brought him success. His character was a remarkable union of genius and industry. Early in life he worked sixteen, even eighteen, hours per day, and later never less than five. From the first he seems to have known his mission, and to have followed it, without error or hesitation, to full success.

Haydn is the father of symphony and of the stringed quartet. He did more to develop instrumental music than any hundred of his predecessors. The leading qualities of his compositions are—perfect lucidity of ideas, perfect symmetry in their development and treatment, and the perfect finish of every phrase and part. In his works are reflected, with surpassing truthfulness, the freshness, calmness, and purity of nature, which so filled his mind that there was no room for storm, passion, or romance. The works of his unceasing industry number about 800; of this extraordinary number, his most esteemed compositions are the twelve grand symphonies written for London, the fifty last quartets for stringed instruments, and the oratorios *The Seasons* and *The Creation*. Yet these were compositions of his later years. The master was already sixty when he turned his attention from instrumental music, in which he had wrought such wonders, to oratorio, in which he expressed the joyous fulness of his nature. Of the 118 symphonies and the 83 quartets that he composed, scarcely a fourth part are ever performed either at public or private concerts in Germany, but the oratorios lose none of their freshness with time. They have all the joyousness of piety. Charles H. Farnham.

Hay'don (Benjamin Robert), b. at Plymouth Jan. 25, 1786; d. in London, by his own hand, June 22, 1846; was a student at the Royal Academy 1804. His first work, *Joseph and Mary Reposing*, was exhibited in 1807, and immediately bought at a high price. Two years later his *Dentatus* gained a first prize from the Academy. In 1815 he opened a school of painting, where Eastlake and the Landseers studied, and delivered lectures on painting and design, which were published in 1844. At his instance the British government bought the Elgin Marbles in 1816. Haydon was a man of eccentric genius, inordinate sensibility, and boundless ambition. His life, as told by Tom Taylor (1853), was saddened by pecuniary want, thwarted ambition, crossed vanity, and defeated passion. His reputed insanity, it was found on examination, was due to cerebral disease. Haydon's pictures treated of grand themes—*Uriel and Satan, Curtius leaping into the Gulf, The Burning of Rome, The Judgment of Solomon, The Agony in Gethsemane, The Raising of Lazarus, Christ's Entry into Jerusalem.* The last is the property of the Roman Catholic cathedral in Cincinnati, O. Haydon's life and genius were the subject of much comment in the London magazines. (See *London Quarterly* and the *Edinburgh* for Oct., 1853.) His reputation as an artist has not increased since his death. His family were provided for by a subscription led by the queen. O. B. Frothingham.

Hayduk. See Haiduk.

Hayes (Augustus Allen), M. D., b. at Windsor, Vt., Feb. 28, 1806; graduated at Norwich, Vt., 1823; was for a time assistant professor of chemistry in New Hampshire Medical College; in 1828 removed to Boston; was long State assayer of Massachusetts, and has been chiefly engaged in the various branches of industrial chemistry, in which he has made several useful inventions. He has published various scientific papers of value.

Hayes (Isaac Israel), M. D., b. in Chester co., Pa., Mar. 5, 1832; graduated M. D. in 1853 at the University of Pennsylvania; was surgeon to the second Grinnell expedition, under Dr. Kane, 1853–55; commanded an expedition (1860–61) in the schooner United States, and with a small party in a boat and dog-sledges reached (*viâ* Smith Sound) land in lat. 81° 37′ N.; was a medical officer in the U. S. service in the civil war; went in the steamer Panther to Greenland 1869; has received gold medals from the geographical societies of Paris and London; author of an *Arctic Boat-Journey* (1860); *The Open Polar Sea* (1867); *Cast Away in the Cold* (1868); *The Land of Desolation* (1872).

Hayesville, post-v., county-seat of Clay co., N. C. Pop. of v. 35; of tp. 884.

Hayesville, tp. of Franklin co., N. C. Pop. 1630.

Hayesville, post-v. of Vermilion tp., Ashland co., O. It has a literary institute. Pop. 576.

Hay′field, tp. of Dodge co., Minn. Pop. 18.

Hayfield, post-tp. of Crawford co., Pa. Pop. 1824.

Hay Fork Val′ley, tp. of Trinity co., Cal. Pop. 172.

Hay′mond, tp. of Taylor co., West Va. Pop. 934.

Hay′nau, von (Julius Jakob), Baron, b. at Cassel, Germany, Oct. 14, 1786, son, by a morganatic marriage, of the elector of Hesse-Cassel; entered the Austrian service 1801; was wounded at Austerlitz and Wagram; became a major-general 1835; field-marshal-lieutenant 1844; commandant of Verona 1848; was distinguished for military skill and executive rigor in Italy 1848–49; took supreme command in Hungary 1849; gained the victories of Raab, Szöreg, Temesvár, etc.; was proclaimed governor of Hungary, and on account of the haughtiness of his manner and the cruelty of his administration was everywhere detested. His execution of the Hungarian generals and other leaders won him the title of the "Austrian butcher." In 1850 he was dismissed from the service for insubordination. D. at Vienna Mar. 24, 1853.

Hayne (Col. Arthur P.), b. at Charleston, S. C., Mar. 12, 1790, was a brother of Gov. R. Y. Hayne. He was employed in mercantile pursuits in youth, but entered the army, and served actively in the war of 1812–15 and in the Creek and Florida wars; was admitted to the Pennsylvania bar after the war with Great Britain, but returned to the army, which he voluntarily left in 1820. In 1828 he was a Presidential elector from South Carolina, and in 1858 was sent to the U. S. Senate. He deplored the secession movement, though sympathizing with the South in the civil war. D. Jan. 7, 1867.

Hayne (Isaac), b. in South Carolina Sept. 23, 1745. He served in a cavalry regiment in the Revolution, but in 1780 was made prisoner and set free on parole. In 1781 he was ordered to bear arms as a British subject. His wife and children being dangerously sick with smallpox, he was carried to Charleston, and there compelled to acknowledge his allegiance to Great Britain, though under protest; permission being granted him to return to his suffering family, while at the same time he was exempted from bearing arms, he went to his home, and found his wife dying and one of his children already dead. Soon after he received orders to take up arms against his country. These orders being a plain violation of the agreement made with him, he considered himself free from his parole. He accordingly assumed command of a regiment of South Carolina militia, in which he distinguished himself for valor and energy, but was soon taken prisoner and mercilessly hanged, without a trial, Aug. 4, 1781. Col. Hayne was a wealthy planter and iron-manufacturer of Beaufort district, greatly honored and beloved by all. He was great-uncle to Gov. R. Y. Hayne.

Hayne (Paul Hamilton), son of Lieut. Hayne of the U. S. navy, and nephew of Gov. R. Y. Hayne, was b. at Charleston, S. C., Jan. 1, 1831. He has been editor of the *Southern Literary Messenger*, *Russell's Magazine*, and other periodicals, and has published four volumes of poems (1854, 1857, 1859, 1873). He resides near Augusta, Ga.

Hayne (Robert Young), b. Nov. 10, 1791, in Colleton district, S. C.; studied law with Langdon Cheves, and came to the bar in 1812; served for a time in the war of 1812; distinguished himself in the State legislature; was in 1818 Speaker of the House, and soon after attorney-general of South Carolina. During his U. S. Senatorship (1823–32) he displayed abilities of the first order. In 1824 he enunciated in an able speech the doctrine that a protective tariff is unconstitutional, and he was the first, at least in Congress, to propound the doctrine that a State has a right under the Constitution to arrest the operation of such Federal enactments as she considers unconstitutional. This led to the famous debate between Daniel Webster and himself. He was in 1822 chairman of a committee in the South Carolina State convention which reported the celebrated "Ordinance of nullification." In the same year he was chosen governor. To President Jackson's denunciation of the nullification acts, Gov. Hayne made a defiant reply, and prepared for resistance of the Federal authority. Meanwhile, Mr. Clay's compromise measure averted the threatened danger, and another State convention repealed the nullification ordinance. In 1834, Mr. Hayne became mayor of Charleston, and in 1837 a railroad president. D. at Asheville, N. C., Sept. 24, 1839.

Haynes, tp. of Etowah co., Ala. Pop. 522.

Haynes (John), b. in England, at Copford Hall, Essex; settled at Boston, Mass., in 1633; was assistant in 1634 and in 1636; governor of the Massachusetts Bay Colony 1635; removed in 1636 to the new colony of Connecticut; was its first governor 1639; and was chosen governor every alternate year till his death, Mar. 1, 1654. He was one of the authors of the first constitution of Connecticut (1638), a man of ability, wealth, and influence, greatly beloved by the people and highly honored for his learning and virtue.

Haynesville Plantation, a plantation and post-v. of Aroostook co., Me. Pop. 165.

Hayneville, post-v. and tp., cap. of Lowndes co., Ala., 23 miles W. S. W. of Montgomery and 6½ miles from the Mobile and Montgomery R. R. It has 4 churches, an academy building, a newspaper, a steam-mill, 2 hotels, etc. Pop. of tp. 3484. Ed. of "Examiner."

Hay′nie (Isham Nicholas), b. near Dover, Tenn., Nov. 18, 1824, his parents removing to Marion co., Ill., when he was but six years of age; studied law, and commenced practice 1846, but left his profession to serve in the war with Mexico as first lieutenant 6th Illinois Vols.; returning at the close of the war, he settled at Salem, where he resumed his profession; was elected to the legislature in 1850; in 1853 graduated from the law school of the Louisville University, and in 1856 was appointed judge of the court of common pleas at Cairo, to which place he now removed. He was an active supporter of Douglas and a Presidential elector in 1860; at the outbreak of the civil war became an ardent supporter of the administration, vacated the bench, raised the 48th Illinois Vols., which he commanded at Forts Henry and Donelson, at the battle of Pittsburg Landing, where he was wounded, but in the field again before Corinth; appointed brigadier-general of volunteers Nov., 1862; his appointment expired Mar. 4, 1863, when he resumed his profession. In Dec., 1864, was appointed adjutant-general of Illinois. G. C. Simmons.

Hays, county of W. Central Texas. Area, 690 square miles. It has a fine rolling surface and a good soil. Livestock, fruit, corn, and cotton are abundantly produced. The county is well timbered and has plenty of good building-stone. Cap. San Marcos. Pop. 4088.

Hays (Alexander), b. at Pittsfield, Pa., 1820; graduated at the West Point Military Academy, July 1, 1844, and entered the army as brevet second lieutenant of infantry; appointed second lieutenant June, 1846; served on frontier duty 1844–46, and in the Mexican war was engaged in the battles of Palo Alto and Resaca de la Palma, being brevetted first lieutenant for gallantry; ordered to Pennsylvania on recruiting duty, he quickly enlisted a large number of men, and returned with them to the seat of war, being engaged in various actions. On the 12th of Apr., 1848, he resigned from the army, and engaged in the manufacture of iron at Venango, Pa., subsequently adopting the profession of civil engineer, which he followed till the outbreak of civil war, in April, 1861, when he was apponted major 12th Pennsylvania Vols., and in the following month a captain in the 16th U. S. Infantry. In Aug., 1861, he was commissioned colonel of the 63d Pennsylvania Vols., and led his regiment in the Virginia Peninsular campaign of 1862, through most of the battles from Yorktown to Malvern Hill, receiving the brevets of major and lieutenant-colonel. In the second battle of Bull Run he was severely wounded and disabled till Sept. 29, 1862, when he was promoted to be brigadier-general of volunteers and assigned to duty in the defences of Washington. At the battle of Gettysburg he was in command of a division of the 2d corps, and subsequently led it at Auburn, Bristoe Station, and the Mine Run affair. In the Richmond campaign of 1864 he fell at the head of his command in the battle of the Wilderness, May 5, 1864. G. C. Simmons.

Hays (William), b. in Richmond, Va., 1819; gradua-

ted from the Military Academy at West Point, July 1, 1840, and entered the army as second lieutenant of artillery; promoted to be first lieutenant 1847, captain 1853, and major 1863; served through the Mexican war with the light artillery in the battles of Palo Alto, Resaca de la Palma, Monterey, Vera Cruz, Cerro Gordo, Churubusco, Chapultepec, Molino del Rey, and the city of Mexico; wounded at Molino del Rey and brevetted captain and major; served subsequently against the hostile Indians in the Everglades of Florida and in Dakota. During the civil war (1861–65) he commanded the brigade of horse-artillery of the Army of the Potomac in the Virginia Peninsular campaign of 1862, and the reserve artillery in the battles of Antietam and Fredericksburg; appointed brigadier-general of volunteers Nov., 1863; at Chancellorsville, where he commanded a brigade of the 2d corps, he was wounded and taken prisoner; rejoined the army at Gettysburg, and upon the fall of Hancock, severely wounded, was assigned to temporary command of the 2d army corps. From Nov., 1863, to Feb., 1865, he was provost-marshal-general of the southern district of New York, at which latter date he joined the army before Petersburg, serving with the 2d corps and in command of the reserve artillery till close of the war. Brevetted colonel and brigadier-general U. S. A. for gallant services in battle. D. at Fort Independence, Boston harbor, Feb. 7, 1875. G. C. Simmons.

Hays (William Jacob), b. in New York Aug. 8, 1830; travelled extensively on the American continent, studying nature and animal life at first hand. His pictures have the merit of entire fidelity, and are marked with a fine animation of feeling. Technically, too, they are admirable as works of art. D. in New York Mar. 13, 1875.

O. B. Frothingham.

Hays City, post-v., cap. of Ellis co., Kan., half a mile from Fort Hays, on the Kansas Pacific R. R., 289 miles W. of Kansas City. It has a large school-house, a weekly newspaper, and the county court-house. Pop. 320.

Wm. P. Montgomery, Ed. "Hays Sentinel."

Hay′ti, an island of the West Indies, next to Cuba the largest of the Antilles, is situated between the Atlantic Ocean and the Bahama Islands to the N., Cuba and Jamaica (from which it is separated by the Windward Passage) to the W., the Caribbean Sea to the S., and Porto Rico (from which it is separated by the Mona Passage) to the E. It extends between lat. 17° 36′ and 19° 59′ N., and lon. 68° 20′ and 74° 38′ W., and comprises an area of 28,000 square miles, including the islands of Tortue or Tortuga to the N., Gonaive to the W., and Saone, St. Catharine, Beata, Alta Vela, and others along the southern coast. Its greatest length from E. to W., from Cape Engano to Cape Tiburon, is 405 miles; its greatest breadth from N. to S., from Cape Isabella to Cape Beata, is 165 miles. The coasts of Hayti, much indented and presenting a line of about 1500 miles, form a great number of bays, safe and commodious for vessels seeking shelter. The great bay of Samana, on the eastern coast, is of paramount importance for the passage into the Mexican Gulf, whether the northern route is chosen through the dangerous Bahama Channel between Cuba and Florida, or the southern through the channel separating Cuba from Yucatan. The principal mountains are Cibao, Bahoraco, La Selle, and La Hotte. The range of Cibao, whose average height is only about 800 feet, but whose culminating point rises about 9000 feet, traverses the island from E. to W., and sends out numerous branches towards the sea which form a multitude of promontories and bays. The slopes, very rough to the N., descend gently to the S. and S. E., and disappear at last in large savannas. The ridge itself, generally cultivable to the very summit, is covered with immense virgin forests. The plains which skirt the mountains or fill the interval between them and the shore occupy the largest portion of the surface of the island; they slope from the mountains towards the sea more or less insensibly, some presenting the aspect of vast amphitheatres, others being seemingly perfectly level. The island is generally well watered by the numerous rivers which descend from the central part of the Cibao range. The principal of these streams are—the Yuna, whose rapid waters traverse the rich valley of Vega Real and enter into the Bay of Samana; the Great Yaque, which runs through the valley of St. Yague and falls into the Bay of Monte-Christi; the Artibonite, which, crowded with caymans, enters into the Bay of Gonaive to the N. of the city of St. Marc; the Ozoma, whose bed is very deep, and the Neyba, both of which, running from N. to S., send their waters into the Caribbean Sea. Other streams discharge their waters into the large salt-lake Euriguillo. On account of the variety of soil through which these streams flow, and the difference of substances which they meet on their passage, and on account of the rapidity of their course, their waters are too turbid for drinking purposes; in the mountain-regions, however, they are limpid and wholesome. From the very configuration of the island, one part of its surface being mountainous, another low and level, results a great variety of climate and temperature. Other causes of a more local character also produce a considerable effect, such as the situation of the island in the region of the trade-winds, the local abundance of water and forests, etc. In Hayti, as in all countries situated between the tropics, the year is divided into two seasons only—the wet and the dry—and the transition from the one to the other is sudden and often violent. The wet season is generally in its full force in the months of May and June. The rain pours down in torrents, and rivers which at other seasons are perfectly dry swell and inundate the country. In the months of June, July, and August the heat generally rises, during the day, to 104° in the plains, and from 63° to 77° on the mountains, and during the night from 59° to 62°. In the same months violent hurricanes reign in Hayti, especially in the southern part, and earthquakes, sometimes strong enough to destroy whole towns, are frequent. But the wet season does not set in at the same time in all parts of the island. Thus, abundant rains fall in the north-eastern districts in the latter part of November, while the northern and eastern districts suffer from an almost perpetual drought. In the western and southern, as well as in the interior districts, the winter—that is, the season of rain and tempests—reigns from May to October. The soil of Hayti is very fertile, and produces coffee, sugar, cacao, maize, rice, cotton, tobacco, fruits, vegetables, etc., besides an enormous quantity of different kinds of trees, shrubs, and plants which might be turned into inexhaustible sources of wealth. Of timber-trees for furniture and building purposes, may be mentioned oak, mahogany, cedar, walnut, ebony, satin-wood, fustic, wax-palm, etc.; of dyewoods, the campeachy, yielding a red dyestuff; the yaws tree, yielding a yellow; and others, besides the indigo-plant and the cochineal fig. The vanilla and the grapevine festoon the forests, the latter yielding an excellent muscatel wine. Of minerals, gold, platina, silver, copper, tin, iron, salt, coal, sulphur, mercury, rock-crystal, jasper, porphyry, and marble have been found on the island. Coal-deposits have recently been discovered and thoroughly explored in the neighborhood of St. Yaque, along the small river Ainbaji, and in the departments of the North, Artibonite, and the South in the republic of Hayti. Copper and iron mines are found on the peninsula of Samana and on the island of Gonaive. The native quadrupeds are few and small, but cattle, swine, horses, and dogs, introduced from Europe, live now in great herds on the savannas. Birds, lizards, insects, and snakes are numerous, and the surrounding seas abound in oysters, lobsters, crabs, and various kinds of fish. The population, numbering about 850,000 (of whom about 700,000 are in the French part of the island, and the rest in the Spanish), consists of whites, creoles, mulattoes, mestizoes, and creole negroes; a few of the aboriginal inhabitants are said to be still living in the Bahoraco Mountains.

The island is divided into two states—the republic of Santo Domingo (which see), comprising the eastern or Spanish part; and the republic of Hayti, comprising the western or French part. This division is old. Hayti (which in the original Caribbean language signifies "mountainous") was the second place which Columbus visited in the New World, and the first European colony was planted here in 1492, and called Isabella. The Spaniards named the whole island Hispaniola, and a new colony was founded in 1496—Santo Domingo. These colonies prospered prodigiously. In 1506 their number had increased to fifteen, and in 1511 Santo Domingo was made a bishopric. But the Spanish government was cruel and barbarous in the highest degree. The native inhabitants, numbering about 2,000,000 at the arrival of the Spaniards, were put to work in the mines, and had to toil like beasts for the advantage of their foreign masters. Rebellions ensued, but, although they were put down with unheard-of severity, in 1517 it was necessary to introduce negro slaves to the island in order to get the mines and the plantations worked. The first negro slaves arrived in 1522, and were kept on the plantations of the viceroy, Pedro Colombo, the son of Christopher. Meanwhile, the native population decreased so rapidly that in 1711 only 21,000 were left, and in our time it is a question whether any exist. The Spanish population also decreased. New and still more wonderful countries were discovered, and the first settlers or their descendants left for Mexico and Peru. The beautiful island became almost a waste. But a new period of its history began with the arrival of the French in 1630. They settled—a number of adventurers—on the island of Tortuga, whence they crossed over to the northern coast of the main island; and so rapid was the growth of this settlement that it was formed into an independent department in 1714. The Spaniards tried to drive the French from the island,

but failed, and by the treaty of Ryswick (1697) Spain ceded the western part of the island to France; in 1777 the boundary was fixed as running from the mouth of the Daxabon or Massacre, on the northern side of the island, to the mouth of the Pederuales or Anses-à-Pitres, on the southern. The prosperity of the French colony was wonderful. The value of the importations from France to St. Domingue amounted in 1792 to 293,454,000 francs, and that of the exportations from the colony to France 279,000,000 francs — namely, of sugar, 190,000,000 francs; of coffee, 80,000,000; of indigo, 18,000,000; of cotton, 10,000,000, etc. 1400 vessels, with crews of 30,000 men, were engaged in this trade, and the total population of the colony amounted to about 780,000—namely, 40,000 white, 40,000 free colored, and 700,000 slaves. Of the free colored people, the mulattoes, many possessed large estates in the colony, and were men of education and refinement, but they had no political rights. Instigated by the revolutionary ideas and movements of the mother-country, they demanded in 1790 to be placed on an equal footing with the whites, and organized an army in order to support their demand by force. They were defeated by the whites, and their leaders were cruelly put to death. Nevertheless, in 1791 the national assembly granted their demand in spite of the remonstrances of the white population, and order seemed to return, when in the same year the negro slaves rose in insurrection. Civil war now raged for several years in the colony, and at the same time the Spaniards broke in from the E., and the English conquered and held the western coast districts. Under these circumstances the French commissioners declared (1793) all the inhabitants of the colony free and equal, and appointed Toussaint l'Ouverture commander of the army which the black people now formed. He succeeded in expelling the Spaniards and English, and restored order once more. By the treaty of Bâle (1795) Spain ceded her part of the island to France, and under the government of Toussaint l'Ouverture the prosperity of the island was revived. But in 1801, Napoleon determined to restore slavery in St. Domingue, and sent for that purpose an expedition under Gen. Leclerc to the island. Toussaint l'Ouverture was treacherously captured and sent to Paris, where he d. shortly after, but his successor in the leadership, Dessalines, was also a vigorous and sagacious man, and the French army became so reduced by ill-luck and yellow fever that it had to capitulate (Nov. 30, 1803) to the commander of an English squadron, and (Jan. 1, 1804) St. Domingue declared itself an independent republic. Dessalines was chosen governor for life, but on Oct. 8, 1804, he broke the constitution, assumed the title of emperor of Hayti, and plunged the island, by his ill-considered and fantastic attempt at royalty, into a long series of civil wars, which ended in almost complete social dissolution. Oct. 17, 1806, he was assassinated, and while the eastern part of the island returned to Spanish rule, the western (or Hayti) was for many years divided between several rival chiefs. In 1822, Boyer succeeded in uniting the whole island under his government, and in 1825 France acknowledged the independence of the republic. But in 1842, Boyer was expelled, the eastern part formed itself into an independent republic under the name of Santo Domingo, and Hayti was again divided into different portions and harassed with internal contests. In 1849, Soulouque, who had been elected president of the republic in 1847, assumed the imperial title, but in 1858 he was deposed and expelled, and a republic was again proclaimed. Its first president was Geffrard, who fled in 1867; the next was Salnave, who was expelled in 1870; then followed Nissage-Saget, who succeeded in establishing peace and order. The present president is Gen. Michel Domingue.

The republic of Hayti is divided into four departments: (1) South, cap. Les Cayes (7000 inhabitants); other towns, St. Louis, Arquin, Miragoane, and Jérémie; (2) West, Port-au-Prince, cap. of the republic (30,000 inhabitants); other towns, Leogane, Grand Goave, and Petit Goave; (3) Artibonite, cap. Gonaives (6000 inhabitants); other towns, St. Marc and Petite-Rivière; (4) North, cap. Cape Haytien (6000 inhabitants); other towns, Petite-Anse, Fort Liberté, and Port-de-Paix. The departments are subdivided into arrondissements and communes. According to the constitution of June 14, 1867, the legislative power is vested in a representative assembly consisting of two chambers, and the executive power in a president elected by the representative assembly for a term of four years. During the civil wars commerce and agriculture suffered very much, and the finances fell into an almost irremediable disorder. The annual revenue amounts to 12,000,000 francs, but the expenditures to 14,000,000; and as yet it has not been possible to bring a balance into the budget. In the last ten years, however, great progress has been made. The tonnage employed in the traffic of the country has risen from 60,000 to 150,000; the exportation of coffee from 40,000,000 pounds to 55,000,000; of cotton, from 1,000,000 to 3,000,000; and of cacao, from 1,000,000 to 1,500,000. The sugar cultivation is also progressing, but the raw sugar is generally distilled into rum, of which about 6,300,000 litres are annually produced. Nevertheless, the resources of the country are very far from being properly utilized. The cultivation of indigo, tobacco, and vanilla is nearly abandoned, and that of coffee, the principal source of the national wealth, is carried on somewhat carelessly. The inexhaustible wealth of timber is unavailable, on account of the total lack of roads and canals.

MELVIL BLONCOURT.

Hay'town, a v. of Cass co., Ind. Pop. 260.

Hay'ward, post-tp. of Freeborn co., Minn. Pop. 382.

Hayward (GEORGE), M. D., b. at Boston, Mass., Mar. 9, 1791; graduated at Harvard in 1809; took his medical degree at the University of Pennsylvania 1812; professor of clinical surgery in Harvard University 1835–49. Author of *Outlines of Physiology* (1834), *Surgical Reports*, etc. (1855). D. Oct. 7, 1863. He was one of the leaders of his profession in Boston.—His father, DR. LEMUEL HAYWARD, b. at Braintree, Mass., Mar. 22, 1749, graduated at Harvard 1768, was a surgeon in the Revolutionary war. D. Mar. 20, 1821.

Hayward (NATHANIEL), b. at Easton, Conn., in 1808, shares with Charles Goodyear the honor of inventing the process of vulcanizing India-rubber. He still later made several important improvements in the manufacture of rubber goods, and in 1847 established the Hayward Rubber Co. at Colchester, Conn. He was a man of active benevolence. D. at Colchester, Conn., July 18, 1865.

Hay'wood, county of North Carolina, bounded on the N. W. by Tennessee. Area, 750 square miles. It is mountainous, and has beds of marble, iron ore, and other valuable minerals. The soil is mostly good. Live-stock, wool, tobacco, and grain are staple products. Cap. Waynesville. Pop. 7921.

Haywood, county in the W. of Tennessee. Area, 650 square miles. It is level, fertile, and well cultivated. Cotton, cattle, wool, and corn are staple products. It is traversed by the Hatchie River and the Memphis and Ohio R. R. Cap. Brownsville. Pop. 25,094.

Haywood, post-v. of Alameda co., Cal., 19 miles S. from San Francisco, and 1 mile from the Western Pacific R. R. It has a large school-house, 3 churches, Odd Fellows' building, a regularly organized fire department, 1 weekly newspaper, and a temperance hall; is in a good agricultural district. Pop. 504. C. T. WARD, JR.

Haz'ard, a game of chance played with dice, not for amusement, but for money. The character of the game is such that a professional player, who knows all the possibilities and probabilities of the game, has a twofold advantage over another person.

Hazard, post-v., county-seat of Perry co., Ky.

Hazard (ROWLAND GIBSON), A. M., b. at South Kingston, R. I., Oct. 9, 1801. He is a large and successful manufacturer at Peacedale, R. I. In 1841–42 he succeeded with much difficulty in freeing large numbers of negroes from the North who were illegally held in confinement at New Orleans. He has been several times in the State legislature. Author of an *Essay on Language* (1834), *Freedom of the Mind in Willing* (1864), *Causation and Freedom* (1869), and several other works.

Hazard (THOMAS R.), a brother of R. G. Hazard, was b. at South Kingston, R. I., in 1784. Author of *Facts for the Laboring Man* (1840), *Capital Punishment* (1850), *Report on the Poor and Insane* (1850), *Appeal to the People of Rhode Island* (1857), and other works.

Haz'ardville, post-v. of Enfield tp., Hartford co., Conn., has manufactories of the Hazard brand of gunpowder, a large carpet-factory, etc.

Hazebrouck, town of France, in the department of the Nord, on the Bourre. It has considerable manufactures of linen and yarn. Pop. 8273.

Ha'zel, a genus (*Córylus*) of trees and shrubs of the order Cupuliferæ. Of these, the *C. Avellana* and *Colurna* of Europe and Asia produce the FILBERT (which see), as well as some of the varieties of nut called cobnut and hazelnut, which are used not only as food, but for their oil. The hazel-bush is extensively planted for copses in Europe, and yields material for hoops, hurdles, gunpowder, etc. The *C. Americana*, or wild hazel, and *C. rostrata*, or beaked hazel, yield nuts smaller and not so good as those of the European. There are still other foreign species.

Hazel, tp. in Luzerne co., Pa., contains the borough of HAZLETON (which see), and extensive mines of anthracite coal. Pop. 7110.

Hazel Green, post-tp. of Delaware co., Ia. Pop. 752.

Hazel Green, post-v. of Wolfe co., Ky. Pop. 77.

Hazel Green, post-v., in a fertile township of the same name in Grant co., Wis., on the Illinois line. Pop. 723; of tp. 2161.

Ha'zelton, post-tp. of Buchanan co., Ia. Pop. 885.

Hazelton, post-tp. of Shiawassee co., Mich. Pop. 822.

Ha'zen (WILLIAM B.), b. in Hartford, Windsor co., Vt., Sept. 27, 1830; graduated at the U. S. Military Academy July 1, 1855, and entered the army as brevet second lieutenant of infantry, receiving his full appointment as second lieutenant in September following. Immediately on graduating he was assigned to frontier duty, and mostly engaged in scouting against hostile Indians to Nov., 1859, when severely wounded by the Camanches; appointed first lieutenant April, and captain May, 1861. During the civil war he recruited the 41st Ohio Vols., of which he was appointed colonel, and commanded it in defending the Ohio frontier and in operations in Kentucky. In the Tennessee campaign (1862) he commanded a brigade in the armies of the Ohio and of the Cumberland, being engaged at he battles of Shiloh, Perryville, and Stone River; appointed brigadier-general of volunteers Nov., 1862. In the campaign of 1863 he was engaged at Chickamauga, Chattanooga, Missionary Ridge, etc., and in East Tennessee against Gen. Longstreet. In the invasion of Georgia (1864) he was engaged in the various battles and actions up to and including the siege and capture of Atlanta, in command of a division from Aug., 1864, and with the army of Gen. Sherman in the march to the sea. Appointed major-general of volunteers Dec., 1864, and engaged in the march through the Carolinas up to the surrender of the army of Gen. J. E. Johnston, Apr., 1865. He commanded the 15th army corps from May to Aug., 1865; district of Middle Tennessee Oct., 1865, to Jan., 1866; mustered out of volunteer service Jan. 15, 1866. In July, 1866, he was appointed colonel 38th Infantry, transferred to 6th Infantry, 1869. During the Franco-German war (1870) Gen. Hazen visited the seat of war, and on his return prepared a work on school and army in Germany and France. For gallant services in battle during the civil war he received the successive brevets from major to that of major-general U. S. A.

G. C. SIMMONS.

Ha'zle Hill, tp. of Johnson co., Mo. Pop. 1904.

Ha'zlehurst, post-v. of Copiah co., Miss., on the New Orleans Jackson and Great Southern R. R. It has 2 weekly newspapers. Pop. 662.

Ha'zleton, post-v. of White River tp., Gibson co., Ind., on White River, 8 miles S. of Vincennes, and on the Evansville and Crawfordsville R. R. Pop. 356.

Hazleton, post-b. of Hazel tp., Luzerne co., Pa., on the Lehigh Valley and the Danville Hazleton and Wilkesbarre R. Rs., 80 miles N. N. W. of Philadelphia. It has important anthracite coal-mines; is the seat of a thriving trade; has varied manufactures, 1 daily and 2 weekly newspapers, 8 churches, 2 banks; and from its elevated position is becoming a very popular summer resort. Its population has largely increased since the U. S. census. Pop. 4317.

Ha'zlewood, post-tp. of Alexander co., Ill. Pop. 674.

Hazlewood, post-tp. of Webster co., Mo. Pop. 1267.

Hazlewood, post-tp. of Chester co., S. C. Pop. 1556.

Haz'litt (WILLIAM), b. at Maidstone, England, Apr. 10, 1778, the son of a Unitarian minister; studied at Hackney College, and for a time labored as an artist, but without high success; became noted as a contributor to journals, writing chiefly upon theatrical and literary topics. D. in London Sept. 18, 1830. Author of *Memoirs of Holcroft* (1809); *English Grammar* (1810); *The Round Table* (1817); *Characters of Shakspeare* (1817); *View of the English Stage* (1818); *Lectures on English Poets* (1818); *Lectures on English Comic Writers* (1819); *Lectures on the Literature of the Elizabethan Age* (1821); *Table Talk* (1824); *The Spirit of the Age* (1825); *Life of Napoleon* (1827); *Conversations with Northcote* (1830), and several other works evincing critical talents of a high order.

Hazlitt (WILLIAM, JR.), b. in Wiltshire, England, Sept. 26, 1811; became a barrister of London 1844; a registrar of the London bankruptcy court 1854, of which court he is (1874) senior registrar; chiefly known as translator of historical works of Michelet, Thierry, and Guizot, and of Huc's *Travels;* with his colleague, H. P. Roche, has published some law-compilations, etc.

Hazlitt (WILLIAM CAREW), son of William Hazlitt, Jr., b. Aug. 22, 1834; was educated at Merchant Taylors' School and the Inner Temple; became a barrister 1861. Author of *British Columbia* (1858); *History of the Venetian Republic* (2 vols., 1858; enlarged to 4 vols. 1860); *Sophy Laurie* (1865); *Memoir of William Hazlitt* (1867); *Bibliography of Old English Literature* (1867); *English Proverbs* (1867); *Popular Antiquities of Great Britain*, and has performed much editorial and other literary work.

Head (Rt. Hon. Sir FRANCIS BOND), BART., P. C., K. C. H., and knight of the Prussian military order of Merit, b. near Rochester, England, Jan. 1, 1793; served with the royal engineers at Waterloo, at Fleurus under the Prussian general Ziethen; retired from the army and took charge of a gold and silver mining company in South America, riding over 6000 miles, a narrative of which he published in 1826, entitled *Rough Notes of a Journey across the Pampas;* in 1835 was appointed lieutenant-governor of Upper Canada, where he suppressed an insurrection, for which service he was created a baronet. The title of privy councillor was conferred on him in 1867. Among his many published works are *Bubbles from the Brunnen* (1833); *Life of Bruce* (1844); *The Defenceless State of Great Britain* (1850); *The Horse and his Rider* (1860); *The Royal Engineer* (1870). Wore the Waterloo medal, and was a major (retired list). D. in England July 23, 1875.

Head (Sir GEORGE), b. near Rochester, Eng., 1782; went to Portugal as commissariat clerk 1809; became assistant commissary-general 1811; was sent to Canada 1814, to Nova Scotia 1816; knighted 1831; d. in London May 2, 1855. Author of *Forest Scenes and Incidents in the Wilds of North America* (1829), *A Home Tour* (1836–37), *Rome* (1849), a translation of Cardinal Pacca's *Memoirs* (1850), a good translation of *The Golden Ass* of Apuleius (1851), etc.

Head'ache (*Cephalalgia*) is of many kinds. It is often the result of indigestion, of excess in eating or drinking, of malarial or other specific poison, of uterine disease, or of neuralgia. It is also a common symptom of many fevers and other acute diseases. If persistent headache be not relieved by a correction of the hygienic conditions as regards diet, clothing, exercise, etc., the case requires medical treatment, the character of which must depend upon the probable cause of the difficulty.

Head'ley (JOEL TYLER), b. at Walton, Delaware co., N. Y., Dec. 30, 1814; graduated at Union College 1839; studied theology at Auburn; for two years held a pastorate at Stockbridge, Mass.; was (1856–57) secretary of state for New York. He resides near Newburg, N. Y. Has published *Letters from Italy* (1845); *The Alps and the Rhine* (1845); *Napoleon and his Marshals* (1846); *Washington and his Generals* (1847); *Adirondack* (1849); *History of the Second War between England and the U. S.* (1853), and numerous other popular works.

Headley (Rev. PHINEAS CAMP), a brother of J. T. Headley, was b. at Walton, N. Y., June 24, 1819. Among his works are *Women of the Bible* (1850); *Life of Josephine* (1850); *Life of Mary Queen of Scots* (1856), and others.

Healds'burg, post-v. of Sonoma co., Cal., on the San Francisco and North Pacific R. R., 70 miles N. of San Francisco, the point at which tourists leave the cars for the Geysers. It has 1 academy, 1 seminary, 7 churches, 1 bank, 1 newspaper, Odd Fellows, Masonic, and Good Templars lodges, 2 hotels, 1 incorporated chair, basket, and wine manufactory. Principal business, farming, fruit-culture, stock-raising, and quicksilver-mining. Pop. 959.

JOHN G. HOWELL, ED. "RUSSIAN RIVER FLAG."

Heal'ing Springs, tp. of Independence co., Ark. Pop. 320.

Healing Springs, post-tp. of Davidson co., N. C. Pop. 675.

Healing Springs, post-v. of Bath co., Va., in Falling Spring Valley. It has three thermal mineral springs, whose waters are useful in a wide range of diseases.

Health [Ang.-Sax. *hal*, "hale," "sound," "whole"], physiologically considered, is that condition of organized living bodies in which the blood and tissues are in the state of integrity and functional activity inherent in their normal constitution. All of the structures are incessantly undergoing change, owing to the waste and renewal of their ultimate elements, the cells. There is in the constitution of these elements a tendency to development and a tendency to decay or retrograde metamorphosis. Upon their development depends the growth and maintenance of the organism, while in their retrograde metamorphosis we have their destruction after they have performed their proper functions. This tendency to development and to retrograde metamorphosis of the elements of tissues is impressed upon the organism as a whole, but differs in intensity at different periods of life. In the young the tendency to development is greatest, and we have as a result growth; in the middle-aged these forces are balanced, and the structures are maintained in bulk and symmetry; in the later periods the tendency to retrograde metamorphosis predominates and the organism wastes, and at length

falls into inevitable decay and death. At all periods in the life of any organized body, therefore, molecular changes are in active progress in every tissue, and yet while these changes are in exact accordance with the normal constitution of their elements, a state of health is maintained. But, though this definition is strictly in accordance with the teachings of physiology, it is evident that such a condition of health can be affirmed only in the most general sense of any complex living organism like man. So infinitely numerous are the elementary parts, and so various and powerful the causes which impair their integrity and prevent their functions, that there must be abnormal conditions constantly occurring, which do not sufficiently impair structure and function to enable us to appreciate the deviation from the natural standard. It is only when changes in structure and function are so great as to be detected by the means which we employ for investigation that we can decide that a condition of health does not exist. The terms "good health," "poor health," are improper. STEPHEN SMITH.

Hea'ly (GEORGE PETER ALEXANDER), b. in Boston 1808. The larger part of his life has been spent abroad, in Rome and Paris, whither he went at about the age of twenty-eight, and where he still resides. He is chiefly known by his portraits; twenty years ago he was the fashionable portrait-painter of Boston. The striking merit of his great historical picture, *Webster Delivering his Reply to Hayne*, is the portraiture of 130 persons. In twenty years of his art Healy executed 577 portraits, many of distinguished people—Cardinal McCloskey, W. H. Seward, M. Guizot, Marshal Soult, George Peabody, H. W. Longfellow, John A. Lowell, and others, as well American as foreign. His style is free, vigorous, effective, but marked rather by boldness than by carefulness. O. B. FROTHINGHAM.

Heard, county of Georgia, bounded on the W. by Alabama. It is hilly, but fertile. Corn and cotton are leading products. Gold, lead, and iron are found. Area, 286 square miles. Cap. Franklin. Pop. 7866.

Heard's Beat, tp. of Perry co., Ala. Pop. 615.

Heard's Island, an island in the Antarctic (South Indian) Ocean, lying S. E. of Kerguelen's Land, extending between 53° 2′ and 53° 14′ S. lat., and between 73° 30′ and 72° 30′ E. lon. It is about 24 nautical miles long and 9 broad, and its highest point (Kaiser Wilhelm Peak) about 6000 feet high. It was discovered by Capt. Heard Nov. 25, 1853. American and other vessels have here collected large amounts of the oil of sea-elephants and the smaller seals.

Hearing. See ACOUSTICS, by PROF. O. N. ROOD, A. M.; also EAR, ANATOMY OF THE, by PROF. H. HARTSHORNE, A. M., M. D.

Hearne, post-v. of Robertson co., Tex., at the junction of the International and Great Northern and the Houston and Texas Central R. Rs.

Hear'say Ev'idence, evidence which does not consist of a statement of facts within the personal knowledge of the witness by whom it is given, but which is a reproduction by him of statements or information derived from others, upon whose authority alone the credibility of the testimony depends. The term applies as well to written as to oral matter, though the mere name by itself would lead to a different inference. As a general rule, hearsay evidence is not admissible, on account of the little dependence which can be placed upon its accuracy, since its original author cannot be examined and the grounds of his declarations ascertained. But there are certain important classes of exceptions to this rule, which will be found, together with a fuller statement of the reasons for the rule itself, under the topic EVIDENCE. G. CHASE. REV. BY T. W. DWIGHT.

Hearse [Late Lat. *hercia*], the candelabrum in churches upon which candles are burned for ceremonial purposes. It was anciently the custom to place a hearse at the head of a new-made grave; and sometimes the framework which protected the effigy upon a tomb was called the hearse. From these uses of the word arose the modern signification, by which it designates either the funeral car or the catafalque employed in state funerals.

Heart, Human. This organ, as is generally known, is the great central power regulating and compelling the circulation of blood throughout the body. It is really two organs united in one, one-half governing the circulation through the lungs—the other half, that of all the rest of the body. Except for economy of space and synchronism of action, there might as well have been two hearts, placed in different parts of the body. Each of the halves is composed of a receptacle of blood and a propeller of the blood-current—*auricle* and *ventricle*. This heart, then, has four cavities—the right auricle and the right ventricle, and the left auricle and ventricle. The walls of these several cavities are composed essentially of muscular tissue, more or less abundant as the required force is greater or less. The walls of the left ventricle are more than half an inch in thickness, although much thinner at the apex, and those of the right ventricle only a little over two lines. Those of the left auricle are still thinner, and those of the right auricle the thinnest of all. The muscular fibres of the heart are of the variety called striated, having light-colored lines running in the direction of the length of the fibres, and others crossing these at right angles, so as to divide each fibre into little squares, altogether microscopic, called sarcous elements. This is one of two or three instances in which nature has departed from the rule of composing the voluntary muscles of striated fibres, and the involuntary of non-striated.

FIG. 1.

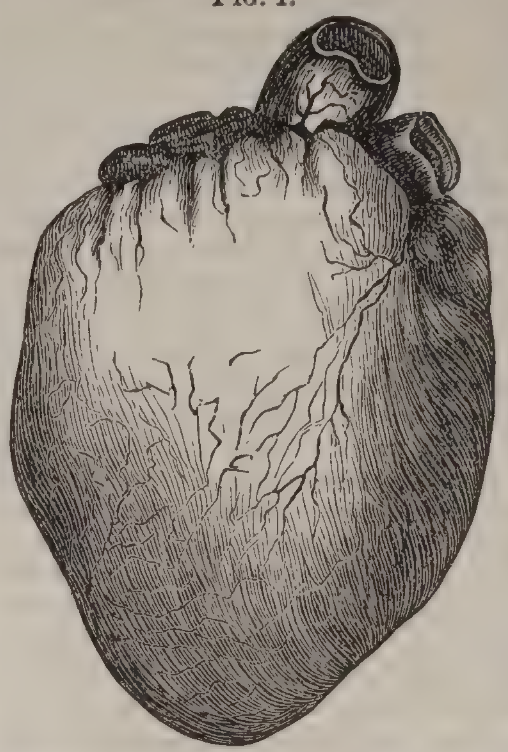


Fig. 1. External view of the heart, showing the beginning of the aorta and pulmonary artery, and parts of the right and left auricles; reduced to one-third its natural size.

The right and left hearts are united by muscular fibres which pass in a broad layer from one to the other, and by the union of the fibres of each in the septum. The different layers run in different directions, thus crossing each other at various angles. A plane of muscular fibres runs from before backward obliquely to the left. This is common to the two hearts, acting as a part of each. It unites them into one organ, and at the same time effects the paradox of dividing them into two, hence called the *septum*. The septum ventriculorum is thick and strong; the septum auriculorum corresponds in thickness and strength with other portions of the auricular walls, and is thin.

The capacity of the four cavities of the heart is not equal. In the healthy circulation the two ventricles must receive and expel equal quantities of blood at each contraction, but the auricles may be and are of small size, because the dilatable veins emptying into each serve to supplement their capacity. The left auricle is smaller than the right. The ventricles, it was once generally held, discharge, with each contraction, two ounces, or four tablespoonfuls, each. Substances that can be quickly detected by chemical reaction have been injected into the venous blood, and have been found in the secretions one minute afterwards. Both the pulmonary and general or systemic circulations are completed, then, and secretion or excretion is effected, in one minute. Regarding either ventricle as a blood-meter, multiply 72, the average number of beats per minute in the adult man, by 2 (ounces), and we get 144 ounces, or nine pints, as the quantity of blood in all the vessels of the body. This falls a good deal below the physiologists' estimate. The ventricular working capacity is underrated, or the quantity of blood is over-estimated. This is certain, that after death either ventricle may be found holding fully twice two ounces.

If the blood entered the ventricle by an unguarded opening, there would be no reason why it would not flow back into the auricle and veins, as well as onward into the arteries in each ventricular contraction. To prevent this, on the left side there is a thin but strong membrane attached to the auriculo-ventricular opening, as a bag may be attached to a hoop. As this bag hangs downward into the ventricle, we will suppose the bottom to be cut off and the opposite sides slit up a little distance toward the opening or mouth. Now we have two open flaps below. Narrow them a little, and attach numerous little strings to the lower ends of the flaps; attach these to elastic straps fixed at the other end in such a manner that when the elastics contract the ends and edges of the flaps are brought together. This represents the principle on which the valve between the auricle and ventricle, one on each side, is constructed. That on the left side has two flaps, and has some resemblance in form to that of a bishop's mitre; so this is called the *mitral valve*. That on the right side has three slits, instead of two, and is called the *tricuspid valve*. The elastic straps in this comparison represent the *fleshy columns*, which are rather stout muscular bundles coming out of walls of the ventricles a little above the lower termination of their cavities. Standing upward in the cavity, and half an inch or more in length to the upper or free end of these columns,

the tendinous cords (strings) or threads coming off from lower edges of the mitral and tricuspid valves are attached. Now, when the ventricles contract, two things will happen: the two leaves of the mitral valve and the three of the tricuspid will be drawn together, and so the valves will be closed by the simultaneous contraction of the fleshy columns, and thus the muscles of the ventricles will make pressure on the blood as it is forced out into the arteries; and this pressure will cause a more complete coaptation of the valve-leaves, as it is admitted behind the posterior leaf, and is in front of the anterior. Thus, a valve is formed for each auriculo-ventricular opening, which is complete when it is first closed, but becomes more secure by the increase of the force that it is constructed to resist, unless that force becomes so great as to rupture the structures of which it is composed—an accident which is hardly compatible with a healthy state of these structures. Thus, the blood once received by the ventricles is forbidden a return to the vessels and parts from which it came.

But there is still another prevention or stoppage to be explained. The current of blood being forced into the

FIG. 2.

Fig. 2. Position of the aortic, or the pulmonary valve, in contact with the wall of the vessel, when the valve is open.

FIG. 3.

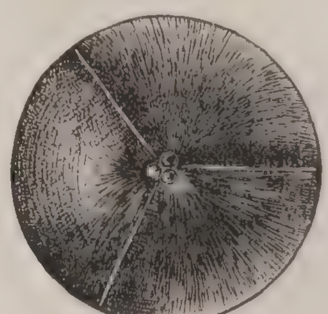


Fig. 3. Position of the same valve when closed.

aorta from the left ventricle, and into the pulmonary artery from the right, what is to prevent its return into the cavity from which it has just been expelled? At the very opening of these arteries a valve is provided, the like of which human ingenuity has never invented or imitated. Each is formed of three cups, of which the outer portion is the artery itself, and the rest is formed of a delicate but strong membrane attached at its sides and bottom to the arterial wall. Thus are formed three cups, each of which is about half an inch deep. The membranous portion of each can fall inward, so as to fill just one-third of the arterial tube. When the blood goes out of the ventricle the membranous portion of these cups yields to the current and becomes closely applied to the wall of the artery, and so offers no obstacle to the flow. As soon as the ventricle ceases to contract, the elasticity of the now distended artery produces a reflux, as well as an onward current. This reflux causes a sudden filling of the cups, and they each fall into the arterial tube, meeting in the centre, and form an obstacle to any return of the blood. The margins of these membranes or folds are thicker and stronger than the other parts, and the evidence of design in their construction is completed in the production, at the exact centre of each (margin), of a prominence of unyielding material (fibro-cartilage) to fill the triangular space that would otherwise be left open at the centre of their lines of meeting. This contrivance is called the *semilunar valve of the aorta*, or aortic valve. In the pulmonary artery it is called the *semilunar valve of the pulmonary artery*, or the pulmonary valve. By this arrangement all the contractile force of these arteries is made to supplement the action of the ventricles and carry the blood forward.

FIG. 4.

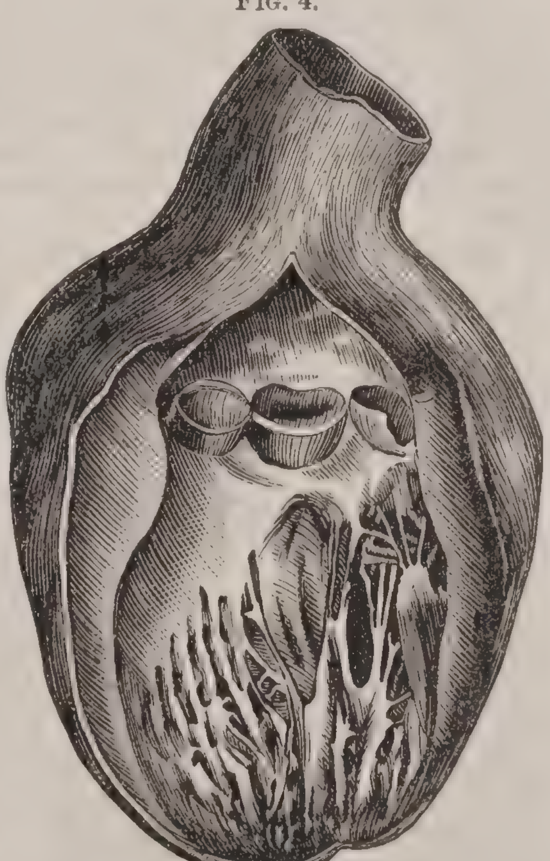


Fig. 4. The left ventricle and the beginning of the aorta, interior view, showing the aortic valve; and below it, and to the left, the mitral valve, with its tendinous cords and fleshy columns.

The muscular structure of the heart is covered on the outside by a thin, diaphanous, attached membrane called the *serous pericardium*, while the name *pericardium* is also applied to the fibrous bag in which the heart moves (heart-sac). This latter is lined on the inside by a diaphanous membrane which is continuous with the visceral serous pericardium; it is "reflected off from the heart," so that the heart-sac has an outer and rather thick layer of fibrous tissue, and an inner delicate lining of serous membrane. This pericardium is attached to the heart only at its *base*, or upper extremity, and where the great vessels pass through it. It lies naturally in contact with the heart, but can in disease be distended and forced off a considerable distance from it. It is made fast below to the diaphragm at the cordiform tendon. Its serous lining secretes a little transparent fluid which serves to diminish friction as the heart contracts and expands.

Endocardium is the name given to the membrane which lines the cavities of the heart. It is a thin, diaphanous structure, resembling the serous pericardium. By the folding of this membrane on itself as it passes from one cavity to another, or from the ventricles into the aorta and the pulmonary artery, the several valves are formed. They are strengthened, however, by the addition of a little fibrous tissue between their folds.

Two *coronary arteries* nourish the heart. They are the first vessels given off from the aorta. Their open mouths can be seen by depressing the membranes of the semilunar valves of the aorta. They descend on opposite sides of the organ, giving off numerous branches till they become capillary and countless. The venous blood of the heart is returned into the right auricle by several veins, which open into it through its outer wall.

The *nerves of the heart* have very little connection with those of the voluntary system, yet it is reported that men have lived who could stop the heart's action at will. The par vagum, the great nerve of the lungs and stomach, sends some of its fibres to the heart; so does the phrenic nerve, though chiefly distributed in the diaphragm. But the hearts of many of the inferior animals will beat after they are removed from the body. The heart of the bullock can be made to beat after such removal by a little irritation. It has been suggested that the muscle of the heart possesses the peculiar power of contracting, in and of itself, without nervous excitation. But since the discovery of nerve-centres of the kind called ganglia about the base of the organ, in the midst of its other structures, it has become probable, if not certain, that an essential part of its nervous supply is centred in itself.

Systole and *diastole* are the contraction and dilatation of the several cavities. The two ventricles contract simultaneously, as do the two auricles, but this action in the latter begins just perceptibly before the same action in the former. The repeated systole of the left ventricle, with what accessories and aids it may meet in its circuit, sends the blood into the right cavities with enough of ventricular force to open and occupy them. So the systole of the right ventricle sends the blood into the lungs with a force that is not wholly lost when it returns to the left chambers of the heart. Thus, diastole is passive, produced by the residual force of the systole of the opposite side.

The *sounds* produced by the action of the heart are two. Anybody can hear them by placing the ear on another person's chest in the region of the heart; indeed, one may hear the sounds produced in his own heart if, in the stillness of the night, in bed, he turn on his side and place the palm of his hand over the ear and rest his head on the pillow. The first begins with the first of the ventricular contraction, and continues till it is ended; the second has no more duration than the sound produced by the snapping of a handkerchief. Half a dozen theories have been proposed to explain the first, but the opinion of the writer is that its essential cause is the friction of the muscular fibres on each other. It has already been stated that in different layers they cross each other at various angles, and they all act together; but even in muscles of parallel fibres a similar sound is produced by contraction. Regarding the second, there is but little difference of opinion, for by experiment it has been proved to result from the collapse or striking together of the aortic and pulmonary valves at the close of the systole. The sound is one or single, because the closure on the two sides is simultaneous.

The force of the heart's action, once regarded as enormous, has been carefully studied in the inferior animals, and by inference it is assumed that the average human heart at the maturity of its strength would sustain a column of blood in a perpendicular tube nine feet high, or a column of mercury of eight inches. This is equal to something less than one-third the pressure of the atmosphere—say, nearly five pounds to the square inch. This estimate relates to the strongest portion of the heart only—that is,

the left ventricle. But a material addition must be made to this reckoning. The atmospheric pressure must be overcome by the central force. When Humboldt and his party ascended the South American mountains they found at the high elevations an unexpected source of annoyance and weakness in a bleeding from the nose, gums, and lungs. The cause of this was twofold: the capillary vessels were not made strong enough to resist the power of the heart when the external pressure was considerably diminished, and their effort in climbing had increased the force, as well as the frequency, of the cardiac contraction. So that, really, the contractions of the left ventricle are effected with a force that can move about twenty pounds through the space of one foot in one second in the course of the vessels. The strength which the left ventricle *can* exert is by no means measured in these estimates, for they relate to the ordinary quiet action of the heart. Its possible power, it is fair to assume, is equal to that of a muscle of equal bulk—including, however, only one side of the ventricular walls—in any other part of the body; and that would much exceed the force of the ordinary heart-beats. The power of the right ventricle is assumed to be about one-half that of the left; but of its actual strength, and that of the two auricles, there are no means of accurate measurement.

The velocity of the blood-current in the larger arteries is assumed, from experiments made on the inferior animals, to be about twelve inches in a second of time. In dogs substances easily recognized, injected into one jugular vein, have been recognized in the jugular vein of the other side in from twenty to thirty seconds. In other words, the blood had completed the rounds of the double circulation in twenty to thirty seconds. It has already been said that such substances, similarly injected, appear in the secretions in one minute. There is but one source of error in these experiments. It is possible that a little of the chemical may pass, by endosmosis, through the thin septum of the auricles from the right to the left, and so shorten its course nearly one-half. It does not seem possible that the law of diffusion would cause the dissolved chemical to outrun the blood-current.

The position of the heart in the chest is easily described. In its shape the organ has an imperfect resemblance to a cone. The base of this cone is uppermost, the apex downward and to the left. The heart is very much imbedded in the left lung. Portions of the lung are behind the left half, to the left of it and in front of it, except about two superficial inches. Its base lies under the third rib of the left side, extending three inches from the middle (median) line of the body; the right auricle, when filled, extends half an inch to the right of the right border of the breastbone (sternum) in the second intercostal space, retreating under the sternum in its contraction. The apex is found in the fifth intercostal space, three and a half inches from the median line. Unite this point with the point three inches to the left of the median line on the third rib by a curve that will cross the fourth rib at a point four inches from the median line, and the left border of the heart is indicated. From the point indicating the apex carry a line to the right and a little upward, so that it will strike the right border of the sternum at the fourth rib, thence upward along this right border to the second intercostal space, and we have followed the external lines that represent the internal position of the heart. In the very rare instances of "transposition of the viscera," while the liver occupies the left upper part of the abdomen, the heart is found on the right side of the chest, filling the space on that side which corresponds with its natural position on the left.

The impulse of the heart, or "the heart-beat," as it is felt on the outside of the chest, has been a subject of much discussion, and each one of the many writers on the subject has proposed a new explanation; but Mr. Searle's studies of the course of the muscular layer in its walls have probably suggested the true explanation. Strong muscular bands are found starting from the base, passing over the anterior face of the heart, winding completely around the apex, some of them passing into the ventricles constituting and ending in the fleshy columns. These, it is evident, will draw the apex forward during contraction, directing it against the chest-wall. There is also a recoil of the whole organ at this moment, so far as the large vessels entering at the base will permit it, in obedience to the laws of action and reaction. If the heart exerts a power that can force ten pounds to move in one direction, there is a tendency to recoil in the opposite direction which is equal to the same number of pounds; and as there is some yielding in the great vessels (which under these circumstances act as ligaments), there is actually some recoil, a part of which is by these muscular bands directed against the wall of the chest. But there is a lifting of the whole precordial region in some cases of enlarged heart. This is probably due to the sudden hardening of the organ as its muscles become tense at the beginning of contraction, and to a real want of room for it in its enlarged state.

Weight of the Heart, and the Dimensions of its Orifices.—The size of this organ varies in the adult a little with the stature and weight of the body, but more with breadth of shoulders, and it is in advanced age a trifle larger than at forty. The average from twenty to ninety years, in the male, is ten ounces—in the female, eight to nine; but twelve ounces in man and eleven in woman would not be pronounced hypertrophy. The *left auriculo-ventricular opening* has, according to Bouillaud, an average circumference of 3 inches 6½ lines; the *aortic opening*, 2 inches 5½ lines; the *right auriculo-ventricular opening*, 3 inches 10 lines; the *pulmonary artery* has a circumference of 2 inches 7¾ lines. Thus, it will be seen that the orifice is smallest when the force propelling the blood is greatest, and everywhere, as that force diminishes, compensation is provided by opening a wider door.

The *fœtal heart*, when it begins to show itself as a beating organ, suggests nothing of the elaborate organization it is to become before independent breathing life can be possible. It is at first merely an enlargement of a beating blood-vessel. From this state it changes to such forms as are permanent in inferior types of animal life, passing from one to another, but always from a lower to a higher type, till it is completed. (See CIRCULATION OF THE BLOOD.) It grows, and gets a single partition through it, with an opening in this partition. This is a single heart of two cavities, an auricle and a ventricle. After a time a partition is developed in the lower of these cavities. It is then a heart with one auricle and two ventricles. Still later, a partition is formed in the upper cavity, with, however, an opening which allows free communication from right to left. This is a heart of four cavities, which, after closing the opening in the auricular partition, prepares the individual for life in "this breathing world." So long, however, as the lungs have to perform no function, they receive but little blood through the arteries which are to be enlarged into the right and left pulmonary; but most of the blood propelled by the right ventricle, instead of turning to right and left, goes directly forward into the aorta at the concavity of its arch, through a channel that will disappear soon after birth, called the *ductus arteriosus*. At the same time, the blood coming into the right auricle, or a part of it, passes freely into the left by the opening described above, which is called the *foramen ovale*. Thus, with the exception of the little blood sent for the nourishment of the lungs, this heart of four cavities acts as a single heart of two cavities. The first act of the new-born is to cry. This is the means appointed by nature to expand the chest and compel the opening of the lungs by the atmospheric pressure. No sooner are the lungs expanded than the blood of the right heart is literally drawn into the lungs, the right and left branches of the pulmonary artery expanding. The ductus arteriosus at the same time closes, and is soon to be obliterated. The blood in the right auricle is all directed into the right ventricle by the mechanical closing of a valve already provided on the left side of the foramen ovale. The valve soon grows into the septum, closing the foramen for ever, leaving, however, a little scar-like depression, which is called the *fossa ovalis*. ALONZO CLARK.

Heart Diseases. Every tissue entering into the organization of the heart is liable to morbid change, and some of them to many such changes. An enumeration of these diseases, and a brief synopsis of the nature and leading phenomena of each, are all that will be attempted in this article.

Hypertrophy of the Heart.—This is enlargement, and the term means nothing more, although there are usually other changes attending it. The heart naturally increases in size with advancing years, but the increase is not considerable, and is not regarded as a disease. Hypertrophy is simple when the muscular walls are increased in thickness and there is no other change in the organ. When at the same time there is expansion or enlargement of one or more of the cavities, whose walls are hypertrophied, it is *eccentric hypertrophy*, or hypertrophy with dilatation. Some of the medical authors recognize a concentric hypertrophy, or an increase in the thickness of the cardiac substance and a diminution of the corresponding cavity or cavities. But the better opinion is that this diminution is not the result of disease, but announces that natural contraction, more or less complete, was the last act of cardiac life. The internal cause of hypertrophy, as the studies of the writer of this article demonstrated twenty-five years ago, is an increase in the number of muscular fibres in the cardiac walls, and not an increase in the size of the original fibres. Cardiac hypertrophy is analogous to the enlargement of the blacksmith's arm or turner's leg; new demands made on its strength produce a multiplication of its muscular

fibres. The external cause of this hypertrophy is generally some obstacle to the circulation, requiring increased strength of muscle to overcome it, as a diseased valve, or a tumor pressing upon a large artery, or a large organ so diseased that the circulation through it is seriously obstructed. It is produced by the mental emotions, which increase the force and frequency of heart-beats, as frequent anger and the anxieties that excite the heart (some depress its action), and, it may be added, by causes that have not yet been discovered. Its subjective manifestations are a strong impulse of the heart-beats, which, however, may be very strong and never be noticed by the affected person, and shortness of breath on exertion, and very little else. The physician discovers it by many signs, the chief of which is the extension of dulness on percussion to the left of the line already given as the left boundary of the healthy heart. The heart, once enlarged, never returns again to its original size, and alone it rarely causes death. This usually is the result of secondary disorders, apoplexy or kidney disease, or it may wait for the intercurrence of other entirely distinct diseases. Indeed, if hypertrophy is produced by obstruction to the circulation, within certain limits it is compensatory and conservative.

Dilatation of the heart is an enlargement of its cavities. The left ventricle may be so dilated that its capacity is considerably greater than would be sufficient to contain the whole of a healthy heart. The dilatation may be in all of the four cavities, or may be confined to one. The ventricles are far more liable to dilatation than the auricles, and the left much more than the right. Dilatation and hypertrophy very commonly go together, so that eccentric hypertrophy or hypertrophy with dilatation, already explained, associated with and caused by morbid changes in the shape and function of the valves, is the most common form of heart disease. The conditions of the heart may be regarded as alternately active and passive—active in systole, passive in diastole. If in the passive state, while the blood is flowing naturally into a heart-cavity, there is at the same time a reflux of blood into the same cavity in consequence of a defective valve, dilatation of that cavity will be sure to occur. The extended wall of such a cavity may not be thicker than it is in health, yet as it bounds a greater space it will require more material, and is hypertrophied by multiplication of the muscular fibres. In this state the heart has been known to weigh sixty ounces, or six times its natural weight. There is one preserved at the College of Physicians and Surgeons in New York, which weighed, when first removed from the body, fifty-seven ounces. Hearts like these are *enormitas cordis*, or *cor bovinum vel taurinum*. They are almost always found in persons who have had rheumatism and heart disease in childhood, and have grown to manhood with a damaged heart. It is noticeable that children bear these cardiac affections better than adults. The body, as it grows, seems to accept and tolerate an amount of such disease that would overwhelm a grown-up person. When it begins thus early, it is usually carried to manhood, and often to advanced manhood. It is the repetition of the attack which is fatal in childhood. Dilatation with hypertrophy is, after it reaches a certain stage of progress, attended by shortness of breath on exertion, sometimes palpitations, irregular heart-beating, and consequently irregular pulse. Its chief danger is, however, an induced or secondary Bright's disease, with dropsical swellings of the legs and body; without which the common forms of heart disease are not generally fatal. There is a form of dilatation of the heart in which there is not only no hypertrophy, but in which the walls of one or all the cavities gradually grow thinner and thinner by fatty degeneration and absorption of the muscular tissue, till this tissue is almost wholly removed, and the walls are stretched and expanded in the effort to expel the blood from their cavities. But this is a rare disease, and may be passed with the statement that it is possible.

Simple *atrophy of the heart* (diminished size and weight) occurs only with wasting diseases, in which the quantity of blood in the system is diminished also, and it should not be regarded as a disease.

Diseases of the Valves of the Heart.—Endocarditis, or inflammation of the lining membrane of the cavities of the heart, is a common attendant on acute rheumatic inflammation of the joints, but it may occur without rheumatism. This inflammation is one of the principal causes of derangement and imperfection in these essential appendages of the heart. Thus, endocarditis expends its force principally on those duplications of the endocardium which constitute the valves. It deposits a new material between their folds, and at first increases their thickness. A portion of this new material is converted into fibrous structure, and finally the fibres contract. The result is, that these valves become thick and unyielding, so that the semilunar cannot be applied to the arterial wall when the blood is forced into the aorta or pulmonary artery. The mitral and tricuspid grow stiff and hard, and do not fully give place to the blood passing from the auricle into the ventricle. Again, this new fibrous structure contracts and shortens the valves, so that their parts cannot meet properly and prevent the reflux of the blood. So blood from the ventricles sent into the great arteries will flow back again into the heart, to be forced out again by new contraction. This is *insufficiency*, or regurgitative disease of a valve. The stiff, unyielding state, when it obstructs the current, is called *obstructive disease of the valve* (*stenosis*). The valves are thickened also by the deposit between their folds of a yellowish substance, made up partly of small microscopic cells, and partly of fat-globules, called *atheroma*, one of the products, it is believed, of a slow or chronic inflammatory action. In time this atheromatous deposit is apt to be converted into, or rather is replaced by, a hard calcareous material, or even organized bone-structure. In the same way the least organizable portion of the deposit of acute inflammation (endocarditis) may slowly be replaced by the same material. This is the *ossification of the valves*. It is not a very frequent occurrence, and is limited usually to a small portion of a valve. But it does mischief, partly as an obstacle to the blood-current, but more by irritating these movable folds and keeping up chronic inflammation in them, and causing thickening, inflexibility, and shortening (just described), or increasing them if they have already occurred.

Rupture of the valves is possible. The aortic valve may yield in the bottom of one of its cups; or the marginal thread may separate from the deeper part of the cup; or the upper attachments of the cups to the aorta may give way; or the anterior leaf of the mitral valve may be perforated; or one or more of its tendinous cords may be broken. These accidents usually occur after the ruptured part has been weakened by the deposit in it of a plate of atheroma; yet they may yield without previous disease, but then always at the time of great exertion of muscular strength in lifting weights, running, jumping the rope, or the like. The reader may remember to have seen a few years ago a newspaper statement that a girl about twelve years old had been seriously injured by jumping the rope nearly 200 times without stopping. It was ascertained in that case that there was rupture at the mitral valve, probably of some of its tendinous cords.

Vegetations on the Valves.—This is another of the results of inflammation. They are minute hard warts that are formed on the free surface of the aortic valve just below its thickened margin. These are chiefly important as being the occasion of the deposit of masses of the fibrin of the blood upon the valves, so producing large granular-looking warts, which obstruct the outflow from the ventricle. Any roughening of a valve-surface by inflammatory or other disease, or by rupture, may cause the deposit of these *fibrinous concretions*. When they occur they not only obstruct the flow of the blood, and partially disable the valves, but portions of them may be washed off into the arterial current, and be carried into a distant organ, as the brain, spleen, or kidney; and one of these reaching an artery too small to receive it, it stops there, and cuts off the arterial blood from all portions of the organ usually supplied by the obstructed vessel. This mode of plugging up the arteries is called *embolism;* the plug itself is an *embolus*.

In the advanced stages of these diseases of the valves and muscular structure it is not difficult to arrive at the opinion that there is heart disease. Shortness of breath, induced by exercise, the strong heart-beating, beating of the vessels in the neck, and, when the kidneys become diseased, the dropsies, the distress produced by lying down, tell the truth but too certainly. But they do not designate the particular form or forms of disease. This can only be learned by listening to the sounds produced by the action of the heart, and by actual measurement by percussion. Thus, in addition to the two natural sounds remaining, from one to four new ones may be produced, called *murmurs*. If there is a murmur heard most distinctly under the breast-bone, where the third ribs are joined to it, and while the ventricle is contracting (in systole), it is probable that there is obstructive valvular disease, either in the aorta or pulmonary artery, and the chances are thirty to one that it is in the former, for in this proportion at least is valvular disease found more frequently on the left than on the right side. Indeed, the grave valvular diseases of the right heart are almost always found to have occurred before birth. The aortic-valve murmurs are heard somewhat more distinctly at the right border of the breast-bone, and those of the pulmonary valve at the left border. If there is a murmur with, and after the second, heard most distinctly at the same place, it indicates insufficiency—that is, regurgitation, as already explained. It will be remembered that the two hearts contract simultaneously, and that the two second sounds are

simultaneous. If, then, the second sound on one side is silenced by deformity of the valve, the valve on the other side is, in all probability, normal, and produces its own normal second sound strongly enough to be heard. A murmur heard most distinctly in the left and lower part of the heart-region (toward the apex) is referred to a diseased mitral valve. If it is in systole, the valve is insufficient, and there is regurgitation from the left ventricle into the left auricle. If it is in "the period of repose"—that is, the period between the second natural sound of the heart and the recurring first—it will indicate an obstruction, from the stiffness or other diseased change in the valve, to the flow from auricle to ventricle, for it is in this period that the auricle is emptying itself into the ventricle. There is nothing in the tone or other characters of these murmurs which indicates the character of the valve-change, except that a musical murmur is sometimes produced by the string left when the thicker border of an aortic cup is split off from the membrane below it, or a similar cord may be formed by rupture of the mitral valve. This must be learned, if it can be learned at all, from the general history and symptoms of each particular case.

With two exceptions, these murmurs are positive indications of change in the form, thickness, dimensions, or structure of these valves. There may be an *anæmic murmur* with the ventricular contraction at the aortic opening when the blood is thin, or does not contain its normal quantity of animalized elements—or, in other words, when it contains too much water (*hydroæmia* and *chlorosis*)—and there may be actual regurgitation, and the corresponding murmur at the mitral valve, caused by the irregular or imperfect contraction of fleshy columns of the left ventricle. The same rules are applicable to valvular diseases of the right heart, except that the murmurs of the tricuspid valve are heard at the junction of the sternum and fourth right rib, and those of the pulmonary artery, at the junction of the left third rib with the same bone.

These are the common forms of heart disease; and there will be in this article no better place than here to say that the popular opinion of their fatality is erroneous. Few persons can hear the announcement that they have disease of the heart, of whatever kind, without hearing in it the command, "Set thine house in order, for thou shalt surely die," and the general expectation is that the death will be sudden. It is true that there are sudden deaths from heart disease, even in persons who have not been ill enough to consult a physician. But these sudden deaths are exceptions. For one such, a quarter of a hundred live on till death comes through some disease which could not have been looked for, or the kidneys become involved in secondary Bright's disease, and perhaps become the chief actor in the concluding scene. The writer discovered in a young lady thirty-four years ago mitral regurgitation and decided hypertrophy of the heart. Now she is the mother of seven children, and, as far as her friends can judge, is in perfect health, except that she has shortness of breath at times. He examined a gentleman sixty-five years of age who had obstructive aortic disease and hypertrophy, in whom he traced the origin of the affection back to an attack of rheumatism when the patient was fifteen years old; yet this gentleman had had the energy to amass for himself a fortune of a million of dollars, and to build up the fortunes of two brothers; and that, too, in the good old times of honest industry. He knows physicians who carry considerable heart disease for indefinite years through an active practice. He knew one, an old gentleman, who had the disease nearly all his life, and continued his professional work till within a few days of his death. His heart weighed after death two pounds three ounces and two drams. The former possessor of the heart which weighed 57 ounces, referred to in this article, became diseased when he was six years old, and he died at twenty-eight, having been active as foreman in a large cotton-mill till four weeks before his death; and even then death was caused more by the kidneys than by the heart. These are not rare instances, but represent the important fact that these diseases, even when extreme, do not generally cause death without aid from another important organ; and when moderate in degree, if the avoidable causes of their increase are avoided, have till the age of sixty and upward but little influence in shortening life, except, again, with the concurrence of other and dangerous diseases.

Pericarditis.—As the lining membrane of the cavities is subject to inflammation, so is the external covering. This and the lining of the fibrous pericardium are alike liable. They are indeed but one membrane. Pericarditis and endocarditis often occur at the same time, being both produced by an extension or migration of articular rheumatism, or rather by that same state of the system which causes the articular disease. Either of these diseases may accompany Bright's disease. Beyond the concurrence with these affections the causes of pericarditis are not well defined. The disease itself, as well as endocarditis, has only been intelligently observed during the present century. The changes produced by pericarditis are, first, an increase in the quantity of blood in the vessels of the membrane; second, absorption of the fluid which in health diminishes the friction between the heart and pericardium; third, the discharge from the engorged blood-vessels of the fluid portion of the blood (*liquor sanguinis*) in condition to form new tissue, *false membrane*, or of the more watery parts, known as *serum*. Both of these products of this inflammation are commonly found, but the serum is usually much the most abundant and the most oppressive. When there is little serous fluid, the disease may run its course with but little general disturbance; but when the quantity is large, there is a rapid pulse, oppressed breathing, and a tendency to faint when sitting or standing. The pericardium is distended by its watery contents, sometimes even to tension; then the normal dilatation of the heart-cavities becomes difficult. But this fluid is absorbed usually in about a week, and the pericardium comes back to its contact with the heart. The common opinion regarding the fibrinous coating produced by inflammation is that it receives blood-vessels, and remains for a time the medium of the union which almost always takes place between the pericardium and the heart, after pericarditis; but according to some late German teachings it readily breaks up into granular and fatty matter, and is carried away by absorption; and they account for the adhesion by stating that the serous membrane is roughened during the inflammatory process by the production on its surface of many little granules or warts composed of fibrin, and that these mutually grow into the opposite surface, and so cause a blending. There is produced by the dry condition of the membrane, caused by the first engorgement of the vessels, a distinct creaking or rubbing noise as the heart moves in the pericardium. This sound is renewed when the fibrinous exudation takes place, heard first in systole, and soon after in both contraction and expansion of the heart. This may be interrupted when the serous effusion lifts the pericardium off from the heart, to be renewed again when the serum is absorbed and contact is renewed. The adhesion above spoken of takes place soon after the renewal of contact, so that in this recurrence the friction-sound does not commonly continue for more than a day. When the area of dulness on percussion is rapidly extended to the left of the heart and above the third rib, and this extension follows the friction-sound, it is produced by the serous effusion. The heart-sounds under these circumstances become a little less distinct as the heart is buried in water. This is the condition indicated by the phrase "water on the heart," popularly supposed to be a common malady, but it is not found to exist in one in twenty of the cases in which it is suspected. Pus is not often found in the pericardium after inflammation. In *chronic pericarditis*, implying chronic distension of the heart-sac, the fluid causing the distension is partly pus (sero-purulent). Chronic pericarditis is a grave disease; it is almost always fatal. In it the pericardium, in one case treated by the writer, was found to contain a gallon of sero-purulent fluid. Acute pericarditis is rarely fatal in the first attack. But in young persons subject to recurring rheumatism each return is more and more dangerous; even the third is not unfrequently fatal.

Pneumo-pericardium (air or gaseous matter in the pericardium).—A man amid the horrors of delirium tremens had a plate on which two teeth were set detached from his mouth, and he tried to swallow it, but it was stopped in the œsophagus (gullet) at a point just behind the heart. A projecting angle of the plate pierced the walls of the œsophagus and pericardium, and opened a passage by which the food and drink passed directly into the latter. Air also entered the pericardial sac. With each contraction of the heart there was a splashing noise, such as is produced by the agitation of a bottle containing air and water. Cancerous disease sometimes produces a similar opening. Gaseous matter of some sort—perhaps carbonic acid gas—is in rare instances liberated in this sac, and, so far as is known to the writer, there is always fluid in the cavity at the same time. The splashing in contraction of the heart is heard even a few inches from the body. The signs of this kind of pneumo-pericardium pass away as the signs of the pericarditis which it accompanies disappear. The perforation of the pericardium with admission of air is almost always fatal, while the elimination of gas in the cavity is not generally attended with serious consequences.

Carditis, or *myocarditis*, is an inflammation of the muscular structure of the heart. It is an occasional attendant of endocarditis or pericarditis, or may occur independently. The symptoms are vague and uncertain, so that it is difficult, and often impossible, to recognize it during life. It is, then, chiefly known by certain conditions found after death. In

limited portions of the left ventricle, or in the septum of the ventricles, the muscular fibres are broken up into fatty matter and fine granules, forming what is commonly called an abscess; indeed, real abscesses are seen when the cause of the carditis is septicæmia (poisoning of the blood by decomposing animal matter), as in gangrene of the lungs. But what is more frequently met with is a cicatrix, one or more, showing that while the muscular element is broken down, its fibrous covering (perimysium) has increased in quantity, and forms a depressed cicatrix, the pyoid matter having been absorbed and carried away. These cicatrices do not always restore the strength of the structure they replace. Hence, they sometimes yield gradually, producing aneurism of the heart. Such is the current view of myocarditis, but the writer gravely doubts whether this kind of *fatty degeneration* of the cardiac muscle is the result of full inflammatory action.

The muscular fibres of the heart sometimes undergo a *fatty degeneration*, in which, without change of size or change in the valves, little globules of oil have replaced the muscular substance. This degeneration weakens the heart, and causes it to act irregularly, changes its color from dark red to yellow, and materially diminishes its firmness. The disease is named after the English surgeon who first described it, *Quain's degeneration*, or, better, *Quain's disease*. The same gentleman has recently announced that there is an hypertrophy of the heart which is caused by an increase of the fibrous structures of the organ, while the muscular elements remain unchanged. The admission of the existence of such a disease awaits further investigation. Should the observation be verified, we shall have to admit into medical nomenclature *Quain's hypertrophy*.

Fatty degeneration has long had a significance very different from that of "Quain's disease." There is always on the outer surface of the heart a limited amount of what is called *adipose tissue*, or, in common language, "fat." This tissue is composed of layers of cells almost large enough to be seen by the unassisted eye, each having one or more capillary blood-vessels passing over and nearly around it. These cells contain oil, the quantity of which is large, when a person is said to be "fat," or they are empty and small, when he is pronounced to be "lean." This tissue is found under the skin in many parts of the body, but not in all, and in considerable quantity in the abdominal cavity. The portion of it that naturally belongs to the heart is small, and lies outside the muscular structure, and within its external serous investment (*serous pericardium*). The quantity of this is sometimes dangerously increased. It increases always at the expense of the muscle of the organ, so that the muscular wall becomes thin at certain places; and as the adipose tissue has not the strength of muscular, which it has displaced, the heart-wall is weakened where it is most increased. The undiminished strength of the other portions of the wall of the same cavity will sometimes cause this weaker part to give way.

Rupture of the heart occurs in the manner just described. It may occur also when the wall of either ventricle is weakened in one part only or principally. This may be the effect of a local development of Quain's disease; of an ulcer caused by the deposit of atheromatous matter on the outer surface, and its subsequent softening; of abscess and pseudo-abscess resulting from myocarditis, as above described; or from *aneurism* of the heart, in which an external tumor is formed by the internal pressure of the blood and the gradual yielding of a limited portion of the wall. There is then really *a broken heart*. When this rupture occurs, the blood pours through it, and soon fills the pericardial sac, and the heart-dilations are prevented. Such a sudden death is preceded by few symptoms, and sometimes by none. This occurrence is, however, rare. When it results from adipose degeneration, it is commonly found in the right ventricle; when from other causes of local weakness, it is usually found in the left.

Heart-Clot.—In rare instances the blood coagulates in the heart before death. This coagulation may be the cause of death, or the subject of it may survive for years. It may occur in the left ventricle, where it may be an inch or more in diameter, but being attached to the raised cross-muscles of this cavity, it does not obstruct the passage of the blood into the aorta. The fibrin which constitutes this mass is arranged in layers, and in most of the few instances that have been seen the central portion had already broken down into a yellowish fluid, which has been erroneously taken for pus. The late distinguished Dr. Cheesman presented to the New York Hospital Museum a ball fourteen lines in diameter, of a dull gray color, composed of several concentric layers of fibrin, having a cavity at its centre which held a teaspoonful of a black thick fluid. This was taken from the heart of a lady who had been subject to fainting, and died suddenly. It had long occupied the left auricle, resting unattached directly over the opening into the ventricle. The auricle was only moderately enlarged, but the irritation caused by this body had produced fibrous thickening in all the approaches to the opening. This was an evidence that the ball had been in that position for a long time. The collection of the coloring-matter in the central cavity, the laminated arrangement of its walls, and the dull opaque appearance of the fibrin, proved the same thing. It had all been produced in one coagulation, probably in one of the faintings. The opening had become elongated by the pressure of the blood-current, so that the blood passed on the right and left of the ball, till, at the last moment, a vigorous contraction of the auricle drove the ball so far into the opening that it acted as a ball-valve, and in this position it was found after death. Clots and fibrinous aggregations, then, can be formed in the heart-cavities during life, and may be the cause of death, either suddenly or remotely. The clots found after death usually fill one or more of the cavities, and are attached to the cavity-wall *in all its circuit*, or they are divided into two parts —one yellow or yellowish-white, glistening, and not wholly opaque; the other very dark, almost black. In hundreds of instances, such coagulations as these have been regarded as ante-mortem clots, and the immediate cause of death. If a clot is formed before death, the heart must contract upon it at least once. One such contraction is sure to separate it from its adhesion through a considerable portion of its circumference. The production of the light-yellow clot is only possible when the blood has been at rest long enough to allow its red corpuscles to sink in the fluid as far as this buffy portion extends; and the reason for its forming so considerable a portion of the whole coagulum is that the blood does not usually coagulate in the body till about six hours after death.

Embolism and Thrombosis of the Coronary Arteries of the Heart.—The first of these terms refers to the fact that clot or fibrinous concretion may form in the heart, as already explained, and that a part or the whole of it may be detached and carried forward till it reaches an arterial division too small to receive it; it cannot go back, but must remain there, preventing the circulation of arterial blood in the artery beyond it, till it is disintegrated and carried away. It is possible that a portion of a fibrinous concretion on the valves or wall of the left ventricle, so detached, may enter one of the coronary arteries, and so obstruct it. But a section of the aortic valve covers the mouth of each of these vessels during the contraction of the ventricle, and they receive their blood in the reflux, after the closure of the valve; and the force that propels it is the elasticity of the aorta. This protected condition must render such an accident very rare. What we are more familiar with is *thrombosis*, or the coagulation of blood in the artery. This cuts off half of the supply of blood to the heart; a pretty rapidly increasing feebleness of the heart-action follows, with a weak and slow pulse, great prostration of strength, extreme paleness of countenance, coldness of the feet and hands, and after these symptoms death occurs in ten to twenty hours in the majority of the cases.

Angina pectoris (breast-pang) is a suffocative pain felt in the position of the heart, shooting into the left shoulder and arm to the elbow or wrist; or it is a sensation such as the patient thinks would be produced if the heart were grasped in the hand of a strong man and crushed; or it is such as would be produced by a load of ice laid over the heart. It is attended by the dread of instant death. It is a neuralgia, and more than a neuralgia, and commonly occurs in those who have disease of the heart, although it has been known to depend on injury of the spinal cord near to the head. The particular conditions of disease that produce it have not been ascertained very accurately. Dr. Forbes, however, found that ossification of one or both of the coronary arteries was associated with it oftener than any other single change. It is produced in many persons having disease of the heart by walking. This form of it subsides with rest for a few minutes, but is immediately reproduced by the same cause. That which occurs when the patient is at rest or sleeping is more severe, and has often a duration of one to four hours. It is only rarely the immediate cause of death. The pulse is often entirely unaffected by it.

A *nodule of bony* or *calcareous matter* has been seen buried in the muscle of the heart, producing great disorder in the heart's action without change in its size. A *hoop of similar material* has been found encircling the organ between it and the heart-sac, in some places more than an inch wide and wholly unyielding. *Tubercles*, such as produce consumption when they occur in the lungs, and cancer, are not unknown in the heart.

The *parasites* of the heart are the *Cysticercus* and the *Echinococcus*. The *Cysticercus* has no popular name. It is like a bottle or cyst, and has a retractile neck, or, by its etymology, tail. It is most frequently found in the

flesh of pork, and when introduced from that source into the human intestine it elongates by the growth of joints on its bottle extremity, and forms one of the varieties of tapeworm (*Tænia solium*). In the heart it lives out its life as a bottle and a neck, undergoing no transformation. It is large enough to be seen by the unassisted eye. The *Echinococcus* is again a bottle, a round bottle, and a neck, the extremity of which is armed with a double circle of hooklets. This neck is extended when the animal is, so to speak, confident of safety, but on any alarm it, with its hooklets, is drawn into the centre of the bottle. This little creature, when received into the intestines, like the *Cysticercus*, is produced by its lower portion growing into a succession of joints, resulting in a tapeworm different from the *Tænia solium;* found often in dogs and some other animals, not yet found in man.

Deformities and Defects.—The growth of the heart may be arrested in any of the imperfect stages referred to under the head of *Fœtal Heart.* It may have but two cavities, an auricle and ventricle, or two ventricles and one auricle, or two auricles and one ventricle; the pulmonary artery may be small or not developed; so also the aorta may be small or wholly obstructed at its origin; the foramen ovale may remain open after birth; there may be an opening in the septum of the ventricles which will permit free communication from one to the other; the ribs over the heart may be absent, so that the skin is its only chest-covering—indeed in certain rare instances the organ has been found beating and wholly outside the chest (*ectopia cordis*), suspended by its vessels, which were internal; in rare instances there is no heart: such a fœtus usually has no head or arms, but lumpy growths instead, and must always be one of twins, the circulation being produced by the twin heart through the placenta. The most common of these defects is an open foramen ovale, permitting venous blood from the right auricle to mingle with the arterial in the left. This is produced when the current through the pulmonary artery is obstructed. This state of the heart is known as *morbus cœruleus.* The name, however, applies equally to other congenital defects that permit venous blood to pass into the left heart or into the aorta to circulate in the arteries, producing blueness of the skin. This color is not constant, except in a few, but is produced by crying, a fit of coughing, excitement, or unusual physical exertion. It is not incompatible with a life of limited duration, but is likely to be attended by diminished growth of body, bodily and mental sluggishness, shortness of breath, palpitation at times, and occasional fainting. If the subject of any of these defects survive the first years of life, the defect alone will not probably be the immediate cause of death, but it will diminish the power of resisting a fever, a pneumonia, or any grave disease, and especially one that disturbs the balance of the two circulations. A woman died in Bellevue Hospital of pneumonia, aged forty years. While sick, *cyanosis* (blueness) was very marked, and finally extreme. She was attended by two grown-up daughters, who both assured the physician that they had never seen anything of that appearance before, and the patient informed us that she had been in perfect health till this attack of pneumonia. She had earned her living and supported her family by making the paper boxes in which matches are sold. After death the heart was found a little above the normal size, and a round hole, an inch in diameter, was discovered at the top of the ventricular septum, permitting a very free flux and reflux from one cavity to the other if the balancing force of the two ventricles was at any time lost. But it seemed that it had never been lost till the inflammation of the lung obstructed the pulmonary circulation, and turned the venous blood into the left heart. The heart of two cavities and obliteration of the pulmonary artery must be attended by an enlargement of the bronchial arteries if life can be maintained even for a short time. If there are two auricles and one ventricle, the foramen ovale must remain open; if there are two ventricles and one auricle, there is a permanent opening in the septum; if the aorta is obstructed, the ductus arteriosus remains, as well as the opening in the septum. In all these cases the action of the organ is practically the same as in a heart of one auricle and one ventricle.

The reader may say that in view of this long list of diseases it is a misfortune to possess a heart, and lose confidence in its physical integrity. But he should remember that less than $\frac{1}{25}$th (4 per cent.) of all the deaths in New York City are caused by all these agencies put together; that a very large proportion of the deaths so occurring are in persons of advanced age; that even when disease fastens on the heart, it does not, as a rule, preclude the hope and expectation of "length of days;" and that among the persons with whom he is in daily intercourse, counting from youth to age, not one in a hundred has any kind of disease or defect of the heart; and he may not only regain his confidence, but may come to the conclusion that the vital offices of this organ cannot be performed with less risk of morbid changes, since it must contribute its quota to the agencies which make death inevitable, and "the days of our age threescore years and ten." ALONZO CLARK.

Heart's Content, a v. on the S. E. side of Trinity Bay, N. F.; lat. 47° 50′ N., lon. 53° 20′ W. It is the landing-place of the Atlantic telegraph cables extending to Valentia, Ireland. Here is a fine telegraph-building. The harbor is good; most of the inhabitants are fishermen. P. 880.

Heartt (JONAS C.), b. in Troy, N. Y., in 1793, became a successful hardware-merchant, and was (1836–42) mayor of Troy, and in 1854 Speaker of the New York assembly. He was for many years a trustee of the Rensselaer Polytechnic Institute. D. in New York City Apr. 30, 1874. He was distinguished for business enterprise and benevolence.

Heat. It is difficult to give a *scientific* definition of the term *heat* in any other way than by the enunciation of the "dynamic theory," upon which all its manifestations depend. In its most common acceptation it refers to physical effects which bodies in nature, in certain conditions, produce upon others. A person exposed to the direct action of the sun or a fire experiences a feeling of comfort or discomfort, which is involuntarily attributed to some sort of emanation from these sources; and bodies in certain conditions are observed to produce effects on other bodies near them, or in contact with them, which are attributed to the same kind of influence. It was formerly supposed that a material agent passed from one body to another. Under this hypothesis it was conceivable that a body might "contain" heat, and that this substance might exist in greater "quantity" at one time than another in the same body; and although the term *heat* and the expressions "quantity of heat," "transfer of heat," and others having significations which involve the idea of quantity, are still retained, even in scientific explanations, the quantities referred to are not those of matter, but of dynamic effects.

The dynamic theory of heat—a theory which has revolutionized the physical sciences—is founded on the assumption that all substances in nature are composed of indefinitely small material molecules, which are maintained by the forces which act upon them in a constant state of vibration or oscillation. When a body, whether solid, liquid, or gaseous, becomes hotter in the popular sense of this term, the scientific condition involved is that the vibrations of the molecules become more rapid; and a decrease in the velocity of vibration of the molecules accompanies or produces the effect called cooling. The forces which act upon the molecules, and which determine the velocity of vibration, are presumed to be their own mutual attractions and opposing centrifugal forces, to which is added the external pressure of the atmosphere or other medium which surrounds the body. Each molecule in motion possesses a certain *vis viva*, or living force, corresponding to that which is manifested by *bodies* having visible or sensible motions; so that the living force due to the heat-vibrations may be said to represent generally the heat-condition of the body.

The dynamical process of heating or cooling may be effected in various ways. The most common and universal phenomena of this kind in nature take place through *radiation* of heat. If a heated body be placed near another which is cooler, a transfer takes place until an equilibrium is attained in their conditions. This equilibrium is assumed to be effected through the vibrations of an elastic medium which pervades all space, and which is composed of ponderable molecules so small that they penetrate the spaces between the molecules of other substances, and form, so to speak, an atmosphere around them. The ethereal atmosphere may be said to perform the same office in the transfer of heat that the common atmosphere performs in the phenomena of sound. The cooling of a body through radiation implies a loss of living force through the impact of its molecules with the atoms of the ethereal atmosphere, waves or vibrations being communicated to the latter, which are propagated in all directions. Another body within the influence of these waves will receive heat by the impulsion communicated to its molecules; or, in other words, an increased rate of vibration will be communicated to its molecules, its living force will be increased, and it will become hotter. In any system of bodies or particles, if no chemical action takes place, and no mechanical or dynamic influence is exerted upon the system from without, any change of heat in one of the bodies of the system is accompanied by a corresponding change of the same kind in an inverse sense in one or all of the other bodies: when, however, any external force is applied to the system, such as friction, pressure, or a shock, the effect of such external energy exerted is manifested by a change of heat in the whole system; and, according to the principles of conservation of energy, these opposite effects must be equivalent.

The variations of the heat of a body are thus known by common observation to be connected with the action of ordinary forms of dynamic energy.

The supposed motions of the separate molecules of bodies with which the phenomena of heat are connected cannot be made evident to the senses, and hence the dynamic theory was the result of inductive reasoning, and not of observation. It had its origin in the fundamental principle of the science of dynamics, connected with that force in nature which arises from the inertia of matter. The well-known law of dynamics, that when the velocity of a material particle or of a body is changed by the action of a force, the *work of the force* in a given time is equal to the *variation* of the *living force* of the particle or body, is a law which may be derived directly from the definition of the mass of a body and the principle of measuring forces by velocities. Applied to a system of bodies acted upon by a system of forces, this theorem of dynamics assumes the following general form of expression: *The aggregate work of the forces applied to a system in a given time is equal to the variation of the living force of the system in the same time.*

The discovery that this theorem of the transformation of energy, as applied to sensible finite velocities of bodies, is applicable to the insensible or indefinitely small vibrations of the molecules of a body which accompanies the changes of volume and the excitation of energy in the phenomena of heat was definitely demonstrated and received as a new theory about the year 1852. During many years previous to this the subject of the true theory of heat had been discussed, and the new theory was even announced in precise language by Lavoisier and Laplace as early as 1780, in the following language (Verdet, *Théorie Mécanique de la Chaleur*): "Other physicists think that heat is only the result of insensible vibrations of matter." . . . "In this system heat is the living force which results from the insensible movements of the molecules of a body;" "it is the sum of the products of the mass of each molecule by the square of its velocity." "We shall not decide between the two preceding hypotheses [referring to the material theory]. Many phenomena appear favorable to the latter. Such is, for example, that of the heat which is produced in the friction of two solid bodies; but there are others which are applied more simply in the first." "Perhaps they both have place at the same time." Laplace afterwards, however, in his discussions on heat, defended the material theory. The experiments of Rumford and of Davy in 1798 and 1799 upon the heat produced by friction served to demonstrate the failure of the *material* theory, and gave a new impetus to investigation.

The discoveries which led to the foundation of the science of thermodynamics were made between the years 1842 and 1849, and were due to the independent and separate investigations of Dr. Robert Mayer, a German physician, Mr. Colding, an engineer of Copenhagen, and Mr. Joule of Manchester, England. An approximate determination of the *dynamic equivalent* of a unit of heat was first published by Mayer; while Mr. Joule was the first to give by exact experiments the determinations which established the principle, and placed the value of the dynamic equivalent beyond doubt. The final development of the science into a definite form, immediately following the determinations of Mayer and Joule, was principally due to the labors of R. J. E. Clausius, Mr. M. Rankine, and Sir William Thomson, their most important researches having been published in the years 1849 to 1851. To these illustrious philosophers and mathematicians we are principally indebted for the establishment of the science of thermodynamics.

Heat being no longer regarded as a material substance, but its phenomena being those of force, motion, and work, it is proper to explain the meaning of the term "quantity of heat," which is retained even in scientific discussions. For this purpose it will be necessary first to explain the signification of the term *temperature*. The thermometer is so common an instrument that its construction need not be described. Degrees of temperature, as exhibited when the thermometer is brought in contact with a body, indicate, as is well known, various conditions of the body in regard to heat, and under the material theory it was rational to suppose that the lowering of the thermometer when in contact with a body would indicate the quantity of heat which passed out of the body; or, in other words, variations in the thermometer might be taken to represent variations of quantities of heat in a given mass. Under the dynamic theory, however, a change of heat in a body indicated by the thermometer involves three effects, an increase or decrease of the living force due to the heat-motions, the work of the force of attraction of the molecules, due to the change if the body expands or contracts; and also the work of the external pressure upon the bounding surfaces. The variation of heat in the body is the resultant of these effects. If the body heated or cooled retains its form and dimensions, then the only effect of an external modifying force is to produce a change of molecular movement, provided no visible or sensible motion is communicated to it; and this increment of living force, or "heat," will be indicated by the thermometer, or become *sensible* through the thermometer. The *dynamic equivalent* of a certain quantity of heat or living force will in such a case be the work of the exterior force which produces it. One mode of finding such an equivalent may be mentioned, especially, as that followed by Mr. Joule. He found by experiment the quantity of work expended in producing friction among particles of water, corresponding to the heating of one unit of weight, or one pound, one degree of the thermometer. The water was taken at its maximum density, so that the only effect of friction was the heating effect, no part of the external force being expended in producing expansion or in overcoming the attraction of the particles and the force of external pressure; or at least these effects were insensible. It was found that 772 foot-pounds of work correspond to an elevation of temperature in one pound of water one degree F. This quantity of heat being represented by 1, the dynamic equivalent of a unit of heat in English measures is said to be 772 foot-pounds. This operation being merely a transformation of the energy of a force exerted into another form of energy, the energy of motion in a mass, is necessarily invariable. To find the equivalent *thermal* effect in any other substance, it is only necessary to find experimentally the quantity in weight of such substance that will have its temperature changed one degree by the quantity of heat thus represented by unity. It is obvious that any other quantity of water might be taken, as, for instance, a kilogramme, and any other thermometer, the centigrade for instance. This would give a different unit of heat, which would correspond, however, to a different quantity of work of the modifying force, but the relations of the two units and the quantities of work would be invariable. Thus, a French unit of heat, a "caloric," is such a unit; it corresponds, nearly, to four British units, the exact ratio being 3.968, the quantity of work equivalent to a calorie being 423.55 kilogrammètres.

Various modes of determining the dynamic equivalent have been adopted, and laborious experiments and investigations have been made by eminent physicists with this view. These experiments include those in which heat is generated by friction of water, mercury, and iron; experiments with steam and air; the electro-magnetic machine; and the shock of bodies, all leading substantially to the same result, small differences only occurring in the determinations arising from causes of loss of heat or work which could not be always experimentally ascertained, the accepted result being that stated above.

The determinations by Joule in 1843–45, which first gave to the dynamic equivalent a value worthy of confidence, may be said to have been the starting-point of modern progress in the science of heat. We are thus led to the enunciation of the fundamental principle of the dynamic theory of heat, sometimes called the principle of equivalence of heat and work—viz. *Heat and dynamic energy are mutually convertible;* the law of this equivalence, stated with reference to British measures, being that *1 unit of heat corresponds to 772 foot-pounds of dynamic energy exerted.* A quantity of heat expressed in British units of heat may therefore be expressed as work by multiplying the number of units of heat by 772, the result being work in foot-pounds.

The general conclusions to be deduced from what precedes are as follows: (1) The word *heat* implies a condition of bodies in nature which is a condition of energy, or capacity for producing changes. (2) This capacity is indicated by the thermometer; and one kind of change effected between two bodies in different conditions through the action of heat is the *transfer of heat*, by which bodies are brought to the same degree of temperature, as indicated by the thermometer, through radiation or actual contact. (3) The changes of heat in a body are accompanied by corresponding changes of the density and elasticity, or by changes in volume and in pressure, upon the medium which envelops the bounding surfaces of the body. (4) Among the changes produced by a change of heat also may be enumerated chemical, electric, and magnetic changes. (5) Heat, considered as a source of energy, is identical with the kind of energy called living force, and may be regarded as a quantity capable of being measured by its dynamic effects; and in this respect it is subject, like other forms of energy, to the law of conservation. This law, as applied to heat, gives rise to the principle of equivalence, and its proof is the determination experimentally of the *dynamic equivalent* of heat.

In a complete study of heat two very different systems of investigation are necessary. One consists in the determination of the quantities of heat which are absorbed or dis-

engaged by bodies when they pass from one condition of heat to another through intermediate states, in which the relation between the temperatures, volumes, and external pressures are considered. In this system of investigation the equivalence of heat and work is to be taken into account, and also the principles which form the basis of the science of thermodynamics. The phenomena of greatest interest to be considered are the changes of volume and of states of aggregation of bodies which accompany changes of heat; the performance of external work through the elastic force in the expansion of bodies; the applications of heat to electricity, magnetism, and chemistry. The investigations are prosecuted partly by experiment and observation, and partly by analytical investigation, the experimental investigations furnishing usually the constants or coefficients of the mathematical formulas.

The other class of investigations relates to the phenomena of heat as exhibited between bodies in which the interchange of temperatures is effected without any modifying external cause, and embraces the laws of the *propagation* or *transfer* of heat; the study of radiant heat in its relation to the wave-motions of the ethereal medium; and the action of bodies in reference to radiation and absorption. In these investigations the phenomena of heat and light are regarded as identical in character or as resulting from the same physical agencies.

The first system of investigation mentioned will be first discussed. Let it be supposed that the exterior forces which act on a body are uniform normal pressures, such, for instance, as the pressure of the atmosphere upon the surfaces of solids and liquids, or the pressure, equal and opposite to the elastic forces, of the sides of vessels upon the gases or vapors which the vessels contain, the temperatures of the bodies being uniform throughout their whole extent. Then the condition of any body will be completely determined by the relations which exist at any instant between the three quantities, p, the pressure, v, the volume, and t, the temperature—a relation usually expressed mathematically in the form of an equation, $f\ (p\ v\ t) = 0$, the expression $f\ (p\ v\ t) = 0$ being read *function* of $(p\ v\ t) = 0$. It is a common algebraic principle that in such an expression, *when the relations are known*, if any two of the quantities are known, the third can be determined. If the volume, and temperature, for instance, be taken as independent variables, the relation may be expressed $p = f\ (v\ t)$; and if the pressure and temperature be taken as independent variables, the volume would be expressed $v = f\ (p\ t)$. $t = f\ (p\ v)$ is another form of the same expression.

It is a matter of common observation that bodies assume different forms and conditions or states, which depend on their conditions in regard to heat. These states give rise to a classification of bodies under three general states, known as solid, liquid, and gaseous. A solid substance is one the molecules of which, though in a state of incessant vibration, nevertheless are retained in such a state of equilibrium between the attraction of the molecules for each other and the elastic force due to heat, that the body, as a whole, retains the state which is called solid. In the liquid state the molecules of the body move freely among themselves, but are not permanently attached to each other. In other words, a single molecule may transfer its contact from one set of molecules to another set, subject to the condition that the particles or aggregated molecules remain in mutual contact, like so many minute spheres or globules, rolling freely upon each other, but still retained in mass by the attractive forces which act through their point of contact. The term *gas* refers to that condition of substances in which the molecules are nearly or quite removed from the spheres of their mutual attractions. *A perfect gas* implies that this removal is complete. A gas will thus continue to expand indefinitely if it be not enclosed by an envelope. Nearly all substances in nature are known to assume all these states; and it is considered probable that all substances might be brought to these states under proper conditions of heat and pressure. Perfect gases do not probably exist, although some gaseous substances have never been reduced even to the liquid state; such are common air and its constituent elements, hydrogen, nitric oxide, carbonic oxide, and marsh-gas. These take the name of *permanent gases*. They approach so nearly to the conditions of perfect gases that in all technical applications they may be treated as perfect gases.

The effect of a transfer of heat to all substances is similar in all three states of aggregation. The transfer of heat to a solid not only causes an increase of molecular vibration, which is exhibited by an increase of temperature, but an expansion, which consists in the separation of the particles from each other, or an increase of volume; but this expansion involves the overcoming of the external pressure of the air or other enveloping medium. In the case of liquids, a transfer of heat to the liquid produces precisely the same effects as in the case of a solid—increase of molecular vibration, disintegration, involving expansion of volume and overcoming of the external pressure. In the case of perfect gases, the molecules having already become entirely separated, the effect of a transfer of heat is exhibited simply in increase of vibration of the particles, or increase of sensible heat (temperature), and capacity for overcoming the external pressure. When heat is abstracted from a body the effects described above are all reversed. The molecular oscillation is diminished, the volume contracts, and the external pressure, acting through the volume passed over by the contracting envelope, will perform work which appears in the heat abstracted.

These general laws may be illustrated or explained in a very simple manner, according to the fundamental theory of heat which has been enunciated, by the use of algebraic symbols. Suppose a definite quantity of any body, solid, liquid, and gaseous, to receive heat from some external source. Let the quantity of heat received, expressed in units of heat, be denoted by Q. The body will undergo the following changes: 1st, an increase of molecular movement involving an increase of actual energy or living force, which may be represented by W; 2d, a certain amount of expansion or change of position of the particles, which involves a certain amount of work in overcoming the attractive forces of the body, which may be represented by R; 3d, the change of volume involves the work of overcoming the external pressure to an amount which may be represented by S; and since Q is expressed in units of heat, and W, R, and S are supposed to be expressed in units of work—foot-pounds—we shall have, for the total effect of the heat transferred, $Q.E = W + R + S$; E representing the dynamic equivalent of a unit of heat. This expression is the enunciation, algebraically, of the principle of equivalence. The quantity W in the general expression represents a quantity of work equivalent to the change of *vis viva* of the mass of the body from the change of heat-motions of the molecules; the quantity R, the *work* of the forces of attraction of the molecules due to their change of position in reference to the centres of attraction; and S, the work of the external pressure. The two former are often combined in discussions under the head of *internal work*, while the latter is called *external work*, and the expression of equivalence then assumes the form $E.Q = U + S$; U designating the *internal*, and S, the *external* work, their sum being equivalent to the change of heat Q expressed in foot-pounds, or multiplied by E.

The principle of equivalence of heat and work is sometimes called the "first law of thermodynamics." Another law, called by some authors the "second law of thermodynamics," by others the "principle of Carnot," and by others, again, the principle of the "equivalence of transformations," depends upon the relation which exists between the quantity of work which a body can perform when undergoing an indefinitely small change of heat, and the temperature of the body at the time of the change. The principle, as enunciated by Clausius, is, that the capacity of a body for producing changes or performing such indefinitely small amount of work is proportional to the absolute temperature of the body, the *absolute temperature* being the temperature measured from a zero-point, at which any thermometer would stand if a substance to which it was applied were to be deprived of heat. This is a theoretical limit downward of all thermometers; and, although it cannot be realized in nature, yet its position on any scale may be determined. For Fahrenheit's scale it is at 459.4° below the ordinary zero, and for the centigrade scale 273° below. It follows from the principle above enunciated that if an indefinitely small quantity of work, represented by a change in the pressures, volume, and temperature of a body, be represented by $d\,z$, expressed in thermal units, then $d\,Q$, or the corresponding change in the heat of the body, will be represented by $d\,Q = T\,dz$; T being the absolute temperature. From this we get $\frac{dQ}{T} = d\,z$, $\frac{dQ}{T}$ being the transformation value of the work $d\,z$ at the temperature T. When a body passes through a series of changes in regard to heat, and finally returns to its original state, the process is called a cycle, and if the operations are all reversible—that is, if the body undergoes expansions and contractions which with the pressures involved are reversible—the total work performed, both internal and external, will be zero, and we shall have $\int\frac{dQ}{T} = 0$. The expressions $f(t, v, p) = 0$, $E\,Q = W + R + S$, or $E\,d\,Q = d\,W + d\,R + d\,S$, and $\int\frac{dQ}{T} = 0$, are three expressions on which the mathematical theory of heat are based, and which, when developed and combined for all changes of a body, constitute the science of thermodynamics.

It will be impracticable in this very general account to do more than refer to some of the problems relating to the expansive action of heat in fluids as illustrations of such applications. The relations between the temperature, pressure, and volume of unit of weight of any particular substance being given, the principles of thermodynamics serve to *compute* the quantity of heat which will be absorbed or rejected by unit of weight of that substance under given circumstances—the computation, for instance, of the *real and apparent specific heat*, the *heating and cooling of gases and vapors by compression and expansion*, the *free expansion of gases*, the *flow of gases and vapors*, the *latent and total heat of evaporation*, the *latent heat of fusion*, and the *efficiency of heat-engines*. Most of these subjects have been treated also by experimental methods. It is by experiment alone that the relations between the pressure, volume, and temperature are first determined. The specific heats of substances, or the numbers which are found in tables of specific heats, represent the quantity of heat required to change the temperature of 1 pound of the substance 1° of the thermometer under certain standard conditions as to pressure, volume, and temperature. The specific heat of water at the temperature of its maximum density, 39.1° F., is the *unit of heat*, represented in work by 772 foot-pounds. It will readily be observed that since the quantity of heat required to raise the temperature of 1 pound of a substance 1° involves not only an increase of temperature, but a certain quantity of work if the body be allowed to expand, the specific heats will depend on the amount of expansion. The specific heats of solids and liquids, which are found in the ordinary tables of specific heats, are generally average values of the apparent specific heats, the true values increasing generally with the temperature.

It is difficult, if not quite impracticable in most cases, to determine the real specific heats of solids and liquids at constant volume experimentally, owing to the impossibility of retaining substances in these states at constant volume, except under very great pressures. For gases the specific heats are usually restricted to two particular cases—(1) those in which the volume is retained constant during a change of temperature, and (2) those in which the pressure maintained is constant. It is difficult also, in the case of gases and vapors, to determine the specific heat at constant volume, on account of the dissipation of heat through the sides of the vessel containing the substance. The specific heats at constant pressure are therefore determined experimentally, and the specific heat at constant volume computed. For a perfect gas the specific heat at constant pressure may be shown to be equal to the specific heat at constant volume, added to the thermal equivalent of the work performed by the gas in expending, at constant pressure, an amount corresponding to one degree of temperature.

Numerous problems arise in physical and mechanical investigations in which the intermediate changes between the initial and final states are not the object of examination, but the initial and final states alone, and the total quantities of heat involved in the changes.

The specific heats of substances have been referred to as the quantities of heat in thermal units required to cause a change of temperature in one unit of weight of the substance one degree. To find the quantity of heat corresponding to any given change of temperature in a given quantity of any substance requires, then, three factors—the *number of pounds*, the *change of temperature in degrees*, and the *specific heat;* this last factor for water (at 39.1°, or maximum density) being unity, and for other substances the specific heats may be found from the tables. A quantity of heat represented by Q—that is, a change of heat equivalent to Q expressed in heat-units—may be expressed by symbols thus: $Q = W \times c \times t$, W being the weight of the body, c the specific heat, t the number of degrees of change of temperature. It is evident that if three of the above quantities are the known quantities in any problem, the fourth can be determined. This is a very simple but a very useful formula, which serves to solve a large class of problems which occur in everyday life, and which requires only ordinary arithmetical or algebraic knowledge for its application. For instance, suppose we have a cubic foot of water, about 7½ gallons, at the temperature 60° F., in a wooden vessel, and we wish to heat the water to the boiling-point by putting in heated stones; required the number of pounds of stones heated just to redness that will produce this effect. The water being at 60°, and being heated to 212°, the change of temperature of the water will be 152°, and the quantity of heat to be taken up by the water will be $Q = 62.4\text{lbs.} \times 1 \times 152 = 9484.8$ units of heat. Suppose W to be the weight of stones required; the specific heat of stones is about .22, and at a red heat the temperature of the stones may be estimated at 1000° F. The quantity of heat lost by the stones when immersed in the water, if both are brought to 212°, will be $Q = W \times, 22 \times (1000° - 212°) = W\ 173.36$; and since this quantity of heat must be equal to that gained by the water, we have $W \times 173.36 = 9484.8$.

$$W = \frac{9484.8}{173.36} = 60.5 \text{ lbs.}$$

Similar applications might be made for liquids mixed with liquids, for the quantity of heat abstracted from gases by contact with solids, and for any change of heat of a substance when the weight, specific heat, and change of temperature are known.

Coefficient of Expansion.—The rate of expansion of a body is the increase of volume which takes place for equal increments of temperature, the volumes being referred in each case to the volume of the same body at a standard temperature. When a body exists in the form of a rod or bar, the length of which is to be determined under different degrees of heat, the increase of length is called the linear expansion. Tables giving coefficients of expansion may be found in nearly all works on heat.

Liquefaction, Melting, or Fusion.—The continuous transfer of heat to a solid, causing a continuous rise of temperature and expansion of volume, produces ultimately a change of aggregation or change of state to the liquid form, called the fusion, melting, or liquefaction of the substance. This law is general for substances which do not change their composition in changing their state. For substances which do not change their composition the following phenomena occur: (1) "Each substance begins to melt at a certain temperature, which is constant for the same substance if the pressure be constant." (2) "The temperature of the solid remains at this constant point from the time when fusion commences till it is complete." (3) "If a substance expands in congelation, its melting-point is lowered by pressure; but if a substance contracts in congealing, its melting-point (or point of congelation) is raised by pressure." The laws which have been enunciated are subject to certain qualifications, such as slow process of cooling and variations of external pressure, which may lower the temperature of solidification, but under the same conditions they are invariable. The continuous application of heat to a solid at its melting-point does not raise its temperature as long as any portion remains solid; and, commonly, the abstraction of heat from a liquid at its point of solidification does not lower its temperature as long as any portion remains liquid. The change of state is also usually accompanied by a sudden change of volume. Some substances, however, pass from the solid to the liquid state without showing a definite melting-point, becoming plastic between these states. Glass and iron are examples, and instead of a definite melting-point a certain interval of temperature is required for the change.

Latent Heat of Fluidity.—The increase of the specific heat of a solid as it approaches its melting-point appears to be connected with the increase of the coefficient of expansion, which also increases simultaneously. At the melting-point the whole of the heat applied to a body is apparently required to overcome those molecular attractions which keep the molecules in the state of proximity belonging to the solid condition. The *work* of the heat applied is thus absorbed or expended without producing increased molecular vibrations. Heat which would have become sensible heat in the pure solid or liquid disappears or is transformed into the work of overcoming these molecular attractions, and is said to become *latent*. The latent heats of fusion of a few substances, estimated in units of heat, have been determined experimentally.

The total change of volume from the lowest to the highest temperature consistent with the solid or liquid condition of any substance is very small compared with the actual volume of the body which undergoes such a change, and hence the influence of the external pressure upon the bounding surfaces is very slight during the change. In other words, the work performed by heat in expanding liquids and solids may be regarded as chiefly expended in producing change of temperature and change of aggregation, the external work in all ordinary cases, especially when the solid or liquid is exposed only to atmospheric pressure, being so small that it may be disregarded. In the case of bodies in the gaseous condition, however, this is different. Gaseous bodies cannot exist in a fixed or determinate volume ordinarily, unless they are enclosed within bounding surfaces or envelopes. The force of cohesion among the particles of a gas no longer exists as in the solid and liquid states, and the heat-condition of a perfect gas consists simply in the oscillation of the molecules (which is represented by the actual *temperature* of the gas), and the outward pressure or repellent action of these molecules, which must be resisted by the envelope. For a definite volume of a perfect gas thus confined there are thus but

two conditions involved in changes of heat—the temperature and the pressure which it exerts against the bounding surfaces of the envelope. If such an envelope is perfectly elastic, and heat be transferred to the gas (the external pressure, such as the pressure of the atmosphere, remaining constant), the effect will be an expansion of volume. This expansion will be much greater than the expansion of liquids and solids for the same increase of heat.

The coefficient of expansion or increase of *volume* of the permanent gases under such circumstances, for an increase of temperature of 1° F., has been determined, through the well-known experiments of Regnault and others, to be 0.002035, or $\frac{1}{491.4}$ of the volume of the gas at 32° F., and for 1° C., 0.00366, or $\frac{1}{273}$ of the volume of the gas at 0° C. Thus one volume of a perfect gas at 0° C. or 32° F. will become $1 + 0.00366$, or $1 + \frac{1}{273}$ volume at 1° C., or $1 + 0.002035$, or $1 + \frac{1}{191.4}$ volume at 32° + 1° F. A slight difference in the coefficients was found by Regnault for the different gases, and also a slight difference at different external pressures, but for purposes of ordinary calculation the coefficients of all *permanent gases* may be regarded as the same.

We may conceive, however, that when heat is transferred to a gas enclosed within an envelope (for instance, within a cylinder which is closed at one end by a movable piston), the *volume* and the *external pressure* may change simultaneously, and thus the three quantities which determine the condition of the gas—viz. the volume v, the pressure p, and the temperature t—may all be variable quantities. The relation between these quantities has been found, and is represented by what is well known as the law of Mariotte and Gay-Lussac. The following simple equation is the mathematical enunciation of this law: $P\,V = R\,(a + t)$ or $P\,V = R\;T$; R representing a constant for any particular gas, and T the absolute temperature; in which P is the external pressure upon unit of surface, V the volume of unit of weight, R a constant which depends on the specific gravity or density of the gas (the weight of this unit of volume), T the temperature, and A the number 273, Centigrade degrees being employed, and 459.4 if Fahrenheit degrees be employed. The quantity P, defined as the external pressure upon a unit of surface, is evidently also the outward pressure or elastic force of the gas.

It is well known, from common observation, that many liquids, such as water, alcohol, and ether, if not confined in close vessels, become transformed into a condition resembling the gaseous condition at ordinary temperatures, and disappear *as liquids*, being diffused in the atmosphere as vapors. This transformation takes place in nearly all liquids more or less rapidly at ordinary temperatures, though for some no such transformation takes place at very low temperatures. It is considered probable, however, that this quiet change takes place in all liquids above certain fixed temperatures. Many solids, also—*e. g.* ice and camphor—pass to the state of vapor without passing through the intermediate liquid state, under certain conditions. If a *closed* vessel be partly filled with a liquid, the space above the liquid will thus ordinarily become filled with the vapor of the liquid, and the *elastic force* of the vapor will depend on the nature or *kind* of liquid, the *volume* of the enclosed space, and the *temperature*. If heat be applied to the liquid in this condition, the formation of vapor will continue, the vapor exerting a certain additional elastic force depending on the *temperature alone*, as long as there remains any liquid. Evaporation will cease when the application of heat is suspended, and, if the liquid be cooled, *condensation* will occur; so that the relative quantities of liquid and vapor, and the elastic force of the latter in a given space and for a given liquid, are dependent on the condition of heat or *temperature* solely. Similar phenomena will follow if the extent of the enclosed space be enlarged or contracted, the *temperature remaining the same*. If the space be enlarged, an additional quantity of the liquid will pass into the state of vapor; and if the space be contracted, a certain amount of the vapor will be reconverted into liquid. For every liquid in an enclosed space there is thus a certain tension or elastic force depending on the temperature (whatever be the relative volumes of the liquid and the free space above it) which is the greatest elastic force that the vapor can have at each particular temperature. If the vapor be compressed, liquid is formed by condensation, and if the space be enlarged, or the external pressure which confines the vapor be diminished, additional vapor will be formed, and the elastic force will remain thus constant for each constant temperature. A vapor in this condition in presence of its liquid is said to be *saturated*.

This law of vapors—viz. that the elastic force in a given volume depends solely on the temperature—is approximately true whether the space in which the vapor is formed be vacuous, or whether it contain air or any other permanent gas, provided that the liquid exerts no solvent or chemical action on the gas. The combined elastic forces or the resultant pressure on the sides of the vessel, when a permanent gas is present which is not acted upon by the liquid, is nearly the sum of the elastic force of the gas and the maximum tension of the vapor at the given temperature. It was found by Regnault, in experiments on this subject, that liquids do not give off vapor of quite so great a tension in a space occupied by a permanent gas as they do in a vacuum, and that the difference increases as the temperature rises; but for technical applications under ordinary temperatures the law may be considered true. The only difference between evaporation in a vacuum and in a space occupied by a gas is, that the formation of vapor takes place more slowly if a gas be present—a fact of great importance in the economy of nature connected with the evaporation of water from the surface of the earth.

When heat is continuously applied to a liquid in a closed vessel, the space enclosed remaining constant, the temperature of the liquid and vapor will continually increase if there be no dissipation of heat through the sides of the vessel: the quantity of the liquid will diminish and the pressure will increase, the vapor remaining saturated as long as any liquid remains. After the last element of liquid shall have passed to the state of vapor, if heat be still applied the vapor begins to assume the properties of the permanent gases. Under this condition, if the temperature could be indefinitely raised, or the volume of the space indefinitely increased, under a constant temperature, the vapor would finally arrive at a state corresponding to that of perfect gas, and would then follow strictly the law of Mariotte and Gay-Lussac; and hence it may be said that the physical properties of vapors, when sufficiently expanded or at sufficiently high temperatures, and when they are not in contact with their liquids, are identical with those of perfect gases.

Complete Vaporization.—The temperature at which the complete evaporization of a liquid in a given space will occur depends on the relative volumes of the liquid and the space above it. With alcohol, the empty space being about equal to that occupied by the liquid, complete vaporization takes place at about 400° F. In the case of water, if the space occupied by the water be about one-fourth of the whole internal volume of the vessel, the liquid will be wholly converted into vapor, if the vessel be strong enough to resist the pressure, at about 680° F. (*Cagniard de la Tour*). The elastic force of the vapors of *mixed liquids*, as determined by Regnault, is the sum of the tensions of the two vapors taken separately if the liquids have no solvent action on each other. With water and ether the tension of the vapor of the mixture is less than that of the sum of the tensions of the two liquids taken separately, being hardly equal to that of ether alone. When two liquids dissolve each other in all proportions—*e. g.* water and alcohol—the resultant tension is intermediate between the tensions of the separate liquids.

Boiling-points.—The *boiling-point* of a liquid is an expression which usually refers to a fixed or standard pressure upon the exterior surface, the pressure of the atmosphere, and it indicates the temperature at which the elastic force of the vapor is equal to such standard pressure. *Ebullition* is a phenomenon which takes place when heat is applied to the lower part of the mass of a liquid which has been heated to the boiling-point, and arises from the formation of bubbles of vapor at the point at which the heat is applied, the bubbles rising through the liquid and escaping at the free surface. The formation of such bubbles may occur before the whole mass of the liquid has been heated to the boiling-point, but in this case the bubbles are usually condensed before they reach the surface.

"*Boiling-point due to the pressure*" is an expression sometimes employed to designate the *temperature* corresponding to the *pressure*, whether that temperature be above or below the standard temperature for which the boiling-points of the tables are determined. The boiling-point of a liquid under any pressure is, properly speaking, the lowest temperature at which ebullition *can* occur, since there may be circumstances under which ebullition, or the formation of vapor, does not take place until the liquid has been heated many degrees above its tabulated boiling-point. If the free surface of a liquid be covered or surrounded by another which has a higher boiling-point, the bubbles of vapor of the interior liquid having no escape, this liquid may attain a temperature higher than its ordinary boiling-point. The boiling-points of liquids are also influenced by the nature of the vessel. Water has generally a higher boiling-point by several degrees, under atmospheric pressure, in

glass vessels than in iron vessels. Liquids holding solid bodies in solution generally boil at higher temperatures than when the liquid is pure.

Nebulous or *vesicular* vapor is that which arises from the condensation of particles of a vapor in the atmosphere or in its own vapor, constituting cloud or mist. If heat be applied to vesicular vapor, the condensed globules evaporate and the vapor becomes transparent, though still saturated. If heat be abstracted, new particles are condensed; the globules coalesce and fall in drops.

Superheated Vapor.—When a vapor at the point of saturation is removed from contact with its liquid and heated, it is said to be *superheated.* A saturated vapor not in contact with its liquid may become superheated by the enlargement of the space which contains it, for it will then admit of compression without condensation, and will have a pressure, at the same temperature, inferior to that of saturated vapor, and also a temperature more elevated than that due to saturation for the same pressure.

Spheroidal State.—It is a matter of common observation that when water is sprinkled upon the horizontal flat surface of a hot stove, the drops are not immediately converted into steam, but roll about on the heated surface, and gradually evaporate, retaining all the time the spherical or spheroidal (flattened sphere) form. This condition is not peculiar to water, but may be experimentally demonstrated with all volatile liquids, and is usually described as the *spheroidal state.* It arises from the fact that the rapid formation of vapor makes a layer or bed of vapor on which the drop rests, and which prevents actual contact between the drop and the surface. The phenomenon may occur also whether the heated surface be liquid or metallic, the condition being that the surface shall be heated to a point considerably above the boiling-point of the liquid drop. Experiments by Boutigny showed that the *lowest* temperature at which a metallic vessel will cause the spheroidal state is 289° F. for water, 273° F. for alcohol, and 141° F. for ether. The spheroidal condition, sometimes called "Leidenfrost's phenomenon," illustrates an important fact in regard to the transfer of heat which will be treated of subsequently. It shows that for the rapid transfer of heat to a liquid there must be actual liquid contact with the heated surface—the interposition of a thin film of gas acting as an obstruction to the passage of heat.

Humid Vapor.—The vapor of water which is usually employed in industrial operations usually contains particles of water mechanically suspended in the vapor. The steam is then not only saturated, but *wet.* When in the simple condition of saturated vapor it is called *dry steam. Steam-gas* is a term applied by some writers to superheated steam, or steam in the condition of a perfect gas.

Expansion of Dry Saturated Steam.—If dry saturated steam be enclosed in a vessel, and the volume be enlarged by extending the space in such a manner that the elastic force of the steam performs no *work*, the steam will become superheated—*i. e.* its temperature will be, at the end of the expansion, higher than that due to the boiling-point corresponding to the pressure, and it will remain transparent. If, however, the expansion takes place against a pressure, so that there is work performed by the elastic force, condensation of a portion of the steam will take place, and the mass of steam will present a cloudy appearance. This fact was first determined theoretically by Rankine and by Clausius, and experimentally by Hirn. It is supposed that no heat is communicated to, or abstracted from, the vapor during the expansion. This condensation does not take place in steam sufficiently *superheated.* From the experiments of Fairbairn and Tate on superheated vapors it appears that for an interval of about 18° F. above the temperature due to the pressure the coefficient of expansion of a superheated vapor is greater than that of perfect gases, but above this temperature the relation between the volume and pressure follows closely the law of Mariotte and Gay-Lussac.

The elastic force of saturated vapors may be illustrated experimentally by taking several barometer-tubes, filling them with mercury, and inverting them in a trough of mercury. The surface of the mercury in each tube will drop about six inches, leaving a vacuous space at the top of the tube. If now a small quantity of liquid water be passed up into this vacuous space in one tube, alcohol into another, and ether into another, the quantity of liquid being more than can be evaporated in each space at ordinary temperatures, it will be found that a portion of each liquid will be instantly evaporated, and the mercurial column will be depressed in each tube, but by different amounts. If each tube be now heated by surrounding it with warm water, the elastic force of each vapor will be increased, the mercury will descend in the tubes, and will finally press the mercurial column down to the level of the reservoir. At this point it is evident that the elastic force of each vapor is equal to that of the atmosphere, or *1 atmosphere.* But the temperature of the liquid and vapor in each tube will be different from that in the others. The temperature of the watery vapor will be found to be 212° F., the temperature of the alcohol 173°, and the temperature of the ether 95°. These are the temperatures at which the elastic forces of these vapors are equal, respectively, to 1 atmosphere. At these temperatures the liquids will *boil* under the atmospheric pressure. If the temperatures be reduced below these points, the pressure remaining the same, a portion of the vapor in each tube will be liquefied; and, the temperatures remaining the same, if the pressure be increased above 1 atmosphere, a portion of each vapor will become liquefied. The tension or elastic force of 1 atmosphere is thus the *maximum tension* which the saturated vapors can bear at the temperatures given above. If the three tubes and the basin of mercury could be enclosed in a chamber in which, by compression of the air, different pressures can be obtained higher than 1 atmosphere, it would be found that, for each of the substances named, the temperatures at which the mercury will be forced down to the level of the reservoir under each additional atmosphere of pressure will be increased. The elastic force of saturated vapors is thus *independent of the volume and proportion of liquid mixed with the vapor, and depends only on the temperature.*

It has been found impossible to determine, *theoretically*, the relation which the temperatures bear to the pressures, and reliance is placed mainly on the celebrated experiments of Regnault. These tables show that no *simple* relation exists between the maximum tension and the temperature. Different empirical formulas have been proposed, however, to express this relation with certain degrees of approximation.

The effects which follow the transferring of heat to a body, solid, liquid, or gaseous, have been described by employing the simple algebraic expression, $Q\,E = W + R + S$. The quantity W represents a change which is exhibited by a change of sensible heat or change of *temperature.* That part of the whole heat transferred which produces the work R and the work S is expended in producing a change in the relative positions of the particles and in *external* work; and disappears as *sensible heat*—*i. e.* it is not afterwards contained in the body or exhibited in the body as heat. These two quantities of heat, R and S, become *latent.* The term *latent heat* is a technical expression, designating a quantity of heat which has apparently disappeared, but which really has been employed in producing changes in the body, in the form of work, other than the change of velocity of molecular motion or change of *temperature.* By reversing the process by which heat is thus made to disappear, this latent heat may be reproduced.

The total heat necessary to transform 1 pound of water from the liquid condition at the melting-point of ice to the condition of saturated vapor or steam at the temperature t is called the *total heat of vaporization*, and represents the sum of the heat which is required to heat the water from the temperature 32° to the temperature t, and the heat which disappears as latent heat. By algebraic symbols this sum is evidently expressed as follows: $Q = c\,(t - 32°) + L = q + L$; c being the mean specific heat of water between the limits of temperature, and L the latent heat of vaporization at the higher temperature.

The results of Regnault's experiments, already referred to, led him to the discovery that *the total heat of the vapor of water from the temperature of melting ice increases at a uniform rate as the temperature rises.* Regnault's formula by which this law is expressed is as follows: $Q = 606.5 + 0.305\,t$, Q being the total heat in calories, and t being expressed in centigrade degrees. The equivalent English formula is $Q = 1091.7 + 0.305.\,(t - 32°)$. The expression for the total heat of vaporization is $Q = q + L$, from which we have $L = Q - q$; that is, the latent heat of vaporization is equal to the total heat, diminished by the quantity of heat necessary to raise the temperature of the liquid from the melting-point of ice to the final temperature of evaporation.

Density of Gases and Vapors.—The term density refers to the degree of approximation of the particles of a body to each other. It is specific when it refers to the number of particles or quantity of matter in a unit of volume of a given substance, this unit being a standard for all bodies. In English measures, 1 cubic foot is the standard unit of volume, and the weight of a cubic foot of a substance in any condition is the *specific weight* of that substance in that condition. It is usual to express specific weights in terms of the weight of a unit of volume of a standard substance, the latter weight being taken as unity. Water is the general standard for specific weights, but for gases and vapors air is also taken as a standard, the weight of 1 cubic foot of air being unity. The following table shows the relative

densities at 32° F. and one atmosphere pressure of some of the gases commonly met with:

Relative Densities.

Air	1.00000	Water	1.0000000
Nitrogen	0.97137	Air	0.0012932
Hydrogen	0.06926	Nitrogen	0.0012562
Oxygen	1.10563	Hydrogen	0.0000896
Carbonic acid	1.52901	Oxygen	0.0014298
		Carbonic acid	0.0019774

The following are the *weights* of 1 cubic foot of each of the same substances in pounds avoirdupois under the same conditions—viz. at 32° F. and one atmosphere pressure—except for water, which is taken at 39.1° F.:

Weight in Pounds Avoirdupois of 1 cubic foot.

Water	62.425
Air	0.08073
Nitrogen	0.07860
Hydrogen	0.00559
Oxygen	0.08926
Carbonic acid	0.12344
Steam	0.0502

The density of a perfect gas at any other pressure and temperature may be found from the law of Mariotte and Gay-Lussac, $PV = RT$, by substituting for V the volume of 1 pound, $\frac{1}{D}$, and for R its value for the gas under consideration. Fahrenheit's scale being used for T, the values of R are:

Air	$R = 53.35$
Nitrogen	$R = 54.93$
Oxygen	$R = 48.26$
Superheated steam	$R = 85.77$

The *specific volume* of a gas is the volume of unit of weight. In English measures *1 pound avoirdupois* is the unit of weight, and to obtain the specific volume we have $V = \frac{1}{D}$, the reciprocal of the *specific weight. Specific volumes*, or *volumes of 1 pound of each* of the *substances named, are given below* in cubic feet, for 32° F. and 1 atmosphere:

Air	12.3870
Nitrogen	12.7226
Hydrogen	178.8909
Oxygen	11.2032
Carbonic acid	8.1011
Steam, at 212°	26.4216
Steam theoretically, at 32°	19.9203

Chemical action, when accompanied by the development of light and heat, is usually called *combustion. Inflammation* denotes that kind of combustion in which the products are gaseous and flame is produced. *Ignition* is simply the incandescence of a body unattended by chemical change. The phenomena of heat being those of rapid molecular motions, the heat and light developed by combustion must indicate an increased molecular movement in the particles of bodies, when combustion takes place, proportional to the amount or force of the chemical attractions. The heat of combustion may therefore be rationally explained by saying that intense and violent increase of motion in the particles of the compound is produced by the chemical attractions. Ordinary combustion consists in the combination of oxygen with various substances, the temperature required being different for different substances, and varying for the same substance with the rapidity of the combustion. Phosphorus combines slowly with oxygen at 77° F.; charcoal burns *slowly*, but does not ignite below a red-heat; sulphur burns in air at 550°. But most elementary substances require to be heated to redness before combustion in oxygen or the air takes place. According to Peclet, solids emit light or become dull red at about 950° F. Most substances burn with great rapidity when in a finely divided state. Fine dust of many substances burns in this manner with a rapidity which in a closed space may give rise to such a degree of pressure from the expansion of the gases as to produce phenomena like explosions. A single spark may thus produce instantaneous combustion in a space filled with fine dust.

Porous substances often absorb and condense air within their pores; oxidation begins, accompanied by an elevation of temperature, which accelerates the oxidation until the process produces spontaneous combustion. Charcoal-powder, masses of tow, cotton, or rags, saturated with oil, sawdust mixed with oil, moist hay, and other substances in similar conditions, have thus been known to burst into flame. Wood does not take fire in oxygen gas, according to Thénard, at temperatures below about 600° F., but if it be long exposed to a high temperature, even longer than this, in air, it may become partially charred, and rendered so inflammable as to favor the conditions of spontaneous combustion. Under such conditions a single spark or accidental exposure of the substance to a higher degree of heat may cause it to take fire.

Ordinary combustion is accompanied usually by *incandescence* and flame. If a solid burns without flame, the heat evolved at the surface of contact of the air and the solid causes an elevation of temperature of the residual solid particles, which gives rise to a *glow* or *incandescence*, the color and intensity of the light being dependent on the temperature. Dull red indicates the lowest temperature at which light appears, and dazzling white the highest degrees of heat; between these extremes the light passes from dull red or cherry red to bright red, dull white, then to yellowish, and finally to a bluish white, and a full or dazzling white. If the combustible is gaseous, the combination with oxygen may be instantaneous, producing by the violent concussion of the air an explosion; or it may be gradual. In order that the phenomenon of explosion may take place, the combustible gas must be mixed uniformly with air or oxygen in the proper proportions, and then heated to the burning-point. A similar effect takes place when a solid combustible, such as sulphur or charcoal, is mixed with a *nitrate* or other solid which gives up its oxygen readily. In both cases it is only necessary that the temperature be raised to ignition at one point by friction, percussion, or the contact of a hot body, the action being then propagated instantaneously throughout the whole mass. When the combustion is gradual, the contact of the combustible gas with oxygen or the air takes place usually at the bounding surface of the gas; as, for instance, when a jet of gas issues from an orifice or when a column of gas rises from the wick of a candle. The inner mass of the combustible gas does not ignite at first, and the ignited surface assumes the form of a hollow cylinder or cone. The brightness and color of such a flame depend not only on the degree of temperature, but upon the presence of solid incandescent particles in the flame. These solid particles arise sometimes from the compound produced by the combination, but in ordinary forms of combustion of fuel they are particles of carbon. Hydrogen gas, carbonic oxide, alcohol, and sometimes coal-gas, burn thus with a dull flame. A bright flame is produced by compounds which contain carbon, from which a portion of the carbon becomes separated by the heat produced, the separated particles being first heated to incandescence, and afterwards burned by contact with the air. If the quantity of air supplied be not sufficient, these solid particles may become cooled and form soot. The visible part of smoke is this soot cooled below red heat. Marsh-gas, olefiant gas, ether, volatile oils, resins, fats, etc., when burned, give off carbon in this manner, and may form bright flames, or produce, if the separated particles are not all burned, soot or smoke. *A purely gaseous substance does not become luminous at any degree of temperature, however high, luminosity being caused by particles of incandescent solids in the gas.*

The combustible ingredients of ordinary fuel, and of the liquids and gases usually employed for the generation of heat, are *carbon* and *hydrogen*. These substances combine readily with oxygen, the former producing by the combination carbonic acid or carbonic oxide, and the latter water. The oxygen required is usually supplied by the atmosphere, which contains about one-fifth of its weight of this substance.

As a general rule, all chemical *combinations* produce heat, while chemical *decompositions* cause a disappearance of heat. In the combination of two simple isolated elements heat is evolved only, but where the combination is effected through the simultaneous decomposition of compound substances, the heat evolved is the resultant of that which is produced by the combination of the combustible elements and that which *disappears* through the decompositions. In compounds containing oxygen and hydrogen in the proper proportions to form water, the surplus hydrogen only contributes to the development of heat when combustion takes place.

An important consequence of the dynamic law of heat, and one which has been experimentally verified, is, that all chemical changes are accompanied by corresponding changes of heat. *Chemical action and heat are mutually convertible;* and although the quantity of *heat* evolved or annihilated in any chemical change can only be experimentally determined, yet it has been established that the *combination of any two bodies, chemically, is attended by the evolution of a quantity of heat equal to that which disappears in their separation.* The quantities of heat evolved or disengaged in chemical combinations are found experimentally by means of *calorimeters*. These measures of heat are employed in various forms, and operate, generally, in such a manner as to exhibit the effects of the heat evolved in acting on a given substance, such as the melting of ice or the raising of the temperature of a given quantity of

water, the quantities of heat being thus indirectly measured by being transferred to some body in which these effects can be estimated in units of heat. In this manner the heat evolved in the combination of both simple and compound bodies has been determined by many observers, especial authority being given to those of Favre and Silberman. In the chemical changes which compound bodies undergo it may be stated as a general law that the heat which appears or disappears is the resultant of the action of the simple elements; and where a compound consists of *combustible* elements only, like *carbon* and hydrogen, *the heat disengaged is the sum of the quantities of heat disengaged by the combustion of the elements separately.* This law, though not indisputably established, is considered sufficiently exact for all ordinary purposes. The *temperature* at which bodies combine, although affecting the rapidity or energy of chemical action, does not affect the *total* quantities of heat involved in the change.

The transfer of heat from a heated body to one that is at a lower temperature consists, according to the dynamic theory of heat, in the loss of living force, due to heat-motion, in the hotter body, and an equivalent gain of living force in the colder body. When the two bodies are quite distinct, or separated, and do not form part of one and the same body, this transfer takes place generally, as has been stated, through the intervening ethereal medium by the process of radiation. Through this medium there is a tendency to equilibrium of temperature or of living force, the relative exchange of heat being inversely proportional to the masses of the bodies. It is probable that the transfer of heat between two bodies is always thus accomplished by *radiation,* although, technically, a distinction is made between the transfer at appreciable distances, or *radiation,* and the transfer by actual *contact* of the two bodies. Heat may be transferred practically also by the actual change of position of the body in which it exists. In this mode of transfer, which is called *convection* or carrying, the transfer is a mechanical one, and is not in any way connected with the change of heat in the body carried. Although this mode of transferring heat is of great importance in the arts, and especially in connection with the generation of steam, involving as it does the question of circulation of heated fluids, yet after the convection of heat by the transfer of the body in which it exists, whether that body be solid, liquid, or gaseous, there still must take place the transfer from the heated body to another, by the process of radiation or contact, before the heat can be utilized *as heat.* Thus, a heated gas or liquid may be carried through pipes, or may be mingled mechanically with other gases or liquids for the purpose of conveying heat, but the final process by which that heat is actually transferred from the heated gas or liquid to another body, *as heat,* must depend on the dynamic laws of heat. In adopting, therefore, the usual designations of the modes by which heat is transferred—viz. radiation, contact, convection—it is to be understood that the latter is a mechanical mode, and need be discussed only in connection with the carrying of bodies to the places or points at which it is desirable or necessary for them to impart their heat to other bodies.

The experiments of Melloni are usually quoted as giving the first direct proofs that radiant heat like light consists in vibrations of the ethereal medium. It is now a matter of almost universal popular knowledge that the white light of the sun is composed of rays of various colors, which may be produced at will by means of a prism. The rays are deviated in the well-known order from red to violet, the number of vibrations for the red rays being 481 billions per second, and for the violet 764 billions. The greatest intensity of light, according to Fraunhofer, is in the yellow, and the least in the violet. This spectrum is also a *heat spectrum,* the heat spectrum extending over about four times the space occupied by the visible spectrum. In the heat spectrum the maximum of heating effect lies beyond the red, on the obscure part of the spectrum. The greatest calorific effect is thus produced by rays for which the ethereal vibrations present waves of greater length and greater duration than those of the red rays of the light spectrum. The heat-rays beyond the violet, although not visible, are known to influence chemical action, in certain bodies, in a remarkable manner. While the light spectrum is thus only a part of the total spectrum, the invisible rays possess the same general properties as the light rays, and it appears that the ethereal vibrations affect the eye only between certain limits. A heated particle of a substance communicates vibrations to the ethereal medium whether the particle be surrounded by air or whether it be in a vacuum. In ordinary language, the particle sends *rays* of heat in every direction; these rays or waves proceed indefinitely, without change in strength or character, and with the same velocity as light, until they are intercepted by some body in the paths of the rays. If such a particle be a *molecule* on the surface of a body, it is evident that it will send off rays of heat in every direction not intercepted by the body itself.

It is a common error to suppose that the intensity of *a ray* of heat diminishes as the distance between the body emitting and the body receiving the heat increases—*i. e.* inversely as the square of the distance. The law of the inverse squares of the distance is rather a geometrical than a physical law, and refers to the action of *one* body on *another,* whether the question be one of heat or gravitation. A body or collection of molecules possessing a certain amount of living force, due to heat, imparts this energy to the ethereal medium in all directions, and the quantity of energy *intercepted* by another body will depend on the distance between the two bodies—the quantity thus intercepted by the *same body* at *different distances* being inversely proportional to the squares of the distances.

The inclination of the surface which intercepts radiant heat determines, for similar reasons, the quantity of radiant heat received. Even if the rays be supposed parallel, as in the case of the radiant heat of the sun, it is apparent that all the heat conveyed by a beam of rays may be represented by the section of the beam perpendicular to its direction. If the beam falls upon a surface inclined to its direction, the amount of surface over which the beam will be distributed will be greater as the inclination of the surface is greater. If the surface be plane, when it becomes parallel to the axis of the beam, it will receive no heat. Hence in estimating the intensity of radiant heat by units of surface, the inclination of the receiving and absorbing surfaces must be considered. The regions of the earth's surface near the poles, from their approach to parallelism with the direction of the sun's beams, receive less heat on each square mile of surface than is received by a square mile at the tropics.

Attempts have been made to determine the quantity of heat in units of heat emitted by any given surface at a given temperature, supposing the temperature of the absorbing surfaces to remain at constant temperature. MM. Dulong and Petit, whose researches in this and other branches of physics are universally known, made numerous experiments on this subject, which resulted in the determination of certain general laws. The experiments were made to determine the rate of cooling of bodies in an enclosed space, the space being filled with different gases, and the enclosure being maintained at constant temperature. The results were enunciated as follows: (1) "The cooling of a body results from radiation and from contact of the fluid or gas which surrounds it. (2) The rate of cooling, from radiation alone, is the same for all bodies at the same temperature, but its absolute value depends on the nature of the surfaces." It is represented by the following formula: $Q = Ca\ (a^{t'}-1)$, in which Q represents the number of French units of heat emitted by one unit of surface in a unit of time; C, a constant depending on the nature of the surface of the radiant body; a, the number 1.0077; t, the temperature of the enclosure or absorbent; and t' the *excess of temperature* of the radiating body over the absorbing body in degrees centigrade. (3) "The rate of cooling by *contact* of a fluid surrounding the heated body is also the same for all heated bodies, but its absolute value does not depend on the *nature of the surface,* and depends only on the form of the heated body."

For air under ordinary atmospheric pressure the law of cooling by contact is expressed by the formula $Q = C'.t^{1.233}$, in which Q represents the quantity of heat in calories abstracted from one unit of surface by the air in a unit of time; C' a constant depending on the form of the surface; and t the excess of temperature of the body over that of the air surrounding it.

The *relative* radiating powers of different surfaces at 180° F., as determined by Leslie, are represented approximately in the following table:*

Lampblack	100	Mica	80
Paper	98	Graphite	75
Resin	96	Tarnished lead	45
Sealing-wax	95	Mercury	20
Crown-glass	90	Polished lead	19
India-ink	88	Polished iron	15
Ice	85	Tin plate	12
Red lead	80	Gold, silver, copper	12

It is stated by Magnus that the greater or lesser density of the surface has no influence on radiation from the surface. Platinum which has been strongly hammered possesses the same emissive power as platinum carefully annealed. But the same surface roughened with emery-paper has its emissive power greatly increased. As far as quantities of heat are concerned, it is doubtful whether anything further than such *relative* determinations can, in the present state of

* Watts, *Dict. Chem.*

knowledge, be depended on, the actual or absolute quantities for different temperatures being still uncertain. The radiating powers of different bodies or different surfaces represent also their absorptive powers, and, as has been already stated, radiant heat does not affect the eye, or solids do not become luminous, until the temperature reaches about 950° F.

The radiation and absorption of gases, according to Prof. Tyndall, present very peculiar laws, and our knowledge of the action of gaseous bodies on radiant heat is still very slight. It has been demonstrated experimentally by Prof. Tyndall that a ray or beam of heat is wholly or almost wholly transmitted through moderate distances in air, oxygen, hydrogen, and nitrogen; and, conversely, no radiation takes place from the heated particles of these gases. The only mode, therefore, by which heat can be imparted to these gases, or by which they can impart heat to other bodies, is by actual contact. Some other gases possess remarkable powers in absorbing or intercepting *dark* radiant heat. The absorption of radiant heat by vapor of water diffused in air, under circumstances of average humidity, was shown by Prof. Tyndall to be seventy times greater than the absorption by dry air. As the quantity of watery vapor was increased, the amount of heat absorbed was increased.

Conduction of heat refers to the transmission of heat from one part of a continuous and homogeneous body to another part of the same body. When a body is heated at one point, the heat is transmitted with greater or less rapidity throughout the whole mass, depending on the nature of the body and the differences of temperature of the heated part and other parts of the body. If the body is terminated by two parallel surfaces which are each kept at a constant temperature, there will be a flow of heat, so to speak, at a constant rate from the hotter surface to the other by conduction. The *law of conduction* under these circumstances is, that the quantity transmitted for a unit of area perpendicular to the direction of transmission, and per unit of time, is directly proportional to the difference of temperatures of the parallel surfaces, and inversely proportional to the thickness or distance which separates the two surfaces. If t_1 and t represent the temperatures of the two surfaces, and e the distance separating them, the quantity of heat transmitted will be represented algebraically by the formula $Q = \frac{c\,(t_1 - t)}{e}$. The coefficient c depends on the nature of the body. When the quantities of heat thus transmitted for different bodies across an interval 1 unit of length in thickness, and for 1 unit of area and time, are determined, these quantities of heat represent the *relative* conductibilities of the substances, and the numbers thus found, when referred to 1 as a standard, may be called the *conductivities* of the different substances.

The relative conductivities of metals, determined by experiments on bars of a given cross-section, the transmission of heat being determined by thermometers placed at different distances in holes drilled in the bars, have been determined by different investigators. The following table of conductivities, from experiments made by MM. Wiedemann and Franz, the temperatures along the bars being determined by a thermo-electric arrangement, is given by Balfour Stewart:

Relative Conductivities.

Name of metal.	In air.	In vacuo.
Silver	100.	100.
Copper	73.6	74.8
Gold	53.2	54.8
Brass	23.6	24.
Tin	14.5	15.4
Iron	11.9	10.1
Steel	11.6	10.3
Lead	8.5	7.9
Platinum	8.4	7.4
Palladium	6.3	7.3
Bismuth	1.8	

The conducting power of liquids is greater at high temperatures than at low temperatures. And when there is no convection of heat in liquids, by which heated particles are carried from one point to another, the conducting power of liquids is very small, the conducting power of water being, according to Depretz, only about $\frac{1}{100}$th that of copper.

Conduction by Gases.—Gases possess such a feeble power of conduction that they have been regarded as having no conducting power. Experiments by Magnus and theoretical deductions by Clausius, however, demonstrate that there is a slight power of conduction in perfect gases. Clausius estimates the conducting power of air to be about $\frac{1}{1400}$th that of lead.

The calorific *intensity* of combustion, or degree of temperature of the products of combustion, and of the solid incandescent combustible, seems to depend on the rapidity of combustion, rather than the quantity of heat evolved. Nearly all writers on the subject have given a method for finding what may be called the theoretical temperature of combustion, by supposing that all the heat evolved is contained in the gaseous products, and calculating the temperature by means of the specific heats and the weights of the products of combustion and the heat evolved. Making use of formulas corresponding to that which has already been given, $Q = W.\ C.\ t$; Q representing, in units of heat, the heat evolved; W the weight; C the specific heat of the gaseous products of combustion; and t the number of degrees rise of temperature. From this formula we have $t = \frac{Q}{C \times W}$. Such determinations, however, have but little practical value for solid combustibles, because the residual incandescent solid gives off rapidly, by radiation, heat which does not pass off with the gases.

The quantity of heat radiated from an incandescent combustible depends not only on the temperature of the combustible, but also on the temperature of the absorbent and the nature of the surfaces. On this account there does not appear to be sufficient ground for ascertaining the temperatures of furnaces or of the escaping gases by this process. It is well known from common observation that the temperature in ordinary furnaces is greatly increased by a more rapid supply of air; so that the quantity of heat evolved in a given time, and the temperature, are thus increased. Chemical action is promoted by high temperatures, and the conditions for increase of temperature, increase of heat evolved in a given time, and rapidity of chemical action, are coincident.

Among the most important of the applications of the dynamic theory of heat in the physical sciences may be mentioned its applications to the constitution of bodies, to electrical phenomena, to chemistry, to physiology, to astronomy, and to geology. All of these sciences have felt the influence of the science of thermodynamics in a remarkable degree, the investigations of the present day in regard to heat being largely devoted to the development of these applications. In the practical sciences its applications to the theory of *heat-engines* is perhaps the most important; and these applications will be given in the articles STEAM-ENGINE and THERMODYNAMICS, to which the reader is referred.

W. P. TROWBRIDGE.

Heath, or **Heath′er** [Ger. *Heide*], small shrubs of the order Ericaceæ, found mostly in the Old World. The common ling or heather of Europe (*Calluna vulgaris*) grows also very sparingly in parts of New England and in Newfoundland. It is the only true heath known in America. In Europe it covers great tracts of waste land. Its spikes of rosy flowers are well known. It affords valuable bee-pasture. Its tops are used for oven-fuel, brooms, thatch, etc., and locally are brewed with ale and used for tanning leather. It is the only species of the genus. Most of the heaths are of the great genus *Erica*, nearly 500 species of which are known. A few of these are small trees. Most of the heaths are South African; none except *Calluna* are American; none are South American or Australian. Of the genus *Erica*, seven species are British, but only two are very common, *E. tetralix* and *cinerea*, the beautiful flowers of which are known to literature as heather-bells. A very large proportion of the heaths are richly beautiful when in flower. They are not much cultivated in the U. S., for the rearing of them in our climate is peculiarly difficult. They are best raised in special structures called heath-houses.

Heath, tp. and post-v. of Franklin co., Mass. It has 3 churches and some manufactures of lumber. Pop. 613.

Heath, tp. of Allegan co., Mich. Pop. 1000.

Heath, tp. of Jefferson co., Pa. Pop. 247.

Heath (ASA), b. at Hillsdale, N. Y., July 31, 1776; entered the Methodist Episcopal ministry in 1797; went to Maine in 1799, and until 1842 was one of the most active and influential ministers of his denomination in that State. D. Sept. 1, 1860.

Heath (BENJAMIN), recorder of Exeter, England, was author of an *Essay towards a Demonstrative Proof of the Divine Existence* (1740), *Notæ sive Lectiones ad tragicorum Græcorum quæ supersunt dramata* (1792), a *Revisal of Shakspeare's Text* (1765), and other learned works. D. 1766.

Heath (CHARLES), b. in 1784; d. Nov. 18, 1848. He is chiefly distinguished as an engraver of plates for illustrated works. The *Shakspeare Gallery*, *Waverley Gallery*, and *Book of Beauty* were celebrated in their day. The modern engravers Doo and Watt were pupils of Heath.

Heath (WILLIAM), b. at Roxbury, Mass., Mar. 2, 1737; became captain of the Suffolk regiment; commandant of the Ancient and Honorable Artillery of Boston 1770; after-

wards a provincial colonel; was often in the legislature; was in the Provincial Congress 1774–75; a brigadier, and then major-general, 1775; brigadier-general of the Continental forces 1775; major-general 1776; was an exceedingly useful officer throughout the Revolutionary war; State senator 1791–92; became judge of probate for Norfolk co., Mass., 1793; was elected lieutenant-governor in 1806, but delined to serve. D. at Roxbury Jan. 24, 1814.

Heath'cote (Ralph), D. D., b. in Leicestershire, England, 1721; was educated at Jesus College, Cambridge; became vicar of Barkby 1748; assistant preacher of Lincoln's Inn 1753; vicar of Sileby 1765; rector of Sawtry-all-Saints 1766; a prebendary of Southwell 1768; vicar-general of Southwell church 1788. D. May 28, 1795. Author of *Historia astronomiæ* (1746–47), *The Use of Reason in Matters of Religion* (1755), *Discourse on the Being of God* (1763, a portion of his 24 Boyle sermons), besides a number of other works. He also assisted in the preparation of the *General Biographical Dictionary*.

Heath's Creek, tp. of Pettis co., Mo. Pop. 2523.

Heath'ville, post-v., county-seat of Northumberland co., Va., 92 miles N. E. of Richmond. Pop. of tp. 1996.

Heav'en. Among its names, the Ang.-Sax. word *heaven* is that which is "heaved" up; *Cœlum* means that which is "hollowed;" *Olympus*, the Greek abode of the gods, was a high mountain on the Macedonian frontier of Thessaly; *Elysium* is of unknown derivation [Egyptian *elisont* (?); Gr. *luo*, to "loose" (?); *eleusis*, the "coming" (?)]; the Babylonian name *Albordsh* (*el burdj*) was the "mountain of meeting" in the North (Isa. xiv. 13). The Hindoo heaven for the ordinary righteous was on Meru, a mountain rising from the centre of the earth, 2,000,000 of miles high; that for those who had reached Brahmaship was *Nirwana*, or virtually "nothingness." The Hebrew words for heaven mean "height," "high places," the "rolling" (sky), "cloudy expanse," that which is "stretched or beaten out." The common New Testament word means "elevated."

The highest conception of heaven among the heathen is that of the Greeks—*e. g.* Plato, who describes it (*Phædo*) as it "may be," the home of the just who have led holy lives and purified themselves with philosophy. It is above the air, where all colors, trees, flowers, fruits, stones, minerals, animals, seasons, senses, etc. are immeasurably better than on earth. Poets—*e. g.* Virgil—describe it as the shadowy isles of the blest, Elysian Fields in the Atlantic, or in the sky or the under-world, where heroes were gathered. The Hindoo Vedas describe it as a continuation of this life, though under better conditions and overruled by the divine Yama, the progenitor of man. After the Vedas came the doctrines of the transmigration of souls and Nirwana. The Persian book *Avesta* taught of a paradise (Persian, "pleasure-ground") for the true and pure beyond the eastern mountains. The heaven of the Egyptians was in the course of the sun; of the Druzes, is in China; of the Druids, was in the sky, reached after transmigrations; of the Scandinavians, was *Walhalla*, the gathering-place of heroes, where they continued the earthly life and delights of feasting and fighting. The North American Indians look forward to a happy hunting-ground in the West. The Mohammedan paradise is mainly depicted with sensuous imagery of earthly delights. The Hebrew description is of a firmament between the upper and lower waters, through which rain, dew, etc. are poured, transparent like sapphire, hung with stars as lamps, and resting on the mountains. Above it is the throne of God. Some of the later Jews hold to two heavens, some to three, the aërial, sidereal, and divine (as appears in the New Testament), and some to seven. Amos speaks of the "stories of heaven." The seven were—(1) Velum, (2) Expansum, (3) Nubes, (4) Habitaculum, (5) Habitatio, (6) Sedes fixa, (7) Araboth, or treasury.

The New Testament speaks of heaven as a country, a city, a house, a kingdom, an assembly, etc., but emphasizes its spiritual and moral attractions. It is a place of rest, glory, holiness, of the manifestation of God and increase of all good. Mention is made rather of *what* it is than *where*. The inhabitants are God, Father, Son, and Spirit, angels, spirits of the just, martyrs, and all the redeemed. Among pagans the occupations of heaven were generally of the same character as the pleasures of life—feasting, fighting, the chase, social and intellectual pleasures, and rest. The Bible represents it as a place of delightful activity in learning, worship, ruling, honoring God, in spiritual intercourse, and enjoyment of divine favors.

Proof of the doctrine of the heavenly recognition rests on the almost universal consent of all ages and races; the Old Testament phrase being "gathered to one's fathers or people;" the expectation expressed by Jacob (Gen. xxxvii. 35), by David (2 Sam. xii. 23); the recognition of the king of Babylon (Isa. xiv. 9); the story of the rich man and Lazarus; accounts of the future gatherings with the patriarchs (Matt. viii. 11); the rebukes at the judgment given by the "men of Nineveh," the "queen of the South," etc.; the history of the transfiguration; the recognition of Christ's glorified body by the disciples, and by Stephen, Paul, and John; the social character of the delights of heaven; our continued personality and consciousness; and the descriptions of Christ's second coming. Isaac Riley.

Heavy Spar, a popular name for the natural sulphate of baryta or barytes, has reference to the high specific gravity of that mineral. (See Baryta.)

Heb'bel (Friedrich), b. at Wesselburen, in Holstein, Mar. 18, 1813. He was a peasant-boy, and twenty-two years old before he acquired any systematic education. He studied for several years at the University of Munich, and in 1841 he succeeded in attracting considerable attention by his tragedy of *Judith*. The king of Denmark gave him a stipend, and after travelling through France and Italy he settled at Vienna, where he married the actress Christine Enghaus, and resided there till his death, Dec. 13, 1863. As a dramatist he belongs to the school of Schiller. It is the idea, not the picture, which in a subject inspires him. His characters strike by the logic of their development, but they excite no sympathy. He never reached Schiller's spiritual freedom and artistic harmony. There is exaggeration and coldness even in his best productions. The most remarkable of his dramas are *Marie Magdalena* (1844), *Herodes und Mariamne* (1850), *Agnes Bernauer* (1855), and *Die Nibelungen* (1862). His lyrical poems (2 vols., 1842 and 1848) are not interesting.

He'be [Ἥβη], in the Greek mythology, the goddess of youth and the cupbearer and attendant of the Olympian gods. She was the daughter of Zeus and Hera, and the wife of Heracles.

He'bel (Johann Peter), "the German Burns," b. at Bâle May 11, 1760; was educated at Lörrach, Carlsruhe, and at Erlangen; became subdeacon and professor of ancient languages in the Carlsruhe gymnasium, and in 1798 professor of theology and Hebrew; church councillor 1805; director of the Lyceum 1808; in 1819 prelate of the Evangelical Church; was for some years editor of *Der Rheinländische Hausfreund*; author of *Biblischen Geschichten* (1824), but is chiefly remembered for his *Allemannische Gedichte* (1803), poems written in the Black Forest dialect, chiefly on rustic themes, yet displaying refined and delicate sensibilities. They have been very popular in Germany. Hebel was a man of gentle nature, and had a noteworthy passion for buying lottery-tickets. D. at Schwetzingen Sept. 22, 1826.

He'ber (Reginald), D. D., b. of wealthy parents at Malpas, Cheshire, England, Apr. 21, 1783, and was a half-brother of Richard Heber; was educated at Brasenose College, Oxford, and wrote (1803) the prize poem, *Palestine;* became a fellow of All Souls; and in 1807 rector of Hodnet. In 1812 published a volume of hymns; was Bampton lecturer 1815; a prebendary of St. Asaph 1817; became (1822) preacher of Lincoln's Inn; and in 1823 was consecrated bishop of Calcutta, and labored in India with zeal and wisdom until Apr. 3, 1826, when he was found dead in his bath at Trichinopoli. His works, besides those mentioned above, are *Narrative of a Journey in Northern India* (1828), a *Life*, etc. of Jeremy Taylor (1822), and some volumes of poetry. Heber was a man of saintly character, polished and dignified manners, and kindly and humble spirit. He belonged to the High Church and Tory parties, was Arminian in his theology, and possessed the profoundest convictions of the adaptation of Christianity to human needs. His hymn "From Greenland's icy mountains" (1819) is the most popular missionary hymn in the English language.

Heber (Sir Richard), b. in London in 1773; was educated at Brasenose, Oxford, and when nineteen published the text of Silius Italicus (1792); his edition of the songs of Claudian was printed privately in 1793; he was M. P. for Oxford University 1821–26; is chiefly known as the most indefatigable of book-collectors. He possessed, according to Allibone, no less than 146,827 volumes, besides bound and unbound pamphlets, which cost him some £180,000. D. in London Oct. 4, 1833.

Heber City, post-v., county-seat of Wasatch co., Ut., about 45 miles S. E. of Salt Lake City. Pop. 658.

Hébert (Jacques René), nicknamed the "Père Duchêne," from the ultra-radical paper published by him during the French Revolution, which paper was imitated in Paris under the late Commune; was b. at Alençon in 1755, and guillotined Mar. 24, 1794, in Paris. Previous to the Revolution, as he was uneducated, he led a miserable life as lackey and ticket-seller at the doors of the theatres. Immediately after the capture of the Bastile in 1789 he started his journal, *Le Père Duchêne*, the real patriotism,

but also the extreme opinions, of which soon made Hébert extensively known, and carried him to be attorney-general of the then Paris Commune, and afterwards a member of the National Convention. Hébert wielded a tremendous influence, but Robespierre understood that the exaggerations of the Hébertist or ultra-radical party founded by Hébert discredited the cause of the Revolution, and the committee of public safety sent to the guillotine the "Père Duchêne" and his partisans. FÉLIX AUCAIGNE.

Hébert (PAUL O.), b. in Louisiana in 1819; graduated at the U. S. Military Academy in 1840, and entered the army as second lieutenant of engineers; engaged as professor of engineering at the Military Academy, and in constructing defences in Louisiana till 1845, when he resigned and was appointed chief engineer of the State of Louisiana. On the outbreak of the war with Mexico he was reappointed in the army, lieutenant-colonel 14th Infantry, being engaged in the battles of Contreras, Churubusco, Molino del Rey, Chapultepec, and at the final assault and capture of the city of Mexico, and was brevetted colonel for gallant conduct. Returned to private life at the close of the war, and engaged as planter in Louisiana until 1853, when he was chosen governor of the State. During the civil war he served as a brigadier-genéral in the Confederate army.

Hebrew Language. The Hebrew belongs to the Semitic family of languages, and shares their general peculiarities. (See SEMITIC.) It is the medium of the Old Testament revelation, and, next to the Greek, in which the New Testament was written, the most important for the biblical student. The name is usually derived from עֵבֶר (*Eber* or *Heber*), the ancestor of Abraham (Gen. xiv. 13). In the Old Testament it is called "the language of Canaan" (Isa. xix. 18), and, with reference to the dialect of the kingdom of Judah, "the Jews' language" (Isa. xxxvi. 11, 13; 2 Kings xviii. 26, 28). In the New Testament it is designated γλῶσσα τῶν Ἑβραίων and Ἑβραϊστί (John v. 2; xix. 13, 17). The latter term, however, embraces the Aramaic then current. (See JOSEPHUS, *Antiq. Jud.*, i. 1, 2, γλῶττα τῶν Ἑβραίων.) It was the language of the Jewish people during the time of their national independence, and, with some modification, down to the destruction of Jerusalem (A. D. 70). It has continued to be their sacred language, and is used in the synagogue to this day. Prior to the immigration of Abraham, who originally spoke Aramaic (comp. Gen. xxxi. 47), it was probably the language of the Canaanites, the Phœnicians, and the Punic race. The Phœnician and the Punic, whose character is determined by the remains found in the lapidary and numismatic inscriptions, numbering more than 100, agree closely with the Hebrew. Jacob and his family carried it with them to Egypt, and their descendants preserved it as the medium of communication among themselves (as the colonies of Greeks maintained their mother-tongue in foreign lands), and after a sojourn of 400 years carried it back again to its original home in Canaan. It was the universal belief among the rabbins, the Christian fathers, and the older theologians that the Hebrew was the language of Adam and Eve, and that it prevailed among all mankind till the dispersion of Babel; many of them even held that it was the medium of communication between God and the angels. They called it *lingua Dei, lingua angelorum, lingua prophetarum.* The elder Buxtorf advised all Christians to learn Hebrew, that they might carry on their devotional services in it.

Owing to the greater stability of the Eastern nations and the Semitic languages as compared with the Indo-European or Aryan, the firm character of the Mosaic institutions, its confinement to sacred literature, the isolation of Palestine, and the exclusive spirit of the Jews, the Hebrew remained substantially unmodified, either by accretions from other languages or by growth and development within itself, during the period of its literary activity. Its literature may be properly divided into three periods: (1) the Mosaic, (2) the Davidic or Solomonic, (3) the post-Babylonian. Gesenius and other writers who deny the Mosaic origin of the Pentateuch assume only the two latter periods, but the Mosaic writings (as Hengstenberg, Hävernick, and others have well shown) have some marked linguistic peculiarities. They contain archaic and poetic words and forms either peculiar to themselves or seldom found elsewhere. (For examples see KEIL'S *Introduction to the O. T.*, Eng. trans., vol. i. p. 46 *seq.*) Many Egyptian words are peculiar to the Pentateuch. (See CANON COOK'S second excursus to his *Commentary on Exodus*, in the *Speaker's Commentary*, vol. i. p. 476 *seq.*) The second or golden age extends from Samuel to Hezekiah (B. C. 1100–700), and attained its most glorious height during the reigns of David and Solomon. Here belong the older prophetic and poetic writings and all the Davidic Psalms. This period includes the lives and writings of David, Solomon, Isaiah, Micah, Nahum, Habakkuk, Obadiah, Jonah, Amos, and Hosea. The third period includes the interval between the Babylonian exile and the times of the Maccabees (about 600–160 B. C.). Its marked feature is the approximation of the Hebrew to the kindred Aramaic and Chaldee. It may be seen to a greater or less extent in Ezra, Nehemiah, Chronicles, Esther, Haggai, Zachariah, Malachi, Jeremiah, Ezekiel, Daniel, and the later Psalms.

Gradually the Aramaic (Chaldee) superseded the Hebrew as the spoken language of the people. It was the mother-tongue of Christ and the apostles. When the New Testament speaks of Hebrew as the then current language in Palestine, we must understand it to mean the Aramaic dialect. The evidence for this assertion is derived from such words as Βηθεσδά, ῥαββί, μεσσίας, μαμωνᾶς, Γολγοθά, βάρ Ἰωνᾶ, ταλιθά κοῦμι, ἐφφαθά, κηφᾶς, Ἀκελδαμά, and others, which are Aramaic. Josephus also not infrequently uses *Hebrew* in the sense of *Aramaic* (*Antiq.*, iii. 1, 1; iii. 7, 2; iii. 10, 6). Christ is reported by Mark to have spoken Aramaic on three occasions: when he raised the daughter of Jairus (Mark v. 41, ταλιθὰ κοῦμι, טָלִיתָא קוּמִי, *puella surge*, "Damsel, arise," cf. BUXTORF, *Lex. Talm.*, p. 875); when he opened the ears of the deaf man (Mark vii. 34, ἐφφαθά, imper. Ethpael, διανοίχθητι, "Be thou opened"); and upon the cross, when he exclaimed ἐλωΐ (the Syriac form for ἠλί, אֵלִי, given by Matt. (xxvii. 46), ἐλωΐ, λαμᾶ σαβαχθανί (Mark xv. 35). It is characteristic that Mark, in keeping with the dramatic vivacity of his narrative, should introduce these instances of the original words used by our Lord. When Christ appeared to Paul on the way to Damascus he addressed him in Hebrew (Acts xxvi. 14), and Paul addressed the excited crowd at Jerusalem in Hebrew when he wished to appease their wrath and awake their sympathy (Acts xxi. 40; xxii. 2).

After the dispersion the Jews used for ordinary conversation the language of the countries in which they resided. This was especially the case with the Greek. The Jews who spoke this language were known by the appellation of *Hellenists.* This term distinguished them from the *Hebrews*, who lived in Palestine, and used, as a general rule, the Aramaic.

The history of the critical study of the Hebrew begins with the Jewish grammarians and scribes, the Talmudists and Masoretes, who carefully collected all that pertains to the text of the Hebrew Scriptures. The Christian fathers, with the exception of Origen, Epiphanius, and especially Jerome (who learned the language from a Jewish rabbi and utilized it for his translation of the Vulgate), were ignorant of the Hebrew language, and derived their knowledge of the Old Testament from the Greek Septuagint and the Latin Vulgate. During the Middle Ages the Hebrew was almost exclusively cultivated by learned Jews, especially in Spain during the Moorish rule, such as Eben Ezra († 1170), David Kimchi, Moses Maimonides († 1204). Even the greatest scholastic divines knew nothing of Hebrew. After the revival of letters some Christians began to learn it from Jewish rabbis. Reuchlin († 1522), the uncle of Melanchthon, is the father of modern Hebrew learning in the Christian Church. He wrote a Hebrew grammar (1505), coined most of the technical terms which have since been in use in Hebrew grammars (*status absolutus, affixum, verba quiescentia*, etc.), and introduced the pronunciation that prevails in Germany. The Reformers cultivated and highly recommended the study of Hebrew, and the Protestant translations of the Bible were made directly from the original languages, and not from the Vulgate. During the seventeenth century Buxtorf, father and son, of Bâle, Louis Cappel of Saumur, and Salomon Glassius of Jena were the most prominent Hebrew and Talmudic scholars. In the present century, Wilhelm Gesenius, professor in Halle (1786–1842), and Heinrich Ewald, professor in Göttingen (b. 1803), created a new epoch in the study of Hebrew. Rödiger, Hupfeld, Hitzig, Fürst, Delitzsch, and others are prominent in this department of learning. In our own country, Moses Stuart of Andover (d. 1852), Edward Robinson of Union Seminary, N. Y. (d. 1863), James Addison Alexander of Princeton (d. 1859), Bush, and Conant deserve special mention as Hebrew scholars.

Literature.—Hebrew grammars by GESENIUS (20th ed. by Rödiger, 1866; transl. by Conant, Stuart, Davies), EWALD (7th ed. 1863), BÖTTCHER (1868), SEFFER (4th ed. 1864), NORDHEIMER (New York, 1842), and W. H. GREEN (New York, 1861). Hebrew dictionaries by BUXTORF (1639), SIMONIS (new ed. by Winer, 1828), GESENIUS (the manual edition, trans. by ROBINSON, and also by TREGELLES; the *Thesaurus* in Latin, finished by RÖDIGER, Leipsic, 1829–58, in 3 vols.), and FÜRST (1863, 2 vols., trans. by SAM. DAVIDSON, 4th ed. 1871). Hebrew concordances by FÜRST (1840, pp. 1428, fol.); *The Englishman's Hebrew and Chaldee Concordance of the Old Testament* (3d ed., London, 1868, 2 vols.). The latter gives the passages

from the authorized English version, but in the order of the Hebrew words. Also W. WILSON, *An English, Hebrew, and Chaldee Lexicon and Concordance*, 3d ed., London, 1866. PHILIP SCHAFF.

Hebrew Literature. See JEWISH LITERATURE, by PROF. FELIX ADLER.

Hebrews. See JEWS, by PROF. FELIX ADLER.

He'brews, Epistle to the, an anonymous Epistle of the New Testament, written by St. Paul, or, what is more probable, by one of his disciples and companions under his inspiration (Luke, or Barnabas, or Apollos), is addressed to the Christians of Hebrew descent in the East. Its object is to show the infinite superiority of Christ over Moses, and of Christianity over Judaism, and to warn its readers against apostasy. The writer makes the Old Testament itself prove the New, to which it pointed as its fulfilment. He sets forth especially the eternal priesthood and sacrifice of Christ, of which the Levitical worship was a significant symbol and type. The ninth chapter furnishes the key to the understanding of the tabernacle and the temple. The doctrinal expositions are interwoven with solemn warnings and rich consolations in view of the heavy persecutions to which the readers were exposed from the unconverted Jews. The eleventh chapter contains a most eloquent sketch of the ancient heroes of faith for the encouragement of timid believers, and forms a parallel to the seraphic description of love in the thirteenth chapter of First Corinthians. The Epistle belongs to the Pauline type of doctrine, and mediates between it and the Christology of St. John. It was written before the destruction of Jerusalem, when the temple worship was still in existence, probably in Italy during the first imprisonment of Paul in Rome, A. D. 63 or 64. See commentaries on the *Hebrews* by Bleek (in 3 vols.), Tholuck, Delitzsch, De Wette, Ebrard, Turner, Stuart, Alford, Lünemann (in Meyer's *Com.*), Moll (in Lange's *Com.*, Am. ed., with valuable additions by Kendrick), William Lindsay; also the able work of Riehm on the *Lehrbegriff des Hebräerbriefs* (1859, 2 vols.), and the relevant sections in critical introductions to the N. T. PHILIP SCHAFF.

Heb'rides, or **Western Islands,** is the common name given to the large group of islands which stretches along the western coast of Scotland, numbering about 490, of which, however, only 120 are inhabited. They are divided into the Outer Hebrides, among which the most remarkable are St. Kilda, Lewis, Harris, North and South Uist, Benbecula, and Barra; and the Inner Hebrides, the principal of which are Skye, Eigg, Mull, Iona, Staffa, Ulva, Lismore, and Kerrera. Their area is estimated at 3000 square miles. Pop. 100,000. Most of these islands, of which the remarkable ones will be described in separate articles, are rocky and unproductive, but their mild and moist climate, due to the presence of the Gulf Stream, produces excellent pastures, and cattle and sheep are reared in great numbers. In the ninth century these islands were colonized by emigrants from Norway, who largely replaced the original Celtic population, but the Gaelic language even now is in general use. The islands in the following centuries were alternately under Norwegian and Scotch authority, or under "Lords of the Isles," who were often virtually independent, until in 1540 they were finally annexed to the Scotch crown by James V.

He'bron [Heb. *Hebron*], a place in Palestine, about 20 (17½ geographical) miles a little W. of S. from Jerusalem, one of the oldest existing cities in the world. Its original name (Gen. xiii. 18), displaced for a time by *Kirjath-arba*, "city of Arba" (Josh. xxi. 11), was restored by Caleb. The Arabs now call it *El Khŭlil,* "the friend" (*i. e.* of God, meaning Abraham, whose home it was for many years). It was one of the cities of refuge. David reigned there seven and a half years before getting possession of the whole kingdom of Israel. The Maccabees recovered it from the Edomites, who had taken it after the Captivity. It was burned by an officer of Vespasian just before the destruction of Jerusalem. It was taken by the Arabs in 637, by the Crusaders about 1100; became the seat of a Latin bishopric in 1167; and ever since 1187 has been in the hands of its present masters, the Mohammedans. It is situated in a valley, generally supposed to be the "Eshcol" of the Mosaic period, about 3000 (Schubert says 2664, Russegger 2842, Tristram 3029) feet above the level of the sea. This valley is exceedingly fertile, abounding in grapes, olives, figs, pomegranates, and the like. The great mosque of Hebron, on rising ground, is over the cave of Machpelah, in which Abraham, Isaac, and Jacob, with their wives, are buried. The cave itself no one is permitted to enter; and until 1862, when the prince of Wales was the guest of the government, no Christian was permitted to enter even the area of the mosque. The population is some 8000 or 10,000, of whom some 400 or 500 are Jews, and the rest Mohammedans, noted for their bigotry and fanaticism. (See Appendix I. to *Sermons in the East*, by DEAN STANLEY, who accompanied the prince of Wales, 1863.) R. D. HITCHCOCK.

Hebron, tp. and post-v. of Tolland co., Conn., on the New Haven Middletown and Willimantic R. R. It has several cotton-mills and other manufactories. Pop. 1279.

Hebron, tp. and post-v. of McHenry co., Ill., 90 miles N. W. of Chicago, and on the Chicago and North-western R. R. Pop. 930.

Hebron, post-v. of Porter co., Ind., on the Columbus Chicago and Indiana Central R. R., 51 miles by rail S. E. of Chicago. It has a weekly newspaper.

Hebron, tp. and post-v. of Oxford co., Me., on the Portland and Oxford Central R. R., 45 miles N. of Portland. It has an academy. Pop. 744.

Hebron, post-v., cap. of Thayer co., Neb., on the Little Blue River, 65 miles S. W. of Lincoln, the capital of the State. It has a fine school-building, a religious organization, 1 grist-mill, 1 newspaper, 2 hotels, and 8 stores. The soil in the vicinity is well watered and fertile. Pop. about 250.
RALPH K. HILL, PUB. AND PROP. "HEBRON JOURNAL."

Hebron, tp. and post-v. of Grafton co., N. H., 40 miles N. W. of Concord. Pop. 382.

Hebron, post-tp. of Washington co., N. Y., 55 miles N. E. of Albany, has valuable slate-quarries. Pop. 2399.

Hebron, post-v. of Union tp., Licking co., O., 27 miles E. of Columbus, on the Ohio Canal and National Road. Pop. 478.

Hebron, post-tp. in Potter co., Pa. Pop. 754.

Hebron, tp. of Marlboro' co., S. C. Pop. 1581.

Hebron, tp. of Orangeburg co., S. C. Pop. 311.

Hebron, post-tp. of Jefferson co., Wis. Pop. 1372.

He'brus [Ἕβρος, now called *Maritza*], a river of European Turkey, anciently in Thrace, and celebrated in Greek mythology and history. It drains nearly all of Roumelia. It is boatable as high as Philippopolis; vessels of 200 tons ascend to Adrianople, except in low water, when they stop at Demotica, 25 miles below. The river is 240 miles long and flows into the Ægean Sea.

Hecatæ'us, of Miletus, one of the earliest and most important of the chroniclers (*logographi*), was the son of Hegesander, and lived about B. C. 549 to 479. He is referred to in terms of respect by Herodotus, and would seem to have been of noble birth, from the prominent part he took in the affairs of his native city. He opposed at the outset the attempt of Aristagoras to arouse the Ionians of Asia to free themselves from the Persian dominion; was instrumental subsequently in procuring more lenient treatment for his countrymen from the Persian satrap; visited many countries, and published the results of his travels in a work entitled Περίοδος γῆς or Περιήγησις, in two books, of which the first was devoted to Europe, the second to Asia, including Egypt; wrote also Γενεαλογίαι or Ἱστορίαι, containing the mythological histories of the Greeks, in four books. His geographical work is the more important, as he described what he himself saw; wrote in the Ionic dialect. Some fragments remain, and are collected in *Hecatæi Fragmenta*, ed. Klausen (Berlin, 1831), *Fragm. Hist. Græc.*, ed. Müller, vol. i. pp. 1–31. (See MURE'S *Hist. of Greek Lit.*, vol. iv. p. 140.) H. DRISLER.

Hec'ate [Ἑκάτη], a mysterious Greek goddess, whose mythus is variously given. The old traditions make her one of the Titans, honored by the Olympian gods, whom she assisted against the giants. She is oftenest reckoned as one of the infernal divinities, of a most mysterious and terrible character. She was worshipped with gloomy sacrifices and magical rites.

Hec'atomb [Gr. ἑκατόμβη] strictly signifies the offering of a "hundred bullocks" (ἑκατόν, βοῦς) in a sacrifice to the gods; but most commonly it designates the slaughter of a considerable number of animals of any kind. Sometimes the whole hecatomb, but more often the thighs, legs, and hides, were burned as a part of the ceremony, the flesh of the beasts being eaten by the worshippers.

Heck (BARBARA), "the foundress of American Methodism," was b. in Ireland, in a settlement of German emigrants from the Palatinate on the Rhine. These people came early under the influence of Wesley and his Irish itinerants, and formed some of the strongest Methodist societies of the island. In 1760, Philip Embury, Paul Heck, and Barbara his wife, with others of the settlement, sailed for New York. There the little company lapsed from their faith, or at least from their Wesleyan usages; but in 1766, Barbara Heck recalled Embury to his duty as a Methodist local preacher (in which capacity he had labored in Ireland). She gathered a little congregation at his house, and rested not till she saw the famous "Old John street

chapel" completed. Methodism was thus effectively introduced into the U. S. When Wesley's preachers arrived to take charge of the John street society she removed with her family and that of Embury to Northern New York, where they founded Methodist societies. They finally settled in Upper Canada, and became the founders of their denomination there. Barbara Heck d. there at the residence of her son, Samuel Heck, in front of Augusta, in 1804, aged seventy years. A. STEVENS.

Heck'er (Very Rev. ISAAC THOMAS), the founder of the congregation of Paulists, was b. in New York Dec. 18, 1819. In 1843 joined in the Brook Farm experiment, and afterwards spent some time in a socialistic community at Fruitlands, Worcester co., Mass., and also lived with H. D. Thoreau in his hermitage for a while. In 1845 he became a Roman Catholic; joined the Redemptorists in Belgium in 1847; was ordained a priest in 1849 by Cardinal Wiseman; returned to the U. S. in 1851; was released from the order of Redemptorists at Rome by the pope in 1857, and founded the congregation of St. Paul the Apostle in 1858. In 1865 established a periodical called the *Catholic World*. In 1869 was Bishop Rosecrans's procurator at the Vatican Council. Author of *Questions of the Soul* (1855), *Aspirations of Nature* (1857).

Hecker (JOHN), a merchant of New York and brother of Rev. I. T. Hecker, was b. in New York July 25, 1812. In 1835 established a large bakery; in 1840, with his brother, George V., engaged in an extensive flour manufacture. In 1850 started *The Mint*, a periodical, and in 1854–56 served as an alderman from the 7th ward. Was (1857–61) editor of the *Churchman*, and (1864–74) was a public school inspector. Was a strong friend of the ritualistic movement in the Protestant Episcopal Church, and was much interested in popular education. He published a work on *The Scientific Basis of Education*. D. May 7, 1874.

Heck'ewelder (JOHN GOTTLIEB ERNEST), b. at Bedford, England, Mar. 12, 1743, of Moravian parents, with whom he came in 1754 to America; became in 1762 an Indian missionary, laboring in Ohio, Pennsylvania, and Michigan; became in 1788 missionary agent for the Moravians, serving at times as U. S. peace commissioner with the Indians; residing 1801–10 at Gnadenhütten, O., and after that at Bethlehem, Pa., where he d. Jan. 21, 1823. His chief works are *An Account of the History, etc. of the Indian Nations* (1818) and a *Narrative of the Mission of the United Brethren* (1820). Heckewelder's love and admiration for some traits of the Indian character exposed his books to severe criticism. (See RONDTHALER, *Life*, 1847.)

Hec'la, or **Hek'la,** a famous volcano of Iceland, is in the south-western part of the island, 20 miles from the coast. It is conical in shape, 5110 feet high, covered with snow, and presents a dreary, desolate aspect. Since 1104 A. D. eighteen eruptions of this volcano are on record, of which five have been simultaneous with those of Vesuvius, and four with those of Ætna. The last and most tremendous eruption was that of 1845, lasting seven months, pouring out a stream of lava 1 mile broad and 50 feet deep, and sending its clouds of dust 400 miles over the ocean, as far as the Orkney Islands.

Hecla (HECLA WORKS P. O.), a v. of Westmoreland tp., Oneida co., N. Y., has a large manufactory of iron goods and hardware. Pop. 125.

Hec'tic Fe'ver [Gr. ἑκτικός, from ἕξις, "habit"], a fever which is so continued as to constitute a *habit* (ἕξις) of the body. Such fevers are probably always symptomatic of some local or extended irritation. Thus, hectic attends pulmonary consumption, chronic pleurisy with extensive exudations, peripheral caries of the bones, etc. Hectic, as it occurs in pulmonary consumption, is sometimes intermittent, with evening exacerbations; sometimes almost constant. The latter kind generally affords a bad augury, and it cannot in general be much relieved by treatment; but intermittent hectic may often be palliated, greatly to the patient's relief.

Hec'tor, one of the central characters of the *Iliad*, a valiant Trojan prince, son of Priam by Hecuba, husband of Andromache, and father of Astyanax. He is the principal champion of the Trojans, the slayer of Patroclus, and is himself slain by Achilles, aided by Pallas Athena.

Hector, post-tp. of Schuyler co., N. Y. It lies on the E. shore of Seneca Lake, and has numerous small manufacturing villages, 9 churches, and manufactures of leather, lumber, woollen goods, castings, agricultural implements, etc. Pop. 4905.

Hector, tp. of Potter co., Pa. Pop. 651.

Hec'uba, wife of Priam, the king of Troy, and mother of nineteen of his children, including Paris, Hector, Polydorus, Cassandra, Creusa, and Polyxena. She became a slave among the Greeks after the fall of Troy, but the narratives of the residue of her life are various.

Hed'ding (ELIJAH), D. D., b. at Pine Plains, N. Y., June 7, 1780; entered the Methodist ministry 1800; labored for many years with distinguished zeal and success, mainly in New York and New England; was elected a bishop in 1824, after which time his usefulness and ability were even more conspicuous than before. D. at Poughkeepsie, N. Y., Apr. 9, 1852. (See his *Life* by D. W. CLARK, 1855.)

Hed'dle, or **Heald,** in weaving cloth, is the vertical thread or wire which raises or depresses a certain part of the threads or every alternate thread of the warp preparatory to the passage of the shuttle. There is a heald attached to each warp-thread; and in every loom there are at least two, often several more sets of heddles, according to the kind of weaving. Many improved styles have been introduced for special kinds of looms.

Hedge, a fence of growing shrubs set closely together. The setting of hedges is a matter of great importance in regions where timber and stone are scarce or expensive, as in Great Britain and many parts of the U. S. The thorns (*Cratægus*) are extensively employed in England, but in the U. S. they are peculiarly liable to the attacks of borers, and are therefore not much used. Buckthorn, barberry, beech, hornbeam, Japan quince, privet, arborvitæ, holly, honey-locust, the Cherokee rose, and especially the Osage orange or bois d'arc (*Maclura aurantiaca*), are used successfully in the U. S. Much depends upon the proper setting of the hedge-plants, and still more upon subsequent care and proper clipping.

Hedge (FREDERIC HENRY), D. D., a clergyman of the Unitarian faith, b. in Cambridge, Mass., Dec. 12, 1805. At the age of thirteen he went to Germany, and studied there for several years; returned in 1823, and entered Harvard College in the class of 1825; studied theology three years at the Cambridge Divinity School; was settled in West Cambridge 1835; in Bangor, Me.; spent the year 1847–48 in Europe; took charge on his return (1850) of the Westminster church in Providence, R. I.; accepted a call to Brookline, Mass., 1856, and in 1872 took the office of instructor in German at Harvard College, where previously he had lectured on church history. Dr. Hedge has a powerful mind, and wields a powerful pen. His greatest work, *Prose-Writers of Germany* (1 vol. 8vo, Philadelphia, 1848), has a standard reputation. Other volumes are *Reason in Religion* (Boston, 1865), *The Primæval World of Hebrew Tradition* (Boston, 1870). He is known as the author of remarkable papers on Augustine, Leibnitz, Schopenhauer, and Coleridge, in magazines. He has been a valued contributor to popular literature, a lecturer and orator besides; from 1857 to 1860 he edited the *Christian Examiner*; was part compiler of a book of hymns; composed hymns; translated poems from the German; prepared a brief form of liturgy for the Unitarian Church; and was at one time (1857) president of the Unitarian Association. All his work indicates the scholar and the man of culture. He is eminent outside of his sect as a preacher and writer, for the vigor of his thought, the dignity of his presence, and the noble purity of his English style. Dr. Hedge is a Christian rationalist, combining intellectual independence with fidelity to ecclesiastical tradition, and might easily have been a leader had he been able to surrender his mind to any single school of thought. O. B. FROTHINGHAM.

Hedge (LEVI), LL.D., b. at Warwick, Mass., Apr. 19, 1766; graduated at Harvard 1792; a college tutor 1805–11; professor of Latin in Harvard College 1811–17; of natural theology, political economy, and moral philosophy 1817–22 and 1827–32; of logic and metaphysics 1810–27. Author of a treatise on logic (1816); editor of an abridgment of Brown's *Philosophy* (1827). D. at Cambridge, Mass., Jan. 3, 1844. Father of F. H. Hedge.

Hedgehog, properly the name of the insectivorous animals of the genus ERINACEUS (which see). In parts of the U. S. the name is incorrectly given to various species of PORCUPINE (which see).

Hedge-Sparrow. See ACCENTOR.

Hedgesville, tp. of Berkeley co., West Va. Pop. 2499.

Hedjaz, El ("the land of pilgrimage"), is the name of a partly sandy, partly stony region of Arabia, extending along the coast of the Red Sea from Yemen to the Syrian desert. As both Mecca and Medina, the two holy cities of the Mohammedans, are situated in this region, it is annually traversed by thousands of pilgrims. It is divided into a lowland (Tehama) and a highland region (Nejd); constitutes with Yemen a vilayet of the Turkish empire. Pop. of Hedjaz (*Gotha Almanac* 1874) is given as 518,750.

Hedj'rah, or **Heg'irah** [Arab., the "separation;" more fully *Hedjrat-al-Nebi*, the "prophet's departure"], the es-

cape of Mohammed in secret from Mecca, where the Koreish were determined to kill him. He fled to Medina, where he found many followers. This event, regarded as the true origin of Mohammedanism, occurred Sept. 13, 622, but it was not until 639 that Omar the caliph established the Hedjrah as the beginning of the Mohammedan era. As the Arabic year is nearly 11 days shorter than ours, it is very difficult to transfer dates accurately from one to the other year. If 3 per cent. be taken from the number of the year of the Hedjrah, and 622 be added to the remainder, the sum is usually, not always, the year of the Christian era.

Hee'ren (Arnold Hermann Ludwig) was b. at Arbergen, near Bremen, Oct. 25, 1760, and studied at the University of Göttingen, at which he was afterwards appointed professor—1787 in philosophy, 1801 in history. D. at Göttingen Mar. 7, 1842. His first works were critical editions of Menander, *De Encomiis* (1785), and Stobæus, *Eclogæ physicæ et ethicæ* (1792–1801); but the study of Polybius attracted his attention to the influence which trade and commerce had exercised on the foundation and development of the ancient states, and between 1793 and 1796 published his excellent work, *Ideen über Politik, den Verkehr und den Handel der vornehmsten Völker der Alten Welt;* also his *Geschichte des europäischen Staatensystems und seiner Colonien* (1809), and many of his minor historical essays were well received by the German public, and his *Untersuchungen über die Kreuzzüge* received a prize from the French Academy.

Hef'ele, von (Karl Joseph), D. D., Roman Catholic bishop of Rottenburg, Würtemberg, was b. at Unterkochen Mar. 15, 1809; studied at Tübingen; became a *privat docent*, and in 1840 professor of church history, archæology, and patrology in the Roman Catholic faculty of Tübingen. In 1869 he was made bishop. His edition of the *Apostolic Fathers* (1839), *Review of Wessenberg's Church Councils* (1841), *History of the Christian Councils* (1855–74, 6 vols.), *Pope Honorius, Cardinal Ximenes* (1851), *Contributions to Church History*, etc., have given him a wide fame as a profound scholar. He was a member of the Vatican Council, and voted with the minority against papal infallibility, but afterwards submitted.

Heg (Hans C.), b. in Norway in 1829; came to America with his father in 1840, and settled in Wisconsin. During the gold excitement in 1849 young Heg went to California, returning at the end of two years to Wisconsin, settling near Milwaukee, and devoting himself to agricultural and mercantile pursuits till 1859, when he was chosen commissioner of State prisons. On the outbreak of the civil war in 1861 he entered the volunteer service as major 4th Wisconsin, and in September following was promoted to be colonel 15th Wisconsin Vols., participating in the affair of Island No. 10 and the battles of Perryville, Stone River, and Murfreesboro'. From Apr. 29, 1863, commanded a brigade in the 20th army corps, leading it in all the actions of that corps and in the battle of Chickamauga, where he was killed, Sept. 19, 1863.

He'gel (Georg Wilhelm Friedrich), b. at Stuttgart Aug. 27, 1770. He was descended from an old Suabian family which had migrated into Würtemberg from Carinthia shortly after the Lutheran Reformation, in order to secure religious freedom. His father was an officer under the ducal government. Hegel began to attend a Latin school in his native town when five years of age, and at seven entered the gymnasium. At the age of eight he read Shakspeare in Wieland's translation, and before thirteen he had studied geometry, surveying, Latin, Greek, and Hebrew. He translated the whole of Longinus on the *Sublime* at seventeen, and at eighteen the *Antigone* of Sophocles, which remained his favorite work of art through life. His efforts at declamation while at the gymnasium were unsuccessful. He stammered, and was very awkward in his manners. His French was good, chirography distinct. He early began the practice of entering in his commonplace-book whatever interested him, and his extracts became voluminous. He entered the University of Tübingen in the autumn of 1788 as student of theology; heard lectures on metaphysics and natural theology by Flatt, and attended numerous other courses by different professors on various parts of the Bible, particularly the Psalms and New Testament; studied anatomy and botany, and reviewed his beloved Greek tragedies; was delighted with the book of Job. He received the degree of master of philosophy in 1790, and on the occasion wrote a dissertation, *De limite officiorum humanorum seposita animorum immortalitate*, evincing the fact that he had begun to ponder the question of the Kantian dualism. He had made some acquaintance with the Wolffian philosophy as early as his fifteenth year. In his personal demeanor towards his fellow-students he was honest and jovial. He appeared older than he was, and received from his mates the familiar name of *Alter*, or "the old man." In 1790, Schelling, then in his sixteenth year, came to the university, and his precocious intellect seems to have awakened in Hegel a new activity. Hegel had read Rousseau at an early age, and was influenced by him quite strongly, as, indeed, were Kant and most other German thinkers. The philosophy of Kant and his successors may be regarded as a speculative reaction against the tendencies that led to the French Revolution. Goethe's *Faust* portrays the same reaction in literature. In 1790, Young Germany looked for the social regeneration of Europe. "Liberty, equality, and fraternity" were the magic words of the time. Hegel took part in a political club formed for the dissemination of French ideas. In 1793 he left the university, and became a private tutor in a family in Berne. Fichte shortly before, and Herbart about the same time, held similar positions in Switzerland. He passed this epoch of his life in a quiet and studious manner, gradually departing from the ideas he had received at Tübingen, and beginning seriously to grapple with the problem of human responsibility, and to feel distinctly the want of a fundamental principle that should subordinate both the theoretical and practical phases of life. He wrote a life of Christ; studied Kant more thoroughly; was charmed by the theories of Benjamin Constant; finally bent all his strength upon the mastery of Fichte's *Science of Knowledge*, which just then appeared. His characteristic stubbornness and patience were put to a severe test. His correspondence with Schelling at this time assisted him in gaining an insight into the subtle psychological analysis of Fichte. Schelling's fiery nature was thoroughly aroused by the *Science of Knowledge*, and he stormed, Titan-like, the subjective limits which Fichte in the spirit of Kant placed to the validity of his theoretical principles. The universal and necessary truths which, according to the critical system, demonstrated the subjectivity of all our knowledge, seemed to Schelling to establish its objectivity; for they were not universal and necessary unless they were the necessary condition of the existence of objects in time and space. With this view he hastened to construe the world of nature *a priori* by means of transcendental ideas. Self-consciousness revealed the hidden laws and principles implicit in the ordinary knowing, and these laws and principles, drawn out of the unconscious activity of the mind, were identified with the moving forces of nature, and thus came to be attributed to an impersonal Reason, a Soul of the World. Schelling departed further and further in this direction during his first career, and developed a system in strong contrast to that of Fichte, which laid all stress on the conscious Ego and the free moral will. There was no necessary incongruity in the two systems, except what arose from one-sidedness, due to the intense emphasis given to the opposite poles of this philosophy: Fichte emphasizing the self-conscious Ego and the moral will, and subordinating all else as merely phenomenal and scarcely worthy of human investigation; while Schelling turned to nature and history as the unconscious realizations of spirit in time and space, and hence worthy of all study, as though charged with the fulness of divine incarnation. Fichte slighted time and space, and hence everything real and conventional—institutions, beliefs, systems; the world in short. He was ascetic, subordinated the world to the soul, somewhat as did George Herbert or Thomas à Kempis. Schelling looked upon the world as the revelation of the Absolute, and held it sacred, while subjectivity became less and less important in his eyes, and as a consequence morality and practical aims and endeavors lost their interest for him.

Through the assistance of his friend Hölderlin, Hegel obtained a situation in 1797 as tutor in Frankfort, the birthplace of Goethe. His interest in philosophical studies increased. He studied Plato and Sextus Empiricus, and began to seize the objective dialectic into which he could translate the psychological process of Fichte. In 1799 his father died, leaving him some property, and in 1801 he removed to Jena, the centre of literary activity at that time. Fichte had recently gone to Berlin, having been dismissed from Jena on account of complications arising from the charge of atheism made against him. Schelling was there as professor extraordinarius. Hegel lectured on logic and metaphysics, the philosophy of nature, and the philosophy of spirit. In 1805 he lectured on the history of philosophy, pure mathematics, and natural rights; in 1806, on the unity of philosophical systems and the phenomenology of spirit. Up to this time he had been a follower of Schelling, with whom he had edited the *Critical Journal of Philosophy* four years before. His own system begins to reveal its outlines at this period: I. Logic or science of pure thought or Reason—universal ideas applying to nature and mind alike; II. philosophy of nature, treating of the realization of Reason in time and space; III. philosophy of man as finite spirit; rising through Re-

ligion to the Absolute or Pure Reason again, and thus completing the circle of philosophy. During this period his style evinced improvement, and his use of illustrations from Greek mythology gave to his abstractions a popular hold. He studied Goethe's philosophy of colors, and followed out the experiments indicated; reviewed Homer, and began to see the outlines of the process which includes the evolution of the world and as Providence guides human history. Schelling had removed to Wurzburg in 1803. Hegel had for four years been clearing up in his mind the relation of his own results to the presuppositions of Schelling. The relation of Fichte, as subjective idealist, to Schelling, as objective idealist, he had already defined in the *Critical Journal of Philosophy*. He now was ready to define his own relation toward Schelling. In the *Phenomenology of Spirit*, published in 1807—a work which he called his "voyage of discovery"—he undertakes to trace the history of consciousness in its growth from the first stages of culture up to the theoretical and practical conviction which underlies modern civilization. In the preface to this work he attacks the "immediate intuition" of Schelling, and shows that thought or knowledge without mediation is entirely empty. He employs in this "voyage of discovery" a dialectic method as strict as that of Fichte, but used objectively—as the necessity of the object under consideration, rather than as a mere subjective necessity of thought. Consciousness in the stage of simple sensuous knowing is proved to know nothing immediately. Its first preception is shown to be a mediated one, depending upon inference, which is made implicitly or unawares. Further analysis reveals the presupposition upon which the inference involved in perception is based: this inference is found to be not subjective alone, but to correspond to an objective activity of mediation, which is seen to be the necessity of the objective world, and is named *Force* by the consciousness. Herewith the reflective stage of Consciousness begins, or the realm of understanding. The presupposition underlying Force is investigated: it is a unity in multiplicity, self-united in its utterance; force in expending itself manifests its unity in all its effects. This dualism (force and manifestation) involves further the dualism of each of its sides, and thus we have the internal duality as Law on the one hand, and the external duality as Phenomenon on the other hand, containing force and manifestation. In natural law Consciousness perceives an ideal type or form, which as internal and ideal measures and shapes the phenomenal world. Law is not abstract unity, but it includes in itself difference, multiplicity. The difference in the law is ideal and posited through the unity, which, again, is unity only as revealing itself in self-opposition—in other words, the ultimate presupposition of law is self-determination. Beyond self-determination analysis does not proceed, for the former presupposes no higher principle; all its determinations (characteristics, properties, and attributes) are products of its own activity. Herein consciousness recognizes the image of itself; it has traced up the external world to its internal truth, self-determination (or "subject-objectivity," as Fichte named the Ego), an internal, essentially active, and self-opposed being; the Ego is such an activity as exists in self-opposition or as subject and object at the same time. Thus, the objective has been traced back to an Ego or spiritual personality (God) as its necessary essence, and in the contemplation of this essence of the world Consciousness finds itself contemplating its own prototype, and becomes self-consciousness. It must be understood that the mind makes all this experience in its pre-historic stages of culture, contemporaneous with its formation of language, but in a naïve, unconscious manner, having no philosophic knowledge of its method. It comes to a scientific knowledge of the course it has trodden only after thousands of years. The result of human experience, wherein it arrives at self-consciousness, is only a conviction, not a scientific idea. Hegel proceeds in the remaining part of the *Phenomenology* to trace out the necessary stadia of history by which man realizes this conviction in institutions, commencing with the patriarchal one of slavery. In the subtlest manner he shows how the mind reflects upon an institution as soon as realized, and elevates itself to a new realization, making at each step its unconscious conviction more and more a conventional, universally recognized conscious principle, enunciated in its revealed religion, portrayed in its art and poetry, organized in its state, civil society, and family, and finally generalized in its science. Hegel's philosophy is all contained *in unce* in the *Phenomenology*, and in some respects this work is the best example of his method of dialectical procedure. His entire system may be regarded as the philosophy of Civilization, or as the demonstration of the personality of the Absolute and an exhibition of His revelation in the world of time and space. √

The *Philosophy of Nature* attempts to exhibit the return from pure empty externality—time and space, or the pure form of God's Not me—through the mechanical and dynamical phases of matter, up to organized life as a phenomenal appearance of self-determined being. The *Philosophy of Spirit* attempts to show the development from mere consciousness (which is *real* self-determining being, instead of the phenomenal appearance of it in the animal, which is nature's highest being) up to the realization of this subjective consciousness (which exists in the savage only as a mere possibility) in objective institutions, family, society, state, and Church, with codes of laws and morals, ceremonials and conventionalities, as well as in theoretical presentations in art, literature, and science.

To this vast undertaking he devoted the rest of his life. Closing his lectures at Jena Sept. 18, 1806, on occasion of the approach of the French, he repaired early in 1807 to Bamberg, where he edited a political newspaper until the autumn of 1808, when he took charge of a gymnasium at Nuremberg. Here he remained eight years; he was married Sept. 16, 1811, to Marie von Lucher, of one of the oldest patrician families in Nuremberg. He elaborated and expounded his *Science of Logic* (1812–16) in three volumes, presenting in it the science of pure thought or the fundamental basis of his entire system. Its divisions are three: I. Being, or Immediateness; II. Essence, or Mediation; III. Idea, or Notion ("*Begriff*" and "*Idee*"), or Absolute Mediation. It may be called a search for the true first principle by an examination of abstract ideas, commencing with the simplest and most empty—to wit, pure being, which is so abstract and inadequate as to be the same as nothing—and proceeding by the method of discovering presuppositions up to the highest idea, which he names *The Idea, par excellence*, as it is the thought of a self-subsistent personality, a self-object, a Creator who creates nature or the world as his Image. The outline of the philosophy of nature he presented in the *Encyclopædia of Philosophical Sciences* in 1817, at Heidelberg, whither he had gone in Oct., 1816, to assume a professorship in the university. The principle of evolution in nature is the inadequateness of externality to manifest personality. Each lower phase of nature presents us the phenomena of a struggle to reach the realization of the three constituent phases involved in personality. Each higher phase achieves what the next lower one was most deficient in. The vertebrate animal is the summit of nature. The generic appears in him *ideally* as instinct (but not as Ego), and *really* as the process of reproduction. But no individual animal, as such, is more than half a personality, so to speak, being either male or female, and becoming whole only in the generic act. With consciousness appears personality, as incarnated in the world, and a new world, that of spirit, begins. In the world of spirit each individual soul is a monad—the generic entering it as Ego, and thereby constituting an immortal individual. Where the generic is only instinct, as in the animal, there is born as yet no *self*. The species lives, but the individual dies. Human beings are, as animals, sexual (dis-sected), and only half-persons, hence mortal. But as conscious Egos each is a totality and the possibility of the entire race. Hence, the human being proceeds to realize this possibility through the creation of symbols and language, science and institutions—family, society, state, and Church—in each of which he portrays for himself his generic nature, some phase or phases of the Absolute, so as to make it possible for the mere individual to participate in the life of the race, of the generic, of the Absolute. Culture or education is the name of the process of initiation of the individual into this heritage. The whole race is thus made to live vicariously for each man, and by theoretical participation each one avails himself of the life of the whole, without being obliged actually to suffer the penalties of living experience. This point is of the greatest importance as the transition from nature to spirit, and has been overlooked by countless students of Hegel, who have for this reason interpreted his doctrines pantheistically as a genial naturalism.

The *Philosophy of Spirit*, which is the third part of Hegel's system, attempts to trace out in its details this self-emancipation from nature and history, and is the labor of his Berlin period, which began in 1818, Oct. 22. He was called to the chair of Fichte by the minister Von Altenstein. In 1821 he published his *Philosophy of Rights*, containing the science of jurisprudence, morals, and politics. The constitutional monarchy is held by him to be the highest form of government. In the following years he wrote his *Æsthetics*, published after his death, in three volumes, treating of the three epochs of art—symbolic (Oriental), classic (Greek and Roman), and romantic (Christian)—as well as of the special arts, architecture, sculpture, painting, music, and poetry. The lectures on the philosophy of history were written in 1822–23, and delivered with modifications five times. According to Hegel, the history of the

world narrates the progress of humanity into a consciousness of freedom. A series of lectures on the proof of the being of God were delivered by him in 1830. While engaged on a new edition of his complete *Logic*, having finished the revision of the first volume, he died of cholera, Nov. 14, 1831.

His complete works were edited, and in some cases compiled, from notes taken at his lectures, by his disciples Marheineke Schulze, Gans, Von Henning, Hotho, Michelet, Förster, and Boumann. They included the writings of the Schelling period (1 vol.), the *Phenomenology of Spirit* (1 vol.), *Science of Logic* (3 vols.), *Outlines of the Philosophy of Rights* (1 vol.), *Philosophy of History* (1 vol.), *Æsthetics* (3 vols.), *Philosophy of Religion* (2 vols.), *History of Philosophy* (3 vols.), miscellaneous writings (2 vols.). To these should be added the *Life* of Hegel by ROSENKRANZ. Access to Hegel's system through English translations and original expositions is becoming quite ample. A partial analysis and paraphrase of the first chapters of the third volume of the *Science of Logic* was published in London (1855), under the title of *The Subjective Logic of Hegel*, translated by H. SLOMAN, DR., and J. WALLON; *Lectures on the Philosophy of History*, translated from the 3d Ger. ed. by J. SIBREE (*Bohn's Library*, London, 1857); *The Logic of Hegel*, with prolegomena, by WM. WALLACE, Oxford, 1874 (containing vol. i. of the *Encyc. Phil. Sci.*); *The Secret of Hegel, being the Hegelian System in Origin, Principle, Form, and Matter*, by JAMES HUTCHISON STIRLING, 2 vols., London, 1865 (contains a translation of a portion of the first volume of the *Logic*, with full commentary); *General Principles of the Philosophy of Nature, with an Outline of some of its Recent Developments among the Germans, embracing the Philosophical Systems of Schelling and Hegel, and Oken's System of Nature*, by J. B. STALLO, Boston, 1848 (contains a concise but genial exposition of Hegel's entire system); *The Science of Thought, a System of Logic*, by CHARLES CARROLL EVERETT, Boston, 1869 (contains an original exposition and justification of a system substantially identical with Hegel's *Logic*); *The Nation; the Foundations of Civil Order and Political Life in the U. S.*, by E. MULIFORD, New York, 1870 (contains an original exposition and discussion of positions substantially agreeing with Hegel's *Philosophy of Rights*). In the *Journal of Speculative Philosophy* (St. Louis, 1867–75) have appeared translations of Bénard's *Analysis of Hegel's Æsthetics*; of chapters from the *Phenomenology of Spirit*, with analysis and commentary; of the *Philosophical Propædeutic* (written at Nuremberg) *on Rights, Morals, and Religion*, the outlines of *Logic* and the *Phenomenology*; of the chapters in the *History of Philosophy* on Plato and Aristotle; of the chapter on Chivalry from the *Æsthetics*; of the greater part of Rosenkranz's *Hegel as the National Philosopher of Germany* (written in 1869 for the centennial anniversary of Hegel's birthday); of Trendelenburg *On the Logical Question in Hegel's System*; of Michelet and Von Hartmann on *Hegel's Dialectic*; besides original articles on different phases of Hegel's system, and in particular an extended *Introduction to Speculative Philosophy and Logic*, by A. Vera (an attempt at popular presentation of Hegel's point of view). German works on various phases of Hegel's system exceed a thousand. Scarcely a new book in science or literature appears in Germany but exhibits some trace of the influence of Hegel. Perhaps Karl Rosenkranz is to be named as the foremost defender of the Hegelian system, and its most genial interpreter; R. Haym is its most bitter opponent. A. Vera is the leading expounder of Hegel in French and Italian. He has expanded the *Encyclopædia* into 7 volumes in French by his copious commentary. He is now (1875) publishing a French translation of the *Philosophy of Religion*. Charles Bénard has published 5 volumes in French, giving a translation of nearly all of the *Æsthetics*.

Hegel's school is so widespreading, and includes such a variety of thinkers, that it is not easy to give an account of it. The most distinguished names in it are Göschel, Hinrichs, Gabler, Erdmann, Marheineke, Daub, Rosenkranz, Gans, Vatke, Michelet, Conradi, Kuno Fischer, Hotho, Carrière, Vischer, Bruno Bauer. The best history of the Hegelian school is to be found in ERDMANN's *Grundriss der Geschichte der Philosophie*. (See articles on GERMAN PHILOSOPHY, FICHTE, SCHELLING, KANT.)

WM. T. HARRIS.

Hegesip'pus, a contemporary of Demosthenes and Æschines; acted with great energy against Philip of Macedon, advocating the Phocian alliance and the declaration of war against Macedon. Two of the orations which have come down to us under the name of Demosthenes are ascribed to Hegesippus by the ancient grammarians—namely, that on Halonesus and that on the treaty with Alexander.

Hegirah. See HEDJRAH.

He'gins, post-tp. of Schuylkill co., Pa. Pop. 1154.

Hei'berg (ANDREAS PETER) was b. at Vordingborg, in the island of Sealand, Nov. 16, 1758; studied at the University of Copenhagen, in which city he afterward lived as a translator. He played a very conspicuous part in the literary, social, and political life, but his liberal ideas were blended with a kind of revolutionary passion, and the scourging satire with which he attacked any kind of abuse was often mixed with scandal. In 1799 was exiled, and went to Paris; received a position in the ministry of foreign affairs, and was frequently employed by Talleyrand in diplomatic negotiations. In 1817 was pensioned, and spent the last years of his life in lonesome retirement; he was blind, and his beautiful and accomplished wife had not followed him in his banishment. D. in Paris Apr. 30, 1841. His comedies, of which one, *Heckingborn*, has been translated into English and has had quite a run on the English stage, were much appreciated in their time, but are now entirely out of date. But some of his songs and prose-writings, as, for instance, *The Life of a Dollar-bill*, are still interesting.

Heiberg (JOHAN LUDWIG), son of the preceding, was b. at Copenhagen Dec. 14, 1791. Remained with the mother when the father was exiled. In 1817 took a degree as doctor in philosophy at the University of Copenhagen. From 1819 to 1822 lived in Paris with his father. From 1822 to 1825 occupied a chair as professor at the University of Kiel. After 1825 resided in Copenhagen, closely connected with the Royal Theatre as poet and translator, as director from 1849 to 1856, and as censor. D. Aug. 25, 1860. He was a highly accomplished man, at once broad and acute, and always elegant, especially when he had to tell people that they were stupid. His prose writings comprise 11 vols. of criticisms on Danish literature. The tendency of his criticism was to educate the public, and make it capable of appreciating literature and art; and in this tendency the critic was eminently successful. His poetical works comprise 9 vols., and consist mostly of dramas, of which one, *Elverhöi* ("Elves' hill"), has become the national drama of the Danes, in spite of Holberg's comedies and Oehlenshlager's tragedies. His chief work, however, is a comedy not destined for the stage, *A Soul after Death*. A shopkeeper of Copenhagen dies. From the sky he witnesses his burial and hears the minister's speech. He then strolls along; knocks at the gates of heaven, but is rejected; tries to get into Elysium, but is rejected again; and settles down at last in a comfortable place, where he finds newspapers, beer, tobacco, and slander, exactly as in Copenhagen. He has only one objection to the place: its name is hell.

CLEMENS PETERSEN.

Hei'de, or **Heyde,** town of Germany, in the former duchy of Holstein, in North Ditmarsch, near the North Sea. It carries on a lively trade in cattle and grain. Pop. 6280.

Hei'delberg, town of Germany, in the grand duchy of Baden, on the Neckar, has one of the oldest and most celebrated universities of Germany; in 1862 it numbered 88 professors and 785 students. It has a library of 200,000 volumes. A zoological museum, a botanical garden, a laboratory, and an observatory are connected with it. The old castle, built in the twelfth century, enlarged in the fourteenth and fifteenth, much injured by the French in 1688, and nearly destroyed by fire in 1764, forms a very interesting and picturesque ruin. The manufactures of Heidelberg are very varied, comprising tobacco, madder, ultramarine, and other dyestuffs, optical, surgical, and musical instruments, paper, and leather; and its trade, especially in wine, is extensive. Pop. 19,983.

Heidelberg, tp. in Berks co., Pa., on the Lebanon Valley R. R. It has manufactures of iron. Pop. 1193.

Heidelberg, tp. in Lebanon co., Pa. Pop. 2256.

Heidelberg, tp. in Lehigh co., Pa. Pop. 1441.

Heidelburg, tp. in York co., Pa. Pop. 2266.

Hei'denheim, town of Würtemberg, Germany, connected by rail with Aalen, Stuttgart (45 miles to the W. N. W.), and Nördlingen. It has varied and important manufactures. Pop. 5167.

Heights (Measurement). See HYPSOMETRY, by C. A. SCHOTT, U. S. C. S.

Heil'bronn, town of Germany, in the kingdom of Würtemberg, on the Neckar, is a curious old place, with narrow and crooked streets, and high, quaintly ornamented houses. Among its public buildings the church of St. Kilian, built from 1013 to 1529, the city hall, and the tower in which Götz von Berlichingen was imprisoned in 1529, are the most remarkable. Its trade is very lively, and its manufactures extensive and varied, comprising white lead, soap, chemicals, woollen cloth, gold and silver ware, cutlery, and musical and scientific instruments. Pop. 18,955.

Heim'dall, or **Heimdallr,** the watchman of the Æsir, or Scandinavian gods, son of Odin by a mother of the Jotun race. He has golden teeth, rides a horse with a golden mane, can see by night as well as by day, and beholds everything within a hundred leagues. He can hear the growing of the grass, and even that of the wool. He dwells in the bright Himinbjörg, at the place where the rainbow-bridge enters heaven. When danger approaches he blows the great trumpet Gjallar-horn so loudly that the whole universe can hear.

Hei'ne (HEINRICH), b. at Düsseldorf of Jewish parentage Dec. 12, 1799, was early sent to Hamburg to his uncle, the well-known banker, Salomon Heine, to prepare himself for commercial pursuits; but as he utterly disliked business, he went in 1819, with his uncle's consent and support, to Bonn to study law. After a short stay in that city, during which he became quite intimately acquainted with A. W. Schlegel, he proceeded to Berlin, where Schlegel's letters introduced him to the celebrated literary circle which gathered around Rahel Levin, and which was frequented by Hegel, Chamisso, Grabbe, and others. Here he studied literature and philosophy, and published his first book, a volume of poems, in 1822. The poems were hardly noticed, however, and the young poet, disappointed and disgusted, left Berlin for Göttingen, where, after two years' unwearied study, he took his degree in law in 1825. Once more he returned to Berlin, and published his two tragedies, *Almanzor* and *Radcliff*, but this second attempt was still more unsuccessful than the first had been. It was his *Reisebilder*, published in Hamburg in 4 vols., from 1826 to 1831, which first attracted public attention. They made quite a sensation at their first appearance. The audacity with which the author ridiculed every idea and institution for which people felt veneration, the recklessness with which he slandered every person who had an established name in literature, the malice, wickedness, and deviltry of the book, amazed people, at the same time that they were charmed by its vivacity, sprightliness, elegance, and brilliant wit. Next year he published his *Buch der Lieder*, in which he inserted the greatest part of his earlier poems from 1822; and this book made him at once the most widely read author in Germany. There was a new sense of beauty in these poems. Everything they sung of, from the greatest in historical remembrances to the most insignificant traits of every-day life, became wonderfully living and fresh, and whether they moved in a strain of melancholy or mockery they were always original and impressive. People became almost intoxicated. From 1827 to 1831, Heine resided partly in Munich, where he edited *Politische Annalen* together with Lindner; partly in Berlin, where he fell out with Platen and enriched the German literature with a piece of polemics to which no other literature has an equal, either in scandal or in wit; and partly in Hamburg. The revolution of July put him in a sort of democratic frenzy; and as it perhaps was not very safe for him to live in Germany after the publication of *Kahldorf über den Adel, in Briefen an den Grafen M. von Moltke* (Hamburg, 1831), he removed in that year to Paris, where he resided with some short interruptions for the rest of his life; he d. there Feb. 17, 1856. From 1836 to the fall of the cabinet of Guizot in 1848 he received an annual pension from the French government of 4000 francs. From 1847 he was for the most time bedridden, suffering from a disease of the spine, which also affected his eyes. During the first part of his residence in Paris he developed a great literary activity. But all that he wrote was only a repetition of the two original types with which he began—*Buch der Lieder* and *Reisebilder*—and he who knows those two books knows Heine. His prose style improved, but his ideas did not improve, and his poetical genius weakened. The freshness became artificial, the intensity forced. A lack of true nobleness and elevation became apparent, and his influence was reduced to a mere dissolving process. The principal books written in Paris were *Neue Gedichte* (1844), *Atta Troll* (1847), *Romanzero* (1854), *Beiträge zur Geschichte der neuern schönen Litteratur in Deutschland* (1833), *Französische Zustände* (1833), *Der Salon* (1834–40), *Die Romantische Schule* (1835), *Ueber Börne* (1840), *Vermischte Schriften* (1854). CLEMENS PETERSEN.

Hein'sius (ANTONIUS), b. about 1641, and d. at The Hague Aug. 13, 1720. When William of Orange ascended the English throne, Heinsius became the real governor of Holland, and he acted in this position with great success and in perfect harmony with his royal master. He was, if not the creator, a most energetic promoter, of the grand alliance between England, Holland, Hanover, Denmark, Prussia, Austria, and Savoy against Louis XIV., and it was to him, as the real soul of the alliance, that Louis XIV. made overtures of peace in 1708, 1709, and 1710. But the negotiations were every time broken off on account of the enormous and humiliating sacrifices which Heinsius demanded of France, and which he clung most doggedly to. A caprice of Queen Anne, however, changed the whole situation (see SPANISH SUCCESSION, WAR OF THE), and as at the same time the French became successful once more in the field, the Peace of Utrecht was concluded Apr. 11, 1713. Heinsius signed it, but he was the last to do it.

Heinsius (DANIEL), a disciple of Joseph Scaliger, b. June 9, 1580, at Ghent, wrote Latin elegies in his tenth year; became professor at the University of Leyden in his twenty-fifth year; charmed the whole world by his Latin tragedies, *Herodes Infanticida*, *Auriacus*, etc.; received great honors from Gustavus Adolphus, Urban VIII., and other monarchs; and d. Feb. 25, 1655. Published critical editions of many Greek and Latin authors, and some of these editions have great value.—His son, NIKLAAS HEINSIUS (b. July 20, 1620; d. Oct. 7, 1681), also acquired a great name for his critical editions, especially of Latin poets. He was not a poet himself, nor did he fill the office of a professor. He was a statesman, and was for some years in the service of Christina of Sweden.

Heint'zelman (SAMUEL P.), b. in Manheim, Lancaster co., Pa., Sept. 30, 1805; graduated at West Point, and entered the army as second lieutenant of infantry July, 1826. For twenty years he served principally on the Northern frontier and in the Florida war. In 1847–48, being now a captain, he served in the Mexican war, and was brevetted major Oct. 9, 1847, for gallantry at Huamantla. From 1849 to 1855 he served in California against the Coyote and Uma Indians, and subsequently to the breaking out of the civil war was mostly employed on frontier duty in Texas, commanding operations on the Rio Grande against Cortinas' marauders, etc. He attained a majority in the army in 1855, and in May, 1861, was commissioned colonel of the 17th Infantry, and assigned to duty in Washington as acting inspector-general of that department; appointed brigadier-general of volunteers May 17, 1861, he commanded the forces which captured Alexandria, Va., May 24, and commanded at that place till July following. He took part in the first battle of Bull Run, July 21, 1861, where he was wounded. In the Virginia Peninsular campaign of 1862 he commanded the 3d army corps before Yorktown, Apr.–May, and at the battle of Williamsburg, May 5. Promoted to be major-general of volunteers from the date of the latter battle, he commanded the 3d and 4th corps at Fair Oaks, May 31, June 1, and in the "Seven Days'" fight. At the second battle of Bull Run (Aug., 1862) he was engaged; also present at Chantilly, Sept 1. On Feb. 2, 1863, he was placed in command of the defences of Washington and the 22d army corps, which command he held till Oct., 1863; and from Jan. to Oct., 1864, commanded the northern department, embracing the States of Ohio, Michigan, Indiana, and Illinois; subsequently on court-martial duty till Aug., 1865, when he was mustered out of the volunteer service. Brevet brigadier-general and major-general U. S. A. for gallant conduct in battle. Resumed command of the 17th Infantry in Sept., 1865, and commanded in New York harbor and in Texas. In Feb., 1869, he was retired from active service upon the full rank of major-general. G. C. SIMMONS.

Heir [Lat. *hæres*], one who is entitled by law to succeed to the real estate of a deceased person who dies without a will or who leaves property undisposed of by his will. The name is only strictly applicable after the ancestor's death, since it is a maxim of the law that "no one can be the heir of a living person;" still, it is sometimes used in a secondary sense, to designate specified persons, during the ancestor's life. Personal estate does not pass primarily to an heir, but is received by the administrator, to be distributed among the next of kin, according to definite rules of apportionment, after the satisfaction of debts and other proper charges. (See ADMINISTRATOR.) But the rights of heirs appertain to all forms of real estate, tangible or intangible, in possession or in expectancy, and are vested in them immediately upon the occurrence of death, without any formality of transfer or acceptance. Hence it is a legal principle that no man can make another his heir, since heirship exists independently of any individual creation, and depends solely upon the ties of nature and established rules of law. Property passing to an heir is said to be acquired by descent, while all other modes of obtaining title to land are denominated, in law, acquisitions by purchase. An ancestor is under no obligation to refrain from disposing of his real estate in order that his heir may not be deprived of his prospective interest therein, but may, if he desires, devise it entirely to third persons in his will. This rule is sometimes modified by statute, as in New York, where a testator cannot devise, in certain cases of nearly related heirs, more than half of his estate to charitable corporations. When the heir is vested with the real estate, he does not take

it absolutely, discharged of all the claims of creditors, but subject to their right to levy upon it, as if the ancestor were living, in case the avails of the personal property are not sufficient for the payment of debts. The question as to what relatives shall constitute the heirs of an intestate is determined upon different principles in England and the U. S. It is the policy of the English law to keep landed estates undivided, and inheritance is therefore governed by the law of PRIMOGENITURE (which see). The eldest son and his descendants have the superior claim to the property, and in default of these the second son and his descendants receive the title, and so on with the other sons if there be any in the family. If there be only daughters, they all inherit equally by virtue of the doctrine of coparcenary. In the U. S. no preferential claim is given to any one of the children above the others, and all share the inheritance equally, being generally considered tenants in common. If there be no children living or their descendants, the other blood relatives who are nearest in degree inherit the property according to rules prescribed by statute. They will be found considered more at length under the title DESCENT. When there are no heirs of the deceased the property escheats to the State.

An *heir-apparent* is one whose right of succession is indefeasible in case he survive his ancestor; as, for example, the eldest son under the English law of inheritance. An *heir-presumptive* is one who would succeed if the ancestor were to die immediately, but whose right may be displaced, if the ancestor live, by the coming into existence of another as heir. Thus, in England an only daughter would be heir-presumptive until a son were born. So a brother would be an heir-presumptive until the birth of a child.

(The necessity of using the word "heirs" in conveyances of land is considered under the topic FEE. For the difference between *heir* at common law and *hæres* in the civil law, see HÆRES.) G. CHASE. REV. BY T. W. DWIGHT.

Heir-Apparent and **Heir-Presumptive.** See HEIR.

Heir'looms, such personal chattels as go, by force of a special custom, to the heir, along with the inheritance, and not to the executor or administrator of the former owner, as the usual laws for the disposition of personal property would require. The term "heirloom" is frequently employed in English law at the present day as applying to pictures, plate, or other articles of property which have been directed by deed of settlement or conveyance in trust to pass, with the mansion-house in which they are placed, into whosesoever hands the house may come. The ancient jewels of the Crown are also heirlooms. Charters and deeds evidencing the title to the land, together with the receptacles in which they are deposited, pass likewise to the heir with the inheritance. Ancient authorities define heirlooms as consisting chiefly of such articles as are firmly attached to the freehold, but these are now considered to pass with the land as fixtures. (See FIXTURE.) The owner of heirlooms cannot dispose of them by will if the land is left to descend to the heir; they are considered as constituting too essential a portion of the real estate to be thus dissevered. The law concerning heirlooms is confined to English jurisprudence, and is of no importance in the U. S., unless title-deeds to land are considered as passing to the heir under this designation in this country. This, however, is not definitely determined.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Hel [related to the word *hell*], the Norse goddess of the dead, was the daughter of Loki and Augurboda, and dwelt in Niflheim, under one of the roots of Yggdrasil, the mystic ash tree, where she had been hurled by the All-Father. Her awful abode was the home of monstrous evils of every kind, and from it there was no escape.

Hel'amys [Gr. ἕλος, "meadow," and μῦς, "mouse"], a name sometimes given to *Pedetes Capensis*, a South African rodent of the family Pedetidæ, also called jumping hare and grand jerboa. It is over a foot long, and can leap like a kangaroo—over 30 feet. Is nocturnal, and can rapidly hide itself in the ground. It is exceedingly timid.

Hel'der, The, town of the Netherlands, in the province of North Holland, on the Marsdiep, which separates the mainland from the island of Texel. The natural barrier against the sea to the lowlands is the coast-range of "dunes" or *downs*—hillocks of sand thrown up by the waves and drifted inward with the winds—which has a width in some places exceeding 2 miles. Towards the southern extremity of the peninsula of North Holland the barrier becomes much enfeebled, and the very extremity, the Helder, has required works of extraordinary magnitude. The great dyke of the Helder, built of Norwegian granite and Belgian limestone, forms for 6 miles an artificial coast-barrier. The Helder, previously little more than a fishing-village, was strongly fortified and made a naval station by Napoleon I., who called it his northern Gibraltar. The government of Holland maintains here a naval establishment, with dry docks, etc. The difficulties of navigation of the Zuyder-Zee caused the construction in 1820 of the "North Holland Canal," from the Y at Amsterdam to the Helder, by which the latter place became the real *seaport* of Amsterdam. In this capacity, however, it will be in great degree superseded by the "North Sea Canal" port now in construction. Pop. 17,296.

Hel'en [Ἑλένη], wife of Menelaus, and the most beautiful woman among the Greeks, was a daughter of Leda, born at the same time with Castor and Pollux. Her seduction by Paris (with whom she fled to Troy) was the cause of the Trojan war. Her story is variously given by different Greek poets.

Helen, post-tp. of McLeod co., Minn. Pop. 476.

Hel'ena, city, cap. of Phillips co., Ark., on the Mississippi River, 80 miles below Memphis, Tenn. It is the terminus of the Arkansas Central R. R., has 2 banking-houses, 6 churches for white and 2 for colored people, 2 daily and 1 weekly newspaper, public schools, 2 oil-mills, gasworks, 2 fire-engines, a hook-and-ladder company, a city-hall, and a theatre building. Pop. 2249.

Q. K. UNDERWOOD & Co., PUBS. "SOUTHERN SHIELD."

Helena, tp. of Antrim co., Mich. Pop. 483.

Helena, post-tp. of Scott co., Minn. Pop. 1089.

Helena, post-v., cap. of Lewis and Clarke cos., Mont., in the heart of the gold and silver mining district of Montana, 150 miles S. of Fort Benton. It has 2 national and 1 private bank, silver-smelting works, foundry and machine-shops, 2 carriage-shops, 2 door, blind, and sash factories, 5 quartz and 3 lumber mills, and 2 daily and weekly journals. It is the chief town of Montana. Pop. 3106.

R. E. FISK, ED. "HELENA HERALD."

Helena, post-tp. of Johnson co., Neb. Pop. 333.

Helena, post-v. of Brasher tp., St. Lawrence co., N. Y. It has water-power. Pop. 150.

Helena, a v. of Newberry co., S. C., 1 mile W. of Newberry Court-house, at the junction of the Greenville and Columbia and the Laurens R. Rs.

Helena, post-v., county-seat of Karnes co., Tex., 56 miles S. E. of San Antonio, on San Antonio River.

Helena, SAINT, mother of Constantine the Great, b. at Drepanum in Bithynia in 247 (or, as some say, at Gloucester in Britain). She was married to the emperor Constantius Chlorus, who for reasons of state divorced her in 292; but her son, Constantine the Great, on succeeding to the throne in 306, treated her with great honor, and conferred upon her the title of Augusta. After her conversion to the Christian faith she made a pilgrimage to Jerusalem, where, with almost miraculous success, if the legend is credible, she succeeded in identifying all the remarkable objects and places connected with our Saviour's history; more especially his sepulchre and the real wood of the cross on which he suffered. She also, as we are told, discovered the burial place of the "Magi" or Wise Men of the East (the "Three Kings"), removed their bodies to Constantinople, whence they were transferred to Milan, and thence (1164) to Cologne, where they constitute one of the chief wonders and sights of the noble cathedral. D. about 328. For her many virtues and charities she was subsequently canonized by the Church.

Hel'enus, a son of Pyrrhus, king of Epirus, accompanied his father on his expedition to Italy in 280 B. C. After the defeat at Beneventum, in 275 B. C., and the return of Pyrrhus to Epirus, Helenus was left in Tarentum with a small garrison of Epirotes. He was soon recalled, however, and took part in the attack on Argos, in which Pyrrhus was killed. He was taken prisoner himself, but Antigonus Gonatas treated him with great regard, and allowed him to return to Epirus with the remains of his father.

Héliade (JEAN), b. in 1801 at Turgowitz, was brought up at Bucharest, then capital of Wallachia, in a college, where he made such remarkable progress that at twenty years of age he was chosen one of its professors. As a literary man he introduced French literature into Roumania by translating the *Meditations* of Lamartine, the works of Voltaire, and other authors of the seventeenth century. He published also *The Cherubim and Seraphim*, and another poem, *Michael the Brave*, which is the national poem, the *Iliad* of Roumania. Héliade in 1831 founded the *Wallachian Courier*, a paper which was soon suppressed by the Wallachian government, then under the influence of Russia. In 1848, Héliade was a member of the revolutionary government, and in September he was exiled. He went to Paris, then to the island of Chio, where he finished his poem of *Michael the Brave*, and since 1850 he has lived in Roumania. FÉLIX AUCAIGNE.

Helianthus. See SUNFLOWER.

Hel′icoid [Gr. ἕλιξ, a "scroll," and εἶδος, "form"], a warped surface that may be generated by a straight line moving so that each of its points shall advance uniformly in the direction of a given straight line, and at the same time have a uniform angular motion around it. The fixed line is called the *axis* of the surface, the moving line is called the *directrix*, and any position of the directrix is called an *element*. The conditions imposed require that the same point of the generatrix shall remain continually on the axis, and that the angle between the directrix and axis shall be constant. When this angle is a right angle, the helicoid is *right;* otherwise it is *oblique*. The curve generated by any point of the directrix is called a *helix*. The right helicoid, which is a particular case of the helicoid, is also a particular case of the right conoid. The under surface, or soffit, of the spiral stairway is an example of the right helicoid; also the upper, or lower surface of the thread of the rectangular-threaded screw. The upper and lower surfaces of the thread of a triangular-threaded screw are examples of the oblique helicoid. Since the helicoid is a warped surface, every plane passing through an element is tangent to the surface at some point of the element. To construct a plane that shall be tangent to a helicoid at a given point, draw the element of the surface through the given point; also a tangent line to the helix that passes through the same point; the plane of these lines is the required plane. A plane through the point of contact, perpendicular to the axis, intersects the surface in a curve called the spiral of Archimedes, and the tangent plane in a line tangent to this spiral. If tangents are drawn to any helix at every one of its points, these tangents form a surface called the *developable helicoid,* from the fact that it can be developed, or rolled out, on a plane. W. G. PECK.

Hel′icon [Gr. Ἑλικών], **Mount,** a mountain of Greece, in Bœotia, between the Gulf of Corinth and Lake Copais. It is strictly a range of mountains, a continuation eastward of Parnassus. Its highest point is a cone 5000 feet high. Its eastern side is fertile and abounds in springs. Helicon was sacred to the Muses, probably because Hesiod the poet lived at Ascra, near its eastern foot. Near Ascra was the fountain Aganippe. Higher up was the grove of the Muses. Still higher up was the well Hippocrene. These points are well identified in modern times.

Hel′igoland, or **Hel′goland** ("holy land"), a small island in the North Sea, captured by England from Denmark in 1807, opposite to and about 40 miles from the mouth of the Elbe, in lat. 54° 11′ N. and lon. 7° 53′ E. Including Sandy Island, it is about 1 mile long from N. to S., one-third of a mile wide, and about 3 miles in circumference. The inhabitants are mainly of Frisian descent, and engaged in fishing and piloting, though of late years they have turned their attention to accommodating visitors who resort here for the fine sea-bathing. The island is divided into two parts—the low ground and the rock; the latter, a red sandstone, rises to a height of 200 feet above the sea. There are several excellent roadsteads. Although much has been said of the gradual washing away of the island by the sea, the probable rate is but very small; and by the best authorities it is stated that the island has suffered a diminution of but three miles in circumference for a century. The government is vested in a governor appointed by the Crown, aided by an executive council. The island is fortified, and has a lighthouse. In ancient times it was inhabited by Frisii, and it is said that on this island the temple of the Frisic god Fosete stood, before the introduction of Christianity in the eighth century, when it was destroyed. Pop. 1912.

Heliodo′rus [Ἡλιόδωρος], classed among the *scriptores erotici Græci*, b. at Emesa in Syria, and flourished towards the end of the fourth century A. D.; wrote, probably in early life, a romance entitled *Æthiopica* in 10 books, describing the loves of Theagenes, a Thessalian youth, and Chariclea, daughter of a king of Æthiopia. Heliodorus became in later life bishop of Tricca. The best editions are by Mitscherlich in the *Scriptores Erotici Græci* (the 2d vol. in 2 parts, Strasburg, 1798), by Coraës (Paris, 1805, 2 vols.), and in Didot's *Scriptorum Græcorum Bibliotheca* (Paris). H. DRISLER.

Heliogabalus. See ELAGABALUS.

Heliom′eter [Gr. ἥλιος, the "sun," and μέτρον, a "measure"], an instrument first invented to measure the diameter of the sun in seconds and parts of seconds, but now employed to measure small arcs generally upon the celestial sphere. There are several remarkably ingenious forms.

Heliop′olis, one of the most famous cities of ancient Egypt, situated near the delta of the Nile, on the canal which connected that river with the Red Sea. It was the chief seat of the worship of the sun and the cradle of the legends of the sacred bull Mnevis and the wonderful bird Phœnix. It was celebrated for the magnificence of its temples and for the learning and wisdom of its priests. Many of the Greek philosophers spent some time in Heliopolis to study; Plato lived there for thirteen years. In the fifth century it began to decline, and when Strabo visited it at the beginning of the Christian era, he found it a city of magnificent ruins, of which now only a few fragments are left. Its site is occupied by a small village, Matareeyeh.

Heliopolis of Syria. See BAALBEC.

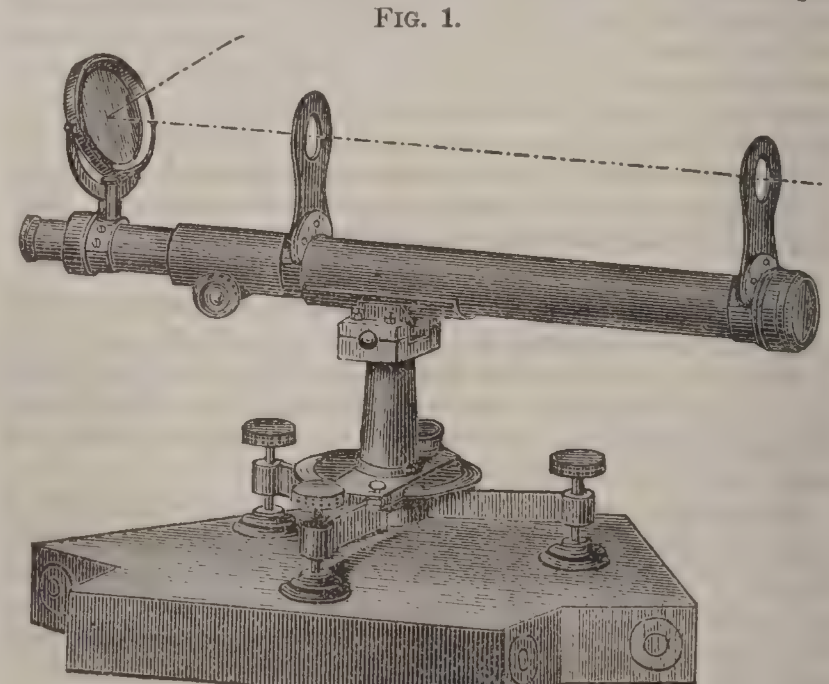
He′liostat [Gr. ἥλιος, the "sun;" στατός, "placed," from ἱστάναι, to "place"], a mirror carried by a clockwork mechanism, so contrived as to reflect a beam of solar light in an unvarying direction, notwithstanding the apparent change of place of the sun in its diurnal motion. The heliostat has long been in use in physical investigations and experiments, without possessing a high degree of precision. More recently it has been employed in aid of astronomical observation, for which purpose it has been greatly improved. The American expeditions sent out to observe the transit of Venus of 1874 (and also the French) made use of the heliostat in photographing the successive aspects of that phenomenon by means of telescopes of long focus (40 feet), instruments which without it could not have been employed at all. A nearly or quite perfect form of heliostatic apparatus, as it respects precision of movement, was one of the latest inventions of the very ingenious Foucault, and was called by him the *siderostat* (Lat. *sidus*, a "star or constellation;" *statuere*, to "place" or "fix"), being designed for use in all the ordinary observations of astronomy, for the purpose of enabling the observer to occupy constantly the same and the most convenient position. F. A. P. BARNARD.

He′liotrope, or **Bloodstone,** a variety of jaspery quartz, much used in jewelry, and presenting bright red spots upon a deep green ground.

Heliotrope [Gr. ἥλιος, the "sun;" τροπή, "turning"], an instrument employed in geodesy to reflect the sun's rays from one signal-station to another in order to facilitate observation; the reflecting surface presenting to the distant observer the appearance of a brilliantly luminous point or star. There are several varieties.

Steinheil's Heliotrope.—The following description of this useful instrument may be acceptable to observers, since the inventor's own account is not readily accessible.* This extremely simple and portable little instrument may be used directly to indicate the position of a distant object, for the purpose of angular (horizontal or vertical) measures, or it may be employed for giving time-signals (chronometer comparisons, for instance) to a distant point; and observers at distant stations may even converse by adopting an alphabet composed of long and short intervals of time. Should the station to which the light of the heliotrope is to be shown be at a distance too great for the unaided vision, the instrument may be attached to a telescope.

FIG. 1.



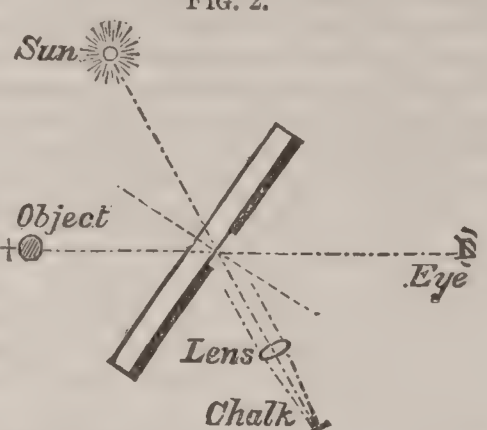
Steinheil's Heliotrope.

By the aid of the annexed figure, representing the instrument two-thirds its actual length, its adjustment and use may be easily understood. Its principle of construction involves the formation of an image of the sun 180° distant from the direction of the reflected rays, by means of which the eye may perceive the distant area over which the solar light, reflected by the mirror, is diffused. This is effected as follows: The reflecting surface of the mirror is perforated in the centre, and that axis of the instrument which is directed to it carries a small lens, in the focus of which is

* Schumacher's *Jahrbuch* for 1844, p. 12.

placed a surface of white chalk or plaster of Paris. If the solar rays, admitted through the hole, are made to fall upon the lens, they are united on the white surface, and are returned back through the lens and reflected by the lower surface of the glass where the metallic surface had been removed, and in a direction, according to the laws of optics, exactly opposite to that in which the *same lower* surface of the mirror reflects the sun towards the distant object. (See Fig. 2.) To use the instrument adjust as follows: Imagine a plane to pass through the vertical axis of the supporting screw and the optical axis of the lens (and consequently also through the centre of the opening in the reflecting surface of the mirror), and direct the latter to the sun. F. A. P. BARNARD.

FIG. 2.



Heliotrope [Gr. ἥλιος, "sun," and τρέπω, to "turn;" the flowers were once believed to turn with the sun], a genus (*Heliotropium*) of herbs and shrubs of the order Boraginaceæ. The *H. Peruvianum* and its hybrids are green-house shrubs, having flowers of delightful fragrance. They are extensively cultivated for their flowers, which are used by perfumers. *H. curassavicum* and *myosotoides* are natives of the U. S., where also the common heliotrope (*H. Europæum*) is naturalized. The Indian heliotropes (*Heliophytum*) have a few representatives in the flora of the U. S.

Helix. See PULMONATA.

Helix [Gr. ἕλιξ, a "winding"], a curve described by any point of the generatrix of a helicoid. (See HELICOID.) If a screw is turned around in a fixed nut, every point of the screw describes a helix. From the method of its generation it follows that every point of a helix is equally distant from the axis; hence, if we suppose the axis vertical, the horizontal projection of a helix is the circumference of a circle; further, every tangent to a helix makes a constant angle with the horizontal plane. If the projecting cylinder of a helix on the horizontal plane is developed, or rolled out, on a tangent plane, the helix will develop into a right line, which makes with the development of the base an angle equal to the angle that the helix makes with the horizontal plane. The tangent of this angle is equal to the vertical distance through which the generatrix ascends in one revolution, divided by the horizontal projection of the same portion of the helix. The different helices that make up an oblique helicoid are differently inclined to the horizontal plane, the limits of this varying inclination being 90° and 0°. The nearer a helix is to the axis, the greater is its inclination. If tangents are drawn to a given helix at every point, and produced to meet a plane perpendicular to the axis, they will intersect that plane in a curve which is an involute of that circle which is the horizontal projection of the given helix. W. G. PECK.

Hell. Hell is originally that which is "covered" [Ang. Sax. *helan*], the invisible world; the Hebrew *Sheol* (to "ask," or "to be hollow") is the *under-world;* the Greek *Hades* is the *unseen* place; *Gehenna* means the valley of Hinnom. The Old Testament uses Sheol, and the New Testament uses Hades, for the place of the dead; sometimes the words may be restricted to the grave, at others to the place of the spirit without regard to character, though there are acknowledged distinctions and divisions there. The Jews after the exile divided Sheol into Paradise and Gehenna. (On *Hades* see Dr. E. R. CRAVEN'S *Excursus*, Lange's *Comment. on Revelation*, p. 364.)

The place of punishment (the present meaning of "hell") is described in the Bible as a place of torment or everlasting punishment. It is figuratively spoken of as under the earth, as Gehenna (the valley of Hinnom, where the rites of Moloch were celebrated), as Tartarus, as silence, the prison-house, the pit of destruction, outer (or blackness of) darkness, where the worm dieth not, etc. The condemned suffer (1) the punishments which *naturally* follow sin—loss of happiness, pain, propensities to sin, the company of the evil, etc.; and (2) God's *positive* judgments. Sufferings vary with degrees of guilt. Between hell and heaven the scholastic divines placed Purgatory, with various compartments.

The Church has almost always and universally held to the future, eternal punishment of the wicked. Here and there some have taught (1) no future punishment; (2) a partial, (3) or complete restoration. Almost every nation and tribe has believed in the existence of hell as a place of punishment. Descriptions have depended largely on the power and character of men's imaginations. (See the accounts of the Scandinavian Niflheim and the minute and boundless extravagance of the later Hindoo doctrine.) The pagan accounts vary according to the peculiar views of each people as to the character of evil and that which constitutes the horrible. The Bible is very reticent as to particulars; heathen writings are generally very minute, sensuous, and revolting. (See art. "Gehenna" and the literature by Prof. Ezra Abbot in the Appendix to Alger's *History of the Doctrine of a Future Life.*) ISAAC RILEY.

Hell (MAXIMILIAN), b. at Schemnitz May 13, 1720. In 1738 he entered the Society of Jesus, and in 1751 took holy orders. From early youth he evinced great interest in astronomy and natural science, and while in Vienna studied at the observatory belonging to the society. Later, he held the chair of mathematics at the University of Klausenburg, Transylvania, for a couple of years, but from 1756 filled the position of director of the observatory in Vienna to his death, Apr. 14, 1792. His principal works are *Ephemerides Astronomica ad meridianum Vindobonensem* (1757–86), and *Observatio transitus Veneris ante discum Solis die 3 junii, anno 1769* (1770); which observation was made at Vardöhuus, the northernmost town on the mainland of Europe. On this northern journey he was said to have made most important observations, but they were never published, though announced.

Helladotheri'idæ [Ἑλλάς, "Greece," and θηρίον, "wild beast"], a family established for an extinct form whose remains have been found in the Miocene deposit of Pikermi, near Athens. The animal in its external appearance had some resemblance on the one hand to the giraffe, and on the other to the antelopes or deer, the body in front being upraised higher than behind, as in the giraffe, but the legs being relatively shorter, and the neck not prolonged, thus rather resembling the antelopes. It excelled in bulk any of the living ruminants. The skull was distinguished by the extension of the supra-occipital and parietal far backward, and by its contraction forward in front of the molars, the facial portion being normally produced. The molars (M. $\frac{3}{3}$, P.M. $\frac{3}{3}$) were broad, and the inner crescentic plates of enamel described a simple curve. No horns appear to have been developed. The generic name is *Helladotherium.* (See GAUDRY, *Animaux fossiles de l'Attique*, pp. 252, 264, pl. 41–44.) THEODORE GILL.

Hel'lam, post-tp. of York co., Pa. Pop. 1639.

Hellani'cus [Ἑλλάνικος], the most distinguished of the old λογογράφοι, preceding Herodotus, was a native of Mitylene in Lesbos, b., according to Pamphila, B. C. 496, and d. about 411; but these dates are much questioned. Like Herodotus and Hecatæus, he visited the countries he describes, though scarcely any particulars of his life are known. He wrote a number of works (some state 30), but probably parts of works are quoted by distinct titles. They related chiefly to the early Greek and Persian history. His principal writings are *Deucalionea*, in two books; *Phoronis*, in 2 books; *Atlantis*, in 2 books; *Troica*, in 2 books; *Atthis*, in 4 books; *Æolica*, in 2 books; *Persica*, in two books; and a chronological work, ἱέραιαι τῆς Ἥρας (a list of the priestesses of Juno at Argos), in 3 books. Of his writings, fragments are left, collected by Sturz, *Hellanici Lesbii Fragm.* (1826), and by Müller, *Hist. Græc. Fragm.*, vol. i., pp. 45–69. (See MURE'S *Hist. Greek Lit.*, vol. iv.) H. DRISLER.

Hellas. See GREECE, by PROF. H. C. CAMERON, PH. D.

Hell-bender, the *Menopoma alleghaniensis* or *Protonopsis horrida*, called also **Mud Devil, Ground Puppy,** and **Young Alligator,** a tailed batrachian found throughout a large part of the U. S. It lives at the bottom of streams, is one or two feet long, and is incorrectly believed by fishermen to be poisonous. It is very greedy, and often bites a fish-hook, to the angler's great annoyance.

Hel'le [Ἕλλη], in Greek mythology, a daughter of Athamas and Nephele. When Phrixus, Helle's brother, was to be put to death, Nephele placed her children on the back of Chrysomallus, the ram with the golden fleece, who went with them through the air; but Helle fell off, and was drowned in the Hellespont, which was named from her.

Hel'lebore [Gr. ἐλλέβορος], a famous remedy used especially by the ancients in cases of insanity. The best grew at ANTICYRA (which see). It was the root of *Helleborus orientalis*, an herb of the order Ranunculaceæ. The "black hellebore" of modern pharmacy is chiefly the product of *H. niger* (which produces the flower called Christmas rose). Its properties are shared by *H. viridis* and *fœtidus*. These are all Old-World species, and have violent cathartic properties. In overdoses they are active irritant poisons. Hellebore is at present not much used in medicine, except as an emmenagogue. (For white hellebore, so called, see VERATRUM.)

Hel'len, according to the Greek mythology, was a son of Deucalion and Pyrrha, and the progenitor of the whole Hellenic nation. He had three sons—Dorus, Æolus, and

Xuthus. From the two former, and from the two sons of Xuthus, Ion and Achæus, descended the four different branches of the Greek nation—the Dorian, Æolian, Ionian, and Achæan peoples.

Hel'lenist [Gr. Ἑλληνιστής], among the Jews of Palestine and other countries in the Roman period, and among the Jewish Christians of the same times, a name applied to those persons who yielded themselves to the influence of Gentile, and especially Grecian, civilization, letters, language, and habits, probably including also Judaized Greeks. It is a disputed point whether there were or were not distinct Hellenistic sects among Jews or Judaizing Christians, but the weight of the evidence seems to indicate that there were not. The Hellenistic spirit did much in preparing the way for the spread of Christianity.

Hellenis'tic Greek, the Greek language as it appears in the LXX., the New Testament, the writings of Josephus and Philo, and those of some of the early Christians. It abounds in Hebrew and Aramaic forms, idioms, and even words.

Hellenop'olis [originally *Drepanum* or *Drepane*], a Bithynian city on the Propontis (Sea of Marmora), near the river Draco. It was named Hellenopolis by the emperor Constantine the Great, probably because it was the birthplace of Helena, his mother. Constantine did much to build up the town, and so did Justinian in later days, but the place seems never to have been very important. Constantine lived much in this place, on account of its mineral springs. It is now called *Hersek*.

Hel'ler's, tp. of Newberry co., S. C. Pop. 2061.

Hel'lertown, post-v. of Lower Saucon tp., Northampton co., Pa., on the North Pennsylvania R. R., 50 miles from Philadelphia and 4 miles S. of Bethlehem, has extensive iron and zinc mines.

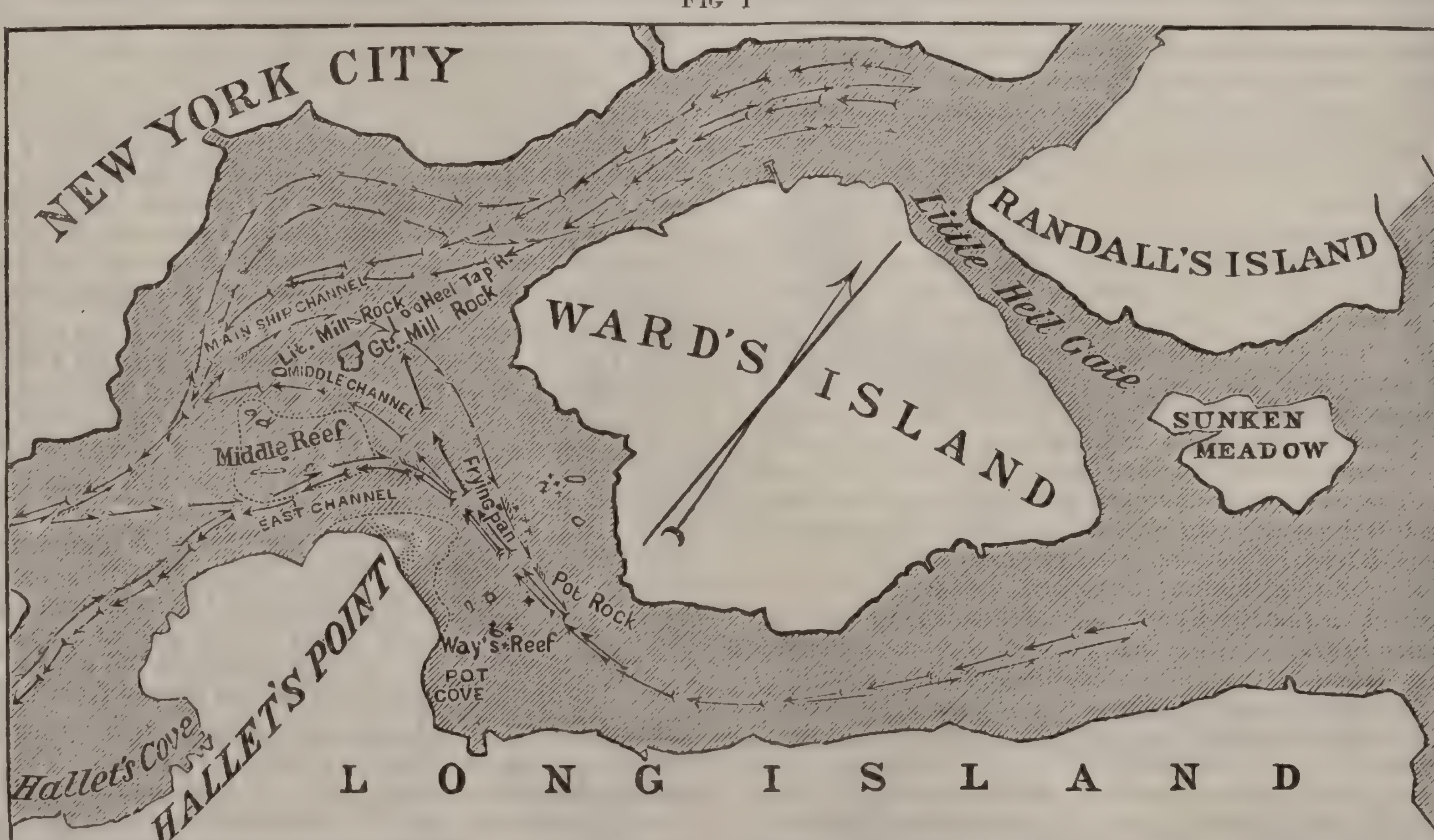
Hel'lespont [Ἑλλήσποντος], the ancient name of the DARDANELLES (which see), the strait which connects the Propontis and the Ægean; named from the old legend of HELLE (which see), according to the ancients. It was the scene of many events conspicuous in the history and mythology of antiquity.

Hell Gate. The important relation which the East River holds to the commercial prosperity of the city of New York has always been so evident, that every effort which promised to remove the obstructions to its navigation, has promptly received public attention and appreciation. This stream receives the tide at its two extremities—at the eastern, the Sound tide, and at the western, the Sandy Hook tide. The times as well as heights of these tides are different, and by such want of uniformity, velocities are imparted to the currents sufficient to keep the channel dredged to depths suitable for the largest class of vessels now employed in commerce, or that it is possible to conceive in the future, will ever be so employed. This magnificent stream has, fortunately, been so endowed with capacities for self-preservation that the mistakes of man have hitherto been effective only in increasing the natural velocities at certain points of its course, between the cities of New York and Brooklyn, to such degree as at certain periods of the tide to prove a delay and embarrassment to navigation. When the risks are considered to which this river has been in the past, and in the future probably will be subjected, arising from the cupidity of riparian owners, corrupt legislation, and, it may be added, the general lack of knowledge appropriate to the treatment of rivers, it should be a matter of congratulation that the bountiful provisions of nature, though they may not be effective against injury, will nevertheless, as it is confidently believed, prevent the destruction of this thoroughfare.

The facts of the East River connecting the waters of the Hudson and of Long Island Sound, and of forming at the same time a large portion of the wharf-front of the cities of New York and of Brooklyn, constitute the causes of the interest manifested in the projects for its improvement. It has been assumed that the difference in the length of the voyage to Europe by way of the Sound, and that by way of Sandy Hook, would determine in favor of the former the course of Transatlantic steam-navigation; but this difference is too little to effect the result claimed or to influence it greatly. On the other hand, it has been asserted that the rock-bound shores of the Sound, its fogs, and comparatively intricate channel, will cause a discrimination against it, and compel the preference to be given to the outlet at Sandy Hook. The true conclusion would seem to be, that railroad lines having their natural termini upon the East River, must draw steamers to load at such points; and this, taken in connection with the superior depth of water, will determine the course of a considerable portion of the foreign commerce through the Sound. The position here taken is enhanced in probability by existing tendencies in the carrying-trade to consolidation, which have of late years caused a great increase in the size and draught of ocean-steamers, the largest of which, even now, test to the utmost the depth upon the bar at Sandy Hook—a depth which it is practically impossible to improve.

All of the obstructions of moment existing in the East River are to be found in that portion which passes under the name of Hell Gate, and are due to numerous reefs of rocks encroaching upon the channels, and to the violent currents caused by them. A survey was made in 1848 by Lieutenants-commanding Charles H. Davis and David Porter, U. S. navy, and from the results obtained, a very clear idea of the dangers and obstructions to navigation to be encountered may be formed. Lieutenant-commanding Davis writes: "The strength of the current is such that sailing vessels can only stem its force or escape from it by a commanding breeze; but as the main course of the flood tide keeps the middle of the eastern channel, it is most secure for vessels which are coming from the westward with the tide to place themselves in the middle of the stream and follow its direction. They are thus carried through safely. This plan, however, is inadmissible for any but small vessels, on account of two rocks, the Pot and Frying Pan, which lie in or very near the mid-channel, are in the way, both going to the eastward and westward, and have but

FIG 1



Ebb current. Map of Hell Gate. Flood current.
Scale 1 : 25,000.

little water on them at low tide. There is also a reef, called Way's Reef, which lies in the course followed by steamboats principally when coming from the eastward against a strong flood. It is their custom to keep close round Pot Cove, and run up under Hallet's Point, by which they avoid the strength of the flood. In this part they find an eddy current in their favor. But on the ebb the greatest danger arises from the divergence of the current where the ebb branches off into three directions to take the course of the three channels—the main S. channel, the middle channel, and the eastern channel. The safe navigation depends here upon deciding sufficiently soon, at the point of separation, which channel shall be taken, and the neglect to do this, or a loss of control over the vessel for any reason, frequently results in being carried on the Gridiron. When a vessel that has attempted the eastern channel finds herself carried toward the Gridiron, her only chance for safety is to run for the middle channel, which is narrow and made precarious by the middle reef, the outer rock of which is the Negro Head. The Gridiron is, owing to the strong set of the tide on it, the most dangerous reef in the passage. The reef known as the Bread-and-Cheese, on the eastern end of Blackwell's Island, is also very dangerous. Vessels are liable to go on it in the flood, when it is covered, by getting into the eddy near it with a light wind. The chief danger is on the ebb, and from the same reason that makes the Gridiron dangerous—*i. e.* the strong set of the tide in that direction."

The obstructions in the East River necessary to be removed lie within the corporate limits of New York and neighboring cities, and in a few years, when this portion shall have become a busy harbor, the existence of the present obstacles would prove to be an intolerable nuisance. The large water-commerce with the East, all of which tends to this river, demands the improvement, as the crowded state of the thoroughfare at Hell Gate daily demonstrates to the most casual observer. The removal of obstructions, by which the harbor of New York would have two outlets into the ocean instead of one, will much increase the capability of a naval defence, while the difficulty and risk of blockading the port would be at the least doubled. Existing obstructions, while forbidding the use of this thoroughfare to large vessels of deep draught, are far from permitting a safe navigation to those of the smallest class, as the record of the large number lost or damaged sufficiently demonstrates.

To distinguish more clearly the positions and designations of the reefs, the Gridiron, Flood Rock, Hen-and-Chickens, and Negro Head, all of which constitute parts of one reef, will hereafter be known by the name of the Middle Reef, between which and the reef whose visible projections are called Great and Little Mill Rocks, the Middle Channel is situated. The Eastern Channel is included between the Middle Reef and Hallet's Point. The main South or Ship Channel lies to the W. of Great and Little Mill Rocks, and between them and New York Island.

Lieut.-commd'g Davis recommended "that Pot Rock, the Frying Pan, and Way's Reef be blasted and scattered. The two former are single rocks of a pointed shape, the latter is long, and has the character of a ledge;" and also that the Middle Channel be improved by blasting, so as to make a clear channel of sufficient depth for common vessels and steamboats. He further says: "Something has been said of removing and scattering all the rocks in Hell Gate, those out of the water as well as those under water. But it appears to me that this proposition is best answered by asking where the materials are to go. Unless carried off, they must obstruct the neighboring channels, and the process of blasting would never be completed." The large reefs he proposed to face with sea-walls or piers, showing above the surface of the water at high tide at least four feet, and "that these piers be faced with wood, and be provided with the spring-fenders used at the steamboat ferries, and that their forms should correspond to the natural shape of the reef; by which means vessels coming in contact with them would be guided into the channel-ways." Certain small rocks of less importance, situated near the shores, were likewise indicated by Lieut.-commanding Davis in this report for removal.

On the subject of an improved naval defence of Long Island Sound and of the harbor of New York he writes: "But a still more serious consideration is that of the increased facilities for naval defence which this improvement would afford." In the event of a rupture with a superior naval power, Long Island Sound and its shores would not, as before, be at the mercy of the enemy. "During the war with Great Britain our frigates were blockaded in the harbor of New York, which would not have been the case if the Hell Gate passage had been open. Com. Decatur ventured to carry his squadron through, but with such risk that the attempt with a frigate was only made once afterward, notwithstanding the constantly recurring necessity. The removal, therefore, of the obstructions to the safe navigation of Hell Gate is recommended by a regard to the future naval defences of the country." The substitution of iron-clad ships for the wooden walls of a former period, while endowing the naval defence of these waters with more certainty as well as with more power, will be deprived of much of its advantage by a failure to remove these obstructions. Lieut.-commd'g David Porter, while agreeing with the views of his brother-officer, did not think it feasible to attempt the deepening of the Middle Channel, but rather that it be entirely filled in with docks. He recommended the removal of a part of the reef at Hallet's Point, on account of the eddies which it creates at flood and ebb tide respectively in Pot Cove and in the East Channel, and the dangers resulting therefrom to navigation.

Valuable as the reports of these officers were in pointing out the dangers to navigation, and specifying the particular obstructions to be removed or otherwise treated, they do not enter into the question of how the removal of the rocks should be effected, except by the general term *blasting*. The art of blasting under water at that period, was incompetent to deal with even the small rocks, which alone were selected for removal; and it may be said that their recommendations, limited as they are, were practically impossible of execution. Under such circumstances the idea of removing the large reefs was not so much as entertained, and consequently the diminution of velocities in the currents could form no part of their project.

The necessity of doing something to diminish the dangers to navigation was a continual pressure upon the public mind, for according to the first of these reports, one sailing vessel out of every fifty sustained more or less damage from being forced by the violent currents upon the rocks and shoals; while, according to the second, fifty vessels went on shore during the time occupied, two months, by the survey. Notwithstanding, nothing was attempted until 1851, when the process of surface-blasting, introduced by M. Maillefert, was applied by him. This process was very simple, and consisted in placing upon the rock a charge of gunpowder, usually 125 pounds, contained in a tin canister, and exploding it by means of the voltaic current. The weight of the water resting upon the charge served to tamp it and to increase the effects of the explosion. The services of divers were not called into requisition to examine the rock and to place the charges where, from the configuration of the bottom, they might be most effectual, but the charges were simply let down from a boat by means of an iron rod. No means were provided of removing the broken rock after the blasts, it having been taken for granted that the force of the explosion would be sufficient to project the débris into deep water. This assumption was a manifest error, and the consequence was, that in default of mechanical means of removing the broken rock, it was broken fine and powdered by the successive charges until it was small enough to be carried away into deep water by the tidal currents.

The rock in Hell Gate, so far as it has been examined, is a gneiss, stratified in thin layers, the direction being about N. 52° E., and the dip a few degrees from the perpendicular. From Hallet's Point the direction of the stratification is continuous across the channel, and can be verified upon the rocks on Ward's Island opposite. The different layers, differing in composition, hardness, and durability under exposure to abrading influences, would necessarily be unequally worn, whether exposed to the action of the air or to rapid currents of water, and this unequal action has been tested by observation. The surfaces of the reefs are consequently very uneven. Sheets of rock or clusters of sheets composed of the more durable materials, are continually found projecting many feet above the general surface. Pot Rock had 8 feet over it at low water, deepening quickly to 14 feet on two sides, and suddenly to 24 feet on the other two. Its form was quite pointed, and essentially that of a truncated pyramid, down to a depth of 18 feet, where the surface became flattened and of considerable development in every direction. Frying Pan on the top was 16 feet long and only 6 inches wide, and had over it a depth of 9 feet at low water. Way's Reef on the top was conical, and had a depth over it of 5 feet at low water. Bald-headed Billy was described as a single rock about 6 feet by 6, and capable of being easily blown into deep water.

The descriptions given of some of the rocks operated upon by Maillefert are important, as showing how readily their surfaces lent themselves to rupture and removal by an exploding agent, and are necessary in order to qualify in our minds any extravagant notions that might arise of the efficacy of his process. The citizens of New York raised by subscription about $13,000 to test Maillefert's process, disbursed under the direction of Mr. Meriam. M. Maillefert commenced operations Aug. 19, 1851, and operated with the result as shown in the following

Recapitulation.

Name.	Number of charges.	Pounds of powder.	Cost in gold.	Original depth, feet.	Depth at close of operations, feet.	Remarks.
Pot Rock	284	34,231	$6,837.50	8	18.3	
Frying Pan	105	12,387	2,116.81	9	16.	
Way's Reef	135	15,549	2,543.66	5	14.	
Shelldrake	6	750	110.34	8	16.	
Bald-headed Billy	1	125	500.00	...	......	Blown into deep water.
Hoyt's Rocks	8	1,000	250.00	...	......	" " "
Diamond Reef	78	9,750	1,434.42	16	18.?	In 1869 the least depth was still 15.7 feet.
Hallet's Point	3	400	69.06	...	......	No effect.
Total	620	74,192	$13,861.59			

In 1852, Congress having made an appropriation of $20,000 for the removal of rocks at Hell Gate, this operation was assigned to the engineer department of the army, and Major Fraser was selected for that duty. He adopted the process already in use, and in this there was no alternative, as Maillefert's method was the only one known, and capable of application in Hell Gate. The sum of $18,000 was expended upon Pot Rock, the depth of which, being already 18.3 feet, Major Fraser succeeded in still further reducing to 20.6 feet. If we compare results, we find that at the commencement it required only $6837.30 to reduce the height 10.3 feet, but at the end the expenditure of $18,000 gained but a little more than two additional feet of depth; and the reason is obvious: the rock as the depth increased expanded both in width and length, and while the surface offered itself less readily to the action of the powder, the quantity to be removed for each foot of additional depth increased very largely in amount.

We are now in a position to estimate the value of Maillefert's process upon hard rock like gneiss. Whenever the rock was of small area, projecting above the general level of the bed-rock, of a conical or columnar shape, or when it presented itself in narrow sheets, the process became very effective, and was in fact generally cheaper than any other. On the contrary, when the rock was in large mass, with flattened surface—which is the condition to which the rocks are generally brought after the projecting parts have been broken off—then the process becomes very slow and inefficient. It is, however, often valuable as an auxiliary to better modes of blasting.

No further appropriations had been made, when in 1856 the advisory council to the commissioners relative to the encroachments and preservation of the harbor of New York made their report upon the necessity and mode of improving the navigation at Hell Gate. They advise the removal of Pot Rock, Frying Pan, and Way's Reef, and other smaller rocks near the shore, including a part of the reef at Hallet's Point, and the building of sea-walls or piers along the edge of the larger reefs; in fine, presenting very much the same project as that formerly advocated by Lieut.-commd'g Davis, and already given in the former part of this article. They state that the removal of Pot Rock and other small rocks by blasting could be easily effected—that, in fact, it had ceased to be matter of experiment; but they do not recommend the application of Maillefert's process, used in 1851 and 1852, upon these rocks, but rather the process by drilling.

It is difficult to account for the assertion that these rocks could be readily removed, since, Maillefert's process of surface-blasting laid aside as incompetent by itself to perform the task, the only other mode of blasting under water then practised was by drilling at the bottom from within a diving-bell, which in the rapid currents in Hell Gate would have proved unmanageable, even if it were not first knocked over by a colliding vessel. It is to be regretted that, as the advisory council believed drilling at the bottom to have been an easy operation, they did not indicate the mode of doing this, especially as the means then known of accomplishing this result were entirely inadequate to cope with the difficulties and dangers to be encountered. The council reported that it was not expected to reduce the velocity of the regular tidal currents in the channel, that the existing state of things could only be altered by a change in the capacity of the cross-section; and that such change was impracticable. It is evident, then, that the operations of blasting, after a thorough examination by the ablest men of that day, were limited to the smaller rocks lying in the channel, while the removal of the large reefs was expressly stated to be a practical impossibility.

The duty of an examination of Hell Gate was committed in 1866 to Brevet Major-Gen. J. Newton, U. S. Engineers, who was instructed by the engineer department to prepare a project with a view to its improvement for the purposes of navigation, and sufficiently in detail to present a plan and estimate for the necessary operations. This officer submitted his report in Jan., 1867, in which the estimate was based upon removing the reefs by blasting, after drilling the surface from a fixed platform above the water. This arrangement was described as follows: A platform of suitable size, with vertical sliding supports capable of being raised or lowered through a considerable height, is prepared and floated to its position, supported on the decks of two scows or other floats, one on each side. Arrived at the place, the floats are moored, the vertical supports of the platform let down to the bottom, securely fastened to the platform, and braced to each other if necessary. This operation being done at the top of the tide, the scows are floated away when the water falls. The supports to the platform may be placed within ten feet of each other, and the weight of the platform, to ensure steadiness and stability, fixed at any desirable standard. To avoid the interference of the currents with the drills, these were to be worked within iron tubes reaching from the platform to the rock. The engines to work the drills would be placed upon the platform. To remove the rock blasted, it was thought necessary to protect the divers from the force of the currents, and for this purpose a species of dam was described—viz. two cylindrical floats, of sufficient buoyancy, made of boiler iron, to be placed say thirty feet from centre to centre, towards their extremities to be inclined towards each other until they meet, forming one float, say 160 feet long and 40 wide. Curtains of iron, extending along the whole outer line of the floats, to be permanently fastened at their upper lines to these floats, and the lower end of the curtain to be attached by falls to small derricks or davits upon the floats, so as to be lowered or raised at will. The curtains to be flexible, made of plates of iron connected with each other by hinge-joints, and capable of reaching to the bottom at any height of the tide. An interior space of 160 feet by 40 to be thus protected, where the divers could fill the buckets, afterwards to be raised and emptied into scows lying alongside.

The particular machines above described were not relied upon as the sole or even the best means of effecting the object desired, one purpose for making such design being to show that no insuperable difficulties intervened to prevent a practical consummation of the work, and another to furnish data for the estimate. Two requisites of success were steadily kept in view: First, that the drills operated in drill-tubes should be attached to a platform or other framing kept absolutely fixed in position while the drilling was going on; and, second, that the divers, or the machinery necessary to handle and remove from the bottom the rock blasted, should be protected from violent currents. Another machine, which was arranged upon the same principles, combining in one both the platform and dam, was also proposed—viz. an iron caisson or cylinder, open at top and at bottom, having self-adjustable legs at the bottom to accommodate themselves to the inequalities of the rock and to support and level the machine. In plan the caisson was to be oval or pointed at both ends. The top was to be above the level of the highest tides, and to be framed across, so as to form a platform upon which the engines and the men directing the operations of drilling were to be placed. The sides, stiffened and strengthened with a sufficient framework, were to be covered with boiler iron, or with flat bars crossing each other, or with a meshwork of chains, it being supposed that the intervals so left would not permit the entrance of violent currents into the interior of the dam. The lower edge of the dam, though it might be in contact at one or two points with the bottom, would be held above it for the rest of its perimeter, owing to the legs which supported and levelled it, and therefore a strong current would force itself under the bottom through the intervals thus left. But a mesh of chains was to be arranged to cover these spaces, and protect the interior from the rush of water for any locality which would have demanded this additional precaution. The upper line of the chainwork was to be fastened to the sides of the dam near its bottom edge, and the lower line, triced up when not needed, would be lowered to rest on the rock when circumstances should have demanded it.

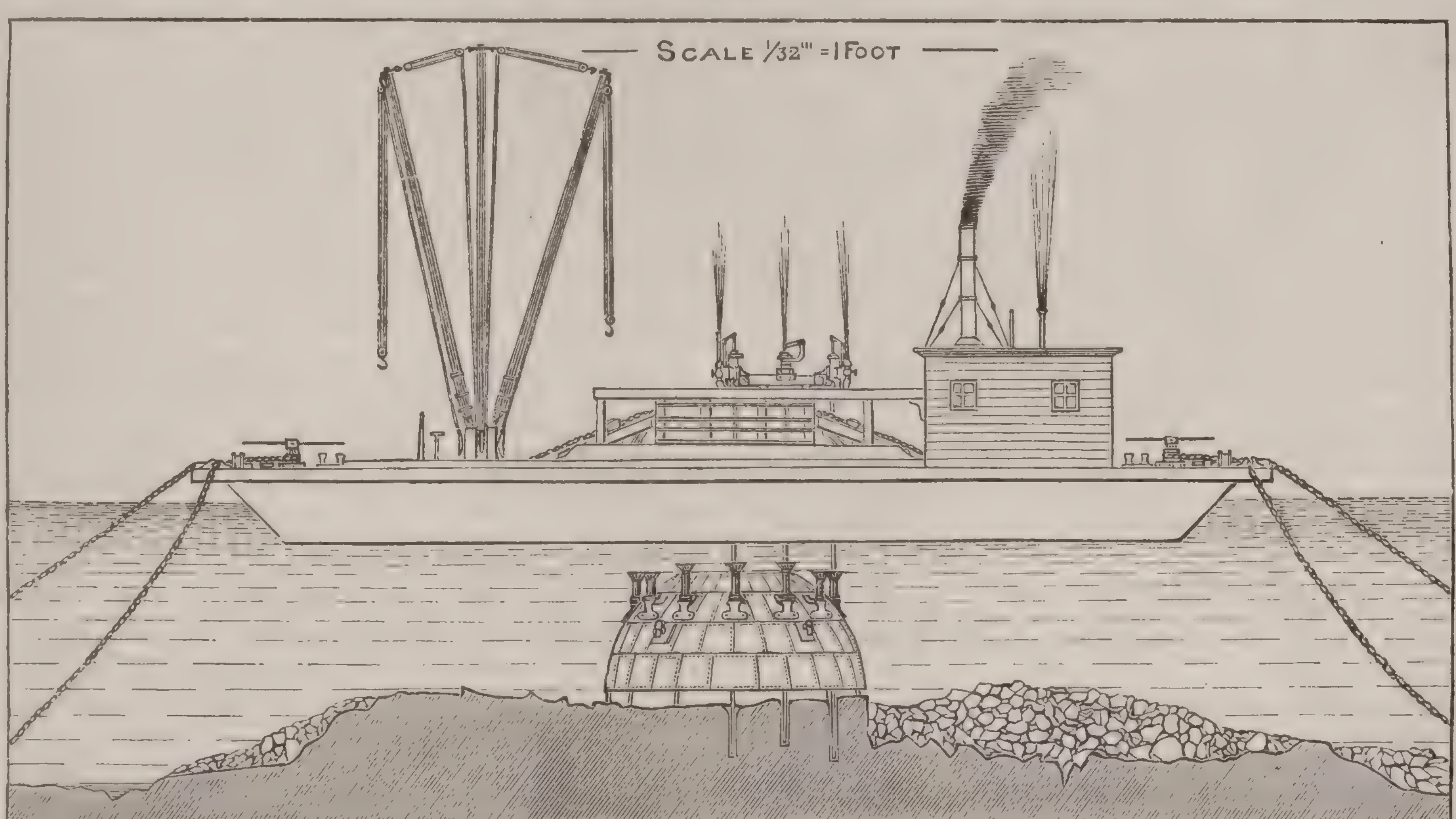
The dam was to be provided with pontoons or camels to float it, or, better still, with chambers to contain air or water as might be needed. When moored over the position intended the air was to be let out and the water introduced into the chambers, and as soon as the dam touched the rock, or was nearly touching, the legs, let go by the men, would support it in a horizontal position. The work of drilling was then to commence. After this was finished charges would be introduced into the holes. the chambers filled with air, the dam floated off, and the blasts fired. The dam was then to be brought back, moored over the same position, sunk to the bottom, when the work of removing the rock would commence within the sheltered area.

It would appear, after the principles had been settled, and even the mechanical mode of their application thus arranged, that there should have been no further difficulties to encounter, but that as soon as the money could be furnished the work of removal of the obstructions would have been commenced after either of the plans as stated. But, in reality, to construct a machine adapted to the peculiar requirements of the case demanded an arrangement in detail which was equivalent to a treatment *de novo* of the whole problem. The exposure of a platform, or of the caisson with upright sides, to the violent currents of Hell Gate might result in an overthrow unless the base of the machine should be large. But the varying sizes of the rocks to be operated upon, as well as the rugged inequalities of their surfaces, would make it inconvenient to apply a large machine in all cases, while the difficulty and risk of handling it would increase with the size. It was necessary, or at least very convenient, to design a machine which, although small, would nevertheless possess in itself the element of perfect stability against the action of the currents, and of applicability to the rocks in Hell Gate, irrespective of size or the nature of their surfaces. This was effected by adopting a caisson of a peculiar shape on the exterior, by which the resulting pressure of the currents of water on its surface would always be made to intersect the bottom within the area covered by the machine; and no overthrow could consequently take place.

But, after all, this consideration, important as it may appear to be, was really secondary to another; which was the mode of protecting the machine against the colliding of passing vessels. This is the most formidable danger to be encountered in Hell Gate. Platforms or caissons could be framed large and heavy enough to withstand the currents and to afford a stable and fixed support to the drills, but of what avail would all this have been when it was certain that in the crowded thoroughfare where the work was to be done, a week could not elapse before the machine would be crushed and overthrown by collisions, with a loss both of life and of a large amount of property? It was evident, therefore, that all idea of successful work was to be abandoned unless security against collisions could be attained. To moor hulks around the drilling-machine would not only have been very inconvenient, but even impracticable, from the room which would be thereby abstracted from the already contracted width of channel; hence, after much consideration, it was determined to surround the drilling apparatus with a structure, floating of course, which should be proof against collisions.

From the considerations which have been presented the construction and working features of the steam-drilling

Fig. 2.



Submarine Drilling Scow.

cupola scow resulted. This machine consists of two parts —a large float or scow, having a well-hole in it of a diameter of 32 feet. It is built very heavy and strong, and is provided with an overhang or guard around it, faced with iron, and has proved itself, up to this time, capable of withstanding violent collisions with other vessels. Besides affording this security, it serves also to transport the caisson or dome from place to place, and is a working platform from which the drilling-engines are operated. The caisson or dome is a hemisphere of the diameter of 30 feet, composed of a strong iron frame covered with boiler iron. The dome is open at bottom and at top, and is provided at the bottom with legs to support and level it, which are arranged to be let go all together after the dome is lowered. Owing to the hemispherical shape of the caisson, the pressures of the moving mass of water which are normal to the surface necessarily pass through the centre, and there is consequently no tendency to an overthrow by the action of horizontal currents, but, on the contrary, an additional downward pressure favorable to stability is produced. This would not necessarily be the result if the dome were of small diameter, for in this case, when on the bottom, it might lie entirely within the region of vertical eddies produced by the uneven character of the rock, and these forces acting within the interior of the dome would tend to an overthrow. When the dome is large, a small portion comparatively lies within the area of these abnormal currents, while the outer surface acted upon by the horizontal currents gives rise to normal forces which tend to an equilibrium.

The caisson or dome is simply a framework, affording a fixed support to 21 drill-tubes through which the drills operate. The dome is connected with the scow by four chains communicating with four hoisting-engines, by which it is lowered or raised. A framework is built upon the scow around the well-hole, to support the carriage holding the drill-engines, which by these means may be placed directly over the drill-tubes. The engines simply raise the drill-rods, and allow them to fall by their weight upon the rock, the vertical play being 18 inches. The drill and drill-rods together are about 10 feet long, and weigh from 600 to 700 pounds. The cutting edges are in the form of a cross, and are $5\frac{1}{2}$ inches long.

The scow, having the dome swung by chains, is first anchored over the rock to be operated upon, so that the bow and aft moorings pull against the direct currents of the ebb and flood tides; but as these may vary somewhat in direction from one tide to another, as well as during the course of the same tide, it becomes necessary, in order to steady the scow, to have side anchors also. The diver descends to ascertain whether the location is well suited to placing the dome on the bottom, and, if not, to select a better. The required change in the position of the scow is made by lengthening and shortening the mooring-chains with capstans, which are arranged to be worked, at will, with steam or man power. The dome is then lowered, and

when it touches or approaches near the bottom the legs are let go by the run, and, being held by self-acting cams, support the weight of the dome. The chains are now unslung from the dome, which is thereby without connection with the scow. The diver, if practicable, descends to ascertain which of the drill-tubes it is necessary to use to break up the rock within the dome, and how the surface offers itself to each particular drill. The drill-rods being introduced within the drill-tubes—which is easily effected during the most violent currents—a rope or other flexible connection is now made between the top of the drill-rod and the piston-rod of the drilling-engines. A flexible connection is necessary to the act of drilling, as in this machine, the dome remaining fixed upon the bottom in one position, while the scow holding the drill-engines swings for short distances from changes in the directions and strength of the currents, no rigid connection between the engines and drills would be practicable. The length of the rope attachment is regulated by a feed-gear for the rise and fall of the tides and continual changes of water-level.

The drilling being completed, preparations are made for charging the holes with nitro-glycerine. The chains are hooked on the dome, which is then raised from the bottom, and the scow swung off from the spot to a safe distance, without casting loose the moorings. This distance will depend upon the proposed amount of charge of nitro-glycerine, and will vary from 175 to 350 feet. The nitro-glycerine and tin cases, of different lengths to suit the varying depths of the drill-holes, are carried to the spot upon a small scow, from which the diver descends to the first hole to be charged. He is guided to this by a line. Withdrawing the plug, he introduces into the hole the tin cartridge, which has been filled by the men on the scow and passed down to him. Each cartridge is attached, before it is sent down, to the wires. The diver then passes on to the second hole, guided by the plug-line which connects the stoppers of the adjacent holes, and in this way the whole circuit of holes is visited and charged. The leading wires are connected with the battery when the small scow has been withdrawn, and the explosion is made. The batteries used are the friction and the wet batteries, and with the latter the underground connection, by which a long length of leading wire is saved. The fuzes, which have been much improved by the care devoted to the subject by Mr. J. H. Striedinger, C. E., who superintends the operations of the steam-drilling scow, never miss fire or fail to produce an explosion even with frozen nitro-glycerine. They contain, as detonator, about 25 grains of fulminate of mercury.

To break up the rock thoroughly the drill-holes should be from 6 to 8 feet apart, of the size of 5½ inches at top, with the usual tapering towards the bottom, and charged with amounts varying with the depths of hole, which will average between 50 and 60 pounds for each. Under these conditions the depth to which the drill-hole reached, below the level to which it was desired to break the rock, was about 4 feet.

The dome would, in no sense of the term, be a dam without the attachment to the bottom part of the chain-netting before described, which might be replaced by one of rope, or by widths of canvas suitably loaded; for the reason, that there would be nothing to check the force of the currents penetrating between the lower rim of the dome, supported on legs and the uneven bottom. It must likewise be taken into consideration that the top of the dome, when drilling is going on, is many feet below the surface of the water, and there is no protection against the currents throughout this space. So far, in the operations of this machine, no occasion has made it necessary to convert the dome into a dam, though the manner of so doing has been prescribed should necessity ever arise to use the devices above indicated. The drill-rods are perfectly protected against currents by the tubes in which they work; they can be taken out and replaced without regard to these currents; while the diver has always been able to perform satisfactorily his functions during the times of slack water. So that for drilling and blasting the rock no necessity has existed for the use of a dam as protection against currents.

After the rock broken by the explosion covers the greater part of the reef, its removal is commenced. This is effected by means of Morris & Cuming's steam-grapple. So far, it has not been necessary to protect this operation against the violence of the currents, but it is foreseen that such emergency may arise at some localities in Hell Gate. In such event it has been determined to use a network of chains, the lower part resting on the bottom, and weighted if necessary, or provided with a sufficient number of small grappling-hooks to catch the irregularities of the bottom; and the upper part attached to a boat or float of some description, so as to form in this way an enclosed space from which violent currents would be excluded. A steam-grapple mounted upon the boat could then operate regardless of the currents. The depth from the top line to the bottom of the chain-netting should be more than sufficient to reach the bed of the channel during the highest rise of the tide. The boat would be provided with the necessary apparatus connecting with the lower part of the chain-netting, to raise it off the bottom to a suitable height for the purpose of changing location, as the process of removing the broken rock might require.

Operations of the Steam-Drilling Scow.—The delay by Congress to appropriate money postponed the commencement of this machine until July, 1869. The necessary experiments upon the drilling-engines, upon the drills to ascertain their proper weights and size of cutting edges, and upon the effect of nitro-glycerine to determine the proper charge, prevented its practical application until May, 1871, upon *Diamond Reef*, near the mouth of East River. This reef was found covered, for the greater part, with sand, gravel, deposits of silt of various kinds, with ballast-stone, and with boulders, and before it can be removed by blasting its surface must be cleared by a dredging-machine. All the ledge-rock which was uncovered has been operated upon. The holes drilled were from 7 to 13 feet deep, the diameter 4½ inches at top and 3½ inches at bottom; the charges of nitro-glycerine 30 to 55 pounds per hole.

Coenties Reef was also operated upon in alternation with Diamond Reef during the working season of 1871. The number of holes drilled and blasted was 93, and of surface-blasts 17; nitro-glycerine consumed amounted to 5479 pounds. During the working season of 1873, 307 holes, 4½ inches in diameter at top and 3½ inches at bottom, were drilled. The nitro-glycerine consumed amounted to 17,127 pounds, and this included the charges, likewise, of 39 surface-blasts. The operations of this season left the reef thoroughly broken up, and a large portion of the débris was removed. Unfortunately, the next appropriation, by a blunder in its title, became inapplicable to the lower East River, in which this reef is situated, and it has perforce been left until this year (1875) to be finished. Its complete removal will require but a short period of time for the disposal of the stone already broken up. During the operations upon Diamond and Coenties reefs the scow was collided with many times.

Frying-Pan in Hell Gate.—The drilling-scow was moored upon this reef July 22, 1872; drilled 17 holes and made 11 surface-blasts.

Pot Rock in Hell Gate.—The machine commenced work here Aug. 5, 1872, and remained upon this rock until Dec. 28, when running ice put an end to these operations. During this period it was collided with 16 times; four of the colliding vessels were sunk, and one of them, loaded with 200 tons of coal, was by the rapidity of the current drawn under the scow, and carried off the dome, which was recovered afterwards in 80 feet depth of water, having experienced great damage to the drill-pipes and supporting legs. Most of the collisions, while not injuring the scow, caused the mooring-chains to part, and great delays resulted therefrom, on account of having to search by divers for the other end of the chain remaining attached to the anchors. If it were possible to make use of buoys to the anchors, much valuable time in such searches would be saved, but their use is not practicable on account of fouling with passing vessels, and being carried off by this means. Forty holes were drilled and blasted; 60 seam-blasts and 24 surface-blasts were made; a large portion of stone was raked from the reef, of which no account could be kept. Owing to the rapidity of the current, it was impossible to use the steam-grapple to hoist up the rock, and to accomplish this buckets were let down to the bottom and filled by divers during the period of slack water, removing by this means 211 cubic yards. Work has not since been resumed upon these rocks, which lie in the channel and directly in the way of vessels, owing to the dangers which careless or inexperienced pilots entail upon the vessels they are navigating by colliding with the scow; and until certain regulations can be enforced upon the pilots it would be unwise to subject passengers on board steamers passing through, to risk of life. The exposure to damage, as experience has so far shown, lies with the colliding vessel, and not with the scow.

Way's Reef.—This rock was operated upon by M. Maillefert in 1851, who succeeded in knocking off a few of the most prominent projections; and again in 1869 by the same process, surface-blasting, he removed from the surface of this reef 1621 cubic yards, increasing its depth to 17½ feet. The drilling-scow commenced work upon this reef Aug. 4, 1874, and on Jan. 20, 1875, it was wholly removed to a depth of 26 feet at mean low water. The size of the rock within the 26 feet curve was 235 feet long by a maximum width of 115 feet. The ebb currents, which are the strongest, run three knots per hour on the channel side, gradually diminishing in velocity as the shore is approached.

The average working force of the scow was thirty-seven men.

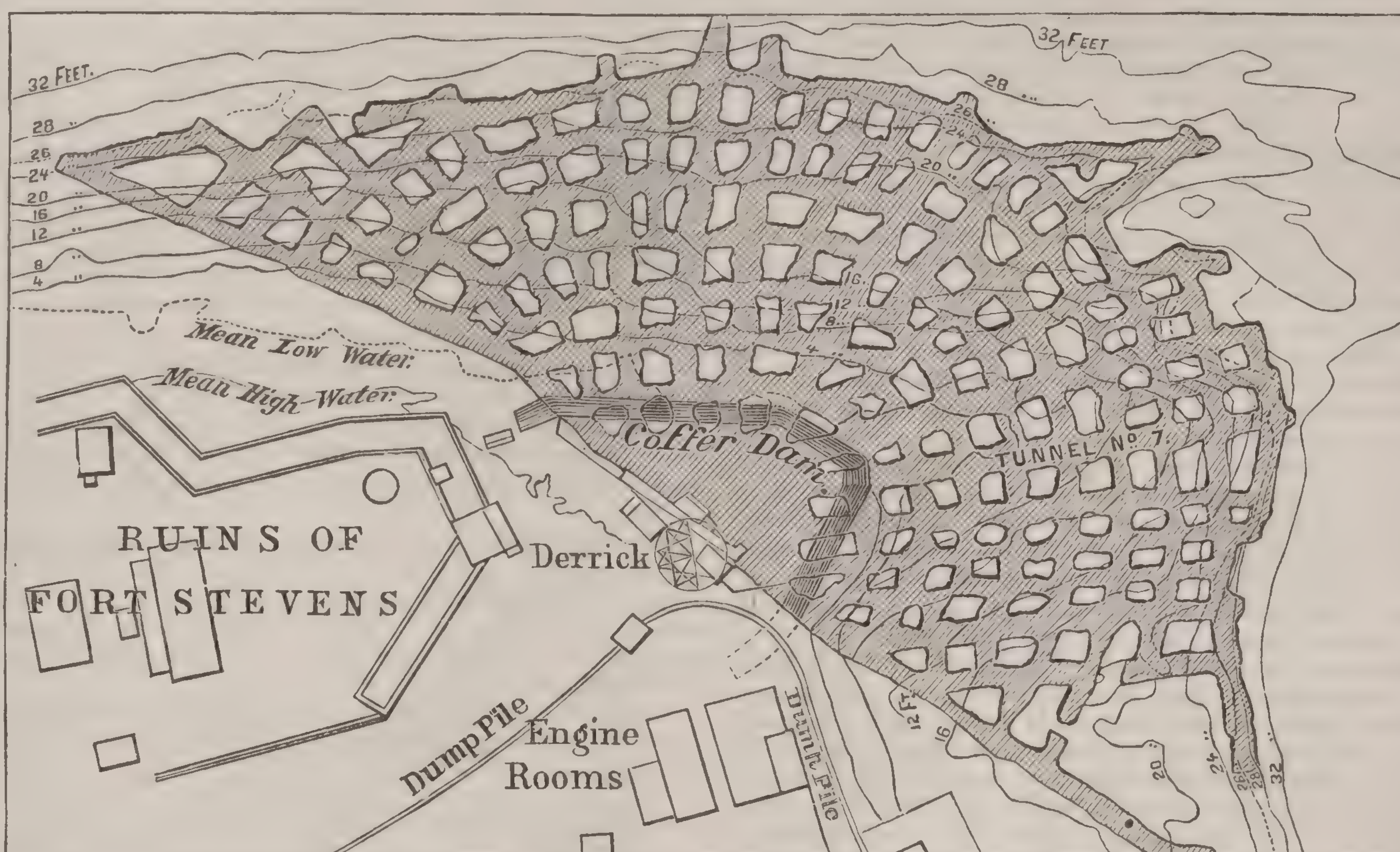
Number of holes drilled.......................................262
" " feet " 2130.4
Explosives used—
For 65 drill-blasts......................15,308¾ lbs. } nitro-glycerine,
" 16 surface-blasts...................... 1,484 " } nitro-glycerine,
and.. 38½ " dynamite.
Cubic yards, exclusive of the operation of raking, removed by steam-grapple.......................................3029
Total time of grappling.......................................86¼ days.
" " " stone-raking....................................... 7¼ "
Average No. of feet of drilled hole to each cubic yard........0.7
" " pounds of nitro-glycerine " " 5.54
" " feet drilled by each machine per shift of eight hours.......................................6.5
" depth of holes, in feet 8.13
Average cost of linear foot of hole drilled, including placing of scow, lowering dome, expenses of drilling, sharpening drills, loss of steel, hoisting up dome, and heaving off scow.......................................$2.05
Average cost of sharpening a drill....... ....$1.41
" No. of feet drilled to each sharpening................ 8.13
" expenditure of steel to each foot drilled, oz......... 2.7
" cost of dredging and dumping 1 cubic yard of débris.......................................$4.29

The above data are from the report of Mr. J. H. Striedinger, assistant engineer superintending the operations of this machine, to Gen. Newton, and furnish a proof of the ability and skill with which the machine was directed by Mr. Striedinger. Upon the chart accompanying this report the position, depth, and charge of each drill-hole are recorded, so that the effects of blasts disposed at certain distances and charged with known quantities of nitro-glycerine are clearly revealed.

Having finished this description of the drilling-scow and of its operations, it remains only to say that its use has been, and will be, confined to the smaller reefs situated in the channel until these are all removed. These operations are necessarily the most costly. What it could accomplish, or at what cost upon the larger reefs, must remain a matter of conjecture until tried, though it is certain that it would be fully successful in such essay.

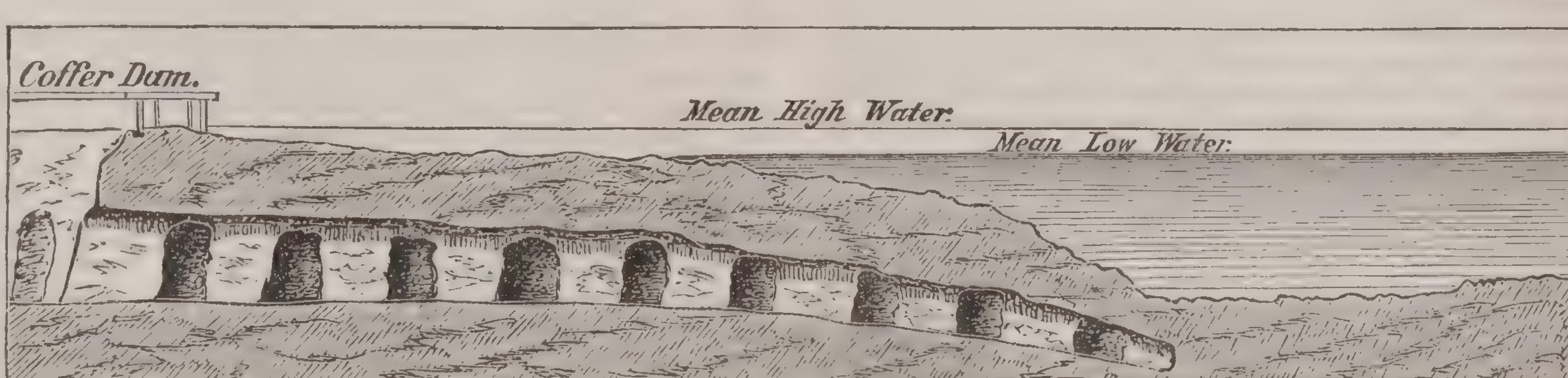
Hallet's Point Reef.—This reef is in shape an irregular semi-ellipse, the longer axis, which lies next to the shore, being 720 feet in length, and the shorter semi-axis, projecting straight into the channel, about 300 feet. The cubic contents above the depth of 26 feet at mean low water

FIG. 3.



Plan of Excavations; scale, 1:1500.

FIG. 4



Longitudinal Section through Tunnel No. 7; scale, 1:750.

amount to 51,000 cubic yards. The shallowest portion of this reef is a ridge coincident with the line of stratification, and having a direction of N. 52 E. Besides the risk of striking the reef, it produces eddies on both sides of it according to the direction of the tidal currents, and is much in the way of vessels coming down with the ebb in the effort to hug the shore, and thus avoid being thrown upon the Middle Reef. It is in the way of small and large vessels equally, and its removal is an essential element in the improvement of the channel. The removal of this reef might have been undertaken in either of two methods—viz. that by drilling into the surface, blasting, and removing the débris by the steam-grapple, or by means of tunnels and galleries used to explore the interior of the rock, and thus obtain places for blasting charges or mines to overthrow the whole mass of rock at once; the broken rock to be taken away by mechanical means.

The first time, so far as known, that tunneling was suggested as a means of removing rocky obstructions in a channel was in the spring of 1868 by Mr. G. C. Reitheimer, a gentleman who had formerly served as superintendent at the breakwater at Holyhead. His proposition was to remove the channel-rocks by the application of a circular iron shaft to reach to the rock, and after the bottom was secured against leakage to begin within this enclosure to sink into the rock, and after attaining the requisite depth, by a series of tunnels or galleries to explore the whole rock and place in it the mines for blowing it up. A letter dated Oct. 3, 1868, from Gen. Alexander, U. S. Engineers, gives the same project, except in the material of which the shaft is to be composed, for the removal of Blossom Rock in San Francisco harbor, Cal. Mr. A. W. von Schmidt, C. E., Nov. 20, 1868, gives his project for the removal of Blossom Rock, in which he proposes to reach to the surface by means of an iron shaft, then to sink into the rock to a suitable depth, and excavate such a cavity into its body that the débris of the explosion falling into this receptacle would leave the depth overhead required for purposes of navigation. The leading idea of this mode is identical with that of Mr. Reitheimer and of Gen. Alexander also.

Tunnelling under water was nothing novel, as shown by the coal-mines in England. Nothing could be done in the way of removing rocks in Hell Gate until a sufficient sum could be allotted to begin upon a competent scale; and it was consequently not until the month of July, 1869, that operations were undertaken at Hallet's Point with a view to the construction of a coffer-dam upon the reef, between high and low water levels. The dam was finished in October following, and the excavation of the shaft commenced. The form of the dam is that of an irregular polygon, being about 145 feet across on the shore-line, and about 90 feet out upon the rock. The form of the shaft conforms to that of the dam, and it has been excavated to a depth of 33 feet at mean low water. Ten principal tunnels, radiating through the rock, were commenced from the walls of the shaft. As the distance apart of the tunnels increased subsidiary tunnels were interpolated. Transverse galleries, averaging in distance 25 feet from centre to centre, were excavated as the work progressed. In all, there are 35 tunnels and 10 transverse galleries. The tunnels at the shaft vary from 22 to 17 feet in height, and from 12½ to 9 feet in width; as they were advanced the height rapidly decreased, owing to the downward slope of the surface of the reef, and the width also decreased, so that the dimensions soon did not exceed those of a heading. The galleries vary likewise in size, from 12 feet high by 9 feet wide to much smaller dimensions. The number of feet in length of tunnels and galleries is 7400. The number of cubic yards removed from the tunnels and galleries is 45,000 to the end of Feb., 1875. At Blossom Rock the contractor, Mr. A. W. von Schmidt, commenced sinking an iron tube to serve as a shaft on Oct. 5, 1859, at the time when the dam at Hallet's Point was completed. The interior of the rock was excavated and the explosion made on Apr. 23, 1870, but the débris was not finally removed and the work completed until Dec. 6, 1870. Blossom Rock was of small dimensions, 180 feet by 100, within the limits to be removed, and the period of its removal occupied one year. The idea advanced by the contractor, of excavating a cavity within the rock sufficient to receive the entire débris of the explosion, was abandoned on account of the danger of the process, and the work, after being exploded in the ordinary way, was finished by removing the broken-up rock by mechanical means. Way's Reef in Hell Gate, 235 feet by 115 feet, was removed by the operation of the steam-drilling scow in about five months, while the cost was less than that of Blossom Rock.

The explosives used in tunnelling at Hallet's Point have been nitro-glycerine and its compounds, and gunpowder. The latter has been used only when the rock was weak and seamy. Reliance has been placed upon nitro-glycerine to drive the headings forward, and no accident has befallen the miners from its use, either at Hallet's Point or in the operations of the steam-drilling scow. To drive a heading, the drill-holes are made at an angle with the face, so that the charge may lift out the rock by its explosion. In this way, after a cavity is made, holes are drilled around it, and the surrounding rock blown into it. When large charges can be used, a square or rectangular portion of the face of the heading is marked out by drill-holes, inclining towards each other, and one or more perpendicular holes drilled within the boundary marked; the holes being drilled deep and well charged, the explosion would generally lift the rock according to the dimensions traced by the drills.

Owing to the risk from using large charges at Hallet's Point, the work of forming a cavity around which to excavate the heading was a piecemeal process. The charges of nitro-glycerine were usually only 8 ounces, and to avoid the vibration which would be caused from a simultaneous discharge of many blasts, the battery was not employed. Ignition was made with the Bickford fuze, and there was consequently no volley firing. The nitro-glycerine is contained within small paper cases, rendered proof against leaking by a composition. The cartridge is exploded by a cap containing fulminate of mercury, with which the fuze communicates. The necessity of using small charges and of avoiding volley-firing has been unfavorable to such rapid progress, as would have been possible on land under the same circumstances.

The average of twelve months' work with six Burleigh drills, was the excavation of 235 lineal feet of heading per month. Up to June 30, 1872, the work had been prosecuted by hand-drilling, with the exception of 20,160 lineal feet of drilling by the Burleigh drill and of 7000 feet by the diamond drill. That by the Burleigh drill was by contract at a certain rate per foot; and the diamond drill, purchased at the work for the purpose of exploring the rock ahead, was put in competition with it. The work of the Burleigh drill, though more satisfactory in the hard gneiss than that of the diamond drill, was still far from being perfectly so; and it was not until the former was tried by our own men that its advantages over hand-drilling became marked. Before this trial there was real doubt concerning its economical advantages for these works, owing to the small size of the headings, the limited depth of holes, and the minute charges which it was necessary to adopt. The Burleigh drill previously had made but 18 or 19 feet of holes per shift of 8 hours, and required one drill in the shop under repair for each one at work. The last fact indicated the necessity of extensive repairs and appliances for the same, the cost of which it was necessary to consider in the general problem. The cost of drilling, after a long trial with the Burleigh drill, is found to be between 36 and 37 cents per foot, including repairs and all items of expense except first cost and interest. The cost of hammer-drilling was found to be about 95 cents per foot. With nine Burleigh drills seven can be kept at work. The number of feet of holes drilled by each machine per shift of 8 hours was 30 feet. The diamond drill, owing to the encounter of frequent veins of pure quartz in the rock, did not answer well, but it should prove a valuable drill for rocks of inferior hardness. The Ingersoll rock-drill, which, like the Burleigh, is a percussion drill, was used experimentally at the works, and proved itself fully equal to the other.

A pump of the capacity of 1000 gallons proved itself capable of removing the leakage. As the floor of each tunnel declines in level from the shaft outward, it was necessary, in order to draw the water from the extremity of the tunnel by means of the pumps placed in the shaft, to lay down radial pipes in the tunnels communicating with the pumps. Owing to the restricted area of the tunnels and galleries, the work of excavation was almost exclusively that denominated the *heading,* without advantage of enlargement, and hence the following refers to the most costly and laborious part of the work of tunnelling:

Blasting One Cubic Yard in Headings.

10 feet of drilled hole.
1.22 pounds of nitro-glycerine.
.39 " " gunpowder.

The difference of cost between these operations by hand-drilling and by machine-drilling may be found at once by the substitution of the price per foot of these modes of drilling.

The rock, after being blasted, is lifted by hand into a box resting upon a truck-car, which is run down to the place upon a rail-track, and thence drawn by a mule to the shaft, where the box is hoisted by a derrick, and its contents emptied into the dump-cars to be rolled away and deposited in the pile.

Calling the cost of blasting and removing one cubic yard 1.00, the following gives the proportion of each item of expenditure:

Blasting	0.46
Transporting rock to shaft	0.17
Hoisting "	0.0328
Dumping "	0.0203
Pumping	0.1037
Incidental	0.2132
	1.00

The cost of plant and interest is not included in the proportion thus given. Repairs are included.

The tunnels and galleries are, it may be said, finished; but little remains to be done except to prepare for the final explosion, after which the débris will be removed by mechanical means. The means of explosion would appear to be simple: by destroying simultaneously — by cutting down with charges of nitro-glycerine or similar compounds of quick explosive character—the piers which support the roof of the excavation; at the same time, by introducing a sufficient number of charges in or under the roof, to break this up into pieces of convenient size. A simultaneous explosion can be effected by igniting with electric batteries a certain number of centres of explosion; and the connection of the charges of one pier with those of the adjacent piers will ensure the propagation of the explosion throughout the whole extent of the excavation.

The comparative cost of excavation between the system of tunnelling and that by means of drilling the surface of the rock, as performed by the steam-drilling scow, cannot be satisfactorily made until the removal of Hallet's Point be completed. Great credit is due to Capt. Wm. H. Heuer of the Corps of Engineers, who has been the resident engineer at Hallet's Point since June, 1872, for his careful and economical supervision of these operations.

JOHN NEWTON.

Hellin', town of Spain, in the province of Albacete, on the Menedo. In its vicinity are rich sulphur-mines and sulphurous springs used for bathing. Pop. 7632.

Hell'muth (Rt. Rev. ISAAC), D.D., by birth a Polish Jew, became in 1856 an Anglican minister of Canada; founded Huron College (1863) and Hellmuth College (1865), London, Ont., and Hellmuth Ladies' College (1869); was successively

archdeacon and dean of Huron; became in 1870 suffragan bishop of Norfolk and coadjutor of Huron, and in 1871 succeeded Dr. Cronyn as lord bishop of Huron, Ont.

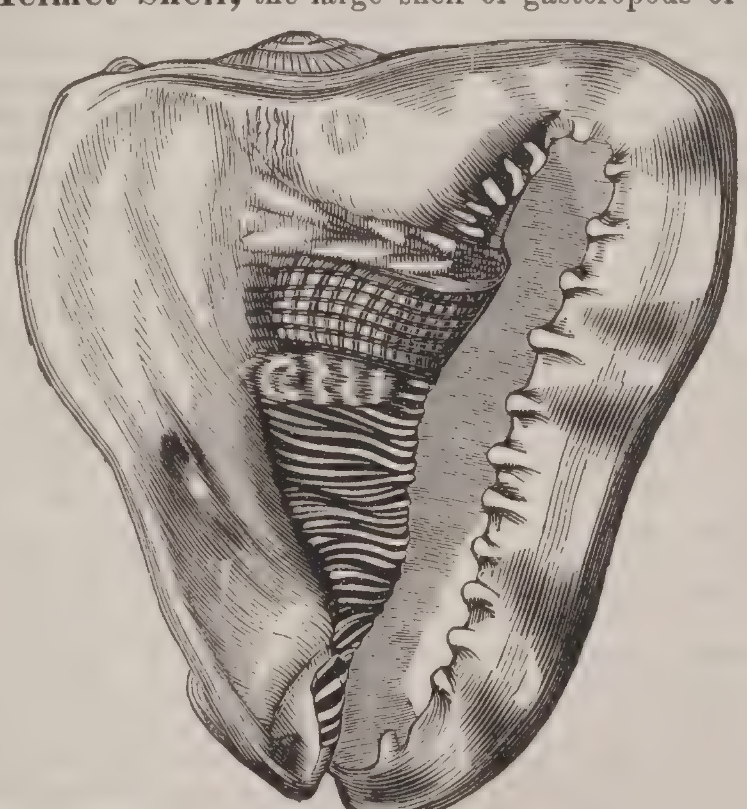
Helm, on shipboard, the steering apparatus, including wheel, tiller, and rudder. To *put down the helm* is to bring the ship's head to the wind; to *put up the helm* is the reverse. By means of the wheel the rudder is inclined to an angle varying from the ship's course, until by the action of the water upon the rudder the ship's direction is properly modified, when the rudder is returned to its normal position, in a line with the ship's course.

Helm (Ben. Hardin), b. in Kentucky in 1831; graduated at West Point July 1, 1851, and entered the army as brevet second lieutenant of dragoons, resigning in Oct., 1852, his commission, and followed the practice of the law at Elizabethtown and Louisville till 1861, having been a member of the State legislature and commonwealth attorney. He joined the State guards under Gen. Buckner in 1861, and as a colonel in the Confederate army was engaged at the battle of Shiloh, being shortly after promoted to be brigadier-general. He took part in the battle of Perryville, and commanded a division at Stone River, and at Chickamauga (Sept. 19–20, 1863), where he was mortally wounded. D. Sept. 21, 1863.

Helm (John L.), b. in Hardin co., Ky., in 1802; studied law under Duff Green, and attained a wide and early fame at the bar, and was several times Speaker of the house of representatives of Kentucky. In 1848 he was chosen lieutenant-governor, and succeeded Mr. Crittenden as governor in 1850. During the civil war he strongly sympathized with the South, and his son, B. H. Helm, was a Confederate general of brigade. In 1865, Mr. J. L. Helm became a State senator, and in 1867 governor, but d. Sept. 8, only five days after his inauguration.

Hel'met, in ancient times the metallic or leathern head-dress worn by soldiers. Helmets of various forms are still employed to some extent in different nations. Helmets of forms varying according to the bearer's rank appear upon coat-armor beneath the crest. This is a comparatively recent innovation in heraldry. The forms of heraldic helmets are derived from the age of chivalry.

Helmet-Shell, the large shell of gasteropods of the



The Cassis tuberosa.

genus *Cassis*, of which there are some thirty-five living and as many fossil species. The living ones are found in all tropical seas, and are used in making shell cameos. *Cassis cornuta* gives a white figure on an orange ground; *C. tuberosa* and *madagascarensis*, white on claret color; *C. rufa*, a salmon color on orange.

Helm'holtz (Hermann Ludwig Ferdinand), physicist and physiologist, b. at Potsdam, Prussia, Aug. 31, 1821; studied medicine at Berlin, and became an army surgeon; was professor of anatomy at the Art Academy, Berlin, in 1848–49; professor of physiology at Königsberg 1849–58, and in 1858 was called to the chair of physiology at Heidelberg; went in the spring of 1871 as professor of physics to Berlin; is widely known as one of the ablest of students of the physiology of the organs of special sense. His principal works are *The Conservation of Force* (1847), *Handbook of Physiological Optics* (1856), *Theory of the Impressions of Sound* (1862), *Popular Scientific Lectures* (1865–71), and he has published numerous valuable scientific papers. He is the inventor of the ophthalmoscope, an instrument of the greatest value to the ophthalmic surgeon, and has made discoveries of the first importance in acoustics. He was chosen to the French Academy of Sciences in 1870.

Hel'mont, van (Jan Baptista), b. at Brussels 1577, and studied at the University of Louvain. The mystical bent of his mind first assumed a religious character; he conferred all his property on his sister, studied medicine in order to serve Christ by curing the sick, and lectured in the seventeenth year of his age on medicine. But having met with a case which he could not cure, he gave up his science in despair, and strolled around for ten years, conversing with mountebanks and charlatans, and searching after the hidden knowledge,—the philosopher's stone, or panacea. Chemistry and alchemy became his favorite studies. He married a rich lady, settled down at Vilvoorden, and spent all his time in his laboratory and in curing people according to a new method. His fame soon grew great. His numerous mystical writings were much read; they contain real discoveries in chemistry, and, although he claimed to possess a means of prolonging human life, his system of physiology, anatomy, and medicine is clearer and more scientific than that of Paracelsus. Thousands of people gathered to his house, and many of his cures were so wonderfully successful that they attracted the attention of the Inquisition as probable works of the devil. Many brilliant offers were made him from kings and kaisers, but he declined them, and remained at Vilvoorden, where he d. Dec. 30, 1644.

Helm'städt, or **Helmstedt,** town of Germany, in the duchy of Brunswick. It has large alum and vitriol works, and carries on a lively trade. Pop. 7469.

Hel'mund, a river of Afghanistan, rises in the Hindoo-Koosh, flows with a course of 650 miles through a barren desert, and empties itself in the salt lake of Hamoon. Its banks, which are fertile, bear at many points traces of former cultivation.

Heloder'midæ [from ἧλος, a "nail," and δέρμα, "skin"], a family of pleurodont saurians belonging to the group of Diploglossæ, and distinguished therein by the skin being furnished with tuberculigerous or nail-bearing scales (whence the name); head also tuberculigerous; skull with the temporal fossa overarched by dermo-ossification; no premaxillary foramen; teeth with short dilated bases, obliquely ankylosed; and mesosternum longitudinal and without lateral limbs. This family has been established by Gray and Cope (*Proc. Acad. Nat. Sc.*, Philadelphia, 1864, p. 228; 1866, p. 322) for the reception of a large lizard (*Heloderma horridum*, Wiegmann) found in Northern Mexico and the contiguous U. S. territory. It is characteristic in its color, which is blackish, reticulated by yellow interspaces. The animal has a suspicious reputation, and is believed by the inhabitants of the country in which it is found to be poisonous, but no evidence of the fact has been obtained by Dr. Irwin, who experimented with it. In Southern Arizona, where it is common, it is known as the "scorpion." Theodore Gill.

Héloise. See Abelard, by Prof. J. H. Seelye, S. T. D.

He'los, town of Laconia, near the mouth of the Eurotas, was founded by Heleius, the youngest son of Perseus. It defended itself with great stubbornness against the Dorians, who after conquering it took revenge by making all its inhabitants slaves; hence perhaps the name *Helots* for the Spartan serfs. When Pausanias visited it in the second century of our era, he found it in ruins, and at present even its site is not precisely known.

Helostom'inæ, or **Helostom'idæ** [from ἧλος, "nail," and στόμα, "mouth"], a sub-family of the family Anabatidæ, or, according to others, a peculiar family of acanthopterygian fishes, with the upper joints of the branchial arches composed of thin laminæ for the reception of water, and all lined with a soft vascular membrane and without toothed tubercles. The head is unarmed; the mouth very small and transverse, and with movable teeth on the lips; the lateral line is interrupted. The representatives of this family are peculiar to the fresh waters of Java, Sumatra, and Borneo. Theodore Gill.

He'lots [plu.; Gr. εἵλως, εἱλώτης, plu. εἵλωτες, meaning either "captives" or "inhabitants of Helos," a town of Laconia], the serfs of the ancient Spartans; a peasantry of Greek blood, owned by the state and compelled to do certain kinds of military duty. Their lot was a hard one, though they might not be sold. It was the custom of the Spartans to keep their numbers within bounds by the occasional slaughter of the strongest of the Helots, and young Lacedæmonians were from time to time sent out to slay numbers of them secretly.

Hel'per (Hinton Rowan), b. in Davie co., N. C., Dec. 27, 1829; removed in 1851 to California, and was U. S. consul at Buenos Ayres 1861–67. Author of *The Land of*

Gold (1855), *Impending Crisis of the South* (1857), *Nojoque* (1867), *The Negroes in Negroland* (1868).

Helps (Sir Arthur), K. C. B., D. C. L., b. in England in 1817; graduated at Cambridge in 1838; became private secretary to the chancellor of the exchequer, and in 1859 became clerk of the privy council for England. Among his numerous works are *Thoughts in the Cloister and the Crowd* (1835), *Essays written in the Intervals of Business* (1841), several dramas; *The Claims of Labor* (1844), *Friends in Council* (1847; 2d series, 1859), *Companions of my Solitude* (1851), *Conquerors of the New World* (1852), *Spanish Conquest of America* (1855–61), *Life of Pizarro* (1869), *Brevia* and *Casimir Maremma* (1870), *The Life of Cortez*, and *Thoughts on Government* (1871), *Life of Brassey* (1872), *Ivan de Biron* (1874), *Social Pressure* (1874), etc. Helps' writings all have a noble moral purpose, and are written in a pure though not forcible style. He enjoyed the special favor and patronage of Queen Victoria for many years. D. in London Mar. 7, 1875.

Hel'singborg, town of the province of Malmö, Sweden, on the Sound, opposite to Elsinore, in Denmark. P. 7560.

Hel'singfors, the capital of the grand duchy of Finland, on the Gulf of Finland. It has an excellent harbor, and is strongly fortified. Its fortifications, of which Sweaborg and Gustavswärd are the two most important points, stretch over a row of seven rocky islands, and were in 1854 bombarded by the allied French and English fleet. (See Bombardment.) Helsingfors has a university attended by 600 students, a military academy, and a considerable trade. Pop. 32,113.

Helt, tp. of Vermilion co., Ind. Pop. 2794.

Hel'ton, post-tp. of Ashe co., N. C. Pop. 1004.

Helvel'lyn, a mountain of Cumberland, Eng., 3055 feet high, one of the highest points of land in England.

Helve'tia, post-tp. of Waupacca co., Wis. Pop. 148.

Helve'tii, the ancient Celtic inhabitants of Switzerland. Cæsar's *Commentaries* (*De Bello Gallico*) give a graphic account of their attempt to occupy more fertile parts of Gaul, and their terrible punishment and subjugation by the Romans (58 b. c.). They had previously (107 and 101 b. c.), in company with the Cimbri, experienced the power of the Roman armies. In 70 a. d., refusing to recognize Vitellius, and taking the part of Galba, the former fell upon them and put an end to their existence as a distinct people.

Helvétius (Claude Adrien) was b. at Paris in 1715, and educated in the College of Louis-le-Grand. After finishing his studies he was sent to Caen, to an uncle of his, who was a directeur des fermes, in order to make himself acquainted with the science and practice of a financier. In 1738 he obtained, through the influence of the queen, Marie Leczinska, a place as fermier-général, which gave him a yearly income of 100,000 francs. He grew rich, bought land, and after marrying the beautiful and talented countess de Ligniville, retired in 1751 to his estate, Voré, in Le Perche, where he spent the rest of his life. His famous book, *De l'Esprit*, appeared in 1758. He d. in 1771. Helvétius was a handsome man, with pleasant and elegant manners, kind-hearted, benevolent, full of sympathy with human sufferings, and always ready to help. But he was extremely vain, and although his vanity was ludicrous rather than offensive, the one aim of his life was to be noticed and applauded. He succeeded. After many years' labor the book was done and came out, and the sensation it made was so immense as to actually frighten the author. In thorough good faith, as if it did not contain anything extraordinary, or rather as if he himself did not understand what it contained, he sent copies to the queen, the dauphin, and all his friends at court, and he was entirely bewildered when suddenly the hurricane broke down on him. The court was scandalized and the clergy were in a fury. The doctors of the Sorbonne denounced the book, the Parliament of Paris condemned it to be burnt by the hangman, and the pope put it under ban. To all this the author answered by retracting. He wrote four retractions, each more sweeping than the preceding, but no one heard him. The book ran like wild-fire over all Europe, and when the storm was over Helvétius found himself one of the most famous authors of the time, the great revealer of *le secret de tout le monde*. Frederick the Great invited him to Berlin, and treated him like a prince; Catharine II. complimented him; France, England, the whole world applauded him. He had accomplished a great deed, and he was not going to outshine himself. He wrote no more books. After his death were found an unfinished poem, *Le Bonheur*, and an unfinished commentary on his book, *De l'Homme, de ses Facultés intellectuelles et de son education*. But they were watery; nobody read them; and as very few had noticed his passionate retractions, very few noticed the wicked whisper that Diderot had written all the good pages in his book.

De l'Esprit is the gospel of materialism. The principal ideas which it propounds are that all our mental faculties are reducible into physical sensibility, and the difference between man and animals is only a difference in exterior organization; that self-interest, guided by our love of pleasure and fear of pain, is the sole motive of our actions and affections, and the ideas of justice and injustice are nothing but reflections of habit; that mental inequalities do not depend on a more or less perfect organization, but merely on education, etc. But it was not these ideas which scandalized and enraged people. On the contrary, they were the charm of the book; they were the revelation of *le secret de tout le monde*. But Helvétius often employed some very clever illustrations; and when he, for instance, said, "Give the son of a carpenter smartness, courage, prudence, and energy, and in a republic he will become a Themistocles or a Marius, while in Paris he will become a Cartouche," such ideas were of course dangerous; people are generally more ridiculous in what they abhor than in what they admire.

Clemens Petersen.

He'mans (Felicia Dorothea), *née* Browne, b. at Liverpool, England, Sept. 25, 1794; married Capt. Hemans in 1812, and in 1818, after the birth of five sons, separated on account of the uncongenial character of the union. Mrs. Hemans from that time resided in Wales, Lancashire, and Ireland, engaged chiefly in literary production. D. near Dublin, May 12, 1835. Mrs. Hemans's best poetry is characterized by grace and tenderness, which is especially exhibited in her less ambitious pieces. But she wrote too much to write always well, and several of her tragedies and longer pieces were unsuccessful. Her works include *Early Blossoms* (1808), *The Domestic Affections* (1812), *The Forest Sanctuary* (1827), *Records of Women* (1828), *Songs of the Affections* (1830).

Hematine. See Hæmatine.

Hematite. See Hæmatite.

Hemibran'chii [from ἡμι-, "half," and βράγχια, "gills"], an order of Teleost fishes with the palatine bone directly articulated with the quadrate, without the intervention of the pterygoid; with jaws normally developed; the mouth being bounded above by the pre-maxillary, behind which is the super-maxillary; branchial apparatus imperfect, the superior branchihyals being rudimental, and at least the fourth wanting; anterior pharyngeal bones distinct; scapular arch connected directly with the post-temporal, no postero-temporal being developed; meso-coracoid absent; and ventral fins abdominal, the pubic bones having no connection with the scapular arch. To this order belong several families: the sticklebacks, (1) Gasterosteidæ and (2) Aulorhynchidæ; (3) the short pipe-fishes, or Aulostomidæ; (4) long pipe-fishes, or Fistulariidæ; and certain peculiar types with high bodies; (5) Centriscidæ, and (6) Amphisilidæ. The first four groups resemble each other, and are "gasterosteiform," and the last two "centrisciform." They differ from most fishes in the structure of the shoulder-girdle, and the union of the palatine arch directly with the quadrate bone, as well as by the imperfection of the branchial arches, to which the ordinal name refers.

Theodore Gill.

Hemiple'gia [from the Gr. ἡμι-, "half," and πλήγη, a "stroke"], that kind of paralysis which affects only one side of the body; or if both sides are affected, it is from the occurrence, a very rare one, of double hemiplegia—that is, of two concurrent paralytic strokes, one affecting each side. It manifests itself usually in the upper and lower extremities of one side, and in the parts of the head which are supplied by the fifth nerve. It may be the result of an apoplectic stroke, or of a slow effusion, or of the growth of a tumor within the brain. Owing to the decussation of the pyramids, the paralysis takes place usually on the side of the body opposite to the side of the brain in which the lesion has occurred. For example, if there be a tumor growing in the left hemisphere of the brain, the paralysis will, as a rule, be manifested in the right side of the body, because the nerve-fibres cross over from side to side near the base of the brain. But if the lesion occur below this crossing, there may be hemiplegia on the same side. Hemiplegia affects chiefly the nerves of motion, but affects more or less those of sensation also. Temporary attacks of hemiplegia are also observed in chorea, epilepsy, and hysteria. The treatment of hemiplegia varies with the condition of the patient and the cause of the stroke. Generally, time and rest are important to the relief of the patient.

Revised by Willard Parker.

Hem'ipode (*Hemipodius*, "half-foot," so named from the absence of the hind toe), a genus of gallinaceous birds, including the smallest birds of that group. *H. tachy-*

dromus, the Andalusian quail, ranges eastward from Spain to Australia. The fighting quail (*H. pugnax*) of Java is domesticated and trained to fight like a gamecock. Each of these birds is about five inches long.

Hemip'tera [Gr. ἡμι-, "half," and πτερόν, "wing"], an order of insects which have the mouth-parts formed into a slender horny beak or sheath of horny substance, enclosing three sharp bristle-shaped organs, the whole fitted for suction. Such are bugs, plant-lice, etc. They are named from the fact that such of these insects as have wings of typical form have the upper or basal portion of the wings thick, while the terminal portion is thin (Hemiptera heteroptera); but the cicadas, plant-lice, etc. have wings of uniform thickness (Hemiptera homoptera). Indeed, many forms have no wings at all. (See article ENTOMOLOGY, by PROF. SANBORN TENNEY, A. M., section *Hemiptera*.)

Hem'isphere [Gr. ἡμι-, "half," and σφαῖρα, "sphere"], one-half a sphere; applied particularly to the halves of the terrestrial globe. The distinction between the eastern and western hemispheres is an arbitrary one. The meridium of Ferro is assumed as the dividing line, and it serves the purpose, though but rather imperfectly, since a small part of North-eastern Asia is by this arrangement thrown into the western hemisphere. The equator gives a very natural division into a northern and southern hemisphere. As the land-surface of the earth is generally situated to the N. of the equator, and as the land-areas expand northward and taper to the S., the northern hemisphere contains nearly three times as much land as the southern, in which water correspondingly predominates. And as four continents are crowded together in the eastern hemisphere, it contains two-thirds, and the western only one-third, of the lands. The Old World is thus double the size of the New. As the lands are crowded on the N. and E. sides of our planet, the north-eastern hemisphere contains more land and the south-western hemisphere more water than any other we can devise. They are therefore contrasted by the celebrated Carl Ritter as the land and water hemispheres. In the land hemisphere are gathered together the largest parts of all the great continents, making over six-sevenths of all the land, and occupying only a little less than one-half of the surface. In the water hemisphere, Australia, the smallest of the continents, stands alone, with only the southern points of Asia and South America, making less than one-seventh of the land, and leaving twelve-thirteenths of the surface to the water. The centre of the land hemisphere is about London; that of the water hemisphere at some point in the ocean S. of New Zealand. (For cuts of Hemispheres see article EARTH in Vol. I. of this work.)

Areas in Square Miles.

	Land.	Water.	Total.
The earth	52,900,000	144,000,000	196,900,000
Northern hemisphere	38,780,000	59,670,000	98,450,000
Southern hemisphere	13,965,000	84,485,000	98,450,000
Eastern hemisphere	36,100,000	62,350,000	98,450,000
Western hemisphere	15,900,000	82,550,000	98,450,000
Land hemisphere	45,000,000	53,450,000	98,450,000
Water hemisphere	7,000,000	91,450,000	98,450,000

ARNOLD GUYOT.

Hemitripter'idæ [from ἡμι, "half," τρεῖς, "three," and πτερόν, "fin"], a family of acanthopterygian fishes, with the vertebræ in greatly increased number (16 + 23), having an enlarged suborbital bone articulating with the preoperculum, and distinguished by the elongated spinous dorsal fin, combined with the characters of the true cottoid (the head not compressed, no true scales, and ventrals imperfect and enveloped in a thick skin). The family is represented on the coasts of the U. S. by a species known as the deep-water sculpin (*Hemitripterus acadianus*).

THEODORE GILL.

Hem'lock, or **Spot'ted Hem'lock** (*Conium maculatum*), a biennial plant, natural order Umbelliferæ, native in Europe, but naturalized and cultivated in the U. S. for medicinal purposes. It has an erect, round, branching stem from three to six feet high, marked with brownish-purple spots, whence the name "spotted hemlock." It bears large deep-green, decompound leaves, and small white flowers in compound terminal umbels. The plant, especially in summer, has a peculiar fetid, mousy smell. The leaves and fruit are used in medicine, the active principle being an alkaloid, *conia*, most abundant in the fruit. This is a yellowish oily fluid, volatile, of acrid taste, and strong mousy odor, slightly soluble in water, but freely in alcohol, ether, and oils. The action of hemlock has only of late years been carefully analyzed, and is simply to destroy the conducting power of the nerves of motion, producing thus muscular weakness and paralysis, the effect showing itself first in the muscles of the eyes and lids and of the legs. In poisonous doses it produces complete muscular paralysis, and thus death by paralysis of the muscles of respiration. It is not certain whether the hemlock used by the ancients as a state poison was this plant or the *Cicuta virosa*, a much more virulent herb. Hemlock has had a variety of medicinal virtues assigned to it, but its only rational use is to subdue abnormal motor activity or irritability. Many of the preparations of hemlock are apt to be inert, from loss of the volatile active principle. EDWARD CURTIS.

Hemlock, tp. of Columbia co., Pa. Pop. 1170.

Hemlock Lake, a manufacturing post-v. of Livonia tp., Livingston co., N. Y. Pop. 257.

Hemlock Tree, called also **Hemlock Spruce**, the *Abies Canadensis*, one of the most common of the coniferous trees of the Northern States and British America. It is a very large tree, and when young is very graceful. Though the timber is coarse and cheap, it is very serviceable, and immense quantities of it are employed in house-carpentry in the older and longer-settled parts of the North. The bark and its extract are very extensively employed in tanning leather in the U. S.—much more so than any other astringent substance. The wood is very inferior as fuel, burning up very quickly and with a loud crackling noise. "Hemlock oil" is distilled from its leaves and twigs, and "Canada pitch" is obtained from the old trees. Several very closely allied Asiatic trees are described.

Hemp, a fibre, the use of which in Persia and India antedates the period of accurate knowledge, and whose introduction into Europe was contemporaneous with civilization. This fibre is similar to that of flax, but coarser and stronger. The plant which produces it is also known as hemp, and is cultivated for its seed and for the oil which is expressed from the seed, and the hemp of warm countries, especially of India, possesses peculiar medical properties. (See HASHISH.) The plant is known botanically as *Cannabis sativa*, and is an annual belonging to the nettle family (Urticaceæ). It is a diœcious plant, having the fruit-bearing or female flowers, and the sterile or male flowers, upon different plants. Hemp grows four to twelve feet high, and makes its growth almost as rapidly as Indian corn. The stem is somewhat angular, rough, and hairy, branching freely when growing singly, but very little when crowded. The leaves are generally compound, five to seven leaflets being united upon the end of one leaf-stalk. The leaflets are three to five inches long, slender, and toothed at the edges. The staminate or male flowers are of a greenish-white color, and occur in loose clusters in the axils of the leaves near the top of the plant or the ends of the branches, while the pistillate or fruit-bearing flowers occur mostly in pairs close set in the axils of the upper leaves. As usually cultivated, it flowers in June, and ripens its seed in August.

The hemp-producing countries of the world are Russia, Turkey, India, Holland, Germany, Italy, and Great Britain. The Riga hemp of Russia combines fineness and strength, and is regarded as the best. There is, however, a kind produced in Italy called "garden hemp," raised with great care by hand-culture, which is the finest. The fibre is separated from the boon much as flax is, and is spun and woven in almost identically the same way. Excellent sheetings and shirtings, white and strong, are made from hemp, but towellings (huckaback), osnaburgs, tablecloths, napkins, floorcloths, sail-duck, and the like are manufactured on a large scale, and form articles of extensive commerce. By far the greatest consumption of the fibre is for rope, cordage, and twine.

Cultivation.—A large portion of the U. S. is well adapted to raising hemp, but it is principally raised in the following States, named in order of greatest production: Kentucky, Missouri, Tennessee, Ohio, Indiana, and New York. The cultivation for fibre is simple, the seed being sown as early as the ground is warm on well-prepared sward ground, which, if of a clayey nature, should be ploughed in the autumn and worked again in spring. It is not usual to manure directly for the crop. Four to six pecks of seed are used in this country to the acre, but the quantity varies according to the climate and to the strength of the soil, upon which also the vigor of the plants depends. In England they use two to three bushels of seed, but there the height of the plants is about four to six feet, while here it is frequently seven to nine. The seed is thoroughly harrowed in and rolled, and requires no attention until it is cut. Cutworms are often quite injurious to it, and crows and blackbirds on a hemp-field are the farmer's best friends. Hemp has no diseases that we know of. When the blossoms of the flowering (male) plants turn yellow and fall off, it is usual with us to cut the whole crop; but in Europe, as soon as the "blossom hemp" has fertilized the crop and the seed is set, the hands pass through, pull all the male plants, and binding them in bundles, dry and stack them for subsequent rotting. The female plants remain until the seed is ripe, when they are cradled, the tops, in which the seed is, cut off, and the stalks dried and stacked. Hemp

is generally cradled, but if over seven feet high this is hardly possible, and it should be cut with sharp bush-scythes. After two or three days' sunning the hemp is bound and stacked, either upon the ground if it is to be dew-rotted, or near the pools if it is to be water-rotted. The rotting is performed in the autumn at the commencement of cool weather, and requires in pools or vats ten to twenty days, according to the temperature. Vats under cover are preferred, each being about 20 by 40 feet, and 2 to 3 feet deep. The hemp is laid in crossways, and weighted down by stones laid upon planks. The water is changed by drawing off and refilling when required. The process is completed when the fibre separates readily from the stalk, or of its own accord springs off from it like a fiddle bow-string. It is dried and stacked, and "broken" in the winter. This operation is like that of breaking flax, but performed with heavier implements. The boon is scutched and beaten out of the fibre, which is twisted into hands or hanks and pressed into bales for market. In dew-rotting the hemp is exposed to the weather in thin layers, and turned occasionally until the gumminess of the stalks is gone and the fibre separates from the boon as before described.

When hemp is cultivated for the seed, it is planted upon good corn-ground, manured the fall before if the soil be not too light and sandy. It delights in moist rich soils. The culture is like corn, the hills being three and a half to four feet apart, according to the richness of the land. A dozen or more seeds are dropped in each hill, and at the first hoeing these are thinned to five or six plants. Cutworms may take two or three of these, and at the second hoeing they are reduced to four. When the blossom-hemp can be distinguished, these plants are removed, and two or three of the others left to each hill. One plant of the male or blossom-hemp is allowed to remain in the alternate hills each way, making one to each four hills, and as soon as the seed is set, the blossoms having ceased to shed their pollen (the yellow dust which falls when they are shaken), these plants too are removed, leaving only the seed-bearing plants in possession of the soil. The seed-hemp is cut before the seed will shell out of itself, stacked till dry, and the seed beaten out. This must be winnowed with care, and spread in thin layers in warm airy lofts, or otherwise, so that it shall not heat. The crop is 12 to 15 bushels per acre. Hemp-seed is largely consumed as food for cage-birds and fancy poultry. It contains about 25 per cent. of oil, which may be extracted, leaving a cake still rich in oil. The oil is of a greenish-yellow color, and is used in the manufacture of certain soaps and somewhat in paints and varnishes.

The name "hemp" is commercially applied to several coarse fibres which come chiefly from tropical or extreme southern countries. They resemble true hemp only in the fact that the fibre may be used for cordage and perhaps other purposes for which hemp is employed. M. C. WELD.

Hem'pel (CHARLES JULIUS), M. D., b. at Solingen, Germany, Sept. 5, 1811; studied in Paris and the University of New York, where he graduated, having come to the U. S. in 1835. He became in 1857 professor of materia medica and therapeutics in the Homœopathic Medical College of Philadelphia. He has published a German grammar (1842), *True Organization of the New Church* (1848), several translations of homœopathic medical works, *Homœopathic Theory and Practice* (1865), *The Science of Homœopathy* (1874).

Hemp'field, tp. of Mercer co., Pa. Pop. 1119.

Hempfield, tp. in Westmoreland co., Pa. It includes the borough of GREENSBURG (which see). Pop. 5819.

Hemp'hill, post-v., county-seat of Sabine co., Tex.

Hemp'stead, county in S. W. of Arkansas. Area, 790 square miles. It is a fertile rolling country, with fine timber. Cattle, maize, and cotton are staple products. Cap. Washington. Pop. 13,768.

Hempstead, post-v. and tp. of Queens co., N. Y., 21 miles E. of New York City, on the Long Island Central, the South Side, and the Long Island R. Rs. It has 4 churches, 2 fine public halls, 6 hotels, 30 business-houses, 1 flour-mill, 1 patent-leather factory, numerous mechanical shops, and many fine residences. It has 2 weekly newspapers. The township contains a large number of villages. Pop. of v. 2316; of tp. 13,999.

HENRY M. ONDERDONK, PROP. "INQUIRER."

Hempstead, post-v., cap. of Waller co., Tex., 100 miles N. of Galveston, on the Texas Central R. R. at the junction of the Austin branch. It has 4 schools, 5 churches, 1 bank, 1 cotton-factory, 1 cotton-seed oil-mill, and 1 newspaper. The surrounding country is high, fertile, and healthy. Cotton and corn are the chief products. Pop. about 2500.

RIDDELL & HIERONYMUS, EDS. AND PROPS. "MESSENGER."

Hems. See HOMS.

Hem'sterhuys (FRANCIS), son of the philologist, b. at Groningen in 1722, and d. at The Hague in 1790. He held a subordinate diplomatic position, studied art, literature, and philosophy, and wrote, in the French language, letters, *Sur la sculpture, Sur les désirs, Sur l'Homme et ses rapports*, etc., which were collected in 1792 in two volumes as *Œuvres Philosophiques*. He belongs to the sentimental school of the philosophy of the eighteenth century.

Hemsterhuys (TIBERIUS) was b. at Groningen Jan. 9, 1685; studied mathematics, philosophy, and philology in his native city and at Leyden; was appointed professor of mathematics at Amsterdam in 1704, of Greek at Franeker in 1717, and at Leyden in 1740, and d. in the last-named city Apr. 7, 1766. His principal works are critical editions of the *Onomasticon* of Pollux (1706), Lucian (1743), and the *Plutus* of Aristophanes (1744). He possessed a more intimate knowledge of the Greek language than any of his predecessors among modern scholars, having extended his study of Greek literature also to its mathematicians and astronomers; and he was the first who employed the study of Greek art as a means of better understanding the literature.

Hen'bane, *Hyoscyamus niger*, a plant, generally biennial, though sometimes annual, natural order Solanaceæ, native in Europe, but naturalized in the U. S., growing in waste places in the northern and eastern sections of the country. The root somewhat resembles that of parsley, and poisoning has resulted from eating it by mistake. The stem is erect, round, branching, from one to four feet high; the leaves numerous, large, deeply sinuate, sea-green, and both leaves and stem viscid and hairy. The flowers are yellow, beautifully veined with purple. The whole plant has a rank, offensive smell. The leaves and seeds are used in medicine, the active principle being an exceedingly poisonous alkaloid, *hyoscyamia*, which may be obtained in colorless needle-like crystals. The action of henbane on the system is almost identical with that of belladonna, causing increased pulse-rate, dryness of the throat, giddiness, staggering gait, dilatation of the pupils, delirium, and, in sufficient dose, death. It is considered to have more tendency to produce sleep than belladonna, though this is doubtful. Its uses in medicine are in the main similar to those of the latter drug. EDWARD CURTIS.

Hendec'agon, less correctly **Endecagon** [Gr. ἕν, "one," δέκα, "ten," and γωνία, "angle"], a plane rectilineal figure of eleven sides. The area of a regular or equilateral endecagon is very nearly equal to 9.36564 times that of the square of one of its sides.

Hen'derson, county of Illinois, separated from Iowa by the Mississippi River. Area, 540 square miles. It is very fertile, containing both prairie and timber land. Cattle, grain, and wool are staple products. Carriages and wagons are leading articles of manufacture. It is intersected by branches of the Chicago Burlington and Quincy R. R. Cap. Oquawka. Pop. 12,582.

Henderson, county of Kentucky, separated from Indiana by the Ohio River. It is hilly, productive, and abounds in coal. Cattle, corn, and tobacco are staple products. The county is traversed by the Evansville Henderson and Nashville R. R. Area, 600 square miles. Cap. Henderson. Pop. 18,457.

Henderson, county in the W. of North Carolina, bounded on the S. by South Carolina. Area, 325 square miles. It is mountainous, but fertile, and has iron, limestone, slate, and other valuable mineral resources. Corn and tobacco are staple products. Cap. Hendersonville. Pop. 7706.

Henderson, county in the W. of Tennessee. Area, 620 square miles. It is level and fertile, producing live-stock, tobacco, wool, corn, and cotton. Cap. Lexington. Pop. 14,217.

Henderson, county of N. E. Central Texas. Area, 934 square miles. It is mostly undulating prairie, with some timber. The soil is generally good. Cotton and corn are staple products. Cap. Athens. Pop. 6786.

Henderson, tp. and post-v. of Knox co., Ill. P. 1742.

Henderson, post-v., cap. of Henderson co., Ky., 212 miles W. S. W. of Louisville, on the St. Louis and Southeastern R. R. It has 5 schools, 8 churches, 2 banks, 2 newspapers, 5 hotels, 1 foundry, carworks, 2 carriage and 2 wagon factories, fair-grounds, etc. Pop. 4171.

J. G. STAPLES, ED. "REPORTER."

Henderson, post-v. and tp., cap. of Sibley co., Minn., 60 miles S. W. of St. Paul, on the St. Paul and Sioux City R. R. It has 2 mills, 3 hotels, 2 newspapers, and the usual number of stores. Principal business, farming. Pop. of v. 706; of tp. 1291. W. R. COLTON, ED. "TIMES."

Henderson, tp. of Jefferson co., N. Y., on Lake Ontario, from which Henderson Bay enters the town. It has

5 churches, and a lighthouse at Stony Point. The post-village of Henderson is on Stony Creek. Pop. of v. 339; of tp. 1926.

Henderson, post-v. and tp. of Granville co., N. C., 43 miles N. of Raleigh, on the Raleigh and Gaston R. R. It has 2 academies, 5 churches, 1 newspaper, 2 tobacco-factories, 2 warehouses for the sale of leaf tobacco, 2 hotels, and 16 stores. Pop. of v. 545; of tp. 3033.

S. J. SKINNER, ED. "REGISTER."

Henderson, tp. of Huntingdon co., Pa. Pop. 661.

Henderson, tp. of Jefferson co., Pa. Pop. 884.

Henderson, post-v., cap. of Rusk co., Tex., 14 miles from Overton. It has 6 church buildings, an Odd Fellows hall and Masonic hall, with active lodges, a temperance council, a flourishing Sabbath-school, 25 or 30 business-houses, a weekly newspaper, a wagon and buggy manufactory, a hotel, a fine school, and is the seat of Henderson College. Pop. 918. W. W. SPIVY, ED. "TIMES."

Henderson (JAMES PINCKNEY), b. in Lincoln co., N. C., Mar. 31, 1808, from whence he removed to Mississippi and engaged in the practice of law. In 1836 he was appointed a brigadier-general in the army of the republic of Texas; on its disbandment was chosen attorney-general, and subsequently (1837–39) secretary of state of Texas; minister from Texas to England to procure the recognition of the republic, and in 1844 to the U. S. to secure its annexation, which being accomplished he was chosen its first governor in the Union (1846–47). In the war with Mexico he commanded a division of Texan volunteers, with the rank of major-general, and for gallant conduct at Monterey was presented by Congress with a sword, accompanied by the thanks of that body. In 1857 he was elected U. S. Senator from Texas. D. at Washington, D. C., June 4, 1858. G. C. SIMMONS.

Hen'dersonville, post-v., county-seat of Henderson co., N. C., 255 miles W. by S. of Raleigh. Pop. 278; of tp. 1636.

Hen'dricken (THOMAS FRANCIS), D. D., b. at Kilkenny, Ireland, May 5, 1827, of partial Dutch descent; graduated at St. Kieran's College, Kilkenny, 1847; studied at Maynooth; was ordained at Dublin for the American mission 1853; occupied important Roman Catholic parishes at Providence, R. I., at Winsted and at Waterbury, Conn., where he remained seventeen years, built a costly church, and founded a flourishing academy for ladies; took an active interest in public and other schools; was theologian for the bishop of Hartford at the Plenary Council of Baltimore 1866; received the degree of D. D. from the pope 1868; was consecrated bishop of Providence Apr. 28, 1872, the first of that title; has founded numerous churches and schools, and published sermons, addresses, magazine articles, etc.

Hen'dricks, county of W. Central Indiana. Area, 400 square miles. It is level and fertile. Cattle, grain, and wool are staple products. Carriages, lumber, flour, bricks, harnesses, etc. are leading articles of manufacture. It is traversed by the Terre Haute and Indianapolis R. R. Cap. Danville. Pop. 20,277.

Hendricks, tp. of Shelby co., Ind. Pop. 1704.

Hendricks, tp. of Otoe co., Neb. Pop. 440.

Hendricks (THOMAS ANDREWS), b. in Muskingum co., O., Sept. 7, 1819; removed with his father in 1822 to Shelby co., Ind.; graduated in 1841 at South Hanover College; was admitted to the bar in 1843. In 1850 he was an active member of the State constitutional convention; member of Congress 1851–55 from the Indianapolis district; commissioner of the general land-office of the U. S. 1855–59; U. S. Senator (Democratic) 1863–69. He was chosen governor in 1872 for the term of four years.

Hendricks (WILLIAM), b. in Westmoreland co., Pa., in 1783; settled in Madison, Ind., in 1814; held many important offices, and was a member of Congress from Indiana 1816–22, governor 1822–25, U. S. Senator 1825–37. D. May 16, 1850.

Hen'gist, a prince of the Jutes, who in 446, with Horsa his brother, landed with 300 followers at Ebbsfleet on the Isle of Thanet, and was employed by Vortigern, king of Britain, to repel the Picts and Scots. This the Jutes accomplished by aid of fresh reinforcements from the Continent, but soon turned their arms against the Britons, whom they overcame in a series of bloody wars. Horsa was slain at Æglesthrep 455; Hengist declared himself king of Kent 457, and repeatedly defeated the Britons in battle (465–473). D. 488. The very existence of Hengist and Horsa has been sharply questioned by modern critics, but Freeman believes that, after rejecting the obviously mythical parts of this story, a considerable portion of historic truth remains.

Heng'stenberg (ERNST WILHELM), b. Oct. 20, 1802, at Fröndenberg, Westphalia, and studied (1819) at Bonn Oriental languages and theology. In 1826 he was appointed professor of theology at the University of Berlin. In 1827 he founded the *Evangelische Kirchenzeitung*, which soon became one of the most prominent religious periodicals in Germany; and after some years' labor as professor, journalist, and author he stood as the acknowledged head of the old Lutheran orthodox party. During the reign of the late king of Prussia he had great influence at court, and consequently great power at the university. But the exclusiveness of his theoretical views made him intolerant in practical life, and he raised a bitter opposition against himself. D. May 28, 1869. His best services were directed to the defence of the Old Testament against destructive criticism. His principal works are *Christologie des Alten Testaments* (3 vols., 1829–35; translated by Meyers, 1854); *Einleitung ins Alte Testament* (3 vols., 1831–39); *Commentar über die Psalmen* (4 vols., 1842–45); *Das Hohelied Salomons* (1853); *Das Evangelium des Johannes* (2 vols., 1861–62); *Die Offenbarung Johannis* (2 vols., 1849); and *History of the Kingdom of God in the Old Test.*, published after his death, and translated for Clark's *Foreign Theological Library*.

Henk'le (Rev. MOSES MONTGOMERY), D. D., b. in Virginia about 1799. He entered the itinerant ministry of the Methodist Episcopal Church at an early period in Ohio, and filled important stations in Ohio, Pennsylvania, Kentucky, Tennessee, and Alabama. He was for some time associated with Dr. McFerrin in editing the *Christian Advocate* at Nashville; he also edited the *Lady's Companion*. He wrote largely for the periodical press. He published several books, among which are the *Life of Bascom*, *Analysis of the Principles of Church Government*, *Platform of Methodism*, etc. He was connected with several literary institutions as professor or president. He was teaching in Baltimore during the war, and was sent within the Southern lines, and d. in Richmond, Va., 1864. T. O. SUMMERS.

Hen'le (FRIEDRICH GUSTAV JAKOB), M. D., b. at Fürth, Bavaria, July 9, 1809; graduated M. D. at Bonn 1832; became an assistant in the anatomical museum at Berlin, and in 1834 prosector in the university, but was imprisoned for connection with the *Burschenschaft*; became in 1837 a private tutor of histology and pathological anatomy; was 1840–44 professor of anatomy at Zürich; held a similar professorship at Heidelberg 1844–52, and in the latter year took the chair of anatomy at Göttingen; has done much for microscopic anatomy, pathology, physiology, anthropology, etc., and has a world-wide fame in these departments of science. Among his works are *Ueber Schleim und Eiterbildung* (1838), *Vergleichende Anatomie des Kehlkopfes* (1839), *Pathologische Untersuchungen* (1840), *Handbuch der allgemeinen Anatomie* (1841), *Handbuch der rationallen Pathologie*, *Handbuch der Systematischen Anatomie* (3 vols., 1855–68).

Hen'ley (JOHN), known as **Orator Henley,** b. at Melton-Mowbray, Eng., Aug. 3, 1692; was educated at St. John's College, Cambridge, where he wrote two numbers of the *Spectator* (396, 518); took orders in the Church; received appointments in London and elsewhere; became incumbent of Chelmondiston 1723, but soon gave up that living in consequence of reports affecting his character; opened the Oratory in London 1726, where he declaimed twice a week upon religion, fashion, and other subjects, and where he attempted to found a sect of Henleyarians and to establish a system of popular education. In 1746 he was arrested for treasonable speeches by order of Lord Chesterfield. D. Oct. 4, 1756. Among his somewhat numerous works are the *Complete Linguist, or a Universal Grammar*; *Oratory Transactions* (1728 *seq.*); *Esther, a Poem*; *History of Sweden*, and *Primitive Liturgy*, for the service in his Oratory, etc.; and for a time he edited the *Hyp-Doctor*, a stupid weekly comic paper, subsidized by Walpole.

Hen'na, or **Alkan'na** [Arab.], a paste made from the leaves of *Lawsonia inermis* or of *L. spinosa*, mixed with catechu, and used in the East to stain the nails, the finger-tips, and the edges of the eyelids of women and the beards of men. It primarily gives an orange color, which, if desired, may be changed to black by adding other stains. Some species of *Hibiscus* are in Eastern Asia put to the same use. The Lawsonias are shrubs of the order Lythraceæ. Their leaves are used in Europe for dyeing leather.

Hen'nepin, county in the E. of Minnesota, bounded on the E. by the Mississippi River. Area, 600 square miles. It has a varied surface, partly covered with forests, and a good soil. Grain is a leading product. Lumber, furniture, flour, carriages, clothing, etc. are manufactured. The county is traversed by the St. Paul and Pacific R. R. Cap. Minneapolis. Pop. 31,566.

Hennepin, post-v. and tp., cap. of Putnam co., Ill., 48 miles N. of Peoria and 114 S. W. of Chicago, on the E. bank of the Illinois River, 4 miles from the Chicago Rock Island and Pacific R. R. It is connected with Chicago by the Illinois and Michigan Canal. It has a fine court-house, 2 churches, a public-school building, 3 dry-goods houses, 3 groceries, 3 drug-stores, 1 newspaper, 2 hotels, a flouring-mill, and a planing-mill. Principal business, farming. Pop. of tp. 2144. I. H. Cook, Ed. "Record."

Hennepin (Louis), a Reformed Franciscan missionary and explorer, b. about 1640 at Ath, in Flanders. In 1675 he became a missionary to Canada. He was (1679–80) a member of La Salle's memorable band of explorers, who traversed the great lakes and the Upper Mississippi and its tributaries. He returned to Europe in 1697. He published *Description de la Louisiane* (1683), a valuable work, though full of exaggerations, and *Nouvelle découverte d'un très grand pays* (1697), which contains his previous work, enlarged by a narrative of a pretended voyage down the Mississippi to its mouth. In later life Hennepin abandoned the habit and the obedient life of his order, though still claiming the title of Recollet missionary. D. at Utrecht about 1706.

Hen'niker, post-tp. of Merrimack co., N. H., 15 miles S. W. of Concord, on the Contoocook River R. R. It has manufactures of lumber, furniture, paper, wooden wares, cooperage, etc. Pop. 1288.

Hénon (Jacques Louis), b. in 1802; author of two memoirs on botany and diseases of the horse, but better known as mayor of Lyons, France, after the revolution of Sept. 4, 1870, and as a prominent member of the Left in the Corps Législatif under the empire, and of the present national assembly. Hénon is not a political leader, and his best speeches were especially devoted to supporting the interests of Lyons, where his popularity has notwithstanding been overshadowed lately by that of more radical politicians. Félix Aucaigne.

Henri'co, county in the E. of Virginia, bounded on S. W. by the James River. Area, 280 square miles. The soil is generally light, but easily tilled. Triassic coal of good quality is mined. Tobacco and grain are staple products. Tobacco, furniture, clothing, metallic wares, cigars, saddlery, carriages, etc. are among the articles manufactured, chiefly at Richmond, the capital of the county and State. The water-power and the commerce of the county are extensive. It is traversed by the railroads which centre at Richmond. Pop. 66,179.

Henriet'ta, post-tp. of Jackson co., Mich. Pop. 976.

Henrietta, post-tp. of Monroe co., N. Y., traversed by the Rochester branch of the Erie R. R. It has 3 churches, an academy, and some manufactures. Pop. 2280.

Henrietta, post-tp. of Lorain co., O. Pop. 927.

Henrietta, post-tp. of Richland co., Wis. Pop. 754.

Henriville, post-v. of Iberville co., Quebec, Canada, 40 miles S. E. of Montreal, has a convent of nuns of the Presentation. Pop. of sub-district, 1918.

Hen'ry, the south-easternmost county of Alabama, having Georgia on the E. and Florida on the S. Area, 930 square miles. The navigable Chattahoochee is on the E. border. This county is in the great pine-region, but produces good crops of corn and cotton. Cattle are bred extensively. Cap. Abbeville. Pop. 14,191.

Henry, county of N. W. Central Georgia. Area, 400 square miles. The surface is in part heavily timbered. Iron and gold are found. Cotton and corn are leading products. The Macon and Western R. R. traverses the S. W. part. Cap. McDonough. Pop. 10,102.

Henry, county in the N. W. of Illinois. Area, 830 square miles. It is very fertile, partly prairie and partly timber-land. Cattle, grain, and wool are staple products. Carriages, harnesses, etc. are manufactured. Coal is abundant. The county is traversed by the Chicago Rock Island and Pacific, the Chicago Burlington and Quincy, and other railroads. Cap. Cambridge. Pop. 35,506.

Henry, county of E. Central Indiana. Area, 360 square miles. It is generally undulating and fertile. Cattle, grain, and wool are staple products. Carriages, lumber, harnesses, and flour are leading articles of manufacture. It is traversed by the Pittsburg Cincinnati and St. Louis and the Fort Wayne Muncie and Cincinnati R. Rs. Cap. New Castle. Pop. 22,986.

Henry, county in the S. E. of Iowa. Area, 432 square miles. It is a fertile prairie region, with considerable timber and limestone, with perhaps coal. Cattle, grain, and wool are staple products. Carriages and wagons are leading manufactured articles. It is traversed by the Burlington and Missouri River R. R. Cap. Mount Pleasant. Pop. 21,463.

Henry, county in the N. of Kentucky. Area, 220 square miles. The navigable Kentucky River flows along the E. border. The soil is calcareous and very fertile. The county is well timbered and undulating. Tobacco, corn, and live-stock are leading products. The Louisville and Cincinnati and the Louisville and Lexington R. Rs. traverse the county. Cap. Newcastle. Pop. 11,066.

Henry, county of the W. of Missouri. Area, 775 square miles. It is fertile, consisting of prairie and woodland. Coal is mined; cattle, grain, and wool are the other staple products. The county is traversed by the Missouri Kansas and Texas R. R. Cap. Clinton. Pop. 17,401.

Henry, county in the N. W. of Ohio. Area, 393 square miles. It is level and fertile, and is traversed by the Toledo Wabash and Western and the Dayton and Michigan R. Rs., and the Maumee River and Canal. Cattle, grain, wool, and lumber are staple products. Cap. Napoleon. P. 14,028.

Henry, county of West Tennessee, bounded on the N. by Kentucky. Area, 550 square miles. The Tennessee River forms a part of its E. boundary. It is highly fertile, and produces live-stock, corn, and especially tobacco. It is traversed by the Memphis Clarkesville and Louisville R. R. Cap. Paris. Pop. 20,380.

Henry, county of Virginia, bounded on the S. by North Carolina. Area, 325 square miles. It is a hilly region. Tobacco and grain are staple products. Cap. Martinsville. Pop. 12,303.

Henry, city and tp. of Marshall co., Ill., on the Illinois River, 120 miles S. from Chicago, also on the Peoria branch of the Chicago Rock Island and Pacific R. R. A combined wood and iron bridge, costing $80,000, spans the river, with a high turnpike half a mile long at its eastern terminus. The first lock and dam to improve the Illinois River is located here. The city contains 2 grist-mills, a paper-mill costing $45,000, 3 carriage-factories, a large wagon-factory, a fire-engine company, with hose company and hooks and ladders, several fire-alarm bells, 8 churches, 1 newspaper, 2 public school buildings, a seminary in the suburbs, a national bank. Pop. of v. 2162; of tp. 2613.
George Burt, Jr., Ed. "Republican."

Henry, tp. of Fulton co., Ind. Pop. 1919.

Henry, tp. of Henry co., Ind. Pop. 2818.

Henry, tp. of Vernon co., Mo. Pop. 680.

Henry, tp. of Wood co., O. Pop. 685.

Henry, tp. of Hanover co., Va. Pop. 3347.

Henry, post-tp. of Sussex co., Va. Pop. 1220.

Henry, tp. of Clay co., W. Va. Pop. 484.

Henry I. (Beauclerc), king of England, son of William the Conqueror and Queen Matilda, and successor of William Rufus, was b. at Selby, Yorkshire, in 1068. His youth was marked by strange quarrels with his elder brothers; and when William II. died Henry hastened to assume the crown (1100) while Robert was absent in Palestine. He at once recalled Anselm, declared the validity of the Confessor's laws, and married Maud of Scotland, shrewdly securing the Church, the Anglo-Saxon English, and the Scots against Robert in the coming struggle, in which Henry was entirely successful; he was acknowledged duke of Normandy in 1106, and soon engaged in advantageous wars with France. The drowning of his son William in 1120 broke the king's heart, and the troubles with his nephew William in Normandy, and with the Welsh in the W. of England, greatly disturbed the last of his reign. D. at Rouen Dec. 1, 1135, leaving as his heir his daughter, the countess Matilda of Anjou, former wife of Henry V. of Germany.

Henry II., first Plantagenet king of England, son of Geoffrey Plantagenet and of Matilda, former empress of Germany, the heiress and only surviving child of Henry I., was b. at Mans, in Maine, Mar., 1133; was educated in Normandy and England; and in 1152 invaded England with troops for the overthrow of the king Stephen, with whom in 1153 a peace was concluded by which Henry was acknowledged as heir to the crown; succeeded Stephen in 1154, having in 1151 become count of Anjou, Touraine, and Maine by his father's death; and by his marriage in 1152 with Eleanor of Aquitaine, the divorced and dishonored queen of France, he acquired sovereignty over nearly half of France, subject in some degree to French suzerainty. The great events of Henry's eventful reign were the Irish conquest; the wars with the Scots, Welsh, and the French king; the destruction of more than 1000 feudal castles in England—"dens of thieves," Henry called them; the contest with Thomas à Becket; the subscription to the Constitutions of Clarendon (1164); and the rebellion of his sons and queen. He was, says Freeman, the great legislator of English feudalism, but was always Angevine, never English, in his feelings. D. at Chinon July 6, 1189.

Henry III. of England, b. at Winchester Oct. 1, 1207, succeeded John, his father, in 1216. His reign of 65 years was the longest except that of George III. in British history. Henry's minority at his accession, and the great power acquired by the barons under King John, crippled his power and made his reign a weak one. Simon de Montfort, earl of Leicester, is the central figure of this reign, and he was the great leader in the task of recovering for the nobles the privileges lost under Henry II. Henry III. was, notwithstanding the misfortunes of his reign, a man of fine talents,—chiefly eminent as a builder; many of the finest structures in the Early English Gothic style are the work of Henry and of his brother Richard, king of the Romans. D. at Westminster Nov. 16, 1272, and was succeeded by his son, Edward I.

Henry IV. of England, first Lancastrian king, b. at Bolingbroke, Lincolnshire, Apr. 4, 1366, son of John of Gaunt, the fourth son of Edward III., while his mother was a lineal descendant of Henry III. He was made earl of Derby and duke of Hereford. With his adversary, the duke of Norfolk, he was banished in 1398 by Richard II., who seized his immense estate upon the death of John of Gaunt in 1399. Soon Henry landed at Ravenspur with a small following, the king being absent in Ireland. All England joined Henry, and Richard was dethroned and Henry crowned. Henry's defective title led him to persecute the Lollards, so as to win the support of the Church, but his reign was much disturbed by formidable rebellions. D. Mar. 19, 1413.

Henry V. of England, son and successor of Henry IV., was b. at Monmouth Aug. 9, 1388; served in his youth against the rebellious Glendower and Hotspur. The tales of his irregular life in youth are not supported by good evidence. He was very popular with the people, and his father seems to have been jealous of him. He came to the throne in 1413, persecuted the Lollards, and in 1414 announced to Parliament his intention of making the conquest of France upon the strength of Edward III.'s claim to that sovereignty; landed at Harfleur, which he took Sept. 22, 1415; totally defeated the greatly superior force of the French at Agincourt Oct. 25; occupied the greater part of France, aided by the duke of Burgundy and other malcontents; married in 1420 the French princess Catharine, and was recognized as heir-presumptive. The remainder of his reign was occupied by wars in France. D. at Vincennes Aug. 31, 1422.

Henry VI. of England, the last Lancastrian king, son of Henry V., b. at Windsor Dec. 6, 1421, succeeded his father on Sept. 1, 1422, and in 1431 was crowned king of France at Paris. His reign was marked by the wars of the Roses, maintained on the Lancastrian side more by the energy of Margaret of Anjou, the queen, than by the pious but irresolute Henry. In these wars the old nobility of England was almost exterminated, and the power of the Lancastrian house overthrown. In France, Joan of Arc and her followers had expelled the English, and the popular sense of disgrace vented itself upon the unoffending king, whose title was indeed defective. Henry founded Eton School (1440) and King's College, Cambridge (1443). Was found dead in the Tower (where he had been imprisoned) May 22, 1471.

Henry VII. of England, the first of the Tudor kings, was b. in Wales Jan. 21, 1456. He was descended, on his mother's side, from John of Gaunt (son of Edward III.) and Catharine Swynford, whose offspring had been legitimated by the pope, the king, and the Parliament. His father was a son of Owen Tudor, a Welsh gentleman, and Catharine, widow of Henry V. of England, whose marriage to Tudor has been denied. Young Henry became earl of Richmond; was attainted by the Yorkists 1461; and in 1471 retired to France; attempted a revolt in 1483; landed at Milford Haven in 1485; defeated and killed Richard III. at Bosworth; married Elizabeth, heir of the Yorkist sovereigns, 1486. His reign was much disturbed by insurrections. The king was politic, encouraged commerce and industry, and filled his treasury by means previously untried, and unquestionably illegal. D. Apr. 22, 1509.

Henry VIII. of England, son and successor of Henry VII., was b. at Greenwich June 28, 1491; became in 1502 prince of Wales on the death of his brother Arthur; married Catharine of Aragon, Arthur's widow, in 1509, a papal dispensation having permitted the unlawful union; succeeded to the crown in 1509; joined the emperor Maximilian in a war with France 1511–14, during which war the Scots were utterly overthrown at Flodden Sept. 9, 1513; made Wolsey chancellor 1515; was involved in competition with Francis I. and Charles V. for the empire of Germany; wrote in 1521 his book on the sacraments against Luther, for which he received from the pope the title of "defender of the faith," a distinction claimed, as we are told, by some ancient English kings; made war in 1522 against France in the interest of Charles V.; applied in vain in 1528 to the pope for a commission to inquire into the legality of his marriage. The king applied in 1529, by Cranmer's advice, to the universities with better success. The influence of the king and Wolsey at Rome was completely foiled by the Spanish interest in the queen's behalf, and the great seal was taken from Wolsey and given to Sir Thomas More. The convocation was now compelled to acknowledge Henry as the head of the English Church; the king married Anne Boleyn in 1533, and Cranmer, now archbishop of Canterbury, declared the former marriage null. In 1535 the papal authority was set aside by act of Parliament, More and Fisher were executed, Thomas Cromwell made vicar-general, and the visitation and destruction of monasteries commenced. Anne Boleyn was executed, and Jane Seymour married in 1536; Roman Catholic insurrections broke out in 1536, and Queen Jane d. in 1537; Anne of Cleves was married to the king in 1540, soon after which Cromwell was executed, and the marriage annulled by convocation and Parliament; Henry married Catharine Howard in the same year, and had her executed in 1542; was married in 1543 to Catharine Parr, his sixth and last wife. Many Roman Catholics, and Reformers as well, were executed during the latter part of Henry's reign, and great numbers of the nobles and aristocracy died on the scaffold on suspicion of treason. Among the darkest stains upon the conduct of the king is the murder of his best and truest friends, such as Cromwell, earl of Essex, whose only fault seems to have been a too faithful devotion to Henry's policy, and the carrying out of that policy in such a way as to seem too officious in the king's affairs. D. at Westminster Jan. 28, 1547. The two modern English political parties have been said to date from this reign, in which there was a conservative or national Catholic party, led by Bishop Gardiner and others (many of them becoming Roman Catholics again under Queen Mary), and a reforming party, led by Thomas Cromwell, Cranmer, and others scarcely less distinguished. (For the best defence of Henry's character see FROUDE's *History;* see also PROF. JOHN SHERREN BREWER's *Calendar of State Papers* (1862 *seq.*), and Brewer's ed. of FULLER's *Church History.*)

Henry I., king of France, b. 1011, succeeded Robert II., his father, 1031; was a weak prince, whose reign was much disturbed by civil wars and public calamities. D. at Vitri Aug. 4, 1060, and was succeeded by Philip I., his son.

Henry II. of France, b. Mar. 31, 1519; married Catharine de' Medici 1533; succeeded Francis I., his father, 1547. His reign was distinguished by bloody persecutions of the Protestants, and by wars with Charles V. and his son, Philip II. of Spain. These wars were advantageous to France as military operations, but by the disastrous peace of Cateau-Cambresis (1559) Henry gave up the greater part of his advantages. D. July 10, 1559, in consequence of a wound received in a tournament.

Henry III. of France, son of Henry II. and Catharine de' Medici, b. at Fontainebleau Sept. 19, 1551; served as duke of Anjou against the Huguenots 1569–73; was crowned king of Poland in 1574; abandoned Poland, and succeeded his brother, Charles IX., as king of France 1575. His reign was disturbed by the wars of the League, designed to prevent the succession of Henry IV., and is further memorable for the assassination of the Guises 1588, and for the king's unbounded licentiousness. Henry was stabbed with a knife by Jacques Clément, a partisan of the Guises, and d. Aug. 2, 1589. He was the last of the Valois line, and was succeeded by Henry IV., the first Bourbon king.

Henry IV., king of France and Anjou, the first Bourbon monarch of France, succeeded Henry III. in 1589, being a lineal descendant of Louis IX. Henry was b. at Pau Dec. 14, 1553, the son of Antoine de Bourbon and Jeanne d'Albret, queen of Navarre; he was bred a Protestant by his mother, and trained to all hardy exercises. In 1569 he joined the Protestant army under Coligny. In 1572, after the peace of St. Germain, and just before the massacre of St. Bartholomew, he married Margaret of Valois, sister of Charles IX., and was compelled to abjure his faith. Henry, who had just succeeded to the crown of Navarre, was detained at court until 1576, when he escaped and put himself at the head of the Protestants, and by his valor and skill greatly bettered their circumstances in the wars which followed. In 1584, Francis of Anjou d., and Henry became heir-presumptive to the crown. In 1585 he was excommunicated by Sixtus V., and declared incapable of the succession. Then followed the "war of the three Henries" (1586–87), the murder of Henry III. (1589), the claim of the cardinal of Bourbon to the throne, the battle of Ivry, the siege of Paris, the Spanish invasion under Parma, and a long and varied war, in which Henry, with small means and the ineffectual support of the English, performed prod-

igies of valor and activity. In 1593, Henry professed the Roman Catholic faith, and the fear of the ambition of Philip II. caused many of Henry's former enemies to go over to his side; he was anointed king at Chartres 1594; entered Paris, and in the course of four years had expelled the Spaniards and brought all France to subjection. In 1598 he published the Edict of Nantes and restored toleration. Prosperity followed such as France had never known before. Henry was murdered by one Ravaillac, a fanatic, May 14, 1610, and all France mourned the event as a national calamity. Brave, courtly, amiable, and talented, Henry's worst fault was licentiousness. His religious preferences must have been unimportant, and his lifelong friendliness to the Protestants was only a feeling of comradeship for his old companions-in-arms.

Henry (I.) the Fowler, king of Germany and duke of Saxony, b. in 876, succeeded his father, Otho I., as duke in 912; elected to succeed Conrad I. in 919; carried on wars with Lorraine (which he conquered 923–925), with the Hungarians, the Slavi, Danes, etc. This great monarch was one of the founders of the German supremacy in the Middle Ages, as terrible in war as he was just and wise in peace. He is reckoned as Henry I. in the line of German emperors, but never bore the imperial title, except in consequence of having been saluted *imperator* by his troops, in the old Roman fashion. D. at Mansleben July 2, 936.

Henry II., Saint, emperor of Germany, the last of the Saxon line of German monarchs, and the first Henry who properly bears the imperial title, known also as *the Lame*, was b. May 6, 972; succeeded to the duchy of Bavaria 995; was elected king of Germany, to succeed Otho III., in 1002; carried on wars in Poland, and with vassals in Germany, and with Italy and France, etc.; erected Hungary into a kingdom 1007; was crowned emperor of the Romans 1014. D. at Grone, Saxony, July 14, 1024; was canonized 1152 on account of his zeal for the Church, and is honored July 15.

Henry III. of Germany, "the Old," "the Black," or "the Pious," b. at Osterbeck, in the Low Countries, Oct. 28, 1017; was elected king in 1026, and succeeded Conrad II., his father; ruled with the greatest dignity and success, managed the affairs of Church and State alike, and made and unmade popes at his will; was crowned emperor in 1046; won applause by challenging Henry I. of France to mortal combat, and d. at Botfeld Oct. 5, 1056. His first wife was a daughter of Canute of England.

Henry IV. of Germany, b. Nov. 11, 1050, was elected king when but three years old, and succeeded Henry III., his father, in 1056. His reign was a long series of bloody contests with vassals at home and with Pope Gregory VII. in Italy, who at the period of Henry's lowest fortunes compelled him to sue at Canossa for absolution in the most humiliating manner (1077). This he received, and after many years of warfare in Germany he compelled the pope to retire under the protection of Robert Guiscard to Salerno (1064). Henry was dethroned and imprisoned by his son, Henry V., in 1105, but escaped, and d. at Liège Aug. 7, 1106.

Henry V. of Germany, b. Aug. 11, 1081, was crowned king and colleague of his father, Henry IV., in 1099; deposed his father 1105; was crowned emperor 1111. His reign was much disturbed by discussions with the popes regarding investitures, and he was four times excommunicated. Wars at home and with Flanders, Hungary, and Poland vexed Germany during his reign. He married Matilda, daughter of Henry I. of England. D. at Utrecht May 23, 1125. He was the last of the Salic line.

Henry VI. of Germany, the Cruel, b. in 1165, succeeded Frederick Barbarossa, his father, in 1190. His reign was much disturbed by Italian wars, and is famous for the imprisonment of Richard Lion-heart at Trifels (1192–94). D. at Messina Sept. 28, 1197, poisoned, as it was thought, by his wife.

Henry VII. of Germany (Henry of Luxemburg), b. 1262; was elected king of the Romans in 1308; invaded Italy at the head of a Ghibelline army, and had an interview with Dante; received the iron crown in 1311; was crowned emperor in 1312. D. at Buonconvento Aug. 24, 1313, poisoned, it was said, while receiving the Eucharist.

Henry (Caleb Sprague), D. D., b. at Rutland, Mass., Aug. 2, 1804; graduated at Dartmouth in 1825, studied divinity at Andover and at New Haven. After holding Congregational pastorates at Greenfield, Mass. (1828–31), and at Hartford, Conn. (1833–35), he was ordained in the Protestant Episcopal Church, and was appointed professor of mental and moral philosophy in Bristol College, Pa. In 1837 he became one of the founders of the New York *Review*. He was (1839–52) professor of philosophy and history in the University of New York; 1847–50 rector of St. Clement's, New York. He afterwards held rectorships in Poughkeepsie and Newburg, N. Y., and Litchfield, Conn. In 1874 he removed to Stamford, Conn. Among his works are an enlarged translation of Bautain's *History of Philosophy*, Cousin's *Psychology* (1834; 4th ed. 1856), *Compendium of Christian Antiquities* (1837), *Moral and Philosophical Essays* (1839), Guizot's *History of Civilization*, *About Men and Things* (1873).

Henry (Gustavus Adolphus), a distinguished orator and statesman of Tennessee, supported Harrison for the Presidency in 1840, Clay in 1844, Taylor in 1848, Scott in 1852, Fillmore in 1856, Bell in 1860. Was a member of the Senate of the Confederate States 1862–65.

Henry (Joseph), LL.D., b. Albany, N. Y., Dec. 17, 1797; educated in the common schools of that city and in the Albany Academy, where (1826) he became professor of mathematics, and (1827) commenced a course of investigation which was continued for a number of years, and resulted in certain highly important discoveries in electricity and electro-magnetism. Though previously to these investigations the electro-magnet in a certain sense was known, it was nothing more than a philosophic toy, in which a feeble magnetism was excited by currents of low intensity and short circuit. The means of developing in soft iron a high degree of magnetic energy, or of producing such an effect at a distance in any appreciable degree at all, were unknown. Prof. Henry's first success consisted in producing the electro-magnet properly so called; an exceedingly important invention which no subsequent improvement has essentially modified. He next demonstrated that the difficulty of exciting magnetic energy at a distance, which had led Barlow in 1824 to pronounce the idea of an electric telegraph to be "chimerical," may be completely overcome by the use of an intensity battery, provided that the receiving electro-magnet be constructed with many turns of a single wire. He also showed that a large iron bar may be powerfully magnetized by a quantity battery, if surrounded by many helices forming separate short circuits; but that if the wires of these helices be so united as to form a single continuous circuit, a battery of intensity is required to produce the effect. It was the invention of the intensity-magnet which first made the electric telegraph a possibility. In a communication made to the *American Journal of Science* in 1831, describing some of his experiments, Prof. Henry called attention to the practicability of applying the intensity-magnet to telegraphic uses. During the same year he produced the first mechanical contrivance ever invented for maintaining continuous motion by means of electro-magnetism; a contrivance which, though simple in form, involved the essential principle (pole-changing) of every effective electro-magnetic machine which has been since devised; and he also constructed and exhibited a similar contrivance for making signals by electro-magnetism at a distance—the signals being produced by means of a lever striking on a bell. This was operated by an intensity-current sent through more than a mile of insulated wire carried in successive turns around the walls of an apartment in the Albany Academy. He also devised a scheme for producing large mechanical effects at a distance, by causing heavy weights to fall in consequence of the rupture of electric currents. Some of the electro-magnets constructed by him at this time were of enormous power. One of these, prepared for Yale College (1831), sustained a weight exceeding a ton, and another at the College of New Jersey carried not less than 3600 pounds. In 1832 he made the discovery of the secondary currents produced in a long conductor by the induction of the primary current upon itself; and succeeded also in the same year in producing the electric spark by means of a purely magnetic induction. The spark was similarly and almost simultaneously produced by Mr. J. D. Forbes of Edinburgh (afterwards Principal Forbes), but the two results were independent of each other. These discoveries embraced the germ of the science of magneto-electricity, which received subsequently from Faraday so large a development, and of which the recent practical applications are so numerous and important.

In 1832, Prof. Henry was elected professor of natural philosophy in the College of New Jersey, and in his earliest lectures at Princeton demonstrated the feasibility of an electro-magnetic telegraph, with experimental illustrations. He visited Europe in 1837, and in London held interesting interviews with Prof. Wheatstone, the inventor of the needle magnetic telegraph, to whom his discoveries were already well known, and whom he acquainted with his plans for producing not only signals, but large mechanical effects at distances indefinitely great, by means of electro-magnetism. In 1846 he was elected secretary of the Smithsonian Institution at Washington, being the first incumbent of that office, a position which he continues still to hold.

In 1849 he was elected president of the American Association for the Advancement of Science. In 1868 he was elected president of the National Academy of Sciences, succeeding the lamented Bache. This distinguished post he also still retains. He was made chairman, in 1871, of the lighthouse board of the U. S., an important bureau of the treasury department; and in this capacity has been constantly since engaged in very active and laborious duty. He received the honorary degree of doctor of laws from Union College in 1829, and from Harvard University in 1851. He has published *Contributions to Electricity and Magnetism* (1839), and numerous papers of greater or less extent in the *Am. Philos. Trans.*, the *Am. Jour. of Science*, the *Jour. of the Franklin Inst.*, the *Proceedings of the Am. Assoc. for the Adv. of Sci.*, and in the annual reports of the Smithsonian Institution from its foundation. F. A. P. BARNARD.

Henry (MATTHEW), son of Philip Henry, b. at Broad Oaks, Flintshire, Wales, Oct. 18, 1662; studied law and divinity; became nonconformist (Independent) pastor at Chester 1687, at Hackney, London, 1712. D. at Nantwich June 22, 1714. Chiefly remembered for his *Exposition* of the Bible (1710, often reprinted and still very highly esteemed; best ed. London, 1869). He also wrote other religious works and a *Life* of his father (1698). His own *Life* has been written by J. B. Williams and by W. Tong.

Henry (PATRICK), b. at Studley, Hanover co., Va., May 29, 1736. His father, Col. John Henry, was a magistrate and school-teacher, a native of Aberdeen, Scotland, and a nephew of the historian Robertson. Young Henry was instructed chiefly by his father, but was easily diverted from his studies by his passion for hunting and fishing. At eighteen years of age he married the daughter of an innkeeper, and for a time assisted his father-in-law at Hanover Court-house. He twice became bankrupt before the age of twenty-four, when, after six weeks' study, he was admitted to the bar. For three years he obtained no practice, when his triumphant plea for the people's rights in the celebrated "parsons' cause" won him immense applause and popularity. In 1765 he introduced into the conservative or passive house of burgesses his famous resolutions against the Stamp Act, which he carried through by a majority of one after a stormy debate, in which he exclaimed, "Cæsar had his Brutus, Charles I. his Cromwell, and George III." (here he was interrupted by cries of "Treason!") "may profit by their example. If this be treason, make the most of it." Thenceforward, Mr. Henry was the acknowledged leader of the friends of freedom in Virginia. In 1769 he was admitted to practise law in the general court, where his distinguished ability as a speaker won him a fortune, for, though poorly read in the law, and never of more than respectable legal knowledge, he possessed a marvellous power over the feelings of juries. He was the first Speaker of the General Congress at Philadelphia in 1774, where his power as an orator was fully recognized. In 1775, in the Virginia convention, was delivered his most famous speech, that in favor of his resolution for putting the colony into a state of defence. This speech contained the well-known passage, "There is no retreat but in submission and slavery. Our chains are forged! Their clanking may be heard on the plains of Boston. The next gale that sweeps from the North will bring to our ears the clash of resounding arms. . . . I know not what course others may take, but as for me, give me liberty or give me death!" This effort destroyed the strong opposition, and turned the convention from a halting disposition to an unanimous impulse for liberty, in which every vote was cast in favor of Mr. Henry's measure. In 1775 he was for a time a colonel of militia, and from 1776 to 1779 was governor of the State, and again 1781–86. In 1788 he opposed the ratification of the Federal Constitution as inconsistent with the sovereignty of the States. In 1794 he left public life, and afterwards declined the secretaryship of state, the mission to France, and the governorship. Elected to State senate in Mar., 1799, but did not take his seat. D. at Red Hill, Charlotte co., Va., June 6, 1799. Patrick Henry was tall in person, awkward in manner, and of stern and grave aspect, but simple, kindly, and unaffected in private life, frugal and temperate in his living, and a devout and serious Christian. He was tenderly beloved by people in the humbler walks of life. He printed and circulated at his own expense an edition of Butler's *Analogy* and Jenyns's *View of Christianity*. CHARLES W. GREENE.

Henry (PHILIP), b. Aug. 24, 1631, at Whitehall Palace, where his father was a page; was educated at Westminster and Christ Church, Oxford; was Presbyterian minister of Worthenbury, Flintshire, 1657–62; d. June 24, 1696. His published sermons and miscellaneous writings have found many warm admirers.

Henry (ROBERT), D. D., b. at Muirtown, Stirlingshire, Scotland, Feb. 18, 1718; was educated at Edinburgh; became Presbyterian minister of Carlisle 1748, of Berwick 1760, of New Grey Friars, Edinburgh, 1768, of Old Grey Friars 1776. D. Nov. 24, 1790. Chiefly remembered for his unfinished *History of Great Britain* (6 vols., 1771–93).

Henry (ROBERT), D. D., LL.D., b. at Charleston, S. C., Dec. 6, 1792; graduated at the University of Edinburgh 1814; became minister to the French Protestant church of Charleston; professor of logic and moral philosophy 1818, and later of metaphysics and political philosophy in South Carolina College; its president 1834–35 and 1840–43; besides holding other professorships there. D. at Columbia, S. C., Feb. 6, 1856. His abilities were of the first order.

Henry (WILLIAM), M. D., F. R. S., b. at Manchester, Eng., Dec. 12, 1775; took his medical degree at Edinburgh 1807; published *Elements of Chemistry* (1810), for many years a standard work; made important observations on the laws of the absorption of gases by water under pressure; won the Copley prize of the Royal Society 1809; committed suicide Sept. 2, 1836.

Henry (WILLIAM ALEXANDER), Q. C., a Canadian statesman, b. at Halifax, N. S., Dec. 30, 1816; was admitted a barrister in 1841 and queen's counsel in 1849. He has been for many years prominent in the affairs of Nova Scotia; was solicitor-general 1854, 1859, and 1863; provincial secretary 1856–57; and has been surrogate, mayor of Halifax, etc. He took a prominent part in the question of the union of the provinces in 1867.

Henry Clay, tp. of Fayette co., Pa. Pop. 951.

Hen'ry's, tp. of Pickens co., Ala. Pop. 589.

Hen'shaw (DAVID), b. at Leicester, Mass., Apr. 2, 1791, where he was educated; apprenticed to a firm of druggists in Boston, during which period he devoted his spare hours to the improvement of his mind; entered business with his brothers in 1814; elected to the State senate 1826; member of the board of internal improvements 1828, and during its continuance; active promoter of railroad enterprises, and director of Worcester R. R. from its organization till his death; collector of the port of Boston 1830–38; member of the legislature 1839; in 1843 appointed secretary of the navy by Pres. Tyler. In politics he was an ardent Democrat and advocate of free trade. Author of numerous political papers and pamphlets. D. Nov. 11, 1852.

Hen'shaw (JOHN PRENTISS KEWLEY), D. D., b. at Middletown, Conn., June 13, 1792; graduated at Middlebury College in 1808; was ordained deacon in the Protestant Episcopal Church 1813, a priest in 1816; officiated for a time in St. Ann's, Brooklyn, N. Y., and was (1817–43) rector of St. Peter's, Baltimore. In 1843 he was consecrated bishop of Rhode Island. D. at Frederick, Md., July 20, 1852. He published *Theology for the People* (1840), *Memoir of Bishop Moore* (1842), *On the Second Advent* (1842), and several other works.

Hens'ley, tp. of Champaign co., Ill. Pop. 804.

Hensley, tp. of Johnson co., Ind. Pop. 1668.

Hen'son Spring, post-v. and tp. of Sanford co., Ala. Pop. 334.

Hentz (CAROLINE LEE), a daughter of Gen. John Whiting, was b. at Lancaster, Mass., in 1800. In 1825 she married N. M. Hentz, a French gentleman who taught the languages and belles-lettres (d. 1856), and with him she resided successively at Northampton, Mass., Chapel Hill, N. C., Covington, Ky., Cincinnati, O., Florence, Ala., Tuscaloosa, Ala., Tuskegee, Ala., Columbus, Ga., and Marianna, Fla., where she d. Feb. 11, 1856. She wrote a novel, poem, and play before she was thirteen years old, and afterwards the prize play *De Lara, Lamorah*, a tragedy, *Constance of Weidenberg*, the tales *Linda* (1850), *Rena* (1851), *Eoline* (1852), *Helen and Arthur* (1853), *The Planter's Northern Bride* (1854), *Ernest Linwood* (1855), and numerous other novels and some poetry. Her writings enjoyed a great popularity.

He'par Sul'phuris [Lat., "liver of sulphur," so called from its color], a crude mixture of the bisulphide and trisulphide of potassium with the sulphate of potash. It is employed to some extent as a remedy for some diseases.

Hepat'icæ, or **Liv'erworts** (*Musci hepatici*, or "liver-mosses"), a natural order of little moss-like plants, mostly of a loose cellular structure throughout, usually procumbent, and emitting rootlets from beneath, propagated by spores, and also frequently by gemmæ, rarely by tubers. Vegetation sometimes frondose—*i. e.* the plants without distinct stem and leaves, but expanded into a leaf-like mass (*frond*), which is usually furnished with a midrib, with scales, or (rarely) with slender hairs underneath, and

often with pores above; sometimes foliaceous, when there is a distinct stem and leaves, as in *Musci*, the leaves entire or lobed (most commonly 2-lobed), or often laciniated, never costate, and never composed of more than one thickness of (flattish) cells, 2-ranked, and often with an imperfect row (*amphigastria*) on the under side of the stem, which is often much branched, but the branches do not proceed from axillary buds, as in mosses; if one of the lobes of the leaf is inflated, it is termed an *auricle*. Rootlets consisting of a simple, much-elongated, flattish cell; excepting in the Jungermanniaceæ this cell is usually granulose or papillose on the inner surface of its wall; it is merely a modified cell of the frond, stem, or leaf from which it proceeds. Inflorescence monœcious or diœcious. Reproductive organs and evolution of the fruit much as in mosses, but the calyptra usually closely invests the capsule until this is nearly or quite mature, when it commonly ruptures irregularly near the apex, and is left at the base of the fruit. The capsule, usually globose or ovate, is immersed in or sessile upon the frond, or attached to the under side of disk-like peduncled receptacles, or borne on a long cellular pedicel; it is 4-valved (rarely either more or less) in the Jungermanniaceæ, dehisces more or less irregularly by 2 to 8 valves, or by an operculum in the Marchantiaceæ (rarely indehiscent in both); it is long and pod-like, usually tapering into a pedicel, 2-valved, often with stomata in its outer wall, and bears the calyptra (which ruptures early near the base) upward on its apex in the Anthocerotaceæ; it contains spores mixed with elaters (*elateres*), (rarely wanting); these are thin, usually threadlike, simple cells, containing 1 to 4 spiral (rarely annular) fibres: a columella is rarely present. The *perianth* is a tubular organ (sometimes absent), enclosing the pistillidia, and is usually (if not always) formed after their fertilization. Surrounding the perianth is the *involucre* (occasionally wanting), which is either tubular or composed of leaves of particular forms (*involucral leaves*). The antheridia in the foliaceous species are usually situated in the axils of perigonial (occasionally of the involucral) leaves; in the frondose species they are naked upon the surface of the frond, or immersed in its substance, or in sessile or peduncled receptacles, which are disk-like in the Marchantiaceæ. In the Marchantiaceæ the central portion of the midrib and peduncle is composed of a kind of vascular tissue, consisting of remarkably long and slender cells, marked within by annular or short spiral fibres, or oftenest by papilla-like points (rudimentary or imperfect rings or spirals). A peculiar kind of vascular tissue also occurs in at least one species of the Jungermanniaceæ (*Pellia epiphylla*), in a series of parallel vertical and transverse networks of anastomosing fibres. COE F. AUSTIN.

Fimbriaria tenella: 1, plants; 2, a fertile receptacle; 3, vertical section through two involucres, showing perianths and capsule; 4, capsule dehiscing; 5, 5, spores; 6, 6, elaters.

Hepati'tis [Gr. ἧπαρ, the "liver"], an inflammation of the liver. Hepatitis is not a very common disease in any country. Several kinds are recognized: (1) Suppurative hepatitis, or abscess of the liver, sometimes occurring in India, but rare in other countries. (2) Interstitial hepatitis, called, rather incorrectly, cirrhosis, known also as granular liver and gin-drinker's liver. It is incurable, and is probably always caused by the improper use of alcoholic drinks. It frequently leads to ascites or abdominal dropsy. (3) Portal phlebitis, or inflammation of the portal vein, may occur. (4) Inflammatory disease of the liver is sometimes a syphilitic complication. Each of the above-named conditions is a grave one, and in few cases can treatment be of much avail.

Hep'burn, tp. of Lycoming co., Pa. Pop. 971.

Hephæs'tion, the friend of Alexander the Great, b. at Pella about 357 B. C. At what time he and the prince became companions is not known; they are first mentioned together on the occasion of Alexander's visit to Troy, where Hephæstion brought the same honors to the grave of Patroclus as Alexander to that of Achilles. But after that time they never separated until the death of Hephæstion in Ecbatana in 325, one year before that of Alexander. The beauty of their friendship was not only its intimacy, but its soundness. Alexander never preferred Hephæstion to a better man, and Hephæstion never disappointed the confidence Alexander placed in him.

Hephæstion [Ἡφαιστίων], a Greek grammarian of Alexandria, according to Suidas, flourished about A. D. 150, as Julius Capitolinus speaks of him among the tutors of the emperor Verus. To him is ascribed the Ἐγχειρίδιον περὶ μέτρων ("Manual of Metres"), from which most of our knowledge of the Greek metres is obtained. Suidas assigns to him other works not now extant. Best edition of the *Manual* is by Gaisford (Oxford, 1810, 8vo; Leipsic, 1832; revised, Oxford, 1856, 2 vols.). H. DRISLER.

Hephæstus. See VULCAN.

Hep'penheim, an old, queer-looking town of Hesse-Darmstadt, with about 5000 inhabitants, is noted for the excellent wine produced in its neighborhood, and for the interesting ruins of the castle of Starkenburg.

Heptan'omis ("the seven nomes") was the name of the central part of Egypt, from the Delta to Upper Egypt—that is, from lat. 30° to lat. 27° N.. It contained all the greatest Egyptian cities and monuments, and its inhabitants were less mixed up with Greeks and Nubians than those of the two other parts.

Hep'tarchy [Gr. ἑπτά, "seven," and ἀρχή, "sovereignty"], a government by seven, especially applied to the seven principalities of the Anglo-Saxons in England before the reign of Egbert, the first king of England, who became king of Wessex 800, and d. 836. Eight kings, of six different kingdoms (all except Essex and Mercia), had at times possessed a certain supremacy over the rest. The actual number of kingdoms was sometimes greater and sometimes less than seven, and yet seven stand out so prominently as to justify the use of the term heptarchy. The seven kingdoms were 1st, Kent (449–823); 2d, Sussex (477–823); 3d, Wessex (519–823); 4th, Essex (526–823); 5th, Northumbria (547–827); 6th, East Anglia (571–823); 7th, Mercia (584–827). In 828, Egbert of Wessex, the eighth bretwalda, became the first hereditary king of England; but some of the minor kingdoms existed for many years thereafter.

Hep'worth (GEORGE HUGHES), b. in Boston, Mass., Feb. 4, 1833; studied divinity at Cambridge, Mass.; was pastor of a Unitarian church at Nantucket 1855–57; of the Church of the Unity, Boston, 1858–70; became in 1862 a regimental chaplain in Louisiana, and served in 1863 on the staff of Gen. Banks. He was (1870–72) pastor of the Church of the Messiah, New York. In 1872 he became a Trinitarian, and soon organized the "Church of the Disciples," of which he became pastor. Author of *Whip, Hoe, and Sword* (1864) and *Rocks and Shoals* (1870).

Hera. See JUNO.

Heraclei'a, a Greek city of Lucania, in Southern Italy, near a place now called Policoro, and not far from the Tarentine Gulf. It was founded 432 B. C., and attained great wealth and power, and became a kind of capital for the Italiote Greeks. It had peculiar privileges under the Romans. Its site is marked by extensive mounds, and among the relics found here in 1732 were the bronze tablets containing the *Lex Julia municipalis* (45 B. C.), so highly important to the student of Roman jurisprudence. Many other ancient towns bore this name, among which was one on the S. coast of Sicily, which was long a place of great naval and commercial importance.

Heraclei'dæ [Gr. Ἡρακλεῖδαι], the descendants of Heracles (Hercules), to whom many prominent Greek families traced their origin. But the name especially belongs to those Heracleidæ who joined the Dorians in their invasion and conquest of the Peloponnesus, which is often called the "return of the Heracleidæ," because they were considered as Achæans by race. The Greek historians narrate with considerable detail the exploits and successes of the Heracleidæ in the early Dorian wars, and it is considered that much of the story must be regarded as possessing historic truth. The Heracleidæ became the progenitors of several princely houses, and were even admitted to rule over Dorians.

Heracli'des [Ἡρακλείδης] **Pon'ticus** (so called from his native place, Heraclea, on the *Pontus* Euxinus), b. probably B. C. 378. He appears to have gone at an early age to Athens, where he attached himself to Plato, about 361 or 358; he attended the lectures of Aristotle also, and must have studied the Pythagorean philosophy, which he followed in his writings on natural philosophy. He was a man of great learning, and wrote on a great variety of subjects—philosophy, natural science, mathematics, music, grammar, history, and poetry—so that he was fairly entitled to the designation of *polyhistor*. Of all his writings only fragments remain, with the exception of a small treatise entitled (Ἐκ τῶν) περὶ πολιτειῶν ("Extracts from Forms of Government"), which is believed to be merely a compilation from different writings of the author, possibly also from Aristotle's treatise on the subject. Another work, called Ἀλληγορίαι Ὁμηρικαί ("Allegories from Homer"),

passes under the name of Heraclides, but does not belong to this author. The best editions of the Περὶ πολιτειῶν are that of Köler (Halle, 1804), that of Coraës (Paris, 1805), of Schneidewin (Göttingen, 1847), and in Müller's *Fragm. Hist. Græc.* (vol. ii. pp. 197–224); of the Ἀλληγορίαι, that of Schow (Göttingen, 1782) and of Mehler (Leyden, 1851). (See ROULEZ, *Comment. de vita et scriptis Heraclidis* (Louvain, 1828); *Proleg.* to Schneidewin's and Müller's editions.) H. DRISLER.

Heracli'tus, surnamed THE DARK (σκοτεινός), was b. at Ephesus, according to some authorities, about 535 B. C., according to others, about 500. The son of Blyson (or Heracion), he belonged to the noble family of the Codrids. Unlike most of the philosophers of his time, he took no part in public affairs. He is said to have refused the proffered sovereignty of Ephesus, as well as an invitation to the court of Darius. The stories related about him—how, disgusted at the expulsion from Ephesus of his friend Hermodorus—perhaps the same who aided the Roman decemvirs in the drawing up of the Twelve Tables (see CURTIUS, *Ephesos*, pp. 16 *seq.*)—he retired to the mountains and lived the contemplative life of a hermit, feeding upon roots and herbs; how, becoming, in consequence, affected with dropsy, he returned to the city in search of medical aid; how, failing in this, he tried to exsiccate his dropsy by imbedding himself in cow-dung; and how the experiment terminated in his death—are to a very great extent legendary. They serve, however, to give us a general notion of his character. His contempt for the unthinking rabble, as well as for the social and political condition of Ephesus, was extreme. Though he was evidently acquainted with the works of Hesiod, Pythagoras, Xenophanes, and Hecatæus (see *Diog. Laert.* ix. 1, 1), he was apparently justified in asserting that he had learnt everything from himself. Dignified, self-sufficient, lofty, profound, devoted to truth and right, impatient of falsehood and wrong, contemptuous of ignorance and unreason, he looks to us now as a great, lonely, snow-clad mountain-peak, half hidden from us in the clouds of heaven and spurning the earth upon which it stands. The profoundest of the pre-Socratic philosophers, he had numerous disciples for many succeeding ages. He is known to have written only one work, which, like most other philosophical works of the time, was entitled *On Nature*. It went under several other names, and was divided into three parts: I. *On the All;* II. Political; III. Theological. The much talked-of obscurity of his writing, usually considered as intentional on his part, or as owing to fear of persecution for impiety, was probably due rather to the fact that he wrote only for the few, and that prose-writing and philosophical terminology were in his day very undeveloped. Socrates, who admired Heraclitus, thought it would require a Delian diver to explore his depths, and Aristotle tells us that his writing was hard to punctuate (διαστίξαι). Of the work of Heraclitus, which was apparently extant in the third century A. D., numerous fragments have come down to us scattered through the works of various authors. The best collections of them are in MULLACH'S *Fragmenta Philosophorum Græcorum*, vol. i. pp. 310–329, and in SCHUSTER'S *Heraklit von Ephesus*, vol. iii. of RITSCHL'S *Acta Societatis Philologæ Lipsiensis*. The latter is the best work on Heraclitus, and contains on pp. 351–358 an excellent Heraclitean bibliography. Besides these, the following works are valuable: SCHLEIERMACHER, *Herakleitos der dunkle von Ephesos* (1808); HEGEL, *Geschichte der Philosophie* (1833), vol. i. pp. 327–353; J. BERNAYS, *Heraclitea* (1848); F. LASSALLE, *Die Philosophie Herakleitos des dunkeln von Ephesos* (1858, 2 vols. 8vo, written from an extreme Hegelian standpoint, and with a very imperfect knowledge of Greek); A. GLADISCH, *Herakleitos und Zoroaster* (1859); BERNAYS, *Die Heraklitischen Briefe* (1869); E. ZELLER, *Philosophie der Griechen*, 3d ed., vol. i. pp. 523–603.

Philosophy.—The philosophy of Heraclitus, which Gladisch and others have tried to connect with Zoroastrianism, was, in fact, a development of the Ionic or Hylozoic doctrine, influenced by the speculations of the Eleatic Xenophanes. This development consists in an advance from the idea of *being* to that of *becoming*. The principle—*i. e.* the inner essence of all things (not their origin)—is fire (πῦρ, πρηστήρ), a fine, dry, ever-active, necessarily self-determined ether, whereof the purest form is soul or spirit, and which, by rhythmical, qualitative, and local change, resulting in condensation and rarefaction, creates and uncreates the sensible world. The way to creation (διακόσμησις), or the downward way (ἡ ὁδὸς κάτω), is through extinction or deprivation (χρησμοσύνη), and proceeds thus—fire, water, earth; the way to dissolution (ἐκπύρωσις), the upward way (ἡ ὁδὸς ἄνω), is through ignition or fulness (κόρος), and proceeds—earth, water, fire. All things are in motion (πάντα χωρεῖ): stability is an illusion produced by uniformity of motion. Resolution into original fire is utter spiritual activity, and, at the same time, rest and peace in the union of contraries; creation is relaxation of activity, but, at the same time, war, through the declared opposition of contraries. War, strife, is therefore the parent of all relative created things. These are known to us through our senses, which, however, though necessary, are bad witnesses, unless corrected by the inner, universal wisdom which alone recognizes in and through itself the inner λόγος or fate, which is the law of the universe—a law hidden from the foolish, but open enough to the wise. The soul is immortal, a part of the dry, primal fire, but takes rest from utter activity in the creation of a body. The microcosm is the image of the macrocosm, a shorter rhythmic pulse within a longer. No wonder that in Heraclitus, Hegel found a kindred spirit. THOMAS DAVIDSON.

Her'ald, an official connected with European courts, whose duties at present are the conducting of processions and the funerals of those entitled to bear coat-armor, the inspection of arms, the tracing of genealogies and titles. In the Middle Ages they marshalled the combatants in the lists, and served as messengers between princes. Wars were declared and defiances uttered by them in the sovereign's name. In England, besides the heralds mentioned in the article HERALDS' COLLEGE (which see), there are the following heralds: Bath king of arms (for Wales and the order of the Bath), with two subordinate heralds, Blanc Coursier and Brunswick, whose offices are, however, frequently performed by the members of the Heralds' College. There is also a king of arms for the order of St. Michael and St. George, kings of arms being heralds of the first rank, ordinary heralds occupying the second rank, while pursuivants are novices in the art. Further, there have been from time to time extraordinary heralds (as Norfolk) and extraordinary pursuivants (Blanch Croix, Mowbray, Blanch Lyon, Rouge Rose, Guisnes, Harrington). Esperance pursuivant (like many others whose names are forgotten) was attached to service of a noble family—the Percies.

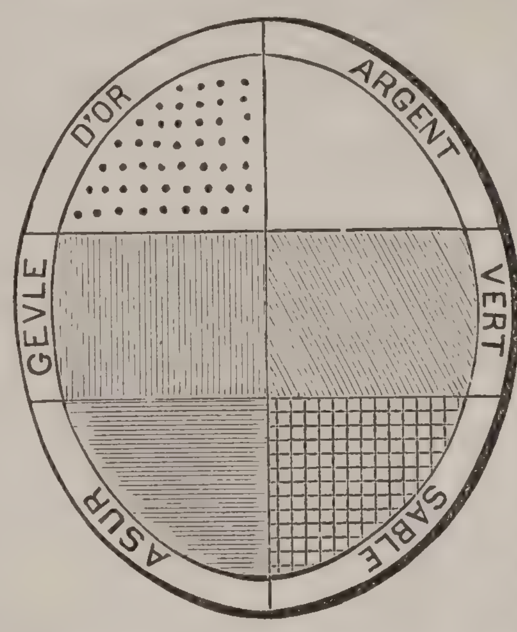
The extinct English heraldships are Faucon, Blanch Sanglier, Carlisle, and Montorgeuil. The Scottish heralds are Lyon king of arms; the heralds proper, Islay, Rothesay, Snowdoun, Marchmont, Albany, Ross; the pursuivants, Kintyre, Unicorn, Dingwall, Carrick, Bute, Ormond. The Irish heralds, Ulster king of arms; the heralds proper, Cork and Dublin; pursuivants, Athlone and St. Patrick. There was an Anglo-French king of arms called Guienne, whose title in England seems to have been maintained till Henry VIII.'s time. The same title occurs among the French heralds.

The principal French herald was Montjoie king of arms. There were 28 French provincial heralds, called also kings of arms. Other famous European heralds were Toison d'Or king of arms for Burgundy (whose title still exists in Austria), and Tower and Sword king of arms for Portugal.

Her'aldry, in general, the science which treats of coat-armor, descents, precedence, ceremonies, and processions; in a narrower sense, the science of coat-armor, or the art of identifying, drawing, and describing coats of arms. In England the whole subject is entrusted to the College of Arms or Heralds' College, which has the right of granting and confirming coats of arms; of recording pedigrees and descents, and of visiting the counties of the kingdom for that purpose; of directing solemn ceremonies, particularly those of a coronation; and of deciding all questions of precedence. Its officers are Garter, Clarenceux, and Norroy kings of arms, with six heralds and four pursuivants. In the U. S. there is no official body charged with these functions. Private persons bear their hereditary arms, but there appears to be no mode by which new ones can be acquired. The subject of descents is left wholly to individuals or to voluntary societies, and questions of precedence are not likely very often to arise in a democratic republic. There, the chief value of this science is in tracing descents, a matter sometimes of very great importance when it becomes desirable to find the heir to a family which has ceased to exist in England. Cadets of many honorable families were among the early settlers of Virginia and other colonies. In case the older branches should become extinct, the descendants of the younger would be entitled to the family inheritance. Hence the necessity of preserving clear evidences of descent. Little attention, however, seems to have been paid to this, and there probably are not many American families which can trace their descent beyond the first emigrant. The general subject is too wide for this article, which will therefore be limited to that of coat-armor only.

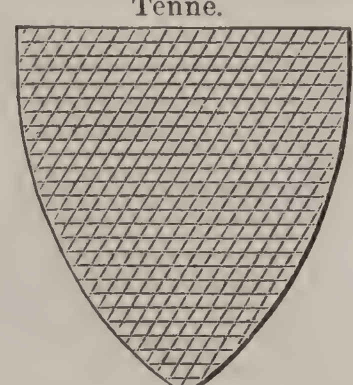
The older (though perhaps not the oldest) writers have attributed to this branch of heraldry a fabulous antiquity. When Lady Juliana Berners tells us, in the *Book of St. Alban's*, that Adam was a gentleman, she does not perhaps, in one sense at least, go beyond the bounds of reason; but

when Guillim ascribes coat-armor to the tribes of Israel, he, to say the least, gives free play to his imagination. The science of heraldry cannot be traced with any certainty beyond the twelfth century. It appears to have had its origin in necessity and common sense, and to have served much the same purpose as the modern uniforms and decorations of military officers. When warriors wore armor and looked exactly alike, even concealing their faces in their helmets, some method of distinguishing them was absolutely necessary. The shield was the most conspicuous part of their armor, and nothing would be more natural than to decorate it with color, applied according to certain fixed rules, or to enrich it with figures of natural or artificial objects. Hence arose tinctures, ordinaries, and charges; from which simple beginnings the whole science of heraldry, or, as some prefer calling it, of armory, has been developed. The tinctures are divided into metals, colors, and furs. The metals are two, gold and silver, called *or* and *argent.* The colors are red, black, blue, green, and purple, called respectively *gules, sable, azure, vert,* and *purpure.* To these some writers add orange tawny and blood-color, in heraldic language, *tenné* and *sanguine,* which they call *stainand* colors. Heralds of that school have also devised certain arrangements of the shield which they call abatements of honor, and distribute with much precision to the cowardly and slothful and to others; but as most men would be reluctant to carry about with them such tokens of disgrace, it is not surprising that stainand colors and abatements should have been long ago forgotten, if indeed they ever had any real existence. The usual pigments are gold, if possible, or else gamboge, for or, and pure white (flake-white) for argent. Silver is more correct, but its tendency to tarnish makes it objectionable. Vermilion, India-ink, ultramarine, and verditer with gamboge answer well for the colors, and purple can be readily made by mixing carmine (lake) with Prussian blue. The furs are ermine and vair; the former white, with black spots, arranged in a peculiar way, the latter composed of bell-shaped figures, alternately argent and azure, placed in rows, base to base, so that the base of every white figure touches that of every blue one. Modifications of these furs have been introduced from time to time. They are ermines, with the field sable and the spots argent—*i. e.* ermine reversed—and therefore more correctly called by the French heralds contre-ermine; erminois, the field or and the spots sable; erminites, the same as ermine, but with a red hair on each side of the white spots; pean, the field sable and the spots or. The derivatives of vair are vair en point, when the point of one figure is opposite the base of another, and countervair, when those of the same tincture are placed base to base. The term vairé is also used, when the figures, but not the tinctures of vair are given. Thus, the arms of Earl Ferrars are blazoned vairé, or, and gules. A modification of vair in which the skins take the form of crutch-heads, or potents, is known as potent-counter-potent. This fur, which is extremely rare in English heraldry, only two coats appearing in Burke in which it forms the field (Amos and Manchester), may be of any metal and color. When a charge appears in its natural colors, it is said to be proper. The annexed arrangement of tinctures (omitting purpure, which is given separately) is borrowed from Mr. Planché, who has engraved it from Sir Nicholas Bysshe's edition of *Upton,* A. D. 1674. The mode of indicating the tinctures which it presents, and which is found very useful in engravings or in sculpture, or under any circumstances in which the blazon or description cannot be given, is said to have been invented by Father Silvestre de Petrasancta in the seventeenth century. Or is shown by a multitude of dots; argent is left plain; gules is indicated by perpendicular and azure by horizontal lines; vert by diagonal lines from right to left, and purpure by similar lines from left to right; sable

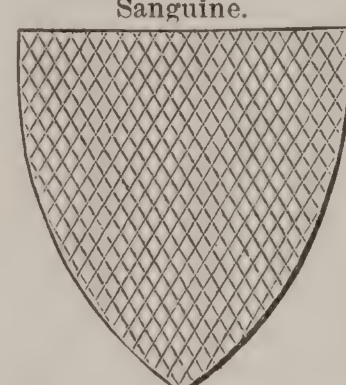


Purpure.

Tenne.

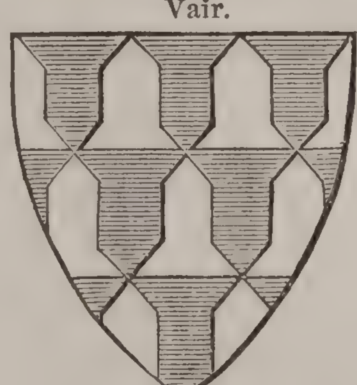


Sanguine.

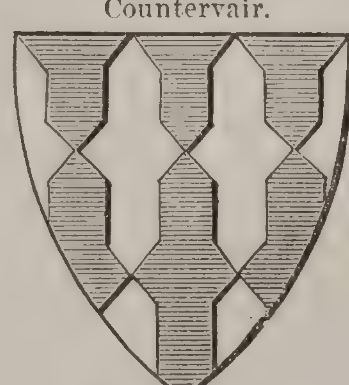


Ermine.

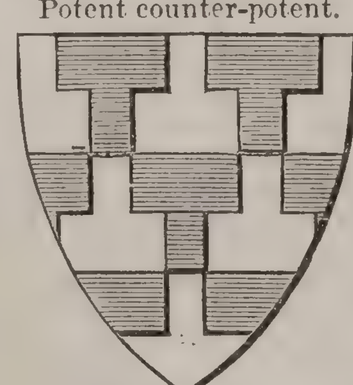
Vair.



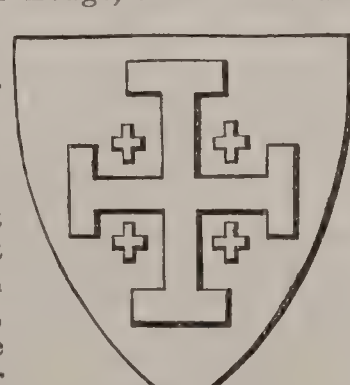
Countervair.



Potent counter-potent.



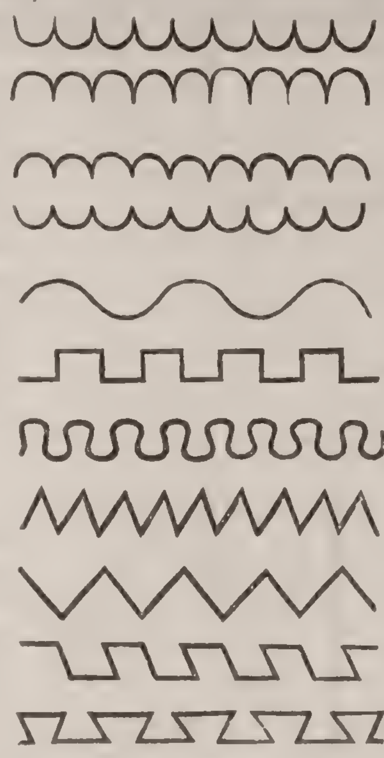
is marked by perpendicular and horizontal lines crossing each other. It should be borne in mind that the right or dexter part of the shield is opposite the left hand of the person looking at it, and the left or sinister opposite his right hand; and that charges, unless it be otherwise specified in the blazon, always look to the dexter. Modern writers, however, like Burke and Lodge, make little use of the lines of Petrasancta, but, following the example of Guillim, prefer giving the arms in their books in outline or trick, and accompanying them with the blazon—an arrangement which is, upon the whole, more satisfactory. It is a general rule that color is not to be placed upon color, nor metal upon metal. Exceptions, however, occasionally occur; and they are called by the French, arms pour enquirir, meaning that there is something peculiar in their origin, about which inquiry is to be made. A celebrated example is found in the arms of the kingdom of Jerusalem: "Argent, a cross potent between four plain crosses or." The allusion is said to be to the psalm, "Ye shall be as the wings of a dove that is covered with silver wings and her feathers like gold."



The ordinaries are divisions of the shield formed usually by straight lines, though the lines may be engrailed, invected, embattled, wavy, nebuly, indented, dancettée, raguly, and dovetailed. Invected is the reverse of engrailed—*i. e.* in the former the points turn outward, in the latter toward the inner part of the ordinary. The honorable ordinaries are nine in number, and are usually reckoned thus: the chief, the bend, the fess, the pale, the bend sinister, the cross, the saltire, the chevron, and the bar. Mr. Planché, indeed, suggests the substitution of the quarter and the pile for the bend sinister and the bar, but he supports his proposal by no very cogent argument. "The two latter," he says, "are merely varieties of the bend and the fess;" but that is probably the very reason why they are introduced. The principle of the ordinaries is the triple division of the shield. The four first named are the same division in different positions. The cross is compounded of the pale and fess, and the saltire of the bend and bend sinister. The bar, which seldom or never occurs singly, is the fess divided into parts; and the chevron is probably two bars shortened

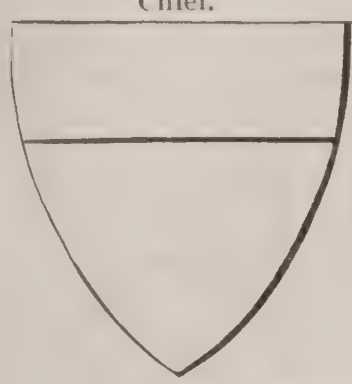
and placed end to end, so as to resemble the rafters of a roof. The argument for the usual arrangement thus seems to be sufficient.

The dimensions of the ordinaries are usually one-third of the shield when charged, or one-fifth when uncharged, except the chevron and the bar, which occupy one-fifth. In practice, however, it is hardly possible to follow these stringent rules; and if it were, the effect upon the educated eye would be much the same as that of the earlier examples of the Gothic revival upon persons accustomed to the study of older art. The earlier draughtsmen permitted themselves to be guided by the eye, and the accomplished modern painter should yield to circumstances. The character of the charges may require slight variations in the dimensions of the ordinaries. Working by rule, without judgment or intelligence, may lead to accuracy, but to an accuracy which will be distressing.

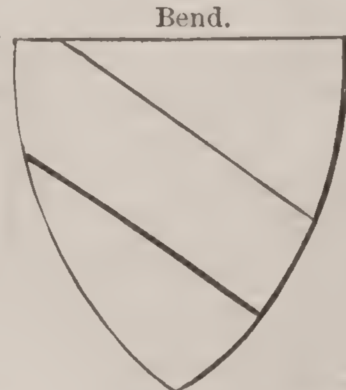


The chief is formed by a horizontal line, cutting off the chief or upper part of the shield; the bend, by two parallel diagonal lines from the dexter chief to the sinister base; the fess, by two similar lines crossing the shield; and the pale, by the like lines from chief to base. The bend sinister is the bend reversed. Several of the ordinaries have diminutives, as the couple close for the chevron, and the cottise for the bend. A bend borne between two cottises, or narrow figures like itself, is said to be cottised, and the same word is applied to other ordinaries in like positions. If the field—*i. e.* the groundwork—of the shield be metal, the ordinary must be color, and the reverse; but furs may be combined with either metal or color. The same rule applies to charges. The ordinaries also admit of certain variations of form. Except the chief, they may be humetty—*i. e.* they may have the ends cut off. The chevron may be rompu or couched, and the bend may be enhanced, or borne in the upper part of the shield, instead of the middle. The cross admits of an immense variety of forms. More than 100 varieties of crosses are said to be known to heralds, though it is probable that many of them exist only in im-

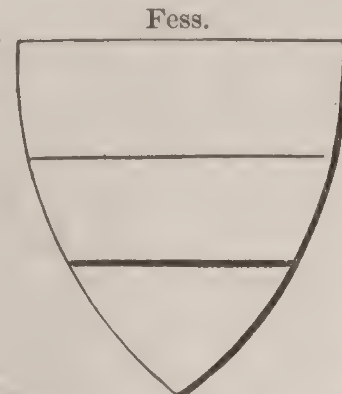
Chief.



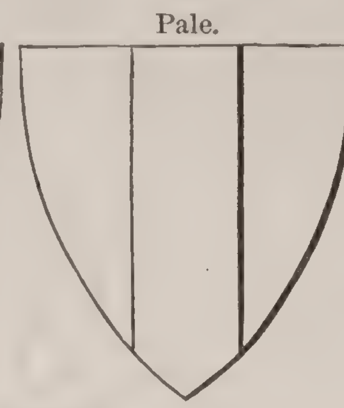
Bend.



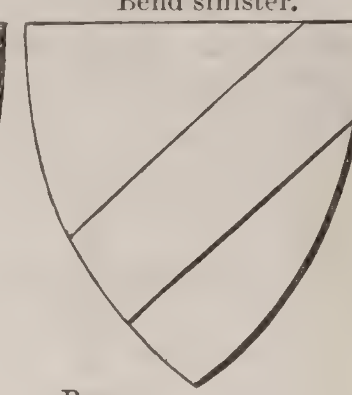
Fess.



Pale.



Bend sinister.

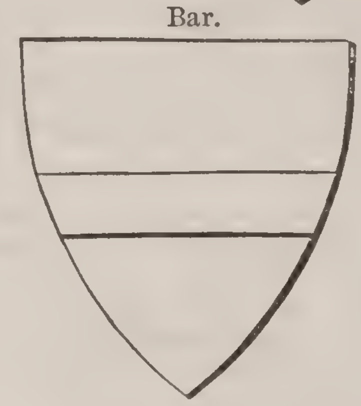


Cross.

Chevron.

Saltire.

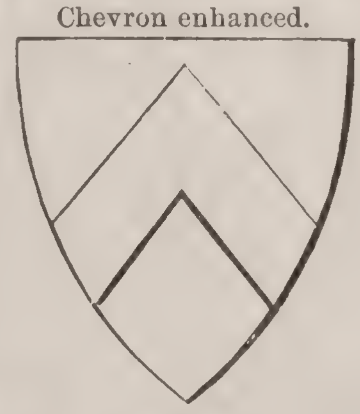
Bar.



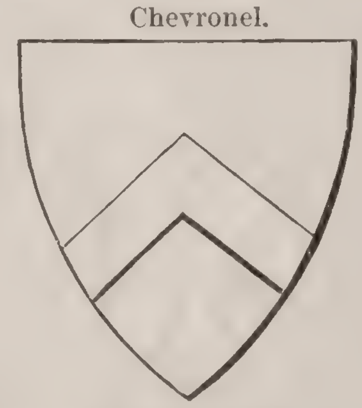
Chevron rompu.

Chevron couched.

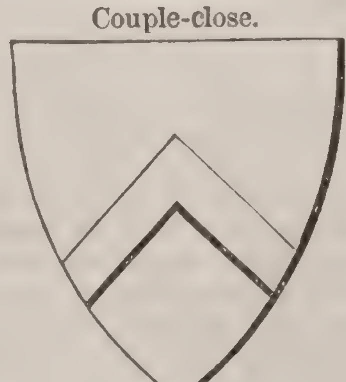
Chevron enhanced.



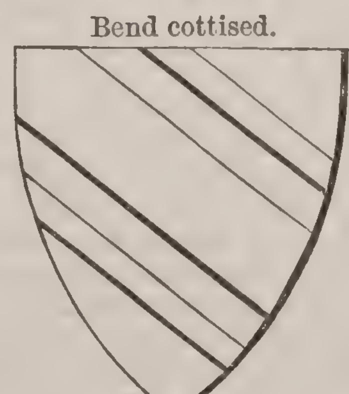
Chevronel.



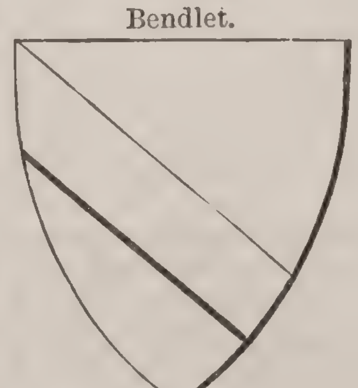
Couple-close.



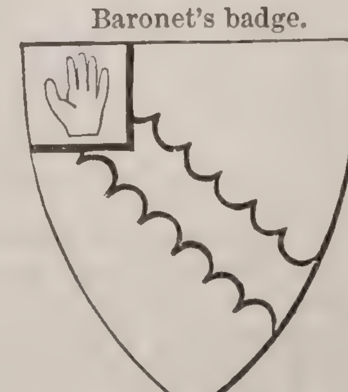
Bend cottised.



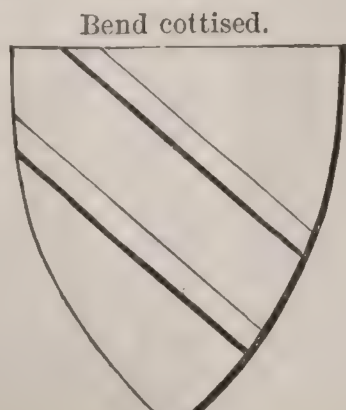
Bendlet.



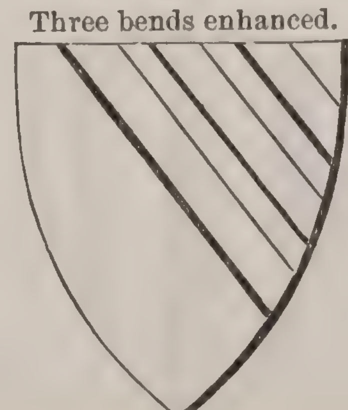
Baronet's badge.



Bend cottised.

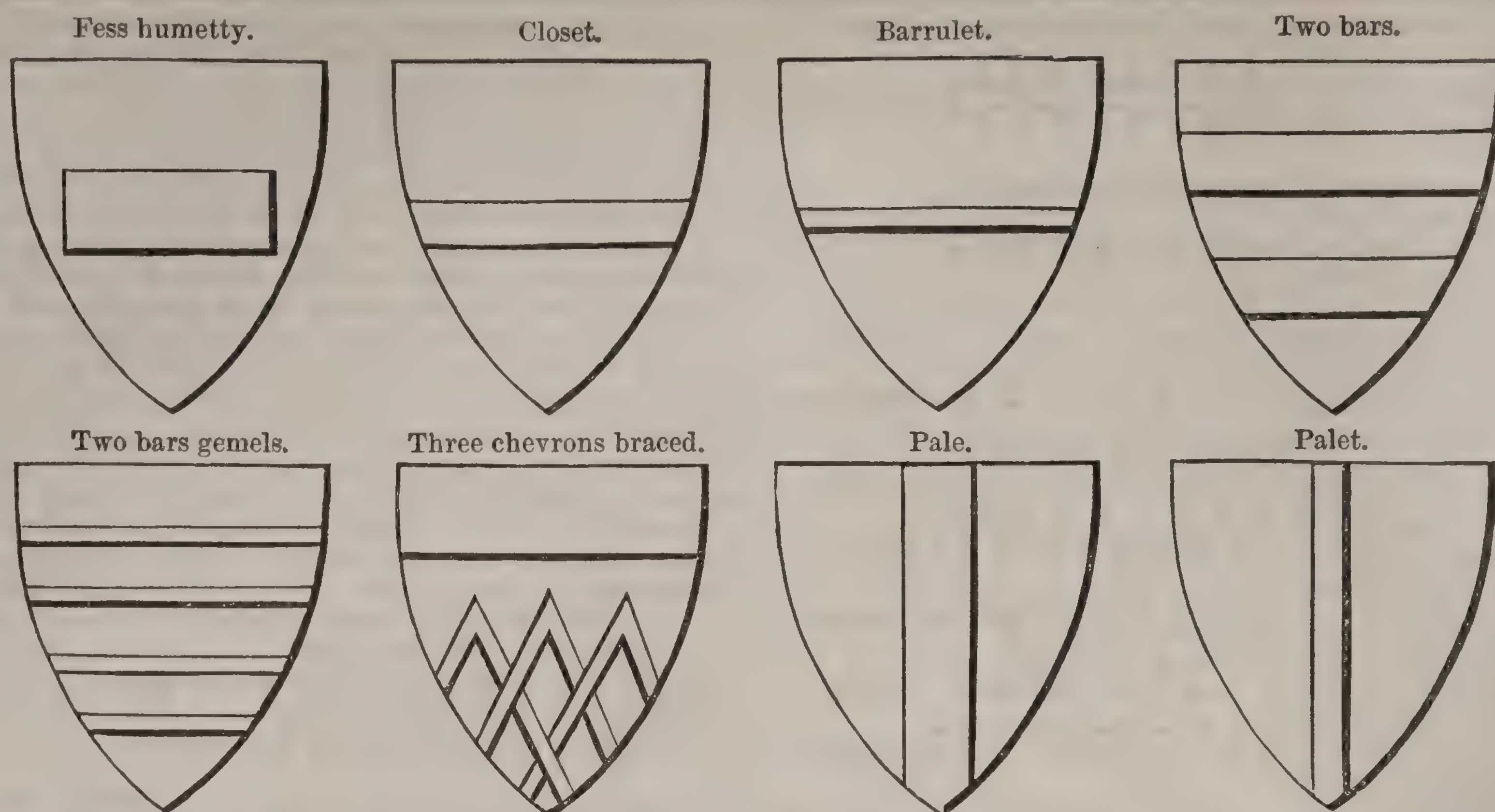


Three bends enhanced.



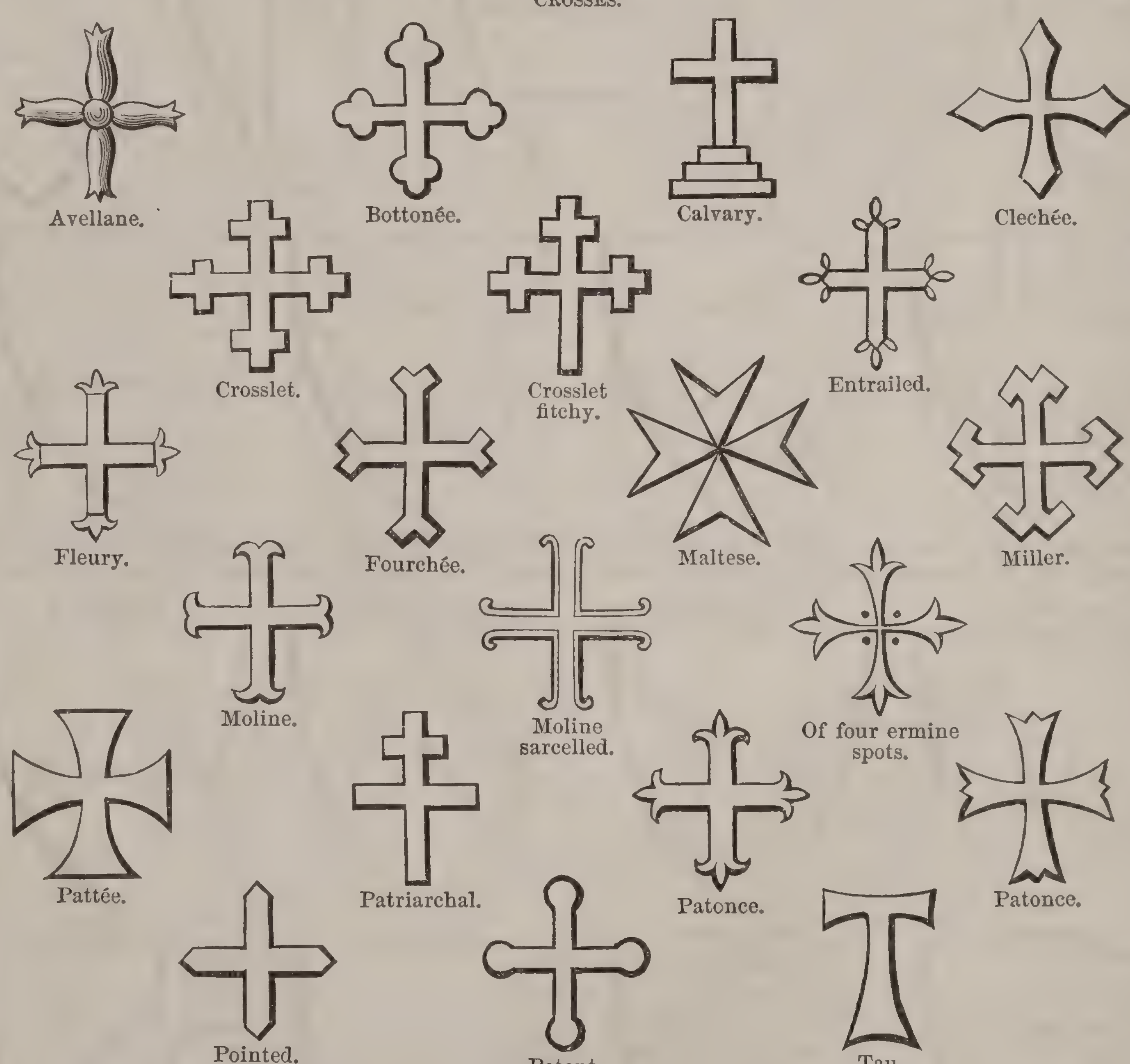
Scarpe.

Baton.

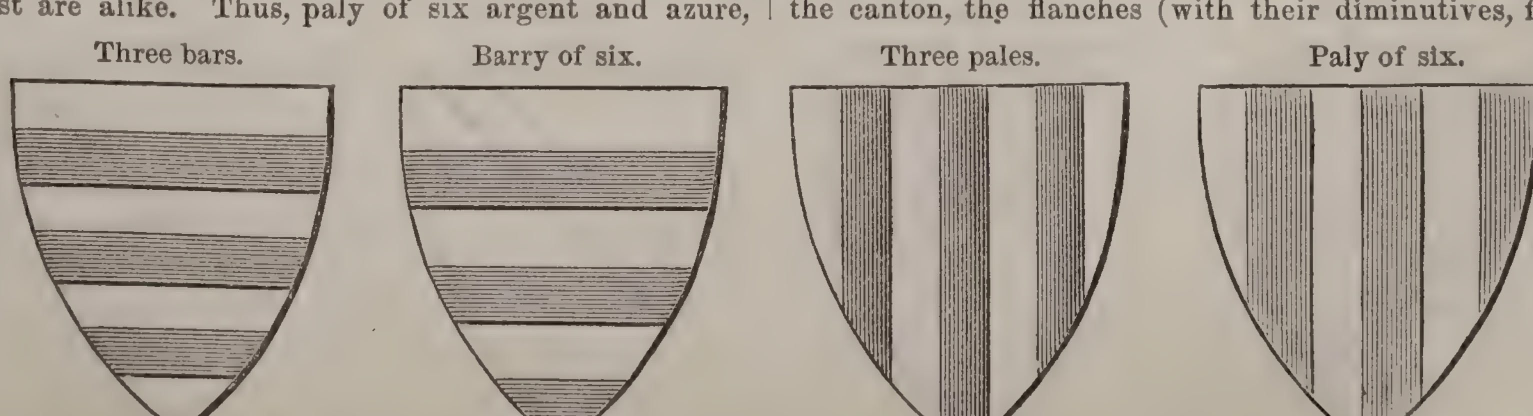


agination. The shield may also be divided by lines derived from the ordinaries, and is then said to be paly, bendy, barry, etc.; it is apparently filled with many little pales or bends, alternately of metal and color. There is a

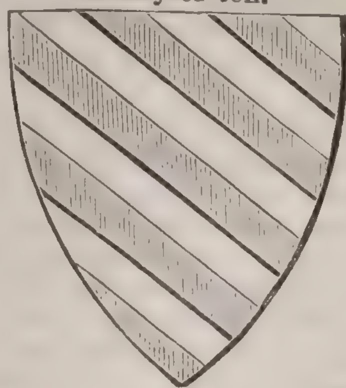
CROSSES.



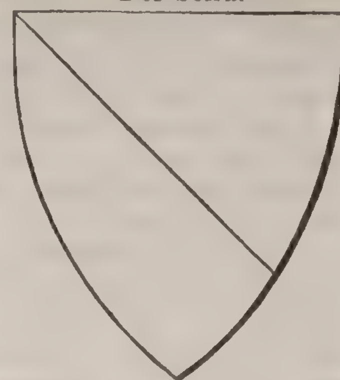
distinction to be observed between arms which are paly or bendy, for instance, and those which contain several palets or bendlets. In the former case the number of divisions is even, and if the first be a metal the last is a color; in the latter, the number of divisions is unequal, and the first and the last are alike. Thus, paly of six argent and azure, given by Burke to a family of Gorney, is to be carefully distinguished from argent three pales azure, the arms of Thornton; and the arms of the U. S. are to be blazoned, not paly of thirteen argent and gules, but argent six palets gules, a chief azure. The sub-ordinaries are the bordure, the canton, the flanches (with their diminutives, flasques



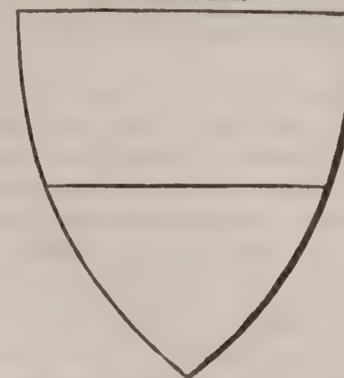
Bendy of ten.



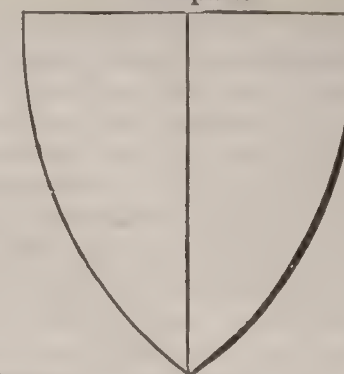
Per bend.



Per fess.

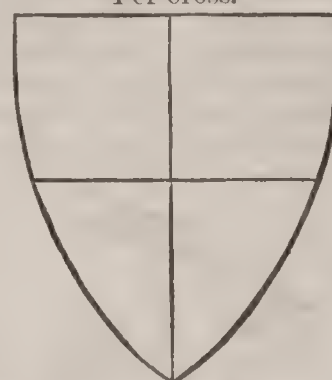


Per pale.



Per chevron.

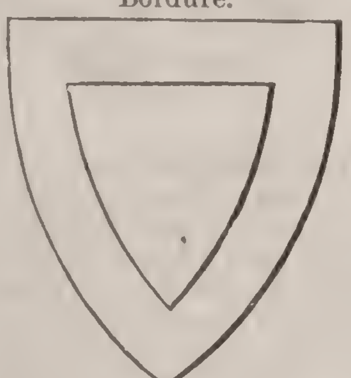
Per cross.



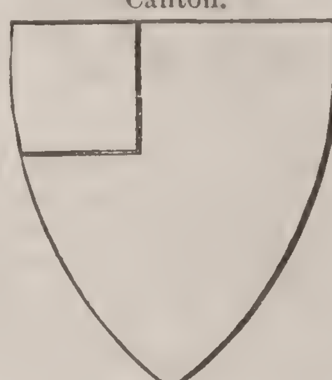
Per saltire.

and voiders), the fret, the gyron, the inescocheon, the orle, the pile, the pall, the quarter, and the tressure; and these in their turn lead to new divisions of the shield, such as pily, checquy, company, counter-company, fretty; some

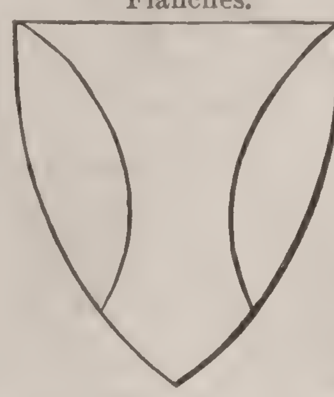
Bordure.



Canton.

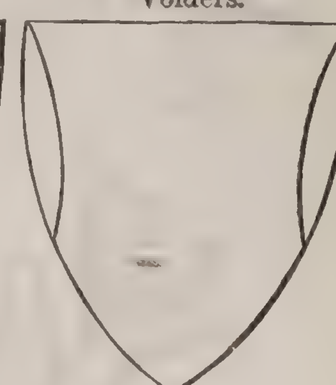


Flanches.



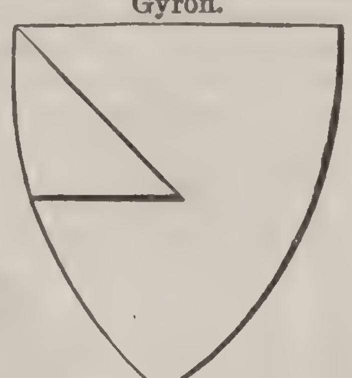
Flasques.

Voiders.



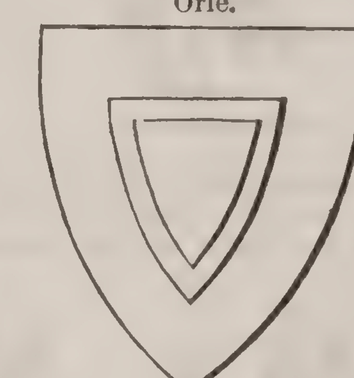
Fret.

Gyron.



Inescocheon.

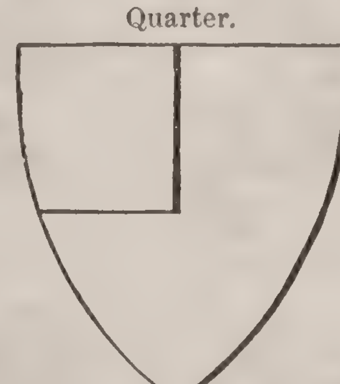
Orle.



Pile.

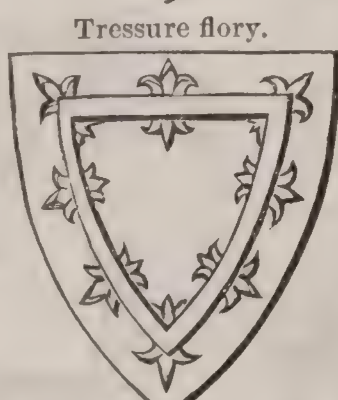
Pall.

Quarter.

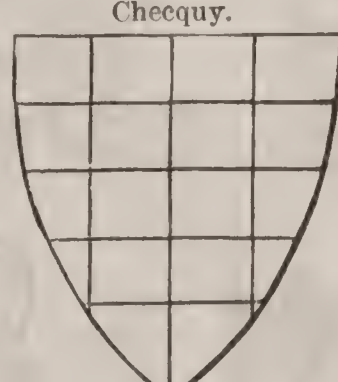


Tressure.

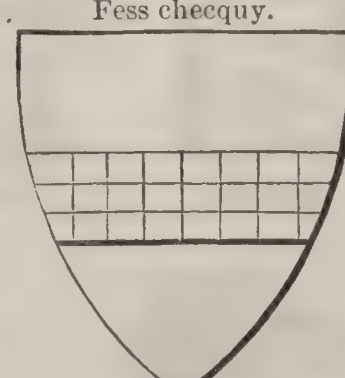
Tressure flory.



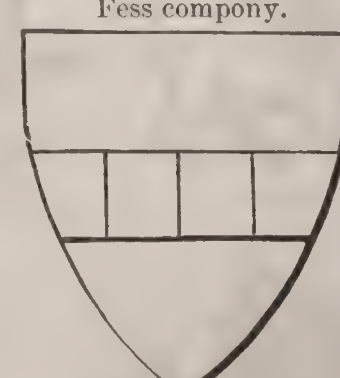
Checquy.



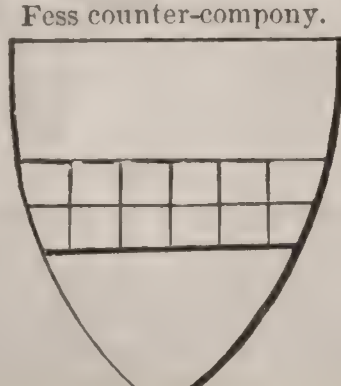
Fess checquy.



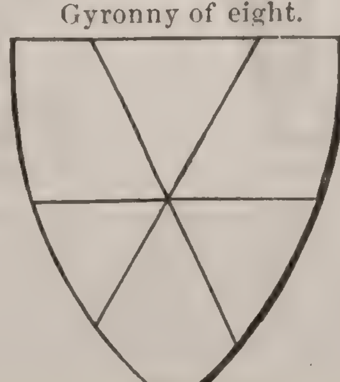
Fess company.



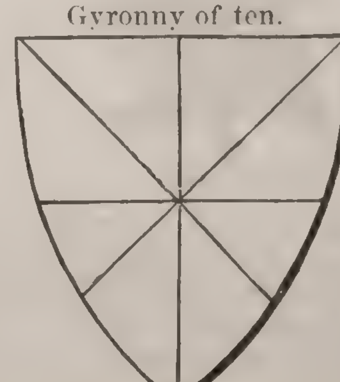
Fess counter-company.



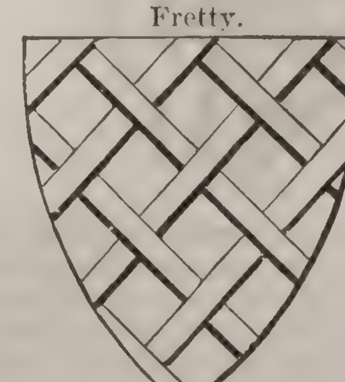
Gyronny of eight.



Gyronny of ten.



Fretty.



of which, like barry pily, bendy pily, are extremely complicated. A detailed account of these must be sought in heraldic manuals and grammars.

Charges may be anything in nature, or indeed out of it. Without following the elaborate divisions of Guillim and the older writers, who have overlaid what is really a very simple matter with a multitude of words, or have obscured it by irrelevant speculations, it will be sufficient to say that charges may be natural, artificial, or chimerical; the first speak for themselves; the last are the figures of imaginary animals, such as griffins, wiverns, harpies, dragons, and sphinxes, which have been invented or adopted by the heralds. A charge is a figure drawn either upon the field or upon an ordinary. The earliest charges appear to have been the lion, the eagle, and the boar's head. The first appears upon the shield of Philip I., count of Flanders, A. D. 1164, and, according to Mr. Planché, is "the earliest unquestionable example in which the lion appears as an heraldic bearing." About the same time it makes its appearance in definite heraldic form in the arms of the kings of England, and the eagle, as the arms of the Western emperors, is traced to the same age.

From the middle of the twelfth century heraldry developed itself as rapidly as printing did afterwards, and, like printing, it immediately reached perfection. Many of even the earliest coats are as elegant and graceful as any that have been since devised; far more so, indeed, than those of the last century, and even of the earlier part of the present, most of which show a decline in knowledge, skill, and correct taste, from which, however, this beautiful science is now happily recovering. The variety of figures used as charges is very great, and there appears to be no limit to the choice. Lions, eagles, wolves, tigers, and antelopes are generally drawn conventionally, and not naturally, though some modern painters seem disposed to depart in this respect from the ancient rules. Other animals, fruits,


Griffin.


Wivern.


Antelope.


Wolf.


Tiger.


Lion rampant.


Eagle displayed.

and flowers commonly follow nature, but the heavenly bodies do not. Fishes do, except the dolphin. Artificial figures are drawn as they appear. There are also definite terms employed to describe the position of animals and other charges, as a lion rampant, a lion passant gardant. The former is called by the French heralds a lion, the latter a leopard. Ignorance of this simple fact has led to prolonged discussions whether the arms of England, gules three lions passant gardant in pale, or, gave lions or leopards. The disputants, for want of a very simple clue, failed to perceive that the two words were really intended to describe the same animal, but in different positions. Charges are generally readily understood, but some few, like the fleur-de-lis, the clarion, and the fylfot, are obscure, and are called doubtful charges. It is uncertain whether the fleur-de-lis be intended to represent a spear-head or a lily, and whether the clarion be a musical instrument or a lance-rest. No explanation has been given of the fylfot; and it is believed that the suggestion is here made for the first time


Lion saliant.


Crowned.


Double quevée.


Lion gardant.


Regardant.


Passant.


Passant gardant.


Segant.

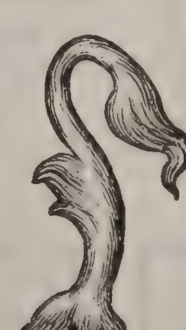

Couchant.


Dormant.


Demilion.


Lion's head.


Gamb.


Tail.


Stag's head caboshed.

that it is intended to represent the asterisk of the Greek Church, an instrument employed to cover the holy loaf at mass. The resemblance between the asterisk, as it is drawn in Dr. Neale's *Primitive Liturgies*, particularly when it is folded, and the mysterious fylfot of heraldry, is very striking.

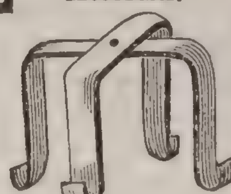
Although there is practically no limit to the choice of charges, there are certain figures peculiar to heraldry, and of very frequent occurrence. The roundle is supposed to be derived from the gold coin of Byzantium, and therefore when it is or is called a bezant. When gules, it becomes a torteau; azure, a hurt; vert, a pomey; sable, a pellet or

ogress; purpure, a golpe; argent, a plate; tenné, an orange; and sanguine, a guze. A roundlo barry wavy

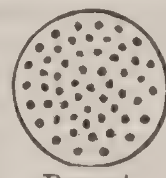

Fleur-de-lis.


Fylfot.


Rest.

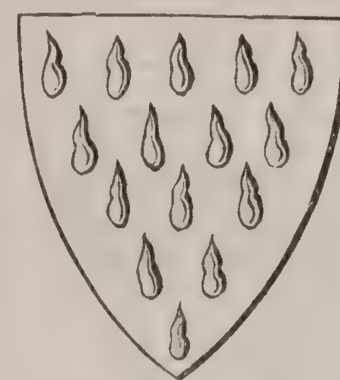

Asterisk.

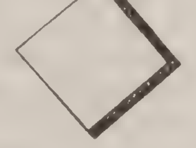
argent and azure is a fountain or sykes, and is borne by a family of the latter name. When the field is replenished with pointed figures resembling drops, it is said to be gutté, and a single drop is called also a gutté. If the drops be white, the field is gutté d'eau—filled with drops of water. Guttés de larmes, blue drops, represent tears; de poix, sable, drops of pitch; de sang, red, drops of blood; d'huile or


Bezant.

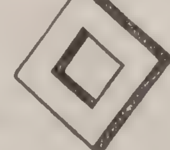

Fountain.

d'olive, green, drops of oil; d'or, gold, drops of gold. A lozenge is the common figure of that name: the horizontal diameter is equal to one of the sides, but the perpendicular diameter is longer; a mascle is a lozenge voided—*i. e.* having the middle removed, so that the field is visible through it, and marking the outline by two slender lines, one within the other. Ordinaries also may be voided. The fusil was originally the spindle, and in some old arms is borne in its original form; it is now merely the lozenge elongated. These charges give rise to the divisions of the shield known as lozengy, masculy, and fusilly, with their combinations. When lines like those of the fret are extended throughout the shield or cover an ordinary, it is said to be fretty. Billets are oblong figures representing a letter. Bird-bolts are blunt-headed arrows. The annulet is a ring; the mill-rind or fer-de-moline, the iron of a millstone; the pheon, an arrow-head; the caltrop, an iron instrument formerly strewn in a field of battle to entangle the feet of horses, and so constructed that a sharp point was always upper-

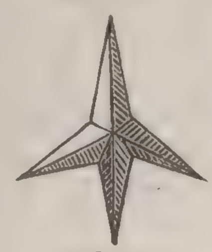

Guttés.

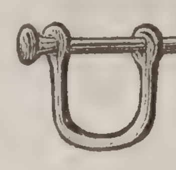

Lozenge.


Fusil.


Mascle.


Billet.

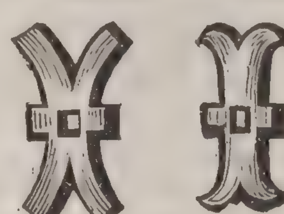

Caltrop.


Shackbolt.

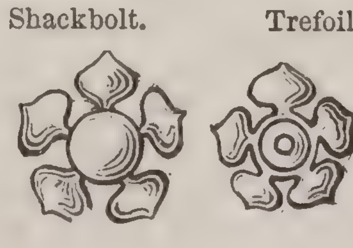

Trefoil.


Bird-bolt.


Annulet.


Fer-de-moline.

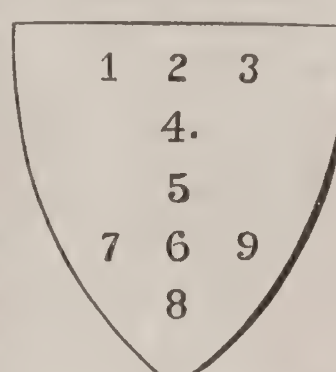

Pheon.


Cinquefoils.

most. For other charges it is necessary to refer the reader to some manual of heraldry.

Blazon is the art of so describing arms that a drawing can be made from the description. It is necessary first to understand the points of the escocheon, which are: (1) the dexter chief point; (2) the middle chief; (3) the sinister chief; (4) the honor point; (5) the fess point; (6) the nombril point; (7) the dexter base; and (8) the sinister base point. The terms of art must next be learned; not only the names of things, but the various attitudes of animals and the position of charges. Beasts of prey are blazoned rampant, passant, passant-gardant, sejant, rampant-gardant, couchant, and dormant; and when at rest, statant, though this is generally understood. Beasts of

Points of escocheon.

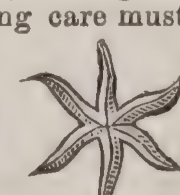


chase, however, are not rampant, but springing; not passant, but trippant; not couchant, but lodged. A griffin is not rampant, but segreant. Lions are always langued and armed. If the field or the lion be gules, the tongue and claws are azure; if of any other tincture they should be gules. Stags, etc. are attired and unguled, horned and hoofed. Birds are displayed rising, volant, or at rest. Fishes are naiant when in fess, or hauriant when in pale. Flowers are often slipped, and trees eradicated or torn up by the roots. Certain charges, also, are blazoned in a peculiar manner. The sun, surrounded by rays and or, is said to be in his splendor; the full moon, argent, in her complement. Both are drawn conventionally, with a human face. When sable, the moon is said to be eclipsed. A crescent has its horns towards the chief, an increscent towards the dexter, and a decrescent towards the sinister side of the escocheon. A peacock with his tail extended is said to be in his pride, and is depicted proper. A pelican in her nest, feeding her young, is said to be in her piety. In blazoning care must be taken to use language with ex-

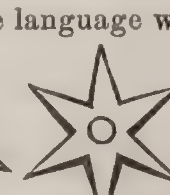

Crescent.


Decrescent.


Increscent.


Estoile.


Mullet.

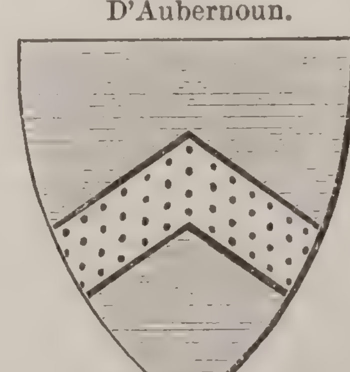

Pierced.


Sun.


Trunk.

treme accuracy, since the least departure from correctness may produce an entirely different coat from that which it is intended to describe; to use as few words as possible, and to avoid repetition, particularly of the name of a tincture or of numbers. The field must first be mentioned, then the ordinary, as, Azure a chevron or (*D'Aubernoun*). If the field be not plain—*i. e.* of one color—it must be blazoned first, as, Paly of six argent and gules (*Fitz-Neele*). Next to the ordinary, charges placed upon the field are to be named, as, Ermine, a chevron azure between three garbs or (*Masterson*). Garbs are wheat-sheaves. If the ordinary and charge be of the same tincture, it need be named but once, as, Azure a chevron between three garbs or (*Finch*). If the ordinary be charged, it must be next mentioned, Azure on a bend ermine three mullets sable (*Gay*). Lastly,

D'Aubernoun.



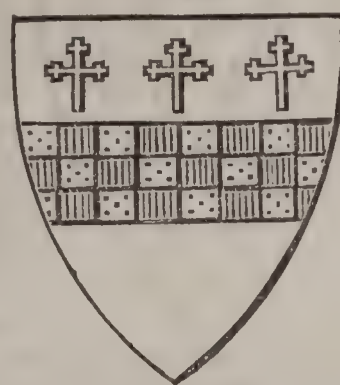
Fitz-Neele.

the bordure or chief must be mentioned, with its charges, if any, Azure, on a chevron or between three bells argent, an eagle displayed between two lions rampant gules, all within a bordure ermine (*Belhouse*). If there be no ordi-

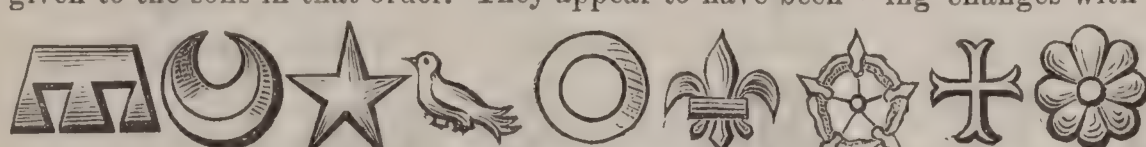
nary, but a charge, it is to be treated in the same way, as, Sable a lion rampant or (*Bramhall*). Azure, a lion rampant

Gay.

Borges.



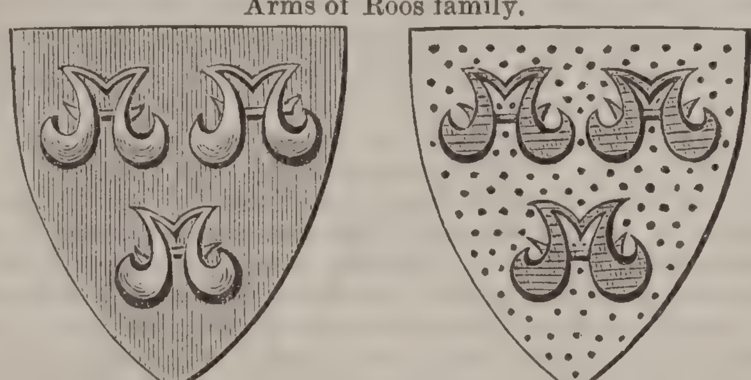
between three crosses crosslet or (*Jordon*). The repetition of the names of tinctures is to be avoided by using the expressions, "of the field," "of the first," "of the second," etc., as, Argent a fess checquy or and gules, in chief three crosses crosslet fitchy of the third (*i. e.* gules) (*Borges*). The repetition of numbers may be avoided thus: Sable on a chevron or between three estoiles of the second, as many crosses pattée fitchée gules (*Laud*). Finally, the difference and the baronet's badge, if there be any, the crest and the supporters, are to be described. The difference is a small charge employed to distinguish the arms of the sons of a house, from the first to the ninth. Modern differences, or marks of cadency, are the label, the crescent, the mullet, the martlet, the annulet, the fleur-de-lis, the rose, the cross moline, and the double quatrefoil, which are given to the sons in that order. They appear to have been



Differences.

in use since the fourteenth century as differences, but have been longer employed as charges. Ancient differences were much more conspicuous, and consisted in a variation of the tinctures, or even in the addition of a charge. An excellent illustration is found in the well-known and ancient family of Roos or Ros, two branches of which bore respectively Gules three water bougets argent, and Sable three water bougets or. The baronet's badge is the arms of Ulster in

Arms of Roos family.



Ireland, Argent a sinister hand, erect, open, and couped at the wrist or, and was given in commemoration of the purpose of the institution of that order by King James I. in 1611, to encourage plantations in Ulster. The badge of the Nova Scotia baronets appears to have been laid aside since 1629. As borne by the celebrated William Alexander, first earl of Stirling, it was, Argent on a saltire sable, an escocheon charged with the arms of Scotland, and was borne in an inescocheon ensigned with the royal crown. Above the arms the helmet is placed, which varies in form and material according to the degree of the wearer. This, in a complete atchievement, is covered by the mantling, which is understood to represent the lambrequin or cover of the helmet, and is slashed or jagged to indicate the cuts which it is presumed to have received in battle. Above the helmet is placed the wreath, in form like two cords twisted together; the tinctures of the mantling and wreath are properly those of the principal color and metal of the arms; but modern mantlings are oftenest red lined with white. Sometimes a cap of maintenance, or a coronet resembling that of a duke, is substituted for the wreath. Above all is the crest. Below the shield is the motto in a scroll. This is a brief sentence or a single word, frequently breathing some pious sentiment or vigorous thought, but often alluding to the arms, the name, or the crest. Of the former character are "Dum spiro spero" (*Dillon*), "Garde la foy" (*Cox*); of the latter, "Pie repone te" (*Pierrepont*). The motto of the late Dr. Hawks, "Never check," is admirable. That of Livingston, "Spero meliora," is an elegant allusion to the crest, a ship tossing in a stormy sea. It is the modern custom, however, to give only shield, crest, and motto, omitting the helmet and mantling.

Supporters are figures of men or animals placed one on each side of the shield, and so called because they appear to support and hold it up. They are borne in England by the sovereign and the princes of the blood, by peers and knights of the Garter, and grand crosses of the Bath, and, either by patent or prescription, by some baronets and private gentlemen.

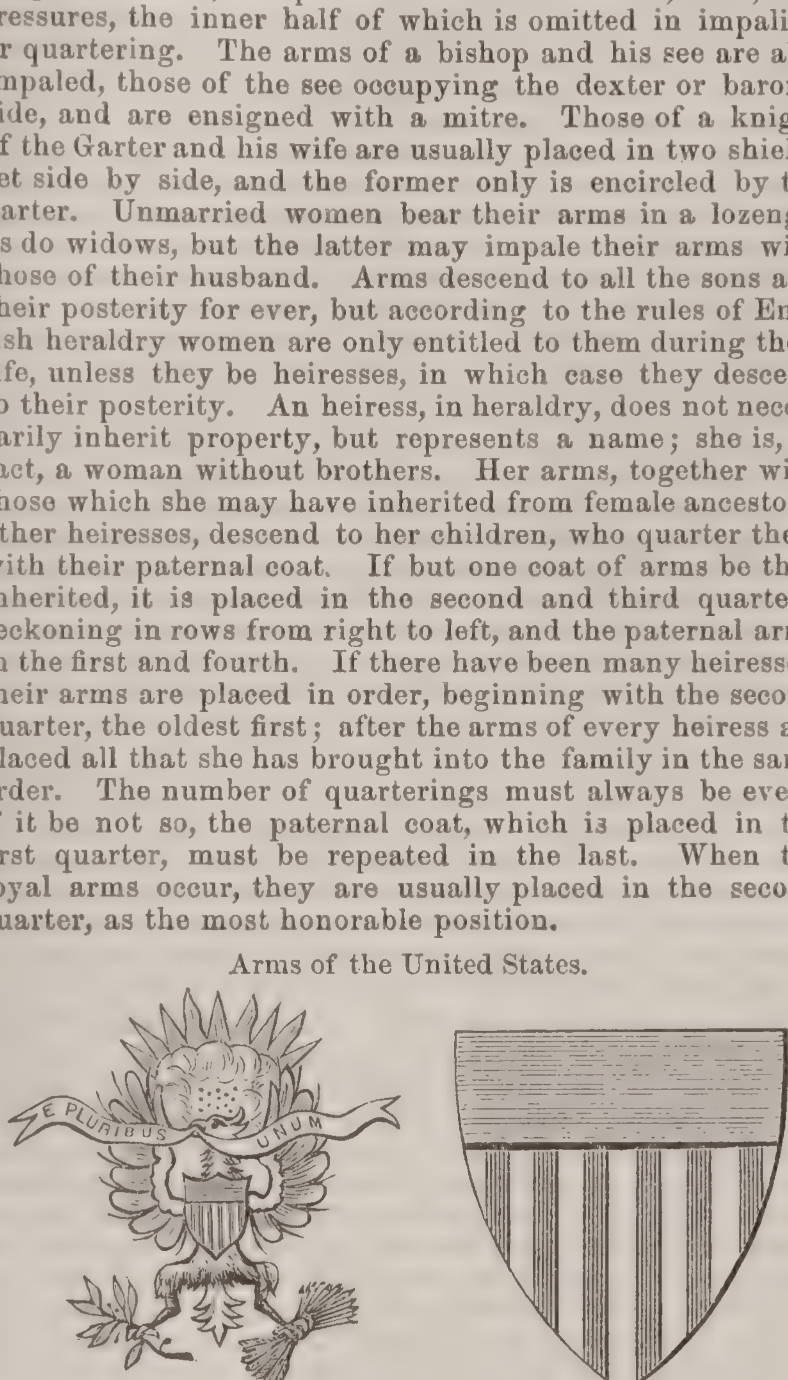
It is right to add that the foregoing is the merest outline of the rules of blazon. It is only possible to learn to blazon well by acquiring a correct knowledge of the terms of art and by the careful study of examples. It is not necessary to do more here than to allude to the methods of blazoning by planets and precious stones adopted by some of the older heralds, and not forgotten even so lately as the time of Guillim, but which nevertheless must be understood in order to read their works with satisfaction. Briefly, in blazoning the arms of sovereigns, they substituted the names of planets for those of the tinctures as they are now employed. Thus, or is Sol; argent, Luna; azure, Jupiter; gules, Mars; purpure, Mercury; sable, Saturn; vert, Venus. By this method the royal arms would be disguised as Mars three lions passant gardant in pale Sol. The arms of peers were blazoned by precious stones. Or is topaz; argent, pearl; azure, sapphire; gules, ruby; purpure, amethyst; sable, diamond; vert, emerald; sanguine, sardonyx; and tenné, jacinth. These fanciful methods have, however, long been abandoned as inconvenient and useless. Still more frivolous are the attempts of some of the older writers, like Leigh and Peacham, to give an arbitrary significance to every tincture and almost every charge. Gold is made to signify strength, silver charity, and the meaning changes with every combination. It is of course impossible to apply these allegorizing ideas in practice, or to extract any rational meaning from them. As Mr. Lower well observes, the application of them would produce the most startling combinations. "The coat Vert a bull's head or would signify as to the tinctures pleasure and joy, while as to the charge it would mean rage and fury. Again, Purpure, a wolf argent would mean a wrangler with a peaceable disposition."

Marshalling is the art of arranging arms with the externals in an atchievement. The mode of doing this when there is only one coat in the shield has been just explained. It should be added that in the arms of the sovereign the royal crown of England, sometimes called the imperial crown, or in those of peers of the realm the coronet of their degree, is interposed between the helmet and the shield. The crown of England is a circle of gold adorned with jewels, having upon its upper rim four crosses pattée, and as many fleurs-de-lis, and surmounted with two arches of gold and pearls, crossing each other, and having at the intersection a globe, above which is a cross pattée. The coronet of the prince of Wales is the royal crown, with one arch: that of the princess royal is composed of four fleurs-de-lis, two crosses pattée, and two strawberry-leaves. Other princes and princesses of the blood have coronets like that of the prince of Wales, without the arch. A duke's coronet is a rim of gold having on the upper edge eight strawberry-leaves, five of which are seen in profile; this must be distinguished from the ducal coronet, which is sometimes placed under the crest, and which shows only three strawberry-leaves; a marquess's coronet has four strawberry-leaves and as many large pearls set upon short points; an earl's has on the upper edge eight strawberry-leaves and as many pearls on high points; a viscount's has twelve, or, some say, sixteen pearls, and a baron's six (four of which are seen in a drawing), set upon the rim. Coronets are usually worn around a cap of crimson velvet, with a gold tassel and turned up with ermine, the velvet cap appearing above and the ermine below the coronet; but in drawing the coronet as a part of the atchievement the cap is omitted, except when, as is occasionally done, the crest, the mantling, and the helmet are left out, and the arms are ensigned with the coronet. Marshalling includes the arrangement of several coats of arms in a shield. Arms are classed under several heads, of which it will suffice to mention arms of dominion, of assumption, and of inheritance. The first are those which indicate sovereignty, as those of Scotland and Ireland added to the royal arms of England. The second are those of a prisoner of war, which the captor and his posterity may bear for ever. Thus, the Black Prince is said (though the story is probably untrue) to have won the ostrich-feathers and the motto "Ich dien" from John, the king of Bohemia, at the battle of Crecy. The third are those of families, which descend from father to son, to which are added, in English heraldry, those of heiresses who have intermarried into any family, as well as the arms which the heiresses themselves may have inherited. In French and German heraldry, however, the

arms of parents, grandparents, etc.—*i. e.* of all ancestors in a direct line, whether heiresses or not—are introduced into what is called a genealogical atchievement, and every gentleman of blood and coat-armor perfect is expected to be able to give not less than sixteen quarters. On the Continent they look only to descent, but the English arrangement contemplates both descent and inheritance, or the representation of families which are extinct in the male line.

The correct placing of many coats of arms in one shield is called quartering, and the rules which govern it are included among those of marshalling. There are several methods of marshalling arms. Those of a husband and wife, called *baron* and *femme*, are impaled, or placed side by side in one shield, and divided by a perpendicular line. Formerly, arms were occasionally dimidiated—*i. e.* only half of each coat was drawn—but this practice has been long abandoned, except in the case of bordures, orles, and tressures, the inner half of which is omitted in impaling or quartering. The arms of a bishop and his see are also impaled, those of the see occupying the dexter or baron's side, and are ensigned with a mitre. Those of a knight of the Garter and his wife are usually placed in two shields set side by side, and the former only is encircled by the garter. Unmarried women bear their arms in a lozenge, as do widows, but the latter may impale their arms with those of their husband. Arms descend to all the sons and their posterity for ever, but according to the rules of English heraldry women are only entitled to them during their life, unless they be heiresses, in which case they descend to their posterity. An heiress, in heraldry, does not necessarily inherit property, but represents a name; she is, in fact, a woman without brothers. Her arms, together with those which she may have inherited from female ancestors, other heiresses, descend to her children, who quarter them with their paternal coat. If but one coat of arms be thus inherited, it is placed in the second and third quarters, reckoning in rows from right to left, and the paternal arms in the first and fourth. If there have been many heiresses, their arms are placed in order, beginning with the second quarter, the oldest first; after the arms of every heiress are placed all that she has brought into the family in the same order. The number of quarterings must always be even; if it be not so, the paternal coat, which is placed in the first quarter, must be repeated in the last. When the royal arms occur, they are usually placed in the second quarter, as the most honorable position.

Arms of the United States.



The arms of the U. S. are arms of dominion. They are borne in rather an unusual way. The following is the blazon: Argent, six palets gules, a chief azure, borne on the breast of the American eagle displayed proper, in his dexter talon an olive branch, in his sinister thirteen arrows, also proper; above his head a sky azure charged with as many mullets 5, 4, 3, 1, argent, and environed with clouds proper, and beyond rays or; in his beak a scroll with the words "E Pluribus Unum." This blazon is from a painting in St. Paul's chapel, New York. As an illustration of a gentleman's atchievement borne in the modern manner, without helmet or mantling, the arms of Sigismund Hugget are given from a mural tablet in the same chapel. They are, Argent, a chevron gules, on a chief azure, two fleurs-de-lis of the first. Crest, two wings expanded, per fess gules and argent. Motto, "Dene agendo vel cavendo." This is an evident mistake for "Bene," but it is literally copied from the mural tablet. These are not the arms borne by the English family of Hugget. They may possibly be Dutch. The

Hugget.

arms in the episcopal seal of the late Bishop Hopkins show the manner in which bishops should give their arms. They are Vermont impaling Hopkins, ensigned with a mitre. The arms of the diocese were devised by the bishop himself, and are an excellent piece of modern heraldry. The blazon is, Azure, a long cross argent, surmounted in base of a crosier in bend, over all a key in bend sinister, both of the second, impaling sable on a chevron between three pistols or, as many roses gules, barbed and seeded proper.

Bishop Hopkins of Vermont.

Funeral atchievements or hatchments, though familiar in England, are little known in America. They are usually hung on the fronts of houses or placed in churches. They follow the usual rules of marshalling, but are commonly drawn very large, and the arms, crest, and motto are placed on a ground in the form of a lozenge. If the hatchment be in memory of an unmarried person, the ground is all black, and the arms of a maid or widow are drawn in a lozenge and ensigned with a cherub instead of a crest. If the husband be dead and the wife living, his arms are placed on a black ground and hers on a white. If the wife die first, her arms are on the black ground, and her husband's on the white; but if both be dead, the ground is all black. The arms of a deceased bishop are impaled in the usual way with those of his see, and the latter are on a white ground. When the deceased is the last of his line, it is said that a death's head may be placed over his arms instead of or beside the crest. Marshalling is, in America, one of the most important parts of heraldry, since its purpose is to record descents and to give a clue by which pedigrees can be constructed.

The bibliography of heraldry is extensive, and it may be as well to mention one or two of the better books. Leigh's *Accidence of Armoury*, Ferne's *Blazon of Gentry*, and Peacham's *Complete Gentleman*, are entertaining and historically useful, but their authors belong to the mystical school, which tries to discover recondite meanings in the simplest matters, and their works must be read by the neophyte with caution. Guillim is high authority; his *Display of Heraldry* marks the beginning of the transition from the mode of treatment which allies heraldry with every subject under heaven and the stricter scientific method of the modern writers, though it nevertheless contains a great deal that is curious but irrelevant. Clark's *Grammar of Heraldry*, published in 1776, which has passed through fourteen editions, is the precursor of the modern method. Porny's *Heraldry* (by Pyron, French master at Eton College and an accomplished scholar), published first in the *Encyclopædia Britannica*, and afterwards in a volume by itself, is a very good but not very complete treatise. Of recent works, Boutwell's and Whitmore's *Heraldry* are well adapted to the beginner; the latter, published in Boston, Mass., contains much information not to be found in the English books. The champions of the modern school are Lower and Planché. *The Curiosities of Heraldry* and *The Pursuivant of Arms* are endeavors to discuss the subject upon an historical and scientific basis. The *Glossary of Heraldry*, published by J. H. Parker in 1847, is perhaps the most complete of modern treatises, but it presupposes a great deal of elementary knowledge, as do the works of Fairbairn and the Burkes. The former has made a collection of crests in two large volumes. The *Peerages* and the *General Armory*, and the numerous productions of John and Sir Bernard Burke, are well known. Other peerages, Collins's, Douglas's, Lodge's, have a high reputation. Berry's *Encyclopædia* is one of the most voluminous of modern books. He, however, has a leaning to the imaginative school, and should be read with caution. B. R. BETTS.

Heralds' College, or **College of Arms,** a corporation comprising all the English heralds except Bath king of arms, St. Michael and St. George king of arms, and the two heralds of Wales and the order of the Bath, the latter titles being indeed often bestowed upon members of the college. Heralds' College was instituted in 1464 by Edward IV., chartered in 1483 by Richard III., confirmed by Edward VI. in 1549, and rechartered by Philip and Mary in 1554. Its office is at Benet's Hill, Doctors' Commons, London. Its president is the duke of Norfolk, hereditary earl-marshal of England. The three English kings of arms, Garter, Clarencieux, and Norroy,

the heralds, Richmond, York, Windsor, Chester, Somerset, and Lancaster, and the pursuivants, Portcullis, Bluemantle, Rouge Croix, and Rouge Dragon, are members of the chapter. The Lyon Office in Scotland and the Office of Arms in Ireland perform similar functions. (See HERALD.)

Her'ald's Prai'rie, tp. of White co., Ill. Pop. 1160.

Her'apath (WILLIAM), F. C. S., b. at Bristol, England, May 26, 1796; was a successful brewer; became in 1828 professor of chemistry in the Bristol Medical School; assisted in founding the London Chemical Society 1841. D. at Bristol Feb. 6, 1868; was a distinguished toxicologist.

Herapath (WILLIAM BIRD), M. D., b. 1820; graduated M. B. at London University 1844; M. D. 1851; D. at Bristol Oct. 12, 1868. He discovered the sulphate of iodoquinine, and announced its remarkable optical qualities, and subsequently prepared several other analogous compounds new to science.

He'rat, an important city in Western Afghanistan, on the Huri, in lat. 34° 50′ N. and lon. 62° 30′ E. It is fortified, and situated in a fertile and highly cultivated country. It has large bazaars, and besides its own manufactures of carpets, woollens, and leather, it has a considerable trade with China, India, and Persia. On account of its position it may become the point of contention between England and Russia in their Asiatic rivalries. Its population is estimated at between 30,000 and 80,000.

Hérault, department of Southern France, on the Mediterranean. The northern part is traversed by branches of the Cevennes, which enclose fine valleys. The coast is low and marshy. The mountains are rich in minerals—coal, iron, lead, copper, and marble; the valleys produce wheat, wine, and fruits. In the marshes is manufactured much salt, and the lakes and the sea furnish large quantities of fish. Cap. Montpellier. Pop. 429,878.

Herba'rium, or **Hor'tus Sic'cus** [Lat. "dry garden"], a botanist's collection of dried plants. If possible, plants with flowers, buds, and leaves should be chosen, and many small plants may be gathered, roots and all. If too large, collect branches with a few radical leaves. Thick roots may be sliced before drying. For drying, take plenty of soft, unsized bibulous paper, folded into a convenient size; common soft wrapping-paper will do. Stitch a dozen sheets or so into a book called a drier. Fold each specimen in a single sheet, place the sheet between driers, and put the whole into the press under as much weight as the specimen will bear without crushing. Change the driers every day or oftener for about a week. Plants which turn black in drying are sometimes rapidly dried by artificial heat under pressure, the process lasting but a few hours. Finally, the specimens may be carefully folded in sheets of thickish white paper, or fastened by slips of paper or by hot glue to half sheets of paper, about seventeen inches long and a foot wide. On each sheet should be written the name of the genus and species, the place and date of collection, and such other information as may seem important. The plants of one genus are folded in *genus covers* of stout paper; these are arranged in the appropriate natural orders, and are best preserved by placing them flatwise in compartments or on suitable shelves. Care must be taken to prevent the ravages of destructive insects. An alcoholic solution of mercuric chloride (one ounce to the quart), applied to the specimens before they are mounted, is useful to this end.

Her'bart (JOHANN FRIEDRICH), b. at Oldenburg May 4, 1776, his father being a public officer at that place. Herbart attended the gymnasium there, studying Wolff and Kant. In 1794 he entered the University of Jena, when Fichte was there unfolding his science of knowledge. From Fichte he received a great impulse. He criticised the system of Schelling and struck out an original path. In 1797 he became a tutor at Berne, where he made the acquaintance of Pestalozzi and composed a treatise on education. In 1802 he became *Docent* of philosophy and pedagogics in Göttingen, and in 1805 professor extraordinarius. In 1809, Wilhelm von Humboldt called him to Königsberg as professor ordinarius to succeed Krug, the successor of Kant. He founded a pedagogical seminary also. In 1833 he returned to Göttingen, where he remained till his death in 1841. His chief works are: *Lehrbuch zur Einleitung in die Philosophie* (1813), *Lehrbuch zur Psychologie* (1816), *Psychologie als Wissenschaft, neu gegründet auf Erfahrung, Metaphysik und Mathematik* (1824–25), *Allgemeine Metaphysik nebst den Anfängen der philosophischen Naturlehre* (1828–29), *Kurze Encyclopædie der Philosophie, aus practischen Gesichtspuncten entworfen* (1831). The complete works of Herbart have been edited in 12 vols. by G. Hartenstein (Leipsic, 1850–52).

The design of this article confines us to a brief sketch of the plan of Herbart's investigations, and forbids the introduction of much of his novel terminology, as it would be misunderstood without lengthy explanations. While engaged in the study of philosophy under Fichte, Herbart became convinced that, for a satisfactory settlement of the questions involved in self-consciousness, it was not only possible, but indispensable, to enter into the consideration of infinitesimal quantities by means of the Calculus, and all the ideas advanced by him are meant to subserve that end. He contends that the ultimate real elements of which the world is composed are infinitesimal parts of that which appears, absolutely simple, without parts as to space or time, mathematical points, distinguished only by difference of quality. In accordance with this view, he holds that original change and development, that infinite continuity of space and time, that substances possessing a multiplicity of qualities and forces, that causality transferring something from one essence to another, and that a self endowed with arbitrary and conflicting faculties, are, one and all, crude and contradictory suggestions of phenomena. The principal aim of his *Introduction to Philosophy* is to interrupt, by vigorous dialectic, the general dream as to the truth of such suppositions. Next, he proposes to reform them so as to satisfy both experience and the principle of identity embodied in his "real elements," in his *Metaphysics*. Impenetrability of simple substances must be limited to the extent of their similarity; if it was absolute, communication, relation, and causation between them, or the thoughts thereof, would be completely incomprehensible. Contiguous substances of different qualities attract each other with infinite force, occupying the same point of space, and exert repulsion in the measure of their identity. This elementary action does not, however, alter the primary qualities of the substances; and he therefore calls it self-preservation. The number of substances holding the same point of space is comprehended by the terms of "internal state" or "internal constitution;" the attractions and repulsions resulting from the "internal state," and producing a more or less constant relation to the surrounding elements, is termed the "external state or constitution." Consequently, the external constitution is defined by the internal state. The only substance and elementary actions of which we are directly conscious are the soul and its simple sensations, like those of sounds and colors; but the simple acts of all substances are acts of self-preservation, sensations; therefore are self-preservations of the soul. When an element, partly similar and partly dissimilar, enters the space of another element, a perturbation is created to which a definite self-preservation corresponds. While the soul, by perceptions, responds to countless perturbations, it expels from consciousness that which is contradictory, blending what remains in definite succession and order. The rich experience of the outer world is thus produced by the soul without innate categories of time and space, without being contaminated by an influx foreign to it, and without a fatalistic law of evolution. Moreover, the soul preserves itself with reference to these its own products, forming series of perceptions, weaving the series into textures, and grouping the textures. This is the origin of higher generalizations and of complicated intuitions, which are generally attributed to special faculties of an inner sense. The very idea of self is thus created by the soul; it is a work of the soul, not the soul itself; this latter operates not only consciously, but in sleep also. The construction of matter, of the imponderables, and of life by modifications of the preceding principles, constitute Herbart's *Natural Philosophy*. The proportion of attraction and repulsion, in a sum of simple substances filling space with incomplete interpenetration, determines for matter its density, elasticity, and crystallization. A great number of elements of one kind being required to produce a complete self-preservation in a single element of different kind, this furnishes the basis for discussing the facts connected with the imponderables. Life is defined as a system of self-preservations in one and the same substance, higher or lower, in proportion as the internal culture of the elements is more or less rich. The purpose of his *Rational Psychology* is to do away with the foundation of empirical psychology, the faculties of the soul, which evidently act without precision, concert, or assignable laws, and to explain, by a mathematical analysis, the apparently irregular and anomalous facts of consciousness, which seem to violate the autonomy of the soul. He lays down the principle that if the influence of moral laws resulting from the direct effort of the soul is set aside, the ideas become forces themselves, resisting the impediments by which they are partially obliterated in the direct ratio of their intensity. Distributing the total amount of impediment or arrest among several ideas, he finds that under certain conditions two of them are sufficient to force and hold below the horizon of consciousness a third, which henceforth and until revived is excluded from any influence upon whatever may be present to the mind. This view be-

comes the fruitful source of explanation for every kind of inner experience which is inconsistent with the expected operation of moral and logical laws, ranging from the slightest inattention through all the degrees of power exerted by error and passion, till it reaches that state of insanity in which the former idea of self is lost, and a foreign personality substituted. Such complete enthralment of ideas, and of what depends on them, is only in rare cases achieved all at once; more frequently it is effected gradually, under an infinite variety of modifying circumstances; while at the same time ideas partially free, and either isolated or associated, continue the effort to regain the maximum of consciousness, and those crowded out of it rebound into the mind as soon as the obstacle is removed.

We have thus far given an outline of his theoretical philosophy. The principles determining what ought to be are kept separate to ensure freedom of investigation, and are contained in his *Practical Philosophy.* The latter is not founded upon commands, either of society or conscience, nor is it based upon desires in connection with objects, but upon involuntary and axiomatic intuitions, succeeding inward and outward actions, approving of the harmonious, disapproving of the inharmonious relation of volitions. These momentary decisions are called "æsthetical judgments." We approve of the harmony of such intuitions with the will, disapprove of their discord—idea of inward liberty. The product of the will, uniting more complementary predicates, is preferred in comparison with the product containing less of them—idea of perfection. One will helping another will, in accordance with said ideas, without thought of compensation, is approved as divine—idea of benevolence. Not to intermeddle with volitions not conflicting among themselves is approved as the idea of right. To resist wrong and to return good for good is the idea of compensation (*Billigkeit*). We give scope to these ideas by cultivating them separately, without reference to definite purposes. Their joint application to the concerns of individual and social life constitutes virtue. The person who, in a conflict between the ideas and their reverse, is constrained to obey the ideas, has acquired moral character. God cannot be known by means of "real elements;" faith in his existence rests exclusively upon his moral attributes corresponding to the ideas enumerated, and is supported by the evidences of design in nature, for which the practical ideas are the organ of sight. The soul is of course indestructible, but the ministering organism is a beneficent arrangement of Providence. The degree of faithfulness with which these ideas are cultivated defines our actual freedom; the soul is neither absolutely free, nor is it ruled by laws foreign to itself, save in the measure that the ideas are neglected. An application of both his theoretical and practical philosophy was made by Herbart in his *Pedagogics*, with the design to educate by means of instruction. His *Encyclopædie* investigates the relation and interaction between the arts and sciences of civilized life.

The circle of scholars who have adopted Herbart's system is quite numerous, and their influence is increasing. Mor. Wilh. Drobisch, Gust. Hartenstein, H. G. Brzoska, Fried. Exner, G. F. Taute, C. A. Thilo, Theod. Wittstein, Ludw. Strümpell, Rob. Zimmermann, and others are authors of distinguished works on Herbart's philosophy.

HUGO HAANEL.

Herbelot, d' (BARTHÉLEMY), b. at Paris Dec. 4, 1625; studied at the University of Paris, and became a profound scholar in the Oriental tongues; sojourned much in Italy; was patronized by Fouquet and Colbert; was royal secretary and Oriental interpreter, and in 1692 became Syriac professor in the College of France. D. at Paris Dec. 8, 1695. His *magnum opus* was *Bibliothèque Orientale* (1697), a storehouse of facts regarding Eastern literature which is even now highly valued.

Her'bert (EDWARD), BARON, of Cherbury, b. of an ancient family at Montgomery Castle, Shrewsbury, in 1581; educated at University College, Oxford; served with renown in the Netherlands, and became a gentleman of the court of James I.; was ambassador to France 1618–24; entered the Irish peerage in 1625, and the English in 1631. His deistical *Tractatus de Veritate* appeared in 1624, and the *De Religione Gentilium* was added in 1645. His writings are somewhat obscure, but he maintained the existence of innate ideas and of a personal Deity, and taught that the mind of the devout seeker for truth may become illuminated by an inward light. The indistinctness of his expressions and the somewhat mystical subtlety of his notions have caused him to be little read or understood. D. at London Aug. 20, 1648.

Herbert (GEORGE), a brother of Lord Herbert of Cherbury, b. at Montgomery Castle Apr. 3, 1593; was educated at Trinity, Cambridge, where he received a fellowship in 1615 and proceeded M. A. in 1616; was university orator 1619–27, and sought in vain for civil promotion, which was promised by the king and courtiers; took holy orders in 1625; became a prebendary under the bishop of Lincoln 1626, and in 1630 rector of Bemerton, where he d. of a quotidian ague Feb., 1633. Herbert was a man of profound learning, sincere piety, refined taste, and extraordinary wisdom. The writings of the "holy Herbert" in prose and verse have often been reprinted. His poetry, with its rich imagery and quaint expressions, somewhat marred as it is by forced *concetti*, after the fashion of his times, includes some of the finest sacred lyrics in our language. The admirable sketch of Herbert by Izaak Walton has been often reprinted.

Herbert (HENRY WILLIAM), a son of the dean of Manchester and grandson of the earl of Carnarvon, was b. in London Apr. 7, 1807; was educated at Eton and Cambridge, and came to New York in 1831, having become hopelessly involved in debt. In this country he was for a time a highly successful teacher of Greek. He published a successful series of historical novels and some translations from the French and other languages, including a poetic version of the *Prometheus* and *Agamemnon* of Æschylus (1849). He was also author of the "Frank Forester" series of sporting volumes, partly tales of out-door life, but also including the *Field-Sports of the U. S.* (1849), *The Fish and Fishing of the U. S.* (1850), *The Horse and Horsemanship of America* (1857), *The Horse and his Management*, and other works of this character. He also produced some well-written historical works, such as the *Captains of the Old World*, etc., besides performing much editorial and other literary labor. He was a man of varied and remarkable accomplishments, but of extravagant and somewhat loose habits. D. at New York by suicide May 17, 1858.

Herbert (JOHN ROGERS), R. A., b. at Maldon, Essex, Eng., Jan. 23, 1810; attained distinction as a painter; became a Roman Catholic; an associate R. A. 1841; full academician 1846; was employed upon the frescoes of the new Houses of Parliament, and has executed many religious and scriptural pieces, especially since the death (in 1856) of his eldest son, Arthur J. Herbert, a young artist of much promise.

Herbert (SIDNEY), BARON, b. at Richmond in 1810, a younger son of the eleventh earl of Pembroke; studied at Harrow and Oriel College, Oxford; entered Parliament in 1832; secretary to the admiralty 1841; secretary at war 1845–46, 1852–55, and 1859; privy councillor 1852; raised to the peerage as Lord Herbert of Lea 1861. D. at Wilton Aug. 2. 1861. He was an able and popular Conservative leader, a liberal patron of art, and a man of great political ability and industry. His eldest son became in 1862 the thirteenth earl of Pembroke.

Herbiv'ora [Lat. plu. for "plant-eaters," cf. ANIMALIA], a name given by some systematists to a proposed order of mammals corresponding in its limits to that known to most late writers as UNGULATA (which see). The name Herbivora is objectionable, since it is equally applicable, as a descriptive term, to a very large number of mammals which cannot be included in the proposed order.

Hercula'neum, or, less properly, **Hercula'num,** a city of Campania, on the slope of Vesuvius, between Naples and Pompeii, to which Retina served as a port. This site was first occupied by the Osci, afterwards by Greek colonists, who named it *Herakleion*, and both in architecture and in institutions it had the character of a Greek city. Herculaneum was conquered by the Romans after the so-called War of the Allies, and in the time of the empire was much frequented as a pleasant resort. The Fabii and the Balbi had residences in Herculaneum; Agrippina also had a villa there. The earthquake of A. D. 63 did great damage to Pompeii, but comparatively little to Herculaneum, which appears to have been more solidly constructed. The houses of Pompeii were small, while Herculaneum had its palaces and temples. The great eruption of Vesuvius which buried Pompeii (A. D. 79) also overwhelmed Herculaneum; not, however, with burning lava, as many have supposed, but with volcanic ashes, afterwards converted into mud by water, and finally hardened into stone. Upon the soil deposited above the city have arisen Portici and Resina. Herculaneum was buried deeper and deeper by later eruptions of Vesuvius, until it had almost passed out of memory. In 1684 some ruins, now known to be those of the theatre, were found in digging a well. In 1720, in the excavations for the prince of Elbeuf's villa at Portici, several statues (among them those now in the Dresden Museum, called by Winckelmann vestal virgins, but by later archæologists the daughters of Balbo) were found, with twenty-four columns of giallo antico, etc. Charles III., having become king of the Two Sicilies in 1736, assumed possession of the property, and carried on the excavations energetically. The Academy of Herculaneum, founded in 1775, neglected the architectural

objects and concerned itself with the statues only. Between 1750 and 1760 a villa was excavated, where, besides beautiful pictures, candelabra, vases, household utensils, and works of art in bronze (the most beautiful bronze objects in the museum at Naples came from Herculaneum), was found a library of 2000 rolls or volumes. The wooden shelves and cases were decayed, but many of the manuscripts, though damaged by water and externally decomposed, have been unrolled by means of an invention of Padre Antonio Piaggi, and made legible. About 500 have been already opened, for the most part Greek treatises on philosophy by Epicurus and other less known writers. The Italian government is now publishing these texts at Naples. In 1828, under the reign of Francis I., the excavations were renewed with some zeal, and the house of Argos and that entitled the Publicium were found. Fiorelli, director of the excavations at Pompeii, is now turning his attention to Herculaneum, but means are wanting, and thus far no new discoveries of importance have been made. The student is referred to the volumes *Delle Antichità d'Ercolano del Museo Borbonico* (especially vol. viii.); the *Manuale per Ercolano, Pompeii, e Stabia, di* FINATI (Naples, 1844); ROUX AINÉ, *Herculanum et Pompeii*, accompagné d'un texte explicatif par M. L. BARRÉ (Paris); SELVATICO, *Le Arti del Disegno in Italia* (Milan, 1874, in course of publication); QUATREMÈRE DE QUINCY, *Dictionnaire*, article "Herculaneum;" BEULÉ, *Le Drame du Vesuve* (Paris, 1872). ANGELO DE GUBERNATIS.

Herculaneum, a v. of Jefferson co., Mo., on the Mississippi River, 23 miles below St. Louis. It has shot-towers, and exports shot and lead, which is mined in the vicinity.

Her'cules, or **Her'acles,** the most famous hero in the Greek mythology, was a son of Zeus and Alcmena. He was possessed of most extraordinary physical strength. While a babe in the cradle he strangled two serpents sent by Hera to kill him. When full grown he upheld the dome of the heavens while Atlas was away in the gardens of the Hesperides. He was sensual, but good-hearted, straightforward, and just. He happened to intoxicate himself and make an unseemly noise in the house of Admetus, but when he heard that his friend mourned the death of his wife, shame at once made him sober, and according to some writers he descended into Hades and carried back Alcestis. He killed the eagle and unchained Prometheus, whom Zeus had unjustly bound to the rocks. But Hera hated him, and struck him twice with insanity. During the first fit he slew his three children, and in order to expiate this horrible crime the Delphic oracle sent him to serve Eurystheus. While here he performed the twelve famous labors: (1) slaying the Nemean lion; (2) killing the Lernæan hydra; (3) catching the Arcadian stag; (4) hunting the Erymanthian boar; (5) cleansing the Augean stable; (6) destroying the Stymphalian birds; (7) capturing the Cretan bull; (8) carrying away the mares of Diomedes; (9) fetching the girdle of the queen of the Amazons; (10) chasing the oxen of Geryon; (11) stealing the apples of the Hesperides; and (12) seizing Cerberus and carrying him up into the daylight. During the second fit he killed his good friend Iphitus, and in obedience to the Delphian oracle he now went and served Omphale, the queen of the Lydians, as her slave. His death was tragical, and much more purely sublime than any part of his life. Believing that it was a philtre, Deianira, his wife, tinged his garment with a poison she had received from Nessus. When Hercules put on the garment the poison attacked his body, and, tearing the flesh from his bones, he fled from place to place in frightful agony. At last he could bear it no more. He heaped up a huge pile of wood, and, setting fire to it, he placed himself on its top. But when the flames began to lick his tortured body a cloud came down from the sky and carried him up to heaven. There is perhaps no name in the whole Greek mythology around which myths cluster so thickly as around that of Hercules; and although most of these tales are gross and indecent, many are genuinely humorous, and some exquisitely beautiful and sublime. He was also a favorite subject in epics and dramas, and with sculptors.

Her'cules Bee'tle (*Dynastes Hercules*), a giant beetle of the family Scarabæidæ, a native of Brazil. It is about six inches long, and the male has a huge horn upon the head and a smaller one upon the thorax.

Hercules, Pillars of, the name given by the ancients to Calpe (Gibraltar) and Abyla (now Ceuta), two rocky promontories, one on each side of the Strait of Gibraltar. It was fabled that Hercules found them one mountain, but tore them asunder, thus making a connection between the ocean and the Mediterranean Sea. In heraldry, they figure as the supporters of the Spanish national arms. They are seen with the motto *Ne plus ultra* ("No more beyond"), indicating that the pillars are at the end of the world, as anciently believed. These are the well-known pillars on Spanish coins; and the sign $, standing for "dollars," probably represents these pillars with the fillet for the motto across them.

Hercyn'ian For'est (*Hercynia Silva*), a name employed by ancient Greek and Latin geographers to denote the great central and southern forest-region of ancient Germany. The term was always a vague one. In its widest sense it seems to have included the Bohemian Forest, the Hartz (whose name seems allied to the ancient one), the Black Forest, and others.

Her'der, von (JOHANN GOTTFRIED), one of the founders of modern German literature, and one of the most powerful and wholesome influences of modern German civilization, b. Aug. 25, 1744, at Mohrungen, East Prussia, where his father kept a small school and held a subordinate position in the Polish Church. He was educated in his home till his fifteenth year, after which time he spent a couple of years in a position midway between a secretary and an errand-boy in the house of the minister, which he left to go to Königsberg and hear Kant. While here he had to maintain himself, yet when he left his knowledge of theology, philosophy, languages, art, and literature was very extensive, and his intellect was as bright and vigorous as comprehensive. From 1764 to 1769 he lived in Riga as rector of a kind of theological seminary, and there he published his *Fragments on German Literature*, which attracted considerable attention. After 1769 he travelled much in Germany, and held different positions until (1776) he settled down in Weimar, beside Goethe, Wieland, Schiller, and Schlegel, in an influential and responsible position as court-preacher, ephorus of the schools, and president of the consistory. D. Dec. 18, 1803. Although a theologian both by education and profession, the worth of his theological writings is nevertheless comparatively small. It is his influence on German poetry, literature, and civilization in general which constitutes his merit. The co-operation of Goethe and Winckelmann gave the German literature a new impulse, which may be characterized as a modern German recasting of the ideas of the antique Greek art. From the co-operation of Goethe and Herder started another movement, which is well known as the romantic school. Goethe gave the school its artistic form; Herder gave it its poetical principle. In his *Letters on Hebrew Poetry*, an analysis of the æsthetical character of the poetical part of the Old Testament; in his *Cid*, a translation or remodelling of the old Spanish ballads celebrating this hero; and in a number of minor essays published in different literary magazines, he showed that all the greatest works of art are also the most exclusively national. By establishing the principle of nationality as the vital principle of all great poetry, Herder made the German poetry German, and the wild aberrations of some members of the romantic school are no faults of his, or of his principles. He was a sober-minded and sound-hearted man; the elegance and dignity of his style are a true reflex of the brightness and soundness of his ideas. His most interesting and most important work is his *Ideen zur Philosophie der Geschichte der Menschheit* ("Ideas of the Philosophy of the History of Mankind"). During the eighteenth century the old, narrow view of history as a string of events, without any other causation than the passions and follies of individuals, had faded away. But, very characteristic with respect to the pedagogical turn of all ideas of that century, the highest idea of history became that of an educational process. (See LESSING's *Ueber die Erziehung des Menschengeschlechts*.) Herder was the first to set forth the idea of history as the development of a national genius, as the growth of a vital power, as an evolution—an idea which reached its most brilliant perfection in the philosophy of Hegel. CLEMENS PETERSEN.

Herd Grass. See TIMOTHY.

Herd's Island, one of the sea-islands of McIntosh co., Ga. Pop. 13.

Heredit'aments, Incorpo'real, in law. By the term "hereditaments" is meant any property which on the death of an individual owner, without a disposition of it by will, passes to an heir. By the English common law all the property of an intestate must devolve either upon his administrator or his heirs; personal property passing to the administrator, and real to the heirs. The word "hereditaments" thus becomes one of the most comprehensive terms in the law to indicate real property or landed interests. The distinction between "hereditaments" on the one hand, and "chattels" (as indicating personal property) on the other, is thus of great practical importance, as the two classes of property are governed by distinct sets of rules. (See REAL PROPERTY.) Hereditaments are of two kinds—corporeal and incorporeal. The former term is used to indicate the land itself. (See LAND.) Incorporeal hereditaments, the subject of this article, are intangible, and are rights claimed by one person in the land of an-

other. The right in legal phrase is *dominant;* that is, it is superior to the claims of the owner of the land over which it is exercised. The land to which the right is attached is said to be *servient.* In other words, the right of the owner of it is subordinate to that of the owner of the incorporeal interest. The Roman lawyers, regarding the subject principally from this point of view, used the term "servitutes" to indicate this class of rights. (See SERVITUDES.) An illustration is readily found in the case of a highway. A private owner may own the land over which a highway passes, but his right to make use of it is plainly subservient to the power of the public to use it for the purposes of travel, etc.

There are a number of rights in England that are deemed to be incorporeal estates which have no existence in this country, such as *advowsons,* or a right of presentation to a church; *tithes,* a right of an ecclesiastical nature to take a portion of the profits of land for the use of the church (see TITHES); and certain public *offices,* of which an example is the office of a sheriff. *Dignities* or titles of nobility, and *annuities,* belong to the same class. In the U. S. incorporeal hereditaments are divisible into three principal classes—*profits à prendre, easements,* and *rents. Profit à prendre* is a phrase derived from the Norman-French language, indicating a profit which consists in taking something from the land of another, such as a right to take fish, petroleum, or minerals. Rights of this kind in the English law are sometimes known as "rights of common." These have been divided into four principal classes—pasture, piscary, turbary, and estovers. The first signifies a right of one or more persons to pasture cattle upon the land of another; the second, to take fish from another's land; the third, to take turf, coal, or minerals; and the fourth, to take necessary wood or timber for the purpose of repairs of buildings. These rights, so far as they refer to pasturage or fishing or repairs of buildings, are not frequently under consideration before the courts of this country. The right to take minerals is of great importance in certain districts. It is not uncommon in these localities to find grants by the owners of land conferring upon grantees the right to take specified minerals, or to sink wells to obtain salt or other substances. In this class of cases the right is dominant in the sense already explained; and if a grant of this kind be unrestricted, the owner of the land must submit to the disturbance of the soil in order to reach the minerals, and may, perhaps, be debarred from all profitable use of the land. A distinction must be carefully taken between the right to mine and a grant of the minerals. In the latter case there would be two ownerships—one of the surface land, and the other of the minerals beneath it; and it would not necessarily follow that the owner of the minerals could disturb the surface. The subject may be pursued in works upon mining; *e. g.* Bainbridge or Collier.

An easement differs from a *profit à prendre* in the fact that nothing is taken by the owner of the incorporeal right from the land over which it is exercised. This class of rights has already been considered. (See EASEMENT.) A special instance of the application of this branch of the law may be found in the interest which the public may acquire in the land of an individual by an act termed "dedication." The meaning of this word is the act of giving up one's land to public use, as for the purposes of a highway or park. The public, *as such,* cannot be a grantee, as it is a fluctuating body of persons. An easement is, however, acquired over the land of the dedicator by the doctrine of estoppel. (See ESTOPPEL.) The theory of the case is that there is a representation by the owner to the public that they may make use of his land for a special purpose, and an act done by them on the faith of the representation. A dedication may be implied in cases where the public encroach on the rights of the owner, and he makes no resistance for a considerable period of time; *e. g.* for twenty years. Under these doctrines the public must take the subject-matter dedicated according to the intent of the owner as expressed by his acts. Thus, if he should dedicate land for a highway in which there is an open pit he would be under no obligation to fill it up or make the place convenient for travel. The owner after dedication may still use the land in any way not inconsistent with his action towards the public, and must be regarded in all respects as owner, except so far as the public have claims upon him by virtue of the dedication. (The subject of easements may be further studied in WASHBURN *On Easements,* and in GALE on the same.)

The third class of incorporeal hereditaments is that of rents. By a rent is meant the right which one person possesses to call upon another to pay him periodically a sum of money or a thing as a return for the use of land. It differs from a *profit à prendre* in the fact that while this is a part of the land itself, a rent is no part of the land, but is some new and independent thing. (The details of this subject will be stated under RENT. See also GILBERT *On Rents,* and LUMLEY.)

There is an important class of incorporeal rights termed franchises (see FRANCHISE), which cannot be strictly ranged under either of the three principal classes of hereditaments already considered. A franchise is an exclusive privilege vested by law in individuals or corporate bodies. It is sometimes a *profit à prendre,* as an exclusive right to fish in public waters or to hunt on public grounds. Again, it may impose on the land of another an easement. Thus, an exclusive right to maintain a bridge or ferry within certain limits over a stream would impose a negative easement upon owners of lands within the prescribed limits not to use or permit their lands to be used so as to establish an interfering ferry or bridge. Accordingly, it is more convenient to consider franchises separately from other incorporeal rights, from the point of view that they are grants of the sovereign power conferring privileges and imposing obligations, and are in the nature of a contract between the state and the grantees, and liable to be resumed by the state, through judicial action, when improperly exercised or abused.

When an incorporeal right is enjoyed in connection with the ownership of an estate, it in general follows the ownership as that passes from one to another. A sale transfers it to a purchaser. An example is a right of way over the land of another as incidental to the ownership of adjoining land. On the other hand, the right may be a mere personal privilege, having no connection with the ownership of land, when it would be termed a right "in gross."

T. W. DWIGHT.

Hered'itary Characteris'tics. The laws which govern the transmission of hereditary characteristics are generally unknown, but the number and diversity of inheritable deviations of structure and peculiarities of temperament are endless. Every breeder of cattle is satisfied that the vigor, fleetness, and other qualities of the dam and sire are hereditary; theoretical writers alone have doubted the fact. Darwin considers that the correct way of viewing the subject is to look at the inheritance of every character whatever as the rule, and non-inheritance as the anomaly. No one, however, can explain why the same peculiarity in different persons is sometimes inherited and sometimes not. Scientists have not explained how it is that a man may possess characteristics which have been observed in his grandfather or great-grandmother, and have not appeared in his own parents. Equally inscrutable too is the fact of the transmission of a characteristic from one sex to both sexes, or to one sex alone, generally the like sex. Darwin is of opinion that at whatever period of life a peculiarity first appears, it tends to reappear in the offspring at a corresponding age, though sometimes earlier. An instance in point is in the writer's knowledge. A lady in her youth observed one of her toes to be growing in a slanting direction. In her daughter the same peculiarity was observable in early youth, and two granddaughters are at present developing the same feature. Another circumstance related by Mr. Galton is equally interesting. A gentleman of position was found by his wife to be in the habit, when lying on his back fast asleep in bed, of raising his right arm and dropping it suddenly with a jerk, so that the wrist fell heavily on the bridge of his nose. The nose was prominent, and suffered, as at times the trick was continued for an hour or more. It was not of nightly occurrence, but took place occasionally, and we are assured was independent of any ascertained cause. Some years after this gentleman's death his son married a lady who observed the same peculiarity in her husband. The blows were dealt with the right hand, were intermittent, and sometimes lasted during a greater portion of the night. They did not occur when the sufferer was half asleep, dozing in an arm-chair for instance; only when he was fast asleep. One of his children, a girl, has also inherited the trick. In her case the right arm is raised, and the palm of the half-closed hand, not the wrist, drops over and down the nose, striking it rather rapidly. The trick is intermittent; sometimes it will not occur for periods of some months, at other times it takes place incessantly. The value of the above anecdote consists in the fact that the hereditary characteristic cannot but be natural; as it occurs only during sound sleep, it cannot be due to imitation. Tendency to blush is likewise inherited. Dr. Burgess has treated this especial feature in detail in his work on the *Physiology of Blushing.* He gives a case of a family consisting of a father, mother, and ten children, all of whom blushed painfully. Separation from one another by travel was tried without success. Blush they all did until the end of their days. Sir J. Paget relates that when once examining the spine of a girl he was struck with the peculiarity of her manner of blushing. A splash of red appeared first on one cheek, and then other splashes scattered over the face and neck. The surgeon inquired of the mother

whether the daughter always blushed in the same manner, and the former, whilst assuring him of the fact, blushed in the same peculiar way herself.

With respect to animals, it has been ascertained that there is a prepotency in transmitting likeness running more strongly in one sex than the other. This rule applies to cases when one species is crossed with another, and when one variety is crossed with another variety. Darwin maintains that the ass has a prepotent power over the horse, so that both the mule and the hinny more resemble the ass than the horse, but that the prepotency runs more strongly in the male ass than in the female; so that the mule, which is the offspring of the male ass and mare, is more like an ass than is the hinny, which is the offspring of the female ass and stallion. (*Origin of Species.*) In like manner the offspring of a union of persons of the black and white human races is of an intermediate tint, but the color of the father usually predominates over that of the mother. Dr. Prosper Lucas, the author of two volumes on the subject (*L'hérédité Naturelle*), arrives almost at the same conclusion as does Mr. Darwin.

There are numerous instances on record of the strange and undoubted transmission of peculiarities. Lambert, "the porcupine man," whose skin was covered with warts which were moulted periodically, had all his six children and two grandsons similarly affected; whilst faces and bodies covered with long hair and deficient teeth were observable in three generations of a Siamese family. Dr. Hodgkin tells of an English family in which for many generations certain members possessed a single lock of a color different from the rest of the hair. Mr. Darwin knew an Irish gentleman who had a small white lock in the midst of black hair—a peculiarity evidently inherited, for his grandmother had a similar lock on the same side of the head, and his mother one on the opposite. Another remarkable case came under Mr. Darwin's own observation. "A boy had the singular habit when pleased," he writes, "of rapidly moving his fingers parallel to each other, and when much excited of raising both hands, with the fingers still moving, to the sides of the face on a level with the eyes; this boy, when almost an old man, could still hardly resist this trick when much pleased, but from its absurdity concealed it. He had eight children. Of these, a girl when pleased, at the age of four and a half years moved her fingers in exactly the same way, and, what is still odder, when much excited she raised both her hands, with her fingers still moving, to the sides of her face in exactly the same manner as her father had done, and sometimes even still continued to do when alone. I never heard of any one excepting this one man and his little daughter who had this strange habit; and certainly imitation was in this instance out of the question." (*Variation of Animals and Plants under Domestication.*) Anderson, in his *Recreations in Agriculture and Nat. Hist.*, states that a rabbit gave birth to a young one having but one ear, and that from this animal a breed was formed which produced one-eared offspring. Also a bitch with three legs has been known to produce puppies with the same deficiency. According to Hofacker (*Ueber die Eigenschaften*), a one-horned stag was seen in 1781 in a German forest; in 1788 two, and subsequently from year to year many more were seen carrying one horn on the right side of the head. Lord Brougham once found some of his grandfather's handwriting exactly similar to his own, which was itself peculiar. His grandfather had died before he was born, and his father's handwriting was widely different. Blumenbach declares that parents, either human or brute, that have suffered amputation or mutilation, often transmit the injuries to their offspring; that a bitch with a cropped tail will frequently produce puppies with cropped tails. Considerable doubt is felt whether the theory be correct; Darwin is not certain. Smallpox marks are not inherited, neither are Chinese children born with feet compressed and stunted. Jewish medical men aver that circumcision which has been practised for ages has produced no inherited effect (*Darwin*); and on the other hand Blumenbach asserts that in Germany Jews have been born in a state rendering circumcision difficult, to whom the term "born circumcised" has been applied. Dr. Prosper Lucas holds to Blumenbach's views, and gives a list of inherited injuries, of which that of a cow losing a horn from an accident and producing three calves hornless on the same side of the head, may be taken as an example. Blumenbach relates how a man suffered mutilation of one of his little fingers, causing the member to grow crooked, and how each of his sons had the same finger on the same hand crooked also.

It was for a long time doubted whether genius and talent were hereditary even where both parents were endowed. An admirable work by Mr. F. Galton (*Hereditary Genius*, London, 1869) has, however, settled the question. The writer desires to prove that, as it is easy by careful selection to obtain a remarkable breed of horses or dogs, it would be equally practicable to produce a highly-gifted race of men by judicious marriages during several consecutive generations; that, in fact, a man's natural abilities are derived by inheritance under the same limitations as are the form and features of the whole organic world. To prove the case the author discusses the relationships of a large body of eminent men, taking reputation to be the test of eminence. He reviews the judges of England from 1660 to 1868, the statesmen of the time of George III., and the prime ministers during the last 100 years. Subsequently, after discussing the relationships of illustrious commanders, men of letters and science, poets, painters, musicians, divines, scholars, oarsmen, and wrestlers, he arrives at his results. In the 300 families under discussion nearly 1000 are eminent and 415 illustrious. The general result is that one-half of the illustrious men have one or more eminent relations. For instance, in the case of lord chancellors the proportion is 24 in 30; statesmen of George III., 33 in 53; premiers, 8 in 16; commanders, 32 in 59; literary men, 37 in 56; scientific men, 65 in 83; poets, 40 in 100; musicians, 26 in 100; painters, 18 in 42; divines, 33 in 196; scholars, 14 in 36. These proportions reduced to decimals are .8, .6 and .5, .5, .7, .8, .4, .2, .4, giving a general average of .5, or one-half. (*Hered. Genius*, p. 322.)

The same writer has satisfactorily shown also that tendency to sterility is inherited. It is a fact that a large proportion of new English peerages are constantly dying out, and the ascertained reason is that many fresh-created peers or their sons marry heiresses. It can be argued that a woman who has no brothers or sisters is more likely to be sterile than one who possesses several, whilst the reasons for marriages between the eldest sons of new peers and heiresses are many and intelligible. Such marriages are usually unprolific. Mr. Galton draws a long list of judges who obtained peerages, and arrives at the conclusion—1st, That out of the thirty-one peerages there were no less than seventeen in which the hereditary influence of an heiress or co-heiress affected the first or second generation; that this influence was sensibly an agent in producing sterility in sixteen out of the seventeen peerages, and the influence was sometimes shown in two, three, or more cases in one peerage. 2d, That the direct male line of no less than eight peerages was actually extinguished through the influence of the heiresses, and that six others had very narrow escapes from extinction, owing to the same cause. One case alone, that of Lord Kenyon, is known where the influence of the heiress was not felt. 3d, Out of the twelve peerages that have failed in the direct male line, no less than eight failures are accounted for by heiress-marriages. (*Hered. Gen.*, p. 135.) Further research shows the following results from a list of marriages of certain peers after comparison with the numbers of the children when the mother was an heiress with those when she was not: One hundred who are heiresses have 208 sons and 206 daughters; 100 who are not heiresses have 336 sons and 284 daughters. (*Ibid.*, p. 139.)

That certain diseases are inherited is beyond all doubt. Insanity, gout, syphilis, consumption, scrofula, and kindred maladies have been long regarded as hereditary. Sir Henry Holland says: "The hereditary tendency to disease, regarding the subject in its most general light, shows itself either in the abnormal conformation of particular organs or textures, or in the presence and transmission from parent to offspring of certain morbid products, either altogether new or vitiated in kind or faulty by excess." Whether, however, these products be referable, as effects, to variations in some part of the organic structure, whether, in fact, the solids of the body alone, or the animal fluids and the blood also, carry on the peculiarities through generations, is a question not to be satisfactorily answered at present. The physician whose words are quoted above relates many personal experiences of hereditary disease. He knew a family in which the father and two children were unable to distinguish red as a color; he has seen squinting occur in five children when both father and mother were similarly afflicted. In another family, where the father possessed an elongation of the upper eyelid, seven children were born with the same malformation, whilst two or three did not inherit it. Dr. Jackson of Boston, Mass., discovered that emphysema of the lungs depends for the most part on hereditary influence, independently of any disposition to tubercular pulmonary disease. The frequency of certain maladies in particular districts is illustrative also of a tendency to the inheritance of disease. The goître, for instance, stone in the bladder, and plica polonica are known to infest certain localities where there is no obvious peculiarity of air, water, or food as a possible cause. Holland (*Medical Notes*) writes that when in Iceland in 1810 he had the opportunity of collecting some facts as to the singular frequency of the disease *Trismus*

nascentium in the Vestmann Isles on the southern coast of this island. On these desolate rocks, the population of which does not exceed 160 souls, he found that in a period of twenty-five years 186 infants perished of this disorder under the age of twenty-one days, of which 161 died between the fourth and tenth days after birth; 75 on the eighth day. Though the condition of life of the people is destitute—fish and eggs of sea-birds are their only nutriment—yet it is not so different from that of the Icelanders of the mainland as to explain the frequency of the disorder among them. Sir H. Holland was of opinion that some constitutional and hereditary causes were concerned. In scrofulous temperaments it is well known that there is a marked diversity in the forms of the disease and the parts of the body it afflicts, yet there is a strong tendency to the same form in the same branch of a family affected. In some cases it results in partial or complete blindness; in others the joints are affected; in many cases pulmonary consumption sets in.

Disorders of the brain and the nervous system are generally hereditary, insanity being conspicuous as an inherited taint. Whence Holland is of opinion that some deviation of physical structure, obvious or not, is the cause of mental aberration—that part of the fabric of the brain, too minute for even subtle research to follow, is concerned in the transmission. Headaches and neuralgia offer constant evidence to medical men of the transmission of these disorders, although in nervous diseases like results are occasionally due to imitation. A noteworthy point in the consideration of the subject is the disposition of individuals of the same family to be similarly attacked by given maladies, and to suffer from the same after-effects, as in hooping cough, measles, and other infantile maladies. From which parent a predisposition to disease is more frequently derived is still an open question. Dr. Nasse of Bonn considers that in some cases the mother is answerable, whilst Sir H. Holland opines that the matter merges in the more general one of the transmission of physical resemblance from parent to child, and that diseases must be considered as derived equally through the two sexes. (*Principles of Human Physiology*, CARPENTER, London; *Medical Notes and Reflections*, HOLLAND, London.)

We have stated above that Mr. Darwin has declared the transmission of characteristics to be the rule, not the exception. The following are in his opinion checks to inheritance: "First, circumstances hostile to the particular character in question; secondly, conditions of life incessantly inducing fresh variability; and, lastly, the crossing of distinct varieties during some previous generation, together with reversion or atavism—that is, the tendency in the child to resemble its grand-parents or more remote ancestors, instead of its immediate parents." (*Variation of Animals and Plants under Domestication.*) W. J. DIXON.

Hereditary Privileges. See PRIVILEGES, by PRES. T. D. WOOLSEY, S. T. D., LL.D.

Her′eford, city of England, the capital of the county of Hereford, on the Wye. It is the see of an Anglican bishop; has a noble cathedral commenced in 1079, some manufactures of gloves and flannels, and a large cattle-fair. Pop. 15,585.

Hereford, post-tp. of Berks co., Pa. Pop. 1260.

Her′efordshire, county of England, situated between South Wales and the counties of Worcester and Gloucester. It contains 534,823 acres of land, consisting of a heavy red loam, and has an undulating surface, which towards the W. rises into the Black Mountains, and towards the E. into Malvern Hills. Wheat, barley, oak-bark, and apples are the principal products; 20,000 hogsheads of cider of superior quality are made annually. Herefordshire belonged to the old province of Mercia, and is rich in interesting ruins from the times of the Saxons. The county is famous for its fine breed of cattle. Pop. 123,659.

Heren′cia, town of Spain, in the province of Ciudad Real. It is a handsome town. Pop. 7317.

Her′esy [αἵρεσις, from αἱρέω, "to take," "taking" (as of a city)], choice, preference, chosen way of life, of belief, doctrine, or teaching; a sect, school, party in philosophy, medicine, literature, or religion; the doctrine of such a party; hence discord, separation, faction as the result of such views. In the New Testament *hairesis* means sect and faction. The *hairetikos* (Tit. iii. 10) is a fomenter of divisions, whether by false doctrines or factious practices. Nearly all the languages of Christian nations have terms derived from the Greek *hairesis*. In its later sense, heresy involves an idea unknown to the classic religions. In this now universally prevalent sense, heresy is a doctrine in conflict with important truth. In the Church it is a doctrine perversely held by nominal Christians in conflict with an ARTICLE OF FAITH (which see). *Blackstone:* "Heresy consists not in a total denial of Christianity, but of some of its essential doctrines, publicly and obstinately avowed." (*Comm.* iv. 4.) *Carpzov,* the jurist: "A pertinacious error in articles of faith." *Sir Matthew Hale:* "An opinion concerning divine things devised by the human mind, publicly taught, and pertinaciously defended." *Jäger:* "In its broader sense, every doctrine which indeed on one side still retains the Christian religious character, but on the other embraces elements which logically carried out destroy the principle of Christianity and its absolute force." (*Herzogs, R. E.*, v. 453.)

As the term is relative, all enumerations of heresies are relative. That is considered heresy on one standard which is accepted as sound belief on another. Heresy may be the opinion of individuals unorganized, or it may be the doctrinal basis of *heretical sects*. Such were the GNOSTICS and MANICHEANS (which see). That is heresy by the general judgment of the great body of the Christian world which is in conflict with the three general Creeds. (See CREED.) The Roman Catholic Church and Greek Church consider as heresy all doctrines conflicting with the general Creeds and their own confessional standards. *Hilgers:* "Heresy is a dogma or system claiming to be Christian, in opposition to the definitively expressed, universal faith of the Catholic Church." (*Aschbach's K. L.*, iii. 172.) Among evangelical Protestants the term heresy was most commonly applied to doctrines in conflict with the general Creeds. But at the beginning, almost universally, and still to some extent, the word is used to mark all doctrines in conflict with FUNDAMENTALS (which see), as defined in the confessions of particular Protestant bodies. A heretic is a fundamental errorist. The term is less and less used. From fixing odium, it has, by reaction produced by its abuse, become odious. Men dislike the term, and have become careless about the thing. Heresy is allied to HETERODOXY (which see), but is a narrower and harsher term. INFIDELITY (which see) rejects, and SKEPTICISM (which see) doubts revealed truth. SCHISM or SECTARIANISM (which see) rends the Church on questions which really belong to her liberty. Heresy corrupts what it professes to accept. Schismatists separate from the Church, and heretics are cast out of it. Error, simple, may be no more than a mistake of the intellect; heresy involves a voluntary and persistent perversion of the truth; blasphemy is reproachful language against God or divine things. *Gerhard:* "Four things are necessary to constitute heresy: (1) error in the understanding; (2) in conflict with the faith, for not every error is heresy; (3) conjoined with pertinacity in the will; (4) membership in the Christian Church by baptism." (*Loci* (*Cotta*), xi. 231.) The heresies of an age are usually the shadows of its characteristic truths. The entire body of opinions seem to need shaking to bring truth to the top. When the human mind is attempting to settle in some finality of decision, all the theories which can test that decision or help to make it up become prominent. When God was manifest in the flesh the crisis of demon-power was also manifest in the flesh. The ultimata of orthodoxy and the counter-assertions of heterodoxy came to ripeness together. We have in the same age Arius and Athanasius, Pelagius and Augustine.

The infirmities of the human mind and character, the vast and profound problems involved in religion, the obscurities of the language interpreted and of the language interpreting, the extravagant development of isolated parts of a truth, the tardiness of pace on the part of some who remain behind in a position once general, but afterwards abandoned (such was MONTANISM, which see), the influences of education, of special mental types, of speculative and practical systems, the passions of men, the love of novelty, and the overbearing of a blind conservatism, and many of the best principles of our nature, mistaken, distorted, or perverted, are among the causes of heresies. Many heresies are mere blunders of phraseology, and the wars in them have been wars of words.

The *treatment* of heresy in the Church has been very varied. In the early Church, not merely from the necessity of her condition, but from principle, the means of correcting it were purely moral. Not until admonition, reproof, and instruction were exhausted did the Church resort to excommunication and anathema. The early Church was averse to capital punishment in general. Irenæus († 202) and Tertullian († before 240) were among the earliest authors of treatises against heresies. NOVATIANISM (which see) was punished by deposition (251). With the conjunction of Church and State heresy came to be regarded as also a civil offence, in the nature of a double treason, and was punished by the magistracy with forfeiture of office and dignities, deprivation of the right of bequeathing and receiving bequests, with confiscation of property, and death. The first instance of the infliction of death on heretics was the beheading of Priscillian and two of his adherents (385). It was brought about by some of

the Spanish bishops, but was offensive to the larger part of the Church, and was protested against, among others, by Pope Siricius (384–398), though he had been specially active in repressing Priscillianism. From the twelfth and thirteenth centuries the treatment of heresy was one of general persecution, leading to bloody wars. Courts for the trial of heresy were established throughout Western Christendom, with a body of *judges* of heresy, presided over by *masters* of heresy. These courts formed the INQUISITION (which see). They made decisions involving the property, freedom, and life of all who were charged with deviation from the faith of the Roman Catholic Church. The first great official voucher for an important change from this state of things was the Peace of Westphalia (1648), according to which the three Confessions, the Roman Catholic, the Lutheran, and the Reformed, were acknowledged as in all civil respects non-heretical. The pope issued a bull declaring the provisions of the instrument of this peace null and void. In Rome, on Thursday of Holy Week, there was until Clement XIV. (1769–74) a public reading of the bull IN CŒNA DOMINI (which see), in which there is an enumeration and anathematizing of heresies. A similar document is read in the Greek Church by the patriarch of Constantinople on Quadragesima (hence called Orthodox) Sunday. In the Church of England the third collect for Good Friday embraces a prayer for all heretics.

In the earlier Reformed views of the treatment of heresy there was a concurrence in general with the principle that it should be dealt with by the civil magistracy. Calvin (1554) and Beza wrote in defence of the right and duty of putting heretics to death, and this was almost unchallenged among the earlier Calvinistic divines. It is the influence of association with this style of thought which accounts for the fact that Melanchthon, contrary to his gentle spirit and the judgment of all the German divines, concurred in the righteousness of the execution of SERVETUS (which see). Luther opposed the use of coercion in removing heresy, and Castellio quotes him and Brentius in his reply to Calvin (1554). The Augsburg Confession expressly denies the right of civil government over questions of heresy. (Abus. art. vii. 6.) The preface to the Book of Concord makes a solemn protest against the persecution of the HUGUENOTS (which see). The Lutheran Church stood almost alone for a time in denying that heresy should be punished with death. (See KRAUTH's *Conservative Reformation*, 138–147.) In England, under the statute "De hæretico comburendo" (1401), many of Wiclif's followers were burned to death. Under Henry VIII. offences against the see of Rome ceased to be heresy, but (1539) the Six Articles, all of them asserting distinctive parts of the Roman Catholic doctrine, were set forth, and the penalty of death attached to the rejection of any of them. (See BROUGHAM's *Political Philosophy*, iii. 261.) They were repealed in the first year of Edward VI. (1547). The law under which heretics were burned to death was abolished under Charles II. (1676). The last person put to death in Great Britain for heresy was Thomas Aikenhead, a young student of divinity, executed in Edinburgh (1696), under a statute against BLASPHEMY (which see). (See MACAULAY's *History of England* (New York, 1856), iv. 621, and HUGH MILLER's *Macaulay on Scotland*, a critique from the *Witness*.) The statute was repealed under George III. (See PERSECUTION.) The Arminian divines of Holland favored the milder judgment and treatment of heresies. (See CURCELLÆUS, *Opera* (1675), 81, 579–595, 830.) (For the most important trial for heresy of recent date see GORHAM CONTROVERSY.) It may now be regarded as a fixed principle of nearly the entire Protestant world that civil government has no right to interfere with the mere holding of religious opinions, however wrong, nor to repress any publication of them or acting upon them which does not interfere with the civil order and law of the land.

Heresy has given us a number of terms: *Heretic*, one who holds a heresy; *heretical; heresiarch*, a leader in heresy; *arch-heretic*, one who is prominent as a representative of heresy; *heresio-mastix*, a scourger of heresy; and the now obsolete *hereticate*, to stamp as heresy.

The literature of heresy embraces works on its general character (see *Danz. U. W. Ketzerei*); heresiology, the polemical works which discuss the various forms of heresy (see POLEMICS, THEOLOGICAL); works on its general history (such as Mosheim, 1748–50; Walch, 1762–85; Baumgarten, 1766; Fuessli, 1770–74; Von Einem, 1789); history of particular heresies (see under the special articles ALBIGENSES, APOLLINARIS, ARIUS, etc.). The best histories of the Church and of dogma in general also embrace the history of heresies; see ECCLESIASTICAL HISTORY. The bibliography will be found in Buddeus's *Isagoge*; Walch's *Bibliotheca Th. Sel.*; Winer, *Handbuch d. Theol. Lit.*; and in Hagenbach, *Encykl. u. Methodol.*, 9th edit. 1874, 244, 275–277.

C. P. KRAUTH.

Her'ford, town of Prussia, in the province of Westphalia, on the Werra. It has some manufactures of linen and yarn. Pop. 10,968.

Her'ing (CONSTANTIN), M. D., a Homœopathic physician, b. Jan. 1, 1800, at Oschatz, in Saxony, and in 1825 received medical, chirurgical, and obstetrical degrees at Würtzburg, and soon started on a scientific tour to Guiana, under the botanist Weigel. In 1834 he became a resident of Philadelphia. Author of *Rise and Progress of Homœopathy* (1834), *The Domestic Physician* (1858), *American Drug Provings* (1853), and various medical and other essays.

Her'iot (GEORGE), founder of the Heriot Hospital and Heriot Schools of Edinburgh, b. in that city about 1563. Having been appointed goldsmith to the king and the queen, he removed to London when James VI. became king of England, and here he accumulated a large fortune, of which he left the greater part on his death in 1624 to the town council and ministers of Edinburgh to found a hospital in that city for the maintenance and education of the sons of poor, deceased, or decayed burgesses. As in the course of time the revenues considerably exceeded the expenditures, a number of schools, in which free instruction is given to poor children, was added to the hospital in 1837. About 180 boys are now educated in the hospital, and about 3000 children receive instruction in the schools.

Heriot (JOHN), b. at Haddington, Scotland, Apr. 22, 1760; studied at the University of Edinburgh; entered in 1778 the royal marines, and became a lieutenant; was put on half-pay in 1791, and started, on the suggestion of Burke, *The Sun* in 1792, and *The True Briton* in 1793, which were published against the ideas of the French Revolution. In 1809 he received an office as paymaster, and in 1810 as controller at the Chelsea Hospital. D. June 30, 1833. He wrote also romances—*The Heart-broken, The Half-pay Officer*, etc.

Her'isau, an old, romantic, beautifully situated town of Switzerland, in the canton of Appenzell, capital of the Outer Rhodes, on the Glatt, has large manufactures of muslins and calicoes, and extensive dyeworks and bleaching-fields. Pop. 9736.

Heristal, or **Herstal,** town of Belgium, province of Liège, on the Meuse, forms now nearly a suburb of Liège, and is mostly inhabited by mechanics and workingmen. Is the seat of great manufacturing establishments, especially in iron and steel, and was the birthplace of Pepin, founder of the Carlovingian dynasty. Pop. 9326.

Her'kimer, county of N. E. Central New York. Area, 1745 square miles. Its surface is broken by numerous ridges. Iron ore and limestone are found, the latter abundantly. The soil is generally good, except in the N., and is especially adapted to grazing. Live-stock, wool, grain, hops, and dairy products are the great staples. Cheese, lumber, boxes, harnesses, flour, leather, lime, metallic wares, furniture, etc. are largely manufactured. The N. part of the county is a part of the great wilderness of Northern New York, and is very sparsely settled. The county is traversed by the Erie Canal, the river Mohawk, and the New York Central R. R. Cap. Herkimer. Pop. 39,929.

Herkimer, post-v. and tp., cap. of Herkimer co., N. Y., 81 miles W. of Albany, on the New York Central and the Hudson River R. Rs. It has good educational advantages, 1 bank, a paper-mill, 1 flouring-mill, a hoop-skirt factory, and the principal office of the Farm Building Fire Insurance Co.; 1 weekly newspaper, 3 churches, 4 hotels, and a horse railway $1\frac{1}{2}$ miles in length. Pop. of v. 1220; of tp. 2949.

JACOB H. WEBER.

Herkimer (NICHOLAS), b. about 1720, the son of J. J. Herkimer (or Erghemar), a German from the Palatinate, who was one of the patentees of the Burnettsfield patent, now in Herkimer co., N. Y. The son became a militia lieutenant 1758, and commanded at Fort Herkimer on the Mohawk (now in German Flats, N. Y.) in that year, at the time of the French and Indian attack. He soon afterwards lived in the Canajoharie district, now in Montgomery co.; became colonel of militia for Tryon co. 1775; appointed brigadier-general by the State convention 1776; marched against Sir John Johnson's Tories and Indians 1776; led an expedition to the relief of Fort Stanwix (now Rome, N. Y.), then besieged by St. Leger; was ambuscaded by the Indians, defeated, and wounded in the leg, at Oriskany, Aug. 5, 1777; suffered unskilful amputation, and d. in consequence Aug. 17, 1777, at Danube, N. Y., where he resided. Congress voted (Oct. 1777) to erect a monument to "Brigadier Harkemer," but the vote was forgotten and the monument was not erected.

Her'man, post-v. of Washington co., Neb., on the Omaha and North-western R. R., 40 miles from Omaha.

Herman, post-tp. of Dodge co., Wis. Pop. 1935.

Herman, tp. of Sheboygan co., Wis. Pop. 2252.

Her'mandad (Sp., "brotherhood"), a general name for the leagues entered into by the Spanish cities in the Middle Ages for the preservation of public order and the defence of private property. The most celebrated (called Santa Hermandad, or Holy Brotherhood) was probably organized in Aragon in the thirteenth century; was established in Castile in 1282. Another, of thirty-five towns in Castile and Leon, was organized in 1295. Kindred societies throughout Spain soon followed. Their laws were codified in 1485, and published in 1527. In 1488 the Holy Brotherhood was reorganized, and in 1496 it was extended over a great part of Spain. In 1498, Ferdinand and Isabella reduced it from its high office of conservator of the peace and defender of popular rights against the feudal nobility, and it became an organized police force. In 1520–21 the Hermandad of Valencia rose in insurrection against the government. The name has come down to the present century simply as that of a police force.

Her'mann [Lat. *Arminius*], a German chieftain of the Cherusci, a son of Sigimer, was b. 18 B. C.; entered the Roman service, and became an equestrian. In 9 A. D., when Germany was groaning under the oppression of Varus, Hermann ambuscaded the Romans in the Teutoburger Forest, and almost all the Romans, Varus included, lost their lives. He fought Germanicus (14–16 A. D.), with disadvantage; defeated Marbodacus, king of the Suevi, 17; was put to death by his own relations 19 A. D., on the ground that he was aiming at absolute power.

Hermann, post-v., cap. of Gasconade co., Mo., 81 miles from St. Louis, on the Missouri Pacific R. R. and the Missouri River. It has a savings bank, a high school, 2 newspapers (English and German), 4 hotels, a planing-mill, and a large number of stores and public places. It is noted for wine-growing, its annual production being 400,000 gallons. Pop. 1335, exclusively German.

CHAS. EBERHARDT, PUB. "ZEITUNG UND ADVERTISER."

Hermann (JOHANN GOTTFRIED JAKOB), b. at Leipsic Nov. 28, 1772; studied law, languages, and philosophy at Leipsic and Jena, and was appointed *professor eloquentiæ* in 1803 at the University of Leipsic, which position he filled to his death, Dec. 31, 1848. He exercised great influence on metrical science by his *De metris Græcorum et Romanorum poetarum* (1796) and *Handbuch der Metrik* (1798), etc.; and on grammar by his *De emendanda ratione Græcæ grammaticæ* (1801), and a number of minor essays. Also as a text critic he acquired a great name; he edited Æschylus, Euripides, Aristophanes, Bion and Moschus, and others. His lectures were very attractive by their liveliness and clearness, and very instructive by their fulness of knowledge; but his standpoint as a philologist, considering the classical languages as the only key to the understanding of the classical spirit, involved him in disagreeable contests with Böckh, O. Müller, and Creuzer.

Hermann (KARL FRIEDRICH), b. at Frankfort Aug. 4, 1804; studied at Heidelberg and Leipsic; travelled in 1825 in Italy, and was appointed professor in philology at Marburg in 1832, whence he removed in 1840 to Göttingen. D. Jan. 8, 1856. He combined in a happy manner the linguistical element of classical scholarship with the antiquarian, historical, and philosophical, and his *Lehrbuch der griechischen Alterthümer* (1841) and *Geschichte und System der platonische Philosophie* (1839), as well as his *Culturgeschichte der Griechen und Römer* (1857), are much appreciated.

Her'manstadt, town of Hungary, in the province of Transylvania, on the Zibin. It is a beautifully situated and well-built town, the seat of the governor of the province and of a Greek archbishop, metropolitan of Transylvania. Pop. 18,588.

Hermaph'rodism, or **Hermaph'roditism** [named from the fabled HERMAPHRODITUS (which see)], the union of the characteristic organs of each of the sex in one individual. This union of the male organs (producing sperm-cells) and female (producing germ-cells) in one and the same organism is the normal condition in the great majority of plants and in many of the lower animals. Though the higher forms of radiates, mollusks, and Arthropoda all have the sexes quite distinct, except in abnormal instances, many of the inferior types of each are always hermaphrodites. Such, for instance, are the common snail and the earth-worm. No insect hermaphrodites (unless the Tardigrades are insects) are known, except in abnormal instances. Siebold found hermaphrodites among honey-bees, but he records that the workers threw them out of the cells, and that they speedily perished. It has been suggested that this hermaphrodism in bees may exist normally in some slight degree, and that it may give rise to the parthenogenesis of male bees, for it is well known that queen bees will produce male offspring without coitus with the male.

Hermaphrodism has not been observed with certainty in vertebrates, except perhaps in eels and fishes of the family Serranidæ. It has been stated with considerable force that the homologies existing between the male and female organs prevent any possibility of hermaphrodism in the higher vertebrates; but there is no apparent reason why of bilateral or double organs one side should not assume the male and the other the female development. Thus, there might, it would appear, be one ovary and one testis—a condition analogous to what is often seen in the lower animals. In what are known as monstrosities by fusion, or the blending of two germs, by which have been produced such abnormalities as the presence of three legs upon one fœtus, we seem to see that true hermaphrodism is not *a priori* impossible, even in human beings.

Many of the lowest forms of hermaphrodite plants and animals are self-fertilizing; that is, reproduction takes place without the sexual union of two individuals. But in very many plants which have both kinds of reproductive organs in one flower, fertilization is accomplished by means of insects, which carry the pollen of one flower to the pistil of another, nature having prevented self-fertilization by wonderfully ingenious yet often very simple means. Many bisexual animals, like the snail, conjugate for mutual fertilization. Spurious hermaphrodism, in which the characteristic organs of one sex assume, from incomplete or abnormal development, something of the appearance of those of the opposite sex, has been often observed. Under this head must be placed most or all of the recorded instances of hermaphrodism in the human species. The true hermaphrodism is *double* sex; spurious hermaphrodism is *doubtful* sex. CHARLES W. GREENE.

Hermaphrodite Brig. See BRIGANTINE.

Hermaphrodi'tus was a son of Hermes and Aphrodite, and inherited the beauty of both of his parents. Once, when he was bathing in the well of Salmacis, near Halicarnassus, in Caria, Asia Minor, the nymph of the well fell in love with him, and prayed to the gods that she might remain united with him for ever; and when he ascended from the bath he was changed so that he was neither man nor woman, but both. The idea of this myth is of Asiatic, the myth itself of Roman, origin. In its later period Greek sculpture often represented Hermaphroditus, the upper part of the body female, the nether male.

Her'mas, the author of a once-celebrated book, *The Shepherd,* was by Irenæus, Clemens Alexandrinus, and Eusebius considered identical with the Hermas mentioned by St. Paul in his Epistle to the Romans (xvi. 14), while others have placed him a little later, and made him a brother of Pius I., bishop of Rome in the middle of the second century. *The Shepherd* is divided into three parts—the *Visions, Precepts,* and *Similitudes.* It is in the form of a dialogue, and consists of a blending of fantastic poetry and *naïve* morals, a character which explains how the book at once could be the *Pilgrim's Progress* of the old Church and yet be called childish by St. Jerome and Tertullian. It was originally written in Greek (ὁ ποιμήν), but exists now only in translations. The Greek text found in a monastery on Mount Athos, and published in 1857, is generally considered a translation of the Latin translation. An English translation of *Pastor Hermæ* was published in Edinburgh in 1867 in the *Ante-Nicene Christian Library.*

Hermeneu'tics [from the Greek verb ἑρμηνεύειν, to "interpret," and that from the name of *Hermes,* the son of Zeus and Maia, the messenger and interpreter of the gods] is the science and art of interpretation, or of ascertaining the meaning of an author from his language. It is closely allied to grammar, logic, and rhetoric, and presupposes them. Its aim is to reduce interpretation to fixed laws and principles, and to the precision of an exact science, so far as the elastic nature of thought and language will permit. The business of *ex*position has often been confounded with *im*position, whereby all sorts of arbitrary subjective fancies are introduced into the text of which the writer never dreamed. The work of interpretation requires intellectual and moral qualifications, natural and acquired—viz. a full knowledge of the author's original language, historical situation, mental status, and range of ideas, and an appreciating sympathy with his spirit and aim.

Biblical Hermeneutics is general hermeneutics applied to the Sacred Scriptures. It has been most cultivated on account of the vast importance and general interest of these books. Its first germs may be traced to the Jews and to Philo of Alexandria, who reduced the allegorical method of interpretation to a system, which through Origen (d. 254) passed into the Christian Church. Origen of Alexandria distinguished a threefold sense of the Scriptures, corresponding to the tripartite nature of man (a somatic or literal, a psychic or moral, and a pneumatic or mystical sense). The grammatical school, on the other hand, which

was best represented among the Fathers by Chrysostom and Jerome (though by no means consistently), adhered to the natural and literal sense as the only one which the writer had in view. Assuming the last principle to be correct, there are still three legitimate kinds of interpretation, which, however, must harmonize with each other, and together give the one full meaning of the text: (1) The *philological* (also called *literal* or *grammatico-historical*) exegesis is concerned with the body or letter of the text, with verbal, critical, and antiquarian questions. It brings out the meaning of words and phrases according to the general rules of grammar, the particular idiom and vocabulary of the author, his age, nation, and country, and clears up all references to contemporaneous history and antiquities. It deals with the literary and human aspects of the Scripture, with the earthly form into which its divine contents are cast. It is the basis of all sound exegesis. It has been successfully cultivated during the present century in Germany and England by Winer, De Wette, Lücke, Bleek, Meyer, Ewald, Dillmann, Alford, Ellicott, Lightfoot. (2) The *theological* (or *doctrinal* and *ethical* interpretation) deals with the divine thoughts and spiritual truths of the Bible, and explains them in connection with its general teaching and according to the analogy of faith; but it ought not to be fettered by dogmatic prejudice or made subservient to sectarian interest, as was done in the scholastic periods of theology during the Middle Ages and the seventeenth century, when the Bible was used simply as a repository of proof-texts for certain tenets of orthodoxy and against heretical opinions. Among the most distinguished theological expounders are Augustine, Luther, Calvin, Olshausen, Tholuck, Hodge. (3) *Practical* and *homiletical* exegesis applies the text to the wants of the human heart, and draws from it lessons of wisdom and comfort for the battle of life. It belongs properly to the pulpit and to popular works. Of this character are the exegetical homilies of Origen, Chrysostom, Augustine, and other Fathers, and the commentaries of Matthew Henry, Burkitt, Doddridge, Starke.

Literature.—ERNESTI, *Principles of Biblical Interpretation* (1861, Latin; Engl. transl. by Terrot, 1843); WILKE, *Hermeneutik des N. T.* (1844, 2 vols.); LUTZ, *Biblische Hermeneutik* (1861); CELLERIER, *Manuel d'Hermeneutique* (1852); FAIRBAIRN, *Hermeneutical Manual* (1859); MUNSCHER, *Manual of Biblical Interpretation* (1865); IMMER, *Hermeneutik des N. T.* (1873). PHILIP SCHAFF.

Hermes. See MERCURY.

Her'mes (GEORG), a German theologian who under the influence of the "new philosophy" endeavored to carry out the doctrines of unity and identity into forming a common basis for Protestantism and Roman Catholicism. B. in Dreierwald, Westphalia, Apr. 22, 1775, he d. at Bonn May 26, 1831. Having studied theology at Münster, where he became in 1807 professor, he was subsequently teacher of Catholic theology at Bonn. "He had found," says Binder, "the futility of the attacks of Kant and Fichte on Christianity, and the truth of Roman Catholicism." He, however, busied himself for many years in trying to base the principles of the latter on those of the former, setting forth his views in the *Einleitung in die Christ-katholische Theologie* ("Introduction to the Catholic Christian Theology"). His work was not in any respect heretical, but confined itself to negativing the arguments of those who declared the instability of the Catholic dogma. He founded a school or doctrine termed Hermesianism, and his followers, the Hermesianer, occupied many important positions as preachers and teachers in Germany. He maintained that the principle of *pure reason*, which, as Kant teaches, is innate in every soul, enabling it to decide on all principal truths, should be applied to religion; or rather that the Church should teach its doctrines on this basis. But this principle was disapproved of at Rome, and a papal letter was directed against it (Sept. 16, 1835) by Pope Gregory, beginning with the words *Dum acerbissimus*. During the life of Hermes his school had great influence and made many converts. Binder attributes the delay in proceeding against it to the usual system of formalities followed at Rome in such cases. The fundamental principle of the Hermesian doctrine is, that human reason can grasp the truth, and that religion, being true, is or may be based on this "natural sense." But the Church holds a directly different doctrine, and does not look up to philosophy or science to authorize her doctrines, as the Roman Catechism declares "the mysteries which are contained in God's holy Church are to be understood only by faith, and not by reason." Hermes did in fact quite unconsciously seek to put the Catholic Church on that Protestant foundation of independent reason which from Luther to Döllinger has been so strongly characteristic of the Teutonic mind. Among the principal works referring to Hermesianism are the following: *Hinweisungen auf den Grundcharakter des Hermesischen Systems*, by J. B. BALTZER (1832, 8vo); *Blätter zur Orientirung in Sachen des Hermesianismus* (1838), by F. X. BIUNDE and J. J. ROSENBAUM; *Acta Romana*, by J. W. J. BRAUN and P. J. ELVENICH (documents relating to the condemnation, by the pope, of G. Hermes (1838, 8vo); *Acta Hermesiana*, by A. J. ELVENICH; *Novæ Annotationes*, by LANG (1839); *Apologie des Hermesianismus*, by J. B. LUTTERBECK (1835); *Ueber Glauben*, by J. J. ROSENBAUM (1838, 8vo); *Christ-katholische Dogmatik*, by G. HERMES; *Der Hermesianismus und Joh. Perrone* (Breslau, 1844). CHARLES G. LELAND.

Hermesi'anax, b. at Colophon, lived in the times of Philip and Alexander the Great, and d. before the destruction of his native city by Lysimachus in 302 B. C. He wrote an elegiac poem in three books to his mistress Leontium, of which a large part of the third book has been quoted by Athenæus, and thus come down to us. It has been separately published by J. Bailey (London, 1839), together with a critical epistle by G. Burgess.

Hermesianism, the religious philosophy taught by GEORG HERMES (which see).

Her'mes Trismegis'tus ("thrice-great Hermes," or Mercury), or **Thoth,** an Egyptian god, regarded as inventor of all science and learning; *e. g.* speech, writing, religion, geometry, architecture, and the arts. Every Egyptian book relating to religion or science was inscribed with his name, as if inspired by him; and according to Jamblichus there were of these 36,000. The name "thrice-great" is supposed to refer to the god's triple manifestation as philosopher, priest, and king. Certain dialogues on mystical theology, still extant, and which were very popular during the fifteenth and sixteenth centuries, were subsequently regarded as forgeries. They had been transmitted from an early age in a rude Greek form. More recent research has indicated that the Greek, by its very defects, possesses the character of a translation. The writer professed a belief in their authenticity, as Champollion the Younger had done. More recently a French Egyptologist, M. Pierrat of the Louvre, in the *Mélanges d'Archéologie* (4to, Paris, 1873, p. 112), has pointed out that many of the very peculiar phrases and ideas contained in the Hermetic books are to be found in the papyri and inscriptions. The works or fragments bearing the name of Hermes Trismegistus are as follows: (1) *Pœmander, of the Nature of Things and of the Creation of the World;* (2) *Of Divine Wisdom and Power;* (3) *Asclepius;* (4) *The Aphorisms of Hermes;* (5) *On the Revolutions of Nativities.* Fragments of five other works are preserved by John Stobæus. The most recent text, Greek with the Latin versions, is the *Hermetis Trismegisti Pœmander*, by Gustavus Parthey (Berlin, Nicoli, 1854). Among all the mysticism of the *Pœmander*, etc., there is much that is grand and beautiful. The first editors of Hermes Trismegistus erred in attributing the works to Moses himself, or in giving to them a fabulous antiquity, while the later critics were as much in the wrong in boldly declaring that they were Neo-Platonic or Christian forgeries of the third century A. D. CHARLES G. LELAND.

Hermet'ic Writings [from *Hermes* (Mercury), with whom the Greeks identified the Egyptian *Thoth*, the god of literature and learning], a name in its widest sense designating the whole body of Egyptian literature; but the name is especially given to a mass of works in Greek and Latin, fragments of which have come down to our time, and which profess to have been inspired by HERMES TRISMEGISTUS (which see). They treat of astrology, ontology, and other subjects, and are of no value. There were also a number of works written in the Middle Ages by alchemists, and in later times perhaps by the Rosicrucians, which profess to have been written by Hermes Trismegistus. The Zabians of the East have writings in Greek which they ascribe to Hermes.

Hermi'as was a eunuch and slave in the household of Eubulus, tyrant of Atarneus and Assus, in Mysia, Asia Minor; but he gained his master's confidence, was made free, travelled to Athens, where he heard Plato's lectures in company with Aristotle, and succeeded Eubulus on the throne of Atarneus in 347. Aristotle spent several years at his court, but had to flee when Artaxerxes, king of Persia, sent an army to reduce all the petty tyrants in Asia Minor. Hermias was captured and sent to the Persian court, where he was put to death, but Aristotle raised a statue at Delphi in honor of him, and married his relative Pythias.

Hermip'pus lived in the middle of the third century B. C., and wrote a work containing the biographies of the Greek philosophers, historians, and poets. The work itself is lost, but it is frequently quoted by subsequent writers, and seems to have enjoyed a great reputation in antiquity.

The fragments which are found in other authors have been collected and edited by Lozynski (Bonn, 1832).

Her'mit [Gr. ἐρημίτης; Lat. *eremita*, a "dweller in solitude"], a person who retires from human society and dwells alone; a title given especially to religious recluses, and particularly to those who do not live in common with others. So also the Augustinian monks, though living in monasteries, are called hermits, being accustomed to spend a part of their time in solitude. There are many other monastic congregations called hermits, notably certain lay members of the third order of St. Francis, who, being married before taking their vows, cannot be received in full into the order.

Her'mitage, post-v., county-seat of Hickory co., Mo., 80 miles S. W. of Jefferson City.

Hermit Crab. See CRAB.

Hermodac'tyl ("Mercury's finger"), the name of a bulbous root sometimes used in medicine. It appears that some hermodactyls are produced from *Iris tuberosa*, and others from *Colchicum variegatum*, European and Asiatic plants. The ancients used hermodactyls for gout, but in modern times they are considered nearly or quite inert.

Hermog'enes [Ἑρμογένης] lived in the time of the emperor M. Antoninus, son of Calippus, and b. at Tarsus in Cilicia. He was noted for the early development of his oratorical powers, so that at the age of fifteen he attracted the attention of the emperor, who listened to his extempore discourses with great pleasure. When seventeen he became a public teacher of rhetoric, and at eighteen or twenty he composed his rhetorical works, which Suidas speaks of as most worthy of admiration, and which were for several centuries the established books of instruction. At the age of twenty-five he lost his intellectual power and sank into imbecility. Five of his works, forming a Τέχνη ῥητορική ("System of Rhetoric"), have come down to our time: (1) On general issues; (2) On invention; (3) On the forms of oratory; (4) On the method of acquiring skill in speaking; (5) Preparatory exercises (προγυμνάσματα). This last work was abridged by Aphthonius (A. D. 315), and was thus in time superseded. They are found in the *Rhetores Græci* of Walz (Stuttgart, 1832–36) and of Spengel (Leipsic, 1853–56, 3 vols.). The *Progymnasmata* were first published in Greek by Heeren (Göttingen, 1791), with Heeren's and his own notes by Veesenmeyer (Nuremberg, 1812). (See MÜLLER's and DONALDSON's *Greek Literature*, vol. iii. p. 156.)

H. DRISLER.

Her'mon, post-tp. of Penobscot co., Me., on the Maine Central R. R., 11 miles W. of Bangor. It has manufactures of cooperage. Pop. 1489.

Hermon, tp. and post-v. of St. Lawrence co., N. Y. It has iron ore and other minerals, and contains 3 churches. Pop. of v. 573; of tp. 1792.

Hermon, Mount, is the highest elevation of the whole Syrian system of mountains. It is formed by a spur from Anti-Lebanon, which, separating the valley of Cœle-Syria from that of the Jordan, unites to the W. with the range of Lebanon. Great Hermon, or Mount Hermon proper, is about 10,000 feet high. Its top is generally covered with snow, and is visible from Tyre and Damascus. Its sides are clad with white poplars. The Psalms speak of the "dew of Hermon," and modern travellers say that during the night their tents become as wet with dew as by a rainstorm.

Hermop'olis Mag'na, an ancient city of Egypt, was situated on the left bank of the Nile, near the boundary between Upper and Middle Egypt, on the site now occupied by the village of Oshmoonegu or Eshmoon. At the time of the Ptolemies it was a rich and magnificent city, prominent among whose buildings was the temple of Thoth or Tauth, the ibis-headed god, the inventor of the pen and letters, identified with the Greek Hermes. But it was entirely destroyed by the Mohammedans, who carried away its monuments for building purposes, and left nothing behind but large mounds of ruins and rubbish.

Hermosi'llo, town of Mexico, in the state of Sonora, stands on the river Sonora, at the entrance of an exceedingly fertile valley which produces wheat, wine, and all kinds of fruit in abundance, and carries on a very lively trade. Pop. 14,000.

Hernan'do, county of Florida, bounded on the W. by the Gulf of Mexico. Area, 1800 square miles. The soil is undulating and generally very fertile. It has extensive hard-wood forests. Rice is the largest crop, but the soil is adapted to all the products of the Southern States. Cap. Brookville. Pop. 2938.

Hernando, post-v., cap. of De Soto co., Miss., on the Mississippi and Tennessee R. R., 22 miles S. of Memphis, has a weekly newspaper, a female college, a male seminary, 4 churches, a very fine court-house, and 22 commercial houses. Pop. 730. W. S. SLADE, ED. "PRESS."

Hern'don (WILLIAM LEWIS), b. at Fredericksburg, Va., Oct. 25, 1813; entered the U. S. navy when fifteen years old; was engaged in the Mexican war, and employed in the National Observatory, Washington, D. C., for three years. He crossed the Andes from Lima eastward, and with Lieut. Lardner Gibbon conducted the exploration (1851–52) of the Amazon Valley. The published report of this expedition was in 2 vols. (1853–54), the first by Herndon, the second by Gibbon. Herndon was in command of the steamer Central America when she was lost (Sept. 12, 1857) in a storm on the voyage from the Isthmus of Panama to New York. There were on board some 580 persons, of whom 427 were lost, but the women and children were all saved. Herndon went down with the ship, standing on the bridge in full uniform.

Her'nia [Lat.], the protrusion of a viscus from the cavity to which it normally belongs; but the term is generally used to express the protrusion of an abdominal viscus, as when we speak of other forms of hernia we express it thus: hernia cerebri, hernia corneæ, etc. The predisposing cause of hernia is a weakness of some portion of the abdominal walls, and there are certain parts which are naturally weaker than others, as the inguinal, umbilical, and femoral regions. This weakness very often exists congenitally, and may be increased or produced by injury, disease, or pregnancy. Among the exciting causes may be mentioned violent muscular exertion, jumping, straining from lifting heavy weights or at stool, playing on wind instruments, etc. The usual contents of a hernial sac is a portion of the small intestine, or the omentum, but we may find portions of any of the viscera in it, especially when the abdominal walls are congenitally weak. The sac is formed of peritoneum, which is covered by the integument and subjacent fasciæ.

Hernia is generally divided in two ways: 1st, according to its situation, as inguinal, femoral, umbilical, phrenic, etc.; 2d, according to the condition of the protruded viscus, as reducible, irreducible, and strangulated. Reducible hernia is that variety in which the contents of the sac may be returned into its normal cavity without recourse to a surgical operation. It sometimes disappears spontaneously when the patient seeks the recumbent position, but more often needs a greater or less amount of pressure to be made in the proper direction. The symptoms of it are—the appearance of a soft and compressible swelling at some portion of the abdominal wall, which increases when the patient stands up and diminishes when he lies down; by placing the hand upon the tumor and directing the patient to cough a distinct impulse is imparted. The treatment usually adopted consists of the reduction of the contents, and the application of a suitable truss to prevent the re-protrusion. If the patient is young, this method will effect a radical cure in time, but in the adult recourse must be had to an operation to effect this.

Irreducible hernia differs from reducible in that the protruded viscus cannot be returned into its normal cavity. The general causes of it are adhesions between the sac and its contents, the growth of membranous bands across the sac, or enlargement of the contents. It is much more troublesome than the preceding variety; in the first place, it is much more inconvenient, and is always exposed to the danger of strangulation; the patient suffers from indigestion, constipation, colic, flatulence, and dragging pains in the loins. The treatment of this variety must be generally palliative, and consists of the patient's avoidance of all violent exercise; regulation of the bowels, which should never be allowed to become confined; and the wearing of a truss to support and protect the tumor.

"Hernia is said to be strangulated when it is constricted in such a way that the contents of the protruded bowel cannot be propelled onward, and the return of its venous blood is impeded." There is always more or less inflammation, caused by the constriction. The causes of this condition are sudden enlargement of the contents of the sac by fæces or gas, or congestion or swelling of the neck of the sac. The symptoms are—pain, flatulence, a desire to go to stool, constipation, nausea, and vomiting, the vomited matter after a time becoming stercoraceous. The tumor is hard, and cannot be replaced in the abdominal cavity, and there is very little impulse transmitted to the hand when the patient coughs. The pain in the tumor continues to increase, and extends over the whole of the abdomen; the countenance assumes an anxious expression; the pulse becomes small and wiry, and the skin cold and clammy. Should the pain cease, and the tumor feel doughy and crepitate when handled, we may be sure that the intestine has mortified; when this happens, there is very little hope for the patient; in fact, the only chance for recovery now is by an artificial anus. The object of treatment is to return the intestine into its cavity. When this cannot be accomplished by manipulation, or manipulation combined

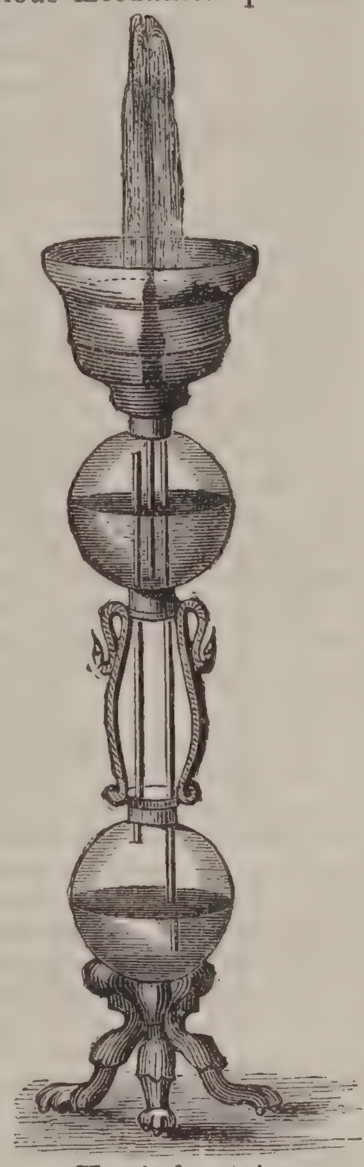
with warm baths and the administration of ether—the patient having first been placed in such a position that all the parts in the neighborhood of the trouble shall be completely relaxed—recourse must immediately be had to an operation. This consists of enlarging the constricted portion, so as to allow of the return of the gut, and consists of cutting down to the sac, and then either opening it and dividing the stricture, dividing the stricture without opening the sac, or by merely incising the neck of the sac.

EDWARD J. BERMINGHAM.

Hero. See HEROIC AGE.

He'ro, or **He'ron,** an ingenious mechanical philosopher, b. about the end of the 164th Olympiad, or 120 B. C., famous for an acquaintance with the principles of pneumatics and hydraulics quite in advance of his age. He wrote a number of books and invented a variety of machines, two of which, the æolipile (see ÆOLIPILE) and the fountain which bears his name, are still among the familiar forms of illustrative apparatus in the physical lecture-room. Hero's fountain is shown in the annexed figure, in which it is seen that the elastic force of a confined body of air, increased by hydraulic pressure and reacting upon the surface of water in a closed reservoir, produces a jet which may rise (theoretically) above that surface to a height equal to the effective height of the pressing column.

F. A. P. BARNARD.


Hero's fountain.

Hero, a priestess of the temple of Aphrodite at Sestos, on the coast of Thrace, was loved by Leander, a native of Abydos, on the opposite shore of the Hellespont. Guided by the light of the torch which Hero planted on the cliffs of Sestos, Leander used to swim across the sea to meet her, but one night the storm put out the torch, and when next morning Hero discovered the corpse of her lover floating on the waves, she threw herself into the sea. There is a Greek epic poem by Musæus, a ballad by Schiller, and a drama by Grillparzer on this subject, and it has been painted over and over again by the disciples of the school of David.

Her'od THE GREAT, king of the Jews, was b. in 62 B. C. at Ascalon in Judæa, and was of Idumean descent. When in 47 B. C. his father, Antipater, was made procurator of Judæa by Julius Cæsar, he himself received the government of Galilee, to which was afterwards added that of Samaria and Cœle-Syria. He was expelled for a short time by Antigonus, the nephew of Hyrcanus II. and the representative of the Asmonean dynasty, but in Rome, whither he fled, he succeeded in gaining the favor of Antony; not only were his claims recognized by the senate, but the title of king of Judæa was conferred on him (40 B. C.). He established himself by force in Jerusalem, and by unheard-of cruelty he maintained his power. All members of the old dynasty, even his own wife, Mariamne, the daughter of Hyrcanus II., and the three children he had by her, were executed. And the older he grew the more suspicious and atrocious he became. The slaughter of the infants at Bethlehem, of which we are told in Matthew ii. 16, was so common and insignificant an affair that Josephus does not mention it. A few days before he died he had his son, Antipater, strangled. But, although cruel, his government was vigorous and brilliant. He was highly esteemed by Augustus. There was peace in Judæa; commerce and industry prospered; literature and art flourished. His buildings were especially magnificent; he founded Cæsarea, rebuilt Samaria under the name of Sebaste, and adorned Jerusalem with numerous splendid structures. The Jews, however, found in his government a leaning towards Rome, which humiliated them, and a general tendency towards Roman civilization, which they hated; and the latter part of his life was much troubled by conspiracies and riots. He was ten times married, and died between Mar. 13 and Apr. 5, a few weeks after the birth of Christ, of a horrible disease, the same as killed Sulla and Philip II. of Spain.—His son, HEROD ANTIPAS, by his wife Malthace, a Samaritan, was by his will appointed tetrarch of Galilee and Peræa. He divorced his first wife, and married Herodias, the wife of his half-brother Philip, and when John the Baptist remonstrated against this incestuous connection, he had him put to death. During a visit to Jerusalem for the purpose of celebrating the passover, Christ appeared before him, sent by Pilate as a former resident of his tetrarchate. In 42 A. D. he made a journey to Rome in order to obtain the royal dignity, but, through the intrigues of Herod Agrippa, he was exiled by Caligula, and d. in Lyons.—HEROD AGRIPPA I., son of Aristobulus, brother to Herodias, and grandson of Herod the Great, was educated in Rome, and received from Caligula the tetrarchate of Judæa with the title of king, and after the banishment of Herod Antipas, Claudius gave him all the old provinces of Judæa. He was much liked by the Jews, especially for his vigorous measures against Christians; he had the apostle St. James the Greater beheaded and St. Peter thrown into prison. He d. early (44 A. D.).—HEROD AGRIPPA II., a son of the preceding, was, like his father, educated in Rome, and resided there, at the court of Claudius, at the death of Agrippa I. He did not inherit his father's dominions, however; they were made a Roman province, and Herod Agrippa II. obtained at first (50 A. D.) only the small kingdom of Chalcis. Abilene and Trachonitis were subsequently added. In 60 A. D., when he went down to Cæsarea to compliment Festus, the Roman governor, the apostle St. Paul appeared before him. In the Jewish war he sided against his countrymen, and after the destruction of Jerusalem (70 A. D.) he resided in Rome, where he d. in 100 A. D.

REVISED BY R. D. HITCHCOCK.

Hero'des At'ticus, one of the most celebrated Greek orators, was b. at Marathon in 104 A. D., and d. at Athens in 180. M. Antoninus was one of his pupils, and during his reign he held public offices. He was immensely wealthy. His father left an annuity to each Athenian citizen. Still more remarkable was his eloquence. He was called the "tongue of Greece," and his speeches were compared to silver streams running in golden beds. Unfortunately, the only one of his works which has come down to us (Περὶ Πολιτείας, edited by Bekker in his *Oratores Attici,* 1824) is miserable, a maze of affected sophistry.

Hero'dians, a Jewish party in the time of Christ, first mentioned in Mark iii. 6. They were partisans of the Herod family, whose tyranny they preferred to that of the Romans. They appear to have been mostly Sadducees.

Herodia'nus was a Greek by birth, but lived for a long time in Rome, and wrote in the Greek language a work in eight books on the history of Rome from the death of M. Aurelius (180 A. D.) to the accession of Gordianus III. (238 A. D.), narrating events, as he informs us, which had occurred in his own lifetime. The work, which is still extant, is interesting, and is considered truthful and impartial in the main; the best editions of it are by Irmisch (5 vols., Leipsic, 1789–1805), by Weber (1816), and by Bekker (1826 and 1855).

Herod'otus, a Greek historian, often called the "father of history," was b. at Halicarnassus, a Doric colony in Caria, Asia Minor, in 484 B. C. Thus his life falls within the happiest and most glorious period of the history of the Greek nation. Like a spring flood the Persian power came rolling on, swelling through centuries by the absorption of Media, Babylon, Egypt, Asia Minor, Thracia, and Macedonia; and now it burst upon Greece. But its force was broken in the battles of Marathon (Sept. 12, 490), Thermopylæ (July 6, 480), Salamis (Oct. 5, 480), Platæa and Mycale (Sept. 23, 479). Harmless it retired, and the Greek nationality arose. Within a few generations some of the noblest and loftiest instruments of civilization were either invented—such as philosophy, history, tragedy, and comedy—or brought to greater perfection, such as public education, republican government, architecture, and sculpture. Herodotus became the inventor of the art of history. He belonged to a wealthy and influential family; among his relatives was the celebrated epic poet Panyasis. Under the reign of Lygdamis, Panyasis was killed, and Herodotus and his family expelled from Halicarnassus. He went to Samos, where he lived several years, and where he learnt the Ionian dialect, in which he wrote his book. He returned once more to Halicarnassus, and took part in the expulsion of the tyrant; but he soon again left his native city, and entered on the long and extensive travels which formed the necessary preparation for his great work. He wandered through the whole of Greece, studying the history of each place on the spot by making himself acquainted with its monuments and its traditions. Thus he acquired a most intimate acquaintance with the whole route which the Persian armies had taken; with Marathon, Thermopylæ, Salamis, Platæa and Mycale, where the great battles were fought; with Athens and other cities which formed the political, commercial, and intellectual centres of the Greek nation; with Delphi and Dodona, the sacred and awe-in-

spiring seats of the oracles; and in all the principal parts of his narrative he simply relates what he has seen himself or heard from eyewitnesses. No less intimate and comprehensive was his acquaintance with Egypt. He had visited Memphis and Heliopolis, and crossed the whole country from the Delta to Elephantiné, and from the Libyan desert to the Red Sea. Modern travellers are still surprised at the accuracy of his observations and the correctness of his descriptions. In Asia Minor he knew from personal acquaintance every place he mentions, and in Asia proper he travelled as far as Colchis to the N. and Babylon to the S. The latter part of his life he spent in Thurii, a Greek colony in Southern Italy, established in 444 B. C., near the ruins of Sybaris. From his residence in this city he is often called the *Thurian* by the ancients, and here he probably wrote, or at least finished, his book. It is also probable that he died here, about 408 B. C. At what time and place he actually wrote his history is a much-disputed point. Lucian says at Halicarnassus, Suidas in Samos, and Pliny at Thurii, which indicates three different epochs of his life. Lucian furthermore says that he read it or recited it to the people assembled at the Olympian games, and adds that Thucydides was present and burst into tears from enthusiasm. According to Plutarch, he also read it at the Panathenæa at Athens (445 B. C.), and was rewarded by a grant of ten talents from the public treasury; and Dion Chrysostomus mentions that he read it to the Corinthians. However dubious and even contradictory these statements are, the general impression of all is, that Herodotus wrought for many years on his book, beginning it at Halicarnassus and finishing it at Thurii; and the character of the book itself, its style and method of composition, seem to confirm this impression. It narrates the history of the war between the Greeks and the Persians, but every new element which is introduced into the composition is explained to the reader in its whole signification by long digressions, tracing it back to its origin, and following up its development to the moment it enters the narrative; and thus the book actually gives the history of the world. It must not be understood, however, that the narration of the Greek-Persian war was a mere framework to which the history of the world is hung by the somewhat clumsy artifice of digressions. By no means; although in the details Herodotus is a minute and circumstantial chronicler, in the composition of the whole he is a great artist. His digressions are numerous, and, on account of their great elaboration, they may appear distracting at a first perusal, and burdensome even at a second; but in the final impression of the total work they simply act as a substructure on which stands the temple itself, the narrative of the Greek-Persian war. They give this narrative its pathos; they explain what this war was—namely, a war between two worlds, Europe and Asia; a war between two principles, barbarism and civilization; a war on whose fortune the destiny of mankind depended. This total view, which made Thucydides burst into tears when it dawned upon him, and which the world has accepted as an undoubted truth, is the great merit of the book of Herodotus. But it is not the only one. Modern scholars, especially certain modern English historians, blame Herodotus for his credulity and propensity for the wonderful; and it cannot be denied that in comparison with the tone and character of modern history the wonderful plays a very conspicuous part in his book. The blame is unjust, however—as unjust as if any one would compare Watt's first steam-engine with the latest produced and most improved, and then blame Watt for weakness in mechanical conception and awkwardness in mechanical construction. Herodotus wrote in an age whose consciousness, still half mythological, perceived the wonderful as the natural, and would have considered many of the ideas of modern history as impiety, or even insanity. Instead, therefore, of blaming him for credulity and propensity for the wonderful, it would be more just to praise him for the soberness of his observation and the soundness of his criticism; for in these two points he truly denotes an advance in the human intellect. He is called "the father of history" because he was the first who really succeeded in reaching the fact in its concatenation of cause and effect. The best editions are that of Wesseling (Amsterdam, 1763, folio); that of Schweighäuser (Strasburg, 1806, 6 vols.; reprinted London, 1818–24, with a Herodotean lexicon, Greek and Eng., separately, by Cary, Oxford, 1843); that of Gaisford (Oxford, 1824, 4 vols.; 3d ed. 1849), of W. Dindorf (Paris, 1844, in DIDOT's *Bibl. Græca*), of G. C. F. Bähr (Leipsic, 1830–35, 4 vols.; 2d ed. 1856–61), of Stein (in WEIDMANN's *Collection*, Berlin, 2d ed., 5 vols., 1868–74), of Abicht (in TEUBNER's *Collection*, 5 vols., Leipsic, 1863), and of Blakesley (in *Bibliotheca Classica*, 2 vols., Cambridge, 186–). His *History* has been translated into English by Rev. G. Rawlinson (London, 1858). CLEMENS PETERSEN.

Hero'ic Age, the more than half-mythical age of Grecian history preceding the true historic period. In it the heroes, who were often of half-divine descent—great warriors, kings, navigators—are the central figures. "In these myths," says Ernst Curtius, "the people recalls to its mind, in their full life, those times when the monotonous existence of the old Pelasgians was interrupted, and new forms of worship, new openings for popular activity, new ways of life, continuing ever after with abundance of great fruits, were called into existence. These founders are figures like those of living men, but greater, nobler, nearer the immortals. They are no empty creations of the fancy, but in them the real deeds of the early times are illustrated and endowed with life. The tales of the heroes contain a certain documentary truth." In later times the heroic age furnished abundant material for dramatic and epic poetry, and the heroic character afforded many noble examples of fortitude, piety, purity, and justice which the Greek people too generally failed to imitate.

Hero'ic Metre, in English verse, is the unrhymed iambic pentameter, known as blank verse. In Greek and Latin poetry it is the common hexameter verse, in which the *Iliad* and the *Æneid* are written. German and Italian heroic verse is of the same metre as the English. The French heroic is an iambic hexameter. The name is given because these metres are deemed appropriate to lofty themes.

Herold (LOUIS JOSEPH FERDINAND), b. in Paris Jan. 28, 1791; d. near Paris Jan. 18, 1833; studied with Cherubini, and with distinction at the Conservatoire, and finally in Italy. His first pieces, which were comic and very successful in their day, are now obsolete. *Zampa* and the *Pré aux Clercs*, his greatest operas, still hold the stage in Europe, but are unknown here, except by fragments.

Her'on, a general name for a part of the birds of the family Ardeidæ, wading birds found in all parts of the globe. In the same family are the egrets and the bitterns. Among the herons of the U. S. are the *Demiegretta ludoviciana*, or Louisiana heron of the South; the *Garzetta candidissima*, or snowy heron; the *Herodias egretta*, or white heron; the *Ardea herodias*, or great blue heron, a splendid bird, but dangerous when wounded, as it aims severe blows of its long bill at the eyes of its captor; the great white heron, *Audubonia occidentalis;* the night herons (*Nyctiardea* and *Nyctherodias*); the green heron, *Butorides virescens*, and many others. The common European heron (*Ardea cinerea*) was anciently esteemed for the table, and hunted by falconry or shot with the long-bow. It was at times forbidden to any but kings and great nobles to kill it, and when taken by falconry it was customary to let the heron's wounds be dressed, and then set it free. Heron-plumes, once highly prized, are still worn upon the helmets of some corps of British cavalry.

Heroph'ilus [Ἡρόφιλος], b. at Chalcedon, in Bithynia, about 300 B. C.; studied medicine under Praxagoras; removed to Alexandria in Egypt, and was there one of the founders of the famous medical school of that city; was a distinguished surgeon, and the most celebrated anatomist and zoötomist of antiquity. It is also stated (with probable truth) that he practised vivisection upon human beings, probably condemned criminals. Tertullian says he dissected no less than 600 living persons. It is to be remembered that the ancients regarded the dissection of the dead body as something almost impious, while they had comparatively few scruples with regard to inflicting pain upon the living. His fame is commemorated by the *torcular Herophili* (the name of the place where the superior longitudinal sinuses of the *dura mater* join the lateral sinuses). He was one of the fathers of what is called heroic practice, in which excessive doses of powerful drugs were used; and he did much to introduce the useless compounding of many drugs in one prescription—a custom which lasted till the present century. Of his writings only fragments remain.

Heros'tratus, an Ephesian, who in 356 B. C. set fire to the temple of Diana at Ephesus, one of the most magnificent buildings of antiquity, and destroyed it, simply in order to make his name immortal; he succeeded, though the Ephesians passed a decree that he should never be named.

Her'pes [from the Gr. ἕρπω, to "creep"], a name applied to several skin diseases, characterized by the development of a series of vesicles or clusters of vesicles, which generally run a definite, self-limited course. By far the most important of these diseases is *Herpes zoster*, *zona*, or "shingles," as it is called. This may surround one thigh or one arm with a band of vesicles, or more frequently it starts from the backbone and follows an intercostal space half round the body. More rarely it goes half round the neck or half across the face. There is usually some neuralgic pain, and sometimes considerable fever. The disease must depend upon some abnormality in the nervous action, as it frequently maps out upon the surface the part of the integument supplied by some one branch of a nerve. The

vulgar have a great dread of "the shingles," and believe that when it so extends as to completely girdle the patient he will die. But, in the first place, it almost never does go more than halfway around the body, and, what is more, there would be no danger if it should, for the disease is a self-limited or cyclical one, and the patient is sure to get well if let alone. Other forms of so-called herpes, such as *H. circinatus*, are caused by parasitic vegetation, and should be treated with applications of sulphurous acid and water or other parasiticide agents.

REVISED BY WILLARD PARKER.

Herpetol′ogy [from the Greek ἑρπετόν, a "creeping thing," and λόγος, a "treatise"] is that branch of zoology which is dedicated to the natural history of REPTILES and AMPHIBIANS. Referring to those articles for information respecting the characters of the several groups, our remarks here will be confined to the indication of the growth of our knowledge and the best sources of information respecting them.

Little positive information existed among ancient or mediæval naturalists respecting the forms in question. In Aristotle are found isolated anatomical details respecting some species, but he did not recognize the group as a whole, combining the footed forms with mammals as oviparous quadrupeds, and isolating from them the serpents, with which he even, at least provisionally, combined some eels (*Book* ii. ch. 10, and *Book* ix. ch. 25, § 4); he nevertheless appreciated the resemblance between the serpents and saurians (*Book* ii. ch. 12, § 10), and once defines the former as land animals (*Book* i. ch. 6 § 2). Pliny, with less exact information, mixes much fable. No mediæval writer is worthy of mention. Gesner (1554), Aldrovandi (1640), and Jonston (1653) need only to be referred to as compilers. Ray (1693) published the first attempt at a systematic arrangement, in which, although nominally confounding the reptilian quadrupeds with the mammalian quadrupeds, he recognized the serpents as related, and combined them in an unnamed group, distinguished by having a heart with a single ventricle. Linnæus (1735–68) first introduced an essential reformation, definitely combining the oviparous quadrupeds (tortoises, lizards, etc.) and serpents in a single class, which he called Amphibia, and placed between the birds and reptiles. He distinguished this class by the (1) naked or scaly body, (2) acuminate teeth, and (3) absence of rayed fins; and, subsequently and erroneously, by the unilocular and uniauricular heart. He distributed its members into two orders: (1) Serpentes, without feet, and (2) Reptilia, with feet. Later, he made the class more heterogeneous by the addition to it of the branchiostegous fishes, being misled by the erroneous observations of Dr. Garden of South Carolina. He failed to notice any distinction between the true amphibians and reptiles, and even confounded the salamandroids and crocodilians with the typical saurians in one genus under the name Lacerta. His several combinations and divisions into forms without feet and with feet showed also an utter want of appreciation of the value of morphological characters in this group. Gmelin (1788), in his edition of the *Systema Naturæ*, removed from the class the branchiostegous fishes, and restricted it to the limits originally recognized by Linnæus. In the last edition of the *Systema Naturæ* published by Linnæus, 213 species were recognized, distributed among the following groups: (1) *Testudo*, 15; *Rana*, 17; *Draco*, 2; *Lacerta*, 47 (not 49); (2) *Crotalus*, 5; *Boa*, 10; *Coluber*, 97; *Anguis*, 16; *Amphisbæna*, 2; and *Cæcilia*, 2. In the edition of the *Systema Naturæ* published by Gmelin, 365 species were recognized, apportioned to the groups as follows: (1) *Testudo*, 33; *Rana*, 35; *Draco*, 2; *Lacerta*, 77; (2) *Crotalus*, 5; *Boa*, 10; *Coluber*, 170; *Anguis*, 26; *Amphisbæna*, 5; *Cæcilia*, 2: many of the additional species are spurious. Klein meanwhile (1755) published a *Tentamen Herpetologiæ*, distinguished by a singular ignorance of zoological science, as will be readily understood when it is known that he ranked with the serpents the ordinary earth-worms, the tape-worms, and the leeches. Laurenti in 1768 made a decided advance in herpetology. He recognized a class "Reptilia:" in it he included all the reptiles but the tortoises (which he did not mention) and amphibians. These he divided into three orders: (1) Salientia, including the frogs, toads, etc.; (2) Gradientia, including the salamandroids and saurians; and (3) Serpentia, including the serpents, as well as serpentiform saurians and pseudophidian amphibians. He recognized four genera of Salientia, 13 of Gradientia, and 15 of Serpentia. Lacépède in 1788 and 1790 divided the same animals into four "classes:" (1) oviparous quadrupeds which have tails; (2) those which have none; (3) reptiles with two feet only, which may be either in front or behind; and (4) serpents, or footless forms.

Brongniart in 1799 made another decided advance: he characterized the class better than any of his predecessors, and apportioned its representatives among four orders: (1) Chelonians, including the tortoises; (2) Saurians, comprising the lizards and crocodiles; (3) Ophidians, comprising the serpents; and (4) Batrachians—*i. e.* the present class of amphibians, less the Cæcilians. He was doubtful respecting the systematic relations of the Cæcilians, but placed them provisionally with the Ophidians. The great advance in his work is evinced in his recognition of the orders, and more especially in the segregation of the forms combined under the name of Batrachians. This classification came into quite general vogue, and particularly among French writers, Daudin (1802–03), Cuvier (1817–29), and Duméril and Bibron, among others, having made it the basis of their respective works.

Merrem in 1800 and 1820 published editions of a system of amphibians in which he recognized two classes: (1) PHOLIDOTA, equivalent to reptiles proper, and (2) BATRACHIA, or amphibians. Among the Pholidota, three orders were recognized—Testudinata, Loricata (*i. e.* crocodiles), and Squamata (*i. e.* saurians and serpents). Among the Batrachia, also, three orders were established: (1) Apoda (*i. e.* Pseudophidians), (2) Salientia, and (3) Gradientia. De Blainville in 1816 recognized two classes among the amphibians of Linnæus: (1) the "Reptiles" or "Squamifères ornithoïdes," scaly; and (2) "Amphibiens" or "Nudipellifères," naked. The reptiles were divided into three orders: (1) Cheloniens, (2) Emydo-Sauriens or Crocodiliens, and (3) Saurophiens or Bipéniens, including two suborders: (A) "Sauriens" and (B) "Ophidiens." The amphibians were distributed among four orders: (1) the "Batraciens" (Salientia), (2) "Pseudo-Sauriens" (Gradientia), (3) "Sub-Ichthyens" (Proteus and Sirens), and (4) "Pseudophydiens" (Cæcilidæ).

Merrem and De Blainville, in the appreciation of the mutual relations of the several forms and of the subordination in the values of characters, thus advanced far ahead of their predecessors; they were also the first to definitely include the Apoda or pseudophidians among the amphibians or batrachians. The first edition of Merrem's work not being available, and no satisfactory account being published, it is uncertain how far Merrem or De Blainville anticipated or borrowed from each other.

Thus had the *general system* of herpetology assumed nearly all the characteristics which now mark it. The successive stages of its improvement were manifested in the isolation of the four-footed forms from mammals, and the recognition of their affinity with the serpents; the recognition of the batrachians as a natural group, and the consequent depreciation of the importance of the members as exponents of affinity; the eventual separation as a class of the batrachians or amphibians from the reptiles; and at length the perception of the value of anatomical characters and the comparative unimportance of external resemblances in the estimation of the affinities of the various types. With this recognition came the separation of the crocodilians as an order distinct from the saurians. The tendency thus marked became more and more decided as time advanced. The details of the system were gradually improved by scientific zoologists, with the aid of anatomical investigations; and among the most notable in this work may be mentioned Johannes Müller, Stannius, Owen, Cope, and Huxley. A remarkable discovery was made also by Günther (1867) in the dissection of a curious New Zealand lizard-like reptile (*Sphenodon punctatum*), which strongly illustrated the insufficiency of external characters as evidence of the relations of these forms. That animal very closely resembles in its external appearance the agamoid lizards, and indeed had been referred without suspicion to that family till examined by Günther. A detailed study of its anatomy, however, indicated that it was in nowise related to the Agamidæ or other typical lizards, but that it was really the representative of a peculiar order of reptiles, for which the name Rhynchocephalia was proposed. It has also been demonstrated by Prof. Cope and others that to this same order belonged species which had lived in the older ages of our globe, and as far back as the Devonian period.

While these improvements in the system of the living reptiles were being effected, palæontological investigations were rapidly bringing to light many remarkable types of the past world, which, on being subjected to the careful investigations of osteologists, were found to have remarkable relations with the living members of the class. The gigantic swimming reptiles of the Triassic seas were first confounded together in a peculiar order by geologists under the name Enaliosaurians, but subsequent observations indicated that they should be separated into two widely distinct orders, and several others were from time to time constituted for the reception of various species. The comparative examinations of the living and extinct forms naturally reflected mutual light upon each other. The herpetologi-

cal system is thus now tolerably understood. Much, however, yet remains to be done, especially by the palæontologists and embryologists, before we shall be conversant with the exact mutual relations of the several orders. Nothing certainly can be as yet predicated as to the degree of generalization of the known forms; and the sequence in the list of orders (as well as the combination of orders in Perospondylia) which is here appended must be considered entirely as a provisional arrangement, subject to great modifications hereafter.

While the general system was thus being perfected, numerous special investigators were engaged in the discovery and elucidation of new species. The old genera were gradually more and more definitely restricted and subdivided. Many of the newly-discovered species were also recognized as representatives of new genera, and the list began to increase in numbers and importance. Families were introduced as intermediate terms between the genera and higher groups, and, at first very comprehensive, were subsequently restricted in their limits; and in order to indicate their value at once, naturalists generally began to adopt for each the uniform patronymic termination *-idæ* following the name of the typical genus of the including group. The naturalists that have described the most species within the last half century have been Duméril and Bibron of Paris, Gray and Günther of London, Peters of Berlin, and Cope of Philadelphia.

The orders now generally adopted for the inclusion of all these various members of the classes in question, recent and fossil, are as follows:

CLASS AMPHIBIA OR BATRACHIA.

Order Labyrinthodontia (extinct forms).
" Pseudophidia (worm-like forms).
" Gradientia (salamanders, etc.).
" Salientia (frogs, toads, etc.).

CLASS REPTILIA.

Sub-class Euchirota.

Super-order Perospondylia.

Order Crocodilia or Loricata (crocodiles).
" Anomodontia (extinct).
" Dinosauria (extinct).
" Ornithosauria (extinct flying reptiles).
" Rhynchocephalia.
" Sauropterygia (extinct swimming reptiles).
" Pythonomorpha (extinct snake-like lizards).
" Sauria (lizards, etc.).
" Ophidia (snakes, etc.

Super-order Pleurospondylia.

Order Chelonia or Testudinata (tortoises).

Sub-class Pterochirota.

Order Ichthyopterygia (extinct whale-like reptiles).

The anatomical investigations which have been prosecuted rendered it more and more evident that the amphibians and reptiles, notwithstanding their external resemblances, have very little true affinity with each other, and that, indeed, their closest relations in some respects are with other types; thus, (1) the amphibians are so closely connected with the fishes by means of the Labyrinthodonts in one class and the Dipnoans (*Lepidosiren*, etc.) in the other that by many (*e. g.* Huxley) they are combined in one peculiar group under the name Ichthyopsida; while, on the other hand, the reptiles and birds agree so thoroughly, and when the extinct forms are recalled differ in so few characters, that they are also united in a special group designated the Sauropsida.

It only remains to add references to the principal authorities which the student can most advantageously use. The volumes and articles published have been very numerous, but only the following need be specially named: *Erpétologie générale, ou histoire naturelle complète des Reptiles*, by DUMÉRIL and BIBRON (Paris, 1834–55, 9 vols.); *The Catalogue of Shield Reptiles*, by Dr. J. E. GRAY: (Part I., Testudinata, London, 1855; Supplement, 1870; Appendix, 1872; Part II., Emydosaurians, Rhynchocephalia, and Amphisbænians, London,1872, 4to); *Catalogue of the Specimens of Snakes in the Collection of the British Museum*, by Dr. J. E. GRAY (London, 1849, 12mo); *Catalogue of Colubrine Snakes in the Collection of the British Museum*, by Dr. ALBERT GÜNTHER (London, 1858, 12mo); *Iconographie générale des Ophidiens*, by Messrs. JAN and SORDELLI (Paris, 1860–72, 8vo and 4to); *Catalogue* of the Specimens of Lizards in the Collection of the British Museum*, by Dr. J. E. GRAY (London, 1845, 12mo); *Catalogue of the Batrachia Salientia in the Collection of the British Museum*, by Dr. ALBERT GÜNTHER (London, 1858, 8vo); *Revision der Salamandriden-Gattungen nebst Beschreibung einiger neuen oder weniger bekannten Arter dieser Familien*, by A. STRAUCH (Mém. Acad. Sc. St. Pétersbourg, v. xvi., No. 4, 1870, 4to), and *Anatomische Abhandlungen über die Perennibranchiaten und Derotremen*, by Dr. J. G. FISCHER (Hamburg, 1864, 4to). The principal recent authorities on the American reptiles and batrachians are HOLBROOK (*North American Herpetology, or a Description of the Reptiles Inhabiting the U. S.*, Philadelphia, 1836–43, 5 vols. 4to); BAIRD and GIRARD (*Catalogue of North American Reptiles in the Museum of the Smithsonian Institution*, Part I., Serpents, Washington, 1853, 8vo, etc.); AGASSIZ (*Contributions to the Natural History of the United States of America*, first monograph, North American Testudinata, Boston, 1857); and COPE (in numerous memoirs in the *Proceedings* and *Transactions of the Academy of Natural Sciences of Philadelphia*, etc.). The most recent guide to the reptiles of Europe is Dr. E. SCHREBER'S *Herpetologia Europæa, Eine systematische Bearbeitung der Amphibien und Reptilien, welche bisher in Europa aufgefunden sind* (Braunschweig, 1874). THEODORE GILL.

*The "catalogues" enumerated are really descriptive monographs of all the known species, whether in the Museum or not.

Her'peton tentacula'tus, a serpent brought from tropical countries, and chiefly noteworthy for the singular appendages which are attached to its muzzle. These are covered with scales, and are of no known use to the serpent.

Her'rick, post-tp. of Bradford co., Pa. Pop. 1009.

Herrick, tp. of Susquehanna co., Pa. Pop. 950.

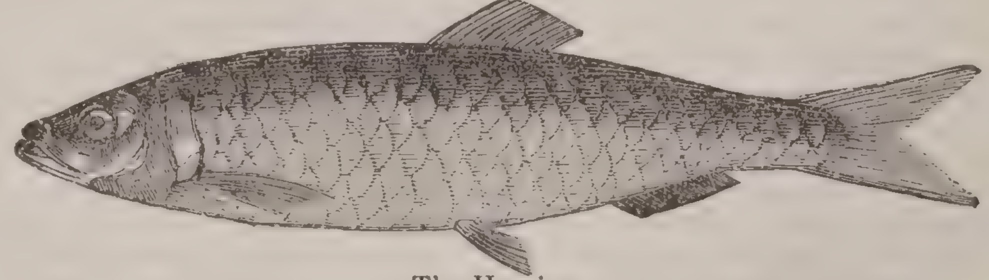
Herrick (JOHN RUSSELL), S. T. D., b. at Milton, Vt., May 12, 1822; graduated at the University of Vermont 1847; studied at Andover two years, and graduated at Auburn Theological Seminary 1852; from 1854 to 1867 was over a Congregational Presbyterian church, Malone, N. Y.; professor of systematic theology in Bangor, Me., 1867 to 1873; became pastor at South Hadley, Mass., in 1874; received the degree of D. D. from Union College in 1867; same year S. T. D. from his alma mater. Author of *Positivism* in Boston Lectures (1870), also of various articles, philosophical and theological, in reviews.

Herrick (JOSHUA), b. at Beverly, Mass., in 1792; removed to Maine, where he became a sheriff; was deputy collector of the port of Kennebunk, Me., 1829–41, 1847–49, and 1850–54; member of Congress 1843–45; and in 1856 register of probate for York co. D. at Alfred, Me., Aug. 30, 1874.

Herrick (ROBERT), b. in London Aug. 20, 1591; was educated at Trinity Hall, Cambridge, and took his master's degree 1517; took orders and became vicar of Dean Prior's, Devon, 1629; and d. there in Oct., 1674. He is one of the best of English lyric poets and song-writers, his chief fault being the indelicacy which too often disfigures the erotic poems in which his genius is best displayed. His pastoral relations were suspended for a time during the civil war, but were resumed at the restoration of Charles II. His chief publication was the *Hesperides* (1647–48).

Herrick (STEPHEN SOLON), M. D., b. at West Randolph, Vt., Dec. 11, 1833; graduated at Dartmouth 1854; was an instructor in Kentucky and Mississippi 1854–59; took his medical degree at the University of Louisiana 1861; assistant surgeon in Confederate army and navy 1862–65; visiting surgeon Charity Hospital, New Orleans, 1865–69; managing editor *New Orleans Medical and Surgical Journal* 1866–67; professor of chemistry in the New Orleans School of Medicine 1869–70. His essay on *Quinine* (1869) won the prize of the American Medical Association. Author of various professional papers.

Her'ring (*Clupea*), a genus of fishes which furnish a large supply of food to mankind. There are several spe-



The Herring.

cies, the chief of which are the *C. harengus* of Northern Europe and America, and the *C. mirabilis* of the Pacific coast of the U. S. The celebrated white-bait is the young of the common herring. The herring fisheries of America are prosecuted chiefly along the New England coasts, and especially in British American waters. In Europe the great herring fisheries are those of Great Britain, Ireland, Scandinavia, the Netherlands, and the north of France. Herrings at tolerably regular periods visit extensive lines of coast, and were formerly believed to migrate periodically from the Arctic seas, but this belief is not now generally held by scientific observers. They are

generally caught in gill-nets or scoop-nets. The annual catch of herrings must amount to many hundreds of millions. So important was the Dutch fishery in former days that it was said that Amsterdam was built on herring-bones. A large part of the so-called herring caught in the U. S. are alewives, which are in no wise inferior to the real herring, which they much resemble. Herrings are smoked and dried, pickled, or eaten fresh.

The most important herring of our Pacific coast appears to be the *C. mirabilis*, which in size, appearance, and habits resembles the common herring, but has fewer vertebræ and a ray less in the anal fin. It is not as large as the *C. harengus*, but is said to be equal in flavor. It can be taken in very large quantities, and its fishery will soon become an object of national importance. The "herring" of the great lakes is *Coregonus clupeiformis*, a sort of white-fish.

Herrn'hut, town of Germany, in the kingdom of Saxony, was founded in 1722 by a colony of Moravian Brethren, who were driven from their homes by the Jesuits, but were received and established here by Count Zinzendorf. The town has only 1000 inhabitants, but it enjoys a comparatively great reputation, partly because it has become the assembling-place or metropolis of the UNITED BRETHREN (which see), partly because the life led in this town commands respect for its simplicity, honesty, purity, and vigor. The colored paper and the linen fabrics manufactured here are very celebrated, and known under the name of *Herrnhuter Papier* and *Herrnhuter Leinwand*.

Her'ron (FRANCIS JAY), b. at Pittsburg, Pa., Feb. 17, 1837; graduated at the Western University of Pennsylvania 1853; entered the U. S. army Apr., 1861, as captain 1st Iowa Vols., and engaged in the battles of Dug Springs, Ozark, and Wilson's Creek; promoted to be lieutenant-colonel 9th Iowa Vols., and in command of the regiment through campaigns in Missouri, Arkansas, and Indian Territory; engaged in the battle of Pea Ridge, where he was severely wounded. Appointed brigadier-general of volunteers July, 1862, and in command of Army of the Frontier at battles of Prairie Grove and Van Buren; for conduct at former promoted to be major-general of volunteers Nov. 19, 1862. In command of the left wing of investing forces at Vicksburg, and of the army and navy expedition that captured Yazoo City; subsequently of 13th army corps on Texas coast till assigned to command the northern division of Louisiana. In May, 1865, negotiated, and in June received, the formal surrender of the Trans-Mississippi army and all Confederate forces W. of the Mississippi. Appointed one of the commissioners to negotiate treaties with Indian tribes July, 1865. Resigned commission as major-general and Indian commissioner Aug., 1865. Was U. S. marshal district of Louisiana 1867–69, and secretary of state of Louisiana 1870–72. G. C. SIMMONS.

Her'schel (CAROLINE LUCRETIA), b. at Hanover Mar. 16, 1750. She was appointed assistant astronomer to George III. of England in 1781, with a moderate salary. She attended her brother, Sir William, in all his night-watches, which generally lasted till morning; wrote from his dictation, as he swept the heavens with his telescope, his observations; noted the clocks; reduced and arranged his journals; prepared the zone catalogues for his sweeps, and performed for him all the laborious mathematical calculations necessary for the reduction of his observations. She discovered independently eight comets, besides numerous nebulæ and clusters of stars. At the death of her brother in 1822 she returned to her native city, where she spent the remainder of her life with her only remaining brother, honored and beloved by all. She was elected member of the Royal Astronomical Society in 1832, and d. at Hanover Jan. 9, 1848. MRS. S. B. HERRICK.

Herschel (Sir JOHN FREDERICK WILLIAM), BART., b. at Slough, near Windsor, England, Mar. 7, 1792. He was educated at home under the guidance of his parents and his aunt. Associated always with mature minds, breathing the very atmosphere of science, the boy spent his singular childhood in the silent house where the star-watchers slept. He went direct from his home to Eton, and from there to St. John's College, Cambridge, where he graduated in 1813 as senior wrangler and Smith prizeman. In the same year he read before the Royal Society a mathematical paper, and was elected, at the age of twenty-one, a fellow. In 1831, William IV. bestowed upon him the Hanoverian Guelphic order, and five years later, at the coronation of Victoria, he was created baronet. Several gold medals were awarded to him by the Royal Society and the Astronomical Society of London, and he was made D. C. L. by the University of Oxford. He was successively elected rector of Marischal College, Aberdeen, president of the Astronomical Society, and finally permanent master of the mint, which last position his enfeebled health forced him to resign in 1855. He was honorary or corresponding member to the academies of Brussels, St. Petersburg, Vienna, Göttingen, Turin, Bologna, Naples, Copenhagen, Stockholm, and others, besides being chevalier of the Prussian order of Merit. In 1829 he married Margaret Brodie, daughter of Rev. Dr. Alex. Stewart, by whom he had nine daughters and three sons. He d. at Collingwood Apr. 13, 1871. From 1813 to 1822 he devoted himself to mathematics, chemistry, and optics, as his memoirs testify. He then began his astronomical work in earnest. In 1825 he began, in connection with Sir James South, a series of very important observations. Though his especial tastes lay in the direction of physics, his filial devotion determined his lifework. He passed in review the nebulæ discovered and catalogued by his father; while engaged in this work he catalogued between 3000 and 4000 double stars. In order to perfect the work begun by his father, he went, at his own expense, in 1833, to the Cape of Good Hope. That the results might be accurately comparable, he used the same instrument used by his father. He spent four years at the Cape observing, and five years more reducing and arranging his observations, which appeared in 1847 under the title *Results of Astronomical Observations made during the years 1834–38 at the Cape of Good Hope, being the completion of a Telescopic Survey of the whole visible heavens, commenced in 1825.* This included seven treatises upon—1, nebulæ; 2, double stars; 3, apparent size of stars; 4, distribution of stars and constitution of Milky Way; 5, Halley's comet, etc.; 6, satellites of Saturn; 7, solar spots. While in South Africa he inaugurated a valuable system of simultaneous meteorological observations, and instituted a fine public-school system. He prepared two elaborate and exhaustive treatises upon "Light" and "Sound," for the *Encyclopædia Metropolitana* (1830–31), and wrote for Lardner a treatise upon the study of natural philosophy, which gave a strong and immediate impulse to the study of natural science in England; also a treatise upon astronomy, which was afterwards expanded into his *Outlines of Astronomy*. In all, Sir John added to the 2500 nebulæ discovered by his father, 2208 of his own discovery, the whole number known being 5200. He performed a great service to photography by the discovery of a process for making the impressions permanent. Not the smallest part of his work was that of popularizing without falsifying science. These discoveries, together with those recorded in 131 papers contributed to various scientific societies, compose the results of fifty-eight years of labor, included between the day of his graduation and the day of his death. The entire labor of this enormous work was performed by himself, except that which was purely mechanical in the use of his instruments. MRS. S. B. HERRICK.

Herschel (Sir WILLIAM) was b. in Hanover Nov. 15, 1738. Besides music, to which he was educated professionally, he received instruction in French and metaphysics in his early years. At the age of fourteen, being forced to earn his own bread, he became a member of a Hanoverian band; in this capacity he came to England in 1759, where the story of his life for some years is a record of bitter privation silently and heroically endured. He became successively master of a military band, organist at Halifax, and organist at the Octagon chapel at Bath. In spite of innumerable professional duties, he pursued his abstract studies with ardor, sometimes going to them after fourteen hours of professional labor. He learned Latin, Italian, and something of Greek, with no aid but that of a grammar and dictionary, and mastered alone an obscure mathematical treatise upon music. The harmony of sound soon led, by the way of optics, to a study of the "harmony of the spheres." A small Gregorian telescope fell into his hands, and waked into passionate life the longing which determined his future career. Finding the most ordinary telescope beyond his means, he determined to construct one. The fact that he made and polished 200 metal specula before he succeeded to his own satisfaction reveals the secret of his successful life. In 1781 he discovered, by the aid of one of his own telescopes, a new planet, called by him Georgium Sidus, by his contemporaries Herschel, but now known under the name of Uranus. This brought him under the notice of George III., who bestowed upon him the position of special astronomer to the king, a pension of 300 guineas a year, and a residence at Slough, near Windsor Castle. He married, in 1788, Mary, daughter of Mr. Adee Baldwin, a widow, by whom he had one son, John F. W. Herschel. He was made member of the London Royal Society, of the Academy of Sciences, Paris, and president of the Royal Astronomical Society, London. The Hanoverian Guelphic order was bestowed upon him by the regent, and the title of LL.D. by the University of Oxford, besides other distinctions. In his eighty-fourth year, on Aug. 23, 1822, Sir William Herschel died without a pang. His disposition was marked by

sweetness and benevolence; his character by directness and simplicity, by untiring patience and indomitable energy; and his mind by breadth of view and extreme caution. His work is comprehended, in great part, in memoirs presented before the Royal Society of London, which "constitute," says Arago, "one of the principal riches of the celebrated collection known under the title of *Philosophical Transactions*." The front-view telescope suggested by Jacques Lamaire was perfected by Herschel; the mechanical contrivances by means of which he mounted and adjusted his forty-foot telescope, with its speculum weighing a ton, showed him to be possessed of high mechanical genius. He so improved the construction of telescopes as to be able to use magnifying powers of 6000 times in a reflecting telescope seven feet long. Though we cannot give even the titles of the papers contributed by him to the *Philosophical Transactions*, we shall take a hasty survey of those discoveries—recorded in them from 1780 to 1822—which are permanent acquisitions to science. In optics he discovered the dark heat-rays of the solar spectrum, and made many experiments upon radiant heat, upon Newton's rings, and upon the illuminating power of the various prismatic rays. In his researches upon the solar system he made many remarkable observations upon the physical constitution of the sun; he discovered the planet Uranus and his six satellites, as well as two satellites of Saturn. He added much to the subject of the form, time of rotation, and comparative magnitudes of the asteroids and planets. He discovered that the moon possessed no atmosphere, and made many valuable observations upon comets. But the real work of the Herschels, father and son, lay beyond the limits of our system in the sidereal depths. Sir William made many and accurate observations upon variable and binary stars; in his investigations upon sidereal parallax, though he failed to find it, he made the astounding discovery that the sun, with all its attendant planets, is rushing on through space toward a point situated in the constellation Hercules. By means of a twenty-foot telescope he made a survey of the whole of the northern heavens, cataloguing and placing the stars as they came within the telescopic field. To the known nebulæ, 500 in number, he added 2500 of his own discovery, and under his trained eye and powerful telescopes numbers of what had been considered nebulæ resolved themselves into clusters and systems of self-luminous suns. He is well denominated by his biographer "one of the greatest astronomers that ever lived in any age or country." MRS. S. B. HERRICK.

Her'sey, post-v. and tp., cap. of Osceola co., Mich., near the junction of the Flint and Père Marquette and the Grand Rapids and Indiana R. Rs., and at the confluence of the Hersey and Muskegon rivers. It has a court-house, a jail, 2 churches, a graded school, a printing-office and weekly newspaper, 4 hotels, several stores and shops, a wagon-factory, 3 large saw and shingle mills, a planing-mill, a grist-mill, and an express office. It is in the midst of a fine agricultural and lumber district. Pop. of tp. 286.
J. F. RADCLIFFE, ED. "OSCEOLA OUTLINE."

Hers'feld, town of Hesse-Nassau, Prussia, on the Fulda, has important manufactures. Pop. 6434.

Hert'ford, town of England, the capital of Hertfordshire, on the river Lea. It has several educational institutions. Pop. 7164.

Hertford, county of North Carolina, bounded on the E. by the navigable Chowan River and on the N. by Virginia. The surface is generally level. Corn is the principal agricultural product. Cap. Winton. Pop. 9273.

Hertford, post-v., county-seat of Perquimans co., N. C., on the navigable Perquimans River, 12 miles from its mouth. Pop. 486; of tp. 1188.

Hert'fordshire, or **Herts,** county of England, bounded by the counties of Essex, Middlesex, Buckingham, and Bedford. It contains 391,141 acres of fertile and well-cultivated land, consisting of chalk overlaid with gravel and loam, and presenting a pleasantly undulating surface. The products of its meadows and orchards are brought to the London market. Malt is a very important product. Cap. Hertford. Pop. 73,294.

Hertz (HENRIK), b. at Copenhagen Aug. 25, 1798, and d. there Feb. 26, 1870. With the exception of a tour through Germany, France, and Italy in 1833–34, he spent his whole life in his native city in a quiet way, and devoting himself exclusively to literary work; in 1850 the Rigsdag gave him a pension. But several of his works caused a great commotion, especially his *Poetical Epistles from Paradise* (1830), whose satire and criticism made people furious, though at the same time they could not help being charmed by the wit, elegance, and freshness of the style. He has written other satirical, lyric, and epical poems, and also some novels; but his talent was eminently dramatic. He used to write a new drama every winter, and many of them have become very dear to his countrymen, such as his tragedy *Svend Dyrings Huns* (1837), his character comedies *Sparekassen* (1836) and *Et Offer* (1853), his romantic comedies *Ninon* (1848) and *Den Yugsti* (1854); some of them have been performed in all the principal theatres of Germany, France, and England, such as *Kong Renés Datter* (1846), twice translated into English, and not seldom performed in America, and *Scheich Hassan* (1851). His general character as an author shows a perfect training—he never failed in what he undertook to do; and a perfect veracity—not one adjective in all his volumes was ever allowed to tell a lie. CLEMENS PETERSEN.

Her'uli, a Germanic race who first appear in history in the third century A. D. on the shores of the Euxine. They were conquered by the Ostrogoths under Hermanric, and bands of Heruli appear after this in all parts of Europe. They swelled the train of Attila, and are later found among the enemies of the Huns. In the valley of the Theiss, on the lower Danube, and in Illyria they founded governments, and were everywhere among the bravest and most barbarous and unruly of the Germanic peoples. Odoacer was called king of the Heruli, but was not of this race. After the fall of the Western empire (476 A. D.) the Heruli became one of the dominant races, but the subject Lombards rose and almost annihilated them about 512 A. D. From that time they were important only as soldiers in the service of the more powerful tribes.

Hervé (EDOUARD), b. in 1835 at St. Denis (Réunion Island); entered, after brilliant studies in colleges, the famous Paris Normal School, where he had as fellow-mates Prévost-Paradol, About, Sarcey, Weiss, Taine, all the pleiad of modern French polemists and writers. Hervé contributed to many Paris journals, and with Weiss founded in 1869 the *Journal de Paris*, of which he is the present editor, and which supports the cause of a liberal constitutional monarchy, modelled after the British constitution. Hervé is the author of *One Page of Contemporaneous History* and of a *History of the Liberal Ideas in England*.
FÉLIX AUCAIGNE.

Hervé (assumed name of FLORIMOND **Ronger**), b. at Houdain, near Arras, June 30, 1825, was at first dramatic artist and manager of small theatres. He took afterwards to composing opéras bouffes, like *L'Œil Crevé, Les Turcs, Chilpéric, Le Petit Faust*. FÉLIX AUCAIGNE.

Her'vey (JAMES), b. at Hardingstone, Northamptonshire, Eng., Feb. 26, 1713; studied (1731–38) at Lincoln College, Oxford, where, from his acquaintance with John Wesley and from Zimmerman's writings, he received strong religious impressions. He took orders in the English Church and held various rectorships, notably that of Weston-Favel, where he d. Dec. 25, 1758. Author of *Meditations and Contemplations* (1746 and 1747), which became exceedingly popular, notwithstanding its turgid and extravagant style, which found many admirers, attracted partly by the devout spirit of the author; of *Theron and Aspasia* (3 vols., 1755), consisting of dialogues upon religious topics—a work which called forth replies from Robert Sandeman and John Wesley; and other works, among them posthumous *Letters to John Wesley*, which, it is believed, suffered much from the reckless interpolations of Hervey's editors. He was a man of learning, but not of intellectual power.

Her'warth von Bit'tenfeld (KARL EBERHARD), b. at Grosswerther, Prussian Saxony, Sept. 4, 1796; entered the military service in 1811. He took part in the campaign against France in 1814, and took two hostile pieces at the storming of Montmartre. In 1847 he received the command of the 1st regiment of the guard, in 1850 of the 16th brigade of infantry, in 1854 of the confederate fortress of Mentz, in 1860 of the 7th army corps. In 1863 he became a general of infantry, and commanded in 1864 the Prussian troops against Denmark under Prince Frederick Charles, who was commander-in-chief of the allied Austrian-Prussian force. June 29 he took the island of Alsen. After the peace of Vienna he was appointed chief commander in the duchies of the Elbe, and in 1865 he received the command of the 8th army corps. In 1866 he was commander-in-chief of the army of the Elbe, gained victories in the encounter at Hünerwasser and Münchengrätz (June 26 and 28), and played a very conspicuous part in the battle of Königgrätz by crossing the Biestritz and attacking the villages of Problus and Prune. The Austrian left wing rested on these two points, and by storming and taking them he completely destroyed this wing of the enemy. In 1870, in the war against France, he was appointed governor-general on the Rhine and of all the western provinces, which difficult and responsible position lost a great deal of its importance, as the war was carried on in the enemy's country. On Apr. 8, 1871, Herwarth retired from active service as field-marshal-general. AUGUST NIEMANN.

Herz'berg (EWALD FRIEDRICH), b. at Lottin, in Pomerania, Sept. 2, 1725; studied law at the University of Halle, and entered in 1747 the service of the Prussian ministry of foreign affairs. He wrote in 1756 the famous *Mémoire raisonné*, founded on papers stolen from the archives of Dresden, and intended to defend the invasion of Saxony by Frederick II.; he also wrote a memoir in defence of the first partition of Poland in 1772; and the peace of Hubertsburg in 1763, as well as the formation of the so-called "Fürstenbund" in 1785 against Austria, was his work. Frederick II. appreciated him very much, and made him first minister of state, but after his death Herzberg's influence soon decreased, though Frederick William II. made him a count and president of the Academy of Science of Berlin. The convention of Reichenbach in 1790 proved a failure, and Herzberg retired. In 1793, when the second division of Poland and the unfortunate war against France had brought Prussia into a critical position, he offered his services once more, but the offer was not accepted, and the old man felt this disappointment so keenly that he fell sick and d. shortly after, May 25, 1795.

Herzegovi'na, province of Bosnia, in European Turkey, bounded W. by Dalmatia and S. by the Gulf of Cattaro and by Montenegro. Area, 6420 square miles. It is peopled largely by Slavic races; is occupied by the ridges and valleys of the Dinaric Alps; produces much grain, tobacco, and honey. Two-thirds of its people are of the Greek faith, and of the remainder one-third are Roman Catholics, the rest Mohammedans. The name is corrupted from Herzog ("duke"), because at the time of the Moslem conquest it had for some years been governed by a line of independent dukes. Cap. Mostar. Pop. 290,000.

Her'zen (ALEXANDER), b. at Moscow Mar. 25, 1812. In 1834 he was imprisoned for a short time, and banished to Viatka, near Siberia, on account of the radical ideas he entertained without concealing them. Having been pardoned in 1839, he was appointed clerk in one of the government offices at St. Petersburg, but his ideas had not changed, nor his desire for making them known, and consequently in 1842 he was ordered to reside in Novgorod. At the death of his father in 1847 he inherited a large fortune, and he now sought permission to go abroad. It was granted, and, steadily watched by the Russian police, he travelled for several years in Italy and France. In 1852 he settled in London; in 1865 he removed to Geneva; he d. in Paris Jan. 21, 1870. His most important literary undertaking was no doubt the *Kolokol* ("The Bell"), a Russian periodical, issued through many years, first in London and then in Geneva, and very extensively read in Russia. But besides some novels and sketches of a lighter description, though generally very interesting—as, for instance, *Whose is the Fault? Doctor Krupow* (both in 1847), *Recollections of my Travels* (1854), etc.—he wrote a great number of political and polemical works, as, for instance, *Russia and the Revolution* (3 vols., 1860), *Russia and the Old World* (1864), *Mémoires de l'Impératrice Catherine, écrits par elle-même*, with an introduction (1859), *Biloe i Domni* (3 vols., 1864), etc., which exercised great influence on Russian civilization. He was the channel through which the ideas of Western Europe flowed into Russia, but this channel was provided with a filter; some impracticable ideas may have slipped through, but much unclean matter was stopped. Of the revolutionists of Europe, Herzen is considered one of the noblest and one of the most powerful.

Her'zog (HANS), b. at Aarau in 1830; devoted himself to technical studies, and took charge of the factory of his father. He was very fond of studying military science, especially artillery; served as a volunteer in the Würtemberg artillery; visited the Sardinian camps, and was often present as a spectator at the German manœuvres. After serving for many years in the militia, he was appointed inspector of the confederate artillery. As the Franco-German war of 1870–71 made it necessary for Switzerland to take some military measures in order to protect her frontiers, Herzog was appointed commander-in-chief of the army in July, 1870. With the corps of 37,000 men which Switzerland raised he formed a line of observation, beginning in the valleys of the Jura, at Delsberg and Pruntat, increasing in strength along the banks of the Birr, Ergolz, and Rhine, continued over Schaffhausen into the canton of Zurich, and ending on the Aar at Brugg. As the war drew away from the Rhine in August, the greater part of this army was disbanded. Herzog resigned, but gave a report of the army organization which showed that the fighting capacity of the Swiss army was a mere illusion. He was persuaded, however, to assume the command once more when Bourbaki's army approached, and occupied the frontier with 30,000 men. In this position he mediated the passing of the French army, defeated at Belfort, across the Swiss frontier. AUGUST NIEMANN.

He'siod [Ἡσίοδος], next to Homer the oldest of the Grecian poets whose works are known to us, and founder of the epic-didactic school of poetry at the foot of Mt. Helicon in Bœotia, as Homer was the representative of the epic Ionian school of Asia Minor. The two schools had little in common except the epic form and dialect, for while Homer sang the exploits of heroes and sought to inspire admiration for adventurous enterprises, Hesiod inculcates the duty of labor and frugality, and treats of the daily round of domestic life. From these characteristics Cleomenes claimed the former as the bard of the Spartan warriors, while Hesiod was termed by him the poet of the Helots. Of the period when he flourished and the circumstances of his life we know little. What little is known is derived from his own writings; for while Homer, in whom there is greater objectivity than in any other poet, has left in his productions no personal allusions, Hesiod has introduced in many passages incidental accounts of his life and family relations. But in neither poet is any indication given of the period in which he lived. Nor is there any external testimony worthy of confidence. Herodotus (ii. 53) says that Hesiod and Homer lived 400 years before his time, and not more, which would give their date about 840 B. C. Most writers make the two contemporary, while some place Hesiod before, others 100 years later than, Homer. (The various statements are collected in CLINTON'S *Fasti Hellenici*, vol. i. pp. 359–361.) Göttling coincides in the opinion of Herodotus, while Grote, from the internal evidence of style and sentiment, places him shortly after 700 B. C. Hesiod was of Æolian parentage, b. at Ascra in Bœotia. His father had been a resident of Cyme, a town of Æolis in Asia Minor, but had removed to Ascra, where he possessed and cultivated a farm, which he left at his death to his two sons, Hesiod and Perses. After the division, Perses, the younger brother, who seems to have been fond of lawsuits and the harassing business of the agora, managed by bribing the judges to defraud his brother of a portion of his inheritance. Hesiod thereupon in disgust left his native Ascra and removed to Orchomenus, where he spent the rest of his life. He further intimates that he was engaged in farming pursuits, and the precepts which are embodied in his *Works and Days* appear to be the result of a practical acquaintance with agriculture. The way in which he was led to attempt poetic composition is related in the opening of the *Theogony*. The Muses, who frequented Mt. Helicon, on one occasion met Hesiod as he was pasturing his flocks at the foot of the mountain. They thereupon bestowed on him the gift of poetry, and consecrated him to their service by presenting him a laurel branch. The only other incident in his life is his visit to Chalcis in Eubœa, to take part in a poetical contest at the funeral celebration in honor of King Amphidamas, in which he gained a tripod as the prize, which he dedicated to the Muses. From this arose the story of a poetical contest between Homer and Hesiod, which gave rise to a production (Ἀγὼν Ὁμήρου καὶ Ἡσιόδου), still extant, and often printed with the works of Hesiod. His death was said to have been brought about through the false suspicions of two youths of Locris. His bones were subsequently removed, by command of the oracle, to Orchomenus, where a tomb was erected to his memory, and he was honored as a hero. The works ascribed to Hesiod are numerous, but some of these are not his own productions, but belong to the school of which he was the founder: (1) Ἔργα καὶ Ἡμέραι ("Works and Days"), a poem treating of the duties of the farmer and the best method of conducting the operations of agriculture, also inculcating justice, maintaining the dignity of honest labor, laying down rules for the regulation of life and the rearing of children (the "Works"); followed by a calendar of the days of the month on which it is advantageous or otherwise to undertake any labor (the "Days"). This poem is the only one accepted by the Bœotians about Mt. Helicon as genuine, though regarded as somewhat interpolated. (2) The *Theogony* (Θεογονία), which treats of the genealogy of the gods, being in great measure a mere enumeration of names, but containing some episodes of considerable beauty. From the battle of the Titans and the gods in this Milton borrowed for his battle of the angels. Herodotus recognizes the genuineness of this poem when he says that Hesiod and Homer formed a theogony for the Greeks and gave names to the gods. In its present form it has undergone many variations and been largely interpolated. The ancients regarded as a sort of continuation of the *Theogony* the poem called Ἠοῖαι, sometimes called Ἠοῖαι μεγάλαι or κατάλογοι γυναικῶν, an account of the women who had been loved by the gods, and who had become mothers of the great heroes and demigods from whom the princely houses of Greece were derived. The name is said to be formed from the expression used in introducing each character, ἢ οἵη. The work is now lost. (3) The *Shield of Hercules* (Ἀσπὶς Ἡρακλέους) is the title of a poem made up apparently

from other works of Hesiod; a part of it at least is believed to have belonged to the Ἠοῖαι, and only a portion is devoted to the description of the shield, and this is an imitation of Homer's shield of Achilles. The titles of other poems ascribed to Hesiod are—Αἰγίμιος, Μελαμποδία, Ἐξήγησις ἐπὶ τέρασιν, and Χείρωνος ὑποθῆκαι. The best editions of Hesiod are by Th. Gaisford in *Poetæ Minores Græci*, vol. i.; by Göttling (Gotha, 1843, 2d ed.); by Van Lennep (Amsterdam, 1843–47, 3 vols.); by F. A. Paley (London, 1861). Chapman has translated the *Works and Days* into English under the title *Hesiod's Georgics and Book of Days*, and Elton has given the entire poems. (See MÜLLER'S *Hist. Greek Lit.*, vol. i. p. 77; MURE'S *Hist. Greek Lit.*; GROTE'S *Hist. of Greece*, vol. i.; CREUZER u. HERMANN, *Briefe über Homer und Hesiod* (Heidelberg, 1817); GUIGNIAUT, *De la Théogonie d'Hesiode* (Paris, 1835); BÄHR, in *Pauly's Real-Encyklop.*) H. DRISLER.

Hes'peler, a v. of Waterloo tp. and co., Ont., Canada, on the Great Western Railway, 59 miles from Toronto, has manufactures of worsted, woollen, cotton, and other goods. Pop. of sub-district, 797.

Hes'per, post-tp. of Winneshiek co., Ia. Pop. 1041.

Hesper'ides, three or four, or even seven in number, were the daughters of Atlas and Hesperis. To their guardianship were entrusted the golden apples which Gea gave Hera as a bridal present, and which Heracles stole and brought to Eurystheus. Not only their number, but also their descent and the place of their garden, is variously given in the Grecian mythology.

Hesper'omys, a genus of Muridæ, including the white-footed or deer-mouse of the Northern States, and some thirteen other species of North American mice.

Hes'se [Ger. *Hessen;* Lat. *Hessia*], a mountainous territory in the western part of Central Germany, situated between the Neckar, Rhine, Main, Lahn, and Fulda. It was inhabited by the tribe of the Catti at the time of Germanicus, but the Catti became lost as an individual tribe among the Franks, and when these emigrated to Belgium and France, the Hessian territory became nearly depopulated. Meanwhile, the Saxons pushed into the country from Thuringia, and for a period Hessia was united with the Thuringian principality; but at the death of Henry Raspe in 1247 a succession-war broke out between his nephew, Henry of Misnia, and his niece, Sophia, married to Henry, duke of Brabant, which ended in 1263 in a separation of the two countries. Sophia obtained Hessia, and her son, Ludwig the Child, was acknowledged as landgrave, took up his residence at Cassel, and founded the Hessian dynasty. One of his descendants, Philip the Magnanimous, divided his land at his death in 1567 between his four sons, William IV., Ludwig IV., Philip II., and George I. But Ludwig IV. died in 1604 and Philip II. in 1583, without children, and thus only two branches of the family were continued—that of Hesse-Cassel, descending from William IV., and that of Hesse-Darmstadt, descending from George I. The elder branch, that of Hesse-Cassel, ceased to reign Aug. 17, 1866, when its dominions were incorporated with Prussia; but it reigned long enough to acquire quite a conspicuous place in history, for no family was ever meaner, more treacherous, or more infamous; and as if to intensify the character of their history, most of its members possessed a peculiar art of mixing their stupidity and their crimes with the ridiculous. Frederick II., landgrave from 1760 to 1785, hired to England 22,000 of his subjects to fight against the Americans (1776–84), and was paid therefor 21,276,778 thalers. He had sixteen palaces, some of them large enough to contain sixteen landgraves, yet he left a mysterious treasure, which his son in the days of trouble deposited with the Frankfort Jew, Rothschild. This son, William I., made first a bargain with Napoleon, and rose accordingly in dignity from landgrave to elector in 1803; but unable to predict whether France or Prussia would carry the day, and having prepared himself for siding with Prussia if that should prove the way to profit, he was discovered by Napoleon and expelled shortly after the battle of Jena (Nov. 1, 1806); his dominions were incorporated with the kingdom of Westphalia. After Napoleon's fall he returned to his electorate (Nov. 21, 1813), with many golden promises to his subjects of constitution, representative government, etc., all of which he broke as soon as he discovered that constitution and representative government had something to do with the finances. His intrigues, however, in Vienna to be created king by the congress, like the electors of Saxony and Bavaria, and the indignation of the other kings on account of this impertinent demand, form a very entertaining episode. He d. Feb. 27, 1821. Under his son and successor, William II., the discord between monarch and subjects became dangerous, and when in 1830 a revolution actually broke out, he followed his father's example: he promised everything on one day, and broke his promises the next. Still worse was Frederick William I., who succeeded his father Nov. 20, 1847. When the revolution of 1848 came, nothing was too dear to him: censorship of the press, religious restrictions, arbitrary judicatory authority, irresponsible financial measures, etc.,—he gave up all, and granted an excellent constitution, but in 1852 foreign soldiers sat in courts-martial and condemned Hessian civil officers because they had declined to act against the constitution on which they had made oath. From 1834 to 1861 the population of the Hessian electorate decreased more than 6 per cent., and it was a great benefit, not only to Hesse, but to Germany and to civilization in general, when in 1866, the elector happening to side with Austria, Count Bismarck had him carried as prisoner to Stettin and his dominions incorporated with Prussia.

The younger branch, that of Hesse-Darmstadt, is still reigning. One of its members, Ludwig I., joined the confederation of the Rhine and obtained from Napoleon large accessions of territory and the title of grand duke. He followed Napoleon faithfully until after the battle of Leipsic, when he was fortunate enough to join the allies just in time to be accepted. After 1814 he promised, like all the German princes, to give a constitution, but he redeemed his word conscientiously, and the country was in a prosperous condition when he d., Apr. 6, 1830. His grandson, Ludwig III., who succeeded to the throne June 16, 1848, concluded a special military convention with Prussia in 1867, according to which the army of Hesse became a part of the army of the North German confederation, and as such it took part in the Franco-Prussian war in 1870. CLEMENS PETERSEN.

Hes'se-Darm'stadt, German grand duchy, consists of two large and eighteen small separate districts, situated partly between Prussia, Bavaria, and Baden, partly within the Prussian frontier. Area, 2964 square miles. Pop. 852,894; namely, 585,399 Protestants, 238,080 Roman Catholics, and 25,373 Jews. The country is mountainous or hilly, covered by Vogelsberg, Odenwald, and spurs of Taunus and Westerwald, but the soil is very productive and well cultivated. Wheat, wine, fruit, and tobacco are raised; some iron, salt, and brown coal is mined; linen and woollen fabrics, leather and straw goods, are manufactured; the carriages from Offenbach are celebrated. The annual revenue amounts to $4,500,000; the expenditures to $4,250,000; the public debt to $5,500,000. Cap. Darmstadt.

Hes'se-Nas'sau, province of Prussia, formed in 1866 of the electorate of Hesse-Cassel, the duchy of Nassau, the landgraviate of Hesse-Homburg, and the free city of Frankfort, is situated between Hesse-Darmstadt, Bavaria, and the provinces of Saxony, Hanover, Rhenish Prussia, and Westphalia. Area, 6021 square miles. Pop. 1,400,370. The surface is mountainous, occupied by the Spessart, Rhön, Westerwald, and Taunus, but the soil is very fertile and well cultivated. Agriculture, cattle-raising, and manufacture of cloth, iron, jewelry, and pottery are the chief occupations. Much and excellent wine is produced. Mineral springs are numerous, and the watering-places of Ems, Wiesbaden, Schlangenbad, and others are celebrated.

Hes'sian-Fly [so called because it was believed to have been brought from Germany by the Hessian troops during the Revolution], the *Cecidomyia destructor*, a dipterous insect which is very destructive to wheat in parts of the U. S. In spring and autumn the larvæ crawl in between the stalk and the sheath of a leaf, and remain near the ground, head downward, sucking the juice. In five or six weeks they enter a semi-pupa or "flaxseed state," from which they go into the pupa, and then become perfect insects. They are destroyed in great numbers by insect parasites, and burning the stubble in the autumn will destroy a great proportion of their larvæ.

Hes'ychasts [Gr. ἡσυχασταί, "quietists"], a body of mystics in the Greek Church, chiefly monks of Mt. Athos, who professed that by retirement and contemplation they could come to behold the divine glory (called the "Taboritic light," because it was regarded as the same as that which shone at Christ's transfiguration on Mt. Tabor). They believed that the best position they could assume for beholding this light was to sit and gaze upon the navel. They flourished in the fourteenth century, but the leaven of their doctrine is not yet extinct in the East. Barlaam was their great opponent.

Hesych'ius [Ἡσύχιος], a grammarian of Alexandria, under whose name a valuable Greek lexicon has come down to us. Nothing is known of his life, and his date is so uncertain that critics vary in regard to it from 390 A. D. to the tenth century. The former is more generally accepted, and the forms and references which imply a later date are believed to be interpolations. The work is based on the ear-

lier lexicon of Diogenianus, and is valuable as containing explanations of words and forms and literary and archæological information derived in part from writers now lost. The explanations of words from the Scriptures and from Christian writers are the additions of later hands. The best editions are by Alberti and Ruhnken (Leyden, 1746–76, 2 vols., fol.), and by M. Schmidt (5 vols. 4to, Jena, 1858–61); the *Glossæ Sacræ* separately by Ernesti (Leipsic, 1785). (See RANKE, *De Lex. Hesych. vera origine*, etc., Quedlinburg, 1831.) H. DRISLER.

Hesychius, of Miletus, a philosopher and historian, surnamed Ἰλλούστριος (the Latin *illustris*), lived in the sixth century A. D. under the emperor Justinian. He wrote a synoptical history (Ἱστορικὸν ὡς ἐν συνόψει κοσμικῆς ἱστορίας) of the world, in six parts, from Belus, king of Assyria, to the death of Anastasius I. Of the sixth part a portion, relating to the origin of Constantinople, still remains. He was also the author of a work treating of persons distinguished for their learning (Περὶ τῶν ἐν παιδείᾳ διαλαμψάντων σοφῶν), arranged under the letters of the alphabet, probably extracted from the work of Diogenes Laertius. Best edition of both treatises by Orelli (Leipsic, 1820). H. DRISLER.

Heterocer'cal [Gr. ἕτερος, "another," and κέρκος, "tail"], a name applied to the tails of those species of fish which have the vertebral column extended into the upper lobe, which is the larger of the two. A symmetrical fish-tail is called *homocercal*. The terms were introduced by Agassiz. The cartilaginous fishes and many extinct species have heterocercal tails, and fishes with homocercal tails have, while imperfectly developed, tails of heterocercal character. This fact was formerly held to indicate a relatively low rank for fishes with heterocercal tails; but this opinion is not generally accepted.

Heteropy'gia [from ἕτερος, "abnormal," and πυγή, "anal region"], a group of fishes represented by a single family (Amblyopsidæ), belonging to the order Teleocephali and the sub-order Haplomi, and especially distinguished by the abnormal position of the vent under the opercular region, and consequently far in advance of the pectoral fins (and hence the name). The fishes are subfusiform in outline, with minute scales on the body, but none on the head, with the dorsal and anal fins opposite to each other, and with the ventral fins very small and abdominal or entirely wanting. The margin of the upper jaw is formed wholly by the intermaxillaries. The intestinal canal has two turns; the stomach is well defined and cæcal; and pyloric appendages are present. The species are viviparous. To this family belong four species, which have been referred to three distinct genera: (1) AMBLYOPSIS (which see), including the celebrated large blind fish of the Mammoth and some other caves of Kentucky and Indiana (*Amblyopsis spelæus*), in which there are no functional eyes and ventral fins are present; (2) *Typhlichthys*, represented by a small species (*Typhlichthys subterraneus*), which is also found in the Mammoth Cave, as well as in some other subterranean streams in Kentucky, Tennessee, and Alabama, which is also destitute of eyes, but has no ventral fins; and (3) *Chologaster*, containing two species (*C. cornutus*, Ag., discovered in rice-ditches in Carolina, and *C. Agassizii*, Putnam, found in subterranean streams in Tennessee), both having eyes and being destitute of ventral fins. *Amblyopsis* and *Typhlichthys* have each a single pyloric appendage on each side, and the ovary is at each side of the stomach, and the head has tactile ridges; while *Chologaster* has two pyloric appendages on each side, and the ovary is placed behind the stomach, and the head is without ridges. The species of *Amblyopsis* sometimes reaches nearly five inches in length; those of *Typhlichthys* and *Chologaster*, less than two. The affinities of these fishes have been generally supposed to be with the killy-fishes or minnows (Cyprinodontidæ), but their relation to those forms is not close, although there is some resemblance in general appearance.

Much speculation has been spent upon the question of the origin of the blind fishes, but it is sufficient to state that they are very closely related to perfectly seeing fishes (*Chologaster*) found in the streams of the same region, and that at the same time there are other differences between the two forms than those of sight; therefore we cannot attribute the parentage of the blind fishes directly to the eyed ones. Inasmuch, however, as we know by experiment and the occurrence in entire groups of animals of the tendency towards atrophy of parts that are disused, it is tolerably certain that the want of sight could be readily effected by confinement to dark caves, and we should doubtless search for the original progenitors of the blind fishes in formerly existing eyed ones. (See PUTNAM (J. W.) in *Annual Report of the Peabody Academy of Science* for 1871, and in *American Naturalist* for Jan., 1872.) THEODORE GILL.

Heteroso'mata [from ἕτερος, "unequal," and σῶμα, "body"], a sub-order of teleocephalous fishes, peculiar among the vertebrates in the asymmetry of the body, to which the name alludes. The animal is very much compressed, with dorsal and abdominal edges trenchant, and generally it rests on the sandy or muddy bottoms of the water flat on one side, and hence the inferior is white, while the side which is kept uppermost is dark; the ventral fins are jugular or thoracic; the dorsal and anal fins very elongated; the scapular arch is destitute of a mesocoracoid bone. They are most nearly related to the cod-fishes and allied tribes. In the early embryonic stage these fishes are symmetrical, but they very soon assume that dissimilarity of the sides which is characteristic of the mature condition. Their development has been studied by Malm, Steenstrup, Thompson, Traquair, Schrödte, etc. Steenstrup (1864) contended that the combination of the eyes on one side was effected by a transfer of the upper one from the blind side through the tissues below the arch formed by the frontal bone of its own side to the opposite one. But a more consecutive study of the development and anatomy of the various forms seems to establish the fact that this transfer is rather effected by a rotation of the eye and contiguous parts from the one side to the other. The rotation of the eye has been explained on the principle of its tendency, while the fish is yet young and symmetrical, but prone to lie on one side, to turn towards the light; this tendency, confirmed and established by slow degrees, finally culminated in the habit now universal. The least generalized of this type is the *Reinhardtus hippoglossoides*, a kind of halibut found in the Arctic seas and as far S. as the Banks of Newfoundland. The sub-order embraces two families (PLEURONECTIDÆ and SOLEIDÆ) and numerous species. THEODORE GILL.

Heth, tp. of Harrison co., Ind. Pop. 1615.

Hetman. See ATAMAN.

Het'zel (PIERRE JULES), b. at Chartres in 1814, began as the partner of Paulin, the celebrated publisher of the works of the greatest modern French writers. In 1848, Hetzel exercised a great influence in favor of the republican movement, and occupied several offices in the capacity of an under-secretary in two ministries, and finally as general secretary of the executive power. During the empire Hetzel busied himself exclusively with publishing the books of Victor Hugo, Georges Sand, etc., and he wrote also, under the pseudonym of "Stahl," some highly moral books, like *The Familiar Moral, A Student's Travels, New and Sole Adventures of Tom Thumb, The Esprit of Women and Women of Esprit*, etc. FÉLIX AUCAIGNE.

Heug'lin, von (THEODOR), BARON, b. at Hirschlanden, Würtemberg, Mar. 26, 1824; travelled in the East 1850–52; became Austrian consul at Khartoom, and explored Abyssinia and the White Nile Valley 1852–54; travelled along the Gulf of Aden and the shores of the Red Sea 1856–58; from 1860 to 1865 was again engaged in African explorations; made a journey in the region of Spitzbergen and Nova Zembla 1870–71. Author of *Reisen in Nordostafrika* (1857), *Ornithologie Nordostafrikas* (1860), *Systemat. Uebersicht der Säugethiere Nordafrikas* (1867), *Reise nach Abessinien*, etc. (1868), *Reise in das Gebiet des weissen Nil* (1869), etc.

Heus'ser (Mrs. META), the best female song-writer in the German language, and a woman of rare genius sanctified by deep piety, b. Apr. 6, 1797, the fourth daughter of Pastor Diethelm Schweizer, in the mountain-village of Hirzel, canton Zürich, Switzerland, within 8 miles of Mount Rigi, where she spent her life, and still resides. She married Dr. Heusser, an eminent physician, and became the mother of a large family, but her household duties did not prevent her from singing "like the bird on the tree," giving utterance to her love of nature and nature's God, and the joys and sorrows of her heart. She never dreamed that her lays would ever be given to the world, but her friends thought differently, and after many vain efforts they obtained her consent to publish anonymously some of them in Knapp's *Christoterpe* (1834). They were most favorably received, and passed into many collections and German hymn-books of Europe and America. In 1857, Albert Knapp edited a volume of her poems (under the title *Lieder einer Verborgenen*), which was followed by another volume (Leipsic, 1867) under her real name, which at last became generally known. A selection from both volumes has recently been translated into English by Miss Jane Borthwick (translator of *Hymns from the Land of Luther*), under the title *Alpine Lyrics* (Edinburgh and London, 1875). Koch, in his *History of German Church Poetry* (3d ed.), well characterizes her poems in these words: "From contemplation of the glorious Alpine world, and the atmosphere of spiritual freedom which she daily and hourly breathes out of the Sacred Scriptures, have sprung

the tender yet deeply reflective poems which have made Meta Heusser the most eminent and noble among all the female poets of our whole Evangelical Church. Her lays flow freely from the fresh fountain of a heart in constant, holy communion with God." PHILIP SCHAFF.

Heus'tis (JABEZ WIGGINS), M. D., b. in 1786 in St. John, N. B. It is believed he graduated in the College of Physicians and Surgeons of New York City; made a cruise in a man-of-war as surgeon's mate, and on his return was appointed surgeon in Gen. Jackson's army, and served throughout the Southern campaigns. Dr. Heustis was a ready writer, and from 1816 to the time of his decease, which occurred from blood-poison contracted by a puncture made while operating, he wrote on the topography and diseases of Louisiana, etc., and contributed largely to the *American Journal of Medical Sciences.* In 1835 he removed from Cahawba (where in 1825 he was selected to welcome La Fayette) to Mobile, but was at the Talladega Springs when he d., 1841. Few in the South were more active in the profession than he, or more deserving. PAUL F. EVE.

Heves, town of Hungary, carries on a considerable trade in wine, wheat, tobacco, flax, and hemp, raised in its vicinity. Pop. 5700.

Hewes (JOSEPH), a signer of the Declaration of Independence, b. of Quaker stock at Kingston, N. J., in 1730; was educated at Princeton, and went into business, first in Philadelphia, and then at Edenton, N. C.; was a member of the General Congress from North Carolina 1774–77, and again in 1779. In Congress he took a prominent part in the performance of public business. D. at Philadelphia Nov. 10, 1779.

Hew'it (AUGUSTINE FRANCIS), a Roman Catholic (Paulist) priest, a son of N. Hewit, b. at Fairfield, Conn., in 1820; graduated at Amherst in 1839; studied theology at East Windsor, Conn., and became an Episcopalian minister. In 1846, while residing in North Carolina, he became a Roman Catholic; was ordained in 1847; joined the Paulists in 1848, and afterwards was appointed professor of philosophy, theology, and Holy Scripture in the Paulist seminary, New York. Author of *Problems of the Age, Light and Darkness,* and of several translations, and of many articles in periodicals.

Hewit (HENRY STUART), M. D., b. at Fairfield, Conn., Dec. 25, 1825; studied at Yale College; was a pupil of Drs. Van Buren and Mott; graduated 1847 at New York University; was an assistant surgeon (1847–52) in the U. S. army, serving in Mexico and on the Pacific coast; practised three years in California; became a Roman Catholic 1855; returned to New York; served 1861–65 as a surgeon of volunteers on the staffs of Gens. Grant, Scofield, etc.; was eminent for charitable labors. Son of Rev. Nathaniel Hewit and grandson of James Hillhouse. D. in New York Aug. 19, 1873.

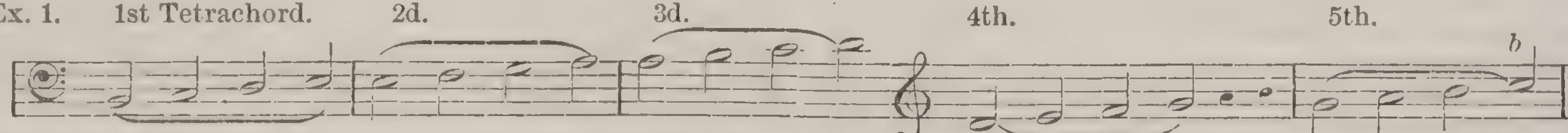
Hewit (NATHANIEL), D. D., b. at New London, Conn., Aug. 28, 1788; graduated at Yale in 1808; taught for some years, and in 1811 was licensed to preach; studied theology at Andover; held Presbyterian and Congregational pastorates at Plattsburg, N. Y., 1815–17, and at Fairfield, Conn., 1818–27; engaged in the temperance reform 1827–30; held pastorates at Bridgport, Conn., 1830–62, receiving an assistant in the latter year. He was one of the founders of the East Windsor (now Hartford) Theological Seminary, and an able and eloquent defender of the Old School theology. D. Feb. 3, 1867.

Hew'itt (ABRAM STEVENS), A. M., b. at Haverstraw, N. Y., July 31, 1822; graduated at Columbia College 1842; studied law, but engaged in the manufacture of iron; was commissioner to the French Exposition of 1867; was elected in 1874 to the 44th Congress (1875–77) from the Tenth district of New York; has been secretary of the Cooper Union for the Advancement of Science and Art, New York City, from its organization to the present time (1875); and is widely known as an expert in questions relating to the iron manufacture. Author of the official *Report on the Iron and Steel of the Universal Exposition of 1867.*

Hew'ston (GEORGE), A. M., M. D., b. at Philadelphia Sept. 11, 1826; graduated A. M. at the Central High School, Philadelphia, 1845; M. D. at the Philadelphia College of Medicine 1850; received the same degree in 1860 from the University of Pennsylvania; was professor of anatomy in the first-named medical college, and afterwards became professor of the theory and practice in the University of California, a position which he still holds (1875); was supervisor of San Francisco 1873–75; president of the Odd Fellows' Library of San Francisco, etc., and member of various scientific societies.

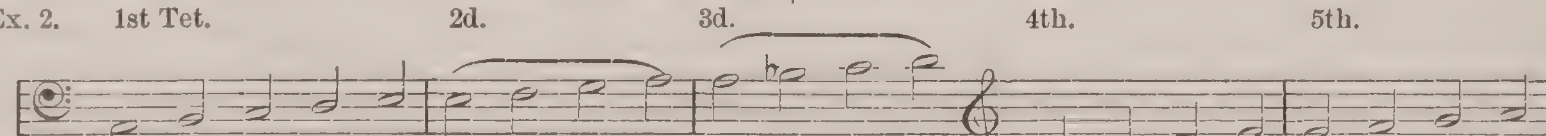
Hex'achord, in music, a series of six notes in direct succession, forming a portion of a scale. The extension of the musical scale and its division into hexachords are attributed to Guido, a monk of the eleventh century. Under the system of the ancient Greeks, which continued for ages to influence all music, both ecclesiastical and secular, the scale was divided into *tetrachords*, or portions of four notes each. As the Greek scale comprised only about fifteen notes, or two octaves, these tetrachords could not apparently exceed four and a fraction in number; but the Greeks, by an ingenious use of some extraneous elements, obtained no less than five. According to our modern reckoning—taking B in the bass, as the Greeks did, and following their mode of division—the four tetrachords would not fill the double octave, and a fifth tetrachord added would reach beyond it, as at *a, b* in Ex. 1:

Ex. 1. 1st Tetrachord. 2d. 3d. 4th. 5th.



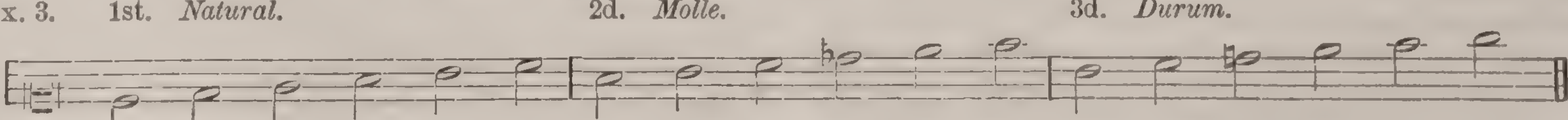
But under the Greek system the five tetrachords were obtained—1st, by adding an initial note A, which note was called the *Proslambanomenos;* 2d, by using B♭ in the third tetrachord, and then commencing the fourth tetrachord by a descent to B♮, thus:

Ex. 2. 1st Tet. 2d. 3d. 4th. 5th.



It is evident that the fourth and fifth of these tetrachords are merely repetitions in the octave of the first and second, but, as Dr. Burney remarks, "the several sounds of which they are composed have in the Greek music different denominations," and also were no doubt different in their treatment and effect. Guido's system, imperfect and unsatisfactory as it is, was nevertheless an advance towards the modern and only rational system of the division of the scale—viz. into successive *octaves*. It is commonly supposed also that Guido invented the mode of writing his hexachords and other music on lines and spaces. This, however, is an opinion for which the evidence is weak. For many ages after him the stave consisted of only *four* lines, with their spaces, and in the Church of Rome and elsewhere the same system of notation is extensively used for Gregorian music at the present day. The hexachords of Guido were three in number, and were based on C, F, and G, the first being called the *natural;* the second, the *molle*, or soft; and the third, the *durum*, or hard. To each of these were assigned the syllables *ut, re, mi, fa, sol, la;* and in the F hexachord B *flat* was substituted for B natural. These hexachords may be thus expressed, and their range extends to an octave and a third—viz. C———C—E, etc.

Ex. 3. 1st. *Natural.* 2d. *Molle.* 3d. *Durum.*



It is known, however, that in Guido's time more notes than these were in use, he himself having invented the gamut, which began on the lower line of our modern bass stave. Taking, therefore, gamut G as the first of an ascending series of notes, and E of the last example as its termination, we have a succession of twenty-two notes (including B flat), which admits of easy arrangement in the form of seven hexachords, thus:

Ex. 4. 1st. 2d. 3d. 4th. 5th. 6th. 7th.

The system of hexachords is of no practical use in modern music, being superseded by the simple and natural division of the scale on the normal type of the series of notes forming the octave. WILLIAM STAUNTON.

Hexam′eter [Gr. ἑξάμετρος, "of six metres," ἕξ, "six," μέτρον, "measure"], in Greek and Latin prosody, is the name of the heroic verse of Homer, Virgil, Ovid, and others. Ancient rhythm is based chiefly on the distribution of long and short syllables, while the less delicate ear of the moderns is satisfied with the alternate presence or absence of accent. Taking a succession of Virgil's lines (bk. 1, l. 8–10)—

Mū′să mĭ′ | hī cāvs′ | ās mĕm′ŏ | rā, qvō | nū′mĭnĕ | læ′so, |
qvīd′vĕ dŏ′ | lēns, rēg | ĭ′nă dĕ′ | ūm, tōt | vōl′vĕrĕ | cā′sus |
īnsīg′ | nēm pĭĕ | tā′tĕ vĭr | ūm, tŏt ăd | ĭ′rĕ lăb | ō′res,

and representing them in English, syllable for syllable and accent for accent,

Mùse relate | those trèa | sōns cónsum ‖ mātēd, ‖ càuses of | tòrture, |
whènce the ób | durate | queen of hón ‖ or'd gods ‖ drìving a hèro |
supè | ryor in his | vìrtūe, ún ‖ dēr such im ‖ pòsing mis ‖ fòrtune, |

we find that the feet are composed of dactyls (¯ ˘ ˘) and spondees (¯ ¯), with the accents entirely absent or present at any point—in some cases (as mū′să mĭ′-) two being present in a single dactyl. Looking farther, we find that any foot from the first to the fourth may be dactylic or spondaic at pleasure; the fifth in nearly every case is a dactyl, and the sixth a spondee. This recurrence of final dăc′ty̆lŭs-spōndēe would not be sufficient to enable the listener to seize the metre; he is therefore aided by an *initial accent* on each of these feet (see ADONIC VERSE); and, as if this were not enough, Virgil in many cases separates them from the four feet with mixed accents, by making the fifth foot accentless, or what we may term *neutral*, because it has *neither* the irregular accent of the earlier feet nor the regular accent of the close. The following is a longer specimen (bk. 1, l. 23–33):

Remembering this, Saturnia, thinking o'er various conflicts
waged at Troy's stronghold for Argōs, dear to remembrance:
nor no-w had grievous causes resentful escaped from
her angry soul. Paris, whose verdict rankles sorely her bosom,
a stigma on slighted form, and also stol'n Ganyme-de,
a nation despising cordially for evils unequall'd,
she (these urging) scatters far fàr from Latyum the Trojans
over wide ócean—those relics lèft by ruthless Achilles
and Grecian heroes. Many years they wander'd in sailing
âround thro' num'rous waters, Fāte alluring them onward.
Founding such a nation, required these arduous labors.

To an ear trained to the strong accent of German and English verse the rhythm of such lines is not readily appreciated, and accordingly efforts have been made to prove that the *Æneid* must be commenced with "Arma virumqve cănō′," instead of căn′ō; for, according to Priscian, no Latin words have a final accent. Richard Roe (*Principles of Rhythm*, 1823) goes so far as to say of the ancients that "there is reason to believe that their perceptions of quantity were confused and imperfect"—where the imperfection is his own.

The misnamed hexameters of Southey, Coleridge, and other moderns are mere hexametroids, or accentual hexapodies in mixed rhythm, and without dactyls and spondees, as shown in two of Prof. Longfellow's lines, in which "ruddy" is supposed to be a spondee, and "then through those" an equivalent dactyl:

Fĭllĭng ĭt | fŭll of | lŏve and the | rŭddȳ | fāces of | children. . . .
Then through those realms of shade, in multiplied reverberations,

the second line of which has quantitive matter enough for seven feet, and other lines would pass for distichs of *Hiawatha*, as—

Louis | burg is | not for | gotten, |
nor Beau | Séjour, | nor Port | Royal. |

These spurious hexameters belong to what Guest (*English Rhythms*, i. p. 177) mentions as "these slovenly verses the 'tumbling' metre. . . . the impudent license of the tumbling metre." Such forms tend to the perversion of Latin scansion, and to the destruction of just ideas of the nature of feet. They have neither the rhythm of Latin nor of English verse, but, on the contrary, they constitute an offensive system which is tolerated only because it is supposed to be classic. S. S. HALDEMAN.

Hex′apla [Gr. "the sixfold"], a celebrated edition of the Septuagint text of the Old Testament, the original Hebrew, the Hebrew in Greek letters, the Greek versions of Aquila, Symmachus, and Theodotion. Besides these, there were columns containing parts of three other Greek versions, whose authors are not known. Origen was the author of this great work, which he originally prepared as a tetrapla, giving four columns only. The Hexapla had also marginal notes, and marks indicating variations, retrenchments, and additions in the texts. The Hexapla is not extant except in fragments, of which the most complete edition is that of the Benedictine Montfaucon (2 vols. folio, Paris, 1714).

Heyst-op-den-berg, town of Belgium, in the province of Antwerp, has some cloth-factories and corn-mills. Pop. 5676.

Hey′ward (THOMAS, JR.) was b. in St. Luke's parish, S. C., in 1746, and was the son of a wealthy planter, Col. Daniel Heyward. The son studied law in London, and was early and prominently connected with the Revolutionary movement in North Carolina. He was (1775–78) one of the signers of the Declaration of Independence, and was afterwards a judge in his native State, holding also a military command. He was (1780–81) a prisoner in the hands of the British. D. in Mar., 1809.

Hey′wood, town of England, in the county of Lancaster, on the Roach, has large iron-foundries and extensive manufactures of cotton fabrics. Pop., with surroundings, 19,454.

Heywood (CHARLES), U. S. M. C., entered the marine corps as second lieutenant Apr. 5, 1858; became first lieutenant early in 1861, and captain in November of that year; served on board the Cumberland in her encounter with the Merrimack, Mar. 8, 1862, and in the flagship Hartford at the great battle of Mobile Bay, Aug. 5, 1864; and is very highly spoken of in the despatches of his commanding officers. Received the brevets of major and lieutenant-colonel for "gallant and meritorious conduct."
FOXHALL A. PARKER.

Hey′worth, post-v. of Randolph tp., McLean co., Ill., on the Illinois Central R. R., 12 miles S. of Bloomington. Pop. 300.

Hezeki′ah ("The Lord hath strengthened"), thirteenth monarch of Judah, son and successor of Ahaz. He reigned twenty-nine years (726–697 B. C.). He was a devout man, a severe enemy of idolatry, and the restorer of the ancient worship. He warred successfully against the Philistines, and refused to pay the established tribute to Tiglath-Pileser, king of Assyria, in consequence of which Jerusalem was besieged, and Hezekiah was forced to purchase peace by a heavy mulct in silver and gold and by the loss of parts of his dominions. It is probable that Sennacherib, the Assyrian general, next marched into Egypt to punish the Ethiopians and Egyptians, Hezekiah's allies, that he was repelled by Tirhakah, and that the miraculous destruction of 185,000 Assyrians took place in a second invasion, after the failure of the Egyptian campaign. Hezekiah was soon after visited with a severe sickness, from which he was miraculously healed. The remaining years of his reign were peaceful and prosperous. D. 697 B. C.

Hiacoomes, an Indian minister of Martha's Vineyard, b. about 1610; converted under the preaching of Thomas Mayhew; learned to read, and began himself to preach in 1653 to his people, among whom he labored with much success and with great faithfulness. In 1670 he was ordained by Eliot and Cotton as pastor of the Indian church of Martha's Vineyard, organized in that year. He is believed to have been the first Indian convert in New England. D. about 1690.

Hiawas′see, post-v., county-seat of Towns co., Ga., 85 miles N. of Athens.

Hiawa′tha, post-v., cap. of Brown co., Kan., 42 miles W. of St. Joseph, on the St. Joseph and Denver City R. R. It has 4 churches, 1 bank, 1 newspaper, a steam flouring-mill, 2 grain elevators, 2 hotels, several schools, and the usual number of stores. It is situated in a fine agricultural region, with excellent water-power. Pop. about 800.
A. N. RULEY, ED. "DISPATCH."

Hib′bard (BILLY), b. at Norwich, Conn., Feb. 24, 1771; joined the New York Methodist conference 1798, and labored with great success in New York and New England. D. Aug. 17, 1844. His memoirs have been published.

Hibbard (FREEBORN GARRETSON), D. D., b. at New Rochelle, N. Y., Feb. 18, 1811; entered the Methodist Episcopal ministry; labored 1830–60 chiefly in the State of New York; was editor of the *Northern Christian Advocate*, Auburn, N. Y., 1860–64; resumed active labor, and became presiding elder of the Geneva district. Author of *Baptism* (1841), *Geography and History of Palestine* (1845), a work on *The Psalms* (1852), *The Religion of Childhood* (1864); edited the *Sermons* (1869) and the *Works* (2 vols., 1872) of Bishop Hamline.

Hiberna′tion [from the Lat. *hibernus*, "pertaining to winter"], a condition into which certain mammals (bats, rodents, Insectivores, bears, etc.) and many inferior animals, both vertebrate and invertebrate, pass in cold weather, the temperature of the blood being lowered nearly to that of the air, and many of the vital functions entering a state of abeyance. The power of the will over the muscles is quite suspended, and respiration is nearly abolished, while the muscular irritability in the case of the higher

hibernating animals is remarkably increased. Meanwhile a very great loss of weight occurs from the slow destruction of the store of fat which the animal has laid up in the autumn. It is evident that animals feeding on insects and succulent vegetables could never survive a northern winter but for the state of hibernation which suspends the need of food. Accordingly, while northern bats and some bears hibernate, those of tropical regions do not do so.

Somewhat analogous to hibernation is the long slumber which many reptiles, mollusks, and other inferior organisms undergo in the dry season in very hot countries. The animal becomes more or less completely desiccated, and from the loss of moisture the functions of life are suspended. This suspension also serves to preserve animal life in very untoward conditions. Cuvier states that the tenrecs (Insectivores) of Madagascar remain torpid through the hot season, but this statement has been denied.

Hiber′nia, Iber′nia, Iver′nia, and **Ier′ne** are the names under which Ireland is mentioned by the ancient writers—by Aristotle, Diodorus Siculus, Strabo, Pomponius Mela, Pliny, and Ptolemy.

Hibernia, post-v. of Morris co., N. J.

Hibis′cus [Gr. ἱβίσκος], a large genus of malvaceous trees, shrubs, and herbs, often with large and showy flowers. The herbaceous species are numerous in the U. S., and are known as rose-mallows. Among the cultivated species are the GUMBO (which see), the *H. cannabinus*, or Deccanee hemp of India, a useful fibre-plant, and *H. Syriacus*, the ornamental, shrubby althæa of gardeners. Other species, mostly tropical, are cultivated for their fruit or seeds or the beauty of their flowers. One of the most interesting species is *Hibiscus tiliaceus*, a very large but not tall tree, growing in Florida, the East and West Indies, and the South Sea Islands. Its wood is light, tough, and very useful; its bark yields material for matting and cordage, and the same bark is used as food in the Pacific Islands.

Hib′ler, tp. of Edgefield co., S. C. Pop. 1607.

Hic′cough, or **Hic′cup** [Lat. *singultus*], a clonic spasm of the diaphragm and of the glottis, accompanied by a sharp sound, produced by the rush of air into the larynx from without. It may attend an over-distension of the stomach with food, and sometimes accompanies intoxication. In young children it often is the forerunner of intestinal disturbances. When persistent, it is, in some diseases, such as low fevers, peritonitis, and gangrene, a rather grave symptom. Lumps of ice frequently swallowed or small doses of antispasmodic medicines will usually relieve obstinate hiccough.

Hick′man, county of Kentucky, bounded on the W. by the Mississippi River. Area, 240 square miles. It is level and fertile, producing tobacco and corn as the chief staples. It is traversed by the Mobile and Ohio R. R. Cap. Clinton. Pop. 8453.

Hickman, county of W. Central Tennessee. Area, 350 square miles. It is a hilly and fertile region, having good water-power and deposits of iron ore. Cattle, corn, tobacco, and wool are staple products. Cap. Centreville. Pop. 9856.

Hickman, tp. of Scott co., Ark. Pop. 1310.

Hickman, city, cap. of Fulton co., Ky., on the Mississippi River, at the terminus of the Nashville Chattanooga and St. Louis R. R. It has 2 academies, 6 churches, a city library, a steam furniture and wagon factory, and several steam flouring-mills. The Masons, Odd Fellows, and Good Templars have flourishing lodges here. It has 1 weekly newspaper. Pop. 1120, composed largely of Germans.

GEO. WARREN, ED. "COURIER."

Hick′man's, post-tp. of Tuscaloosa co., Ala. Pop. 592.

Hick′ok (LAURENS PERSEUS), D. D., LL.D., b. at Bethel, Conn., Dec. 29, 1798; graduated at Union College 1820; ordained and settled as pastor of the Congregational church at Kent, Conn., 1824; removed, and again installed pastor at Litchfield, Conn., 1829; became professor of theology in Western Reserve College 1836, and in the Auburn Theological Seminary 1844; was again transferred to Union College as vice-president and professor of mental and moral philosophy 1852, where for eight years he was associated with Dr. Nott in the government and discipline of the college, and where for the eight years succeeding he had sole charge thereof, being officially inducted into the presidency only at Dr. Nott's death, 1866. At the age of seventy, in fulfilment of a purpose long cherished, he retired from all public and official station, and removed to Amherst, Mass., where he has since resided, devoting his time to philosophical studies. Besides occasional sermons and addresses, he has been a frequent contributor to such periodical publications as the *Christian Spectator*, *Bibliotheca Sacra*, *Biblical Repository*, *Presbyterian Quarterly*, etc. on various theological and philosophical themes. His more extended published works are—*Rational Psychology* (1848), *System of Moral Science* (1853), *Empirical Psychology* (1854), *Creator and Creation* (1872), *Humanity Immortal* (1872), and *Logic of Reason* (1875).

Dr. Hickok has from the first held firmly the necessary distinctions in the intellectual functions of the sense, the understanding, and the reason, and the peculiarity of his philosophy is seen in his clear idea and discriminative use of the reason. The sense perceives single phenomena; the understanding puts these together in judgments according to the relations given in experience, while the reason attains an insight of these faculties of perception and judgment, which beholds in the phenomenal relations of experience the necessary prerequisites, without which such an ordered experience could not have occurred. This knowledge of the necessary conditions for experience reaches to the distinguishable forces underlying all physics, and the life-power—a combination of force and feeling—underlying the organic world; and nature thus becomes known in its intrinsic connections, and not alone in its apparent collocations and sequences. The reason also has an insight of its own being and activity, involving a conscious selfhood and personal agency, and putting the human in a sphere of freedom and responsibility to which the mere animal never attains. In this same insight also is attained the ultimate standard of the beautiful, the true, and the good, and the whole rational region of art, philosophy, and morals lies open to man, but into which the brute consciousness never comes. The finite reason also knows the Absolute Reason as its own necessary source and original, and therein finds open the transcendent themes of doctrinal theology and practical piety. In Dr. Hickok's separate works these first principles are applied particularly to psychology, physics, æsthetics, ethics, and divinity—the same philosophy ruling unchanged in them all—but are maturely and completely developed only with the teachings of his latest publication. J. H. SEELYE.

Hick′ory, the common name of trees of the genus *Carya* (order Juglandaceæ), erroneously called walnut trees in New England. The hickory trees are North American. Besides the PECAN TREE (which see), there are four species (*C. alba*, *microcarpa*, *tomentosa*, and *sulcata*) known as shellbark or shagbark hickories, having excellent timber and nuts generally edible, the bark of the trees becoming very rough. The pignut or bitter hickories (*C. porcina*, *amara*, *myristicæformis*, and *aquatica*) have more generally a smooth bark, inedible nuts, and rather inferior wood. Hickory timber is excellent for handspikes, axe-helves, spokes, barrel-hoops, and the like. It is prized as fuel, but will not stand the weather. The oil of the nuts is recommended for oiling clocks and delicate machinery. The nuts are marketed in considerable quantities. There are numerous varieties of the hickories, so that the botany of the genus is rather obscure.

Hickory, county in S. W. Central Missouri. Area, 414 sq. m. It is uneven, but fertile, producing tobacco, corn, wool, and live-stock. Cap. Hermitage. Pop. 6452.

Hickory, tp. of Carroll co., Ark. Pop. 660.

Hickory, tp. of Cass co., Ill. Pop. 513.

Hickory, tp. of Coles co., Ill. Pop. 1402.

Hickory, tp. of Schuyler co., Ill. Pop. 557.

Hickory, post-v., county-seat of Newton co., Miss., on the Vicksburg and Meridian R. R., 116 miles E. of Vicksburg. Pop. 155.

Hickory, a v. of Catawba co., N. C., on the Western (N. C.) R. R. It has 3 schools, 3 churches, 1 coach-factory, 1 saddle and harness factory, 3 hotels, 1 tobacco-factory, flour and saw mills, tanyard, and 1 weekly newspaper.

W. F. AVERY AND J. T. MURRILL, EDS. "PIEDMONT PRESS."

Hickory, tp. of Forest co., Pa. Pop. 513.

Hickory, tp. of Lawrence co., Pa. Pop. 915.

Hickory, tp. of Mercer co., Pa. It embraces Sharon, Sharpsville, and other villages. Pop. 7700.

Hick′ory Flat, post-tp. of Chambers co., Ala. P. 1460.

Hick′ory Grove, tp. of Jasper co., Ia. Pop. 462.

Hickory Grove, tp. of Scott co., Ia. Pop. 1298.

Hickory Grove, tp. of Warren co., Mo. Pop. 1763.

Hickory Grove, tp. of Grant co., Wis. Pop. 907.

Hick′ory Hill, tp. of Wayne co., Ill. Pop. 878.

Hick′ory Moun′tain, tp. of Chatham co., N. C. Pop. 960.

Hick′ory Plains, post-tp. of Prairie co., Ark. P. 1030.

Hick′ory Point, tp. of Macon co., Ill. Pop. 1136.

Hick′ory Ridge, post-tp. of Monroe co., Ark. P. 778.

Hick′ory Tav′ern, p.-tp. of Catawba co., N.C. P. 1591.

Hicks (Elias), an eminent minister of the Society of Friends, b. at Hempstead, L. I., Mar. 19, 1748; at the age of seventeen years was placed as an apprentice to a carpenter, and became master of that trade; subsequently followed the business of building houses. In the more advanced period of his life he engaged in agriculture. When about twenty-seven years of age, he began, to use his own words, "to have openings leading to the ministry," and was "deeply engaged for the right administration of discipline and order in the Church, and that all might be kept sweet and clean, consistent with the nature and purity of the holy profession which Friends made before the world." In 1781 and subsequently he visited the meetings and families of Friends extensively through the country, working at his trade in the intervals passed at home, whereby he obtained means to pay his own expenses, declining to have them borne by the society, which made provision for its travelling ministers in necessity. He held it to be no less a religious duty to work than to preach when called, of which his journal bears frequent record, as follows: "Spent two days in my salt-meadows assisting my men in securing the hay. On my return visited a poor widow with the surplus of our provisions. . . . Closely engaged in temporal business, but did not forget my accountability to my great Lord and Master. I see no time when it would be right to indulge in idleness. . . . Occupied in collecting relief for the poor in the city of New York (1814). Labored hard in my harvest-field; and although sixty-six years of age, found I could wield the scythe nearly as in the days of my youth." Such was the high esteem in which he was held by all classes of people in his neighborhood that he was frequently chosen as an umpire to settle differences. Very early in life he denounced slavery as a crime, and preached persistently against it. As early as 1811 he published a valuable essay on the subject, and exerted constant personal influence to induce persons who held slaves to set them free. But this fell short of the measure of justice in his view, and he obtained for many of the emancipated wages for their time in addition. He was a bold and fearless preacher, both in deed and word. His religious visitations were not confined to members of his own society, but extended to distant sections of country where few such resided. His meetings were crowded by people of every sect and opinion. He was an impressive speaker, with direct and clear enunciation, of commanding presence, and profoundly serious deportment in his public appearance. The following sentence from his journal is characteristic of his career as a minister and servant of God. "Spent Second and Third days in preparing my business for setting out on my journey. As I trust and believe a dispensation of the gospel is committed to me, woe is unto me if I preach not the gospel!" He was the subject of much misrepresentation in his religious opinions by bigots and by many dissenters from the original doctrines of Friends. The name Hicksite was given as a reproach to that part of the old Society of Friends with which he continued in fellowship, but was never recognized by it or him, his true relation being well described in the memorial of the immediate meeting to which he was attached: "He felt himself called upon, under the influence of the love of the gospel, to admonish his brethren to rally to the ancient standard, the light of truth manifested in the heart, and to follow no man any farther than he should be found a follower of Christ." A journal of his religious travels was published (1832), *Observations on Slavery* (1811), and *Doctrinal Epistle* (1824). There have been published since his death a volume of his sermons and one of his letters. (See Quakers.) J. S. Gibbons.

Hicks (Thomas), a descendant of Elias Hicks, b. in Newtown, Bucks co., Pa., Oct. 18, 1823; came to New York to study art in 1838; exhibited a picture, *The Death of Abel*, in 1841; went to Italy in 1845, to Paris in 1848, where he studied under Couture; returned and made New York his residence. Mr. Hicks has painted composition pictures, out-door and in-door scenes, and landscapes, but his reputation rests on his portraits, of which he has painted a great number, many of distinguished men; among them, Dr. Kane in the cabin of his vessel, Dr. Cogswell in his library, Edwin Booth as Iago. He is cultivated in his profession and laborious—a man of genial humor, greatly beloved by his friends. O. B. Frothingham.

Hicks (Thomas Hollyday), b. in Dorchester co., Md., Sept. 2, 1798; was elected to several important offices, and in 1849 became a member of the Maryland constitutional convention; was governor of Maryland 1858–62, standing firmly for the Union in those trying days; U. S. Senator 1863–65. D. at Washington Feb. 13, 1865.

Hicks'ford, post-v., county-seat of Greenville co., Va., 62 miles S. of Richmond, on the Petersburg and Weldon R. R., at the junction of the Gaston branch, and on the Meherrin River. Pop. 116; of tp. 2367.

Hicks'ville, post-v. of Queens co., N. Y., in Oyster Bay tp., on the Long Island R. R., 25 miles from New York, at the junction of the Port Jefferson branch, has 1 weekly newspaper.

Hicks'ville, post-tp. of Defiance co., O. Pop. 1287.

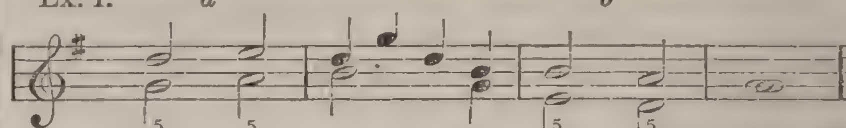
Hi'co, tp. of Fayette co., Ala. Pop. 286.

Hico, tp. of Halifax co., Va. Pop. 3576.

Hidal'go, county in S. W. of Texas. Area, 3200 square miles. It is bounded on the S. by the navigable Rio Grande. Most of the soil is light, and the climate is very dry. The county is adapted to pasturage. Cattle and wool are the staple products. Salt is produced from the salt-lake Sal del Rey. Cap. Edinburgh. Pop. 2387.

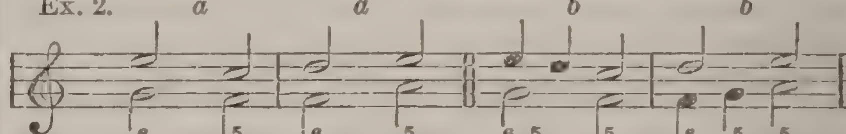
Hid'den, in music, a term applied to certain errors in counterpoint which are not obvious, direct, and open violations of rule, but more or less concealed, implied, or covered up. These errors are chiefly indirect or implied consecutive fifths and octaves. The rule, *e. g.*, that two perfect fifths must not immediately follow in the same parts in equal motion, is *directly* violated when we write as at *a* or *b* in Ex. 1:

Ex. 1. a b



But in Ex. 2, though the notes at *a*, *a*, do not actually *express* fifths, yet the effect on the ear is nearly as offensive as if the fifths were direct, because it is impossible to move from the first note of the upper part to the second, or from the third note of the lower part to the fourth, without *passing through* or *over* the interval of a fifth, and thus creating an impression like that at *b*, *b*:

Ex. 2. a a b b



Such fifths are therefore said to be "hidden" or implied, and should be avoided, either by placing the parts in contrary motion, or by a change of the harmony. That similar remarks will apply to hidden *octaves* will be evident without an example. William Staunton.

Hides, in commerce, the skins of large animals, such as domestic cattle, horses, and the buffaloes of the Old World. They appear in commerce either dried, salted, or in the undried and natural state. Hides are used chiefly in the manufacture of leather, and the fragments and waste go to the glue-maker. The hair is also saved for plasterers' use, and is used to some extent in upholstery. (See also Leather.) *Domestic* hides are those sold in the green state, and manufactured into leather in the country where produced. The hides of general commerce are the product of South America, South Africa, Australia, India, California, Russia, etc. The hides of sheep, goats, deer, etc. are known in commerce as "skins."

Hierap'olis, the birthplace of Epictetus, was situated in Phrygia, Asia Minor, between the rivers Lycus and Meander, and was celebrated for its warm mineral springs. Among its ruins, which are a mile and a half in circumference, is one of the most complete and best preserved Greek theatres. The place is mentioned by St. Paul in his Epistle to the Colossians (iv. 13). Its present name is *Pambook Kalessi* (the "cotton castle"), which is probably derived from the singular appearance which the deposit of the springs has given to the place. It is totally deserted.

Hierap'olis (*i. e.* "sacred city"), or **Bamby'ce,** a once splendid but now utterly ruined city of Cyrrhestica, in Syria, five days' journey from Antioch, on the road to Seleucia and Babylon. It stood on a rocky barren plain, and derived its prosperity from the caravan trade. Its palmy days were under the Seleucidæ. Extensive ruins mark its site.

Hi'erarchy [Gr. ἱερός, "sacred," and ἀρχή, "rule"] or **Hieroc'racy,** the power, post, dignity, or office of a *hierarches*, a steward or president of sacred rites, one supreme in holy things, a high priest, a hierarch; especially in ecclesiastical Greek, the episcopate or patriarchate. The word is unknown to the classic Greek and to the Septuagint and New Testament. In the work of the sixth century, of a Neo-Platonic cast, attributed to Dionysius the Areopagite (which see), the angelic orders are the prototypes of the ecclesiastical hierarchy. He enumerates three orders of angels, with three hierarchies in each—seraphim, cherumbim, thrones; dominations, powers, principalities; virtues, archangels, angels. (See Moreri, *Dict. Historique.*) Milton adopts in *Paradise Lost* every one of these titles, though he does not use them all in any one place or in the order given. The word *hierarchy* came to be applied to

the orders of clergy in the Christian Church—the ecclesiastical hierarchy. It is sometimes transferred to other spheres of government, as the political, military, social hierarchy—the hierarchy of the court of Constantinople. It is, however, most commonly applied to the orders of clergy in the Christian Church, the ecclesiastical hierarchy, or to the body of priests in the various systems, in which they are regarded as divinely instituted administrators of holy things. It is also applied to the rule which they exercised as at once priests and civil magistrates—the Egyptian, the Hindoo, the Hebrew hierarchy.

Among the Hebrews the administration was hereditary. It was a lineal hierarchy, and its headship was in the high priest. In the Christian Church the hierarchy is the government of the Church by the clergy. It took its historical shape as the congregations increased in number and came into closer conjunction. The government of the Church is conceded to have originally been, at least relatively, popular in part (democratic hierarchy), and to have changed more and more into a spiritual aristocracy (aristocratic hierarchy). The line of historical advance is generally supposed by Protestant writers to have been from a government of perfect co-ordination among the presbyter-bishops of a congregation to the congregational and parochial episcopate, then to the diocesan episcopate. From this arose the metropolitan system, in which a governmental superiority was exercised by the bishops of the chief cities of the provinces. Then came the system of patriarchates, under which the bishops of the great sees of Rome, Constantinople, Antioch, Alexandria, and Jerusalem were recognized as patriarchs of the metropolitan. Civil events destroyed the prominence claimed for the last three. The tendency to unification remained fixed at the patriarchate in the Eastern Church, but advanced in the Western Church till it culminated in the papacy. Among the earlier representatives of this tendency was Leo I. (440–461). In the ninth century this papal hierarchy was greatly strengthened by the PSEUDO-ISIDORIAN DECRETALS (which see). They systematized and professed to give historical vouchers for the tendency of the era, which made the pope a spiritual monarch, regent and lord of Western Christendom, to whose rule neither princes nor councils were able to put any well-determined limits. This great hierarchy, preserving the unity of its purpose and plan amid the confusions of the time, supplementing by moral power the feeblenesses of civil rule, preserved order when social life without such a bond might have been reduced to chaos. Something governmentally equivalent to the papacy was a necessity of the Middle Ages. From the eleventh century to the thirteenth it had a political supremacy which was not successfully challenged. This it owed especially to several popes of distinguished ability and force of character. Gregory VII. (1073–85) is more readily recalled by his earlier name, Hildebrand, which made Hildebrandism the synonym of that hierarchical system of which he was so great a master. Clear in vision, iron in will, cautious and bold, he did much to subordinate the civil authority to the ecclesiastical. He made the papacy a universal theocracy of all Christian states, with the pope as Christ's vicar, by whom kings reigned; people and princes were simply, in different degrees, the virtual subjects of the pope. Innocent III. (1198–1216), in many respects the greatest of the popes, whose history is the history of his era, finished the work of Hildebrand and brought the hierarchy to the summit of its glory and power. Political independence and unlimited spiritual authority were the objects of his struggle. He brought to it the greatest qualities of Hildebrand, with others of the highest order, and the mightiest powers of Christendom bowed before him. Boniface VIII. (1294–1303), not inferior in intellectual force to his predecessors, but destitute of their nobler qualities, urged to the extremest point their principles of domination over the temporal power. As in him the loftiest assertion of the hierarchical claims to power over the state came to a crisis, so with his reign began that great reactionary movement of the fourteenth century by which that power was narrowed in various ways. His great opponent was Philip (IV.) the Fair of France (1268–1314). The pope interfered as umpire in the war between France and England, and in favor of the latter. The pope sent a legate; the king threw him into prison; the pope pronounced the king a heretic; the king called the pope a fool; the pope issued a bull; the king burned it; a council excommunicated the king, and the agents of the king seized the pope on his throne and held him captive. The Roman people said of him, "He crept in like a fox, he lorded it like a lion, and died like a dog." But harsh judgment did not cease with his death. He has been "damned to everlasting fame" by Dante, who assigns him a place in hell, as a Simonist, between Nicholas III. and Clement V. The French king came forth victorious in this conflict. Clement V. (1305–77) was the mere tool of the French policy, and formally transferred the curia to Avignon, where it remained during the "Babylonian exile" (1305–77). The French party elected John XXII. (1316–44). In the contest between Louis of Bavaria and Frederick of Austria for the imperial crown, John took sides against Louis. Louis was chosen by the electors; appealed to a general council against the pope; was excommunicated (1324); was crowned at Rome (1327); procured the temporary deposition of John, and the nomination, though not the permanent establishment, of Nicholas V. as a counter-pope. The residence of the popes in France, the great schism (1378–1429), with one pope at Rome, another at Avignon, for a time three popes (1409), the great reformatory councils of Pisa (1409), of Constance (1414–18), of Bâle (1431–43), and the character and conduct of John XXIII. and other popes, greatly weakened the papacy. Though it seemed to come forth triumphant from the struggle, it had received deep wounds. The Church was yearning for reformation. Many symptoms of reaction from the Hildebrand type were manifest, and at length the great struggle of the sixteenth century began.

The influence of the Reformation on the hierarchical claims was very marked. The part of European Christendom which sympathized with that movement entirely rejected all these claims. All the Reformers, and none more radically than Luther, declared in the most uncompromising manner against the whole hierarchical system. But even the states which adhered to the Roman Catholic Church found their power increased by the new tendencies of the minds of men. Vast changes took place in political relations, and the powers claimed for the pope were more and more restricted. Various concordats marked the definition and limitation of the hierarchical power. The progress of events has made the civil and hierarchical powers more completely independent of each other. Civil constitutions, the regulation of police and finance, show the influence of the modifications of the polity of the Church. (See POLITY, ECCLESIASTICAL. For the latest history of the hierarchy see PIUS IX.)

The *divisions* of hierarchical power made in the theology of the Roman Catholic Church may be stated thus: I. The authority which belongs to the Church is connected either with her agency as the distributer of divine grace and blessings, especially of the sacraments, or with the preservation and control of the Church's life. In accordance with this, the power correspondent with the authority is divided either into three parts, *potestas ordinis, magisterii*, and *jurisdictionis* (so Walter, Hinschius), or into two, the *potestas ordinis* (the power derived from ordination, and embracing the *potestas magisterii*, or teaching function) and the *potestas jurisdictionis*, or ruling authority. The second classification is that of St. Thomas Aquinas (*Bouvier*, iv. 97), and of the majority of theologians, and accords with the Catechism of the Council of Trent (ii. 7. 7). (See RICHTER, *Lehrbuch d. K. u L. Kirchenrecht bearb. v. Dove*, Sieb. Auflage, 1874, § 91.)

II. The *potestas ordinis* respects the spiritual goods, especially the sacraments, which those in holy orders are to distribute to believers. It rests in its fulness on the bishops, from whom, by ordination, it passes over to the priests in *quantitative restriction*. The sacrifice of the mass, which is the supreme point of this power, appertains to both bishops and priests, and in virtue specially of this fact the bishops and priests constitute one priestly order—*ordo*. In apostolic times the deacons were aids to the bishops and priests, and at a later period, for the same end, there were appointed subdeacons, acolyths, exorcists, lectors, and vestiarii, all of whom receive the necessary gifts for their offices by ordination. Hence the organs of the Church in the sphere of *ordo*, the sphere of the power conferred by holy orders on bishops, priests, and ministers. Under this last name are grouped all the clergy but those of the first order, which embraces the bishops and priests. This is called the hierarchy of (holy) orders—*hierarchia ordinis*.

III. The *potestas jurisdictionis*, or governmental power, is divinely committed to the bishops and the pope. Between the diocesan bishop and the pope exist by human right the gradations of archbishops, primates, exarchs, or patriarchs. The priest, with no *potestas jurisdictionis*, exercises the *potestas ordinis* in his parish; the bishop with the *potestas jurisdictionis* rules the clergy of his diocese; the metropolitan has as his suffragans the bishops of his province; the primate ordinarily has under him several metropolitans or archbishops; the patriarch is the superior of the metropolitans; and the pope, patriarch of patriarchs, primate of primates, metropolitan of metropolitans, bishop of bishops, priest of priests, and servant of the servants of God, is earthly head of the whole Church on earth. This is the *hierarchia jurisdictionis*. (See DECORDE, *Diction. d. Culte Catholique*, 1859.)

The hierarchy of orders is of divine institution; the hie-

rarchy of jurisdiction is of ecclesiastical institution. The former may exist without the latter, but the latter exists by virtue of the former. In the hierarchy of order respect is had to the sacramental "character" impressed in ordination; in the hierarchy of jurisdiction respect is had to degree. As regards the hierarchy of orders, the diocesan bishop and the primate are on the same level; the parish priest is the same as the vicar-general, and is the superior of the cardinals when they are deacons. It is in the hierarchy of jurisdiction the gradations exist which have been enumerated. There is also in some cases a simple honorary hierarchy. (See PASCAL, *Orig. et Raison de la Liturgie Catholique*, art. "Hiérarchie.")

The theory on which the papal hierarchy rests is that the one catholic Church of Christ on earth is a divine monarchy, under one catholic head, the pope, who is the œcumenical pastor of all the churches. The prelates under him govern particular churches, participating in the solicitude, but not possessing the plenary power, which belongs to the pope alone. To the spiritual rule, supreme in the pope and subordinate in the prelates, the whole laity, from the humblest to the most exalted, owe obedience. In the great body of the older Roman Catholic divines who have been distinguished as defenders of the hierarchy the names of those now most frequently quoted are Bellarmin and Petavius. (For the literature of recent date on the questions of the hierarchy, see PAPAL INFALLIBILITY.) In the Roman Catholic *system* the hierarchy is usually treated of under *Ordo*, the sacrament of holy orders. Ordo is defined as (1) the ecclesiastical hierarchy, or estate of the ministers of the Church; and (2) the act by which they are constituted a part of that estate—ordination. (See BAILLY, *Theol. dogm. et moral.* (Lugduno, 1822), v. 340; PERRONE, *Prælect. Theolog.* (Paris, 1852), ii. 439.) "It is an article of faith that there exists in the Church a plurality of orders, constituting the sacred hierarchy—to wit, the episcopate, the presbyterate, and the diaconate." (BOUVIER, *Instit. Theolog.*) "If any man shall say that there is not in the Catholic Church a hierarchy instituted by divine ordination, which consists of bishops, presbyters, and ministers, let him be anathema." (Can. 6, Sess. 23, Council of Trent.) Under the "ministry" is embraced certainly the deacons. How many more, or whether any more, are included, is left an open question. (*Bouvier*, iv. 96.) The theology of the fifth and sixth centuries, in which the priestly office was greatly exalted, is sometimes styled the hierarchical theology. (See GELASIUS, LEO I.) Offences against the hierarchical government are called sacrilege of the hierarchy. The *celestial* hierarchy of Cellot is the rule of the Trinity, of Christ, the Virgin, and the angels in heaven. (TREVOUX, *Diction. Universel*, 1740.)

In Protestant theology the term hierarchy is sometimes used in a generic sense to designate the sacred and divine rule of the Church established by Christ. The body of Protestant divines hold that Christ instituted no hierarchy in the ecclesiastical sense, but condemned it; that he endowed his Church with no civil power; and that the functions of its teachers and officers are purely moral and spiritual. From these views many of the writers of the Church of England dissent, rejecting the papal supremacy and what is involved in it, but holding in substantials the rest of the hierarchical views of the Church of Rome. (See BLUNT, *Dict. of Doctrin. and Histor. Theology*, arts. "Hierarchy," "Jurisdiction.") The Lutheran Reformers (at Augsburg, 1530) rejected the whole theory of the hierarchy. Retaining the twofold division of the *potestas ordinis* and *potestas jurisdictionis*, they defined the former as covering only the ministry of the word and sacraments—the latter as involving no more than the cognizance of doctrine, the office of the keys, absolution and excommunication; and that both powers are by divine right conferred on one and the same body of ministers, all of whom are equal. (*Augsb. Confess.*, Abus. vii.) In the official reply of the Roman Catholic divines (the *Confutatio Pontifica*) they assert over against this that "the bishops not only have the power of the ministry of the word of God, but also the power of regimen and coercitive correction." (Given in full in FRANKE, *Lib. Symbol.*, App. 68; HASE, do. *Prolegom.*, 84.) On this the *Apology* (xiv. 13) says: "We are satisfied with the old division of power into the *potestas ordinis* and the *potestas jurisdictionis*." It defines both in substance as defined in the Confession. The Reformers at the same time expressed their desire to retain the canonical polity and the grades existing in the Church, even though they rested on human authority, provided the bishops would cease their cruelty to the evangelical churches.

In Protestant theology the name *hierarchy* is also applied to the divinely instituted government in the three great institutions, the Family, the Church, and the State.

The literature of the subject, direct and indirect, is very large. The dogmatic and polemic works of a general kind largely take it up. Those on the Church and the associated topics more particularly discuss it. The great names connected with special discussions of the monarchy, priesthood, power of order and jurisdiction, the papal power and infallibility, are—Sander (1571), Palatin (1794), Rocaberti (11 vols. folio, 1695–99), Pineda (1588), Maimburg (1685), Ballerini (1776), Veith (1781), Fischer (1819), Pinel (1829), Rothensee (1836–38), Ellendorf (1841), Himioben (1840), Vestermayer (1867–70), on the Roman Catholic side. On the Protestant side may be mentioned the names of Chamier (1601), Brochmand (1628), Salmasius (1608), Calixtus (1650), Hase (1871). To these are to be added the special historical works on the constitution of the Church, the hierarchy, and the papacy, and works on church polity. (See POLITY, ECCLESIASTICAL, the articles on the different forms of church government, CONGREGATIONALISM, EPISCOPAL SYSTEM, INDEPENDENCY, PAPACY, PRESBYTERIANISM; articles on the ecclesiastical orders, BISHOP, ELDER, PRESBYTER, PRIEST, DEACON, ACOLYTE; ecclesiastical dignities, POPE, EXARCH, ARCHBISHOP, CARDINAL, ARCHDEACON, PRIMATE, METROPOLITAN, PATRIARCH; divisions of ecclesiastical territory, DIOCESE, PARISH, PROVINCE; rites connected with the clerical office, INSTALLATION, INVESTITURE, ORDINATION.) C. P. KRAUTH.

Hi'ero [Ἱέρων], tyrannus of Syracuse, in Sicily; was victor at Olympia 488 B. C. (*Müller*); succeeded Gelon, his brother, in 478; conquered Naxos and Catana in Sicily; defeated the great fleet of the Etruscans 474, and in the same year won a victory at the Pythian games. He was a generous patron of art and letters. In 472 and 468 he won his second and third victories in the Olympic games. Pindar celebrated these victories in his odes. D. in 467 B. C.

Hiero, king of Syracuse, was a natural son of one Hierocles, b. before 306 B. C.; served with distinction under Pyrrhus; became general of the Syracusans; sent a supply of corn to Rome 272; routed the Mamertines at the river Longanus, and was declared king in 270 B. C.; waged a disadvantageous war with Rome 264–263 B. C., after which he was a most faithful ally of that power. He was a popular ruler, and his reign as a whole was one of splendor and prosperity. There are many coins, inscriptions, and other existing remains of Hiero's time. D. 216 B. C.

Hier'ocles, a grammarian, so called by way of distinction from the philosopher and others of the name, wrote a guidebook (Συνέκδημος), containing an account of the 64 provinces of the Eastern Roman empire, and of the 935 towns situated in them. Its date is probably about the beginning of the sixth century A. D. It was inserted by Wesseling in his *Vet. Rom. Itineraria* (Amsterdam, 1735); also edited by Bekker at the end of his *Constantinus Porphyr.*, in the *Byzantine Historians* (Bonn, 1840).

Hierocles [Ἱεροκλῆς], a New Platonist, lived in the middle of the fifth century, and taught philosophy at Alexandria. Very little is known of his life. He wrote a commentary on the golden verses of Pythagoras, which is useful for the understanding of the Pythagorean doctrines; also a work in seven books on Providence, Fate, and Freewill, of which Photius has preserved a few fragments; and a third treating of morals, no longer extant. To this Hierocles is sometimes ascribed a collection of *Facetiæ*, entitled Ἀστεῖα, but it belongs to a later writer. The best edition of the *Commentary* is by Mullach (Berlin, 1853); of the *Facetiæ*, by Schier (Leipsic, 1768) and by Eberhard (Berlin, 1869). H. DRISLER.

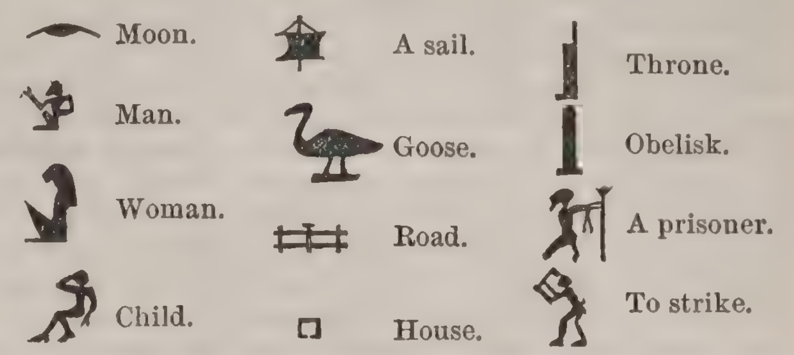
Hieroglyph'ics [Gr. ἱερογλυφικός, from ἱερός, "sacred," and γλυφή, "carving"]. All writing began with pictorial representation. As only a small part of the words in any language can be directly represented by pictures, the first step to a system that allowed of the expression of all words whatever was taken when the picture which represented any given word was allowed to represent any other word having a different meaning and proximately the same sound. This may be illustrated by supposing the picture of a gate to be made to stand also for *gait*, or for the first two letters *ga*, or for the consonant *g*. If, while the transfer is made of the signification of the character from the entire word to the single letter, the character itself is worn down into a conventional form, and a single character is adopted out of all those that might represent a letter, then the passage has become complete from the system of the pictorial hieroglyphic to that of the alphabet. All alphabets have arisen in this way, but not all hieroglyphics have reached the purely alphabetic stage.

The hieroglyphics of Egypt are the only ones that contain a literature of any value, and the term is generally applied to the Egyptian system from which it first had its name. There are scanty traces of the original picture-writing in the Assyrian and Chinese; the inscriptions from Hamath, as yet unread, are hieroglyphical, and the more civilized natives of aboriginal America had their systems

of hieroglyphics, though exceedingly rude and undeveloped. It was a false notion of the Greeks that of the three kinds of writing used by the Egyptians, two—for that reason called hieroglyphic and hieratic—were employed only for sacred, while the third, the demotic, was employed for secular purposes. No such distinction is discoverable on the more ancient Egyptian monuments, but we retain the old names founded on misapprehension. The hieroglyphics consist of full pictures carved on stone and brilliantly colored according to conventional rules or the fashion of the dynasty in which they were prepared. The characters themselves suggested to both the ancients and the moderns that they were the symbols of ideas rather than the signs of sounds. The number of these signs being a thousand or more, gave color to the idea that they were exclusively diagraphical. Greek authors even gave the meaning of a few signs. This misapprehension of the force of the characters continued till the beginning of the present century. In 1799 the famous Rosetta Stone was dug up by one of Napoleon's officers belonging to his expedition into Egypt. It contained inscriptions, partly mutilated, in hieroglyphics, in demotics, and in Greek. The name of Ptolemy occurred in the Greek, and in the corresponding portion of the hieroglyphic there were a number of characters enclosed in a ring, which it was conjectured might be the sign of a proper name. De Lacy first announced the phonetic character of these proper names, and Champollion and Thomas Young simultaneously caught the secret of the characters, and announced the combination of phonetic with ideographic elements. Fortunately, there was found at the Isle of Philæ a little obelisk with an inscription both in Greek and in hieroglyphics, containing the names of a Ptolemy and of his sister Cleopatra. A ring containing the same characters as those on the Rosetta Stone was conclusively proved thus to be the name of Ptolemy, while another ring could contain nothing other than the name of Cleopatra. Very fortunately, these two names contain the letters *P, T,* and *L* in common, and these were soon fixed, and the others followed. The monuments of the Roman epoch contained a large number of names in rings, and these were speedily unlocked with this key, and found to embrace a full series of the Roman emperors, with the title emperor (αὐτοκράτωρ) added. The names of the old Egyptian kings followed, some of them familiar, as Psammetichus and Ramses. The process thus outlined was sufficient to give the value of all the more common hieroglyphic signs. The next step was to read and translate the portions not marked as proper names. For this recourse was had to the Coptic, which was known to be the immediate descendant of the old Egyptian. Champollion first applied himself to short sepulchral monuments on which the proper names were connected by words that evidently expressed relationships. These terms he found to agree with the Coptic, and by various stages the discovery was perfected by him and by his associates in the study. The history need not be pursued farther. At present a hieroglyphic inscription may be read nearly as fluently as one in the classical languages, and apparatus for study is abundant in texts, and especially in the magnificent dictionary of M. Brugsch, published in 1867–68.

The Egyptian hieroglyphical characters are either ideographic, syllabic, alphabetic, or determinative. All writing originated in ideographs—pictures of objects to be suggested by them to the reader. The Egyptians very early passed through the pure ideographic stage into the syllabic, and even the alphabetic, but the idea of the alphabet, depending wholly on ultimate vocal analysis, never dominated in their writing, as it did in the Phœnician. Even in our own writing we employ some purely ideographic signs, like +, plus, and §, section, although they are not, like the original ideographs, pictorial. A vast number of objects could be directly drawn, as, for example, portions of the body, the head, ear, eyes, eyebrows, lips, nose, mouth, arm, hand, either open or shut, leg, foot; also numerous actions, as writing, building, and walking; also such objects external from man as sun, moon, star, the lotus-flower, the lion, water (represented by a line of waves), etc. A combination of single figures might express an appropriate idea. Thus, if a waved line expressed water, an ellipse enclosing the waved line would represent a cistern. If a circle represented the sun, a half circle with rays streaming upward would represent sunrise, and a circle half sunk below a line sunset. A canopy represented the heavens, and a star underneath the canopy suggested night; while a circle in the same position represented midday; and the same canopy with something like tunnels running through it represented rain. Of these pictorial objects there are about 400. Their range is considerable, but abstract ideas and connecting words, most verbs, and all inflected forms cannot be expressed by mere pictures. A complete sentence is impossible by this system. Its limitations are soon reached.

FIG. 1.



The next step was that of allowing the figure not merely to represent the idea and its name, but the sounds by which that word is expressed. Thus, the figure becomes entirely the representation of a sound, and no longer of an object. This may be illustrated by the picture of an altar, which might also stand for the word *alter*. But the Egyptians regarded the consonants as the substantial parts of a word, and, disregarding the vowels, the same figure might stand for *later, letter, litter,* or *ultra.* Thus, the owl, *mulak,* might also stand for *melich,* king; the hyæna, *hoite,* for *hote,* an hour; the serpent, *hop,* for *hepi,* a cave, and the obelisk, *maein,* for the god *Amun.* Since the Egyptian ear did not distinguish the surd (sharp) from the sonant (flat) consonants, the range was somewhat further extended. Thus, the finger, pronounced *tep,* would represent any other word whose consonants were *tp, tb, dp,* or *db;* as, for example, *taipe,* a magazine, and *tba,* ten thousand.

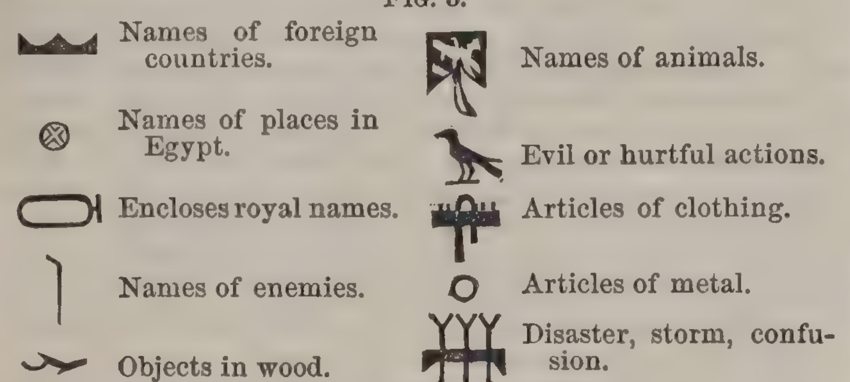
The next stage was to allow any character to stand for only the first one or two sounds in the word which it primarily represented, generally for the first consonant and vowel, but in the case of a few characters, called by Brugsch fundamental, for the first sound only. A single letter or syllable may often be represented by a number of different signs. Thus, *A* might be represented by an arm, an eagle, or a reed; *T,* by a serpent or a hemisphere. The sense often guided the selection of the character. Thus, in writing the Greek word for emperor (αὐτοκράτωρ) the eagle, symbol of the Roman power, would be selected to represent *a.* Of the syllabic characters there were 400 or 500. The accompanying table includes the common alphabetic characters:

FIG. 2.

The Egyptians paid regard to vowels only as they were needed to avoid ambiguity in writing. Where there might be doubt which of two words was to be read, or in the case of words having an initial vowel, or of monosyllables with a final vowel, and especially of foreign proper names, it became necessary to express the vowels. These were not put in their place between their consonants, but either after or under the consonants which formed the word. Thus the three fundamental characters given in the order *n, p, u,* are to be pronounced *nup,* not *npu.* The scribes often found it necessary to employ certain signs, not as characters to be

pronounced, but as suggestions to the reader how to read other ambiguous signs. Thus, a figure like a hill—pronounced *tove*, and meaning *much*—indicated that the characters preceding it were to be read not as single letters, but in their larger content, as full syllables with two or more consonants. Sometimes the character was repeated for the same purpose. When the characters had settled into their almost completely phonetic use, a word spelled out was often followed by its pictorial representation. Thus, were it desired to write *sukhi*, a crocodile, instead of simply giving a picture of the crocodile, which might signify either *sukhi* or *sk*, the word might be spelled out by its consonants: first an *s*, expressed by a siphon and pronounced *seppe;* then *k*, expressed by the breast, *kibe*. To show that these two characters are not to be pronounced syllabically, *sapa kap*, as they may be, but consonantally, *sukhi*, the figure of the crocodile, *sukhi*, is appended. This system of determinatives had considerable extension, of which the following are examples:

Fig. 3.



The direction of the hieroglyphic writing was unfixed. On the same monument it was in one place read vertically and in another horizontally. The common way was from right to left, as in Hebrew. In the older temples the characters were raised; but after the fifth dynasty they were generally cut in intaglio, often very deep, as in the temple at Zepe, where Bruce found them six inches deep. The portions cut out were sometimes filled with white lime, or often with mastic or richly colored enamel.

The hieratic writing was an abbreviation of the hieroglyphic. Most of the papyrus is inscribed in this character. In the seventh century B. C. a still more abridged style, called demotic, came into use, in which no trace can be recognized of the original pictures, although there is in it the same mixture of both the phonetic and the ideographic characters. It was about the third century that hieroglyphics ceased to be written. WILLIAM H. WARD.

Hieron′ymites [from St. Jerome, or *Hieronymus*], properly the hermits of St. Jerome, were originally Franciscan Tertiaries of the Strict Observance. In 1373 the new order was accredited by Pope Gregory XI., and received an Augustinian rule. P. F. Pecha and one Vasco were its founders. Charles V. entered the order upon his abdication. This order, once very rich and extensive, is now small and feeble.—Another small congregation called Hieronymites was founded at Pisa by one of the Gambacorti about 1390. It still exists.

Hier′ophant [Gr. ἱεροφάντης], the mystagogue, prophet or priest of Demeter who had charge of the Eleusinian Mysteries, and initiated new members into those mysteries. He must be a descendant of the hero Eumalpus, unmarried, and unblemished in character and in body. He preserved and expounded the unwritten law.

Hies′ter (JOSEPH), b. of parentage of remote Silesian origin in Bern tp., Berks co., Pa., Nov. 18, 1752; became a merchant of Reading in 1771; raised, equipped, and commanded a company in the Revolutionary army; was wounded at the battle of Long Island, and imprisoned a year in the Jersey hulk; wounded again at Germantown; a member of the constitutional conventions of 1787 and 1789; was a member of Congress 1797–1805 and 1815–21; governor of Pennsylvania 1821–23. D. at Reading, Pa., June 10, 1832.

Hig′gins, tp. of Perry co., Ark. Pop. 292.

Higgins, tp. of McDowell co., N. C. Pop. 401.

Hig′ginson (FRANCIS), b. in England in 1588; graduated at St. John's College, Cambridge, and became a parish clergyman of Leicester, but was deprived for nonconformity, and in 1629 became teacher of the congregation at Salem, Mass., where he d. Aug. 6, 1630. He wrote *New England's Plantations* (1630).

Higginson (FRANCIS J.), U. S. N., b. July 19, 1846, in Massachusetts; graduated at the Naval Academy in 1861; became a lieutenant in 1862, a lieutenant-commander in 1866; served on board the Cayuga, as aide to Capt. Bailey, in the great victory of New Orleans, and was wounded in the very gallant boat-expedition from the Colorado Sept. 14, 1861, which succeeded in destroying the Confederate privateer Judah, moored to a wharf at the Pensacola navy-yard. FOXHALL A. PARKER.

Higginson (Sir JAMES MACAULAY), K. C. B., b. in 1805; in 1824 he joined the Bengal army, and served during the Bhurtpore campaign and assault of that fortress in 1826; was appointed to the staff of the army in 1828, and filled the positions of aide-de-camp to Lord William Bentinck, governor-general of India; military secretary to the governor of Agra; private secretary to the governor-general of Canada, and in 1839 accompanied Lord Metcalfe to Jamaica as secretary to the governor; following that statesman to Canada, he was made civil secretary and superintendent of Indian affairs. From 1846 to 1850 he was governor and commander-in-chief of the Leeward Islands, when he was transferred to the governorship of Mauritius (1850–57); created companion of the Bath in 1851, a knight-commander 1856; retired from active service in 1857.

Higginson (JOHN), a son of Francis Higginson, b. at Claybrooke, Leicestershire, England, Aug. 6, 1616; came to Salem with his father; became a teacher of Hartford; was a short-hand writer to the Massachusetts synod of 1637; chaplain of Saybrook; assistant minister of Guilford, Conn., 1641–59; minister of Salem, Mass., 1660–1708. He was a popular preacher, and left some valued writings. D. Dec. 9, 1708.

Higginson (THOMAS WENTWORTH), b. Dec. 22, 1823, in Cambridge, Mass.; graduated at Harvard College 1841; received the degree of A. M. 1869; studied divinity at Cambridge; was ordained at Newburyport, Mass. (First Religious Society), in 1847, the year he left the Divinity School; was Free-soil candidate for Congress in 1850; went to Worcester, Mass., in 1852 as minister of the Free church; resigned in 1858, and left the ministry. Mr. Higginson had taken a leading part in the anti-slavery conflict that preceded the civil war; had visited Kansas in 1856; was acquainted with John Brown, and was active in sustaining the Free-State men in the West. On Sept. 25, 1862, he was made captain in the 51st Massachusetts Vols.; on Nov. 10 accepted the colonelcy of 1st South Carolina Vols., colored; was wounded Aug., 1863, and mustered out Oct., 1864. He has since lived in Newport, R. I., devoting himself to literature and the work of social reform; is a vice-president of the Free Religious Association, a leader in the cause of woman suffrage, and an earnest friend of the higher education of the youth of both sexes in public schools and colleges. His efforts to introduce modern ideas and men into the management of Harvard College, and to have its facilities extended to women, have been assiduous. Mr. Higginson is the author of several volumes of collected essays: *Out-door Papers* (1863), *Army Life in a Black Regiment* (1870), and *Atlantic Essays* (1871); wrote a novel, *Malbone, an Oldport Romance* (1869), *Oldport Days* (1874); a history, *Young Folks' History of the U. S.* (1875); besides various pamphlets and magazine articles, memoirs of Lydia Maria Child and Margaret Fuller Ossoli in *Eminent Women of the Age* (1868), and a memoir of T. W. Harris, prefixed to his *Entomological Correspondence* (1869). He also edited (in connection with S. Longfellow) a book of poems, *Thalatta* (1853), a translation of Epictetus (1865), *Harvard Memorial Biographies* (2 vols., 1866), *Child-Pictures from Dickens* (1868), *Brief Biographies of European Statesmen* (1875). Is also well known as a lyceum lecturer. He visited Europe in 1872. O. B. FROTHINGHAM.

Hig′ginsport, post-v. in Lewis tp., Brown co., O. It is on the Ohio, 46 miles above Cincinnati. Pop. 530.

Hig′ginsville, post-v. of Verona tp., Oneida co., N. Y. Pop. 219.

High, in music, a term indicating acuteness of sound, generally by way of comparison or contrast with other and graver sounds. Thus, of two sounds, notes, or parts, one is said to be higher than the other because it is more acute, though both notes may chance to be in the graver portion of the scale. In a general and indefinite way *all* musical sounds are said to be either high, low, or of a middle grade. Hence, the use of the terms *ascending* and *descending* when we change from the graver part of the scale to the more acute, and *vice versâ*. WILLIAM STAUNTON.

High Bridge, post-v. of Hunterdon co., N. J., on the New Jersey Central R. R., 54 miles W. of New York. Here are extensive iron-works and a remarkable railroad bridge.

High For′est, tp. and post-v. of Olmsted co., Minn., 15 miles S. of Rochester. Pop. of v. 249; of tp. 1243.

High′gate, post-tp. of Franklin co., Vt., on Missisquoi Bay (Lake Champlain), and on the Canada line. It is also on the Central Vermont R. R. (northern division), 13 miles N. of St. Albans. It is a place of summer resort, has 4 churches, 4 hotels, and manufactures of castings, scythes,

and leather. It has sulphurous mineral springs, which are very useful in certain skin diseases. Pop. 2260.

High Lake, tp. of Emmett co., Ia. Pop. 182.

High'land, county in the S. S. W. of Ohio. Area, 460 square miles. It lies between the Scioto and Little Miami valleys, and is well cultivated and fertile. Cattle, grain, and wool are staples. The manufactures include carriages, flour, harnesses, etc. It is traversed by the Marietta and Cincinnati R. R. Cap. Hillsborough. Pop. 29,133.

Highland, county of Virginia, bounded on the W. and N. by West Virginia. Area, 400 square miles. It is very mountainous. Live-stock, grain, and wool are staple products. Cap. Monterey. Pop. 4151.

Highland, tp. of Shelby co., Ala. Pop. 657.

Highland, tp. of Grundy co., Ill. Pop. 980.

Highland, post-v. of Madison co., Ill., 30 miles E. of St. Louis, on the St. Louis Vandalia and Terre Haute R.Rs. It contains 2 public schools, 4 churches, 1 Catholic university, 2 large flouring-mills, 1 foundry, 1 bank, 1 woollen-mill, and 1 newspaper. Pop., composed of Swiss and Germans, 1757. AD. F. BANDELIER.

Highland, tp. of Franklin co., Ind. Pop. 1796.

Highland, tp. of Greene co., Ind. Pop. 1321.

Highland, tp. of Vermilion co., Ind. Pop. 2294.

Highland, post-tp. of Clayton co., Ia. Pop. 834.

Highland, tp. of Guthrie co., Ia. Pop. 229.

Highland, tp. of Tama co., Ia. Pop. 503.

Highland, tp. of Union co., Ia. Pop. 247.

Highland, tp. of Wapello co., Ia. Pop. 959.

Highland, tp. of Washington co., Ia. Pop. 753.

Highland, tp. of Winneshiek co., Ia. Pop. 922.

Highland, post-v. of Iowa tp., Doniphan co., Kan., is the seat of Highland University (Presbyterian) for both sexes, and has a coal-mine. It is near the Atchison and Nebraska R. R., and 25 miles N. by W. of Atchison. P. 282.

Highland, tp. and post-v. of Oakland co., Mich., on the Flint and Père Marquette R. R., 28 miles S. of Flint. Pop. 1241.

Highland, tp. of Osceola co., Mich. Pop. 58.

Highland, tp. of Wabashaw co., Minn. Pop. 716.

Highland, a v. of Saline co., Neb., 17 miles S. W. of Lincoln.

Highland, a v. of Lincoln co., Nev. Pop. 21.

Highland, tp. of Sullivan co., N. Y., on the Delaware River. It contains many small lakes. Here was fought the battle of the Minisink, July 22, 1779, between the Indians in the British service, under Brant, and the American militia. Pop. 958.

Highland, post-v. of Ulster co., N. Y., opposite Poughkeepsie, with which it is connected half hourly by ferry. It contains a seminary for both sexes, 3 churches, 7 flouring-mills, 1 foundry, a felloe-factory, 1 weekly newspaper. It has 3 daily lines of steamers to New York. The inhabitants are largely engaged in the grape-culture. Pop. about 700. W. F. HENDRICK, ED. "JOURNAL."

Highland, tp. of Defiance co., O. Pop. 946.

Highland, tp. of Muskingum co., O. Pop. 784.

Highland, tp. of Adams co., Pa. Pop. 421.

Highland, tp. of Chester co., Pa. Pop. 958.

Highland, tp. of Clarion co., Pa. Pop. 524.

Highland, tp. of Elk co., Pa. Pop. 98.

Highland, tp. of Greenville co., S. C. Pop. 1261.

Highland (called also *Franklin*), post-v. of Iowa co., Wis., 12 miles S. by W. of Avoca. P. of v. 482; of tp. 3016.

High'landers, properly the Gaels or Celtic inhabitants of the Highlands of Scotland. In the British army the term designates the eight regiments of foot-soldiers who wear the old Highland costume, each with its own distinctive tartan. These are the 42d, 71st, 72d, 74th, 78th, 79th, 92d, and 93d regiments. The 91st (Argyleshire regiment) is also sometimes reckoned with the Highlanders. There are several Highland volunteer regiments.

Highland Falls, post-v. of Cornwall tp., Orange co., N. Y., on the Hudson, 2 miles below West Point; has hotels and 4 churches, and is a place of summer resort.

Highland Park, post-v. of Deerfield tp., Lake co., Ill., on Lake Michigan and on the Chicago and Northwestern R. R. (Milwaukee division), 22 miles N. of Chicago.

High'lands, of the Hudson, are the broken hills which stretch from S. W. to N. E. through Rockland, Orange, Putnam, and Dutchess cos., N. Y., being the N. E. continuation of the Blue Ridge, and extending farther N. E. in the Taconic and Green Mountains of Western New England. The passage of the Hudson through the Highlands is marked by very fine scenery, and it is remarkable as almost the only instance in the U. S. of a navigable river-passage through a great mountain-range. The Highlands are mainly composed of azoic rocks, with rugged and steep sides and a somewhat scanty soil. The highest peaks do not reach higher than 1700 feet above tide.

High Market, tp. of Lewis co., N. Y. It has 3 cheese-factories. Pop. 1051.

High Places. In the Old Testament frequent mention is made of high places, where the people unlawfully went to worship strange gods. The custom of erecting shrines upon hilltops is a very ancient and widespread one, and seems to have arisen from the belief that the tops of hills were nearer the abode of Deity. In spite of the strong denunciations of the practice in the Jewish law, the custom became a prevalent one, and such men as Samuel, David, and Elijah conformed to it, but in later times a reform occurred, and the more devout kings of Judah actively destroyed the high places.

High Point, tp. and post-v. of Decatur co., Ia., 13 miles S. of Woodburn. Pop. 796.

High Point, post-tp. of Guilford co., N. C. Pop. 1627.

High Prairie, tp. of Leavenworth co., Kan. P. 1300.

High Priest, in the hierarchy of the Hebrews, the principal religious dignitary of the nation. By the Mosaic law the office was held for life, and was hereditary in the line of Eleazar, son of Aaron, the first high priest. But in the New Testament times the office had ceased to be hereditary, and was held at the will of the civil ruler. Some of these officers in those times were men of low birth. One of the most brilliant periods of this pontificate was that of the Asmonæan princes (Maccabees), some of whom joined regal to priestly authority.

High Shoals, tp. of Rutherford co., N. C. Pop. 904.

High'spire, post-v. of Lower Swatara tp., Dauphin co., Pa., on the Pennsylvania R. R., and on the N. E. bank of the Susquehanna, 5 miles below Harrisburg. Pop. 612.

High'towers, tp. of Caswell co., N. C. Pop. 1502.

Hights'town, post-b. of Mercer co., N. J., 14 miles N. E. of Trenton, on the Amboy division of the Pennsylvania R. R. It is an incorporated borough, containing 3 educational institutes, 6 churches, 2 foundries, 2 hotels, chain, plough, and door factories, 1 newspaper, and 2 national banks. Pop. of borough, 1347.

THOS. B. APPLEGET, ED. "GAZETTE."

High Was'sie, tp. of Pulaski co., Va. Pop. 1897.

High'way, a road or way over which the public at large have a free right of passage. The term, in popular usage, is commonly restricted to ways upon land, as carriage- or foot-roads or turnpikes, but it is employed in law as a generic designation, including not only ways of this kind, but also watercourses which are, in a similar manner, open to public convenience, as, for instance, natural streams. Ferries are also sometimes comprehended within the same category. Highways upon land are created either by express dedication of the owner, by prescription, or in pursuance of legislative authority. Dedication occurs when the owner of the property appropriates it to the public use as a common passage-way, and there is a sufficient acceptance of the privilege on the part of the public, evidenced either by positive acknowledgment and assent or by constantly enjoying the advantage offered. A right is obtained by prescription by a continuous, undisturbed use of the land as a common way for a particular period of time established by law, usually twenty years. The validity of a claim originating in this manner is sustained by the fiction of a presumed grant or dedication by the owner on account of his long acquiescence in the violation of his proprietary rights. (See PRESCRIPTION.) But much the most common mode of establishing public ways is by the exercise of the governmental prerogative of taking private property for public uses. Laws have been enacted, both in England and in the several States of the Union, regulating the methods by which new roads may be laid out as occasion may require. The authority in this country is usually delegated to towns or bodies of commissioners, who, in conjunction with a jury, determine upon the necessity of a road, its direction, and extent. The commissioners may also have power to direct its construction and make all necessary repairs. As this is an interference with the rights of private owners under the law of EMINENT DOMAIN (which see), adequate compensation must be made for the loss which they sustain in consequence. This power must never be capriciously or arbitrarily exercised, but only to satisfy a public necessity. Highways by water, in the case of natural streams, exist independently of the granting of any privilege by dedication or of any

legislative interposition — by force of the natural right which every citizen possesses of free passage along all watercourses not of artificial construction.

The establishment of a highway does not necessarily give the public a right of ownership in the soil over which the privilege of passage is exercised. It is a general rule, applying both to highways upon land and to watercourses above the point where the tide ebbs and flows, that the property in the soil is vested in the adjoining owners. If a single individual own the land upon both sides of a road or stream, he has in general also the exclusive title to the entire highway as far as the limits of his estate extend; but if the proprietors upon the opposite sides be different persons, the right of each extends to the middle of the highway. The right of the public in such a case constitutes merely an easement, and though this is so far restrictive upon the owner's management and control of his property that he can do nothing to deprive the public of their privilege of free passage or to incommode them, yet it must be enjoyed simply as a right to travel over the land, and an obligation rests also upon the public not to interfere with the owner's interests further than the appropriate use of the way demands. If there are trees or grass growing along the line of a road, the adjoining owner has an exclusive right to them, as against all but the public, and can maintain an action against any one who attempts to carry them away. In like manner, he may obtain redress for injuries occasioned by encroachments upon the soil, or unlawful excavations, or any violation of his rights as owner which is not strictly incidental to the public privilege. If there are mines beneath the surface of the highway, he may continue to work them, provided he does not deprive the public of the right of way or impair their exercise of it. Under similar limitations he may construct water-pipes or drains, excavate cellars, etc. below the surface. But the public right of easement, especially in villages and cities, sometimes includes particular privileges not directly incidental to the right of transit, but so important and essential for the common welfare of communities that they are deemed to be included within the interest which the public acquires by establishing the highway. For instance, the soil may be opened for the construction of sewers or gas- or water-pipes for the convenience of neighboring residents. But acts of this nature can only be done by virtue of public authority, and if any individual or combination of individuals attempt to lay gas- or water-pipes without obtaining special powers for that purpose, they commit an actionable offence for which the owner may seek redress. But nothing additional to such privileges as these is embraced within the easement which the public acquires; and if the legislature authorizes the use of the soil for other purposes, this is a new exercise of the right of eminent domain, for which further compensation must be made. Thus, it has been held that the construction of a steam-railroad is not a legitimate exercise of the easement, and that for such a use of the highway additional compensation must be made to the adjoining proprietors. Grants of property bounded upon a highway carry with them the same interest in the soil of the road as the grantor previously possessed, even though there be no distinct statement to that effect. Such a presumed conveyance can only be prevented by the use of precise expressions in the deed of transfer, limiting the boundary to the edge of the way. The statute law may, as it sometimes does, provide that the entire interest in the land over which the highway passes shall vest in the public. This is the case with the modern streets in the city of New York.

The public right of transit must be entirely unrestricted. If obstructions be placed in the way impeding free travel, they will constitute public nuisances, and will afford ground for an indictment or for a private action by any person especially discommoded. They may also be abated or removed by any one, so far as may be necessary to permit him to continue on his way. Moreover, in order that the privilege of passage may be enjoyed with as little inconvenience as possible, it is the duty of every traveller to observe proper care to avoid collisions and accident. To promote this desirable end, it has been made the rule in England that vehicles in passing each other must keep to the left. In the U. S. the regulation is exactly the reverse —that they must keep to the right. The obligation of this requirement ceases when one of the vehicles is confined to a specific line of travel, as a horse-car, and in such a case the other carriage may turn to either side. In England the repair of highways is a duty obligatory upon the inhabitants of the parishes, and they may be indicted if they suffer defects to continue after knowledge of their existence. In the U. S. the liability is created by statute. In New England the duty is imposed upon the towns, and a statutory right of action is given against them if any injury be sustained by a traveller in consequence of their neglect. In other States the obligation devolves, as a general rule, upon municipal corporations, such as cities and villages, while towns, which are usually considered quasi corporations, are sometimes made liable, as in New England, or the roads within their limits are placed under the charge of specially-appointed commissioners, who may be subjected to an action if they fail to make repairs after they are provided with the means to obtain the requisite funds. If a person brings an action for an injury sustained through a defect in the highway against the body bound to make repairs, he must show that they had knowledge of the existence of the alleged defect, or a reasonable opportunity and means of obtaining such knowledge. If the defect or obstruction be caused by a resident adjacent to the highway, and the city or town be compelled to respond in damages to a person injured in consequence, a suit for indemnification may be instituted by the city, etc. in its turn against the party primarily responsible by reason of his unauthorized act or culpable negligence.

George Chase. Revised by T. W. Dwight.

Hi'ka, post-v. of Manitowoc co., Wis., on Lake Michigan, 12 miles N. of Sheboygan.

Hi'ko, post-tp. of Lincoln co., Nev., 215 miles S. of Elko. Pop. 54; of tp. 110.

Hi'lary. Four persons of this name are prominent in church history: I. Hilary of Arles, Saint, was b. at Arles, in S. Gaul, about 401 A. D.; was persuaded by Honoratus, afterwards (426–429) bishop of his native place, to enter the monastery of Lerins; in 429, on the death of Honoratus, was chosen his successor in the see of Arles, and d. there May 5, 449. Zealous in discipline and strong of will, he had a bitter controversy with Pope Leo the Great, which, however, was amicably settled at last. He was learned, eloquent, and charitable to the poor. His sermons, it is said, were sometimes very long (four hours), so that his hearers were driven into the novelty of sitting. His *Life of Honoratus* is in the *Acta Sanctorum*, Jan. 16. —II. Hilary of Poitiers, Saint, "the Athanasius of the West," of distinguished but heathen parentage, was b. at Poitiers in Central Gaul, near the end of the third century; became a Christian in mature life after prolonged and careful investigation; was chosen bishop of Poitiers about 350; in 355 was banished to Phrygia, because he would not sanction the condemnation of Athanasius; returned to Poitiers in 360, and d. there Jan. 13, 368. He was one of the ablest men of his century—clear-headed, incisive, resolute, learned, and eloquent. The leading characteristic of his career was the sharp and steady war he waged against Arianism. The earliest edition of his works was by Erasmus (Bâle, 1523); the best is the Benedictine, by Constant (Paris, 1693; republished, with additions, by Maffei, Verona, 1730). (See Reinkens's *Hilarius von Poitiers*, 1864.) —III. Hilary the Pope, was b. (date unknown) in Sardinia; while deacon at Rome, under Pope Leo the Great, was sent as legate to the "Robber Council" at Ephesus (449 A. D.); succeeded Leo in the papal chair in 461, being consecrated Nov. 12, two days after the death of Leo; and d. at Rome Feb. 21, 468. He was zealous for the faith and strict in discipline. A synod which met in Rome Nov. 12, 465, passed five canons, inspired by him, endorsing the canons of Nice, and forbidding, amongst other things, the ordination of men twice married or marrying widows, and forbidding bishops to nominate their successors. (See *Acta Sanctorum*, Feb. 21.)—IV. Hilary the Deacon. A Roman deacon of this name was sent by Pope Liberius (352–366 A. D.) to a council (attended by 300 bishops) which met at Milan in 355. He appears afterwards to have joined the schism of Lucifer (who d. 371), bishop of Cagliari (Lat. *Calaris*) in Sardinia. He has generally been identified with the unknown author (Ambrosiaster) of the commentary on the Pauline Epistles, wrongly ascribed to Ambrose of Milan; who also wrote the *Quæstiones Veteris et Novi Testamenti*, wrongly ascribed to Augustine. But this identification is now questioned. The commentary on St. Paul's Epistles contains passages which have important bearings on questions of church polity.

R. D. Hitchcock.

Hil'burn, tp. of Madison co., Ark. Pop. 424.

Hildburghau'sen, town of Germany, in Saxe-Meiningen, was once the capital of Saxe-Hildburghausen. It is on the river Werra and the Eisenach-Coburg Railway; has a gymnasium, a teachers' school, and institutions for deaf-mutes and for the insane, besides manufactures of considerable importance. Pop. 5148.

Hil'debert of Tours, the most celebrated Latin poet of his time, b. at Lavardin, in the Vermandois, in 1057, and educated in the monastery of Clugny. In 1097 he was appointed bishop of Mans, and in 1125 archbishop of Tours, where he d. Dec. 18, 1134. His dogmatical essays have in-

terest on account of their systematic form. A collected edition of his works was published in 1708 by Beaugendre.

Hildebrand. See Gregory (VII.).

Hil′desheim, town of Germany, in Hanover, on the Innerste. It contains several fine old monuments, as, for instance, the cathedral, built in 1015, with its famous bronze gates and glass-paintings; the church of St. Godehard, built in 1133; and the church of St. Michael, built in 1022. It has a lively trade in corn, linen, and yarn. It is a Roman Catholic bishop's see. Pop. 20,804.

Hil′dreth (Richard), the son of Rev. Hosea Hildreth (1782–1835), b. at Deerfield, Mass., June 28, 1807, and graduated at Harvard in 1826; was admitted to the bar at Boston; in 1832 became editor of the Boston *Atlas;* resided 1834–35 in Florida, where he wrote *Archy Moore* (1837), an anti-slavery tale, republished in 1852 as *The White Slave.* He translated Dumont's version of Bentham's *Theory of Legislation* (1840, 2 vols.), and published *History of Banks* (1837), a *Life of W. H. Harrison* (1839), whom he vigorously supported for the Presidency, and *Despotism in America* (1854), an anti-slavery work. He resided (1840–43) in Demerara, where he edited two free-labor journals. He published a *Theory of Morals* (1844) and a *Theory of Politics* (1853), but his great work is a *History of the U. S.* (6 vols., 1849–56), written in a style pure but without adornment. The author's standpoint is anti-Jeffersonian. He also produced *Japan as it Was and Is* (1855) and *Atrocious Judges* (1856), prepared from Lord Campbell's *Lives.* He was for several years on the editorial staff of the New York *Tribune,* and became U. S. consul at Trieste in 1861. D. at Florence, Italy, July 11, 1865.

Hildreth (Samuel Prescott), M. D., b. at Methuen, Mass., Sept. 30, 1783; studied medicine with Dr. Kittridge of Andover; removed from New Hampshire to Belpré, O., in 1806, and to Marietta, O., in 1808. He was a valued contributor to periodicals, and prepared various scientific and genealogical papers, etc. He wrote a *History of the Diseases and Climate of South-eastern Ohio* (1837), *History of Belleville* in West Virginia (1837), *Pioneer History* (1848), *Lives of Early Settlers of Ohio* (1852), and other works. His valuable library and scientific collections he gave to Marietta College. D. July 24, 1863.

Hil′gard (Eugene Waldemar), Ph. D., b. in Zweibrücken, Rhenish Bavaria, Jan. 5, 1831; emigrated with his father to Bellville, Ill., 1835–36; in 1849 returned to Europe, and studied at the Academy of Mines, Freiberg, Germany; also at the universities of Zürich and Heidelberg, graduating at Heidelberg in 1853; in 1855 returned to the U. S., and became assistant State geologist of Mississippi; in 1857 was in charge of the laboratory at the Smithsonian Institution, Washington, D. C.; in 1858 was appointed State geologist of Mississippi. Since 1871 he has held that office in connection with the chair of agricultural chemistry in the State University at Oxford, Miss. In 1873 he took a similar position in the University of Michigan, and in 1874 was elected professor of geology in the University of California, which position he still occupies (1875). Author of a report on the geology and agriculture of Mississippi, and various papers on chemical and geological subjects, chiefly on the geology of Louisiana and of the Mississippi delta, in the *Am. Jour. of Science;* is a member of the National Academy of Sciences.

Hilgard (Julius Erasmus), b. Jan. 7, 1825, in Zweibrücken, Germany; emigrated in 1835 to Illinois with his father, from whom he received a classical education; studied civil engineering in Philadelphia; in 1845 entered the Coast Survey service, which has been the principal sphere of his labors, and to the success of which he has largely contributed. His writings on geodetic methods, tides, and terrestrial magnetism are published in the Coast Survey reports and in various scientific journals. In 1862 he took charge of the Coast Survey office, and of the construction of standard weights and measures, a position which he still retains; in 1863 he was named a member of the National Academy of Sciences; in 1872 took an active part in the international metric commission which met at Paris, and was chosen a member of its permanent committee. He at the same time conducted a determination by telegraph of the longitude between America and Europe, including that between the observatories of Greenwich and Paris. Was elected president of the Am. Assoc. for the Adv. of Sci. in 1874.

Hilgard (Theodore Charles), M. D., b. in Zweibrücken, Germany, Feb. 28, 1828; came to the U. S. in 1835, and afterwards completed his education at the German universities; settled as a physician in St. Louis, and devoted much time to the microscopic study of zymotic fungi and the circuits of generation of the lower forms of life. His papers on these and kindred subjects—such as fresh-water algæ, the spawn of mosses, natural orders of the vegetable kingdom, phyllotaxy, and the genetic explanation of its numerical law, the numerical law of the vertebrate system, contributions to the physiology of sight, and other essays —are published in the *Transactions* of the St. Louis Academy of Science and in those of the American Association for the Advancement of Science. D. Mar. 5, 1875, of pneumonia, aged forty-seven.

Hilgard (Theodor Erasmus), b. in Nassau, Germany, July 7, 1790; educated at Heidelberg and Paris; counsellor at law at Trèves during the empire, and after the restoration of the Rhenish provinces to Germany judge of the court of appeals at Zweibrücken. While holding this position he published a series of reports on the working of the French system of jurisprudence and the Code Napoléon, which remained operative in those German provinces, contributing largely to the preservation and extension of that system. He was during five years member of the provincial assembly, maintaining the right of local self-government, but, dispirited by the reaction towards absolutism under the influence of Austria, he emigrated in 1835 to the U. S. with a family of nine children, whose education he personally directed at his new home in Illinois. He afterwards returned to Germany, and settled in Heidelberg, where he d. Feb. 14, 1873. Author of publications on important social questions, such as pauperism, the death-penalty, woman's rights, and the war-power. He also published metrical translations into the German language of Ovid, Homer, and Moore, an original poem entitled *The Hundred Days,* and many minor poems.

Hill, county of N. Central Texas. Area, 950 square miles. It is half prairie and half timber land. The soil is fertile. The chief products are cattle, maize, and cotton. The Brazos forms part of the western boundary. Cap. Hillsborough. Pop. 7453.

Hill, post-tp. of Merrimack co., N. H., on the Northern R. R., 25 miles N. W. of Concord. It has manufactures of furniture, carriages, etc. Pop. 620.

Hill, tp. of Montgomery co., N. C. Pop. 477.

Hill (Ambrose Powell), b. in Culpeper co., Va., 1825; graduated at the U. S. Military Academy July 1, 1847, and appointed in the army brevet second lieutenant of artillery, receiving his full commission the following month, and promoted to be first lieutenant Sept., 1851. Repairing at once to the seat of war in Mexico, he was in time to participate at Huamantla and Atlixco; subsequently serving in garrison and on frontier duty, and in the field in Florida against the hostile Seminoles, until 1855, when he was placed on duty in the Coast Survey office at Washington, where he remained until Oct., 1860, from which latter date he was on leave of absence to Mar., 1861, when he resigned his commission to follow the fortunes of his native State. On the secession of Virginia he was appointed colonel 13th Virginia Vols., and despatched to Harper's Ferry, rejoining the army at and engaged in the first battle of Bull Run. Promoted to be brigadier-general, he was distinguished at the battle of Williamsburg, and advanced to be major-general. In the succeeding operations on the Peninsula he bore a prominent part, and gained a brilliant reputation as a division commander. In Aug., 1862, his division was added to Jackson's force in Northern Virginia, arriving in time to render important aid in the defeat of Gen. Banks at Cedar Mountain (Aug., 1862), and in the succeeding battles of Bull Run and Chantilly. In the following month he received the surrender of Harper's Ferry, and hurrying forward arrived with his command at Antietam at the critical moment when he was most needed. At Fredericksburg his division formed the right of Jackson's command, which encountered the vigorous assault of Union troops under Meade, and which was finally repulsed; at Chancellorsville, still with Jackson, he participated in the famous flank movement which broke the Federal lines, and on the death of Jackson assumed command of the corps, himself being wounded soon thereafter. For gallantry on this occasion he was promoted to be lieutenant-general and placed in command of one of the three corps composing the Army of Northern Virginia. In the campaign of 1864–65 he was indefatigable in his exertions, commanding with great ability at all the bloody conflicts from the Wilderness to the final assault of the Confederate lines before Petersburg, Apr. 2, 1865, where he displayed the greatest bravery, meeting his death by a rifle-shot while engaged in reconnoitering at the moment it was decided that Richmond could no longer be held. G. C. Simmons.

Hill (Benjamin Harvey), b. in Jasper co., Ga., Sept. 14, 1823, of Irish descent on the father's side, and of English on the mother's side; graduated at the State University with high honor in 1844; studied law, and entered the profession at La Grange, Ga., in Aug., 1845, in which

he has since attained great eminence; in 1851 was elected a member of the legislature from Troup county as a Union man; in 1855 was defeated for Congress by the Hon. Hiram Warner (in this race he was supported by the American or "Know-Nothing" party, as it was then called, though he did not advocate the ritual or secresy of the organization, and disavowed membership with it); in 1856 was elector at large on the Fillmore or American party ticket, and by his canvass of the State this year made much reputation as an orator and a popular speaker; in 1857 was run without success by the same party as their candidate for the office of governor; in 1859 was returned to the State senate as a Union man; was elected a trustee of the State University in 1855; in 1860 was run as an elector for the State at large on the Bell-Everett ticket; was a member of the secession convention of Jan., 1861; was an earnest advocate of the Union until the convention passed a resolution delaring that the State ought to secede; he then voted for the ordinance, and cast his fortunes with those of all other citizens of the State, earnestly resisting coercion as the only means of avoiding the calamity of subjugation. He was elected to the provisional Confederate Congress that met at Montgomery, Ala., on Feb. 4, 1861; at the fall session of the State legislature the same year he was elected to the Confederate Senate, in which body he served until the end of the war. He was arrested at his home, La Grange, Ga., in May, 1865, and confined in Fort La Fayette, New York, until July following, when he was released on parole. In 1867 he presided over the convention held at Macon, Ga., for the purpose of reorganizing the Democratic party; in this and the next year (1868) appeared his celebrated *Notes on the Situation*, embodying arguments of great power against the reconstruction policy of Congress; on July 4, 1868, was delivered in Atlanta his famous "Bush-Arbor" speech; in the fall of 1870 he issued an *Address to the People of Georgia*, which brought upon him severe censure from many quarters previously friendly to him; he, however, is understood to maintain that it was but a step in advance toward that position afterwards taken by other distinguished leaders of the Democratic party throughout the Union, known as the "New Departure," and the policy of which culminated in the nominations made and the platform adopted by the national convention of the Democratic party in 1872 at Baltimore. Mr. Hill therefore supported the "Greeley movement" with all the zeal and eloquence he could command. On this line of policy he competed in Jan., 1873, for a seat in the U. S. Senate which was to become vacant in the March following by the expiration of the term of Hon. Joshua Hill. There were two other candidates for the same office. One of these was Gen. John B. Gordon, who, though he had supported Mr. Greeley as the nominee of his party, disapproved of the principles set forth in the "New Departure" platform. The other was Alexander H. Stephens, who had been utterly opposed to the election of Mr. Greeley, as well as to any departure from the fundamental principles of Jeffersonian Democracy. In this triangular contest Gen. Gordon bore off the palm. Mr. Hill's speech pending the canvass on this occasion, in vindication of his course, and in urging the Democracy of Georgia to stand by the policy adopted at Baltimore in 1872, was one of the ablest of his life. He is still (Mar., 1875) in the full vigor of body and intellect, and his friends look forward with confident expectation to his acquiring much higher honors and distinction in the future than any yet attained in his past career. A. H. STEPHENS.

Hill (DANIEL HARVEY), b. in South Carolina in 1821; graduated from the U. S. Military Academy, and was appointed brevet second lieutenant of artillery July 1, 1842; transferred to the infantry in 1847, with rank of first lieutenant. Called to active duty in the field in the war with Mexico, he served with distinction from Monterey to the final capture of the city of Mexico, winning the brevet of captain for gallantry at Contreras and Churubusco, and that of major for Chapultepec; in addition to which he was presented by his native State with a sword of honor. In Feb., 1849, he resigned his commission, and accepted the chair of mathematics in Washington College, Va., which he filled until 1854; that of mathematics and engineering in Davidson College, N. C., 1854–59, when he assumed superintendency of the North Carolina Military Institute at Charlotte. On the outbreak of the civil war he at once offered his services in support of the cause of the Confederacy, and as colonel 1st North Carolina Vols. was engaged at the affair of Big Bethel, Va., June, 1861. Speedily promoted to be major-general, he commanded a division during the Seven Days' fight on the Virginia Peninsula, remaining in command of the James on the departure of the main army of Gen. Lee for Northern Virginia, but rejoining it in season to participate in the battles of South Mountain and Antietam, where he led his division, as subsequently at Fredericksburg. Detached for a period during 1863 on duty in North Carolina, he was in September at the battle of Chickamauga, Ga., and in 1864 at Bermuda Hundred, Va. At the time of the capitulation of the armies his division was among the command of Gen. Johnston, who surrendered at Durham Station. At the close of the war he returned to Charlotte, N. C., and published *The Field and the Farm.* Among his works published prior to 1861 are *Elements of Algebra, Consideration of the Sermon on the Mount, The Crucifixion of Christ.* G. C. SIMMONS.

Hill (ISAAC), b. at Cambridge, Mass., Apr. 6, 1788; was apprenticed in youth to a printer at Amherst, N. H. In 1809 he became editor of the New Hampshire *Patriot*, which was long one of the ablest Jeffersonian or Democratic journals in the country. In 1824 he was second comptroller of the U. S. treasury; U. S. Senator 1830–36; governor of New Hampshire 1836–39, and afterwards was U. S. sub-treasurer at Boston. He again edited, with his sons, the *Patriot* (1840–47), and for fifteen years he published *The Farmer's Monthly Visitor*. D. Mar. 22, 1851.

Hill (JOHN HENRY), D.D., LL.D., b. Sept. 11, 1791, in New York City; graduated at Columbia College; became a minister of the Protestant Episcopal Church; has now (1875) been a missionary at Athens, Greece, for forty-five years, and for thirty years chaplain to the British legation in Greece.

Hill (JOSHUA), b. in Abbeville district, S. C., in 1812; removed to Georgia early in life; studied law, and was admitted to the bar; was a member of Congress from Georgia from 1857 to 1861, when he resigned his seat after the convention of his State passed the ordinance of secession in Jan. of that year, though he was strongly opposed to that measure. During the war he took no part on either side, except that he allowed his friends to run him for governor of the State in 1863. After the war he was a member of the constitutional convention called in pursuance of the proclamation of Pres. Johnson, and which met in Nov., 1865. He took a prominent and leading part in the proceedings of that body, and was a candidate for the office of U. S. Senator before the legislature of 1866. Upon his failure of election on that occasion, he left the State and took up his residence in Washington City. In 1868, after another constitution was formed and another legislature was elected under the reconstruction acts of Congress, he was chosen U. S. Senator for the term which expired upon Mar. 4, 1873. A. H. STEPHENS.

Hill (ROWLAND), an eccentric divine, b. at Hawkstone, England, Aug. 13, 1744; was educated at Eton and St. John's, Cambridge; became a Calvinistic Methodist; took orders in the Church of England, though six bishops refused his ordination on account of his Methodistic opinions; became an itinerant, and in 1773 became rector of Kingston, Somerset; minister of the Surrey chapel, London, 1782–1833; and was remarkable for wit, eloquence, and success as a preacher. D. in London Apr. 11, 1833. He was a son of Sir Richard Hill, Bart.—His brother, SIR RICHARD (1733–1808), was also an active and successful Calvinistic Methodist preacher.

Hill (ROWLAND), VISCOUNT, nephew of the great preacher, b. at Prees, Shropshire, Aug. 11, 1772; entered the army in 1790; served with the greatest distinction in most of the battles against Napoleon in which the British participated from Toulon to Waterloo; was raised to the peerage in 1814; took the chief command in 1828, and became a viscount in 1842. D. near Shrewsbury Dec. 10, 1842. Hill was called the "right arm of Wellington," and was the most popular general in the British army.

Hill (Sir ROWLAND), K. C. B., D. C. L., F. R. S., b. at Kidderminster in Oct., 1795; entered the British civil service in 1835, and in 1837 brought forward in a pamphlet a plan for uniform penny postage, which was adopted in 1840; has been chiefly employed in postal and railway affairs, and has been the recipient of abundant honors and pensions, the result of his labors for postal reform.

Hill (THOMAS), D. D., LL.D., Unitarian minister and mathematician, b. at New Brunswick, N. J., Jan. 7, 1818. His parents were poor, but the boy's thirst for knowledge overcame all difficulties; he entered Harvard College in the class of 1843; gave two years to the study of theology; was settled in Waltham, Mass., 1845; was made president of Antioch College 1859; of Harvard College 1862; resigned in 1868 on account of ill-health; retired to Waltham; accompanied Agassiz on the expedition to South America; accepted on his return a call to Portland, Me., where he still preaches (1875). His mathematical genius showed itself early, and distinguished him in college. As a mathematician he might have reached eminence had he not preferred the office of a Christian minister to any scientific position. Mr. Hill is a man of remarkable intellectual

power, and of singular simplicity and devoutness of heart, and his ambition is to make science tributary to faith. He has published a volume of poems (Cambridge, 1843), an elementary treatise on arithmetic (1845), *Geometry and Faith* (1849 and 1874), a treatise on curves (1850), *First Lessons in Geometry* (1855), *Liberal Education* (1855), *The True Order of Studies, Jesus the Interpreter of Nature* (1859), *The Natural Sources of Theology* (1875), being five articles reprinted from the *Bibliotheca Sacra*. Mr. Hill's distinction is as a mathematician; his special distinction is as a discoverer in the laws of curves. O. B. FROTHINGHAM.

Hil'la, or **Hil'lah,** town of Asiatic Turkey, in the province of Bagdad, on the Euphrates, which here is 450 feet broad and crossed by a floating bridge. It has manufactories of silks, tanneries, dyeing establishments, and large bazaars. It is built on the ruins of Babylon. Pop. 6000.

Hil'lard (GEORGE STILLMAN), LL.D., b. at Machias, Me., Sept. 22, 1808, and graduated at Harvard in 1828. He taught for a time in the Round Hill School, Northampton, and was admitted to the bar in 1833 at Boston. In 1833 he became one of the editors of the *Christian Register* (Unitarian), and was afterwards connected editorially with the *Jurist* and the Boston *Courier*. He has taken a high position at the bar, and has published *Six Months in Italy* (1853), *Life of G. B. McClellan* (1864), *Political Duties of the Educated Classes*, and educational and other works.

Hil'lear, tp. of Knox co., O. Pop. 931.

Hil'lel, THE GREAT OR THE ELDER (*Hazaken* or *Hassaken*), b. at Babylon about 75 B. C., or, as others say, 110 B. C.; became one of the most illustrious of Jewish rabbis, eminent alike for wisdom, holiness, and learning; went about 36 B. C. to Jerusalem, and worked with his hands for his living, at the same period attending the lectures of the principal officers of the Sanhedrim, of which, about 30 B. C., he became president, retaining that exalted position till his death, 10 A. D. He became the founder of the "school of Hillel," which numbered thousands of adherents, while Shammai, vice-president of the Sanhedrim, was at the head of the rival "school of Shammai." The two schools disputed mainly about questions of the law and discipline in sacred things; Hillel's, which was the more liberal party, finally becoming the dominant one.—HILLEL THE YOUNGER, a descendant of the foregoing, became president of the Sanhedrim and head of the school of Tiberias, as some say in 258 A. D., dying in 320; or, as others say, was chosen president 330 A. D., and d. before 400. Distinguished as the great reformer of the Jewish calendar.

Hill'grove, post-v. of Washington tp., Darke co., O. Pop. 117.

Hill'house (JAMES), LL.D., b. at Montville, Conn., Oct. 21, 1754; graduated at Yale in 1773. His father, William, who d. in 1816, was a member of the Continental Congress 1783–86, and forty years a judge in Connecticut. Dr. Hillhouse was a lawyer, served against Tryon in the Revolution, was a member of Congress 1791–94, U. S. Senator from Connecticut 1794–1810, and held many offices of trust and honor. D. at New Haven Dec. 29, 1832.

Hillhouse (JAMES ABRAHAM), a poet, son of James Hillhouse, b. at New Haven, Conn., Sept. 26, 1789, and graduated at Yale in 1808; became a merchant in New York, and in 1822 married and retired from business. His principal poems were *The Judgment* (1812), *Percy's Masque* (1820), and *Hadad* (1825). His collected works in 2 vols. appeared in 1839. D. at New Haven Jan. 4, 1841.

Hil'liard, post-v. of Norwich tp., Franklin co., O., on the Columbus Chicago and Indianapolis Central R. R., 9 miles N. W. of Columbus. Pop. 282.

Hilliard (HENRY WASHINGTON), b. in Cumberland co., N. C., Aug. 8, 1808; graduated at the South Carolina College in Columbia in 1826; soon after he moved to Athens, Ga., where in 1829 he was admitted to the bar; in 1831 was elected to a professorship in the Alabama University at Tuscaloosa, which position he filled with distinction for three years; then resigning, he resumed the practice of law at Montgomery in that State, which he pursued with ardor and distinguished success. He was a member of the Harrisburg Whig Convention in 1840, and zealously supported the nomination of Harrison, though Mr. Clay was the man of his choice for the Presidency at that time. He was a member of the State legislature in 1838, and was a Presidential elector on the Whig ticket in 1840. In 1842 he was appointed by Pres. Tyler minister to Belgium, and afterwards was a member of Congress from Alabama from 1845 to 1851, when he declined being again a candidate. He was a warm supporter of the Compromise measures of 1850. In 1856 he was a candidate on the Fillmore electoral ticket of Alabama, and also on the Bell-Everett ticket in 1860. He opposed secession in 1861 with all his might, but after the convention of Alabama passed their ordinance of secession he espoused the cause of his State with firmness and decision. He accepted from Pres. Davis the appointment of commissioner to Tennessee, and met with signal success in the objects of his mission. He also accepted the commission of brigadier-general in the provisional army of the Confederate States. After the war he returned to Georgia, when he resumed the practice of law, first at Augusta, and then at Atlanta, where he now (Mar., 1875) resides. Mr. Hilliard has through life evinced quite as much fondness for letters as for legal or political distinction; has been a preacher of the Methodist Episcopal Church, South. A volume of his speeches was published in 1855, and since the war he has contributed to the literature of the country a work entitled *De Vane, a Story of Plebeians and Patricians*. A. H. STEPHENS.

Hil'liardsville, post-tp. of Henry co., Ala. Pop. 1867.

Hills (ALFRED KIMBALL), M. D., b. Oct. 23, 1840, at Hudson, N. H.; studied in the Massachusetts Medical College and the Hahnemann College, Philadelphia; took his medical degree 1870; professor of materia medica in New York Medical College and Hospital for Women since 1871; surgeon to New York Ophthalmic Hospital. Author of professional papers.

Hills (Right Rev. GEORGE), D. D., Protestant Episcopal bishop of British Columbia, b. in England in 1817, a son of Rear-admiral Hills, was educated at Durham University; received several Church preferments, and in 1859 was consecrated lord bishop of British Columbia, having his see-house at New Westminster.

Hills (GEORGE MORGAN), D. D., b. in Auburn, N. Y., Oct. 10, 1825; at the age of fourteen removed with his parents to New York; graduated with honors at Trinity College, Hartford, Conn., 1847; was ordained deacon by Bishop De Lancey, and took charge of Grace church, Lyons, N. Y. The next year he was advanced to the priesthood by the same prelate, and in 1853 was called to Trinity church, Watertown, N. Y. This he resigned in 1857 to accept the rectorship of St. Paul's church, Syracuse. In 1862 he was elected a trustee of the General Theological Seminary in New York, and was placed by that corporation on the committee for the examination of students. In 1865 he was selected as one of four clergymen to represent the division of Western New York in the General Convention. In 1867, in addition to the care of his parish, he inaugurated a very successful mission among the Onondaga Indians. At the organization of the diocese of Central New York in Nov., 1868, he was chosen president of its standing committee. On Aug. 3, 1870, he was called to the rectorship of St. Mary's church, Burlington, N. J., and entered upon its duties Sept. 4. On the 28th of the same month he was appointed an examining chaplain of the diocese of New Jersey, and on the 24th of Nov. following lecturer on homiletics and pastoral theology in the divinity department of Burlington College. On July 13, 1871, he received the honorary degree of doctor of divinity from his *alma mater*. In 1873 he was chosen a fellow of Trinity College, and in 1874 was elected sub-dean of the house of convocation of that body. In Sept., 1874, he was appointed dean of the convocation of Burlington, having previously served as treasurer and secretary of the same. Among his publications those most known are *The Wise Master-Builder*, a sermon commemorative of Bishop De Lancey; *A Step between Us and Death; A Mother in Israel; The Record of the Past an Incentive for the Future;* an *Historical Sketch of St. Paul's Church, Syracuse;* and *Historical Records of the Church in Burlington, N. J.*

Hills'boro', tp. of Lawrence co., Ala. Pop. 1863.

Hillsboro', tp. of Shelby co., Ala. Pop. 522.

Hillsboro', post-v. and tp., cap. of Montgomery co., Ill., 66 miles N. E. of St. Louis, on the Indianapolis and St. Louis R. R. It is the centre of a good agricultural district; has 8 churches, 2 banks, and 2 weekly newspapers. Pop. of tp. 3417.
E. J. C. ALEXANDER, ED. "HILLSBORO' DEMOCRAT."

Hillsboro', a v. of Henry co., Ind. Pop. 95.

Hillsboro', post-v. of Louisa co., Ia. Pop. 46.

Hillsboro', post-v. of Fleming co., Ky., 9 miles S. S. E. of Flemingsburg. Pop. 1464.

Hillsboro', post-v. and cap. of Orange co., N. C., 40 miles W. of Raleigh, on the North Carolina R. R. The country in the vicinity is hilly and broken, climate salubrious. It contains 6 churches, 2 academies, 1 newspaper, and 4 tobacco-factories. Pop. of v. 809; of tp. 3624.
J. D. CAMERON, ED. "HILLSBORO' RECORDER."

Hillsboro', post-v., cap. of Highland co., O., 60 miles E. of Cincinnati, on the Marietta and Cincinnati R. R. It has 2 female institutes, 4 churches, 4 banks, 2 newspapers,

scale and agricultural works, planing-mills, flouring-mills, 3 hotels. Pop. 2818. J. C. SPRINGER, ED. "GAZETTE."

Hillsboro', tp. of Marion co., S. C. Pop. 1318.

Hillsboro', post-v., cap. of Hill co., Tex., pleasantly situated in a picturesque and well-watered valley. It has a good academy, 1 flour and grist mill, and 1 weekly newspaper. Pop. 313.

L. J. STURGIS, ED. "HILL CO. EXPOSITOR."

Hillsboro', post-v. of Loudoun co., Va. Pop. 246.

Hillsboro', post-tp. of Vernon co., Wis. Pop. 985.

Hills'borough, port of entry of Albert co., N. B., on Petitcodiac River, has a good harbor, and exports large quantities of gypsum and gas-coal (albertite) to the U. S. It has several handsome public buildings. Pop. about 900; of sub-district, 2995.

Hillsborough, county of Florida, bounded on the W. by the Gulf of Mexico. Land area, 1830 square miles. It includes Tampa Bay, a broad inlet, which furnishes a splendid harbor for vessels of nineteen feet draught. The county is generally level, partly sandy, partly rich marl hammock-land, and partly marsh. Cotton is the staple crop. Cap. Tampa. Pop. 3216.

Hillsborough, county of New Hampshire, bordering on Massachusetts. Area, 960 square miles. The surface is hilly. It principally lies on the W. side of the Merrimack River. The soil is mainly fertile. Cattle, wool, and grain are staple products. The cities of Manchester and Nashua, with many smaller towns, are extensively engaged in manufacturing. Lumber, cotton, woollen, wooden and metallic goods, furniture, cooperage, harness, and many other wares are manufactured. The county is traversed by several railroads. Caps. Amherst, Manchester, and Nashua. Pop. 64,238.

Hillsborough, post-v., county-seat of Scott co., Miss., 6 miles N. of Forest.

Hillsborough, post-v., cap. of Jefferson co., Mo., 40 miles S. of St. Louis. It has a good school, 2 churches, 3 hotels, 1 newspaper, and the usual mechanical shops. Principal occupations, farming, mining, and fruit-growing. Pop. about 400. R. W. MCMULLIN, ED. "DEMOCRAT."

Hillsborough, post-v. and tp. of Hillsborough co., N. H., situated in the Contoocook Valley. It has a bank, a weekly newspaper, a hotel, 10 stores, 2 large woollen-mills, and bedstead and shovel-handle shops. Pop. of tp. 1595.

WM. M. SARGENT, PROP. "HILLSBORO' MESSENGER."

Hillsborough, tp. of Somerset co., N. J., embracing several villages. Pop. 3443.

Hillsborough, post-v., cap. of Washington co., Or., 17 miles W. of Portland, and on the Oregon Central R. R.

Hillsborough River, in Volusia co., Fla., is a salt-water lagoon continuous with Halifax River, and extending 30 miles S. of Mosquito Inlet. It abounds in fish and oysters, is separated from the sea by a strip of land from half a mile to 5 miles wide. It is shallow, though navigable for small boats, but its navigation is obstructed by mangroves, coral, sand, etc. Its W. bank is a range of oyster-shells. From its head to Indian River a short and shallow canal has been dug. This channel was once called Mosquito South Lagoon, and (with Halifax River) it is still known as Mosquito River. It averages a mile in width.—Another Hillsboro' River flows into Tampa Bay in Dade co., Fla.

Hills'dale, county in the S. W. of Colorado, formed in 1874. Area, 1400 square miles. It contains important gold-mines. Cap. San Juan.

Hillsdale, county of Michigan, bordering on Ohio and Indiana. Area, 570 square miles. It is undulating, fertile, and well timbered. It has quarries of good sandstone. Grain, cattle, and wool are staple products. Lumber, carriages, etc. are manufactured. It is traversed by the Michigan Southern and the Detroit Hillsdale and Indiana R. Rs. Cap. Hillsdale. Pop. 31,684.

Hillsdale, city and tp., cap. of Hillsdale co., Mich., on the Lake Shore and Michigan Southern and the Detroit Hillsdale and Indiana R. Rs., 66 miles W. of Toledo and 177 E. of Chicago. It is the seat of Hillsdale College, and has 6 churches, several schools, 3 weekly newspapers, 2 national banks, 3 hotels, a chair factory, 2 steam flour-mills, and 2 foundries and machine-shops. Pop. of city, 3518; of tp. 562. H. B. ROWLSON, ED. "STANDARD."

Hillsdale, tp. of Winona co., Minn. Pop. 417.

Hillsdale, tp. and post-v. of Columbia co., N. Y., on the New York and Harlem R. R., 110 miles N. of New York. Pop. 2083.

Hillsdale College was founded as Michigan Central College at Spring Arbor, Mich., in consequence of a vote (1844) of the Michigan yearly meeting of the Freewill Baptist denomination. The college was chartered in 1845 by the legislature, rechartered and removed to Hillsdale, Mich., in 1855. It now has departments for the classical course, for theology, science, music, and art, besides two preparatory departments. A portion of the principal college building was burned in 1874, and a new building has been since erected. Both sexes are educated in this institution, in which there are 7 professors and 14 other instructors, the greater number of students thus far being in the preparatory departments. The college has a capital of more than $200,000.

Hill's Grove, post-tp. of Sullivan co., Pa. Pop. 249.

Hills'ville, post-v. of Carroll co., Va., situated on the Blue Ridge, 13 miles E. of New River. It has 1 newspaper, 1 church, 2 hotels, and 4 stores. Pop. 268.

CHAS. C. HARRYMAN, ED. "NEWS."

Hill Top, tp. of Charles co., Md. It constitutes a peninsula in the river Potomac. Pop. 4040.

Hill'town, tp. of Bucks co., Pa. Pop. 2869.

Hill'yer (JUNIUS), b. in Wilkes co., Ga., Apr. 23, 1807; graduated at the State University in 1828; studied law while in the university, and was admitted to the bar immediately after his graduation. In 1834 was elected by the legislature solicitor-general of the western judicial circuit of his State; was elevated to the bench in 1841, where he served several years; and was a member of Congress from Georgia from 1851 to 1855; in 1857 was appointed solicitor of the U. S. treasury, which position he held until Georgia passed her ordinance of secession in 1861. He then resigned and returned home, and resumed the practice of law, to which (Mar., 1875) he is still devoted.

A. H. STEPHENS.

Hill'yer (WILLIAM SILLIMAN), b. at Henderson, Ky., Apr. 2, 1831; graduated in 1847 at Anderson College, Ind., with honors, and became a brilliant and successful lawyer and politician of New Albany, Ind. In 1855 he removed to St. Louis, where he was a warm friend of U. S. Grant, afterwards President of the U. S. In 1861 he served for a time as a private in a volunteer organization under F. P. Blair, Jr., and then removed to New York, where he commenced the practice of law. In 1863 he served on Gen. Grant's staff with the rank of brigadier-general, but after the Vicksburg campaign resigned on account of ill-health, and returned to New York. D. at Washington, D. C., July 12, 1874.

Hi'lo, an important seaport of Hawaii, and the second town in size in the Sandwich Islands. It has a spacious and commodious harbor. Pop. 4220.

Hil'son's, tp. of Henry co., Ala. Pop. 774.

Hil'ton, tp. of Iowa co., Ia. Pop. 563.

Hilton Head, post-v. and tp. of Beaufort co., S. C. It is on Hilton Head Island, and has on the N. the Port Royal entrance, which constitutes a noble harbor. It was fortified by the Confederates, and taken by the U. S. naval forces Nov. 7, 1861. Pop. 3073.

Hil'versum, town of the Netherlands, in North Holland, is beautifully situated, and has manufactures of carpets and horse-cloths. Pop. 6294.

Himala'ya ("the abode of snow"), the highest and most majestic system of mountains on our globe, forms the boundary between the high table-land of Thibet on the N. and the low, alluvial plain of Hindostan, around the Ganges and Brahmapootra, on the S., and stretches in a curved line, 1500 miles long, and at some points 350 miles broad, from Hindoo-Koosh to Assam, from lon. 73° to lon. 98° E. To the S., towards the plain of the Ganges, Himalaya stands almost perpendicular, from 4000 to 5000 feet high, like a wall, from which the mighty rivers formed by the melting of the snow burst forth with tremendous violence, splitting the granite masses and forming long, winding, but narrow chasms. To the N. the mountains slope more gently towards the plateau of Thibet. The Himalaya consists of several ranges, with a direction parallel to each other, and enclosing fertile and well-cultivated valleys, some of which are among the most beautiful places on earth; as, for instance, the valleys of Cashmere, Nepaul, and Bootan. The central range is the highest, its average height being from 16,000 to 20,000 feet, and forty-five peaks are known to rise above the height of 23,000 feet. Mount Everest, the highest mountain on our globe, is 29,002 feet high; Kanchinjinga, 28,156; Dhawalagiri, 25,826; Nanda Devi, 25,749; and Shumalari, 23,929. The line of perpetual snow descends to 16,200 feet on the southern side of the range, but only to 17,400 feet on the northern—a singularity which probably can be explained from the peculiarly dry atmosphere of the plateau of Thibet. Glaciers abound, and at some places they are known to descend from the regions of perpetual snow to about 12,000 feet. At an elevation of 2000 feet the heat

varies from 100° to 37°; at 7000 feet, from 80° to 26°; at 12,000 feet, the thermometer falls during the nights of September below zero. But wheat can be grown at an elevation of 13,000 feet, and up to the height of 5000 feet the vegetation still retains a tropical character; the tea-plant has been introduced, and can be cultivated on the southern side up to a height of 5000 feet, but it succeeds best at an elevation of 2000 to 3000 feet. The passes of the Himalaya are few and extremely difficult. Ibi-Gamin, leading into Guhrwal, is the highest known pass, 20,457 feet; the highest pass used for traffic is Parany, 18,500 feet above the sea. With respect to their geological structure, the Himalaya Mountains consist of granite and gneiss, which form the loftiest peaks, and against which strata of the Silurian period rest. Mines of gold, copper, iron, and lead exist, but are not worked with energy, and seem not to be of importance. The flora of the Himalaya is peculiarly rich and interesting.

Hi′mera, an ancient city of Sicily, situated on the northern coast, was founded in the seventh century before Christ by a colony from Zancle, and was destroyed in 408 B. C. by the Carthaginians under Hannibal. The first time the Carthaginians invaded Sicily (in 480) they were utterly defeated, and their commander, Hamilcar, fell in the battle at Himera. The second time they were victorious, and Hannibal, the grandson of Hamilcar, after taking Himera, put a part of the inhabitants to death and razed the city to the ground.

Hime′rius, a celebrated Greek sophist of the fourth century after Christ (probably from 315 to 386), b. at Prusa in Bithynia; studied at Athens; travelled, and settled finally at Athens as a teacher of rhetoric. For some time he lived in Antioch at the court of the emperor Julian, who fully appreciated him. Of his orations, twenty-four have come down to us complete, and have been edited by Wernsdorf (Göttingen, 1790). We have fragments of eleven others, and extracts by Photius of thirty-six. His style is, as that of his time, obscure, overladen with figurative expressions, and affected, but he enjoyed a great reputation in his time. Among his disciples was Gregory Nazianzen. He was, like Libanius, a pagan, but he speaks with moderation, and sometimes even with kindness, of the Christians.

Himil′co, or **Hamilcar,** is a name of common occurrence in the history of Carthage. Pliny mentions one Himilco, a Carthaginian, who made a voyage of discovery along the western coast of Europe at the same time that Hanno explored the western coast of Africa; but Himilco's voyage is stated to have been stopped by the absence of wind and by the sea being loaded with seaweed. —Both in the first and third Punic wars there were noted Carthaginian generals of this name, but the most famous was that Himilco, the son of Hanno, who in 406 B. C. commanded the Carthaginian expedition against Sicily, together with Hannibal, the son of Gisco. The expedition was very successful, and the whole western part of the island was conquered. In 397, however, Dionysius, tyrant of Syracuse, renewed the war. Himilco again commanded the Carthaginian force, and was very successful in the beginning, but while he besieged the city of Syracuse a pestilence broke out in his camp. In this emergency Dionysius attacked and defeated him, and Himilco now made an infamous capitulation, paying 300 talents in order to be permitted to depart unmolested with all native Carthaginians, while he left his allies and the mercenary troops to the mercy of Dionysius. Having returned to Carthage, the popular odium which he incurred pressed so heavily on him that he committed suicide.

Himyarit′ic Lan′guage, a Semitic language formerly spoken in South-western Arabia by the Himyarites (or Homerites), a people of whose history comparatively little is known. A modern Himyaritic kingdom was destroyed 525 A. D. by the Ethiopians, who compelled the people to abandon Christianity. Himyaritic inscriptions of great but uncertain age have long been known to exist, but have not been deciphered until a quite recent date. The modern Ekhili Arabic is regarded as a representative of the old Himyaritic.

Hinck′ley, town of England, in the county of Leicester. It has a fine Gothic church and some manufactures of hosiery. Pop. 6902; with surroundings, 8082.

Hinckley, post-tp. of Pine co., Minn. Pop. 255.

Hinckley, post-tp. of Medina co., O. Pop. 972.

Hincks (EDWARD), D. D., b. at Cork, Ireland, Aug., 1792; studied under his father, Hebrew professor at Belfast; graduated with honors 1812 at Trinity College, Dublin, and received a fellowship; took Anglican orders, and became rector of Ardtrea, and in 1826 rector of Killyleagh, Ireland, where he d. Dec. 3, 1866. Though living in a remote country parish, and possessed of but small means, he became one of the first and ablest restorers of the lost knowledge of the meaning of the Assyrian inscriptions. He discovered the key to the Assyrian numeral system, and his papers *On Assyrian Verbs* (1855–56) contain the first successful attempts at an Assyrian grammar. Among his writings are valued papers on Egyptian MSS., and some polemical and other works.

Hincks (Sir FRANCIS), K. C. M. G., C. B., b. at Cork, Ireland, in 1805, a son of the Rev. Dr. Hincks, a learned Presbyterian divine of Belfast, and brother of Rev. Edward Hincks (1792–1866), the Assyrian archæologist. Sir Francis became a merchant, and in 1832 settled at Toronto, Canada, where he became a prominent editor and politician; finance minister of Upper Canada 1842–43 and 1848–54; prime minister in 1851; governor of the Windward Islands 1853–62, of British Guiana 1862–69; finance minister of Canada 1869–73. He was knighted in 1869.

Hind, the female of the red deer or STAG (which see) of Europe.

Hind (JOHN RUSSELL), b. at Nottingham, England, May 12, 1823, the son of a manufacturer of laces; became interested in astronomy in childhood; became an assistant to a civil engineer, and went in 1840 to London; found employment in Greenwich Observatory, and in 1843 was for three months employed in Ireland upon the task of exactly determining the longitude of Valentia; entered Mr. Bishop's observatory, Regent's Park, 1844. Here he discovered (1847–54) ten new asteroids, and made many other even more important observations; became foreign secretary of the Royal Astronomical Society 1847; corresponding member of the French Institute 1850; is superintendent of the *Nautical Almanac*, which under his direction has attained unsurpassed excellence both for astronomical and nautical purposes. Among his works are *The Solar System* (1846), *Illustrated London Astronomy* (1853), *Elements of Algebra* (1855), and treatises on comets.

Hin′dersin, von (GUSTAV EDUARD), b. July 18, 1804, at Wernigerode, Prussian Saxony; entered the artillery as a volunteer in 1820; distinguished himself by his quick apprehension, indefatigable application, and eminent business capacity, and was attached to the staff as first lieutenant in 1841. In 1846 he became major, and was appointed director of the topographical department. In the campaign of 1849 against the insurgents of Baden he had the misfortune to be taken prisoner while reconnoitring from a belfry, but was liberated after the capitulation of Rastadt. In 1854 he received the command of the 2d brigade of artillery, in 1858 that of the 3d, and in 1864 the position of inspector-general. Shortly before the assault on the Düppel intrenchments in Sleswick, during the war against Denmark, he was called to the head-quarters of Prince Frederick Charles and appointed leader of the artillery attack; after the victory he was ennobled and received the title of a general of infantry. In the war against France (1870–71) he followed the royal head-quarters as commander of the artillery, and took a very active part in the siege of Paris. D. at Berlin June 25, 1872, of heart disease. He did much for the improvement of the Prussian artillery, and introduced the breech-loading gun. But he was nevertheless not popular; he was vehement and haughty. A. NIEMANN.

Hind′ley, town of England, in the county of Lancaster, has extensive cotton manufactures and large coal-mines in its vicinity. Pop. with surroundings, 23,706.

Hin′doo-Koosh′, Hindu-Kush, or **Indian Caucasus,** a mountain-range in Central Asia, extending from lon. 68° to lon. 75° E., and forming the boundary between Afghanistan and Toorkestan. At its eastern extremity it is connected with the Himalaya, which it resembles in many of its features, though it is lower and destitute of forests. Its highest point is Hindoo-Koh, 20,000 feet high.

Hindostan. See INDIA, by R. C. CALDWELL.

Hinds, county of W. Central Mississippi. Area, 930 square miles. Its surface is pleasantly diversified and well timbered, and its soil very fertile. Corn and cotton are staple crops. The county is crossed by the Vicksburg and Meridian and the New Orleans Jackson and Great Northern R. Rs. Cap. Jackson. Pop. 30,488.

Hinds (SAMUEL), D. D., born in Barbadoes 1793; graduated in 1815 at Queen's College, Oxford; became vice-president of Albion Hall, Oxford, and principal of Codrington College, Barbadoes; was vicar of Yardley, Hants, 1834–43; prebendary and rector of Castleknock, Dublin, 1843; chaplain to Archbishop Whately; chaplain to the lord lieutenant of Ireland 1846–48; dean of Carlisle 1848; bishop of Norwich 1849–57, when he resigned. D. Feb. 7, 1872. Author of a *History of Christianity* (1829 *seq.*), a treatise on logic, *Sonnets and Sacred Poems*, *The Three Temples of the One True God Contrasted* (1830), *Inspiration and Authority of Scripture* (1831), *Scripture and the*

Authorized Version (1853), etc. His *History of Christianity*, originally published in the *Encyclopædia Metropolitana*, has gone through many editions.

Hindu Philosophy. The primitive religion of the Hindu branch of the Aryan race seems to have been monotheistic, but as it is exhibited in the hymns of the Vedas it is a pure nature-worship, its praises and its offerings being devoted to the various phenomena of nature and their deified personifications. Such a religion was suited only to a people in a primitive state. As the Hindu race advanced in knowledge, men began to "look through nature up to nature's God," and to seek "if haply they might feel after Him and find Him." This was an inquiry peculiarly suited to the subtle and analytical Hindu intellect, and it resulted in the formation of six distinct schools of philosophy. All the six systems are supposed to start from the Vedas, and are all recognized as orthodox. But the simple Vedic hymns afforded but scant material for metaphysical investigation, and were soon left far behind. The philosophical dogmas have only a very slight basis in the Vedas, and rest almost exclusively upon the deductions of pure reasoning. The nature of the Supreme Being, the origin of the universe, the mysteries of life, intelligence, and future existence, are the great subjects to which philosophy addresses its speculations. Though widely differing in their developments, all the schools recognize one fundamental maxim, *ex nihilo nihil fit*—"from nothing comes nothing." All also have one final object, the attainment of *mukti*, or deliverance, the emancipation of the soul from future birth and existence, and its absorption into the Supreme Soul of the universe.

The names of the six schools, or *darsanas*, are *Nyáya, Vaiseshika, Sánkhya, Yoga, Púrva Mímánsá*, and *Uttara Mímánsá* or *Vedánta*. But certain points of resemblance bring the six into association in three pairs, called *Nyáya, Sánkya*, and *Vedánta*.

I. (1) *Nyáya*, founded by the sage Gautama. The word *Nyáya* means "propriety or fitness," and was adopted because the author's primary object was to find the *proper method* of arriving at truth and of arranging the arguments. It is hence called the "logical school." The founder held the *sensations* to be the source of all knowledge, and set himself to inquire into their nature and functions. So his school is also known as the "sensational." (2) *Vaiseshika*.—This was founded by Kanáda, and is called the "atomic school." Its method is generally the same as that of the *Nyáya*, though it is not so precise and comprehensive. It pushes the sensation theory farther into an investigation of the objects of sense, but its distinctive doctrine is the existence of a transient world composed of aggregations of eternal atoms. Both divisions recognize a Supreme Being. To the Western World the Nyáya is especially interesting, as the only logical system which is not distinctly traceable to the teachings of Aristotle.

II. (1) *Sánkhya*, with which is classed the *Yoga*, the former being atheistical, the latter theistical. The Sánkhya was founded by the sage Kapila, and received its name *Sánkhya* ("numeral") from its discriminative tendencies. The first principle it asserts is the necessity of true and perfect knowledge. It defines the nature of evidence, and the principles of which a knowledge is attainable. First among the latter is nature, "the universal material cause." Matter it declares to be eternal, and so far it may be considered materialistic, but it recognizes also an intellectual power with affections, sentiments, and faculties. It admits the existence of separate souls, and admits that "intellect is exercised in the evolution of matter, or, in other words, in the work of creation, but it denies the existence of any Supreme Being, either material or spiritual, by whose *volition* the universe was produced." The doctrines of this school are set forth in the *Sánkhya Kárika*, translated with a gloss and commentary by Colebrooke and H. H. Wilson. (2) *Yoga*, founded by Patanjali, and sometimes called after him *Pátanjala*. This pursues the same method and holds most of the doctrines of the *Sánkhya*, but it asserts not only the existence of separate individual souls, but of one all-pervading Spirit, unaffected by the influences to which other souls are subject, the Supreme Ruler, God. The followers of the Sánkhya devote themselves to contemplation and to abstruse reasonings upon the nature of mind and matter. The *Yoga* insists upon the necessity of devotion, and prescribes the exercises and discipline to be practised. The disciples of both these schools are called *Yogis* (or *Jogis*), but the Sánkhya *yogi* sits in calm meditation, while the *yogi* of the Yoga school practises all kinds of austerities and bodily torments as acts of devotion.

III. *Vedánta*.—This includes the *Púrva-Mímánsá*, founded by Jaimini, and the *Uttara-Mímánsá*, attributed to Vyása. The *Púrva*, or prior *Mímánsá*, started with the express object of aiding the interpretation of the Vedas, and its most distinctive dogma is the eternity of the Word, meaning the Vedas. The *Uttara*, or later *Mímánsá*, is the more important, and it is to this that the term *Vedánta* especially applies. This professes to be founded on the Vedas, and cites texts as authorities, but its conclusions are worked out by pure reason. It teaches that "God is the omniscient and omnipotent cause of the existence, continuance, and dissolution of the universe. Creation is an act of His *will*; He is both the efficient and the material cause of the world," and in the end all things are resolved into Him.

The time when these systems of philosophy sprang up is, as is usual in all matters of Hindu chronology, very uncertain. The *Uttara-Mímánsá*, or Vedánta, is generally admitted to be the latest, and is supposed to have been especially directed against the teachings of the Buddhists. This would bring it within three or four centuries B. C. The other schools are to all appearance older, but reasons have been urged for placing them all after the rise of Buddhism. If this be the correct view, the date of the Vedánta must be brought down later. This is a question of some interest, for the later the rise of these schools the greater is the possibility of their having been evoked by the teachings of the Greek philosophers. Mr. Colebrooke, the highest authority on the subject, expresses his decided opinion that "the Hindus were the teachers, not the learners."

The principal authorities are COLEBROOKE'S essays in the *Transactions of the Royal Asiatic Society*, subsequently published separately in 2 vols.; *Dialogues on Hindu Philosophy*, by the Rev. K. M. BANERJEA (Calcutta, 1860); *Refutation of Hindu Philosophy*, by PUNDIT NEHEMIAH NILKAUTH SASTRI, translated by Dr. HALL (Calcutta, 1862); BALLANTYNE'S *Essays* (various). JOHN DOWSON.

Hindu Religion. The origin of the Hindu religion is veiled in the mists of a remote antiquity. When the old Aryans crossed the Indus in their emigration from Irán or Central Asia, they carried with them certain hymns which were probably even then committed to writing. These hymns were afterwards increased in number, for there are allusions in some hymns to the new land in which their authors had settled. The language in which the hymns are composed is the oldest known form of Sanscrit, and centuries probably passed before these scattered compositions were collected and arranged in the books called *Vedas*. The date of these compositions is a matter of very great uncertainty, and the best opinions are based upon deductive reasoning from uncertain premises. The date which has received perhaps the greatest approval is 1400 B. C. The hymns have a strong mythic character about them. They are addressed to the elements and powers of nature personified—to fire, to the wind, to the firmament, the moon, and other objects. Those addressed to the dawn are peculiarly interesting from their mythical significance. No one of the divinities has any recognized superiority over the others, but the differences in the numbers of the hymns addressed to the individual deities show that they were held in various degrees of dread and reverence. There are glimpses in some of the hymns of a high and spiritual conception of the Deity, or direct mystical allusions to one superior Being, from whom all the rest emanate; and texts are found which speak more or less explicitly of "One Supreme Spirit, the Lord of the universe, whose work is the universe." But the general character of the hymns does not rise above earthly objects. Protection from the elements, from sickness, and from enemies, aspirations for the favors of nature, for increase of children and of cattle, are their main topics. Various rites and ceremonies are provided for and enforced, and very frequent reference is made to the fermented juice of the *soma* plant (*Asclepias acida*), a beverage in high favor among mortals, and therefore presented as an acceptable offering to the superior powers. In course of time the scattered hymns were collected and arranged in books by a sage who is known as Vyása "the compiler." The Vedas as they are now known, and have been known for ages, are four in number, named *Rig, Yajur, Sáma*, and *Atharva*. The *Rig* is the most important and original. The second and third Vedas consist principally of hymns from the *Rig* adapted to special purposes. Those of the Yajur are intended for sacrificial, those of the *Sáma* for choral uses. The *Atharva*, or fourth Veda, is of later date, and its contents are more original and diverse than those of the second and third. The hymns of the Vedas recognize a priestly class and a regal class, which are evidently the beginnings of the *Bráhman* and *Kshatriya* castes of later days. The great body of the people was called *vis*, a word which was afterwards expanded into *Vaisya*, and used as the name of the third or mercantile and agricultural caste. The fourth or servile caste, called *Súdra*, seems to have had no recognized existence in those days. In the later portion of the *Rig*, and in the more modern *Atharva veda*, there are references to a future state, and an abode of bliss is promised after death to the victorious.

The difference between the religion of the Vedas and modern Hinduism is very wide—so wide indeed that the two religions have little or nothing in common beyond the Vedic texts and formulas which still remain in use. "The great feature of difference," says H. H. Wilson, "is the total absence of the divinities, both *nomina* and *numina*, who have for ages engaged, and, to a great degree, engrossed, the adoration of the Hindus. We have no indications of a Triad, the creative, preserving, and destroying power; Brahmá does not appear as a deity, and Vishnu, although named, has nothing in common with the Vishnu of the Purânas; no allusion occurs to his *avatárs* or incarnations. As a divinity Siva is not named; nor is his type, the *Lingam*, ever adverted to. Durgá and her triumphs, and Kálí, 'whom the blood of man delights a thousand years,' have no place whatever in the hymns of the Vedas." The doctrine of transmigration seems to be entirely unnoticed in the Vedic hymns; and the rite of *sati*, the burning of widows with the corpses of their husbands, although known to Greek writers 300 years before Christ, and said to be a Vedic institution, proves upon examination to have no better authority than a misquoted verse. Some portion of the ceremonial of the Vedas still survives in the domestic observances of the Bráhmans and in their obsequial offerings. It is incumbent on every householder to make offerings of cakes and other viands to his own ancestors, and to the collective *Pitris* or Patres of the human race. Every *bráhman* also, on approaching maturity and being invested with the sacred thread, is taught the celebrated verse called the *Gáyatri:* "Let us meditate on the adorable light of the Sun (or Divine Ruler): may it guide our intellects!" This may be the only verse of the Veda he may ever learn, but this he must repeat in all his devotions.

The hymns collectively, the whole metrical part of the Veda, is called *Mantra*, and is thus distinguished from another part written in prose and called Bráhmana. There are several works bearing this title. They are of later date, but they are held to be part and parcel of the *Veda*, and of equal authority with the *Mantra*. The *Bráhmanas* have been compared to the Talmud, and though "gleams of beautiful thought occasionally break out" in them, their contents are in general wearisome. They enter into long details about ceremonies, and of the origin and meaning of various rites, and they illustrate them with curious legends, both human and divine. The four castes are distinctly named in the *Bráhmanas*, and one of them indicates, rather than lays down, the doctrine of transmigration.

Next in order come the writings called *Aranyakas* and *Upanishads*. These are works of a far higher character, and give clear evidence of a vigorous intellectual life interesting itself in questions about life and eternity. They are the beginnings of Hindu philosophy, and cast aside matters of rites and ceremony to deal with abstract questions and make "guesses at truth."

Second only to the Veda in importance is the Code of Menu, which is also a pre-Christian production. This shows a considerable advance in the development of the Hindu system. A future state of reward and punishment is clearly recognized, and the doctrine of transmigration is distinctly enunciated. No one of the three great gods of modern times was known to the *Veda*, but Menu recognizes Brahmá, the Creator. But Brahmá is not the One Supreme Being, the Soul of the universe, but merely the creative energy; and after the world which he has produced has endured for long ages, the Divine energy is withdrawn and Brahmá himself returns to the Supreme essence from which he emanated. It is remarkable that no mention is made by Menu of the burning of widows; and as he prescribes the kind of life that widows were to lead, the inference to be drawn is, that the practice was unknown to him. Yet, as we have seen above, the custom was well known to Greek authors 300 years B. C. But the most remarkable feature in Menu is the full development of the caste system. Not only are the four great castes recognized, but the "mixed castes" also have come into being through the intercourse of couples belonging to different castes. Most stringent rules are laid down for the separation and guidance of all the castes, the chief and leading object throughout being the elevation of the *Bráhman* and the degradation of the others. The *bráhman*, according to Menu, is the chief of all created beings; kings are inferior to him, and must show him respect; his person and property are guarded by the severest laws in this world, and by denunciations of tremendous punishments in the next. But the *bráhman's* life was not to be one of luxury and ease: all his days were to be spent in study, devotion, and austerity, in acquiring and imparting a knowledge of the holy books, in performing the duties and ceremonies they enjoin, and in so mortifying the flesh that it might cease to care for the things of this world, and rise nearer and nearer to assimilation and unity with the Great Soul of the universe. The *bráhman's* life was divided into four portions or stages. The first portion he was to spend as a *Brahmachárí*, or student, in strict service and obedience to his religious superior until his investiture with the sacred cord about the age of sixteen. Next he was to marry and become (2) a *Grihastha*, or householder and head of a family. During this stage he was to be diligent in studying and teaching the Veda, to officiate at sacrifices, to receive alms and bestow alms. But the grand object of marriage was to obtain male offspring, and so provide for the obsequial offerings to himself after death, and to his ancestors and the general progenitors of mankind. These duties accomplished, he was to proceed to the next stage, (3) the *Vánaprastha*, or dweller in the woods, whose duty it was to divest himself of all fleshly luxuries and comforts, to despise all trials of heat and cold, wet and dry, to live upon the coarsest fare, and to mortify the body in every way as a clog and burden to the soul. Lastly, he was to become (4) the *Sannyási*, or mendicant, when, freed from all earthly attachments and religious observances, his only duty was to abstract his mind from material objects, and to strive after that perfect equanimity, that complete indifference to everything mundane, which is the nearest approach in this world to the all-pervading Spirit which rules it. Such was the high ideal of the life of a bráhman—an ideal which few sought to realize, even in the days when the ordinance was young, and of which the mere name and shadow only now remain.

In the days of the *Upanishads* the duty of studying and teaching the Veda had been shared by the second caste, but now it was restricted exclusively to the bráhmans; the law was either derived directly or deduced from the same writings, so the bráhman was the judge and the exponent of the law. Government and administration were to be in accordance with the law, so the bráhman was the king's counsellor and guide, the chief director and administrator in all political transactions. Fighting was the more especial duty of the *kshatriya*, but, as will be presently seen, the bráhman took a prominent part even in this. The Code declares that "the world and all that are in it are his;" the world was made for the bráhman; it was for him to rule and guide it. Others might act as instruments, but he was the director and controller.

The *Kshatriya*, or military class, were charged with the duties of government and war. They were entitled to honor and obedience, but were far inferior to the bráhman. The sacerdotal class required the protection of the ruler and warrior; the soldier needed the advice and guidance of the sage and lawyer. The two classes were mutually dependent on each other, but the one contributed mental and spiritual influence, the other physical power, and the former asserted and maintained its ascendency.

The business of the *Vaisya*, or third class, was to carry on trade and agriculture, to perform sacrifices through the bráhmans, and to bestow alms.

The *Súdra* was the fourth or servile caste, and its whole duty was service of the others, especially the bráhman. Ingenuity almost exhausted itself in the effort to describe the utter vileness of the súdra, a being so base that a bráhman could not receive a gift from him, and even in the extremity of hunger could accept nothing more than a little dry grain. But the degradation of the súdra was only religious. Though he was to serve, he was not a slave; he could choose his own master, and was entitled to payment. He could accumulate wealth and acquire property, and he often became rich and sometimes rose to power.

The "mixed castes" are fully recognized by Menu: their social status is declared, as well as the course of life to which their degraded birth had called them.

In the present day it is asserted by the bráhmans—and with much apparent reason—that they alone of the four castes remain unchanged and unmixed. The *rájpúts* claim to be the representatives of the kshatriyas, and there are other castes who assert themselves to be the descendants of the vaisyas and súdras, but it is difficult for them to prove the purity of their descent. The bráhmans themselves have broken up into divisions and subdivisions without end, and the higher classes hold the lower divisions in the utmost scorn. The mixed castes have naturally greatly increased, and the general tendency is to still further multiply them by all kinds of artificial and arbitrary distinctions.

The two great poems *Rámáyana* and *Mahábhárata* are supposed to have been written a little before the Christian era. They depict the heroic age, and those deified heroes come upon the scene who occupy so prominent a position in modern Hinduism. The *Rámáyana* celebrates the exploits of the hero Ráma in effecting the conquest of the S. of India and Ceylon. He was a bráhman, and in the poem appears as a mere mortal hero, but he has since been raised to the dignity of an incarnation of Vishnu. The *Mahábhárata* records the wars between two rival families for the sovereignty of a state whose capital stood near the site of

modern Delhi. In this war, Krishna, the most celebrated of the incarnations of Vishnu, took a leading part. Like Ráma, he was bráhman, but even in the poem he has many of the attributes of divinity, and is more of a god than a mortal. He it is who is represented as reciting the *Bhagavad-gítá*, the "Divine Song," a philosophical poem of great elevation of thought and beauty of language.

From the epic poems to the *Puránas* is a wide interval, full of important changes. There are many works bearing this name, but the recognized *puránas* are eighteen in number, and are supposed to have been written between the eighth and fourteenth centuries of our era. In these works the Hindu religion receives its full development. Brahmá the Creator, Vishnu the Preserver, and Siva the Destroyer (or rather Regenerator) are acknowledged as the three great divinities constituting the Triad. The first of the Puránas is the *Brahmá-purána;* the others are devoted, some to the exaltation of Vishnu in one or other of his many forms, and some to the honor of Siva and his emblem, the *lingam*. It is doubtful if Brahmá was ever an object of worship, for even the Brahmá-purána does no more than indicate a local worship of him at one place near Ajmír. Vishnu the Preserver was then, as now, the most popular deity, under one or other of his *avatárs* or incarnations. The avatárs were ten: (1) *Matsya*, the Fish, the object of which was to recover the Vedas, which had been lost in a general deluge. (2) *Kúrama*, the Tortoise. This is connected with one of the wildest legends of Hindu mythology. The deluge had destroyed thirteen precious things, among which was the *amrita* or water of immortality; Vishnu converted himself into a tortoise, and sustained the mountain Mandara on his back while the gods churned the ocean with it till they recovered the lost treasures. (3) *Varáha*, the Boar. (4) *Narasinha*, the Man-lion. (5) *Vámana*, the dwarf named Bali. (6, 7, 8) The three Rámas—Parasu-ráma, Ráma or Ráma-chandra, and Bala-ráma. (9) Buddha. (10) Kalki, the White Horse, which will appear hereafter to destroy the world and restore purity. For Bala-ráma some substitute Krishna, but Krishna has attained to such honor that he is held to be Vishnu himself, not simply an incarnation. A foreshadowing of one of these incarnations appears in the Veda. The sun is represented mythically as taking three steps—his rising, culmination, and setting. Bali the dwarf is represented as having begged three steps of land from a tyrant, and then to have strode over the whole world. Vishnu in his abstract form receives little or no adoration. Ráma and Krishna, the deified heroes, are the great objects of worship. Both were mortals, and are represented as dying, one by suicide, the other by accident. Ráma, the hero of the *Rámáyana*, is the especial deity of the mendicant sects. His name is used as a salutation and benediction by all classes, and the constant repetition of it is a religious exercise of great merit. Krishna, the hero of the *Mahábhárata*, enjoys unbounded popularity, particularly as Gopála, the youthful cowherd. He was of royal race, but was hidden among the cowherds from a tyrant who sought his life. His gambols with the milkmaids and the frolics of his childhood and youth are related in the *Bhágavata purána* and in the modern *Prem-ságar*. They are the delight of all classes, especially of females and the young. In later life he performed many wonderful exploits, and after taking a leading part in the war of the Mahábhárata he retired to Dwáraka, his capital, in Guzerat, where he was killed by an arrow shot at him by mistake. The name Krishna signifies "black," and the god is represented as a youth of very dark complexion. The ceremonies and rejoicings at the great spring festival, the *Holi*, are principally in honor of Krishna.

Vishnu is "the thousand-named," and the repeating of these names is a very meritorious work. Prominent among these forms—for each name carries with it some special significance—is that of *Jagan-náth*, "the lord of the world," in which form he is worshipped at the great car-festival in Cuttack.

Siva, the Destroyer and Regenerator, has also a vast number of votaries, but fewer than Vishnu. His appearance and attributes are of a very gloomy character. He is represented as sitting absorbed in thought—naked, smeared with funereal ashes, with matted hair, and a necklace of human skulls and bones. He has three eyes, and the fire from them consumes those who interrupt his devotions. But the especial form under which he is worshipped is the *lingam*, or phallus, the male organ of reproduction, which symbolizes his office of regenerator. There is nothing offensive in the way this is represented, nor anything obscene in the ideas attached to it. A plain column of stone, a cone of clay, or even a natural oblong stone, is its representative. This, in the eyes of the worshipper, is simply Siva, its symbolical purport being altogether unknown or unheeded. At the time of the Mohammedan conquest of India in the eleventh century there were twelve celebrated lingams at different places, and it was one of these that Mahmúd destroyed at Somnáth. One of the names of Siva is *Soma-náth*, "lord of the moon," and he is represented as bearing the crescent on his forehead. It is in honor of Siva, but especially of his consort, Deví, that bloody sacrifices are offered and tortures inflicted.

Saraswatí, the wife of Brahmá, is the goddess of learning and the arts, and the inventress of the Sanscrit language. She receives more honor than her lord. Lakshmí, the wife of Vishnu, is the goddess of prosperity and fortune. Both of these deities receive adoration on particular occasions, and the latter is very frequently invoked, but they are not the objects of any regular worship. It is far different with the consort of Siva, who is known under a great variety of names—Deví, Dúrgá, Kálí, Párvatí, Bhavání, etc.—and is the recipient of a fierce fanatical adoration. This goddess is represented in a variety of ways, all more or less terrible and disgusting. In the mildest form she is a handsome woman riding on a tiger in a fierce and menacing attitude. In another and more common one she is Kálí, "the black," with a black skin, a hideous and terrible countenance, dripping with blood, wreathed with snakes, and adorned with human skulls. The worship of this deity is very widely spread, especially in Bengal, and it is from her that Calcutta obtained its name. The worship of Deví owes its diffusion, perhaps its rise, to a class of writings called *Tantras*. These are works of a comparatively late date, but their origin is very obscure and their authors are unknown. They are ascribed to Siva, and are generally in the form of dialogues between him and his consort. "They are very numerous, and some are of considerable volume. They have been but little examined by European scholars, but sufficient has been ascertained to warrant the accusation that they are authorities for all that is most abominable in the present state of the Hindu religion. The great feature of the religion taught by the *Tantras* is the worship of Saktí—divine power personified as a female, and individualized, not only in the goddesses of mythology, but in every woman; to whom, therefore, in her own person, religious worship may be, and is occasionally, addressed. The chief objects of adoration are, however, the manifold forms of the bride of Siva. Even in its least exceptional division the Saktí worship comprehends the performance of magical ceremonies, and rites intended to obtain superhuman powers and a command over the spirits of heaven, earth, and hell. The popular division is, however, called by the Hindus the *left-hand* faith. It is to this that the bloody sacrifices offered to Kálí must be imputed, and that all the barbarities and indecencies perpetrated at the annual worship of Dúrgá and the swinging festival are to be ascribed. There are other atrocities which do not meet the public eye." (*H. H. Wilson.*)

The religion of the Hindus is thus principally directed to the worship of three leading divinities, Vishnu, Siva, and Deví—each of whom has many names and forms. Each form or manifestation has some peculiar attribute, some special kind of worship, but the general features are maintained throughout. The worship of Vishnu is cheerful and sensuous; of Siva, sombre and severe; of Deví, terrible and disgusting. But besides these great divinities there are many others of less dignity and power, who have their special attributes and spheres of action. They are not the objects of any regular worship, but they are invoked and adoration is offered to them when it is desired to propitiate them and secure a favorable exercise of their powers. There is Indra, the god of the firmament and heaven; Súrya, the sun; Soma, the moon; Varuna, the waters; Pavana, the wind; Agni, fire; Kuvera, wealth; Kártikeya, war; Káma, love; Yama, the god of the infernal regions and judge of the dead; Ganesa or Ganapati, the god of wisdom and the remover of obstacles. He is represented as a short fat man with an elephant's head. His image is frequently found at the entrance of temples, and he is invoked at the beginning of important works and ceremonies. The total number of gods is said to be 330,000,000.

Two very remarkable features in the Hindu religion are the great powers and virtues ascribed to sacrifice and faith. Sacrifice and austere penance, perseveringly and rigidly performed, make even the gods subservient to the wishes of the devotee, and that quite irrespective of the object in view. The merit is in the performance, not in the spirit of the observance, and the most impious and worthless are represented as gaining their ends by sacrifice and severe bodily torture. The virtue of faith was a leading principle in the *Bhagavad-gítá* ascribed to Krishna. Trust in the chosen deity, constant repetition of his name, the bearing of his sectarial marks—in short, the outward show of religion upheld by a fanatical faith—is of more avail than sacrifice and piety. Morality and innocence may be inculcated, but the saving principle is belief.

The worshippers of Vishnu and Siva are broken up into an infinite variety of sects and divisions, and they have also a great number of monastic and mendicant orders intent upon the maintenance of their respective phases of belief. Many instances are recorded of rival devotees coming in conflict at some of the great places of pilgrimage, and of hundreds and thousands being killed. There are among the Hindus men of superior intelligence who philosophically see through all these varieties of divinity the One Supreme Being, to whom alone worship is due. There have been others who, influenced by that feeling of mysticism so prevalent in the East, have treated all the forms of religion as mere symbols. Such were the founders of some of what may be called the dissenting sects, who deny the merit of religious ceremonies, and strive to seek above and beyond them the One Great Being. Such was the sect established by the weaver Kabir at the beginning of the fifteenth century; such also was that of the Sikhs, founded by Nának at the end of that same century. Many a pure thought and lofty idea is to be found in the verses of these and other such independent thinkers—for it is to be noted that all of them express their thoughts in verse—but there is a strong disposition in all such sects, as time wears on, to unduly exalt their *guru* or founder, and to adore him as a saint. JOHN DOWSON.

Hindus. See INDIA, by R. C. CALDWELL.

Hinesburg, post-tp. of Chittenden co., Vt., 12 miles S. E. of Burlington, has an academy, 4 churches, and manufactures of castings, woollen goods, cooperage, carriages, leather, boxes, yarn, etc. Pop. 1573.

Hinesville, post-v., cap. of Liberty co., Ga., 35 miles W. of Savannah. It contains the usual county-seat buildings, a high school, a flouring-mill, 1 weekly newspaper, and a sulphur spring of marked medicinal properties. Principal occupation, farming and stock-raising.
S. D. BRADWELL, ED. "GAZETTE."

Hinge, the pivot on which a door or shutter, or sometimes a window, turns in opening or shutting. Hinges are also used in fastening on one side of the covers of trunks, boxes, and the like. In ancient Egypt, Syria, etc. hinges were usually pivots, one below resting in a socket in the doorsill, and another above in the lintel. Such are still seen in the East. A simple strip of leather is another early and rude form. From this the transition to metallic hinges was an easy one. In mediæval times, and again at the present day, the custom has prevailed of employing elaborately designed and highly ornamented hinges. A strap-hinge is one which is screwed to one side of a door. The more common sort, called *butt* by the builders, screws into the edge of the door.

Hing'ham, post-v. of Plymouth co., Mass., 14 miles S. E. of Boston, on the Old Colony R. R. It has both rail and steamboat communication with Boston. It contains an academy, 9 churches, 2 banks, a fire insurance company, 2 hotels, 1 newspaper, a public library, an agricultural society, and manufactures of wooden ware, cordage, bagging, furniture, iron castings, worsted upholstery, fancy knit goods, etc. Pop. 4422. GEORGE LINCOLN.

Hink'ley, tp. of Washington co., Me., on Grand Lake. Pop. 19.

Hin'man (CLARK TITUS), D. D., b. at Kortwright, N. Y., Aug. 3, 1819, graduated at the Wesleyan University in 1839; was connected with the Methodist Seminary, Newbury, Vt., 1839–46; principal of Albion Seminary, Mich., 1846–53; founder of North-western University, Evanston, Ill., and its first president 1853–54. D. at Troy, N. Y., Oct. 21, 1854. He was an able orator and scholar, and a laborious and successful instructor.

Hinman (JOHN), LL.D., b. in Fairfield co., Conn., in 1802; was admitted to the bar at New Haven, and afterwards practised law at Waterbury, Conn.; was appointed a justice of the superior court 1842; of the State supreme court 1850; its chief-justice 1861. D. at Cheshire, Conn., Feb. 21, 1870.

Hin'mansville, post-v. of Schroeppel tp., Oswego co., N. Y., on Oswego River. Pop. 154.

Hin'ny, or **Jen'net** [Gr. ἴννος, γίννος, a "mule"], a hybrid between the horse and the she-ass, a very different animal from the mule, which is bred between the ass and the mare. The hinny neighs like a horse, the mule brays like the ass. The mule's ears, tail, and general aspect are asinine. The hinny more nearly resembles the horse; is of slighter build, and of strength inferior to that of the mule. It is bred to some extent in Spain and Barbary. It was once called *jumart*, and was absurdly believed to be the fruit of a cross between the bull and the mare.

Hinojo'sa del Du'que, town of Spain, in the province of Cordova. It has some manufactures of linens and woollens. Pop. 8637.

Hins'dale, post-tp. of Berkshire co., Mass., 8 miles E. S. E. of Pittsfield. It is a mountainous town, and has some manufactures. Pop. 1695.

Hinsdale, post-v. of Cheshire co., N. H., on the Ashuelot R. R. It has a fine water-power, and contains large woollen-mills, 3 churches, 2 newspapers, manufactories of mowing-machines, lumber, etc. Pop. 1342.
HENRY E. HUNTER, ED. "STAR-SPANGLED BANNER."

Hinsdale, tp. and post-v. of Cattaraugus co., N. Y., on the Erie and the Buffalo New York and Philadelphia R. Rs., 60 miles S. E. of Buffalo. It has some manufactures. Pop. of v. 321; of tp. 1491.

Hinsdale (BURKE AARON), A. M., b. at Wadsworth, Medina co., O., Mar. 31, 1837; was educated at the Elective Institute, now Hiram College; received in 1871 the degree of A. M. from Bethany College, W. Va., and from Williams College, Mass.; entered the ministry of the Christian Church (called also Disciples, Campbellites, etc.) in 1861; was pastor in Solon, O., 1864–66; in Cleveland 1866–68; assistant editor of the *Christian Standard* 1866–69; professor of history and English literature in Hiram College 1869–70; became its president 1870, and performs the duties of professor of philosophy, history, and biblical literature; is also assistant editor of the *Christian Quarterly*, Cincinnati. Author of *Genuineness and Authenticity of the Gospels* (1873), *The Evolution of the Theological and Doctrinal Systems of the Ancient Church* (in preparation), and has contributed much to periodical literature.

Hin'ton, tp. of Mecosta co., Mich. Pop. 390.

Hinton, post-v., cap. of Summers co., W. Va., on the Chesapeake and Ohio R. R., at the confluence of the Greenbrier and New rivers. It has a large sash and door factory, 1 newspaper, the round-house and machine-shops of the C. and O. R. R., 4 hotels, and the usual stores. Pop. about 500. C. L. THOMPSON, ED. "MOUNTAIN HERALD."

Hinton (JOHN HOWARD), M. A., b. at Oxford, England, Mar. 24, 1791; was educated at Edinburgh University; became a Baptist minister, and held various pastorates, principally in London; attained distinction as a preacher. Author of a *History of the U. S.*, *Memoirs of W. Knibb*, *Theology*, *Elements of Natural History*, etc. D. at Bristol Dec. 17, 1873.

Hio'go, or **Fiogo,** seaport of Japan, on the island of Nipon, 20 miles W. of Osaka, to which a railway extends. It has a very large trade in tea, and its harbor is the best in the empire. Pop. 20,000.

Hip, the fruit of the rosebush. Hips are used in pharmacy as a material for making "confection of hips" (*confectio rosæ caninæ*), the *Rosa canina*, or dog rose, and *R. pomifera* of Europe, furnishing the most of the fruit. The seeds are taken out, and the hips beaten in a mortar with white sugar—2 pounds of sugar to 1 of hips. This makes a pleasant sourish confection. The more fleshy and juicy sorts of hips are in some places preserved or dried, and in winter are boiled in pottage, after taking out the seeds and bristly substance within them.

Hip-joint, Diseases of. See COXALGIA.

Hipparchus, generally considered the founder of the science of astronomy, lived in the middle of the second century B. C.; b. at Nicæa, in Bithynia. Of his life nothing is known, and of his writings only the least important, *A Commentary on Aratas*, has been left to us. But from the *Syntaxis* of Ptolemy we know that by his great discoveries, and more especially by his method, he actually laid the foundation of the science of astronomy. (More detailed information will be found in the article on PTOLEMY.)

Hippa'rion. See HORSE, FOSSIL, by PROF. O. C. MARSH.

Hippeau (CELESTIN), b. at Niort, Deux-Sèvres, May 11, 1803; made his first studies in his native city, and filled different positions as a teacher and professor at Poitiers, Napoléon-Vendée, Strasburg, Paris, and Caen. The most prominent of his writings are—*Histoire de l'Abbaye de Saint-Étienne de Caen, 1066–1790* (1855), *Les Écrivains normands au dix septième siècle* (1857), *Histoire du Gouvernement de la Normandie* (9 vols., 1863–73), *Dictionnaire de la langue Française au Douzième et Treizième siècle* (1873).

Hip'pias, a contemporary of Protagoras and Socrates, b. at Elis, and lived mostly at Athens. Of his life nothing is known, and of his writings none have come down to us, but his character has been very vividly drawn by Plato in the two dialogues which bear his name. He seems to have been a man of great gifts and comprehensive knowledge, but arrogant, vain, and superficial.

Hippocam'pidæ [from Ἱππόκαμπος, a proper name], a family of fishes of the order Lophobranchii, distinguished by the prehensility of the tail and the want of a caudal fin, combined with a tubular snout, narrow gill-openings, a

single soft dorsal, belonging partly to the abdominal and partly to the caudal portion, and the absence of ventral fins. To this group belong five genera — *Gastrotoceus, Solenognathus, Phyllopteryx, Acentronura,* and *Hippocampus.* The most characteristic and familiar form is the little sea-horse, *Hippocampus,* remarkable for the resemblance of its head and neck to those of a horse, and the winding downward and inward of its caudal portion, or tail. THEODORE GILL.

Hippocam'pus [in Greek mythology, a sea-monster half horse and half fish], a singular genus of Lophobranchiate marine fishes of the family Hippocampidæ. They

The Sea-Horse.

have ganoid scales, and swim generally in a vertical posture. The males carry the spawn in pouches upon the tail until the fry are hatched. The tail is prehensile, the caudal and ventral fin absent. All the species are small. *H. Hudsonius* is found along our Atlantic coast. From the peculiar shape of the head it is called the sea-horse. The cut shows the *H. brevirostris,* a common European species.

Hippoc'rates [Ἱπποκράτης], the father of medicine and the most distinguished of Greek physicians, was b. in Cos in 460 B. C. (according to Soranus), and was the son of Heraclides, one of the Asclepiadæ, and Phænarete, a woman who belonged to the Heracleidæ. Hippocrates studied medicine with his father and with Herodicus of Selymbria; learned rhetoric of Gorgias the Leontine; practised his profession chiefly at Cos, and rendered its medical school, already very famous, by far more illustrious than it had ever before been. He travelled much among the Grecian towns, and d. at Larissa B. C. 357. (*Clinton.*) Little more than the above facts is known regarding his life, but ancient writers relate of him many fabulous tales. His sons, Thessalus and Draco, and Polybus, his son-in-law, perpetuated his fame, and probably wrote some of the works which bear his name. Those now extant are more than sixty in number (some of them very short), but by far the larger part are either spurious or incorrectly ascribed to Hippocrates. Part or all of the *Aphorisms,* parts of the *Epidemics,* parts of the *Prognostics,* the *Regimen in Acute Diseases,* the treatise on *Wounds of the Head,* and that *On Air, Water, and Places,* are considered genuine works of Hippocrates; and (according to Littré) the treatises *On Ancient Medicine,* on *Joints,* on *Fractures,* on *The Use of the Lever* (in reducing luxations), on *Law,* on *Ulcers,* on *Hæmorrhoids,* on *the Sacred Disease,* on *Fistulæ,* and the *De Medici Officina,* are possibly genuine. As a practitioner, it would be unfair to judge of Hippocrates' merits by any modern standard. His pathological notions were founded mainly on natural analogies and *a priori* reasoning; they consequently have no scientific value, but are memorable as the direct source of the humoral pathology so long dominant in the schools. He also taught the doctrines of *crases, coctions,* and *crises,* treated disease chiefly by attention to regimen, and earnestly advocated the expectant treatment in many acute diseases. He was a careful observer and excellent describer of symptoms, and (as his genuine writings show) was a man of the noblest mental and moral qualities. Among the most valued works upon the Hippocratic writings are the commentaries of Galen. The best editions of the entire works are by C. G. Kühn (3 vols., Leipsic, 1825–27), and by Littré, with French translation (Paris, 1839–61, 10 vols.).

Hippocrat'ic Oath, a solemn engagement entered into in ancient times by young men about commencing the practice of medicine, and especially by the Asclepiadæ. The formula itself has been ascribed to Hippocrates, and is certainly very ancient. It was as follows: "I swear by Apollo the physician, by Æsculapius, by Hygieia, Panacea, and all the gods and goddesses, that, according to my ability and judgment, I will keep this oath and stipulation; to reckon him who teaches me this art equally dear to me with my parents; to share my substance with him, and relieve his necessities if required; to look upon his offspring upon the same footing as my own brothers, and to teach them this art, if they shall wish to learn it, without fee or stipulation; and that by precept, lecture, and every other mode of instruction I will impart a knowledge of this art to my own sons, to those of my teachers, and to disciples bound by a stipulation and oath according to the law of medicine, but to no others. I will follow that system of regimen which, according to my best judgment, I consider best for my patients, and abstain from whatever is injurious. I will give no deadly medicine to any one if asked, nor suggest any such counsel. Furthermore, I will not give to a woman an instrument to procure abortion. With purity and holiness will I pass my life and practice my art. I will not cut a person who is suffering with stone, but will leave this to be done by those who are practitioners of such work. Into whatever houses I enter I will go for the advantage of the sick, and will abstain from every voluntary act of mischief and corruption, and, further, from the seduction of females or males, bond or free. Whatever in connection with my professional practice, or not in connection with it, I may see or hear, I will not divulge, holding that all such things should be kept secret. While I continue to keep this oath inviolate, may it be granted me to enjoy life and the practice of my art, respected always by all men; but should I break through and violate this oath, may the reverse be my lot." This oath is not now administered to practitioners, though something equivalent to it was used in the Middle Ages, and especially in the school of Salerno; but every honorable and right-minded physician governs his private and professional life by its noble principles. It is the oldest and one of the best of the codes of medical ethics, there being but one simpler and better code, the Golden Rule of doing as one would be done by.

Hippocre'ne [Gr. ἵππος, κρήνη, "horse-spring"], a famous fountain upon the side of Mt. Helicon, in Bœotia, was believed by the ancients to be a favorite haunt of the Muses and a source of poetic inspiration. It was fabled to have been produced by a stroke of the foot of Pegasus. It is still a fine spring.

Hip'podrome [Gr. ἱππόδρομος, a "horse-race"], the name anciently given in Greece and Constantinople to the ground where chariot and other horse-races took place. Of these races, those in chariots were the most popular. In these races many competitors for the prize entered the race, which was consequently attended with much danger to the drivers—a danger much increased by the limited size of the hippodrome and the consequent necessity of frequent turning of goals. The hippodrome at Olympia was long the most famous, but in later times that at Constantinople acquired great renown, and the whole Byzantine populace was divided in their social and political relations by factions which took their origin in the hippodrome.

Hippol'ytus, according to the Grecian mythology, was a son of Theseus. His stepmother, Phædra, fell in love with him, and accused him to his father in order to revenge herself for his coldness. Theseus then cursed his son, and asked Ægeus to destroy him, but after the death of Hippolytus the king learned the innocence of his son and fell into great grief; Phædra killed herself. According to the Roman mythology, Hippolytus was restored to life by Æsculapius, and placed in a grove at Aricia by Diana, where he received divine worship under the name of Virbius.

Hippolytus, SAINT, bishop and martyr. There is still some uncertainty about the dates and the events of his life, but he was probably b. after the middle of the second century, and in Italy, though he travelled in the East, and was also a disciple of Irenæus of Gaul. Le Moyne (1685) makes him bishop of Portus Romani, the modern *Aden* in Arabia. But his diocese was certainly in the neighborhood of Rome, and probably at Portus Romanus, 15 miles from the city, at the northern mouth of the Tiber. In 235, under the emperor Maximinus, he was banished, along with the Roman bishop Pontianus, to Sardinia, and is supposed to have suffered martyrdom the year following, but whether in Sardinia or after returning to Italy cannot be determined. His statue in a sitting posture, with a list of his writings inscribed upon the back of the chair, was dug up in 1551 near the basilica of San Lorenzo in Rome. By much the most important of his writings is the *Philosophumena, a Refutation of All Heresies,* in 10 books. Until recently only the first book was known to be extant, and this was ascribed to Origen. The second, the third, and the commencement of the fourth book are still wanting. The rest were discovered at Mount Athos in 1842 by Minoides Mynas, a learned Greek sent by M. Villemain, minister of public instruction under Louis Philippe, to make researches in the Greek monasteries. *Philosophumena* was first published at Oxford by Miller in 1852, as a work of Origen. But the best edition is that of Duncker and Schneidewin (1859). This treatise is one of great value historically, philosophically, theologically, and critically. The works of Hippolytus have been edited by Fabricius (1716–18),

Galland (1766), and Lagarde (1858). (See also monographs by Bunsen (1852; 2d ed. 1854); Cruice (1853), who also edited the *Philosophumena* in 1859; Döllinger (1853), Wordsworth (1853), and Volkmar (1855).)

R. D. Hitchcock.

Hippo'nax, a Greek satirical poet of the sixth century B. C., of whom about 100 lines are still extant. He was banished from his native city, Ephesus, on account of his satires, and lived afterwards at Clazomenæ, always fighting against everybody. He is the inventor of the choliambic verse, in which a spondee or trochee is placed in the last foot, instead of an iambus, thus giving to the rhythm a peculiar jarring movement which is well adapted for satire. The fragments collected and edited by F. G. Welcker (Göttingen, 1817, 4to).

Hippoph'agy [Gr. ἵππος, "horse," and φαγεῖν, "to eat"], the eating of horseflesh. From the earliest times the Northern races of Europe ate the flesh of the horse, and, in consequence of religious associations, sacrificed it to their gods. Owing to this, early Christian missionaries made the abstinence from horseflesh a test of religion. In the eighth century the popes anathematized it, and Gregory III. declared *immundum est et execrabile*—"it is foul and vile." In the Njall saga a converted Icelander, taunting an enemy, tells him that he has but lately eaten horseflesh. In time it was popularly believed that horseflesh was unhealthy. The French were the first to doubt this, and in the retreat from Moscow, Larrey killed his horses to make broth for the sick. According to experiments and reports made by Baron Guerrier de Dumost, horseflesh contains one-seventh more nutriment than its equivalent weight of beef, and, taking the average horse with the average ox, the former yields 110 to the 104 of the latter. In 1842, Dr. Perner of Munich began to combat the prejudice against horseflesh, and in 1845 the sale of it was legalized in Bavaria. At the same time hippophagic societies were formed in Paris and Berlin. Messrs. Leblanc of the Academy of Medicine and M. de Quatrefages were zealous in dissipating the prejudice against this food. Since 1855 horse-butcheries have been established throughout Germany. In Paris the first were opened in 1865 in the quarters of St. Marceaux and Popincourt. But it was not until the privations of the siege of 1870–71 had taught all Paris by experience the real excellence of horseflesh that it became popular. In 1867 the total consumption of horses, asses, and mules during the first quarter of the year was 535 head; in the corresponding period in 1872 it rose to 1144. During the present year (1874) the quarterly returns from the *abattoirs-chevalines* show that 1555 horses, mules, and donkeys were slaughtered in August, September, and October, yielding 630,000 pounds of meat. A like increase was reported from the provinces. A fat horse, injured but not diseased, sells for $50 or $60 at the abattoir, whereas he would not have brought a tenth part of that sum in the old days. The average price is from $25 to $30. Horseflesh has a pleasant taste, and expert cooks in Paris excel in dressing it so as to make it resemble venison. The meat is dark in color, but, taking it of relative ages and feeding, it is better than beef under the same conditions. It is stated that during the Stone Age the hare was not eaten, as its bones are not found among the remains of food of those days, and even in the time of Charlemagne the Franks rejected it, as do the Russians at present. The Jews and other Orientals avoid pork, the Hindoos consider it impious to touch beef, and in England the gypsies are the only people who will eat the hedgehog, an animal which the writer has found by experience equals any meat in quality and any game in flavor. It is to be regretted that the prejudice against horseflesh has existed with these kindred superstitions to the loss of humanity. C. G. Leland.

Hippopotam'idæ [from ἵππος, a "horse," and ποταμός, "river"], a family of artiodactyl ungulates belonging to the group Omnivora, and distinguished by the massive body, phalangigrade feet, and well-developed external toes, round snout and nostrils open upward and sidewise, overhanging upper lips, and inguinal mammæ. The molars have nearly straight or irregular sinuous longitudinal and transverse valleys dividing four tubercles, of which the external two are convex extrorsely, and the inner two convex introrsely; the canines are very large and furrowed along their posterior surfaces. This family includes two recent genera, which are so different as to have been differentiated as distinct sub-families—*Hippopotamus*, including a large species, and *Chœropsis*, established for a smaller species found in Liberia. *Hippopotamus* has the skull depressed between the orbits, the frontal sinus obsolete, and the orbits prominent above the level of the forehead and closed behind; *Chœropsis* has the skull convex between the orbits, the frontal sinus well developed, and the orbits depressed below the level of the forehead and incomplete behind. Only two living species are known, both of which are confined to Africa; one (*Hippopotamus amphibius*) is the animal well known to menagerie visitors, and is found in most of the African rivers; the other (*Chœropsis Liberiensis*) is a very small species confined to Liberia. In previous geological epochs the family was, however, widely extended, and remains have been found in England and other parts of Europe, as well as in India. The nearest relations of these animals are the hogs (Suidæ); they have no affinity to the rhinocerotids or to the tapirs. Theodore Gill.

Hippopot'amus [Gr. ἱπποπόταμος, "river-horse"], a genus of artiodactyl and omnivorous ungulate mammals (pachyderms), of which only one living species is known. The *Hippopotamus amphibius* inhabits most of the rivers and lakes of Africa from the Nile to the Cape of Good Hope, and occasionally is known to visit the salt water. The largest males sometimes are fourteen or fifteen feet long. It is usually inoffensive and quiet, but has been reported as occasionally attacking beasts, and even men, with unaccountable fury. It is an unwieldy beast, living chiefly upon soft water-plants, but quite often visiting cultivated fields, which it devastates. It is hunted for its flesh, which somewhat resembles pork, and for its skin, which is tanned and makes leather sometimes an inch thick, now used as a material for buffing-wheels and heavy belts, and for other mechanical purposes. Its teeth also furnish a very considerable amount of the best ivory, used in making philosophical instruments, etc.

Hip'po Re'gius, the royal city of the Numidian kings, was a Tyrian colony on the W. side of the Gulf of Bona. It became under the Romans a splendid city, and was famed as the see of St. Augustine, who d. there Aug. 28, 430. It was captured by the Vandals, after a siege of fourteen months, in Aug., 431. About the middle of the seventh century it was destroyed by the Arabs, and its materials were used in building Bona, the present Algerine city, 2 miles N. of the ancient site.—Hippo Zar'itus, or Diar'rhytus, now *Bizerta*, was a Tyrian, and afterwards a Roman colony, near the extreme N. point of Africa, on the sea, at the entrance to a lagoon called *Hipponitis Palus*.

Hippotherium [Gr. ἵππος, a "horse," and θηρίον, a "beast"]. See Horse, Fossil, by Prof. O. C. Marsh.

Hippu'ric Acid ($HC_9H_8NO_3$). This acid exists in the urine of herbivorous animals, and in small quantity in that of man. Hippuric acid is readily converted into benzoic acid, the change often taking place in the animal organism. When horses are kept in the stable or lightly worked the urine contains hippuric acid; when they are put to hard work it contains benzoic acid. Cows' urine contains about 1.3 per cent. of hippuric acid; that of oxen sometimes as much as 2.1 to 2.7 per cent.; of horses, 0.38; the quantity varies with the food and other conditions. Benzoic acid taken into the alimentary canal appears as hippuric acid in the urine; the same is true of quinic acid. Hippuric acid is readily separated from cows' urine in an impure form by the addition of an excess of hydrochloric acid. When purified and recrystallized, it forms colorless, transparent crystals. Its taste is bitter; it reddens blue litmus, dissolves in 600 parts of water at 32° F., is readily soluble in boiling water and in alcohol. Like uric acid, it dissolves readily in water containing ordinary phosphate of sodium, in such quantity as to change the reaction from alkaline to acid. Liebig attributes to this fact the acid reaction of fresh urine. Hippuric acid is converted by a ferment in the presence of an alkali, and by boiling with strong acids, into benzoic acid and glycocine:

$$\underset{\text{Hippuric acid.}}{HC_9H_8NO_3} + H_2O = \underset{\text{Glycocine.}}{C_2H_5NO_2} + \underset{\text{Benzoic acid.}}{HC_7H_5O_2}.$$

(See *Watts's Dict.* and *Supplement.*) C. F. Chandler.

Hippuri'tes [once considered a fossil *Hippuris*, the plant called mare's tail], an interesting genus of extinct conchiferous mollusks, of which the shells of some sixteen species are found fossil in the *hippurite limestone* and other European Lower Cretaceous strata. There have been many theories and much dispute as to the origin of these shells, but they are now generally referred to an extinct order (Rudista) of conchifera.

Hi'ram, post-tp. of Oxford co., Me., on the Portland and Ogdensburg R. R., 35 miles W. by N. of Portland. It has manufactures of furniture, lumber, cooperage, etc. Pop. 1393.

Hiram, tp. and post-v. of Portage co., O., 4 miles N. W. of Garrettsville, a station on the Atlantic and Great Western R. R. It is the seat of Hiram College. Pop. 1234.

Hiram [called also Hirom and Huram; Heb. *Chiram*, "high-born," the Hiromus of Mercander], a king of Tyre, contemporaneous with David and Solomon, and the ally of both. He sent a supply of cedar-timber, with skilled craftsmen, to assist David in constructing his palace, and in

Solomon's reign supplied timber, treasure, and men for the building of the temple at Jerusalem (969 B. C.). He was likewise a great builder at Tyre, and is said to have reigned thirty-four years; was son and successor of Abibal.

Hire, tp. of McDonough co., Ill. Pop. 1186.

Hir'ing. This term has a variety of applications in law as well as in common usage, and may refer to the engagement of servants or to the leasing of real property, as well as to the hire of things or professional services. But in its more specific legal signification it denotes a species of bailment by which the use of a chattel is contracted for, or labor or services affecting it are stipulated to be given for a compensation, express or implied. In this sense alone will the subject of hiring be here considered. Reference may be made for its other applications to the titles MASTER AND SERVANT, LEASE, AGENT, while the hire of vessels will be considered under SHIPPING and CHARTER-PARTY. Hiring as a form of bailment is of three varieties, whose names are expressed in Latin phrases: (1) *Locatio rei,* the hiring of a thing for temporary use; (2) *Locatio operis faciendi,* the hiring of work and services or care and attention to be bestowed upon articles delivered by the hirer to the person whose labor is engaged; (3) *Locatio operis mercium vehendarum,* the hire of the transportation of goods from one place to another. (The third species is examined under the title CARRIER, COMMON, and need not therefore be reconsidered. The other two will be discussed separately.)

(1) *Locatio rei.*—The hire of things constitutes a contract for the mutual benefit of both parties, since the owner receives a compensation, while the hirer becomes entitled to the use of the property; and the latter is accordingly bound to ordinary care and diligence, and is liable only for ordinary neglect. He must conduct himself with such prudence, forethought, and discretion as a man of ordinary sagacity and reasonable soundness of judgment would exhibit in similar circumstances. The degree of care requisite will vary with the nature of the property with which he is entrusted. If it be delicate and fragile, or of great value, or subject to deterioration unless attended to and preserved with unusual watchfulness, greater care will be necessary than if it be of such a character that injury or loss is not to be presumed probable unless there be excessive imprudence. If a watch or a valuable horse were hired, greater precaution would need to be taken for its security than would be required if the article were of insignificant value. But if injury is occasioned by some accident which a reasonable foresight could not have anticipated, or by theft or violence against which proper measures of protection had been taken, the hirer is not responsible, but the owner must bear the loss. The hirer becomes invested with a special property in the goods for the period during which his right of temporary use is to continue, and for any interference with his possession or injury to the property by third persons he has a right of action to recover damages for the loss sustained. If the hiring be for a definite time, as is usually the case, any attempt even by the owner to retake the property or to prevent its intended use will give the hirer a claim for redress. This rule is, however, subject to the qualification that if the hirer makes any unwarrantable misuse of the property the owner has a right to retake it, if he can do so peaceably, or to bring an action for its immediate recovery. The articles hired must only be used for the purposes contemplated by the contract, and the hirer's exclusive interest is defined and limited precisely by the stipulations agreed upon. They must be used also in the manner ordinarily appropriate, and must be surrendered when the time of the hiring has expired. The obligations of the owner of the property, other than those already stated, have not yet been definitely settled at common law. There have been some decisions holding that he impliedly warrants the property to be fit for the purposes for which it is hired, without reference to his knowledge of its unfitness. It is quite clear that he would be liable if he knew of its unfitness, and did not disclose the defect, and injury was sustained by the hirer in consequence; so that, for instance, if he let a horse which he knew to be dangerous, without informing the hirer, and injury occurred through the animal's viciousness, he would be responsible. The contract of hiring may be terminated by the expiration of the time for which the contract was made, or the completion of the intended purpose, when the property reverts to the owner, who has a claim for whatever compensation was agreed upon, or, if no definite arrangement had been made, to whatever sum might be deemed reasonable under the circumstances.

(2) *Locatio operis faciendi.*—The same principles in reference to the degree of care to be required of the bailee apply to contracts for labor and services to be bestowed upon the thing bailed as in the hiring of chattels. Ordinary care is required, and the measure of obligation is estimated by the value and nature of the articles delivered. But the obligations of the workman depend also, in large measure, upon the nature of his occupation. He is held responsible for the exercise of such a degree of skill and careful workmanship in fulfilling the task imposed upon him as is requisite in the ordinary labors of his trade or profession. In accepting an engagement to perform a particular kind of work he impliedly represents himself as competent for such an undertaking, and may be made to respond in damages for injuries sustained through any exhibition of unskilfulness or incapacity. If, however, his incompetence were known to the person engaging his services, the hirer must suffer the consequence without remedy. If any instructions be given to the workman as to the manner in which his labor is to be performed, they must be adhered to strictly. If there be a material deviation from them, he can recover nothing for his services, unless the deviation be attributable to some unavoidable cause or be acquiesced in by his employer. The employer's assent need not be indicated by any express agreement, but may be presumed from his conduct, if he has knowledge of the deviation from the terms of the contract before its execution is completed, and makes no objection. If the bailee only completes a portion of the desired work, he can claim a proportionate compensation if the benefit of what was actually performed was received in its incomplete state by the assent of the employer; but if the employer insist on full performance or decline to make compensation on account of some substantial imperfection in the workmanship or some injury which the goods have sustained, the workman is not only entitled to no reward, but may even be held liable for the original value of the goods. The acceptance of the goods by the employer is not of itself sufficient to constitute an assent to a deviation from the contract, since an owner has a right to the possession of his goods. If the property is destroyed by some unexpected casualty, without any fault on the part of the workman, or is carried away by robbers notwithstanding the use of reasonable precautionary measures for security, since the absolute ownership remains continually in the employer, he must sustain the loss. If any labor has been expended upon it before the disaster occurs, the workman is, according to the general rule of the common law, entitled to a proper recompense for services actually rendered, unless the entire fulfilment of his engagement had been made a condition precedent to payment. Under the French law and the Code of Louisiana the employer in such a case loses the value of his materials and the employé the value of his labor. But that the loss of the property in such instances may fall upon the employer, it is necessary that the contract be strictly in the nature of bailment; and interesting questions sometimes arise as to whether a delivery of articles to a workman and an engagement of his services constitutes this relation. If cloth be given to a tailor or gold to a jeweller, and the identical piece of cloth is to be returned in the form of a suit, or the same gold to be made into an article of ornament, it is a case of bailment, even though additions be made to the original article delivered in the course of its alteration. But if the workman has liberty to expend his labor upon other materials of the same kind as those delivered, being under no further obligation than to return articles similar to those which would be made if the employer's goods were used, this is not generally considered as constituting a bailment, but only a species of barter or sale. The employer makes use of his goods to purchase others of the same nature in an altered form. The workman, therefore, owns the goods until his labor is complete and the finished product accepted; and if they are destroyed before that time the loss is his alone, and the employer has still a claim for the delivery of the article ordered. A similar question arises when grain is deposited in a warehouse or elevator with the understanding that a similar amount of the same quality may be returned instead of the very same grain delivered. The courts have generally adjudged an agreement of this kind to be a sale, and not a bailment, so as to make the bailee responsible in case of accidental loss. In all cases where a person is to furnish materials himself, and expend labor upon them, the contract is evidently not one of bailment, but rather one of sale, so that the employé is subject to all the obligations of a vendor.

The law concerning warehousemen, wharfingers, and innkeepers is also included under the head of *Locatio operis faciendi,* since such persons devote care and attention to the objects entrusted to them, but their liabilities will be considered under these several names respectively.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Hirpini, an ancient people of Italy of Samnite race, inhabiting the central group of the Apennines between Lu-

cania, Apulia, and Campania, and deriving their name from *hirpus*, the Samnite name of a wolf. They were subjugated by the Romans (probably together with the other Samnite tribes) before 268 B. C., at which time the Roman colony of Beneventum, which formed the strategical key to their country, was established. Immediately after the battle of Cannæ (216 B. C.) they declared in favor of Hannibal, but when he (in 209 B. C.) was driven towards the southern part of Italy, they bought peace on good terms from the Romans by betraying the Carthaginian garrisons in their cities. In the Social war (90 B. C.) they were among the first who took up arms against Rome, but they were soon reduced by Sulla, and after the end of the war their name as an independent nation is not mentioned.

Hirsch'berg, handsome town of Prussia, in the province of Silesia, on the Bober. It has considerable linen manufactures, and one Lutheran and three Catholic churches. Pop. 11,773.

Hirst (HENRY B.), b. in Philadelphia Aug. 23, 1813, was admitted to the bar in 1843, having previously to some extent been occupied in mercantile pursuits. He published several volumes of poems which had a wide popularity—*The Coming of the Mammoth, etc.* (1845), *Endymion* (1848), and *The Penance of Roland* (1849). D. Mar. 30, 1874.

Hir'tius (AULUS) belonged to a plebeian family, but played a conspicuous part in Roman politics on account of his personal friendship and intimate political connection with Cæsar. He served him in Gaul as legate, and was often employed as negotiator. He lived mostly in Rome, on his Tusculan estates, in the neighborhood of the villa of Cicero, with whom he was on friendly terms and held frequent social intercourse. He was chosen consul for the year 43 B. C., and entered on his official duties Jan. 1. Of the horrible convulsions into which the assassination of Cæsar threw the Roman republic, Hirtius was by no means the master, but his moderation and freedom from personal ambition exercised a beneficial influence; and when he fell at the head of the army which was sent against Antony, then besieging Mutina, the people mourned him. He was a man of refined tastes and literary accomplishments, and the eighth book of Cæsar's *Commentaries* is generally supposed to have been written either by him or by Oppius.

Hispania, the Latin name of SPAIN (which see).

Hispaniola. See HAYTI, by MELVIL BLONCOURT.

Histiæ'a, one of the oldest and most important towns of Eubœa, became subject to Athens during the Persian wars, but revolted in 445 B. C. As a punishment the Athenians removed all the inhabitants, replaced them with Attic colonists, and changed the name of the place to *Oreus*.

Histiæ'us, tyrant of Miletus, won the attachment and gratitude of Darius by guarding faithfully the bridge of boats over which the Persian army crossed the Danube on its expedition into Scythia in 513 B. C.—a service by which he saved the army and the life of the Persian king. His adventurous and ambitious character, however, could not help exciting suspicion, and he was detained at the Persian court for thirteen years. At last he succeeded in raising his Greek countrymen in Ionia in rebellion against Persia, but Darius had still so much confidence in him as to send him down to quench it. The rebellion itself failed utterly, and the treachery of Histiæus was discovered by Artaphernes, the Persian satrap of Sardis. He now fled from place to place, stirring the different Greek colonies in Asia Minor into premature insurrections; but at last he was captured and put to death by Artaphernes, who sent his head to the Persian king. Darius, however, mourned deeply, buried the head with honors, and blamed Artaphernes for having acted hastily.

Histol'ogy [Gr. ἱστός, "web," and λόγος, "discourse"] is the branch of anatomy which treats of the minute structure of the tissues of which living beings are composed. It is subdivided into *Human histology*, which treats of the tissues of man; *Comparative histology*, which treats of the tissues of the lower animals; and *Vegetable histology*, which treats of the tissues of plants. Each of these subdivisions may be again divided into *Normal* and *Pathological* histology—the first referring to the healthy tissues, the second investigating the changes they undergo in disease.

Histology may be said to date back only to the appearance of the *Anatomie Générale* of Bichat in 1801, for although many interesting observations had previously been made by Malpighi (1628–94), Leeuwenhoek (1632–1723), Swammerdam (1637–80), Ruysch (1638–1731), Lieberkühn (1711–58), Hewson (1739–74), and others, yet Bichat was the first who treated the subject in a comprehensive way, classifying according to their structure, so far as it was then understood, all the tissues of the human body, and giving a general view of their relations, both in health and disease. His work gave a great impulse to the study of the tissues, but the imperfect condition of the compound microscope at that time was a serious obstacle to progress, and it was not until the opticians succeeded in devising efficient methods of correcting the spherical and chromatic aberrations of that instrument that histology made any important advance beyond the position in which Bichat left it.

The next epoch in the development of histology is marked by the appearance of the works of Schwann (1838–39), who endeavored to show that the observations of Schleiden in vegetable histology were substantially true for animals also; that all tissues are formed by the transformation of nucleated cells; and that these arise *de novo* under favorable circumstances in a formless nutritive fluid or blastema. This theory was extended to pathological anatomy by Johannes Müller, and continued to be almost universally accepted until the appearance of the cellular pathology of Virchow (1858), which was speedily followed by the very general acceptance of his doctrine, that cells can only arise out of pre-existing cells, and that in both normal and pathological growth the cells of the growing part multiply by division, and thus give birth to all the elements ultimately produced. This doctrine seemed to be permanently established on a sure foundation, when the discovery of the wandering cells in living connective tissue by Von Recklinghausen (1863), and the demonstration by Cohnheim (1867) that these movable elements are in fact white blood-corpuscles which have migrated from the blood-vessels, compelled a modification of opinion, and showed that the actual details of the growth and nutrition of the tissues are much more complex than had been previously supposed. Since the time of Schwann the number of histological investigators of reputation has multiplied so greatly that it would occupy more space than can here be given even to enumerate them. The names of a few of the more prominent will appear in the list of works appended. In the present article a sketch of some of the more important and best-established elementary facts with regard to human histology is all that can be attempted, and greater prominence will be given to the normal than to the pathological branch of the subject. The reader who desires more detailed information is referred to the special treatises and essays.

Elementary Cells.—The tissues are composed of elementary cells and their derivatives. According to the long-received views of Schwann, elementary cells are hollow vesicles composed of an external membrane or cell-wall, which encloses, besides fluid or solid contents of various characters, a smaller vesicle, the nucleus, in which again is contained a still smaller body, the nucleolus. It has, however, been shown that many kinds of cells have no distinct walls, and in many others the existence of a wall is in the highest degree problematical; Max Schultze accordingly defines the cell simply as a little mass of protoplasm containing a nucleus, and Brücke and Stricker, going a step farther, are disposed to regard the nucleus itself as unessential.

Protoplasm, thus brought into prominence in our conceptions of the ultimate structure of living organisms, is an albuminoid body, which under the microscope either appears to be quite homogeneous or presents a more or less granular aspect. It may be fluid, semi-solid, or solid, and probably varies considerably in its composition in different situations and under different circumstances. All its forms, however, possess certain special properties in common, of which the most important are the capability of manifesting spontaneous movements; of taking up nutritive materials from the surrounding media and transforming them into its own substance, or of growing; and of reproducing its kind by detaching portions which are capable of independent existence and growth. The elementary cells of the human tissues usually contain a nucleus. This is an oval or rounded body generally between .0002″ and .0006″* in long diameter, composed of a material that certainly differs from the protoplasm of the body of the cell in offering greater resistance to the action of acids and alkalies, and in behaving somewhat differently with various reagents, but the precise composition of which has not been determined. The nucleoli are even less constant and more imperfectly known than the nuclei. The spontaneous movements in the protoplasm of the elementary cells are most constant and noteworthy while the cells are young. These movements, during which the nucleus remains quite passive, occur in part as changes in the form of the cells, in part in consequence of these changes in their form; the cells change place, or wander, among the surrounding elements in a manner which,

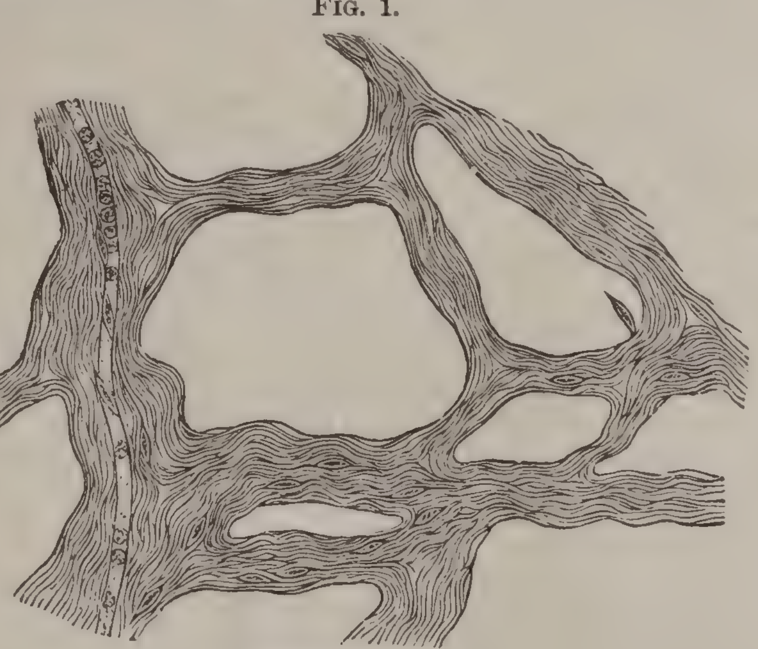
* In this article dimensions will be given in decimals of an inch, indicating the inch by the sign ″. It must be understood that the figures given are only offered as approximations to the *average* size of the several elements, and that the individual elements vary greatly in dimensions.

on account of its similarity to the movements of the amœba, has been called amœboid. When, at a later period in the history of certain cells, they acquire a cell-wall or outer membrane, they become fixed, and are no longer capable of amœboid movements.

The various transformations which cells undergo in building up the several tissues will be indicated in connection with each. Here, however, a word must be said as to the mode in which the reproduction of cells takes place. Cells usually multiply by division. In so doing, the nucleus first elongates, then becomes constricted in the middle, and finally separates into two parts, which recede from each other; fission of the protoplasm of the body of the cell subsequently occurs. Besides this mode, endogenous cell-multiplication, and multiplication by gemmation or budding, are admitted by many histologists. The first is, in most instances, if not always, merely the result of the continued multiplication by division of a protoplasmic mass contained within a membrane or capsule; the second has been observed chiefly in the case of certain low vegetable forms; as, for example, the yeast-fungus. As already mentioned, it was taught by Schwann that cells might also arise spontaneously in a formless fluid of suitable composition. This supposition was brought into disrepute by Virchow, who held that cells could only arise from pre-existing cells—*omnis cellula e cellulâ*. Of late, however, numerous investigations have been published which appear to favor the doctrine of the spontaneous generation of the lower organisms under suitable conditions; and if this view should be established, it may turn out that the theory of Schwann has been too hastily condemned.

Connective Tissue.—The designation connective tissue (*Bind-gewebe* of the German histologists) is bestowed upon the widely diffused tissue which unites together the organs and their several parts, and includes not merely the capsules, sheaths, fascia, tendons, and ligaments, but also the more delicate tissue which forms the supporting framework of the special elements of the complex organs. Connective tissue consists of special fixed cells, the connective-tissue corpuscles, united together by an intercellular substance or

Fig. 1.



Connective tissue.

matrix. In the latter a series of minute passages are channelled, and through these granular cells, identical in structure and appearance with the white corpuscles of the blood, wander freely. The fixed cells are usually either spindle-formed or stellate, and are provided with an elliptical transparent nucleus, immediately around which the protoplasm of the cell is usually more granular than elsewhere. They vary greatly in dimensions in different situations, the nucleus averaging about .0004″ in long diameter, and the cells being from twice to five or six times as large. From the extremities of the spindle-formed cells and all parts of the stellate ones proceed branching processes, which vary considerably in number and length. In the living tissue slow changes in the form of these processes may be observed, but so far as can be ascertained these do not lead to any change in the position of the cells. The wandering cells are much less numerous under normal conditions than the fixed, but in inflammation increase in number often to an enormous extent. They are derived from the blood, and escape into the channels of the connective tissue through stomata in the walls of the small blood-vessels. A part of them, both in health and in inflammation, find their way from the channels of the matrix into the lymphatic capillaries. That others remain in the tissue and become fixed corpuscles is a plausible suggestion not yet positively established.

The matrix varies greatly in characters and arrangement in different situations, and by these variations determines the external characteristics of the several varieties of connective tissue. The diversity consists not merely in the conformation, but also in the chemical composition of the matrix, as is shown by the fact that certain forms of connective tissue yield gelatine on boiling, while others do not. To the former belongs the so-called fibrillar connective tissue, which is the dominant form in man and the vertebrates, at least in the adult state. The latter includes the delicate connective tissue in the interior of the kidneys, the liver, and the lymphatic glands, that in the brain and spinal cord (the neuroglia of Virchow), and the succulent translucent tissue of the umbilical cord, which has been called mucous tissue because acetic acid produces in it a precipitate of mucin in threads and flocculi, which dissolve in an excess of the acid.

In the form of fibrillar connective tissue, which occurs in the ligaments and tendons, the matrix appears, when examined in indifferent fluids (aqueous humor, amniotic fluid, or blood-serum), to be composed of indistinctly fibrillated bundles .0005″ to .001″ or more in diameter, lying parallel to each other, and anastomosing at comparatively long intervals. Long narrow anastomosing channels are thus left between them, in which, on the margins of the bundles, lie the spindle-formed fixed cells. When examined in water or neutral saline solution the fibrillar appearance is much more distinct, and after maceration in lime-water or baryta-water the bundles are easily split into their component fibrils, .00004″ or less in diameter, which cannot be satisfactorily done in the fresh state, so that indeed some have gone so far as to pronounce the fibrilla an altogether artificial product. On treatment with dilute acids the bundles swell up and hour-glass contractions appear at intervals. These have been ascribed by some to spiral elastic fibres wound around the bundles. Others have supposed each bundle to be enveloped in a delicate sheath, which is partially ruptured by the swelling produced by acids, the remaining portions producing the constrictions. The latter view has received considerable support from the recent investigations of Boll, who has arrived at the conclusion that the cells of connective tissue are in fact thin scale-like plates which form an endothelial lining to the channels between the bundles, and ascribes the appearance of the cells, as usually seen, to imperfect methods of investigation. In the fascia, the skin, the subcutaneous, submucous, and subserous membranes, the periosteum, and the perichondrium, the fibrillar bundles do not run parallel, but cross each other in diverse directions and inosculate at various angles, so as to leave irregular spaces of various sizes, which freely communicate with each other. Except in this more areolar arrangement the matrix in these situations differs little from that of the tendons and ligaments.

When fibrillar connective tissue is boiled or treated with dilute acids, the fibrillæ disappear, and certain sharply defined, more or less spiral, fibres come into view, which are known as *elastic fibres.* These vary from .00005″ or less to .0004″, or even more, in thickness; they branch frequently, and in some situations form intricate networks. Characteristic coarse networks of this sort exist in the skin, more delicate ones in the serous and mucous membranes. In the elastic coats of the arteries, the yellow ligaments of the vertebral column, and the ligamentum nuchæ, they are very coarse, and form the most conspicuous tissue-element. The varieties of connective tissue which occur in the kidneys, the lymphatic glands, etc. will be described in connection with the organs in which they exist; a word must, however, be said here with regard to the mucous tissue of the umbilical cord. This, in early fœtal life, consists of a transparent, apparently structureless matrix, in which are embedded delicate stellate cells with branching, freely inosculating processes. Interspersed throughout the matrix a certain number of wandering corpuscles are found. At a later period fibrillar bundles begin to appear on the matrix. The interest which attaches to this tissue is due in part to the fact that it resembles the embryonic condition of the fibrillar connective tissue, in part to its resemblance to certain pathological new formations. Connective tissue serves as the substratum for the ramification of the blood-vessels, lymphatics, and nerves of all parts of the body. It stands indeed in special relations to the lymphatics, the channels and spaces of its matrix being the ultimate lymphatic passages.

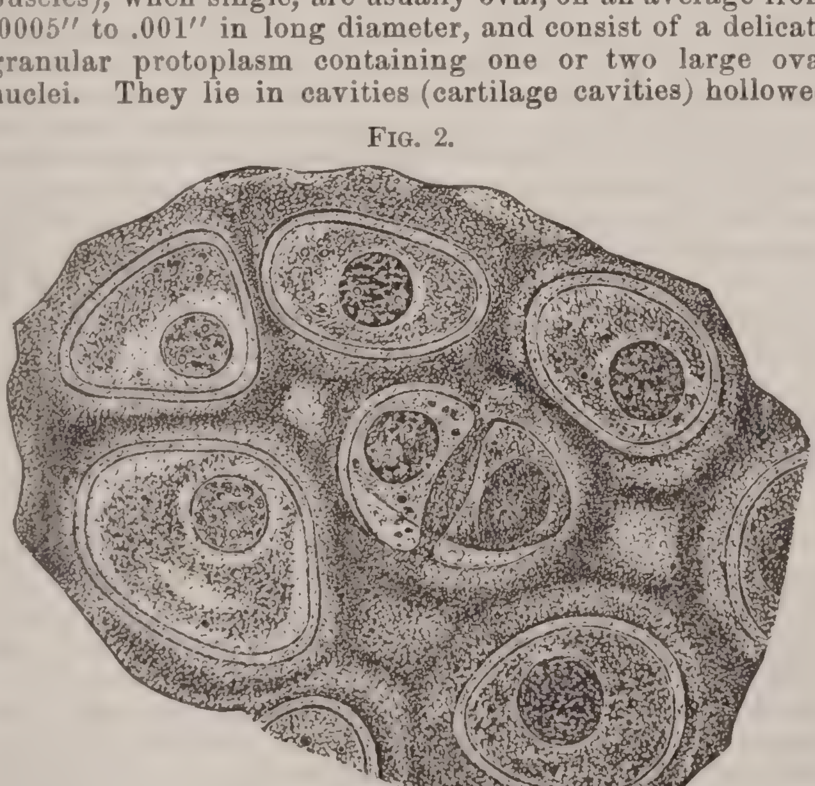
Development of Connective Tissue.—At an early period of the history of the embryo connective tissue consists of round formative cells in close juxtaposition. Between these the matrix gradually makes its appearance, pushing the cells farther and farther apart. Simultaneously the cells change their shape, becoming gradually spindle-formed or stellate. In the tendons and ligaments the matrix is more or less distinctly fibrillar from its first appearance. In most other situations it is at first homogeneous, resembling that of the mucous tissue described above, and only subsequently acquires a fibrillar character. Considerable diver-

sity of opinion still exists as to the interpretation of these phenomena. Some hold still to the view of Schwann, that the formative cells themselves elongate and split up into the bundles of fibrils; some, like Beale, suppose the peripheral portions of the protoplasms of the cells (germinal matter) to be gradually transformed into matrix (formed material), so that this is created by the continual growth of the cells, the peripheral portions of which undergo continual transformation. This view is substantially that adopted by Rollet as the most probable. Finally, it is held by others that the matrix is independently formed between the cells by the transformation of the nutritive blood-plasma. That the elastic fibres originate by the transformation of a portion of the formative cells was long held as certain. Doubts as to the accuracy of this view have, however, been expressed, and Rollet advocates the opinion that they originate by a direct deposit from the plasma in the form of fibres. The evidence on which this opinion rests is, however, far from conclusive.

Adipose Tissue.—In many parts of the body the areolar connective tissue encloses in its meshes groups of cells containing fat. These cells are round or oval, sometimes polygonal, as from mutual pressure, and .001″ to .005″ in diameter. The presence of the fat conceals their nuclei, but after its extraction by absolute alcohol, and the staining of the tissue by carmine, a nucleus can generally be observed in each, attached to the interior of the cell-wall, which here appears as an undoubted membrane. The groups of fat-cells contained in individual areolæ of the connective tissue are designated fat-lobules. Each is supplied with blood by one or more arterial twigs, whence proceed numerous capillaries so arranged that each of the larger cells at least is surrounded by its own capillary loops. In their embryological condition the fat-cells are at first nucleated masses of protoplasm, like other formative cells. The fat makes its appearance in the substance of the protoplasm in small drops, and there finally coalesces into a single large one, occupying the central portion of the cell. As the fat-drops grow still larger, the protoplasm becomes more scanty, until only a thin membrane remains, with the nucleus embedded in it. In certain forms of dropsy and some other diseases the adipose cells lose their fat, which is replaced by serum. A similar disappearance of the fat has been observed in animals deprived of food, the fat promptly reappearing when food is again supplied.

Cartilage.—Cartilage, like connective tissue, consists of cells imbedded in an intercellular substance or matrix; the latter may be homogeneous or fibrous, and accordingly two varieties of cartilage are recognized—hyaline cartilage and fibro-cartilage. Hyaline cartilage forms the cartilages of the ribs, the ensiform cartilage, the articular cartilages of the bones, the cartilages covering the opposed surfaces of the symphyses, the nasal cartilages, all the cartilages of the larynx except the epiglottis and the cartilages of Wrisburg, and the cartilaginous rings of the trachea and bronchial tubes. In this variety of cartilage the cells (cartilage corpuscles), when single, are usually oval, on an average from .0005″ to .001″ in long diameter, and consist of a delicate granular protoplasm containing one or two large oval nuclei. They lie in cavities (cartilage cavities) hollowed

FIG. 2.



Cartilage.

out in the solid matrix. Sometimes the cavities are of larger size, and contain two or more cells, and then the adjacent sides of these are flattened. Sometimes groups of two, four, or more cells, with their adjacent sides flattened, lie quite near together, but are separated by a narrow layer of matrix. In living or perfectly fresh cartilage the cells exactly fill the cavities in which they lie, but on the addition of water, or even of indifferent fluids, as aqueous humor or blood-serum, the cells shrivel and separate from the parietes of the cartilage cavities, so that they appear to be surrounded by a clear transparent space; or they may shrivel irregularly, remaining attached at points to the parietes of the cavity, so as to present a stellate appearance. At the same time the matrix becomes more or less distinctly granular. These changes occur also shortly after death without the addition of reagents. The matrix when fresh is homogeneous and quite transparent, no traces of the existence of layers or cell-territories being observable even with the highest powers. After the action of certain reagents, however, such as dilute chromic acid, or after digesting for some time in acidulated water at a temperature of about 100° F., the matrix may be split up into concentric layers surrounding the cell-groups and individual cells. If cartilage be boiled in water for some time, the matrix is entirely dissolved, the solution containing the substance known as chondrin.

Where cartilage is continuous with connective tissue there is no abrupt boundary between the two, but the one passes by a gradual transition into the other. As we proceed from the cartilage to the connective tissue, the matrix becomes first indistinctly, then distinctly fibrillated, and is continuous with the connective-tissue matrix, while the cells are more and more elongated until they present the character of connective-tissue corpuscles. In the interarticular cartilages little masses of hyaline cartilage are imbedded in fibrillated connective tissue. This has sometimes been considered a variety of fibro-cartilage, but is simply a mixture of cartilage with connective tissue.

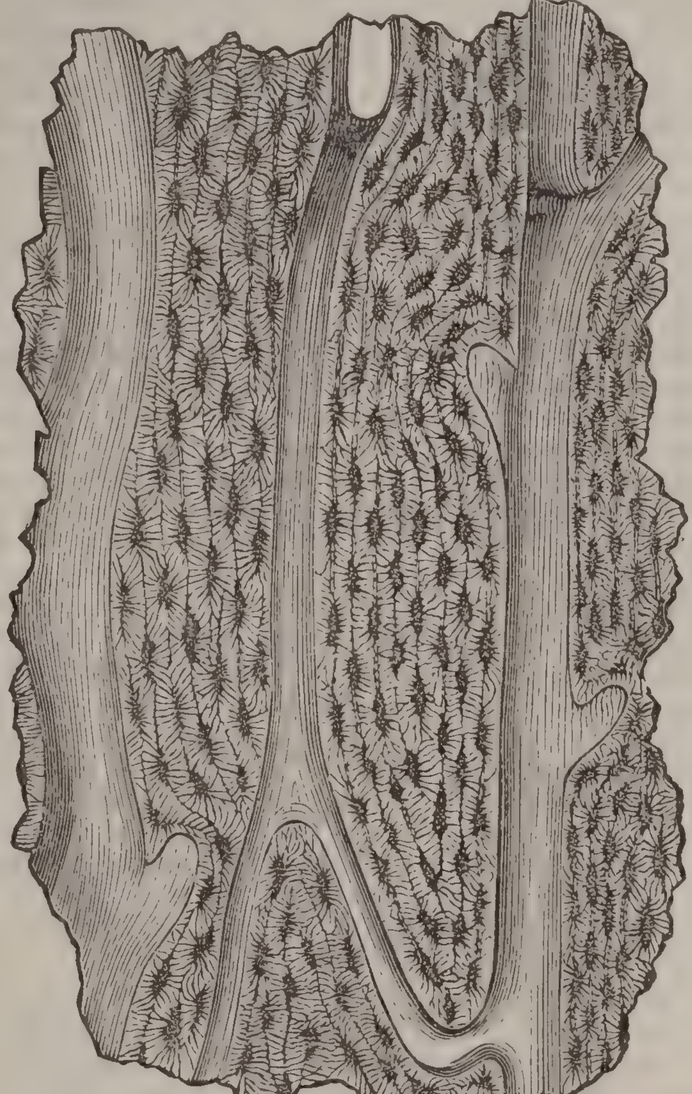
Fibro-cartilage (*Reticular Cartilage, Yellow Cartilage*).—The cells of fibro-cartilage are quite like those of hyaline cartilage, but the matrix consists chiefly of a plexus of anastomosing fibres resembling elastic fibres. Between these, however, a homogeneous substance similar to the matrix of reticular cartilage no doubt exists, since these cartilages yield a small proportion of chondrin on boiling. This homogeneous substance, in certain situations, is most abundant immediately around the cells, where it is visible under the microscope as a clear or slightly granular area in which no fibres are discerned. When fibro-cartilage is anatomically continuous with connective tissue, the fibres of the matrix are continuous with the yellow elastic fibres. Fibro-cartilage, as above described, forms the cartilages of the ear and of the Eustachian tube, the epiglottis, the cartilages of Wrisburg, and a part of the intervertebral cartilages. Neither hyaline nor fibro-cartilage contains either blood-vessels, lymphatics, or nerves.

Development of Cartilage.—In early embryonic life cartilage is composed of simple formative cells in immediate juxtaposition. These enlarge, and are transformed into cartilage-cells, and meanwhile the matrix gradually makes its appearance between them, at first as a thin layer surrounding each cell. In this condition the cells can readily be isolated with the capsule of matrix about them; after a time, however, the capsules surrounding adjacent cells become fused together, and can no longer be isolated except by the aid of reagents. As in the case of connective tissue, several interpretations of these facts have been offered. The view of Beale, that the matrix is formed by the transformation of the peripheral portions of the protoplasm of the growing cells, is substantially accepted by many excellent histologists—among others, by Max Schultze; while on the other hand, the view that it is produced independently by the direct transformation of the nutritive plasma is not without supporters. During the process of growth the cartilage-cells multiply by division. Cells containing two nuclei are frequently observed, as well as groups of two or more cells lying together in a single capsule, as if just divided. Direct observation of the process of division is, however, no easy matter. The division of the cells is immediately followed by the formation of a thin layer of matrix between the two resulting cells, and this will generally be found to exist when two or more cells appear to lie together in the same capsule, if the cells be caused to shrink as described above. This thin partition-wall of matrix gradually increases in thickness, pushing the new-formed cells farther and farther apart. The fibres of the matrix of reticular cartilage are developed in the same way as the elastic fibres. With advancing age a deposit of lime-salts takes place in the matrix of certain cartilages, as in those of the larynx and of the ribs. A similar change takes place in ossifying cartilages and in certain morbid conditions. It is known as the calcification of cartilage.

Bone, like cartilage, consists of cells imbedded in a matrix. In thin sections of dried bone the position of the cells is marked by the presence of small stellate cavities about .0008″ in average length, and rather less than half as broad—the bone-lacunæ, from which radiate delicate canals, .00005″ in diameter, the canaliculi. The canaliculi

of adjacent lacunæ anastomose freely. Examined by transmitted light, the lacunæ and canaliculi appear dark, the matrix transparent; by reflected light the former appear white and opaque, the latter translucent. These appearances depend upon the fact that in dried bone the lacunæ and canaliculi are hollow and contain air, as may be demonstrated by first flowing turpentine upon a thin section while under microscopical observation, and then permitting it to dry. In recent bone, and especially in growing bone, the lacunæ are filled with a mass of protoplasm containing a nucleus, which sends processes into the canaliculi. These

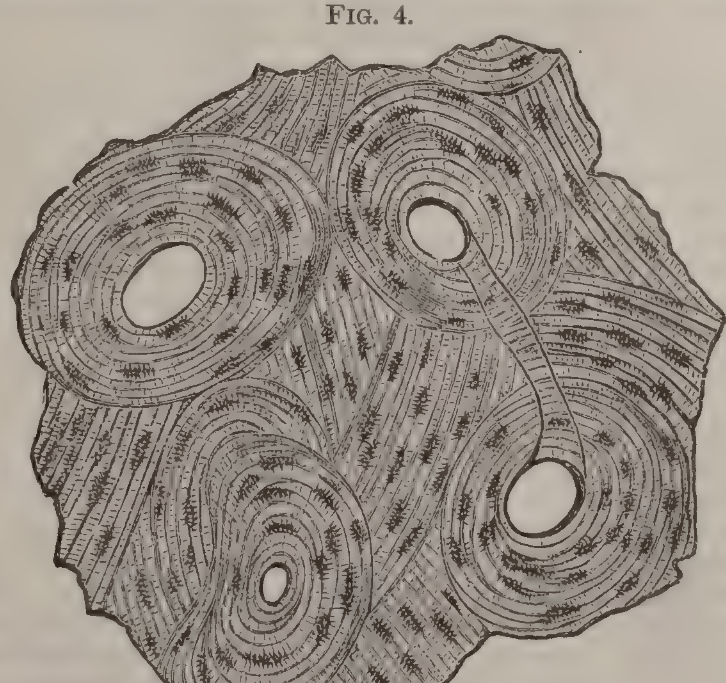
FIG. 3.



Bone (longitudinal).

masses of protoplasm are the proper bone-cells. Osseous tissue is very vascular, and the capillaries lie in the compact substance of the long bones in a series of longitudinal anastomosing channels—the canals of Havers—which are continuous with the larger canals containing the nutritive arteries, with the areolar spaces of the spongy extremities of the bones, and with the marrow cavities. In transverse sections of the compact shafts of the long bones, therefore, the canals of Havers appear as rounded or oval openings, disposed at tolerably regular intervals, with the lacunæ arranged regularly around them in concentric rows. In lon-

FIG. 4.



Bone (transverse), treated with acid.

gitudinal sections the canals appear as a network with elongated interspaces, in which the lacunæ lie in rows parallel to the canals. In the extremities of the long bones and in the spongy bones thin sections display an areolar structure, and the bone-lacunæ are always arranged more or less evidently in rows parallel to the margins of the areolar spaces.

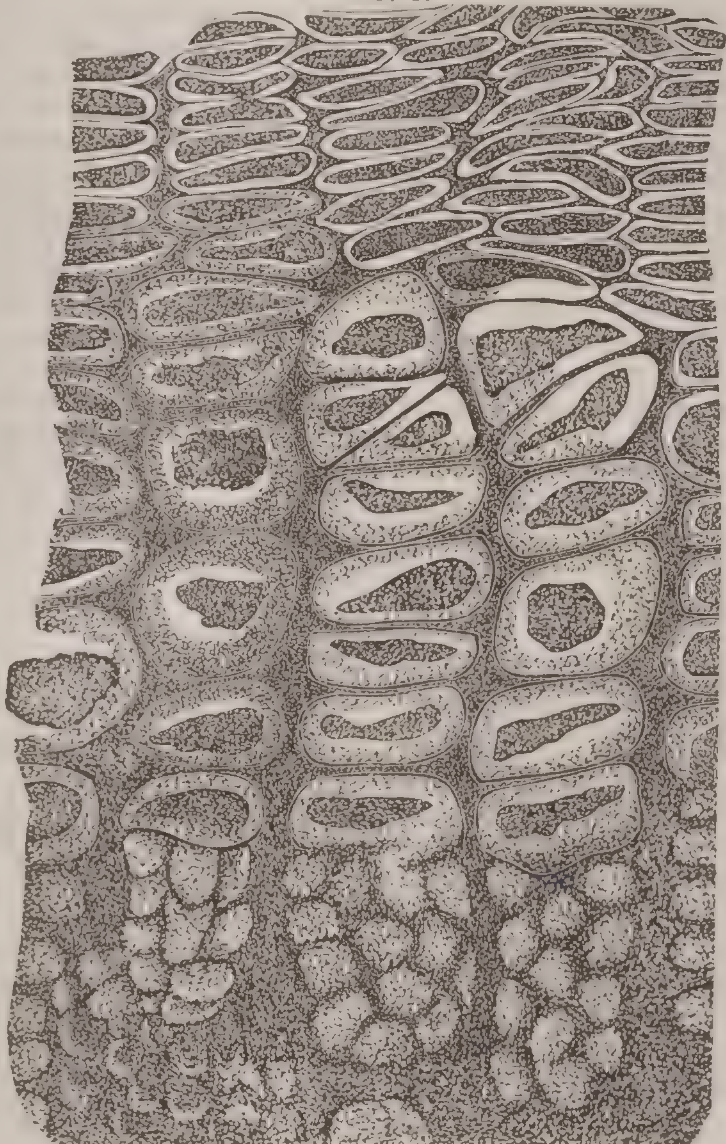
If bone be treated with dilute acids the earthy matter of the matrix is dissolved, and a material resembling cartilage is left behind, which, however, does not yield chondrin on boiling, but gelatine. When transverse sections are made through the shaft of a long bone, after the removal of the earthy matter by acids the matrix no longer appears homogeneous, but is disposed in a number of thin concentric layers (*Haversian lamellæ*) around each Haversian canal. The spaces between the systems of lamellæ thus formed are occupied by *intermediate lamellæ*, which run parallel to each other without any definite relation to the course of the adjoining Haversian lamellæ; and, lastly, just beneath the periosteum is a series of *peripheral lamellæ*, the course of which is parallel to the surface of the bone.

The medullary cavities of the long bones are filled with a delicate, very vascular connective tissue, rich in fat-cells —the marrow. The areolæ of the spongy extremities of the long bones and of the spongy bones also contain a delicate vascular connective tissue, in which, however, there are few fat-cells; instead, it abounds in round granular cells and masses of protoplasm containing many nuclei, the myeloplaxes of Robin. Wandering cells are abundant in this tissue, less numerous in the marrow, in which, however, they accumulate in certain pathological conditions.

Development of Bone.—In early fœtal life the skeleton is entirely cartilaginous, and bone first makes its appearance by a transformation of the cartilaginous skeleton, commencing at certain definite centres or points of ossification. There are usually several such centres to each bone, which are separated by cartilage until the growth of the bone is complete. The cartilaginous septa thus left, of which those between the epiphyses and shafts of the long bones may be taken as types, maintain their dimensions by a continual growth, while their margins are constantly being transformed into bone. Besides this development of bone in cartilage, it is also developed in connective tissue. This is the case with the thin cranial bones, in which a primordial cartilaginous stage does not exist. A similar formation of bone out of connective tissue takes place beneath the periosteum of all growing bones. It is by this process, for example, that the long bones increase in thickness, while their increase in length takes place by the growth and ossification of the cartilages between the shaft and epiphyses. The earlier histologists supposed that the formation of bone out of cartilage occurred by a deposit of earthy salts in the matrix of the cartilage, transforming it into bone-matrix, while the cartilage-cells were metamorphosed into bone-cells. Subsequent observations have shown, however, that the process is by no means so simple. The first formation of bone in the fœtal cartilaginous skeleton is preceded by an ingrowth of blood-vessels, surrounded by a delicate layer of cells (fœtal marrow), into the substance of the cartilage, which is absorbed to permit the entrance of the new tissue. Shortly after a deposit of earthy salts takes place in the matrix of the cartilage at the point of ossification. Detailed observations as to the earliest development of true bony tissue are yet wanting, but it seems probable that from the first, as certainly always occurs afterwards, the bone is formed by the transformation of the peripheral portions of the fœtal marrow. When, after the process is fairly under way, thin sections are cut, including the developing bone on one side and the fœtal cartilage on the other, the following conditions are observed: In the portion of the cartilage immediately adjoining the already formed bone the cells are disposed in closely packed rows perpendicular to the surface of advancing ossification. In these rows the cells which are more distant from the bone are flattened and have flattened nuclei; those nearer to it progressively more oval or rounded, with rounded nuclei. A deposit of lime-salts in the matrix between these rows extends in the form of fine trabeculæ some little distance beyond the already formed bone. The cartilage-cells nearest to the ossifying territory are always unusually large and clear, and immediately next to them groups of small granular cells, surrounding one or more capillary loops, lie in the most external areolæ of the already formed bone. These groups of granular cells are the terminal buds of the fœtal marrow. No transition forms between them and the adjacent row of large clear cartilage-cells have been observed, and it therefore seems improbable that these become converted into the granular cells by any process of division. It has been suggested by Henke that the granular cells are formed from migrated white corpuscles, but it is more generally believed that from the first the fœtal marrow intrudes into the cartilage along with the blood-vessels by continued cell-multiplication. Both views lack the support of actual observation. It is more positively established that the peripheral granular cells become bone-cells. These peripheral cells are known as osteoblasts, and form a distinct layer (the osteoblastic

layer) on the surface of the terminal buds of fœtal marrow. The details of the transformation have not been fully made out; some holding that all the osteoblasts become stellate

Fig. 5.



Ossifying cartilage.

bone-cells, between which the bone-matrix accumulates as the transformation proceeds, while others suppose that a large proportion of them are transformed into bone-matrix, and that this transformation, being limited in a certain number to their peripheral portions only, leaves the stellate bone-cells. It will be understood from the above that the cartilage of the fœtal skeleton is to be regarded as merely a temporary formation, and that the multiplication of its cells in rows, and the deposit of lime-salts in the matrix between them, are preliminary steps to its complete disappearance before the growing bone-tissue. The formation of bone beneath the periosteum takes place in a manner essentially similar to what has just been sketched. A layer of osteoblasts is developed between the connective tissue of the periosteum and the part of the bone which has already been formed, and these are transformed into bone in the same way as the osteoblasts of the fœtal marrow.

Muscular Tissue.—There are two varieties of muscular tissue, the non-striated and the striated. The *non-striated* muscles are composed of spindle-formed contractile fibre-cells with elongated or rod-like nuclei. These occur in the muscular coats of the intestinal canal, the middle coat of the arteries and veins, the posterior part of the walls of the trachea and bronchial tubes, the ciliary muscle and the iris, the skin (where they constitute especially the erectores pili muscles), the lymphatic glands and spleen, the walls of the gall-bladder and biliary ducts, the ureters and urinary bladder, the uterus and Fallopian tubes, etc. etc. The fibre-cells are composed of a contractile substance, which is either homogeneous or faintly striated longitudinally; in this, besides the nucleus, a number of strongly refractive granules are imbedded, a pyramidal group of them generally appearing at each extremity of the nucleus. Sometimes the extremities of the fibre-cells are divided into two or more branches. In length these cells for the most part range between .0015″ and .008″; their average breadth is about .0004″, and their nuclei range from .0005″ to .001″ in long diameter. They are united into larger or smaller fasciculi by a delicate connective tissue consisting of a homogeneous matrix, with scattered stellate, anastomosing cells. On a transverse section through these fasciculi the divided fibre-cells present irregular polygonal outlines. The fasciculi are united by septa of ordinary fibrillar connective tissue. The arteries and veins supplying the muscular tissue lie in these septa; the capillaries enter the muscular fasciculi and are distributed between the fibre-cells. The relation of the muscular fibre-cells to the nerves will be described in connection with the nerves. The *striated muscles* consist of cylindrical or somewhat fusiform fibres, .0004″ to .0025″ in diameter, which in short muscles extend from one insertion of the muscle to the other; in long ones, seldom exceed an inch and a half in length. These are marked transversely by close parallel lines, the well-known transverse striæ. Each fibre is invested by a delicate structureless sheath, the sarcolemma, beneath which, and on the exterior of the muscular substance proper, oval nuclei, the so-called muscle-corpuscles, are scattered at irregular intervals.

With proper management the muscular fibres may be split longitudinally into a bundle of minute fibrils, or transversely into a series of narrow disks. Hence, as was first taught by Bowman, each fibre is composed of a great number of quadrangular particles, the sarcous elements. Cohnheim, by the investigation of thin sections of frozen muscles especially, has shown that these sarcous elements are separated from each other by a transparent intervening substance. Brücke has pointed out that the sarcous elements polarize light, while the intervening substance does not. He found their doubly refractive power to be uniaxial and positive, and by a study of their behavior when examined with polarized light during contraction, arrived at the conclusion that each consists of a group of smaller doubly refractive bodies (disdiaclasts) capable of changing position with reference to each other during contraction, and thus modifying the form of the sarcous elements. To this view Stricker appears to incline, though he expresses himself with a certain reserve. Various other views of the structure of muscular fibres have been offered, with regard to which the reader must consult the special treatises. The muscular fibres are bound together into fasciculi by a delicate connective tissue resembling that which unites the fibre-cells of organic muscles. The fasciculi are united by septa of ordinary fibrillar connective tissue, in which the nutritive blood-vessels lie. The latter give off a system of capillaries which form a network between the individual muscular fibres. The termination of the nerves in striated muscular fibres will be described hereafter. All the voluntary muscles of the body, and certain of the involuntary ones also, among which the most notable is the heart, consist of striated muscular fibres. In the heart the muscular fibres offer several marked peculiarities. They branch and anastomose with each other, forming thus a continuous network, and they are divided by highly refractive transverse lines into segments .002″ to .003″ in length, each of which has a single nucleus in its centre, so that they have been described as chains of muscle-cells. Besides this, they frequently contain numerous fat-molecules, even when apparently quite healthy. In their transverse striation, and most of the details of their minute structure, however, they resemble the other striated muscles.

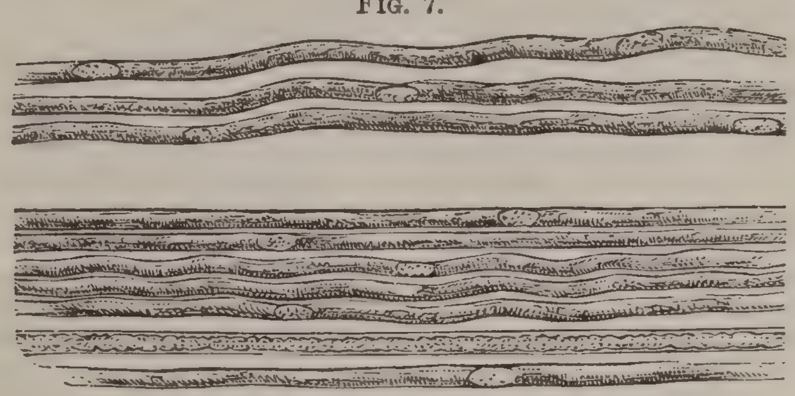
Nerves and Nerve-centres.—The nervous system consists of a series of branching cords, the nerves, which originate in the brain, spinal marrow, and ganglia, and are distributed to the tissues, where, for the most part, they end in certain special terminal organs. The *nerves* consist either of single nerve-fibres or of fasciculi of fibres united together by vascular connective tissue. In most of the cerebro-spinal nerves, with the exception of their central and peripheral terminations, the nerve-fibres consist of a central portion, the axis-cylinder, surrounded by a medullary sheath, the white matter of Schwann, and this again covered by a delicate investing membrane, the sheath of Schwann. Such fibres are designated medullated nerve-fibres. The sheath of Schwann is a transparent structureless membrane, like the sarcolemma of the muscular fibres. The medullary sheath is a peculiar, highly refractive, oily substance containing protogon, which, when the fibres are torn across, exudes from their extremities as the so-called myelin drops. The axis-cylinder consists of a bundle of extremely minute fibrils united by a delicate granular material. Medullated nerve-fibres range for the most part from .0002″

Fig. 6.

Medullated nerve-fibres.

to .0008″ in diameter; when perfectly fresh they appear smooth and round, with here and there an oval nucleus, but in a short time the medullary sheath undergoes a kind of coagulation, changing it into a granular semi-transparent mass, which shrinks away from the peripheral sheath in some places, and encroaches upon the axis-cylinder in others, so as to present very irregular contours. Medullated nerve-fibres branch frequently, especially towards their peripheral terminations, the axis-cylinder dividing into two or more portions, each of which is invested with a medullary layer, and a sheath of Schwann continuous with those of the primitive fibre. The secondary nerve-fibres thus produced are individually smaller than the one from which they spring, but in the aggregate the thickness of the branches is usually greater than that of the original fibre. Still farther towards the periphery both the sheath of Schwann and the medullary sheath disappear, the latter sometimes before the former, and the axis-cylinder which alone remains then divides and subdivides until it is broken up into its primitive fibrils, which are extremely minute, .00002″ or less in diameter, and often present a delicate beaded appearance. Another variety of nerve-fibres is found in the branches of the great sympathetic nerve, which, on account of the absence of the medullary sheath, have been called non-medullated fibres (also Remak's fibres). These correspond in size for the most part to the medium and smaller medullated fibres, and when fresh are smooth or somewhat granular, often marked by faint longitudinal

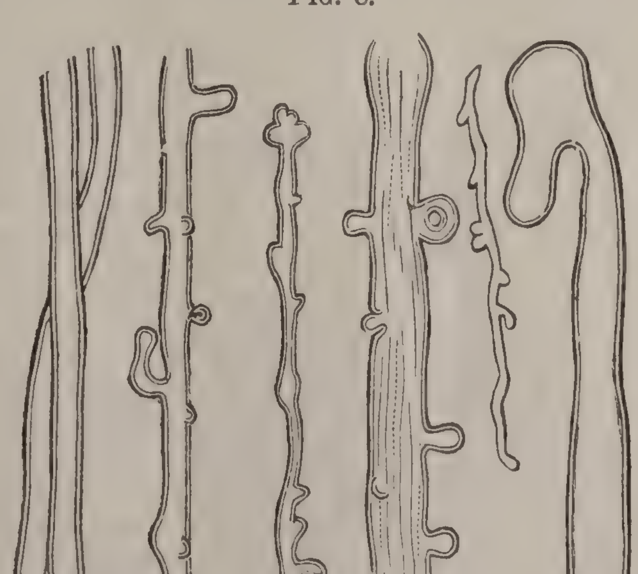
Fig. 7.



Remak's nerve-fibres.

striations. They consist of a peripheral sheath, identical with that of the medullated nerve-fibres, enveloping a bundle of primitive nerve-fibres united by a finely granular interfibrillar substance. Such non-medullated fibres exist also in the olfactory nerves, and in the white matter of the brain and spinal cord fibres are encountered which are quite similar, except that they do not possess the peripheral sheath of Schwann. The medullated nerve-fibres of the brain and spinal cord are also destitute of the sheath of Schwann, to

Fig. 8.



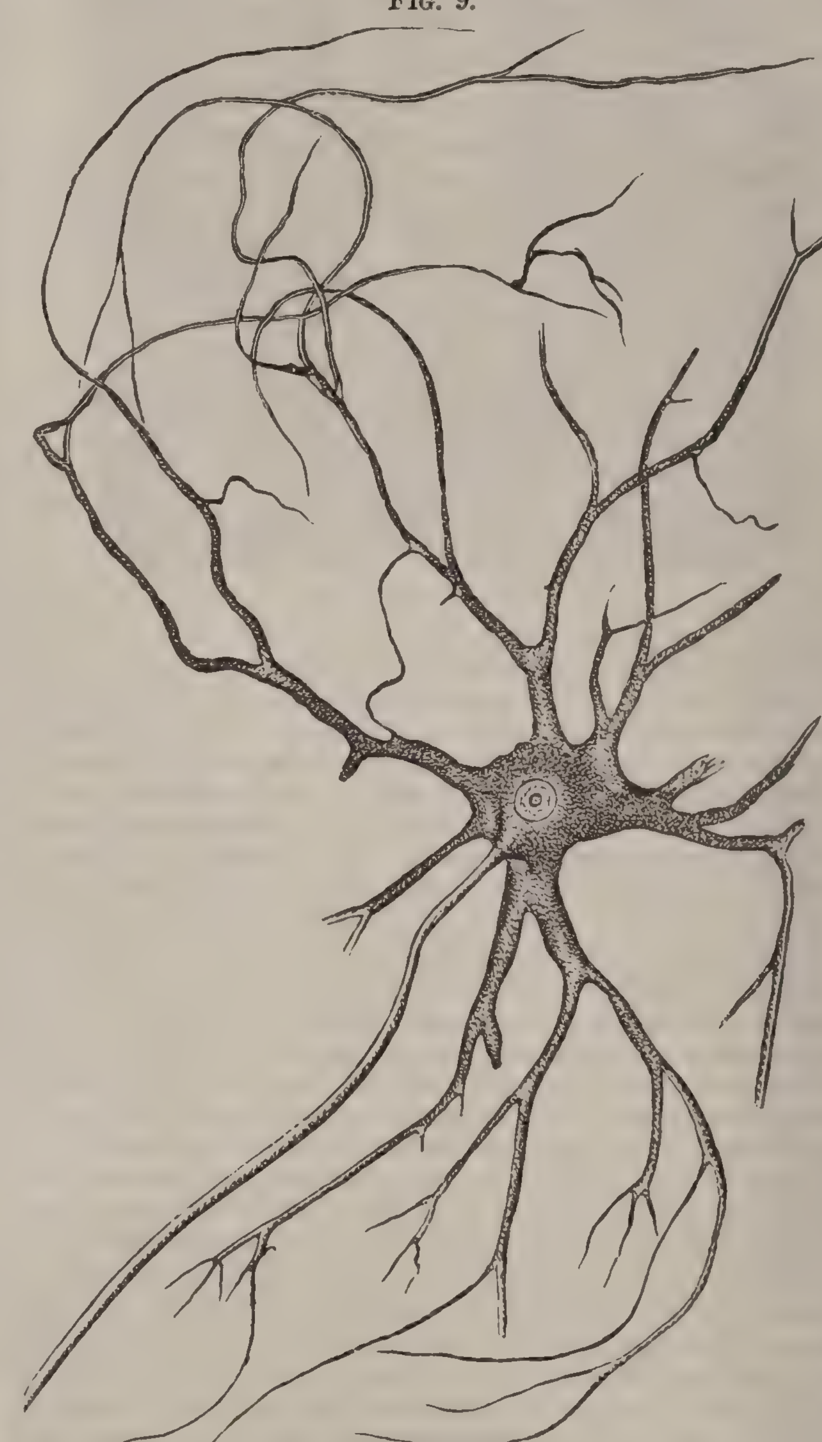
Myelin coagulated nerve-fibres.

the absence of which from both kinds of fibres, together with the delicacy of the connective tissue in which they are imbedded, the softness of the white matter of the nerve-centres is due.

From the foregoing it will be understood that the primitive nerve-fibrils are the characteristic elements of all nerve-fibres, and that the various appearances of nerve-fibres in diverse situations depend upon whether the fibrils occur singly or in fasciculi, and are or are not invested with medullary and peripheral sheaths. Max Schultze has proposed, on the basis of these circumstances, the following classification of nerve-fibres: I. Non-medullated fibres: 1, primitive fibrils; 2, fasciculi of primitive fibrils; 3, these last, with a sheath of Schwann. II. Medullated fibres: 1, primitive fibrils with medullary sheath; 2, fasciculi of primitive fibrils with medullary sheath; 3, these last, with a sheath of Schwann.

The Nerve-centres.—The brain and spinal marrow consist, as is well known, of two varieties of nerve-tissue, the white and the gray. The characteristic elements of the former are medullated and non-medullated nerve-fibres, neither of which possess the sheath of Schwann; in the latter, besides similar fibres, nerve-cells are encountered, which are also the characteristic element of the several ganglia. The nerve-cells are rounded, oval, or stellate bodies .0002″ to .003″ in diameter, consisting of a granular protoplasm, with a round or oval nucleus which usually contains a nucleolus. Each cell gives off one or more protoplasmic processes twice to six times as long as the diameter of the cell or layer. According to the number of these the cells are called unipolar, bipolar, or multipolar. The large multipolar nerve-cells in the anterior horns of the gray matter of the spinal cord are particularly available

Fig. 9.



Nerve-cell.

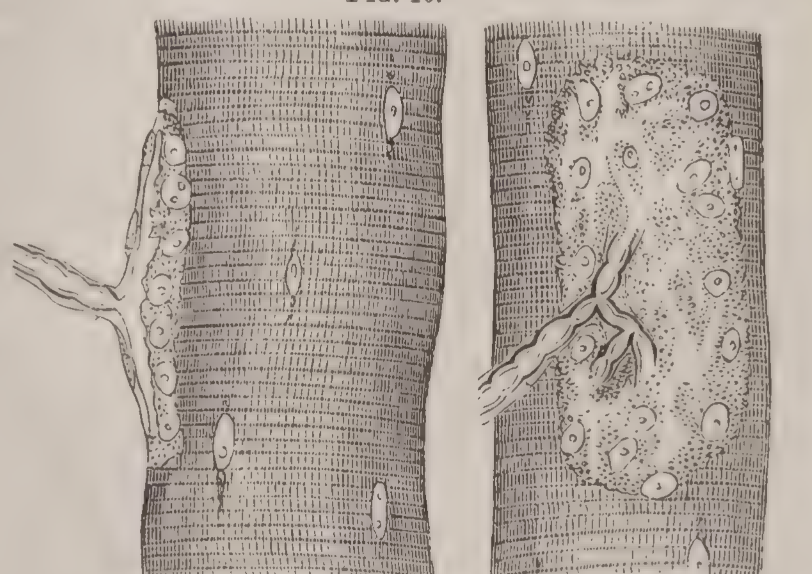
for study. In each of these cells all the processes but one branch frequently, until finally the ramifications escape observation. The exceptional process, as first demonstrated by Deiters, pursues its course without branching, and becomes ultimately the axis-cylinder of the medullated nerve-fibre. Like the axis-cylinder, this process consists of delicate fibrils united by a granular interfibrillar material. The fibrils can be traced into the substance of the nerve-cell. Indeed, recent investigations have shown that all the protoplasmic processes of the nerve-cells contain similar fibrils which interlace in the substance of the cell, and many of which can be traced through it from one process to another. Cells essentially similar to these, though smaller, are found in the gray substance of the cerebrum and cerebellum. Besides these, there are, in the gray substance of the brain especially, an immense number of small cells in which no peripheral process has been demonstrated, all their processes branching until they become fine fibrils, or having a fine fibrillar character from the very first. The destination of these fibrils is still a matter of, uncertainty.

The nerve-cells and nerve-fibres of the brain and spinal cord are imbedded in a delicate connective tissue, the neu-

roglia of Virchow. This consists of branching and anastomosing connective-tissue cells and delicate elastic fibres imbedded in a finely granular matrix. The sympathetic ganglia are traversed by medullated and non-medullated fibres, and contain numerous nerve-cells, which, like those of the spinal cord, give origin to fibres, all being united together by ordinary fibrillated connective tissue. Some of the nerve-cells are multipolar, like those of the spinal cord, but it is impossible to follow their processes for any distance on account of the density of the connective tissue in which they lie. Others are unipolar, and in this case the single process, like the peripheral process of the cells of the spinal cord, is continuous with the axis-cylinder of a nerve-fibre. Beale has described a form of cell in the sympathetic ganglia of the frog which gives off two processes, one of which winds spirally around the other.

The Peripheral Terminations of the Nerves.—The periph-

FIG. 10.



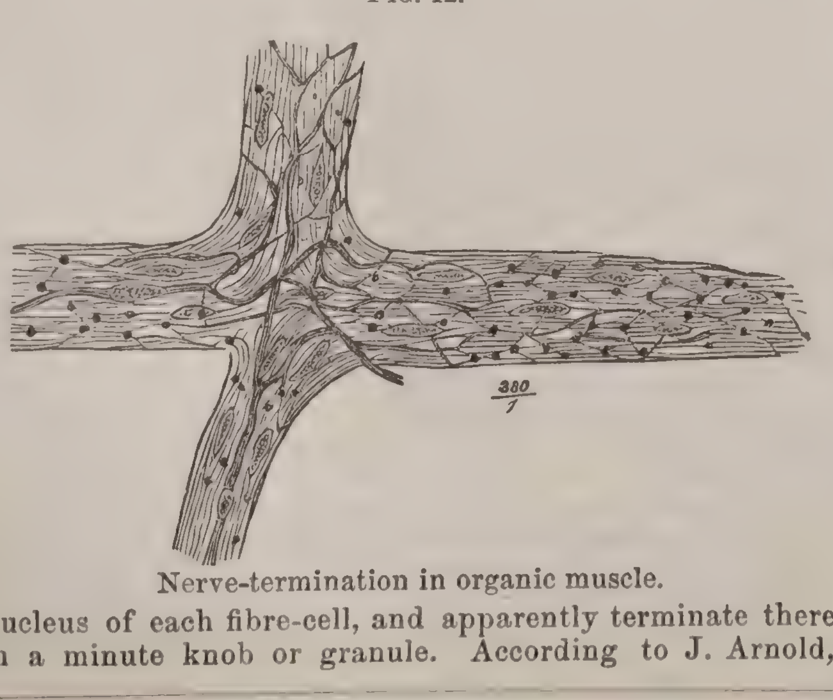
Termination of nerve in voluntary muscle.

eral terminations of the nerves in the organs of special sense, in the cornea, skin, and other situations, will be described in connection with these several parts. Here, therefore, we shall sketch only the termination of the nerves in muscle and in the Pacinian bodies. In the case of the voluntary muscles, medullated nerve-fibres terminate in peculiar organs situated immediately beneath the sarcolemma. At the point where the nerve-fibre joins the muscular fibre the sheath of Schwann becomes continuous with the sarcolemma, while the medullary sheath ends abruptly, and the axis-cylinder, penetrating beneath the sarcolemma, expands into a delicate, transparent, more or less branched terminal plate, which is separated from the striated substance of the muscular fibre by a little elliptical granular mass in which several nuclei are imbedded. Every striated muscular fibre has at least one of these nerve-terminations; the longer fibres receive several of them. In the case of the non-striated muscles the nerve-fibres first lose their medullary sheaths, then branch, and finally split up into their ultimate fibrils, which form a plexus between the fibre-cells of the muscle. From this plexus a series of short delicate branches is given off, one or more of which enter the substance of the

FIG. 11.

Organic muscle.

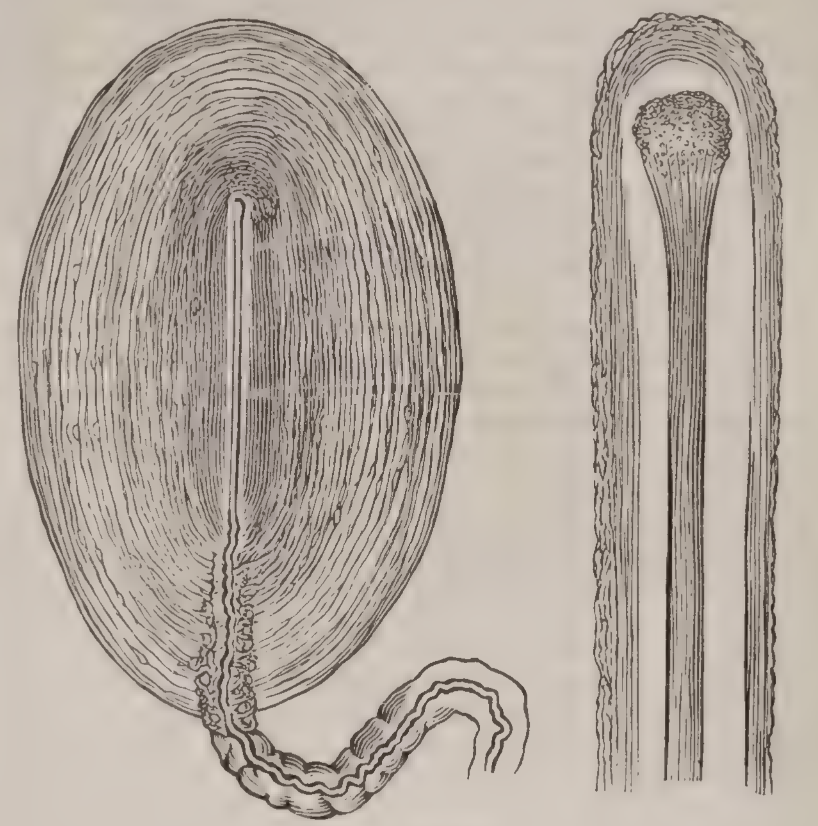
FIG. 12.



Nerve-termination in organic muscle.

nucleus of each fibre-cell, and apparently terminate there in a minute knob or granule. According to J. Arnold, however, these knobs give off filaments which pass through the substance of the nucleus and fibre-cells to join the intermuscular plexus again. The Pacinian bodies are peculiar terminations of the sensory nerves, which in man are found in the subcutaneous connective tissue of the sides of the fingers and toes, in the intermuscular spaces, and in the vicinity of joints. They are elliptical bodies .04″ to .1″ in long diameter, which consist of numerous

FIG. 13.

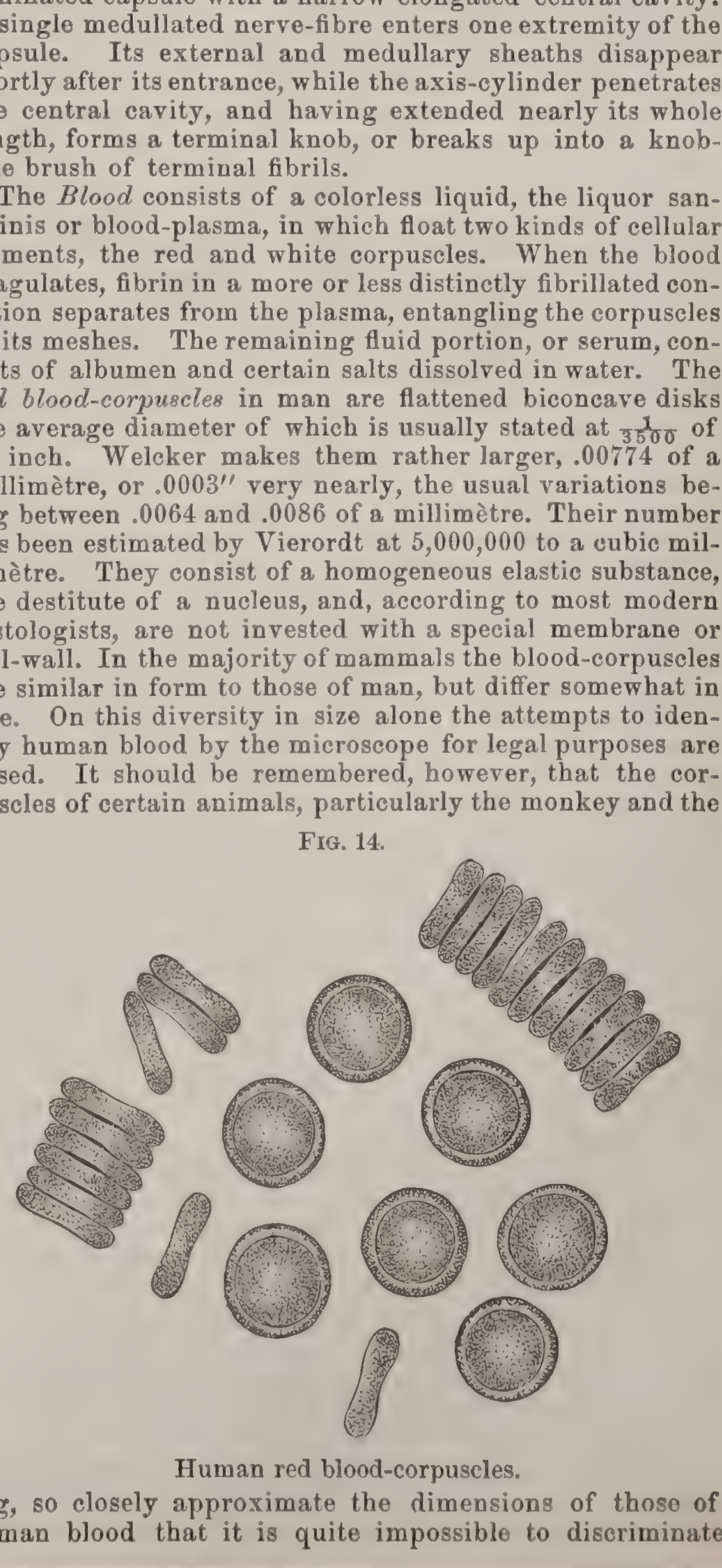


Pacinian body.

concentric layers of delicate connective tissue, forming a laminated capsule with a narrow elongated central cavity. A single medullated nerve-fibre enters one extremity of the capsule. Its external and medullary sheaths disappear shortly after its entrance, while the axis-cylinder penetrates the central cavity, and having extended nearly its whole length, forms a terminal knob, or breaks up into a knob-like brush of terminal fibrils.

The *Blood* consists of a colorless liquid, the liquor sanguinis or blood-plasma, in which float two kinds of cellular elements, the red and white corpuscles. When the blood coagulates, fibrin in a more or less distinctly fibrillated condition separates from the plasma, entangling the corpuscles in its meshes. The remaining fluid portion, or serum, consists of albumen and certain salts dissolved in water. The *red blood-corpuscles* in man are flattened biconcave disks the average diameter of which is usually stated at $\frac{1}{3500}$ of an inch. Welcker makes them rather larger, .00774 of a millimètre, or .0003″ very nearly, the usual variations being between .0064 and .0086 of a millimètre. Their number has been estimated by Vierordt at 5,000,000 to a cubic millimètre. They consist of a homogeneous elastic substance, are destitute of a nucleus, and, according to most modern histologists, are not invested with a special membrane or cell-wall. In the majority of mammals the blood-corpuscles are similar in form to those of man, but differ somewhat in size. On this diversity in size alone the attempts to identify human blood by the microscope for legal purposes are based. It should be remembered, however, that the corpuscles of certain animals, particularly the monkey and the

FIG. 14.

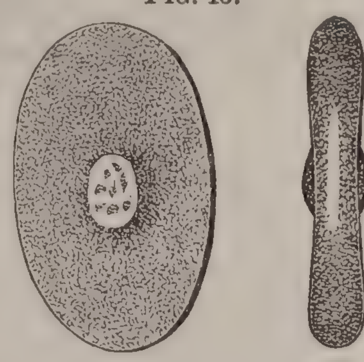


Human red blood-corpuscles.

dog, so closely approximate the dimensions of those of human blood that it is quite impossible to discriminate

them by the microscope even in fresh blood; and as after soaking out a blood-stain the original size of the blood-corpuscle is not always exactly reproduced, it becomes difficult to distinguish human blood under such conditions from the blood of a considerable number of animals the corpuscles of which approximate those of man in size. It is also to be noted that the dimensions assigned to the corpuscles of man and mammals by various authors differ considerably. In the camel and llama the corpuscles are elliptical, but possess no nuclei. In birds, reptiles, and fishes the corpuscles are elliptical flat disks possessed of an oval nucleus, which, when the edge of the corpuscle is turned towards the eye, is seen to project on each side above the surface of the disk. The following are the mean dimensions of the corpuscles of a few animals, as given by Welcker, in decimals of a millimètre:

FIG. 15.

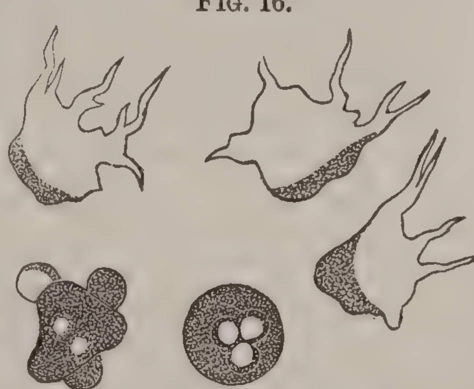


Red blood-corpuscles: Reptile.

Circular Corpuscles.		*Elliptical Corpuscles, long diameters.*	
Man	.0077	Llama	.0080
Dog	.0073	Pigeon	.0147
Cat	.0065	Frog	.0223
Rabbit	.0069	Triton	.0293
Sheep	.0050	Proteus	.0582
Moschus Javanicus	.0025	Sturgeon	.0134

The *white blood-corpuscles*, as seen circulating in the living blood-vessels, are spherical granular bodies, most of which in man have rather greater diameter than the red (on the average nearly .0004″). Each is a little mass of protoplasm which contains one or more nuclei. When a drop of human blood is watched with the microscope while the temperature is kept at about 100° F. and evaporation is prevented (by means of the hot stage and moist chamber), it will be observed that the majority of the white corpuscles assume the most diverse forms, and creep across the field of view with a motion resembling that of the amœba. Similar amœboid motions are observed in transparent living tissues in white blood-corpuscles which have migrated from the vessels. Two varieties of these amœboid corpuscles may be distinguished—one coarsely, the other finely granular; there is besides a third variety of white corpuscles, which are very delicately granular, smaller than the red corpuscles, and exhibit no amœboid motions. Lastly, the blood contains considerable numbers of still more minute protoplasmic particles destitute of nuclei. The white corpuscles in all vertebrated animals are essentially similar to those of man, but the amœboid motions in those of the cold-blooded animals take place at a lower temperature. Their differences in dimensions in the various classes of animals are much less than in the case of the red corpuscles. The white corpuscles are much less numerous than the red. Welcker estimates the proportion at 1 to 335, but it varies with age and sex, and indeed in different individuals and in the same individuals at different times. The blood of the splenic and hepatic veins contains a much larger proportion of white corpuscles than that of the splenic artery and portal vein.

FIG. 16.

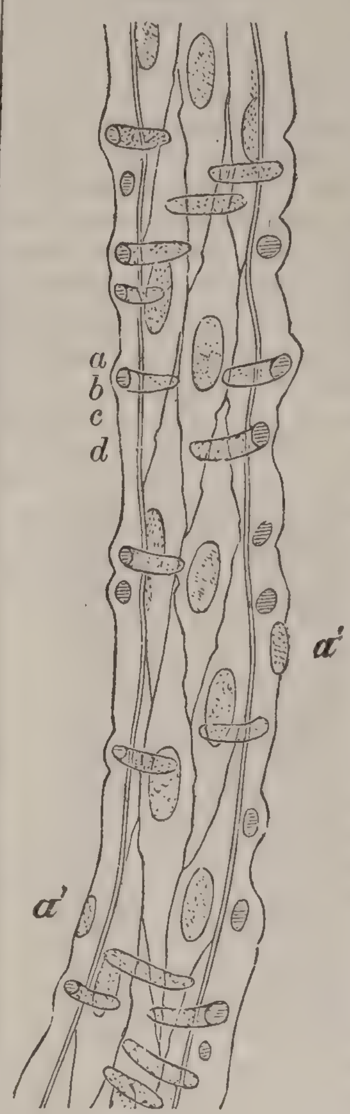


Amœboid movement of white blood-corpuscles.

Development of the Blood.—The earliest red corpuscles are derived immediately from the primitive cells of the embryo, and even in man and the mammals are nucleated. The non-nucleated red corpuscles make their appearance later, and entirely replace the nucleated ones before birth. They appear to originate by the transformation of white corpuscles, and the subsequent supply is kept up in the same manner as has been shown in the case of the frog by Von Recklinghausen and Golubew. The white corpuscles themselves originate in the lymphatic glands and the spleen in a mode which as yet is undetermined, probably by the multiplication by division of the cells of the parenchyma. Lastly, attention has been directed to the marrow of the bones as a situation in which the transformation of white corpuscles into red is particularly active.

The Blood-vessels.—The heart and blood-vessels, including the capillaries, are lined throughout by an endothelium consisting of a single layer of flattened nucleated cells, the boundaries of which are best displayed by the imbibition or injection of dilute solutions of nitrate of silver and subsequent exposure to light. The nuclei may afterwards be demonstrated by carmine staining. These cells range usually from .001″ to .004″ in length; the nuclei on an average are about .0005″ long. The walls of the true capillaries appear to consist merely of this single layer of cells, which are irregular in outline, and vary considerably in form in the capillaries of different organs. As the capillaries pass into the small arteries the endothelial cells become fusiform; in the small veins they are irregularly polygonal. In the line of junction between these cells small irregular openings, the so-called stomata, are mapped out by the action of silver, especially in the smaller veins. As they proceed from the capillaries towards the heart both veins and arteries acquire an investment of connective tissue, in which a layer of circular muscular fibre-cells soon makes its appearance. After this three distinct coats can be distinguished in both arteries and veins, consisting of the epithelial lining, reposing upon a thin layer of connective tissue, rich in elastic fibres, many of which run longitudinally; a middle or muscular coat, consisting of muscular fibre-cells disposed circularly and united together by connective tissue abounding in elastic fibre; and an external coat, or adventitia, composed of fibrillated connective tissue. The coats of the veins are considerably thinner than those of arteries of the same size, and contain less elastic tissue. On the other hand, the thick middle coat of the larger arteries is distinguished by the great quantity of elastic tissue which it contains. Longitudinal muscular fibre-cells occur in the adventitia of some of the larger arteries and veins. The coats of the veins within the cranium, in the bones, and in the maternal portion of the placenta contain no muscular fibres. The larger arteries and veins are nourished by a system of vessels, the vasa vasorum, which ramify in the external coat and send capillary branches to the muscular layers beneath. Nerves enter the middle coat of both larger and smaller vessels (with the exception of the true capillaries), and terminate in the muscular fibre-cells in the manner already described.

FIG. 17.



Small artery: *a*, tunica adventitia; *a′*, nucleus of tunica adventitia; *b*, muscle nucleus; *c*, elastic internal tunic; *d*, cell-membrane of fusiform cells.

FIG. 18.

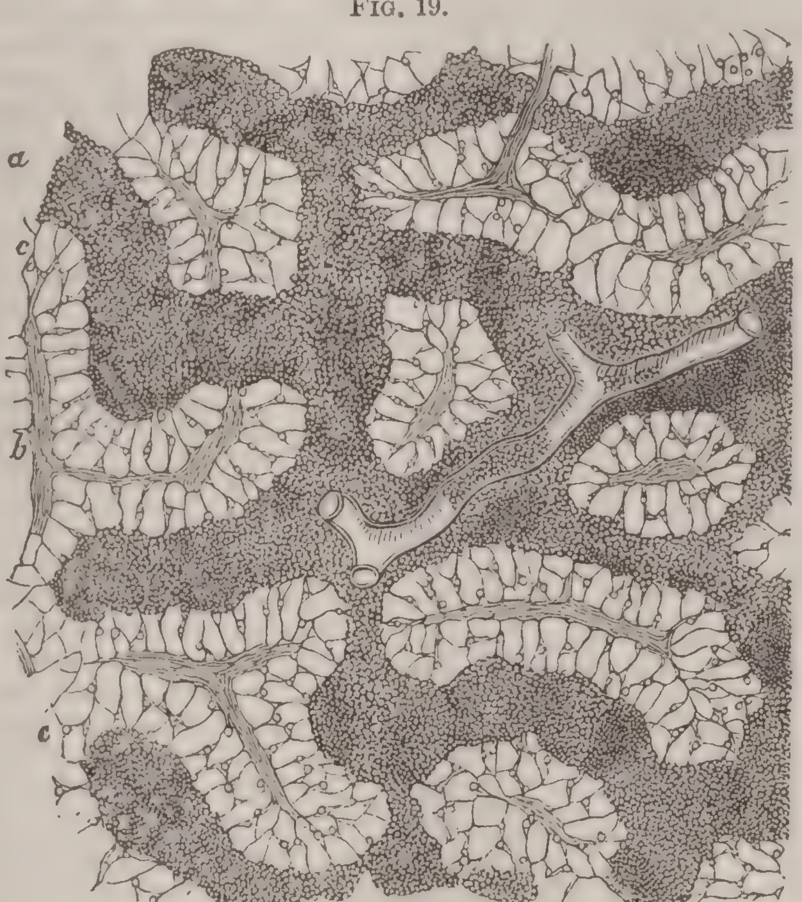
Lymphatics: central tendon diaphragm of rabbit: *a*, lymph capillaries; *c*, connective tissue with serous canals; *d*, flask-shaped dilatations.

The *lymphatics*, like the blood-vessels, are lined by a single layer of flattened endothelial cells, the boundaries of which are best displayed by the action of silver, while their nuclei

can be demonstrated by the use of carmine. In the smaller lymphatics and in the lymphatic capillaries these cells are distinguished by the sinuous character of their margins and by the large size and great number of the stomata between them. The larger lymphatics possess a middle muscular and an external connective-tissue coat, resembling the corresponding tunics of the veins. The stomata of the lymphatic network communicate with the system of spaces already described as everywhere existing in the connective tissue. These form a system of canals (plasmatic canals, serous canals), which vary in size and form in various parts of the body, and which, as Von Recklinghausen has shown, are best demonstrated by the action of silver, which blackens the intervening matrix, leaving the plasmatic canals uncolored. The plasmatic canals communicate also with the blood-vessels by the stomata of the latter, and thus form the passages through which the white corpuscles move when they migrate from the vessels.

The *lymphatic glands* are interposed in the course of the lymphatics. When these, on their way from the peripheral portions of the body, arrive at a gland (vasa afferentia), they ramify on its surface and enter its substance from the periphery. The branches leading from the gland towards the larger lymphatic trunks (vasa efferentia) escape from the hilus. The lymphatic glands are invested by a capsule of connective tissue, and consist essentially of a delicate reticulum of branching connective-tissue cells, the meshes of which are filled with small granular cells resembling the white corpuscles of the blood. When thin sections of glands, hardened in alcohol, are pencilled with a brush, a portion of these elements are detached, and the more firmly attached cells which remain in situ appear as cord-like masses (follicular cords), which form a plexus in the central medullary portion of the gland, while in the cortical portion they expand into rounded or club-shaped dilatations.

Fig. 19.



Lymphatic gland: *a*, follicular ends; *b*, trabeculæ; *c*, lymph-path.

If the pencilling be continued, the lymphoid cells are detached from these follicular cords also, and it is then seen that the meshes of the reticulum are smaller in them than in the intervening portions of the gland. The connective-tissue capsule gives off to the interior of the gland a series of trabeculæ which form an areolar network, interlacing with the plexus formed by the follicular cords in such a way that in sections the trabeculæ appear to occupy the centres of the spaces between the cords, with which they are connected by the coarse reticulum above described. This coarse reticulum between the trabeculæ and the follicular cords constitutes the lymph-path, the easily detached lymphoid elements of which are constantly carried away by the current of the lymphatic circulation, and as constantly renewed; it communicates directly with the vasa afferentia at the periphery of the organ, and with the vasa efferentia at the hilus. Connected with the lymphatic plexuses of the mucous membrane of the alimentary canal especially are certain glandular bodies, the *lymphatic follicles*, the parenchyma of which is very similar in its structure to that of the follicular cords just described, and which, for this reason, and on account of their relations to the lymphatic vessels, are to be regarded as minute lymphatic glands. The solitary glands and glands of Peyer in the intestines, the closed follicles of the tonsils, pharynx and back of the tongue, are of this nature.

The *lymph* is the colorless, slightly opalescent fluid contained in the lymphatics. Its morphological elements, the lymph-corpuscles, are in all respects identical with the white corpuscles of the blood, which in fact are continually recruited by the lymph-corpuscles entering the subclavian veins through the thoracic duct and the lymphatic duct of the right side, while on the other hand, white blood-corpuscles which have migrated from the blood-vessels into the serous canals of the connective tissue continually enter the lymphatic capillaries and became lymph-corpuscles. The lymph which leaves the lymphatic glands by the vasa efferentia is so much richer in corpuscles than that which enters them as to leave no doubt that these glands are one important seat of the formation of the lymph-corpuscles. They probably originate by the multiplication by division of the cells of the parenchyma, but the details of the process have hitherto escaped observation. A similar formation of white corpuscles takes place in the spleen, and probably also in the lymph-follicles and the marrow of the bones.

The *serous membranes* consist of a thin layer of connective tissue coated on the side next the serous cavity by a single layer of endothelial cells. These are flattened polyhedral, nucleated elements, generally with sinuous margins, which are best displayed by the action of silver. It is then seen, also, that numerous sharply defined, rounded, or irregular spaces, the so-called stomata, exist between the margins of the cells. The membrane on which this endothelium reposes consists of a network of interlacing bundles of fibrillar connective tissue with stellate fixed corpuscles and elastic elements. It contains, besides blood-vessels and nerves, a rich plexus of lymphatic capillaries, which appear to communicate freely with the serous cavities by means of the stomata. In consequence of this arrangement, milk or colored fluids, such as carmine solution, introduced during life into serous cavities—as, for example, the peritoneum or the pleural sacs—are speedily taken up by the lymphatics, a natural injection of which may thus be effected. The lymphatic capillaries may also be demonstrated by soaking the membrane in nitrate of silver and exposing it to the light. The connective-tissue matrix is thus blackened, while the blood-vessels and lymphatics appear as light-colored channels lined by their characteristic endothelium. From the abundance of these lymphatics, and the readiness with which they take up fluids introduced into the serous cavities, the latter have been of late regarded by some as belonging to the lymphatic system.

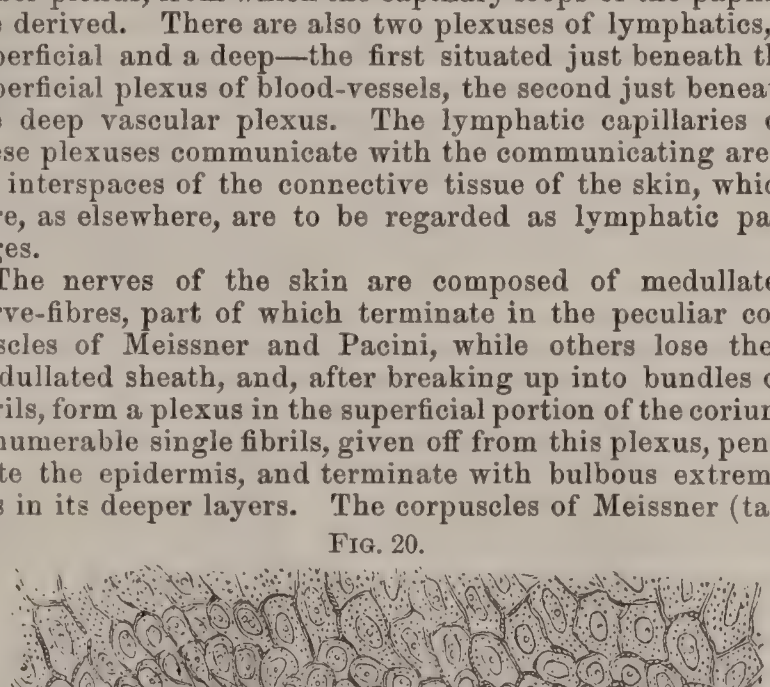
The Spleen.—The spleen is invested externally by the peritoneum, immediately beneath which is a firm connective-tissue capsule. From the inner surface of the capsule numerous processes (trabeculæ) proceed into the substance of the organ, uniting with each other to form a network, the areolar interspaces, which are filled with the splenic pulp. Both the capsule and the trabeculæ contain a considerable number of muscular fibre-cells and elastic elements. Where they adjoin the veins the trabeculæ become continuous with the adventitia of these vessels, which thus acquire unusual firmness and are prevented from collapsing. The splenic pulp consists of lymphoid elements resembling those of the lymphatic glands, like which, when examined fresh, they exhibit amœboid movements. These elements are united by a faintly granular, tenacious intercellular substance. In the mass thus formed, according to Frey, an anastomosing system of passages, lined by an endothelium consisting of a single layer of spindle-formed cells, is hollowed out. These passages communicate with both the arteries and veins, and serve for the transmission of blood. In consequence of their existence the splenic pulp may be considered as itself disposed in a network, in the meshes of which lie the trabeculæ, the blood-vessels, and the passages just described. The splenic artery, after entering the organ, breaks up into smaller and smaller branches, which soon become characterized by the large numbers of lymphoid elements in their adventitia, and also by the presence of peculiar oval structures, the Malpighian bodies. These are from .01″ to .04″ in diameter, and are readily recognized by the naked eye on account of their whitish color. They consist of cells resembling those of the splenic pulp, held together, like them, by an intercellular material, which, towards their peripheries, acquires a resemblance to ordinary connective tissue, without, however, forming a complete capsule; the parenchyma of the Malpighian bodies being thus continuous with the splenic pulp. The arteries and veins of the spleen are united by a rich plexus of capillaries, which ramify in the substance of the splenic pulp, and form a well-developed network on the peripheries of the Malpighian bodies, into the interior of which they also penetrate, though with wider meshes. Besides, according to Frey, as already mentioned, both

arteries and veins open into the parenchymatous passages described above. This view is, however, not universally accepted, some histologists holding that the splenic arteries communicate with the veins by capillaries in the ordinary way only. Further investigations are needed to reconcile these conflicting views. The nerves of the spleen are derived from the sympathetic system, and primarily accompany the arteries. They terminate in the muscular fibre-cells of the middle coats of the blood-vessels, and in peculiar ellipsoid organs described by W. Müller, which are well developed in carnivorous animals, but only rudimentary in man. The lymphatics of the spleen form a close plexus in the capsule of the organ, whence numerous branches are given off into its interior; there a second plexus is formed, the larger branches of which for the most part accompany the arteries.

The Skin and its Appendages.—The skin consists of a superficial epithelial layer, the epidermis, and a deeper layer, the corium or true skin. The corium is from .02″ to .1″ thick, and is composed of dense connective tissue, many of the fixed corpuscles of which are stellate, especially in its more superficial portions, where also they are smaller and more numerous. The fibrillated matrix of this connective tissue is so disposed as to form a dense network with small intercommunicating meshes, which are largest in the deeper parts of the corium, and there contain groups of fat-cells. Still deeper, the network becomes continuous with the loose connective tissue of the subcutaneous fat. Interlacing with this connective-tissue network is a second network of coarse and fine elastic elements. On its exterior surface the corium presents great numbers of little elevations, the papillæ. These are merely rounded projections over the greater portion of the body, but in some situations, especially in the palmar surface of the hands and fingers, become conical elongated processes .004″ in length or longer. They are divided into vascular and nervous, the first containing capillary loops, the second the terminations of nerves. The blood-vessels of the corium form in its deeper portion a close plexus, whence numerous branches are given off towards the surface. These form, in the most superficial portion of the corium, a second still closer plexus, from which the capillary loops of the papillæ are derived. There are also two plexuses of lymphatics, a superficial and a deep—the first situated just beneath the superficial plexus of blood-vessels, the second just beneath the deep vascular plexus. The lymphatic capillaries of these plexuses communicate with the communicating areolar interspaces of the connective tissue of the skin, which here, as elsewhere, are to be regarded as lymphatic passages.

The nerves of the skin are composed of medullated nerve-fibres, part of which terminate in the peculiar corpuscles of Meissner and Pacini, while others lose their medullated sheath, and, after breaking up into bundles of fibrils, form a plexus in the superficial portion of the corium. Innumerable single fibrils, given off from this plexus, penetrate the epidermis, and terminate with bulbous extremities in its deeper layers. The corpuscles of Meissner (tactile corpuscles) are contained in the nervous papillæ, and are most numerous in the palmar surface of the hand and fingers. They are oval bodies about as long as the papillæ in which they are contained, but rather narrower, composed of a modified connective tissue with transversely disposed nuclei, and marked superficially with transverse lines. Each is penetrated at its inferior extremity by one or more medullated nerve-fibres which run towards the opposite extremity, either straight or in a spiral manner, and terminate there in a mode which is not yet fully made out.

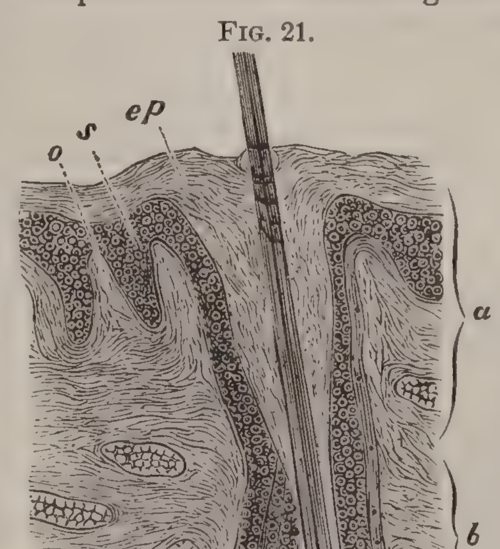
FIG. 20.



Tactile corpuscles: *a*, vascular papilla; *b*, nerve-papilla; *c*, blood-vessel; *d*, medullated nerve-fibre; *e*, tactile corpuscle; *f*, transverse section of medullated nerve-fibre.

The *epidermis* varies in thickness from .002″ to .15″, and is composed of numerous strata of epithelial cells, the deeper ones being soft and rounded, while the more superficial are flattened and horny; it is hence divided into a mucous and a horny layer. The cells of the mucous layer are nucleated masses of granular protoplasms. Those of them which are immediately in contact with the corium are elongated or columnar, and about .0004″ in average length. Next above these the cells have about the same diameter, but are rounded or polygonal from mutual pressure, and succeeding strata increase in size towards the surface of the mucous layer, becoming more and more flattened, till the uppermost cells have a transverse diameter of .001″ or more, with less than half the thickness. The nuclei of the cells of the mucous layer vary with the size of the cells from .0001″ to .0004″. The horny layer consists of strata of cells flattened into mere polygonal scales .001″ to .0015″ or more in diameter, and extremely thin. In most of them no nucleus can be made out. The most superficial cells of this layer are constantly being thrown off, while the superficial cells of the mucous layer continually undergo the horny transformation, and thus replace the loss. To maintain this process a constant development of new elements goes on in the deeper parts of the mucous layer. This is generally believed to take place by the multiplication of the epithelial elements of the deepest strata. Recently, however, it has been shown that wandering corpuscles migrate from the corium into the mucous layer, where they can always be found in thin sections between the epithelial cells. It has hence been suggested that the new elements arise, in part at least, by the fixation and transformation of these migrated cells.

FIG. 21.



Hair from beard: *a*, orifice of hair-follicle; *b*, neck of follicle; *c*, dilatation of follicle; *d*, outer follicular sheath; *e*, inner follicular sheath; *f*, outer root-sheath; *g*, inner root-sheath; *h*, cortical substance of hair; *k*, medullary substance of hair; *l*, root of hair; *m*, adipose cells; *n*, erector pili; *t*, sebaceous gland; *o*, papillæ of skin; *s*, mucous layer; *ep*, horny layer projecting into hair-sac.

The dark color of the skin in certain races is due to the deposit of pigment-granules in the cells of the lower part of the mucous layer.

The *hairs* vary considerably in thickness in different situations. The long soft hairs of the head, beard, etc. usually range between .0015″ and .004″ in thickness; the short stiff hairs of the eyelashes, eyebrows, nostrils, and auditory meatus, from .0025″ to .006″; and the downy hairs of the general surface of the body from .0005″ to .001″. The proper substance of all these varieties of hairs can be broken up, by the action of sulphuric acid, into flat elongated fibre-cells .002″ in average length. Each hair is coated externally by a cuticle composed of a single layer of flattened scales, which overlap each other like the shingles on a roof; internally, in the coarser hairs at least, is a central medulla composed of granular polygonal cells .0006″ to .0008″ in diameter. The color of the hair is due to pig-

ment-granules deposited both in the medulla and the proper hair-substance. Each hair grows from a vascular papilla, which projects into the bottom of the hair-follicle. Immediately upon the surface of this papilla is a single layer of columnar cells similar to those of the deepest layer of the epidermis. To these succeed several strata of polygonal ones, and these, according to their position, pass by transition into the elements of the hair-cuticle, hair-substance, and medulla. The growth of the hair is effected by the multiplication of the cells in the immediate vicinity of the papilla. The hair-follicles are from .08″ to .25″ long, and extend deep into the corium—in the case of the larger hairs, quite through it. The connective tissue of the corium immediately adjoining them is so condensed as to form an external sheath, the fibres of which run parallel to the hair. The portion of this sheath nearest to the follicle is more homogeneous, and contains muscular fibre-cells disposed longitudinally; it is known as the internal sheath of the follicles; its very innermost part, being quite transparent, is called the vitreous membrane. Both the mucous and horny layers of the epidermis are continued into the sheath, which they line as far as the papilla; the first lies next to the vitreous membrane, and is called the external root-sheath; the second is thinner, and is designated the internal root-sheath. From near the orifice of the follicle to the papilla the internal root-sheath is adherent to the outermost layer of cells on the surface of the root of the hair, which is termed the sheath of Huxley. The hair-papillæ are vascular processes of connective tissue which project into the bottoms of the follicles; they are conical in shape, with constricted necks. Two small arteries enter each papilla; these usually unite to form a single trunk, which breaks up into a capillary network from which two emergent veins proceed. A small artery and vein also ramify in the substance of the external sheath of the follicle. Nerves have been traced as far as the neck of the papilla, but their mode of termination remains unknown.

The *erector muscles of the hair* are narrow bands of muscular fibre-cells .0018″ to .009″ in thickness, which arise in the upper part of the corium and run obliquely inward to be inserted into the internal sheath of the hair-follicles just below the sebaceous glands. Each hair-follicle enters the skin obliquely, forming an acute angle with the surface, and as the muscle lies in the corresponding obtuse angle, its contraction erects the hairs.

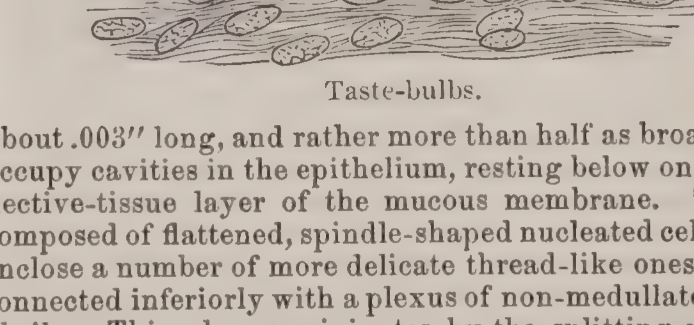
One or more *sebaceous glands* open into each hair-follicle just below the level of the general surface of the corium. Each of these glands consists of from two to twenty somewhat oval sacculi .005″ to .014″ in long diameter, composed of a transparent nucleated membrane, filled with nucleated gland-cells, resembling the cells of the mucous layer of the epidermis. The cells nearest the walls of the sacculi often contain no oil; in the more central cells oil is usually present in drops of various sizes imbedded in the cell-substance. The size of the sebaceous glands is quite independent of the size of the hairs with which they are connected, and sometimes, though rarely, they open directly upon the surface of the skin without being connected with any hair.

The *sweat-glands* are simple tubular glands, each consisting of a delicate nucleated sheath, lined by a single layer of columnar nucleated cells, which leave in the centre a narrow cylindrical passage. The diameter of the tube averages about .0025″; its deepest extremity forms a coil or glomerulus .008″ to .016″ in diameter, which is surrounded by a plexus of blood-vessels, and lies in the lower part of the corium or in the subjacent adipose tissue. From this coil the tube pursues a nearly straight path to the surface of the corium, where both the sheath and the columnar cells terminate, and the central passage becomes continuous with a spiral canal hollowed out between the cells of the epidermis, which opens on the external surface of the horny layer. The hairs, sebaceous glands, and sweat-glands are developed from the mucous layer of the epidermis, papillary outgrowths of which invade the corium and undergo the requisite transformations. Simultaneously, the adjacent layers of the corium are metamorphosed into the external sheaths of the hair-follicles and glands.

The *nails* are to be regarded as special modifications of the epidermis, and consist, like it, of a mucous and a horny layer, the latter being the true nail. In the fold of skin from which the root of the nail grows the corium is elevated into papillæ projecting forward, which in the true bed of the nail are replaced by a series of parallel longitudinal ridges or laminæ .002″ to .008″ high. These papillæ and ridges are abundantly supplied with blood-vessels, and numerous medullated nerve-fibres exist in the subjacent connective tissue, which lose their medullary sheath on entering the corium, and break up into fine branches, the ultimate termination of which is not fully known. An active development of cells takes place in the mucous layer at the root of the nails; and as a similar development occurs, though less actively, in the mucous layer of the nail-bed, the nails are at once pushed forward and increased in thickness towards their free margins. The horny layer, or nail-substance, is composed of irregular polygonal cells intimately united together, but which can be isolated by reagents, as, for example, by maceration in solution of potash.

The Digestive Organs.—The *mouth* is lined by a mucous membrane which is directly continuous with the skin, and like it consists of a vascular layer of connective tissue beset with papillæ and a many-layered epithelium, the superficial cells of which are flattened scales, the deeper ones polygonal, and those next the connective-tissue layer columnar. The connective-tissue layer, however, is much thinner than the corium; in the epithelium a horny layer cannot be discriminated as in the epidermis, and the large superficial epithelial scales, .0016″ to .003″ in long diameter, contain oval nuclei .0003″ to .0004″ long. The papillæ of the mucous membrane vary in size and shape in different parts of the oral cavity; they are particularly conspicuous on the upper surface of the tongue, where three varieties are discriminated—viz. the filiform, fungiform, and circumvallate. The filiform papillæ are pretty uniformly distributed over all portions of this surface. They are conical elevations of the mucous membrane, the apices of which terminate in a number of secondary papillæ, the whole being covered with a thick layer of epithelium, which, at the apices, breaks up into a number of slender processes, each composed of epithelial cells adhering together. The fungiform papillæ are situated at the anterior part of the tongue, chiefly on its tip and edges. They are club-shaped projections of the mucous membrane with narrow necks, beset upon the surface with small secondary papillæ, and smoothly covered over with epithelium. The circumvallate papillæ are arranged in the form of a V at the root of the tongue. They are flattened elevations, somewhat constricted at their bases, beset, like the fungiform, with small secondary papillæ, and surrounded by a circular elevation of the mucous membrane, from which they are separated by a narrow depression. All these varieties of papillæ are provided with both blood-vessels and nerves. Connected with the nerves are special organs of taste, the so-called gustatory bulbs, which are situated chiefly on the sides of the circumvallate papillæ, but also exist, though less plentifully, on the fungiform papillæ. They have the form of round-bellied flasks

Fig. 22.



Taste-bulbs.

about .003″ long, and rather more than half as broad, which occupy cavities in the epithelium, resting below on the connective-tissue layer of the mucous membrane. They are composed of flattened, spindle-shaped nucleated cells, which enclose a number of more delicate thread-like ones, and are connected inferiorly with a plexus of non-medullated nerve-fibrils. This plexus originates by the splitting up of the axis-cylinders of the terminal medullated fibres of the gustatory nerve in the substance of the papillæ. The central cells of these bulbs are believed to be the true gustatory cells, while the others are regarded as epithelial in their nature, and are so arranged as to leave at the apex of the bulb a circular opening about .00014″ in diameter, the gustatory pore, through which sapid solutions gain access to the gustatory cells. The oral cavity is provided with a considerable number of small mucous glands .03″ to .16″ in diameter, similar in structure to the salivary glands, and designated, according to their situation, labial, buccal, palatine, and lingual glands.

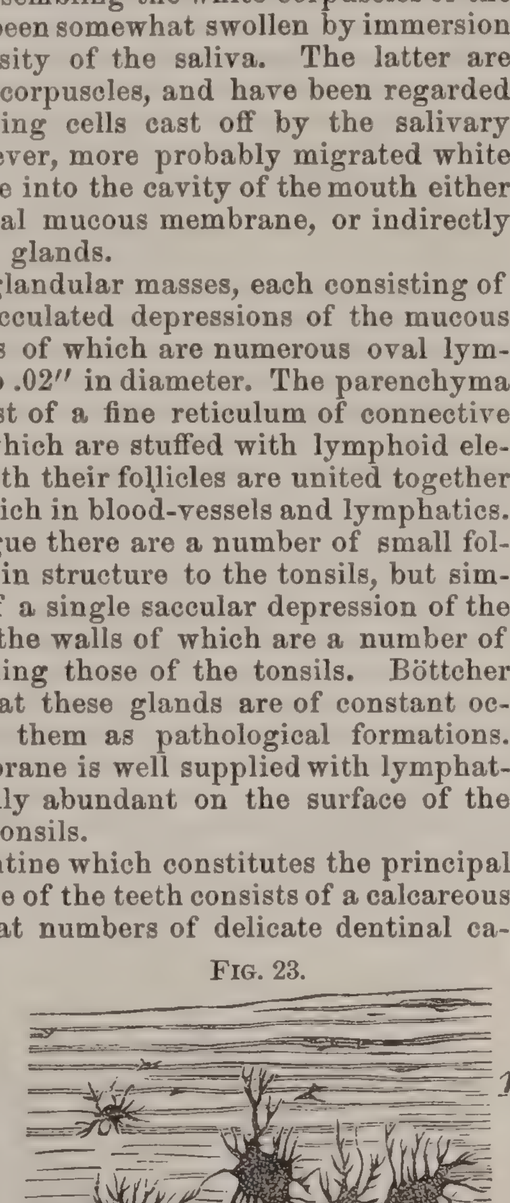
The *salivary glands* are racemose glands, the ducts of which are lined with a cylindrical epithelium and branch in a tree-like manner, terminating finally in sacculi or alveoli .0015″ to .003″ in diameter, and lined with polygonal secreting cells .0004″ to .0007″ in diameter. The whole is united into a mass by a delicate connective tissue in which numerous blood-vessels and nerves ramify. On the surface of the alveoli and smaller ducts this connective tissue is

condensed into a delicate membrana propria, while in the larger ducts it forms a comparatively thick wall. The secreting cells are granular nucleated masses of protoplasm, which line the alveoli, and so nearly fill them as to leave a comparatively small central cavity. The nerves of the salivary glands consist of both medullated and pale fibres. According to Pflüger, a portion of the former penetrate the alveoli, and are continuous with the protoplasm of the secreting cells, while others terminate in small multipolar cells, some of the processes of which are also continuous with the secreting cells. A number of small ganglia, each consisting of a group of round or oval nerve-cells, occur in the course of the nerves. The oral fluid consists of the secretion of the salivary glands mixed with that of the small racemose glands above described. It always contains large numbers of flattened epithelial cells, derived from the surface of the oral mucous membrane, together with small round granular cells resembling the white corpuscles of the blood after they have been somewhat swollen by immersion in a fluid of the density of the saliva. The latter are known as the salivary corpuscles, and have been regarded as undeveloped secreting cells cast off by the salivary glands; they are, however, more probably migrated white corpuscles which escape into the cavity of the mouth either directly through the oral mucous membrane, or indirectly by way of the salivary glands.

The *tonsils* are two glandular masses, each consisting of from ten to twenty sacculated depressions of the mucous membrane, in the walls of which are numerous oval lymphatic follicles .008″ to .02″ in diameter. The parenchyma of these follicles consist of a fine reticulum of connective tissue, the meshes of which are stuffed with lymphoid elements. The sacculi with their follicles are united together by a connective tissue rich in blood-vessels and lymphatics. At the root of the tongue there are a number of small follicular glands similar in structure to the tonsils, but simpler, each consisting of a single saccular depression of the mucous membrane, in the walls of which are a number of closed follicles resembling those of the tonsils. Böttcher has recently denied that these glands are of constant occurrence, and regards them as pathological formations. The oral mucous membrane is well supplied with lymphatics, which are especially abundant on the surface of the tongue and about the tonsils.

The Teeth.—The dentine which constitutes the principal portion of the substance of the teeth consists of a calcareous matrix containing great numbers of delicate dentinal canals .00005″ to .00015″ in diameter, which branch and anastomose as they radiate from the pulp-cavity towards the periphery of the dentine. The crown of the teeth is covered with a harder material, the enamel, made up of hexagonal prismatic enamel-fibres .00012″ to .00018″ in diameter, arranged perpendicularly to the surface, or nearly so. The roots of the teeth are covered with a thin layer of true bone, the crusta petrosum or cementum. The tooth-pulp occupies the central cavity of each tooth, and is a delicate mass of connective tissue containing both blood-vessels and nerves. Its external layer consists of large nucleated cells, the odontoblasts, provided with long branching processes which line the dentinal canals. The investigations of Boll render it probable that the delicate terminal fibrils of the nerves of the pulp accompany these processes into the dentinal canals. In the development of the teeth a longitudinal furrow in the mucous membrane of the gum is first formed, into which papillary outgrowths from the mucous

Fig. 23.



Canine tooth: Transverse section of root: 1, cement; 2, interglobular substance; 3, dentinal tubules.

membrane sprout, and ultimately become the pulps of the several teeth. The enamel originates by the transformation of portions of the epithelium of the primary dental groove, while the peripheral cells of the pulp send out branches and are transformed into odontoblasts, between the processes of which the calcareous matrix of the dentine is deposited.

The *pharynx* is lined by a mucous membrane resembling that of the mouth, except in the portions adjoining the posterior nares and the orifices of the Eustachian tubes, where the pavement epithelium is replaced by one composed of ciliated columnar cells like those of the nasal mucous membrane. The mucous membrane is well supplied with vessels, nerves, and lymphatics, and contains a considerable number of racemose glands resembling those of the oral cavity, as also numerous closed follicles, arranged around sacculi like those at the root of the tongue or in the tonsils.

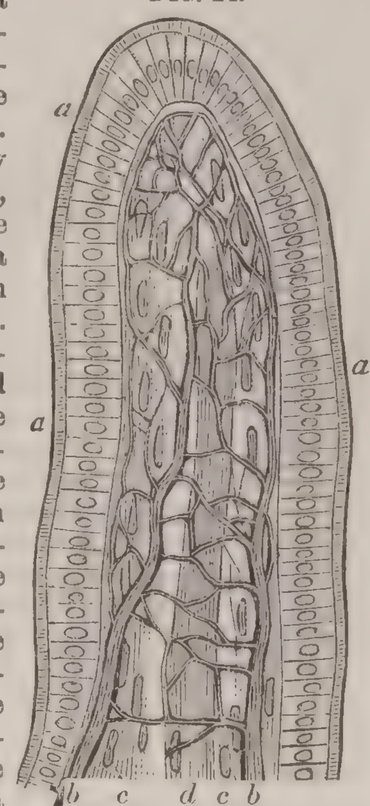
A laminated pavement epithelium, like that of the pharynx, also lines the *œsophagus* as far as the cardiac orifice of the stomach, where it terminates with a dentated border, and is replaced by the columnar epithelium of the stomach. This epithelium reposes upon a vascular layer of delicate connective tissue, the proper mucous membrane, which is separated from the more loosely meshed submucous connective tissue by a thin stratum of muscular fibre-cells, the muscle of the mucous membrane, which commences with a few scattered fibre-cells in the upper part of the œsophagus, and becomes a continuous layer farther down. A few small racemose glands lie in the submucosa and open by minute ducts on the mucous surface. The external muscular coat of the œsophagus consists of an internal circular and external longitudinal layer; in its upper fourth these are composed chiefly of striated muscular fibres, but contain also numerous bundles of muscular fibre-cells; in the next fourth the latter elements predominate; and in the lower half the muscular coat is wholly composed of them. Externally the muscular coat is invested by a sheath of fibrillated connective tissue.

The walls of the *stomach* consist of a mucous membrane, a layer of submucous connective tissue, a muscular coat, and the peritoneum. The epithelium of the mucous membrane consists of a single layer of nucleated columnar cells .0008″ in average length, among which occur certain peculiar cup-shaped elements, the so-called goblet-cells. Beneath the epithelium the mucous membrane is composed of a tissue designated adenoid by His, consisting of a delicate reticulum of branching cells, the meshes of which are filled with lymphoid elements, as in the lymphatic glands and follicles. In this adenoid tissue innumerable tubular glands, .015″ to .06″ long and .002″ to .003″ broad, are arranged perpendicularly to the mucous surface, and placed so closely side by side as to occupy more space than the intervening adenoid tissue. In the vicinity of the cardiac and pyloric orifices of the stomach these glands are lined throughout by a columnar epithelium similar to that of the surface of the mucous membrane. In the rest of the stomach this epithelium only lines the upper portion of the glands, the rest being filled with spheroidal granular elements, the so-called pepsin-cells. At the two extremities of the stomach some of the glands are divided at their fundus into two or more branches. The mucous membrane is separated from the submucosa by a stratum of muscular fibre-cells, on an average about .002″ thick, the muscle of the mucous membrane, or muscle of Brücke, consisting of an internal circular and external muscular layer. The submucosa is a layer of rather loose connective tissue, which unites the muscle of the mucous membrane to the external muscular coat. The latter is .02″ to .08″ thick, and consists most internally of a series of oblique fasciculi, next of a circular layer, and still more externally of a longitudinal layer, all composed of muscular fibre-cells. Lastly, the peritoneum, which has the structure of serous membranes generally, is united to the external muscular coat by a thin layer of subperitoneal connective tissue. The blood-vessels of the stomach ramify in the submucosa, and there form a network whence numerous small branches proceed to the mucous membrane, where they form a close capillary plexus around the tubular glands. The external muscular coat and the peritoneum are partly supplied by branches given off by the vessels as they pass through them, partly by branches derived from the submucous plexus. The nerves of the stomach form in the submucosa a plexus in which numerous small ganglia are found. A second plexus, also with numerous ganglia, exists between the circular and longitudinal layers of the external muscular coat. The ultimate relations of the nerves to the mucous membrane are yet uncertain. The lymphatics form three networks—one in the mucous membrane between the tubular glands, the second in the submucosa, the third to the peritoneum.

The description of the coats of the stomach just given

applies, with certain modifications, to both small and large *intestines*. The lining epithelium is similar throughout, as is the structure of the mucous membrane, except that the tubular glands, which in the intestines are called the glands or crypts of Lieberkühn, are shorter, .01″ to .02″ long, do not branch, and are lined throughout by columnar epithelium. What has been said of the muscle of the mucous membrane, the submucosa, the external muscular coat, the peritoneum, and the general distribution of blood-vessels, lymphatics, and nerves of the stomach, will apply with but little alteration to the intestinal canal. The more important points of difference are as follows: In the *small intestine* the mucous membrane, besides being thrown, on its upper portion especially, into numerous transverse folds, the valvulæ conniventes, presents a great number of conical elevations .008″ to .04″ long, the so-called villi. These consist of the adenoid tissue of the mucous membrane, and are coated externally by its cylindrical epithelium. Each contains a central lymph-sinus, which terminates either by a blind extremity or in a loop, and which is the commencement of the lacteals. Between this and the periphery of the villus lie the blood-vessels, consisting of one or more minute arteries which break up into a capillary network, the blood from which is collected by a small vein. Each villus also contains a number of longitudinally arranged muscular fibre-cells, which are continuous below with the muscle of the mucous membrane. The crypts of Lieberkühn open on the surface of the mucous membrane between the villi, and are so arranged that the deeper portions of those adjoining opposite sides of the bases of the villi appear as close together as the others. Lying partly in the mucous membrane, partly in the upper portion of the submucosa of the small intestine, there are a number of lymph-follicles, .015″ to .08″ in long diameter, which either occur singly (the solitary follicles), or are aggregated together in groups consisting of twenty or more follicles placed side by side (the patches of Peyer). These follicles are somewhat flask-shaped, their apices penetrating into the mucous membrane almost or quite to the epithelium, while their rounded bases lie in the submucosa. Their parenchyma resembles the adenoid tissue of the mucous membrane, with which it is continuous, except that the meshes of the reticulum in which the lymphoid elements lie are rather finer. They are surrounded by a vascular plexus which sends capillary branches into their parenchyma, and are partially enveloped inferiorly by rather wide lymph-sinuses. Immediately above each follicle the villi are absent. On the surface of the patches of Peyer, however, villi are found on the mucous membrane between the individual follicles. The solitary follicles are found in all parts of the small intestine; the patches of Peyer, on the other hand, occur chiefly in its lower portion, and especially in the ileum. In the upper part of the small intestine the submucosa contains a number of small racemose glands about .04″ in average diameter, the glands of Brunner, the ducts of which perforate the mucous membrane and open into the intestinal canal. The muscular coat of the small intestine is from .015″ to .02″ thick, and consists of an internal circular and external longitudinal layer; some oblique fasciculi exist also, chiefly in the duodenum. The lymphatics form a network on the mucous membrane which surrounds the crypts of Lieberkühn, and are continuous with the central lymph-sinuses of the villi and the coarser plexus in the submucosa. The peritoneum has its own plexus of lymphatics, as in the stomach. On account of the milky appearance of their contents during the digestion of fatty matters, the lymphatics of the intestinal mucous membrane and the mesenteric lymphatic trunks with which they communicate are known as lacteals. As in the stomach, there are in both small and large intestines two nervous plexuses provided with numerous ganglia; the first, situated in the submucosa, is known as the plexus of Meissner; the second, between the circular and longitudinal layers of the muscular coat, is the plexus of Auerbach. In the *large intestine* there are no villi; in other respects its mucous membrane closely resembles that of the small intestine, except that it is rather thicker, the crypts of Lieberkühn somewhat longer, and the muscle of the mucous membrane a little better developed. Solitary follicles rather larger than those of the small intestine, but otherwise resembling them, and having similar relations to the lymphatics, occur at intervals. The external longitudinal layer of the muscular coat is much thinner than the circular, except in three longitudinal bands, in which the two layers are of equal thickness, together measuring about .025″.

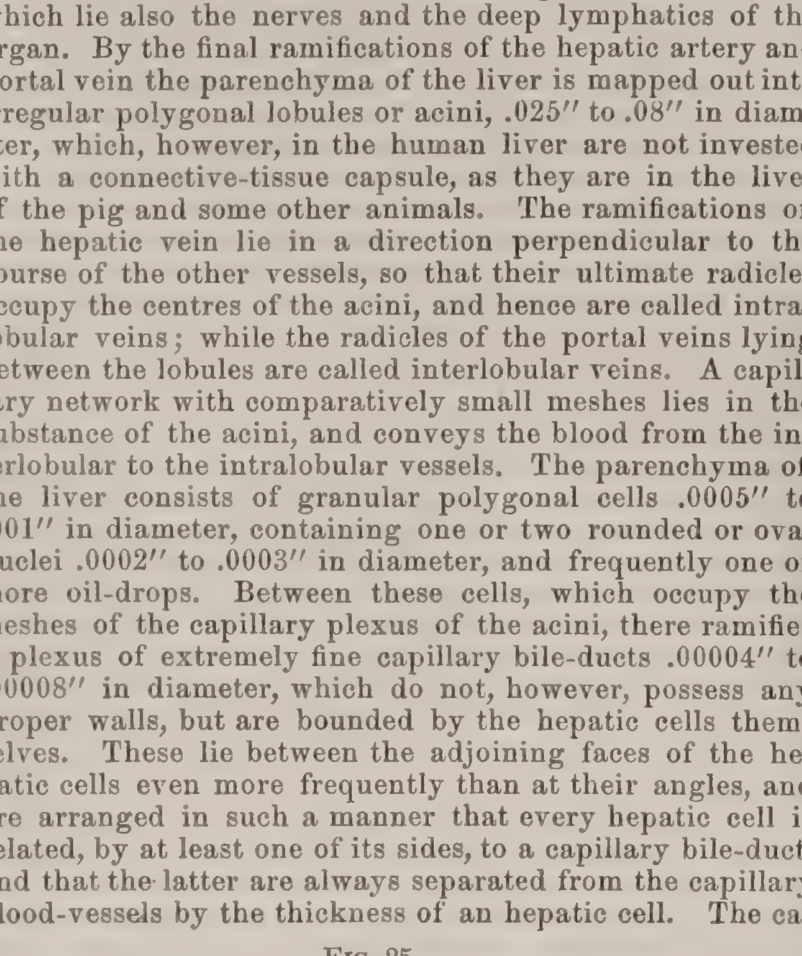
FIG. 24.



Intestinal villus: *a*, cylindrical epithelium; *b*, capillary blood-vessel; *c*, involuntary muscle-cells; *d*, central chyle radicle.

The Liver.—Two sets of blood-vessels enter the liver and ramify in it side by side—branches of the hepatic artery and of the portal vein. The blood from these is carried by a common system of capillaries into the radicles of the hepatic vein. The hepatic artery and portal vein are accompanied in their ramifications by the branches of the biliary duct, and the three are united together by a delicate connective tissue, the sheath or capsule of Glisson, in which lie also the nerves and the deep lymphatics of the organ. By the final ramifications of the hepatic artery and portal vein the parenchyma of the liver is mapped out into irregular polygonal lobules or acini, .025″ to .08″ in diameter, which, however, in the human liver are not invested with a connective-tissue capsule, as they are in the liver of the pig and some other animals. The ramifications of the hepatic vein lie in a direction perpendicular to the course of the other vessels, so that their ultimate radicles occupy the centres of the acini, and hence are called intralobular veins; while the radicles of the portal veins lying between the lobules are called interlobular veins. A capillary network with comparatively small meshes lies in the substance of the acini, and conveys the blood from the interlobular to the intralobular vessels. The parenchyma of the liver consists of granular polygonal cells .0005″ to .001″ in diameter, containing one or two rounded or oval nuclei .0002″ to .0003″ in diameter, and frequently one or more oil-drops. Between these cells, which occupy the meshes of the capillary plexus of the acini, there ramifies a plexus of extremely fine capillary bile-ducts .00004″ to .00008″ in diameter, which do not, however, possess any proper walls, but are bounded by the hepatic cells themselves. These lie between the adjoining faces of the hepatic cells even more frequently than at their angles, and are arranged in such a manner that every hepatic cell is related, by at least one of its sides, to a capillary bile-duct, and that the latter are always separated from the capillary blood-vessels by the thickness of an hepatic cell. The capillary bile-ducts open into the finest interlobular bile-ducts, which are passages channelled in the connective tissue accompanying the interlobular vessels, and lined by a single layer of polygonal cells. The larger ducts are lined by a columnar epithelium, and have a wall of connective tissue which becomes thicker as the tubes increase in diameter. In this wall numerous racemose mucous glands are imbedded, the excretory canals of which open into the bile-ducts. The liver is coated externally by a very thin capsule of connective tissue, and this again is covered, over the greater part of the surface of the organ, by the peritoneum. In the peritoneum and the subjacent connective tissue lies an abundant plexus of superficial lymphatics. The deep lymphatics, which penetrate the substance of the organ, lie in the capsule of Glisson, as has already been mentioned. The nerves of the liver are composed chiefly of non-medullated, with a few medullated, fibres. They enter the liver with the portal vein, and for the most part accompany its branches. They have not been traced into the substance of the acini, and their relations to the hepatic cells remain undetermined.

FIG. 25.



Liver of rabbit: 1, part of a lobule—*a*, vena hepatica; *b*, portal twig; *c*, bile-ducts; *d*, capillaries of portal vein; *e*, bile-capillaries. 2, *a*, portal blood-capillaries; *b*, bile-capillaries. 3, *a*, bile-capillaries; *b*, hepatic cells; *c*, bile-ducts; *d*, capillary blood-vessel.

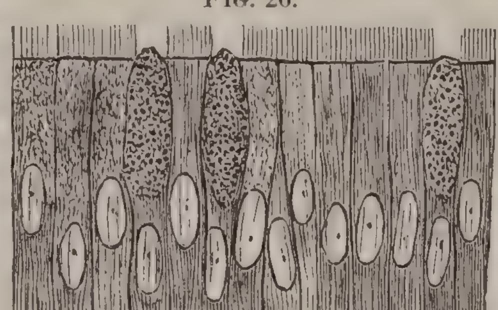
The *gall-bladder* is lined throughout by a single layer of columnar epithelial cells, supported upon a membrane

of connective tissue, in which there are numerous decussatory fasciculi of muscular fibre-cells. Externally, it is in part coated by the peritoneum, in part comes into immediate contact with the hepatic tissue.

The *pancreas* agrees in its structure with the salivary glands so closely that no separate description of it need be given.

The Respiratory Organs.—The cartilages of the *larynx* are all of the hyaline variety, except the epiglottis and the cartilages of Wrisberg and Sanctorini, which are composed of fibro-cartilage. The muscles are of the striated variety. The interior of the larynx is lined by a mucous membrane connected with the cartilages, ligaments, and muscles by a layer of submucous connective tissue. The epithelium of the mucous membrane on the anterior surface of the epiglottis resembles that of the oral cavity, but at its borders the superficial layers of cells become fewer and fewer, the cells of the deep columnar layer longer and longer, and a transition is thus effected on the posterior surface of the epiglottis into the ciliated epithelium which lines the larynx, and is continued through the trachea into the bronchial tubes. The ciliated epithelium consists of a layer of columnar cells .001″ to .0016″ long, attached to the mucous membrane by narrow elongated prolongations, while on their free margins they are provided with a number of thread-like processes about .00015″ long (the cilia), which during life keep up a constant waving motion. Between the attached extremities of the ciliated cells are numerous smaller round and oval cells. The true vocal cords are ligaments composed chiefly of yellow elastic tissue, which lie in folds of the mucous membrane, on the surface of which the ciliated epithelium is replaced with a layer of pavement cells. A number of small racemose glands are found in the submucous connective tissue of the larynx, and open by their ducts upon the free surface of its mucous membrane. Similar glands occur abundantly in the trachea, which is lined by a mucous membrane in all respects resembling that of the larynx. The rings of the trachea are composed of hyaline cartilage, and are united together by a mixture of connective tissue and elastic fibres. Posteriorly, the rings are incomplete, the spaces thus left being occupied by a layer of transverse muscular fibre-cells.

FIG. 26.



Epithelium of bronchial tubes.

The Lungs.—On entering the lungs the bronchial tubes branch in an arborescent manner, and finally terminate, when about .01″ in diameter, in groups of infundibula, or funnel-shaped terminal expansions, each consisting of a number of polygonal cavities, the air-vessels or alveoli, which open into the central passage of the infundibulum. The infundibula of each group are connected with the small bronchial tube to which they belong by thin walled passages, the alveolar canals, which differ from the finest bronchial tubes chiefly in the character of their epithelium, and in having their walls beset by air-vesicles which open into them. Down to about .04″ in diameter the bronchial tubes consist of four layers—an external fibrous coat in which are imbedded a series of incomplete rings and plates of hyaline cartilage; a thin layer of muscular fibre-cells; an internal fibrous coat rich in elastic fibres; and lastly, an epithelium similar to that of the trachea. Scattered groups of fat-cells lie in the outer portion of the external fibrous coat; in its inner portion there are a number of racemose mucous glands, the ducts of which open into the lumen of the tube. In bronchial tubes of less than .04″ in diameter the external fibrous coat becomes thinner and thinner; the plates of cartilage and the mucous glands become more and more scanty, and finally disappear, and the muscular layer is gradually reduced to a few scattered fasciculi; the elastic inner fibrous coat is, however, prolonged upon the finest bronchial tubes, and is continuous with the elastic walls of the alveoli. The ciliated epithelium also continues in the smallest bronchial tubes, but its cells become shorter and shorter, and finally, at the transition from the bronchial tubes to the alveolar canals, lose their cilia and acquire the characters of the epithelial lining of the alveoli. The bronchial tubes are nourished by branches of the bronchial artery which supply the mucous membrane with a close capillary plexus. Their walls also contain numerous nerves and lymphatics. The air-vesicles, when undistended, measure from .006″ to .01″ in diameter, but can be blown up to twice these dimensions, or even more. Their walls are composed of a transparent connective tissue in which characteristically arching elastic fibres are plentifully imbedded, and in which the capillaries derived from the pulmonary arteries form a close plexus with rounded or oval meshes. They are lined at birth by a layer of flat granular, nucleated hexagonal epithelial cells, which form a continuous lining for both the air-vesicles and the alveolar passages. In the adult only a part of the cells retain these characters, the rest being transformed into thin structureless plates. This epithelium, the existence of which has been a matter of dispute until quite recently, is best demonstrated by the silver method. The adjacent elastic walls of air-vesicles belonging to the same infundibulum coalesce to form a single septum. The walls of adjacent vesicles belonging to different infundibula are for the most part separated by a small quantity of interstitial connective tissue. The whole lung is made up of the bronchia and infundibula described, with blood-vessels, nerves, and lymphatics, united together by connective tissue. The nerves for the most part accompany the bronchial tubes and blood-vessels, and are largely distributed to their muscular fibre-cells. The lymphatics commence as anastomosing lacunæ in the walls of the air-vesicles, whence proceed lymphatic capillaries, which unite to form trunks accompanying the bronchial tubes and the larger blood-vessels. There is, besides, an abundant superficial lymphatic network which lies just beneath the pleura.

FIG. 27.

Epithelium of air-cell of lung.

Urinary Organs.—The *kidney* consists essentially of a great number of secreting tubes lined by epithelium, the tubuli uriniferi. These, with the blood-vessels, nerves, and lymphatics of the organ, are united together by a characteristic connective tissue composed of a nearly homogeneous matrix with stellate cells. The tubuli uriniferi com-

FIG. 28.

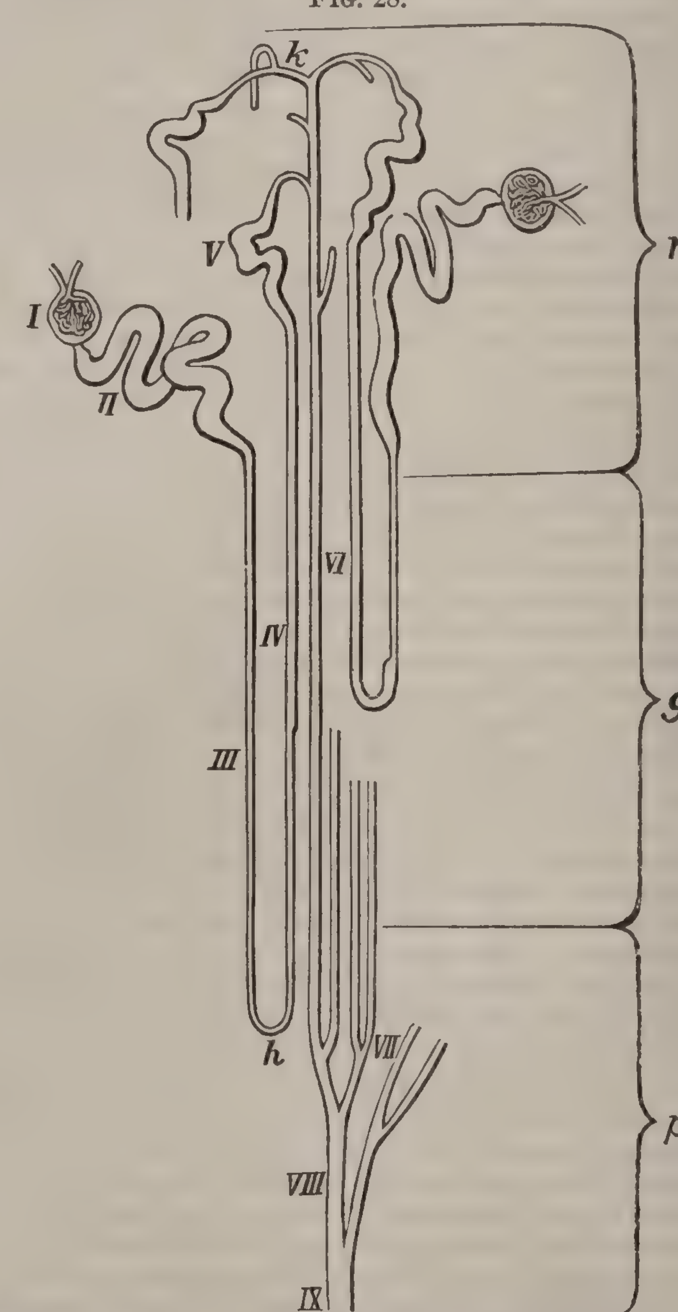
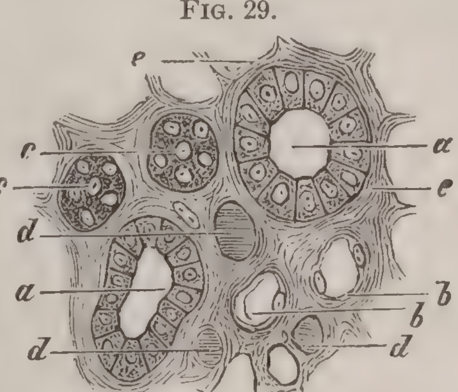


Diagram of course of uriniferous tubes in human kidney: *p*, papillary portion; *g*, boundary portion of medulla; *r*, cortex; I., capsule of glomerulus; II., convoluted tubes; III., descending limb of Henle's looped tube; *h*, loop; IV., ascending limb; V., intercalated portion; *k*, summit of collecting tube; VI., VII., VIII., collecting tubes; IX., papillary duct.

mence in the cortical portion of the organ as globular expansions, the capsules of Bowman, which embrace peculiar tufts of capillaries, the glomeruli of Malpighi. These, which are usually from .005″ to .008″ in diameter, consist of a number of capillary loops united together by connective tissue. The capsules of Bowman, which embrace them, are lined by a layer of large pavement epithelial cells, best demonstrated by the action of silver, and are continuous by constricted necks with the uriniferous tubes. Each uriniferous tube, which at first is about .002″ in average diameter, pursues for a short distance a very tortuous course; it then rather suddenly diminishes in size to half its original diameter, or less, and runs in nearly a straight line into the base of the nearest pyramid, in which, at a variable depth, it turns back upon itself, forming a narrow loop (the loop of Henle), and returns to the cortical portion, where, after a time, it again becomes wide and tortuous, then again constricted, and finally unites with one or more tubuli which have pursued a similar course to form a straight collecting tube. This collecting tube runs towards the pyramid, receiving at first a few additional tubuli, after which it pursues a separate course into the base of the pyramid, where adjacent collecting tubes coalesce in pairs; so that the number of passages which finally open at the apex of each pyramid is very much smaller than the original number of tubuli. When sections of the kidney are examined by the naked eye, a number of striæ (medullary rays) are seen proceeding from the bases of the pyramids almost to the surface of the cortical portion. These consist in part of bundles of the straight collecting tubes, in part of the straight narrow portions of tubuli, returning after having formed the loops of Henle. The glomeruli and the convoluted part of the tubuli lie in the parenchyma between these medullary rays. The walls of the tubuli uriniferi consist of a transparent nucleated membrane lined by a single layer of epithelial cells. These consist, in the first tortuous portion of the tubuli, of a granular protoplasm, without distinct cell-walls, and contain single, spherical, sharply-defined nuclei. In the narrow part of the tubuli, forming the loop of Henle, the epithelium appears as an attenuated layer of protoplasm, with swellings containing nuclei at intervals. On the other side of the loop the cells assume more of a columnar character, and being inclined to the axis of the tubuli, present an imbricated arrangement. When the tube again becomes tortuous the epithelium again assumes the character it possessed in the first tortuous portion, and finally, the collecting tubes are lined by a single layer of well-defined columnar epithelial cells.

The renal arteries divide in the pelvis of the *kidney* into a number of branches, which, on reaching the bases of the pyramids, ramify between these and the cortical portion of the organ, and send into the latter a series of straight twigs, the arteriæ interlobulares. These give off a number of short side-branches, each of which supports a glomerulus on its extremity. The efferent vein of each glomerulus, after leaving it, speedily breaks up into a capillary plexus continuous with that formed by adjacent efferent veins, and which surrounds the convoluted portions of the tubuli uriniferi. The venous radicles which collect the blood from this plexus open into the veins which accompany the interlobular arteries. In the medullary portion of the kidneys the capillary network which surrounds the uriniferous tubules is derived from a series of straight vessels, the so-called arteriæ rectæ, which in part arise from the arterial branches ramifying between the cortical substance and the bases of the pyramids; in part are not arteries at all, but the unusually prolonged efferent veins of the glomeruli adjacent to the bases of the pyramids. A superficial plexus of lymphatics is situated in the fibrous capsules of the kidneys. The deep lymphatics accompany the larger blood-vessels; their ultimate relations to the parenchyma of the organ are not yet known. The same remark applies to the nerves of the kidneys, which also accompany the vessels. A number of small ganglia occur in connection with these nerves.

Fig. 29.



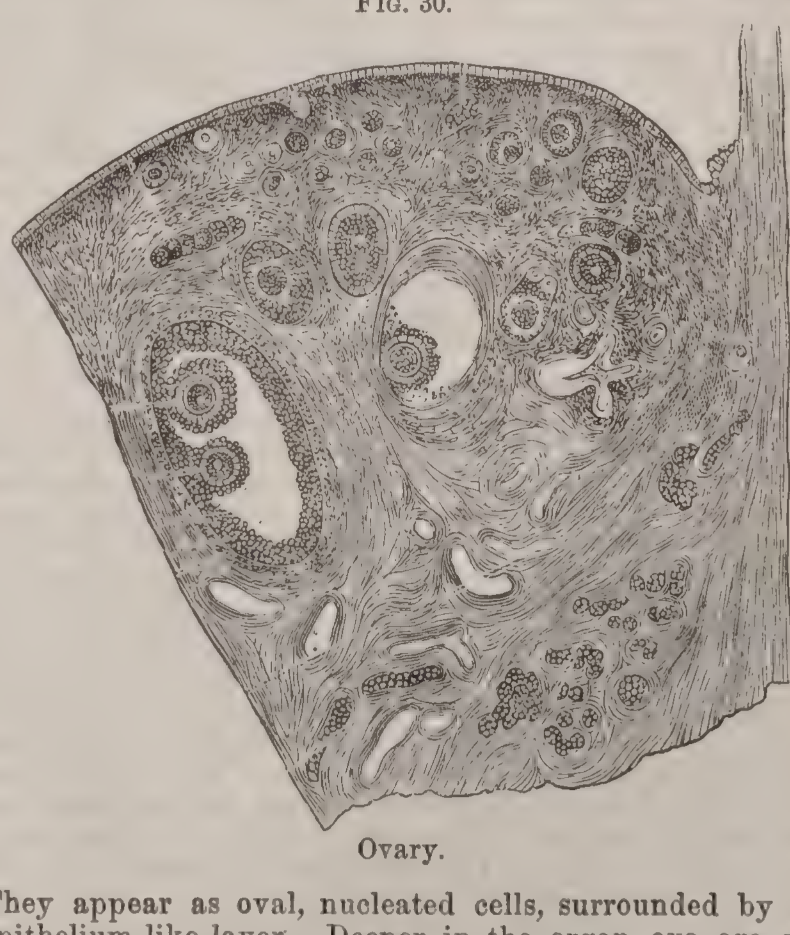
Transverse section through a renal pyramid: *a*, collecting tube; *b*, descending arm of looped tube; *c*, recurrent arm; *d*, blood-vessel; *e*, connective tissue.

The *ureters* and *urinary bladder* are lined by an epithelium consisting of several layers of cells. The most superficial are polygonal and somewhat flattened; to these succeed a layer of elongated cells, the upper extremities of which are rather broad, while the lower portions are prolonged into narrow processes, between which is a third layer of oval cells. This epithelium rests on a layer of rather dense connective tissue, beneath which is the muscular coat composed of muscular fibre-cells. Externally to this is a second layer of connective tissue. The fundus of the bladder is, besides, coated by the peritoneum.

Generative Organs.—The space assigned to this article permits only a brief sketch of the most characteristic organ of each sex. The *testicle* consists essentially of a number of secreting tubes lined by epithelium, the tubuli seminiferi. The organ is enclosed in a dense capsule of connective tissue, the tunica albuginea, from the inner surface of which a number of septæ proceed, dividing the gland into pear-shaped lobules 100 to 250 in number, each containing one to three convoluted tubuli seminiferi. These unite in the corpus Highmori, and form a network whence proceed twelve to fourteen canals, the convolutions of which constitute the epididymis. In the epididymis these canals unite and form finally a single excretory duct, the vas deferens. The tubuli seminiferi in the lobules are .008″ in average diameter, and consist of a membrana propria, lined by secretory cells. The membrana propria is composed of homogeneous connective tissue with numerous nuclei imbedded. On its inner surface is a layer of nucleated cells with branching, anastomosing protoplasmic processes. To these succeed several layers of rounded cells with one or several nuclei, which, in fresh preparations, exhibit amœboid movements. These are the so-called seminal cells, and it is in their interior that the spermatozoa are developed. The testicles are abundantly supplied with blood-vessels, lymphatics, and nerves. The lymphatics originate in wide passages between the tubuli seminiferi, lined by a characteristic epithelium, which forms a partial coating for the tubuli, and which is best demonstrated by the action of silver. The terminal branches of the nerves, according to Letzerich, can be traced through the membrana propria of the tubuli, and terminate between it and the first row of cells. The spermatozoa, which are the characteristic elements of the seminal fluid, are, in the human subject, about .0016″ in average length, and have the form of thread-like filaments, enlarged at one extremity into an oval head .00015″ to .0002″ long.

The *ovary* consists of a stroma of vascular connective tissue in which are imbedded numerous cyst-like formations of various sizes, the Graafian follicles, containing the ova in various stages of development. The portion of the ovary which projects into the peritoneal cavity is not covered by the peritoneum, but by a layer of columnar cells, the so-called germ-epithelium. All the Graafian follicles, and the ova which they contain, are developed from ingrowing buds of this epithelium, which invade the connective-tissue stroma as gland-like tubules. A portion of the epithelial cells of these tubules are transformed into ova, while the remainder retain their epithelial character. The ova are subsequently isolated by the ingrowing of the connective-tissue stroma between the epithelial cells. Thin sections of the adult ovary show great numbers of the most unripe ova immediately beneath the surface of the organ.

Fig. 30.



Ovary.

They appear as oval, nucleated cells, surrounded by an epithelium-like layer. Deeper in the organ ova are encountered in a more advanced stage of development, surrounded by an epithelial layer of several rows of cells. Finally, fluid accumulates between these cells, and the follicles then rapidly increase in size. The total number of

Graafian follicles, in all stages of development, contained in a young ovary has been variously estimated from 36,000 to 400,000. The fully-formed Graafian follicles are from .02″ to .25″ in diameter. They consist of a tunica propria of connective tissue, which is merely a condensation of the ovarian stroma, lined by several strata of nucleated epithelium-like cells—the epithelium of the follicle or the membrana granulosa—and filled with a transparent albuminous fluid. The elements of the epithelium of the follicles are accumulated at some one point into a little mass—the discus proligerus—in which the ovum is imbedded. Where a single follicle contains two or more ova, as occasionally happens in man, and very generally in Mammalia, there is a proligerous disk for each.

The human ovum, when fully developed, is a round or slightly oval vesicle. 008″ to .01″ in diameter. Its investing membrane exhibits distinct double contours, and is known as the zona pellucida; this encloses a granular protoplasm, the vitellus or yelk, in which is imbedded a distinct round nucleus .0016″ in average diameter (the germinal vesicle), and this again presents a round prominent nucleolus—the germinal spot. The ovum of man and mammals differs from the eggs of birds and reptiles in that in these an ovum similar to that of the Mammalia is surrounded by a quantity of secondary yelk, as well as by additional layers acquired during its passage through the oviducts. As fluid continues to accumulate in the cavity of the ripe Graafian follicle, it approaches more and more to the surface of the ovary, until finally it ruptures and permits the ovum to escape. This is followed by hæmorrhage from the vascular walls of the follicle, which is speedily filled with coagulated blood; numbers of white corpuscles soon migrate into the clot, and a retrograde metamorphosis of its constituents takes place, by which it acquires a yellow color, and is then known as the corpus luteum. Subsequently, connective tissue is developed in the substance of the corpus luteum, which becomes smaller and smaller until finally a mere cicatrix remains.

Organs of Special Sense.—A brief account of the special nerve-terminations in the organs of touch and taste has already been given. We recognize as the essential organs of *smell* certain nerve-terminations in the nasal mucous membrane. This mucous membrane is coated for the most part by a ciliated epithelium, closely resembling that of the respiratory organs; but in the proper olfactory region, which is limited to the uppermost part of the nasal cavities, extending downward three-quarters of an inch to an inch from the cribriform plate of the ethmoid bone, the cilia disappear, and a columnar epithelium remains, between the cells of which the proper olfactory cells appear in considerable numbers. These are oval, nucleated cells, the two extremities of which are prolonged as delicate filaments. One of these runs between the columnar cells of the epithelium to the surface, where it terminates in a free extremity, which gives off in most animals several fine, cilia-like projections; the other runs towards the connective-tissue layer of the mucous membrane, where it is believed, though not demonstrated, to be continuous with the terminal fibrils of the non-medullated fibres of the olfactory nerve. According to Max Schultze, the ciliar projections of the superficial extremities of the olfactory cells do not occur in man.

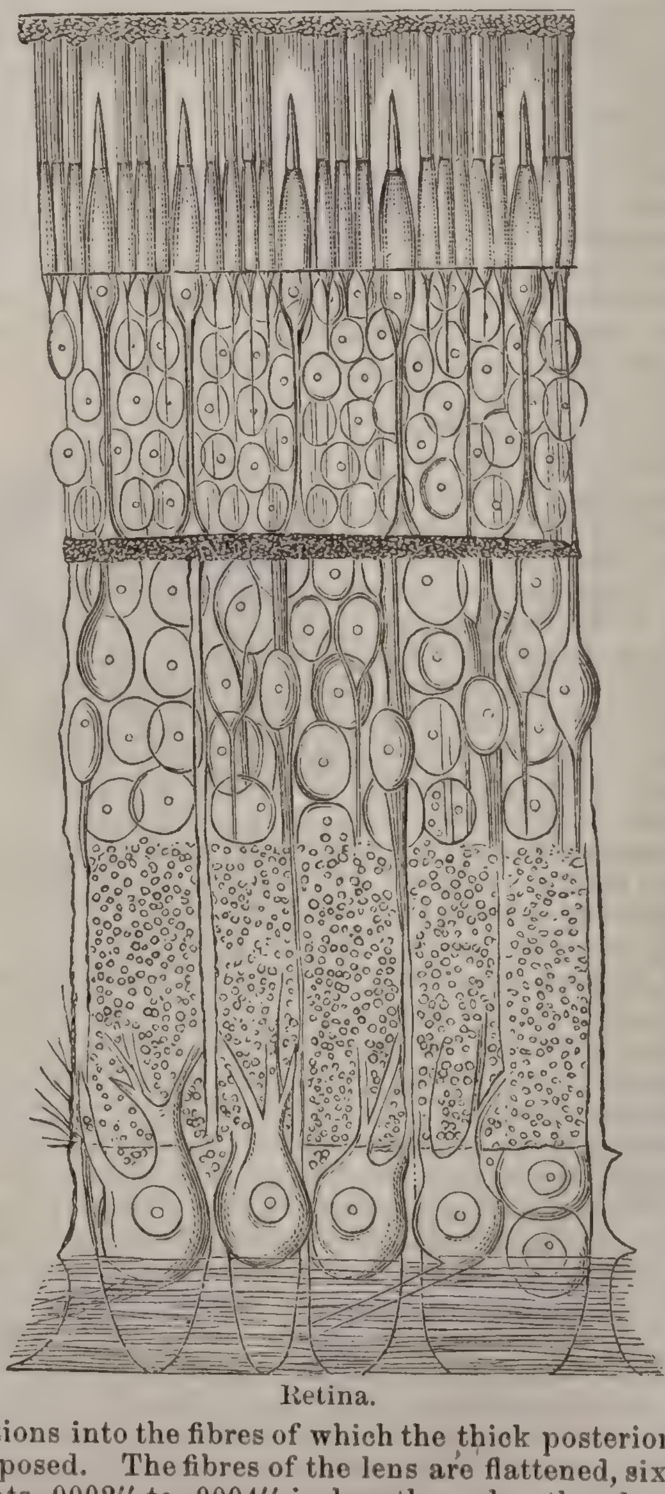
In the case of the *eye* our space permits only brief descriptions of the cornea, the crystalline lens, and the retina. The *cornea* substance proper is composed of connective tissue with stellate cells and a homogeneous matrix. It is coated anteriorly with a laminated pavement epithelium, which consists of a stratum of columnar cells, several layers of rounded or polygonal cells, and several layers of flattened cells; posteriorly it is coated by the membrane of Descemet, which is a single layer of flattened cells. The stellate cells of the proper substance of the cornea are designated corneal corpuscles. They are granular, flattened cells about .001″ in long diameter, containing rounded, oval, or irregular nuclei .0004″ to .0006″ or more long. Each gives off a variable number of protoplasmic processes which anastomose with those of the adjacent cells. Besides these fixed cells, a certain number of wandering corpuscles are always present, and from the motions of these, as observed in recent corneæ, the existence of a series of passages or channels in the matrix may be inferred. The corneal corpuscles are not visible in perfectly fresh corneæ, but become so after the lapse of a short time. They may be displayed in an admirable manner by immersing the cornea in a solution of chloride of gold, and subsequently exposing it to light. The protoplasm of the cells and the nuclei are thus stained different shades of purple by the reduction of the gold, while the matrix remains uncolored or only slightly tinged. When the cornea is soaked in a solution of nitrate of silver and exposed to sunlight, the matrix is stained brown, and a series of light-colored, stellate, anastomosing figures make their appearance, which agree in distribution with the corneal corpuscles, but are rather larger, and have thicker, more varicose processes. These represent the serous canals of the matrix, in which

Fig. 31.

Nerves of cornea and corpuscles.

the corneal corpuscles lie, as may be shown by the subsequent action of chloride of gold or of carmine. The cornea is richly supplied with nerves, best demonstrated by the action of gold, which gives them a dark purple color. Twenty or thirty medullated nerve-fibres enter at its margin, and soon lose their medullary sheaths, while the axis-cylinders break up into fasciculi composed of a number of ultimate fibrils, with oval nuclei scattered along their course. These fasciculi branch and anastomose, forming a rich plexus in the corneal substance, and finally break up into ultimate nerve-fibrils, the extremities of which penetrate between the epithelial cells on the anterior face of the cornea, and terminate by giving off laterally, among the most superficial flattened cells of the epithelium, a number of fine terminal branches, which, having divided once or several times, terminate in somewhat swollen extremities. The *crystalline lens* consists of an extremely thin anterior and a thick posterior layer. The first is composed of a single stratum of flattened, polygonal, nucleated cells, which towards the margins of the lens become more and more elongated, and finally, at its equator, pass by gradual

Fig. 32.



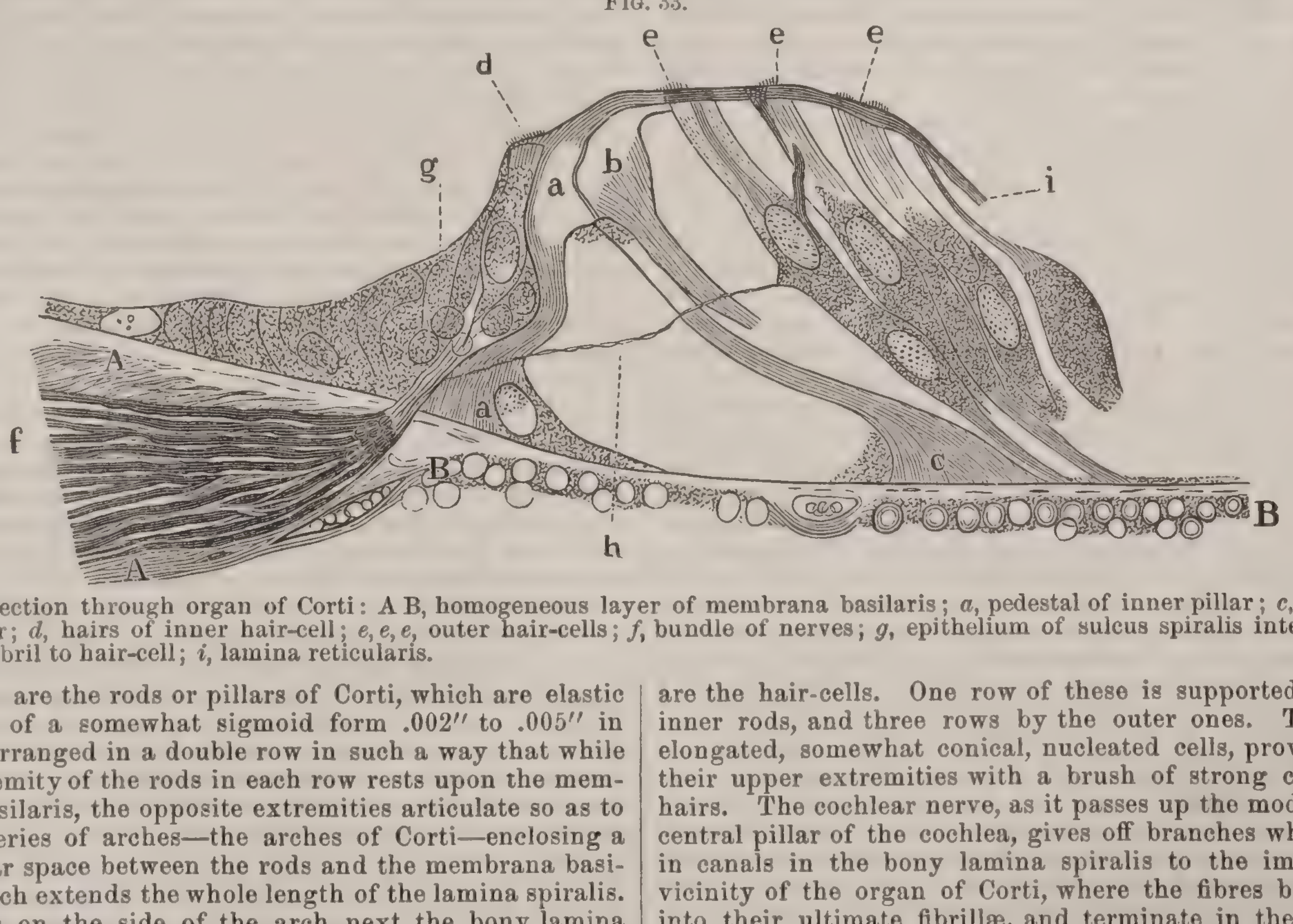
Retina.

transitions into the fibres of which the thick posterior layer is composed. The fibres of the lens are flattened, six-sided elements .0002″ to .0004″ in breath, and rather less than

half as thick, and unite to form curved lamellæ which cover each other concentrically, somewhat like the coats of an onion. In these lamellæ a stellate raphé, radiating from the axis of the lens, is observed both anteriorly and posteriorly, which marks the commencement and termination of the individual fibres. In the deeper strata of the human lens this raphé presents but three rays; more superficially their number increases to as many as nine anteriorly and ten or more posteriorly. In these rays the opposite extremities of the individual fibres come into immediate juxtaposition, and are not separated by a homogeneous transparent substance, as was formerly believed. The lens is developed from an ingrowing bud of the epidermis of the embryo, and its fibres are to be regarded as greatly elongated epithelial cells. It is enclosed in a transparent, apparently structureless capsule. The *retina* is composed of the special terminal elements of the optic nerve, united together by delicate connective tissue, the whole forming a layer .008″ thick in its posterior portion, and less than half as thick anteriorly. Its intricate structure has been the object of many investigations, of which those of Max Schultze are most noteworthy. According to this investigator, the following layers of elements may be discriminated: (1) Most internally the membrana limitans interna, a delicate layer of connective tissue which immediately adjoins the vitreous humor. (2) The optic fibre-layer, composed of non-medullated nerve-fibres of various sizes, continuous with the medullated fibres of the optic nerve. (3) The ganglion cell-layer, in which are imbedded numerous nucleated, for the most part multipolar, nerve-cells .0006″ to .0012″ in diameter. (4) The internal molecular layer, consisting of an admixture of extremely fine nerve-fibrils and delicate connective tissue. (5) The internal granular layer, composed of two kinds of elements, the first and most numerous resembling small bipolar nerve-cells with relatively large nuclei and scanty granular protoplasm; the second are oval, nuclear bodies, belonging to the supporting connective tissue. (6) The external molecular layer or intergranule layer, which is similar in its structure to the internal molecular layer, but much thinner. (7) The external granular layer, in which are numerous oval nucleated bodies, situated in the lower portion of the rod and cone fibres, and scattered oval nuclei belonging to the supporting connective tissue. (8) The membrana limitans externa, an extremely thin layer formed by a condensation of the supporting connective tissue. (9) The layer of rods and cones. This consists of two kinds of fibres. Each cone-fibre appears to commence on the surface of the external molecular layer as a conical enlargement, speedily tapering to a fine smooth or varicose fibre, which runs in a radial direction through the external granular layer, and just before it reaches the membrana limitans externa presents a fusiform enlargement in which an oval nucleus is imbedded; it then penetrates the limiting membrane and forms the cone, a flask-like body which terminates in a conical point. The rod-fibres also can be traced only as far as the external molecular layer. In the external granule-layer they each present one or several oval nucleated enlargements, after which, penetrating the limiting membrane, they form the rods, which are cylindrical bodies .002″ in average length and .0001″ or less in thickness, and consist of an inner and outer portion, of which the latter is more highly refractive than the former. The cones are rather more than half as long as the rods, and their bases three to four times as thick. As a rule, three or four rods intervene between each pair of cones. (10) The last layer enumerated by Max Schultze is the pigment-layer. It is usually known as the pigment epithelium of the choroid, and consists of hexagonal elements containing the brownish-black pigment in the form of granules. The delicacy of the retina and the intricacy of its structure are such that the connections of the nervous elements in its several layers with each other have not fully been made out; but it is known that the non-medullated fibres of the optic fibre-layer are continuous with the cells of the ganglion cell-layer, and it may be conjectured with probability that the fine fibrils in which the processes of these terminate are continuous through the remaining layer with the bases of the rod and cone fibres.

In connection with the *ear*, space permits only a brief mention of the *organ of Corti*, which appears to be to the sense of hearing what the retina is to the sense of sight. The spiral canal of the cochlea is nearly divided in two by a thin plate of bone, the lamina spiralis. From the edge of this lamina two membranes proceed to the walls of the cochlear canal, which is thus divided into three passages—the scala vestibuli, the central canal of the cochlea, and the scala tympani. The membrane which divides the scala vestibuli from the central canal of the cochlea is extremely delicate, and is known as the membrane of Reissner. That which divides the central canal from the scala tympani is known as the membrana lamina spiralis, and is much thicker, consisting on the side of the scala tympani of the membrana basilaris, on the side of the central canal of the membrana tectoria, and between the two of the organ of Corti. The most remarkable elements in this complex

FIG. 33.



Vertical section through organ of Corti: A B, homogeneous layer of membrana basilaris; *a*, pedestal of inner pillar; *c*, pedestal of pillar; *d*, hairs of inner hair-cell; *e, e, e*, outer hair-cells; *f*, bundle of nerves; *g*, epithelium of sulcus spiralis internus; *h*, nerve-fibril to hair-cell; *i*, lamina reticularis.

structure are the rods or pillars of Corti, which are elastic elements of a somewhat sigmoid form .002″ to .005″ in length, arranged in a double row in such a way that while one extremity of the rods in each row rests upon the membrana basilaris, the opposite extremities articulate so as to form a series of arches—the arches of Corti—enclosing a triangular space between the rods and the membrana basilaris, which extends the whole length of the lamina spiralis. The rods on the side of the arch next the bony lamina spiralis are spoken of as the inner rods, the opposite ones as the outer rods; they are so arranged that three inner rods correspond to every pair of outer ones. Their total number has been estimated at about 5200 inner and 3500 outer rods. According to Pritchard, they progressively increase in length from the base of the cochlea to its apex, the differences being more marked in the outer than in the inner rods. The arches of Corti support on each side a complex arrangement of cells, of which the most conspicuous are the hair-cells. One row of these is supported by the inner rods, and three rows by the outer ones. They are elongated, somewhat conical, nucleated cells, provided at their upper extremities with a brush of strong cilia-like hairs. The cochlear nerve, as it passes up the modiolus or central pillar of the cochlea, gives off branches which run in canals in the bony lamina spiralis to the immediate vicinity of the organ of Corti, where the fibres break up into their ultimate fibrillæ, and terminate in these hair-cells. Besides the termination of the cochlear nerve in the organ of Corti, special terminations of the fibres of the auditory nerve in peculiar fusiform cells, with thread-like extremities, exist in the membranous labyrinth.

The foregoing outline, which is necessarily extremely meagre, will, however, it is hoped, serve to give the reader accurate elementary ideas with regard to normal human histology. It now remains to offer a few remarks on pathological histology.

Pathological Histology.—In this domain we have to study, on the one hand, the changes which take place in the normal histological elements of the tissues; on the other hand, the development of new pathological elements which either occur diffused among the normal ones in the form of infiltrations, or are localized as morbid growths. Among the morbid changes in the normal elements we may enumerate—*cloudy swelling*, which takes place especially in the early stages of inflammation, and in which the elements increase in size and become more granular than normal; *fatty degeneration*, which may arise independently or occur as a sequel to cloudy swelling, and in which a portion of the substance of the affected elements is transformed into molecular fat or into minute fat-drops; *mucoid degeneration*, in which a portion of their substance is transformed into a material possessing the reactions of mucin; and *colloid degeneration*, in which a portion of their substance is transformed into globules of a peculiar gelatinous character. To the foregoing changes may be added those which result from the infiltration of the tissue-elements with various substances derived from the blood especially: *calcareous infiltration*, in which lime-salts are deposited in minute molecules; *pigment infiltration*, in which pigment-granules are deposited; *fatty infiltration*, which closely resembles fatty degeneration in its appearances; and the so-called *amyloid infiltration*, in which the affected elements are infiltrated with a peculiar transparent albuminoid substance, characterized by acquiring a mahogany-red color on treatment with iodine. This latter change has also been designated as lardaceous or waxy degeneration. Any of these degenerations and infiltrations may occur also in pathological new formations, as well as in the normal tissues.

The production of the pathological new formations is frequently initiated by those nutritive and circulatory disturbances which are embraced under the designation *inflammation*. When this process takes place in a vascular tissue a notable dilatation of the small arteries and veins occurs, which is usually preceded by their temporary contraction, and is followed by a diminution in the speed of the blood-stream, and an accumulation of white blood-corpuscles in the peripheral portion of the stream in the small veins. Soon after, as demonstrated by Cohnheim, the white corpuscles begin to migrate in considerable numbers, escaping not only from the small veins, but also from the true capillaries. In the inflammation of non-vascular parts a similar migration takes place from the nearest blood-vessels—in the case of the inflamed cornea, for example, from the blood-vessels of the sclerotic and conjunctiva. A portion, at least, of the cellular elements of the characteristic products of inflammation, pus and lymph, are simply these migrated corpuscles. Whether all of them have the same origin is still a matter of discussion. It was formerly believed that in inflammation the elements of the tissues, especially as indicated by Virchow, the connective-tissue corpuscles, multiplied by division, and thus gave rise to the pus and lymph cells as their progeny. The analogies of vegetable growth, and much that had been observed of the growth of animal tissue, favored this view. Unfortunately, however, the swarm of white corpuscles migrate so early in inflammation that the proper tissue-elements are speedily concealed by them, and it is difficult to trace with precision the changes they undergo. Stricker and Norris, however, have described appearances in the inflamed cornea which would seem to indicate that the wandering corpuscles may originate by the division of the fixed cells, as well as by migration from the blood-vessels. Whether by thus dividing and producing new elements, or by falling into a condition of fatty degeneration and perishing, the proper tissue-elements of the inflamed part *may* disappear, and be replaced by an accumulation of pus, forming an *abscess*; or when the affected tissue is superficially situated, the loss of substance may manifest itself as an *ulcer*. In other cases the inflammation terminates in *resolution*, the migrated corpuscles finding their way back into the torrent of the circulation through the lymphatics; or the inflammatory products may *organize* into new tissue. This at first resembles embryonic connective tissue, and is subsequently transformed into fully-developed connective tissue by a process in all respects similar to that which occurs in normal development, and which is accompanied by an outgrowth of blood-vessels, lymphatics, and sometimes of nerves, from the adjacent parts into the new tissue. Other new formations may occur under favorable circumstances; as, for example, epithelium may be developed out of the lymph-cells on the surface of healing wounds and ulcers; bone may be produced, as in the repair of fractures; in inflammatory processes involving the periosteum, etc. etc. By these various transformations of the inflammatory products, on the one hand, the repair of wounds and other losses of substance is effected, and on the other hand, the adhesions, indurations, and thickenings which result from inflammation are produced. Moreover, degenerative changes may involve the new-formed tissue at any stage of its development. Fatty degeneration is especially frequent. It is prone to set in before the new elements have lost their original lymphoid character, and often goes so far as to convert the new formation into a cheesy mass of granular detritus, in which shrunken and deformed nuclei are all that remain of the original cell-forms.

Besides the pathological new formations which result from the inflammatory process, manifold new formations occur without previous inflammation, appearing sometimes as more or less extensive infiltrations, at other times as isolated masses or tumors. With regard to these also it is undecided how far the new elements originate by the transformation of migrated white corpuscles, or how far they may arise by the multiplication by division of the normal elements of the affected parts. The more important of these new formations are the following.

New Formations resembling Connective Tissue in some Stages of its Development.—These may occur as a more or less widely disseminated increase or hyperplasia of the connective tissue of the part affected—as, for example, in certain chronic diseases of the liver and kidneys, in the peculiar thickening of the skin and subcutaneous tissue known as elephantiasis, etc.—or they may manifest themselves as tumors. The group of tumors which resemble in their structure the embryonic stages of connective tissue is designated *sarcoma*, and several varieties are discriminated, according to the stage of development the cells have attained, their arrangement, and the characteristics of the matrix in which they are imbedded. According as the cells are round or elongated, a *round-celled sarcoma* and a *spindle-celled sarcoma* may be discriminated, and each of these again may be divided into a small-celled and a large-celled variety. The matrix may be homogeneous or more or less distinctly fibrillated, giving rise to considerable variations in the consistency and appearances of the growth. When the matrix consists of a mucin-yielding material, the tumor is discriminated from sarcoma under the designation *myxoma*. Certain tumors of the brain and nervous system, which resemble in their structure the neuroglia or connective tissue of the nerve-centres, are also separated from sarcoma under the designation *glioma*. Sometimes spindle-cells, like those of spindle-celled sarcoma, are so arranged as to form an areolar structure, the meshes or alveoli of which are filled with cells resembling those of round-celled sarcoma. The structure thus produced is so analogous to certain forms of cancer that it has been called *carcinomatous sarcoma*. The cells of such growths are sometimes the seat of an abundant deposit of black pigment, constituting one of the varieties of melanotic cancer. A similar pigment deposit also takes place sometimes in spindle-celled sarcoma. Tumors which resemble fully-developed connective tissue are known as *fibroid tumors* or *fibroma*. They are characterized by the abundant and distinctly fibrillated matrix in which their oval or spindle-formed cells are imbedded. All the tumors of the connective-tissue group are more or less abundantly supplied with blood-vessels. In certain cases these are so numerous and so large as to constitute the most prominent feature of the new formation. Such growths are embraced under the term *angioma*.

New formations of adipose tissue may occur either as a general hyperplasia of the fat of certain organs or of the whole body, as in obesity, or as the form of tumor known as *lipoma*, which is quite similar in its structure to normal adipose tissue. Sometimes a development of groups of fat-cells takes place in the substance of a sarcoma, constituting the variety known as *lipomatous sarcoma*.

New formations of cartilage, occurring in the form of tumors, are designated *enchondroma*. They most generally resemble hyaline cartilage in their minute structure, but present considerable diversities in the size and form of the cells and in the characters of the matrix. Portions of the matrix are frequently calcified; other portions are often found to have undergone mucoid softening. Combinations in the same tumor of enchondroma with sarcoma or with new-formed bone as osteoid-chondroma also occur.

New formations of bone are observed in the formation of outgrowths from existing bones, as *osteophytes* or *exostoses*, which, when they acquire considerable size, are spoken of as bony tumors—*osteoma*; besides which, a partial ossification of sarcomatous and enchondromatous tumors, or even of cancerous growths, may take place, and must be distinguished from calcification due to a mere deposit of lime-salts.

New formations of muscular fibres sometimes occur, constituting the form of tumor known as *myoma*. Tumors composed chiefly of striated muscular fibres are rare, but have been observed in the walls of the ventricles of the

heart. Those composed of muscular fibre-cells are more common; they are sometimes found in connection with the muscular coat of the alimentary canal, and still more frequently in the uterus.

New formations of nerve-fibres and nerve-cells also occur in a rare form of tumor situated in the course of the nerves, and designated *neuroma*. The same term has been applied to sarcomatous tumors and various other growths situated on the nerves, but should be reserved for the group just indicated.

New formations of gland-tissue have been presumed to exist, constituting a variety of tumor known as *adenoma*, which is observed in the female breast, the salivary glands, etc. These tumors consist of gland-ducts and lobules, resembling those of the gland affected, but pushed apart by an intervening tissue which presents the characters of sarcoma. It has not been demonstrated, however, that the glandular tissue in these growths is actually of new formation, and it appears on the whole more probable that these growths are simply sarcomata entangling a portion of the structure of the gland in which they are seated.

Besides the foregoing new formations, the histological elements of which closely resemble those of the normal tissue, there are certain growths in which the resemblance is much less striking. These are *carcinoma* or cancer and *tubercle*. In fully-developed cancers the older portions of the growth consist of a stroma or framework which resembles more or less developed connective tissue in its structure, and which, being arranged in an areolar manner, has its interspaces or alveoli filled with cells of a more or less decidedly epithelial character. In the marginal or more recently formed portions of the growth a network of elongated cylindrical cell-masses are observed, which are continuous with the cell-masses of the older portions of the growth, and which evidently lie in the lymphatic passages of the part. The connective tissue between the terminal extremities of the *cancer cylinders* is infiltrated with a swarm of small elements resembling migrated white corpuscles, and a similar swarm infiltrates the connective-tissue stroma of all parts of the growth. In cancers of the skin, and those mucous membranes which are clad with a pavement epithelium, the elements of the cell-masses and cancer cylinders present a striking likeness to the cells of the deeper layers of the normal epithelium, a row of columnar cells being situated next to the connective-tissue stroma, and the remaining cells, which are oval or polygonal in outline, becoming more and more flattened in proportion as they are more removed from the columnar layer. The most distant cells even undergo a horny transformation, like that which occurs in the superficial layers of the epidermis, and accumulate in the midst of the older cell-masses as peculiar concentric bodies, the so-called pearly globules, or *globes epidermiques*. Growths presenting these characters are designated *epithelioma* or epithelial cancer. In certain cancers commencing in the mucous membrane of the stomach and other situations, in which the surface is clad with a columnar or cylindrical epithelium, the cells of the alveoli and of the cancer cylinders present similar characters, constituting a variety of epithelial cancer known as *cylindroma*, or cylindrical epithelial cancer. In most other cancers—as, for example, in those commencing in the mammary gland—the resemblance of the cells of the cancer cylinders to epithelium is not so striking. They have comparatively small oval nuclei, and are surrounded by a scanty protoplasm without any distinguishable cell-wall. In the older portions of the growth, however, the cells are larger, with larger nuclei and irregular polygonal outlines, so that they approximate to the epithelial type. Such cells were formerly called *cancer-cells*, and supposed to be specific. When in cancers of this character the connective-tissue stroma is firm and abundant, making the tumors dense and hard, they are designated *scirrhus;* when the cell-masses of the alveoli are relatively the most abundant, the connective-tissue stroma being scanty and often imperfectly developed, they are known as *medullary cancer*. All the forms of cancer are characterized by the tendency of the primary growth to be succeeded by multiple growths of the neighboring lymphatic glands and in the internal organs, and by their proneness to undergo various degenerative changes. Fatty degeneration, which is one of the most frequent of these latter, speedily goes on to complete cheesy metamorphosis and destruction of tissue, resulting in the cancerous ulcer. Colloid degeneration also occurs, though less frequently, sometimes filling the alveoli with glue-like masses, and constituting what is known as *colloid cancer*.

Tubercle occurs primarily as minute nodules, the so-called gray granulations, situated most frequently in the adventitia of the minute arteries. They consist of lymphoid elements, smaller or larger cells, with strongly refractive nuclei, and sometimes still larger cell-like plates with several nuclei, all united together by a finely fibrillated matrix. These growths are especially prone to undergo the cheesy metamorphosis, and are also prone to be associated with inflammatory processes in which the products of the inflammation also undergo the same change. This cheesy metamorphosis was formerly regarded as so characteristic of tubercle that inflammatory products which had undergone it were generally spoken of as tubercular, without reference to their association with the gray granulations. Especially was this the case in the chronic inflammations of the lymphatic glands and of the smaller bronchial tubes and lung alveoli. In the latter instance, when the cheesy metamorphosis of the inflammatory product involves also the entangled lung-tissue, giving rise to the production of cavities, the disease has been very generally confounded with tubercular phthisis; from which, however, most modern histologists would separate it. (The reader, desirous of further information, must be referred to the special treatises.)

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J. J. Woodward.

His'tory [Gr. ἱστορία, from ἱστορέω, to "learn by inquiry," to "examine"], etymologically, denotes *ascertainment by inquiry*, hence the process of investigation; hence, further, an account of the circumstances thus ascertained. In its most ordinary sense it is restricted to a narrative of transactions in the order of time, with or without critical and philosophical commentary. As such alone we propose to consider it. We shall commence with a brief account of the progress of historical narrative from its primitive origin to our own times; we shall next enumerate the recent modifications which are more and more transforming it from a simple record to a complex department of study; and shall conclude with a few words of advice on the method of obtaining a competent acquaintance with it.

In its origin, history, considered as a method of recording events, is indistinguishable from oral tradition, which seldom preserves the memory of any but the most remarkable occurrences beyond three or four generations. A considerable advance was made when traditions assumed the form of ballads, easily remembered and repeated, but no really authentic record could exist previous to the invention of writing. The first application of this art was to monumental purposes, and along with the invocation of deities, chronicles of the actions of kings began to figure upon Egyptian temples. The invention of papyrus as a writing-material was a further step in advance, and from this period (possibly about 3000 B. C.) the Egyptians may be said to have possessed an historical literature. The practice of recording events in writing spread in due time to the Hebrews, the Phœnicians, the Chaldæans, and the Assyrians, but the pursuit of history as a branch of literary art, and the study of it as a department of intellectual culture, were reserved for the Greeks. About the middle of the fifth century B. C., Herodotus of Halicarnassus composed the first work fully answering to our present idea of history, presenting the results of his own inquiries into a series of previous transactions in a thoroughly artistic form. As mere narrative the work of Herodotus has never been surpassed to this day, and, notwithstanding his occasional credulity, he is fully impressed with the principle that the historian's first duty is to ascertain and record the truth. A considerable step in advance was taken by the next great historian, Thucydides, who, not content with relating the actions of men, endeavors to penetrate into their motives, and to investigate not merely the accompanying incidents, but the determining causes of changes in human affairs. As Herodotus is the first great narrator, so is Thucydides the first great philosophical historian; and almost all good history since their time has been written on the model afforded by one or the other. Some new elements were added to the conception of Thucydides by the next distinguished philosophical historian, Polybius, who, living in the age when all other states were succumbing to the power of Rome, was enabled to investigate the causes of national greatness and decay on a much larger scale than his predecessor. Xenophon's *Anabasis* and Cæsar's *Commentaries* are perfect examples of pure narrative unaccompanied by reflection. Of the two great Roman historians, Livy, like Herodotus, aims principally at narrative, but aims at another purpose alien to the simplicity of his model—the glorification of his own people, whose prose epic, in fact, he has written. He also follows the example of Thucydides in interspersing his own reflections, frequently in the form of speeches placed in the mouths of historical personages; his work may be considered as the finest ancient example of the eclectic or composite style. Tacitus imitates Thucydides, but with the addition of an element distinctively his own—an intense moral purpose. Escaped from an era of tyranny, the subject of his history, he aims at painting it in the blackest colors to prevent any subsequent relapse into it. He has thus become the typical representative of an important department of history. Many valuable historians flourished during the decline of the Roman empire, but we meet with none of special mark before Eusebius (A. D. 330), the first great ecclesiastical historian, and Procopius (A. D. 550), neither philosophical nor eloquent, but the model of the dry, impartial, businesslike historian.

During the Middle Ages history was entirely eclipsed, except among the Saracens. Ignorance, superstition, the slow circulation of intelligence, the barbarism of language, and the total loss of the critical spirit conspired to reduce historians for several centuries to mere annalists. The intellectual revival of the twelfth century produced a marked improvement, but History was not replaced upon her old footing until the resurrection of classical literature had brought good models to light, and the invention of printing rendered them generally accessible. Two great Italian historians, Macchiavelli and Guicciardini, kindred spirits to Thucydides and Tacitus, traced, the former the mediæval, the latter the contemporary history of his country, with a mastery that fixed the standard of historical composition for the language. Their example, though not their style, was emulated by De Thou, the French, and Davila, the Italian, historian of the wars of religion in France; by Mariana, the historian of Spain, and Strada, the elegant but inaccurate narrator of the revolt of the Low Countries; Raleigh, the first Englishman to attempt a history of the world, and Clarendon, whose account of the Rebellion is perhaps the best example of a partisan history. These remain the only eminent English historians until Hume, the magic of whose style and the symmetry of whose narrative atones in some degree for his negligence and prejudice. Robertson gave the first example of a high-class English historian devoting himself to the transactions of foreign nations. His knowledge of the world ensured him a full measure of success as a political historian, though his *History of America* has been superseded by Prescott, and his *History of Charles V.* is marred by his ignorance of German. A far greater name is that of his contemporary, Gibbon, whose *Decline and Fall of the Roman Empire* is perhaps the greatest historical work ever produced—the most signal example of diligence in the accumulation and of mastery in the control of enormous materials. Gibbon's judgment is almost infallible, and his historical portraits are as accurate as they are brilliant. His principal defect is his insensibility to the spiritual side of man's nature.

Since the eighteenth century history has claimed more and more the attention of superior minds, and we must be content with a bare enumeration of some of the principal works. Early English history has been treated by Freeman, that of the Tudor dynasty by Froude, the Commonwealth by Guizot, the Revolution by the dazzling but too rhetorical Macaulay, Scottish history by Tytler and Burton. France boasts a constellation of the brightest historical names, including Michelet, her general historian; Thierry, the investigator of her early history; Thiers, the least scrupulous, but the most genuinely national of all her writers; Guizot, Barante, Lamartine, Louis Blanc, Henri Martin, etc. The subordinate historical branch of memoir-writing has also flourished more among the French than among any other nation. In virtue of its subject, Mr. Carlyle's *French Revolution* may be included among French histories. This extraordinary work, a poem rather than a narrative, is the only modern book that has added an entirely new type to history.

Some of the most valuable contributions to Italian history have been made by foreigners, Sismondi, Roscoe, Gregorovius, but Italy also boasts her Botta, Cantù, and Colletta. Germany has produced a national historian in Johannes Müller, and the greatest of merely political historians in Ranke; her mediæval history is recounted by Von Raumer. Schlosser's general history of the eighteenth century, Schiller's *Thirty Years' War*, and Heeren's *History of Commerce* are additional instances of first-class German histories; the number of the simply meritorious is legion. The American Motley has immortalized himself as the historian of the revolt of the Netherlands. The history of Bohemia has been classically written by Palacky, of Russia by Karamsin, of Sweden by Geijer, and of Portugal by Hercolano. The story of the Greek war of independence has been told by Tricoupi. Bancroft is as yet the standard historian of the U. S., though it is unlikely that he will remain so. The best histories of the Spanish conquest of South America are by Prescott and Arthur Helps. Very great ability has been displayed in technical military histories, of which we can only mention that of the Peninsular war by Gen. W. F. P. Napier.

The reconstruction of philology and archæology has directed attention to classical history, which, with the exception of the era comprehended in Gibbon's work, may be said to have been completely rewritten during the present century. Niebuhr, though sometimes unduly skeptical, effectually disentangled the legendary from the authentic portions of early Roman history. The history of the Republic has been written on a grand scale by Mommsen, and the interval between him and Gibbon has been ably bridged by Dean Merivale. Grote has produced what will long remain the standard history of the Greek republics, although its animation is by no means equal to its erudition and sagacity. The history of the Christian Church has been admirably told by Milman. Duncker's *History of the Aryan Race* gives a brilliant and comprehensive view of the early historical period of this section of mankind. The history (as yet so obscure) of Egypt is told by Brugsch, and that of Assyria by Rawlinson. India has found eminent historians in Mill and Orme, and its ancient annals have been critically investigated by Lassen and his coadjutors. The rise of Mohammedanism has employed the pens of Muir, Sprenger, and others. Nor ought we to omit the native Oriental historians, among whom may particularly be named Mirkhond, the historian of Persia.

Finally, an important class of history, much cultivated in modern times, may be described as collateral or auxiliary to history proper. Its office is to treat of the origin and progress of human pursuits or institutions, such as commerce or law, which involves a chronological arrangement, though the mention of persons or events is only subsidiary to the main design. Hallam's *Constitutional History* is an example.

The spirit of modern times has modified the study of history in four principal ways: (1) By the resort, as a main source of information, to archives, including statutes, charters, public documents of all kinds, diplomatic and even private correspondence. (2) By the endeavor to reconstruct the private as well as the public life of nations, involving an intimate knowledge of the minutiæ of their daily existence. (3) By the application of the mythical theory to fabulous, sometimes even to extraordinary, narratives. (4) By the attempt to frame a philosophy of history—*i. e.* to discover the general laws on which particular events depend.

Archives, Statutes, etc.—It was long before it was recognized that the history of every civilized people was in some sort written in its public institutions, and that the essential principles underlying great struggles were displayed in such manifestoes as the Solemn League and Covenant or the Declaration of Independence. Such were comparatively rare in antiquity, during which period the value of documentary evidence as an aid to history was very imperfectly recognized. Nor was it sufficiently attended to among the moderns until the obscurity and imperfection of the annalists of the Middle Ages led historians to resort to the contemporary archives as a supplementary source of information. It was soon discovered that laws and charters not only filled up the outlines of historians, but corrected their errors; and it is now universally admitted that an authentic history of any period must be based upon documentary testimony where such is procurable. The principle is of course liable to exceptions from the occasional deliberate falsification of such testimony, the preambles of laws frequently stating considerations notoriously at variance with truth, and letters expressing the wishes and designs, rather than the convictions, of the writer. It is nevertheless certain that this self-delineation presents, on the whole, both a truer and livelier picture of an age than any formal narrative; and no history would now be considered adequate where every possible use had not been made of documentary materials. The researches of palæographical scholars, and the disclosure of state archives long jealously secluded, have immensely increased the resources of this nature at the disposal of historical scholars. The valuable histories of Ranke are based almost entirely upon the examination of confidential state papers. Much has been done and is doing in England by the official publication of abstracts of the correspondence preserved in the Record Office.

History in its Relation to Private Life.—It was natural that in its infancy the attention of history should be principally fixed upon great public events and picturesque occurrences. "To rescue from oblivion the memory of former incidents, and to render a just tribute of renown to the many great and wonderful actions both of Greeks and barbarians, Herodotus of Halicarnassus produces this historical essay." The same principle actuated all ancient historians, and their references to the state of manners or the social condition of the people are in general merely incidental. The conviction that the intrigues of cabinets and the shocks of armies are only important in so far as they affect the general well-being originated with the humane philosophy of the eighteenth century. It has now thoroughly leavened every branch of historical research, and has powerfully contributed to give birth to a philosophy of history. External incidents, so far from being considered as the sole objects of historical inquiry, are now chiefly valued for the light they afford to the primal causes on which the march of history depends, and, unless in the case of professedly military or political histories, no historian is satisfied unless he can exhibit the moral and social condition of a nation at a given period with the same vividness as that with which he would detail a public occurrence or depict a political character. Macaulay's view of the social state of England at the Revolution, and Mill's picture of the condition of India at the British conquest, are famous examples. This expansion of the scope of history has necessarily introduced the most important modifications into historical composition, and greatly extended the range of accomplishments requisite for the historian.

The Mythical Theory.—In the earliest ages of historical authorship stories of the supernatural, even if referring to contemporaries, were accepted as intrinsically credible, and all the early history of nations was enveloped in a cloud of legend. The existence of a critical spirit, however, soon makes itself manifest, but the legendary element was scrutinized on no satisfactory principle. According to the theory of Euhemerus, improbable stories were regarded as distortions of actual prosaic occurrences; thus, when Hercules is said to have slain the Lernæan hydra, it is to be understood that he drained the Lernæan marsh. Another theory, prevalent in the Middle Ages, and of which Bryant is the most characteristic modern representative, regards all legendary fables as perversions of a really veracious archetype; thus, Hercules is to be identified with Samson. Both these views are now exploded, and legends regarded either as "the natural effusions of the unlettered, imaginative, and believing man" (*Grote*), or as anthropomorphic representations of natural phenomena, whose original signification had been forgotten. (*Cox, Max Müller,* etc.) Whether their origin be referred to nature or imagination, they are equally regarded as poetry, only available in small measure and with the utmost caution for the ascertainment of authentic history. The first application of this principle on a large scale was made by Niebuhr in his Roman history, and the result has been to clear our histories of innumerable popular legends, and to free ancient history in particular from formidable chronological difficulties, besides destroying one great source of error in the construction of theories to account for what never took place. The study of folk-lore has also discredited many occurrences not intrinsically incredible; the story of Tell and the apple, for instance, loses its claims to credence as soon as it is shown to be an ordinary incident in popular mythology. It can scarcely be disputed, on the other hand, that the interpretation of tradition has frequently afforded pretexts for the most extravagant theories, such as the resolution of the heroes of the *Iliad, Ramayana,* and other epics into mere celestial and atmospheric phenomena. It might be safe to admit, as a general principle, that where gods alone are introduced in a legend the deification of Nature may be suspected, but that there is room for the supposition of actual event where mortals are also concerned.

Philosophy of History.—The idea of a philosophy of history could not arise until after the conception of a universal history had been formed; and this was scarcely possible until after the realization of a universal empire. The Roman empire, however, was hardly established ere it began to decline, and the accompanying decadence of intellectual power prevented any attempt at a general philosophy of history until the days of St. Augustine, who was led to undertake it by the necessity of exonerating his religion, to whose prevalence the downfall of the empire was naturally attributed by its adversaries, from responsibility for the political disasters of the time. From this point of view his *De Civitate Dei* is a masterly performance, but its inadequacy to afford a theory of the course of historical development may be inferred from its regarding the whole course of occurrences merely in their relation to the Christian Church, and its consequent restriction to the records of the Old and New Testaments, and of the heathen nations affected by the promulgation of Christianity. Its limitations, however, were unnoticed by the incurious spirit of the Middle Ages; and no progress towards historical philosophy was discernible until (in 1567) Jean Bodin enunciated the proposition that the course of events is controlled by definite laws admitting of investigation by the human intellect. The next great writer who took up the subject was Bossuet, but his *Discourse on Universal History,* often cited as the foundation of the science, is little more than an improved republication of Augustine. The true founder of historical philosophy was the Italian Vico, whose *New Science* (1725) first attempted that scientific explanation of the course of events whose possibility had been asserted by Bodin. The author, who had reflected profoundly on the phenomena attending revolutions in human history, deduces from them the principles which regulate the origin and development of society. The germ of his political speculations exists in a memorable passage in Plato's *Republic,* but what with Plato is mere assertion is with Vico corroborated by a command over the vast mass of experience which had accumulated since Plato's age. His great problem is to reconcile the existence of a divine plan of history with the freedom of human agency, in which he has perhaps been as successful as any of his successors. The idea of a deduction of all human events from first principles being once admitted, various attempts to ascertain these principles began to be made, leading to the establishment of rival historical schools. The great maxim, that the grand determining causes of history are general laws which even the most distinguished individuals obey while they seem to control, was placed in the clearest light by Montesquieu (1745). The chief merit of his contemporary, Voltaire, is not the application of any principle, but the fearless and independent spirit which cleared history of everything intrinsically insignificant or dependent

upon mere traditional sanction. With all his brilliancy of detail, his general view of history is discouraging and ignoble. Condorcet (1793) arrived at the opposite conclusion, and first laid it down distinctly that the operation of the laws recognized by Vico leads definitely and inevitably to the elevation of humanity as a whole. This generalization would now hardly be disputed by any philosophical writer, but great differences still exist as to what tendencies should be allowed to rank as laws, and as to the best method of expressing and classifying them. The grandest attempt ever made to sum up all historical principles under a single formula is, so far, that of Hegel (1837). Hegel conceives the development of history to represent the progress of the principle of the universe itself from a condition of chaos to one of self-consciousness. Every important stage in history is identified with some ruling idea which it has been its mission to express and exhaust, that humanity may proceed to develop the next. Friedrich von Schlegel, on the contrary, explains history as the striving back of mankind to a lost condition of original blessedness. It is the great merit of Herder (1791) to have pointed out the vast influence of external nature on mankind, and of St. Simon (1813) to have shown the connection of history with the physical sciences. St. Simon, borrowing perhaps a hint from Turgot, also enunciated the principle of two necessary stages of human thought—the theological and the physical—subsequently expanded by Comte into his famous doctrine of the three stages—the theological, the metaphysical, and the positive. The significance of this pregnant suggestion is evinced by the debate which it has excited; but it certainly cannot be allowed to rank as a demonstrated law so long as all three of these hypothetically successive stages continue to coexist in all civilized nations. Michelet and Pierre Leroux have contributed valuable principles to historical science by insisting on the fundamental unity of all peoples in spite of national distinctions, and De Tocqueville by his recognition of the fact that real progress inevitably tends to democracy. Bonald, on the contrary, has revived the theocratic conception of Augustine. To Bunsen we are indebted for the proof of the degree to which history has inscribed itself upon language; to Buckle, for a demonstration of the paramount importance of intellectual progress as an instrument of national development. Mr. Lecky has exhibited in a most striking manner the sudden and, as it almost appears, spontaneous disappearance of accredited beliefs, whose hold upon men's minds has long been imperceptibly loosening. The principal danger of such speculations is their tendency to subordinate individual action altogether to general laws, and to overlook the diversities of human character as agencies in shaping the destinies of nations. The American and French Revolutions were no doubt equally inevitable, but in the present state of our knowledge no satisfactory reason can be given why one might not as well as the other have brought forth a Washington. Russia owes her present position to Peter, Prussia to Frederick, but no rule can be deduced from historical science to show that either of these sovereigns must necessarily have been a man of genius. Mr. Carlyle, on the other hand, greatly exaggerates the hero's independence of circumstances. An excellent account of the chief writers on the philosophy of history, by Prof. Flint of St. Andrew's, is now in course of publication.

The Study of History.—As there is no study more delightful than that of history, so is there none more vitally necessary to the citizen of a free state. The constitution of a democratic republic especially, assuming as an indispensable condition of its working that every citizen shall take an intelligent interest in public affairs, imposes the study of history as a duty incumbent upon all. It is impossible to form a correct judgment of present circumstances without the means of comparison with the past supplied by a knowledge of history. The student must bear in mind, however, that all such knowledge is not equally useful. The annals of great military monarchies supply comparatively little that the citizen of a free state can turn to account, and some of the most attractive chapters of human history—that of Egypt, for instance—are chiefly important to the cultivators of special studies. The American citizen should especially familiarize himself with the history of free states, his own country before all others; then the great and free country from which it sprang, and from whose institutions its own are derived; then the prototypes of freedom in ancient Greece and Rome. If possible, he should also familiarize himself with the slow development of Roman institutions into the feudalism of the Middle Ages, and the continuous transformation undergone by the latter. To state the conclusions which he might probably deduce from such an inquiry would involve trespass on the ground of contemporary politics; nor need we do more than allude to the splendid examples of excellence with which history abounds, and their obvious tendency to encourage a high standard of public and private virtue. The best method of study is that which commences with an outline or skeleton of the subject, serviceable even if the student proceeds no further, but capable of being filled up indefinitely. Commencing with simple and condensed narratives, such as the excellent series now appearing under the editorship of Mr. Freeman, let the student proceed to comprehensive histories like Grote's or Gibbon's, filling up, as it were, the interstices of his knowledge by a resort to memoirs and detached narratives of particular transactions, and crowning his labors by the endeavor to comprehend and apply some system of the philosophy of history. Such general conspectuses of a subject as Voltaire's *Essai sur les Mœurs* will save him much toilsome research; but with these, even more than with regular historical narratives, he will need to be on his guard against the idiosyncrasies of his author, no matter of what school. In conclusion, we may confidently affirm that the more progress he is able to make towards recognizing all history as one great whole pervaded by an absolute unity of plan, the more reason will he have to congratulate himself on genuine progress in his historical studies. R. GARNETT.

Hit [anc. *Is*], town of Asiatic Turkey, on the W. bank of the Euphrates, about 90 miles W. N. W. of Bagdad, still noted for the fountains of naphtha and bitumen existing in its neighborhood. This bitumen was used in the building of Babylon, and was carried to Egypt by Thothmes III. of the eighteenth dynasty, some 1500 or 1600 B. C. The modern town is mean and dirty, and has a population of about 2000.

Hitch'cock, county in the S. W. of Nebraska, bounded S. by Kansas. It is traversed by the Republican River, and affords good pasturage. Area, 720 square miles. Cap. Culbertson.

Hitchcock (CHARLES HENRY), A. M., PH. D., b. at Amherst, Mass., Aug. 23, 1836; graduated at Amherst College, Mass.; has been instructor in geology in that institution and at Lafayette College, as also professor of geology at Dartmouth College, N. H., 1869; assistant geologist of Vermont 1857–61; State geologist of Maine 1861–62, and of New Hampshire 1868. He has written largely upon geology, and in 1870–71 established the meteorological observatory upon Mount Washington, N. H., which has since been adopted by the signal service of the U. S. army.

Hitchcock (EDWARD), D. D., LL.D., b. in Deerfield, Franklin co., Mass., May 24, 1793. His father, Deacon Justin Hitchcock, was a hatter in moderate circumstances. His mother, Mrs. Mercy (Hoyt) Hitchcock, was a woman of active mind and marked character. Interrupted in his preparation for Harvard College by sickness and weakness of the eyes, he educated himself while following the plough. From 1815 to 1818 he was principal of Deerfield Academy, assisted by Miss Orra White, the lady who afterwards became his wife, who rendered him invaluable aid in illustrating his scientific works, and to whom he dedicated his *Religion of Geology*. His first publication was *The Downfall of Bonaparte*, a dramatic poem of 500 lines; this appeared in 1815. From that date till 1818, while principal of the academy, he furnished the calculations for the *Farmer's Almanac* and frequent corrections to the *Nautical Almanac*. From 1821 to 1825 he was pastor of the Congregational church in Conway, and meanwhile found exercise, health, and recreation in making a geological survey of Western Massachusetts. From 1825 to 1844 he was professor of chemistry and natural history in Amherst College. In 1830 he was appointed State geologist of Massachusetts, having suggested the survey which he was appointed to make. In 1836 he was commissioned to do the same work in the first district of New York, but resigned the office on account of his health. From 1844 to 1854 he was president of Amherst College and professor of natural theology and geology, and the college never had a more inspiring lecturer nor a more popular and progressive president. He accepted the presidency when it was sinking under the weight of poverty and debt; and having secured for it liberal endowments, doubled the number of students in ten years, and greatly increased its literary and scientific advantages, he resigned that office, and, retaining the professorship, devoted the remainder of his life to his favorite science of geology, but always in its connection with religion. He was an eloquent preacher and the faithful pastor of the college church. Religion was the inspiration of his writings and his life. He was a prolific writer. He left a record of the titles and dates of 24 volumes, 35 pamphlets (including sermons), 94 papers in the journals, and 80 newspaper articles—some 8000 pages in all—on a great variety of subjects, but chiefly on his favorite themes of science and religion. His earliest publications in geology and natural history were *Geology of the Connecticut Valley*

(1823) and *Catalogue of Plants within Twenty Miles of Amherst* (1829; new ed., revised by Prof. Tuckerman, 1874). In 1830 he published *Dyspepsia Forestalled and Resisted*, and about the same time several other productions on temperance. In 1832 appeared *First Report on the Economic Geology of Massachusetts*, and in 1835 the full report on the geology, zoology, and botany of the State, which have given Massachusetts the honor of being the first in Europe or America to provide at public expense for the survey of an entire State. The final report on the geology of Massachusetts was made in 1841 in 2 vols. quarto of 831 pages, with 55 plates. Further works on geology are *Fossil Footsteps in the U. S.* (1848), *Outlines of the Geology of the Globe, and of the U. S. in Particular* (1853), *Illustrations of Surface Geology*, published by the Smithsonian Institution (1856), and *Report to the Government of Massachusetts on the Ichnology of New England* (1858); also reports on the *Geology of Vermont* (1857–59), and *Final Report* (in part by his son, Prof. C. H. Hitchcock) in 1861 (pp. 988, 38 plates, and 365 wood-cuts). *The Elementary Geology*, which first appeared in 1840, has gone through many editions in America and England, and has been widely used as a textbook in schools and colleges. *The Religion of Geology and its Connected Sciences* (1851) and *Religious Truths Illustrated from Science* (1857), together with numerous kindred articles in the *Biblical Repository*, the *Bibliotheca Sacra*, and other journals, were the works to which he gave the most thought and study. Among the most popular of his books have been *History of a Zoological Temperance Convention in Central Africa* (1850), *A Wreath for the Tomb* (1839), and *Religious Lectures on the Peculiar Phenomena of the Four Seasons* (1850), which illustrate his playful fancy, creative imagination, and strong moral, philanthropic, and religious nature. Several of Dr. Hitchcock's works have been reprinted in England, and they have been favorably noticed by the leading journals and scientific men of both countries. (See *N. Amer. Rev.*, xlii. 422–448; lii. 103–107; lvi. 435–451; *Amer. Jour. of Sci.*, i. 106; xxii. 1; xli. 232; *Lond. Cong. Mag.*, 1842, etc.; and testimonies by Dr. J. Pye Smith, Dr. Mantell, Dr. Buckland, and the elder Prof. Silliman.) In turn he furnished introductions to American editions of Dennis Crofton's *Genesis and Geology*, and to the *Plurality of Worlds*, a new edition of the latter being published in 1875.

Pres. Hitchcock was one of the originators and founders of Mount Holyoke Seminary and of the Massachusetts Agricultural College. And in connection with these we may mention his *Memoir of Mary Lyon* and his *Report to the Massachusetts Legislature on the Agricultural Schools of Europe*, which he visited and examined by appointment of the government in 1850. He was for many years a member of the Massachusetts board of agriculture, and was invited to become its secretary. He was a favorite of the farmers and the common people, who had very generally made his acquaintance in his geological explorations. The last book which he published was the *Reminiscences of Amherst College* (1863), in which he interweaves with history and autobiography many valuable suggestions touching college education. His most unique and enduring monument is the Hitchcock Ichnological Museum of Amherst College, created by his genius, science, and industry, and containing a complete collection, comprising every known variety of those fossil footmarks from the Connecticut Valley which he was the first scientifically to examine, classify, and interpret. Dr. Hitchcock was among the first and foremost of the pioneers of American geology. The American Geological Society owes its existence to his suggestion, and he was its first president. He left his mark especially in the inauguration of new enterprises and institutions, and in the origination of new doctrines and arguments in geology and natural theology. He d. Feb. 27, 1864, and the plain and massive granite obelisk which marks the place of his burial is fitly inscribed with those favorite words of his: "The cross in nature, and nature in the cross," which were the principal theme of his writings and the keynote of his character and life. W. S. Tyler.

Hitchcock (Edward), A. M., M. D., b. at Amherst, Mass., May 23, 1828; graduated at Amherst College 1849, and at Harvard Medical School 1852; has since been an instructor in the Williston Seminary, Easthampton, Mass., and in 1861 was appointed professor of hygiene and physical education in Amherst College.

Hitchcock (Ethan Allen), b. at Vergennes, Vt., May 18, 1798; graduated from the U. S. Military Academy, and entered the army as third lieutenant of artillery July, 1817. Till 1829, except for three years as assistant instructor of infantry tactics at West Point, he served on garrison and recruiting duty, after which he became commandant of cadets at the Military Academy. At the outbreak of the Florida war, he volunteered his services, and became acting inspector-general in Gaines's campaign of 1836. From Florida he returned with Gen. Gaines to the Western department, from which he was transferred to recruiting service, and subsequently to Indian duty, where his honest administration of affairs as disbursing agent was of great value in protecting the Indians against swindlers. Promoted to be major 8th Infantry in 1838, he was placed on garrison duty from 1839 until called to Washington in 1841, and placed in charge of the Indian bureau. Leaving Washington in 1842, he joined his regiment in Florida, from which (in 1842–43) he removed Pascofa's band of hostile Indians. In the Mexican war he was inspector-general of Gen. Scott's army, and for his services in battle received the brevets of colonel and brigadier-general. After the Mexican war he made an extended tour in Europe and the East, and on his return was placed on duty in Washington. In 1851, then colonel of the 2d Infantry, he was ordered to San Francisco, Cal., and commanded the military division of the Pacific till 1854, where his services were most valuable. In consequence of personal differences with the secretary of war he resigned Oct. 18, 1855, and made his home at St. Louis, where he devoted himself to literature and the peculiar philosophical investigations which had for many years occupied his thoughts. On the outbreak of the civil war he offered his services to the U. S. government. Though not accepted at the time, in Feb., 1862, his merits were recognized by his appointment as major-general of volunteers, which, though once declined on account of failing health, he was induced to retain, and was placed on duty in the war department, and to which duties were added in November those of commissioner for exchange of prisoners of war and commissary-general of prisoners. These duties he discharged ably and acceptably, and was retained in service till Oct., 1867. Among the published works of this accomplished officer and student of the "problem of life" are—*The Doctrines of Swedenborg and Spinoza Identified* (1846), *Remarks upon Alchemy and the Alchemists* (1857), *Swedenborg a Hermetic Philosopher* (1858), *Christ the Spirit, being an attempt to State the Primitive View of Christianity* (1861), *Remarks on the Sonnets of Shakspeare*, and *Colin Clout Explained* (1865). *Notes on the Vita Nuova of Dante* (1866). D. at Sparta, Ga., Aug. 5, 1870. G. C. Simmons.

Hitchcock (Henry Lawrence), D. D., b. at Benton, O., Oct. 31, 1813; son of Chief-Justice Peter Hitchcock (1780–1853) of Ohio; graduated at Yale 1832; studied divinity in Lane Seminary; held Presbyterian pastorates in Morgan, O., 1837–40, in Columbus 1840–55; president of Western Reserve College 1855–71, a position which he filled with great ability and usefulness. D. at Hudson, O., July 6, 1873.

Hitchcock (Peter), LL.D., b. at Cheshire, Conn., Oct. 19, 1780; graduated at Yale 1801; was admitted to the bar 1804; removed to Ohio 1806; was chosen to the Ohio general assembly 1810; State senator 1812–16; in Congress 1817–19; was afterwards for twenty-seven years a justice of the supreme court of the State, and a part of that time chief-justice. D. at Painesville, O., May 11, 1853.

Hitchcock (Roswell Dwight), D. D., LL.D., was b. in East Machias, Me., Aug. 15, 1817; joined the sophomore class in Amherst College in 1833; graduated in 1836; was principal of an academy in Jaffrey, N. H., 1836–37; pursued biblical and other studies under private tuition 1837–38; entered Andover Theological Seminary in 1838; was assistant teacher in Phillips Academy, Andover, for one term; was tutor at Amherst 1839–42; and in 1869 was elected one of the trustees of the college. From 1842 to 1844 he was a resident licentiate at Andover; then preached for a year in Waterville, Me.; and was ordained and installed over the First Congregational church in Exeter, N. H., Nov. 19, 1845. One year (1847–48) was spent in Germany at the universities of Halle and Berlin. In 1852 he resigned his pastorate to accept the Collins professorship of natural and revealed religion in Bowdoin College; and in 1855 he was chosen Washburn professor of church history in Union Theological Seminary, N. Y., which position he still (1875) holds. In 1866 he visited Italy and Greece, and in 1869–70 Egypt, Sinai, and Palestine. In 1871 he was made president of the American Palestine Exploration Society. During the civil war he took a decided stand on the side of the general government, and when the war was over hastened to heal its wounds and repair its damages. He received the degree of D. D. from Bowdoin College in 1855, and of LL.D. from Williams College in 1873. From 1863 to 1870 he was one of the assistant editors of the *American Theological Review*, for which, as previously for the *Presbyterian Quarterly*, he wrote many articles, mostly relating to church history. Besides numerous orations, addresses, and sermons, he has also published *A Complete*

Analysis of the Bible (1869), and has edited (with Drs. Eddy and Schaff) *Hymns and Songs of Praise* (1874) and *Hymns and Songs for Social and Sabbath Worship* (1875).

Hitchcock (SAMUEL A.), a prominent citizen of Brimfield, Mass., b. about 1784; acquired great wealth, and was distinguished as the founder of the Hitchcock Free High School, Brimfield, and as a liberal benefactor of Amherst College, Mass., Tabor College, Ia., Illinois College, Andover Theological Seminary, and of various churches and charities. These gifts exceeded $650,000 in aggregate value. D. at Brimfield Nov. 24, 1873.

Hit'chin, town of England, in Hertfordshire, on the Ivel, has breweries, manufactures of straw-plaiting, and a trade in corn, malt, and flour. Pop., with surroundings, 27,657.

Hitopade'sa [Sans., "good instruction"], a celebrated collection of fables of a didactic character and quite ancient origin, existing in the Sanscrit language. It is an abbreviation of the old *Panchatantra.* The text of the *Hitopadesa* was published by Von Schlegel and Lassen (Bonn, 1829), a German translation by M. Müller (Leipsic, 1844), and an English translation by Wilkins and Jones (1787). In substance, the *Hitopadesa* is nearly identical with the reputed fables of Pilpay, and obviously came from the same source.

Hit'teren. an island on the W. coast of Norway, belonging to the stift of Trondhjem, and important for its fisheries. It is 30 miles long by 10 miles broad, and has about 3700 inhabitants.

Hit'tites [Heb. *Chitti,* "descendants of Heth"], a Canaanitish nation whose original seat was Hebron. They were a commercial race, are frequently mentioned on the Egyptian monuments, as well as in the Bible, and seem to be noticed in the cuneiform inscriptions. After the conquest of Palestine it is almost certain that they established a kingdom in the Orontes valley. Numbers of them remained with the Jews even as late as the time of Ezra and Nehemiah. The Egyptian records contain the names of several of the Hittite kings.

Hit'tle, tp. of Tazewell co., Ill. Pop. 940.

Hit'torff (JACQUES IGNACE), b. at Cologne Aug. 20, 1793; studied in Paris; travelled through England, Germany, and Italy, where he spent two years in archæological studies in Sicily; and d. in Paris Mar. 25, 1867. The most prominent of his works as a practical architect are—the Cirque de l'Impératrice, Hôtel de Louvre, and different embellishments of the Place de la Concorde and Bois de Boulogne. The most remarkable of his writings are—*Architecture antique de la Sicile* and *Architecture moderne de la Sicile,* but especially his *Architecture Polychrome chez les Grecs,* showing the connection, with the Greeks, between painting, architecture, and sculpture.

Hit'zig (FERDINAND), b. June 23, 1807, at Haningen, Baden; studied after 1824 at the universities of Heidelberg, Halle, and Göttingen, and was in 1833 appointed professor at the University of Zurich, whence in 1861 he removed to that of Heidelberg. In Halle he heard Gesenius, and from that time he concentrated his studies principally on the exegesis of the Old Testament; and by his freedom from dogmatic prejudices, by his comprehensive learning and acuteness, he contributed much to the true understanding especially of the Prophets and Psalms, on which he published large exegetical works. He also wrote *Die Erfindung des Alphabets* (1840), *Urgeschichte und Mythologie der Philistäer* (1845), etc., and *Geschichte des Volkes Israel.* D. in 1875.

Hivaoa, an island in the Pacific Ocean, belonging to the Marquesas. It is the most fertile and most densely peopled of the whole group, but its inhabitants, numbering about 6500, are described as the wildest and most inaccessible to European civilization of all the Polynesian tribes. All efforts of missionaries, Catholic and Protestant, have so far been in vain.

Hi'vites [Heb. *Chivvi,* "midlanders" or "villagers"], a Canaanitish race conquered by the Hebrews. A part of them, the Gibeonites and their neighbors, became Jewish proselytes, but the great mass of them, living in the region of Tyre, seem to have been unconquered; but Solomon made them tributaries, and even menial subjects. They were a peaceful commercial race, of whom little is known.

Hiwas'see, tp. of Clay co., N. C. Pop. 418.

Hix'ton, post-tp. of Jackson co., Wis. Pop. 899.

Hoad'ley (BENJAMIN), b. at Westerham, Kent, Nov. 14, 1676; was educated at Clare Hall, Cambridge, of which he became a fellow in 1697; took holy orders 1700; became rector of St. Peter-le-poor 1702; rector of Streatham 1710; was distinguished by his advocacy of Low Church views in a famous controversy ("the convocation controversy") with Atterbury and others, Burnet and Wake being on Hoadley's side. In 1715 he was made bishop of Bangor, and in 1717 a sermon preached before the king on the words, "My kingdom is not of this world," led to the famous Bangorian controversy, in which he was assailed by the nonjurors and the High Church party, headed by William Law, Archdeacon Warren, and Canon Snape. This controversy led to the prorogation of the convocations and the almost complete extinction of their powers. In 1721 he was translated to the see of Hereford, to Salisbury 1723, and to Winchester 1734. D. at Chelsea Apr. 17, 1761. Among his works are—*Letters on Miracles* (1702), *Reasonableness of Conformity* (1703), *Brief Defence of Episcopal Ordination* (1707), *A Preservation against the Principles of Non-jurors* (1716), *Nature and End of the Lord's Supper* (1735).—His two sons, BENJAMIN and JOHN, also distinguished themselves. The former was b. in London Feb. 10, 1706; studied at Cambridge; took his degree as doctor of medicine in 1729; settled in London; was appointed physician to the royal household in 1746; and d. at Chelsea Aug. 10, 1757. He wrote in 1747 the comedy *The Suspicious Husband,* assisted Hogarth in his *Analysis of Beauty,* and published in 1756 *Observations on a Series of Electrical Experiments.*—The younger brother, John, was b. in London Oct. 8, 1711; studied first law, and then theology; took orders, and became chaplain to the prince of Wales; d. Mar. 17, 1776. He wrote several comedies—*The Contrast* (1731) and *Love's Revenge* (1737)—several oratorios and pastorales, and edited his father's works.

Hoaglin, tp. of Van Wert co., O. Pop. 622.

Hoang-Hai. See YELLOW SEA.

Hoang-Ho ("yellow river"), one of the principal rivers of China, rises in Thibet, flows first in a north-eastern direction into Mongolia, then in a southern and south-eastern direction through China proper, and enters into the Yellow Sea in lat. 34° N. Its course is winding and tortuous; its current rapid and turbulent, and when it reaches the lowland it becomes almost unmanageable, and is scarcely navigable. The immense amount of yellow clay which it carries along with it, and from which it has received its name, is deposited partly at its mouth, partly along its bed. Thus, not only the level of its waters, but even the level of its bed, is higher than the surrounding land, which must be protected against its inundations by immense levees. It costs the Chinese government yearly $7,000,000 to keep these levees in good repair, and an extensive system of canals has been devised and constructed in order to lead parts of its waters into other river-beds, and prevent the devastations with which it threatens one of the most fertile provinces of the empire. Its principal affluent is Hoei-Ho; among the large cities along its shores are Lan-Choo and Kai-Fung. In 1853 the Hoang-Ho broke from its old course, and began pouring its waters into the Yellow Sea by a mouth some hundreds of miles N. of its former one.

Hoar (EBENEZER ROCKWOOD), LL.D., b. at Concord, Mass., Feb. 21, 1816, a son of Samuel Hoar (1778–1856). He graduated at Harvard in 1835, and was admitted to the bar in 1840; was 1849–55 a judge in the court of common pleas; a judge of the superior court 1859–69; U. S. attorney-general 1869–70; joint high commissioner on the Washington treaty of 1871; member of Congress from Massachusetts 1873–75.

Hoar (GEORGE FRISBIE), a son of Hon. Samuel Hoar, b. at Concord, Mass., Aug. 29, 1826; graduated at Harvard in 1846; was admitted to the bar in 1849, and settled at Worcester, Mass. He was elected to the 41st Congress, and re-elected to the 42d, 43d, and 44th, and has held various other public offices.

Hoar (SAMUEL), LL.D., b. in Lincoln, Mass., May 18, 1778; graduated at Harvard, 1802; was a teacher in Virginia two years; was admitted to the bar in 1805, and attained great eminence as a lawyer; was in 1820 a member of the State constitutional convention; a State senator 1825 and 1833; a State councillor 1845–46; and a member of Congress 1835–37. In 1844 he was sent by the legislature of Massachusetts to South Carolina to test the constitutionality of certain acts authorizing the imprisonment of free negroes from outside the State, and on Dec. 5 of that year he was forcibly expelled from Charleston, the State legislature on the same day authorizing the governor to expel him. D. at Concord, Mass., Nov. 2, 1856. He was an active member of many charitable and religious organizations.

Hoare (Sir RICHARD COLT), b. at Stourhead, England, Dec. 9, 1758; d. May 19, 1838. He inherited a large fortune from his father, and made extensive scientific travels on the Continent and in his native country, of which he published richly illustrated accounts: *A Classical Tour*

through Italy and Sicily (1818) and *Ancient History of South Wiltshire* (8 vols. folio, 1810–19 and 1822–52, edited by the aid of other antiquarians).

Hoare (William), b. near Ipswich in 1707; d. at Bath in 1792. He was the first English painter who went to Rome to finish his education, and he was one of the original members of the Royal Academy. The best known of his paintings are his portraits of Pitt, Grenville, Lord Chesterfield, etc.—His son, Prince, was b. at Bath in 1754, and d. at Brighton in 1834. After studying at the Royal Academy and in Rome, he succeeded Boswell in 1799 as foreign secretary to the Academy, and was a very prolific dramatic writer, especially in the department of comic opera.

Ho'atzin, the *Opisthocomus cristatus*, a South American bird resembling somewhat the peacock in appearance. It exhibits a number of peculiarities in structure, and is the type of a group of Gallinaceous birds of equal value with the Alecteromorphæ (Phasianidæ), Pteroclomorphæ, and Turnicimorphæ. It has a large crop and a small gizzard, is gregarious, and frequents marshes, where it feeds upon the leaves of *Arum arborescens*. Its flesh has an intolerably rank taste.

Ho'bart, tp. and post-v. of Lake co., Ind., on the Pittsburg Fort Wayne and Chicago R. R., 33 miles S. E. of Chicago. Pop. 1037.

Hobart, post-v. of Stamford tp., Delaware co., N. Y., on the Delaware River, 4 miles below Stamford; has a national bank.

Hobart (Harrison C.), b. at Ashburnham, Mass.; graduated at Dartmouth College 1842; removed to Wisconsin in 1846, and settled at Sheboygan; was a member of the Territorial legislature and of the first State senate; Speaker of the assembly 1850; accompanied the 4th Wisconsin Vols. to the seat of war as captain; subsequently appointed lieutenant-colonel and colonel of his regiment; was captured and confined in Libby Prison, Richmond, and one of the party who escaped by means of the famous tunnel in 1864. In 1865 he was Democratic nominee for governor of Wisconsin. G. C. Simmons.

Hobart (John Henry), S. T. D., an American bishop, b. in Philadelphia Sept. 14, 1775; graduated with honors at Princeton in 1793; was tutor there 1796–98; ordained deacon of the Protestant Episcopal Church in 1798, a priest in 1801; became assistant bishop of New York in 1811, and bishop in 1816. In 1799 he was made rector of Christ church, New Brunswick, N. J.; in 1800, for a short time rector of St. George's, Hempstead, L. I., and in the same year assistant minister of Trinity church, New York, of which in 1812 he became assistant rector, and in 1816 rector. In 1821 he became professor of pastoral theology and pulpit eloquence in the General Theological Seminary, New York, of which he was one of the founders. Among his writings are *Companion for the Altar* (1804), *Apology for Apostolic Order* (1807), 2 vols. of sermons (1824). (See *Memoir* by William Berrian, D. D., published with his posthumous works (3 vols., 1833); *The Early Years of Bishop Hobart* (1834) and *The Professional Years of Bishop Hobart*, by J. McVickar (1836). D. at Auburn, N. Y., Sept. 10, 1830.

Hobart (John Sloss), LL.D., b. at Fairfield, Conn., in 1738; graduated at Yale in 1757; was in the New York Congress, and in 1766 was appointed a member of a committee to prepare a State constitution; became in 1777 a justice of the district court of New York, and afterwards was on the bench of the State supreme court; U. S. Senator in 1798; resigned in the same year, and became justice of the U. S. district court for New York. D. Feb. 4, 1805.

Hobart Town, or **Hobarton,** capital of Van Diemen's Land, on the navigable Derwent, which at its entrance into Storm Bay forms an excellent harbor, safe and accessible to the largest vessels. Hobart Town was founded in 1804. It is beautifully situated at the foot of Wellington Mountain, and well built with straight and broad streets and many handsome buildings, among which there are several Episcopalian, Roman Catholic, and Presbyterian churches and a Jewish synagogue, and fine government house, 4 banks, 3 public libraries. Has good public schools, gas and water works, etc. It is connected with Melbourne by steamers, and carries on quite a lively trade. It has an Anglican and a Roman Catholic bishop. Pop. 19,092.

Hob'bema, or **Hobbima** (Minderhout), a celebrated Dutch landscape-painter. Of his personal life nothing is known, but the circumstance that the figures in his landscapes are painted by Berghem, Van der Velde, Lingelbach, and I. van Loo shows that he lived in the latter part of the seventeenth century, and by some he is believed to have been a disciple of Ruysdael. He painted mostly forests and ruins, and his pictures are found in all the large galleries.

Hobbes (Thomas), one of the most distinguished thinkers of the period of English emancipation from scholasticism, b. Apr. 5, 1588, at Malmesbury, in Wiltshire. His father was a country clergyman. After a thorough preparation, he was sent to Oxford before his sixteenth year, and there studied Aristotle and scholastic philosophy for five years, acquiring certain nominalistic principles which marked all his subsequent thinking, although he early assumed a hostile attitude towards scholasticism. He became tutor to the future earl of Devonshire, and in 1610 travelled with his charge through France, Italy, and Savoy. On his return, and on subsequent visits to the Continent, he met the foremost thinkers of the time, and became more or less intimate with Lord Bacon, Ben Jonson, Lord Edward Herbert of Cherbury, Descartes, Gassendi, Galileo; later in life with Selden, Cowley, and Dr. Harvey. In 1628 he translated and published Thucydides, with the express purpose of showing his countrymen a warning example of the "fatal consequences of intestine troubles." Just at this time the foundations of civil order were shaken by the struggle between the House of Stuart and the supporters of individual liberty and the rights of conscience. Of an unusually timid disposition (congenital, arising from premature birth at the fright occasioned by the approach of the Spanish Armada), Hobbes felt very keenly the lack of security which the state should afford, and this subject (the state) occupied his chief thoughts for the rest of his life. Retiring to Paris with the royalists in 1640, he published a small edition of his *Elementa Philosophica de Cive* in 1642, the work being reprinted, much enlarged, in 1647 at Amsterdam by the famous Elzevirs. In 1647 he became mathematical instructor to Charles, prince of Wales, a relation which was broken in alarm upon the publication of his views on political, moral, and theological subjects in the treatises (1) *Treatise on Human Nature* in 1650, (2) *De Corpore Politico* (London, 1650), and (3) his collected views in the *Leviathan, or the Matter, Power, and Form of a Commonwealth, Ecclesiastical and Civil,* in 1651. He escaped persecution by fleeing secretly from Paris and taking refuge in England, where Cromwell's absolute power in 1653 furnished a government much in accordance with Hobbes' doctrines. He published a remarkable *Letter upon Liberty and Necessity* in 1654, and the first and second divisions of his great work, *Philosophical Rudiments*, in 1655–58; the first division treating *of Body*, the second division *of Human Nature*, the third *of the State*. His *Leviathan* and *De Cive* were censured in Parliament in 1666, and very many works were written to refute them, the most able of these being Cudworth's *Intellectual System*. After the Restoration, Hobbes received a pension of £100 from Charles II., his former pupil. In 1675 he published a translation of Homer's *Iliad* and *Odyssey*. He wrote his autobiography in Latin verse, and his *Behemoth*, a dialogue on the civil wars between 1640 and 1660, was finished in the year of his death, which occurred in Dec., 1679, at the seat of the earl of Devonshire, his constant friend and supporter.

The literary style of Hobbes is pronounced admirable, being always clear and never tedious. His system of philosophy was a materialistic scaffolding built for the purpose of supporting and complementing his philosophy of the state, which is his only valuable contribution to human thought, besides certain negative or skeptical principles afterwards elaborated by Locke and Hume. He held sensation to be the basis of all knowledge; matter to be the only reality; philosophy to be the knowledge of effects in their causes and of causes in their effects; scientific method, consequently, to be twofold (*a*) inductive or analytical, and (*b*) deductive or synthetical. In his *Prima Philosophia* he defines the ideas of space, time, thing, cause, etc. somewhat after the manner of the Schoolmen. But the subject of philosophy is the two kinds of bodies, natural and artificial, the latter including human organizations, of which the state is the highest example. He held mind to be material; thought to be a process of adding and subtracting representations produced by physical impressions; language to be the most essential instrumentality to human life, rendering possible the existence of civil society and the state and the development of science and reason itself; ideas of good and evil to have their origin in the sensations of pleasure and pain; the human will to be under the control of circumstances and necessity. The state of nature is not the ideal state of man, but a state of war on the part of each against all—*bellum omnium in omnes*—and its result a condition of complete misery. Self-interest impels man to combine with his fellows and institute government, a "leviathan power" which adjusts and subordinates individual selfishness and produces the maximum of happiness. Outside the state are found constant war, fear,

poverty, filth, ignorance, and wretchedness; within the state dwell peace, security, riches, science, and happiness. Coercion is essential, and absolute monarchy is the most perfect form of government. Individual conviction should not be considered. The state is the Grand Man which makes possible the rational development of the individual man, like a mortal god subduing his caprice and passion, and compelling obedience to law, developing the ideas of justice, virtue, and religion, creating property and ownership, nurture and education. Hobbes was so much impressed with the importance of the authority of the state that he could not appreciate the necessity of mediation by which the individual will shall be adjusted and reconciled to the universal will (of the state) through the principle of popular representation. Complete *Works*, ed. by Molesworth, 16 vols. (5 vols. Lat., 11 vols. Eng.), London, 1839–45. WM. T. HARRIS.

Hobbs, tp. of Jefferson co., Neb. Pop. 378.

Hob'by, name given in Great Britain to certain small falcons, especially to the *Hypotriorchis subbuteo*, a bird about one foot in length and of very elegant shape. It was once much employed in hawking.

Hob'house (JOHN CAM), LORD BROUGHTON, b. June 27, 1786; graduated at Cambridge in 1808; entered the cabinet of Earl Grey as secretary of war in 1831; was made secretary of state for Ireland in 1833, and president of the board of control from 1835 to 1841 and from 1846 to 1852; was created a baron in 1851, and d. June 3, 1869. His *Journey through Albania and other Provinces of Turkey with Lord Byron* (1812), *Illustrations of the Fourth Canto of Childe Harold* (1818), and *Italy* (1859), attracted much attention.

Ho'boken, city of Hudson co., N. J., on the W. side of the Hudson River, directly opposite New York City, and N. of and adjoining Jersey City; incorporated in 1855. Four lines of European steamers start from this point, and the Morris and Essex and the Delaware Lackawanna and Western R. Rs. have their eastern termini here, and connect the city with all the great railroad systems S. and W. of New York City. Various lines of street-cars also connect it with Jersey City and the villages in the northern part of the county. Its trade in coal is extensive, it being one of the principal dépôts from which New York City and its shipping are supplied. It has 3 good public schools, several academies, 12 churches, 3 weekly newspapers, the St. Mary's Hospital, 2 savings and 1 national bank, several foundries, and a large lead-pencil factory. Prominent among its academies is the Stevens Institute of Technology, which has very extensive, expensive, and complete apparatus and arrangements for teaching the natural sciences and their applications to the arts and industries. The Franklin Lyceum Association has a library of over 2000 volumes. Its principal industries are connected with the European steamers and the coal-docks. Pop. 20,297.
DONALD MANN, ED. "HUDSON COUNTY DEMOCRAT."

Hob'son's Choice. It is related in the *Spectator* (509) that Tobias Hobson, university carrier at Cambridge and the subject of two poems by Milton, was the first person in England who kept a hackney-stable. He always politely asked his customers to take their choice of his forty horses, but no matter which horse was chosen, Hobson always managed to put off the traveller with the horse which stood nearest the door. Hence "Hobson's choice" signifies a nominal choice with no real alternative.

Hoche (LAZARE), b. June 25, 1768, at Montreuil, the son of a poor workman, who could give him no education. In 1784 he enlisted in the army; in 1791 he fought as sergeant in the regiment of Gardes Françaises with the rabble before the door of Marie Antoinette; in 1792 he became lieutenant in the regiment of Rouergue; and in 1793 he distinguished himself in the siege of Thionville and in the battle of Neerwinden. Having been imprisoned on some suspicion, he sent a plan of a campaign to the Committee of Public Safety, and he was immediately liberated, made a brigadier-general, and sent to serve in the army of Houchard. He soon received an independent command, and in 1793 he defeated the Austrians at Weissenburg, and compelled them to withdraw from Alsace. In 1795 he foiled the invasion of the royalists and the English, attempted from the peninsula of Quiberon. In 1796 he pacified the Vendée, while his expedition to Ireland failed, as stormy weather scattered his ships. In Apr., 1797, he again commanded against the Austrians, and defeated them in three battles; he was at Wetzlar when the armistice of Lisbon ended the war. In the fall of that year he was suddenly taken ill, and d. Sept. 18, twenty-nine years old; a post-mortem examination showed that he had been poisoned.

Hochela'ga, county of Quebec, Canada, includes the eastern part of the island of Montreal in the river St. Lawrence. It territorially includes the city of Montreal, which, however, does not belong to it. Cap. Hochelaga. Pop. 25,640.

Hochelaga, the county-seat of Hochelaga co., Quebec, Canada, is a beautiful suburb of Montreal, with which it is connected by a street railway. Its convent of the Holy Name is the largest nunnery in the province. Pop. of sub-district, 1061.

Hoch'heim, town of Prussia, in the province of Hesse-Nassau, is situated on the Main, and is celebrated for its excellent wine. Pop. 2536.

Hoch'kirch, v. of Saxony, 7 miles S. E. of Bautzen. Here Frederick the Great was completely defeated by the Austrians under Daun, Oct. 14, 1758.

Höchst, town of Prussia, in the province of Hesse-Nassau, at the influx of the Nidda into the Main, is noted for the battles fought here—June 20, 1622, in which Tilly defeated Duke Christian of Brunswick, and Oct. 11, 1795, in which the Austrians defeated the French under Jourdan. Pop. 3013.

Hoch'städt, town of Bavaria, on the Danube, is famous for the battle fought here Aug. 13, 1704, in which the Austrians and English under Prince Eugène and Marlborough utterly defeated the French and Bavarians. The battle is by the English named after Blenheim (or Blindheim), a small village near Hochstädt, at which one of the most decisive episodes of the battle took place.

Hock, a popular name in Great Britain for all Rhenish wines. It originally designated the wines of Hochheim, in the Main Valley. Of the Hochheim vineyards, the small Dechanerei and Stein plantations, the property of the German emperor, have the best reputation. Still and sparkling hocks are produced. (See RHENISH WINES.)

Hock'ing, or **Hockhocking,** a river of Ohio, rises in Fairfield co., flows S. E. through Hocking co., and joins the Ohio in Athens co., after a course of 80 miles. For nearly 70 miles it is navigable for boats; the Hocking Canal connects with the Ohio Canal.

Hocking, county of S. E. Central Ohio. Area, about 390 square miles. It is hilly and fertile, and has mines of coal and iron. Cattle, grain, tobacco, and wool are staple products. It is intersected by the Hocking Valley R. R. and the Hocking River and Canal. Cap. Logan. P. 17,925.

Hocking, tp. of Fairfield co., O. Pop. 2005.

Hock Tide, or **Hoke Days,** the Monday and Tuesday occurring two weeks after Easter, a former English festival in memory of Ethelred's great victory over the Danes in 1002. Tolls were taken at the town-gates and money was collected throughout the parish for the priest. Traces of the old customs existed in some places in the eighteenth century.

Hodeida', or **El Hudaidah,** seaport of Arabia, on the Red Sea, in lat. 14° 40′ N., about 2 miles N. W. of Mocha, is of some importance for the transfer of pilgrims from India and for the exportation of coffee.

Hodg'don, post-tp. of Aroostook co., Me., on the New Brunswick line, 5 miles S. of Houlton. It has 3 churches, and manufactures of furniture and lumber. Pop. 989.

Hodge (ARCHIBALD ALEXANDER), D. D., son of Dr. Charles Hodge, noticed below, was b. in Princeton, N. J., July 18, 1823; graduated at the College of New Jersey in 1841; was tutor 1844–46; graduated at Princeton Theological Seminary in 1847; went the same year as a missionary to Allahabad, India; returned in 1850 on account of the impaired health of his wife; was settled as a pastor in Lower West Nottingham, Md., 1851–55; at Fredericksburg, Va., 1855–61; and at Wilkesbarre, Pa., 1861–62. In 1864 he was elected by the General Assembly of the Presbyterian Church to the chair of didactic, historical, and polemic theology in the Western Theological Seminary, Allegheny, Pa. In connection with the professorship, he became in 1866 pastor of the North Presbyterian church of the same city. In 1862 he received the degree of D. D. from the College of New Jersey. He has published *Outlines of Theology* (1860), *The Atonement* (1867), *Commentary on the Confession of Faith* (1869). He wrote for this work the admirable article on CALVINISM.
R. D. HITCHCOCK.

Hodge (CHARLES), D. D., LL.D., of Scotch-Irish descent, was b. in Philadelphia, Pa., Dec. 28, 1797. His father, Dr. Hugh Hodge, a physician of large practice and great promise, d. early. In 1812 he entered the sophomore class in the College of New Jersey, and graduated with the highest honors in 1815. From 1816 to 1819 he was a student in the Theological Seminary at Princeton, in the same class with Bishops McIlvaine and Johns. In 1820 he accepted the appointment of assistant teacher of the original languages of Scripture in the seminary, and in 1822 was

elected by the General Assembly professor of Oriental and biblical literature. In 1828 he returned to his chair, after an absence of some three years spent in study at the universities of Paris, Halle, and Berlin. In 1840 he was transferred to the chair of exegetical and didactic theology, to which, in 1852, polemic theology was added, Dr. Archibald Alexander, the incumbent of that professorship, having d. in 1851. He was moderator of the General Assembly (Old School) at Philadelphia in 1846, and in 1858 one of a committee to revise the *Book of Discipline.* The celebration at Princeton, Apr. 24, 1872, of the semi-centennial anniversary of his professorship was a memorable occasion, the first of its kind in American history. The patriarch of our theological professors, he is still (1875) in active service. His contributions to sacred literature have been of the most scholarly and solid character. In 1825 he founded the *Biblical Repertory,* the scope of which was enlarged and *Princeton Review* added to its title in 1829. In 1872 it was united with the *Presbyterian Quarterly and American Theological Review,* the organ of the New School branch. Till then, for nearly forty years, he had been not only editor-in-chief of the *Princeton Review,* but also chief contributor, more than one-fifth of all that was written for it coming from his pen. He has also published *A Commentary on the Epistle to the Romans* (1835; abridged 1836; rewritten and enlarged 1866), *Constitutional History of the Presbyterian Church in the U. S.* (2 vols., 1840–41), *The Way of Life* (1842), commentary on *Ephesians* (1856), *First Corinthians* (1857), *Second Corinthians* (1860), *What is Darwinism?* (1874). But the great work of his life is the *Systematic Theology* (3 vols., 1871–72), which is regarded as one of the ablest expositions of Calvinism ever yet made. (See *Index Volume of the Bib. Rep. and Princ. Rev. from 1825 to 1868* (1871), and *Semi-Centennial Commemoration of the Professorship of Charles Hodge, D. D., LL.D., Sept. 24, 1872* (pp. 128, 1872). R. D. HITCHCOCK.

Hodge (HUGH LENOX), M. D., LL.D., b. in Philadelphia June 27, 1796, brother of Prof. Charles Hodge and son of Dr. Hugh Hodge, an eminent practitioner; graduated at Princeton with honors 1814; took the medical degree in 1817 at the University of Pennsylvania; professor of obstetrics in that institution 1835–63, when he became emeritus professor. Author of a *System of Obstetrics* and a work on *Diseases Peculiar to Women,* both standard treatises of the first authority; wrote much and ably for the professional journals, and had a wide fame as a practitioner and instructor. D. at Philadelphia Feb. 23, 1873.

Hodge (H. LENOX), M. A., M. D., b. July 30, 1836, in Philadelphia, Pa.; studied at the University of Pennsylvania, and received the degrees of B. A. 1855, M. A. 1858, and M. D. 1858; was resident physician in the Pennsylvania Hospital 1858–60. In 1861 was appointed demonstrator of surgery and chief of the surgical dispensary of the University of Pennsylvania, and in 1870 was made demonstrator of anatomy. During the war was one of the surgeons attached to the U. S. Satterlee Hospital, belonged to the Pennsylvania reserve corps of surgeons, and was pension examining surgeon to the U. S. Sanitary Commission; was present with the army in McClellan's campaign before Richmond, in the Gettysburg campaign, and at Fredericksburg in Grant's advance on Richmond; has been attending surgeon to the Children's Hospital since 1864, and attending surgeon to the Presbyterian Hospital since its opening in 1872. He has written and published a number of articles in medical journals in connection with original investigations on the subjects of metallic sutures, treatment of fractures of the thigh by an improved apparatus, drainage of wounds by a solid metal probe instead of Chassaignac's soft-rubber tube, deformities after hip disease, tracheotomy in cases of pseudo-membranous croup, ovariotomy, and a new form of trochar for the evacuation of ovarian and other fluids, excision of the hip-joint, etc.

Hodge′man, county of the W. of Kansas, in the valley of the Arkansas. Area, 900 square miles. It is well adapted to grazing.

Hod′genville, post-v., county-seat of La Rue co., Ky. Pop. 404.

Hod′ges (JAMES), b. at Queenborough, Kent, England, 1816; was assistant engineer of the railway tunnels and cliff-works near Dover 1839–44; was employed upon the construction of Lowestoft harbor 1844–48; constructing engineer of the Grand Trunk Railway, Canada, 1859 *seq.;* and published in 1860 a folio account of the Victoria Bridge at Montreal.

Hodges (WILLIAM), b. in London about 1744; painted landscapes and theatrical decorations; accompanied, in 1772, Cook on his South Sea voyage, and furnished the illustrations to his account; went in 1784 to India on the invitation of Warren Hastings. Published in 1792 *Travels in India,* with plates, and d. Mar. 6, 1797.

Hodg′kinson (EATON), b. at Anderton, Cheshire, Feb. 26, 1789; evinced early a decided talent for the study of mechanics; made a series of experiments concerning the strength of iron when applied as columns, for an account of which he received the gold medal of the Royal Society; made the calculations entering into the construction of the Britannia bridge, which were rewarded with a medal at Paris in 1855; was appointed a member in 1847 of the royal commission on the application of iron in railway buildings; and communicated a number of valuable engineering papers to the *Transactions* of the British Association. D. at Broughton, near Manchester, June 18, 1861.

Hodg′son (JOHN E.), b. in London in 1811; made many studies in Venice and the East; and was in 1873 elected an associate of the Royal Academy. Of his pictures, *The Reorganization of the Army of Morocco* and *The Snake-Charmer* are the most widely known.

Hodgson (WILLIAM BALLANTYNE), a political economist, b. at Edinburgh in 1815; studied at the university of his native city; was principal of the Liverpool Institute from 1839 to 1847, and of the Chorlton High School in Manchester from 1847 to 1851; traveled through France, Italy, Germany, and Switzerland; resided from 1863 to 1870 in London, where he acted as examiner in political economy at the University of London; and was in 1871 appointed professor in political and commercial economy and mercantile law at the University of Edinburgh. His principal writings are—*Lecture on Education* (1837), *Classical Instruction* (1853), *The Conditions of Health and Wealth educationally considered* (1860), *Exaggerated Estimates of Reading and Writing as Means of Education* (1867), *What is Capital?* (1868), *True Scope of Economic Science* (1870), *Competition* (1870), and *Turgot, his Life, Times, and Opinions* (1870).

Ho′dograph [ὁδός, "path," and γραφεῖν, to "write" or "describe"]. If from any fixed point lines be drawn at every instant representing in magnitude and direction the velocity of a point describing any path in any manner, the extremities of these lines form a curve which is called the *hodograph.* The invention of this construction is due to Sir W. R. Hamilton, and the most beautiful of the many remarkable theorems to which it leads is this: *The hodograph for the motion of a planet or comet is always a circle, whatever be the form and dimensions of the orbit.* Since the radius-vector of the hodograph represents the velocity at each instant, it is evident that an elementary arc represents the acceleration, and thus a finite arc represents the whole acceleration of the moving point during the corresponding time; and it is evident also that the tangent to the hodograph is parallel to the direction of the acceleration of the moving point in the corresponding position of its orbit. (*Thomson and Tait.*) The intensity of heat and light emanating from a point, or from a uniformly radiating spherical surface, diminishes with increasing distance according to the same law as gravitation. Hence the amount of heat and light which a planet receives from the sun during any interval is proportional to the whole acceleration during that interval—*i. e.* to the corresponding arc of the hodograph. From this it is easy to see, for example, that if a comet move in a parabola, the amount of heat it receives from the sun in any interval is proportional to the angle through which its direction of motion turns during that interval. There is a corresponding theorem for a planet moving in an ellipse, but somewhat more complicated. (*Ibid.*)

Hodom′eter [Gr. ὁδός, a "road," and μέτρον, "measure"], a more correct form of the word ODOMETER (which see).

Hoe, an instrument of farm-husbandry of various forms. The best known is a plate of steel attached to a handle at somewhat less than a right angle, and used for cutting and drawing the earth. The shuffle-hoe is drawn and thrust backward and forward for the purpose of cutting off weeds. Various forms of horse-hoe are used for cultivating those crops which are planted in rows and drills.

Hoe (RICHARD MARCH), an inventor, b. in New York Sept. 12, 1812, the son of Robert Hoe (1784–1833), an ingenious English mechanician who became a manufacturer of printing-presses in New York. R. M. Hoe became after his father's death a partner in the business, to which was added the manufacture of saws, in which Mr. Hoe introduced important improvements. In 1841, Mr. Hoe, with his brothers, Robert Hoe and Peter Smith Hoe, assumed the whole business, the former partners retiring. In 1846 he brought out "Hoe's lightning press," extensively employed for newspaper-work. It has been since much improved. He has also made many less celebrated inventions.

Hoe′fer (JOHANN CHRISTIAN FERDINAND), b. Apr. 21, 1811, at Döschnitz, in the principality of Schwarzburg-Ru-

dolstadt, and educated at the gymnasium of Rudolstadt. In 1830 he started, for the sake of his health, on a rather adventurous journey; went from Bremen to Lille, where he enlisted in the foreign legion as a soldier, and from Lille to Marseilles, whence he was sent to Navarino, the station of his regiment; returned in 1831 to France and taught foreign languages at the Colleges of Lyons, St. Etienne, and Roanne; co-operated with Cousin in translating Kant's *Kritik der reinen Vernunft* in 1834, and removed to Paris, where he began to study natural science and medicine, while he made his living by writing and translating for different periodicals. In 1840 he received the degree of doctor, and in 1848 he was naturalized as a French citizen. The most prominent of his writings are—*Histoire de la Chimie* (1842), the first complete history of the science of chemistry; *Dictionnaire de Physique et de Chimie* (1846), *De Médecine pratique* (1847), *De Botanique* (1850), *D'Agriculture et d'Horticulture* (1855), *Histoires du Café, du Chocolat, de la Pomme de Terre, du Lotus, du Poivrier, etc.* (1850–51), *Histoire du Maroc* (1848); besides a great number of articles in the *Biographie Générale*, of which he is editor-in-chief.

Hoei-Shin, or **Hui-Shên,** a Booddhist monk from China, who, according to his own narrative, regularly entered on the Chinese Year-Books, returned A. D. 499 from a long journey to the East, where, as he declared, he had visited a country which, according to the distances as he gave them, would be California or Mexico. He describes a plant as being very common there which he calls *fusang*, and from which he named the country. From its fruit, "like a red pear," and the description of the cloth and paper made from its fibres, this appears to have been the maguay or *Agave Americana*, so characteristic of the country. "No iron," he says, "is found in this land, but copper, gold, and silver are not prized, and do not serve as a medium of exchange in the market." In this and all other particulars the narrative of Hoei-Shin applies accurately to what is known in part of Mexico and in part of Peru. The monk declares that he found Booddhistic institutions which had been introduced fifty years before him by five beggar-priests from Kipin (Beloochistan). The writer in a work on this subject (*Fu-sang, or the Discovery of America by Chinese Booddhist Priests in the Fifth Century*, London) explains the coincidence of certain details in the narrative with what is known of Peru by the probability that Peruvian customs derived from Mexico descended to the South subsequent to the fifth century. The account of Fusang was first introduced to Europe by a learned Sinologist, De Guignes, who in 1761 published an admirable memoir on the subject in the *Mémoires de l'Académie des Inscriptions et Belles-Lettres* (vol. xxviii.). In 1841, Prof. Karl Neumann translated Hoei-Shin's narrative again more accurately from the original, adding to it copious comments of his own. This work, translated by the writer into English, with the aid and under the superintendence of Prof. Neumann, appeared in the New York *Knickerbocker Magazine* in 1850. De Guignes' memoir was attacked by Klaproth in his *Annales des Empereurs du Japon* in a spirit very little to his credit; but Klaproth was in turn refuted in a series of articles distinguished for their moderate tone, but replete with sagacious criticism and sound scholarship, by M. Gustave d'Eichthal (*Révue Archéologique*, Paris, 1862–63). (See also *L'Amérique sous le nom de pays du Fu-Sang ait elle été connue en Asie des le cinquième siècle de notre era, dans les grandes annales de la Chine*, Paris, by M. Taravey; also, by the same writer, *L'Amérique sous le nom de Fu-Sang Nouvelles épreuves que la pays de Fu-Sang est l'Amérique* (quoted by Andræ and Geiger, 1864, *Bibliotheca Sinilogica*).) Julius Heinrich von Klaproth renewed his attack from the *Annales d'E. du Japon* in 1831 in a work entitled *Recherches sur le pays de Fou-sang mentionné dans les livres chinois et pris mal après pour une partie de l'Amérique*, in *Nouvelles Annales des Voyages*, t. 21, *deuxième Série*, 1851; also K. F. Neumann, *Ostasien und West-Amerika, Zeitschrift für allgemeine Erdkunde*, Apr., 1864, and an article by José Perez in the *Revue orientale et Américaine*, No. 46, p. 189, 195. A few minor articles on the subject were also published in the *Notes and Queries* for China and Japan, 1867–70, and the *Chinese Recorder* for 1870. A summary of all that has appeared on the subject, with the most perfectly revised version of the original Chinese narrative of Hoei-Shin yet made, including an article by Col. Barclay Kennon, late of the North Pacific U. S. surveying expedition, on the feasibility of a passage from China to California, may be found in the work *Fu-sang* already cited. C. G. Leland.

Hoe'ven, van der (Jan), b. Feb. 9, 1801, at Rotterdam; studied medicine at Leyden; practised 1826 at Rotterdam; became professor of zoology at Leyden in 1835; and d. there Mar. 10, 1868. He wrote a *Handbook of Zoology* (1833), which was translated into German and English, and *Bijdragen tot de natuur lijke Geschiedenis van den Negerstam* (1842).

Hof, town of Bavaria, in Upper Franconia, on the Saale. It has extensive manufactures of cotton, woollen, linen, leather, and colors. Pop. 16,010.

Ho'fer (Andreas), b. at St. Leonard, in the Tyrol, Nov. 22, 1767; became a vintner and horse-merchant; took command of a party of riflemen serving against the French 1796; took a prominent part (1803–09) in the public affairs of the Tyrol; led in the uprising of the people against the French and Bavarians 1809; gained the important battles of Sterzing and Innspruck; defeated Lefebvre and drove him out of the province, and was declared ruler of the Tyrol. Soon after, Austria having been reduced to submission by Napoleon, Hofer became unable to sustain himself. Betrayed for money by one of his most trusted followers, he was taken prisoner and shot by order of Napoleon at Mantua Feb. 20, 1810.

Hoff'man (Charles Fenno), A. M., b. in New York in 1806, and educated at Columbia College. In 1817 he met with an accident which required the amputation of a leg. When twenty-one years of age he was admitted to the bar, and was afterwards editorially connected with the New York *American*, the *Knickerbocker Magazine*, the New York *Mirror*, etc. He published *A Winter in the West* (1835), *Wild Scenes in the Forest and Prairie* (1837), *Greyslaer*, a novel (1840), *The Vigil of Faith and Other Poems* (1842), *The Echo*, poems (1844), *Love's Calendar* (1848), and an edition of his poetical works, edited by E. F. Hoffman, appeared in 1874. He was in 1846–47 editor of the *Literary World*, and soon after was attacked by a mental disease, in consequence of which he has since lived in retirement. He is a brother of Ogden Hoffman.

Hoffman (David), LL.D. Oxon., J. U. D. Göttingen, b. in Baltimore Dec. 25, 1784; was professor of law in the University of Maryland 1817–36; after which he practised law in Philadelphia, though passing some years in Europe, from which he returned in 1853. He published *A Course of Legal Study* (1836), *Legal Outlines, Miscellaneous Thoughts*, etc., by Anthony Grumbler (1837), *Viator* (1841), *Legal Hints* (1846), *Chronicles from the Originals of Cartaphilus, the Wandering Jew*. D. in New York Nov. 11, 1854.

Hoffman (John Thompson), LL.D., b. at Sing-Sing, N. Y., Jan. 10, 1828; graduated in 1846 at Union College; was admitted to the bar in 1849; became in 1860, and again in 1863, recorder of New York City; was Democratic mayor of New York 1866–69; governor of the State 1869–73.

Hoffman (Murray), b. in New York Sept. 29, 1791; graduated in 1809 at Columbia College; was admitted to the bar, and was (1839–43) assistant vice-chancellor, and (1853–61) judge of the superior court of New York. He has published *Office and Duties of Masters in Chancery* (1824), *Practice in the Court of Chancery* (1840–43, 3 vols.), *Treatise on the Corporation of New York, Vice-Chancery Reports* (1839–40), *On the Law of the Protestant Episcopal Church* (1850), *Ecclesiastical Law in New York* (1868), *The Ritual Law of the Church* (1872).

Hoffman (Ogden), a son of Judge Josiah Ogden Hoffman, b. in New York in 1799, and graduated at Columbia College in 1812; served three years as a midshipman in the war with Great Britain; was admitted to the bar of Orange co., N. Y.; removed to New York City in 1826; became a partner of Hugh Maxwell, and held various important offices; was a member of Congress 1837–41, and was again elected in 1848. In 1854 he was chosen attorney-general of New York. D. May 1, 1856. He was a most able and eloquent jury-lawyer, and a prominent Whig leader.

Hoffman (William), b. in the city of New York Dec. 2, 1807; graduated from the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry, rising through successive grades to be colonel, 1862; he early saw much active service in the Black Hawk and Florida wars against the Sac and Seminole Indians, being thus engaged and on frontier duty till 1846; in the war with Mexico he participated in the siege of Vera Cruz and the various battles up to and including the final assault and capture of the city of Mexico, receiving the brevets of major and lieutenant-colonel for gallant conduct. Subsequently he commanded various expeditions, being on duty in Texas at the outbreak of the civil war in 1861, where he was made a prisoner of war; exchanged Aug., 1862. Appointed commissary-general of prisoners in 1862, he supervised and controlled all captured and paroled prisoners until the close of the war (brevetted brigadier-general and major-general), when he assumed command of his regiment. At his own request he was in 1870 retired from active service. G. C. Simmons.

Hoff'mann (Ernst Theodor Wilhelm), a German novelist of great talent, but of somewhat unsound character, b. at Königsberg in 1776. He studied law, and held for some years various judicial offices in Posen and Warsaw. In 1816 he was appointed councillor of the court of judicature in Berlin, in which city he d. in 1822. His life was full of troubles and very unhappy. His father, who deserted him, was a man of bad temper, and his uncle, who educated him, was a man of pedantic character. He himself, who had his father's temper, was trained to take his uncle's habits, and the result was an unnaturalness and unsoundness of mind which he never outgrew. In his early manhood he was thrown out of his position by Napoleon's invasion, and for several years he was compelled to earn an uncertain livelihood by giving lessons in music and drawing, two arts of which he was a perfect master; he composed several operas. When he was once more reinstated in his judicial office he evinced an irritability of mind and had contracted habits which made him unfit for society. He retired from the drawing-room to the tavern, where his sparkling wit and brilliant imagination soon gathered a circle of revellers around him, and where the last of his fine gifts were as rapidly destroyed. His first book, *Phantasie-stücke in Callot's Manier* (1814), is a collection of essays or papers chiefly on music, and in spite of a somewhat wilful singularity, both in style and ideas, they belong to the finest and most charming efforts of German genius. His next great work, *Elexiere des Teufels* (1816), is still more brilliant and powerful, though it is wild, weird, and eccentric. His last effort was *Lebens ausichten des Kater-Murr* (1821–22); but although this book by many is considered his chief work, it is really only the ruin of his mind. Its humor is forced, its pathos is bombast, its irony is despair, and its passion is hardly anything more than gesticulation. Among his minor novels there are many which may be considered as masterpieces, such as *Meister Martin, Fraülein Scudery, Doge und Dogeresse*, etc.; and for the student of German genius and character his writings in general are of the greatest importance. Clemens Petersen.

Hoffmann (Friedrich), M. D., F. R. S., b. at Halle, Germany, Feb. 19, 1660; graduated M. D. at Jena 1681; practised medicine with great renown at Minden and Halberstadt; became physician to the king of Prussia 1708; was professor of medicine at Halle 1693–1742. D. at Halle Nov. 12, 1742. Hoffmann is memorable as one of the first to introduce the modern or scientific spirit into the Galenic or regular medical system of his time. His special medical theories, however, were of only temporary value, and have been long forgotten. His greatest work was *Systema Medicinæ Rationalis* (9 vols., 1718–40). Others were *Medicina Consultatoria* (12 vols., 1721–39) and other works, including 5 vols. of posthumous *Opuscula*. His name is perpetuated by "Hoffmann's anodyne" (*Spiritus ætheris compositus*), a preparation devised by him.

Hoffmann (Jean Jacques), b. at Bâle in 1635. He studied in his native city, where he later on became professor in Greek and history, and where he d. May 10, 1706. His principal works are—*Lexicon Universale Historico-Geographico-Chronologico-Poetico-Philologicum* (1667) and *Historia Paparum* (1687), besides a great number of *Poemata* and *Dissertationes.*

Hoffmann (Wilhelm), D. D., b. at Kornthal 1806; studied at Tübingen; president of the mission-house at Bâle for twelve years; chaplain to the king of Prussia, and general superintendent of Brandenburg; d. at Berlin Aug. 28, 1873. An able scholar and eloquent preacher. Wrote against Strauss in defence of the gospel history, several volumes of sermons, and on the mission of Prussia and Germany.

Hoffmann von Fallersleben (August Heinrich), b. Apr. 2, 1798, at Fallersleben, in Hanover; studied at Göttingen and Bonn; became librarian in 1823, and professor of German language and literature in 1830 at the University of Breslau, but was dismissed in 1842 on account of his *Unpolitische Lieder*, and banished from Prussia. For several years he led a wandering life, but settled in 1845 in Mecklenburg; was rehabilitated in Prussia in 1848 and received a pension; edited 1854–57 the *Wiemar Jahrbuch*, and became in 1860 librarian at the castle of Corney. The most prominent of his linguistic and historical writings are—*Horæ Belgicæ* (1830–62), *Fundgruben für Geschichte Deutscher Sprache und Literatur* (1830–37), *Geschichte des Deutschen Kirchenliedes bis auf Luther* (1832), *Die Deutschen Gesellschaftslieder des 16 und 17 Jahrhundert* (1860). Of his poems, besides the above mentioned, *Unpolitische Lieder* (1841), *Allemannische Lieder* (1843), *Soldatenlieder* (1851), *Kinderlieder* (1845), etc.

Hoffmann's Anodyne (*Spiritus ætheris compositus*), a valuable anodyne mixture of common ether, ethylic alcohol, and the heavy oil of wine. It overcomes spasm, pain, and nausea. It is very expensive, and consequently much that is sold under this name is a comparatively worthless mixture. It was named from its inventor, Friedrich Hoffmann (1660–1742).

Hoff'mannsegg (Johan Centurius), Count, b. in Dresden May 23, 1766, and d. there Dec. 13, 1849. He studied at Leipsic and Göttingen, and spent four years in Portugal exploring the flora of that country. From 1809 to 1833 he published in Berlin his magnificent *Flore Portugaise* in Latin and French, containing descriptions of several hundred new plants. He also wrote *Vogage en Portugal* (1805).

Hofhof, or **El Hofhof,** town of Arabia, in the Lahsa oasis, near lat. 25° 20′ 56″ N., lon. 49° 40′ 50″ E., about 4 miles S. of Mebarraz. It is somewhat decayed. Pop. 24,000.

Hofland (Barbara), b. in 1770 at Sheffield, Eng., the daughter of Robert Wreaks, a manufacturer; married in 1796 Mr. Hoole, who d. in 1798, and in 1808 Mr. Hofland, an artist; produced about 70 novels and moral tales; and d. Nov. 9, 1844. The best known of her compositions are *The Clergyman's Widow* and *The Son of a Genius.*

Hö'fler (Karl Adolph Konstantin), b. at Memmingen, Bavaria; studied at Munich and Göttingen; visited Italy; became professor of history at Munich in 1840, but was removed in 1847 on account of his *Concordat und Constitutionseid der Katholiken in Bayern*, and accepted in 1851 a chair of history at Prague. The most prominent of his writings are—*Die Deutschen Päpste* (1839), *Fränkisch Studien* (1853), *Die Geschichtsschreiber der hussitischen Bewegung* (1856–65).

Hof'mann (August Wilhelm), Ph. D., F. R. S., b. at Giessen, Germany, Apr. 8, 1818; studied philology and law, and was trained as a chemist by Liebig; was afterwards professor of chemistry at Bonn, and then director of the College of Chemistry, London. In 1864 he became a chemical professor at Berlin. He has made important discoveries in chemistry, and is author of *Einleitung in die Moderne Chemie* (1865) and other works.

Hof'wyl, a v. of the canton of Berne, Switzerland, 6 miles N. of Berne, and near Schönbühl station on the Central Railway to Bâle. It is noted as the site of the educational establishments founded and for many years conducted by Fellenberg, and for some years after his death by his sons.

Hog [a word of Cymric origin], the domestic swine,* the remote offspring of the wild swine (*Sus scrofa;* see Boar). Its flesh, rejected as unclean by Jews, Mohammedans, and ancient Egyptians, and untouched by Hindoos and strict Booddhists, is a very important article of food among most civilized and many barbarous nations. This arises from the fact that the swine is easily kept and fattened, and affords an easy and profitable means of converting bulky and low-priced farm-products into a portable and salable commodity. The flesh is not the only valuable product. The skin makes a leather valued by the saddler; the bristles make the best brushes; the fat supplies lard, lard oil, glycerine, soap, and star candles. There are many breeds of domestic swine, which differ greatly among themselves in size, fattening qualities, and profitableness in raising. Among these we may specify the Neapolitan stock; the large and coarse Berkshire swine; the delicate and easily fattened Chinese varieties, crosses of which with the old European stocks have led to great improvements in swine, new breeds having been developed having more hardiness and greater size than Chinese pigs and far more valuable fattening qualities than the old breeds of Europe. The Sussex and Bedford breeds are among the stocks thus improved. The Chester whites, a breed which originated in Pennsylvania, and the Magic stock from Ohio, are among the American breeds; but some breeders deny that either stock has characters sufficiently marked and permanent to warrant for it a distinct name as a breed. When neglected and bred in the woods, and fattened upon nuts and acorns, the swine tends strongly to revert to the wild type. Pigs for market should be fed when young upon a relatively small amount of grain, mixed with fruits, boiled vegetables, clover, grass, and weeds; and when older they should be fed almost exclusively with grain. Ground (and especially cooked) Indian corn, buckwheat, and barley are excellent fattening materials. (For other species of the hog family, Suidæ, see Babyrousa, Bosch-vark, Peccary, Wart-hog, etc.)

Ho'gan, tp. of Dearborn co., Ind. Pop. 949.

*In many parts of England, and in most recent English farming and market literature, the word *hog* denotes a young sheep, a lamb in his second year. Domestic swine are there almost universally called pigs.

Hogan (John), b. at Tallow, Waterford, in 1800; studied at Rome; and d. at Dublin Mar. 27, 1858. Most of his works are religious and monumental; his *Drunken Faun* became widely known.

Hogarth (George), b. about 1797 in Scotland; became a writer to the Signet at Edinburgh; was many years dramatic and musical critic for the London *Morning Chronicle;* in 1846 became associated with Charles Dickens, his son-in-law, in conducting the *Daily News.* Author of *Musical History, Biography and Criticism* (2 vols., 1836), *Memoirs of the Musical Drama* (1838), revised and republished as *Memoirs of the Opera* (2 vols., 1851), both works of permanent value. D. Feb. 12, 1870.

Hogarth (William), a celebrated English artist, foremost in his line of subjects; b. in London 1697 or 1698, date uncertain; d. Oct. 26, 1764. His father, a schoolmaster, apprenticed him in 1712 to a silversmith as an engraver of armorial bearings on plate. A few years later he was engaged in engraving for booksellers. His first profession was that of portrait-painter, where he exhibited great facility in catching likenesses and originality in grouping figures; but his talent leading him in other directions, he soon struck the vein that made him famous. The genius for delineating scenes in real life, which early showed itself in grotesque forms, as in the *Scuffle at Highgate* and other ludicrous sketches, burst forth in full splendor in the remarkable series of plates entitled the *Harlot's Progress,* soon followed by the *Rake's Progress* and *Marriage à la Mode,* all done between 1734 and 1744. The rude prints that he engraved and published from these paintings had an immense sale. The paintings were the wonder of the town. Sir James Thornhill forgave the genius who had stolen his daughter. Hogarth's industry was indefatigable, and his achievements too numerous to be mentioned here even by name. His works are legion. No phase or aspect of life escaped him. Seven prints in illustration of Apuleius's *Golden Ass,* twelve prints for *Hudibras: The Sleepy Congregation, The Distressed Poet, The Enraged Musician, Strolling Actresses in a Barn, Garrick as Richard III., The Stagecoach, The March to Finchley;* four prints of *The Election, Paul before Felix, Moses and Pharaoh's Daughter, The Good Samaritan*—display the breadth and variety of his work. *The Analysis of Beauty,* a volume published in 1753, contained much keen observation and abounded in clever hints, but has not materially added to his fame. The public galleries of London hold many of Hogarth's great pictures, the best of which are accessible to everybody in prints from the artist's own plates. A list of the most important of these may be found in Spooner's *Dictionary* and Mrs. Clements' *Handbook.* The estimate of Hogarth's genius and artistic ability has been steadily on the rise since the beginning of the present century, owing in large measure, probably, to the persuasive *Essay* of Charles Lamb. The judgment of him as a coarse and vulgar caricaturist has been superseded by the enthusiastic and almost unqualified praise of later generations, which see in him one of the most eminent masters and powerful moral teachers in the whole realm of art. (For the life of Hogarth see the *Encyclopædia Britannica;* Ireland's *Hogarth Illustrated;* Nichols's *Essay,* including anecdotes; *Blackwood's Magazine,* Aug., 1869; *Foreign Quarterly,* Jan., 1836. The best editions of his *Works* are Boydell's folio, London, 1790; Nichols and Steevens's 4to, 1808–17; 12mo, London, 1874.) O. B. Frothingham.

Hog'buck, tp. of Transylvania co., N. C. Pop. 243.

Hogg (James), "the Ettrick Shepherd," b. in Ettrick parish, Selkirkshire, Scotland, Jan. 25, 1772; followed his ancestral occupation of shepherd, and several times attempted, with poor success, to gain a living as a farmer on his own account. His school education was very slight, but he was a great reader, and when twenty-four years old began to compose songs, some of which attracted much attention and gave him a local fame. In 1801 he published *Scottish Pastorals, Poems and Songs,* followed by *The Mountain Bard* (1803); became in 1810 editor of *The Spy,* a journal in Edinburgh. Here he was the associate of Scott, Wilson, and the other Tory men of letters, and a frequent contributor to *Blackwood.* His figure in the *Noctes Ambrosianæ* did not please him, but it added to his fame. In 1817 the duke of Buccleugh settled him upon the farm of Altrive, where his unlucky business ventures brought him many troubles; but here he lived for the greater part of his remaining years, engaged mainly in literary work, varied by field-sports, of which he was very fond; and here he d. Nov. 21, 1835. His best work, *The Queen's Wake* (1813), was followed by a large number of volumes of prose and verse of very unequal merit, his best poems and simplest tales evincing a rare genius.

Hogg Island, tp. of Russell co., Ala. Pop. 885.

Hog-Gum, or **Gum Hog,** a variety of Bassora gum, used in preparing paper for the marbling process. The hog-gum of the West Indies, used in medicine and for paying boats, is furnished by various trees of the genera *Clusia* and *Moronobea,* and perhaps by *Rhus Metopium* and *Helwigia balsamifera.*

Hog Island, an island off the coast of Northampton co., Va., extending from Great to Little Matchepungo Inlet. It has a lighthouse in lat. 37° 23′ 16″ N., lon. 75° 41′ 35″ W.

Hog Isle, off the coast of Hancock co., Me. Pop. 6.

Hog Plum, the fruit of *Spondias lutea, tuberosa, purpurea,* and *Mombin* of Brazil and the West Indies, so called because hogs are fed upon the abundant and rather agreeable fruits. The fruit of *S. Birrea* of Senegal and Abyssinia yields an intoxicating drink. That of *S. dulcis* or *Poupartia,* in the Society Islands, is very delicious. Several of the above and other species have medicinal qualities. They belong to the order Anacardiaceæ.

Hog-Rat, a name given to certain large rodents of the rat family, and genus *Capromys,* mostly arboreal and natives of Cuba. They are sometimes employed as food. Some of the species are reported as having somewhat prehensile tails. The hair is coarse, but not spiny.

Hogs'head [derivation uncertain], in wine-measure one half a pipe, or 63 wine-gallons. In beer-measure a hogshead contains 54 beer-gallons. The first kind contains 52½ imperial gallons, nearly; the second about 55 imperial gallons. Any large cask is in popular language called a hogshead. A hogshead of tobacco weighs from 750 to 1200 pounds, varying in the different States.

Hohenlin'den, a v. of Bavaria, in Upper Bavaria. Here the French under Moreau completely defeated the Austrians Dec. 3, 1800.

Hoh'enlohe, a princely family of Germany, sprung from Franconia, where the castle of Holloch was the family seat; since the twelfth century the possessors of this castle have called themselves lords of Holloch. They acquired much landed property, became counts, and branched off into various lines. In 1776 the counts of Hohenlohe were created princes of the empire. At present the family comprises two principal lines—Hohenlohe-Neuenstein and Hohenlohe-Waldenburg, of which the former is subdivided into the lines of Hohenlohe-Langenburg and Hohenlohe-Oehringen, the latter into those of Hohenlohe-Bartenstein and Hohenlohe-Schillingsfürst; these lines consist furthermore of many branches. The following members of the family are known to history: (1) Friedrich Ludwig, prince of Hohenlohe-Ingelfingen, Prussian general, b. 1746; d. 1818. He is famous for the infamous capitulation at Preuzlau, Oct. 28, 1806, where, having received the command of the Prussian army after the duke of Brunswick, who was wounded in the battle of Jena, he made 17,000 men lay down their arms. (2) Ludwig Aloysius, prince of Hohenlohe-Waldenburg-Bartenstein, b. 1765; d. 1829. He distinguished himself in the French, Dutch, and Austrian services as an able officer, and became marshal and peer of France; he always fought against Napoleon. (3) Alexander Leopold Franz Emmerich, prince of Hohenlohe-Waldenburg-Schillingsfürst, b. 1794; d. 1849. He was educated by the Jesuits, became a priest, wrote mystical books, attracted great swarms of believing patients, and had a great fame as a healer of the sick by miraculous power, and d. bishop of Sardica *in partibus.* (4) Chlodwig, prince of Hohenlohe-Waldenburg-Schillingsfürst, ambassador of the German emperor to France, was b. Mar. 31, 1819. He entered the Bavarian service, pursued a national policy, worked with success for a good understanding between Prussia and Bavaria, and became president of the Bavarian ministry in 1866. He has done much for the unity of Germany, especially as vice-president of the German Zoll-Parliament of 1868 and 1869. But the anti-union party in Bavaria became so hostile that he resigned his office a short time before the Franco-German war broke out. In 1874 the German emperor appointed him ambassador to the French government. A. Niemann.

Hoh'enstaufen was the name of a princely family in Germany which arose in the middle of the eleventh century, bore the imperial crown from 1138 to 1254, and died out in the latter part of the thirteenth century. The founder of the family was Friederich von Büren, who in the middle of the eleventh century moved his residence from Büren, a place in the valley, on the bank of the Danube, in the present kingdom of Würtemberg, to the castle of Hohenstaufen, situated on the brow of the hill. With the change of residence changed also the name of the family. Friedrich von Büren's son, Friedrich von Staufen or Hohenstaufen, followed Henry IV. as his true knight, and distinguished himself so much by valor and military talents, especially in the battle of Merseburg (1080), that

the king made him duke of Suabia, gave him his daughter Agnes in marriage, and appointed him regent in Germany during his absence in Italy. By this rapid rise the family of Hohenstaufen (also called by the Italians *Ghibellines*, from another of their possessions, the castle of Weiblingen) could not help coming into collision with the powerful family of the Welfs or Guelphs, which in Germany held the dukedom of Bavaria, besides large possessions in Italy. Friedrich had to defend his dukedom by armed force, but was compelled by his enemies to renounce parts of it. On his death in 1105 he left two sons, of whom the eldest, Friedrich II., was confirmed as duke of Suabia by Henry V., and the younger created duke of Franconia in 1112. Both the brothers adhered with great fidelity to the emperor, and when, in 1125, the Franconian dynasty died out with Henry V., the family of Hohenstaufen inherited a large part of the emperor's private fortune, which greatly increased its wealth and power. Friedrich II. even attempted to obtain the imperial dignity, but failed. Lothair the Saxon, an enemy of him and his family, was chosen emperor, and at one time the Hohenstaufens were pressed so hard that they had to sue for peace at the diet of Mühlhausen in 1135. Nevertheless, on the death of Lothair in 1138, Friedrich II.'s brother, Conrad, duke of Franconia, succeeded in being elected emperor, and the family now held the dignity for more than a century in the persons of Conrad III., 1138–52; Frederick I. Barbarossa, 1152–90; Henry VI., 1190–97; Philip, 1197–1203; Frederick II., 1212–50; Conrad IV., 1250–52. The general character of these men, whose biographies will be found in other places in this book, was vigor and energy, tending towards despotism, but generally allied with magnanimity and many brilliant qualities. The most prominent feature of their reign was their perpetual contest with the Guelphs and the popes, during which, however, the poetry and art of German chivalry reached their highest perfection. In 1252, Conrad IV. left Germany for Italy, in order to consolidate his power in his inherited countries in Southern Italy, but in 1254 he was poisoned. His half-brother, Manfred, endeavored to sustain the authority of the family, but was killed in the battle at Benevento in 1266, and when (1268) Conradin, the son of Conrad IV., tried once more to come into possession of Naples, he was defeated at Tagliacazzo and beheaded. The male line of the family of Hohenstaufen died out with him, and its possessions in Germany were divided between Bavaria, Baden, and Würtemberg. A branch of the family, descending from Manfred's daughter, Constance, who married Peter III., king of Aragon, ascended fourteen years later the throne of Sicily.

Hoh'enstein, town of Saxony, 12 miles N. E. of Zwickau. It has extensive manufactures of woollens and linen. Pop. 5400.

Hohenzol'lern, a small territory of Germany, entirely enclosed by Würtemberg and Baden, but belonging to Prussia. Its area is 453 square miles; it is mountainous, but fertile, watered by the Neckar and the Danube. Pop. 65,568, mostly Roman Catholics. Until 1849 it formed two independent principalities, Hechingen and Sigmaringen, which represent the elder line of the house of Hohenzollern, while the younger line is represented by the reigning dynasty of Prussia. In 1849 the king of Prussia bought the sovereignty of the country by paying the two princes an annual pension.

Hohenzollern, a princely family of Germany, which now occupies the imperial throne in the person of the emperor Wilhelm. The history of the family begins in the eighth century, at which time its ancestors possessed the castle of Hohenzollern. Thassilo, count of Zollern, was the oldest member of the family known to history; he d. about the year 800, and left four sons, of whom the eldest, Tharcho, propagated the family and d. in 866. His son Rudolf rendered good service in the war between the German king, Henry I., and the Huns and Wends. A descendant of his, Rudolf II., acquired much landed property by the important services he rendered in the battle of Tübingen between the count palatine, Hugo of Tübingen, and the Guelphs. On his death (1210) the family branched off into two lines, of which the elder kept the paternal possessions in Suabia, and continued up to our days under the name of Hohenzollern, while the younger line, called the Conradine, settled in Franconia, founded the house of the burgraves of Nuremberg, and formed the dynasty of Brandenburg and Prussia. Count Konrad I. of Zollern, the younger son of Rudolph II., married Maria, the daughter and heiress of Count Diebold of Vohburg, and came thereby into the possession of the burgravate of Nuremberg, which belonged to Vohburg. The Suabian line separated in 1576 into two branches—Hohenzollern-Hechingen and Hohenzollern-Sigmaringen. The former was raised to the princely rank Mar. 28, 1623, by the emperor Ferdinand II., but the title of prince was bestowed only on the chief and the first-born; the other members of the family were counts. The emperor Leopold I. gave the title of prince to all members in 1692. In the same year a covenant of inheritance was concluded between the two branches of the family, of which the younger one had now assumed the name of Brandenburg. Hermann Friedrich Otto, sovereign prince of Hohenzollern-Hechingen, joined in 1806 the Rhenish confederation, but as the prince could not master the revolution of 1849, he concluded a treaty with Prussia, by which he transferred his sovereignty to the Prussian crown, Apr. 8, 1850. The branch of Hohenzollern-Sigmaringen obtained the princely dignity in 1638, joined the Rhenish confederation in 1806, became allied to the imperial house of Napoleon by the marriage of Prince Carl with the daughter of Murat, king of Naples, and ceded its sovereignty to Prussia in consequence of the revolution of 1849. The male line of the branch of Hohenzollern-Hechingen is now extinct; the princes of Hohenzollern-Sigmaringen take rank as younger sons of the house of Prussia; one of them is sovereign prince of Roumania. The younger line, the Franconian, generally named after its chief possession, the burgravate of Nuremberg, obtained the princely dignity in 1273 from the emperor Rudolf. Friedrich VI., burgrave of Nuremberg, bought the margravate of Brandenburg from the emperor Sigismund for 250,000 gulden, and was created elector of Brandenburg in the same year. In 1605, the elector Joachim Friedrich obtained the regency in the duchy of Prussia, and his successor, Johann Sigismund, secured for his family the possession of that country. Georg Wilhelm added the title of duke of Prussia to his other titles, and his successor, Frederick William, the "Great Elector," gave the country political influence, acquired new provinces, and left at his death (Apr. 29, 1688) a state with 1,500,000 inhabitants. His son, Frederick III., attained the royal dignity, and was crowned Jan. 18, 1701, in Königsberg as Frederick I., king of Prussia. He was followed by the thrifty Frederick William I.; then Frederick II., "the Great," who left his state with 6,000,000 inhabitants; then Frederick William II.; then Frederick William III., who was defeated by Napoleon, but regained his country; then his son, Frederick William IV.; and then his younger son, William, who assumed the dignity of emperor of Germany Jan. 18, 1871.

August Niemann.

Hoho'kus, tp. and post-v. of Bergen co., N. J., on the Erie R. R., 23 miles N. by W. of Jersey City. Pop. 2632.

Ho'kah, tp. and post-v. of Houston co., Minn., on the Southern Minnesota R. R., 6 miles W. of La Crosse, Wis. Pop. of v. 525; of tp. 1038.

Hokendau'qua, post-v. of Lehigh co., Pa., on the Lehigh River and the Lehigh Valley R. R., 4 miles N. of Allentown.

Hoke's Bluff, tp. of Etowah co., Ala. Pop. 1049.

Hol'bach, von (Paul Henri Thyry), Baron, b. at Heidelsheim, in the Palatinate, in 1723. He went at an early age to Paris, where he married and spent his whole life. D. Jan. 21, 1789. His father had left him a large fortune, and in his rich and elegant house he gathered, with the greatest hospitality, a large circle of literary men. At his dinner-parties, which took place twice a week, Helvétius, D'Alembert, Diderot, Raynal, Grimm, Buffon, Rousseau, Marmontel, and others met, learned to know each other, and discussed their ideas with the utmost freedom. The baron himself was a man both of knowledge and talent, and a very prolific author. His first works, *Le Christianisme dévoilé* (Amsterdam, 1767), *Esprit du Clergé* (London, 1767), and *De l'imposture sacerdotale* (Amsterdam, 1767), made an attack on Christianity more open, direct, and vehement, than any to which it hitherto had been exposed. The Christian doctrines are declared to be an incoherent mass of fiction, the Christian morals to be inferior to most other moral systems, and the influence of Christianity to have been very detrimental to the development of the human race in every social, political, and moral respect. In a second series of writings, *Le système de la nature* (London, 1770), *Le bon sens, ou idées naturelles opposées aux idées surnaturelles* (Amsterdam, 1772), and *Le système social* (Amsterdam, 1773), he gives the positive, systematic development of those materialistic and atheistic views which in the first series are given under form of criticism only. All these writings contain hardly anything new or original. D'Holbach repeated the ideas of Voltaire and D'Alembert, of Diderot and Helvétius; he only pushed them farther. Indeed, he pushed the ideas of the Encyclopædists so far that the Encyclopædists themselves would not acknowledge them. His style is dry or sentimental, affected or trivial. But his influence is said to have been very great. He reached layers of society to which philosophy never before had penetrated, and his

cynical ideas are often recognizable during the first years of the Revolution. Personally, he was a good and kind-hearted man, without pretensions. He wrote his books under different pseudonyms, and for a long time even his most intimate friends knew nothing of his authorship.

Holbein (HANS), called THE YOUNGER, b. at Augsburg, Bavaria, in 1494, or perhaps even a few years earlier, received his first instruction from his father, a painter of some note. The days of his youth were spent in Bâle, and as early as 1512 his brilliant talent had attracted great attention, and he received large orders both for private houses and public buildings. Erasmus admired his work, and with a letter of introduction from him to Sir Thomas More he went to England in 1526. After living three years in More's house, he was introduced to the king, and Henry VIII. was so charmed by his pictures that he made him court-painter and heaped both honors and money on him. D. in London in 1543, of the plague. In accuracy of drawing, in truth and richness of coloring, Holbein surpassed all contemporary painters in Germany, and stands, indeed, among the greatest painters of the world. His portraits especially are excellent, and he produced a great number, which are scattered among all the larger European galleries. He painted a portrait of Erasmus which the latter preferred to the one engraved by Dürer. One of his finest pictures is the portrait of his friend and patron, Boniface Amerbach, to whom we owe the collection of Holbein's drawings and paintings now at Bâle. While in England, Holbein painted or drew not only the king, but his queens, Jane Seymour and Anne of Cleves, Prince Edward, and nearly every distinguished nobleman and noble woman of his court, besides distinguished commoners. These pictures and drawings are a splendid possession alike for art and for history. Holbein worked for the engravers, but to what extent is not precisely known. Two important series, *The Dance of Death* (see DANCE OF DEATH) and *Pictures from the Old Testament*, are ascribed to Holbein. One of the most famous pictures by Holbein is the *Madonna of the Meyer Family*, in the gallery of Dresden. This is now, however, believed to be a copy, probably by Holbein's own hand, of the original in the palace of the dukes of Darmstadt. Many of Holbein's best pictures have been engraved, and nearly all his finest drawings photographed, the last chiefly by Braun. (See *Hans Holbein der jüngere*, von Ulrich Hegner (Berlin, 1827), a well-executed, useful work, which only needs revision to take its place among the standard books on the subject; *Holbein und seine Zeit*, by Alfred Woltmann (Leipsic, 1867, 2 vols. and appendix; 2d ed. 1 vol., 1874), a book absolutely necessary to the student for its facts, but ill-arranged, and, critically, little to be depended on; the second ed. is full of contradictions of the first; *Life and Works of Holbein*, by R. N. Wornam (1 vol., London, 1867), almost useless from its want of arrangement, its slipshod style, and its want of the critical spirit.) CLARENCE COOK.

Hol'berg (LUDVIG), b. Nov. 6, 1684, in Bergen, Norway; studied at the University of Copenhagen; travelled in Holland, France, and Northern Italy, and stayed for one and a half years at the University of Oxford; was in 1718 appointed professor at the University of Copenhagen; accumulated great wealth, which he bequeathed to an educational institution, the Academy of Sorö; was created a baron in 1747, and d., unmarried, Jan. 27, 1754. His sound practical ideas, and clear, solid reasoning, sustained by learning and seasoned by humor, made his works on history, *Ecclesiastical History, History of Denmark, Jewish History, Lives of Great Men and Women*, and on philosophy, *Epistles and Moral Meditations*, a most influential element in the Danish civilization. (For his comical writings see DANISH LANGUAGE AND LITERATURE.) ✓

Hol'brook, a beautiful post-v. and tp. of Norfolk co., Mass., on the Old Colony R. R., 14 miles S. of Boston. It has a large manufacture of boots and shoes, a free library, a town-hall, a fire department, and good public schools. It was incorporated in 1872, before which time it was called EAST RANDOLPH.

Holbrook (ALFRED), b. at Derby, Conn., in 1816, son of Josiah Holbrook, a prominent and philanthropic educator and inventor. The son was for a time pupil of Elizur Wright in the academy at Groton, Mass. Though possessed of remarkable inventive talents and of a decided taste for civil engineering, he devoted himself to the work of instruction; founded a large and successful institution, chiefly for the training of teachers, at Lebanon, O. Author of a volume of *Lectures* on the subject of education.

Holbrook (JOHN E.), M. D., b. in Beaufort, S. C., Dec. 31, 1796; d. in Norfolk, Mass., Sept. 8, 1871. He was carried North when an infant; graduated in 1815 at Brown University, and took the degree in medicine at the University of Pennsylvania. After visiting the hospitals of Europe, he commenced the practice of his profession in Charleston, S. C., and upon the organization of the Medical College of South Carolina was assigned to the chair of anatomy, which he occupied for more than thirty years. Dr. Holbrook would never attend an obstetrical case nor perform a surgical operation, yet as a lecturer on anatomy he was seldom equalled. He possessed a peculiar talent for description, and a minute comprehension of comparative anatomy. His reputation rests especially upon his investigations as a naturalist. In 1842 he published his great work on herpetology, and this, with the unfinished one on the fishes of South Carolina, gave him high distinction. His friend, the late Prof. Agassiz, said before the Natural History Society of Boston, "I well remember the impression made in Europe, more than five and thirty years ago, by his work on the North American reptiles. Before then, the supercilious English question, so effectually answered since, 'Who reads an American book?' might have been repeated in another form, 'Who ever saw an American scientific work?' In that branch of investigation Europe had at that time nothing to compare with it." Author of *American Herpetology* (5 vols., 1842), and of unfinished works on *Southern Ichthyology* and the *Ichthyology of South Carolina*. PAUL F. EVE.

Hol'comb, tp. of Dunklin co., Mo. Pop. 608.

Hol'combe (AMASA), A. M., b. at Southwick, Mass., June 18, 1787, a farmer's son; when nineteen years old made surveyors' compasses, and at twenty began to compile almanacs, several of which he published. When twenty-seven he began to teach engineering, astronomy, and surveying; adopted the profession of civil engineer 1826; began to make telescopes in 1828, and had, it is believed, no competition from any other maker in the U. S. until 1842. He was a member of both branches of the State legislature, and was the recipient of several medals and other distinctions. The honorary degree of A. M. was conferred upon him by Williams College.

Holcombe (JAMES P.), b. in Lynchburg, Va., in 1820; was educated at Yale College and the University of Virginia, where he was for some years a law-professor. Author of *Leading Cases upon Commercial Law* (1847), *Digest of Decisions of the U. S. Supreme Court* (1848), *Merchants' Book of Reference* (1848), *Literature in Letters* (1868). ✓

Holcombe (WILLIAM FREDERIC), M. D., b. at Sterling, Mass., Apr. 2, 1827; graduated at the Albany Medical College in 1850, and studied several years in Europe; became professor of ophthalmic and aural surgery in the New York Medical College, surgeon to the New York Ophthalmic Hospital, and secretary and librarian of the New York Genealogical and Biographical Society. ✓

Holcombe (WILLIAM H.), M. D., b. at Lynchburg, Va., in 1825; was educated at Washington College, Va., and studied medicine in the University of Pennsylvania; has practised his profession in Lynchburg, Cincinnati, and New Orleans. In 1852 he became a homœopathist. He has published *How I became a Homœopath* (1867), *Scientific Basis of Homœopathy* (1855), *Yellow Fever* (1856), *Poems* (1860), *Our Children in Heaven* (1868), *The Sexes* (1869), besides numerous brochures and contributions to homœopathic and Swedenborgian periodical literature.

Hol'croft (THOMAS), b. in London Dec. 10, 1745, a shoemaker's son; served for a time as a stable-groom at Newmarket; became an actor, and then an author; was arrested for high treason in 1794, being a member of the Society for Constitutional Information, but was released without trial. D. Mar. 23, 1809. Author of 30 plays, besides novels, poems, translations, etc., some of which are of an irreligious tendency. His noteworthy works are *The Road to Ruin*, a comedy (1792), still popular; *The Life of Trenck* (1788), from the German; *Hermann and Dorothea* (1801), translated from the German of Goethe; *Memoirs* by himself, finished by Hazlitt (3 vols., 1816).

Hold, a compartment or series of compartments in a ship, below the lowermost deck. The hold extends fore and aft the whole length of the ship. In it are stored portions of the cargo, the ship's stores, ballast, etc.

Hold, a musical character 𝄐, placed over a note, signifying a pause, or the holding of the note longer than its proper time. The hold may also be placed over a rest or a double-bar, or as an indication of the end of a canon or other piece.

Hold'brook's, tp. of Cabarrus co., N. C. Pop. 1115.

Hol'den, post-tp. of Penobscot co., Me., 6 miles S. E. of Bangor. Pop. 758.

Holden, post-tp. of Worcester co., Mass., 52 miles from Boston, on the Boston Barre and Gardner R. R. It is a good farming town, with abundant water-power, manufac-

tures of woollen, cotton, and other goods, 3 churches, and numerous small villages. Pop. 2062.

Holden, post-tp. of Goodhue co., Minn. Pop. 1199.

Holden, post-v. of Johnson co., Mo., 50 miles S. E. of Kansas City, on the Missouri Pacific and the Missouri Kansas and Texas R. Rs. It has 4 churches, 2 banks, 1 newspaper, 4 dry-good stores, 2 hardware and agricultural implement stores, 2 boot and shoe stores, 3 jewelry stores, 2 hotels, 1 mill, etc. Holden is situated in a fine farming section; timber, coal, and building-stone are plenty. Pop. 1576. G. N. RICHARDS, ED. "ENTERPRISE."

Holden, tp. of New Hanover co., N. C. Pop. 2056.

Holden, tp. of Wayne co., N. C. Pop. 751.

Holden (OLIVER), the composer of the psalm-tune *Coronation* and other excellent pieces; was a carpenter, and afterwards a music-teacher and the keeper of a musical bookstore; d. at Charlestown, Mass., in 1831. Published *American Harmony* (1793), the *Worcester Collection* (1797), and other tune-books, and was one of the pioneers of American psalmody.

Hol'derness, post-tp. of Grafton co., N. H., 36 miles N. of Concord. It has manufactures of lumber, boxes, etc. Pop. 793.

Hol'dich (JOSEPH), D. D., b. Apr. 20, 1804, at Thorney, Cambridgeshire, Eng.; came in 1818 to the U. S.; entered the Methodist ministry in 1822; was stationed in Philadelphia, New York, and other cities; received the degree of A. M. from Princeton in 1828; that of D. D. from La Grange College 1843; was 1835–36 assistant professor, and 1836–49 professor, of moral science and belles lettres in the Wesleyan University, Middletown, Conn.; became in 1849 corresponding secretary of the American Bible Society. Author of *Life of Wilbur Fisk* (1842), of *A. H. Hurd* (1839), *Bible History* (1833), and other works.

Hold'ing-note, in musical compositions of two or more parts, a note sustained or prolonged in one of the parts while the others are in motion. In fugues, and in adagio, andante, and legato movements, holding-notes are of constant occurrence, and give unity, compactness, and a binding effect to the general texture of the harmony.

Holed, tp. of Somerset co., Me. Pop. 1.

Holins'hed (RAPHAEL or RALPH), M. A., an English chronicler who d. between 1578 and 1582. He took the master's degree, probably at Cambridge, and was perhaps a clergyman. Almost nothing is known of his life, but his fame is perpetuated by the *Chronicles of England, Scotland, and Ireland* (2 vols. folio, 1577), but he was not the sole author, for Harrison, Stow, Fleming, Stanihurst, Thin, Hooker, and others prepared large portions. There is no doubt that Shakspeare found abundant material for his historical plays in the pages of Holinshed.

Hol'kar, the name of a family of Mahratta chieftains who have played a conspicuous part in the history of India during the two last centuries, and often proved themselves formidable enemies of the British empire in Hindostan. Mulhar Rao Holkar was the founder of the family. He was born in 1693, received in 1736 the western part of Malwah, with Indore for its capital, and d. 1765. But the most remarkable member of the family was Jeswunt Rao Holkar, a natural son of Tokhagi Holkar, who reigned from 1801 to 1811. Although he was defeated at Indore (Oct. 14, 1801) by Dowlat Rao Sindia, his reputation for valor and energy was so great that a part of the victorious army went over to his side, and next year (Oct. 25, 1802) he entirely routed Sindia at Poona. Sindia took refuge with the British, and now a war began between Holkar and the British, which was carried on with various success to Dec. 24, 1805, when peace was concluded and Holkar compelled to give up some maritime districts, and bind himself to take no Europeans into his service. He d. insane, and was succeeded by his son, Mulhar Rao Holkar, who reigned from 1811 to 1833. He began war against the British in 1817, but was defeated, and under the peace of Jan. 6, 1818, an English residency was established at Indore. The present ruler of Indore, Mulkerji Rao Holkar, who came into power in 1852 and remained true to the English in 1857, is not of the Holkar family, though he bears the name; with Kumdi Rao Holkar the family died out in 1852.

Hol'land. See NETHERLANDS.

Holland, North and **South,** two provinces of the Netherlands, adjacent and very similar in all natural and social relations. The ground is very low, and must be protected against inundations of the North Sea and the Zuyder-Zee by artificial dams and dykes. It is everywhere intersected by rivers, the Rhine, Yssel, Lek, Maas, and Mervede, and canals. But the soil is very fertile, and marvellously well cultivated. The rearing of cattle and the production of butter and cheese are the main pursuits of the inhabitants, but many other kinds of industry are carried on with success. North Holland has an area of 955 square miles, with 602,539 inhabitants; the area of South Holland is 1162 square miles, with 710,753 inhabitants. The principal towns of North Holland are Amsterdam, Haarlem, and Alkmaar; of South Holland, The Hague, Leyden, Rotterdam, and Gouda. (See NORTH HOLLAND CANAL and NORTH SEA CANAL OF HOLLAND.)

Holland, post-tp. of Shelby co., Ill. Pop. 1352.

Holland, post-tp. of Hampden co., Mass., 70 miles W. S. W. of Boston, on the Connecticut line. Pop. 344.

Holland, post-v. of Ottawa co., Mich., on the Chicago and Michigan Lake Shore R. R. It contains 1 college, 1 public school, several churches, 5 papers, 2 tanneries, 1 savings bank, 3 hotels, 3 drug-stores, and 1 iron-ore smelting furnace, with the usual number of shops, etc. The town was settled by Hollanders, who form three-fourths of the present population. Pop. of v. 2319; of tp. 2353. WM. BENJAMINSE, PUB. "DE HOLLANDER."

Holland, tp. and post-v. of Erie co., N. Y., on the Buffalo New York and Philadelphia R. R., 26 miles S. E. of Buffalo. The township has 4 churches, 3 cheese-factories, and manufactories of lumber, leather, etc. Pop. 1451.

Holland, post-tp. of Orleans co., Vt., on the Canada line, 59 miles N. E. of Montpelier. It has manufactures of lumber and shingles. Pop. 881.

Holland, post-tp. of Brown co., Wis. Pop. 1279.

Holland, tp. of La Crosse co., Wis. Pop. 819.

Holland, tp. of Sheboygan co., Wis. Pop. 2704.

Holland (HENRY), BART., M. D., D. C. L., F. R. S., b. at Knutsford, Cheshire, England, Oct. 27, 1788; graduated M. D. at Edinburgh 1811; was for many years a physician in ordinary to Queen Victoria, and one of the most popular men, professionally and socially, in London. He several times visited the U. S., and travelled extensively in Europe and Asia. His second wife, a daughter of Sydney Smith, and a writer of ability, d. Nov. 2, 1866. Sir Henry was the author of several books on various subjects; the most important are *Medical Notes and Reflections* and *Recollections of Past Life* (1871). D. Oct. 28, 1873.

Holland (HENRY RICHARD **Vassall-Holland**), LORD, b. in Wiltshire Nov. 21, 1773; succeeded in 1774 to the peerage as the third Lord Holland of the Fox family, but his patronymic was changed from Fox to Vassall in 1797, the latter being the family name of his wife, the divorced Lady Webster, by whom he had had a son, the late Gen. Charles R. Fox, b. before the divorce. Holland was a man of fine manners and most amiable character. His uncle, Charles James Fox, trained him up to liberal political principles, and he was educated at Eton and Christ Church, Oxford; he was (1806) made a commissioner and plenipotentiary for settling disputes with the U. S.; was lord privy seal 1806–07; chancellor of the duchy of Lancaster 1830–40. D. at Kensington Oct. 22, 1840. Lord Holland was a most brilliant debater and parliamentary tactician, the steady friend of every political reform, and had a large personal following of strongly attached social and political friends. He did much to develop a taste for Spanish literature. Author of *Life and Writings of Lope de Vega Carpio* (1806), *Three Comedies from the Spanish* (1807), *Foreign Reminiscences* (1850), *Memoirs of the Whig Party* (1852), and other works.

Holland (JOSIAH GILBERT), M. D., b. at Belchertown, Mass., July 24, 1819; graduated at Berkshire Medical College, Pittsfield, and practised medicine three years; was for a short time an editor in Springfield, Mass., and for one year superintendent of schools Vicksburg, Miss. He was (1849–66) editorially connected with the Springfield *Republican*, and in 1870 became editor of *Scribner's Monthly*, New York. His works, some of them published under the name of "Timothy Titcomb," are a *History of Western Massachusetts* (1855), *The Bay Path*, a novel (1857), *Letters to the Young* (1858), *Bitter Sweet*, a poem (1858), *Gold Foil* (1859), *Miss Gilbert's Career*, a novel (1860), *Lessons in Life* (1861), *Letters to the Joneses* (1863), *Plain Talk on Familiar Subjects* (1865), *Life of Lincoln* (1866), *Kathrina*, a poem (1867), *The Marble Prophecy* (1872), *Arthur Bonnicastle* (1873), *Garnered Sheaves*, poems (1873), *The Mistress of the Manse* (1874).

Holland (Sir NATHANIEL DANSE), b. in London in 1734; studied in Rome, and painted portraits and landscapes; but having married a wealthy lady and become a baronet and member of Parliament, he gave up art. D. at Winchester in 1811.

Holland (PHILEMON), b. at Chelmsford in 1551; studied at Cambridge; became master of the free school of Coventry; and d. Feb. 9, 1636. He gave the first English translation of Livy, Suetonius, Ammianus Marcellinus, Pliny, and Plutarch's *Moralia*.

Hol′land Isl′and, tp. of Dorchester co., Md., consisting of Bloodworth Island, Holland Island, etc. Pop. 141.

Hol′land Pa′tent, post-v. of Trenton tp., Oneida co., N. Y., on the Utica and Black River R. R., 12 miles N. from Utica. It has 6 churches. Pop. 320.

Hol′lansburg, a v. of Harrison tp., Darke co., O. Pop. 239.

Hol′lar (Wenzel), b. at Prague in 1607; attracted the attention of the earl of Arundel, ambassador to the German emperor, and followed him in 1636 to England; became implicated during the time of the Commonwealth in political affairs, and was imprisoned for a short time; joined then the earl of Arundel at Antwerp in 1645, and returned with him in 1652 to England, where he d. Mar. 28, 1677. His most celebrated engraving is that of Holbein's *Dance of Death.*

Hol′lenback, tp. of Luzerne co., Pa. It has beds of anthracite coal. Pop. 1303.

Hol′lengsworth, tp. of Montgomery co., N. C. P. 695.

Hol′ley, post-v. of Orleans co., N. Y. It has 4 churches, 1 weekly newspaper, 1 bank, 1 hotel, 1 furnace, foundry and machine-shop, 2 lumber and coal yards. Pop. about 1000. C. Marsh, Pub. "Standard."

Holley (Alexander Lyman), C. E., b. July 20, 1832, at Lakeville, a part of Salisbury tp., Conn.; graduated at Brown University 1853, and was technically educated at the Corliss Steam-Engine Works. From 1856 to 1861 he edited and contributed to various engineering newspapers, and published his *Railway Economy,* and, in connection with the late Zerah Colburn, a *Report on European Railways.* In 1864 he published his *Treatise on Ordnance and Armor.* In 1865 he introduced the Bessemer process into America, and built the first steelworks at Troy, N. Y. He afterwards built Bessemer steelworks and rolling-mills at Harrisburg, Troy, Chicago, Joliet, and Pittsburg, and is now consulting engineer to a number of iron and steel works.

Holley (Horace), LL.D., b. at Salisbury, Conn., Feb. 13, 1781; graduated at Yale 1803; studied law, and then divinity; was pastor of the Hollis street church, Boston, 1809–18; became a Unitarian; president of Transylvania University, Ky., 1818–27; went to New Orleans to take charge of a seminary, but fell sick and d. on the passage thence to New York July 31, 1827.

Hol′lidaysburg, post-b., cap. of Blair co., Pa., 7 miles from Altoona, on a branch of the Pennsylvania R. R. It has 2 rolling-mills, 2 nail-factories, 2 furnaces, and 3 foundries, a large and flourishing female seminary, 2 newspapers, 7 churches, a fine court-house and jail, and a national bank. Its industries are principally manufacturing. Pop. 2952. David Over, Ed. "Register."

Hol′lins (George N.), b. at Baltimore, Md., Sept. 20, 1799; appointed midshipman U. S. navy in 1814, and was with Com. Decatur on the frigate President when she was captured by the British, and held as prisoner at Bermuda during the remainder of the war; subsequently served with Decatur in the war with Algiers, and at its close commanded an East India merchant ship. In 1825 was commissioned lieutenant U. S. navy, rising to be captain 1855. In 1854 he commanded the Cyane, and gained considerable notoriety by the bombardment and destruction of the town of Greytown (San Juan de Nicaragua). In 1861 he resigned from the U. S. navy, but his resignation was not accepted, though he effected his escape, and, joining the Southern cause, was appointed commodore in the Confederate navy. On the morning of Oct. 12, 1861, before dawn, with the ram Manassas, three fire-rafts, and five armed steamers, he surprised the U. S. squadron blockading the mouths of the Mississippi, causing much confusion, but in reality effecting scarcely any damage, although he sent exaggerated despatches announcing a great victory, and was made naval commandant at New Orleans. He was, however, superseded before the decisive attack of Admiral Farragut in 1862. G. C. Simmons.

Hol′lis, tp. and v. of Peoria co., Ill., on the Illinois River, 8 miles below Peoria, at the junction of the Peoria Pekin and Jacksonville and the Toledo Peoria and Warsaw R. Rs. Pop. of tp. 980.

Hollis, post-tp. of York co., Me., on the Portland and Rochester R. R., 18 miles S. W. of Portland, has 3 churches, and manufactures of woollens and lumber. Pop. 1541.

Hollis, tp. and post-v. of Hillsborough co., N. H., 7 miles from Nashua and 3 miles from the Worcester and Nashua R. R. It has a high school, 1 church, a town-hall, and a library containing 1800 volumes. Large quantities of lumber and some 70,000 casks are annually manufactured. Principal occupation, farming. Pop. of tp., 1079. S. H. Keeler.

Hollis (Thomas), a successful merchant of London, b. in England in 1659. In 1721 he founded the Hollis professorship of divinity in Harvard College, and in 1727 founded a professorship of mathematics and natural philosophy; he also presented books for the library, and considerable sums of money. Several others of the Hollis family were benefactors of the college. A *Life of Thomas Hollis* was published by T. B. Hollis (1780). Thomas Hollis, Sr., was a Baptist, though a member of an Independent church, and was distinguished for his charities both to Baptist and Independent churches. D. Feb., 1731.

Hol′lister, post-v., cap. of San Benito co., Cal., 94 miles S. of San Francisco. It contains 1 seminary, a graded public school, 5 church organizations, 3 public halls, and 2 telegraph and 1 express office. It derives its trade from agriculture, stock-raising, and quicksilver-mining. There are 2 weekly newspapers, about 30 business-houses, 1 steam flouring-mill, 1 brewery, 2 lumber-yards, and 4 hotels and stables. The principal tobacco plantations of California are near the town, and the quicksilver and coal developments are rich and promising in the mountain-ranges. Pop. about 2000. F. W. Blake, Ed. "Advance."

Hol′liston, post-tp. of Middlesex co., Mass., 26 miles S. W. of Boston, on the Milford branch of the Boston and Albany R. R. It has important agricultural interests, manufactures of boots, shoes, nails, pumps, wrenches, etc., 1 national and 1 savings bank, 4 churches, a high school, and a free library. Pop. 3073.

Hol′loman, tp. of Darlington co., S. C. Pop. 1590.

Hol′low, tp. of Bladen co., N. C. Pop. 1243.

Hol′loway (Thomas), b. in London in 1748, and d. at Coltishall, near Norwich, in 1827. He engraved the illustrations to the English translation of Lavater's *Physiognomy,* but his most celebrated work is his engravings of the cartoons of Raphael.

Hol′loway's, tp. of Person co., N. C. Pop. 1279.

Hol′low Creek, post-tp., Lexington co., S. C. P. 1315.

Hol′low Pop′lar, tp. of Yancey co., N. C. Pop. 382.

Hol′low Square, tp. of Hale co., Ala. Pop. 3360.

Hol′lowville, or **Smoky Hollow,** post-v. of Claverack tp., Columbia co., N. Y. It has manufactures of woollens, candles, lumber, etc.

Hol′low-ware includes cast and wrought iron domestic utensils. The casting of the best kinds of hollow-ware is followed by turning and annealing, and sometimes by enamelling, tinning, or japanning. Excellent wrought-iron ware is now produced by pressing, there being no joints left in the work. (See Hardware, by L. P. Brockett, A. M., M. D.)

Hol′ly, the name of various shrubs and small trees, chiefly of the genus *Ilex* and order Aquifoliaceæ. They are mostly evergreens, with rich green leaves and red berries. The typical species is *I. Aquifolium,* the European holly, whose leaves are so highly prized for Christmas decoration. Its bark yields bird-lime, and has medicinal powers. The finest American species is the *I. opaca,* a small tree, used also in Christmas decoration, but its appearance is far inferior to that of the former species. The wood of both the above species is very hard and white, and is used by turners, inlayers, and carvers. *I. Cassine* and other species yield the "yaupon tea" of the Carolinas and the "black drink" of the Creek Indians. Paraguay tea (see Maté) is produced by certain South American hollies. The U. S. have some twelve or fourteen species of *Ilex,* mostly unimportant shrubs, some with deciduous leaves, besides one, the mountain holly, *Nemopanthes Canadensis,* of another genus closely allied. The sea-holly or sea-holm of Europe is the *Eryngium maritimum.*

Holly, tp. of Van Buren co., Ark. Pop. 153.

Holly, tp. and post-v. of Oakland co., Mich., at the crossing of the Flint and Père Marquette and the Detroit and Milwaukee R. Rs., 52 miles from Detroit. It has fine schools and churches, a high-school building which cost $50,000, 7 hotels, manufactures of flour, castings, furniture, and other goods, and a large trade. Ice is extensively shipped from this vicinity, which is one of the most fertile and attractive in the State. A State insane asylum is to be opened in the vicinity. The village has 2 national banks, a weekly newspaper, railroad machine-shops, etc. Pop. 1429; of tp. 2437. Henry Jenkins, Ed. "Register."

Holly, tp. of New Hanover co., N. C. Pop. 1016.

Holly, tp. of Webster co., W. Va. Pop. 612.

Holly Grove, tp. of Gates co., N. C. Pop. 1213.

Hol′lyhock, the name of certain biennial plants of the genus *Althæa* (*A. rosea, ficifolia, Chinensis*), tall Old-World herbs, much cultivated in gardens for their flowers, of which there are many varieties, single and double. The

culture of these plants for forage purposes has been proposed. The stalks abound in a fibre which may be utilized as paper-stock.

Holly Neck, tp. of Nansemond co., Va. Pop. 3275.

Holly Springs, post-tp. of Dallas co., Ark. Pop. 636.

Holly Springs, post-v., cap. of Marshall co., Miss., on the Mississippi Central R. R., 43 miles S. E. from Memphis, Tenn. It has 1 foundry, 1 hub and spoke factory, 3 wagon-factories, 3 potteries, 1 marble manufactory, 1 savings bank, 2 newspapers, 2 hotels, 6 schools, 7 churches, and 42 stores. It ships annually 23,000 bales of cotton. Pop. 2406. CALHOON & HOLLAND, EDS. "REPORTER."

Hol'lywood, tp. of Carver co., Minn. Pop. 534.

Hol'man City, a v. of Paris tp., Oneida co., N. Y. Pop. 75.

Holman (JAMES), "the blind traveller," b. in England 1791; entered the royal navy 1798; commissioned a lieutenant 1807; invalided 1810; became blind 1812; was appointed a naval knight of Windsor, and in 1819 began to make his journeys, which extended to all parts of the world. He published some seven volumes of travels, and his books had at one time considerable currency. D. in London July 29, 1857.

Holman (JOSEPH GEORGE), b. at London 1764; was educated at Queen's College, Oxford; appeared as Romeo at Covent Garden 1784, and soon became a rival of Kemble on the British stage; came to the U. S.; was for some time manager of a theatre in Charleston, S. C.; was very successful for some years in the U. S. D. at Rockaway, L. I., of yellow fever, Aug. 24, 1817. Author of several comic operas and comedies.

Holm'boe (CHRISTOPHER ANDREAS), b. at Vang, Norway, in 1796; studied Oriental languages in Christiania and Paris, and became in 1822 professor at the University of Christiania. The most prominent of his writings are—*De prisca re monetaria Norvegia* (1841), *Sanskrit und Oldnorsk* (1846), *Det Oldnorske Verbum* (1848), *Det norske Sprogs vosentligste Ordforraad, sammenlignet med Sanskrit* (1852), *Norsk og Keltisk* (1854). As a member of various commissions he has exercised a great and beneficial influence on educational affairs in Norway.

Holm'del, tp. and post-v. of Monmouth co., N. J., 6 miles S. of Raritan Bay. Pop. 1415.

Holmes, county of Florida, bounded on the N. by Alabama. Area, about 390 square miles. Much of its surface is covered with heavy pine timber. It is traversed by the navigable Choctawhatchie River. Rice and cotton are the chief crops. Cap. Cerro Gordo. Pop. 1572.

Holmes, county in N. W. Central Mississippi. Area, 940 square miles. It is traversed by the navigable Yazoo River and the Mississippi Central R. R. Its surface is diversified, its soil productive. Cotton and corn are staple crops. Cap. Lexington. Pop. 19,370.

Holmes, county of N. E. Central Ohio. Area, 420 square miles. Its surface is rolling, the soil productive. Cattle, grain, wool, and flour are staples. Coal has been found. It is traversed by the Cleveland Mt. Vernon and Delaware R. R. Cap. Millersburg. Pop. 18,177.

Holmes, tp. of Mackinac co., Mich., bounded on the S. by Lake Huron. Pop. 938.

Holmes, tp. of Crawford co., O. Pop. 1572.

Holmes (ABIEL), D. D., LL.D., b. at Woodstock, Conn., Dec. 24, 1763; graduated at Yale in 1783, and was a tutor there 1786–87; held Congregational pastorates at Midway, Ga., 1785–91, and at Cambridge, Mass., 1792–1832. He married a daughter of President Stiles, and after her death a daughter of Hon. Oliver Wendell. He published *Annals of America*, a work of permanent value (2 vols., 1805, enlarged ed. 1829); *Life of President Stiles* (1796); papers on Stephen Pannenius; on the Mohegan Indians; biography of John Lothrop, and many others in the *Massachusetts Historical Collections*. He received the degree of D. D. from Edinburgh University. D. June 4, 1837. He was the father of Dr. Oliver Wendell Holmes.

Holmes (DAVID), son of Col. Joseph Holmes of Frederick co., Va.; was in Congress 1797–1809; governor of Mississippi Territory 1809–17; governor of the State of Mississippi 1817–19 and 1825–27; U. S. Senator 1820–25. D. near Winchester Aug. 20, 1832.

Holmes (GABRIEL), b. in Sampson co., N. C., in 1769; was educated at Harvard College; became a lawyer; State senator 1827; governor of North Carolina 1821–24; in Congress 1825–29; also general of militia, besides holding other public positions of honor. D. in Sampson co., N. C., Sept. 26, 1829.

Holmes (GEORGE FREDERICK), b. in British Guiana in 1820; educated in England at Durham University. When eighteen years old he came to the U. S., and was a teacher in Virginia, Georgia, and South Carolina, and in 1842 was admitted to the bar of South Carolina by the legislature, although not naturalized. He was for a time assistant editor of the *Southern Quarterly Review*, and in 1845 accepted a professorship in Richmond College, Va. In 1846 he was chosen president of the University of Mississippi; in 1847 professor of history, political economy, and international law in William and Mary College, and in 1857 professor of history and literature in the University of Virginia. He is the author of a series of school-books for the Southern States.

Holmes (ISAAC EDWARD), b. at Charleston, S. C., Apr. 6, 1796; graduated with honors at Yale 1815; became a lawyer of his native town 1818; was one of the founders of the South Carolina Association and a leader of the extreme States' Rights party; was an able and distinguished member of Congress 1839–50; resided in California 1850–61; strove to avert the civil war in 1861. D. at Charleston Feb. 24, 1867. Author of the *Recreations of George Telltale*, and, with R. J. Turnbull, of *Carolinensis* (1826), a political work.

Holmes (JOHN), b. at Windsor, Vt., in 1799. While preparing for the Methodist ministry he became a Roman Catholic; afterwards studied in the Montreal Seminary; was a professor in Nicolet College; became a priest and home missionary. In 1828 he was appointed a professor, and afterwards principal, of the Quebec Seminary, and in 1836–37 was government commissioner to Europe and the U. S. to examine the normal schools. After 1838 he retired from public life. D. at Lorette, Quebec, in 1852. He published *Manuel abrégé de géographie* and *Conférences de Notre Dame de Québec* (1850).

Holmes (JOHN), b. at Kingston, Mass., Mar., 1773; graduated at Brown University 1796; removed in 1799 to what is now Maine, and became a prosperous lawyer of the town of Alfred; was very prominent in the convention which drew up the constitution of Maine 1820; was in Congress 1817–20; U. S. Senator 1820–27 and 1829–33; in the legislature 1829 and 1835–38; U. S. district attorney 1841–43; was distinguished for wit and eloquence. Author of *The Statesman, or Principles of Legislation and Law* (1840), etc. D. at Portland, Me., July 7, 1843.

Holmes (MARY J.), b. in Brookfield, Mass. Her maiden name was HAWES, and she is a niece of the late Joel Hawes, D. D. She was married to Mr. Daniel Holmes, a lawyer, then of Richmond, Ontario co., N. Y., and has since then resided in Versailles, Ky., and at Brockport, N. Y. She has written a large number of very popular novels, mostly of an unambitious or domestic character, and of excellent moral tendency.

Holmes (OLIVER WENDELL), M. D., a son of Dr. Abiel Holmes, b. at Cambridge, Mass., Aug. 29, 1809; graduated at Harvard in 1829; studied law for a time, and afterwards medicine, receiving his doctor's degree in 1836, after several years' attendance in the European hospitals. In 1838 he became professor of anatomy and physiology in Dartmouth, and in 1847 was called to the same chair in the Massachusetts Medical School, Boston. He is distinguished as an accurate anatomist, a skilful microscopist and auscultator, and a successful amateur photographer, but his widest fame is as a poet, wit, and man of letters. The first collected edition of his poems appeared in 1836. His Phi Beta Kappa poems, *Poetry* (1836), *Terpsichore* (1843), *Urania* (1846), and *Astræa* (1850), gave him fresh laurels; and his *Autocrat of the Breakfast Table, Professor at the Breakfast Table*, and *Poet at the Breakfast Table*, all originally published in the *Atlantic Monthly*, were a series of brilliant prose papers, with occasional poems, nearly all in his happiest vein of mingled humor, pathos, healthy sentiment, and practical wisdom. His after-dinner poems and other short lyrics are among the best of their kind in the language. He has written also various medical addresses, papers, and pamphlets: *Currents and Counter-currents in Medical Science* (1861), *Elsie Venner*, a romance (1861), *Songs in Many Keys* (1864), *Soundings from the Atlantic* (1864), *The Guardian Angel* (1868), and *Mechanism in Thought and Morals* (1870).

Holmes (THEOPHILUS HUNTER), b. in North Carolina in 1805; graduated at the U. S. Military Academy 1829; first lieutenant 7th Infantry 1835; captain 1838; brevet major for conduct at Monterey 1846; major 8th Infantry 1855; resigned in 1861; commanded a Confederate brigade in reserve at Manassas, and afterwards held command at Acquia; with the rank of lieutenant-general he held (1862–64) a command in Arkansas; attacked Helena July 3, 1863, and was repelled with heavy loss. D. Mar. 31, 1864. He possessed a large amount of property in his native State.

Holmes'burg, a v. of Philadelphia co., Pa., now within the limits of Philadelphia, on the Pennsylvania R. R.

It contains good public and private schools, 5 churches, public halls, a library, 1 newspaper, shovel and print works, 1 steam saw and planing mill, a grist-mill, 2 hotels. Principal occupation, agriculture and mechanical pursuits. Pop. about 1500. W. F. KNOTT, ED. "GAZETTE."

Holmes City, post-tp. of Douglas co., Minn. P. 452.

Holmes'ville, post-v. of Prairie tp., Holmes co., O., on the Cleveland Mt. Vernon and Delaware R. R., 6 miles N. of Millersburg. Pop. 299.

Holm Oak, or **Holly Oak** (*Quercus Ilex*, the *ilex* of Roman authors), a beautiful evergreen oak tree of Southern Europe and Northern Africa, prized for its beauty, as well as for the great excellence and durability of its timber.

Holoceph'ali [from ὅλος, "entire," and κεφαλή, "head"], an order of selachians distinguished by the confluence of the hyomandibular bone with the cranium; the coalescence of the maxillary and palatine elements with the skull; the development of a rudimentary operculum; and the existence of a single external gill-opening on each side behind the head. To this order belongs a single existing family (Chimeriidæ), represented by three living genera and numerous extinct forms. In all the living forms the body is elongated, and terminates in a slender fin. THEODORE GILL.

Holofer'nes. See JUDITH.

Holopho'tal. See LIGHTHOUSE ILLUMINATION, by PROF. J. HENRY, LL.D.

Holoptych'ius [Gr. ὅλος, "all," and πτυχή, "wrinkle," alluding to the appearance of the scale], an extinct genus of lepidoganoid fishes with imbricated bony scales. There are numerous species found in Devonian and Carboniferous strata in both hemispheres. There are, however, marked differences between the Carboniferous and the Devonian species. Some of these fishes were of great size.

Holos'tomi [from ὅλος, "complete," and στόμα, "mouth"], a group, and probably sub-order, of eels, but distinguished as an order by Prof. Cope, who has attributed to it the following characters: "Epiclavicle suspended to fourth vertebra, post-temporal wanting. Parietals in contact. Mouth bounded by the premaxillaries, which are in contact medially, and bounded behind by maxillary. Symplectic present; vertebræ unaltered; no pectoral fin. Third superior pharyngeal not smaller than fourth." In addition to these characters, the pectoral fins are absent, and the vertical fins quite rudimentary and reduced to mere folds of the integument; the anus is situated very far backward; the gill-openings are confluent in a single outlet under or near the throat; and the ovaries have oviducts. This group has been formed for the reception of two families of eel-like fishes confined to the tropical regions—viz. (1) Symbranchidæ, represented in both the East Indies and America, and (2) Amphipnoidæ, confined to Bengal. THEO. GILL.

Holothu'rians [from *Holothuria*, one of the genera; Gr. ὅλος, "whole," and θυρίον, a "mouth," an "opening"], or **Holothuroi'dea,** an order of echinodermatous radiates, including the highest in rank of radiate animals, having a long, cylindroid, somewhat worm-like body, with no calcareous shell, and with a row of appendages around the mouth. Instead of a shell, there is a leathery rind, capable of much expansion and contraction, in which there are calcareous particles. There are several families, some of which have locomotive suckers. The trepang or *bêche de mer* (*Holothuria edulis*) and sea-cucumber (*Pentacta frondosa*) of the North Atlantic are typical species. The individuals are bisexual. Some of the tropical kinds are very beautifully colored.

Hol'stein, a former duchy which belonged to Denmark, whose king, as duke of Holstein, was a member of the German confederation, but which in 1866 was annexed to Prussia, and now, together with Sleswick, forms a part of the North German confederation. It is situated between the Baltic and the German Ocean, and between the Elbe and the Eider, which separate it respectively from Hanover and Sleswick. Its western part is marshy, and so low that it must be protected from inundation by dykes, but it is very fertile and presents excellent grazing-grounds; the central part is heathy and sandy; the eastern part fine soil fitted for agriculture. The rearing of cattle and the production of butter and cheese, together with agriculture, are the main branches of industry. Area, 3230 square miles. Pop. 592,182. Principal cities, Kiel and Altona. It now constitutes a portion of Sleswick-Holstein, a province of Prussia.

Holste'nius (LUCAS), b. at Hamburg in 1596; studied at Leyden; travelled in Italy and France; was converted to Catholicism; became librarian to the cardinal Barberini, and afterwards at the Vatican; and d. at Rome in 1661. He wrote a great number of *dissertationes* and *epistles*, which have been published since his death.

Hol'ston River rises in Smyth co., Va., by two heads, the N. and S. forks, which unite at Holston boatyard, near Kingsport, Tenn., and flows S. W. 200 miles to Kingston, Tenn., where it joins the Clinch and forms the Tennessee River. It is navigable for light-draft boats throughout, and for large steamers to Knoxville for nine months in the year. It is a beautiful stream, with no dangerous rapids. It is proposed to extend navigation by artificial means for some distance up its forks. Its affluents, the French Broad, the Little Tennessee, and the Watauga, are navigable to some extent.

Holt, county in the N. W. of Missouri, separated by the Missouri River, its S. W. boundary, from Kansas and Nebraska. Area, 470 square miles. Its surface is varied. Cattle, grain, wool, and lumber are the staple products. The county is traversed by the Council Bluffs and St. Joseph R. R. Cap. Oregon. Pop. 11,652.

Holt, county of Nebraska, bounded N. by Dakota. Area, 2515 square miles. Its N. border is washed by Keya Paya and Niobrara rivers. It is also traversed by the Elkhorn and other streams, and contains choice farming and grazing lands.

Holt, post-tp. of Taylor co., Ia. Pop. 356.

Holt, tp. of Fillmore co., Minn. Pop. 784.

Holt (Col. JOHN SAUNDERS), b. in Mobile, Ala., in 1826, and comes of an old family of Bedford co., Va.; was educated in New Orleans and at Centre College, Danville, Ky.; is a lawyer of Woodville, Miss.; served both in the Mexican and the civil wars; and has written three successful tales of Southern life—*The Life of Abraham Page, Esq.*, *What I Know about Ben Eccles*, and *The Quines*.

Holt (Sir JOHN), b. at Thame, Oxfordshire, England, 1642; studied law and became a prominent advocate; in 1685 he was appointed recorder of London, administering the responsible duties of his office with much ability until the following year, when, by opposing a court measure, he became unpopular and was removed. Subsequently he held the office of sergeant-at-law. In the Convention Parliament which proclaimed William and Mary as king and queen he displayed such ability as to attract the notice of William (prince of Orange), who upon his accession to the throne (1689) appointed Holt lord chief-justice of the king's bench. Subsequently the king offered him the office of the great seal, but this he declined, and remained chief-justice until his death, which occurred at London in 1709. He was celebrated for his unbending firmness, strict integrity, and justice. As a jurist he was also very highly regarded.

Holt (JOSEPH), b. in Breckenridge co., Ky., Jan. 6, 1807; educated at St. Joseph's College, Bardstown, and at Centre College, Danville; in 1828 he entered upon the practice of law at Elizabethtown, Ky., removing to Louisville in 1832, and the following year was attorney for Jefferson circuit. In 1835 he removed to Port Gibson, Miss., where he practised his profession with great success until 1842, when he returned to Louisville. In 1857, Pres. Buchanan appointed him commissioner of patents, and in 1859 to a seat in his cabinet as postmaster-general. Upon the resignation of John B. Floyd (Dec., 1860), which Buchanan quietly accepted, Gen. Holt was appointed to succeed him as secretary of war, and during the eventful months which preceded as well as on the occasion of the inauguration of Pres. Lincoln, he actively co-operated with the general-in-chief in maintaining order and suppressing threatened traitorous outbursts at the capital. He subsequently made a report detailing the facts of the intended seizure of the capital. His next service was as a member of the commission appointed to investigate the military claims against the department of the West. In Sept., 1862, Pres. Lincoln selected him as judge-advocate-general of the army, with the rank of colonel, which he accepted, and upon the establishment of the bureau of military justice in June, 1864, was retained at its head with the same title, but with the increased rank of brigadier-general. In this capacity he has borne a conspicuous part in the various important courts-martial, courts of inquiry, and military commissions—notably that before which were arraigned the assassins of Pres. Lincoln.
G. C. SIMMONS.

Hol'ton, city, cap. of Jackson co., Kan., on the Kansas Central (narrow gauge) R. R., 56 miles W. of Leavenworth. It has 2 banks, 5 churches, a high school, 2 hotels, a steam flouring-mill, and 1 weekly newspaper. It is in an excellent fruit and stock region, has good timber, building-stone, and fine streams. Pop. 426.
F. A. ROOT, ED. "EXPRESS AND NEWS."

Holton (SAMUEL), b. at Danvers, Mass., June 9, 1738; was a physician of his native town; a prominent colonial legislator and an ardent patriot, holding important public offices in his province; assisted in forming the Confederation 1777; was in Congress 1778–83, 1784–87, and 1793–95; judge of probate 1796–1815; twenty-seven years a State councillor,

and was for a time a justice of the common pleas; was also eminent as a practitioner. D. Jan. 2, 1816.

Höl'ty (Ludwig Heinrich Christoph), b. at Mariensee, near Hanover, Dec. 21, 1748; studied theology at Göttingen, but was of a very delicate constitution, and d. at Hanover Sept. 1, 1776. After his death his lyrical poems were published by Voss and Stolberg in 1783, and attracted much attention on account of the sweet, elegiac feeling which pervades them and the delicate harmony of their form.

Holtz'endorff, von (Franz), b. at Vietmannsdorf, Prussia, Oct. 14, 1829; studied at Berlin, Heidelberg, and Bonn, and became in 1861 professor of jurisprudence at the University of Berlin. He wrote *Französische Rechtszustände* (1859), *Die Deportation als Strafmittel* (1859), *Das irische Gefängniss-system* (1859), *Principien der Politik* (1869), *Encyklopädie der Rechtswissenschaft* (1870), *Handbuch des Deutschen Strafrechts* (1874).

Holtzendorff (Karl Friederich), b. at Berlin Aug. 17, 1764; entered the military service in 1778 under his father, who was an eminent general of artillery; became lieutenant in 1781; distinguished himself in Poland in 1794; was wounded at Halle in 1806; took part in the defence of Dantzic in 1807; and commanded the artillery of the army of Bülow in 1814, and of that of Blücher in 1815. D. at Berlin Sept. 29, 1828.

Holtz'mann (Adolf), b. at Carlsruhe May 2, 1810; studied theology at Berlin, Old German at Münich, Sanscrit at Paris, and was in 1852 appointed professor of German language and literature at the University of Heidelberg. His most prominent writings are—*Ueber den Umlaut* (1843), *Ueber den Ablaut* (1844), *Indische Sagen* (1843–45), *Celten und Germanen* (1855), *Niebelungenlied* (1855), *Klage* (1859).

Holy Alliance, a compact entered into at Paris Sept. 26, 1815, by the sovereigns of Russia, Austria, and Prussia, joined by most of the other European powers, and published Feb. 2, 1816. It for ever excluded all members of the Bonaparte family from any throne in Europe, expressed the intention of the contracting powers to live together in Christian harmony, and exhorted the people to faithful daily fulfilment of Christian duties. Thus they concealed the chain they had welded with which to restrain the progress of liberal ideas in Europe.

Holy Coat of Treves, a garment preserved in the cathedral of Treves, in Germany, which was declared by Pope Leo X. in 1514 to be the veritable seamless garment worn by Jesus Christ at his crucifixion, and for which the soldiers cast lots. This coat, it is alleged, was left at Treves by the empress Helena in the fourth century. No less than nine other holy coats have been exhibited, and in 1843, Pope Gregory XVI. pronounced that of Argenteuil in France to be the true one. The one at Treves was lost for a season, and rediscovered in 1196. It has been from time to time exhibited, when hundreds of thousands of pilgrims flock to see it, as in 1844. Among the consequences of this last exhibition was the secession of Johann Ronge and his numerous followers from the Church.

Holy Communion. See Eucharist, by F. A. P. Barnard.

Holy Communion, Sisters of the, a society of ladies of the Protestant Episcopal Church, founded in New York in 1845 by the Rev. Dr. W. A. Muhlenberg. They are not bound by vows, and do not wear a strictly uniform habit. They are devoted to the care of the sick in hospitals and to other charitable labors.

Holy Cross, Congregation of the, an association of regular clerks, founded by the Abbé Moreau in 1834. Their present rule was approved in 1856, in which year the Brotherhood of St. Joseph was merged into this congregation. They were introduced into the U. S. in 1842, and have now numerous establishments here. There is a congregation of Canons Regular of the Holy Cross (anciently called Crutched Friars in England), founded by Theodore de Celles 1211. They have a college at Watertown, Wis., and are numerous in continental Europe; called also Croisiers and Cross-bearers.

Holy Cross, Sisterhood of the, founded 1834 by the Abbé Moreau, at Mans, Belgium. Their rule was approved in 1857. There are two orders of "Daughters of the Cross" and one of "Sisters of the Cross," independent of the above.

Holy Ghost, or **Holy Spirit** [Heb. *Ruah Elohim* and *Ruah Jehovah;* Gr. πνεῦμα ἅγιον], the Spirit of God, of Christ, of the Lord, etc., is the third Person of the Trinity, whose existence, character, and offices are revealed in the Bible. Sax. *ghost,* Ger. *geist,* Dan. *ånd,* Heb. *ruah,* Greek πνεῦμα, Lat. *spiritus,* Eng. *spirit,* all originally mean "wind," then "breath," then "life," then the self-conscious, intelligent, self-determined, thinking substance of God, angels, and man. The term πνεῦμα ἅγιον, "Holy Ghost," in Scripture and Christian theology, does not designate the spiritual substance common to the three Persons of the Godhead, but the third Person or Hypostasis existing in the unity of that substance. We propose here a condensed statement (I.) of the scriptural and Church doctrine as to his personality, divinity, procession, and offices; (II.) of the history of opinion on the subject; (III.) its literature.

I. Scriptural and Church Doctrine of the Holy Ghost. 1. *His Personality.*—The attributes of personality are intelligence, will, individual subsistence; and in Scripture all of these are predicated of the Spirit. (1) He uses the pronoun "I," and the Father and Son use the pronouns "he" and "him," when speaking of him (Acts xiii. 2; John xv. 26 and xvi. 13, 14); "When he (ἐκεῖνος) shall come . . . he shall glorify me." (2) His functions all imply distinct personal subsistence: he "speaks," "searches," "selects," "reveals," "reproves," "testifies," "leads," "comforts," "distributes to every man as he wills," "knows the deep things of God," "is grieved," etc. (Acts xiii. 2; 1 Cor. ii. 10, 11 and xii. 11; 1 Tim. iv. 1). (3) All Christians profess personal allegiance to the Holy Spirit precisely as to Father and Son. They are baptized εἰς τὸ ὄνομα—*into the name* of the Father, and of the Son, and *of the Holy Ghost* (Matt. xxviii. 19). If the two former are Persons, the latter must be. Hence he is our Sanctifier and Comforter. (4) Blasphemy against the Holy Ghost, and the possibility of "resisting," "grieving," and "doing despite to" him, imply his personality (Matt. xii. 31, 32; Mark iii. 28, 29; Luke xii. 10; Acts vii. 51; Heb. x. 29; Eph. iv. 30). (5) This has been from the beginning the common faith of all historical churches. (See *Nicene* and *Athanasian Creeds; Thirty-nine Articles of Church of England; Articles of Methodist Episcopal Church; Westminster Conf. of Faith,* ch. 2, § 3; *Augsburg Confession,* art. 1.)

2. *His Divinity.*—(1) He is called by the exclusive names of God. What Jehovah says in the Old Testament the New Testament writers ascribe to the Holy Ghost. (Cf. Isa. vi. 9 with Acts xxviii. 25, and Jer. xxxi. 31–34 with Heb. x. 15; see Acts v. 3, 4.) (2) Divine attributes are predicated of him: (*a*) omnipresence (Ps. cxxxix. 7; 1 Cor. xii. 13); (*b*) omniscience (1 Cor. ii. 10, 11); (*c*) omnipotence (Luke i. 35; Rom. viii. 11). (3) Divine works are ascribed to him: (*a*) creation (Gen. i. 2; Job xxvi. 13; Ps. civ. 30); (*b*) inspiration (Heb. iii. 7; 2 Pet. i. 21); (*c*) miracles (1 Cor. xii. 9–11); (*d*) spiritual regeneration (John iii. 6; Tit. iii. 5). (4) Divine worship is to be paid to him (Matt. xxviii. 19; 2 Cor. xiii. 14; Matt. xii. 31, 32).

3. *The Procession of the Holy Ghost* is a technical phrase, originating in John xv. 26 ("the Spirit of truth which proceedeth from the Father"), and used by theologians to express the essential relations of the Holy Ghost to the other Persons of the Trinity. The teachings of Scripture and of the whole Church, Roman and Protestant, involve the following points: (1) There is but one God, and he is indivisible. Therefore there is but one indivisible substance which is God. (2) This one whole substance subsists eternally as three equal Persons, the entire substance subsisting as each Person concurrently. (3) The Scriptures reveal (so far forth) the nature and relations of each Person by their names and relative actions. The Father is always first, the Son second, and the Spirit third. The terms Father and Son express an eternal reciprocal relation. The Father eternally begets the Son. The Spirit is the infinite personal "Breath" of God, as the Son is his infinite personal "Word." He is the "Spirit of God" and "from God" (ἐκ τοῦ Θεοῦ, 1 Cor. ii. 12), and the "Spirit of the Father," "who proceedeth from the Father" (ὁ παρὰ τοῦ πατρὸς ἐκπορεύεται, John xv. 26). He is also the Spirit "of the Son" and "of Christ" (Rom. viii. 9; Gal. iv. 6). He is sent by and acts for the Father; so he is sent by and acts for the Son (John xvi. 7–14). (4) Hence, the Athanasian Creed concludes (§§ 20–22), the "Father was made from none, nor created, nor begotten. The Son is from the Father alone, neither made nor created, but begotten. The Holy Ghost is from the Father and the Son, neither made nor created nor begotten, but proceeding." This the Church proposes not as an explanation, but simply as a statement of scriptural data.

The Generation of the Son is an eternal constitutional (non-volitional) act of the Father, whereby he communicates his whole divine essence to the Hypostasis of the Son, whereby the Son is the "express image of the Father's Person" and "the brightness of his glory." The Procession or Spiration of the Holy Ghost is a like eternal act of the Father and of the Son, whereby they communicate their whole common substance to the Hypostasis of the Holy Ghost, whereby he becomes their consubstantial per-

sonal Breath. As these acts are eternal, they are neither past nor future, but present, without beginning or ending.

4. *His Offices in Nature.*—The "Spirit" or personal "Breath" is the Executive of the Godhead, as the "Son" or "Word" is the Revealer. The Spirit of God moved upon the face of Chaos and developed Cosmos (Gen. i. 2). Henceforth he is always represented as the author of order and beauty in the natural as of holiness in the moral world. He garnished the astronomical heavens (Job xxvi. 13). He is the organizer and source of life to all provinces of vegetable and animal nature (Job xxxiii. 4; Ps. civ. 29, 30; Isa. xxxii. 14, 15), and of enlightenment to human intelligence in all arts and sciences (Job xxxii. 8 and xxxv. 11; Ex. xxxi. 2–4).

5. *His Offices in Redemption.*—Christ promised his disciples on the eve of his crucifixion that he would send them the Spirit of truth as another *Comforter, παράκλητος, Paraclete, Advocatus* (Patron, Counsel, Champion, Helper, etc.; also applied to Christ himself, 1 John ii. 1). Although he had been the divine agent effecting the salvation of men ever since Adam, it is said this Paraclete was not given until after the ascension and glorification of Christ (John vii. 39 and Acts ii. 32, 33); that is, he is now given with a universality, fulness, power, and clearness of manifestation infinitely surpassing that of the past. The present is the dispensation of the Spirit in contrast with the preceding preparatory dispensation of the Law. (1) The Spirit fashioned the body of Christ in the womb of the Virgin, enriched and supported his human soul, and co-operated with him in all the offices he performed in his estate of humiliation (Luke i. 35; Isa. xi. 1, 2; John i. 32 and iii. 34. (2) He inspired the writers of both the Old and the New Testaments as to thoughts and words (Mic. iii. 8; 1 Cor. ii. 10–13). (3) He teaches those who are spiritually minded the meaning of Scripture (1 Cor. ii. 14, 15), and applies to all the redemption purchased by Christ (John xvi. 13, 14). Hence he is called the "Spirit of grace" (Heb. x. 29), "of wisdom and understanding" (Isa. xi. 2), "of truth" (John xvi. 13), "of adoption" (Rom. viii. 15), "of prophecy" (Rev. xix. 10), "of promise" (Eph. i. 13), and "of glory" (Pet. iv. 14). He regenerates, sanctifies, and preserves the souls and raises the dead bodies of the saints (John iii. 6; Rom. xv. 16 and viii. 11). He is to the Church and to the individual Christian the immanent source of life—τὸ ζωοποιόν, the *Life-Giver.* (4) He is the bond of life and the organizing principle of the historic Church on earth (1 Cor. xii. 13), and Church teachers and rulers are properly only the organs of the Holy Ghost (2 Tim. i. 13, 14).

6. *Blasphemy against the Holy Ghost* (Matt. xii. 31, 32; Mark iii. 29, 30; Heb. vi. 4–6 and x. 26, 27; 1 John v. 16).—This appears to be an intelligent, deliberate, and malignant "speaking against," and rejection of, the Spirit of grace by one who has been under his special influence. It is never pardoned, because of its peculiar guilt, and because it is a definite and final rejection of Christ's salvation. (See SCHAFF, *Sin against the Holy Ghost* (1841).)

II. HISTORY OF OPINION.—1. *The State of Opinion in the Early Church, and the Definition of the Universal Church Doctrine by the Council of Constantinople,* A. D. 381.—The Christian Church from the beginning expressed its faith in the terms of the (so-called) Apostles' Creed, which acknowledges a Trinity of divine Persons. Nevertheless, the prevalent conceptions were very vague and variable (see testimony of GREGORY NAZIANZEN, *Orat. 31, De Spiritu sancto,* cap. 5), the majority regarding the Spirit as more decidedly subordinate to the Son than the Son to the Father. The complete statement of the final faith of the Church was introduced into the Nicene Creed by the Council of Constantinople (A. D. 381) in these words: "And I believe in the Holy Ghost, the Lord, the Giver of Life, who proceedeth from the Father and the Son [this phrase, "*filioque,*" was added by the Council of Toledo (A. D. 589), and was accepted by the Latins and all Protestants, and rejected by the Greeks], who with the Father and Son is to be worshipped and glorified, who spake by the prophets." For the most detailed of the universally received definitions see the Athanasian Creed (cir. A. D. 450). These Creeds, either in form or substance, have been adopted by all historical churches.

2. *Heretical Views.*—Some of the Gnostics considered the Holy Ghost and Christ two celestial *Æons,* generated to restore the disturbed harmony of the Pleroma. The Alogians and other ancient deniers of the divinity of Christ regarded the phrase Holy Ghost as another name for the single person of God. The Sabellians held that it designates one mode of divine operation and the phase of divine revelation peculiar to the present dispensation. The Arians and Semi-Arians regarded the Holy Ghost as the first and greatest creature of Christ, of superangelic but not divine perfection. After the Council of Nice these parties were called *Macedonians, Pneumatomachi,* and *Tropici.* All modern Arians and Socinians interpret the phrase Holy Ghost as a designation of the energy of God manifested in action. De Wette says the Spirit is God operative in nature; Schleiermacher says he is God operative in the Church.

III. LITERATURE. — *Nicene and Athanasian Creeds;* HASE'S *Collection of Lutheran* and NIEMEYER'S *Collection of Calvinistic Confessions;* HAGENBACH'S *Hist. of Doctrines;* SHEDD'S *Hist of Christ. Doctrines;* NEANDER'S and SCHAFF'S *Histories of the Christian Church;* WATSON'S *Theo. Institutes;* HEFELE'S *History of Councils;* OWEN'S *Discourse concerning the Holy Spirit;* JULIUS CH. HARE'S *Mission of the Comforter;* HARVEY'S *Hist. of the Three Creeds; The Paraclete,* anon.; PEARSON *On the Creed; American Quarterly Church Review,* Apr., 1868, Art. 5. A. A. HODGE.

Holy Ghost, Orders of the (Roman Catholic). (1) An order, at first consisting of hospital knights of St. Augustine, was founded in 1178 by Guido of Montpellier, and in part removed to Rome in 1204, receiving the hospital of Sassia. Here they became in part canons regular, and after many vicissitudes the knightly branch of the order ceased in 1700 to exist, but the canons regular are not yet extinct. In 1254 the Hospitallers of the Holy Ghost, a secular branch of the above, were organized, containing both brethren and sisters. The latter, called White Sisters, are still numerous and active in benevolent works. With them became connected another sisterhood of the Holy Ghost, established in 1212. (2) Another congregation of canons of the Holy Ghost was confirmed in 1588. (3) A society of missionary priests of the Holy Ghost was founded in 1700, and is still active.

Hol'yhead, seaport town of North Wales, on an island of the same name as the town, forming the western part of Anglesea co., and connected with the main portion of Anglesea by a huge causeway and a bridge. The island is mainly a barren rock, but the town contains numerous fine buildings. It is a parliamentary borough. Pop. 18. Holyhead is most notable for the breakwater by which harbor accommodation is provided for the packet service between England and Ireland, and at the same time an important harbor of refuge is constituted. The successful bridging for military purposes of the Menai Straits by Stephenson's tubular bridge decided a mooted question as to the terminus of the great railway route between London and Dublin and choice of site for harbor in favor of Holyhead. The breakwater, commenced in 1847, was planned by the late J. M. Rendel. On his death, Mr. John Hawkshaw became the superintending engineer, under whom the work was finally completed in 1873. As originally planned, it was one mile in length, forming, in conjunction with islands, an almost close harbor of 267 acres. A subsequent extension of 2500 feet has added an area of 400 acres of "sheltered roadstead." It consists of 7,000,000 tons of stones thrown in "à pierre perdue," surmounted by a vertical wall starting from low-water line near the inner edge and rising 38¾ feet above low water, three-fourths of its height being masked and protected by a long fore-shore of "rip-rap." Behind this wall, and 12 feet lower than its top, is a terrace or quay 40 feet wide. The average depth of water being 40 feet and tidal rise 18 feet, the stone mound has necessarily great dimensions, averaging 225 feet width at low water and (in 50 feet depth) 400 feet at base. The enormous quantities of stone (quartz rock from the neighboring Holyhead Mountain) required gave rise to some of the largest and most interesting quarrying operations ever undertaken. Shafts or "headings" of large dimensions were run into the rock, in which charges amounting sometimes to the enormous amount of ten tons of powder were exploded. The breakwater cost £1,500,000. (See article BREAKWATER, and *Engineering,* Sept. 26, 1873.)

Holy Innocents. See CHILDERMAS.

Holy Island, or **Lindisfarne,** an island (a peninsula at low tide) off the E. coast of England, in the county of Durham; lat. 55° 46′ N., lon. 1° 47′ W.; 3 nautical miles N. of the Farne Islands proper. Lindisfarne in 635 became a bishop's see, and was the episcopal seat of St. Cuthbert. In 900 the see was transferred to Durham. Holy Island is a favorite bathing-place, and its old castle and ruined abbey are interesting objects.

Holy League, a name applied to several alliances of European princes for war or defence. (1) That of 1511, between the pope, Julius II., Spain, and Venice, to expel the French from Italy. It lasted till the Truce of Orthes (1513). (2) That of Nuremberg (1538), between Charles V. and the Catholic princes of Germany against the League of Schmalkald. (3) That of 1571, of the pope, Venice, and Spain against the Turks. (4) The great league of the Guises, the French Parliament, the monks, Spain, and the pope against the Huguenots (1576). (See LEAGUE, THE.)

(5) That of 1609 between the pope and the Catholic states of Suabia and Bavaria. (6) That of 1684, Poland, Germany, and Venice, against the Turks.

Holy Maid of Kent, an epileptic maid-servant of an inn at Aldington, Kent, who in 1525 acquired a great reputation for sanctity and prophetic gifts. Her name was Elizabeth Barton. She became a nun of St. Sepulchre's, Canterbury, and her pretensions were favored by Archbishop Warham and Bishop Fisher. Presuming to denounce the judgments of Heaven against King Henry VIII. in case of his persistence in his suit for divorce from Catharine of Spain, she with five priests, her alleged accomplices, was attainted of high treason and beheaded, Apr. 21, 1534.

Holy Names of Jesus and Mary, Sisters of the, a Roman Catholic sisterhood, first established at Longueuil, near Montreal, in 1843, by Mmes. Durocher, Dufresne, and Céré. Their special work is the instruction of young ladies.

Hol'yoake (George Jacob), b. at Birmingham, England, Apr. 13, 1817; became a teacher of mathematics at the mechanics' institute of that city, and edited for many years *The Reasoner*, an organ of political and religious radicalism. Intellectually a positivist, and morally a utilitarian, he believes that there is a material state of the world in which it is impossible for man to be depraved and poor; and to produce this state is the aim of his reforms. He published in 1874, in London, a *History of Co-operation* (2 vols.).

Hol'yoke, city of Hampden co., Mass., on the Connecticut River R. R., and the terminus of the Holyoke and Westfield R. R. It has 9 churches, 2 national banks, 2 savings banks, 3 hotels, a public library, 1 semi-weekly and 1 weekly newspaper, 28 schools and 1800 pupils, and a granite city-hall costing above $220,000. It has an immense water-power, and contains 17 paper-mills, 8 cotton-mills, 4 woollen-mills, 1 wire-mill, 1 grist-mill, 1 reed-factory, 1 lumber manufactory, and 3 planing-mills. New waterworks have just been completed at a cost of $250,000. It has a free bridge across the Connecticut River, connecting it with South Hadley. Pop. 10,733.

W. S. Loomis, Ed. "Transcript."

Holyoke (Edward Augustus), M. D., LL.D., a centenarian and eminent physician and surgeon of Salem, Mass., was a son of the Rev. Edward Holyoke (1689–1769), who was president of Harvard College. Dr. Holyoke was b. at Marblehead, Mass., Aug. 1, 1728, and graduated at Harvard in 1746. In 1749 he began his practice at Salem, where he remained actively engaged in his profession seventy-nine years. He was temperate in his habits, ate much fruit, walked habitually in his professional business, and took great care to have abundant sleep. D. at Salem, Mar. 31, 1829, aged one hundred years and eight months, retaining his faculties in a good degree to the last. (See his *Memoir*, 1829.)

Holyoke, Mount, a steep, narrow ridge of greenstone trap in Hampshire co., Mass., separating the towns of Hadley and Amherst on the N. from South Hadley and Granby on the S. It is 7 miles long, and terminates in Belchertown on the E. Its W. extremity is separated from Mount Tom by a cleft through which the Connecticut River flows. The name is appropriately limited to the W. extremity, where there is a hotel upon the summit, which is reached by a railway whose cars are drawn up by a stationary engine. The highest point is 1120 feet above the sea. Mount Holyoke is well timbered, and some parts formerly abounded in rattlesnakes, which are, however, becoming very rare.

Holy Rood. See True Cross.

Holy Sepulchre, the tomb in which our Lord lay. It was hewn out of a rock in a garden in the place of the crucifixion, just outside the walls of Jerusalem. In the opinion of many, the spot has not yet been identified, and never will be. The traditional site, fixed upon early in the fourth century, is a cave underneath the pile of buildings known as the Church of the Holy Sepulchre. The edifice, begun by Constantine in 326 and dedicated in 335, was destroyed by the Persians under Chosroes in 614; rebuilt after about sixteen years; destroyed again by Khalif Hakim, the Fatimite, in 1010; again rebuilt in 1048; enlarged and improved by the crusaders (after 1099); suffered severely from fire in 1808; and in 1810, after extensive repairs, was consecrated anew. In Fergusson's opinion, the architecture of the edifice is "wholly of an age subsequent to that of the Crusades, and without a trace of the style of Constantine." It contains chapels for Greeks, Latins, and Armenians, with smaller apartments for Copts, Jacobites, and Maronites. The pretended miracle of the Holy Fire on Easter Eve each year is one of the greatest scandals in history. The identity of this traditional site, first disputed by Korte, the German bookseller, in 1738, has been ably argued for by Williams (*Holy City*, 1845), and ably argued against by Robinson (*Biblical Researches*, 1841; *Later Researches*, 1856; *Bibliotheca Sacra*, 1846). Fergusson (*Ancient Topography of Jerusalem*, 1847) identifies the cave underneath the mosque of Omar with the holy sepulchre. Fisher How (1871) looks for it on the N. side of the city, just outside of the Damascus gate. Barclay (*City of the Great King*, 1858) and others look for it on the E. side of the city, just outside of St. Stephen's gate, either N. of it or S. of it.

R. D. Hitchcock.

Holy Sepulchre, Orders of the. (1) Canons Regular and Canonesses of (Augustinian), founded at Jerusalem in 1099 or 1114, spread throughout Europe. The canons ceased to exist in the seventeenth century, but there are still some nuns who live in seclusion and instruct children. (2) Knights of the Holy Sepulchre, perhaps founded by Alexander III., and still found in small numbers. They are now appointed by the pope as guardian father, and by the patriarch of Jerusalem. An order of this name existed in England from 1174 to the seventeenth century. The Franciscans once had the sole right to confer this rank. At present the Latin patriarch of Jerusalem is grand master.

Holy Spirit Plant, or **Dove Plant,** the *Peristeria alata*, an orchidaceous plant of Central America, having white symmetrical floral envelopes, and the stamens and pistil united into a column which curiously resembles a bird with expanded wings. It is venerated in its native regions as the symbol of the Holy Dove, the form in which the Divine Spirit descended at the baptism of our Lord. The plant is not uncommon in cultivation.

Holy Water, in the Greek, Roman Catholic, and the various Oriental churches, water which has been consecrated by a priest and is used in religious ceremonies. Its use in churches is very ancient, and it is by many believed to be derived from a custom of the ancient Hebrews. In the Church of Rome it is composed of pure spring-water in which a little consecrated salt has been cast. The Greeks use pure water, and the faithful drink a portion of it at Epiphany and Christmas.

Holy Week, the last seven days of Lent, the week before Easter, popularly known in continental Europe as *Still Week*—often called *Passion Week*, but that name is also given to the week preceding it. It contains Palm Sunday, Spy Wednesday, Maundy or Holy Thursday, Good Friday, and Holy Saturday. It is a penitential season, in commemoration of our Lord's passion and death.

Ho'lywell, town of Flintshire, North Wales. It received its name from the well of St. Winifred, which is said to be the most copious spring in England. In its vicinity are found the richest coal, lead, and copper mines in the country, and besides its manufactures of cotton and flannel Holywell has many establishments for lead and copper smelting. It is a rapidly growing town. Pop. 5335; with surroundings, 11,692.

Homalop'sidæ [from ὁμαλός, "flat," and ὄψις, "face"], a family of colubroid serpents with regular large plates on the head; plates on the abdomen uniserial, and behind biserial; and distinguished by the extension forward of the postorbital bones over the superciliary region, and the development of hypapophyses to the vertebræ as far backward as the anal region. This family, differentiated especially by the last-mentioned character, comprises a number of genera, among which are the North American ones *Tropidonotus, Thamnophis, Ninia, Storeria*, etc., *Haldea*, etc.

Theodore Gill.

Homalopter'idæ [from ὁμαλός, "flat," and πτερόν, "fin"], a family of eventognathous teleocephalous fishes, characterized by the horizontal trend of the pectoral and ventral fins, the absence of an air-bladder, and the development of the pharyngeal teeth to the number of from ten to sixteen in a single series on each branch. The family includes two genera peculiar to the fresh waters of the East Indies, one of which (*Homaloptera*) has six barbels, and the other (*Psilorhynchus*) has none. The relations of the latter genus, however, are still uncertain, and require confirmation by anatomical investigations. Theodore Gill.

Hom'burg, or **Homburg-vor-der-Höhe,** town of Central Germany, capital of the former landgraviate of Hesse-Homburg. It is famous for its mineral springs and elegant bathing establishments, which, before the closing of the gambling-saloons, attracted more than 10,000 visitors annually. Pop. 8626.

Home, tp. of Nemaha co., Kan. Pop. 719.

Home, tp. of Montcalm co., Mich. Pop. 173.

Home, post-tp. of Brown co., Minn. Pop. 779.

Home (David Dunglas), b. near Edinburgh, Scotland,

Mar. 20, 1833; came in childhood to the U. S., and became distinguished as a spiritualistic medium, marvellous phenomena having, it is asserted, attended him from infancy. He has resided mainly in Europe since 1855; became a Roman Catholic in 1856; has been twice married, both his wives being Russian ladies of high birth; became secretary of the Spiritual Athenæum, London, in 1866; is author of three volumes of an autobiographical character.

Home (Sir Everard), b. at Greenlaw Castle, Berwickshire, Scotland, May 6, 1756; studied medicine under John Hunter; practised in London 1790; was appointed surgeon to the court and professor of anatomy; created a baronet in 1813; and d. at Chelsea Aug. 31, 1832. His most prominent work is his *Lectures on Comparative Anatomy* (6 vols., 1814–28).

Home (Henry). See Kames, Henry Home.

Home, or **Hume** (John), b. at Ancrum, Roxburghshire, Scotland, in 1722; studied theology at the University of Edinburgh; fought on the Hanoverian side in the rebellion of 1745; was appointed minister at Athelstaneford in 1746. In 1756 his tragedy of *Douglas* was produced at Edinburgh with great success, but the circumstance that it was written by a clergyman caused such a scandal that Home resigned his office in 1757. George III. gave him a pension and a sinecure office, and he continued to write tragedies—*Alonzo, Alfred, Aquileia*, etc. He also wrote a *History of the Rebellion of 1745*, but his *Douglas* and the story connected with it have alone survived. D. in Edinburgh Sept. 5, 1808.

Ho'melyn, Spotted Ray, or **Sand Ray,** the *Raia miraletus*, a fish common in European seas. It is an abundant food-fish.

Ho'mer, post-v., county-seat of Banks co., Ga., 30 miles N. of Athens. Pop. 120.

Homer, city of Champaign co., Ill., on the Toledo Wabash and Western R. R., 20 miles S. W. of Danville, 273 miles S. W. of Toledo, O., and 89 miles E. of Springfield. It has 1 savings bank, 1 newspaper, 3 churches, 1 hotel, and 1 large flouring-mill. It is situated in a rich agricultural district, adapted to raising grain and fruit, which are annually shipped from this point in large quantities. P. 767.
J. Harper & Sons, Pubs. "Press."

Homer, tp. of Will co., Ill. Pop. 1279.

Homer, tp. of Benton co., Ia. Pop. 567.

Homer, tp. of Buchanan co., Ia. Pop. 581.

Homer, post-v., cap. of Claiborne parish, La., 50 miles from Shreveport. It has 2 institutions of learning, 3 churches, a large court-house, 2 newspapers, stores, shops, etc. Principal business, cotton-buying and merchandising. Pop. 80. D. B. Hayes, Ed. "Advocate."

Homer, post-v. and tp. of Calhoun co., Mich, on the Lake Shore and Michigan Southern and the Michigan Central R. Rs. It has an academy, 3 churches, large flouring-mills, a savings bank, 1 newspaper, 2 hotels, and a furnace. Pop. of v. 685; of tp. 1575.
W. A. Lane, Ed. "Index."

Homer, tp. of Midland co., Mich. Pop. 247.

Homer, tp. and post-v. of Winona co., Minn. Pop. of v. 91; of tp. 837.

Homer, tp. and post-v. of Cortland co., N. Y., 27 miles S. of Syracuse, on the Syracuse Binghamton and New York R. R. Area, about 49 square miles. It contains an academy and graded school, 5 churches, a banking-house, 2 foundries, 4 dry-goods stores, 3 flouring-mills, 3 carriage and 1 firkin factory, an axe-factory, 1 newspaper, and 4 hotels, with a variety of smaller stores. Pop. of v. 2008; of tp. 3813. Jos. R. Dixon, Ed. "Republican."

Homer, post-v. of Burlington tp., Licking co., O., 3 miles W. from Utica. Pop. 226.

Homer, tp. of Medina co., O. Pop. 886.

Homer, tp. of Morgan co., O. Pop. 1690.

Homer, tp. of Potter co., Pa. Pop. 160.

Homer, post-v., county-seat of Angelina co., Tex., 90 miles from Marshall. Pop. 216.

Homer, the greatest of epic poets, and the earliest and most eminent author in the literature of Greece. He lived at so early a period that no certain record of its date has come down to us, and his birthplace is equally a matter of doubt. Herodotus places his birth about 850 years before Christ, and Aristotle makes him contemporary with the Ionian migration, about 140 years after the Trojan war. That it was many years after that war may be inferred from the frequent reference made by the poet to the superior size and strength of the warriors engaged in the siege of Troy, as a generation which had long before passed away. It is proverbially said that seven cities contended for the honor of being Homer's birthplace, but, according to Suidas, the list might be nearly doubled. Two different traditions mentioned by Greek authors make him to have been born on the banks of the Meles, a little river, the windings of which are seen from the highlands overlooking Smyrna. It is inferred from the style and language of his poems that, at all events, he was born in some part of Asia Minor. One of the traditions concerning him is that he was blind, which is not improbable when we consider that blindness is generally accompanied with great tenacity of verbal memory—a quality essential to the minstrel who like Homer sang his poems to the sound of the harp. The tradition that in his later years he opened a school in the island of Chios might have had no other foundation than this, that after his time there existed in that island a fraternity called *Homeridæ*, or Sons of Homer, who preserved among them his poems, and were, like him, minstrels by profession.

The fame of Homer rests upon his two great poems, the *Iliad* and *Odyssey*. Others have been ascribed to him—several hymns to the gods, for example—but though some of these were regarded by the ancients as genuine, they are now rejected as the productions of a later age. The common consent of the civilized world has placed his *Iliad* and *Odyssey* at an unapproachable height of poetic excellence. All the qualities which make the great poet are there—sublimity, fire, pathos, grace, knowledge of the human heart, the power of vividly representing action to the eye of the mind, and sweetness and majesty of numbers. The modern reader is sometimes oppressed or fatigued with the passages describing minutely and at length the bloody havoc which marked the path of Homer's warriors on the battlefield; but in that age, when all greatness consisted in military prowess, the Greek audiences may be supposed to have listened to them with enthusiasm. For the long speeches, also, made by the heroes of the *Iliad* when about to engage in combat, there must have been a reason which satisfied the listening crowd; for in that age, as there was no room for affectation, we may be sure there was no occasion for tediousness. The verses of Homer were addressed to the general mind; they were such as deeply to move from the highest to the lowest class a rude yet by nature a reflecting and highly endowed race of men.

Thus far in this article Homer has been spoken of as a single author, to whom the composition of both these poems has been truly ascribed. But about the time of the Christian era there were in Greece certain critics called Separatists, who maintained that the *Iliad* and the *Odyssey* were the work of different poets. The difference, however, between the style and treatment of the subject in the two poems is not greater than is observed between the *Paradise Lost* and *Paradise Regained* of Milton, and Longinus accounts for it with sufficient probability by supposing the *Iliad* to be the work of Homer's youth, and the *Odyssey* that of his declining years. But the personality of Homer as the author of these poems has been made in modern times the subject of a formidable attack. In 1795, F. A. Wolf, a German scholar of great learning and ingenuity, brought forward the theory that the Homeric poems were composed in portions, while the art of writing was little practised, by the different minstrels who sang them in the public assemblies, and afterward, when the art of writing became more general, collected and put together in the form and order which they now present. It was impossible, he urged, for one poet to compose and retain in memory works of such great length; but this is simply begging the question, for examples of recollection as remarkable as this are even now to be met with. A more plausible argument was founded on the discrepancies and inconsistencies in the narrative, which a careful analysis showed to be not infrequent. If these cannot be explained in any other way, the theory of Wolf must be accepted.

But there is this explanation. About the year 560 before Christ, Pisistratus, the tyrant of Athens, caused the different books of the Homeric poems to be collected and arranged in their proper order. In arranging the dispersed manuscripts chasms might occur, or portions might seem to want a proper connection. Here was both the opportunity and the temptation to interpolate, and the interpolation might be made without sufficient regard to the context. All manuscripts, especially of works so often transcribed as the Homeric poems in ancient times, are in danger of interpolation; and if we admit this, it is quite unnecessary to refer the different portions of the *Iliad* and *Odyssey* to different authors. Besides, the universal consent of antiquity in favor of the personality of Homer ought to count for something; and still more forcible is the consideration that the theory of Wolf would oblige us to suppose, what is hard to believe, that Greeçe could in any age produce a fraternity of men all of whom could write like Homer.

Notwithstanding the praise which has been bestowed upon the *Iliad* for the perfection of its plot, there are those who see in it only part of the narrative of the siege of Troy, without any proper conclusion or catastrophe. In his invocation the poet only promises to speak of the wrath of Achilles, and the calamities which it brought upon the Greeks as a consequence of the quarrel between him and Agamemnon. But he gives us much more than this. He relates the quarrel, the withdrawal of Achilles from the army, and the bloody successes of the Trojans while he indulges his anger. But in the nineteenth book Achilles and Agamemnon are reconciled, and then begin the disasters of the Trojans. Their soldiery is slaughtered, their champions are slain—Glaucus, Sarpedon, and finally Hector—and all Troy is in despair. The narrative breaks off at the most interesting moment of the siege. To those who take this view of the poem it seems not improbable that Pisistratus, or those whom he employed to collect and edit the books forming the *Iliad*, might have failed to recover the concluding part of the original poem.

The editions of Homer are almost innumerable. His commentators have found an ample storehouse from which to obtain their notes in the work of Eustathius, bishop of Thessalonica. The translations of the Homeric poems into all the languages of civilized Europe have been numerous, and are still multiplying. WILLIAM CULLEN BRYANT.

Homer (WINSLOW). See APPENDIX.

Ho'merville, post-v., county-seat of Clinch co., Ga., on the Atlantic and Gulf R. R., 122 miles S. W. of Savannah.

Homes (HENRY AUGUSTUS), LL.D., b. at Boston, Mass., Mar. 10, 1812; graduated at Amherst in 1830; was ordained in 1835 at Paris as a missionary of the *Église Réformée* to Turkey; served as a missionary of the American Board at Constantinople 1836–50; was assistant dragoman in the American legation to the Porte 1850–53; became in 1854 librarian of the State Library, Albany, N. Y.

Home'stead, post-v. of Iowa co., Ia., on the Chicago Rock Island and Pacific R. R., 20 miles W. of Iowa City.

Homestead, post-tp. of Benzie co., Mich. Pop. 163.

Homestead Legislation in the United States. It is hardly necessary to remind the reader that in a large proportion of the States the English common law forms the basis of the body of the laws by which they are respectively governed. Among the dogmas of the common law which were adopted here with few or no limitations were those by which the relations of husband and wife were regulated in respect to the effect of marriage upon the property of the wife. It was a practical disfranchisement on her part, clothing the husband with the right of possession and enjoyment of her real estate, and of property in her personality, and merging her individuality of action or control over whatever she possessed at marriage in that of her husband.

Another principle borrowed, in part at least, from the laws of England, was from the first adopted in the colonial and provincial governments in this country; and that was the right of creditors to seize upon and appropriate the goods and estates of their debtors in satisfaction of their debts. Nor was there, in this respect, any distinction made between what a debtor had inherited or acquired by his own industry, and what had come to him from his wife by virtue of his marital rights. As a natural consequence, it not unfrequently occurred that wives found themselves stripped of all their possessions by the folly or misconduct of their husbands, and reduced to penury without any fault of their own, and rendered powerless to do anything to retrieve their fortunes by the incapacity which the law itself had imposed upon them.

That such a state of things should have been tolerated by intelligent men and women for one or two hundred years serves to illustrate how strong an influence the laws of a people exert over their ideas of legal and moral duty; and the change in the character of these laws which has been made chiefly within the last fifty years is to be ascribed to the progressive spirit of liberal legislation which has distinguished the century in which we live. In no way has it been more marked than in its tendency to restore to women a just and equal share in the management of property; and where, if married, they could not with propriety be entrusted with the control of a husband's business, they should not be subjected to become passive sufferers, together with their children, with no chance of relief, if by misfortune or otherwise his means of affording them a comfortable support were cut off, by placing beyond his control, and that of his creditors, a modicum of property to serve the immediate and pressing wants of his family. This has been extensively carried out by provisions for securing, to some extent, the enjoyment of a home and shelter for the family under the name of a *homestead*, which was to be held exempt from the ordinary incidents of ownership, the right of free alienation by its owner, and a liability to be seized upon and sold for the payment of his debts.

It is proposed in the present article to examine the laws of the different States upon this subject of homestead exemption, which in some form have been incorporated into the legislation of at least thirty-two of them, and in at least fifteen of them the principle aimed at by these laws has been more or less fully declared in their constitutions of government.*

In pursuing this inquiry it is often not a little difficult to ascertain the precise limits within which the several States have confined the application of the principle which pervades these laws, since no aid is to be found in construing their statutes upon the subject by a reference to the rules of the common law. Nor can the legislation of one State throw light upon that of another, since the policy indicated by the one differs essentially from that of another. Thus, in some of these all that seems to be aimed at is to exempt the smallest pittance which can serve to relieve immediate distress for a brief period, while in others the purpose is to secure to every one who can command the means a comfortable competence, although it be at the expense of his less fortunate creditors. In Arkansas, for example, $5000 in real and $2000 in personal estate are exempted from levy; and in Georgia $2000 in real estate and $1000 in personal chattels. And this, as calculated by a writer in the 19 *Am. Law Reg.* 149, if shared by every family in the latter State to the amount of $2000, would exceed the total value of the lands within its limits by some $400,000,000.

So radical a change in what had been deemed the common-law rights of creditors of the States naturally led them to question the validity of these laws in the light of the Constitution of the U. S., which forbids State legislatures to enact laws which shall impair the obligation of contracts, the ground being that so far as existing contracts at the time of the passage of the law were concerned, it took from the creditor what he had previously had, his claim upon the debtor's property as a means of satisfying his debt. In Wisconsin it was contended that it was an unconstitutional act to declare a deed of a husband invalid unless executed also by his wife, but this objection was not sustained by the court. The homestead laws of South Carolina were declared constitutional. So were those of North Carolina, although in the latter they expressly extended the exemption to debts contracted before the adoption of her constitution, which contains the provision. A like doctrine was held in Alabama, Louisiana, Georgia, and Mississippi. But in Nevada a statute declaring any mortgage or abandonment of a homestead for securing a debt of the owner invalid was declared unconstitutional. In Virginia a law exempting homesteads from debts contracted before the passage of the act was held to be in violation of the Constitution of the U. S.; and a like decision in respect to the laws of Georgia, so far as they extended the exemption to cases of judgments recovered before the statute was passed, was recently adopted by the Supreme Court of the U. S. In several of the States questions of this kind are obviated by limiting the exemption to debts which are contracted after the right of homestead in the debtor has attached to the estate, while in others it does not extend to debts contracted before the passage of the act. And it may be mentioned, in passing, that in applying these statutes of homestead exemption, different courts adopt different rules as to the degree of strictness with which they should be construed. Being in derogation of common-law rights, some of these courts restrict them to the precise language of the act; while others, regarding them as remedial in their character, have had reference to what they regarded as the spirit and intent of the law in ascertaining the meaning to be attached to such language.

One purpose seems, obviously, to be aimed at by these laws, however construed; and that is, to secure to every man who has a family, and has provided a home for them, the enjoyment of this home free from any right or power in his creditors to deprive him thereof by seizing upon the same for the purpose of satisfying their debts. And the propriety of these local laws is so far recognized in legislating by Congress for the whole Union that the U. S. bankrupt law exempts from its effect such property as, in the place of domicil of the bankrupt, is by law exempted from levy and sale under execution; and this provision has been held to be constitutional by the Supreme Court of the U. S.

In carrying out this principle of securing for the family what the head of it has provided as a home, the statutes of the various States differ essentially in the limits which

*The States in which there are no laws upon the subject are Connecticut, Delaware, Oregon, Rhode Island, and West Virginia. Those in whose constitutions provisions for such laws are made are Alabama, Arkansas, California, Florida, Georgia, Indiana, Kansas, Michigan, Minnesota, Nevada, North Carolina, South Carolina, Texas, Virginia, and Wisconsin.

they prescribe to the power of the owner to convey it away or abandon it, or at his pleasure deprive his family of what the law intended to guard for them. In some of the States it is left to the owner to decide to what extent this protection shall be enjoyed. In a large proportion of these, however, the wife is so far clothed with power over the homestead estate that it is not competent for the husband to convey, mortgage, or abandon the same for any purpose or effect affecting her, unless she voluntarily joins in the act.

Another singular diversity in the laws of the different States upon this subject is observable in the different kinds of interests or estates which they create or assume to exist in the house and land which are held by virtue of this right of homestead. In some, this interest is regarded as a life estate; in others it descends to children; in some it is of the nature of an estate in the husband, and afterward in his widow and children, with a reversion in himself which may be reached by creditors; in others the entire homestead is put out of the reach of creditors in any form so long as the exemption continues. But they seem to agree in this, that the exemption of a homestead, as such, continues no longer than there is a wife or widow, and children under the age of twenty-one years, to enjoy it, or if no wife or widow, there are children under age residing upon the premises. But what becomes of the estate when there is neither wife, widow, nor minor children alive to share it, seems to be left to be settled by its analogy to the common law applicable to reversionary interests in land.

If, now, we pass from these general considerations of homestead laws as a system to their respective provisions in more specific detail, it may be remarked that with very few exceptions the exemption does not extend to taxes or indebtedness for the purchase-money of the estate; and in a majority of cases, it is believed, this is also true of mechanics' liens upon the same. And it may be further stated that in many, if not most, of the States the exemption continues no longer than the homestead is occupied as a residence by the family of the owner, and when abandoned by them it at once becomes subject to be levied upon by his creditors.

In treating of the subject more at length, it will be necessary to consider—(1) what amounts of real estate, in value or otherwise, are exempted as homesteads by the statutes of the several States. (2) How far a homestead right, when ascertained, avails in favor of a debtor or his wife and children, and how far the agency of such wife is requisite in releasing, abandoning, or aliening the same. In Alabama the exemption is of 80 acres of land, with a dwelling-house, if without a city, town, or village; if within it, a lot and dwelling-house, not exceeding $2000. In Arkansas, Florida, Kansas, Louisiana, Nebraska, and Missouri, 160 acres of land, with buildings, are exempt if situate outside of a city, town, or village, except that in Louisiana, when taken with certain enumerated articles of personal property, the total shall not exceed $2000 in value, and in Missouri the land must not exceed $1500 in value. But if the homestead be taken in a city, town, or village, the limit in Arkansas is that the house and lot must not exceed $5000; in Florida it is half an acre; in Kansas it is one acre; in Missouri, if it be in a city of 40,000 inhabitants, it is limited to 18 square rods, not exceeding $3000 in value, and in one of a less number of inhabitants it may extend to 30 square rods, not exceeding $1500 in value; and in Nebraska a homestead in a city, town, etc. is limited to two lots, or a single lot not exceeding 20 acres. The exemption in California extends to a lot of land and dwelling-house, not exceeding $5000 in value; the law is the same in Nevada. The amount in value of homestead exemption in Georgia is $2000; in Virginia it is to the same amount, and may be taken by a debtor in either real or personal estate. In Illinois, Kentucky, New Jersey, New York, North Carolina, South Carolina, and Tennessee the exemption to each debtor is of lands and buildings not exceeding $1000 in value. In Indiana it may be in value $300, real or personal as the debtor may elect. In Maryland it is but $100, with the same right of election in the debtor. In Iowa the debtor may claim one or more lots, not exceeding half an acre in a city or town, with a house thereon, or 40 acres of land outside of a town or city, not exceeding in value $500, together with a shop or building owned by him and used by him in his business, not exceeding in value $300. The exemption in Maine is of land and a dwelling thereon, not exceeding in value $500; and the same is the law of New Hampshire, Ohio, and Vermont, while in Pennsylvania it is limited to $300 in value, and in Massachusetts to $800. In Michigan 40 acres of agricultural land and a dwelling-house are exempted, or, what is equal, to a lot in a city or town with a dwelling-house, not exceeding in value $1500. It may not, however, include two tenements, although together they do not exceed that sum in value. In Minnesota the exemption is of a city lot and dwelling-house, or 80 acres of land with a dwelling-house outside of a city, irrespective of the value of the same. In Mississippi it covers 240 acres of land and a dwelling-house if outside of a city or town, irrespective of their value, or if in a city a proper homestead, together with personal property enough to make a total of $4000 in value. In Texas 200 acres of agricultural land are exempt without regard to value, or instead of it a city homestead of the value of $2000; while in Wisconsin the exemption is of 40 acres of agricultural land, or a quarter of an acre within a city or village, with the houses thereon, without respect to the value of the same.

In treating of the topics embraced in the second part of this inquiry, it may be proper to remark that there are various modes of setting apart a debtor's homestead from his other estate, the laws of some of the States requiring it to be done by a formal declaration of the debtor and a recording of the same; those of other States providing for setting it out by the officer holding an execution against the debtor which he is about to levy upon his estate, upon his claiming the same. So provision is made in most of the States for determining by appraisement any questions as to the value of the part claimed as homestead if creditors are dissatisfied upon the point, and for moreover disposing of the entire homestead if it is so connected with other parts of the debtor's estate that it cannot be severed therefrom, and paying to the debtor the value of what had been exempted in money, to be invested in a new homestead. But the forms by which these purposes are to be accomplished are so varied that it would occupy too much space to attempt to give them in detail. In most cases, it may be added, where the debtor has not set apart a homestead during his life, it is done by the ordinary or judge of probate in favor of his widow and children upon her application; and in several of the States, if the debtor neglects or declines to claim or have set apart a homestead, his wife may interpose and cause it to be done in his lifetime. In some of the States, as will appear, the widow takes both dower and homestead out of her husband's estate; in others she can claim but one. In some of the States ownership on the part of the debtor of the homestead claimed is required; in others a lease or a right of possession by contract is sufficient. In some the exemption applies to estates held in severalty alone; in others it includes estates held in common. The exemption in most of the States is from "forced sale," which in some of them means any sale under and by virtue of a legal process, including the foreclosure of a mortgage by a sale of the premises.

Taking up the several States in their order, the exemption in Alabama is to one who owns the estate and is the head of a family, and at his death it is continued to his children during their minority, and if he have no children it comes to his widow. Nor can a husband mortgage or convey the homestead unless the wife join in such conveyance. But it is not required that it should be occupied by the one in whose favor the exemption is claimed in order to hold it.

In Arkansas it is to every householder, whether male or female, who is the head of a family, and extends to lands held in common. After the debtor's death the exemption continues in favor of the widow and children of the owner so long as they continue to occupy the homestead.

In California the exemption is in favor of "heads of families," but not to unmarried persons, unless they have the charge of minor children of brothers and the like. And if the debtor's wife dies without children, he may no longer claim it. If he dies leaving a widow, she becomes entitled to it for the benefit of herself and children; and this is set out to her by the judge of probate if it had not been done during the life of the husband. This selection may be made by the owner or his wife, by a declaration in writing which is to be recorded; and when so selected the husband and wife become joint tenants of it. A homestead may be claimed of lands held by possession only or held in common. The husband has charge and exercises protection of the homestead, but he cannot convey it without the consent of the wife if he have one. Upon the death of the husband or wife the estate vests absolutely in the survivor, exempt from any debt contracted before that event. If the debtor dies leaving a widow and children, one-half of the estate goes to her, and one-half to the children. So essential is the joining of the wife with her husband in a deed in giving it validity, that it would not otherwise operate even as an estoppel against him.

In Florida the exemption is in favor of the head of a family, and when he or she dies it descends to the issue of the owner, if any, and if there be no child, but the owner leaves a widow, it goes to her, unless he disposes of it by will, which he may do. If there is neither widow nor children, the estate may be sold for the payment of debts.

The homestead law of Georgia is in some respects peculiar. The exemption is in favor of heads of families and of trustees and guardians of minor children, excluding bachelors living alone. If the estate of the debtor exceeds in value the amount of the exemption, he must, in order to secure it, set it out, or if he fails to do so his wife or her next friend may have it done for him. Nor can a husband defeat his wife's homestead right by conveying it or removing from it unless he acquire a new one. Such exemption does not extend to judgments recovered in actions of tort. If a widow have no children, she cannot claim a homestead. The homestead does not affect her claim to dower, which must be first set out, and then the homestead, if any, after deducting the dower; and this the minor children take, subject to the claim of dower, but free from the claims of the father's creditors, and hold it in connection with the widow till she is married or dies. If, however, the estate of the father is solvent, the children take the estate independent of any homestead right, subject only to the dower of the widow. A homestead can only be conveyed by the joint deed of the husband and wife, done with the approbation of the ordinary. But if the debtor is declared a bankrupt before his homestead is set out, it so far divests him of his estate that he cannot afterwards avail himself of the exemption.

The provision in Illinois is made for householders with families, and does not extend, as in some of the States, to houses standing upon another's land. The benefit of it enures to the widow of a debtor during her life, and to her children until they are of the age of twenty-one years if they occupy the premises. The husband, however, is the only one who can assert this right, but in so doing he acts, in some sense, as a trustee for his wife and children. No conveyance or mortgage of it can be valid unless it be by deed signed by the wife, in which the right of homestead is expressly released, and the same is acknowledged by her. If the husband abandon the premises, his deed will have the effect to create a lien upon the estate for whatever may be its value beyond that of the homestead right. And if both husband and wife abandon the estate, their deed will effectually convey it, although not executed so as to expressly release it. If, however, he ceases to occupy the estate, but leaves it in possession of his wife and children, it has not this effect, and otherwise his homestead is thereby lost, as it is if he ceases to have a family. And a widow cannot defeat the rights of her minor children after the husband's death by abandoning possession of the homestead. The statute of exemption extends to judgments in actions *ex delicto*, as well as *ex contractu*. It matters not whether the debtor owns his land in fee, for life, or for years, or simply holds it under a contract for a deed. But the exemption does not attach until the same is in his actual occupation. This homestead right is not an estate; it is distinct from dower, and does not merge in it, and the widow may have both. If a wife is divorced for his fault, she may claim a homestead right in the premises if she continues to occupy them. Creating an exemption of a homestead does not affect any debts contracted before that takes effect. If a husband convey the estate, but the wife do not join in the deed, the grantee cannot disturb the occupant in the enjoyment of the estate so long as the homestead right continues; but such purchaser, or a creditor who shall levy upon the same, may claim the premises when the homestead right ceases. And in such case, if the widow of the debtor abandon the premises after his death, the husband's deed takes full effect and cuts off the rights of the children, but her surrender would not give present effect to a sale under a levy of an execution.

In Indiana the homestead exemption is in favor of "a resident householder," which may include a wife if she owns the land and is herself a debtor. If the debtor neglects to make claim of this right when his land is levied on, he thereby waives it. The owner cannot convey or mortgage the homestead without his wife joining in the deed and acknowledging it; but though she do not join in a mortgage, if it be made by him it would not be competent for him to set up a homestead right to avoid it. At her husband's death the widow becomes entitled to the enjoyment of the homestead estate independent of any provision made for her by her husband by way of devise.

The subject of homestead has led to considerable legislation in Iowa, and to somewhat numerous decisions of her courts. It exists there in favor of "a family," which includes a widow or widower, though without children. It is incident to occupation, and the right does not attach until an occupation begins, nor even then so as to affect a debt contracted prior to that time if that were the only property the debtor then had. It is broad enough to cover a shop or other building connected with the homestead in which the debtor carries on his business. The debtor may select the homestead, and have the same recorded, and if he fail to do this, it may be done by his wife. A debtor may make his homestead liable for a debt if when he contracts it he agrees that it shall not be exempt as to such debt. And a judgment may attach as a lien upon the homestead when it shall cease to be held as such, but a conveyance in the mean time would defeat it. But a mortgage or conveyance made by the husband alone would be void. On the death of either husband or wife the property goes to the survivor, and descends to the issue of whichever of these was the owner, unless he or she may have devised the same. The right of a widow, as such, vests in her at marriage if her husband then owns the estate, and by virtue of it she may occupy the estate during her life, whether she marries again or not, and at her death the estate goes to the heirs of the owner. If the estate belongs to the wife, and he survives her, he takes it as her successor, although they have no children, and the owner may devise the estate subject to the homestead right. The husband has such a control over the subject of the homestead right that he may, at his election, change his residence, and if he abandon the estate or gains a new homestead, the original homestead right is lost. Such would be the effect if the widow abandons the estate; and if she sells the homestead, the husband's heirs may come in and divide it among themselves; she cannot claim both homestead and dower, and if she claims dower, she waives the homestead.

In Kansas the exemption is in favor of the family of the owner as a residence, and it will be held exempt from the time he acquires his title if he begins to occupy it within a reasonable time thereafter. If it is levied on, the debtor or his wife may make claim for the homestead of the officer. A judgment forms no lien upon the debtor's homestead, either in respect to his present or prospective interest therein. The husband and wife have to join to convey the estate, and their joint deed would take effect as against any deed or mortgage made either by the husband or wife alone.

In Kentucky the law exempts a homestead in favor of a *bona fide* housekeeper, whether it be of one sex or the other. It is set out by the officer having an execution against the debtor if he claims the same. After his or her death it goes to the survivor with his or her children, to occupy until the youngest child is of age. Nor will any abandonment of it by a parent affect the rights of the children. Accepting a homestead by a widow does not affect her right to dower, except that the value of the homestead is taken into account in setting off the dower. The estate may be sold subject to the homestead right, but no mortgage, waiver, or release of the homestead, as such, has any validity, unless it be executed by the husband and wife and recorded.

The law of homestead in Louisiana is very brief. It secures it to such as own *bona fide* residences, and have families or persons dependent upon them. And if a wife die, leaving an estate and a husband and children, he cannot claim homestead out of the estate as against her creditors.

In Maine the exemption is in favor of a householder in actual possession, who shall file in the registry of deeds a description of what he claims as a homestead. But it does not extend to debts contracted before such claim and description is filed in the register's office. After the owner's death his widow may occupy the premises during her widowhood, and her children during their minority; and during this time it is exempt from the debts of the deceased, but no longer.

In Massachusetts householders having families and actually occupying premises may claim homesteads out of the same, but it only takes effect when they shall have begun to occupy the same, and does not affect any liens or mortgages thereon then existing. To make an effectual claim of such exemption there must be a declaration to that effect in the deed conveying the premises, or it must be made by the owner, and a record of the same duly entered. The reversionary right of the debtor after the expiration of the homestead right is subject to his debts, but a levy upon the homestead interest is void, even if done by the consent of the wife. The exemption is as much in his favor as hers. And if he convey the land, even with covenants of warranty, it would not estop him from claiming a homestead right out of it then existing in favor of his wife and children. A mortgage or conveyance by a husband, however, will carry the reversion after the right of homestead has been satisfied, although his wife does not join in the deed; and in order to convey the homestead right there must be words in the deed expressly carrying that right by name, and the husband and wife must join in the same. The right does not attach to lands held in common, nor does a declaration of homestead become of any avail till the owner has a house thereon which he occupies. At the owner's death his widow, if he have one, has a right to continue to occupy the homestead, nor can he do anything by his will

which can curtail this right. The homestead, like her dower, is set out to her in the same manner, and she is entitled to both. This right of hers continues during her widowhood, and to any minor child who occupies the same until twenty-one years of age; and it is the subject of sale by her and the guardians of the minor children. This homestead right is regarded as an estate of freehold, first in the husband, afterwards in the widow and children until the youngest is of age. And the interest of the minor children after her death may be sold by their guardian by license of court; but neither the widow nor children can convey their respective interests, except with the consent of the other. If a husband dies leaving only adult heirs, she may claim the homestead as well as her dower, although there are no debts to be satisfied. No abandonment of a homestead after the right has once attached can effect a claim to the same until a new one shall have been gained.

In Michigan, while the exemption is in favor of the owner and occupant of an estate, no formal declaration of homestead is required until some creditor is about to levy upon his land, and then it may be done orally. It may be claimed in a merely equitable as well as a legal estate. And if it be the estate of the wife, and is occupied by both, it may have the properties of a homestead. If the owner be married, he cannot waive or defeat the homestead right, and a mortgage or conveyance of the premises in order to be good must be signed by the wife; a deed by the husband alone would not be sufficient, though made by her consent orally expressed. After his death his widow is entitled to the rents and profits of the estate, which she takes in connection with his minor children, but to that end they must be in occupation of the premises.

In Minnesota the exemption is in favor of a debtor, his widow, and minor children, but continues only so long as the premises are owned and occupied as such. It does not require any formal declaration of claim of homestead beyond the notice which the debtor may give to the officer when levying upon the same. The owner cannot convey it if he have a wife unless she joins with him in the conveyance, unless it be in mortgage to secure the purchase-money or a lien for work on the premises. It may be lost by abandoning the premises, and the husband may forfeit it by conveying the premises to his wife to defraud his creditors. A judgment against the debtor becomes a lien on the land, and may be enforced by levy as soon as it ceases to be occupied as a homestead, though the owner may convey it or temporarily abandon it without subjecting it to a creditor's process. After the owner's death his widow is entitled to it so long as she remains unmarried and continues to occupy it; and the children are also entitled to the premises until twenty-one years of age, if they occupy them.

The laws of Mississippi secure homesteads to heads of families without any formal act on the part of the debtor, who to avail himself of it must be in occupation of the premises. The husband selects the homestead, and may change it at his pleasure. But merely leaving it, while his wife and children continue to occupy it, is not held to be an abandonment. He may sell one homestead for the purpose of reinvesting the proceeds in a new one, and have a year in which to do it; so he may sell it or any part of it free from any judgment lien. After the debtor's death his widow and children take it by descent, and after her death the children hold it by descent until they are twenty-one years of age. But this does not interfere with her right of dower in the premises. During his life the wife has no vested right in the premises; so with the children. The estate is impressed with the character of homestead only while and so long as the debtor is in occupation of it, except that if the widow is not in a condition to carry on the estate, she may let it to a tenant to occupy in her stead.

Every householder and head of a family in Missouri may claim a homestead, and this right extends to household estates. If a creditor levies upon his debtor's estate, the latter may claim his homestead, and hold it exempt from all debts and liabilities. At the debtor's death the estate goes to his widow, and to his children until they are of age, and if not set out in his lifetime, the same is set out to her by the judge of probate. She may then have her dower set out in the same estate, unless the homestead covers one-third of its value; if it does, she cannot claim that and dower also.

There is little detail in the law of homestead in Nebraska. It is limited to owners, occupants, and residents as heads of families, and descends to heirs at law or goes to devisees. It is exempt from sale so long as it is owned by the debtor. If a creditor levies upon the land, the debtor gives notice to the officer of what he claims as his homestead. The debtor by joining with his wife may mortgage the homestead. The exemption does not extend to the liabilities of an attorney for moneys collected by him.

The common provision in favor of heads of families who occupy the premises in which a homestead is claimed is adopted in New Hampshire, and the part so claimed may be selected when an officer levies an execution upon the debtor's estate. It still would be liable for debts contracted before the homestead is set out. It can only be waived or released by a deed of husband and wife, if she be alive, or if dead and there are minor children, by assent of the judge of probate. If a levy is made upon the estate, the husband or his wife or her next friend may claim the homestead, and the officer is thereupon required to set it off by metes and bounds. If no such claim is made, the creditor who causes the levy to be made, takes the estate in common with the homestead right, and the same may then be set out by process of partition. If such partition cannot be made, and the homestead is sold with the rest of the estate, the amount of the exemption is to be paid into a savings bank, to be drawn out upon the joint order of the husband and wife, if she is living; otherwise, of the husband and the guardian of the children. A husband can convey the estate subject to the homestead right in the wife and children, and his covenants would estop him. But the husband and wife might, nevertheless, recover the land thus conveyed during her lifetime, and after his death she and her children might recover it. But the wife and children could not recover the land during the life of the husband. If the husband conveys his estate without his wife's joining in the deed before a homestead has been set out, she may have the homestead set out in the same even during his lifetime. The estate of homestead is a conditional life estate. When it is set out it is wholly exempt from levy, and this extends to the reversionary interest there is after the homestead right is determined. If the wife survive, and the husband dies seised of the estate, the judge of probate sets out her homestead in the same, in the same manner as dower is set out. Otherwise, she may have partition against the grantee of the estate, and have her homestead set out to her. Her right, however, is inchoate until the homestead has been set out to her in one of the forms above mentioned. This right is that of possession of the estate during life, and a right in the children during their minority. Nor can the husband change or affect this by any disposition of it in his last will and testament, so long as the widow or minor children continue to occupy the premises. Leasing homestead land is not an abandonment of the right, but upon acquiring a new homestead the prior one is lost.

In Nevada a homestead is selected by a husband and wife, or either of them, or any one who is the head of a family, and is done by a declaration in writing, which is recorded. Upon the death of either husband or wife the homestead is set apart for the survivor and their children; and if the tenant of the homestead have a wife, they together hold the same as joint tenants. He cannot convey, mortgage, or lease the premises without the concurrence of his wife, if he have one, unless she is insane. In that case it may be done by order of court, and the proceeds invested for her benefit. If, because the homestead is not separable from the rest of the debtor's estate, it is levied upon and sold, the money is deposited with the court, and can only be drawn by the order of the husband and wife. Nor can there be an abandonment of a homestead otherwise than by a written declaration signed, acknowledged, and recorded by both husband and wife, if there be one.

The exemption in New Jersey is in favor of a householder of what is occupied by him as a residence. It may be claimed either by the deed conveying the estate, or by a written declaration of the owner of such estate, duly recorded. When thus ascertained, it cannot be conveyed or leased for a longer term than one year, unless the wife, if there be one, joins in such deed or lease, and the same is conveyed for its full value, and the proceeds thereof are invested in a new homestead.

New York, by its law, exempts a homestead in favor of a householder for the purposes of a residence, and the dedication of premises to that purpose must be contained in the deed conveying the same to the claimant, or by a written notice and declaration on his part that it is to be held as such; and this must be recorded. The exemption does not extend to claims for torts. It is for the benefit of the debtor's widow and children till the youngest is of age, if they continue to occupy the same. But the debtor may release the homestead by any of the ordinary modes of conveyance; but though he is the owner of the estate to most purposes, it remains exempt from his debts until his death, and then for the benefit of his widow and family of minor children if they shall continue to occupy the same. A judgment is, nevertheless, so far a lien upon the debtor's estate that as soon as the homestead interest is determined it may be levied upon the land. A temporary cessation to occupy the premises does not defeat the right of homestead therein.

A homestead exemption in North Carolina is in favor of an owner and occupant of an estate and his widow, if he leaves one, and continues during coverture, and afterwards during her widowhood and the minority of her children, if she have any. If she have no children, the widow takes it in her own right. But actual residence and occupancy are indispensable conditions to the claim of a homestead exemption. It is a determinable fee, but there is an interest in the owner answering to a reversion, though it is not the subject of levy for his debts. If when the husband dies he leaves no debts, no homestead can be set out, because the object of such exemption is to protect it from creditors. Homestead does not interfere with the widow's right of dower. The exemption does not extend to claims for torts done. No conveyance of a homestead can be of any validity if the owner has a wife unless she join with her husband in the deed and its acknowledgment. If the homestead is not set out to the husband during his life, the widow, or his children under twenty-one years, may have it set out to her or them. And among the kinds of interests in which it may be claimed are included equities of redemption of mortgaged estates.

The right of homestead in Ohio extends to leasehold estates and buildings standing upon another's land. If a creditor levies upon the land of his debtor, he may apply to the officer holding the execution and have his homestead set off by appraisers. If this is not done during the life of the debtor, his widow may have it done in her favor after his decease. It thus enures to her benefit, or, if she be dead, to her minor children residing on the premises. A temporary leasing or removing from the estate does not work a forfeiture of the right; nor can a mortgage of a homestead be valid or effectual unless the wife join in it, so as to affect her right or that of the family.

Before a homestead exemption can attach to any premises in Pennsylvania the owner must have elected to hold the same as his homestead. And if when a levy is made upon a debtor's estate he neglects to make claim for such exemption, it is deemed an entire waiver of it on his part. He may also render the same liable to levy if, when he contracts a debt, he expressly agrees as to that debt to waive the right of homestead. After the death of the debtor his widow takes it for herself and children; and if she have none, she takes it absolutely to herself, and can convey it as her own by her own deed. But if she do not claim her homestead within a reasonable time after her husband's death, she will be held to have waived it. The bankrupt law does not reach a debtor's homestead estate.

The exemption in South Carolina is in favor of the head of a family; and if a creditor is about to levy upon the estate of such a person who claims his homestead of the officer, the latter sets it off to him. But if he neglects then to claim his homestead, he is taken to have waived it. If it is not done in the life of the debtor, it will be set off to his widow by commissioners. When thus set off it reverts to the widow and the debtor's minor children until her death or marriage and until the youngest child is of age. If the husband and wife both die leaving children, whether minors or not, they will hold the premises exempt from debts, just as their parents held. But there still is a reversion after the homestead estate is determined, which is the subject of sale or devise by the owner. But sale of an intestate's estate by order of the judge of probate does not cut off the widow's right of homestead. No waiver of the right of homestead by the head of a family will have the effect of defeating the same.

As in most of the States already mentioned, the exemption in Tennessee is in favor of the head of a family. The mode of claiming it is by a writing signed, sealed, and recorded, and the same is set out by appraisers. It cannot then be conveyed or mortgaged except by a joint deed of husband and wife, if he have one. But if he cease to occupy it, it becomes liable to be levied on by his creditors. At his death it goes to his widow during life or till she is married, when it goes to his minor children. She cannot claim dower as well as homestead if the value of the latter is as much as $1000. If her homestead is not of that value, she may have enough out of the estate in the form of dower to make it equal to that sum.

The exemption in Texas is to "a family," and by the "forced sale" to which this applies, is meant any process of court or manner prescribed by law. If the owner have a wife, he cannot convey the estate except by her consent expressed by joining in and acknowledging a deed of the premises. But if he sell the land, and then he and his wife abandon the estate, the sale becomes valid. So if he sell his homestead and then acquire a new one, the sale becomes valid; and if he gain a new one, his former one becomes liable for his debts. If he contracts to sell his homestead, the court will not enforce the conveyance so long as his wife continues to occupy the premises; but if she abandon them the contract may be enforced. And if the debtor abandons the homestead, it becomes liable for his debts. By abandonment is meant the leaving the estate with an intent not to return to claim the exemption. If the debtor have no wife, though he may have children, the homestead may be conveyed by him or be levied upon for his debts. And whether children can take a homestead after their father's death depends upon his leaving a widow to take it in his stead. Even then, if she had left her husband in his lifetime without good cause, and had remained separate till his death, her right would be lost. If, on the contrary, the husband remove from the homestead, and thus abandons her and his children, she would be remitted to her right of homestead, and may resume possession thereof. And a married woman is competent to appear and litigate her rights in court. Homestead may be claimed in lands held in common. A sale of the homestead by the husband alone, if the wife do not join with him in making the conveyance, is a nullity; but if he convey it fraudulently to keep it from his creditors, and he then abandons possession, it becomes liable to levy by his creditors. If the owner die leaving a widow and children, the children cannot have partition thereof so long as she lives; and if the court grant her a divorce with the custody of the children, she may claim the homestead to her own use.

In Vermont the exemption is in favor of a housekeeper who is the actual occupant of the same himself. It is subject to any of the owner's debts which he owed at the time of acquiring the homestead. If he acquire a new homestead, it defeats the prior one. The husband cannot impair his wife's right to the homestead by conveying it unless she joins in the conveyance. But the purchaser under such a deed may hold the premises during the coverture. The right of the wife is to enjoy the premises after the husband's death, but this right does not vest any title in her; it is only a kind of lien in her favor upon her husband's estate. She may enforce this after his death if he shall have conveyed it in his lifetime without her joining in the deed. It is to be set out to him by the judge of probate, and passes at once to the widow and children in the way of descent. It is, however, to be held by them as one entire thing, so that those who are not in possession can claim no rents out of the property. It is independent of her right of dower, and belongs to her in fee, and at her death goes to her heirs. It may, moreover, be set out to her in the same lands which have already been assigned to her as her dower; and where both are claimed, the value of the homestead is to be deducted from that of the dower; and if the homestead is equal to one-third of the estate, she can claim no dower. If she gives a deed of her homestead estate, she does not thereby affect her right of dower. A homestead may be set out in an equitable as well as a legal estate, and in incumbered as well as unincumbered premises. If the husband conveys the homestead in the lifetime of his wife, it would not have the effect to disturb the occupancy of the household and family so long as they continue to retain such actual occupancy.

It is a housekeeper and head of a family who may claim a homestead in Virginia, and the exemption may cover real or personal estate, at the election of the debtor. It is claimed either by inserting a clause to that effect in the deed conveying the estate to the debtor, or by a declaration of the owner describing what he claims, which is done by a deed duly recorded. It may be claimed in a legal or an equitable estate, and it may be claimed and selected at the time of a levy made upon it. The debtor when contracting a debt may waive the exemption as to that specific debt, and thereby render the estate liable for the same. After the death of the owner, if the homestead has not been set out, it may be done so at the request of the widow or the children of the deceased, and she will be entitled to his homestead during her widowhood, in connection with the children, until the youngest shall have arrived at majority. And the same would be the effect if she were divorced from her husband; she would take it as if he were dead.

A married or unmarried man may claim a homestead exemption in Wisconsin if he has a family dependent upon him; but it does not include estates held in common, though it would cover a house standing upon another's land. The debtor selects his homestead, and notifies the officer when making a levy upon his estate, who sets it out by metes and bounds. In order to convey it the wife must join with the debtor in a deed which she must acknowledge. Nor would a voluntary conveyance of a homestead by husband and wife render the same liable to be levied on for his debts, although made for the purpose of defrauding his creditors. A temporary leasing or absence from the estate does not affect the owner's right of homestead in the same. Upon the death of the owner the homestead descends to the widow during her widowhood, and to her children until they are of age. A wife does not lose her right in the

homestead by abandoning it if she is driven from it by her husband; nor would a husband and wife be taken to have abandoned a homestead by taking in a son to occupy it with them and carry on the estate. If the wife is insane the court may order the estate to be sold, and direct how the proceeds shall be invested. And if when the debtor dies the estate be under a mortgage or other lien, and the same is sold for more than enough to pay this charge, the judge may order enough of such surplus to be invested in a homestead for the family, and may, to that end, order $500 to be thus invested in a new homestead. (For a reference to the provisions of the laws of the U. S. concerning the rights of individual settlers to acquire public lands in the character of "heads of families," see LAND LAWS OF THE U. S.; also TERRITORIES.) EMORY WASHBURN.

Hom'icide [Lat. *homicidium*, from *homo*, "a man," and *cædo*, to "kill"], the killing of one human being by another. The word *homicide* is the most comprehensive designation employed in law to denote the causing of a person's death by human agency, and has reference to every mode by which such an act may be committed, whether it be innocent or criminal. There is no resulting implication, therefore, from the mere use of this generic appellation, that the act to which it is applied constitutes a legal offence or is attended with any legal responsibility. Homicide, at common law, is divided into three classes—justifiable, excusable, and felonious. In the ancient history of English jurisprudence there was an essential distinction between justifiable homicide and that termed excusable, since the former was regarded as involving no imputation of guilt whatever, while the latter did partake, in some slight degree, of criminality. As a consequence of this distinction, acts of justifiable homicide received no punishment, while those which were deemed excusable merely were attended by a forfeiture of the offender's goods. But at a very early period the imposition of this or any penalty for acts which were either attributable to pure accident or were done in necessary self-defence was felt to be a sentence of unjust severity, and the person charged with the offence escaped the consequences by being held entitled to a writ of pardon and restitution as a matter of course and right, or the judges, in order to relieve him of the expense of suing out the writ, would permit or direct a verdict of acquittal. Any practical diversity between the two kinds of homicide therefore became virtually obsolete, since both were adjudged equally undeserving of punishment. The old names, however, were retained, and a difference was still asserted to exist between them, because excusable homicide did involve some trivial element of heinousness, though too slight to merit any legal penalty. But the distinction, if maintained at all, is too vague and shadowy to be of any importance, and all kinds of homicide not felonious are better termed defensible or innocent. As, however, the old designations are still employed in English law and in some of the American States, they will be retained for the sake of convenience in this article. Felonious homicide is the killing of a human creature without justification or excuse, and is divided into manslaughter and murder. These two subjects will be examined under their respective titles, so that acts of a defensible nature will alone be considered here. (See MURDER, MANSLAUGHTER.)

I. *Justifiable Homicide.*—This is of various kinds. (1) Where the proper officer executes a criminal in strict conformity with his sentence. Such an act is not only not wrongful, but is obligatory upon the officer as a legal duty. It is, however, necessary that the officer should follow the sentence precisely, otherwise the act may amount to murder. (2) Where an officer of justice (or other person acting in his aid), in the proper performance of a legal act which he is required to perform, kills a person who resists or prevents him from executing it. An officer who has authority to arrest and imprison may repel force by force in the attempted discharge of his duty, even to the extent of killing his assailant if he cannot otherwise take the person whom he intends to arrest into custody, or it is necessary for self-protection. So, if a person charged with a felony escapes after arrest or flees to avoid an arrest, the officer is justified in killing him if it be impossible to effect his capture. It is a further rule that a private individual may justify a homicide necessarily committed in preventing the escape of one who has actually committed a felony. There will be no such justification, however, if the alleged crime be merely a misdemeanor. (See CRIME, FELONY.) Jailers may prevent the escape of prisoners by killing them if it be necessary. But in all such cases killing must only be resorted to as the last alternative, without which the performance of the officer's duty cannot be accomplished. (3) Where the prevention of a forcible and atrocious crime renders the homicide necessary. Whenever any offence of a felonious nature is attempted, such as murder, robbery, burglary, arson, rape, etc., either the person whose life or property is endangered, or any one who has knowledge of the intended crime, may use every effort to prevent its commission, and causing the death of the offender is justifiable if the imminent danger cannot otherwise be averted. Nor is it essential to his justification to show that the crime would actually have been perpetrated if the act of homicide had not been performed. For a person under such circumstances is warranted in acting upon a natural and reasonable presumption, and if there be sufficient indications of a felonious design and of an immediate purpose to carry it into execution, he may conclude that there is actual premeditation, and use the same means for his protection as would, if such were really the case, be allowable. Therefore, if an empty pistol be pointed at any one who believes, and has reason to believe, it to be loaded, and a threat is made to fire it immediately, the person who supposes his life to be in danger may kill his assailant with impunity. But if he knew the weapon to be unloaded, he would not be justified in such an action. Under no circumstances can the homicide be committed if the crime can be averted by less severe precautions, or unless the necessity continue to the time when the felon is killed. Hence, if the killing occur after a seizure of the wrongdoer has been effected and he has been properly secured, it will be murder. (4) Killing of the enemy during time of war in the actual prosecution of hostilities is, of course, justifiable on the ground of military necessity.

II. *Excusable Homicide.*—This is of two kinds: (1) By misadventure, or accident. This is, however, innocent only when the person committing the homicide is engaged in a lawful act, without any intention of inflicting injury upon another, and without any failure to use proper precautions to prevent danger. If the act is unlawful, the homicide will be felonious. If the head of a hatchet which a person is using, and which he has reason to believe is firmly fastened, flies off and kills a bystander, or if a wagoner drives over and kills a person lying on the road upon a dark night, the homicide is accidental and excusable. The degree of care and prudence to be exercised is variable under different conditions. The use of poisons or dangerous weapons would require much greater precaution than the employment of articles not in themselves liable to occasion injury, as, for instance, the common utensils in every-day use. The lawful act which results in a person's death may be the administering of reasonable and moderate correction by a parent or school-teacher or other person occupying a position of similar authority. But the homicide is only innocent in such a case when the bounds of a proper restraint upon the severity of the punishment are not exceeded. In like manner, if several persons should engage amicably in athletic sports, and by some unfortunate mischance one of them should be killed, he who occasioned the death would be innocent. (2) Homicide in self-defence, or in protection of one's property or his wife, child, parent, or servant. But under this head are not included cases of defence against felonious crimes, which have been already considered, but only against any other modes of attack or injury which may be attempted, as in cases of common assault or trespass, where there is no intention to commit a felony. The distinction is of considerable importance, on account of the difference in the nature of the legal obligation which is imposed upon the person against whom an offence is perpetrated to seek to avoid the commission of homicide. When an attack is made with intent to kill, or any other felony is attempted, the person whose life or property is endangered is under no duty to seek to avoid the threatened injury by availing himself of every practicable means of escape, but he may stand his ground, use every possible means of defence, and kill the wrongdoer if a reasonable and necessary precaution requires such an act. But when the attempted injury is not felonious, homicide cannot be committed in defence unless all available measures are first adopted to escape from or avert the danger. Therefore, if a simple assault be committed, though the person assailed may protect himself by blows, he must, as the old phrase expresses it, "retreat to the wall," or forbear as long as is consistent with safety before he ventures to kill his assailant. In the defence of property retreat is not necessary in order that the homicide may be justified, since that would be a yielding of the property without attempting protection; but the wrongdoer must first be requested to leave a house or to refrain from interfering with goods before preventive measures can be adopted, and even then the trespasser cannot be killed unless he persists so strenuously in effecting his purpose that such a course is rendered necessary. Only a reasonable degree of force can be used against an intruder if that will prove sufficient. A felony is so heinous an offence that the laws regard the destruction of life no disproportionate penalty if the wrongful act be per-

sisted in; but offences of any less degree ought not to entail so fearful a punishment unless they can, by no practicable means, be otherwise averted. In the U. S. crimes are generally defined by statute, and the principles relating to homicide have therefore received various modifications. Very essential alterations, however, have rarely been made. The distinction between justifiable and excusable homicide has in some States been discarded, but the same classes of offences which were formerly included under these respective designations have usually, to the same extent, been declared innocent.

George Chase. Revised by T. W. Dwight.

Homilet'ics, following the etymology of the term (ὁμιλία; see Homily), denotes the science and the art of preaching. It is that part of practical theology which relates to the composition and delivery of sermons. It is the technical synonym of "sacred rhetoric." The latter term denotes the application of rhetorical canons to *religious* discourse. There are not two kinds of rhetoric, as there are not two kinds of logic. Homiletics relate to the application of the universal laws of conviction and persuasion to the utterances of the pulpit. These laws have their origin in the constitution of our intellectual and moral nature. Homiletics, therefore, are not supposed to treat of the philosophy of rhetoric in general; but, presupposing some knowledge of this, it undertakes to show the method in which rhetoric may successfully be employed in the restricted province of the Christian preacher. As preaching is admitted to be a divine appointment, as it is acknowledged to be the chief human instrumentality by which revealed truth is to be lodged in the convictions of men, no subject deserves more careful study than sacred rhetoric. Homiletics naturally recognize two general divisions—(1) The Matter. (2) The Manner of preaching. Ancient writers on rhetoric, particularly Quintilian and Cicero, make much of *invention.* The material of the preacher is to be found in the word of God. This is what defines his office in distinction not only from the secular orator, the advocate at the bar, but from even the ethical lecturer. His official occupation is to interpret, proclaim, and enforce the contents of revelation. It belongs therefore to the department of sacred rhetoric to teach the best method of evolving the truths contained in the sacred volume for popular impression. It aims to elucidate the different kinds of preaching, such as expository, textual, and topical, giving the history and examples of each, and the rules by which each should be conducted. The chief object of homiletics relates to the *manner* of preaching, including in this general term the structure of the discourse and its enunciation. Truth depends for its power very much on the mode of its presentation. The order of thoughts may be so confused that the thoughts themselves lose half their force. Arguments and motives depend as much upon their disposition as their intrinsic weight. Sacred rhetoric looks to the *arrangement* of material in sermons, the statement of propositions, the different kinds of proof by which they are sustained, such as those drawn from the authority of the Scriptures, the reason, consciousness, experience, the conscience, and processes of reasoning, especially those exemplified by Christ and his apostles. The methods of producing persuasion, as well as conviction, of exciting emotion, moving the affections, all founded in the laws of our nature, belong also to the province of homiletics. Style, language, elocution, management of the voice, the carriage of the person, manner, gesticulation, different modes of preparing for the pulpit, different modes of delivery, with or without the manuscript, memoriter or extemporaneous, all these and many other particulars, are included in this general designation of homiletical instruction. Treatises on homiletics are numerous in all languages, ancient and modern. Augustine in his *Doctrina Christiana* treated the subject systematically. The German, French, and English tongues are rich in this species of literature. That would be a large catalogue which should include only the names of authors on the art of preaching who are distinguished and renowned, such as Bossuet, Fénelon, Maury, Claude, Schott, Reinhard, Theremin, Campbell, and Vinet. The U. S. have given many very valuable contributions to this department of authorship. All religious denominations appear to vie with each other in the attention given to the art of preaching. All the theological seminaries of this country give great prominence to homiletics in the curriculum of ministerial education. All treatises on sacred rhetoric, ancient and modern, regard self-conviction as the secret of all persuasive and earnest speech. Personal experience, deepened and vivified by the Spirit of God, is universally regarded as the prime force in sacred oratory, without which everything else is of little avail. "I believe, therefore do I speak;" "Out of the abundance of the heart the mouth speaketh."

William Adams.

Hom'ily [Gr. ὁμιλία; Fr. *homélie*], a simple religious discourse. The distinction between the *homily* and the *sermon*, as made by writers on sacred rhetoric, is, that the former is less elaborate, with less of method and disposition after rhetorical rules than the latter. A technical sense attaches to the word in history which is not strictly observed in ordinary usage. The French observe nice distinctions between homilies, conferences, discourses, and sermons. By "homilies," in modern English use, we should understand that description of sermons which has more of exposition than rhetorical system. So many are the forms of pastoral instruction in the present day, so frequent the occasions when ministers address the people, on the Sabbath, during the week, in churches, in lecture-rooms, in Bible classes, and Sabbath schools, that the old distinction between the homily and the sermon is nearly obliterated. Historically, homilies were designed to supply the deficiencies of an ignorant clergy and an ignorant people. When philosophical and rhetorical method had greatly vitiated pulpit discourse, making it scholastic, subtle, and cold, the homily was intended to provide a simpler mode of conveying religious instruction. In the Roman Church at that period, when few of the clergy were capable of making discourses for themselves, collections of homilies, consisting of compilations from the Fathers, were authorized for their use. (See Neander, *Ch. Hist.* iii. 174, concerning the *Homiliarium* of Charlemagne.) Similar collections were prepared, at the Reformation, in the English Church by Cranmer and Jewell. Their use in the Church was authorized (see 35th Article) as a means of religious instruction at a time of imperfect education. The language of the Article enjoining their use requires them to be "read in churches by the ministers, diligently and distinctly, that they may be *understanded* by the people." The first volume of the *Homilies* was published in the reign of Edward VI.; the second volume was published in the reign of Elizabeth. The substance of these English *Homilies* is generally accepted as good and wholesome doctrine, but very considerable differences of opinion (see *Bishop Burnet*) have long existed as to the *authority* attached to their contents as parts of the constitution of the Anglican Church.

William Adams.

Homin'idæ [from *homo, -inis,* "man," and the patronymic termination *-idæ*], a family established for the reception of man, in contradistinction to the other families of Primates. In contrast with those other families, man is distinguished (1) by his habitually erect form (except in infancy), the fore limbs being withdrawn completely from the *locomotive* series and transferred to the *cephalic;* (2) the foot has the inner toe produced and developed as a "great toe," and this is in the same plane with the others; (3) the hair is scant, except upon the top of the head, but it varies in extent of development on other parts of the body according to the race as well as to the individual; (4) the teeth form an uninterrupted series in each jaw (there being no diastemata, or interruptions, for the reception of enlarged canines in the opposite jaws); and (5) they are in number 32, of which each side of each jaw has two incisors (I. 2), one canine (C. 1), two premolars (P. M. 2), which succeed two deciduous molars, and three permanent and later developed molars (M. 3); furthermore, (6) a bony external auditory meatus is developed, and at the bottom of this is a membranum tympani; (7) the nose has its median septum thin and narrow, and the nostrils are correspondingly approximated. In the first four mentioned characters man contrasts with all the other members of his sub-order, but in the last three mentioned (5–7) he agrees with the apes and monkeys of the Old World, in contradistinction with the monkeys of the New World. In his organization generally man agrees closely with the higher apes (Simiidæ), and this similarity extends to the brain as well as to the other parts of the organization. The brain differs chiefly in size and the development of the gyri and sulci of the cerebrum. The extent of agreement is expressed by the association of man with the monkeys of the Old World in one group, opposed to the monkeys of the New World, and the combination of all those in a major group (sub-order Anthropoidea), contrasted with the lemurs (Lemuridæ), Tarsiidæ and aye-aye (Daubentoniidæ or Chiromyidæ), which are combined in a corresponding sub-order (sub-order Prosimiæ). Such are the characters which distinguish man as a member of the animal kingdom, and which have induced naturalists to adopt the classification thus sketched; but it is to be remembered that in this case no attention is given to psychological characters, or to those other endowments which distinguish man so trenchantly from all the other members of the animal kingdom, to which in his purely physiological nature he belongs. These important characters more fitly belong to another province, and will be treated under the title Man, by Prof. M. B. Anderson, LL.D.

Theodore Gill.

Homœop'athy [Gr. ὅμοιος, "like," and παθεῖν, "to be affected"], a method or system of medical treatment based upon the peculiar principle that the therapeutic or curative properties of drugs and other medicinal agents are represented by their morbific effects upon the healthy. Hence the name, in contradistinction to allopathy (*dissimilar suffering*), by which term the homœopathists designate the ordinary methods of practice. This system was first propounded by DR. SAMUEL HAHNEMANN (which see) about the end of the last century, and although greeted at first with little favor from the medical profession generally, has gradually gained in popular estimation, and obtained acceptance with considerable numbers of reputable physicians, not only in Germany, where it originated, but in most other countries of the Old and New World. It is not claimed that Hahnemann was the first to observe or promulgate the therapeutic principles upon which his system is founded. Indications of its recognition as a rule of occasional though rare applicability in the treatment of the sick are found in the medical literature of the past; and even the Greek equivalent of the fundamental maxim, *similia similibus curantur*, has been discovered in writings attributed to Hippocrates. But it is admitted that Hahnemann was the first to adopt it as a general law in the practice of medicine.

The alleged discovery of the real importance of this supposed relation between the disease-exciting and the disease-curing powers of drugs, and the gradual development of the homœopathic system, are briefly, but perhaps sufficiently, described in the article on HAHNEMANN, to which the reader is referred. The following propositions, it is believed, comprise the essential points of the homœopathic doctrine, as held and taught by the best and most recent authorities of the school: (1) That the cure of disease is most easily and completely effected by medicines that are themselves capable of producing in a healthy person morbid conditions analogous to those of the disease; and the more exact the similarity, the greater probability of a favorable result. (2) Consequently, the most certain way of ascertaining the therapeutic value of medicinal agents is by repeated and carefully conducted trials of them, singly, upon persons in ordinary health. (3) That in order to secure the best results medicines should not be administered to the sick in combination, but singly and in the simplest preparations. (4) That remedies prescribed according to the homœopathic method may be, and in fact generally require to be, administered in smaller and more attenuated doses than are necessary to produce their characteristic effects upon the healthy. The practical application of these rules to the treatment of diseases necessitates the individualization of each particular case. To be strictly homœopathic a medicine should correspond not only to the general pathological state, but also to the peculiar symptoms of the patient.

In order to furnish remedies for the great variety of possible morbid conditions, the work of "proving" drugs—as the administration of them to persons in health for the purpose of observing their effects is technically called—which was begun by Hahnemann, has been diligently followed up by his disciples ever since. The homœopathic materia medica consists of the collected and collated results of the "provings" of a large number of drugs, many of which, however, require further verification. These experiments are conducted partly by individuals and partly by numerous associations formed for the purpose. Homœopathists condemn the commixture of several medicines in one prescription. When two or more remedies are required, they are usually given in alternation, and at considerable intervals. They have always avoided, as unnecessary and injurious, the use of bloodletting, drastic purgatives, mercurial salivation, blisters, and indeed all the so-called "heroic" expedients so generally relied on a generation since. Particular attention is paid, however, to diet, exercise, bodily habits, and all other sanitary and hygienic helps.

Upon the question of the proper *dose*, homœopathic practitioners are, as yet, by no means agreed among themselves. While all assent to the general statement contained in the fourth of the above propositions, the extent to which the dilution or attenuation of medicines may be advantageously carried is still a moot point, in regard to which the school is somewhat divided in opinion and practice. But although there are representatives of either extreme who profess to use exclusively in their practice "high" or "low" dilutions respectively, it is probable that the greater number of physicians consider the question of the dose quite subordinate in importance to the choice of the remedy, and that further experience is necessary to settle the range of greatest efficiency for each drug.

Before the publication of Hahnemann's *Materia Medica Pura* (1811 *seq.*) the practical application of the new law of cure was necessarily limited to prescribing the very few drugs of whose effects upon the healthy organism some scanty particulars were known. Such facts were too few and uncertain to answer the requirements of the art; consequently, the systematic proving of even the best known remedies was a necessity. The above-named work (in 6 vols.), containing the ascertained pathogenetic effects of some 60 drugs, was the first fruit of this necessity. As now the means of testing the truth of the homœopathic principle became accessible, the doctrine, and the practice based upon it, began to spread more rapidly, and soon obtained the support of a number of well-known medical men of Germany. Its progress, however, was much impeded by the state laws, which restricted the right of preparing and dispensing medicines to the apothecaries, who, being naturally opposed to a practice calculated to interfere materially with their ancient franchise, did not hesitate to invoke the aid of the law to harass its adherents. Gradually, however, these and other restrictive laws affecting the medical profession were relaxed in favor of the new school. The court-physicians in several German states were among the early disciples of Hahnemann, and were doubtless instrumental in promoting a more liberal policy. Hahnemann himself was appointed physician and state councillor to the duke of Anhalt-Coethen. Dr. Rau, physician to the duke of Hesse-Darmstadt, Dr. Muhlenbein, physician to the duke of Brunswick, Dr. Grieslich, surgeon to the grand duke of Baden, and several others who held similar official and intimate relations to the ruling powers, were retained in their positions, notwithstanding their adoption of homœopathy. From Germany the new medical doctrine extended itself to other parts of the Continent, so that before 1840 homœopathy had its professional representatives and its lay patrons in nearly every considerable town in Europe. Homœopathy was introduced into England about 1828 by Dr. Quin, physician to the king of Belgium. Not long after Scotland and Ireland were also invaded by pioneers of the same school. In all these countries the system has made considerable progress.

The earliest practitioner of homœopathy in the U. S. was Dr. Hans B. Gram, an American by birth, though by parentage and education a Dane, who after many years' absence returned in 1825 and established himself in New York. His first attempts to attract the attention of the profession to the scientific claims of the system of which he was the pioneer were unsuccessful, but before his death, in 1840, it had made decided progress in the metropolis, and gained a foothold in Philadelphia, Boston, and other cities. In 1844 was formed a national association of physicians under the name of the American Institute of Homœopathy, with about 50 members. This society now has a membership of over 1000. The whole number of avowed homœopathic physicians in the U. S. is variously estimated at from 3000 to 5000. State and county societies have been established by law in most of the States. In New York, Philadelphia, Cleveland, Cincinnati, Chicago, St. Louis, and Boston are fully-equipped medical colleges, in which the therapeutics of the new school are taught in connection with the usual branches of medical instruction. Hospitals, infirmaries, and dispensaries have been founded in many cities and large towns for the benefit of the sick poor who desire homœopathic treatment. At Middletown, N. Y., a homœopathic insane asylum has been erected by the State, and is in successful operation.

The literature of the new school is already remarkable for its extent, comprising expository, controversial, journalistic, and practical publications in almost every department of medical science. The works of Hahnemann alone form a considerable collection, while some of his disciples have also been prolific writers. The *Organon* has appeared in numerous editions and in various languages. A collection of Hahnemann's *Lesser Writings*, edited by Dr. Dudgeon of London, has also attained a large circulation. As early as 1822 was founded at Leipsic the first periodical of this school, the *Archiv für die Homœopathische Heilkunst*, which continued for many years the leading exponent of the system in Germany. In 1830 the *Bibliothèque Homœopathique* was commenced at Geneva, Switzerland. In 1834 the publication of the *Archives de la Médecine Homœopathique* was begun in Paris. About the same time *The American Journal of Homœopathia*, by Drs. J. F. Gray and A. Gerald Hull, appeared in New York—the pioneer of the homœopathic periodical literature of this country. The *British Journal of Homœopathy* (London) was founded in 1843. The following are the principal publications of this class in the U. S. in 1875: *North American Journal of Homœopathy*, quarterly, New York; *U. S. Medical Investigator*, bi-monthly, Chicago; *American Observer*, monthly, Detroit; *Hahnemannian*, monthly, Philadelphia; *Am. Journal of Mat. Med.*, monthly, Philadelphia; *New England Medical Gazette*, monthly, Boston; *Medical and Surgical Reporter*, monthly, Cleveland. H. D. PAINE.

Homoge'neousness, or **Homogene'ity** [Gr. ὁμός, "same," and γένος, "kind"]. An algebraical expression is called *homogeneous* when all its terms are of like "degree"—*i. e.* products of the same number of literal factors. Were these the symbols of abstract numbers *only*, the term would be nearly destitute of important signification. But the *principle of homogeneousness* applies to equations expressive of relations between symbols for physical magnitudes (as well as abstract numbers), and these physical magnitudes of various kinds, incommensurable with each other, are only made commensurable and susceptible of mathematical relations by simulation to abstract numbers through the agency of, for each, some arbitrary *unit*. Thus, we measure *time* by *days* or hours; linear extension by *miles* or *feet*, etc., or *mètres*, etc.—units, so-called, of wholly arbitrary selection—while those of one kind (*e. g.* the *hour*) are wholly incommensurable with those of another kind (*e. g.* the *mètre*), except that each is a *unit* and represented by the abstract number *one*. An equation expressing a relation between physical magnitudes should be true whatever be the arbitrary unit taken for each; and, indeed, failure to bear this test is a conclusive evidence of error. But a change of arbitrary unit will evidently cause a change in the numerical value by which each particular magnitude is expressed. Thus, if f, f', l, l', t, t', etc. symbolize, respectively, *forces, lengths*, and *times*, and n, n', n'', etc. *abstract* numbers, and we diminish the unit for each in the ratio of $\frac{1}{n}, \frac{1}{n'}$, etc., these physical magnitudes will *then* be expressed by $nf, nf', n'l, n'l'$, etc., and the relation expressed by $F(f, f' \ldots l, l' \ldots t, t', \text{etc.}) = 0$, should become, truthfully, $F(nf, n'f' \ldots n'l, n'l' \ldots n''t, n''t' \ldots) = 0$, in which F denotes any function of the magnitudes.

Literal homogeneousness in general secures the existence of this condition; unless, indeed, there be unit symbols which involve in themselves the *repetition* of an inferior unit in different senses (*e. g.* a unit of *surface* and of *volume* involve in themselves the repetition of the linear unit *two* and *three* times, repeatedly, in different *directions*), in which case their symbols will by the change supposed above involve the numbers n, n', etc. in higher powers. Thus, a unit of surface s would become $n'^2 s$, etc., and its symbol is to be ranked as *itself* of that degree to which it involves the inferior unit.

The *principle of homogeneousness* demands that, whatever be the character of the unit symbols, the relation expressed by the above equations, if true for one form, shall be true for the other, whatever be the value of the arbitrary numbers n, n', etc. Important *a priori* conclusions may sometimes be deduced. Thus, if a *force* f' is to be expressed in terms of *but one* other force f *and* symbols of other kinds of physical magnitudes, it is required by the above principle that the expression shall be of the form $f' = Nf$, in which N contains *only* symbols of the other kinds of magnitudes which do not vary with the unit of force, and f enters as a factor of the first degree.

J. G. BARNARD.

Homol'ogy [Gr. ὁμολογία, "agreement"], in philosophical anatomy, the essential structural correspondence of different parts of the same organism, or of different organisms. Thus, the arm of a man, the fore leg of an ox, the wing of a bird, and the pectoral fin of a fish are homologous parts. So, in the same animal, the foot is the homologue of the hand, because it is formed on the same type.

Homology, a term expressing a principle in the chemistry of organic compounds of high importance and significance, first introduced by the illustrious Gerhardt.* A series of homologues, or *homologous series*, constitutes what, in a classification of carbon compounds, might be called a family or genus, of which the individual compounds are the species. Such a classification is a *natural* one.

A homologous series is formed by additions to an elementary molecule or group of such—which constitutes a nucleus or *homologenic radical*—of successive equivalents of a certain molecular group of hydrogen and carbon atoms represented by H^2C. This group, H^2C, we may, for convenience, call the *homologen*. Whether such a compound is capable of existing in an isolated form is unknown. Methylene, or methene, which has not been yet obtained, would have this empirical formula, but it is not probable that the homologen H^2C is itself methylene.

*The discovery of the principle of *homology* is generally given to Gerhardt, who developed and established it; but Dr. J. Schiel of St. Louis first announced in the *Annalen* (July, 1842) the arrangement of organic compounds in what he called "progressive series," corresponding to series of homologues. (See Dr. Schiel's reclamation in the *Am. Jour. of Science*, July, 1861.) The principle of homology was also extended to mineralogy by T. Sterry Hunt in the *Am. Jour. of Science*, Sept., 1854, ten years before Tschermak, to whom it has been attributed. (See SILICATES, CHEMISTRY AND CLASSIFICATION OF.)

Examples of Homologous Series (confined to known compounds).

Generic Name.	*Paraffines*, or Saturated Hydrocarbons of the Marsh-gas Series.	Monatomic *Alcohols*.	*Aldehydes*; of the Fatty Series.	Monatomic *Fatty Acids*.	Hydrocarbons of the "*Ethine*" Series.	Hydrocarbons of the Olefiant Series: *Olefines*.
Empirical Formula.	C^nH^{2n+2}.	$C^nH^{2n+2}O$.	$C^nH^{2n}O$.	$C^nH^{2n}O^2$.	C^nH^{2n-2}.	C^nH^{2n}.
Fundamental or Nuclear Molecule, or Radical.	The Compound Hydrogen-Molecule of Water.......... H^2.	Water.......... H^2O.	Oxygen.......... O.	A Compound Oxygen-Molecule.......... O^2.	Carbon.......... C.	Methene (?).......... CH^2.
Homologenic Formula.	$H^2 + n(H^2C)$.	$H^2O + n(H^2C)$.	$O + n(H^2C)$.	$O^2 + n(H^2C)$.	$C + n(H^2C)$.	$H^2C + n(H^2C)$.
Series of Homologues. 1.	Marsh-gas.......... $C\ H^4$	Wood-spirit.......... $C\ H^4\ O$	Formic aldehyde.......... $C\ H^2\ O$	Formic acid.......... $C\ H^2\ O^2$	Acetylene.......... C^2H^2	Ethylene (olefiant gas)... $C^2\ H^4$
2.	Ethane-gas.......... $C^2\ H^6$	Spirit of wine.......... $C^2\ H^6\ O$	Common " .... $C^2H^4\ O$	Acetic " .... $C^2\ H^4\ O^2$	Allylene.......... C^3H^4	Propylene.......... $C^3\ H^6$
3.	Propane.......... $C^3\ H^8$	Propylic alcohol.......... $C^3\ H^8\ O$	Propionic " .... $C^3H^6\ O$	Propionic " .... $C^3\ H^6\ O^2$	Crotonylene.......... C^4H^6	Butylene.......... $C^4\ H^8$
4.	Quartane.......... $C^4\ H^{10}$	Butyric " .... $C^4\ H^{10}O$	Butyric " .... $C^4H^8\ O$	Butyric " .... $C^4\ H^8\ O^2$	Valerylene.......... C^5H^8	Amylene.......... $C^5\ H^{10}$
5.	Quintane.......... $C^5\ H^{12}$	Fusel oil.......... $C^5\ H^{12}O$	Valeric " .... $C^5H^{10}O$	Valeric " .... $C^5\ H^{10}O^2$	Diallyle.......... C^6H^{10}	Hexylene.......... $C^6\ H^{12}$
6.	Sextane.......... $C^6\ H^{14}$	Caproic alcohol.......... $C^6\ H^{14}O$	Caproic " .... $C^6H^{12}O$	Caproic " .... $C^6\ H^{12}O^2$	....	Heptylene.......... $C^7\ H^{14}$
7.	Septane.......... $C^7\ H^{16}$	Heptylic " .... $C^7\ H^{16}O$	Œnanthylic " .... $C^7H^{14}O$	Œnanthylic " .... $C^7\ H^{14}O^2$	....	Octylene.......... $C^8\ H^{16}$
8.	Octane.......... $C^8\ H^{18}$	Caprylic " .... $C^8\ H^{18}O$	Caprylic " .... $C^8H^{16}O$	Caprylic " .... $C^8\ H^{16}O^2$	....	Nonylene.......... $C^9\ H^{18}$
9.	Nonane.......... $C^9\ H^{20}$	Nonylic " .... $C^9\ H^{20}O$	....	Pelargonic " .... $C^9\ H^{18}O^2$	....	Paramylene.......... $C^{10}H^{20}$
10.	Decane.......... $C^{10}H^{22}$	Cetylic " .... $C^{10}H^{22}O$	....	Capric " .... $C^{10}H^{20}O^2$	....	
	etc. etc.	etc. etc.		etc. etc.		

In the extended table of examples of homologous series herewith presented the formulæ we have designated "homologenic" convey simply the theory which must be directly deduced from the facts of homology. It will be observed that the first four series given are strictly *parallel* in every way, the series found in each horizontal line being what Hofmann has called "isologous" series, or those based upon the same number of carbon equivalents. These series may be believed to have the same molecular derivation, in the sense of being compounds of the same elementary molecule, with different other elements and molecular groups. Like the latter, the members of these series of isologues are altogether without chemical or physical resemblances and relations among each other. On the contrary, the homologues in each of the vertical columns have strong chemical similarities and analogies one with another, and frequently occur in admixture in products of both natural and artificial chemical processes, being then often difficult to isolate individually. They present a regular and perfect gradation, or progression in degree, of physical relations and properties, from top to bottom of the column, in correspondence with the increasing number of H^2C groups combined in the molecule. Thus, the volatility constantly decreases, and the degree of fusion constantly increases, from the top to the bottom of each series.

The most remarkable fact of this kind about homologues was discovered by Kopp—namely, that generally each successive addition of H^2C corresponds to a definite increase of *atomic volume* of 22 units; which argues that if the homologen is susceptible of isolation, it will be found to possess this specific atomic volume.

In the last two series of homologues given in the table it will be seen that there is not the complete parallelism and *isology* with the first four that is presented by the latter between each other. Homologous series are not therefore all parallel for the same number of homologen groups. The admission of the theory of homology seems to compel the admission of the existence in each series of homologues of a fundamental or basal molecule, or group of such; which we have called here the *radical* of the series. The "organic radicals" of the earlier organic chemists were but a series of homologues based upon one atom of hydrogen as their homologenic radical. Thus, $H + H^2C = H^3C$ (methyle), $H + 2H^2C = H^5C^2$ (ethyle), and so on. Ammonia, NH^3, constitutes also the radical of the beautiful series of homologues discovered by Adolphe Wurtz, the *compound ammonias*, or—

Monamines. $NH^3 + n(H^2C)$.	
Methylamine	$C\,H^2$, NH^3
Ethylamine	C^2H^4, NH^3
Propylamine	C^3H^6, NH^3
Butylamine	C^4H^8, NH^3
Amylamine	C^5H^{10}, NH^3
Hexylamine	C^6H^{12}, NH^3
Heptylamine	C^7H^{14}, NH^3
Octylamine	C^8H^{16}, NH^3
Nonylamine	C^9H^{18}, NH^3

Very many other such nuclear radicals appear to exist, containing multiple atoms or molecular groups of carbon, and of carbon and oxygen, such as it is difficult, on our ordinarily accepted views, to believe to be capable of existing. The following table illustrates two series of highly important substances, with their constitution and structure on the homologic theory; and this table will serve also to show how this theory enables us to predict the existence and composition of compounds yet unknown. Thus, it may be deduced from the first column that coal-gas may be expected to be found to contain two gaseous compounds as yet unknown, C^4H^2 and C^5H^4. The aromatic aldehydes also, of which the *benzoic, toluic,* and *cumic* aldehydes are known, are based upon a homologenic radical C^4O (possibly C^3, CO).

Generic Names.	Coal-Tar, or "Aromatic" Hydrocarbons.	"Aromatic" Acids.
Homologenic Radicals.	C^3.	C^4O^2(or C^3, CO^2).
Homologenic Formulæ.	$C^3 + n(H^2C)$.	$C^4O^2 + n(H^2C)$.
Series	(Unknown)....$C^4\,H^2$	(Unknown) ......$C^5\,H^2\,O^2$
	(Unknown)....$C^5\,H^4$	(Unknown) ......$C^6\,H^4\,O^2$
	Benzene.........$C^6\,H^6$	Benzoic acid.....$C^7\,H^6\,O^2$
	Toluene.........$C^7\,H^8$	Toluic " .....$C^8\,H^8\,O^2$
	Xylene..........$C^8\,H^{10}$	Xylic " .....$C^9\,H^{10}O^2$
	Cumene.........$C^9\,H^{12}$	Cumic " .....$C^{10}H^{12}O^2$
	Cymene.........$C^{10}H^{14}$	Cymic " .....$C^{11}H^{14}O^2$
	Laurene.........$C^{11}H^{16}$	

The monatomic phenols, including common *phenol, cresol, xylenol, thymol,* etc., constitute a series of the radical C^3O. The apparent existence, in combination at least, of such curious molecular groups will serve to suggest the importance of the further pursuit of the somewhat neglected study of homology. HENRY WURTZ.

Homotax'is [Gr. ὁμός, "same," and τάξις, "arrangement"], a word introduced into use by Prof. Huxley to express an idea in geology remotely analogous to that expressed by homology in zoology. It had been tacitly assumed in geological reasoning that a stratum or a formation was throughout its horizontal extent of contemporaneous origin. The impossibility of this had long been apprehended by the more philosophic geologists, as Edward Forbes, De la Beche, and others, and Prof. Huxley finally gave clear expression to the contradiction by applying the term homotaxis to signify *similarity of position in a series of rocks,* apart from any question as to contemporaneity or sequence of origin of the parts of the series. (See HUXLEY, *Anniv. Addr. to the Geol. Soc.* for 1862; *Quart. Journ. of Geol. Soc.*, vol. xviii., and *Essays and Reviews*, Eng. ed., 1871, p. 202.)

Homs, or **Hums,** the *Emesa* of Strabo and Pliny, town of Syria, in the valley of the Orontes, 1 mile E. of the river and about 60 miles N. E. of Baalbek. It was the birthplace of the Roman emperors Elagabalus (218–222) and his cousin, Alexander Severus (222–235), and was noted for its splendid temple of the Sun, in which these youths were sharing between them the office of high priest when (in 218) the former was chosen Augustus and the latter was made Cæsar. The modern town is well built, of black basalt, with which also most of the streets are paved. It is surrounded by a wall of no great strength, but which suffices to keep off the prowling Bedouin. Nothing ancient is now found there except some ruins and Greek inscriptions. It is a place of considerable trade, and has a population of about 20,000, including 7000 Greek Christians and some 200 Jacobites. R. D. HITCHCOCK.

Ho'nan ("south of the river"), province of China proper, comprising the lowland S. of Hoang-Ho, between lat. 32° and 37° N., and between lon. 110° and 116° E. Area, 65,114 square miles. Pop. 23,037,171. Cap. Kai-Fung.

Hon'da, town of Colombia, in the department of Cundinamarca, on the Magdalena. Its climate, though hot, is not unhealthy. It is the natural dépôt of the commercial produce of the very fertile province. But its streets are unfit for carriages and trucks; goods must be transported to the warehouses by carriers, and consequently its commerce is steadily decreasing. It had formerly 10,000 inhabitants.

Hondt, the name of a celebrated family of Flemish engravers. The founder of the family, JOSSE HONDT, b. at Wackene, in Flanders, in 1546, and d. in London Feb. 16, 1611; spent a large part of his life in England, where he sought refuge from the religious persecutions of the Spaniards. He was celebrated as an engraver of maps.—Of his sons, HENRY DE HONDT, THE ELDER, b. at Ghent in 1573, and d. at the Hague in 1610; HENRY DE HONDT, THE YOUNGER, b. in London about 1581, and d. at Amsterdam about 1650; and WILLIAM HONDT, b. at the Hague in 1601, and d. at Dantzic. A series of portraits by Henry de Hondt the Elder of 144 artists, mostly Flemish, and of Melanchthon, Bugenhagen, Wycliffe, Savonarola, Calvin, and Knox, are widely known; so are those by Henry de Hondt the Younger of Queen Elizabeth and William of Orange, and a view of the Hague.—ABRAHAM HONDT, b. at Rotterdam in 1638, and d. in London in 1691, also belonged to the family. He acquired a great name as a painter of animals.

Hondu'ras, a republic of Central America, is situated between lat. 13° 10′ and 16° 5′ N., and bounded by the Caribbean Sea, Nicaragua, the Bay of Fonseca, San Salvador, and Guatemala. Area, about 50,000 square miles. The Caribbean coast is low and marshy E. of lon. 85°, lined with extensive salt-water lagoons, such as Laguna de Cartago and Laguna de Cartine; W. of lon. 85° it is higher, often rocky, and lined with islands, among which are the Bay Islands, belonging to the jurisdiction of Jamaica. The following rivers are found here: Segovia, also called Coco, Oro, or Wanks, about 350 miles long, but navigable only for canoes on account of rapids, forms the boundary between Honduras and Nicaragua; the Patuca, navigable for small steamers, receives the Guayape, famous for its rich gold-washings; the Ulua, with 9 feet of water on the bar traversing its mouth, and navigable for steamers and small craft up to its junction with the Santiago, 70 miles from its mouth. The principal ports along this coast are Omoa, Trujillo, and Puerto Cortes, formerly Puerto Caballos—all commodious and safe. The Pacific coast, along the Bay of Fonseca, is also low, even inundated at spring tides, but

it presents several fine harbors, among which is Amapala. The Choluteca, which flows into the Bay of Fonseca, is navigable for light craft for a considerable distance from its mouth. The interior is high, but much diversified by mountain-ranges, plateaus, terraces, and valleys. The Sierra Madre enters the country from the W., and separates at Merendon into two branches, of which one runs eastward under the name of Espiritu Santo and Grita, and ends in the Omoa Mountains; and the other runs S. and S. E., forming the Selaque Mountains, whose highest peak rises 10,000 feet; the Puca, Santa Barbara, Sulaco, and Chili mountains. The climate is hot, along the coasts very unhealthy, and everywhere very capricious. April, May, and June are the hottest, November, December, and January the coolest, months. The rainy season is generally ushered in with violent hurricanes and thunderstorms. The soil is exceedingly fertile. The valleys and lowlands are covered with an exuberant tropical vegetation, and on the plateaus all the finest fruits and plants of the temperate zone succeed. The sugar-cane is indigenous; excellent tobacco is produced; coffee, cotton, and cochineal succeed well, but are very little cultivated. Immense forests cover the mountains, and yield excellent timber, fine cabinet woods, especially mahogany, gums, drugs, and dyestuffs. The wealth of the country, however, consists in its mines. Gold, silver, copper, coal, and excellent marble are found in many localities and in great quantities, but very few mines are worked. None of the rich resources are duly utilized, and the reasons are the total lack of roads, the unsettled state of society, the want of sufficient capital, and the comparatively small amount of energy which the inhabitants display. The principal occupation is cattle-raising, and even this is done in a sluggish and careless way. The number of inhabitants is about 400,000, of whom about 180,000 are Indians, 200,000 mestizoes, 6000 negroes, and the rest whites of Spanish descent. The religion is Roman Catholic, but there is very little public education. The government is republican; the executive power is vested in a president elected for four years; the legislative, in a senate and a chamber of deputies. The finances are in great disorder. The foreign debt amounted in 1872 to about $30,000,000—loans which were raised for the construction of an interoceanic railway. The value of the annual exportation of bullion, indigo, cattle, timber, hides, tobacco, etc. is estimated at $1,230,000. Cotton and silk fabrics are imported from England; cutlery and machinery from the U. S. Cap. Comayagua, with 18,000 inhabitants.

Honduras, British. See BALIZE.

Honduras, Bay of, a large inlet of the Caribbean Sea, between Yucatan, Guatemala, and Honduras. It receives many streams, among which Belize and Montagua are the largest, and contains many islands.

Hone, a name given to a stone of fine grain used for giving a fine edge to steel blades. Hones are usually of much finer grain than ordinary whetstones and grindstones. They are made of several kinds of stone, often of Palæozoic age. Various greenstones, siliceo-argillaceous slates, etc. are used. One of the very best hone-stones now used is the novaculite of Arkansas, of Carboniferous age. There are also excellent oil-stones from Turkey, Austria, Siberia, England, Wales, and Scotland. For many purposes the Turkey stone is considered the best.

Hone (WILLIAM), b. at Barth in 1779. His first attempts in the literary field were unsuccessful, but in 1817 he made a great hit by his pamphlets, illustrated by George Cruikshank. One of them, a parody on the *Book of Common Prayer*, brought him before the courts. He was acquitted, however, and a public subscription was made for him. Afterwards he lost both his money and his fame. He became a preacher to a congregation of dissenters, and d. at Tottenham Nov. 6, 1842, in straitened circumstances. The most prominent of his writings are *The Political House that Jack Built* and *A Slap at Slop* (1816).

Ho'nea Path, post-tp. of Anderson co., S. C., on the Greenville and Columbia R. R., 35 miles from Greenville. Pop. 1926.

Honeoye', post-v. of Richmond tp., Ontario co., N. Y., at the outlet of Honeoye Lake, 8½ miles from Livonia, on the Erie R. R.

Honeoye Falls, post-v. of Monroe co., N. Y., 16 miles S. of Rochester, on the New York Central and Hudson R. R. It contains a union school, 6 churches, a bank, a printing-office, 1 newspaper and news-room, a circulating library, 2 flouring-mills, 1 plaster-mill, 1 sash and blind, a stave and heading shop, a woollen, pump, and axe-handle factory, 2 wagon-shops, foundry and machine-shops, 2 cooper-shops, 1 Masonic lodge, stores, etc. The surrounding country is well adapted for agriculture. Pop. 921.

S. F. JORY, ED. "HONEOYE FALLS FREE PRESS."

Honeoye Lake, in the tps. of Richmond and Canadice, Ontario co., N. Y., discharges its waters by the Honeoye outlet into Genesee River. The lake is 5 miles long, 1 mile in breadth, and surrounded by high hills.

Hones'dale, post-b., cap. of Wayne co., Pa., 160 miles N. E. of Harrisburg, on the Delaware and Hudson Canal, Delaware and Hudson and the Honesdale branch of the Erie R. Rs., was incorporated as a borough 1831; made the county seat 1842. It contains a fine graded school, 9 churches, finely shaded streets, gas and water works, 2 banks, 2 weekly newspapers, a public library, handsome public grounds, manufactories of glass, axes, and edge tools, woollen goods, pottery, leather, boots and shoes, lumber, canal-boats, and steam-engines. The "Stourbridge Lion," the first locomotive made in America, made its trial-trip from this place in 1828. Large quantities of coal are shipped during the summer by the canal, and more than 500,000 tons are stored on the docks through the winter, awaiting shipment in the spring. Pop. 2654.

THOMAS J. HAM, ED. "WAYNE CO. HERALD."

Hon'ey, the saccharine material collected from flowers by several kinds of insects for the food of themselves and progeny, especially by the honey-bee (*Apis mellifica*). In bee-honey there have been reported as present four kinds of sugar—common cane-sugar, or sucrose; glucose (dextrose), or fruit-sugar; lævulose, or *inverted* sugar (which turns the plane of polarization to the left, or inverts the action of glucose); the fourth being a sugar stated by Soubeiran to be lævo-rotatory to a degree three times as great as lævulose, but which is little known. There are other substances present, among them an acid ferment, which gradually changes the cane-sugar into a mixture of dextrose and lævulose, so that the clear, limpid fresh honey from the comb often becomes granular and opaque, from the crystallizing out of the less soluble glucose. Wasp-honey (of *Polybia apicipennis*) gives large crystals of ordinary sucrose, and Mexican ant-honey yielded to C. M. Wetherill an uncrystallizable sugar of composition $C^{12}H^{28}O^{14}$. Honey varies in aroma and flavor with the flowers from which it has been collected; clover honey, buckwheat honey, and wild honey being readily distinguishable in this respect; and some cases are on record of poisonous qualities derived from the like source. Honey is said to be now much adulterated with glycerine, and even imitated, as a whole, by combining the latter product with other materials, and flavoring with appropriate essential oils.

H. WURTZ.

Honey-Ant. See ANT.

Honeybrook, post-v. and tp. of Chester co., Pa. It has a national bank. Pop. 1957.

Honey-Buzzard, a name given in England to *Pernis apivorus*, a chiefly insectivorous bird of the falcon family, differing from other birds of the family in its food, and in having the space between its eyes and bill completely feathered. *Pernis cristatus*, the crested honey-buzzard, is an Asiatic bird. Bees, wasps, and honey are sought by them.

Honeycomb, tp. of Marshall co., Ala. Pop. 247.

Honey-comb Moth, or **Bee Moth** (*Galleria cerecina* and *G. alvearia*), are small lepidopterous insects of the Pyralidæ, or snout-moth family. The larvæ spin silken galleries in beehives, running between the layers of honey-comb, upon which the young insects feed. The moth lays her eggs at evening, while the bees are at rest. It appears that neither moth nor larvæ are ever stung by the bees. The moth is a most formidable enemy to the bees. Quite a number of kinds of moth-traps are employed, and some are very useful in destroying these pests.

Honey Creek, tp. of Adams co., Ill. Pop. 1495.

Honey Creek, tp. of Crawford co., Ill. Pop. 1868.

Honey Creek, post-v. of Fall Creek tp., Henry co., Ind. Pop. 100.

Honey Creek, tp. of Howard co., Ind. Pop. 732.

Honey Creek, tp. of Vigo co., Ind. Pop. 1519.

Honey Creek, tp. of White co., Ind. Pop. 611.

Honey Creek, tp. of Delaware co., Ia. Pop. 1088.

Honey Creek, tp. of Iowa co., Ia. Pop. 1081.

Honey Creek, tp. of Sauk co., Wis. Pop. 1180.

Honey Cut, tp. of Macon co., Ala. Pop. 1708.

Honeycutt's, tp. of Sampson co., N. C. Pop. 1283.

Honey-dew, a sweet substance of uncertain origin found on many kinds of plants and trees.

Honey-Eaters, a large Australasian family of passerine birds, akin in habits, food, and other characteristics to the humming-birds of the New World, though of larger size. They are also closely connected with the sun-birds (Promeropidæ), the humming-birds of the Old-World tropical lands. The honey-eaters are mostly very beauti-

ful. A few are good songsters. The name honey-eaters is given to some of the sun-birds, and even to other birds which are, or are believed to be, fond of honey.

Honey Grove, post-v. of Fannin co., Tex., 18 miles from Bonham. Pop. 382.

Honey-Guide, a name given to certain birds of the genus *Indicator* and of the cuckoo family, found in Africa, Borneo, and India, and named from their curious instinct which prompts them to guide the hunter to a hive of wild bees—a feat which it often, but by no means infallibly, accomplishes.

Honey Locust, the *Gleditschia triacanthos*, a large and well-known leguminous tree of the U. S. It takes its name from its long pods filled when ripe with a sweet substance. The tree has stout, often triple thorns, and is used as a hedge-plant. The wood is coarser than that of the common locust (*Robinia Pseudacacia*), but is not much inferior to it. (See GLEDITSCHIA.)

Hon'eysuckle, the popular name of many shrubs, erect or twining, of the genera *Lonicera*, *Diervilla*, etc., and of the order Caprifoliaceæ. Many of them are common in cultivation, being prized for the fragrance and beauty of their flowers. The U. S. have several species, a few of which are seen in cultivation. Most of the finest ones are from Northern Asia or Europe. They have been much improved by cultivation. Many other plants, azaleas, aquilegias, etc., are locally known as honeysuckles.

Honfleur, town of France, in the department of Calvados, on the left bank of the Seine, 7 miles S. E. of Havre. It is busily engaged in fisheries, and carries on a lively trade in eggs and fruits with England. Pop. 9553.

Hong, a Chinese word meaning a "row" or "series," was first applied to the European warehouses in the Chinese ports, then to whole blocks of such houses, and at last to the entire factory.

Hong-Kiang ("red river"), or **Si-Kiang** ("west river"), a large navigable stream of Southern China, enters the China Sea through several mouths, of which that at which Canton is situated is generally called *Choo-Kiang* ("pearl river").

Hong-Kong ("red harbor"), an island off the south-eastern coast of China, at the mouth of the Canton River, 75 miles S. E. of Canton. This island, whose area is 29 square miles, was ceded to Great Britain in 1842, and together with a small strip of the opposite mainland, the peninsula of Kooloon, which was ceded in 1861, and from which it is separated by a narrow strait, it forms a most flourishing colony. The island itself is rocky and bare, not able to grow so much as would feed its inhabitants one day, but on its northern side it presents a fine harbor, deep and safe, and here is built the city of Victoria, in lat. 22° 16′ N., lon. 114° 8′ E., which in a few years has become a place of the greatest commercial importance. Steamers from Bombay, Calcutta, San Francisco, Canton, Macao, and Singapore go and come daily, and thousands of sailing-vessels, especially Chinese junks, throng the harbor. In 1869 the total tonnage of vessels entering was 2,525,498; in 1872 it amounted to 3,777,676. The principal articles of importation are cotton goods, opium, and ships' supplies, whose value is estimated at £4,000,000. The principal article of exportation is tea, estimated at £2,000,000. The transfer of passengers also forms an important item in the business of the place. The city stretches for about 3 miles along the bay, from the foot of the hills to the edge of the water, and contains several fine thoroughfares, with large and elegant houses of brick and stone, and surrounded with beautiful gardens belonging to the merchants, and with a number of stately public buildings—the cathedral, the governor's house, the bishop's palace, the exchange, the jail, the hospital, etc. Beautiful public gardens have been laid out, and good free schools for the lower Chinese population established. A strong police force, consisting of Indian Sepoys, is kept, but in spite of the generous expenditure of the colony, its revenues bring annually a surplus. Pop. in 1872, 121,985, of whom 4931 were Europeans, 1490 Indians, and 115,564 Chinese, of whom about 13,000 live on boats in the harbor.

Hon'iton, town of England, Devonshire, on the left bank of the Otter. The celebrated Honiton lace received its name from this place, though at present it is manufactured in many other places. Pop. 3470.

Honolu'lu, capital of the Hawaiian Islands and the residence of the king, is situated on the southern side of the island of Oahu, in lat. 21° 18′ N., lon. 157° 55′ W. Its harbor is formed by a deep and spacious basin in the coral reef which surrounds the island. It is safe at all seasons, and lined with substantial and commodious wharves. In 1872 it was visited by 47 whalers and 138 merchant vessels, of which 22 were Hawaiian and 86 American. The steamers from San Francisco to Melbourne touch regularly at Honolulu. The city itself is situated among beautiful tropical surroundings, and enjoys an equable and healthy climate, the heat ranging between 60° and 87° F. Among its public buildings the most remarkable are the king's palace, the parliament-house, the Roman Catholic cathedral, the treasury, the post-office, etc. It has 1 Anglican and 2 American churches, 2 hospitals, and a number of good schools. It has a theatre, 5 printing establishments, a bank, billiard-rooms, fine stores, etc., and its trade is quite considerable. The value of its importations amounted in 1872 to $1,583,583, and of its exportations to $1,345,585. Pop. 14,852.

Hono'ria (JUSTA GRATA), a daughter of Constantius III. and Galla Placidia, and a sister to Valentinian III., b. at Constantinople in 418 A. D., lived after the death of Honorius in 424 and the usurpation of Joannes in Rome, at the court of Valentinian III. By a secret mission she invited Attila, king of the Huns, to come to Italy and marry her, and sent him her ring; but Attila took no notice of the invitation. Having become pregnant by her steward, Eugenius, she was sent to Constantinople, but returned to Rome after the death of Theodosius II. in 450. She now again invited Attila, and this time he saw fit to accept the invitation. He claimed her as his betrothed bride, together with her part of the empire; and as his claims were disregarded by Valentinian III., he invaded Gaul. What became of Honoria is not known. Gibbon says that she was condemned to perpetual imprisonment, but he does not state his authority.

Honorius, Roman emperor from 395 to 423, b. at Constantinople Sept. 9, 384, and d. at Ravenna Aug. 27, 423. At the death of Theodosius the Great (395) the Roman empire was divided between his two sons, Arcadius and Honorius. Honorius received the western part—Italy, Africa, Spain, Gaul, Brittany, and Illyria—with Ravenna for his residence; and as he was only eleven years old, he was placed under the guardianship of Stilicho. Stilicho was a vigorous and successful ruler, but when he was treacherously killed at Ravenna (408) the barbarian tribes poured in over the frontiers and rebellion arose in all the provinces. Brittany was entirely given up; Gaul was overrun by Gothic and German invaders; Africa made itself independent under Heraclian; and Italy was thrice plundered, and Rome besieged and taken by Alaric. The weak and indolent emperor could do nothing, and when one of his generals succeeded in defending the empire, he became suspicious and had him killed. After Stilicho followed Constantius. During the reign of Honorius a general persecution was raised against paganism.

Hono'rius I., POPE, a Campanian, became pope in 625, and d. in 638. Special interest has arisen in this pope since the promulgation of the doctrine of papal infallibility from the fact that the letters of Honorius are conceived to teach, *ex cathedrâ*, the Monothelite heresy, so called, for which heresy he was anathematized by the third Council General of Constantinople, and afterwards was officially pronounced a heretic by Leo II.—HONORIUS II., ANTIPOPE, bishop of Parma, was elected in 1061, and deposed in 1064. D. in 1072.—HONORIUS II., POPE, was chosen in 1124, and d. Feb. 14, 1130.—HONORIUS III. (*Cencio Savelli*), a Roman, succeeded Innocent III. in 1216, and after a disturbed pontificate d. Mar. 18, 1227.—HONORIUS IV. (*Giacomo Savelli*) became cardinal-deacon in 1261, became pope in 1285, and d. Apr. 3, 1287.

Hon'ors of War, stipulated terms granted to a vanquished enemy, by which he is permitted to march out of a town, from a camp or line of intrenchments, with all the insignia of military etiquette. In another sense they signify the compliment paid to distinguished personages, military, etc., when they appear before any armed body of men, or such as are given to the remains of a deceased officer. The circumstances attending the latter vary in different countries, while respecting the former almost everything depends upon the general granting the capitulation. In some cases the troops of a besieged garrison are permitted to march out with drums beating, colors flying, etc.; in others, they are required to lay down their arms at a named spot, and then depart; while in still other cases they are required to march back to their works, after having been permitted to march out either silently or with drums beating, and pile their arms in front of their works. In our own late civil war at the first surrender (Apr. 14, 1861), that of Fort Sumter, Gen. Anderson, commanding, was allowed to march out of the fort with colors flying and drums beating, bringing away company and private property, and paying a salute of fifty guns to his flag. At the surrender of the army of Northern Virginia (Apr. 9, 1865) the terms required the officers to give their individual paroles not to take up arms against the U. S. until properly

exchanged, and each company or regimental commander to sign a like parole for the men of his command; the arms, artillery, and public property to be packed and stacked, and turned over to officers appointed to receive them; officers, however, were permitted to retain their side-arms, private horses, and baggage. Upon compliance with these terms each officer and man was allowed to return to his home, not to be disturbed by the U. S. authorities "so long as he observed his parole and the laws in force where he may reside." The surrender of the army of Gen. Johnston was received Apr. 26, 1865, on the same basis.

Hon'theim, von (Johan Nicolaus), b. at Treves Jan. 27, 1701; studied jurisprudence at Louvain and Leyden; became ecclesiastical counsellor to the consistory of Treves in 1728, professor of civil law in 1732, and suffragan of the see of Treves in 1748. In 1788 he resigned his offices and retired to Montquentin, where he d. Sept. 2, 1790. Author of *Historia Trevirensis* (3 vols., 1750) and *De Statu Ecclesiæ* (1763), the latter attacking the Roman Catholic Church, for which he was persecuted, and to escape which he retracted in 1778; his ideas, however, had taken root.

Honvéd, the Hungarian militia. The name was first used in 1848, when in order to combat the Austrian supremacy the Hungarian Diet called out about 200,000 men, who were interspersed among the regular soldiers. This militia was called *Honvédség*. Afterwards, when after the defeat of 1866 the Austrio-Hungarian government increased the army according to the principle of universal military duty, and likewise established an Hungarian militia, the name was retained from regard to the national feeling of Hungary. It was determined by the law of Dec. 5, 1868, that the honvéd should aid the regular army in times of war. It should not be employed, however, outside the country, unless with the consent of the Hungarian Diet. It should be composed of men who had served their time in the reserve of volunteers, and of men who had made no military service on account of the fulness of the cadres. At present (1875) the honvéd, thus organized, consists of 206,707 men—namely 60 men of the Hungarian crown-guard; 124 battalions of infantry, comprising 187,812 men; 40 squadrons of cavalry, comprising 14,338 men; and 4497 artillerists. The officers who drill and command this army are taken from the regular army. A. Niemann.

Hoo'bly, town of British India, in the presidency of Bombay, is poorly built, but carries on an important trade in cotton. Pop. about 15,000.

Hood, county of N. Central Texas. Area, 614 square miles. It is traversed by the Brazos River. It is finely diversified, fertile, well watered and timbered, has a good climate, abundant water-power, and excellent building-stone. Live-stock, corn, cotton, and wool are staple products. Cap. Granbury. Pop. 2585.

Hood, the name of two noted English admirals, sons of a rector of Bath. The elder brother, Samuel, b. Dec. 12, 1724, became admiral in 1780, Irish baron in 1782, English viscount in 1796, and d. Jan. 27, 1816. He fought with great valor against the French during the North American war of independence, and again in the war of 1793, when he commanded in the Mediterranean, took Toulon, which, however, he had to give up again, and expelled the French from Corsica.—The younger brother, Alexander, b. in 1727, became admiral in 1782, Irish baron in 1794, British peer in 1796, viscount in 1800, and d. May 3, 1814. He commanded under Lord Howe at Gibraltar and in the Channel in 1794, and gained in 1795 a victory over a French fleet off L'Orient, which he attacked, though he was inferior in number to the enemy.

Hood (John Bell), b. at Owingsville, Bath co., Ky., June 29, 1831; graduated from the U. S. Military Academy, and appointed brevet second lieutenant of infantry July, 1853; transferred to the cavalry as second lieutenant 1855, and promoted to be first lieutenant 1858. Lieut. Hood was actively engaged on frontier duty until 1861, when he entered the Confederate army, serving in every position from first lieutenant to that of commander-in-chief of an army with the rank of lieutenant-general, serving throughout the Virginia Peninsular campaign, at the second battle of Bull Run, at Antietam, at Gettysburg, and at Chickamauga, where he suffered the loss of a leg; in 1864 he succeeded Gen. Johnston in command of the army resisting Gen. Sherman's invasion of Georgia; met the Union forces in battle at Franklin Nov. 30, 1864, and at Nashville Dec. 15–16, shortly after which he was relieved by Gen. Richard Taylor. After the war he settled in New Orleans. G. C. Simmons.

Hood (Robin), the hero of a great number of the most popular among the old English ballads, was an outlaw and a robber who lived in the beginning of the fourteenth century in the depths of Sherwood Forest, Nottinghamshire, and Barnsdale Forest, Yorkshire, with a company of similar fellows—some say 100—and among them Little John and Friar Tuck, not to forget the Maid Marian. Although a robber by profession, he had some gallant and magnanimous qualities, which won for him not only the admiration, but even the affection, of the lower classes. He was the best archer in the world, his arrow never missing the aim. He was brave; a fight with four knights and a victory over two was a small matter with him. He was not cruel; he never killed people when it was not necessary. He was rather jovial and good-hearted, and what he took from the rich he often gave to the poor. Nevertheless, if he had been nothing but a simple robber, he would never have attained that romantic glory which attached very early to his name. It is probable, therefore, that he was driven into this kind of life by some political circumstances which naturally made him the knight of the lower classes; and Mr. Hunter finds it likely that he was one of those yeomen who under Edward II. joined the rebellion of the earl of Lancaster, but failed and were ruined. According to tradition, he was bled to death by a nun and buried in Kirklees Park, Yorkshire. He is first mentioned in the *Vision of Piers Ploughman*, written between 1355 and 1365, and next in the *Scotichronicon*, written between 1377 and 1384. In 1495, Wynkyn de Worde published a long poem under the title *Lytle Geste of Robyn Hood*, which seems to be a combination of several ballads. In the sixteenth century rustic sports and masqueradings were celebrated in many places under the name of "Robin Hood games." In 1795, Rittson published a collection of all the ballads and historical anecdotes referring to Robin Hood; which collection was considerably enlarged in 1847 by J. M. Gutch. At one time most modern critics agreed in considering Robin Hood as a mythical creation, representative of the general relation between the Anglo-Saxon population and the Norman-French barons in the twelfth and thirteenth centuries, but without any individual and concrete historical foundation. A German mythologist, Adalbert Kuhn, even went so far as to identify the poor robber with the old pagan god Woden (*Hood—Wood—Woden*). But in 1852, Rev. Joseph Hunter published in London a learned and ingenious pamphlet on the subject, and although many of the details of his researches are nothing more than hints and suggestions, yet the whole goes far to establish an historical basis for the tradition.

Hood (Thomas), b. in London May 23, 1799. His father, who was a bookseller, d. in 1811, up to which time the son had received but a very unprofitable preparatory education; in 1812, however, his mother placed him at a day school, where, under the care of a good teacher, he made rapid progress, and gained his first fee for literary labor in revising a new edition of *Paul et Virginie*. From school he entered a counting-house, but his health failing, he was sent to Dundee, where he continued his reading and contributed various pieces to the local publications. Returning to London in two years with improved health, he entered the service of his uncle to learn the art of engraving, in which he acquired some skill, which was of value to him in his subsequent career. In 1821 the *London Magazine* fell into the hands of some friends, and Hood became sub-editor. In this position he formed the acquaintance of all the leading literary men of the time, and with Charles Lamb an intimacy sprang up which lasted during the latter's life. In this society his own powers developed, and his first separate publication, *Odes and Addresses*, soon appeared, being, however, the joint work of himself and J. H. Reynolds. *Whims and Oddities* appeared in 1826, followed by *National Tales* (1827), *Plea of the Midsummer Fairies, Hero and Leander, Lycus the Centaur, and Other Poems*. In 1829 the *Comic Annual* was issued, and continued nine years. For a year he edited *The Gem*, in which appeared his poem entitled *Eugene Aram's Dream*. In 1831 he occupied Lake House, near Wanstead, where he wrote his novel *Tylney Hall*. In 1838 *Hood's Own* was started, a monthly publication consisting chiefly of extracts from the *Comic Annual* series, with new contributions. His health still being delicate, he went to the Continent, where he remained for several years, and from Belgium published his *Up the Rhine*, constructed, as he says in the preface, on the groundwork of *Humphrey Clinker*. On his return to England he became editor of the *New Monthly Magazine*, from which he retired in 1843. In 1844 *Hood's Magazine* was started, for which he furnished most of the best work until near his death. A short time before his death, while on a bed of sickness which he never left alive, he contributed to *Punch* those touching verses which have rendered his name immortal—"The Song of a Shirt," "Bridge of Sighs," and "The Lay of a Laborer." A short time before his death a government pension of £100 was secured to him by Sir Robert Peel, and continued to his widow after his death, which occurred in London May 3, 1845.

Hood (Thomas), son of the above, b. at Wanstead, Essex, Jan. 19, 1835; educated at Oxford; his first literary work, *Pen and Pencil Pictures*, appeared in 1854–55, followed by numerous books for juveniles; he was also the author of several bright novels and a number of successful farces and humorous poems. In 1865 he was appointed editor of *Fun*, a comic periodical and the most successful rival to *Punch;* was a good designer, and illustrated his father's comic verses, "Precocious Peggy," etc. D. in London Nov. 20, 1874.

Hood′ed Seal, the *Cystophora cristata*, a seal of the North Atlantic coasts, is about eight feet long, and is characterized by a cartilaginous inflated hood or crest, which in the adult male is of considerable size. It may be a reservoir of air for the service of the animal when diving. It is a formidable biter, but is hunted for its fur and oil. When surprised by the hunter it sheds copious tears.

Hoof, the horny shell which covers the foot, or the separate digits of the foot, of certain herbivorous (or mostly herbivorous) mammals. It is the homologue of finger and toe nails of the claws of other vertebrates. It is, histologically, composed of the agglutinated and dried cell-walls of epithelium, with a small proportion of intercellular substance and of cell-contents. Chemically, it consists chiefly of an albuminoid substance, of uncertain composition, provisionally called keratin. The hoofs of beef-cattle are extensively used in making buttons, combs, and ornamental articles. Horse-hoofs are used in making prussiate of potash and in case-hardening iron.

Hoogh′ly, town of British India, the capital of the district of Hooghly, in the presidency of Bengal, on the left bank of the Hooghly. It has a college in which both English and Asiatic literature is taught, and which was founded by a native. Pop. 12,000.

Hooghly River is the westernmost outlet of the Ganges, formed in lat. 23° 25′ N. and lon. 88° 22′ E. by the confluence of the Bhagrutti and the Jellinghy, two branches of the Ganges, and considered as the proper mouth of this river. It is about 200 miles long, 10 miles broad at its entrance into the Bay of Bengal, and although its mouth and shores are encumbered by mud-shoals, it is navigable for the largest vessels, its draught being 17 feet up to Calcutta. During the S. W. monsoon the Bore (which see) appears here, and generally the tide is felt 17 miles above Calcutta. Its waters are considered holy by the natives.

Hoogstraten, von (Samuel), b. at Dort in 1627; belonged to a family of painters; received instruction from Rembrandt; travelled in Germany, Italy, and England; and d. in his native city in 1678. He painted history, portraits, flowers, and animals, but became most celebrated as a painter of still life.

Hook (Theodore Edward), b. in London Sept. 22, 1798; at Harrow he appears to have been careless and inattentive to his proper studies; he was, however, extremely precocious, and displayed at a very early age remarkable aptitude in making verses and arranging them to music. In 1805 his first farce was produced, *The Soldier's Return*, a comic opera in two acts, which met with great success, and was speedily followed by numerous farces and melodramas. But it was his own life at this time which attracted public attention toward him. His practical jokes were of the boldest kind, while his brilliant conversational powers, his remarkable talent for punning and improvisation, his convivial disposition, soon made him a favorite in aristocratic society and gained him the friendship of the prince regent, who in 1812 secured for him the appointment of accountant-general and treasurer of Mauritius. In 1818 irregularities were discovered in his accounts, and he was returned to England in arrest, but no grounds for a criminal charge existing, he was soon liberated. In 1820 he assumed the editorship of the new journal, *John Bull*, which at once reached, and for some time maintained, a large circulation. The board of audit declared him in 1823 a debtor to the Crown in the sum of £12,000, and he was again arrested, and confined for nearly two years. Although no portion of the missing funds was ever traced to Hook, and it was believed the guilty parties were among his subordinates, the government never abated its claim, and at the death of Hook the small sum realized from the sale of his effects was claimed by the Crown. In 1824 the first series of *Sayings and Doings* appeared, followed by the second in 1825, and third in 1828; *Maxwell* was published in 1830; *The Parson's Daughter* in 1833, etc.; in 1836 he became editor of the *New Monthly Magazine;* in sixteen years he published some 38 volumes. Hook retained his position in society to the last, but his high living, habit of gambling, and forced mental labor overtaxed his powers, and he d. deeply in debt at Fulham Aug. 24, 1841.

Hook (Walter Farquhar), D. D., F. R. S., dean of Chichester, b. in 1798, and educated at Winchester and Oxford; was appointed in 1827 chaplain in ordinary to the king; was long incumbent of Leeds, where he accomplished much in the erection of churches, school-houses, chapels, parsonages, etc. His *Church Dictionary*, *Ecclesiastical Biography*, *Lives of the Archbishops of Canterbury*, and his numerous published sermons, pamphlets on education, etc., are all valuable.

Hooke (Nathaniel), b. in Ireland about 1690; lost his fortune in the South Sea Bubble; was engaged by the duchess of Marlborough in arranging her memoirs; and d. July 19, 1763. He was a friend of Pope, and wrote *The Roman History from the Building of Rome to the Ruin of the Commonwealth* (4 vols., 1757–71), which was much read in its time.

Hooke (Robert), b. at Freshwater, in the Isle of Wight, July 18, 1635. He was intended for the Church, but his instincts drew him to the study of mathematics, astronomy, and mechanics. In 1664 he became professor of geometry at Gresham College, London; in 1666 was appointed city surveyor, on account of a plan he presented for the rebuilding of London after the Great Fire, though the plan was not followed; in 1677 was made secretary of the Royal Society. D. in London Mar. 3, 1703. While a young man the art of flying was the subject of his inventive speculations; he afterwards accused Huygens of having stolen his invention of regulating the balance of a watch by a spiral spring, and laid claim to the first discovery of the principle of gravitation against Newton. The most prominent of his writings are *Micrographia* (1666) and *Lectiones Cutlerianæ* (1678–79).

Hook′er, tp. of Laclede co., Mo. Pop. 1114.

Hooker (Edward), U. S. N., b. Dec. 25, 1822, at Farmington, Conn., entered the navy as an acting master July 19, 1861; was promoted to acting volunteer lieutenant "for gallantry in action" in 1862, and became an acting volunteer lieutenant-commander in 1865; was commissioned as a lieutenant-commander in the navy in 1868; served in the North Atlantic squadron during 1861 and 1862, and commanded a division of vessels in the Potomac flotilla for the remainder of the civil war; was severely wounded in a boat expedition (Oct. 5, 1861), and behaved with distinguished bravery; is mentioned in the official reports of Rear-admiral Lee and Commanders Murray, Parker, and Renshaw as a "brave, cool, and able officer." Lieut.-commander Hooker is descended from Rev. Thomas Hooker, who landed at Plymouth, Mass., in 1635, and afterward led the colony which settled at Hartford, Conn. Many of the name took an active part in the early Indian wars, and Col. Noadiah Hooker, the grandfather of Lieut.-commander Hooker, was an officer of some distinction in the army of the Revolution. Foxhall A. Parker.

Hooker (Joseph), b. at Hadley, Mass., Nov. 13, 1814; graduated at West Point, and entered the army as second lieutenant of artillery July 1, 1837; after a campaign in Florida against the Seminoles, he served on frontier and garrison duty till 1846, and 1846–48 in the war with Mexico on the staff of Gens. Persifer Smith, Hamer, and Butler; in 1847 appointed assistant adjutant-general, serving as such in Pillow's division; brevetted captain, major, and lieutenant-colonel for gallantry at Monterey, the National Bridge, and Chapultepec. In Feb., 1853, he resigned from the army, and engaged in farming in California, where for two years previous he had served; also engaged as superintendent of military roads in Oregon. On the outbreak of the civil war (1861) he tendered his services to the government, and was appointed (May 17, 1861) brigadier-general of volunteers, serving in the defences of Washington and on the lower Potomac until Mar., 1862, when he was assigned to the command of a division of the 3d corps, Army of the Potomac; in the Virginia Peninsular campaign, 1862, was engaged in the siege of Yorktown, April–May; battle of Williamsburg, May 5, where his division bore the brunt of the battle nearly all day; at Fair Oaks (second day), Frazier's Farm, and Malvern Hill. Hooker was now promoted to be major-general of volunteers, to date from the battle of Williamsburg, continuing in command of a division and engaged at the battle of Manassas, Aug. 29–30, and Chantilly, Sept. 1; appointed to command the 1st corps Sept. 6, 1862, he displayed great bravery at South Mountain and Antietam, being severely wounded at the latter battle, and disabled until November, when he returned to the field, having in the mean time (Sept. 20) been appointed brigadier-general in the regular army, and on Burnside's succession to the command of the Army of the Potomac was assigned to command the centre grand division (3d and 5th corps) in the new organization of that army, and held this command at the battle of Fredericksburg, Dec. 13, 1862. In Jan., 1863, Hooker succeeded Burnside in command of the Army of the Poto-

mac, and in May following fought the battle of Chancellorsville, where, though outnumbering the enemy, he decided after two days' fighting to return to the N. bank of the Rappahannock. At the time of the invasion of Pennsylvania by the Confederate army the Army of the Potomac, following, had reached the vicinity of Frederick, Md., when, owing to the refusal of Gen. Halleck to place the troops at Harper's Ferry at the disposal of Hooker, the latter requested to be (June 27), and was, relieved from command of the army the next morning. For the skill and energy by which he first covered Washington and Baltimore from the meditated blow of the advancing enemy Gen. Hooker received the thanks of Congress. In Sept., 1863, he was assigned to the command of the 20th army corps (Army of the Cumberland), and was distinguished at the capture of Lookout Mountain, battle of Missionary Ridge (Nov. 24–25), pursuit of the Confederate army, and the action of Ringgold, Ga., Nov. 27, 1863. In the invasion of Georgia by the army of Gen. Sherman, Hooker led his corps in the almost constant fighting up to and including the siege of Atlanta, until July 30, 1864, when on a question of command he was relieved at his own request. He subsequently commanded the northern department, the department of the East, and that of the Lakes; brevetted major-general U. S. A. for gallantry at Chattanooga, and Oct., 1868, retired upon full rank of major-general. G. C. SIMMONS.

Hooker (JOSEPH DALTON), M. D., D. C. L., LL.D., C. B., F. R. S., a son of Sir W. J. Hooker, b. in 1817; went in 1839 as botanist to the Erebus Antarctic expedition; was 1847–51 engaged in an expedition to the Himalayas; became in 1855 assistant director, and in 1865 director, of the Kew Gardens; explored in 1871 Morocco and the Great Atlas Mountains; is a member of many learned societies. Author of *Flora Antarctica* (1844–47), *Cryptogamia Antarctica* (1847), *Rhododendrons of the Sikkim-Himalaya* (1849–51), *Flora of New Zealand* (1852–54), *Himalayan Journals* (1854), *Sikkim-Himalayan Plants* (1855), *Flora Tasmanica* (1855), *The Student's Flora* (1870), with G. Bentham, *Genera Plantarum* (publishing in 1875), and other valuable works and many scientific papers.

Hooker (RICHARD), b. near Exeter about 1554; studied at Oxford, and took orders in 1581. Shortly after he married rather unhappily, and held ecclesiastical offices in Drayton-Beauchamp, Temple, Boscombe, and Bishopsbourne, where he d. Nov. 2, 1600. His colleague in Temple was Travers, one of the most zealous Puritans in the times of Elizabeth, and between him and Hooker a sharp controversy arose, which occasioned the famous work of the latter, the *Laws of Ecclesiastical Polity*. The four first books were published in 1594; the fifth followed in 1597; the remaining three were posthumous. The work is a defence of the Church of England and Church establishments in general, and its learning and style are generally praised, even by such as hold opposite views.

Hooker (THOMAS), b. at Markfield, Leicestershire, England, in 1586; studied theology at Cambridge; preached in London, but left England in 1630, persecuted for nonconformity. After preaching in Delft and Rotterdam, he came to America in 1633, and settled at Newtown (now Cambridge), Mass., whence in 1636 he removed with 100 others to the present Hartford, Conn. He and Stone were the first ministers at the church here, and his influence was very large. D. here July 7, 1647. His principal work is *A Survey of the Summe of Church Discipline*, written in connection with John Cotton. Some of his sermons were published in England. A selection of his works and a memoir of his life were published by the Rev. E. W. Hooker (Boston, 1849).

Hooker (Sir WILLIAM JACKSON), D. C. L., F. R. S., b. at Norwich, Eng., in 1785; became in youth a zealous botanist; travelled abroad in his favorite pursuit 1806–14; became regius professor of botany at Glasgow 1820; edited the *Botanical Miscellany* (1828–33); the *London Journal of Botany* (1834–51); was knighted 1836; became director of Kew Gardens 1841; d. at Kew Aug. 12, 1865. Author of *Tour in Iceland* (1811), *British Jungermanniæ* (1816), *Muscologia Britannica* (with Taylor, 1818), *Flora Scotica* (1821), *Exotic Flora* (3 vols., 1823–27), *Icones Filicum* (with Greville, 1826–37), *Icones Plantarum* (10 vols., 1836–54), *Flora Boreali-Americana* (1829–40), *British Flora* (1830), *Genera of Ferns* (1838–42), *Species Filicum* (1846–53), and many other botanical works.

Hooker (WORTHINGTON), A. M., M. D., b. at Springfield, Mass., Mar. 3, 1806; graduated at Yale in 1825; received his medical degree at Harvard in 1829; practised at Norwich and New Haven, Conn., and was professor of the theory and practice of medicine in Yale College 1852–67. He was the author of a series of scientific books for the young, and of a number of professional works which gave him a wide reputation as a physician and scholar. D. at New Haven, Conn., Nov. 6, 1867.

Hook'erton, tp. and post-v. of Greene co., N. C., 82 miles S. E. of Raleigh, on Moccasin River. Pop. of v. 163; of tp. 1286.

Hooks and Eyes, for fastening garments upon the person, have been worn for ages. Some forms of the Roman *fibulæ* or clasps are essentially the same as our modern hooks and eyes, which are at present made with great rapidity entirely by machinery.

Hook'sett, post-tp. of Merrimack co., N. H., on Merrimack River and on the Boston Nashua and Concord R. R., at the junction of the Suncook Valley R. R., 8 miles below Concord. It has manufactures of brick, lumber, and cambrics. Pop. 1330.

Hook-Squid, a name given to certain cephalopods of the genera *Onychoteuthis* and *Enoploteuthis*, mostly, as far as known, of small size, but much dreaded for their long hooked tentacles and suckers and their voracious habits. There are nearly twenty known species, mostly found in warm seas only. *O. Banksii* ranges through most seas, warm and cold.

Hooks'town, post-b. of Greene tp., Beaver co., Pa. Pop. 259.

Hoop'er (JOHN), b. in Somersetshire about 1495; studied theology at Oxford, but having adopted the views of the German Reformers, he was compelled to leave Oxford, and went to Switzerland. On the accession of Edward VI. in 1547, he returned to England, preached with great success in London, and was in 1550 appointed bishop of Gloucester. In the beginning of the reign of Mary, in 1553, he was imprisoned, and as he refused to retract, he was condemned as a heretic and burned at the stake at Gloucester, Feb. 9, 1555. He wrote several works, among which was *Twelve Lectures on the Creed* (1581); also several interesting letters from him have been discovered, and published by Rev. C. Nevinson (Cambridge, 1852).

Hooper (JOHNSON J.) was b. and bred in North Carolina, but early became a lawyer and an able Whig journalist of Alabama. He was (1849–63) solicitor of the ninth Alabama circuit, and in 1861 secretary of the Provisional Congress of the Confederate States. His principal works are *Widow Rugby's Husband* (1851) and the *Adventures of Simon Suggs*, the last an exceedingly popular book. Mr. Hooper was a man of convivial habits, and late in life became a Roman Catholic. D. in 1863.

Hooper (LUCY), b. at Newburyport, Mass., Feb. 4, 1816; removed at fifteen, with her father, to Brooklyn, N. Y., where she wrote poems for the Long Island *Star*. D. Aug. 1, 1841. Among her works were *Scenes from Real Life* (1840), *Domestic Happiness*, a prize essay (1840), *Lady's Book of Flowers* (1845). Her *Works*, with a memoir by John Keese, appeared in 1842, and *Complete Poetical Works* in 1848.

Hooper (SAMUEL), M. A., b. at Marblehead, Mass., Feb. 3, 1808. His father was engaged in the European and West India trade, and the son as his agent visited Russia, Spain, and the West Indies. In 1833 he became a partner in the mercantile house of Bryant, Sturgis & Co., of Boston, who traded largely on the Pacific coast and in China, sending their vessels to California for hides, to the N. W. coast for furs, and to China for teas and silks. About 1842 he became a member of the firm of William Appleton & Co., who were also engaged in the China trade. Mr. Hooper also was largely interested in the iron business, and devoted much attention to questions of finance and currency. In 1851 he was chosen a member of the Massachusetts house of representatives, where he served three years, when he declined a re-election; in 1857 he was chosen a member of the State senate. In 1861 he was elected to Congress to fill a vacancy, and was re-elected at each successive biennial election, and was a member of Congress at the time of his death, at Washington, Feb. 13, 1875. He served on the committees of ways and means, of banking and currency, and of the war debts of the loyal States, and to his efforts was in no small degree due the success of the national loan of Apr., 1861, and of the national banking system. He wrote two pamphlets on the currency question, which are notable for broad and comprehensive views. He was the founder of the School of Mines in Howard University, from which in 1866 he received the degree of master of arts.

Hooper (WILLIAM), a signer of the Declaration of Independence, b. at Boston, Mass., June 17, 1742; graduated at Harvard in 1760; studied law under James Otis; removed in 1767 to North Carolina, where he held many important public positions, serving in the old Congress 1774–77. D. at Hillsborough, N. C., Oct., 1790.

Hooper's Creek, tp. of Henderson co., N. C. P. 755.

Hooper's Island, tp. of Dorchester co., Md., consist-

ing chiefly of a long narrow peninsula between Hong River and Chesapeake Bay. Pop. 760.

Hoope'ston, post-v. of Vermilion co., Ill., 104 miles S. of Chicago, on the Chicago Danville and Vincennes and the Lafayette Bloomington and Mississippi R. Rs. It has a seminary, several churches, a bank, 1 newspaper, elevators, public halls, 4 hotels, stores, etc. Principal occupation, merchandising and trafficking in grain. Pop. about 1200.
SEAVEY & WALLACE, EDS. "CHRONICLE."

Hooping Cough. See WHOOPING COUGH.

Hoop'oe (so named from its note), the *Upupa epops*, a slender-billed bird of Europe, Asia, and Africa, and of the family Upupidæ. It feeds on insects, and is the subject of many popular superstitions, being regarded as ominous of evil. It is in reality a very harmless and even useful bird. It is quite small, but very elegant in appearance. Other species are described, none of them American.

Hoorn, town of the Netherlands, in the province of North Holland, on the Zuyder-Zee. Its fortifications have been transformed into promenades, and now it has importance only as a trading and manufacturing place. It has considerable shipbuilding and a naval college. Pop. 9503.

Hoo'sac River rises in Lanesboro', Berkshire co., Mass., flows N. and N. W., traverses the S. W. angle of Vermont and Rensselaer and Washington cos., N. Y., affording abundant water-power, which is extensively utilized. It is called *Hoosick* in New York.

Hoosac Tunnel. The Hoosac Tunnel is in the north-western part of the State of Massachusetts, and is contained within the limits of the towns of Florida and Adams in Berkshire co. It is on the railroad route from Boston, Mass., *viâ* Greenfield, to Troy, N. Y. The distance from Boston to the E. portal is 137 miles, and thence to Troy 54 miles. That part of the route in Massachusetts, W. of Greenfield, which embraces the Hoosac Tunnel, is called the Troy and Greenfield R. R. Experimental work was first commenced in 1851, but no actual tunnelling until 1856. In 1862 the State took possession, and has since prosecuted the work. The tunnel is a little more than 4¾ miles long, and is made large enough for the passage of two lines of railway trains. It reaches through the Hoosac Mountain, which is the summit-range that extends southward into Massachusetts from the Green Mountains of Vermont. The greater part of the rock penetrated is a micaceous schist, exhibiting, however, widely variant conditions and characteristics in different portions of the length. A working-shaft 1028 feet deep, which has been sunk near the centre of its length, will be the only one kept open for the purpose of aiding in the ventilation of the tunnel. The work of excavating since 1866 has been greatly expedited by the application of machine-drills. These have been driven by pneumatic power, and in this, and also in availing of the force of percussion in drilling, they resemble those which were employed in the Mont Cenis Tunnel, and are believed to be of superior advantage and efficiency. Near the E. end constructions were made to utilize the flow of the Deerfield River for driving the compressors. At the other points of supply compression of air has been obtained entirely by steam-power. The cost of the tunnel and 39 miles of adjoining railroad, including the accumulation of interest, has been about $13,000,000. The tunnel has been opened for limited use, and trains pass through it daily, but the work of arching the portions in which the roof requires support is still in progress (May, 1875). BENJAMIN D. FROST.

Hoo'sick, post-tp. of Rensselaer co., N.Y. It is traversed by the Hoosick River, and is on the Troy and Boston and Troy and Bennington R. Rs., 30 miles from Troy. The township has extensive water-power and several manufacturing villages. Lime and slate are procured here. The so-called battle of Bennington (Aug. 16, 1777) was fought in this town. Pop. 5728.

Hoosick Falls, post-v. of Rensselaer co., N. Y., 26 miles N. N. E. of Troy, on the Troy and Boston R. R. It contains a graded school, 6 churches, a large mowing-machine factory employing 800 hands, malleable iron-works, 1 newspaper, a steam saw-mill, and other manufactories, and 2 hotels, stores, etc. Pop. about 4000.
J. H. LIVINGSTON, ED. "RENSSELAER CO. STANDARD."

Hoo'sier Prai'rie, tp. of Clay co., Ill. Pop. 1179.

Hop Bottom, post-v. of Susquehanna co., Pa., on the Delaware Lackawanna and Western R. R., 27 miles N. by W. of Scranton.

Hop-culture. HOPS (which see) grow wild in most parts of the Northern U. S. and Europe. There is but one botanical species—namely, *Humulus Lupulus*—but this is broken into varieties by cultivation. The plant belongs to the nettle family (Urticaceæ), and like the hemp is diœcious. It is a climbing vine with harsh foliage and rough stems, twining with the sun—that is, from left to right. In its wild state it clambers up the stems of shrubs and copsewood, and reaches high up among the limbs of lofty trees. The root is perennial, but the stems die in winter. Plantations of hops are not profitable S. of lat. 40.

The soil of a hop-yard should be made deep and rich; good corn or wheat ground will serve. It should be dry at all seasons, deeply and thoroughly worked, and subsoiling is a great advantage. It should be on sunny and elevated ground, where it may have the influence of the sun and air, and be exposed neither to high winds nor to early frosts. The confined atmosphere of valleys or close proximity to woods induces disease and favors parasitic insects. Though there are several varieties of hops, possessing diversities of flavor and appearance, the market seems to favor no particular kind as such. Hence, growers select varieties which in their own localities enjoy a reputation as yielding most or suffering least from rust and insects. The best known varieties are the "grape hop," which has large clusters, easily picked, the "English cluster," a free-fruiting, golden-yellow variety, with reddish stems, and the "Pompey hop," a rank grower, having medium-sized clusters of long green, quadrangular fruit, of very marked appearance, but said to be liable to rust and mildew.

Hops are cultivated in hills set 7½ to 8 feet apart. The roots do not fill the ground until the end of the second or third year. The first year, therefore, any crop may be raised to fill the soil which will not interfere with the cultivation. The land being manured and ploughed in autumn, and left rough, is ploughed again in the spring, and marked off—best by furrows 8 feet apart each way. Stakes are set at the intersection of the lines to mark the hills. Cuttings ("sets") are obtained from some established and healthy yard. They are the shoots which come from the crown of the plant, and are removed at the annual pruning, cut in lengths containing two joints or four eyes, and sold by the bushel. They should be fresh, and may be kept in the cellar or in the ground until wanted. Two to four bushels are required to plant an acre. Three or four sets are placed equally distant near the centre of the hill, just below the surface, their tops inclining together. As soon as convenient poles 6 or 8 feet high, like common bean-poles, are set. If the soil is rich, the sets vigorous, and planted early, a fair crop may be gathered the first year. In all hop-yards there must be some male hops, in order that the blossoms may become fruitful. The number required is about one hill in 60 or 80. The male sets are therefore kept separate, and every seventh or eighth hill each way is set with male hops and distinctly marked. The ground is cultivated the first year in connection with the accompanying crop, and kept free from weeds, especially from grass. At the close of the season one or two forkfuls of coarse manure are thrown upon each hill, not only as a fertilizer, but to protect the plants through the winter. Autumn is the best time to cut poles for setting the next spring. These may be 16 to 25 feet in length, and of some durable timber. In hop-growing regions young trees fit for poles have long since been exhausted, and poles are brought great distances at heavy cost. This has given rise to certain patented systems of training which are more or less in vogue. One of the simplest is to set light sawed poles to stand about 8 feet high, one to each hill, and connect them at their tops by tarred hempen twine. The vines are trained upon these cords, except those of the male hills, which run upon lofty poles, that their pollen may be scattered. The picking is much simpler and easier than picking from poles, and numerous advantages are claimed, such as freedom from disease and insects. The system has obvious and important merits.

In the spring of the second and subsequent years the earth is drawn away from the hills, the plants exposed, the crowns cut back to the new sprouts, taking usually an inch or two from the crowns. The poles, which are preferably 18 feet long, are pointed, and holes being made with an appropriately shaped crowbar, two and sometimes more are set to each hill, 15 to 18 inches apart and bending or inclining slightly away from each other, yet not so as to come near to the poles of other hills. The largest and strongest poles are set in the direction of the highest winds and around the outside. Ordinary corn-cultivators are generally used for hoeing hops, the ground being thoroughly ploughed at least once early in each year. As soon as the vines are two feet long they must be trained to the poles, selecting two strong ones for each pole, and cutting the rest away. The vines are tied to the poles with bast-matting, old yarn, or cheap strings, and should be looked to frequently until all cling well to the poles, it being necessary for some vines to use a light ladder or steps. Hop-vines are very brittle in the morning or evening, but may be handled when the sun is hot. They must always be wound about the poles with the course of the sun. Tillage in the hop-

yard continues until they bloom, and then, on account of some prejudice, it is discontinued usually until this is past and the hops are set. It is best to cultivate or stir the ground as often as the weeds start, and enough to keep it open and porous.

Hops are usually ripe enough to pick by the last week in August, and the harvest continues several weeks. The hop is known to be ripe when the seeds are hard and purple or beginning to get purple. Men take the poles down, first cutting the vines for some feet above the ground and loosening them from the poles, which are then laid upon supports over the boxes or "bins," into which women and girls pick the hops, taking care not to let leaves and stems fall in. If the picking commences too early, the vines bleed, and not unfrequently are thus destroyed or receive great injury. The "horizontal" hop-yards, or those upon cords, offer thus a great advantage, for the strings are loosened at the poles, and the vines, thus lowered within easy reach, allow of the hops being picked into large baskets. The "bins" before mentioned usually hold 7 to 10 bushels. When full they are emptied into immense bags, and taken upon wagons to the kiln, where they are dried immediately after picking, for they spoil easily if they lie in heaps.

The kiln is a building ordinarily of wood, containing usually four rooms—a lofty stove-room, a low drying-loft immediately above the stove-room, a store-room on a lower level than the drying-loft, and a press-room beneath it. The kilns are built to correspond with the size of the yard, or two or more are used, and they are of various plans. There are several patent kilns or patented methods of drying. The floor of the drying-loft is of slats covered with a hempen carpet, tightly spun, but loosely woven to allow the air to pass freely. The hops are spread upon this carpet to the depth of 12 to 14 inches, and stirred when they become nearly dry. After from 12 to 22 hours' drying they are generally cured, and are shoved and swept off into the store-room. In one of these patent kilns the carpet rolls back and forth, thus carrying the dried hops and depositing them on the floor of the store-room. In another the carpet is on a frame which tilts when over the store-room floor. Hops are dry enough when they crumble two-thirds to pieces in the hand, and when the stems do not feel moist or cool when pressed by the lips. After the first heat, and subsequently, flowers of sulphur are burned in the stove-room. The fumes passing through the hops serve to liberate the moisture rapidly, and in case the hops are rusty the effect is very marked, but much more sulphur is needed. For fair hops one pound to one and a half is sulphur enough, but for rusty hops several pounds are required. It is important to get hops dry enough, and they should be stirred once during the drying, but not until all perceptible steam has passed off. Should a charge get too dry, a pan of coals is set in the store-room, the ventilators are closed, and salt thrown upon them. This gives out moisture, which toughens the overdried hops. The fire must go down and the hops cool off considerably before they are removed to the store-room, and the newly-dried hops cannot be mingled with the others until the next day; and the best way is to leave them on the cooling floor, shoving them back as space is needed, keeping two or three charges spread over the floor all the time, and putting the oldest daily into the bins. After ten days or so, and within six weeks, the hops should be baled, the press being in the room below the cooling floor. The usual size of the hop bale is 20 or 24 inches, by 4 feet or thereabouts; screw-presses are generally employed. The press is lined with cloth made for the purpose called "Dundee sacking," and this is sewed tight after the pressing and before the pressure is relieved. Hops are marketed through commission merchants, and are consumed by the brewers almost exclusively.

Hops are raised in the U. S. not only in sufficient quantities for home consumption, but for export. The production has vastly increased within a few years, it having been in 1850 about 3,500,000 pounds; in 1860, 11,000,000; and in 1870, according to the last census, 25,456,699. Over 22,000,000 were produced within the States of New York (17,558,000) and Wisconsin (4,630,000). The principal hop-producing States named in order of production are as follows: New York, Wisconsin, Michigan, California, Vermont, Maine, Minnesota, Iowa, and Illinois. (See Hops, by Prof. Henry Wurtz, A. M.) M. C. Weld.

Hop-devouring Insects are quite numerous in species, and in some seasons and places are extremely destructive. Among the more important kinds are *Grapta interrogationis, G. c-argenteum, G. comma,* and *Thecla humuli,* all hop-butterflies; *Hepialus humuli,* a European moth; *Hypena humuli,* a very destructive hop-moth, common in the U. S.; *Amthycephalus interruptus,* a froth-fly; *Haltica concinna,* a flea-beetle; *Aphis humuli,* a plant-louse, and others. The best methods for treating them are hand-picking, the use of whale-oil soap, frequent shaking of the vines, etc. Generous culture may enable vines to thrive in spite of insect ravages.

Hope, tp. of La Salle co., Ill. Pop. 1437.

Hope, post-v. of Haw Creek tp., Bartholomew co., Ind. Pop. 765.

Hope, post-tp. of Knox co., Me., 14 miles N. N. W. of Rockland. It has manufactures of sash, doors, furniture, etc. Pop. 907.

Hope, tp. of Barry co., Mich. Pop. 1143.

Hope, tp. and post-v. of Warren co., N. J. Pop. 1542.

Hope, tp. of Hamilton co., N. Y. It has manufactures of lumber and leather. Pop. 698.

Hope, tp. of Williamsburg co., S. C. Pop. 1591.

Hope (Alexander James Beresford), LL.D., son of the author of *Anastasius,* b. 1820; educated at Harrow and Cambridge, graduating at Trinity 1841; member of Parliament for Maidstone 1841–52, and again in 1857; elected for Stoke-upon-Trent 1865, and in 1868 for the University of Cambridge, which he now (1875) represents; was president of the Royal Institute of British Architects 1865–67. He has taken an active part in the Church movement and in artistic architectural questions, being strongly on the Gothic side. In 1844 he purchased the ancient buildings of St. Augustine's Abbey, Canterbury, which he restored and endowed as a college for missionary clergy. Author of *Letters on Church Matters,* by D. C. L.; *The English Cathedral of the Nineteenth Century,* and numerous pamphlets, etc. In 1854, by royal license, he assumed the name of Beresford, the name of his mother, who married a second husband, the viscount Beresford.

Hope (Admiral Sir James), G. C. B., b. at Edinburgh in 1808: educated at the Royal Naval College; entered the British navy as midshipman 1822; became captain 1838; served near Buenos Ayres 1844–45; in the Baltic 1854–56; in the East Indian and Chinese waters 1859–60; was distinguished in the operations that led to the taking of Peking; transferred to duty in the West Indies 1863; became a G. C. B. 1865, a full admiral 1870; is deputy lieutenant for Linlithgowshire, and also first and principal naval aide-de-camp to the queen.

Hope (Thomas), b. in London in 1774; made extensive travels through Europe, Asia, and Africa, and attracted considerable attention in 1805 by his book on *Household Furniture and Internal Decoration.* Less influence had *The Costumes of the Ancients* (1809), *Designs of Modern Costumes* (1812), and *Architecture of Theatres;* while his romance, *Anastasius, or the Memoirs of a Modern Greek* (1819), made quite a sensation. D. in London Feb. 3, 1831. After his death an essay by him *On the Origin and Prospects of Man* was published.

Hope (Thomas Charles), b. in Edinburgh July 21, 1766; became professor of chemistry at the University of Glasgow in 1787, and in 1799 at the University of Edinburgh. D. June 13, 1844.

Hope & Co., a firm of bankers at Amsterdam, founded before 1700 by a Scotchman named Henry Hope. By marriages and business alliances the house has had intimate connection with the Barings, and by blood and marriage the house is also connected with several noble and aristocratic families of Great Britain.

Hope′dale, tp. and post-v. of Tazewell co., Ill., on the Chicago and Alton R. R., 25 miles W. by S. of Bloomington. Pop. 1096.

Hopedale, a beautiful post-v. of Milford tp., Worcester co., Mass., the seat of the Hopedale Community.

Hopedale, post-v. of Cadiz tp., Harrison co., O., 8 miles N. E. of Cadiz. Pop. 359.

Hope′field, tp. of Crittenden co., Ark. Pop. 157.

Hope Val′ley, post-v. of Richmond tp., Washington co., R. I., has important manufactures.

Hope′well, tp. of Marshall co., Ill. Pop. 753.

Hopewell, tp. of Cumberland co., N. J. Pop. 1857.

Hopewell, tp. and post-v. of Mercer co., N. J., on the Mercer and Somerset branch R. R. Pop. 4276.

Hopewell, post-tp. of Ontario co., N. Y., on the Northern Central R. R., 6 miles S. E. of Canandaigua. P. 1863.

Hopewell, tp. of Licking co., O. Pop. 1009.

Hopewell, tp. of Mercer co., O. Pop. 894.

Hopewell, tp. and post-v. of Muskingum co., O. Pop. of v. 75; of tp. 1763.

Hopewell, tp. of Perry co., O. Pop. 1260.

Hopewell, tp. of Seneca co., O. Pop. 1370.

Hopewell, tp. of Beaver co., Pa. Pop. 1015.

Hopewell, tp. of Bedford co., Pa., on the Huntingdon and Broad Top R. R. The post-borough of Hopewell, on the same railroad, is in the adjoining tp. of Broad Top. Hopewell tp. contains ironworks. Pop. 1078.

Hopewell, a b. of Chester co., Pa. Pop. 268.

Hopewell, tp. of Cumberland co., Pa. Pop. 977.

Hopewell, tp. of Huntingdon co., Pa., on the Huntingdon and Broad Top R. R. It has iron-works. P. 412.

Hopewell, tp. of Washington co., Pa. Pop. 804.

Hopewell, tp. of York co., Pa. It contains the village of Stewartstown. Pop. 3830.

Hopewell, tp. of Anderson co., S. C. Pop. 1296.

Hopewell, tp. of Orangeburg co., S. C. Pop. 293.

Hopewell Cape, post-v., the cap. of Albert co., N. B., on Shepody Bay and the junction of the Memramcook and Petitcodiac rivers, 21 miles S. W. of Dorchester. It has some shipbuilding. Pop. about 500.

Hop'kins, county of W. Kentucky. Area, about 400 square miles. It is fertile, having a hilly surface, with plenty of coal and iron ore. Live-stock, tobacco, and corn are staple products. It is traversed by the Evansville Henderson and Nashville and other railroads. Cap. Madisonville. Pop. 13,827.

Hopkins, county in the N. E. of Texas. Area, 480 square miles. It is fertile and well timbered. Live-stock, grain, cotton, and wool are staple products. Cap. Sulphur Springs. Pop. 16,651.

Hopkins, tp. of Whitesides co., Ill. Pop. 1436.

Hopkins, post-tp. of Allegan co., Mich., on the Michigan Southern R. R., 8 miles N. E. of Allegan. Pop. 1271.

Hopkins, post-v. of Nodaway co., Mo., is the S. terminus of the Creston branch of the Burlington and Missouri River R. R., and the N. terminus of the Maryville branch of the Kansas City St. Joseph and Council Bluffs R. R. It is near the Iowa line.

Hopkins (Arthur F.), b. in Virginia about 1796, was well educated; removed in early life to Alabama, and became a prominent Whig politician; a lawyer of Huntsville, Tuscaloosa, and Mobile successively; was long in public life, and for many years a judge of the supreme court of the State, and afterwards president of the Mobile and Ohio R. R. D. in 1866.

Hopkins (Edward), b. at Shrewsbury, England, in 1600; was a successful merchant of London; removed to Boston, Mass., in 1637; was seven times governor of Connecticut between 1640 and 1654, and assisted in forming the union of the colonies of New England 1643. He afterwards returned to England, became a member of Parliament, and held important offices under the Commonwealth. D. in London Mar., 1657, bequeathing a portion of his estate to the support of schools in Hartford, New Haven, Hadley, and Cambridge in New England. The town of Hopkinton, Mass., was named for him, having been purchased in 1700 of the "praying Indians" with moneys of his which fell to Harvard College.

Hopkins (Esek), b. at Scituate, R. I., in 1718; was commissioned by Gov. Cooke as brigadier-general at the beginning of the war of independence. In 1775 he was appointed commander-in-chief of the navy by the Continental Congress, and addressed officially by Washington as admiral. In the beginning he was very successful in his undertakings, but afterwards he failed to fulfil the expectations of the government, and, having neglected to appear at Philadelphia when summoned, he was dismissed from the service in 1777. He retired to North Providence, where he resided till his death, Feb. 26, 1802, taking part very actively in the politics of the State.

Hopkins (John Henry), D. C. L., LL.D., b. in Dublin, Ireland, Jan. 30, 1792; came in 1800 with his parents to America; received a good education, and assisted Alexander Wilson in preparing the illustrations of four volumes of his *Ornithology;* and afterwards was an iron manufacturer in Western Pennsylvania. He failed in business in 1817; was admitted to the bar at Pittsburg in 1818; in 1824 became rector of Trinity church, Pittsburg (Protestant Episcopal), of whose church edifice he was the architect. In 1831 he became assistant minister of Trinity church, Boston, Mass., and professor of systematic divinity in a theological seminary in Massachusetts. In 1832 he was consecrated the first bishop of Vermont, became rector of St. Paul's, Burlington, and afterwards devoted much time to the establishment of the Vermont Episcopal Institute. He took a strong stand for the High-Church movement, and was an active member of the Pan-Anglican Synod. D. at Rock Point, Vt., Jan. 9, 1868. Among his works are many brochures, sermons, etc., besides *Christianity Vindicated* (1833), *Primitive Creed Examined* (1834), *The Primitive Church* (1835), *Essay on Gothic Architecture* (1836), *The Church of Rome in her Primitive Purity* (1837), *Vindication of Slavery* (1863), etc. etc.

Hopkins (John Henry), A. B., A. M., S. T. D., b. Oct. 28, 1820, at Pittsburg, Pa.; graduated in 1839 at the University of Burlington, Vt.; appointed rector of St. John's church, Essex, N. Y., in 1869, and of Trinity church, Plattsburg, N. Y., in 1872; ordained priest in 1872; elected trustee of the General Theological Seminary, N. Y., in 1871, and member of the board of missions in 1874. Besides minor works, he wrote *Decline and Fall of the Low Church Party* (1874), founded and edited *The Church Journal* (1853–68), *The Canticles Noted* (1866), *Life of Bishop Hopkins of Vermont* (1872), and *Works of the Rev. Milo Mahan, D. D.* (1872–75).

Hopkins (Johns), b. in Anne Arundel co., Md., May 19, 1795, was carefully educated, became a wholesale grocer, retired with an ample fortune in 1847, and became president of the Merchants' Bank and a director of the Baltimore and Ohio R. R. He was never married, and was a member of the Society of Friends. In 1873 he founded the Hopkins free hospital, Baltimore, at a cost of some $4,000,000; an orphanage for colored youth, a convalescent hospital, and the Johns Hopkins University at Clifton, near Baltimore, with 400 acres of land and an endowment of $3,000,000, poor and deserving youth from Maryland and Virginia to receive free scholarships. These benefactions exceeded $8,000,000 in aggregate value. D. at Baltimore Dec. 24, 1873.

Hopkins (Lemuel), b. at Waterbury, Conn., June 19, 1750; graduated at Yale College; practised medicine at Litchfield, and removed to Hartford in 1784, where he d. Apr. 14, 1801. With Trumbull, Barlow, and others, styled the "Hartford wits," he put forth the *Anarchiad,* advocating an efficient federal constitution. He wrote several satires and other poems, among which are *The Political Greenhouse, The Guillotine, The Hypocrite's Hope,* and an elegy on a *Victim of a Cancer Quack.* Author of a favorite version of Psalm cxxxii.

Hopkins (Mark), M. D., D. D., LL.D., b. at Stockbridge, Mass., Feb. 4, 1802, and graduated at Williams College in 1824; and M. D. in 1828; was professor of moral philosophy and rhetoric in Williams College 1830–36; president of the college 1836–72; then resumed the former position; in 1857 he was also president of the A. B. C. F. M., an office whose duties he still discharges. Has published *Evidences of Christianity* (1846; new ed. 1864), *Law of Love, and Love as a Law* (1869), *An Outline Study of Man* (1873), and many occasional addresses, etc.

Hopkins (Samuel), D. D., b. at Waterbury, Conn., Sept. 17, 1721; graduated at Yale in 1741; studied theology with Jonathan Edwards. In 1743 he was ordained over a church at Housatonic, now Great Barrington, Mass.; in 1770–76 minister of a church at Newport, R. I., and again in 1779. In consequence of his labors against slavery the State of Rhode Island freed all her slaves born after Mar., 1784. He published several works, the most noted of which is *System of Doctrines* (1793), and his views have had a wide influence. His complete works were published in 1805, with a *Life* by Dr. Stephen West, and in 1852, with a *Memoir* by E. A. Park. He is the hero of Mrs. Stowe's novel, *The Minister's Wooing.* D. at Newport Dec. 20, 1803.

Hopkins (Stephen), LL.D., a signer of the Declaration of Independence, b. at Scituate, R. I., Mar. 7, 1707; was bred a farmer; removed in 1731 to Providence, where he was a land-surveyor and merchant; Speaker of the Rhode Island Assembly 1732–41; became chief-justice of the common pleas 1739; chief-justice of the superior court 1751–54; ten times governor of Rhode Island between 1754 and 1768; a member of the Continental Congress 1774–78. Author of *Rights of the Colonies Examined* (1765) and other writings, and long the chancellor of Brown University, then Rhode Island College. D. at Providence July 19, 1785.

Hopkins (William), M. A., LL.D., F. R. S., b. in 1793. With little early education, and after an unsuccessful attempt in business, he entered at the mature age of thirty at St. Peter's College, Cambridge, where he graduated as seventh wrangler, and, taking private pupils, became the most celebrated mathematical teacher of his day. Many of the most eminent mathematicians now living were trained by him. From Prof. Sedgwick he imbibed a strong interest in geology, and his published works consist chiefly of the application of the methods of mathematical analysis to the elucidation of problems of physical geology, such, chiefly, as the effects of elevatory forces from below in producing faults and fissures in the rocks, on the formation of crevasses in glaciers, on the geological theories of elevation and earthquakes, on the causes which may have produced changes in the earth's superficial temperature,

and on the conductivity of rocks and some other substances for heat. But his name is most widely known through his masterly mathematical investigation (*Phil. Trans.*, 1839–40–42) of the effects which internal fluidity should have upon the "precession of the equinoxes," and the much-quoted result which he arrived at, that the solid *crust* of the earth must have a thickness of *at least* 800 or 1000 miles. The erroneousness of this conclusion, and the analytical source of it, is pointed out in the *Smithsonian Contributions to Knowledge*, vol. xix. Mr. Hopkins was president of the British Association 1853, and of the Geological Society 1851 and 1852. D. Oct. 13, 1866. O. FISHER.

Hopkins (WILLIAM FENN), A. M., LL.D., b. in Connecticut 1802; graduated from the U. S. Military Academy, but retained as professor of chemistry, mineralogy, and geology till 1835; resigned 1836, and engaged in business. He subsequently held various professorships, and in 1850 was appointed professor of natural and experimental philosophy at the U. S. Naval Academy, which he retained until appointed U. S. consul at Jamaica, W. I., where he d. July 13, 1859. G. C. SIMMONS.

Hop′kinson (FRANCIS), a signer of the Declaration of Independence, b. in Philadelphia in 1737, and was a grandson of the bishop of Worcester, Eng. He graduated at Princeton in 1763; in 1765 was admitted to the bar. He held a profitable public office in New Jersey, which he was deprived of for his republican principles. He was a member of Congress from New Jersey 1776–77, and a resident of Bordentown. His witty and satirical writings during and after the Revolution had much influence in political affairs. He was an admiralty judge in Pennsylvania 1779–89; U. S. district judge for Pennsylvania 1790–91. D. in Philadelphia May 9, 1791. His humorous and patriotic poetical and other pieces—*The Treaty, The Battle of the Kegs, Ode to Science, Essay on Whitewashing*, and many others—enjoyed an immense popularity, and were really meritorious. Three volumes of his *Works* were published in 1792. He had considerable artistic and musical talent.

Hopkinson (JOSEPH), LL.D., a son of Francis Hopkinson, b. in Philadelphia Nov. 12, 1770; graduated at the University of Pennsylvania in 1786. He became one of the ablest lawyers of his time, residing mostly in Philadelphia. He is chiefly remembered as the author of "Hail Columbia." He was (1816–20) a prominent member of Congress, and in 1828 was appointed U. S. district judge for the eastern district of Pennsylvania. D. Jan. 15, 1842, at Philadelphia.

Hop′kinsville, city, cap. of Christian co., Ky., 71 miles N. W. of Nashville, Tenn., on the St. Louis and South-eastern R. R., situated in the most fertile section of Western Kentucky. It contains an academy and 2 seminaries, 8 churches, 2 banks, 2 carriage-factories, 2 weekly newspapers, a planing-mill, a plough-factory, 2 large mills, a public library, a city-hall, and a State insane asylum. Tobacco is the principal staple. Coal and iron are found in the vicinity. Pop. 3136.

SAM. M. GAINES, ED. "KENTUCKY NEW ERA."

Hop′kinton, post-v. of Delaware co., Ia., 4 miles from Sand Spring, a station on the Dubuque South-western R. R.

Hopkinton, post-tp. of Middlesex co., Mass., on the Hopkinton and Milford R. R., 30 miles W. S. W. of Boston. It has 4 churches, 1 national and 1 savings bank, a good public-school system, and extensive manufactures of boots and shoes. Pop. 4419.

Hopkinton, post-tp. of Merrimack co., N. H., on the Contoocook River R. R., 7 miles S. W. of Concord. It contains the village of CONTOOCOOK (which see), and has 7 churches and important manufactures. Pop. 1814.

Hopkinton, tp. and post-v. of St. Lawrence co., N. Y. It has 3 churches, and manufactures of starch, lumber, cooperage, etc. The township is very extensive, comprising large forests and numerous lakes. Pop. of v. 200; of tp. 1907.

Hopkinton, tp. and post-v. of Washington co., R. I., 35 miles S. W. of Providence. The township has good water-power and several manufacturing villages, where cotton goods, machinery, etc. are made. Hopkinton has a national bank. Pop. 2682.

Hoplegnath′idæ [from ὁπλή, "nail," and γνάθος, "jaw"], a family of acanthopterous fishes, with the body compressed and covered by ctenoid scales; the lateral line continuous; the spinous division of the dorsal fin longer than the soft; the ventrals thoracic, with one spine and five soft rays; and the intermaxillary and maxillary bones provided with a trenchant edge, with which the teeth, when developed, are continuous, and form then a serrated margin, somewhat as in the Scaridæ. The pharyngeal bones are separate. This family is limited, so far as now known, to a single genus (*Hoplegnathus*, Richardson), which has, however, received several generic names, and is represented by species in the Eastern Asiatic and Australasian seas.

THEODORE GILL.

Hoplophor′idæ [ὁπλοφόρος, "armor-bearer"], an extinct family of loricate edentate mammals, most nearly related to the existing pichiegos (Chlamydophoridæ) and armadillos (Dasypodidæ), but also related to the extinct megatheriids. They were of large size, and some of them attained gigantic dimensions. (1) The carapace, instead of being articulated, as in the armadillos, formed an inarticulated shell resembling in shape the carapace of the turtle; (2) a breast-shield or plastron was also developed; (3) the teeth were uniform in number, there having been in all the species five molars on each side of each jaw; and (4) these characters were co-ordinated with numerous more or less decided modifications of the skeleton. This family (which has also been named Glyptodontidæ) was composed of a number of species which existed in South America, and, especially in the later Tertiary epoch, in the Argentine Republic and Brazil. In external appearance they bore considerable resemblance to gigantic tortoises, and some of them attained a length of fifteen feet or even more. The various forms exhibited two decided modifications in the structure of the members: (1) Some had four digits before as well as behind, those corresponding to the thumb and great toe of man being wanting, as in the group comprising the genera *Hoplophorus* (Lund) and *Panocthus* (Burmeister); while (2) others had four digits before and five behind, those corresponding to the thumb and great toe being present, and the missing digit of the fore foot being the outer of the other species, or, in other words, corresponding to the little finger of man. This group includes one genus with two well-marked sub-genera (*Glyptodon*, Owen, and *Schistopleurum*, Nodot). The Hoplophoridæ have been the objects of special study on the part of several eminent naturalists, and especially Huxley and Burmeister, the latter of whom has published very elaborate monographs in the 1st and 2d vols. of the *Anales del Museo Publico de Buenos Aires*. THEODORE GILL.

Hop′per (ISAAC TATEM), a benevolent Hicksite Quaker, b. at Deptford, N. J., Dec. 3, 1771; became a tailor in Philadelphia, and afterwards a successful merchant and bookseller of New York; was a prominent abolitionist, and devoted a large part of his lifetime to works of benevolence. D. in New York May 7, 1852. (See his *Life*, by L. M. CHILD, 1853.)

Hop′pin (AUGUSTUS), b. at Providence, R. I., July 13, 1828; graduated at Brown University 1848; became a lawyer; studied art in Europe, and became distinguished as one of the first of American artists in his special department, that of the illustration of books. His female figures and scenes from society are often full of spirit.—His brother, THOMAS F. HOPPIN (b. 1816), a pupil of Paul Delaroche, is also distinguished as an artist.

Hop′pin (Rev. JAMES MASON), D. D., b. in Providence, R. I., Jan. 17, 1820; graduated at Yale in 1840 and at Andover in 1845; was settled over the Crombie street church in Salem, Mass., Mar. 27, 1850, and was appointed professor of homiletics in the theological department of Yale College in 1861. He received the degree of D. D. from Knox College, Ill., in 1870. He has published *Notes of a Theological Student* (1854), *Old England, its Art, Scenery, and People* (1867), *The Office and Work of the Christian Ministry* (1869), *Life of Andrew Hull Foote, Rear-Admiral U. S. N.* (1874). R. D. HITCHCOCK.

Hops [Ger. *Hopfen*; Fr. *houblon*; bot. *Humulus lupulus*], a diœcious plant. The pistillate flowers are clustered in short axillary catkins; the two-flowered leafy bracts are imbricated, and in fruit form a kind of membranaceous strobile. The fruiting calyx is sprinkled with yellow resinous grains (lupuline). The nervine, aromatic, bitter tonic, and other supposed virtues of the hops, as imparted to beer, etc., reside chiefly in this yellow powder, though the scales of the strobiles also possess most of them, to a far less extent. The constituents of commercial hops, which consist of the dried strobiles, are a highly aromatic essential oil, residing almost entirely in the yellow powder; a resinous substance, a bitter crystalline principle, tannic acid (morintannic, Wagner), gum, cellulose, extractive matter soluble in water, quercitrin, and, according to some, a waxy matter. The yellow powder, called lupuline, forms in a pure state about 10 per cent. of the whole—a proportion overstated (up to 18 per cent.) by some authorities. This, according to Personne, is of the nature of a gland, which secretes a resin. The name was given to it by Dr. A. W. Ives of New York, who first analyzed it, and whos name and analytical results are strangely misquoted in the textbooks. Thus, *Watts's Dictionary*, apparently following E. Kopp, makes him *Monsieur Yves*, a Frenchman, and gives his figures very incorrectly.

Analyses of the Yellow Granules, Lupuline.

	Wimmer.	Chevallier and Payen.	Wagner.	Dr. Ives.	Alsatian hops, C. Nène.
Essential oil	0.12	......	......	......	0.50
Bitter substance	3.01	8.3 to 12.5	......	9.25	
Resin	2.91	52.5	......	30.00	15.90
Wax	......	......	......	1.00	
Astring. constituent	0.63	......	3.2 to 5.7	4.17	3.02
Cellulose	8.99	......	......	38.33	48.33
Extractive matter	4.92	......	......	8.33	6.40
Gum	1.26	......	......	......	11.10
Water	78.16	......	......	8.92	14.50
Soluble salts	......	......	......	......	0.25
	100.00	......	......	100.00	100.00

Dr. Ives's figures are misquoted in European works of high authority (under the name of Yves) as 11 per cent. of bitter, 36 of resin, 12 of wax, 5 of tannic acid, 10 of extractive, and 26 of "residue insoluble in water" (*cellulose?*), footing up just 100, *without any water.* The discrepancies among the different figures given, however, detract almost wholly from their value. Another authority states that the whole hop contains *two per cent.* of volatile oil. (*Watts's Dictionary*, art. "Lupulin.") Wimmer gives an analysis of the scales of the strobiles, apart from the yellow granules, in which he found no volatile oil, 5.83 of gum, 64 of cellulose, and 12.22 of extractive matter.

The hop-crop is one which exhausts the soil rapidly. The ashes of the strobiles contain from 20 to 25 per cent. of potash (anhydrous), 15 to 20 per cent. of phosphoric acid, and 10 to 23 per cent. of silica. The potash is estimated to be equivalent to an exhaustion from an acre of from 20 to 25 pounds of hydrate of potash annually.

Essential Oil of Hops, obtained usually by distilling the cones with water; but Prof. C. A. Seeley, of New York, claims, with much reason, that this method alters its constitution and greatly injures its natural aroma. Indeed, Personne found the malodorous substance, valerianic acid, in the products of distillation of lupuline with water. Seeley has within a few years introduced and patented a new and ingenious mode of procuring this oil, sufficiently economical to be used for the preparation of a commercial oil of hops to be used for flavoring beer, for which purpose it is said to be now coming largely into use. This consists in dissolving out the essential oil by means of very light petroleum naphtha, or "gasoline," and then distilling off the latter, which is as volatile as ether, and requires a temperature so low as not to alter the essential oil. The oil of hops obtained by the first method has an odor like thyme, and contains, according to Wagner, a terpene, $C^{10}H^{16}$, and a compound, $C^{6}H^{10}O$, near to valeric acid, $C^{5}H^{10}O^{2}$, and convertible into the latter by oxidation. Hence, hops acquire by age a valerianic odor. Personne considered this essential oil as analogous to oil of valerian, the terpene in which is *borneene.* No dextro-rotatory camphor, however, like borneol (Borneo camphor) has been obtained from oil of hops. H. Wurtz.

Hop Tree (*Ptelea trifoliata*), also called **Shrubby Trefoil,** an American shrub of the rue family, found from Pennsylvania southward and westward. When kept trimmed to a single stem it attains a height of 30 or 40 feet. The leaves are trifoliate, with leaflets ovate, pointed, and downy when young. The flowers, borne in cymes at the ends of the new shoots, are greenish, small, and not conspicuous; they are polygamous—staminate, pistillate, and perfect ones being found on the same plant. The fruit is two-celled and two-seeded, having a broad wing, and resembles that of the elm, whence its generic name (Gr. πτελέα, "elm"). The flowers and bruised leaves have an unpleasant odor. The fruit is intensely bitter, and is destitute of the aromatic principle of the true hop, for which, however, it is often substituted in the manufacture of beer. An infusion of the leaves and young shoots is used as a remedy for worms. It is a neat ornamental shrub, not liable to the attacks of insects, and from the compound character of its leaves contrasts well with other trees and shrubs. It is a late plant, the branches remaining bare in spring long after other shrubs are clothed with foliage, but later in the season its large clusters of winged fruit give it an attractive appearance.

Hor, a mountain of Arabia Petræa, forming a part of the range of Seir or Edom, upon which Aaron died. The summit which is generally conceded to be the Mt. Hor of this incident still bears the name of Mt. Aaron (Arab. *Jebel Harûn*), and, rising to the height of 4800 feet above the sea, is the most conspicuous summit of the range. The mountain has a double top, and is surmounted by an edifice, of later date than the Crusades, which is called Aaron's tomb. There is another Mt. Hor, mentioned in Num. xxxiv. 7, 8 as one of the marks of the N. boundary of the land which the Israelites were to conquer. The word *Hor* means simply "mountain," and in this instance probably designates the entire Lebanon range.

Hor'ace (Quintus Horatius Flaccus), b. Dec. 8, 65 b. c., at Venusia, in Apulia. His father, a freedman, was a collector of money for tax-gatherers and bankers, and owned a little farm, which he sold in order to give his son a liberal education. After finishing his studies in Rome, Horace went in 45 b. c. to Athens to study philosophy and rhetoric, but the murder of Cæsar and the civil war which ensued made him a soldier, and he fought as a tribune under Brutus in the battle of Philippi (42 b. c.). After the defeat he fled to Rome, and his offence was forgiven or forgotten. With the rest of his patrimony he bought a position as a registrator in the office of the prætor, but he soon gave it up in order to devote himself entirely to literary pursuits. His first productions were satires, or, as he calls them himself, *sermones*, on account of the colloquial tone in which they are written. These he read to his friends, and thus by degrees he was admitted to the literary circles of Rome. He made the acquaintance of Varius and Virgil, who introduced him to Mæcenas, who again introduced him to Augustus; and Mæcenas appreciated his talent and his friendship so much that he gave him a fine country-seat near Tivoli, in the Sabine Mountains, and also a competency. After the satires (35 b. c.) followed the epodes or *iambi* (30 b. c.), then the odes or *carmina* (23 b. c.), and at last the epistles (19 b. c.), the second book of which contains the long epistle *Ad Pisones*, generally known under the title of *Ars Poetica.* D. Nov. 27, 8 b. c., and was buried at the Esquiline Gate, beside Mæcenas. With the great social and political movements of their time the poems of Horace have no connection, but they possess another (and to us a still greater) charm: they tell in a thousand different ways, and always in an intimate and pleasant manner, of private life. But for Horace we should have a very imperfect and meagre idea of refined and educated life in pagan Rome, its tastes and vanities, its convivialities and extravagances, its forms and implements. This, however, was not the secret of his wonderful success. That which through eighteen centuries has made him the most-read poet of antiquity was his representativeness. He had exactly genius enough, and not too much, to express the instincts, moods, and methods of average humanity. His imagination is not very great; he visits no man's mind with strange visions; but that which he has is precise and graceful. Nor is his feeling very warm either; he stirs no man's heart with excitement, but that which he has is sound and pleasant. His principal faculty is his power of reflection. His intellect, always clear, never deep, always striking, never strong, makes him complete master of himself—a decent and humorous cynic, a prudent and elegant epicurean, always polite, seldom noble, always cordial, seldom kind. And this genius, so well adapted to be the representative of average humanity, was equally well trained to fill its task. His verses have no music, perhaps with the exception of a few drinking-songs. But they have all a piquant, catching movement. His form has no simplicity or naturalness, and it lacks almost entirely plasticity. But the artificiality is so elaborate, so easy and elegant, that the mind of average humanity is impressed by this manner of expressing ideas and sentiments as would be their body by a garment of velvet, satin, and lace. Since the beginning of this century, however—that is, since the predominance of the romantic school—the verses of Horace have lost some of their poetical charm; their historical interest they will, of course, never lose. Of recent editions we mention those of Anthon (New York, 1830), Orelli (Zurich, 1837), Lincoln (Boston, 1851), Ritter (Leipsic, 1855), Didot (Paris, 1855), and Wickham (London, 1873). Clemens Petersen.

Horæ. See Hours.

Horanyi (Francis Joseph Alexis), b. at Buda, Hungary, Feb. 15, 1736; d. at Pesth, Sept. 11, 1809. Author of *Memoria Hungarorum et Provincialium scriptis editis notorum* (1775–77) and *Nova Memoria* (1792); edited *Johannis Bethlemii Historica transilvanica* (1782) and the *Chronicon Hungaricum* of Simon of Keza (1782).

Horapol'lon, or **Horus Apollo,** the name of the author of a small Greek essay entitled *Hieroglyphica,* which is the only work on the interpretation of the Egyptian hieroglyphics which has come down to us from antiquity. The book is believed to belong to the fourth century a. d.; of the author nothing is known.

Ho'reb, according to some, a lower part or elevation of Mt. Sinai; others consider it to be a general name for the whole range of which Mt. Sinai was one of the principal summits. The name itself in Hebrew means "desert."

Hore'hound, the name of several labiate herbs of temperate climates. *Marrubium vulgare*, the common or white horehound, is naturalized in the Eastern U. S., but is a

native of Europe and Western America. It is an excellent tonic remedy, very useful in coughs and colds, and is generally taken in syrup or candy. The fetid horehound (*Ballota nigra*) is also a naturalized plant from Europe. It resembles the former in appearance, taste, and properties. The water horehound (*Lycopus Europæus*) grows in Europe and America. It is considered a good tonic. *Lycopus Virginicus* (bugle-wort) nearly resembles it, and is sometimes used on account of its expectorant properties.

Hor′gen, or **Hor′chen,** town of Switzerland, in the canton of Zürich, on the Lake of Zürich, has some manufactures of silk, cotton goods, and chemicals. Pop. 5311.

Hor′icon, post-tp. of Warren co., N. Y. It abounds in lakes and mountains, has 4 churches, and manufactures of leather and other goods. Pop. 1500.

Horicon, post-v. of Dodge co. (Hubbard tp.), Wis., on the Chicago Milwaukee and St. Paul R. R., 54 miles N. W. of Milwaukee, at the junction of the Ripon branch, and on Rock River at the outlet of Horicon Lake. It has manufactures and extensive water-power.

Horicon Lake. See George, Lake.

Horicon Lake, in Dodge and Fond du Lac cos., Wis., is 15 miles long, and 5 miles across. Its waters flow into Rock River, and finally fall into the Mississippi. It is a shallow, grassy basin, sometimes called the Winnebago Marsh.

Ho′rites, the aboriginal inhabitants of Mt. Seir before the Canaanites conquered Palestine. Their name is derived from Hori, the grandson of Seir (Gen. xxxvi. 22), and refers to their habit of dwelling in caves, of which there still are many extant in the cliffs of Edom.

Hori′zon [ὁρίζων, the "bounding" (circle)], the line formed by the apparent contact of the sky and earth. This, or, more exactly, the circle upon the heavens bounding the plane which is tangent to the earth at the point where the observer stands, is the *sensible* horizon. The *rational* horizon is a circle on the celestial sphere bounding a plane parallel to the sensible horizon, which plane divides into two equal parts both the terrestrial and the celestial spheres. Except the moon, all the heavenly bodies may be practically considered as always situated either above or below each of the horizons alike.

Hormis′das, Pope, a native of Frosinone, became pope in 514, and d. Aug. 6, 523. Eighty of his letters are extant.

Horn, a hard projection, diminishing from its base to a point, on the heads of many animals, especially the cloven-footed quadrupeds. It is generally curved or spiral, but that of the cow, bull, or ox, being most familiar, has become a familiar descriptive term for all similarly formed projections—*e. g.* the horns of the moon. The word in its origin is of very great antiquity, since it is found in both Aryan and Semitic tongues. In Sanscrit *karna*, it is true, signifies an ear, but the Latin *cornu*, Greek *keras* and *korôneê*, Gothic *haurn*, Persian *karna* ("trumpet"), and the Irish and Cymric *corn*, all indicate an Indian origin, while the Hebrew *karn*, the Chaldæan *garna*, and the Arabic *garn*, *gurnat*, show that it has always been known to the southern branch of civilized humanity. The word is conjectured by speculative philologists to be allied to a large family of terms, such as the originals of *crown*, *corn*, etc. As a very prominent symbol in ancient literature the horn signified strength, power, or dignity (Jer. xlviii.; 1 Sam. ii.), and with the Greeks abundance or fertility, as was set forth in the cornucopia, or horn of plenty. The connection of horns with sexual attributes appears to have been partly due to their association with the bull and the goat, and their extraordinary increase in size in the ox, who in all countries was regarded as the type of one whose privileges are usurped by the bull. In all animals bearing them "the formation of the horns has been long known to be much influenced by the condition of the organs of generation: in the deer they acquire their full bulk and complete form just before the season of rutting." The most dignified of the deities, whether Semitic or Aryan, were represented as horned, and for a different reason all those which were most closely connected with reproductive nature—as, for instance, the rural gods.

Horn, *per se*, is of four kinds. That of the rhinoceros "consists of a uniform, compact, or glutinate mass of epidermal fibres, the slightly concave base of which is attached to the dermo-perioste of a slightly elevated or rugous tract of bone." The second type is that of most ruminants, in which the growth extends from the frontal bones, and the dermo-periosteum develops a sheath of horny fibres, the horn being hollow. The bone is termed the *core;* it has usually a rugous or grooved exterior. In Bovidæ and Ovidæ the frontal sinuses extend therein; in Antelopidæ the core is solid. The growth each year is marked by a circular groove near the root, from which the age may be determined. The giraffe (third type, Owen) has a pair of small, short, cylindroid, unbranched horns, which consist of bone covered by hairy skin, terminated by a tuft of coarser hair. The bones are not processes of the skull, but are joined, like epiphyses, by synchondrosis to both frontal and parietal bones, the base crossing the coronal suture. The young are born with such horns, and are the sole horned mammals that enter the world with such weapons. In deer (fourth type) the horns consist wholly of *bone*, which grows from the frontal; the periosteum and finely haired integuments called "velvet" coextending therewith during the period of growth; at the end of which the formative envelope loses its vascularity, dries, and is stripped off, leaving the bone as a hard, insensible weapon. After some months these horns lose all vascular connection with the skull, and are shed; after which the growth of a new pair commences. The reindeer is one of the very few Cervidæ in which antlers are developed by the female. Thus, deer are the only ungulates that annually shed their horns; the prong-buck is the only known hollow-horned ruminant that annually sheds the extra-vascular part of the horn, called the sheath. The horns of ungulates may be summarized as consisting either of *horn* only, as in the rhinoceros; of bone only, as in the *Cervus* or deer genus; of horn and bone, as illustrated by the bovine or ox genus; and of skin and bone, as in the giraffe. From these facts it has been observed that in the English language we have in *horn* only one word to express two quite different substances—the branched bony horns of the stag genus, and the laminated horns of the genus *Bos* (ox). In French the antlered kind are called *bois*, or forest, from their branches, while the other kind, as of the ox, antelope, and goat, is called *corne*.

In olden times horns were extensively used, especially among the Northern races, for drinking-cups, and in Saxon and Norman sculptures it is the common goblet.

Manufacture of Horn.—The peculiar texture of horn, its toughness and agreeable natural colors, have always caused it to be a favorite material for many works, though of late years the increasing cheapness of glass, gutta percha, and metal wares has caused a great disuse of it. At one time there was held annually in England a fair at which every object for sale was made of horn, and until within a few years a large class of Scottish gypsies maintained themselves entirely by making and selling horn spoons. As true horn consists, chemically, of albumen (keratin) and a little phosphate of lime, it is readily softened in boiling water or by heat; sometimes the process is aided by the addition of quicklime. It is usual to prepare the horns of oxen and sheep by steeping them for several weeks in cold water, which has the effect of separating the cored bony part from the cover of true horn. The latter is then heated, first for half an hour in boiling water, and then over fire. In this condition it may be cut or moulded with great ease. To make sheets for lanterns or combs, the horn is slit lengthways at the side, heated and pressed out, either between plates or by machines, of which several have been invented for the purpose. Care must, however, be exercised as to the application of both heat and pressure, since, owing to its peculiarly laminated structure and the striæ abounding through it—as may be specially observed in that of the rhinoceros—horn has a tendency to split. It receives dyes of different kinds, and is made to closely resemble tortoise-shell, but this process also is apt to render it fragile. Its softness may, however, be restored by steeping it in glycerine and water; and if it be then treated with nitric and pyroligneous acids, tannin, potash, sulphate of zinc, and water, it assumes a peculiar strength and great elasticity. As sheets or other pieces of horn may be incorporated together, there is little waste in the manufacture. Of late years there has been an extensive manufacture in London of so-called Abyssinian drinking-cups, made of segments of horn straightened and with a bottom, colored in imitation of the beautiful gray and black cups brought from the plunder of Magdala. The horn of the rhinoceros has been greatly esteemed in all ages in the East, partly from a belief that it neutralized poison in liquids, and partly from its rich natural color and great beauty. It is often elaborately carved by the Egyptians and Chinese, and the writer has seen one from Canton which, owing to its exquisite work, cost $600. He has in his possession one presented to him by a wealthy Copt which was highly esteemed, owing to its delicate semi-transparency, and has seen another which was supposed to be almost unique in this respect. Some years ago parasol-handles of rhinoceros horn became fashionable in Paris, and to this day they are extensively imitated in horn. The Romans made oil-flasks both of ox and rhinoceros horn, and from an epigram in Martial it may be inferred that they too sometimes imitated the latter material with the former. The epigram is in reference to a lantern, and might serve as its inscription:

"Though by a bull I here of late was borne
You'd say I am of true rhinoceros horn."

These cups require occasional oiling, or they will "chip" or crack. In the East this is a favorite material for the hilts of weapons, preference being given to that which comes from Sumatra. It is worked, like ivory, entirely with the chisel and without heat. Deer or buck horn is used in all countries for knife-handles. As it is simply bone, and of coarse cellular structure within, it is seldom or never made up except in such a manner as to preserve in part, at least, its agreeably colored and peculiar rugged structure. In Germany thousands of artisans are devoted to making from deer-horn ornaments which vary from carvings of almost microscopic delicacy to large articles of furniture. Immense numbers of deer-horns (of the *Axis maculata*) are annually brought to Germany for such work, even England requiring about 250,000. The horns of the Eastern buffalo and of the American bison are in great demand; the latter, from its color and fine hard grain, being especially prized for the handles of dental instruments. The interior of ox-horns is used to make "bone-earth;" the refuse of all kinds is applied to the manufacture of prussiate of potash and ammoniacal salts; while fragments of ox and buffalo horn, powdered, are of value as manure. C. G. LELAND.

Horn, a wind instrument of music, usually of brass, much used in the orchestra. The French horn is usually coiled in such a way as to become portable, and its key may be modified by the insertion or withdrawal of suitable pieces. The sax-horn is a modification of the older instrument. Various other wind instruments are called from their shape "horns," and in ancient times the horns of animals were employed as trumpets, but they probably served only as the means of calling.

Horn (GUSTAF CARLSSON), b. at Örbyhus, Sweden, Oct. 23, 1592; studied at Rostock, Jena, and Tübingen; received his military training in Holland under Prince Maurice of Orange; and entered the Swedish army in 1624. Gustavus Adolphus called him his right arm, and after the battle of Lützen he made a brilliant campaign in the Rhenish Palatinate, but was taken prisoner in the battle of Nördlingen in 1634, and kept for seven years in the fortresses of Ingoldstadt and Burghausen. Having been exchanged in 1641, he returned to Sweden; commanded in 1644 in Scania against the Danes; was made a count and field-marshal in 1651; and d. at Skara May 16, 1657.

Horn, or **Hoorne** (PHILIPPE), COUNT OF, b. in 1522, a son of De Montmorency-Nivelle, a Flemish nobleman. When his mother, having become a widow, married Count Horn, Philippe was adopted by his stepfather and assumed his name. He distinguished himself both in the battles of St.-Quentin and Gravelines and in the councils of Philip II. and Margaret, viceregent of the Netherlands. He was a good Catholic, but he was tolerant. He was loyal to the Spanish crown, but he would not deliver up the rights of his native country without resistance. Thus, when Alva arrived in the Netherlands, he was seized, together with Egmont, at Brussels in 1567, a case was made out against him, and he was beheaded June 5, 1568.

Horn'beam, a name given to various trees. The hornbeam of Europe is the *Carpinus Betulus*, a handsome forest tree which has very tough, white wood, highly prized by turners and joiners. It is also excellent fire-wood, and makes good charcoal. In the U. S. the *Carpinus Americana* is called hornbeam, lever-wood, iron-wood, and blue beach. It is very hard, tough, and close-grained. The hop-hornbeam, called also lever-wood or iron-wood, is a slender tree, the *Ostrya Virginica*, with wood of the same qualities as those possessed by that of the former tree. Both grow extensively throughout the U. S. All the above belong to the order Cupuliferæ.

Horn-bill. See BUCEROS.

Horn'blende, a term used in mineralogy, sometimes as synonymous with amphibole, sometimes to designate only the dark-colored varieties of that very variable mineral. In the former sense hornblende is a mineral crystallizing in the monoclinic system, but occurring also imperfectly crystallized, or massive, fibrous, and granular. Its hardness varies from 5 to 6, and its specific gravity from 2.9 to 3.4. In composition it varies much, being, however, essentially a silicate of magnesia and oxide of iron, with generally lime, and with or without alumina, manganese-oxide, or soda. It is one of the more important rock-forming minerals, occurring especially in granitic and metamorphic rocks, and volcanic rocks of deep-seated origin. It presents a great variety of forms and great differences in color; black and dark-green varieties are especially known as *hornblende;* lighter green as *actinolite;* white varieties as *tremolite*, and fibrous forms as ANTHOPHYLLITE, ASBESTOS, and AMIANTHUS (which see). EDWARD C. H. DAY.

Horn'blower (JOSEPH COURTEN), LL.D., a son of Judge Josiah Hornblower of New Jersey (1729–1809), b. at Belleville, N. J., May 6, 1777; was admitted to the bar in 1803; was chief-justice of the New Jersey supreme court 1832–46; a prominent member of the constitutional convention of 1844; and a man of practical benevolence. D. at Newark June 11, 1864.

Horn'book, a written or printed tablet of parchment or paper, covered with a thin transparent layer of horn, and framed in wood, containing the alphabet in Roman or black letter, with some other simple lessons, often followed by the Lord's Prayer. Hornbooks appear to have been chiefly English. Their use originated before the invention of printing, and continued till about the middle of the last century. There are but few existing specimens known.

Horn'by, post-tp. of Steuben co., N. Y. It has several manufactories. Pop. 1202.

Horne (GEORGE), b. at Otham, Kent, England, Nov. 1, 1730; took orders in 1753; became chaplain to the king in 1771, dean of Canterbury in 1781, bishop of Norwich in 1790; and d. at Bath Jan. 17, 1792. His principal work is his *Commentary on the Psalms* (1776); he also published several volumes of sermons, *Letter to Dr. Priestley, Letters on Infidelity*, and a letter to Adam Smith on David Hume.

Horne (RICHARD HENRY), b. in 1803 in London; studied in the college at Sandhurst, and became a midshipman in the Mexican navy; was in Australia 1852–70, where he held several local magistracies. Author of several tragedies, and a number of poems and miscellaneous works, among which are a *Life of Napoleon* (2 vols., 1841), *Orion, an Epic* (1843; of which three editions were sold at one farthing a copy), *Australian Facts and Figures* (1859).

Horne (THOMAS HARTWELL), D. D., b. in London Oct. 20, 1780; studied at Christ's Hospital 1789–95, and read law; was sub-librarian of the Surrey Institution 1809–23; took orders in the Church of England 1819; was senior assistant librarian in the British Museum 1824–60; became rector of St. Edmund's and St. Nicholas's 1833; was made a prebendary of St. Paul's 1841; d. in London June 27, 1862. In early life he was a Methodist. His principal work is the *Introduction to the Critical Study of the Scriptures* (1818, latest edition, London, 1856, 4 vols.); also author of a *Brief View of the Necessity of Revelation* (1800), *Lakes of Lancashire, Westmoreland, and Cumberland* (1816), *Deism Refuted* (1819), *Romanism Contrary to the Bible* (1827), *Manual for the Afflicted* (1832), *Protestant Memorial* (1835), *Manual of Biblical Bibliography* (1839), and *Mariolatry* (1840). (See *Reminiscences of T. H. Horne*, by his daughter, S. A. CHEYNE, London, 1862.)

Horned Toad (*Phrynosoma*), a genus of true lizards, of which ten or eleven species are found in Texas, Mexico, California, Utah, etc. They are not toads at all. They are rather sluggish, especially in captivity. They do not leap, but crawl like other lizards. *P. Douglassii, Blainvillii*, and *cornutum* are the best-known species.

Douglass's Phrynosoma.

Hor'nellsville, post-v. of Steuben co., N. Y., 58 miles S. of Rochester, on the Erie R. R. It has good schools, 5 churches, extensive railway-shops, a mowing-machine factory, large boot and shoe, furniture, machine, and other factories, planing-mills, 3 weekly and 1 tri-weekly news-

paper, and a handsome opera-house, 1 national bank, etc. Pop. of v. 4552; of tp. 5837.

H. H. GREENHOW, ED. "EVENING TRIBUNE."

Hor'ner (FRANCIS), b. at Edinburgh Aug. 12, 1778; studied law at the university of his native city; removed to London in 1803, and entered Parliament in 1806. He soon acquired a conspicuous position in the House of Commons by his business capacity, his insight into political economy, and the nobleness of his character; but, having injured his health by excessive labor, he was obliged to travel, and d. at Pisa Feb. 8, 1817. A monument was erected to him in Westminster Abbey, and his *Memoirs and Correspondence* were edited by his brother (London, 1843).

Horner (WILLIAM EDMONDS), M. D., b. at Warrenton, Va., June 3, 1793; graduated at the University of Pennsylvania 1814; served in the navy as a medical officer 1813–15; became a distinguished practitioner of Philadelphia; was prosector and demonstrator of anatomy in the University of Pennsylvania; became adjunct professor of anatomy in the same 1819; full professor 1831; announced the discovery of the so-called Horner's muscle 1824; founded St. Joseph's Hospital 1847. D. in Philadelphia Mar. 12, 1853. Published a treatise on *Pathological Anatomy* (1826), *Practical Anatomy, Special Anatomy and Histology* (2 vols., 1851), *U. S. Dissector*, and an *Anatomical Atlas*.

Horner's Method of Detached Coefficients. The method of detached coefficients simplifies the processes of algebraic multiplication and division when the coefficients in the expressions to be operated upon are chiefly numerical. It consists in omitting the letters (or at least the letter according to the powers of which the expressions are arranged), and using the coefficients only of the successive powers. Before employing the method the expressions must be prepared so that the exponent of the letter according to which each expression is arranged must increase by one in each term toward the right from 0 to the highest given, or decrease in like manner, from the highest given to 0.

To illustrate the method in multiplication: Let it be required to multiply $5x^4 + 2x^2 - x + 1$ by $5x^3 - 2x + 1$. In the multiplicand the term containing x^3 is wanting, and in the multiplier the term containing x^2; these must be supplied, so that the expressions, when properly prepared, will read $5x^4 + 0.x^3 + 2x^2 - x + 1$ and $5x^3 + 0.x^2 - 2x + 1$. The operation is performed as follows:

$$\begin{array}{l}
5+0+\ 2-1+1 \\
\underline{5+0-\ 2+1} \\
25+0+10-5+5 \\
\quad -10-0-4+2-2 \\
\underline{\qquad +5+0+2-1+1} \\
25+0+\ 0+0+1+4-3+1
\end{array}$$

Since the expressions to be multiplied are arranged according to the descending powers of x, the product will be so arranged, the highest power being that obtained by multiplying x^4 by x^3, or x^7. The complete product will then be $25x^7 + 0.x^6 + 0.x^5 + 0.x^4 + x^3 + 4x^2 - 3x + 1$, or, omitting the insignificant terms, $25x^7 + x^3 + 4x^2 - 3x + 1$.

To illustrate the method in division: Let it be required to divide $x^7 - 2x^4 - 3x^3 - x - 1$ by $x^3 - 2x - 1$. Supplying the wanting terms in both the dividend and divisor, the expressions will read $x^7 + 0.x^6 + 0.x^5 - 2x^4 - 3x^3 + 0.x^2 - x - 1$ and $x^3 + 0.x^2 - 2x - 1$, and the operation will read as follows:

$$\begin{array}{l|l}
1+0+0-2-3+0-1-1 & \underline{1+0-2-1} \\
\underline{1+0-2-1} & 1+0+2-1+1 \\
\quad 2-1-3+0 & \\
\quad \underline{2+0-4-2} & \\
\quad -1+1+2-1 & \\
\quad \underline{-1-0+2+1} & \\
\qquad 1+0-2-1 & \\
\qquad 1+0-2-1 &
\end{array}$$

As there are four terms in the divisor, four terms of the dividend are first dealt with. To the first remainder $(2-1)$ the next term of the dividend $(+3)$ is annexed; and since the divisor of four terms is not contained in $2-1-3$, 0 is written in the quotient, and the next term of the dividend $(+0)$ is brought down: the rest of the operation needs no explanation. The power of x in the first term of the quotient will be that obtained by dividing x^7 by x^3 or x^4; and the complete quotient will be $x^4 + 0.x^3 + 2x^2 - x + 1$, or $x^4 + 2x^2 - x - 1$.

The process of division by detached coefficients is the inverse of that of multiplication by detached coefficients. To exhibit this, let it be required to multiply $3x^2 - x + 2$ by $x^2 - 2x + 3$, and then divide the product by $x2 - 2x + 3$:

$$\begin{array}{l}
3-1+2 \\
\underline{1-2+3} \\
3-1+2 \\
\quad -6+2\ -4 \\
\underline{\qquad +9\ -3+6} \\
3-7+13-7+6
\end{array}$$

The first term of the product is obtained by multiplying the first term of the multiplicand by the first term of the multiplier; hence, the first term of the quotient in division must be obtained by dividing the first term of the dividend by the first term of the divisor; the second term of the product is obtained by adding together the product of the second term of the multiplicand by the first term of the multiplier, and the product of the first term of the multiplicand by the second term of the multiplier; hence, the second term of the quotient must be the result obtained by subtracting from the second term of the dividend the product of the first term of the quotient by the second term of the divisor: the third term of the product is the sum of the three products obtained by multiplying the third term of the multiplicand by the first term of the multiplier, the second term of the multiplicand by the second term of the multiplier, and the first term of the multiplicand by the third term of the multiplier; hence, the third term of the quotient must be the result obtained by subtracting, in succession, from the third term of the dividend the product of the second term of the divisor by the second term of the quotient, and the product of the third term of the divisor by the first term of the quotient; and so on. If, now, the terms of the divisor, with the exception of the first, have their signs changed, the successive subtractions may be changed into additions, and the operation may be performed thus (the example being to divide $3x^4 - 7x^3 + 13x^2 - 7x + 6$ by $x^2 - 2x + 3$):

$$\text{Divisor.}\left\{\begin{array}{r|l}
1 & 3-7+13-7+6 \\
+2 & \quad +6-\ 2+4 \\
\underline{-3} & \underline{\qquad -\ 9+3-6} \\
 & 3-1+\ 2,+0+0
\end{array}\right.$$

the quotient being $3x^2 - x + 2$. The method of proceeding will be apparent from what has gone before. The method of division here exhibited was discovered, a little more than fifty years ago, by W. G. Horner of Bath, Eng., and is known as Horner's synthetic division or method of division by detached coefficients. It is of importance in the solution of higher equations.

It has heretofore been stated that Horner's method of division by detached coefficients is applicable only when the coefficient of the first term of the divisor is one. Mr. E. D. Hearn of England has recently shown that this is not really the case, though when that coefficient is not one, the process has to be modified. The reason for the modification and the character of it will be apparent from an example. Let it be required to divide $12x^4 - 192$ by $4x^3 + 8x^2 + 16x + 32$. Using the coefficients alone, and supplying the terms wanting in the dividend, the ordinary process would be as follows:

$$\begin{array}{l|l}
12+\ 0+\ 0+\ 0-192 & \underline{4+8+16+32} \\
\underline{12+24+48+96} & 3-6 \\
\quad -24-48-96-192 & \\
\quad \underline{-24-48-96-192} &
\end{array}$$

Since the quotient of x^4 by x^3 is x, the quotient will be $3x - 6$. It will be observed that in this quotient the first term is obtained, as before, by dividing the first term of the dividend by the first term of the divisor; the second term is not, however, the remainder left after subtracting from the second term of the dividend the product of the first term of the quotient by the second term of the divisor, but, instead, that remainder divided by the first term of the divisor; and a similar remark will apply to the remaining terms of the quotient, if such there be. The operation, conducted after Horner's method, would be as follows:

$$\begin{array}{r|l}
4 & 12+\ 0+\ 0+\ 0-192 \\
-\ 8 & \quad -24+48 \\
-16 & \qquad -48+96 \\
\underline{-32} & \underline{\qquad\qquad 96+192} \\
 & \underline{\quad -24} \qquad \left\{\text{"False quotient line," each term in which is to be divided by the first term of the divisor.}\right. \\
 & \underline{3-\ 6} \qquad \text{True quotient line.}
\end{array}$$

EDW. DAVID HEARN. REVISED BY J. H. VAN AMRINGE.

Horner's Method of Solving Higher Equations. Until Horner, in 1819, communicated to the Royal Society his method of solving algebraic equations of all degrees, no direct and reliable method of finding the roots of equations beyond the fourth degree was known; by his method the process is comparatively simple. It consists, in principle, in transforming the equations by one or more figures of the root at a time, and in a direct and reliable method of discovering those figures; whilst the operation itself is performed by means of detached coefficients. The explanation will be most facilitated by first enunciating the rule, and then elucidating the several steps or sections of the rule whilst working an example.

Rule 1. To Find a Positive Root.—Having found the number and situation of the roots, transform the given equation into another whose roots shall be less than those of the given equation by the initial figure of the root; then

divide the absolute term of the reduced equation by the penultimate coefficient to find the next figure of the root, with which transform the reduced equation as before, and repeat the process until the desired accuracy is attained.

Rule 2. To Find a Negative Root.—Change the signs of the alternate terms of the given equation, and proceed as for a positive root.

Example.—Find the roots in the equation $2a^3 + 3a^2 - 4a - 10 = 0$, where, as there are two permanences and one variation of sign, there will, if all the roots are real, be, according to Harriot's rule of signs, two negative roots and one positive root. The true number and situation of the roots may be found by STURM'S METHOD (which see). By this method the following expressions are obtained:

$$F = 2a^3 + 3a^2 - 4a - 10$$
$$F_1 = 6a^2 + 6a - 4$$
$$F_2 = 11a + 28$$
$$F_3 = -593$$

If, now, there be substituted in F, F_1, etc., for a, the values 0, 1, 2 in succession, the following changes of sign will occur:

```
                        F, F1, F2, F3.
If a = 0 the signs  —  —  +  — ...2 var.
   a = 1  "    "    —  +  +  — ....2 var. } Hence there is a root
   a = 2  "    "    +  +  +  — ...1 var.  }   between 1 and 2.
```

We will now make $a = 1$ and $a = 2$ respectively, and transform the functions by the synthetic division, thus:

```
F = +2 +3 −4 −10 (a = 1        F = +2 +  3 −  4 −10 (a = 2
       +2 +5 + 1                      +  4 +14 +20
       +5 +1 − 9                      +  7 +10 +10
       +2 +7                          +  4 +22
       +7 +8                          +11 +32
       +2                             +  4
    +2 +9 +8 −9                   +2 +15 +32 +10

F1 = +6 +  6 −  4 (a = 1        F1 = +6 +  6 −  4 (a = 2
        +  6 +12                        +12 +36
        +12 +  8                        +18 +32
        +  6                            +12
     +6 +18 +  8                     +6 +30 +32

F2 = +11 +28 (a = 1             F2 = +11 +28 (a = 2
          +11                             +22
     +11 +39                         +11 +50
     F3 = —                          F3 = —
```

$\therefore a=1=F = 2a^3 + 9a^2 + 8a - 9$
$F_1 = 6a^2 + 18a + 8$
$F_2 = 11a + 39$
$F_3 = -$

$\therefore a=2=F = 2a^3 + 15a^2 + 32a + 10$
$F_1 = 6a^2 + 30a + 32$
$F_2 = 11a + 50$
$F_3 = -$

One variation is lost between 1 and 2, indicating that one root has been passed over. Taking the transformed functions just found (by making $a = 1$ and $a = 2$), and treating them in the same manner, we could ascertain whether the root is between 1.1 and 1.2, or between 1.2 and 1.3, and so on. In the given equation it is between 1.6 and 1.7. Again, we might take this third series of functions and treat them again, which would show us that it is between 1.62 and 1.63, and so on to any degree of accuracy; but it is usually sufficient, when three or four decimal places in the root have been found, to continue the operation in the same manner as contracted division, as much time and labor is thereby saved. For the given equation the working will stand thus:

```
+2   +3               −4                −10 (1.6248190836
      2                5                  1
      5                1                 −9 A
      2                7                  8.472
      7                8 A               −.528 B
      2                6.12               .424256
      9 A             14.12              −.103744 C
      1.2              6.84                86069248
     10.2             20.96 B            −17674752 D
      1.2               2528               17262760
     11.4             21.2128              −411992 E
      1.2               2536                215888
     12.6 B           21.4664 C            −196104 F
        04               50912              194299
     12.64            21.517312               −1805
         4               50944                1726
     12.68            21.56825|6 D              −79
         4                1019|5                 65
     12.72 C          21.57845|1                −14
       008                1019|5                 13
     12.728           21.5886|4 E                −1
          8                  1|2
     12.736           21.5887|6
          8                  1|2
     1|2.7|44 D,E,F   21.588|8 F
                      21.58|8
                      21.5|8
                      21|5
                      2|1
                      |2
```

Now, if we analyze this working, we shall observe that the given equation was first depressed in order to eliminate the first figure of the root; that this depressed equation was further depressed to eliminate the second figure of the root—that is, the first figure of the decimal portion—and so on, until the desired approach to accuracy was attained. In this case the root is correct to five places of decimals, and approximately so to ten places of decimals. The SMALL CAPITALS show the successive depressions from the given equation so far as the coefficients are concerned, thus:

Given equation......$F =$	$2a^3$	$+3a^2$	$-4a$	-10
A......$a = 1$..........$F =$	$2a^3$	$+9a^2$	$+8a$	-9
B......$a = 0.6$..........$F =$	$2a^3$	$+12.6a^2$	$+20.96a$	-0.528
C......$a = 0.02$.........$F =$	$2a^3$	$+12.72a^2$	$+21.4664a$	$-0.10374\mid 4$
D......$a = 0.004$........$F =$	$2a^3$	$+12.744a^2$	$+21.568256a$	$-0.01767\mid 4$
E......$a = 0.0008$......$F =$	$2a^3$	$+12.74\mid 4a^2$	$+21.5686\mid 4a$	$-0.00041\mid 1$

and so on.

It should be mentioned, with regard to the application of Sturm's theorem, that it takes no notice of the duplication of a root; therefore, when the equation has equal roots, we shall have a divisor which exactly measures a dividend, so that the process will terminate without a remainder which is independent of the unknown quantity. In this case we can divide the several functions by the common measure, and use the depressed functions to determine the distinct roots, or we can employ the original functions, merely remembering that two of the roots are equal. (For an explanation of Horner's "new method of solving numerical equations of all orders by continuous approximation," see *Philosophical Transactions of the Royal Society of London*, for the year 1819, part ii.) EDW. DAVID HEARN.

REVISED BY J. H. VAN AMRINGE.

Hor'net, a name applied to several large stinging insects of the wasp family. The most common in the U. S. is the *Vespa maculata*, which builds a great nest of brown paper, and hangs it from the branches of a tree. Its paper is made from the fibre of wood. Its sting is very severe. The hornet is omnivorous, devouring fruits, honey, and insects of many kinds. Some of the foreign species build nests of paper, and some of clay. Some make only the cells of paper, housing the cells in a hollow tree. This is the case with *Vespa crabro*, the commonest European hornet, now naturalized to some extent in the U. S.

Horn'pipe, a musical instrument formerly common in Wales, consisting of a wooden pipe, with holes at graduated intervals, and a horn at each end. A lively tune and several popular dances have been composed for this instrument, and known by its name. The tune is in compound triple time, with nine crotchets in a bar—six down and three up.

Horn's Creek, tp. of Edgefield co., S. C. Pop. 1945.

Horoden'ka, town of Austro-Hungary, in the province of Galicia, near the Dniester, carries on an active general trade. Pop. 8451.

Horol'ogy [Gr. ὥρα, "hour," and λόγος, "treatise"], the science of the divisions and measurements of time, or, in a narrower sense, the description of the construction of clocks, watches, sun-dials, and other devices for measuring time. Calendars, zodiacs, cycles, and the larger measurements of time are not usually treated of as forming the subject of any part of the science of horology. (See CLOCKS, by LINUS P. BROCKETT, A. M., M. D.; and WATCHES.)

Hor'oscope [Gr. ὥρα, "hour," and σκοπεῖν, to "observe"], a diagram of the position of the heavenly bodies, especially of the planets and the twelve imaginary signs of the zodiac, at the time of a person's birth, from which was derived an augury of his career and fortunes. The most important thing was the sign of the zodiac which rose at the moment of the child's birth. Arbitrary significations were given to the different heavenly bodies according as they appeared singly or in conjunction, or as they were in opposition. As a rule, one born under Jupiter would be powerful; one under Mars, warlike; one under Venus, successful in love; one under the Pleiades, exposed to storms at sea, etc. Horoscopes were also calculated upon the same general principles to foretell the issue of any important undertaking.

Horr (ASA), M. D., b. at Worthington, Franklin co., O., Sept. 2, 1817; took his medical degree at Cleveland in 1846 in the medical department of Western Reserve College; has practised medicine since 1847 at Dubuque, Ia.; erected a private astronomical observatory 1864, and was the first to determine accurately the longitude of Dubuque; has given much attention to botany and the other natural sciences, and to the perfecting of a system of phonographic shorthand. Author of many professional and scientific papers; with J. M. Bigelow published a catalogue of the plants of Franklin co., O.; is a member of many learned societies; and has been president of the Iowa Institute of Science and Arts

since 1868, of which society he was (1868) one of the founders.

Hor′rocks, or **Horrox** (Jeremiah), b. at Toxteth, Lancashire, England, about 1615; studied as a sizar in Emmanuel College, Cambridge; took holy orders and became curate of Hoole, where in 1639 he made an observation of the transit of Venus (Nov. 24). William Crabtree was apprised by Horrocks of the calculations which led him to expect this transit (which not even Kepler had predicted), and accordingly Crabtree and Horrocks both made observations (the first on record) of the transit of Venus. The transit occurred on a Sunday, and Horrocks felt compelled to attend divine service, and thus lost a part of the observation. D. at Hoole Jan. 3, 1641. Author of *Venus in Solivisa Observationum Cœlestium Catalogus* (1672), *Novæ Theoriæ Lunaris explicatur*, of published *Letters* to Crabtree in Latin, and of a few other posthumous papers. It is possible that he was the inventor of the micrometer, but the point is uncertain.

Hor′ry, the easternmost county of South Carolina, having North Carolina on the N. E. and the Atlantic Ocean on the S. E. A part of its surface is marshy, and a part is sandy, with pine forests. Rice and pork are the staple products. Area, about 1000 square miles. Cap. Conwayborough. Pop. 10,721.

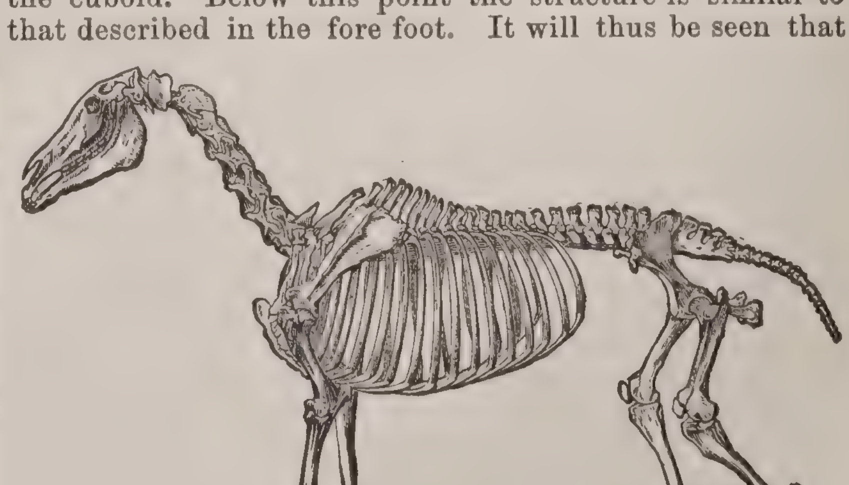
Horry (Peter), a distinguished South Carolinian in the Revolutionary war of 1776, was a brigadier-general under the partisan command of the celebrated Gen. Francis Marion. Gen. Horry was distinguished not only for his prowess in arms, but for his achievements with the pen. The life of Marion prepared by him and Weems, published in 1824 by Carey & Lea of Philadelphia, has gone through many editions, and will hold a permanent place in American literature. A. H. Stephens.

Horsa. See Hengist.

Horse (*Equus caballus* of Linnæus), a well-known domestic animal, non-ruminating and simple-hoofed, belonging to the soliped family of Cuvier's order Pachydermata (thick-skinned); but, according to the modern classification, the genus *Equus* belongs to the family Equidæ, sub-order Perissodactyla (odd-toed), order Ungulata (hoofed), class Mammalia. The horse, with the ass, zebra, quagga, and a few other similar animals, constitutes a natural family of hoofed quadrupeds, the forms now living being closely related to each other, and widely separated from all other existing mammals. The horse differs from the other species of this family in having the tail covered with long hairs from the base, instead of tufted at the end, and in the presence of horny callosities on the inner side of the hind legs below the "hock," as well as on the fore legs above the "knee," where they are also found in the other species. The pattern of coloration in the horse is, moreover, not striped, but in most respects he closely resembles the other living representatives of the family. Nearly all these animals may breed together, producing hybrids, which are, however, usually sterile, as in the case of the well-known mule, the offspring of an ass by a mare, or the hinny, the product of a stallion by a female ass.

The principal characteristics of the Equidæ, as exemplified by the horse, are the following: There are in the adult 3 incisors or cutting teeth, 1 canine, and 6 molars or grinding teeth on each side, above and below—40 teeth in all. The canines, however, are usually wanting in mares. An additional small tooth is occasionally found in advance of the upper molar series. This tooth, when present, is the smallest of all the teeth, and, as it has neither predecessor nor successor, its nature is in doubt. The grinding teeth are long, and have thick, square crowns. They are deeply implanted in the jaw, and without true fangs or roots, except in old age. These teeth are composed of interblended enamel, dentine, and cement, and when their summits are worn down by mastication a peculiar and complicated pattern is presented, especially by the upper teeth. The enamel, being much harder than the dentine or cement, takes in the section the form of an irregular, elevated ridge surrounding the tooth; outside this ridge is cement, and within dentine. There are also in the upper teeth two crescentic "lakes" of cement surrounded by a ridge of enamel, which often presents, especially in some fossil species, very complicated foldings. The canines are small when present. The incisors are arranged close together in a curve at the end of the jaw. They differ from those of ruminants by their greater length and curvature, and from those of all other mammals by the fold of enamel, which penetrates the crown like the inverted finger of a glove. When the tooth begins to be worn this fold becomes a ring of enamel, enclosing a cavity filled by cement and particles of food, and is called the "mark." In "aged" horses the incisors are worn down below the extent of the fold, and the "mark" disappears. This occurs in the lower middle incisors at the sixth year, and in the next and outer pairs in the seventh and eighth years respectively. The "mark" remains somewhat longer in the upper teeth. The skull is much elongated, chiefly in consequence of the great size of the face as compared with the hinder or true cranial portion. It is wide between the orbits, which are small, and closed behind by a bridge of bone, as in ruminants. The premaxillaries project beyond the nasals. The condyle of the lower jaw is much elevated above its alveolar border. The cervical vertebræ have their centra elongated, strongly convex in front and concave behind. The *ligamentum nuchæ* is a strong band of elastic tissue for the support of the head, extending from the spines of the anterior dorsal vertebræ to the occiput. In the dorsal region the vertebræ become gradually less convex anteriorly. The neural spines increase in length to the fourth or fifth. The dorso-lumbar vertebræ number 24, and there are 18 or 19 pairs of ribs. There are 5 sacral and about 17 caudal vertebræ. The clavicle is absent, as in all ungulates. The scapula, or shoulder-blade, is long and narrow, the low spine has no acromion, and the coracoid process is small. The humerus is short and strong, and the articulation with the radius and ulna is a very perfect hinge-joint. The two bones of the fore arm are co-ossified. The shaft of the ulna is obsolete, and the distal end small, so that the articulation for the carpus or wrist, commonly called the "knee," is furnished almost entirely by the radius. The carpus is composed of seven bones in two rows—the first row of the usual four bones, the second of three bones—the trapezium being obsolete, or sometimes represented by a small ossicle. The trapezoid and unciform are small, and the magnum large. Three metacarpals only are present, corresponding with those of the index, middle, and fourth or "ring finger" of the human hand. Of these, the middle, articulating with the magnum, is much the largest, supports the foot, and is called the cannon-bone. The other two metacarpals are small, and placed somewhat behind the middle one. They taper rapidly to a point, and, except in rare abnormal cases, support no digits. They are called splint-bones, and by their displacement give rise to the disease known as "splint." The cannon-bone is nearly symmetrical on the opposite sides, and at its lower end, at the fetlock-joint, articulates with the first phalanx, called the "great pastern-bone." The second phalanx is the "little pastern-bone," and the crescent-shaped ungual phalanx, supporting the hoof, is the "coffin-bone." The transversely elongated sesamoid bone in the tendon of the *flexor perforans*, at the articulation of the two latter bones, is the "navicular" of veterinarians.

The pelvic bones are elongated, and their long axis, on the length of which depends the proportional size of the "quarter," forms an acute angle with the back-bone. The femur is short, stout, and included in the common integument of the body. The third trochanter, as usual in odd-toed ungulates, is well developed for the insertion of the *gluteus maximus* muscle, and there is a characteristic fossa on the under surface of the bone above the external condyle. The fibula is rudimentary. In the ankle, or "hock," joint, the astragalus is deeply and obliquely grooved. It has a flat distal face, not borne upon any distinct neck, and articulates almost entirely with the navicular, presenting only a small face to the cuboid. The internal and middle cuneiform bones are small and united, and support the inner splint-bone. The ectocuneiform is large, and with the cuboid supports the cannon-bone, or metatarsal of the middle toe. The outer splint-bone is also supported by the cuboid. Below this point the structure is similar to that described in the fore foot. It will thus be seen that



Skeleton of a horse.

throughout the whole extent of both the hind and fore limbs, except in the proximal portions of the carpus and

tarsus, development is principally confined to a single median series of bones, and thus, with the single solid hoof, is formed the highest type of a purely locomotive organ for progression over solid, even ground, and no mean weapon of defence.

The skin of the horse is thick, firmly adherent, especially along the back, and well provided with sweat-glands. The lips are very delicate tactile organs, and capable of much motion. They are set with long whiskers or bristles, the bases of which are lodged in the subcutaneous muscular tissue, and are furnished with sensory nerves. Respiration is performed through the nostrils. The stomach is simple; the cæcum very large, fully twice the size of the stomach. The alimentary canal is about eight times as long as the body. There is no gall-bladder. The principal peculiarities of the muscular system are, as might be expected, in the muscles of the limbs. The *serratus magnus* and the *levator anguli scapulæ* with the *sterno-scapularis* form a great sling, by which the weight of the body is transmitted to the anterior extremities. The power of abduction and adduction not being needed in a purely cursorial animal, the deltoid is much reduced. On the other hand, the pro- and re-tractors and the flexors and extensors are well developed. The pronators and supinators are wanting, the limb being fixed in a constant state of pronation. In the hind leg the femoral muscles are the same as in man, but enormously developed. The *tibialis anticus* and *posticus* and the *peroneus longus* and *brevis* are wanting. The *flexor hallucis* and the *flexor longus digitorum* are united into a single perforating tendon for the distal phalanx. In this tendon is developed the sesamoid bone, known as the "navicular." The epidermis covering the terminal phalanx is developed into the hoof, a horny cylindrical or somewhat conical case, separable by maceration into the wall, the sole, and the frog. The wall is that part of the hoof that is seen when it rests upon the ground, and its anterior portion is called the toe. The heels are formed by the inflexion of its posterior extremities, and these extremities, passing along the inner border of the sole, are called the bars. The sole is a thick horny plate occupying the inferior surface of the hoof, and the frog is a pyramidal mass of horn lodged between the two posterior re-entering angles of the wall. The hoof of the ass and mule is narrower than that of the horse, the wall higher and thicker, the sole more concave, and the horn harder.

The period of gestation in the horse is eleven months. It often lives thirty years or more, but is usually serviceable for less than half that time. Its perception is quick, its memory retentive, and it is capable of much affection. It is surpassed in docility by no animal except the dog, and perhaps the elephant. Its flesh is often used for food.

The original habitat of the horse is unknown. It is found wild in Central and Western Asia, and upon the plains of both North and South America. In the latter country, especially upon the pampas of Brazil and Buenos Ayres, it is abundant and lives in large herds. All these animals are, however, known to be descended from domestic horses brought from Europe by the Spaniards. The horse has been domesticated from a very early period, probably first in Central Asia or Northern Africa. Its remains are very rare in the Stone Age, but a few bones have been found in the Swiss lake-villages, enough to indicate its presence. In the Bronze Period, however, its bones become more numerous. Upon Egyptian monuments it is not represented earlier than the eighteenth dynasty, but the horse appears to have been abundant in Egypt after that time. It is first mentioned in the Bible after the children of Israel went into Egypt, no reference being made to the horse in the full account of the pastoral lives of the early patriarchs.

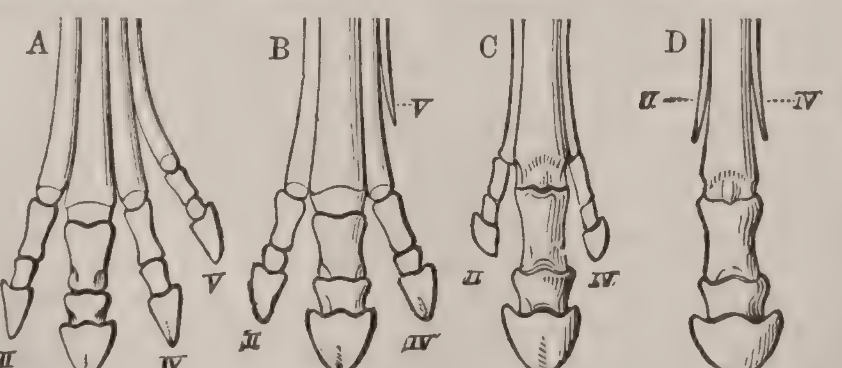
The most celebrated races of the horse are those of Arabia, Turkey, and Barbary, and from these, by a thorough and judicious system of breeding, has sprung the English race-horse, an animal that now so far surpasses the originals from which it has sprung that almost no benefit has been derived from imported blood for the last three-quarters of a century. A single mile in $1\frac{3}{4}$ minutes is considered fast running time for a race-horse. The height of a race-horse is about $15\frac{1}{2}$ hands, or 5 feet 2 inches. A horse under 13 hands high is called a pony, and some Welsh and Scotch breeds of ponies are very celebrated for their endurance. A Shetland pony $11\frac{1}{2}$ hands high has carried a rider 44 miles in 3 hours and 45 minutes. In America more attention has been paid to the rearing and training of trotting-horses, and the constant improvement is shown by the fact that nearly every year the fastest time previously recorded is surpassed. At present the best time for a single mile is 2 minutes 14 seconds, and was made by Goldsmith Maid in 1874 at Mystic Park, Boston.

The horses of the N. part of Africa, from Barbary (hence called Barbs), from Arabia, and from Turkey resemble each other, and are usually confounded under the name of Arabians. They are beautifully formed, have fine legs and feet and small bony heads, and are usually small, not over 15 hands high. The Flanders horse is a large, heavy, coarse-legged, slow horse, and the Tartar horse, which has been carried into Russia and Hungary, is a small, bony, rough horse, with a large head and great endurance. From various mixtures of these three types the modern horses are descended. The Barb blood spread into Spain and Italy, and there met that of the other two races. The favorite horses of the fifteenth and sixteenth centuries seem to have been various crosses of the Barb and the Flanders horses. It is difficult to say what the original English horse was, but he is spoken of in the highest terms by Markham in 1609, who puts the breeds in the following order of merit: English, Neapolitan, Corsican, Turk, Barb, Spanish, Polish, German, Hungarian, Flanders, etc. The English horse of that time was probably a cross between the Flanders and the Hungarian, and being early used for racing and hunting purposes, he was swift and enduring. At least as early as 1600 it was discovered that the cross of the Barbary horse upon English mares was the best for producing speed and bottom, and in the reign of James I. Markham's Arabian and Place's White Turk were imported. Charles II. imported what were known as the Royal mares from Tangiers. The Darley Arabian was brought in during the reign of Queen Anne, and from this date (about 1705) there were numerous importations, and by crossing them with the native horses the foundation of the great family of thoroughbreds was laid. These horses now undoubtedly surpass all others for size, strength, bottom, beauty, and swiftness combined. The proper definition of a thoroughbred at the present time is a horse whose progenitors for five generations back are to be found in the *Stud Book*, which is a record of horses bred for racing purposes since about 1700, the complete pedigrees commencing about 1759. The first importations of thoroughbred horses into America were about 1725–30, and the *Stud Book* of the American branch is kept up on this side of the water. This class of horses is bred and used primarily for racing purposes, but the cross improves horses for all purposes, as is clearly shown by the superior quality of the average horse of Virginia and New Jersey, into which States the taste for racing introduced the thoroughbred horse at an early period. Owing to three and four mile races and heat-races having been kept up in America while short races and single dashes have been in vogue in England for some years, the average American thoroughbred is probably a stouter and stronger horse than his English cousin. It can hardly be said that there are any distinct families of horses in America, although those of different localities present some peculiarities. The average horse of the New England States and of Canada is small, hardy, good-tempered, a good traveller, and very enduring. The Morgan horse of Vermont is one of the best types. Lancaster co., Pa., possesses a breed of horses, now somewhat scarce, called Conestogas—large, well-made, slow draught-horses. In Virginia, Kentucky, and the South generally the thoroughbred and his connections predominate, and in Texas, California, and Mexico we find the mustang—a small horse, evidently descended from the Spanish horses introduced by the early conquerors of that region.

Horse, Fossil. The existing species of the horse family are so closely related to each other as not to be distinguished generically by any characters derived from the skeleton, but a large number of extinct genera have left their remains in Quaternary and Tertiary strata of various parts of the world, and especially of North America. At the time of the discovery of this continent by Europeans, no species of horse or ass existed in either North or South America, but since the introduction of these animals the climate and conditions of life have proved so favorable that large herds of wild horses are now common on the pampas and prairies of both continents, the descendants of those that have escaped from domestication. This complete absence of indigenous species is the more remarkable in view of the fact that not less than twelve species of *Equus* have been described from Quaternary deposits, and more than thirty other related forms from the Tertiary of America. Some of these are readily distinguished from the living species by the greater complexity in the foldings of the enamel as they appear upon the worn surface of the molars. In the Pliocene Tertiary, the horse was represented by several extinct genera, the best known being *Hipparion* (or *Hippotherium*), in which the body was supported, as in *Equus*, on the extremity of the middle toe of each foot, which was also provided at the fetlock-joint with an additional pair of small toes, not reaching the ground, and resembling the dew-claws of cattle. In the upper molar teeth there is in *Hipparion*, on the anterior portion of the inner side, an isolated ellipse of enamel enclosing dentine,

and not joined with the main body of the tooth by an isthmus of dentine, as in *Equus*, at least until the teeth are nearly worn out. The species are small, as the name implies, *Hipparion* being a diminutive from the Greek *hippos*, a "horse." *Protohippus* and *Pliohippus* of the Pliocene are genera nearly related to *Hipparion* and *Equus*. *Anchippus*, also from the Pliocene, resembled in its teeth *Anchitherium* of the Miocene, a genus now considered as typical of a family distinct from that of the horse. In *Anchitherium* the shaft of the ulna is complete, moderately developed, and more or less separate from the radius. The fibula is ankylosed with the tibia. The orbit is not closed behind, and there is a deep ant-orbital fossa. The molars have short crowns devoid of cement, and are inserted by distinct fangs. There are three digits in each foot, the middle being much the largest, but all appear to have reached the ground. *Miohippus*, also from the Miocene, was closely related to *Anchitherium*. In this genus the radius and ulna are free or only loosely united. The tibia and fibula are co-ossified at the distal end. There were three digits in each foot, all of which reached the ground, and they are more nearly equal in size than in *Anchitherium*. Another closely related Miocene genus, *Mesohippus*, had, besides the three toes of the fore foot, a splint-bone representing the outer toe, or little finger of the human hand. The Miocene species were not larger than a sheep. The Eocene representatives of the group were still smaller, the largest hardly exceeding a fox in size. They belong to the genus *Orohippus*, which has four functional digits in the fore foot, and no ant-orbital fossa. The orbit is open behind. The dentition is very similar to that of *Anchitherium*, but the first upper premolar is larger, and the succeeding ones smaller than in that genus. The diastema, or "place for the bit," is distinct. The canines are large, and near the incisors. The crowns of the molars are short and destitute of cement. The skeleton is decidedly equine in its general features. The radius and ulna are distinct, the latter larger than in *Anchitherium*. The carpal bones are eight in number, and resemble those of the tapir, but the trapezium is proportionally much smaller. All the digits of the fore foot except the first are well developed. The third is the largest, and its resemblance to that of the horse is clearly marked. The terminal phalanx, or coffin-bone, has a shallow median groove in front, as in many species of this group from the Later Tertiary. The fourth digit exceeds the second in size, and the fifth or outer toe is much the smallest of all, and has its metacarpal bone considerably curved outward. There are but three digits in the hind foot. The tibia and fibula are distinct.

All the above genera except *Anchitherium* are found in the Tertiary and Quaternary of this continent, and *Anchitherium* is represented by the closely-allied genus *Mesohippus*. This large number of equine mammals and their regular distribution in geological time afford a good opportunity to ascertain the probable lineal descent of the modern horse. The American representative of the latter is *Equus fraternus*, a species almost, if not entirely, identical with *Equus caballus*, to which the recent horse belongs. Huxley has traced the later genealogy of the horse through European extinct forms, but the line in America was a more direct one and the record is more complete. Taking, then, as extremes of the series, *Orohippus agilis*, from the Eocene, and *Equus fraternus*, from the Quaternary, the natural line of descent, as indicated by over thirty intermediate forms, would seem to be through the following genera: *Orohippus* of the Eocene, *Miohippus* and *Mesohippus* of the Miocene, *Anchippus*, *Hipparion*, and *Pliohippus* of the Pliocene, and *Equus*, Quaternary and Recent. The most marked changes undergone by these successive genera are the following: 1st, increase in size, from *Orohippus*, as large as a fox, to the modern horse; 2d, increase in speed through concentration of the limb-bones; 3d, elongation of the head and neck and modification of the skull. The increase of



A, *Orohippus* (Eocene); B, *Mesohippus* (Miocene); C, *Hipparion* (Pliocene); D, *Equus* (Quaternary and Recent).

speed was a direct result of a gradual and striking modification of the limbs. These were slowly concentrated by the reduction of their lateral elements and enlargement of the axial one, until the force exerted by each limb came to act directly through its axis in the line of motion. This concentration is well shown in the fore limb. There was, 1st, a change in the scapula and humerus, especially in the latter, which facilitated motion in one plane only; 2d, an expansion of the radius and reduction of the ulna, until the former alone remained entire and effective; 3d, a shortening of all the carpal bones and enlargement of the median ones, ensuring a firm wrist; 4th, an increase in size of the third digit at the expense of those on each side, until the former alone supported the limb. The latter change is clearly seen in the above diagram, which represents the fore feet of four typical genera in the equine series, taken in succession from each of the geological periods in which this group of mammals is known to have lived. The ancient *Orohippus* had all four digits of the fore feet well developed. In *Mesohippus*, of the next period, the fifth toe is only represented by a rudiment, and the limb is supported by the second, third, and fourth, the middle one being the largest. *Hipparion* of the Later Tertiary still has three digits, but the third is much stouter, and the outer toes have ceased to be of use, as they do not touch the ground. In *Equus*, the last of the series, the lateral hoofs are gone, and the digits themselves are represented only by the rudimentary splint-bones. The middle or third digit supports the limb, and its size has increased accordingly. The corresponding changes in the posterior limb of these genera are very similar, but not so striking, as the oldest type (*Orohippus*) had but three toes behind. An earlier ancestor of the group, perhaps in the lowest Eocene, probably had four toes on this foot and five in front. Such a predecessor is as clearly indicated by the feet of *Orohippus*, as the latter is by its Miocene relative. A still older ancestor, possibly in the Cretaceous, doubtless had five toes on each foot, the typical number in mammals. This reduction in the number of toes may perhaps have been due to elevation of the region inhabited, which gradually led the animals to live on higher ground, instead of the soft lowlands where a many-toed foot would be most useful.

The gradual elongation of the head and neck may be said to have already begun in *Orohippus*, if we compare that form with other most nearly allied mammals. The diastema, or "place for the bit," was well developed in both jaws even then, but increased materially in succeeding genera. The number of the teeth remained the same until the Pliocene, when the front lower premolar was lost, and subsequently the corresponding upper tooth ceased to be functionally developed. The next upper premolar, which in *Orohippus* was the smallest of the six posterior teeth, rapidly increased in size, and finally became in the horse the largest of the series. The grinding teeth had at first very short crowns, without cement, and were inserted by distinct roots. In Pliocene species the molars became longer, and were more or less coated with cement. The modern horse has extremely long grinders, without true roots, and covered with a thick external layer of cement. The large canines of *Orohippus* become gradually reduced in the later genera, and the characteristic "mark" upon the incisors is found only in the later forms. The bridge of bone bounding the orbit behind first appears in the Pliocene genera. It is an interesting fact that the peculiarly equine features acquired by *Orohippus* are retained persistently throughout the entire series of succeeding forms. Such, *e. g.*, is the form of the anterior part of the lower jaw, and also the characteristic astragalus, with its narrow, oblique superior ridges, and its small articular facet for the cuboid.

Such is, in brief, a general outline of the more marked changes that seem to have produced in America the highly specialized modern *Equus* from its diminutive, four-toed predecessor, the Eocene *Orohippus*. The line of descent appears to have been direct, and the remains now known supply every important intermediate form. Considering the remarkable development of the group throughout the entire Tertiary period, and its existence even later, it seems very strange that none of the species should have survived, and that we are indebted for our present horse to the Old World. O. C. Marsh.

Horse′-Chestnut. See Sapendaceæ.

Horse Creek, tp. of Marengo co., Ala. Pop. 1337.

Horse Creek, tp. of Dade co., Mo. Pop. 597.

Horse Creek, post-tp. of Ashe co., N. C. Pop. 813.

Horse Distemper, a species of catarrh. As the disease is contagious, an animal having it should be kept apart from the others, and after a thorough purge should be fed on light bran mashes and kept warm until recovery.

Horse-Fly. The females of many dipterous insects of the family Tabanidæ are called horse-flies, from the great annoyance their bite causes the horse. Among the

most common are *Tabanus lineola*, the green-headed fly, which in hot weather has been known to worry horses and cattle to death. The bite is severe, and even venomous, always drawing blood. *Tabanus atratus* and *cinctus*, the orange-belted fly, are also common. Their larvæ are very destructive of snails and of other larvæ. The horse-fly of Great Britain is *Hippobosca equina*. (See FOREST-FLY.)

Horse Guards. (See GUARDS.) The term was used to denote the head-quarters of the British army, Whitehall, London, in consequence of the building being guarded by a squadron of horse guards, and of the striking appearance of the mounted sentinels on duty at the entrance. The head-quarters were changed in 1871 to the War Office, Pall Mall; papers emanating therefrom are still headed "Horse Guards," "War Office, Pall Mall," being added.

Horse'head, tp. of Johnson co., Ark. Pop. 995.

Horseheads, post-v. and tp. of Chemung co., N. Y., on the Northern Central and the Utica Ithaca and Elmira R. Rs., has 6 churches, 2 weekly newspapers, 2 grist-mills, a tannery, a sash and blind factory, a steam saw-mill, a woollen-mill, and the second largest brickyard in the U. S. Pop. of v. 1410; of tp. 2961.

T. J. TAYLOR, ED. "HORSEHEADS JOURNAL."

Horse Isl'and, an island in Lake Ontario, in Houndsfield tp., Jefferson co., N. Y., 1½ miles from Sackett's Harbor. It has a lighthouse. Area, 27 acres.

Horse-Mackerel, a name given in Great Britain to the SCAD (which see), but applied in the U. S. to *Thynnus secundo-dorsalis*, called also albicore and American tunny. It is often ten or twelve feet long, is very destructive to fish and fishermen's nets, and is caught chiefly for its abundant oil, although its flesh is pronounced excellent by good judges. It is best killed by the harpoon.

Horse'manship. It seems quite proper to suppose, taking into consideration the ancient myths relating to the Centaurs and to Pegasus, that the horse was used by man from the earliest periods for the purposes of war and the chase. This was unquestionably true in India and in Persia. The earliest regular treatise on horsemanship with which we are acquainted is by Xenophon, and from that it appears that the horsemen of his time were accustomed to feed, clean, and ride their horses much as we do. The saddle was not, however, known to them, and their bit seems to have been of the simplest possible form. The animal was ridden either barebacked or with a cloth or skin secured by a band. There were no stirrups, and the rider mounted by vaulting on, or by stepping from a projection upon the shaft of the lance. The saddle came into use in the fourth century, and the stirrup was no doubt invented soon after. From that time, and through the Middle Ages, the more civilized nations used most elaborate horse-trappings, and the art of riding was no doubt considerably advanced as the equipments were improved. As a recognized art, requiring long and difficult training, it seems to have had its origin at Naples, whence its professors spread over Europe. Spain took it up next to Italy, then France, and lastly England. The tournaments which were in fashion from the eleventh to the sixteenth century, and the Crusades, brought the art into special prominence; the carousals, which succeeded the tournaments, kept up the interest, and during the sixteenth and seventeenth centuries equitation held the first place in the education of a gentleman. The riding-school was the fashionable lounge or club of young men of rank, and some superb buildings were erected in various places dedicated to this use alone. The interior court of the Louvre was used as the place of instruction of King Louis XIII. by his riding-master, Pluvinel. The saddle in the time of the Crusades was made principally of wood, very deep, and so formed that the rider sat upon his fork perfectly straight up and down, as if standing. The armor of man and horse was heavy, and a stout horse was required to carry its weight. About 1500 the equipments were somewhat modified to suit the purposes of civil life, but the position of the rider remained nearly the same until the time of De la Guerinière, whose folio volume, with beautiful plates drawn by Ch. Parrocel, appeared in 1733, when the saddle assumed more nearly the modern form, and the seat of the rider was changed by bending the knee and sitting down more in the saddle, much in the manner of the present European military seat. The Eastern nations have from the earliest times used a deep saddle, but with a very short stirrup, rising in their stirrups to use the javelin or lance. In the early part of the eighteenth century the saddle by successive changes approached nearly to the present English saddle, and the English riders adopted the short stirrup which is now characteristic of their school of riding, most other nations retaining the military seat. The heavy curb bit of the Middle Ages was retained until quite a late period, and the equipments and mode of riding of the Mexican and South American of the present day are almost exactly those of the beginning of the eighteenth century. Among the continental European nations riding as a civil accomplishment has declined, but in England it still holds its place in the foremost rank among the amusements and accomplishments of a gentleman. FAIRMAN ROGERS.

Horse Pasture, post-tp. of Henry co., Va. P. 2302.

Horse-Power. See DYNAMIC UNITS, by PROF. W. P. TROWBRIDGE, A. M.

Horse-Racing. Though horse-racing has probably been coeval with the possession of the horse by man, it seems likely that the Persians were the first to elevate the sport to a great institution. Horses with them were identified with the sun or with the fiery chariot driven once a day over the heavens. From the Persians the Greeks perhaps derived the sacred races which were held at the Olympian, Pythian, Isthmian, and Nemean games. These races were all conducted with clumsily-built chariots, without springs, exceedingly difficult to drive, the course involving as much danger as skill. Great as was the difficulty of driving, it was much increased by the horses being all the time near the spectators, who crowded close to the twenty short turns of the ground, and maddened the animals by their cries, "while artifice was employed for the express purpose of frightening the horses when they approached the statue of the genius Taraxippus." The charm of Greek races, apart from the interest in the victor, consisted in the excitement of seeing the chariots strike and shatter each other, the horses trampling on and killing the fallen drivers, and the overturns, in which the whole population of refined Athens delighted. The Roman races were much like the Greek, but with this difference, that the Romans employed their slaves as charioteers, instead of driving themselves. In time, the Romans, however, introduced mounted races, and with the exception that the riders were often expected to perform circus tricks and acrobatic feats, they were in many respects strikingly like the modern. The horses were entered thirty days in advance, and were trained, the jockeys wearing four colors—green, red, white, and sea-color (*veneta*), to which Domitian added yellow and purple. There were prizes given, but as betting was not practised, it would appear that races among the Romans were a far more creditable institution than those known at the present day. The Romans did not use saddles (which, according to Beckmann, were invented in the fourth century), but they and the Persians had thick saddle-cloths. The jockeys were called *sensores*, the trainers *agitatores*. Caligula once gave 2000 sesterces to the jockey Eutychus.

An old French song describes a horse-race run in the sixth century, the winner receiving for a prize the hand of a Breton princess. From the twelfth to the fourteenth century there appears in feudal grants mention of sums awarded at annual and regularly established races, "but it is not until the reign of Louis XV. that the history of horse-racing in France, seriously considered, begins." There is good ground for believing that in England the ancient Britons, decidedly addicted to horsemanship, had races, and that the Mithraic courses established by the Romans were continued by the Saxons. It is certain that the latter had mounted races, since "running horses" were among the presents sent by Hugh Capet to Athelstan when suing for his sister Ethelsnitha. This king took great pains to improve the breed of the British horse by importations from the Continent, particularly from Spain, by which means a breed was produced, says Blaine, that flourished from the time of the Crusades until the days of the Tudors—a period which has been called "the era of the great horse." In the romance of *Bevis of Southampton* we are told that at Whitsuntide the knights

> "A cours let them make on a daye,
> Steeds and palfraye to assaye
> Which horse that best may run."

Fitzstephen informs us that in the time of Henry II. there was a great deal of racing on the ground where Smithfield Market now stands. In the time of Henry VIII. turfed courses were laid out and prizes allotted. The chief of these was a silver bell, whence perhaps comes the phrase "to bear away the bell."

Modern English horse-racing began strictly with James I., who was very fond of it. In his reign public and regular runnings were held in Yorkshire and Surrey. Attention was now paid to feeding and training horses and instructing jockeys. Eastern horses were imported during this reign, but none of them proved to be of any value. During the civil war and the Protectorate racing declined, but with the Restoration there was a grand revival of all field-sports, and especially of this. Charles II. was an enthusiastic admirer of the turf, even entering his horses in his own name. He established races at Datchet Mead, that he might more conveniently enjoy his favorite sport. He was also regular in his attendance at Newmarket, now

boasting every accommodation for the training of horses, with an excellent race-course, which, as the system progressed, was apportioned into distances corresponding with the several ages and supposed powers of the horses. By this arrangement, as well as by a judicious appropriation of the weights to be carried, according to similar circumstances, a scale of equality was kept up highly to the credit of the turf regulations. Indeed, much of the arrangement and most of the rules and regulations since in force were formed about this time and under the auspices of this prince. William III. encouraged the turf, and George, consort of Queen Anne, greatly aided it in every way. During his reign Curwen Baybad and the Darley Arabian were imported. Charles II. introduced the silver prize cup, value 100 guineas. "George I.," says "Nimrod," "was no racer, but he discontinued silver plates as prizes, and instituted the king's plates, being 100 guineas in cash." During the reign of George II. the Godolphin Arabian appeared, the founder of the best English "blooded" horses. George III. gave the turf some encouragement. His brother, the duke of Cumberland, was passionately addicted to racing. From his stud came the famous horses Herod and Marak, who sired the famous Eclipse, born in the fourth year of George IV. O'Kelley, the great turfman of these times, owned Eclipse, and was the breeder of Volunteer and Dungannon by Eclipse, who became the sire of 160 winning horses. The earl of Grosvenor is also held in honor as one of the great racing magnates of this reign. He raised the two famous mares Meteor and Violante, and lost his entire fortune in the end, though he won £200,000 by betting. "Honesty," says Blaine, "which ensures riches in most other pursuits, is almost certain to occasion loss in racing." The king, George IV., bred the famous horses Whiskey, Manfred, and Maria. This monarch, according to Blaine, was very shrewd in turf-matters, and "surrounded himself with men deeply versed in the 'mysteries' of racing. The turf abounded in rascals, and the prince found it necessary to meet the manœuvres of such men by proper caution." By the exercise of this proper caution, he at last, in the affair of the notorious Escape against Grey Diomed, "succeeded in getting the accusation of foul play affixed to his name." His brother, the duke of York, was, however, a heavy loser, being less suspicious. Cowper had long before said of England,

> "We justly boast
> At least superior jockeyship, and claim
> The honors of the turf as all our own."

Unfortunately, the dishonors of the turf must also be claimed, and it was during the reign of George IV. that the turf became as noted for villainy as for sport. In the language of "Nimrod," "A set of masked, unprincipled miscreants are now usurping the place of gentlemen of integrity. No honorable man can be successful for any length of time against such a horde of determined depredators as have lately been seen on our race-courses." Among the celebrated jockeys employed by George IV. were Samuel Chipney, who became rich; South, Goodson, Robinson, and Nelson. Earl Fitzwilliam, "a princely conductor of his stud," bred the eminent racers Orville and Mulatto. The earl of Derby raised Sir Peter Teazle, a descendant of the Godolphin Arabian, as of Blank, Snap, and Regulus. He produced more winners than any English horse known; 10,000 guineas were refused for him. The late duke of Dorset was a first-class jockey, and, like the duke of Grafton, was a great winner. It is remarkable that several racing authorities lay great stress on the fact that this nobleman was not a cheat, and always "ran to win." (For a fuller account of the great patrons of the turf from this time to the year 1833 the reader may consult the article "The Turf" in the *Quarterly Review*, No. 98.)

There are about 120 provincial race-meetings in England, Scotland, and Wales, and some of these are held twice in the year. Those of Newmarket, Epsom, Ascot, York, Doncaster, and Goodwood stand first in all respects. The annual Derby (Epsom) is the great London holiday, where 350,000 people often assemble. The Goodwood is called the "ladies' race," because it is specially visited by ladies, many of the highest rank, in splendid toilette. The better class of visitors sit and lunch in their carriages, while a stream of female gypsies, clamorous to tell fortunes or beg, itinerant musicians and peddlers, go from one to the other, and the background is filled in with booths for eating, exhibitions, cocoanut "shys," "Aunt Sallies," and similar rude games, usually managed by gypsy men. It is said that the telegraphic department of the English post-office takes several hundred thousand pounds annually from turfmen, and that this "chief national pastime," which receives, in fact, nothing from the state, or which against £4000 received pays out £8000 excise-duty, "demands for its support an expenditure equal to the revenue of such small kingdoms as Portugal or Denmark." This is perhaps the true reason why race-betting is not reformed out of existence, or rather why it exists as an anomaly and a national reproach. It is not long since a poor man was sent to prison for simply looking on at a game of pitch-penny in London, while the betting on the races fills columns not only in "sporting papers," but is recorded more or less in every daily journal. The usual pretext, that racing keeps up the quality, strain, and value of horses, is a weak apology; for, though it is true that that refined and highly artificial animal, the thoroughbred, executes the greatest feats of running, it is as useless to the world at large, save for *betting on*, as the giraffes or lions in the zoological gardens. Horses partly of this stock are found, however, to excel for almost every purpose. There is a great desire on the part of the English government to abolish betting, but as the entire system of racing depends on gambling, and as it involves such an immense amount of capital, and is, moreover, so near and dear to at least one-half the aristocracy, no violent reforms in it can at present take place. Much has, however, been done, and the Betting Act of the present year and other action show that there is a settled determination to do away with the greatest scandal which at present disgraces any Christian country, excepting, perhaps, bull-fighting in Spain. The most experienced writers on the turf admit that if the best horse the world ever saw were to be run at present, "he would have no more chance to win than if he had but the use of three of his legs," if he were heavily backed to lose. It is impossible to make the poor understand that they are justly punished for trivial gambling, when the journals with which they are most familiar represent the "plunging," or desperate betting-feats, of this and that lord as his crowning glory.

Steeple-chasing—so called either from the *steep-hill* riding which it involves, or from a steeple in the distance having been originally the goal—consists of headlong riding over a ground abounding in ditches, hedges, gullies, and all kinds of impediments. It is of Irish origin, and no longer enjoys its former popularity in England. *Hurdle*-racing was originally invented by George IV. on Brighton Downs. Hurdles are like segments of light fences or *wattles* of coarse basketwork. In a course of one or two miles three or more hurdles may be placed to be leaped over.

Great efforts have been made in France to render racing national, but it has always existed as a distinct imitation of an English institution. During all the reign of Louis XV. it was, as Larousse admits, the *Français Anglomanes* (or French who affected the English) who were fond of horses. Extravagant betting became fashionable, and races were abolished by the Revolution. Napoleon re-established them, and in 1833 a jockey-club was founded by Count Max Caccia, De Cambis, Count Demidoff, M. Lafitte, and others. There are now in France sixty race-grounds, the principal of which are at the Bois de Boulogne and Chantilly. As the French only admit native-bred horses to their races, it seems hardly fair that they should send runners of English extraction to compete at English races, and then rejoice, as they do, over an occasional victory. When it is considered that these horses are generally trained and perfected in France by English grooms and jockeys, the ground for exulting over such triumphs as "French" is seriously diminished. Admiral Rous, the head of the turf in England, has recently endeavored, but in vain, to induce the French to abolish this restriction.

Much depends in racing on the skill of the jockey—so much, in fact, that a very good rider is sometimes almost able to win with any horse entered.

Great efforts have been made in America to perfect the race-horse or thoroughbred of Anglo-Arab origin, but the number is as yet far inferior to that of English horses, though, as the annals of our turf indicate, there are many such among us perfectly qualified to compete at any English course. When it is considered, however, that the best English writers on the subject are of the opinion that the race-horse is among animals what a dandy is among men, it may be something more than problematical whether Americans should not remain contented with trotting, in which they are unrivalled, save perhaps by the Russians, and which has the advantage of developing practically useful animals.

The trotting-horses of America have long been remarkable. At first the breed appeared to be merely the result of accident, but breeders now recognize the fact that the best have a strong dash of thoroughbred blood. A large number of the most successful among them are traced back to Messenger (imported about 1785–90). Trotting-time has gradually been reduced from a mile in 3 minutes, which used to be considered very good, to a mile in 2m. 14s., which time was made in 1874 by Goldsmith Maid. Up to the end of that year, 516 horses are recorded as having trotted in public in 2m. 30s. or less, the ten fastest having done it in less than 2m. 19s. Some of the lighter Norman

or Percheron horses of France have shown trotting action, and there is a family of horses in Russia, called "Orloff trotters," that has produced some only second to those of the U. S. Owing to the great difference between the speed of trotting-horses, it is necessary to divide them into classes, such as "those which have not done better than 2.20, 2.25, or 2.30," as the case may be; and very strict rules are made by the National Association regarding changes of name or any action which may cloud the identity of horses which trot for public money. Racing proper, as distinguished from trotting, has always been a favorite sport in the Southern States, and has lately been revived at the North with great success, as the summer meetings at Jerome Park, N. Y., Long Branch, and Saratoga show. Only thoroughbreds are fit for racing, and a part-bred horse would have no chance whatever to win. There is no classification, as in trotting, as all good race-horses can run within a few seconds of the best speed. There is a classification, however, as to age, the youngest horses carrying the least weight in cases where horses of different ages are engaged in the same races. Regular tables of weights are established; as, for instance, 3-year olds, 90 pounds; 4-year olds, 108 pounds; 5-year, 114 pounds; 6-year, 118 pounds; mares being weighted about 3 pounds less than horses. The best racing time made in the U. S. is that made by Grey Planet in 1874—one mile in 1m. 42½s. Until within a few years 1m. 44s. was the best, but that has now been beaten by several horses. The best four-mile time for many years was that of Lexington in 1855 in 7m. 19¾s.; it was beaten in 1874 by Fellowcraft in 7m. 19½s. There is no official time taken at English races, and therefore no means of comparing their time with ours. No confidence is placed by horsemen in the story that Flying Childers ran a mile in a minute. English courses are usually straight or nearly so, and over the turf. The regular American course is one mile, made up of two semicircles, each a quarter of a mile long, joined by two straight quarters, and is kept in order by harrowing and scraping, as turf becomes too hard in the dry summer for horses to run over. C. G. LELAND.

Horse'-Radish (*Nasturtium Armoracia*), a perennial herb of the order Cruciferæ, whose large white roots furnish a well-known pungent condiment for the table. The roots yield a volatile oil which contains sulphur. The plant is European, and half naturalized in the U. S. Horse-radish leaves and roots are used in medicine as local stimulants. They have also antiscorbutic properties. The young leaves are boiled as potherbs, and are very delicate and pleasant.

Horse-radish Tree, the *Moringa pterygosperma*, a tree of the order Leguminosæ, so-called from the acrid quality of its leaves. Its trunk yields a gum like that of the acacias, and the leaf has medicinal qualities; but its seeds, with those of *M. aptera*, are important as furnishing the commercial oil of ben. These trees grow in the East and West Indies, Arabia, Africa, and Southern Europe. The expressed oil is of admirable keeping qualities, and is used for oiling watches and as a basis for perfumes. The oil is mostly prepared in Europe.

Hor'sens, town of Denmark, in the province of Jütland, on the Horsens Fjord. It is an old town, but neatly built, thriving, and carrying on a lively trade. Pop. 10,501.

Horseshoe Crab. See KING CRAB.

Horseshoeing. See FARRIERY, by M. C. WELD, PH. B.

Horse'tail, Shave-grass, or **Scouring Rush** (genus *Equisetum*). There are eleven varieties of this plant, the two principal of which are denominated the great and little horsetail, and belong to the cryptogamous or flowerless series. They have stems and branches, but neither leaves nor flowers. The stems are rush-like, hollow, and jointed, arising from running root-stocks, and terminated by the fructification in the form of a cone or spike, composed of shield-shaped stalked scales, with spore-cases underneath. The great horsetail (*E. Telmateia*) has stems as thick as a man's finger, the sheaths enlarging upward; is very rare, and only found on the shores of the upper great lakes and north-westward. It is from the fact that it contains so large a quantity of silex, and is consequently much used for polishing, that it derives its name of "scouring rush." The little, common, or field horsetail, as it is variously called, is indigenous to Illinois and New Jersey, but is found on almost every continent, and in every country from Africa to the Arctic zone, and is chiefly distinguished by its alleged poisonous influence on cattle which partake of it, though no tangible proof of its toxic effects has, as yet, been brought to light. One thing is certain—that the plant, when dried, is perfectly innocuous, from the fact that it has frequently been largely mixed, in that condition, with the hay and other food given to horses and other animals. The other varieties are *E. pratense*, found in Michigan, Wisconsin, and other northern districts; *E. sylvaticum*, growing in wet, shady places in northern localities; *E. palustre*, prolific in Wisconsin, Niagara River, and other moist localities; *E. limosum*, rather common in marshes and shallow water; *E. lævigatum*, indigenous to dry, clayish soils, and found in Illinois and southward; *E. hyemale*, used for scouring purposes generally, growing on wet banks, and common in northward districts; *E. variegatum*, very rare, and found on shores and river-banks, such as in New Hampshire and Niagara, to Wisconsin northward; *E. scirpoides*, a variety peculiar to wooded hillsides from New England to Pennsylvania, Michigan, and northward. Finally, the appropriately-named *E. robustum*, from three to six feet in height, and growing along the river-banks from Ohio to Illinois and southward, is one of the most respectable members of the horsetail family.

Hors'ford (EBEN NORTON), M. D., a chemist, b. at Geneseo, N. Y., in 1818; became principal of the Albany Female Academy; studied chemistry in Germany under Baron Liebig; was Rumford professor in Harvard University 1847–63, and one of the founders of the Lawrence Scientific School. He is the author of many scientific papers, and has given much attention to improved methods of making bread.—His wife, MARY (GARDINER), (1824–55), was the author of a volume of poems (1855) and of contributions to periodical literature.

Hors'ham, parliamentary borough of England, in Sussex, on the Adar. It has a fine old church and several good educational institutions. Pop. 7831.

Horsham, tp. of Montgomery co., Pa. Pop. 1382.

Hors'ley (CHARLES EDWARD), son of William, b. at Brompton, near London, Dec. 16, 1824. His general education was conducted at the Kensington grammar school, and for a time his parents tried to check his evident love for music, but a favorable opinion of Mendelssohn, who visited London in 1832, decided the question, and after some years of preliminary study under his father, Dr. Crotch, and other eminent English musicians, young Horsley was placed with the celebrated Moritz Hauptmann, then residing with Spohr at Cassel. Here for three years (1838–41) he had the advantage of thorough theoretical instruction from Hauptmann and the intimacy and advice of Spohr. Before returning home, Horsley passed several months with Mendelssohn in Leipsic, where the great pleasure and usefulness of this part of his education resulted in a lifelong friendship. Horsley returned to London in 1842, where he remained until 1861, when, owing to ill-health, he went to Australia, residing for some years in Melbourne, Victoria, where it may truly be said he created the true taste for music which now exists. In 1871 he returned to England, and in 1872 proceeded to New York, where as organist of St. John's chapel, Trinity parish, he is pursuing an active course of professional success. His principal works are three oratorios, *David* (1849), *Joseph* (1852), *Gideon* (1860); cantatas, *Comus* (1854), *Euterpe* (1870), *Bridal Cantata* (1870), besides a large number of symphonies, songs, glees, etc. As a composer, Horsley ranks on an equality with the best men of the present day in originality and learning.

Horsley (JOHN CALLCOTT), R. A., eldest son of William, an excellent painter of the modern English school, b. in London Jan. 29, 1816. His great and early love for drawing was observed and fostered by the celebrated painter (Horsley's great-uncle), Sir A. W. Callcott, R. A., and at the age of fourteen the young student entered the drawing academy of Mr. Sorsse, one of the best trainers of juvenile artists, and subsequently was elected a student of the Royal Academy of Arts. Here he gained all the best prizes for drawing, etc., and on the competition for cartoons for the new Houses of Parliament he received a premium of £300 and two commissions for large frescoes in the same building. Since that time his career has had an uninterrupted success. His works, too numerous to mention, command universal attention and very large prices. Mr. Horsley became a Royal Academician in 1865. One of his latest and most admired paintings is a large altar-piece for the chapel of St. Thomas's Hospital in London, a commission ordered by the will of Sir W. Tite, the celebrated English architect. Mr. Horsley resides in London, where he is greatly respected and honored.

Horsley (SAMUEL), b. in 1733 at St. Martin's-in-the-Fields, London, studied at the University of Cambridge; was appointed rector of Newington in 1759, bishop of St. David's in 1788, of Rochester in 1793, and of St. Asaph in 1802; and d. at Brighton Oct. 4, 1806. He gave new editions of Apollonius Pergæus (1770) and Newton (1779–85); translated Hosea; published *Critical Disquisitions on the Eighteenth Chapter of Isaiah*; and wrote essays on mathematics and the prosody of the Greek and Latin lan-

guages. But his controversy with Dr. Priestley concerning the divinity of Christ, which lasted for several years, attracted most attention. His theological works were collected in 6 vols. in 1845, and published in London.

Horsley (William), b. at Whitehaven, in Cumberland, England, Nov. 15, 1774. Shortly after his birth the parents removed to London, and at a very early age the boy developed great talents for musical composition. His father's means were inadequate to afford his son a complete artistic education, but the youth possessed sufficient self-reliance to present himself to the distinguished composer, Dr. J. W. Callcott, who, perceiving his talents, took the lad under his protection, made him his assistant at the orphan asylum, and finally gave him his daughter in marriage, Jan. 12, 1813. Mr. Horsley proved himself worthy of such confidence, and almost surpassed his father-in-law in the excellence of his works and the correctness, learning, and effect of his compositions. For learning, his six *Books of Canons* are unrivalled by any similar specimens since Sebastian Bach; as a glee-writer, "By Celia's Arbor," "See the Chariot at Hand," "Blow, Wind, thou Balmy Air," and many others testify in undying beauty to the greatness of this master of the English school of music. Mr. Horsley took the degree of Mus. Bac. Oxon. early in the present century; was organist of the female orphan asylum for fifty years, also of the Charter-house and Belgrave chapels. His house at Kensington was the favorite resort of Mendelssohn, Spohr, Thalberg, and all the great musicians of his day. His eldest daughter married I. K. Brunel, the distinguished engineer. His long life was one of great purity, industry, and benevolence. D. June, 1859.

Hor'ta, the largest town of Fayal, one of the Azore Islands, itself sometimes incorrectly called *Fayal.* It has a good trade. Pop. 8549.

Hor'ten, town of Norway, on the Gulf of Christiania, the station of the Norwegian fleet, has an arsenal and good shipbuilding yards. Pop. about 5000.

Hortense' (Eugénie de Beauharnais), b. in Paris 1783; d. 1837; was daughter of the French general Alexandre de Beauharnais and of Joséphine Tascher de la Pagerie, who became the wife of Napoleon I. In 1802 she married Louis Bonaparte, afterwards king of Holland, and brother of Napoleon I. She gave him three sons, the youngest being afterwards Napoleon III., b. in 1808. After the fall of the First Empire, Queen Hortense resided usually in her château of Arenenberg, Switzerland. She wrote light poetry and is the author of one song—"Partant pour la Syrie," which under the Third Empire was a kind of national air for the Bonapartists. She is buried by the side of the empress Josephine at Rueil, a suburb of Paris, near the château of Malmaison. Félix Aucaigne.

Horten'sius (Quintus), son of L. Hortensius, a prætor of upright character. The son was b. 114 B. C.; made a speech in the forum when nineteen years old which gained the applause of the ablest men of the republic, and at once gave him rank with the ablest advocates of his time; served (91–90 B. C.) in the Social war, in which he became a military tribune; defended the youthful Pompey (86 B. C.), who was accused of the embezzlement of public booty; attached himself to the side of Sulla and the aristocrats, and was the ablest advocate at Rome until Cicero arose to distinction; was quæstor B. C. 81; ædile in 75; prætor urbanus 72; unsuccessfully defended Verres against Cicero 70; was consul 69 B. C.; and after this was a prominent opponent of Pompey and a zealous defender of Milo in the quarrel with Clodius. Cicero was never a very hearty friend of Hortensius, whom he seems to have suspected unjustly of evil designs. The moral character of Hortensius was not altogether admirable. He was unscrupulous as to the means by which his successes were attained, and his private life was exceedingly luxurious, if not immoral; but his nature was kindly and generous, and he had many friends and few enemies.

Hor'ticulture [Lat. *hortus*, a "garden," and *cultura*, "attendance," "care"], the management of the garden, the cultivation of a smaller area of land than a farm or field. Horticulture may be divided into Floriculture (which see), or the cultivation of flowers for profit, use, or ornament, and kitchen and market gardening; or the production of vegetables too perishable to form part of the staple crops of agriculture, and hence either raised in small quantities for the supply of a single family, or else grown as the product of a special branch of farming near large towns, where there is a ready market and where manures are to be had in abundance. Landscape-Gardening and Fruit-Culture (which see), and the care of botanic gardens, form no part of general horticulture (except in the case of small fruits and dwarfed trees). Market-gardening is separated from agriculture by no definite line. What is called *truck-farming* in the U. S. is market-gardening upon a large scale, and is a department of agriculture. For market-gardening the first essentials are abundant fertilizers (intelligently applied) and an unfailing supply of well-directed labor. The work of market-gardening is not heavy, but it is wearisome and incessant. Almost any soil can be made to grow vegetables, but a very light soil will usually afford but small profits, if any; and a very heavy soil requires thorough and expensive underdraining, and even then is harder to work and does not afford so early crops as some others. A good exposure to the sun and protection from heavy winds by hills, forests, or screens of trees are very desirable. It is ordinarily best for the market-gardener to raise a succession of products, the spinach, asparagus, and rhubarb of early spring and the growths of early summer, etc. following each other in such a way that there is something to sell throughout the season. Frequently, two crops may be raised from the same ground in a single year. Many early crops are greatly forwarded by the proper use of hot-beds and cold-frames. In the application of fertilizers regard should be had to the chemical constitution of the plant to be raised; and the same consideration ought to govern the rotation of crops. Success in market-gardening depends largely upon tact and skill in buying and selling, and upon buying and selling at the right time. Two days may make a difference of 50 per cent. in the prices of early products; hence the need of promptness and energy. The bulk of a crop is often sold at a small margin above cost; hence the need of economy and prudence. Two other most important things are the use of the best seeds of the best varieties, and fair dealing with marketmen and jobbers, for of two market-gardeners one may sell his goods at a fair price even when the market is dull, while the other cannot sell his at any price, because the latter does not supply products of uniform quality; his berries do not "grow bigger downward through the box." This principle holds good in every department of trade, but in no business is it so important as in the one we are considering. (See Henderson, *Gardening for Profit* and *Practical Horticulture;* Quinn, *Money in the Garden.*)

Horticulture has thriven from the earliest ages and in every country that has had any claim to be called civilized. In Japan, China, India, Persia, Rome, Egypt, Palestine, Assyria, Chaldæa, from the earliest times, great attention was paid to gardens. At the very first man was put "into the garden of Eden to dress it and to keep it." Most elaborate and interesting representations of gardens exist on the monuments of Egypt and Assyria. The Old Testament Scriptures abound in references to gardens, and in the literature of the East gardens are still a favorite theme. The *Gulistan* ("Rose-Garden") and the *Bostan* ("Fruit-Garden") of Saadi are names which illustrate the Oriental fondness for gardens. The hanging gardens of Babylon and the floating gardens of Cashmere and Mexico may be noticed. Hallowed associations surround the forever memorable garden of Gethsemane. The gardens of Alcinous and those of the Hesperides are a part of the traditions of the heroic age. The Greeks, says Plutarch, sometimes planted violets and roses among the onions and leeks. Of the Roman gardens we have full accounts. Floriculture, kitchen-gardening, landscape-gardening, and topiary work were carried by them to a high perfection. They had hot-houses and conservatories also. In Charlemagne's time, when gardening was one of the lost arts, the imperial edict commanded every man who could do so to have a garden, and the very plants to be grown were named. Among others, house-leek was to be set upon every roof; and it is believed that the geographical range of several herbs was greatly widened by the decree. The Saracens brought the love of horticulture into Spain, France, and Sicily; and in later times every monastery had its well-kept garth. Italy and the Low Countries especially excelled in gardening. The Dutch delighted in straight lines, clean culture, and topiary work. The Italian taste was more natural. In still later times the Scotch have excelled as gardeners, and at present they take the first place in this department of industry.

Charles W. Greene.

Hor'ton, tp. of Elk co., Pa. Pop. 631.

Horto'nia, tp. of Outagamie co., Wis. Pop. 1080.

Ho'rus [Gr. Ὧρος; Egyptian, *Har*, the "day"], the name of several Egyptian gods, of which the principal was the son of Osiris and Isis. He was the sun-god, and is often confounded with Harpocrates, who was called the Younger Horus; also with Harodris, the hawk-headed god, called the Elder Horus. He is also confounded with the god Ra and with the Greek Apollo, whence Edfou was called Apollinopolis Magna, since it was a great seat of the worship of Horus.

Horvath' (Mihaly), b. Oct. 30, 1809, at Szentes, Hungary; studied theology at the Seminary of Waizen 1825;

took orders in 1830; and was in 1844 appointed professor in Vienna of the Hungarian language and literature. During the Hungarian revolution in 1848 he was made bishop of Csanàd and minister of public education and worship. After the revolution he lived alternately in France, Italy, and Switzerland until 1866, when he was permitted to return to Hungary. His principal work is a general *History of Hungary* (4 vols., 1842–46), but he has also treated of several periods of Hungarian history separately.

Hos'ack (David), M. D., LL.D., F. R. S., b. in New York Aug. 31, 1769; graduated at New Jersey College in 1789, and in 1791 received his medical degree at Philadelphia; studied in Europe until 1794; became in 1795 professor of botany in Columbia College; was (1797–1807) professor of materia medica; professor of materia medica and midwifery in the College of Physicians and Surgeons 1807–11; after which he held other professorships there until 1826. After this he was until 1830 connected with Rutgers Medical College. He was one of the first mineralogists and botanists of his time, founded the first botanic garden in America, and was the author of several medical treatises which long had a standard value. He also wrote a *Life* of Dr. Hugh Williamson (1820) and one of DeWitt Clinton (1829). D. Dec. 23, 1835.

Hosan'na, a Hebrew term of blessing, congratulation, or well-wishing, adopted into use by the Christian Church. The name is also given to one of the subdivisions of musical masses, "Holy, holy, holy, Lord God of Sabaoth; heaven and earth are full of thy glory. *Hosanna* in the highest."

Hose'a [Heb. *Hoshea*, "deliverance"], the **Ose'e** ['Ωσηέ, 'Ωσεή] of the LXX., Vulgate, and New Testament, the first in order of arrangement, but apparently third in order of time, of the twelve minor prophets. His prophetic activity covers a period of about 60 years—say from 784 to 724 B. C. He belonged to the northern kingdom of Israel, and set himself against the idolatrous apostasy which had seemed almost essential in order to political independence. In style he is the obscurest of all the Hebrew prophets. In the Roman martyrology he is commemorated with Haggai on the 4th of July. R. D. Hitchcock.

Hoshe'a (another form of *Hosea*), the last king of Israel, was a son of Elah; conspired against his predecessor, Pekah, and put him to death 737 B. C.; became established on the throne after eight years of war. His reign was much disturbed by civil commotions and by the invasions of the Assyrians. He very probably perished at the destruction of Samaria (720 B. C.). His name occurs on Assyrian monuments.

Ho'siery [from *hose*, "stockings"], in a large sense, includes knit goods of all kinds. Stockings were originally made of cloth and woven goods. The ancient Greeks employed stockings of felt. The Romans, we are told, used no stockings until after Hadrian's time. The Anglo-Saxons used them, and so did the people of mediæval Europe. Trunk-hose were a combination of stockings and breeches. The art of knitting is reputed to be a Scottish invention of the sixteenth century, and St. Fiacre, a Scoto-Irish saint, was made patron of a French stocking-weavers' guild in 1527. It is almost certain, however, that the art of knitting is older than this. Hosiery is now largely manufactured in the U. S. by machinery. Some of the most important improvements in knitting-machines are of American origin.

Ho'sius [Gr. Ὅσιος, "holy"], b. about 257 A. D., perhaps in Spain or perhaps in Egypt; became bishop of Cordova about 296; took part in the Council of Iliberi (about 300 A. D.); was persecuted under Diocletian and Maximian; was highly honored for integrity and faithfulness; was sent by Constantine the Great to Alexandria to conciliate the contending parties of Alexander the bishop and of Arius; was present at the Council of Nice (325 A. D.), and was, according to some writers, its president; induced Constantine to ratify the Nicene Creed 325; was at the Council of Sardica 347, and perhaps its president; was directed by Constantius in 355 to write against Athanasius, but refused; was compelled by the emperor to attend the Council of Sirmium, and after wearisome persecution the aged Hosius felt compelled to submit in part to the imperial will, and to take the communion with Arians, but he would not condemn Athanasius. In 357 he was permitted to return to Cordova, where he d. in 358 A. D.

Hos'kins, or **Hoskyns** (John), b. in Herefordshire; was educated at Oxford; became a fellow of New College, sergeant-at-law, and a justice itinerant in Wales; was the instructor of Ben Jonson. Author of the *Art of Memory*, of a Greek lexicon, unfinished, of legal writings, and of Latin and English epigrams. D. 1638.—Another John Hoskins, an Oxonian, an author, and a prebendary of Hereford, was a contemporary of the foregoing, and is stated to have been his brother.

Hos'mer (Harriet), b. at Watertown, Mass., Oct. 3, 1831. Her mother d. when she was young, and her father, anxious for the health of his only child, insisted upon outdoor exercise and athletic sports. She became expert in rowing, riding, and skating; had the spirit of adventure; travelled alone in the West as far as the Falls of St. Anthony; visited the Dakota Indians, and on her return was distinguished by originality of mind and independence of manner. She took anatomical lessons in St. Louis, and both worked in clay and chiselled marble at home. In 1852 she went to Rome with her father and Miss Charlotte Cushman; was received into Gibson's studio; studied hard under him, and soon won her way to public favor. Her statue of *Puck*, sent to Boston in 1856, made her reputation in her own country; it was copied three times. Her *Beatrice Cenci* and *Zenobia*, both full-length statues, the latter of colossal size, were more ambitious works, but of less originality. She exhibited at the Paris Exposition in 1867 a statue called *The Sleeping Faun*. The legislature of Missouri honored Miss Hosmer with a commission to make a statue of Thomas H. Benton. With the exception of a brief visit to her native country, the artist has remained in Rome since her first visit. O. B. Frothingham.

Hosmer (William Henry Cuyler), A. M., b. at Avon, N. Y., May 25, 1814; was educated at Genesee College; became a lawyer of Avon and a master in chancery; removed in 1854 to New York, and became a custom-house officer. Author of *The Fall of Tecumseh* (1830), *Yonondiyo* (1844), *The Months, Bird-Notes, Legends of the Senecas, Indian Traditions and Songs* (1850), etc. His *Complete Poetical Works* (2 vols.) were published in 1853.

Hos'pice [Fr. for "hospital"], the name given to the houses maintained by ecclesiastics for the relief of travellers passing over the Alps in stormy weather. That of the Great St. Bernard, founded in 962 and inhabited by Augustinian monks, is the most celebrated. Others are kept up at the principal passes of the Alps. The name is also applied to other charitable institutions, such as the former asylum upon the Abendberg, Switzerland, for the treatment of cretins, and various establishments for those suffering with mental disease.

Hospin'ian (Rudolph), b. at Altdorf Nov. 7, 1547; studied at Marburg and Heidelberg; held different positions in the Reformed Church of his native country, and d. at Zurich Mar. 11, 1626. The most prominent of his works are—*De Monachis* (1588), *De Festis Christianorum* (1593), *De Festis Judæorum et Ethnicorum* (1592), *Concordia Discors* (1609), which occasioned much controversy with the German Lutherans; and *Historia Sacramentaria* (1598–1602). A collected edition of his works was published in 7 vols. fol. at Geneva in 1681.

Hos'pital [from the Latin *hospitalis*, "pertaining to guests or strangers;" Fr. *hôpital;* Ger. *Krankenhaus, Lazareth;* It. *ospedale*]. Hospitals for the sick poor appear to have been established in India, through the influence of Booddhist priests, about 220 B. C. They are, however, more especially characteristic of Christianity, and were recognized institutions in the fourth century. (For account of the first hospitals, properly so called, consult H. Häser, *Dissertatio de cura ægrotorum publica a Christianis Oriunda*, Gryphiswald, 1856.)

Hospitals, as now existing, are institutions intended primarily for the care of the sick and wounded; secondarily, to furnish means of instruction to students of medicine, to serve as monuments or memorials of their founders, or as a means of support or excuse for the existence of a society, charitable organization, or medical school. The general principles of hospital location, arrangement, and construction, with reference to the requirements of the sick and to facility of administration, may be considered as fairly established; but while, theoretically, these requirements outweigh all others, it will usually be found in practice that for any proposed hospital there will be something in the site, limit of cost, or purpose of the builder which will require a modification of what may be termed the standard plan; and that in many cases the so-called secondary objects will be really, though not perhaps avowedly, of primary importance. Hospitals may be designed to receive patients of both sexes and all ages, or may be more or less specialized, as for women, for the insane, for contagious diseases, etc.

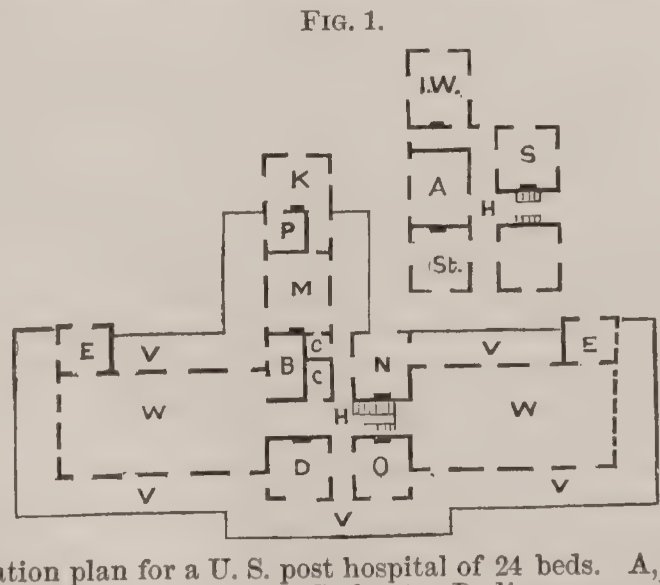
In some respects the simplest form of hospital is that intended for adult males only, as in the military and naval service; and it is now believed that in these, in which the secondary objects above referred to need not be considered, the buildings should be temporary in character—that is, not intended to last more than ten or twelve years.

Such hospitals are found, by experience, to be more favorable to the recovery of the sick and wounded, because of the less prevalence of erysipelas, hospital gangrene, and other septicæmic diseases, than the much more ornamental, pretentious, and costly structures which are usually desired by societies, municipalities, or private donors. In a financial point of view, the temporary hospitals are the most economical, for, as has been elsewhere shown,* if the money required to construct a stone or elaborately ornamented brick hospital were divided into two equal parts, one-half being used to put up frame buildings of the same capacity, and the other half being invested at 6 per cent., the income from the latter sum would suffice to furnish a new hospital every twelve years for succeeding generations.

The true principles of hospital construction, as first established by a commission of the French Academy of Sciences in 1778, and subsequently elaborated as to details by Nightingale, Galton, Oppert, and others, may be briefly stated as follows: The important part of the hospital is the ward, which should be separated from the administrative part of the institution, and should be arranged in pavilions, preferably of one story, and never more than two, in height. These pavilion wards should be about 25 feet wide, 14 feet high, and of sufficient length to allow not less than 100 square feet per bed. In warm climates the height should be 15 feet and the floor-space per bed 120 square feet. Not more than 32 beds should be placed in each ward. The windows should be opposite each other, and reach from within three feet of the floor to one foot from the ceiling; they should occupy one-third of the wall-space, have a nearly E. and W. exposure, and in cold climates should be double sashed or of plate-glass. The floors and other woodwork should be of hard pine or oak, with impervious joints, waxed, oiled, or permeated with paraffine, and polished. It is usually stated that the walls should be made as smooth and non-absorptive as possible by the use of parian cement, paraffine, silicates, oil-paint, etc. It has been even proposed to make them of glass. The advantage of this is doubtful. An ordinary plastered wall absorbs gases and organic compounds to a very considerable extent, and they are then oxidized and reduced to more stable compounds, much as sewage is affected in a running stream, and the depurative and quasi-respiratory powers of such walls should not be overlooked. Making them impermeable is somewhat like varnishing an animal's skin, and there is no satisfactory evidence as to its good effects. For a permanent hospital it might be best to construct the walls with the ordinary hard finish—to have, as suggested by Dr. George Derby, one ward always empty and open to the outer air—each ward being thus emptied and freshened in succession—and to have the old plaster torn out and the walls fresh plastered once in five or six years.

The great object is to have the ward supplied with plenty of light and fresh air, and to keep it at a proper temperature. The minimum amount of fresh air to be furnished is 3000 cubic feet of air per hour per man, and under some circumstances it may be desirable to double this amount. The modes of effecting this will be discussed in the article Ventilation. The ventilation of each ward, water-closet, bath-room, and kitchen should be entirely independent of all other rooms, halls, or parts of the building. The kitchen and laundry should be either in a separate building, or in the upper story of the administrative building; they should never be put beneath the wards or offices. The various offices required for the administrative department are necessarily much alike, whether the institution be large or

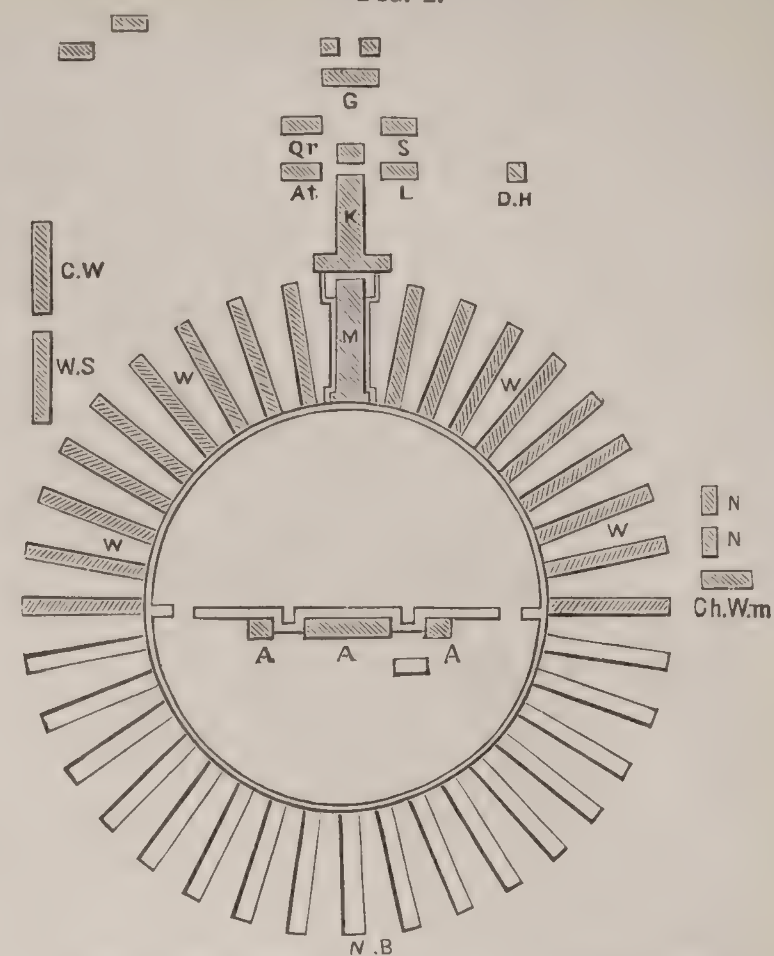
Fig. 1.



Regulation plan for a U. S. post hospital of 24 beds. A, attendants' room; B, bath-room; C, closets; D, dispensary; E, earth or water closets; H, hall; K, kitchen; M, mess-room; N, nurse; P, pantry; S, stores; St, steward; V, verandah; W, ward; I W, isolation ward.

* Circular No. 4, War Department, Surgeon-General's Office, Washington, 1870; *Report on Barracks and Hospitals*, pp. xxii., xxiii.

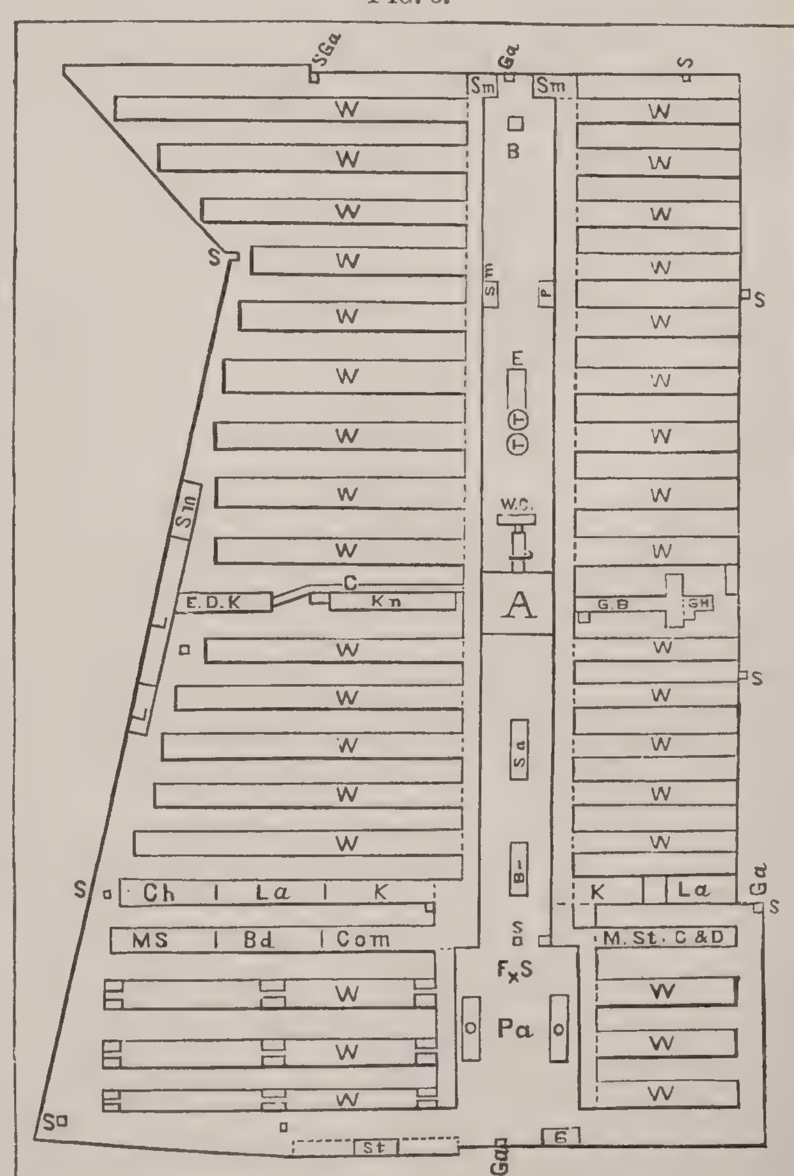
Fig. 2.



Plan of the Hicks Hospital, near Baltimore, Md.

A, administration buildings; M, mess or dining-room; K, kitchen and laundry; At, attendants' quarters; L, linen and clothing; Qr, quartermaster's quarters; S, stores; G, guard-house and quarters; W, wards; Ch W M, chief wardmaster's quarters; N, nurses' quarters; D H, dead-house; W S, workshop; C W, ward for contagious diseases. N. B. The light portion (N B) not built.

Fig. 3.



Ground-plan of U. S. Army General Hospital, West Philadelphia, Pa., 1862.

A, administration building; O, officers' quarters; W, wards; K, kitchens; E D K, extra-diet kitchen; La, laundry; Ms, mess-room; M St, medical store-room; Com, commissary store-room; C, corridor; Bd, band; Sm, smoking-room; B, boiler and boiler-room; E, engineer's gong, fire-pump, etc.; W C, water-closets; *l*, laboratory; L, lecture-room and library; S, sentry; Ga, gate; G, guard; G B, guard-barracks; G H, guard-house; P, printing-office; C and D, clerks' and druggists' mess-room; T, tanks; St, stables and sheds; F S, flag staff; Pa, parade.

Note.—Capacity beds: min. 2662; max. 3124. This includes guard-barracks, 132.

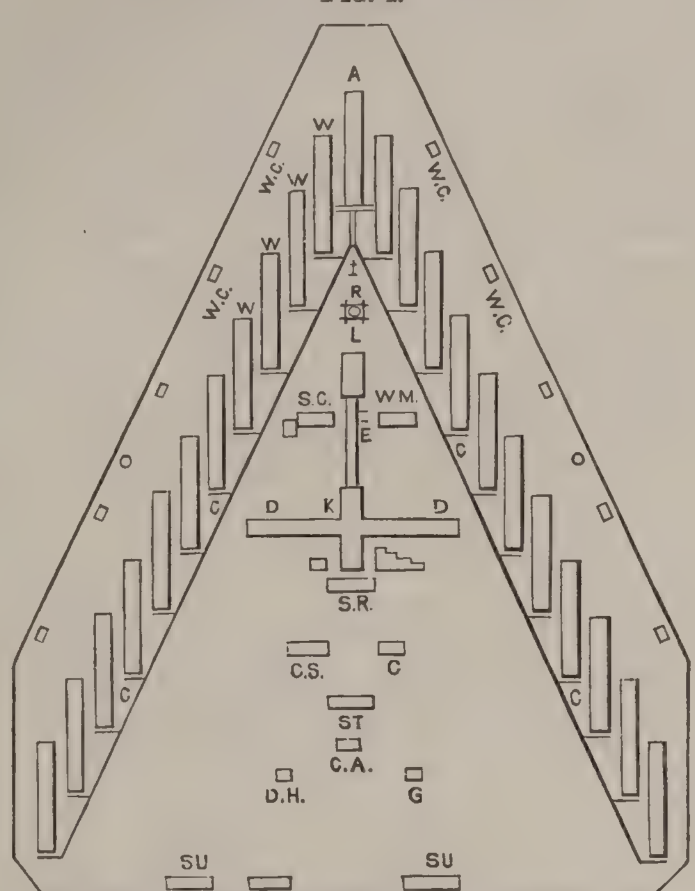
The wards are each 24 feet wide, 13 feet high at the wall, and 19 feet at the peak. The ward-masters' and Sisters' rooms in front, and the bath-rooms and water-closets in the rear, take 20 feet from each ward. The wards are ventilated at the ridge. The central or administration building, the store-houses, extra-

diet kitchen, and smoking building, are each two stories high. The second story of the first named furnishes quarters for the officers; that of the store-rooms and extra-diet kitchen for the Sisters of Charity, clerks, druggists, and hospital attendants.

small; hence for small hospitals, such as those for military posts in the U. S. army, which usually contain from 12 to 24 beds, the ward becomes a comparatively small part of the building. (Fig. 1.)

When a large number of patients are to be provided for, the pavilions may be arranged to radiate from a common centre, or from H-shaped corridors, or *en echelon* in a triangle. These plans are illustrated by Figs. 2, 3, 4:

FIG. 4.



Plan of Lincoln Hospital, Washington, D. C.
A, administration building; W, wards; L, laundry; D, dining-room; K, principal kitchen; W M, chief wardmaster's quarters; S C, Sisters of Charity's quarters; E, steam-engine; S R, store-room; W C, water-closets; C, chapel; St, stable; G, guard-house; D H, dead-house; Su, surgeons' quarters; C, corridor (covered); R, reservoir; C S, cow-stable; C A, colored attendants.

The three large hospitals above figured were all American army hospitals in use during the late war. Many other ways of arranging the pavilions can be easily devised to suit locality, direction of prevailing winds, etc.

Besides the care of the sick, it is necessary in many hospitals to provide for the supervision and restraint of the vicious. A considerable portion of the applicants for hospital relief in our large cities are suffering from the effects of lust and drink, and if opportunity be allowed will perpetuate or aggravate their maladies by repeating the original cause. The proper restraint of patients without giving the building a gloomy and prison-like aspect is best secured by placing the hospital in such a location that access to means of dissipation shall be as difficult as possible. On this account a small island is a very desirable locality, and especially so in seaport towns and for marine hospitals. Floating temporary hospitals also have many advantages at such points. Whatever be the plan of the hospital, the most important thing is that it shall be under the constant hygienic supervision and management of a competent man who should be a physician. A hospital under non-professional superintendence, or which is to rely on the occasional advice of its attending physicians, who have other interests, will almost surely deteriorate, and the temporary barrack-plan is specially useful in such cases, as making the evil results less permanent and costly.

(For details on this subject consult OPPERT, *Hospitals, Infirmaries, and Dispensaries* (London, 1867), in which is given, pp. xiii.–xvi., a good bibliography; HUSSON, *Étude sur les Hôpitaux* (Paris, 1862); NIGHTINGALE, *Notes on Hospitals* (London, 1868, 3d ed.); ESSE, *Die Krankenhäuser* (2d ed., Berlin, 1868); DEMOGET (A.), *Étude sur la construction des ambulances temporaires, sous forme de Baraquements suive d'un essai sur les hôpitaux civils permanents* (Paris, 1871); *Report of the Royal Commission* (SUTHERLAND and GALTON) *appointed for Improving the Condition of Hospitals and Barracks* (London, 1863); GALTON, *Report Descriptive of the Herbert Hospital* (London, 1865); GALTON, *An Address on the General Principles which should be Observed in the Construction of Hospitals* (London, 1869); SMITH (STEPHEN), *Principles of Hospital Construction* (New York, 1866); *Report on Barracks and Hospitals*, Circular 4, Surgeon-General's Office (Washington, 1870).

JOHN S. BILLINGS, M. D.

Hos'pitallers, a name given to the members of various fraternities and sisterhoods of the Roman Catholic Church, who join to the vows of perpetual poverty, chastity, and obedience, another which binds them to serve the poor and sick in hospitals. Some knightly orders also took the monastic and hospital vows—such as the Knights of St. John of Jerusalem, Knights of the Holy Sepulchre, and the Teutonic Knights; but in the case of the first-mentioned order, at least, it appears that the *hospitals* they founded were rather in the nature of *hostels* or public inns. There have been twelve or more monastic congregations whose members were popularly called Hospitallers, but the term more generally denotes the Knights of St. John of Jerusalem. (See ST. JOHN OF JERUSALEM, KNIGHTS OF.)

Hos'podar [Slavic], a former title of the governors of Wallachia and Moldavia under the Turks. The term signifies "master." The same officers were also called waiwodes or wojewods—*i. e.* dukes or leaders. The czar of Russia is popularly called *hossoodar* or *gospodar*, forms of "hospodar;" and equivalent titles were employed by Polish kings and Lithuanian princes in former days.

Host [Lat. *hostia*, "victim," "sacrifice"], in the Roman Catholic Church, the consecrated Eucharistic bread, believed by that Church to be the veritable body of the Lord Jesus Christ. As such, it is elevated by the priest at the mass for the adoration of the people. It is a circular wafer or cake of unleavened bread, having various emblematic figures, made of the finest wheaten flour. It is borne upon a plate called the paten, broken by the priest over the chalice, and distributed to the laity.

Hos'tages are persons placed under the control of the government of a state as pledges of the faithful fulfilment of a treaty. The same custom has taken place when a captured vessel is allowed to go on its way upon what is called a ransom contract, and also in other stipulations between parties at war. The practice is going out of use in the first-mentioned case, the last instance known to the writer of this article having been the detention of two British noblemen on parole at Paris after the peace of Aix-la-Chapelle in 1748, who were, in fact, to remain in this condition until Cape Breton should be restored to France.

T. D. WOOLSEY.

Ho'strup (JENS CHRISTIAN), b. in 1819; studied theology at the University of Copenhagen, and took orders in 1854. While yet a young man he became the favorite of the Danish people on account of his comedies—*Gjenboerne, Et Eventyr paa Fodreisen, Mester og Lærling*, etc.—which give a fresh, original, and exquisitely humorous picture of the Danish middle classes. After taking orders he ceased to write for the theatre. "Life has become too grave an affair to me; I have forgotten to laugh."

Hot-air En'gine, a prime mover in which the motive-power is derived from the expansion of atmospheric air by heat. Numerous inventions of this kind have been produced, of which the earliest to excite interest was that of the Rev. Dr. Stirling, now of Galston, Ayrshire, in Scotland, patented in 1816; though earlier air engines were constructed by Sir George Cayley and others which seem to have been very simple and were unsuccessful. An improvement on Stirling's engine was suggested, later, by his brother, Mr. James Stirling; and this was patented in 1827, and again, with further improvements, in 1840. Among more recent inventions of this class which have been more or less successful, may be mentioned those of Ericsson, Wilcox, Roper and Shaw, all of this country, and those of Lauberau and Belou of France. At the Vienna Exposition of 1873 there was exhibited, by Friedrich Siemens, of Berlin, under the name of a *calorimotor*, a working model of a hot-air engine on quite a novel plan; more remarkable however for its ingenuity than for promise of utility. It would be impossible within the limits of an article like the present, to give a detailed description of these various forms of mechanism. Those who desire such particulars, are referred to the *Report on the Machinery and Processes of the Industrial Arts*, etc. in the Paris Exposition of 1867, by the present writer. In what follows, it is proposed to give only their characteristic differences, and to set forth certain general principles relating to this mode of generating motive power.

All forms of the hot-air engine have certain advantages in common, and all are subject to certain disadvantages which are inseparable from the system. It is an advantage that they require no boiler, and are exempt from the dangers which arise from that source. Could air be employed at a pressure equal to that of steam, it would be an important advantage to be free from the great weight which the use of the boiler necessitates, and unembarrassed by its bulk. As yet, however, this condition has not been realized, and hence the dimensions of the working parts of air-engines are necessarily so much more considerable than

those of steam-engines of corresponding power, as to render the gain in this direction, if there is any, unimportant. It is, however, an advantage that air-engines are cheaper of construction than those driven by steam, and that their management is easier, and requires less constant watchfulness. It has generally been claimed for them that they economize fuel. Theory might seem to justify this claim, but in practice it has not been generally sustained. The disadvantages of air-engines consist in the difficulty of heating and cooling the air employed, with the rapidity necessary to secure the best performance; and in the fact that the supply of the cylinder consumes more than half the power developed. To this it may be added, that, while the efficiency of the machine depends upon the difference between the maximum and minimum temperatures, there are certain practical limits which neither of these temperatures can transcend.

Air-engines may be arranged in two classes, of which the first embraces those which draw their supplies directly from the atmosphere, and discharge them into the atmosphere again after they have produced their effect; and the second, those which employ continually the same air, which is alternately heated and cooled but is not allowed to escape. Stirling's first engine belonged to the first of these classes; his later forms, to the second. To the first also belong Ericsson's, Wilcox's, Roper's, Shaw's and Belou's; to the second, Lauberau's. The second class have the advantage that they admit the use of high pressures; but this is attended with the disadvantage that they require refrigerating appliances, which, with the first, are wholly unnecessary.

In each of these classes a subordinate classification may be made, according as the air is heated in the cylinder in which it performs its work, or in a separate chamber. The plan of the Ericsson engine is the first of these. That of Roper's, Shaw's and Belou's, the second. In Lauberau's, which does not discharge the air, the heat is applied in one cylinder, and the work is done in another. In this class of engines the arrangements admit of a variety of modifications. The heater and the refrigerator, for example, may be both independent of the working cylinder, and of each other; presenting an analogy to the boiler and condenser of the steam-engine; or the refrigerator only may be separate; or finally, as in the engine of Lauberau, the heating and refrigeration may take place at the opposite extremities of the same vessel, the air being driven from one end to the other alternately by means of a plunger.

It is true of these, as of all engines operated by heat, that there is a theoretic limit to the economy of which they are capable—that is to say, whatever be the amount of heat received from the source, a fraction only of this can under any circumstances be converted into mechanical force; and theory enables us to state definitely the maximum value which this fraction can have. This maximum depends on the extreme temperatures at the command of the engineer. Suppose the highest of these temperatures, as referred to the absolute zero (a point 273° C. below the freezing-point of water) to be represented by T, and the lowest, referred to the same zero, by T′; then if Q be the entire quantity of heat imparted to the air, steam, or vapor operating any thermo-dynamic engine; and U, the portion of that quantity capable of being converted into useful effect, it is true in all cases that

$$\frac{U}{Q}=\frac{T-T'}{T}.$$

This principle we take at present for granted. For the demonstration of its truth see *Thermodynamics.* It follows that, in proportion as the interval between T and T′ is increased, the machine will work with correspondingly greater economy. This interval can be increased by increasing T, or by diminishing T′, or by doing both at once. It is impracticable, however, to employ a refrigerator having a temperature below that of the weather. We must therefore take for a mean lower limit about 17° C., or 62.5° F., a temperature which, referred to the absolute zero, is equal to 290° C. On the other hand, a practical upper limit is imposed by the consideration that a red heat is reached for solids at about 650° C., which is 923° C. above the absolute zero. This limit could not be safely approached; but supposing it to be actually attained, the economical coefficient would be

$$\frac{923-290}{923}=0.684,$$

or a little more than two-thirds of the heat taken up by the air. Probably no hot-air engine has yet been actually employed in which the temperature has been carried much above 300° C. With a maximum temperature of 307° C. = 580° C. above the absolute zero, the economical coefficient would be

$$\frac{580-290}{580}=0.50,$$

which would show a utilization of one-half the heat taken up. The first Ericsson engine was designed to work at a maximum temperature of about 450° F. = 232° C = 505° above the absolute zero. The limit of economy realizable by it, had it been successful, and provided the air could have been made to pass through the complete cycle of changes of temperature and pressure embraced in the theory, would have been

$$\frac{505-290}{505}=0.426.$$

But in point of fact, no hot-air engine fulfils, or can fulfil completely, the theoretic conditions. In order to do so it would be necessary that the air should leave the working cylinder at the minimum temperature; that is to say, at a temperature as low as that of the supply; or else that, by some contrivance, the excess of heat which it retains should be transferred to the supply on its way to the working cylinder. As the first of these conditions—that is to say, the expansion of the air, in working, sufficiently to reduce the temperature to the minimum—is practically unrealizable, it is the second which inventors have in many instances sought to secure. In order to accomplish this, the emergent air has, in some cases, been made to pass through successive sheets of wire gauze, or between thin sheets of metal, or has been in some other manner brought into contact with metallic surfaces of large extent in proportion to the weight of the mass, in order that the excess of heat being transferred to these might be afterwards taken up by the cold air of the supply as it enters. The first of the expedients here mentioned was employed by Ericsson, and the second in the successive inventions of Stirling. In Shaw's engine, the hot air escapes through a cluster of thin tubes, while the cold air circulates between them. The term "regenerator" was applied by Ericsson to this contrivance, as applied to his original engine, and this term has come into general use. The regenerator is applicable to any form of engine, but it is not employed in all. The theoretic advantage is considerable, but in practice is not fully realized; and it is attended with the disadvantage of sensibly increasing the amount of the passive resistances of the machine. In fact, in order that the regenerator, suppose it for instance to be a succession of wire gauze sheets, should entirely absorb the excess of heat of the escaping air, the number of sheets should be very considerable. It is easily seen that if this number were quite unlimited, there would be somewhere a point at which the air would have no longer any heat to impart; its temperature being sensibly reduced to that of the metal. From this point backward to the cylinder from which it was discharged, the successive sheets of wire gauze would rise in temperature, and the last one would have sensibly the same temperature as that with which the air emerged. The number of sheets which would be required effectually to absorb the heat would depend for a given excess of temperature upon the closeness of the meshes, and in any case must be considerable. The obstruction which every such contrivance necessarily presents to the free passage of the air, creates a resistance which makes its presence objectionable, and which may go far to neutralize the advantage which it is designed to secure. By diminishing the number of the sheets and the closeness of the meshes, the resistance is reduced, but the absorption of the heat is proportionally less complete. Practically, where the regenerator continues to be used, a middle course is taken; the economy is not wholly realized, and the obstruction to circulation is not very serious. This is the case in the engine of Shaw, in which the regenerator consists, as above remarked, of a series of tubes. It is to be considered, however, that the loss of heat suffered in operating engines driven by heated air or steam is by no means limited to the fraction, large as it is, of the heat which, after being actually imparted to the medium, is unavailable for work. If this were true, the cost of working such engines would fall to a very small proportion of what it actually is. It is unfortunately the case that by far the largest source of loss is to be found in the escape of a great part of the heat which the combustible develops, in other ways than in raising the temperature of the elastic medium which does the work. And the improvement of all these engines, so far as economy is concerned, is to be sought in such forms of furnace and such modes of applying heat as may reduce what is now the sheer waste of the chimneys or of the radiating surfaces, rather than in the endeavor to push to extremes the temperatures employed in the working cylinder. It is to be observed that the difficulty of guarding against losses by conduction and radiation is enormously increased when excessive temperatures are employed; and also that such temperatures decompose lubricants, destroy packing, and, by the large expansion which they give to metals, loosen joints, and impair the strength of the whole structure. Since the largest room for economy is evidently in

the direction of preventing the useless waste at present occurring, the effort should be to keep the maximum temperature as low, and not to push it as high, as possible.

In passing to particular forms of hot-air engine, a few words only can be given to each.

Ericsson's Engine.—This engine is more generally known in this country than any other of its class. In its present form it differs essentially from that which it had when constructed on a large scale, about the year 1855, to be employed as the motive-power of a sea-going vessel; or, more properly, the present one is a different machine. In the original model a working cylinder was placed immediately over the fire of the furnace, and a cylinder of supply of about two-thirds the capacity was placed immediately over that. The engine was single-acting, the working cylinders were quite open, and the working pistons were of great bulk and formed of non-conducting substances, being designed to fill the cylinders when at the point of the lowest depression, so as to prevent their cooling by contact with the air of the atmosphere. The bottom of each cylinder was arched, forming a dome for a furnace, and the piston received at its lower surface a corresponding figure. The pistons of the supply cylinder and working cylinder were firmly connected, and had therefore an equal length of stroke. At the descent of the piston, the supply cylinder was filled by aspiration from the atmosphere; and in the ascent, the charge, after undergoing compression, was driven into a reservoir, from which it passed subsequently into the working cylinder. The upward stroke being completed, the heated air escaped through a regenerator formed of wire gauze, depositing there its excess of heat; and the new charge from the reservoir, passing to the working cylinder through the same regenerator, re-absorbed this heat, and thus entered the heating-chamber already at an elevated temperature. This engine performed very well in practice, so far as its performance was merely a question of mechanics. But it failed practically, because the heating arrangements were inadequate to the demand made upon them. Mr. Ericsson did not expect to be dependent on his furnaces for the supply of more than a moderate fraction of the heat which each successive charge of air was to receive. He supposed that the regenerators would serve to transfer so large a quantity from each charge to the next, that it would be necessary to provide for little more than the always inevitable loss by mere radiation; but this anticipation was not realized. Superadded to this, however, there was a further cause of failure, arising from the difficulty of heating air at all by means of a furnace. Radiant heat produces scarcely any impression upon air. The inventors of all the air engines which have been to any degree successful have recognized the necessity of applying their heat as much as possible by conduction and actual contact. Mr. Ericsson himself is no exception, as his more recent and successful invention shows. This machine possesses a special interest, from the fact that it was the first of its class to secure for itself a recognized place in the industrial world as a valuable aid to productive power.

The engine at present known as the Ericsson is far less simple to appearance than the one above described. It has a horizontal cylinder within which at one end, and occupying about two-fifths of its length, is the furnace, also cylindrical, between which and the surrounding cylinder is an annular space. Within the cylinder there are two pistons, the inner, or that nearest the furnace, acting as a supply piston, and the other as the driving piston. The rods of the supply piston pass through the driving piston. When, by the action of the mechanism, the distance between the two pistons is increased, the supply is received by inspiration through valves opening inward in the driving piston. When this distance is diminished, the charge is driven by compression through valves in the supply piston opening towards the furnace. But these valves open on the outside of a sheet-iron cylindrical bell, carried by the supply piston, which enters into the annular space above mentioned between the furnace wall and the external cylinder, and therefore the air in passing them is obliged to pass down outside this bell to the extremity of the annular space, and to return inside the bell, in a thin annular sheet in close contact with the furnace wall. The working power is derived from the heat thus imparted. This power is effective through not quite half the revolution. Through the remainder it is zero, or the resistances predominate. Hence, a heavy fly-wheel is necessary.

As to the economy of this engine, tests were made by Mr. Tresca, sub-director of the *Conservatoire des Arts et Métiers*, of Paris, in 1861, upon a specimen engine of two-horse-power, in which the consumption of coal amounted to $4\frac{13}{100}$ kilogrammes (about 9 pounds) per horse power per hour—two or three times that of a good steam-engine. The mean maximum temperature of the heated air did not exceed 270°, and the expansion of volume was hardly 50 per cent. ($1\frac{48}{100}$).

Shaw's Engine.—Of this the principal parts are a furnace, cylindrical in form, of boiler iron, lined with refractory brick; two single-acting cylinders working alternately; and a regenerator, which consists of a chamber filled with tubes similar to those of a tubular boiler, through which the exhaust air escapes. The air is heated in the furnace immediately in contact with the fuel, of which it at the same time supports the combustion. This furnace is accordingly closed air-tight, fuel being supplied when necessary by means of a box or receiver on the top, between which and the interior of the furnace, communication can be opened; the box itself being, in the mean time, tightly closed. From the furnace, the air, along with the gaseous products of combustion, is admitted beneath the pistons of the working cylinders alternately; and after it has performed its function, it is discharged through the tubes of the regenerator into the chimney. The upper portions of the working cylinders are employed to furnish the supply of cold air from the atmosphere. For this purpose each piston is provided with a trunk considerably smaller in diameter than the cylinder; and the annular space between the trunk and the cylinder, being closed in at the top, forms an air pump. As the piston descends, the air of the atmosphere enters this annular space through valves opening inward; and on its ascent this air is forced into the regenerator, where it becomes partially heated by contact with the tubes through which the dilated air is escaping, and thence passes into the furnace. The brick lining of the furnace is double, with a space between the walls; and this space the entering air from the regenerator is obliged to traverse before it reaches the fire. Its temperature, which is already somewhat raised by compression and by contact with the tubes of the regenerator, becomes still more elevated in its passage through this space; and the additional heat which is wanted to bring up the pressure to the point required, is supplied by the fuel. In this engine, the difficulty which impeded the success of most earlier inventions of the kind, viz., that of adequately heating the air, is ingeniously overcome. The heat developed by combustion is necessarily taken up by the air which supports the combustion, and by the gaseous products at the same time generated. Hence it has been found practicable to maintain a pressure under the pistons averaging about an atmosphere. But it must be observed that such a pressure can only be secured by carrying the temperature to a point destructive of lubricants and packing, and liable to cause leaks by unequal expansion.

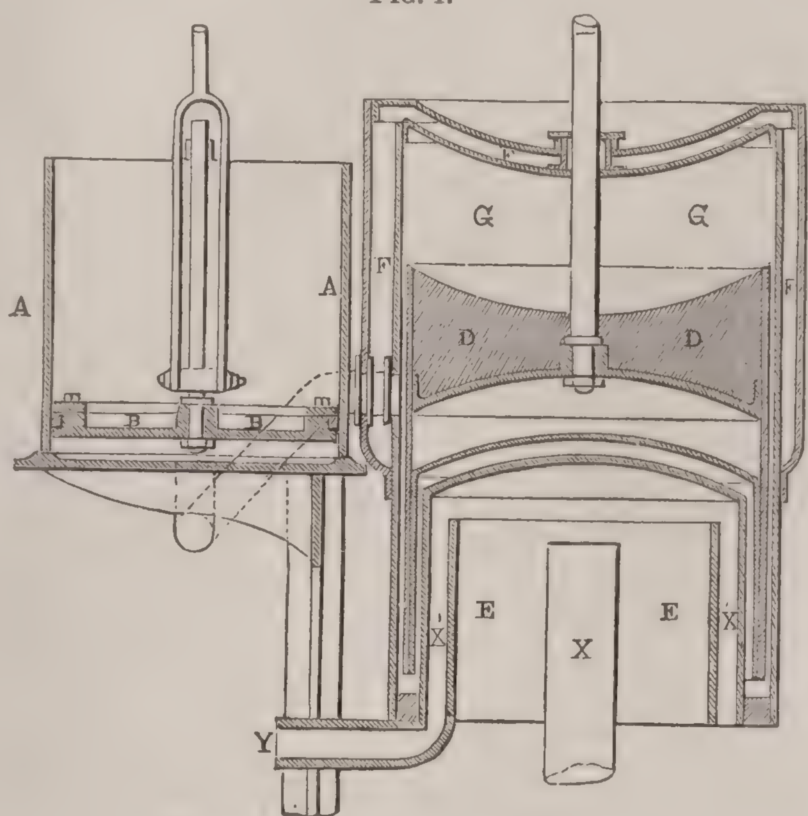
Roper's Engine.—This is very compact and well adapted to small industrial operations. The furnace is a cast-iron cylinder lined with fire-brick. Immediately over the furnace, and formed in the same casting, is the working cylinder, smaller in diameter than the furnace, and open above. The piston rod is kept vertical by means of a guide; and two connecting rods, one on each side of the proper piston-rod, operate balance levers united at their opposite ends by a cross-bar, to the middle of which is attached the connecting rod which turns the crank of the main shaft. The balance levers are pivoted in supports secured to the working cylinder itself, and they carry, also, a pair of rods which operate the piston of the supply cylinder. The supply cylinder is immediately under the working shaft, and is as conveniently near the furnace as practicable, standing upon the same base with it. The furnace is air-tight, and the air supply is forced into it beneath the grate, passing through the fuel, and so upward into the working cylinder. Provision is made to divide the air current so as to allow a part, at pleasure, to enter the furnace above the fuel, for the purpose of regulating the rapidity of combustion, and the temperature of the charge. No provision is made for introducing the fuel while the engine is in operation. Occasional interruptions will therefore occur in order to replenish the fire. In starting the machine it is necessary to turn the fly-wheel for a few revolutions by hand. And it is also necessary that the fire shall be well lighted before the door of the ash-pit is closed.

Wilcox's Engine.—A hot-air engine under this name was exhibited at the International Exposition of London in 1862. The distinctive peculiarity of this consists in the employment of two working cylinders through which the air successively passes. The furnace is in the lower portion of one of these cylinders, and the supply pump is in the upper chamber of the same cylinder. The engine is further provided with a regenerator of thin metal plates. The air, after being compressed in the supply pump, passes through the regenerator, taking up the heat left there by the last charge of escaping air, and thence into the second working cylinder. In this it produces a partial effect, due to the heat already absorbed, and then enters the first or principal working cylinder, where it receives the heat of the

furnace. The advantage of admitting the supply air to the cylinder which contains the furnace is very considerable, as it tends to prevent that cylinder from being overheated, while it utilizes the heat which would otherwise be injurious.

Lauberau's Engine.—In this a certain volume of air is enclosed in a cylinder of metal, in which there is also a large moving plunger, which, by occupying alternately one end and the other of the cylinder, displaces the air and drives it in the opposite direction. The upper portion of the cylinder is surrounded by a jacket, between which and the cylinder itself there is a constant circulation of cold water. As the plunger itself is but slightly less in diameter than the interior of the cylinder, the air during the transfer is reduced to a thin cylindrical stratum, and is brought into close contact with the cold walls. The effect of the engine depends as much upon the efficiency of this cooling process as upon the subsequent heating, and therefore it is desirable that the water of refrigeration should be as cold as possible. But as this water must necessarily be drawn from natural sources, it is obvious that the engine will be more efficient in winter than in summer. The lower por-

Fig. 1.



Lauberau's engine, small model.

tion of the cylinder is occupied by a furnace resembling the furnace of the Ericsson engine; viz. a cylinder smaller than the air cylinder, with an annular space between the walls of the two. The plunger also, like that of the Ericsson engine, is provided with a bell-shaped continuation, which enters the annular space around the furnace.

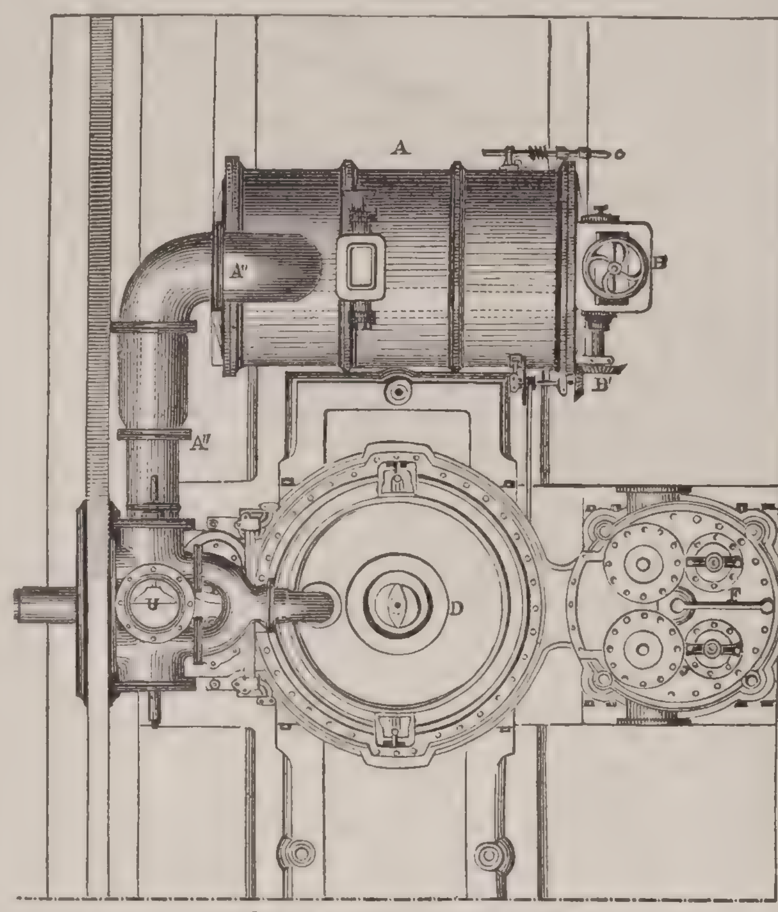
Fig. 1, above, shows a section of one of these engines of small model, in which E is the furnace-room; but here the heat is applied by means of a powerful gas-lamp, X. The flame, reverberating, passes down the narrow annular space X′ X′, and the products of combustion are conducted off at Y. D is the plunger with its attached bell. For lightness it is partially hollow. F is the space filled by the refrigerating water. A A on the left is the working cylinder, and B the working piston. A communicating tube shown in dotted lines admits the heated air to the space in A A beneath the piston when the plunger rises, and allows it to return to G G when the plunger descends. The plunger of course receives its motion from the working piston. As the engine is but single-acting, a fly-wheel is necessary. Provision must be made by a force-pump to maintain the flow of the refrigerating water. If the confined air employed is under more than the atmospheric pressure, there must also be some contrivance to make good the gradual waste by leakage through the packings. If no superior pressure is employed, a small shifting valve on the cold side will suffice for this purpose.

The main advantage, however, of using a confined body of air in these engines, rather than to draw the successive charges directly from the atmosphere, is that we may thus obtain a higher pressure, and consequently a greater power within the same bulk. But this advantage brings with it the attendant necessity of employing refrigerators, which with the other class of engines are wholly unnecessary.

In the larger forms of Lauberau engines, the cylinders are horizontal. A test made by Mr. Tresca of the performance of one of these, having a horse-power of about four-fifths, showed a consumption of $4\frac{55}{100}$th kilogrammes (about 10 pounds) of coal per horse-power per hour; while the refrigeration required 700 kilolitres (180 gallons) of water per hour also. It cannot, therefore, be called an economical source of power; but for many uses in which but a small power is required, it may be practically such.

Belou's Engine.—The only hot-air engine which has as yet been employed on a large scale as the motive power of an important industry, is that patented by Belou, in France, in 1860. This was introduced, ten or twelve years ago, into a large paper manufactory at Cusset; and as the experiments made with it there seem to have been economically successful, while little is known of it in this country, it deserves a more particular description than we have given of the others. Belou's engine in some respects re-

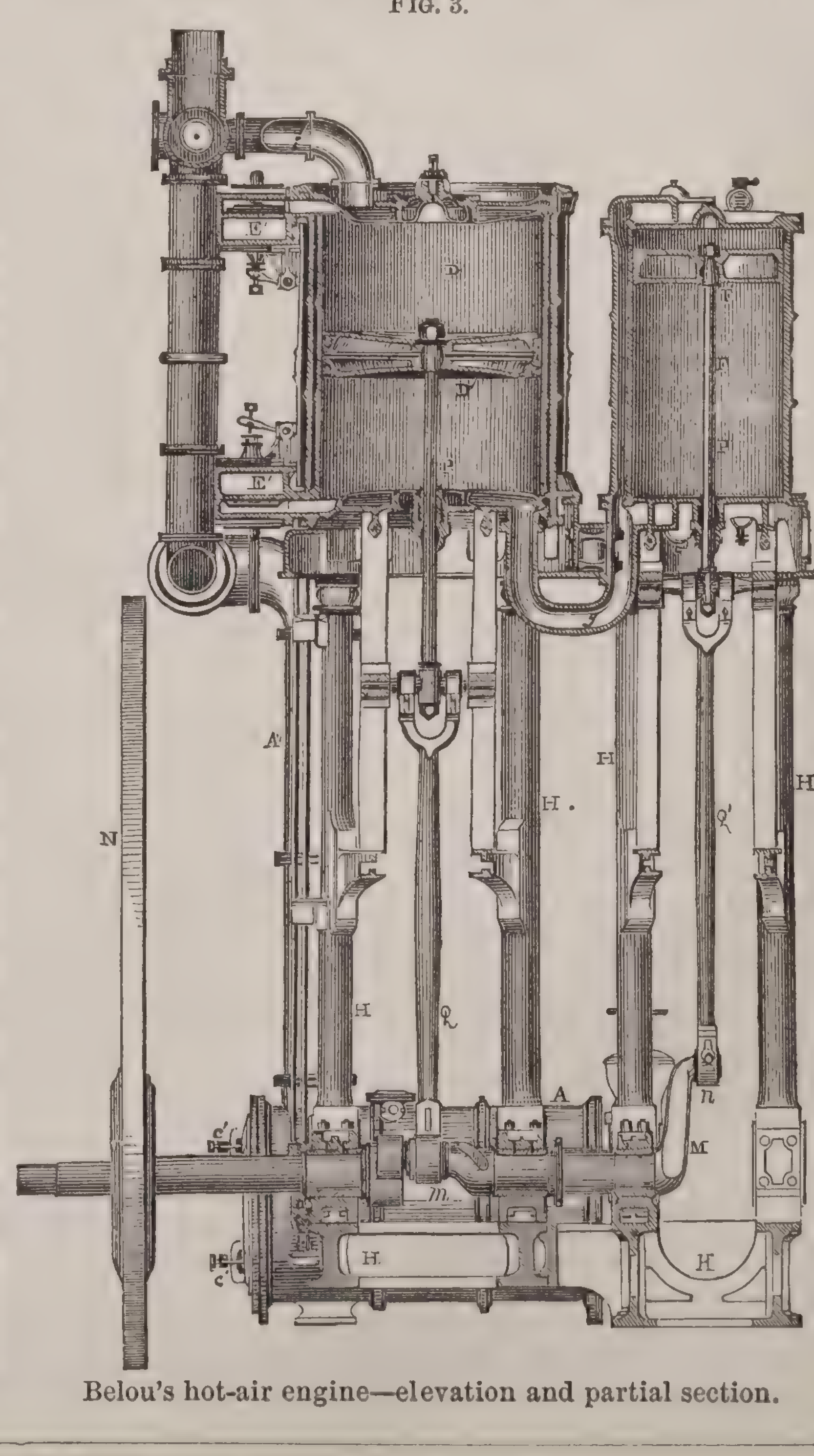
Fig. 2.



Belou's hot-air engine—plan.

sembles Shaw's, but differs from it in employing but one cylinder, which is double-acting, and in having an independent supply-pump and no regenerator. The cylinder, however, is surrounded by a jacket, between which and the cylinder itself the air circulates in passing from the supply-

Fig. 3.



Belou's hot-air engine—elevation and partial section.

pump to the furnace. The engine is represented in Figs. 2 and 3. The first is a general plan; and the second, a vertical section passing through the axis of the cylinder and of the supply-pump. The furnace is at A, and the hopper for fuel at B. D is the cylinder and F the supply-pump. The air, in passing from F to the furnace, is driven through the space *d* between the working cylinder and its enveloping jacket. A portion of the air, larger or smaller as occasion may require, may be made to pass into the furnace over the fuel, and not through it. By this means the intensity of the heat may be varied, and the working pressure increased or diminished. M is the main shaft, N the fly-wheel, and Q Q′ connecting rods which explain themselves. The fly-wheel on the large engine at Cusset weighs about fifteen tons. The fuel introduced into B is spread over the grate by a mechanical contrivance operated by the arbor B′, connected with an eccentric on the main shaft.

Two Belou engines have been tested by Mr. Tresca; one of about four horse power, and the other (which is the engine at Cusset) of nearly thirty. In the smaller, the consumption of coal per horse power per hour amounted to $2\frac{64}{100}$ kilogrammes (nearly 6 pounds); in the larger, only $1\frac{46}{100}$ kilogrammes (three pounds). The working cylinder of this latter had a capacity of about eighty cubic feet; that of the supply cylinder was about half as great. In this case the amount of force developed, as measured by the indications of the manometer, was equal to one hundred and twenty-horse power, but of this the supply absorbed eighty-horse power, or two-thirds of the whole; and more than ten-horse power was estimated to be necessary to overcome the passive resistances. Less than thirty-horse power, therefore, or one-quarter of the whole, was actually utilized. It is of course upon the horse power actually utilized, and not upon the aggregate energy developed, that the foregoing statement of consumption is founded. The performance is therefore about equal to that of an economical steam engine.

It is to be observed, however, that the heat was carried to a height which could not but tend to deteriorate rapidly the parts of the engine exposed to it; and especially the interior of the working cylinder. In order to protect this surface, it was constantly lubricated with a solution of soap in water, of which about five gallons were consumed per hour. There was also a large final loss; the escaping air in the chimney having a temperature of not less than 250° C. = 450° F. above that of the atmosphere. Mr. Tresca computes that fully seven-eighths of the heat produced by the furnace was expended unproductively. Notwithstanding these drawbacks the practical result actually obtained is eminently encouraging to those who hope to see steam-power advantageously replaced by something safer and more universally available.

To the class of hot-air engines belongs properly the so-called inflammable gas engine known as Brayton's Ready Motor. For an account of this, see Gas Engine.

F. A. P. Barnard.

Hot′-bed, a frame for forcing the early growth of plants in cold regions. Its top is a glazed sash, sloping towards the S. The glass permits the sun's rays to enter and heat the air, and at the same time prevents the escape of the warm air. The heat of the sun is reinforced by that of fermenting animal and vegetable matter—horse dung, wool-waste, leaves, chopped straw, and the like — which fill a trench beneath the soil of the hot-bed. These are very necessary to prevent freezing at night and in cloudy weather. When the sun shines brightly it is often necessary to admit some cold air, or partly to cover the hot-bed with mats, otherwise the sun's heat may blast the plants. In very cold weather bast matting is spread over the glass to keep from freezing. Hot-beds are very essential in market-gardening in the Northern States.

Hotch′kiss (Velona R.), D. D., b. at Spafford, N. Y., June 3, 1815; educated at Madison University, N. Y.; pastor of Baptist churches in Poultney, Vt., 1839–42; Rochester, N. Y., 1842–46; Fall River, Mass., 1846–49; Buffalo, N. Y., 1849–54 and 1865–73; was professor of biblical literature in Rochester Theological Seminary 1854 to 1865. He is now (1875) pastor of the Washington street Baptist church in Buffalo, N. Y. He is an accomplished theologian and scholar.

Hot Creek, post-tp. of Nye co., Nev. Pop. 40.

Hotel′ [Old Eng. *hostel;* Fr. *hôtel*, radical, *hôte*, "landlord" or "guest," derived by some from the Latin *hospes*, by others from *hostis*, "guest" or "enemy;" Middle Lat. *hostellaria*], an inn or house for the accommodation of travellers, at present applied in England and America to the larger or better class of such establishments. In France the word is used not only in this sense, but also means, as it did exclusively once, any large or magnificent residence, synonymous with château and palace. The present English word *hotel* is rather of French than English origin. From the earliest ages, among the Jews and other Semitic people, the house of entertainment for travellers was, like the caravanserai or khan of the present day, simply a lodging, the occupants of which provided their own food. People of rank or respectability were entertained by the local governor or by their friends, to whom they took in some cases letters of introduction. For those of a lower or poorer class there arose at an early period, in addition to the caravanserai, a tavern, at which food and drink were sold, but which appears to have been invariably also of so bad a character in other respects that in Hebrew there was but one word (זוֹנָה) for landlady and courtesan. Recent investigation makes it probable that the inn or khan at Bethlehem where Christ was born was the habitation of Chimham (Jer. xli. 18), which had been an inn for more than 600 years, and was perhaps originally a dwelling given by David to Chimham (2 Sam. xix. 38). "In these khans," says Olivier, "the stables join the chambers, and are better lighted. During the winter-time the former are often preferred by travellers for night-lodging; and when, as is often the case, they are of solid masonry or even real caves, they are favorite summer retreats." The Egyptians had lodging-taverns, but among the earlier Greeks of rank travellers were entertained only by private individuals. This was systematized by giving tickets (*σύμβολα, tesseræ hospitalitatis*), on presenting which the guest was received; and these tesseræ were handed down from father to son. (Full details of classic inns are given by Michell; also in Pollux.) The Romans, with their system of roads and posting, developed post-houses or inns, which under the Cæsars were not inferior to those of the Middle Ages. The emperors were accustomed to give to ambassadors and others, as a great privilege, letters which not only entitled the bearer to horses and lodging, but also commanded the postmaster to furnish bread, wine, beer, pigs, poultry, sheep, fish, fruit, wax, and many other things in abundance properly and promptly. Polybius states that in his time inns abounded on the roads, and that provisions were so cheap that people were charged for all they ate in a day only the fourth of an obolus, or three-fifths of a cent per head. All the inns of the cities, whether good or bad, were morally infamous. Whether it was a *caupona, taberna, diverserium, ganea*, or *popina* (cook-shop), the Roman tavern was invariably a brothel—none the less because its female inmates were by law exempted from classification with ordinary prostitutes. It appears from Plautus, Martial, Apuleius, and others that tavern-keepers were supposed to murder their guests, and even to feed others on their bodies—a story which passes current at the present day in Spain, Italy, and Cuba. The Greek taverns, according to Aristophanes, Lucian, Aristotle, and Athenæus, had signs; and the Romans often used the bush and jug-handle (*ansa*) to indicate the sale of wine. Other signs were the Mice and Weasels, the Fighting Men, the Cock, and the Old Shepherd. In later times inns had the Cross for Christian customers, while heathens were attracted by the sun or the moon.

The inns of the Middle Ages long resembled the Roman, and are invariably described as a place of vile debauchery, where every device was used to induce guests to gamble, to waste their money on wantons, or where they were robbed outright. The evil character of ordinary inns caused the establishment of houses of entertainment for men belonging to different callings or nations. Thus, in Venice the Germans established the *Albergo dei Tedeschi*, at which Germans only were accommodated, and in all towns there were guild-taverns for the travelling members of their respective crafts. So early, however, as the thirteenth century public inns began to improve, especially on the grand route from Venice *viâ* Augsburg and Ghent, and in the fourteenth century taverns appear to have become more and more "the general lounge even of the industrious." There are many hotels in Europe bearing the name of "The Cross of Malta," the origin of which was as follows: Before the Crusades hospitality had greatly declined throughout Europe. The Templars, as well as the Knights of St. John of Jerusalem, having been impressed in the East by the Arab *fundiks*, or inns for poor travellers, established similar ones near their "commanderies." Hence, the Knights of St. John derived the name of *Hospitallers*. Many of these, as in Bavaria, Provence, and Castile, were really palaces, in which the young knights also lived. The *Croix de Malta* is familiar to all who have travelled on the Continent.

The modern hotel dates from the peace which followed the downfall of Napoleon I. The annual streams of tourists caused the establishment of a better class of accommodation, and competition rapidly made luxury commoner and cheaper. To furnish a hotel in Switzerland or Germany properly, according to Guyer (*Das Hotelwesen der*

Gegenwart, Zurich, 1874), costs, admitting that the hotel is to contain 300 boarders—

Furniture	154,700 francs.
Beds and carpets	92,120 "
Linen	48,230 "
Service—*i. e.* silver, metal, glass, and porcelain	63,494 "
Kitchen utensils	5,000 "
	363,544 francs,

or about $72,708. But until railroads were established hotel-keepers on the *grande route*—*i. e.* from London to Naples *viâ* the Rhine—were generally amenable to the charge of petty deception, as is indeed still too much the case in France and Italy. But the immense business which grew on the route soon induced a wiser policy. It was found more profitable to establish fixed rates for everything—rooms, *table d'hôte*, and service. Thirty years ago it was usual to bargain for rooms, the host often asking three times as much as he intended to take.

The extraordinary increase of hotels of late years, especially in summer resorts, has been such as to render prosperous many districts which at one time seemed destined to endless poverty; and it seems at present as if in another generation these public palaces will be in sight of one another all over the mountain-country of Europe. Thirty years ago the wretchedness of Switzerland was painful; at present real poverty seems hardly known there to any one who can remember the old time; and this change is due in a great measure to the railroads, and with them the numerous and excellent hotels and *pensions* which annually attract so many visitors. CHARLES G. LELAND.

Hotels in America. The hotel, in its strictest sense as a *public-house*, has reached its highest development in the U. S., and particularly in our larger cities. This is no American boast, but the united testimony of unprejudiced travellers. The American hotels are not perfect—very far from it—but they excel all European hostelries in several particulars. They are on a much larger scale; the elevator, an American invention, and rendered necessary by the great height to which the buildings are carried, is now connected with all first-class hotels. The charges at these hotels of the first class are high, but when the service rendered is considered they cannot be regarded as exorbitant. It is certain that the expenses of the great hotels are so heavy that even with their rooms generally filled, and often crowded, the actual profit is very moderate, and in a dull season they not unfrequently become bankrupts. The largest hotels are not, as might have been supposed, in New York, though some there are very large, but in some of the largest of the Western cities, Chicago, St. Louis, and San Francisco taking the lead in this particular. Of the new Palace Hotel at the latter city we are told that it is to cover an area of 96,250 feet, to be six stories in height, and to afford comfortable accommodation for 1200 guests. It is to have a large open court in the centre with flower-gardens and fountains, and is to cost, including the land, $2,500,000. One or two of the Chicago hotels, and one at least of the St. Louis, have larger accommodations for guests than this, though possibly not a larger area. The summer hotels at Saratoga, Long Branch, and Newport are still larger, but they are open merely for three or four months. A very elaborate and exhaustive article recently (Dec., 1874) published in the New York *Tribune* gives very full statistics in regard to fifteen of the leading hotels of New York City (less than one-seventh of the whole number, though, perhaps, from their size and accommodations, receiving one-fourth of the guests). These hotels were the Albemarle, Ashland, Brevoort, Fifth Avenue, Gilsey, Grand Central, Grand Union, Hoffman, Metropolitan, New York, St. Nicholas, Sturtevant, Union Square, Winchester, and Windsor. Together, they had 4662 rooms—five of them having less than 150 rooms each. They could accommodate comfortably 6030 guests, and upon an emergency, 7640. Their daily average through the year was 3925; they employed 2935 servants, of whom 1456 were females, 1479 males, and had 390 coaches and carriages in attendance. The beef they consumed required the slaughter of 20,000 beeves every year, and other meats almost as large a number of sheep, calves, and swine; 600,000 pounds of fish and 15,000,000 oysters were also served up upon their tables; 5,000,000 eggs and 1,500,000 pounds of poultry and game; 10,000 barrels of flour, 20,000 barrels of potatoes, and a vast amount of green and root vegetables; 150,000 pounds of coffee, 35,000 pounds of tea, and 700,000 pounds of sugar, 1,500,000 quarts of milk, 170,000 quarts of cream, more than 450,000 pounds of butter, about 120,000 pounds of dried fruits, and nearly 63,000 gallons of canned fruits, jellies, etc. Of gas 60,000,000 feet were required for illumination, worth, at the current price in New York, $165,000; 25,000 tons of coal, 12,000 tons of ice, and, for various uses, 1,250,000 pounds of soap, were among the other articles required. The washing of table-linen, bed-linen, towels, etc. amounted to about 19,000,000 pieces a year. This was aside from the personal clothing of guests washed in the laundries. The waste of these establishments is enormous. That from the tables is of two kinds—the broken meats, etc., much of which, though good and wholesome, cannot be served up a second time, and is given to the charitable institutions which have the feeding of the poor, or in some instances disposed of to low eating-houses, etc.; the other kind, coming under the general denominations of swill and garbage, is nearly an absolute waste, and amounts in these fifteen hotels to 11,000,000 pounds annually, or 55,000 tons. The wear and tear of hotel furniture is estimated at 20 per cent. per annum, requiring refurnishing on an average once in five years. The receipts of these fifteen hotels average about $40,000 per day, or $14,600,000 per year, but the amount of net profit is not so large as it should be for such a vast expenditure. These figures represent, as we have said, but 15 of the 108 hotels of New York City, and their expenditures and receipts do not differ materially from those of a like number of hotels of the first-class in the other large cities, especially those of the West. The hotels of the second and third class fix their tariff of charges considerably lower, and, really, giving less service and luxuries in proportion to their prices than the first-class hotels, are generally more profitable. Some of these are well managed, and with less display are quite as comfortable and home-like as the high-priced houses. The usual charge per diem at the hotels of the first-class is from $4.50 to $5 per capita, but this includes no extras, such as wine, cigars, fire in the room, etc. etc. Hotels of the second and third classes, when not on "the European plan"—*i. e.* affording lodging only—charge from $2.50 to $3.50, and somewhat less than the others for extras.

The management and keeping of hotels, as conducted in this country, involves larger aggregate receipts and expenditures than any one branch of manufacture. Both receipts and expenditures are counted by hundreds of millions of dollars, and employ in various ways a vast number of people. L. P. BROCKETT.

Hotel, tp. of Surry co., N. C. Pop. 709.

Ho'tho (HEINRICH GUSTAV), b. in Berlin May 22, 1802; studied at the university of his native city, and became professor of æsthetics at the same in 1830. He also held different positions at the art-galleries of Berlin, and d. there Dec. 25, 1873. He was a disciple of Hegel, and his books —*Geschichte der Deutschen und Niederländischen Malerei* (1843), *Die Malerschule van Eycks* (1859), etc., as well as his criticisms in the *Morgenblatt* and his lectures—bore very striking marks of the ideas and of the terminology of his master. But he deserves great praise for the manner in which he edited Hegel's *Vorlesungen über Æsthetik* (3 vols., 1835–38), chiefly from notes taken by his hearers.

Hot-house. See GREEN-HOUSE.

Hot House, tp. of Cherokee co., N. C. Pop. 645.

Hot'man (FRANÇOIS), b. at Paris Aug. 23, 1524, and began to lecture on Roman law at the university in 1546; but having embraced the Reformed religion, he was compelled to leave his native city in 1547, and retired to Lyons. From this moment, and up to his death at Bâle, Feb. 12, 1590, his life was wandering and adventurous, though generally brilliant, and his participation in the political intrigues of his time was very active, though not very honorable. By his lectures on law at Lyons, Geneva, Strasburg, Valence, Bourges, and Paris, and especially by his work, *Franco-Gallia* (1573), he made a revolution in the political and social views of his time, and many of his writings are still read with great interest; as, for instance, *Commentarii in XXV. Ciceronis Orationes* (1554) and *Commentarius in IV. Institutionum Libros* (1560).

Hot Spring, county of S. W. Central Arkansas. Area, 550 square miles. It is mountainous, well timbered, and abounds in mineral wealth. Iron ores, novaculite (Arkansas hone-stone), salt, and a great variety of other valuable minerals are obtained. Corn, pork, and tobacco are staple products. Cap. Rockport. Pop. in 1870, 5877.

Hot Spring Lake, a beautiful lake 3 miles N. of Salt Lake City, Ut., fed by the hot springs near by. It is 3 miles long and over 1 mile broad. Its surface partly freezes over in winter.

Hot Springs, post-v., cap. of Garland co., Ark., 55 miles S. W. of Little Rock. It has about sixty thermal springs, much visited by invalids and others. The town has a weekly newspaper, and several hotels and churches. The springs are very copious, and some of them discharge waters of the temperature of 150° F. Pop. of v. 1276; of tp. 1604.

Hot Springs, tp. of Napa co., Cal. Pop. 2120.

Hot Springs, post-v. of Bath co., Va., 35 miles N. E. of White Sulphur Springs. It contains several thermal

saline springs (of a temperature of 100°-106° F.), whose waters are useful in a wide range of diseases.

Hot'tentots, the native race of Cape Colony, South Africa. Their present territory extends northward from Cape Colony to Orange River, and eastward from the Atlantic to the boundaries of Caffraria. There are in this vast territory some well-wooded regions and tracts of good pasture-land, but generally it is an arid desert, miserable as the race which inhabits it. The Hottentots look like a mixture of the Mongolian and the negro race. They are tall, meagre, with high cheek-bones, sallow complexion, and oblique eyes, but they have thick lips, flat nose, and woolly hair growing in tufts. When the Dutch first settled at the Cape of Good Hope, in the middle of the seventeenth century, the Hottentots were quite numerous. They lived as herdsmen and hunters, and evinced some skill in rearing cattle and catching game; but their huts were miserable, they were nearly naked, their religious and moral ideas very few and weak, and their customs and habits often extremely savage. In contact with the Dutch they sunk still lower—that is to say, they sunk below the possibility of life. They sold their herds for rum, and died from starvation; their number decreased at a fearful rate. Under the English government they are much better off. Some of the tribes have become good and steady workmen, and show receptibility of civilization, though others—as, for instance, the Bushmen—have proved entirely unfit for civilized life. The Bushmen are very small of stature, ugly above description, and disgustingly degraded. They are widely scattered through all the English colonies in Southern Africa, but their number is rapidly decreasing. The language of the Hottentots has several marked dialects, all remarkable for the presence of clicking sounds. (See Bleek, *Comparative Grammar of the S. African Languages*, 1862–69.) Curious anatomical peculiarities, such as the steatopyga, or prominent nates of the women, have been observed in the Hottentot race, but are not universal. The present number of Hottentots and Bushmen does not exceed 150,000. (See Fritsch, *Drei Jahre in Südafrika*, 1869; *Die Eingebornen Südafrikas*, 1872.)

Hottentot's Bread, a kind of yam (*Testudinaria elephantipes*, order Dioscoreaceæ) growing in South Africa. It is a beautiful vine, growing from the back of the large, rough, tortoise-like tuberous rhizoma, which grows half uncovered. The rhizoma affords starchy food.

Hot'tinger, the name of a family of Swiss scholars, the most prominent of whom were—Johann Heinrich, b. at Zürich Mar. 10, 1620; studied at Groningen and Leyden; became professor in church history and Oriental languages at Zürich and Heidelberg; and was drowned near the former city June 5, 1667. By his writings, *Grammatica Quatuor Linguarum Hebraicæ, Chaldeæ, Syriacæ, et Arabicæ* (1659), and *Etymologicum Orientale* (1661), etc., he contributed very much to a better understanding and a more general study of the Semitic languages.—Johann Jacob, a son of the preceding, b. at Zurich in 1652, and d. Dec. 18, 1735, as professor of theology at the university of his native city. He wrote *Helvetische Kirchengeschichte* (4 vols., 1708–29), a work still appreciated.—Johann Jacob, grandson of the preceding, b. at Zurich in 1750, and d. there Feb. 4, 1819. He was professor in Latin and Greek, and took part very actively in the great literary movement in German Switzerland under the leadership of Bodmer.—Johann Jacob, a nephew of the preceding, b. at Zurich in 1783, and d. there in 1859; wrote *Geschichte der Schweizerischen Kirchentrennung* (1825–27).

Hottonia. See Feather-foil.

Hou'brachen (Arnold), b. at Dort Mar. 28, 1660, and d. in Amsterdam Oct. 14, 1719. Of great value are his biographies of Dutch painters, *Groote schonburgh der nederlandsche konstschilders en schildressen* (1718).

Houdin' (Robert), b. at Blois in 1805; was apprenticed to a watchmaker at Paris; studied mechanics, and won a medal for his toys and automata at the Paris exhibition of 1844. In 1845 he opened in the Palais Royal a series of soirées fantastiques, which he continued for ten years. In 1855 he retired to Blois with a large fortune. But in 1856 he went to Algeria on the invitation of the French government, and entered into a competition in making miracles with the marabouts or priests. His success was complete, and he contributed much to the breaking down of the bad influence of these impostors on their superstitious countrymen. After his return he published his *Life* (1857) and his *Confidences* (1859). D. at Blois in 1871.

Houdon' (Jean Antoine), b. in Versailles Mar. 20, 1741; d. in Paris July 15, 1828. He spent ten years in Rome as the king's pensioner, he having won the first prize at the Royal Academy for sculpture, and there executed the statue of St. Bruno in the S. Maria degli Angeli; afterwards, in Paris, made statues of Voltaire, Cicero, Tourville, and busts of Napoleon, Josephine, Ney, Rousseau, Diderot, D'Alembert, Barthelémy, Mirabeau, Franklin, Turgot, and other eminent men of the time; came to the U. S. with Franklin in 1785, and modelled the statue of Washington in the capitol at Richmond, Va. While making studies for the statue he was the guest of Washington at Mt. Vernon. The models of the human frame, without the covering of skin, executed for the Academy, exhibit his knowledge of anatomy. His finished statues and busts are highly valued as portraits. O. B. Frothingham.

Hough (Franklin B.), A. M., M. D., b. at Martinsville, N. Y., July 20, 1822; graduated at Union College in 1843, and at Cleveland Medical College in 1849; practised his profession 1848–52 at Somerville, N. Y. He has since been engaged in literary and scientific pursuits, and resides at Lowville, N. Y. Has published a *Catalogue of Plants of Lewis Co., N. Y.* (1847), *History of St. Lawrence and Franklin Cos., N. Y.* (1853), of Jefferson co. (1854), of Lewis co. (1860), *Meteorological Observations, 1826–50* (1854), *New York Civil List* (1861), *Gazetteer of New York* (1872), and many other works, principally historical.

Hough (John Stockton), M. D., b. at Yardleyville, Bucks co., Pa., Dec. 5, 1845; was educated at Trenton, N. J., Fort Edward and Poughkeepsie, N. Y., and the Polytechnic College of Pennsylvania; took his medical degree 1868 at the University of Pennsylvania. Author of numerous papers upon questions in biology, social science, pathology, etc.; was resident physician of the Philadelphia Hospital 1868–69, etc.

Hough'ton, county of the N. peninsula of Michigan, bordering on Lake Superior. Its winter climate is severe. It has abundance of valuable ores of copper, iron, and silver, which are extensively wrought. Keweenaw Bay and other inlets of Lake Superior break its outline, and abound in excellent fish. The working of copper-mines is the principal industry. The surface is broken. Cap. Houghton. Pop. 13,879.

Houghton, post-v., cap. of Houghton co., Mich., on Lake Portage, an arm of Lake Superior, is the centre of the great copper-producing district, 15,000 tons being annually shipped from this port; contains 3 churches, a national bank, a newspaper and binding establishment, 2 hotels, machine-shops, stores, etc. Principal business, mining. Pop. about 1700. J. R. Devereaux,
Prop. "Portage Lake Mining Gazette."

Houghton, tp. of Keweenaw co., Mich. Pop. 1325.

Houghton (Douglass), M. D., b. at Troy, N. Y., Sept. 21, 1809; graduated in 1829 at the Rensselaer Institute at Troy, in which he was in 1830 appointed assistant professor. He made a valuable report of the botany of the Upper Mississippi region, to which he was sent with an expedition. He became a practising physician in Detroit, Mich.; State geologist in 1837; mayor of Detroit in 1842; a professor in the State University; and a member of many learned societies. While on a government survey he was drowned in Lake Superior, near Eagle River, Oct. 13, 1845.

Houghton (George Frederick), b. at Guilford, Vt., May 31, 1820; graduated at the University of Vermont in 1839; became a lawyer in 1841; secretary of state of Vermont 1848–49; State attorney for Franklin co. 1852–53; founded the *Vermont Transcript* 1854, and became connected with the *Church Journal* (N. Y.) soon after. D. at St. Alban's, Vt., Sept. 22, 1820.

Houghton (Henry Clark), M. D., b. at Roxbury (Boston), Mass., Jan. 22, 1837; educated at Bridgewater Normal School; became an instructor; served two and a half years in the late Christian Commission; graduated M. D. from New York University 1867; resident physician to Five Points House of Industry 1867–69; surgeon to New York Ophthalmic Hospital since 1868; professor of physiology in New York Homœopathic College 1868–70; professor of physiology in New York College for Women since 1869; member and officer of various professional societies. Author of *Lectures on the Diseases of the Ear*, etc.

Houghton (Richard Monckton **Milnes**), Baron, D. C. L., F. R. S., b. June 19, 1809; was educated at Cambridge, and was long an independent and moderately conservative member of the House of Commons; widely known as a poet and an elegant critic. In 1863 he was raised to the peerage. He has published several volumes of poetry and travels; *The Real Union of England and Ireland* (1845), *Life of Keats* (1848), and other works.

Houghton (Royall), b. at Guilford, Vt., Feb. 12, 1798, and in 1833 removed to New York, where he was (1835–51) a prominent banker and broker, distinguished for honor and probity. After leaving business he became a citizen of St. Augustine, Fla., where he d. Mar. 22, 1873.

Houghton (William), b. at Norwich in 1807; grad-

uated at Highbury College, London, in 1832; became minister of the Congregational church at Windsor in 1833, of the Congregational society at Kensington in 1844, and was elected in 1855 chairman of the Congregational Union of England and Wales. He wrote *The Ecclesiastical History of England* (4 vols., 1870) and *Country Walks of a Naturalist with his Children* (1869).

Houl'ton, post-v., cap. of Aroostook co., Me., 120 miles N. E. of Bangor, on the New Brunswick and Canada R. R. It is the rendezvous for the lumbermen of that region. Has a savings bank, 2 weekly newspapers, 7 churches, stores and shops. Pop. 2850.

W. S. Gilman, Ed. "Aroostook Pioneer."

Houl'town, tp, of Marion co., W. Va. Pop. 33.

Hou'ma, post-v., capital of Terre Bonne parish, La., 70 miles S. W. of New Orleans, with which it is connected by Morgan's R. R. It has several public and private schools, a convent and an academy, 4 churches, and 2 weekly newspapers. Pop. 593.

E. W. Condon, Ed. "Terre Bonne Republican."

Hou-Nan', or **Hu-Nan,** province of China, situated between lat. 25° and 30° N., and between lon. 109° and 114° E., comprises an area of 74,325 square miles, with 18,652,507 inhabitants. The surface is elevated, in many places mountainous, but the country is very little known. The northern part is very fertile, and produces large quantities of cotton. Metals are said to abound, but mines are not worked. Cap. Chang-Sha.

Hound [Ger. *Hund*, a "dog"], a term properly restricted to those dogs which hunt by following the track of the game by scent. This definition includes the bloodhound, staghound, foxhound, beagle, harrier, and a few others, but does not include the greyhound. Most hounds are muscular, strong, sagacious animals, with large pendulous ears. The more important varieties are described under their aphabetical heads.

Hound'-fish, a name given to some of the larger dogfishes (which are themselves small species of sharks), such as the *Mustelus lævis*, or smooth hound-fish of European seas, two or three feet long, represented in America Atlantic waters by *M. canis*, a rather larger fish. These fishes have flat grinding teeth, adapted well to their food, which consists of crustaceans and mollusks.

Houns'field, tp. of Jefferson co., N. Y., on Lake Ontario. It includes Sackett's Harbor (which see) and several islands. Pop. 2636.

Houns'low, town of Middlesex, Eng., 10 miles W. of London, consisting mainly of a single street. Pop. 9294.

Hour [Lat. *hora*], the twenty-fourth part of a day, or of the interval between two consecutive meridian passages of the mean sun (mean solar day), true sun (apparent solar day), or of a fixed star (sidereal day). As mean solar time is the legally recognized time according to which the affairs of business are regulated, and is the time kept by ordinary clocks and watches, the word *hour*, in its usual acceptance, is understood to signify a mean solar hour. As the mean solar meridian passage commonly divides the interval between sunrise and sunset unequally, clocks are sometimes, and for certain purposes, constructed to give apparent time. Such clocks are called equation clocks (see Equation of Time), and are designed to mark exactly twelve when the true sun is on the meridian. Astronomical clocks (so called), or the clocks of astronomical observatories, are regulated to sidereal time for convenience in recording right ascensions (which are measured in such time), or to facilitate the finding of celestial objects whose right ascensions are known. (See Time.) F. A. P. Barnard.

Hour'-glass, a contrivance much used, before the invention and introduction into general use of clocks and watches, for the measurement of time. It consists of a hollow glass vessel blown into a form externally resembling the figure 8, or presenting the appearance of two spherico-conoidal bulbs united at their vertices. In the blowing, the contraction in the middle is such as almost to close communication between the bulbs. This passage is then smoothly drilled out, by passing the drill through the aperture left in the base in blowing; and a quantity of fine and dry sand is then introduced, sufficient to occupy an hour in running through this passage from one bulb to the other when the instrument is held in a vertical position. During the adjustment the external aperture is temporarily closed by a cork. After the adjustment this aperture should be sealed in such a manner as effectually to exclude moisture. The whole should then be protected by a surrounding frame. The hour-glass is by no means a very exact instrument. A perceptible difference will not unfrequently be observed between the times of running out, according as one or the other of the bulbs is uppermost. Temperature also affects its performance; and in case of the absorption of moisture by the sand, in consequence of imperfect sealing, its irregularities are much increased. Half-hour glasses, minute-glasses, half-minute glasses, etc. are constructed on the same principle. The hour-glass is now rarely used, more accurate and convenient time-keepers having superseded it; but the half-minute glass is still employed at sea to time the running of the log-line.

F. A. P. Barnard.

Hour'is (pl.), (*i. e.* the "black-eyed"), the nymphs of Paradise, whose society, according to the Koran, is to be one of the great felicities of the Mohammedan believer after death. These beings are of pure musk, and are endowed with perpetual youth, health, and beauty.

Hours, The [Gr. Ὧραι; Lat. *Horæ*], in Greek mythology, the goddesses of nature and the seasons of the year; in later times the personifications of justice and good order. Their number and mythus is variously given. At Athens there were two—Thallo (Spring) and Carpo (Autumn). Hesiod makes them three—Eunomia, Dice, and Irene. In art they are blooming nymphs, laden with fruits and flowers.

Housaton'ic, post-v. of Great Barrington tp., Berkshire co., Mass., on the Housatonic R. R., 21 miles S. of Pittsfield. It has manufactures of bank-note paper, etc.

Housatonic River rises by several head-streams in Berkshire co., Mass., flows S., and traverses the State of Connecticut, falling into Long Island Sound in lat. 41° 9′ 5″ N., lon. 73° 5′ 53″ W. For 14 miles it is a tidal stream. Its valley abounds in wild and beautiful scenery, and it affords water-power for numerous manufactories.

House'-Fly, the *Musca domestica* of Europe and probably of the U. S. (though it is not quite certain that the house-flies of the two continents are identical in species), a very common household pest, breeding as a maggot in heaps of filth, upon which it feeds. It is regarded as a preventer of disease because it acts as a scavenger, and thus defers and distributes over much space and time the fermentation and destruction of organic substances. Flies are especially abundant late in summer and early in autumn. They are generally most numerous near stables and ill-kept dairies, and their presence anywhere in numbers may be regarded as indicating possible danger to health from putrefying organic matter. Against the annoyance of flies, cleanliness is the best preventive.

House'hold Suf'frage. Under the English law, the right to vote in boroughs for members of Parliament is granted to male persons of full age who during twelve months preceding the last day of July in any year, as well as on that day, have been occupiers, either as owners or tenants, of any dwelling-house within the borough, and have been rated, and have paid the rates, in a specified way for the relief of the poor in respect to the premises. The phrase "dwelling-house" is defined by the act to mean any part of a house occupied as a separate dwelling, and separately rated for the relief of the poor. The right of suffrage is also extended to lodgers occupying the same lodgings for a similar period to that prescribed for occupants of dwelling-houses, such lodgings being of the clear yearly value, if let unfurnished, of £10 a year and upwards. (See for the details of the subject 30 and 31 Vict. c. 102, A. D. 1867.) Rules of a similar nature in respect to the right of voting as a burgess of a borough at municipal elections are found in 32 and 33 Vict. ch. 55. A. D. 1869. T. W. Dwight.

Household Troops. See Guards.

House'-Leek (*Sempervivum tectorum*), an herb of the order Crassulaceæ, a native of Europe, often cultivated in the U. S. It takes its trivial name from the fact that it is often set upon the roofs of cottages, where it grows well, propagating abundantly by offsets on short and thick runners, rarely flowering. As a remedy for bee-stings, slight burns, and the like the bruised leaves are very efficacious. The plant was once so highly esteemed as a cure for disease that Charlemagne by edict compelled his subjects to keep it in their houses and plant it on their roofs. The name house-leek is popularly applied to several other crassulaceous plants.

House'maid's Knee (so called because it is said, though with little reason, to be most common among housemaids, who scrub stairs and floors upon their knees), an acute or chronic dropsical effusion into the bursa before the knee-pan. It is easily diagnosticated, and does not communicate with the knee-joint proper. Acute cases may be cured by rest and the application of iodine, mercurials, and tight bandages; chronic ones, by compression with suitable splints, or even by evacuation and injection of iodine solution into the sac.

House's Creek, tp. of Wake co., N. C. Pop. 2098.

Hous'sa, or **Haus'sa,** is the name of a large territory

of Central Africa, extending between lat. 12° and 13° N., and between lon. 5° and 10° E., and consisting partly of tracts of low land inundated by the Niger and its affluents during the rainy season, partly of ranges of rocky hills enclosing elevated table-land. The inhabitants have in some places formed independent states, in others they have been subjugated by neighboring tribes, especially the Fellatahs, and thus the name Haussa signifies a race and a language, rather than a political unit.

Houssaye′ (Arsène), b. at Bruyères, in the department of Aisne, Mar. 28, 1815, of a wealthy father, who had made his fortune in the milling business. About 1835 young Houssaye presented himself in the Paris fashionable and literary circles, and was so fortunate as to become the friend of Jules Janin, Théophile Gauthier, Jules Sandeau, then the princes of criticism and light literature. Thanks to them, Arsène Houssaye soon attracted public attention to his first books, and afterwards conquered a well-earned celebrity. In 1849 he became director of the Théâtre Française, and under the empire was appointed inspector-general of the museums. Author of the periodical letters on Paris life being published by the New York *Tribune* (1875). Among his works are—*Philosophes et Comédiennes, Les filles d'Ève, Sous la Régence et sous la Terreur, Blanche et Marguerite, Nos grandes dames, History of the Forty-first Fauteuil of the French Academy, King Voltaire, History of French Art*, etc.—Henri, his son, b. Feb. 24, 1848, is just beginning to make his mark in the literary world of France, through the publication of his *History of Apelles, History of Alcibiades*, etc. Félix Aucaigne.

Hous′ton, county of Central Georgia, bounded on the E. by the Ocmulgee River. Area, 550 square miles. It is level, and has a fertile, calcareous, and well-cultivated soil. Cotton, pork, and corn are staple products. It is traversed by the South-western and other railroads. Cap. Perry. Pop. 20,406.

Houston, the south-easternmost county of Minnesota, having Iowa on the S. and the Mississippi River on the E. Area, 570 square miles. It is well timbered and fertile, and grain is its chief staple. Cap. Caledonia. P. 14,936.

Houston, county of N. W. Central Tennessee. Area, about 360 square miles. It is bounded on the W. by the Tennessee River, and is traversed by the Memphis Clarksville and Louisville R. R. It is diversified and fertile. Cap. Erin. It was constituted since the census of 1870.

Houston, county of the E. of Texas. Area, 1090 square miles. It is well timbered and watered, and generally rolling and fertile. Coal and iron are found. The International and Great Northern R. R. traverses the county, which has the navigable Neches and Trinity rivers respectively on its E. and W. borders. Cotton, corn, and live-stock are largely produced. Cap. Crockett. Pop. 8147.

Houston, post-v., county-seat of Winston co., Ala., 55 miles N. W. of Elyton. Pop. of tp. 498.

Houston, tp. of Adams co., Ill. Pop. 1239.

Houston, tp. and post-v. of Houston co., Minn., on the Southern Minnesota R. R., 19 miles from La Crosse. Pop. 1075.

Houston, post-v., cap. of Chickasaw co., Miss., about 42 miles N. W. of Columbus. It has 2 academies, 2 churches, a newspaper, 2 hotels, stores, etc.; contains the usual public buildings. Pop. 400.

Frank Burkitt, Ed. "Chickasaw Messenger."

Houston, post-v., cap. of Texas co., Mo., about 75 miles S. of Jefferson City, situated in a mineral region; has large forests of pine and saw-mills in the neighborhood, an academy, the county court-house, 3 hotels, 2 newspapers, stores, shops, etc. It is 35 miles from the St. Louis Salem and Little Rock R. R. Pop. about 200.

Ben. C. Lowell, Ed. "Texas Co. Pioneer."

Houston, post-v. of Shelby co., O., on the Cleveland Columbus Cincinnati and Indianapolis R. R. Pop. 56.

Houston, city, cap. of Harris co., Tex., in lat. 29° 30′, lon. 94° 50′, at the head of navigation on Buffalo Bayou, 50 miles N. W. of Galveston. It is the railroad centre of Texas. The city is situated on both sides the bayou, on gently undulating land, and has steamboat communication with Galveston daily. It contains numerous schools, 2 academies for white and colored scholars respectively, 13 churches, 2 national, 5 private, and 1 savings bank, 2 home insurance companies, the Masonic temple of the Grand Lodge of Texas, in which the annual meetings are held, a city-hall and market-house unsurpassed in the South. It has cotton, car, soap, and Portland cement factories, while its manufactories of wagons, carriages, ploughs, and other agricultural implements are a source of large revenue; a large flouring-mill, 2 steam, 3 hand fire-engines, and 1 hook and ladder company. The annual State fair is held here on the fair-grounds. A horse railway from the general dépôts through the principal streets to the fair-grounds is in successful operation. There are 4 large hotels, 3 daily and 5 weekly newspapers, and its importance as a railroad and manufacturing centre is rapidly being developed. Pop. 9382. E. W. Taylor.

Houston (David C.), b. in New York; graduated at the U. S. Military Academy 1856, and assigned to the corps of engineers with the rank of brevet second lieutenant; but retained at the Academy as assistant professor of natural and experimental philosophy until Sept., 1857, when he was placed on construction duty at Hampton Roads, and subsequently at Sandy Hook. In the civil war he was engaged at Blackburn's Ford and Bull Run as engineer of Tyler's division; assistant engineer on defences of Washington; chief engineer 1st army corps, department of the Rappahannock; of 3d army corps at Cedar Mountain and second battle of Bull Run; of 1st army corps at South Mountain and Antietam; of department of the Gulf at the siege of Port Hudson, Red River campaign, etc.; brevet captain, major, lieutenant-colonel, and colonel for gallantry and meritorious conduct. Since the close of the war he has had charge of the defences of Narragansett Bay, R. I., and is at present in charge of extensive river and harbor improvements in the North-west. G. C. Simmons.

Houston (George P.), U. S. M. C.; entered the marine corps as a second lieutenant Oct. 23, 1860; became a first lieutenant in 1861; was brevetted major for "gallant and meritorious services" in the battle of Mobile Bay Aug. 5, 1864, where he commanded a division of the Brooklyn's guns, which Capt. Alden, in his official report, says he fought "nobly and well." Foxhall A. Parker.

Houston (George Smith), b. in Williamson co., Tenn., Jan. 17, 1811; removed in youth to Limestone co., Ala.; was admitted to the bar in 1831; was chosen district solicitor in 1837; was in Congress 1841–49 and 1851–61, taking a prominent position; was chosen in 1865 to the U. S. Senate, but did not take his seat. In 1874 was elected governor of Alabama.

Houston (Gen. Sam), b. in Rockbridge co., Va., Mar. 2, 1793. Left an orphan early in life by his father's death, he went with his mother in destitute circumstances to Tennessee, then the verge of civilization. Here he received a scanty education, and spent most of his youthful years among the Cherokee Indians. During a portion of this period he served as clerk to one of the traders, and also taught a rustic school. In 1813 he enlisted as a private in the U. S. army, and served under Gen. Jackson in his famous campaign against the Creek Indians. He had so distinguished himself on several occasions that at the conclusion of the war he had risen to the rank of lieutenant, but on the return of peace he resigned his commission in the army, and took up the study of law at Nashville. His political career now commenced. After holding several minor offices he was sent to Congress from Tennessee in 1823, and continued a member of the House until 1827, when he was elected governor of the State. In 1829, he resigned this office before the expiration of his term; went to Arkansas and took up his abode among the Cherokees. He not long after became the agent of this tribe to represent their interests at Washington. On a first visit to Texas, just before the election of delegates to the convention called there to form a constitution preparatory to the admission of Texas into the Mexican union, he was unanimously chosen a delegate to that body. The constitution so formed was rejected by the Mexican authorities, and Texas was denied admission as a state into that union. Santa Anna, the president of the Mexican confederated republic, demanded of the Texans a surrender of their arms. Resistance to this demand was determined upon. A military force was organized, and Houston, under the title of general, was soon appointed commander-in-chief of it. He conducted the war which ensued with great vigor, and brought it to a successful termination by the battle of San Jacinto in Apr., 1836, in which Santa Anna was captured, and by which the independence of Texas as a separate republic was achieved. In Oct., 1836, Gen. Houston was inaugurated the first president of the new republic. In 1845–46, Texas was admitted into our Union as one of the U. S., and Gen. Houston was elected as one of the two Texas members to the Senate of the U. S. This position he held for twelve years. His decided opposition to the policy of secession lost him the confidence of the people for whom he had done so much. He went into retirement, and survived the outbreak of the war in 1861 for a short time. Taken all in all, Gen. Houston was one of the most remarkable men who has ever figured in American history. D. at Huntersville, Tex., July 25, 1863. A. H. Stephens.

Ho′ven, or **Hoove,** a disease of cattle and sheep, characterized by great distension of the stomach by car-

bonic acid gas, derived from fermentation of food. It is often seen after a marked change from a meagre to a rich pasture. A smart purge, the administration of lime-water or weak ammonia-water, and the introduction of the stomach-tube are to be tried. If these fail, plunge a trocar and canula into the stomach at a point halfway between the haunch-bone and the last rib, and near the back-bone. There is some danger of fatal peritonitis after the operation, but most animals recover.

Hov′ey (Alvah), D. D., b. at Greene, N. Y., Mar. 5, 1820; graduated at Dartmouth College, N. H., 1844, and Newton (Mass.) Theological Institution in 1848; was Baptist pastor at North Gloucester, Me.; from 1850 to 1853 instructor in biblical literature at Newton Theological Seminary; from 1853 to 1856 professor of ecclesiastical history. Since 1856 he has been at the same institution professor of Christian theology, and its president since 1868. He has published, with Rev. D. B. Ford, a translation of Perthe's *Life of Chrysostom*, and by himself, *Life and Times of Isaac Backus* (1858), *State of the Impenitent Dead* (1859), *The Miracles of Christ* (1864), *Scriptural Law of Divorce* (1868), *God with Us* (1872), and, privately, *Lectures on Theology, Religion, and the State* (1874).

Hovey (Alvin P.), b. at Mt. Vernon, Ind., May 8, 1821; studied law and practised his profession with success. During the civil war he was appointed major of Indiana volunteers, subsequently colonel, serving in the South-west at Shiloh and Corinth; promoted to be brigadier-general of volunteers Apr. 28, 1862; commanded a division at the battle of Champion Hills, contributing largely to the success of that day; subsequently engaged in the Vicksburg campaign. Brevetted major-general of volunteers July, 1864; resigned Oct., 1865. In 1866 he was appointed U. S. minister to Peru. G. C. Simmons.

How (Lyman Bartlett), A. M., M. D., b. in New Bedford, Mass., Feb. 25, 1838; graduated A. B. at Dartmouth College 1860; studied medicine in the medical department of that college and in the New York College of Physicians and Surgeons; took the medical degree in 1862; practises at Manchester, N. H.; became professor of anatomy and physiology in the medical department of Dartmouth College 1869, which position he holds (1875).

How′ard, county in the W. of Arkansas. Area, 625 square miles. Its W. border is washed by Saline Creek. It is fertile, rolling, and well wooded. Cap. Centre Point.

Howard, county of Dakota, traversed by the Missouri and the Little Missouri rivers. Its N. W. corner extends to the mouth of the Yellowstone. Area, 4320 square miles.

Howard, county of N. Central Indiana. Area, 310 square miles. It is level and very productive. Cattle, grain, wool, and lumber are staple products. It is intersected by the Indianapolis Peru and Chicago and the Cincinnati and Chicago R. Rs. Cap. Kokomo. Pop. 15,847.

Howard, county of the N. E. of Iowa, bounded on the N. by Minnesota. Area, 576 square miles. It is partly prairie and partly timber-land, and has a fertile soil. Grain is the staple product. It is intersected by the Milwaukee and St. Paul R. R. Cap. New Oregon. Pop. 6282.

Howard, county of the S. E. of Kansas, bounded on the S. by Indian Territory. Area, 1271 square miles. It has a great amount of water-power and much fine tillage-land, but is especially adapted to pasturage. Cap. Peru. Pop. 2794.

Howard, county near the centre of Maryland. Area, 300 square miles. It has a good soil and undulating and hilly surface, with abundant water-power. Grain and tobacco are staple products. Cotton goods, flour, and iron are manufactured. Granite and iron ores are abundant. Cap. Ellicott City. Pop. 14,150.

Howard, county of N. Central Missouri. Area, 460 square miles. It is undulating, well cultivated, fertile, and abounds in coal, sandstone, and limestone. Cattle, grain, tobacco, and wool are staple products. The Missouri flows along the W. and S. boundaries. Cap. Fayette. P. 17,233.

Howard, county of Central Nebraska, drained by the Loup Fork of the river Platte. Area, 576 square miles. It is well adapted to grazing. Cap. St. Paul. There is no statement of its pop. in the census of 1870.

Howard, tp. of Conway co., Ark. Pop. 745.

Howard, tp. of Howard co., Ind. Pop. 1707.

Howard, post-tp. of Parke co., Ind. Pop. 554.

Howard, tp. of Washington co., Ind. Pop. 1158.

Howard, tp. of Howard co., Ia. Pop. 204.

Howard, tp. of Story co., Ia. Pop. 968.

Howard, tp. of Tama co., Ia. Pop. 1043.

Howard, tp. of Wayne co., Ia. Pop. 575.

Howard, tp. of Cass co., Mich., on the Michigan Central R. R. Pop. 1171.

Howard, tp. of Gentry co., Mo. Pop. 1310.

Howard, tp. and post-v. of Steuben co., N. Y. Pop. of v. 167; of tp. 2122.

Howard, post-tp. of Knox co., O., on the Cleveland Mt. Vernon and Columbus R. R. Pop. 800.

Howard, tp. of Centre co., Pa. Pop. 875.

Howard, post-b. of Centre co., Pa., on the Lockhaven and Tyrone R. R., 13 miles S. W. of Lockhaven. It has iron manufactures. Pop. 334.

Howard, tp. of Brown co., Wis. It contains the village of Fort Howard. Pop. 3620.

Howard (Catharine), the fifth wife of Henry VIII. and queen of England for some months, b. in 1520, a daughter of Edmund Howard, third son of Thomas Howard, duke of Norfolk. The king first saw her at a banquet given by the bishop of Winchester in 1540. He had just married Anne of Cleves, and his dislike for that vulgar woman grew into disgust by comparison with the graceful and spirited Catharine. On July 9, 1540, he was divorced from Anne, and on Aug. 8 he married Catharine. The marriage was very happy. The queen understood how to dispel the gloom which gathered now and then in her husband's soul, and to manage the moroseness of his temper. But the happiness did not last more than five months. Archbishop Cranmer communicated to the king the confessions of a certain Lascelles, according to which Dereham and Mannock, two gentlemen in the service of the duchess of Norfolk, had been Catharine's lovers before her marriage. The king at first refused to believe. Nevertheless, Dereham and Mannock were seized and questioned. They confessed, and were executed. At last, even the queen confessed. But as such a crime, committed before marriage, was not a sufficient reason of divorce, her conduct after marriage was subjected to a most rigorous scrutiny. Very suspicious circumstances came to light. She had taken Dereham into her service after her marriage. Another of her former lovers, Thomas Culpepper, a relative of hers on her mother's side, she had admitted to her bed-chamber one night for several hours, no other being present than Lady Rochford. After a protracted trial she was sentenced, and decapitated Feb. 13, 1542. Most historians admit the dissoluteness of her conduct before her marriage, and few put any confidence in her loyalty after that time, but there seems to be an under-current of political intrigue running through her history. At the head of the religious reform party stood Cranmer, archbishop of Canterbury, while the duke of Norfolk and Bishop Gardiner represented a party which wished a reaction in favor of the Roman Catholic Church. The king's marriage to Anne of Cleves was the work of the Reform party, which hoped to bring the king entirely over to their side by placing him in more intimate connection with the German Lutherans. But the plan had failed. The Howards were in power. The Roman Catholic cause was in the ascendant, and it is more than probable that the fate which overtook Catharine Howard arose from these circumstances.

Howard (Flodoardo), M. D., Ph. D., b. in Stafford co., Va., Mar. 11, 1811; was educated at Columbian College and Georgetown College, D. C.; is professor of obstetrics, puerperal diseases, and diseases of children in the medical department of Georgetown College, Washington, D. C.; president of the Medical Association of the District of Columbia 1874–75.

Howard (Henry), M. D., b. in Frederick co., Md., May 28, 1792; d. at Charlottesville, Va., Mar. 2, 1874. He took the degree of M. D. from the University of Pennsylvania, and for twenty-four years practised in Maryland. In 1837 he filled the professorship of obstetrics and diseases of women and children in the university of his native State, and then was elected professor of practice and obstetrics in the University of Virginia, which he occupied to 1867, when the infirmities of age compelled him to resign. He left an enviable reputation for his devotion to the profession and zeal as a teacher. Paul F. Eve.

Howard (Jacob M.), LL.D., b. at Shaftesbury, Vt., 1805; d. at Detroit in 1871. Graduated at Williams College 1830; taught in academies in Massachusetts and Michigan in 1832; was admitted to the bar in 1833; became a member of the legislature in 1838; member of Congress in 1841–43, and attorney-general of Michigan in 1855–61. From 1862 to 1871 he represented Michigan as its Senator, and was the sponsor of the Republican party in 1854, the drawing up of the platform at the first convention being also attributed to him. He is known in the literary world by his translation of the *Secret Memoirs of the Empress Josephine*, from the French.

Howard (John), b. at Hackney, near London, Sept.

2, 1726. From his father he inherited a considerable fortune, and he spent his youth in studying medicine and in travelling. Having settled at Cardington, Bedfordshire, in 1758, and having made himself conspicuous by his schools and model cottages for the peasantry, he was elected sheriff in 1773. On visiting the jails he became acquainted with the intolerable conditions under which prisoners lived; thus it often happened that a man spent several years in jail because he could not pay the jailer's fee for his deliverance. Howard now travelled through the whole kingdom, visited all its jails, and presented in 1774 a report to the House of Commons, the result of which was the passing of two reform bills. Next he went to the Continent, visited France, Germany, and Holland, examined their prisons, and published on his return, in 1777, *State of the Prisons in England and Wales, with Preliminary Observations and an Account of some Foreign Prisons*, to which he afterward added supplements, having made new travels and new researches. The immediate result was the adoption, on trial, of the hard-labor system in some of the English prisons. In 1785 he started on a new tour through Italy, Turkey, and Asia Minor, in order to make himself acquainted with the lazarettos, and on his return published, in 1789, *An Account of the Principal Lazarettos of Europe*. In order to push his researches into this subject still further, he started in the same year on a tour to Asia, but d. Jan. 20, 1790, at Kherson, Russia.

Howard (John Eager), b. in Baltimore co., Md., June 4, 1752; served throughout the Revolutionary war with the greatest honor, and was present upon most of the important battle-fields of the war, attaining the rank of lieutenant-colonel, and receiving a medal from Congress for his valor at the Cowpens, Jan. 17, 1781. He was a member of Congress 1787–88; governor of Maryland 1789–92; U. S. Senator 1796–1803; and in 1798 was appointed a brigadier-general by Washington. He was a man of wealth, and his reputation for valor and patriotism made his old age one of great honor. D. Oct. 12, 1827.

Howard (Oliver Otis), LL.D., b. at Leeds, Me., Nov. 8, 1830; graduated at Bowdoin College 1850, and at the Military Academy 1854, when he was promoted in the army to be brevet second lieutenant of ordnance; promoted to be second lieutenant Feb., 1855, first lieutenant July, 1857; served as assistant at, and in command of, arsenals 1854–56; as chief of ordnance against hostile Indians in Florida 1857; and at the Military Academy as assistant professor of mathematics from Sept., 1857, to June 3, 1861; resigned June 7, 1861. Appointed colonel of the third Maine Vols. June 4, 1861, and commanded a brigade in the battle of Bull Run, July 21; appointed brigadier-general of volunteers Sept., 1861; served in the Virginia Peninsular campaign 1862, and at the battle of Fair Oaks (June 1) was twice wounded, losing his right arm; rejoined the army Aug., 1862, and was engaged in the battles of Antietam and Fredericksburg; appointed major-general of volunteers Nov., 1862; at the battle of Chancellorsville (May, 1863) he commanded the 11th army corps, as also at Gettysburg, July, 1863. Transferred with his command to Tennessee Oct., 1863, he was engaged in the battles of Lookout Valley and Missionary Ridge. In Apr., 1864, the 11th and 12th corps were united to form the 20th corps, and Gen. Howard was assigned to the command of the 4th corps, Army of the Cumberland, and in the July following to that of the Army of the Tennessee, being engaged around Dalton, at Resaca, Kenesaw Mountain, siege and occupation of Atlanta, and in the various actions and battles during the famous march to the sea with Gen. Sherman, and subsequent invasion of the Carolinas, terminating with the surrender of Gen. J. E. Johnston at Durham Station, N. C., Apr. 26, 1865. Appointed commissioner of Bureau of Refugees, Freedmen, and Abandoned Lands May, 1865, which position he retained till June, 1872; served as special commissioner of Indian affairs 1865, and was president of Howard University 1869–73. Gen. Howard was appointed a brigadier-general in the U. S. army Dec. 21, 1864, and brevet major-general U. S. A. 1865.

G. C. Simmons.

Howard (William A.), b. in Vermont; graduated at Middlebury College 1839; moved to Michigan, from which State he was a leading member of Congress on the anti-slavery side 1855–61. Being a man of high order of talents, strong convictions, and unquestioned integrity, he had not only the respect but the esteem of his most decided opponents. Became postmaster of Detroit 1861.

A. H. Stephens.

How'ard Cen'tre, post-tp. of Howard co., Ia. P. 294.

How'ard Cit'y, post-v. of Montcalm co., Mich., 33 miles N. of Grand Rapids, on the Detroit Lansing and Lake Michigan and the Grand Rapids and Indiana R. Rs. It has good graded schools, 3 churches, an exchange bank, 1 newspaper, several large lumber, shingle, and planing mills, 2 hotels, and stores. Pop. about 1000.

W. E. Morris, Ed. "Record."

How'ardsville, post-v., cap. of La Plata co., Col.

Howardsville, post-v. of Scottsville tp., Albemarle co., Va. Pop. 83.

How'ard Univer'sity, an educational foundation situate at Seventh street, Washington, D. C., established by virtue of a charter granted by Congress in 1867, and deriving its patronymic from one of its most prominent founders, Gen. O. O. Howard, who continued to occupy the presidential chair until 1873, when he resigned. Though neither creed, color, nor sex is permitted to preclude admission to the ranks of its alumni, the institution was specially designed for colored people, of which fully two-thirds of its students consist. In 1872–73 the total number receiving instruction in the several departments (the normal, preparatory, collegiate, theological, legal, and medical) was 567. The university is placed under the management of twenty-one trustees; and though the U. S. government granted aid at its establishment, it is now entirely dependent upon voluntary contributions and the fees of students for its support. It possesses a library of 7500 volumes, a picture-gallery, a mineralogical collection, and a museum of curiosities. The terms of study allotted for the students in the various departments are—normal department, 2 years; preparatory, 3 years; collegiate, 4 years; theological, 2 years; law, 2 years; and medical, 3 years. Over fifty students have already graduated from this institution.

Howe, tp. of Forest co., Pa. Pop. 78.

Howe, tp. of Perry co., Pa. Pop. 410.

Howe (Albion Paris), b. at Standish, Me., Mar. 13, 1818; graduated from the U. S. Military Academy, and appointed second lieutenant of artillery July 1, 1841; after a term of two years passed on frontier and garrison duty, he returned to West Point as assistant professor of mathematics, where he remained until 1846; served throughout the war with Mexico with credit from Vera Cruz to the city of Mexico, winning the brevet of captain for Contreras and Churubusco. From 1848 to 1861 the monotony of garrison-life was relieved by occasional expeditions against Indians, and in 1859 he was at Harper's Ferry during the John Brown insurrection; on the outbreak of the civil war he was a captain of artillery, and accompanied Gen. McClellan in his campaign in West Virginia, at Rich Mountain, etc., and throughout the Virginia Peninsular campaign (1862) in command of light artillery brigade, having been appointed brigadier-general of volunteers June 11, 1862; subsequently in all the various battles of the Army of the Potomac, in command of a brigade and division of the 6th army corps, until the spring of 1864, when he was assigned to duty in Washington as inspector of artillery. At present serving on the Pacific Coast with his regiment (4th Artillery), of which he is major. G. C. Simmons.

Howe (Elias), inventor of the sewing-machine, b. at Spencer, Mass., July 9, 1819; was the son of a farmer and miller; went in 1835 to Lowell, and worked there, and afterwards in Boston, in machine-shops. In 1845 he completed his first machine, and patented it in 1846, laboring with the greatest persistency, in spite of poverty and neglect, working for a time as an engine-driver on a railroad for small wages and with broken health. He spent two years of unsuccessful exertion in England, striving in vain to bring his invention into notice. He returned to the U. S. in almost hopeless poverty, to find that his patent had been violated; but he at last found friends who assisted him with money, and after years of litigation he made good his claims in the courts in 1854. He afterwards realized a large fortune from his invention. During the civil war he volunteered as a private of the 17th Connecticut volunteers, and served for some time. He received the cross of the Legion of Honor and many medals. D. at Brooklyn, N. Y., Oct. 3, 1867.

Howe (John), b. May 17, 1630, in Leicestershire, England; d. Apr. 2, 1705; completed his education at Cambridge and Oxford. After holding for several years a rural curacy, he was appointed (1654) domestic chaplain to Cromwell, a position he held until the death of the Protector (1658). He was an eloquent preacher, and universally esteemed for his ability and Christian character. He was the friend of Baxter, and labored in the same line with him for Christian unity. He was one of the leading controversialist writers of his day among the nonconformist party, but free from all animosity and bitterness. His principal works are — *The Oracles of God*, *The Living Temple*, *The Redeemer's Tears over Lost Souls*, and *The Blessedness of the Righteous*. Editions of his *Complete Works* during the present century have been issued at London,

1810–22, 8 vols.; ibid., 1848, 3 vols.; and at Philadelphia, 2 vols. The best biography is that of Rogers, London, 1836.

Howe (Hon. Joseph), b. in Halifax, N. S., in 1804, was the son of John Howe, a loyalist refugee from Boston. He was bred a printer, and in 1827 became connected with the *Acadian* newspaper, and in 1828 editor and proprietor of the *Nova Scotian*. As an outspoken liberal and friend of responsible government he was involved in a vexatious libel-suit and fought a duel with Mr. Haliburton. As a member of the Provincial Parliament, colonial agent in England, provincial secretary, etc., he was long one of the most prominent men in Nova Scotia, and was one of the founders of responsible government in the province. He was (1869–72) secretary of state for the provinces in the Dominion government, and superintendent of Indian affairs, and afterwards became a member of the Dominion Parliament for Hants, N. S.; was afterwards lieutenant-governor of Nova Scotia. He published two volumes of *Speeches and Public Letters* (1858). D. at Halifax June 1, 1873.

Howe (Julia Ward), the daughter of Mr. Samuel Ward and the wife of Dr. S. G. Howe, b. in New York May 27, 1819; married Dr. Howe in 1843. Her *Passion Flowers* (1854), *Words for the Hour* (1856), and *Later Lyrics* (1866) contain her most important lyric poems. *The World's Own* (1855) and *Hippolytus* (1858) are dramas. She has also published two volumes of travel, and many able papers upon social and philosophical subjects. Many of her poems are of a high order of merit. She is an active worker in the woman's suffrage movement.

Howe (Richard), Earl, b. Mar. 19, 1725, was the third son of the second Viscount Howe; studied at Eton and Westminster; became a midshipman under Anson 1739; post-captain for gallantry at Fort William 1745; captured Cherbourg and Martignan 1758; succeeded his brother as viscount (Irish peerage) 1758; defeated Conflans 1759; treasurer of the navy 1765; rear-admiral of the blue, with chief command in the Mediterranean, 1770; with William Howe, his brother, was appointed commissioner to avert the war in the American colonies 1776; fought D'Estaing off Rhode Island 1778; became admiral and viscount in the British peerage, by creation, 1782; relieved Gibraltar in 1782; first lord of the admiralty 1783; created earl 1788; took command of the Channel fleet 1793; defeated the French off Brest 1794; K. G. and general of marines 1795. D. in London Aug. 5, 1799. Howe was of a stock related closely to the royal family by illegitimate descent.

Howe (Samuel Gridley), M. D., b. in Boston Nov. 10, 1801; graduated at Brown University in 1821; was a surgeon in the Greek war for liberty 1824–27; organized the surgical service and was placed at its head. He then returned to America for aid, and afterwards founded a colony on the Isthmus of Corinth. In 1831 he visited Europe again after his appointment to the superintendency of the Perkins Asylum for the blind, and while there attempted, as president of the Polish committee of Paris, to carry aid to the struggling Poles, but was imprisoned for six weeks in Prussia. Since 1832 he has had charge of the Perkins Institute for the blind, South Boston, Mass. He was long a prominent abolitionist. In 1871 he was one of the U. S. commissioners to Santo Domingo. Author of *An Historical Sketch of the Greek Revolution* (1828), *Reader for the Blind* (1839).

Howe (Timothy O.), b. at Livermore, Me., Feb. 24, 1816; received an academic education; adopted the profession of law and was admitted to the bar; member of State legislature 1845; removed to Wisconsin late in 1845, and in 1850 was elected judge of the circuit and supreme courts of Wisconsin, which position he held until 1855, when he resigned. Chosen U. S. Senator for Wisconsin in 1861, and has been twice re-elected.

Howe (Sir William), Viscount, b. Aug. 10, 1729, brother of Richard, Earl Howe; studied at Eton; entered the dragoons; served at Quebec under Wolfe; colonel of the 4th Foot 1764, and major-general 1772; took the chief command in North America 1775, after Gage's departure, Howe having previously commanded at Bunker Hill; evacuated Boston Mar., 1776; went to Halifax, and thence to Staten Island; gained the battle of Long Island Aug. 27; occupied New York Sept. 15; won the victory of White Plains Oct. 28; of Fort Washington Nov. 16; of Brandywine Sept. 11, 1777; occupied Philadelphia Sept. 26; repulsed Washington at Germantown Oct. 4; was superseded by Sir H. Clinton in 1778; returned to England, where his conduct was vindicated after a parliamentary investigation; became a lieutenant-general 1782; general 1786; succeeded to the Irish peerage as viscount 1799. D. July 12, 1814.—The families both of Earl and Viscount Howe are now extinct, the present Earls Howe being of the Curzon family, ennobled in 1788 and raised to the earldom in 1821.

How'ell, county of Missouri, bounded on the S. by Arkansas. Area, 864 square miles. Its soil is fertile, and it is extensively covered with pine forests. Corn is the principal product. Cap. West Plains. Pop. 4218.

Howell, post-v., cap. of Livingston co., Mich., 50 miles N. W. of Detroit, on the Detroit Lansing and Lake Michigan R. R., is surrounded by a fine agricultural district; has good educational advantages, 3 churches, 2 banks, foundry and machine shop, sash and door factory, 2 flouring-mills, 2 newspapers, stores, etc. Principal occupation, dealing in agricultural products and implements. Pop. of tp. 2563.
J. D. Smith, Ed. "Livingston Republican."

Howell, tp. of Howell co., Mo. Pop. 976.

Howell, tp. of Monmouth co., N. J. It contains a number of villages. Pop. 3371.

Howell (David), LL.D., a native of New Jersey, was b. in 1747, and d. in July, 1824. At the age of twenty-three he was appointed professor of natural philosophy and mathematics, and filled the chair of law at the Brown University from 1790 to 1824. In the interval he filled the several offices of attorney-general of the State, judge of the supreme court, member of the Continental Congress, commissioner for settling the eastern boundary of the U. S., district attorney, and subsequently district judge for Rhode Island, which he retained till his death. He was equally distinguished as a classical scholar and forcible political argumentator.

Howell (John Adams), U. S. N., b. Mar. 16, 1840, in New York; graduated at the Naval Academy 1858; became a lieutenant in 1861, a lieutenant-commander in 1865; served as executive officer of the Ossipee at the battle of Mobile Bay, Aug. 5, 1864, and is honorably mentioned in the despatches of his commanding officer, Com. W. E. Le Ray. Foxhall A. Parker.

Howell (John C.), b. Nov. 24, 1819, in Philadelphia; entered the navy as a midshipman June 9, 1836; became a passed midshipman in 1842, a lieutenant in 1849, a commander in 1862, a captain in 1866, a commodore in 1872; was executive officer of the steam-frigate Minnesota at the battle of Hatteras Inlet, which resulted in the capture of Forts Hatteras and Clark, and commanded the Nereus in both the Fort Fisher fights. For "cool performance of duty" recommended for promotion by Rear-admiral Porter Jan. 28, 1865; from 1868 to 1870 chief of staff of the European fleet; from 1870 to 1872 commandant of navy-yard at League Island, Philadelphia; from 1872 to 1874 commandant of navy-yard at Portsmouth, N. H.; in Sept., 1874, appointed chief of the bureau of yards and docks.
Foxhall A. Parker.

Howell (Robert Boyté Crawford), D. D., b. in Wayne co., N. C., Mar. 10, 1801; graduated at Columbian College 1826; pastor of Baptist church, Norfolk, Va., 1827–35; Nashville, Tenn., 1835–50; Richmond, Va., 1850–57; Nashville, Tenn., 1857–68; and rendered good service to the cause of education. He wrote several works; the best known is *On the Deaconship*. D. at Nashville, Tenn., Apr. 5, 1868.

How'ells (William Dean), b. at Martinsville, Belmont co., O., Mar. 1, 1837; removed to Hamilton, O., in 1840 with his father, who was a printer. His father was of Welsh, his mother of Pennsylvania-German stock. Mr. Howells learned the printer's trade of his father, and was afterwards editorially connected with the Cincinnati *Gazette* and the *Ohio State Journal*. He was (1861–65) U. S. consul at Venice. In 1871 he became editor-in-chief of the *Atlantic Monthly*. He is one of the most facile and readable authors of our time, a graceful poet, and a writer of dainty, elegant prose. His works are *Poems of Two Friends* (written with J. J. Piatt, 1860), *Venetian Life* (1866), *Italian Journeys* (1867), *No Love Lost* (1868), *Suburban Sketches* (1870), *Their Wedding Journey* (1872), *A Chance Acquaintance* (1873), and *A Foregone Conclusion* (1874).

How'ellsville, tp. of Robeson co., N. C. Pop. 1023.

Howe's Cave, post-v. and station on the Albany and Susquehanna R. R., in Cobleskill tp., Schoharie co., N. Y. It has a large natural cave and important quarries and limekilns.

How'ison (Robert R.), b. at Fredericksburg, Va., in 1820, has been since 1845 a prominent lawyer of Richmond. He has published a *History of Virginia* (2 vols., 1846–48), *Lives* of Morgan, Marion, and Gates, *Criminal Trials* (1851), a *History of the War of 1861–65*, and other works.

How'itt (Mary), wife of William Howitt, b. at Uttoxeter, England, about 1804, the daughter of a Mr. Botham, a Quaker; was married in 1823; has written many poems, hymns, and ballads, some novels, and instructive books for the young; translated Miss Bremer's works and some of those of H. C. Andersen, and was with her husband joint author

of *The Literature and Romance of Northern Europe* (1852) and other valuable works.—Her daughter, MRS. ANNA MARY WATTS, is author of *The Art Student in Munich* (1853), *The School of Life*, etc., and a painter of merit.—Another daughter is a successful writer of books.

Howitt (WILLIAM), b. at Heanor, Derbyshire, in 1795, of Quaker stock. His first books were written partly by his wife, Mary Howitt. He also published a *History of Priestcraft* (1834), *Rural Life in England* (1837), *Student Life in Germany* (1841), *Rural and Domestic Life in Germany* (1842), *Land, Labor, and Gold* (1855), an account of his experiences in Australia; a *History of England* (6 vols., 1854–61), and translations from the German.

How′itzer [derived by Grimm and Littré from the Bohemian *haufnice*, "catapult"], a short cannon for firing shells *horizontally*, differing in this from the *mortar*, which is used for *vertical fire*. It was introduced by the Dutch in 1606, and soon became of general use, except by the French, who, considering it of small value because of the short range and inaccurate fire, did not introduce it until after Napoleon's wars had shown him its value. The howitzer was made with a chamber for the powder (of smaller diameter than the bore), and with a length of bore regulated to admit of the shell being reached by the hand, to adjust the fuze in the axis, after the gun was loaded. After the adoption of *sabots* (a block of wood to which the shell is attached) this could be secured in long guns, and the howitzers for field and garrison service were then made of greater length and came into universal use. The siege howitzer, generally of 8-in. diameter, is still made short, as the sabot cannot be safely used if the gun is fired over advance parties, as is necessary in siege firing. The first cannon cast by the colonial authorities of America were 8-in. and 24-pdr. brass howitzers, some of which are now preserved. The Russians in 1777 introduced the *licorne*, an improved howitzer. Howitzers, except for siege and mountain service, are no longer manufactured in the U. S., as our present guns are equally suitable for shell-firing in field or garrison service. P. V. HAGNER.

How′land, post-tp. of Penobscot co., Me., on the W. side of the Penobscot River, 32 miles N. of Bangor, Me., near the European and North American R. R. It has manufactures of lumber. Pop. 176.

Howland, tp. of Trumbull co., O. Pop. 664.

Howland (HON. WILLIAM PEARCE), C. B., b. in the State of New York May 29, 1811. He removed when young to Canada, and became one of the wealthiest merchants of the Upper Province. In 1858 he was elected to the Parliament of Canada; in 1862 became minister of finance; in 1863 receiver-general; in 1864 postmaster-general; in 1866 minister of finance; was sent as a delegate to England, and was made a C. B.; in 1868 became lieutenant-governor of the province of Ontario. He is a liberal in politics.

Howl′ing Mon′keys, a genus of prehensile-tailed monkeys of South America, of a low grade of intelligence, fierce and untamable disposition, and large size. Some twelve or fourteen species are reported. The genus (*Mycetes* or *Aluatta*) is distinguished from all others by the presence of a great chamber within the hyoid bone and communicating with the larynx. The possession of this chamber gives these monkeys the power of producing those tremendous howls which in the night re-echo for half a league through the Brazilian forests. This hideous roar is probably an amorous serenade. The ursine howler (*M. ursinus*) is the best known species.

Hows (JOHN A.), b. in New York City in 1831, and d. in the same city Sept. 27, 1874. He graduated at Columbia College, and after studying first for the ministry, and afterwards for the law, besides being connected with religious and society journals, adopted art as his profession. He painted several pictures which achieved considerable prominence, but his best known works were his drawings on wood. Among the books which were illustrated by him exclusively were *A Forest Hymn, In the Woods, Forest Pictures in the Adirondacks, A Christmas Carol,* and Coxe's *Christian Ballads.* J. B. BISHOP.

How′son (JOHN SAUL), D. D., b. in England in 1816; graduated with high honors at Cambridge in 1837; was ordained in 1845, and was principal of the Liverpool College 1849–65; became dean of Chester in 1867, and is examining chaplain to the bishop of Ely. With W. J. Conybeare he published (in 1850–52) *The Life and Epistles of St. Paul*, furnishing the principal part of the geographical and historical matter. He has also published *The Character of St. Paul* (1862; 3d ed. 1871), *The Metaphors of St. Paul* (1868), *The Companions of St. Paul* (1871).

Höx′ter, town of Westphalia, Prussia, anciently a Hanse town. It is 28 miles E. N. E. of Paderborn, and stands on the Weser. It is a place of venerable antiquity, and has brisk manufactures of flax, cotton, and paper. Pop. 5041.

Hoy, one of the Orkney Islands, 2½ miles from Pomona. It presents a coast of wild, precipitous cliffs, in some places more than 1000 feet high, but to the S. it has a fine harbor at Longhope. Pop. 1486.

Hoyle (EDMUND), author of several works on games, was an Englishman, b. 1672, and d. 1769. Since his death there have been many much improved editions, British and American, of *Hoyle's Games.*

Hoyt (BENJAMIN THOMAS), son of the Rev. Benj. R. Hoyt, b. at Boston Oct. 18, 1820; was successively teacher, professor, and president in various collegiate and educational institutions, and editor of the *Indiana State School Journal.* From 1846 to 1852 he occupied the position of principal in the schools of Middletown, Conn., and Chelsea, Mass. From 1852 to 1858 he was president of the institute of Lawrenceburg, and of the College for Young Women in Indianapolis. He was professor of Latin from 1858 to 1863, and professor of belles-lettres and history in the Indiana Asbury University until his death at Greencastle, Ind., in 1867. His services to the cause of education in Indiana as superintendent of schools, as president of the State Teachers' Association, and as an educational writer were invaluable.

Hoyt (EDWIN), b. in Stamford, Conn., in May, 1805. When nineteen years old he became a dry-goods merchant of New York. In 1835 the firm of Hoyt & Bogart was established, afterwards Hoyt, Tillinghast & Co. In 1858 the firm of Hoyt, Spragues & Co. was constituted. Mr. Hoyt d. in New York May 15, 1874. At the time of his death he was the oldest dry-goods merchant in New York, universally honored for probity and mercantile rectitude.

Hoyt (FRANCIS SOUTHACK), D. D., b. at Lyndon, Vt., Nov. 5, 1822; graduated at Wesleyan University, Middletown, Conn., in 1844; was president of Willamette University, Salem, Or., 1854–60; professor of chemistry, etc. in the Ohio Wesleyan University 1860–72; and in 1872 became editor of the *Western Christian Advocate.*

Hoyt (JOSEPH GIBSON), LL.D., b. at Dunbarton, N. H., in Jan., 1815; graduated at Yale College 1840; became instructor in mathematics and natural philosophy, and subsequently for eighteen years fulfilled the duties of member of the faculty in Phillips Academy, Exeter, N. H., from 1841 to 1858; and was appointed chancellor and professor of Greek in Washington University, St. Louis, from 1859 to his decease at St. Louis, Mo., in 1862. His chief literary labors comprised a carefully revised and enlarged *Colton's Greek Reader*, and a volume of miscellaneous writings, reviews, lectures, and addresses.

Huaca. See GUACA, by COM. FOXHALL A. PARKER, U. S. N.

Hualapais′ Indians, a hostile tribe of Arizona, found near the Colorado, N. of the Mohaves. They number some 1500.

Hualla′ga, a river of Peru, rises in the Andes in lat. 11° S., and empties itself into the Amazon after a northerly course of nearly 500 miles.

Huamanga. See AYACUCHO.

Huancaveli′ca, or **Guancabelica,** town of Peru, situated in the Andes at an elevation of 11,000 feet, and engaged chiefly in mining gold and quicksilver. It is regularly built, is the capital of a province of the same name, but is rather decreasing. Pop. 5000.

Huan′ta, a well-built town in the department of Ayacucho, Peru, about 200 miles S. E. of Lima. It has a large trade in drugs, grain, and cattle. Pop. 5000.

Hua′nuco, or **Guanuco,** town of Peru, situated in an exceedingly beautiful and fertile valley of the Andes. Sugar and coffee are raised here, both of excellent quality, but as there are no roads, they cannot be raised for exportation. The town is decaying. Pop. 5000.

Huaraz′, town of Peru and the capital of the department of Huaraz, on the Santa. It is a beautifully situated and well-built town, with about 8000 inhabitants, mostly mestizoes, engaged in agriculture and garden cultivation.

Hub′bard, tp. and post-v. of Trumbull co., O., on a branch of the Atlantic and Great Western R. R. Here are important coal-mines. Pop. of v. 1126; of tp. 4588.

Hubbard, tp. of Dodge co., Wis. It contains the village of HORICON (which see). Pop. 3008.

Hubbard (DAVID), b. in Virginia, removed to Lawrence co., Ala., and in 1842 entered the State legislature, having previously for many years been connected with the State government; was in Congress 1839–41 and 1849–51; a man of decided ability, and an extreme State rights man; was a prominent State legislator, and after the war of 1861–65 removed to Nashville, Tenn.

Hubbard (Henry), b. at Charlestown, N. H., May 3, 1784; graduated at Dartmouth in 1803; became a lawyer, and was several times Speaker of the New Hampshire House; judge of probate in Sullivan co. 1827–29; Democratic member of Congress 1829–35, and for a short time Speaker; U. S. Senator 1835–41; governor of New Hampshire 1842–43; U. S. assistant treasurer 1846–49. D. at Charlestown, N. H., June 5, 1857.

Hubbard (John), M. D., LL.D., b. at Readfield, Me., Mar. 22, 1794; graduated at Dartmouth in 1816; taught in Maine and Virginia; practised medicine in Dinwiddie co., Va., 1822–29, and in 1830 removed to Hallowell, Me.; was State senator 1842–43; governor of Maine 1850–53, and a Maine-law Democrat; agent for the U. S. treasury 1857–59; commissioner under the Reciprocity Treaty 1859–61. D. at Hallowell, Me., Feb. 6, 1869.

Hubbard (Joseph Stillman), b. Sept. 7, 1823, at New Haven, Conn.; graduated at Yale College in 1843; in 1844 was appointed an assistant in the High School Observatory at Philadelphia, then in charge of the distinguished astronomer, Sears C. Walker. The next autumn he was employed by Capt. (afterwards Maj.-Gen.) Fremont to reduce his Rocky Mountain observations, and was invited to accompany him on his next expedition. Declining this offer, he was appointed and commissioned a professor of mathematics in the U. S. navy May 7, 1845, at the instance of Fremont and Senator Benton, and was at once assigned to duty in the Naval Observatory at Washington, where he remained until the time of his death. He soon acquired a brilliant reputation, and the printed volumes of the Washington observations are full of the evidences of his skill as an observer and computer. He was a frequent contributor to the *Astronomical Journal*, which contains his elaborate investigations on Biela's comet, as also those on the great comet of 1843, on the orbit of Egeria, and on other subjects. D. Aug. 16, 1863. G. C. Simmons.

Hubbard (Samuel Dickinson), LL.D., b. at Middletown, Conn., Aug. 10, 1799; graduated at Yale in 1819; was a lawyer and a wealthy and benevolent manufacturer; a Whig member of Congress 1845–49; postmaster-general 1852–53. D. at Middletown, Conn., Oct. 8, 1855.

Hubbard (William), b. in England in 1621; came in youth to New England; graduated at Harvard College 1642; settled as minister of Ipswich, Mass., 1658; temporary president of Harvard University in 1688; and d. at Ipswich Sept. 14, 1704. Author of *The Present State of New England* (1677), *Memoirs of Maj.-Gen. Denison* (1684), and a *History of New England*, for which the colonial authorities paid him £50. Editions of this work were printed in 1815 and 1848.

Hub'bardston, post-tp. of Worcester co., Mass., 64 miles W. N. W. of Boston. It is traversed by the Boston Barre and Gardner and the Ware River R. Rs.; has a fertile soil and manufactures of chairs and boxes. It has 3 churches and a public library. Pop. 1654.

Hubbardston, post-v. of Ionia co., Mich., 6 miles from the Detroit and Milwaukee R. R. It has 3 churches, a flouring-mill, foundry, and steam saw-mill, sash and blind factory, 5 dry-goods and clothing stores, 2 drug stores, mineral springs, 1 newspaper, and good water-power. Pop. 531. A. V. Phister, Ed. "Advertiser."

Hub'bardsville, post-v. of Hamilton tp., Madison co., N. Y. Pop. 117.

Hub'bardton, post-tp. of Rutland co., Vt., 7 miles N. of Castleton. It has 2 churches and manufactures of leather. Here the Americans under Warner and Francis were defeated by the British and Hessians under Fraser, July 7, 1777. Pop. 606.

Hub'ble, tp. of Cape Girardeau co., Mo. Pop. 1689.

Hu'ber (François), b. at Geneva July 2, 1750. Before the age of fifteen he had completed a course of physics under De Saussure, and familiarized himself with practical chemistry in the laboratory of a relation. Inheritance and education combined to awaken early in him a passion for natural history, but intense application and study at night by dim lamplight or moonlight forced him for a time to suspend his studies. His father took him to Paris, when he was just fifteen, to consult the best physicians. Tronchin ordered him to spend some months in the performance of common farm-work, which soon restored his general health, but his ophthalmia was declared incurable, and he became, in a few years, totally blind. He married Marie Aimée Lullin, a wife who proved unfailing in her tenderness and devotion. By the aid of his wife, his son, and an intelligent peasant named Francis Burnens, whom he trained to the work of observation, Huber devoted his life to the study of bees. He discovered that the fertilization of the queen-bee takes place in the air, and but once, and that a queen whose impregnation is deferred beyond the twenty-first day produces only drones. He confirmed Schirach's statement that bees when left queenless can convert a worker-larva into a queen by enlarging its cell and supplying it with different food. He determined the fact of the yearly massacre of the drones, and that it takes place only when swarming-time is past and a fertile queen secured. He observed that queens manifest bitter animosity against each other, engage in combats if there are two in the hive at the same time, and destroy all royal pupæ. He investigated the question of the modification of bees in consequence of the size of cells in which they are reared, and witnessed through blown-glass cells all the processes of the cocoon-spinning. He examined into the senses of bees, and determined their seat, and discovered that they use their antennæ for the communication of ideas and for the accurate performance of their varied work within the darkened hive. He found that the workers were of two kinds—wax-workers and nurse-bees—demonstrated the origin of propolis, and discovered the whole secret of the secretion and manipulation of wax for building purposes. He detected the *Sphinx atropos* in its ravages in the hive, and witnessed the bees' contrivances for their own protection. He found that bees respired, absorbing oxygen and evolving carbonic acid, and that the purity of the air is maintained by a system of ventilation, the currents of air being induced by the rhythmic motion of their wings. By means of dissections made at his request by Mdlle. Jurine he exploded the theory of neuters, and proved the worker to be an imperfectly developed female. The record of his work he first gave to the world under the title of *Lettres à Ch. Bonnet* (1792). In 1796 other discoveries were added to the former, and the new edition was entitled *Nouvelles Observations sur les Abeilles.* Later editions have included his subsequent observations under the same title. In connection with Senebier he published the *Mémoire sur l'influence de l'air dans le germinations des grains* (Geneva, 1801). To this last work he contributed only the materials, which were worked into form and recorded by Senebier. He d. Dec. 22, 1831, in full possession of all his faculties. The work done by Huber in his own department perhaps equals that done by all observers before and since; his observations are almost without a flaw, and his generalizations remarkably accurate. Mrs. S. B. Herrick.

Huber (Johann Nepomuk), b. in Munich Aug. 18, 1830; graduated at the university of his native city 1854; became in 1859 professor of theology, at which time he published his *Philosophie der Kirchenväter*, which was soon after placed in the *Index Expurgatorius.* He was the avowed antagonist of the Ultramontanists; and they, in turn, used every effort to coerce him to silence, but without success. In 1871 he took a prominent part as a leader in the war against the Jesuits, and was an active and formidable opponent of the dogma of papal infallibility, in connection with the Old Catholic movement in Bavaria. He wrote several other polemical works and pamphlets in support of his peculiar views.

Huber (Pierre), b. at Geneva Jan. 23, 1777. He made investigations upon humble-bees, ants, butterflies, etc. His work is recorded in sixteen memoirs, to be found in *Bibl. Britannique* (1804 and 1805), and in the *Mémoires Soc. Phys.* (Geneva, from 1821 to 1843). He assisted his father in the observations and publication of the second part of *Nouvelles Observations sur les Abeilles.* His most valuable work is translated under the title *History of the Nature and Habits of Ants* (1820). D. at Yverdun Dec. 22, 1840.
Mrs. S. B. Herrick.

Hub'ley, tp. of Schuylkill co., Pa. Pop. 547.

Hub'meyer, or **Hübmaier** (Balthasar), one of the originators of the Anabaptist movement in Germany in the first part of the sixteenth century, b. about 1480 at Friedberg, near Augsburg; studied theology and philosophy at Freiburg under Eck 1503; became professor of theology in Ingolstadt in 1512, and in 1516 preacher at the cathedral of Regensburg, whence he removed in 1523 to Waldshut. Here he embraced the Reformation, but began soon to develop original, or rather separatist, ideas, especially after his acquaintance with Thomas Mümzer. He taught that it was wrong to baptize small children; the baptism ought not to take place until the full-grown man demands it as the external symbol of his faith. As Hubmeyer was a very gifted preacher, his whole congregation adopted his ideas, but soon the Austrian government interfered, and he then fled (in 1525) to Zurich. Imprisoned and persecuted here also, he went to Nikolsberg in Moravia, where he formed a large Anabaptist congregation. Although he was a sound and clear-minded man himself, he could not prevent the religious fanaticism and social eccentricities which generally characterized the Anabaptists from breaking out in his congregation. Disorders arose, and

when, at the death of Ludwig of Hungary, Moravia fell to Ferdinand of Austria, Hubmeyer was seized, carried to Vienna, sentenced to death, and burned at the stake, Mar. 10, 1528. Some of his writings were collected and published in 1746. (See ANABAPTISTS and BAPTISTS.)

Hübner (JOSEPH ALEXANDER), BARON, b. at Vienna Nov. 26, 1811. Having completed his studies at Vienna, he travelled in Italy, and on his return (in 1833) was introduced by Prince Metternich into the service of the government. His diplomatic career began at Paris in 1837. After several minor appointments he was sent ambassador to Paris in 1849, and recalled in 1859. It was to him, on New Year's Day, 1859, that Napoleon III. addressed the remark which foreshadowed the impending Franco-Austrian war. From 1866 to 1867 he was a second time at the head of the Austrian embassy at Rome. He has managed many delicate and difficult matters with consummate ability and tact. He visited the U. S. in 1870, and again in 1871, when he went around the globe. He is now (1875) residing in Rome. He has published an admirable work on Pope Sixtus V.—*Sixtus der Fünfte* (2 vols. 1871; English trans. 1872), and a charming account of his ramble around the globe—*Promenade Autour du Monde* (1873; 3d ed. 1874; Eng. trans. 1874). R. D. HITCHCOCK.

Huc (ÉVARISTE RÉGIS), b. Aug. 1, 1813, in Toulouse, where he studied theology; entered the order of the Lazarists and took holy orders in 1839. Immediately after he set out for Macao, where he lived for eighteen months, studying the Chinese language. With his skin dyed, his head shaved, and in Chinese costume he then travelled from Canton through the interior of the empire to Peking, and from Peking to He-Shuy in Mongolia. In 1844 he started from He-Shuy for Lhassa in Thibet, which he reached in 1846, but had to leave after a stay of a few months. He now travelled through the southern parts of the empire to Canton, and in 1852 he left China in order to return home. His health had suffered very much, and he d. in Paris Mar. 31, 1860. Published *Souvenirs d'un voyage dans la Tartarie, le Thibet, et la Chine* (2 vols., 1852), *L'Empire Chinois* (2 vols., 1854), *Le Christianisme en Chine, en Tartarie, et en Thibet* (4 vols., 1858), all translated into English.

Huck'leberry and **Blueberry,** names applied to the North American representatives of the WHORTLEBERRY (which see) of Europe. Our huckleberry-bushes are ericaceous shrubs of the genera *Gaylussacia* and *Vaccinium*. The berries are extensively marketed, and eaten as dessert fruit and in pies and puddings. *Gaylussacia brachycera, dumosa, frondosa, resinosa,* and *ursina* furnish most of the proper huckleberries, mostly hard and dark-colored fruits; the blueberries, generally lighter-colored, softer, and sweeter than the huckleberries, are mostly from *Vaccinium Pennsylvanicum, Canadense, vacillans, corymbosum,* and others. The annual product and the money-value of fruits of these two genera are very great.

Hud'dersfield, town of England, in the county of York, at the confluence of the Holme and the Colne. It has very large manufactures of cloths, kerseymeres, flushings, and serges, extensive coal-mines in the vicinity, and easy communication with all important commercial points of England. Pop. 70,253; of parliamentary borough, 74,358.

Hud'son, county of the N. E. of New Jersey, bounded on the E. by the Hudson River and New York harbor. Area, 180 square miles. Its eastern border is marked by the Palisades, a remarkable ridge of trap-rock. The county is almost entirely suburban to New York City. It has manufactures of cigars, clothing, and many other kinds of goods. It is traversed by numerous railroads, centring at Jersey City and Hoboken, its largest cities. Cap. Jersey City. Pop. 129,067.

Hudson, tp. and post-v. of McLean co., Ill., on the Illinois Central R. R., 8 miles N. of Bloomington. P. 1392.

Hudson, tp. of La Porte co., Ind. Pop. 636.

Hudson, post-tp. of Penobscot co., Me., 15 miles N. N. W. of Bangor. It manufactures lumber. Pop. 739.

Hudson, tp. and post-v. of Middlesex co., Mass., 16 miles N. E. of Worcester, on the Fitchburg R. R. It contains 3 churches, a savings bank, several large shoe-shops, foundry, and pianoforte manufactory, 1 newspaper, 1 hotel, stores, etc. Principal occupation, shoemaking and farming. Pop. 3389. WOOD & RAWSON, EDS. "PIONEER."

Hudson, tp. and post-v. of Lenawee co., Mich., 50 miles W. of Toledo, on the Lake Shore and Michigan Southern R. R. It has 2 union schools, 7 churches, 2 banks, large spoke and butter-tub factories, 2 newspapers, carriage-shops, and other manufactories. P. of v. 2459; of tp. 4094. W. T. B. SCHERMERHORN, ED. "HUDSON GAZETTE."

Hudson, tp. of Douglas co., Minn. Pop. 448.

Hudson, tp. of Macon co., Mo. Pop. 1376.

Hudson, tp. and post-v. of Hillsborough co., N. H., 3 miles E. of Nashua. Pop. 1066.

Hudson, city, cap. of Columbia co., N. Y., situated on the E. bank of the Hudson River, at the natural head of navigation, 115 miles N. of New York, and 36 miles below Albany, on the Hudson and Boston and the Hudson River R. Rs. It contains the Hudson Academy, one of the oldest collegiate schools in the State, 15 churches, 4 banks, large manufactories of paper car-wheels, steam fire-engines, and stoves, 2 iron furnaces, 2 daily and 3 weekly newspapers, 6 hotels, and an orphan asylum. The city, covering an area of about one square mile, is supplied with gas, and water from the river is being introduced (1875) at an expense of $250,000. It has an extensive trade by the river. Pop. 8615. M. PARKER WILLIAMS, ED. "DAILY REGISTER" AND "WEEKLY GAZETTE."

Hudson, tp. and post-v. of Summit co., O., at the junction of the Cleveland and Pittsburg and the Cleveland Mt. Vernon and Delaware R. Rs., 24 miles S. E. of Cleveland. It is the seat of Western Reserve College. P. of tp. 1520.

Hudson, post-v., cap. of St. Croix co., Wis., 18 miles E. of St. Paul, Mo., on the West Wisconsin R. R. It has an academy and other schools, 5 churches, 2 banks, 3 newspapers, 3 hotels, railroad machine-shops, wagon and plough manufactories, numerous wheat warehouses, flouring-mills, etc. Principal occupation, farming. Pop. of v. 1748; of tp. 2203. H. A. TAYLOR, ED. "STAR AND TIMES."

Hudson, tp. of Walworth co., Wis. Pop. 1312.

Hudson (ERASMUS DARWIN), M. D., b. Dec. 15, 1806, at Torringford, Conn., was educated by private tutor and at Torringford Academy; graduated in medicine at the Berkshire Medical College 1827; practised in Bloomfield, Conn., and was a member of the Connecticut State Medical Society, etc. In 1828 he began to lecture on temperance. From 1837 to 1849 he was lecturing agent of the Connecticut Anti-slavery Society and general agent of the American Anti-slavery Society. Since 1849 he has devoted himself to mechanical and orthopædic surgery, not only in private practice, but in a majority of the government cases of gunshot injuries of bones, resections, ununited fractures, and amputations at the knee and ankle joint. He has written *Essay on Temperance* (1828); was a contributor to *The Liberator* and *National Anti-slavery Standard* (1837–49); co-editor of *The Charter Oak* (1838–41); has published monographs on *Resections* (1870), *Syme's Amputation* (1871), *Immobile Apparatus for Ununited Fractures* (1872); and has contributed numerous reported cases, published in the *Medical and Surgical History of the War of the Rebellion* (Washington, 1870–72).

Hudson (ERASMUS DARWIN, JR.), A. B., M. D., b. Nov. 10, 1843, at Northampton, Mass.; graduated at the College of the City of New York in 1864, and at the College of Physicians and Surgeons, New York City, in 1867; in 1867 and 1868 was house-surgeon of Bellevue Hospital; since 1868 has been engaged in the practice of medicine; served as health inspector 1869–70; was attending physician to the class for diseases of the eye, out-door department of Bellevue Hospital, same year; was attending physician at North-western Dispensary 1870–72; attending physician to Trinity chapel parish and Trinity Home 1870–75; and since 1872 has been professor of principles and practice of medicine at the Woman's Medical College of the New York Infirmary. He has published *Report of Pulse and Respiration of Infants* in Elliot's *Obstetric Clinic* (1872), and monograph on *The Prevention and Early Arrest of Pulmonary Phthisis.* He is a contributor to *Johnson's Universal Cyclopædia.*

Hudson (FREDERIC), b. at Quincy, Mass., Apr. 25, 1819; was educated in Boston; was for thirty years on the editorial staff of the New York *Herald*. Author of *Journalism in the U. S.* Resides in Concord, Mass.

Hudson (GEORGE), b. at York, England, about 1800; commenced life as a draper. He made a large fortune in railway speculations during the railway excitement of 1845–46, was known as the "railway king," and was regarded in England and France as an oracle on the subject of railway operations. He was a member of Parliament from 1845 to 1859, and was three times elected lord mayor of York. After exercising influence in every branch of society, he d. in reduced circumstances Dec. 14, 1871.

Hudson (HENRY or HENDRIK), an English discoverer of whose birth and early history nothing is known. In 1607 he made a voyage in search of the North-west passage. In 1608 he sailed to Nova Zembla, and in 1609, in the service of the Dutch India Company, he sailed in the Half Moon for Davis' Straits; but reached Cape Cod, went to Chesapeake Bay, discovered the Hudson River, up which he sailed as far as where Albany stands. In 1610 he sailed again in an English ship, discovered Hudson's Strait and Hudson's Bay, in which he wintered; but

after suffering many hardships his crew became mutinous and set him, with his son John and seven infirm sailors, adrift in a shallop; after which he was never heard of. A part of his crew arrived in England in 1611. Hudson published *Divers Voyages and Northern Discoveries* (1607) and *A Second Voyage* (1608). (See GEO. ASHER'S monograph (Hakluyt Soc., 1859), and J. MEREDITH READ, JR.'S, *Inquiry concerning Hudson* (1866).

Hudson (HENRY NORMAN), b. in Cornwall, Vt., Jan. 28, 1814; was bred a farmer and coachmaker; graduated in 1840 at Middlebury College; he afterwards taught in Kentucky, Alabama, and elsewhere, and became a successful lecturer on Shakspeare. In 1849 he was ordained a priest of the Protestant Episcopal Church; was for a time editor of the *Church Journal;* rector of a church at Litchfield, Conn., 1859–60, and was an army chaplain during the civil war. He has published *Lectures on Shakspeare* (2 vols., 1848), an edition of Shakspeare (11 vols., 1850–57), *A Chaplain's Campaign with Gen. Butler* (1865), *School Shakspeare* (1870), *Shakspeare, his Life*, etc. (1872), *Sermons* (1874).

Hudson River, called also **North River** in its lower course, is one of the noblest of American streams. It rises some 3000 feet above tide-water in Essex co., N. Y., among the Adirondacks. After a rapid and devious course among the mountains, it is joined by the Schroon River, and 10 miles farther on by the Sacondaga. Thence its course is generally eastward to Sandy Hill, from which point it flows almost due S. to its mouth. The Batten Kill and Hoosick join it from the E. At Cohoes it receives the Mohawk, which more than doubles its volume. Three miles below, at Troy, it becomes a navigable tidal stream. Above this it is chiefly noteworthy for its romantic scenery and its noble and unfailing water-power. But it is proposed to open slack-water navigation, by means of locks and dams, to Fort Edward. The largest affluent received below Troy is the Walkill. The tidal rise at Albany is only one foot, and below this point there are some obstructions to rapid navigation, the most noteworthy of which is the "Overslaugh" or bar at Castleton. To remedy these difficulties the U. S. have expended over $1,500,000 (besides large State appropriations) in deepening and dredging channels, building dykes, revetments, and the like, and the work is not yet complete. There are also 21 lighthouses and lighted beacons owned by the general government upon the banks of this river. The appropriations have been almost entirely expended above the city of Hudson, where the obstructions cease. The river is navigable 117 miles to this city for ships of the first class, and to Troy, 166 miles, for steamers and schooners. Thirty miles below Troy the river approaches the remarkably fine scenery of the Catskill Mountains. At Newburg, 60 miles from New York, the Hudson enters the Highlands, through whose impressive scenery it flows for 20 miles. Below Verplank's Point the river expands into Haverstraw Bay and the Tappaan Sea, a noble, lake-like expansion. Below, the western bank of the river is marked by the Palisades, a precipice of lofty trap-rock, at some points 500 feet high. The fisheries of the Hudson are of considerable importance. Shad, bass, and sturgeon are extensively taken, and several species of fish native to the St. Lawrence basin have naturalized themselves in the Hudson since the opening of the Champlain and Erie canals. It is probable that the Hudson was never a salmon stream, but some attempts have been made to stock it with *Salmo salar* and *S. quinnat*, the true and the California salmon. The Erie Canal connects the river with Lake Erie, the Champlain Canal with Lake Champlain, the Delaware and Hudson with the Pennsylvania coal-regions. The river is thus the thoroughfare for large numbers of canal and freight boats to and from New York and the neighboring cities. Its passenger steamers are not excelled in splendor by any vessels afloat, and for size and speed they take a high rank. The waters of the Hudson enter the inner bay of New York, flowing between New York City and Jersey City on the E. and W. respectively. The river, with its canal connections, has done much to make New York what it is industrially and commercially. It is about 300 miles in length. It was named in honor of Henry Hudson, its first European explorer.

Hudson's Bay, a great landlocked sea of British North America, 800 miles long from N. to S., and 600 miles across, lying between 51° and 64° N. lat. and 78° and 95° W. lon. It is so much obstructed by ice that in winter it is not navigable. At no time is its navigation safe or easy. It has many islands and shoals. Of late there is a considerable summer whale-fishery within its limits. Area, 300,000 square miles. Hudson's Strait is its outlet to the Atlantic.

Hudson's Bay Company, the last of the great English commercial corporations, was chartered May 2, 1670, by Charles II., and ceased to exercise its monopoly June 23, 1870, after 200 years of authority in the northern parts of North America. For many years after its foundation the French were in possession of Canada. The North-west Company of Montreal was a formidable rival from 1783 to 1821, when the younger company was merged into the older. The principal trade of the company was in furs, and it was uniformly a profitable trade. It originally possessed a proprietorship and a monopoly of trade throughout Rupert's Land, as the land whose streams flow into Hudson's Bay was called. This name was derived from the famous Prince Rupert, the principal original corporator. In 1821 this jurisdiction (with the original authority to govern and also to make war upon savage nations) was extended westward to the Pacific—the authority for the new territory to last only for periods of twenty years by royal license. From 1849 to 1859, Vancouver's Island was also licensed to this company. After 1859 the company had no monopoly W. of the Rocky Mountains. In 1868 the company was authorized by act of the British Parliament to surrender its powers and rights to the Crown and incorporate its territories with the Dominion of Canada. In 1869 this was carried out, and in 1870 the full transfer was accomplished.

Hudson's Strait, connecting Hudson's Bay with Davis's Strait and the Atlantic Ocean, in British North America, is situated between 60° and 64° N. lat. and 65° and 77° W. lon. It is 450 miles long, and its breadth averages 100 miles, the narrowest point being 60 miles.

Hué, the capital of Anam, on the Hué, near its entrance into the China Sea. In the beginning of the present century it was regularly fortified by French engineers, and it is generally well built, but it is accessible only to small vessels, on account of the shallowness of its harbor. Pop. 100,000.

Huel'va, town of Southern Spain, the capital of the province of Huelva, at the junction of the Odiel and the Tinto. It is a handsome town, but unhealthy on account of the salt-marshes in its vicinity. It has a lively coasting-trade, especially in fruits. Pop. 8423.

Huerfa'no, county of Southern Colorado, lying principally E. of the main Rocky Mountain range. Area, about 1600 square miles. It is well watered, and contains the Huerfano Park. The raising of cattle and wool is a leading pursuit. Cap. Badito. Pop. 2250.

Huer'ta, de la (VICENTE GARCIA), b. at Zafra, in Estremadura, in 1729, and d. in 1797 in Madrid, where he held the office of first librarian of the royal library. In the hot contest which took place at that time in the Spanish literature between the adherents of the French influence and the defenders of the old Spanish taste, Huerta headed the latter party, and exercised a considerable influence, both by his tragedy, *Raquel*, which was first produced in Madrid in 1778, and made a great success, and by his collection of the best works of the elder Spanish dramatists (17 vols., 1784–85). He also published two volumes of poems, *Obras Poeticas* (1778–79).

Hues'ca, town of Spain, the capital of the province of the same name, on the Isuela. It is beautifully situated on a plain covered with vineyards and olive-forests, and has many interesting buildings, among which are a Gothic cathedral built in 1400, a university founded in 1354 (not now in operation), and a circus for bull-fighting. It is a bishop's see. Pop. 10,069.

Hues'car, town of Spain, in the province of Grenada, on the Guardal. It has some manufactures of linen goods. Pop. 7332.

Huet' (FRANÇOIS), b. at Villeau, department of Eure-et-Loire, Dec., 1814; d. July 1, 1869, at Paris, where he requested to be buried *civilement*—that is, without the accompaniment of any religious ceremonies. Huet was one of the precursors of Döllinger, Hyacinthe, and other Old Catholics, though his own doctrine, which found some adherents in France, bore the name of Neo-Catholicism, was opposed to the ultra dictates of the Vatican, and claimed to have realized the alliance of reason with religion. Huet was a pupil or disciple of Bordas-Demoulin; he held a professorship in the University of Ghent. About 1865 returned to Paris, and was tutor to Prince Milan Obrenovitch, whom he accompanied to Servia when the prince was elevated to the throne. Huet has published *Cartesianism, or True Renovation of Sciences, Social Reign of Christianity, Essays on the Catholic Reform*, etc. FÉLIX AUCAIGNE.

Huet (PIERRE DANIEL), b. at Caen Feb. 8, 1630, and educated by the Jesuits; accompanied, in 1652, Bochart to the court of Queen Christine of Sweden; was in 1670 appointed sub-governor under Bossuet to the dauphin; took holy orders in 1676; became bishop of Avranches in 1692; retired in 1699 first to Caen, and then to the house of the Jesuits in Paris; and d. there Jan. 26, 1721. As a young man he cultivated polite literature, composed a romance,

Diane de Castro, published *Carmina Latina et Græca* (1664), and wrote *Sur l'origine des romans* (1670). He was also an adherent of the Cartesian philosophy, but afterwards became one of its adversaries: *Censura Philosophiæ Cartesianæ* (1689) and *Mémoires pour servir à l'histoire du Cartesianisme* (1692). The most prominent of his other writings are—*Demonstratio Evangelica* (1679), *Histoire du commerce et de la navigation des anciens* (1716), a book still of great value, and *Commentarius de rebus ad eum Pertinentibus* (1718), lately translated by Nizard.

Hu'ey, tp. of Calhoun co., Ark. Pop. 153.

Hu'feland (Christoph Wilhelm), b. Aug 12, 1762, at Langensalza, in Thuringia; studied medicine at the universities of Jena and Göttingen; was appointed a professor in medicine at the University of Jena in 1793, and removed in 1798 to Berlin, where in 1809, on the establishment of the new university, he became professor in special pathology and therapeutics; d. Aug. 25, 1836. He was a noble and kind-hearted man, of sound and comprehensive views, and, with the exception of his *Enchiridion medicum, oder Anleitung zur medical Praxis* (1836), most of his writings have a generally instructive, philanthropical, rather than a scientific character, such as *Makrobiotik oder die Kunst das menschliche Leben zu verlöngern* (1796), *Guter Rath an Mütter über die wichtigsten Punkte der physischen Erziehung der Kinder* (1799), etc. These books were often republished, and exercised a beneficial influence.

Huff, tp. of Spencer co., Ind. Pop. 1569.

Huff's Creek, tp. of Wyoming co., W. Va. P. 342.

Hug (Johann Leonhard), b. at Constance June 1, 1765; an eminent Roman Catholic theologian and professor, author of numerous learned works in biblical criticism, of which the best known is an *Introduction to the Study of the N. T.* (1808; Eng. trans. 1827). D. Mar. 11, 1846.

Hü'gel, von (Karl Alexander Anselm), Baron, b. at Ratisbon Apr. 25, 1796; studied law at Heidelberg 1811; entered the Austrian army in 1813, and was employed in different diplomatic missions; retired in 1824 to devote himself exclusively to the study of natural science; undertook (1831–37) very extensive travels through Western and Southern Asia; and d. at Brussels June 2, 1870. He wrote *Kaschmir und das Reich der Sikhs* (4 vols., 1840–42) and *Das Becken von Kabul* (2 vols., 1851–52). His rich collections in ethnography and natural science were bought by the Austrian government and incorporated with the collections of Vienna.

Huger' (Benjamin), b. at Santee, St. James parish, S. C., Nov. 22, 1805; graduated at West Point, and entered the army as second lieutenant of artillery July, 1825; served on topographical and ordnance duty till May 1, 1832, when he was promoted to be captain of ordnance. In the war with Mexico he was chief of ordnance and artillery with Gen. Scott's army, being in charge of the siege-train at Vera Cruz, and present at the battles of Cerro Gordo, Molino del Rey, Chapultepec, and final capture of the city of Mexico. For gallant conduct in battle he was brevetted major, lieutenant-colonel, and colonel, and was presented with a sword of honor by the State of South Carolina. From 1848 to 1861 he commanded various arsenals, and was employed on important board duties. In Apr., 1861, being at that time a major of ordnance, he resigned his commission and espoused the Southern cause. He was made a major-general of the Confederate army, and bore a prominent but unsuccessful part in the early days of the civil war. Since 1869 he has been engaged in farming in Virginia.

Hug'gins, tp. of Gentry co., Mo. Pop. 1112.

Huggins (William), F. R. S., D. C. L., LL.D., b. in London Feb. 7, 1824; was educated at the City School and by private instructors, giving much attention to the experimental study of the physical sciences and to astronomy; in 1852 was made a member of the Microscopical Society, and became a student of biology; in 1855 established a private astronomical observatory, where after 1862 he gave great attention to spectroscopic observations upon the heavenly bodies, with important results, especially with respect to the discovery of the direction and rate of the proper motions of the fixed stars.

Hughes, post-v. of Arapahoe co., Col., at the junction of the Denver Pacific and the Boulder Valley R. Rs., 19 miles N. of Denver.

Hughes, post-tp. of Nodaway co., Mo. Pop. 1420.

Hughes (Ball), b. in London Jan. 19, 1804; d. in Boston, Mass., Mar. 5, 1868; studied with Edward Hodge Bailey, and while a student won prizes awarded by the Royal Academy, and other silver and gold medals; made busts of George IV. and the dukes of York, Sussex, and Cambridge; came to New York in 1829; made the marble statue of Hamilton—the first work of the kind done in America—for the Merchants' Exchange, which was destroyed by fire in 1835; also the high relief of Bishop Hobart in Trinity church; the casts of *Little Nell* and *Uncle Toby* in the Boston Athenæum are his work, and the bronze statue of Dr. Bowditch in the cemetery of Mt. Auburn. Other works from his studio are a bust of Washington Irving, a statuette of Gen. Warren, a *Crucifixion*, a model for an equestrian statue of Washington. He was a man of various ingenuity, a lecturer on art as well as an artist.

O. B. Frothingham.

Hughes (Most Rev. John), D. D., b. at Annaboghan, co. Tyrone, Ireland, June 24, 1797; emigrated to America in 1817, and worked for a time as a gardener and nurseryman; was educated at Mt. St. Mary's College, Emmittsburg, Md., which he entered in 1819, and where he sustained himself for a time by the care of the college garden. Here he won the lifelong esteem of Drs. Dubois and Bruté, both afterwards bishops. In 1825 he was ordained a deacon of the Roman Catholic Church, and in the same year a priest. He had (1826–38) pastoral charges in Philadelphia, where he founded St. John's Asylum in 1829, and established *The Catholic Herald* in 1833. In 1838 he was made bishop of Basileopolis *in partibus*, and coadjutor to Bishop Dubois of New York, and in 1842 he became bishop of New York. In 1839 he founded St. John's College, Fordham. In 1850 he was made archbishop of New York. In 1861–62 he was a special agent of the U. S. in Europe, and in 1863 publicly addressed the draft-rioters in New York with a view of dissuading them from violence. He d. Jan. 3, 1864. Archbishop Hughes early attracted much attention by his controversial correspondence with Rev. John Breckinridge in 1833–35. In 1839–42 he was prominent in the struggle of the Roman Catholics against the public school system of New York, and in 1851 had a famous controversy with the Hon. Erastus Brooks respecting the tenure of church property. Personally he was a kindly and genial man. His writings, nearly complete, have been published in two vols. 8vo. (See his *Life* by J. R. G. Hassard, 1866.)

Hughes (Thomas), Q. C., b. Oct. 20, 1823, at Newbury, Berks, Eng.; was educated at Rugby and at Oriel College, Oxford, where he graduated in 1845; studied at Lincoln's Inn; was called to the bar in 1848; became queen's counsel in 1869; was in Parliament from Lambeth 1865–68, from Frome 1869–74. Author of *Tom Brown's School Days* (1856), *Scouring of the White Horse* (1858), *Tom Brown at Oxford* (1861), *Alfred the Great* (1869), etc. Is (1874) principal of the College for Workingmen and Women, London, and prominent in practical reforms and questions of social science.

Hughes'ville, post-b. of Lycoming co., Pa., in Wolf tp., 19 miles E. of Williamsport. It has a large lumber trade. Pop. 456.

Hughs, county of Dakota, having the Missouri River as its S. W. boundary. It is not organized. Area, about 700 square miles.

Hughs, tp. of Tuscaloosa co., Ala. Pop. 637.

Hu'go (Victor Marie), Vicomte, b. at Besançon Feb. 26, 1802. His father was an officer in the army of Napoleon; his mother came from La Vendée, and was a staunch royalist. In his childhood he led a rather errant life, moving from France to Italy, and from Italy to Spain, but he received, nevertheless, an excellent education. In 1817 an ode he addressed to the Academy, *Sur les Avantages de l'Étude*, was highly commended by that institution, and in 1818 he gave up his professional education to devote himself exclusively to literature. He was eminently successful. In 1840, after publishing his novels, *Han d'Islande* (1823), *Bug-Jargal* (1826), and *Notre Dame de Paris* (1831), his dramas, *Cromwell* (1827), *Marion Delorme* (1831), *Le Roi s'amuse* (1832), *Lucrèce Borgia* (1833), *Ruy Blas* (1838), and *Hernani* (1839), and the two celebrated volumes of lyrical poems, *Les Feuilles d'Automne* (1831) and *Les Chants de Crepuscule* (1835), he stood as the founder of a new literary school in his country, and was acknowledged as the greatest living poet of France, perhaps of Europe. In 1823, Louis XVIII. gave him a pension; in 1845, Louis Philippe created him a peer of France; and in 1848 he was elected a representative of the city of Paris both to the constituent and to the legislative assembly. When, in 1851, Napoleon banished him from France, he took up his residence on the island of Guernsey, and in his exile he wrote *La Legende des siècles* (1859), *Les Misérables* (1862), *Les Travailleurs de la Mer* (1866), *L'Homme qui rit* (1869), and *Quatre-vingt treize*, which works have extended his fame, though without strengthening it. During the latter part of his life a marked change has taken place in his social views. He first changed from a royalist into a worshipper of Napoleon, and when he came in actual contact with politics he became a republican with a peculiar touch of socialism. The

influence which this change exercised on his literary productions was not good. His political writings, *Napoléon le Petit* and *Les Châtiments,* are nearly worthless; his talent broke down completely under his ire. And whenever his social views become visible in his romances and poems the effect is painful; his ideas are obscure, because they are based not on understanding, but on sympathy, and his sympathy with the mass, the poor, the depressed, the persecuted, is offensive to the reader, because it is violent and exaggerated. Of far greater and much more beneficial influence was the change which early in his life took place in his artistic views. He began a classicist, and he became the founder of the romantic school; Madame de Staël and Chateaubriand wrought this change in him. The supreme law of the classical school was, the idea shall be beautiful and the expressions shall be polished; literature is a mirror of good society. Against this maxim Victor Hugo proclaims that the idea shall be true and the expression natural; literature is a mirror of nature. And although he had to fight an authority of 200 years' standing, he carried his point, and made his principles an actual influence in French literature—not, like Goethe, by the magic of a fresh and rich sensibility, for his taste is narrow and even a little coarse, but by dint of a brilliant, creative power. His imagination is his talent. His poems lack the moving warmth of a full heart. His dramas lack the magical presence of a complete characterization. His romances are like turbulent seas, formless expanses of colossal forms. And yet in all his writings, even the latest and weakest, he gives pictures of nature in uproar and of man in passion which delight by their truth as much as they astonish by their grandeur. The limits of his genius would never have been visible but for the faults of his method. Although in the famous preface to *Cromwell,* he tells us that *order* is the principle of freedom in art, *regularity* that of thraldom, yet his own method is too often a dead mechanical regularity. Both his plans of composition and his delineations of characters show it, and his style more than shows it; it cries it out aloud. There are whole pages in his books in which his "brilliant" antitheses sound like the monotonous, ever-recurring grating of a plane, and which tell too plainly that brilliancy, especially of style, is something which can be made by machinery. CLEMENS PETERSEN.

Hu'guenot, tp. of Powhatan co., Va. Pop. 2527.

Huguenots, the name by which in the sixteenth century the Roman Catholics designated the adherents of the Calvinistic Reformation in France. It is of doubtful origin, some deriving it from the German *Eidgenossen,* others from the words *Huc nos,* with which one of the earliest public documents of French Protestantism begins, and others again from *Hugo* (or *Hugues*) *Capet,* the first king of the Bourbon dynasty. Prof. Mahn (who quotes fifteen derivations) connects the name with *Hugues,* an obscure heretic. After the consolidation of the Reformation in France, it fell into disuse, and the Protestant establishment of that country is now known under the name of the Reformed Church of France. Protestantism was not introduced into France from Germany. There were from olden times dissenting elements in the Gallican Church, especially in the southern parts of the country, where the Visigoths had settled. The Visigoths were Arians, and in the course of time one sect after the other arose in these regions and protested against the authority of the pope and the doctrines of the Roman Catholic Church; as, for instance, the Albigenses. The general commotion which at the end of the fifteenth and in the beginning of the sixteenth century took place within the Roman Catholic Church itself was strongly felt in France, and showed itself even at the Sorbonne, which, next to the pope, was the highest theological authority in Christendom. But in France, at the court of Queen Marguerite of Navarre, this movement partly assumed a merely literary form, and became a simple assertion of independence rather than a protest, until Calvin with his iron hands grasped the somewhat vague tendency and gave it a more striking stamp and a more decided direction than it received anywhere else. Francis I. tried to stop the movement, and Huguenots were burned. But during the reign of Henry II. (1547–59) Protestantism was rather favored, and at his death there existed a Protestant party of great political power; and a religious war began which lasted almost without interruption to the end of the century, was renewed in the following, and did not finally subside until the spirit of tolerance, the best acquisition of the eighteenth century, made religious persecutions an impossibility in France. At the head of the Roman Catholic party stood the famous family of the Guises, represented by Duke Francis and the cardinal of Lorraine; at the head of the Protestants stood the family of Bourbon, represented by the king of Navarre and the prince of Condé. Between the two parties the royal power, represented first by Catharine of Medici, last by Cardinal Richelieu, occupied an intermediate position, using with great art the one to crush the other. Francis II., a son of Henry II. and Catharine of Medici, married in 1558 Mary Stuart, a niece of the cardinal of Lorraine. He was only fifteen years old when in 1559 he ascended the throne, and with him the Guises were brought to the court and came into power. Their arrogance, ambition, and audacity caused immediately the formation of a Protestant party, and the war began. Next year (1560) Francis died, and in order to curb the Guises, Catharine, regent during the minority of her second son, Charles IX., favored the Protestants. The edict of Jan. 17, 1562, gave them freedom of conscience and a limited liberty of worship, and to these rights were added several fortified cities, among which was Rochelle, as places of safety, by the peace of St. Germain-en-Laye, Aug. 8, 1570—a peace which for a moment stopped the war that was still raging in spite of all edicts and treaties. Catharine, however, meant by no means to tolerate Protestantism in her realm. She hated it as an abominable heresy, and she began to fear the party since, during the preceding wars, she saw how it was supported from England with money and from Germany with troops. Immediately after the peace of St. Germain-en-Laye she concluded an alliance with the Guises, which resulted in the massacre on the night of St. Bartholomew (Aug. 25, 1572) of 5000 Protestants—among whom was Coligny, their leader—in Paris, and 30,000 in the provinces. The Protestants fled to their places of safety, and the war began again; but the royal army was repelled from Rochelle, and when in 1574 the duke of Alençon, the youngest son of Catharine, and a large party of the Roman Catholic nobility, allied themselves with the Protestants against the queen and the Guises, the cause of the Reformation stood better than ever before. Treaties of peace were concluded and broken several times, but when (in 1584) Henry of Navarre, the head of the Protestant party, became heir-apparent to the French throne on the death of the duke of Anjou, it came at last to a final battle. The Guises now openly avowed that they aspired to the crown of France, and the king, Henry III., had both Duke Henry and Cardinal Louis murdered at Blois in 1588. Pursued by the Roman Catholic party, he then fled to the Protestant camp, but next year he was himself killed by a monk, and Henry IV. ascended the throne. Henry entered the Roman Catholic Church from political reasons, but by the Edict of Nantes in 1598 the position of the Reformed Church in France became finally settled and secured, and there was peace for about twenty years. But the Protestants possessed in their places of safety and in their right of assembling a political power which it was difficult for the royal authority to consent to; and when the idea of the absolute power of royalty found an adequate representative in Cardinal Richelieu, a change in the political position of the Protestants was unavoidable. The war lasted from 1624 to 1629. On Oct. 28, 1628, Rochelle was taken after a siege of fourteen months; of its 24,000 inhabitants only 4000 were left; the rest had fallen or perished from hunger. Their other strongholds were also taken, but their freedom of conscience, and even their liberty of worship, were respected; Richelieu's measures were purely political. Once more, however, the Protestants of France had to experience persecutions on account of their religion. Louis XIV. and Madame Maintenon, who was herself bred a Protestant, were both very devout, and after the death of Colbert (1684) their devotion showed itself in the harshest and most cruel measures against the Protestants. Their churches were destroyed and their property confiscated; bands of soldiers, accompanied by fanatical monks, scoured the country, and such as would not renounce their religion were exiled or killed. Some fled to the Cevennes, where they were butchered; others to Switzerland, Holland, and England. In the three years following immediately after the Revocation of the Edict of Nantes (Oct. 23, 1685) France is said to have lost nearly 1,000,000 inhabitants. Louis XV. also tried to do something "to the glory of God," and issued in 1752 an edict which declared the Protestant baptism and marriage invalid; but the edict caused such an indignation, even among the Roman Catholics, that it had to be revoked. By the *Code Napoléon,* the *Chartes* of 1815 and 1830, and the constitutions of 1848 and 1872, the social and political position of the Protestants in France has been made equal to that of the Roman Catholics, and during the last twenty years their spiritual life has developed with great energy and exercised a considerable influence on the Protestant churches of other countries. (FELISE, *Histoire des Protestants de France;* HAAG, *La France Protestante.*)

CLEMENS PETERSEN.

Huiets, tp. of Edgefield co., S. C. Pop. 2556.

Hulin', or **Hullin** (PIERRE AUGUSTIN), COUNT, b. at Paris Sept. 6, 1758; enlisted in the army in 1771; distin-

guished himself at the storming of the Bastile July 14, 1789; was appointed captain of the national guard Oct. 8, same year, but became suspicious to Robespierre on account of his moderation, and was imprisoned. Liberated at the fall of Robespierre, he entered the Italian army; was made a brigadier-general in 1803; presided over the court-martial which sentenced the duke of Enghien to death Mar. 24, 1804; was military governor of Vienna in 1806, of Berlin in 1807, of Paris in 1812, and was created a count in 1808. On the restoration of the Bourbons he was banished from France in 1816, but allowed to return in 1819; and d. in Paris, blind, Jan. 9, 1841. In 1823 he published *Explications offertes aux hommes impartiaux au sujet de la commission militaire instituée en l'an XII. pour juger le duc d'Enghien.*

Hull, or **Kingston-on-Hull,** one of the commercial centres of England, is situated in the East riding of Yorkshire, at the influx of the Hull into the Humber, and is defended by a citadel, commanding the entrance of the Hull roads, and by two forts lower down the Humber, at the village of High Paul. The most remarkable of its public buildings are the church of the Holy Trinity, the oldest brick building in England, erected in 1312, and the church of St. Mary, Lowgate; of its monuments, an equestrian statue of William III., standing in the market-place, and a statue of Wilberforce, raised on a fluted Doric column 80 feet high. It has many benevolent and good educational institutions, a Latin and a medical school, a school of navigation, a botanical garden, museum, and several associations for science and art. Its manufactures are quite considerable, especially of linen and cotton goods, cordage, machinery, chemicals, leather, sugar, and pottery. In its docks, which comprise an area of more than 87½ acres, much shipbuilding is carried on; in 1870, 584 vessels, of 71,865 tons burden, were owned at Hull. But it is more especially its commerce which gives Hull its great importance. Nearly all the traffic between England and Northern Europe is carried on through this port. It is connected by regular steamship lines with St. Petersburg, Königsberg, Stettin, Copenhagen, Gothenburg, Hamburg, Bremen, Amsterdam, Rotterdam, Antwerp, and Havre. Linen and cotton goods, hardware, machinery, iron, and coal are exported; corn, cotton, flax, hemp, timber, and bones are imported. In 1871, 3417 vessels, of 1,188,841 tons, entered the harbor, and 2911, of 1,044,158 tons, cleared it. The total value of imports was in the same year £15,076,095; of exports, £27,387,076. Pop. 84,690 in 1851; 97,661 in 1861; 123,111 in 1871.

Hull, a thriving v. of Ottawa co., Quebec, nearly opposite the city of Ottawa, with which it is connected by a suspension bridge. It has a very great water-power, and manufactures immense quantities of lumber and some woollen goods, cooperage, axes, etc. There are valuable iron-mines in the vicinity. Pop. of sub-district, 8318.

Hull, a v. of Aviston tp., Clinton co., Ill., on the Ohio and Mississippi R. R., 25 miles W. of Sandoval. Pop. 300.

Hull, post-tp. of Plymouth co., Mass., consisting of a peninsula connected with the mainland by a long isthmus called Nantasket Beach. It is 9 miles S. E. of Boston, and is an attractive summer resort. Pop. 261.

Hull, tp. of Portage co., Wis. Pop. 621.

Hull (Asbury), son of Hope, b. in Washington, Wilkes co., Ga., Jan. 30, 1797; graduated at the State University 1814; was for more than forty years secretary and treasurer of the board of trustees of the same; was often a member of the legislature, and repeatedly Speaker of the House; was a member of the secession convention of 1861, but declined its presidency. He was a man of a high order of talent and spotless purity of character. D. at his residence in Athens Jan. 25, 1866. A. H. Stephens.

Hull (Henry), son of Hope, b. in Washington, Wilkes co., Ga., Oct. 20, 1798; graduated at the State University 1815; studied medicine, and rose to distinction in its practice; afterwards was professor of mathematics in his alma mater from 1830 to 1846, when he resigned, and has since devoted his time to literary and scientific pursuits.
A. H. Stephens.

Hull (Hope), one of the founders of Methodism in Georgia (son of an Englishman of the same name), b. in Worcester co., Md., Mar. 13, 1763; moved to Georgia, and established a high school at Washington in the latter part of the last century. He was a man of great usefulness and distinction in his day, and made an impression upon the times in Georgia that will remain for generations to come. D. near Athens, Ga., Oct. 4, 1818. A. H. Stephens.

Hull (Isaac), b. at Derby, Conn., Mar. 9, 1775, the son of a Revolutionary officer; became a mariner, and when nineteen years of age was master of a merchant ship in the London trade; became lieutenant U. S. navy 1798; was made first lieutenant of the Constitution frigate 1801; distinguished himself by valor and skill against the French on the coast of Hayti; served with distinction in the Barbary expeditions; sailed from Annapolis in command of the Constitution July 12, 1812, and for three days was chased by a British squadron of five ships, from which he escaped by bold and ingenious seamanship. On Aug. 19 he encountered the frigate Guerrière, Capt. Dacres, one of his late pursuers, and fought her for half an hour at close quarters, when she surrendered, but was so much cut up that she had to be burned. For this, the first naval advantage of the war, Hull received a gold medal from Congress; was afterwards made a naval commissioner, and had command of various navy-yards. D. Phila. Feb. 13, 1843.

Hull (William), b. at Derby, Conn., June 24, 1753; graduated at Yale 1772; studied divinity one year; went to Litchfield Law School, and in 1775 was admitted to the bar; served with distinction throughout the Revolutionary war, in which he rose from the rank of captain to that of colonel; became a very successful lawyer of Newton, Mass.; was major-general of militia in Shay's insurrection; commissioner to treat with the Indians of Upper Canada 1793; was very prominent in the public affairs of Massachusetts, in which State he became a judge of common pleas; governor of Michigan Territory 1805–14. As brigadier-general commanding the army of the North-west he surrendered Detroit to Gen. Brock, for which he was court-martialed, found guilty of cowardice, and sentenced (1814) to be shot, but was pardoned in consideration of his age and former services. He published *The Campaign of the North-west Army* (1824). D. at Newton, Mass., Nov. 29, 1825. (See his *Life*, by Maria Campbell and James Freeman Clarke (1848), in which Hull's character is fully vindicated.)

Hull (William Hope), son of Asbury, b. in Athens, Ga., Feb. 2, 1820; graduated at the State University 1838; studied law; was elected solicitor-general of the western judicial circuit; held many positions of public trust; was assistant in the U. S. attorney-general's office during Mr. Buchanan's administration. When Georgia passed her ordinance of secession he returned to his native State and resumed his profession. Since the war he has resided in Augusta. d. N.Y. City Sept. 12, 1877. A. H. Stephens.

Hul'lah (John), b. at Worcester, Eng., in 1812; drew general attention in 1836 by his comic opera, *The Village Coquettes*, and began in 1838 to work for the establishment of popular singing schools in England after the French model. Having met with eminent success in this undertaking, he was appointed musical inspector for the United Kingdom and leader of the orchestra and chorus of the Royal Academy of Music in London.

Hulme'ville, post-v. of Bucks co., Pa., 20 miles from Philadelphia. It contains a school, 2 churches, a large cotton and grist mill, 1 newspaper, 3 building associations and several societies, a steam-laundry, stores, etc. Pop. about 400. William Tilton, Ed. "Hulmeville Beacon."

Hulse'an Lec'tures, a number of lectures, not exceeding six and not less than four annually, delivered at the University of Cambridge, explanatory of the evidences of Christianity and of the difficulties of Scripture. There are also a Hulsean professorship of divinity, a Hulsean prize and scholarships, etc. These were founded by the Rev. John Hulse (1708–90) in a will of 200 pages closely written, with nine codicils.

Humane Society (Royal). See Resuscitation, by B. Howard, A. M., M. D.

Humanita'rians, a name which sometimes designates that school of Unitarians who consider Jesus Christ to have been a mere man, without superhuman attributes. It also sometimes designates the professors of the so-called "religion of humanity."

Hum'ber, the estuary of the Trent and the Ouse, having its entrance on the E. coast of England, in lat. 53° 38′ N. Its average breadth is between 2 and 3 miles, and it is navigable for the largest vessels up to Hull, 22 miles from its mouth.

Humbert', prince of Piedmont, crown prince of Italy, b. Mar. 14, 1844. He is a good soldier; took part in the wars of 1859 and 1866; commanded a division in 1866, and made successful exertions in order to cover the retreat of the Italian army after the battle of Custozza. He is married to the princess Margaret of Savoy. A. Niemann.

Hum'ble-bee, a name common to the hymenopterous insects of the genus *Bombus*, nearly fifty species of which are known to live in North America alone, besides numerous Old World species. The mother-bee hibernates, and in the spring selects a place for her nest in a wet, mossy place, or in a mouse's nest, or under a stump. She collects pollen, mixes honey with it, laying her eggs in the mass from time to time, and meanwhile busily adding to her store of food.

From the egg to the perfect insect the transformation is very gradual. The larvæ eat out cells in the pollen mass, spinning a lining of silk, which the old bee fortifies with wax. The young bees come forth from time to time and add to the stores. There are many ways, among so many species, of constructing the nest. The males, females, and working bees appear to live together in harmony. The aggregate number of insects in one community is usually very small as compared with the number in one swarm of honey-bees. The humble-bee is beset by numerous parasitic insects. Foxes, skunks, and bears, as well as boys, know well how to extract the sweet treasures of the humble-bee from the earth; for, though the sting is severe, most species of humble-bees are less active in attack or defence than honey-bees, hornets, and yellow wasps.

Hum'boldt, county of the N. W. of California, bounded on the W. by the Pacific Ocean. Area, about 2800 square miles. Its climate is cool and moist, its surface broken, and covered with forests of enormous redwood and other trees. Cattle, wool, potatoes, lumber, and grain are staple products. Petroleum is found. Cap. Eureka. Pop. 6140.

Humboldt, county of N. W. Central Iowa. Area, 432 square miles. Its surface is varied, its soil productive and well watered. Coal, iron, gypsum, and limestone are found. Grain is the staple agricultural product. It is traversed by the Des Moines Valley R. R. Cap. Dakota. Pop. 2596.

Humboldt, county of Nevada, bounded on the N. by Oregon. Area, 16,500 square miles. It contains numbers of lakes and streams having no connection with the sea. Most of the surface is arid and broken desert-land, which in some parts yields pasturage. The county affords silver, gold, sulphur, and other minerals. It is traversed by the Humboldt River and the Central Pacific R. R. Cap. Unionville. Pop. (exclusive of Indians), 1916.

Humboldt, tp. of Coles co., Ill. Pop. 2023.

Humboldt, tp. and post-v. of Humboldt co., Ia., 17 miles N. of Fort Dodge, settled by a colony from Western New York, their original constitution forbidding the existence of either liquor or gaming saloons, which has been rigidly enforced to the present time. It is the seat of Humboldt College, and has 1 church, 2 mills, 1 newspaper, 1 hotel, stores, shops, etc. The Des Moines River furnishes ample water-power, not utilized to any extent. The village contains several fine parks. Pop. 334.

Geo. Elliott, Ed. "Kosmos."

Humboldt, post-v. and tp. of Allen co., Kan., on the Neosho River and on the Leavenworth Lawrence and Galveston and the Missouri Kansas and Texas R. Rs., 86 miles by rail S. of Lawrence. It has a weekly and a monthly periodical, some fine business-houses, a bank, and manufactures of cigars, etc. The river is crossed here by a bridge. Pop. 1202; of tp. 2035.

Humboldt, post-v. of Marquette co., Mich., on the Marquette Houghton and Ontonagon R. R., 27 miles W. of Marquette, in the iron-region.

Humboldt, tp. and post-v. of Richardson co., Neb., on the Atchison and Nebraska R. R., 21 miles N. W. of Falls City. Pop. 605.

Humboldt, a station of the Central Pacific R. R., 422 miles N. E. of San Francisco, Cal., is in Humboldt co., Nev. Pop. of Humboldt tp. 136.

Humboldt, post-v. of Gibson co., Tenn., 128 miles W. of Nashville, at the crossing of the Mobile and Ohio and Memphis and Louisville R. Rs. It contains an Odd Fellows' female institute and Masonic high school, 6 churches, and several large mills and shops. It has 1 newspaper. Pop. about 3000. D. L. Rivers, Ed. "Journal."

Humboldt, tp. of Brown co., Wis. Pop. 735.

Humboldt, von (Friedrich Heinrich Alexander), Baron, b. Sept. 14, 1769, at Berlin, of a wealthy family, received, together with his elder brother, Karl Wilhelm, a most careful education in his home under the direction of his mother, his father having died very early. In 1787 he studied at the University of Frankfort-on-the-Oder, and after spending the following year in Berlin, occupied in the study of the technology of manufactures and the Greek language, he passed two years at the University of Göttingen, studying philology under Heyne and natural history under Blumenbach. His first published work, *Ueber die Basalte am Rhein* (Berlin, 1790), belongs to this period. After a rapid journey through Belgium, Holland, England, and France, in company with George Foster, he settled for some time in Hamburg, studied the modern languages with great zeal, and heard lectures on banking and bookkeeping, having determined to devote himself to commercial pursuits. His passion for studies, especially of nature, was too strong, however, and in 1791 he entered the celebrated mining school at Freiberg, where he studied under Werner and Leopold von Buch, and where he wrote his interesting essay on the *Flora Subterranea Fribergensis*, which appeared in 1793. From 1792 to 1797 he occupied a superior position as a mining officer at Bayreuth, at the same time exploring and conducting mines, making observations and experiments in almost every field of natural science, studying history and philology, making geognostic journeys, filling diplomatic missions, and finishing his great work *Ueber die gereizte Muskel- und Nervenfaser, nebst Vermuthungen über den chemischen Process des Lebens in der Thier- und Pflanzenwelt* (2 vols., Berlin, 1797); which book is still admired, in spite of the subsequent progress of physiological knowledge, on account of the correctness of its observations, the ingeniousness of its experiments, and the general validity of its conclusions. On the death of his mother (in 1797) he determined to gratify his desire and make a scientific journey in the tropical zones. He had prepared himself for the task through several years. He mastered a great number of living languages; he understood how to use all kinds of scientific instruments; he was thoroughly familiar with the present state of all branches of natural science; he had a large experience in scientific travelling and in making observations and experiments; he had health and he had money. He first planned a tour to Egypt with Lord Bristol; then he determined to join the expedition of Baudin which the Directory of France sent out; then he thought of accompanying the Swedish consul, Skjöldebrand, to Tunis; but all these plans failed. It was the generosity of the Spanish government which at last brought him to America. On June 5, 1799, he started from Corunna; on Aug. 3, 1804, he returned to Bordeaux. He spent five years in the Spanish colonies of Central and South America, walking, riding on horseback, sailing, rowing, always carrying along with him a whole caravan with helpers and instruments. The world had not seen anything like it since the days when Alexander the Great fitted out a scientific expedition for Aristotle. And the results corresponded to the preparations. Humboldt brought back with him an immense store of the most valuable scientific materials, astronomical determinations of localities, barometric measurements, meteorologic, climatologic, and magnetic observations, maps, profiles of mountains, herbariums, etc. He settled in Paris as the scientific centre of the world, and, although frequently engaged in scientific travels or diplomatic missions, he resided here from 1803 to 1827, occupied with the arrangement and publication of his scientific acquisitions, which appeared successively during this period in twenty-nine volumes, written in French and translated into German, and accompanied by upwards of 2000 exquisite illustrations. The world was astonished. The information was new, exceedingly attractive, ranging over the whole field of natural science; and it was correct. New ideas were started, the geography of plants, the isothermal lines, etc.; new impulses were received by every branch of science; nay, an influence was felt even in poetry and art. In 1827 he removed to Berlin at the solicitation of the king, and resided in his native city for the rest of his life, occupying himself with diplomatic offices of a lighter description and the most severe studies. The two remarkable events of this period of his life were the Russian expedition to Central Asia and the publication of his *Kosmos*. In 1829 the Russian emperor Nicholas fitted out a most magnificent expedition, which he placed under the direction of Humboldt, and which went through Moscow, Kasan, and Tobolsk to the Atlas Mountains and the Chinese frontier, and thence back to the Caspian Sea. The results of this journey Humboldt communicated in his *Asie Centrale* (3 vols., Paris, 1843). The first volume of *Kosmos* appeared in 1845; the fourth and last was not published till after the death of the author, May 6, 1859. *Kosmos* is Humboldt's chief work, the most perfect and the most characteristic. It gives a striking and attractive description of the numberless varieties of forms which the world contains, but this multitude it gathers under total views, and represents the world as one consistent existence; and there is no mysticism or sentimentality in the representation. There is only clear generalization. It is a wonderful book, stupendous in its learning, admirable in its ease. But it is a popular book, rather than a scientific one; and although we suppose that science is proud of having produced such a work, it occasioned a swarm of imitations which had better have remained unwritten. There is a peculiarity with Humboldt which posterity must remember in order not to be unjust to him. "With him ends a great period in the history of science," says Agassiz; and that is just his peculiarity; he was the end of a period, not the beginning. He was the plastic, forming power which finishes, not the weird, breaking force which starts. (See Klenke, *Alexander von Humboldt, ein biographisches Denkmal*, 1859.) Clemens Petersen.

Humboldt, von (Karl Wilhelm), Baron, brother of the preceding, b. at Potsdam June 22, 1767. After finishing his studies of philology and philosophy at Göttingen, he lived alternately at Erfurt, Weimar, Jena, and Berlin in intimate intercourse with Schiller, Goethe, F. H. Jacobi, and other celebrities of his time, and on the Thuringian estates of his wife, the spirited Karoline von Dacheröden, whom he married in 1791. From 1797 to 1799 he resided with his family in Paris, whence he made a journey into Spain, spending his time partly in literary occupations, poetical and critical, of a lighter description, partly in penetrating and exhaustive linguistic studies. In 1801 he was appointed Prussian ambassador to the court of Rome, but returned in 1808 to Berlin as minister of the interior, in which office he developed great activity for the reorganization of the Prussian state, more especially for the establishment of the University of Berlin. In 1810 he went as minister plenipotentiary to Vienna, and he played a conspicuous part in the immense diplomatic stir which accompanied and followed the fall of Napoleon. He sat at the congresses of Prague, Chatillon, Vienna, and Aix-la-Chapelle; he signed the treaty of Paris, and represented Prussia in the first German diet. He was a member of the Prussian council of state up to 1819; and he exercised a great and beneficial influence on the development of German affairs. His influence was preventive, however, rather than productive. As a statesman he possessed great business capacity, industry, clearness, and tact, and he entertained liberal and even large views; but he had no invention, hardly any ideas. His noble sentiments made him an ally of everything noble, and the respect which his character, his connections, and his talents commanded prevented much evil from taking place; but there is hardly anything positive which can be called his work. In general literature he occupied a similar position. He was a man of exquisite taste, of warm interest, of ready sympathy, and his correspondence with Schiller, Goethe, and others shows how he brought light and elevation along with him wherever he went. But his poems, his criticisms, his letters, have only historical interest. The influence died out with the man. Not so, however, with his scientific works. His merits in the establishment and development of the science of comparative philology are lasting as they are great, and his linguistic researches are in many points both ingenious and exhaustive. His principal works in this line are—*Berichtigungen und Zusätze zu Adelungs Mithridates über die cantabrische oder baskische Sprache* (1817); *Prüfung der Untersuchungen über die Urbewohner Hispaniens vermittels der baskischen Sprache* (1821); *Ueber Dualis* (1828); *Ueber die Verwandtschaft der Ortsadverbien mit dem Pronomen* (1830); *Ueber die Kawisprache* (1836–40); *Vocabulaire inédit de la langue Tatienne* (1843), etc. This great and even brilliant scientific activity began after his removal from office. The Prussian king, like the other German princes, broke the promise of a representative constitution which he had given during the war against Napoleon, and under the pretext of putting down demagogism he persecuted liberty. Humboldt understood the manœuvre, and fought against it with all his power. Suddenly (Dec. 31, 1819) he was dismissed in a signal manner. He afterwards lived on his estate of Tegel at the Lake of Spandau, where he d. Apr. 8, 1835. (See Schlesier, *Erinnerungen au Wilhelm von Humboldt*, 1846.) Clemens Petersen.

Humboldt River, the longest river of Nevada, rises in Elko co., and flows 384 miles in a generally S. W. course. Its waters are alkaline, being charged with soda. It is nowhere many yards in width, and is generally fordable. Its banks have clumps of willows and other vegetation, and there are some fertile alluvial plains. It finally ends in Humboldt Sink, "a marshy spot in a sandy plain," not really a lake except in high stages of the river. The river is chiefly remarkable as furnishing the only E. and W. valley through this region, while N. and S. valleys are numerous. The Central Pacific R. R. follows its valley for many miles. The river-bottoms average a mile in width; outside of these the land is good, but needs irrigation. Numerous streams approach the Humboldt, but sink after leaving their cañons. The Little Humboldt is its largest affluent. But in high water the Reese River passes its sink and flows into the Humboldt. Some five miles above Humboldt Lake are the "Big Meadows," with an area of 5000 acres, furnishing great quantities of hay and some peat. The sink is 3920 feet above the sea-level.

Humboldt Wells, tp. of Elko co., Nev., on the Central Pacific R. R. (Wells Station), 669 miles N. E. of San Francisco. Here are some twenty very deep natural wells of good water, supposed to be of volcanic origin. Silver, lead, and copper ores are found and smelted here. Wood, water, and grass are abundant. Pop. of tp. 42.

Hum'bug, tp. of Siskiyou co., Cal. Pop. 251.

Hume, tp. of Whitesides co., Ill. Pop. 676.

Hume, tp. of Huron co., Mich., on Lake Huron. P. 475.

Hume, tp. and post-v. of Allegany co., N. Y. The township has several villages and very extensive water-power. Pop. of Hume or Cold Creek v. 254; of tp. 1920.

Hume (David), the most noted of modern skeptical philosophers and a distinguished essayist and historian, b. Apr. 26, 1711, at Edinburgh. His father, Joseph Hume (or Home), a member of the Faculty of Advocates, and proprietor of the estate at Ninewells in the parish of Chirnside, Berwickshire, died leaving David still an infant. At the age of fifteen Hume entered Edinburgh University, and, although he was intended for the bar, his own inclination was toward literature, his favorite authors being Cicero, Virgil, Seneca, and Plutarch. His slender means led him at the age of twenty-three to enter mercantile life at Bristol, but after some months he resolved to pursue his literary projects, and sought cheap living and retirement in France at Rheims and La Flêche, where he composed his *Treatise on Human Nature,* which he published in 1738, after his return to England. "It fell dead-born from the press," says Hume, "without reaching such distinction as even to excite a murmur among the zealots." In 1741–42 he published the first part of his *Moral and Political Essays,* which were favorably received. In 1744 his reputation for skepticism prevented the success of his application for the chair of moral philosophy in the University of Edinburgh. In 1747 he attended Gen. St. Clair on an embassy to Vienna and Turin, where he recast the first part of his *Treatise,* and published it as an *Inquiry concerning the Human Understanding.* In 1751 he became librarian of the Advocates' Library in Edinburgh, which position he held for five years, and, availing himself of its resources, undertook his *History of England,* publishing the first volume in 1754, treating the reigns of James I. and Charles I., and bringing much obloquy upon himself for his leniency shown towards Strafford and Charles I.; but his subsequent volumes achieved great popularity for the work. His *Political Discourses,* published in 1752, obtained wide fame on the Continent, and contributed largely to the creation of the science of political economy. His *Inquiry concerning the Principles of Morals* appeared in 1752. He accepted the earl of Hertford's invitation to attend him on his embassy to Paris in 1763, and on his arrival was "loaded with civilities" by the nobility, foreign ambassadors, the savants, and the royal family. He became intimate in the circle of D'Alembert, Marmontel, Diderot, Duclos, Helvétius, Hérault, Buffon, Malesherbes, Holbach, and Turgot, and was the special favorite of the ladies. In 1767–68 he was under-secretary of state, appointed by Lord Conway, brother of the earl of Hertford, and had charge of Scottish affairs, including the patronage of the churches. He resided at Edinburgh, and was chief of a literary circle including Robertson, Blair, Lord Kames, Adam Ferguson, Adam Smith, and others. Warned by an incurable disease, he wrote his own *Life* and provided for the publication of his *Dialogues on Natural Religion,* a work written in early life, and calmly awaited death, which came Aug. 25, 1776. His philosophy is the completest statement of the ideas that produced the French Revolution, and may be regarded as the culmination of the reactionary movement towards individualism and naturalism inaugurated in the era of Bacon and Locke, and reaching its *dénouement* in the eighteenth century. It has been the stimulating cause of the notable systems since. Kant confessed that "Hume's exception to the idea of causality first interrupted my [Kant's] dogmatic slumber." Hume exposes the basis of his system thus: "All the perceptions of the human mind resolve themselves into two distinct kinds, which I call *impressions* and *ideas.* The difference betwixt them consists in the degrees of force and liveliness with which they strike upon the mind and make their way into our thought and consciousness. Those perceptions which enter with the most force and violence we may name *impressions,* and under this name include all our sensations, passions, and emotions as they make their first appearance in the soul. By *ideas,* I mean the faint images of these in thinking and reasoning." Thus, ideas are copies of impressions of individual things, and the phase of universality belonging to them is completely ignored. He consistently denies all objective validity to complex ideas, and holds the conceptions of substances, modes, and relations to be fictions of the mind. Hence, "the identity which we ascribe to the mind of man is only a fictitious one." The complex idea of cause and effect is, as Hume says, "derived from experience, which, presenting us with certain objects constantly conjoined with each other, produces such a habit of surveying them in that relation that we cannot, without a sensible violence, survey them in any other." Habit is the sole universality and necessity. Hence, the

doctrine of an Absolute First Cause is unwarranted in philosophy. Pleasure and pain form the basis of moral principles. His famous argument against miracles—invented in 1736 at La Flèche to silence a Jesuit who claimed the recent occurrence of miracles at his convent—is this: "Invariable experience is in favor of the uniformity of nature, while it is not in favor of the infallibility of human testimony; hence there is, in all cases, a greater probability of the falsity of the testimony as to the occurrence of a miracle than of the violation of a law of nature thereby implied." (For best sources of information see the *Life and Correspondence of David Hume*, by John Hill Burton, 2 vols., Edinburgh, 1846; also *My Own Life,* in vol. i. *Hist. of Eng.*, by D. Hume, Boston, 1850.) Wm. T. Harris.

Hu'merus, the large cylindrical bone of the upper arm from the shoulder to the elbow, forming at its upper extremity a hemispherical head, which is connected with the scapula and two tuberosities for the attachment of muscles. The whole combination of the head of the humerus, the scapula, and the clavicle is also called humerus.

Humes (Thomas William), S. T. D., b. at Knoxville, Tenn., Apr. 22, 1815; graduated in 1830 at East Tennessee College (now a university); was rector of St. John's church (Protestant Episcopal) 1846–61 and 1863–69, and since 1865 has been president of East Tennessee University. Author of various published sermons and addresses.

Humil'iate Nuns, an order of Benedictine nuns, called also **Nuns of Blassoni,** from the name of their foundress. They served as nurses, etc. In 1571 they were suppressed by Pius V. for some disorders, but a few convents, greatly decayed, still exist in Italy.

Humil'iates (*Humiliati*), an order of canons and lay brothers following the rule of St. Benedict. They were originally lay brothers of a congregation founded about 1134. In 1151 they were reformed by St. John of Meda, and became in part canons regular of St. Benedict.

Hum'mel (Johann Nepomuk), b. at Presburg Nov. 14, 1778; d. at Weimar Oct. 17, 1837. His father, a proficient and an orchestra leader, commenced his son's musical education by teaching him the violin. But the child showed little aptitude, and was thought to have no talent. He was then taught to sing and to play the piano, and in these studies his extraordinary gifts soon became manifest. In one year he acquired a skill that made him a musical prodigy. The Hummels removed to Vienna, where they found Mozart. The talented boy so interested the celebrated man that he took the lad to his own house and gave him lessons, though such work was much against Mozart's taste. At nine years of age he was so much admired by all who heard him that he and his father made a concerting tour through Germany, Denmark, and Scotland. The years 1791 and 1792 he passed in London, and there studied the pure, methodical style under Clementi. At fifteen years of age he returned home, and settled down to hard study in Vienna under his severe and exacting father. He afterwards became the pupil of Albrechtsberger for harmony, and of Salieri for singing and the principles of dramatic composition; in 1803 entered the service of Prince Nicholas Esterhazy, for whom he wrote his first mass, which was well received by Haydn. In 1811 he left the Esterhazy service, and for five years gave piano-lessons in Vienna; in 1816 was appointed chapel-master to the king of Würtemberg; in 1820 resigned that office and became chapel-master to the grand duke of Saxe-Weimar; in 1822 obtained leave of absence to make a pedestrian tour in Russia, where he was enthusiastically received; in 1823 travelled through Holland and Belgium on his way to Paris, where the artistic world showed a worthy appreciation of his fame and genius. From Paris he returned to Weimar, which he made his permanent home. Some altercation had estranged Beethoven from Hummel. In 1827, when Beethoven's illness gave anxiety, Hummel went to Vienna, and their differences were lost in the fullest reconciliation. In 1829 he made a second visit to Paris, where, six years before, his reception had been one of the most brilliant passages in art; but now his performances were a failure. In London his presence was scarcely remarked. One other tour, in Poland, was the last of his wanderings; the rest of his life he passed quietly at Weimar.

In Hummel were three artists—the performer, the improviser, the composer—in each respect he was a genius of high order. As a performer he founded a school which is the means by which most of his noted successors have risen to eminence. His voluminous *Method* for the piano was a new and valuable creation in the field of study, classifying the difficulties of fingering and other details of piano practice. The greater volume and sonority attained by his successors made Hummel's touch appear weak and tame perhaps, but no one surpassed him in purity, regularity, and correctness of execution, or in delicate shading and beauty of phrasing. As an improviser he was very remarkable; his inspirations, so regular in form, so finished, yet so fresh and full of unexpected fancies, seemed like meditated compositions. As a composer he is not generally appreciated by the public. Had Beethoven not been his contemporary, he probably would stand as the first composer of his age in instrumental music. In his works noble, elegant, and graceful themes are treated with the skill and experience of a consummate master. But the most perfect finish was no match for the passion and power of the unapproachable Beethoven. His most esteemed works are—the Septuor in D minor (op. 74), the quintet for piano (op. 87), the concertos in A minor (op. 85), in B minor (op. 89), in E major (op. 110), and in A flat major (op. 113), and the grand sonata for piano for four hands (op. 92). He wrote 11 dramatic compositions, including operas, ballets, and cantatas; 4 compositions for the church; 22 instrumental works, including overtures, concerted pieces for the piano, violin, violoncello; and many sonatas and other compositions for the piano. C. H. Farnham.

Hum'melstown, post-b. of Dauphin co., Pa., 9 miles E. of Harrisburg, on Swatara Creek, the Union Canal, and the Philadelphia and Reading R. R.; has fine schools, a weekly newspaper, bank, 4 churches, several mills and machine-shops, brownstone saw-mill, 2 carriage manufactories, terra-cotta works, hotels, etc. Pop. 837.
W. R. Hendricks, Pub. "Sun."

Hum'ming-Bird, the name of many genera of small slender-billed American birds of the family Trochilidæ. They are most numerous in species and individuals near the equator, are very numerous in Mexico, and one species is found northward in summer even in British America. This species is the *Trochilus colubris,* the only species often seen in the Northern States. It is known as the ruby-throated humming-bird. In its flight its wings produce that well-known humming sound which is so characteristic of the family. It has been supposed to live entirely upon the honey which it is well known to gather from flowers, but it has been known to swallow spiders and other species, at least, certainly eat small insects. There can, however, be no doubt that the long bill and the slender, almost projectile tongue, which is attached to the hyoid bone in a very singular manner, are especially adapted to the collection of honey from flowers; and the sight of these brilliant little birds darting about from flower to flower with lightning speed is one we are all familiar with. Its lichen-covered nest, lined with a silky fibre, is a wonderfully neat structure. In the far North-west the *Selasphorus rufus,* a very brilliant red species, appears to replace the foregoing. To enumerate even the genera of the humming-birds would be tedious. There are some 400 species. Of these only eight or ten are ever found in the U. S. The largest known species (*Hylocharis gigas,* eight inches long) and the smallest (*Mellicaga minima,* whose body is barely one and a quarter inches long) are both tropical.

Hump'back Whale, a name given by sailors to those fin-backed whales (Balænopteridæ) which have the dorsal fin represented by a hump or bunch, generally about the size of a man's head. They form a group, Megapterinæ, comprising three genera, *Megaptera, Poescopia,* and *Eschrichtius.* One of the best known is *Megaptera longimana,* called Johnston's humpback, found in the North Atlantic and Arctic waters. It is fierce and dangerous, but is killed for its oil, which is worth nearly as much as sperm oil. The baleen is short and poor.

Hum'phrey, post-tp. of Cattaraugus co., N. Y. P. 1065.

Humphrey, tp. of Darlington co., S. C. Pop. 896.

Humphrey (Edward Porter), D. D., LL.D., eldest son of Heman, noticed below, b. at Fairfield, Conn., Feb. 10, 1808; graduated at Amherst in 1828, and at Andover in 1833; was tutor at Amherst 1832–33; from 1833 to 1835 preached at Jeffersonville, Ind.; was pastor of Second Presbyterian church in Louisville, Ky., 1835–53; was professor of ecclesiastical history in Danville (Ky.) Theological Seminary 1853–66; and in 1866 took charge of College street church in Louisville. He has published numerous discourses and review articles. Although living at the South during the war, he was loyal to the Union, and bore an important part in the reunion of the two branches (Old School and New School) of the Presbyterian Church.

Humphrey (Heman), D. D., b. in West Simsbury, Hartford co., Conn., Mar. 26, 1779; graduated at Yale College in 1805. He was pastor of the Congregational church in Fairfield, Conn., ten years; pastor of the church in Pittsfield, Mass., five years; and president of Amherst College twenty-three years (1823–45). Taking charge of that institution in its infancy, he contributed largely to its growth and prosperity, and impressed upon it much of his own character. At the same time he exerted a leading in-

fluence in the Congregational and Presbyterian churches, and in the revivals, missions, and national religious societies which had their origin in his day. He wrote often for the religious newspapers and journals, particularly *The Panoplist, The Christian Spectator*, and *The New York Observer*. He gave to the public some twenty-five or thirty sermons and addresses on special occasions, and left, besides, published works to the number of eleven volumes. Among the pamphlets, the most celebrated was his *Parallel between Intemperance and the Slave-Trade*, which, while it struck a heavy blow at intemperance, was a scarcely less formidable indictment of slavery. Of his books, the *Tour in France, Great Britain, and Belgium*, in 2 vols., has had the widest circulation. Dr. Humphrey's accurate observation, practical wisdom, and racy style all appear to advantage in this work. D. at Pittsfield Apr. 3, 1841. (See *History of Amherst College*, by the author of this sketch, and *Memorial Sketches of Heman and Sophia Humphrey*, by Z. M. HUMPHREY and H. NEILL.) W. S. TYLER.

Humphrey (JAMES), a son of Dr. Heman Humphrey, b. at Fairfield, Conn., Oct. 9, 1811; graduated at Amherst in 1831; became a lawyer of Louisville, Ky. (where he resided but one year), and of New York. He was (1858–60 and 1864–66) a member of Congress from New York. D. at Brooklyn, N. Y., June 16, 1866.

Humphrey (ZEPHANIAH MOORE), D. D., fourth son of Dr. Heman Humphrey, b. at Amherst, Mass., Aug. 30, 1824; graduated at Amherst College 1843, and at Andover Theological Seminary 1849; a popular preacher and pastor of churches at Racine and Milwaukee, Wis., 1850–59; of First Presbyterian church, Chicago, 1859–68; of Calvary church, Philadelphia, since 1868; moderator of the General Assembly of the Presbyterian Church, Chicago, 1871; was moderator of the last General Assembly of the New School Presbyterian Church at the same time that his brother Edward was moderator of the last Assembly of the Old School, and, like his brother, contributed his influence to the reunion.

Hum'phreys, county of N. W. Central Tennessee. Area, 550 square miles. It has the Tennessee River for its western boundary, and is traversed by the Nashville and North-western R. R. It is a fertile and undulating region. Cattle, corn, and tobacco are staple products. Cap. Waverly. Pop. 9326.

Hum'phreys (ANDREW ATKINSON), LL.D., b. at Philadelphia, Pa., Nov. 2, 1810; graduated at the U. S. Military Academy, and appointed second lieutenant of artillery July 1, 1831; began his military career with a season of garrison duty at Fort Moultrie, S. C.; thereafter employed on varied service, including a period in the Cherokee Nation and an eight months' active campaign in Florida, participating in several actions against the Seminoles, until Sept., 1836, when he resigned his commission. Returned to the service of the government as civil engineer the following year, when his health was restored, and reappointed in the army July 7, 1838, as first lieutenant topographical engineers; promoted to be captain 1848, major Aug., 1861, serving during this time on harbor improvements; again actively engaged for eight months in Florida war, and for five years (1844–49) in charge of the Coast Survey office at Washington. In Nov., 1850, he commenced the topographic and hydrographic survey of the delta of the Mississippi, directed by Congress for the purpose of determining the most practicable plan for securing it from inundation, as well as for deepening the channels of the river. Compelled by sickness in 1851 to relinquish charge of this work, he visited Europe, and from a personal examination of its river-deltas informed himself of the knowledge there acquired by the experience of centuries as to methods of protection against inundation. Returning in 1854, he was assigned to special service to determine the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean, upon which he continued until 1861, meanwhile serving on the lighthouse board and on various commissions, and in 1857 resumed the survey of the delta of the Mississippi, which shortly after his retirement from the work in 1851 had been discontinued, Lieut. Abbot being assigned to personal direction of the work. The valuable report upon the Physics and Hydraulics of the Mississippi River was submitted in Aug., 1861, having been hastened to a close by the outbreak of civil war. In Dec., 1861, Humphreys, now major, was assigned to duty on the staff of Gen. McClellan, and upon the transfer of the Army of the Potomac to the Virginia Peninsula was appointed its chief topographical engineer, serving as such throughout the campaign, having been promoted, however, to be colonel, A. A. D. C., Mar., and brigadier-general of volunteers Apr., 1862. Upon the return of Gen. McClellan to the command of the Army of the Potomac, Gen. Humphreys was (Sept. 13, 1862) assigned to command a division of new troops attached to the 5th corps as 3d division, and followed the army, making a night-march of 26 miles from Monocacy Bridge, joining it at Antietam on the morning of Sept. 18; made reconnaissance from Sharpsburg to Leetown Oct. 16–17; engaged at Fredericksburg, Dec., 1862, the battle closing with the assault of his division on the "stone wall" at Marye Heights; in command of his division at Chancellorsville, the time of service of which expiring soon after, he was (May 20) assigned to the 2d division 3d corps, which he commanded with great ability at Gettysburg, extricating it from its perilous position, though with great loss; on July 8 was promoted to be major-general of volunteers and appointed chief of staff to the commanding general Army of the Potomac, which important and responsible duty he performed with great credit until assigned to the command of the 2d army corps, Nov. 25, 1864, a period when, though the close was nigh, much hard fighting remained to be done. In the stirring events before Petersburg and subsequent pursuit of the Confederate army the 2d corps continued to bear an important part, up to the final action at Farmville Apr. 7, its commander winning the brevet of major-general U. S. A. for Sailor's Creek, Apr. 6, 1865. Continued in the volunteer service until Aug. 31, 1866, during the first half of the year engaged on plans for the relief of the alluvial region of the Mississippi from inundation; Aug. 8, 1866, appointed chief of engineers, U. S. army, with the rank of brigadier-general, which position he still retains (1875). In addition to the high duties of his office has served on the lighthouse board and on various commissions concerning important engineering works. Is also member of various American and foreign scientific societies. G. C. SIMMONS.

Humphreys (DAVID), LL.D., b. at Derby, Conn., in 1752; entered the army as a captain at the beginning of the Revolutionary war; was appointed aide-de-camp to Washington in 1780; accompanied Jefferson to France in 1780 as secretary of legation; went in 1794 to Lisbon, and in 1797 to Madrid, as ambassador, and returned to America in 1802. He was one of the first to introduce merino sheep to this country, and established a large woollen and cotton factory in Derby. During the war of 1812 he commanded the militia of Connecticut, and d. at New Haven Feb. 21, 1818. While residing at Hartford (1786–88) he published, together with Hopkins, Barlow, and Trumbull, the *Anarchiad*. The most prominent of his other poems are—*An Address to the Armies of the U. S.* (1782), *The Future Glory of the U. S., The Love of Country*, and *The Death of Washington*. He also wrote a *Life of Putnam* in 1798. His works were collected and published in New York in 1790 and 1804.

Humphreys (HENRY NOEL), b. at Birmingham in 1810; resided for several years on the Continent, especially in Rome; and published in 1840 his first work, the descriptions to W. B. Cooke's *Views in Rome*. Together with I. O. Westwood, he published in the same year *British Butterflies, and their Transformations* and *British Moths, and their Transformations*. Among his other publications are—*Ancient Coins and Medals* in 1850, *The Coinage of the British Empire* in 1854, and a number of anonymous novels.

Hum'phry (WILLIAM GILSON), M. A., b. in 1815; graduated in 1837 at Cambridge; was Hulsean lecturer at that university in 1849–50; and was nominated vicar to St. Martin-in-the-Fields, London, 1855. His Hulsean lectures were on *The Doctrine of a Future State* and *The Early Progress of the Gospel*. He has also written *A Commentary on the Book of the Acts of the Apostles, The Character of St. Paul* in 1858, *Theophilus of Antioch*, etc.

Hu'mus [Ger. *Humin;* Fr. *humine;* from Lat. *humus*, "moist earth" (soil)]; **Humic Acid** [Ger. *Huminsäure;* Fr. *acide humique*]; **Ulmine** [Ger. *Ulmin;* Fr. *ulmine;* from Lat. *ulmus*, the "elm tree"]; **Ulmic Acid** [Ger. *Ulminsäure;* Fr. *acide ulmique*]; **Geic Acid** [Ger. *Geinsäure;* Fr. *acide géique;* from Gr. Γῆ or Γέα, the "earth"]; **Crenic** and **Apocrenic Acids** [Ger. *Quellsäure* and *Quellsalzsäure;* Fr. *acides crénique* and *apocrénique;* from Gr. κρήνη, a "well" or "spring"]; **Nitrohumic Acids, Silico-nitrohumic Compounds, Peat,** etc. This large class of substances—comprising the proximate or more immediate products of decay, fermentation, and eremacausis of plant-tissues, under subaërial or subaqueous agencies, or both—presents great chemical difficulties in its exact investigation. It has therefore, notwithstanding its essential importance in connection with several sciences and arts—including plant physiology, plant nutrition, chemical geology, agriculture, water-supply, etc.—received, so far, the attention of but few chemists. Fortunately, these few include some of the greatest and most reliable names, such as Berzelius, Mulder, Berthelot, Paul Thénard, etc.; so that our knowledge, imperfect and incomplete as it is, has especial value. The ulmic and humic substances found in soil and vegetable "mould," rotten wood, peat, etc. were chiefly investigated by Mulder about 1840–45;

the crenic and apocrenic compounds by Berzelius about the same period, and later also by Mulder; while the highly important relations of the humic substances to *silica* were announced only five years since by Paul Thénard, and are but obscurely known.

Ulmine.—This is the name given by Mulder to that portion of brown decaying or decayed vegetable matter, such as rotten wood, peat, etc., which is insoluble in water, acids, and alkalies. The name *ulmine* originated with Klaproth, who applied it to what was probably a gummy exudation from an elm tree. The propriety of its use *here* is not evident. Mulder found also that cane-sugar, when boiled with acids, air being absent, yielded brown substances so similar in composition and chemical characters that he prepared most of his ulmine and ulmic acid for investigation in this way. Mulder's analyses of ulmine, both from peat and from sugar, yielded him the formula (new notation) $C_{20}H_{16}O_7$; which it will be useful to us to reduce to an expression "isologous" (having the same carbon-number) with those now most commonly in use for cellulose, the proximate plant-constituent from which natural ulmine is generally, or at least chiefly, formed—and for sucrose.

Sucrose (cane-sugar)........................$C_{12}H_{22}O_{11}$.
Cellulose ....$C_{12}H_{20}O_{10}$.
Ulmine...$C_{12}H_{9.6}O_{4.2}$.

There seems small probability that this so called ulmine is composed of a single definite compound, and it is doubtless a mixture of two or more.

The illustrious Berthelot published in 1869 some curious experiments with Mulder's ulmine from sugar, consisting in the application thereto of his new synthetic method of *hydrogenation*, by heating to 275° C., under pressure, with concentrated hydriodic acid. (*Bulletin de la Société Chimique de Paris*, Apr., 1869, p. 281.) The ulmine was changed almost entirely into liquid hydrocarbons, from which he obtained, by fractional distillation, the principal one, boiling at about 200°, which gave him the composition $C_{12}H_{26}$. He calls it *hydruret of duodecylene.* This is evidently a saturated hydrocarbon, homologous with marsh-gas, C_nH_{2n+2}. Like the paraffines and other petroleum-hydrocarbons, he found it to be indifferent to the action of the most powerful reagents. These facts have an obvious bearing on the true theory of petroleum-genesis.

Ulmic Acid.—This is the portion of brown peat, rotten wood, sugar rotted by hot acids, etc. which is soluble in alkalies. Mulder's formula, amended, is $C_{20}H_{14}O_6$, or reducing, as before, to an isologue of cellulose, $C_{12}H_{7.4}O_{3.6}$. This is much more likely to be a definite compound than ulmine, and it will be observed that it differs from cellulose by not very far from $6H_2O$, which difference, if exact, would give for ulmic acid (doubling the formula) $C_{24}H_{16}O_8$, and would make the action of the acid one of simple dehydration, as usual. Another chemist, named Stein, has since made analyses of ulmine and ulmic acid, and claims that they are isomeric, both corresponding to $C_{24}H_{18}O_9$. Ulmic acid, precipitated from alkaline solutions by a mineral acid, is a brownish jelly, which, as soon as the precipitating acid is washed out, begins to dissolve in the wash-water. Its perfect solubility in pure water and in alkalies is partly impaired by strong desiccation, ulmine being probably formed. Nitric acid converts it into formic and oxalic acids, and into *apocrenate of ammonia.* Concentrated muriatic acid, without access of air, converts it into ulmine. A number of *ulmates* were described by Mulder.

Humus or Humine.—Mulder makes this to be a product of oxidation of ulmine, with separation of water. His derivation of humine from ulmine may be thus expressed: $C_{12}H_{9.6}O_{4.2} + O_{0.6} - 0.3H_2O = C_{12}H_9O_{4.5}$ = humine. Humine is also obtained directly from sugar by long boiling with acids in the presence of air, and dissolving out the ulmic and humic acids formed from the humine by an alkali. It is converted by strong alkalies into humic acid.

Humic Acid ($C_{12}H_{7.2}O_{3.6}$).—Black peat contains humic acid in combination with ammonia, a compound so strong that boiling with sodic carbonate will not decompose it, but only dissolve it to a double humate of soda and ammonia. Potash expels the ammonia, but with destruction of the humic acid. Mulder appears to have obtained pure humic acid only artificially, by long boiling of sugar 8 parts, sulphuric monohydrate 2, and water 20, dissolving the dark-brown product in potash, and precipitating with muriatic acid—a brownish-black slimy mass, which when dry is insoluble in water, black, jet-like, amorphous, tasteless, and inodorous. Nitric acid converts it into apocrenate of ammonia, with formation of formic and oxalic acids. Concentrated sulphuric acid, without air, forms a new black substance of curious properties, not named by Mulder. Mulder makes the remarkable statement that this humic acid, wholly free from nitrogen, exposed in a moist place for six months to the air, is then found to contain considerable ammonia; inferring that during its oxidation the aërial nitrogen is caused to combine with the hydrogen of the humic acid, and presumably also that in soils this same process of ammonia-genesis must proceed by virtue of their contained humic acid. Boussingault's experiments have appeared to disprove this; but F. H. Storer has shown (*Bulletin of the Bussey Agricultural Institution*, 1874, pp. 262–268) that Boussingault's experiments were not conclusive, and has reopened a number of questions connected with this subject; insomuch that a re-examination of the original researches of Mulder seems desirable. Mulder found rotten willow-wood to be composed, in part, of humate of ammonia, evolving ammonia with potash. In black garden-mould humic acid exists also as humate of ammonia, with crenic and apocrenic salts, and is difficult to isolate. From such soils Mulder obtained his *geic acid*, which he makes to be $C_{12}H_{7.2}O_{4.2}$.

Crenic and Apocrenic Acids.—Berzelius discovered these two compounds together in a mineral *spring* in Sweden, whence these names. They are now known to be common products of vegetable decay. Mulder first found them in soils, as above stated. They are also found in some iron ochres and bog ores; and Berzelius recommends their preparation from these latter by boiling with potash, adding acetic acid and acetate of copper, which precipitates brown apocrenate of copper. On filtering, saturating with carbonate of ammonia, and adding cupric acetate again in excess, the greenish-white crenate of copper goes down completely on warming. For the composition of these acids Berzelius's analyses afford

Crenic acid..................................$C_{24}H_{30}O_{19}$.
Apocrenic acid...........................$C_{24}H_{14}O_{13}$.

Mulder states that they cannot be obtained wholly free from ammonia. Crenic acid, isolated from the cupric crenate by sulphohydric acid, and dried, forms a hard, transparent, yellowish, amorphous, inodorous mass, of acid and astringent taste, soluble in all proportions in water and alcohol. Its aqueous solution absorbs oxygen, producing apocrenic acid; dissolves in cold nitric acid without reaction, and is apparently not much acted on by the *boiling* acid. Apocrenic acid is dark in color, dissolves with brown color in water, also in alcohol, not in ether; has an acid reaction on litmus, but its taste is astringent, like tannin, and not sour. Sal-ammoniac and muriatic acid both precipitate it from aqueous solution as dark-brown flocks.

A recent experimenter, M. W. Detmer, reports that he could not accomplish the absorption by the roots of plants, or by a seaweed, of solutions of humic acid or of soluble humates, but that crenic acid, on the contrary, was readily absorbed. He attributes this to the possession, by the humic compounds, of a *colloid* nature; and he concludes that humic matters in the soil must pass by oxidation into crenates and apocrenates before nourishing plants. According to a very possible hypothesis, however, these humus-matters merely act as ammonia-providers for the roots, without any absorption thereinto on their own part, but by forming ammonia from the air. If this be their function, their incapacity of absorption by the roots becomes merely a provision to secure their continuance of action.

Humic Matters and Silica.—In 1870, M. Paul Thénard made a communication to the French Academy of Sciences of a merely preliminary kind, which appears to promise an era in the history of this subject, although it appears to have awakened little attention. (*Comptes Rendus*, vol. lxx. p. 1412.) He claimed to have discovered that by certain modes of fixing ammonia in humic compounds by substitution (as in the formation of ethylamine, for example), he had formed at least four new compounds of the humic type which had the power to dissolve great quantities of silica. These bodies possess a remarkable fixity, not completely losing their nitrogen at temperatures between 1000° and 1200° C. These new compounds, which he calls nitro-humic acids (*acides azhumiques*), contain from 7.5 to 24 per cent. of nitrogen, and the proportions of silica which they are able to take up are proportional to these numbers. There are thus formed new acids, which he calls silico-nitrohumic (*silico-azhumiques*) acids. His nitrohumic acids exist naturally in small proportion in soils. In his brief discussion of the subject he maintains that the silica which is always found in solution in the colored liquids that leach from soils (as had been shown analytically by MM. Verdeil and Risler) has entered into solution in the form of his silico-nitrohumic acids; also distinctly favoring the view that the *nitrogen of the air* enters here into the process for the behoof of vegetation.

Peat.—It is manifest that the above facts have an intimate bearing upon the origin, history, composition, nature and properties of the common material known by this name. Peat, according to the circumstances of its formation or subsequent exposure to aërial oxidation, will contain either ulmic or humic compounds, or both, in admixture with

more or less of unaltered cellulose. These compounds will contain more or less ammonia already in combination—even if the ammonia-making power be denied to it—and hence should have its value, greater or less, as an agricultural agent. The discussion of peat as a fuel, the conditions of its growth and formation, with other points relating to peat, will be elsewhere treated of. HENRY WURTZ.

Hun'dred [perhaps because originally supposed to contain a hundred families], a division of many English counties, is stated to have been first made by King Alfred. Some of the counties have no hundreds, but have wapentakes, wards, or other similar divisions. The counties of Delaware are likewise divided into hundreds.

Huner'ic [Ὀνώριχος], the second king of the Vandalic empire in Africa, reigned from 477 to 484 A. D. He was a son of Genseric, and married to a daughter of the emperor Valentinian. He was cruel and cowardly, and became most noted for the persecutions which he raised against the orthodox Christians.

Hunfal'vy (PÀL), b. Mar. 12, 1810, at Nagy-Szalok, in Hungary; studied law; was appointed professor in jurisprudence in 1842 at the academy of Käsmark; sat in the Hungarian diet 1848–49, and has lived since in Pesth. By his philological and ethnological researches he has defined the position of the Hungarian language in the Uro-Altaic family, and explained its relations to the Finnish and Turkish. In 1856 he founded *Magyar Nyelvészet*, a periodical for the Hungarian language, in Pesth; in 1861 he gave a *Chrestomathia Fennica*.—His brother, JÀNOS HUNFALVY, b. at Gross-Schlagendorf June 8, 1820, became professor of statistics and history at Käsmark in 1846; took part in the Hungarian rising in 1848, and lives since 1853 in Buda as professor of history at the Polytechnic School. He has written a *Universal History* (1862), a *Geography of Hungary* (3 vols., 1863–66), etc.

Hunga'rian Grass, an annual grass much sown as a forage-plant, is merely a variety of *Setaria Germanica*, the common millet. It is valuable for its quick, luxuriant growth on even poor soils, and is much relished by horses and cattle; but if overfed it appears to act as a diuretic, and is hence by many considered injurious to horses. If fed in reasonable quantity, it is very nutritious and quite harmless. It gives a good weight of excellent hay.

Hun'gary, in the wider sense of the word, meaning the countries of the Hungarian crown, consists of Hungary proper, Transylvania, Croatia, and Slavonia, and comprises an area of 98,717 square miles, with a population of 15,509,455. It forms an independent state, the kingdom of Hungary, and constitutes one part of the Austrian empire, the Transleithan kingdom, being connected with the German and Slavic countries, which form the other, the Cisleithan part of the empire, by a common dynasty, a common army and navy, and a common representation in foreign countries. The emperor of Austria bears the title of king of Hungary, and governs the kingdom of Hungary by a responsible ministry and a diet, which assembles annually and consists of 473 members, of whom 359 are returned from Hungary proper, 96 from Transylvania, and 18 from Croatia and Slavonia.

Hungary, in the narrower sense of the word, meaning Hungary proper, comprises an area of 68,583 square miles, with 11,530,397 inhabitants, of whom, with respect to races, 4,950,000 are Magyars, 2,380,000 Slavi, 1,470,000 Roumanians, 1,430,000 Germans, and the rest belonging to other different nationalities; and with respect to religion, 5,933,813 are Roman Catholics, 2,607,983 Protestants, 2,395,818 belong to the Greek Church, and 517,338 are Jews.

The surface of the country presents a vast plain sloping down from the Carpathian Mountains, which form the northern boundary, and the Alps, which cover the southern frontier districts towards the Danube, which, with its powerful affluents, the Theiss, the Drave, and the Save, traverses it and drains the soil. The soil of this plain is in some places sandy, almost desert-like, in others, especially along the Theiss, swampy and marshy, but generally it is extremely fertile, and by the rapid progress of agriculture the unproductive portions of the soil are annually diminished. The climate has also its drawbacks. The winters are often severe and protracted; the summers are often very hot, and droughts and destructive hailstorms are not unfrequent. But in general it is agreeable, healthful, and favorable to agricultural pursuits. Of the soil, one-third is covered with splendid oak forests, in which large flocks of swine are fed, and which literally swarm with pheasants, partridges, deer, stags, wild-boars, and wolves. Another third is under tillage, and although agriculture, in spite of recent progress, is still in a backward state, between 60,000,000 and 70,000,000 bushels of wheat of first quality are annually raised over the demand for home consumption. The remaining portion is partly occupied by meadows, where large herds of cattle, sheep, and horses of superior quality are reared, partly by gardens, orchards, and fields of flax and hemp, and partly by vineyards, which produce the finest wines and in sufficient quantity to supply the half of Europe. No less abundant is the mineral wealth of the country. The supply of rock-salt is inexhaustible; and of other useful minerals there were produced in 1858, 44,000 ounces of gold, 48,000 ounces of silver, 6300 cwts. of quicksilver, 27,000 cwts. of lead, 36,750 cwts. of copper, 1,575,000 cwts. of iron, and over 7,000,000 cwts. of coal. What Hungary lacks to become one of the richest countries in the world are, first, the tools of modern civilization—namely, associations to create capital, machinery to cheapen production, and railways to carry the products into the market—and then a little more of that spirit which understands how to use these tools, a little more of that modern spirit which prefers the bustle and energy of enterprise to the half-dreamy enchantment of the imagination.

Hungary is inhabited by several distinct races speaking several distinct languages, but the predominant race is the Magyar, a high-spirited, proud, and generous people, richly gifted in every respect, in body strong, mentally bright, and possessed of an inexhaustible energy. They came into Hungary at the close of the ninth century. The country had been a Roman possession, forming parts of the two provinces of Pannonia and Dacia. After the fall of the Roman empire it was overrun by different nations, among which the Huns and the Avars sustained themselves on the soil for the longest period, and are supposed to have given the country its name. At the close of the ninth century it was divided into many small kingdoms, and Wallachs, Bulgarians, and Germans formed a large portion of the population. The Magyars are a Turanian people, allied to the Turks and to the Finns. For a long time they dwelt first in Caucasus, and then in the region between the Don and the Dniester, but in 887 they descended under Arpad into the plain of the Danube, and after ten years' fighting they conquered the country and ruled from the summits of the Carpathian Mountains to the foot of the Styrian Alps. Their history falls into three periods—under the dynasty of the Arpads to 1301; under the elective monarchy from 1301 to 1526, and under the dynasty of the house of Hapsburg from 1526 to our time—but during its whole course, and in spite of the many splendid deeds and great achievements which it contains, its general character throughout is a peculiar backwardness, tending either to enslave the nation by indolence or to break it into factions. The most remarkable of the Arpad dynasty was Stephen I., from 997 to 1038. He was crowned by Pope Sylvester II. in 1000 as king of Hungary, and received the title of "His Apostolic Majesty" (which since that time has been the title of the Hungarian kings) as a reward for his exertions in behalf of the Church. Under him Christianity was established among the people, the country was divided into bishoprics, and schools were founded for classical and theological learning. But it was also under him that Latin became not only the official language of the Hungarian government, but also the only acknowledged vehicle of Hungarian civilization; and this pitiful mistake, this great calamity, stood unremedied for nearly 800 years, and affected the people like a somniferous potion. During the next period the elements of faction were grafted on the nation. Of all forms of government, the elective monarchy is the worst. People think it a privilege to choose for their king him whom they like. But that privilege is a curse. If a king were elected only for a limited time, the election would be a privilege, for then it would be possible for those interests which were defeated at the election to live and work on as a party. But as soon as the king is elected for life the party, defeated at the election, immediately becomes a faction. Furthermore, the elective monarchy gave the Hungarian nobility an opportunity of carrying changes into the constitution of the country which made it possible for them to depress the peasantry into serfdom, and prevent the formation of a powerful third estate living independent in the cities; and the nobility did not forget to utilize the opportunity. The most backward period, however, is that under the government of the house of Hapsburg. Twice the Hungarians saved this house from utter ruin—first, under Maria Theresa, when all Europe felt a desire to divide her dominions; and a second time, under Francis, when Napoleon hesitated whether he would let this family cease to reign, or whether he would marry one of its daughters. But this fidelity has more than once been rewarded with infamous treachery. Up to the days of the present emperor it was always the policy of Austria to try to dissolve the Hungarian constitution, and recast the Hungarian nation in German moulds. The effect of this policy was just opposite to what was intended; it brought the different estates of the Hungarian people, the haughty nobility and the poor serfs, nearer together, and that political movement in modern

civilization which demands equal participation in the government for all citizens of the state, equal taxation of all the members of the society, equal acknowledgment of all religious denominations, and absolute abrogation of all privileges and monopolies, was in Hungary brought about by the nobility itself. A constitution dictated by this spirit, abolishing feudality, enacting a new election law, and proclaiming the liberty of the press, was sanctioned by the diet and by the Austrian emperor in 1848, but at the very same time the Austrian government in Vienna began agitating, through its agents, the German, Slavic, and Roumanian races living in Hungary, against the Magyars, and it succeeded in creating such an uproar and confusion in the country that the abrogation of the free constitution by Russian arms and the establishment of an unmixed despotism seemed the only means by which to procure order. The relations between Hungary and Austria were very near an open rupture when the revolution of Feb., 1848, broke out in Paris, and occasioned a similar rising in Vienna. On Mar. 13, Prince Metternich fell, and with him the old régime. The emperor Ferdinand acceded in principle to all the demands of the Hungarians. An independent Hungarian ministry was formed under the presidency of Count Batthyányi; Kossuth and Déak were among its members, and the Diet of Presburg dissolved after sanctioning the necessary measures for the convocation of a national assembly at Pesth in July. It can hardly be doubted, however, that the Austrian government began to undermine this agreement almost from the very moment it made it. The Slavonian, Roumanian, and German parts of the population of Hungary were jealous of the predominance of the Magyars. The Germans and Slavonians of Hungary proper protested against the separation from Austria, and Transylvania and Croatia demanded the same independence of the Hungarian crown as Hungary of the Austrian. This movement was stirred up by secret emissaries from Vienna, and in some cases—as, for instance, in the election of Jellachich as ban of Croatia, and his defiant opposition to the Hungarian government—it was openly encouraged. Soon a war of races broke out with fury within the boundaries of Hungary. The national assembly convened in July, and, fired by the eloquence of Kossuth, it promptly agreed on measures for the suppression of the Slavonian rebellion: 42,000,000 florins were granted, 200,000 troops were levied, the Honvéds were formed, the fortresses equipped, etc. But from this time the central government at Vienna made greater and greater difficulties. It declared a separation between Hungary and Austria in military and financial respects an impossibility, and it continued to employ the Hungarian troops for the suppression of the insurrection in its Italian provinces. At last it plainly refused to sanction the measures of the national assembly, and Jellachich crossed the Drave. In September the cabinet of Batthyányi resigned, and a committee of defence under the presidency of Kossuth was formed. A vigorous resistance against the Slavonians on the one side and the central Austrian government on the other was organized; Jellachich was defeated; and when a new rising took place in October at Vienna, the Hungarian cause seemed to have won. But in December the emperor Ferdinand abdicated; Francis Joseph acceded to the throne; the Austrian arms were successful in Lombardy; and in the spring of 1849 an Austrian army under Prince Windischgrätz entered Hungary, demanding unconditional obedience to the Austrian authority. The national assembly, which had moved from Pesth to Debreczin, declared the house of Hapsburg deposed, chose Kossuth governor-general of the country, and a deadly struggle commenced. The various successes, the military heroism, and the political confusion with which it was carried on are described in the articles on BEM, DEMBINSKI, GÖRGEI, KLAPKA, KOSSUTH, etc. It was decided by the intervention of Russia. One Russian corps under Paniutine entered Hungary from the W., another under Lüders from the E., while a third army, numbering 130,000 men, under Paskewich, entered the Hungarian plain from the N., Aug. 13, 1849. Görgei surrendered at Viláyos; Kossuth, Mészáros, and others fled to Turkey; and many of the richest and noblest men of the nation became scattered all over the world. Batthyányi, Kis, and others were executed, and all the dungeons of the empire were filled. Thus Austrian order was once more restored. Nevertheless, in spite of the terrible defeat, the resistance of the Hungarian people was by no means broken. An opposition against the Austrian rule was soon formed on a broader basis and with a clearer consciousness, and the demands for the constitution of 1848 became louder and louder every year. At last, after the battle of Sadowa (July 3, 1866), and the entire separation of Austria from Germany, the Austrian government felt compelled to submit. In Feb., 1867, an independent Hungarian ministry was formed under the leadership of Count Andrássy, and in December of the same year the final emancipation of the Hungarian crown on the basis of the constitution of 1848 was accomplished. There still reigns a good deal of confusion and some strife in the relations of the country, both within and without, but, generally speaking, the country is now rapidly progressing in material as well as intellectual respects.

When in the ninth century the Magyars settled in the Hungarian plain, their language was already fixed, and seems to have undergone comparatively few and unimportant changes. The foreign words it has adopted, Latin, Greek, Slavic, German, and Turkish, have been thoroughly remodelled. It belongs to the Turanian family, is nearest akin to the Turkish and Finnish, and resembles the latter closely in its phonetic system, especially in its vocalization and in its grammatical formations. It has, however, in its compound sibilants *cs* and *cz*, and generally in its accent, when spoken with passion, something weird and wild which the Finnish has not, and which sounds very strange to a Saxon ear. It is spoken, at present, in four dialects—the Györi, on the Raab; the Bihari, on the Theiss; the Palócz, in the Mátra Mountains; and the Székely, in Transylvania. The last is said to be somewhat mixed with Tartar words, the third to contain most ancient words, but the difference between them and the written language is not great. It was not, however, until the latter part of the eighteenth century that this language became a truly literary language and the bearer of a national civilization. With the introduction of Christianity, about 1000, Latin became the language not only of the Church and its service, but also of the law and all court proceedings. There were monasteries and ecclesiastical seminaries in Hungary in the eleventh century; in the twelfth, Magyars frequented the universities of Paris and Bologna; and in the thirteenth, they founded libraries and schools at home. But all communication with Western Europe, and, indeed, the whole process of civilization, was carried on in the Latin language, and the national tongue, so far as it appeared in public, was confined to the camp and the tavern. In this a change took place with the Reformation, which was introduced into Hungary from Bohemia. Translations of the Bible occur as early as 1382, but in the sixteenth they became frequent; Komjáti (1533), Pesti (1536), Sylvester (1541), Heltai (1546), Székely (1548), Melius (1565), etc. The chronicle of the country was written in the native tongue by Székely (1559), Temesvári (1569), and Heltai (1572). Hymns, and even popular songs, were produced. The development stopped very soon, however, here as in Germany and the Scandinavian countries, though from different causes. The accession of the house of Hapsburg to the Hungarian throne after the death of Louis II. in 1526, confirmed Latin as the official language of the country. The Reformation itself spread German widely among the middle classes to the detriment of the native tongue, and after the introduction of the Jesuits in 1561 the Magyar language was looked upon as a cover for heresy. In the seventeenth and the first part of the eighteenth century Latin predominated more than ever. The first regular newspaper of the country, started in 1721, was published in Latin. It was the school reforms of Joseph II. which first awakened the popular spirit, and it was his attempt at Germanizing the people which made the awakened spirit national; the attempt was met with the most decided resistance. Laws were promulgated which introduced the Hungarian language in schools and courts of all degrees, and social life commenced to assume, in all its various branches, a most decidedly national character. In 1787, Matthias Ráth started in Presburg the first Hungarian newspaper, thereby inaugurating a journalistic literature which probably has employed greater talent and exercised a deeper influence than that of any other European country. Its most brilliant period embraces the years between 1840 and 1844, when Louis Kossuth edited the *Pesti Hirlap*, and treated all vital questions involved in the situation of the Hungarian people with a nobleness of tone and elegance of manner which actually raised the literary standard of the nation. In 1788, Kazinczy commenced his *Magyar Museum*, and although this, as well as its nearest descendants in the periodical press, was confined to the rich and educated classes, from it sprung a peculiar kind of annuals of miscellaneous contents, *Ellenör*, *Emlény*, etc., which became very popular. In 1793, Raday established a national theatre in Pesth; in 1817 appeared the first comedy by Károly Kisfaludy, and since the début of Joseph Szigligeti as a playwriter in 1834 the Magyar theatre rests principally on the national drama. In 1836, Baron Josika commenced his very prolific and successful activity as a romance-writer, treating subjects of the history of the Magyars after the mode of Walter Scott, and from 1842 to 1846 appeared the *History of Hungary* by Horváth. Other

fields of literature and science, especially travelling sketches and languages, have been taken up and cultivated with equal success during the course of the present century. But its true inauguration as a literary language, as the bearer of a national civilization, as the expression of a national genius, the Hungarian language received by the publication in 1817 of *Himfy's Love*, by Sándor Kisfaludy. An unbroken chain of lyrical productions or epics, with a strong lyrical tone, of different character, but generally of great merit, connects *Himfy's Love* with our days, and culminated with Sándor Petöfi. With him all inspiration from foreign ideas, all institution of foreign models, ceased. The Magyar genius stood fully revealed, free and independent, in one of its phases, and a truly national school of poetry was formed; one of its chief members is Johann Ararcy. Nor was the check which this development received from the failure of the revolution of 1848 absolute; on the contrary, after a short and merely temporary disturbance, it went on, as it seems, with renewed vigor. CLEMENS PETERSEN.

Hungary Neck, tp. of Somerset co., Md., on Chesapeake Bay. Pop. 938.

Hungary Water, a perfume for the toilet, is simply dilute alcohol aromatized with sage, rosemary, ginger-root, or other fragrant substances, and then distilled. It has had a limited use in medicine as a stimulant.

Hun′ger [Ang. Sax. *hunger*], the craving for food, the sensation which impels animals to eat. It is an intensification of what is called the appetite. An abnormal condition of hunger is also induced in animals by the ablation of the spleen, and perhaps by the removal of other ductless glands. Hunger is probably induced normally by the general need of nutriment throughout the system, but the sensation is chiefly referred to the stomach. It may be diminished by the administration of various drugs and by the use of tobacco.

Hun′newell, post-v. of Jackson tp., Shelby co., Mo., on the Hannibal and St. Joseph R. R., 37 miles W. of Hannibal. Pop. 327.

Huns, The [Lat. *Hunni*], were an extremely savage and ugly tribe of warlike nomades, with dark complexions, small, deep-set, black eyes, broad shoulders, and flat noses. They came from the vast barren plateaus of Eastern Asia, N. of China, and while one part of them settled along the shores of the Caspian Sea, and later became known as the White Huns, the other part crossed the Volga and conquered the Alani, who became incorporated with them. In 376 they crossed the Dnieper, defeated the Goths, and drove them over the Danube into the Roman province of Pannonia. In 434, under Attila, they crossed the Danube, and the Roman emperor, Theodosius II., had no other means of stopping them than by paying them an annual tribute. When, after the death of Theodosius, the tribute ceased to be paid, Attila pushed forward and visited Gaul, where he was defeated on the Catalaunian plain, and Italy, where Pope Leo I. persuaded him to retreat. After the death of Attila the Huns dissolved and disappeared among the other barbarian tribes. The Huns were probably Tartars, perhaps of the Mongol branch, but the term appears to have been used somewhat vaguely, and to have included Turkish or Ugrian peoples, perhaps even the Magyars.

Hunt, county of the N. E. of Texas. Area, 935 square miles. It is a rolling country, with abundance of hardwood timber. The soil is generally fertile. Live-stock, corn, cotton, and wool are staple products. Cap. Greenville. Pop. 10,291.

Hunt, tp. of Scott co., Ark. Pop. 280.

Hunt (EDWARD B.), b. in Livingston co., N. Y., 1822; graduated at West Point Military Academy July 1, 1845, and entered the army as brevet second lieutenant of engineers; promoted to be second lieutenant Dec., 1845, first lieutenant July, 1853, captain July, 1859, and major Mar., 1863. Upon entering the army in 1845 he was ordered to New York as assistant to the board of engineers for coast defence, and served in this capacity about one year, when he was detailed for duty at West Point as assistant professor of engineering, which position he retained till 1849, when he was ordered to Boston, Mass., as assistant engineer in the construction of Fort Warren. From 1851 to 1855 he was on duty in the office of Prof. Bache, superintendent U. S. Coast Survey, and from 1855 to 1857 was engaged in the construction of fortifications and lighthouses on the coast of Rhode Island. He was transferred to Key West, Fla., in 1857, and engaged in the construction of Fort Taylor until 1862, when he was relieved, and became chief engineer of the department of the Shenandoah, which position he held but a short time, being engaged from Apr., 1862, to Oct., 1863, in the construction of fortifications in Connecticut and Rhode Island, and during the same time on special duty under the navy department in perfecting his invention of a submarine battery (the "Sea-Miner"); and it was while conducting experiments at Brooklyn, N. Y., with this device that he was overcome by escaping gas, and, falling into the hold of the vessel, was killed, Oct. 2, 1863. He was a brother of ex-Gov. Washington Hunt of New York, and a man of high scientific attainments, and earnestly devoted to his country and profession; member of several scientific associations, and a frequent contributor to various literary and scientific publications. G. C. SIMMONS.

Hunt (FREEMAN), b. at Quincy, Mass., Mar. 21, 1804; entered in 1816 a printing-office in Boston; established the *Ladies' Magazine* and recommenced the publication of the *Penny Magazine;* became managing director of the Bewick Company and edited *The American Magazine;* removed in 1831 to New York, where he established *The Traveller* in 1831 and the *Merchant's Magazine* in 1839. He also published *The Library of Commerce* (1856–57) and *The Lives of American Merchants.* D. at Brooklyn Mar. 2, 1858.

Hunt (HELEN), a daughter of the late Prof. N. W. Fiske, b. at Amherst, Mass., in 1831, became the wife of Maj. E. B. Hunt (1822–63) of the U. S. engineers. She resides at Newport, R. I. Her *Verses by H. H.* (1871) and *Bits of Travel* (1872) have won a brilliant popularity.

Hunt (HENRY JACKSON), b. in Detroit, Mich. (then a Territory), Sept. 14, 1819; graduated at West Point Military Academy July 1, 1839, and entered the army as second lieutenant of artillery; promoted to be first lieutenant 1846, captain 1852, major 1861, lieutenant-colonel 1863, and colonel 1869; served on frontier and garrison duty 1839–46; in the Mexican war 1846–48, at Vera Cruz, Cerro Gordo, Churubusco, Molino del Rey (wounded), Chapultepec, and the capture of the city of Mexico (brevet captain and major). During the civil war served as aide-de-camp to Gen. McClellan, and commanded the artillery reserves of the Army of the Potomac in the Peninsular campaign of 1862, and commanded in chief the artillery of that army from Sept. 18, 1862, to the close of the war. Appointed brigadier-general of volunteers Sept. 15, 1862; brevet major-general of volunteers and brevet colonel, brigadier-general, and major-general of volunteers for gallant services in the field. Author of various reports and papers on artillery, artillery projectiles, tactics, army organization, and organization of artillery schools; member of various boards for the armament of fortifications, and president of the permanent artillery board for the army. G. C. SIMMONS.

Hunt (JAMES HENRY LEIGH), b. at Southgate, Middlesex, England, Oct. 19, 1784, the son of a clergyman who had been a lawyer in Philadelphia. Leigh Hunt was educated at Christ's Hospital, read law for a time, and found a place in the war office, which he left in 1808. His *Juvenilia* (poems, 1801) was published by his father, and in 1805 he became a critic for the *News*, a journal, and in 1808 established, with his brother John, *The Examiner*, a journal which became a power in the political world by reason of the independent course of its editors. The brothers were imprisoned (1812–15) for using language which was regarded as lacking in respect for the prince regent, but the kindness of Moore, Byron, and the Whig literati made Hunt's jail-life a very pleasant episode in his career. His best poem, *The Story of Rimini* (1816), was among the books written during his imprisonment. His literary life was one of much activity; many volumes of poems, essays, translations, and romance followed; but in spite of his industry Hunt was always very poor. In 1822 he visited Byron in Italy, and quarrelled with him, but after the latter's death published *Recollections of Byron* in 1828. Hunt performed much editorial labor, and in 1847 received a pension of £200. Hunt was a man of happy disposition, but was of a character not altogether admirable. Dickens's Harold Skimpole is believed to set forth Hunt's least admirable qualities. As a writer he had a felicitous style and an artistic way of putting things, but he wrote too often when he had nothing important to say, and most of his many books are already forgotten. Among the best are *Men, Women, and Books* (1847) and *Autobiography* (1850), edited by Thornton Hunt, his son. Leigh Hunt d. at Putney Aug. 28, 1859.

Hunt (JOHN), b. near Lincoln, England, June 13, 1812; joined the Wesleyan conference in 1836, and in 1838 was sent to the Fiji Islands, where for ten years he travelled and preached, introducing Christianity in many tribes. D. there in 1848, having translated the New Testament into the Fiji tongue, besides writing in English a treatise on *Entire Sanctification.*

Hunt (RICHARD MORRIS), b. in Brattleboro', Vt., Oct. 28, 1828; went to Europe in 1843; was a pupil at the École

des Beaux Arts in Paris, and attained distinction there; was made an inspector of the building between the Louvre and the Tuileries; returned to America in 1855; devoted himself actively to his profession, and has been of service in elevating the taste for architecture at home. He has built villas in Newport, residences in Boston and New York, the Stevens' apartment-house, the Lenox Library, the Divinity College building at Yale, the Capitol extension at Washington, and is the architect of the *Tribune* building in New York. His summer residence is at Newport; in winter he lives in New York. O. B. FROTHINGHAM.

Hunt (ROBERT), b. at Devonport, England, Sept. 6, 1807. He is a self-educated man, but has acquired a great name, partly by his annually published *Mineral Statistics* for the United Kingdom, which he was the first to establish, partly by his researches on light, communicated to the *Transactions of the British Association,* whence resulted the discovery of several important photographic processes and a better understanding of the chemical influences of the solar rays. He is conservator of the Museum of Geology in London, and has published *Poetry of Science* (1848) and *Panthea* (1849).

Hunt (THOMAS), M. D., b. in Charleston, S. C., May 18, 1808; d. in New Orleans Mar. 30, 1867; graduated in the medical department of the University of Pennsylvania 1829, and in 1863 the same degree was conferred upon him by the Royal University of Havana, Cuba. He was the first professor of anatomy and physics in the medical department of the University of Louisiana 1834; then its dean, and in 1848 became professor of physiological and pathological anatomy, which he held at his death. He was also house-surgeon to the Charity Hospital; president of the Physico-Medical Society of New Orleans, and became the president of the University of Louisiana 1866. He also contributed largely to medical journals. PAUL F. EVE.

Hunt (THOMAS STERRY), F. R. S., LL.D., PH. D., b. at Norwich, Conn., Sept. 5, 1826; studied medicine and chemistry, and in 1845 became assistant in chemistry to Prof. Silliman; served under Sir W. E. Logan as chemist and mineralogist for the geological survey of Canada; was in 1855 one of the English jurors at the Paris Exposition, when he received the cross of the Legion of Honor. In 1859 he was chosen a fellow of the Royal Society. He has been professor of chemistry in the University of Quebec and in McGill College, Montreal, and now (1875) holds a similar position in the Massachusetts Institute of Technology. He has written many important papers upon mineralogy, chemistry, dynamic geology, and kindred topics.

Hunt (WARD), LL.D., b. at Utica, N. Y., June 14, 1810; educated at Hamilton and Union Colleges, graduating in 1828; was mayor of Utica and member of the New York assembly; was judge of the court of appeals of the State of New York from 1865 to 1873, when he became justice of the Supreme Court of the U. S.

Hunt (WASHINGTON), b. at Windham, N. Y., Aug. 5, 1811; admitted to the bar at Lockport in 1834; appointed first judge of Niagara co. in 1836; member of Congress 1843–49; comptroller of New York 1849, and governor 1851–53. He was one of the leaders of the conservative wing of the Whig party, and when this party was dissolved he became a Democrat. He was a delegate to the Chicago Convention in 1864, and d. in New York Feb. 2, 1867.

Hunt (WILLIAM HOLMAN), b. in London in 1827; studied in the school of the Royal Academy, and exhibited for the first time in 1846. In the first years he generally took his subject from some poet, Keats, Bulwer, and others, but with his picture *A Converted British Family Sheltering a Christian Missionary from the Persecution of the Druids,* exhibited in 1850, a radical change had taken place, not only in his choice of subjects, but also in his style of execution; with this picture the new school of pre-Raphaelites was, if not founded, at least announced. In 1853 he painted *Our English Coasts;* in 1854, *The Awakened Conscience* and *The Light of the World,* explained in two letters by Ruskin, published in the *Times;* in 1867, *After Sunset in Egypt;* and in 1872, *The Shadow of Death.*

Hunt (WILLIAM MORRIS), brother of Richard M., b. in Brattleboro', Vt., Mar. 31, 1824; entered Harvard College in 1840, but did not complete his course; went to Düsseldorf in 1846; in 1848 was a pupil of Couture in Paris; returned to the U. S. in 1855, and took up his residence in Newport, but removed thence to Jamaica Plain near Boston, where he now resides. Hunt was one of the first to introduce what is commonly known as the French school of art into America, but he made it his own, and used it to express original ideas. His pictures are numerous and of great variety in subject, genre-painting and portrait being his great excellence. *The Lost Kid, The Choristers, Girl at the Fountain, Marguerite, Morning Star, Bugle Call, Drummer Boy* are well known, and have most, if not all, been reproduced in lithograph. Some of his portraits—those of Dana the poet, Chief-Justice Shaw, and several of ladies—are much admired, but in this work he is unequal, his success depending greatly on his sympathy with the sitter. For several years Mr. Hunt has taught classes of ladies in Boston, and awakened enthusiasm in the study of art. O. B. FROTHINGHAM.

Hunt'er, tp. of Edgar co., Ill. Pop. 1029.

Hunter, post-tp. of Greene co., N. Y., in the Catskill Mountains. It was formerly celebrated for its extensive tanneries, and is an attractive summer resort. Pop. 1524.

Hunter, tp. of Laurens co., S. C. Pop. 2557.

Hunter (DAVID), b. at Washington, D. C., July 21, 1802; graduated from the U. S. Military Academy, and entered the army as second lieutenant of infantry July, 1822; engaged for fourteen years on frontier duty, rising to the rank of captain of dragoons 1833; resigned in 1836. In 1842 he re-entered the service as paymaster, with the rank of major, on which duty he served until 1861, when (May 14) he was appointed colonel 6th U. S. Cavalry, and three days later brigadier-general of volunteers, as such commanding division at Bull Run (July 21), where he was wounded; promoted to be major-general of volunteers Aug., 1861. In May, 1862, while in command of the department of the South, he issued an order declaring slavery abolished in that department, which order was annulled by Pres. Lincoln in a proclamation. In May, 1864, Hunter succeeded Gen. Sigel in command of the department of West Virginia; the battle of Piedmont and subsequent march against Lynchburg *viâ* Lexington occurred the following month; a strong Confederate force arrived in good time to the relief of that city, however, and Hunter's ammunition giving out, he made a hasty retreat, closely pursued by the enemy. In 1865 was member of the military commission to try the conspirators engaged in the assassination of Lincoln. Retired from active service July, 1866. G. C. SIMMONS.

Hunter (JOHN), F. R. S., b. at Long Calderwood, near Glasgow, Scotland, July 14, 1728; youngest of ten children, of whom one was the afterwards celebrated William Hunter. John received very imperfect instruction at school; was apprenticed to a cabinetmaker; went in 1748 to study anatomy with his brother; studied at Oxford 1753–54; became a surgical pupil at St. Bartholomew's 1751, and at St. George's 1754; studied surgery under Cheselden and Pott; lectured upon anatomy 1754–59; attained great knowledge of human and comparative anatomy; served in France and Portugal as staff-surgeon 1761–63; began to practise surgery in London 1763; was made F. R. S. 1797, in consequence of the publication of important papers containing new discoveries in pathology and physiology; became surgeon to St. George's Hospital 1768; surgeon extraordinary to the king 1776; surgeon-general of the forces and inspector-general of hospitals 1790. D. in London Oct. 16, 1793. John Hunter was the boldest and best operator of his time, an anatomist of marvellous knowledge, and one of the fathers of zoological science. His style as a speaker and writer was bad, owing to his defective early training. His manners were coarse and repulsive and his temper violent, but he possessed many strong and noble moral qualities. He was one of the founders of the modern school of surgery. Author of *Natural Hist. of the Human Teeth* (1771–78), *On Venereal Disease* (1786), *Observations on Certain Parts of the Animal Economy* (1786), *On the Blood, Inflammation, and Gunshot Wounds* (1794). He was the collector of the great Hunterian Museum, chiefly of pathological and anatomical specimens, purchased by the British government and presented to the Royal College of Surgeons.

Hunter (JOHN KELSO), b. at Dunkeith, Ayrshire, Dec. 15, 1802; was at first a cobbler, and afterwards a portrait-painter of repute. He published *The Retrospect of an Artist's Life* (1867), *Life-Studies of Character* (1870), the last highly valued as containing fresh information upon the persons and places celebrated by Burns, Tannahill, and other Scottish poets. D. at Pollockshield Feb. 3, 1874.

Hunter (JOHN W.), b. in Bedford (now in Brooklyn), N. Y., Oct. 15, 1807; became a clerk in the New York custom-house 1831; was assistant auditor there 1837–65; was long prominent in the educational affairs of Brooklyn, and was an officer of the Dime Savings Bank; chosen to Congress in 1866, and in 1874 became mayor of Brooklyn.

Hunter (JOSEPH). See APPENDIX.

Hunter (ROBERT MERCER TALIAFERRO), b. in Essex co., Va., Apr. 21, 1809, and was educated at the University of Virginia and the Winchester Law School; member of the Virginia house of delegates; was a member of Congress 1837–41 and 1845–47, taking a prominent position, and being Speaker 1839–41. He was (1847–61) a U. S. Senator

from Virginia, chairman of finance committee, and was afterwards Confederate secretary of state, and still later a member of the Confederate Senate, and was one of the commissioners who met Pres. Lincoln and Mr. Seward at the Hampton Roads conference in Feb., 1865.

Hunter (William), M. D., F. R. S., elder brother of John Hunter, was b. at Long Calderwood, Scotland, May 23, 1718; studied at Glasgow University 1732–37, with a view to the ministry; became the medical pupil of Cullen; studied medicine in Edinburgh and London, whither he went in 1741; began to lecture on surgery and anatomy 1746; acquired a wide fame as a surgeon and accoucheur, devoting himself after 1749 chiefly to the practice of obstetrics; took his degree at Glasgow 1750; became physician to the queen 1764; F. R. S. 1767; professor of anatomy 1770; president of the College of Physicians 1781; associate of the Academy of Sciences, Paris, 1782. D. in London Mar. 30, 1783. His splendid collection of anatomical and pathological specimens, coins, books, etc. is now the Hunterian Museum of the University of Glasgow; it was partly collected by John Hunter, from whom he was for many years estranged. William Hunter surpassed his brother in scholarship and courtesy, but was not his equal in professional ability. His principal published works were *Medical Commentaries* (1762–64) and the splendid *Anatomia Humani Uteri Gravidi* (1774).

Hunter (William), D. D., b. May 26, 1811, in the county of Antrim, Ireland; brought to the U. S. in 1817, he entered Madison College in 1830. In 1833 he began his ministry in connection with the Pittsburg (Pa.) conference. He has edited the Pittsburg *Conference Journal*, also the Pittsburg *Christian Advocate* (M. E.), and was presiding elder in the Clarksburg (Pa.) and Beaver (Pa.) districts. In 1855 he became Kramer professor of Hebrew and biblical literature in Allegheny College, Pa. In 1870 he returned to pastoral work, and in 1872 to religious journalism, being then re-elected as editor of the *Christian Advocate*. He is the author of several books of hymns and spiritual songs, and of a poem on *American Methodism, a Plea for Unity*. Some of his devotional songs have obtained a wide popularity, and are sung in many lands. They have been translated into various languages, as the Bulgarian, several dialects of India, Africa, Ceylon, and China.

A. Stevens.

Hunter (William), LL.D., b. at Newport Nov. 26, 1774; graduated at Brown University in 1791; studied medicine for some time under his celebrated kinsman, John Hunter, in London, but left this study and adopted that of law, and was admitted to practise in Newport on his return in 1795. He was member of Congress 1799–1811, and U. S. Senator 1811–21. From 1834 to 1845 he was *chargé d'affaires* and minister plenipotentiary to Brazil. D. at Newport Dec. 3, 1849.

Hunter (William, Jr.). See Appendix.

Hunt'erdon, county of New Jersey, bounded on the S. W. by the Delaware River. Area, about 400 square miles. A part of its surface is broken, but its soil is generally very fertile. Cattle, grain, fruit, and wool are staple products. It has manufactures of metallic wares, flour, harnesses, carriages, lumber, and other goods, and is traversed by the Central R. R. of New Jersey, the Belvidere Delaware, and other railroads. Cap. Flemington. Pop. 36,963.

Hunt'er's, tp. of Tehama co., Cal. Pop. 40.

Hunter's Hill, tp. of Gates co., N. C. Pop. 1461.

Hunter's Point, the S. W. portion of Long Island City (which see), Queens co., N. Y. Pop. 1596.

Hunt'ersville, a v. of Spring Creek tp., Miami co., O. Pop. 233.

Huntersville, post-v., county-seat of Pocahontas co., W. Va., on a fine plateau, 40 miles N. by E. of White Sulphur Springs, a station of the Chesapeake and Ohio R. R.

Hunt'ing, like war, is coeval in origin with man. "Before it was a pleasure," says E. Blaze, "hunting was a necessity," since people were urged to it not only by hunger, but by the need of protecting themselves from wild beasts. But though King David was respected for skill in the field, it is evident that of all people the Jews were least inclined to the chase, owing to their being religiously trained to avoid almost all amusements, as savoring of Gentilism. But among Greeks and Romans hunting became sacred, Apollo and Diana being its chief patrons, while even its subordinate departments had each a tutelary deity, Pollux presiding over the training of horses for the chase, Orion of assembling dogs in packs, and Hippolytus of snares and toils. The influence of hunting on culture has been very great, and, with a few drawbacks, very beneficial to man. It is exhilarating, and in most forms very conducive to health, as it induces much exposure to fresh air and involves exercise in many forms; in fact, it may be assumed as a broad principle that those races which take no interest in field-sports, and thereby become unfamiliar with Nature in her wilder forms, are generally cowardly and depraved. It is said that the chase induces cruelty, but it has been remarked that the Romans as they left off hunting became more sanguinary in their games, and the French, who ridicule "*le sport*," and say that an Englishman always remarks if the weather is fine that "one ought to kill something," are themselves much bloodier and more vindictive in their political outbursts and punishments. This is also true of the Chinese.

A subject whose history is as old as that of humanity, and which embraces the taking of almost all animals, from the hare to the elephant, cannot be even sketched within our limit, and we shall therefore simply speak of what is at the present day chiefly understood by hunting, or that branch of it which involves such an outlay of capital as to have almost entirely appropriated the word to itself. This is the pursuit of the deer, fox, and hare on horseback, which in Great Britain probably costs more every year than all the games of ancient Rome did in the same time. The ancient Britons, in fact, were vigorous sportsmen, and Strabo informs us that their dogs for deer were exported to the Continent, and particularly to Gaul. The Saxons were far more addicted to hunting than the Romans, and at an early period established those forest-restrictions which play such an important part in English history, and which, in fact, did much to develop the art into that earnest form which in England is a serious part of most country gentlemen's lives. As early as the ninth century, says Strutt, and probably long before, hunting constituted an essential part of the education of a young nobleman. Alfred the Great, according to Asserius, was most carefully trained in all the branches of the art, and excelled in them before he was twelve years old. It is somewhat remarkable that antiquaries more familiar with MSS. than with nature have doubted whether horses were ever employed in hunting previous to the Norman Conquest, since it is not probable that people who, as we know, had horses both good and fleet, would dismount in order to chase a deer or fox. The very fact that fox-hunting was a special amusement among the Saxons would indicate its pursuit on horseback. The fondness of every Saxon for the chase, and the feeling which appears to be innate with men that animals *feræ naturæ* are common property, led to much resistance to forest-laws through the Middle Ages, and incredible suffering. Hundreds of villages were destroyed by the Norman kings to make immense parks; and so severe were the penalties enforced for poaching that it was commonly said that one might kill a man with more impunity than a deer. This spirit of pre-emption and resistance has continued to the present day in England, and it is not many years since Mr. Thomas Carlyle discovered that England had "more game-laws than poor-laws." Robin Hood and his followers were in a great measure the result of forest-laws. Through the Middle Ages hunting increased in importance, in luxurious details, and, so to speak, in *science*. It had from remote times possessed a literature. Aristotle had at the command of Alexander the Great written on field-sports, and the *Cynegeticus* (a treatise on dogs and hunting) of Xenophon may still be read with pleasure. The Roman writers on hunting embrace Pliny, Horace, Cicero, Virgil, Seneca, and Justin. Early in the fourteenth century England had several treatises on the subject. That of William Twici, huntsman-in-chief to Edward II., written in Norman French, also exists in an English translation. In it the poet-sportsman thus speaks of animals:

> "And for to sette young hunterys in the way
> To venery, I cast me first to go
> Of which four bestes be, that is to say,
> The hare, the herte, the wulf, and the wild boor.
> But then there ben other bestes five of the chase,
> The buck the first, the seconde is the do;
> The fox the third, which hath ever hard grace;
> The forthe the martyn, and the last the roe."

As these beasts disappeared or became rare, the fox gradually rose to be the first in consequence. "Nimrod" (Charles James Apperly) observes that it was about 150 years ago when the fox was first considered an animal of the higher chase. *Hudibras*, he observes, has a great deal about the hare, but not one word about the fox, and in Somerville's poem of the *Chace*, very little is said of the latter, but a great deal of the hare and deer. The reason for this is that in England then, as now on the Continent, the *value* of the game, especially as an edible, was always considered. This has entirely disappeared at present; all that is cared for in the fox is his "brush," while "puss" (the hare) generally goes "to the dogs." Chaucer gave in his time a spirited picture of an improvised foot fox-hunt:

> "Aha the fox, and after him they ran,
> And she with staves many another man.
> Ran Coll our dog, and Talbot and Gerlond,
> And Malkin with her distaff in her hond.

Ran cow and calf, and eke the veray hogges,
So fered were for barking of the dogges,
And shouting of the men, and women eke,
They ronnen so, hem thought her hertes brake."

The first fox-hunting was with so-called "trencher dogs," which one authority declares were an assembly of any and everything in dog shape, but it is more probable that they were of the breed of broken-haired harriers which still abound in Wales, and are an excellent dog. Blaine states that "the first real steady pack of foxhounds" was that of Thomas Fownes, Esq., of Stepleton in Dorsetshire, in 1730. "They were," says a writer of 1818, "as handsome and fully as complete in every respect as most celebrated packs of the present day"—an assertion which of itself indicates that good packs had existed long before; and "Nimrod" tells us that a pack of foxhounds was kept by Lord Arundel in 1690, and this pack subsequently contributed materially to the celebrated Quorndon Hounds. But this Arundel pack—as its excellence proves—was probably far from being the first in England. With the great improvement in dogs in modern times, and the constant efforts to secure better horses, the system of hunting has changed, and instead of sounding the horn at cock-crow, as soon as they could see to ride, ten, eleven, or even twelve o'clock is now the hour for huntsmen's assembling. In fact, in the old time gentlemen were often obliged to ride many miles *before* daybreak, but now the horses are sent by "rail," while the rider takes the same conveyance. In the old time hares and foxes were rare, but now they are so carefully preserved that hunters are sure of them. In fact, foxes are often imported from the Continent when they become scarce in any part of England, and the writer knows of a gentleman who recently brought a number to Ireland. He also knows of another gentleman who, having been suspected of shooting or poisoning a troublesome fox, was completely *cut* by the whole country and shunned like a felon. The change in horses for hunting has also been very great. A century ago the hunter was a half-breed animal, of great strength and handsome, powerful frame—"a complete snaffle-bridle horse, and a standing as well as a flying leaper." He had great endurance. At present the thoroughbred, as shown in the "cock-tail," or three-fourths pure blood, delicate but fleet, is gradually taking the place of the true hunter. The *expense* of hunting has accordingly been increased in proportion to these changes. A thoroughbred horse, though he can for a short time perform greater feats of speed, and in fact of leaping, is soon disabled, and must be kept from three to seven days quiet after a hunt. Gentlemen who can afford it have two and even three horses brought for them to a hunt. In short, hunting, like all other sports, is rapidly assuming in England an intensely artificial and highly elaborate character, entirely foreign to the spirit of the *chase* as expressed by poets and understood by the world at large. In old times the buckskin breeches, well stained and worn, were characteristic of hunting, but the ideal rider at a "meet" at present is an *élégant* in primrose kid gloves and snow-white cords. His hounds run faster, his horses leap, it is said, higher than did those of old, but to one who has, like the writer, hunted both buffalo in America and foxes and hares in England, the latter compares with the former as a walk down Bond street in the season does with a pedestrian tour among the Alps. Hunting in England, notwithstanding the ostentation of expense which is rapidly reducing it more to a matter of money and style than is popularly supposed, is still of incalculable benefit, since it practically familiarizes hundreds of thousands of people with good riding in its truest and fullest sense. The man has always a physical—we may say a nervous—superiority who can without an emotion clear hedge and ditch or keep the saddle all day in a thorough chase. Were it not for hunting many gentlemen would never get beyond a trot on the highway, and that familiarity with the horse in all his best qualities which makes a man manlier would be lost. It is amusing to observe the manner in which the rules of sport are carried out in foreign countries. It is not long since a gentleman twenty-five years a resident in India, and an experienced tiger-hunter, assured the writer that any one known to have killed a tiger-cub would be "cut" by every gentleman in his part of the country. It is but just to say that there has been of late a strong reaction against this spirit of selfish cruelty, both in India and England. The extent to which hunting is pursued may be judged from the fact that during the week beginning with Nov. 28, 1874, 170 packs were advertised to run in Great Britain, and that these met from two to four times during the week. Fifty pounds is the lowest price for an ordinary hunting-horse; at many meets the average would be £150. In 1840 a writer estimated the average cost of fourteen hunters at £700; at the same time, he wrote that including these horses the annual expense of a pack, but not including the value of the hounds, would be £2235. It would be safe to double this sum at present. A few years later "Nimrod" tells us that ten couple of hounds were sold for 1000 guineas, and that Lord Middleton had many hounds for which he would not take 200 guineas apiece. Strangers can, however, join in a hunt at moderate expense. A "tolerably fair," though seldom a really good, horse may be hired at a livery stable for £1 to follow the harriers, and £2 for the fox-hounds. During the hunt an official will demand from him from five to ten shillings as the regular fee. Stag-hounds are larger than fox-hounds; otherwise they are nearly the same. The harrier, used for hunting hares, "is the next remove after the stag or fox-hound from the talbot," or old English hunting-dog. There are three prominent varieties. The modern harrier is little more than a dwarf fox-hound. The beagle is a very small hound, used almost entirely for hares, and is frequently, if not generally, followed on foot. CHARLES G. LELAND.

Hunt'ingburg, post-v. of Dubois co., Ind., has manufactures of flour, lumber, carriages, wagons, woollens, furniture, tobacco, saddlery, etc.; a weekly newspaper (German), numerous stores, a fine school-house, 5 churches; is situated in a region abounding in block and cannel coal, plumbago, iron ores, fine potter's clay, mineral paints, lime, and sandstone, and is the centre of four projected railroads. Tobacco is extensively produced here, as well as grain, fruits, etc. E. PICKHARDT, PROP. "SIGNAL."

Hunt'ingdon, borough of England, the capital of the county of Huntingdon, on the left bank of the Ouse. The house in which Oliver Cromwell was born still stands. Pop. of parliamentary borough, 6605.

Huntingdon, a fertile county of Quebec, Canada, the westernmost of the counties S. of the St. Lawrence. Cap. Huntingdon. Pop. 16,304.

Huntingdon, post-v., cap. of Huntingdon co., Quebec, Canada, 50 miles S. W. of Montreal, in a good agricultural region, has manufactures of farm-implements, castings, lumber, etc., an academy, a weekly newspaper, and a convent. Pop. of sub-district, 763.

Huntingdon, county of S. Central Pennsylvania. Area, 730 square miles. It is traversed by grand mountain-ranges, but has very fertile valleys. Bituminous coal, iron ore, and limestone are abundant. Metallic wares, leather, carriages, flour, and furniture are among the leading articles of manufacture. Cattle, grain, and wool are staple products. It is traversed by the Juniata River and the Pennsylvania and the Huntingdon and Broad Top R. Rs. Cap. Huntingdon. Pop. 31,251.

Huntingdon, post-b., cap. of Huntingdon co., Pa., on the Juniata, at the junction of the Huntingdon and Broad Top R. R. with the Pennsylvania R. R., 104 miles W. of Harrisburg. It has a national and a private bank, 1 religious and 4 secular newspapers, 2 planing-mills, gas-works, manufactures of brooms, boots and shoes, furniture, etc., car-works, an academy, a select school, and 8 churches, and is in a region abounding in iron, lead, coal, fire-clay, limestone, and fine timber. Pop. 3034.
A. B. BRUMBAUGH, LIT. ED. "JOURNAL" AND "PILGRIM."

Huntingdon, post-v., cap. of Carroll co., Tenn., on the Nashville Chattanooga and St. Louis R. R. It has a weekly and semi-weekly newspaper. Pop. 609.

Huntingdon (SELINA), COUNTESS OF, daughter of Washington Shirley, Earl Ferrers, b. 1707, and became distinguished in the religious history of the time in which she lived. In 1728 she was married to Theophilus Hastings, earl of Huntingdon, a man of great religious zeal, who died Oct. 13, 1746. Numerous children were the fruit of this marriage, of whom four died young. Whether owing to this affliction or not, the countess became a very devout and zealous Christian; and as at this time the revivals under Wesley and Whitefield were at their height, a strong religious excitement existed in England. The countess inclined to the Calvinistic tenets of Whitefield, whom she made her private chaplain, and she became the leader of Calvinistic Methodism in England, and her followers were known as the "Countess of Huntingdon's Connection." Her large means were devoted to the dissemination of her religious views, and to this end she built and maintained a college at Trevecca, Wales, for the education of Calvinistic ministers; she also built chapels throughout England, and provided for their support. It is said that in all she erected 64 chapels, the finest of which is at Bath, for the management of which she bequeathed the bulk of her fortune in trust. D. June 17, 1791.

Hunt'ingdonshire, county of England, bounded by the counties of Cambridge, Bedford, and Northampton. It contains 229,544 acres of low, mostly level or slightly hilly ground, watered by the Ouse and the Nene, and well adapted to agriculture. Pop. 64,250.

Hun′ting Quar′ter, tp. of Carteret co., N. C. P. 945.

Hunt′ington, county of the N. E. of Indiana. Area, 400 square miles. It is very fertile and generally level. Cattle, grain, wool, and lumber are staple products. It is traversed by the Toledo Wabash and Western R. R. Cap. Huntington. Pop. 19,036.

Huntington, tp. of Elmore co., Ala. Pop. 1317.

Huntington, tp. and post-v. of Fairfield co., Conn., 15 miles W. of New Haven. Pop. 1527.

Huntington, city, tp., cap. of Huntington co., Ind., on the Toledo Wabash and Western R. R. and the Wabash and Erie Canal, 24 miles S. W. of Fort Wayne and 118 miles S. W. of Toledo. It contains 12 factories working wood into various shapes, 2 iron-foundries, 1 national and 1 private bank, 8 churches, 2 newspapers, a free graded school, a public-school building costing $50,000, the usual number of stores, and is the dépôt for a large lime-burning region operating 30 kilns. A library, reading-room, and museum are being established in connection with the public school. The city is built on both banks of Little River. Pop. of city, 2925; of tp. 4449.
JOHN F. MOSES, ED. OF "INDIANA HERALD."

Huntington, tp. and post-v. of Hampshire co., Mass., on the Boston and Albany R. R., 119 miles W. S. W. of Boston. It has extensive water-power, and manufactures of paper, flannels, etc. There are 4 churches. Pop. 1156.

Huntington, post-v. and tp. of Suffolk co., N. Y., on Long Island R. R., 38 miles from New York, with which it is also connected by steamboat the greater part of the year. It has 8 churches, a union graded school building which cost $20,000, 2 weekly newspapers, and some manufactures and trade. About 30,000,000 bricks are annually made in the vicinity. Pop. 2433; of tp. 10,704.
G. H. SHEPARD, ED. "LONG ISLANDER."

Huntington, tp. of Brown co., O. Pop. 3020.

Huntington, tp. of Gallia co., O. Pop. 1609.

Huntington, post-tp. of Lorain co., O. Pop. 834.

Huntington, tp. of Ross co., O. Pop. 2367.

Huntington, tp. of Adams co., Pa. Pop. 1595.

Huntington, tp. of Luzerne co., Pa. Pop. 1847.

Huntington, post-tp. of Chittenden co., Vt., 19 miles W. of Montpelier, has manufactures of lumber. Pop. 864.

Huntington, city of Cabell co., West Va., on Ohio River, and on Chesapeake and Ohio R. R., was founded in 1871, and has extensive manufactures. It is the seat of Marshall College, has 2 public schools, 9 churches, 3 hotels, and 2 newspapers. J. J. GILBERT, ED. "ADVERTISER."

Huntington (COLLIS POTTER), b. at Harwinton, Conn., Oct. 22, 1821; received a common-school education, and became interested early in life in the management of railroads; is president of the Southern Pacific Railroad Co.; vice-president of the Central Pacific Railroad Co.; trustee of the Atlantic and Pacific Telegraph Co., and a director of the Occidental and Oriental Steamship Co. J. B. BISHOP.

Huntington (C. S.), U. S. N., b. Jan. 2, 1841, in Illinois; graduated at the Naval Academy in 1861; became a lieutenant in 1862, a lieutenant-commander in 1866; was in several actions on the Mississippi River in 1863 while serving on board the Monongahela, and in 1864, at the battle of Mobile Bay, owing to the wounding of Commander Mullany, was for a while in command of the Oneida, during which period he distinguished himself for his coolness and bravery. FOXHALL A. PARKER.

Huntington (DANIEL), b. in New York Oct. 14, 1816; educated at Hamilton College; was first stimulated to the pursuit of art by Charles L. Elliot, whom he met while a student; in 1835 began to study under Morse; later was a pupil of Inman; in 1836 travelled and sketched in the Highlands of the Hudson; in 1839 went to Italy and painted figure-pieces; returned to New York, painted portraits and commenced illustrations of the *Pilgrim's Progress*, which failure of eyesight compelled him to discontinue; revisited Europe in 1844, and painted other composition pictures, which added to his fame; on his return resumed the painting of portraits, but found time to execute two or three historical pieces, *Henry VIII. and Catharine Parr, Mary Signing the Death-warrant of Lady Jane Grey*, and *Lady Jane Grey in the Tower*. For many years past his permanent residence has been in New York, where his reputation is very high. Huntington has been successful in several fields of art. He has painted mountain scenery, marine views, landscapes, historical compositions, cabinet and genre pictures, groups and figures of fancy, ideal heads, subjects of religious story and sentiment; but his most distinguished work is in portraiture. Among his numerous sitters have been Bishop McIlvaine, Dr. Muhlenberg, Gulian Verplanck, Chancellor Kent, Lord Morpeth, Sir Charles Eastlake, Agassiz, Bryant, Lincoln, R. B. Minturn—names that suggest a wide and eminent fame. Huntington's most ambitious picture is *The Republican Court in the Time of Washington*. It contains sixty-four figures, all portraits of men and women celebrated in the Revolutionary epoch—some copied from original paintings by Malbone, Stuart, Copley, or less known artists, others constructed by the aid of family lineaments and traditions—the whole grouped as naturally as the conditions allowed. The picture is owned by A. T. Stewart. Mr. Huntington has been greatly honored by his profession and by the public. In 1850 a special exhibition was made in New York of all the pictures of his that could be collected, the best known artists and citizens joining to make the tribute worthily expressive of their regard. On May 14, 1862, he was elected president of the National Academy of Design, a position to which none but artists of recognized ability are chosen. O. B. FROTHINGHAM.

Huntington (Right Rev. FREDERIC DAN), D. D., b. at Hadley, Mass., May 28, 1819; graduated at Amherst in 1839 and at the Cambridge Divinity School in 1842. Entering the Unitarian ministry, he held a pastorate in Boston 1842–55, when he became Plummer professor of Christian morals and preacher to Harvard University. In 1859 he took orders in the Episcopal Church; in 1861 was one of the founders of the *Church Monthly;* and in 1869 was consecrated bishop of Central New York. He has published 2 vols. of sermons, one of lectures on *Human Society* (1860), and *Lessons on the Parables*, and other works.

Huntington (JEDIDIAH VINCENT), M. D., b. in New York Jan. 20, 1815; was educated at Yale College and the University of New York, where he graduated in 1835; graduated M. D. at the University of Pennsylvania 1838; was professor of mental philosophy in St. John's College, near Flushing, N. Y., for three years; rector of a Protestant Episcopal church in Middlebury, Vt.; in Europe 1846–49; became a Roman Catholic in 1850; was editor of the *Metropolitan*, Baltimore, 1853–54; founded and edited (1855–57) the *Leader*, St. Louis; author of *Poems* (1842), *Lady Alice*, a novel (1849), *Alban, The Forest* (1852), *The Pretty Plate* (1852), *Rosemary* (1860), *Blonde and Brunette* (1858), *America Discovered* (1853), a poem, and some translations from the French. D. at Pau, France, Mar. 10, 1862. He was a brother of Daniel Huntington, the artist.

Huntington (SAMUEL), LL.D., a signer of the Declaration of Independence, b. at Windham, Conn., July 3, 1731; learned the trade of a cooper; became in 1758 a lawyer of Norwich, Conn.; held many important offices; was a member of the Continental Congress 1776–83, and its president 1779–81; judge of the Connecticut superior court 1774–84; its chief-justice 1784; lieutenant-governor of Connecticut 1785; governor 1786–96. He received the honorary degree of LL.D. from Yale in 1787. D. at Norwich, Conn., Jan. 5, 1796.

Huntington (SAMUEL), a nephew of Gov. Samuel Huntington (1731–96), b. at Coventry, Conn., Oct. 4, 1765; graduated at Yale in 1785; became a lawyer in 1793; settled near Painesville, O., in 1800; was a judge of the common pleas court 1802–03; of the superior court in 1803, and afterwards chief-justice; governor of Ohio 1808–10; a colonel and paymaster in the war of 1812–14. He was also a member of the first constitutional convention of Ohio, and Speaker of the first State senate. D. at Painesville, O., June 8, 1817.

Huntington City, post-v. of Prince George co., Md., 16 miles from Washington, D. C., at the junction of the Baltimore and Potomac and the Bowie and Pope's Creek R. Rs.; has 2 hotels, a weekly newspaper, railroad machine-shops; is situated in a farming and tobacco-growing region.
J. W. SCOTT, ED. "HUNTINGTONIAN."

Hunt′ley Grove, post-v. of Grafton tp., McHenry co., Ill., on the Galena division of the Chicago and North-western R. R., 7 miles N. W. of Elgin.

Huntoon′ (JONATHAN G.), b. at Unity, N. H., in 1781; removed to Maine, of which State he was governor 1830–31. D. at Fairfield, Me., Oct. 14, 1851.

Hunts′burg, post-tp. of Geauga co., O. Pop. 824.

Hunts′ville, city, cap. of Madison co., Ala., the "Queen city of the mountains," is one of the most beautiful, thriving, and important towns in the State. It stands upon the bench of a mountain which is a spur of the Cumberland Mountains; is on the Memphis and Charleston R. R.; has a brass and iron foundry, railroad machine-shops, planing mills, fire department, gas and water works, a national and a savings bank, a female college (Methodist), a female seminary (Presbyterian), 9 churches, 3 weekly newspapers, and fine public and private buildings. It has a large spring, which supplies a copious stream,

tributary to the Tennessee, 10 miles distant. Pop. 4907; of tp., exclusive of city, 3511.

G. M. Johnston, Ed. and Pub. "Advocate."

Huntsville, post-v., county-seat of Madison co., Ark. Pop. 224.

Huntsville, post-tp. of Schuyler co., Ill. Pop. 1228.

Huntsville, post-v. of Madison co., Ind., on the Cleveland Columbus Cincinnati and Indianapolis R. R., and in Fall Creek tp. Pop. 202.

Huntsville, a v. of West River tp., Randolph co., Ind. Pop. 130.

Huntsville, post-v., cap. of Randolph co., Mo., on the St. Louis Kansas City and Northern R. R., 153 miles from St. Louis. It has a college for both sexes, important coal-mines, a woollen-mill, machine-shop, flouring-mill, public high school, 4 churches, 2 hotels, 2 newspapers, etc.

Bogie & Hunter, Pubs. "Herald."

Huntsville, tp. of Rockingham co., N. C. Pop. 1880.

Huntsville, post-v. of McArthur tp., Logan co., O., on the Cincinnati Sandusky and Cleveland R. R. Pop. 322.

Huntsville, post-v., county-seat of Scott co., Tenn., on New River. Pop. 85.

Huntsville, city, cap. of Walker co., Tex., 200 miles S. E. of Austin, on a branch of the Houston and Great Northern R. R. It is the seat of the State penitentiary, in which are manufactured elegant furniture, cotton and woollen goods, boots, wagons, buggies, etc. There are 8 churches. It is the seat of Austin College (Presbyterian) and Andrew Female Seminary; has 2 steam corn-mills and cotton-gins, a newspaper, hotels, 3 brickyards, and a large tannery. Here Gen. Sam Houston was buried. Chief business, shipping cotton. Pop. 1599. G. Robinson, Ed. "Item."

Hunya'dy (János), b. in Hungary at the close of the fourteenth century, but the year and the place of his birth, as well as his parentage and the origin of his surname, *Corvinus*, are unknown. Under Sigismund and Albert he acquired great fame by the valor and military skill with which he fought against the Turks, at that time the terror of Europe; and by Albert he was made governor of the Hungarian provinces S. of the Danube. In 1439, Albert d., and Vladislas, king of Poland, was elected king of Hungary. Under his reign the arms of Hunyady were still more successful. He drove the Turks behind the Balkan, and compelled them to conclude an armistice of ten years (July 12, 1444). But Vladislas broke this armistice, and the result was the battle of Varna, in which the Hungarians were totally routed and the king fell (Nov. 10, 1444). During the minority of Ladislas, a son of Albert, who was elected king of Hungary in 1444, Hunyady governed the country, and he showed no less ability as a statesman than as a warrior. He kept order in the country; and although in his contests with the Turks he met with some severe reverses—as, for instance, in the three days' battle of Kossova, Oct. 17, 1448—he nevertheless succeeded in checking their progress and preventing them from overrunning the whole of Europe. His most brilliant exploit was the attack on the Turkish camp at Belgrad (July 14, 1456). Mohammed II. had laid siege to this city with an army of 150,000 men and 300 cannons. But with a far inferior force Hunyady compelled him to break up the siege and draw back, leaving behind him all his artillery. Shortly after Hunyady died. Of his two sons, the oldest, Ladislas, was beheaded at Buda for having killed Count Cilley, a personal enemy of his father; the younger, Matthias Corvinus, was educated by Georg Podiebrad of Bohemia, and became king of Hungary after Ladislas.

Hupeh', or **Hoopeh,** province of Central China, between lat. 29° and 33° N., and between lon. 108° and 116° E., traversed by the river Yang-tze-Kiang. Area, 70,450 square miles. Pop. 28,000,000. It is the most fertile province of the Chinese empire, and no corner of it is left uncultivated. Cap. Woo-Chang.

Hup'feld (Hermann), b. at Marburg Mar. 31, 1796; d. Apr. 24, 1866; was successively professor at Marburg and Halle, where he succeeded to the chair of Oriental languages on the death of Gesenius, 1843. His most important work is a *Commentary on the Psalms* (4 vols., 1855–62), which is remarkable for its originality and scholarship. An English translation is now (1875) in process of preparation.

Hupp (John C.), M. D., b. in Washington co., Pa., Nov. 24, 1819; graduated at Washington College, Pa.; took the degree of M. D. from the Jefferson Medical College, Philadelphia, 1847, and settled in Wheeling, Va., where he now resides. He has contributed largely to the *Medical and Surgical Reporter* of Philadelphia; has now a large practice in West Virginia and Ohio. Paul F. Eve.

Hu'ra, or **Sand-box Tree** (*Hura crepitans*, order Euphorbiaceæ), a native of tropical America. When the seed is ripe the woody capsule bursts with a loud report. It was once customary to make sand-boxes of the unripe woody fruit, and it is related that these boxes would sometimes spontaneously explode after being used for years. The seeds are sharply purgative.

Hurd (Richard), D. D., b. in Staffordshire, England, in 1720; educated at Emmanuel College, Cambridge, where he took his degree in 1742, and continued to reside till 1757, when he was appointed rector of Thurcaston, in Leicestershire, where he remained until 1765, when he was chosen preacher of Lincoln's Inn; promoted to the archdeaconry of Gloucester in 1767, and to the bishopric of Lichfield and Coventry in 1775, from whence he was transferred in 1781 to that of Worcester, where he continued until his death, declining the offer of the archbishopric of Canterbury on the death of Dr. Cornwallis in 1783. He was the lifelong friend and admirer of Bishop Warburton, whose biographer he also was, and wrote numerous pamphlets vindicatory of Warburton's views. Of his writings, which were very numerous, the most prominent are his *Dialogues, Letters on Romance and Chivalry, English Commentary on the Epistle of Horace on the Art of Poetry, Twelve Discourses on the Prophecies*, his *Sermons*, and the *Life* of Bishop Warburton. D. in 1808.

Hur'dle, a flat rectangular framework of stakes and wattles employed for fencing material by European farmers, and sometimes used in warfare in the construction of earth-works. Hurdles are often set up in the race-course for horses to leap over.

Hurdwar', a small town of Hindostan, situated in lat. 29° 57′ N. and lon. 78° 14′ E., at an elevation of 1024 feet above the sea, on the spot where the Ganges bursts from the hill-country into the plain of Hindostan. During the latter part of March and the beginning of April this place is yearly visited by more than 200,000 pilgrims, who come to make their ablutions in the holy water, and on some occasions the number of visitors is said to increase to 2,000,000. A large fair is held here at the same time, to which the products of all the neighboring countries are brought. Pop. 5000.

Hur'dy-gurdy, a musical instrument of the stringed kind, formerly much used by the European peasantry, but now seldom seen except in the hands of Savoyard boys, who play it in the streets. It consists of a flat sounding-board, connected by tolerably deep ribs to a back of the same size and shape. It has four strings of gut, which are put into vibration by the edge of a wooden wheel turned by a handle. It is suited only to very simple melodies.

Hurl'burt, tp. of Logan co., Ill. Pop. 476.

Hurl'but (Stephen A.), b. at Charleston, S. C., Nov. 29, 1815; received a liberal education, studied law, and was admitted to the bar in 1837; removed to Illinois and settled in Belvidere. In 1847 he was elected to the State constitutional convention as a Whig; Presidential elector on the Whig ticket 1848; member of the State legislature 1859, 1861, and 1867, and Presidential elector on the Republican ticket 1868. During the civil war he was appointed in May, 1861, a brigadier-general of volunteers, commanding a division at the battle of Pittsburg Landing; promoted to be major-general of volunteers Sept., 1862, and commanded the 16th army corps and department of the Gulf. In 1869 he was appointed minister resident to the U. S. of Colombia, which office he held till 1872; elected member of the 43d Congress from the 4th district of Illinois. G. C. Simmons.

Hurlbut (William Henry), b. in Charleston, S. C., July 3, 1827. He was graduated at Harvard College in 1847, at Harvard Divinity School in 1849; went the same year to the University of Berlin, and the next year to Rome and Paris. In 1852 he entered Harvard Law School, and in 1853 went to the West Indies; in 1854 published *Pictures of Cuba;* in 1855 joined the staff of *Putnam's Magazine* and the *Albion;* in 1856 went to England; in 1857 joined the New York *Times;* in 1858 travelled through England, Germany, and Russia; in 1862 joined the New York *World;* spent 1866–67 in travelling through Mexico, Austria, Hungary, and Italy; visited Suez in 1869; the Œcumenical Council at Rome in 1870, Santo Domingo in 1871; revisited Mexico in 1871, and again in 1872; in 1873 visited Spanish America, to Cape Horn, returning by Montevideo, Brazil, Portugal, and England. Author of *Gan Eden* (1854), *Gen. McClellan and the Conduct of the War* (1864), etc. J. B. Bishop.

Hur'ley, post-tp. of Ulster co., N. Y., has extensive quarries of flagging and building-stone. Pop. 2987.

Hu'ron, county of Ontario, Canada, on the E. side of Lake Huron. Area, 1392 square miles. The soil is very productive, and the scenery often picturesque. There are 2 ridings. The county is intersected by a branch of the Grand Trunk Railway. Cap. Goderich. Pop. 66,165.

Huron, county of Michigan, having Lake Huron upon the N. and E. and Saginaw Bay upon the W. Area, about 830 square miles. It is mostly covered with pine forests. Lumber and grain are staple products. Cap. Port Austin. Pop. 9049.

Huron, county of the N. of Ohio. Area, 464 square miles. It is level, fertile, and well cultivated. Cattle, grain, wool, and fruit are produced. The manufactures include lumber, carriages, harnesses, cooperage, etc. It is traversed by the Cleveland and Columbus, the Sandusky Mansfield and Newark, and the Cleveland and Toledo R. Rs. Cap. Norwalk. Pop. 28,532.

Huron, post-tp. of Des Moines co., Ia. Pop. 807.

Huron, tp. of Houghton co., Mich. Pop. 769.

Huron, tp. of Huron co., Mich. It contains the post-v. of Huron City, on Lake Huron. Pop. 403.

Huron, tp. of Wayne co., Mich. Pop. 1263.

Huron, post-tp. of Wayne co., N. Y., on Lake Ontario. Pop. 2000.

Huron, post-v. of Erie co., O., on Lake Erie and on the Lake Shore R. R., 8 miles S. E. of Sandusky, at the mouth of Huron River. It has a good trade, the river serving as a harbor. Pop. 697; of Huron tp. 1483.

Huron Indians, or **Wyandots,** a tribe of Iroquois stock. They anciently occupied a large area in Canada, from Montreal westward. Having joined the Roman Catholics, they were set upon by the Six Nations, and, with the Eries, were nearly exterminated by them in 1636. A large party of them took refuge on St. Joseph's Island, and there perished by hunger. A party of them settled at Ancienne Lorette, in Lower Canada, where some 250 of their descendants remain. A large body settled S. of Lake Superior, whence they were expelled by the Dakotas. We next find them in Detroit, and then about Sandusky and N. of Lake Erie. In 1764 they could muster 300 fighting-men. They served against the U. S. in 1812–15. In 1832 they were removed to a point near the mouth of the Kansas River. They numbered in 1832, 687; in 1836, 575; in 1847, 687; in 1860, 435; in 1870, 222. This loss is partly owing to the adoption of U. S. citizenship by a portion of the tribe. This portion is generally prosperous; the others by no means so. Their reservation of 20,000 acres is in the Indian Territory, between the Shawnee and Seneca Indians. Those of the U. S. bear the name of Wyandots, the name by which they called themselves, while their long-separated brethren of Canada are still called Hurons.

Huron, Lake, the third in area of the great lakes of the St. Lawrence Basin. Its area is 23,800 square miles. It lies between the State of Michigan on the W. and the province of Ontario, which bounds it on the E. Lake Huron has more bays and good harbors than any other of the great lakes. The principal bay is Georgian Bay or Lake Manitoulin, in Canadian territory. Near the entrance to this bay is a chain of islands, of which the principal is Great Manitoulin, a rocky and thinly inhabited region. Lakes Superior and Michigan exceed it in area. The river St. Mary connects it with the former, and Mackinac Straits with the latter, while its outlet is the river St. Clair. Lake Huron averages about 1000 feet deep, the maximum being about 1800 feet. Its waters are clear and cold, and abound in fish, of which the white-fish is commercially the most important. The lake is subject to severe storms. The season of navigation extends from about May 1st to about Dec. 5th. Its surface is 574 feet above the sea-level. The lake receives the waters of numerous streams, which are mostly not very large.

Hur'ricane, tp. of Bradley co., Ark. Pop. 689.

Hurricane, tp. of Greene co., Ark. Pop. 385.

Hurricane, post-tp. of Saline co., Ark. Pop. 390.

Hurricane, tp. of Fayette co., Ill. Pop. 1333.

Hurricane, post-tp. of Montgomery co., Ill. P. 724.

Hurricane, tp. of Carroll co., Mo. Pop. 2285.

Hurricane, tp. of Lincoln co., Mo. Pop. 3712.

Hurricane [originally a Carib word, signifying a "high wind"] is distinguishable from cyclones, storms, etc. by its extreme fury and sudden change in character. It is not necessarily rotatory, as in a cyclone, or spiral, as in whirlwinds, but may partake of all or any of these characteristics. Hurricanes are unknown in the polar regions; of frequent occurrence in the torrid zone, where they are especially violent; and occasionally occur in the temperate zone, either independently or on their transit from the torrid zone. They are generally accompanied by rain, thunder, and lightning. In the Pacific and Northern Indian oceans and the China Sea they are called typhoons, but possess the same distinctive elements as the hurricanes of the districts bounded by the Atlantic and Southern Indian oceans. The premonitory indications of a hurricane are a peculiar haziness of atmosphere, a general and ominous stillness or calmness of wind and tide, and a peculiar feeling of physical lassitude or indolence. The barometer falls sensibly, and gradually increasing winds from some unexpected quarters of the compass arise. The hurricane arrives at its climax of strength in from four to twenty-four hours, when the opposing currents of wind, rain, etc. subside as gradually as they commenced, leaving a sad wreck of property and life behind. In violence the hurricane exceeds the force of the strongest waves. The highest hurricane winds on the British coast are recorded to have attained a velocity of 130 miles per hour. In reference to hurricane-tracks, their course appears to be, in the North Atlantic Ocean, southerly, to the N. of the Windward Islands; northwardly, over Newfoundland. Very few hurricanes occur in the South Atlantic Ocean. The most frequently visited portions of the U. S. are the coasts of Georgia and South Carolina. The origin and cause of the hurricanes of the Atlantic Ocean are but little known; they have occurred in the neighborhood of Florida when a cold N. wind has conflicted with the warm, moist air of the Gulf and ocean. They have also occurred in the western portion of the Gulf of Mexico after the presence of a Texan norther. The great proportion of the Atlantic hurricanes (both as to number, extent, and violence) originate between the Windward Islands and the African coast, moving along the American coast on its route to Iceland and Norway. (See WINDS.)

Hurst (JOHN F.), D. D., b. Aug. 17, 1834, in Dorchester co., Md.; educated at Dickinson College, Carlisle, Pa., and Halle University, Germany; entered the Methodist ministry in 1858, and in 1866 went to Germany to take charge of the theological instruction in the Martin Mission Institute, Bremen. He remained five years in Germany, during which time he visited all the leading European countries, and in 1870 made the tour of the East. In the same year he accepted the professorship of historical theology in the Drew Theological Seminary, Madison, N. J., made vacant by the death of Rev. Dr. B. H. Nadal. In May, 1873, he was elected president of the same seminary, a position which he still occupies, retaining his connection, however, with the chair of ecclesiastical history. Author of translations of Hagenbach's *History of the Church in the Eighteenth and Nineteenth Centuries* (2 vols.), Lange's *Commentary on Romans*, Van Oosterzee's *Lectures on John's Gospel*, and of an original *History of Rationalism*, *Outlines of Bible and Church History*, and *Martyrs to the Tract Cause*. He has in preparation a *History of the Church*, which will cover the entire period down to the present day.

Hur'ter, von (FRIEDRICH EMANUEL), b. at Schaffhausen Mar. 19, 1787; studied theology at Göttingen; was appointed minister at Schaffhausen in 1824, but resigned his office in 1841, and embraced Catholicism in 1844. In 1846 he settled at Vienna, and was appointed historiographer to the emperor of Austria. D. at Gratz Aug. 27, 1865. The principal of his works are—*Geschichte des ostgothischen Königs Theodorich und seiner Regierung* (1807), *Geschichte Papst Innocenz III. und seiner Zeitgenossen* (1834–42), *Geschichte Kaiser Ferdinand II. und seiner Eltern* (1850–57), *Die Befeindung der Katholischen Kirche in der Schweitz seit dem Jahre 1834* (1842–43), and *Geburt und Wiedergeburt* (1845).

Hurtes'ville, post-tp. of Russell co., Ala. Pop. 1440.

Husband and Wife. See MARRIED WOMEN, by PROF. T. W. DWIGHT, LL.D.

Husbandry, Patrons of. See PATRONS OF HUSBANDRY, by L. P. BROCKETT, A. M., M. D.

Hus'bands (HERMAN), b. in Pennsylvania, but removed to Orange co., N. C., where he became a member of the legislature and leader of the Regulators, of which party he published a full account in 1770. On May 16, 1771, a conflict took place between Gov. Tryon and the Regulators; the latter were defeated, and Husbands fled to Pennsylvania. In 1778 he was a member of the legislature there; was concerned in the whisky insurrection in 1794, and associated with Gallatin, Brackenridge, and others as a committee of safety. Having been imprisoned for a short time in Philadelphia, he determined to return home, but d. on the way, Mar., 1795.

Husch'ke (GEORG PHILIPP EDUARD), b. at Münden June 26, 1801; studied 1817 at Göttingen, and was appointed professor of jurisprudence at the University of Breslau in 1827. His principal writings are—*Studien des römischen Rechts* (1840), *Gaius* (1855), *Die Iguvischen Tafeln* (1859).

Hush, town of Roumania (Moldavia), has a Greek bishop, a normal school, and is a place of commercial importance. Pop. variously estimated at from 4000 to 16,000.

Hus'kisson (William), b. at Birch-Moreton, Worcestershire, England, Mar. 11, 1770; resided as a student in Paris 1783–92, where he was a member of the Société de 1789, a moderate republican club, and at the same time was private secretary to Lord Gower, the British minister. He witnessed the destruction of the Bastile and opposed the issue of the assignats. In 1795, Pitt appointed him an under-secretary for war and for the colonies; in 1796 he entered Parliament; became secretary of the treasury 1804; commissioner of woods and forests 1814; member of the finance committee 1819; president of the board of trade and treasurer of the navy 1823; was colonial secretary 1827–29. On the occasion of the opening of the Liverpool and Manchester Railway (Sept. 15, 1830) he was struck by one of the engines, and d. on the same day. Huskisson's brilliant state papers, his ability in public affairs, and his liberal principles, which had great influence upon the course of reform in England, entitle him to a permanent place in history; but throughout his public life he had to contend with the strong prejudices of the English people, who generally regarded him as a dangerous innovator, with deep designs against the interests of society.

Huss (John), b. in 1373 at Hussinetz, in Southern Bohemia, near the Bavarian frontier; entered in 1389 the University of Prague, where he took the degree of M. A. in 1396, and began to give lectures on theology and philosophy in 1398. In 1401 he became president of the faculty of theology, and in 1409 rector of the university. In philosophy he was a realist, and in opposition to the German professors, who were nominalists. By reviving an old ordinance of Charles IV., which gave the native students four votes in all discussions of university matters, and the foreign only one, he caused a rupture, and the Polish, Saxon, and Bavarian students, with their professors, 5000 in number, left the university. But those remaining, consisting chiefly of native Bohemians, drew so much the more closely around him, and in his contest with the Church, which now began to grow hot, the university was one of his principal supports. In 1400 he had taken holy orders, and in 1402 he was appointed preacher at the Bethlehem chapel at Prague. He delivered his sermons in the Bohemian language, and gathered immense audiences. He was a mild and kind-hearted man, with a pure, spiritual enthusiasm, but his sympathy with the suffering and downtrodden was impassioned, and his opposition to vice, falsehood, and abuse was fierce. In a short time he became the idol of the lower classes of Prague, and at court he was high in favor; he was the confessor of Queen Sophia, and King Wenceslaus was his friend. Nor was he at first met with enmity by the Church, though his denunciations of the false doctrines in her teaching and the vices in her discipline were very loud. But by degrees Archbishop Sbynko of Prague became frightened at the commotion which Huss's preaching caused, and as he knew the connection existing between the ideas of Huss and the writings of Wycliffe, he ordered all books by the latter to be deposited in his palace, and appealed to the pope. Alexander V. sent a bull against Wycliffe and all who held his opinions, and Sbynko had the books, 200 volumes, publicly burnt. Huss protested, not against the pope, but against the measures of Sbynko, and addressed a brilliant exposition of the whole matter to the new pope, John XXIII. A committee of cardinals was appointed, and Sbynko's acts were denounced as transgressions of his legitimate power, but at the same time Huss was accused of heresy and summoned to appear before the pope. The king, the queen, the university, the magistrates of Prague, even the archbishop himself, wrote to the pope to attest the orthodoxy of Huss, but in vain; and, as he refused to appear, he was condemned and excommunicated, and a ban was placed on the city which received him within its walls. He left Prague, but the popular movements became so violent that Sbynko had to flee for his life, and Huss returned to his chapel, where his preaching against the pope and the Church became bolder and bolder; the pope was compelled to acquiesce. But in 1412, John XXIII. preached a crusade against Ladislas, who fought with Louis II. for the possession of Naples, and the pope granted indulgences to all who would take arms against Ladislas. Scandalized at seeing the head of the Church meddle in this way with secular affairs, Huss gave, in his *Quæstio de Indulgentiis sive de cruciatu papæ Joannis XXIII.* and *Contra Bullam papæ Joannis XXIII.*, an exposition of the frauds and lies, doctrinal and historical, on which the whole Church establishment rested; and in clearness and conclusiveness of demonstration, and in simplicity and impressiveness of representation, these writings have perhaps never been surpassed. A new bull of ban was flung against him, but he now appealed to a general council in open opposition to the pope. Provided with a safeguard from the emperor Sigismund, he repaired to Constance, where (Nov. 19, 1414) the general council opened. He was well received both by the pope and the prelates, and seemed even to inspire confidence. But by the intrigues of his enemies affairs soon took another turn. He was imprisoned first in the cathedral, then in a Dominican convent on an island of the Lake of Constance, then in the castle of Gottleben, where chains were put on him; and when at last (June, 1415) he actually appeared before the council, it was evident that he was condemned before he was heard. On July 6 he was sentenced, and the same day he was burnt at the stake outside of the city, and his ashes were strewn on the Rhine. Many attempts were made to persuade him to recant, but he refused, and he died singing with loud voice the *Kyrie eleison.* Of his collected works there are two editions, Strasburg (1525) and Nuremberg (1558). Of his Bohemian writings there is an edition by Erben in 1864. His letters were translated into French in 1846 by Emile de Bonnechose. Clemens Petersen.

Hussar' [Hung., from *husz*, "twenty;" every twenty families were obliged to furnish a man], originally the irregular cavalry of Hungary and Croatia. The name is now applied to many light cavalry regiments in various armies. The British army (1873) had sixteen hussar regiments.

Hus'sites is the name of the followers of Huss. Immediately after his martyrdom they arose in Bohemia, and took a frightful revenge on the priests, monks, and prelates of the Roman Catholic Church. King Wenceslaus succeeded, however, in appeasing the storm by granting them religious freedom and appropriating a number of churches for their use. But when the king died in 1419, and the pope issued an order for the conversion of the Hussites by force, a civil war began. They assembled under the leadership of John Ziska on Mount Tabor, captured Prague, pillaged and burnt the monasteries, and defeated at Deutchbrod in 1422, and in several other minor encounters, the troops of Sigismund, the German emperor and the heir of Wenceslaus. Ziska d. in 1424, but his successor, Procopius, a former monk, was still more successful. He defeated Sigismund at Miess and Tachau, and carried the war into Austria, Bavaria, Franconia, and Saxony. Meanwhile, the Hussites had separated into two parties, the Taborites and the Calixtines. The former were the most radical, and acknowledged no doctrine which was not immediately given by the text of the Scriptures; while the latter held a more moderate position. In the beginning, however, they acted in perfect concert with each other. But in 1433 the Council of Bâle succeeded in coming to an agreement with the Calixtines and in drawing them out of the contest, the result of which was that the Taborites were totally defeated at Bömischbrod in 1434. By the treaty of Iglau (1436) the emperor Sigismund granted to Bohemia both religious and political freedom, but the civil war did not cease until 1485, when King Ladislas, at the diet of Kuttenberg, solemnly confirmed the treaty of Iglau. (See Bohemian Brethren.)

Husson' (Jean Honoré Aristide), b. at Paris July 3, 1803; studied sculpture under David, and received the first prize in 1830 for his *Theseus*, and the gold medal in 1837 for his *Guardian Angel.* His most celebrated statues are *Haidée*, in the museum of Grenoble, and *Summer* and *Autumn*, in the Place de la Concorde, Paris.

Hu'sted (James W.), b. at Bedford, N. Y., Oct. 31, 1833; graduated with honors at Yale 1854; was admitted to the bar 1857; early entered public life; was chosen school commissioner for Westchester co., N. Y., in 1858; deputy superintendent of insurance department 1860; was afterwards harbor-master and then deputy captain of the port of New York; judge advocate for the 7th brigade New York National Guard, etc.; became major-general of the 5th division New York National Guard in 1873; Speaker of the assembly 1874; president of the New York State Military Association 1874; is a high official of the Masonic order and a successful lawyer. Residence, Peekskill, N. Y.

Hu'stisford, post-tp. of Dodge co., Wis. Pop. 1696.

Hu'ston, tp. of Blair co., Pa. Pop. 1335.

Huston, tp. of Centre co., Pa. Pop. 863.

Huston, tp. of Clearfield co., Pa. Pop. 587.

Hu'stonville, post-v. of Lincoln co., Ky., 53 miles S. by E. of Frankfort. Pop. 320.

Hut'cheson (Francis), b. Aug. 8, 1694, at Drumalig, Ulster, Ireland, whither his grandfather had immigrated from Scotland; studied theology at the University of Glasgow 1712–16; lived as a public teacher in Dublin 1717–29, during which period he published *Inquiry into the Original of our Ideas of Beauty and Virtue* (1720) and *Nature and Conduct of the Passions and Affections* (1728), and was in 1729 appointed professor of moral philosophy at the University of Glasgow. He d. during a visit to Dublin Aug. 8, 1746. His *System of Moral Philosophy* was published by his son in 1755. In the history of Scottish philosophy, Hutcheson occupies a conspicuous place, though his books ceased to

be generally read soon after his death. He was strongly opposed to Locke and the whole empirical tendency of the English philosophy, and this may be considered as the pre-eminently Scottish element in his philosophy, as an anticipation of Dr. Reid. But by his own time he was, on the other hand, suspected as belonging to the "new lights," and intending to put a new face on Scotch theology; and the suspicion was right. Moral goodness he defines as the right relation between the propensities; virtue he represents as benevolence; and the whole moral state of man he rests on a sense peculiar to man, the moral sense. But the assumption of a moral sense brought him in dangerous propinquity to the opinion that man could be moral without knowing God; which opinion evidently involved that the heathen were not necessarily condemned; and for this very sentence his former teacher, Prof. John Simson, had been dismissed from the University of Glasgow in 1729. Hutcheson delivered his lectures in English, though the handbooks in logic, metaphysics, etc., which he published for the use of his classes are written in Latin.

Hut′chins (THOMAS), b. at Monmouth, N. J., about 1730. At an early age he entered the British military service, and became captain in the "Royal American" regiment; acted as engineer in Gen. Henry Bouquet's famous expedition against the Shawnees (1764), and participated creditably in a campaign against the Florida Indians. Being in London in 1779, his known devotion to American independence led to an imprisonment for six weeks on a charge of maintaining correspondence with Franklin, by which circumstance he is said to have lost £12,000. Soon afterward he sailed from France to Charleston, S. C., and joined the army under Gen. Greene, receiving the title of "geographer-general." He furnished the maps and plates for Dr. Smith's *Account of Bouquet's Expedition* (Phila., 1765; London, 1766); published *A Topographical Description of Virginia, Pennsylvania, Maryland, and Carolina, with maps* (London, 1778; in French, Paris, 1781); and *An Historical and Topographical Description of Louisiana and West Florida* (Phila., 1784), besides several papers in the *Transactions* of the scientific societies at Philadelphia. His geographical works were largely used by Dr. Morse in the compilation of his *American Gazetteer*. D. at Pittsburg Apr. 28, 1789.

Hut′chinson, county in the S. E. of Dakota. Area, about 720 square miles. It is intersected by the Dakota River. Cap. Maxwell. Pop. 37.

Hutchinson, city, cap. of Reno co., Kan., on the Arkansas and the Atchison Topeka and Santa Fé R. R., has a weekly newspaper, a court-house, bank, churches and schools, and is in a healthy, fertile region. Founded 1871.
C. C. HUTCHINSON, ED. "RESOURCES OF KANSAS."

Hutchinson, post-tp. of McLeod co., Minn. P. 440.

Hutchinson (ANNE), a famous religious enthusiast, founder of the Antinomian sect of New England, b. at Alford, Lincolnshire, England, in 1591, the daughter of Francis Marbury, a parish clergyman. On her mother's side she was a second cousin of the poet Dryden. In 1634 she came to Boston, Mass., to enjoy the preaching of John Cotton. Here she instituted meetings of women for the discussion of doctrinal questions, and her influence created a powerful faction and led to public disturbances. She even claimed a measure of divine inspiration. In 1637 she was banished to Rhode Island, where she was the leader of a small sect until 1642, when, after her husband's death, she removed to the Dutch colony of New Amsterdam, where (as some say near Hell Gate, or according to others near Albany) she was murdered by the Indians in 1643. Among her followers was her brother-in-law, John Wheelwright, the founder of Exeter, N. H., and Sir Harry Vane, the governor of Massachusetts, was her defender. Even John Cotton seems to have been at one time favorably inclined to her doctrine.

Hutchinson (JOHN), b. about 1616; married, in 1638, a daughter of Sir Allen Apsley, governor of the Tower of London, and settled on his estate at Owthorpe. In the beginning of the civil war he was appointed governor of Nottingham Castle; represented Nottingham in the Parliament, and was a member of the high court of judiciary which sentenced the king to death, but retired from public life, disagreeing with Cromwell. Shortly after the Restoration he was arrested and detained in prison, first in the Tower, and then in Sandown Castle, Kent, where he d. Sept. 11, 1664.—His wife, LUCY HUTCHINSON, who survived him many years, wrote a memoir of his life, which was published in London in 1806 from the original manuscript, and is considered a valuable record of events.

Hutchinson (JOHN), b. at Spennithorne, Yorkshire, in 1674; d. in 1737. He was first steward and then riding purveyor to the duke of Somerset, and had dabbled a little in many different things; as, for instance, mineralogy and Hebrew. In 1724 he published the first volume of his *Moses's Principia*, in 1727 the second, and then followed a long series of miscellaneous writings, 12 vols. in all, in which he ridiculed and reduced *ad absurdum* Newton's views of nature and expounded his own. These he professed to have extracted from the Old Testament by means of the only true and competent method of interpreting the Hebrew language, which he alone was possessed of. By itself, this maze of craziness and ignorance has nothing remarkable, but it is a curious fact that it found believers and adherents in England.

Hutchinson (THOMAS), b. at Boston Sept. 9, 1711; graduated at Harvard College in 1727; studied law, and served as representative for Boston in the general court for ten years; was three times Speaker; became lieutenant-governor in 1758, chief-justice in 1760, acting governor in 1769, and was commissioned full governor in 1771. Hutchinson early became obnoxious to the patriots on account of his unwavering support of all the tyrannical measures of the British ministry. In the Stamp Act riots of 1765 his house was twice attacked; on the second occasion (Aug. 26), his furniture was burned in the street and an invaluable collection of historical MSS. lost or destroyed. Brought into constant collision with the assembly and council during the stormy years preceding the Revolution, Hutchinson was the most prominent mark in America for the invectives of Otis, Bowdoin, Hancock, and the two Adams. Wearied with the conflict, he sailed for England on leave of absence June 1, 1774, and never returned to America. His services were rewarded by a pension from the Crown. Hutchinson was an accomplished scholar, and his writings are valuable sources of information for New England history. He published in 1764 and 1767 two volumes of a *History of the Province of Massachusetts Bay*, and in 1769 a *Collection of Original Papers relative to the History of the Colony of Massachusetts Bay*. A third volume of the *History*, completing the work to 1774, appeared in 1828, edited by the author's grandson, Rev. John Hutchinson. D. at Brompton, Eng., June 3, 1780.

Hutchinson (THOMAS JOSEPH), F. R. G. S., served as senior surgeon on the English expedition in 1854–55 to the rivers Niger, Tshadda, and Bine, and was appointed British consul in this territory in 1855; in 1861 he was transferred to Rosario in the Argentine Republic, and in 1870 to Callao. He has published *Narrative of the Niger Expedition* (1855), *Impressions of Western Africa* (1858), *Ten Years Among the Ethiopians* (1861), *Buenos Ayres* (1865), *Parana* (1868), and *Two Years in Peru* (1874).

Hut′sonville, post-tp. of Crawford co., Ill. Pop. 1851.

Hut′ten, von (ULRICH), was a kind of literary knight-errant, whose influence it would be impossible to realize unless his life were viewed in connection with a detailed description of his time. He was b. in the castle of Steckelberg, near Fulda, in the electorate of Hesse, Apr. 20, 1488, and in 1498 he was placed in a monastery in Fulda in order to become a monk. But in 1504 he fled to Erfurt, where he conversed with poets and scholars; and when, in the next year, a pestilential disease broke out and compelled him to leave the city, he went to Cologne. Here he made acquaintance with some of the most marked specimens of the *viri obscuri*—as, for instance, Hoogstraten—and also with one of their most decided opponents, Johannes Rhagius. He allied himself with the latter, and followed him in 1506 to Frankfort-on-the-Oder, where a new university was just established. Here he received the degree of M. A., and published his first poem, *Carmen in Laudem Marchiæ;* but in 1508 he was attacked himself by the above-mentioned disease, and for several years he wandered around in Northern Germany, experiencing many turns of fortune, courted to-day and beaten to-morrow. In 1511 he was in Wittenberg, where he published his *Ars versificatoria*, and in 1512 he went through Moravia and Bohemia, through Vienna, to Pavia, in order to study law. But after the conquest of Pavia he was plundered of all he owned, and was at last compelled by the danger of starvation to enlist in the imperial army. He left it very soon, however, and returned home to Germany, and during the two following years (1513–15) his denunciations of Ulrich, duke of Würtemberg, and especially his defence of Reuchlin, made his name quite famous. The publication of *Epistolæ obscurorum virorum*, in the writing of which he probably bore a part, is generally considered as having furthered the cause of the Reformation. In 1515 he once more went to Italy, but returned again in 1517; was knighted by the emperor at the diet of Augsburg, and entered the service of the archbishop of Mentz. Next year, however, he retired from the court, and at this time he began the publication of the severest attacks on the pope and the clergy written in German. The pope demanded his surrender as a prisoner, and Hutten fled, first from his own

castle, and then from that of Franz von Sickingen, where he found refuge. He went to Switzerland, and here, again attacked by his old disease, he d. Aug. 23, 1523, in Ufenau, an island in Lake Zurich. A collected edition of his works was published by Böcking (1862), and a biography by Strauss (1857).

Hut′ter (Leonhardt), b. at Nellingen, Bavaria, in 1563; studied theology at Strasburg, Leipsic, Heidelberg, and Jena, and was appointed in 1596 professor in Wittenberg, where he d. Oct. 23, 1616. His most prominent works are —*Concordia concors* (1614), written in defence of the Lutheran system of doctrines, which had been attacked by Hospinian in his *Concordia discors;* and *Compendium locorum theologicorum*, a Lutheran dogmatic treatise, which has been published several times; last ed. 1863.

Hut′ton, post-tp. of Coles co., Ill. Pop. 2196.

Hutton, tp. of Putnam co., West Va. Pop. 1568.

Hutton (Charles), b. at Newcastle-on-Tyne Aug. 14, 1737; lived at Newcastle as teacher from 1760 to 1773, during which period he wrote his *Treatise on Arithmetic and Book-keeping* (1764), *Treatise on Mensuration* (1771), and *Principles of Bridges and Mathematical Demonstration of the Laws of Arches* (1772): was in 1773 appointed professor of mathematics at the military academy of Woolwich, and in 1774 elected a member of the Royal Society. D. Jan. 27, 1823. Besides a number of papers in the *Transactions* of the Royal Society, in the *Philosophical Transactions*, and the *Ladies' Diary*, he published *Tables of Products and Powers of Numbers* (1781), *Mathematical Tables* (1785), *Course of Mathematics* (1798–1801), and *Recreations in Mathematics and Natural Philosophy* (4 vols., 1803).

Hutton (James), b. in Edinburgh June 3, 1726: studied medicine in his native city, in Paris, and at Leyden, where he took the degree of M. D.; engaged after his return to England first in the manufacture of chemicals, then in agricultural pursuits, concentrating his studies on the fields of natural science, especially geology. The principal results of his researches were a *Theory of Rain*, communicated to the *Transactions* of the Royal Society of Edinburgh, and a *Theory of the Earth*, in which he claims that most geological phenomena which by Werner and his school were explained as effected by aqueous influences were produced by igneous fusion. The former is still considered a valuable contribution to the science of meteorology; by the latter (2 vols., 1795–96) he established the principle of plutonism. D. in Edinburgh Mar. 26, 1797.

Hux′ley (Thomas Henry), M. B., Ph. D., LL.D., F. R. S., b. at Ealing, Middlesex, England, May 4, 1825; became a student of Charing Cross Hospital 1842; graduated M. B., with honors, from the University of London 1845; was assistant surgeon of the royal navy 1846–53; sailed around the world in H. M. S. Rattlesnake, which then performed surveying service in Australasia, 1846–50; became F. R. S. 1851, in acknowledgment of the value of the observations in natural science made by him while in the naval service, concerning which he had from time to time sent papers to that society; became in 1854 professor of natural history in the School of Mines, which position he retains in 1875; Hunterian professor in the Royal College of Surgeons 1863–69; president of the Geological and the Ethnological societies 1869–70; was appointed one of the royal commissioners on scientific instruction and the advancement of science 1870; was on the London school board 1870–72; secretary of the Royal Society 1872; lord rector of the University of Aberdeen 1872; and has twice been named Fullerian professor in the Royal Institution. Prof. Huxley has for many years been one of the most laborious workers in biological science. The comparative anatomy of both vertebrate and invertebrate animals, and the systematic arrangement of organisms, have been the fields in which he has been chiefly distinguished. He has proposed several bold rearrangements of animals into new classes, orders, and has discovered some remarkable analogies in the development of vertebrate and invertebrate animals. His theory of protoplasm, his able advocacy of the Darwinian hypothesis, and the doctrine boldly advanced by him in his address before the physiological section of the British Association at its Belfast meeting in 1874, that the seemingly voluntary movements of animals, and even of men, are automatic and independent of the will, have attracted much attention. Author of *The Oceanic Hydrozoa* (1857), *Man's Place in Nature* (1863), *On the Physical Basis of Life* (1868), *Elementary Physiology* (1866), *Introduction to the Classification of Animals* (1869), *Lay Sermons*, etc. (1870), *Critiques and Addresses* (1873), and of many important scientific papers.

Huy, town of Belgium, in the province of Liège, at the confluence of the Hoyoux and the Maas. It is strongly fortified, and has rich coal and iron mines in its vicinity, which is mountainous, almost alpine, in its character. Pop. 11,055.

Huydecop′er (Balthasar), b. in Amsterdam in 1695; filled for many years the office of sheriff of his native town, and d. there Sept. 21, 1778. His Latin poems and his Dutch tragedies, *Achilles*, *Arsaces*, etc., are not now read, but his remarks on Vondel's translation of *Ovidii Metamorphoses*, and his other critical and linguistic works, started in the Netherlands the grammatical cultivation of the Dutch language.

Huy′ghens (Christian), b. at the Hague Apr. 14, 1629, and educated at the universities of Leyden and Breda, where he studied law and mathematics. He made several journeys to Denmark, France, and England, and resided from 1665 to 1681, at the invitation of Colbert, at Paris, where he was made a member of the Academy of Science and had apartments assigned him in the royal library. The latter part of his life he spent at the Hague, where he d. July 8, 1695. As a mathematician, especially as a geometrician, he enjoyed the greatest fame, and his papers on the calculus of probabilities and on the quadrature of a portion of a cycloid were considered masterpieces. His views on optics and mechanics also attracted great attention. He was the most able advocate of the undulatory hypothesis of light, which he developed in 1678. It was not generally adopted, by reason, probably, of the great authority of Newton, who embraced the emission hypothesis. By the later labors of Young, Fresnel, and others the doctrine of Huyghens was restated, and is now universally received. But it was more especially his astronomical discoveries which made his name celebrated. At different times in his life he was much occupied in making improvements in the construction of telescopes, and in 1656 he discovered the first satellite of Saturn, and in 1659 the ring; which discoveries he described in his *Systema Saturnium* (1659). He became still more widely known as the inventor of the pendulum clock, which he described in his *Horologium Oscillatorium* (1658). His works were published in two collections, *Opera varia* (1724) and *Opera reliqua* (1728).

Huy′sum, van (Jan), b. at Amsterdam in 1682; received instruction in landscape painting from his father, but devoted himself exclusively to the painting of flowers and fruits, in which *genre* he became one of the greatest masters, if not the very greatest. D. in his native city in 1749. He was proud, jealous, and of a difficult temperament; kept his knowledge of the preparation of colors and other technicalities a deep secret; worked slowly, but acquired a naturalness and life in drawing and a warmth and brilliancy of coloring which have never been surpassed. His representation of dewdrops resting on the tips of grass, of down floating in the air, or of an insect crawling over a leaf, are often too true, making an impression as if the fly were sitting on the picture and not on the flower. His paintings are found only in the greatest galleries.

Hy′acinth [so called from the youth Hyacinthus, slain by the quoit of Apollo; from his blood the flower was fabled to have sprung], a genus of bulbous-rooted flowering plants of the order Liliaceæ. Several species are natives of the Old World. Besides these, some species of *Muscari* (globe-hyacinths) and *Scilla*, or squill, are called hyacinths by florists. The true hyacinths of cultivation are varieties of *Hyacinthus orientalis*. There are a great many kinds produced from seed, but for ordinary culture the bulbs are planted. These bulbs come chiefly from Haarlem in the Netherlands. They do best in a rich but sandy soil. They are often planted in pots, and for house-culture they do tolerably well in hyacinth-glasses with water only. According to tradition, the petals of the hyacinth are inscribed with the Greek letters *αι, αι*, Apollo's exclamation of grief when he found that he had slain the beautiful Hyacinthus; or *υα*, the first two letters of his name. Hence, Milton calls it "that sanguine flower inscribed with woe." Most people fail to find any such mark upon the hyacinth, and it is not certain that the hyacinth of the ancients was identical with ours. But Sprengel and others profess to have seen hyacinths with the inscription. *H. non-scriptus* is the bluebell of Great Britain. (See Bluebell.)

Hyacinth, or **Jacinth,** is a term applied to bright-colored varieties of zircon, a mineral that crystallizes in the dimetric system, and is in composition a silicate of zirconia. The hyacinth is used as a gem, and varies in color from various shades of red to orange. It is doubtful, however, whether this is the *ὑάκινθος* of the ancients, which may have been the amethyst or the sapphire.

Hyacinthe (Charles **Loyson,** called Father), b. at Orléans in 1827; after his regular course of studies in the college of Pau he entered the ecclesiastical college of St. Sulpice. Four years after he was ordained priest, and was professor of theology in several schools. Hyacinthe was

then attached, as a working priest, to the parish of St. Sulpice in Paris, but he soon made himself a monk, and entered the convent of the Carmelites in Lyons. From 1864 till 1869 he was one of the most celebrated preachers ever heard, at Bordeaux, Nantes, and in Notre Dame of Paris. But he was then suspected of uttering too liberal religious doctrines, severely attacked by the Ultramontane papers, and finally excommunicated by the pope. Father Hyacinthe soon after (1869) made a voyage to the U. S., where he was warmly received. On his return to France he married an American lady, who bore him a son. Persecution, open and concealed, compelled him to take refuge in Switzerland, where he established an Old Catholic church at Geneva, but here he was assailed by some dissenters of his own Church, who thought he was not sufficiently radical in his doctrine, because he continued to affirm his faith in Roman Catholicism, minus the maintenance of papal infallibility and other secondary dogmas. For some time Father Hyacinthe did not preach, but he has recently found another congregation, and again begun preaching in another church at Geneva. FÉLIX AUCAIGNE.

Hyæ'na [Gr. ὕαινα; Lat. *hyæna*], a genus of carnivorous mammals belonging to the Æluroidea, or cat-like division of the sub-order Fissipedia, order Feræ. As in the cats and dogs, the feet are digitigrade, the weight of the body being supported by the toes instead of by the whole foot, as in the bears. The dental formula is—incisors $\frac{3-3}{3-3}$, canines $\frac{1-1}{1-1}$, premolars $\frac{4-4}{3-3}$, molars $\frac{1-1}{1-1}$. The last upper tooth, or true molar, is small, transversely elongated, and tubercular; the last premolar, or successional tooth, being the sectorial or flesh tooth. In the lower jaw the true molar is the sectorial tooth. All the teeth, especially the molars, are large and strong, and set in powerful jaws, which are worked by muscles of corresponding development. The hyæna is thus fitted to obtain its living by devouring the cartilages, and even gnawing and crushing the bones of animals killed by the lion and other active predaceous beasts; and most of its subsistence is thus obtained, although it sometimes captures living prey by the chase. The auditory bullæ are destitute of the septum found in the cats. The toes are straight, with blunt, nonretractile claws. The hind legs are usually short, the tail short and bushy, and the neck provided with a short bristly mane, whence the classical name, signifying a "sow." Three living species are known; two of these are from Southern Africa—viz. the brown hyæna (*H. brunnea*), with the fur clouded, rather long, brain-case compressed, a large and deep sub-caudal gland, and the legs of nearly equal length; and the spotted hyæna (*H. crocuta*), with no subcaudal gland, and having the hinder legs short. The striped or banded hyæna (*H. striata*) ranges over Africa and Southern Asia. The fur is striped, and there is a sub-caudal gland. The brain-case is larger than in *H. brunnea*. The cave hyæna was a large and fierce species that roamed over the continent of Europe during the Quaternary, and left, especially in the cave-deposits of England, abundant fossil remains of its own bones, mingled with those of other animals bearing unmistakable marks of its powerful teeth. This species, notwithstanding its large size, is now regarded as identical with the spotted hyæna of South Africa. No species of hyæna, recent or fossil, is yet known from the continent of America. O. C. MARSH.

Hyæn'idæ [from Gr. ὕαινα, a "sow;" Lat. *hyæna*], a family of fissipede feræ belonging to the group Æluroidea (distinguished by the relations of the foramina of the basis of the skull and the relations of the auditory bulla to the paroccipital and mastoid processes), having the external appearance of a dog, but with the shoulders elevated; 34 teeth (M. $\frac{1}{1}$; P. M. $\frac{4}{3}$; C. $\frac{1}{1}$; I. $\frac{3}{3}\times 2$), of which the molars are large and approximate, the true molars reduced and tubercular, and the last upper premolar sectorial and like that of the cat; the true molar of the lower jaw sectorial; the jaws and muscles thereof are very powerful. This family has been established for the well-known hyænas, of which there are two genera: (1) *Hyæna*, including species with a large sub-caudal gland, the tubercular grinders of the upper jaw enlarged and with three roots, and colored with clouded areas or bands; (2) *Crocuta*, with no subcaudal gland, the tubercular grinders of the upper jaw small with only two roots, and the color distributed in spots. The three living recognized species of the family are confined to Africa, and two of them (*Hyæna brunnea* and *Crocuta maculata*) are restricted to South Africa. In former times, however, forms scarcely distinguishable from the living species existed in Northern Europe, and their remains have been found in abundance in caves in England, especially at Kirkdale in Yorkshire.
THEODORE GILL.

Hyæn'odon [Gr. ὕαινα, a "hyæna," and ὀδούς, a "tooth"], an extinct genus of carnivorous mammals, the type of an extinct family, Hyænodontidæ, partaking, in part, of characters of the wolves, cats, and hyænas. The name was first used for a species from the Lower Miocene of France, and the genus also occurs in the Upper Eocene of that country. Dr. Leidy has also described three species from the Miocene of Dakota. The largest of these, *H. horridus*, is the largest known species of the genus, and equalled in size a large black bear. The form of the skull is intermediate between that of the wolf and that of the opossum, the brain-case being small, as in the latter animal. The temporal fossæ are large, and the lower jaw is strong. The dental formula is—incisors $\frac{3-3}{3-3}$, canines $\frac{1-1}{1-1}$, premolars $\frac{3-3}{4-4}$, molars $\frac{3-3}{3-3}$. All the true molars, both above and below, are sectorial in character, the posterior one being much larger and stronger than the other two, and the series is remarkable for the entire absence of the posterior tubercular molars usually found in Carnivores. The canines resemble those of the wolf. The *H. cruentus* and *H. crucians* are smaller species, the latter a little larger than the red fox. O. C. MARSH.

Hyænodon'tidæ [from ὕαινα, "hyæna," and ὀδούς, a "tooth"], a family of mammals which has generally been referred by some naturalists to the order Feræ, and by others to the order Marsupialia. They had apparently 44 teeth (M. $\frac{3}{3}$, P. M. $\frac{4}{4}$, C. $\frac{1}{1}$, I. $\frac{3}{3}\times 2$), and the second and third, as well as first, true molars were sectorial; the last premolar of the lower jaw was enlarged. The family has been based upon the fossil remains of several species of animals which have been found in the Lower and Middle Tertiary deposits of France, and especially the Paris basin. There has been considerable diversity of opinion as to the systematic relations of these forms, but the latest original investigator, Prof. Gervais, has recently obtained casts from the interior of the cranium of one of the species, and has shown that in the former the brain was much more like that of a marsupial than that of a placental Carnivora: it further agrees with the marsupial Thylacinids in the sectorial nature of all the true molars; but on the other hand it apparently resembled the Carnivores in the development of only six incisor teeth in each jaw, and the absence of the inflected margin of the lower jaw. THEODORE GILL.

Hya'lea [Gr. ὑάλεος, "glassy"], a genus of transparent-shelled pteropod mollusks, of which nineteen species are found in the Atlantic, Mediterranean, and East Indian waters. The mollusk has two long appendages to the mantle. *Hyalea tridentata* is the typical species. Some five or six fossil species are known.

Hy'alite, or **Muller's Glass,** a form of opal or hydrated silica, of glassy lustre. It occurs as an incrustation, generally in the form of pellucid drops.

Hyan'nis, post-v., seaport, and harbor of refuge on the S. side of Cape Cod, in Barnstable tp., Barnstable co., Mass., is the S. terminus of the Hyannis branch of the Cape Cod R. R., and is 79 miles from Boston. It has a national bank. Its outer harbor is protected by a breakwater. Besides a harbor-light, Hyannis has a fixed catoptric light in lat. 41° 38′ 9″ N., lon. 70° 16′ 59″ W.

Hybernation. See HIBERNATION.

Hybrid'ity, or **Hy'bridism** [Lat. *hybrida*, a "mongrel;" perhaps from the Gr. ὕβρις], treats of the issue of dissimilar kinds of animals and plants, or, in other words, the offspring of parents which belong respectively to different varieties or species. Few subjects have been so much misunderstood or have given rise to so many superstitions as this. In the olden times, and indeed until quite recently, among the educated as well as among the ignorant, the grossest credulity prevailed respecting the possibility of offspring between the most dissimilar forms. Nor was this credulity always an innocent one: it has even affected the laws and customs of states. The belief prevailing that women could become pregnant from intercourse with beasts, laws have been framed condemning to death the parents who were judged guilty of the crime of such unnatural commerce. In 1543, *e. g.*, a woman in Avignon, France, was delivered of a child which was thought to look like a dog, and this supposed resemblance was sufficient evidence that the mother had had intercourse with the dog, and she was consequently condemned, with her quadruped paramour, to die at the stake, and was accordingly executed. Although such beliefs have now been driven to more obscure quarters, they are by no means extinct, and indeed are still very prevalent; in fact, extravagant accounts of animals of mongrel origin are frequently published in the daily and weekly newspapers. It may therefore be advisable to enter into some detail, and in advance to deny the truth of most of the reports.

Under the general designation of hybrids are embraced all those forms whose parents belong to different varieties or species, whether the offspring is fertile or not. The word *hybrid* is thus essentially similar in its meaning to the Anglo-Saxon term *mongrel*, but for present use it has superseded that term, leaving the latter for the offspring between *varieties*, and, to a considerable extent, for figurative expressions. French writers have classified the forms embraced under this general term under three categories—viz. (1) Métis (mestizoes); (2) Hybrides (hybrids); and (3) Mulets (mules). (1) Métis, originally specially employed to designate the offspring of an Indian mother by a white father, has been extended, as a generic term, to animals and plants of mixed origin—*i. e.* to the offspring of two races or *varieties* of the same species, as well as of two distinct *species*—and consequently to every organized being owing its origin to dissimilar parents, or to every product of a cross. (2) Hybrid is, in general terms, any animal or plant engendered of two different *species*. (3) Mulet, originally applied to the offspring of a mare by a jackass, is extended to embrace all those organized beings which are analogous to it, as well in mixed origin as in *sterility*, and also to forms characterized by their sterility, even though their origin may not be mixed, as in the case of bees, wasps, etc.: thus, infecundity is the prime element.

Such are the distinctions employed by French authors, and followed in the dictionary of the French Academy, but they are not recognized by English writers, and indeed scarcely seem to be definite enough to warrant recognition. It is only necessary to indicate that we use the word *hybrid* in the same sense as the French do *métis*. A distinctive term is, however, needed for the offspring of hybrids *inter se*, and the word *mongrel* might be extended, in accordance with analogy, to such forms.

Repeated and prolonged critical observations and experiments have amply demonstrated that fruitful union is impossible between animals or plants of widely different species (*i. e.* belonging to decidedly different families), and that such is only possible within comparatively narrow although uncertain limits. We may therefore at once dismiss, as utterly unworthy of belief, the many reports of offspring from such forms which have been published by even accredited writers of natural history in past times, such, *e. g.*, as the alleged cases of hybrids between a hen and a duck; an opossum and a cat; a boar and a camel; an otter and a rabbit; an otter and a sheep; an otter and a cat; a raccoon and a cat; a bear and a hog; a bear and a dog; a cat and a rat; a monkey and a slut; and especially women and apes, dogs, or other animals. Whatever details may be given have been found to lack essential requisites, and in almost all cases the belief has had its origin in some vague external characteristics which suggested a similarity which had, however, no real existence in structure. In the name *cameleopard* we have a term which is the expression of a past belief that the animal in question was a hybrid between the camel and the leopard; and such was actually claimed to be the origin of that animal by some old writers—*e. g.* Matthieu in the eleventh century. In the case of an alleged hybrid between a cat and a raccoon, seen at Taunton, Mass., an Angola cat was the supposed hybrid: the explanation lay in the fact that the Angola cat is a large animal with a bushy tail and color somewhat resembling the raccoon, and thus it received the name of raccoon cat; the step thence to the belief that it was the offspring of a raccoon and cat was natural; this belief at a distance became embodied in the assertion of such origin as a matter of fact: such was the basis of a statement which was fully examined into by the writer of this article. Another case was simply the result of a misconception of the meaning of authors. Geoffroy St.-Hilaire and Hyrtl refer to an alleged hybrid between the axis deer and hog, said to have been recorded by Hamilton Smith and Morton, and very properly urge that such an offspring would be impossible. On referring to the two authors mentioned, however, it is evident that they simply alluded to supposed hybrids between the axine buck (*Cervus axis*) and the hog deer (*Cervus porcinus*), designating the latter under the name "porcine species" (*i. e.* of deer). Geoffroy St.-Hilaire interpreted the word "porcine species" to mean hog, and hence a belief quite venial (whatever may have been its basis in truth) was exaggerated into one entirely unpardonable in a scientific man. The alleged cases of hybrids between otters and other animals are doubtless the expressions of another series of facts. There is somewhat of a tendency among animals towards a diminished size or an offturned position of the legs which recalls the form of an otter, as is exemplified, *e. g.*, in the turnspit dog and Ancon sheep. These Ancon sheep (which have been especially referred to by Darwin in his *Origin of Species*) were also called, on account of this peculiarity, "otter sheep," and from this name was doubtless developed the report of hybrids between sheep and otters. Such has doubtless been the origin of the belief in the other otter-like animals.

Hybrids partake of the characteristics of their parents, and the extent to which they do so is, within a certain range, definitely fixed for those of each kind; further, the degree in which the hybrid shares the characters of the parent is determined by the sex of each species contributing to the hybrid. Thus, in the case of hybrids between horses and asses, which are the best known, we have in the mule the offspring of the mare and jackass, and in the hinny that of the stud-horse and she-ass: the mule resembles in many of its characters the ass most, but is larger, while the hinny more resembles the horse, but is smaller than the mule. These conditions will be found to affect the internal organization and external appearance, and the like is the case respecting other hybrids. Therefore, every alleged hybrid should exhibit positive evidences in its organization, as well as its external appearance, of the parentage on both sides; and if such evidences are not afforded, or if only a vague superficial similarity to some alleged species exists, while the fundamental characters are all those of another species, we are necessarily forced to conclude that the allegation as to hybridity has no real foundation, and that the external indications are illusive. The natural love of man for the marvellous prompts to a ready belief in extraordinary hybrids. Pecuniary interests are also often involved with this belief, and inducements are thus held out to propagate it. Hence are constantly arising fables respecting hybrids of various kinds.

Hybrids have been classed in various categories; *e. g.* (1) according to general affinities as expressed in their structure; (2) according to the degree of affinity of the parents—*i. e.* whether congeneric with each other or bigeneric (*i. e.* representatives of distinct genera); (3) according to the fertility of the progeny of the hybrids or otherwise; (4) according to the degree of prolificacy of the hybrids; and (5) according to the frequency or rarity of their occurrence. Our present purpose will be best subserved by the consideration of the species arranged according to their affinity.

Among the Primate mammals, or monkey order, numerous hybrids have been obtained by congeneric species of monkeys; *e. g.* (1) the common macaque or kra (*Macacus cynomolgus*) and bonnet monkey (*Macacus sinicus*); (2) the macaque and maimon or bruh (*M. nemestrinus*); and (3) the papion and chacma baboons (*C. sphinx* and *C. porcarius*). Among the Carnivores also numerous hybrids have been obtained, the chief of which are those (1) between domestic or feral common cats and the smaller species of the countries into which they been introduced; (2) the lion and tiger; (3) the jaguar and panther; (4) common dogs and native wild species—*e. g.* wolves, jackals, etc.; and (5) dog and red fox. Among seals several cases have been reported of hybrids between the sea-lion (*Eumetopias stelleri*) and fur-seal (*Calorhinus ursinus*), but these require confirmation. Among the ungulates numerous hybrids have also been produced, among which may be especially enumerated of the horse family (Equidæ) (1) the mule between the ass and mare; (2) ass and zebra; (3) ass and dauw; (4) quagga and horse; (5) kiang and zebra; (6) kiang and dauw; (7) kiang and ass; (8) horse and zebra; and (9) quagga and horse. Of the ox family (Bovidæ), hybrids have been raised from the domestic cattle and almost all other well-known species and representatives, even of different genera (*e. g.* buffalo, yak, and bison), and also between these and so many other forms that specification is unnecessary. Hybrids have also been obtained from sheep and goats, and various species of each group. Among the rodents successful intercourse has been effected between the hare and rabbit; and their offspring have been advantageously raised even for the market. Among the birds hybridity is so frequent, and has been effected between such widely distinct species, and representatives of even markedly distinct genera, that inability to hybridize is rather the exception than the rule. The most notable cases are those between different generic types of the Phasianidæ (common fowl, pheasants, etc.) and Anatidæ (ducks, geese, etc.). Little is known respecting hybridity in reptiles or amphibians; and the only case that need be specifically alluded to is one that has very recently been procured, by Prof. Paul Gervais, between the siredon of Mexico and the triton (*Triton cristatus*) of Europe, members of two different families. In this case young were hatched from the eggs of females of siredon impregnated by the triton, but did not live to maturity, all having died within a short time after hatching. Among the fishes also hybrids between diverse genera have been obtained; *e. g.* between various species of Salmonoids and Cyprinoids. A number of very distinct forms, existing in a state of nature, have been declared by certain authors of high reputation (*e. g.* Siebold

and Günther) to be hybrids between representatives of different genera: such are especially (1) *Carpio Kollarii*, between *Cyprinus carpio* and *Carassius vulgaris*; (2) *Abramidopsis Leuckartii*, between species of *Abramis* and *Leuciscus*; (3) *Bliccopsis abramo-rutilus*, between a species of *Abramis* and *Scardinius erythrophthalmus*; (4) *Leuciscus dolabratus*, between *Alburnus lucidus* and *Squalius cephalus*: and (5) *Chondrostoma rysela*, between *Chondrostoma nasus* and *Telestes Agassizii*. These, however, have not been experimentally determined to be hybrids (except, perhaps, in the case of the first), and there is still ground for skepticism.

Such are some of the best known and most characteristic cases of hybridity among the vertebrates. Among the invertebrates there are less known and determined cases, but hybrids have been obtained between different species of bees, butterflies, etc., and many intermediate forms found in a state of nature have been supposed to be hybrids. Several botanists—*e. g.* Gärtner, Kölreuter, Herbert, Noble, etc.—have devoted much time and attention to the subject, and their results, although affording some basis for difference of opinion, essentially coincide with the facts rehearsed as to the best known animals. The results thus far obtained from all these various departments may be summarized as follows: (1) Allied species are capable, as a rule, of pairing and producing offspring, and this capability is in indefinite ratio to the degree of their likeness. (2) Hybrids are frequently fertile with their parents when those parents are closely related to each other. (3) Hybrids are more rarely fertile among themselves, and mostly (but not always) in cases where the parents are very closely and even suspiciously related.

The degree of fertility between original species and their hybrids need not be in ratio to each other; *e. g.* offspring between certain species is very difficult to be obtained, but hybrids which have been once obtained may be fertile among themselves. On the other hand, certain species will pair and have progeny without difficulty, but the hybrid offspring may be nearly or absolutely (?) infertile; and this case may even occur in the same genus, as, for example, in the plant-genus *Dianthus*.

From all these facts it is plain that there is every degree of difference between absolute sterility and perfect fertility in the intercourse between different species; that, however, infertility to some degree attends sexual intercourse between different species; that fertility is certainly no evidence of specific unity. Fertility, it is equally plain, is almost impossible between species of different families, and all popular accounts to the contrary may be at once set down as destitute of a real foundation. The explanation of this want of fertility between forms that are very dissimilar is doubtless to be found in some difference of structure in the genital organs, although the differences may be so obscure as to have escaped detection till the present time. These differences, at the same time, need not necessarily be co-ordinated with other differences, at least to a greater extent than in other parts of the animal economy; and hence we may find species that differ considerably in appearance quite fertile, while others that resemble each other much more closely may be less so. There must, however, be some degree of co-ordination between the modification of the genital organs and those of the other organs and parts, and hence fertility is only possible within a certain limited range.

A noteworthy fact is that domestication and cultivation exercise an appreciable effect upon the intercourse between animals and plants of different species, and increase the degree of fertility: in a state of nature members of different species rarely pair, and hence hybrids are exceptional, and thus specific forms are perpetuated pure and undefiled; under the influence of man, however, mongrel races readily arise and are indefinitely sustained.

Before dismissing the subject it is advisable to allude to some very curious and, at first sight, inconsistent phenomena exhibited by cross-breeding. Many plants depend for impregnation upon pollen brought by insects from other individuals; and although the sexes may be combined in the same individual flower, the pollen of its stamens appears to be insufficient to impregnate its ovary. Even making allowance for the disturbing effects of manipulation, enough is known to at least indicate that there is a less degree of fertility between closely related individuals than more distant ones. The evils of close breeding are even recognized by man in the laws affecting the marriage state, as well as in his usage in the rearing of his domestic animals. It may be, therefore, that even the difficulty of obtaining hybrids fertile among themselves may be in part due to the fact that those hybrids are too closely related by consanguinity, and that the conditions for perfect experiments have thus not been completely fulfilled. Much has been done towards the elucidation of the subject, but much still remains to be done. THEO. GILL.

Hydas'pes, the name by which the Greeks and Romans designated the present JHYLUM (which see), an affluent of the Ganges. On its banks was fought the great battle between Alexander the Great and Porus in 327 B. C.

Hydat'id, a morbid growth characterized by the development of a cyst, which contains an aqueous and transparent fluid, in which floats a parasitic worm, generally the acephalocyst. The term was formerly used to designate any encysted tumor containing a transparent liquid, but it is now restricted to that form which encloses a parasite. The organs most commonly affected by this peculiar disease are the uterus, ovaries, and liver; next frequently we find it in the breast and testicles, but rarely in other parts of the body. It generally appears as a round hard tumor, which occasions more or less pain and inconvenience; this tumor is made up of hydatids, although we sometimes have it occurring singly, when it will be proportionately large. Each parasite consists of a body and head; around the latter we find a row of teeth which are hook-like and sharp. The body is solid, and displays a number of ovoid bodies beneath its coat, which give it a speckled appearance. As the tumor increases in size, if it is near the surface, we can feel fluctuation; the pressure under the skin causes it to ulcerate, and the hydatids may thus perish. If they are situated in some internal organ, they may produce very serious complications, as peritonitis, osteitis, etc. The treatment consists in excision if they are sufficiently superficial, otherwise we can do nothing. EDWARD J. BERMINGHAM.

Hyde, town of England, in the county of Chester. It is a rapidly growing place, with numerous cotton-factories, and in the neighborhood are extensive coal-mines. Pop., with surroundings, 21,221.

Hyde, county of S. E. Central Dakota. Area, about 995 square miles. The Missouri River flows for some distance along its S. W. border.

Hyde, county of the E. of North Carolina, bounded on the E. and S. by Pamlico Sound. Area, 720 square miles. It abounds in marshes, lakes, and forests. Corn, rice, and forest products are the staples. Cap. Swan Quarter. Pop. 6445.

Hyde (ALVAN), D. D., LL.D., b. at Franklin, Conn., Feb. 2, 1768; graduated at Dartmouth College in 1788; studied theology, and in 1792 was ordained pastor of the Congregational church at Lee, Mass., where he remained the rest of his life. He was an able and influential pastor, and a zealous friend to Williams College, of which he was for twenty-one years vice-president. Dr. Hyde published a number of sermons. D. at Lee Dec. 4, 1833.

Hyde (AMMI BRADFORD), D. D., b. at Oxford, N. Y., Mar. 13, 1825; graduated at Wesleyan University in 1846; entered the Methodist Episcopal ministry; taught (1846–61) in the seminary at Cazenovia, N. Y., and in 1864 became professor of Greek in Allegheny College, Meadville, Pa.

Hyde (ANNE), a daughter of Edward Hyde, earl of Clarendon, b. in 1637, and lived at the Hague as maid-of-honor to the princess of Orange, sister to Charles II. and James II. Here James, at that time duke of York, formed a liaison with her, and shortly after the restoration of his family to the throne of England in 1660 he married her clandestinely. For some time the royal family would not recognize her, and much intriguing was going on for the purpose of breaking the marriage; but Anne's perseverance at last conquered all difficulties. She was not handsome, but very prepossessing, spirited, and dignified, and she exercised a great influence on her husband. She was a Roman Catholic, and converted him. Her two daughters, however, Mary and Anne, who both became queens of England, were educated in the Protestant religion. Anne d. in 1671.

Hyde (EDWARD). See CLARENDON.

Hyde Park, an enclosure comprising 400 acres, and extending from the western extremity of London to Kensington Gardens. When the monasteries were dissolved under Henry VIII., these grounds became the property of the Crown, and after the Restoration it became the favorite drive and promenade of London. (See LONDON.)

Hyde Park, post-tp. of Cook co., Ill., a southern suburb of Chicago, now under village organization. It covers 49 square miles, and includes 49 villages, towns, and hamlets; has 25 churches, 25 schools, 13 post-offices, 30 manufactories, gas and water works, and all city conveniences. Except in South Chicago, Hyde Park is chiefly inhabited by persons who do business in Chicago. Pop. in 1870, 3644; estimated pop. in 1873, 35,000.

I. L. VANSANT, ED. "SOUTH SIDE NEWS."

Hyde Park, post-v. and tp. of Norfolk co., Mass., 7 miles from Boston, on the river Neponset, and on the Boston and Providence and the New York and New England

R. Rs.; has a savings bank, public library, newspaper, 5 churches, excellent graded schools, and a good fire department. It is chiefly a place of residence for persons whose places of business are in Boston. Pop. 4136.

R. C. GETCHELL, ED. "GAZETTE."

Hyde Park, post-tp. of Wabasha co., Minn. Pop. 380.

Hyde Park, tp. and post-v. of Dutchess co., N. Y., on the Hudson River and the Hudson River R. R., 5 miles N. of Poughkeepsie. The township has many splendid country-houses. The village has 4 churches, and is beautifully situated. Pop. 600; of tp. 2695.

Hyde Park, a portion of Scranton, Pa. (in Luzerne co.), separated from the main part of the city by the river Lackawanna. It has 8 churches (3 with Welsh services), 3 halls—Odd Fellows', Masons', and Red Men's—a savings bank, 3 hotels, etc. Coal-mining is the principal industry. Hyde Park embraces the 4th and 5th wards of the city, and is built upon a hill. It has a weekly and a monthly periodical, both in the Welsh language.

W. ROBERTS, ED. OF "Y CYFAILL."

Hyde Park, post-v., cap. of Lamoille co., Vt., on the Portland and Ogdensburg R. R., has a national bank, a newspaper, an academy, a quarry of limestone, beds of mineral paint, a copper-mine, 8 large saw-mills, besides several smaller ones, manufactures of pails, tubs, pegs, starch, and a very great water-power. There are 3 churches and 3 hotels. The manufacturing, agricultural, and commercial interests of the place are important. The township has 14 small natural lakes and numerous streams, and is a good place for fishing and as a summer resort. Pop. of tp. 1624. C. C. MORSE, ED. "NEWSDEALER."

Hyderabad' (or **Haiderabad,** as it is written in official English papers), the capital of the nizam of the Deccan, the most powerful of the Indian princes under English protection. The number of inhabitants is variously given; the best source, however (Thornton, *Gazetteer of the Territories under the Government of the East India Company*, London, 1857), says 200,000. The city is situated in the centre of the plateau of the Deccan, about 520 mètres above the sea, on the Mussi River, which here is nearly 160 mètres broad, and presents a magnificent prospect with its numerous mosques and surrounded by granite cliffs of a strikingly picturesque form. The larger part of the city, more especially the old city, stands on the southern bank of the Mussi; on the northern is that quarter which by Englishmen is called the Princess Bazaar, and which contains the magnificent building of the English residency. This building communicates directly with the palace of the nizam, standing on the opposite bank of the river, by a beautiful stone bridge constructed by Col. Oliphant. The building of the English residency, which was commenced in 1803, after a plan by T. Russell, and executed in grand style and with great splendor, is the most beautiful and most important structure of the city. The palace of the nizam is badly situated, and has nothing striking about it. Among the private houses the palace of the influential minister, Salar Jung, is the most remarkable; the palace of Shumsul Umra, who is at the head of the administration together with Salar Jung, is also noteworthy. The city is principally Mohammedan, and the most prominent of its mosques are the cathedral mosque, with immensely high minarets, and the mosque of the Prophet, a structure of enormous dimensions. A very striking building is the Chahar Minar, formerly a university. Where the four principal streets cross each other it rises on four immense arches, so that the streets run below it. The city is very extensive, but contains many small and poor houses in narrow streets; it is surrounded by a wall, which, however, is too weak and insignificant to make a real fortification. The surrounding country is rich in magnificent gardens with numerous ponds, pavilions, and villas. Hyderabad was formerly the principal market for the diamonds cut in the neighboring Golconda; its manufactures of cotton and paper are still considerable; *kimkhwab*, a silk embroidered with gold, and turbans are made. A railway is projected, which will connect Hyderabad with Gulbarga on the one side and Chanda on the other.

The city was founded in the sixteenth century by Mohammed Kuli, who waged many wars with the neighboring rajahs and formed an alliance with Persia. Among his successors, Abdullah and Abu Husain are noteworthy; the latter was defeated in 1687 by Aurungzebe. The present territory of the nizam is the same as that of the subah of the Deccan in the time of the Mogul. Area, 95,337 square miles. Pop. 10,500,000. A grandson of one of the ablest generals of Aurungzebe, Asuf Jah, made himself independent lord of the country as subadar of the Deccan in 1724, and took Hyderabad for his capital. He founded the Asuf dynasty. His successors concluded an alliance with Dupleix, the French governor of Pondicherry, and kept a French army corps, commanded by Bussy. But on the outbreak of the war of 1756 the policy of the country changed. On Mar. 14, 1759, the first treaty was concluded with the English; the nizam, Salabut Jung, ceded the district of Masulipatam and dismissed the French. The second treaty was concluded Nov. 12, 1766; the nizam ceded the districts of Ellore, Guntur, and Rajamandri, and bound himself to furnish troops on the receipt of an annual subsidy of £90,000. Several wars, in which the nizam furnished auxiliary troops to the English against Tippoo and against the Pindarees, and several new treaties (Sept. 1, 1798, July 13, 1799, Oct. 12, 1800, and Dec. 12, 1822), brought the nizam more and more under English authority, and great misery came over the country. Great reforms were commenced, however, in 1853, when Salar Jung became minister. According to a treaty which the resident, Col. Low, mediated, the nizam was to cede more land in order to get rid of all his financial obligations to the English, and only furnish 5000 men, infantry, 2000 horses, and 4 batteries. But Nasru-d-Daulah would not consent to the cession, and the treaty was not ratified until under his successor, Afzula-d-Daulah, when Salar Jung had become minister. On Dec. 31, 1860, it was determined that the nizam, as a reward for his services during the war of 1857–58, should receive the conquered territory of Shorapur, that of the formerly ceded districts, those of Raichur Doab and Dharasco should be restored to him, and his debt, £500,000, cancelled. The English retained only so much of the territory of the nizam as would yield an annual revenue of £320,000, to pay for the contingent of auxiliaries which the nizam was to furnish. This district is called Haiderabad assigned districts, or Berar, and forms a province with an area of 16,960 square miles and a population of 2,231,565. Afzulu-d-Daulah d. Feb. 26, 1869, and was succeeded by Mir Mahbub Ali Khan.

AUGUST NIEMANN.

Hyderabad, town of British India, the capital of the district of Sinde, in the presidency of Bombay, stands near the Indus, in lat. 25° 22′ N., lon. 68° 28′ E. It is famous for its manufactures of arms and cutlery. Pop. about 24,000.

Hy'der A'li, b. in 1728 at Bangalore, which his father held as a fief of the rajah of Mysore. In 1756 he inherited the fief at the death of his elder brother, and in 1759 he made himself actual ruler of Mysore, leaving to the rajah nothing but his title and a portion of the revenues. Hyder was one of the most prominent of the Mohammedan princes of India, both with respect to talent and to character. He was mild and just, and had great respect for all the inventions of a higher civilization. He encouraged agriculture, manufactures, and commerce. His army he organized on the Prussian plan, and had it commanded chiefly by European officers, but he was himself possessed of great military talent, and was eminently successful in his wars. He conquered Calicut, Bednor, Onor, and Cananor, and threw off the supremacy of the Mahrattas over Mysore. In his first war with the English he dictated peace under the walls of Madras, Apr. 15, 1769, and in the war between the English and French he sided with the latter, and fought with various success, but d. at Chitore in 1782, before the war was over; his son, Tippoo Saib, succeeded him.

Hydra (Polyp). See HYDROIDA.

Hy'dra, an island of Greece, off the E. coast of Morea, 11 miles long and 3 miles broad. Pop. in 1871, 11,684. It is high, rocky, and bare; and almost all its inhabitants live in the town of Hydra, situated on the northern coast of the island, with a good harbor. The island was uninhabited in ancient times. In the fifteenth and sixteenth centuries fugitives from Albania, Argolis, and Attica, who fled from Turkish oppression, founded the city, and it soon rose to a high degree of prosperity. Hydra is still one of the finest cities of Greece. In 1825 the population of the island was estimated at 40,000.

Hydrac'id [*hydrogen* and *acid*], a name formerly applied by chemists to those acids of which the base was supposed to be hydrogen. The generally received theories of the constitution of acids are quite at variance with those once prevalent; all acids, according to Dulong's hypothesis, being regarded as compounds of hydrogen with some radical. The term is at present used (when used at all) to designate acids formed upon the hydrochloric acid type. (See ACIDS, by C. F. CHANDLER, PH. D., M. D., LL.D.)

Hydran'gea [Gr. ὕδωρ, "water," and ἄγγος, a "vessel," perhaps from the fondness of the plants for water], a genus of shrubs of the order Saxifragaceæ. The U. S. have three (Southern) species, all elegant shrubs in cultivation—*H. radiata*, *arborescens*, and *quercifolia*. The common hydrangea of the green-house is *H. hortensis* of China. It is remarkable for the mutable color of its flowers. It requires peaty earth and plenty of water, and is very hardy. *H.*

Thunbergii furnishes leaves which are highly prized in Japan as a substitute for tea. There are other species.

Hydras'tis Canaden'sis, the only known species of its genus, a ranunculaceous plant of the U. S., common in many parts, and known as puccoon, yellow root, etc., is used to a considerable extent in medicine, and has the power of dyeing a rich and permanent yellow. Its valuable tonic powers depend in part on the presence of berberin and hydrastin.

Hydrate of Chloral. See CHLORAL.

Hy'drate of Cro'ton-Chlo'ral. By passing dry chlorine gas over pure aldehyde, there are formed hydrochloric acid and the chlorated aldehyde of crotonic acid, or *croton-chloral* ($C_4H_3Cl_3O$), a body holding the same place in the allyl group that chloral does in the ethyl. Obtained pure, it is a dense oily liquid of peculiar odor. Mixed with excess of warm water, it forms croton-chloral hydrate ($C_4H_3Cl_3O + H_2O$), a crystalline substance almost insoluble in cold, but soluble in hot water and in alcohol. By contact with an alkali, croton-chloral first forms a trichlorated compound, allyl-chloroform, which speedily decomposes into the bichlorated body bichlorallylene. Croton-chloral hydrate has been lately tried in medicine as a substitute for chloral-hydrate in certain cases. Its asserted advantages are a greater freedom from danger of paralyzing the heart, and a special power of producing anæsthesia—and thus relieving pain—in the parts of the head and face innervated by the fifth pair of cranial nerves. EDWARD CURTIS.

Hy'drates [Gr. ὕδωρ, "water"]. This term is applied to compounds formerly supposed to contain water. According to the recent theories of chemistry, most hydrates are supposed to be compounds of hydroxyl (OH), and to be produced by the replacement of half the hydrogen in water (H_2O). The following examples illustrate the two views:

Sodic hydrate	$Na_2O.H_2O$.	$Na(OH)$.
Calcic "	$CaO.H_2O$.	$Ca(OH)_2$.
Bismuthic "	$Bi_2O_3.3H_2O$.	$Bi(OH)_3$.
Aluminic "	$Al_2O_3.3H_2O$.	$Al_2(OH)_6$.
Ethylic alcohol	$(C_2H_5)_2O.H_2O$.	$C_2H_5(OH)$.
Ethene "	$C_2H_4O.H_2O$.	$C_2H_4(OH)_2$.
Propenyl "	$(C_3H_5)_2O_3.3H_2O$.	$C_3H_5(OH)_3$.
Mannite "	$C_6H_8O_3.3H_2O$.	$C_6H_8(OH)_6$.
Nitric acid	$H_2O.N_2O_5$.	$(HO)NO_2$.
Sulphuric acid	$H_2O.SO_3$.	$(HO)_2SO_2$.
Phosphoric acid	$3H_2O.P_2O$.	$(HO)_3PO$.

The formation of hydrates from water by the replacement of hydrogen is shown in the following formulas:

$H_2O + Na = Na(OH) + H$.

H_2O is $H - O - H$	Sodic hydrate is $Na - O - H$.
	Nitric acid is $H - O - NO_2$.
$2H_2O$ is $H_2 = O_2 = H_2$.	Calcic hydrate is $Ca = O_2 = H_2$.
	Sulphuric acid is $H_2 = O_2 = SO_2$.
$3H_2O$ is $H_3 \equiv O_3 \equiv H_3$.	Bismuthic hydrate is $Bi \equiv O_3 \equiv H_3$.
	Phosphoric acid is $H_3 \equiv O_3 \equiv PO$.
$4H_2O$ is $H_4 ≣ O_4 ≣ H_4$.	Stannic hydrate $Sn ≣ O_4 ≣ H_4$.
$6H_2O$ is $H_6 ≣ O_6 ≣ H_6$.	Ferric " $Fe_2 ≣ O_6 ≣ H_6$.

(See article CHEMISTRY.)

Hydrates may be formed by—(1) The displacement of hydrogen in water, as in the case of the alkaline metals, as already shown for sodium. (2) By the direct union of the anhydrous base or acid (anhydride) with water, the combination being often attended with the evolution of heat:

$$H_2O + Na_2O = 2NaOH.$$
$$H_2O + CaO = Ca(OH)_2.$$
$$2H_2O + SO_2''O_2SO_2'' = 2(HO)_2SO_2.$$
$$3H_2O + PO'''O_3PO''' = 2(HO)_3PO.$$

(3) By double decomposition, as when soluble metallic salts are precipitated by alkaline or alkaline earthy hydrates:

$$MgSO_4 + Ca(OH)_2 = Mg(OH)_2 + CaSO_4.$$
$$Fe_2Cl_6 + 6KOH = Fe_2(OH)_6 + 6KCl.$$

Hydrates retain their water with various degrees of force. Some, as cupric hydrate, give up water at a moderate heat; others, as calcic, ferric, and stannic hydrates, lose it at a red heat; others, as sodic and potassic hydrate, are not decomposed by any degree of heat. Tribasic phosphoric acid loses, when exposed to a red heat, first one-third, then another third, of its water, but the last third cannot be removed. (See PHOSPHORUS.)

The volatile acids exhibit peculiar relations to water. They form a series of hydrates with one, two, three, four, or more molecules of water, each hydrate being permanent under certain fixed conditions of temperature and pressure. A weaker acid under these conditions gives off water, a stronger gives off acid, till the most permanent compound alone remains. Thus, we have $H_2O.SO_3(H_2SO_4$ or $(HO)_2SO_2)$, $2H_2O.SO_3$ and $3H_2O.SO_3$. The hydrates of the alkaline metals, of barium, strontium, and thallium, are very soluble in water, forming strongly alkaline solutions. Hydrate of calcium, mercury, lead, and silver are slightly soluble. The other metallic hydrates are insoluble, or nearly so. The hydrates of the acid radicals (the acids) and the alcoholic hydrates (the alcohols) are nearly all soluble, the exceptions being certain organic bodies of high molecular weights, such as palmitic, stearic, oleic acid, etc. Many compounds contain water evidently as such. Thus, crystallized baric hydrate is $Ba(OH)_2.4H_2O$; alum is $K_2SO_4.Al_2(SO_4)_3.24H_2O$; gypsum is $CaSO_4.2H_2O$; cupric sulphate is $CuSO_4.5H_2O$. Most of such water is expelled by a temperature of 100° C., but some salts retain a portion of this water with greater tenacity than the rest. Sulphate of zinc, $ZnSO_4.7H_2O$, becomes $ZnSO_4.H_2O$ at 100° C., and retains the last H_2O till heated to 238° C. This last molecule of water may be replaced by another salt, thus:

Crystallized sulphate of zinc...... $ZnSO_4.H_2O + 6H_2O$.
Sulphate of zinc and potassium... $ZnSO_4.K_2SO_4 + 6H_2O$.

The water easily expelled is called *water of crystallization;* the water in $ZnSO_4.H_2O$ is called by Graham *constitutional water*, and such compounds are called by Liebig *halhydrates.* C. F. CHANDLER.

Hy'dra, The Lernæan, in Grecian mythology, was a monster with the body of a serpent, but with many heads, seven, nine, fifty, or even one hundred, which grew up again as often as they were cut off, and from whose mouths issued a deadly venom. It inhabited the marshes of Lernæa, in Argolis, but was destroyed by Hercules.

Hydrau'lic Crane, a device by which the enormous power of the hydrostatic press is utilized in the working of derricks, cranes, etc. It is chiefly employed in Great Britain, where the "hydraulic" or hydrostatic press is a favorite means of exerting great force. In unloading and loading ships, and in filling railway cars with heavy goods, it is sometimes convenient to have a considerable number of cranes, which if managed by the direct application of steam-power would require complicated and cumbrous machinery; but a steam-engine working a hydrostatic press, with an accumulator attached, is made to work the cranes by very simple means, the necessary rapidity of motion being gained by long leverage and the use of pulleys.

Hydraulic Elevator, or **Ascenseur Édoux.** This is an invention of M. Léon Édoux of Paris, France, designed to lift weights by hydraulic pressure from level to level, though in its actual application employed only to elevate persons from story to story in public hotels or other lofty buildings. Its construction may be understood from the following description of an elevator of this kind which was in operation during the Exposition of 1867 in Paris, in the gallery of machines of the Exposition: The essential parts of this apparatus consisted of a cylinder 20 mètres (66 feet) long, sunken perpendicularly into the earth, with a plunger descending into it to the same depth, and packed water-tight at the top of the cylinder. Into this, below the packing, water, from the source from which the Exposition received its supply for general purposes, was admitted, by means of a valve which was under the control of the attendant. The piston rose under the pressure to the required height, and was maintained there by closing the valve. A car or kiosk, for the accommodation of passengers, rested on the upper extremity of the piston, and was elevated as it rose. The descent was effected by opening another valve which allowed the water to escape at the level of the earth's surface; when, the pressure being relieved, the car descended by its own weight. The diameter of the piston plunger was 0.25 mètre (10 inches), and that of the cylinder only sufficiently greater to allow free water-way. The plunger was a hollow casting, turned and polished on the exterior, and closed at the bottom. It was formed of four lengths carefully united. A strong wire cable extending through the interior from end to end firmly bound the parts together, and served as a security for holding them in position in case of the occurrence of any accident. In its ascent, the car was guided by four cast-iron columns, which formed a rectangular framework or tower around it. These columns were hollow also, affording space for the ascent and descent of heavy weights within them, by which the weight of the empty car was principally counterpoised. Chains passing over pulleys at the top connected these weights with the car at its four angles. Only sufficient preponderance was given to the car to allow it to descend without a load. The resistance to which the hydraulic pressure was opposed amounted, therefore, to little more than the weight of the varying charge. It is to be noticed, however, that as the car ascends the weight opposed to the pressure virtually increases, since the plunger, so long as it is immersed, is buoyed by the weight of an equal bulk of water. A compensation for this increase of resistance is provided by Mr. Édoux, in giving to the chains a weight per running foot equal to the eighth part

of the thus accruing increase of weight of the piston—that is to say, about 2 kilograms, or a little more than 4 pounds. There being four chains, and each chain being diminished one foot in length on the side of the car, and increased in length on the side of the counterpoise, one foot for each foot of elevation, the counterpoise is thus increased at the same time 15 kilograms, or about 34 pounds, which is equal to the simultaneous increase in the virtual weight of the piston.

The charge which an apparatus of this kind will elevate, the cross-section of the piston remaining the same, will depend on the height of the hydraulic head. If we assume the system of counterpoises to be such as to maintain the whole moving apparatus (supposed to be without a load) in equilibrio when the pressure of the head is shut off and the escape-valve is open, or with only a slight predominance of weight in favor of descent, and to do this in every part of the course, the elevating force will be found by making the proper substitutions in the expression $F=\frac{1}{4}\pi d^2wh$, in which F represents the force, d the diameter of the piston, w the weight of a cubic unit (mètre or foot as the case may be) of water, and h the height of the head. It was stated that the reservoir from which the supply of water was received was situated at an elevation of 30 mètres above the point of application. Putting, therefore, $h=30$, $d=0.25$, and $w=1000$ kilograms, we shall obtain the result $F=3.14159\times 0.0625\times 30\times 1000\div 4=1473$ kilograms nearly. Putting the average weight of an adult at 60 kilograms, say 130 pounds, the *ascenseur* was capable of carrying up twenty-four or twenty-five persons at a time.

It will be seen that the ingenious system of counterpoises introduced by Mr. Édoux makes the height to which the charge is elevated quite independent of the height of the hydraulic head. Other considerations, however, practically limit the extent to which the system can be applied. In proportion as the length of the piston is increased it becomes necessary to increase its diameter and the thickness of its walls, in order that it may preserve a sufficient rigidity under the increasing strain and pressure to which it will be liable. Its weight will be correspondingly increased, entailing the necessity of equally increasing the weight of the chains and counterpoises. Thus the apparatus will become too ponderous to be advantageously employed. The weight of the pistons of the *ascenseurs* in the Exposition was 2100 kilograms, or more than 2 tons each. This weight exceeded, therefore, alone, not considering the cars, the whole force of elevation, by more than 600 kilograms; so that without the system of counterpoises the apparatus would not have worked at all.

On the other hand, for the ordinary purposes of a hotel elevator, it is not necessary to have a source of water by any means so high above the point of application as that which operated the *ascenseurs* of the Exposition. It is sufficient, we will suppose, that such an elevator may be capable of carrying up eight persons at a time, having a total weight of 1000 to 1100 pounds. Assuming an outside weight of 1200, and, transforming the expression above for the value of h, we have $h=\frac{4F}{\pi d^2w}=\frac{4800\times 144}{3.14159\times 100\times 62.5}=$ 35 feet nearly, putting the diameter of the piston at 10 inches, and taking 62.5 pounds as the weight of a cubic foot of water.

If the diameter of the piston be enlarged to 12 inches, the hydraulic head required will be but twenty-four feet. Such an elevator can therefore be introduced into any house in which the water rises to a height of 35 feet, or even 24 feet, above the lowest point at which it can be conducted off after being discharged. It is desirable, of course, to have a superfluity of force, but that can abundantly be obtained in any house in which water from the public works is delivered in the third story, and communication with the public drains can be established from the basement.

Hydraulic elevators in dwellings have the advantage over mechanical contrivances for the same purpose worked by steam-engines, turbines, or other motors, because of their simplicity of construction, their extreme facility of management, their perfectly smooth and silent motion, and, in general, their large superiority in point of economy in operation. The economy, however, may not be realized in large cities, where water rates are high; but the advantages are in other respects so much in favor of these elevators, especially when the security attending their use is also taken into consideration, as to justify their introduction even in cases where it might be necessary to create the hydraulic head by means of steam-pumps. If steam-power has to be used at all, it may as well be employed in elevating water as in directly operating an elevator. And if this plan is once adopted the establishment becomes independent of public waterworks, and even of natural sources altogether, after having provided a moderate original supply, since the same water may be constantly used over and over again. It will be necessary for this purpose to have a tank at the lowest level and another at the highest. And if we assume (as has been shown above to be just) a height of 35 feet to be sufficient in ordinary cases, it is not difficult to compute the work which an engine would have to perform in lifting the water required for the daily service from the lower tank to the upper.

Supposing the course of the piston to be 60 feet, and its diameter, as above, 10 inches, it will require an expenditure of about 33 cubic feet of water for each ascension. Supposing an ascension to take place every six minutes, or ten every hour, which is about the fact at the Charing Cross Hotel in London, and that the elevator is in operation eighteen hours a day—*i. e.* from six in the morning until twelve at night—the total daily expenditure of water will be 5940 cubic feet—say 6000—to raise which 35 feet gives a total work of 13,125,000 foot-pounds. This work a one-horse power engine would do in a little more than six hours and a half.

It would not be desirable, however, to raise the whole quantity at once, nor even desirable to have so large a quantity at a time in the tanks, since the weight of 6000 cubic feet of water would be somewhere near 190 tons. A tank capable of containing 200 cubic feet would suffice for six ascents; and if an engine should be employed constantly in raising the water as it is drawn down, one-third of a single horse-power would exceed the demand. Such an engine could probably be run at a much less cost than is paid in London for the supply of the elevator of the Charing Cross Hotel, which was stated to exceed £1 a day.

F. A. P. BARNARD.

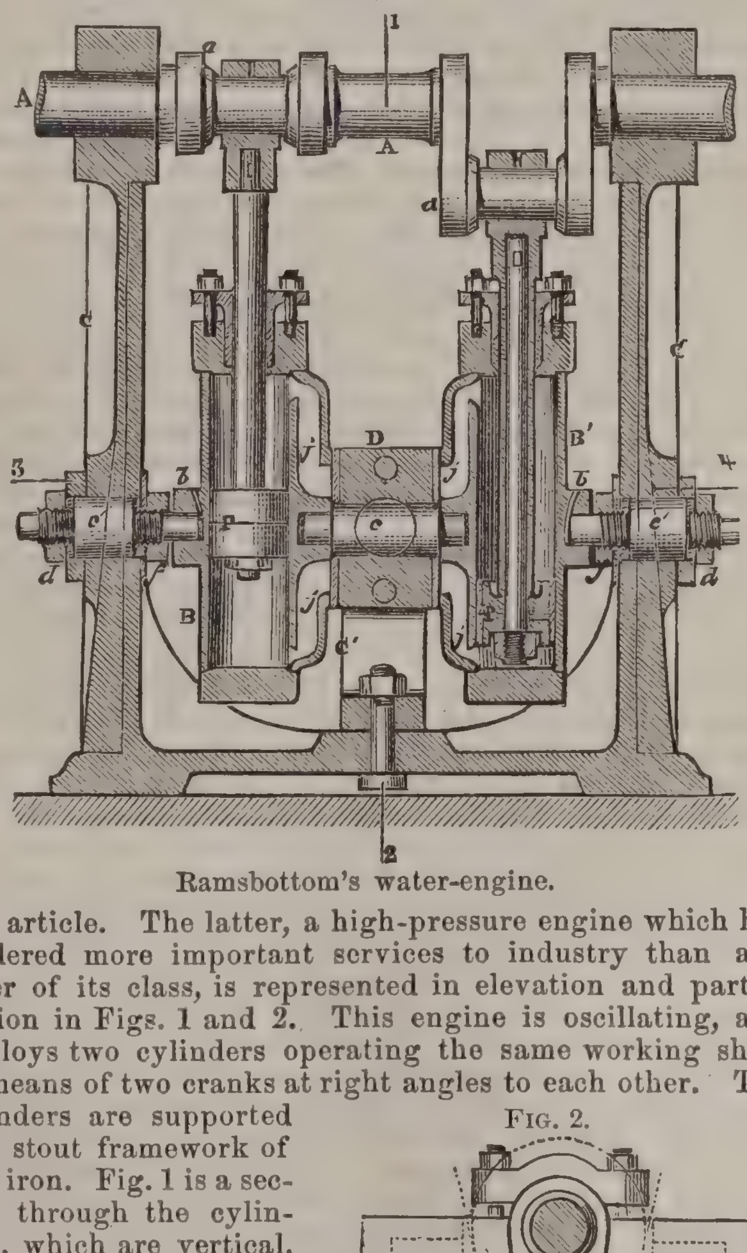
Hydraulic Engines. The usual, and generally the most eligible, mode of employing water-power is to apply it to the circumference of a wheel. (See WATER-WHEEL and TURBINE.) Occasionally, however, it may be more advantageous to use it as steam is used, to act on a piston in a cylinder. This mode of application is especially adapted to the case of a small supply of water having a large fall. Hydraulic engines, like steam-engines, may be either reciprocating or rotary. Some modifications are necessary in the construction of the parts, to accommodate them to the different physical properties of the denser fluid. The induction and eduction pipes, for instance, must be larger than are required for steam, and should have no abrupt angles. Freer valve-ways also are necessary; the eduction valve should open very promptly at the end of the stroke, and the induction valve should not close until the stroke is quite completed—that is to say, the influx should cease and the efflux should begin exactly at the same moment. Any material error in making the adjustments designed to accomplish this end, or any imperfect working of the machinery which prevents its attainment, will produce concussions (*coups de bélier*, "water-ram blows," as they are called by the French), which will very certainly be injurious, and which may be destructive. In the hydraulic engines which have been most extensively introduced, and most successful in practice, provision is made by relief valves or other expedients to mitigate or obviate the evil resulting from this cause; but in so far as it is possible by the adjustments of the machine itself to permit the column by which it is operated to maintain a uniform velocity, both true economy of power and durability of parts will be best consulted. In the case of steam, attention to the particulars here pointed out is not so rigidly necessary; the difference arising from the fact that steam is eminently compressible, while water is so only to a degree which for ordinary purposes may be regarded as insensible.

It is only in some special industries that hydraulic engines have as yet been extensively introduced. In large foundries they have been found very convenient in the working of cranes and other heavy machinery. They have also been employed occasionally for the drainage of mines. A remarkably ingenious illustration of their possible usefulness for this latter purpose may be seen at present in operation at Huelgoat, in Brittany. The great water-engine of Huelgoat, the invention of Mr. Juncker, engineer of the mines it is employed to drain, has been often described. A very full description is given by Mr. Delaunay in his *Mechanics*. This engine is single-acting, and it acts directly to lift the piston of the pump by which the water is drawn from the mines. It makes five and a half strokes per minute, the stroke being $2\frac{1}{2}$ mètres, or more than 8 feet in length. The piston rod is 230 mètres (767 feet) long, and it weighs 16,000 kilograms—say 16 tons. The power of the engine is derived from a source at a height 110 mètres (370 feet) above its own level. In this case, though the direct application of the power reduces the en-

gine to its simplest form, yet the great inertia of the moving columns of water requires that their movements should be very carefully regulated. In a reciprocating engine there are moments of rest, and successive periods in which the piston moves in opposite directions. When the driving force is communicated to a machine through a crank, it is a favorable circumstance that crank-motion necessarily retards the movement of the piston toward the end of the stroke, and brings it insensibly to zero, while at the beginning of the stroke it in like manner favors gradual acceleration. But in the engine at Huelgoat, without some mechanical contrivance to reduce very gradually the volume of inflowing water toward the end of the stroke, the piston would reach the limit of its course with its maximum velocity, and the sudden arrest of its motion would produce a concussion which no strength of materials could resist. The ingenuity and the simplicity of the contrivances by which this powerful machine is made to regulate automatically its own motions, so as to prevent the occurrence of the slightest perceptible shock, has excited the highest admiration of every engineer who has examined it.

Hydraulic engines upon a smaller scale, and designed for use in the operations of ordinary industry, have been constructed in a variety of forms. Several of these—as, for instance, the hydraulic motors of Perret and Coque of France, and of Carret, Marshall & Co. and Ramsbottom of Great Britain—are described in full in the *Report on the Industrial Arts* at the Paris Exposition, by the writer of

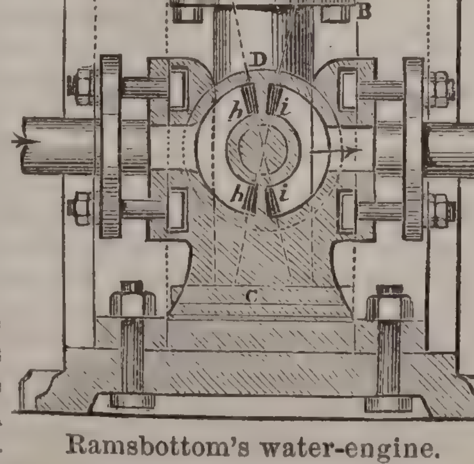
Fig. 1.



Ramsbottom's water-engine.

this article. The latter, a high-pressure engine which has rendered more important services to industry than any other of its class, is represented in elevation and partial section in Figs. 1 and 2. This engine is oscillating, and employs two cylinders operating the same working shaft by means of two cranks at right angles to each other. The cylinders are supported in a stout framework of cast iron. Fig. 1 is a section through the cylinders, which are vertical, and shows the mode of suspension of the cylinders, and the channels of induction and eduction, which are marked *j*, and which are cast with the cylinder. The dotted circles *c* and *c′* show the position of the supply and discharge pipes. Fig. 3 shows a cross-section of the cylinders and their pivots, and in this will be seen the places of attachment of the pipes just mentioned at K and K′. The pivots are of steel. Those intermediate between the cylinders are firmly fixed in the support. The external pivots admit of adjustment by means of the screws and screw-nuts *d* and *f*, Fig.

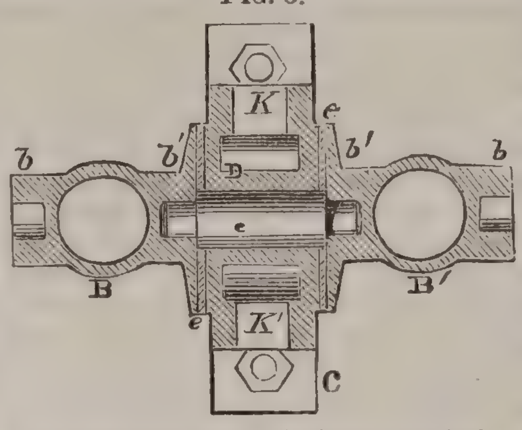
Fig. 2.



Ramsbottom's water-engine.

2, which is a section through the line 1 and 2. Fig. 1 shows the system of water-distribution. The apertures of induction and eduction are represented at *h* and *i*, and have the form of truncated circular sectors, whose centre is the centre of motion. The spaces marked *h* are divided from those marked *i* by a sectoral partition, which is of precisely the same area in cross-section as they. The apertures of admission and discharge on the side of the cylinders are also of the same form and dimensions. The surfaces of contact between the cylinders and the support D are perfectly plane and polished, and are made water-tight by means of the adjusting screws *d* and *f* of the pivots. When the piston is at the end of its course in either direction the cylinder will be truly vertical. In this position the piston is momentarily at rest, and both induction and eduction valves should be closed. Accordingly, the disposition of the parts is such that, when the cylinder is vertical, the openings by which the channels *j j* communicate with the supply and discharge pipes, present themselves exactly opposite to the solid sector dividing *h* from *i*. In the next moment the flow of water will recommence, the cylinder discharging itself from the full side of the piston, and filling anew on the opposite side.

Fig. 3.



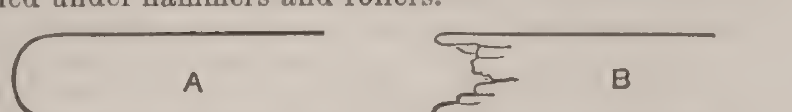
Cross-section of cylinders and their pivots.

From this statement it is apparent that the influx and efflux of the water proceed with more and more freedom from the beginning to the middle of the stroke, when the passages are at their maximum opening, and that from this point to the end the reverse takes place. But it is to be also observed that, from the nature of crank-motion, the velocity of the piston varies correspondingly, and that the relation of the supply of water to the demand is very nearly constant. Very nice adjustment is evidently necessary in these engines, in order that the moment of the absolute closing of the valves may correspond to that of the completion of the stroke; and as it is possible that this perfect coincidence may not be exactly secured or permanently maintained, some provision against counter-pressure and the effects of hydraulic shocks is necessary. Air-chambers and relief-valves are employed for this purpose. The relief-valves open a backward communication between the cylinder and the driving column, so that if there occurs an obstruction to the discharge, the pressure on the two sides of the piston will be equilibrated by the opening of the valve. The engines of this model heretofore in use are generally small, some of them having cylinders of not more than two inches in diameter. They have been used for a variety of industrial purposes, as for operating printing-presses, circular saws, lathes, etc., as well as for cranes and other machinery in foundries. Their simplicity and neatness render them preferable to almost any other form of small motor wherever the hydraulic head can be easily secured for working them. But in general it is not a natural hydraulic head that is depended on; and indeed no natural head could furnish, in machines of so small model as those employed in foundries, anything like the large power which they exert. The head is established in an *accumulator* of power, which is a body of water driven into a reservoir under heavy pressure by forcing-pumps worked by steam. For lighter industries such expedients are unnecessary. In cities in which the water-distribution is from elevated reservoirs, and in which the water-supply is sufficiently abundant to justify the application of a portion of it to industrial uses, the water-engine is recommended by the combined advantages of simplicity, neatness, compactness, constant readiness for work, perfect safety, economy while working, and the absolute cessation of expenditure during interruptions and after the work of the day is ended.

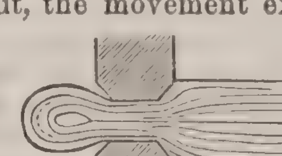
F. A. P. Barnard.

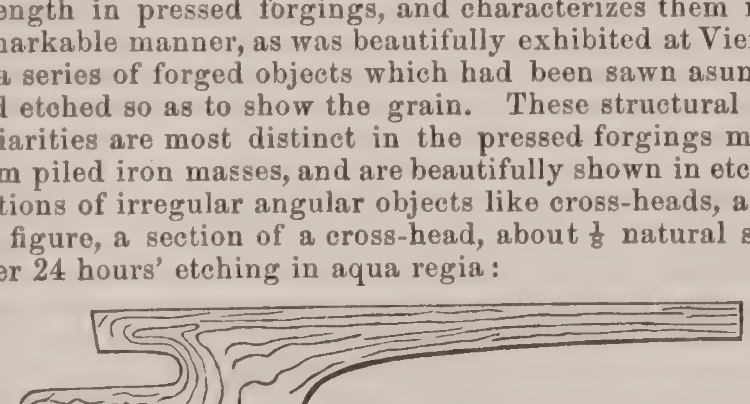
Hydraulic Forging. This process of forging consists essentially in substituting the powerful and continuous pressure of the hydraulic press for the repeated blows of a hammer in shaping wrought iron and steel. A swedge, or mould, of the desired object is necessary, and under the proper conditions of temperature the metal may be forced into every angle and recess as perfectly as if made fluid by fusion and cast; but objects so made are very much stronger than castings, and are claimed to be even superior to forgings made in the ordinary way. The process has been carried to great perfection, after years of patient experimenting, by Mr. Haswell at the machine-shops of the Imperial State Railway Co. of Austria, in Vienna. It is used

there chiefly for forming such parts of locomotives as cross-heads, link-bars, axle-box frames, and for car-wheels and various other intricately formed parts of railway rolling stock, where superior strength and lightness are important. It is also used instead of heavy steam-hammers for drawing down large ingots of Bessemer steel. The results appear to justify the conclusion that ingots so treated give stronger and more homogeneous bars than are obtained by hammering. At Vienna two large hydraulic presses are in use—one with a piston 24 inches in diameter, giving 1200 tons pressure, and one with an 18-inch piston, working up to 600 tons pressure. The pressure in the pumps is 600 atmospheres. The action is vertical; the piston descends upon the work, and for forging ingots has a hammer-like head opposed to an anvil of the usual form below. In drawing down an ingot, say of one ton weight, of soft Bessemer steel, the work commences at the end, and after each squeeze by the descending piston the mass is pushed along until the first half of the length of the ingot has been acted on, when it is turned end for end. It is then turned over and back and forth, as is usual under a hammer, until the whole has been drawn down to the required size. In this operation there is no noise or jar. The piston descends slowly, but irresistibly, and forces the hot metal each way as if it were a mass of soft putty. The work is effectively performed, and it requires less time than ordinary forging or rolling. The pressure affects the very centre of the mass of the ingot. Its action is by no means superficial, and it is far more effectual in modifying the structural condition of the bar than blows on the surface can be. There is no distribution of the force of the blow through the anvil to the foundation, as there is in the violent impact of a steam-hammer. The ingot yields gradually to the pressure, and bulges out at the sides and end as in Fig. A, and is not drawn over more at the surface than at the centre, so as to give a ragged hollow end (Fig. B), such as is usually formed under hammers and rollers.



Before the forging of an ingot is completed a distinct structural arrangement of the steel is developed, and is seen most distinctly when the hot steel sinks down under the pressure. As the piston-head descends into the mass, and squeezes it upon the anvil, the lines of structure visible in the sides of the ingot bend downward, and are compressed as shown in the annexed cut, the movement extending to the very centre of the mass. This structure or "fibre" is doubtless the result of a difference in chemical constitution in planes approximately parallel to the squeezing surfaces, and, so regarded, the process may be considered to be more favorable to the development of structure or "grain" than ordinary forging. But, from whatever cause it originates, this grain is an important factor of strength in pressed forgings, and characterizes them in a remarkable manner, as was beautifully exhibited at Vienna in a series of forged objects which had been sawn asunder and etched so as to show the grain. These structural peculiarities are most distinct in the pressed forgings made from piled iron masses, and are beautifully shown in etched sections of irregular angular objects like cross-heads, as in the figure, a section of a cross-head, about ½ natural size, after 24 hours' etching in aqua regia:





The lines of the grain, it will be seen, conform in a remarkable degree to the form of the mass, winding in and out around the curves and angles in such a manner as to give the greatest strength where it is most needed. These lines show in a very interesting way the flow or movement of the viscid metal when under pressure. Experience has taught that very sharp angles in some parts of moulds interfere with the proper flow of the metal. This difficulty is avoided by rounding off the angles, or by building them out so as to give more space for the metal to move in. The superfluous metal is cut away, leaving the internal curves of the grain in the best shape for the strength of the object.

In forging such objects as the parts of machines weighing from 50 to 150 pounds or more, a mass or ball of metal is cut as nearly as possible of the required weight from the end of an ingot, and is heated nearly white hot preparatory to being thrown into the mould. The moulds are made of iron or steel, in several parts if necessary, and these parts are securely held together by bands of wrought iron. They are left open at the top for the reception of the metal and for the descent of the plunger or follower, which is attached to the piston-head of the hydraulic press. The shape of this follower, called by the workmen the "stamp," determines the shape of the inside of the object to be formed. The mould is placed directly under the piston-head. All the parts being properly adjusted, and the inside of the mould and the surface of the plunger being smeared with thick oil or grease, a mass of hot steel is thrown into the open top of the mould; the plunger is brought slowly down, and pushes the hot metal before it into every part and recess of the mould. The excess of metal, if any, after the mould is filled, rises on each side of the plunger and protrudes. This leaves a wing or "burr" which is afterwards easily cut off with chisels; but a little practice enables the workmen to cut off masses so near the required weight that there is but little excess to be trimmed off. When the stamp has reached the required depth the pressure is removed; the key which attaches the stamp-head to the piston is knocked out; the piston is raised out of the way, and the mould and contents are removed from the bed of the press. A few blows of a sledge-hammer detach the fastenings of the mould and liberate the forging, which is thrown aside to cool. If the work has been well done, all the angles of the object are full and solid. All pieces pressed in the same mould are alike in dimensions, and there is no great excess of metal in any part to be cut away; and consequently it requires less labor and expense to fit up such forgings than it does for those of irregular dimensions made in the ordinary manner.

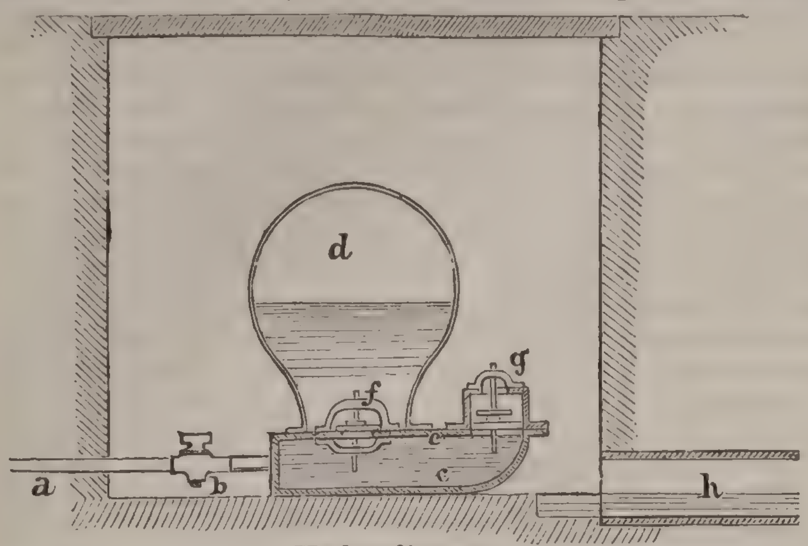
The rapidity with which intricate forgings are made is one of the greatest advantages of the method. It is especially adapted to heavy work, where there are many angles and interior surfaces to be shaped. Of such objects as cross-heads for locomotives from twenty-five to thirty or more can be made in a day with but little labor. The moulds are made of cast iron, and are used cold. The stamp-heads are also of cast iron, and duplicates are kept on hand to replace those which break. The wheels for locomotives and for railway carriages are forged out in this way in segments, which are afterwards united by welding under the press. The process is also applied to forming boiler-heads, steam-domes, etc., large plates of Bessemer steel being forced through a ring. The total production of pressed forgings at the railway-works, Vienna, during nine months previous to 1873, was 7830 pieces, weighing 1,071,200 pounds. W. P. Blake.

Hydraulic Press. See Hydrostatic Press, by J. P. Frizell, C. E.

Hydraulic Ram, a well-known machine invented by Montgolfier for elevating a part of the water furnished by a stream to a height greater than that of the source from which it is drawn. Its action depends upon the property of inertia which water, in common with all heavy bodies, possesses. A heavy body, moving with a given velocity, performs, while being brought to rest, an amount of mechanical work sufficient to raise the body to the height due to the velocity. A car, for instance, moving upon a track with a velocity of 48 feet per second, or nearly 33 miles per hour, and reaching a steep incline, would mount it to a height of 35.82 feet (friction and resistance of the air not considered), that being the height which a heavy body must fall to acquire a velocity of 48 feet per second. The mechanical work performed by a moving body in coming to rest is represented by the resistance opposed to its motion, multiplied by the distance which the body moves against this resistance; so that the resistance necessary to stop a moving body, or the pressure which it can exert while stopping, is great or small according as its motion is arrested suddenly or slowly.

In the hydraulic ram the moving body is the mass of water contained in a long pipe, the exit of which is alternately opened and closed. The resistance opposed to the water's motion when its exit is closed, is the elastic force of air confined in a closed vessel, and the work performed by it consists in compressing this air, which, by its tendency to expand, forces the water to a higher level. The accompanying figure is a section of a hydraulic ram, showing also the chamber or pit in which it is placed. *a* is the supply-pipe leading from the pond or other source of supply. The longer this pipe is, the better, provided there is fall enough to give the necessary velocity; *b* is a cock for closing the supply-pipe; *e* is a plate to which the air-vessel *d*

is bolted. Below this plate are two compartments—one, *c*, forming a channel through which the water passes freely when the valve *g* is open, and communicating with the air-



Hydraulic ram.

vessel by the valve *f*, which allows the water to enter the air-vessel, but not to return. The other compartment communicates freely with the air-vessel, and with a rising pipe, not shown in the figure, for conveying the water to the higher level. The valve *g* being in the position shown, the water commences to move through the supply-pipe, escaping at *g* and passing off through the waste-pipe *h*. The velocity soon becomes so great as to lift the valve *g*, which closes the outlet. While coming to rest the water in the pipe exerts a pressure sufficient to lift the valve *f*, and compress air in the air-vessel by flowing into it. As soon as the water comes to rest, the pressure ceases, the valve *f* closes, the valve *g* opens, and the same thing occurs again. The expansion of the air in the air-vessel causes a uniform flow through the rising pipe. J. P. FRIZELL.

Hydraulics of Rivers. See RIVERS, HYDRAULICS OF, by GEN. H. L. ABBOT, U. S. Army.

Hydrides [Gr. ὕδωρ, "water"], compounds of hydrogen with metals, alcohol-radicals, organic acid radicals.

Metallic Hydrides.—Hydride of copper, Cu_2H or CcuH, is produced by the action of hypophosphorous acid on cupric sulphate. With HCl it yields CcuCl + H. Hydride of iron is formed by the action of zinc-ethyl on ferrous iodide. It is a black metallic powder which evolves H in water. Arsenuretted hydrogen (H_3As) and antimonuretted hydrogen (H_3Sb) are formed when solutions of these metals are brought in contact with metallic zinc and dilute sulphuric or hydrochloric acid or potassic hydrate. They are gases. (See ANTIMONY and ARSENIOUS OXIDE.)

Hydrides of the Alcohol Radicals.—The paraffins, as marsh-gas, CH_4, etc., are often viewed as hydrides, CH_3H, etc. (See HYDROCARBONS and PARAFFINS.)

Hydrides of Acid Radicals.—The aldehydes referred to the type HH constitute this class of compounds. Acetic aldehyde $C_2H_4O = C_2H_3O.H$; benzoic aldehyde, bitter-almond oil, is the hydride of benzoyl, $C_7H_5O.H$. (See ALDEHYDES and ALMONDS, OIL OF.) C. F. CHANDLER.

Hydriodic Acid. See IODINE, by E. WALLER, E. M.

Hydrobromic Acid. See BROMINE, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Hydrocar'bons [Gr. ὕδωρ, "water," and Lat. *carbo*, "coal"], compounds consisting of carbon and hydrogen only. Many such compounds are found ready formed in nature; most of the essential oils, as turpentine, lemon, orange, bergamot, neroli, etc., are hydrocarbons. (See ESSENTIAL OILS.) Caoutchouc (see INDIA-RUBBER) and GUTTA-PERCHA (which see) are hydrocarbons. Methane (marsh-gas) is found in the mud of stagnant pools and in coal-beds, and under the name of *fire-damp* produces the disastrous explosions in mines. Petroleum and ozocerite are mixtures of several homologous hydrocarbons. (See PETROLEUM.) The most fruitful source of hydrocarbons is the destructive distillation of vegetable and animal substances. This always results in the formation of four distinct products: (1) the charcoal or coke which remains behind in the retort; (2) the fixed gases; (3) the tar; (4) the watery product, which is acid when distilled from non-nitrogenous bodies, such as wood, etc., owing to the presence of acetic acid, and alkaline when derived from nitrogenous bodies, owing to the presence of ammonia. The gas and tar consist largely of hydrocarbons, solid, liquid, and gaseous. (For a detailed statement of the products of the destructive distillation of coal, see article GAS-LIGHTING.)

The hydrocarbons are the simplest of all organic compounds, and are regarded as the starting-points from which all other organic bodies may be derived by substitution or addition. (For the methods by which organic compounds are formed from hydrocarbons, see articles ALCOHOL, ALIZARENE, ANILINE, and ANILINE COLORS.) The hydrocarbons may be formed (1) synthetically from carbon and hydrogen, as when hydrogen is passed over carbon heated to redness by the voltaic arc:

$$\underset{\text{Carbon.}}{C_2} + \underset{\text{Hydrogen.}}{H_2} = \underset{\text{Acetylene.}}{C_2H_2}.$$

From acetylene other more complicated hydrocarbons may be built up. (2) From compounds containing these elements:

$$\underset{\text{Carbon disulphide.}}{CS_2} + \underset{\text{Hydrogen sulphide.}}{2H_2S} + \underset{\text{Copper.}}{8Cu} = \underset{\text{Methane.}}{CH_4} + \underset{\text{Cuprous sulphide.}}{4Cu_2S}.$$

Methane (marsh-gas) may also be formed from carbon dioxide (CO_2) by first converting this into carbon monoxide (CO), converting this into formic acid ($HCHO_2$), and then subjecting a salt of this acid to destructive distillation. Alcohol heated with an excess of sulphuric acid yields ethylene (olefiant gas):

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\text{Sulphuric acid.}}{H_2SO_4} = \underset{\text{Ethylene.}}{C_2H_4} + H_2SO_4 + H_2O.$$

A hydrocarbon may be transformed into another of greater or less complexity; methane (CH_4) may be changed to acetylene (C_2H_2) by a series of induction sparks, or to naphthalene ($C_{10}H_8$) by a very high temperature. Methane and carbon monoxide yield tritylene when passed through a red-hot tube: $2CH_4 + CO = C_3H_6 + H_2O$. In the process of *cracking* (see PETROLEUM) the heavy hydrocarbons are split up into lighter oils by exposure to temperatures near their boiling-points. By substitution, the hydrocarbons yield haloid ethers: $CH_4 + Cl_2 = CH_3Cl + HCl$. These, in turn, may be changed to alcohols by the action of potassic hydrate: $CH_3Cl + KHO = CH_3OH + KCl$. Hydrocarbons may be oxidized either by the action of the air, long continued, or by the action of powerful oxidizing agents. (See article on the oxidation of petroleum, by W. P. Jenney, in the *Am. Chemist*, Apr., 1875, and also "Oxidation of Carbides of Hydrogen" (by chromic acid) in the *Chem. News*, xix. 273.)

Classification and Nomenclature of the Hydrocarbons.—The simplest of all hydrocarbons is methane or marsh-gas, CH_4. This is a saturated molecule, and is consequently incapable of combining directly with chlorine, bromine, etc., or of receiving any addition of hydrogen. It may, however, unite with any number of dyad elements or radicals, as such a radical introduced into a group of atoms neutralizes one unit of equivalence, and introduces another, leaving the combining power or equivalence of the group the same as before. The saturated molecule, CH_4, may therefore take up any number of molecules of the dyad group, CH_2, giving rise to a homologous series (see HOMOLOGY) of saturated hydrocarbons: $CH_4, C_2H_6, C_3H_8, C_4H_{10} \ldots . C_nH_{2n+2}$. These saturated hydrocarbons may be deprived of two atoms or one molecule of hydrogen (H_2), and thus produce a second series of homologous hydrocarbons: $CH_2, C_2H_4, C_3H_6, C_4H_8 \ldots . C_nH_{2n}$. By a similar removal of H_2 from these bodies a third series may be produced: $C_2H_2, C_3H_4, C_4H_6 \ldots . C_nH_{2n-2}$. Twelve such successive series are already known, containing even numbers of hydrogen atoms. The first six of these series, with the names proposed for them by Hofmann (*Proc. Roy. Soc.*, xv. 57), are given in the following table:

Methane.	Methene.					
CH_4	CH_2					
Ethane.	Ethene.	Ethine.				
C_2H_6	C_2H_4	C_2H_2				
Propane.	Propene.	Propine.	Propone.			
C_3H_8	C_3H_6	C_3H_4	C_3H_2			
Quartane.	Quartene.	Quartine.	Quartone.	Quartune.		
C_4H_{10}	C_4H_8	C_4H_6	C_4H_4	C_4H_2		
Quintane.	Quintene.	Quintine.	Quintone.	Quintune.		
C_5H_{12}	C_5H_{10}	C_5H_8	C_5H_6	C_5H_4	C_5H_2	
Sextane.	Sextene.	Sextine.	Sextone.	Sextune.		
C_6H_{14}	C_6H_{12}	C_6H_{10}	C_6H_8	C_6H_6	C_6H_4	C_6H_2.

First Series (C_nH_{2n+2})—*Paraffins.*—Methane (marsh-gas), CH_4, is the simplest; ethane (C_2H_6) and propane (C_3H_8) are also gases at ordinary temperatures. Butane (C_4H_8) is a liquid above 34° F. The following fifteen or twenty members of the series are liquids, and constitute the greater portion of petroleum; $C_{27}H_{56}$, and the higher members of the group, constitute the beautiful white solid known as PARAFFIN (which see).

Second Series (C_nH_{2n})—*Olefines.*—The simplest member of this series is ethylene (olefiant gas), C_2H_4, and the series includes gases, liquids, and solids. (See ETHYLENE and OLEFINES.)

Third Series (C_nH_{2n-2}).—Five members of this series are known: ethine or acetylene (C_2H_2), propine or allylene (C_3H_4), quartine or crotonylene (C_4H_6), quintine or valerylene (C_5H_8), and sextine or diallyl (C_6H_{10}). They are readily formed by heating the monobrominated deriva-

tives of the olefines with sodium ethylate: $C_3H_4B_2 + C_2H_5NaO = NaBr + C_2H_5OH + C_3H_4$.

Fourth Series (CH_nH_{2n-4})—*Quintone or valylene* (C_5H_6).—The TERPINES (which see) were supposed to belong to this series, but oil of turpentine is now believed to be a hydride of cymol.

Fifth Series (C_nH_{2n-6}) — *Aromatic Hydrocarbons.* — Benzol (C_6H_6) is the simplest member of the series. Other known members are toluol (C_7H_8), xylol (C_8H_{10}), cumol (C_9H_{12}), cymol ($C_{10}H_{14}$), and laurol ($C_{11}H_{16}$). This and most of the following series of compounds are remarkable for the readiness with which the members exchange H for NO_2 and form nitro-derivatives:

$$\underset{\text{Benzol.}}{C_6H_6} + HNO_3 = \underset{\text{Nitro-benzol.}}{C_6H_5NO_2} + H_2O.$$

From these nitro-derivatives the amines are readily formed by the action of nascent hydrogen (see AMINES and ANILINE):

$$\underset{\text{Nitro-benzol.}}{C_6H_5NO_2} + H_6 = \underset{\text{Aniline.}}{C_6H_7N} + 2H_2O.$$

Sixth Series (C_nH_{2n-8}).—Phenylene (C_6H_4), styrol, or cinnamene (C_8H_8).

Seventh Series (C_nH_{2n-10}).—Cholesterene ($C_{26}H_{42}$).

Eighth Series (C_nH_{2n-12}). — NAPHTHALENE ($C_{10}H_8$), (which see).

Ninth Series (C_nH_{2n-14}).—Diphenyl ($C_{12}H_{10}$) and dibenzyl ($C_{14}H_{14}$).

Tenth Series (C_nH_{2n-16}).—Stilbene ($C_{14}H_{12}$).

Eleventh Series (C_nH_{2n-18}).—ANTHRACENE ($C_{14}H_{10}$), (which see).

Twelfth Series (C_nH_{2n-20}).—No members known.

Thirteenth Series (C_nH_{2n-22}). — PYRENE ($C_{16}H_{10}$), (which see).

Fourteenth Series (C_nH_{2n-24}).—Chrysene ($C_{18}H_{12}$).

Hydrocarbons containing Uneven Numbers of Hydrogen Atoms.—The saturated hydrocarbons of the first series may give up one, two, three, or more atoms of H in exchange for Cl, Br, or I, producing haloid salts, from which the alcohols are readily derived, as already shown in this article. The hydrocarbons existing in these haloid salts and alcohols are compound radicals, as methyl $(CH_3)^{i}$, ethyl $(C_2H_5)^{i}$, ethene $(C_2H_4)^{ii}$, propene $(C_3H_6)^{ii}$, ethenyl $(C_2H_3)^{iii}$, propenyl $(C_3H_5)^{iii}$, ethine $(C_2H_2)^{iv}$, propine $(C_3H_4)^{iv}$, ethinyl $(C_2H)^{v}$, propinyl $(C_3H_3)^{v}$, propone $(C_3H_2)^{vi}$, proponyl $(C_3H)^{vii}$, etc. The radicals with even numbers of H atoms are included in the series already mentioned: those with uneven numbers of H atoms may be included in a separate group of series.

First Series.—(C_nH_{2n+1}).—Methyl (CH_3), ethyl (C_2H_5), etc. These are the radicals of the common alcohols, methyl hydrate, wood-naphtha (CH_3OH), ethyl or common alcohol (C_2H_5OH), etc.

Second Series (C_nH_{2n-1}). Methenyl (CH), the radical in chloroform ($CHCl_3$) and iodoform (CHI_3); propenyl (C_3H_5), the radical in propenyl alcohol, glycerine ($C_3H_5(OH)_3$).

Third Series (C_nH_{2n-3}).—Propinyl (C_3H_3).

Fourth Series (C_nH_{2n-5}).—Proponyl (C_3H).

C. F. CHANDLER.

Hy′drocele [Lat. *hydrocele;* Gr. *ὑδροκήλη*, from *ὕδωρ*, "water," and *κήλη*, "tumor"], an accumulation of water between the two serous coverings of the testicles or of the spermatic cord, known as the tunica vaginalis. It may follow an inflammation of the testes, but generally follows strains. It may affect both sides at the same time, but usually we find the effusion on one side only. It is a curious fact that musicians who play on wind instruments are more subject to this disease than any other class of individuals; it seems to be due to the constant strain produced by blowing. It forms a pear-shaped, painless tumor, which causes uneasiness to the patient only on account of its size; it sometimes grows so large as to reach nearly down to the knees. Unless the sac in which the fluid is enclosed be abnormally thick and distended to its utmost by the contained fluid, fluctuation can be felt. There is no impulse felt upon coughing. By stretching the integuments over the tumor, and placing a candle behind it in a dark room, the light will be transmitted; this would not occur if the swelling were solid. Another test to determine the consistence of it is to plunge a needle into the mass, and see whether it falls over to one side and floats about, or retains the position in which it was placed. The treatment of hydrocele may be divided into the palliative and the radical. The former consists in drawing off the effused fluid by the trocar and canula; this relieves the patient for a longer or shorter time, but the sac is apt to fill again, when the operation has to be repeated. We find patients submitting to this operation from once to four times annually throughout their lives, rather than submit to a procedure which is perfectly harmless and would ensure their complete recovery. The radical cure is effected by exciting an inflammation in the sac which shall cause the opposing surfaces to adhere, and thus obliterate the cavity and prevent further effusion. This is sometimes accomplished by irritating the surfaces with the end of the canula before it is withdrawn, but this method is uncertain. Generally, it is done by injecting some stimulating fluid; for this it was customary to use port wine or zinc lotion, but more recently tincture of iodine seems to be the favorite. A prominent New York surgeon has lately used the lunar caustic for the same purpose; this causes more general disturbance of the system, but it is never necessary to use it a second time. After the operation the patient should keep in bed for a few days and avoid all stimulating articles of diet. If there is much inflammation, cold applications locally and opium internally are the indications. EDWARD J. BERMINGHAM.

Hydroceph′alus [Gr. *ὑδροκέφαλον*, from *ὕδωρ*, "water," and *κεφαλή*, "head"], a dropsical effusion of fluids into the interior of the skull, occupying one or more of the ventricles of the brain or the sub-meningeal space, or both. Acute hydrocephalus is ordinarily a symptom of MENINGITIS (which see), particularly of tubercular meningitis; but cases occur in which no tubercle can be discovered after death. The causes of chronic hydrocephalus are various. Gross states that, in his opinion, a sub-acute or chronic arachnitis, usually congenital, is a frequent cause. It is regarded as certain that arrest of development of the brain-substance, pressure upon the veins of Galen by masses of tubercle or cancer, and in fact any condition which obstructs the venous circulation in the brain, may lead to hydrocephalic effusion, just as a contracted liver produces ascites. It is probable also that in arrest of brain-development the increase of the normal sub-arachnoid fluid is a conservative process, serving to keep full the space between the brain and the cranium. The large majority of cases are congenital, and hydrocephalus must be set down as a disease (or symptom) belonging to infantile life; but cases occasionally occur in mature life or in old age. Dean Swift, after three years of illness, died with hydrocephalus, the result, doubtless, of organic brain-disease. The prognosis of chronic hydrocephalus is very grave. The child may live for many years, but (with rare exceptions) becomes idiotic, and in some cases is epileptic. The head becomes distended, the fontanels remain open, *ossa triquetra* form in the courses of the cranial sutures, and in some cases quarts of fluid are effused, consisting of water, with earthy salts and a little albumen; while in acute hydrocephalus there is sometimes much albumen present, with some pus-corpuscles or a little blood. When the disease is detected early, mercurial inunctions, with the administration of the iodides, may possibly afford benefit. Treatment by systematic compression or by tapping the skull (the latter operation to be followed by firm compression) has been tried in many cases, but the most common result has been the speedy death of the patient, although in a few instances it would appear that more or less advantage has been obtained by these means. The term *spurious hydrocephalus* is sometimes applied to infantile typhoid or other enteric disease, the general symptoms of which may simulate those of acute meningitis. C. W. GREENE.

Hydrochlo′ric Acid, called also **Muriatic, Chlorohydric,** and **Chlorhydric Acid** [ancient names, *marine acid, spirit of salt;* Fr. *acide muriatique, acide chlorhydrique;* Ger. *Salzsäure, Chlorwasserstoffsäure*]. The muriatic or hydrochloric acid of commerce and of the laboratory is a solution in water of the gaseous compound, HCl, of hydrogen and chlorine. It occurs in nature only as an irregular product of volcanic eruptions. It is, however, a natural constituent of *gastric juices.* Artificially, it is always prepared by the action of sulphuric acid upon common salt, the chloride of sodium—an action evolving the gaseous chloride of hydrogen, the latter being passed into water kept cold, which absorbs it with great avidity to the maximum extent of about 460 times its volume, increasing in bulk one-third, and in weight about 75 per cent. In commerce, there are three distinct qualities—the common yellow commercial acid, which is sold in carboys, and which is usually quite impure, owing its yellow color, in part at least, to iron, and usually containing sulphurous and sulphuric acids, with other contaminations; the grade called "jeweller's acid," which, when prepared with the use of distilled water, is likely to be a good article, sufficiently so even for medical use; and the so-called "chemically pure" acid, for analytical uses, which should of course be made from distilled water, and should justify its name.

Hydrochloric acid gas is colorless and transparent, and of suffocating odor. In the air it forms white fumes by condensing the aqueous vapor to a liquid fog. It contains by weight 97.26 per cent. of chlorine and 2.74 of hydrogen, and by volume equal measures of these two gases combined without condensation. Under a pressure of 40 atmospheres

it condenses into a liquid. Its density is 1.269, air being 1. The affinity of HCl for water is so great that the latter, when free to enter a vessel filled with the gas, will rush thereinto with almost as much violence as into a vacuum, and a piece of ice introduced into the gas will melt as rapidly as in a fire. When saturated with the gas the liquid acid has a density of 1.20 or 1.21. Such acid requires a cold of 60° below zero F. to freeze it. Heated, it gives off the gas, with appearance of ebullition, until its density runs down to 1.094, when it will distill over unchanged. The following is one of Dr. Ure's tables, giving the composition for varying specific gravities:

Specific gravity.	Aqueous acid of sp. gr. 1.2.	Gaseous acid.	Chlorine.
1.2000	100	40.777	39.675
1.1910	95	38.738	37.692
1.1822	90	36.700	35.707
1.1721	85	34.660	33.724
1.1701	84	34.252	33.328
1.1620	80	32.621	31.746
1.1599	79	32.213	31.343
1.1515	75	30.582	29.757
1.1410	70	28.544	27.772
1.1308	65	26.504	25.789
1.1206	60	24.466	23.805
1.1102	55	21.822	22.426
1.1000	50	20.388	19.837
1.0899	45	18.348	17.854
1.0798	40	16.310	15.870
1.0697	35	14.271	13.887
1.0597	30	12.233	11.903
1.0497	25	10.194	9.919
1.0397	20	8.155	7.935
1.0298	15	6.116	5.951
1.0200	10	4.078	3.968
1.0100	5	2.039	1.984

Tests for Purity.—Pure acid should leave no *tache* when a drop is dried on bright platinum foil and the latter ignited. To test for sulphuric and sulphurous acids, evaporate in a clean porcelain dish after adding a crystal of nitrate of baryta, or a little chlorate of potash and chloride of barium. The dry residue should then form a clear solution in distilled water again. Any turbidity is sulphate of baryta. After warming with a fragment of chlorate of potash, saturation with ammonia should give no precipitate (iron). It must not tarnish bright copper when boiled in it (arsenic). It must not dissolve on boiling therewith the minutest speck of gold-leaf (nitric and nitrous acids). For most uses sulphurous acid is likely to be the most detrimental impurity, and, unfortunately, is one of the most common.

In case of poisoning with muriatic acid, the symptoms of which are generally similar to those of other corrosive mineral acids, *magnesia*, *prepared chalk*, or even *soap*, may be administered in large quantities as an immediate antidote. H. WURTZ.

(For the medicinal uses of hydrochloric acid see MINERAL ACIDS, by EDWARD CURTIS, M. D.)

Hydrochœr′idæ [Gr. ὕδωρ, "water," and χοῖρος, "hog"], a family of symplicidentate rodents distinguished by the large size, the great oval anteorbital foramen, and the structure of the four molar teeth (the posterior of which is very much elongated, and transversely simply folded, while the others are provided with transverse Y-shaped folds), and especially by the union of the alveolar portion of the maxillary bone with the squamosal about the level of the condyle; the clavicles are obsolete; the fibula and tibia separate from each other; and the nails are blunt and somewhat hoof-like (whence they have been called subungulate); the hair is but little harsh. This family is established for the reception of the capybara of South America, which is by far the largest of living rodents. As indicated by the name, it frequents the water, and its aspect somewhat (but very slightly) resembles that of a hog. Unlike other rodents, it has not a "squat" body, with limbs much flexed, but it walks with its limbs extended from the body at about the same angle as do the large quadrupeds. THEODORE GILL.

Hydrocyan′ic Acid. Hydrocyanic acid is a most deadly poison to both animals and plants. In the anhydrous state it is one of the most active destroyers of life known, a single drop put on the tongue killing a large dog in a few seconds, and death being even caused by breathing its fumes. Even the medicinal preparation, a dilute aqueous solution containing 2 per cent. of the anhydrous acid, is a tremendous poison, and must be used cautiously. In excessive dose the symptoms are merely those of the act of death. The sufferer falls as if struck by lightning, all the vital functions being apparently arrested simultaneously. In less dose death ensues by failure of breathing after a brief interval of from a few minutes to half an hour of convulsion or paralysis and collapse. The nature of the poisonous action is not yet thoroughly made out. There is no chemical antidote, and in cases of poisoning by accident or malice death is generally so speedy that all remedies are too late. Ammonia, atropine by subcutaneous injection, artificial respiration, and alternate dashings of hot and cold water on the chest, are the means that offer most hope. Medicinally, the dilute acid is useful to arrest nausea and vomiting, allay cough, and, locally applied, to relieve irritation and itching of the skin. EDWARD CURTIS.

Hydrodynamic Engines. See HYDRAULIC ENGINES, by F. A. P. BARNARD.

Hydrodynam′ics [Gr. ὕδωρ, "water," and δυναμικός, "power," from δύνασθαι, to "be able"], as used by most writers, treats of the laws governing the motion of fluids. Its application, in what follows, is restricted to liquids, of which water is considered the representative. Water remains at rest only when confined on all sides. In this condition the pressure in any given direction, at any point in the liquid mass, is balanced by an exactly equal pressure in the opposite direction. This equality of pressures may be disturbed, in water confined on all sides, by external forces acting intermittently, as the wind acting upon the surface of large bodies of water. This gives rise to oscillatory movements called waves, but does not move any particle of water permanently away from its position of rest. Continued motion in any one direction takes place only when an opening is made in the boundary of the confining reservoir. The liquid particles adjacent to the opening are no longer sustained by the resistance of the boundary, and, yielding to the pressure on the opposite side, are set in motion and driven through the opening. Their displacement disturbs the equilibrium of adjoining particles, and the movement extends to all parts of the reservoir, being, if we suppose the opening to be small as compared with the total boundary of the reservoir, active in the vicinity of the opening and slower in parts more remote. Water thus moves whenever a way is opened by which its surface may reach a lower level. Its velocity, other things being equal, is great or small according as the descent of its surface during the movement is great or small. This descent of the surface is called the *head*.

Velocity.—A heavy body falling freely, acquires velocity at the rate of 32.2 feet per second. This figure represents the effect of gravity acting without obstruction. A body moving under a force greater or less than its own weight acquires a proportionally greater or less velocity. The velocity acquired in falling through any given height is found by multiplying the height by twice this quantity and extracting the square root of the product. The velocity acquired in falling 4 feet, for instance, is the square root of 4 times 64.4, or 16.04 feet per second. In other words, 16.04 feet per second is the velocity due to a height of 4 feet. For all ordinary purposes, it is sufficiently accurate to say that the velocity is 8 times the square root of the height, and the height is 1-64th of the square of the velocity. The velocity imparted to water by a given head is the same as that acquired by a heavy body in falling through a height equal to the head. A few words of explanation are necessary to avoid misapplication of this term "head." When water issues from an orifice in the vertical side of a vessel, the head producing the velocity with which it leaves the orifice is the height of the surface of water in the vessel above the centre of the orifice. If, after leaving the orifice, it falls to a lower level C, the head producing the

FIG. 1.

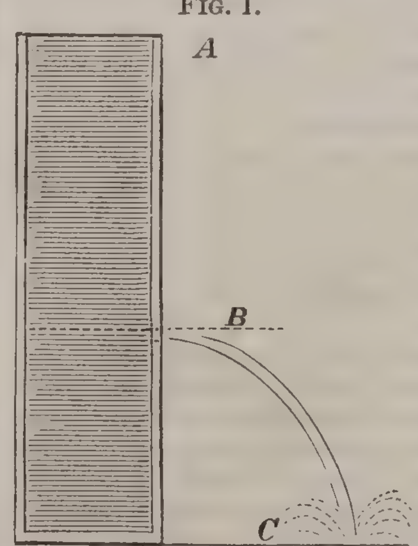
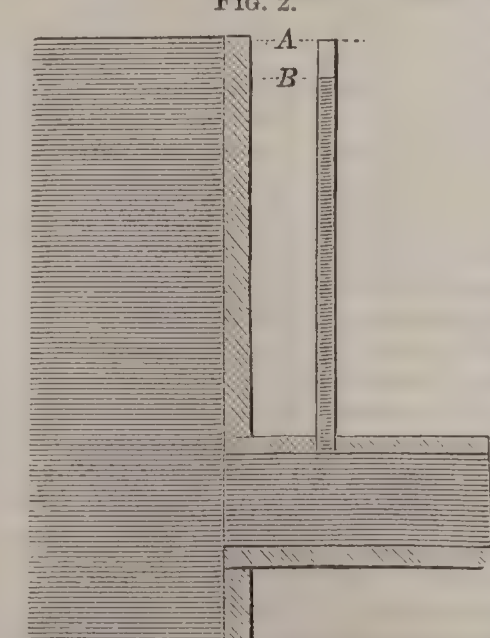


FIG. 2.



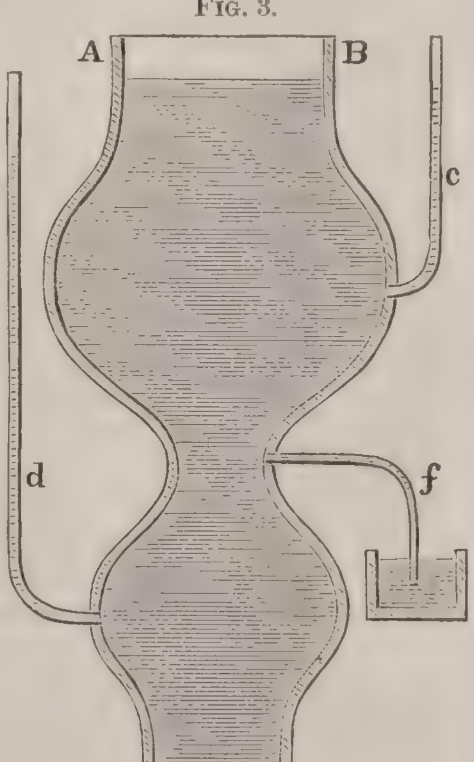
velocity at such lower level is the height A C. When water issues from an orifice under water, the head is the height of the surface in the discharging above that in the receiving basin. When water flows from one basin to another through a long pipe, the head producing the velocity in the pipe is not the height of the surface in the discharging above that in the receiving basin. The motion in this case is not free. It is resisted, and a part of the head is expended, not in producing motion, but in overcoming certain resistances. Let Fig. 2 represent the entrance to the pipe. Suppose a small vertical tube to be inserted in the pipe near its origin. The head producing motion is the height at which the water in the reservoir stands above that in the tube. The following table gives the velocities due to heads up to 15 feet:

TABLE 1.

Head in feet.	Velocity in feet per second.	Head in feet.	Velocity in feet per second.	Head in feet.	Velocity in feet per second.	Head in feet.	Velocity in feet per second.
0.0	0.000	1.8	10.760	3.6	15.217	7.0	21.219
0.1	2.536	1.9	11.055	3.7	15.427	7.5	21.964
0.2	3.587	2.0	11.342	3.8	15.634	8.0	22.685
0.3	4.393	2.1	11.622	3.9	15.839	8.5	23.383
0.4	5.072	2.2	11.896	4.0	16.040	9.0	24.061
0.5	5.671	2.3	12.163	4.1	16.240	9.5	24.720
0.6	6.212	2.4	12.425	4.2	16.437	10.0	25.362
0.7	6.710	2.5	12.681	4.3	16.631	10.5	25.988
0.8	7.173	2.6	12.932	4.4	16.823	11.0	26.600
0.9	7.609	2.7	13.179	4.5	17.013	11.5	27.198
1.0	8.020	2.8	13.420	4.6	17.201	12.0	27.783
1.1	8.412	2.9	13.658	4.7	17.387	12.5	28.356
1.2	8.786	3.0	13.891	4.8	17.571	13.0	28.917
1.3	9.144	3.1	14.121	4.9	17.753	13.5	29.468
1.4	9.490	3.2	14.347	5.0	17.934	14.0	30.009
1.5	9.823	3.3	14.569	5.5	18.809	14.5	30.540
1.6	10.145	3.4	14.789	6.0	19.645	15.0	31.062
1.7	10.457	3.5	15.004	6.5	20.448		

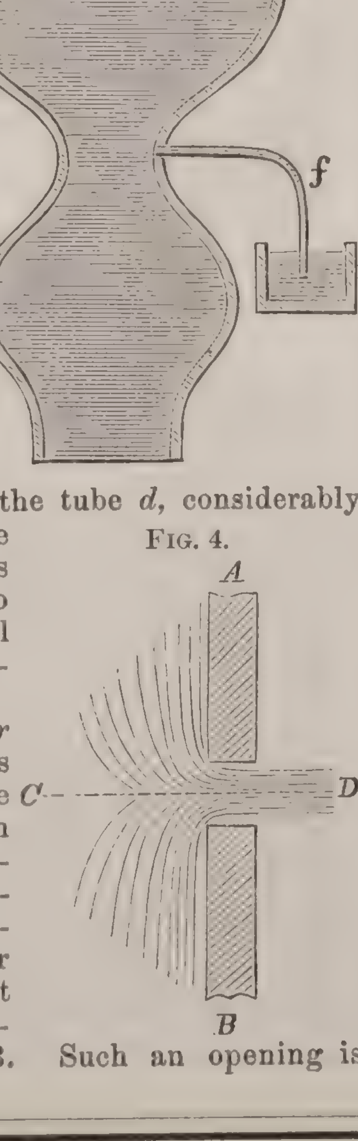
Hydraulic Head.—It is shown in the article HYDROSTATICS that the pressure per square inch at any point in a reservoir of water, when at rest, not counting the atmospheric pressure, is equal to the weight of a column of water 1-inch square reaching vertically from the given point to the level of the surface. This is not true of water in motion. The head cannot exert its full static effect of pressure and its dynamic effect of motion at the same time; any exertion of one of these effects is accompanied by a corresponding abatement of the other. Water moving with the full velocity due the hydrostatic head is under no pressure. The diminution of pressure consequent upon the motion of water is represented by the head due the velocity. In Fig. 2, if the velocity in the pipe is 4 feet per second, the pressure upon the sides of the pipe will be less than that corresponding to the height of the water in the reservoir by the head due the velocity of 4 feet per second—viz. 0.25 foot; *i. e.* the water in the vertical tube will stand 0.25 foot lower than that in the reservoir. Let water be flowing through a vessel of the form shown at Fig. 3, A B representing the surface supposed to be maintained at an invariable level. The water will move fast in the contracted and slow in the expanded section. In a tube *c* branching upward from the widest part the water will stand nearly as high as in the vessel; in the tube *d*, considerably lower. At the narrowest part the pressure may be negative, or less than that of the atmosphere, so that water will enter the vessel through a tube *f*, branching downward as indicated.

FIG. 3.



Efflux, or the Discharge of Water from Orifices.—An orifice, in its simplest form, is an opening in the wall of a reservoir remote from any other side, the wall being supposed to have no sensible thickness. This supposition merely implies, as in Fig. 4, that the water escapes as a jet, and does not touch the prolongation of the orifice after passing the plane A B. Such an opening is called an orifice in a thin plate, and when the term *orifice* is used without qualification, this is usually understood. C D is the axis of the orifice, A B the plane of the orifice.

FIG. 4.



Contraction.—To compute the quantity of water discharged from an orifice of known dimensions under a known head would be a very simple matter if the fluid particles traversed the orifice in parallel directions and without resistance. In that case the discharge would be the product of the velocity due the head multiplied by the area of the orifice. The fluid particles, however, approach the orifice in converging directions, some in diametrically opposite ones. Arrived at the plane of the orifice, they do not instantly change their direction, but still tend toward the axis of the orifice. This produces what is called contraction of the fluid-vein. At a distance from the plane of the orifice equal to one-half its diameter the fluid particles assume parallel directions, and here the contraction is greatest, the diameter of the stream being about eight-tenths that of the orifice. The velocity in this section of the stream is very nearly that due the head, falling short of it, ordinarily, about 3 per cent. The product of the area of the orifice by the velocity due the head is called the theoretical discharge. This term is used for lack of a better, though it implies what is not true. No rational theory indicates this as the true discharge. The discharge from orifices is always considerably less than this. It is found by multiplying the theoretical discharge by a certain fraction called the coefficient of efflux. The coefficient of contraction is the fraction by which the area of the orifice must be multiplied to give the area of the most contracted section of the stream; and the coefficient of velocity is the fraction by which the velocity due the head must be multiplied to give the actual velocity in the most contracted section of the stream. Very numerous and accurate experiments have been made to determine these coefficients, particularly the first. The most extended series of experiments was made in 1828, under the auspices of the French government by two of its military engineers, Poncelet and Lesbros. It results from these experiments that the coefficient of efflux is not constant for orifices in a thin plate, being greater for small orifices and low velocities than for the opposite conditions—that it is much greater for long, narrow orifices than for those with circular or nearly square forms. For circular orifices Weisbach found the results given in Table 2.

TABLE 2.

Diameter of orifice, feet.	Coefficient of efflux for a head of—	
	1.968 feet.	0.82 feet.
0.0328	0.628	0.637
0.0656	0.621	0.629
0.0984	0.614	0.622
0.1312	0.607	0.614

It will be seen that the coefficient of efflux diminishes slightly as the diameter of the orifice increases, and increases as the head diminishes.

Table 3 gives values of the coefficient of efflux obtained by Poncelet and Lesbros for rectangular orifices:

TABLE 3.

Head in feet.	Coefficient of efflux for an orifice 0.656 feet wide, with a height of—						Coefficient of efflux for an orifice 1.97 feet wide, with a height of—	
	0.656 feet.	0.328 feet.	0.164 feet.	0.098 feet.	0.066 feet.	0.033 feet.	0 656 feet.	0.066 feet.
0.033	....	....	0.607	0.630	0.660	0.701	....	0.644
0.066	0.572	0.596	0.615	0.634	0.659	0.694	....	0.643
0.164	0.585	0.605	0.625	0.640	0.658	0.679	0.597	0.641
0.262	0.589	0.610	0.629	0.638	0.656	0.670	0.601	0.640
0.328	0.592	0.611	0.630	0.637	0.654	0.666	0.602	0.639
0.820	0.599	0.616	0.630	0.632	0.646	0.653	0.606	0.634
1.640	0.603	0.617	0.628	0.630	0.640	0.644	0.607	0.630
2.297	0.604	0.616	0.627	0.629	0.637	0.640	0.607	0.628
3.281	0.605	0.615	0.626	0.628	0.633	0.632	0.605	0.626
6.562	0.601	0.607	0.613	0.612	0.612	0.611	0.602	0.620
9.843	0.601	0.603	0.606	0.608	0.610	0.609	0.601	0.615

The head was measured at a point in the reservoir where the water was sensibly still. It was measured from the level of the upper edge of the orifice.

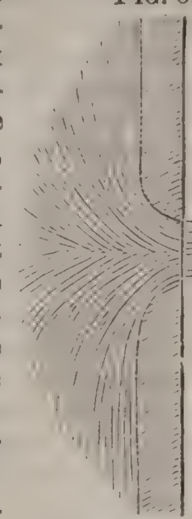
Rounded Orifices.—An orifice may be so rounded internally as to almost entirely obliterate the contraction; in which case the coefficient of contraction becomes very nearly equal to unity. The rounding should be such as to make the orifice conform in shape as nearly as possible to the contracted vein. Weisbach found for a well-rounded orifice about 0.4 inch in diameter the following results:

For a head of..............	0.066 ft.	1.64 ft.	11.5 ft.	56 ft.	328 ft.
Coefficient of efflux.....	0.959	0.967	0.975	0.994	0.994

It is hardly necessary to remark that the smallest section of the opening is to be regarded as the orifice.

To exemplify the use of these results, let the orifice at Fig. 5 be square, 2 inches diameter; let the head acting on the centre of the orifice be 3 feet. The coefficient of efflux should be about 0.97; area of the orifice, 4 square inches = 0.028 square foot; velocity due head by Table 1, 13.89 feet per second; theoretical discharge, $0.028 \times 13.89 = 0.389$; actual do. $= 0.389 \times 0.97 = 0.377$ cubic foot per second. For an orifice of the same size not rounded the coefficient, according to Table 3, should be 0.60, and the discharge $0.389 \times 0.60 = 0.233$ cubic foot per second. The discharge is, therefore, increased 61 per cent. by rounding the orifice.

FIG. 5.



Different Degrees of Contraction.—The more the direction of the water is changed in passing the orifice, the smaller the coefficient of efflux. The greatest change of direction undergone by any particle of water in passing an orifice may be as much as 180 degrees, and from that down to nothing. In the orifice Fig. 6 it is 180 degrees; in Fig. 7, between 180 and 90; in Fig. 8, 90; in Fig. 9, less than 90; and in Fig. 10, nothing, this being a rounded orifice involving no abrupt change in the direction of the water.

FIG. 6.

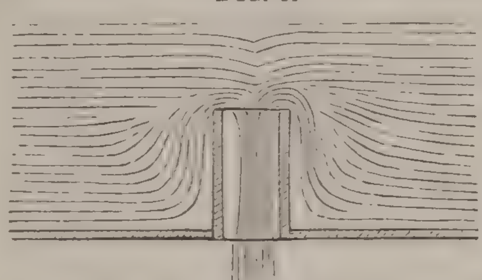


FIG. 7.

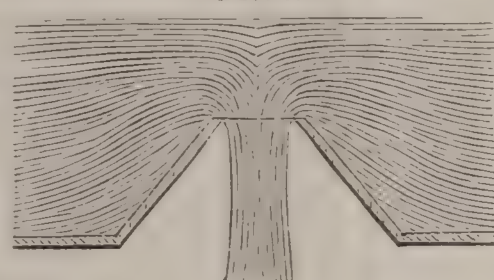


FIG. 8.

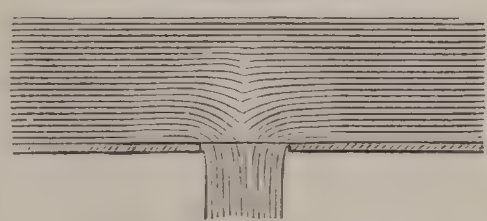


FIG. 9.

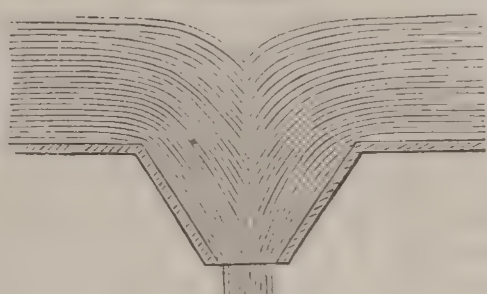
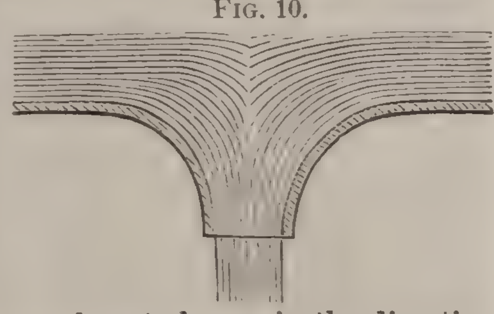


FIG. 10.



Weisbach gives the following as the result of his experiments on this point:

Greatest change of direction—	180°	157½°	135°	112½°	90°	67½°	45°	22½°	11¼°	5¾°	0°
Co. of effl.	0.541	0.546	0.577	0.603	0.632	0.684	0.753	0.882	0.924	0.949	0.966

Incomplete Contraction.—An orifice may be so situated with reference to the sides of the reservoir that the water cannot approach it from all directions. Thus, in Fig. 11 the orifice *a* can be approached from all sides by the water; *b* can be approached on three sides; *c* on two, and *d* on one. The contraction is here said to be suppressed on the sides from which the approach of the water is prevented. The effect of incomplete contraction is to give an increased discharge, and also to incline the direction of the effluent stream toward the sides on which the contraction is suppressed. In the orifice Fig. 12 the tendency which the water coming from A, has, to approach the axis, after passing the orifice, is not balanced by a similar tendency in the opposite direction, and the result is an inclined direction of the effluent stream. In such an orifice, according to Weisbach, the axis C D of the stream is inclined to E F, the axis of the orifice, about 9 degrees. Table 4 shows the effect of suppressed contraction, according to Weisbach, upon the discharge. It explains itself. When, *e. g.*, the contraction is suppressed upon four-tenths of the perimeter of the orifice, the discharge is 6 per cent. greater than from a simple orifice of the same size and form, and under the same head.

FIG. 11.

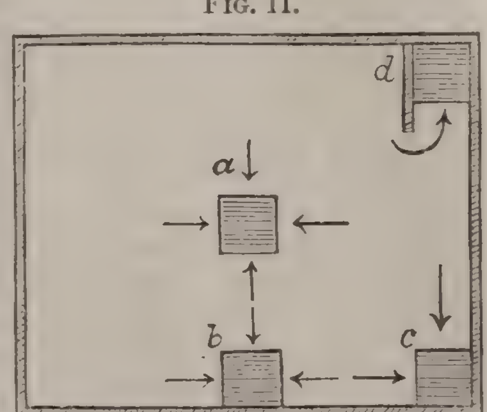


FIG. 12.

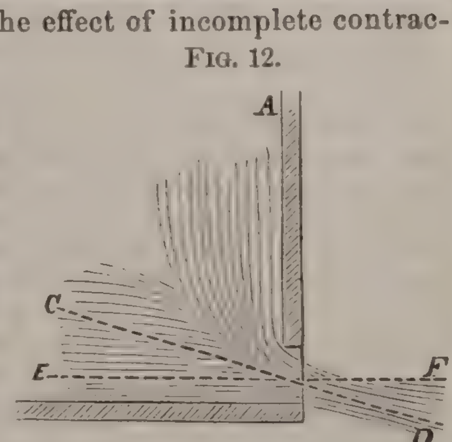
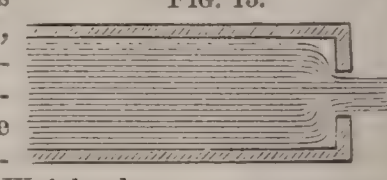


TABLE 4.

Part of the perimeter of the orifice on which the contraction is suppressed.	Discharge, as compared with that from a simple orifice under the same conditions.
0.1	1.015
0.2	1.031
0.3	1.046
0.4	1.062
0.5	1.077
0.6	1.093
0.7	1.108

Imperfect Contraction.—In what precedes, the orifice is supposed to be small as compared with the wall of the reservoir in which it is placed. When, as in Fig. 13, the orifice is but slightly less in area than the wall containing it, the result is a diminished contraction, showing itself in an increased discharge, and also in the appearance of the issuing stream, which is opaque and troubled, while that from a simple orifice is transparent. Table 5 shows the effect of imperfect contraction, according to Weisbach.

FIG. 13.



This table requires no explanation. For an orifice, *e. g.*, three-tenths as large as the wall containing it, the discharge is 6 per cent. greater for a circular orifice, 7 per cent. for a rectangular one, than for a simple orifice similarly circumstanced as to size, form, and head, in a wall of practically unlimited extent.

Weirs.—This form of orifice is peculiarly adapted to the measurement of water, and has for that reason been the subject of very numerous and elaborate experiments, not only in the series undertaken by Poncelet and Lesbros, but also, upon a larger scale and with every precaution necessary to accuracy, by Francis of Massachusetts. Table 6 is computed by him from the results of his experiments. It

TABLE 5.

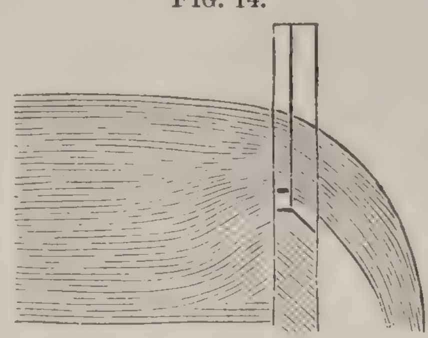
Area of the orifice as compared with that of the side containing it.	Discharge as compared with that from a simple orifice under the same conditions.	
	Circular.	Rectangular.
0.05	1.007	1.009
0.10	1.014	1.019
0.15	1.023	1.030
0.20	1.034	1.042
0.25	1.045	1.056
0.30	1.059	1.071
0.35	1.075	1.088
0.40	1.092	1.107
0.45	1.112	1.128
0.50	1.134	1.152
0.55	1.161	1.178
0.60	1.189	1.208
0.65	1.223	1.241
0.70	1.260	1.278
0.75	1.303	1.319
0.80	1.351	1.365
0.85	1.408	1.416
0.90	1.471	1.473
0.95	1.546	1.537
1.00	1.631	1.631

TABLE 6.

Depth in feet.	Disch. cub. ft. per sec.	Depth in feet.	Disch. cub. ft. per sec.	Depth in feet.	Disch. cub. ft. per sec.	Depth in feet.	Disch. cub. ft. per sec.	Depth in feet.	Disch. cub. ft. per sec.
0.10	0.105	0.30	0.547	0.50	1.177	0.70	1.950	0.90	2.843
0.11	0.121	0.31	0.575	0.51	1.213	0.71	1.992	0.91	2.891
0.12	0.138	0.32	0.603	0.52	1.249	0.72	2.034	0.92	2.938
0.13	0.156	0.33	0.631	0.53	1.285	0.73	2.077	0.93	2.986
0.14	0.174	0.34	0.660	0.54	1.321	0.74	2.120	0.94	3.035
0.15	0.193	0.35	0.689	0.55	1.358	0.75	2.163	0.95	3.083
0.16	0.213	0.36	0.719	0.56	1.395	0.76	2.206	0.96	3.132
0.17	0.233	0.37	0.749	0.57	1.433	0.77	2.250	0.97	3.181
0.18	0.254	0.38	0.780	0.58	1.471	0.78	2.294	0.98	3.231
0.19	0.276	0.39	0.811	0.59	1.509	0.79	2.338	0.99	3.280
0.20	0.298	0.40	0.842	0.60	1.548	0.80	2.383	1.00	3.330
0.21	0.320	0.41	0.874	0.61	1.586	0.81	2.428	1.1	3.842
0.22	0.344	0.42	0.906	0.62	1.626	0.82	2.473	1.2	4.377
0.23	0.367	0.43	0.939	0.63	1.665	0.83	2.518	1.3	4.936
0.24	0.391	0.44	0.972	0.64	1.705	0.84	2.564	1.4	5.516
0.25	0.416	0.45	1.005	0.65	1.745	0.85	2.610	1.5	6.118
0.26	0.441	0.46	1.039	0.66	1.785	0.86	2.656	1.6	6.739
0.27	0.467	0.47	1.073	0.67	1.826	0.87	2.702	1.7	7.381
0.28	0.493	0.48	1.107	0.68	1.867	0.88	2.749	1.8	8.042
0.29	0.520	0.49	1.142	0.69	1.909	0.89	2.796	1.9	8.721
								2.0	9.419

gives the discharge for different depths, from a weir one foot in horizontal length. The depth is reckoned from the level of the crest of the weir, and is taken at a point a little up-stream or aside, beyond the curve of the surface consequent upon the discharge. To correct the results for the effect of contraction at the ends of the weir, the length is to be diminished by one-tenth of the depth for each end-contraction. If an end of the weir coincide with a vertical wall of the canal or reservoir, the contraction at that end is annulled. Fig. 14 shows the form of the horizontal crest and vertical sides or ends of the weir for which this table is computed. The computation by Mr. Francis's formula is uncertain for depths less than 0.1 foot. A weir for measuring water should always be short enough to give a greater depth than this.

FIG. 14.



To find, *e. g.*, the discharge from a weir with two end-contractions with a depth of 0.83 foot, the length of the weir being 20 feet; length to be used in calculation, $20 - 2 \times 0.83 \times 0.1 = 19.834$; discharge for one foot in length, 2.518 cubic feet per second; total discharge $= 19.834 \times 2.518 = 49.942$ cubic feet per second. In the above table it is assumed that the opening of the weir is inconsiderable, compared with the cross-section of the channel through which the water approaches it. Where this is not the case, the water passes the weir with a velocity greater than that generated by the head, as measured at the weir, and the discharge is consequently greater than indicated above. The correction for this source of inaccuracy is made by the aid of Table 7, given by Weisbach. In the above example let the section of the weir-stream be four-tenths that of the approaching stream; the discharge, according to Weisbach's table, will be $49.942 \times 1.044 = 52.139$ cubic feet per second.

TABLE 7.

Section of weir-stream as compared with that of the channel by which the water approaches the weir.	Discharge as compared with that given in Table 6.	
	For a weir with end-contractions.	For a weir without end-contractions.
0.05	1.000	1.042
0.10	1.000	1.045
0.15	1.001	1.049
0.20	1.003	1.056
0.25	1.007	1.064
0.30	1.014	1.074
0.35	1.026	1.086
0.40	1.044	1.100
0.45	1.070	1.116
0.50	1.107	1.133

Short Tubes.—If we apply a short tube externally to an orifice, the conditions of the discharge are entirely changed. From the simple orifice the issuing stream is contracted and transparent; from the tube it is uncontracted and troubled: The velocity of the stream is diminished, but its cross-section is increased. A very material increase takes place in the quantity of water discharged. The tube must have a length of $2\frac{1}{2}$ or 3 times the diameter of the orifice, otherwise the stream, when the head is considerable, is liable to issue without touching the tube, in which case the latter has no influence upon the discharge. Under heads of from 3 to 20 feet the coefficient of efflux through a short tube $1\frac{1}{2}$ to 3 inches diameter is about 0.815. It increases somewhat if the size of the tube is increased or the head is diminished, being, in some cases, as much as 0.855. It is sufficiently correct for most purposes to say that the discharge from an orifice in a thin plate is increased one-third by the addition of a short tube.

Resistance to the Motion of Water.—Though water moves under the action of the slightest force, its movement is always accompanied by a certain resistance, analogous to that which solid bodies experience in sliding or moving one upon another. There is this difference, however, between the friction of solids and that of fluids: the former is the same whether the movement is rapid or slow; the latter increases with the velocity. A car, *e. g.*, runs down a track of uniform grade. It moves because the force of gravity exceeds the resisting force of friction. This excess takes effect in increasing the velocity, and does not diminish as the velocity increases. The longer the car continues in motion, the faster it moves. This, at least, would be the case if it did not encounter a fluid resistance—that, namely, of the air. When, on the contrary, water flows down an inclined channel or through an inclined pipe, or, what is the same thing, through a horizontal pipe under the action of a head, the resistance increases as the velocity increases. Uniform velocity always establishes itself at such a rate as to make the resistance equal to the moving force. The head or force of gravity is entirely expended in overcoming the resistance to the water's motion.

Motion of Water in Long Pipes.—The head expended in overcoming the resistance to motion in long pipes is called "frictional head," and sometimes "lost head" or "loss of head." It is directly proportional to the length of the pipe, and nearly, though not exactly, proportional to the square of the velocity. It is less, *cæteris paribus*, for a large pipe than for a small one, and depends greatly upon the nature of its internal surface, being much greater for rough than for smooth surfaces. Table 8, computed from the results of experiments made by Henry Darcy at the expense of the French government, serves for any calculations ordinarily required as to the motion of water in pipes. The formula is $R\,I = b\,v^2$, in which R is the radius of the pipe in feet; I, the loss of head in feet per linear foot of pipe; v, the velocity in feet per second; b is a number varying with the size of the pipe. It is given in the third column. If the loss of head per foot is required, the velocity and size of the pipe being known, $I = \frac{bv^2}{R}$. I is found by multiplying the quantity in the fourth column by the square of the velocity. If we desire to find the velocity corresponding to a given loss of head per foot, we must multiply the square root of the given loss of head by the quantity in the fifth column.

TABLE 8.

1. Diameter of pipe, feet.	2. Radius, feet.	3. b.	4. $\frac{b}{R}$.	5. $\sqrt{\frac{R}{b}}$.
0.04	0.02	0.0004780	0.023900	6.46846
0.08	0.04	0.0003163	0.007908	11.24520
0.12	0.06	0.0002623	0.004372	15.1238
0.16	0.08	0.0002354	0.002942	18.4365
0.20	0.10	0.0002192	0.002192	21.3589
0.24	0.12	0.0002085	0.001737	23.9939
0.28	0.14	0.0002007	0.001434	26.4074
0.32	0.16	0.0001949	0.001218	28.6534
0.36	0.18	0.0001904	0.001058	30.7438
0.40	0.20	0.0001869	0.000934	32.7210
0.44	0.22	0.0001839	0.000836	34.5857
0.48	0.24	0.0001815	0.000756	36.3696
0.52	0.26	0.0001794	0.000690	38.0693
0.56	0.28	0.0001776	0.000634	39.7151
0.60	0.30	0.0001761	0.000587	41.2744
0.64	0.32	0.0001747	0.000546	42.7960
0.68	0.34	0.0001735	0.000510	44.2808
0.72	0.36	0.0001725	0.000479	45.6912
0.76	0.38	0.0001715	0.000451	47.0882
0.80	0.40	0.0001707	0.000427	48.3934
0.84	0.42	0.0001699	0.000405	49.6904
0.88	0.44	0.0001692	0.000385	50.9647
0.92	0.46	0.0001686	0.000367	52.1996
0.96	0.48	0.0001680	0.000350	53.4522
1.00	0.50	0.0001674	0.000335	54.6358
1.04	0.52	0.0001669	0.000321	55.815
1.08	0.54	0.0001665	0.000308	56.980
1.12	0.56	0.0001661	0.000297	58.026
1.16	0.58	0.0001657	0.000286	59.131
1.20	0.60	0.0001653	0.000275	60.302
1.24	0.62	0.0001649	0.000266	61.314
1.28	0.64	0.0001646	0.000257	62.378
1.32	0.66	0.0001643	0.000249	63.372
1.36	0.68	0.0001640	0.000241	64.416
1.40	0.70	0.0001637	0.000234	65.372
1.44	0.72	0.0001635	0.000227	66.372
1.48	0.74	0.0001632	0.000221	67.267
1.50	0.75	0.0001631	0.000217	67.884
1.60	0.80	0.0001626	0.000203	70.186
1.70	0.85	0.0001621	0.000191	72.357
1.80	0.90	0.0001617	0.000180	74.536
1.90	0.95	0.0001613	0.000170	76.696
2.00	1.00	0.0001610	0.000161	78.811
2.10	1.05	0.0001607	0.000153	80.845
2.20	1.10	0.0001604	0.000146	82.761
2.30	1.15	0.0001601	0.000139	84.819
2.40	1.20	0.0001599	0.000133	86.711
2.50	1.25	0.0001597	0.000128	88.388
2.60	1.30	0.0001595	0.000123	90.167
2.70	1.35	0.0001593	0.000118	92.057
2.80	1.40	0.0001591	0.000114	93.659
2.90	1.45	0.0001590	0.000110	95.346
3.00	1.50	0.0001588	0.000106	97.129

This table applies to new cast-iron pipes. For pipes coated internally with bitumen or pitch the loss of head will be about two-thirds as much, and for uncoated pipes, long in use, twice as much, as indicated by this table.

Example.—What is the loss of head in a new cast-iron pipe 1 foot in diameter, 3000 feet long, conveying 1 cubic foot of water per second—cross-section of pipe, 0.7854 foot; velocity, $\frac{1}{0.7854} = 1.273$ feet per second? $I =$ loss of head per foot of pipe $= \frac{b}{R}v^2 = 0.000335 \times 1.273 \times 1.273 = 0.000543$. Total loss $= 3000 \times 0.000543 = 1.629$ feet. What

quantity of water would this pipe deliver with a loss of head of 10 feet? $I=\frac{10}{3000}$, $\sqrt{I}=0.05773$, $v=54.6358\times0.05773=3.154$. Quantity, $0.7854\times3.154=2.477$ cubic feet per second.

Jets.—When water issues vertically upward from an orifice in a vessel under pressure, it would rise to a height corresponding to the pressure, if it encountered no resistance from the air or in passing through the orifice. The last-named resistance, however, prevents the velocity from being quite equal to that due the pressure, and the first prevents the stream from rising to the height due the velocity. When the velocity of issue is from 3 to 20 feet, the height of the jet is substantially that due the velocity. For higher velocities the resistance of the air has a greater influence. A contracted stream rises higher than an uncontracted one of the same size and issuing under the same pressure, the contracted stream having the greater initial velocity. But an uncontracted stream will rise higher than a contracted one of the same initial velocity, as the latter presents swells and bulges which increase the resistance of the air. Other things being equal, a thick stream rises higher than a thin one. An orifice well rounded internally, and provided externally with a conical converging tube, is most favorable for a great height of jet. Table 9 gives, upon the authority of Weisbach, the height of jet for different velocities and different forms of orifice:

TABLE 9.

No. of orifice.	Height of jet, the head due the velocity being—						
	10 feet.	20 feet.	30 feet.	40 feet.	50 feet.	60 feet.	70 feet.
1	9.61	18.31	25.98	32.58	38.12	42.76	45.99
2	9.71	18.74	26.75	33.77	39.72	44.63	48.25
3	9.48	18.53	26.77	33.97	39.98	44.79	48.47
4	9.69	19.08	28.02	36.39	44.09	51.08	57.31

No. 1 was a circular orifice in a thin plate 0.4 inch diameter; No. 2 was a circular orifice 0.56 inch diameter; No. 3 was a circular converging tube 5.9 inches long, 1.18 inches diameter at the inner end, 0.39 at the outer end; No. 4 was a shorter tube with an external orifice of 0.56 inch diameter.

Expanding Submerged Tubes.—When water flows through an expanding tube A C (Fig. 15), discharging under water, after passing the narrowest part of the tube it moves with a continually diminishing velocity. Now, as a certain force must be exerted upon water to accelerate its motion, a certain force is exerted by water when its motion is retarded. This force is here employed in diminishing the pressure opposed to the movement of the water —viz. that due to the submergence of the tube, and the atmosphere. The result is a virtual increase of the head. The velocity in this case may be greatly in excess of that due the difference of level between the discharging and receiving basins. Mr. Francis has made very careful and accurate experiments upon this subject. He employed a tube of the form shown at Fig. 15, diverging at an angle of 5 degrees. It was made in five parts, A, B, C, D, E, each one foot in length. The mouthpiece A was 1.37 feet diameter at the inner end, rounded by a cycloidal curve to a diameter of 0.1 foot at the outer end. The sections B, C, D,

FIG. 15.

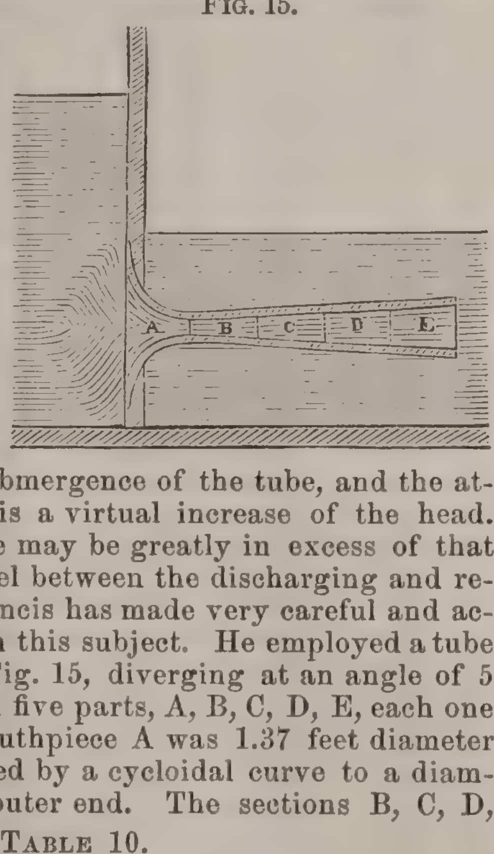


TABLE 10.

Parts of the tube in use.	Head or difference of level between the two basins, feet.	Velocity at the smallest section as compared with that due the head.
A	0.0339	0.815
	0.230	0.863
	0.958	0.928
	1.514	0.941
A, B	0.020	1.151
	0.100	1.396
	0.854	1.592
	1.470	1.575
A, B, C	0.014	1.418
	0.062	1.784
	1.100	2.164
	1.312	2.123
A, B, C, D	0.014	1.385
	0.059	1.817
	1.177	2.431
	1.361	2.427
A, B, C, D, E	0.014	1.438
	0.057	1.876
	1.282	2.421
	1.408	2.267

E, were respectively 0.145, 0.234, 0.321, 0.408 foot in diameter at the outer ends. Table 10 is a summary of his results. The principles of the flow of water through diverging tubes find a useful application in the diffuser, an appendage applied to the turbine water-wheel by Mr. Boyden. The water is discharged from the wheel through an expanding passage, and the momentum which would otherwise be wasted is employed in increasing the velocity and consequent effectiveness of the water passing the wheel.

Various Resistances to the Motion of Water.—Every abrupt change of velocity or direction in the motion of water is accompanied by a loss of head, manifesting itself in pipes by a diminished pressure, and in channels by a depression of the surface, after passing the point of such change. An abrupt change of velocity results from an enlargement of the pipe (Fig. 16). In this case the head lost is that due the change of velocity. Thus, if the pipe B have a diameter 3 times that of A, the velocity in A being 6 foot per second, the velocity will be $\frac{6}{9}=\frac{2}{3}$ foot per second in B. The change of velocity is $6-0.67=5.33$ feet per second. The head due this velocity is 0.442 foot. This is the loss of head. If two small pipes *a* and *b*, reaching indefinitely upward, are inserted one in A and one in B, the water in *b* will stand 0.442 foot lower than in *a*. This loss of head may be avoided by making the enlargement gradual. At the entrance to a pipe from a reservoir or from a larger pipe a loss of head takes place. If the water enters through an orifice smaller than the pipe B, this loss may be very great. Table 11 is given by Weisbach as the result of his experiments on this point. When, *e. g.*, the area of the orifice is one-half that of the pipe, the head lost is 5.256 times that due the velocity.

FIG. 16.

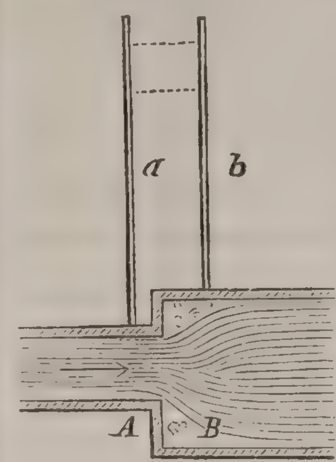


FIG. 17.

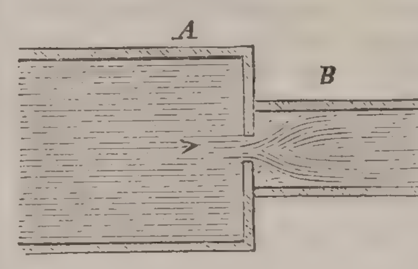


TABLE 11.

Area of the orifice, as compared with that of the pipe.	Loss of head, as compared with that due the velocity in the pipe.
1.00	0.480
0.9	0.734
0.8	1.169
0.7	1.876
0.6	3.077
0.5	5.256
0.4	9.612
0.3	19.78
0.2	50.99
0.1	231.7

TABLE 12.

Angle of deviation, degrees.	Loss of head, as compared with that due the velocity.
20	0.046
40	0.139
60	0.364
80	0.740
90	0.984
100	1.260
110	1.556
120	1.861
130	2.158
140	2.431

Elbows or *Angles* in pipes occasion a loss of head depending upon the amount of deviation from a straight line. Table 12 is given by Weisbach for a pipe a little less than $1\frac{1}{4}$ inches in diameter. The loss of head is considerably greater for smaller pipes. For a pipe 0.4 inch diameter, deviating 90 degrees, it was 1.536 times that due the velocity.

Bends in pipes occasion a considerable loss of head, though materially less than occurs with elbows. This loss is found to depend upon the proportion which the semi-diameter of the pipe bears to the radius of the bend. Table 13, given by Weisbach, applies to this case, the bends being full quadrants, or what are called quarter turns:

TABLE 13.

Semi-diameter of pipe, as compared with radius of curve.	Loss of head, as compared with that due the velocity.	
	Rectangular pipe.	Circular pipe.
0.1	0.124	0.131
0.2	0.135	0.138
0.3	0.180	0.158
0.4	0.250	0.206
0.5	0.398	0.294
0.6	0.643	0.440
0.7	1.015	0.661
0.8	1.546	0.977
0.9	2.271	1.408
1.0	3.228	1.978

Resistance of Valves and Cocks.—A knowledge of the resistance occasioned by the various contrivances for controlling the flow of water in pipes is of great importance. The several types of these contrivances are indicated by Figs.

18 to 22. For large pipes a sliding gate (Fig. 18) is used. It is raised into a chamber by a screw working through a stuffing-box. When partly closed, it leaves a crescent-shaped opening in circular pipes, and a rectangular one in rectangular pipes. Fig. 19 is a cock consisting of a cylindrical or conical plug pierced with a rectangular opening. It closes the passage by turning about its centre. Fig. 20 is a throttle-valve, Fig. 21 a puppet-valve, and Fig. 22 a clack-valve. Prof. Weisbach gives the following results for these different forms of valves:

FIG. 18.

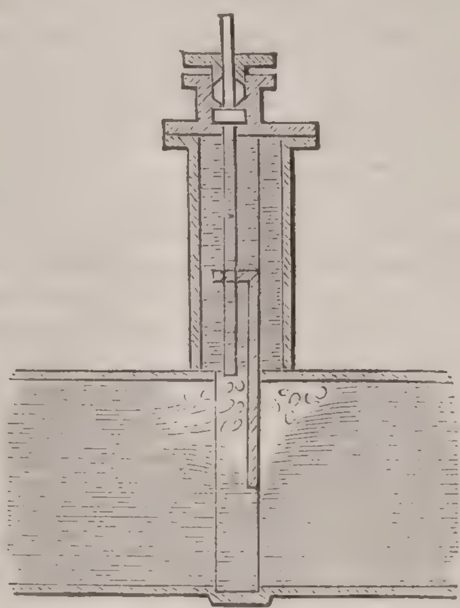


FIG. 19.

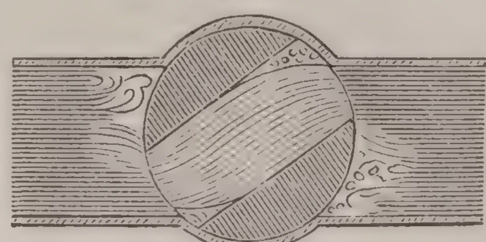


FIG. 20.

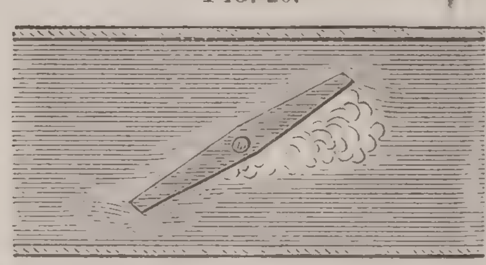


FIG. 21.

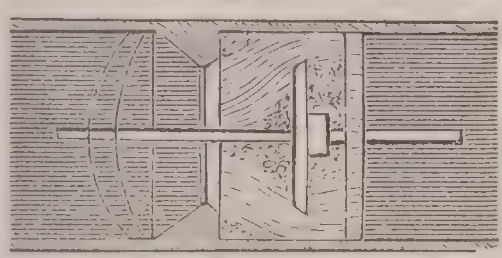


FIG. 22.

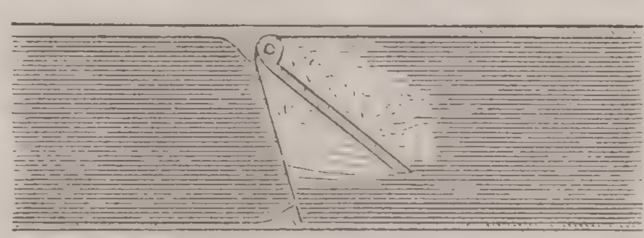


TABLE 14.

Sliding-valves (Fig. 18).				Cocks (Fig. 19).			
Cylindrical pipes.		Rectangular pipes.		Cylindrical pipes.		Rectangular pipes.	
Area of open'g, as compared with section of pipe.	Head lost, as compared with that due the velocity in the pipe.	Area of open'g, as compared with section of pipe.	Head lost, as compared with that due the velocity in the pipe.	Area of open'g, as compared with section of pipe.	Head lost, as compared with that due the velocity in the pipe.	Area of open'g, as compared with section of pipe.	Head lost, as compared with that due the velocity in the pipe.
1.000	0.000	1.00	0.00	0.926	0.05	0.926	0.05
0.948	0.07	0.9	0.09	0.850	0.29	0.849	0.31
0.856	0.26	0.8	0.39	0.772	0.75	0.769	0.88
0.740	0.81	0.7	0.95	0.692	1.56	0.687	1.84
0.609	2.06	0.6	2.08	0.613	3.10	0.604	3.45
0.466	5.52	0.5	4.02	0.535	5.47	0.520	6.15
0.315	17.00	0.4	8.12	0.458	9.68	0.436	11.2
0.159	97.8	0.3	17.8	0.385	17.3	0.352	20.7
		0.2	44.5	0.315	31.2	0.269	41.0
		0.1	193.0	0.250	52.6	0.188	95.3
				0.190	106.	0.110	275.0
				0.137	206.		
				0.091	486.		

TABLE 15.

Throttle-valves (Fig. 20).			Puppet-valves (Fig. 21).		Clack-valves (Fig. 22).	
Area of opening as compared with section of pipe.	Head lost, as compared with that due the velocity.		Area of open'g, etc.	Head lost, etc.	Angle of opening, degrees.	Head lost, etc.
	Cylindrical pipe.	Rectangular pipe.				
0.913	0.24	0.28	0.9	0.69	15.	90.
0.826	0.52	0.45	0.8	1.10	20.	62.
0.741	0.90	0.77	0.7	1.82	25.	42.
0.658	1.54	1.34	0.6	3.03	30.	30.
0.577	2.51	2.16	0.5	5.24	35.	20.
0.500	3.91	3.54	0.4	9.67	40.	14.
0.426	6.22	5.70	0.3	20.0	45.	9.5
0.357	10.8	9.27	0.2	52.0	50.	6.6
0.293	18.7	15.07	0.1	239.0	55.	4.6
0.234	32.6	24.9			60.	3.2
0.181	58.8	42.7			65.	2.3
0.134	118.0	77.4			70.	1.7
0.094	256.0	158.				
0.060	751.0	368.				

Efflux under Variable Pressure.—When a vessel (Fig. 23) empties itself through an orifice in its bottom, the head, and consequently the rapidity of the flow, diminishes as the surface falls. The same thing occurs when a vessel is filled through an orifice in its bottom, as, for instance, by sinking it to a certain depth in a body of water so large that its surface would not be affected by the operation, and opening an orifice in the vessel's bottom. If the vessel is of uniform horizontal section, and the orifice is of the same size in each case, and the same form with reference to inward as to outward flow, it would be filled to the level of the external water in the same time that it would require to empty itself when so filled if suddenly raised clear of the water. If the coefficient of efflux were constant, this time would be twice that required to discharge the same quantity of water through the same orifice under a constant head equal to that acting at the commencement of the flow; or, in other words, to twice the time required to discharge an equal quantity of water at the initial rate. The slight increase of the coefficient of efflux as the head diminishes modifies this and the following statements slightly, but not materially. For a vessel larger or smaller at the top than at the bottom, the above proportion would not hold good, neither would the time of emptying be equal to that of filling. A vessel larger at the top than the bottom requires less time to empty and more to fill than one of uniform horizontal section, and *vice versâ*. Such a vessel will empty with its small end uppermost in the same time that it will fill in a reversed position, and *vice versâ*, the orifice and initial head being the same in both cases; the orifice being in the face or extremity which forms the bottom for the time being. A wedge-shaped vessel (Fig. 24) will empty itself with its vertex uppermost in $2\frac{2}{3}$ times the time required to discharge an equal quantity at the initial rate of flow. In a reversed position it will empty itself in $1\frac{1}{3}$ times the time required to discharge an equal quantity at the initial rate. A vessel having the form of a pyramid or cone will empty itself with its vertex upward in $3\frac{1}{5}$, with its base upward in $1\frac{1}{5}$ times the time required to discharge an equal quantity at the initial rate.

FIG. 23.

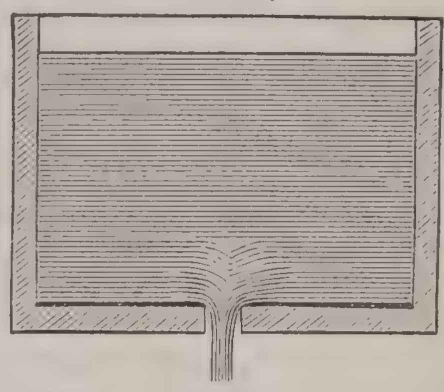
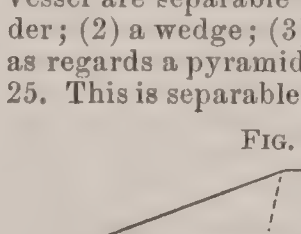
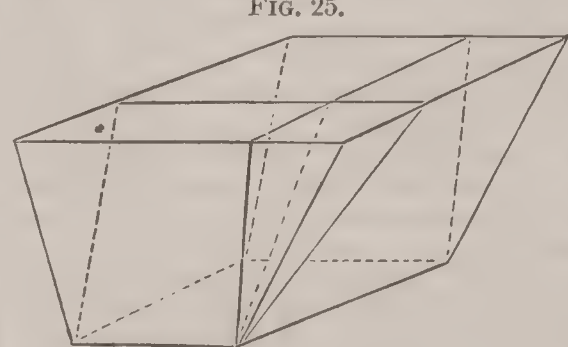


FIG. 24.



The commonest form of vessel for holding water is a conical or pyramidal frustum. The contents of such a vessel are separable into three parts: (1) a prism or cylinder; (2) a wedge; (3) a pyramid. This will readily appear, as regards a pyramidal frustum, from an inspection of Fig. 25. This is separable into—(1) a prism or parallelopipedon; (2) two wedges, which may be considered as one; (3) a pyramid. A conical frustum or tub contains approximately—(1) a cylinder whose base is the small end; (2) a wedge whose base has a length equal to the circumference of the small end, and a breadth equal to the excess of the radius of the large end over that of the small end; and (3) a pyramid whose base is half the product of the difference of the circumferences by the difference of the radii. The common height of the prism, pyramid, and wedge is the depth of water in the vessel. When a vessel of this form stands upon its small end, the time required to empty it is twice the time required to discharge the cylinder or prism of water, one and one-third that required to discharge the wedge, and one and one-fifth that required for the pyramid, at the initial rate. When it stands on its larger end, the time is twice that required for the prism or cylinder, two and two-thirds times that for the wedge, and three and one-fifth times that for the pyramid, at the initial rate of flow. J. P. FRIZELL.

FIG. 25.



Hydrofluoric Acid. See FLUOHYDRIC ACID, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Hydrogen [Fr. *hydrogène;* Ger. *Wasserstoffgas;* earlier chemists, *inflammable air*]. *History.*—The ancients believed water an elementary substance. In the sixteenth century Paracelsus discovered that iron and sulphuric acid engender together an aëriform body or gas. Not until 1672 was this observed, by both Mayerne and Boyle, to be combustible. It was henceforward known as inflammable air, until Lavoisier, after the discovery of its chemical nature and origin, called it *hydrogen*, or water-generator, from the Greek ὕδωρ and γεννάω. In 1700, Lemery discovered that it explodes in admixture with air. Henceforth, it was regarded as being or conveying the principle of fire, and under the famous theory of Stahl was believed to be wholly or chiefly composed of the so-called *phlogiston*. In 1766 the great English chemist Cavendish first took up its investigation, and quickly discovered that when burned it produces water. Two other chemists, Macquer and De la Metherie, recorded the same observation at the same date. Not till 1781, however, did Cavendish complete the discovery by burning together *oxygen*—previously discovered, in 1774, by Priestley—and hydrogen, and finding that the sole product was water. James Watt is also believed to have made the same discovery, independently, in this same year (1781).

Occurrence in Nature.—Many authorities assert that hydrogen is never found free in nature upon the earth. It certainly exists, however, in volcanic gases. H. Rose and others have asserted that the gas found compressed in the decrepitating salt of Wieliczka contains free hydrogen. Graham found it, in the condition he called "occlusion," in the iron of aërolites. De Candolle made the remarkable statement that certain fungi evolve free hydrogen night and day. The spectroscope detects hydrogen in the chromosphere of our sun and in many other stars; also in certain nebulæ. Water contains one-ninth of its weight, or 11.11 per cent., of hydrogen. Steam, and water in other vaporous forms, contain an amount of hydrogen which, when set free in gaseous form, is found to assume, at the same temperature, exactly the volume of the vapor itself; gaseous water being made up of two measures, or volumes, of hydrogen, and one of oxygen; the three measures condensing, in combining, to two measures. Steam therefore contains its own volume of hydrogen. Liquid water, however, contains 1238 times its volume of free gaseous hydrogen. Hydrogen occurs also in nature in combination with nitrogen, as ammonia; with carbon, as marsh-gas, the chief constituent of the gas of gas-wells and of the fire-damp of coal-mines, which, of all known compounds, is the richest in hydrogen, containing one-fourth of its weight, or more than twice as much as water. It also contains twice its own volume of hydrogen. With carbon also, as petroleum and paraffine; and as an essential constituent of most of the solid tissues of organic beings, both animal and vegetable; and therefore of all mineral substances of organic origin, such as coals, asphalts, bitumens, mineral resins and resinoids, etc. In volcanic gases it occurs as muriatic acid gas; also as sulphuretted hydrogen under many circumstances; and, some believe, also in combination with phosphorus, as native phosphuretted hydrogen.

Preparation.—Hydrogen gas may be obtained from water by many methods, of which there are *seven* principal ones that have been and may be used, according to circumstances: 1. The method of Paracelsus, with iron (or zinc, which is oftener now used) and a dilute acid, generally either sulphuric or muriatic acid. This is the most common method, but yields generally an impure and very malodorous hydrogen, contaminated by combination with the impurities of the metal and acid used. In the case of iron, important quantities of volatile and gaseous hydrocarbon compounds are formed with the carbon of the iron, and it is doubtful whether pure hydrogen can be obtained by any modification of this method, unless possibly by the use of zinc of chemical purity, which must then be mixed with platinum to produce voltaic currents, or else it will decompose the acidulated water but very slowly. 2. Metals whose oxides are soluble in caustic alkaline solutions, such as zinc and aluminum, will decompose water and evolve hydrogen when warmed with such alkaline solutions. With aluminum free from carbon, hydrogen thus prepared should be pure. 3. The alkali metals, such as potassium and sodium, decompose pure water directly by appropriating its oxygen and setting the hydrogen free—a method useful only as a lecture experiment. 4. Metallic iron, when incandescent, will decompose steam, with formation of magnetic oxide of iron and free hydrogen. This method is not to be recommended in practice. The action is very quickly retarded, and becomes sluggish, from the coating of oxide formed over the iron. 5. A far more rapid and practicable method is arrived at by substituting for the iron some form of mineral or artificial carbon. Hydrogen is thus obtained in admixture with carbonic oxide. Unless the temperature be very high, more or less carbonic acid is also formed. At very high heats, a mixture of about two volumes of hydrogen with one volume of carbonic oxide, and but a small percentage of carbonic acid, may in this way be prepared on a large scale from steam. This is known technically as "water-gas," and is used by some as a diluent for coal and petroleum gases for illuminating purposes, and is proposed to be used by itself, on a large scale, for warming, cooking, motor, and manufacturing purposes. 6. By "dissociation," or the method discovered by Grove in 1846—that is, by the direct decomposition of steam by a high heat, which will furnish a mixture of oxygen and hydrogen. Prof. B. Silliman discovered in 1869 that this mode of preparation may be effected on a considerable scale by forming beneath the surface of pure water the voltaic arc from a battery of considerable power, the mixed gases coming off in torrents. Pure hydrogen may be procured by absorbing the oxygen from such a mixed gaseous product. 7. By electrolysis of water containing in solution some substance which increases its conducting power for the voltaic current. Hydrogen is then evolved from the cathode or negative electrode, and may be collected in a state of purity.

Hydrogen is also a product of the destructive distillation, at incandescent heats, of all organic substances. Thus, common coal-gas contains 40 per cent. or more of this gas as a proximate constituent.

Hydrogen is the lightest known gas, and of course, therefore, the least dense of all known substances. Air being 1, its density is 0.0693, but water being 1, its density is only 0.00008974. One cubic foot weighs 39.1545 grains, an equal volume of air weighing 565 grains; hence its use sometimes for filling balloons. Air is 14.43 times as heavy as hydrogen, and water is 11,143 times as heavy. The metallic mineral platiniridium, the heaviest known substance (sp. gr. = 23.), is over 256,000 times as heavy as hydrogen, the lightest. Pure hydrogen is colorless, inodorous, and tasteless. It is not directly poisonous when inhaled pure, death ensuing from mere absence of oxygen; but it should never be inhaled unless certainly pure, the contaminations that are incident to it being often highly poisonous, and several chemists having lost their lives through reckless experiments of this kind. A person breathing it speaks with a peculiar squeak. The great tenuity of hydrogen gas gives it a great penetrative or rapid *diffusive* power; many solid metals are even readily penetrated or permeated through their pores, iron being one of these. When there is an adhesive attraction—or, it may be, a feeble chemical affinity—between hydrogen and the metal, the former may become largely condensed in the pores of the latter. This condensation, called by Graham "occlusion," occurs with iron (as in meteoric iron), but much more notably with palladium, which Graham caused to condense and retain 600 or 700 times its volume of hydrogen, forming what he imagined to be of the nature of a metallic alloy; whence he believed hydrogen passed here into a *metallic* form, called by him "hydrogenium." Few chemists, however, have favored this hypothesis of hydrogenium. When soft iron is permeated by condensed hydrogen, its tenacity is greatly injured; and Klein and other chemists have obtained by voltaic precipitation iron otherwise chemically pure, but so largely impregnated with condensed hydrogen that it was as brittle as glass, and would take fire from a flame, and burn as if it were wet with alcohol, from the hydrogen expelled by the heat. Such iron becomes soft and malleable on losing its hydrogen. Iron wire often loses its tenacity when it is immersed in acid "pickle," to remove films of oxide, through the condensation of hydrogen in the substance of the metal; but the tenacity is said to return after a time, by reason of the spontaneous escape of the hydrogen.

Hydrogen, in its tendency to combine directly under normal pressures and temperatures with other elements, is almost as passive and inert as nitrogen; the only element towards which it manifests much activity being chlorine. With this it does not combine spontaneously in the dark, but light causes an immediate combination to form muriatic acid gas; and direct sunshine will even set up rapid and explosive combustion. When mixed with oxygen or air no combination takes place spontaneously, but contact with certain metals causes a condensation and combination, to form water, on the surfaces of such metals, developing heat; which may easily be so managed as to raise the metal to incandescence, and thus cause the gaseous mixture to kindle throughout, with explosion if confined. This phenomenon, discovered by Döbereiner, furnishes the principle of what is known as Döbereiner's "hydrogen lamp," in which a jet of hydrogen, generated in a self-regulating reservoir of that gas, may be emitted into the air, and the gaseous combustible mixture thus formed caused to impinge on a small mass of platinum in spongy form, which latter instantly becomes red hot and kindles

the hydrogen jet. Thus fire may be at any moment obtained. At temperatures higher than normal, hydrogen will combine with some other elements, as with sulphur at the boiling-point of the latter, to form sulphuretted hydrogen, and with bromine and iodine, at a red heat, to form the hydracids corresponding. Even with carbon, at the intense temperature of the voltaic arc, it was found by Berthelot that a tendency to direct combination was developed, one product being acetylene gas. There are other cases in which hydrogen appears to enter directly into combination—namely, when in the act of being evolved from water by the agency of a metal, or of electrolysis, or in what has been called the "nascent state." Under these conditions it will even manifest sufficient activity to decompose other existing combinations present in the liquid, and appropriate their elements. It will thus take up, for example, *arsenic* and *antimony*, and carry them along with itself in gaseous combinations. This is the principle on which is founded the well-known "Marsh's test" for arsenic and antimony, which is of such immense toxicological importance.

Henry Wurtz.

Hy'drogen, Peroxide of, called also **Bioxide, Binoxide, Dioxide,** and **Deutoxide of Hydrogen;** also **Oxygenated Water** [Fr. *eau oxygénée ;* Ger. *Wasserstoff Hyperoxyd, Säuerstoffwasser, Oxydirtes Wasser*]. It was discovered in 1818 by the French chemist Thenard. He found, when peroxide of barium, BaO_2, was added in the cold to dilute muriatic acid, HCl, instead of a decomposition, such as might have been anticipated, $BaO_2 + 2HCl = BaCl_2 + H_2O + O$—that is, the formation of neutral chloride of barium and water, with a setting free of the second equivalent of oxygen of the peroxide — that no oxygen appeared to be set free at all; and he was finally led to comprehend that the reaction is as follows: $BaO_2 + 2HCl = BaCl_2 + H_2O_2$, a new compound being formed, containing twice as much oxygen as water. By a long, complex, and laborious process of alternate purifications and concentrations Thenard finally obtained the hydrogen peroxide almost free from excess of water, and almost of the composition stated, containing 475 times its volume of oxygen over and above that of the water itself. Pelouze afterwards devised a simpler method, founded on the use of hydrofluoric or hydrofluosilicic acid (instead of hydrochloric), which acids precipitate the baryta at once in an insoluble form. The final concentration, for separation of intermixed water, is effected *in vacuo* over oil of vitriol, by reason of the fact that the new compound, though volatile without decomposition, is nevertheless less so than water itself. The resulting product is transparent and colorless, with a density = 1.452, nearly half as high again as water; not freezing at 22° F. below zero; tastes like tartar-emetic; and makes itching sores on the skin. It breaks up spontaneously at ordinary temperatures into water and free oxygen when pure, but the presence of acids makes it more stable, and that of alkalies less so. Cold preserves it. By suddenly heating it to the temperature of boiling water oxygen is evolved with explosive rapidity. Mere contact with certain substances, as charcoal, some metals, and some oxides, sets up more or less violent decomposition, often with strong evolution of heat. On many substances it acts as a most powerful oxidizer, converting them into their highest oxides. Among these are arsenious and sulphurous acids. Sulphide of lead becomes sulphate. Arsenic, molybdenum, chromium, and selenium are at once converted into their highest oxides. On the other hand, on another class of substances this peculiar compound actually operates as a powerful reducer, as on argentic and mercurous oxides, manganic and plumbic peroxides, chromic and permanganic acids; oxygen being evolved simultaneously from the oxide operated on and from the peroxide of hydrogen itself. Brodie first (in 1850), and Schönbein afterwards, proposed the view that in the cases in which peroxide of hydrogen and another oxide decompose each other, the two compounds contain oxygen in two different "allotropic" modifications, represented as positive and negative (+ and — oxygen), and that the ordinary molecule of oxygen set free was produced by the combination of these positive and negative molecules. Schönbein showed that the peroxide of hydrogen destroys ozone, and he viewed ozone as being the negative oxygen $\overset{-}{O}$, and the second equivalent of oxygen in peroxide of hydrogen as positive oxygen $\overset{+}{O}$, which he also called "antozone." These views may be regarded as still in controversy. Meidinger, and subsequently Schönbein, found hydrogen-peroxide in water that has undergone electrolysis. It has been found also to be formed in many cases of slow oxidation of moistened substances, such as metals. It bleaches indigo and decomposes iodide of potassium, with liberation of iodine, easily detectable by starch. It also decolorizes a solution of permanganate of potash by reduction. With chromic acid it forms perchromic acid; and one method of detecting it in a liquid is to add chromic acid and ether, whereupon the latter is colored bright blue by perchromic acid, in its presence.

The discoverer of peroxide of hydrogen, Thenard, proposed its use—after testing it personally—for restoring paintings which had become dim through the conversion of the white lead-carbonate used in the pigments to black sulphide of lead. The latter is at once converted by it into white lead-sulphate. Of late years it is stated that it has been largely sold, in France at least, for *bleaching living human hair*, in accordance with certain dictates of fashion.

Henry Wurtz.

Hydrogen, Phosphides of. See Phosphorus, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Hydrogen, Sulphides of. See Sulphur, by Prof. C. F. Chandler, Ph. D., M. D., LL.D.

Hydrog'raphy. Hydrography, a comparatively modern term, is derived from two Greek words, one of which signifies "water," and the other to "write" or to "describe." This science has for its object the measurement and description of all the surface-waters of the earth, together with their coasts and islands, in so far as they are important and useful for purposes of navigation and commerce. Hydrography embraces within its scope, therefore, marine surveying, the construction of marine charts, and the collection and publication, under various suitable forms, of all physical and other information tending in any manner to the perfecting of navigation.

Hydrography naturally divides itself into three grand and distinct branches — viz. Continental Hydrography, having for its object the measurement and investigation of the continental waters; Marine Hydrography, having for its object the ordinary measurement and description of the seas, coasts, and islands; and, lastly, Physical Hydrography, having for its object the determination of the winds, currents, variation, and many other things respecting the sea as a whole, which can only be discovered by the careful and laborious study of a vast number of observations, taken in all quarters of the globe.

The early history of hydrography, like that of many other of the arts and sciences, is involved in much obscurity. We know, however, that from the earliest times mariners have made use of charts; hence it may be said that hydrography is, in reality, as old as navigation. The charts of the ancients were of the rudest description, being mere sketches of the coasts, which were laid down according to roughly estimated distances; hence, in such of them as remain to us it is no unusual thing to find the coasts and islands represented at many times in excess of their actual extent. Owing to various causes, among which may be mentioned superstition, timidity, the lack of proper instruments for making observations and of proper ships for making extended voyages, the acquisition to hydrographic knowledge was, for many centuries, scarcely worth considering. Down to the time of Homer, who flourished 907 B. C., as little was known of the surface of the earth as is now known of the interior. Greece was then regarded as the centre of the earth, which was surrounded, at the distance of 500 miles, by the *Ocean River;* later, the land was extended farther, and a limited form given to the old continent. In the time of Pliny (about A. D. 80) the Mediterranean Sea was referred to as the centre of everything; and even as late as 1500 the pope gave to the king of Spain all countries to the West as an extended plain; the theory of the rotundity of the earth was treated as a heresy, and was not fully established until the completion of the first voyage of circumnavigation in 1522.

When, however, we consider that the mariner's compass was not introduced into Europe until about the twelfth century, that the chronometer was only invented in 1675, and reflecting instruments, for measuring angles, brought into use at somewhere near the same time, we can readily understand the backward state of hydrography at so late a period; and we are prepared to accept the date commonly given as the one when the first steps were taken towards its erection into a science; this was about 1440, when Henry the Navigator, a Portuguese prince, and son of King John I. of Portugal, founded an observatory at Sagres, in Algarve, near Cape St. Vincent, and by causing persons to be instructed in the science of navigation, by sending out numerous expeditions of discovery, by collecting hydrographic information from persons who had made noted voyages, and by constructing many marine charts worthy of the name, there laid the foundation for the science of hydrography. The charts in the time of Henry, though a great improvement over those of an earlier date, were yet rude and imperfect; the instruments for determining positions and measuring distances with accuracy had not yet come into existence; the log was unknown; and the astrolabe, a graduated ring with sights, was the only

instrument for taking altitudes. Henry, whom we may style the first hydrographer, died in 1463, and next to him, as a noted laborer in the science, came Christopher Columbus, who, after having obtained much hydrographic knowledge by study and an experience of many years at sea, became a maker and seller of marine charts. While engaged in this occupation he conceived his grand design of a voyage of discovery to the W., and in 1492 discovered America, thus extending the field for hydrographic research more, in a single voyage, than had the labors of all the preceding centuries. The way having been thus pointed out, voyages of discovery were prosecuted in every direction, and the increase in hydrographic knowledge was vast and rapid; but the formation of hydrography into an exact science, such as we find it at the present day, had scarcely yet begun. Founded upon mathematics and astronomy, and wrought out by means of many instruments of the utmost precision, the accuracy of hydrographic work is now limited only by the accuracy of the observer.

Pursuing further the events connected with the gradual development of the science of hydrography, we find many of them worthy of mention. Among the collections of the works of the French Academy of Sciences for the year 1692 may be found a memoir by Pothenot, having for its aim to fix the place occupied by an observer in relation to three other neighboring points, the positions of which are known; this is the famous three-point problem, the very foundation of marine surveying, and which, though thus early discovered, does not seem to have been put in practice until many years later. Camus, in his *Course of Mathematics*, in the year 1753, and Dalrymple, in a memoir published in 1771, recommended to navigators, for surveying upon the sea, the use of the circle and the observation of three points. To the French hydrographic engineers is due the credit of having first applied the theorem of Pothenot, and they made by it a great advance in hydrography. Alexander Dalrymple, as just mentioned, published in 1771 a memoir entitled *An Essay on the Most Commodious Modes of Marine Surveying;* this is considered as the first hydrographical work; and in it we find a description of the construction and adjustments of Hadley's quadrant. M. Beautemps-Beaupré, a celebrated French hydrographer, published at Paris in 1808 a work called *An Introduction to the Practice of Marine Surveying and the Construction of Sea-Charts, illustrated by thirty-four plates;* this is considered as the second hydrographical work. Other early writers upon hydrography were the Jesuits Ricciolus, De Charles, and Fournier, the latter of whom published in 1844 the *Manuel du Caboteur*. Cook, in the remarkable voyages which have immortalized his name, was the first to introduce the system of running surveying; his running surveys, however, were very defective, as they were based upon compass-bearings and other unreliable data; later followers of Cook improved upon his method by substituting astronomical for compass-bearings; but it was not until 1837, in the hydrographic surveys under M. Dumont d'Urville, that reliable running surveys were made, and the present mathematical system introduced. In 1823 the work of M. Beautemps-Beaupré was translated into English by Capt. Richard Copeland, R. N., and in his preface this officer writes: "At no period of our history has the attention of naval men been so generally directed to the study of hydrography as the present; yet this branch of nautical science has been hitherto so little cultivated that it is difficult to find officers qualified to undertake the duties of surveyors."

Although numberless discoveries had been effected, and vast additions made to the stock of hydrographic information, prior to the commencement of the present century, yet the great hydrographic works did not begin until that time. Then France reorganized her corps of hydrographic engineers, and began the survey of her coasts; and other maritime powers, in imitation of her, created special corps for hydrographic work, and the true hydrographic survey of the world began. For some time France took the lead in the now established science of hydrography, but her unfortunate political complications soon caused her to fall behind some of her rivals in the work, and the lead was taken, and has ever since been maintained, by England; which nation at the present time does more home and foreign hydrographic work in each year than does any other; and to her are we at this time indebted for by far the greater portion of all our foreign charts.

For about 300 years after the time of the discovery of America by Columbus the expeditions fitted out and sent abroad by maritime powers in the interests of hydrography, navigation, and commerce were more properly voyages of discovery, and they did not result in great and permanent additions to hydrography; the surveys made during these voyages were rough ones, and the charts rude in comparison with those of the present day. Of this nature were all the famous voyages completed up to 1791. At this time was fitted out the French expedition, under Rear-admiral d'Entrecasteaux, to go in search of La Pérouse. Writing of this expedition, M. Beautemps-Beaupré, who was the principal marine surveyor of it, says: "During the time which has elapsed between the time of the first attempt at bringing the art of navigation to perfection by means of reflecting instruments and chronometers, and the year 1791, many celebrated navigators have materially increased our knowledge of hydrography, and it has already become difficult to exceed the point at which they have arrived; every sea has been explored, and there remain no great discoveries to be made." He then goes on to state that the aim of the present expedition, in order that it might be of benefit to hydrography, navigation, etc., would be to give more accurate surveys and more detailed information of the various foreign places visited by it. Here, then, ended the era of reconnoissance, so to speak, and began the era of thorough hydrographical surveying; the discoverers were now succeeded by the surveyors, who hold the field up to the present time, and have yet a vast work before them, while the field for marine discovery has been almost exhausted.

The vast accumulation of hydrographic information by maritime powers led early to the establishment by them of hydrographic offices, where this information was taken in hand and wrought into marine charts, books of sailing-directions, and other practical shapes, for the benefit of navigation and commerce. These offices soon became, and have ever since continued, matters of prime concern to all governments having a marine, and they form a most important branch of the naval administration. Without her own efficient hydrographical establishment no maritime nation can feel perfectly independent respecting her commerce, nor respecting herself, in the event of foreign complications, for if she be largely dependent upon foreign hydrographical supplies, they are liable to be cut off at any time, thus creating serious delay and embarrassment. The largest, best appointed, and most important hydrographic offices in the world are those of England and France; these together publish charts and sailing-directions for every portion of the known world; they each issue about 3000 different charts, almost all of which are printed from engraved plates, and about 100 hydrographical works on various subjects. Both these offices are under the direction of naval officers of high rank and great ability in the special branch in which they are serving. The original surveys made by the French and English during each year are much greater in extent and more numerous than are those furnished by all the other maritime powers combined. The French have now in hand a complete survey of the coast of Brazil, besides many others in divers quarters of the globe. The English are constantly surveying all over the world, and produce many new and original charts each year, besides sending out many scientific expeditions in various fields. All the home surveys are worked up and converted into marine charts at the various hydrographic offices, as are also all foreign surveys which may come into their possession by exchange, tracing, etc. Here are written the sailing-directions, and hence issue the light-lists, notices to mariners, etc.

The U. S. support, at present, two hydrographical establishments—a regular Hydrographic Office and a Coast Survey Office. The former of these is of comparatively recent origin, having been founded only in 1866, yet already it issues many very important and valuable charts and works, derived, in great measure, from the U. S. exploring and surveying expeditions under Wilkes, Rodgers, Perry, Page, and others, and from numerous surveys by individual vessels in various quarters of the world. This office has now in hand, besides its regular office-work, the survey of Lower California and its gulf, the survey of an extensive belt across the Pacific, the running of a line of soundings across the Pacific, the survey of the Gulf coast of Mexico, and the telegraphic establishment of longitudes in the West Indies. It issues already some 600 charts of various kinds, and the most complete works and charts ever produced on physical hydrography. Besides the charts of its own issue, this office keeps constantly on hand some 20,000 English and many French charts for the use of our navy, and requires annually not less than 5000 foreign charts to supply deficiencies in this stock. Some 12,000 copies of its own charts, and many hundred copies of its works, are sold annually by this office, through its agents, to foreigners and to our mercantile marine.

The Coast Survey office was created many years ago for the purpose of executing the hydrography of the coasts and inland waters of the U. S., and it has made great progress in that work, which is the greatest hydrographical work ever undertaken by any country. This office does no foreign work whatever, being confined strictly to the home field; it issues about 700 charts and several hydrographical works, and keeps constantly employed a considerable sur-

veying force, both on our E. and W. coasts, making the most exact and elaborate surveys of any hydrographical establishment in the world.

To give some idea of the demand for charts and nautical books upon one of the older offices by navies and mercantile marines, it may be stated that during the year 1869 the English office alone sold 68,280 charts and 6918 books of sailing-directions, etc.; and even this large amount would fall very far short of an annual sale at this date.

By reason of the very perfect mail and telegraphic communication between countries at the present day, hydrographers are enabled to keep themselves thoroughly posted on all which takes place concerning the science in any quarter of the globe. All new surveys are published at once by the office of the country making the survey, and no new light is established, nor any rock, shoal, or danger discovered, that is not immediately announced in a notice from some one of the offices, and copied by all the rest; all the charts and plates affected by these notices are corrected at once; the notices are forwarded to all naval vessels in commission, that they may correct their charts, and the contents of the notices are further published in the leading papers, for the benefit of the merchant marine. There is a perfect system of exchange between all the hydrographic offices, so that all the publications of any one are known to all the rest as soon as they are issued.

Of the arts embraced within the scope of hydrography, the first and chief one is the art of marine surveying—an art which, it is said, may be traced back to the time of the Pharaohs—an art of very ancient origin, therefore, but nevertheless of very recent perfection. Marine surveys, according to circumstances, are conducted in two distinct manners. When the surveyor is fully supplied with all the necessary instruments, skilled assistants, etc., has ample time and perfect command over the territory which he is to survey, then he carries on a combined system of sea and shore observations, which should result in the production of an almost faultless work. On the other hand, when there is a lack of time, when a hostile coast is to be surveyed, or a coast of such a nature as to preclude the possibility of landing, then the surveyor must resort to the method known as running surveying, and make all his observations from afloat; this method, when skilfully and carefully executed, gives very reliable results, which, though deficient in details, are sufficient for the construction of charts for coasting purposes. The aim of the surveyor is to furnish such plans and other data as will suffice for the determination of the following particulars of the locality surveyed: tides, currents, depths, bottom, rocks, shoals, channels, anchorages, variation, latitude, longitude, landmarks, leading-marks, contour, and general topography of coasts. These particulars concerning a locality, being forwarded to the hydrographic office, are there taken in hand, carefully examined, verified, and finally constructed into a marine chart. A marine chart is a representation, by projection in plano, of a portion of water, with the land which it surrounds or by which it is surrounded. These charts give all the points of the compass, variation, meridians, parallels, coasts, capes, bays, islands, shoals, depths, channels, rocks, bottom, etc. in their proper positions and proportions. The Mercator projection, which represents all the meridians, parallels, and courses as straight lines, is the one commonly employed in the construction of marine charts, except in the high latitudes, where, owing to various causes, it becomes absolutely necessary to employ some one of the circular projections.

According to the use for which they are intended, marine charts are divided into three distinct classes—viz. general charts, coast charts, and harbor charts. The first class, or general charts, are usually constructed upon a small scale—that is, a small fraction of an inch to a degree of latitude. They furnish only general outlines, often cover whole oceans, and are used only for reference charts or for open off-shore navigation—say, to within 50 or 75 miles of a coast. The second class, or coast charts, are constructed upon such a scale, depending much upon the nature of the coast to be represented, as will enable a vessel to navigate by them clear up to the very entrances to the harbors thereon. The third class, or harbor charts, are upon a still larger scale, and by them the navigator is enabled to conduct his vessel through the most intricate channels of entrance, and bring her to the proper spot for anchoring in any well-surveyed harbor.

Most charts are printed from engraved copper or steel plates; some few are lithographed; and, by a process of photo-lithography of recent invention, we are now enabled to reproduce hundreds of copies of any foreign chart which we may desire in almost as short a space of time as would be required to print them had we the plates. The charts of the present day, issued from the leading hydrographic offices and covering exact surveys, are so perfect in topography, construction, and detail as to seem to leave nothing more to be added to them which would be of any aid or benefit to navigation.

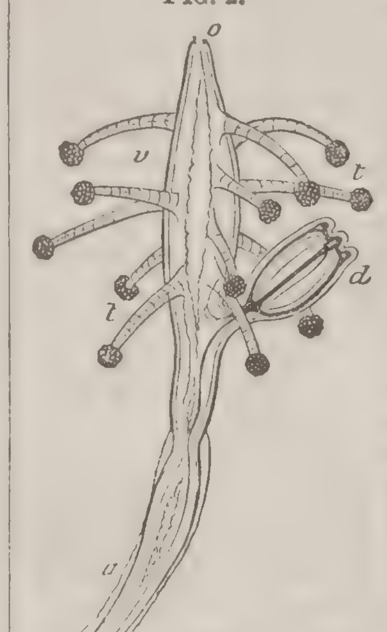
Such, in brief, is the history of the origin, rise, progress, and present state of the science of hydrography—a science which, except in its physical department, has reached at this time to such a state of perfection as to render it one of the most exact of all the sciences. GEORGE W. SUMNER.

Hydroi'da [Lat. *hydra;* Gr. ὕδρα, a "mythological monster," and εἶδος, "form"], one of the orders of Acalephs, remarkable for forming compound colonies, usually consisting of numerous individual zoöids of two or more distinct kinds, organically united together, one set of the zoöids being, in all cases, devoted to feeding the community, another to sexual reproduction. The feeding or hydriform zoöids are usually fixed, and originate from eggs produced by the reproductive or medusiform zoöids, which originate as buds from the former, and may either remain permanently attached to them or may finally become free-swimming medusæ (Figs. 2 and 3). The nutritive zoöids usually consist of a more or less swollen, oval, or fusiform body, changeable in form, containing a large digestive cavity, with a simple terminal orifice or mouth, and bearing externally a number of more or less slender tentacles, either scattered or in one or more circles. The tentacles are covered with peculiar minute stinging organs, known as thread-cells or "lasso-cells," for seizing and killing the minute animals upon which they prey. The body of these zoöids is usually supported upon a hollow stem (Fig. 2, *a*), which is usually covered with a chitinous, flexible sheath. It may be long or short, and is sometimes wanting; and then the body arises immediately from the creeping root-like tubes serving for the attachment of the colony to some solid support. The central tube of the stem communicates freely with the digestive cavity of the zoöids, and with those of the branches and basal tubes, so that all the zoöids of a colony are intimately connected. The nutritive fluid is circulated freely through the stems and branches by means of vibrating cilia that cover all the interior surfaces. There may be but one nutritive zoöid, but in most cases the primitive one, originating from the egg, very soon gives rise to buds, either from its stem or from hollow, stolon-like extensions of its base; and these may develop into other zoöids, like the first, thus producing more or less complex branching colonies, often consisting of hundreds, or even thousands, of zoöids. Such colonies often grow to the height of one or two feet on our sea-coasts, though the zoöids themselves may be very minute. The buds destined to form reproductive zoöids, or medusoids, are produced at certain seasons of the year, generally on particular parts of the body, stems, or root-fibres, the position varying according to the species. They start as hernia-like, hollow swellings, the cavity communicating with that of the stem or zoöid from which the bud arises. In some species (Figs. 2, 4) the medusoid buds arise directly from the nutritive zoöids; in others they arise from another kind of asexual zoöid (Fig. 6, *b*), usually destitute of mouth and stomach, and apparently destined for this particular office (*blastostyle*). The reproductive zoöids often develop into perfect medusæ (Figs. 3, 9), provided with tentacles, locomotive disk, proboscis, stomach, radiating and circular tubes, and sometimes with reproductive organs, even before they break away from the pedicels by which they were attached; but they commonly increase in size and perfection of parts after they become independent medusæ. In many species, however, the medusoid buds never develop a mouth, stomach, nor locomotive disk (Figs. 4, 5), and often neither tentacles nor radiating and circular tubes (Fig. 6, *d*, *e*), though these sometimes appear in a rudimentary state. Such medusoids, known as *sporosacs,* seldom become free, but develop their reproductive organs, either male or female, and produce embryos while still attached to the colony, after which they wither away and disappear. In one genus (*Dicoryne*) the sporosacs become detached, and swim about by means

FIG. 1.

Syncoryne mirabilis, with medusæ buds (Agassiz).

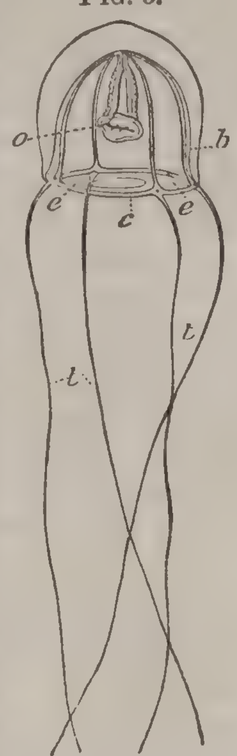
FIG. 2.



One of the zoöids of *S. mirabilis,* much enlarged: *o*, mouth; *v*, body; *t*, tentacles; *d*, a medusa bud not fully developed (Agassiz).

of the cilia that cover the whole surface. The free medusæ of hydroids often grow to large size after becoming free, in some species attaining the diameter of ten inches, while others never exceed a quarter of an inch. As a rule, large hydroid medusæ (*e. g. Zygodactyla, Lafoëa*) come from small and inconspicuous hydroid colonies, while those hydroids which produce large branching colonies, or which have large nutritive zoöids, generally give rise to minute fixed medusoids (sporosacs) or to small free medusæ (*e. g. Obelia, Sertularia, Eudendrium, Tubularia*). The free hydroid medusæ may be distinguished from those of the *Discophoræ* by the presence of a diaphragm-like membrane or *velum* (Fig. 3, *e*) partially closing the opening of the umbrella or bell-shaped disk; by the simple (rarely branched) radiating canals; by the existence of either colored ocelli or of spherical sense-organs (*lithocysts*), containing one or more hard granules, and attached to the margin of the umbrella (Fig. 9); and by the position of the reproductive organs, which are either situated between the outer and inner walls of the digestive cavity (Fig. 3), or else depend, in the form of purse-like lobes, from the lower side of the radiating canals (Fig. 9), and discharge their contents externally through a rupture of the outer wall. All the sexual zoöids of one colony are also usually of one sex, though a few exceptions to this occur (*e. g. Hydra, Diphasia*). The free medusæ of some species

FIG. 3.

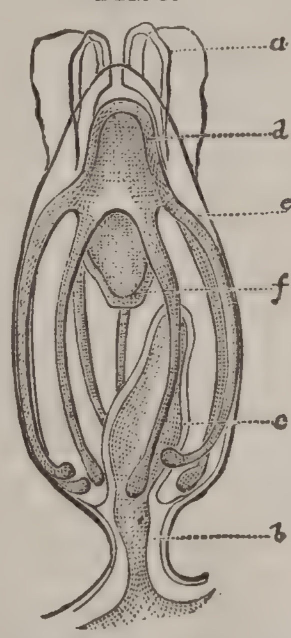


Mature free medusa of *S. mirabilis*: *o*, mouth; *b*, a radiating tube; *c*, circular tube; *e*, velum; *t*, tentacles (Agassiz).

FIG. 4.

Parypha crocea, one of the zoöids, with clusters of medusoid buds (sporosacs), about natural size (Agassiz).

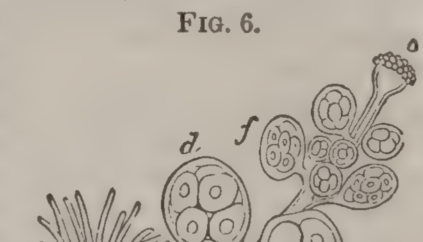
FIG. 5.



A female sporosac, much enlarged: *a*, tentacles; *b*, pedicel; *c*, spadix; *d*, body of embryo; *e*, tentacles; *f*, rudiment of stem of embryo (Agassiz).

of Hydroidea (*e. g. Lizzia, Dysmorphosa, Hybocodon*, etc.) in their turn produce medusæ-buds, which become detached and develop into medusæ similar to those from which they originated. In *Hybocodon* these buds arise from the base of the large solitary tentacle on the margin of the disk; in the two other genera named above they are produced on the sides of the digestive cavity or "proboscis." These buds may coexist with true ova in the same medusa. A few instances of reproduction by spontaneous division have been observed, both in the medusæ and in the nutritive zoöids.

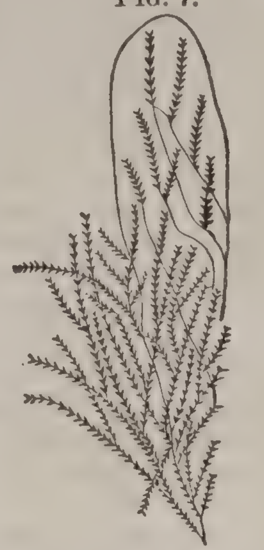
FIG. 6.



Hydractinia polyclina, part of female colony enlarged: *a*, nutritive zoöid; *b*, blastostyle; *c*, defensive zoöid; *d*, *e*, *f*, sporosacs or medusoid buds containing eggs in different stages of development (Agassiz).

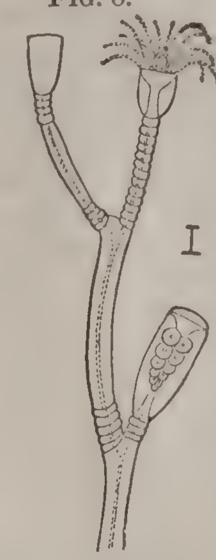
Two types of sexual reproduction have been observed. In most of the species the eggs, after fertilization by spermules, undergo complete segmentation and develop directly into round and somewhat elongated embryos (Fig. 10, *a*), which are covered externally with cilia, by means of which they swim actively about for a time; these young embryos are known as *planulæ*. They consist of an outer layer (*ectoderm*) made up of prismatic cells, and an inner layer (*endoderm*), of larger and more globular cells, which encloses

FIG. 7.



Sertularia pumila, on a sea-weed (Fucus), natural size.

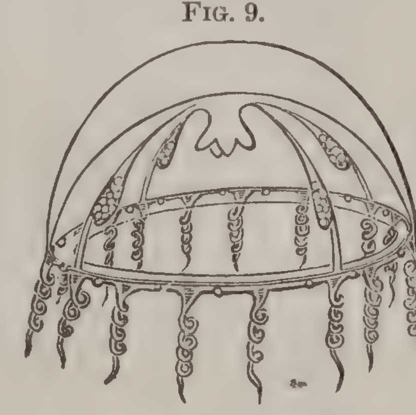
FIG. 8.



Obelia commissuralis, a gonotheca and two hydrothecæ, enlarged (Agassiz).

the central cavity. In this stage there is no external opening. The planulæ soon attach themselves to some object like a stone, shell, seaweed, or submerged timber, by one end, which rapidly enlarges (Fig. 10, *b*) into a flattened disk-like form; the cilia disappear at the same time; the upper end then begins to enlarge, and the intermediate portion becomes narrow and elongated to form a stem; very soon the upper end enlarges into a body, and develops a mouth at the end, and the central cavity becomes a stomach; at the same time tentacles grow out around the mouth, and a thin covering of chitinous matter is deposited over the stem and lower portion of the body (Fig. 11); so that the little hydroids begin to resemble the adult nutritive zoöids.

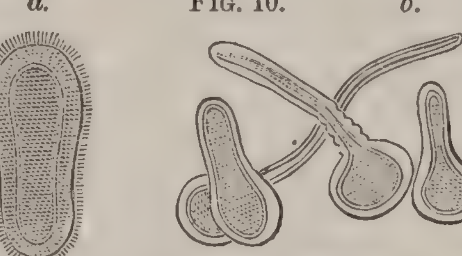
FIG. 9.



Clytia Johnstoni, the mature medusa, enlarged.

The second mode of sexual reproduction is only met with in *Tubularidæ, Hydra*, and a few other genera. In *Tubularidæ* the medusoids are small oval sporosacs (Figs. 4, 5), arising in clusters from the body just above the long tentacles. The *spadix* (Fig. 5, *c*) becomes surrounded by a cellular mass of germinal matter, from which, in the female, irregular egg-like masses are separated from time to time. Each mass soon flattens into a concave disk, which rapidly becomes angular, and then the angles elongate so that the form becomes star-shaped; the rays gradually elongate into tentacles (Fig. 5, *e*); the outer convex surface protrudes, and shows an internal cavity (*d*), and in some cases small oral tentacles grow out around the end; from the concave side a projection (*f*) is developed, which will ultimately form the stem. In this state the embryo hydroid (*actinula*) is discharged. It then swims about, and also creeps upon its tentacles, mouth downward; finally it attaches itself by the opposite end (*f*), which expands into a disk at the base, and elongates into a stem; a mouth and stomach are formed, and it then becomes a nutritive zoöid.

a. FIG. 10. *b.*



Embryos of *Melicertum campanula*: *a*, planula; *b*, embryos just attached, much enlarged (A. Agassiz).

The existing Hydroida may be divided into four principal sub-orders. The coral-forming species (*Millepora*) may constitute a fifth, but are little known. The extinct *Graptolites* probably represent a sixth sub-order.

I. The Thecophora (or Calyptoblastea), including the families Sertularidæ (Fig. 7), Campanularidæ (Figs. 8, 9), Plumularidæ, etc., are characterized by having all parts, except the upper portion of the zoöids, covered with a chitinous sheath; around the body of each zoöid this forms a protective calicle, into which the upper parts can be retracted when disturbed. In Plumularidæ there are also smaller cup-like calicles from which irregular processes of naked sarcode may be extended. The medusoid buds arise from a blastostyle enclosed within a chitinous capsule (*gonotheca*), which also serves to contain and protect

the buds until developed either into fixed sporosacs or free medusæ. The latter usually have reproductive organs (regarded as sporosacs by Allman) on the radiating tubes.

II. The Athecata (or Gymnoblastea), including Corynidæ (Figs. 1, 2, 3), Clavidæ, Hydractinidæ (Fig. 6), Tubularidæ (Figs. 4, 5), etc., usually have the root-fibres and stems covered with a chitinous sheath, but this does not form calicles around the nutritive zoöids, nor gonothecæ around the medusoid buds, which are naked, and become either sporosacs or free medusæ. The latter have their reproductive organs on the digestive cavity, and do not have lithocysts on the margin.

FIG. 11.

Young hydroids of *M. campanula*, much enlarged (A. Agassiz).

III. The Siphonophora, including Physalia (the "Portuguese man-of-war"), Velella, Porpita, etc., are very complex, free-swimming colonies, composed of many united hydroids. In these one or more of the zoöids becomes transformed into a floating apparatus, usually in the form of a vesicle or bladder filled with air; others are nutritive zoöids; others locomotive; and still others reproductive. Some species produce free medusæ, others fixed ones or sporosacs.

IV. The Gymnochroa, including only the fresh-water Hydræ, have the body naked and furnished with a sucking disk for voluntary adhesion at the posterior end. They can creep about, and also float free in the water. The reproductive zoöids are very simple sporosacs, arising from the sides of the body, both sexes often on the same hydra. The male sporosacs are conical bodies just below the tentacles; the female ones are irregular tuberculiform, and situated toward the base. The eggs develop into *actinulæ*, which become Hydræ. The ordinary buds arise from the sides of the *Hydra* as simple herniæ of the body-walls, but they soon elongate and develop a mouth, stomach, and tentacles like those of the parent; then the hollow pedicel by which they are united to the parent becomes constricted, and the young hydræ detach themselves, and soon become exactly like the first. The species of *Hydra* inhabit fresh water, and are noted for their wonderful powers of repairing injuries, restoring lost parts, and reproducing the entire body even from minute fragments. A. E. VERRILL.

Hydrom′eter [Gr. ὕδωρ, "water," and μέτρον, "measure;" Fr. *hydromètre*], **Aræometer,** or **Gravimeter,** an instrument consisting of three parts: (1) a graduated stem of uniform diameter and cross-section; (2) a bulb; (3) a counterpoise or ballast. On being placed in a liquid it sinks until a certain point on the scale is on a level with the surface of the liquid, and from the reading of the scale at that point the specific gravity of the liquid is either ascertained directly or by a simple calculation. The principle of the hydrometer is simply that of the law of floating bodies—viz. that when a body floats the weight of the bulk of liquid displaced is equivalent to the weight of the body floated. The bulb is put on in order that the instrument may float, and the counterpoise or ballast ensures its floating in an upright position. The stem is of small diameter, in order that small differences of specific gravities in liquids may show considerable differences on the scale. Hydrometers are usually of glass, though they are sometimes made of metal. Glass has the advantage of cleanliness, resistance to corrosion, incapability of fraudulent alteration except by an experienced worker in glass, and its facility of manufacture. Its fragility, however, is a point against it. Some of the first hydrometers constructed were made so that weights might be added to them, either in a pan at the top of the stem, or attached between the bulb and counterpoise, and therefore below the surface of the liquid. Fahrenheit's hydrometer is a sample of one having the pan at the top of the stem, to which weights may be added in order to sink the hydrometer to a certain mark. The hydrometers of Sikes and Dycas are hydrometers where the weights are added to the portion immersed in the liquid. The addition of weights in this way, by increasing the volume of the immersed portion, as well as the weight of the entire

Hydrometer.

hydrometer, however, introduces considerable complication into the instrument, and renders it difficult of accurate adjustment. The Sikes and Dycas instruments have, however, been used as standards in the British custom-house for a considerable period. The Dycas hydrometer was ordered by the U. S. Congress as the official instrument in 1790, and was still in use in 1844. This instrument possessed the advantage that by the addition of weights a considerable range might be given to the instrument. Nicholson's hydrometer is, like the preceding ones, of metal, and has not only a pan at the top of the stem for the reception of weights, but has also a pan just above the counterpoise for the reception of solids of which it may be desirable to determine the specific gravity. The majority of the hydrometers at present in use are invariable in size and weight, and are usually constructed of glass. Some of these are graduated, so as to read off directly in specific gravities. The hydrometers of Schmidt of Berlin, constructed carefully on mathematical principles, have given his name to some instruments made on this plan; but usually hydrometers made on this plan have not the name of any individual attached to them. Wilson's or Lovi's beads are a peculiar form of hydrometer (if a number of bodies can be spoken of in the singular number). They consist of a number of bead-like bulbs of glass, slightly differing from each other in weight or volume, each engraved with a number. On being thrown into a liquid, some float, while others sink, while the figures on the one which neither floats nor sinks, or barely floats or sinks, show the specific gravity of the liquid under examination. Most hydrometers are, however, constructed with an arbitrary scale, so that their readings contain no decimals. The Twaddell hydrometer is so graduated that the number of degrees indicated, multiplied by 5 and added to 1000, give the specific gravity of a liquid referred to water as 1000. The marine hydrometer for sea-water has a range of 40 degrees, the number of degrees indicating the third place of decimals in expressing specific gravities; thus, 5 degrees indicate a sp. gr. of 1.005; 22 degrees, of 1.022, etc. Hydrometers with an arbitrary scale are extensively used in certain manufactures or for testing the products of such manufactures, and are graduated with this object. Thus, that of Brix (sometimes called a saccharometer) is graduated so as to indicate at once the percentage of sugar in an aqueous solution. This is used by sugar-refiners on the Continent. Southworth's hydrometer, adopted some time since in the State of New York by act of the legislature, has the zero-point at the point to which the instrument sinks in proof spirits (50 vols. of alcohol to 50 of water), and the graduations above and below indicate the percentages above or below proof. The hydrometer of Gay-Lussac (also called alcoholometer) is graduated so that the readings give the percentage of alcohol by volume in an alcoholic solution, in which alone it is intended to be used. The temperature, which is an important factor in considering the indications of a hydrometer, is for Gay-Lussac's instrument, 15° C. or 59° F. A table of corrections for temperature has been published. The alcoholometer of Tralles is essentially the same as that of Gay-Lussac, but is intended for a temperature of 60° F. This is now the official instrument for testing alcoholic liquors in the U. S. Numerous other hydrometers for testing alcoholic liquids have been devised, among which may be mentioned Richter's, which reads in percentages by weight of alcohol; Meissner's, which has two scales, one giving percentages by weight, and the other by volume, etc. Dinacourt's galactometer is intended for use in testing samples of milk for watering. The 0 of the scale is at the point to which the instrument sinks in pure water; the 100, the point to which it sinks in pure milk, which ordinarily has a specific gravity of 1.029. The space between is divided into 100 equal parts, and the readings of the instrument show, with a close approximation to the truth, the amount of pure milk which the sample contains. The hydrometer of Balling is arbitrarily graduated, its indications being converted into specific gravities by the formula sp. gr. $= \frac{200}{200 \pm n}$, in which n represents the reading of the hydrometer, the + sign being used when the liquid is lighter than water, the − sign when it is heavier. This instrument is used by many manufacturers, dyers, etc. in England.

The instrument, however, which is most generally used, both here and abroad, is that of Baumé. Properly speaking, there are two instruments bearing the name of Baumé, the one for liquids lighter than water, the other for those heavier, and the scales do not correspond. For liquids lighter than water the zero-point is the point to which the instrument sinks in a solution containing 10 parts of common salt, by weight, in 90 of water, while the 10-mark is at the point to which the instrument sinks in pure water.

The space between is divided into ten parts, and the gradations are continued indefinitely. For liquids heavier than water the zero-point is the point to which the instrument sinks in pure water, and 15° is at the point to which it sinks in a solution containing 15 parts by weight of common salt in 85 of water. The space is divided into 15 parts, and the gradations are continued indefinitely downward. The first-mentioned instrument is called the *pèse esprit*, the latter the *pèse acide*. The formulæ for converting the readings into specific gravities are—

$$\left.\begin{array}{l}\text{For the pèse esprit, sp. gr.} = \dfrac{146}{136+x}\\[2ex] \text{For the pèse acide, sp. gr.} = \dfrac{152}{152-x}\end{array}\right\}$$

McCulloh, *Report on Hydrometers*, Pub. Doc. 50, 1848.

$$\left\{\begin{array}{l}\text{Sp. gr.} = \dfrac{144}{134+x}\\[2ex] \text{Sp. gr.} = \dfrac{144}{144-x}\end{array}\right\}$$

Gilpin, and *U. S. Disp.*

Numerous tables have been constructed by different scientific men, showing the specific gravities corresponding to the indications of the Baumé hydrometers. They differ somewhat among themselves, owing to the fact that the common salt used to standardize the instruments often contains impurities, which cause a slight difference in the indications. Moreover, the liquids used, in consequence of the attraction of the glass stem of the hydrometer, rise in a curve against it, so that it is difficult to determine the exact point which coincides with the level of the liquid, and errors of manufacture are thus introduced. The specific gravities corresponding to the indications of the Baumé and Beck hydrometers are given as follows (*Watts's Dict.*, vol. iii. pp. 209, 210):

Comparison of the Degrees of Baumé's Hydrometer with the real Specific Gravities of Liquids heavier than water, calculated by Gilpin's formula.

Degrees.	Specific gravity.	Degrees.	Specific gravity.	Degrees.	Specific gravity.	Degrees.	Specific gravity.
0	1.000	20	1.152	39	1.345	58	1.617
1	1.007	21	1.160	40	1.357	59	1.634
2	1.013	22	1.169	41	1.369	60	1.652
3	1.020	23	1.178	42	1.382	61	1.670
4	1.027	24	1.188	43	1.395	62	1.689
5	1.034	25	1.197	44	1.407	63	1.708
6	1.041	26	1.206	45	1.421	64	1.727
7	1.048	27	1.216	46	1.434	65	1.747
8	1.056	28	1.226	47	1.448	66	1.767
9	1.063	29	1.236	48	1.462	67	1.788
10	1.070	30	1.246	49	1.476	68	1.809
11	1.078	31	1.256	50	1.490	69	1.831
12	1.086	32	1.267	51	1.505	70	1.854
13	1.094	33	1.277	52	1.520	71	1.877
14	1.101	34	1.288	53	1.535	72	1.900
15	1.109	35	1.299	54	1.551	73	1.924
16	1.118	36	1.310	55	1.567	74	1.949
17	1.126	37	1.322	56	1.583	75	1.974
18	1.134	38	1.333	57	1.600	76	2.000
19	1.143						

Baumé's Hydrometer for Liquids lighter than Water, calculated by Gilpin's formula.

Degrees.	Specific gravity.	Degrees.	Specific gravity.	Degrees.	Specific gravity.	Degrees.	Specific gravity.
10	1.000	23	.918	36	.849	49	.789
11	0.993	24	.913	37	.844	50	.785
12	.986	25	.907	38	.839	51	.781
13	.980	26	.901	39	.834	52	.777
14	.973	27	.896	40	.830	53	.773
15	.967	28	.890	41	.825	54	.768
16	.960	29	.885	42	.820	55	.764
17	.954	30	.880	43	.816	56	.760
18	.948	31	.874	44	.811	57	.757
19	.942	32	.869	45	.807	58	.753
20	.936	33	.864	46	.802	59	.749
21	.930	34	.859	47	.798	60	.745
22	.924	35	.854	48	.794		

Table for converting degrees of Beck's Hydrometer into real Specific Gravities.

Degrees.	Specific gravity.		Degrees.	Specific gravity.		Degrees.	Specific gravity.	
	Greater than 1.000.	Less than 1.000.		Greater than 1.000.	Less than 1.000.		Greater than 1.000.	Less than 1.000.
1	1.006	.994	25	1.172	.872	48	1 393	.780
2	1.012	.988	26	1.181	.867	49	1.405	.776
3	1.018	.983	27	1.189	.863	50	1.417	.773
4	1.024	.977	28	1.197	.859	51	1.429	.769
5	1.030	.971	29	1.206	.854	52	1.441	.766
6	1.037	.966	30	1.214	.850	53	1.453	.762
7	1.043	.960	31	1.223	.846	54	1.466	.759
8	1.049	.955	32	1.232	.842	55	1.478	.756
9	1.056	.950	33	1.241	.837	56	1.491	.752
10	1.063	.944	34	1.250	.833	57	1.504	.749
11	1.069	.939	35	1.259	.829	58	1.518	.746
12	1.076	.934	36	1.268	.825	59	1.532	.742
13	1.083	.929	37	1.278	.821	60	1.546	.739
14	1.090	.924	38	1.288	.817	61	1.560	.736
15	1.097	.919	39	1.298	.813	62	1.574	.733
16	1.104	.914	40	1.308	.810	63	1.589	.730
17	1.111	.909	41	1.318	.806	64	1.604	.727
18	1.118	.904	42	1.328	.802	65	1.619	.723
19	1.126	.899	43	1.339	.798	66	1.635	.720
20	1.133	.895	44	1.349	.794	67	1.651	.717
21	1.141	.890	45	1.360	.791	68	1.667	.714
22	1.149	.885	46	1.371	.787	69	1.683	.711
23	1.157	.881	47	1.382	.783	70	1.700	.708
24	1.164	.876						

The Holland hydrometer is essentially the same as Baumé's, used, as its name implies, in Holland, where it is the official standard. The instrument of Cartier, adopted at one time by the French government, is essentially the same as that of Baumé. The 22°-mark of each is the same; for other points, either above or below, 15° of the Cartier scale correspond with 16° of the Baumé scale. The construction of this instrument was really an infringement upon Baumé, who was thereby deprived of the emoluments which he would otherwise have received had his instruments, instead of Cartier's, been adopted by the government.

Beck's hydrometer is one having the zero-point corresponding to a sp. gr. of 1, and 30 to sp. gr. 0.850, and the scale is extended by equal divisions both above and below 0. Several other hydrometers with arbitrary scales have been constructed, but as a general rule their use is so limited that a further enumeration of the instruments is unimportant.

Temperature naturally has a considerable effect on the indications of the hydrometer. All the above-mentioned instruments are intended to be used at the ordinary temperature, or about 60° F.

A hydrometer resembling a flute—in fact a graduated brass tube closed and loaded at one end—is described, under the name of *hydroscopium*, in a letter of Synesius to Hypatia, but Archimedes is claimed to be the real inventor. It was not introduced into general use, however, until the close of the seventeenth century. E. WALLER.

Hydrop'athy [Gr. ὕδωρ, "water," and παθεῖν, from πάσχειν, to "suffer"]. The numerous health institutions in the U. S. and other countries under the names of "water-cures," "hydropathic establishments," "hygienic institutes," and "hygeian homes," where invalids of all classes are treated by means of bathing, diet, exercise, and other hygienic agencies to the exclusion of all drug medicines, illustrate the extensive results that can often be traced to insignificant beginnings. The incident of a sprained wrist, and the instinctive application of water from an adjacent pump, originated an entire system of the healing art. Vincent Priessnitz, a German peasant of Silesia, being then thirteen years of age, sprained his wrist, and, finding that water allayed the pain and inflammation, followed the application with that of a wet cloth (*Umschlag*), from which also he received much benefit. Another accident, the crushing of his thumb, enabled him soon after to repeat the experiment of water-treatment with a similar result. But in this case the cure was attended with a rash on the skin, which he attributed to impurity of the blood, and at once conceived the idea that water favored the elimination of morbid matter from the system, and was therefore a purifying as well as a soothing agent. This rash was the origin of the idea of "crisis" which subsequently became an important feature in the hydropathic treatment of chronic diseases, although at the present time crises are regarded as accidental complications, rather than essential conditions, of the eliminating processes. In his nineteenth year Priessnitz met with an accident which fractured several ribs, and so displaced the bones that the surgeons found it difficult to replace them satisfactorily. But the sufferer was equal to the emergency. Leaning over a window-sill and inflating the lungs to the utmost, the ingenious patient succeeded in bringing the broken ends of the bones in juxtaposition. To alleviate the soreness and inflammation, Priessnitz applied his favorite wet bandage. This relieved, and was followed by another rash, which confirmed him in the theory that water was a powerful eliminating agent. In his intercourse with his neighbors Priessnitz naturally suggested the water-treatment to others in their various accidents and ailments, and acquired considerable reputation as a "water-doctor." But he soon learned that many severe and protracted chronic diseases required a more thorough and careful management and a stricter regimen than most persons were able or willing to attend to in connection with business and family cares at home. This observation induced him to open an institution where patients could have proper nursing facilities, and where the necessary discipline could be enjoined; and in 1839 the famous Gräfenberg water-cure began to receive patients—where, reducing his plan to something like order and system, a variety of baths, adapted to different cases and constitutions, was added to the remedial appliances. Among these

were the *Hin-tuch*, or rubbing wet sheet, the wet-sheet pack, the dry-blanket or sweating pack, the hip or *Sitz*-bath, the head-bath, foot-bath, douche, spray, plunge, wave, etc. baths.

Patients were soon attracted to Gräfenberg from nearly all parts of the civilized world, and the writings of Claridge, Scudamore, Johnson, Wilson, and Gully of England, Francke, Weiss, and Munde of Germany, and Henry C. Wright and Drs. Trall and Shew of the U. S., made the public familiar with the leading features of the system. It has been charged that some of the practice at Gräfenberg, in the application of cold water, water-drinking, and exercise, was too severe, especially for the feeble invalids suffering from nervous and dyspeptic affections. It would be very strange if, in the infancy of the system, such errors did not occur. But it is not true that his method was a "*cold* water-cure," nor that he treated all diseases with "water alone." He attached great importance to the auxiliaries of simplicity of diet, due exercise, a proper amount of sleep, and other hygienic influences. Priessnitz was suspected of using more or less medicine clandestinely, and on that suspicion he was arrested and imprisoned for practising medicine without a license; but as no medicine of any kind could be found by analyzing the water in which his patients were bathed and the sponges through which the patients drank while enveloped in the "pack," he was acquitted and released.

A hydropathic society was organized in London in 1842, and soon after institutions were opened at Malvern and other places in Great Britain. The system was introduced into the U. S. in 1843 by the writings of Drs. Trall and Shew. In the spring of 1844, Dr. Trall opened an institution in New York, and in the fall of the same year Dr. Shew opened another. In the spring of 1845, Dr. Shew opened an institution at Lebanon Springs, N. Y., in connection with David Campbell. In a few years thereafter there were 100 similar institutions in the country.

The entire literature of the system embraces about 100 volumes, the most popular and comprehensive of which are Dr. Trall's *Hydropathic Encyclopædia* and Dr. Shew's *Hydropathic Family Physician*. Of European works, the best known are *Francke on the Water-cure*, *Johnson's Hydropathy*, and *Gully on Chronic Diseases*. The *Water-Cure Journal* was started by Dr. Shew in 1844, and in 1845 transferred to Fowler & Wells, who continued its publication for twenty years. About 1873 S. R. Wells, who succeeded the firm of Fowler & Wells, commenced the publication of a monthly periodical entitled the *Science of Health*, on the plan of the original *Water-Cure Journal*, and intended to be an exponent of the system. But it must be observed that in the U. S. the term *hydropathy*, which literally means "water-disease," is generally regarded as a misnomer; and the majority of practitioners have adopted the term hygienic, for the reason that the system contemplates the treatment of diseases by means of all hygienic agencies, of which water is only one. They claim, too, that while in many cases—fevers and inflammations, for example—water may be the leading remedy, in other cases—dyspepsia, scrofula, plethora, etc.—diet, exercise, rest, or some other agency may be of much more relative importance than water. R. T. TRALL.

Hydroph'idæ [from ὕδωρ, "water," and ὄφις, "serpent"], a family of proteroglyph serpents (*i. e.* serpents with front teeth grooved to serve as canals for the contents of the poison-glands) distinguished by the compression of the caudal vertebræ and the extension of their neural spines and hypapophyses to serve as a basis for a compressed tail, which is adapted for swimming by propulsion from side to side. The serpents contained in this group are highly venomous, and are pre-eminently adapted for aquatic life. They are chiefly inhabitants of the East Indian seas, but one species is also found on the Pacific coast of Central America. They are generally beautifully colored, and may at once be recognized by their very compressed tail. Several genera and a number of species have been described.

THEODORE GILL.

Hy'drophile, or **Hydrophilidæ** [from *Hydrophilus*, "water-lover," one of the genera], a name given to various water-beetles, coleopterous insects often having oar-like legs for swimming purposes. They constitute a family, Hydrophilidæ, whose larvæ are carnivorous, while the perfect insects live on decaying vegetables. Thus they are important water-scavengers. The brown hydrophile (*Hydrophilus piceus*) is one of the largest European beetles.

Hydropho'bia (syns. *Water-dread, Rabies, Rabies canina, Rabies contagiosa, Lytta, Lyssa, Cynolyssa, Lyssa canina, Entasia lyssa, Hygrophobia, Aërophobia, Erethismus hydrophobia, Clonos hydrophobia, Pantophobia, Paraphobia, Phobodipsia, Pheugydron, Cynanthropia, Dyscataposis, Phrenitis latrans;* Fr. *Rage, Hydrophobie, Brachypotie, Mal de St. Hubert;* Ger. *Wuth der Hunde, Hundswuth, Hundtollheit, Wuthkrankheit, Wasserscheue;* Dutch, *Watervrees, Hondsdolheid;* Sp. *Rabia, Hidrofobia;* It. *Rabbia, Idrofobia;* Hung. *Dwhobeg, Kutyak dubossegek;* Polish, *Wscieklizna;* Roumanian, *Turbarea;* Turk. *Kùduz, Quoduozlyg, Keleb;* Arab. (pure) *Dā al kalab aw al khawf mia almā;* (Algiers) *Mkloub;* (Barbary) *Isith;* Dan. *Bandskrock;* Swed. *Wattenskrack;* Hind. *Bautānā kutta*), [from the Greek ὕδωρ, "water," and φόβος, "fear"] is a remarkable disease to which both the human species and probably all of the brute creation are subject. In examining its very interesting history we find that the Hebrew writers are altogether silent in regard to it, and we can discover only rare allusions to it among other authors previous to the Christian era. Such references, however, are sufficient to indicate that, although it may not have been so prevalent among the nations of antiquity as among those of more modern periods, yet it was in very ancient times recognized as a peculiar disorder infesting certain animals, and even man himself. The earliest distinct mention of the disease occurs in a Hindoo medical work of great antiquity—dating probably as far back as nine or ten centuries before Christ—written by a renowned physician named Susruta. It is observed therein that when dogs, jackals, foxes, wolves, bears, or tigers become rabid, they foam at the mouth, which remains open and from which flows saliva; their tails hang down; they do not hear or see well; they snap at and bite one another, and thus communicate the same malady. The symptoms of hydrophobia in human beings who have been bitten are likewise detailed briefly, and are said to terminate in convulsions and death. Scarification of the wound and burning it with boiling *ghee*—a sort of oil made from butter—are recommended, as well as various antidotes to be subsequently administered. This concise and remarkably accurate description of the affection, with suggestions for treatment, may be regarded as an epitome of all ancient and modern research upon the subject. The extract given can be found in Wise's *History of Medicine among the Hindoos*. Homer is supposed to allude to hydrophobia in the expression κύνα λυσσητῆρα of the *Iliad*, where Hector is compared to a raging dog. There are two passages in Hippocrates which appear to indicate that the physician of Cos had observed its characteristic symptoms in man, but failed to regard it otherwise than as a variety of idiopathic phrenitis. His contemporary, Democritus, however, who was a famous traveller, had probably encountered the disease in foreign regions, as he was evidently well acquainted with its most striking peculiarities. We are informed by the distinguished physician Cœlius Aurelianus that Democritus, in a treatise upon opisthotonos, had described the affection in the human subject, admitting its origin from the bite of rabid animals, but considering it simply as a form of tetanus. Theocritus and Plato refer to madness among wolves. Aristotle, in his *History of Animals*, remarks that dogs are afflicted with madness, quinsy, and gout; that the first renders them furious and inclined to bite other animals, which thereupon also become rabid; and that all animals except man are liable to be seized with and destroyed by the malady so engendered. Artemidorus and Gaius, who flourished some two centuries B. C., allude to the disease, the former locating it in the stomach, and the latter in the pneumogastric. Asclepiades, less than 100 years B. C., refers the chief cause of hydrophobia to irritation of the brain membranes.

In the early portion of the Christian era the allusions to this affection become more frequent. M. Artorius, the friend and medical attendant of Augustus, speaks of it in a treatise on the subject as being situated in the stomach. Gratius Faliscus, a poet of the same period, describes rabies in a work entitled the *Cynegeticon*. Virgil, in his *Georgics*, classes rabies among the distempers of cattle and sheep induced by a pestilential condition of the atmosphere. Ovid speaks of a rabid she-wolf and rabid centaurs (*rabidi Bimembres*), and Pliny of the bite of a mad dog. Ovid states, moreover, that hydrophobia and gout are incurable maladies, while Pliny advises a number of specifics for the prevention of the former. Horace employs the expression *rabies canis* in a figurative sense, applying it to the fierce heat of the dog-star, instead of using the ordinary phrase, *æstus caniculæ*. The disease is mentioned by Columella, a writer on husbandry in the first century, who alludes to an opinion common among shepherds that a dog may be ensured against rabies by biting off the last bone of its tail on the fortieth day after birth. This is still a popular superstition. Suetonius refers to wild animals affected with madness (*fera rabida*). Eumedes, a physician in the reign of Tiberius, makes some interesting observations upon the disease, remarking that even the shedding of tears will excite pharyngeal spasms in an affected person. Dioscorides, in the time of Nero, appears to be the first who claims to have actually observed and treated the disease. Both

he and Galen describe it as attacking animals and men, and agree in the opinion of its communicability from the former to the latter by contact of morbid saliva with the second skin. But Galen, and Celsus as well, concern themselves rather with the prevention and treatment of hydrophobia than with its history and progress. Their contemporary, Magnus of Ephesus, locates the affection in the stomach and diaphragm. According to Plutarch, it was not until the time of Pompey the Great that the rabific poison first began to manifest itself among human beings. Andreas of Caryste, a physician of the Alexandrian school, has left a work upon the disease, which he terms κυνόλυσσος. Cœlius Aurelianus, whom we have mentioned, a distinguished physician of the reign of Trajan or Hadrian, or perhaps as late as the fifth century, is the first to furnish an accurate detailed description of the affection in man, and of the various controversies regarding it. He mentions it as being endemic in Caria and Crete. He called it *passio hydrophobica*, and relates one instance of its occurrence in a seamstress who used her teeth to rip the cloak of a hydrophobic patient. About the same period the affection is treated of with more or less minuteness by Pedanius Dioscorides the Cilician, Claudius Ælianus, Claudius Galenus, Oribasius, and Vegetius Renatus. Ætius, a Mesopotamian doctor of the sixth century, is the first to furnish anything like an accurate description of rabies in dogs. A century later the physician Paulus Ægineta gives an excellent account of hydrophobia, dividing it into two varieties—viz. that arising from inoculation, always fatal, and that due to nervous irritability, capable of cure. A similar distinction is now sometimes made, particularly by French authors. Among the Arabian physicians, Yahia-ebn-Serapion, Rhazes, Africanus, and Avicenna mention the disease. Yahia-ebn-Serapion, who lived in the ninth century, expresses the opinion that the affection produced by the bite of a mad dog is incurable. Rhazes affirms that a certain hydrophobic man barked by night like a dog and died, and that another when he beheld water was seized with trembling, extreme terror, and rigors. Avicenna, at the commencement of the eleventh century, describes hydrophobia with considerable fulness, noticing several of its phenomena ignored by the Greek and Roman authors. He terms it simply *canis rabidi morsus*. Since the time of Paulus Ægineta we find the disease described by numerous European writers, the study of its symptomatology especially keeping pace with the general progress of medical science. In 1026 an outbreak of rabies among dogs is mentioned in the laws of Howel the Good. From that time it appears to have been well known in England, numerous specific remedies, charms, and incantations against it being recommended in old Anglo-Saxon manuscripts still extant. On the continent of Europe the modern history of rabies is obscure until the thirteenth century. One of the earliest reports of scientific interest refers to wolves afflicted with the disease in Franconia, Germany, in 1271, where more than thirty shepherds and peasants fell victims to their attacks. Since that period we find frequent mention of the affection as prevailing in an epizoötic form in almost every country of Europe, but more particularly in the wooded districts of Germany, Switzerland, and France, appearing to attack principally wolves, dogs, and foxes. Vulpine madness, however, was not noticed until the beginning of the present century in Europe, although it had appeared in the neighborhood of Boston, U. S., in 1768. In 1776 rabies made its first appearance in the French West Indies, and in 1785 it became extremely prevalent throughout the U. S., and since that time the disease in both animals and men has occupied a prominent place in our medical literature. It was unknown in South America until 1803, when it broke out in Peru. It has been recognized for centuries in Northern Africa, but its presence in Western and Southern Africa is denied upon the authority of distinguished travellers. In Asia its history, as we have seen, is very ancient. It has never appeared in Australia or New Zealand.

The popular belief that hydrophobia is in all animals characterized by an *abhorrence of water* was long since proved to be erroneous. The mad dog laps it eagerly, and will not hesitate to swim in it when it obstructs his course. In the case of man, however, the attempt to drink, or whatever is suggestive in any manner of that act, induces such dreadful spasms of the muscles of deglutition and respiration, with sense of suffocation, that a horror of fluids, even though associated with intolerable thirst, may be truly regarded as one of the most prominent and characteristic features of the disease. For these reasons a distinct term, *rabies*, has been employed by some writers to designate this affection as it prevails among the brute creation, the word *hydrophobia* being restricted to the disorder as manifested in man. Such a distinction is observed by Fleming, a recent English author, who has written certainly the best work upon the subject. Others have spoken of *rabies* in a universal sense, while endeavoring to abolish entirely the term *hydrophobia*. Numerous other more or less comprehensive terms have been proposed to distinguish the affection, but *hydrophobia* has continued, and will probably always continue, to be its most popular and general name among English-speaking nations.

Although the manifestations of hydrophobia are clearly modified by character, habit, and temperament in various species and varieties of animals, and even in individuals, it is undoubtedly the same disease in all, whatever its peculiar form or mode of origin and propagation. It is almost universally conceded that *the introduction of a specific virus, from a rabid animal, into the system, through either an actual wound, an abraded surface, or a delicate mucous membrane, is an essential preliminary to the development of this affection in man.* But its origin among brutes has always been, and still is, a subject of much discussion, and one worthy of our most serious consideration. Hydrophobia certainly infests, and by many is regarded as originating *de novo* among, certain Carnivora — viz. the dog, wolf, jackal, cat, skunk, and raccoon — while herbivorous and other creatures, including man, contract it by inoculation alone. Of the various conditions asserted as favoring its spontaneous development in the canine race, few have even a probable foundation. They are principally repressed sexual desire, extremes of atmospheric temperature, excitement of anger, want of water, and putrid or insufficient food. Ziegler fixes the origin of the disease in lack of the instinctive degree of nourishment from blood and flesh, and hence designates it *Blutdurst* and *Fleischgier*. Still another presumed influence is the presence under the dog's tongue of a worm-like appendage, whose extirpation in puppyhood is considered an infallible preventive of the disease. This idea may doubtless be referred to a very ancient myth. Pliny speaks of it, terming the peculiar appendage *lyssa*. The Germans term it *Tollwurm*, or worm of madness, and among them it has long been a popular superstition. The practice of removing this so-called worm still exists in Thrace, Turkey, Greece, Roumania, Moldo-Wallachia, Spain, and even in the Southern U. S. Its efficacy has been entirely disproved by scientific investigation, and the operation may be best characterized, in the expressive language of Dr. Johnson, as "a substance—nobody knows what, extracted—nobody knows why." The other presumed causes of spontaneous hydrophobia would appear to be equally equivocal. Unsatisfied salacity, putrid food, hunger, thirst, anger, and extremes of temperature are manifestly circumstances which obtain among dogs quite generally throughout the world. But in some regions abounding in dogs hydrophobia has always, so far as can be learned, been either totally unknown or extremely rare, while in others exempt from it for ages it has only recently appeared, and in most instances can be traced positively to importation. Such exemption has been particularly noticed in various islands throughout the world and in isolated localities. It is related that Mr. Meynell, the most eminent English sportsman of the last century, preserved his kennel of hounds from hydrophobia during many years by forcing every new dog to undergo a rigid quarantine of several months preparatory to his admission into the pack. There is little doubt that were the universal adoption of such a system of sequestration practicable, rabies would become extinguished.

Rabies canina prevails indifferently in all seasons, as the following figures prove most conclusively. They embody the large number of 2520 distinct and authentic cases observed in France, Italy, Austria, England, and the U. S. The foreign statistics refer almost exclusively to cases investigated by distinguished veterinary surgeons; those of our own country (101) are derived from a report on the subject by Dr. Blatchford to the American Medical Association in 1856. Of the 2520 cases, there occurred 704 in the spring, 621 in the summer, 608 in the autumn, and 587 in the winter. These figures demonstrate the absurdity of repressive laws designed to be in operation only in the dog-days, when the canine race is popularly supposed, as Mr. Mayo observes, to be afflicted with a sort of dog-lunacy, having the same relation to Sirius that human insanity has to the moon.

We must acknowledge our ignorance of any influences concerned in the spontaneous development of this disorder, and accept the theory of *its reproduction solely by inoculation from one animal to another.* Such certainly is the mode of its transmission *in the vast majority of instances;* and although it be urged that the disease must have sprung from a beginning, such argument when used with regard to any communicable affection can only remove us from the sphere of susceptible proof back to the confines of the mysterious and impenetrable domain of original causes. It seems quite well established that all creatures liable to con-

tract the disease are also in a greater or less degree competent to transmit it, and we know of no animals exempt from it. It is true that herbivorous and ruminating beasts, owing to the formation of their jaws and teeth, as well as to their seldom attempting to bite when rabid (sheep only excepted), rarely communicate the disease; and hence the belief, entertained for some time by such eminent men as Sir Astley Cooper and the veterinary professors Coleman and Renault, that the power to propagate the affection was confined to such animals as naturally employ their teeth for weapons of offence. The fallacy of this opinion has been proved by numerous unquestionable experiments, and it is now likewise conceded by the best authorities that the saliva of a hydrophobic human being is capable of inoculating the disease.

Among the various creatures subject to hydrophobia, the dog, on account of its intimate association with man, is not only our greatest source of danger, but it affords us the most frequent opportunities for observing the phenomena of this redoubtable affection. A knowledge of the disease, therefore, as manifested in the canine race is of vital importance in enabling us to recognize it promptly, and thus to escape the dreadful consequences of its communication to ourselves. Hydrophobia in the dog has been by some writers divided into two varieties, *dumb* and *furious* rabies, according as the animal is silent and undemonstrative or noisy and fierce. Other authors recognize still a third variety, which they term *tranquil* rabies, where the animal is quiet, indifferent, and unaggressive. These distinctions, however, are by no means clear, and are altogether denied by Virchow, who considers the different forms merely as prolonged conditions or stages which, according to him, are—1st, the stage of *melancholy;* 2d, the *irritable* and *furious;* 3d, the *paralytic* stage. It is often very difficult to detect the existence of rabies in its nascent state. This accounts for most cases of hydrophobia in persons inoculated by dogs supposed not to have been mad which died or were injudiciously destroyed before the full development of the disease. Fortunately, however, the disposition to bite is not apt to be exhibited until the affection is well established. The disease is first manifested by constant restlessness, uneasiness, and irritability of temper, the dog of fondling and sociable disposition becoming snarly, morose, and shy, retiring under pieces of furniture, into dark corners, or the interior of its kennel, but not remaining long in any one spot, and being continually engaged in licking, scratching, or rubbing some portion of its body. Costiveness and vomiting are often present. The appetite becomes depraved, such indigestible substances as bits of thread, hair, wood, glass, straw, and dung being swallowed by the animal, which also shows a propensity to lap its own urine and eat its own excrement. It grows quarrelsome towards its canine companions, and chases and worries the cat. The countenance undergoes a marked change; that of the docile and affectionate dog assumes an earnest, inquiring, appealing expression; that of the savage brute becomes the very picture of ferocity. In the early stages the animal's attachment for its master appears greatly exaggerated, and as long as it retains its consciousness it will refrain from injuring him. Two early and characteristic signs of rabies are a peculiar delirium, causing the animal to snap at imaginary objects in the air, and a remarkable alteration in its voice, the bark ending very abruptly and singularly in a howl a fifth, sixth, or eighth higher than at the commencement. Sometimes it will utter a hoarse inward bark, rising slightly in tone at the close. Common symptoms are strabismus and twitchings of the face. In a couple of days the animal begins to lose control of its voluntary muscles and experiences difficulty in eating and drinking. In the early stages frothy spume or slaver is generally seen dripping from its jaws, but this soon lessens in quantity and becomes thick and glutinous, adhering to the corners of the mouth and fauces, and causing intense desire to drink. In its eagerness to lap water the dog often overturns the vessel containing it. It is now insensible to pain—will munch burning coals or even mutilate itself without apparent suffering. It exhibits an inclination to escape from home, to which it will sometimes return after many hours of absence. It is restless and savage, wandering about, attacking imaginary objects or venting its fury upon real ones. If confined, it gives utterance to the peculiar bark and howl described. When at large, however, it gives forth no warning noise, but seems only determined upon a straightforward trot. If interfered with, and more especially if struck, it will wreak its vengeance on the offender, but will seldom, as a rule, go out of its way to do a mischief, and if pursued will generally endeavor to escape. This is not invariably the case, as a naturally ferocious dog is apt to hunt out its prey diligently, often attacking many animals and persons in its fearful course. It does not continue its progress long, but becomes exhausted, and moves with unsteady, tottering gait, drooping tail, head toward the ground, mouth open, and protruded tongue of a lead-blue color; finally paralysis ensues, first of the hind quarters and then of the whole body, which is promptly followed by death. The progress of canine rabies is rapid, and its termination almost always fatal. Its duration rarely exceeds ten days; the ordinary time is from four to six days. Nothing has been positively determined with regard to the interval elapsing between the receipt of the injury and the appearance of rabies in the dog and other animals. It seldom, however, exceeds six months.

The phenomena of rabies in the cat are gloominess of disposition, restlessness, tendency to bite and keep aloof, thirst, refusal of food, and sometimes depraved appetite. When the disease reaches the furious stage, the original tiger-like ferocity of the animal becomes predominant; it froths at the mouth; its eyes glare; its back is arched; its tail beats its flanks; its claws are rigidly protruded. If disturbed, it usually flies at the face. It soon gets haggard and emaciated, its voice sounds hoarse and sinister, and paralysis and death finally supervene. The wolf and fox, and in fact most wild Carnivora, when rabid become extremely audacious, taking to the fields and roads, entering towns, and without hesitation furiously attacking men, dogs, horses, herds, and flocks. They usually fly at the hands or face, and hence their wounds are much more frequently followed by inoculation than those of dogs, who are apt to snap at the legs, and from whose teeth the rabid saliva is often absorbed by the clothing. Renault, in a report to the Paris Academy of Medicine in 1852, presented statistics of 254 persons bitten by mad wolves, of whom 164 perished from hydrophobia; while, according to Niemeyer, of 145 persons bitten by rabid dogs in Würtemberg, only 28 contracted the disease. In the pig, horse, sheep, goat, and bovine species the general symptoms of rabies are very similar. They are manifestations of disagreeable sensations at the seat of injury, restlessness, irascibility, hallucinations, alteration in voice, salivation, exaltation of sexual desire, great susceptibility to external influences, loss of appetite, difficulty in swallowing, dilatation of pupil, congested eye, emaciation, and finally paralysis, coma, and death. The desire to bite is often exhibited in the pig, horse, and particularly the sheep. All have paroxysms of rage, during which they attack everything within reach with their natural weapons. Fowls manifest the disease by restlessness, excitability, mental delusions, and frenzied movements—finally staggering, convulsions, and paralysis. They are often aggressive, and sometimes endeavor to bite.

Hydrophobia in our own species possesses a deep and melancholy interest on account of the peculiarity of its mysterious and often prolonged latency, the horrible intensity of its paroxysms, and its irresistible fatality. The most venomous reptile or insect may inflict a wound for whose effects an antidote may be successfully administered, but the virus of the rabid animal, when once its insidious operation has begun, defies the most consummate therapeutical skill. When the rabific poison has been deposited within the body no extraordinary appearances succeed about the point of reception, which seems to heal and cicatrize entirely in a natural manner. At that spot, however, the virus remains *perdu*, until at some uncertain period it comes forth stealthily upon its deadly errand. Watson infers that it is shut up in a nodule of lymph, or detained in temporary and precarious union with some of the tissues, until liberated by an injury to the cicatrix or some constitutional disturbance. The duration of this union is no less variable in man than in the lower animals. According to Thamhayn's statistics of 220 cases of hydrophobia in the human subject (in *Schmidt's Jahrbücher*, 1859), the period of incubation in 202 instances ranged from three days to six months. In 145, or the large majority, it extended to from four to thirteen weeks. One occurred after four years, and another after five and a half years. Many other unquestionable cases of prolonged incubation have been recorded, and it is by no means improbable that the poison may, if undisturbed by causes such as those mentioned, remain latent until the occurrence of natural death.

About the year 1818, Dr. Marochetti, a Russian physician, announced that he had discovered in a number of cases which he had attended in the Ukraine characteristic phenomena never previously noticed. These consisted of pustules beneath the tongue, appearing ordinarily between three and nine days after the bite, and which contain the virus transmitted from the point of injury, their immediate destruction by cauterization being necessary in order to arrest the disease. Similar appearances, termed *lyssæ*, were said to exist in rabid dogs. This announcement created a great sensation in the medical world, but Marochetti's opinions were soon proven to be entirely erroneous, the so-called

pustules being simply enlarged mucous follicles caused by the disease.

One of the earliest symptoms is usually a tingling sensation at the cicatrix, which sometimes opens and discharges a thin ichorous fluid. In a short time the person grows dejected, morose, taciturn, restless, and irritable; he seeks solitude and shuns bright and sudden light. Within a period varying from a few hours to several days the more serious and characteristic symptoms are developed. The patient is sensible of a stiffness or tightness about the throat, and is troubled with some difficulty of swallowing, especially liquids. Deglutition soon becomes impossible unless attempted with the utmost resolution. The real paroxysms of the disease then supervene: they are either spontaneous or produced by anything suggestive in the slightest degree of the idea of drinking; they are preceded by chills and tremors. During these attacks sensations of stricture about the throat and chest are experienced; the respiration is painful and embarrassed, and interrupted with sighs and sobs; in fact, there occur terribly violent spasms of the muscles of the throat, almost intercepting the entrance of air into the trachea. In the intervals between the paroxysms the patient is sometimes calm and collected, retaining full consciousness and knowledge of his condition, but generally he exhibits more or less excitement and irregularity, and occasionally has fits like those of insanity. Frequently he is seized with a species of delirium; he seems to see about him swarms of flies; he converses with imaginary persons or fancies himself in the midst of perils. When suddenly addressed, however, his hallucinations are for a time dispelled. Occasionally, in some of his fits of violence he will attempt to bite his attendants, will roar, howl, curse, and endeavor to destroy anything in his reach. He often seems conscious of the approach of such attacks, and will beg to be restrained. Hyperæsthesia of the skin and acute sensibility of the nerves distributed to the other organs of the senses are usual. In some instances there is developed unwonted loquacity, and in others a singular increase of intelligence. The latter phenomenon is recorded in the *Gazette des Hôpitaux*, Aug. 27, 1854, as having been noticed in the case of a confirmed cretin, seventeen years old, suffering from hydrophobia. The paroxysms are sometimes attended with involuntary micturition, priapism, and seminal emissions. A very characteristic symptom is the copious secretion of a viscid, tenacious mucus in the fauces, which the patient constantly hawks up and spits out with vehemence in every direction, producing a sound sometimes imagined to resemble a dog's bark. The tongue is at first coated and red, afterwards dry and brown. Occasionally, there is vomiting of a "coffee-ground" fluid. The pulse is quick and excited, becoming very frequent and feeble before death. The urine is high-colored and scanty. It generally contains albumen, sometimes sugar. The temperature of the body is always elevated, which is coincident with rapid waste of tissue. Often within a few hours a plump and well-nourished patient grows shrunken and emaciated, and the face of youth is transformed into the shrivelled visage of old age. As the disease advances cerebral disorder becomes more and more marked. The eyes are staring, bloodshot, and always open, with frequently dilated pupil; the speech is abrupt, rapid, and incoherent, and at length there is confirmed delirium. Sometimes remissions occur, and the patient eats and even drinks—with great difficulty, however. Toward the end such a remission, with complete subsidence of agony and agitation, is not uncommon. But this relaxation is only a delusive calm, the prelude to dissolution, which is usually unattended with violent symptoms. Death ordinarily ensues from asphyxia. The duration of the disease is generally from two to five days. It has been known to terminate within twenty-four hours, four of such cases being recorded by Thamhayn, while in a case mentioned by Tardieu life was prolonged for nine days.

It is now quite generally admitted that although hydrophobia may be originally due to a blood-contamination, its action when developed is manifested exclusively through the nervous system, and principally that portion whose functions are governed by the medulla oblongata. In former times there was much diversity of opinion upon the character of this disease. Some eminent men believed it to be a *continued fever*, while others even went so far as to consider it a *putrid fever*. Some maintained its analogy to *yellow fever*, principally on account of the "coffee-ground" or black vomit occasionally observed. Boerhaave regarded it as an *inflammatory* affection, and this idea was generally accepted until the time of Cullen, who placed it in the class *Neurosis*, order *Spasmi*.

The autopsical appearances in both hydrophobic dogs and human beings are variable and non-distinctive. Bruckmüller, after the most careful autopsies of 375 rabid dogs during a period of twenty years, arrived at the conclusion that the evidence furnished by dissection is of no value in defining or distinguishing the disease, and is worthless as a foundation for any theory. In man the most careful examinations of those who have perished from hydrophobia have proved similarly inconclusive as to the pathogeny of the disease. In some instances the cerebrum, cerebellum, medulla oblongata, spinal cord, and eighth pair of nerves, in both origin and distribution, have been found apparently normal after the closest scrutiny with the naked eye as well as skilful microscopical investigation. It is true that congestion, effusion of lymph, and even softening, have occasionally been observed in portions of the brain, medulla, or cord, but these and all other lesions thus far discovered in the body can only be regarded as *results* of the dreadful disturbance in the nervous centres and respiratory and circulatory systems. The other morbid alterations noticed may be briefly mentioned as follows: great vascularity of the mucous membrane of the fauces and air-passages; intense pulmonary congestion; injection of the gastric vessels; sometimes ecchymoses and effusion of dark blood in the stomach. The whole blood is usually dark and grumous. There is apt to be more or less hyperæmia of all the parenchymatous organs. Autenreith, Brandreth, and Sallin have seen the nerves communicating with the cicatrix inflamed. Hallier has recently affirmed that he has discovered in the blood of hydrophobic animals a micococcus which when cultivated is transformed into a cryptogam, to which he gives the name *Lyssophyton*. The distinctive character, however, of these disease-germs remains to be established. The diseases with which hydrophobia in man may be confounded are tetanus and delirium tremens, and in dogs anthrax, epilepsy, and distemper. An enumeration of the distinctions between hydrophobia and these various affections would occupy more space than the limits of this article will permit. Suffice it to say, that to those who are acquainted with such disorders there can be little difficulty in the differential diagnosis. There is, moreover, a special hysterical or *mental hydrophobia*, as Trousseau named it, induced by emotion on seeing hydrophobic patients, through fear of the disease after having been bitten, or even in very nervous people from simply hearing the description of a case. In this spurious hydrophobia there is only difficulty in swallowing, and no convulsions, scantiness of urine, or elevation of temperature. It is very rarely fatal.

When once the rabific virus has declared its presence in the human system, all measures hitherto adopted would appear unavailing to arrest its course. It would be quite useless to mention the almost numberless "specifics" which have been proposed for the disease, and have been employed without success, from time immemorial. The fact is, that with our present knowledge the most satisfactory treatment after the disease has appeared consists in simply fulfilling rational indications—viz. by palliating the symptoms as far as possible, excluding all controllable causes of mental and physical disturbance, and supporting the powers of the system with stimulants and appropriate alimentation. There is no doubt, however, that we have at our command effectual *prophylactic* means for destroying the poison, provided they be employed within a reasonable time after the infliction of the injury. These precautions consist in the application of a ligature, if possible, to impede the circulation from the wound, in sucking the wound, and in its thorough cauterization, nitrate of silver being the most valuable agent; but if this be not available, the hot iron, a burning coal, potassa fusa, or almost any acid may be used. Mr. Youatt, the very best authority upon this subject, testified in 1830, before a committee of the British House of Commons, that he had been successful in arresting the inoculation of the virus by means of cauterization with nitrate of silver in some 400 human cases and in innumerable dogs—in his own person, moreover, as he had been very frequently wounded by rabid dogs, and once severely by a mad cat. CHARLES P. RUSSEL.

Hydrostat'ic Press, a machine much employed in the mechanic arts for producing great pressures. The pressure applied to a small piston or plunger is transmitted, through the medium of water, to a larger one, and increased in the same proportion in which the sectional area of the latter exceeds that of the former. Fig. 1 shows the main features of this machine. A is a very thick and strong cylinder, generally of cast iron. A broad flange surrounds its mouth, resting upon masonry. B is the plunger, with a water-tight packing at *f*. It carries the platform C, on which is placed the body to be submitted to pressure. E, a very strong plate confined by the uprights D D, receives and resists the pressure exerted by B. F is a shaft turned by a belt and pulley, which, by means of an eccentric, works the plunger G of the force-pump I. The force-pump and its accessories are shown on a larger scale at Fig. 2. I is the force-pump with its plunger G, working through a stuffing-box. The valve H opens during the up stroke of

the plunger G, and closes during its down stroke, preventing the water from being driven backward through the supply-pipe N. In like manner, the valve K is closed during the up stroke and opens during the down stroke of the plunger. The pipe O leads to the cylinder. L is a safety-valve so weighted that when the pressure becomes great enough to endanger the bursting of the cylinder, it allows the water to escape into the waste-pipe. M is a branch communicating with the waste-pipe. A cock in this pipe, upon being opened, allows the water to escape from the cylinder and the plunger to descend. The packing of the plunger consists of a cupped leather collar (Fig. 3). It is a channel-shaped collar encircling the plunger in a recess formed in the mouth of the cylinder, its open side being turned toward the chamber of the cylinder. The water entering it from the cylinder, and tending to escape on the opposite side, keeps it firmly pressed against the surface of the plunger. If the diameter of the plunger G be one inch, and that of the plunger B one foot, the area of the cross-section of the latter will be 144 times that of

FIG. 1.

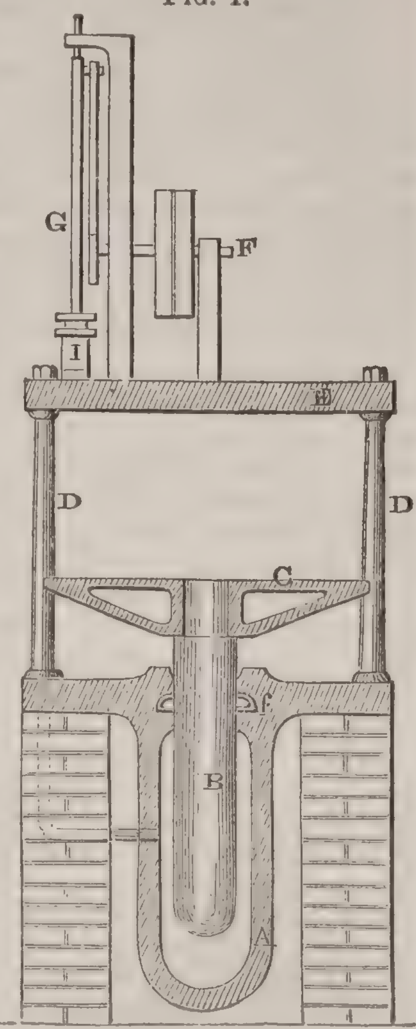


FIG. 2.

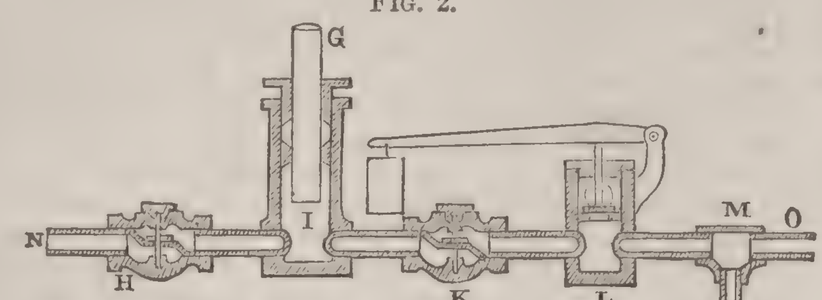
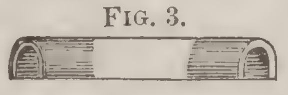


FIG. 3.



the former, and a pressure of 1 ton applied to G will exert a pressure of 144 tons upon B. About 10 per cent. of the power applied to B is absorbed by the friction of the packing collar. These are the essential parts of the hydraulic press, though in the different forms of the machine adapted to its numerous uses they occupy all conceivable positions with reference to one another. In presses for fixing car and other wheels upon their axles the cylinder is sometimes horizontal. In many machines the force-pump is worked by hand. J. P. FRIZELL.

Hydrostat'ics [Gr. ὕδωρ, "water," and στατική, "statics," from ἵστασθαι, to "stand"]. The term hydrostatics is used by most writers to mean the science which treats of the mechanical properties of fluids in a state of rest. A fluid is a body which offers no resistance to a change of form. Fluids are of two kinds: (1) elastic fluids, which may be compressed to any extent by a sufficient force, recovering their original volume upon the withdrawal of the force; (2) liquids which, though strictly speaking, admitting of slight compression, are for all practical purposes to be regarded as incompressible. In this treatise the term hydrostatics is restricted to liquids, of which water is taken as the representative, it being understood that whatever is affirmed of water is true, with certain modifications depending upon the weight, for any other liquid.

General Properties of Water.—As indicated above, water is slightly compressible. Its volume is diminished about $\frac{50}{1000000}$ by a pressure equal to that of the atmosphere, or 14.7 pounds per square inch, while the volume of air would be reduced one-half by the same pressure. Water is expansible by heat. Its exact weight per cubic foot depends upon its temperature. The accompanying table gives the weight of a cubic foot of pure water, corresponding to different temperatures by Fahrenheit's scale. The weight of a cubic foot of water at the temperature of maximum density is taken upon the authority of Rankine. The weights at other temperatures are computed by the aid of a table given in the *Transactions* of the Berlin Academy of Sciences for 1855, by G. Hagen, deduced by him from his own experiments, which were made with all the care and accuracy characterizing that distinguished investigator. It will be noticed that the density of water—*i. e.* its weight per cubic foot—increases from 32° up to 39° (in strictness, 39.1°), and thence diminishes up to the boiling-point. This temperature, 39.1°, is called the temperature of maximum density. For ordinary temperatures, and for calculations not requiring great exactness, the weight of water may be taken at $62\frac{1}{2}$ pounds, or 1000 ounces, per cubic foot. In what follows the weight will be assumed as that corresponding to a temperature of 60 degrees, being 62.37 pounds per cubic foot. Water expands about $\frac{1}{12}$ of its volume in freezing. A cubic foot of ice weighs 57.5 pounds.

Table of the Weight of a Cubic Foot of Pure Water at Different Temperatures.

Tem. Fahr.	Weight, lbs.	Tem. Fahr.	Weight, lbs.	Tem. Fahr.	Weight, lbs.	Tem. Fahr.	Weight, lbs.	Tem. Fahr.	Weight, lbs.
32	62.417	57	62.382	82	62.201	114	61.807	164	60.920
33	62.419	58	62.377	83	62.191	116	61.777	166	60.879
34	62.421	59	62.372	84	62.181	118	61.747	168	60.838
35	62.422	60	62.367	85	62.171	120	61.716	170	60.796
36	62.424	61	62.361	86	62.161	122	61.685	172	60.755
37	62.424	62	62.356	87	62.150	124	61.653	174	60.712
38	62.425	63	62.350	88	62.140	126	61.621	176	60.670
39	62.425	64	62.344	89	62.129	128	61.588	178	60.627
40	62.425	65	62.338	90	62.118	130	61.555	180	60.584
41	62.424	66	62.331	91	62.107	132	61.521	182	60.540
42	62.424	67	62.325	92	62.095	134	61.487	184	60.496
43	62.423	68	62.318	93	62.084	136	61.452	186	60.452
44	62.421	69	62.311	94	62.072	138	61.417	188	60.407
45	62.420	70	62.303	95	62.060	140	61.381	190	60.363
46	62.418	71	62.296	96	62.048	142	61.345	192	60.318
47	62.416	72	62.288	97	62.036	144	61.308	194	60.272
48	62.414	73	62.280	98	62.024	146	61.271	196	60.227
49	62.411	74	62.272	99	62.012	148	61.234	198	60.181
50	62.408	75	62.264	100	61.999	150	61.196	200	60.135
51	62.405	76	62.255	102	61.973	152	61.158	202	60.088
52	62.402	77	62.247	104	61.947	154	61.119	204	60.042
53	62.398	78	62.238	106	61.920	156	61.080	206	59.995
54	62.394	79	62.229	108	61.893	158	61.041	208	59.948
55	62.390	80	62.220	110	61.865	160	61.001	210	59.901
56	62.386	81	62.210	112	61.836	162	60.961	212	59.853

Pressure.—The condition of fluidity implies that the fluid particles move, with reference to one another, under the action of the slightest force; one consequence of which is, that a pressure applied at any part of a fluid mass acts at all parts of it and in all directions. If a vessel with a horizontal bottom be filled with water to a depth of one foot, every square foot of its bottom will sustain a pressure of 62.37 pounds; every square inch will sustain a pressure of $62.37 \div 144 = 0.433$ pound. Let Fig. 1 be a prismatic vessel containing water, A B the surface of the liquid, and C D a horizontal plane. The fluid immediately below this plane sustains a pressure in pounds per square inch of 0.433 time the height A C in feet. This is true not only of the vertical pressure, but also of that in every other direction. The fluid particles in the plane C D exert the above pressure against one another and against the sides of the vessel. The pressure now under consideration is that due to the weight of the water. If an additional pressure be applied to the surface, the pressure at any point within the vessel will be increased by the same number of pounds per square inch. Such an additional pressure is always present, consisting in the weight of the atmosphere, which in its ordinary state, at heights not far above the sea-level, exerts a pressure of 14.7 pounds per square inch. Thus, the absolute pressure at any point within a vessel is that due to the superincumbent water, increased by 14.7 pounds per square inch. Inasmuch, however, as the atmospheric pressure acts upon the outside of the vessel as well as the inside, it may, for most practical purposes, be neglected, and we may regard the pressure as that due to the weight of the liquid. The pressure at any point in a mass of water does not depend at all upon the form of the vessel containing it. This may be a prismatical vessel, as in Fig. 1, a vessel with a vertical tube (Fig. 2), with an inclined tube (Fig. 3), or an entirely irregular form (Fig. 4). In either case, if we neglect the weight of the atmosphere, the pres-

FIG. 1.

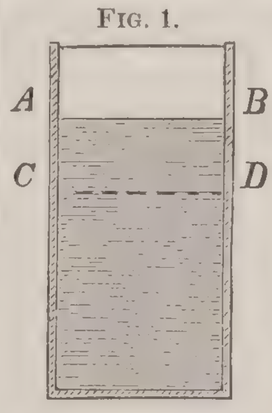


FIG. 2.

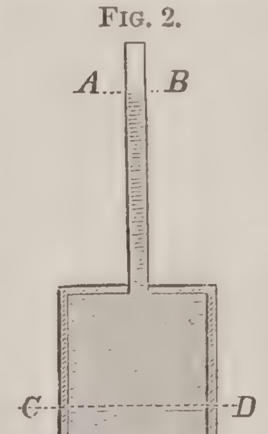
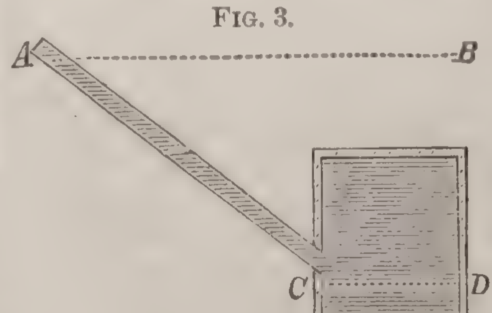
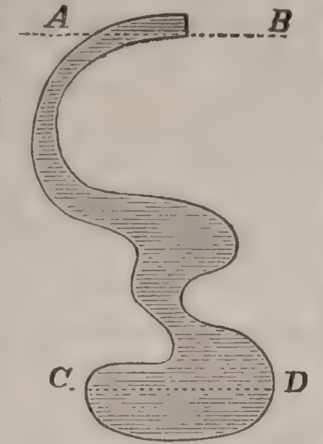


FIG. 3.



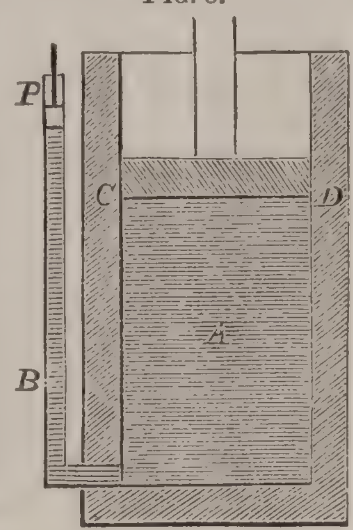
sure in any horizontal plane C D depends solely upon the vertical height from this plane to the horizontal plane A B of the surface. This vertical height is called the *head*. In most hydraulic calculations the pressure is designated as so many feet of head. Thus we say, a head of 10 feet, 20 feet, 100 feet, in preference to saying a pressure of 4.33, 8.66, 43.3, etc. pounds per square inch.

FIG. 4.



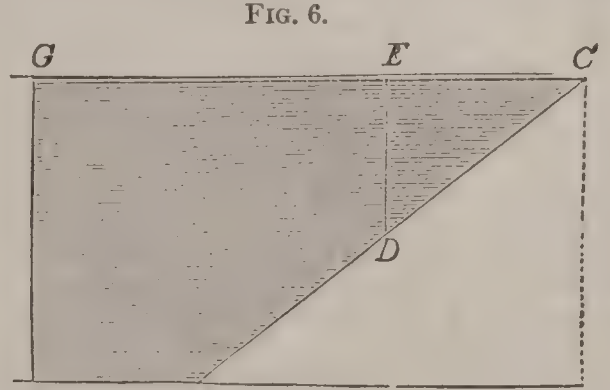
The foregoing considerations apply to vessels having free communication with the atmosphere. The pressure in confined vessels depends upon other conditions. In a steam-boiler, for instance, the pressure depends upon the tension of the steam, and this, again, upon the temperature. It is often convenient to reduce such pressures to an equivalent head of water by dividing the pressure in pounds per square inch by 2.3. Let B (Fig. 5) be a pipe communicating with the closed vessel A, both filled with water. Let P be a piston fitting closely in the tube B. Any pressure applied to this piston will be transmitted to all parts of the vessel A. If the area of the piston be 1 square inch, and the pressure applied to it be 10 pounds, the pressure at all points within the vessel A will be increased by 10 pounds per square inch. The aggregate pressure transmitted to the surface C D will be as many times 10 pounds as the surface contains square inches. If we suppose A to be a strong cylinder accurately bored, and C D to be a close-fitting piston capable of moving therein, we have a hydrostatic press, and may readily conceive what enormous pressures these machines are capable of exerting.

FIG. 5.



Pressures upon the Surfaces of Immersed Solids.—To find the pressure upon a horizontal immersed surface offers no difficulty. We simply multiply the area of the surface by the pressure due the head. Thus, the pressure upon a horizontal area 100 square inches in extent lying 10 feet below the surface of the water is $100 \times 10 \times 0.433 = 433$ pounds. When the given surface is vertical or inclined, however, the question is not so simple, the head being different upon different parts of the surface; and when the surface is bounded by curved lines, the operation becomes very complicated, involving the more intricate processes of mathematics. The general principle applicable to all plane surfaces, whether bounded by straight lines or curved lines, and whether vertical or inclined, is this: If we understand by *head* the depth of the centre of gravity of the surface below the surface of the water, the pressure may be found in the same way as for horizontal surfaces. For a plane surface partly immersed the centre of gravity of the immersed portion is to be used. The pressure so found is the normal pressure, or that perpendicular to the surface. In the case of an inclined surface, it is often necessary to find the pressure in a horizontal or vertical direction. Understanding the term *head* as above, the horizontal or vertical pressure upon an inclined plane is found by multiplying its horizontal or vertical projection by the pressure due the head. Thus, in Fig. 6, let A C represent the inclined face of a dam, D the

FIG. 6.



centre of gravity of the part under water, F A B the horizontal line of the bottom, C B a vertical line. Then, if A C represent the normal pressure upon the dam, C B will represent the pressure tending to shove it horizontally, and A B that tending to load it down. It will be noticed that the pressure tending to move an inclined dam is the same as for a vertical dam of equal height. The advantage of the former consists in the pressure tending to load it, which has the same effect as an increase of its weight. It must be observed that the pressure upon a weir or dam does not depend at all upon the extent of the body of water behind it. The pressure upon A C is the same whether the body of water confined by the dam is limited by a wall or surface at F G, or is practically unlimited in extent, as a great pond or lake.

Pressures upon Curved Surfaces.—In considering such pressures, the object usually is to find the resultant pressure, or that with which the fluid tends to give motion to the surface, or to resist its motion in some particular direction, usually horizontal or vertical. The pressure, for instance, tending to burst a water-pipe is not the entire pressure upon the curved surface of the pipe, but the pressure tending to separate one half the pipe from the opposite half, and is represented by the pressure which the same head would exert upon a plane whose width is the diameter of the pipe. The pressure acting upon a curved surface in any given horizontal direction is the same as would be exerted upon the projection of the surface on a vertical plane perpendicular to the given direction. The pressure upon a curved surface in a vertical direction is equal to the weight of the mass of water lying vertically above the surface. In finding, according to this principle, the upward pressure upon the lower surface of an immersed solid, we must for a moment regard it as a surface merely, not pertaining to a solid, and suppose the space between it and the surface of the water to be wholly occupied by water.

Weight Lost by Immersed Solids; Specific Gravity.—The upward pressure upon an immersed solid tends to raise it; the downward pressure tends to sink it. This latter is equal to the weight of the mass of water lying vertically above the upper surface. The excess of the upward over the downward pressure is evidently equal to the weight of the mass of water displaced by the solid. If the weight of the solid is less than this, it floats; if greater, it sinks. In either case, the weight lost by the body is equal to that of the mass of water displaced by it. This property is employed in determining the relation between the weight and volume of solid bodies. If we weigh a body in air, or, more strictly, in a vacuum, and again while suspended in water, the difference is the weight of a volume of water equal to that of the body. Dividing the entire weight of the body by the loss of weight in water, we have the ratio of the weight of the body to that of an equal volume of water. This ratio is called the *specific gravity* of the substance. A body lighter than water is immersed by attaching to it a body heavier than water whose weight and specific gravity are known. The weight of a volume of water equal to that of the lighter body is the loss of weight of the aggregate, less the loss of weight of the heavy body. A piece of dry pine, *e. g.*, weighs 27 pounds. It is attached to a piece of lead, sp. gr. 11.33, weighing 45 pounds. The aggregate weight in water is 8 pounds; loss of weight, 64 pounds; loss of weight of the lead, $45 \div 11.33 = 3.97$ pounds; loss of weight of the wood, or weight of equivalent bulk of water, $64 - 3.97 = 60.03$ pounds; sp. gr. $27 \div 60.03 = 0.4498$; weight per cubic foot, $62.37 \times 0.4498 = 28.05$ pounds.

Stability of Floating Bodies.—When a solid floats in water, it takes a position such that its centre of gravity is in the same vertical line with the centre of gravity of the fluid displaced by it. This position is called a position of rest or equilibrium. Most floating bodies have more than one position of rest. A position of rest is said to be stable when the body tends to return to it on being tilted or inclined; unstable, when it tends to rotate into another position. One body has more or less stability than another according as a greater or less inclination is necessary to overcome its tendency to return to its position of rest, and a greater or less force is necessary to produce that inclination. The theory of the stability of floating bodies is of the greatest importance in shipbuilding. Let G (Figs. 7 and 8)

FIG. 7.

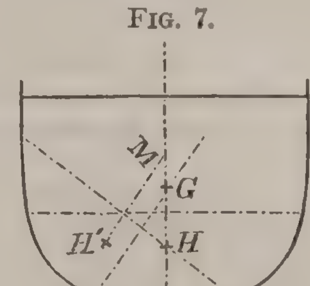
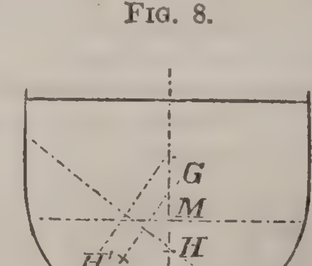


FIG. 8.



be the centre of gravity of a floating body; H the centre of gravity of the fluid displaced by it in its position of rest; H′ the corresponding point in an inclined position. A line H M drawn through H and G is vertical when the body is in its position of rest. In the inclined position H′ M is vertical. Two forces act upon the body: (1) its own weight, acting vertically downward through G; (2) the pressure of the water, acting vertically upward through H′. The direction of this latter force intersects the line H G in M. If M lies above G, as in Fig. 7, it is evident that the two

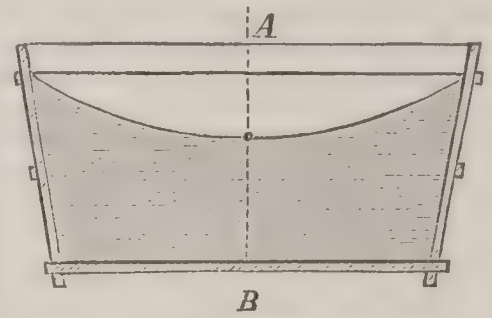
forces will tend to bring the body back to its position of rest; if below G, as in Fig. 8, they will cause it to recede farther from that position. When the body is in its position of rest, these forces act in the same line and have no tendency to cause rotation. The position of M, corresponding to a very slight inclination, is called the metacentre. A section of the body made by a plane coincident with the surface of the water, the body being in its position of rest, is called its plane of flotation. A floating body in rocking or oscillating always tends to revolve around a horizontal line drawn through the centre of gravity of its plane of flotation. The height of the metacentre above the centre of gravity of the displaced fluid is equal to the moment of inertia of the plane of flotation with reference to a horizontal line drawn through its centre of gravity, divided by the volume of the displaced fluid. The height of the metacentre above the centre of gravity of the body determines its degree of stability. That is to say, among all the positions of equilibrium which can be assumed by a body of given weight, it will have the greatest relative stability in that in which its metacentre is highest. The absolute stability of a very light body is but slight in any position, since the lighter the body the less the forces tending to restore it to its normal position when disturbed. Up to a certain point the stability of a floating body is increased by increasing its weight. It is for this reason that a vessel returning without cargo from a distant port is obliged to take on board a quantity of heavy material, usually sand, to give her what seamen call "stiffness." On the other hand, beyond a certain point an increase of weight diminishes the stability of a floating body. A homogeneous body when entirely submerged has no stability; it rests indifferently in any position.

Surface of Liquids.—It is a law of mechanics that the surface of a liquid in equilibrium under any forces whatever is, at any point, perpendicular to the resultant of the forces acting upon it at that point. When, as is commonly the case, the only force acting upon water of limited extent is gravity, its surface, so far as our senses can perceive, assumes the form of an exactly horizontal plane. In strictness, however, since gravity does not act in parallel lines, but in lines tending toward a common point—viz. the centre of the earth—no liquid surface is an exact plane, but forms a part of the surface of a vast sphere.

When water is contained in a vessel revolving around a vertical axis, its surface is acted on at any point by two forces—viz. gravity, acting vertically, and the centrifugal force, acting horizontally. The resultant force is neither horizontal nor vertical, but inclined, and the surface takes such a form that the resultant force is at all points perpendicular to it. A vertical section of the surface of water in a vessel (Fig. 9) revolving around the vertical axis A B, is the curve called a parabola. J. P. FRIZELL.

FIG. 9.

A



B

Hydrox'yl [Gr. ὕδωρ, "water," ὀξύς, "sharp," and *yl*, the acid radical termination], a univalent radical (OH) which in its chemical relations is analogous to chlorine, bromine, and iodine, and may be substituted in compounds for an atom of hydrogen or other monads. Water may be regarded as H.OH, analogous to HCl; potassic hydrate, K.OH, to KCl; baric hydrate, $Ba(OH)_2$, to $BaCl_2$. (See HYDRATES.) By the substitution of OH for H in hydrocarbons the alcohols are produced; marsh-gas, CH_4, yields methylic alcohol, CH_3OH; ethane, C_2H_6, yields ethylic (common) alcohol, C_2H_5OH; propane, C_3H_8, yields propenylic alcohol (glycerine), $C_3H_5(OH)_3$, etc.

C. F. CHANDLER.

Hyères, town of Southern France, in the department of Var. It is famous for its delicious climate, which seems to be an everlasting spring. Pop. 10,878.

Hygie'ia, in ancient mythology, the goddess of health, was a daughter of Æsculapius, and worshipped in connection with him. She is generally represented as a young girl feeding a serpent, the symbol of health, from a cup which she holds in her left hand, the serpent winding around the right arm.

Hy'giene, the science and art of preserving health and preventing disease. Coming directly from the French word *hygiène*, the term may be traced to the Greek ὑγιεινός, "healthy," Hygieia, the ancient goddess of health, being the daughter (some say the wife) of Æsculapius, the god of medicine. From the earliest times men must have observed somewhat of the favorable or unfavorable influences of the circumstances under which they lived. As an art, in its rude beginnings, hygiene must have preceded medicine, and even surgery. The early temples of Æsculapius, before Hippocrates, were *sanitaria* rather than medical schools. Hygieia was named, with other deities, in the oath which every physician was required to take as one of the Asclepiadæ: "By Apollo the physician, by Æsculapius, by Hygieia, Panacea, and all the gods and goddesses." Hippocrates wrote the first hygienic treatise now extant—on *Airs, Waters, and Places.* He therein pointed out the effects of climates and localities, not only upon health, but also upon the characters of races of men, anticipating at so early a date (400 B. C.) the conclusions arrived at in recent times by Montesquieu, Michelet, Guyot, and Buckle. Positive sanitary measures were probably first instituted by Acron of Crotona, of the school of Pythagoras, who is said to have dissipated the cause of a plague at Athens by means of fires burned in the streets. Empedocles afterwards found it possible to destroy or impede the action of malaria, in one instance by draining a swamp, and in another by building a high wall to protect an exposed town. Herodicus was so famous for his application of gymnastics to the improvement of health that Plato accused him of doing an ill service to the state by keeping alive people who ought to die, because, being valetudinarians, they cost more than they were worth to the community. The Spartans reversed this in their custom of exposing young children to the elements, whereby only those survived and grew up who were possessed of natural hardihood. Early writers upon the preservation of health were Philiston, Diocles, Plutarch, Celsus, Galen, Oribasius, Aëtius, and Paulus Ægineta. Ancient Rome showed an appreciation of sanitary art by extensive drainage of the base of the hills on which the city was built; by the immense sewer, *Cloaca Maxima*, of which a part is left, the oldest ruin in Europe, thirteen feet in diameter at the outlet; by the aqueducts; by suburban interments, whose number is still attested all along the Appian Way; and by the appointment of officers (*ædiles*) whose duty it was to inspect and regulate the construction, with a view to salubrity and safety, of all private and public buildings. In Egypt the great pyramid of Cheops has an arrangement showing an early recognition of the principles of ventilation applied to its interior chambers. Embalming the bodies of the dead, not only of men but of animals, however it may have been associated with religious ideas, is so well adapted to the prevention of insalubrity in a populous land with a tropical climate as to make it appear likely that it sprang, in part at least, from the sanitary sagacity of the priesthood. Since a resemblance is traceable in many particulars between the Mosaic ceremonial law and the usages of the ancient Egyptians, it is also likely that some measures for the preservation of health, prescribed in the Levitical code, corresponded with usages known to the Israelites while in the land of bondage. Moses, however, must have much extended the provisions required for the care of the health of his people. His regulations concerning food, ablutions, and other purifications, and segregation of persons having certain diseases, were precise and imperative.

All the most enlightened nations of antiquity held physical culture in high estimation. Socrates, the philosopher, was of powerful bodily frame. Plato also was a superior athlete, and so were Pericles and Alcibiades. It is not improbable that the intellectual supremacy of the Greeks was in some part owing to their sedulous care of the development of the *whole organization*, brain and body together. Archiaters (chief physicians) were appointed publicly by the Greeks for gratuitous attendance upon the poor. In most of the cities of ancient Greece public baths existed, for the poor as well as the rich. Rome also had, at one period, hundreds of private and public baths, some of which, as those of Caracalla, were palatial in grandeur. Although at first designed for health, these degenerated afterwards into effeminate luxuriousness, as the *gymnasia* did, at last, into the scenes of gladiatorial fights of men and beasts. Imitating the Greeks, the Roman emperor Antoninus Pius appointed public medical officers of towns, and Valentinian and Valens confirmed the privileges of the colleges of *archiatri populares* in the larger cities of the empire. Under the name of *medici condotti* such officers continued to be maintained in Italy down to the fifteenth century. About 1430 the emperor Sigismund created the offices of *meister arzt* in every chief city of Germany. Of this functionary the modern *Kreisphysicus* and *Stadtarzt* may be regarded as in some sort the successors. In the school of Salernum, in Italy, the oldest medical school of Europe, founded in the ninth century, instruction was given upon the prevention of diseases, as well as the preservation of health. That institution gave forth in the twelfth century a very remarkable treatise, the *Regimen Sanitatis Salernitanum*, a poem upon the maintenance of health, in "leonine" or rhyming Latin verses. Many of the precepts in this "Code of Saler-

num" are sound and good; some of them have passed into almost proverbial modern use. The institution of *quarantine* in the fourteenth century in Italy, to exclude the plague, was an event in the history of sanitary progress. From Florence this method of restriction of intercourse with infected places spread first to Venice and Sardinia, and afterwards throughout Europe. In America the first quarantine law was enacted under William Penn in 1700, at Philadelphia. (See QUARANTINE.)

England was somewhat later than Italy and Germany to advance in sanitary improvements, yet some quite early legislation was in this direction, as an ordinance in the reign of Edward II., forbidding the sale of "muzzled swine's flesh;" one under Richard II., to prevent the pollution of rivers, drains, etc.; and others during the times of Henry VI. and VII. and Elizabeth, for the inspection and cleansing of sewers, prohibiting the slaughtering of cattle in towns, and interdicting the overcrowding of dwellings. Jenner's introduction of vaccination for the prevention of smallpox is perhaps the greatest of all the triumphs of "preventive medicine," as sanitary science has sometimes been called. This event dates from 1798. (See VACCINATION.) But the benefits conferred upon mankind through the advance of knowledge in regard to the causes of disease and the conditions necessary for health, especially in communities, have been obvious, great, and numerous. In the time of the great medical author Sydenham (1624–87) the largest part of the mortality of London was produced by four diseases—plague, smallpox, scurvy, and dysentery. Of these, the first has long disappeared from Great Britain and the continent of Europe; the second has been, by prevention, shorn of most of its destructive power; the third is now seldom known except in places remote from civilized life; and the fourth is at least very much less mortal than formerly, especially in cities. Macaulay, in his *History of England*, estimated that the difference between London in the seventeenth and the same city in the nineteenth century is as great, in regard to mortality, as between that of the time of prevalence of epidemic cholera and that of ordinary years. In Constantinople, in 543 A. D., 10,000 people died daily during one season of plague alone; in 1665, 68,000 died of that disease in the city of London; in 1685, not a sickly year, the deaths in London were 1 in 20 of the inhabitants; now they average about 1 in 40. In France in 1772 the annual proportion of deaths was 1 in 25; in 1846, 1 in 45. The mean duration of life in the same country was, in 1806, 28½ years; now, 34½ years. At Geneva the mean probability of life in the sixteenth century was 8 or 9 years; in the seventeenth century, 13 to 14 years; in the eighteenth, about 30 years; in the nineteenth, 40 to 45 years. Life may be safely said to have been, on the average, prolonged 25 per cent. during the last fifty years. While improvements in medical and surgical practice no doubt have had their share in effecting this result, the greater part of this very important change must be ascribed to increased knowledge and appreciation of the laws of health. Yet much remains to be done before the ideal of perfect sanitation is attained. Yellow fever and cholera are still at times the deadly scourges of cities and of some other places; malarial fevers render certain localities almost uninhabitable; and the mortality of towns, especially with young children, continues to be far in excess of what it ought to be were the conditions of health properly maintained. The best hope of the sanitarian and philanthropist on this subject is that which is derived from the increased and increasing interest in all that concerns health, now prevailing in all civilized communities amongst educated men.

The modern literature of hygiene had its beginning chiefly in France. Boerhaave in Holland (1668–1738), Locke (1632–1704) in England, and Cullen (1712–90) in Scotland, had written upon physical culture and other sanitary subjects, but French writers first gave a definite form to the science. Prominent among those who have dealt with it in France have been Tourtelle, Hallé, Du Chatelet, Tardieu, Villermé, Fodéré, Cabanis, Boudin, Levy, and Motard. A comparatively early English writer upon personal health was Dr. Andrew Combe. Climatology has been ably treated of by Johnson, Martin, and Johnston. Public hygiene has had its later lights in Great Britain in Chadwick, Southwood, Smith, Simon, Letheby, Rumsey, Greenhow, and Florence Nightingale. On the general subject of hygiene must be added the names of Angus Smith, Parkes, Wilson, Mapother, Guy, Cameron, and Tilt. On the continent of Europe, outside of France, most noted as sanitarians have been Quetelet, Friedlander, Mühry, Casper, Hufeland, Thiersch, and Pettenkofer. In America, Dr. Benjamin Rush (1745–1813) wrote ably upon some sanitary subjects. The first American treatise on the *Elements of Hygiene* was that of Prof. Robley Dunglison, of which a second edition was published at Philadelphia in 1844. No second work with a similar title appeared until the issue of a *Treatise on Hygiene, etc.*, by Dr. W. A. Hammond, then surgeon-general of the U. S. army, in 1863. Dr. John Bell of Philadelphia wrote with much ability and learning on *Regimen and Longevity* (1842), and not long after on *Baths and Mineral Waters*. The number of authors upon subjects connected with personal and public health has latterly become so large that to name a few may seem invidious. It may be justly mentioned, however, that the late Drs. Forrey and Gouverneur Emerson wrote usefully upon climatology and vital statistics; the best treatise on mental hygiene yet published has been that of Dr. Isaac Ray; and the late Dr. Wilson Jewell of Philadelphia, the late Dr. George Derby of Boston, Drs. H. I. Bowditch, Jarvis, and Curtis of the latter city, Dr. Snow of Providence, R. I., the late Dr. J. H. Griscom, and also Drs. E. Harris, A. N. Bell, and others of New York, Dr. Barton of New Orleans, and the late Dr. Drake of Cincinnati, O., have contributed much by their labors to the progress of sanitary science. The oldest periodical published chiefly in the interest of the same class of subjects is the *Annales de Hygiène Publique*, issued now for many years at Paris. Amongst other journals at present in circulation are *Public Health* in London, and the *Sanitarian*, established in 1873 in New York. Associations devoted to hygienic investigations and to the promulgation of their results are the Epidemiological Society of London and the American Public Health Association. The latter was founded in 1872. The Social Science Associations, both of Great Britain and of the U. S., take cognizance of public health as constituting one of their leading departments. No subject has of late years advanced more rapidly in public interest, or in the actual development of practical knowledge concerning it.

A natural classification of the departments belonging to this branch of science is that into *Personal, Domestic*, and *Public Hygiene*. The second of these, however, may be merged into the two others. Connected also with public health is the hygiene of *encampments* (military or otherwise) and *maritime* (or naval) hygiene. Moreover, certain topics are necessary to be considered as affording facts, theoretical and practical, fundamental to the above departments; *e. g. Vital Statistics* and *Etiology*, or the causation of disease. Personal hygiene may either refer to adults or to persons of all ages and both sexes, or it may be considered especially in reference to children or to women. Most of its practical precepts, as well as its essential principles, are common to all human beings. We may therefore divide personal hygiene in a physiological manner, according to the functions of the body, thus: alimentation (food and drink); respiration, including all atmospheric influences; circulation of the blood; clothing; bathing; excretion; reproduction (sexual hygiene); exercise and muscular development; and cerebro-nervous (including mental) hygiene. Public hygiene embraces measures for the exclusion of certain causes of disease from communities, commonly named under quarantine, and the methods of preserving health by internal regulation and supervision, designated as sanitary police. The latter refers to the maintenance of cleanliness in streets, markets, dwellings, wharves, etc.; drainage and sewerage; abatement of nuisances; inspection of water and food supply; public vaccination; oversight of certain avocations in reference to health; and medical attendance upon the poor.

In the present article, considering personal hygiene chiefly, our space may be best occupied with a brief and summary statement of some of the most important conditions of health, in connection with the different functions, as well as with the causes of disease.

Alimentation.—Requisites in connection with food are, that material be furnished to supply the needs of the body for two purposes—(1) to form and repair its *tissues* or solid structures and fluid secretions for special uses; (2) to generate and maintain *force*, which is consumed in the *external* activities of the body and also in its *internal* functions—*i. e.* in external and internal *work*. The latter sort of work is exemplified by the propulsive contraction of the heart and the slower "*peristaltic*" movement of the stomach and intestines; also by the chemical manufacturing processes, from which result complex materials, such as the gastric juice, milk, etc. For *tissue-making*, food-substances must be obtained which contain the elements of which the body is composed (carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorus, iron, calcium, etc.); these must be in an organic state (vegetable or animal, not mineral, except salt), and of such consistence as to be broken up or crushed by the teeth and dissolved by the digestive fluids. The same kinds of materials avail also for *force*-food, the *amount* of force, as manifested in animal heat, muscle-power, nerve-force, growth-force, etc., being about equivalent to that which may be obtained from the *oxidation* of the same substances in ordinary combustion. For healthy alimentation

food must be taken in sufficient *quantities* at such *intervals* as will meet the waste of the body. It must also be eaten *slowly, chewed* thoroughly, and at a time of *repose* both of body and mind. Since the same ultimate elements exist, in nearly the same states of elaboration, in plants and in animals, it is sometimes asserted that vegetable food alone is necessary or advantageous to man. It may be admitted that men can, under favorable circumstances, exist through long periods without meat. This is shown in the instances of many tribes in Asia and Africa, who live almost entirely on rice and other grains, and also by many of the peasantry of continental Europe and the Scotch Highlanders, who are confined to a diet containing very little animal food. Yet it is equally true that men can exist on meat alone, as is done by the Indian riders of the South American pampas for months together, and by some impoverished dwellers by the sea, who live constantly on fish, as the Pecherais of Terra del Fuego, the poorer Norwegians, and also the Esquimaux and other natives of the frigid zone. The teeth and digestive organs of man, compared with those of other animals, show him to be adapted to a mixed diet. Experience shows, moreover, that, at least in the artificial circumstances of ordinary civilization, such a diet is the most favorable to the maintenance of full vigor in an active or laborious life. *Concentrated* diet is especially needful for those engaged in severe or protracted *brain-work.* Not more than one-fourth of the whole amount of food consumed ought to consist of animal substances. Nature's model food is milk, consisting of representatives of three classes of substances—(1) caseine and albumen, *nitrogenous* (*i. e.* containing carbon, hydrogen, oxygen, and nitrogen); sugar of milk or lactin, *saccharine* (non-nitrogenous, composed of carbon, hydrogen, and oxygen); and *fatty* substances (making butter); these last also being non-nitrogenous. It is an absolute rule in alimentation that with man and all the higher animals life can be sustained for a length of time only by a diet containing at least *two* of the above-named three classes of food-principles. Milk contains also saline ingredients (chloride of sodium, other chlorides, sulphates, phosphates, and carbonates); and these are requisite in certain proportions either in our solid food or in our drink.

Errors concerning diet are chiefly the following: (1) Eating too fast, thus promoting indigestion, which when chronic or habitual is termed dyspepsia; (2) excess in the amount of food taken; (3) insufficiency in amount or defect of quality for full nutrition; (4) unwholesome conditions of food—*e. g.* commencing putrefaction, or changes produced by disease in animals whose meat is eaten. Cooking our food aids digestion, extending the range of articles available for human diet, besides often giving a more agreeable flavor to things which we eat. Raw vegetables, as celery, lettuce, radishes, etc., and fruits in moderation, are wholesome. Raw meat *frozen,* and thus made tender, is so also. One danger attends the consumption of underdone meat—namely, that of thus receiving parasites into the body; in the case of beef, *Tænia,* the tapeworm; of pork, the more dangerous, sometimes fatal, *Trichina.* (See TRICHINA.) This danger is entirely obviated by thoroughly cooking meat. *Scurvy* is produced especially by long deprivation of *fresh vegetable food.* Captain Cook first ascertained this to be the mode of causation of this disease about 1770.

Condiments are articles used in diet in small amounts for seasoning, as salt, vinegar, pepper, mustard. Salt is needful as an ingredient in the blood and secretions of the body. Vinegar is innocent at least, when moderately used. Pepper and mustard are most serviceable in hot climates and for persons of weak digestion, especially in old age. For the stomach, as for other organs, it is a true principle that *all unnecessary stimulation involves a waste of force in proportion to the degree of excess.*

Water is indispensable to the sustenance of life. From 20 to 40 fluidounces of it, alone or in the form of some beverage, are needed by every adult daily, the greatest amount under active exercise or in warm weather. Its purity is of great importance. Excess of mineral ingredients (most commonly carbonate, sulphate, and chloride of calcium, making *hard* waters) may irritate the stomach and bowels. More injurious is excess of organic matter, as in rivers or wells poisoned by sewage, streams flowing through graveyards, etc. Typhoid fever, cholera, and other disorders are thus produced or promoted. A pure and abundant water-supply is one of the most essential requisites for every habitation, and, on a large scale, for every city. Filtration through charcoal and gravel will improve that which is defective; but if no good supply can be obtained from terrestrial sources, rain-water may be used. This also requires filtration when it passes through the air over a crowded city. Spring-water is mostly the best; well-water, free from contamination, is about equal to it. Wells for drinking-water should never be placed near privies, cess-pools, or barnyards. Artesian wells yield water free from organic matter, but often warm and containing an excess of mineral matter. Good drinking water should contain not more than 1.5 organic matter per gallon; total of solids, not more than 30 or 35 grains per gallon. Variation in the mineral constituents, so perceptible in many rivers (the Mississippi, Nile, and Ganges especially), does not necessarily render water unwholesome. The water of a large, deep river is more generally desirable than that of a small, shallow stream, as water grows purer as it flows by oxidation of impurities and deposition of sediments. Sea-water is absolutely undrinkable. At sea, sometimes *distillation* is resorted to for a supply. Distilled water is tasteless, but may be made more agreeable by agitation with the air.

On the subject of the effects of *stimulants,* weaker and stronger, as tea, coffee, cocoa, alcohol, etc., on health, reference must be made to the articles in this work treating of those substances. We may repeat, with emphasis, in connection with them, the important hygienic law, that all unnecessary or excessive stimulation involves a waste of force in proportion to the degree of excess above the level of natural, healthy action. Cocoa is scarcely to be called a stimulant; it is, for most persons, an entirely wholesome beverage. Black tea, in moderation, is innocent for all, and under the wear and tear of ordinary life an often useful means of refreshment. Coffee is too powerful an excitant of the heart and nervous centres to be beneficial to most persons as a daily drink. Its best place is that of a prop under special strain of muscular or mental fatigue. Arctic travellers and navigators find tea and coffee the best of stimulants under exposure to cold, wet, anxiety, and exhaustion. Alcohol has been and continues to be a subject of much contention. Avoiding extreme views, it may be stated that *during perfect health* it is *never necessary,* and *therefore never wholesome.* In great prostration from disease it is often the most valuable of supporting agents. States occur, also, between illness and full health, in which, under the judgment of physicians, dilute alcoholic beverages (ale, wine, etc.) may be employed in regulated quantities with advantage. No such article does good when it hurries the pulse, flushes the face, or disturbs the brain—*i. e.* acts as an inebriant narcotic. By actual observation, Drs. Parkes and B. W. Richardson, and Count Wollowicz, have proved that alcohol unnecessarily used consumes force by excessive action of the heart, reduces muscular strength, and lowers the bodily temperature. Excess causes subsequent depression, begetting a craving for renewal of the stimulation; and thus grows the *habit* of indulgence, with loss of power of the will to resist the increasing demand. Intemperance in this manner becomes a frequently incurable disease. (See METHOMANIA.)

Hygiene of Respiration.—On this extensive topic we can here remark but very briefly. The conditions necessary for healthy respiration are as follows: (1) Sound lungs and air-tubes; (2) muscular power and nerve-force; (3) pure atmosphere; (4) renewal of the air, including removal of the exhaled carbonic acid and organic matter, and a sufficient supply of oxygen. (See ATMOSPHERE, DISINFECTION, RESPIRATION, and VENTILATION.)

Clothing.—This must, for health, be—(1) sufficient; (2) not excessive in amount or pressure; (3) properly distributed over the body; (4) permeable to air and moisture; (5) changed frequently enough for cleanliness. Being insufficiently clad in cold weather is depressing to the system, inviting attacks of disease, especially of the organs within the chest. Wearing too much clothing makes the skin delicate and the whole body morbidly susceptible to changes of temperature. The order of warmth in materials is as follows: (1) furs and wool; (2) silk; (3) cotton, as muslin; (4) linen. In distribution over the body, the *chest* needs especial protection in winter and in cold climates, the *abdomen* in warm seasons and countries, and the feet in all times and places, unless near the tropics. Habit of course makes a difference in this respect with every one, but exposure never hardens any one, unless the system reacts at the time, so as to suffer no chilling or depression. It is needful in hygiene, as in constructive engineering, to keep within the limits of perfect recovery. Children should be at least as warmly clad as adults, since their power of resisting exposure is less than that of grown persons. Aged people also suffer more from cold than adolescents or those of middle age.

On *Bathing,* see the article on BATHS.

Excretion.—Health requires the constant or regularly periodic removal from the body of the results of waste of the tissues and combustion of material for the generation of force. These are analogous to the smoke and ashes of the locomotive-engine. By the lungs we excrete carbonic acid; other matters by the skin, kidneys, and large intestine. If either of these eliminative processes be arrested, disorder

must at once occur in the body; a continued interruption of either of them will be fatal. Insufficiency or irregularity in the action of the kidneys or bowels promotes or causes disease. Neglect of the proper action of the bowels is a frequent error, often bringing on habitual constipation. Evils connected with this, always endangered, though not always resulting, are—(1) irritation or inflammation of the bowels; (2) hernia or rupture, with possibly fatal strangulation; (3) irremediable obstruction of the bowels; (4) sympathetic disorder of other parts of the system, as the liver, brain, etc.; (5) blood-poisoning from non-excretion of effete putrefiable matter. To prevent constipation the most important measures are—sufficient daily exercise in the open air; a varied diet, including a moderate amount of fresh or dried fruit; bran bread; and, if these fail, rhubarb-root or some other laxative medicine.

Exercise.—Referring, for much that might be said on this head to GYMNASTICS, the most general statements are the following: Every organ, including the muscles, requires for its healthy development while growing, and afterwards for maintenance of vigor, these conditions: (1) a sufficient supply of blood of good nourishing quality; (2) innervation—*i. e.* a supply of nerve-force; (3) exercise, according to its function; (4) intervals of repose. Violent exercise is not conducive to health, because it tends to exhaust instead of adding to the strength, and also because it agitates the heart, sometimes, when often prolonged and repeated, producing morbid enlargement of that organ. Increase of strength follows exercise only when it is followed by *periods of rest sufficient to remove all the effects of fatigue*. Dr. Windship's rule has been never to exert himself up to the top of his capacity, and not to continue any very severe muscular efforts long at a time. Upon this principle, by frequent and considerable though still moderate daily exercise, the strength of most persons may be doubled in a few months. Invalids require to be very cautious in the amount of their exercise. Many cases of feeble health require absolute rest, or only passive exercise, as riding in a carriage, sailing, etc.

Sexual Hygiene is a subject not adapted to this work. *Mental Hygiene* is too extensive a topic to be embraced within the limits of the present article. The best treatise upon it is that of Dr. Isaac Ray (Boston, 1863). (See VITAL STATISTICS for facts of importance bearing upon hygiene; also, PUBLIC HEALTH and STATE MEDICINE.)

HENRY HARTSHORNE.

Hygi'nus, a name which occurs in Roman literature prefixed to a variety of treatises, most of which are now lost. Suetonius in his lives of distinguished grammarians has given a brief account of C. Julius Hyginus, whom he calls a freedman of Augustus and a Spaniard by birth, although, he adds, some consider him a native of Alexandria, and say that he was brought to Rome when a boy by Julius Cæsar. He studied under Cornelius Alexander, and was placed by Augustus over the library founded by him in the temple of Apollo on the Palatine Hill. He was an intimate friend of Ovid. Hyginus wrote scholia on the poems of Virgil and of Helvius Cinna; lives of illustrious men, a work similar to that of Cornelius Nepos, in at least six books; on the cities of Italy; on the gods, and on agriculture. These are all lost. To this writer also are assigned by some critics two works still extant—the first entitled *Fabularum liber*, containing 277 fabulæ, considered by some an extract from a work entitled *Genealogiæ* by C. J. Hyginus; and the second an astronomical treatise of the signs and constellations, interspersed with fables, in four books, entitled *Poeticôn Astronomicôn libri IV*. Many, however, regard these as of much later date than the time of Augustus. The best edition of the two works is in the *Auctores Mythographi Latini* of Van Staveren (Leyden, 1742, 4to). To a different writer, styled Hyginus Gromaticus by way of distinction, of the time of Trajan, are assigned several treatises on surveying and mensuration and a work on castrametation. The remains of the former treatises are collected in Lachmann's and Rudorff's *Gromatici Veteres* (vol. i., Berlin, 1848), and the work *De Munitionibus Castrorum* by C. C. L. Lange (Göttingen, 1848). (See, for the former writer, Teuffel's *Hist. Latin Lit.*, § 257; and for the latter, § 339.)

H. DRISLER.

Hyginus, SAINT, reckoned the ninth bishop of Rome, is thought to have been an Athenian philosopher at one time, and to have been bishop 139–142? A. D.; but very little is certainly known of his life.

Hygrom'etry [Gr. ὑγρός, "moist," and μέτρον, "measure"]. This term is applied to the measurement of the amount of vapor in the air. The atmosphere over every part of the earth contains a greater or less quantity of invisible vapor, which gives it the variable qualities denominated humidity, dryness, dampness, and aridity. As these are elements of climate, and as the human body is very much affected by these states of the air, the subject is one of much practical importance. Before speaking of the methods which have been devised for measuring the amount of vapor in the atmosphere, it will be necessary to say a few words in regard to the relation which exists between air and vapor. In former times it was supposed by the meteorologists that water in the form of vapor was dissolved in the atmosphere, and that it could hold in solution, at a given temperature, only a definite quantity, and when this quantity was present the air was said to be saturated. It was, however, proved by Mr. Dalton that vapor exists in the atmosphere in an almost independent state, its quantity depending, where water is present for its generation, entirely on the temperature. In studying this subject, Mr. Dalton placed two barometers near each other in the same vessel, containing mercury. One of these barometers was used as a standard, and into the other was introduced a small quantity of water, which ascended through the mercury up into the vacuum at the top of the column. A portion of this water immediately flashed into vapor, and by its elastic or expansive force depressed the column of mercury. The tube and its contents were then gradually heated through a series of degrees of the thermometer, and the diminution of the height of the column corresponding to each degree, as compared with the standard, was noted. At each increase of temperature a new portion of vapor was given off from the water, as shown by the diminution of the latter; which vapor, being forced into the same space, increased the density of that already existing, and consequently its elastic force, in accordance with the law of Marriotte; the elastic force, however, was also increased by the increase of temperature, and hence in the table formed from these experiments the increment of elastic force, or of tension of the vapor, as it is called, as measured by the depression of the mercury in the barometer-tube, was in a geometrical ratio, while that of the temperature was only in an arithmetical ratio. By making similar experiments with a small quantity of air, not sufficient to drive the mercury entirely from the tube, and forming a table of the increase of expansive force of the air for every degree of heat, and then allowing a small quantity of water to ascend through the mercurial column, a portion of this would spring into vapor less rapidly than before, and would occupy the interstices of the air, as it were, and, exerting its own elastic force, would depress the mercury an additional quantity to that due to the elasticity of the air. A new table being formed of the elastic force of this mixture for different degrees of the thermometer, and the corresponding figures of the table of elastic force of air subtracted from it, the result was found precisely the same as that given by vapor alone. Another point to be determined was the density or weight of a given volume of vapor of a liquid formed at a given temperature. For this purpose a large barometer-tube was employed by Gay-Lussac, and a known volume of water, contained in a bubble of very thin glass, was allowed to ascend to the top of the mercurial column, where, by a gentle increase of heat, the bubble was burst, in consequence of the more rapid expansion of the liquid than the glass. The water thus exposed was then converted into vapor by gradually increasing the heat, and at the moment the liquid entirely disappeared the elastic force was noted, and also the volume. By repeating this experiment with different quantities of water at different temperatures, a table of the density of vapor was formed. A table of this kind indicates the ratio of a given volume of the vapor to that of the same volume of air at the same pressure and temperature.

What we have given in the preceding is merely a general view of the process by which the elastic force and density of vapor at different temperatures existing over the water from which it is formed is determined. To form accurate tables exhibiting these relations requires more refined processes, especially such as have been used by Regnault of Paris, for which we must refer to the articles ELASTICITY, DENSITY, etc. Mr. Dalton inferred from his experiments that air and vapor are vacuums to each other—that an equal quantity of each may exist in the same space at the same time, each, however, exerting its own elastic pressure on the sides of the containing vessel. He also arrived at a similar conclusion in relation to the diffusion of different gases through each other, each acting as if it were a vacuum to the other, and repelling only its own atoms. This hypothesis is in accordance with the dynamic theory of heat, and also of the diffusion and elasticity of gases and vapors through each other. That the air is a vacuum to the vapor of water is true only in their statical condition, after time has been allowed for the diffusion of the latter through the former; during the process of diffusion a resistance has to be overcome, and the air itself is expanded.

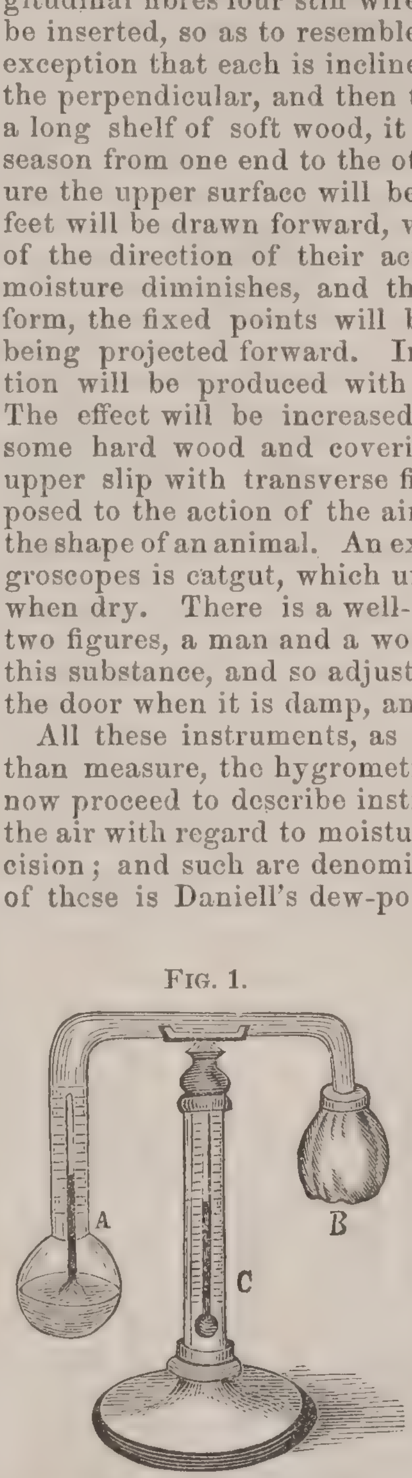
At no part of the surface of the earth is the air entirely devoid of moisture, and it is rarely at any point so charged with aqueous vapor as that the quantity is equal to that

which a given space could contain at the given temperature. This is owing to the prevalence of wind and the slow permeation of the air by vapor. If the air is entirely filled with vapor—that is, if there is as much vapor in it as the space can contain at that temperature—the slightest diminution of the temperature will cause a precipitation of the vapor in the form of dew or mist. If, for instance, at a higher temperature there be present not quite as much vapor as the space can contain at that temperature, then, if the air be cooled down only a few degrees, some of the vapor will be deposited in the liquid state. The temperature at which this takes place is called the *dew-point.* From this it is evident that if the quantity of vapor in the air at its existing temperature be great, the dew-point will be high. All substances exposed to the air will be affected by the deposition of moisture when the dew-point is reached, but many substances will be affected long before this takes place; our bodies, for instance, will experience dampness, although the vapor of the air is far above the dew-point. On the other hand, if the temperature be far above that of the deposition of moisture, the air will have a condition of dryness. From these facts it may be inferred that the sense of dryness or dampness does not depend upon the absolute amount of aqueous vapor present in a given quantity of air. If the temperature be very low, although the air does not contain much vapor, yet this may approach very near to the maximum amount which the space can contain at that temperature, and being near the point of precipitation, it will have the characteristics of wetness. If the same mixture of air and vapor be heated up many degrees, the vapor will represent only a small fraction of the amount which can be retained at the higher temperature, and hence the air will feel very dry. In a space saturated with vapor, water ceases to evaporate; and conversely, in a space where there is little vapor in relation to the temperature, water evaporates rapidly. The condition of dryness or dampness of the air is expressed numerically by the conception of relative humidity which is the fraction expressing the ratio between the tension (that is, elastic force) of vapor actually present in the air at a given temperature, and that of the greatest amount of vapor which it can contain at that temperature. The amount representing complete saturation is generally indicated as 100, and on this principle 40, 50, 30, etc. will denote that the air contains 40, 50, or 30 per cent. of the maximum amount which can be contained at that temperature.

We shall now proceed to describe various instruments made use of in hygrometry. For determining the relative dryness or dampness of the air various modes and instruments have been employed: most of the latter in use previous to the experiments of Mr. Dalton would more appropriately be denominated hygroscopes than hygrometers. They consist principally of three different classes: 1st, those composed of substances which are augmented or diminished in weight by a change in the humidity of the air; 2d, those of substances which increase or diminish in volume; and 3d, those of substances which twist or untwist by changes of moisture. Of the first class are sulphuric acid; various deliquescent salts, such as the chlorate of potassa, sulphate of soda, and nitrate and chlorate of lime; sponges, paper, etc. A given weight of these substances being suspended from one end of the beam of a balance, counterpoised at the other by a weight, so that the beam will be horizontal when the substance is in a state of extreme dryness, or, in the case of sulphuric acid, in the condition of a given degree of density, by an increase in the moisture of the air the weighted end of the beam rises, and by an index indicates the change in the moisture of the atmosphere. All the instruments of this kind are affected by temperature, as well as by the moisture of the air. The amount of water absorbed by sulphuric acid is less at a high temperature, and the affinity of all substances for moisture varies with the temperature. Hygroscopes of the second class, those that depend upon change of volume of bodies, consist chiefly of hair, of threads of silk, of linen, of hemp cords, of goldbeaters' skin, of slips of whalebone, of ivory, and of wood. The most celebrated of these is that of the hygroscope of Saussure, which consists of a human hair deprived of grease by boiling it in a weak solution of carbonate of soda. This, being fixed at its upper end, is stretched by a small weight after passing round a delicate pulley to which a hand is attached; by an increase of moisture the hair expands, the weight at the other end descends, and the pulley turns, giving motion to the hand or pointer, which indicates the degree of moisture by pointing to the division on a graduated arc. This instrument is graduated experimentally by placing it in air which has been dried by sulphuric acid, and afterward in a vessel saturated with moisture; the extreme positions of the pointer in these two conditions is divided into 100 parts called degrees. In using the instrument a correction must be applied for temperature, which is also ascertained by direct experiment. A simple hygroscope which will serve to indicate a greater or less degree of humidity is formed by a long fishing-line (previously boiled in a weak solution of carbonate of soda), fastened at one end and passed backward and forward along a corridor over pulleys, with a weight to keep it tense at the farther end. By increase of dampness a greater amount of water is absorbed, the transverse diameter of the cord is increased, its linear extent diminished, and the weight consequently rises. A pointer attached to the weight indicates changes in the moisture by an arbitrary scale. An amusing hygroscope of this class can be constructed of two pieces of wood glued together, one of which is soft and readily absorbs moisture. For this purpose a rectangle is formed of one piece of say 6 or 8 inches in length and 2 inches in width, the longer axis of which is in the direction of the fibre of the wood; to this is glued another piece of the same dimensions, of which the fibre is at right angles to the length. If the gluing has been effected in a dry condition of the wood, the compound structure will be straight; if, however, the air is afterwards charged with vapor, the wood will absorb moisture and expand unequally in different directions, assuming the form of a bow. If, now, into the slip of wood having longitudinal fibres four stiff wires, sharpened at the outer end, be inserted, so as to resemble the legs of a table, with the exception that each is inclined at an angle of 30° or 40° to the perpendicular, and then the arrangement be placed on a long shelf of soft wood, it will travel in the course of a season from one end to the other. By an increase of moisture the upper surface will become convex, and the hinder feet will be drawn forward, while the fore ones, on account of the direction of their action, remain fixed; when the moisture diminishes, and the wood resumes its straight form, the fixed points will be the hind feet, the fore ones being projected forward. In this way a progressive motion will be produced with every variation of moisture. The effect will be increased by making the lower slip of some hard wood and covering it with varnish, while the upper slip with transverse fibres is of soft wood and exposed to the action of the air. The wood may be cut into the shape of an animal. An example of the third class of hygroscopes is catgut, which untwists when moist and twists when dry. There is a well-known toy in which there are two figures, a man and a woman, suspended by a piece of this substance, and so adjusted that the man comes out of the door when it is damp, and the woman when it is dry.

All these instruments, as we have said, indicate, rather than measure, the hygrometric state of the air. We shall now proceed to describe instruments by which the state of the air with regard to moisture can be determined with precision; and such are denominated hygrometers. The first of these is Daniell's dew-point hygrometer. This instrument (Fig. 1) is composed of two glass bulbs; the one, A, is more than half filled with ether, and contains a delicate thermometer, the bulb of which is plunged in the liquid. The space above is void of air and of everything but the vapor of ether. The bulb B is covered with fine muslin, upon which, during the experiment, ether is dropped. The evaporation of this produces intense cold, in consequence of which the ether vapor inside B is rapidly condensed, and hence the ether in A as rapidly evaporates. The evaporation of the ether in A cools the bulb until the air surrounding it sinks below the dew-point. Dew is therefore deposited on the outside of A, which is made of black glass, in order that this deposition may be more readily observed. At the moment of the deposition the temperature is read from the scale of the thermometer in A. When the dew disappears as the temperature rises by ceasing to drop ether on the bulb B, the same thermometer is read again, and the mean of the two readings is taken as the temperature of the dew-point. A thermometer, C, placed on the outside of the column which supports the instrument, gives the temperature of the air at the moment of observation. By taking from a table the elastic force or tension of vapor at the temperature of the air, as given by C, and also the tension of vapor at the temperature of the dew-point, the ratio of the two numbers, the first being called 100, will give the relative humidity. The dew-point may also be obtained approximately by suspending a thermometer in a bright metallic

FIG. 1.

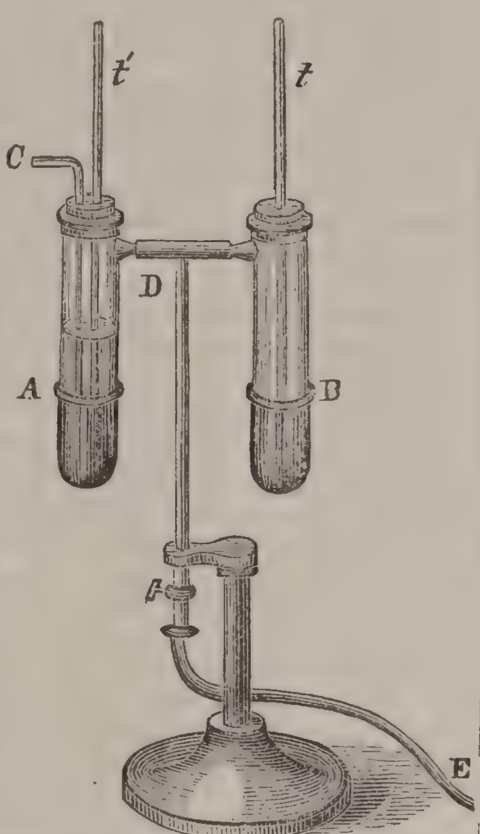


Daniell's dew-point hygrometer.

tumbler half full of water at a temperature a little above the dew-point, and gradually cooling it by pouring in ice-water until dew begins to appear on the surface of the metal; at this moment the temperature of the dew-point is indicated by that of the immersed thermometer. In making this experiment care must be taken to stir the water in the tumbler, and not to suffer the moist breath to fall upon the tumbler. The objection to this method is its want of delicacy, and the liability to produce a local dew-point by the evaporation of the water.

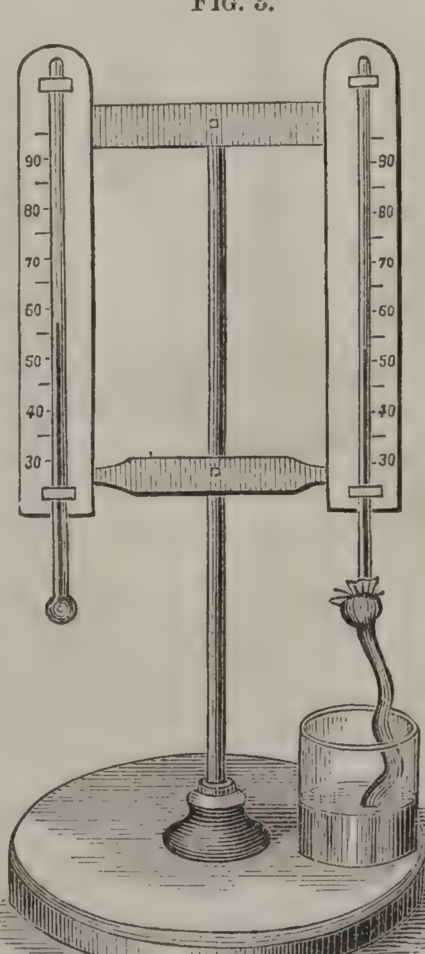
Regnault's dew-point hygrometer is an improvement upon that of Daniell. It consists (Fig. 2) of two tubes or short cylinders, closed at the end, of polished silver, having glass tubes fixed to them. The cylinder A is half filled with ether. It contains a thermometer t', with its bulb in the ether, and also a fine glass tube open at each end, the extremity c being exposed to the atmosphere, and the other being plunged below the ether in A. The cylinder B also contains a thermometer t, the object of which is to indicate the temperature of the air. There is a communication between the air in A and an exhausting tube D E. To the end E of the latter tube is attached an aspirator—that is, a vessel filled with water, which being allowed to run out through a stop-cock near the bottom, an equal quantity of air takes its place, which, entering at C and bubbling up through the ether, causes the latter rapidly to evaporate, and a diminution of temperature is thus produced until at length dew is deposited on the polished silver of A; and if the temperature of t' be immediately noticed, the dew-point may be obtained with great exactness, since the agitation of the ether renders it certain that the temperature of this thermometer is precisely the same as that of the polished silver, while the thermometer t gives the undisturbed temperature of the air. Although observations with this instrument give the elastic force of vapor of the air with great precision, yet it is not as convenient to use as could be desired for the daily registration of the hygrometric condition of the air by ordinary observers. To obviate this difficulty the wet and dry bulb hygrometer has been invented. It was devised by Mason, and consists of two thermometers, of the same size of bulb and bore, placed alongside of each other (Fig. 3), one having a naked dry bulb, and the other a bulb covered with fine muslin, moistened at the time of observation, or kept continually moist by the ascent of water in a cotton wick, as shown in the figure. Owing to the evaporation from the covered bulb, its temperature will be generally below that of the naked bulb, and this difference will be greater when the air is very dry. When it is wet, or near the dew-point, the evaporation will be very slow, and the two thermometers will indicate nearly the same temperature. It has been objected to this instrument that the evaporation is greater when there is a current of air, but it must be remembered that the same current tends to elevate the temperature of the covered bulb in nearly the same proportion. By comparing the indications of this instrument with that of the Regnault hygrometer, a table may be formed experimentally by which the dew-point and elastic tension of the air can be determined at once by inspection. Dr. Apjohn of Trinity College, Dublin, who has given much attention to this subject, has obtained the following formulas: $f' = f - \frac{d}{87} \times \frac{h}{30}$, in which f denotes the maximum elasticity or tension of vapor corresponding to the temperature of the wet-bulb thermometer; f' the elasticity of vapor present in the air which we desire to find; d denotes the difference in degrees of Fahrenheit's scale between the two thermometers; and h the height of the barometer when accuracy is required. This formula is for temperatures above 32°. For temperatures below this point the formula is $f' = f - \frac{d}{96} \times \frac{h}{30}$. Having found f', or the elasticity or tension of vapor present in the air, we have only to look in our table for the temperature of saturated vapor f, which gives the dew-point. A series of tables for facilitating the process of obtaining the relative humidity by means of the wet and dry bulb thermometers, as well as by the dew-point instrument, have been constructed for the Smithsonian Institution by Prof. Guyot of Princeton College, which are now in general use in this country and in various parts of Europe. JOSEPH HENRY.

FIG. 2.



Regnault's dew-point hygrometer.

FIG. 3.



Mason's wet and dry bulb hygrometer.

Hyk'sos, or **Hykshos** ("shepherd kings"), the name given by Manetho to the kings of the fifteenth, sixteenth, and seventeenth dynasties in Egypt. Their capital was Tanis in the Delta, the "Zoan" of the Old Testament, now called *Sân*. Important discoveries recently made there by Mariette throw much light upon this very obscure portion of Egyptian history. The Hyksos were not, as some have supposed, the Hebrews, but probably a collection of the nomadic hordes of Arabia and Syria, mostly Canaanites. They were not mere savage conquerors, but adopted Egyptian manners and customs and worshipped Egyptian gods. They held the country for about 500 years—according to Mariette, from about 2200 B. C. to about 1700 B. C.; Poole and Wilkinson say from about 2000 to about 1500 B. C. The present inhabitants of Sân and the shores of Lake Menzaleh have exactly the same Semitic cast of features as compared with the regular Egyptian type. R. D. HITCHCOCK.

Hylæosau'rus [Gr. ὕλη, a "forest," and σαῦρος, a "lizard"], a large extinct reptile from the Wealden of England, belonging to the order Dinosauria. It was described by Mantell in 1832. The teeth are small in proportion to the size of the animal, close together, and set in sockets, with a subcylindrical fang and a somewhat compressed, expanded, and incurved crown, having the borders of the apical half straight and converging to a blunt apex, but not serrate, and indicating, according to Owen, a mixed or vegetable diet rather than a carnivorous one. The skin appears to have been defended by subcircular bony scales, and large bony spines indicate the existence of a strong crest along the back. The length of this animal may have been twenty-five feet, and the particulars of its structure, so far as known, correspond with those of other Dinosauria, for which see article on HADROSAURUS.

O. C. MARSH.

Hy'lidæ [from *Hyla*, the ancient name of the "tree-frog"], a family of batrachians of the order Salientia or Anura, with the vertebræ procœlian; the sacral diapophyses dilated at their extremities; the coccyx articulated by condyles; the external metacarpals bound together; the terminal phalanges articulated below to the extremity of the penultimate, swollen at the base, and with slender curved and claw-like ends; fronto-parietal bones shortened anteriorly, and usually embracing a fontanelle; superior plate of ethmoid never covered by fronto-parietals, and usually produced anteriorly between the fronto-nasals. The family, with the limits thus given, embraces the ordinary tree-frogs of America and forms related in structure inhabiting other parts of the world. It has been thus limited by Prof. Cope, independently of adaptation to arboreal life, and solely with reference to the agreement of its members in the particulars of structure implied in the definition. Almost all the species of the family, however, are arboreal, living among the branches of trees. Some of them, at least, undergo their development out of water, and come out from the egg with the form of the adult, the tadpole stage being very transitory, or suppressed and limited to intraoval life. The toes are dilated at the extremities into round pellet-like extensions which act as suckers. Prof. Cope has recognized 17 genera and 132 species with the characters assigned to the family. These are distributed in the northern

hemisphere, as well as in South America and Australia, but none are found in Africa. The types of structure, however, are distributed in a very unequal manner; thus, of the known species, more than half belong to the genus *Hyla*, and most of these are South American, a number, however, being found in Australia and North America. Of the other generic types, 13 are peculiar to tropical America, and (except *Trachycephalus*) have only one to three species each, while Australia has only a single peculiar and monotypic genus (*Ranoidea*), in addition to its *Hylæ*. Two genera (*Acris*, with one species, and *Chorophilus*, with five) are peculiar to North America, and twelve species of *Hyla* are also inhabitants thereof. (See Cope, *Trans. Acad. Nat. Sc. Phila.*, n. s., vi. 83–88, etc.) THEODORE GILL.

Hylobat'inæ [Gr. ὕλη, "wood," and βαίνειν, to "walk"], a sub-family of apes (embracing the long-armed gibbons), and contrasting with the group Simiinæ (including the gorilla and chimpanzee), and distinguished from them by the slender form; the iliæ of the pelvis not alate; the cerebrum scarcely or not at all projecting backward over the cerebellum; the molars of the upper jaw with no oblique ridge; and the buttocks provided with callosities. The gibbons thus form an intermediate link between the large apes and the typical monkeys of the Old World, although they are most nearly related to the apes. They live chiefly among the trees, swinging to and fro with their very long arms. They delight in fruit. When walking they generally apply their knuckles to the ground, and yet stoop but little, but sometimes walk erect with their long arms thrown upward and used as balancing-poles. To this group belong two genera, *Siamanga* and *Hylobates*. THEODORE GILL.

Hy'men [Gr. Ὑμήν or Ὑμέναιος], the Greek god of marriage, perhaps a personification of the nuptial song, called also *hymen*, and probably related etymologically to *hymn*. The mythus of Hymen varies greatly. He is represented as a comely youth bearing the bridal torch.

Hymenop'tera. This extensive and interesting group of insects comprises the bees, paper, wood and sand wasps, ants, ichneumon-flies, gall-flies, and saw-flies. There are estimated to be 25,000 species, of which perhaps 5000 species inhabit the U. S., the number of ichneumon-flies and their allies carrying the number up. Their range is not confined to the tropics and temperate zone alone, but a few species occur near the North Pole, a humble-bee and several species of ichneumon-flies having been found in Polaris Bay, the northernmost point yet reached. Their geological range is not great, the earliest species known occurring in the Jurassic formation, while other well-developed insects (Neuroptera) have been found as low down as the Devonian formation.

The Hymenoptera (so called from ὑμήν, a "membrane," and πτερόν, a "wing") are usually characterized by the four membranous, naked wings, with a peculiar arrangement of the veins, the hinder pair being much smaller than the others; by the large head; the complication of the mouth-parts, the jaws being adapted for biting as well as seizing prey, while the maxillæ and labium are much elongated and adapted for lapping the sweets of flowers: the ligula, or so-called tongue, which is a prolongation of the labium or under lip, sometimes attaining a great length; by the presence of a well-developed ovipositor—in the ants, wasps, and bees modified to form a sting. The more important character separating the Hymenoptera from other insects is the fact that in all except the saw-flies the thorax consists of four rings, the fourth being the basal ring of the abdomen, which in the course of the transformations of the bee or wasp is thrown forward on to the thorax or middle region of the body. This indicates a transfer of force headward, an admirable instance of the law of cephalization discovered by Prof. Dana. For these and other anatomical features, their social instincts, the differentiation of the sexes in certain groups, and their complete transformations, the Hymenoptera stand at the head of the insect series. The young, or larvæ, are white, soft, fleshy, and worm-like, without feet, except in the young of the saw-flies, which closely resemble caterpillars. All except the latter are fed by the parents either directly or from stores of honey and pollen or animal food laid up before their birth by their parents. The pupa is inactive, closely resembling the adult, and protected by a thin silken cocoon, except in the saw-flies, which approach the Lepidoptera in spinning a dense cocoon, as well as in the caterpillar-like form of the larvæ.

The anatomy of the Hymenoptera is very complicated, and greatly modified in accordance with the varying habits of the different species. They have a sucking stomach opening into the long œsophagus. The salivary glands consist of two short ramified tufts, often contained entirely in the head. The honey is formed, by some chemical change as yet unknown, from the food contained in the crop, which is regurgitated into the honey-cells. A characteristic of those species provided with a sting is the two large poison-glands situated in the end of the abdomen. The poison secreted in them is discharged into a pear-shaped sac lodged near the base of the sting, which is provided with a peculiar muscular apparatus for its sudden extension and withdrawal. The poison has as a base formic acid, which imparts the poisonous properties to the secretion. The sting may be seen in a rudimentary condition under the integument of the larva. At that period it consists of three pairs of simple appendages or buds, which, by their increase in length and by changes in the form of the segments at the end of the body towards the close of the pupa state, form the sting. Just previous to this period the three pairs of long blades may be separated, the two outer pairs ensheathing the inner, which are barbed, and constitute the sting proper.

Another feature of much interest in the bees is their power of secreting wax. This is accomplished by special minute one-celled glands lodged just under the skin, opening externally by pores connecting with a fine chitinous tube in the integument. In the honey-bee these pores and glands are situated on the under side of the abdomen. In the stingless bees (*Trigona*) the wax is secreted on the upper side. The jaws of the bees and wasps are rounded at the extremity, with slightly marked teeth. This form is of use in the honey and pollen gathering bees, while in those species which build clay nests they are used as trowels. In the carnivorous wasps, such as the *Sphex* and *Pompilus*, the jaws are sharp and hooked, adapted for seizing and retaining large insects. The legs are also exposed to much variation in the different genera. For example, in the hind legs in the pollen-gathering bees, such as the honey and humble-bee, the tibia or shank is very broad and hollowed out on the outer side, while stiff bristles project over the depression from each side, forming the honey-basket (*corbiculum*) in which the masses of honey and pollen are piled up. The mode in which the bee collects the pollen is very curious. She gathers it from the flowers with her mandible, from which it is removed by the anterior pair of legs. From there it is passed to the intermediate pair of legs by manifold scrapings and twistings of the limbs, whence it is by similar manœuvres deposited on the hind legs. (Shuckard.) In the fossorial species, on the contrary, the legs are slender, but very hairy. The sand-wasp, or *Sphex*, for example, by the aid of its large sickle-like mandibles, which are of use in removing small stones and gravel, digs a hole from four to six inches deep in half an hour. The hairy legs are used much as a dog does its paws, and with perhaps nearly equal intelligence. The carpenter-bee and wood-wasp by means of their powerful jaws tunnel regular holes several inches deep in solid wood, the stems of plants and shrubs, or the trunks of trees. The complicated, many-chambered nests of the ants are familiar objects. Indeed, there are no insects which in their structure are more highly differentiated than the various genera of Hymenoptera, and we find in them an intelligence and power of adaptation to new and unforeseen circumstances which evince something more than "blind instinct," in fact, a reason perhaps not inferior to that shown by many of the vertebrate animals, and differing but in degree from that of man.

Not only is the individual structure of the Hymenoptera highly complicated, but in certain genera of bees, wasps, and ants there is a differentiation of the individual into three instead of two sexual forms—*i. e.* males, females, and workers (wrongly called neuters), the latter being sexually undeveloped females. In the bees and wasps the workers differ from the queen in having undeveloped ovaries and incomplete accessory organs, but differ externally only in size, being a little smaller than the females. In the ants, however, while the workers are much smaller, they are also wingless, and differ in the proportions of the body.

The honey-bees and certain wasps and gall-flies lay eggs which produce young without being fertilized by the male. Von Siebold discovered that only the queens' and workers' eggs are fertilized by the spermatozoa stored in the *receptaculum seminis* of the female. These she can fertilize *at will* (the only animal known to possess this power of producing either sex at pleasure), and retains the power for a period of five years, as the muscles guarding the duct leading from the sperm-bag are supplied with a nerve, being thus rendered voluntary and subject to her will. When she wishes to lay an egg to produce a drone, the egg is allowed to slip out of the oviduct past the orifice of the receptaculum seminis, kept closed by the voluntary muscle. Drone eggs are also laid by unfertilized queen-bees, and in some cases even by worker-bees. It is well known that bees when deprived of their queen select several worker eggs or very young larvæ for the purpose of rearing queens. "The cells in which these eggs are situated are lengthened out

and the end turned downward." Whether, as Leitch (from whom we have quoted) thinks, the development into a queen is caused by the increased temperature of the queen-cell, or, as Huber previously thought, by being fed with different food (the royal paste or jelly), is not entirely settled. Probably both causes—*i. e.* a higher temperature and richer food—taken together, are sufficient to produce an increased development of the young and an acceleration in the development of the ovaries. We know that the virgin reproduction of the *Aphis* is terminated on the approach of cold weather, and that differences in temperature and the density of the saline lakes in which the *Artemia*, a crustaceous animal, lives, causes it to develop either by laying eggs in the normal way or to reproduce parthenogenetically. Von Siebold has also ascertained that the common European *Polistes Gallica* reproduces parthenogenetically, the workers laying eggs without intercourse with the males. The Cynipides, or gall-flies, have long been supposed to reproduce in this manner, but it has recently been proved to be the case by an American entomologist, Mr. Walsh. He ascertained that a species of *Cynips* in Illinois in the autumn is represented by females alone. These lay eggs, and the spring brood consists of males and females. He proved this by colonizing certain trees with a number of individuals of *Cynips quercus-aciculata*, and finding the next spring that the eggs laid by them produced *C. quercus-spongifica*. The autumn brood of *Cynips* consists entirely of agamous females, while the vernal brood consists of both males and females; and Mr. Walsh declares, after several experiments, that "the agamous autumnal female form of this *Cynips* (*C. q. aciculata*) sooner or later reproduces the bisexual vernal form, and is thus "a mere dimorphous female form" of *Cynips q. spongifica*. Mr. H. F. Bassett states in confirmation that in Connecticut *Cynips quercus-operator* is double brooded; thirty of one brood of females ovipositing in the buds of *Quercus ilicifolia*, while some of a second brood oviposited in the young acorns of the same species of oak. From these and other facts he infers "that all our species that are found only in the female sex are represented in another generation by both sexes, and that the two broods are, owing to seasonal differences, produced from galls that are entirely distinct from each other." Here again, we find temperature the main active agent in inducing an abnormal mode of generation, the eggs laid by the fertilized female in the heat of summer producing agamous females.

With the exception of the white ants, which belong to the Neuroptera, the Hymenoptera is the only group of insects affording species which are truly social and live in colonies. In the social species there are almost invariably three sexual forms, the workers forming the large majority and doing most of the work of the colony. They even assist largely in rearing the young, the males and females not usually laying up food or providing for their offspring. This division of labor is carried on unequally in the different species, and is best marked in the honey-bee, whose colony contains but one female, the queen. In the colonies of the ants there are numerous males and females, and in some genera (*Pheidole, Eciton*) two sorts of workers—one with a large head, called a worker major or soldier, and the usual form or worker minor. In the honey-ant of Texas and Mexico, while the normal workers are of the usual shape and perform the active duties of the formicarium or nest, the large worker is inactive and does not quit the nest, but lies almost immovable in its gallery, and elaborates a kind of honey in its abdomen, which swells up as large as a pea. Certain ants also enslave other species, making them do the work of the colony. They also herd aphides in their underground nests, and entertain as permanent visitors certain beetles, thus adding much to their labors and to the complexity of their social life.

The following synopsis presents briefly the characters of the more important families of Hymenoptera, beginning with the lowest:

1. Body short, abdomen sessile, and provided with an ovipositor forming a saw; larvæ caterpillar-like, with 9–11 pairs of legs: *Tenthredinidæ* (saw-flies).
2. Like saw-flies, but the body longer; larvæ with six thoracic legs, and abdomen ending in a horn: *Uroceridæ* (horn-tails).
3. Minute, with a short compressed abdomen, and a slender long ovipositor: *Cynipidæ* (gall-flies).
4. Body slender, with a long prominent ovipositor: *Ichneumonidæ* (ichneumon-flies).
5. Body usually short and small, ovipositor short, inconspicuous; antennæ elbowed; wings with one vein, with metallic colors: *Chalcididæ* (ichneumon-flies).
6. Minute; wings with one or no veins: *Proctotrypidæ* (egg-parasites).
7. Body oblong; skin very dense, with a powerful sting: *Chrysididæ* (cuckoo-flies).
8. Body slender; antennæ elbowed; wingless workers: *Formicidæ* (ants).
9. Ant-like; body very hairy, with a powerful sting: *Mutillidæ*.
10. Body hirsute, with short, hairy, spiny legs; eyes often lunate; species often of large size and gayly colored: *Scoliidæ*.
11. Antennæ long; body compressed; color usually blue: *Pompilidæ* (sand-wasps).
12. Like the Pompilidæ, but the body not compressed, and abdomen petiolated: *Sphegidæ* (sand and mud wasps).
13. Somewhat like the Sphegidæ, but with the abdomen sessile and oval, conical: *Larridæ*.
14. Head large, body flattened, highly colored: *Bembecidæ*.
15. Body with a long, club-shaped, or a conical sessile abdomen; antennæ clavate: *Nyssonidæ*.
16. Head large, cubical; fore legs of males variously modified in form; body high colored, like the wasps; tongue short: *Crabronidæ* (wood-wasps).
17. Males, females, and workers; fore wings folded once longitudinally: *Vespidæ* (paper-wasps).
18. Males, females, workers; social in the higher genera. Body usually hirsute; tongue long; living in nests or underground tunnels: *Apidæ* (bees).

A. S. Packard, Jr.

Hymet'tus, a mountain-ridge of Greece, 4½ miles S. E. of Athens, 2680 feet high. The honey collected here has been famous from remote antiquity to the present time for its exquisite flavor.

Hymnol'ogy [Gr. ὕμνος, a "festive song" or "ode," and λόγος, "discourse"], the science of sacred lyrical poetry. A hymn, according to St. Augustine, "must be praise to God in the form of song." By the looser definition which prevails now, it is a lyric expressive of religious feeling, or celebrating, however indirectly, the object of worship. The Greek pagan hymns were in honor of gods and heroes, and were usually sung at their festivals. (See a fine example, translated, in Mr. Palgrave's *Lyrical Poems*, p. 258.) A parallel may be traced between these and the Christian hymns for saints' days, etc. The more ancient Greek hymns, as Homer's, are chiefly descriptive, and are considered epic; the later ones, as of Callimachus and Pindar, lyric. In most of these, to a modern mind, the devotional and ethical elements are wanting; not, however, in Cleanthes' "Hymn to Zeus," and in the noble (unmetrical) outburst of Epictetus, "Of Providence," end of chap. xvi., B. 1. The Oriental sacred books, especially the Vedas, contain many hymns, which have received no little attention of late. Of all the sacred poems of antiquity, the Jewish Psalms of course are the most familiar and most precious. They have become practically incorporated with Christian hymnody, and their influence has been great on all its developments.

Christian hymnody is coeval with Christianity; from the Christmas song of angels the lyrical element had large place among the belongings of the new religion. Every language in which the gospel was proclaimed had probably very soon its own supply of sacred verse. The "Tersanctus," the "Gloria in Excelsis," and the "Te Deum" are of early though unknown date. The Syriac hymns of Ephrem (d. 381) have been translated. (For primitive Greek hymns in an English dress see *The Voice of Christian Life in Song*.) Clemens Alexandrinus and Gregory Nazianzen are the earliest Christian hymnists or hymn-writers known. In later times Anatolius, Andrew of Crete, John Damascene, Cosmas, Stephen the Sabaite, Theodore and Joseph of the Studium, Methodius, Theoctistus, Metrophanes, and others supplied the wants of Greek worship till the tenth century. Some of their productions are exquisitely translated in Dr. Neale's *Hymns of the Eastern Church*. (See also Mrs. Browning's *Greek Christian Poets*.)

The seed of religious song was soon carried into Latin soil, where it bore yet more abundant though hardly richer fruit. (See Dr. Neale's paper on "Sacred Latin Poetry," *Encycl. Metrop.*, vol. "Roman Literature.") The great name here is Ambrose (d. 397); he founded a school of hymn-writers, and had many now forgotten imitators, whose work is often indistinguishable from his own. The Ambrosian hymns are marked by a severe simplicity, which to readers unfamiliar with them may seem hard and dry. After him came Prudentius (d. about 413), Venantius Fortunatus (d. 609), Gregory (d. 604), Bede (d. 735), Theodulph (d. 821), Rabanus Maurus, Godeschalcus, and many others. By degrees these mediæval hymnists assume a more ornate style and a more passionate devotion. St. Bernard (d. 1153) and his namesake, the monk of Cluny, have given us glowing strains, than which none are more precious to English and American worshippers of our day. Peter Damiani (d. 1072), Hildebert (d. 1133), Hildegarde (d. 1179), Adam of St. Victor (d. 1192), and Thomas Aquinas (d. 1274) were also no mean poets. Some of the world's

most famous hymns, produced at this period, are of doubtful origin or by authors who are known by a single piece; thus, eminent for grandeur, "Veni Creator Spiritus" and "Dies Iræ" (by Thomas à Celano), and for loveliness or pathos, "Veni Sancte Spiritus" (Robert II. of France), "Stabat Mater" (by Jacopone), and "O Deus, Ego amo Te," questionably ascribed to Xavier. One or two moderns have written good Latin hymns, as the brothers Santolius Maglorianus and Victorinus (d. 1684, 1697), and Charles Coffin (d. 1749). For this department of literature see the Roman and Parisian *Breviaries* and DANIEL'S *Thesaurus;* and for translations, the works of Newman, Chandler, Mant, Isaac Williams, Caswall, Copeland, Campbell, Blew, Neale, Chambers, Kynaston.

With the Reformation came a new birth of lyric fervor, and great waves of sacred song in the vernacular rolled over the Protestantizing lands. Clement Marot rendered the Psalms into French metre, and Calvin himself wrote a hymn or two. But the effect was naturally greatest in Germany, where arose by degrees what is probably the largest, and claimed by many to be the finest, body of hymns in any language. (For this subject see MISS WINKWORTH'S *Christian Singers of Germany* and MR. KÜBLER'S *Historical Notes to the Lyra Germanica*, and especially KOCH'S *Geschichte des Deutschen Kirchenlieds*, 3d ed. 7 vols.) Luther led the van, and was closely followed by Hans Sachs, Paul Eber, M. Weiss and other "Bohemian Brethren," N. Hermann, Selnecker, Nicolai, etc. We can mention but a few names of the following centuries, in chronological order: Stegmann, Meyfart, John Heermann, Rinkart, Rist, Gesenius, Clausnitzer, Alberti, Paul Gerhardt (1606–76), by common consent the greatest of German hymnists; John Frank, Neumark, Scheffler or Angelus Silesius, Von Rosenroth, Tersteegen; J. Neander, Von Canitz, C. F. Richter, Rodigast, G. Arnold, Laurenti, A. H. Franke, Bogatzky, Zinzendorf (who was followed by other Moravian writers), S. Frank, Schmolke; Gellert, Klopstock, Novalis, Fouqué, Spitta, Knapp, Lange, Meta Heusser. The various schools among which these poets divide are elaborately discriminated by Mr. Kübler. An immense and valuable collection of over 3000 hymns has been made by Albert Knapp —*Liederschatz.* Many German hymns have been rendered into English by John Wesley, 1739–40; by Jacobi and Haberkorn, 1722–60; by the Moravians, 1754, etc.; and more recently by Miss F. E. Cox, A. T. Russell, R. Massie, Miss Borthwick, and others; specially by Miss Winkworth, whose *Lyra Germanica* (2 vols.) and *Chorale Book* have added much to our English stock.

The Scandinavian countries have their own hymnic supplies, and are proud of them, but these are little known to English readers. In Italy and France there is not so much material of this sort. Many sacred lyrics of Madame Guyon (d. 1717) were translated by Cowper in 1782.

In England hymnody was a plant of late growth; its place was long filled by psalmody. Myles Coverdale, one of the Reformers, in 153– put forth forty *Ghostly Psalmes and Spirituall Songes*, but there is no evidence of these having come into use. A better fortune attended Thomas Sternhold's *Psalms* (1549), completed by Hopkins and others in 1562; this *Old Version* became popular, and was bound up with the Prayer Book for nearly three centuries. It was afterwards in part superseded by the *New Version* of Tate and Brady (1696). Meantime, the Puritans used the Scotch version by Francis Rous (1645). Hymns, as such, were not written till later, for George Herbert and his contemporaries were sacred poets rather than hymnists. A beginning on a small scale was made by Bishop Jeremy Taylor (1655), and followed up by John Austin (1668), R. Baxter (1681), and eminently by John Mason (1683), whose hymns were perhaps the first to be sung to any extent in England as accessories of worship. William Barton, Joseph Stennett, and Bishop Ken had also the honor of preceding Dr. Watts. The latter is properly the father of English hymnody; the appearance of his *Hymns* in 1707–09, and of his *Psalms* in 1719, introduced a new era; they were hailed with delight by the bulk of Dissenters, and for a long time by them used exclusively, or nearly so, in Britain and America. The publication of Charles Wesley's first hymns in 1739 marked another era. He is the most voluminous of sacred poets, and one of the most gifted. For fifty years he continued publishing, and his verses, recently collected, fill thirteen volumes. The influence of these lyrics was great in promoting the Wesleyan revival. John Wesley also wrote hymns, though but few. His great *Collection* (1779), composed chiefly of his brother's pieces, was long used by the Methodists everywhere, and is still the basis of their various hymn-books. The other hymnists of the eighteenth century, except Addison, Pope, and Byrom, were chiefly followers either of Watts or Wesley, or of both. To the first school belong Simon Browne, the Scotch Paraphrasers, Gibbons, Beddome, Fawcett, Haweis, S. Stennett, T. Scott, Needham, Mrs. Barbauld; to the second, Cennick, Hammond, Olivers, Toplady. Hart, Cowper, Newton, Medley, W. Williams, Ryland, Grigg, Perronet, Seagrave, Robinson, Shirley, and others, show the influence of both masters. (Much of our knowledge of these old authors is due to Mr. Daniel Sedgwick of Bishopsgate, London, who for many years has made hymnology a special study.)

With the present century arose James Montgomery, whose services and influence in this field were great, and Thomas Kelly. The year 1827 was marked by the appearance of Bishop Heber's *Hymns* and of Keble's *Christian Year.* About the same time Sir J. Bowring, Sir R. Grant, Conder, Edmeston, Reed, Lyte, Miss Auber, and Mrs. Adams wrote; more recently Charlotte Elliott, Dr. Bonar, George Rawson, T. T. Lynch, T. H. Gill, and many others. Faber, Caswall, and Bridges belong to the Romish Church. That of England, long negligent in this particular, was awakened to its importance by the Oxford movement of 1833, and a fresh and increasing tide of lyric life has since been poured in. Dr. Neale, Dean Alford, Bishop Wordsworth, Dr. Monsell, Mrs. Alexander, Sir H. W. Baker, Earl Nelson, F. T. Palgrave, W. C. Dix, J. Ellerton are noticeable names. New and carefully prepared hymnals are constantly appearing, and the material for them is increasing every day. In no previous age, perhaps, were more and better hymns written than now.

In America, having the literature of England at her back, comparatively little has been done or was needed. Davies, Dwight, Doane, Onderdonk, Muhlenberg, Bryant, Alexander, Pierpont, Furness, Coxe, Ray Palmer, Sears, and others have given us hymns, a few of which will not die. Here, as in England, attention is being paid to hymnology, and the improvement in this department of knowledge and worship is already visible. We have better hymnals than our ancestors had, and the next generation will have still better. Various books have been written on the bibliography of hymnology, but none that thoroughly covers the entire ground. The best thus far is Josiah Miller's *Singers and Songs of the Church* (1872).

FREDERIC M. BIRD.

Hynes, tp. of Russell co., Ala. Pop. 1120.

Hynobi'idæ [etymology uncertain], a family of salamanders established by Prof. Cope, and with the cranium deficient in an anterior axial bone; the palatines contiguous and prolonged over the parasphenoid, and with teeth on their posterior external margins; the prefrontals and pterygoids are well developed; the frontal not embraced by parietals and prefrontals; the orbito-sphenoid separated by a membranous wall from the proötic; the postfronto-squamosal arch is atrophied, and the occipital condyles are sessile. The family includes a single genus (*Hynobius*) from Japan, and is most nearly related to the Desmognathidæ and Plethodontidæ of the U. S. THEODORE GILL.

Hyodon'tidæ [from Υ, *i. e.* the U-shaped or hyoid bone, and ὀδούς, "tooth"], a family of isospondylous teleocephalous fishes, having a herring-like form; cycloid scales; head scaleless; the margin of the upper jaw formed by the supramaxillaries on the side, and with those bones articulated to the extremities of the intermaxillaries; and the dorsal fin behind the anus; the stomach is not cæcal, and has only one pyloric appendage; the air-bladder is simple; the ovaries discharge their eggs first into the abdominal cavity. This group has been constituted especially for the reception of the "moon-eye herring" (*Hyodon tergisus*) of the lakes and Western rivers, to which it is peculiar. It is most nearly related to the Clupeids (herrings, shad, etc.).

THEODORE GILL.

Hyoganoi'dea [from Υ, *i. e.* the U-shaped or hyoid apparatus, and *Ganoidea*], a super-order of ganoid fishes, characterized by the completely ossified skeleton; development of the intermaxillary and supramaxillary bones; the external nasal apertures; the development of the opercular apparatus; and the complete hyoid apparatus (whence the name). It embraces the existing families Amiidæ and Lepidosteidæ, and numerous extinct forms. (See FISHES.)

THEODORE GILL.

Hy'oid Bone, a bone comparatively unimportant in man, supporting the tongue, but represented either in an osseous condition or by rudimentary cartilages throughout the Vertebrata, and of great importance in the lower classes, in which it is of increased complexity, forming the support for the branchial apparatus.

Hyopotam'idæ [from ὗς, a "hog," and ποταμός, "river"], a family of ungulate mammals belonging to the sub-order Artiodactyla and the group with "selenodont" molars (*i. e.* like those of ruminants), with the upper molars crowned with five (3 ante + 2 post) well-developed crescentiform lobes; the canines of the lower jaw simulating and parallel with the incisors; incisors persistent ($\frac{3}{3} \times 2$) in both jaws; dental series interrupted by very long diaste-

mata above and below; and the canine teeth of the upper jaw well developed; the snout was correspondingly elongated; the mastoid processes but slightly developed, and the zygomatic processes of the squamosals were directed forward and backward from their bases: the lower jaw had its rami produced backward, and frequently armed with tubercles projecting outward from the sides towards the front. This family was richly developed in the early Tertiary period, and especially in the Eocene and Miocene ages. The name Anthracotheridæ has been also given to the group. It embraces numerous genera and species, among which are *Hyopotamus* (with its synonyms or sections, *Ancodus, Cyclognathus, Bothriodon*), *Anthracotherium, Tapinodon, Diplopus*, etc. The richest field in which their remains have been found are the Miocene deposits of Auvergne in France, and near relations have been found in this country in the Oreodontidæ or Merycodoidontidæ. The species varied in size, from dimensions little more than those of a rat to those of an ass. The members of this family have lately (1875) been the subjects of a very elaborate monograph by Dr. Kowalevsky ("On the Osteology of the Hyopotamidæ," part i.) in the *Philosophical Transactions* of the Royal Society of London (vol. clxiii. pp. 19–95, pl. 35–40). THEODORE GILL.

Hyop'sodus [Gr. ὗς, a "hog," ὄψις, "appearance," and ὀδούς, a "tooth"], an extinct genus of small mammals from the Eocene of Wyoming, named from its supposed resemblance to the suillines, but now known to belong to the Quadrumana. (See QUADRUMANA, FOSSIL.) O. C. MARSH.

Hyoscyamus. See HENBANE.

Hypa'tia ['Υπατία], daughter of Theon, a Greek of Alexandria, no less renowned for her knowledge of mathematics than of the Neo-Platonic philosophy, which she taught with applause in her native city. Her beauty and modesty were also celebrated, but the clergy believed that she made use of her influence with Orestes, prefect of Alexandria, to the injury of St. Cyril, then the archbishop of Alexandria. Accordingly, she was set upon by a mob led by priests, who carried her into a church, stripped her of her clothes, and then tore her in pieces (415 A. D.). Theodoret accuses Cyril of instigating this murder, but of his guilt there is no proof.

Hyper'bola [Gr. ὑπέρ, "over," and βάλλειν, to "throw"], a plane curve that may be generated by a point moving in such a manner that the difference of its distances from two fixed points is always equal to a given distance. The fixed points are called *foci*, and a straight line drawn through them and limited by the curve is called the *transverse axis*. The *centre* is that point of the transverse axis which is midway between the foci, and a line through this point perpendicular to the transverse axis is called the *conjugate* axis. This axis does not cut the curve, but it is limited by the condition that the diagonal of the rectangle describes upon it and the transverse axis shall be equal to the distance between the foci. The *eccentricity* is the distance from the centre to either focus, divided by the semi-transverse axis. The diagonals of the rectangle described on the axes indefinitely prolonged are *asymptotes* to the curve; as we recede from the centre the curve continually approaches these lines, becomes tangent to them at an infinite distance, but never crosses them. These asymptotes are the limits of the curve. If b is less than a, the angle between the asymptotes is acute and the hyperbola is *acute;* if b is greater than a, the hyperbola is *obtuse;* if b is equal to a, the hyperbola is *rectangular* or *equilateral*.

The hyperbola is one of the conic sections. The conic surface from which every variety of hyperbola may be cut by a secant plane is a surface that may be generated by a straight line moving in such a manner as to touch a given circle and pass through a given point. The directing circle is called the *base* of the cone, the fixed point is called the *vertex*, the moving line is the *generatrix*, any position of this line is an *element*, and a line through the vertex and centre of the base is the *axis*. The surface thus described consists of two parts, united at the vertex, which are called *nappes;* the lower nappe is the one that is on the side of the base; the other one is called the upper nappe. By varying the position of the vertex with respect to the base, the cone may be made right or oblique, acute or obtuse. If we pass a plane through the vertex of this general cone, it will cut out two elements, and by suitably varying the position of this plane these elements may be made to have any inclination to each other. If we pass a second secant plane parallel to the first, it will cut from the cone a hyperbola whose asymptotes are parallel to the elements cut out by the first plane. The plane of the hyperbola cuts all the elements of the cone except the two to which it is parallel, half on one nappe and half on the other. These points of intersection make up two branches, one lying on the lower and the other on the upper nappe of the cone. A system of planes parallel to the first cut out a system of similar hyperbolas—that is, hyperbolas whose axes are in a given ratio. If this system of hyperbolas is projected on the plane through the vertex by projectors parallel to the line that joins their centres with the vertex of the cone, these projections will be equal, in all respects, to the curves themselves, and will all have the same rectilineal asymptotes; they will also be curvilinear asymptotes to one another. The lines cut out by the plane through the vertex may be regarded as a hyperbola whose axes are infinitesimal; that is, they may be regarded as the limiting case of this group of similar hyperbolas. If we take the case of an oblique cone, and suppose the vertex to move towards the plane of the base, and ultimately to coincide with it, the cone will reduce to a sector of that plane, the elements cut out by the plane through the vertex will coincide with each other, and planes parallel to the first plane will cut out straight lines limited towards the centre; that is, indefinite straight lines with a part removed. Such lines may be regarded as hyperbolas whose foci are at the vertices of the transverse axis.

Two hyperbolas which are so related that the transverse axis of either is the conjugate axis of the other are called *conjugate* hyperbolas. Two conjugate hyperbolas have the same asymptotes, and their four foci are all on the circumference of the same circle. Conjugate hyperbolas are so related that a complete discussion of either necessitates that of the other; in fact, they ought to be regarded as a single curve with four branches. From this point of view the equation of the complete curve may be written thus: $a^2y^2 - b^2x^2 = \mp a^2b^2$, in which a and b are the semi-axes; the upper sign corresponds to the branches whose semi-transverse axis is a, and the lower sign to the branches whose semi-transverse axis is b. An examination of the above equation shows that there are four values of y for each value of x, and that these values, taken in pairs, are equal with contrary signs; also that there are four values of x for each value of y, and that these, taken in pairs, are equal with contrary signs; consequently, the entire curve is symmetrical with respect to both axes. All values of x between $-a$ and $+a$ render one pair of values of y imaginary and the other pair real; all values of x less than $-a$, or greater than $+a$, make both pairs of values of y real. In like manner, all values of y between $-b$ and $+b$ make one pair of values of x imaginary and the other pair real; all values of y less than $-b$, and greater than $+b$, make both pairs of values of x real. The equation of the common asymptotes of the four branches is $y = \pm\frac{b}{a}x$, as may be shown by a discussion of the general equation of the curve.

Two conjugate hyperbolas may be cut from a pair of conjugate cones, or from a pair of conjugate hyperboloids. Let there be two straight lines intersecting each other at right angles, and let there be a third line lying in their plane and passing through their common point; if the last line is revolved about each of the others in turn, it will generate a pair of conjugate cones tangent to each other, and any plane parallel to their axes will cut from these cones a pair of conjugate hyperbolas whose asymptotes are parallel to the elements of contact. (For particular properties of the hyperbola refer to special treatises on conic sections, of which SALMON'S *Conic Sections* is probably the most full and complete.) W. G. PECK.

Hyper'boloid, a surface such that the sections made by passing planes in certain directions are hyperbolas. There are two classes—*elliptical* and *parabolic* hyperboloids. In the former all the plane sections that are not hyperbolas are ellipses, and in the latter all the sections that are not hyperbolas are parabolas. The elliptical hyperboloids are divided into two species—hyperboloids of one nappe and hyperboloids of two nappes. The former are warped surfaces, and the latter are surfaces of double curvature. In the hyperboloids of one nappe every section made by a plane parallel to a tangent plane is a hyperbola, and all other plane sections are ellipses; in the hyperboloid of two nappes every section made by a plane parallel to a tangent plane is an ellipse, and all other sections are hyperbolas. If two conjugate hyperbolas are revolved about either axis, they will generate a pair of conjugate hyperboloids of revolution, and their common asymptotes will generate a cone which separates the two and is a common asymptote to both. The hyperbola that revolves about its conjugate axis generates a hyperboloid of one nappe; that which revolves about its transverse axis generates a hyperboloid of two nappes; and the asymptotic cone is their common limit. Any plane parallel to two elements of the asymptotic cone will cut from the system of surfaces a pair of conjugate hyperbolas.

The parabolic hyperboloid is a warped surface which

may be generated by a straight line moving so as to touch two straight lines and be parallel to a given plane. The fixed lines, which must not be parallel, are called *directrices*, the plane is called the *plane director*, the moving line is called the *generatrix*, and any position of the directrix is called an *element* of the surface. If we take a new plane director parallel to the given directrices, and any two elements of the surface as directrices, and generate a surface in the same manner as before, it will coincide with the surface just described. The surface has therefore a double mode of generation. Through any point of the surface two straight lines can always be drawn that will coincide with the surface, and the plane of these lines will be tangent to the surface at that point. Any plane parallel to a tangent plane intersects the surface in a hyperbola; every other plane, in a parabola. W. G. PECK.

Hyperbo'reans [Ὑπερβόρειοι, "beyond the north wind," or Boreas], a mythical people who, as the ancient Greeks supposed, dwelt in the far North in a happy clime, where sickness, old age, and sorrow were unknown. Herodotus believed that the myth of the Hyperboreans was based upon facts; which opinion, it need not be said, is now known to be incorrect. The myth is variously given.

Hypercor'acoid [Gr. ὑπέρ, "upper," κόραξ, "crow," and εἶδος, "form"], the upper bone apposed to the inner surface of the great scapular cincture of the typical fishes. It is one of three bones which together are homologous with a single cartilage in the more generalized fishes—*i. e.* ganoids—and was regarded by Cuvier as the radius; by Owen, as the ulna; and by Gegenbaür and Parker, as the scapula. THEODORE GILL.

Hyperi'des, a patriotic Athenian orator, b. about 400 B. C., a friend of Demosthenes and a pupil of Plato and Isocrates; began life as a practitioner of law; was faithful to the interests of the people in the contests with Philip, and in 338 B. C. proposed to free all the slaves and enfranchise the resident aliens and the disfranchised Athenians. In 324 he was for a time at variance with Demosthenes, whom he accused of receiving money from Harpalus. In 322 B. C. he was cruelly murdered at Ægina by the emissaries of Antipater. His private character was not above suspicion, but his public acts appear to have been uniformly disinterested and wise. The ancients speak in high terms of the purity and grace of his style, but of his many orations only slight fragments existed up to 1847, when four orations were discovered in Egypt, one of which, ὑπὲρ Εὐξενίππου ("in defence of Euxenippus"), only was entire. Published by Babington (in fac-simile), London, 1850, 1853, and 1858; edited by Blass, Leipsic, 1869, and by Müller in *Oratores Attici*, Paris, 1858. (See *Journal of Philology*, vol. i. pp. 109–124.)

Hyperoar'tia [Gr. ὑπερῴα, "palate," and ἄρτιος, "perfect"], an order of marsipobranchiates distinguished by the development of the skull and the cœcal nature of the median external nasal aperture; no duct perforating the palate, which is therefore left entire (whence the name). The branchial apertures are on each side behind the head, and seven in number; the inner branchial ducts debouch into a separate common tube. The ova are small, and superficially like those of fishes. The young undergo a complete metamorphosis after leaving the egg. The larvæ have an elongated slit-like mouth, and are without teeth or eyes, In this condition they were formerly considered to be members of a peculiar group (*Amonocœtes*). At maturity the mouth is circular, surrounded by a lip, and armed with dentigerous lamellæ on its disk, as well as with lingual teeth; enlarged plates above and below the antrum of the œsophagus have been called maxillary and mandibular, but they have no homological relation with the upper and lower jaws of ordinary fishes, and the lower jaw in them is absolutely wanting. This order embraces only a single family of existing species (the Petromyzontidæ or lampreys), of which there are at least five genera, three of which are represented in North America. THEO. GILL.

Hyperotre'ta [Gr. ὑπερῴα, "palate," and τρητός, "perforated"], an order of marsipobranchiates characterized by the structure of the cranial cartilages and the complete tubulation of the median nasal aperture, and its perforation of the palate (and hence the name). The branchial apertures are developed on each side far behind the head, and are variable in number; the inner branchial ducts communicate directly with the œsophagus; the ova are large, and provided each with an oval horny case constricted at each end, and with numerous filaments thereto. The embryology is still unknown. In the adult condition the mouth has no lips and no plates on the disk, but a median tooth is above the entrance of the œsophagus, and two pectiniform rows or teeth on the tongue. The order thus defined is composed of two families—viz. (1) Myxinidæ, with one genus, *Myxine*, represented by species in the northern and southern hemispheres; and (2) Bdellostomidæ, whose species are confined to the Pacific Ocean, one of them ascending as far northward as California. THEO. GILL.

Hy'persthene [Gr. ὑπέρ, intensive, and σθένος, "strength"], the Labrador hornblende, or, more strictly, the thin-leaved, brittle, and bronze-colored variety of pyroxene, an impure ferro-silicate of magnesia. It is often quite handsome, and is cut as an ornamental stone.

Hyper'trophy [Gr. ὑπέρ, "over," and τροφή, "nourishment"], in pathology, the overgrowth of any part or organ, or the disproportionately large size of such an organ. Hypertrophy is simple, homœoplastic, heteroplastic, or hyperplastic, these terms defining the character of the added material which gives the increased size. It may be caused, 1st, by an increased exercise of the part, an exemplification of which we have in the blacksmith's arm; 2dly, by an increased supply of blood to a part, the part being healthy; 3dly, from some local derangement, as may be seen in exostoses, fatty tumors, etc. The treatment of hypertrophy has been very unsatisfactory; in fact, we can do next to nothing for patients suffering from the first and second varieties. The third should be removed by the knife if any inconvenience is caused. EDWARD J. BERMINGHAM.

Hypnotism. See MESMERISM.

Hyp'num [Gr. ὕπνον], a very large genus of mosses of the sub-order Pleurocarpi and tribe Hypneæ. Many of them are large, and grow on wet ground or on old logs. The U. S. have some 100 species, many of which are European also. There are many sub-genera, some of which are probably worthy of being considered genera.

Hypochlorous Anhydride; and Hypochlorites, or Bleaching Salts. The compounds that belong under these heads comprise many of the most valuable of our bleaching and disinfecting agents. *Hypochlorous anhydride*, formerly called hypochlorous acid (a name we now use for the product of its union with water), has the composition Cl_2O, containing its own volume of gaseous chlorine, and by weight 81.6 per cent. of that element. It is a pale yellow gas, which explodes, though without much energy, when heated. It differs much in odor from chlorine, and is condensed by snow and salt to a deep red, very explosive liquid. It is prepared in the gaseous form by reaction of dry *precipitated* mercuric oxide on chlorine gas, an oxychloride of mercury being formed: $2HgO + Cl_4 = HgCl2HgO + Cl_2O$. Both the liquid and the gas combine with water to form hypochlorous acid: $Cl_2O + H_2O = H^2Cl^2O^2$. Solutions of the acid in water may be prepared also by several other methods; as by distilling together, with special precautions, bleaching salt and a mineral acid; by passing air and muriatic acid gas together through a heated solution of permanganate of potash in a retort; by passing chlorine into water in which carbonate of lime is suspended. In the latter case carbonic acid is set free, and the reaction is as follows: $CaO,CO_2 + Cl_4 + H_2O = CaCl_2 + CO_2 + H_2Cl_2O_2$. The aqueous hypochlorous acid that distills over in each case is yellowish, smells like the gas, has a strong peculiar but not acid taste, and corrodes the skin more rapidly than nitric acid. It cannot be preserved in concentrated form, decomposing spontaneously in time, though it is sufficiently stable to be distilled. With hydrochloric acid it evolves chlorine, as follows: $H_2Cl_2O_2 + 2HCl = 2H_2O + Cl_4$. It is of course a very powerful, and would be a very useful bleaching and oxidizing agent, were it not for its instability, which unfits it for storage and transportation. The immensely valuable properties of this substance must be secured, therefore, by means of compounds, which are capable of evolving or producing it.

Hypochlorite of potash is the active ingredient of what has been known as "*Javelle water*," or "*eau de Javelle*;" also called "chloride of potash." This is a colorless liquid, of peculiar smell, which is prepared by passing chlorine gas through a cold solution of carbonate of potash: $2K_2O,CO_2 + Cl_4 = 2CO_2 + 2KCl + K_2Cl_2O_2$. It, therefore, contains both potassic hypochlorite and chloride of potassium. The potassic carbonate solution must be kept cold, and the operation must cease before an excess of chlorine over two equivalents for each one of potash-carbonate has been used; as, unless an excess of the latter is present, potassic chlorate and chlorite may be formed, with an increased proportion of chloride of potassium. Hence, strong Javelle water of necessity contains an excess of unchanged potassic carbonate. Another method of preparing Javelle water is by adding to a solution of "bleaching powder" or "chloride of lime" (see below) a solution of potassic carbonate, in quantity sufficient to precipitate all the lime as calcic carbonate. The clear decanted liquid will contain the same constituents as before, but will be likely to be less potent, or to contain less, in proportion, of the active constituent. Javelle water is used for taking out stains, such

as those of fruit, from white textile fabrics, and for bleaching wood, straw, etc.

Hypochlorite of soda, in solution, constitutes what is called "Labarraque's disinfecting liquor," after a Parisian druggist who manufactured and sold it for disinfecting purposes. It is also called "chloride of soda," and in medicine "chlorinated soda." The methods of preparation are precisely similar to those given above for the potash-hypochlorite, using sodic instead of potassic carbonate. In making the Labarraque solution, for which sodic carbonate and gaseous chlorine are the materials, but half the amount of chlorine needed for complete reaction is used, and no carbonic acid is evolved, being retained apparently as sodic bicarbonate. This is stated to furnish a more permanent or stable preparation than the other method. The sodic hypochlorite solution, as prepared for commerce, has a feeble chlorine-like odor, alkaline reaction, and strong bleaching and disinfecting powers. It is considered a very valuable medicinal material.

Hypochlorite of Lime.—Under this head it is proper to treat the important commercial product known as *bleaching powder* or *chloride of lime* (Ger. *Chlorkalk;* Fr. *chlorure de chaux*). It is proved, however, by recent researches that *solid dry* bleaching powder does not contain calcic hypochlorite, which is first formed by the action of water or moisture upon it. The chloride of lime of commerce is prepared by exposure of dry or slightly damp slacked lime to chlorine gas. The lime is spread on trays placed in a stone chamber whose interior can be inspected through glass windows. The gas must be passed in slowly at first, to prevent heating of the lime, which would promote the formation of chloride of calcium, to the detriment of the product. The whole time required is about four days. If the process be too rapid, and heating occurs, there is formed, according to Scheurer-Kestner, some calcic *chlorite*, $CaCl_2O_4$. It forms a dry or slightly moist grayish-white powder, having a peculiar, highly nauseous odor, differing from, though suggesting, that of chlorine. It gradually decomposes and deteriorates with time, and cannot be preserved in sealed packages, by reason of slowly evolved gas, probably chiefly oxygen. Barreswil proposed to compress it into cakes or blocks made as hard as stone, asserting that it was thus rendered far more permanent.

Chemical Composition and Constitution.—This has been the subject of much controversy, and various theories have been successively supposed proved, adopted, and abandoned. Of these the one even now generally in vogue, and taught in the textbooks of all countries, makes it to be a mixture of calcic chloride and calcic hypochlorite, $CaCl_2 + CaCl_2O_2$, which would be simply formed by the interaction of 2CaO and 4Cl. As long since, however, as 1862, Fresenius showed that cold water, when first added, dissolves from it chiefly calcic chloride, and that to get much hypochlorite requires successive washings and time. He suggested that hypochlorite may not pre-exist, but may be formed from some unknown ingredient by reaction with the water. Since 1867 this fact has been confirmed, and the view rendered certain by J. Kolb, who found that pure dry hydrate of lime, when completely saturated by chlorine, forms a mass containing 38.5 per cent. of the latter, and having the empirical composition $Ca_3H_6O_6Cl_4$, in which the three equivalents of water and the three equivalents of oxide of calcium (hypothetically or possibly present) are wholly essential, and cannot be eliminated without a complete destruction of the constitution of the body. Water, by its solvent action, leads to a breaking up into hydrate, chloride, and hypochlorite: $Ca_3H_6O_6Cl_4 = CaO,H_2O + CaCl_2 + CaCl_2O_2 + 2H_2O$. If we suppose the last factor of this equation, the $2H_2O$, to pre-exist, as such, in the bleaching powder, then the latter is a hydrate of an unknown compound whose empirical formula is $Ca_3Cl_4H_2O_4$. The whole question of the true nature and constitution of this product in the solid form would appear, therefore, to be now reopened, and to be a matter for speculation and investigation. It is regarded now as proved that in the atmosphere, by virtue of its moisture, the same breaking up occurs as represented above with liquid water, and that then, by the carbonic acid of the air, hypochlorous acid is set free from the hypochlorite that has been formed; to which latter acid the *disinfecting* action is due, and not to the evolution of free chlorine, as has been most generally believed.

Chlorimetry—Testing the Value of Bleaching Powder.—This is a highly important laboratory operation. The practical point to be settled is of course the relative amount of *active* chlorine, or its equivalent, that is present. At the present day this must be, and is almost altogether, effected by rapid methods of the volumetric class, in which very closely and accurately *measured* quantities are employed, of solutions of known strength or value, of appropriate reagents. One simple method that has been much used is to prepare a solution of the lower oxide of iron (ferrous oxide) of known strength, and ascertain how much of it a certain weight of the bleaching powder will oxidize up to the higher, or ferric oxide; the point being determined by testing—after every addition of the normal ferrous solution—a drop of the solution examined with red prussiate of potash. Another method is to mix the weighed bleaching powder with muriatic acid and iodide of potassium, iodine being thus set free in amount equivalent to the effective chlorine, and coloring the liquid brown. A normal solution of *hyposulphite of soda* is then added, in successive measured quantities, until the color vanishes, when the quantity of hyposulphite that has been used will be a datum for the calculation of the value. Many other methods, similar in principle, have been used. A first-class, fresh-made article should furnish 28 to 30 per cent. of effective chlorine.

Hypochlorite of Magnesia.—This, in solution—formed either by passing chlorine into a mixture of magnesia with water, or by precipitating a solution of chloride of lime with sulphate of magnesia—is recommended for bleaching uses by Bolley, on the grounds that its action is more rapid than common bleaching-powder by reason of the more ready decomposition of the magnesia compound, and that magnesic hydrate is less caustic, and hence less liable to injure delicate fabrics, than the calcic hydrate.

HENRY WURTZ.

Hypochon'dria (pl.), [Gr. τὰ ὑποχόνδρια, the regions "under the cartilages"], in anatomy, the regions of the abdomen on either side of the epigastrium. The name is also given to the diseased condition of late more frequently called hypochondriasis by the medical profession.

Hypochondri'asis [so-called from the old belief that the hypochondria were the seats of the disease], a morbid state of mind, more common in men than in women, in which the patient imagines that he suffers from diseases which he does not possess, and in which he suffers from subjective sensations entirely unaccounted for by the objective signs of disease in his case. The disease itself is real. It may result from dyspepsia, from sexual excess, or from other causes interfering with the nutrition of the nerve-centres. The disease may amount to positive insanity, and is then classed as *melancholia*. Medicine and hygienic regimen often do but little good. Cheerful companionship, fishing, hunting, and boating, long journeys, even the reading of well-selected novels—in fact, anything which will divert the mind from its habit of morbid self-observation—will be found useful.

Hypocor'acoid [Gr. ὑπό, "under," κόραξ, "crow," and εἶδος, "form"], the inferior bone connected with the inside of the great scapular girdle of the typical fishes. It is one of three bones which together are homologous with the intrascapular or coracoid cartilage of the ganoid fishes, and was regarded by Cuvier as the ulna; by Owen, as the radius; by Gegenbaür, as the precoracoid; and by Parker, as the coracoid. THEODORE GILL.

Hypocy'cloid [Gr. ὑπό, "under," "within," and κυκλοειδής, "circular"], a curve whose course is generated by a point in the circumference of a circle rolling on the concave side of a fixed circle. When the rolling circle has a radius equal to just half that of the fixed circle, one revolution of the smaller circle will generate a hypocycloid equal to the diameter of the greater circle. If the rolling circle is the larger, the hypocycloid becomes equivalent to an epicycloid. If the generating point of a hypocycloid be in the plane of the rolling circle, but not in its circumference, the curve generated is a hypotrochoid; and if the radius of the fixed circle is double that of the rolling one, the hypotrochoid becomes an ellipse.

Hyp'ogene [from the Gr. ὑπό, "under," and γίνομαι, "to be" or "to be born"], a term in geology, proposed by Lyell to designate rocks that are nether-formed, or formed at great depths, and consequently underlie sedimentary and ejected volcanic rocks, which are of superficial origin. Granite, gneiss, and diorite are examples of hypogene rocks.

Hyponitric Acid. See NITROGEN, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Hypophos'phites, salts of hypophosphorous acid. In medicine the term is currently used as referring to potassium, sodium, and calcium hypophosphite, which are considered by some to yield the medicinal effects of phosphorus, while free from the latter's poisonous qualities. They were not long since highly vaunted as remedies for consumption, but have not sustained their reputation in that particular. (See PHOSPHORUS.) EDWARD CURTIS.

Hypophosphorous Acid and **Hypophosphites.** See PHOSPHORUS, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Hypophthal′midæ [Gr. ὑπό, "under"—*i. e.* "inferior or low down"—ὀφθαλμός, "eye," and *idæ*, the family termination], a family of nematognathi or siluroids distinguished by the persistent distinction and very slight modification of the anterior dorsal vertebræ, and with the head depressed; opercula developed; the inferior pharyngeal bones united for their entire length; branchiostegal rays numerous; the dorsal fin developed from the caudal portion of the vertebral column; and the skin naked. This family is confined to South America, and is represented there by two genera—*Hypophthalmus*, with several species, and *Helogenes*, with a single one. These differ from all other representatives of the order in the separation of the anterior vertebræ in contradistinction to their confluence into one, as in the other members of the group; the eyes are situated very low down behind and below the angle of the mouth; and from this peculiarity the typical genus and family have received their names. In other respects they have considerable superficial resemblance to the cat-fishes of our own waters. THEODORE GILL.

Hyposul′phites, salts of hyposulphurous acid. Medicinally, the alkaline hyposulphites may be used for the same purpose as the corresponding sulphites. (See SULPHITES.) EDWARD CURTIS.

Hyposulphurous and **Hyposulphuric Acids, Hyposulphites** and **Hyposulphates.** See SULPHUR, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Hypotheca′tion [Gr. ὑπό, "under," and τίθημι, to "place"]. In the civil law this was a kind of pledge in which the possession of the thing pledged remained with the debtor instead of being delivered to the creditor or lender, as in cases of pledge properly so called. Strictly speaking, it applies to immovable things, not susceptible of delivery from hand to hand. (See PLEDGE.) The term is but little used at common law, but is sometimes employed with reference to bottomry bonds, which are given to obtain a loan of money by making a vessel security for the repayment. (See BOTTOMRY.)

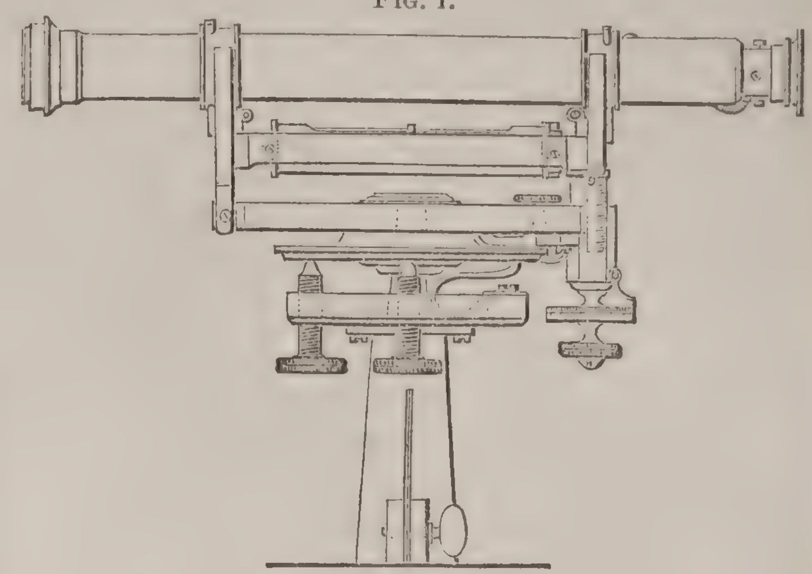
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Hypoth′esis [Gr. ὑπόθεσις, from ὑποτίθημι, to "place under," to "suppose"], a judgment which is provisionally proposed as an explanation for some fact or group of facts in science, and which may be discarded if found untrue. When an examination of a sufficient number of the facts of the case shows that the hypothesis will stand the tests of experience, and is not inconsistent with known facts and principles, it becomes a *theory*. The *hypothesis* is the work of imagination, the *theory* the fruit of observation and reasoning. The *hypothesis* is the temporary scaffolding by means of which the arch, the perfect theory, is constructed.

Hypsom′etry [Gr. ὕψος, "height," and μέτρον, "measure"], a branch of geodesy which treats of the measurement of heights, either absolute, when referring to the sea-level, or relative, between any two distant places on the earth's surface. There are three principal and independent methods in use. The first and most accurate depends on the property of fluids when at rest to present their surfaces at right angles to the direction of gravity; the second depends on the angular measure of elevation, in combination with the known distance of the object, and having regard to the effect of atmospheric refraction; the third and least accurate method depends on the law of the decrease of pressure of the atmosphere with an increase of altitude. The first method employs the levelling instrument, the second the theodolite, the third the barometer. Since the introduction of the aneroid barometer (an instrument of precision and of great simplicity and portability) the method of measuring differences of elevations by means of the temperature of boiling water has almost been abandoned; it depends on the known relation between the variations in the atmospheric pressure and the corresponding changes in the boiling-point of water, as measured by a very sensitive thermometer; the results, however, are subject to considerable uncertainty. The second or trigonometrical method is the only one applicable in case one or both stations are inaccessible.

(1) Spirit levelling is generally conducted as follows: The levelling instrument is set up nearly midway between any two consecutive stations, A and B, on the line of levels, and after its adjustment the readings of the staves placed over the stations are successively taken; the line of sight having been made horizontal, the difference in the readings equals the difference of heights (A—B). The instrument is next placed midway between stations B and C, and the difference of heights (B—C) is ascertained in a similar way; this process is repeated until the terminal point is reached, which is frequently many hundred miles distant from the starting point. The principal adjustment of the instrument consists in placing the optical axis or line of collimation, as determined by the centre of the objective and the intersection of the cross-threads, parallel to a tangent to the level, thus rendering the sight-line horizontal. For accurate measure the level must be very sensitive; it is filled with

FIG. 1.



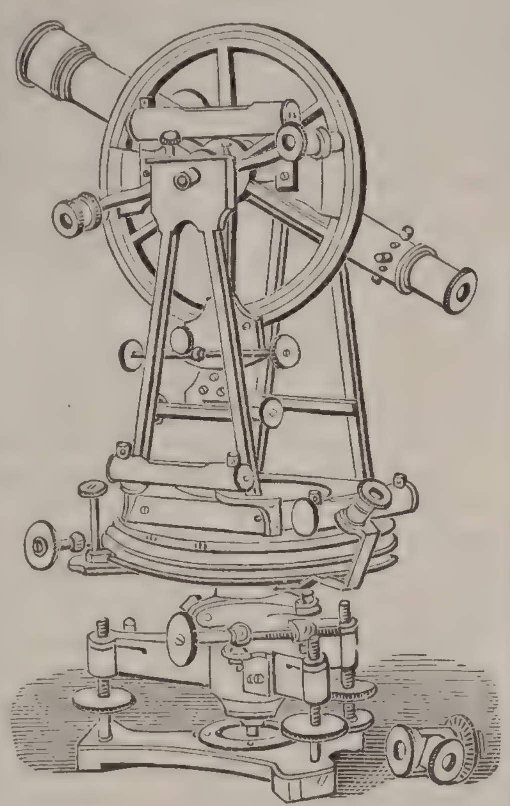
Level.

alcohol or ether, and its inner surface is generally ground to a radius between 50 and 250 mètres, and its least count usually varies between a few seconds and less than a single second for the best levels. The magnifying power of the telescope employed is generally within the limits of 20 and 40 for the better class of instruments. To render the effect of any imperfection in the various adjustments the least possible, also to make the effect of refraction in the line of sight and of the earth's curvature insensible, the instrument is placed midway between any two stations; if this should not be the case, corrections for difference of refraction and for difference of curvature for the distances to the staves must be applied. This is done readily by means of tables. The distances may be stepped off, or may be measured by a tape-line, but are most readily ascertained by a telemeter arrangement in the telescope; such, for instance, as two horizontal threads equidistant from the central thread, the number of divisions on the staff included between them being read off, from which the distance becomes known. If the distance between telescope and staff is not limited by the slope or configuration of the ground, it should be taken as great as the optical power of the instrument and the sensibility of the level will permit without detriment to accuracy; ordinarily, the distance varies between 50 and 150 mètres, though occasionally it may even be double the last-mentioned distance. The staff should be divided decimally (the unit being the mètre or foot); and if read by the observer through the telescope, which is preferable, should be divided into block spaces with block figures, so as to be seen at the greatest possible distance; if the pointing is to be made by means of a movable target, time will be saved, after the assistant has placed the target very nearly at the correct height, by effecting the exact pointing through dislevelling the instrument and correcting the result for change of level. Respecting the accuracy attainable, the mean error may be stated to be about $\frac{1}{70000}$ of the distance for telescopes magnifying ten times, but will decrease to about $\frac{1}{200000}$ with the best instruments. By convention, the average surface of the ocean has been chosen as the zero-level from which to count absolute heights; to connect a line of levels with it a series of consecutive high and low waters must be observed, from which the mean or half-tide level is to be deduced. It follows that if we could level from the equator to the pole, we would find no difference of height, though we approached the earth's centre by nearly 13 miles. The difference of height between any two distant stations should be the same, no matter over what route the levels have been carried; that is, the local deflections of the direction of gravity will not affect the result, provided the intermediate stations have not been too far apart in passing over a region of rapidly changing deviations of the plumb-line. (For detailed information the reader may consult *Theoretische und practische Anleitung zum Nivelliren*, von S. STAMPFER (Wien, 1845); *Tables of Heights, etc. determined by the Great Trigonometrical Survey of India* (Calcutta, 1863); *Nivellement de précision de la Suisse, sous la direction de A. Hirsch et E. Plantamour* (Genève, Bâle, Lyon, 1874).)

(2) Trigonometrical levelling consists in measuring the vertical angle between the zenith of the station occupied and the distant object the height of which is to be determined; the horizontal distance to this object must be known, and is generally given by triangulation, and the measured angle must be increased on account of refraction, which may be taken roughly as proportional to the length of arc of junction, and ordinarily equal to about $\frac{1}{14}$ of the corresponding angle at the earth's centre. We may either measure the double zenith distance—one-half of the operation with

position of theodolite, say circle left, the other half with circle right (the instrument having been turned 180° in azimuth)—or if the zenith point (or horizontal point) of the vertical circle be previously determined, it will suffice to measure the single zenith distance (or altitude, a depression being a negative altitude). Irrespective of other adjustments of the theodolite, those for collimation, for verticality of the vertical axis, and for horizontality of the horizontal axis of the telescope must be carefully attended to; the observer should also examine the verticality of the plane of his circle to the last-named axis. The principle of repetition (use of the repeating circle) is not recommended unless the graduation be very inferior in comparison with the optical power of the telescope and the sensitiveness of the level; the accuracy depends mainly on the level, which must be read before and after reversal. We may also measure differences of zenith distances or small angles of elevation (or depression) micrometrically, either by an eye-piece micrometer or by a micrometer screw, as shown in the cut of the levelling instrument. All measures of zenith distances are affected by any deflection of the plumb-lines which may exist in the vertical planes of the stations, but the uncertainties in the results for height depend chiefly on the variations of the atmospheric refraction, on account of which, for accurate work, the distances may be limited to about 20 and 25 kilomètres (say 12 and 15 statute miles). For such distances very accurate results may be had by observing only within about two hours of apparent noon, during which period the refraction is steady and is near its minimum value; observations taken on objects at great distances, say 100 kilomètres and above, should of necessity be restricted to this period of the day (from 10 A. M. to 2 P. M.). Although the refraction exhibits daily variation, and is a function of the temperature and pressure of the atmosphere, yet it is extremely irregular; in its ordinary variations the coefficient keeps within the range of $\frac{1}{9}$ to $\frac{1}{16}$, but occasionally and abnormally it may be several times greater, or it may become zero, or even take a negative value. The refraction is slightly greater for lines crossing water than for lines over land; it diminishes with altitude and with increasing temperature, but increases with increasing atmospheric pressure; in general, its value depends on the law of the distribution of temperature with height. Thus, the more rapid the decrease of temperature the smaller the refraction, and the slower the decrease of temperature the greater the refraction; with a sufficiently rapid decrease of temperature it may become zero, with no decrease, or for a constant temperature the refraction is large, and will still increase should the temperature increase with height. If we measure only one zenith distance, a value of the refraction must be adopted suitable to the circumstances; if we measure the zenith distances at the two stations, the difference in the two results for difference of heights will indicate a change in the value of the coefficient and the error of the assumed value combined; if we measure reciprocal and simultaneous zenith distances, the coefficient of refraction can be eliminated under the supposition that it is the same at each station, and that there is no effect from station errors, and from such measures its value may be determined. If, besides, the difference of level between the two stations has been ascertained by the spirit-level, the angle of refraction may be deduced for each station, and we shall generally find the refraction at the upper station less than at the lower one. Observations of the sea-horizon in connection with an assumed value for the refraction will roughly determine the height of the station; the state of the tide may also be considered. (For the usual trigonometrical formulæ applying to these cases see art. GEODESY, also the account of the principal triangulation of the ordnance survey of Great Britain and Ireland, by Lieut.-Col. H. James (London 1858).)

FIG. 2.



Theodolite.

In Nos. 1478–1480 and 1587–1590 of the *Astronomische Nachrichten* (1866), Dr. Bauernfeind has developed at length the equation to the path of a ray of light passing through the atmosphere, based upon Laplace's differential equation for the atmospheric refraction. (*Mécanique Céleste*, tome iv. p. 246.) An application of this to experiments made in California will be found in *Coast Survey Report* for 1871, Appendix No. 11.

(3) Passing now to the measure of heights by means of the barometer (see BAROMETER), this instrument, in the form of a mercurial barometer, may be regarded as essentially a balance in which, under the influence of gravity, the mass of the superincumbent atmosphere is equilibrated by a mass of mercury; in the ANEROID BAROMETER (which see), on the contrary, the atmospheric pressure is counteracted by the elasticity of a corrugated metallic vessel (generally filled with gas, sometimes supplied with a spring). A change of gravity could not therefore be indicated by an instrument of the first form, but would be by one of the second form. Thus, if two such instruments, side by side, were to read alike at the equator, they would, if they could be transported to the Pole, differ at the latter place, the mercurial barometer remaining unchanged, but the aneroid indicating the greater pressure existing at the Pole. This distinction should be kept in view in hypsometry: the aneroid barometer, however, is generally used only as a differential instrument, and as such may possess great accuracy, especially when the following reductions are carefully attended to.

According to Mariotte's law, the elastic force of the atmosphere is proportional to its density; further, the densities decrease in a geometrical progression when the altitudes increase in an arithmetical one; this leads directly to the simple logarithmic formula for the difference of height, $H = N \log \frac{b}{b'}$, where b and b' are the respective heights of the mercurial columns at the lower and upper stations, and N represents a numerical coefficient, found either theoretically or practically by comparisons of results by the spirit-level or vertical angles and the barometric pressure. N equals nearly 18,400 mètres. The mercurial columns should be at the same temperature; if not, they may be reduced to 0° C., or H may be corrected by means of the expression $\left(\log \frac{b}{b'} - \frac{T-T'}{12780}\right)$. Since we must rise higher in warmer than in cooler air for the same decrease in height of the mercurial column, a correction for temperature is needed; taking the coefficient of expansion for air $= \frac{1}{273}$ for the centigrade scale, and for t and t' the atmospheric temperatures at the lower and upper stations, the factor becomes $\left(1 + 0.00367\,\frac{t+t'}{2}\right)$; further, multiplying with the factors $(1 + 0.00262 \cos 2\phi)$ to allow for change of gravity with change of latitude ϕ, and with $\left(1 + \frac{2a+h}{R}\right)$, to allow for decrease of gravity with height, a being the altitude of the lower station above the sea, R the earth's radius (about 6366740 mètres), and h an approximate value for H, we obtain finally the expression—

$$H = 18400^{\mathrm{m}}.\left[\log \frac{b}{b'} - \frac{T-T'}{12780}\right]\left(1+\frac{t+t'}{546}\right)(1+0.00262 \cos 2\phi)\left(1+\frac{2a+h}{R}\right).$$

This formula is only intended as a typical one; numerous expressions have been given in various forms, of greater or less complexity, with various numerical coefficients, for different units, and for use either with or without logarithms, most of them accompanied by tables to facilitate their application. They may be divided into two classes—those adapted to a mean state of humidity of the air, such as Laplace's (see *Mécanique Céleste*, tome iv. p. 292), and those taking into consideration the actual amount of the vapor pressure, such as Bessel's (see *Astronomische Nachrichten*, Nos. 279, May, 1835, and 356, 357, Sept., 1838), which contain perhaps the most complete investigation made on the subject. The first height determined barometrically was that of the Puy de Dôme in 1648, at the suggestion of Pascal, and Dr. Halley was the first (in 1686) to establish the correct theoretical basis for computation of heights; many of the formulæ constructed since his time have been collected by Dr. Rühlmann, who also gives an extensive list of authors showing the great extent of the literature on the barometer. (See *Die barometrischen Höhenmessungen*, etc., von DR. R. RÜHLMANN, Leipsic, 1870. For a selection of formulæ and tables, see the *Smithsonian Meteorological and Physiological Tables*, by DR. A. GUYOT, Washington, 1859.)

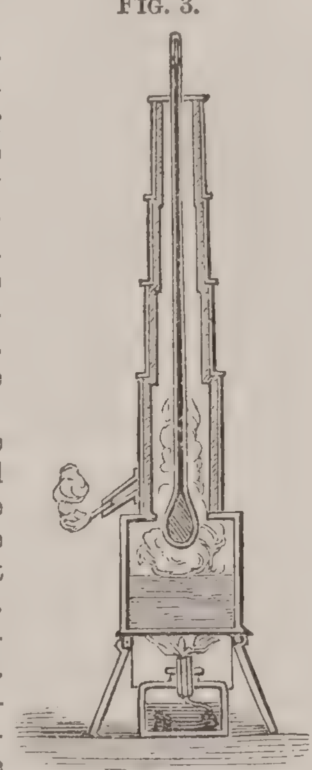
Respecting the accuracy in resulting heights attainable by means of the barometer very divergent opinions exist, but it is believed that with close attention to sources of error, instrumental and local, and especially to the effect of the daily variation of the pressure and temperature,

great relative accuracy may be reached. Errors of considerable magnitude may creep in if the two stations are at a great distance horizontally, but they will arise principally from the difficulty of ascertaining the true temperature of the intervening stratum of air, which cannot be taken equal to the mean of the temperature observed at the lower and upper stations; indeed, the problem has been inverted, and from the known (by level or triangulation) difference of height and the observed pressures the temperature of the air has been inferred. In this way it was ascertained that the intervening air partakes very considerably less of the daily variation of temperature than what is found by direct observations near the earth's surface. Ramond (about 1810) appears to have been the first to notice the relation between barometrically-deduced heights and the time of the day when these measures were taken; Kreil proposed the use of the annual means of pressure and temperature to secure reliable results. Plantamour and Rühlmann have given special attention to this subject; it appears that differences of heights, barometrically determined, reach their maximum value shortly before the time of the greatest heat of the day; this is fully developed on clear days, less so in cloudy weather; in winter, differences of heights are generally found too small, and too great in summer; heights deduced from annual means differ little from the truth. For accurate hypsometric measures the hours recommended are the following: beginning with March and ending with October, 8, 7½, 7, 6½, 6½, 7, 8, 10 A. M., and 6, 7, 7, 9½, 9½, 7½, 6 P. M. (See *Coast Survey Report* for 1871, Appendix No. 11.)

To correct or reduce to a given place the reading (A) of an aneroid to the corresponding reading (B) of a mercurial barometer, we may use the relation $B = A + x + y(t - t_0) + z(p - p_0)$, where x is an index correction, y is a temperature coefficient, and z a pressure coefficient; which three quantities have to be ascertained experimentally for each instrument, and require to be tested from time to time, to make sure of their constancy, or otherwise allow for change. In one of the latest forms of the instrument, in which the elastic chamber is doing no mechanical work, it has been provided with a long index-arm, and the reading is made after bringing two lines to coincidence by means of a screw (made by J. Goldschmid of Zürich).

When the temperature of the boiling-point of water has been observed, we may find the corresponding indication of a mercurial barometer by means of Regnault's table, revised by A. Moritz, as given by A. Guyot in the *Smithsonian Meteorological and Physical Tables* (*Miscellaneous Collection No. 31*, Washington, 1859). The idea of measuring heights by means of the temperature of boiling water originated in the early part of the last century with Fahrenheit (*Phil. Trans.*, vol. xxxiii.) and Cavallo (*Phil. Trans.*, vol. lxxi.); the apparatus itself is due to Dr. Wollaston (*Phil. Trans.*, 1817, part ii.). Fig. 3 presents the instrument as made by Casella of London.

FIG. 3.



The idea of delineating a surface by contour-lines, or lines of equal level, originated in 1737 with the Academician Buache, who applied the principle to lines of equal depth, but refers also to those of equal elevation. A general hypsometric atlas was published at Winterthur in 1856 by J. M. Ziegler, but beautiful and most instructive applications of this principle may be seen in the hypsometric charts in Dr. Petermann's *Geographischen Mittheilungen* (Gotha); for instance, in No. ii., 1875. C. A. SCHOTT.

Hyra'ceum, a substance imported from the Cape of Good Hope, and now believed to be the excrement of the klip-das (*Hyrax Capensis*). (See HYRAX.) It is a brown pitch-like substance, having much the taste and smell of American castoreum, for which it has been used as a substitute. It was formerly collected by the colonists for a fertilizer, but the supply has given out.

Hyrac'idæ [Gr. ὕραξ, "mouse," and *idæ*, the family termination], the only existing family of mammals of the order Hyracoidea, at once distinguishable by the rabbit-like form of the body and the small size of the animals (about that of the rabbit), combined with the peculiarities noticed under the ordinal name. The best known species of the family is *Hyrax Sinaiticus*, an inhabitant of Palestine, known under the vernacular designation of *uabi*, and whose ancient designation has been translated in the accepted version of the Bible, coney—*i. e.* rabbit. The species is frequent in rocky regions in Palestine. (See Tristram's *Natural History of the Bible.*) A number of other species are found in Africa. THEODORE GILL.

Hyracoi'dea [Gr. ὕραξ, "mouse," and *oidea*, the super-family affix], an order of educabilian placental or monodelph mammals, with feet whose inferior surfaces are furnished with pads (as in rodents and carnivores), toes (four to the front, three to the hind feet) with the terminal phalanges encased in hoofs (inner nail of hind foot curved); fore feet with the carpal bones in two interlocking rows, the cuneiform extending inward and articulating with the magnum, and thus forming an enlarged attachment for the ulna, which is antrorsely produced, and the unciform and lunar separated by the interposition of the cuneiform and magnum; hind feet with the astragalus at the anterior portion extended and much deflected inward, articulating in front only with the navicular; teeth peculiar, the molars resembling those of the rhinoceros, and the incisors four in each jaw, those of the upper jaw next to the symphysis with persistent pulps, long and curved, and those of the lower straight and normal. The placenta is deciduous and zonary. This order has been constituted for the reception of the Hyracidæ, which were formerly supposed by naturalists to be related to the rodents, but were later (*e. g.* by Cuvier, etc.) referred next to the rhinoceros.

THEODORE GILL.

Hy'rax [Gr. ὕραξ, "mouse"], a genus of herbivorous mammals belonging to the order Hyracoidea. These animals were formerly classed with the rodents on account of superficial resemblances, and Cuvier considered them as closely related to the rhinoceros from the form of the molar teeth. They are now regarded as constituting a distinct order. In fully adult animals the dental formula is—incisors $\frac{1-1}{2-2}$; canines $\frac{0-0}{0-0}$; premolars $\frac{4-4}{4-4}$; molars $\frac{3-3}{3-3}$. The upper incisors are large, triangular, and somewhat tusk-like; as in the rodents, they are curved and grow from persistent pulps. The lower incisors are straight and normal in their mode of growth. The molar series strongly resembles that of the rhinoceros in miniature. The soles of the feet are furnished with pads, as in the rodents and carnivores, but the terminal joints are furnished with hoofs or flat nails, four in front and three behind. The innermost nail of the hind foot is peculiarly curved. The astragalus articulates in front only with the navicular. There are from 29 to 31 dorsolumbar vertebræ, the greatest number known in any terrestrial mammal. The tail is short or wanting, the body is covered with fur, and the snout or muffle is split, as in the rodents. Several species have been described, but they are found only in Syria and Africa, where they inhabit rocky places and are known as damans. The best-known species is perhaps the klipdas (*H. capensis*) from South Africa. *H. Sinaiticus* or *H. Syriacus* is the coney of the Bible, where it is erroneously regarded as a ruminant from its habit of moving the jaws constantly from side to side. O. C. MARSH.

Hyrca'nia, an ancient district of Asia, the present Mazanderan, was bounded N. by the Caspian Sea, E. and S. by Parthia, and W. by Media. It was inhabited by nomades of rude and savage habits, and its extensive forests swarmed with wild beasts, of which the Hyrcanian tiger is often mentioned. The honey of its bees was much appreciated.

Hyrcan'us [Ὑρκανός], the name of several historic Jews of the Maccabæan period, of whom the most noteworthy are —(1) JOHN HYRCANUS, son and successor of Simon Maccabæus, prince and high priest of the Jews, restorer of the independence of Judæa, and founder of the monarchy, which continued in his family till the accession of Herod. When, in 137 B. C., Antiochus VII. had established himself on the throne of Syria, he determined to reduce Judæa to its former condition of a tributary province of the Syrian monarchy. His general, Cendebeus, invaded the country with a great force, but was defeated by Judas and John Hyrcanus, two sons of Simon Maccabæus. Shortly after, however, in 135 B. C., Simon, together with his two sons, Judas and Mattathias, was assassinated by his son-in-law, Ptolemy. Hyrcanus now assumed the title of prince and high priest, and led an army against Ptolemy, whom he shut up in the fortress of Dagon. Meanwhile, Antiochus Sidetes invaded Judæa with a large army, and Hyrcanus, unable to meet him in the field, retreated to Jerusalem, where he was besieged and pressed hard by Antiochus. At last a treaty of peace was concluded in 133 B. C., according to which the fortifications of Jerusalem were to be demolished and an annual tribute paid to Syria. Four years afterwards he followed Antiochus with a force of Jewish auxiliaries on his expedition against Parthia, but was fortunate enough to escape the disaster which overtook the

Syrian king and army by an earlier return to Judæa. As soon as Antiochus was dead, Hyrcanus hastened to secure the independence of his own realm, and sent an embassy to Rome in order to get the alliance concluded during the reign of Simon confirmed by the senate. In this he succeeded. He also conquered Sichem in Samaria, destroyed the temple of Gerizim, subdued Idumæa, and extended the boundaries of Judæa. Meanwhile, Demetrius II., the brother and successor of Antiochus, returned from his captivity in Parthia, and prepared himself to invade Judæa, but was prevented by an internal war, in which he was killed, 125 B. C. Hyrcanus now ruled for several years in peace, but at last, deeming himself strong enough for the task, he invaded Samaria with a great army and laid siege to the capital. The Samarians invoked the assistance of Antiochus Cyzicenus, but this king was defeated by Antigonus and Aristobulus, two sons of Hyrcanus, and Samaria was taken and razed to the ground, 109 B. C. Hyrcanus reigned three years longer, but these latter years of his government were disturbed not a little by the quarrels of the two powerful sects, the Pharisees and Sadducees. Hyrcanus belonged originally to the former party, but left it and allied himself to the latter; he d. 106 B. C. (2) JOHN HYRCANUS II., grandson of the foregoing, son of Alexander Jannæus; was appointed high priest by Alexandra, his mother, 78 B. C., and on her death (69 B. C.) assumed the sovereignty, which in 66 he resigned to his more energetic brother, Aristobulus; fled for protection and assistance to Aretas, king of Stony Arabia, 65; engaged in a civil war, but without success until 63, when he was reinstated by Pompey and made high priest and ethnarch; was deprived of the latter title 49, but in 47 the actual sovereignty was restored to him by Julius Cæsar. Meanwhile, his brother Aristobulus and Alexander, son of Aristobulus, who made him much trouble, were put to death by the Romans. Antipater, the able lieutenant of Hyrcanus, was poisoned with the consent of the high priest 44 B. C., and the young Herod, afterwards called the Great, a son of Antipater, became the virtual ruler. In 40 B. C., Antigonus, son of Aristobulus, induced the Parthians to send an army against Hyrcanus, who was by treachery taken prisoner, deprived of his ears, and then allowed to live in peace at Babylon, where he remained until 33 B. C., when he returned to Jerusalem, but, falling under the suspicion of having plotted against Herod, he was put to death 30 B. C.

Hyre, de la (LAURENT), b. in France in 1605, and d. in 1656. He belonged to the so-called school of Fontainebleau, whose founders were Primatice and Rosso, and which developed chiefly under Italian influence.

Hyria, or **Hyrium,** an inland city of ancient Calabria in Southern Italy, situated on the Appian Road, about midway between Brundusium and Tarentum. Herodotus represents it as having been the metropolis of the Messapians, founded by a colony of Cretans on their return from Sicily. Strabo mentions that a palace of one of the ancient native kings was shown there in his time. In early times it was a place of importance, and near the modern town of Oria inscriptions have been found in the Messapian dialect, and numerous coins in Roman characters bearing the name of Orra. There was at least one other place of the same name in Southern Italy, as is proved by coins of another class found in Campania.

Hyrmentrude, or **Ermentrude,** a daughter of Eudes, count of Orléans, was married Dec. 14, 842, to Charles the Bald; d. Oct. 6, 869. She did not mix in politics, but many religious institutions were founded and endowed by her.

Hyrtacina, city of Crete, S. E. from Polyrrhenia, on the southern coast of the island, near the temple of Artemis Dictynnia. Ruins have been found by Mr. Pashley, being numerous vestiges of polygonal masonry, on a hill near the modern village of Temenia. Coins of the ancient city are also found.

Hyr'tl (JOSEPH), M. D., b. Dec. 7, 1811, at Eisenstadt, Hungary; was educated at Vienna, where in 1833 he became prosector in anatomy; was professor of anatomy at Prague 1837–45; professor of anatomy at Vienna 1845–74, and for a part of the time was rector of the university. He founded the Vienna Museum of Comparative Anatomy, and made an incomparably fine private collection of materials illustrative of some departments of comparative anatomy (now in possession of Prof. E. D. Cope, Haddonfield, N. J.). Hyrtl was the first German to give much attention to regional anatomy, and has made many discoveries in human and comparative histology. Author of *Topographische Anatomie* (2 vols., 1847), *Lehrbuch der Anatomie* (1847; many editions since), *Handbuch der praktischen Zergliederungskunst* (1860), *Ueber endlose Nerven* (1865), *Ueber Ampullen am Ductus Cysticus der Fische* (1868), *Die Blutgefasse der menschlichen Nachgeburt in normalen und abnormalen Verhaltnissen* (1870), *Das Nierenbecken der Säugethiere und des Menschen* (1870).

Hysiæ, town of Bœotia, at the northern foot of Mount Cithæron, was situated on the high-road from Thebes to Athens, and formed an important point in the strategic disposition to the battle of Platæa. In the time of Pausanias it was in ruins; an unfinished temple of Apollo and a sacred well were still extant; now nearly every trace of it has disappeared.

Hys'sop [Gr. ὕσσωπος; Heb. *êzôb*], the *Hyssopus officinalis*, a half-shrubby labiate plant, a native of Europe, sparingly naturalized in the U. S. It is an aromatic stimulant, abounding in a volatile oil. In domestic medicine it is a very useful expectorant. Hedge hyssop is the popular name of various species of *Gratiola*, of the order Scrophulariaceæ. As the hyssop of Greek authors is conceded to be the common plant of that name, it has been inferred that it was also that of the Old and New Testaments, but this is by no means certain. Celsius has enumerated eighteen different plants which have been considered as the scriptural hyssop. Dioscorides, a Greek botanist, described two kinds, and the Talmudists have done the same, distinguishing the wild hyssop from the garden plant used for food. It is mentioned of Solomon that he "spake of trees, from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall;" and in Psalm li. it is said, "Purge me with hyssop and I shall be clean," etc.; from which indications Dr. J. F. Royle has, after a careful study of the ancient and modern notices, identified the hyssop of Scripture with the modern caper-plant (*Capparis spinosa*, Linn.), which is still found in abundance in Egypt, Sinai, and Palestine.

Hystaspes, author of a prophetico-apocalyptic work, *Vaticinia Hystaspis*, which was much read by the early Christians, and believed to contain predictions of Christ and the future of his kingdom. Of his life nothing is known, and the book itself has vanished; but it is often mentioned by the early Christian Fathers. Justin says of it that "the bad demons, in their efforts to prevent man's knowing the truth, succeeded in establishing a law which forbids the reading of the βίβλοι Ὑστάσπου. . . under penalty of death; but the Christians, notwithstanding this law, not only read the books themselves, but even incited the heathen to study them." Clement of Alexandria says of it that "the Christians found in it, even more plainly than in the books of the Sibyllines, references to Christ and the future of his kingdom, and especially a reference to Christ's divine Sonship, to the sufferings which awaited him and his followers, and to his final return."

Hyste'ria [from ὑστέρα, the "womb"], a peculiar nervous affection which in former times was supposed to have had its seat in the womb, but at the present day Hasse's theory of its origin is generally received—viz. that it arises from a nutritive derangement of the general nervous system, both central and peripheral. This may be caused by any organ of the body being diseased, and there can be no doubt but that it is dependent most frequently upon disorders of the uterus and ovaries, simply because these affections produce a deeper impression upon the nervous system. Sometimes irritation of the genitals, arising from excessive sexual intercourse, has as marked an influence on the general nervous system as a well-marked lesion of an internal organ; but we must not be too ready to ascribe a case of hysteria to deranged sexual function, for Hasse attributes these cases to a psychical rather than to a physical cause. This condition of the nervous system may also be produced by improper nourishment. There is a predisposition to the disease manifested. A tendency, either congenital or acquired, plays a much more important part in inducing this affection than all the causes enumerated.

Hysteria generally attacks women from the age of puberty to the decline of menstruation. It is of rare occurrence among men, and in them is produced in a manner similar to that in which it is produced in the opposite sex. Hysteria may manifest itself in a great variety of ways; in fact, it simulates almost every known disease, and often with the greatest care the practitioner is unable to differentiate them. The most common form, however, is the hysterical fit. In some cases this consists merely of the twitching of the muscles of a particular region, as of the face, arm, or leg. In other cases the whole body is affected at once. The patient generally laughs and cries alternately; this is due to spasm of the group of muscles which operate in producing these acts. Another very common accompaniment of these paroxysms is the so-called *globus hystericus;* this consists in the sensation as of a ball rising from the uterus and ascending through the abdominal and thoracic cavities to the throat, and is caused by a spasmodic contraction of the œsophagus. The patient may scream, tear her hair and clothes, and beat her breasts. In severe cases

we sometimes have loss of consciousness and convulsions; when this occurs it is almost impossible to distinguish it from epilepsy. The fits usually terminate with the discharge of a large quantity of almost colorless urine. Perhaps the next most common manifestation of the disease is hyperæsthesia, either general or localized, but most frequently the latter. Under this heading would come hysterical peritonitis, in which the patient will complain of great pain and tenderness over the region of the abdomen; she will jump and cry out upon the slightest touch. Accompanying this condition there will be a rapid pulse and increased temperature. The characteristic of the hysterical affection is that the pain is not aggravated upon deep pressure, and if you distract the patient's attention from her trouble, you can very often knead the abdomen without the least discomfort to her. The "stitch in the side" of young girls and women can generally be ascribed to hysterical hyperæsthesia. The opposite condition, anæsthesia, may occur, sometimes, to such an extent that the patient will allow your finger to be thrust into her eye or needles to be plunged deeply into the flesh without wincing. Hysterical hemiplegia and paraplegia very often occur. They are very perplexing cases, and can hardly be differentiated by any but a careful and experienced observer. Paralysis of the muscular fibres of the bladder, or spasm of its sphincter, is sometimes simulated. Hysterical patients very often pretend that they are suffering intolerably from retention of urine, and can only be relieved by the introduction of the catheter several times a day; which, indeed, seems to be all that they desire. When such an affection is made out beyond a doubt to be feigned, it is best to leave the patient to her own resources. Even in cases where this has been done, the patients have been known to drink their own urine in order to carry out the deception. Gravel and stone in the bladder are other diseases simulated; the patient will put common gravel in the urine after it has been voided and pretend to have passed it, or she may even place sand in the urethra. Watson records a case in which a young woman made the surgeons in one of the London hospitals believe that she had stone in the bladder, and who actually submitted to be tied upon a table in the position usually adopted for operations for lithotomy, before a theatre full of students, before the deception was discovered. Hysteria very commonly mimics affections of the spine and joints. Patients have been known to have been kept on their backs for months, and even years, and to have had blisters, leeches, and issues almost constantly applied for supposed disease of the spine, which subsequently was ascertained to be purely nervous. So with hip-joint disease, etc.

There are many hysterical affections referred to the fauces, aphonia or loss of voice, mock laryngitis or pharyngitis, stricture of the œsophagus, and many curious sensations. One patient imagined that a number of tapeworms came up from her stomach to her throat, filled her ears, and came out upon her tongue. Every time she attempted to catch them with her finger they would disappear. This occurred several times a day, and it was impossible to persuade her that such a thing could not happen. Among the other more common affections simulated by hysteria are pleurisy, consumption, cough, hiccough, indigestion, in which the patient swallows a quantity of air, and then pretends to be suffering from tympanitis and eructations; vomiting also sometimes accompanies this hysterical dyspepsia, simulating cancer of the stomach. Very often patients suffering from hysteria have a depraved appetite; they eat very little of anything, especially at table, and will hardly touch meat at all, except it be a little ham; they will devour slate-pencils, wafers, chalk, pickles, lemons, and such out-of-the-way articles. Notwithstanding this mode of life, their health does not materially deteriorate.

We next come to speak of the treatment. This may be divided into two modes—viz. that of the paroxysm, and that between the paroxysms. In the first variety the dress should be loosened and plenty of fresh air admitted into the room. An emetic should then be administered and cold water dashed in the face; sometimes it is necessary to continue doing this for quite a while (fifteen or twenty minutes), but the patients will generally succumb at last. If at the end of this time no improvement be noticed, the strong aqua-ammonia should be held to the nostrils, and when the patient draws her head away, it should be followed by the bottle. You should get the confidence of the attendants, and be very careful not to say anything in the presence of the patient that you do not wish her to hear. Having done this, if there is still no improvement, order, so that the patient can hear you, two or three flat-irons to be heated nearly red hot; say that it is a very urgent case, and that you intend applying them along the spine. The cases in which the patients will give the irons time to heat will be very few, and sometimes, when they have resisted every other means, the mention of such harsh treatment will make them start up instantly. However, should they still resist, the irons should be applied *ice-cold* along the spine, at intervals of two or three minutes. In the intervals between the paroxysms, or in the other forms of hysteria, laxatives, tonics, and the correction of any diseased function should be our first care. Besides this, the patient may take assafœtida pills, infusion of quassia, or, what seems to be much better now, the ammoniated tincture of guaiac.

EDWARD J. BERMINGHAM.

Hysterot'omy [Gr. ὑστέρα, "womb," and τομή, "a cutting," from τέμνειν, "to cut"], or **Cæsarean Opera'tion,** the delivery of a child by opening the abdomen of the mother. Pliny (lib. vii. cap. ix.) says that Cæsar was so called from being taken by excision out of the womb of his mother, and that such persons were called *cæsones*, from the Lat. *cædo*, to "cut." There is an obvious improbability in this story, for there were other Cæsars in the family before the man who made the name illustrious. It may be that Julius Cæsar was born in the manner described, but it is very unlikely that this was the origin of his name. If the story be true, the mother must have survived, as Aurelia was alive when her son invaded Britain. The incision is made in or near the middle line of the body, to the length of six or seven inches. The uterus is exposed, carefully opened, the child lifted out, and then the after-birth. The uterus contracts, the wound is closed, and opium is given to allay pain and nervous irritability. Anæsthetics should of course be given. In recent times the Cæsarean operation has repeatedly been performed with complete success, the life not only of the child but the mother having been saved. Some women, indeed, have had several children, each removed through an abdominal incision; one woman submitted to it seven times. Practitioners are not quite agreed as to all the circumstances which justify the performance of this operation. The late Dr. Gibson of Philadelphia, who performed the operation twice on the same woman with entire success, considered the operation comparatively safe if commenced early, before the patient's strength has been impaired by labor. It appears that out of 17 operations performed during or at the close of the first day of labor, 14 of the children and 12 of the women were saved. (See *American Journal of Medical Sciences* for July, 1872, pp. 290, 291.)

REVISED BY WILLARD PARKER.

Hystric'idæ [Gr. ὕστριξ, "porcupine"], a family of symplicidentate rodents, of moderate size, with a large anteorbital foramen; four molar teeth (on each side of the upper as well as lower jaw), traversed by re-entering valleys from the inner as well as outer walls, and with pit-like excavations of the surface; the alveolar portion of the supramaxillary normally connected; the clavicles rudimentary or obsolete; the fibula and tibia separate from each other; the claws of all the feet acute or little blunt, and hairs developed as robust spines. To this group belong the porcupines of the Old World, but not those of the New, they being distinguished from the former by the completely developed clavicles, as well as differences of the skull and dentition. About a dozen species are distributed in the tropical as well as temperate portions of the Old World, and especially in Africa and India. They have been combined under three genera, *Hystrix*, *Acanthion*, and *Atherura*.

THEODORE GILL.

Hythe [Ang.-Sax. *hyde*, a "haven"], a parliamentary and municipal borough and market-town in the county of Kent, England, 14 miles S. of Canterbury. Though formerly one of the Cinque Ports, it is now half a mile from the sea, while the adjacent ancient Roman port of Lymne (*Portus Lemanis*) is now nearly 3 miles from the coast. In ancient times an important battle must have taken place here, as is shown by the piles, containing many hundreds of human bones and skulls, still to be seen under the chancel of the well-preserved Norman church. Many of the skulls are of extraordinary size, and have deep sword-cuts in them: local traditions make them Danes, and fix the date of the battle at about 1000 A. D., but no certain account has been preserved. During the last century smuggling was carried on at Hythe to a great extent, but since it became a summer watering-place and the seat of the national school of musketry (1854) smuggling has ceased. Pop. of municipal borough, about 3000.

Hytú, Hitú, or **Itú,** town of Brazil, in the province of São Paulo, on the Tieté, which becomes navigable here, just below the great cataract, is neatly built, and is one of the most prosperous provincial towns of the country. The plain in which the town stands extends along the Tieté at the foot of a plateau of considerable elevation, and is extremely fertile, covered with plantations of sugar and cotton. The trade in mules and asses is a considerable one. Pop. about 10,000.

I.

I, the ninth letter of the Roman alphabet, was once interchangeable with J, which is a form of the same letter, although at present of very different power. I is a vowel, and in English has three well-marked sounds: (1) the sound of long ē, as in *machine, marine;* this is the sound almost invariably given to it in all other languages which have this letter; (2) the "long sound," that heard in *mind, sign;* this sound is strictly a diphthong between *a* broad and long ē; and (3) the "short" sound, heard in *pin, minion.* As a numeral, I stands for *one* (1). In chemistry it is the symbol of iodine.

Iaba'dius, the name under which Ptolemy described a vast island of the East Indies, near the Golden Chersonesus. It was fertile in grain and produced gold; the capital was called Argyre. From the similarity of names, both of which mean "barley," it is generally thought to be identical with *Java,* though Humboldt argues for Sumatra.

Iac'chus, the mystic name of the god Dionysus at Athens and Eleusis. (See ELEUSINIAN MYSTERIES.) It is probable, however, that Iacchus, the Roman Bacchus, was originally distinct from the Theban Dionysus; the former being a Phrygian divinity, represented as a child, the son of Zeus and Demeter, while the latter was always called the son of Zeus and Semele.

Ial'ysus, one of the three principal Doric cities in Rhodes, anciently the chief place of the island, and often taken as a synonym of the island itself. It was very flourishing in the time of the Homeric poems, and some remains of its ancient greatness are still seen at the modern village of *Ialiso.* The foundation of Ialysus was ascribed to a mythical personage of that name.

Iam'bic [Lat. *iambicus,* from *iambus;* Gr. ἴαμβος], a poetic metre much used in Greek, Latin, and modern verse, consisting of a succession of *iambi.* An iambic foot is formed either of one short and one long syllable, as in *ămāns,* or of an unaccented syllable followed by one accented, as in *ĕstēēm.*

Iam'blichus, a Neo-Platonic philosopher of the fourth century after Christ, was a disciple of Porphyry, and resided in Syria. With him that combination of Greek philosophy with Oriental mysticism which was the characteristic of the Neo-Platonic philosophy became mere theurgy. He taught that it was possible for man to put himself in direct communication with the Deity by means of certain rites and ceremonies. Five books of his work on Pythagoras, and his book on the Egyptian theology, are still extant.

Ian'thina [Gr. ἰάνθινος, "violet-colored"], a genus of mollusks including the ocean-snails or violet snails. They have a snail-like shell, and float on the open sea, supported by a cartilaginous raft, containing air-vesicles. The float is a part of the operculum. They have no power of rising or sinking in the water. The eggs and young are attached below the float. They are carnivorous gasteropods of the family Haliotidæ, and feed on little acalephs. There are six known species. They are named from their purple juice.

Iap'etus [Gr. Ἰαπετός], in Grecian mythology, a son of Uranus and Ge, brother of Kronos and Oceanus, and father of Atlas, Prometheus, and Epimetheus. He was regarded by the Greeks as the father of all the human race, and the name is supposed to be the same as the JAPHETH of Genesis (which see).

Iatan', post-v. of Marshall tp., Platte co., Mo., on the Missouri River and on the Kansas City St. Joseph and Council Bluffs R. R. Pop. 129.

Iba'gue, town of Colŏmbia, department of Cundinamarca, 70 miles W. of Bogotá. Pop. 6000.

Ibar'ra, town of Ecuador, at the foot of the volcano Imbaburu, 60 miles N. E. of Quito. The surrounding country is exceedingly fertile and the inhabitants are mostly engaged in the cultivation of cotton and sugar. It suffered severely from an earthquake 1868. Pop. 13,200.

Iberá, or **Yberá,** a series of marshy lakes in the province of Corrientes, Argentine Republic, between the rivers Paraná and Uruguay.

Ibe'ria, one of the names under which Spain was known to the ancients, was chiefly used by the Greeks, and probably derived from *Iberus,* the Ebro.

Iberia, parish of Louisiana, bounded on the S. by the Gulf of Mexico. Area, about 600 square miles. It is divided into three portions by Grand Lake and Vermilion Bay. It has very important deposits of rock-salt. The soil is very fertile, the surface low, level, and well timbered. Cotton, corn, rice, molasses, and sugar are staple products. Cap. New Iberia. Pop. 9042.

Iberia, post-v. of Washington tp., Morrow co., O., on the Cleveland Columbus and Cincinnati R. R. Pop. 238.

I'berville, fertile county of Quebec, Canada, on the E. side of the river Richelieu. Area, 189 square miles. It is traversed by the Stanstead Shefford and Chambly R. R. Cap. Iberville. Pop. 15,413.

Iberville, a v. (P. O. ST. ATHANASE), cap. of Iberville co., Quebec, Canada, on the E. bank of the river Richelieu, opposite St. Johns, with which it is connected by a fine bridge. It is the seat of Canadian Institute. Pop. of sub-district, 1497.

Iberville, parish of Louisiana, extending eastward from the Atchafalaya River, and having the Mississippi as a part of its eastern boundary. Area, about 450 square miles. Its surface is low, but fertile, and it is sometimes subject in part to inundations. Cotton, corn, sugar, molasses, staple products. Cap. Plaquemines. Pop. 12,347.

Iberville, d' (PIERRE LEMOINE), the brother of the Sieur de Bienville and of five other able public men, b. at Montreal July 20, 1661; captured Fort Nelson 1686; served in the Schenectady affair 1690; in 1696 destroyed St. Johns, and took nearly all of Newfoundland from the British, whom he defeated in Hudson's Bay in the naval fights of 1697. In 1699 he fortified Biloxi, and in 1700 ascended the Mississippi River. In 1702 he fortified Dauphin Island and founded a settlement near Mobile. In 1706, with three ships, he attacked and captured the Isle of Nevis. D. at Havana, Cuba, July 9, 1706.

I'bex [Lat.], a genus or sub-genus of the goat family, distinguished by very large horns and rather scanty beards. The species of *Ibex,* as generally recognized, are *I. Alpinus* (the BOUQUETIN (which see) or ibex of the Alps), *I. Pyrenaicus, Hispanicus, Caucasicus, Sibiricus, Nubianus, Himalayanus,* and others; but it is likely that some or all are mere varieties. The Alpine ibex breeds freely with the goat.

Ibiapába, a mountain-chain in Brazil, in the province of Ceará.

Ibicuí, a large river in the Brazilian province of Rio Grande do Sul, flowing W. into the Uruguay.

I'bis [Gr. ἶβις], a genus of wading birds of the family Tantalidæ, allied to the snipes and herons, and having very long legs, neck, and bill, and a very short tail. The American species are *I. falcinellus,* the glossy ibis, common also to the Old World; the white ibis (*I. alba*) of Florida (believed with some reason to be a mere variety of the sacred ibis, hereafter noticed), and the scarlet ibis (*I. rubra*). All these are handsome birds, found mostly in warm regions. The wood-ibis of America is *Tantalus loculator.* The sacred ibis (*I. religiosa*) of Egypt, as well as the glossy ibis, is frequently found embalmed in that country. It was regarded as an incarnation of the god Thoth, and was looked upon with peculiar reverence by all classes of the people. The staw-necked ibis (*Geronticus spinicollis*) is a large Australian bird of this family.

Sacred Ibis.

Ib'rahim Pasha', a son of Mehemet Ali, b. at Kavala, Roumelia, in 1789. His father was appointed viceroy of Egypt in 1806, and Ibrahim very soon gave brilliant proofs of the great personal qualities of which he was possessed by subduing the wild tribes of Upper Egypt in 1812, by reducing the Wahabees and conquering a great part of Arabia in 1819, by reorganizing the Egyptian army after European models and founding a navy, and by his campaign in the Peloponnesus from 1824 to 1828. His greatest exploit, however, was his Syrian campaign in 1831. Having defeated the Turks in decisive battles at Tripoli and Homs, he conquered the whole of Syria in one year,

and pushed forward into Asia Minor to Konieh. Here he completely routed the Turkish army, Dec. 20, 1832, and as his fleet had chased the Turkish fleet from place to place, the way to Constantinople was open to him. But Russia interfered. Peace was concluded, and the whole of Syria was ceded to Mehemet Ali. Ibrahim was appointed governor of the new province, and in this position he showed that he had talents not only as a general, but also as a statesman and administrator. In 1839 war again broke out between Egypt and the Porte, and Ibrahim again succeeded in routing the Turkish army completely at Nezib, June 24, but this time too the Ottoman empire was saved by the interference of the European powers. England, Austria, and Russia agreed to compel Mehemet Ali to give up Syria and Arabia, and content himself with the hereditary possession of Egypt; and after a short resistance Mehemet Ali had to submit. Ibrahim Pasha lived for several years as a private gentleman on his estates at Heliopolis, where he established large and very fine cotton and olive plantations. But about 1844, Mehemet Ali began to fall into dotage, and the government now devolved on Ibrahim Pasha. In 1848 he went to Constantinople, and was confirmed as viceroy of Egypt, but he d. very soon after his return, at Cairo, Nov. 9, 1848.

Ib′ycus, b. at Rhegium in the sixth century B. C., and lived for some time in Samos at the court of Polycrates. Of his poems only a few fragments are left, but the story of his death is known by all. He was attacked by robbers and mortally wounded while travelling through a desert place near Corinth, but before dying called upon a flock of cranes flying over him to avenge his death. Shortly after it happened at Corinth that a flock of cranes flew over the theatre while a performance was going on, and one of the murderers cried out involuntarily, "Behold the avengers of Ibycus!" which led to the discovery and punishment of the crime. Edited by Schneidewin (Göttingen, 1833), and in the *Poetæ Lyrici Græci* of Bergk.

I′ça, town of Peru, is situated in lat. 14° 41′ S., and connected by railway with Pisio on the Pacific Ocean, through which it exports large quantities of wheat, maize, wine, and brandy. Its climate is very hot, but not unhealthy. Pop. about 8000.

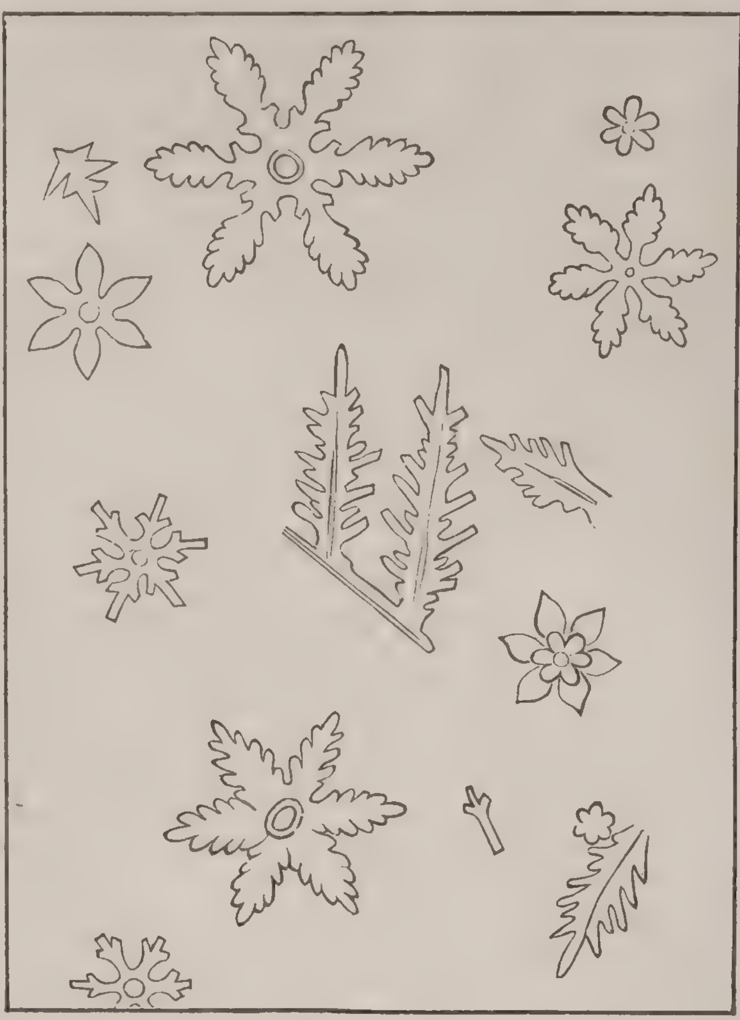
Icard′, tp. of Burke co., N. C. Pop. 929.

Ica′ria, or **Ic′arus** (*Nikaria*), an island of the Ægean Sea, W. of Samos. It is some 15 miles long from N. E. to S. W., and rather narrow; area, 50 square miles. It has a population of 8000, and, as of old, is valued for its pasturage.

Ic′arus, the son of Dædalus, who forgot, according to the old myth, his father's advice on their flight from Crete, and flew so high that the sun melted the wax with which the wings were attached to his shoulders, and he fell down and was drowned in the sea which after him is called the Icarian.

Ice. The freezing-point of water is 32° F. or 0° C. The presence of salt impedes congelation; sea-water, therefore, requires a temperature several degrees lower than fresh water to solidify. Pure water placed in polished vessels may be reduced 17° below freezing-point (to 15° F.) without congealing if it be kept perfectly still; the slightest agitation or the introduction of a foreign body will, however, cause it immediately to freeze; in which case heat is engendered, and the frozen mass comes up to the usual temperature, 32° F. Ice in assuming the solid form expands by about one-ninth of its own volume, its specific gravity being 0.9184 at the temperature 32° F. or 0° C. As cold increases, solid ice contracts; the ice on ponds occasionally cracks from this cause with a loud report. Ice sometimes forms at the bottom of streams when the water above does not freeze; this is probably due to the extreme stillness below. This "anchor ice," if detached from the body around which it has formed, rises and floats on the surface.

Ice is the normal condition of water. Ice, water, steam, aqueous vapor, fog, cloud, etc. are chemically identical; their physical difference is due, in the main, to the greater or lesser separation of the molecules by the action of heat. As heat is withdrawn from water its constituent particles approach, in accordance with the general law that heat expands and cold (or the absence of heat) contracts bodies. When the temperature 39° F. or 4° C. is reached, the volume of water begins slowly to expand; a new force, that of crystallization, coming in to modify the result. The particles of water are marshalled into orderly array, and their arrangement is so changed that in uniting they leave larger inter-atomic spaces than they possessed before freezing began. The expansion of crystallization compensates, and more than compensates, for the contraction of cold, and the mass expands by the difference of the opposing forces. Water in freezing gives out heat—*i. e.* that molecular force which had been devoted to the work of holding asunder the particles of water and maintaining it in a liquid form, is released from its work as the mass solidifies, and becomes again the molecular motion known as heat. In crystallizing each molecule approaches every other under the controlling power of a fixed law; each spicule, as it forms, unites with every other at an angle of 60°. As a result, ice-crystals are formed infinite in beauty and variety, but all obedient to this law—six-rayed ice-blossoms and stars and feathery foliage, where every spine joins the central stem at the invariable angle 60°. The ice which covers every sea and lake and pond is built up of film upon film of just such exquisite frostwork as sometimes covers the inner surface of our window-panes. The architecture of the frost may be slowly undone, and the process, in the reverse, watched. A slab of ice, cut with its faces parallel to the plane of freezing, is placed in the path of the electric beam; liquid flowers and leaves start into view in the interior of the slab. (See fig.) A brilliant central nucleus



Ice-crystals.

appears in each figure with an audible click. The ice as it melts contracts; the space filled by the frozen flower is not quite filled by the liquid one, and the water, which has been rendered very cohesive by the elimination of the air in freezing, ruptures with a sound, producing the central vacuum. A property of ice discovered by Faraday in 1841 (see REGELATION) accounts for the advance of the great glacial ice-masses which move down the Alpine and Arctic valleys. (See GLACIERS.) The magnificent icebergs of the northern seas are generally only the terminal masses of the Arctic glaciers, which have crept over the beach to the sea, and there been worn away and broken off by the action of the waves and the tides. The ice-caves described by Alpine travellers as existing in the glaciers are very beautiful; stalactite and stalagmite of pellucid ice, clustering branches, pillars, and domes adorn their roofs, floors, and walls. One of them shows in every crevice and depression of its walls the lovely blue tint characteristic of glacial ice in shadow, while the roof, which is thin enough to permit the sun's rays to penetrate it, glows with a delicate rosy tint. Ordinary ice, though crystalline, is not prismatic, but that which has frozen at a temperature below 32° F. shows a decided prismatic structure. In many of the ice-caves of France and Switzerland this structure is found; sometimes the stalactites are formed of common ice surrounded with a shell of the prismatic. The interior, being the softer, melts, leaving the stalactite hollow. Some ice-prisms, as mentioned in *Poggendorf's Annalen* (vol. iv. p. 475), when examined by polarized light, manifested a feeble double refracting power. The sudden disappearance of enormous sheets of lake-ice is explained by the breaking up of the vast mass into prismatic blocks. A slab of ice through which the beam of the electric lamp is sent will mark its path by the formation of innumerable little luminous spots, as the motes mark the path of a sunbeam. The spots form in any plane, but in those which are parallel to the plane of freezing they shoot out spicules, and finally produce the flowers before described. The planes of freezing of a block of ice may always be determined by thus

sending the beam through it and noting the formation of the flowers and leaves.

In lake-ice bubbles may be seen, with solid layers between, evidently marking the limits of successive acts of freezing, and with each block composed of such layers of solid ice and bubbles, a surface layer is associated, which gives evidence of having been acted upon by external influences. In this surface layer are numerous small air-bubbles around which a bleb of water exists. This phenomenon Agassiz explains as being due to the arrest of heat by the air, and the melting of the surrounding ice by its elevation of temperature. Tyndall holds, and proves conclusively, that the melting of the ice in the interior of the block is due to its conducting power. In summer, ice is often only a congeries of water-cells in a skeleton of ice; a saw will go through the mass with comparative ease. In freezing, water excludes the largest part of any solid held in solution by it; this quality is used in the arts to concentrate certain liquids. As a geologic agent ice has been very prominent (see GLACIERS), not only by means of glacial action, but by the disintegration of rocks and mountain-masses, which have then been carried away and deposited as laminated strata on the lowlands or the ocean's bed. Hoar-frost, one of the most familiar forms of ice, is only frozen dew. (See DEW.) MRS. S. B. HERRICK.

ICE. *Its Relations to Navigation, Travel, and Transportation.*—The closing of rivers, bays, sounds, and estuaries by ice greatly impedes, and sometimes completely prevents, navigation for several months of the year. N. of the 40th degree of latitude in North America, and of the 50th degree in Europe and Asia, the navigable rivers are closed for three or four months, and in the higher latitudes for six or seven, to all passage of steamers or sailing vessels. In exceptionally cold seasons the estuaries, harbors, bays, and sounds of these regions are sometimes closed for several weeks. The obstruction of the East River, or the estuary between New York and Brooklyn, and of the Narrows and inner harbor of New York, the Kill von Kull, and Newark Bay for some days is not a very infrequent occurrence; the winters of 1857–58, of 1865 and 1866, and of 1874–75 are among recent instances of this obstruction, and during the last-named severe season Long Island Sound was frozen over at its western extremity except a narrow channel, and Cape Cod Bay was closed for two or three weeks. In 1741 it is said that Long Island Sound was frozen in its whole extent, and that an adventurous citizen drove over it from New York to Greenport in his sleigh or cutter. As we approach the Arctic regions the obstructions to navigation from ice become more formidable. The whaling fleet has met with heavy losses by the crushing of their vessels in the ice, and the numerous Arctic expeditions have almost without exception been thwarted or prevented by the ice from attaining their desired results. But, though these obstructions to navigation cause serious delays, and often occasion much suffering, they are in other respects a benefit. The Finns, Laplanders, Ostiaks, Kamtchadales, Esquimaux, and other Northern tribes regard the winter season as the most agreeable of the year. Warmly clad in furs which are impenetrable by the intense cold, they go forth from their huts built of the ice, and journey long distances on sledges drawn by dogs or reindeer, preferring for rapid travel the comparatively smooth ice of the bays and sounds to the rougher surfaces of the drifted snow and ice of the shores. In more civilized countries skating is not only a favorite amusement, but in Europe is turned to practical account, the pack-peddlers, messengers, and many of the servants performing their journeys on skates with great ease and rapidity. The ice-boat, a triangular platform rigged with large and strong skating irons, and propelled by immense sails which enable it to scud before a strong wind at the rate of 50, 60, or even 70 miles an hour, is becoming a very popular though somewhat dangerous amusement on our Northern rivers; and the ice-bridges which span the larger streams above the 42d degree of N. lat., often for several months of the winter, furnish a safe and easy transit to thousands of teams and tens of thousands of foot-passengers, though to the manifest dissatisfaction of ferrymen and bridge-tenders.

As an Article of Commerce.—There is a large demand for ice as a commodity for three distinct purposes: viz. for its cooling qualities, for its antiseptic or preserving power, and for its use in medicine and surgery. In all tropical and semi-tropical countries there has been a demand in all ages for some means of cooling wine and other beverages, and imparting to the drinking-water of those countries sufficient coldness to make it palatable. The means naturally suggested was the use of snow brought from the mountains and stored up to be used in cooling the beverages in use. Solomon undoubtedly refers to this practice (which was even before his time in extensive use in Oriental countries) in Prov. xxv. 13: "As the cold of snow in the time of harvest, so is a faithful messenger to them that send him; for he refresheth the soul of his masters." Repeated references are made to the practice by Greek and Roman writers. Theocritus, Aristotle, Horace, and Plutarch all mention it, the last describing minutely the methods adopted for preserving the snow. Nero established storehouses for ice and snow in Rome, but they were not sufficient to supply the demand. It is worthy of notice that snow is still gathered for this purpose on the Apennines by Italian peasants (or was, a very few years since), and brought into Naples, Rome, and Florence, where it is stored in cellars and sold to the wealthy inhabitants. Our countryman Mr. W. J. Stillman, when consul at Rome, undertook to introduce American ice there, importing a cargo of Wenham Lake ice, and offering it to the people at the price asked for this dirty snow; but he was informed that he could not be permitted to do this, as the right to gather and vend this snow was one of the vested privileges of the Italian peasants, and must not be disturbed. In Spain and Portugal, and in Sardinia and the S. of France, snow, and sometimes ice, was gathered from the mountains and stored to some extent in the cities and in icehouses on the estates of wealthy nobles and grandees, but was used very sparingly. In England and Scotland it has been the practice for two or three centuries, among the wealthy, to have icehouses on their estates, and fill them with ice each year from the nearest accessible lake, river, or mountain. In England, however, the ice was generally thin and not very pure. Ice was not for sale, to private customers generally, in London before 1845, and only a few of the first-class fishmongers and confectioners made use of it. Their supplies were brought from ponds, or after 1825 from Norway. The wealthiest citizens and some of the nobility had a small supply brought from their country-seats. In this country icehouses have been very common in the rural districts for almost two centuries. They were cheap affairs—a cellar dug in the ground, floored with stone on which straw or sawdust was thickly strewn; the sides ceiled with rough boards placed nearly a foot from the earthy wall, and the space between filled with spent tan-bark or sawdust; the peaked roof covered first with rough boards, then heavily thatched with straw, and then another roof of rough boards with broken joints; the ice put in during the coldest weather of the winter, with layers of sawdust or straw between, and then, if the weather was cold enough, water thrown over each layer to freeze it into a solid mass, and the whole covered closely, and the double or triple roof put on. Access to it was generally indirect, and it was only opened at night in hot weather. The expense was considerable, but the supply was generally sufficient for several families. In our large cities at the North as late as 1820 it was difficult to obtain ice even for the purpose of cooling water or other beverages, and the Southern cities were entirely without it. In the country, and to some extent in the cities, those who had no icehouses and no interest in any, made use of cool cellars or deep wells for keeping butter, milk, etc. cool, and for the preservation of wines. The pitcher of water was wrapped with a moistened napkin and cooled by the evaporation. Ice became a commercial product on a small scale in Boston about the beginning of this century; *i. e.* it was kept in storehouses, and probably carried around to the few customers who were disposed to buy at about that period. As early as 1805, as we shall see further on, ice was exported from that city to the West Indies. In New York City it was not a commodity to be generally bought and sold before 1825, though it was used by the butchers, fishmongers, and perhaps the confectioners, at an earlier date. The traffic has grown enormously in fifty years. It now employs in the seven or eight companies in New York City a capital of nearly $8,000,000, gathers from 1,000,000 to 1,500,000 tons of ice annually (the ice-crop of 1875 exceeded 2,000,000 tons), employing over 10,000 men and over 4000 horses, and collects from $6,000,000 to $10,000,000 for its products, including the ice exported. Portland, Boston, Hartford, New Haven, Philadelphia, Albany, Rochester, Buffalo, Cleveland, Chicago, Cincinnati, Louisville, and St. Louis are all largely concerned in the ice-trade, though the last three draw their supplies from a distance and ship little or none to other points. Many of the smaller cities have a large local trade in the commodity, and a few of them export considerable quantities. The capital invested in the business is estimated at about $30,000,000.

The first demand for ice had reference solely to its cooling qualities, but its antiseptic properties soon created for it a still larger market. Indeed, had men but comprehended the lessons taught them by nature, the antiseptic character of ice would have given it its first value. That meats and the carcases of animals intended for food could be transported for a great distance when frozen, without injury, was a fact well known ages ago; but the practica-

bility of using ice to preserve such meats and carcases, even without freezing them, does not seem to have occurred even to the keenest observers, though glimpses of the truth came to their eyes, from time to time; thus, in King Alfred's Anglo-Saxon version of Orosius's *Historiarum adversus Paganos*, lib. vii., in an addition by Alfred himself, giving the narrative of one Wulfstan, an early Northern navigator, in regard to the Esthonians, a Finnish tribe E. of the Vistula, whom he had visited, we find an account of their practice of keeping the bodies of their dead in their houses for a long time (from one to six months, according to their rank) unburnt and not embalmed; and then follows this remarkable passage (we use Thorpe's translation): "And there is among the Esthonians a tribe that can produce cold, and therefore the dead, in whom they produce that cold, lie so long there and do not putrefy; and if any one sets two vessels full of ale or water, they contrive that one shall be frozen, be it summer or be it winter." This, be it remembered, was in the eighth century, or perhaps in the latter part of the seventh. At a later period a more striking illustration of the antiseptic property of ice occurred. In 1703, after an unusually protracted period of rain and thaw, there was discovered near the mouth of the Yenisei and along the shores of the Frozen Sea in Siberia a vast deposit of the carcases of the mastodon and other pre-historic quadrupeds, with their flesh untainted and edible, preserved from putrefaction and decay by the protecting influence of the ice in which it had been imbedded for thousands of years. This flesh was greedily devoured by the Samoiedes, as well as by their dogs, the wolves, and other carnivorous animals who gathered to prey upon this mighty feast. In that region, according to Erman, an attempt to sink a well resulted in finding alternate layers of ice and gravel to a depth of 382 feet. In this vast natural refrigerator, flesh not salted or prepared in any way had been kept from putrefaction, change, or decay for, at the very least, several thousand years. Yet so slow are mankind to learn, that more than a century passed before the idea of preserving dead bodies by surrounding them with ice, or of preserving meats, fruits, butter, milk, etc. from putrefaction, fermentation, or decay by an artificial uniform low temperature produced by ice-packing, occurred to any one, or, at all events, before it was reduced to practice. Now, however, ice is regarded as absolutely necessary during the summer months in preserving the bodies of the dead until the time of burial; and it forms in the refrigerating closet or chest one of the most indispensable articles of household use for the preservation of meats, milk, butter, vegetables, or fruits. But its antiseptic value does not stop here. Refrigerating cars bring to us from the Pacific coast choice ripe fruits, game, and other articles which it would otherwise be impossible to obtain in this market, and bear back oysters and other shellfish, condensed milk, butter, and other articles from the Atlantic coast. Steamers fitted up with refrigerating chambers bring beef and mutton from Texas, ripe oranges, lemons, bananas, and guavas from the West Indies, South American fruits from Brazil, and carry in return milk, butter, oysters, apples, peaches, pears, etc. to tropical climates. Preserving-houses in several of our cities preserve with a slight percentage of loss, oranges, lemons, grapes, apples, pears, peaches, etc. from one to three years.

The exportation of ice, which commenced in 1805 by the shipment of 130 tons to Martinique by Mr. Frederick Tudor of Boston, had a slow growth. For the first ten years Mr. Tudor made little or no profit by his ventures; in 1815 he obtained some exclusive privileges from the Cuban authorities, and between 1817 and 1820 began to send cargoes also to Charleston, Savannah, and New Orleans; but in all these years he met with frequent disasters, and from the long passages of the sailing vessels often lost the greater part of his cargoes. As late as 1832 his whole annual shipments amounted to but 4352 tons, all of which was taken from Fresh Pond in Cambridge, Mass. In 1833 he sent his first cargo to the East Indies, shipping 180 tons to Calcutta. Eighty tons melted before the arrival of the cargo at that port, but the remainder sold promptly at a large profit. From that time the business began to thrive. In 1836, 12,000 tons were exported from Boston alone; in 1846, 65,000 tons; in 1856, 146,000 tons; in 1866, nearly 250,000 tons; and in 1874, though other ports were, and had been for twenty years or more, participating in the export trade, the shipment from Boston was more than 300,000 tons. The entire export from the Northern cities, aside from the supply of New Orleans and other cities along the Mississippi River, which was drawn mainly from the North-west, was in 1870 about 500,000 tons, and in 1875 did not fall below 900,000 tons. In using this term *export*, however, it is proper to say that by far the largest portion of these shipments are to the cities of our own coast and of the interior, the entire export to foreign countries in the year ending June 30, 1873, being only 53,553 tons, and in 1874, 51,572 tons, having a declared value in 1873 of $188,095, and in 1874 of $198,013, though probably realizing three or four times those sums. The trade with Great Britain in this commodity is increasing, though Norway is a large competitor for the traffic, and commenced it as early as 1821; and the Dominion of Canada is also competing. In the Southern cities of this country and of Europe, as well as in the West Indies and South America, artificial ice is supplying a considerable part of the demand.

As a Remedial Agent in Medicine and Surgery.—The use of ice for medical and surgical purposes is one of the additions made to our materia medica in the present century. The Russians had, indeed, for 200 years or more passed from their intensely hot steam-baths into a bath of snow, but this was rather an experiment in hygiene than an item of medical treatment. Ice is now used medically, internally and externally; in the former way, by breaking it up into small bits to be swallowed by the patient, and in iced drinks in gastritis and gastric fevers, as well as in some diseases of the pharynx, larynx, or bronchial tubes. Its external uses are manifold; it is applied, pounded, in ice-bags to the head in acute mania, brain fever, or some injuries of the brain; to the temporal arteries and carotids in some fevers and in cases of diphtheria and scarlet fever; along the spine in ice-bags in cholera, yellow fever, etc.; over the bowels in cholera; locally in rare cases, to diminish sensation preparatory to surgical or dental operations, rhigolene and other frigorific preparations being more easily manageable and more convenient of application than ice. It is a remedial agent of great value.

The Gathering and Storing of the Ice-crop.—Although the act of freezing expels from the crystallized mass the salt and other mineral ingredients, leaving it when in a frozen state very nearly pure fresh water, yet ice formed from or floating in salt water gathers in the interstices between the crystals so much salt, brackish, or impure water that it becomes unfit for household purposes. Hence, the ice-crop must be gathered from fresh-water ponds or lakes or from rivers above tide-water. The supply of Boston, both for home use and export, is derived from several small lakes at no great distance from the city, such as Fresh Pond in Cambridge; Wenham Lake, about 18 miles from the city; Saugus Lake or Pond, etc. Portland and Bangor derive their supply from the Kennebec, Penobscot, and Androscoggin rivers, above tide-water, and from some of the great lakes of Maine; New York, from the Hudson above tide-water, and from Rockland, Mahopac, Greenwood, and other lakes; Philadelphia, from the Delaware and Schuylkill above the Falls, and from several lakes of Pennsylvania and New Jersey; the North-western cities, from the great lakes and the numerous smaller lakes of Wisconsin, Minnesota, and Dakota. In most cases the ice-companies have secured the right to take the ice from these lakes and ponds by the purchase of the lands bordering on them, and have erected large storehouses on the shores in which to deposit the crop. These icehouses are sometimes of brick, but oftener of wood, from 100 to 200 feet in width and from 200 to 400 feet in length, with double, triple, or quadruple walls, and generally three, four, or five stories in height, with strong floors and doors closing tightly on each floor, but no windows. There are numerous inclined planes, movable and adapted to each story, and to service without as well as within; in the larger storehouses a steam-elevator is used to drag the blocks of ice up the planes. The capacity of these storehouses varies with the locality and the conveniences for shipping ice from them, many of them being capable of storing from 20,000 to 40,000 tons. The spaces between the walls are filled with sawdust, spent tan-bark, or some other poor conductor of heat.

When a favorable time has come for storing the ice, there is a scene of great activity in the vicinity of the storehouses. On the Hudson and its neighborhood the period for gathering the ice is rarely more than four or five days at one time, and sometimes not more than ten or twelve in all, and hence the greatest speed is necessary in securing the crop. The thickness of the ice being ascertained (and this should not be less than ten or twelve inches, and two feet is better), the ice-field is temporarily fenced, the snow, if there is any, scraped off by a broad scraper drawn by one horse, and the ice planed by another scraper armed with a steel blade to the depth of perhaps two inches, to remove the porous ice. In seasons like that of 1874–75, where the ice has not been covered with snow and is two feet or more thick, clear, solid, and transparent, very little scraping is required. The surface being cleared, the marker commences his work, using a kind of plough drawn by one horse, which makes a narrow groove about three inches deep, and running the lines five feet apart, and then turning and crossing these by another series of grooves, also

five feet apart, so as to make square blocks five feet each way. If the ice is thick, these blocks are reduced by an implement like a harrow with three parallel rows of long sharp teeth, one row running in the groove, and another plough, with a long, sharp, and comparatively thin blade, is run rapidly through the principal grooves. One row of blocks is then cut through by means of hand-saws, the blocks pushed under or hauled up on the ice, and run to the inclined planes or loaded on sleds. The succeeding blocks are pried off with a crowbar by one gang, and another catches them with boat-hooks and drags them up, or tows a sheet of perhaps fifty blocks, with a grappling-iron and rope or chain, by horse-power, toward the storehouse, where it is broken into blocks, run up the inclined plane by the elevator, and packed away, the blocks standing on end and being separated by sawdust, shavings, rice-hulls, or spent tan. As soon as a floor or story is filled the doors are closed tightly, and the inclined planes raised to the next story, which is filled in the same way. There are gutters and drainways near the walls which receive and carry off the drainings from the melting of the ice. During the moonlight nights the work is carried on by night and day until the storehouses are filled, all parties working with a will. The cutting and storing of 600 tons in an hour at a single storehouse is not an uncommon feat. The cost of the labor for gathering and storing the ice in a favorable season does not exceed eight or ten cents per ton.

Ice is very perishable if exposed to the air in the summer temperature, though that from Canada, Maine, and Massachusetts, being much more dense than that of the Hudson River, melts less readily. On the Hudson it is kept in the storehouses till just before it is wanted, and then loaded into barges, which, if possible, are brought directly to the storehouse, and a half dozen or more of these barges are towed by a steamer to the company's city wharves, where it is either received into a storehouse or loaded directly from the barges upon the heavy covered wagons which are waiting to receive it. The net cost of the ice delivered to city customers in New York or Brooklyn varies from $2 to $3 per ton, and in unfavorable seasons may reach $4. It can be shipped in large cargoes from their wharves in most seasons profitably at $1.50 to $2 per ton. The profits on the business are immense, the prices to the large packing establishments and the larger hotels ranging from $5 to $15 per ton; to butchers, grocers, druggists, and confectioners, from $8 to $20 per ton; and to families and small consumers, from $14 to $30. These prices have provoked such competition that it is doubtful whether the maximum will again be reached in those cities. In 1874 ice was brought in large quantities from Maine and sold to consumers at half the prices which the New York companies had fixed, and a profitable business was done at those rates. Ice has within the past few years become a necessity of life, the loss of which entails great suffering, and should no more be subject to the caprices of speculating monopolies than wheat flour or any other indispensable article of food or clothing.

Artificial Ice.—That ice could be produced by mechanical and chemical processes has been long known, but until recently it has not been possible to do this at so low a cost as to make it profitable. Within the past fifteen years, however, there have been several processes patented and machines constructed which accomplish this at a cost sufficiently moderate to warrant their use in regions below the 35th parallel of N. lat. Siebe's ether ice-machine was the first of these, and made ice in thin plates by the vaporization of ether acting upon a strong brine which circulated through a cistern containing the ice-moulds. A better machine was Carré's ammonia ice-machine, which produced cylinders of ice by the vaporization of liquid ammonia, at a moderate expense, though with some danger of explosions. A German modification of this produced plates of ice with less danger and somewhat less expense, but the cost of the machines was so high as to prevent their general use; $6000 being the price of one which would produce ten tons of ice per day by very hard work. An American company attempted the manufacture, using for the purpose one of the most volatile and inflammable of the naphthas produced in the distillation and refining of petroleum. Their machinery was simpler than that of the foreign processes, but it was rather a refrigerating than an ice-making process, and required some motive-power to keep the refrigerating liquid in motion, and the material used was so explosive and dangerous that their success was not great. By none of these processes could ice be produced at a less cost than $4 or $5 a ton, and by some of them the cost was from $6 to $3 per ton. In the Southern cities, like Charleston, Savannah, Mobile, New Orleans, and Memphis, they could be used to advantage, but not in Northern cities, where large consumers could ordinarily, by combining, obtain their ice from nature's manufactory at $4 per ton, or even lower. There is, however, a wide field for the inventive genius of man to signalize its power in the construction of a simple, cheap, and effective ice-machine, employing no dangerous or explosive chemicals, and making a pure ice in solid cakes, at a price so low as to compete favorably with the natural product. L. P. BROCKETT.

Ice′berg, a great mass of ice floating in the sea. Icebergs are huge fragments of glaciers detached by the action of the water from the lower end of the glacier. Greenland, from the great number of its glaciers, is the fatherland of the iceberg. Icebergs are far more numerous in the northern than in the southern polar regions. They bring with them in their journeys masses of rock, earth, and sometimes seeds of plants. Polar bears and seals are sometimes thus transported from one region to another. Icebergs are often of prodigious size and most remarkable shape. They have often been observed to measure 300 feet in height. Only one-eighth of the mass is above the surface of the water. Icebergs are extremely dangerous to navigators in polar seas. These dangers are extended southward by the Labrador current, which brings great numbers of them into the Atlantic, where they are melted by the warmer waters of the Gulf Stream, and drop their loads of gravel and stone upon the banks off Newfoundland. The streams of water from their sides are always fresh.

Ice′land [Dan. *Island*], a large island subject to the rule of the king of Denmark, and situated between the Atlantic and the Arctic oceans, between lat. 63° 24′ and 66° 33′ N., and between lon. 13° 31′ and 24° 17′ W., 600 miles distant from Norway, 250 from Greenland, and 500 from Scotland. Area, 39,207 square miles. Pop. 69,763. Cap. Reykiavik. Iceland is of volcanic formation, and the double effects of the intense cold of a northern climate with its long, bleak winter and short, dreamy summer, and the tremendous volcanic powers which, under one form or another, seem to be active at every minute and on every spot, have given the whole island a most singular appearance—desolate but grand, poor but interesting. With the exception of the southern part, which presents some tracts of low and level land, the whole coast is high and precipitous; on the eastern and northern sides barren and inhospitable, on the southern and western sides indented with numerous deep and narrow fjords, which afford excellent harbors, and along which stretch the inhabited valleys. The interior is a high table-land resting on Plutonic rocks, covered with immense beds of lava, and broken now and then by hot springs (geysers), which throw columns of boiling water sometimes 200 feet high into the air, and form steaming streams, which after a short course disappear under the lava. It is studded all over with conical hills of smoking ashes and boiling pits of sulphur, and traversed by ranges of mountains whose summits are often connected with glaciers, which form wherever the ground rises above 4000 feet, and which often descend to the ocean, making it dangerous, almost impossible, to travel from one valley to the other. Oeräfa Jökul (*jökul* being the Icelandic name for glacier) is the highest point of the island, 6426 feet above the level of the sea, and forms in the south-eastern part the centre of an immense system of glaciers and volcanoes. Its first eruption within the historic period took place in 1724, when it suddenly burst forth, filling the valleys with red-hot lava, raising up islets far off in the ocean, and sending its clouds of ashes hundreds of miles over the sea. The famous HECLA and GEYSER (which see) are situated in the south-western part; Krafla in the northern. The activity of these volcanoes is not continuous; there seems to be 70 or 80 years between each great eruption of Hecla. Meanwhile, an innumerable multitude of smaller mud-volcanoes and hot springs are playing, and these are often of so changeable a nature that they may be formed in one month and disappear in the other. The climate of Iceland has changed, and seems to be still changing. It would seem that the island had formerly large forests. Sulphurized remains of them, forming a peculiar kind of brown coal, are found in many places, and are used, together with the white turf and drift-wood, for fuel. Now there is not more than one tree on the whole island, the mountain-ash at Akureyri on the N. coast, 25 feet high. The Thingvalla Forest, covering an area of about ten square miles, and composed of willows and birches, consists of shrubs which are only between three and four feet high. Different sorts of grain, which were extensively cultivated 300 years ago, cannot now be raised at all. The winter is not extremely severe, but it is very long; in July, and even in August, ice may be found drifting along the coast. Only a few garden vegetables and potatoes can be raised, and bread made from imported meal is a luxury. But in the valleys grow good grass and many fine herbs, among which Iceland moss constitutes a considerable item of exportation. The rivers and the fjords abound in fish—salmon, trout, and cod. Numerous seals and whales gather along the coasts and

swarms of wild sea-fowls, among which are the eider-duck and the swan, visit the shores. Thus, hunting, fishing, and rearing of sheep are the chief pursuits of the Icelander's life, and eider-down, dried and salted fish, wool—generally manufactured into socks and mittens—tallow, and fish-oil are the main articles he can give in exchange for manufactured goods, coffee, tea, wine, tobacco, coal, and grain. Among minerals, sulphur is found in enormous quantities; also iron, rock-crystals, and the famous double-refracting spar, but the mineral wealth of the country is very little developed. The value of the total annual exportation is about $3,000,000. Iceland was discovered and colonized in the ninth century by the Norwegians, who here formed an independent republic. In a short time the country attained a high degree of prosperity, and developed a civilization which far surpassed that of the mother country. But feuds between the different families, in which whole estates, with all their occupants and all the property belonging to them, were burned down, brought the independence of the republic to an end, and made the country a dependency of Norway. In 1380 it was, together with Norway, united to Denmark, and remained so until 1814, when Norway was separated from that country. Iceland was governed by a *Stiptamtmaðr*, who had the executive power, and was appointed by the king, and an *Althing*, which had the legislative power, and consisted of deputies chosen by each county. It required an annual support of $60,000 from Denmark. But in 1874, upon the celebration of the one-thousandth anniversary of the colonization of the island, Iceland became entirely independent of Denmark, though subject to the king as the head of the Icelandic government. Its new governmental institutions are entirely republican in spirit, all citizens having equal rights and perfect religious liberty.

The Icelanders are a noble race of people—brave, of pure morals, and intellectual in a very high degree. The old tongue, which is the foundation of the three Scandinavian languages, they have kept during 3000 years in its original purity, and the humblest workman can read and write, and is thoroughly conversant with the Sagas, the history and the laws of his country, and with his Bible. A comparatively large number of students come yearly to the University of Copenhagen, and many of them have acquired celebrated names in science. Nay, there are Icelandic poems so thoroughly imbued with the loftiest ideas and sentiments of modern civilization, and so thoroughly impregnated with the elegance and brilliancy of modern art, that in reading them nobody would believe that they were written in a low hut built of lava-blocks and moss, and looking out on the dreary gloom of a winter of nine months. CLEMENS PETERSEN.

Iceland'ic Language and Literature. Under the name of *Dönsk tunga* ("Danish tongue") or *Norræna* ("Northern speech") one language was generally spoken throughout the three Scandinavian countries, Denmark, Sweden, and Norway, during the pagan times and down to about the eleventh century. There were no doubt local modifications of this language, the more so as the Goths had come into the country in two different swarms, on two different roads, and probably also at two different periods. But the skalds travelling from court to court, or visiting the great jarls (earls) on their estates, were universally understood, and the Runic inscriptions spread over the whole of Scandinavia show no differences. In the ninth century this language was brought to Iceland by the Norwegians who settled on the island, and here, in a distant corner of the world, where a little republic flourished for more than three centuries (from 928 to 1262), it was consolidated into a rich, and even brilliant literature, and has been preserved, almost without any changes, up to this very day. For the study of the languages of the Teutonic family this Icelandic language, as it is now generally called, is of paramount importance; for although its literary monuments are much younger than, for instance, Ulfila's translation of the Bible, still its growth was more independent, its development more energetic, than that of any of its sister-tongues, and it is extant in a literature whose study is necessary for a full understanding of the history of Europe during the Middle Ages. Its most characteristic features, when compared with other Teutonic languages, are these: it has no indefinite article, and the definite is not put before the noun, but appended to the end of it; the first and second personal pronouns have a dual form; the verbs have a passive form unknown to other Teutonic languages; and while in the Germanic tongues the infinitive always ends with a consonant, it ends in Icelandic invariably in a vowel. When compared with modern languages, its purity, flexibility, and richness of forms give it a peculiar charm. Etymology, which in English, for instance, is a dead knowledge, employable only by a process of reflection, is in Icelandic a living principle in the mind of the speaker, working instinctively. New words, expressive of new ideas or new shades, are formed with the greatest facility, universally understood, and easily kept alive as long as the idea lives, but with the idea they die. Originally, this language was written with Runic characters, but with the introduction of Christianity the Roman alphabet came into use. The letters *c* and *g* were dropped as fully represented by *s* and *k*, and two new letters, ð and þ, were formed to represent the aspirated *d* (*th* in *though*) and the aspirated *t* (*th* in *thought*). For the complete representation of the somewhat intricate system of vocalization the vowels were provided with dots and strokes. The oldest monument of Icelandic literature is the poetical Edda, compiled by Sæmund Sigfusson (1054–1133), but whose single parts probably belong to the eighth or ninth century. This, as well as the prose Edda, compiled or written by Snorri Sturleson (1178–1241), is chiefly of religious or mythological interest, giving a representation of the contents of the old pagan faith. The prose Edda, however, gives also a kind of review of the art of poetry, of synonyms, of poetical words and phrases, of metres and strophes, etc. Proofs of this art have been left us, not only in the songs of the poetical Edda, and in fragments of songs occurring in the different prose works, where they are quoted as evidence or applied as ornaments, but also in about twenty complete poems or *drapas*. The Icelandic skalds and their art were highly esteemed, and the names of Egill Skallagrimson, Eyvind Finsson, Thord Kolbeinsson, and Ivar Ingimundarson were celebrated throughout Scandinavia as much as those of the greatest kings and jarls. But most of their productions have perished, and we may add that not much seems to have been lost thereby. Periphrase, not poetry, artificiality, not art, were the character of these poems. Nothing was called by its true name or represented in a true manner. Figures, almost contorted into enigmas, stalked along in difficult metres, ringing with alliterations and rhymes. Quite otherwise with the prose literature, the *Sagas*. They are of great importance for the history of the Scandinavian countries, of still greater interest to the history of European civilization, and perfect in their artistic form. They are partly fictitious, taking their subjects from old songs—as, for instance, *Völsungasaga* and *Frithjofssaga*—or from foreign tales, such as *Karlamagnussaga*, *Tristamssaga*, and *Trojumannassaga;* partly biographical, narrating the history of some great and powerful Icelandic family, as, for instance, *Njalssaga*, *Egilssaga*, *Laxdælasaga*, *Vatnsdælasaga* and *Grettissaga;* and partly historical—as, for instance, *Knytlingasaga* and *Jomsvikingasaga*, treating Danish history, *Heimskringla*, treating Norwegian, and *Sturlungasaga*, treating Icelandic. But of these three divisions of the sagas, the main importance rests on the second one, the biographical. With respect to form, the *Iliad* has nothing to boast of before *Njalssaga*, either in plasticity and precision of representation or in simplicity and grandeur of style. The form of the Icelandic saga is perfect, like that of the Greek epic, and probably produced in the same manner, though under such very different circumstances. In the solitude of that island, far away from the rest of the world, in the loneliness of that hearth, many miles distant from the nearest neighbor, and separated from him by flaming volcanoes and boisterous fjords, in the stillness of that long twilight, when people sat frostbound or snowbound for months, the father would tell about Njal slowly and with emphasis, and the son would listen, rapt and pondering. Then, when the time came for the son to tell the story to a younger generation, he would repeat it word by word, just as it had been fixed in his mind, and making no other changes than such as were inspired by enthusiasm and reverence. Thus worked out into perfection, the saga was at last written down some time before the middle of the fifteenth century, at which period literary life utterly declined in Iceland. Great, however, as the æsthetic interest of the sagas is, their historical interest is nevertheless still greater. They are the only pure and unmixed source from which any knowledge can be had of the primitive character of the Scandinavian races. Those conceptions of life and of the laws of life, and those representations of passions and of the ideals of passions, which the sagas contain, may be differently judged, but whether they are considered sublime or rude, it was nevertheless these which formed the German nation, and to some degree also the French; it was these which conquered Normandy and England, and it was these which made the Crusades and settled down at last in feudalism. The great importance of the Icelandic sagas for the study of European civilization has become more and more appreciated during the course of the present century. CLEMENS PETERSEN.

Iceland Moss, a lichen belonging to the genus *Cetraria* (*C. Islandica*), so called from its habitat, but found in the northern parts of both continents. It is used as an article of food; boiled, having been freed from its bitter-

ness by repeated maceration, it forms a nutritious jelly, or it may be powdered and mixed in cakes or bread. It is also used as a medicine in pulmonary complaints.

Iceland Spar, transparent calc-spar, of which the best specimens are obtained from Iceland. It displays in great perfection the phenomena of double refraction.

Ice-Plant, an herb of Southern Europe and Northern and Western Africa, the *Mesembryanthemum crystallinum*, of the order Mesembryaceæ. Its succulent leaves are covered with vesicles which appear like crystals of ice. It is often seen in house-culture, and has demulcent, diuretic, and expectorant properties.

Ichneu'mon [Gr. ἰχνεύμων, the "tracker"], a name in its largest sense applicable to the numerous genera of small quadrupeds of the family Viverridæ, sub-family Herpestinæ—all Old-World carnivorous mammals of active habits and fierce disposition, preying upon serpents, birds, and small game of many kinds. But strictly, the name designates the *Herpestes ichneumon* of Egypt. It is famous as the devourer of the eggs of the crocodile and as a destroyer of venomous serpents. Hence it was worshipped by the ancient Egyptians. Spain has an ichneumon, *Herpestes Widdringtonii.* (See MUNGOOS.)

Ichneumon-flies (Ichneumonidæ), a great family of hymenopterous insects which are of the greatest service to the agriculturist and to mankind, since they deposit their eggs either upon or within the eggs or larvæ of larger insects and spiders, the future larva of the ichneumon-fly devouring the insect upon which it is hatched. Immense numbers of noxious insects are thus destroyed. There are nearly 5000 known species (one-half American), of which some 300 species belong to *Ichneumon*, the typical genus.

Ichnol'ogy [ἴχνος, "track," and λόγος, "discourse"], or the science of tracks, a name proposed by Dr. Buckland. The animals whose existence is made known by their footmarks upon stone may be called *Ichnozoa*. President Hitchcock has detailed sixteen permanent characters in footmarks which serve to distinguish satisfactorily different classes of animals. The following are examples of them: whether tracks of feet; trails made by the body or its caudal extremity drawn along in the mud; width of the track-way; relative size of hind and front feet; length of step; number of toes; mode of progression; spread of the toes; character of the heel, claws, and pellets. (See further under FOSSIL FOOTPRINTS.) C. H. HITCHCOCK.

Ich'thin, or **Ichthulin,** albuminoids found in the eggs of cartilaginous fishes.

Ichthyocol, or **Isinglass.** See GELATINE.

Ichthyol'ogy [ἰχθύς, a "fish," and λόγος, "discourse"] is that branch of zoology which treats of the vertebrated animals formerly collectively known under the name of fishes, but which are now distributed among the classes (1) FISHES, (2) SELACHIANS or ELASMOBRANCHIATES, (3) MARSIPOBRANCHIATES, and (4) LEPTOCARDIANS. Referring to the articles under those several heads, as well as that under VERTEBRATES, for information respecting the structure and relations of each, remarks will be here confined to the most important facts in the bibliography and history of the group of classes. In order to ensure clearness of conception, (1) the great general works on fishes will be first noticed, and then (2) the principal stages in the systematic arrangement of the class or its primary constituents.

I. *General Works and Numerical Acquisitions.*—Many ancient and mediæval authors had published compilations containing descriptions of various species of fishes, but none can be said to have advanced ichthyology. The chief authors after the revival of learning were Belon, Salviani, Rondelet, Gesner, etc. Their works, however, were chiefly of local interest, and related mostly to the fishes of the Mediterranean. The first general work that deserves special mention was the *Historia Piscium* of Willoughby and Ray, published in 1686. In 1735, Linnæus, in the first edition of the famous *Systema Naturæ*, first introduced to the world a synopsis of the arrangement of fishes and digest of known species, which Artedi, his fellow-student, had elaborated; but that author having come to an untimely death, his manuscripts were left to Linnæus, and published under his editorship in 1738 in five parts. In these parts were successively considered in his own words —(1) ichthyological bibliography, or the literary history of fishes, in which was given an enumeration of the authors who had written on fishes; (2) ichthyological philosophy, in which were elucidated the fundamental principles of the science; (3) the genera of fishes, in which a complete system of ichthyology was proposed, with classes, orders, characters of genera, specific differences, and many observations; (4) the synonymy of almost all fishes, in which was given an enumeration of the names of fishes mentioned by all authors who had ever written of them; and (5) descriptions of the species of fishes which Artedi had dissected and examined alive; these subjects being entitled at length in Latin, with corresponding titles. Artedi admitted into the system 242 nominal species under 52 genera, but these are to be divided among 228 species and 45 genera of true fishes, and 14 species and 7 genera of Plagiuri or cetaceans, Artedi having, like all his predecessors, confounded these two groups in the same class. Linnæus, in (1) the first edition of the *Systema Naturæ*, which was published in 1735, enumerated 145 nominal species of fishes under 36 genera, and 10 cetaceans in 5 genera; (2) in the fourth titular (or second original) edition he had 238 species of fishes under 48 genera, and 8 cetaceans under 5 genera; (3) in the sixth titular (or third original) edition, published in 1748, he recognized 281 species of fishes, distributed under 47 genera, and 12 cetaceans under 6 genera; (4) in the tenth titular (or fifth original) edition (wherein the class was first restricted to the fishes proper, and the cetaceans separated to be united with the mammals) he increased the number to 414 species (including, however, the Amphibia Nantes), ranged under 57 genera; and (5) in the twelfth titular (or sixth original) edition (which was the last one in the lifetime of Linnæus) 477 nominal species of fishes (including the Amphibia Nantes) were described and placed in 61 genera. The eighth titular (or fifth original) edition was limited to the vegetable kingdom.

Between 1740 and 1749, Jacob Theodor Klein, secretary of state of Dantzic, published five numbers or "missus" of a work on ichthyology, remarkable for its crudity, but which has had a considerable reputation. In this work 518 nominal species of fishes were described, and referred to 61 genera, quite different from those of Artedi or Linnæus. From 1782 to 1795 a great work on fishes was published in two sections—one of three,* and the other of nine† volumes—by Dr. Mark Elieser Bloch, a physician of Berlin, in which about 418 species of fishes were described and illustrated, in fine large oblong folio volumes of plates, but the drawings are very inaccurate, and the coloring still more erroneous. During the time the work of Bloch was being published, several compilations were issued from different European presses.

In 1787, René Just Haüy (better known as "the crystallographer") contributed, anonymously, a volume‡ to the natural history department of the *Encyclopédie Méthodique*, describing the fishes in an alphabetical sequence under their French names, and with tabular synopses, each on a special page, giving the classes, genera, and species under their French names, in connection with the descriptions.

In the following year (1788) the Abbé J. P. Bonnaterre§ contributed also to the same series a volume under the title *Ichthyologie*, in which the species were arranged according to the Linnæan classification, and illustrated in 102 plates, representing about 400 species, which he had collected from all sources. Also in 1788, Johann Friedrich Gmelin issued an edition of the *Systema Naturæ* of Linnæus, in which he collected together from many sources descriptions of species, which were, however, referred to their places in the system with very little judgment; he raised the apparent number of species to 826, which he grouped in 65 genera, but many of these were identical with each other, and the number of real species was therefore much less. A few years later (in 1792) the work of Linnæus's friend (Artedi) also found an editor in Johann Julius Walbaum, who used the *Genera Piscium* as a nucleus around which he brought, in the form of foot-notes and appendices, all the species which he could collect from all sources, and which amounted to about 965, grouped under 228 genera; of these also a considerable proportion were synonymous with other species.

Between 1798 and 1803,‖ Bernard Germain Étienne de la Ville-sur-Illon, Comte de Lacépède, published an extensive work on fishes in the French language, entitled *Histoire Naturelle des Poissons*, in which he introduced, with very great modifications in the system, numerous generic divisions and many species based on figures made chiefly by French naturalists and travellers; very little wholesome criticism was exercised in this work. Fourteen hundred and sixty-three (1463) nominal species were described.

* Bloch's (D. Marcus) *Oekonomische Naturgeschichte der Fische Deutschlands*, Berlin, 1782–83 (text, 3 vols. 4to; atlas, 3 vols., obl. fol.).

† Bloch's (D. Marcus) *Naturgeschichte der ausländischen Fische*, Berlin, 1783–95 (text, 9 vols. 4to; atlas, 9 vols. fol.).

‡ Haüy (René Just), *Encyclopédie Méthodique.—Histoire Naturelle.* Tome troisième. Contenant les Poissons.—A Liège, 1787, 4to.

§ Bonnaterre (J. P.). *Tableau Encyclopédique et Méthodique des trois règnes de la Nature.—Ichthyologie.*—A Paris, 1788 (4to, with 102 pl.).

‖ Lacépède (*Comte de*). *Histoire Naturelle des Poissons*, Paris, 1798–1803 (4to, 5 vols.).

In 1801 the Greek scholar, Johann Gottlieb Schneider,* who had paid considerable attention to natural history, and especially ichthyology, published a posthumous work of Bloch's, but which doubtless owed considerable to himself, under the title *Systema Ichthyologiæ iconibus cx. illustratum.* In this work the species were primarily grouped in classes, distinguished nominally by the number of fins, although very often the species referred to the classes did not support the characters attributed to them. The classes were again divided into orders distinguished by the position of the ventral fins.

In 1803 and 1804, George Shaw published the fourth and fifth volumes (in four parts) of his *General Zoology, or Systematic Natural History,* which were exclusively devoted to the fishes. He adopted, with a few trifling modifications, the system of Linnæus, as rectified by Gmelin, and described 1230 nominal species of fishes.

With Shaw the age of mere compilations of descriptions of species of fishes came to an end, and although the subsequent works devoted to such descriptions were few, they were far more valuable in every respect, and based chiefly on original materials and observation, and a comparison of the fishes themselves.

In 1828, Baron Georges Cuvier commenced the publication, in connection with M. Achille Valenciennes,† of a great work on fishes (*Histoire Naturelle des Poissons*), which was continued through many years (1828–49), and was only brought to a stop in 1849, when twenty-two volumes had been published; all of the apodal fishes, almost all of the ganoids, and all of the elasmobranchiates, marsipobranchiates, and leptocardians being left undescribed. The first ten volumes were prepared by Cuvier and Valenciennes, each elaborating special groups, but on the death of Cuvier, and after the publication of the manuscript he left behind, the work was carried on by Valenciennes alone. Owing to the length of time during which the work was published, a great inequality in its proportions necessarily resulted, the last volumes describing a larger proportion of the now known species than the earlier ones; 4514 nominal species of fishes were described in the twenty-two volumes, almost all of which belong to the typical fishes or to the order of Teleocephali.

In connection with the work of Cuvier and Valenciennes may be considered one by A. Duméril,‡ bearing, in part, the same title—*i. e. Histoire Naturelle des Poissons, ou Ichthyologie générale.* This work is complementary to the preceding, as it embraces the selachians, ganoids, and lophobranchiates, groups which had not been described by Cuvier and Valenciennes. Two large volumes were published between 1865 and 1870, when the death of its author arrested its further progress. 626 nominal species were described in the volumes issued.

Between 1859 and 1870, in the form of a *Catalogue of the Fishes in the British Museum,*, by Albert Günther, M. D.,§ all the species recognized by the author, as well from autopsy as descriptions of species unknown to him, were described. This is the only work published since the early part of the century which contains a complete conspectus of the living fishes. It is in eight volumes, which were issued every one or two years. The author adopted 6843 species as established, while 1682 others are considered as doubtful, and referred to by name only in foot-notes to the genera to which they are supposed to belong. It is assumed that about 1000, however, of the doubtful species will be ultimately confirmed; and, allowing 1000 species to have been described during the course of publication of the series, it is estimated that we may put the total number of fishes known at present as about 9000.

II. *Progress of Classification.*—Nothing like a scientific classification of fishes was known to the ancient or mediæval authors, Aristotle in this respect being but little if any in advance of others, and none of his followers or successors are better. The first germ of a regular system based on anything like scientific principles was not published till near the end of the seventeenth century. In 1686, Ray published the *Historia Piscium* left by his friend Willoughby, in which the species were dichotomously divided, primarily, (*a*) into (I.) Cartilaginei, and (II.) Ossei; (*b*) the former (I.) into *Longi* (including sharks) and *Lati* (including rays); and the latter (II.) into Plani and Non-Plani; (*c*) the Plani included only the flat-fishes; the Non-plani were distinguished according to the form of the body, whether eel-shaped (*Anguilliformes*) or more contracted (*Corpore contractiore*), and (*d*) those according to the absence of ventrals (*sine ventralibus*) or their presence (*cum ventralibus*): (*e*) those without ventrals were only differentiated into genera; those with, into *Malacopterygii,* or soft-rayed fishes, and *Acanthopterygii,* or spiny-rayed fishes. This scheme exhibits some idea of system, but in most respects, and in its details, it is quite defective.

Artedi classified the 45 genera known to him under 5 orders, accepting to a considerable extent the views announced in the work of Willoughby and Ray. These orders were (1) Malacopterygii, (2) Acanthopterygii, (3) Branchiostegii, (4) Chondropterygii, and (5) Plagiuri. It is only necessary to observe that among the Malacopterygians he included the genera *Syngnathus, Stromateus,* and *Anarrhichas,* as well as the true Malacopterygians of later authors; and under the Branchiostegi he combined the genera *Balistes, Ostracion, Cyclopterus,* and *Lophius.*

In 1758, Linnæus published an original system of ichthyology, and (*a*) rejected (as Brisson had previously done) the cetaceans from the class of fishes; (*b*) applied the binomial system of nomenclature to the species; and (*c*) introduced a new system of classification, based chiefly upon the position of the ventral fins, and recognizing 5 orders, distinguished severally (1) by the supposed structure of the branchiæ (Branchiostegi), (2) the want of ventral fins (Apodes), or their presence (3) under the throat (Jugulares), or (4) at the thorax (Thoracici), or (5) behind the ventrals (Abdominales). Linnæus ran to an opposite extreme from his predecessors in limiting the class, and not only excluded the cetaceans, but committed a grave error in separating from the fishes and referring to the amphibians the Chondropterygii of Artedi. He was led into this mistake by erroneous information respecting the air-bladder, communicated to him by Dr. Garden of Charleston, S. C.; and this error was still further aggravated in the succeeding edition (the twelfth, or the last published during his life).

The true fishes were again brought together by Gmelin in his edition of the *Systema Naturæ,* and the class, remaining purged of the cetaceans, was retained with the constituents generally accorded to it till within the last few years.

In 1801, Bloch and Schneider published their *Systema Ichthyologiæ,* in which they distributed the genera under 11 classes, distinguished by the number of fins from eleven down to one—*i. e.* Hendecapterygii, Decapterygii, Enneapterygii, Octopterygii, Heptapterygii, Hexapterygii, Pentapterygii, Tetrapterygii, Tripterygii, Dipterygii, and Monopterygii. Within the classes orders were recognized based upon the ventral fins—*i. e.* whether jugular, thoracic, abdominal, or wanting. This system had not even the merit of being based upon a correct appreciation or count of the fins; and independently of this, it was in the highest degree unnatural, bringing together forms that were in nowise related, and separating others that were very closely allied, or even congeneric. It must be remembered, in this connection, that a greater or less number of fins is often simply the expression of more or less abbreviated or shortened rays, and more or less deeply incised membrane—*e. g.* differences such as may be found between the species of black bass or species and genera of Serranidæ, etc.

Nearly contemporaneously, from 1799 to 1804, appeared the work of Lacépède, in which the classification adopted is a procrustean system of (1) sub-classes, (2) divisions, and (3) orders. *First.—Sub-classes,* based on the supposed consistence of the skeleton (Sous-classes, (1) Poissons cartilagineux, (2) Poissons osseux.) *Second.—Divisions,* under each sub-class, established on the supposed presence or absence and various combinations (4) of the opercula and branchiostegal membrane—that is, the presence of both, of one, or the other, or none. *Third.—Orders,* distinguished by the presence of ventrals (Apodes), or their presence at different regions (Jugulaires, Thoraciens, Abdominaux). Several of these categories are non-existent in nature, and the reference of species to them is due to erroneous observation or supposition. Numerous new genera were in this work for the first time instituted, but most of them were very badly defined and congeneric species were frequently combined with other types.

In 1806, M. Duméril, in his *Zoologie Analytique,* published a system of fishes which was to a considerable extent simply a modification of Lacépède, but he for the first time introduced the category of "families" in the classification of fishes; his arrangement, however, was as artificial as that of Lacépède.

Several other authors published new arrangements or introduced modifications in the classification of the class; among them were Rafinesque in 1810, Pallas in 1811, Rafinesque anew in 1815, De Blainville and Oken in 1816, Goldfuss in 1820, and Risso in 1827. Almost all of their modifications, however, were devoid of merit, and therefore need not detain us.

* Blochii (M. E.) *Systema Ichthyologiæ iconibus cx. illustratum Post obitum auctoris opus inchoatum absolvit, correxit, interpolavit Jo. Gottlieb Schneider.*—Berolini, 1801, 8vo.

† Cuvier (Baron Georges) and Achille Valenciennes. *Histoire Naturelle des Poissons.*—A Paris, 1828–49 (22 vols. 8vo).

‡ Duméril (August). *Histoire Naturelle des Poissons, ou Ichthyologie générale,* ouvrage accompagné de planches, Paris, 1865–70 (text, 2 vols. 8vo; atlas, larger 8vo).

§ Günther (Albert C. L. G.). *Catalogue of the Fishes in the British Museum.*—London, 1859–70 (8 vols. 8vo).

In 1817, Cuvier, who had previously published numerous special memoirs on fishes, and rectified many details in their classification, introduced his complete system in the first edition of the *Règne Animal*. He primarily distinguished fishes into "Chondropterygiens" and "Osseux." The chondropterygian fishes were disintegrated into those with attached branchiæ ("a branchies fixes") and those with free branchiæ ("a branchies libres"): the former were subdivided into "Suceurs" (Marsipobranchiates), and into "Sélaciens" (Elasmobranchiates); the latter included only the sturgeons and paddle-fish ("Sturioniens"). The osseous fishes were divided into the orders "Plectognathes," "Lophobranches," "Malacoptérygiens abdominaux," "Malacoptérygiens sub-brachiens," "Malacoptérygiens apodes," and "Acanthoptérygiens."

The natural groups Plectognaths and Lophobranchs were thus for the first time recognized; as to the rest, the merit consisted chiefly in the criticism exercised in the elimination of doubtful forms and their proper identification, and in approximations of minor groups, rather than in the appreciation of the outlines of classification.

In 1846, Johann Müller, the most able anatomist of the century, who had long been engaged on very elaborate anatomical investigations of different groups of fishes, gave expression to the result of his studies in a remarkable memoir on the classification of fishes. He recognized in the class 6 distinct sub-classes—viz. (1) Leptocardii, (2) Marsipobranchii, (3) Elasmobranchii, (4) Ganoidea, (5) Teleostei, and (6) Dipnoi. These sub-classes were based upon weighty structural differences, and the combinations indicated by them were far superior to any that had been previously proposed. Perhaps his most valuable results were the recognition and characterization of the sub-class of Ganoidea. The members of this group had previously been either (*e. g.* by Cuvier and his followers) widely dispersed and their relations not at all appreciated, or (by Agassiz) very unlike forms had been combined with them in one group, on account of partial agreement in characters of very slight value. Müller was the first to recognize a natural group distinguished by definite characters; he also defined, in a much more scientific manner than had been previously done, the sub-classes which had already received names adopted by him. On the whole, his classification marks the most noteworthy epoch in the history of systematic ichthyology.

The great majority of the other natural classifications of fishes proposed within the last half century have been either slight modifications of Cuvier's or Müller's, or (*e. g.* Owen's) eclectic ones combining selections from each.

To this generalization, however, there are several marked exceptions, and notably the classifications of Prof. Agassiz and Dr. von Bleeker. The former has been so celebrated that some reference to it may be demanded. In 1833, Prof. Agassiz published his views respecting the ichthyological system, and, exclusively basing his arrangement on the character of the scales, segregated all the existing and fossil fishes into four orders: (1) Ganoidei, with enamel-covered scales; (2) Placoidei, with shagreen-like scales; (3) Ctenoidei, with ordinary scales pectinated at their free margins; and (4) Cycloidei, with ordinary scales entire at their free margins. The illustrious and learned author retained this classification till about 1857. It was not, however, received with favor by any other original investigator, and was justly objected to on account of (1) the characters themselves being insufficient, (2) the distinctions being very trivial and intergrading, as well as (3) on account of deficiency in diagnostic precision, large numbers of forms being left unprovided for, inasmuch as many fishes are entirely destitute of scales. Very many fishes, also, have two kinds of scales (cycloid and ctenoid) in different parts of the body.

In 1871, Dr. Albert Günther proposed a modification of the system which has been much noticed. The tendency among zoologists had always been towards a differentiation of the fishes into the teleost and ganoid forms on one hand, and on the other the selachian types, but Dr. Günther reversed this, combining the ganoids and selachians in one sub-class ("fourth sub-class, *Palæichthyes*"), contrasted with that of the Teleosts. The Palæichthyes were subdivided into two "orders"—order 1, Chondropterygii, with two "sub-orders" (Plagiostomata and Holocephali), and order 2, Ganoidei, with five "sub-orders" (Amioidei, Lepidosteroidei, Polypteroidei, Chondrostei, and Dipnoi).

Many other modifications have been proposed by various authors, but scarcely require notice here. Only one other system need detain us. In 1871, Prof. Edward D. Cope, after first recognizing three classes by most authors confounded under the old term "Fishes" (Leptocardii, Dermopteri, and Pisces), divided the fishes proper primarily into 5 sub-classes—viz. (1) Holocephali (= Elasmobranchii holocephali, Müller), (2) Selachii (= Elasmobranchii selachii, Müller), (3) Dipnoi (Müller), (4) Crossopterygia (= Ganoidei crossopterygidæ, Huxley), and (5) Actinopteri (new). The Holocephali, Selachii, and Dipnoi had the same limits as the homonymous subclasses or orders of Müller. The Crossopterygia included those having the "hyomandibular articulated, opercular bones well developed, a single ceratohyal; no pelvic elements; limbs having derivative radii of the primary series on the extremity of the basal pieces, which are in the pectoral, metapterygium, mesopterygium, and propterygium." Three orders were recognized—viz. Haplistia, Cladistia, and Actinistia. The Actinistia embraced such forms as had "opercular bones well developed or separate and complex suspensorium; a double ceratohyal, no pelvic elements; primary radii of fore limb parallel with basilar elements, and entering the articulation with scapular arch; basilar elements reduced to metapterygium, and very rarely mesopterygium; primary radii of posterior generally reduced to one rudiment." This sub-class was primarily divided into three tribes: Chondrostei (Müller) with 2 orders; Physostomi (Müller), with 12; and Physoclysti (Müller), with 10.

Classes.—From this point more lucid ideas may be obtained by considering the primary subdivisions of the group known under the general name of "Fishes." Up to the close of the eighteenth century, under this name all the vertebrated inhabitants of the waters adapted for exclusive progression through the liquid medium were confounded; consequently, the true fishes and cetaceans had not been decidedly separated. In 1756, for the first time, Mathurin Brisson (*Règne animal, divisé en neuf classes*) removed the cetaceans entirely from the fishes, distinguished them as a class, and placed them immediately after the mammals; he therefore was the first naturalist who limited the class Pisces to the typical branchiferous vertebrates. As previously indicated, Linnæus never recognized anything like the true limits of the class, at one time confounding with them the cetaceans, and later, when he excluded them, also excluding typical fishes which he referred to the class of amphibians. Gmelin, however, rectified this error, and thenceforth the fishes were recognized as a homogeneous class until a comparatively recent date. To this statement, however, several exceptions must be noted. E. Geoffroy St.-Hilaire and Latreille (1825) differentiated the fishes thus understood into *two* classes—viz. (1) Poissons (= Fishes proper) and (2) Ichthyoderes (= Elasmobranchiates and Marsipobranchiates), the Leptocardians being then unknown. I. Geoffroy St.-Hilaire, Bonaparte (1856), and Moquin Tandon also recognized *two* classes, but with different limits—viz. Poissons (= Fishes, Elasmobranchiates and Marsipobranchiates) and Myelozoa (= Leptocardians). Agassiz has distinguished *four* classes—viz. (1) Myzontes (= Marsipobranchiates and Leptocardians), (2) Fishes, (3) Ganoids (2 and 3 = Fishes proper), and (4) Selachians (= Elasmobranchiates). Hæckel has likewise adopted *four* classes, but very different from those proposed by Agassiz—viz. (1) Pisces, (2) Dipneusta (= Dipnoi), (3) Cyclostoma, and (4) Leptocardii. Gegenbaür, Schmidt, Cope, and several other recent naturalists recognize *three* classes—viz. (1) Pisces, (2) Cyclostoma, Cyclostomata, Dermopteri, or Marsipobranchii, and (3) Leptocardii.

It will be thus seen that the present tendency and the weight of authority is decidedly in favor of the recognition of class-value for the differences of structure exhibited by several constituent groups of the old so-called class of "Fishes," and the more thoroughly we enter upon the comprehensive study of the anatomy of all the vertebrates, the more disposed we must be to the recognition of the naturalness of such associations.

In fine, on a review of the various steps in the progress of knowledge gained respecting these animals, it appears that the early Linnæan and post-Linnæan authors rather added to the confusion in which species were already involved than advanced the science; that Cuvier and his disciples did much to clear that confusion away, and introduce sound methods of study; that Müller made a great advance in the rigorous application of anatomical principles to the distinction of the several groups; and that subsequent progress has chiefly resulted from the more or less general recognition of the principle that the consideration of the entire structure must be the paramount guide to a correct appreciation of the true relations of the various types of organization, and that teleological modifications are quite unimportant in comparison with morphological.

Classification.—In conclusion, we append a synopsis of the primary and secondary groups, down to sub-orders, that may be most advantageously admitted among the fishes; they are arranged in an inverted ascending series:

Class PISCES, or FISHES (E. Geoffroy St.-Hilaire, Latreille, Agassiz (fraction), Cope, Gill).

Sub-class Teleostei.

Order Plectognathi.
Sub-order Gymnodontes,
" " Ostracodermi,
" " Sclerodermi.
Order Lophobranchii.
Sub-order Syngnathi,
" " Solenostomi.
Order Pediculati.
Order Hemibranchii.
Order Teleocephali.
Sub-order Heterosomata,
" " Anacanthini, or Jugulares,
" " Acanthopteri,
" " Percesoces,
" " Synentognathi,
" " Haplomi,
" " Isospondyli,
" " Eventognathi,
" " Gymnonoti.
Order Scyphophori.
Order Nematognathi.
Order Apodes.
Sub-order Ichthyocephali,
" " Holostomi,
" " Enchelycephali,
" " Colocephali.
Order Opisthomi.
Sub-class Ganoidei.
Super-order Hyoganoidei.
Order Cycloganoidei.
Order Rhomboganoidei.
Super-order Chondroganoidei.
Order Chondrostei.
Order Selachostomi.
Super-order Brachioganoidei.
Order Crossopterygia.
Order Actinistia (extinct).
Super-order Dipnoi.
Order Sirenoidei.
(?) Order Placoganoidei (extinct).
Super-order (?) Aspidoganoidei (extinct).
Order Cephalaspidoidea (extinct).
(?) Super-order Acanthoganoidea (extinct).
Order Acanthodoidea (extinct).
Class Selachians or Elasmobranchiates.
Super-order Chimæræ.
Order Holocephali.
Super-order Plagiostomi.
Order Raiæ.
Sub-order Masticura,
" Pachyura.
Order Squali.
Sub-order Rhinæ,
" Galei.
Class Marsipobranchii.
Order Hyperoartia.
Order Hyperotreti.
Class Leptocardii.
Order Cirrostomi.

Authorities.—In addition to the general works whose titles have been subjoined in foot-notes to this account, the following articles may be referred to—viz.: "Ichthyology," by Sir John Richardson, in the *Encyclopædia Britannica*; "Observations on the Systematic Relations of the Fishes," by Edward D. Cope, in the *Proceedings of the American Association for the Advancement of Science for 1871* (1872), pp. 317–343; and "Arrangements of the Families of Fishes," by Theodore Gill. Lists of all the fishes of North America have been given by DeKay, Storer, and Gill; those of British America have been described by Richardson, Fortin, Storer, Perley, and Knight; those of Maine by Holmes; of Massachusetts, by Storer and others; those of Connecticut, by Linsley; of New York, by Mitchill, DeKay, and Ayres; of New Jersey, by Baird and Abbott; and of South Carolina, by Holbrook. The most important of these for the general student are those of DeKay,* Holbrook,† and Storer.‡ The latest list of the species has been given by Gill,§ and in that work references will be found to other authors. Numerous articles on American fishes will be found in the *Proceedings of the Academy of Natural Sciences of Philadelphia*; *Proceedings of the Boston Society of Natural History*; *Boston Journal of Natural History*; *Annals of the Lyceum of Natural History, New York*; and especially in the *Reports of the U. S. Commissioner of Fish and Fisheries*, Prof. S. F. Baird.

The fossil fishes have been chiefly studied by Agassiz, Pander, Egerton, Hugh Miller, Huxley, and Kner, and those of the U. S. have been well illustrated and received much attention from Dr. Newberry, whose article on FOSSIL FISHES in this volume will give further information.

THEODORE GILL.

Ichthyor'nis [Gr. ἰχθύς, "fish," and ὄρνις, "bird"], an extinct genus of birds described by Prof. Marsh from the Cretaceous of Kansas. They possessed teeth and biconcave vertebræ, from which fish-like character the name is derived. (See ODONTORNITHES.)

Ichthyosau'rus [Gr. ἰχθύς, "fish," and σαῦρος, "lizard"], an extinct genus of marine reptiles having some fish-like characters, whence the name, meaning "fish-lizard." In general form these reptiles were elongate, with the head set immediately upon the body, without any constriction at the neck. They had four fin-like paddles, and the tail was flattened, and probably expanded toward the end into a powerful vertical tail-fin, as in the fishes. The skull of the ichthyosaurus is elongated and tapering at the

Ichthyosaurus (head).

snout, which, in the upper jaw, is formed principally by the much-enlarged premaxillaries. The rami of the mandible are also united in an elongated symphysis, as in the modern gavial. The teeth are simple, conical, of nearly equal size, and in an uninterrupted series. Their surface is marked by longitudinal impressions and ridges, varying in the different species. They are inserted loosely in a long and deep continuous furrow, and were retained by slight ridges extending, between the teeth, along the sides and bottom of the furrow, and by the gum and the organized membranes continued into the groove and upon the base of the teeth. The nostrils are small and near the orbits, which are large and evidently enclosed highly developed eyes. There is often found in front of the orbit in fossil skulls a circular series of petrified thin bony plates ranged round a circular aperture. Such a series of sclerotic plates is now found only in the eyes of turtles, lizards, and birds, showing, writes Dr. Buckland, "that the enormous eye of which they formed the front was an optical instrument of varied and prodigious power, enabling the ichthyosaurus to descry its prey at great or little distances, in the obscurity of night or in the depths of the sea." There are in the skull large supratemporal fossæ, and the infratemporal fossæ are closed over by plates of bone. The centra of the vertebræ are short flattened disks and deeply biconcave, resembling those of fishes. The only transverse processes they possess are tubercles developed from the sides of these centra. The neural arches are forked bones, connected only by cartilage, with two flat surfaces, one on each side of the middle line of the upper surfaces of the centra; and in the greater part of the body they are not articulated with one another. The cervical and dorsal series of vertebræ are not separated by any marked characters; and there is no sacrum, but the caudal vertebræ are distinguished by the chevron bones which are attached to their under surfaces. The anterior ribs have a capitular and tubercular articulation. The scapula is narrow. The coracoids are broad, and meet on the median line below. The clavicles are stout, curved, and united with a T-shaped interclavicle. The shoulder-girdle formed by the union of these bones resembled that of the singular aquatic mammal of Australia, the ornithorhynchus, and probably enabled the ichthyosaurus to visit the shore, perhaps to deposit its eggs, when it would crawl with its belly dragging on the ground. The humerus is short and prismatic, and distally supports two bones representing the radius and ulna. Six or seven bones in the two following series are reckoned as carpals, and the next series are metacarpals. They are followed by not more than three to five complete series of polygonal bones, representing as many digits, which, however, sometimes fork, and there are in addition marginal series of bones upon each side of the paddle. This construction, which is peculiar to the ichthyosauri, is repeated in the hind paddles, but they are much smaller. The pelvis consisted of the ordinary three bones on each side, but was not connected with the verte-

*Dekay (James E.), *Zoology of New York, or the New York Fauna*, part iv., Fishes (Albany, 1842, 4to); 335 nominal species are described and mostly figured as New York fishes.

†Holbrook (John Edwards), *Ichthyology of South Carolina* (Charleston, S. C., 1st ed. 1855; 2d ed. 1860, 4to, unfinished).

‡Storer (David Humphreys), *A History of the Fishes of Massachusetts* (Cambridge and Boston, 1867; reprinted from *Mem. Am. Acad. Arts and Sci.*, 1853–67, 4to); 133 species figured on 39 plates.

§Gill (Theodore), *Catalogue of the Fishes of the East Coast of North America* (Washington, 1873, 8vo, published by the Smithsonian Institution); 351 species enumerated.

bral column. The ischium, as well as the pubis, met its fellow on the median line. The body seems to have been covered with a smooth or finely wrinkled skin, and destitute of scales. These animals sometimes attained a length of more than thirty feet, and were predaceous in their habits, as is witnessed by the scales and bones of contemporary fishes sometimes found under the ribs of these fossils. The composition of the singular spiral "coprolites" affords additional evidence of this fact, which might also be easily inferred from the construction of the jaws and teeth. Ichthyosauri may have abounded in the Triassic seas, but their remains have not been certainly identified earlier than the Lias, and the latest species occur in the Chalk. O. C. MARSH.

Ichthyo'sis [Gr. ἰχθύς, a "fish;" *i. e.* "fish-skin disease"], a disease of the human subject characterized by the presence of scaly growths in or upon the integument. Three distinct diseases have been called by this name: (1) Intra-uterine ichthyosis, in which the *vernix caseosa*, or glutinous secretion of the skin of the fœtus, becomes hardened into a horny armor, crippling the development of the child and leading to its death. (2) True ichthyosis is a hypertrophy of the papillary layer of the skin and of the epidermis. The patient is covered, as to a great part of the body and limbs, with unsightly scales of forms varying in different patients. This disease is thus far quite incurable. It is generally hereditary, but is not always so. Ichthyosis has been known to cover the skin of the knee after recovery from severe destructive disease of the joint. Frequent bathing and anointing are useful, but never curative. (3) The so-called sebaceous ichthyosis depends on excessive functional activity of the sebaceous glands, the secretion of which rapidly hardens into scales. This disease is often caused by some reflex disturbance, and is curable as a rule. REVISED BY WILLARD PARKER.

Ic'ica Res'in, a resin from Guiana, similar to elemi.

I'co, town of Brazil, in the province of Ceara, on the Salgado, is well built and thriving, carrying on a lively trade in the products of the province and in European manufactures. Pop. about 6000.

Ico'nium [now *Konieh*], in Asia Minor, on the high-road between Ephesus and Antioch of Syria, a place of considerable importance in the time of the apostles (Acts xiii. 51). An oasis in the desert, it was called the Damascus of Lycaonia. In 1099 A. D. the Seljukian Turks made it the capital of their kingdom of Roum. It was captured by Frederick Barbarossa in 1189, and recovered by the Turks in 1190. It has massive walls, between two and three miles in circumference, with suburbs almost as populous as the city itself. Its most remarkable building is the tomb of Hazret Mevlana, the founder of the Mevlevi Dervishes. Pop. nearly 30,000. R. D. HITCHCOCK.

Icon'oclast [from Gr. εἰκών, "image," and κλάω, "I break"], a name given in the eighth century to the destroyers of images, distinguishing them from *iconolaters*, image-worshippers. The excessive and ever-increasing reverence paid to images in the Christian Church had already been reproved by some of its most enlightened members, but the great iconoclastic conflict was begun A. D. 726 by Leo the Isaurian, who had ascended the throne of Byzantium in 717. As the writings of his partisans were either destroyed by the iconolaters or lost through neglect, the emperor's motive for opposing image-worship is unknown to us. His opponents accused him of listening to Jewish and Mohammedan advisers, especially to the renegade Beser; and it may be that a contemplation of the simpler Mohammedan worship led him to condemn the semi-pagan Christianity of his subjects. His first edict (726) forbade the adoration of images, and ordered that such pictures as were movable should be hung higher, so as no longer to receive kisses and other marks of devotion. Authors disagree as to the chronology of these events, but according to Theophanes and later Byzantine historians, Pope Gregory II., upon Leo's publication of his edict, wrote to him demanding its revocation, and when the emperor refused compliance, forbade the Italians to pay their customary tribute. In 730, Leo held a council at Constantinople, at which he commanded the destruction of images in churches, imposing severe penalties on those persons who should persist in worshipping them; he also deposed the aged patriarch Germanus, who disapproved of his measures, and put Anastasius in his place. This second edict excited the iconolaters, among whom were nearly all the clergy, to open revolt. An officer who, by Leo's order, attempted to destroy a miracle-working image of Christ at Constantinople, was beaten to death by the populace. The islanders of the Archipelago proclaimed a new emperor, one Cosmas, and sailed against Constantinople; the rebels were discomfited by the Greek fire, and Cosmas was made prisoner and executed. In 731, Gregory II. was succeeded by Gregory III., also an enemy to iconoclasm. This pope and Leo the Isaurian both died in 741. The emperor was succeeded by his son, Constantine Copronymus, who, having defeated the usurper Artavasdus, continued the opposition to images. In 754 he convoked a council at Constantinople, called by the Greeks the seventh general council, but never recognized by the Roman Church. It was composed of 338 Oriental bishops, who prohibited all images, and anathematized those persons who should set up any, either in a church or private house. They also cursed by name the principal champions of image-worship—Germanus (who had not long survived his deposition), George of Cyprus, and the learned John of Damascus. The monks now took refuge in their cloisters or in deserts, whence many of them were dragged to prison, torture, and even death. The patriarch Constantine, successor of Anastasius, being accused of disrespect to the emperor, was publicly degraded and beheaded. Constantine Copronymus died of fever in 775. His son and successor, Leo Chazarus, though in weak health and of a mild disposition, enforced the laws against iconolatry. After Leo's death (A. D. 780) his wife, Irene, who was devoted to images, became guardian of her young son, Constantine VI., and immediately proclaimed liberty of conscience. She promoted her secretary, Tarasius, a layman, to the patriarchate, made friends with the pope, Adrian, and assembled a council, first in 786 at Constantinople, where it was dispersed by the iconoclasts, then in the following year at Nicæa. It was attended by 375 bishops, who set aside the decrees of the Council of Constantinople (754), anathematized the persons who had composed it, restored the worship of images, and solemnly cursed all iconoclasts. The churches of France, Germany, England, and Spain took a middle course between the destruction and the adoration of images, which they regarded simply as useful memorials of faith and history. A book of controversy was composed and published in the name of Charlemagne, who assembled a council of 300 bishops at Frankfort. This assembly, while blaming iconoclasts, pronounced a more severe censure against the Council of Nicæa. In the Eastern Church the decrees of the Nicene Council remained in force until 813, when Leo Armenus, an enemy to images, became emperor, and treated the iconolaters with great severity. Among those who suffered for their doctrines was the historian Theophanes. Leo was murdered in 820, and succeeded on the throne by Michael the Stammerer, who restored image-worship and recalled the monks banished by his predecessor. Michael's son, Theophilus, became emperor in 829, and opposed image-worship, which, after his death (in 842), was again established by his wife, Theodora, who governed the empire for her young son, Michael, afterwards called the Drunkard, and instituted a festival, still kept in the Greek Church, to celebrate this final triumph over iconoclasm.

The original motive for iconoclasm is, as already said, unknown to us; but whatever it may have been, and however much we may condemn the use of images, we must allow that their overthrow by Leo and his successors was a mistake, "a premature rationalism," as Dean Milman expresses it. It was a violent change, but not a reformation; a rooting up, unfollowed by any planting. Pictures and statues, sacred books for those who could read no others, were destroyed, and nothing better was given to replace them. The very fact that they frequently were not regarded simply as emblems, but adored for their own sakes, made the unwisdom of their destruction so much the greater. Ignorant and superstitious persons would probably have cared little to defend mere symbols, but they clung obstinately to carvings and paintings which were to them as present gods. The images worked miracles of healing, wept tears, and shed blood—in short, lived, so believed their worshippers, as truly as the invisible Christ and his saints in heaven. When Leo's edicts against images were followed by rebellion, the hatred of the iconoclasts was extended from pictures and statues to those who adored them. We may suppose that each party in this struggle was actively cruel towards the other, but the emperors had the army on their side, and consequently greater power of injury. The persecution of iconolaters became particularly violent under Constantine Copronymus, of whose barbarities the Byzantine historians give many terrible examples. This emperor was chiefly incensed against the monks. He destroyed or secularized the monasteries, and subjected their inmates to every possible insult, causing them to break their vows of celibacy under pain of exile or death. The governors of provinces were Constantine's willing agents, the most zealous being Michael Lachanodraco, prefect of Thrace, in which prefecture there was soon left hardly one man bold enough to wear the monkish dress. Andrew and Stephen were the two chief martyrs of this reign. The former, having reproached the emperor for his persecutions, was scourged to death. Stephen, an eloquent

preacher against iconoclasm, was killed after a long imprisonment. The cause of his violent death is curiously like that of Thomas à Becket's. Constantine, hearing that even in prison he spoke in defence of images, cried, "Am I or is this monk the emperor of the world?" Some soldiers having heard these words, took Stephen from his dungeon, fastened thongs to his feet, and so dragged him through the streets until he died; they then cast his body into the common grave of criminals. The patriarch Constantine, though an iconoclast, was accused of conspiracy and of using disrespectful words against the emperor. Having been deposed from the patriarchate and forced to acknowledge a eunuch as his successor, he was banished from Constantinople. But the emperor, not content with this much vengeance, had him brought back to be scourged, exposed to the derision of the populace, and finally beheaded.

The term iconoclast has in modern times been used to designate those reformers who, through excess of zeal, destroyed statues, painted windows, and other works of art in Roman Catholic churches. JANET TUCKEY.

Icti'nus, a contemporary of Pericles, built, in connection with Callicrates, the Parthenon in the Acropolis of Athens, which was finished in 438 B. C.; also the temple of Apollo Epicurius, near Phigalia in Arcadia, and the building at Eleusis in which the mysteries were celebrated. All these were of the Doric order.

I'da [Gr. ἡ Ἴδη], a mountain in Asia Minor, is a spur or branch of the Taurus system, and traverses the ancient Phrygia and Mysia, itself throwing out many spurs. From it flow the Granicus, the Simois, the Scamander, and other streams whose names are historic. Its highest point is Mount Gargarus, 4650 feet high.—Another IDA [now called Psiloriti], equally famous in song and story, is in the island of Crete. It terminates in three peaks, and rises to the height of 7674 feet.

Ida, county in the W. of Iowa. Area, 432 square miles. It is intersected by the Maple River, and is very fertile. Cap. Ida. Pop. 226.

Ida, post-v., cap. of Ida co., Ia., on the line of the unfinished I. P. R. R.; has a court-house, weekly newspaper, graded schools, 2 churches, etc., and is in a very fertile region. Pop. 30, much increased since the census.

W. P. EVANS, ED. "IDA COUNTY PIONEER."

Ida, post-tp. of Monroe co., Mich., on the Michigan Southern R. R. Pop. 1020.

Ida, tp. of Douglas co., Minn. Pop. 224.

Ida'cius, or **Itha'cius,** b. at Limica, in Galicia, Spain, in the latter part of the fourth century, was appointed bishop of his native city about 427, but was deposed by the invading Suevi in 461, and d. after 469. He wrote a *Chronicum*, arranged according to the succession of emperors, and embracing the period from 379 A. D. (at which point Hieronymus breaks off) to 429. It gives a brief account of events besides the enumeration of names and dates, and is considered as a valuable repertory of facts. It was first published complete in 1619 by Sirmond, and is incorporated in Rösler's *Chronica Medii Ævi* (1798).

I'daho, a Territory of the Pacific slope of the U. S., lying almost wholly in the upper Columbia River basin. It is bounded on the N. by British Columbia, where its breadth is but one degree of longitude, about 48 miles in that latitude; on the E. it is bounded by Montana and Wyoming, contributing also for about 25 miles to form the western boundary of the National Yellowstone Park, a narrow strip of which was contributed by this Territory; the line of its separation from Montana is, in the N. E., the watershed or divide of the Bitter Root Mountains, and lower down the principal Rocky Mountain chain, which sweeps around the head-waters of the sources of the Missouri River. The Teton range, a spur of the Rocky Mountains which branches off almost due S., coincides nearly with the boundary-line between Idaho and Wyoming Territory; on the S. it is bounded by Utah and Nevada, the boundary-line being the 42d parallel; on the W. by Oregon and Washington Territory for about two-fifths of the distance (from Fort Boisé to the mouth of the Clearwater River), the Snake River forming the actual boundary. The Territory lies between the 42d and the 49th parallels of N. lat., and between the 111th and the 117th meridians of W. lon. from Greenwich. Its length from N. to S. is about 442 miles; its breadth varies from 48 miles at the northern boundary to 308 on the southern, the mean breadth at the parallel of 44° 30′, about 257 miles. Its area is 86,294 square miles, or 55,228,160 square acres.

Face of the Country.—Idaho is for the most part a mountainous country. The Bitter Root Mountains, which from their origin in British Columbia form the westernmost or outlying range of the Great Rocky Mountain chain, form at the north-eastern line of Idaho the divide between it and Montana, and from the northern bank of the Columbia River and its tributary, Clark's Fork, these mountains have covered the whole country to the Sierra Nevada with a succession of spurs or short ranges running nearly due W. Prominent among these, both from their height and breadth, are the Kootenai Mountains in the extreme N., the Cœur d'Alène Mountains near the 47th parallel, and the Clearwater or Lapwai Mountains along the Clearwater River and its tributaries. As the Bitter Root Mountains near the 45th parallel draw closer to the main chain of the Rocky Mountains, a new range of outliers, forming almost a distinct mountain-system of its own under the name of the Salmon range, follows the course of the Salmon River and its affluents. The summits of this range are mostly lofty, rugged, and snow-capped. Many of them are above 12,000 feet in altitude, and several of the loftiest over 13,000 feet. The town of Florence, in Florence Basin, 2000 feet below the summit of Florence Mountain, is 11,100 feet above the sea, and is probably the highest town in the U. S. Spurs from this range along the Snake River and its tributaries have received the names of Weiser, Payette, Boisé, Owyhee, and Sand Tooth mountains. Below these, and towards the S. E. along a part of the Snake River, is a somewhat elevated plateau or prairie with two or three terraces, as at the American and the Shoshone Falls, but constituting a broad and tolerably fertile tract of arable soil. S. of the Snake River Valley we find the Bear River Mountains, the Goose Creek Mountains, and other ranges which form a part of the rim of the Great Salt Lake Basin, while in the extreme S. E. of the Territory Bear River and Bear River Lake are within that basin.

Rivers, Lakes, etc.—Although some of the summits of the Salmon Mountains, and perhaps of the others, are higher than those of the Rocky Mountains proper in the same latitude, yet no portion of the waters of the Territory flows eastward. With the exception of Bear River in the extreme S. E., which discharges its waters into the Great Salt Lake, the entire drainage of the Territory is into the Columbia River, and the whole region is a part of the upper basin of the Columbia. The Clark's or North Fork of the Columbia and its affluents, including the Vermilion River, the Pend d'Oreille Lake and its tributary streams, and the outlet of the Hoo-doo or Tessentines Lake; the Spokane River, a smaller but considerable branch of the Columbia, with the beautiful Cœur d'Alène Lake and its affluents, of which it is the outlet; and, as the principal river of the Territory, which has a course of about 850 miles within it, the Lewis Fork or Snake River, which, with its branches, the Clearwater and the Salmon, with their numerous affluents, Weiser Creek, Payette River, Boisé River, Owyhee River, Bruneau Creek, Salmon Creek, Malade River, Goose Creek, Raft River, Bannack Creek, Pont Neuf River, Blackfoot River, Teton or Pierre's River, and Henry's Fork, which has its source in Henry's Lake on the borders of Montana, only a few miles from the Yellowstone Park, drains nearly 70,000 square miles of the Territory. The only other river of any size in the Territory is Bear River, which drains the S. E. corner, and is, as we have said, tributary to Great Salt Lake. The principal lakes besides Pend d'Oreille, Cœur d'Alène, Tessentines, Bear, and Henry's lakes, already mentioned, are the Payette lakes in Idaho co., and several unnamed lakes in Alturas and Boisé cos. Many of these rivers have fertile valleys, some of them of considerable extent, which constitute the best arable lands of the Territory, and which yield even to a rude cultivation large crops. Prominent among these valleys are those of Wood River, North Malade, Raft River, Bear River, Owyhee River, the upper waters of Snake River as far down as Fort Hall, Long Valley around Payette lakes, Round Valley, the Upper Payette valleys, Indian Valley, Lower, Upper, and Weiser River valleys, Boisé Valley, the Great and Little Camas Prairies, Goose Creek Valley, etc. The Snake River is navigable without difficulty for about 200 miles of its course in the Territory — viz. from the mouth of Powder River to the Salmon Falls, just above the mouth of Malade River. Below the mouth of Powder River for 150 miles to Lewiston, where it turns westward into Washington Territory, the Snake River navigation, though not impossible in a high stage of water, is difficult and dangerous from the numerous obstructions, rapids, etc. Above the mouth of the Malade, and between that and the junction of Bannack Creek, W. lon. about 112° 40′, there are three remarkable cataracts—Salmon Falls, in W. lon. about 114° 45′, Shoshone Falls, 114° 20′, and American Falls, about 112° 50′. Of these, Shoshone Falls are the most noted. The river is here 600 feet wide, the descent a little greater than that of Niagara, and at some seasons of the year the volume of water nearly as large, while the surrounding scenery is magnificent. There are numerous waterfalls in the Territory of great beauty and much greater height, though of smaller volume of water. In the E. S. E.

the Territory contributes a small portion to that wonder of the world, the Yellowstone National Park, and the region adjacent, about Henry's Lake and the whole course of Henry's Fork of the Snake River to its delta-like junction with that river near the Crater Buttes and the Lava Hills, is a region full of wonders and interest. In S. E. Idaho there are a number of sinks or tracts where the roofs of deep caves have broken through, and considerable streams suddenly sink below the surface and become subterranean in their subsequent course. The whole region is volcanic, and must have been at some period of the remote past in a condition of active eruption, though now the geysers, steam-springs, and soda springs and the natural hot baths, give but faint indications of its former activity.

Geology.—The geological system of Idaho is very simple. The Eozoic rocks cover nearly three-fourths of the Territory, but the Snake River Valley, the valleys of the Lower Salmon River, the Owyhee, Bruneau, Malade, McArthur, and Weiser rivers are evidently volcanic. The upper waters of Salmon River and its tributaries, the S. fork of the Clearwater, and Bear River, flow through valleys of considerable width, which are wholly of Tertiary formation, and there are also Tertiary plateaus of considerable extent in Southern Idaho. There are eight or nine small patches of Silurian rocks, none of them of any great extent, but lying among the foot-hills on either side of the Bitter Root Mountains. In the Bear River Valley, not far from the Yellowstone Park, there is a small outcrop of Cretaceous rocks.

Mineralogy.—Gold and silver ores are found abundantly in Idaho. Gold was first discovered in the Territory in 1852, on the Pend d'Oreille River, and near the lake of the same name, but there were no considerable mining operations commenced until 1860, when placer-mining was begun on the S. fork of Clearwater River. There are now mines of gold or silver at the sources of all the rivers and in every county of the Territory. In Kootenai co. there are extensive leads in the quartz veins, and many quartz-mills have been established. The placer-mines of Shoshone, Nez Percés, Idaho, and Lemhi cos. yielded in 1872 about $500,000 gold in each county. In Boisé co. over $1,000,000 worth of gold-dust was taken out in the summer of 1872, and several quartz gold-mines were opened and tunnelled which yielded largely. In Ada, Alturas, Owyhee, and Oneida cos. the mining is mostly for silver, the argentiferous galena and other silver ores of that region yielding bountiful returns, ranging from $126 to $280 the ton of ore. Placer gold is found also in considerable quantities in Alturas and Owyhee. New silver-mines of very rich ore have recently been opened near the Utah line. The yield of gold and silver in 1872 in the Territory was estimated at somewhat more than $8,000,000. The placer-mines under the improved methods of washing will give out in a few years, but before that time there will be sufficient quartz-mines opened and a sufficient number of quartz-mills in operation to keep up and probably increase the gold production of the Territory. But Idaho is rich in other metals, ores, and minerals, as well as in gold and silver. The lead from the argentiferous galena is so pure as to be worth saving for its own sake. There are extensive deposits of coal and iron at various points in the Territory; quarries of valuable building-stone could be opened at small expense; and the volcanic region of S. E. Idaho yields sulphur, soda, magnesia, carbonates and sulphate of lime, very pure salt, and other valuable minerals and alkalies, and the mineral springs of that region bid fair to furnish healing to the nation.

Vegetation.—The mountains of the Territory are for the most part covered with forests up nearly to the snow-line, and the forests are largely evergreen, having numerous varieties and species of pine, spruce, hemlock, tamarack, and fir, of which there are many on the western slope of the Rocky Mountains and on the eastern slope of the Sierra Nevada, but aside from these there are large tracts of red cedar in Kootenai and Shoshone cos. on the foot-hills and mountain-slopes. This is supposed to be the largest single tract of red cedar in the U. S., and it is of excellent quality. In the more southern counties there are many deciduous trees, and in some districts vast sage-plains which were at first supposed to be worthless, but it has been ascertained that the white sage, which is the principal species, after ripening its seed is preferred by cattle to any of the grasses, and that they will fatten on it as a winter browse. The soil of sage-lands is mostly a decomposed granite, with a considerable quantity of vegetable humus, and when irrigated, for which the Territory offers extraordinary facilities, they yield very large crops—from 30 to 45 bushels of wheat and corresponding amounts of other cereals to the acre. There are said to be nearly 16,000,000 acres of these lands. The river-valleys are very fertile, and though some of them require occasional irrigation they yield large crops. Agriculturally, Idaho is, with the exception of these valleys, better adapted to grazing than to the culture of cereals. Indian corn is not a sure crop, owing to the late and early frosts. The greater part of the Territory is from 3000 to 5000 feet above the sea, yet even in the northern counties snow seldom lies to any considerable depth in the valleys, and cattle can browse, and even fatten, through the winter without being housed. The ordinary garden vegetables, as well as potatoes, do well in the valleys, and fruit trees generally yield fruit in great abundance and of fine flavor. The smaller wild fruits are found in great profusion in the fertile valleys and on the mountain-slopes. There are native wild grapes of the *Vitis labrusca* or fox-grape species which ripen in the valleys, but the cultivated species and varieties require a higher temperature and less liability to frosts during the summer and early autumn months than are found in most sections of the Territory. In the southern part, however, on the mountain-slopes having a southern aspect, and especially where there are considerable lakes with steeply sloping banks, the culture of the grape may be made very profitable.

Zoology.—The beasts of prey are those characteristic of the Columbia basin and of the Pacific slope. The grizzly bear (*Ursus horribilis* or *ferox*) is the largest and most formidable of them, and his congener, the black bear (*Ursus Americanus*), is also found in the forests of the Territory. The raccoon, badger, wolverine (*Gulo luscus*), two species of skunk (the California and the little striped skunk), the fisher-marten, the American sable or marten, the mink, the panther, wild-cat or red lynx, and the banded lynx, raccoon-fox or mountain-cat, the gray wolf, the coyote or barking wolf, and four or five species of fox, are found. Among the rodents, there are beavers, moles, several species of ground-squirrels, and at least three of the tree-squirrels, the yellow-footed marmot, and at least three species of bat. There are ten or twelve species of the mouse family, musk-rats, gophers, one species of porcupine, and several new species of rabbits and hares. Among the ruminants there are the bison or American buffalo, the moose (*Alce Americanus*), the elk, the black-tailed and mule deer, the Rocky Mountain or prong-horn antelope, and the big-horn or Rocky Mountain sheep (*Ovis montana*). The birds are very numerous, and many of them of beautiful plumage. Ninety-five species, including specimens of most of the orders and families found on this continent, were shot by the naturalists of the Hayden expedition either in or near this Territory. The species of reptiles are not very numerous, though some of the harmless snakes and batrachians abound in the marshy portions of the Territory. There are three, and possibly four, species of rattlesnake, fifteen or sixteen species of harmless snakes, two tortoises, at least fifteen species of lizard, ten or twelve of frogs, several toads, newts, etc. Fish of the usual fresh-water kinds are found in the lakes and rivers. There are also several fresh-water mollusks and testaceans. The various geological expeditions which have traversed this and the adjacent Territories have unearthed numerous and very interesting fossils. Among the larger mammals discovered are several of the mastodon, elephant, and tapir families; new fossils of the bear and monkey families, ten or eleven genera allied to the horse, marsupials, rodents, several genera of crocodiles, alligators, and other saurians, tortoises and turtles in great numbers, lizards, serpents, batrachians, and twenty-six species of fish, many of them of large size. Not all, perhaps not the greater part, of these were found within the geographical limits of Idaho, but they occurred in the geological formation and the deposits which are common to S. E. Idaho and the adjacent Territories of Montana, Wyoming, and Dakota.

Climate.—Statistical tables of the climate of the greater part of Idaho are wanting. We know, indeed, that W. of the Rocky Mountains, especially in the upper Columbia River basin, there is but a moderate amount of either snow or rainfall, and that the climate is much milder, even though the land is elevated, than E. of those mountains. The annual range of the thermometer in Northern Idaho, in the river and lake valleys, is said to be between 5° and 93° F., though in exceptional seasons it may surpass either boundary by two or three degrees. The most of the central portions of the Territory is very mountainous, though with valleys from ten to fifteen miles in width wherever there are streams of water. These valleys are from 3000 to 5000 feet above the sea, but the climate is very equable. Farther S. are extensive plains covered with sage-bushes and grease-wood, but these give way to fine crops when the land can be irrigated. The rainfall is small here, though greater than in Colorado, or perhaps than in Wyoming, but the facilities for irrigation are much better, and on all the higher summits there is perpetual snow. In S. E. Idaho, which belongs really to the Great Salt Lake Basin, there is a somewhat different climate, and perhaps a slightly greater rainfall. At Fort Hall, 4754 feet above the sea, in 1871 the

barometric range from June to October was but $\frac{24}{100}$ of an inch; the mean temperature for June was 64.62° F.; of July, 70.44°; of August, 70.90°; of September, 57.79°; and of the first eighteen days of October, 57.28°. The average observations of the Hayden expedition the same summer for June and July, from the southern boundary of the Territory to the Montana line, corresponded very nearly with the temperature at Fort Hall.

Agricultural Products.—According to the census of 1870, there were in that year only 77,139 acres of land in farms in the Territory, of which only 26,603 were under tillage, 50,536 being woodland or other unimproved lands, being 65.5 per cent. of the entire land in farms. The average size of the farms was 186 acres, or a little more than a quarter section. The value of the farms in the Territory in 1870 was $492,860, and of farming implements and machinery, $59,295; the farm products of the same year were valued at $637,797; animals slaughtered or sold for slaughter were valued at $57,932; home manufactures, at $34,730; the forest products, though of considerable amount, were not reported; market-garden products were estimated at $24,577; orchard products, at $725; wages paid to agricultural laborers, including board, $153,007. In 1869, 75,650 bushels of wheat were harvested, almost all of it spring wheat; 1756 bushels of rye; 5750 bushels of Indian corn; 100,119 bushels of oats; 72,316 bushels of barley. There were 2775 horses reported; 59,996 neat cattle; 3415 pounds of wool; 6985 tons of hay; 21 pounds of hops; 64,534 bushels of potatoes; 610 bushels of peas and beans; 14 bushels of grass-seed; the value of all livestock was $520,580. Besides the horses enumerated above, there were 371 mules and asses; of the neat cattle, 4171 were milch cows, 522 working oxen; the remainder were probably for the most part cattle driven into the Territory for pasturage; the number of sheep was 1021; of swine, 2316. The dairy products were 111,480 pounds of butter, 4464 pounds of cheese, and 11,250 gallons of milk sold. The increase of population since 1870 has unquestionably more than doubled, perhaps quadrupled, all these amounts, but there are no available returns which give even approximately accurate figures of the actual production.

Manufactures and Industrial Products.—The industrial progress of Idaho since 1870 has been rapid, but there are not, we believe, any existing statistics to show its extent. In 1870 there were 101 manufacturing establishments of all kinds, in which 11 steam-engines of 311 aggregate horse-power, and 16 water-wheels of 295 horse-power, furnished the motive force; in these establishments 265 hands were employed, a capital of $742,300 was invested, $112,372 wages were paid, raw material to the value of $691,785 was used, and the annual product was $1,047,624. Of this amount, the greater part was the product of smelting furnaces for the extraction of silver and gold from the argentiferous galena and other ores, and Owyhee co. claimed $464,116 of the product, Ada co., $317,025, and Boisé co., $156,147, leaving only $110,000 between the other six counties. The milling of quartz, a branch of this smelting industry, yielded alone a product of $523,100.

Railroads.—As yet (May, 1875) there is not a mile of railroad in the Territory, though the Ogden and Franklin branch of the Union Pacific comes to its southern border. The Northern Pacific was intended to traverse by two distinct and widely separated lines the northern counties of the Territory—one line following the valley of the Clearwater through Shoshone co. and the northern border of Nez Percés co. to Lewiston, at the junction of the Clearwater and Snake rivers, while the other or more northern route, striking north-westward near Frenchtown, Mont., was to follow the valley of Clark's Fork of the Columbia, around the northerly shore of Lake Pend d'Oreille, and then turn south-westward till it reached the Spokane River in Washington Territory, its whole course in Idaho being in Kootenai co. Eventually this road will probably be built, but whether it will follow either or both these routes is uncertain. A road is projected, in continuation of the Ogden and Franklin branch already spoken of, to extend through S. E. Idaho to the Yellowstone National Park. It would probably follow the valleys of the Bear River, the upper Snake River, and Henry's Fork. Another road, projected, is from Monument Point or Terrace on the Central Pacific, up the valley of Salmon Creek to Silver Bar at the mouth of Malade River, from whence the Snake River is navigable for 200 miles to the mouth of Powder River, and could be rendered navigable at a moderate expense to Lewiston at the junction of the Clearwater. Eventually, probably, this road would follow the valley of Snake River, and thus connect the Central Pacific with the Oregon and Washington lines. All these projects, however, have been postponed almost indefinitely by the failure of the great banking-house which was engaged in promoting them.

Finances, etc.—The assessed valuation of Idaho Territory in 1870 was $5,292,205, and the true valuation was estimated to be $6,552,681; of this, three-fifths were in the two counties of Boisé and Owyhee, and nearly four-fifths in the three counties of Boisé, Owyhee, and Ada. The entire taxes, not national, of the Territory were $174,711, of which $40,594 were territorial and $132,171 county taxes. In 1873 the internal revenue tax of the Territory was $19,275.80. The public debt of the counties in 1870 was $218,522, and Boisé City had besides a debt of $4099. The Territory has an assay-office at Boisé City which assays several hundred thousand dollars of gold and casts it into bars for transportation. The principal exports of Idaho are gold and cattle. Of the former, about $7,500,000 is sent from the Territory yearly; of the latter, probably about 20,000 head go to market. The imports are mostly of manufactured products, which, owing to the great expense of transportation, bear a high price. There is one national bank at Boisé City, with a capital of $100,000 and liberty to increase to $500,000; no savings banks, and 4 private banking-houses—2 at Boisé City and 2 at Idaho City. There are no life or fire insurance companies in the Territory.

Population.—The true population of Idaho Territory in 1870, including Indians, nomadic and on reservations, was 20,583, of whom 5631 were Indians, 3284 were on the various Indian reservations of the Territory, 4274 were Chinese, 10,618 whites, and 60 colored. As the Territory was not organized until 1863, and there was only a mere handful of settlers within its limits in 1860, there is no record of population earlier than 1870. The density of the population in the Territory in 1870, exclusive of tribal Indians, was 0.17 to the square mile. Of the constitutional population (14,999), 12,184 were males, 2815 females; 7114 were natives, of whom 5054 were males and 2060 females; 7885 were of foreign birth, of whom 7130 were males and 755 females; 10,618 were whites, of whom 7973 were males and 2645 females. Of these 10,618 white persons, 7018 were natives (5002 males and 2016 females); 3600 were of foreign birth (2971 males and 629 females). Of the 60 of African descent, 42 were males and 18 females; of these, 47 were natives of the U. S. and 13 of foreign birth. Of the 4274 Chinese, 4148 were males and 126 females; there were 47 civilized Indians, 21 males and 26 females. Of the total population, 1695 (897 males and 798 females) were of school age, 9430 males were of military age (18 to 45), 10,313 males were 21 years old and upwards (citizen's age), and 5557 males were actually citizens.

Education.—In 1870 there were 25 schools of all classes in Idaho, having 23 male and 10 female teachers, and 602 male and 606 female pupils; the income of these schools for the year ending June 1, 1870, was $19,938, of which $16,178 was from taxation and public funds and $3760 from other sources, including tuition. Of these schools, 21 were public, having 20 male and 6 female teachers, and 1048 pupils and $16,178 income; there were 4 private schools, having 7 teachers (3 male and 4 female) and 160 scholars (75 male and 85 female), and $3760 income, mostly from tuition. There was no college, scientific, professional, or technical school. At the beginning of 1873 there were 37 school districts, 32 public schools, 60 teachers (26 male, 34 female); 26 school-houses; the average monthly pay of teachers was $162.50; there were 1898 children of school age, of whom 1416 were enrolled in school, with an average attendance of nearly 1000. The sum of $22,496.81 was received for school purposes from all sources, and $17,219.56 expended. There is a school law and school board, with a superintendent, in each of the nine counties.

Libraries, Newspapers, etc.—In 1870 there were 11 public libraries, with 2860 volumes, and 32 private libraries, with 7765 volumes, making in all 43 libraries, with 10,625 volumes. There were 6 newspapers in the Territory—1 tri-weekly, 1 semi-weekly, and 4 weekly—with an aggregate circulation of 2750, and an aggregate annual issue of 200,200 copies. In the same year there were 15 churches of all denominations, 12 church edifices, 2150 sittings, and $18,200 estimated value of church property. Of these, 2 were Baptist, having 2 church edifices, 175 sittings, and church property valued at $2000; 6 Protestant Episcopal churches, with 4 edifices, 600 sittings, and $4000 of church property; 1 Presbyterian church; and 4 Roman Catholic congregations, with 4 church edifices, 575 sittings, and $11,000 of church property. In 1873 the number of congregations had increased to 10, of which, however, 6 were missions. There were also 6 missions of the Jesuit Fathers among the Indians. Of the 9 regular priests, 6 were missionaries among the Indians, and one was the vicar apostolic of the vicariate of Idaho.

Constitution, Courts, Representatives in Congress, etc.—The governor and secretary of state are appointed by the President for a term of four years; the treasurer, comptroller, and superintendent of public instruction are elected by

the people. The legislature comprises a council of 13 members, chosen for two years, and a house of representatives of 25 members, chosen for one year. The constitution of the Territory is similar to other territorial constitutions, and will be abrogated when the Territory becomes sufficiently populous for admission as a State. The supreme court consists of a chief-justice and two associate justices, appointed by the President for four years. It holds at least one session annually at the territorial capital. The Territory is divided into three judicial districts, in each of which one of the supreme court justices holds a district court session. The Territory has a delegate in Congress, who is entitled to speak on any question, but not to vote.

Counties.—The Territory is divided into ten counties, as follows:

Counties.	Pop. in 1870.	Counties.	Pop. in 1870.
Ada	2675	Lemhi	988
Alturas	689	Nez Percés	1607
Boisé	3834	Oneida	1922
Idaho	849	Owyhee	1713
Kootenai (new county taken from Shoshone).		Shoshone	722

Principal Towns.—Boisé City, the capital both of the Territory and of Ada county, has a population of 1500 to 2000. Idaho City, county-seat of Boisé county, is of about the same population; Lewiston, capital of Nez Percés county, Silver City, Malade City, and Florence are the other towns of note.

History.—The history of Idaho Territory is very brief. With the exception of the bold explorers, Lewis and Clark, who early in the present century followed up nearly to their sources the two forks of the Columbia, Clark's and Lewis's Forks, which traverse this Territory, the only white men who had trodden its soil previous to 1850 were some of the trappers and hunters who had penetrated its mountains and valleys in pursuit of their game. In 1852 gold was discovered in the extreme northern part of the Territory, but it attracted few miners or settlers. It formed a portion of the Territory of Oregon up to 1863. Its first paying gold-mine was opened at Oro Fino in 1860, and others in Owyhee county in 1862. When first organized it included portions of the previous Territories of Oregon, Washington, Utah, and Nebraska. In 1864 its boundaries were changed, and a part set off to Montana. While it possesses as much arable land, as large a proportion of forest and grazing lands, and as valuable mineral wealth as most of the Territories, its settlement has been much impeded by its inaccessibility. It has no railroads, and no good wagon-roads traversing any great extent. Yet it is steadily and healthily growing, and from its fine climate, its valuable mines, and its large extent of grazing lands it must become an important Territory and State.

Governors.—

William H. Wallace	1863–64	David W. Ballard	1868–70
Caleb Lyon	1864–66	Gilman Marston	1870–71
David W. Ballard	1866–67	Thomas W. Bennett	1871–75
Isaac L. Gibbs	1867–68		

L. P. Brockett.

Idaho, county of Idaho, extending E. and W. from Oregon to Montana. It is generally mountainous, and is very deficient in roads. The river-valleys are generally deep, fertile, and so well sheltered from winds that cattle need no protection in winter. The Payette Valley is a splendid prairie, producing grass, grain, cattle, and some timber. It abounds in game and fish. Cap. Washington. Pop. 849.

Idaho, post-v., county-seat of Clear Creek co., Col., in Clear Creek Valley, among the Rocky Mountains, 34 miles W. of Denver and 5 miles from Concord, on the Colorado Central R. R. It is in a most romantic region, and is well known for its hot and cold mineral springs, which are useful in a very wide range of diseases. Idaho has ample hotel accommodation, and is visited every summer by great numbers for the purpose of regaining health by means of the baths and the charming climate.

Idaho City, post-v., cap. of Boisé co., Id., in a valley of a spur of the Salmon River Mountains; lat. 43° 45′ N., lon. 115° 30′ W. It is in the centre of a very important mining region; has a national bank, a weekly newspaper, public and private schools, 2 churches, a court-house, jail, and various manufacturing and business firms.

T. J. Sutton, Ed. "Idaho World."

Ida′lium (now *Dali*), a promontory of the E. coast of Cyprus, on which was situated a celebrated temple of Aphrodite; hence her surname, *Idalia.*

I′daville, post-v. of Jackson tp., White co., Ind., on the Columbus Chicago and Indiana Central R. R. P. 197.

Ide, a fish of the carp family (Cyprinidæ), the *Leuciscus Idus*, found in rocky lakes of Northern Europe. It is a good table-fish.

Ide (George Barton), D. D., b. at Coventry, Vt., in 1806; graduated at Middlebury College in 1830; entered the ministry; became pastor of a Baptist church in Albany, N. Y., in 1834, of the Old Federal street church in Boston in 1835, of the First Baptist church in Philadelphia in 1838, and of a church in Springfield, Mass., in 1852. Dr. Ide was distinguished for scholarship, eloquence, and logical power; he was averse to writing for publication, but in the course of a ministry of forty-two years quite a number of his sermons appeared separately or in volumes. D. at Springfield, Mass., Apr. 16, 1872.

Ide′a, one of the most important terms in mental philosophy (from the Greek ἰδέα or εἶδος, as employed by Plato to signify what is objectively permanent under changing phenomena), used in modern times, especially since Descartes, to designate subjective notions and representations with or without objective validity. Plato discovered, as a result of his "dialectic," that under the constant change which goes on with individual things there is a permanent form or type of the process, which abides—somewhat after the manner of the "persistent force" or "law of nature" described in modern science. These archetypal forms or "ideas" he represented as existing prior to, and independent of, things manifest to the senses. Aristotle held to the doctrine of a pure, self-active form (πρῶτον εἶδος), which transcends material existence, but he opposed Plato's doctrine of independent ideas. The doctrine of the existence of ideas as logical conditions of reality, and as conditions of the possibility of all the general conceptions which the mind forms, was held by Spinoza, Malebranche, and Leibnitz, in a modified form. Descartes was so strongly impressed with this doctrine that he attempted to prove the existence of God from the subjective idea of a most perfect being. The ancient philosophers investigated the question, What is true in and for itself? The moderns propose the problem of certitude, How to proceed from thought to being? Since the time of Locke it has been common usage to designate by the term "ideas" all thoughts, notions, conceptions, images, perceptions, and intuitions, whether necessary or arbitrary. According to the sensational school of Locke and Hume, all ideas take their rise in sensation, and immediate sensuous impressions give the most adequate knowledge, while ideas, and especially complex ideas, are fainter and less valid copies of reality. Kant pointed out the objective validity of universal and necessary ideas; they were to be regarded as expressing logical conditions of reality in time and space. But ideas proper were with him the product of the reason in its regulative activity. Hegel gave the name of idea (*Idee*) to the highest actuality—the universal form of existence considered as a totality, self-related activity, or thinking reason. This was a return to Plato's insight, or rather to that of Aristotle. Taking "idea" in the modern acceptation as the common term for all representations, it may signify—I. Sensuous ideas = images of sense formed in the lowest stage of thinking; II. Abstract ideas = general concepts formed by abstraction and generalization from experience; III. Concrete ideas = synthetical conceptions or notions formed by tracing out necessary relations and correlations dialectically; IV. Absolute idea = the comprehension of the totality in its self-determination (what the Platonists speak of as "knowing by wholes"). Ideas are spoken of as simple or complex, necessary or contingent, absolute or relative, universal or particular, innate or adventitious, clear or obscure, adequate or inadequate, etc.

W. T. Harris.

Ide′alism, a philosophical doctrine defined (*a*) as holding that in external perception the objects immediately known are ideas, or (*b*) as holding that the external world is a mere phenomenon manifesting a supersensuous essence which is (1) spirit, reason, or thinking intelligence and will, or (2) force, law, or some unconscious principle of evolution. According to the former definition, nearly all philosophers, excepting those belonging to the Scottish school, would fall in the class of idealists, thus numbering such different systems as those of Locke, Hume, Kant, Plato, Aristotle, Descartes, etc. all in one school. According to the latter definition, the theistic or spiritualistic thinkers would be classed in one division of the idealistic school, while the pantheistic thinkers (including even the modern "positivists") would belong to the other division; and opposed to these would be the nominalistic branch of materialists and the self-styled "common-sense" thinkers. It has been contended, in fact, that all philosophy must be impliedly idealistic in that it undertakes to explain immediate things—or at least the knowledge of them—and thereby presupposes a unity or ground for them upon which they depend. All dependent things are in a certain sense ideal or potential, and underlying the external multiplicity of such things there is a unity. Were there no interdependence or correlation among things, it is held that

there could be no philosophy. Although Parmenides, Anaxagoras, and especially Pythagoras, are to be regarded as idealists, yet Plato is the idealist *par excellence*, and the father of that school of thinkers. His "ideas" or archetypal forms—παραδείγματα—are immaterial and eternal essences which are shadowed forth or manifested by finite realities. Finite things are "copies" of ideas, and by reason of their inadequateness as copies they are in a state of perpetual flux or transition from one phase to another, each imperfection giving place to a more correct copy, which, again, is defective in some other respect. Thus, the process of finite things arises from their mutual imperfection, and from the consequent struggle to attain adequateness. Substantially identical with this is the doctrine of Aristotle, who opposes the doctrine of "ideas" as separate archetypes, and lays stress on an intelligent First Cause as the supreme principle of explanation. The Neo-Platonists were Aristotelian in the scientific form of their systems, but they betray a strong Oriental influence upon their modes of thinking. Oriental idealism is unable to reconcile the infinite with the finite, holding the former to be the unconditioned and indeterminate, consequently as impersonal. The Neo-Platonists endeavor to seize a first principle higher than intelligence or than consciousness; they seek, after the manner of Oriental idealism, an impersonal absolute unity. The idealism of Plotinus and Proclus, and especially that of Iamblichus and Synesius, strives to reach a primordial essence as the secret ineffable cause and final goal of all things. The visible world of time and space is a creation of the soul in its "lapse" or descent from the divine world of ideas or eternal verities. Valentinian Gnosticism undertook to furnish a Neo-Platonic basis for Christianity, adding, however, a more explicit principle of mediation or means of return from the "lapse" to the highest principle. Alexander of Aphrodisias, and more especially the Arabian commentators of Aristotle, set up a pantheistic idealism; which indeed is the outcome of Oriental monotheism as contrasted with the Christian Trinitarianism. The ideal principle to which all individual existences in the world are subordinated, and before which they perish, is a world-soul conscious in individuals not endowed with immortality, and not possessing, of itself, personality. Christian philosophy, as such, is essentially idealistic, inasmuch as it has to provide a speculative basis for the doctrine of a personal Creator and for an immortal creature. Thomas Aquinas says that God "eternally knows all things as present, and through this knowledge these things themselves are caused." But with the disputes of Nominalism and Realism arose the distinction which separates later philosophy into idealism and materialism. The "realism" of Anselm, Albertus Magnus, and Aquinas, is idealism in the proper sense of the term, holding to the origin of the world from the thought of God, through his eternal ideas which make possible our cognition of things by means of general ideas, these being the subjective correlates to the eternal ideas manifested in individual things. Realism thus holds the universe to exist *ante rem* in the mind of God, *in rem* in the phenomena of the world, and *post rem* in the human mind recognizing it by the act of cognition. Nominalism, as developed by Roscellinus, Abelard, and Occam, looked upon general terms as arbitrary creations (*flatus vocis*) without objective reality corresponding to them. Each individual thing exists in its isolated independence, and there is no species or genus or class in nature, but only individual beings. Hence, sensuous certitude is the nearest approach to truth, and abstract or general ideas are the farthest removed from it.—But when the mind perceives the existence of essential relations in nature, such as it names *force, law, life*, etc., indicating dependence and interdependence among the things in the world, it finds itself obliged to recognize, perforce, the objective validity of its complex or general ideas expressing "substances, modes, and relations." Powers and forces give rise to individuals, and cause them to vanish again. While the particular individuals begin and cease, the power or force persists, and is *manifested* in the evanescence of things as much as in their origination, and thus proves itself to possess greater reality than the particular things which Nominalism supposes to be the only reality. The existence of processes which are generic in their nature and correspond to our general ideas, comes to consciousness in modern natural science as the doctrine of the "persistence of force." In the first stage of idealism, accordingly, all individuality is looked upon as transitory, and an abstract unity of force is regarded as the ultimate reality which swallows up all special existences, spiritual or material. From this pantheistic idealism to spiritual idealism the transition lies in the perception that all force or essential relation is necessarily, in the last analysis, a phase of self-determination, and hence of personal being. This insight is the key to the idealism of Aristotle, Leibnitz, Aquinas, Eckhart, Hegel, and of most thinkers who have founded systems that explain human institutions. Idealism, according to Sir William Hamilton, deduces the object from the subject, while materialism deduces the subject from the object. This would exclude the numerous forms of idealism wherein both subject and object are deduced from a spiritual principle. Among distinguished modern philosophers, called idealists in accordance with one or the other of the above definitions, are to be named Berkeley and Malebranche as theological idealists; Descartes, as problematical idealist; Hume, as skeptical idealist; Kant, as transcendental idealist; Fichte, as subjective idealist; Schelling, as objective idealist; Hegel, as absolute idealist; Schopenhauer, as theoretical idealist; Jacobi and Schleiermacher, as sentimental idealists; Spinoza, as substantial idealist. These and similar designations are liable to convey a false impression unless supplemented by reference to the full systems of those thinkers. (See KRAUTH'S *Berkeley*, Philadelphia, 1874; also the several articles in this work on the philosophers above named, on SCHOOLMEN, and on PHILOSOPHY.) W. T. HARRIS.

I'deler (CHRISTIAN LUDWIG), b. at Gross-Brese, in the Prussian province of Brandenburg, Sept. 21, 1766, and appointed professor of astronomy and chronology at the University of Berlin in 1821. His principal works are—*Handbuch der mathematischen und technischen Chronologie* (1831) and *Die Zeitrechnung der Chinesen* (1839); but his earlier writings, *Historische Untersuchungen über die astronomische Beobachtungen der Alten* (1806), *Handbuch der Französischen Sprache und Litteratur* (1852), etc., were also well received. D. in Berlin Aug. 10, 1846.

Iden'tity, a philosophical term used to indicate unity with persistence and continuity. By it is not meant abstract unity, but unity in plurality, in multiplicity, succession, diversity, or change. Hence it is predicable of substance, and of the quantity of force, matter, and other essential relations in nature. It is more especially predicable of life and of personality. Personal identity is attested through consciousness and memory. In consciousness there is the antithesis of subject and object, and the self is certain of the identity of itself as subject with itself as object. This identity is a mystery, perhaps identical with the mystery of the Trinity, or of the participation of the particular thing in the generic or universal. Identity may be regarded as existing in various degrees: I. As the identity of the inorganic substances in nature—of the mineral, for example. Here there is supposed to be an identity in material or substance—an identity of composition, but scarcely any identity that might be called individual identity, although in the crystal this begins to be suggested. II. In the plant, according to Aristotle, dwells the *nourishing* soul, so that there is identity of life, and even of propagation of species—identity of individual and identity of genus. There is a preservation of identity under diverse conditions and transmutations. III. In the animal there is a still more remarkable preservation of identity, inasmuch as to the *vegetative* soul is added the *feeling* soul, and the individual animal feels his identity even in his extremities. IV. Man *thinks* his identity, and consciousness is the result. In his entire history man may be regarded as coming into identity with himself—*i. e.* as realizing, by education, in himself, his faculties and possibilities as mind, and as making these actual in the world in the shape of institutions and social organizations. Man's identity is personal identity, and essentially different from the identity of the plant, which grows and repeats its species in new individuals, or from the animal, which also *feels*, but cannot generalize. In man the species, or the generic process, enters entire in each individual as consciousness, the universal and particular being identical with the individual—constituting subject, object, and union of the two. The doctrine of identity, as taught by Schelling (see SCHELLING), holds the absolute to be the identity of the ideal and real, or of the subjective and objective—matter and mind being the two poles of one infinite substance. The Principle of Identity in logic states in another form what the Principle of Contradiction lays down as the fundamental law of thought—namely, that a thing cannot *be* and *not be* at the same time. (See LOGIC, and IMMORTALITY.)

W. T. HARRIS.

Ides. See CALENDS.

Id'iocy [from the Gr. ἰδιώτης, a "private person," hence an unlettered man, and finally an *idiot*, or person without mental capacity], the want of a natural and harmonious development of the mental, active, and moral powers and faculties of a human being, dependent upon some defect or infirmity of the nervous organization. It varies in degree, contingent upon the extent of nervous degeneracy, from a slight impairment of the mental faculties, or imbecility, by insensible gradations and shades, down to complete idiocy.

This maximum of imperfection and incapacity stops short only at a condition of nerve degeneracy inconsistent with the continuance of human life. Idiocy may exist with an apparent condition of bodily health, but is more commonly associated with obviously diseased physical states or some impairment of general physiological functions. There is a notable form of idiocy that is known as cretinism, which is a marked want of mental development, associated with extreme scrofulous degeneracy and great bodily deformity. This is more commonly prevalent in mountainous districts. Idiocy is sometimes confounded with dementia, which is a loss of mental powers and faculties once possessed. This occurs at a period of life later than childhood.

Various methods of classification of idiocy have been suggested, but these are either arbitrary or based upon pathological distinctions that are valueless for any practical purposes of classification. Of the first class, those based upon differences in mental capacity, it may be said that they have a certain convenience when it is fully understood that they are proposed only to define general degrees of mental deficiency that nevertheless run into each other by insensible gradations. Of the latter, where idiocy is classified by known or probable pathological conditions underlying it, such distinctions are of little practical value in devising modes of obviating the resulting mental states or in predicting the results of such methods. A pathological classification may, however, be used to indicate the ordinary and immediate causes which produce idiocy. From such a study it would be seen to occur, first, as a form of human degeneracy, the result of congenital or postnatal influences; or, secondly, as a consequence of accidental causes that have interrupted or checked the laws of normal human growth. Of the former, a majority may be classed as the result of hereditary neuroses in one or both families. The intermarriage of near relatives is a not infrequent cause of idiocy, because it intensifies the family defects and vices in the offspring. Again, ill-health, any serious constitutional affection, or the intemperance of one or both parents at the time of conception, insufficient food, continued ill-health, depressing influences, or any sudden shock to the mother during gestation. Of the latter, all injuries to the brain in infancy, whether the result of primary or secondary disease or from accidental causes. Thus, on the one hand there may be the ill effects of convulsions, epilepsy, hydrocephalus, or any primary brain disease, or the translation of eruptive diseases to the brain. On the other hand, there may be injuries to the brain in parturition from instrumental interference or otherwise, from blows on the head or concussion in infancy, and in rare instances from fright. Premature ossification of the skull may prevent mental development by checking or stopping cerebral growth. In many cases, however, the search for causation is a blind one.

Idiocy has existed in all ages and in every country. The relative number of idiots in any community will depend upon the physical and social influences that lead towards nerve-degeneracy, but the ratio to the general population seems to be an increasing one. With the present imperfect civilization of the *civilized* world, it is safe to estimate the number as at least one to every thousand in the population. The statistics of the subject would support this estimate, after excluding all cases of dementia, and not including those unrecognized as idiots on account of infancy. Their status as subjects of law and objects of pity and charity had been recognized from time immemorial, but any known attempts to ameliorate their condition were reserved for quite recent times. In fact, systematic efforts for the improvement of their condition date back only some forty years. There was a prior period of incubation, in which circumstances combined to direct attention to this class, to their peculiarities and their needs. Efforts to improve the condition of the insane, to educate deaf-mutes and the blind, had been attended with great success. In individual instances, where idiocy had been studied and some degree of improvement had been attained, the facts had found their way to the public ear. Scientific curiosity had been awakened as to the nature of idiocy and the extent to which remedial means might be rationally applied. Civilized communities were thus made ripe for an extension of experimental measures of relief to the class of idiots. By general consent the name of Dr. Edward Seguin of Paris stands at the head of European specialists in the management and training of idiots. He organized a school for the purpose in 1838. His intelligence, skill, and zeal, together with a happy faculty of presenting his principles and methods of instruction and the results, attracted public attention. The public authorities of France and scientific bodies acknowledged the merits of his system. Visitors from many nations went to see the wonderful results. Thus were sown the seeds that have ripened into extended labors in the same direction in many lands. His work on the management, training, and education of idiots, published in Paris in 1846, has been almost the only textbook on the subject till the issue of a second treatise in English published in 1866 in New York, where he now resides.

Institutions have been established in many of the continental states of Europe. In Great Britain the growth and spread of institutions for idiots has been almost unexampled. Beginning with a small school founded by some benevolent ladies in Bath but a little more than twenty-five years ago, there are now eight institutions, public and private, in England, three in Scotland, and one in Ireland. More than 1000 idiots and imbeciles are now gathered in institutions designed for their management and instruction, supported by their friends or by the liberality of wealthy and benevolent individuals. Besides these, several large custodial establishments exist where indigent and pauper cases of idiocy are properly cared for at the public expense. In Great Britain, therefore, the cause of the amelioration of the condition of idiots may be regarded as having been fairly adopted and placed upon a firm foundation, both as a charity and a measure of public policy. In the U. S. efforts at instruction in individual cases of idiocy or imbecility were undertaken as early as 1818. The first school, however, was opened at Barre, Mass., in 1848. Only a few months later, an experimental school, under the patronage of the State of Massachusetts, was begun at Boston. To this enterprise Dr. S. G. Howe, long identified with the education of the blind and other works of philanthropy, gave the prestige of his name. Thence followed the establishment of similar institutions in other States, a list of which is here given:

Name and location of Institution.	When founded.	Superintendent.	No. of pupils.
Priv. ins., Barre, Mass.	1848	Dr. George Brown.......	77
State " South Boston, Mass.	1848	Dr. S. G. Howe............	120
State " Syracuse, N. Y.......	1851	Dr. H. B. Wilbur.........	198
State " Media, Pa..............	1853	Dr. I. N. Kerlin...........	223
State " Columbus, O..........	1857	Dr. G. A. Doren..........	357
State " Lakeville, Conn.....	1858	Dr. H. M. Knight........	57
State " Frankfort, Ky.......	1860	Dr. E. H. Black...........	99
State " Jacksonville, Ill.....	1865	Dr. C. T. Wilbur..........	100
City " New York City......	1865	Com. of Charities........	200
Priv. " Fayville, Mass.......	1870	Mm'es Knight & Green	7
Total number under instruction.........			1438

The underlying or associated physical causes of idiocy have been referred to. From the nature of the case, they are, the most of them, not directly remediable; but in an indirect way much may be done to obviate their consequences, if no more. These physical causes may be classed either as defects or infirmities. As a defect, there may be want of size or want of brain-capacity, from whatever cause arising; a want of proper anatomical relation or connection in the elementary parts of the brain, or various abnormal modifications of its more intimate structure or organization. As an infirmity, there may be a general default of normal functional activity. This statement includes a variety of subtle conditions or influences that may be suggested or inferred, rather than demonstrated, originating in the brain itself or derived from impairment of function of remote but correlated organs. Of these physical causes of the first category, it will be seen that they cannot absolutely be removed by any treatment. They are congenital, organic defects or abnormal organic conditions induced by disease in a region and in tissues not susceptible of much modification by remedial measures. In other words, absorption and regeneration cannot be rendered active and operative. Of the second class of physical states or influences, some degree of reformation under favoring circumstances may be predicated. Thus, to establish a healthy functional activity of the nervous system and other bodily organs, hygienic and remedial measures may be undertaken with a reasonable hope of success. To bring the brain and the nerves of relation into exercise, increasing their forces, actual and potential, is the work of education. And inasmuch as all physiological growth is the result of reciprocal action between organ and function, while size or capacity and perfection of organism controls and determines the amount of functional activity, so imperfection of organic structure and want of size may be the result of the absence of proper functional exercise in the brain, as in any other organ. Education, then, may have an indirect effect in obviating even the profounder causes of idiocy. Rational efforts for the amelioration of the condition of idiots resolve themselves, first, into measures of management, training, and education. In institutions for this purpose the same general features are everywhere seen: a gymnasium, to develop muscular power, attention, dexterity and a proper carriage; a nursery, where the younger and lower grades of pupils are trained to habits of cleanliness, decency, order, and self-care; a school-room,

with a complete scale of mental exercises, from those applicable to the first dawnings of sense-power and sense-perception up to the ordinary studies of an elementary school. The same principles of education are here as in any other system of instruction. But the special adaptations of these principles to meet the peculiar needs of this class of pupils may be quite varied. The will of the teacher may be needed to supplement an absence of spontaneousness on the part of the pupil. The beginnings of instruction will be at such a point in the series of exercises as the exigencies of each case may demand. The progress will be by such gradual steps as are within the reach of each pupil's intelligence. The acquisitions of each day, in the way of greater nerve-force, awakened intelligence, and increased self-control, are applied to the practical matters of every-day life in the household or elsewhere. The ultimate end of all these efforts is to establish good habits, to impart a capacity and a willingness for some form of useful occupation, to develop greater power of self-control, and, if possible, to bring idiots under the sway of moral obligation. The experience of institutions now for many years in operation has established the fact that the majority of idiots of a school-attending age and condition are susceptible of marked improvement, and may attain the end proposed by their education in the manner and by the means thus briefly indicated. Ordinarily, the precise extent of improvability can be determined only by experiment, as the actual physiological limitations of the mental growth can only thus be ascertained. Of some, unimprovability may be predicted at the very outset; thus, where the degeneracy is of a kind to be self-developing with the progress of age; where there is an obviously underlying pathological condition progressive in its nature; where there is such a degree of deformity as to prevent the use of the various means of training, etc.; and, finally, where there is an extreme nervous excitability, the natural termination of which is in some form of insanity,—for all such unimprovable cases there is needed another class of institutions—namely, of a custodial character. As a question of social science two practical principles may be laid down as to the disposition of idiots. First, it involves less trouble and no more actual expense to care for them by themselves in the hands of competent persons, and with proper surroundings and appliances, than in the public almshouse with other socially dependent classes, or even in the homes of indigence. Secondly, whenever practicable it is a wise public economy that provides for them appropriate means of management, training, and education.

H. B. WILBUR.

Idiosyn′crasy [Gr. ἰδιοσυγκρασία, a "peculiar admixture"], a marked individual trait of any function of body or of mind which is possessed by only one or by very few persons. Certain bodily idiosyncrasies appear to be compatible with perfect health. Others arise from diseased conditions, and cease upon the cure of the disease. Mental idiosyncrasies may not amount to marks of insanity, and yet it is impossible to draw a line between the two.

I′dlewild Cave, a large cave at White Pine, Nev. It was discovered by miners who ran a shaft into it. It has been but imperfectly explored.

I′docrase [Gr. εἶδος, "form," and κρᾶσις, "mixture," from its resemblances to other minerals], a mineral crystallizing in the dimetric system, and essentially a silicate of alumina and lime, with a smaller proportion of iron, and in some cases also containing magnesia, etc.; hardness, 6.5; specific gravity, 3.4. It occurs chiefly in lavas, but is also met with in gneiss, serpentine, and granular limestone.

Idol′atry [from the Gr. εἶδος, an "image," and λατρεύειν, to "serve"] is distinguished from IMAGE-WORSHIP (which see) or iconolatry in this, that the former is applied to literally worshipping the images themselves, whereas iconolatry is restricted to signifying simply the use of images to direct the mind in worship to the deity or saint represented. The ignorant find it difficult to distinguish between the two, and end by believing that there are sanctity and miraculous or magical virtue in the image itself. Idolatry appears to be of great antiquity. The Turanian races (*i. e.* the Finnic, Turkish, Tartar, and Ural-Altaic, Dravidian, and cognate tribes, including perhaps the Basque and Etruscan) worshipped the spirits of their ancestors, and represented these by little images, as did the Romans, who derived the custom from the Etrurians. As soon as the belief was established that the departed were immortal, it would occur to the survivors that their spirits might benefit them, and that this might be made sure by worship. The beginning of this *cultus* was before all history, since Boucher de Perthes found that the earliest races buried their dead in urns with offerings. The more civilized branch of humanity divided into the Indo-European and Semitic. The former appear to have been inspired with a deeply poetical and pantheistic spirit, from which came the tendency to deify not only the principal forces in nature, but all their subdivisions, so that eventually there was a god or goddess for every separate river or kind of plant—all represented more or less by images, which were worshipped. The Semitic races limited their ideas, expressed in gods, to the first principles of reproductiveness and death, especially the former, whence resulted a sex-worship and obscene rites. But they found in Moses and Mohammed reformers who vigorously repressed all nature-worship and its resultant idolatry to such an extent as to very strictly forbid the making of graven images; Mohammed, with great practical shrewdness, going so far as to forbid the making of any image whatever. It is a curious fact that the literal worship of images in themselves appears to be in proportion to their monstrosity and ugliness. The Greeks made statues of their gods, but seem to have merely admired the former while they adored the latter. In the Roman Catholic Church the Virgins of Raphael and of the great artists generally serve merely for *iconolatry*, but where *idolatry* is developed it is common to some barbarously adorned rural image or to one absolutely hideous—*e. g.* the jet-black Virgin of Altötting. The tendency of humanity to invest material objects with magical virtues is universal. A savage who has by chance always killed his enemies or his game with a certain weapon soon believes that it possesses a peculiar virtue, and this belief readily extends to ornaments and amulets, which are supposed to bring luck. From amulets—pebbles or beads—the faith readily extends to human images, whether of ancestors or representing powers of nature. Idolaters of every country endeavor to please their divinity by sacrifices, and many punish it when their prayers are not answered. It is not many years, as the writer can vouch, since the inhabitants of Segni, in Italy, having prayed in vain to St. Bruno for rain, took his image down, punished it with stripes, and stuck it into the mud of a river head downward. A great shower happening to fall immediately after, the people came in solemn procession, took the image up, washed it, and reinstated it in its shrine. It is needless to say that the Catholic Church does not sanction such idolatry, though it encourages iconolatry. A curious form of idolatry is the totem-worship by which a certain sacred animal is regarded as originating and protecting families and tribes of a common descent. This was to be found, *e. g.*, among the Teutonic Wolfinge—whose names survive in Rudolf, Wolfgang, etc.—as also among North American Indians. Sir John Lubbock briefly explains this as follows: "In endeavoring to account for the worship of animals we must remember that names are very frequently taken from them. The children and followers of a man called the Bear or the Lion would make that a tribal name. Hence the animal itself would be first respected, then worshipped." Mr. Herbert Spencer regards this as the origin of fetichism, or the lowest forms of all idolatry. "He whose family tradition is that his ancestor was the crab, will conceive the crab as having a disguised inner power like his own. Hence . . . multitudinous things around will acquire imaginary personalities." Idols representing forms half human, half brutal, also originate, in all probability, from this source. There is more than one royal or noble family in Europe and the East which has a tradition that it sprang from the amours of a woman with an animal, the animal having been simply a man named after one. According to Max Müller, races so rude as to have simply one word for every one idea, cannot represent active powers, natural or supernatural, in any but a personal and more or less human form. This would also account for the origin of much rude idolatry. Iconolatry becomes idolatry when the image is believed to wink, bow, or display signs of life, owing to the actual presence in it of the spirit which it represents, or when it is believed to possess healing or magical power. The most extensively disseminated idols are those of Booddha and of the Chinese queen of heaven, which bears a striking resemblance to Isis. CHARLES G. LELAND.

Id′ria, town of Austria, in Carniola, on the Idriza. It is situated in a kettle-shaped valley, and is famous for its quicksilver-mines, which are said to be the richest in Europe, producing annually 3000 cwts. Pop. 4300.

Id′stedt, a v. of Sleswick, noteworthy on account of the battle (July 24 and 25, 1850) by which the Danes crushed the Sleswick-Holstein rebellion.

Idumæ′a, territory of Western Asia, was bounded N. by Judæa, W. by the Mediterranean. At one time it comprised parts of Judæa as far N. as Hebron, and in Arabia the peninsula of Petræa. It was inhabited by the descendants of Esau, and was annexed to Judæa by David, and later by the Maccabees. The relations between the Jews and the Idumæans (Edomites) were always hostile and full of hatred, even after the Jews had received an Idumæan

dynasty in the son of Herod the Great, in whose time the Idumæans were, however, Jews in religion.

Ie'si, town of Italy, in the province of Ancona. It is said to be of Pelasgian origin, and through the Umbrians and Gauls it passed to the Romans, traces of whose civilization are everywhere seen. The city walls are flanked by towers, and the place is well supplied with good water. The public buildings are very respectable, and contain some fine pictures, as well as some curious antiquities. The trade and manufactures of this town are very considerable. Pop. in 1874, 18,912.

If'fland (August Wilhelm), b. at Hanover Apr. 19, 1759; took to the stage at Gotha in 1777; acted in Manheim 1779, and became in 1796 director of the National Theatre of Berlin, where he d. Sept. 22, 1814. His dramas, of which he wrote a great number, and which in their time were performed on all the stages of Germany and Scandinavia, are narrow, sentimental, and affected pictures of the trivialities of every-day life; but they are not altogether without psychological interest and theatrical effect. As an actor he was the perfection of that which his dramas intended to represent—the natural, the noble, the true; but he was great only in the representation of that which in reality is small. Clemens Petersen.

Igasu'ric Acid [Malay, *igasura*, "vomiting-nut"], an acid found in *Nux vomica* and St. Ignatius' beans, and in the root of *Strychnos colubrina*.

Igasu'rine [Malay, *igasura*, "vomiting-nut"], an alkaloid which occurs in *Nux vomica* in company with strychnine and brucine. It is intensely poisonous. (See Desnoix, *J. Pharm.* [3], xxv. 202, and Schützenberger, *Compt. rend.*, xlvi. 1234; *Ann. Ch. Pharm.*, cviii. 348.)

Iglau', town of Austria, in the province of Moravia, on the Iglawa. It is an old but well-built town, with extensive manufactures of cloth, tobacco, and machinery, and rich silver-mines in the vicinity. Pop. 20,112.

Igle'sias, town of Sardinia, in the province of Cagliari. It is a walled city, with crenelated towers and a castle, and is situated in one of the most fertile portions of the island. Silver and other mines are found in the vicinity, and so prosperous are the mining operations that this town is known in Sardinia as the "city of the mines." There is, however, little general industry except among the women, who make quantities of linen and woollen stuffs. P. 9816.

Iglesias (José Maria). See Appendix.

Ig'lo, town of Hungary, in the county of Zips, on the Hernad, has copper and iron works, and a considerable trade. Pop. 5900.

Igna'tius, Saint, bishop and martyr. It is not known whether he was of Syrian or of Greek descent, nor whose disciple he was. Eusebius (*Hist.*, iii. 22) makes him the second bishop of Antioch, Evodius having been the first. The *Apostolic Constitutions* (vii. 46) make Evodius and Ignatius bishops together—Evodius appointed by Peter, and Ignatius by Paul. Baronius and Natalis Alexander think they were bishops together—Evodius of the Jews, Ignatius of the Gentiles. That he was a martyr, having been condemned at Antioch, and taken to Rome to be thrown to the lions, is hardly to be doubted. The *date* of his martyrdom is, however, a mooted question. The earliest date is that recently given by Dressel on the authority of a new codex of the *Martyrium*, first edited by him in 1857 (2d ed. 1863), which begins: "In the fifth year of the reign of the emperor Trajan," *i. e.* 102 A. D. The old *Martyrium*, which has the appearance of having been tampered with, names Dec. 20, 107. But as it is now generally admitted that Trajan did not go to the East till 114, wintering at Antioch 114–15, critical opinion is now gravitating towards 115. Perhaps we may say Dec. 20, 115. Bearing the name of Ignatius there are fifteen *Epistles*, eight of which (three in a Latin and five in a Greek recension) are now generally considered spurious. The remaining seven (*Ephesians*, *Magnesians*, *Trallians*, *Romans*, written at Smyrna; *Philadelphians*, *Smyrnæans*, *Polycarp*, written at Troas) are in two Greek recensions: (1) the longer, first published by Pacæus in 1557; (2) the shorter, first published by Archbishop Usher in 1644. Three of the seven (*Ephesians*, *Romans*, *Polycarp*) were published, with a translation, in a still shorter Syriac recension, by Cureton in 1845. Since then the Ignatian controversy has been renewed with great sharpness. The several opinions are as follows: (1) Killen thinks them all spurious, but imagines that the Syriac three were the first to be forged, in the time of Origen (185–254), soon after which they were translated into Greek, expanded, and others added, before the time of Eusebius, who had the seven. (2) Baur and Hilgenfeld think them all spurious, but are of the opinion that the seven shorter Greek epistles were the first to be forged, after 150. The Syriac three, it is contended, read like extracts. (3) Cureton, Bunsen, Ritschl, and Lipsius advocate the genuineness of the Syriac three. (4) A strong array of the ablest critics, both Protestant and Roman Catholic, such as Gieseler, Uhlhorn, Möhler, and Hefele, may still be reckoned on the side of the shorter Greek recension. The longer Greek differ from the shorter in the greater emphasis which is put—(1) upon episcopacy; (2) the divinity of Christ. R. D. Hitchcock.

Ignatius, Loyola. See Loyola.

Ignatius' Bean, or **Bean of St. Ignatius,** the bean-like seed of *Strychnos Ignatii*, a rather large shrub with curious vine-like branches growing in the Philippines, and belonging to the order Loganiaceæ. The seed is an inch long, half an inch thick, and has the properties of nux vomica, but more actively, for it contains a much larger percentage of strychnia. The commercial supply is irregular. The seed was named by the Jesuits in honor of Ignatius Loyola, their founder.

Ig'neous Rocks are those which have been formed by the cooling of melted materials, as distinguished from *sedimentary* rocks, which are formed of material deposited from water, and *metamorphic* rocks, sedimentary in their origin, but much changed in character by the action of heat and pressure. Igneous rocks are formed by the cooling of lavas from volcanoes or of the fused matters cast up through fissures in the earth's crust, constituting dykes of non-stratified rock. Igneous rocks are either *feldspathic* (white trap, porphyry, trachyte, phonolite, pitchstone, obsidian, pumice, etc.) or *augitic* (diorite, basalt, dolerite, etc.). Granite, greenstone, etc. are sometimes reckoned as igneous rocks, but in many cases they appear to be truly metamorphic.

Ig'nis Fat'uus [Lat. "vain or foolish light;" Fr. *feufollet;* Ger. *Irrlicht* or *Irrwisch*], a luminous meteor, appearing during summer and autumn nights on marshy land, near stagnant water, in graveyards and other places where decomposition is going on. It is an unsteady bluish light, usually seen a few inches above the surface of the ground, sometimes stationary, but commonly moving with great rapidity. It appears brightest at a distance, and recedes from the observer as he tries to approach it; thus travellers have frequently lost their lives through being deluded by it into dangerous bogs. From its resemblance to a lighted wisp of straw or torch borne quickly along, it has received a number of names, such as Will-o'-the-Wisp, Jack- (or Peg-) o'-Lantern, Friar's Lantern, Kit-with-the-Canstick (*i. e.* candlestick), and has given rise to many popular legends. It was formerly attributed by the country-people to evil spirits, who found pleasure in luring human beings to destruction, but was sometimes supposed to be souls escaped from purgatory, all in flames, with the hope of inducing men to pray for their deliverance. When appearing in churchyards, the ignis fatuus is still in some places called "corpse-candle," and regarded as a presage of speedy death, generally to the person by whom it is seen. The English gypsies, to whom, owing to their out-of-door life, the ignis fatuus is a familiar spectacle, call it *mullos momelis*, or ghost-light. A light of this species, called in Buckinghamshire "the Wat," is said to haunt prisons, and when seen by a prisoner before his trial is considered an unfavorable omen. The cause of the ignis fatuus is not fully decided. Some meteorologists refer it to electricity; others to an issue of marsh-gas (light carburetted hydrogen), caused by the decomposition of vegetable matter and inflamed by an electric spark. It is most generally supposed to be phosphuretted hydrogen arising from decomposing animal matter; this gas takes fire spontaneously upon coming into contact with atmospheric air. Before the introduction of an improved agricultural system, and the almost universal drainage of marsh-lands, the ignis fatuus was a very ordinary phenomenon. At present it is more rarely seen, and is often vainly sought for by students of meteorology. Sir Isaac Newton defined it as "a vapor shining without heat," but other observers have described it as producing a slight degree of warmth, and have even succeeded in igniting flax at its flame. Janet Tuckey.

Ignoramus. See Grand Jury.

Ignorantia Facti. See Ignorantia Juris.

Ignoran'tia Ju'ris [Lat., "ignorance of the law"]. It is a cardinal legal principle that ignorance of the law affords no excuse for a violation of, or failure to observe, its requirements. It is conclusively presumed that every one is acquainted with the established rules of law, and understands that his conduct should be regulated in accordance with them, without regard to his lack of opportunity to acquire such knowledge. This presumption, though it may work great hardship in particular cases, is based upon the necessity of securing the practical and uniform enforcement of the law, and is therefore demanded by considerations of

public policy. If a different rule were adopted, the desire to avoid legal accountability would lead to a general disregard of the law, and it might therefore be transgressed with impunity, and would become wholly ineffective. In regard to *ignorance of fact*, however, there is not the same reason for a similar presumption, and a different rule is established. Acts done or transactions entered into in consequence of ignorance of material facts, when the lack of knowledge is not attributable to unreasonable remissness in inquiry or a disregard of readily available sources of information, will not, therefore, as a general rule, be held to impose any legal liability, or at least the same degree of liability as would otherwise have been incurred. These rules as to ignorance of law and of fact are at present recognized in the common-law tribunals, as well as in courts of equity. For example, in civil cases it is held that if money is paid in any transaction with full knowledge of the facts, but in ignorance of the doctrines of law applying to the case, it cannot be recovered back if there be nothing unconscientious on other grounds in the retention of it; but, on the other hand, if money be paid through ignorance of the facts merely, and without laches, it will in general be recoverable. In like manner, in criminal law, if an offence be committed which is in fact a crime, though not known to be such by the wrongdoer, the plea of ignorance that the law forbade such an act will not be accepted in justification; but if a house-owner should, in the exercise of a reasonable degree of caution, and in the belief that it was necessary for self-protection, kill a person by night in his house whom he innocently but mistakenly believed to be a burglar, his ignorance would be upon a point of fact, and would free him from responsibility. Ignorance of the laws of a foreign state is deemed to be ignorance of fact, and the States of the Union are for this purpose deemed to be foreign to one another.

But these rules in regard to the effect of ignorance are modified at times by other principles of law, so that their application is not invariable. Thus, if a point of law be doubtful, and certainty of knowledge thereon cannot be attained, a compromise of claims affected by it will generally be sustained as establishing the rights of the parties, since it is desirable that litigation be diminished. Moreover, if a person's ignorance of law has afforded another opportunity to practice fraud or imposition upon him, his ignorance will not preclude him from obtaining relief, since, if such were the case, the other party would be permitted to profit by his own wrong. Again, it is a salutary rule of law that when one of two innocent parties must suffer the loss resulting from any act, the consequences should fall upon the one who has caused or enabled the act to be committed, rather than upon the other. Hence, if a person assume to act as agent for another in conducting any transaction, believing that he has authority so to act, while he has no authority in reality, the interests of the third person with whom he deals upon such a basis will generally be protected, and the pretended agent will have no claim to relief on the ground of ignorance of material facts. The generally prevalent doctrine is, that he would be liable to the third person in such a case upon an implied warranty of authority. In like manner, special considerations may at times lead the courts to modify the application of the rules concerning the effect of ignorance, and courts of equity particularly may, in peculiar cases of hardship, occasionally grant special indulgence to one innocently violating the law. (See MISTAKE.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Ignorantines. See BRETHREN OF THE CHRISTIAN SCHOOLS.

Iguala'da, town of Spain, in the province of Barcelona, on the Noya. It is an old and gloomy town, with a bright and handsome suburb, a brisk trade in wine, oil, and fruits, and extensive manufactures of weapons and cotton and woollen goods, with several paper-mills in the vicinity. Pop. 14,000.

Igua'na [Sp.], a genus of lizards inhabiting Central and South America and the West Indies. These animals are of large size, often four or five feet in length to the end of the tail, which is long, slender, compressed, and covered with small, equal, imbricated, and carinated scales. The body is also scaly, and provided with a prominent median fold of integument under the throat, forming a conspicuous dewlap, which is serrated in front, with large scales. Another fold along the back is similarly raised into a deeply and acutely serrated crest, highest on the dorsal region and extending upon the tail. There is a single row of femoral pores. The tongue is short, contractile, and notched at the tip. There is a double row of small teeth upon the pterygoid bones of the palate, and larger teeth upon the usual maxillary bones. These teeth have the crown compressed, acute, and with a serrated margin. The external surface of the crown is coated with enamel and traversed by a median longitudinal ridge. The bases of the teeth are elongated, subcylindrical, and soldered to excavations on the inner surface of the outer wall of a shallow, oblique alveolar groove, thus exhibiting the pleurodont type of dentition. The vertebræ, besides the ordinary articulation by the zygapophyses or oblique processes from the arches, are further united by a process (zygosphene) from the front part of each arch, which fits into a cavity (zygantrum) upon the posterior face of the preceding arch; and in this respect they resemble the vertebræ of serpents. There are five well-developed toes on each foot, all provided with claws. They are active animals, living mostly upon trees, and are herbivorous. Their flesh is considered a delicacy. The best-known species is *Iguana tuberculata*, so named from the tubercular scales upon the sides of the neck.

O. C. MARSH.

Igua'nodon [from Sp. *iguana*, a species of lizard, and Gr. ὀδόυς, "tooth"], a genus of extinct reptiles belonging to the order Dinosauria, and found in the Wealden and Cretaceous of Europe. These reptiles were first discovered by Dr. Mantell in the Wealden of Tilgate Forest, and the remains first found consisted of teeth. The name of the animal was intended to express the resemblance of these teeth to those of the iguana. As in that animal, the base of the tooth is elongated, the crown expanded and notched on the margin; at first it is acuminated and compressed, its sloping sides serrated, and one surface, external in the upper jaw, internal in the lower, is traversed by a median longitudinal ridge and covered with a layer of enamel. On each side of this ridge are one or two lower ridges, separated from each other and from the serrated margin by wide smooth grooves. The marginal serrations are seen under a low magnifying power to be transversely notched. These teeth were set in sockets giving a firm support for mastication, by which they seem to have been worn until nearly the whole crown was gone. In the earlier stages of use a sharp, irregular edge was maintained by the layer of enamel; later, the ossified pulp, harder than the dentine, formed a transverse ridge, fitting the tooth for its work as a molar for grinding and bruising the coarse vegetables that formed the food of these animals. The vertebræ of the neck were moderately convex in front, concave behind, becoming concave on both faces in the dorsals, resembling those of some mammals, while other points of structure allied these animals with the birds. The ribs were bifurcate. The shoulder-girdle resembled that of lizards, and the fore legs were comparatively small. The pelvis had the ilium extending far in front of the acetabulum, and furnishing only a widely arched roof to that cavity. The ischium was much elongated, had an obturator process as in birds, and probably united with its fellow in a median ventral symphysis. The unusually large bones of the hind limbs were excavated by a large medullary cavity, and fitted for terrestrial locomotion. The femur had a strong inner trochanter, and its distal end was bird-like in the development of a strong ridge, which played between the tibia and fibula. The metatarsals were elongated, and so fitted together as to hardly if at all move on one another. The inner and outer digits were short or rudimentary, leaving only three well-developed toes, of which the middle was the largest and strongest. Large three-toed tracks in the Wealden are such as might have been made by these animals. *Iguanodon Mantelli* (so named by Prof. Owen for its discoverer) was thirty feet in length, with a bulky body, and was perhaps the largest of terrestrial animals. This genus has not yet been identified from America. (See HADROSAURUS.)

O. C. MARSH.

Ih'lang-Ih'lang [Tagel, for "flower of flowers"], the rich and powerful perfume of *Unona odoratissima*, a noble forest tree of the Philippines and Malay Islands. The volatile oil of the flowers of the tree is largely employed in making the rich handkerchief-perfume of this name. This oil is distilled in the East, and is worth about $250 a pound.

Il'chester, small town of England, in Somersetshire, on the Ivel, is noteworthy as the birthplace of Roger Bacon, and there are in the neighborhood many Roman remains. Pop. 781.

Ile-de-France', an old province of France, with Paris for its capital, is now divided into the departments of Seine, Oise, Aisne, Seine-et-Marne, and Seine-et-Oise.

Iles'boro, a village of Washington tp., Hocking co., O. Pop. 62.

Il'eum [Gr. εἴλω, to "twist," from its convoluted appearance], the lowest portion of the small intestine, extending from the jejunum to the head of the colon. In man it is about twelve feet long, thus including some three-fifths of the length of the small intestine. It is one and a quarter inches in calibre, is thinner and narrower than the je-

junum, has less marked *valvulæ conviventes*, and is ordinarily the only part of the intestine which has Peyer's patches (agminated glands) upon its inner surface.

Il'eus [Gr. εἰλεός, a "twisting;" Lat. *volvulus* or *miserere mei*], a very painful disease of the intestine, produced by mechanical obstruction, as by twisting, intussusception, or knotting of the entrail. Intense pain, persistent vomiting (sometimes stercoraceous), hiccough, etc. are characteristic symptoms. Intussusception, or the passage of a part of the intestine into the cavity of another part, is one of the most common conditions, as when the lower part of the small intestine is slipped down into the large intestine. The disease is very often fatal. Spontaneous reduction of the displacement may occur; the intussuscepted part may slough away and an inflammatory process occur, resulting in recovery; dilatation of the bowels by the bellows may effect a cure. As a last resort, gastrotomy may be tried with possible success.

Ilex. See Holm Oak and Holly.

Ilha'vo, town of Portugal, in the province of Beira, is well built and thriving. In its neighborhood is the celebrated glass and porcelain manufactory of Vista Alegre. Pop. 8215.

Ilic'ic Acid [Lat. *ilex*, "holly"], an acid contained in the leaves of the holly, *Ilex aquifolium.*

Ilic'in [Lat. *ilex*, "holly"], the bitter principle of holly, *Ilex aquifolium.*

Ilijats', or **Iliyats'**, the name of the nomadic tribes of Persia. They are of various descent, Turkish, Arabic, etc., and most of them are Mohammedans of the Sunni sect. Each tribe has a district or grazing-ground appointed to it, for which it pays a tribute in lambs, oxen, etc., money being unknown among them; but on account of the somewhat unsettled social state, it happens every now and then that a tribe falls into habits of robbery and plunder.

Ilini'za, or **Ilinis'sa,** a volcano of the Cordilleras of Ecuador, South America, 10 miles S. of Quito. Its two peaks, from which smoke and flames have been seen to issue, rise 17,380 feet high.

Il'ion, post-v. of German Flats tp., Herkimer co., N. Y., on the S. bank of the Mohawk River and on the Erie Canal. Ilion Station, on the New York Central R. R., 70 miles from Albany, is on the opposite side of the river, in Herkimer tp. Horse railroads connect Ilion with Mohawk and Herkimer. It has 4 churches, a national bank, 2 weekly newspapers, and extensive manufactures of firearms, sewing-machines, agricultural implements, and other goods. P. 2876.

Ilion, or **Ilium.** See Troy.

Ilis'sus, a river of Attica, rises near Hymettus and flows to the Phaleric Bay. In ancient times it was celebrated for its beautiful scenery, but its waters have now greatly decreased.

Ilixan'thin [Lat. *ilex*, "holly," and Gr. ξανθός, "yellow"], $C_{17}H_{22}O_{11}$, a yellow dye contained in the leaves of holly, *Ilex aquifolium.*

Il'keston, town of England, in Derbyshire, 8 miles N. E. of Derby. It has large manufactures of hosiery, lace, and silk, and rich coal and iron mines in the vicinity. P. 9662.

Illawa'ra, post-v. of Carroll parish, La.

Ille-et-Vilaine', department of North-western France, in Brittany, bordering on the English Channel. Area, 2554 square miles. Pop. 589,532. The ground is mostly low, occupied along the sea by dunes and marshes, but much of the soil is fertile, producing, besides good crops of grain, large quantities of hemp and flax, which are manufactured into thread, cordage, and woven goods. The oyster fisheries are considerable. Cap. Rennes.

Il'ler, a river of Southern Germany, rises in the Tyrol, flows N. through Bavaria, and empties into the Danube.

Illima'ni, the highest peak of the Bolivian Andes, situated in lat. 16° 37′ S. and lon. 67° 49′ W. It is 21,149 feet high, and covered with glaciers to the height of 16,350 feet.

Illini, tp. of Macon co., Ill. Pop. 821.

Illinois', one of the central States of the Union, lying in the upper Mississippi Valley, extending from the parallel of 36° 59′ N. lat. to that of 42° 30′, and from 87° 35′ to 91° 40′ W. lon. It is bounded N. by Wisconsin, E. by Lake Michigan, Indiana (from which it is in part separated by the Wabash River), and by Kentucky, from which it is separated on the S. E. and S. by the Ohio River. It is also separated from Missouri for a short distance on the S. by the Mississippi River, which forms its entire western boundary, severing it from the States of Missouri and Iowa. Its territory extends both on the Ohio and Mississippi rivers to the middle of those rivers. Its area is 55,410 square miles, or 35,462,400 acres.

Face of the Country.—Illinois may be described in general terms as a gently inclined plain sloping from Lake Michigan toward the Mississippi and Ohio. A somewhat elevated plateau extends from Wisconsin into the N. W. section of the State, and is there manifest in some bluffs

Seal of Illinois.

and hills, and another moderate elevation includes Ford and the adjacent counties; but neither of these sections rises to a greater height than 800 feet above the sea, while the Grand Prairie is not more than 500 feet above the sea, and the lowest portion of the State, at the junction of the Ohio and Mississippi, is 340 feet above the Gulf of Mexico. The State is therefore very nearly level. The N. W. corner is the most uneven portion of the State, though the rivers have in some instances cut such deep channels into the clay and alluvial soil as to give a broken appearance to the surface. In the extreme S. there is a range of remarkable hills crossing the State from Grand Tower to Shawneetown.

Rivers, Lakes, etc.—The State is drained almost exclusively by the Mississippi and its tributaries, the Ohio and its affluent the Wabash, the Kaskaskia, the Illinois, and Rock rivers, and the smaller affluents and tributary streams of these. A few short and inconsiderable streams flow into Lake Michigan, but the largest of these, the Chicago River, now flows by an artificially deepened channel through the Illinois Canal into one of the branches of the Illinois River. The Illinois, formed by the junction of the Des Plaines River from Wisconsin and the Kankakee from Indiana, is the largest river wholly within the State. Its course is nearly 500 miles in length, of which 245 are navigable, and its principal affluents are Fox, Spoon, and La Main rivers and Crooked Creek from the N. and W., and Vermilion, Mackinaw, and Sangamon rivers and Macoupin Creek from the S. and E. In Woodford and Peoria cos. its bed expands and forms Peoria Lake. It enters the Mississippi River 15 miles above Alton. The Kaskaskia River rises in Champaign co., and runs in a nearly parallel course with the Illinois for 250 miles, joining the Mississippi near Chester in Randolph co. Rock River enters the State from Wisconsin, and finds its way to the Mississippi at Rock Island. The Big Vermilion, Embarras, and Little Wabash are tributaries of the Wabash; the Saline and Cash of the Ohio. The Big Muddy is a smaller but considerable affluent of the Mississippi. Lake Pishtaka in the N. E. is the only considerable lake, besides the expansion of Illinois River already mentioned, in the State.

Geology.—The greater part of the surface of Illinois belongs to the Carboniferous era, the great coal-field of the State extending 375 miles in length from N. W. to S. E., and in breadth from St. Louis to the N. E. about 200 miles. The thickness of these coal-measures is much less than those of the same formation in Ohio and Pennsylvania; and as the strata are thrown into waves, traversing the State from N. W. to S. E., the limestones and sandstones of the formations below are frequently brought to the surface. The workable beds of coal are comparatively small for the large area occupied by the coal-measures. The N. E. portion of the State for a considerable distance from Lake Michigan belongs to the Post-tertiary formation. The valley of the Illinois River (which has cut for itself a deep channel) consists of successive terraces of limestone, indicating that at a period not geologically remote the waters of the great lakes found an outlet through this channel to the Gulf of Mexico. In the S. E. strata belonging to the Permian group have been discovered overlying the coal-measures conformably. In the N. W. corner of the State, in Jo Daviess co., there is a small district forming the terminal portion of the great Western lead-bearing belt. The

argentiferous galena is found in the lower Silurian limestones, and the mines are so productive as to form an important item in the products of the State. The soils of the State are of diluvial origin, and seem to indicate that at an early period the greater part of the surface of the State was a portion of the bed of an immense lake. The prairie soils are very deep and fertile; in some of the bottom-lands the loam and mould are reported to be from 25 to 100 feet in depth. Whatever the depth, the loam is underlaid by a dense, almost entirely impervious, clay, which keeps the moisture from leaching away.

Mineralogy.—First among the minerals of the State is the coal. We have already spoken of the extent of the great coal-field. Its area is estimated at 45,000 square miles, but much of it is not workable. The coal is bituminous, containing from 3 to 20 per cent. of incombustible materials; and in some of the mines the cannel coal predominates; in others excellent smelting coals are found. In 1870 there were over 400 mines worked, and the product amounted in round numbers to 2,500,000 tons. It has since increased to a little more than 3,000,000 tons. The position of these coal-mines, readily accessible by railroads and convenient to the Ohio, Mississippi, and Wabash, and furnishing to the vast manufacturing establishments of St. Louis and Chicago, as well as to the countless steamers on the Mississippi, abundant fuel for steam purposes, greatly enhances their value. The iron ores of the State are not very valuable, though they answer a good purpose when mixed with the valuable specular, spathic, and hæmatitic ores so readily and cheaply brought into the State from Missouri and from the Lake Superior iron-region. Lead ore containing a considerable percentage of silver (argentiferous galena) is mined in large quantities in Jo Daviess co., and the flourishing city of Galena derives its name from it. There are fine and productive veins of copper ore in the northern part of the State, on the Peckatonica River and Plum Creek. Zinc is also mined in the northern part of the State. Limestone of excellent quality, both for burning and for building, a drab freestone of great beauty, gypsum, and a fine variegated marble, are among the other mineral treasures of economic value; there are salt-springs in Jackson, Vermilion, and Gallatin cos.; sulphur and chalybeate springs in Jefferson co., and other medicinal springs between Ottawa and Peru. A cave in the rock in Hardin co., on the Ohio, presents, as the place is approached, a vast mass of rocks of a castellated appearance, resembling the ruins of some fortress of the Middle Ages. The entrance to the cave, which is from the river, and is but a little above high water, introduces the visitor to a chamber 80 feet square and 25 feet high, with a farther chamber of smaller size beyond. It was in the early years of this century the resort and hiding-place of bands of robbers, counterfeiters, and river-pirates. Starved Rock, the Lover's Leap, and Buffalo Rock are well-known points on the Illinois River near Ottawa.

Vegetation.—Though not by any means a densely wooded State, Illinois has a sufficiency of woodland for its present home requirements, but imports much timber from the States farther N. Most of its prairies have islands of oak and other forest trees, and where the limestones and sandstones have broken through the overlying coal-measures there are wooded belts of considerable extent. But for her extensive coal production, however, the State would have been long ere this completely denuded of its forests. As it is, a little more than one-sixth (16.9 per cent.) of its surface is woodland. The forest trees most abundant are oak, black walnut, sugar maple, ash, elm, locust, linden, hickory, persimmon, pecan, and in the bottom-lands cottonwood, sycamore, buckeye, tulip tree, poplar, beach, and black birch prevail, and in the vicinity of the Ohio River yellow pine, cypress, and cedar. The prairies in the spring and early summer, where not under cultivation, are carpeted with a profusion of flowers, those of the same or allied species forming large masses of bloom, and then giving way to those of an entirely different family. Later in the season the intense heat of the sun renders these broad lands much less attractive. The grasses in the rich and fertile soil attain great height, and their stems are stiff and almost woody. The State abounds in fruit trees, and much of its fruit is of excellent quality. The apple, peach, pear, plum, cherry, apricot, etc. are successfully cultivated; grapes of all varieties do well, and the smaller fruits, as strawberries, raspberries, blackberries, etc., are raised in great quantities.

Zoology.—There are a few deer left in the State, though most of the larger game has disappeared. Bears, wild-cats, and panthers are very rare. The coyote or prairie wolf is occasionally found in the sparsely settled districts; there are some foxes, mainly the fuscous or red fox, and of the rodents, the gopher, several species of squirrel, and numerous field and dormice. There are at least two species of hares. The wild-turkey, stateliest of game-birds, the prairie-hen, a species of grouse, and an abundance of other feathered game, are still found in great numbers on the prairies and in the woodlands. The rivers and lakes abound in fish of good quality—the white-fish, the great lake-trout, black bass, catfish, and other species. The insect tribe are in their usual variety, about 20,000 species having been enumerated in the State, though less troublesome than farther S., except the small number of species injurious to vegetation. These in some years appear in countless numbers.

Climate.—Stretching as Illinois does over five and a half degrees of latitude, there is of course considerable variety in its climate. In the northern portion the annual range of the thermometer is very great, the summer heat being at times intense, and the cold of winter very severe. At Chicago, and in the N. of the State generally, the prevalent winds throughout the year are those from the S. W. and S., though in the spring and summer N. and W. winds are moderately frequent. The wind blows almost constantly in some direction, only 44 out of 1100 observations noting a calm condition of the atmosphere. At Cairo, in the southern extremity of the State, the most prevalent wind was that from the S., though closely followed by that from the N. E., while those from the N. and the S. E. were less frequent. About one-eleventh of the observations represented the absence of wind. At Rock Island the S. W. wind was the prevalent one, though N. W. and N. E. winds were also common. The annual range of the thermometer in Peoria in 1859 and 1860 was 117° F. (the maximum being 104° in July and the minimum −13° in December); in Riley, McHenry co., near the N. line of the State, 123° F. In 40 N. lat. the mean temperature of the year is about 54°; of the summer 77°, and of the winter 33° 30′. At Beloit on the N. line of the State the mean annual temperature is 47° 30′; at Cairo 58° 30′. About 245 days of the year are clear and 120 cloudy or rainy. The climate is generally healthy, the paludal fevers which prevailed in the early settlement of the State having mostly disappeared or become greatly mitigated with more thorough cultivation and drainage. In the low and swampy bottom-lands, especially in the southern part of the State, bilious and intermittent fevers and diseases of the bowels are prevalent. The following table, compiled from the signal service report of 1873, gives the mean temperature, and range and barometer mean, together with the rainfall of each month, and the annual rainfall and the annual means of barometer and thermometer in 1872–73 for Chicago, Rock Island, and Cairo:

Cities.	Barometer, monthly and annual mean pressure.												
	Oct., 1872	Nov., 1872	Dec., 1872	Jan., 1873	Feb., 1873	Mar., 1873	Apr., 1873	May, 1873	June, 1873	July, 1873	Aug., 1873	Sept., 1873	Annual mean.
Chicago * (lat. 41° 52′, lon. 87° 38′; alt. above sea, 657 ft.)..........	30.093	30.080	30.23[illegible]	30.051	30.076	30.000	29.901	29.868	29.934	30.009	30.012	30.008	30.022
Rock Island (lat. 41° 30′, lon. 90° 36′; alt. above sea, 603 ft.).....	30.110	30.118	30.295	......	30.050	30.019	29.885	29.882	29.883	29.954	30.000	29.993	......
Cairo † (lat. 37°, lon. 89° 10′; alt. above sea, 352 ft.)	30.156	30.190	30.294	30.130	30.054	30.082	29.909	29.865	29.929	30.004	30.028	30.046	30.057

Cities.	Thermometer, monthly and annual mean temperature.												
	Oct., 1872	Nov., 1872	Dec., 1872	Jan., 1873	Feb., 1873	Mar., 1873	Apr., 1873	May, 1873	June, 1873	July, 1873	Aug., 1873	Sept., 1873	Annual mean.
Chicago	° 50.8	° 32.5	° 20.3	° 20.7	° 24.6	° 34.6	° 42.3	° 53.9	° 70.2	° 71.2	° 71.7	° 62.4	° 46.26
Rock Island	52.1	32.9	18.7	17.1	23.9	36.7	46.9	59.6	77.9	75.6	78.0	62.3	48.47
Cairo	57.6	40.7	29.2	30.3	38.4	46.5	55.4	66.7	77.5	78.7	78.2	68.9	55.67

Cities.	Thermometer, monthly ranges.											
	Oct., 1872	Nov., 1872	Dec., 1872	Jan., 1873	Feb., 1873	Mar., 1873	Apr., 1873	May, 1873	June, 1873	July, 1873	Aug., 1873	Sept., 1873
Chicago..............................	54°	61°	69°	67°	71°	72°	58°	52°	48°	43°	39°	47°
Rock Island..............................	....	....	....	....	....	....	....	....	....	....	....	....
Cairo..............................	51°	61°	65°	71°	55°	62°	51°	46°	33°	34°	35°	46°

Cities.	Rainfall, monthly and annual amounts in inches, etc.												
	Oct., 1872	Nov., 1872	Dec., 1872	Jan., 1873	Feb., 1873	Mar., 1873	Apr., 1873	May, 1873	June, 1873	July, 1873	Aug., 1873	Sept., 1873	Annual amount of rainfall.
Chicago	0.65	1.06	0.19	2.56	0.47	0.89	6.12	7.20	1.44	4.04	1.58	2.53	28.73
Rock Island	0.61	1.86	0.61	3.56	0.77	1.43	3.96	6.37	2.16	2.37	0.51	1.00	25.21
Cairo	1.16	0.57	1.56	5.03	6.68	3.27	5.54	5.07	4.45	1.68	2.48	4.09	41.58

* Annual range of thermometer, 116°, from 93° (July) to −23° (Dec.).

† Annual range of thermometer, 104°, from 96° (July) to −8° (Jan.).

The report of the State department of agriculture, presented to the Illinois legislature in 1874, throws additional light on the climate of different parts of Central Illinois. At Sandwich, De Kalb co. (lat. 41° 31′, lon. 88° 30′, elevation above sea-level, 674 feet), the highest degree of heat in 1873 (June 24) was 98°; the lowest (Jan. 29) was —25°, the range 123°; the mean temperature of the year 48.7°; mean temperature of summer months, 71.5°; of winter months, 22.9°; the prevailing wind was W. for 10 months of the 12; E. and N. W. for the other two. There were 127 fair and 238 cloudy days, 143 days without frost; the last frost of spring was April 24, and the first of autumn Sept. 14. The total rainfall was 45.4 inches, April, July, Dec., and Aug. being the months of greatest precipitation. This town seems to be the centre of greatest precipitation in the State, its average rainfall for sixteen years being 50.17 inches. Havana, in Mason co. (lat. 41° 14′, lon. 90° W., elevation 465 feet above the sea), had for its maximum temperature in 1872, 102° (in Aug.), for its minimum —23° in Dec.—giving an annual range of 125°. The mean temperature of the year was 49.3°; of the winter months 22.7°; of the summer months, 74.3°. The annual rainfall of the same year, 33.10 inches, of which 9.83 inches fell in the month of June. In 1871 the rainfall was 33.90 inches, and in the first nine months of 1873 it was 33.42 inches. Evanston, near Chicago, elevated 644 feet above the sea, from observations taken for several successive years, has the least rainfall of any town in the State, the average being 24.78 inches.

Agricultural Productions.—In 1870, according to the census, the value of the farms in Illinois was $920,506,346; of farming implements, $34,576,546; of forest products, $1,087,144; of home manufactures, $1,408,015; of animals slaughtered or sold for slaughter, $56,718,944; of all livestock, $149,756,698; of farm products, $210,860,585; of orchard products, $3,571,789; of market-gardens, $765,992; making a grand total of farming lands and productions of $1,379,252,100. Vast as this aggregate is for a State which sixty years ago had not 20,000 inhabitants, the four years which have since passed have greatly increased it. In 1873 the assessed value of cultivated farm-lands (stated by the State auditor to be less than 40 per cent. of their real value) was $642,912,908, representing a real value of not less than $1,600,000,000; the assessed value of town and city lots was $243,961,152; and these were similarly underrated. The valuation of railroad property (70 per cent. of actual valuation), the vast property of the Illinois Central R. R. being excluded, that road paying a specific tax, was $98,400,545.53, representing an actual value of $128,000,000; while the assessment of personal property, which was of course greatly underrated, was $302,778,499. The actual property of the State, real and personal, was not less than $2,800,000,000. The live-stock of the State was reported as follows by the State board of equalization in the summer of 1873: horses, 930,947 (the *Agricultural Report* of Jan., 1873, estimates them at 1,049,400, at the average price of $66.31), averaging a value of $52.41, and giving an aggregate value of $48,790,933 (the *Agricultural Report* above named gives their value as $69,585,714); cattle, board of equalization, 2,014,801, valued at $17.74 per head = $35,742,563 (the *Report* makes the number 1,971,800, but the value $51,769,806); mules and asses, 98,316, average value, $59.09, aggregate $5,809,404 (the *Agricultural Report* makes the number about the same (98,800), but the valuation $72.58, giving an aggregate of $7,778,524). The State board gives the number of sheep as 1,092,080, and the aggregate value, $2,140,474, while the *Agricultural Report* makes the number 1,394,300, and their value $4,461,460. The State board reports 3,560,083 hogs, averaging $3.17, and worth in the aggregate $11,285,464, while the *Agricultural Report* makes the number 3,706,300, averaging $4.30, and having an aggregate value of $15,937,090. The aggregate value of the live-stock was probably somewhat greater than the very large sum stated in the census report. We have not the full crop-returns of 1873, but those of 1872 give 283,481,600 bushels of corn, worth $68,035,584; 25,329,027 bushels of wheat, worth at a low estimate $31,154,703; 66,519,146 bushels of oats, worth $13,303,829; 3,267,356 tons of hay, worth $31,039,877; rye, barley, buckwheat, etc., worth $4,240,790; tobacco, valued at $1,276,000; hemp, flax, etc., $1,316,000; dairy products, $13,798,630; pasture, valued at $24,361,563, and other farm products, not specially enumerated in the returns for 1872, were valued at over $25,000,000. The year 1873 showed a very considerable increase on these large sums.

Manufacturing Industry.—The State has made great strides in manufacturing since the census of 1870 was taken, especially in Chicago and the other cities; and there is good reason for believing that the manufacturing statistics of the State, always ascertained with great difficulty, and often only by crude estimates, are very inadequately represented in the ninth census; still, these returns are later and more complete than any other. In 1870 there were reported in Illinois 12,597 manufacturing establishments, employing for motive-power 2330 steam-engines having an aggregate of 73,091 horse-power, and 528 water-wheels with an aggregate of 12,953 horse-power. These establishments employed 82,979 hands, of whom 73,045 were men, 6717 women, and 3217 children; the capital used was reported as $94,368,057; the wages paid amounted to $31,100,244; the raw material purchased to $127,600,077; the annual product to $205,620,672. The first rank in these manufactures belongs to flouring-mill products, for which there were 681 establishments, employing 3581 hands and a capital of $12,931,600, paying wages to the amount of $1,704,778, using raw material valued at $32,090,825, and producing flour and meal valued at $39,413,618. Next in importance was the packing of pork and other cut meats, in which 33 establishments were reported as engaged, employing 2236 hands and a capital of $6,921,000, paying $448,560 wages; using $16,836,541 of raw material, and producing $19,818,851 of packed meats annually. In Jan., 1873, the product of this branch of industry in the city of Chicago alone for the previous year was $19,153,851. As many of the smaller cities of the State are engaged in this business, it is evident that it had largely increased, or that the census report was much below the facts. Malt and distilled liquors, in which 193 establishments were engaged, employing 1955 hands and $7,397,900, paying $1,031,142 wages, using $6,898,377 of raw material, and producing liquors valued at $12,042,975, came next; and lumber, planed and sawed, is not far behind, 410 establishments producing $11,382,649. Agricultural implements came next, 294 establishments producing these to the value of $8,880,390. The various manufactures of iron produced in 130 establishments wares valued at $7,738,443; 458 establishments produced clothing valued at $8,407,005; 1165 manufactories produced carriages and wagons valued at $6,019,291. Machinery of all descriptions was produced in 131 establishments to the value of $6,398,794; the manufacture of tobacco in its various forms, in 274 factories, produced goods of the value of $4,319,716; leather, tanned and curried, in 97 establishments, was produced to the value of $4,148,163; woollen goods, in 85 factories, were produced to the value of $2,725,690; printing and publishing, in 129 offices, to the amount of $2,727,549; furniture, 371 factories, to the amount of $2,982,522; 391 cooper-shops produced goods valued at $2,501,531; boots and shoes, in 88 factories, were made to the amount of $2,298,136; oils, animal and vegetable, in 17 establishments, were produced to the value of $2,642,733; saddlery and harness, in 687 establishments, to the amount of $2,581,416; sash, doors, and blinds, in 94 factories, to the value of $2,316,320; tin, copper, and sheet-iron wares, in 478 shops, to the amount of $2,194,812; 24 confectionery establishments produced goods to the value of $1,948,710; 128 bakeries produced goods valued at $1,732,885; 240 brick-kilns made bricks to the value of $1,638,764; marble and stone work, including monuments and tombstones, were produced in 122 establishments to the value of $2,098,209; soap and candles, in 24 factories, to the amount of $1,250,930; grease and tallow, in 5 rendering-factories, to the amount of $1,412,900; paper was made in 16 mills to the amount of $1,188,400; railroad cars, in 5 car-shops, to the amount of $1,010,007. The other branches of manufacture, though of large aggregate amount, did not individually produce goods to the value of $1,000,000.

Railroads.—The railroad system of Illinois has acquired a remarkable development, scarcely any county being untraversed by one or more lines. The number of miles of railroad now existing in Illinois exceeds that of any other State of the Union, the increase having been especially rapid since the close of the war, during which time the mileage has more than doubled. In 1850 there were only 111 miles of track, while in 1855 there were 887; in 1860, 2790; in 1865, 3157; in 1870, 4823; in 1871, 5904; and in 1872, 6361. This statement shows the remarkable fact that more than 1000 miles of railroad track were constructed in Illinois in a single year. The most important railroad, the Illinois Central, traverses the length of the State from Chicago to Cairo, 705 miles; it was commenced in 1851, and by the aid of an immense grant of public lands was completed within about five years. The railway interests of Illinois form so vast and complicated a portion of its material wealth as to have become the subject of much special legislation. By the constitutional convention of 1870, State control over the railroads was organized in considerable detail, and general supplementary laws for their government were enacted in 1871 and 1873. The following table gives the condition of all the railroads of the State to Jan. 1, 1874:

Names of Companies.	Right of Way and Improvements.			Length of Line in Illinois.				Cost of road and equipment.	Investments.					Earnings and Expenses.				Freight carried.	Pass'gers carried.	Av'ge dist. trav'd by each.
	Acres.	Value.	Improvements on right of way.	Main line.	Br'ches.	Total.	In process of construction.		Preferred stock.	Common stock.	Bonded debt.	Floating debt.	Total paid-up stock and debt.	Gross earnings.	Am't of operating and gen. ex'ps.	Excess of earnings.	Excess of expenses.			
		$	$	Miles.	Miles.	Miles.	Miles.	$	$	$	$	$	$	$	$	$	$	Tons.	No.	Miles.
Chicago and Alton....	4,399.86	92,397.06	3,691,811.13	280.	268.	548.	......	15,777,300.00	2,425,400.00	8,929,900.00	4,422,000.00	None.	15,777,300.00	4,517,586.17	2,816,445.88	1,701,140.29				
Chicago Burlington and Quincy	9,865.76	219,924.96	8,489,679.01	207.	566.	783.	......	39,921,153.28	None.	18,652,910.00	17,516,281.05	258,769.44	36,427,960.49	7,859,065.12	4,973,782.80	2,885,282.32	....	1,928,472	1,461,021	38.51
Chicago Danville and Vincennes..........	1,212.00	22,365.00	405,452.32	108.	....	108.	30.	....	None.	2,500,000.00	3,325,000.00	....	5,825,000.00	654,849.81	417,314.18	237,535.63	....	253,865	72,116	35.50
Chicago and Iowa....	914.41	19,202.61	359,932.12	80.	....	80.	......	....	None.	1,318,000.00	1,750,000.00	100,000.00	3,168,000.00	472,619.94	379,215.97	93,403.97				
(a) Chicago and Northwestern............	5,841.81	163,648.38	4,957,680.00	455.	....	455.	......	15,662,343.88	(f)3,749,138.34	5,372,285.10	6,281,609.10	None.	15,403,032.54	3,244,697.90	2,167,146.07	1,077,551.83	....	742,045¾		
(a) Chicago Rock Island and Pacific.........	3,085.42	86,119.88	2,495,220.00	181.750	....	181.750	......	8,687,104.75	(f) None.	7,249,700.72	2,609,892.28	None.	9,859,593.00	3,979,043.42	2,118,252.58	1,860,790.84	....	372,189½	755,077	36.14
(a) Columbus Chicago and Indiana Central....	311.70	21,819.00	164,472.00	23.200	....	23.200	......	1,481,354.10	(f)	528,630.12	984,352.83	4,545.35	1,517,528.30	180,118.84	153,449.27	26,669.57	....	56,843¾	643,860	55.60
Cairo and St. Louis..	552.06	12,463.46	112,143.05	54.	....	54.	96.	....	....	478,000.00	2,500,000.00	....	2,978,000.00	52,987.02	....	....	....	5,000	10,221	20.80
Cairo and Vincennes.	1,178.00	24,751.02	434,000.00	156.658	....	156.658	......	....	None.	3,820,000.00	4,775,000.00	54,435.00	8,649,435.00	146,467.46	165,333.92	....	18,866.46	21,823	31,031	17.27
Chester and Tamaroa.	466.00	6,524.00	112,835.62	40.700	1.3	42.	......	....	None.	1,000,000.00	660,000.00	59,045.17	1,719,045.17	39,950.42	48,127.64	....	8,177.22			
Chicago Milwaukee and St. Paul (leased by M. and St. P.)...	253.05	12,657.78	42,000.00	47.620	....	47.620	......	....	(f) None.	1,120,470.60	1,400,588.20	....	2,521,058.80	339,277.82	241,382.45	97,895.37	....	83,854	39,351	43.
(a) Cincinnati Lafayette and Chicago........	388.61	8,160.81	88,704.00	32.300	....	32.300	......	1,414,840.45	(f) 801,470.66	29,371.46	482,346.66	91,461.84	1,404,650.62	122,365.21	90,975.20	31,390.01				
Gilman Clinton and Springfield.........	1,208.98	25,388.58	306,871.95	111.	....	111.	......	4,436,797.13	....	2,000,000.00	3,000,000.00	93,652.00	5,093,652.00	237,006.43	224,029.05	12,977.38	....	109,567	58,320	21.
Grand Tower and Carbondale............	309.30	4,330.20	67,102.35	24.150	....	24.150	......	....	....	....	....	....	....	65,212.82	167,302.80	....	102,089.98	277,640		
(b) Hannibal and Naples.	577.90	9,413.25	214,618.39	44.	....		......	1,357,000.00	....	457,000.00	900,000.00	....	1,357,000.00	116,170.39	126,757.09	....	10,586.70	78,900	34,948	17.03
(d) Illinois Central.......	......	....	....	308.990	396.510	705.500	......	34,150,819.00	None.	25,484,070.00	8,390,000.00	None.	33,874,070.00	6,039,477.00	4,464,636.94	1,574,840.06	....	2,299,162	1,136,862	38.29
Illinois and St. Louis Railroad and Coal Company..........	182.16	6,375.60	111,300.00	14.500	....	14.500	......	1,549,132.00	743,100.00	618,000.00	....	198,412.00	1,559,512.00	124,437.10	113,656.67	10,780.43				
Indianapolis Bloomington and Western.	1,384.96	29,100.36	2,496,212.72	131.300	....	131.300	260.	8,467,673.05	None.	3,463,871.00	4,095,000.00	45,628.54	7,604,499.54	925,978.50	521,083.81	404,894.69	....	251,727⅓	243,338	
Indianapolis and St. Louis	2,208.35	45,857.52	1,357,860.00	181.	5.	186.	......	(c)...........	(h)...........	....	....	....	....	1,455,442.78	990,693.11	464,749.67	....	527,241	245,049	39.
(a) Lake Shore and Michigan (Southern).....	138.99	9,729.30	155,680.00	14.	....	14.	......	1,011,570.00	(f) 6,896.58	639,455.42	380,908.59	36,124.42	1,063,475.01	240,632.00	174,801.66	65,830.34	....	60,003	2,417,869	69.
(b) Lafayette Bloomington and Western....	913.16	19,176.36	326,293.05	80.	....	80.	......	2,300,000.00	....	1,000,000.00	1,300,000.00	....	2,300,000.00	157,130.99	122,204.43	34,926.56	....	100,965		
(a) Michigan Central.....	461.47	24,112.30	267,960.00	6.250	14.	20.250	......	1,844,066.25	(f) None.	458,852.89	149,230.77	11,493.02	619,576.68	322,709.47	165,838.32	156,871.15	....	57,396		
(a) Ohio and Mississippi.	2,030.00	42,630.00	1,597,787.45	147.500	....	147.500	......	13,252,046.05	1,512,531.29	7,506,361.32	3,963,017.24	270,136.52	13,252,046.37	1,409,102.22	989,526.96	419,575.26	....	....	477,062	77.50
Peoria Pekin and Jacksonville........	907.72	19,062.12	316,600.52	83.	....	83.	......	408,575.75	239,700.00	1,000,000.00	2,000,000.00	411,447.62	3,651,147.62	319,167.87	288,215.47	30,952.40	....	135,465		
(b) Pekin Lincoln and Decatur...............	622.55	13,073.55	315,543.95	67.200	....	67.200	......	2,576,000.00	....	1,500,000.00	1,076,000.00	None.	2,576,000.00	141,260.99	102,522.45	38,738.54	....	98,848	47,627	18.66
(a) Pittsburg Ft. Wayne and Chicago........	112.71	7,889.70	154,886.13	14.500	....	14.500	......	841,189.80	(f) None.	660,732.60	403,561.02	512.47	1,064,806.09	287,724.51	172,452.14	115,271.37	....	68,353	2,134,653	44.70
Paris and Decatur....	768.40	16,136.40	282,135.00	72.	27.	99.	......	2,800,000.00	None.	1,600,000.00	1,200,000.00	150,000.00	2,950,000.00	139,796.44						
(b) Paris and Danville...	272.71	5,726.91	60,534.09	34.	....	34.	......	417,932.89	....	160,000.00	1,190,000.00	10,000.00	1,360,000.00	40,287.28	45,028.64	....	4,741.36	....	19,819	
Peoria and Rock Island	910.38	19,117.98	273,065.65	91.	....	91.	......	3,772,327.23	None.	1,858,950.00	1,650,000.00	49,639.27	3,558,589.27	300,044.90	194,677.07	105,367.83	....	194,348	70,500	
Quincy Alton and St. Louis..............	118.64	3,321.92	242,074.02	42.	....	42.	......	1,260,000.00	None.	780,100.00	1,000,000.00	52,000.00	1,832,100.00	68,939.34	80,460.00	....	11,520.66			
Rockford Rock Island and St. Louis.......	3,455.33	72,561.93	648,374.79	292.660	25.370	318.030	......	15,996,316.71	....	6,490,579.41	9,000,000.00	319,936.10	15,810,515.51	947,650.28	697,694.56	249,955.72	....	262,148	187,568	36.50
St. Louis Alton and Terre Haute........	759.00	21,052.50	304,060.90	....	75.	75.	......	....	2,468,400.00	2,300,000.00	7,000,000.00	None.	11,768,400.00	575,436.01	324,739.71	250,696.30	....	474,588	153,090	
St. Louis and Southeastern............	2,112.65	37,007.42	752,165.83	132.	48.	180.	......	8,828,400.00	2,574,000.00	2,054,400.00	4,200,000.00	(g)........	8,828,400.00	661,753.00	437,753.00	224,000.00	....	257,859½	70,531	42.62
Springfield and Illinois South-eastern.	2,304.37	37,718.66	699,903.43	221.400	....	221.400	......	7,910,639.90	....	3,784,500.00	3,866,000.00	260,153.90	7,910,653.90	371,219.61	379,274.94	....	8,055.33			
St. Louis Vandalia and Terre Haute....	2,039.89	39,967.25	736,946.88	158.400	....	158.400	......	5,830,000.00	....	2,377,450.00	4,500,000.00	1,000,000.00	7,877,450.00	1,168,547.79	824,786.14	343,761.65	....	....	175,263	
Toledo Peoria and Warsaw............	2,705.82	56,822.22	1,654,029.73	220.250	10.	230.250	......	12,585,523.50	2,700,000.00	3,000,000.00	6,450,000.00	446,723.50	12,596,723.50	1,262,266.18	1,042,437.23	249,828.95	....	517,596	175,784	36.50
Toledo Wabash and Western.......	3,217.05	67,558.05	3,902,057.25	232.	154.	386.	......	21,671,232.74	592,236.22	8,883,543.38	10,404,000.00	....	19,879,779.60	3,666,670.54	2,851,123.61	815,546.93	....	747,303¾	615,711	51.89
Western Union.......	1,611.00	28,205.98	494,325.36	127.210	....	127.210	......	4,682,326.60	(f) None.	2,395,555.76	2,096,111.28	256,116.77	4,747,783.81	535,483.31	448,087.30	87,396.01	....	165,224	187,546	27.
	59,802.17	1,351,352.04	39,086,318.69	4,516.538	1,600.180	6,116.718	(e) 386.000	240,893,665.06	17,812,873.09	131,472,689.78	124,920,989.02	4,180,232.93	278,386,784.82	43,188,576.88	29,521,209.06	13,638,622.07	164,037.71	10,148,427½	11,464,217	38.33

(a) Estimated for this State on basis of mileage of entire line. (b) Does not own any equipment. (c) Answered by St. L., A. and T. H. (d) The Ill. Cent., holding a peculiar and unique relation to the State, does not report its right of way or improvements. (e) Besides these, 297 miles of minor roads are now completed and in operation, making the total length of line 6,413,718. (f) Estimated for Illinois on the basis of the mileage of the whole line. (g) Answered by St. L., A. and T. H. (h) (St. L. and S. E.) $1,000,000 secured by unsold bonds.

Finances.—The assessed valuation of property in 1873 was: real estate, $642,912,908; railroad property (not including the Illinois Central, which pays annually into the State treasury a certain percentage of its gross receipts), $98,400,545.53. This was stated to be 70 per cent. of the true valuation, while that of real estate was only about 40 per cent. Personal property, certain specified kinds of property, including, besides stocks and bonds, live-stock, fireproof safes, carriages and wagons, musical instruments, plate and jewelry, diamonds, agricultural and manufacturing tools and machinery, watches and clocks, sewing-machines, etc., $302,803,262; making the entire assessed valuation $1,044,116,715.53. The increased assessment of railroad property and stocks, and of stock of telegraph and other corporations, ordered by the State board of equalization, brought the whole assessment of the year up to $1,339,570,950, which is probably not quite one-half the actual value of real and personal estate of the State. The State tax on this valuation is three mills, and there are also school fund and canal debt fund taxes, aside from the county, town, and city taxes, which are of varying amount. The other items of revenue to the State are—7 per cent. of the gross earnings of the Illinois Central R. R., paid semi-annually, and which now amounts to nearly $500,000 per annum; insurance fees and fines collected from agents, and other fines and forfeitures; tolls and rents from the State canal and slack-water navigation; and occasionally other sources. The annual State expenditure for the fiscal years 1871 and 1872 was $6,600,639.57, but this included the payment of $3,408,470 of the State debt. In Jan., 1873, the entire State debt was $1,732,467.18, the treasury reserve having been used for this reduction. In Jan., 1874, it had been still further reduced, and then stood at $1,706,750.39. The amount of railroad bonds outstanding Jan. 1, 1874, which had been issued by counties, townships, cities, and incorporated towns in the State, was $13,501,051.58; this was apportioned as follows: 45 counties had bonds outstanding to the amount of $5,380,904; 212 townships, bonds to the amount of $6,603,147.58; 17 cities, bonds amounting to $1,049,500; 27 incorporated towns, bonds amounting to $467,500. But the counties, towns, and cities had other debts besides these. In 1870 the amount of these was for the counties $12,817,922, and of the towns and cities, $24,483,010. It has been considerably reduced since that date, but more than one-half of the last item is the debt of the city of Chicago.

Commerce.—The grand system of railroads which cross the State in all directions and connect it with the great lakes, with all the ports on the Ohio, the Mississippi, and the Missouri, as well as with the opulent cities of the Atlantic and the Pacific coasts; the Illinois Canal, 100 miles in length, which connects Lake Michigan with the Mississippi; the Mississippi River, navigable for the largest steamers along the whole western boundary of the State; and the Ohio and Wabash, which are navigable for one-half the eastern and the whole southern boundary, together with the other navigable rivers in the State,—give to Illinois unsurpassed facilities for commerce which are most industriously improved. The entire amount of its internal traffic cannot well be ascertained, for its surplus agricultural and mechanical products are shipped from ports without as well as from those within the State. Some idea of their magnitude can be formed when we state that the receipts and shipments of grain, flour, and other articles of commerce in the port of Chicago alone in 1872 were over $370,000,000. A very considerable portion of the commerce of St. Louis is in the productions of Illinois, and considerable quantities of its products find their way to market through Indianapolis, Louisville, Cincinnati, and Toledo, while no small amount is shipped directly and without breaking bulk to Boston, New York, Philadelphia, Baltimore, and New Orleans. The direct foreign commerce of the State is mostly carried on through the port of Chicago by the way of the great lakes, the Welland Canal, and the St. Lawrence River. This is large and constantly increasing.

Banks.—There were in Nov., 1874, 152 national banks in the State, of which 10 were closing, leaving 142 in operation. The capital paid into these banks was $20,338,670; the amount of bonds on deposit, $16,742,400; the circulation issued, $23,296,405; the amount of actual circulation, $16,635,201; their assets, Sept. 12, 1873, $41,489,877.57; their surplus and undivided profits, $3,790,083.84; and their liabilities, $37,699,793.73. There were at the same time 12 State banks and savings banks doing a discount and deposit business; these had an aggregate capital of $3,300,000. There were also 217 private banking-houses doing business in the State.

Insurance Companies.—After the great fire in Chicago in 1871, many of the fire insurance companies of the State went into liquidation, but in June, 1873, there were 8 in operation, having an aggregate capital of $1,708,400 and assets to the amount of $2,568,000. There were in July, 1873, 6 life insurance companies, all in Chicago, having an aggregate capital of $1,800,000, and assets to the amount of $3,355,000.

Population.—The following table shows the population at each census, beginning with 1800, when the population of what was then the North-west Territory was first distinguished by districts, so that the inhabitants of what is now the State of Illinois could be distinguished from the other inhabitants of that vast Territory; it also includes the distinctions of color and nativity, and the density of population, so far as obtainable:

Census year.	Density of pop. to a square mile.	Total population.	Whites.	Colored.	Native.	Foreign-born.	Remarks.
1800	.0044	2,458	2,275	183			
1810	.22	12,282	4,501	781	....	....	168 slaves.
1820	1.00	55,162	53,788	1,374	....	....	917 slaves.
1830	2.84	157,445	155,061	2,384	....	....	747 slaves.
1840	8.59	476,183	472,254	3,929	....	....	331 slaves.
1850	15.37	851,470	846,034	5,436	736,149	111,892	3,429 of unknown nativity.
1860	30.90	1,711,951	1,704,291	7,628	1,387,308	324,643	
1865	38.64	2,141,510	2,124,170	17,340			
1870	45.84	2,539,891	2.511,096	28,762	2,024,693	515,198	986,035 of foreign parentage.

Of those of foreign birth in 1870, 203,758 were born in Germany; 192,960 in Great Britain and Ireland; 32,550 in British America; 29,979 in Sweden; 11,880 in Norway; 10,911 in France; 8980 in Switzerland; 7350 in Bohemia; 4180 in Holland; 3711 in Denmark; 2099 in Austria; 1696 in Poland; 1071 in Belgium; and 2633 in all other foreign countries. In the enumeration of sexes, there were in 1850 448,321 males and 403,149 females; of these, 445,544 were white males and 400,490 white females, 2777 colored males and 2659 colored females. In 1860 there were 902,761 males and 809,190 females; of these 898,941 were white males and 805,350 white females, 3809 colored males and 3819 colored females. In 1865 there were 1,102,223 males and 1,041,287 females, of whom 1,093,111 were white males, 1,033,059 white females, 9112 colored males, and 8228 colored females. In 1870 there were of all races and colors 1,316,537 males and 1,223,354 females in the State; of these, 1,033,161 were native males, and 991,532 native females; 283,376 males of foreign birth and 231,822 females; 1,301,583 white males, and 1,209,513 white females; 14,934 colored males and 13,828 colored females; 19 Indian males and 13 females. Of the total male population (1,316,537 males), 525,873 were between the ages of 18 and 45, or of military age; of these, 346,564 were natives and 179,309 foreigners; 518,924 white and 6941 colored; 625,139 males were 21 years old and upward, or of the voting age; of these, 390,735 were natives and 234,404 of foreign birth, and 542,833 were citizens. Of school age—*i. e.* between 5 and 18 years—there were 414,547 males and 404,219 females.

Education.—In 1870 there were in the State 86,368 persons of ten years old and over who could not read, and 133,584 who could not write; of these, 90,595 were of native and 42,989 of foreign birth; 97,658 whites (40,801 males and 56,857 females) were over 21 years of age, while 8051 colored (3969 males and 4082 females) over 21 were equally illiterate. Of the persons attending school in 1870 (548,225 in number), 522,939 were natives and 25,286 of foreign birth; 285,283 were males (284,084 whites and 1169 colored) and 262,968 females (261,813 whites and 1155 colored). According to the census of 1870, there were in the State 11,835 schools of all classes, with 24,056 teachers (10,411 males, 13,645 females) and 767,775 pupils or students (389,955 males and 377,820 females). The annual income of these schools was $9,970,009, of which $252,569 was derived from endowments, $6,027,510 from taxation and public funds, and $3,689,930 from other sources, including tuition. Of these schools, 11,050 were classed as public schools, having 20,097 teachers (8791 males and

11,306 females) and 677,623 scholars (343,445 males and 334,178 females). The income of these schools was $7,810,265, of which $5,858,249 was from taxation and public funds, and $1,952,016 from other sources, including tuition; 80 schools were classical, professional, and technical, having 571 teachers (354 males and 217 females) and 11,755 students (7255 males, 4500 females), and $896,372 of income, of which $222,374 was from endowment, $161,318 from taxation and public funds, and $512,680 from other sources, including tuition; 705 were private schools of lower grade, having 3388 teachers (1266 males and 2122 females) and 78,397 pupils (39,255 males and 39,142 females), and an annual income of $1,263,372, of which $30,195 was from endowment, $7943 from public funds, and $1,225,234 from other sources, including tuition. The sessions of the Illinois legislature being only biennial, there is no report from the superintendent of public instruction of later date than Jan., 1873, and the statistics are only to the autumn of 1872. This report gives the number of persons of school age (6 to 21 years) in the State in Sept., 1872, as 882,693; the number of school districts, 11,231, of which 10,767 had schools in session six months or more of the year, and 275 for less than six months, while 189 had no schools. There were 11,396 public free schools, of which 91 were public high schools, 651 graded schools, and 10,414 ungraded schools. In these schools there were 20,924 teachers, of whom 9094 were male teachers and 11,459 females; and 662,049 scholars attended them, of whom 345,623 were males and 316,426 females. The schools were maintained an average period of 6.9 months. The number of private schools reported in 1872 was 436, having 34,784 pupils. The total number of public school-houses in the autumn of 1872 was 11,289, of which 470 were built during the year at an average cost of $1517.65 each. The estimated value of school-houses in the State in the autumn of 1872 was $12,477,639; of the school lots, grounds, and appurtenances, $2,603,938; of other lands and property belonging to districts, $2,537,917; of furniture, apparatus, and libraries, $1,373,950; of repairs and improvements, $883,264; making a total approximate value of $19,876,708. The number of district school libraries was 830, and of volumes in them 54,286. The aggregate principal of township school funds was $4,868,555.01, and the interest received $528,811.47. The highest monthly wages paid to teachers was, to males, $250; to females, $120; the lowest was, to males, $12; to females, $9.50. The average monthly salaries were, to males, $50; to females, $39. In 75 of the 102 counties of the State the salaries of the best male teachers range from $100 to $250, and in 80 counties the salaries of the best female teachers range from $50 to $120. The total annual cost per scholar, including tuition, incidental expenses, and 6 per cent. interest on the estimated valuation of school property, is, upon the number enrolled, $9.25; upon the average daily attendance, $18.58. In 1872, 160 teachers' institutes were held and attended by 7771 teachers, and instructed by 532 lecturers and instructors. They continued an average of 5.4 days, or, in effect, a week. The amount received from all sources for school purposes in 1872 was $7,500,122.76, and the expenditures for the same year $7,480,889.24. The whole amount of principal of the common school funds of the State, Oct. 1, 1872, was $6,382,248.08. For the instruction of the teachers of these schools, besides the teachers' institutes, there is the Illinois State Teachers' Institute, which holds an annual session of fourteen days, generally devoted to natural science; two normal universities —viz. the Illinois State Normal University at Normal, founded in 1857, a most admirable institution, with every facility for thorough instruction in the art of teaching, expending about $31,500 annually, and having an average of 266 normal pupils annually, besides the large attendance on its model school; and the Southern Normal University, at Carbondale, which, founded in 1869, commenced actual instruction in Dec., 1873. There are also other very efficient normal training schools—the Cook County Normal School, at Englewood, 7 miles S. of Chicago court-house, established in 1867, which in 1872 had 207 pupils; the Peoria County Normal School, in Peoria, established in 1868, and having about 85 pupils; and the German-English Normal School, at Galena, etc.

The State has also provided liberally, in connection with the national agricultural college grant, for the scientific and practical education of those desiring to obtain such education. The Illinois Industrial University, located at Urbana and Champaign, is now in its seventh year of instruction, and is in most respects a model institution of its kind. In Jan., 1874, it had lands valued at $86,000, buildings and improvements valued at $175,000, furniture, library, cabinets, and apparatus valued at $75,000, and funds and investments to the amount of $424,000, making its total assets $760,000. Its annual current expenditure is about $68,000, but of this about $27,000, belonging to the expenses of the farm, gardens, and mechanical shops, is repaid from their products. It has eleven distinct courses of study, agricultural, mechanical, civil engineering, military, chemical, mathematical, natural history, classical, etc., a faculty of 24 professors and other instructors, and in 1873 had 326 male and 74 female students, of whom 360 were from Illinois, 33 from other States and Territories, and 7 from foreign countries. There is also an efficient and well-conducted soldiers' college at Fulton, Ill. Of the other institutions of higher education in Illinois, there are 6 so-called universities, 4 of them, as well as 3 of the colleges, being universities in fact, in the sense of having professional or scientific schools connected with them; 19 colleges, several of them with professional or scientific schools attached to them, and nearly all under the care and patronage of some religious denomination. These institutions have about 220 professors and over 4000 students. There are also 10 female colleges and seminaries of the highest grade, having 98 professors and teachers and over 2300 pupils; and 40 seminaries and academies of high grade for both sexes, having about 300 professors and teachers and nearly 4200 pupils. There are also, aside from the Illinois Industrial University, 3 scientific schools—the scientific departments of Chicago and Blackburn universities, at Chicago and Carlinville, and the Illinois Agricultural College at Irvington; 10 theological schools or seminaries, 4 of them at Chicago, having 35 professors and about 280 students; 2 law schools, one at Chicago and the other at Lebanon; 3 medical schools of the regular practice, 1 eclectic, and 1 homœopathic, and 1 college of pharmacy. These have 75 professors and over 500 students.

The institutions of special education for the unfortunate, orphans, diseased, and endangered classes are—(1) the Illinois Institution for the Education of the Deaf and Dumb, at Jacksonville, founded in 1840, and having 25 teachers and other officers, and 294 pupils. Its current annual expenditure is about $68,750 per annum, all of it appropriated by the State; (2) the Illinois Institution for the Education of the Blind, also at Jacksonville, founded in 1848, and having 9 teachers and other officers, and 66 pupils, and expending annually about $17,000, all of it appropriated by the State; (3) the Illinois Charitable Eye and Ear Infirmary, at Chicago, expending about $15,000 per annum, of which $10,000 is derived from the State; (4) the Illinois Institution for the Education of Feeble-Minded Children, at Jacksonville, founded in 1865, and incorporated in 1871; it has 7 teachers and other officers, and 107 pupils; it is now in rented premises, but is to have a new building completed in the winter of 1875; its expenses are about $24,000, all furnished by the State; (5) the Illinois Soldiers' Orphans' Home, at Normal, founded in 1865, has 6 teachers and 326 pupils, and expends annually about $52,000, all furnished by the State, besides the products of the farm and house, which are applied to materially reduce the expense *per capita*; (6) the Illinois State Reform School, at Pontiac, founded in 1870, which has 3 officers, 166 inmates, and expends about $33,000 per year, of which $25,000 is derived from the State. There are other reform and industrial schools in the State, but they are established by cities or counties, and not by the State. That in Chicago is a great success. It had 212 inmates in 1872, most of whom were reported reformed.

In this connection it is as well perhaps to speak of the charitable institutions of the State, which, though not directly educational in their character, have yet some connection with education. The Hospital for the Insane, at Jacksonville, founded 1847, has an average of 450 patients, and its current expenses are about $110,000 per annum; the Northern Hospital and Asylum for the Insane, at Elgin, founded in 1868, in 1873 had 7 officers and an average of about 200 patients, and its expenditure is in round numbers $50,000 per annum; the Southern Hospital for the Insane, at Anna, is a new institution, intended for 250 patients, and has nearly that number now. Its annual expenses are about $250 per patient, and when it is full will require $62,500 per annum. The two latter, when their buildings are completed, will accommodate 950 patients. There is also an insane asylum for Cook county, really a part of Cook county almshouse, which has 260 patients, and 2 small private asylums. The number of insane persons in the State exceeds 3000.

Pauperism and Crime.—Of the 2363 paupers returned in the census of 1870, 1213 were native whites, 41 native colored, 1109 foreigners. Of 1795 persons in prison June 1, 1870, 1229 were native whites, 143 native colored, and 423 foreigners: 1552 persons were convicted during the year. The State penitentiary, at Joliet, was for many years managed at a heavy loss, but since June, 1872, it has earned a considerable sum over its expenses, while its general condition has been greatly improved. There were in Jan., 1873, 1321 convicts in the penitentiary, 15 of them females. The

prison has a large library, and provision is made for the instruction of the prisoners in elementary studies, as well as for their religious welfare.

Libraries.—There were in the State in 1870, 13,570 libraries of all classes, public and private, containing 3,323,914 volumes; of these, 3705, containing 924,545 volumes, were public libraries; these included one State library, with 10,000 vols.; 53 town and city libraries, with 35,010 vols.; 135 court and law libraries, with 23,832 vols.; 1122 school and college libraries, with 140,759 vols.; 2308 Sunday school and church libraries, with 486,100 vols.; 7 literary and benevolent associations, with 153,492 vols.; 79 circulating libraries, with 75,352 vols.; and 9865 private libraries, with 2,399,369 volumes.

Newspapers and Periodicals.—There were in Illinois in 1870, 505 newspapers, having an aggregate circulation of 1,722,541, and an aggregate annual issue of 113,140,492 copies. Of these, 39 were dailies, with a circulation of 166,400; 10 were tri-weekly, with 40,570 circulation; 4 were semi-weekly, with 2950 circulation; 364 were weekly, with 890,913 circulation; 11 were semi-monthly, with 107,900 circulation; 72 were monthly, with 490,808 circulation; 2 were bi-monthly, with 11,000 circulation; and 3 were quarterly, with 12,000 circulation.

Churches.—There were in 1870 in the State 4298 churches, of all denominations, 3459 church edifices, 1,201,403 sittings, and $22,664,283 of church property. Of the churches at that date, 722 were Baptist, with 571 church edifices, 181,454 sittings, and $2,601,612 of church property. According to the *Baptist Year Book* for 1875, the number of associations in 1874 was 44; of churches, 1056; of ordained ministers, 732; of communicants, 68,313; of additions, 7333; of Sunday schools, 540; of teachers and scholars, 59,700; of volumes in libraries, 61,088; of contributions for benevolent and church purposes, $924,179. The Christian Connection and the Disciples, in 1870 had 350 churches, 251 church edifices, 85,175 sittings, and $621,450 of church property. They have increased somewhat in four years, but their statistics are so incomplete that it is difficult to say how much. The Congregationalists in 1870 had 212 churches, 188 church edifices, 66,137 sittings, and $1,867,800 of church property. At the close of 1874 they had 239 churches, 221 ordained ministers, 20,557 communicants, and 25,766 scholars in the Sabbath schools. The Protestant Episcopal Church had in the State in 1870, 105 parishes, 85 church edifices, 30,395 sittings, and $1,426,300 of church property. In 1874 there were 101 parishes, 91 clergymen, 6785 communicants, 953 confirmations, 6838 Sunday school teachers and scholars, and the contributions to benevolent and church purposes were $149,812.97. The Evangelical Association had in 1870, 58 churches, 55 church edifices, 20,176 sittings, $329,650 of church property. In 1873 they had 73 itinerant and 72 local preachers, 94 churches, 8171 members, and about $500,000 of church property. The Friends had in 1870, 5 meetings, 4 meeting-houses, with 1000 sittings, and $13,400 meeting-house property. They have increased considerably within the last four years. The Lutherans in 1870 had 230 churches, 207 church edifices, 74,301 sittings, $1,043,476 church property. The Lutheran Church has so many different councils, ministeriums, and synods in the U. S. that it is difficult to isolate the churches of any one State; but as nearly as can be ascertained they had about 266 churches and 25,500 members in Illinois in 1873. The Methodists of all the Methodist bodies in 1870 had 1426 churches, 1124 church edifices, 357,073 sittings, and $5,205,620 of church property. In 1874 the Methodist Episcopal Church alone had in the State about 1900 ministers, of whom 998 were itinerants, 1321 churches, 108,120 members, $5,760,731 of church property, 1646 Sabbath schools, 145,861 teachers and scholars; while the other Methodist bodies had perhaps one-third of that number. The Presbyterians, including all branches, in 1870 had 595 churches, 523 church edifices, 184,849 sittings, $3,637,625 of church property. In 1873 the Presbyterian General Assembly (Northern) had 435 ordained ministers, 482 churches, and 38,557 members; the United Presbyterians had 74 ministers, 87 churches, and 6836 communicants. There were also considerable numbers belonging to the Presbyterian Church, South, to the Cumberland Presbyterians, and to the Reformed and other independent synods. The Reformed Church in America (late Dutch) in 1870 had 14 churches, 14 church edifices, 4880 sittings, and $150,200 of church property. In 1873 the same Church had 20 ministers, 19 churches, and 1782 communicants. The Reformed Church in the U. S. (late German) in 1870 had 32 churches, 30 church edifices, 7170 sittings, $93,600 of church property. It has since increased, but the arrangement of their statistics is such that we cannot separate those of Illinois. The Roman Catholic Church had 290 congregations, 249 church edifices, 136,900 sittings, $4,010,650 of church property. In 1874 there were in the State 313 priests, 459 congregations, and an adherent population of probably 225,000. The Second Adventists in 1870 had 8 churches, 5 church edifices, 1300 sittings, $7100 of church property. The Unitarians had 23 congregations, 17 church edifices, 5960 sittings, and $492,900 of church property. The United Brethren in Christ (German Methodists) had 125 churches, 58 church edifices, 17,995 sittings, and $126,800 of church property. In 1873 there were 324 churches, 210 ministers, and 11,351 members. The Universalists in 1870 had 52 congregations, 44 church edifices, 15,225 sittings, and $543,300 of church property. In 1873 they reported 79 parishes, 52 congregations, 2776 members, and about 15,000 adherent population. There were also perhaps 200 congregations of the minor denominations, with 150 church edifices, 35,000 sittings, and $125,000 of church property.

Constitution, Courts, etc.—The present constitution of Illinois was adopted by a constitutional convention held in 1870, and ratified by the people of the State the same year. It contains a bill of rights based on the principles of English constitutional law, defines the qualifications for legislators, prescribes that the senate shall consist of 51 senators, elected for four years, but in two classes, those in the odd-numbered districts being elected in 1874, and every four years thereafter, and those in the even-numbered districts in 1872, and every four years thereafter; the house of representatives to consist of 153 members, elected for two years. The legislative sessions are biennial. They are prohibited from special legislation; the house of representatives has the sole power of impeachment, but the senate must be the trial court for the impeachment. Minority representation is provided for. The pay of senators and representatives is $5 per day, 10 cents a mile for actual mileage, and $50 per session for postage, stationery, etc. The executive department consists of a governor, lieutenant-governor, secretary of state, auditor of public accounts, treasurer, superintendent of public instruction, and attorney-general, all elected by the people, and all, except the treasurer (whose term is two years), for four years. The treasurer is ineligible for re-election for two years after the expiration of his term. The governor has the veto power, which can only be overridden by a vote of two-thirds of all the members elected. The judicial powers of the government of the State are vested in one supreme court (which is also a court of appeals), circuit courts (which may have appellate jurisdiction to a certain extent), county courts, justices of the peace, police magistrates, and such courts as may be created by law in and for cities and incorporated towns. The supreme court consists of seven judges, one of whom shall be the chief-justice, and four shall constitute a quorum. The judges of the supreme court are elected by the people of their respective districts for a term of nine years, and provision is made so that their terms of office shall expire at different times. The chief-justice is chosen by his associates, and holds his office till the expiration of his term. The circuit courts are held in judicial circuits of 100,000 inhabitants, except in Cook county or other counties having more than 100,000 inhabitants (which form a single judicial circuit whatever their population), and the circuit judges hold office for six years. Judges of county courts hold office for four years. Probate judges are elected for four years, and, except as above, 1 to every 50,000 inhabitants. The minor judicial officers are to be elected in such districts as the legislature shall provide. Every person having resided in the State one year, in the county 90 days, and in the election district 30 days next preceding any election therein, who was an elector in the State on Apr. 1, 1848, or obtained a certificate of naturalization before any court of record in the State prior to Jan. 1, 1870, or who is a male citizen of the U. S. above the age of twenty-one years, shall be entitled to vote at such election. All votes are by ballot. No elector loses his residence by reason of absence on business of the U. S. or of the State of Illinois, or in the military and naval service of the U. S., and no soldier, seaman, or marine in the army or navy of the U. S. is deemed a resident of the State in consequence of being stationed therein. The general assembly has power to pass laws excluding from the right of suffrage persons convicted of infamous crimes. An efficient system of free-school education is provided for, and the legislature and counties, cities, towns, etc. are for ever prohibited from making any appropriation or paying from any public fund whatever anything in aid of any college, seminary, literary or scientific institution which is controlled by any Church or sectarian denomination whatever. No teacher or school officer is allowed to be interested in the sale, proceeds, or profits of any book, apparatus, or furniture used in any school. There are also provisions in relation to counties, to railroads, warehouses, State revenues, etc. The State under the new apportionment has 19 members of the House of Representatives in Congress.

Counties.—The State is divided into 102 counties, whose names and population in 1870, 1860, and 1850 were as follows:

COUNTIES.	Total pop. 1870.	Male, 1870.	Female, 1870.	Total pop. 1860.	Total pop. 1850.
Adams	56,362	28,527	27,835	41,323	26,508
Alexander	10,564	5,266	5,298	4,707	2,484
Bond	13,152	6,765	6,387	9,815	6,144
Boone	12,942	6,565	6,377	11,678	7,624
Brown	12,205	6,259	5,946	9,938	7,138
Bureau	32,415	16,898	15,517	26,426	8,841
Calhoun	6,562	3,562	3,000	5,144	3,231
Carroll	16,705	8,700	8,005	11,733	4,586
Cass	11,580	6,089	5,491	11,325	7,253
Champaign	32,737	17,423	15,314	14,629	2,649
Christian	20,363	10,881	9,482	10,492	3,203
Clark	18,719	9,650	9,069	14,987	9,532
Clay	15,875	8,131	7,744	9,336	4,289
Clinton	16,285	8,614	7,671	10,941	5,139
Coles	25,235	12,984	12,251	14,203	9,335
Cook	349,966	180,007	169,959	144,954	43,385
Crawford	13,889	7,018	6,871	11,551	7,135
Cumberland	12,223	6,274	5,949	8,311	3,718
De Kalb	23,265	12,002	11,263	19,086	7,540
De Witt	14,768	7,845	6,923	10,820	5,002
Douglas	13,484	7,118	6,366	7,140	
Du Page	16,685	8,784	7,901	14,701	9,290
Edgar	21,450	11,077	10,373	16,925	10,692
Edwards	7,565	3,840	3,725	5,454	3,524
Effingham	15,653	8,256	7,397	7,816	3,799
Fayette	19,638	10,170	9,468	11,189	8,075
Ford	9,103	5,039	4,064	1,979	
Franklin	12,652	6,484	6,168	9,393	5,681
Fulton	38,291	19,739	18,552	33,338	22,508
Gallatin	11,134	5,716	5,418	8,055	5,448
Greene	20,277	10,677	9,600	16,093	12,429
Grundy	14,938	7,741	7,197	10,379	3,023
Hamilton	13,014	6,582	6,432	9,915	6,362
Hancock	35,935	18,509	17,426	29,065	14,652
Hardin	5,113	2,670	2,443	3,759	2,887
Henderson	12,582	6,801	5,781	9,501	4,612
Henry	35,506	18,487	17,019	20,660	3,807
Iroquois	25,782	13,481	12,301	12,325	4,149
Jackson	19,634	10,361	9,273	9,589	5,862
Jasper	11,234	5,738	5,496	8,554	3,220
Jefferson	17,864	9,010	8,854	12,965	8,109
Jersey	15,054	7,962	7,092	12,051	7,354
Jo Daviess	27,820	14,196	13,624	27,325	18,604
Johnson	11,248	5,713	5,535	9,342	4,114
Kane	39,091	19,866	19,225	30,062	16,703
Kankakee	24,352	12,708	11,644	15,412	
Kendall	12,399	6,455	5,944	13,074	7,730
Knox	39,522	20,014	19,508	28,663	13,279
Lake	21,014	10,696	10,318	18,257	14,226
La Salle	60,792	31,228	29,564	48,332	17,815
Lawrence	12,533	6,383	6,150	9,214	6,121
Lee	27,171	14,220	12,951	17,651	5,292
Livingston	31,471	16,662	14,809	11,637	1,552
Logan	23,053	12,445	10,608	14,272	5,128
Macon	26,481	13,890	12,591	13,738	3,988
Macoupin	32,726	16,965	15,761	24,602	12,355
Madison	44,131	22,888	21,243	31,251	20,441
Marion	20,622	10,501	10,121	12,739	6,720
Marshall	16,956	8,854	8,102	13,437	5,180
Mason	16,184	8,683	7,501	10,931	5,921
Massac	9,581	4,896	4,685	6,213	4,092
McDonough	26,509	13,546	12,963	20,069	7,616
McHenry	23,762	12,174	11,588	22,089	14,978
McLean	53,988	28,340	25,648	28,772	10,163
Menard	11,735	6,237	5,498	9,584	6,349
Mercer	18,769	9,789	8,980	15,042	5,246
Monroe	12,982	6,815	6,167	12,832	7,679
Montgomery	25,314	13,255	12,059	13,979	6,277
Morgan	28,463	14,579	13,884	22,112	16,064
Moultrie	10,385	5,481	4,904	6,385	3,234
Ogle	27,492	14,355	13,137	22,888	10,020
Peoria	47,540	24,244	23,296	36,601	17,547
Perry	13,723	7,135	6,588	9,552	5,278
Piatt	10,953	5,852	5,101	6,127	1,606
Pike	30,768	15,811	14,957	27,249	18,819
Pope	11,437	5,794	5,643	6,742	3,975
Pulaski	8,752	4,571	4,181	3,943	2,265
Putnam	6,280	3,223	3,057	5,587	3,924
Randolph	20,859	10,889	9,970	17,205	11,079
Richland	12.803	6,439	6,364	9,711	4,012
Rock Island	29,783	15,369	14,414	21,005	6,937
Saline	12,714	6,378	6,326	9,331	5,588
Sangamon	46,352	24,010	22,342	32,274	19,228
Schuyler	17,419	9,479	7,940	14,684	10,573
Scott	10,530	5,557	4,973	9,069	7,914
Shelby	25,476	13,234	12,242	14,613	7,807
Stark	10,751	5,665	5,086	9,004	3,710
St. Clair	51,068	27,325	23,743	37,694	20,180
Stephenson	30,608	15,588	15,020	25,112	11,666
Tazewell	27,903	14,545	13,358	21,470	12,052
Union	16,518	8,367	8,151	11,181	7,615
Vermilion	30,388	15,762	14,626	19,800	11,492
Wabash	8,841	4,427	4,414	7,313	4,690
Warren	23,174	12,100	11,074	18,336	8,176
Washington	17,599	9,157	8.442	13,731	6,953
Wayne	19,758	10,204	9,554	12,223	6,825
White	16,846	8,467	8,379	12,403	8,925
Whiteside	27,503	14,371	13,132	18,737	5,361
Will	43,013	23,221	19,792	29,321	16,703
Williamson	17,329	9,062	8,267	12,205	7,216
Winnebago	29,301	14,762	14,539	24,491	11,773
Woodford	18,956	9,993	8.963	13,282	4,415
Total	2,539,891	1,316,537	1,223,354	1,711,951	851.470

Principal Towns.—Chicago is the largest city, not only of Illinois, but of the region formerly comprised in the North-west Territory. Its population in 1870 was 298,977 and has since increased with great rapidity, notwithstanding the terribly destructive fire of Oct., 1871. Quincy, Peoria, and Springfield are cities of between 20,000 and 30,000 inhabitants; Bloomington, Aurora, Rockford, Galesburg, Jacksonville, and probably Alton, have more than 10,000 and less than 20,000; Belleville, Freeport, Galena, Rock Island, Ottawa, Decatur, and Joliet, from 8000 to 10,000; Cairo, East St. Louis, Elgin, Pekin, and La Salle, from 6000 to 8000; Champaign, Danville, Dixon, Waukegan, Monmouth, Moline, Litchfield, Mendota, Penn, Sterling, Warsaw, Princeton, Morris, Belvidere, Canton, Geneseo, and Paris have about 5000 inhabitants each.

History.—The first white settlements in this State were made by the French from Canada, and were the result of the enterprise of the great explorer, the Sieur de la Salle. He set out from Canada in 1679, crossed the lakes, and descended a river, on the banks of which he found an Indian tribe whom he names in his journal the Illini, and from whom he gave the river the name Illinois. Gaining their good-will, he established a small fort at the mouth of the river, and left the Chevalier de Tonty there with a few men, naming his little fort Crève Cœur. After descending the Mississippi for some distance, he returned to Canada, but in 1682 came again to the Illinois River with a colony of Canadians, and made a beginning of settlements at Kaskaskia, Kahokia, and some other towns. These settlements increased, and the Jesuit missionaries who visited the region early in the eighteenth century were so delighted with it that they described it as a new paradise. The colonists, like most of the French emigrants of that period, maintained the most friendly relations with the Indians, and eventually so far degenerated as to become very little above the Indians among whom they dwelt. The vagabond and reckless life of the half-breed Canadian voyageur is well known, and the greater part of the colonists were of this class. In 1763 the English government, by the conquest of Canada, succeeded to the dominion over all this region, to which the French had previously laid claim, but in the twenty years that followed they seem to have paid very little attention to this portion of their domain. At the close of the Revolutionary war this region was ceded to the U. S., and in 1787 the whole country N. of the Ohio River to the Canadian line was erected into the North-west Territory. In 1800, Ohio was made a separate Territory; in 1805, Michigan was set off as a distinct Territory; and in 1809, Indiana Territory was organized. This left for Illinois Territory, as it was soon after organized, the present States of Illinois and Wisconsin and part of Minnesota. The census of 1810 reported 12,282 inhabitants in this Territory. The Indians had for several years been very troublesome, and the settlement of the Territory had been hindered by their hostilities. In Aug., 1812, they attacked the fort at the mouth of Chicago River, and murdered most of the garrison and the settlers in the vicinity. They were severely punished for these outrages, and the hostile tribes being finally driven away, the northern section began to attract a large body of immigrants. In 1818 it was found that there were 35,220 inhabitants in the Territory, and all but a very few within the present limits of the State. In that year Illinois was admitted with the present limits into the Union as a State. Two years later it had 55,211 inhabitants, and in 1830, 157,445, a gain of 185.2 per cent. In 1832 the troubles with the Sac and Fox and other tribes of Indians, which had existed for a year or two, culminated in the Black Hawk war and the final removal of all the Indians from the State. During the continuance of hostilities there was much excitement and alarm in the State, but the result was eminently beneficial in making more widely known the great advantages the State offered to immigrants. Congress granted an appropriation in 1834 for the improvement of the harbor at Chicago, and in 1835 the Illinois and Lake Michigan Canal, connecting the great lakes with the Mississippi River, was projected and the State bank organized. In July, 1836, the canal was commenced and several railroad enterprises undertaken. But the financial panic of 1837 fell with crushing effect upon Illinois, and led to the abandonment of every work of internal improvement. The growth of the State in population continued, however, through all this period of depression, and in 1840 it had 476,183 inhabitants, a gain of 202.4 per cent. from 1830. In 1840 the Mormons removed from Missouri to Nauvoo in Illinois, and, rapidly increasing in numbers, commenced erecting their temple there. From the first their lawlessness and their irregular and profligate lives had prejudiced the people against them, and as their offences became more flagrant there was manifested a very general determination to drive them out of the State. In June, 1844, the brothers Joseph and Hyrum Smith, the

leaders of the Mormons, having been arrested and confined in Carthage jail, the jail was surrounded by a mob on the 27th of that month, and the Smiths were both murdered. In the following autumn the Mormons, to the number of about 20,000, left the State under the leadership of Brigham Young, and commenced their migration to Utah. In 1845 the population, according to the State census, was 643,482. In 1847 a new State constitution was adopted. In 1850, the tide of emigration having set very strongly toward Iowa and Wisconsin, the percentage of increase of population had fallen off considerably, the census reporting only 851,470 inhabitants, an increase of only 80.7 per cent. on the previous decade. In 1850, Congress granted a vast quantity of land to the Illinois Central Railroad Co. for the construction of their railway through the whole length of the State. This, and the other railroad enterprises which followed it, gave a new impulse to the growth of the State, and have made its development more rapid than that of any State which had preceded it. A great city was rapidly growing up on the shores of the lake, and river and lake, canal and railroads, were all contributing to its swift and irresistible progress. In 1860 the population of the State was 1,711,951, a little more than double that of 1850, and it had but very little government land remaining unsold. The civil war taxed the resources of the State very severely, but her citizens responded most nobly, and by the aid of improved agricultural machinery she was able to send a very large force, more than her full quota, into the field, and yet retain her pre-eminence as the granary of the nation. Owing to the losses of the war the increase of her population was proportionally less in 1870 than in 1860, though the actual increase was nearly the same as in the previous decade. The census report gives her in 1870, 2,539,891, an addition of 827,940. Since 1870 she has enjoyed (except the great calamity of the Chicago fire) uninterrupted prosperity, and her growth has been as rapid as at any former period of her history. The conflict in regard to policy which in 1873 and 1874 had occurred between the farming population and the railway companies, though it may cause some bitterness of feeling for a time, is destined to be settled on terms which will be fair and just to both parties, and in the end will result in an increased business and a more satisfactory development of the vast resources of the State. In 1870 the State again revised its constitution very thoroughly, and in the interests of an economical and wise government.

Governors of Illinois.—

	Term.		Term.
TERRITORY.		Thomas Ford	1842–46
Ninian Edwards	1809–18	Augustus C. French	1846–53
STATE.		Joel A. Matteson	1853–57
Shadrack Bond	1818–22	William H. Bissell	1857–61
Edward Coles	1822–26	Richard Yates	1861–65
Ninian Edwards	1826–30	Richard J. Oglesby	1865–69
John Reynolds	1830–34	John M. Palmer	1869–73
Joseph Duncan	1834–38	Richard J. Oglesby	1873–73
Thomas Carlin	1838–42	John L. Beveridge	1873–

Vote at Presidential Elections.—Illinois not having been admitted into the Union as a State until 1818, her first vote for President was cast in 1820.

Elect. year.	Candidates who received the electoral vote.	Elect. vote.	Popular vote.	Candidates.	Popular vote.	Candidates.	Popular vote.
1820	James Monroe P. D. D. Tompkins V.-P.	3	Not rec.	J. Q. Adams P. R. Rush V.-P.	Not rec.		
1824	Andrew Jackson P. John Quincy Adams P. John C. Calhoun V.-P.	2 1 3	1,901 1,542	John Quincy Adams P.	1,542	Crawford P. H. Clay P.	219 1,047
1828	Andrew Jackson P. John C. Calhoun V.-P.	3	6,763	J. Q. Adams P. R. Rush V.-P.	1,581		
1832	Andrew Jackson P. M. Van Buren V.-P.	5	14,147	H. Clay P. John Sergeant V.-P.	5,429	John Floyd and Wilkins. William Wirt and Henry Lee.	
1836	Martin Van Buren P. R. M. Johnson V.-P.	5	17,275	W. H. Harrison P. F. Granger V.-P.	14,292	Hugh White and John Tyler. Daniel Webster. W. P. Mangum and Smith.	Not rep.
1840	Martin Van Buren P. R. M. Johnson V.-P.	5	47,476	W. H. Harrison P. J. Tyler V.-P.	45,537	J. G. Birney P.	149
1844	James K. Polk P. G. M. Dallas V.-P.	9	57,920	H. Clay P. Th. Frelinghuysen V.-P.	45,528	J. G. Birney P.	3,570
1848	Lewis Cass P. W. O. Butler V.-P.	9	56,300	Zach. Taylor P. M. Fillmore V.-P.	53,047	M. Van Buren P.	15,774
1852	Franklin Pierce P. William R. King V.-P.	11	80,597	Winfield Scott P. W. A. Graham V.-P.	64,934	J. P. Hale P., and Julian V.-P.	9,966
1856	James Buchanan P. J. C. Breckenridge V.-P.	11	105,348	John C. Fremont P. W. L. Dayton V.-P.	96,189	Fillmore P., and Donaldson V.-P.	37,444
1860	Abraham Lincoln P. H. Hamlin V.-P.	11	172,161	S. A. Douglas P. H. V. Johnson V.-P.	160,215	Breckenridge P., and Lane V.-P. Bell P., and Everett V.-P.	2,404 4,913
1864	Abraham Lincoln P. A. Johnson V.-P.	16	189,496	G. B. McClellan P. G. H. Pendleton V.-P.	158,730		
1868	U. S. Grant P. Schuyler Colfax V.-P.	16	250,303	Horatio Seymour P. F. P. Blair V.-P.	199,143		
1872	U. S. Grant P. Henry Wilson V.-P.	21	241,944	Horace Greeley P. B. Gratz Brown V.-P.	184,938	C. O'Conor P.	3,058

L. P. BROCKETT.

Illinois, tp. of Pope co., Ark. Pop. 1657.

Illinois, tp. of Washington co., Ark. Pop. 1200.

Illinois and Michigan Canal. This important line of communication unites Lake Michigan with the navigable waters of the Illinois River—that is to say, the Gulf of St. Lawrence with the Gulf of Mexico—and the summit-level of the canal lies about 580 feet above tide-water. The near approach of these waters to each other was known to the early fur-traders and Indian missionaries of Canada. By the Fox River (by Green Bay) and the Wisconsin River, Father Marquette, the Jesuit, passed from the lake to the Mississippi, descending that river to the mouth of the Illinois. He returned to the lake by this last-named stream and Chicago River, having to make but short portages at the two intermediate points; this in the year 1673. Soon after the formation of the State of Illinois from the Northwest Territory—say, in the year 1822—Congress granted the right of way through the public lands "for the route of a canal connecting the Illinois River with the southern bend of Lake Michigan," and in the year 1827 a further grant was made to aid the State in the construction of a canal—viz. a quantity of land "equal to one-half of five sections in width on each side of the canal, reserving each alternate section to the U. S. from one end of the said canal to the other;" this and a similar grant made to the State of Indiana, also in 1827, for aid in the construction of the Erie and Wabash Canal, constituted the first material support by grants of public lands made by Congress under the system of "internal improvements," so called in that day. The number of acres included in the grant to Illinois originally was 286,000; but it having been discovered subsequently that the State had not received its full quota under the terms of the law, an additional 32,895 acres was granted in the year 1854, making the aggregate of 318,895 acres received by the State. Prior to this grant of land by the U. S., the State of Illinois, in the year 1825, had received a report from a board of commissioners appointed by the legislature to examine the route of the proposed canal, favorable to the project, stating the estimated cost of five several plans, varying in amount from $639,000 to $716,000; the length of the canal being about 100 miles. In 1829 a new board of commissioners was organized, with authority to construct the canal and to dispose of the lands granted by Congress to provide means for carrying on the work. In the following year experimental surveys were made by a party of engineers acting under the orders of the war department, but their investigations were confined principally to the question of a supply of water. In the year 1833 other surveys and estimates were made by the State, and the engineers then employed reported the cost of a canal 40 feet wide and 4 feet deep at $4,043,000.

It was not until 1836, however, that really efficient measures were adopted for the prosecution of the work. A board of commissioners was again organized in that year, with authority to construct the canal, an experienced engineer was appointed, surveys were made, and estimates in detail furnished for an enlarged work—to wit, for a canal 60 feet wide at surface, 36 feet at bottom, and 6 feet deep. The estimate upon this basis for the work and its appendages was $8,654,000. The work was put under contract in June, 1836, and was prosecuted uninterruptedly until Mar., 1841,

when operations were suspended for the want of adequate means to carry on the same. In Feb., 1843, the governor was authorized by law to negotiate a loan of $1,600,000 solely on the credit and pledge of the canal, its tolls, revenues, and lands, for the purpose of completing the work. The negotiation of this loan occupied more than two years, for it was not until June, 1845, that the full amount of subscriptions required was secured. At that time a contract was agreed upon and executed between the State of Illinois and the subscribers to the loan of $1,600,000. The canal and all its works, with 225,000 acres of land and 6000 lots in Chicago, Lockport, La Salle, etc., were placed in the hands of three trustees, with full authority to complete the canal, sell the lands and lots, and, possibly, to restore the canal and remaining property (after payment of the loan and the bonds) to the State of Illinois.

In the original plan of the canal it was designed to make a through cut from the waters of Lake Michigan to the main eastern branch of the Illinois River (the Des Plaines); by this the summit-level, some 30 miles in length, would receive a never-ending supply of water from the lake for navigation and for lockage of the inferior levels—say, to the entrance of the main southern branch, the Kankakee, entering the Illinois River 50 miles below Chicago, and about midway of the canal. The formation of the land between the lake and the Des Plaines presented nothing formidable in appearance, being an almost flat prairie, more or less wet, and rising only from 12 to 15 feet above the ordinary level of Lake Michigan; hence the plan adopted for the construction of the line of canal between the two points named established itself, as it were, for there seemed to be no alternative to desire. However, during the year 1837 (the second season of work) the cuttings proved to be very difficult and expensive upon the summit division, 19 miles averaging 18 feet in depth, the lower 12 feet, being cemented clay, next 8 miles (Saganski Loup) the cutting was in magnesian limestone, 14 to 18 feet in depth, with abundance of water. These results, as developed during the later progress of the work, led to the modification of the plan of 1836, by the act of the legislature of 1843, in a most important feature—to wit, authority to abandon the through cut, to raise the summit-level one lock in height, and to rely for the supply of water therefor upon the tributaries of the Illinois River, the Calumet, Des Plaines, etc.

In June, 1845, the trustees before referred to were placed in possession of the canal, lands, etc., and proceeded to organize their work by distributing their duties among each other, appointing a chief engineer and assistants (the same who had planned and constructed the work from the beginning in 1836), a secretary, land-agents, etc. Under the act of 1843 the lands and lots were valued by appraisers appointed for that purpose, contracts were entered into for the construction of the canal and feeders, and the work was pushed forward diligently and successfully to its completion and opening for purposes of navigation in Apr., 1848, the same falling within the period prescribed in the act of 1843—say, three years—and it may be added the cost of completing the canal and its subsidiary works fell within the estimate made by the chief engineer in the year 1843—$1,429,606. This sum, added to the previous cost, estimated at $4,740,620, exhibits the entire cost at $6,170,226 at the opening of the canal for navigation, Apr., 1848.

Description of the Canal and its Works.—The eastern terminus of the canal is at the S. branch of the Chicago River, and 5 miles from the entrance of the main stream into the lake. The line is direct to the valley of the Des Plaines at Summit, about 8 miles distant; thence it pursues that valley uninterruptedly to the mouth of the Kankakee River, 42 miles, passing through the towns of Lockport and Joliet, and receiving within the distance named four feeders—Calumet, Des Plaines, Du Page, and Kankakee; between the junction of the Kankakee and Des Plaines the combined rivers take the name of Illinois, and within this valley the canal pursues its course to its western terminus, La Salle, passing through the towns of Morris and Ottawa, and receiving the important Fox River feeder at the last-named place; the entire length of the canal proper being 96 miles. The difference of level between Lake Michigan and the Illinois River at La Salle is 145 feet, and in the original or through-cut plan this fall was distributed through 15 locks, varying in lift from 3½ to 12½ feet each. Upon the modified or raised-level plan two additional locks became necessary—one of 8 feet at the eastern end of the summit-level, and one of 10 feet at the western end, the difference, 2 feet, being given to the declivity between the two locks. The canal is 96 miles in length, 60 feet wide at the surface, 34 feet at bottom, and 6 feet deep. The 17 locks are 110 × 18 feet, designed for boats carrying 100 to 150 tons.

There are five feeders of the aggregate length of 25 miles, all navigable, and 40 feet wide and 4 feet deep; 4 aqueducts; and 7 dams—two of the last of stone at Joliet, for crossing the river. There are extensive basins at Lockport, Joliet, Du Page, Ottawa, and La Salle; three of these furnishing ample water-power for manufacturing purposes.

Notwithstanding the full provision made for a supply of water by feeders in the original plan, it was found necessary in the modified or raised-level to introduce a further supply upon the summit-level to meet wants which might be produced by droughts. So, in addition to the Calumet and Des Plaines, it was decided to add two pumping-engines (steam) at the eastern terminus of the canal (Bridgeport), of power sufficient to raise any desired quantity of water from the lake-level that might be needed for the summit and for lockages below. As the lift was but 8 feet at an ordinary stage of the lake, the pumping apparatus required was quite simple and not costly. It consisted (finally) of two steam-engines, with the power applied to two wheels of 38 feet diameter, with buckets of 10 feet length or width, called, in England, "scoop-wheels," each wheel working in a stone cell or chamber, independently of each other, and each capable of delivering 15,000 cubic feet per minute upon the summit-level. The entire cost of these two machines, with all the necessary buildings and appendages, was about $55,000, and these were continued in use every year, except the year 1855, from 1848 to 1870, inclusive. In connection with this brief account of these useful auxiliaries for purposes of the canal, they became indispensable to the city of Chicago at an early day for sanitary purposes. That is to say, the drainage and sewage of the city were discharged into the Chicago River for a distance of five or six miles, their only outlet being to the lake through the same river. Now, with the wind in a certain direction, the water of the river could not find its way into the lake; on the contrary, it was forced back towards the interior, and if long continued the effect upon the atmosphere was simply dreadful. To obviate this evil an arrangement was made with the city authorities by which the pumping-engines at Bridgeport were brought into use, thereby withdrawing the foul water from the river, emptying it into the summit-level of the canal, and as a consequence substituting the pure water from the lake for refilling the river. At a later day, when the drainage question became vital, the city of Chicago in the year 1865 obtained an act from the legislature providing for the completion of the Illinois and Michigan Canal upon the plan adopted by the State in 1836. Under the authority of that act the original or through-cut plan was carried out—an operation requiring about four years in time and an expenditure of some $3,000,000; but the great object was secured—drainage for the city; for all that part of it, at least, which lies upon the S. side of the river, and on the S. branch, is carried through the canal to the Des Plaines River, and there discharged. Other means have been proposed, it is understood, for cleansing and purifying the N. branch, and, it is to be hoped, with like good results.

In connection with the Illinois and Michigan Canal, the improvement of the Illinois River by a system of locks and dams has been inaugurated by the State of Illinois, with some moneyed assistance from the general government. This river, for its very moderate fall, some 45 feet only from La Salle (outlet of the canal) to its mouth, a distance of 213 miles, is wonderfully well adapted to improvement by locks and dams, not more than seven, perhaps, being necessary to furnish an unbroken navigation from Chicago to the Mississippi River.

The following schedule exhibits the entire amount of money received and expended by the board of trustees of the Illinois and Michigan Canal from the organization of the trust in June, 1845, to Nov. 23, 1870—23 years:

Classification.	Receipts.	Expenditures.
Loan of $1,600,000, principal and interest	$1,601,891.90	$2,153,771.31
Construction of canal, feeders, etc	2,132.25	1,429,606.21
Canal-lands, sales, protection, etc	4,698,320.02	115,023.23
Arrears of interest on registered bonds	....	2,155,622.38
Principal of registered bonds	....	2,113,840.34
Maintenance and repairs of canal and feeders	111,003.97	1,828,802.05
Tolls, collections, inspections and salaries	4,385,675.77	157,895.17
Canal damages, flowage, etc	....	22,163.32
General expenses and contingencies	3	415,507.71
Premium on gold for dividends on bonds payable in London	923.27	362,303.25
Interest and exchange	179,911.00	21,073.80
Losses on "Wildcat" currency, counterfeit bills, broken banks, etc., 1848 to 1863, inclusive	....	14,563.52
Balance in hands of treasurer Nov. 30, 1870	....	189,688.89
Total	$10,979,861.18	$10,979,861.18

By analyzing the figures in this table the cost of maintenance, repairs, and renewals of the canal and all its works, its feeders, pumping-engines, etc., for a long series of years, can be usefully exhibited, to wit: 96 miles canal proper; 25 miles navigable feeders; 2 pumping-engines, with necessary adjuncts of every description; the cost per mile per annum was $616, the gross sum expended therefor having been $1,717,800. The canal reverted to the State of Illinois in 1871, the registered canal bonds, principal and interest, and the loan of $1,600,000, principal and interest, having been paid by the trustees under the terms of the contract with the State. The amount of the first was $4,631,765, and of the last, $2,153,771; total of both, $6,785,537. Since May, 1871, the canal has been controlled and worked by three commissioners appointed for that purpose by the legislature of the State. W. H. Swift.

Illinois Indians, a confederacy of tribes, including the Cahokia, Peoria, Kaskaskia, Tamaroa, and Moingwena Indians, who were Algonkins, and the Michigameas, probably of Dakota race. Their principal territories were in what is now Illinois, but they also occupied lands W. of the Mississippi. They were faithful allies of the French, and were often at war with the non-Algonkin tribes and with the Sacs and Foxes. At present there are a few relics of these once powerful tribes living in the Indian Territory. The name Illinois means "superior people," according to Gallatin.

Illinois Industrial University, at Urbana, county-seat of Champaign co., Central Illinois. It was the first college established under the laws of Congress of July, 1861, and July, 1866, and under acts of the legislature of Illinois bearing date Jan. 25, Feb. 28, and Mar. 8, 1867, "to teach in the most thorough manner such branches of learning as are related to agriculture and the mechanic arts, including military tactics, and not excluding other scientific or literary studies." The Congressional land-grant amounted to 480,000 acres, which was sold as scrip and the proceeds invested in interest-bearing bonds, except 25,000 acres, which were located in Nebraska and Minnesota, and are held by the university. The county of Champaign made a donation of $450,000 in buildings, lands, and farms. The State of Illinois has for several definite purposes contributed nearly $300,000. The assets of the university are nearly $1,000,000, with a regular income of about $40,000. The main university building is 214 feet in length, with two wings extending 124 feet to the rear, 3 stories high, with basement and mansards. It has one fireproof wing, with a library of nearly 10,000 volumes, a large cabinet of geological, zoological, and other specimens, and a physical laboratory; in the other parts of the building lecture and recitation rooms for 1000 students, a large chapel, society rooms, etc. The old university building contains a large chemical laboratory, with desks for nearly 100 students, chemical library, cabinet of apparatus and mineral specimens, and dormitories for about 250 students. The mechanical and military hall (128×80, two stories high with turrets) contains the mechanical and carpenter shops, iron and wood working machinery, a 20-horse-power engine of the university make, mechanical cabinet, pattern and paint room, foundry, etc. The upper story is one large drill-hall, with armories and artillery-rooms in towers. There is a farm of 410 acres, with large barn and farmhouse, collection of agricultural implements, specimen herds of Durham, Ayrshire, Herefordshire, Devon, and Jersey cattle, Berkshire and Essex swine, Southdown sheep, etc. The horticultural and experimental farms, 200 acres, with specimen orchard of 3000 fruit trees, large nurseries, forest plantation, experimental plots, farmhouse, large barn, and greenhouses. The university was opened in 1869; in 1871 women were admitted, and the attendance was as follows: 1869, 78; 1870, 196; 1871 (254 men, 23 women), 277; 1872 (308 men, 53 women), 361; 1873 (338 men, 76 women), 414.

The plan of instruction in this institution is quite broad and comprehensive, and is divided into the following colleges and schools: (1) College of agriculture and horticulture; (2) college of civil, mechanical, and mining engineering and architecture; (3) college of natural sciences, chemistry, and natural history; (4) college of literature and art; (5) school of commerce; (6) school of military science; (7) school of domestic science (for women). Dr. J. M. Gregory is regent of the university; the faculty consists of 13 professors, 9 assistants, and 6 foremen in the practical departments. The management of affairs is in the hands of a board of trustees of 9 members, who elect their president. They are appointed by the governor of the State, who himself, with the president of the State Agricultural Society, is an ex-officio member. This university is forbidden by State law to confer degrees, but gives certificates of scholarship, with record of all studies pursued, and standing attained in each. S. W. Shattuck.

Illinois River, the largest stream in Illinois, nearly bisects that State. It is formed by the junction of the Des Plaines and Kankakee rivers, and flows S. W., traversing Peoria Lake, and reaches the Mississippi River 20 miles above the mouth of the Missouri. It is navigable 245 miles by steamers, and, with the canal from Chicago to La Salle, affords an all-water route from the Mississippi to Lake Michigan. Its channel is to be dredged to the minimum depth of four feet.

Illiop'olis, tp. and post-v. of Sangamon co., Ill., on the Toledo Wabash and Western R. R., 22 miles E. of Springfield. Pop. of v. 395; of tp. 1829.

Illuminated Manuscripts were very common among the Egyptians, who employed many colored figures, generally red; and the art of illuminating manuscripts was probably practised by all nations of antiquity in which papyrus and parchment were used. It has been denied that the ancient Romans illuminated their manuscripts, but passages in Ovid and Pliny fully indicate that some works were highly ornamented and illustrated. Byzantine and Italian illuminations are no doubt simple developments of an ancient classic art. Both styles are gorgeous with gold and bright colors, and deal very freely in old Greek and Roman architectural ornaments. Quite independent of classic art an original style of illuminating manuscripts sprang up in Great Britain, especially in Ireland, whence it was carried abroad by Irish monks, adopted in the schools founded by Charlemagne, and spread all over Europe. There is doubt as to whether the elaborately intertwined knotwork, generally called Runic, is purely of Irish origin, but there can be none that the most elegant applications of it were Hiberno-Saxon. Of these works Mr. Digby Wyatt remarks, that in delicacy of handling and minute but faultless execution the whole range of palæography offers nothing comparable; a detailed description is found in Owen Jones's *Grammar of Ornament.* With the invention and general introduction of the printing-press the art of illumination vanished from Europe, but the Persians, Arabs, Turks, and Chinese still produce very delicately and beautifully illuminated works, charming as regards industry and grace, but inferior to the European with respect to strength and character. C. G. Leland.

Illumina'ti [from the Lat. *illuminatus*, "those who are enlightened"]. From early times, both in Asia and Europe, the mystics and theosophists of different religions, believing that by abstraction and devotion to God a divine light was shed on the soul, have called themselves Illuminati, or the Illuminated, in one language or another. Among these were disciples of Jacob Böhme, Swedenborg, and many others of the seventeenth and eighteenth centuries. About 100 years ago, when the most radical theories as to government, religion, and morals were inspiring all Europe, two ideas became prevalent—the one of a skeptical philosophy, which taught men that they were free to do as they pleased; and the other of occult philosophy, by which they learned that they might become whatever they would. At this time Adam Weishaupt, a professor of Ecclesiastical law in Ingolstadt, inspired partly by hatred of the Jesuits, with whom he had some personal quarrel, and instructed by certain passages in the works of Bode, a professor in Frankfort, conceived the idea of a secret society which should unite all mankind in brotherly union, introduce justice, abolish all abuses resulting from priestcraft and aristocracy, extend education, surround kings with wise counsellors, and in short reform society. This union founded, it is said, May 1, 1776, received at first for its members the name of Perfectibilists, and then Illuminati. A mystical and magical order, called the Illumines of Avignon, had been already founded in 1760 by Pernety and Grabianca. It does not appear that Weishaupt inclined to magic or Rosicrucianism; in fact, his quarrel with the Rose-Croix Freemasons indicates the contrary. But his disciples were strongly imbued with these fancies. Beginning with his students, Weishaupt made rapid progress. Within three years he had lodges in Germany, Holland, and Italy, and thousands of *adepti.* The grades of initiation were those of novice, minerval, illuminatus minor and major, Scotch knight, epope or priest, regent or prince illuminatus, magus, and king. As in all mysteries of old, Weishaupt led his pupils through different grades of free thought up to complete "emancipation." A noted writer, Baron Adolph Franz Fried. Ludwig von Knigge, joined the order, and through his influence it rapidly increased. Weishaupt, who was a weak man, could not refrain from expressing to his neophytes his advanced opinions, and, moved by fear or jealousy, quarrelled with Knigge. This resulted in complete exposure, and works appeared revealing all the secrets of the order. On Jan. 22, 1784, an edict was issued for its suppression in Bavaria. Weishaupt was dismissed from the university, and retired

to Ratisbon and Halle, where he d. 1830, aged eighty-three. He had used German Masonry to forward his views, having been in advance of it as regards political radicalism; French Freemasonry in its turn borrowed largely from Illuminéeism, the latter being introduced into the seven Masonic lodges of Paris by Bode, who became chief of the order after Weishaupt lost his influence. It is said that Illuminati still exist; if so, they are probably to be found in the ranks of the Communists. The name Illuminati belongs rightly to the QUIETISTS and MYSTICS (which see), who existed in one form or the other under this name since the earliest age of Christianity, but at present the word is popularly understood as applicable only to Weishaupt's order. (For works on this subject see l'Abbé Barruel, *Memoirs;* Prof. John Robison, *Proofs of a Conspiracy,* etc., Edinburgh, 1797; *Proofs of the Existence of Illuminism* (an abstract of the works of Barruel and Robison), by Seth Payson, Charleston (America), 1802. These works, however, are so prejudiced as to be of little real value to any save the most impartial reader. Also, Larousse, *Dict. Universelle,* article "Illuminées," and an article by the writer on the same in the *Princeton-Nassau Monthly* 1842.)

CHARLES G. LELAND.

Illumination. See ILLUMINATED MANUSCRIPTS, by CHARLES G. LELAND, A. M.

Illus'trated Publica'tions are those which combine engravings and graphic figures with letter-press. The oldest form of book-illustration, that by wood-engravings, is still, on the whole, the best. During the eighteenth century, and still earlier, copper-plate engravings were frequent in books, but had to be separately printed. Aquatint came next into favor, but was open to the same objection. Finally, wood-cuts have been restored to favor, and in the hands of the best engravers have fairly surpassed, for illustrative purposes, anything ever done by the old masters of the art. Of late, photography, photozincography, photolithography, nature-printing, and a variety of other transfer processes have been considerably employed, and are valuable for special uses, but there is no process yet devised that is likely to supersede wood-engraving.

Illyr'ia, tp. of Fayette co., Ia. Pop. 851.

Illyr'icum, or **Illyria,** a name which now has no geographical or political signification, but which at different epochs has denoted important provinces of different empires. It was in ancient times inhabited by a fierce, warlike, and savage tribe, allied to the Thracians and addicted to robbery and piracy. The eastern portion of the country, corresponding nearly to the modern Albania, was conquered in 356 B. C. by Philip of Macedon, and annexed to Macedonia. The western portion, comprising the modern Dalmatia, Croatia, Herzegovina, and parts of Bosnia, remained independent till the middle of the last century before the Christian era, when it was conquered by the Romans and made a Roman province. At the division of the Roman empire both Illyris Græca and Illyris Romana fell to the Eastern empire, but the Slavic tribes which had settled in Illyris Romana soon made themselves independent. During the Middle Ages Illyricum was divided between the Venetians, the Hungarians, and the Turks, and the name fell out of use until Napoleon in 1809 organized the Illyrian provinces, consisting of Carinthia, Carniola, Dalmatia, Istria, and parts of Croatia, and incorporated them with France. In 1815 these provinces were formed into a kingdom and annexed to Austria. The kingdom has since been dissolved, and for administrative purposes divided into provinces, but the territories are still Austrian possessions.

Ilmen', a lake of North-western Russia, in the government of Novgorod. It is 30 miles long by 24 broad, and very rich in fish, but unfit for navigation on account of its storminess. The Volchow connects it with the Lake of Ladoga.

Il'menite, titaniferous iron. See TITANATES.

Ilme'nium [from *Ilmen,* a range of mountains in Siberia, where the ore is found], a supposed element announced by Hermann, regarded by Rose as impure niobium (columbium).

Ilopan'go, a lake of Central America, in the republic of San Salvador, bordering on the departments of La Paz, San Salvador, and Cuscatlan, is situated in the centre of a very fertile, well-populated, and well-cultivated plain, and celebrated for its beauty.

Im'age-wor'ship, or **Iconolatry,** as distinguished from idolatry, is the adoration of images or extreme honor paid to them by the Roman Catholic Church. According to ancient legends, images of Christ are as old as Christianity; St. Luke, say they, left portraits both of his divine Master and of the Virgin Mary; our Lord himself gave to St. Veronica a handkerchief upon which his face was miraculously impressed; the woman who was healed by touching his garment (Mark v. 25) set up his statue at Cæsarea-Philippi. Some Greek controversialists, whose assertion is supported by Baronius, affirm that a council of Antioch in apostolic times sanctioned the worship of images; but most authorities, both Catholic and Protestant, agree that they were little, if at all, used during the first three centuries after Christ; and the correctness of this opinion is borne out by the silence of heathens on the subject. They were frequently reproached by the early Christians with adoring lifeless gods, yet we read of no instance in which they recriminated; nor during the last persecution, when Christian churches were plundered, were any images seized in them. The Council of Elvira, about A. D. 300, decreed that pictures were not to be in a church, lest they should become objects of worship. In the same century Epiphanius, bishop of Cyprus, having found before the door of a certain church in Palestine a veil or curtain whereon was a picture of Christ, tore it down, and sent a plain one to be used in its stead. St. Augustine disapproved of images, which evidently were worshipped in his time. "I have known," he says, "many adorers of tombs and pictures" . . . whom "the Catholic Church condemns and daily studies to correct as froward children." The pictures of living persons were frequently put in churches. That of Paulinus, bishop of Nola, was during his lifetime placed in the church built by Severus. Paulinus caused the basilica of St. Felix to be adorned with paintings of Bible stories, that the peasants who assembled there might have their minds occupied with sacred subjects. In the sixth century, Serenus, bishop of Marseilles, seeing that his people gave undue honor to images, caused those in his diocese to be defaced or broken. For this deed, which offended many persons, he was censured by Gregory the Great, who, however, praised his zeal against the worship of things made by hands. From this time image-worship greatly increased, and in the eighth century disputes respecting it caused that great schism (see ICONOCLAST) which separated the Western from the Eastern empire. The decrees of the Council of Nicæa (A. D. 787) were rejected by nearly all Western nations, who, while adorning their churches with images, refused to worship them, and this decision was confirmed by the Councils of Frankfort (794), of Paris (825), and of Aix-la-Chapelle (829). But iconolatry spread by degrees through the whole of Europe. Miracles were attributed to a particular picture or statue, around which flocked crowds of worshippers bringing rich offerings to the church wherein it was placed. This preference for some special image—a remnant, doubtless, of the old pagans' tutelary idolatry—was discouraged by many wise ecclesiastics and condemned by the Council of Mayence (1549), which decreed that such objects of peculiar devotion should be removed from churches. The doctrine, still held by enlightened Roman Catholics, that images are mere reminders of Christ and the saints, was set forth by the Councils of Poissy (1561) and of Trent (1563, sess. 25); the latter insisted that such representations are to receive due veneration, not on account of any divinity or virtue in themselves, but because honor is thus reflected on those whom they represent. This same doctrine is very clearly explained by N. Sanders, a divine of the seventeenth century.

Both pictures and statues are used in the Roman Catholic Church. The Greek Church forbids statues, but this prohibition is comparatively modern, for one of the Virgin was placed by the emperor Johannes Zemisces (A. D. 970) in the metropolitan church, and was honored as the palladium of the state. And in the eleventh century Alexis Comnenus, needing money, caused many gold and silver images to be taken from the churches and made into coin, which act Leo, bishop of Chalcedon, denounced as sacrilege. At the Reformation, images were condemned by Zwinglius and Calvin, but Luther regarded them as unimportant ornaments, useful for instructing the people; and his followers still admit them into their places of worship. They are forbidden by the Church of England, though some of the more advanced Ritualists defend their use.

Even after image-worship was sanctioned by the popes, it was forbidden to delineate God the Father. This may be attributed partly to the influence of Gnostic theories, partly to a fear lest the idea of Jupiter should be recalled. Paulinus describes a painting where the Father is represented by a voice:

> "Pleno coruscat Trinitas mysterio:
> Stat Christus agno; vox Patris cœlo tona
> Et per columbam Spiritus Sanctus fluit."

At a later period God the Father was represented by a hand extended from clouds, generally in the attitude of blessing. After the twelfth century he was depicted as a venerable man, frequently wearing royal or papal attire. Christ was at first represented as a lamb or a lion; afterwards as a man, generally of great beauty. A dove has

always been emblematical of the Holy Ghost; in the twelfth century artists began to depict him as a human being, sometimes very young, but more commonly of mature age. The cross is not merely a symbol of Christ's death, but in itself is an object of veneration. It is personified, as it were, and the details of its history are given. It has been made the subject of many poems, especially by Rabanus Maurus, bishop of Mentz. Saints and martyrs are represented with certain appropriate emblems, for details of which see Didron's *Iconographie Chrétienne;* Mrs. Jameson's *Sacred and Legendary Art*, etc. JANET TUCKEY.

Imag'inaries (in mathematics). It is a very remarkable and important attribute of all *symbols* that, while absolutely essential aids not only to reasoning, but to the very expression of thought, they ever refuse to limit their meaning to the particular idea for the expression of which they were invented. From mere *aids*, they become not only provocatives of thought, but, as it were, revealers of new fields of investigation. Thus, the symbol of *subtraction*, from being the mere sign of a simple arithmetical operation, has become incentive to, and symbolic of, the most transcendental of mathematical conceptions.

If, passing from arithmetic to algebra (or *universal* arithmetic), we symbolize magnitudes by letters a and b, and the operation of subtraction by the minus sign, the *expression* $a-b$ is symbolic both of the operation performed and of the result of the operation. So long as b is less than a, the symbolism, without any stretch of meaning, is complete and simple. But what if b exceed a? Since the given magnitude can yield to the process of subtraction no more than itself, what can $a-b$ (b exceeding a) indicate *but* an *impossibility?* If we commence with considering hypothetical values of b less than a, and go on increasing them, the remainders become smaller and smaller, and finally ($b=a$) becomes zero (or *nothing*), reaching the absolute limit of magnitude, considered *as such merely*. A quantity less than nothing is simply an "impossibility," or a contradiction in terms. Nevertheless, so long as our subtraction is algebraic (that is, merely *symbolic*), and the quantities a and b are indeterminate—that is to say, representatives of any pairs of single values we may have cause to assign—we operate algebraically upon the expression $a-b$ without concerning ourselves with their relative magnitude; and if we obtain a negative quantity as the final result of our operations, instead of regarding it as imaginary, or involving in the problem data of *impossible* fulfilment, we evade this by an interpretation which involves considerations other than those of pure magnitude. The geometrical idea of *direction* is one of the most common of these. If a and b be supposed to represent linear extension (which is but one of many notions of *magnitude*), $a+b$ must represent a length equal to the sum of the respective lengths. But if a be a distance measured *in given direction* from a given point, the adding of another distance implies the laying off of the distance b from the extreme limit reached by a *in the same direction;* the subtracting will therefore imply the *reverse* direction; and if b exceed a, the excess will extend in this reverse direction beyond the starting-point of the distance a. Thus, we have the negative result $a-b$ *interpreted* as a distance equal to the absolute difference, but laid off as a distance in the *reverse direction.*

Now, it appears that if we multiply together algebraical or numerical expressions made up of several terms connected by the signs of addition and subtraction, $+$ and $-$, the individual products resulting from the combination of terms of multiplier and multiplicand having like signs must receive the plus sign; of unlike signs, the *minus* sign. Hence, the "rule of signs" of multiplication and division. But what meaning can we attach to *multiplying* $-a$ by $-b$, or (reverting to numbers) -4 by -5? The sign $-$ was invented simply to indicate *subtraction* without ulterior reference; its existence, therefore, implies a *minuend* as much as it does a *subtrahend*. We have already encountered the difficulty of assigning meaning to the isolated expression $-b$, and now we have another logical problem; we have to use the negative sign as an integral part of a *multiplier—i. e.* to determine how it shall operate in an "operation" quite alien to the idea of that particular one to express which it was invented. Algebraists appreciate very well the *rationale* of the (before-mentioned) "rule of signs," and we need not dwell upon it. It is a logical necessity of our agreeing to accept $a-b$ as symbolizing both the operation of subtraction and the remainder, without regard to (still undetermined, perhaps) relative values of a and b. We have shown how the "impossibility" of a "negative" quantity disappears when we call in besides the ideas of pure physical *magnitude* some of its *attributes*, such as that of *direction*. A negative dimension must be interpreted as one laid off in the *reverse direction* to that attributed to the positive one; *i. e.* the negative sign *reverses direction*. This was arrived at without reference to multiplication; we now see that it is in perfect accordance with the logic of the latter algebraic operation. If multiplying by $+1$, one be understood as taking the multiplicand *once, just as it is*, multiplying by -1 must be understood as reversing its *direction*. Logical as all this is in its *geometrical* interpretations, we must still remember that we have, in inventing a universal *arithmetic*, departed very far from the simple meanings we assigned to the "operations" of common arithmetic. To "multiply" any thing, or any magnitude, or any number, is to take or "repeat" the thing, magnitude, or number a specified *number of times*. Hence, multiplying *by* anything but an arithmetical *number* is unmeaning; still more unintelligible (abstractly) would be multiplying by something *itself less than nothing*. It very soon appears, however, that we cannot make an algebra without conceding wider meaning to its symbols; and in fact they have an inexorable logic of their own which *forces* such extension of meaning.

Since, by the rule of signs, a negative quantity multiplied by itself produces a positive product, we have no means of representing *the square root of a negative quantity* except by indicating upon it the operation itself. The square root of a^2 can be written either as $+a$ or $-a$; but for the square root $-a^2$ we have no alternative but to write $(-a^2)^{\frac{1}{2}}$, or $\sqrt{-a^2}$; or, separating $-a^2$ into two factors, a^2 and -1, to *perform* the operation on the first and indicate it on the second, -1; thus $a\sqrt{-1}$. Hence, the symbol $\sqrt{-1}$ is the symbol of "impossibility," or, as more commonly known, the symbol of an "imaginary quantity." Why? Because we *cannot interpret* it by any real representation of magnitude associated or not with other attributes? We have seen how the absurdity of *quantity less than nothing* was evaded (geometrically) by associating the idea of *direction*. Now, if we multiply a, considered as a line laid off *to the right*, by $\sqrt{-1}$, the analytic product is $a\sqrt{-1}$; multiply again, and the second product is $-a$; *i. e.* we have, by two successive operations, *reversed the direction*, as if we had revolved the length a about its starting-point through a semicircle. Is it not, therefore, perfectly logical to consider *one* operation of the $\sqrt{-1}$ to be *half this* rotation—*i. e.* that $a\sqrt{-1}$ shall indicate the length laid off in the direction *perpendicular to* the direction chosen for a?

So long as we deal with dimensions of *length* only, and interpret these, when real, geometrically by one single line of real direction, this interpretation of $\sqrt{-1}$ is logical and consistent. If we concede that the application $\sqrt{-1}$ be interpreted as indicating a direction perpendicular thereto, and furthermore that the sum of $a+b\sqrt{-1}$ be the distance *accomplished* from the origin, after traversing the distance a in the fixed direction, and then the distance b in a direction perpendicular thereto, and call this accomplished distance ρ (involving also the conception *of its direction*), and call the *linear* distance r, we shall have $\rho=(a+b\sqrt{-1})$. Let θ be the angle which ρ makes with the direction of a; then the foregoing is equivalent to $\rho=r(\cos\theta+\sin\theta\sqrt{-1})$. If, by Taylor's theorem, $e^{\theta\sqrt{-1}}$ be developed (e being the Naperian logarithmic base) into $1+\theta\sqrt{-1}-\frac{\theta^2}{2}-\frac{\theta^3}{2.3}\sqrt{-1}+\frac{\theta^4}{2.3.4}$, etc., we shall find two sets of terms—one real, and the other having $\sqrt{-1}$ as a factor; the sum of the first set makes up the algebraic development of $\cos\theta$; the sum of the others that of $\sin\theta\sqrt{-1}$; hence, the equation, which is the connecting bond between *exponentials* and *circular functions* (the so-called "transcendentals"),

$$e^{\theta\sqrt{-1}}=\cos\theta+\sin\theta\sqrt{-1}. \qquad (1)$$

Hence also

$$r(\cos\theta+\sin\theta\sqrt{-1})=re^{\theta\sqrt{-1}}=\rho.$$

We must therefore interpret $e^{\theta\sqrt{-1}}$ as the symbol of rotation through the angle θ; and as θ may be any angle whatever, it readily follows from (1) that

$$\cos\frac{1}{n}\theta+\sin\frac{1}{n}\theta\sqrt{-1}=(\cos\theta+\sin\theta\sqrt{-1})^{\frac{1}{n}} \qquad (2)$$

a result well known as "De Moivre's theorem."

The conception of *multiple roots* of unity—the assumption of their necessary existence—is a *secondary* one; and the conception and the assumption come not from the nature of things, but as corollaries of the logic of our symbolism. The idea of "powers" and "roots" is based on *numbers*; nothing can, in the strict and *original* meaning of multiplication, multiply itself *by itself*, but a number. Hence, there is no other root of unity *but unity*. Our algebraical symbolism has carried with it an extension of the idea of multiplication, and has created a "rule of signs" by which we have come to regard -1 also as a real root.

For the idea of *still more* "roots"—of roots in number equal to the degree—*that* comes from other considerations. If we multiply together n factors of the form $x-a$, $x-b$, $x-c$, etc., we obtain an *analytical expression* of the nth degree in x of the form

$x^n + (a+b+c, \text{etc.})\,x^{n-1} + (ab+ac+bc+, \text{etc.})\,x^{n-2} - (abc+, \text{etc.}),\ x^{n-3}, \text{etc.} \ldots \pm abcd. \ldots$

A superficial examination will show the law by which the coefficients of the different powers of x are formed from the n symbols a, b, c, etc.; that the independent term is (abstraction made of *signs*) the *product of them all.* Conversely, given an expression of the nth degree,

$$x^n + Ax^{n-1} + Bx^{n-2} \ldots + Q,$$

it should be resolvable into factors $x-a$, $x-b$, etc., of which the a, b, c, etc. would be determinable in terms of the n *given* coefficients $A, B, C \ldots$ and Q; just as, *given*, a, b, c, etc., we have the values of

$$A = -(a+b+c+d, \text{etc.}),$$
$$B = +(ab+bc+ac, \text{etc.}),$$
$$Q = \pm(abcd \ldots);$$

so we should, conversely, have n different expressions for a, b, c, etc., as *analytical combinations of* $A, B \ldots Q$: combinations which have no reference to $A, B \ldots$ etc., as representations of *magnitude* or *quantitative* value (to which, indeed, we have made no reference), but which should result from certain *laws of analytical combination.* For all analytical expressions of the 2d, 3d, and 4th degrees, and, exceptionally, for some cases of the higher degree, we *know* these combinations;* but whether we know them or not, they are *supposed to be* determinable, and in the sense of *symbolic determinations* they would, if found, all be real. Thus, for the 2d degree we would have

$$a = -\tfrac{1}{2}A + \sqrt{\tfrac{1}{4}A^2 - Q},$$
(3)
$$b = -\tfrac{1}{2}A - \sqrt{\tfrac{1}{4}A^2 - Q}.$$

These are the *two* analytical or symbolic *roots* (as they may properly be called). Substituted for a and b in the factors $x-a$, $x-b$, their product becomes $x^2 + Ax + Q$, (the given expression); and in like manner we should obtain $x^n + Ax^{n-1} + Bx^{n-2} \ldots + Q$, had we the n corresponding *expressions* for a, b, c, etc. If, now, we pass to *quantitative* considerations, and ask for *values* of x which shall render the above expression "equal to zero," we recognize that the very "roots" we have obtained are the symbols of such values. Does it follow, therefore, that there are n different *quantitative* values for x? By no means.

If it turns out, on coming to assign values (that is, on converting our symbols into specific magnitudes) that Q is greater than $\frac{1}{4}A^2$ (in our expression of the 2d degree), *then* the *difference* (which we may call D) must have the minus sign, and the symbol of *impossibility* $\sqrt{-1}$ makes its appearance, and we have

$$a = -\tfrac{1}{2}A \pm \sqrt{-D}, = -\tfrac{1}{2}A \pm D\sqrt{-1};$$

by which we learn that the *particular* conditions cannot be fulfilled by any linear magnitude; but all this is an after consideration. The roots are "imaginary" because we cannot assign any idea of "quantity" or "magnitude" to them. But the two symbolic roots (3) are the *real solutions* of the equation, nevertheless. And did we *know how* to combine $A, B \ldots Q$, etc. for the equation of the nth degree, we should have n symbolic expressions for $a, b, c, d \ldots$ the *reality* of which (as distinguished from "imaginary") is entirely a subordinate question; as analytical or symbolical expressions they would be always the same, and *always real.* If we deal directly with *numbers* in place of the *letters* A, B, C, etc., the positive or negative character of quantities under the radical sign are indeed forced into notice at once. Nevertheless, it is supposed that the symbolic combinations which satisfy the conditions—whether we choose to call them *real* or not—*must exist.* Hence, the expression $x^n - 1 = 0$ (a particular case in which A, B, C, etc. are each zero, and $Q = -1$) should be resolvable into symbolic factors, n, in number. It is in this sense that we assert that the number of "roots of unity" must equal the index of the degree of extraction. Analysts have not been able to *discover* the symbolic forms of the roots of the general equation of the nth degree. Nor have they been able to solve *directly* the particular form $x^n - 1 = 0$. They know, however, that had they the *general solutions* for a, b, c, etc. in terms of $A, B, C, \ldots Q$, by making in them $Q = -1$ and A, B, C, etc. zero, they would obtain n different symbolic expressions, each of which would have unity for its nth power; and, moreover, they would have $Q = (-1)$ for their product, and A (zero) for their sum, and B (zero) for sum of products taken two and two, etc. Inasmuch as none of them can be zero, and no combination of $+1$ and -1 can meet these conditions, the sole remaining symbol (for *all* even degrees of extraction resolve into this) $\sqrt{-1}$ must enter; and the roots containing it must be *in pairs* involving like terms multiplied by it with contrary signs, so that the sum of them all (which constitutes the coefficient A), and the sum, in pairs (which constitutes B), etc., shall all be zero.

But such *general* analytic combinations have never been arrived at (except for a few of the lower degrees) by algebraic solution. The real *symbolic* relation between exponentials and circular functions indicated by De Moivre's theorem (already given) led to the discovery of the roots of the particular form $x^n - 1$.

Suppose θ to be zero or 2π, or any even multiple $2m$ of π; the second member of (2) becomes $1^{\frac{1}{n}}$, while the first member $\cos\frac{2m}{n}\pi + \sin\frac{2m}{n}\pi\sqrt{-1}$. For $1^{\frac{1}{n}}$, therefore, we get as many symbolic expressions for the nth root of unity as we can give different forms to the first member by assigning to m values from zero to n. If, *e. g.*, we take 12 for the value of n, we have the twelve roots, grouping them in pairs (since $\cos 30° = \cos 330°$ and $\sin 30° = -\sin 330°$, etc.).

$$\cos\ 0° \pm \sin\ 0° \sqrt{-1} = +1,$$
$$\cos\ 30° \pm \sin\ 30° \sqrt{-1} = \tfrac{1}{2}\sqrt{3} \pm \tfrac{1}{2}\sqrt{-1},$$
$$\cos\ 60° \pm \sin\ 60° \sqrt{-1} = \tfrac{1}{2} \pm \sqrt{3}\sqrt{-1},$$
$$\cos\ 90° \pm \sin\ 90° \sqrt{-1} = \pm\sqrt{-1},$$
$$\cos 120° \pm \sin 120° \sqrt{-1} = \tfrac{1}{2} \pm \sqrt{3}\sqrt{-1},$$
$$\cos 150° \pm \sin 150° \sqrt{-1} = \sqrt{3} \pm \sqrt{-1},$$
$$\cos 180° \pm \sin 180° \sqrt{-1} = -1.$$

In the sense of being *symbolic* solutions, these expressions are truly and perfectly such, and therefore completely *real.* We see also how curiously these solutions lend themselves to interpretation—almost flow from—the geometrical interpretation of *direction*, or the mechanical one of *rotation.* Each one of these roots, thus *interpreted*, indicates a unity-line, or radius, rotated from the normal $+1$ direction through an angle which, *twelve times repeated*, restores that radius *to* that normal position.

For many fields of investigation this wholly logical interpretation of $\sqrt{-1}$, or modifications of it, is fruitful of results. Applied to the study of certain functions of a *single variable* (that is, of a single geometrical dimension), it led to the discovery by Abel of *double periodicity* in certain important and well-known functions, the theory of which, as developed by Cauchy, has led to results of great importance. From what goes before, it need excite no surprise that the consideration of imaginaries—so called—has played so important a part as it has done in the theory of equations, and it seems destined to equal potency in developing the theory of functions. "But," say the authors † of the *Theorie des fonctions doublement périodique*, "to comprehend the importance of this idea we must do away with the sort of antagonism or opposition which has been permitted to subsist between what, up to the present time, have been called *real* and *imaginary* quantities."

Would it not be more correct to say that when we resort to symbols as aids to reasoning, we should dismiss the idea of *quantity* (to which, after all, we attach no very precise notions, blending in various ways the fundamental notions of *magnitude* and *number* with sundry incidentals thereto), and simply accept all the forms which under the laws of symbolization make their appearance, as real; at least so long as they are merely serving their purpose as aids to reasoning. There should then never have been a doubt concerning the legitimacy and truth of solutions obtained through agencies or intervention of the so-called imaginaries.

In thus claiming reality for the imaginary forms as legitimate symbolic instruments of investigation, it is not to be understood that, though geometrical interpretations have been found for imaginary expressions where only linear dimension is concerned, *all* imaginary forms are susceptible of or *need* other interpretation than that of "impossibility."

The Cartesian equations of the circle and the right line involve *two* dimensions of space measured by a common linear unit. We cannot, therefore, use either as a *direction* indicated by $\sqrt{-1}$. If we eliminate between them the symbol representing one of these dimensions (y, for instance), we have an "equation" of the 2d degree in x, the two roots of which are those values of x for which y is the

* It is curiously illustrative that for the case of three real roots for equations of the third degree, these combinations are so purely *analytical* that they cannot be interpreted as expressions of magnitude.

† Briot et Bouquet (Paris, 1859).

same in the two equations: in other words and geometrically speaking, the two roots correspond to the abscissæ of the two intersections of the line with the circle.

If the perpendicular distance of the line from the centre exceed the radius of the circle, there can be no *intersection;* but this is a matter which results from assigning definite values to the symbols by which these relations are determined. Hence, these *analytical roots* must always exist under forms irrespective of such assignment, and *whether there be intersection or not.* If there be no intersection, there can be no linear value of x, answering as an interpretation of the result; if there were, it would be in direct conflict with the geometrical fact, and prove our symbolic logic wrong. The symbol $\sqrt{-1}$ which first revealed itself as one to which no idea of pure magnitude could be assigned, here comes in very logically (*after* specifying *values*) as the symbol of geometrical impossibility. Both planar directions of space have been appropriated otherwise, so that our former interpretations are excluded, and whether there may or may not be, nevertheless, some logical interpretation, is another question. For such a case that of "impossibility" is wholly sufficient, and the expression of it *necessary.* Nevertheless, the processes of analysis—and this is the point to be insisted on—take no account of the distinction between real and imaginary, so important in pure geometry. If, in the above example, we take the combined figure of circle and intersecting line and deduce certain properties (*e. g.* those concerning *poles* and *polars*), such properties may hold true and be predicated on purely analytical grounds (see Salmon, *Conic Sections*), though there be no real intersections. This principle "of continuity" is but another form of the proposition that the so-called "imaginary" forms of symbols are, in the purely symbolic regions of thought to which they legitimately belong, as *real* as any other symbolic forms.

It has been shown that the notion of "n roots" to every equation of the nth degree is a purely analytical conception, founded upon the assumption that since the A, B, C, etc. of the equation are easily derived from the a, b, c, etc. of the factors $(x-a)$ $(x-b)$, etc., when the latter are known, *the inverse operation must be practicable.* But it is not, and it may be safely asserted, I think, that our algebraic symbols *are not susceptible of the required combinations.* All efforts to find them have failed for equations of higher than the 4th degree. It is reasoned, indeed, that there *must be* certain *functions* of A, B, C to express such real values of x as will satisfy the equation, since these values *depend upon* those of the coefficients. But this is another question; the hypothetically realizable analytical solutions could make no distinction between "real" and "imaginary;" they could differ from one another only by *permutations* of letters and signs, while the distinction of "real" and "imaginary" is an *after* result ensuing in the transition from the general to the particular.* *Values*, indeed (if there be such), which satisfy the equation may be found with all desired accuracy by the tentative and test processes known to the "theory of equations" and "higher algebra," but these are not "roots" in the *analytical* sense. It would, therefore, in the writer's opinion, be quite warrantable to say that, instead of "n roots," there are (in general) *no roots at all* to an equation of the nth degree, where n exceeds *four.* Conceptions due to symbolism, the symbolism which should exhibit them, is, *as yet*, quite as "imaginary" as the so-called "imaginaries" for which I have claimed a logical *raison d'être*, and a reality not only as agents of thought, but as true analytical solutions. That a higher transcendental analysis may *yet* give, in visible form, a "local habitation" to these "airy nothings," is quite possible, and, indeed, is rendered, by the theorem of Cauchy, and by other considerations, quite possible.

J. G. BARNARD.

Imagina'tion [Lat. *imago*, an "image;" *imaginari*, to "imagine"]. An image is simply the representation of anything formed of real substance, but as in early times it generally set forth some being which had only a fancied existence, it soon became the base of a verb signifying not only the voluntary creation in the mind of literal things, but all formation of ideas or representations by modifying and combining conceptions. The first stage is clearly set forth by Glanvil when he says, "Now, our simple apprehension of corporal objects, if present, we call *sense;* if absent, we properly name it *imagination.*" From this root, *imago*, which according to Vossius and Festus is derived from *imitor*, to "imitate" (*ab imitatione dicta*), came several words bearing varied meanings, as, for instance, *imaginosus*, "whimsical, full of strange fancies" and "conceits," and *imaginatus*, "fashioned or formed;" in all of which the English language has unfortunately not only followed the Latin, but even gone beyond it, as when, for instance, we hear "I imagine that you are in the right," instead of "I think" or "believe." The consequence of this weakness, so characteristic of Latin derivatives, has been to burden a few words, all from the same source, with very different meanings, the further result being frequently a great confusion of ideas, even among good writers. According to Addison, all that is pleasurable to the imagination—*i. e.* all that engages its active powers—is reduced to greatness, novelty, and beauty. Thus, the *imaginary* here chiefly involves three of the noblest attractions which can give value to a work, while Blair, on the contrary, uses it to signify simply the worthless. The German word for imagination, *Einbildung* (*i. e.* in- or on-building), is derived from *Bild*, an "image," but is more accurately defined and applied than its English synonym. "It is," says Kant, "the power to bring an image when absent before the perception;" while, according to Fichte, "it is the ability to *image* under the name of imagination." In analyzing the faculty we may first observe that when we recall the image of anything we simply remember, and do not in reality imagine it, though many people would misuse the word in this manner. If we recall the image involuntarily, but in any other relation than its own, we exert, so to speak, a passive imagination. But if we deliberately vary and combine ideas derived through observation or memory into *new* forms and relations, we then exert our active imagination. When the mind devotes its active power to truthful and practical objects, we recognize it as *reason;* when it gratifies simply taste, as for the new, the beautiful, or what is agreeable through association or culture, it acts as the imagination. In reasoning we select from or classify that which already exists or is created; in *imagining* we endeavor with this material to create. Hence, imagination is identified with invention and originality. In verbal expression its chief form is poetry, the identification of which art with original creation is shown in the Greek origin of the word *poesis*, from *poein*, to "make;" also in the Old English word *maker*, a "poet."

Imagination is the guiding power in art, as reason is of science. In pure chemistry, geology, or astronomy the only object is to ascertain what exists. As science becomes technology—*i. e.* applied to specific wants, or creative—it also assumes the character of art. Our reasoning power, it may be said, occupies itself with discovering that which is true, which in turn is the basis of the useful; but imagination ministers chiefly and directly to pleasure. Between reason (or science) and art (or imagination) lies, however, a vast range of the application of skill to the *arts*, by which plural we understand something more practical and useful than art in its higher forms. But as no work of imagination can be successful as to the end in view without an outline of reason, so no rational investigation and no sciences appeal to human sympathy unless they be inspired with that spirit of originality which is akin to imagination. It is not unusual to say of men who write on the driest topics, though they confine themselves strictly to the subject, that they are *genial*—meaning that they manifest the keen and active interest caused by genius, and are quick to perceive and set forth what is new. Such minds are those in which imagination is active and makes itself felt, even while strictly reasoning. The poet without reason becomes fantastic, or so unreal that his works are most widely remote from aim or usefulness; while the man of science without imagination sinks into the mere analyst and dull investigator, who plays only a secondary part in the pursuit of truth. The concurrent opinion of mankind establishes the fact that there is such a thing as beauty, and a comparison of human intellect and of natural laws, as developed in form and color, gives us an approximate standard of the beautiful. The Venus of Milo is not only beautiful because people have been trained to think so, but because anatomy has determined that practical perfection agrees with the so-called *æsthetic.* Now, as the exercise of the imagination is a pleasure, and as the beautiful is a pleasure, the two possess a common ground; and it is with the latter that the former is chiefly occupied. It is true that the imagination, like nature, can, and often does, display its power in that which is repulsive, but in precisely the same proportion both seem to act most naturally on the agreeable, the harmonious, or, in a word, on the beautiful. Hence it is generally agreed that the greatest artists, whether painters or sculptors, and the best poets, are also the most imaginative of men; and it is certain that the first among them have devoted their powers to setting forth that which is most purely agreeable—that is, what is most beautiful. The craving for novelty, variety, and contrast is a deeply seated want, Nature herself indicating this in

*Even the appearance of an *essentially imaginary* form $\sqrt{-a^2}$ would not prove non-reality; for we have observed that in the simplest case of the 3d degree real roots appear inextricably involved in imaginary forms.

the constant changes and effects which she makes in colors and in all things. When the imagination leaves the purely beautiful, and busies itself more with widely varied elements for the sake of gratifying the taste for change and contrast, it develops the appalling, the startling, the grotesque or quaint; and when some remarkable incongruity presents at the same time a resemblance to something congruous and real, it gives us humor with its subordinate form, wit. Hence we may say that a writer has a witty imagination, or one which is humorous, grotesque, terrible, or appalling. The same general faculty, that of creativeness, of originating forms and combinations which never existed, underlies all these different developments. It may be observed that there are arts in which a great degree of feeling, whether of beauty, humor, horror, or other sentiments, may be excited with but little imagery—*i. e.* with comparatively little creative imagination—as by music, which acts through ill-defined association; and there are also artists who can produce great effects without much imaginative effort. For imagination is always creative in proportion to its integrity, and though great effects may be produced, they are not due entirely to the imagination of the artist when by suggesting he causes the beholder to complete the work in his own mind. Many modern paintings illustrate this. The connection of association with imagination, as of actual thought and mere emotion, is difficult to analyze, and yet it is in this obscure realm that our creative faculty, often with very little material, exerts some of its most startling effects. A flash of light in darkness or a mysterious whisper will excite the imagination into presenting the most extraordinary forms or apprehensions; and of this we have remarkable illustrations in the witch-manias, vampire-faiths, and similar mental epidemics which have swept over Europe. When the brain is so affected that imagination alone remains active, without the guiding power of reason, insanity invariably exists, while the mind utterly devoid of imagination is that of an idiot. It has been observed that as the flower precedes the fruit, so in the history of races the period in which imagination exerts its principal influence always goes before a more matured and rational age. Thus, the Middle Ages presented in contrast to the nineteenth century a carnival of gay, beautiful, and grotesque life, inspired by imagination, and not without full development of all its darkest and most mysterious forms. Due regard should be had to the true meaning of the imagination in the use of certain words which partake of its nature. One of these is *fantasy*, from which is derived "fantastic." It is generally held that the more a work of imagination is separated from the reasonable, and the more it is devoid of actual meaning or what is popularly understood by a moral, the more fantastic does it become. A work may be highly imaginative without being fantastic, but it is difficult to conceive of any fantastic work proceeding from human will which is not of the imagination. Dreams in their relation to thought and the eolian harp in music are purely fantastic, and the word is well applied to such writings or paintings as resemble them. Closely allied to the fantastic is the *grotesque*, in which, however, the chief distinction is simply as to form and material. When the parts of a composition are extremely varied, novel, and unexpected, it is grotesque. It may have both meaning and moral, but while it is in substance *like* the fantastic, it differs from it in this, that the fantastic need not necessarily be varied and novel in its elements or inspired with startling incongruities. By *fancy* we understand the imagination when it creates fantasies. Common usage, however, while it allows to fancy an action in what is light and graceful, seems to separate it from the fantastic, as though the latter were more extravagant or more nearly allied to the grotesque. To fancy may, in fact, be defined as to imagine, to believe, or to conceive without certainty. To fancy in the sense of to *like* implies that a downright, deeply settled desire is not as yet in being, but only that imagination has surrounded the object with agreeable associations. In one sense, to fancy is used as a synonym for to imagine, which is, strictly speaking, incorrect, since in expressing the act of imagining we should qualify it with some word indicating whether it be devoid of reason.

Charles G. Leland.

Imbecil'ity. The term imbecility, at law, follows in interpretation the etymology of the Latin adjective *imbecillus*, from which it is derived, and means "weakness of mind." But inasmuch as its import, when applied to the admeasurement of civil rights and responsibilities, is one of variable character, the law treats it as a condition of *qualified* rather than *absolute* incompetency. Hence, the acts of imbeciles, whether in the nature of contracts, wills, or torts, are always open to the suspicion of lacking a legally assenting mind, and as such the former are voidable wherever things can be restored to their previous condition. In the Roman law a refined distinction was made between incapacity arising from mental weakness and that arising from disease. In the former case it placed the party under a *tutor*, in the latter under a *curator*. The former were regarded as mental infants, or minors whose weakness age might cure if of the male sex, while women were held to be perpetual minors and always under guardianship. (See *Instit.*, lib. i., tit. xiii., *de Tutelis*.)

The liberality of the common law has never tolerated such refinements in mental discrimination between the sexes as this, nor imported such subtle distinctions into the field of guardianship. Under its canons imbecility derives no special complexion from the sex of its subjects, and their acts are never weighed *per se*, so much as *quoad hoc*, or in relation to the merits of a particular transaction. Imbeciles being possessed of some share of mental capacity, whatever may be its degree, are not therefore disqualified from performing legal acts involving legal responsibilities. But their acts are always looked upon with suspicion, as likely to be influenced by fraud or compulsion; for it is particularly against extraneous influences that such persons need to be guarded. Says Mr. Justice Story in this connection: "The acts and contracts of persons who are of weak understanding, and who are thereby liable to impositions, will be held void in courts of equity if the nature of the act or contract justify the conclusion that the party has not exercised a deliberate judgment, but has been imposed upon, circumvented, or overcome by cunning or undue influence." (1 *Eq. Jurisp.*, § 238.) Under this principle any misrepresentations, over-importunities, improper influences, or anything, in fact, which limits the free moral agency, will tend to annul the acts of an imbecile, although they might not be sufficient to operate coercively upon an ordinary mind; for legal competency must be estimated by the character of the act performed, as well as by the mental power of the actor; and it is by this rule alone that an equitable interpretation can be applied to the contracts of a person alleged to be imbecile. It will be seen by this that the contracts of such persons, whether of marriage, purchase or sale, labor or hire, are not necessarily void, but simply voidable, upon proof that they were made under circumstances disadvantageous to a right comprehension of their full import by the party of weak understanding, and provided always that things can be restored to their original status. But an imbecile has the same right as any other person knowingly to enter into a contract where the advantages to be gained are not mutual. The law can only protect him so far as he did not know the true nature and consequences of the act he was performing, and to that same extent could not be said to have given a legal assent to the transaction.

The voidability of any contract made under such circumstances will further depend upon the fact of its present condition. Is it still *executory* or is it *executed?* And if the latter, to what extent? If not completely so, and the condition of the things operated upon by the contract is not materially altered, then the contract may be annulled, and the parties restored to their previous condition. But in the case of wholly executed contracts, this redintegration of parties cannot always be accomplished without serious detriment to third and innocent parties, who have acted *bona fide* and in ignorance of the taint in the original contract. Hence, in such cases the contract will have to stand, and the injured party must seek his remedy in another way, for here equity follows the law.

In regard to *wills* made by imbeciles, whether the imbecility be congenital or supervene as a consequence of old age, the general rule is to allow the instrument to prove the capacity of the testator, and not to set it aside as void *ab initio* because executed by a person of weak understanding. The subject-matter of wills differs so widely that an imbecile may often find it entirely within the range of his comprehension to dispose rationally of what he possesses. Particularly is this the case where personal property is involved, and the leniency of construction put upon the condition of such testators has always been deemed wiser and more humane than to insist upon the possession by them of a mental power superior to the necessities of the act to be performed. Hence, wills have been sustained where testators were very aged and greatly debilitated; where they were very deaf and partially blind; where they were so paralyzed as to be unable to write or feed themselves; and where they exhibited ridiculous eccentricities in conduct or religious belief. In all the above cases it was shown that they had reason enough to know intelligently what they were doing. The law asks no more. Whatever, therefore, may be the physical condition of a testator, either as to age or bodily infirmities, so long as he has the mental ability to perform the act intelligently, his legal capacity cannot be called into question.

As to *torts* committed by imbeciles, they are placed upon

the same footing as those committed by the insane, and their estates are responsible in civil damages to any party aggrieved. Whenever the tort becomes a crime with a personal penalty affixed, then the legal responsibility of the wrongdoer will be tested by a similar standard to that applied to those who labor under partial insanity. The analogy upon which this rule is founded is not a perfect one in any sense, since mental weakness in the imbecile is not contemporary with actual physical disease, as in the insane; but it serves the purposes of justice and humanity best to associate these two classes into one category, because the law does not concern itself so much with the possible causes of mental weakness as with their consequences upon human conduct; and if an act be done by any mind incompetent at the time to act intelligently and as a free moral agent, it is alike the act of an irresponsible being, whether that being be styled imbecile or insane. In either case the law considers the *malus animus* to be wanting. But this does not negative the fact that both imbeciles and persons partially insane are often found who are legally competent to commit crimes, and if so are fit subjects for punishment.

JOHN ORDRONAUX.

Imbert′ (BARTHOLOMEW), b. at Nîmes in 1747; studied in his native city, and removed in 1767 to Paris, where he engaged in literary pursuits, and d. Aug. 23, 1790. His poem, *Le Jugement de Paris* (published in 1772), achieved a great success, but in spite of the many small triumphs which he enjoyed in nearly all fields of fiction, tragedy, comedy, etc., the only work which has proved to be of lasting interest is his *Choix d'anciens fabliaux*, in verse (2 vols., 1788).

Im′bros [Ἴμβρος, now *Embro*], a Turkish island of the Ægæan, 11 miles W. by N. of the entrance to the Hellespont. It is 18 miles long from E. to W., and contains several villages, though none of them are historically important. The island is rough and wooded, but very fertile, producing corn, wine, oil, and cotton. The highest peak is 1845 feet above the sea. Pop. 4000.

Imhof′ (JACOB WILHELM), b. at Nuremberg Mar. 8, 1651; studied at Altorf; travelled much in Germany, the Netherlands, France, and Italy, and settled in 1673 in his native city, where he devoted himself to genealogical studies, and d. Dec. 20, 1728. His most important works are—*Spicilegium Ritterhusiannum* (6 vols., Tübingen, 1683–85), containing seventy new genealogical tables, and *Notitia S. R. G. Imperii procerum* (2 vols., Tübingen, 1684), of which a fifth edition was issued in 1732, containing fifteen plates of arms. He has also given numerous genealogical contributions to English, French, and Italian history.

Im′ides, monamides in which two atoms of hydrogen are replaced by a diatomic radical, as *succinimide*, $N(C_4H_4O_2)''H$, and pyro-tartrimide, $N(C_5H_6O)''H$. (See AMIDES, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.)

Imita′tion. In music, a subject, group of notes, or short strain is said to be *imitated* when, after its first appearance, it is repeated, with more or less exactness, by one or more of the various parts of the composition. Imitations of a given theme may take place, under certain conditions, on any of the intervals of the diatonic scale, and admit of great diversity in their treatment. Imitations may be either *strict* or *free, direct* or *inverse, retrograde* or *inverse-retrograde.* In strict imitation the answer must correspond exactly with the theme, not only in movement, degrees of the scale, and quality of notes, but also in the succession of tones and semitones in each step of its progress. This rigid species of imitation is practicable only under certain limitations, on account of the peculiar structure of the diatonic scale. If the scale consisted of a regular succession of *whole tones,* it is evident that a given theme might be repeated on any degree of such a scale without undergoing any material change or distortion. But as the scale really is a succession of *tones* and *semitones* in a certain fixed order, it follows that a theme when moved from its place to a higher or lower one on the scale (the octave excepted) will no longer be strictly true in the succession of its intervals. In *free* imitation all this precaution is unnecessary, as a general resemblance to the theme is sufficient.

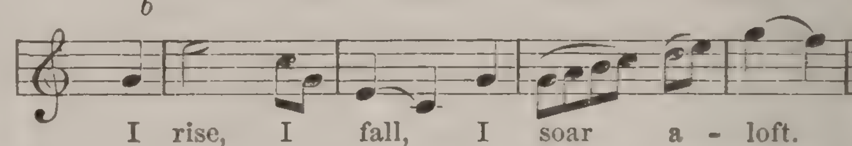
WILLIAM STAUNTON.

Im′itative Mu′sic. Under this term is comprehended such music as is intended to be representative, descriptive, or suggestive of certain ideas and things *external to the music itself*—*i. e.* to music considered as mere melody and harmony. Music thus possesses two distinct properties or offices. A strain of music may be beautiful, grand, and impressive in its own nature, and capable of producing in the mind certain peculiar feelings and sentiments not obtainable from any other agency; or, on the other hand, music may be so contrived and ingeniously written as to bear so near a resemblance to particular external objects, sounds, motions, and even strongly-marked events, as to recall them to the mind of the hearer, *in addition* to the emotions arising out of its own intrinsic powers and emanating from itself alone. A similar effect may also result from mere association of ideas—as, for instance, when theatrical music reminds us of the theatre, and church music of the church, because the music and the place where it is generally heard have become associated together in our minds. But such a case must not be confounded with what we call imitative music. Nor can the mere reproduction of certain sounds under new conditions —as, for instance, when the actual notes of the hunter's horn, the military bugle, or the chimes and changes of church-bells are played on other instruments—be included under this term; they are mere copies.

The simplest kind of imitative music is that which represents *motion,* whether on an even plane, or on ascending and descending grades, or by leaps from high to low, and low to high, etc. There seems to be some mysterious analogy very generally felt between the grave or acute in the musical scale and the familiar idea of depth and height. When we move from the graver part of the scale to the more acute we call it *ascending,* and progress from acute to grave we call *descending.* A sound is said to be *high* or *low* in proportion as it is acute or grave, and the extremes are regarded as very deep, profound, and abysmal, or very high, lofty, and soaring. Advantage is taken of this impression by composers when they connect with words signifying motion, height, depth, etc. notes suggesting corresponding ideas. That this resemblance is not altogether arbitrary or fanciful, but founded on some natural principle, will appear from an examination of Ex. 1, where at *a* the music and the words seem to be in antagonism, while at *b* they mutually support each other:

Ex. 1.—*a*

b



Among imitations, properly so called, are those representative—or at least suggestive—of a large class of *noises* or *unmusical sounds,* such as the roar of cannon, the clashing of swords, the tramp of horses, the steady marching of troops, the cries of wounded men, the wails of the distressed, and the groans of the dying; the solemn movement of a funeral procession, and the elastic spring of merriment in a ball-room; the familiar sounds uttered by domestic animals, the lowing of cattle, the screams and roaring of wild beasts, the croaking of frogs, and the buzz of insects; the pattering of rain and the clatter of hail; the roll of distant thunder, the moaning of the wind, and the furious rushing of the storm. All these and many other noises, including crying, sneezing, and uproarious laughter, the hum of the old spinning-wheel, the strokes on the smith's anvil, the chirp of the cricket, and the rocking of the cradle, have been imitated with more or less success in musical compositions; or, in other words, musical forms and combinations have been so used as to remind the hearer of things which are essentially *un*musical.

More nearly approaching the sounds represented on the diatonic and chromatic scales are the songs or utterances of certain birds, to which may be added the crowing of cocks, the alarm-cry of hens, the cooing of doves, the solitary notes of the cuckoo, and the dismal screech of the night-owl; also the tap and roll of the military drum, the half-musical cries of sailors in hoisting and of hawkers in the streets, together with the rude noises of barbaric music and gypsy songs. Some of these may be imitated so closely as to be understood or recognized by the hearer without effort or previous admonition. With less distinctness music may be made to represent the calmness of eventide, the sweets of pastoral life, the tumult of war, the raging of the sea, the noise of floods, earthquakes, tornadoes, etc. Very few persons, on hearing the introductory movements to Haydn's *Seven Last Words* and the *Creation,* would suspect that the former was intended for an earthquake, or that the latter was set forth as a "representation of chaos."

The most extraordinary of all musical imitations are those which profess to deal with objects not of hearing, but of *sight.* There is an apparent absurdity in all such attempts to represent through one sense things that belong to another. And yet between sight and hearing a certain correspondence has been found to exist, sufficient to form a basis for a partial interchange of symbols. It is very necessary, however, for complete success that *the hearer should be apprised beforehand,* or by words annexed, *what*

it is that the music is intended to represent. More than half of the effect lies in the preparation of the hearer's mind; for the very same music *might* have been used—had the composer so pleased—for the stirring up of an entirely different class of emotions. Haydn's representation of the creation of light, for example, has been both severely criticised and enthusiastically admired. *In itself,* it is doubtless nothing more than a common major triad coming with sudden force on the ear as the termination of a progression in the minor mode. In any other connection, or in any other piece, it would have attracted no special notice; but the hearer's mind having been prepared by the previous words and music, and brought into an attitude of eager expectancy by the Divine command, "Let there be light," he is forcibly struck with the outburst on the words, "And there was LIGHT," so that, as Bombet remarks, his eyes are dazzled, "as by the flash of the midday sun on one just emerging from a dark cavern." Many other visual objects are thus successfully illustrated in musical works by an appeal to the ear, as may be seen in the *Creation,* the oratorios of Handel, Spohr's *Last Judgment*, Mendelssohn's *Elijah*, etc. Among these objects are the brooding of darkness over the deep, the fall of the apostate angels, the rushing floods, the upheaval of mountains, the rising of the sun and moon, the growth of plants, the whirl of insect life, the leaping of deer, the dark and bright sides of nature, decay and death, and finally the resurrection. But music representing these, however skilfully written, cannot be its own interpreter from the very nature of the case. When, however, its meaning is conveyed by words or otherwise to the hearer's mind, there is no difficulty in tracing resemblances, even though their vividness must depend, for the most part, on the help of imagination.

WILLIAM STAUNTON.

Im'lay, post-tp. of Lapeer co., Mich. Pop. 1243.

Im'lay Cit'y, post-v. of Imlay tp., Lapeer co., Mich., on the Chicago and Point Huron R. R., 34 miles W. of Port Huron. It has a very large grain-elevator.

Immac'ulate Concep'tion of the Virgin Mary, a modern dogma of the Roman Church, proclaimed by Pope Pius IX. on the feast of the Conception, Dec. 8, 1854, in the church of St. Peter, and in the presence of more than 200 cardinals, bishops, and other dignitaries, in these words: "That the most blessed Virgin Mary, in the first moment of her conception, by a special grace and privilege of Almighty God, in virtue of the merits of Christ, was preserved immaculate from all stain of original sin" (*ab omni originalis culpæ labe preservatam immunem*). This the papal bull "Ineffabilis Deus" declares to be a divinely revealed fact and dogma which must hereafter be constantly believed by all Catholics, on pain of excommunication. The dogma was not sanctioned by any œcumenical council, but since the Vatican Council of 1870 declared the pope infallible, independent of a council, the decree of 1854 must be received as an infallible utterance, and cannot be changed. Pius IX. had previously, by an encyclical of Feb. 2, 1849, invited the opinion of the Catholic bishops on the subject, and received more than 600 affirmative answers; only 4 dissented from the pope's view, and 52, while agreeing with him in the dogma itself, deemed it inopportune to define and proclaim it. This shows that the tendency of the Roman Church was strongly in this direction. The dogma of the immaculate conception and the Vatican dogma of papal infallibility are the characteristic features of modern Romanism, as distinct from the Romanism of the Council of Trent, and widen the breach between it and the Greek and Protestant churches. By the decree of 1854 the Virgin Mary is taken out of the family of the redeemed, and declared absolutely free from all complication with the fall of Adam and its consequences. The definition of such a dogma presupposes a divine revelation, for God omniscient alone knows the fact of the immaculate conception; and as the Bible nowhere informs us of it, God must have revealed it to Pius IX. in 1854, either directly or through the voice of the 600 bishops assenting to his view. But if he is really infallible, he did not need the advice of others.

From the Roman standpoint this dogma completes the Mariology and Mariolatry, which step by step proceeded from the perpetual virginity of Mary to her freedom from actual sin after the conception of the Saviour, then to freedom from sin after her birth, and at last to her freedom from original or hereditary sin. The only thing left now is to proclaim the dogma of her assumption to heaven, which has long since been a pious opinion in the Roman Church. To this corresponds the progress in the worship of Mary and the multiplication of her festivals. Her worship even overshadows the worship of Christ. She, the tender, compassionate, lovely woman, is invoked for her powerful intercession, rather than her Divine Son. She is made the fountain of all grace, the mediatrix between Christ and the believer, and is virtually put in the place of the Holy Ghost. There is scarcely an epithet of Christ which devout Roman Catholics do not apply to the Virgin (see St. Liguori's *Glories of Mary*), and Pope Pius IX., who is himself an intense worshipper of Mary, has sanctioned the false interpretation of Gen. iii. 15, that she (not Christ) "crushed the head of the serpent."

As to the history of the dogma, no passage in its favor can be found in the Old or New Testament (for the interpretation of the *Protevangelium* just alluded to is clearly ruled out by the Hebrew text). On the contrary, the Bible declares all men to be sinners and in need of redemption, and exempts Christ alone, the sinless Redeemer, from this universal rule. Mary herself calls God *her Saviour* (Luke i. 47), and thereby includes herself in the number of the saved; which implies her sense of personal sin and guilt. With this corresponds also the predicate given her by the angel (i. 28), *endued with grace, highly favored* (κεχαριτωμένη), which the Vulgate has mischievously changed into the active *gratia plena, full of grace*). The Christian Fathers, though many of them (even St. Augustine) exempted Mary from actual transgression, know nothing of her freedom from original sin, but always imply, and often expressly teach, the contrary. Some, as Irenæus, Tertullian, Origen, and Chrysostom, interpret Christ's words at the wedding of Cana (John ii. 4) as a rebuke of her unseasonable haste and immoderate ambition. The origin of the dogma must be sought in the Apocryphal Gospels, which substituted mythology for real history, and nourished superstition rather than rational faith.

The doctrine crept into theology through the door of worship. The first clear trace of it is found in the twelfth century, in the south of France, when the canons of Lyons introduced the festival of the conception of the immaculate Mary, Dec. 8, 1139. This proves that the belief then existed as a pious opinion, but by no means as a dogma. On the contrary, St. Bernard, the greatest doctor and saint of his age, opposed the new festival as an unauthorized innovation, derogatory to the dignity of Christ, the only sinless being in the world. He asked the canons of Lyons whence they discovered such a hidden fact. On the same ground they might appoint festivals for the conception of the mother, grandmother, and great-grandmother of Mary, and so back to the beginning. The same ground is taken essentially by the greatest Schoolmen, as Anselm, Bonaventura, Albertus Magnus, Thomas Aquinas. But during the fourteenth century, through the influence chiefly of Duns Scotus, "the subtle doctor," the doctrine of the immaculate conception became a part of the theology of the Franciscans or Scotists, and was a bone of contention between them and the Dominicans or Thomists. They charged each other with heresy for holding the one view or the other. The Council of Trent did not settle the question, but rather leaned towards the Franciscan side. Soon afterwards the Jesuits took up the same side, and defended it against the Jansenists. To their zeal and perseverance, and their influence over Pope Pius IX., the recent triumph of the dogma is chiefly due. The whole Roman Catholic world quietly acquiesced until the Vatican Council roused the "Old Catholic" opposition against papal infallibility, which extended also to the dogma of the immaculate conception.

Literature.—The papal bull *Ineffabilis Deus* (Dec. 8, 1854); Perrone, *On the Immaculate Conception* (Latin, German, etc., 1849); Passaglia, *De immac. Deiparæ semper Virg. conc.* (1854 *seq.*, 3 vols.); Preuss, *The Romish Doctrine of the Immaculate Conception* (German and English, 1865); Pusey, *Eirenikon* (part ii., 1867); H. B. Smith, *Method. Quarterly Rev.* for 1855; Hase, *Handbook of Protestant Polemics* (1871). Of older Catholic works we mention J.Turrecremata, *De veritate conceptionis beat. Virginis* (1547; republished by Pusey, 1869), and J. de Launoy, a Jansenist, *Præscriptiones de Conceptu B. Mariæ Virg.* (1677), both against the immaculate conception.

PHILIP SCHAFF.

Im'mermann (KARL LEBERECHT), b. at Magdeburg Apr. 24, 1796; studied 1813 at Halle; took part in the campaign of 1815, and wrote, in opposition to the political enthusiasm prevailing at that time at all German universities, *Ueber die Streitigkeiten der Studirenden in Halle* (1817), which book was solemnly burnt at Wartburg by the students. Shortly after he received a government office in his native city, whence he removed to Münster in 1823, and to Düsseldorf in 1827. From 1834 to 1838 he undertook the management of the theatre of Düsseldorf, in which, however, he succeeded only partly, though his perfect taste and pure enthusiasm exercised a beneficial influence on the German theatre. The most remarkable of his many comedies are—*Das Auge der Liebe* (1824) and *Die Schule der Frommen* (1829); of his tragedies, *Alexis* (1832) and *Ghismonda* (1839); of his romances, *Epigonen* (1836) and *Münchhausen* (1838). As an author he had

more artistic training than natural talent, and a greater power of reflection than of imagination or feeling; very charming, however, is his tale, *Talifäntchen* (1830), on account of its naïveté. His controversy with Platen made a great sensation, or rather scandal, and brought no results. D. Aug. 25, 1840.

Immortal'ity (of the Soul), the doctrine that the human soul is imperishable, being separable from the body at death and destined to a conscious life beyond the grave. The history of this doctrine is the history of the development of the idea of substantiality, or, indeed, of the idea of God. Without a personal God there could be no immortality. If the substantial is found to be a rigid, lifeless substance or an unconscious force, there can be no persistent individuality. But, in spite of philosophical or theological tenets, the belief in a future life is almost universally prevalent. Among degraded savages, as in Central Africa, it takes the form of demonology, or belief in spectres or ghosts. In Asia, where the theological dogmas do not reconcile the Universal or Absolute with the existence of the individual being, making the Supreme Being an unconscious substance destined to absorb the individual man at death, still the popular belief holds to the doctrine of immortality. Egypt is especially noted as the country where great stress was laid on the doctrine of immortality. The temples, sphinxes, statues, and pyramids, all had some suggestion of the future life of the soul. The cycle of the rise and fall of the Nile, and of the life of the seed in its germination, growth, fruit-bearing, and decay, is closely connected with the doctrine of immortality. The soul's cycle is set at 3000 years, after which it returns from its wanderings to the body again. Hence the care with which the Egyptians preserved the body by embalming it, and the extravagant outlay of human labor on the Pyramids as tombs of the kings and symbols of their faith. With Greece the Oriental idea of the subordination of the soul to nature gives way for a more spiritual theory. The Greek conceives the spiritual as something independent of, or at least as a reaction against, nature. Spirit is essentially self-determining and free. The portrayal of its ideals of free activity gave to the world the forms of the divinities of Olympus. The Titans or powers of nature are subdued and made serviceable to spirit. The Roman phase of civilization is devoted to the formulating of the will into laws and defined rights. The subordination of the individual to the general will as embodied in the state is the characteristic Roman principle. Immortality, with Greece and Rome, assumed a definite shape, elevated far above the Oriental conception, inasmuch as it eliminated the principle of transmigration. But there was not an adequate realization as yet of the principle of infinite responsibility, which the Christian religion first added to that of the immortal destiny of the soul, making man, moreover, the object of divine mediation. The growth of the idea of the substantiality of the soul, as thus traced, is marked in the world's history by the corresponding growth of institutions of a humanitarian character.

The proofs of immortality are numerous and of varying degrees of strictness. Among those most relied upon by the popular mind are the following: I. The return or resurrection from the dead. II. General belief in the existence of the soul after death; probability that such general beliefs of mankind are well founded. III. General desire of man to live for ever, and his horror at annihilation. IV. The infinite perfectibility of the human mind, never reaching its full capacity in this life; contrary to the course of nature or to the Divine character to endow a being with capacities never to be developed. V. The fact that perfect justice is not dispensed in this life; the good suffer and the wicked triumph; necessity of future retribution to justify God's government.—The metaphysical doctrine of immortality includes various positions, favorable and unfavorable, the most important of which are the following: I. The highest principle is regarded as indeterminate—pantheism; consciousness considered to be a disease or evil of which death or unconsciousness (Nirvana) is the cure. II. Highest principle a rational intelligence—monotheism; the soul a transient incarnation which vanishes in death (Arabic interpretation of Aristotle). III. The soul held to have pre-existed in an intelligible world, and to have come hither through a lapse from holiness or for necessary experience; death releases the imprisoned soul, and it rejoins its former state or enters a new body (emanation theory—Plato). IV. Aristotle's doctrine of the pure reason (νοῦς) as an unconditioned energy, imperishable, while the lower faculties of the soul, such as sensation, imagination, feeling, memory, etc., are perishable. This doctrine has been the occasion of much controversy. An immortality which should cut off an individual from his past would not preserve his identity. But the experience of ordinary life exhibits to us a constant waning of the faculties of mere sensuous perception, of mere mechanical memory, and of fancy, with a corresponding increase of the higher faculty of inference or reason. Hence, the lower faculties may be said correctly to be perishable, while the faculty of insight, which sees in an individual all its past history at a glance, is immortal or continually on the increase. The immortal life would use the perishable faculties less and less, but might never lose them altogether. The disputes of the Schoolmen over this question were very essential to the support of the Christian dogma. V. From the time of the Schoolmen, arguments in favor of immortality, drawn from the "simplicity of the soul," were in vogue, and especially elaborated by the Leibnitzo-Wolffian philosophy. VI. Kant attacks all theoretic proofs of immortality as based on a paralogism involving an unwarranted inference from the phenomenal appearance of the soul as Ego to the same as Noumenon. But he finds immortality to be established as a practical postulate of the Will. VII. Hegel exhibited immortality as the essential attribute of conscious beings, denying it to animals (in the closing chapter of his *Philosophy of Nature*). Recent discussions of the subject have been rather skeptical in their tendency, especially in Germany, England, France, and America, owing to the prevailing evolutional theories in science. German literature was quite prolific in treatises on immortality for several years after the death of Hegel. Feuerbach, Strauss, Conradi, Michelet, F. Richter, and others held a negative attitude toward the doctrine, and contended that the only immortality is that of the race or species. Marheineke, Blasche, Weisse, Hinrichs, Fechner, J. H. Fichte, and, above all, Göschel, defended the doctrine of individual immortality. W. T. Harris.

Immortelles' [Fr., "immortal"], or **Everlasting Flowers,** are flowers largely employed in Europe, especially in France, for the manufacture of wreaths and crosses for the adornment of churches and cemeteries. The *Helichrysum Orientale,* a native of Crete, but much cultivated in Southern France, is the flower chiefly used for the above purpose, though there are many other genera of plants, such as *Rhodanthe,* which are also occasionally employed. The use of immortelles in America is of recent origin, and they are usually imported from France.

I'mola [Lat. *Forum Cornelii*], town of Italy, in the province of Bologna, about 20 miles E. S. E. of the city of Bologna. It was enlarged and embellished, if not actually founded, by the dictator Sulla, who sent a colony here about 80 B. C., and throughout the Roman period it was a town of some importance. Cato had a villa here. During the Middle Ages it was claimed by the see of Rome as a part of the *gift of Constantine,* but was subject to frequent assaults and occupations by the rival powers that then divided the Peninsula. From the time of Julius II. it formed a part of the Roman states, except when held for a short time by the French in 1797, until the whole papal territory was annexed to the new kingdom of Italy. The town is well built, and surrounded by its old walls with towers and trench. Its manufactures, leather, wax, glass, majolica, silk, and hempen stuffs, are very considerable. A choice wine called *vino santo* is made here. Pop. about 12,000.

Imola (Innocenzo Francucci da), an Italian painter of Bologna, an imitator of Raphael. D. 1549.

Impale'ment, or **Empalement** [Lat. *in,* and *palus,* a "stake"], a form of capital punishment by means of a stake thrust through the body. The victim was often raised up from the earth, and one end of the stake was driven into the ground; hence the Greeks applied the name σταύρωσις ("stake-punishment") to crucifixion as well as impalement. Impalement is still practised in half-civilized and barbarous countries. The driving a stake through the heart of a suicide and his burial under the cross-roads arose, it is believed, from a fear that his spirit would otherwise walk and frighten the living.

Impana'tion [Lat. *in,* and *panis,* "bread"], a term belonging to the Eucharistic controversy, invented soon after, and in opposition to, that of *Transubstantiation.* It was intended to express the intimate union of the blessed body and blood with the consecrated elements, without a destruction of the substance of the bread and wine. Rupert, abbot of Deutz near Cologne (d. 1135), who first used the word, likened the mystery implied to that of the incarnation, wherein the divine nature was conjoined with the human nature in the one person of Christ. By body he meant that which hung upon the cross, and by blood, that which flowed from the Crucified; but yet he denied the real presence in a gross and carnal sense: "Fit corpus Christi et sanguis, non mutatum in carnis saporem sive sanguinis horrorem, sed," etc. Impanation, like all terms intended to simplify our conception of a mystery, is liable to misinterpretation, and is not now used by any one as expressive of his own views. W. F. Brand.

Impeach'ment, in law, is commonly used to denote a mode of trial of a criminal offence. The same word is used in the law of evidence to mean the act of discrediting a witness before a jury or court trying a question of fact, by showing that he is unworthy of belief. In this article it will be employed exclusively in the sense first pointed out.

In the early English law when a crime was committed it was regarded in three aspects—either as an injury to the individual or his family, to the king, or to the state or nation. The injury to the individual was prosecuted by a proceeding called an appeal; that supposed to be done to the king or executive officer, by indictment; while the wrong done to the state was redressed by a proceeding termed an impeachment. The appeal having become obsolete, there remained two great criminal proceedings—indictment and impeachment. The resemblance between an indictment and an impeachment should be briefly noticed. The office of an indictment is to present to an ordinary court of justice the opinion of a select body of citizens that there is apparent reason to believe that there has been a criminal violation of law by a specified person. Notwithstanding this, the law still presumes his innocence, and takes no action against him except that which is necessary to secure his attendance at the trial. Ultimately, the case is presented to another (or trial) jury, by whom the result is determined, either acquitting or convicting the person charged in the indictment. It is apparent that an indictment is but a mode of procedure adopted for the purpose of securing caution and deliberation in judicial affairs. It presupposes the existence and definition of the crime for which the prisoner is to be tried.

The same general train of thought is present in the case of an impeachment. Instead, however, of being made by a small number of persons, it is a presentment of the House of Commons as representing the state. It is made in writing under the name of "articles of impeachment." The articles are presented before a tribunal acting judicially—not, it is true, an ordinary court of justice, but the entire House of Lords. The Commons may impeach for any crime, whether it be a felony or misdemeanor, no matter by whom committed, whether a peer or commoner, and may attach to conviction the ordinary punishments. There is one important distinction that should be noticed between the two modes of proceeding. An indictment can only be found in a particular county, and in general only in that where the offence was committed. An impeachment, from the nature of the case, is confined to no locality. It has been sometimes resorted to in England for the prosecution of an ordinary crime, to avoid the necessity that would otherwise exist of prosecuting the case by indictment in a particular county. The effect of an impeachment by the House of Commons, like an indictment by a grand jury, is only an affirmation that there is reason to believe that there has been a violation of law by the person impeached. It must be conducted in accordance with rules of evidence. The person impeached can only be convicted of a crime already known to the law to which regular methods of punishment can be attached.

A court of impeachment should be distinguished from the "court of the lord high steward." This court is organized in the following case. Whenever a peer of the realm is indicted in an ordinary court of justice, in order that his case may be removed to be tried by his peers, the king issues a commission to a particular nobleman to act as judge, who is then called, for the time being, "lord high steward." By the commission other noblemen are associated with him to decide the questions of fact which may arise in the case. The court is therefore substantially composed of a judge and jury. It differs from a court of impeachment in three respects: it can only dispose of the questions arising upon an indictment found by a grand jury; it may, and perhaps must, sit during a recess of Parliament; and it may consist of a small number of peers (*e. g.* twelve), instead of the entire house. It is a court that a king might easily pack with his own creatures in order to ruin an obnoxious nobleman. This is forbidden by statute in cases of trial for treason, and the entire House of Lords must in that case be summoned. As the presiding officer of the court of impeachment in capital cases is also termed a "lord high steward," much care is sometimes required in reading legal history to distinguish between the two tribunals.

The *judicial* nature of an impeachment is also readily seen by contrasting it with a bill of attainder or of pains and penalties. These latter are mere laws. The houses of Parliament in passing such bills enact that a person is guilty of a crime. Though they may go through forms of judicial inquiry, their decision is a *law* and not a *judgment*. Bills of attainder are wholly contrary to sound legislation, as they are an assumption by a legislature of judicial power. An impeachment is decided by the House of Lords alone. Unless that body were to follow judicial forms, and to give their decisions upon evidence and inquiry as applied to a violation of law, an impeachment would be more objectionable than a bill of attainder, for it would need only the arbitrary will of one house to take away one's liberty or life, instead of the concurrence of two.

The result is, that under the English law there have been from time immemorial two parallel modes of reaching an alleged criminal: he might be either indicted or impeached. The two proceedings are deemed to be wholly distinct. If he is indicted first, he may be impeached afterwards; and, conversely, an impeachment is no answer to an indictment. It might seem, at first sight, that if this were so, an impeachment should never be resorted to, as this proceeding is dilatory, cumbrous, and expensive. The reasons for adopting it in special cases have mainly been because it could more readily be made an instrument of faction, or because it was a powerful weapon in times of political disturbance or revolution. Again, there have been instances of a salutary effect from its use, where an alleged criminal was a man of power and influence, and likely by the weight of his name and by his position to disturb the judgment of the ordinary criminal courts. It is a weakness necessarily appertaining to this court that there is no appeal from or review of its decisions. Unlike all other courts with which men trained in English jurisprudence are familiar, it decides at once and irreversibly both upon the law and the fact. The absence of repeated discussion and consideration, which are, in general, so fully accorded to suitors through the action of appellate courts, may in times of political excitement lead to inconsiderate and unjust decisions, and it is too much to expect from these tribunals that there will be an unbroken adherence to wise and safe precedents.

One of the most important questions connected with this whole subject is, whether an impeachment can be had where the act is of such a nature that it cannot be prosecuted by indictment. Can an impeachment be had for any act unless it constitutes a *crime* against the general law of the land? Can this mode of trial be extended to mere acts of indecorum having no fixed criminal aspects? Crimes may, of course, exist either by the rules of the common law or by statute. Can there be an impeachment in the absence of any form of crime? If this question is to be decided by the rules of the English law, it would have to be said that principles and precedents are both opposed to an impeachment except for a crime. The most recent and leading cases upon this subject are those of the earl of Macclesfield, of Warren Hastings, and of Lord Melville. In the case of the earl of Macclesfield, who was impeached for the sale of offices connected with the administration of justice, the whole argument of counsel was, on the one hand, to show, and on the other hand, to disprove, that the sale of such an office was contrary either to a rule of the common law or of an act of Parliament. He was declared guilty, but only on the ground that a statute passed in the reign of Edward VI. had been violated. Lord Campbell, a great jurist of our day, who defends the impeachment, rests its lawfulness solely on the ground that this statute had been violated. (4 Campbell's *Lord Chancellors*, 536; 16 Howell's *State Trials*, 823.) In the case of Warren Hastings (1788), the Lords resolved that they would insist on the same rules of evidence as were applied in the inferior courts of justice. In the trial of Lord Melville in 1806 for malversation in office, the question was put to the judges whether the acts with which he was charged were unlawful, so as to be the subject of information or indictment. It having been decided that they were not, Lord Melville was acquitted. (29 Howell's *State Trials*, 1470.) These decisions were made at a time when there was no party feeling, and when the House of Lords intended to act with judicial impartiality. They are therefore entitled to much weight. In many instances it should be observed that the court asks the opinion of the ordinary judges upon the law of crime and the relevancy of evidence, and closely follows their views. Reference may also be made to the opinion of leading text-writers and jurists. Woodeson is particularly clear and emphatic. He says: "The trial differs not in essentials from criminal prosecutions before inferior courts. The same rules of evidence, the same legal notions of crimes and punishments, prevail. *For impeachments are not framed to alter the law, but to carry it into more effectual execution where it might be obstructed by the influence of too powerful delinquents, or not easily discovered in the courts of ordinary jurisdiction by reason of the peculiar quality of the alleged crimes. The judgment thereof is to be such as is warranted by legal principles or precedents.*" (2 *Lectures*, 611.) The same view is well expressed by Lord Chancellor Cowper in the year 1715, who says: "Though one of your lordships supposes this impeachment to be out of the ordinary and common

course of law and justice, it is yet as much a course of proceeding according to the common law as any other whatever." (See also Cushing, *Law and Practice of Legislative Assemblies*, § 2569; 4 Blackstone's *Comm.*, 259; and the able argument of Mr. Webster, 5 *Works*, pp. 513–515, in defence of Judge Prescott.)

This subject has assumed great importance in recent trials by impeachment in the U. S. It must be conceded that public and professional opinion is here to some extent divided upon it. Impeachment as used under American law does not have so wide a scope as in England, though we have derived it from the law of that country. The object of the trial here is to reach official delinquency, and to remove the offending officer from office or to impose a permanent disqualification upon him. It is, however, conceived that this does not vary the case. The impeachment is still for a crime; the officer is to be removed or disqualified because he has committed an act in the nature of a crime. On no other theory can there be a strictly judicial proceeding. There must have been a wrong committed, but how can that be unless there has been a violation of law? Without a crime how can there be a trial, and how is it possible to apply any rules of evidence? Mr. Hallam contends, with great force of reasoning, that not only must a crime be committed, but it must be set forth in the articles of impeachment. Thus, if there were an impeachment for treason, the offence described should of itself, in point of law, constitute treason. His argument is that the court can only *try* an offender for an existing crime. It cannot *create* an offence by its fiat. (2 *Const. Hist.*, 412, 413, Murray's ed. 1866.) (An able presentation of an opposite view has been made by Judge William Lawrence of Ohio. See *American Law Register*, vol. vi. p. 641.)

In the constitution of New York of the year 1777 impeachment and indictment are coupled together, as if they were deemed to be only different modes of trial of the same offence: "In every trial on impeachment or indictment for crimes or misdemeanors the party impeached or indicted shall be allowed counsel as in civil actions." (Art. 34.) In the U. S. Constitution it is "declared that the President and other civil officers of the U. S. shall be removed from office on impeachment for and conviction of treason, bribery, and *other* high crimes and misdemeanors." (Art. 2, § 4.) Who can doubt that the words "treason" and "bribery" are here used to mean specific crimes. According to all ordinary rules of construction, the words "other crimes" must have a similar application. The same general question was discussed to some extent by the judges of the New York court of appeals in the recent case of the impeachment of George G. Barnard as a judicial officer of the State. The drift of the opinions would seem to be that an act to be impeachable must be of a criminal nature, and usually the subject of an indictment, though this rule might not always apply to a judge. Thus, on grounds of public policy he may be exempt from ordinary criminal prosecutions for acts affecting the administration of justice. (See opinions of Grover, Andrews, and Folger, judges, *Trial*, etc., vol. iii. pp. 2037, 2167, 2170.)

Mode of Procedure.—When an impeachment is resolved upon in England, a member of the House of Commons usually rises in his place and makes a charge of crime, which he supports by proofs, and then moves for an impeachment. If this motion is sustained, the member is ordered to go to the House of Lords in company with others to institute the impeachment. Written articles are subsequently presented. In this country the impeachment is commonly brought forward by the report of a committee of the more popular branch of the legislature. The matter of arrest of the person impeached is of much consequence in the English law, as the proceeding may involve liberty or life. In the U. S. no arrest is necessary, as, if the party has been properly summoned, the trial may go forward in his absence, and the whole object of the proceeding is achieved by removing him from office or imposing a disqualification for the future, or both. The subject of suspension from office is, however, one of grave consequence, particularly in the case of so important an officer as that of President of the U. S. A constitution may provide for a suspension in office while an impeachment is pending, when of course no question arises. The U. S. Constitution is silent upon the subject, and the only source of information open to us is the practice adopted in England. It is not necessary to consider the case which has frequently occurred in England, of the impeachment of a member of either house of the legislature, as no such practice is adopted here, each house by the U. S. Constitution having the power of expulsion. The inquiry will accordingly be limited to the case of the suspension of executive or judicial officers from office after impeachment and before judgment. These cases are of two general classes: (1) where the office is held at the king's pleasure; (2) where the tenure of office is fixed, so that the officer has a claim to continue in his office. In the first class of cases the only way in which the impeaching bodies could express their wishes to the king would be by an "address" or joint resolution. Although the Commons have frequently asked the House of Lords to concur with them in such an address, that body has regularly refused to do so while the impeachment was pending. The course of proceeding is manifest in the case of the trial of Lord Bacon while lord high chancellor. After he had been impeached, and had confessed his crime, we are told by historians that a difficulty remained in proceeding further while he retained the great seal, for by the rules of the House of Lords acting as a court of impeachment a defendant produced before them is to receive sentence on his knees at the bar, and the lord chancellor, if present, must preside on the woolsack and render sentence. This rule made it necessary that Lord Bacon should pronounce sentence on himself. This embarrassment was only removed by the Lords entreating the king, after Bacon's confession, on Apr. 30, 1621, to sequester the great seal. (*Lords' Journals*, Apr. 30, 1621.) The king requested its surrender, and received it on May 1. This course of proceeding is a very potent argument against the existence in the impeaching tribunal of any power of suspension or removal. In fact, it is contrary to all *judicial* theories that a court while a proceeding is pending should do any act savoring of punishment or deprivation of rights. Such an act is executive in its nature; and though it might be allowed by statute in England or by constitutional provision in this country, it would not be tolerated as an ordinary branch of judicial procedure. Reference may also be made to the case of the worthless and incapable Scroggs, chief-justice of the king's bench in the reign of Charles II. The House of Lords absolutely refused to join the Commons in addressing the king to suspend him from office. It was understood by the Commons to be a positive decision upon the point that while an officeholder was uncondemned he should not be suspended from the administration of his office. Their leaders complained in their places that the "Lords would not address to sequester Scroggs from his place, but would leave it to his *modesty* whether he would exercise it or no." (8 Howell's *State Trials*, 213, 214; 13 *Journals House of Lords*, 73; Foss, *Lives of Judges*, 170.)

In the second class of cases, where the tenure of office is permanent, the argument is still stronger. Even the Commons have not insisted on suspension or sequestration in this class of cases. That house has drawn a distinction between the two cases, refusing in a well-known instance to address the king to remove the duke of Buckingham from an office of a permanent nature, though it asked for his dismissal from an office held at the royal pleasure. (6 Howell's *State Trials*, 1064.)

According to these principles, what rule should be applied in the case of the impeachment of the President of the U. S.? Undoubtedly, the people have a right to his continuous services, of which they cannot be deprived by either branch of Congress acting in an impeachment before his conviction, unless by some constitutional provision, either express or implied. There is certainly no express clause in the Constitution, nor, according to what has been seen, are there any implications to be drawn from English practice. It may be added that there is evidence to be derived from the debates of the framers of the Constitution that their opinion coincided with the English view, though great stress should not be laid on discussions of this kind. (See 2 *Madison Papers*, 1154; 3 *ib.*, 1572, 1573.) It seems quite plain that an implied power to suspend the President from office, beginning to operate at the very moment of his impeachment by the House of Representatives, would be of a highly dangerous character, as a majority adverse to that functionary might seize upon this mode of removing a President obnoxious to them, and by dilatory processes might prolong the trial so as substantially to remove him from office without any real cause. In this way, a mode of trial for grave crimes which was only intended to be used in extreme cases when the majesty of the people was offended, might be resorted to on frivolous and absurd pretexts, and as a method of scourging or frightening a political opponent; or an impatient legislature might resort to this process to grasp at executive authority or to overcome executive vetoes.

Assuming that articles of impeachment have been prepared, and an answer received and reply made if necessary, a day is fixed for the trial of the cause. The court in England is organized with much pomp and solemnity. A graphic description of it will be found in the case of the trial of the earl of Stafford (7 Howell's *State Trials*, 1194), as well as in the essay of Lord Macaulay upon the life and career of Warren Hastings. The proceedings on the part of the House of Commons are conducted by a committee, called "managers." An opening speech having been made, the trial proceeds much in the same way as in ordinary

criminal proceedings, counsel representing the accused, and evidence being adduced in a formal and regular way. The proceedings are frequently dilatory, and a prorogation or dissolution of Parliament may intervene. It has been decided that such an event does not vitiate the proceedings so that it will be necessary to commence again, but that they will continue until a conclusion is reached. (1 May's *Const. Hist.*, 437, and authorities cited.)

The rules attending judgment are special. Questions which are considered to involve the merits of the case having been agreed upon, each member of the court is interrogated by the presiding officer as to his opinion in the presence of the accused and the House of Commons. The peers, commencing with the one lowest in rank, as the questions are put to them rise successively in their places, and standing uncovered and placing their right hands upon their breasts, say, as the case may be, "Guilty" or "Not guilty, upon my honor." If the accused is found guilty, the next step is for the Commons to demand judgment. Impeachments in England have within the last one hundred years been very rare, only two being known to have taken place—that of Warren Hastings and that of Lord Melville. (1 May, *Const. Hist.*, 435.)

Under the U. S. Constitution the House of Representatives presents the impeachment. The trial is had before the Senate, except that when the President of the U. S. is tried the chief-justice of the Supreme Court presides, the Vice-President in that case not sitting. The Senators acting as a court of impeachment are required to take an oath or affirmation. There is less formality in rendering judgment. Each member, rising in his place, votes guilty or not guilty upon the respective "articles of impeachment" presented by the House of Representatives. Two-thirds of the members present must concur to ensure a conviction. Under the English law a pardon by the king cannot be *pleaded in bar* of an impeachment. The effect of this provision is that the king cannot prevent the trial and conviction of the accused. After judgment the ordinary rule is understood to apply, and the king may pardon. Under the U. S. Constitution the President is deprived altogether of the power to pardon. There seems to be a good reason for the distinction in the two countries, as under the English law the jurisdiction of the court is both criminal and political in its nature, while in the U. S. it is political, having only to do with officers and their administration of office.

In the various States of the Union it is the common practice to provide in their respective constitutions for the organization of a court of impeachment to try State officers. In the main, the general outlines of the clauses of the U. S. Constitution are followed. The more popular branch of the legislature presents the impeachment, while the upper house or senate tries it. In New York the judges of the court of appeals and the lieutenant-governor are joined with the senate, though the latter officer does not sit when the governor is impeached. Some of the States provide expressly in their constitutions for the suspension of officers from office when on trial. In some there is a requirement that the chief-justice of the supreme or other high court shall preside when the governor is tried. The details must be sought in the respective State constitutions.

Reference is made below to some of the more prominent cases of impeachment in England and in this country: Trial of Lord Latimer, A. D. 1376; ib. of the duke of Suffolk, A. D. 1469; ib. of Mompesson and associates, *temp.* James I.; ib. of Lord Bacon, do.; trial of Lord Danby in the reign of Charles II.; trial of earl of Macclesfield, 1725; trial of Warren Hastings, 1788; ib. of Lord Melville, 1806. Many of these and other cases are found in Howell's *State Trials*, Hatsell's *Works*, and the journals of the two houses should be referred to. Recent impeachments in the U. S. are that of Andrew Johnson, President of the U. S., 1868, published in 3 vols.; also that of George G. Barnard, judge in New York, 1872, published in 3 vols. Earlier cases were the impeachment of William Blount, a Senator of the U. S., 1797, published in Wharton's *State Trials*, 200; that of Samuel Chase, associate justice Supreme Court U. S., 1804, published by Smith & Lloyd, 2 vols.; and that of John Pickering, district judge of New Hampshire, 1803 (see 2 Hildreth's *Hist. U. S.*, 518). See also 2 Story's *Comm. on the Constitution;* Cushing's *Law and Practice of Legislative Assemblies.* T. W. DWIGHT.

Impenetrabil'ity [Lat. *impenetrabilis*, "not to be penetrated"], one of the essential properties of matter, implying that no two bodies can occupy the same portion of space in the same instant of time. If a nail be driven into a piece of wood, it does not, properly speaking, *penetrate* the wood, for the fibres are driven aside before the nail can enter. With regard to liquids, the property may be proved by very simple experiments. Let a vessel be filled to the brim with water, and a solid incapable of solution in water be plunged into it; a portion of the water will overflow, exactly equal in bulk to the body immersed. If a cork be rammed hard into the neck of a phial full of water, the phial will burst, while its neck remains entire. The disposition of air to resist penetration may be illustrated in the following manner: Let a tall glass vessel be nearly filled with water, on the surface of which a lighted taper is set to float. If over this glass a smaller cylindrical vessel, likewise of glass, be inverted and pressed downward, the contained air maintaining its place, the internal body of the water will descend, while the rest will rise up at the sides, and the taper will continue to burn for some seconds encompassed by the whole mass of liquid. (Leslie's *Elements of Natural Philosophy.*) The lightest gases are really as impenetrable as the densest solid, although, owing to their compressibility, it is not readily made apparent.

Strictly speaking, this property applies only to the *atoms* of a body. In many phenomena, bodies appear to penetrate each other; thus, the volume of a compound body is always less than the sum of the volumes of its constituents; for instance, the volume of a mixture of water and sulphuric acid, or of water and alcohol, is less than the sum of the volumes before mixture. In all these cases, however, the penetration is merely apparent, and arises from the fact that in every body there are interstices or spaces unoccupied by matter. (Ganot's *Physics*, ed. Atkinson, New York, 1872.)

Impen'nates, or **Impennes** [Lat. *in*, and *penna*, "a wing"], the name of a tribe of swimming birds having short wings covered with feathers resembling scales; the penguin (*Aptenodytes*) and the great auk (*Alca impennis*) are examples of this group, which, however, is not a natural one.

Imperador', Villa do [Port., "city of the emperor"], large town in Brazil, province of Parahiba, 95 miles N. W. of Pernambuco. It has a considerable traffic in sugar, cotton, coffee, Brazil wood, drugs, and timber.

Imper'ative, Categorical or **Moral.** In the terminology of the Kantian school of psychological ethics, this expression denotes the idea of Duty. "Man, in the consciousness of his moral liberty, recognizes two great laws regulating his will; the first prompts him to seek his own well-being; the second *commands* him to be virtuous, even at the sacrifice of happiness. From this opposition in his moral nature between Desire and Conscience springs up the Idea of Duty," otherwise the Moral Imperative, to which term Kant added the epithet *categorical* to indicate that its commands are absolute and unconditional.

Imperative Mood [Lat. *impero*, "I command"], in grammar, the form of the verb which denotes command, entreaty, or, in general, desire.

Impera'to (FERRANTE), b. in Naples, Italy, about 1565; became a druggist; made a fine collection of minerals; founded a botanical garden at Naples, and devoted himself with great enthusiasm to natural history, on which subject he published a folio volume, *Della Istoria Naturale Libri XXVIII.* (Naples, 1599), which was reprinted at Venice in 1672, and translated into Latin (Cologne, 1695). It is not so much a treatise upon natural history as a descriptive catalogue of plants, minerals, and precious stones, having no great scientific value. It was, however, the occasion of a curious literary controversy, it having been vigorously asserted and denied that the work was written by one Nicolas Stelliola, who sold it to Imperato for 100 ducats. The authority of Tiraboschi is unfavorable to the claims of Imperato, who was, however, on terms of intimacy and correspondence with several eminent naturalists. He lived far into the seventeenth century.

Impera'tor [Lat., "commander"]. During the entire existence of the Roman republic, of which the forms were preserved for hundreds of years after the republican spirit had disappeared before the encroachment of centralization combined with universal dominion, the title *imperator* had a meaning very different from that of the Byzantine, the mediæval, or the modern term "emperor." Originally of purely military application, it meant nearly the same as "captain" or "general," and the soldiers who on the battle-field acclaimed their leader *imperator* meant only to express their belief that he was worthy to exercise command. The concentration of power in the hands of Augustus and his successors, with which their title of *imperator* is popularly associated, was exercised not by virtue of that title, but by accumulating in the hands of a single individual the additional offices of consul, proconsul, tribune, pontifex maximus, and censor; the attribution of all these powers to an *imperator* is a later idea.

Imperatriz', Villa da [Port., "city of the empress"], town of Brazil, province of Ceará, on the Serra Uruburelama. Medicinal plants are abundant in the *monte* (forest), and gold, silver, iron, copper, and salt are all found in greater or less quantities in the adjacent mountains.

Imper′fect, in music, a term indicating deficiency or a want of completeness or finality. An imperfect *interval* is one which is a semitone less than the perfect. Thus, the interval B—F is an imperfect fifth; but by the addition of a semitone to either the higher or lower term—*i. e.* by flattening B or sharpening F—the interval becomes perfect. Thirds and sixths are commonly regarded as imperfect intervals, because they may be readily changed from major to minor, or from minor to major, by the use of a flat, sharp, or natural. An imperfect *chord* is one in which some of its intervals are wanting; as when, in a chord of the seventh, we occasionally omit the third, the fifth, or even the root. In some cases *two* of these intervals are omitted. The imperfect *cadence* (or half cadence) is that in which the harmony of the triad is followed by that of the dominant, being the exact contrary of the *perfect* cadence. By some writers several other cadences, not final, are termed imperfect. WILLIAM STAUNTON.

Impeti′go [Lat. an "attack," from *impeto*, to "rush upon"], a skin disease, resembling eczema in being more or less diffuse inflammation, but resulting, unlike eczema, in pus-formation. The *crusta lactea* of young infants is one of its forms, which are rather numerous. True impetigo is not contagious. It frequently is cured by time alone, but if persistent should be treated with oxide-of-zinc ointment or some other mild stimulant. The so-called *impetigo figurata* is a distinct disease, depending on the presence of *Trichophyton tonsurans*, a parasitic vegetation. Epilation of the part with irritant washes, as of corrosive sublimate, will cure the disease, which is truly contagious.

Impey (Sir ELIJAH), chief-justice of Bengal in 1774, became infamous in history by his atrocious perversion of law. He sentenced the celebrated Nuncomar to death for the assumed crime of forgery in 1775, was recalled in 1782, impeached in 1788, and d. Feb. 1, 1812. His wife, divorced from him by his consent, became Lady Hastings. (See Macaulay's *Essay on Warren Hastings*.)

Im′peyan Pheas′ant, the *Lophophorus Impeyanus*, a fine large pheasant from the Himalayas, is nearly as large as a turkey, splendidly colored, and has been domesticated.

Im′plements, Agricultural. Of these, the more important are noticed under their alphabetical heads. The manufacture of this class of goods is a very extensive industry in the U. S. In 1870 there were reported 2076 establishments, employing 25,249 persons, a capital of $34,834,600, paying $12,151,504 as wages, and producing goods worth $21,473,925.

Imports. See COMMERCE, by J. S. GIBBONS.

Impos′tors, The Three (*De tribus Impostoribus*), a supposed work attacking the Jewish, Christian, and Mohammedan religions, which at various times since the tenth century has been written of by theologians and others. The most diverse statements have been made as to its authorship and character, and it is very doubtful if a genuine work of this title ever existed. But in later times there have been many spurious works written, pretending to be the real *De tribus Impostoribus*. Not one of them is of any great antiquity or of any possible value.

Impress′ment, in English law, is defined as the forcible levying of mariners in time of war for the king's service at sea. It was formerly the usual method of manning the British navy, and a similar procedure was employed by other maritime powers. The power of impressment was a branch of the royal prerogative, first mentioned in the statute 2 Richard II. c. 4 as a recognized usage. Many acts of Parliament from the time of Queen Mary down to George III. regulated the system of impressment and exempted certain classes of mariners. The mariners were seized by an officer acting under an impress-warrant, and having under his orders an armed party of picked men (the press-gang), with which he visited the usual haunts of seamen and violently seized the most robust men, not without frequent and bloody struggles. A merchant-vessel or a privateer was also liable to be so depleted of sailors by any man-of-war as to be crippled for all practical purposes. The laws sanctioning impressment are still unrepealed, but the system of bounties has practically taken its place. The impressment of American sailors was an abuse practised for several years by Great Britain during the great continental war against the French empire, notwithstanding the constant and earnest protest of the U. S. government; and this finally became the immediate cause of the war of 1812 between the two countries. It has been often noted that in the treaty of peace signed at Ghent in 1814 nothing was stipulated regarding this original cause of the war; nevertheless, the American doctrine achieved a practical victory, and impressment has not since been employed by Great Britain, not even during the Crimean war. It will probably never be revived. PORTER C. BLISS.

Impris′onment. In the most comprehensive sense of the term, imprisonment denotes any deprivation of personal liberty, whether by actual confinement or simply by forcible restraint or detention against a person's will. Detaining a man in a public street or taking him into custody, either by the exercise of actual force or by the exhibition of such real or assumed authority as secures his submission, would, in this view, be a sufficient imprisonment. When no actual force is employed the imprisonment is termed constructive; in other cases, actual. When the restraint upon a man's person is unlawful it is called "false imprisonment," and this is a violation of personal rights for which an action at law may be instituted and damages recovered. (See FALSE IMPRISONMENT.) In its narrower signification, however, and according to more popular usage, imprisonment denotes an actual confinement of the person under legal process in some prison or jail which is specifically employed for such a purpose in accordance with provisions of law. The power to imprison, using the word in this narrower sense, is either inherent in courts or magistrates as one of their essential prerogatives, or is conferred upon them by statute. Imprisonment is employed in both civil and criminal proceedings. It may be used as a form of civil remedy, as when a debtor is arrested and held in custody for the purpose of securing the satisfaction of some debt which he is under obligation to pay; or it may be adopted as a means of obtaining testimony, as where, in criminal cases, witnesses are kept in confinement that they may be forthcoming at the trial of a cause; or it may be employed as a mode of punishment, as where persons guilty of contempt of court or convicted of a criminal offence are sentenced to be kept in prison for particular periods. These are the most important purposes for which imprisonment under authority of law is employed, though particular classes of persons may be placed in legal confinement for still different reasons, as, for instance, where lunatics are confined in asylums; but places of this kind are not usually known as prisons, and this kind of imprisonment will not therefore be considered in this connection. (See INSANITY.) Imprisonment for debt was at common law in former times generally allowed at the suit of a creditor as a matter of course, and became the regular practice. But in recent times the tendency has been to abolish it by statute, except in relation to particular classes of debts, among which are usually included those founded upon fraud or misfeasance, fines and penalties, etc. In England the first statute of this kind was passed in 1838, but the act which at present (1875) regulates this subject was enacted in 1869 (32 and 33 Vict. ch. 62). This provides that no person shall be imprisoned for making default in the payment of a sum of money except in cases of penalties not arising upon contract, of default by trustees in making payments directed by a court of equity, of default in payment of a sum recoverable summarily before a justice, and in a few other cases of less importance. In these excepted cases the imprisonment cannot continue longer than a year. There are also some further qualifications of the general rule in special instances. Thus, when a person makes default in the payment of any debt due in pursuance of the order or judgment of a competent court, and is proved to have had the means to pay since the order or judgment was rendered, he may be committed to prison for a term not exceeding six weeks, or until payment is made. Arrest and imprisonment upon mesne process is abolished entirely, with the single exception that where the suit is for £50 or more, and there is reason to apprehend that the defendant will leave England, he may, on proper evidence under oath of these and a few other necessary facts, be imprisoned for a term not exceeding six months, or held to bail. In New York an act to abolish imprisonment for debt was passed in 1831, and is still in force. This provides that no person shall be imprisoned on civil process at law or on execution in equity founded on contract except in the following cases: in proceedings as for contempts to enforce civil remedies, in actions for fines and penalties, or on promises to marry, or for moneys collected by any public officer, and in actions for any misconduct or neglect in office or in any professional employment. Moreover, in cases of debt claimed in any suit or founded upon any judgment or decree of a court of record, the defendant may be arrested upon an affidavit of the plaintiff stating the sum due to be more than $50, and charging the commission of certain fraudulent acts; as, that the defendant is about to remove any of his property out of the jurisdiction of the court to defraud his creditors, that he fraudulently conceals property, or has assigned, removed, or disposed of it with like intent, or that the debt was fraudulently contracted. The defendant is thereupon committed to prison, unless he either pays the debt and costs of the suit or gives security to pay them within a certain time, or unless he makes an assignment of his property for

the benefit of his creditors, or gives security that he will make such an assignment or that he will not dispose of any of his property until the demand against him is satisfied. If he makes such an assignment of his property, there are provisions in the act by which he may be discharged from his indebtedness. Further provisions of an analogous nature to those contained in this act were embodied in the New York code, adopted in 1848. The debtor may be arrested and imprisoned either on mesne or on final process. The principal grounds of arrest are, with a few exceptions, the same as those enumerated in the previous act. The defendant, when arrested upon mesne process, may be admitted to bail. The imprisonment upon final process is for the same causes, and is applicable when the execution against the debtor's property has been returned unsatisfied, in whole or in part. The most important difference between these provisions and those of the earlier statute is that in the later act means only are provided for securing the payment of the debt of an individual creditor, and there is no assignment provided for in behalf of all the creditors, or any means afforded of obtaining a discharge of the debtor from all his obligations. A large number of the States of the Union have adopted similar statutes. (A comprehensive summary of these may be found in Kent's *Commentaries*, vol. ii. pp. 398, 399. For the rules regulating the subject of arrest on civil process, see ARREST.)

In criminal proceedings, imprisonment is employed as a means of detaining alleged offenders in custody, in certain cases, to ensure their appearance at the time of trial, and also as a common form of punishment to which a convicted prisoner may be sentenced. It is the ordinary penalty both in cases of felony and of misdemeanor, and the classes of offences in which a sentence of this kind may be given, and the terms of imprisonment which may be imposed, are generally determined by specific statutory provisions. A minimum and a maximum period are usually declared as appropriate to any particular crime, and the magistrate may impose a greater or less term within these limits according to his discretion. Fines are frequently imposed in connection with imprisonment as an additional penalty. (See FINE.) The means of adequately adapting the severity of the penalty to the degree of heinousness in the offence, which is afforded by the facility with which longer or shorter terms of imprisonment may be meted out, and the opportunity which is given for the reformation of offenders when they are confined in prisons, render this one of the most salutary modes of punishment which the law provides. (See PUNISHMENT. For the methods of prison management and discipline, see PRISONS, PRISON DISCIPLINE.)

Imprisonment in cases of contempt of court is discussed under the topic CONTEMPT. In regard to the imprisonment of witnesses to secure their testimony, see WITNESS.

The remedies which the law affords in cases of unlawful imprisonment are of various kinds. Thus, the person who has wrongfully caused or procured the confinement of another may, as has been stated, be sued by the latter in a civil action for false imprisonment, or he may be subjected to a criminal prosecution. When the prisoner desires to obtain a release or discharge, a petition upon *habeas corpus* may be made by him or in his behalf to the proper court. And a petition of this kind may even be resorted to when the imprisonment is not unlawful, as in cases where a person confined under legal process desires to be admitted to bail, or to have the reasons for his detention investigated and its validity determined. (The rules upon this subject are stated under the topic HABEAS CORPUS.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Improvisa′tion is the art of composing poetry extemporaneously. Although the term embraces every rhythmic form of impromptu song or recitation, and is sometimes even applied to unpremeditated prose declamation, especially to that of a highly figurative and impassioned character, yet it is restricted in popular use not merely to metrical compositions, but to those which please by syllabic consonance or correspondence of sound. The modern ear, in the countries and classes where improvisation is most practised, has been trained to demand not only a regular recurrence of metrical feet or accentual longs and shorts, but full or half rhyme, assonance, or at least alliteration, as an indispensable condition of this species of intellectual entertainment. But even in Italy and Spain, especially in the more elevated and refined exercise of the art, that satiety of rhyme which led Trissino to invent modern blank verse—first employed in his *Sophonisba* in 1524—sometimes induces improvisators to dispense with this ornament, and to content themselves with a simple iambic or trochaic arrangement of syllables in verses of a determinate length. There are, too, nations in whose extemporaneous poetry parallelisms in sense or imagery, coupled with metre, supply the place of consonance. Readers familiar with *Kalevala* and *Hiawatha* will readily perceive that this varied repetition of thought and illustration may be used with very happy effect in improvised as well as in deliberate composition. Improvisation is doubtless the most primitive and universal mode of expressing poetic feeling, and it appears to have always existed among semi-barbarous races sufficiently advanced in intellectual development to derive pleasure from any form of poetry. The early poets of Greece and of many other ancient countries were minstrels, and chanted their compositions, which were in a great degree extemporaneous in detail and expression, though probably not often in subject and general treatment, to a musical accompaniment, which we must suppose too simple to have served much other purpose than to mark the time or metre. The improvisators of recent ages have not generally availed themselves of this expedient. The most genial examples of modern improvisation are found among peoples and in classes possessing a considerable amount of traditional, though not of scholastic, culture. With the diffusion of instruction, and of printed, and especially of periodical literature, and above all, with a wider participation of the higher and middle ranks in active business and political life, it gradually ceases to enjoy favor, and the power of improvisation diminishes with the social demand for it. The rhetorical character of improvised poetry depends less on the material condition and mode of life than on the moral, intellectual, and social training and habits of the composer and his audience; its special forms, as indeed those of all poetry, are determined, or at least greatly influenced, by the orthoepical system and the grammatical structure of the language employed by the bard. It is noticeable that the physical characteristics of the scene of the poem are less frequently reflected in unpremeditated verse than the actions and passions of the bard and his personages. Real nature is too familiarly known to the nomade, the shepherd, and the rustic cultivator as a hard and niggard landlord to be an attractive feature in his imaginative recreations, and his spontaneous lyrics teach us much more of the man himself than of his surroundings. This consideration furnishes an argument against the authenticity of the pretended poems of Ossian. They have too much material *couleur locale* to be accepted as genuine specimens of bardic song. The most untrained ear readily seizes and soon learns to enjoy accented rhythm, and a frequency of corresponding sounds in a given language almost mechanically prompts a disposition to employ them as a means of giving a melodious expression to feeling and to thought. A strongly marked syllabic accent and an abundance of rhymes, therefore, are circumstances favorable to the invention and free and ready employment of poetical forms; and it is chiefly in languages marked by these characteristics that improvisation is most general. The modern languages of the Latin stock—with the exception of French, which is scarcely Latin otherwise than in vocabulary—have a very distinctly accented pronunciation; they abound in rhymed endings, and they accordingly present great material facilities for the construction of verse. All inflected languages to a certain extent supply rhymes, because words of the same class and in the same grammatical category have generally the same final syllable or syllables. But, on the other hand, the very fact that like endings occur only in like categories makes words disparate which in uninflected tongues might freely be paired in rhymes under almost any circumstances. To exemplify: the Italian *anno* is radically the same word as the Latin *annus;* the Italian *panno* the same as the Latin *pannus.* Now, *anno* and *panno* have each but one change of form, the plurals *anni* and *panni; annus* and *pannus,* in their different cases and numbers, have each eight variations of ending. The Italian words, then, in their respective singulars and plurals, rhyme with each other in all syntactical combinations; the Latin, with the exception of the coincidence between the genitive singular and nominative plural, can be employed as rhymes only when they happen to be in the same case. Besides this, the regular diminutive and augmentative uninflected forms, in which Italian is so rich, are a great resource to the rhymer. A comparison between Italian and the Gothic languages would furnish analogous illustrations, and there is one peculiarity of the inflectional system of the Icelandic which merits notice as having probably influenced the poetic forms of its literature in a curious way. *Strong* inflections, or those where etymological variations consist in vowel-change, are more common in Icelandic than in the other Gothic languages, and were so in a still higher degree at an earlier stage of the language. For example, the nominative singular *hönd* has the genitive *handar,* the dative singular *hendi. Land* singular has the nominative and accusative plural *lönd.* It is doubtless to this fact that we are to ascribe the adoption of *half rhyme,* which, as well as alliteration, is now generally an indispensable feature of Icelandic verse, even when ordinary end-rhymes also are

employed. *Half rhymes* are syllables containing the same final consonants with different vowels, and both they and full rhymes are introduced according to certain rules, generally not at the close, but in the body of the verse. Thus, while *hönd* singular and *lönd* plural are full rhymes, both those forms are good half rhymes with the singular *land* and with the genitive and dative *handar* and *hendi*. A vowel-change, therefore, which destroys a full rhyme often makes amends by supplying several half rhymes. But notwithstanding this and peculiar prosodical advantages of other Gothic languages, there is no doubt that in facility of versification Italian surpasses not only these, but the Spanish also. The Spanish, indeed, gains in this respect by allowing *assonance*, or the correspondence of vowels while the final consonants differ; but its consonances appear to be fewer than in Italian, and the rigor of its rules in the employment of rhyme renders it less tractable as a metrical medium than the sister speech. Reasoning from analogy, we should expect to find improvisation in all not absolutely savage races whose languages exhibit uncommon orthoepical facilities for melodious or harmonious expression. Hence the Cherokees—whose remarkable speech has but eighty-five possible syllabic combinations of elementary sounds, and therefore superabounds in rhymes, and who, like the other North American Indians, have great readiness in extemporaneous prose harangue—ought, in their present partially civilized condition, to excel in improvised verse. But we do not know that any species of native poetry is cultivated among them.

Our knowledge of the extemporaneous poetry of unlettered peoples amounts to little more than we have already stated. Such races, of course, cannot commit their own effusions to writing, and strangers rarely know enough of any unwritten language to be able to seize and record its poetic accents. Ancient compositions of this sort have indeed been handed down and long preserved by tradition, but in this mode of transmission the diction, thoughts, and imagery change with changing generations, and after a longer or shorter time the poem ceases to be identifiable with the original. Probably the most authentic specimens we possess of primitive improvised poetry are those which occur in the sagas or narrative literature of Iceland. These usually extend to but a few couplets, and, rhetorically speaking, are little more than ejaculatory expressions of thought or feeling. But, though they are generally frigid in tone and destitute of real poetical merit, they are, to the last degree, artificial and complicated in structure and figurative in diction. We can scarcely suppose that such *nugæ difficiles* could have been truly extemporaneous, and we cannot help suspecting that most of them, like the sudden inspirations of many professional modern orators, belong to the class of premeditated impromptus, deliberately composed and stored up for use when the occasion should present itself, or that they have been much elaborated by the historians who quote them.

There have been *improvvisatori* in almost all European peoples, but in none of the Gothic or Latin countries, except in Italy and perhaps Spain, have they been numerous enough and gifted enough to have had any real literary importance. Some of the Italian improvvisatori of the sixteenth century composed in Latin as well as in their native language, and many of those of the seventeenth and eighteenth, as well as of the present century, were persons almost as remarkable for learning as for dexterity in the production of unpremeditated verse. Perfetti in the seventeenth century, Corilla in the eighteenth, Sgricci in the early part of the nineteenth, were all persons of high culture, and in our own times Regaldi and Giannina Milli combine with a surprisingly ready command of varied versification a range of thought and of illustration which shows a wide acquaintance with history, with life, and with literature. Some of the published works of Italian improvvisatori are of unequivocal merit, and few of them are without more or less frequent flashes of genius, but as a general rule we admire the art rather than the product, the loom rather than the tissue. As we have already hinted, improvisation is now much less common than formerly as an entertainment of highly cultivated circles in Italy. Though still occasionally practised in fashionable society, it is, so far as such society is concerned, substantially a thing of the past, but it subsists with almost unabated vitality among the peasantry of many provinces. Tigri's *Canti Popolari* and Giuliani's *Linguaggio Vivente della Toscana*, which contain many specimens of impromptu verse taken down as faithfully as possible from the lips of peasant reciters, are well worth the attention of the reader. The astonishing quickness of intellect of the Italian people shows itself as brilliantly in the unpremeditated lays of the rustic as in animated discussion and action in the educated classes. Improvisators of both sexes, who are what the Italians call *analfabeti*, or unable to read or write, extemporize, like their brethren of higher culture and social condition, in every metre, every structure of verse, couplet, and stanza, every style of poetic composition, lyric, narrative, didactic, dialogue between two rival bards, *arcades ambo*, and dramatic; and it is worth noticing that at many of the popular theatres the playwright only furnishes the characters—which indeed are usually regular stock *rôles*—and the skeleton of the drama, leaving the personages to extemporize the dialogue, which is often most genial and spirited, as the action proceeds. The rustic bard has an important advantage in the childlike simplicity of his hearers, who, like real children, are never tired of iteration. The child never objects to a tale that is "twice told." The peasant extemporizer, in his narrow range of thoughts, words, and imagery, may use the same maxim or proverb, the same epithets, the same similes, the same pairs of rhymes, indefinitely, and his audience are as little wearied with his repetitions as was the old German with hearing Giselher always called "the youthful" through a narrative which extends from his boyhood to his old age, or the Finlander with the ever-repeated epithet of "old and truthful," which Kalevala constantly applies to Wäinamöinen, even when he is lying. The educated improvvisatore, with his more multifarious culture, has of course a larger and more diversified stock of material, and, like the preacher and the popular speaker, he habitually prepares at leisure new verbal combinations, happy turns of expression, similes, and illustrations, to be introduced into his recitations as occasion serves. But these stores cannot be inexhaustible, and when the stock grows thin and inspiration flags, he cannot repeat himself to his exacting audience, as the humble bard may do in his rustic circle, and he usually retires from the field after a short though, it may be, a brilliant career.

GEORGE P. MARSH.

Imputa'tion of sin, guilt, and merit. This word is the English equivalent of the Hebrew חָשַׁב, *hashav*, which is represented in the Septuagint and the New Testament by the Greek word λογίζομαι. These words are of very frequent occurrence in the Scriptures, and are variously translated in our version; *e. g.*, *to think* (Job xxxv. 2 and Rom. ii. 3); *to regard* (Isa. xxxiii. 8); *to esteem* (Isa. xxix. 16, 17 and Rom. xiv. 14); *to reckon* (2 Sam. iv. 2); *to be reckoned for or among* (Rom. iv. 4; Luke xxii. 37); *to impute* (Lev. vii. 18 and Rom. iv. 6–8); *to lay to one's charge* (2 Tim. iv. 16), etc. Liddell and Scott define the general meaning of λογίζομαι to be "to count, deem, consider, that anything is." Cremer (*Bib. Theo. Lex. of N. Test. Greek*) says λογίζεσθαι τί τίνι, "to reckon anything to a person, to put to his account, either in his favor or as what he must be answerable for." In Christian theology this word is used in connection with the terms "sin," "guilt," "merit," "righteousness," etc.

Sin includes two essential elements: (1) *Macula*, moral pollution or defilement, as sin stands opposed to holiness; (2) *reatus*, *guilt*, as it stands opposed to justice. Again, *reatus* or guilt must be distinguished as (1) *reatus culpæ*, desert of blame, and (2) *reatus pœnæ*, just obligation to punishment. It is agreed by all parties that neither the *macula*, pollution, nor the *reatus culpæ*, desert of blame, can be separated from the person sinning, and imputed or charged to the account of another person. But the whole Christian Church, Roman, Lutheran, and Reformed, is agreed that the *reatus pœnæ*, or just liability to punishment, may be charged to the account of other persons than the actual transgressor when those other persons stand in such a relation to the actual transgressor as, for any reason, to be justly responsible for his action. "To impute sin or guilt," therefore, is to charge the legal responsibility for transgression upon any one as the ground of judicial process. "Not to impute sin" is to "cover it," remit its punishment, and so refuse to make it the substance of a penal indictment (Rom. iv. 6–8). Thus, though for very different reasons, was the guilt (*reatus pœnæ*) of Adam's act of apostasy imputed or charged to the account of all his natural descendants, who are punished together with him; and the "many offences" of all his people were "laid upon" or charged to the account of the Lord Jesus, and he suffered their punishment vicariously—*i. e.* in their stead and behalf. "The Lord hath laid on him the iniquities of us all" (Isa. liii. 6–12; Gal. iii. 13; 1 Pet. ii. 24); "Therefore as by the offence of one, judgment came upon all men to condemnation" (Rom. v. 18).

Merit must also be distinguished (1) as worthiness of praise, which is inseparable from the person, and (2) worthiness of reward, which may be "imputed" or credited to all who by previous union or stipulation may have rights involved in the action of the meritorious agent. *Righteousness* means "that which satisfies law" (*Cremer*), all that constitutes the condition of acceptance or of reward—*i. e.* of forensic justification. This righteousness may be wrought out personally in behalf of one's self, or vicariously in behalf of another. Thus by the rewardableness

of Christ's obedience, or his vicarious righteousness imputed to all who believe, as the ground of their sins being pardoned and their persons accepted and treated as those with regard to whom all the demands of the law have been fulfilled. "Even so by the righteousness of one the free gift came upon all men unto justification of life;" "So by the obedience of one shall many be made righteous" (Rom. v. 18, 19 and iv. 3–9).

The entire Church agrees as to the fact, though different theories exist as to the grounds, of the imputation of Adam's first sin. The imputation of Christ's merits is clearly held by the Lutheran and Reformed churches, but is obscured in the Roman Church by their doctrine of works, subjective justification, etc. Bellarmine, *Amiss. grat.*, v. 17: "(The first sin) was imputed to all who were born from Adam." *Form. of Concord*, p. 639, Hase: "We all, on account of the disobedience of Adam and Eve, are by nature children of wrath." James Arminius (1560–1609): "Whatever punishment therefore was inflicted on our first parents . . . now rests on all their posterity." *Form. of Concord*, p. 684, Hase: "We believe that a sinner is justified before God . . . only on account of the single merit, the perfect obedience and severe suffering, death, and resurrection of our Lord Jesus Christ, whose obedience is imputed to us for righteousness." To the same effect see *Heidelberg Catechism*, ques. 60, and *Westminster Conf. of Faith*, ch. ii. § 1, and all other Protestant symbols.

A. A. Hodge.

In'achus, in Grecian mythology, the god of the river Inachus in Argos, who in the dispute between Poseidon and Here about the possession of Argos decided in favor of the latter, and hence was deprived of his water by Poseidon and made dry except in the rainy season. In other places Inachus is referred to as the first king of Argos, who after the flood of Deucalion led the Argives from the mountains down into the plains; hence Argos is often called Inachus.

Inarching. See Arcuation.

In'ca [a Quichua word, signifying "chief"], in its strictest sense, designates the absolute monarch of the ancient Peruvian empire, who was also chief priest and the recipient of divine honors. He was the descendant, by unmixed blood, of Manco Capac and of the sun. The inca must, if possible, be the child of his predecessor by his own sister—a custom which also prevailed in ancient Egypt, in Persia, and in many other lands. In a larger sense, the whole ruling and sacerdotal caste of ancient Peru were called incas. They also received a superstitious reverence from the lower ranks, and possessed many social and political privileges. It is claimed by certain South American Indians that the old blood-royal is still preserved.

Incanta'tion [from *in*, "upon," "over," and *canto*, to "chant"] was a form of magic which was much believed in during the Middle Ages by all Germanic and many other nations, and of which some remnants are still extant in certain popular superstitions in England, Scandinavia, and Germany. It consisted in the chanting or solemn recitation or mystical murmuring of certain phrases, generally of no meaning, but of a striking rhythm. In the mouths of certain persons these phrases had the power of killing or curing a man, of blessing or blasting a field, of raising or laying a storm; or they could compel the spirits of the elements, or even the spirits of the dead, to appear and make revelations. Most often, however, incantation was applied only as an accompaniment to other witchcraft, as, for instance, to the preparation of love-potions or similar magical drugs; and remnants of this form are still existing among the European peasantry. In many places the first use of a new tool, a new dress, etc. is invariably accompanied by the pronunciation of certain phrases; and now and then some old hag may be met with in Scotland, Norway, Jutland, and certain parts of Germany who acknowledges that she can cure fever, aches, rheumatism, consumption, heart disease, etc. by means of a formula she has received in some mysterious way from another old hag. The incantations in *Macbeth* and *Faust* give a very vivid picture of this kind of magic.

Incar'nate Word, Ladies of the, a congregation of nuns founded 1625 by Jeanne Marie Chezard de Matel (1596–1670), approved by the pope in 1633. Their work was at first one of instruction, but in 1866 they assumed the care of hospitals. They have (1875) eight houses in Texas.

Incarna'tion [Lat. *in*, and *caro, carnis*, "flesh"], a term applied generally to the presence of deity in a mortal form; theologically, to the union of God and man in the person of Christ. The motives for the incarnation were—God's love for man, and will to save him from the worst consequences of sin (John iii. 16), his desire to raise human nature by joining the divine nature to it, and to show mankind "a perfect and exalted model of human excellence." That Christ might be given to the world two principles were united—the Holy Ghost from heaven, the Virgin Mary on earth (Luke i. 35). Through his conception by the Spirit he was entirely holy, "perfect God;" through his human birth he had capability for all human infirmities except sin, was "perfect man," possessing a "reasonable soul." (See Nicene and Athanasian Creeds.) No dogma has caused more dissension in the Christian Church. Among its early opposers were the Sabellians; the Samosatenes, followers of Paul of Samosata; the Origenists; the Manichæans; and, most important of all, the Arians in the fourth century. (See Arius.) In the fifth century arose the sect of Eutychians, who, while acknowledging Christ's Godhead, denied his assumption of humanity. In modern times the doctrine of Christ's incarnation has been rejected by the Monarchians, the Patripassians, and the Unitarians. Many authors, among whom Strauss and Renan are eminent, have in our day written ably to prove the mere manhood of Christ; and the more advanced of the Broad Church party are regarded as tending towards their opinion. (See *The Incarnation*, etc., by J. Meldrum (London, 1807); Bull, *Defensio Fidei Nicenæ;* Whately, *Essays on some of the Peculiarities of the Christian Religion.*)

Janet Tuckey.

In'cense [Lat. *incendo*, to "burn"], a substance burned for the fragrance of its smoke, and used in the performance of a religious ceremony. The ancient Egyptian, the Hebrew, the Brahmanical, and other religious ceremonials made use of incense-burning. The Roman Catholics and some of the Eastern churches use incense in their services. The Catholic Apostolic (Irvingite) Church has adopted the practice. Various gums and spices are employed, but in the Roman Catholic Church olibanum is used, mixed with storax, cascarilla, and other ingredients. It is burned in a thurible or censer swung by chains.

In'cest [Lat. *incestum*, from *in*, "not," and *castus*, "chaste"], cohabitation or carnal intercourse between a man and a woman related to each other in any of the degrees within which marriage is prohibited by law. This was not a criminal offence at common law, but, like adultery and fornication, it was left to the cognizance of the ecclesiastical courts, which had power to annul incestuous marriages and to require the offender to perform a public penance in the parish church. Such a marriage was therefore not void, but voidable, and sentence declaring its nullity was required to be pronounced during the lifetime of both of the parties or it could not be pronounced at all. But by statute 5 and 6 William IV. ch. 54 (1835–36) marriages between persons within the prohibited degrees are declared absolutely null and void. What these degrees are is not stated by the statute, and this point is to be determined by the previously established rules of the canon law and older statutes. Relationship both by consanguinity and by affinity is comprehended within the prohibition in accordance with the so-called Levitical degrees. It is held that marriage with a deceased wife's sister is within these degrees, and consequently void. The disability by consanguinity applies to those who are of illegitimate as well as to those of legitimate birth. No statute has, however, been passed in England declaring incest to be a crime, so that it is not indictable at present any more than formerly. In the States of the Union incestuous marriages are generally prohibited by statute, and the degrees of relationship to which the prohibition applies are, as a rule, specifically declared. Connection by affinity is not usually made a cause of incapacity to marry. In New York, for instance, marriages between parents and children, including grandparents and grandchildren, and between brothers and sisters of the half as well as of the whole blood, are incestuous and void. This provision applies to illegitimate as well as to legitimate children. Incest is also declared to be a crime by some of the States. In New York it is made a felony, and is punishable by imprisonment in a State prison for a term not exceeding ten years.

George Chase. Revised by T. W. Dwight.

Inch'bald (Elizabeth Simpson), b. Oct. 15, 1753, at Stanningfield, Suffolkshire, England; married in 1772 the actor Inchbald, and went upon the stage the same year; acted in London and other English cities with considerable success, but retired from the stage in 1789, and devoted herself to literary pursuits. She translated a great number of dramas from the French and German, and published *The British Theatre*, a collection of dramas in 25 vols. (1806–09), *The Modern Theatre*, a collection in 10 vols. (1809), and a collection of *Farces* in 7 vols. Her greatest success, however, was her romance in 4 vols., *A Simple Story*, published in 1791, and translated into several of the European languages. D. in London Aug. 1, 1821.

Inclined Plane, one of the mechanical powers or

"simple machines," consists of a plane surface inclined at an angle of less than 90° to the plane of the horizon. Since the resistance of a plane is exerted at right angles to the plane, it cannot overcome the weight of a body lying upon it and maintain that body at rest, unless assisted by a third force, which may be that of friction. If there were no friction, a mass would acquire the same downward velocity while moving along the plane as that which it would have in falling from the highest point of the plane freely downward; and if the line of the inclined plane be considered as a chord of a circle, a mass gliding down that chord without friction would reach the base in exactly the time required for that body to fall vertically through a distance equal to the diameter of the circle. The wedge and screw are modifications of the inclined plane.

In Cœ'na Do'mini [Lat. for "at the Lord's Supper;" its first words as at one time written, it having after 1627 been read annually for many years on Holy Thursday, the anniversary of the first eucharistic feast], a famous bull against heretics, schismatics, sacrilegious persons, pirates, forgers, and others. This bull is of very ancient and uncertain date. Opposed by several governments of Europe as an infringement upon royal privileges, this bull was declared void in 1510 by the Council of Tours; but it still was annually read at Rome, though often modified in form, until 1770, when its annual promulgation ceased, another and more modest document taking its place. Easter Monday was finally appointed for its annual promulgation.

In'come-Tax, a form of direct tax based upon the actual annual income of individual citizens. Theoretically, it is the most equitable of all taxes, according most fully with the generally accepted maxim of Adam Smith, that "the subjects of every state ought to contribute to the support of the government as nearly as possible in proportion to their respective abilities; that is, in proportion to the revenues which they respectively enjoy under the protection of the state." It would seem fairest that a small percentage should be levied on all incomes. But most advocates of this tax insist that incomes below a certain amount should go altogether untaxed, and that the percentage should be increased on the larger incomes. Usage has adopted these two features. The chief objection to an income-tax is the difficulty, almost impossibility, of ascertaining men's real incomes; partly because many keep no accurate accounts, and partly because few, comparatively, will make truthful report of their incomes, and the inquisitorial nature of the tax is offensive. Hence the honest and conscientious bear the most of this burden.

In Great Britain an income-tax was first levied in 1798, but it was abandoned soon after the close of the Napoleonic wars. It was again instituted in 1842, and has been continued from that time to the present (1875), not without much murmuring on the part of the people. Incomes under £100 are exempt, and a lower percentage is levied on those between £100 and £150. It is estimated that nearly one-sixth of the annual revenue of the kingdom is derived from this source. In the U. S. the national government collected an income-tax for ten years, from 1863 to 1872. The first law exempted $600, and levied 5 per cent. on all incomes above that sum to $5000, 7 per cent. on all from $5000 to $10,000, and 10 per cent. on all above $10,000. Whatever was paid for rent or repairs was deducted. Subsequent legislation increased the amount exempted—first, to $1000, and later to $2000. The largest amount raised in any one year from personal incomes was in 1866—about $61,000,000, from 460,170 persons assessed. Actual experience under the law tended to relieve difficulties and objections. When most efficiently carried out, concealment and dishonesty were certainly not greater under this form of tax than under any other form affecting personal property. A. L. Chapin.

Incommensurables. See Commensurables, by F. A. P. Barnard.

Incorporeal Hereditaments. See Hereditaments Incorporeal, by Prof. T. W. Dwight, LL.D.

Incubation. See Hatching.

Incum'brance, or **Encumbrance,** a burden, impediment, a hindrance; in law, a legal claim on an estate, for the discharge of which the estate is liable. The term is a general name for liabilities by which an estate in lands and hereditaments may be burdened, such as mortgages and annuities.

Incunab'ula, the name given by bibliographers to books printed before 1500, and important not only for the history of printing, but also in artistic and scientific respects. The name is derived from the Latin *incunabula*, a "cradle," hence generally "beginning."

Indenture. See Deed, by Prof. T. W. Dwight, LL.D.

Independence, The, of the U. S. of America. See Declaration of Independence.

Indepen'dence, county in the N. E. of Arkansas, traversed by the navigable White River. Area, 1010 square miles. It is hilly and very fertile, producing grain, tobacco, cotton, wool, cattle, and hay. The county is well timbered, and contains lead and other valuable minerals. Cap. Batesville. Pop. 14,566.

Independence, tp. of Autaga co., Ala. Pop. 1137.

Independence, tp. of Marion co., Ark. Pop. 226.

Independence, tp. of Phillips co., Ark. Pop. 638.

Independence, tp. of Pope co., Ark. Pop. 240.

Independence, post-v., cap. of Inyo co., Cal., 275 miles N. of Los Angeles, in the fertile Owens Valley, and in a region abounding in gold, silver, and lead ores, both quartz and galena. It is 35 miles N. E. of Mt. Whitney, believed to be the highest mountain in the U. S. Its court-house, destroyed by an earthquake in 1872, has been rebuilt in fine style. It has a weekly newspaper and important business interests. Pop. of tp. 400.

Chalfant & Parker, Pubs. "Inyo Independent."

Independence, tp. of Saline co., Ill. Pop. 648.

Independence, a v. of Madison co., Ind., in Boone tp. Pop. 40.

Independence, post-v. of Warren tp., Warren co., Ind., on the W. fork of White River and on the Toledo Wabash and Western R. R. Pop. 183.

Independence, tp. of Appanoose co., Ia. Pop. 1030.

Independence, city, cap. of Buchanan co., Ia., on the river Wapsipinicon, and on the Illinois Central and the Burlington Cedar Keys and Minnesota R. Rs., 65 miles W. of Dubuque. Its school buildings cost $75,000; it has 2 banks, 2 newspapers, 9 churches, a public library, 3 fire companies, 3 parks, spacious fair-grounds, and very fine mills. It is a very handsome town, and is the seat of a State insane asylum, of which the buildings cost nearly $1,000,000. It is in a rich agricultural region. Pop. 2945.

W. Barnhart, Ed. "Independence Conservative."

Independence, tp. of Jasper co., Ia. Pop. 834.

Independence, post-v., cap. of Montgomery co., Kan., on a branch of the Leavenworth Lawrence and Galveston R. R., 134 miles by rail S. by W. of Lawrence, and on the river Verdigris. It was founded in 1870, has 5 churches, 3 banks, 3 weekly newspapers, a fine school-building, and is an important business centre. Pop. 435; of tp. 1394; much increased since the census. W. T. Yoe, Ed. "Tribune."

Independence, post-v. of Kenton co., Ky., on the Louisville and Cincinnati R. R. Pop. 134.

Independence, tp. of Oakland co., Mich. Pop. 1586.

Independence, tp. of Hennepin co., Minn. Pop. 502.

Independence, tp. of Dunklin co., Mo. Pop. 747.

Independence, city, cap. of Jackson co., Mo., 10 miles E. of Kansas City, with which it is connected by a narrow-gauge railroad. It is 3 miles from the Missouri River; is the seat of 2 colleges and other important public and private schools; is a well-built town; has 2 banks and 2 weekly newspapers. It has a historical fame as being for many years the head-quarters of the overland routes to Oregon, California, New Mexico, etc. Founded 1827. Pop. 3184. J. N. Southern, Ed. "Sentinel."

Independence, tp. of Macon co., Mo. Pop. 1120.

Independence, tp. of Nodaway co., Mo. Pop. 670.

Independence, tp. of Schuyler co., Mo. Pop. 1115.

Independence, tp. of Warren co., N. J. Pop. 1766.

Independence, tp. and post-v. of Allegany co., N. Y. It has considerable manufacturing interests. Pop. 1175.

Independence, tp. and post-v. of Cuyahoga co., O., 4 miles from Cleveland. Pop. 1761.

Independence, tp. of Washington co., O. Pop. 1395.

Independence, tp. of Beaver co., Pa. Pop. 728.

Independence, tp. and post-v. of Washington co., Pa., 7 miles from Wellsburg, W. Va. Pop. of v. 144; of tp. 977.

Independence, post-v. of Washington co., Tex., 25 miles from Hempstead on the Houston and Texas Central R. R., 12 miles from Brenham on the Austin branch of that line, and situated near the Yegua River. It is the seat of Baylor University and Baylor Female College, belonging to the Baptists, the university containing a library of 2700 volumes. It has public schools and 3 churches.

Independence, post-v., cap. of Grayson co., Va.

Independence of States. States are said, in political science, and especially in international law, to be independent when they are self-governing as far as internal

relations are concerned, and can perform towards other states all international acts. The term, denoting the negation of control, is the negative side of sovereignty when that term is taken in its strict sense. Thus, no State of the U. S. is independent, because the separate States are not absolutely self-governing, and because they have properly no international character, while the quality belongs to the U. S. as really as to any simple form of monarchy. But the word does not imply the power of absolutely free action, because treaty, temporary or perpetual, may have limited such free action. T. D. WOOLSEY.

Independence Plantation, a settlement in Penobscot co., Me. Pop. 185.

Indepen'dents. I. A politico-religious party in the time of the Commonwealth of England. The conflict which became a civil war in the reign of Charles I. was, politically, a conflict between a king who thought himself a sovereign by divine right with absolute power, and a people determined to maintain their inherited liberty and to guard it with new securities. But the political questions of the time were intimately blended with religious and ecclesiastical questions, which had been agitated for a hundred years. The English Reformation, if we regard it as proceeding from the people, was characterized by a violent antipathy against the ecclesiastical system of the Middle Ages, and therefore against all compromises with what was, in the view of the Reformers, a mischievous superstition. Regarded as proceeding from the government, it was mainly an attempt to make England independent of Rome by conferring upon the sovereign the ecclesiastical jurisdiction which had belonged to the pope. Consequently, there arose a conflict between the ideal reformation, expected but not yet attained, and the government reformation, abhorrent of radicalism and disposed to retain whatever of the ancient system was not incompatible with the supremacy of the Crown in ecclesiastical affairs. As the conflict proceeded, the Puritan or reforming party became almost identical with the political party opposed to absolutism in the state; and, on the other hand, the court party, devoted to the king, became the conservative party in the Church. At the beginning of the Long Parliament (1640) the party of law and liberty in the state, and of reformation in the Church, had no definite plan for the reconstruction of the ecclesiastical establishment, and all who were opposed to that establishment as then organized and administered could act together. But when the conflict had become a war between the king and the Parliament, and especially after "the Solemn League and Covenant" between the Puritanism of England and that of Scotland (1642) had brought a powerful Scottish influence into the southern kingdom, diversities of opinion as to the future constitution of the Church of England began to be important in their relation to public affairs. It was assumed that the desired reformation of the national Church was to be effected by the authority of the nation, as, in the preceding century, the reformation under Henry VIII. and Edward VI., and afterwards under Elizabeth, had been effected. Accordingly, the Parliament had convened, not a representative synod or convocation that might assume to be the Church and to set up an authority co-ordinate or in conflict with the authority of the state, but only an "Assembly of Divines," who were to consider such matters only as might be referred to them by the Parliament, and to give advice which the Parliament might accept or reject. The members of the Assembly were selected with the evident design that all Protestant diversities of opinion concerning the constitution and order of the Church should be fairly expressed and considered. Such diversities of opinion developed parties both in the Assembly of Divines and in the Parliament. Some had for their ideal a reduced episcopacy, with a liturgy expurgated in the interest of thorough Protestantism. Others, formidable in number and in zeal, desired to see the national Church governed by presbyterial and synodical assemblies, after the fashion of the Reformed or Calvinistic churches on the Continent and in Scotland. Still another party had heard of "the New England way," and, being in correspondence with Puritan friends who had removed to Massachusetts and Connecticut, and were there instituting what they deemed a more primitive system of ecclesiastical order, they had learned to recognize no other church government than that of voluntary churches, self-governed under Christ and mutually independent, yet bound to each other in relations of comity and mutual intercourse. Those who preferred that "New England way" to the scheme of a reformed and purified national Church were known as *Independents*.

In both Houses of the Long Parliament there were some eminent men who, while heartily agreeing with the majority in the subversion of the ecclesiastical system which had been established in the reign of Elizabeth, were not willing to establish in its place a presbyterian discipline like that of Scotland. Among the peers, Lord Say and Seal, Lord Brooke, and a few others were in full sympathy, on religious grounds, with the "dissenting brethren," or Independents, who were a small but able and persistent minority in the Assembly of Divines. In the House of Commons a few men of eminent ability had accepted, with religious faith, the New England church polity as better than any reformed episcopate or any presbyterial and synodical government. One of them was Sir Henry Vane, the younger, who had lived a year or two in New England, where he had made his entrance into public life as governor of Massachusetts. Another was Nathaniel Fiennes, who was a son of Viscount Say and Seal, and a trusted leader, and was associated with his father in the Committee of Safety, the executive council through which Parliament governed England while in conflict with the king. Another was Oliver Cromwell, who was the kinsman and close friend of John Hampden, and had already succeeded to a large share of that illustrious patriot's influence in the House. To these may be added the name of Oliver St. John, one of the most eminent lawyers of England, who had been counsel for John Hampden in the ship-money case, who was afterwards solicitor-general, and who was no less a statesman than a lawyer. In the strictly ecclesiastical use of the name, the Independents, differing from the Presbyterians not on doctrinal points, but only on church government, were a small though able minority in the nation, as well as in the Assembly of Divines and in the Parliament. Their demand was not that their ecclesiastical system should be established by law and all others suppressed, but only that the churches which they were constituting by voluntary agreement might be tolerated. Politically, however, the Independents became a numerous and powerful party. The Baptists (or, as they were then opprobriously called, the Anabaptists) were Independents, religiously as well as politically. All the swarming "sectaries" in that age of excitement, the "sects and schisms" which so terrified those who had set their hearts on national uniformity, were counted with the same party, and the army was full of them. In the progress of inquiry and controversy about ecclesiastical reconstruction the scheme preferred by the majority of the Puritan clergy was not, on the whole, gaining favor in Parliament. An increasing number of enlightened men were determined that the Presbyterian discipline, enforcing by church courts its strict morality and its rigid dogmatism, should not, with their consent, be established in England as a system to which all Englishmen must be by law subjected. Most of the laymen in the Assembly of Divines—among whom the lawyers Selden and Whitelocke were conspicuous—seem to have favored the opinion that there ought to be no distinction between ecclesiastical government and civil, that participation in Christian sacraments should be the right of every citizen, and that there should be no excommunication or church censure but by the magistrate. These men were called Erastians; and two of the clergymen in the Assembly—the two, Lightfoot and Colman, who were in some respects the most learned—held the same theory. The learning and ability of the Erastians, as well as the zeal and enthusiasm of the "sectaries," went to increase the strength of the Independents as a political party in the Parliament and in the nation. What had been the great Puritan party, intent on the reformation of the national Church and the vindication of English liberty, was divided and broken up. On one side were the Presbyterians, as zealous for uniformity of doctrine and discipline in the national Church as Queen Elizabeth and her prelates had ever been for uniformity of ritual, and as abhorrent of sects as Archbishop Laud himself had been. On the other side were the Independents, including all those who thought or felt that an ecclesiastical government of England by presbyteries and synods might be as irksome as that which had been so lately abolished. The division had been, from the first, inevitable, for it was the result of principles that could not be reconciled, and that could not but come into conflict over any definite proposal for ecclesiastical reconstruction. Puritanism, looking to Scotland and relying on the "Solemn League and Covenant," had become Presbyterianism, and, the king and his party being vanquished, it found a new antagonist in the party of the Independents.

When the control of affairs in the name of the Parliament had passed from the Presbyterians to the Independents, the king, who had been for some time a prisoner, and who in his negotiations with all parties had shown himself too faithless to be trusted, was brought to trial before a commission constituted for the purpose, was condemned to death, and was beheaded (Jan. 29, 1649). For that transaction the Independents as a party were responsible. In connection with it, and as preliminary to the ordinance which constituted the commission, the House of Commons, then reduced to a small remnant of its original number,

made a formal declaration that the people, under God, are the original of all just power; that the Commons House in Parliament, being chosen by and representing the people, have the supreme power; and that whatever is by them enacted has the force of law, though the consent of king and peers be not added to it. A few days after the death of Charles I. (Feb. 6) it was voted in the same assembly that the House of Peers in Parliament is useless, dangerous, and ought to be abolished. The next day it was voted that the office of a king in the English nation, and to have the power in a single person, is unnecessary, burdensome, and dangerous to the liberty, safety, and public interest of the people. A council of state, to be annually appointed, was invested with the executive power. Of that body, five were peers (for though the House of Lords had been abolished, such of the peers as had not adhered to the king in his war against the Parliament were permitted to retain their estates and their titles of honor); two were sons of peers; five were baronets; two were keepers of the seal; three were the chief judges respectively of the three great courts of law; three were eminent military commanders in the service of the Parliament; five were knights, and the remaining seventeen, untitled, were, all save one, members of the body that appointed them. John Bradshaw, who had presided in the trial of the king, was chosen president of the council, and his kinsman, John Milton, was its Latin secretary, for it had determined that its correspondence with foreign governments should be only in the language which was common to Christendom.

The attempt of the Independents to convert England into a republic failed, as similar attempts have failed in other countries. It was the attempt of a republican minority against the will of the anti-republican majority. Of the three parties into which the English nation was at that time divided, the Independents, though strong in the ability and enthusiasm of their leaders and in their control of a veteran and victorious army, were numerically the weakest. The most numerous party, when the residuary Parliament decreed the abolition of monarchy, was the Presbyterian, animated with zeal for a national Church and for religious uniformity, but abhorrent of that religious liberty which the republic was to establish, and which to the average Englishman of that age seemed almost identical with irreligion. But only less numerous was the party which, having adhered to the king, retained its sympathy with the lost cause, and which favored an episcopal rather than a presbyterial government over the national Church, and the beauty of a venerable liturgy rather than the fervor of extemporaneous prayers in the worshipping assembly. These two parties together were in truth the body of the English people; and as they were agreed in desiring a national Church, together with the old government by king, lords, and commons, they were also agreed in hating and fearing the victorious Independents. In a true republic the majority must rule, but the founders of "the Commonwealth of England" attempted to establish a republican government over an anti-republican people. Conscious of being sustained by only a small minority, the Parliament, a mere residuum of the great body which met in 1640, dared not appeal to the people by dissolving itself and calling for a new election. All the ability with which it governed through its council of state could not win for it the confidence of the nation. It aimed at the establishment of liberty and justice, but by the great majority of Englishmen it was felt to be a usurpation supported by military power.

In the fifth year of the Commonwealth the republican Parliament, derisively called "the Rump," was working at a bill for its own dissolution, and was endeavoring to provide such arrangements for the election of its successor as would secure the ascendency of its own party, when it was dissolved and dispersed (1653) by the military power which had made it what it was. Then followed the Protectorate of Oliver Cromwell (which see), who attempted in another way what the statesmen of the Rump were unable to do. He was in fact a "king by the grace of God," though without the crown or the name of king; and had his reign been prolonged, the vigor and splendor of his government might have reconciled the English people to that principle of government which first made the Independents a political party; which was so abhorred by the Presbyterians that to escape from it they aided in the restoration of Charles II.; which was only imperfectly recognized in the "Act of Toleration" (1689); and which is now triumphantly marching toward the disestablishment of the national Church in England—the principle of religious toleration. On that principle the Independents were united, though it is not to be supposed that all of them—perhaps not that any of them—saw clearly the reach, or consented to all the legitimate applications, of the principle. (See the histories of England, especially Godwin's *Commonwealth of England.* LEONARD BACON.

II. A religious body in England holding that every stated congregation of Christian believers associated under a voluntary agreement, formal or informal, for Christian worship and for mutual watchfulness and helpfulness in the Christian life, is a complete Church, invested with every prerogative which Christ has conferred on any Church, and dependent for the exercise of ecclesiastical functions on no authority exterior to itself, whether secular or hierarchical. (See CONGREGATIONALISM.) The most considerable difference between Independency in England and Congregationalism in the U. S. is that in the former the principle of the fellowship and mutual responsibility of churches, though recognized, is not so fully developed and made practical as in the latter. The ecclesiastical history of England gives no definite trace of a Church constituted on the platform of Independency earlier than 1567. More than ten years later, Robert Browne, a clergyman of the Established Church, began to preach against all national churches, and to urge the duty of falling back upon the original constitution of Christian societies as deduced by him from the New Testament. Compelled by persecution to take refuge in the Netherlands, he printed there (1582), for circulation in England, two books, in which he propounded his new idea and method of church reformation —a method as unwelcome to the Puritans, who were working and suffering for a reformation by act of Parliament, as it was to the bitterest enemies of Puritanism. His idea was "reformation without tarrying for any," or separation from the national Church as an essentially anti-Christian institution, and the formation of independent churches. It was impossible to suppress the idea, for, notwithstanding the prison and the gallows, the early "separatists" would not attend the parish churches, would hold their conventicles, would propagate their revolutionary opinions, and persecution exacerbated their enthusiasm into fanaticism. They were called "Brownists," though Browne had deserted them. They were also called "Barrowists," from Henry Barrowe, another of their champions, who was one of their martyrs. At a later date (in the time of the Long Parliament) they began to be called Independents, and they accepted the name. By that name their successors have ordinarily been designated till the present century, though now they prefer to call themselves Congregationalists.

The Independents or Congregationalists in Great Britain and the British colonies are a numerous and enterprising body of Christians. They have more than 3000 churches, and the number is constantly increasing. The London Missionary Society, though not exclusively theirs, is the organization through which they conduct their foreign missions. They have a home missionary society for their work in England, and a colonial missionary society to aid their churches in the colonies. Excluded till within a few years past from the universities, they have established colleges of their own for the classical and theological education of their ministers; and their colleges in England are now affiliated with the London University. Several journals, weekly and monthly, are conducted in their interest, and the *British Quarterly Review* may be regarded as representing, unofficially, their principles. (See Skeats's *History of the Free Churches of England.*) LEONARD BACON.

Independent Treasury. See TREASURY OF UNITED STATES, by J. S. GIBBONS.

Indeter'minate. A *mathematical quantity* is said to be *indeterminate* when it admits of an infinite number of values. An *equation* is said to be *indeterminate* when the unknown quantities that enter it admit of an infinite number of values. Thus, the equation of a straight line $y = ax + b$ is indeterminate; for, if we give to x any value, we can find from the equation a corresponding value of y such that the assumed and deduced values will satisfy the equation; that is, there are infinite sets of values of x and y that will satisfy the given equation. In like manner, it may be shown that any equation which contains more than one unknown quantity is indeterminate; it is obvious that any group of simultaneous equations is indeterminate when the group contains fewer equations than there are unknown quantities; hence, the equations of lines and surfaces used in analytical geometry are indeterminate. For this reason analytical geometry is often called indeterminate geometry. A *problem* is said to be *indeterminate* when it admits of an infinite number of solutions. A problem will be indeterminate when the number of independent conditions is less than the number of required parts, for in that case the number of equations that express the imposed conditions will be less than the number of unknown quantities; the equations of the problem will therefore be indeterminate, and consequently the problem itself will be indeterminate. Thus, the problem in which it is required to find a point from which the tangents to two given circles shall be equal is indeterminate; the solution of the problem shows that there are an infinite number of such points,

which, taken together, make up a straight line called the radical axis of the two circles. W. G. PECK.

Indeterminate Analysis is that branch of analysis which treats of the solution of indeterminate problems. In most practical cases the given conditions limit the number of solutions, without affecting the mode of treatment. The method of treating indeterminate problems will be best illustrated by means of a problem of this character.

Let it be required to find what year of the current Julian period corresponds to 1875 A. D., that year being the eighth of the current *solar cycle,* the fourteenth of the current *lunar cycle,* and the third of the current *cycle of indiction.* The statement of this problem depends on the following definitions: the *solar cycle* is a period of 28 years; the *lunar cycle* is a period of 19 years; the *cycle of indiction* is a period of 15 years; the *Dionysian* period is a period of 28×19, or 532 years, whose first year is the first year of a solar and also of a lunar cycle; and the *Julian* period is a period of $28 \times 19 \times 15$, or 7980 years, whose first year is the first year of a solar cycle, of a lunar cycle, and also of a cycle of indiction.

First. To find the year of the current Dionysian period, let x denote the number of complete solar cycles that have elapsed since the beginning of this period, and y the number of complete lunar cycles that have elapsed; from the conditions of the problem we have

$$19y + 14 = 28x + 8, \text{ or } 19y = 28x - 6. \qquad (1)$$

It is required to find the least entire values of x and y that will satisfy equation (1); dividing by 19, we have

$$y = x + \frac{9x - 6}{19}, \qquad (2)$$

in which the last term must be a whole number; placing this equal to t, we have

$$9x - 6 = 19t, \text{ or } x = 2t + \frac{t+6}{9}, \qquad (3)$$

in which the last term must be a whole number; the least value of t that will satisfy this condition is 3; this value of t in (3) gives $x = 7$, and this in (2) gives $y = 10$; hence, the year 1875 is the 204th year of the current Dionysian period.

Secondly. To find the year of the current Julian period, let u denote the number of complete Dionysian periods that have elapsed since the beginning of the current Julian period, and z the number of complete cycles of indiction; we shall have, as before,

$$15z + 3 = 532u + 204, \text{ or } z = 35u + 13 + \frac{7u + 6}{15}; \qquad (4)$$

placing the fractional term equal to s, we have

$$7u + 6 = 15s, \text{ or } u = 2s + \frac{s - 6}{7}. \qquad (5)$$

The least entire value of s that will satisfy (5) is $s = 6$, which gives $u = 12$ and $z = 439$. Hence, the year 1875 is the 6588th year of the current Julian period. We also find that since the beginning of this period 235 complete solar cycles have elapsed, and 439 complete lunar cycles.

W. G. PECK.

Indeterminate Coefficients. An *identical equation* is an equation that is true for all values of the unknown quantity or quantities that enter it. In every such equation the unknown quantity or quantities are indeterminate, and the coefficients of the different powers and combinations of powers of these quantities are called *indeterminate coefficients.* If an identical equation containing any number of unknown quantities is cleared of fractions, the coefficients of the like powers and combinations of powers in the two members are respectively equal to each other. This is *the principle of indeterminate coefficients;* it is much used in developing quantities into series and in resolving fractions into partial fractions. W. G. PECK.

In′dex, Concordance, Digest, Table of Contents. In bibliography, an index is an alphabetical list or table of the principal subjects, facts, words, or names discussed, employed, or noticed in the work to which it is appended, with references to the chapter, page, or paragraph in which they occur. Indexes are usually printed at the end of the last (or sometimes of each separate) volume of the book. An index may be general or special, comprising in the latter case subjects, *real index;* words, *verbal index;* or personal or geographical names. The title "index" is also applied to independent lists of books—*e. g.* the *Index Expurgatorius* or *Index Librorum Prohibitorum* of the Romish Church; or to catalogues of subjects, as the manuscript tables in some libraries, which refer the student to all the works in the library in which a given subject is treated of. Indexes separately printed sometimes embrace the contents of more than one work, as Wöber's valuable index to J. Grimm's *Deutsche Grammatik* and to his *Geschichte der Deutschen Sprache.*

A concordance is an alphabetical list of words occurring in a particular work or collection of works. It differs from a verbal index by being somewhat more full, as it usually cites enough of the passage where the word occurs to show its grammatical relations to the period. (See CONCORDANCE.) To the list there given may be added Flügel's *Concordance to the Koran,* H. H. Furness's *Concordance to the Poems of Shakspeare,* and that of Prendergast to the *Poems of Milton* (Madras, 1857).

A digest is an alphabetical table of subjects, differing from a real index or index of subjects by being sufficiently copious to give a summary of the doctrines of the book on each topic referred to. The word is most frequently applied to tabular abstracts of points judicially decided in books of legal reports. Digests are often published separately, and comprise the contents of voluminous series of reports.

A table of contents is a list of the subjects or important facts discussed in the work or volume to which it belongs, arranged in the order in which they occur in the text. It is usually printed after the preface or introduction. It in some degree serves the purpose of an index, but its general use is rather to give a conspectus or comprehensive view of the matter and method of the work than to aid the student to find particular passages. Tables of contents are doubtless older than indexes with references to folios or pages. The preparation of an index is a work of too much labor to be ordinarily performed for a single copy. The manuscript copies of any work would not usually correspond in column or page, and therefore a page-reference index prepared for one copy would not serve for another, while a table of contents, following the method of the book, would answer equally well for all, however differently paged. The most familiarly known ancient table of contents is that which forms the first book of the *Natural History* of Pliny the Elder. This table, as Pliny says in the dedication, he prepared in order that "as any man is desirous to know this or that, he may seek and readily find in what place to meet with the same." He adds: "This learned I of Valerius Soranus, one of our own Latin writers, who hath done the like before me." Pliny therefore intended this table to serve the purpose of an index, and as the catalogue of precious stones in chapter x. book xxxvii. of the *Natural History* shows that he was acquainted with the value of an alphabetical arrangement, it is singular that he should not have employed it in his table, referring to books instead of pages. We should infer from Pliny's language that he knew no other example of a table of contents than that of Soranus, but Cicero, Varro, Seneca, and Quintilian use the word index in a way which shows that something like tabular summaries or digests of the matter of philosophical and other writings existed in their times. The *Lactantius* of 1465 (the first book printed in Italy with a date) has a table of contents following the order of the chapters, but it refers also to the folios on which the chapters commence. These numeral references are *printed,* but the numeration of the folios, as well as the headings of the chapters, is manuscript. At the end of the second volume of the Latin Bible printed by Pannartz at Rome in 1471 is a copious alphabetical list of Hebrew proper names occurring in the Scriptures, with interpretations of the etymological meaning. The early editions of ancient classics are very commonly provided with tables of contents and with registers of the signatures, but alphabetical reference indexes were hardly known until the practice of numbering the folios or pages became general. The tables of contents in fifteenth-century editions often refer to the folios by printed numerals, but in books of that age the folios themselves are rarely numbered typographically, and Aldus Manutius in one of his prefaces advises students to number them by hand. The *Aulus Gellius* published at the press of Aldus after his death in 1515 has its folios numbered, and is one of the earliest examples of completeness in indexes. It is provided with an *index eorum quæ notatu digna,* etc. in sixteen folios, containing not only subjects, but single words, arranged in nearly exact alphabetical order, and with printed references to the folios; also with an *alter index,* or table of matters, *quæ ad grammaticam sive ad alias artes pertineant,* in fifteen folios, arranged under chapters in the order in which the subjects occur, and with references to the number of the folios. These two tables precede the text. After the text follow a list of the titles of the chapters in the same order as in the volume, in twenty-three folios, without references to the numbered folios, and another list, in twenty-eight folios, of the Greek quotations employed by Aulus Gellius, with Latin translations, and with references to the *signatures* of the sheets. In this book, then, we find nearly all the forms of index known to modern bibliography. It is probable that verbal indexes—and, we may add, glossaries and dictionaries—originated in the practice of making glosses or notes explanatory of particu-

lar words on the margin of manuscripts. When a scholiast had thus annotated a volume it would be an easy step to collect the notes into a table. An alphabetical arrangement would naturally suggest itself as the most convenient, and the collection of glosses would grow until it embraced all the obscure or otherwise noticeable words employed by the author, and finally answer the purpose not only of a glossary or special dictionary of the vocabulary or stock of words of the writer, but also of an index.

Verbal indexes and concordances are most useful, not to say indispensable, aids in philology and criticism, and real indexes are not less so in the study of works of science, and even of general literature, especially history. If such works conformed strictly to philosophical method, real indexes would be less needed, and tables of contents would sufficiently answer the general purpose of a guide to the matter of a volume. But, unfortunately, French writers alone seem to possess the science of method, and English as well as German literature is conspicuous for the want of this excellence. Besides this, the encyclopædic learning of German (and in late years of English) scholars both tempts and facilitates the accumulation of an immense mass of subsidiary, illustrative, and documentary material in their works which it is impossible so to arrange that any perfection of method could conduct the student to it. It is perhaps to a consciousness of the want of a power of orderly arrangement that we owe the English habit of supplying all books of serious scientific or philosophical pretensions with full indexes; and the absence of these conveniences is one of the greatest annoyances a foreigner experiences in the study of the graver literature and science of Germany. The German editions of classical authors, on the other hand, are generally furnished with complete indexes, and we can hardly point to any more satisfactory labor of this sort than the invaluable real and nominal word-lists in the fourth volume of Groskurd's German translation of Strabo. By the force of a habit which seems almost like a conspiracy among authors the books which perhaps above all others require verbal indexes are almost always without them. We refer to grammars, especially of foreign languages, among which it would be hard to find one provided with such an index as the student needs as a help in the actual use of the tongue he is acquiring. Undoubtedly, the habit of desultory reading, which is encouraged by copious indexes, is an evil, but in the present enormous multiplication of works which claim the attention of the scholar it is a necessary evil. Life is not long enough, nor is the action of eye and mind swift enough, to put us in complete possession of the literature of any important subject. The old rule, *multum non multa*, is no longer practicable for men of the comprehensive scholarship required by our age; and those who aspire to the possession of what is called "general knowledge" must content themselves with little more than gleanings from the works of special inquirers. For such persons—and they must always be the vast majority—indexes are an indispensable guide to literature and science. Nor is it merely dilettanti and persons in pursuit of general intelligence alone who need such helps. The most tenacious memory of the most philosophic scholar can retain but a relatively small proportion of what he reads, and for refreshing his recollection, as well as for the use of his learning in his own compositions—for we all build more or less on the labors of our predecessors—he needs indexes almost as much as the mere amateur. Authors ought, as a general rule, to be required to furnish these facilities for the study of their works. Public opinion can do something to enforce the performance of this duty; and in all cases when an index is worth making critics should always stigmatize the want of it as not only a serious defect, but as a grave literary offence. Of course in works of ephemeral literature the result would not be worth the labor, but in books which aspire to a sufficiently wide and permanent circulation to need the protection of copyright it would be neither unjust nor unwise to make good indexes a legal requisite for securing a monopoly to authors or publishers.

George P. Marsh.

Index, tp. of Cass co., Mo. Pop. 795.

In'dex Libro'rum Prohibito'rum. This title is applied to official lists issued from time to time, under papal authority, by the Congregation of the Index at Rome, enumerating books, single sheets, engravings, and other printed matter the use or even possession of which is forbidden by the Church. The proscription of books deemed heretical in religion, treasonable or seditious in politics, or corrupt in morals, is a practice of very ancient date. Not to speak of examples under heathen and modern civil governments, we find that as early as the fifth century the works of Arius were denounced and publicly burnt by the authorities of the Church, and the writings of other heretics often met with the same fate at different periods in the course of the Middle Ages. The right of prohibiting the use of such books is a necessary incident of the general authority claimed by the Romish Church over the consciences of the faithful, and not only popes and councils, but inferior spiritual directors and confessors, have exercised it at all times as a regular part of the discipline of the Catholic Church. These prohibitions were naturally at first special, and it does not appear that any general list of condemned books was promulgated before the year 1540, when the emperor Charles V. published a list of forbidden works, which was followed in 1546 and 1550 by new imperial edicts prohibiting to his subjects the use of all books contained in a catalogue drawn up by his order by the doctors of the University of Louvain. Lists of books condemned by the theological faculty of the University of Paris were issued by royal authority in 1545 and 1551, and similar catalogues appeared about the same time under the sanction of the theologians of other great European schools of learning. The first formal pontifical index is said to be that issued in 1557 by Paul IV., and this, as revised and enlarged in conformity with certain canons of the Council of Trent, by the Congregation of the Index established and charged with the censorship of books by Pius IV., was reissued under his authority in 1564. New and more comprehensive lists appeared under Gregory XIII., Sixtus V., Clement VIII., and Alexander VII., and many more or less modified editions, supplemented from year to year by the Congregation, have been published since. In the earliest indexes the prohibition of the works enumerated was absolute, but Sixtus V. organized a board of censure for the preparation of a list of books which might be used after due expurgation; and this seems to have been printed under the title of *Index Librorum Expurgandorum*, or *Expurgatorius*, but we believe that the same Congregation now exercises the functions of both condemnation and expurgation. The *Regulæ Indicis* prescribed by the Council of Trent, together with additional rules by Clement VIII. and Alexander VII., are contained in many editions of the *Index*. They forbid all books condemned by popes or œcumenical councils before the year 1515; all the works of heresiarchs, as Luther, Zuinglius, Calvin, Friedenberg, Schwenkfeld, and *his similes*, whatever may be their titles or subjects; the writings of all other heretics on religious topics; books of immoral tendency, except the works of ancient heathen authors, which are permitted *propter sermonis elegantiam et proprietatem*, though not to boys; and books on the various arts of divination, auguries, omens, sorcery, and magic. They also contain provisions authorizing the bishop and confessor to allow to learned and pious men the use of modern translations of the Old Testament, not made by heretics, by way of illustration of the Vulgate text, though not as authoritative, as well as for the permission of various other classes of books and for the censure and expurgation of literary works. In modern editions of the *Index* some of the publications are noted as prohibited absolutely, others until corrected or expurgated by new editions, erasure or obliteration of condemned passages, or substitution of cartons for the leaves containing such passages. The *Index* and supplements down to 1754 embrace about 20,000 titles, including flying sheets and engravings. Many of these are repetitions, but, on the other hand, in hundreds of cases these titles include all the works of voluminous authors, so that, upon the whole, the condemned publications greatly exceed the number we have stated. The *Index* is not designed for the common use of lay believers, but rather for the guidance of confessors; and as the vast multiplication of printed books now renders a universal censorship of the literature of the world impossible, spiritual directors are often obliged to avail themselves of the more comprehensive clauses of the rules, some of which admit considerable latitude of interpretation. In the recent supplements to the *Index* the condemnation is generally confined to publications (for the most part by professedly Catholic writers) conspicuous as dangerous attacks upon the doctrines, discipline, prerogatives, or privileges of the Church, and as at the same time likely to acquire a wide popular circulation.

The earlier *Indexes* furnish some interesting contributions to literary history by fixing the date of the original publication of books condemned, and by giving titles of works no copies of which are now known to exist. At the same time they illustrate, by what they insert and what they omit, the fluctuations of religious tendency in the Catholic Church itself; but the value of all this information is diminished by the vagueness of the indications, which are frequently so bald that we cannot now identify the book intended. In earlier centuries the prohibitions of the *Index* controlled the intellectual culture of the Catholic world, and they incidentally caused the destruction of great numbers of works of more or less importance in ecclesiastical literature. Confessors deny absolution to penitents

who refuse to deliver up books expressly or impliedly forbidden, and these, when surrendered, are generally burnt or so mutilated as to be illegible. This explains the rarity of many old books formerly widely read; as an illustration of which we may refer to the treatise on the *Benefits of the Death of Christ*, ascribed to Aonio Paleario, of which only two or three copies are known to survive, though not less than 40,000 or 50,000 were sold within a very few years after its publication in 1543. In the present state of public opinion in many Catholic countries the condemnation of a book by the *Index* discourages few from reading it, but, on the contrary, it often serves as a recommendation which increases instead of diminishing its popularity and circulation. GEORGE P. MARSH.

In′dia: ITS GEOGRAPHY AND ETHNOLOGY, AND ITS LANGUAGES AND LITERATURE OTHER THAN SANSKRIT. India, a large peninsula of Southern Asia, otherwise called "The East Indies," and "Hindustan." The meaning of these terms has frequently been strangely misconceived. Hindustan does not mean "the land of blacks," but "the country of the river Indus—the fertilizer." The river's name, *Sindhu*, is derived from the root *syand*, to "flow," "irrigate," "fertilize." The manner in which the letter *s* has dropped out of its place, and the letter *h* substituted, in *Hindustan*, opens up a strange leaf in the earliest history of India. The old Persians, speaking Zend (see PARSEES), many centuries before the Christian era, crossing over from Persia to India, were met by the broad waters of one of the most magnificent rivers in the world. They asked its name, and were told it was the *Sindhu*, the "irrigator" or the "fertilizer." But, very curious to say, they could not pronounce *s*, nor is that letter to be found in their alphabet. The Zend-speaking people thus called the river the *Hind*. *Stan* being the Persian for "land," we thus have "Hindustan," "the land of the fertilizing river." But there was still to ensue another strange change. The Greeks with Alexander crossed over to India, and also came to the river and asked its name. Upon being told that it was *Hind*, they naturally added the *os*, making *Hindus*. But the Greek alphabet itself is deficient of a letter, and that is *h*. So *Indus* remained for the name of the river, and *India* or *the Indies* for that of the country. The fact is a very strange one, therefore, that were it not for a people living in ancient times close to the north-western frontier of India being unable to pronounce the letter *s*, we should now be talking and writing of the river Sindus and the country Sindia.

Geography.—The India of the present day extends from Peshawur, a frontier town in the N. W. of the Peninsula (33° 57′ N. lat., 71° 40° E. lon.), to the banks of the Burmese river Salwin in the E., and from the long chain of the Himálayas in the N. to Cape Comorin in the S. (lat. N. 8° 4′, lon. E. 77° 30′). It is divided commonly into two great divisions, Hither and Further India—namely, that portion to the W. and that portion to the E. of the Ganges. Hither India—that is, India within the Ganges, otherwise called Hindustan—is that portion which must almost wholly monopolize our attention. The rest consists of the Indo-Chinese peninsula and the islands of the Indian Archipelago; and it is a pity—though it was perhaps unavoidable—that the geography of this portion of the British dominions in the East should have been in any way mixed up with that of so distinct a country as Hindustan. Including Further India, geographers inform us that the extent of India from W. to E. is about 1600 miles, and that from N. to S. it falls little short of 2000 miles. India contains about 1,600,000 square miles. Of British India the entire population, as returned by the census of 1871–72, is about 283,000,000. (See INDIA: HISTORY.) Leaving aside the Aryan and Kolarian inhabitants of India, the population of the Dravidian peoples has been minutely and accurately ascertained by the father of the writer—the Rev. Dr. Caldwell, author of the *Comparative Grammar of the Dravidian Languages*. The list is especially interesting, as it gives a clue to the relative numerical strength at the present time of the chief section of the aboriginal Indian races to that of Hindus of later origin. The Tamil-speaking community numbers 14,500,000; the Telugu, 15,500,000; Canarese, 9,250,000; Malayalam, 3,750,000; Tulu, 300,000; Coorg, 150,000; Tuda, 752; Kota, 1112; Gond, 1,134,578; Ku, 267,501; Rajmahal, 41,089; and Oraon, 263,000. Thus the total number of persons speaking the Dravidian dialects is estimated at 45,660,032. However, a subtraction must be made in this sum-total, as the Tamils are an enterprising and migratory people, and many of them are to be found scattered over the globe. The numerical strength of the ethnological family of Indian Kolarians is much smaller still than that of the Dravidians. The Aryans are everywhere in enormous majority.

British Hindustan is made up, first, of districts wholly under the sway of Britain; secondly, of a few scattered ports and townships belonging to other European nations; thirdly, of protected states; and fourthly, of allied independent states. The whole country is formally divided into three presidencies—that of Bengal, capital Calcutta; that of Madras, capital Madras; that of Bombay, capital Bombay. Bengal is under a lieutenant-governor, but his powers are limited, in that he has only control over that portion of the presidency which comprises North and South Behar, Orissa, Assam, and Bengal proper. The North-west Provinces, capital Allahabad, are also under a lieutenant-governor. The Panjaub has also its lieutenant-governor. Oude is under a chief commissioner, as is also Mysore. Indore, in Central India, is under an agency. The Central Provinces are under commissioners. Rajputâna is governed by a political agent. Commissioners, political residents, and high officials deputed by the governments of the various presidencies overlook the interests of Travancore, Cochin, Poodoocottah, Baroda, Kolapore, Cutch, Vizianagram, Jeypur, the states of Guzerat and Kattiawar, etc. The following are the titles of the rulers of the twelve principal feudatory states in India: the nizam of Hyderabad, maharajah scindiah of Gwalior, the gaikwar of Baroda, maharajah of Jeypur, maharajah of Travancore, maharajah of Cashmeer, maharajah of Jodpore, the holkar, the begum of Bhopal, maharajah of Puttiala, maharajah of Oodeypore, and maharajah of Bhurtpore. The island of Goa, with a small scrap of the adjoining mainland, belongs to the Portuguese. The inhabitants do not exceed 400,000. The French still possess five small settlements in India, and the population of all of them put together does not amount to 250,000 inhabitants. They are (1) Pondicherry, on the Coromandel or eastern coast; (2) Karikal, close to Pondicherry; (3) Yanaon, in Orissa; (4) Chandanagore, in Bengal; and (5) Mahé, on the Malabar or western coast. The physical characteristics of the Indian Peninsula are remarkably striking and simple for so large a tract of country. Hindustan is especially remarkable for the height of its mountains, the breadth of its plains, and the size of its rivers. Whilst other countries, however, can show plains of vaster extent and rivers of greater volume, the Himálayas stand supreme amongst the mountains of the world. The highest peak in them (Mount Everest, in Nepaul) reaches 31,000 feet; and the Himálayan chain possesses thirty-nine other peaks taller than Chimborazo, the height of which is reckoned to be 21,424 feet. The other principal mountain-ranges in Hindustan are the Vindhyas, which extend through Behar and the North-west Provinces, along the N. bank of the Nerbudda River, to Broach; the Eastern and Western Ghauts, which, running southward, meet at the Neilgherry Hills in the Madras presidency, and then continue their united course to Cape Comorin; the Suleiman and Hala Mountains, on the N. W. frontier; the Satpoora Hills; the Rajmahal Hills; and the Garrows, to the E. of Bengal. Most of these great ranges are called "hills" in common Indian parlance. For instance, the Neilgherry *Hills*—not *Mountains*—are spoken of, and yet one of these "hills" rises to the height of 8760 feet. The river-system of Hindustan is very extensive and ramified. The great rivers are the Indus, the Ganges, the Brahmaputra, the Nerbudda, the Taptee, the Mahanuddee, the Godaveri, the Kistna, the Pennâr, the Pâlâr, and the Cauvery. The tributary rivers of the first two of these are such large and important streams in themselves that mention must be made of them. The tributaries of the Indus are the Cabool and the five rivers which irrigate and give its name to the Panjaub—namely, the Jhelum, the Chinab, the Ravi, the Bias, and the Sutlej. The tributaries of the Ganges are, first and foremost, the Jumna; then no less than fifteen other rivers, each of large size, and in the rainy seasons, or "monsoons," of great volume.

The vast peninsula of India is crowded with cities of great size, fertile plains irrigated and cultivated, deserts such as that of Rajputana, and wild, inaccessible jungles. Roughly speaking, in all India there is only one European to 3500 natives, and the standing wonder is, how Britain can keep its footing in the East. One explanation of this is to be found in the fact that the Hindus are, as a nation, the most disunited on the face of the globe. Not only are they separated amongst themselves by natural ethnological distinctions, but by greater barriers of their own raising. Their innumerable religious divisions, and especially their countless caste distinctions, prevent them from becoming a united people capable of governing themselves. If Britain were to leave India to-morrow, the Peninsula could only find safety from utter anarchy, and especially from bloody internecine wars between Mohammedan and Hindu, by seeking the protection of some other civilized power.

A few brief particulars may be further added ere passing from this epitome of Indian geography. The western coast of the Peninsula, washed by the Indian Ocean, is called the Malabar coast; the eastern shore, washed by the Bay of Bengal, is called the Coromandel coast. All kinds

of climate prevail in different localities in India, according to their different situation and elevation. The line of greatest heat is said to pass through the city of Madras. The heat of certain districts, such as Bengal proper and the southern parts of the Malabar coast, where there is a heavy rainfall, and consequently a natural exuberance of tropical vegetation, is moist and enervating, and the climate often malarious; the climate, however, of many other parts of India is dry and exhilarating. Then, again, as the peninsula of India narrows southward, it becomes more open to and affected by the sea-breezes, and its climate consequently becomes more equable. All through India, in the hill-ranges, are delightful sites for stations, cantonments, and retreats, where the climate is balmy and temperate. Tennyson writes of "the sweet half-English Neilgherry air;" and his description is thoroughly true to nature. In these hill-ranges—from the Himâlayas and mountains of Assam to the southernmost spurs of the Ghauts, overlooking the triple line of the breakers of Cape Comorin—tea, coffee, and chinchona cultivation is rapidly extending. Everywhere throughout India a network of roads is being spread, and great attention is being paid to the lining of these with avenue trees, to protect wayfarers as much as possible against the tropical sun. Canals and railways, too, are opening up the country in every direction. One can now travel by rail from Negapatam to Calcutta, and shortly one will be able to pass from the roots of the Himâlayas, at Darjeeling, to Tuticorin, in Tinnevelly, only a few miles from Cape Comorin. The government has been taking up public works of every kind, and in a short time several of the great irrigation works now in progress are expected to alter the face of large tracts in India, where water means wealth. Change is rapidly following change, and we can only dimly guess what the India of a few years hence may be.

Ethnology.—The ethnology of India may be treated of under three heads—namely, the Aryan, the Kolarian, and the Dravidian. But before we enter upon a critical examination of the existing races and languages of India, the question naturally arises, What do we know of the people of Hindustan in the very earliest times? It is a very little indeed that we do know, but that little is extremely interesting, as it carries us back—just as in the case of Egyptian antiquities—to the extreme youth of the world. Long before the Aryans came into India the Peninsula appears to have been peopled by aborigines, and in parts, in all probability, even densely. But when did the Aryans first enter Hindustan? It is impossible to tell, and all we know is that there appears to have been a succession of Aryan invasions, and that the Aryans did not come over in one vast flood at once. In all probability they were pouring in, little by little, wave after wave, even while the Pyramids were being built. Yet when they did arrive in India they undoubtedly found there those two great classes of aboriginal inhabitants which still survive in the Peninsula—namely, the Kolarians and the Dravidians. This is capable of clear proof. But setting this matter for a while aside, let us turn to a still more ancient phase of the subject. How did the Dravidians and Kolarians themselves get into India? or were they really from the first aborigines? Here we come to questions affecting a time not long subsequent to the building of the Tower of Babel. All kinds of theories have been advanced, but some are at least plausible, and appear to be borne out by evidence of considerable weight. It has, for instance, been clearly ascertained that the Dravidian dialects are of the same stock, and intimately connected with the Scythic, etc.; whereas the Kolarian dialects are distinctly Indo-Chinese. It is probable, then, that the Dravidian was introduced into India from the N. W., and that the Kolarian entered from the N. E. But if they so entered, what did they find before them in the land? It has been suggested that the Negrito element evidently observable in some of their tribes can only be explained by supposing that the Dravidians and Kolarians, on entering India, found installed there already a black race, with thick lips, no beards, high cheekbones, and woolly hair, and that to some extent they became commingled with them. In the case of the Kolarians some Orientalists insist on this theory very strongly. In them the distinct Mongolian type of face is apparent, yet frequently the Negrito type appears just as prominently; indeed, many of them appear to be simply Africans with almond-shaped eyes. But, taken as a whole, the Negrito theory is more ingenious than reliable. The Negrito type of physique, if observable in Hindustan, must be a corrupt one, for it is characterized by diminutiveness, and many African races are strong and powerful of build. However, the Negrito facial angle, the flatness of the nose, the woolly head, the absence of beard, etc. are quite strikingly observable in many of the Indian aboriginal tribes. Col. Dalton remarks them in the Orâons. The African temperament, too, is to some extent observable in many of the least civilized Indian races—love for music, light-heartedness, impulsiveness, and the rest. When examining into the ethnology of any country, six considerations should prevail with the student—namely, (1) physical and (2) mental characteristics, (3) religions, (4) languages, (5) laws, and (6) habits and customs. Whatever may have been the origin of the Kolarians and Dravidians, by each one of the above six points we can see clearly that they are distinctly non-Aryan classes of the Indian people. Notwithstanding the theories to which allusion has been made, the Kolarians and Dravidians may, speaking generally, be termed without hesitation Indian aborigines, and Aryans the invaders and civilizers. We know nothing of the state of India before the Aryan invasion. In every probability society was in the rudest and most patriarchal state. The earliest word for "monarch" in Southern India is *gon* (*i. e.* a "cowherd," or a man of the shepherd caste); and this evidently points to a time when the possession of cattle was considered to confer a dignity which is now attained by the possession of an illustrious ancestry and gold and cities and fortresses and armies and fleets. The changes which followed upon the Aryan invasions from the N. W. have left clear traces behind them, and thus we can speak with some certainty concerning this part of the subject. The invaders, not only by their numbers but by their civilization, appear to have driven the aborigines everywhere before them, especially in a southward direction. Not so, however, with the Kolarians, as a whole, was this exactly the case; the advancing Aryan tide seems rather to have gradually surrounded them, cut them off and islanded them, so to speak. This appears also to have been the case with one or two Dravidian tribes, such as that of Rajmahal. Yet one more point must be noticed. Not only did the Aryans push the aborigines southward, but to a considerable extent followed with them and intermingled with them. At a very early age Cape Comorin was as well known to Brahmins as to the aboriginal Shânârs of Tinnevelly and Travancore. Let us now take up the threefold division of this part of our subject, first speaking of the languages and literature of the Kolarians (as this may be dismissed very briefly); then, secondly, of the Prakrits of Northern India and the peoples speaking them; and then, thirdly, of the languages and literature of Southern India.

I. *The Kolarians.*—Under this general head may be classed the Coours of Ellichpoor; the Korewahs of Sirgoojah and Juspore; the Moondahs of Chutia Nagpur, also the Keriahs of that district; the Hos of Singbhoom; the Bhoomij of Manbhoom and Dulbhoom; the Nakales, the Kodas; the Sonthals of Manbhoom, Singbhoom, Cuttack, the tributary Mehals, Hazreebagh, and the Sonthal Pergunnahs; the Juangs or Puttoons of Cuttack, Keonjur, Pal Lehra, Dhenkanal, and Hindole; Ghatwals; Bendkurrs, Birhoes, Boyars; Kharwars and Rajwars in South Behar; Kaurs near Oodeypore; and the Koolees and Bheels of Guzerat and Rajputâna. All these are undoubtedly Indian aborigines, not of the Dravidian stock. Their languages are of the rudest description. Literature they have none. Many of the more civilized of these scattered tribes speak Hindi and other Aryan dialects. As a rule they practice most degraded customs, some living almost entirely naked. "Puttoons," for instance, mean "the leaf-clad." (The reader who is curious to know more of these tribes should consult Dalton's magnificent work on the *Ethnology of Bengal;* Sir George Campbell's interesting but inaccurate contributions to *Indian Ethnology* (*Journal of the Bengal Asiatic Society,* vol. xxxv., part ii., etc.).) Col. Dalton's list of the Bengal Kolarians is as follows: the Juangs, Kharrias, Mundahs, Hos, Bhumij, Ho or Larka Kols, Santals, Birhors, Korwars, Kurs, and Kurkus or Muasis. The particulars of the habits and customs of these tribes given by the gallant author are very curious and interesting. He also furnishes a vocabulary of familiar words in the Kolarian dialects, and photographs carefully depicting the typical characteristics of the various tribes which speak those and other Bengal vernaculars.

II. We have now to turn our attention to the languages and literature, other than Sanskrit, of the Aryan inhabitants of Hindustan. This is one of the most interesting philological fields in the world, and is one which has recently been wonderfully opened up by Mr. Beames in his *Comparative Grammar of the Modern Aryan Languages of India.* These languages are seven in number—namely, Sindhi, Panjaubi, Mahrathi, Guzerati, Hindi, Oriya, and Bengali. Sindhi is spoken in the extreme N. W. of India, and next to it Panjaubi, in the land of the five rivers. In the Bombay presidency Guzerati and Marathi prevail. Hindi holds the great central position amongst the Aryan languages of Hindustan. At the very outset it should be remembered that Hindustani, or Urdu, is simply Hindi

plus a great deal of Persian. There is no doubt that Hindustani has a great hold of India, in that it is the *lingua franca*, so to speak, of Hindustan; it is the language which is chiefly used everywhere in the Peninsula as a medium of general communication; but when treating of the languages and literatures of Hindu Aryans it must merely be considered as a dialect of Hindi. Oriya is the language of Orissa, and Bengali of Bengal. Each one of these seven vernaculars is based on the Prakrits of the Sanscrit. First, let us glance at them as a whole, noting their origin from the grand parent stem. It has been said that the Aryans did not come over to India all at once. There were successive waves of immigration, and the immigrants, in every probability, spoke various dialects of the common language. As Mr. Beames says, "One only of these dialects, however, became at an early period the vehicle of religious sentiment, and the hymns called the Vèdas were transmitted orally for centuries, in all probability with the strictest accuracy. After a time the Brahmans, consciously and intentionally, set themselves to the task of constructing a sacred language by preserving and reducing to rule the grammatical elements of this Vèdic tongue. We cannot tell whether in carrying out this task they availed themselves of the stores of one dialect alone—probably they did not—but with that rare power of analysis for which they have ever been distinguished they seized on the salient features of Aryan speech as contained in all the dialects, and moulded them into one harmonious whole; thus, for the first time in their history, giving to the Aryan tribes one common language, designed to be used as the instrument for expressing thoughts of such a nature as should be deemed worthy of preservation to all time." All this was before the art of writing, but when that art was discovered, it was chiefly used to reproduce works in Sanscrit, that sacred queen of all Aryan languages. But all this time, whilst Panini and others were engaged in fossilizing, polishing, and perfecting Sanskrit, the local dialects continued to exist. As they had been anterior, in their rude shapes, to the perfected sacred tongue, so after Sanskrit ceased to be spoken—save perhaps by a few of the holiest and most learned of the Brahmans—they continued to be generally spoken by the common people, and were being continually developed into new vernacular forms. These forms of Aryan speech, other than Sanskrit, and spoken by the masses, are the Prakrits. They were all of the same stock as the Sanskrit, but they went on changing like clouds, whilst Sanskrit remained within its own fixed limits like the sea. So holy was the language of the Vèdas that many of the formulæ wont to be repeated by Brahmans were regarded by them to be composed of letters each one of which was a divinity. The Prakrits, on the other hand, were constantly being changed as they came in contact with foreign tongues or with each other. At one time they are said to have numbered no less than twenty-two. However, in the earliest records we find that they are generally classed under five distinct heads. First, there was Mahârâshtri, the chief of the five, mainly spoken in Southern Rajputâna and the northern portions of that part of India which we roughly term now "Mahratta country." The second was the Sauraseni, which was spoken near Mathura. The third was the Magadhi, the dialect which was spoken in Behar, and which is the parent of Ceylonese Pali. Fourthly, there was the Paisâchi; and fifthly, there was the Apabhransa, or "corrupt" Prakrit, of Sindh and Western Rajputâna. Beames remarks: "In the Sanskrit dramas a still more artificial distinction prevails, a different dialect being attributed to each class of characters. Thus, kings and Brahmans speak Sanskrit, ladies of high rank Mahârâshtri, whilst servants, soldiers, buffoons, and the like, use one or other of the inferior dialects." But one of the Prakrits has come down to us embalmed in a more noteworthy way. Magadhi will not be forgotten as long as the literatures of the East remain unobliterated. It was used in the sixth century before Christ to preserve the teaching of Sakyamuni, "Gotama Buddha," the founder of a religious system which overran all India and crushed nearly all the life out of Brahmanism for ten centuries. Magadhi is simply Pali, the sacred "written" language of Ceylon. Sakyamuni died in 543 B. C., in Gya in Southern Behar, and his teachings, preserved to us in Magadhi, give us a clear insight into that Prakrit in its form in those days. Buddhists, even at that early time, produced many and voluminous works, and Jains to a great extent copied them, for we have many Jaina sacred writings in the Mahârâshtri prakrit. The last point which need be mentioned about the prakrits is that they are "synthetical or inflectional languages." Out of these prakrits sprung the modern seven Aryan vernaculars of India. In the composition of each of these dialects we have three elements: (1) words the same as Sanskrit words; (2) words like Sanskrit; (3) a number of non-Aryan words. The difference between the non-Aryan vernaculars of India seems mainly to consist in the different apportionment amongst each of these three different classes of words—words which are severally called by the felicitous Sanskrit appellations of *Tatsama*, *Tadbhava*, and *Dêsaja*. Of the modern Aryan vernaculars it may be said—

> "These languages
> Are one at root. Their natures are alike;
> But, being grafted into diverse soils,
> In shape of leafy boughs dissimilar seem,
> Differ in hue and fragrance of their flowers,
> And vary in taste of their abundant fruit."

Let us take each of them in turn. First, Sindhi, the most north-westerly of the modern Aryan dialects of India, and perhaps the roughest and least Sanskritized. The first province in India which was conquered by invaders from the N. W. was undoubtedly Sindh, and next the Panjaub. It was in these provinces that Mohammedanism was rooted the earliest. Brahmins, from the earliest times, appear to have avoided these two provinces to a considerable extent. So we learn that the earliest Prakrits spoken in Sindh were noted for their corruptness. The country seems to have been left by the Brahmins to pastoral tribes, such as the Abhiri, the Gujars, and afterwards to the excommunicated Kshatriya Jats. The whole land from the earliest times appears to have been in a state of chronic convulsion. Towns were constantly pillaged, cultivated tracts desolated, cattle slaughtered, tribes broken up, and the population seems to have carried on a stormy and precarious existence under the shadow of perennial wars. It was but natural that in such a case little time could be devoted by local pundits to the improvement of the language, by correcting it from time to time, and by introducing into it, to give it fresh vitality, new blood from the old and yet vigorously healthy language of the Vèdic hymns and great dramas. So Sindhi is still a rough and in many ways an anomalous language. For instance, whilst Hindi is content with only three forms of the genitive particle, Sindhi demands no less than twenty. (See D. Trumpp's *Sindhi Grammar*.) But there is something charming about the roughness of Sindhi to some scholars, just as some wine-tasters revel in the roughness of some wines. Beames, for instance, speaks of Sindhi as having "somewhat the charm of wild flowers in a hedge, whose untamed luxuriance pleases more than the regular splendor of the parterre. . . . There is a flavor of wheaten flour and a reek of cottage smoke about Panjaubi and Sindhi, which is infinitely more natural and captivating than anything which the hide-bound, pundit-ridden languages of the eastern parts of India can show us." But this is, perhaps, more prettily put than true, just as some poets imagine that there is more real soul-music in the prattle of a child than in the trained voice of a prima donna. Sindhi has three dialects—the Sirai, in the N. of Sindh; Vicholai, in the central parts; and Lari, in the S. and along the sea-coast. There are many other dialects, but only the above need be mentioned. It remains to be mentioned that Sindhi has very little literature and no fixed system of writing. We must now pass on to Panjaubi, but a great deal of what has been said of Sindhi applies to it. It must be borne in mind that the Mohammedan power was in a measure consolidated in the Panjaub 400 years before such was the case in the lands where Hindi is spoken. Thus, the Prakrit had less time in its infancy to become trained and guided, and the Mussulman invaders found a more virgin soil to plant their own idioms. They brought numbers of their own words with them, which became engrafted into Panjaubi before the Sanskrit equivalents had time to spring up in the language. Yet it has been truly said that the Panjaubi of the present day is, after all, an old Hindi dialect. In Panjaubi, for reasons already referred to, there is a great admixture of Arabic and Persian, and but little "Tatsama" Sanskrit terms, such as are to be found in Bengali and Oriya. Panjaubi is similar to Hindi in regard to the nouns in the language, which have the same simplicity of declension. The verbs too are alike, with only faint dialectic differences. The pronouns also are nearly the same in both languages. The claims of Panjaubi to be considered an independent language rest upon its phonetic system and upon its peculiarities of phraseology. The character in which Panjaubi is written is called *Gurumukhi*. It employs thirty-five letters. As for its literature, it is very scanty. Nanak, the religious reformer and founder of the Sikh creed, is the earliest author in the language, yet nothing of his is extant which is distinctively Panjaubi. The dialects of Panjaubi are almost innumerable, but are hardly distinguishable one from the other. But on the borders of the Panjaubi-speaking country, on all sides, the language almost imperceptibly dovetails with other vernaculars. This has given great trouble to superficial linguists, and has led to many mistakes. We now come to Marathi. It must not be too hastily concluded that Marathi is the direct lineal descendant of the Mahârâshtri Pra-

krit. Indeed, these two have little in common save the name. Magadhi and Sauraseni Prakrits mainly lie at the base of Marathi. It is on the whole an elegant and cultured tongue. Mahratta Brahmans took great care of the language in its somewhat rude infancy, and the wave of Mohammedan invasion was somewhat late in sweeping over the country where it had its central hold. Marathi contains a good many "*Tatsama*" Sanskrit words, and is a pleasing fluent tongue. The language is a playful one; it delights in assonances and harmonious phrases and "jingling formations." In structure it is comparatively complicated. Its phraseology is copious and beautiful. Grammatically considered, Marathi is as much the German of the Aryan vernaculars of India as Hindi is the English. It possesses a great array of terminations and inflections. It is just as difficult to determine the gender of a noun in Marathi as in German. In every part the language shows the effects of the labors of learned pundits who worked for centuries to beautify and polish it. The Marathi pronoun is nearly the pure Prakrit. The verb is participial in its formation. The literature of the language is copious. The following may be taken as a brief yet fair summary of it: "Namadeva, the first poet, whose date is uncertain, but probably about 1290 A. D., drew his inspiration, as was the case with so many poets of his time, from the writings of Kabir and other reformers. Contemporary with him was the famous Dynânadeva, who wrote a poem called *Duyâneshwari*. Then follows a long string of more or less obscure poets, among whom Sridhar deserves notice on account of his voluminous Pauranic paraphrases. Tukaram, the most celebrated Marathi author, was (A. D. 1609) a contemporary of the illustrious Sivaji. (See INDIA: ITS HISTORY.) An admirably printed edition of Tukaram's poems has been produced at Bombay recently by two pundits. The poems are called *Abhangas*, or 'Unbroken;' probably from their being of indefinite length and strung together in a loose flowing metre. Tukaram was a half-crazed devotee, such as we see so commonly in India, who began life as a petty shopkeeper, but, being unsuccessful, devoted himself to the worship of the idol Vitoba, whose chief shrine is at Pandharpur. At the temple of this idol at Dehu, near Poona, Tukaram spent the greater part of his life in improvising these endless *Abhangas*, which were collected by his disciples. He eventually started off on a pilgrimage, and, as he never returned, he probably died on the road, but his followers chose to believe that he had ascended to heaven." There is nothing very original or striking in Tukaram's poems. They are like the ordinary run of Indian religious poems. Here is a specimen:

> "Torches, umbrellas, horses—these are of no value.
> Why now, O lord of Pandhari, dost thou entangle me in them?
> Honor, pomp, show—these are merely the excrement of swine.
> Tukaram says, O Lord, hasten thou to deliver me!"

The reader will see that all this is rank commonplace, but in Marathi the mellifluous diction atones for much, and Tukaram's poems are household words in the Bombay presidency. Next to Tukaram came Moropaut (A. D. 1720), and his poems are preferred by some to those of Tukaram. There is also a wide Anacreontic literature in Marathi, which may be styled "Rabelaisian without the wit, and with twice the amount of impurity." The chief prose works in Marathi are the *Bakhars*, or "Chronicles of Kings," much of which is legendary and impossible. We must now pass on to speak of Gujerati. This language has a greater admixture of Arabic and Persian in it than Marathi has. It is avowedly a dialect of the Sauraseni Prakrit, and as a language is only partially developed. It retains three genders, whereas Hindi and Panjaubi have only two. The pronouns are almost identical with those in Hindi. According to some grammarians, the Gujerati verb rejoices in five presents, seventeen preterites, and four futures, but these, in practice, can be greatly reduced and simplified. Of late days Gujerati is becoming more and more employed as a commercial language, especially by the Parsees of Bombay, and thus it is becoming rapidly impregnated with foreign phrases and idioms, to the detriment of the purity of the language. The first Gujerati author of note is Narsingh Mehta, who flourished in 1457 A. D. His writings are religious, and are cast in the form of short poems somewhat resembling sonnets. After him the chief Gujerati writers are Vishnu Das, Shiv Das, and Samal Bhatt. It is a remarkable fact that the Gujerati of the present day is strikingly similar to that language when it was first written. We now come to Hindi. This language is justly regarded as the first of the modern Aryan languages of India. It is spoken in the great valley of the Ganges from the source of the Jumna to Rajmahal. In a word, Hindi holds the central position of all of the Aryan languages of India, and the country in which it is spoken has ever been the centre of Aryan Hinduism. We have already mentioned the close relationship which exists between Hindi and Urdu or Hindustani. It has been truly said that Hindi is to modern India what Sanskrit was to the ancient. The central seat of Hindi itself has ever been Delhi. Mr. Beames says: "In respect of *Tadbhawas*, Hindi stands pre-eminent, whether it be that form of Hindi which relies principally on indigenous sources for its words, or that other widely employed form which has incorporated the flower and grace of Persian and Arabic nouns, and which is sometimes called Urdu, sometimes Hindustani." The multiform strength of Hindi is in a measure owing to the fact that the great central area of India in which that language is spoken has always been occupied by Hindus and Mussulmans, in tolerably equal proportions; thus, whilst Sanskrit has not been forgotten, Arabic and Persian words have been allowed, in due measure, to enrich the vernacular. Of the seven modern Aryan languages, Hindi is the most advanced, as it shows the most marked rise from the synthetical to the analytical state. In its verbs Hindi has greatly rejected the Sanskrit inflectional system. Only one Hindi tense is synthetical—namely, the indefinite present, which has been corrupted from the present indicative of the Sanskrit. The date of the earliest Hindi poem is A. D. 1200. It is a famous one—namely, the *Prithirâja Rasan* of Chand Bardâi. This Chand was a native of Lahore. He was a professional bhât or minstrel, and was attached to the court of the Rajput king Prithiraj, the last Hindu monarch of Delhi. The poem is the record of the ancestry, birth, life, heroic deeds, and final overthrow of Prithiraj; but upon the history which thus forms the basis of the work Chand Bardâi builds a fantastic structure of religion and mythology. The gods come down to earth; celestial garlands descend on the brows of heroes; Siva follows the war-path and drinks the blood of the wounded; the power obtained by sacrifice and penance, even over deities, is magical; and birds and beasts converse like men. Subsequent to Chand Bardâi, Hindi literature became crowded with long, verbose, dull, religious poems. Tulsi Das adapted from the Sanskrit the *Râmâyâna* of Valmiki. Behâri Lal was a correct and elegant Hindi writer, whose poems are concise, pretty, graceful, and sometimes meritoriously thoughtful. We now come to the Oriya language. This language, like the Bengali, is highly impregnated with Sanskrit, and overflows with *Tatsama* words. But it is a neglected tongue, and retains to the present day many rude archaic forms. The mountainous character of the country of Orissa, stretching along a lonely shore-line, peopled by men accustomed to a solitary life in great measure, often decimated by famine and disease or devastated by periodical cyclones, itself furnishes a reason for the very partial cultivation and polish of the language spoken there. The literature of Oriya commences with Upendro Bhanj, who composed a large number of religious poems which are held of high account. The poet was the brother of the rajah of Gumsar, a small hill-state, which has always maintained its reputation for preserving the Oriya language within its borders in the most perfect and pure state. Upendro Bhanj did not live more than 300 years ago. He composed two rhyming dictionaries, the *Sabdamâla* and the *Ghitâbhidâno*. Many of his minor poems are superlatively indecent, and withal filled with puerile verbal quibbles. Nearly contemporaneously with Upendro Bhanj flourished another Oriya poet, named Dinkrishno Dâs, who wrote the *Rasakallola*, the most famous poem in the language. The poem owes its celebrity to its mellifluous and harmonious versification; as for the rest, it is simply a farrago of obscenity. The *Bhagavadgita*, *Ramayana*, *Padma Purana*, and *Lakshmi Purana* are all represented in Oriya by adaptations more or less felicitous. In conclusion, it should be mentioned that the Oriya character is the clumsiest of Indian alphabets. We have now to refer, briefly, to the last of the seven modern Aryan languages of India—namely, Bengali. Occupying the most easterly position of these languages, it possesses the largest share of the purely Sanskrit element in its composition. The origin of the language was a very obscure one, and for centuries it was extremely rude. It is only lately that Bengali literature has, with marvellous success, sprung up. Four centuries ago Bengali was unwritten. Then it closely resembled Hindi, but since that time a marked change has crept over it. The poverty of the language began to be so clearly, from the first, apparent to Bengali pundits that they had to have recourse to an enormous number of *Tatsama* words to patch up their difficulties. The Bengali noun has a purely inflectional genitive. There is no preparation of the base. Gender is practically neglected. The verb is simple and constructed on the participial system. The pronouns are almost the same as in the Prakrit. The singular of the pronoun and of the verb has been banished from use, the plural being used for politeness' sake, and two new plurals being added for convenience' sake. The alphabet of the Bengali is very elegant and facile; the typography of a

Bengali book is simply charming to look at and read. The alphabet may be described as "very little changed from the Kutila brought down from Kanauj by the Brahmans whom King Adisur invited to Bengal in the latter part of the eleventh century." The literature of Bengali, as it is at present, is far ahead of all other portions of Aryan India. The reformer Chaitanya first gave it its impetus in the fifteenth century. The *Kirtans* or lyrics which he collected soon became popular. But the first Bengali poet was probably Vidyâpati. Some writers have ascribed to him a date as early as A. D. 1320, but he probably flourished considerably later. Another famous Bengali writer of the earliest period of its literature is Kabi Kankan. The adapters of the *Ramayan* and *Mahabharat* in Bengali were the poets Kasidas and Kritibas. Another Bengali poet of note is Bhârat Chandra Rai. *Kabi*, or satirical poems, have much popularity in Bengal, and have been composed by different authors at different times. Iswar Chandra Gupta, the Bengali Rabelais, was famous half a century ago for his sparkling wit. Three great modern Bengali writers may be mentioned. The first is Babu Piari Chandra Mittra, who is the author of *Allâler Gharer Dulâl* ("The Spoilt Child of the House of Allâl"), a clever novel, which is by far the best fiction in the language, and abounds in wit and humor. The second is Michael Madhusûdan Datt, a native Christian, whose voluminous works have gained for him a very high rank in Bengali. And the third is Kali Prasauna Singh, a clever but sometimes coarse writer, who has the art of depicting in the most felicitous way the main characteristics and foibles of his countrymen. The most modern developments of Aryan literature may be spoken of, together with the latest phases of Dravidian letters, after we have glanced at the South Indian family of languages, which constitute the third great division of Indian tongues.

III. *Dravidian Languages and Literature.*—This family of languages consists of the following members: Tamil, Telugu, Canarese, Malayalam, Tulu, Coorg, Tuda, Gond, Ku, Rajmahal, and Oraon. In this brief epitome the last seven of these dialects need only be mentioned. They have no literature, and the interest which attaches to the four dialects mentioned first wholly eclipses any these seven might possess were they the only representatives of Dravidian speech in India. For the same reason we only need make a passing allusion to Brahui, a language which has a strong Dravidian element in it, though not Dravidian, nor spoken on the Indian side of the north-western frontier, but which, however, somewhat attracts attention, as it forms an important link in the chain which binds the Dravidian proper to the Scythian group of tongues. With this group all the Dravidian languages of India are radically connected, and the Scythian family to which they are the most intimately allied is the Finnish or Ugrian. (See the introduction to the Rev. Dr. Caldwell's *Comparative Grammar of the Dravidian Languages.*) The most important of the four principal Dravidian languages is undoubtedly Tamil. Next to Sanskrit, it stands supreme as an Indian language, both in regard to its structure, its genius, and its varied, ancient, and original literature. However, our notice of Tamil will at present be very cursory, as particular mention of it is made elsewhere. (See TAMIL.) Speaking generally, Dravidian India is the whole of that portion of the Peninsula which lies to the S. of the Nerbudda River and the Vindhya Mountains. There are, of course, offshoots from this broad base, and we find Dravidian words in use amongst the mountain-fastnesses of Beloochistan, in the northernmost jungles of the Rajmahal hills, and in parts of Ceylon. The term "Dravidian" is of Sanskrit origin. It means "belonging to the country of the Dravidas." The country of the Dravidas properly means Tamil-land. The Dravidas are described in Sanskrit dictionaries as "men of an outcast tribe, descended from degraded Kshatriyas." Of course this simply exemplifies the low opinion which was at first entertained by the Aryan invaders of the aboriginal inhabitants of India. Indeed, as represented in great Brahman poems, the Dravidians were uncouth, savage, given to horrible rites, eaters of raw meat, cannibals, disturbers of holy hermits engaged in contemplation, and giants or apes in form. Even in the famous *Ramâyana*, in which poem the Dravidian chief, Hanumân, is represented as Rama's most devoted and useful ally, that South Indian king is ridiculed at the same time that he is praised by being portrayed as a monkey-god. The Tamils, of all the Dravidas, first experienced the dawn of Dravidian civilization; and with this epoch the name of Agastyar, the "sage," the "Canopus" of Southern India, is inseparably connected. The date of this epoch may be fixed at about the sixth century B. C. But notwithstanding the comparative antiquity of this date, it was not till more than twelve centuries subsequently that, in all probability, Tamil literature began to spring up, and of all Dravidian literature the Tamil is the oldest as well as most important. In the case of Tamil, just as in the case of Telugu and Canarese, the period of the domination of the Jainas was that in which the vernacular literature sprung up and flourished. Malayalam literature is not more than three centuries and a half old. That language has in its composition a very large admixture of Sanskrit, and its literature mainly consists in translations and adaptations from the Sanskrit. This must also be affirmed of Telugu and Canarese, only the literature of these languages dates from several centuries previous to the rise of Malayalam literature. The first Telugu grammar is said to have been written by Kanva, in the days of Andhraraya, the king in whose reign Sanskrit was first introduced into the Telugu country. But his work is not extant, and the oldest which exists is by a Brahman called Nannappa; but this grammar, though about Telugu, is written in Sanskrit. Nannappa translated the *Mahabharata* into Telugu; and this is the earliest work extant in the language. Its date is probably the twelfth century. Telugu is a sweet and sonorous language, but has not the logical precision, sturdiness, and great copiousness of Tamil. Mr. C. P. Brown's admirable *Grammar and Dictionary of Telugu* should be consulted by every student of that language. Canarese uses a character identical with that of Telugu, but differs very widely in most other particulars. It lacks the wonderful richness of Tamil, a language remarkably full of synonyms and exact in its grammatical structure. The Jaina period, during which literature flourished most conspicuously in Tamil-land, extended from the end of the seventh to the thirteenth century of the Christian era. The oldest work extant in the language is the *Tol-Kâppiyam* ("The Old Composition"). This is a grammar of the language, and was probably written in the close of the seventh century, but in it are to be found quotations from poems of a still earlier date, though these have not come down to us intact. The *Kural* of Tiruvalluvar, the greatest work in the Tamil language in the opinion of many, was probably written before the close of the eighth century. It is a great storehouse of polished distichs on all subjects connected with morals and political economy. The *Chintâmani,* a great Tamil epic poem, containing some 15,000 lines, was probably written not a century later; and shortly afterwards the *Nan-nûl*, a High Tamil grammar, appears to have been composed. By this time, too, several of the works ascribed to Auvvei ("the matron"), a distinguished Tamil poetess, were probably written. (For further particulars regarding Tamil and its literature see TAMIL.)

In conclusion, we must make several general remarks concerning Hindu literature as a whole. First, the greater part of it is incontestably poetical in form. That is, Hindus from time immemorial have been accustomed to throw their thoughts—no matter on what subject, and no matter whether using an Aryan or Dravidian language—into verse instead of prose. If, for instance, in the N., Chand Bardâi wishes to perpetuate in writing the history of the glories and sorrows of the heroic Prithiraj, he does so in Hindi verse; and if in the S., Tiruvalluvar desires to teach the priests and sages of Madura the principles of political economy, he does so in Tamil verse. Thus, Hindu literature is chiefly poetical. We have poems on astronomy, and poems on medicine, and poems on grammar. This, after all, was but to be expected, for, just as children are imaginative, nations in their infancy are naturally poetical. But now, everywhere in India, a sound sturdy prose literature is springing up. This is especially the case in Bengali and Tamil. Tricks of style, assonances, mimetic words, flowery metaphors and similes, jingling rhymes, and vaporous expletives,—all these are being gradually exchanged for a sober, robust diction, and simple, straightforward language which clearly expresses the thoughts meant to be conveyed by it. Secondly, Indian poetry, as a whole, is poor. Hindu poets constantly aim more at writing beautifully than at thinking deeply. There is a great deal of glitter, but little intrinsic value. Of course there are some exceptions. I should place Tamil poetry, with that of Sanskrit, wholly outside of this category; that is, taking Tamil poetry as a whole. The thoughtful couplets of Tiruvalluvar, the descriptive power of Kamban's gorgeous verse, Berchi's stately and splendid periods, Auvveiyar's chaste and elegant stanzas, Tâyumânavar's pure and solemn strains of meditative poesy, the exuberant fancy displayed in the *Chintâmani*, the roughly-expressed home-truths of the Sittars or poetical quietists of Tamil-land, the earnest sadness of Pattiragiriyar, and the passionate volubility of Sivavaykkiar, hater of latter-day Brahmanical superstitions,—all these and many more are phases of Tamil poetry which raise it as a whole—if we could only forget the beauty and majesty of the Sanskrit *drama*—higher not only than the poetry of any other Dravidian or modern Aryan language, but also than Sanskrit itself. In the last place, any notice, however brief, of Indian literature would be in-

complete if no allusion were made to two effects which have been produced by the introduction of English civilization into Hindustan. Translations in the various vernaculars are everywhere appearing of the works of the leading thinkers of Christendom, and the native press has become an established fact. It is quite true that many of these translations are in wretched taste, and are worse than merely worthless; it is quite true that many of the translators are foreigners, and barbarize the language into which they translate by flooding it with unnatural idioms and terms; and it is quite true that, in Bengal especially, the vernacular press is in too great a hurry, and works of a trashy nature are being flung in cartloads upon the public. But notwithstanding all this the benefit is incalculably greater than the mischief. The effect now being produced upon the languages and literature of India resembles that wonderful quickening power which began suddenly to exert itself in Europe immediately after the art of printing was discovered; and though much evil may have resulted from the discovery of this art, who can think of that when the untold good it has effected is taken into consideration? The vernacular journalistic literature of India is daily assuming wider proportions, and in Calcutta and Bombay, and to a very slight extent in Madras, the newspaper press is already a power. In Calcutta the Bengalis have what we should call a farthing daily paper, and in Bombay the Parsees have their *Punch*. The number of daily, weekly, and monthly native periodicals throughout India, already very great, is rapidly increasing. The statistics, if given to-day, would have to be added to-morrow. The publication of tracts, books, and Bibles by missionary societies forms a large item in the modern literary activity of India. The schoolbook and vernacular literary societies of India, patronized by the English government, are also aiding in the work of civilization. Attempts have from time to time been made to adapt the Roman character to the vernaculars, many of which employ cumbrous and clumsy alphabets, but as yet such attempts have failed in gaining the approval of Hindus themselves. Many Hindu books were of old written on palmyra-palm leaves; paper, now becoming plentiful, is being widely employed instead. The knowledge of English is rapidly extending, and there has been much discussion as to the ultimate effect of this. French is used in the French settlements, and Portuguese is spoken at Goa. In conclusion, it may be mentioned that a small but very interesting colony of Jews at Cochin on the Malabar use Hebrew much in the same way that modern Brahmans in India use Sanskrit. R. C. Caldwell.

India: its History. There can be little doubt that the population of the whole of the Indian empire must be estimated as, at present, not under 300,000,000. This remarkable fact is made obvious by the results of the Indian census of 1871–72. These results (at the time of the penning of this paper) have not yet been published, but it is known that the number of inhabitants in British India has been computed at 283,000,000, and that in this number the inhabitants of all of the independent provinces, of several Indian protected states, of remote hill and forest tribes, and of the tribes peopling the north-eastern frontier of India have unavoidably not been included. India is the most thickly populated country in the world to which the census has yet been applied; and now that it has been applied, the startling question arises if it be not, after all, the most populous country in the globe, not excepting China itself. The population of China was some time ago supposed to be 500,000,000; now it is computed at 400,000,000. But there has been no census of China, and geographers and ethnologists will begin to ask themselves the question, "On what grounds do we give the pre-eminence in the matter of population to China over India?" In writing a brief epitome of the history of India, we advisedly draw attention thus prominently to the present state of the population of that country. India has never been so thickly populated as it now is, and there are clear signs that its present population is daily increasing at a swift rate. From this fact, as from a pinnacle, we look down on the past. Here is a country which from the earliest ages has been the scene of national convulsions. It has been the prey of successive invasions and the victim of constant intestine strife. Then a civilized power from Europe set its foot on the soil. After a brief and necessary struggle the reign of order began. What is the result? The country is protected from foreign raids, and internal warfare is gradually and thoroughly repressed. Trade and commerce spring up and flourish; wealth and education spread more among the masses; the weak and outcast begin to enjoy safety and peace. Canals fertilize the country they open up. Everywhere sanitary measures are adopted for the security of the people from the ravages of pestilence. Rewards are given for the destruction of snakes and tigers. A terrible famine appears, and it is promptly relieved and loss of life prevented. Is it a wonder, then, that such a change in the history of a country should be followed by a marked increase in its population, and that this increase should be pointed to as one of the evidences of the beneficial nature of that change? The past of India, though writers may describe its glory in some things, has been, after all, only a glorious night. Even now we have only a dawn. The day is yet to come when the full effects of the present civilized government of India will be realized.

In tracing the history of India from the earliest times, we are necessarily led to speak of its ethnology. It may be premised that the conglomerate character of the inhabitants of India is only less remarkable than their number. (With regard to Indian ethnological questions not touched upon in this article, see India: its Geography, Ethnology, Languages, and Literature.)

The history of India may best be written of under ten distinct heads: I. The history of ancient India till the time of Mahmud of Ghazni, A. D. 1001. II. The history of India from this first Mohammedan invasion to the date of the first battle of Panipat, A. D. 1526. III. The history of the Mogul empire from the first battle of Panipat to the death of the last Mogul emperor, in 1859. IV. The history of the Mahrattas from the birth of Sivaji (A. D. 1627) to the present time. V. The history of the Carnatic from the date of the Mohammedan invasion of 1294 A. D. VI. The history of the Portuguese in India since the landing of Vasco da Gama in 1498 A. D. VII. The history of the European companies which vied with each other in the struggle to get a share in Indian trade before 1744 A. D. VIII. The history of the English and French in India till the surrender of Pondicherry, A. D. 1761. IX. The history of the British power in India, leading up to the appointment of the first governor-general. X. The history of the British power in India, as marked out by the successive régimes of different governors-general, since the days of Warren Hastings to the present day.

I. *The Ancient History of India.*—The earliest history of India is involved in the deepest obscurity. No date of a public event can be fixed before B. C. 327, and no connected narrative of Indian national transactions can be attempted till 1300 years after. We have only traditions and legends to guide us, and the very heterogeneous character of the races which from time immemorial have peopled India adds another obstacle to research. However, everything is not guesswork, and authorities who have entered deeply into the subject arrive at a number of conclusions which may be regarded as at least approximately accurate. (1) The *Vedas*, which are the oldest sacred hymns of the Aryan Hindus, were probably arranged in their present form as early as 1400 B. C. Their actual antiquity is much greater, but cannot be decided on, even approximately. (See Sanskrit.) (2) Even before the time of Moses (b. 1574 B. C.) India and Europe were in active communication by sea. Vessels used to ply between India and the ports of the Red Sea and Persian Gulf, and the Sabæan and the Phœnician commerce of those old days with Hindustan was probably the most lucrative in the whole world at that time. (3) In the days of Solomon we read of the ships of Tarshish trading with Ophir, and bringing from thence to Jerusalem "gold and ivory, apes and peacocks." Sir Emerson Tennent, in his admirable work on Ceylon, considers that the port of Galle in Ceylon is Ophir. In the earliest days Galle was one of the greatest of Eastern emporiums. But wherever Ophir may have been situated, one thing is certain—namely, that the Hebrew equivalent for "peacock," which appears in the Bible, is simply the Tamil word *tôkei*. (4) The history of the Solar and Lunar dynasties of India is in a great measure founded on fact, as clear traces of the invasions recorded in connection with them now remain. The magnificent Hindu epic, the *Râmâyana*, records the adventures of Râmâ, the hero of the Solar race, who conquered Ceylon, probably in the year 1200 B. C. The *Mahabharata* is the great record of the Lunar dynasty. It describes the wars of the Pandus and Kurus, which were probably fought between 1400 and 1300 B. C. The great battle was fought at Taneshwar, 30 miles W. of Delhi. (5) Gotama Buddha, the founder of Buddhism, d. at Gya, in South Behar, about 543 B. C. (6) The conquest of India by Bacchus and the expeditions of Semiramis are merely romantic fictions. Diodorus Siculus gives us accounts of the Oriental conquests of Sesostris, who was king of Egypt in 1308 B. C., but it is difficult to credit them implicitly. (7) The Persian monarch Darius, the son of Hystaspes (B. C. 518–485), conquered the Punjaub and Scinde, and made it a satrapy. The tribute paid to him by this satrapy is said to have been wholly in gold, and to have amounted to 1,290,000 pounds sterling. (8) Alexander the Great, having defeated Darius and conquered Persia, proceeded to India. In B. C. 330 he founded the city of Herat on the frontier. Three years later he crossed the Khyber Pass and the Indus at

Attock. He fought and overcame Porus at Gujarât on the Jelum, assisted by Taxiles, a prince of the country between the Jelum and Indus. Thence he advanced to the Sutlej, but had to return because his soldiers, alarmed at his rapid progress into such unknown countries, superstitiously refused to advance. We know this much of the India of Alexander, that the Hindus at that time were considered to be wonderfully civilized. Their cities were most opulent and arts and sciences flourished. (9) About this time in Bengal there were dynasties of Pala and Sêna kings. Other little-known dynasties reigned at Delhi, Ajmeer, Mewar, and Gujerat. The latter, in the second century A. D., had a Rajput dynasty called Balabhi. The Persians, under Nushirvan, are supposed to have conquered and driven these princes out of Newar, where they had emigrated in the sixth century A. D.

Concerning ancient India few other particulars are known, but we have yet to touch on an important subject connected with the general colonization of the peninsula of Hindostan from the earliest times. In the very earliest ages, long before the writing of the *Vedas* or the entry of the Aryan races into India, there appears to have existed in the country an aboriginal people, thoroughly non-Aryan in their characteristics, and who were possibly of the same family as the Mongols and other tribes of Central Asia. Invasion after invasion poured down like successive tides into India, and always from the N. W., and the aboriginal inhabitants were either pushed down southward or left, here and there, in isolated districts of hill and forest land, like islands, surrounded by the advancing wave of colonization. The first invasion we know of is the Aryan, and this may have taken place in the times of the Hebrew patriarchs. Then came the Mohammedan and mixed invasions, also from the N. W., pushing the Indian aborigines still farther southward, or islanding them still more completely in the impenetrable jungles and mountainous regions of the Peninsula. Here we have one great clue to the ethnological puzzles which India of the present day places before the student. But the whole of this subject will be found fully entered into in INDIA: ITS GEOGRAPHY, ETHNOLOGY, LANGUAGE, AND LITERATURE.

II. *The History of the Mohammedan Power in India from its First Establishment in 1001, by Mahmud of Ghazni, to its Overthrow and the Establishment of the Mogul Empire in 1526.*—The period of Indian history we now enter upon is certainly one of the ghastliest epochs which could be presented to the reader's mind. For more than 500 years, India, or at least the northern, and especially the north-western, portions of the Peninsula, literally reeked with blood. One sovereign overturned another, one dynasty supplanted another, and again and again recurred the same old story. The first act of a monarch on ascending his throne was to murder his relatives, spoil a city, desolate a province, and slaughter, immolate, or impale certain given thousands—men, women, and children—of his predecessor's adherents. Except in rare instances mercy was not known. The glory of the Mohammedan dynasties which preceded the establishment of the Moguls—*Monguls*, as they ought to be termed—consisted in the sacking of cities, in the plunder of temples, and in a series of bloody victories. Nearly all the Mohammedan invaders of India at this time were Afghans or Pathans. Originally fire-worshippers, they were converted to Islam, and in bigotry soon surpassed those who converted them. They first, for several centuries, contented themselves with feeble raids into India. But Mahmud of Ghazni was more fortunate, and after ten raids succeeded in annexing Lahore and its fertile territories. His standard was black, fit emblem of his crimes. He stormed Batinda, a fortress of enormous strength, whereupon Jeipal, king of Lahore, abdicated and committed suicide. After this he engaged in nine more bloody raids before making Lahore his residence, and thus finally laying the foundation of Mohammedan power in India. During this period he gained many victories, and still further did he subsequently signalize himself. He attacked Somnath in Guzerat. This was the most ancient and opulent shrine of the Rajputs. A terrible battle was fought. All the Rajput princes banded together, and opposed, with desperate bravery, the iconoclast of Ghazni. But their efforts were unavailing. Somnath was captured, and the booty obtained in gold and precious stones was simply incalculable. For more than 100 years subsequently the desolation of Somnath remained as a monument to the desperate and fanatical courage of Mahmud. He d. in 1030. His son, Masaud, succeeded him, after having blinded his twin-brother, but Masaud was afterwards deposed, and the blind prince rose to the throne. In a few years all was in confusion again, and there was a rapid series of assassinations in the royal households. In 1118, Beiram ascended the throne. He was an estimable prince, as things then went, but could not resist murdering his own son-in-law, because of which he himself was assassinated, and his assassin, named the "Burner of the World," introduced the Ghoriar dynasty and reigned in his stead. A Turki slave, Kutb-ud-Deen, succeeded him, and founded the first Indian slave dynasty. His son, Aram, succeeded him, and was in a year deposed by Altamish. When Altamish in his turn died, his son succeeded him, but in seven months was deposed by his beautiful and clever sister, Rezia, who is known to have been the only female who has ever ruled personally in Delhi. Her Britannic Majesty, Queen Victoria, is "empress of India," but Queen Rezia is the only female potentate who has ruled, as the head of all Indian sovereigns, in the capital of Hindostan, for such Delhi was then reckoned. It is narrated of her that she adopted a very ultra-Bloomer costume, and went about administering justice amongst men as if she herself were a man. A Turki chief, Altunia, rebelled against her. There was a severe battle, and she was defeated; but she soon conquered her conqueror—by marrying him. Shortly afterwards she and her husband fell victims to a rising of nobles. Beiram, her brother, ascended the throne of Delhi after her, but was soon quietly assassinated. His successor, Masaud, was deposed. Nasir-ud-din-Mahmud and Balin followed after him, and were themselves succeeded by Kei Kobad. With him ended the dynasty of the slaves of the sultan of Ghor. Kobad's life appears not to have been remarkable for anything but vice. He poisoned his prime minister, plunged into the wildest debaucheries, and ended his life miserably after an attack of palsy. He was followed by Feroz Shah, who inaugurated a new dynasty of these Pathan kings of India in the year 1288. He was followed by a prince of great ability, who reigned for twenty-one years, and on the whole successfully and gloriously, but was rightly termed, by Mohammedan historians, "the Sanguinary." Alla-ud-din-Khilji—such was his name—began his reign by murdering his aged uncle just as the old man was patting him affectionately on his cheek and assuring him of his friendship. He next distinguished himself by killing the two sons of Feroz Shah, his predecessor. Constantly, at this time, the Moguls were attempting to establish themselves in India. Alla-ud-din sent out his able general, Zafur Khan, against them, and was completely victorious. But the "sanguinary" potentate was jealous, and allowed the valiant soldier who had saved his kingdom to be sacrificed, just in such a manner as we are informed in the Holy Scriptures Uriah was. He then conquered Rajputâna. When the Rajputs found his army at the gates of Chitoor, the queen and all the women of the city, with their children, flung themselves on an immense pyre that had been previously prepared, and died in the flames they themselves kindled, whilst the Rajput men, fighting to the last, allowed themselves to be slain, one by one, outside the walls, rather than yield. Padmani, the queen, was a woman of rare beauty, and the Rajputs still remember her name with devotion. Alla-ud-din captured, during the course of his wars, a young, handsome eunuch named Malik Kafur, whom he appointed his prime minister, field-marshal, and viceroy. Malik subsequently poisoned his master and rose to his throne. Malik Kafur next blinded the two sons of Alla-ud-din, but the third escaped, raised the army, and killed the treacherous eunuch. The name of this son of Alla-ud-din was Mubarik. The very first thing this sovereign did was to murder those who forewarned him of Malik Kafur's purpose and protected him, and the second thing he did was to put out his infant brother's eyes. The rest of his life Mubarik spent in debaucheries and flaying his enemies alive. Khusru Khan, whom he made his vizier, was a Gujerat Parwary slave. After ably conducting his master's affairs, he assassinated him and reigned in his stead, but was soon himself assassinated, and in 1321, Ghiaz-ud-deen-Tughlak, his murderer, sat himself on the vacant throne and began the dynasty of the Tughlaks, which is commonly known as the fifth Afghan dynasty. Juna Khan, the son of Ghiaz, contrived to kill his father by the fall of a gorgeous pavilion into which the unsuspecting king was induced to enter. Juna Khan was a very learned but inefficient ruler; his state grew insolvent and everywhere rebellions menaced him. We need not refer to the remaining kings of this miserable dynasty. The seventh dynasty was more wretched still under the weak sway of the four Syeds. The last dynasty of the Mohammedan power, before the Mogul empire absorbed all, was that of the three Lodis. The last of these, Ibrahim, fought Sultan Baber, the Tartar governor of Cabool. The latter sacked and burnt Lahore, and overthrew Ibrahim at the famous battle of Panipat. Ibrahim was killed, Delhi and Agra were taken, and from this time (1526) must be dated the rise and progress of the Mogul empire in India.

III. *The History of the Mogul Empire.*—The Mogul empire was one of the most splendid dominations India has

ever known. In its palmiest days it was a source of real and wide good to Hindustan. According to Mohammedan authorities there were fifteen emperors of this dynasty; some later authorities say seventeen, for as the tenth and eleventh rulers of this line they include two Rafis, whose combined rule only extended over a period of three months in 1719. Omitting these, we have the following emperors: Baber, who ruled from 1526 to 1530; Humâyun, 1530–56; Akbar, 1556–1605; Jehangir, 1605–28; Shah Jehan, 1628–58; Aurungzeeb, 1658–1707; Shah Alam I., 1707–12; Jehandar Shah, 1712–13; Farukshir, 1713–19; Mohammed Shah, 1719–48; Ahmed Shah, 1748–54; Alamgir, 1754–59; Shah Alam II., 1759–1806; Akbar II., 1806–37; Mohammed Bahadur, 1837–57. Baber, the founder of this noble race of kings, was descended from the Tartar Tamerlane, his mother being a Mongol. He hated the Mongols, yet his dynasty obtained the name of that race under the corrupt form of "Mogul." His life was one long battle. Panipat secured his footing in India. The plunder of Agra and Dehi in 1526 at once raised him to a position of immense power, for opulence means power in the East, as a rule. In 1529 he conquered Behar and Bengal. His death (in 1530) was a romance in itself. His eldest son, Humâyun, was mortally sick. Baber prayed that his own life might be accepted for that of his son. Strange to say, from that hour the son recovered and the father's health declined. A beautiful tomb in Cabul covers his remains. Humâyun now ascended the throne, but in stormy times. He was defeated by his enemies, and during his flight from India his son, the famous Akbar, the glory of the Mogul dynasty, was born. After many years of exile and suffering, during which time India was convulsed under unsettled governments, he returned, invaded India, took Lahore, and shortly afterwards met with a fatal accident in his palace. His son, Akbar, was now only thirteen years old. Under the able generalship of Beiram Khan, a Persian, Akbar's hotly-contested position was established. In 1560, Beiram Khan, who had gradually been usurping too much power, attempted a revolt against Akbar, but was defeated, captured, and generously pardoned, but on his way to religious retirement in Mecca was assassinated in Guzerat. Akbar, then in his eighteenth year, was at length recognized as the real as well as nominal emperor of Delhi. He had been nursed in warfare from his childhood, and undergone a wonderfully successful training for his difficult position. He entered upon a number of campaigns immediately after Beiram's death, proved successful in almost all his undertakings, and exhibited, in the midst of all his most exhilarating victories, an equable temper and a liberality and mercifulness quite remarkable in those savage times. The reader must not forget that all the Mogul emperors were Mohammedans. Some of them were exceedingly bigoted ones, and oppressed the Hindus in the most cruel way. But Akbar set before him a policy of conciliation which has never been paralleled in Indian history till Europe claimed India for her own. In 1592, Akbar obliterated every trace of the Afghan dynasty in India. All over India—amongst the Rajputs, in Cashmeer, Scinde, and Kandahar—the armies of Akbar were victorious. Akbar next annexed Khandeish and took Ahmednuggur in the Deccan. At length (in 1605) this wise politician, great monarch, and large-hearted man died, and was buried near Agra, and Jehangir, his son, reigned in his stead. He was intemperate, violent, and soiled his hands with blood as his father never did before him. He was a bigoted Mussulman, and alienated the Hindus by reversing his father's well-advised policy. This emperor is chiefly known as the husband of a beautiful and wise woman, Nur Jehan, or "Light of the World." The name of that mighty empress upheld the dynasty like a spell. Even when, after a terrible disaster, her unworthy husband had been captured, she rushed to share his captivity, plotted his escape, overthrew the enemy, and restored to the emperor his throne. At length he died, and Shah Jehan succeeded him. Little need be said of this emperor. He lived surrounded by battles with the Deccan in the S., decimated by pestilence and famine. Suddenly he fell dangerously sick. His sons fought for the throne while the parent was still alive. Aurungzeeb was the most successful of these, and assumed the imperial dignity in 1658, putting nearly all his opponents and relations to death, and his aged father in prison, where he died eight years after. Thus began the most superficially magnificent reign India has ever known—a reign to laud which to the utmost Mohammedan chroniclers can find no words sufficient. Aurungzeeb utterly revoked the policy of Akbar. He was a most narrow-minded Mussulman, and the slaughter of infidels was his supreme delight. Everywhere Hindus fled before his hateful power. But he was a man of immense resource, ability, self-reliance, and resolution. His armies, minutely under his personal supervision, carried all before them. Every detail of civil or military government passed under his eye. He spared no labor himself, and enforced in certain military matters the most rigid discipline, whilst in others he gave his fanatical troops the utmost license. But it was dangerous for one of his subjects to become too successful. He was morbidly jealous, and the general who rose to too great eminence after a campaign was as a rule assassinated for his pains. Mosques, mausoleums, minarets, and palaces rose rapidly in the great centres of Mohammedanism, but works of general utility were neglected. Enormous wealth flowed into the coffers of the emperor, and flowed out as fast without doing any good, further than aggrandizing the dynasty. At length, in the eighty-ninth year of his age, Aurungzeeb died, and with him, it has been said, the Mogul empire passed away. Internal divisions rent it; a constant succession of wars between different pretenders to the throne set the whole land aflame; the Mahrattas grew up to be a mighty and warlike people, who defied the power of the kings of Delhi; the Rajputs rose and won for themselves independence; the Carnatic became the great battle-ground of India. So change succeeded change, as one Mogul emperor succeeded another, till in 1857 the last miserable ruler of the house, Mohammed Bahadur Shah, rose against Britain and abetted the mutineers. His sons and grandson were shot, and he himself transported for life to Burmah, where, in Maulmain, he died. Such was the close of the Mogul empire.

IV. *The History of the Carnatic.*—We must briefly glance at this, without entering into any detail. Hitherto, the Indian history we have gone over has related almost wholly to North-western and Northern India. Southern India now claims a word for itself. It was here that, after the first Aryan invasion thousands of years ago, the aborigines chiefly took shelter and became massed in dense communities. Then afterwards, when other invasions from the N. W. succeeded, and the Afghans and the hordes of Baber poured, in wave after wave, into India, still Southern India remained as the great refuge for the earliest inhabitants of the Peninsula. Curious references to Southern India appear in the writings of Ctesias, the Persian court-physician (B. C. 400). Several ports on the Coromandel coast of Southern India have been identified with those mentioned in the famous Peutingerian Tables. The Carnatic, till A. D. 1294, was wholly ruled by Hindu rajahs. After that it became successively a Mohammedan, Mahratta, French, and English battle-field. The Carnatic is interesting as having been the scene of the glories of the Pândiyan and Chôla dynasties. The capital of the Chôla dynasty was Conjeveram. The Pandiya rajahs took Madura in the S. for their capital, and the latter city has been regarded as the Benares of the Deccan. It was the great Carnatic centre of Hindu activity from the eighth century till quite recently. It was the foster-mother of art, science, literature, and religion. From the earliest times Southern India has been one vast granary. It was boasted by the chroniclers of six centuries ago that "not a span of land in the Deccan was free from cultivation under the Chola and Pandiya kings." Everywhere stately temples arose, and in the present day the sculptured shrines of Srirangam, Chillambram, the Seven Pagodas, Madura, Tanjore, and Ramêswaram vie, in their way, with the most famous specimens of ancient architecture in the Bombay or Calcutta presidencies—with the caves of Elephanta or the Tâj at Agra. The Carnatic is the scene of Nizam-ul-Mulk's enduring successes. The famous Vizianagar Hindu kingdom, once occupying nearly the whole of the country now called the Madras presidency, has still a limited place in Southern India. The fertile provinces of Mysore and Travancore have an interesting history: and it was in the Carnatic that the English had to fight to the death—first with Hyder Ali, and then with Tippoo Sultan.

V. *The History of the Mahrattas.*—But, ere passing on, we must at least allude to the Mahrattas, without a mention of whose astonishing successes as a brave, warlike power the briefest epitome of Indian history would be imperfect. The founder of the Mahratta power was the great Sivaji, a man who was at the same time as brave and intrepid as a lion and cunning and wary as a serpent. He was born in 1627 A. D. The Mahrattas at that time were good fighters and thorough haters of the Mohammedans. Their military tactics were formed upon plans which admirably suited the country they inhabited; and these tactics Sivaji perfected. Their country is one which presents a constant succession of rocky hills and masses of boulders, rising above alluvial plains. In these elevations the people constructed their most impregnable hill-forts. The race themselves were hardy, naturally active and brave, capital skirmishers, and ready to go to the world's end, so to speak, for plunder. Their system of warfare was of the rough and impetuous kind, and the *élan* of Mahratta cavalry rendered them dreaded everywhere. Tennyson, the

poet-laureate of England, is quite felicitous when he writes—

"When in *wild* Mahratta battle fell my father, evil-starr'd."

Sivaji began his career at the early age of nineteen in seizing the hill-fort of Tornea and then in building another. He next took in succession several other forts, and attacked the Vizianagar government, and also carried his freebooting expeditions even into Mogul territory, then under Shah Jehan. The Vizianagar power sent Afzal Khan to crush Sivaji, but the wily Mahratta entrapped the general, played Ehud to his Eglon, and destroyed the whole of his army. After three years the Vizianagar government was glad to make peace with the man whose name was a terror from the Malabar to the Coromandel coast; whereupon, at once, Sivaji turned his attention to the Moguls and ravaged their territories to the very gates of Aurungabad. Then, to inspirit his troops, he performed an exploit of incredible daring. At midnight he slipped, wholly by himself, into the city, joined in some marriage festivities, surprised the Mogul viceroy and wounded him, killed his son and attendants, and escaped to his own force scot-free. For many years he carried on this war during the reign of Aurungzeeb at Delhi. Sivaji attacked Surat, got together a fleet of 85 sail, and became the terror of the whole Malabar coast, and annoyed the Mussulmans by constantly chasing and destroying their Arabian pilgrim-vessels. At length, by weight of numbers, Sivaji was partially subdued, and was actually induced to join the Mogul forces as their ally. This he did, and, as he could never live without fighting, attacked the Vizianagar power and gained a series of brilliant engagements. Shortly afterwards, breaking again with the Moguls, he caused himself to be solemnly enthroned in Raighur. He weighed himself against gold, and gave the ten stone of the precious metal which represented his weight to his Brahman subjects. He next engaged in a raid in the South, and returned with great plunder to Raighur, his capital. He d. Apr. 5, 1680. Sambagi succeeded him, but he was the weak son of a great father. At length (in 1689) Aurungzeeb captured him, put a red-hot iron to his eyes, had his tongue torn out by the roots, and then decapitated him. From those days to the present, though the character and fortunes of their successive chiefs have changed, the Mahrattas have still remained a warlike people. They measured swords bravely with the Portuguese and English, and were not thoroughly taken in hand till, after having been over and over again hopelessly vanquished by the British arms, the "subsidiary system" was put in force, and the land is now at peace.

VI. *The History of the Portuguese in India.*—Whilst treating of this portion of our subject, we may also speak of (VII.) the history of the various Indo-European companies; of (VIII.) the history of the French in India till their surrender of Pondicherry; and of (IX.) Anglo-Indian history till the appointment of the first governor-general. In 1497, Vasco da Gama rounded the Cape of Good Hope, procured a pilot at Melinda, struck out boldly across the Indian Ocean, and landed at Calicut on the Malabar coast, where he was received with great pomp by the rajah. Da Gama, having thus opened up the way to India, returned to Portugal, and in 1500 a second expedition was sent out to India under Alvarez Cabral. Eight friars were sent with this expedition to propagate Christianity in India, but on arrival they used the sword as freely as the gospel. War naturally followed, and the Portuguese bombarded Calicut and burnt the shipping in the harbor, and then withdrew to Cochin. In a year's time they returned to Portugal, eminently successful for the time being, as far as mere trade went, for the whole Indian Ocean was now at the command of their fleet. But their arrogant policy made them hated in India. In 1502, Vasco da Gama returned to Calicut, and some of his first acts were to burn a ship with all its crew and to cut off the hands and feet of fifty natives of various classes collected from the native vessels in Calicut harbor. He returned to Europe without accomplishing anything better. In 1505 the Portuguese sent out their first viceroy, Almeyda. In 1508, Albuquerque, the greatest name in Portuguese Indian history, succeeded Almeyda, and in the next year he captured the city and fine harbor of Goa, and at once the power of Portugal rose to importance in India. But soon wars sprung up on every side, and after Albuquerque's death the Mahrattas and Mohammedans pressed the colony very sorely, and within a century the Portuguese empire in the East—in Ceylon and the Moluccas as well as at Goa—may be said to have almost utterly collapsed. With it also, fortunately, collapsed the Inquisition and other peculiar institutions which the Portuguese introduced into India for the "benefit" of Hindus. Shortly after the first appearance of the Portuguese in India four European East India companies followed them—namely, the Dutch in 1594, the English in 1600, the French in 1668, and the Danish in 1616. The Dutch settlements in India have never been very important, and have subsequently all been ceded to England. These were Negapatam, Bimlipatam, Pulicat, and Sadras. The Danes established themselves at Tranquebar and Serampore, and sold these places subsequently to the English in 1845. At the present day it is most curious to notice these quaint Dutch and Danish towns in India, which have a curious Old-World air about them. In 1579 an Englishman named Thomas Stevens travelled to Goa, and published a narrative of his travels in England. The book attracted great attention. Other English travellers recounted their adventures, and some of them travelled to the court of Akbar with letters from the English queen Elizabeth; and then (in 1600) Queen Elizabeth determined on incorporating by charter the famous British East India Company. The company was to be the medium of all trade-communication between Britain and India; was to have twenty-four directors and one chairman; and in 1624 the company was formally authorized to punish, even capitally, their servants, and thus were regarded as a government as well as a trading association. In 1611 the first English factory was established at Surat, on the western coast, and five years later, besides several other factories, the company had one on the eastern coast, at Masulipatam. In 1639, Fort St. George, at Madras, was built. In 1640 the first Bengal factory was established at Hooghly. Everywhere along the sea-line factories, more or less fortified, sprung up, and did a rapidly increasing business. At length, in 1664, Sivaji attacked Surat, and the natives first learned to appreciate the bravery and aptitude for war of the English, who successfully drove the victorious Mahrattas back, and protected the town of Surat in a manner which so delighted Aurungzeeb that he forthwith gave the English traders great concessions. In 1668, Bombay was made into a presidency. It had been given to England as a part of the dowry of Catharine of Braganza. In 1698 a fort was ordered to be built in Bengal; it was called Fort William. Thus begins the history of Calcutta. But before this the French had landed in India. The famous Colbert organized a company on a firm basis in 1664, under the patronage of Louis XIV. This company began rapidly to establish factories near existing British ones; for instance, in Masulipatam and Surat. In 1674 the French bought Pondicherry, on the Coromandel coast, which still belongs to their government; François Martin was the founder. In 1693, Pondicherry was attacked and taken by the Dutch, but was subsequently returned after the Peace of Ryswick. It was then more elaborately fortified by the French, and soon rose into great importance as a mart and port on the Coromandel coast. In 1688, Aurungzeeb gave the French Chandanagore, in Bengal, a small settlement which they possess at the present day. In 1731, Dupleix, the French Clive, was appointed director of Chandanagore. Everywhere the French factories rose and flourished, and it was not long before it was seen that the supremacy of France or that of England in India must be decided by force of arms. From the first there had been no boundaries between the rival companies, and their factories were indiscriminately dotted over the Peninsula. When war between England and France broke out in Europe, the spark would naturally fly to India and the whole country be ablaze. This was clearly anticipated, and thus French and English vied with each other to obtain influence and form alliances with those native potentates who happened to possess at the time large standing armies. At length war did break out between England and France in Europe, and the flame spread to India. Dupleix and La Bourdonnais, the French admiral, attacked Madras in 1746, took it and the garrison, and compelled the English to redeem it with a ransom of four lakhs and 40,000 rupees. The English captives were sent as prisoners to Pondicherry, saving a few who escaped. Among these latter was the future hero of India, Clive. At this brilliant French success the nawab of Arcot grew jealous, and sent 10,000 men against them. But the whole of this army was overthrown by 230 Frenchmen under Dupleix and Paradis, assisted by only 700 native troops. The fame of this splendid achievement spread through all India. The French were regarded as the greatest European power in India. This state of affairs continued till 1748, when by the Peace of Aix-la-Chapelle England and France were once more at unity. Dupleix, mortified and chagrined, had to deliver back Madras to the English. Peace was not long to continue between the two European powers in India. The throne of Arcot was the subject of a war between the occupier, Anwar-ud-deen, and Chanda Sahib, the aspirant. The latter had the sympathies and assistance of the French, and was at first successful. Anwar-ud-deen was killed. The British then supported the succession of his son as against Chanda Sahib's claims, and marched 600 Englishmen, under Lawrence and Clive, together with a vast native army

(a large part of which was composed of Mahratta soldiers), towards Pondicherry. Now the tables were turned, and the English won the day. But in a short time the French, under the able and irrepressible Dupleix, suddenly murdered Nazir Jung, the viceroy of the Deccan whom the English had appointed, and in a great measure regained their prestige in Southern India. In 1751 the French were still the real rulers of the Carnatic. But now a terrible struggle commenced. The English were thoroughly aroused. Clive with 320 men and 4 officers took Arcot, and held it for seven weeks against 10,000 of Chanda Sahib's troops. At length the garrison was relieved by Saunders after a desperate fight; Chanda Sahib fled. The prestige of England rose anew. In 1752, Clive followed up his victories. Dupleix had built a town and pillar to commemorate his successes; these Clive demolished, and thereby greatly impressed the minds of the superstitious Hindus. Next, the rock of Trichinopoly, beleaguered by the French, was relieved. The French army was caught in a trap in an island between the Cauvery and Coleroon rivers, and Law, the general, 785 Frenchmen, and 2000 native troops were captured by Lawrence and Clive. Chanda Sahib fled to Tanjore, and was there soon after assassinated. After this, for several years, Dupleix did his best to retrieve the French cause, but failed. In 1756 the news reached India that England and France were again at war. The French general Lally came and took the field, and unsuccessfully besieged Madras. The English commander, Eyre Coote, soon after landed, and opened the campaign against the French. The decisive battle of Wandewash was fought. The French power was for ever utterly crushed in India. But two years before this the great battle of Plassey had been fought in the North, and all India was already virtually at the mercy of England. At first the English factories had been unimportant in Bengal, as compared with Madras. In 1756 a new native ruler ascended the throne of Bengal, Behar, and Orissa. This was that most infamous name in all Indian history—Nawab Surajah Dowlah. This man suddenly attacked the English in Bengal, first at Cossimbazaar, and then at Calcutta. Drake, the governor, found no means of resisting the overwhelming enemy. Sending all the women and children out of the settlement by ship, he himself followed, leaving Mr. Holwell and 145 Europeans behind to treat with Surajah Dowlah. The infuriated nawab now entered Calcutta. That evening—a sultry one in the hot month of June—the entire number of the 146 English captives was crammed into a dungeon eighteen feet square, with only two small breathing-holes in it. In such a climate as that of India in the month of June, the prison would have been found very oppressive for one European prisoner, but here were 146 thrust into it. The horrors of that night can scarcely be even imagined. In the morning all of the captives were dead with the exception of 23, and these were at the last gasp and presented a sad sight. Such is the memorable episode of the Black Hole of Calcutta. The news of the atrocity quickly flew to Madras, and soon Clive was in Bengal, where he carried everything before him. A hollow peace was made in 1757, but soon broken. The nawab must be deposed. In the intrigues necessary to obtain native co-operation towards this end, a wily Bengalee named Omichund was employed. The plot grew ripe, when suddenly Omichund informed Clive that he would reveal all unless he were promised, by a clause in the treaty nominating Meer Jaffir to the throne of Surajah Dowlah, the sum of 3,000,000 rupees. Clive now lent his hand to the one ignoble action of his life. Two treaties were drawn up—one on red and one on white paper. The one on red was the false treaty, with the clause which Omichund required inserted in it. This was shown to the Bengalee, and he was satisfied. Clive now wrote to the Nawab Surajah Dowlah demanding instant satisfaction for all the injuries which had been incurred by the English, stating that he must answer to the British army for his crimes unless he at once satisfied each one of the claims which should be made. Of course the nawab sprang to arms, and with 50,000 infantry, 18,000 cavalry, and an immense train of artillery, poured down on the English general with his 650 European infantry, 150 gunners, 2100 Sepoys, a few Portuguese, and 10 pieces of artillery. On the evening of June 22, Clive held the only council he summoned in all his campaigns. It was a very anxious one. Thirteen of the members of it voted against attacking the immense army of Surajah. Seven—one of whom was the sagacious and intrepid Coote—voted in favor of the attack. After the council had risen Clive took a lonely walk on the river-bank. The whole scene is an historical one. The next morning was to see the vast peninsula of Hindustan, from the Himalayas to Cape Comorin, virtually won for Britain. Clive and his little army attacked the nawab with the dawn. Plassey was fought and won on June 23, 1757. The victory was terrible and complete, though the English only lost 72 killed and wounded. Surajah was seized and put to death by his successor. But the English soon had occasion to dethrone Meer Jaffir and to appoint Meer Kassim, his son-in-law, as nawab. But he soon rebelled, and at Patna massacred 148 English gentlemen and soldiers in cold blood. He was, however, soon vanquished. By successful wars and the natural operations of trade the English power in India went on increasing and consolidating, till (in 1774) Warren Hastings became the first governor-general of British India.

X. *The Governors-general of India.*—Warren Hastings, as he was the first, may be regarded as also undoubtedly the greatest, of the governors-general of India. Whatever may have been his mistakes, he was brave, honest, disinterested, and of great ability as a statesman and soldier. His governorship extended from 1774 to 1785. The chief events of this time may thus be briefly summed up. The famous Regulating Act was passed, by which the Parliament of Britain formally recognized the East India Company as a ruling body, it being agreed in the charter that the governor-general should be paid £25,000 a year and have a supreme council of four, and that India should possess a supreme court of judicature. It was at the same time stipulated that England should receive from the East India Company forty lakhs of rupees annually. It was in virtue of this act, and under the provisions of it, that Hastings became governor-general. Col. Monson, Gen. Clavering, Philip Francis, and Mr. Barwell were his council of four. The first three of these did everything they could to thwart the governor-general. Francis was their leader. He is well known to English history as that Sir Philip Francis who is supposed to have been the author of the *Letters of Junius.* An implacable hater, in social life a heartless villain and debauchee, in public life a shrewd and calculating politician, he was an unscrupulous enemy of great power; and to him must chiefly be traced Hastings' final impeachment. To proceed, Shujah-ud-Dowlah, nawab-vizier of Oude, died in 1775. His mother and widow, called begums, claimed his treasures, 2,000,000 rupees, and for a time they got possession of them. Thus, the young nawab entered upon his reign with an empty treasury, got into debt, and accused the begums of plotting against Hastings. The latter suddenly cut the knot of the difficulty by making the begums pay 6,700,000 rupees to the East India Company. Shortly before this a wily native named Nuncoomar tried to crush Hastings by ascribing to the governor-general crimes of various kinds. The three members in the supreme council inimical to Hastings actually believed this accuser, and favored him in his designs against their common foe. But Hastings was equal to the occasion. The Brahmin had supported his evidence against Hastings by documents palpably forged. An eminent native merchant suddenly brought a suit against Nuncoomar for forgery. The case was heard before the chief-justice of Calcutta, Sir Elijah Impey. The real prosecutor of course was Hastings. Nuncoomar was found guilty and sentenced to be hanged. To the horror of all Bengal, the holy Brahmin was not reprieved. The execution was not forgotten for many a day. On the part of Hastings it was a stroke as politic as it was pitiless. It at once asserted his power even against the majority of his council, and this was needed at a time when the Mysoreans, the Dutch, the French, and the Mahrattas were all fighting together against the English. At length (in 1785) Hastings retired to England. His impeachment belongs to English history. In 1786, Lord Cornwallis went out to India as the second governor-general. He had done nothing to justify his appointment, unless his delivering himself and his army in America to Washington only five years previously may have been regarded as a sign of his good sense. During his governorship he did nothing remarkable, save to give his imprimatur to an excellent system of land settlement. The third governor-general was Sir John Shore (1793–98). The fourth was the Marquis of Wellesley, whose régime extended from 1798 to 1805. The marquis was one of the ablest men who ever set foot in India. He acted with great decision of character in his dealings with native potentates, and by everywhere pursuing a wise policy of friendly intervention, using violent intervention when absolutely necessary, he aggrandized the British power and firmly consolidated it. Hyder Ali in the Carnatic had been overthrown. Under the marquis Wellesley the fourth Mysore war, against Tippoo Sultan, son of Hyder, was successfully terminated in 1799. Seringapatam was taken. It would require a history in itself to describe seriatim the struggles of the British power in India in the Carnatic with Hyder Ali and the "Tiger of the Deccan," his son. But it was in this year (1799) that the stronghold of the latter, Seringapatam, was stormed, and Tippoo himself slain under a heap of his fierce defenders. In 1801 the affairs of Oude were regulated. Shortly afterwards the second Mahratta war was successfully brought to a close.

Everywhere the British arms were victorious. Lord Cornwallis, for the second time governor-general, succeeded Marquis Wellesley in 1805. His policy was that of peace at any price. He did not live long enough to do serious mischief, and Sir George Barlow succeeded him in the same year, and governed till 1807. He was inclined to copy Lord Cornwallis, with certain laudable exceptions. On July 10, 1806, at 2 A. M., the Sepoys of the Carnatic military station of Vellore mutinied, and massacred 113 European troops. Their reasons for thus rising against the British government were stated to be that the new *puggree* sanctioned as a head-dress for the troops was really a European hat, and that the emblem of the cross had been introduced into their uniforms; by which the Sepoys understood they were to be made forcibly Christians. "So great a fire a little spark kindleth." They were quickly overcome. Earl Minto succeeded Barlow in 1807, and his governor-generalship lasted till 1813. The Travancore war broke out and was quelled during this period. The marquis of Hastings succeeded Earl Minto in 1814, and his rule lasted till 1823. He, like his predecessor, was a man of statesmanlike ability. The war of Nepaul was entered into at this time, and terminated in a measure favorably for the British arms. The eighth governor-general was Lord Amherst (1823–28). His régime was first distinguished by the hazardous undertaking, yet successful termination, of the Burmese war. In 1824, Malacca and Singapore were ceded by the Dutch to the British empire in the East. Lord Bentinck was the ninth governor-general (1828–35). At this time the Thugs were repressed and the horrible practice of the self-immolation of Hindu widows (see SUTTEE) forbidden. Lord Auckland was the tenth governor-general. The fatal Afghan expedition and the Chinese war marked his régime. From 1842 to 1844, Lord Ellenborough ruled as the eleventh governor-general. During this time Sir Charles Napier conquered and quieted Scinde. His laconic despatch after taking the country will be remembered: "*Peccavi!*"—*i. e.* "I have sinned" (Scinde). The twelfth governor-general was Lord Hardinge (1844–47). The first Punjaub war was now fought, and four great battles were won in 54 days. The thirteenth governor-general was the earl of Dalhousie (1848–56). Oude was now annexed, the second Burmese and the second Punjaub wars fought, and the system of Indian railways and telegraphs organized. The fourteenth governor-general was Lord Canning (1856–61), and his régime is not likely to be forgotten in the annals of Hindustan, because of the great Indian Sepoy mutiny of 1857. Here again we enter upon an episode of Indian history upon which hundreds of volumes have been written. The Sepoy regiments were getting dissatisfied. They felt their numerical power. They had been furnished with new Enfield rifles. Bigoted Mussulmans among them declared that the new cartridges which had been supplied to the troops had been smeared with the fat of pigs and cows. On Mar. 19 the mutiny began at Berhampore. Everywhere throughout India fanatics, ascetics, fakirs, and moulvies rushed about spreading disaffection, and prophesying the fall of the British power and the extermination of white men from the face of India. Especially the Mohammedans considered that they were to regain their empire in the East. The last Mogul emperor headed them. The signal for war was circulated from the Himalayas to Cape Comorin in the form of flat flour-cakes called *chuppatties*. At Meerut the first great outbreak took place. The eyes of the European officers throughout India were fatally blinded. They believed in their men, and their naturally honest Anglo-Saxon character could not fathom the depths of the treachery of the wily Asiatic. The European part of Meerut was burnt, and every English man, woman, and child massacred. At Delhi the commissioner, military commandant, the chaplain and his poor daughter first met their doom in the sight of the last Mogul emperor. Everywhere the land was in flames against the white man. The horrible massacre of Cawnpore forms one of the blackest pages of the history of the world, and was performed under the supervision of that supremest of miscreants, Nana Sahib. The garrison defended themselves, but were promised their lives if they would depart and give up the treasures of the place to the mutineers. After a long struggle they consented. When they were once in the boats which were to convey them away, Nana Sahib and the treacherous mutineers on the bank of the river opened fire. Men, women, and children were killed, mutilated, and wounded. Many were dragged back to the shore. Fair and noble European ladies were carried back to the city, suffered pollution worse than death, and were flung with their children down the now famous well of Cawnpore. Sir Henry Havelock soon avenged their death. Outram and Clyde and Lawrence and Neill are a few of the honorable names which shine in that dark and stormy time. Lucknow and Delhi were stormed. The mutiny was quelled, but the shadow of it has not yet passed from the hearts of living men who have had anything to do with India. In 1858, the year after the mutiny, a great change was inaugurated. India was placed under the direct authority of the crown of Britain; the East India Company was done away with; the governor-general was made "viceroy;" the Indian European army, as such, was abolished; the Indian civil service was thrown open to competition. The governor-general is now responsible, not to a board of East India Company directors, but to the secretary of state for India, assisted by a council of fifteen members. Queen Victoria issued, on all this being determined, a solemn proclamation to India, which now the native princes and Hindus generally regard as the supreme charter of their liberties. After Lord Canning's régime, Lord Elgin, Sir John Lawrence, the earl of Mayo (assassinated at the Andaman Islands), and Lord Northbrook have followed as governors-general and viceroys. Lord Northbrook is now (1875) in power, and his government has been especially marked by the wisdom and thoroughness with which a fearful Indian famine in Behar and Bengal has been met and finally overcome.

R. C. CALDWELL.

India (or **China**) **Ink** is of two kinds: (1) the dried pigment from certain cuttle-fishes. When browned by the action of an alkali it becomes *sepia*. It is prepared in Italy, in Turkey, and in Asia. (2) A mixture of fine lamp-black with glue or size and a little camphor. It is prepared in China, and is a very useful pigment. Both of the above are used in Asia as writing inks, and both are practically indelible. (See INK, by PROF. B. SILLIMAN, M. D.)

India Matting, a material largely employed as a summer carpeting and for the covering of the floors of sleeping chambers. It is imported from Bengal, where it is woven from the stems of *Papyrus Pangorei* or *corymbosus*.

In'dian, tp. of Plumas co., Cal. Pop. 880.

Indian, tp. of Washington co., Me. Pop. 14.

Indian, tp. of Williamsburg co., S. C. Pop. 1147.

India'na, one of the central States of the American Union, lying between the parallels of 37° 46′ and 41° 46′ N. lat., and the meridians of 84° 49′ and 88° 2′ W. lon.

Seal of Indiana.

Its greatest length from N. to S. is 277 miles, and its greatest breadth from E. to W. 176 miles, while its average breadth is about 140 miles. It is bounded N. by Lake Michigan and the State of Michigan, the parallel of 41° 46′ being the boundary-line; E. by Ohio, its eastern limit being a line drawn due N. from the mouth of the Great Miami River; S. E. and S. by Kentucky, from which it is divided by the Ohio River; W. by Illinois, the boundary being the meridian of 87° 30′ W. until that meridian strikes the Wabash River, and thence through the middle of the main channel of the Wabash River to its entrance into the Ohio. The area of the State is 33,809 square miles, or 21,637,760 acres. In 1870 it had 49.75 inhabitants to the square mile.

Face of the Country.—There are no mountains in Indiana, and no hills of considerable height except what are called the river-hills. The rivers which drain the State have in the progress of ages eroded valleys of considerable depth and much greater width than their present channels, and the slopes which bound these valleys give the appearance of hills varying from 200 to 400 feet in height above the river-valleys, and at the highest points being about 600 feet above the level of the sea. The highest portions of the State are on its E. and W. sides, some of the river-hills along the Wabash Valley attaining the altitude of

600 feet above the sea; and from these points to the Ohio below the falls near Louisville there is a gradual slope of somewhat more than 400 feet. There is, however, no marked or distinct watershed in any part of the State. About two-thirds of the State is very level, the remainder broken or rolling, but with no high elevations. But owing to this feature of river-hills an account of the river-systems of the State and their valleys is necessary to a full understanding of the face of the country. Beginning with the S., we have first the Ohio River Valley, including that of the White Water River, which occupies a tract of about 5500 square miles in the State. The Ohio River borders the State for a distance, by the course of the river, of about 380 miles. The Ohio River Valley on the Indiana side was originally covered with heavy forests. The river-hills are rugged and broken, and about a dozen streams, mostly small and not navigable—the Great Miami and the Wabash being the only exceptions—break through the river-hills on the N. side and form bold bluffs. The valleys of the E. and W. forks of White River, and the prairie-lands which they enclose, extend from the Wabash to the Ohio line, covering a little more than a degree of latitude and an area of about 9000 square miles, or somewhat more than one-fourth of the area of the State. The region is almost universally level, and the eastern part was originally heavily timbered, while the W. is prairie, with occasionally some low, broken hills. The streams are generally clear and unfailing, and there are sufficient falls to furnish abundant water-power. The soil is very rich—much better than that of the Ohio River Valley. The valley of the Wabash River and its affluents is the largest in the State, covering an area of over 12,000 square miles. It interlocks with the White River Valley, and resembles it in its fertility. The E. portion is somewhat more rolling and broken. There are considerable waterfalls in the middle portion of the valley. The Wabash has a course of 600 miles, and, though much obstructed by drift-wood and silt, might be made navigable for steamboats of light draft to Wabash in Wabash co., about 400 miles, though only by a heavy expenditure. The valley of the Maumee and its principal tributary, the St. Joseph, occupies a tract of about 2000 miles in the N. E. part of the State, and slopes gently toward Lake Erie, into which the Maumee discharges its waters. Another and larger St. Joseph's River, from Michigan, dipping down into Elkhart and St. Joseph cos. and returning to Michigan, drains those counties into Lake Michigan; while in the N. W. the Kankakee, an affluent of the Illinois, with its branches, drains eight counties into that river. The Kankakee Valley is somewhat swampy, and the river expands at several points into broad marshy lakes. The soil is generally good, though near Lake Michigan it is sandy and barren. The tributaries of the Ohio in the State are the Great Miami, which touches its S. E. border, and its main affluent, the White Water, the Laughery, Indian Kentucky, Fourteen Mile, Silver, Buck Creek, Indian Blue, Great Blue, Little Blue, Oil Creek, Anderson's, Little Pigeon, Big Pigeon, and the Wabash; of these only the first and last are navigable or of much importance. The Wabash has its sources in Ohio. Its course is N. W. to Huntington co., thence W. by S. to Amsterdam in Cass co., thence S. W. to Baltimore in Warren co., and thence S., bearing slightly W., till it enters the Ohio. Its principal tributaries are—from the S. and E., the Salamonie, Mississinewa, Deer Creek, Wildcat Creek, Sugar or Rock, Big and Little Raccoon rivers, Otter, Meroni, Patoka, and Big creeks, and White River; from the N. and W., Eel, Tippecanoe, Little, Vermilion, Embarras, and Little Wabash, the last three being mainly in Illinois. The E. and W. forks, which, uniting, form the White River, the largest affluent of the Wabash, have themselves a number of tributaries of considerable size. Among those of the E. fork are the Salt, Muscatatuck, Sand, Clifty, Flat Rock, Sugar, Lost River, and Lick Creek, while the W. fork has Fall Creek, Big Indian, Bean Blossom, Richland, and Prairie creeks, and Eel River. The St. Joseph's and the St. Mary's unite to form the Maumee in the N. E., and the Michigan St. Joseph receives the Pigeon River and the Little and Big Elkhart in the State. The Kankakee has several small feeders in the State, and its principal branch, the Iroquois, after a considerable course in Indiana, unites with it in Illinois. Deep and Calumet rivers, small streams which flow into Lake Michigan, run very near its shores. The State is well watered. There are numerous small lakes and ponds, but none of large size. Beaver Lake, the largest, is in Newton co., and covers about 10,000 acres. The southern shore has an extensive marsh. There are also several very pretty small lakes in Noble, Kosciusko, Marshal, Stark, and La Porte cos., and three or four in Knox co. in the S. W. part of the State.

Geology.—Indiana has not a great variety of geological formations on or near the surface. The Silurian system is the oldest in the State, and, proceeding in a direction about S. W. by S. from both Lakes Michigan and Erie, it appears in the extreme N. W. and S. E. of the State. In both cases it dips under the Devonian rocks, which occupy with their formations about three-fifths of the surface of the State. In Benton co. the Illinois coal-field enters the State, the Devonian rocks dipping beneath it. The coal-measures extend from the Wabash River to Crawford co. on the Ohio, and crossing the Ohio enter Kentucky. Their area in Indiana is about 7700 square miles. There are many different qualities and varieties of this coal. At Cannelton and other points on the river it is found high up on the river-bluffs as cannel coal, and is in great demand for river-steamers and for domestic purposes, and at various points along the Wabash and Erie Canal, from Evansville northward, seams of free-burning bituminous coal of good quality are worked. In Spencer co., and thence N. N. W. to Clay co. and above, the block coal (so named from its occurring in quadrangular blocks of varying thickness) is abundant. It is easily mined, and is found to be superior to any other coal known, and even to charcoal, for the production of pig iron and steel. Two specimens of this block coal analyzed by Prof. Delafontaine gave the following results:

Water at 212° F......	1.86–3.91	Fixed carbon.........	58.23–62.81
Volatile matter.......	37.11–30.84	Ash, white.............	2.80–2.44

On distillation in a closed vessel the following results were obtained:

Coke	63.05	Water, approximately....	15.11
Tar, approximately.........	15.30	Gas..................................	5.97

The water contained ammonia and other soluble chemicals, besides a small amount of hydrosulphate of ammonia. The amount of phosphoric acid was 0.3 per cent., and of sulphuric acid, 0.0 per cent. The amount of phosphoric acid is very much less than that of the best English smelting coals, those of Pontypool, Bedwas, Eborvale, etc., and there was an entire absence of sulphur, of which there was a notable percentage in the English coals. The importance of these facts to iron-masters is very evident, as the phosphorus (or phosphoric acid) and sulphur are the two ingredients which have most seriously injured the quality of American iron. It is found, too, that there is very much less phosphorus than in charcoal, that from elm, oak, and apple tree wood yielding from 4 to 9 per cent. of phosphorus, while the block coal yielded but three-tenths of 1 per cent. This coal is said to make also the best Bessemer steel. Salt-springs are found along the borders of the coal formation. There are also many quarries of white limestone of excellent quality for building purposes, a fine sandstone like the Chemung or Portsmouth (O.) sandstone, slate, brick, and porcelain clays. Some grindstones, small deposits of gypsum, and bog-iron ore, though not sufficiently abundant to pay for working, are the other principal minerals of the State.

Vegetation.—The State in its earlier history was largely covered with forests, having much less open prairie than Illinois, but under the influence of settlements, the demands of its railroads, and the requirements for fuel these forests are rapidly disappearing, and less attention is given to the culture of forest trees than should be. A careful investigation by the agricultural department gives the entire average in woodland in the State at 7,541,145 acres, or 34.8 per cent. of the entire area. The forests are mainly deciduous trees, such as black walnut, white, red, burr, and black oak, hickory, sugar, and red maple, ash, beech, linden, sycamore, elm, and tulip or whitewood. There is very little native pine, spruce, or hemlock in the State. The undergrowths are principally dogwood, pawpaw, wild plum, thorn, persimmon, crab-apple, etc. The mandrake (*Podophyllum*) and some of the species of sumach are found along the streams. Wild flowers are abundant, although the number of species is not large. Wild animals, especially the Carnivora, are nearly extinct in the State. Bears are very seldom seen; the coyote or prairie-wolf is becoming rare; and occasionally the raccoon, opossum, and skunk, as well as the woodchuck or ground-hog and the gopher, are found. Hares or rabbits and squirrels abound in the forests, and the smaller rodents are sufficiently plenty. The grouse or prairie-hen has been hunted so relentlessly that it is comparatively scarce. Pigeons, partridges, and occasionally wild-turkeys are found.

Climate.—The climate is liable to sudden and frequent changes. The range of the thermometer each month is very great. The heat in summer is intense, and the winter's cold equally severe. These extremes are, however, greater in the northern than the southern part of the State. The following table gives the monthly and annual temperature, range of the thermometer monthly, average annual pressure of barometer, direction of winds, and annual maximum and minimum temperature in Michigan City, Logansport, Indianapolis, and New Albany—four points

nearly equidistant from each other, and fairly representing the different climates of the State—in the years 1872–73:

Observations.	Michigan City. Lat. 41° 38′ N. Lon. 86° 57′ W. Elev., 654 feet.	Logansport. Lat. 40° 47′ N. Lon. 86° 22′ W. Elev., 510 feet.	Indianapolis. Lat. 39° 47′ N. Lon. 86° 05′ W. Elev., 746.7 ft.	New Albany. Lat. 38° 20′ N. Lon. 79° 03′ W. Elev., 496 feet.
Ann'l mean pressure barometer.......	30.063	......	30.023	30.060
Monthly range of temperature:				
October.......	54°	64°	54°	52°
November..	61°	48°	42°	58°
December...	69°	.....	35°	65°
January.....	67°	.....	38°	68.5°
February...	71°	54°	56°	61.0°
March........	72°	71°	66°	68.0°
April.........	58°	45°	48°	52.0°
May...........	52°	46°	41°	43.0°
June..........	48°	.....	40°	44.0°
July...........	43°	32°	35°	35.0°
August......	39°	43°	41°	34.0°
September..	47°	44°	53°	52.0°
Monthly mean temperature:				
October......	50.8°	44.5°	50.0°	56.6°
November..	32.5°	35.2°	36.0°	37.5°
December...	20.3°	....	24.4°	29.4°
January.....	20.7°	....	25.0°	31.1°
February...	24.6°	31.3°	30.4°	36.8°
March........	34.6°	31.7°	38.5°	43.3°
April.........	42.3°	47.7°	50.3°	54.6°
May...........	53.9°	58.1°	64.0°	67°
June..........	70.2°	....	77.0°	78°
July...........	71.2°	71.1°	75.5°	79°
August.......	71.7°	73.5°	75.0°	78°
September..	62.4°	62.7°	64.0°	69.5°
Ann'l mean temperature.	46.26°	53.0°	50.84°	55.23°
Monthly rainfall:				
October......	0.65	7.12	1.07	3.92
November..	1.06		0.80	0.56
December...	0.19		2.10	2.58
January.....	2.56	12.3	4.50	2.93
February...	0.47		2.85	5.42
March........	0.89		3.48	3.39
April.........	6.12	10.5	5.91	3.05
May...........	7.20		3.89	5.73
June..........	1.44		3.70	3.87
July...........	4.04	12.8	11.28	3.43
August......	1.58		1.32	3.04
September..	2.53	......	1.76	2.50
An. rainfall...	28.75	42.8	42.66	40.42
Prev. winds: Parts of days				
of N. wind.	128	......	90	96
" N. W. "	85	......	147	188
" W. "	144	......	142	113
" S. W. "	248	......	176	150
" S. "	147	......	180	192
" S. E. "	79	......	78	88
" E. "	79	......	64	143
" N. E. "	141	......	83	100
" Calm "	44	......	133	127
Max. temp.....	102°	102°	101°	95°
Minimum......	—23°	—10°	—8°	—4°

Agricultural Products.—Indiana belongs to the grain-growing States, and in some of the grains takes a very high rank. Its production of cereals in the year 1869–70, according to the census, was—of wheat, 27,747,222 bushels; of rye, 457,468; of Indian corn, 51,094,538; of oats, 8,590,409; of barley, 356,262; of buckwheat, 80,291. Four years later these crops were reported as follows: wheat, 20,832,000 bushels (a decided falling off); rye, 397,000; Indian corn, 67,840,000 (a gain of nearly 16,746,000 bushels); oats, 11,400,000 (a gain of 40 per cent.); barley, 568,000; buckwheat, 139,000 (or almost double). The crop of Irish potatoes in 1869–70 was 5,399,044 bushels; in 1873, only 2,520,000; tobacco in 1869–70, 9,325,392 pounds; in 1873, 15,600,000; hay in 1869, 1,076,768 tons; in 1873, 893,300. The value of these nine crops in 1873 was $70,556,260, these constituting not more than one-half of all farm productions in value. The value of all farm productions in 1869–70 was $122,914,302, and this included, besides other important items to be mentioned presently, $2,858,086 of orchard products, $487,479 of market-garden products, $2,645,679 of forest products, $605,639 of home manufactures, and $30,246,962 of animals slaughtered or sold for slaughter; nearly $37,000,000 in all. In 1869–70, according to the census, Indiana produced 5,029,023 pounds of wool, 35,526 bushels of peas and beans, 150,705 bushels of sweet potatoes, 19,479 gallons of wine, 22,915,385 pounds of butter, 283,807 pounds of cheese; and sold 936,983 gallons of milk. The establishment of butter and cheese factories since that time in the State, nearly 100 being now in operation, has doubled the production of butter and cheese. Among the other agricultural products of 1869 were 61,168 bushels of clover-seed, 17,377 bushels of other grass-seed, 63,884 pounds of hops, 22 tons of hemp, 37,771 pounds of flax, 401,931 bushels of flaxseed, 1,332,332 pounds of maple-sugar, 227,880 gallons of maple-molasses, 2,026,212 gallons of sorghum molasses, 12,049 pounds of beeswax, and 395,278 pounds of honey. In 1870 there were in the State 497,883 horses, 43,250 mules and asses, 393,736 milch cows, 14,088 working oxen, 618,360 other cattle, 1,612,680 sheep, and 1,872,230 hogs. The value of all the live-stock was estimated to be $83,786,782. In 1874 the numbers of each were as follows: Horses, 649,500; mules and asses, 58,500; milch cows, 448,400; oxen and other cattle, 780,300; sheep, 1,722,500; hogs, 2,496,700. The value of this live-stock was estimated at $91,401,474.

Manufactures.—Manufacturing industry has been of slow growth in Indiana, but has now attained to a considerable magnitude, and is rapidly increasing. The largest branches of manufacture are flour and flouring-mill products, lumber, woollen goods, machinery, cars and carriages, iron and iron goods (now rapidly increasing), furniture, boots and shoes, clothing, agricultural implements, packed meats, and saddlery and harness. In 1870 there were 11,847 manufactories in the State, in running which there were used 2881 steam-engines of 76,851 horse-power, and 1090 water-wheels of 23,518 horse-power; employing 58,852 hands, of whom 54,412 were men, 2272 women, and 2168 children; using a capital (under-estimated) of $52,052,425; paying wages to the amount of $18,366,780; working up raw material of the value of $63,135,492; and producing to the amount of $108,617,278. The largest industry was that of flouring and grist mill products, in which 962 establishments, employing 3214 persons and a capital estimated at $8,515,627, produced goods of the value of $25,371,322. Next came lumber, planed and sawed, and sash, doors, and blinds, which together, in 2005 mills and factories, employed 10,724 persons, and produced lumber, etc. to the value of $14,788,263. In wool-carding and dressing and the manufacture of woollen goods there were 175 mills, employing 2469 hands, and producing goods to the value of $4,329,711. In the way of machinery, 98 machine-shops, employing 2592 hands, produced wares of the value of $4,146,384. In the manufacture of carriages and wagons, 770 shops, employing 3325 hands, produced goods to the value of $3,616,068, and 10 car-shops, employing 1403 hands, made cars for passengers and freight valued at $2,577,726. In the manufacture of furniture 352 establishments, employing 3196 hands, made goods of the value of $3,826,930. Carpentering and building, in 995 establishments, employing 2893 hands, produced houses, etc. to the value of $3,448,959. Distilled and malt liquors were produced in 135 distilleries and breweries, with the aid of 723 men, to the amount of $3,353,556. Iron in the various forms of manufacture was produced in 122 establishments, employing 2461 hands, to the amount of $7,447,447; the present amount exceeds $12,000,000. Packed meats (beef and pork) were produced in 12 establishments, employing 467 men, to the value of $2,825,021; boots and shoes, in 988 shops, employing 2702 hands, produced goods to the value of $2,699,114. Clothing for men and women was produced in 267 establishments, employing 1649 hands, to the value of $2,329,787. Agricultural implements were produced in 124 establishments, employing 1268 hands, to the amount of $2,128,794. Cooperage was carried on in 357 shops, employing 1868 hands, to the amount of $1,921,878. Saddlery and harness, in 436 establishments, employing 1833 hands, to the amount of $1,654,341. Tin, copper, and sheet-iron ware, in 322 establishments, to the value of $1,293,206. Printing and publishing, in 69 establishments, to the amount of $1,408,142. Blacksmithing, in 1332 establishments, employing 2652 men and boys, to the amount of $1,916,637.

Railroads and Canals.—Indiana is interlaced with a complete network of railroads, traversing nearly every county. According to Poor's *Railroad Manual* for 1874–75, at the beginning of 1874 there were 22 railroads partially or wholly within the State, showing the total length of railway track to be 3837.65 miles. In Jan., 1875, the number of miles of railroad in the State had increased to 4,378.05 miles, though the cost of roads and equipment was represented by about the same figures as the year before. There are two canals in the State. The Wabash and Erie, from Evansville to Toledo, a part of the way by slack-water navigation of the Wabash and Maumee, is 467 miles in length, 379 of which are in Indiana. It is now unused beyond Lafayette. The White Water Canal is 75 miles in length, from Lawrenceburg on the Ohio to Hagerstown. It is of more service than the other. The statistics of the completed railroads in the State at the beginning of the year 1874 are presented in the table on the next page.

Names of Railroads.	Length.		General Liabilities.				Cost of railroad equipment, etc.	Train mileage.	Traffic.		Gross Earnings.				Earnings, less operating expenses.
	Main and branch.	All other tracks.	Capital stock.	Funded debt.	Floating debt.	Total stock, bonds, and debt.			Passengers carried.	Freight moved.	From passengers.	From freight.	All other.	Total am't gross earnings.	
	Miles.	Miles.	$	$	$	$	$	Miles.	No.	Tons.	$	$	$	$	$
Chicago Cincinnati and Louisville	86.00	3.70	1,500,000	1,000.000	....	2,500,000	2,656,000	....	....	....	40,000	60,000	....	*100,000	*40,000
Cincinnati Lafayette and Chicago	56.40	....	1,929,200	1,120,000	212,373	3,261,573	3,285,233	198,992	....	....	104,197	263.502	13,526	381,225	193,309
Cincinnati and Martinsville	39.00	1.00	400,000	400,000	....	800,000	800,000	....	....	....	40,000	60,000	....	*100,000	*40,000
Cincinnati Richmond and Fort Wayne	91.50	4.50	2,000,000	1,800,000	....	3,800,000	3,800,000	....	....	....	70,000	125,000	5,000	200,000	70,000
Cincinnati Wabash and Michigan	81.00	3.00	2,250,000	1,200,000	....	3,450,000	3,450.000	117,358	....	....	40,000	60,000	....	*100,000	*40,000
Columbus Chicago and Indiana Central	587.00	78.20	13,328,569	23,555,174	694,358	37,578,101	37,578,101	4,817,721	616,627	1,473,623	995,798	3,298,011	183,998	4,477,807	233,183
Evansville and Crawfordsville	132.00	10.00	1,144,415	1,085,000	20,308	2,249,723	2,989,643	362,337	131,036	220,000	180,372	332,987	49,404	562,763	221,713
Evansville Terre Haute and Chicago	55.00	7.25	399,573	775,000	239,422	1,413,995	1,281,010	....	....	....	50,000	190,000	10,000	*250,000	*100,000
Fort Wayne Muncie and Cincinnati	109.00	....	1,000,000	....	....	1,000,000	2,000,000	888,824	88,442	116,594	79,067	164,087	13,954	257,108	81,097
Indiana and Illinois Central	85.00	4.00	2,000,000	1,079,000	740,000	3,819,090	3,794,525	....	....	....	55,000	95,000	....	*150,000	*50,000
Indianapolis Bloomington and Western	334.50	38.00	7,000,000	8,500,000	....	15,500,000	13,440,735	1,961,033	275,561	505,713	436,564	945.480	87,763	1,469,807	632,819
Indianapolis Cincinnati and Lafayette	158.50	20.00	5,587,150	8,088,000	1,224,000	14,899,150	15,763,150	1,350,358	420,358	594,860	635,376	1,161,477	94,598	1,891,451	415,548
Indianapolis Peru and Chicago	75.00	7.50	*5,635,000	....	....	*5,635,000	*5,635,000	....	....	....	200,000	605,000	....	*805,000	*200,000
Indianapolis and Vincennes	117.00	18.00	1,402,000	3,150,000	453,296	5,005,296	4,647,354	224,891	113,616	77,483	95,256	146,189	11,339	253,784	62,137
Jeffersonville Madison and Indianapolis	226.00	27.00	2,000,000	4,871,000	760,617	7,631,617	6,318,944	1,157,796	658,928	624,102	376,294	908,886	94,611	1,379,791	446.200
Logansport Crawfordsville and South-western	95.00	5.00	1,500,000	2,000,000	....	3,500,000	3,500,000	....	....	....	70,000	125,000	5,000	*200,000	*50,000
Louisville New Albany and Chicago	288.00	17.00	3,000,000	....	....	3,000,000	3,000,000	....	238,000	174,577	288,271	439,570	59,471	787,311	148,171
Louisville New Albany and St. Louis Air-Line	27.75	1.00	1,535,930	372,000	401,154	2,309,084	3,309,084	....	....	....	40,000	60,000	....	*100,000	*20,000
Ohio and Mississippi	395.00	39.00	24,030,000	10,559,090	719,753	35,308,843	35.308,843	3,644,714	477,062	927,258	1,009,598	2,589,361	155,378	3,754,337	1,174,658
Terre Haute and Indianapolis	109.30	32.20	1,988,150	1,316,000	250,160	3,554.310	3,081,378	860,344	226,745	821,388	272,845	803,199	31,214	1,107,258	282,183
Toledo Wabash and Western	627.30	109.10	16,000,000	19,800,000	....	35,800,000	35,368,855	4,157,640	627,799	1,442,963	1,050,198	4,335,226	353,383	5,738,808	1,439,376
White Water Valley	61.40	6.50	380,025	1,021,840	123,445	1,525,310	1,420,885	140,087	62,729	105,830	56,827	147,769	9,026	213,622	93,178
Total	3,837.65	432.95	96,010,012	91,692,104	5,838,886	193,541,002	192,429,240	....	....	....	6,185,663	16,915,744	1,177,655	24,279,062	6,036,572

* Estimated.

Finances.—The State debt of Indiana on Oct. 31, 1873, was $4,895,813.34. Of this, $994,030.12 was held abroad, but was payable on presentation, a sufficient balance being retained in the treasury to meet the bonds as fast as they are surrendered. The remainder of the debt, $3,904,783.22, is held by the State for the school fund, and is not negotiable, the State paying the interest on it annually to the schools. The receipts of the State treasury for the year ending Oct. 31, 1873, were, including the balance on hand at the close of the preceding year, $4,300,653.02. The balance from the previous year was $755,024.87. The disbursements of the year, which included the redemption of the unsurrendered bonds of 1836, the reimbursement of over $90,000 of illegal taxes, and the payment of a large portion of the expenses of the legislature of 1871, in addition to the ordinary expenses, amounted in all to $4,115,457.55. The assessed valuation of real and personal estate in 1870 was $663,455,044, of which $460,120,974 was of real estate and $203,334,070 of personal estate. The true valuation of that year, according to the estimates of the U. S. marshals, was $1,268,180,543.

Commerce.—Indiana has no foreign commerce except that transacted through the ports of Chicago, Ill., and Miami and Sandusky, O.; the amount of this is very considerable, but not easily separable from that of the adjacent States. The inter-State commerce of the State is very large. The gross earnings of its railroads from freights in 1873 were $16,915,744, which could hardly represent less than $1,600,000,000 of freight shipped and received, while to this is to be added its lake and river freights. The transportation of iron ores from Lake Superior and from Missouri to the newly-established blast furnaces of the block-coal region for smelting is a branch of commerce which has made great progress within the past three years, while the moving of its vast crop of cereals, its million or more of hogs for slaughter, and its immense droves of cattle, task even the large capacity of its numerous railways. The return freights of manufactured goods, imported and domestic, add largely to the mighty aggregate. There were in Nov., 1874, 104 national banks in the State, 6 of which were closing. These had an aggregate capital of $18,278,800; $16,575,300 of bonds on deposit, $21,333,075 circulation issued, and an actual circulation of $14,905,266. There were also 19 State banks, under special charters, having a capital of $2,080,000 (savings banks' amount of deposits not stated), and 96 private banking-houses, including 2 insurance companies which did also a banking business.

Insurance.—There were in July, 1873, 2 fire insurance companies in the State, both at Indianapolis, one of them mutual, the other with a capital of $250,000, and the two having assets amounting to $606,402. There was 1 life insurance company (mutual), also at Indianapolis, with assets to the amount of $303,159.

Education.—In 1870 there were, according to the census, 395,263 children and youth who attended school some portion of the year; of these, 391,524 were of native and 3739 of foreign birth; 207,996 were males (206,363 whites, 1620 colored, and 13 Indians), 187,267 females (185,777 white, 1469 colored, and 21 Indians). In the same year there were 76,634 persons, ten years of age and over, who could not read, and 127,124 who could not write. Of the latter number, 113,185 were natives of the State and 13,939 of foreign birth; 118,761 were whites, 8258 colored, 105 Indians; 5938 males between 10 and 15 years old, and 5134 females between the same ages; 7878 males were between 15 and 21 years, and 7752 females between the same ages; 36,543 males were over 21 years of age, and 60,839 females were over 21. There were in 1870, 9073 schools of all classes in the State, with 11,652 teachers (6678 males and 4974 females) and 464,477 pupils (237,664 males and 226,813 females). The total income of these schools for the year ending June 1, 1870, was $2,499,511, of which $50,620 was derived from endowment, $2,126,502 from taxation and the public funds, and $322,389 from other sources, including tuition. Of these schools, 8871 were public, or belonging to the common-school system of the State. These had 11,042 teachers (6402 males and 4640 females) and 446,076 pupils (228,189 males and 217,887 females). Their income was $2,063,599, of which $2,002,052 was from taxation and the public funds, and $61,547 from other sources, including tuition. There were 50 classical, professional, or technical schools (including colleges), having 325 instructors (184 males and 141 females) and 8337 students (4936 males and 3401 females). The total income of these schools was $366,511, of which $50,620 was from endowment, $118,250 from taxation or public funds, $197,641 from other sources, including tuition; and 152 other schools, with 285 teachers (92 males and 193 females) and 10,064 scholars (4539 males and 5525 females), with an income of $69,401, of which $6200 was derived from taxation or the public funds, and $63,201 from tuition. Of the public schools, there were 1 normal, with 6 teachers (3 male and 3 female) and 49 male and 54 female students; 69 high schools, with 229 teachers (106 male and 123 female) and 5228 male and 4845 female pupils; 371 grammar and graded common schools, with 171 male and 558 female teachers, and 17,578 male, 18,751 female scholars; and 8430 ungraded common schools, with 6122 male and 3956 female teachers, and 205,334 male and 194,237 female scholars. Of the schools not public, there were 6 universities (so named), with 66 male and 7 female professors or instructors, 1428 male and 239 female stu-

dents, and an income of $32,800 from endowment, $17,700 from the public funds, and $17,050 from tuition, etc. There were 13 colleges, with 115 male and 28 female instructors, 2431 male and 671 female students, and an income of $48,520 from endowment, $17,700 from the public funds, and $96,030 from tuition, etc. There were 16 academies, with 26 male and 99 female teachers, 1305 male and 2275 female pupils, and $73,990 income, of which $1000 was from endowment and $8050 from the public funds. There were 1 law school, with 2 professors and 51 students; 1 medical school, with 5 professors and 43 students; 2 theological schools, with 3 professors and 43 students. There were 7 commercial schools or colleges, with 15 instructors, and 782 male and 33 female pupils; 1 institute for the blind, with 3 male and 4 female teachers, and 43 male and 57 female pupils, which received from the State $32,500 annually; 1 institution for the deaf and dumb, with 8 male and 5 female teachers, 143 male and 129 female pupils, which received $60,000 from the State annually. There were also 4 schools of art and music, with 4 male and 5 female teachers, 34 male and 218 female pupils, and an income of $8720 from tuition. There was also 1 other technical school, with 3 teachers, 61 male and 18 female pupils, and an income of $1720, of which $1100 was from endowment. Of the other private schools of the State, 124 were day and boarding schools, with 58 male and 143 female teachers, and 2802 male and 3494 female pupils, and a revenue from tuition of $47,427; 28 were parochial and charity schools, with 34 male and 50 female teachers, 1737 male and 2031 female scholars, and a revenue of $6200 from the public funds and $15,774 from other sources. There was considerable progress made in the next two years following the census. The State has the largest school fund (though it is not quite all productive) of any State in the Union; it amounted in 1874 to $8,616,931. The amount of revenue for the public schools in 1872 was $1,717,443.34. The legal school age is from 6 to 21 years, and there were in the State 631,549 persons between these ages. The number enrolled in the schools was 459,451, and the average attendance 298,056. The total number of districts was 9100, and schools were taught in all but 70 of these. There were 145 graded schools; the average length of the schools in days was 116 days, or 23 school weeks and 1 day. The whole number of teachers in 1872 was 12,248 (7430 males and 4818 females). The male primary-school teachers receive an average of $1.95 per day, the female primary-school teachers, $1.47 per day; male high-school teachers, $3.77 per day; female high-school teachers, $2.46 per day. The whole number of school-houses in 1872 was 9080; of these, 88 were of stone, 877 of brick, 7568 of frame, 547 of logs. The total valuation of school property for 1872 was $9,199,480.15. In the matter of higher education there are 19 colleges and universities, so called, and 3 collegiate institutions exclusively for the instruction of women. The State university is a university in the sense of having professional and scientific schools connected with it; and, though they have not all the professional schools attached to each, yet as having some schools of post-graduate instruction, Wabash College, Hanover College, the University of Notre Dame, the North-western Christian University, and Howard College may be reckoned as universities. Hartsville University has a Lutheran theological seminary connected with it, but Indiana Asbury University has no post-graduate schools.

Population.—The following table exhibits the population at each period, according to the census, since the organization of the Territory in the various relations of race, sex, and color:

Census years.	White.	Free colored.	Slaves.	Indians.	Total.	Males.	Females.	Natives.	Foreigners.
1800	5,343	163	135	.....	5,641	2,574	2,003		
1810	23,890	393	237	.....	24,520	12,570	11,320		
1815	....	....	.....	.....	60,074				
1820	145,758	1,230	190	.....	147,178	77,303	69,685		
1825	....	....	.....	.....	224,717				
1830	339,399	3,629	3	.....	343,031	177,742	165,286		
1835	....	....	.....	.....	485,053				
1840	678,698	7,165	3	.....	685,866	357,704	329,359		
1845	....	....	.....	.....	823,410				
1850	977,154	11,262	.....	.....	988,416	511,893	476,523	930,458	55,572
1854	....	....	.....	.....	1,143,905				
1860	1,338,710	11,428	.....	290	1,350,428	699,260	651,168	1,232,144	118,284
1866	....	....	.....	......	1,531,080				
1870	1,655,837	24,560	.....	240	1,680,637	857,994	822,643	1,539,163	141,474

Of the native population in 1870, 779,009 were males and 760,154 females; of the foreign population, 78,985 were males and 62,489 females; of the white population, 845,307 were males and 810,530 were females; of the colored race, 12,585 were males and 11,975 females. Of the 567,175 persons of school age (5 to 18 years) in the State in 1870, 287,357 were males and 279,818 females; of those of native birth, 282,424 were males and 274,986 females; of those of foreign birth, 4933 were males and 4832 females; of the white population of school age, 283,486 were males and 275,921 females. There were 3830 colored males and 3842 colored females of school age, 41 Indian male children and 55 female children. Of the military age (18 to 45), there were of all classes 319,658 males; of these 274,648 were natives, 45,010 of foreign birth, 314,329 whites, 5294 colored, and 35 Indians. Of the age of citizenship (21 years and upwards), there were 388,231 males, of whom 318,055 were natives, 70,176 foreigners, 382,070 whites, 6113 colored, 48 Indians, and 376,780 actual citizens. The density of the population to the square mile was in 1850, 29.24; in 1860, 39.94; in 1870, 49.71. The number of families in the State in 1850 was 171,564; the number of dwellings, 170,178; in 1860, the number of families was 248,664, and of dwellings, 256,946; in 1870, the number of families was 320,160, and of dwellings, 318,469. The number of persons to a family at these three periods was respectively 5.76, 5.43, and 5.25. The number of persons to a dwelling, 5.81, 5.26, and 5.28.

Misfortune, Pauperism, and Crime.—The State has a well-conducted hospital for the insane, though overcrowded with patients; on Nov. 1, 1873, it had 474 inmates, and its expenditures for the year were $155,470.33. In the two State prisons, at Michigan City and Jeffersonville, there were respectively 295 and 387 prisoners; these prisons are self-supporting. The house of refuge had 216 boys in charge; its expenditures for 1873 were $56,598.96, of which $34,900 was from the State treasury. There is also a reformatory institute for women and girls, and a home for soldiers' orphans, both supported by the State. The census reports but 3652 paupers, an estimate so far below the truth that it is of no value for statistical purposes. During the year ending June 1, 1870, 1374 persons were convicted in the criminal courts of the State, and 907 persons were confined in the county jails on the 1st of June of that year. Of these, 691 were native whites, 64 native colored, and 152 foreigners.

Libraries.—There were reported by the ninth census 2333 public libraries, containing 627,894 volumes, of which 1 was a State library, with 17,870 volumes; 52 town and city libraries, with 39,029 volumes; 92 court and law libraries, with 10,308 volumes; 1006 school and college libraries, with 323,391 volumes; 1075 Sabbath-school libraries, with 204,692 volumes; 87 church libraries, with 24,356 volumes; 20 circulating, with 8248 volumes; and 2968 private libraries, with 497,659 volumes.

Newspapers and Periodicals.—In 1870 the number of newspapers and periodicals of all classes in the State was 293, having an aggregate circulation of 363,542, and issuing annually 26,964,984 copies. Of these, 20 were dailies, with a circulation of 42,300; 3 tri-weeklies, circulation 2200; 1 semi-weekly, circulation 350; 233 weeklies, circulation 239,342; 6 semi-monthlies, circulation 9200; 28 monthlies, circulation 64,150; 2 bi-monthlies, circulation 6000. There were 6 advertising sheets, with 8700 circulation; 5 agricultural and horticultural, with a circulation of 11,500; 6 organs of benevolent or secret societies, with 7250 circulation; 4 commercial and financial, with 13,000 circulation; 16 illustrated literary or miscellaneous, with 27,350 circulation; 240, including all the dailies and most of the weeklies, political, with a circulation of 256,342; 9 religious, with 29,600 circulation; 7 technical or professional, with a circulation of 9800. There has been a considerable advance in the number of periodicals in the State since 1870, especially in the agricultural and miscellaneous class.

Churches.—There were in 1870, according to the census, 3698 churches of all denominations, with 3106 church edifices, 1,008,380 sittings, and $11,942,227 of church property. Of these, there were 552 regular Baptist churches, 476 church edifices, 135,575 sittings, and $1,047,625 of church property. In 1874, according to the *Baptist Year-Book* for 1875, there were 30 associations, 563 Baptist churches, 333 ordained ministers, and 39,352 members of

the churches; 393 Sunday schools, with 41,199 teachers and scholars; 23,843 volumes in Sunday-school libraries; and the amount expended for benevolent contributions and church purposes was $361,763. The census of 1870 reported 68 churches of minor Baptist denominations, 45 church edifices, 16,800 sittings, $89,700 of church property. Of the Christian Connection, which in the census includes also the Disciples, and probably to some extent the Christian Union churches, the report of 1870 gave 455 churches, 377 church edifices, 122,775 sittings, and $810,875 of church property. In 1870 the Congregationalists in Indiana were reported as having 18 churches, 12 church edifices, 4800 sittings, and $119,900 of church property. In 1874 they had 25 churches, 19 ordained ministers, and 1253 members. The Protestant Episcopal Church had in 1870, 49 parishes, 38 church edifices, 10,300 sittings, $492,500 of church property. The *Protestant Episcopal Almanac* for 1875 gives but 42 parishes, 39 ordained clergymen, 3210 communicants, 3814 Sunday-school teachers and scholars, and $117,503 of contributions for benevolent and church purposes. The Evangelical Association (Albright Methodists) had 47 churches, 40 church edifices, 10,925 sittings, and $124,600 of church property. In 1873 they had 85 ministers, 80 churches, 5909 members. The Society of Friends in 1870 had 81 meetings, 76 meeting-houses, 29,500 sittings, $263,800 of church property. The Jews had 5 societies, 4 synagogues, 1900 sittings, $113,000 of church property. The Lutherans in 1870 had 195 churches, 180 church edifices, 62,285 sittings, and $619,600 of church property. There has been a decided increase since that time, but owing to the formation of their synods it is impossible to give accurate statistics. Their membership is probably about 12,000. The Methodists of all classes had, according to the census in 1870, 1403 churches, 1121 church edifices, 346,125 sittings, and $3,291,427 of church property. In 1873 the Methodist Episcopal Church alone had 605 travelling preachers, 1361 church edifices, 100,434 members, $3,672,215 of church property. The Moravians in 1870 had 2 churches, 2 church edifices, 650 sittings, and $5000 of church property. The New Jerusalem Church (Swedenborgians) had 1 church, 1 church edifice, 100 sittings, $4000 of church property. The Presbyterians (Presbyterian General Assembly, North, and United Presbyterians) in 1870 had 333 churches, 315 church edifices, 116,560 sittings, and $2,006,550 of church property. In 1873 the Northern General Assembly had 2 synods, 8 presbyteries, 210 ordained ministers, 297 churches, and 24,644 members. The United Presbyterians had 9 presbyteries, 72 ministers, 98 churches, and 8547 communicants. There was also a considerable number of Reformed and Cumberland Presbyterian churches. Of the minor Presbyterian bodies, the census reports 42 churches, 42 church edifices, 12,400 sittings, $71,550 of church property. There were in 1870 two Reformed churches (late Dutch), 2 church edifices, 500 sittings, $8200 of church property; 34 Reformed (late German) churches, 33 church edifices, 8880 sittings, $97,300 of church property. In 1870 there were 204 Roman Catholic congregations, 201 church edifices, 86,830 sittings, $2,511,700 of church property. In 1874 there were 2 dioceses, 2 bishops, 183 priests, 243 churches and chapels, 94 congregations and stations, and an adherent population in the two dioceses of somewhat more than 130,000. There was in 1870, 1 Unitarian society in the State. The United Brethren in Christ (German Methodists) in 1870 had 184 churches, 121 church edifices, 33,975 sittings, $188,000 of church property. In 1874 they had 507 churches, 270 ministers, and 21,521 members. The Universalists in 1870 had 18 congregations, 15 church edifices, 6300 sittings, $73,400 of church property. Their present numbers are (1874) 46 congregations, 24 ministers, and 2334 members. There were also in 1870, 4 union organizations, with 5 church edifices, 1200 sittings, and $3500 of church property.

Constitution, Courts, Representatives in Congress, etc.—The present constitution of Indiana was adopted in 1851, but has undergone some amendment from time to time. Its general provisions are similar to those of most of the Western States. The governor, lieutenant-governor, secretary of state, treasurer, auditor, attorney-general, and superintendent of public instruction are chosen by the people at elections held on the 2d of October in each alternate year. The governor and lieutenant-governor hold office for four years; the other officers for two years only. The legislature, which consists of a senate of 50 members, chosen for four years, one-half being elected every second year, and a house of representatives of 98 members, elected biennially, meets regularly in January in the odd years, 1875, 1877, etc. By an amendment to the constitution ratified in 1873, the courts of common pleas were abolished, and the judiciary now consists of a supreme court of four judges, chosen by the people for seven years, and 38 circuit courts meeting in their several districts, the judges of which are elected for six years. There are no county courts. The divorce laws, which have been for many years a reproach to the State, were materially modified and remodelled by the legislature of 1873. Under the new apportionment of 1872, Indiana has 13 members of Congress.

Counties.—The State has 92 counties; the following table gives the names and population (male and female) and total of each in 1870, and the total population of each in 1860 and 1850:

Counties.	Male population, 1870.	Female population, 1870.	Total population, 1870.	Total population, 1860.	Total population, 1850.
Adams	5,711	5,671	11,382	9,252	5.797
Allen	22,474	21,020	43,494	29,328	16,919
Bartholomew	10,763	10.370	21.133	17,865	12,428
Benton	3,113	2,502	5,615	2,809	1,144
Blackford	3,245	3,027	6,272	4,122	2,860
Boone	11,540	11,053	22,593	16,753	11,631
Brown	4,412	4,269	8,681	6,507	4,846
Carroll	8,346	7,806	16,152	13,489	11,015
Cass	12,472	11.721	24,193	16,843	11,021
Clarke	12,734	12,036	24,770	20,502	15,828
Clay	9,908	9,176	19,084	12,161	7,944
Clinton	8,818	8,512	17,330	14,505	11,869
Crawford	4,978	4,873	9,851	8,226	6,524
Daviess	8,375	8,372	16,747	13,323	10,352
Dearborn	12,162	11,954	24,116	24,406	20,166
Decatur	9,698	9,355	19,053	17,294	15,107
De Kalb	8,805	8,362	17,167	13,880	8,251
Delaware	9,763	9,267	19,030	15,753	10,843
Dubois	6,390	6,207	12,597	10,394	6,321
Elkhart	13,318	12,708	26,026	20,986	12,690
Fayette	5,258	5,218	10,476	10,225	10,217
Floyd	11,439	11,861	23,300	20.183	14,875
Fountain	8,535	7,854	16,389	15,566	13,253
Franklin	10,183	10,040	20,223	19,549	17,968
Fulton	6,606	6,120	12,726	9,422	5,982
Gibson	8,893	8,478	17,371	14,532	10,771
Grant	9,461	9,026	18,487	15,797	11,092
Greene	9,782	9,732	19,514	16,041	12,313
Hamilton	10,706	10,176	20,882	17,310	12,684
Hancock	7,740	7,383	15,123	12,802	9,698
Harrison	10,105	9,808	19,913	18,521	15,286
Hendricks	10,363	9,914	20,277	16,953	14,083
Henry	11,688	11,298	22,986	20,119	17,605
Howard	8,005	7,842	15,847	12,524	6,657
Huntington	9,702	9,334	19,036	14,867	7,850
Jackson	9,571	9,403	18,974	16,286	11,047
Jasper	3,226	3,128	6,354	4,291	3,540
Jay	7,626	7,374	15,000	11,399	7,047
Jefferson	15,063	14,678	29,741	25,036	23,916
Jennings	8,117	8,101	16,218	14,749	12,096
Johnson	9,357	9,009	18,366	14,854	12,101
Knox	11,039	10,523	21,562	16,056	11,084
Kosciusko	11,946	11,585	23.531	17,418	10,243
La Grange	7,219	6,929	14,148	11,366	8,387
Lake	6,439	5,900	12,339	9,145	3,991
Laporte	13,970	13,092	27,062	22,919	12,145
Lawrence	7,391	7,237	14,628	13.692	12,097
Madison	11,700	11,070	22,770	16,518	12,375
Marion	36,920	35,019	71,939	39,855	24,103
Marshall	10,420	9,791	20,211	12,722	5,348
Martin	5,696	5,407	11,103	8,975	5,941
Miami	10,750	10.302	21,052	16,851	11,304
Monroe	7,059	7.109	14,168	12,847	11,286
Montgomery	12,301	11,464	23,765	20,888	18,084
Morgan	8,925	8,603	17,528	16,110	14,576
Newton	3,109	2,720	5,829	2,360	
Noble	10,383	10,006	20,389	14,915	7,946
Ohio	2,944	2,893	5,837	5,462	5,308
Orange	6,851	6,646	13,497	12,076	10,809
Owen	8.147	7,990	16,137	14,376	12,106
Parke	9,407	8,759	18,166	15,538	14,968
Perry	7,490	7,311	14,801	11,847	7,268
Pike	7,070	6,709	13,779	10,078	7,720
Porter	7,199	6,743	13,942	10,313	5,234
Posey	9,886	9,299	19,185	16,167	12,549
Pulaski	3,943	3,858	7,801	5,711	2,095
Putnam	11,009	10,505	21,514	20,681	18,615
Randolph	11,618	11,244	22,862	18,997	14,725
Ripley	10,662	10,315	20,977	19,054	14,820
Rush	8,966	8,660	17,626	16,193	16,445
Scott	3,998	3,875	7,873	7,303	5,885
Shelby	11,250	10,642	21,892	19,569	15,502
Spencer	9,247	8,751	17,998	14,556	8,616
Starke	2,076	1,812	3,888	2,195	557
Steuben	6,593	6,261	12,854	10,374	6,104
St. Joseph	13,061	12.261	25,322	18,455	10,954
Sullivan	9,329	9,124	18,453	15,064	10,141
Switzerland	6,045	6,089	12.134	12,698	12,932
Tippecanoe	17,396	16,119	33,515	25,726	19,377
Tipton	6,117	5,836	11,953	8,170	3,532
Union	3,244	3,097	6,341	7,109	6,944
Vanderburgh	16,797	16,348	33,145	20,552	11,414
Vermilion	5,639	5,201	10,840	9,422	8,661
Vigo	17,008	16,541	33,549	22,517	15,289
Wabash	10,840	10,465	21,305	17,547	12,138
Warren	5,309	4,895	10,204	10,057	7,387
Warwick	9,098	8,555	17,653	13,261	8,811
Washington	9,355	9,140	18,495	17,909	17,040
Wayne	16,866	17,182	34,048	29,558	25,320
Wells	6,954	6,631	13,585	10,844	6,152
White	5.519	5,035	10,554	8,258	4,761
Whitley	7,343	7,056	14,499	10,730	5.190
Totals	857,994	822,643	1,680,637	1,350,428	988,416

Principal Towns.—Indianapolis, the capital, has somewhat more than 50,000 inhabitants; Evansville, Fort Wayne, Terre Haute, and New Albany range between 18,000 and 25,000 inhabitants; Lafayette, Madison, and Richmond, between 12,000 and 18,000; Logansport, Jeffersonville, South Bend, Laporte, and Vincennes, between 8000 and 12,000, while Michigan City, Aurora, Columbus, Crawfordsville, Elkhart, Goshen, Greencastle, Lawrenceburg, and Peru each contain from 4000 to 8000 inhabitants.

Electoral and Popular Vote at Presidential Elections.—Indiana was admitted to the Union as a State in 1816, and the same year participated for the first time in a presidential election:

Elect. year.	Candidates who received the electoral vote of the State.	Elect. vote.	Popular vote.	Candidates.	Popular vote.	Candidates.	Popular vote.
1816	James Monroe P......... D. D. Tompkins V.-P....	3	Not rec.	Rufus King P............. J. Marshall V.-P..........	Not rec.		
1820	James Monroe P.......... D. D. Tompkins V.-P...	3	Not rec.	John Quincy Adams P...	Not rec.		
1824	Andrew Jackson P...... J. C. Calhoun V.-P........	5	7,343	John Quincy Adams P.. N. Sanford V.-P..........	3,095	Henry Clay P................................	5,315
1828	Andrew Jackson P...... J. C. Calhoun V.-P........	5	22,237	John Quincy Adams P.. R. Rush V.-P...............	17,052		
1832	Andrew Jackson P...... M. Van Buren V.-P......	9	31,552	Henry Clay P............... J. Sergeant V.-P..........	15,472		
1836	W. H. Harrison P......... F. Granger V.-P...........	9	41,281	M. Van Buren P........... R. M. Johnson V.-P......	32,478		
1840	W. H. Harrison P......... John Tyler V.-P...........	9	65,302	M. Van Buren P........... R. M. Johnson V.-P......	51,701		
1844	James K. Polk P........... G. M. Dallas V.-P.........	12	70,131	Henry Clay P............... T. Frelinghuysen V.-P..	67,867	J. G. Birney P..............................	2,106
1848	Lewis Cass P.................. W. O. Butler V.-P.........	12	74,745	Zachary Taylor P......... M. Fillmore V.-P.........	69,907	M. Van Buren P.......................... C. F. Adams V.-P.........................	8,100
1852	Franklin Pierce P........ W. R. King V.-P...........	13	95,340	Winfield Scott P........... W. A. Graham V.-P......	80,901	John P. Hale P........................... G. W. Julian V.-P.........................	6,929
1856	James Buchanan P...... J. C. Breckenridge V.-P.	13	118,670	J. C. Fremont P............ W. L. Dayton V.-P........	94,375	M. Fillmore P.............................. A. J. Donelson V.-P......................	22,386
1860	Abraham Lincoln P...... H. Hamlin V.-P...........	13	139,040	S. A. Douglas P............ H. V. Johnson V.-P......	115,509	Breckenridge and Lane............... Bell and Everett..........................	12,295 5,306
1864	Abraham Lincoln P...... A. Johnson V.-P...........	13	150,422	G. B. McClellan P......... G. H. Pendleton V.-P...	130,233		
1868	U. S. Grant P............... S. Colfax V.-P..............	13	176,552	H. Seymour P.............. F. P. Blair V.-P...........	166,980		
1872	U. S. Grant P............... Henry Wilson V.-P......	15	186,147	Horace Greeley P......... B. Gratz Brown V.-P.....	163,632	Charles O'Conor P.........................	1,407

History.—Indiana was originally a part of the French possessions, and probably a Canadian French colony had established one or more trading-posts within its present boundaries before the close of the seventeenth century. In 1702 there was a fresh migration of considerable numbers, who settled at Vincennes, Corydon, and other points. They speedily made friends of the Indian tribes then inhabiting the country, and so far amalgamated with them as to adopt their habits and customs. Nothing was heard of them till the cession of the territory to the English in 1763, when by the treaty their territorial rights were confirmed. By the treaty of 1783 this, as well as the whole North-west Territory, was transferred to the U. S. In 1788 there was trouble with the Indians, and a local war ensued which caused great distress among the settlers at Vincennes. The Indians were attacked at the mouth of the Tippecanoe by Gen. Wilkinson in 1791, and through his judicious management and that of Gen. Wayne several victories were gained, the Indians were compelled to submit, and a dangerous confederation of the tribes was broken up. A time of greater peace and quietness followed, very little disturbed by the raids of hostile Indians. In 1795 the U. S. obtained several eligible tracts of land by the treaty of Greenville, and a considerable number of emigrants settled in the Territory. Ohio was erected into a separate Territory May 7, 1800, and all the country W. and N. of it organized as the new government of Indiana. The same year, according to the U. S. census, there were 4875 inhabitants in the present limits of the State. Michigan Territory was set off from it in 1805, and Illinois Territory in 1809, leaving Indiana Territory with its present boundaries. In 1810, notwithstanding some Indian troubles in the five or six years preceding, the population had increased to 24,520. In 1811 the Shawnees, one of the largest tribes of Indians in the Territory, were excited to a complete frenzy by the eloquence of their prophet and leader, Tecumseh, and commenced a series of raids and outrages against the settlers. The governor of the Territory, William Henry Harrison (afterwards President of the U. S.), assembled a force of regulars and militia at Vincennes, and on Nov. 6, 1811, marched to Tippecanoe on the Wabash, the prophet's town, and demanded the restoration of the property which the Indians had taken from the settlers. After a parley the Indians proposed a delay till the next morning, and gave intimations of their readiness to enter into an amicable arrangement. During the night, however, they made a sudden and violent attack on the forces under Gov. Harrison, but, to their surprise, found them watchful and prepared. A short but sanguinary battle ensued; the Indians, under the shouts and encouragements of their prophet leader, fought with the utmost desperation; but they could not resist the steady and resolute advance of the white troops, and after a terrible slaughter they fled, sullen, but thoroughly defeated; and soon after, their town having been burned and the surrounding country laid waste by the victorious troops, the Shawnees sued for peace. The war with Great Britain, which soon followed, gave a fresh impulse to Indian hostilities, but the tribes were again thoroughly humbled and subdued, and after the peace of 1815 never molested the Indiana settlers again. In Dec., 1815, the subject of admission into the Union as a State began to be agitated throughout the Territory; in Apr., 1816, an enabling act was passed by Congress; a convention was called, and the first constitution of Indiana adopted June 29, and on Dec. 11, 1816, Indiana was admitted into the Union. Her growth from this time onward was very rapid, the census of 1820 showing an increase of 500.2 per cent. during the preceding decade. The completion of the Erie Canal and the building of the National Road stimulated immigration into the fertile and beautiful State, and more than 3,500,000 acres of government lands were purchased within the State in the ten years ending with 1830, and the population had increased 133.1 per cent. Then commenced an era of wild speculation. Eight railroad companies were incorporated, the Wabash and Erie Canal was begun and driven forward with great rapidity, a State bank with thirteen branches organized, and numerous other great enterprises fostered by the State and its banks. When the crash came in 1837 there was general bankruptcy and a State debt of $14,057,000, the interest of which was not paid wholly or in part till 1846. Yet in 1840 it was found that the population of the State had doubled, and that immigrants to the State had taken up 9,122,688 acres of government lands. In 1846 arrangements were made for the resumption of interest on the State debt, and prosperity began to return. In 1850 the increase of population during the previous decade was found to be 44.1 per cent. In 1851 a new constitution was adopted, and in 1853 a free-banking law passed. The decade from 1850 to 1860 was marked by the completion of its great canal from the lakes to the Ohio, as well as by the execution of other important public works, and by the great increase of its railroad facilities, from 228 miles in 1850 to 2163 miles in 1860. The financial panic of 1857 made havoc of the free banks of the State, but produced far less disaster than that of 1837. In the late civil war Indiana sent her full quota to the field, and though there was some trouble at first through the machinations of those opposed to the war, which necessitated the assumption of unusual war-powers by the governor, the general record of the State for patriotism and efficient service was in the highest degree honorable to it. In two or three instances its legislature, under the influence of unwise and partisan leaders, has attempted something in the nature of a *coup d'état*, but the result of these efforts has so soon returned to plague and injure their contrivers that it is hardly possible that they will ever again be attempted. Like some of its sister States, Indiana has been agitated of late on the question

of cheap transportation of produce, but it has not developed in that State so decided an antagonism between the railroad companies and the farmers as in some of the other States, mainly perhaps because her facilities for transportation are less dependent upon the railroads than some, and in part, also, because that her railroad companies have been less hostile to the producing classes from whom they derive their support. The National Congress of Agriculture which met at Indianapolis in May, 1873, discussed this question very thoroughly and in an excellent spirit.

Governors.—

	Term.		Term.
TERRITORY.		David Wallace	1837–40
William H. Harrison	1800–11	Samuel Bigger	1840–43
John Gibson (acting)	1811–13	James Whitcomb	1843–48
Thomas Posey	1813–16	Paris C. Dunning	1848–49
STATE.		Joseph A. Wright	1849–57
Jonathan Jennings	1816–22	Ashbel P. Willard	1857–61
William Hendricks	1822–25	Oliver P. Morton	1861–67
James B. Ray	1825–31	Conrad Baker	1867–73
Noah Noble	1831–37	Thomas A. Hendricks	1873–

L. P. BROCKETT.

Indiana, county of S. W. Central Pennsylvania. Area, 770 square miles. It is hilly, but for the most part quite fertile. Cattle, grain, and wool are staple products. Bituminous coal, iron ore, and salt-springs are found. Metallic wares, wagons, leather, lumber, furniture, castings, and farm implements are leading articles of manufacture. Its southern part is traversed by the Pennsylvania R. R. Cap. Indiana. Pop. 36,138.

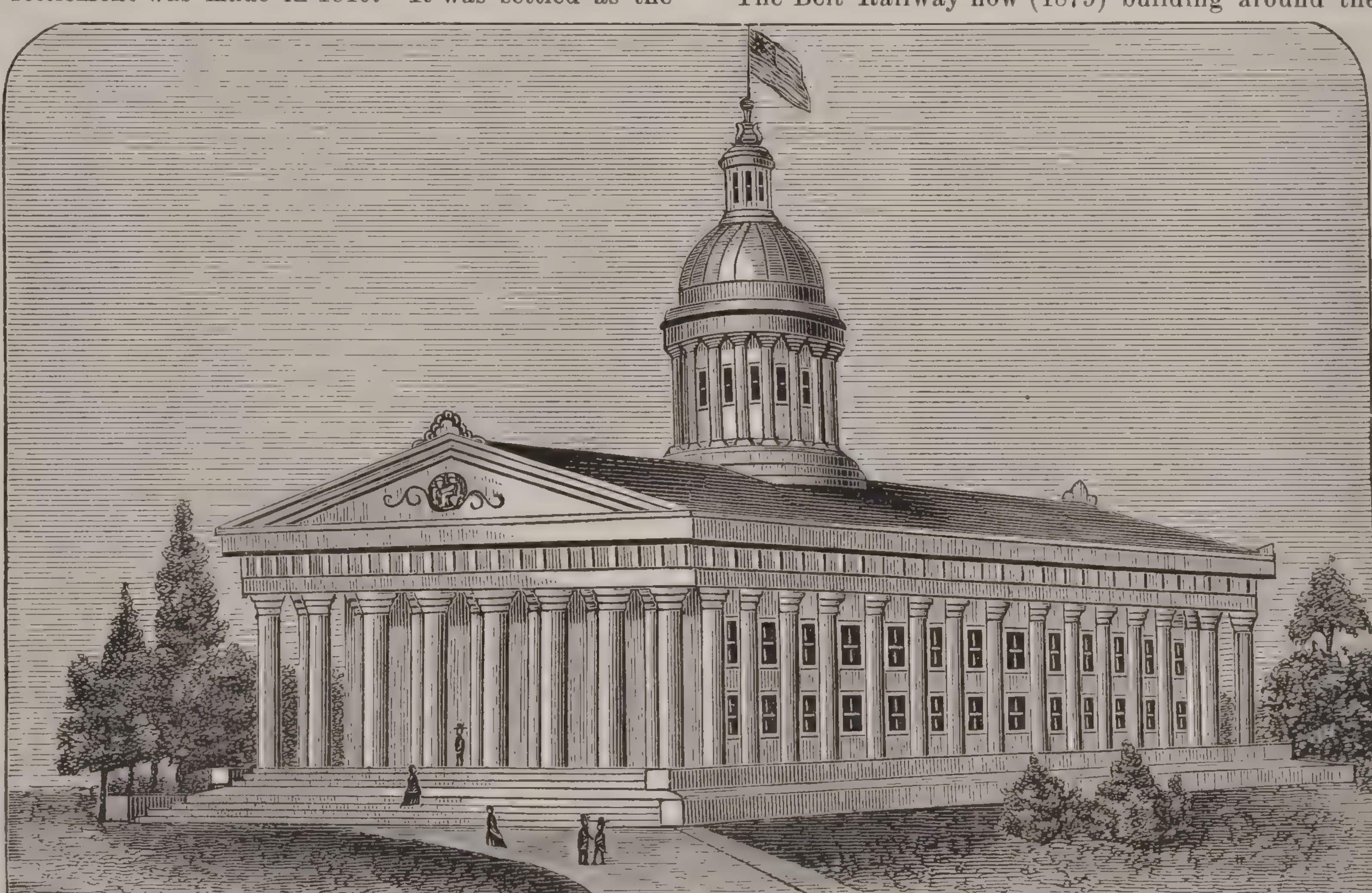
Indiana, tp. of Marion co., Ia. Pop. 1332.

Indiana, tp. of Allegheny co., Pa. Pop. 2806.

Indiana, post-b., cap. of Indiana co., Pa., 72 miles N. E. of Pittsburg, at the terminus of the Indiana branch of the Pennsylvania R. R., has 2 banks, 3 planing-mills, 2 foundries, 1 machine-shop, a fine court-house, 3 newspapers, a national bank, several churches, and a large trade in lumber and agricultural products. It is the seat of a State normal school erected at a cost of $125,000. Pop. 1605. S. A. SMITH, ED. "MESSENGER."

Indianap'olis, city, capital of Indiana, and seat of justice of Marion co., is situated near the geographical centre of the State, mostly on a plain, on the E. bank of White River, in 39° 55′ N. lat. and 86° 05′ W. lon. Its first settlement was made in 1819. It was settled as the seat of government in 1820, laid out in 1821, and occupied as the capital in 1824. Its streets, lined with forest trees, are from 60 to 100 feet wide, crossing each other at right angles, except four broad diagonal avenues, which converge towards a circular park in the centre. Numerous railways have opened communication with every portion of the State and the great commercial cities. Its first railroad, the Madison, was built in 1847. The population then was about 4000. It now has 13 railroads in operation, and one in process of construction, with their numerous branches and connections giving direct access to all but 8 of the 92 counties of the State. These roads centre in the Union dépôt, where 82 passenger-trains and 328 passenger-cars enter and leave daily, with an average of 10,000 persons daily, and 3,000,000 yearly. The number of freight-cars for the last eight months of 1874 was 476,000, making for the year more than 700,000. These railroads traverse localities unsurpassed in agriculture and mineral resources, thus furnishing facilities for supplying the raw material to the manufacturers and for distributing the products of the city. Situated near the centre of the great corn-belt, it is the natural grain-market for a vast area. There are two large grain-elevators and ten flouring-mills. There are 8 pork-packing houses, and 1 for packing beef. The total hog-product for 1874 was valued at $8,500,000. Indianapolis possesses peculiar advantages for manufactures of iron and wood. Immense forests of timber, beds of coal, and mines of iron ore abound in the State. Five railroads in three hours' run reach coal-fields of nearly 8000 square miles. Excellent for fuel, the block coal is unrivalled for working iron and steel. Its manufacturing interests are specially represented by 2 rolling-mills, malleable-iron works, car-works, saw-factories, 18 or 20 foundries, machine-shops, and shops for various branches of iron and brass work, numerous saw and planing mills, and sash, door, and blind factories, manufactories for agricultural implements, carriages, sewing-machines, household furniture, school furniture, church and parlor organs, pianos, boots and shoes, cotton and woollen goods, glass, starch, glue, "Sarven wheels," step-ladders, and wooden ware, and many others. There are 30 incorporated manufacturing institutions. The entire manufacturing capital invested is not less than $12,000,000. The number of buildings erected in 1874 was 2900, in value nearly $8,000,000.

The Belt Railway now (1875) building around the city



State Capitol, Indianapolis.

will more completely connect the various lines of railroad and aid the transfer of freight, location of workshops, warehouses, stockyards, etc. The Central Canal, cutting a bend of White River, furnishes partial water-power for flouring-mills and factories. The fire department has 7 steam fire-engines, with 100 men, and an electric alarm telegraph. Water is furnished by the Holly system, having 45 miles of pipe. The street railway has 18 miles of track, 50 cars and 150 men. There are 6 national, 10 private, and 2 savings banks, with a united capital of about $5,000,000. A manufacturers' and real estate exchange, meeting weekly; a board of trade, meeting daily, exchanging products and securing market reports from the great marts of trade; 7 home insurance companies; 118 American and foreign companies represented here; numerous lodges of Masons and Odd Fellows and orders of secret and benevolent societies; a city hospital; free dispensary; board of health; national surgical institute; home for friendless women; 3 homes for orphans; sisters of Providence; Bible society; Y. M. C. A., etc. Here are State institutions for the deaf and dumb, the blind, and insane, and the women's prison and reformatory institute. There are 5 English and 2 German daily newspapers, 12 English and 5 German weeklies, and 12 monthly publications; 17 job printing and publish-

ing establishments; 6 libraries (the city library has 17,000 vols.); a reading-room, with the leading American and European periodicals. This and the library are supported by a State tax. They are open daily, and free to all. There are a university, law school, 2 medical colleges, a Catholic theological seminary, 5 German and several select and private schools. The free-school system is maintained by local and State taxation and by its share of the State school fund of $8,000,000, which is larger, by more than $2,000,000, than that of any other State; a city high school, training school, and 20 district schools. The number of school children enumerated is over 20,000; value of city school property, $700,000; assessed value of taxables, $72,000,000; rate of city tax 1874, $1.10 on $100, State and county tax, 71 cents on $100. There are 70 churches—12 Presbyterian, 18 Methodist, 7 Baptist, 5 Episcopal, 5 Christian, 5 Lutheran, 4 Catholic, 2 Congregational, 2 Hebrew; all others, 10. Crown Hill Cemetery, 2 miles N. W. of the city, opened in 1864, encloses 330 acres. Among the public buildings is the State-house, built in 1835, of brick, in the Grecian style, containing the legislative chamber, State library, State agricultural society and geological cabinet. It being in a decaying condition, measures have been taken to replace it. The State building, of brick, contains rooms for the State and supreme court officers. The State benevolent institutions are located in or near the city, and are monuments of the munificence of the State. The U. S. court-house and post-office is of iron and dressed stone, costing $200,000; on an elevation just E. of the city are the U. S. arsenal buildings, four in number, in an enclosure of 76 acres, commanding and beautiful. The county court-house surpasses any building here in dimensions and tasteful design, of dressed stone and iron, 275 by 130 feet, three stories with central tower of 200 feet, high basement, and mansard roof in the Renaissance style of architecture. The immense Exposition building, built in 1873 by the State agricultural society, is of brick, 308 by 150 feet, two stories high, with elevated galleries. It is N. of the city, in the State fair-grounds, and cost $150,000. The Union dépôt, of brick, stone and iron, although 420 by 200 feet, is too small for the local trains. The chamber of commerce building, substantial and imposing, erected last year, cost $75,000. Among other structures worthy of note are the Odd Fellows' Hall and the Masonic Hall, the Academy of Music, many of its churches and massive business-blocks, not a few of which are models of construction and finish. The health record of Indianapolis will compare favorably with that of any city East or West. Population in 1850, 8091; in 1860, 18,000; in 1870, 48,244. CHARLES N. TODD.

Indian Archipelago. See EASTERN ARCHIPELAGO.

Indian Architecture. See ARCHITECTURE OF THE AMERICAN ABORIGINES, by HON. L. H. MORGAN, LL.D.

Indian Bean. See CATALPA.

Indian Corn, or **Maize** [*Zea mays*, Linn.], the most abundant of the cereals, and most important grain raised by American farmers, belongs to the tribe Phalaridæ of the natural order Gramineæ or grasses. It is indigenous to America, where it has always formed the chief food of the Indian races, from which the name is derived. Its cultivation was introduced from America to Southern Europe and Asia and to Northern Africa, where it spread with great rapidity. It is alleged that this grain was known in very ancient times to the Chinese, but if so it fell into complete oblivion. Indian corn is properly a sub-tropical grain, a native probably of the table-lands of Mexico or Peru, the great height of which gives them a distinct character from the lowlands in the same latitude. It thrives best under a hot summer sun, and its rapid growth and ripening give it a peculiar value for high Northern latitudes, where the summer heat is as intense as the winter cold. In England the summer heat is not sufficiently intense to favor its production. The chemical ingredients of Indian corn are chiefly starch and oil; it yields abundance of phosphorus, and is a most nutritious and healthful diet. There are many varieties, presenting great differences and possessing very unequal value. The original type was probably the wild variety, having a separate husk to each grain; the lowest variant types appear to be the small rice-corn and pop-corn, and the highest is perhaps the "Improved King Philip." The lower types hybridize very readily; not so the higher, which appear to have nearly or quite reached the limit of perfectibility. New varieties are constantly appearing, and with proper care most valuable improvements might be introduced. As food for man there is a great difference in the varieties. Tuscarora corn contains no oil, rice-corn contains the most, pop-corn next, Canada corn ranks third, and brown corn fourth. It thus appears that the effect of careful cultivation is to augment the starchy at the expense of the fatty contents. The late-ripening kind called sweet corn furnishes when green a savory article of food for several months (say from July 15 to Oct. 15), either boiled or roasted. Indian corn in the U. S. is emphatically the poor man's crop. Being hardy and easily cultivated, it is the first grain planted by the new settler amid stumps and fallen trees, by the aid of the hoe alone. The yield ranges from 10 bushels to the acre, which is the average on the worn lands of the Gulf States, to 200 bushels, the apparent maximum yield which in a few instances has been produced under very exceptional circumstances from small and carefully-tended patches in Kentucky and Tennessee. In the Central States the average yield is from 25 to 30 bushels per acre. The price has fluctuated from 5 or 10 cents per bushel, at which it was often sold in Kentucky and Ohio early in the present century, to $1 and more, at which it has been sold in the Eastern cities. The height of the full-grown corn varies, according to species and soil, from three to eighteen feet. The method of cultivation formerly in universal use was planting in rows of hills some five feet apart, but this has been replaced to a great extent of late years by the more advantageous system of sowing in drills, economizing manual labor by the use of improved ploughs and other implements. The yield and quality of the grain are much improved by careful selection of the best ears for seed, and by soaking the seed-corn in copperas or lime-water, which hastens the process of sprouting and protects the seed from certain insects. The average time of planting is May 20 to June 1. The total yield in the U. S. in 1870 was 760,944,549 bushels; the largest yield in a single State was that of Illinois, 129,921,395 bushels. (For further statistics see articles upon the several States.) PORTER C. BLISS.

Indian Creek, tp. of Bullock co., Ala. Pop. 1162.

Indian Creek, a v. and tp. of Trinity co., Cal. Pop. of v. 183; of tp. 783.

Indian Creek, tp. of Cass co., Ill. Pop. 433.

Indian Creek, tp. of White co., Ill. Pop. 2010.

Indian Creek, tp. of Lawrence co., Ind. Pop. 1348.

Indian Creek, tp. of Monroe co., Ind. Pop. 988.

Indian Creek, tp. of Pulaski co., Ind. Pop. 812.

Indian Creek, tp. of Mills co., Ia. Pop. 690.

Indian Creek, tp. of Story co., Ia. Pop. 1074.

Indian Creek, post-tp. of Monroe co., Mo. Pop. 654.

Indian Creek, tp. of Pike co., Mo. Pop. 1103.

Indian Cress. See TROPÆOLACEÆ.

Indian Cucumber. See MEDEOLA.

Indian Dye. See PUCCOON.

Indian Fields, tp. of Tuscola co., Mich. Pop. 825.

Indian Fig. See CACTACEÆ.

Indian Grove, tp. of Livingston co., Ill. Pop. 2635.

Indian Hemp. See CANNABIS, HASHISH, APOCYNACEÆ.

Indian Hill, tp. of Abbeville co., S. C. Pop. 1920.

Indian Lake, post-tp. of Hamilton co., N. Y., in the Adirondac region. The tp. includes many lakes (among them Indian and the Eckford lakes). Pop. 202.

Indian Land, tp. of Lancaster co., S. C. Pop. 969.

Indian Languages of America. In a general view of the languages of the Western World their number and variety are at first more remarkable than is that approach to uniformity in plan of thought and verbal structure which establishes something like a family likeness among them all. No accurate enumeration of these languages has been or can be made. Kircher in 1675, on such information as he could gather from Jesuit missionaries, estimated the number at about 500. Garcia cited authority for reckoning more than 5000. Herrera had been told that every village in Mexico had a language of its own, and Hervas adopted a statement that the number of South American languages and dialects was between 1500 and 2000. One estimate is as good as another, since none can be based on sufficient data. Somewhat nearer approximation may be had to the number of *stocks* or families of speech in North America. In 1848, Mr. Gallatin enumerated thirty-two distinct families in and N. of the U. S., not including the languages of California, which were not then—and are not even yet—sufficiently well known to justify their arrangement by families. The acquisition of New Mexico by the U. S. made a considerable addition to Mr. Gallatin's list. His classification, so far as it goes, has been generally accepted by philologists, subsequent investigations having confirmed most of his conclusions, or at least having failed (with perhaps two exceptions) to establish affinity between the linguistic groups he separated.

At least four-fifths of North America E. of the Rocky Mountains and N. of Mexico was occupied by nations and

wandering tribes speaking dialects of not more than *four* radically distinct languages—namely, the ESKIMO, ATHABASCAN, ALGONKIN, and Sioux or DAKOTA. The ESKIMO was spoken, in various dialects, near the shores of the Northern Ocean, from the E. coast of Greenland to Behring's Straits, a distance of not less than 5400 miles, and it extended southward on the Atlantic to the Straits of Bellisle and the Gulf of St. Lawrence. S. of the Eskimos the territory between Hudson's Bay and the Rocky Mountains, and stretching westward, between 50° and 60° N. lat., nearly to the Pacific, was occupied by the ATHABASCAN family in numerous tribes, among which may be named the Chepewyans (see NORTHERN INDIANS), and the nearly-related "Dog Ribs," the Slave and the Beaver Indians, the Takullies, and probably the Loucheux. E. of the Rocky Mountains the most southerly of known Athabascan tribes is that of the Sussees, near the head-waters of the Saskatchewan River, about 51° N. lat.; but W. of the mountains offsets from this stock have been traced as far S. as Mexico. Small tribes and bands of Athabascans were found near the Pacific in Southern Oregon and Northern California, and Prof. W. W. Turner showed that the Apache nation of Arizona and New Mexico, including the Navajos, Pinaleños, and Jicarillas, belong to the same great family of speech. (See Dr. J. C. E. Buschmann's *Der Athapaskische Sprachstamm dargestellt,* Berlin, 1855, and his *Das Apache, mit einer system. Worttafel d. Athap. Sprachstamms,* 1860–63.) E. of the Mississippi, and of a line drawn north-westerly from the head-waters of that river to those of the Missinipi (Churchill's) River, was the vast territory of the Algonkins, within the bounds of which, however, was comprehended that of two groups of IROQUOIS tribes, speaking a radically different language. When North America became known to Europeans the Algonkin country was bounded on the N. by the Athabascan, Hudson's Bay, and the Labrador Eskimos; E. by the Gulf of St. Lawrence and the Atlantic as far S. at least as Cape Hatteras; S. by an irregular line running westwardly from that cape to the confluence of the Ohio and Mississippi or its vicinity. One Algonkin tribe, the *Satsikaa* or *Blackfoot,* is found far W., between the head-waters of the Saskatchewan and the Missouri, at the foot of the Rocky Mountains, and another, the *Cheyenne* or *Shyenne,* roamed till lately the country that borders the North and South Platte rivers, to which region they seem to have strayed from the far N. "The most widely diffused and the most fertile in dialects" of all North American languages, the Algonkin, was (in the words of Mr. Bancroft) "the mother-tongue of those who greeted the colonists of Raleigh at Roanoke and of those who welcomed the Pilgrims to Plymouth. It was heard from the Bay of Gaspé to the valley of the Des Moines; from Cape Fear, and it may be from the Savannah, to the land of the Eskimos; from the Cumberland River of Kentucky to the southern bank of the Missinipi. It was spoken, though not exclusively, in a territory that extended through sixty degrees of longitude and more than twenty degrees of latitude." In some of its numerous dialects the polysynthetic type or plan of structure seems to have attained its highest expression and the grammatical apparatus its nicest adjustment. Some of its characteristic features will be noticed hereafter. The fourth great North American family, the DAKOTA, or *Sioux* (the latter being an abbreviation of *Naudewessioux,* itself a French corruption of the name given to the Dakotas by their rivals and enemies, the Algonkins), claimed most of the region between the Mississippi and the Rocky Mountains, from the Saskatchewan on the N. to Arkansas River at the S. A detached tribe, the *Winnebagoes,* were found (with a tradition of a removal from the W.) near Green Bay and Lake Michigan. Another Sioux tribe, the *Assiniboins,* wandered N. along the upper Missouri and the Assiniboin rivers to the W. side of Lake Winnipeg and the Saskatchewan, and became allies of the Algonkins. Next to the Algonkin language, that of the Dakotas, perhaps, has been most thoroughly investigated, and the labors of missionaries of the American Board of Foreign Missions, liberally seconded by the Smithsonian Institution in the publication of a grammar and copious dictionary (edited by the Rev. S. R. Riggs), have brought this language prominently to the notice of American and European philologists. (See DAKOTA INDIANS.) To the tribes named in that article as speaking languages of the Dakota stock may be added the Omahas, Ponkas, Ioways, Otos, Mandans, and Minitaris or Hidatsa. The *Pawnees* and *Comanches* were included by mistake. An *Ioway Grammar,* by Rev. W. Hamilton and S. M. Irwin, was printed in 1848, and a *Grammar and Dictionary of the Hidatsa Language* by Dr. W. Matthews in 1873 (J. G. Shea, New York).

Next after these four principal families, those of the IROQUOIS, the CHAHTA-MUSKOKI, and the CHEROKEE (if the last two may not ultimately be reduced to one) were the most considerable. The Iroquois-speaking tribes were, as has been stated, nearly enclosed within the territory of the Algonkins. Their northern group comprised the "Five Nations" living S. of Lakes Erie and Ontario and of the river St. Lawrence, and W. of the Hudson and Lake Champlain, and, farther N., the Hurons or Wyandots, the Attiwandarons ("Neutral Nation"), the Eries, and the Andastes. The southern Iroquois, separated from their congeners by intervening Algonkin tribes, were the Nottoways, and perhaps the Meherrins or Tuteloes, of Southern Virginia and North Carolina, and S. of these the Tuscaroras, who removed northward early in the eighteenth century and joined the confederated Five (thereafter known as the Six) Nations. (See IROQUOIS, and L. H. Morgan's *League of the Iroquois.*) Recent investigations by Mr. Horatio Hale have thrown doubts on the hitherto accepted affinity of the Tuteloes and Iroquois, if they have not fully established the connection of the former with the Dakota stock. Mr. Hale regards the Tutelo as a Dakota dialect, and inclines to the belief that formerly "the whole of what is now the central portion of the U. S., from the Mississippi nearly to the Atlantic, was occupied by Dakota tribes, who have been cut up and gradually exterminated by the intrusive and more energetic Algonkins and Iroquois." (See *Proceedings of Am. Philological Society,* 1871, p. 15. For a general view of the Iroquois language, see Gallatin's *Synopsis of the Indian Tribes,* pp. 232–238, and *Etudes philologiques sur quelques Langues Sauvages,* par N. O., Montreal, 1866.) The CHAHTA-MUSKOKI family, comprising the Choctaws and Chicasas, Muskokis or Creeks, Seminoles, Coassattis, Alabamas, and Hitchitis, occupied the territory now constituting the States of Georgia, Alabama, Mississippi, and Florida, with a portion of Louisiana E. of the Mississippi, except the shore of the Gulf from Mobile westward and the banks of the Mississippi, inhabited by various small tribes, and a tract in Northern Alabama, on both sides of the Tennessee River, which belonged to the Cherokees. The Choctaws and Chicasas speak nearly related dialects of the same language, to which probably the Hitchiti also belongs. The Creeks, Seminoles, and small tribes of Coassattis and Alabamas speak dialects of another language of the same stock. (For the Choctaw, see Byington's *Choctaw Grammar,* edited by Dr. D. G. Brinton, 1870, and his *English and Choctaw Definer,* 1852; Rev. A. Wright's vocabulary and grammatical notes, in Gallatin's *Synopsis.* Extensive vocabularies of the Muskoki, Coassatti, Alabama, Choctaw, and Hitchiti are preparing for publication by the Smithsonian Institution.) The *Cherokees* (*Tsalagi*) lived in villages along the Tennessee River and its tributaries, their country extending over the mountainous regions of East Tennessee and the northern portions of Georgia and Alabama. In the Cherokee language every syllable ends in a vowel or a nasal, and this peculiarity, with the absence (with rare exceptions) of double consonants, inclined Mr. Gallatin to adopt Barton's suggestion of the affinity of the Cherokee and Iroquois. At present, however, such affinity cannot be considered as established. The invention of a syllabic alphabet by George Guess (or Sequoyah), a half-breed Cherokee, in 1826, has promoted the general education of that nation, but for those to whom the language is not vernacular the necessity of learning eighty-five arbitrarily-chosen characters interposes an additional obstacle to its study. (See Mr. Pickering's *Remarks on the Indian Languages of America,* from the *Encyclopædia Americana,* vol. vi.; Rev. S. A. Worcester's *Remarks on the Principles of the Cherokee,* in Schoolcraft's *Indian Tribes,* ii., 443; H. C. von Gabelentz's *Grammatik d. Tscherokesischen Sprache.*)

The seven families which have been mentioned were spread over more than nine-tenths of the territory N. of Mexico, E. of the Rocky Mountains. Between these mountains and the Sierra Nevada the most important family is that of the SHOSHONE, occupying Utah, Nevada, the southern part of Idaho and Oregon, including the Kizh and Netela of Southern California and the Comanches of the prairies of New Mexico and Texas, with the *Shoshones* or Snake Indians, Wihinasht, and Bannacks in the valleys of Snake and Owyhee rivers, and the several divisions of the Ute (Utah) nation. Dr. J. C. E. Buschmann has endeavored, but as yet with questionable success, to establish the connection of this family with the *Sonora* stock of Northern Mexico. N. of the Shoshones, between 45° and 52° 30′ N. lat., are two considerable families, the SAHAPTIN and the SELISH (TSIHAILI-SELISH of Hale). The former includes, besides the Sahaptins proper (Nez Percés), the Walla-Wallas, Yakamas, Pelouse, and Kliketats, in Northern Oregon, the south-eastern portion of Washington, and the western border of Idaho. The TSIHAILI-SELISH are distributed by Mr. Hale in four groups, represented by (1) the Shushwaps or Atnahs of British Columbia, and the "Flatheads," or Selish proper, on the upper Columbia and its tributaries,

including the Pend d'Oreilles, Cœurs d'Alène, Spokanes, and Piskous; (2) the N'skwally, on Puget Sound; (3) the Tsihailish or Chihailish, between the N'skwally and the ocean, and the Kowelitsk or Cowlitz, S. of the N'skwally; and (4) the Killamuks (Tillamooks), along the coast of North-western Oregon. Of these, only the first group, the Selish and Shushwaps, are inland tribes, the other three divisions being included geographically with the Sound Indians. Little progress in classification of the languages of numerous small tribes of the Pacific coast has been made since the publication of Mr. Hale's vocabularies. (*U. S. Exploring Expedition*, vol. vii., "Ethnography and Philology.") For all that is known of their territorial divisions, past and present, see the first volume of Mr. H. H. Bancroft's *Native Races of the Pacific States*, 1874. Of the structure of the Sahaptin and Selish languages, Mr. Hale's grammatical notes to vocabularies give the best general account. See also M. C. Pandosy's *Grammar and Dictionary of the Yakama* (a Sahaptin dialect), and Mengarini's *Grammatica Linguæ Selicæ*, both printed in J. G. Shea's series of *American Linguistics*.

Of languages spoken near the southern border of the U. S., two or three have already been mentioned as belonging to the Athabascan and Shoshone stocks. The Caddoes (properly, Cado-hadacho), Adais, Chetimachas, and Attacapas, tribes or remnants of tribes W. of the Mississippi, on the Red River and between it and the Gulf, speak four languages, which Mr. Gallatin classes as radically distinct. To the Caddo belong the dialects of the Nandakoes, the Nabedaches, and the Inies or *Tachies*, who have given their name to the State of Texas. The YUMA language is spoken on both sides of the Colorado River, above and below the junction of the Gila. To it belong the dialects of the Coco-Maricopas, now living in a village on the N. bank of the Gila; the Cuchans, near the Colorado; the Mohaves, farther N.; the Hualapais, Yampais, in Arizona; and the Diegueños, near the Pacific in Southern California. The PIMA, with its dialects, spoken on the Gila and its southern affluents, is included by Buschmann in his SONORA family, of which the Tarahumara, Tepeguana, Cora, and Cahita of North-western Mexico constitute the first group; the Tubar, Hiaqui, Eudeve, and Opata of Sonora make the second; the Pima the third; and the Kizh, Comanche, Shoshone, etc. the fourth. (See Buschmann's *Die Spuren d. Aztekischen Sprache*, etc., Berlin, 1859, and his *Die Pima Sprache*, 1857. A grammar of the Pima or Nevome, translated by Buckingham Smith, has been printed in Shea's *American Linguistics*, vol. v.) The isolated languages of the *Pueblos* or Village Indians of New Mexico and Arizona, near the Rio Grande, and between it and the upper Colorado, present problems of special interest to ethnologists and philologists which still remain unsolved. In these scattered villages dialects are spoken of four or five distinct languages, between no two of which have genetic relations been established.

The picture-writings of the Aztecs, the incised symbols on the stones of Palenque, Copan, and Yucatan, with other evidences of a higher civilization than appears to have been attained by northern nations, impart peculiar interest to the languages of MEXICO and CENTRAL AMERICA. Since the publication in 1845 of Mr. Gallatin's *Notes on the Semi-civilized Nations of Mexico*, etc. (*Trans. Am. Ethnol. Soc.*, vol. i.), much has been done for the comparative philology of these tongues, particularly by Pimentel's *Cuadro descriptivo y comparativo de las lenguas de Mexico* (1862–65) and the *Geografia de las lenguas de Mexico* of Orozco y Berra (Mex., 1864). The most important family is that of which the Mexican proper, *Nahuatl* or *Aztec*, is the recognized type. This appears to have been spoken by the Nahuatlacs in the valley of Mexico, and in the adjacent country to the E. and S., and in numerous dialects it extended throughout the Mexican empire. Buschmann in his principal work, *Die Spuren d. Aztek. Sprache*, maintains the northern origin of the Toltecs and Nahuatlacs, and has collected the evidence of affinity of the Aztec with the languages of North-western Mexico, and of the latter with the languages of Sonora and Lower California. De Charencey, *Notice sur quelques familles de langues du Mexique* (1870), accepting Buschmann's classification, recognizes in the "Chichimecan family" two groups—the northern or "Oregon," comprising the Comanche, Kizh, Shoshone, Ute, etc.; the southern or "Mexican," including the Pima and other languages of Sonora, with the Cora and the Aztec. The OTOMI or *Hia-hui*, spoken by tribes N. and W. of the valley of Mexico, differs widely from other languages of this region, and its presumed monosyllabic character, together with certain peculiarities of structure, has led some writers to regard it as utterly discordant from the general type of American speech, and as probably of foreign origin. But the monosyllabic character is much less apparent in the *Mazahui*, a dialect of the Otomi, and disappears in the *Matlazinga* or *Pirinda* of Toluca, the affinity of which to the Otimi seems established by recent investigations. Other Mexican languages of undetermined affinities are represented by the Tarasca (of Michoacan), Tlapanec (Puebla), Totonaco (Puebla and Vera Cruz), Zapoteco and Mixteco (Oaxaca), Zoqui and Mixe (in parts of Oaxaca, Tabasco, and Chiapas). The Huaxteco or Huastec, which is spoken in the N. of Vera Cruz and in Puebla, has few coincidences with the Mexican or the Otomi, but is allied to the great Maya family. To the *Maya* stock belong the Quiché, Kakchiquel, Zutugil, Ixil, Chol (or Putum), Mame, and Pokonchi of Guatemala; Tzendal, Zotzil (Chamula), Chorti, and Lacandon of Chiapas; Chontal of Tabasco; with the Maya of Yucatan. The Abbé Brasseur de Bourbourg, an enthusiastic and indefatigable student of Central American antiquities and languages, published, besides a grammar and vocabulary of the Quiché (Paris, 1862), translations of the *Popol Vuh*, or sacred book, and of a Quiché drama, *Rabinal-Achi*. His discovery in 1863 of an ancient phonetic alphabet employed by the Mayas of Yucatan, preserved in manuscript by Bishop Landa, excited hopes that the pictured annals and sculptured stones of Central America must soon give up their secrets. The hope is not yet realized. The Abbé Brasseur's attempt at translation of a part of the Troano manuscript by means of Landa's alphabet was, as he subsequently admitted, unsuccessful. More ample materials for the study of the Maya language and its dialects may hereafter enable scholars to use the key which his discovery supplied. Dr. H. Berendt, who has given many years to the investigation of Central American languages, has compiled from ancient manuscripts a copious Maya dictionary, which it is hoped will soon be published. (For the literature of Central American languages, see E. G. Squier's *Monograph of Authors who have written on the Languages of Central America*, 1861.)

In SOUTH AMERICA the number and diversity of idioms are much greater than in the North. "Of no part of the world," says Latham, "is the comparative philology more uncertain and obscure." For a general classification, that of A. d'Orbigny (*L'Homme Américain*, Paris, 1839) has been accepted provisionally, though it is founded on the physical types of races which the author regards as distinct, and not primarily on language. Varying (with Dr. Prichard and other recent writers) the order of D'Orbigny's groups, the South American nations may be divided as follows: I. ANDO-PERUVIAN, from the Isthmus of Darien to Cape Horn, comprising (1) the *Peruvian*—Quichuas or Kechuas (whose language was spoken by all tribes subject to the Incas) and the near-related Aymaras; Atacamas or Olipes; and Changos; (2) the *Antisian* (of the Eastern Andes)—Yuracaros of Bolivia, Mocetenès, Tacanas, Maropas, Apolistas, and various isolated tribes of unknown affinities; (3) *South-Andian*—Araucans of Chili, Patagonians (Tehuelhet), and Fuegians (Yacana-cunny, Alikhoolips, Pecherays, etc.).—II. EASTERN NATIONS (Brasilio-Guaranian of D'Orbigny); (1) *Tupi-Guaranian*—including many tribes speaking languages distinct from the Guarani, and of unknown affinities; (2) *Caribbean*—comprising nations of the northern coast of South America, Guiana, and Venezuela, allied to the Caribs of the Antilles, Tamanacas, Chaymas, Guaraúnas, Cumanagotos, etc.; (3) nations and isolated tribes speaking languages which seem not to belong to the Tupi-Guarani or the Carib stock, but which, with few exceptions, have never been adequately investigated. Among these are the "Botocudos" (Aimorés, Guaymarés), Goyatacas, Puris, Guatos, Parecis, etc. (For the names and what little is known of the languages of these nations see Von Martius's important *Beiträge z. Ethnog. und Sprachenkunde Amerika's*, with a volume of vocabularies, 1867.)—III. MIDLAND nations, including (1) those on the Lower Paraguay and the great plain of *Chaco*—the Guaycurûs, Lengoas, Tobas, Abipones, Mbocobis, Mbayas, Guayanos or Gualaches, Guatós, Payaguas or Payaquoás, and others; and (2) the *Chiquitos* and the *Moxos*—between Potosi and the upper streams of the Parana—with whom D'Orbigny groups seventeen other tribes attached to the Chiquito and Moxo missions, speaking different languages.

Looking back to the vast field which has been only partially surveyed, the question presents itself: Is there any bond of union between these numerous families of languages radically distinct? any characteristic features common to them all which testify to the original unity of all, or at least distinguish them as a class from languages of the Eastern hemisphere? The answer must be given less confidently now than it might have been fifty years ago, when the attention of scholars had been directed to only a few of the American families of speech, and it was easy to assume that the structural and grammatical characteristics of these were common to all Indian languages. At present, broad generalizations are felt to be hazardous. As the

range of observation has widened, and new linguistic groups and isolated dialects have been brought to notice, it has been discovered not only that American tongues differ among themselves in some of the features which formerly were regarded as distinctive of the class, but that no one of these features is, in kind if in degree, peculiarly American. After twenty-five years' study Mr. Gallatin reached the conclusion in which scholars have been obliged to rest—that "although he perceived and was satisfied of the similarity of character in the structure of all the known American languages, he could not define with precision the general features common to all." No *morphological* classification which has yet been proposed provides a place for American languages exclusively, nor in fact can their separation as a class be established by morphological characteristics or external peculiarities of structure. Their common likeness is in their *plan of thought*, rather than in their methods of combining elements of words or annexing formatives to roots. Mr. Duponceau was the first to suggest this in his correspondence with Mr. Heckewelder in 1816, and more explicitly in the report of the historical and literary committee of the American Philosophical Society in 1819. He observed in all known American languages, from Greenland to Cape Horn, a common type or plan of construction, for which he proposed the name of "syntactic," or "polysynthetic," as being that "in which the greatest number of ideas are comprised in the least number of words," this being effected principally in two ways: (1) By a peculiar mode of compounding locutions "by interweaving together the most significant sounds or syllables of each simple word" employed in composition; (2) by "an analogous combination of the various parts of speech, particularly by means of the verb, so that its various forms and inflections will express not only the principal action, but the greatest possible number of the moral ideas and physical objects connected with it, and will combine itself to the greatest extent with those conceptions which are the subjects of other parts of speech, and in other languages require to be expressed by separate and distinct words." It is to the union of these two methods of synthesis, or more accurately to the constant *tendency* to extreme synthesis which underlies them both, that American languages owe that common likeness which seems to indicate genetic relationship. The class-distinction founded merely on the peculiar mode of compounding words—which was not quite accurately stated by Mr. Duponceau—was not generally accepted by European scholars. W. von Humboldt in 1822, suggesting a threefold division of human language, as isolating, agglutinative, or inflectional, referred the American tongues to the second or "agglutinative" order, associating them with the so-called Turanian, and denying them the possession of true inflections and grammatical forms. This classification has been generally adopted as sufficient for practical purposes, though manifestly inexact, for "when we analyze each language more carefully, we find there is none exclusively isolating, or exclusively agglutinative, or exclusively inflectional." (Prof. M. Müller, *On the Stratification of Language*, p. 18. Other defects of Humboldt's threefold division are noticed by Prof. Whitney, *Language and the Science of Language*, 360 ff.) If the American languages must be brought under this classification, a considerable number of them certainly are as fairly entitled to inclusion in the *inflectional* class as are the Semitic or the Indo-European. No definition of an inflectional language has been given that will exclude the Algonkin while including the Hebrew. The modification of the root by varying vocalization is as well-marked a feature of one language as of the other. And if the application of the term "polysynthetic" is to be restricted to the morphological features of language, it may be given as appropriately to the Turkish, and perhaps to the Basque, as to the American. Mr. Duponceau was mistaken in supposing that in the mode of *compounding* words the Algonkin materially differed from the Indo-European. There is no "interweaving together the most significant sounds or syllables of each simple word" to form the compound in any other sense than is true of the Latin or the English language. The *roots* of each simple word enter into composition, divested of grammatical formatives, but entire and unchanged.

"The fundamental characteristic of the Indian languages" was first clearly pointed out by Mr. Gallatin (*Synopsis of the Indian Tribes*, 164) as "a universal tendency to express in the same word not only all that modifies or relates to the same object or action, but both the action and the object, thus concentrating in a single expression a complex idea or several ideas among which there is a natural connection. All the other features of the language seem to be subordinate to that general principle." This tendency characterizes the whole plan of thought, and is at the very roots of language. It is found everywhere in American speech, and, so far as the languages of the world have been investigated, it is found in the same degree nowhere else. The word-clusters all gather about verbal roots or assume verbal forms. It may almost be said with truth that Indian languages—pronouns and a few particles excepted—are all verbs. Every word may be conjugated by moods and tenses; every so-called noun has its preterite and future, its indicative and subjunctive; and many nouns have active and passive voices. Every synthesis is predicative, and, however long and cumbrous, is built on a verbal theme and assumes one of the conjugation-forms of a derivative or compound verb. The Chippewa language (said Bishop Baraga, who had attained a remarkable proficiency in its study) "is a language of verbs. All depends on the verb, and almost all is or can be transformed into verbs." Father Lacombe (*Grammaire Crise*, p. 53) characterizes the Cree in nearly the same words. The Rev. Mr. Byington, after fifty years' acquaintance with the Choctaw, asked, "Cannot all Choctaw nouns be treated as verbs?" (*Choctaw Grammar*, p. 45.) Prof. Steinthal has, it is true, taken the opposite view, and he is followed by Fr. Müller and some others in denying to the Algonkin languages true verb-forms, and treating the synthesis as a noun and its prefixed pronoun as always possessive; but no long or very intimate acquaintance with any Algonkin dialect is required for showing the error of this position. Mr. Gallatin justly regarded "the happy manner by which, through the insertion of a single particle, not only tenses and our common moods, but almost every modification of the action, is specially expressed," as the chief excellence of Indian speech. The nature of the polysynthetic structure, and some of the grammatical devices employed in its composition, can best be shown by examples. It must be remembered, however, that these syntheses were framed by missionaries, not by the Indians themselves, to express conceptions foreign to the Indian nature and language, or in some instances merely to exhibit the resources of these languages and the almost infinite possibilities of verbal composition.

Eliot, in his translation of the Bible into the Algonkin dialect of Massachusetts, uses for "our lusts" the word *num-match-e-kod-tan-ta-moo-on-ga-nun-no-nash*. It was not easy to give an Indian the Puritan conception of lust as "sinful longing." Eliot's synthesis is a verbal, with the affixes of the double plural—*i. e.* of the pronoun and the action or desire. The verb *kodtantam* means "to long for, to greatly desire;" *matche-kodtantam* is "badly to desire;" *matche-kodtantam-oo-onk* is a verbal, "badly longing or desiring;" *num* (for *n'*) is the possessive pronoun "my," which becomes plural, "our," by the insertion of *-unnon* before the final *-ash*, which is the plural termination of the verbal. The whole expresses "our evil longings." If for *matche*, *wunni* should be substituted, the meaning becomes "our good (or pleasing) longings;" if *-jish* be substituted for *kodt*, it will be "our evil hatings;" and so on. Lacombe, in his *Grammaire de la Langue des Cris* (1874), gives examples of more cumbrous and exaggerated synthesis. In Western Cree, *kit-osâwâ-soniyaw-i-wâsaskuten-i-gan-âbisk-u-m-i-s-is-i-now-ok* means "our small gold candlesticks." (The hyphens here divide elements of synthesis and euphonic connectives, not syllables.) Lacombe's analysis is too long to be given here. The literal translation is something like this: "Our yellow-silver lighting-instruments of metal, the very small;" but the first letter, *k*, is the characteristic of the *inclusive* plural, and, in connection with the *um* (after *âbisk*), gives the meaning, "belonging to *all of us*," "yours and mine," which the English pronoun does not express. The Rev. Experience Mayhew, a missionary to the Indians of Martha's Vineyard in 1722, gave a similar specimen of word-building: *Nup-pahk-nuh-tô-pe-pe-nau-wut-chut-chuh-quô-ka-neh-cha-neh-cha-e-nin-nu-mun-nô-nōk*, "our well-skilled looking-glass-makers." Of the twenty-two syllables, eight are required for the name of "looking-glass," which, like every Indian name, conveys a specific description of the object as a "clearly-reflecting instrument." In the preceding examples the process of forming highly compounded words by combining several significant roots is nearly the same—the pronominal affixes excepted—as in the Latin, German, or English language. Such compounds as "imperturbabilis," "expergefactus," "incomprehensibleness," do not differ essentially (as Mr. Gallatin observes), "either in the number, nature, or arrangement of their elements, from a large portion of the Indian compounded words." Of another mode of synthesis, and one more characteristic of American speech, some of the conjugation-forms of Algonkin verbs supply good illustrations. Baraga gives, in the Chippewa, *debimâshinadog*, meaning, "I think what they say of that poor fellow is but too true." The significant root here is *déb-i* (in the Massachusetts dialect *tapi*), "it satisfies, it equals," hence, "it is true." The primary verb

is *débwe*, "he speaks true;" the transitive-animate form is *débiman*, "he speaks the truth *of another person*;" and of this the "pitying form" (as Baraga calls it) is *débimashi*, "he speaks the truth of another, poor fellow!" or impersonally, "what they say of him is unfortunately true;" in the "dubitative" form, this becomes *débimashin-adog*, "I think what they say," etc. All except the radical *déb* is grammar, and each successive modification of the meaning is given by regular conjugation-forms. In another family of language we have, as a specimen of Choctaw synthesis (Gallatin's *Synopsis*, 249), *Wi-ni-taw'-ti-gé-gi-na-li-skaw'-lung-ta-naw-ne-li-'ti-se-sti*; translated, "They will by that time have nearly done granting [favors] from a distance to thee and me." The same capacity of synthesis is found in languages of the Pacific coast, of Mexico, and of South America. In the Sahaptin (Nez Percé) of Oregon the word *ki-shap-tau-tu-al-a-wihnan-kau-na-ni-ma* signifies "he travelled by on foot in a rainy night." The primary verb is *wihna*, "to travel on foot;" *tau* and *tuala* are adverbial prefixes, meaning, respectively, "by night" and "in the rain;" *kau* denotes a "passing by;" *na* is the characteristic of the indicative mood, *ki* of the third person, etc. (Hale's *Notes on Languages of the North-west.*) Paredes observes that Mexican compounds usually consist of two words only, occasionally of three, and that such as exceed the latter number are principally used with reference to sacred things, having been formed by the missionaries. Of these, *tlacatzintiliztlatlacolli*, for "original sin," is an example. This is compounded from *tlacatl*, "a person," *tzintiliztli*, "commencement" or "principle," and *tlatlacolli*, "sin." The name seems a long one, but perhaps the doctrine has never been clearly taught in fewer syllables.

The process of word-growth will be most conveniently exhibited by bringing together some of the derivatives of a single root. The following are selected from Chippewa words (in Baraga's *Dictionary*) formed on the verbal root WAB, "to see." With the verb in the indicative is given the conditional participle, which is used as a noun to denote one who may or habitually does perform the act expressed by the verb, or who is *conceived as* performing it. To form this *nomen actoris*, and generally in conditional statements, the principal vowel of the root is strengthened; thus, *wáb-i*, "he sees," makes *waiábid*, "a seer"—*i. e.* one conceived as seeing, who may, can, or habitually does see; *ăbi*, "he remains," makes *ébid*, "one who remains;" *nibo*, "he dies," *nébod*, "a dead person;" *giosse*, "he hunts," *gáossed*, "a hunter," etc. If the verb has an adverbial or other prefix, the change takes place in the vowel of the prefix, and that of the principal root is not affected. This vowel-change, a characteristic feature of Algonkin languages, is in itself a sufficient reason for regarding them as *inflectional*, and a sufficient proof that they are not destitute of true verb-forms.

The root WAB is found in the primary verb *wáb-i*, "he sees;" and by the passive sense, "to be seen," come the meanings "to be light, bright, white," or otherwise *visible*. Hence,

WÁB*an*, it dawns, lit. "there is seeing;" WÁB*ang*, to-morrow, lit. "at the dawn;" conditional (with change of vowel) WAIÁB*ang*, at dawning—*i. e. whenever* it dawns.

WÁB*am* (n.), dawn, the east; WAB*an-ong*, in the east; hence, a name of the morning star.

*bi*WÁB*an*, dawn (lit. "seeing") comes.

nin WÁB*ama*, I see (an animate object); WAIÁB*amad*, one who sees, etc.

nin WÁB*andan*, I see (an inanimate object): WAIÁB*andang*, one who sees, etc.

*nin ban-*ÁB*andan*, I lose sight of (it); *bên*ÁB*andang*, one who loses sight, etc.

nin WÁB*bandis*, I see myself: part. WAIÁB*andised*.

nin WÁB*andige*, I see something (intrans.); part. *waiabandiged*.

nin WÁB*ange*, I see, look on (indef. intrans.); part. *waiábanged*.

*nin ons*ÁB, I see from a distance; p. *wênsabid*.

WÁB*anowi*, he is a sorcerer (seer); p. *waiábanowid*.

nin WÁB*ia*, I make him see; p. *waiábiad*.

*nin*WÁB*as*, I am seeing—*i. e.* I survive the night.

nin WÁB*anish*, I (with difficulty) survive the winter.

WÁB*isi*, a swan (literally, "he is white").

WÁB*os*, a hare.

WÁB*igon*, a blossom (lit. "it is seen").

WÁB*igan*, white clay; *wábigaige*, he plasters with clay.

WÁBAB*igan* (intens.), lime—*i. e.* very white clay; *wábabiganige*, he whitens with lime.

WÁB*igin*, white flannel.

WÁB*oian*, a blanket.

WÁB*abik*, tin—*i. e.* white metal: *abik* is not an independent word, but a generic formative of names for rocks and minerals.

WÁB*ishka*. it becomes white, is whitish or gray.

WÁB*ishkisi*, he is whitish; part. *waiábishkisid*, a whitish man.

WÁB*ishkiwe*, he is (by nature) whitish; part. *waiábishkiwed*, a white (whitish) man.

In the greater number of the derivatives here given, the root has its secondary or passive sense, "seen" = white, or distinctly visible. Still more numerous are the verbs expressing *modes* of seeing and relations of the subject to the object of sight. The variety of conjugation-forms that any of these verbs may assume is practically without limits. A paradigm of the primary *nin wab*—in Schoolcraft's orthography *ne waub*—fills 90 quarto pages (299–388) of the 5th vol. of his *Information respecting, etc. the Indian Tribes.* A manuscript paradigm of the same verb, by the Rev. Thomas Hurlburt, is still more extensive, and he declares, moreover, that having estimated as nearly as he could all the possible "inflections of this one root WAB, he finds about 20,000,000." Evidently, however, he uses the term "inflections" in a larger sense than grammarians will allow it, making it include such modifications of the action as are effected by prefixing or incorporating adverbial particles. But apart from all these, which belong rather to the composition of words than to grammar, Indian conjugational forms are prodigiously numerous. They may be referred to three classes: (1) *personal*, expressing by the so-called "transitions" the grammatical person of the object as well as of the subject of the verb; (2) *animate* and *inanimate*, distinguishing the object or subject, or both, as belonging to one or the other of these two classes; (3) *modal* and *circumstantial*, corresponding more nearly to the Semitic than to Indo-European forms of conjugation, though far exceeding the former in number and variety. The personal conjugations, in which the pronouns of the subject and the object are united with the verb, are found in all American languages that have been investigated, and may be regarded as one of the characteristics of the class. The division of nouns into *animate* and *inanimate* is not peculiar to, nor is it recognized in all, these languages. Such a distinction is observed in the (new) Persian, and by Kafir tribes in South Africa; and there is something like it in the Tamil and other Dravidian tongues of Southern India, which divide nouns into "high caste" or "rational," and "no-caste" or "irrational." It pervades the entire structure of Algonkin languages, and is perhaps their most striking feature, modifying the inflections of all nouns and the conjugations of every verb, according as the action is exerted by or upon an animate or inanimate object. Thus, a Chippewa Indian says, *nin pakitéwa*, "I strike him"—*e. g.* a man or a horse; *nin pakitéan*, "I strike it," a stone, a block, or other inanimate thing; *nin pakitéige*, "I am striking" (somebody or something indefinite); *nin pakitéoman*, "I strike (an animate object) belonging to him"—*e. g.* his child, his horse; *pakitéigan*, "it strikes" (and, used as a noun, "a hammer"); *pakitéiassin*, "it strikes something" (unintentionally), etc. In some cases the distinction is not merely a grammatical one, but inheres in the root—*e. g. nin midjin*, "I eat" something inanimate, whence, impersonally, *midjim*, "it is eaten" or "they eat it," used as a noun meaning "food," and the participial *mádjid*, "an eater;" but *nin amwa*, "I eat" something of the animate class (which includes bread, corn, potatoes, fruits, as well as the flesh of certain animals), and *ēmwad*, "an eater." In no other American family is this distinction so strongly marked or of so extended application as in the Algonkin, but it is found in the Iroquois, less prominently in the Cherokee, in some Mexican languages, in the Arrawak of Guiana, the Quichua of Peru, the Tupi (Guarani) of Brazil, etc. In the Dakota it is indicated only in the plural of animate nouns.

Algonkin verbs have not only conjugation-forms corresponding to the active, middle, and passive voices of Indo-European languages, but a great variety of modal and circumstantial conjugations, such as the inceptive, causative, desiderative, frequentative, habitual, mutual, involuntary, simulative (*e. g. niba*, "he sleeps;" *nibákaso*, "he feigns sleep"), compulsive, deteriorative or derogative, etc.; and many of these forms may be conjugated affirmatively, negatively, and *doubtingly*, the system of personal "transitions" and the distinction between animate and inanimate, in subject and object, being maintained throughout. Similar richness of verbal expression belongs to other American tongues. Von Tschudi enumerates thirteen classes or forms of Quichua verbs, all formed from the primary by conjugational suffixes.

In many languages nouns have the same form in the plural as in the singular, plurality being expressed by an independent word meaning "many," by a numeral, or only by the following verb. Others, like the Sioux-Dakota, have a plural form for *animate* nouns, but not for the inanimate. In the Algonkin each of these two classes has its characteristic plural, that of animate nouns being nearly the same

in all dialects of the family, while the termination of the inanimate plural varies considerably. Cherokee nouns, pronouns, and verbs have *dual* as well as plural forms, and the Iroquois has in addition to these an "indeterminate" or collective plural. The distinction of *persons*, as first, second, and third, is so well established in English grammar that it seems to us the only natural one. In many Indian languages there is no pronoun of the third person, its place being supplied by a demonstrative. In many others there are *two* pronouns of the first person plural, which, combining with nouns and verbs, form the *inclusive* and *exclusive*, or "general" and "limited," plurals, the former including both the speaker and those *to* whom he speaks ("you and I"), the latter including only the speaker and those *for* whom he speaks, and excluding all others ("we, not you"). The Cherokee distinguishes two *third* persons as *present* or *absent*, and has also two first persons, dual and plural; and the same distinction is observed in the Chayma (and perhaps other Caribi-Tamanacan dialects), the Quichua, etc. The double first person plural (inclusive and exclusive) belongs to all Algonkin languages, to the Iroquois, Cherokee, Choctaw, Sahaptin (Nez Percé), Quichua, and others. It is found also in the Dravidian languages of Southern India, in the Manchu, in Polynesian and some Australian dialects, and in those of Hottentot tribes of South Africa, and would seem to have been very generally resorted to, at one stage of the development of language, in finding a way from the primitive dual to the conception of unlimited plurality. In the Cherokee, as has been said, the dual as well as the plural has inclusive and exclusive forms for the first person—"we two" (*i. e.* "he and I"), and "we two" (*i. e.* "thou and I, and not he"); but in the *third* person there is no distinction made between dual and plural.

In some Indian languages, and particularly in the Algonkin family, both transitive verbs and the (animate) nouns and pronouns they govern have two or *three* third-personal forms, distinguishing degrees of relation to the subject of the verb. Baraga (*Otchipwé Grammar*) and Lacombe (*Grammaire Crise*) call these the simple, the second, and the third-third persons; Cuoq (*Études philologiques*) denominates the second as the third person "obviatif," and the third as the "sur-obviatif." To take an example from the English: in "John struck Paul," John is the first-third and Paul the second-third person; in "John struck Paul's son," "son" is the third-third, or "sur-obviatif." If the subject of the verb is in the first or second person, the governed noun (if in the third person) has the first or simple form: (Chip.) *nin sagia noss*, "I love my-father;" if there are two third persons in the sentence, one takes the second-third form—*e. g. aw inini od-anokitawan noss*AN, "that man works for (serves) my father;" if there are three or more third persons, the first is in the simple form, the second in the second-third or obviative, the third and all others in the third-third or super-obviative; *e. g. Josep o-gi-odapinan abinódjïï*AN *ogi*NI-*gaie*, "Joseph took the young child and *his* mother." (This example is taken from Baraga, p. 72.) In the Chippewa, the second-third person ends in *n*, *an*, or *on*, the third-third in *ni*, *ani*, or *oni*, and a corresponding change is made in the form of the governing verb; *e. g. Jak ot-awem*AN *o-sakih*AN-INI *Sabet*AN *ot-anis*INI, "The sister of Jacques loved the daughter of Elizabeth;" lit. "Jacques his-sister she-loved Elizabeth her-daughter," where "sister" and Elizabeth are in the second-third person, "daughter" in the third-third, and the verb has the double affix of second and third, *an-ini*. (Cuoq.) The Eskimo has two forms for the third person, one of which, according to Egede, is used only when the object of the verb *belongs to* the subject; thus, *kitornÂ turnivâ*, "he gave it to his (another person's) child," but *kitorné turnivâ*, "he gave it to his (own) child." Eliot, in his Massachusetts version of the Bible, makes use of the "obviative" form, but has not mentioned it in his grammar of the language; and as Zeisberger seems not to have discovered it in the so-called Delaware, it was not brought to the notice of Duponceau, Gallatin, or Pickering. It is probable that some such distinction between the principal and the dependent third persons may be found in most American dialects. Pandosy in his Yakama (Sahaptin) grammar notices a difference of inflection "when the governing substantive is itself governed by a verb." In the Quichua the distinction is effected by special forms of the demonstrative; in the Tupi of Brazil, by a "reflexive particle."

Not the least remarkable feature of these languages is the facility with which concrete and abstract names may be formed not only from every verb, but from the several voices, moods, and tenses of the verb. One species of verb-noun, of very frequent use in Algonkin speech, has been mentioned before—that, namely, which designates a person who habitually does, or may do, or who is *conceived as* doing, the act expressed by the verb, corresponding to the English *nomen actoris* in *-er*. This name is formed as a conditional participle, or as the third person singular of the conditional present, with a change of the vowel of the root: thus, from Chip. *giosse*, "he hunts," comes *gáossed*, "a hunter;" from *gimódi*, "he steals," *gémodid*, "one who steals, a thief" (and if the name is intended to convey a reproach, *gémodi*SHKID, "one who too much steals, an habitual thief"); from *ojiton*, "he makes it," *wejitod*, "one who makes," etc. Another very large class of nouns is formed from the indicative present, to denote the action of the verb, answering to the English substantive participle in *-ing; e. g.* (Chip.) *gimódi*, "he steals;" *gimódi-win*, "stealing, theft;" *migádi*, "he fights;" *migádiwin*, "fighting, war;" *minikwe*, "he drinks;" *minikwéwin*, "drinking" (so, *minikwé*SHKI*win*, "too much drinking, intemperance;" *minikwé*SSI*win*, "not drinking, abstinence"). Other verb-nouns serve to name instruments for performing the act expressed by the verb; as from Chip. *pakitéige*, "he strikes," is formed *pakitéigan*, "a hammer," literally "it strikes;" from *páshkisi*, "it explodes, bursts" (with noise), comes *páshkisigan*, "a gun"—*i. e.* an exploding instrument; from *jibáiabandan*, "he looks through something," *jibáiabandjigan*, "an instrument made for looking through, a spy-glass," etc. Since every so-called adjective may be conjugated as a verb, from which nouns may be formed for designating the actor, action, and instrument, and since the formation of all such verb-nouns is regular, so that every new name is self-defining, it is plain that the possible enlargement of the vocabulary is absolutely without limit. The Indian languages are far richer in concrete and special than in abstract and general names; but this is not because they are inadequate to the expression of abstract ideas or generalizations, but because the Indian aims always at the attainment of absolute precision, and at an exactness of denotation which higher culture and larger intelligence permit Indo-Europeans to disregard. There is an illustration of this in the nicety of the distinction made between the active and passive substantive-participle in many American languages. The Indian has no expression for *abstract* love, hate, truth, fear, anger, etc. Love, for instance, is either "a loving" or "a being-loved," according as it is referred to its subject or object, and it is named by an active or passive verb-noun. In English "the love of God" may mean either man's love to God, or God's love to man. The Algonkin avoids this ambiguity. In the Chippewa, for example,

from *ságiiwe*, "he loves," is formed *ságiiwewin*, "a loving" (love *given*);

from *ságiigosi*, "he is loved," is formed *ságiigosiwin*, "a being-loved" (love received);

from *ságiidisi*, "he loves himself," is formed *ságiidisiwin*, "self-loving;"

and from the mutual conjugation-form of the same verb, *ságiidiwin*, "mutual loving." So, from *pakitéige*, "he strikes," come *pakitéigewin*, "a beating given," and *pakitéigowin*, "a beating received." And the form of these verb-nouns may be modified according as the object of the action or emotion is animate or inanimate. Similar distinctions are found in other American languages. Paredes (quoted by Gallatin) notes the double forms of verbal nouns in the Mexican, "both of which express the acts of doing that which the verb signifies," the former actively, the latter passively; thus, "*tetla çotla*LIZTLI is 'the love I have for another,' *notla çotla*OCA is 'the love another has for me.'" In the Quichua, Von Tschudi notices four kinds of verb-nouns, formed respectively from the active participle and the imperfect, perfect, and future of the infinitive, in both active and passive voices—*e. g.* from *apa*, "to bear," come *apak*, "bearer," *apay*, "the burden" (that which is borne), *apasca*, "he who has borne," *apanca* or *apana*, "that which is to be borne," etc.

"Some learned Europeans have not disdained to study the structure of the idioms of America with the same care as they study those of the Semitic languages and of the Greek and Latin. They no longer," said Baron von Humboldt, "attribute to the imperfection of a language what belongs to the rudeness of the nation. It is acknowledged that almost everywhere the Indian idioms display greater richness and more delicate gradations than might be supposed from the uncultivated state of the people by whom they are spoken;" and he observed as evidence of this that the *Idyls* of Theocritus "had been translated, with graceful simplicity, into the language of the Incas, and that he was assured that, excepting treatises on science and philosophy, there is scarcely any work of modern literature that might not be translated into the Peruvian." Naxera has given a translation of an ode of Anacreon into Otomi. The Abbé Brasseur de Bourbourg, by his French version of the *Rabinal-Achi*, from the Quiché of Guatemala, has shown that language to be not ill-furnished for poetical and dramatic composition. In the Algonkin, Iroquois, Chahta-

Muskoki, Dakota, and other North American families the readiness and ease with which new words have been formed for ideas and objects previously unknown—the formation being always in strict accordance with the structural laws of the language—give sufficient evidence (as Mr. Gallatin remarked) that these Indian tongues "had within themselves the power of progressive improvement whenever required by an advance in knowledge or civilization." The author of *Études philologiques sur quelques Langues Sauvages de l'Amérique* (Montreal, 1866) and of *Jugement erroné de M. Ernest Renan sur les Langues Sauvages* (1869), who writes with excellent knowledge of his subject so far as the northern Algonkin and the Iroquois dialects are concerned, has shown how slight foundation there is for the opinions expressed by M. Renan and some other eminent philologists of Europe, that these languages are incapable of expressing abstract ideas, that their richness in forms and in special terms is at the expense of accuracy in denotation, and that they are destitute of true inflections. On this last point something has already been said in this article, but it may be well to add the well-considered statement of Mr. Gallatin in his last work, that "the Indian languages abound with inflections, having precisely the same character with those which are universally considered as such in other" —or, as he says elsewhere—"in the classical languages."

However numerous may be the derivatives and possible syntheses, the number of *roots* in any Indian dialect is small. These, of course, are common to all languages of the same family, but they are not exempt from phonetic change in passing from one dialect to another. Their identity may thus be nearly lost, and perhaps cannot be established except by extensive comparison of dialects. The Dakota name for "ten," for example, is in the Sioux *wĭ-kchĕ-mna;* in the Winnebago, *kh'ra-pun;* in the Ponka, *gthe-ba.* These (rejecting a prefix in the Sioux) are merely phonetic variations of the same name; *kche, kh'ra,* and *gthe* are equivalent, and so are *mna, pun,* and *ba.* In the Algonkin family the range of divergence is less wide, yet still considerable; the Abnaki *areni,* "man," and the Illinois *illini,* are not far apart or from Chippewa *inini;* in Micmac *l'nu* (or *el'nu*) and Quinnipi *ren* the difference is more apparent, and still more in Hudson's Bay Cree *ethin'u,* Western Cree *iyinu,* and Shyenne *itâni.*

Till the comparative grammar of the languages of each of the principal American families shall have been investigated, and the laws and limits of phonetic change are better understood than at present, questions as to the genetic relation of one of these families to another must remain unanswered. As yet, philology has no sufficient data for determining either the fact or the degree of such relationship. Still less is the philologist competent to decide, on evidence now supplied by language, that any family of American speech is, or is not, of Asiatic, European, or African derivation. In support of different theories respecting the origin of the Indian races, various resemblances and analogies have been pointed out between American dialects and one or another of the languages of the Old World. Those who believed the Indians to be descendants of the lost tribes of Israel, discovered in their languages striking affinities to the Hebrew, and one writer conjectured that the Mohawks were of the tribe of Levi, because their name corresponds so nearly to Hebrew *Meichokek,* translated "lawgiver" in Gen. xlix. 10. Vater in *Mithridates* gave a long list of words of similar sound and meaning in Indian and Asiatic languages, as evidence that America was peopled by emigration from North-eastern Asia. The vocabulary of the Caribs has been made to give evidence of their African origin. M. de Charencey, impressed by structural and grammatical resemblances between certain American dialects—particularly the Eastern Algonkin—and the Basque, is led to believe that the New World was peopled by Iberian colonists from Western Europe. (*Des Affinités de le langue Basque avec les idiomes du Nouveau-Monde,* 1867.) The supposed likeness of some Indian words to Greek, Latin, and Sanscrit has more than once been pointed out; as, for example, Algonkin *wigwam* and Gr. οἶκος, Lat. *vicus;* Aztec *téotl* and Gr. θέος. Evidence satisfactory to such as were predisposed to accept it has been found of the genetic connection between American speech and Egyptian, Mongolian, Tungusic, Samoyedic, Malayan, and Polynesian, and in fact almost every known language of the world. On the other hand, ethnologists of the school of Morton, Nott, and Gliddon attach little weight to any such evidence of extra-American affinity, and regard the languages of the Indians, like their race, as autochthonous.

For a general view of the structure and comparative grammar of North American languages, Mr. Gallatin's *Synopsis of the Indian Tribes* (*Transactions of the Am. Antiq. Society,* vol. ii.), supplemented by his notes on Hale's *Vocabularies* (*Trans. Am. Ethnol. Society,* vol. ii.), are still the best guides. Mr. Pickering's excellent paper on *Indian Languages of America* (in the Appendix to the *Encycl. Americana,* vol. vi., and separately printed 1831), and his notes to the reprint of Eliot's *Indian Grammar Begun* (in *Mass. Hist. Collections,* 2d series, vol. ix.), should be consulted, and a paper by Dr. F. Lieber *On the Plan of Thought in American Languages,* in vol. ii. (pp. 346–349) of Schoolcraft's great collection of *Historical and Statistical Information respecting the Indian Tribes* (6 vols. 4to, 1851–56)—a work which contains much valuable material, though this, unfortunately, cannot easily be separated from the worthless mass in which it is buried. The third volume of *Mithridates,* by Adelung and Vater (1812–16), supplies much valuable information, particularly as to South American languages. For the general bibliography see Trübner's edition of Ludewig's *Literature of American Aboriginal Languages,* with Prof. W. W. Turner's additions and corrections. *An Essay towards an Indian Bibliography,* by Mr. T. W. Field (New York, 1873), though primarily designed only as the catalogue of a private library, is a convenient and useful book of reference. For languages of the Pacific coast, Horatio Hale's collected vocabularies and grammatical notes in vol. vii. (*Ethnography and Philology*) of the *Report of the U. S. Exploring Expedition,* supplied much valuable material, to which W. H. Dall's *Alaska and its Resources* made important additions. The best authorities for the Dakota and Athabascan languages have been mentioned elsewhere in this article. For the Eskimo see the *Groenlandsk Grammatica* of O. Fabricius (Copenhagen, 1791), and Kleinschmidt's *Grammatik d. Groenl. Sprache* (Berlin, 1851). For the Algonkin, besides the works of Duponceau, Pickering, and Gallatin, see Baraga's *Otchipwe Grammar* and *Dictionary,* J. Howe's *Cree Grammar,* Lacombe's *Grammaire de la Langue des Cris* (Montreal, 1874) and accompanying *Dictionary,* and the two works previously mentioned by "N. O., ancien missionnaire" (M. Cuoq), *Études philologiques,* etc. and *Jugement erroné de M. Ernest Renan,* etc., which give a good outline of Iroquois as well as Algonkin grammar. For the languages of South America generally see C. F. P. von Martius's *Beiträge zur Ethnographie und Sprachenkunde Amerika's* (Leipsic, 1867), and A. d'Orbigny, *L'Homme Américain,* etc. (Paris, 1839); and as an aid to the comparison of South with North American languages, J. J. von Tschudi's *Die Quichua Sprache* (Wien, 1853) is of special value. J. HAMMOND TRUMBULL.

Indian Ocean is the name of the vast sheet of water between Africa, Asia, and Australia, traversed by the equatorial current, flowing from E. to W. with a somewhat varying velocity, and forming a very rapid current along the eastern coast of Africa.

Indiano'la, post-v., cap. of Warren co., Ia., on the Chicago Rock Island and Pacific R. R., Indianola branch, 20 miles S. of Des Moines. It is the seat of Simpson Centenary College (Methodist Episcopal), has a national and a private bank, graded school, grist-mill, planing-mill, manufactures of farming implements, several churches, 3 weekly newspapers, etc., and is situated in a beautiful and fertile region. Pop. 1428.

GRAHAM & KNOX, PUBS. "HERALD."

Indianola, port of entry, cap. of Calhoun co., Tex., on the W. shore of Matagorda Bay, 10 miles from the Gulf of Mexico. Its harbor is large and commodious; it has steamers thrice a week from New Orleans, and two lines of sailing vessels ply regularly to New York, and there are many other domestic ports with which it has a trade. About ten vessels bring lumber from Florida and Louisiana. Cattle, wool, hides, cotton, etc. are extensively shipped from this point, from which the Gulf, Western Texas and Pacific R. R. already extends over 70 miles into the interior. The town has two banks, a weekly newspaper, and several large importing and wholesale establishments. Pop. 1900; of Old Indianola, 206. On Sept. 15, 1875, a severe storm, lasting five days, visited the coast from Galveston to Indianola, causing the waters to rise and flood the more exposed places, sweeping away several small villages, with great loss of life, and destroying much property in Galveston, Matagorda, and other towns. Indianola was submerged, and except the larger business-houses, was entirely swept away. The loss of life throughout this section is believed to have been over 200.

CHARLES A. OGSBURY, ED. "BULLETIN."

Indian Orchard, a pleasant manufacturing post-v., constituting a part of Springfield, Mass. (Hampden co.). It is 6 miles N. E. of Springfield, on the Boston and Albany and the Springfield Athol and North-eastern R. Rs.

Indian Point, tp. of Knox co., Ill. Pop. 1854.

Indian Prairie, tp. of Wayne co., Ill. Pop. 1727.

Indian Red, a mineral pigment from Persia, consisting of ferric oxide and silica.

Indian Ridge, tp. of Clarke co., Ala. Pop. 316.

Indian River, in Brevard and Volusia cos., Fla., is a narrow tidal channel parallel and usually only half a mile from the coast. It extends S. S. E. from a point some 18 miles N. W. of Cape Cañaveral to Indian River Inlet, 100 miles distant, and is continuous southward 50 miles to Jupiter Inlet as St. Lucie's Sound. It is in a beautiful and healthful region, and the river abounds in fish. It is navigable, and the inlet will admit vessels of 5 feet draught. The river is becoming a resort for invalids and sportsmen.

Indian River, hundred of Sussex co., Del. P. 1667.

Indians, American. At the time of the discovery of America the whole continent was occupied by scattered tribes, and as the land was supposed to be a part of Asia, and called India or India beyond the Ganges, the inhabitants received the name of Indians. The question of the origin of this population was for centuries a much-disputed one. Some tribes—for instance, the Athabascans—possessed a tradition concerning their emigration across the Pacific, and different scholars endeavored to establish a connection between the American Indians and the Jews, Welsh, Mongols, Malays, and other races of the eastern continent. The attempts were not successful; and while the modes of living and the implements of the American Indians resemble very much those belonging to the earlier stages of European and Asiatic races, no link of connection has been found between the respective languages. The different dialects or languages spoken by the American aborigines seem, in spite of all variations, to have originated from one common stock, and an identity of race seems furthermore to be confirmed by an extensive community in physiological traits and in the general character of their civilization. At the time of the discovery there was a great difference between the tribes living in Peru, Central America, Mexico, and New Mexico, and those living farther to the S. or to the N., with respect to the stage of civilization which they respectively represented. The former had domesticated the llama; they cultivated maize, squashes, beans, tobacco, plantains, etc.; they built houses of adobe and temples of stone; they understood the art of pottery, of making bronze, etc. The latter were sometimes almost wholly savage, living in holes in the ground, and eating their fish and game raw. And yet there were certain common traits in religious ideas, in moral character, in form of government, in industry and mode of living, etc., which pervaded the whole race from the savage to the semi-civilized. (For more particular information on the different points relating to this subject see the special articles on Architecture of the American Aborigines, Man and his Migrations, Indian Languages, Tribe, etc., and the names of the different tribes.)

Indian Shot. See Canna.

Indian Springs, post-v. of Butts co., Ga., has saline sulphur springs, much visited for the cure of rheumatism and stomach and liver disorders. It has 1 weekly newspaper. Pop. 248.

Indian Springs, tp. and post-v. of Washington co., Md. Pop. 1565.

Indian Springs, tp. of Wayne co., N. C. Pop. 1280.

Indian Territory, a tract of land originally belonging to the Louisiana purchase, and which was set apart by the government of the U. S. as a permanent home for such of the Indian tribes as could be induced to settle there. It included at first all the unorganized portion of the Louisiana cession lying W. of its eastern meridian, and in 1850 its area was stated at 195,274 miles; but Kansas and a part of Nebraska were subsequently taken from it, and the boundary between North-western Texas and the north-western portion of this Territory was carefully surveyed. As it exists at present, its northern boundary is the 37th parallel of N. lat., which separates it from Kansas and for one degree of longitude from Colorado; its eastern boundary is the meridian of 94° 30′ W. lon., which divides it from Arkansas and for a short distance from Missouri; the Red River, which separates it from Texas, is its southern boundary as far as to the 100th meridian, which it follows northward for its western boundary to the parallel of 36° 30′, and then turns westward on this parallel to the 103d meridian (the eastern boundary of New Mexico), when it again runs N. along that meridian to the 37th parallel. It has thus Texas for its southern and western boundary, except for a distance of 35 miles on the 103d meridian, where it joins New Mexico. Its area is stated at 68,991 square miles, or 44,154,240 acres, which is probably a near approximation to the actual area. The greater part of the Territory has been granted in districts proportioned to their numbers to those Indian tribes which would confine themselves to their respective tracts, either cultivating them or using them as hunting-grounds, but about one-fifth of the present area (8,947,473 acres) was ceded back by the Chickasaws, Cherokees, Creeks, and Seminoles to the U. S. in 1866 and 1867, and is now held by the government to be used as a home by other Indian tribes when they can be induced to settle down upon these lands as a permanent home.

Face of the Country.—There is a gentle declination from the foot-hills of the Rocky Mountains, which occupy the extreme N. W. portion of this Territory, towards the Mississippi River, and this general slope trends also somewhat towards the S. E., so as to reach the valley of the lower Red River. Between the Red and Canadian rivers there are several groups and ranges of mountains of no very great elevation, as the Washita Mountains, the Poteau and the Sans Bois mountains. In the eastern part of the Territory the rivers have broad and fertile bottom-lands, sometimes overflowed in spring or early summer, which are usually shut in by bluffs more or less abrupt, which form the boundaries of the undulating uplands. The western portion, especially the narrow strip extending from the 100th to the 103d meridian, is arid and for the most part treeless, forming a portion of that gradually diminishing region formerly known as the Great American Desert. The Arkansas and Red rivers, with their affluents, drain the Territory. Some of these affluents are nearly as large as the main rivers. The Arkansas enters the Territory near the 97th meridian, and leaves it at Fort Smith, in lat. about 35° 30′, but its principal tributary, the Canadian River, traverses the entire Territory from W. to E., as do also its N. fork and the Cimarron or Red fork of the Arkansas. The other affluents of the Arkansas are, from the N., Verdigris and Little Verdigris and Neosho rivers and Flint Creek; from the W., Little Arkansas, Black Bear, Wolf Creek, and Poteau River, a branch of the Canadian. The tributaries of the Red River in the Territory are the N. fork of Red River, Cedar Creek, with numerous branches, the Washita River, a large and long stream, Muddy Creek, Walnut Creek, Baggy River, and Kianashi River.

Geology.—E. of the 97th meridian most of the Territory belongs to the coal-measures, though we believe but little coal has as yet been mined there. There is, however, a small tract of Eozoic rocks on the Arkansas River between the Cherokee and the Creek countries, about lat. 35° 30′, and another in the S. W., crossed by the 35th parallel and lon. 99° W. All the rest of the Territory belongs to the Triassic and Jurassic formations, except a little tract of Cretaceous rocks in the extreme N. W., on the borders of New Mexico. The barren and sandy table-lands of the narrow strip in the N. W. are often covered, especially in summer, with saline efflorescence.

Vegetation.—The eastern part of the Territory has much rich and fertile land, not only on the river-bottoms, but on the upland prairies and woodlands. A belt of forest, known as the "Cross Timbers," from 5 to 30 miles in width, extends along the border of the Carboniferous formation from the Arkansas River to the Brazos, and separates the fertile and rich prairie-lands from the dry and sterile table-lands of the N. W. W. of these there are few trees except in the river-bottoms, and the soil grows more and more arid and unproductive, till at last there are only thorny cacti, yuccas, and the gray sagebush to be seen, and even these only in scattered and widely separated patches.

Animals.—This is still, especially in its central and western portions, the favorite haunt of the buffalo, the antelope, and to some extent of the wild horse; deer and other game abound; the black or brown bear is found in the "Cross Timbers;" and the prairie dog, the wild-turkey, the prairie-hen, the sage-hen, and a great variety of birds of prey, as well as those noted for beautiful plumage or for melodious song, are found in all parts of the Territory. There are not many fish in the rivers, which, except the Arkansas and Red, are usually dry, except in pools, in the summer.

Climate.—Like that of most of the region between the same parallels W. of the Mississippi, the climate is warm and inclined to drought. In the S. E. it is more moist, the average rainfall being 52 inches, but it is also hot, the mean annual temperature exceeding 60° F. In the central portion there is not quite so much heat, the mean annual temperature ranging from 57° to 59°, and the rainfall having diminished to 35 inches. In the N. W. the mean temperature of the year is lower, not exceeding 55°, being reduced by the cold "northers" from the Rocky Mountains, and the rainfall does not average more than 20 inches for the year.

Productions.—The Cherokees, Creeks, Chickasaws, Choctaws, Senecas, Quapaws, and Shawnees have settled on their reservations, and many of them have good farms and have made considerable progress in civilization. These tribes had before the late war many slaves, and raised large crops which they sent to market. Since the emancipation of the slaves many of them still hire laborers and are wealthy;

but as no taxes are levied on either their personal or real estate, the census does not report their productions. The other tribes are nomadic, and make little or no effort to till the soil or engage in any branch of civilized industry. The following statistics were gathered in relation to the Territory in 1872: Acres of improved land, 204,674; bushels of wheat, etc., 6,739,355; value of farm produce, $4,663,610; number of horses, cattle, etc., 464,465; their value, $1,947,101; total value of real and personal property, $16,987,818. Land is held in common, and is not included in this valuation.

There is one railroad, which traverses this Territory from N. to S.—the Missouri Kansas and Texas Railway—250 miles of it within the Territory. The Atlantic and Pacific Railway also extends from Seneca to Vinita, a distance of about 35 miles in the Territory, connecting there with the Missouri Kansas and Texas. Numerous other railroads have been projected, and one, a Pacific Railway to follow the 35th parallel, has been endeavoring to obtain from Congress the right of way and a grant of lands through the Territory, but the Indians oppose it.

Banks, etc.—There are no banks, savings banks, insurance companies, or, so far as we can learn, private banking-houses, in the Territory.

Population.—Until the census of 1870 there had been no attempt to take a full census of the inhabitants of the Indian Territory. As the Indians were not taxed, and had no interest as voters, etc. in the government of the U. S., there seemed no other motive except that of curiosity for such enumeration. The number of white persons and of persons of African descent in the Territory was enumerated. In 1860 these together numbered 9761. In 1870 the change which had taken place in the relations of some of the tribes during and consequent upon the late civil war made an enumeration necessary. The U. S. marshal reported in 1870 that there were in the Territory 68,152 inhabitants. Of these, 2407 were whites, 6378 colored persons of African descent, 59,367 Indians sustaining tribal relations, of whom 19,067 were on reservations and at agencies and more or less civilized. (Of these, 3884 were men, 4485 women, 5146 male children, and 5592 female children.) There were also 5900 reported as estimated members of these reservations and agencies, but not actually enumerated by the assistant marshals. The estimated number of nomadic Indians (*i. e.* not on reservations or located at or near agencies) in the Territory was 34,400. Later statistics, taken in 1872, give a materially different statement. They make the number of civilized Indians, including the Cherokees, Choctaws, Creeks, Chickasaws, Seminoles, Quapaws, Senecas, Wyandots, Shawnees, etc., 55,874, occupying reservations of 19,618,095 acres, of which 216,850 acres are under cultivation by individuals and 4455 by the government. These Indians occupy 5344 dwelling-houses. The uncivilized Indians, including stragglers and Osages, Caddoes, Kiowas, Comanches, Apaches and Delawares, Cheyennes, Arapahoes and Apaches, numbered 14,515, making an aggregate of 70,389 Indians, or about 11,000 more than the census reported. The Osages, Kiowas, Comanches, and stragglers had reservations amounting to 9,544,720 acres, of which only 2603 acres were cultivated by individuals and 666 by the government. The other uncivilized Indians, numbering 6322, had no definite reservations, but roamed at will through the 15,000,000 acres of unallotted lands. The uncivilized Indians had in all but 256 permanent buildings. The total amount of funds held in trust by the U. S. government for all these tribes, civilized and uncivilized, is about $8,000,000.

Education.—The schools are mostly confined to the Cherokees, Choctaws, Creeks, Chickasaws, and Seminoles, the other tribes caring little for schools. In these five tribes there were in 1873, 153 schools, with 4706 scholars. The Cherokees had in 1873, 66 of these schools, attended by 2300 children, and besides, an orphan school, with 90 pupils, 1 female high school, and 1 (Moravian) missionary school. Their school fund amounts to $520,134.64, and their orphan fund to $248,600.51. The Creeks had in 1873, 1 boarding school and 31 day schools, attended by 860 pupils. The Choctaws and Chickasaws had 2 boarding schools and 48 day schools, and 1339 scholars. The Seminoles, 5 day schools and 207 scholars. The school funds for all the tribes except the Cherokees amount to about $251,000. The leading chiefs of the Cherokees, Creeks, and Choctaws advocate the abolition of the tribal system, the holding of the lands in severalty, and the education of the children to fit them for citizenship.

Religion.—The Cherokees, Creeks, Choctaws, and Chickasaws have been for half a century under missionary instruction, and a very considerable proportion of them are members of Christian churches. The aggregate number of church members in these four tribes somewhat exceeds 7500. Of these, over 3100 are Cherokees, 2050 Creeks, 2500 Chickasaws and Choctaws. In the entire Territory the Baptists in 1874 had 3 associations, 61 churches, 47 ministers, and 3910 members. The Methodist Church, South, has also a considerable number of churches and communicants in the Territory, and several missions among the less civilized Indians. Their report of their conferences in 1874 gives for the Indian mission (not all, we think, in this Territory) 20 travelling preachers, 82 local preachers, 172 white, 454 colored, and 4590 Indian members. The Presbyterians, both North and South, have mission stations in the Territory, as have also the Congregationalists. The Roman Catholics have two mission stations, and there are several Moravian congregations.

Newspapers.—There are three or four newspapers printed in the Territory. One, at Tahlequah, is partly in the Cherokee language, and one at Caddo is, we believe, in the Creek or Choctaw. None of these papers have a very large circulation.

The *government* of the civilized Indians, and indeed of all the Indian tribes of the Territory, is one of independent chiefs, whose power is, however, limited. The tribes are the wards of the U. S. government, which nevertheless interferes as seldom as possible. For the purpose of punishing crimes against citizens of the U. S. the Territory is annexed to the judicial districts of Arkansas and Missouri. The Cherokees have a legislature or council of their own, as do some of the other civilized tribes, though not so completely organized. They have also courts and a code of laws, few and simple, but sufficient for their purposes. They are not represented, even by a delegate, in Congress, but occasionally, when they desire some change in their arrangements with the U. S. government, they send some of their most intelligent chiefs to Washington to represent their case before the President, the secretary of the interior, or a congressional committee.

Divisions of the Territory.—There are, of course, no counties or townships in the Territory, but all the civilized tribes, and some of the uncivilized, have their reservations—considerable tracts of land, lying each in one body, which is the joint property of the whole tribe. Some of the tribes, having diminished in numbers, had more land than they needed, and have ceded it back to the U. S. for a liberal sum of money, which is invested and the income applied to the use of the tribe.

The reservations set apart for the tribes now there are as follows:

Tribes.	No. of houses.	Population, est'd.	Acres of reservation.	Improved by individuals.	Impr'd by governm't.
Cherokees	3,965	17,217	5,000,000	89,250	
Choctaws	....	16,000	6,668,000	50,000	
Creeks	....	12,295	3,215,495	31,000	4,390
Chickasaws	....	6,000	4,377,600	39.000	
Seminoles	500	2,438	200,000	7,600	
Quapaws, Senecas, Wyandots, Shawnees, etc.*	879	1,219	157,000	....	65
Osages	83	2,823	1,500,000	90	116
Caddoes	....	1,528	Not sur.	925	180
Kiowas	9	2,000	3,549,440	186	70
Comanches	....	2,198	4,011,440	60	250
Fragments of tribes settled together	104	1,192	483,840	1,342	50

The two branches of the Apache tribe (Pima and Coyote) or so many of them as are in this Territory, the Delawares, Cheyennes, and Arapahoes, numbering together 4774 persons, have as yet no definite reservations.

Towns.—There are no large towns in the Territory. Tahlequah, the capital of the Cherokee country; Caddo, the largest settlement in the Choctaw nation; Vinita, the point of junction of the Missouri Kansas and Texas and the S. W. branch of the Pacific railroads; Blue Jacket, on the former road; Muscogee, in the Creek country; and Tishomingo, in the Chickasaw Nation,—are settlements of moderate size. The U. S. government has ten or twelve forts, some of them of considerable size, in the Territory.

History.—The history of the Territory is very brief. Though a part of the Louisiana purchase, it does not seem to have had at any time any considerable population. It was occasionally traversed by the Apaches, Comanches, or Arapahoes, and perhaps by the Cheyennes, in the pursuit of the buffalo or the wild horse. It was selected by the U. S. government in 1832 as the home of the tribes E. of the Mississippi, principally on account of its remoteness from white settlements, and the Creeks, Choctaws, Chickasaws, and Cherokees were removed thither from 1833 to 1838, and the Seminoles and some fragments of other tribes a little later. The first grants of land secured to them by treaty were much larger than those they now hold, and embraced portions of Kansas and Nebraska. By subsequent treaties these were ceded back to the U. S. During

*These have each a separate though small reservation.

the late civil war several of the more civilized tribes took the side of the South, and were at first held to have forfeited their lands, but were finally reinstated in their possession. L. P. BROCKETT.

Indian Tobacco. See LOBELIA.

In′diantown, a thriving suburb of St. John, N. B., near the mouth of the St. John River. Here the river steamers have their wharves. A steam-ferry connects it with Point Pleasant. Indiantown has large steam sawmills and an extensive lumber-trade. Pop. about 2500.

Indian Town, tp. of Bureau co., Ill. Pop. 1660.

Indian Valley, post-tp. of Floyd co., Va. Pop. 1475.

Indian Village, tp. of Tama co., Ia. Pop. 1523.

Indian Yellow, or **Purree,** a yellow pigment, consisting essentially of euxanthate of magnesium. (See PURREE.)

India Rubber, Caoutchouc (from *cachuchu* of the South American Indians), or **Gum Elastic** [Ger. *Kautschuk, Federharz;* Fr. *caoutchouc*], a peculiar substance, composed of carbon and hydrogen, found in suspension in the milky juice of a great many different families of plants. It has been stated that all milky vegetable juices contain it, but this is not the case, many of these juices yield gum-resins free from caoutchouc.

History.—Although known at a very early date to the Peruvians and the Chinese, it was not brought to Europe till the beginning of the eighteenth century. The first scientific notice with regard to it appeared in the *Transactions* of the French Academy of Sciences in 1735 from the pen of M. de la Condamine, who had noticed it, under the name of *cachuchu,* on his voyage down the Amazon. He describes it as in constant use among the natives in the form of bottles, boots, etc., and for making cloth waterproof. In 1751 he again called attention to "the elastic resin" of Cayenne (*Mém. de l'Acad. Royale,* 1751, pp. 17, 319), his friend M. Fresneau having reported its occurrence in the French colony of Cayenne. Herissant and Macquer (*Mém. de l'Acad. Roy.,* 1763, p. 49) published their chemical investigations on "solution of caoutchouc," and Macquer in 1768, "on means of dissolving the resin caoutchouc." Priestley (1770) mentioned the use of the gum for erasing lead-pencil marks, its cost being three shillings for "a cubical piece of about half an inch." Berniard published investigations in 1781; Fourcroy, on the sap in 1790; Grossart, "on the means of making instruments of gum elastic" in 1791. Important contributions to the chemistry of caoutchouc have been made by Faraday, Nees von Eisenbach and Marquart, Adriani, Himly, Payen, Bouchardat, and others, while the practical applications have been made by Mackintosh, Handcock, Goodyear, A. G. Day, and other inventors. The first use made of caoutchouc in Europe was for erasing pencil-marks; it was then used in solution in oil of turpentine and alcohol and in coal-tar naphtha for waterproofing cloth, the most important industry of this kind having been founded in 1823 by Mackintosh at Glasgow. Rubber overshoes, made by the natives of pure gum, were imported from Pará in 1825, and formed an important article of commerce till the increased price of the gum made it necessary to limit its use to a minimum in the manufacture of the cloth overshoes covered with rubber much diluted with litharge, whiting, etc., and vulcanized with sulphur, which are now in use. In 1826, Rattier and Guibal introduced machinery for cutting threads of rubber for the manufacture of elastic fabrics, which have since been extensively produced. The most important invention in regard to rubber was made by Charles Goodyear of Massachusetts in 1839, and patented June 15, 1844. It consisted in mixing with the rubber a small quantity of sulphur, fashioning the articles from the plastic material, and *curing* or *vulcanizing* the mixture by exposure to a temperature of 265° to 270° F. The product, known as vulcanized rubber, possessed all the desirable properties of rubber with none of its objectionable qualities, and soon found a thousand important applications. The next great step in the rubber industry was the invention of hard rubber or vulcanite. The invention is claimed for Nelson Goodyear, but the writer, after the most careful investigation of the subject, believes that the real inventor of flexible "whalebone" rubber was Austin G. Day of Connecticut. Nelson Goodyear's caveat, filed Dec. 31, 1849, and his patent, granted May 6, 1851, are for a hard, stiff, inflexible compound, which he says is best obtained by heating a mixture of rubber, sulphur, magnesia, etc. Day patented Aug. 10, 1858, a mixture of 2 parts of rubber and 1 of sulphur, heated to 275° to 300° F., which he describes as flexible and elastic. This product, correctly described by Day, is the vulcanite or hard rubber which is so extensively manufactured for combs, pen-holders, jewelry, etc. Goodyear's brittle compound has never been an article of commerce, though his representatives have succeeded in monopolizing Day's invention under the plea that it was covered by Goodyear's patent. (See *Am. Chemist,* ii. 329.)

Botany.—Caoutchouc is produced by numerous trees and shrubs of the families Euphorbiaceæ, Urticaceæ, Artocarpaceæ, Asclepiadeæ, and Cinchonaceæ. The best rubber, which is brought from Pará, South America, is obtained from the *Siphonia elastica* of Persoon, *Siphonia Cachuchu* of Rich, *Jatropha elastica* of Linnæus, and *Hevea Guianensis* of Aublet. Six or seven other species of *Siphonia* furnish caoutchouc in Central and South America. In India the most abundant rubber tree is the *Ficus elastica.* It occurs on the coast of Coromandel, and is abundant over more than 10,000 square miles in Assam; grows solitary or in twofold or threefold groups. The main trunk of one measured 74 feet in circumference, while the girth of the main trunk with the supports immediately around it was 120 feet. The area covered by the expanded branches was 610 square feet, and the height of the central tree was 100 feet. It was computed that 43,340 of these trees grew within a length of 30 miles and a breadth of 8 miles in the forest near Ferozepoor, in the district of Chardwar, in Assam. The same tree was said to be equally abundant in the district of Naudwar. The geographical range in Assam seemed to be between 25° 10′ and 27° 20′ N. lat., and 90° 40′ and 95° 30′ E. lon. It grows on the slopes of hills up to an elevation of probably 2250 feet. The *Urceola elastica* abounds in the islands of the Indian Archipelago, at Sumatra and Penang; produces the gintawan of the Malays. It is described as a creeper of growth so rapid that in five years it extends 200 feet, and is from 20 to 30 inches in girth; can yield by tapping, without being injured, 50 to 60 pounds of caoutchouc in one season. The families of plants yielding caoutchouc thrive in tropical parts of the world where high temperature is combined with moisture. The belt of land around the globe 500 miles N. and 500 miles S. of the equator abounds in trees producing the gum of India rubber. We find, accordingly, that caoutchouc is imported from Pará and other places in South America, from Central America, India, Singapore, Vera Cruz, Sierra Leone, Java, Sumatra, and Penang. The caoutchouc of Pará, South America, is produced by *Siphonia elastica;* Central America, *Siphonia caoutchouc, Castilleja elastica;* Penang, *Urceola elastica;* Sumatra, *Urceola elastica;* Java, a species of *Ficus;* continent of India, *Ficus elastica;* Sierra Leone, a species of *Siphonia.* The industrial demands for India rubber are so important that experiments have been made in Brazil with a view to cultivate the trees, as the cinchonas have been grown in the Himalaya. Caoutchouc occurs in opium to the extent of 4 or 5 per cent.; also in the juice of the milkweed (*Asclepias*), which grows abundantly in the U. S. and Canada. Efforts have been made to extract it from milkweed, and it is said that a company has been recently organized for this purpose in Canada.

Sources of Supply.—Most of the rubber of commerce is derived from South America, from Pará, Central America, Mexico, Carthagena, etc.; smaller quantities from Java, Penang, Singapore, Assam, and Natal.

Collecting the Juice.—The juice is obtained by tapping, that drawn from old trees in the cold season being preferred, and the flow being greater the higher the incisions are made in the tree. When the bleeding is confined to the cold months, and not repeated too often, the trees do not appear to suffer in consequence.

Properties and Composition of the Juice.—Caoutchouc juice or sap has been imported from time to time into England in considerable quantities, but it is found more economical to prepare the crude rubber where the juice is collected. It resembles ordinary cow's milk in color and consistence. Its sp. gr. varies from 1.012 to 1.041. Several circumstances may conduce to give the commercial juice a grayish-brown, milky-gray, or pale-yellow color, but the pure juice, as it issues from the tree, is white. Dr. Adriani, who made some valuable (*Chem. News,* ii. 277, 289) experiments upon the fresh juice of the *Ficus elastica,* tapped by himself, says that as the general result of his experiments the quantity of solid matter contained in the milky juice decreases according to its being collected from incisions made in the higher and consequently younger parts of the plant. The tree which yielded the juice for his experiments was a young plant 2.25 mètres in height.

Am't of juice evaporated.	Height at which it was taken.	Total residue.	Per cent.
0.183 grms.	0.30 mètres.	0.046 grms.	25.15
0.395 "	1.74 "	0.095 "	24.05
0.143 "	2.10 "	0.030 "	20.98
0.825 "	Top.	0.145 "	17.70

These figures prove, as stated above, that the juice in the older parts of the plant does contain more solid matter than that in the younger parts. Old trees, then, furnish the richest juice, and Mr. Griffiths states that the juice of

the reflex roots, which lie exposed, is richer in gum than any which is subsequently drawn off. If the juice be left at rest for a few hours, the globules of the gum rise to the surface and float like cream on milk. Heat and agitation also cause the juice to coagulate. There is a conflict in the statements concerning the action of alcohol, Adriani affirming that it produces coagulation, while Ure states that in two samples of juice containing, respectively, 20 per cent. and 37 per cent. of solid caoutchouc, alcohol of 0.825 sp. gr. afforded no appearance of coagulum when mixed with them in any proportion. The juice of the *Bejuca*, and possibly that of other plants, produces coagulation of the caoutchouc juice. The emulsive juice mixes readily with water, alcohol, and pyroxylic spirit, though it does not become at all clearer; it will not mix with caoutchine, naphtha, nor, indeed, with any of the usual solvents of solid caoutchouc, but remains at the bottom of these liquids as distinct as mercury does under water. When caoutchouc has once been coagulated it is not possible to bring it back again to the emulsive state. Ammonia prevents coagulation, and was used for this purpose in the importation of liquid caoutchouc prior to 1855. The following physical and chemical properties of the juice are taken from Adriani's paper: Under the microscope caoutchouc juice is seen to consist of a clear liquid wherein float a large number of spherical globules. These globules strongly refract light, and present, consequently, black circumferences by transmitted light, while they reflect the light with a white color. The diameter of the globules varies from $\frac{1}{30000}$ to $\frac{1}{5000}$ of an inch, averaging about $\frac{1}{10000}$. The reaction of the juice is slightly acid. The addition of water produces no change. Alcohol does not change the appearance of the globules, but causes the formation of groups of needle-shaped crystals. Ether causes the globules to adhere together and form an amorphous mass, and also develops crystals, which appear to be a magnesian salt of a peculiar organic acid. The following analyses have been published:

Juice of Ficus elastica (*Adriani*).

Water	82.30
Caoutchouc	9.57
Resin, soluble in alcohol, but not in ether	1.58
Magnesia, combined with peculiar organic acid	4.49
A substance soluble in water and alcohol, but not in ether (sugar?)	0.36
An organic substance, soluble in water, takes a yellow tinge with alkalies (dextrine), and traces of salts of lime and soda	2.18
	100.48

Juice of Siphonia cachuchu (*Faraday*).

Water, acid, etc.	56.37
Caoutchouc	31.70
Substances soluble in water, not in alcohol	2.90
Albuminous precipitate	1.90
Peculiar bitter coloring-matter, a highly azotized body } Wax }	7.13
	100.00

Dr. Ure found in two specimens 20 per cent. and 37 per cent., respectively, of caoutchouc. Alcohol of 0.825 sp. gr. failed to afford any appearance of coagulum when mixed in any proportion; whence he infers, contrary to the conclusions of Faraday, that albumen is not a necessary constituent of the juice. A. Girard (*Compt. rend.*, 67, 523) discovered a crystallizable saccharine substance, *dambonite* ($C_4H_8O_3$), in the white liquid found in the interior of the loaves of caoutchouc from Gaboon on the W. coast of Africa. Later, he noticed another saccharine substance, *bornesite* ($C_7H_7O_6$). (*Compt. rend.*, 73, 426.) Both these bodies may be sublimed without decomposition.

Preparation of the Crude Caoutchouc.—The juice is dried over a fire, when it becomes blackened by smoke, or in the sun, when it is very light-colored, on moulds of clay, paddles, or (formerly) on lasts imported from the U. S. for overshoes. According to Mr. Edwards, the last, on the end of a stick, was dipped into the milk, and immediately held over the smoke to dry; it was then redipped, and the process repeated till the shoe was of sufficient thickness. When clay moulds are used, they are subsequently broken and shaken out of the rubber bottles produced upon them. The juice is sometimes evaporated by solar heat, a pellicle of rubber forming on the surface, and being renewed as fast as it is removed until all the rubber is removed. These sheets are rolled into balls and combined into masses. In Nicaragua the juice is coagulated by an application of the juice of the bejuca vine. The coagulated mass is pressed into cakes by hand, and rolled out into a sheet on a board with a wooden roller. These sheets are called tortillas; they are about 2 feet in diameter and 2 inches thick. Faraday recommends for the purification of caoutchouc to dilute the natural juice with four times its weight of water, and leave it at rest for twenty-four hours. The caoutchouc then separates and rises to the surface in the form of a cream. This is removed, diffused through a fresh quantity of water, and again left to rise to the surface. By repeating this operation till the wash-water is perfectly limpid, the caoutchouc may be obtained very nearly pure. It is then to be spread upon a plate of unglazed earthenware to absorb the water, and afterwards pressed. The crude rubber of commerce presents different shapes and structure according to the method and care employed in its preparation. The purest from Pará is much more valuable than that from other localities. It appears in large bottles and thick plates, often entirely free from impurities, and very light colored within. The Carthagena gum comes in very large lumps, often weighing 100 pounds, and evidently formed by pressing thin sheets together. It is black within as well as without. The East Indian gum appears as a conglomerate of light and dark reddish-brown masses, often mixed with much wood, bark, leaves, gravel, etc. Crude impure rubber often undergoes a very injurious change, especially when exposed to the direct rays of the sun. It softens, becomes smeary and semi-fluid like tar. African gum is said to be more liable to suffer in this way than any other. In the interior of many of the balls which come from Brazil and the East Indies spots are often found of a viscid, tarry matter, which when exposed to the air seems to act like a ferment and decomposes the whole mass into a viscid, sticky, semi-fluid substance which is good for nothing.

Physical Properties of Caoutchouc.—Pure caoutchouc freshly prepared is colorless and translucent. The dark color which it generally exhibits is attributed to soot and to aloëtic and other impurities, and to the action of sunlight and oxygen. It is a bad conductor of heat and a non-conductor of electricity. It develops electricity by friction. Its specific gravity varies from 0.920 to 0.962. "Its texture is not fibrous, but under the microscope it is seen to contain pores, irregularly rounded and very numerous, which communicate with each other, and become distended by capillary attraction in those liquids in which caoutchouc is not soluble. Thin sections of different qualities of gum, immersed in water during thirty days, absorbed from 18.7 to 26.4 per cent. Their volumes were increased from $\frac{15}{1000}$ to $\frac{16}{1000}$, and their tenacity and adhesiveness were impaired. It takes a very long time to eliminate water from thick masses of gum, since the exterior pores contract in drying, and thus retard the desiccation of the interior. Anhydrous alcohol, especially when warm, easily penetrates thin sections of caoutchouc. Immersed during eight days and warmed at intervals, the sections become opaque and more adhesive, even in the midst of the liquid; their volume was increased 9.4 per cent., and the weight 18 per cent., although the alcohol had dissolved $\frac{2}{1000}$ of an oily, yellowish, fatty matter. After evaporation of the absorbed alcohol, the caoutchouc was less tenacious, more translucent and adhesive than before treatment." (*Payen.*) Freshly-cut surfaces adhere easily and firmly when pressed together—a property which is made available in forming tubes and vessels out of sheet caoutchouc. By cold or long quiescence it becomes hard and stiff, but not brittle. It is capable of condensation under compression. A cube of $2\frac{1}{2}$ inches was compressed $\frac{1}{10}$ under a pressure of 200 tons. It is perfectly elastic, becoming turbid and fibrous when strongly stretched. Gerard observed that fibres which may be extended to six times their length, might again be extended six times after exposure to a temperature of 212° F., and that the original length could thus be extended from 1 to 16625. The diameter being of course at the same time diminished, fibres of remarkable fineness are obtained in this way. Rubber may be temporarily deprived of its elasticity. If a strip be forcibly stretched, and while in this condition be quickly cooled, it will lose its elasticity, and may be left for an indefinite time without regaining it. A simple way of cooling the strip is to wet it and evaporate the water by vibrating it rapidly in the air. In the above condition the caoutchouc resembles frozen rubber, though it is not quite so rigid as it might be in such a state. It soon regains its elasticity on being subjected to an atmosphere of 70° F., or even much below this; but rubber deprived of its latent heat by compression has been kept several weeks in an atmosphere of 80° F. without returning to its normal condition. If the heat be raised much above 80°, or if the rubber be placed in contact with a good conductor at 80°, it gradually recovers its latent heat, and in a few minutes is restored to its original dimensions. If successive portions of the inelastic strip be pinched between the fingers, it contracts powerfully in these parts, leaving the others unaffected, thereby preserving the appearance of a string of knots or beads, which may be preserved in this state for any length of time if not handled and if kept at a moderate temperature. The junctions of the different portions continue abrupt and well defined, showing that there is no tendency to distribution or equilibrium of the latent

heat. When the inelastic strip is enclosed in the hand a slight degree of coolness is felt from the rapid absorption of heat. The above peculiarity is stated to belong to the native gum, and to be hardly perceptible in the rubber prepared in either of the following methods: (1) solution in turpentine and subsequent drying, and (2) merely grinding the crude material to a pasty mass and reducing to thin sheets between heated rollers. Another method of rendering caoutchouc inelastic was employed in 1840 in the manufacture of "elastic tissues," to prepare the threads for receiving a sheath upon the braiding-machine. The threads were stretched by hand, in the act of winding upon the reel, to seven or eight times their natural length, and left two or three weeks in a state of tension. The elasticity in this case also may be restored by warming the rubber—rubbing it between the palms of the hands, for instance. Considerable heat is developed in the sudden extension of caoutchouc. Mr. Brockedon states that he raised the temperature of an ounce of water two degrees in fifteen minutes, by collecting the heat evolved by the extension of caoutchouc thread. (*Blossom.*) *An apparent paradox* has been announced in the fact that India rubber, when stretched and exposed to the heat, contracts instead of expanding—a fact very contrary to common experience as the result of the application of heat. This is explained, however, by the fact that the rubber is very porous and filled with air-cells, which, when the rubber is stretched, assume an elongated shape. When heat is applied it of course expands the rubber to a certain degree, but at the same time it expands the air-cells, which, by shortening their longitudinal axes, produces a virtual contraction of the rubber.

Effect of Heat on Caoutchouc.—"Below 0° C. it becomes hard and rigid. When heated it gradually softens, and at 120° C. (248° F.) begins to melt; when it is fused it remains greasy and semi-fluid after cooling, but if exposed to the air in thin layers gradually dries up and recovers its original properties, provided it has not been heated much above its melting-point. If, however, it be heated to 200° C. (398° F.), it begins to fume, and is converted into a viscid mass which no longer dries up. If mixed in this state with half its weight of lime slaked to powder, it forms a tenacious non-drying cement, which serves admirably for attaching glass plates to vessels with ground lips, such as are used for preserving anatomical preparations, as it forms an air-tight but easily-loosened joint; if a drying cement be required, a quantity of red lead may be added equal in weight to the lime." (*Watts.*) By destructive distillation caoutchouc yields an empyreumatic oil called *oil of caoutchouc*, which is a mixture of a considerable number of hydrocarbons. The following compounds have been recognized by Bouchardat, Himly, and G. Williams:

	Composition.	Sp. gr.	Boiling-point.
Tetrylene	C_4H_8	0.630	32° F.
Caoutchene	C_4H_8	0.650	58° F.
Faradayin		0.654	91° F.
Isoprene	C_5H_8	0.682	100° F.
Caoutchin	$C_{10}H_{16}$	0.842	352° F.
Heveëne	C_nH_{2n}	0.921	599° F.
Creosote, resin, etc.			

From impure gum small quantities of carbon dioxide, carbon monoxide, water, and ammonia are also produced. The residue left in the retort forms, when dissolved in oil, a varnish impervious to moisture and very elastic. Exposed at once to a red heat, caoutchouc yields 30,000 cubic feet of extremely rich gas to the ton, which is free from ammonia and sulphur compounds. Ignited in contact with the air, it burns with a sooty flame.

Effect of Water on Caoutchouc.—Water, whether hot or cold, has no solvent action upon it, but by long boiling in this liquid it swells to some extent, in which state it is affected by some solvents with greater facility than in its ordinary condition. Exposed to the air, the caoutchouc resumes after a time its original form, though the desiccation proceeds very slowly. The absorption of water by thin sheets has been already alluded to. W. A. Miller noticed that when a sheet of the best masticated rubber was exposed in water, open to the air, to diffused light, it finally absorbed 87 per cent. of water, becoming white, opaque, slimy, and sticky. In this condition water could be squeezed out of it. In sea-water, under like conditions, it absorbed only 5 per cent.

Solubility of Caoutchouc.—In alcohol it swells and softens, but does not dissolve. Alcohol precipitates it from its solutions. It sometimes extracts a fatty, fusible yellow matter, which is probably an oxidation product. Ether, freed from alcohol by washing with water, dissolves caoutchouc in moderate quantity, leaving it on evaporation with its original properties, except that it adheres firmly like a sheet newly cut. "No solvent appears to make a complete solution of caoutchouc, but a mixture formed by the interposition of the dissolved portion between the pores of the insoluble substance, which is considerably swelled up, and has thus become easy to disintegrate. By employing a sufficient quantity of these solvents, renewed from time to time, without agitation, so as not to break the tumefied portion, the caoutchouc may be completely separated into two parts—viz. a substance perfectly soluble, ductile, and adhering strongly to the surface of bodies to which it is applied; and another substance, elastic, tenacious, and sparingly soluble. The proportions of these two principles vary with the quantity of the caoutchouc and the nature of the solvent employed. Anhydrous ether extracts from amber-colored caoutchouc 60 per cent. of white soluble matter: oil of turpentine separates from common caoutchouc 49 per cent. of soluble matter having a yellow color." (*Watts.*) Chloroform, oil of caoutchouc, oil of turpentine, oil of lavender, and many other essential oils are solvents for caoutchouc. A mixture of 1 part of caoutchouc with 11 of oil of turpentine, worked up to a thin paste, to which is then added $\frac{1}{2}$ part of a hot concentrated solution of sulphide of potassium (K_2S_5), leaves the caoutchouc on evaporation perfectly elastic and without viscosity. Bisulphide of carbon is one of the best solvents, particularly when mixed with 6 to 8 per cent. of absolute alcohol. "If the alcohol be mixed with a little water, a dough is obtained, from which the caoutchouc may be drawn out into threads and spun. By Gerard's process gutta percha is also soluble in the above mixtures of sulphuret of carbon and alcohol." (*Ure.*) Considerable discrepancy exists among writers with regard to the solubility of caoutchouc in the fixed oils, especially in linseed oil. According to Booth, linseed oil has no effect. J. Spiller exposed virgin, unmanufactured rubber for nine months to the action of boiled and of unboiled linseed oil. "It resisted the action of the solvents," he says, "almost perfectly retaining its toughness, except in those parts which were above the surface of the liquid and exposed to light. Virgin rubber, masticated and treated in the same way, was in each case greatly swollen and gelatinized, and, indeed, in the case of the unboiled oil, was completely dissolved." Perfectly dissolved by boiling linseed oil. (*Heusler.*) Linseed oil dissolves caoutchouc, forming a varnish which, according to Ure and Parnell, has not the property of depositing the gum on exposure to the air. Varrentrapp, in the *Handwörterbuch*, says linseed oil behaves like other fatty oils, which take up a little caoutchouc when heated. He also remarks that different varieties of gum behave very differently with regard to solvents, some being with difficulty soluble even in bisulphide of carbon. He attributes this difference to the presence of more or less water. Coal-tar naphtha, benzol, coal and shale oil naphthas, and petroleum naphtha are all solvents for caoutchouc. The naphtha solution or varnish was used in preparing the waterproof cloth of Mackintosh, being placed between two thicknesses of the cloth. A mixture of 50 parts of benzol and 70 parts of rectified turpentine has been recently recommended as a solvent for 26 parts of caoutchouc. The crude gum must first be boiled in water to remove dirt, etc., cut under water into sheets about one-third of an inch thick, rolled out into thin strips, and thoroughly dried in a heated room. The mixture of gum, etc. must be passed through a mill. The benzol and turpentine must be free from fat.

Action of Reagents on Caoutchouc.—Acids and alkalies have no effect on it when dilute, and little when concentrated unless heated. Sulphuric acid carbonizes it slightly on the surface when cold, but entirely decomposes it when hot, with the formation of carbonic and sulphurous acids. Strong nitric acid decomposes it, especially when heated, forming carbonic and oxalic acids, and evolving nitric oxide. The strongest potash lye does not attack it at a boiling heat. Gases, such as chlorine, sulphurous acid, and fluo-silicic acid, have no action upon it, but nitrous acid vapor readily attacks it. Ammonia, after a contact prolonged several months, seems to exert the curious influence of bringing it back to the state of an emulsion, in which form it may be used as a varnish, as it recovers its peculiar qualities on drying. Thoroughly kneaded with sulphur and exposed to heat for several hours, it is converted into *vulcanized rubber*, which, with less than 1 of sulphur to 4 of gum, is soft and pliable; with half its weight of sulphur, after exposure to a temperature above 280° F., it is hard and flexible, like whalebone—*vulcanite*. W. A. Miller has shown (*J. Lond. Chem. Soc.*, 1865, p. 273), in an investigation on the *Decay of Gutta Percha and Caoutchouc*, that caoutchouc is liable to deterioration by exposure to the action of oxygen in the presence of solar light, but the gum is less rapidly injured by their influence when in the native state than when it has been previously masticated. When subjected to the action of air, excluded from light, it does not experience any marked change, even during very long periods. It is, however, important to observe that the masticated rubber is much more porous than the unmanufactured caoutchouc. A sample of the best Pará rubber after nine months' exposure had gained 2.8

per cent., had become brown and sticky, and yielded to alcohol 11.81 per cent. of a resin containing C. 67.23, H. 9.54, O. 23.23.

Chemical Composition of Caoutchouc.—According to the experiments of Ure (*Phil. Trans.*, 1822), confirmed by those of Faraday (*Quart. Journal of Sc., Lit., and Art*, xi. 19), caoutchouc is composed wholly of carbon and hydrogen, containing 87.5 per cent. of carbon and 12.5 hydrogen. It is not, however, a simple proximate principle, but chiefly a mixture of two substances, one much more soluble in ether, benzole, and other liquids than the other. The following analyses have been published (Ure's *Phil. Trans.*, 1822; Faraday's *Q. J. Sci.*, 1826, xxi. 19; G. Williams's *J. Chem. Soc.*, xv. 123):

	Ure.	Faraday.	G. Williams. Brown.	G. Williams. Yellow.
Carbon	90.	87.2	86.1	87.2
Hydrogen	9.12	12.8	12.3	12.8
Oxygen	0.88	......	0.7	
Nitrogen	......	......		
Loss	......	......		
Ash	......	......	0.9	
	100.00	100.0	100.0	100.0

The following are the results of W. A. Miller's analyses of pure manufactured Pará rubber, compared with a sample of good sheet masticated or manufactured rubber (*J. Chem. Soc.*, 1865, iii. 273):

	Virgin.	Masticated.
Pure caoutchouc	96.60	96.64
Resin	1.80	2.06
Moisture	1.30	0.82
Ash	0.30	0.48
	100.00	100.00

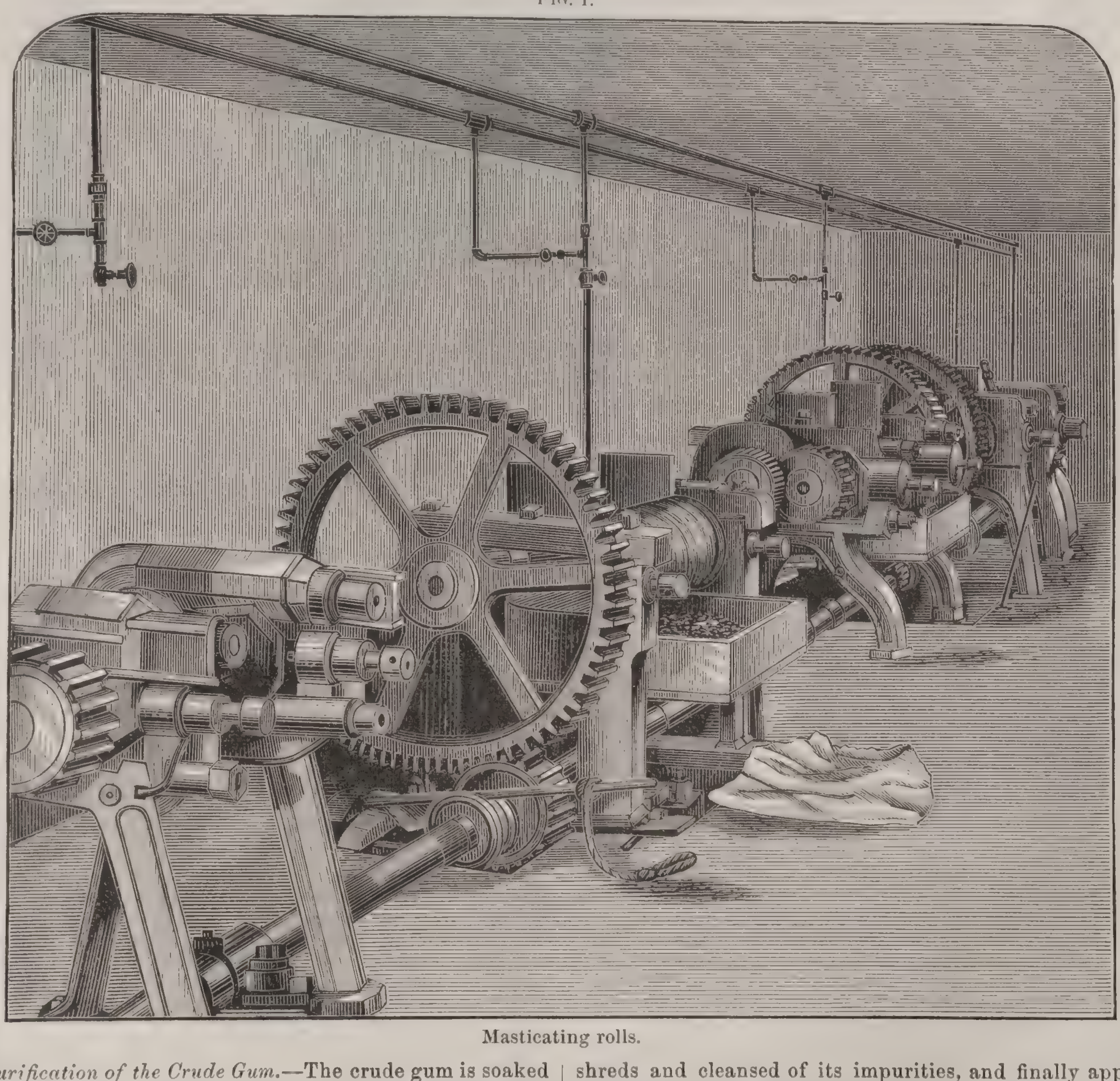
Deducting moisture and ash, the elementary composition gave—

	Virgin.	Masticated.
Carbon	85.82	85.53
Hydrogen	11.11	12.06
Oxygen	3.07	2.41
	100.00	100.00

Adriani (*Chem. News*, ii., 1860, 314) found the following composition for a sample of caoutchouc which had been dried for months over sulphuric acid. The specimen was in part readily reduced to powder, and contained C. 87.25, H. 10.34, O. 11.40; total, 99.99. This sample also contained nitrogen, but its quantity was not determined. Several chemists report the presence of nitrogen in commercial caoutchouc. Adriani found that a sample of the above caoutchouc, after having been confined in very dry air for some weeks, lost its most prominent physical properties, and that a change set in which Payen compares with the growing rancid of fats and oils. "Perhaps," Adriani says, "the decomposition starts from that constituent portion which contains nitrogen, although this element is present in only minute quantity."

Caoutchouc manufactures have of late years acquired enormous importance, and are found in every department of the industrial arts. The caoutchouc is used (1) in blocks, cakes, sheets, etc.; (2) in tapes or threads in woven fabrics for the production of elastic tissues; (3) as a varnish between two surfaces of cloth or on one surface, for the production of waterproof fabrics; (4) in solution alone or combined with other substances as a cement; (5) combined with a small quantity of sulphur and mixed with other substances, as *soft vulcanized rubber*, for the manufacture of overshoes, boots, gloves, waterproof clothing, and other goods, life-preservers, gas-bags, steam and water packing, belting, fire-hose, tubing, springs, artificial sponge, etc.; (6) combined with a larger proportion of sulphur, and cured at a higher temperature, as *hard vulcanized rubber*, or vulcanite, for the manufacture of combs, pen and pencil holders, rulers, inkstands, buttons, canes, syringes, jewelry, and colored with vermilion for mountings for artificial teeth, etc.; (7) combined with asphalts, oils, sulphur, etc., and vulcanized, as the *kerite* of A. G. Day, for covering telegraph wire—a most valuable substitute for gutta percha for air-lines, as it is not affected by atmospheric influences, which so quickly destroy the latter substance.

FIG. 1.



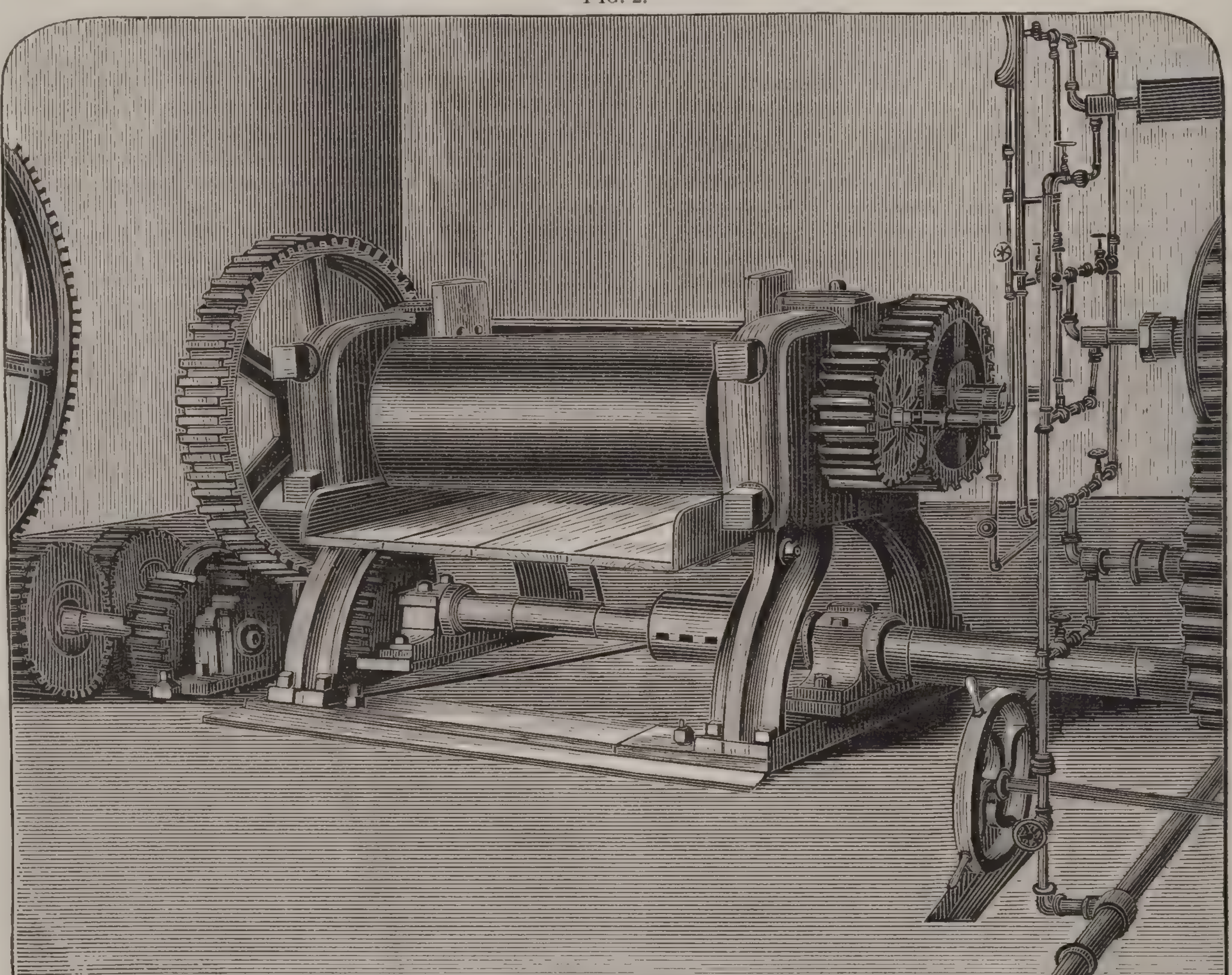
Masticating rolls.

Purification of the Crude Gum.—The crude gum is soaked in hot water, to which is frequently added some soda-ley in order to soften and cleanse it. It is then masticated between most powerful rolls made of chilled iron, under streams of cold water. By this operation it is torn into shreds and cleansed of its impurities, and finally appears as a loose mat composed of shreds. These mats are placed in drying-rooms heated by steam for several weeks, to remove the moisture. When ready for use they are kneaded between smooth rolls, which are hollow and warmed by

steam, one of which revolves much faster than the other. Here the gum is thoroughly mixed and reduced to a homogeneous mass, ready for cutting into any desired form, or for mixture with the materials necessary to convert it into soft or hard vulcanized rubber.

Cutting into sheets is performed by a self-acting machine, in which a straight steel blade, kept cool with water, vibrates in a horizontal position. *Strips or bands* are cut from disks by circular shears, like those used in paper-works. *Threads of India rubber* for weaving into elastic fabrics are either natural or vulcanized; they are cut from ribbons or bands by circular cutting edges. "They are stretched, and kept extended till nearly deprived of their elasticity, and till they form a thread of moderate fineness. This thread is put into a braid-machine and covered with a sheath of cotton, silk, linen, or worsted. The clothed caoutchouc is then laid as warp in a loom and woven into an elegant ribbon. When woven, it is exposed upon a table to the action of a hot smoothing-iron, which restoring to the caoutchouc all its primitive elasticity, the ribbon retracts considerably in length, and the braiding corrugates equally upon the caoutchouc cores. Such bands possess a remarkable elasticity, combined with any desired degree of softness. Sometimes cloth is made of these braided strands of caoutchouc, used both as warp and as weft, which is therefore elastic in all directions. When a light fabric is required, the strands of caoutchouc, either naked or braided, are alternated with common warp yarns." (*Ure.*) *Round threads* are made from a mixture of India rubber and bisulphide of carbon, with a little absolute alcohol. This paste is put into a vertical cylinder, somewhat similar to those which are used by the vermicelli-makers. The elastic matter, forced through by the piston, comes out in threads through small holes placed in a single row, in order that they may not overlie each other—a precaution that is not required in the making of vermicelli. The threads are received on an endless web of velvet in motion, and traverse in this way a course of 13 feet; they are then taken up by a web of common cloth, which passes over a space of 500 to 660 feet in about ten minutes. At the end of this journey they are sufficiently dried; the solvent is in great measure separated; the threads then quit the web, and are received into channels or grooves, which conduct them into small cups disposed in seven rows, in such manner that each one has its own particular cup. When the cups are full the filament is taken out, and is left for some days exposed to the action of the air. The threads produced by pressure have any required thickness, and this may be made to vary at pleasure. Experience has shown that a thickness of .0394 of an inch is preferable for regular work,

FIG. 2.



Mixing rolls.

but these do not suffice for all kinds of fabrics; in a great number of cases they must be used finer. For this purpose annealing is resorted to. The caoutchouc, being drawn out and exposed to a temperature of 239° F., no longer shrinks, but retains the length it has acquired, and moreover may even be drawn out anew. By thus stretching and annealing it successively a thread of caoutchouc may be brought to a degree of fineness limited only by the dexterity of the workman, and may, for example, be represented by a length of 98,400 feet to 2.205 pounds. The thread thus obtained is of common caoutchouc, but nothing is simpler than to make, in the same manner, thread of vulcanized caoutchouc; for this purpose it is only necessary to incorporate the caoutchouc into a paste with flowers of sulphur, and to heat to the temperature of 266° or 284°. Let it be noted in passing that at the temperature of 239°, necessary for the annealing of the stretched thread, no vulcanization takes place. (*Muspratt.*)

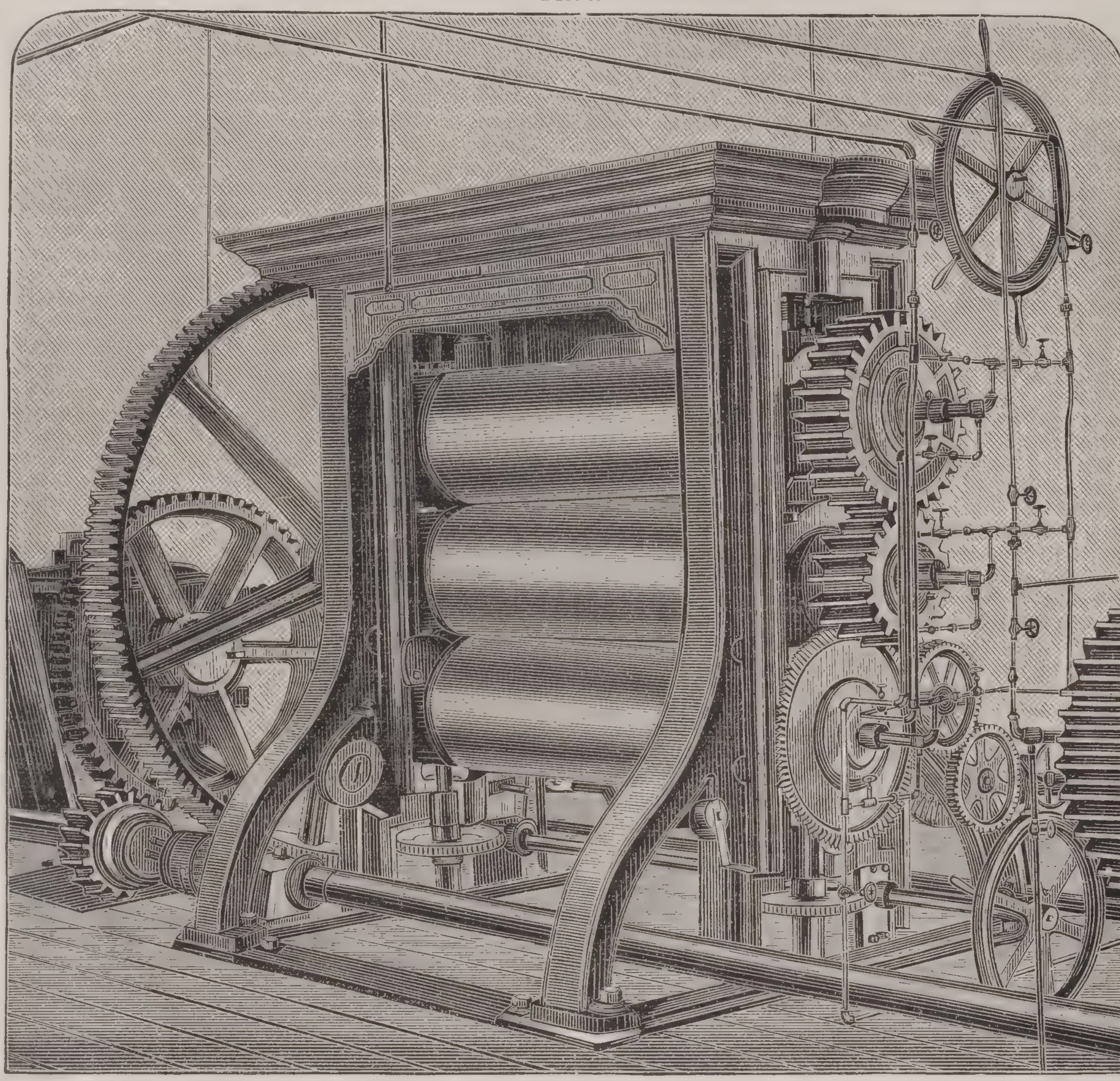
Waterproof fabrics are made by placing a varnish or paste of caoutchouc, dissolved in any of its solvents, between two layers of cloth (*double-texture fabrics*) or on one side of the cloth (*single-texture fabrics*). The poorest kind of rubber may be used for this purpose. An objection existed to the single-texture fabrics, as the rubber surface was liable to become sticky and adhere when exposed to the sun, closely packed, or brought in contact with perspiration, hot surfaces, grease, etc. This was prevented by the sincalor process (*sine calore*, "without heat"), the nature of which was kept secret. It is also prevented by using vulcanized rubber, the mixture of rubber, sulphur, etc. being applied to the cloth by means of calender rolls, and vulcanized afterwards.

Rubber cements, possessing astonishing adhesive properties, are made by combining solutions of caoutchouc in naphtha or other suitable solvent with other materials of a resinous character. Jeffrey's marine glue is made by dissolving 1 pound of caoutchouc in 1 gallon coal-tar naphtha, and adding 20 pounds shell-lac. The mixture is gently heated till uniform, and is then poured out upon plates of iron to solidify. For use it is melted at a temperature of about 250° F. It is insoluble in water, and wood joined by it breaks sooner across the fibres than at the joint. A cheaper marine glue is made by substituting asphalt for the shell-lac. A liquid marine glue is made by increasing the quantity of the solvent.

Soft vulcanized caoutchouc was invented by Charles Goodyear of Massachusetts. In the early introduction of India-rubber goods it was found that the articles were not

only liable to serious injury from various causes, but they were often found to deteriorate and become almost useless after a few years of the most careful use. The following are some of the most serious disadvantages of the unvulcanized gum: (1) It becomes rigid and inflexible in cold weather. (2) It is softened and decomposed in the sun and hot weather. (3) It is very soluble, and quickly dissolved when brought in contact with any kind of grease, essential or fatty oils, and, though more slowly, yet as surely, dissolved by perspiration. (4) It is, in its native state, so very adhesive that when any two surfaces are brought in contact they become, by slight pressure, one mass that cannot be separated. (5) It loses its elasticity by continued tension or constant use. (6) It has a very unpleasant odor. The Mackintosh goods made in England, and in which a solvent was used, were less liable to damage and decomposition, because the gum was protected by being spread between two cloths. Even in these goods, however, the gum was found to melt and penetrate through the meshes of the cloth in a warm climate, or when much worn by those who perspire freely, and purchasers were cautioned against approaching too near the fire with the goods. The inability to overcome these defects caused the failure of many manufacturers in Boston, South Boston, Chelsea, Woburn, and Framingham, Mass., and in Staten Island and Troy, N. Y. Factories had been started in these places with capitals varying from $50,000 to $500,000. In the summer of 1838, Mr. Goodyear became acquainted with Nathaniel Hayward, who had been employed as foreman of the Eagle Company at Woburn, where he had made use of sulphur by impregnating the solvent with it. It was through him that Mr. Goodyear received the first knowledge of the use of sulphur *as a drier* of gum-elastic. Mr. Goodyear purchased the claim for combining sulphur with India rubber, for which a patent was taken out Feb. 24, 1839. "It should be remarked," says Mr. G., "that this claim was for the use of sulphur, and not for the heating or vulcanizing process, which he subsequently discovered." Mr. G. manufactured a large lot of goods containing sulphur, but they all decomposed in a short time. While ex-

Fig. 3.



perimenting upon some of the material, after the failure of the compound, to ascertain the effect of heat upon it, he was surprised to find that the specimen, being carelessly brought in contact with a hot stove, charred like leather. He inferred directly that if the process of charring could be stopped at the right point, it might divest the gum of its native adhesiveness throughout. Upon further trial he was convinced of the correctness of this inference by finding that India rubber could not be melted in boiling sulphur at any heat ever so great, but always charred. On heating one of his specimens before an open fire, he noticed upon the edge of the charred portions of the fabric a line or border that was not charred, but perfectly cured. His discovery was now established; it remained only to complete it in detail. In speaking previously of the obstacles that stood in his way, Mr. Goodyear says: "No one who had any knowledge of the nature of the gum would be likely to apply a high degree of heat to it from design, when it was so well known that it would melt at a low temperature." The process of treating caoutchouc which Mr. Goodyear thus discovered is known as vulcanization. The product of his manufacture is known as *soft rubber*. Since there are to-day other processes for treating caoutchouc different from that of Charles Goodyear, and which in some instances yield an entirely different product, but all of which pass under the same general designation of "vulcanization," the latter term must be understood as embracing *the treatment of caoutchouc with some form of sulphur to effect certain changes in its properties, and yield a soft or a hard product.*

The following valuable properties of the soft vulcanized rubber are enumerated by Mr. Goodyear: (1) *Elasticity.*—Improved and increased as regards strength and continuance, and also made available in all climates and in all circumstances. (2) *Pliability.*—Pliable in the highest degree, not being affected or made rigid by the greatest cold. (3) *Durability.*—Unchanged by time, whether kept in a wet or dry state. (4) *Insolubility.*—Not absolutely insoluble, because it can be softened, and even dissolved, by powerful solvents of the gum when heated and boiled. Its power of resistance to solvents and other destructive chemical agents

is, however, truly great. In a few words, it is either improved or remains uninjured when exposed to destructive agents that destroy other fabrics, and even wood, leather, and the metals, such as iron, copper, and brass. (5) *Unalterability by Climate and Artificial Heat.*—Endurance of artificial heat very great; when compounded with particular reference to this quality, and with a larger proportion of sulphur than is ordinarily used, it will bear a heat of 300° F. Above this chars, but does not melt. (6) *Inadhesiveness.*—Entirely free from this objection, no way being yet found to unite it firmly, even when it is desired. (7) *Impermeability to Air, Gases, and Liquids.*—Improved for retaining water and other liquids, as it is not softened by them, but it cannot be stated that it is more impervious to air and gases. (8) *Plasticity.*—The facility with which it is formed into any shape before being heated in the oven is not surpassed by wax or by lead, or any other material. (9) *Non-electric Property.*—One of the best non-conductors of electricity. (10) *Odor.*—Mr. Goodyear says that vulcanized India rubber is, to a very great extent, freed from the natural offensive odor of the native gum.

Theory of Vulcanization.—The sulphur appears to combine directly with the rubber; the total change in properties and insolubility in the ordinary solvents for rubber makes the theory of mere mechanical mixture untenable; while the fact that no appreciable quantity of sulphuretted hydrogen is evolved during the operation makes it improbable that a substitution of sulphur for hydrogen occurs. In experiments conducted by Prof. B. Silliman and the writer it was found that mixtures of sulphur, even when vulcanized into hard vulcanite, lost only 2 to 3 per cent. in weight, of which much was moisture; in two cases the H_2S produced amounted to 0.36–0.59 per cent. of the weight of the mixture.

The manufacture of soft vulcanite goods is effected by simple mechanical means. The purified and masticated gum is kneaded on the warm rolls with the proper proportion of sulphur; less than one-fourth the weight of the gum, Goodyear's patent states, generally 5 or 6 per cent. in practice. Various other substances are added to increase the volume of the product and make the caoutchouc, which is the most expensive material, go further. The following is a mixture in common use: rubber 16, sulphur 1, whiting 14, white lead 2½, litharge 2. Lead compounds blacken the goods by forming black sulphide of lead; oxide of zinc is sometimes used in its place. Refuse vulcanized rubber and fabrics composed of rubber and cloth are torn up on the masticating rolls and incorporated with the mass for some goods. After the mass is kneaded into a uniform mixture, it is taken from the rolls in the form of a thick sheet and rolled into smooth sheets between calender rolls. From these plastic sheets articles of any desired shape are readily formed by simple mechanical means. The mixture may also be applied on the calender rolls to one or both sides of cloth or canvas. As the mixture is in this condition very adhesive, the coated cloth can be cut and fashioned into overshoes, boots, fire-hose, etc., each article consisting practically of one single piece after vulcanization. The combination with the rubber of cloth or canvas gives great strength to the manufactured articles, while the rubber gives the waterproof properties. Fire-hose made of several layers of rubber-coated cotton duck was found by Prof. Henry Morton and the writer to withstand an internal water-pressure of from 375 to 435 pounds to the square inch. To prevent the decay of the canvas of this hose, Mr. John Murphy of the New York Gutta Percha and Rubber Manufacturing Co. uses carbolic acid, which is simply incorporated with the rubber mixture before it is applied to the cloth. Sheets built up of successive layers of canvas and rubber are extensively employed for valves and for packing.

The heating or vulcanizing is conducted in very strong horizontal cast-iron cylinders (*the heaters*), one end of which is movable and serves as a door. The goods to be vulcanized are loaded upon a car and run in on a railway which extends along the bottom of the heater. To prevent adhesion of the different articles, powdered soapstone (steatite) is freely used, the goods being often packed in boxes filled with this substance. When the heater is charged the door is securely fastened, and steam from a high-pressure boiler let in till the desired temperature is secured. The temperature employed and the time of exposure vary somewhat according to the character of the articles; 5 hours at 240° F. is stated to be the temperature employed for fire-hose. The following 4½-hour "heat" is used in some of the factories where smaller articles are made: 1 hour at 255° F.; 1 hour at 260°; 1 hour at 265°; 1 hour at 270°; ½ hour at 275°. The temperature should never exceed 280° F.

Parkes's cold vulcanizing process was patented by Alexander Parkes of Birmingham, and has been used to a limited extent, though, owing to the fact that the sulphurization of the caoutchouc is more or less superficial, the manufactured articles are inferior to those vulcanized by Goodyear's process; in fact, they are sometimes almost worthless. The caoutchouc articles are simply immersed in a mixture of 40 parts of sulphide of carbon and 1 part of chloride of sulphur; they are next placed in a room heated to 70° F., and when all the sulphide of carbon has been volatilized, the process is in so far complete that it is only requisite to boil them in a solution of 1 pound of caustic potassa to 3 gallons of water, the vulcanized caoutchouc being next washed to remove excess of alkali. Humphrey in 1870 introduced the use of gasolene from petroleum, instead of sulphide of carbon, as the former fluid dissolves chloride of sulphur readily.

Other methods of vulcanization have been tried, but with little success: (1) By immersing the sheet caoutchouc in sulphur heated to 233° F. till it has absorbed about $\frac{1}{15}$ of its weight, and then heating it for a short time to 302° F., or by immersing the caoutchouc in sulphur heated to 302° F., and keeping up that temperature till the sulphuration is complete. (2) Handcock: exposing the rubber in sheets to vapors of sulphur. (3) H. Gaultier de Claubry (1860) vulcanizes caoutchouc by the aid of bleaching-powder and flowers of sulphur. This mixture produces chloride of sulphur, and the caoutchouc treated by it contains some chloride of calcium. (4) Gérard: by immersing articles of caoutchouc in a solution of polysulphide of calcium or potassium, marking 25° Baumé, keeping them in it for three hours at a temperature of 300° F. under a pressure of 5 atmospheres or 75 pounds to the square inch. The goods are finally washed with an alkaline ley of 60° B. (5) Burke: mixing the rubber with 5 to 15 per cent. of orange sulphide of antimony (*kermes*), and heating the articles fashioned from it to 250°–280° F.

Hard vulcanized caoutchouc, vulcanite, ebonite, hard rubber, is prepared by kneading together 16 parts of rubber and 8 of sulphur in the manner already described for soft rubber, rolling the plastic mixture into sheets, rods, tubes, and other forms, and vulcanizing in a steam-tight heater. To secure a smooth, polished surface each article may be enveloped in thick tin-foil, which is stripped off after vulcanization. The articles are placed in the heater in trays filled with powdered soapstone or water. The product is very hard, and possesses a spring-like elasticity, like that of whalebone. It may be sawed, filed, and worked in a lathe like ivory, and admits a very high polish. Its color is dark brown, nearly black. It may be colored jet black by the addition of a little litharge, red by vermilion. A mixture of 16 parts of rubber, 6 of sulphur, and 12 of vermilion is bright red, and is much used. When properly made, vulcanite is not brittle; an elastic shred may be cut with a penknife from its edge. The careful regulation of the temperature of the heater during its vulcanization is necessary to secure the best product. The following heat gives excellent results: 1 hour at 275° F.; 3 hours at 300°; 3 hours at 305°. Vulcanite differs from soft rubber in the proportion of sulphur used, in the high heats used in curing it, and in its hardness. The turnings and borings of vulcanite are reduced to a fine powder and pressed in hot iron moulds for the manufacture of buttons, strips for knife-handles, etc. The vulcanite is not attacked by solvents, neither those which dissolve the pure caoutchouc nor the mineral acids and alkalies. On this account it is used in place of glass for cups for galvanic batteries. It is also especially distinguished by the large quantity of electricity which it evolves when rubbed; hence it makes an excellent material for the plates of electrical machines. It will be impossible to enumerate the various applications of this material; some of them have been already mentioned. An important application is for the manufacture of emery-wheels and hones for sharpening scythes, sickles, etc. For this purpose it is mixed before vulcanizing with emery or quartz. The following proportions give excellent results: rubber, 11 parts; sulphur, 5 parts; emery, 160 parts.

Nelson Goodyear is generally considered to have been the discoverer of *flexible vulcanite*, and was claimed to be such by Henry B. Goodyear, the administrator of his estate. No one will dispute his claim to the discovery of *hard rubber*, but the writer and others who have carefully examined the history of the case believe that Austin G. Day of Connecticut invented the flexible vulcanite, which is the only kind that ever possessed any practical value or commercial importance. Nelson Goodyear's original patent was granted May 6, 1851. In this he says: "The nature of my invention consists in so compounding caoutchouc with other substances that the composition thus formed, when subjected to the heating or curing process described in the patent of Charles Goodyear, dated June 15, 1844, and in the reissue of said patent, dated Dec. 25,

1849, will form a hard, stiff substance hitherto unknown . . . , etc. The indispensable ingredients used in my composition are caoutchouc and sulphur; and when only these two ingredients are used, the best proportions will be about equal parts by weight of each of them; indeed, a much less proportion of sulphur will not suffice. But though the combination of so large a proportion of sulphur with the caoutchouc will produce, when cured, a hard substance, a still better result will be obtained by the introduction of magnesia, lime, carbonate of magnesia or lime, or sulphate of magnesia or lime, into the composition, in which case the following proportion will be found a highly advantageous one—namely, 1 pound of caoutchouc, ½ pound of sulphur, and ½ pound of magnesia or lime, or carbonate of magnesia or lime, or sulphate of magnesia or lime . . . , etc. The compound must be subjected to the heating or curing process already mentioned as patented by Charles Goodyear, and to which reference is hereby made for a particular description thereof; in most cases the heat will be required to be raised as high as 260° or 275° F., and the time of exposure to the heat will range from three to six hours or even longer . . . , etc. What I do claim as my invention, and desire to secure by letters patent, is the combining of India rubber and sulphur, either with or without shell-lac, for making a hard and inflexible substance hitherto unknown, substantially as herein set forth. And I also claim the combining of India rubber, sulphur, and magnesia or lime, or a carbonate or a sulphate of magnesia or of lime, either with or without shell-lac, for making a hard and inflexible substance hitherto unknown, substantially as herein set forth." The product of the foregoing specifications is distinctly stated to be an *inflexible* substance.

On the death of Nelson Goodyear, Henry B. Goodyear, his administrator, obtained two separate reissues of the original patent—one for the process of manufacture, and the other for the product, both bearing date of May 8, 1858. In both these reissues we find an entirely new property claimed for the product—viz. *the spring-like property, under flexure, found in whalebone.* The writer has discussed this subject with the men who worked in the factory when Goodyear made his experiments, and who say that he never made "whalebone rubber," but simply a hard, brittle compound. He used a large proportion of magnesia in all his compounds, and did not heat them above 275° F.; both of which facts are fatal to the theory that he made whalebone rubber. His specimens were cured in a heater used for soft-rubber goods, which was run at heats from 255° to 275° F.; a higher temperature would have ruined the goods. In an elaborate series of experiments on this subject, made on a large scale by Prof. B. Silliman and the writer, it was found that a mixture of rubber 16, sulphur 8, and magnesia 8 was converted into a *hard, brittle* compound by a temperature of 275° F., but under no conditions into whalebone rubber; while a mixture of rubber 16 and sulphur 8 could not be hardened at all unless heated above 275° F. This confirms the other statements with regard to Goodyear's hard, brittle, and useless product. Day has never been able to vindicate his claims to this invention in the courts against the powerful combination of capital which holds the Goodyear patents. (See *Am. Chemist*, ii. 329.)

Dental vulcanite, consisting of rubber 16, sulphur 6 to 8, vermilion 12 to 16, was mixed and sold to the dentists, who used it for plates for mounting artificial teeth. This is one of the most important applications of hard rubber ever made, as it greatly reduced the cost of artificial teeth. The dentist makes a mould of the mouth in plaster of Paris, sets a plate of the plastic-rubber mixture in it, arranges the porcelain teeth in proper position, and heats the whole in a small vulcanizer over a gas-burner, thus converting the whole into a light plate of teeth which fits the mouth of the patient. The high charges of the patentees of this application of vulcanite drove the dentists to seek to evade the patents. The greatest success attended the efforts of J. B. Newbrough and E. Fagan of New York, who obtained patents for hardening rubber by means of iodine and bromine. Considerable litigation resulted, which finally terminated in a compromise. It was found that rubber could be hardened by iodine and colored with oxide of iron without the aid of any sulphur, but when colored with vermilion a certain addition of sulphur was required—less, however, than the minimum of the hard-rubber patents. (See *Am. Chemist*, ii. 373.) Newbrough also succeeded in hardening rubber with a product obtained by treating oil of turpentine with oil of vitriol.

Compounds of coal-tar, asphalt, etc. with caoutchouc have been frequently tested, but they can be used only for very inferior goods.

Kerite is a compound containing coal-tar and asphalt, with several other substances, the exact nature of which is a secret. It was invented by Austin G. Day, and is extensively used for covering telegraph wire. It is cheaper than gutta percha, and possesses the additional advantage of resisting the atmospheric influences which destroy this substance.

Kamptulicon is the name that was given to a mixture of India rubber, gutta percha, and cork or wood sawdust. It was rolled into sheets, vulcanized by contact with sulphur, and used for floor-cloth.

Artificial caoutchouc has been made from oil, chloride of sulphur, and collodion (*Parksene*), and from the resinous body produced by the oxidation of linseed oil (*Campticon*).

Statistics of the India rubber industry are given in the 9th census report. The capital invested in this industry in the U. S. in 1870 was $7,486,600, the number of establishments 56, hands employed 6025, the value of the products $14,566,374.

Literature.—Gum-elastic and its Varieties, with a Detailed Account of its Applications and Uses, and of the Discovery of Vulcanization by Charles Goodyear (New Haven, Conn., 1853); *The Caoutchouc or India Rubber Manufacture in England*, by Thomas Handcock (London, 1857); *The Boot and Shoe Manufacturer's Guide* (including a history of India rubber and gutta percha), by W. H. Richardson (Boston, 1858); *Nouveau manuel complet du Fabricant d'objêts en Caoutchouc, en Gutta percha et en Gomme factice*, par M. Paulin Desormeaux (Manuel Roret, Paris, 1855); *Caoutchouc and Gutta Percha considered chiefly in their Chemical Relations*, by T. M. Blossom (a most valuable series of papers, written largely from notes collected by the writer of this article, and extensively quoted here); *Am. Chemist*, ii. 81, 137, 173, 225, 287, 329, 373. (See also Ure's *Dict.*, Payen's *Précis de Chimie Industrielle, Handw. d. Chemie*, Muspratt's *Chem.*, especially the last German edition.) C. F. CHANDLER.

Indi′bilis, a Spanish prince of the tribe of Ilergetes, first mentioned in B. C. 218 as commanding the native auxiliaries under Hanno, the Carthaginian governor. In 212, Indibilis led a force of 7500 men to the aid of Hasdrubal against P. Cornelius Scipio, who was killed in battle. Soon afterward he came into conflict with the Carthaginian governor, who required the surrender of his daughters as pledges of fidelity. These hostages were captured by the younger Scipio (Africanus) in 210, and the honorable treatment given them so impressed Indibilis that in the following year (209) he joined his forces to the Romans. In 206 they revolted from Rome, but were conquered and pardoned; again revolted in the following year (205), when he was defeated and killed.

In′dican. See INDIGO, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Indicopleus′tes (COSMAS), an Egyptian trader in the sixth century; in early life made extensive voyages in the East, visiting Syria, Arabia, Ethiopia, Persia, and India, carefully observing the modes of life, manners, and customs of all the peoples with whom he opened a traffic, and probably keeping a journal of his wanderings. After many years spent in this manner, Cosmas renounced the world, and, entering a monastery, devoted himself to contemplation and study. His store of personal knowledge of geography, which had gained him the surname of *Indico-pleustes* ("the Indian navigator"), was increased by the study of Scripture and the ancient writers, until he became the oracle of Egypt upon all matters of cosmography. In his old age he wrote in Greek a work in twelve books upon universal geography, usually cited by the Latin title, *Topographia Christiana sive Christianorum Opinio de Mundo*, of which the chief object was to combat the opinion of the astronomers that the earth is a spherical body. According to Cosmas, the shape and proportions of the earth are shadowed forth in Scripture by the description of the Jewish tabernacle. It is a vast oblong plain enclosed by the ocean, the length from E. to W. being just twice that from N. to S. Multitudes of proofs were adduced in support of this opinion from Scripture, reason, testimony, and the authority of the Fathers of the Church. In the part of his work based upon personal observation, Cosmas described the countries he had visited with considerable accuracy, and inserts by way of episodes many curious pieces of information, the most important of which related to an inscribed marble throne set up by Ptolemy Euergetes (247–222 B. C.) at Adulite in Nubia, near the coast of the Dead Sea. He also preserved some fragments of ancient writers otherwise unknown. The book of Cosmas was written at different times, and the manuscripts vary much in completeness. It was first published by Montfaucon in his *Collectio Nova Patrum et Scriptorum Græcorum*, vol. ii. (Paris, 1706), and this is still the best edition. Cosmas wrote other works, commentaries on Psalms and Canticles, a treatise of *Universal Cosmography*, and *Astronomical Tables*, no longer extant.

Indic'tion [Lat. *indictio*, "proclamation"], the name used in chronology for a certain method of reckoning time by periods of fifteen years. This method was occasioned by a tax which was levied in the Roman empire every fifteenth year, and the point of time from which the indictions began was Sept. 15, 312. Its use in reckoning time was commenced chiefly by ecclesiastical historians during the life of Athanasius. Later on, when the method was adopted by the popes, Jan. 1, 313, was fixed as the starting-point, and this change was called the papal indiction. During the Middle Ages reckoning by indictions was commonly used, not only by writers, but in practical life, in charters and public deeds. (As to the historical commencement of the era of indictions, see Gibbon's *Decline and Fall*.)

Indict'ment [Lat. *indico*, to "show"], a written accusation of one or more persons of an indictable offence, consisting of a felony or misdemeanor, preferred to, and presented upon oath by, a grand jury. (See GRAND JURY, CRIME.) A draught of the indictment, prepared by the attorney-general, district attorney, or other proper officer representing the government, is laid before the grand jury when they are lawfully convened, and if twelve or more of them are satisfied, from the *ex parte* evidence presented to them, that there is *primâ facie* reason to conclude that the alleged offender is guilty, the words "A true bill" are written upon the back of the draught, and the indictment is then said to be "found;" and upon the basis of the charges therein contained the prisoner is placed on trial, at a regular session of the proper court, before a petit jury. (See JURY.) When a presentment is made by the grand jury, an indictment containing the charges presented is drawn up subsequently, and upon this the party accused is tried. (For a definition of "presentment" see GRAND JURY.) An indictment commences with a formal preliminary statement termed the "caption," contains next the special charge or accusation, sometimes termed technically the "statement" or the "body of the indictment," and terminates with a formal ending, called the "conclusion." The caption, which is, strictly speaking, in the nature of a preamble only, and no part of the indictment proper, states the name and term of the court in which the indictment was found, the names of the justices, and the fact that the grand jury was lawfully convened, and that they were duly sworn and charged. It shows an observance of such forms and rules of law as must be complied with before the finding of the indictment, in order that the court may acquire jurisdiction in the particular instance. The "statement" or body of the indictment is a narrative of the offence charged, and must contain a full and particular description of the alleged crime, and have such a degree of certainty and precision in the accusation that it may be seen by the court that the act charged, if true, would constitute a crime. The name of the prisoner should be stated, or if that is not known, he should be so described as to be adequately identified. The time and place at which the offence was committed should also be alleged, though it is not generally necessary that allegations on these particular points should be proved exactly as charged. It is, however, essential that in stating the time the offence should appear to have been committed before the finding of the indictment, and within the period prescribed by law for the prosecution of the particular crime alleged. Moreover, in certain classes of cases the time must be specified correctly, and any variance between the allegation and the proof will be fatal. Thus, in the indictment for perjury, the day on which the perjury was committed must be truly stated. When murder is charged, the death must be described as occurring within a year and a day from the time when the fatal injury is alleged to have been committed. The place named must be within the jurisdiction of the court. When several persons engage in the commission of an offence, they may be indicted either jointly or separately. It is an allowable and frequent practice to describe the same offence in the indictment in several different ways, the successive statements being termed "counts;" the object of this is to prevent the possibility of a variance or failure of proof. By variously modifying the terms of the accusation in this way, it is rendered more likely that some one of the counts will accurately correspond with the evidence to be adduced, and if any count is sustained, the prisoner may be convicted. Whenever an indictment charges an offence created or declared by statute, it must be accurately framed in accordance with the provisions of the statute. There are also various rules of law which must be observed to prevent the allegations of an indictment from being absurd, inconsistent, or repugnant. Particular technical averments are sometimes necessary to be employed. Thus, in a charge of felony, the word "feloniously" must be used; in a case of burglary, the word "burglariously." So larceny is alleged by the words "took and carried away." But though there are certain formalities to be observed in framing every indictment, the allegation of the nature of the offence and the acts constituting it will afford scope for the exercise of special discretion and professional skill. The general rule is that the indictment must charge explicitly everything that is necessary to constitute the offence; every material circumstance embraced within the definition of the alleged crime must be stated. The "conclusion" of the indictment is a formal statement with which the law requires that it should end. The usual phraseology is, "against the peace and dignity" of the king or commonwealth. In indictments for a statutory offence it is customary to use also the phrase "contrary to the form of the statute in such case made and provided." Since in the U. S. crimes are generally defined by statute, this mode of concluding the indictment is commonly employed. The mode of framing the body of the indictment is also sometimes modified by statutory provisions. Only the common-law rules upon the subject have been here stated.

At common law, the defendant was not, in cases of treason and felony, entitled to a copy of the indictment. In prosecutions for high treason the rule was changed in England by statute, and it was provided that a copy should be given to him ten days before the trial. But in other cases of felony the rule remained unaltered. The court at the time of the arraignment would order the indictment to be read over slowly to the prisoner, but would grant no further privilege in this respect. This harsh rule has been abolished in several of the States of the Union by statute. Thus, in New York every person indicted for any offence, who shall have been arrested or held to bail, "shall on demand, and on paying the fees allowed by law therefor, be entitled to a copy of the indictment and of all indorsements thereon." Similar statutes have been enacted in New Hampshire, Vermont, Ohio, Illinois, Michigan, Wisconsin, Georgia, Texas, and a few other States.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Indies, East. See INDIA, INDO-CHINA, and EASTERN ARCHIPELAGO.

Indies, West. See ANTILLES, and WEST INDIES.

Indiges'tion, or **Dyspepsia** [Gr. δύς, "bad," and πέπτω, to "digest"]. Indigestion has many forms, and includes groups of symptoms indicative of departure from one or many of the conditions of healthy digestion. The digestive process is complex, and is performed by the agency of the saliva, the gastric juice, and the intestinal, pancreatic, and biliary secretions. For the proper secretion of these several digestive fluids the blood must be in a healthy state, and be freely supplied to the glandular structure of the stomach and intestines. The innervation essential to the digestive process demands moderation of mental activity, emotional tranquillity, vigor and healthful action of the nervous centres, especially of the sympathetic system. Tonicity of the muscular walls of the stomach and intestine is essential for the thorough contact and admixture of food with the digestive fluids, for its transit through the intestinal tract, and for the regular evacuation from the bowels of undigested and excretory matter. Indigestion may be gastric or intestinal—often the two combined. It is either primary—an essential disorder of the digestive apparatus—or secondary and symptomatic of disease in other organs. Obstruction of the circulation of the blood by chronic disease of a large vascular organ—as, the liver, spleen, or kidney—induces passive congestion of the mucous surfaces. Heart disease, rapidity of circulation, and elevation of temperature in fevers and febrile disorders cause gastro-intestinal engorgement, catarrh, and indigestion. When bile is imperfectly eliminated, when urea is imperfectly excreted by the kidneys, when fæcal matter is retained and absorbed, the effete elements circulating in the blood excite gastric or intestinal or gastro-intestinal catarrh. Primary or idiopathic indigestion includes all cases in which careful investigation has failed to discover a dependency on other disease. It may be a simple functional disorder of digestion, or due to an organic cause in some part of the digestive tract. Functional dyspepsia is termed atonic. Organic dyspepsia, if mild and due to temporary and slight lesions of the secretory surface, is termed irritative; if severe, it is designated chronic gastritis, a condition which by associated symptoms and physical exploration may be found to depend upon ulcer, cancer, or inflammatory thickening. Atonic dyspepsia may be due to defective innervation—from continuous and exhaustive mental action; from emotional disturbances, as excitement, sorrow, fear; from prolonged exercise and fatigue; from dissipation. It may be caused by deficient supply and quality of the blood, inactive circulation from indolence and neglect of exercise, anæmia and impoverished blood from privation or recent sickness. Deficient or perverted secretion of digestive fluids results. Reversely, digestion may be interfered with by excess of blood and gastric catarrh, when neglected

cleanliness or chilling of the skin or cold extremities determine blood to internal parts. Obesity, indolence, general debility may lower the tonicity of the muscular structure of the stomach and intestines, and weaken the peristaltic movements, causing failure in the contact of food with digestive fluids, and resulting in its accumulation and fermentation. As a rule, however, nerve-force, blood-supply, and digestive apparatus are not primarily at fault, and are adequate to ordinary digestion, the majority of indigestions being the result of gross excesses of diet and violations of hygienic law, excess of food, too frequent meals, rapid eating with incomplete mastication and insalivation, food unfit for digestion or improperly and insufficiently cooked, the habitual use of condiments, rendering the peptic glands dependent upon their stimulus, the imbibition in excess of liquids, as water, tea, or coffee, at meals, causing dilution of the gastric juice. Alcoholic stimulants create temporary and artificial appetite, but soon destroy healthy digestion. Tea, coffee, and tobacco impair the innervation of the stomach.

The chief symptoms of gastric indigestion are sense of fulness, weight, distress, and dull pain over the stomach, coated or irritable tongue, foul breath, perverted appetite—usually poor in the morning, and often morbid and irregular—sometimes nausea and vomiting, eructations of gas, regurgitation of acid or alkaline liquids and of food, often constipation, and less often colicky pain, with irregularity and looseness. There may exist lassitude, mental inactivity, drowsiness, cranial oppression, headache, vertigo, sometimes clouded vision, diplopia or double vision, and numerous nervous symptoms and perversions of the senses may exist; shortness of breath, sighing respiration, præcordial distress, palpitation and irregular action of the heart. There may be poor circulation; relaxed and pallid or sallow surface and complexion; cold hands and feet; in women, menstrual disorders. With the more marked and aggravated symptoms there may be mental depression, anxiety, despondency, and apprehension, constituting hypochondria. A diagnosis of the form of dyspepsia is essential to a correct treatment. Atonic may be distinguished from irritative dyspepsia by the following differences:

In Functional or Atonic Dyspepsia.	*In Irritative Dyspepsia.*
1. Deficiency or irregularity of appetite, absence of thirst.	1. Morbid craving for food, morbid thirst.
2. Ingestion of food affords sense of comfort for a time.	2. Ingestion of food causes distress.
3. Food retained.	3. Food often ejected when taken, or soon after.
4. Condiments and stimulants craved, aid digestion, and cause sense of comfort.	4. Condiments and stimulants create or intensify distress.
5. Languor and inaptitude for exertion during digestion.	5. Pain and mental distress during digestion.
6. Tongue pale, broad, flabby, thinly furred.	6. Tongue small, compact, red, with elevated papillæ or sensitive abraded patches.
7. Breath foul.	7. Breath may or may not be foul.
8. No fever.	8. Often slight fever.
9. Persons in general good health and flesh.	9. Reduced health, bad nutrition, and emaciation.
10. Constitutional symptoms few.	10. Variable general effects.

The symptoms of functional and irritative dyspepsia often coexist. In functional dyspepsia the fermentation of food develops gases. Eructations may be of carbonic acid gas from acetous fermentation, of hydrogen and carbonic acid gas from decomposition of hydrocarbons or fatty food, or of sulphuretted hydrogen from decomposition of nitrogenous substances, as meats, eggs. Of regurgitated liquids, the most common is a clear, opalescent, insipid, alkaline liquid, sometimes saltish or brackish, probably the accumulation in the œsophagus of saliva, and its frequent rising in the throat is known as waterbrash or pyrosis. In gastric catarrh gelatinous mucus may rise in the throat. The regurgitation of acid, acrid liquid, causes sense of burning in the stomach, beneath the sternum, and in the throat, technically cardialgia, popularly termed heartburn. Such fluid is usually serum or sero-mucus, containing acetic or lactic acid. If brown, acrid, bitter, rancid, and offensive, it is due to the conversion of fatty food into butyric acid. Food may be regurgitated at various stages of its digestion. When food is ejected many hours after ingestion, it may present products of fermentation—sporules of *Torula cerevisiæ*, or sporules aggregated into segmentated, cubical masses, known as *Sarcinæ ventriculi* (*sarcina*, a "woolpack"). Coffee-ground substance in ejecta is due to blood which has undergone gastric digestion, and indicates an abraded, ulcerated, bleeding surface. The accumulation of food and its ejection *en masse* hours after ingestion denote obstruction at the lower or pyloric orifice. The prevalent idea that gastric juice is often regurgitated is erroneous. Bile appears in regurgitated fluids seldom, and in vomited matter only after prolonged or violent emesis. In aged persons a steadily progressive loss of appetite, progressive inanition and emaciation, and death from slow asthenia, without other symptoms of indigestion or evidence of disease in other organs, result from degeneration of the gastric and intestinal tubules, the peptic glands. When fatty food passes in the fæces undigested, disease of the pancreas may be suspected.

Atonic dyspepsia predisposes to acute indigestion, subacute gastritis, gastro-enteric catarrh—the cholera morbus of adults and cholera infantum of children—whenever exciting causes are superadded, as the imbibition of cold water or eating acrid fruits, chilling of the heated body in summer. Indigestion may at first induce looseness of the bowels, irregular action, or diarrhœa, but ultimately produces constipation. Indigestion, by developing lactic acid in excess, is the frequent cause of rheumatism. It is the source of the lithic acid or gouty diathesis. Indigestion is the frequent cause of urinary precipitates. Imperfect digestion of nitrogenous food gives rise to oxalic acid, oxalate of lime in the urine, irritation and congestion of the kidneys and bladder. Indigestion in young and susceptible children and infants is the most frequent cause of convulsions and sudden febrile attacks. It may be the chief or only cause of chorea (St. Vitus's dance). Chronic irritative dyspepsia is most often the result of alcoholic excess, less often of excessive errors of diet, or may be symptomatic of gastric ulcer, pyloric constriction, or malignant disease.

In the treatment of indigestion regulation of diet alone often effects a cure. The diet should be nutritious, moderate in quantity, taken at regular intervals, and slowly eaten. The food at breakfast should be simple and laxative, at dinner substantial, at supper light. Of dishes there should be variety, yet simplicity, including animal food, vegetables, and fruits in restricted quantities. Bread should be stale or aërated. Milk may be freely taken, corrected with soda or lime-water. Fatty food, grease, sugar, and pastry should be avoided. Artificial adjuvants to the diet, as Liebig's prepared food, Ridge's food, and malt extract are of value. Drink of any kind at meals should be very limited. Attention to general regimen is essential. There must be outdoor exercise, freedom from mental stress, from physical fatigue, and dissipation in any form. By clothing, active friction, and judicious bathing the external circulation is kept vigorous. Tendency of the food to decompose demands correctives. For the acid stomach, bicarbonate of soda, the bicarbonate of potash, or lime-water; for alkaline fluid and gastric mucus, dilute mineral acids and acidulated drinks. Bismuth, either the subnitrate or subcarbonate, is the remedy for pyrosis. When the stomach fails to digest albuminoids, pepsine may be given. Pancreatine will aid the intestinal digestion of fat. Fermentation of food, with fetid products and foul breath, may be treated by the sulphite, bisulphite, or hyposulphite of soda, the sulpho-carbolate of soda; charcoal is also efficacious. In atony of the stomach, carminatives, as ginger, calamus, capsicum, and compound tincture of cardamum stimulate glandular secretion; bitter vegetable tonics, chamomile, quassia, calumbo, gentian, wild-cherry bark, cascarilla, and cinchona barks create appetite, and nux vomica increases the muscular tone and activity of the stomach and intestines and prevents flatulence. Quinine and ferruginous tonics, as the citrate of iron and quinine, the lactophosphate and carbonate of iron, and Blaud's pills produce general vigor, improve the blood, and aid digestion. Laxatives are essential when constipation exists; violent cathartics are to be avoided. Laxative food, as the coarse cereals and ripe fruit before breakfast, may be tried. Tamarinds and figs, St. Germain tea, senna, and magnesia may be used to stimulate the bowels to action. Often active exercise, walking, or horseback riding will suffice. Rubbing and kneading the bowels or the application of electricity to the abdominal muscles will cure obstinate constipation. Rhubarb, podophyllin, or dried ox bile in small quantities may be needed to increase the secretion of bile, aloes to unload the rectum, belladonna and nux vomica to create permanent tonicity and regular action of the bowels. A judicious combination of these remedies in a tonic-laxative pill may be taken until the stomach and intestines resume healthy and vigorous activity. Saline purges are to be avoided. But the milder mineral waters may be taken when acid indigestion is present or there is a personal tendency to rheumatism or gout. E. DARWIN HUDSON, JR.

Indighir'ka, or **Zapadnaia Kolima,** a river of Eastern Siberia, rises in the Yablonoi Mountains, in the government of Jakootsk, and enters the Arctic Ocean in lon. 150° E., after a course of 750 miles, mostly through deserts and frozen marshes. A few villages are scattered along its banks, whose inhabitants live exclusively by hunting.

In'digo (*Indicum* of the ancients), the most important blue dye known. It is obtained from several species of the genus *Indigofera* which grow principally in warm climates. It has also been noticed in morbid urine, and Dr. Schunck has shown that it may be obtained from the urine of healthy men and animals by the action of strong acids. It has also been observed in the milk of cows.

History.—This most valuable dyeing substance was used as a dyestuff in India and Egypt long before the Christian era, and the Romans were acquainted with it, although they only used it as a pigment, not knowing how to render it soluble, and so available for dyeing. It is only since the sixteenth century, or from the time of the discovery of the passage to India round the Cape of Good Hope, that it has become generally known in Europe; and its employment as a dye was greatly retarded by the opposition it met with from the large vested interests of the woad-cultivators, who induced the English, French, and German governments to promulgate several enactments against its use. So severe were some of them that Henry IV. of France issued an edict condemning to death any one who used that pernicious drug called the "devil's food." It is only since the year 1737 that the French dyers have had the right of using indigo without restriction. It was urged against this dye that it was fugitive, and even prejudicial to the wool. The Dutch were the first to introduce it.

Indigofera.

Botany.—This coloring-matter is furnished by the leaves of several species of plants belonging to very different genera and orders—from *Indigofera tinctoria, I. Anil, I. disperma,* and *I. pseudotinctoria,* cultivated especially in the East and West Indies; also from *Nerium tinctorium* and *Calanthe veratrifolia,* natives of Hindostan; *Asclepias tinctoria* and *Marsdenia tinctoria* of Sumatra; *Polygonum tinctorium, Isatis indigotica, Justicia tinctoria,* and *Bletia Tankervilliæ* of China; and *Amorpha fruticosa* of South Carolina. The only European plant which yields true indigo-blue is *Isatis tinctoria,* WOAD (which see). This plant was much used in Europe before the introduction of indigo, but it is inferior in quality and small in quantity, and is now used only as an addition to the indigo-vat. Many other European plants yield blue coloring-matters, but they are not believed to be identical with indigo.

Cultivation.—The indigo-plants require a warm climate, with not too much rain. The seeds are sown about the first of April, and in the latter part of June the flower-buds burst and the plants will bear cutting. Two months later a second inferior cutting is taken, and a third and fourth of diminished value may be made.

Indican.—The plants do not contain the indigo when they are gathered, but a peculiar substance, indican, which is a yellow, transparent, glutinous solid, soluble in alcohol, ether, and water. Indican is a glucoside, and is converted by fermentation or by boiling with sulphuric or hydrochloric acid into indigo-blue, indigo-red, etc., and a peculiar glucose-like body, indiglucin:

$$\underset{\text{Indican.}}{C_{26}H_{31}NO_{17}} + 2H_2O = \underset{\text{Indigo-blue.}}{C_8H_5NO} + \underset{\text{Indiglucin.}}{3C_6H_{10}O_6}.$$

Fermentation does not appear to be essential, as a mere infusion of the plant in hot water deposits indigo on standing in the air. Indican yields by decomposition, besides indigo-blue and indigo-red, a variety of bodies, as oxindicanine, oxindicasin, indicasin, indicanin, indifulvin, indihumin, etc. (See *Watts's Dict.,* article "Indican.") Indican has been found in human blood and urine.

The extraction of the indigo in Bengal is effected either from fresh or dry leaves. (1) *From the Fresh Leaves.*—Two large stone cisterns are provided—the *steeper,* or fermenting vat, about 20 feet square and 3 feet deep, and the *beater,* standing lower, of the same width, but a third longer. The fresh plants, tied in bundles, are stratified in the steeper and fastened down by beams. They are then covered with water, when fermentation begins at once, and is completed in fourteen or fifteen hours. The liquid is at first yellow, but becomes dark green, and exhibits a blue scum. It is drawn off into the beater, and ten men beat it with oars or shovels called *busquets.* Paddle-wheels or dashers have been used. After being beaten for an hour and a half, if the previous fermentation has been satisfactory the indigo agglomerates into flocks and settles as a precipitate. The object of the beating is to introduce oxygen. The precipitation may be hastened by the addition of lime-water, but this throws down extractive matter, and makes the indigo hard and red. The precipitate is allowed to subside, the supernatant water is drawn off, and the moist precipitate is strained through a coarse bag. It is then boiled to separate a yellow extractive matter and increase the density and intensity of its color. It is then sent to the *dripping* or filtering vat, which contains a perforated false bottom covered with cotton cloth. The drained magma is placed in a strong bag and squeezed in a press, and the moist mass is cut with a brass wire into cubes about three inches each way. The cubes are dried in the air, a white efflorescence which appears during the drying being removed with a brush: 1000 parts of the liquor from the steeping vat yield 0.50 to 0.75 indigo. (2) *From Dried Leaves.*—The cuttings are dried in the sun, the leaves separated from the stems by thrashing, and stored away for convenient treatment. To obtain the indigo they are macerated for two hours with six times their bulk of water. The solution is treated as when obtained from wet leaves. As the use of dry leaves makes it possible to select the most suitable weather for macerating, the indigo produced is more uniform, and the fermentation, capricious in its course, is superseded by simple maceration.

In the hilly regions of India the leaves of the *Nerium tinctorium,* a small tree, are treated for the extraction of indigo. It is necessary to use hot water for steeping; 250 pounds of fresh leaves yield 1 pound of indigo. Dr. Schunck has explained why if the indigo-manufacturer does not manage the fermentation with great care the indigo will be poor in quality and small in quantity, and even in some cases entirely lose the coloring-matter. The indiglucin produced by the decomposition of the indican is liable to pass by fermentation into alcohol and acetic acid, and these bodies unite with the indigo and form a body which resists oxidation, and consequently fails to furnish indigo:

$$\underset{\text{Indigo.}}{C_8H_5NO} + \underset{\text{Alcohol.}}{8C_2H_6O} + \underset{\text{Acetic acid.}}{3C_2H_4O_2} + CO_2$$
$$= \underset{\text{New compound.}}{C_{31}H_{39}NO_4} + \underset{\text{Water.}}{13H_2O}.$$

The commercial varieties of indigo are very numerous. The Bengal indigo ranks first in quality; it is classified as—fine blue, fine purple and violet, fine red and violet, good purple and violet, middling violet, middling defective, consuming fine, middling and good, ordinary, and ordinary and lean trash. Some merchants recognize sixteen distinct grades. Besides the Bengal, there occurs in commerce the Java, twenty-one grades. The Bengal and Java range from 40 to 80 per cent. of indigo-blue; the remaining varieties vary from 10 to 37 per cent.; they are Coromandel, Oude, Madras, Manila, Egyptian, Guatemala, Caraccas, and Mexican.

Properties of the Crude Indigo.—The color is deep blue, with a shade more or less purple or violet. It is devoid of smell and taste. It may be dry or moist, hard or soft, compact or porous. Being always more or less porous, it adheres slightly to the tongue. Its fracture is dull and earthy. The streak produced by the nail is glossy and purplish-red in the best qualities; when it is dull, and the indigo furrows on each side of the streak, the quality is poor. The best indigo floats upon water.

Composition of Crude Indigo.—Besides indigo-blue (indigotine), which is the characteristic constituent of indigo, and which varies in quantity from 10 to 80 per cent., a variety of other bodies are present, either derived from the plant or added intentionally. Among these are (1) indigo-gluten, a nitrogenous body resembling ordinary vegetable gluten. It is extracted by treating the indigo with acid and then boiling with water. (2) Indigo-brown, extracted by alkalies. The indigo-green of some authors is supposed to be a mixture of indigo-brown and a little indigo-blue. (3) Indigo-red, extracted by boiling alcohol. (4) Brown resinous bodies. (5) Mineral matters (ash), usually from 6 to 12 per cent., but sometimes 30 to 40 per cent. in Madras indigo. They are composed of carbonate and phosphate of lime, oxide of iron, alumina, soda-salts, clay, sand, and sometimes a trace of copper and lead. (6) Water, from 3 to 10 per cent. Chevreul gives the following analysis of a fair sample of Guatemala indigo:

Indigotine	45.
Soluble in water: gum, etc., deoxidized indigo, a green matter combined with ammonia, etc.	12.
Soluble in alcohol: resin, green matters, a trace of indigo-blue	30.
A red resin, soluble in hydrochloric acid	6.
Carbonate of lime	2.
Oxide of iron and alumina	2.
Silica (sand) and clay	3.
	100.

The adulterants are starch (most common), rosin, Prussian blue, smalt, ground dyewoods, etc.

The purification of indigo is effected by boiling it successively with dilute acid, water, and alcohol. The pure indigotine may be extracted by changing it to soluble white indigo by reducing agents, as explained further on, and subsequently reoxidizing it.

Indigo blue, indigotine, oxidized indigo (C_8H_5NO), may be obtained nearly pure by exhausting indigo by solvents as above mentioned. It may also be obtained (1) by sublimation, in crystals, mixing the powdered indigo with plaster of Paris and water, spreading it on an iron plate to harden, and carefully heating the dry cake; (2) by solution in boiling aniline, which deposits it in crystals on cooling; (3) by reducing it to soluble white indigo by contact with grape-sugar, soda-ley, water, and alcohol, or by contact with slaked lime, copperas, and water. The yellow solution obtained deposits indigotine as a blue powder when exposed to the air. Indigotine appears as blue crystals with a coppery lustre, or as a dark-blue powder, acquiring this lustre when rubbed with a hard body. It has neither taste nor smell, acid nor basic properties; sp. gr. 1.500. Heated in the open air, it melts, boils, and burns with a smoky flame. Heated in a current of air at about 550° F., it volatilizes without decomposition as a purple vapor. It is insoluble in water, in dilute hydrochloric and sulphuric acids, and in alkaline lyes, in cold ether, alcohol, oil of turpentine, and fatty oils. Its best solvent is boiling aniline. It is soluble to a greater or less extent in hot creosote, phenol, benzol, chloroform, alcohol, ether, essential oils, fatty oils, petroleum, amylic alcohol; in the acetates, chlorides, etc. of aniline, morphine, etc., bees' wax, Japan wax, Canauba wax, paraffin, spermaceti, and stearic acid. It is soluble in anhydrous acetic acid to which a very small quantity of sulphuric acid has been added, and is precipitated from the solution by the addition of water. This is the only process known by which indigotine can be reproduced in its primitive state on fabrics, without previous reduction to soluble white indigo.

The action of sulphuric acid on indigo gives rise to three distinct compounds, the production of which depends upon the strength and ratio of the acid, the temperature, and the duration of the contact; it is difficult to conduct the reaction so as to prevent the formation of at least a small portion of each. If powdered indigo is digested with oil of vitriol, and the deep-blue liquid poured into 40 or 50 parts of cold water, a purple powder remains undissolved which is (1) sulphophœnicic acid, while the deep-blue solution contains (2) sulphindigotic and (3) hyposulphindigotic acid. By forming the ammonium-salts of the last two acids, evaporating to dryness, and digesting with alcohol, the hyposulphindigotate only is dissolved.

Sulphophœnicic Acid ($2C_8H_5NO.SO_3$), *Sulphopurpuric Acid, Indigo-Purple, Phœnicin.*—This acid is best prepared by adding 1 part of indigo to 4 parts of oil of vitriol, and heating from 30 minutes to an hour, or until a drop gives a deep purple color with a large quantity of cold water. Too high a temperature or too long digestion causes the formation of much sulphindigotic acid. The acid mixture is thrown into 40 to 50 parts cold water, and the beautiful purple precipitate is collected on a filter and washed with weak hydrochloric acid. It forms a blue mass or a purple-red powder. It is soluble in water, and soluble in strong sulphuric acid, especially in the fuming acid; both gradually change it into sulphindigotic acid, more rapidly if heated. It is insoluble in dilute acids. The salts of this acid are prepared by adding its solution to an aqueous solution of any salt. They appear as purple flocks, which are but slightly soluble in water. When dry they are red. Their solutions are blue; are reduced to yellow liquids by sulphydric acid, copperas, and lime, or by caustic alkalies, but become blue again on exposure to the air. Wool may be dyed with this acid by immersing it in an aqueous solution and adding a little hydrochloric acid. By passing the wool so dyed through a weak bath of carbonate of soda various shades of purple may be produced, a small quantity of sulphindigotic, which is always present, being removed, and the sulphophœnicate of soda being formed, which is a faster dye than the acid. A peculiar purple-blue, consisting probably of the soda-salt of this acid, has been invented by L. and E. Boilley (*Dingl. pol. J.*, clix. 318), and patented in England by Johnson. It is made by dropping powdered indigo into 20 times its weight of fused acid sulphate of soda, pouring the product into a large quantity of water, and adding common salt. It separates as a precipitate of silky crystals, possessing a beautiful coppery lustre when dry. See samples dyed with it in *Rep. Chim. app.*, 1861, p. 215.

Sulphindigotic Acid ($C_8H_5NO.SO_3$), *Sulphate of Indigo, Soluble Blue Indigo, Sulphindylic Acid, Sulphocœrulic Acid.*—This acid is prepared by dissolving 1 part of indigo in 10 or 12 parts of concentrated sulphuric acid (6 parts of fuming acid answer the same purpose), and heating the whole for several hours at 120° F. The operation is complete when a portion dissolves completely in cold water. The product is a mixture of this acid with hyposulphindigotic acid. To free it from this, and the impurities derived from the indigo, well-washed wool is allowed to absorb the dyes from the solution. This is washed in water and digested in a dilute solution of carbonate of ammonia, which dissolves both acids. On evaporating to dryness the two ammonia-salts may be separated by alcohol (83 per cent.) in which the sulphindigotate is insoluble. This separation is not resorted to in practice, the mixture of the two acids being used directly. The sulphindigotic acid may be freed from the excess of sulphuric acid by adding an excess of a solution of common salt. It is then obtained as a blue precipitate which may be drained on a filter. Sulphindigotic acid is very soluble in water and in alcohol, but not in strong saline solutions. Charcoal, especially that from blood, removes it completely from its aqueous solution, but yields it to alkaline carbonates. It is decomposed by an excess of caustic alkali, and the color cannot be restored. Reducing agents, as stannous and ferrous salts, sulphydric acid, nascent hydrogen, etc., decolorize it, the color being restored by exposure to the air. Sulphindigotates are formed by neutralizing the free acid or by double decomposition. They do not crystallize, are dark blue with a coppery lustre, and taste feebly saline and decidedly of indigo. The alkaline sulphindigotates are slightly soluble in cold water (requiring 100 to 150 parts), more so in hot water. The lime, magnesia, and alumina salts are freely soluble. The solution is blue by reflected light, red by transmitted light.

Alkaline Sulphindigotates, Indigo-Carmine, Blue-Carmine, Soluble Indigo, and *Precipitated Indigo* are prepared by adding alkaline carbonates to the diluted solution of the acid. They appear as precipitates, being insoluble in saline solutions; the alkaline sulphates formed at the same time are sufficient for the purpose. The potassium-salt dissolves in 140 parts of cold water, and in much less boiling water; 1 part of salt gives a blue color to 500,000 parts of water, about $\frac{1}{70}$ grain per gallon. Water containing 1 per cent. of acetate of sodium does not dissolve it in the cold. It is soluble in sulphuric acid, insoluble in concentrated hydrochloric and in alcohol of sp. gr. 0.800. The sodium-salt resembles the potassium-salt, and is used for similar purposes, much more extensively. It is more soluble in saline solutions. Besides being useful as a dye, the indigo-carmine is used as a water-color pigment, and made into balls with starch and a little gum-water it is used as washing blue.

Hyposulphindigotic Acid, Hyposulphocœrulic Acid.—This acid, the composition of which is not known, has been already mentioned as always occurring in the solution obtained by treating indigo with sulphuric acid. The acid differs little from sulphindigotic acid, and the salts are distinguished chiefly by their solubility in alcohol of 84 per cent.

Commercial Preparations of Indigo and Sulphuric Acid are mixtures of the three acids above mentioned or their salts. There are three distinct kinds of preparation: (1) The simple solution of the acids in water, known as *Saxon*

blue (having been first introduced by Barth at Grossenhayn in Saxony in 1745), *chemic, chemic blue, sour extract of indigo, sulphate of indigo*, etc. Numerous receipts are given for its preparation. Persoz says mix 1 pound each of indigo, fuming sulphuric acid, and oil of vitriol. After standing 48 hours, heat the mixture over a water-bath till it gives no precipitate in cold water. Dilute to 1.134 or 18° B. Haussmann uses indigo 1, fuming acid 6.5. Another adds gradually 1 part indigo to 5 or 6 fuming acid or 10 to 12 common acid, allows it to stand 24 to 48 hours, pours into cold water, and filters. Another: 1 pound indigo in 15 pounds common acid; keep at 120–140° F. for three days. (2) The precipitated acids, *paste, sweet extract*, made by adding a strong solution of salt to the diluted and filtered solution of indigo in sulphuric acid. *Receipts.*—1 pound indigo, 5 acid, 10 to 12 hours at 100° F., diluted with 3 gallons water, filtered, concentrated to 3 gallons, treated with 4 pounds of common salt, drained on a filter. Another: 10 pounds indigo, 80 acid, 24 hours at 80° F., diluted with 5 gallons water, treated with solution of 80 pounds salt in smallest quantity of water. (3) Neutral soda-salts, *indigo-carmine, soluble indigo, solid blue, chemic, cerulein, ceruleo-sulphate, extract of indigo*. This is made by neutralizing the solution of indigo in sulphuric acid by carbonate of soda; being insoluble in saline solutions, it appears as a precipitate, which is washed on a filter with solution of salt, and sold as a paste or as a dry powder. The washing with salt-solution removes green matters (chlorophyl?) and improves the shades. *Receipts.*—Add 37 pounds acid to 4 pounds indigo, keep at 60°–70° F. for 8 days. Pour into it a solution of 40 pounds salt, then a solution of 60 pounds carbonate-of-soda crystals; add 2 pounds precipitated carbonate of lime; filter, wash with salt-solution. The yield is 120 pounds. Adding acid to indigo secures a richer and purer color. An inferior quality is made with 8 pounds indigo, 74 acid, 144 salt, 112 carbonate-of-soda crystals, and 4 chalk, in same manner. A fair sample of carmine of indigo gave water 85., indigo 10.2, saline residue 4.8.

Dyeing with Sulphuric-Acid Compounds of Indigo.—(1) Cotton has no affinity for these compounds, and they are never used except for a faint bluing for market, as in washing clothes. For this purpose the free sulphuric acid is removed by acetate of lead, or neutralized by acetate of soda, the product being erroneously called "acetate of indigo." (2) Wool is dyed only in the acids or in carmines acidulated, as alkalies, and even soap, are liable to remove the color. Saxon blue (acid) was formerly used with alum and cream of tartar. Carmine is now preferred with alum and cream of tartar, used warm. For printing, so-called "acetate of indigo" is used. These colors are fugitive, and are now generally replaced by Prussian blue, etc., except for compound colors, as green, olive, gray, black, etc. (3) Silk is dyed in the same manner as wool, but is generally first alumed. Carmine is generally used, as it is easily fixed, and is free from the green tinge of the acids. For printing, a solution of carmine, with oxalic acid and gum, with sometimes a little alum, is used.

Indigo-White ($C_{16}H_{12}N_2O_2$), *Indigogen, White Indigo, Reduced or Deoxidized Indigo.*—The sulphuric-acid compounds of indigo already described are not suitable for dyeing cotton, and as they do not give colors on wool and silk that can be considered fast, indigo would have but a limited application in dyeing and calico-printing were it not for the indigo-white. This compound is produced by the action of reducing agents on indigo, and results in the addition to a double molecule of indigotine of a double atom or molecule of hydrogen, H_2:

$$\underset{\text{Indigotine.}}{2C_8H_5NO_2} + H_2 = \underset{\text{Indigogen.}}{C_{16}H_{12}N_2O_2}.$$

Chevreul supposed that indigogen existed ready formed in the indigo-plants, but this was shown by Schunck to be erroneous, (1) because indigogen is soluble only in alkaline solutions, while the juices of these plants are acid; (2) because indigogen turns blue on exposure to the air by oxidation, forming indigotine; (3) he determined the compound existing in the plants to be the glucoside indican ($C_{26}H_{31}NO_{17}$), as already stated. The indigogen being soluble in alkalies, the dyer has only to impregnate his yarns and fabrics with the solution and expose them to the atmosphere, when the insoluble blue indigotine is formed throughout their substance, and they are uniformly dyed with the most permanent and insoluble blue.

$$\underset{\text{Indigogen.}}{C_{16}H_{12}N_2O_2} + \underset{\text{Oxygen.}}{O} = \underset{\text{Indigotine.}}{2C_8H_5NO} + \underset{\text{Water.}}{H_2O}.$$

(For advanced views on the constitution of indigotine and indigogen see Löwenthal (*J. pr. Ch.*, lxx. 463); Baeyer (*Ber. Chem. Ges.*, 1868, 17), and A. Strecker (*Jahresb. d. Chem.*, 1868, 789).) A great variety of reducing agents accomplish this change in indigotine:

(1) Alkaline metals which decompose water, as sodium, potassium, sodium amalgam, etc.

(2) Metals which decompose water in the presence of an alkaline base, as tin, antimony, aluminum, zinc, and phosphorus.

(3) Metallic oxides capable of higher oxidation, as ferrous, manganous, and stannous oxides.

(4) Acids capable of higher oxidation, as phosphorous, hypophosphorous, hyposulphurous, and sulphurous acids.

(5) Some sulphurets, phosphurets, and arsenurets, as realgar, orpiment, stannous sulphide, sulphides of antimony, potassium, sodium, hydrogen, etc.

(6) Organic bodies oxidizable in presence of alkalies, as glucose, gallic acid, etc.

(7) Reducing and alkaline fermentations, as the butyrous and urinous.

Löwenthal denies the production of indigogen by sulphurous and phosphorous acids, sulphide of potassium, and some of the other substances mentioned above. (*J. pr. Ch.*, lxx. 463.)

Indigogen may be prepared from indigo purified by hydrochloric acid by mixing it with slaked lime, ferrous sulphate, and water in vessels so arranged that air is excluded. The clear yellow solution produced is transferred to another vessel, and the indigogen precipitated by hydrochloric acid. The precipitate is filtered in an atmosphere of carbonic acid, and washed with dilute sulphurous acid. It is a grayish-white, lustrous body, insoluble in water and acids, soluble in alkalies, alcohol, and ether. Its solutions are yellow, and turn blue and deposit indigotine when exposed to the air. Indigogen forms with lime a neutral compound readily soluble in water, and a basic compound almost insoluble. The latter is precipitated from a solution of the neutral compound by digestion with an excess of lime. It is also formed when indigo is digested with copperas and *an excess* of lime in making the solution of indigogen. It is a lemon-yellow compound, which in the air becomes first green, then blue. Most metallic salts produce in solutions of indigogen precipitates which are generally white, but become blue in the air. Berzelius supposed from these properties of the lime-compounds that an excess of lime should be carefully avoided, but Schlumberger has shown that in practice other conditions occur which not only prevent any injurious results from such excess, but make its presence very desirable.

Application of Indigogen in Dyeing and Calico-printing.—This form of indigo being soluble, can be made to penetrate textile fibres, and when by oxidation the indigogen is converted into insoluble blue indigotine, the color is fixed in the pores of the fibres, so as to adhere firmly and resist the action of washing and soap. Indigogen is employed as follows:

(1) *Ordinary "Vat-dyeing."*—The indigo is reduced and dissolved, and the yarn or cloth is immersed, and then exposed to the air. Figures in white, which may even be colored, are produced by printing on *resists* beforehand, which prevent the penetration of the dye, or discharges after dyeing, which remove the color.

(2) *"Pencil Blue."*—The solution of reduced indigo is printed or painted on certain portions only of the cloth with a "pencil," a small flat, blunt-pointed piece of wood.

(3) *"Precipitated or Fast Blue."*—Indigogen is precipitated as a paste in combination with strongly reducing metallic oxides, as hydrated stannous oxide, to prevent too rapid oxidation. This paste, properly thickened, is printed on the goods, and the cloth is then passed through lime-water or soda-ley to replace the stannous oxide and form a soluble compound of indigogen, which penetrates the fibre and is fixed by subsequent exposure.

(4) *"China Blue."*—Pulverized indigo is printed on the cloth, and then so treated, by passing it successively through milk of lime, copperas, soda-ley, and sulphuric acid, as to fix the color by causing local reduction and solution, and subsequent oxidation.

The *indigo vats* or solutions employed by dyers and calico-printers are varied according to the character of the goods.

Cold vats are produced by reducing agents of a mineral origin, while *warm vats* are produced by organic matters which undergo fermentation, and thus develop indigogen.

(1) *The Copperas Vat.*—To 2000 gallons water are added 60 pounds indigo, 180 slaked lime, 120 ferrous sulphate (copperas), which must be free from every trace of copper-salt. This vat is used for calico, linen yarn, linen thread, and hemp yarn and thread. After exposure to the air the color of the goods can be improved by passing them through hot milk of lime or caustic alkali, by which some yellow matters are eliminated.

(2) *The Tin Vat*, commonly used for calico-printing.—The indigo is reduced by a solution of stannous oxide in soda-ley. By adding to this an acid solution of tin, a pre-

cipitate is obtained consisting of indigogen and stannous oxide, which is used in printing.

(3) *The Orpiment Vat* is made by mixing indigo, sulphide of arsenic, and potash. It is chiefly used in calico-printing.

(4) *The Zinc Vat* has recently been introduced by R. Schloesser & Co. of Manchester, Eng., as a marked improvement on the copperas vat. It is free from the bulky precipitate of oxide of iron, and avoids the loss of indigo due to its combination with this oxide. It is composed of 2000 gallons of water, 20 pounds indigo, 30 iron borings, 30 of their remarkable powdered zinc, 35 quicklime. The zinc furnishes hydrogen by decomposing water.

(5) *The Hyposulphite Vat* was introduced by Schützenberger and De Lalande (*Chem. Centr.*, 1873, 735). The authors employ a solution of sodium hyposulphite as the reducing agent for the indigo. A solution of sodium bisulphite of 30° to 35° B., is agitated with pieces of sheet or granulated zinc in a closed vessel. The quantity of zinc should fill about one-fourth of the internal space of the vessel. After about an hour the solution is mixed with milk of lime in excess, which precipitates the zinc-salt. After agitation and the addition of water, the liquid is filtered or the clear solution decanted, the whole operation being conducted with as complete exclusion of air as possible. The hyposulphite solution so obtained is added to the indigo, together with the necessary amount of lime and soda. The yellow solution obtained contains, as insoluble constituents, only the earthy matters in the indigo. From 1 kilo. indigo a very concentrated vat of from 10 to 15 litres can be prepared. The dyeing of cotton takes place in the cold, that of woollens with gentle warmth. The excess of sodium hyposulphite is said to reduce the froth which forms on the surface of the bath. By adopting the foregoing method in the case of woollens, clearer and fresher tints are obtainable. A new method of printing with a concentrated and thickened alkaline solution of indigo reduced with great excess of sodium hyposulphite, gives universal satisfaction, and is certain to supersede the older costly and troublesome process in which tin and tin-salts are employed. For oxidation, the printed pieces are hung out in the air 12 to 14 hours, and then washed and soaped. In comparison with the older method, 50 to 60 per cent. of indigo is economized, the shades are finer and more permanent, and the definition sharper.

(6) *The Woad or Pastel Vat.*—In former times woad was the only material known to the dyers of Europe for producing the blue color of indigo. For this purpose it was previously submitted to a peculiar process of fermentation, and the product was named *pastel* in France. For most purposes indigo has taken the place of woad in the dye-house, and for cotton goods it is now used alone. In the dyeing of woollen goods, however, the use of woad has been retained to the present day, for the purpose rather of exciting fermentation, and thus reducing the indigo which is employed at the same time, than of imparting any color to the material to be dyed. Indeed, the woad used by woollen dyers in this country contains no trace of coloring-matter. Various substitutes, such as rhubarb-leaves, turnip-tops, weld, and other vegetable matters, have accordingly been tried, but without success, since the fermentation is more steadily maintained by means of woad than by any other material. Pastel, which does contain a little blue coloring-matter, is preferred to woad by many of the French dyers. The materials employed in the ordinary woad or pastel vat, in addition to woad and indigo, are madder, bran, and lime. The chemical action which takes place in the woad vat is not difficult to understand. The nitrogenous matters of the woad begin, when the temperature is raised, to enter into a state of fermentation, which is kept up by means of the sugar, starch, extractive matter, etc. of the madder and bran. In consequence of the fermentation, the indigo-blue becomes reduced, and is then dissolved by the lime, thus rendering the liquid fit for dyeing. Great care is necessary in order to prevent the process of fermentation from passing into one of putrefaction, which if allowed to proceed would lead to the entire destruction of the indigo-blue in the liquor. If any tendency to do so is observed, it is arrested by the addition of lime, which combines with the acetic, lactic, and other organic acids that commence to form when putrefaction sets in. On the other hand, an excess of lime must also be avoided, since the reduced indigo-blue is thereby rendered insoluble, and unfit to combine with the material. In setting a vat the following materials are used: 5 cwt. woad, 30 pounds indigo, 56 bran, 7 madder, and 10 quarts lime. The vat is first filled with water heated to 140° F.; the materials are then added and well mixed. The whole is covered, and allowed to stand over night. At 6 o'clock the next morning 5 quarts more lime are added; at 10 o'clock, 5 pints more; at 12, the vat is heated to 120° F.; and at 3, another quart of lime is added. The vat is now ready for use. (*Ure.*)

(7) *The Potash or Indian Vat.*—Eight pounds of powdered indigo are added to a bath containing 3½ pounds bran, 3½ pounds madder, and 12 pounds potash, which is maintained for several hours at a temperature of 200° F. It is then allowed to cool to 100° F., when fermentation ensues. After about 48 hours the indigo is rendered soluble, being reduced by the decomposition of the sugar and other products contained in the bran and the madder-root during the process of fermentation. The bath should have a greenish-yellow appearance, having a frothy scum of a blue coppery hue. (*Calvert.*)

(8) *The German Vat.*—Of late years improvements have been made in this class of vats, by which the expense of using madder is avoided. They are now prepared by adding to water, at a temperature of 200° F., 20 buckets bran, 26 pounds soda crystals, 12 pounds indigo, and 5 pounds slaked lime. After five hours the bath is allowed to cool to 100° F., when fermentation ensues and the indigo is dissolved in the alkali. (*Calvert.*)

(9) *The Urine Vat* is employed only in small dye-houses and in certain localities, as at Verviers, for the dyeing of wool. The putrefying urine furnishes at once the reducing agents to convert the blue into white indigo, and the ammonia necessary to dissolve the latter. (*Watts's Dict.*)

Resists for printing on cloth to prevent the dying of certain portions, and thus produce figures on a blue ground, act either mechanically, as wax, pipeclay, etc., or chemically, by oxidizing the indigogen before it can penetrate the fibre, as salts of copper, mercuric chloride, etc. The following are receipts for different results (Crooks, p. 474): (1) *For Deep Blue.*—Water, 4 litres; sulphate of copper, 1.25 kilos.; acetate of copper, 500 grms.; nitrate of copper, 875 grms.; alum, 240 grms.; pipeclay, 2.125 kilos.; dextrine, 1.25 kilos. (2) *For Medium Blue.*—Water, 4 litres; sulphate of copper, 500 grms.; acetate of copper, 250 grms.; nitrate of copper, 500 grms.; alum, 240 grms.; pipeclay, 2 kilos.; dextrine, 1 kilo. (3) *Red Resist, so-called Lapis.*—Red liquor (acetate of alumina), sp. gr. 1.07, 12 litres; gum senegal, 2 to 3 kilos.; pipeclay, 4 to 6 kilos.; olive oil, 1 kilo.; sulphate of copper, 1 kilo.; nitrate of copper, 500 grms.; sal-ammoniac, 1.5 kilos. (4) *White Lapis, No. 1.*—Lime-juice, sp. gr. 1.109, 5 litres; thickened lime-juice, thickened with 1.5 kilos. of gum upon 2 litres, 1.5 litres; sulphate of copper, 1 kilo.; pipeclay, 3 kilos. *No. 2.*—Water, 2 litres; sulphate of zinc, 1 kilo.; pipeclay, 725 grms.; gum senegal, 500 grms.; solution of nitrate of copper, sp. gr. 1.52, 0.12 litre. (5) *For White Under-mordants and for Blue Contours.*—Caustic soda solution, sp. gr. 1.070, 8 litres; arseniate of potassa, 3.5 kilos.; corrosive sublimate, 500 grms.; pipeclay, 3 kilos.; gum senegal, 1.5 kilos.

Discharge Patterns are produced by dyeing the cotton cloth of a uniform blue in the copperas vat, and then printing upon it the desired figures with some powerful oxidizing agent, which will destroy the blue indigotine by converting it into soluble isatin, leaving the figure in white. The most useful discharge is chromic acid, but as it would be exhausted by the thickener before it reached the cloth, a circuitous process must be resorted to in order to secure its action. On the blue cloth bichromate or chromate of potash is padded (see CALICO-PRINTING), and when this has been dried in the dark, the figures to be discharged are printed with a mixture of acid; oxalic, tartaric, nitric, or sulphuric; a thickener, gum, dextrine, or starch; and some pipeclay. The chromic acid is set free and the color discharged at once, and the goods are washed in warm water to which some chalk has been added to neutralize the excess of acid. Another plan is to print on the blue cloth chromate of lead properly thickened, and pass through warm hydrochloric acid, when chromic acid and chlorine are liberated, which discharge the color. Hydrated binoxide of manganese may be substituted for chromate of lead. The discharges can be made to include mordants, so that colored designs on a blue ground may be produced. Thus, if acetate of alumina or of iron, or both together, be mixed with a discharge, and the alumina fixed in the washing off, the goods may be dyed in madder or garancine with the production of red, lilac, purple, or chocolate designs. Sometimes the discharge and resist are combined together; for instance, on a light-blue ground are printed simultaneously, first, an ordinary resist; second, the same resist, to which have been added bichromate of potash and hydrochloric acid; on vatting again a pattern of light blue and white will be found on a deep-blue ground. *Receipts.*—(1) Chrome liquor: water, 2 litres; yellow chromate of potash, 500 grms. (2) Acid composition: tartaric acid, 3 kilos.; oxalic acid, 250 grms.; dextrine, 4 kilos.; nitric acid, 500 grms.; water, 4 litres.

Printing Pencil Blue, for which the orpiment vat is used, was formerly effected by hand, but is now accomplished from rolls by the aid of the "doctor box," by which the blue oxidized layer of color is removed and the roll works

last in the green solution containing the indigogen, carrying it at once to the cloth. *Receipt for an Orpiment Mixture for Dark Pencil Blue.*—Indigo-pulp, 10 gallons, containing 40 pounds indigo; yellow orpiment, 40 pounds; soda-ley, 70° Tw., 11½ gallons; water, 18½ gallons; lime, 4 pounds. Boil till yellow, when spread on glass; let settle, and thicken the clear liquor with 120 pounds gum senegal. (For further details with regard to use of indigo in calico-printing see works mentioned at end of this article.)

Products of the Decomposition of Indigo.—Chlorine destroys moist indigo, as well as its sulphuric-acid compounds, with the formation of a variety of products which vary with the conditions of the treatment. Among them have been noticed trichlor-aniline, trichlor-phenol, chlorisatin, and dichlor-isatin. Dilute nitric acid produces isatin ($C_3H_5NO_2$) and a brown resin; a stronger acid forms indigotic (nitrosalicylic) acid ($C_7H_3(NO_2)_3O_3$); very strong acid (sp. gr. 1.45) yields picric acid (trinitrophenol) ($C_6H_3(NO_2)_3O$), forming at the same time carbonic, prussic, and oxalic acids, and the so-called artificial indigo-resin; 5 parts fuming nitric acid become so heated with 1 part indigo that the mass takes fire. Chromic acid destroys indigo, with the formation of isatin. Boiled with dilute potash, indigo is but slightly attacked, but with strong potash it is completely decomposed, with the formation of indigogen and isatate of potassium, $KC_8H_6NO_3$ (Gerhardt, *Rev. Scient.*, x. 371), of chrysanilic acid (Fritzsche). Fused with potassic hydrate, it yields, first, isatic acid ($C_8H_7NO_3$); then, from this, phenyl-carbamic acid ($C_7H_7NO_2$); and further salicylic acid ($C_7H_6O_3$), and phenylamine (aniline), C_6H_7N.

Artificial Indigo.—The nature of the products derived from indigo as just mentioned has created the impression in the minds of chemists that indigo will be prepared artificially from carbolic acid. Recently, Emmerling and Engler have actually produced indigotine from a compound acetone discovered in 1857 by Friedel, which they call *acetophenone*. Indigotine is isomeric with cyanide of benzoyl, $C_7H_5O.CN$.

Testing and Valuation of Indigo.—Water is determined by drying a weighed sample at 212° F. in a platinum crucible. After weighing, the whole is ignited for the percentage of ash. Starch may be detected by boiling with slightly alkaline water, and testing the cold filtrate with iodine. Older methods for determining approximately the percentage of indigotine were based upon oxidation—more recent methods on reduction. The following methods are given in *Watts's Dict.*:

(1) *With Chlorine Water.*—A weighed quantity of the finely pulverized indigo is added by small portions to a measured quantity of a saturated aqueous solution of chlorine as long as it dissolves with yellow color, and the quantity thus dissolved is ascertained by weighing the residue. A similar trial is then made with perfectly pure indigo-blue, and a comparison of the two results gives the proportion of coloring-matter in the sample of commercial indigo under examination. As the strength of the chlorine-water alters very quickly, it cannot be titrated long beforehand. (*Berzelius.*)

(2) *With Chloride of Lime.*—The indigo is first dissolved by digestion for five or six hours at 50° or 60° with fuming sulphuric acid; the solution is thoroughly mixed with distilled water, and poured into a graduated burette, and from this vessel it is added drop by drop to a measured quantity of aqueous chloride of lime, till the blue color just becomes permanent. A similar experiment being then made with an equal weight of pure indigo-blue, the coloring power of the two samples is in the inverse ratio of the quantities of the blue solution consumed in the two experiments. (Schlumberger, *Bull. Soc. industr. de Mulhouse*, vol. xv.)

(3) *With Hydrochloric Acid and Chlorate of Potassium.*—1 grm. of finely pulverized indigo is digested for some hours with 10 grms. of fuming sulphuric acid, agitating from time to time to assist the solution. The liquid is then poured into a basin containing a kilogramme of water; 50 grms. of strong hydrochloric acid are added, and the liquid is heated to the boiling-point. On the other hand, 0.25 grm. of chlorate of potassium is dissolved in 100 grms. of water, and the solution is poured into a graduated burette, and added drop by drop to the boiling indigo solution till the blue color changes to red-brown. The richness of the sample of indigo is directly proportional to the quantity of chlorate consumed. (Bolley, *Ann. Ch. Pharm.*, lxxv. 242.)

(4) *With Sulphuric Acid and Acid Chromate of Potassium.*—The mode of proceeding is the same as that just described; 10 grms. of pure indigo-blue prepared by Fritzsche's method require for decoloration exactly 7½ parts of the acid chromate. (Penny, *Chem. Soc. J.*, v. 297.)

All these methods are liable to the objection that it is difficult to institute an exact comparison between the different shades of color resulting from the oxidation of the indigo in different cases, the pure green tint thus produced in solutions of pure indigo-blue giving place to a dirty olive or brownish-green when crude indigo is used, in consequence of the impurities contained in it. Moreover, in dissolving indigo in strong sulphuric acid it is scarcely possible to avoid the formation of sulphurous acid, the presence of which will of course raise the apparent percentage of indigo-blue in the sample. By employing these methods, indeed, it is common to find in a good sample of indigo more than 80 per cent. of pure indigo-blue, whereas the best qualities seldom contain above 60 per cent., and average qualities not more than 40 to 50 per cent.

The following methods, which depend upon the reduction instead of the oxidation of the indigo, give more exact results:

(5) *With Protosulphate of Iron.*—A weighed quantity of the finely pulverized indigo is well mixed with an equal weight of pure lime previously slaked with water. The mixture is poured into a stoppered bottle of known capacity, and the mortar is well rinsed with water, which is added to the rest. The bottle is now heated in a water-bath for several hours, and a quantity of finely powdered sulphate of iron is added; the bottle is then filled up with water; the stopper is inserted; and after the contents have been well shaken, the whole is left at rest for several hours, till the indigo is reduced and the sediment has sunk to the bottom. A portion of the clear liquor is then drawn off with a siphon, and the quantity of liquid having been accurately measured, it is mixed with an excess of hydrochloric acid, and the precipitate, after having been oxidized (by exposure to the air), is collected on a weighed filter and washed with water. Lastly, the filter with the indigo-blue is dried at the heat of the water-bath and weighed; and the weight of the filter having been subtracted from that of the whole, the weight of the indigo-blue is ascertained. Suppose, for example, that the whole quantity of liquid was 200 measures, and that 50 measures have been drawn off, yielding 10 grains of indigo-blue; then the total quantity of indigo-blue in the sample is 40 grains. For 60 grains of indigo it is necessary to take from 1 pound to 2 pounds of water. This method, though rather tedious, gives better results than any of the preceding. The quantity of indigo-blue indicated by it is usually somewhat less than the actual quantity contained in the sample.

Leuchs (*Zeitschr. f. Chem.* [2], v. 159) converts the indigo into indigo-white by digestion with ferrous sulphate and milk of lime, mixes the clear solution, acidulated with sulphuric acid, with a solution of ammonio-ferric sulphate, and determines the quantity of ferrous salt thereby produced by means of a $\frac{1}{10}$ normal solution of potassium chromate. The conversion of indigo-white into indigo-blue by ferric salts takes place as shown by the equation: $C_{16}H_{12}N_2O_2 + Fe_2O_3 = 2FeO + H_2O + C_{16}H_{10}N_2O_2$. 1.31 grm. of the sample of indigo is mixed, in a tall cylindrical, well-closed vessel, with a quantity of lime and solution of ferrous sulphate occupying 300 cub. cent.; 100 c. c. of the clear solution are then added to 66⅔ c. c. of a solution of ammoniacal iron-alum acidulated with sulphuric acid; the liquid is filtered, and 100 c. c. of it titrated with the $\frac{1}{10}$th chrome-solution. If the latter be added from a measuring tube divided into ½ c. c., each division will correspond to 1 p. c. indigo-blue in the sample under examination.

(6) *With Stannous Chloride.*—The tin-solution is titrated with a solution of pure indigo-blue, prepared by dissolving the substance dried at 210°–230° C. (410°–446° F.) in 16 parts of strong sulphuric acid, with the addition of pounded glass to divide the indigo and facilitate the solution. The indigo-solution thus obtained is diluted with water till a litre of it contains exactly 1 grm. of indigo-blue. The indigo to be examined is then dissolved in a similar manner, and the titrated tin-solution is added to it from a burette till the blue color changes through green to light yellow. Iron, if present in the indigo, must first be removed by digestion in hydrochloric acid, with addition of pounded glass. (E. Mulder, *Scheik. Onderz.*, iii. [1], 37; *Jahresber.*, 1860, p. 613.)

(7) *With Zinc.*—A solution of indigo in sulphuric acid is diluted with water and hydrochloric acid, and decolorized by zinc in an atmosphere of carbonic anhydride. A measured volume of this solution is then introduced into a graduated tube filled with air or oxygen gas, and the volume of oxygen absorbed is read off after a few hours. A similar experiment is then made with pure indigo-blue, and the value of the commercial sample is determined by comparison of the results.

Literature.—In addition to the works mentioned at the end of CALICO-PRINTING, see *Notes upon Indigo*, by John Q. Hayes, in the *Bulletin of the National Association of Wool Manufacturers* (Boston, 1873); Lecture by Dr. Crace Calvert, *Am. Chemist*, iii. 221; *Handbook of Dyeing and Calico-printing*, by W. Crooks (London, 1874). C. F. CHANDLER.

Indigo Bird, *Cyanospiza cyanea*, one of our most beautiful native finches, is of a rich greenish-blue, feeds on seeds and insects, nests in the U. S., usually on a low bush or on tall grass, and winters in tropical America. The bird is nearly six inches long, and has a brief but very pleasant song.

Indigotine. See INDIGO, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Indirect′. In music, consecutive unisons, fifths and octaves, are said to be indirect when they are not actually expressed in form, but still implied or involved in the progression.

In′dium [Gr. *ἰνδικόν*, "dark-blue dye"], a metal discovered by means of the spectroscope in Freiberg zinc-blende by Reich and Richter in 1863. It has since been found in various zinc minerals and in wolfram, also in the flue-dust of the furnaces in which zinc ores are treated, as well as in the zinc itself. The zinc-blende of Roxbury, Conn., was found by Prof. Cornwall to contain a considerable proportion of indium. The Freiberg zinc contains about 0.05 per cent. of indium. Böttger found the flue-dust of the Gosler furnaces to contain about 0.1 per cent. of the oxide In_2O_3. Metallic indium is obtained by dissolving the ores or metal in acid and adding pieces of metallic zinc to the solution. The indium, together with some small amounts of other metals, is thereby precipitated in the metallic state. When purified the metal is found to have a bluish-silvery lustre, resembling lead in its softness and ductility. Its specific gravity is 7.421, atomic weight 113.4. It tarnishes slowly in air. Its melting-point is 176° C. (349° F.). Its very low fusion-point compared with other metals permanent in air is a striking peculiarity. It is not very volatile, and resists oxidation at temperatures considerably above its point of fusion. The spectrum consists of two blue lines. E. WALLER.

Individual′ity [Lat. *individuus*, "that cannot be divided"], in the ordinary sense of the word, is defined as "a state of oneness" (*Arbuthnot*), or "the quality of being individual; separate or distinct existence" (*Worcester*); and the idea obtained is of a complete unit which is itself indivisible without mutilation. The current idea, inasmuch as it is based chiefly upon a contemplation of the higher forms of life, is so distinct in this respect that it assumes an axiomatic character, but, far from being thus self-evident, there are few questions involved in such uncertainty, and concerning which opinions have varied so widely, as respecting this very subject. Some of the definitions that have been given are radically antagonistic. Thus, on one hand, Schultz-Schultzenstein, in the consideration of plants, has regarded "not only the shoot, but even its single parts, the internodes, with their leaves, as series of individuals shooting out of each other, or intimately connected by continuable bud formation." On the other hand, Huxley, by the study of the phenomena of increase in the lower animals, was led to believe that "the *individual animal* is the sum of the phenomena presented by a single life; in other words, it is all those animal forms which proceed from a single egg, taken together." The many intermediate views have been based upon a partial consideration of the facts in the case, and take their shade from the nature of the phenomena studied. If we attempt to apply either of the definitions cited, the results will often appear to be absurd in view of the conventional idea of individuality. Thus, if we accept the signification of Schultz-Schultzenstein for the plant, for the coral animal, or for the protozoon, not only will the flowers and the leaves, as well as the distinct animals, be individuals, but the intermediate spaces will represent indefinite individuals: in this case potentiality of individualism, or the possible future development of a more or less perfect plant or animal from the space in question, is confounded with actual individuality, or the positive development of a plant or animal. But if we accept Huxley's definition it becomes, in the lower forms of life, equally impossible to recognize either the constituents of the individual or the complete individual. Inasmuch as the sum of the production of an egg or a seed constitutes the "individual" in the case of polyps, hydroids, etc., which are capable of indefinite reproduction by budding and by excised parts, the traces of individuality would be only evident if the entire life-phenomena, from the moment of exclusion from the egg to the death of the last constituent, could be observed: in the case of plants, too, the constituents of the individual may be propagated for centuries, and may be spread over the globe—*e. g.* the weeping willows, and the many plants that are almost exclusively raised from buds or shoots—and although they may be thus entirely disconnected, and many of the derivative plants dead, inasmuch as they were derived from the same germ, they are only parts of an individual. Such are the contrary views that have been entertained, and such the logical results of the opposite views. At first, both views might appear equally absurd, but they are really not so, and both are worthy of serious consideration. They follow naturally from different ways of viewing the diffused or limited individuality in the lower forms of life, which differs thus widely from the specific individuality in the higher and more familiar forms. Nevertheless, the mind revolts from such extension of the idea of individuality, and a study of certain phenomena, and the terms generally applied to them in the higher forms of life, may furnish hints for a more satisfactory restriction of the term "individual."

In the domain of teratology, or the science which treats of monsters, there is a special department of double monsters—*i. e.* the undoubted product of a single egg or ovum, but the contents of which were early segregated into two more or less distinct components, and both developed therefrom. There is, among such monsters, every grade of differentiation up to those twin organisms, such as the "Siamese Twins," which severally manifest differences of habit and temperament, as well as possess a nearly or quite complete and independent set of organs. Now, whatever we might call the other double monsters, and wherever we might be disposed to draw the line of distinction, the world would undoubtedly regard each of the constituents of the compound organism known as the "Siamese Twins" as an individual man.

If we also view the female of any vertebrate animal, we shall find a greater or less number of well-developed eggs, and potentially each of those is an individual, as under certain exciting causes it may develop into an organism similar to the parent. Nevertheless, there is room for much difference of opinion as to when, exactly, the individual comes into existence, for there are all grades from the formation of the egg to its maturity as a simple egg, its fecundation, and the development thereafter of a fœtus. A similar although less obvious difficulty as to the precise identification of the individual thus may or does prevail in the vertebrates as in the lowest of animals and plants. It may also be recalled that the body of man as well as all other animals is subject to constant changes by molecular action. Distinguishing, however, between potential and fully-developed individuality, we may, from the consideration and appreciation of the phenomena which would be generally recognized as individuality in the higher animals, be furnished with a clue for its recognition in the lower.

If, now, we are prepared to admit, *e. g.*, the "Siamese Twins" as true individuals, notwithstanding their union and their origin from a single ovum, we must be prepared to apply the same principles to other forms, and designate as individuals forms which resemble and are homologous with others possessing all the elements of individuality. Thus, in the case of the common "sea-flowers" or "sea-anemones" (Actiniidæ, etc.) we have undoubted individuality exhibited in the single product of each egg, and which does not increase by budding. But in the case of the colony of coral animals we have a number of similar forms connected together and constituting a tree-like combination. Inasmuch as there is in all except their union an exact homology between the Actiniidæ and each of the coral animals, we are therefore compelled to recognize each constituent of the colony as an individual. In like manner are we obliged to recognize the individuality of the several constituents of the colony among acalephs, but in the case of many of these there is every gradation between a specialized individual and a mere permanent bud. On the whole, however, the recognition of individuality for the several components in these instances is attended with less embarrassment than an extreme course either way. Individuality, it must, however, be remembered, is much less defined in these budding and composite types than in the monogenetic-egged animals.

Still less is individuality developed in the vegetal kingdom. In plants generally, the elements of generation and reproduction (flowers, etc.) are developed periodically, and apparently as secondary products of the seed. The "flowers" and "fruit," *e. g.*, are simply the outgrowth of the "plant;" in composite animals, on the other hand, the "zoöids" are the prominent objects, and are simply connected by a continuous basis. Nevertheless, the term "individual" is better applicable to the organisms which are destined to continue the species, and which perform the same rôle in the vegetal kingdom as do the sexes in the animal kingdom, than (1) to the undifferentiated as well as differentiated part of the plant, or than (2) to the sum of the products (which may be scattered throughout the world) from a single seed. It will be, however, in any case, impossible to always discriminate exactly the individual, for the adage "Natura non facit saltum" is as applicable in this case as in others. But by recalling the phenomena

connected with reproduction in the several departments of nature, and attending to the distinction between potential and actual individuality, there will be few cases where serious doubt will practically exist.

Although the application of the term "individual" to each more or less perfect expression or simulacrum of the reproductive organism seems thus to be most advisable, it is important to distinguish the difference in the physiological as well as morphological value of the individuals. Thus, the specialized single product of an egg is the perfect "*zoön*" or animal, while the separate constituents of a colony derived from a single egg are called by Huxley "*zoöids*," or animal-like organisms.

The principal differences in the inter-relations of individuals among various animals are the following:

I. The simple product of an egg incapable of multiplication by budding or fission, *i. e.* typical animals.

a. The sexes differentiated in distinct individuals: vertebrates generally, most articulates, majority of mollusks, many radiates, etc.

b. The sexes united in the same individual: a few fishes, many worms, many mollusks, many radiates, etc.

II. The compound product of an egg capable of multiplication by budding or fission, giving rise to new individuals or "zoöids."

a. The zoöids undergo little change, the egg-bearing form being an ordinary individual. Example, *Hydra.*

b. The zoöids undergo great change, the egg-bearing form being a specialized individual. Example, most acalephs.

Thus the individual, as one separate animal, is very definite in the higher types and quite indefinite in the lower. In the Cœlenterates, etc. the phenomena of individuality may be best considered in connection with their reproduction. (See REPRODUCTION.) THEODORE GILL.

Indivis'ibles. In the mediæval geometry *the method of indivisibles* was essentially the same as the modern method of infinitesimals. It proceeds on the supposition that lines are made up of an infinite number of infinitesimal points, that surfaces are made up of an infinite number of lines, and that volumes are made up of an infinite number of surfaces. The method of indivisibles holds the same relation to the infinitesimal calculus, as devised by Leibnitz, that the ancient method of exhaustions does to the method of limits, as employed by Newton. As an example of the method of indivisibles, let it be required to deduce an expression for the volume of a right cone with a circular base. Denote the area of the base by A, the altitude of the cone by h, and let h be divided into an infinite number of equal parts; through each point of division suppose a plane to be passed, cutting out a section parallel to the base, and denote the distance of any such section from the vertex by h'. Then, if we denote the area of this section by a, we shall have, from the principles of elementary geometry,

$$a : A :: h'^2 : h^2, \text{ or } a = \frac{A}{h^2} \times h'^2.$$

From the nature of indivisibles we shall have the volume of the cone equal to the sum of all the sections from the vertex to the base; that is, the volume will be equal to $\frac{A}{h^2}$ multiplied by the sum of the squares of all the values of h' from the vertex to the base. If we take one of the equal divisions of the altitude as a unit, and call it 1, the different values of h' will be the series of natural numbers from σ to h; but the limit of the sum of the squares of the natural numbers from σ to h, when h approaches ∞, is equal to $\frac{h^3}{3}$; hence, the required volume is equal to $\frac{A}{h^2} \times \frac{h^3}{3}$ or to $A\frac{h}{3}$; that is, the volume is equal to the base multiplied by one-third of the altitude. This result agrees with the well-known expression for the volume of a right cone with a circular base. W. G. PECK.

In'do-Chi'na, Farther India, and **India-beyond-the-Ganges** are the names given to that portion of the south-eastern peninsula of Asia which is bounded on the N. by Thibet and China, on the W. by the Gulf of Tonquin and the China Sea, S. and S. W. by the China Sea, the Strait of Malacca, the Gulf of Martaban, and the Bay of Bengal, and on the N. W. by Hindustan. Its area is about 850,000 square miles, and the population is estimated at 25,000,000. The adjacent islands of Andaman, Mergui, Nicobar, and Prince of Wales belong to the Indo-Chinese peninsula.

Physical Features.—A bold, picturesque chain of mountains runs through the country in a continuous and unbroken ridge parallel with the coast, increasing in altitude as it approaches the city of Huè, the capital of Cochin-China. The northern province of Tonquin consists of a vast plain watered by the Songkha River. Cochin-China proper stretches along the coast, and exhibits every diversity of scenery between 11° and 18° N. lat. The Mèikhong, or Cambodia, which is the largest river of the Indo-Chinese peninsula, takes its rise in Yun-nan on the frontiers of S'efan, where it is called Lan-Tsang; towards the S. it is renamed Kew-lung-Keang, or Nine Dragon River. The volume of water which it receives from the stupendous mountains through which it forces its way renders it a mighty stream. It not only traverses the kingdoms of Laos and Cambodia, but after a course of more than 1500 miles separates into several distinct branches before emptying itself into the China Sea. Cochin-China, from its many navigable rivers, its central position, and its numerous excellent harbors, possesses extraordinary advantages for commerce. The Bay of Turon, situated in lat. 16° 7′ N., is equalled by few in the Eastern World for its beauty of scenery; and for the security and convenience which it affords to shipping it can be surpassed by none in the world. The chief town is Huè, or "the head," situated on a river navigable for ships of moderate burden. It is fortified, and all its arrangements are carried on in a style in which both magnitude and neatness are observed, showing a bold and warlike people. The other important towns are Cachoa in Tonquin, Saigon in Cambodia (a mercantile town of some importance, situated on a branch of the Saigon River), Faifi, now in ruins, and Turon, once the chief mart of trade between China and Japan. Udong, the present capital of Cambodia, is situated N. E. of Komput, one of its ports, and about 4½ miles from that arm of the Mèikhong which forms the great lake Tala-Sarp, lying 135 miles from Komput. A marshy plain covered with a dense but magnificent forest stretches in an unbroken line almost to the very gates of the city of Udong. The Songkha, or "great river" of Tonquin, has a course of nearly 400 miles, while Huè, the river of Cochin-China proper, flows through a cultivated country and abounds in the finest scenery afforded by any of the rivers of Asia. The changes of climate in these regions are sudden. Heavy rains fall during the summer, which produce a general inundation at the end of October, after which the climate is pleasant for about three months and best fitted for European travel. British Burmah or Arracan, Pegu, Martaban, and Tenasserim, including all the W. or frontier lands, with their rivers and ports, are permanent portions of British territory and under the direct control of British authorities. The kingdom of Siam lies in the middle, extends to the Gulf of Siam, and comprises some portions of the Malayan peninsula. To the E. and N. E. of the frontier of British Burmah and around some portion of the Salween River are found several tribes of Karens, more properly Khâriens, some of which acknowledge British, some Siamese, and others Burmese suzerainty, while there are other tribes which are not only really but nominally independent, and are said to be as wild as the mountains they inhabit. Passing over the Salween valley, and approaching the northern portions of Cambodia, there are found the Shan states, tributary to Burmah, and acknowledging their vassalage in the inverse ratio of their distance from the Burmese capital. To the W. of these Shan states are other tribes whose comparative proximity to the Irrawaddee makes them more substantially submissive to the Burmese government; and, strange to say, in crossing the Mèikhong River other Shan states are met with which are tributary to China. But within the boundary of the Siamese territory, near the western frontiers of Anam, the southern limits of China proper, and the eastern boundaries of the Burman empire, are all occupied by Shan states whose allegiance to any of these four powers seems to be very ill defined. The Kakhyans are a portion of the vast horde of Singphoos which inhabits the mountains N. of Assam. They have succeeded in ousting many of the Shan tribes, particularly the Pâloungs, from the hill-districts. The commercial state of the Kakhyans, which is the name given to the Singphoos by the Burmese, is in some respects very remarkable. They grow cotton in part of the country, out of which they manufacture a strong fabric for export and for their own consumption, which is of such excellent quality that Manchester could not attempt to compete with it in cheapness and durability, owing, no doubt, to the nominal value of labor among them. The Kakhyans constantly levy black-mail even to within 6 miles of Bambo, the seat of a Burman governor of the rank of wongyee. Everywhere they inspire the people with such terror that no Burmese or Siamese will travel alone in their vicinity. The general population of Northern Burmah is Shan; there are also several other tribes along the upper defile, such as the Pawons, Kạtha, Khadoos, etc. All these tribes are Booddhists, bearing a good character for quiet, orderly conduct, with some enterprise in trade and agriculture. The mineral products are yet undeveloped; the

lead and silver of Burmah, however, are found in the Shan states. The Shans are a fine, athletic, large-boned race, with long hair, which they twist into a knot behind, after the fashion of the Burmese; their dress is simply a coarse bag, with holes cut in it for the head and arms. Their language is a dialect between that of the Burmese and the Laotians. The latter call them Khonpâh, "wild forest-men." The Mai Longee teak-forests are found in this region; they have three large streams running through them, the Salueng, the Ma Uome, and Ma Noi. These large streams are supplied by numerous small ones which the people call *hueis*. Through these lesser streams most of the teak-timber is floated into the larger streams, by which it is carried for sale into the Maulmein River. Many thousands of logs are thus floated annually into the great markets of Burmah, Maulmein, and Siam from the famous Mai Longee forests. These forests, which produce unfailing supplies of the finest teak-wood in the world, are owned by a few hereditary princes of Chiengmai. The Laos iron-works are next in importance. Ban Boor, the home of iron, is a Laotian mining-town. The iron-works are about two days' journey from the town; the reason the miners live so far from their work is that the ground in the locality of the mines is sterile, and they believe the place to be infested with evil spirits. They always offer fowls and a variety of other offerings to the place before they commence operations, from a superstition that if they did not do so they would be afflicted with some dreadful malady. The iron is very abundant here; it is smelted at the mines, and conveyed to the town by means of elephants. The process of working the iron is very simple, the heaviest of the work being done by the women. The young men are the miners, the elderly men are the blacksmiths, the young women use the sledge-hammers, and the old women and children are the bellows-blowers. Taking the slender means they have for working iron into consideration, it is surprising to see the variety of tools they make. Chiengmai is the capital of the Laos. The surrounding scenery is very beautiful. To the westward, about 3 miles from the capital, are the Doie Sua Tape Hills, about 800 to 1000 feet high. The female population of Chiengmai are a hard-working, industrious people. They are all weavers and spinners. The whole process of spinning, weaving, and dyeing the cotton and silk is performed by the Laos women. They make silk saroangs of a strong, durable, and excellent texture. They are dyed after the fashion of the Scotch tartan, only of a broader pattern. The woollen patoarps are also made by them, many of which are exported. The whole of the market business is carried on by women. The market-girls come from the suburbs of Chiengmai, bringing with them vegetables, fruit, flowers, eggs, preserves, and fowls for sale, or for exchange for salt and salt fish, which are very dear here. The Laos are a hardy, industrious, and peaceable people, having a wholesome sense of what is right and just. The laws are severe; theft is invariably punished by death, drunkenness by imprisonment. The persons of the females are held sacred. The Laos form of marriage is in most cases performed and recorded by the *nai*, or magistrate; a divorce may be obtained where the parties are not comfortably suited to each other; morality is nowhere better observed. The Laos are a decidedly musical people, and certainly one of the most interesting of the Indo-Chinese races.

French or Lower Cochin-China lies in the southern extremity of the eastern portion of the Indo-Chinese peninsula, lat. 9° 5′–10° N., lon. 105°–107° E. This vast territory has been gradually acquired by the French after the dreadful war said to be provoked by the continuous persecution of the Christians by the king of Anam, who is supposed to have secretly instigated the cruel murder of certain French and Spanish missionaries in his kingdom. At the conclusion of this war, which very greatly increased the military prestige of the French army in Cochin-China, three rich provinces, called Ban-Hoa, Mèitho, and Saigon, with the islands of Puloh, Condour, and a few others off the coast, came into the French possession (1861). In 1867 new hostilities led to fresh annexations of three provinces. A new treaty was formed ceding Vinchalong, Chandour, and Haytieng, thus yielding to the colony of Cochin-Chine Française an area of 21,600 square miles, and a population in 1870–72 of 1,204,287. According to the established system of the Indo-Chinese governments, every male belongs to the king, and must either enlist in his army, or work one-third, if not one-half, of the year for the sovereign without any pay. In urging on the vigorous measures which led to the French and Cochin-Chinese wars Napoleon III. seems to have been inspired with the tradition that France had prior claims to be adjusted, and far greater wrongs to be redressed, than even those which ostensibly led the French and Spanish governments to resolve on war. Cambodia was formerly a large, powerful, and independent nation, and its kings were often at war with Anam and Siam. On some occasions the Cambodians were victorious, and succeeded in subjugating the provinces, at other times the Anamites or the Siamese had the advantage. During the reign of His Siamese Majesty P'hra-Chow-Maha-Chakrapât, who reigned in the old capital of Ayodhya in the year 1540 (A. D.), the Siamese, being at war with Pegu, were laid siege to by the Cambodians. Having subdued the Peguans, the king of Siam pursued the Cambodians, marched to the very capital of Cambodia, and besieged it, cutting off all supplies, until the king of Cambodia acknowledged himself vanquished, and offered to become tributary to Siam; on which the king of Siam returned to Ayodhya, taking with him as hostages the two sons of the king of Cambodia, the elder of whom was appointed governor of the Siamese province of Savankalok. On the death of the king of Cambodia the king of Siam was about to appoint as his successor the governor of Savankalok, when he learned that a relative of the deceased king, assisted by the Cochin-Chinese, had resolved to throw off his allegiance to the monarch of Siam. The latter sent a large army against the insurgents, but the Siamese were defeated and Cambodia became a province of Cochin-China. Finally, the king of Siam, having once more repelled the invasion of the Peguans and Burmese, marched to Cambodia, captured the capital, put the king to death, and appointed king in his stead one of the princes, P'hra-Narai-Rama, who was friendly to Siam. From that time for the space of 300 years the kings of Siam have held the right to establish the rulers of Cambodia and to the payment of an annual tribute. In 1787, Ghialong, the king of Anam, desirous of securing his throne against the joint armies of Cambodia and Siam, entered into the famous treaty with Louis XIV. of France, by which he agreed, in return for French aid, to cede to his allies the beautiful town and harbor of Turon Kwang Han and two adjacent islands. The vigorous help afforded by France proved effective not only in establishing Ghialong on the throne, but in adding to his dominions the rich provinces of Tonquin and Cambodia. But the promises made in the treaty to France were never fulfilled, with the exception that the French Christian missionaries enjoyed perfect civil and religious freedom. After the death of Ghialong, and during the reigns of the three successive emperors who followed him, Cochin-China was once more plunged into a series of wars, which led to the persecution of French Catholic missionaries, and which continued off and on for several years, until the establishment of Lower or French Cochin-China, when the kingdom of Cambodia was once more declared independent of Siam. The ruler of this kingdom, in reality only a viceroy appointed by the king of Siam, was crowned king in the presence of the French and Siamese representatives, at his capital of Udong, under the title of P'hra-Narodom, etc., in June, 1864. P'hra-Narodom has lately ceded to the French authorities the right of forming a settlement on the banks of the Mèikhong River at the junction where its four arms divide before falling into the China Sea, said to be one of the most delightful sites in the entire kingdom. Ever since the instalment of P'hra-Narodom under the French protectorate nothing has been left undone to secure the good-will of the natives. The laws and customs of the ancient régime are respected, and even upheld; the natural municipalities are carefully preserved; the land-tax, which has always been obnoxious to the cultivator of the soil, has been lowered; and, above all, the proportion of able-bodied men annually required for military and police service has been considerably lessened. In 1866 a new law was issued regulating civil offices. The resources of the country, however, are as yet but poorly developed, although rice of a very fine quality is produced in great abundance; cotton, sugar, indigo, silk, and tobacco are also successfully cultivated, but not with their utmost possible results. The dwarf mulberry grows freely; silkworms are raised with great facility, even with the poor attention given to this branch of industry; hemp, the betel, and the areca-nut are also abundant. The natives particularly excel in naval architecture, owing no doubt to the magnificent size and quality of the timber employed for that purpose; their row-galleys and pleasure-barges are often from 50 to 80 feet in length, composed of fine single planks, each extending from one extremity to the other. They employ various descriptions of vessels in their coasting-trade, in fishing, and in collecting the *bêche-de-mer*, or sea-slug, and the swallows' nests among the cluster of islands called the Paracels. Their trading vessels are built on the plan of the Chinese junks. The religion of the most part of the inhabitants of the Indo-Chinese peninsula is a modification of the system of Booddha. A yearly contribution is levied by the government for the support of a certain number of temples, priests, and monasteries, in which the priests invoke the deity for the public welfare. Voluntary

contributions of the people for the support of the priests are very great, as they are extremely superstitious.

Indo-Chinese Races and Languages.—The chief characteristics of the various races inhabiting the Indo-Chinese peninsula are mainly two: (1) they are more or less of Mongolian type; (2) they speak languages classed as monosyllabic. These races are now divided into seven groups: The Thibetiyan and Bhotyah, who inhabit Thibet proper N. of the Himalaya Mountains, comprise the first group. The most important of the races under this head are Bhors, Dhophlas, Lepchas, Bhotans, Khamtis, Semboos, Nawars, with many others. The second group comprises the Burmese and the Lohyta races, now in possession of the western portion of the Indo-Chinese peninsula. A number of wild tribes, commonly called Lohyta, are offshoots of these respective races. The third group is the numerous Nagha tribes, or serpent-worshippers. They style themselves Khawphee, and are found scattered all along the regions W. of the river Khopheeli. The remaining tribes worthy of mention are the Khyengs, who inhabit the Yoomahdong Mountains, which separate Assam from the beautiful valley of the Irrawaddee; the Khâriens, a wild but remarkable hill-tribe, who occupy the mountains of Pegu and the southern part of Burmah (the more civilized Khâriens are found scattered in the valleys of the Irrawaddee and the Salween); the Sabaing, who occupy the valley of the Sittawong, may be classed with this group. All the various tribes which are found among the mountain-regions and river-valleys of this province are probably the aborigines of the Indo-Chinese peninsula. Another ancient and aboriginal tribe inhabiting the delta of the Irrawaddee is the Mongs, called Talaengs by the Burmese. The Khamains, or inhabitants of Cambodia; Shans, called Penoms by the Cambodians, Kho by the Siamese, and Moie by the Anamites—all these names simply mean savages. The whole chain of mountains which extends from the N. of Tonquin to the S. of Cochin-China is inhabited by wild primitive tribes speaking many different dialects. The savage Stiens also inhabit these mountain-regions. The Siamese, or rather the Thais ("free men"), are one of the most important of these Indo-Chinese nations. (See SIAM.) The Laos inhabit the interior; they are classed under two heads—Laou poouk khoa, "white" or "not tattooed" Laos, and the Laou poouk dun, "tattooed Laos."

The Indo-Chinese languages are of monosyllabic character. On the primitive language of the Anamites was grafted the Chinese. Booddhism had specially selected the vernaculars of the day as the vehicle for its teaching; thus, all over Indo-China are found in use a stratum of words having no affinity with their languages, but which have been introduced by the early Booddhist missionaries. All the Indo-Chinese languages are distinguished by certain rising and falling accents, and a great number of words when thus modified express entirely different meanings. There are eight of these accentuations, properly speaking—the soft, the abrupt, the grave, the sharp, the circumflex, the broad, the rising, and the falling; only five are used in common. Without some knowledge of the musical inflections and modifications of sound it is impossible to understand any of the Indo-Chinese languages. All the other languages of this group were originally dialects. In this sense the Cambodian, Siamese, and Burmese represent the most widely diffused form of the Indo-Chinese languages. But there is a marked difference between the speech of the Siamese, the Cambodians, and the Burmese. The Burmese alphabet employs a great number of double and triple consonants; the *th* sound is used with a marked guttural breathing, which the Siamese and Cambodians render into *sh*. In all these dialects not only the words, but the vowels themselves, are so complicated by virtue of a system of tones, like those of music, that a single vowel has several distinct methods of utterance, and unless the word be pronounced correctly, not only as to sound but to tone, the meaning is entirely changed. The alphabets of the Burmese and Siamese are very different in character. The Burmese use a round character supposed to be derived from Ceylon. The Siamese use a very handsome upright character, borrowed from the ancient Cambodians, which is still used for their sacred books, and sometimes called Maghadhi and at others Pali. Pali means simply writing, not language. The Laos, in the N. of Siam, speak a dialect peculiar to themselves, but with many Siamese and Cambodian affixes, and the alphabet is like that of the Burmese. (See *Asiatic Journal; Siam and Cochin-China*, by John Crawfurd; *Travels in Indo-China*, by M. H. Mouhot; and *Travels in the Kingdom of Chiengmai*, by Lieut. S. H. Poole.)

MRS. A. H. LEONOWENS.

Indo-Germanic Languages. See LANGUAGE, by PROF. W. D. WHITNEY, PH. D., LL.D.

Indo're, a subsidiary or protected state of Hindustan, belonging to the family of Holkar, and consisting of several almost insulated territories situated on the slope of the Vindhya Mountains along the river Nerbudda. Area, 4250 square miles. Pop. 815,614. The inhabitants belong mostly to the aboriginal tribe of the Bheels, one of the wildest and most savage of India. Cap. Indore, situated in lat. 22° 42′ N. and lon. 75° 50′ E., with 15,000 inhabitants.

Indorsement. See BILL OF EXCHANGE, by PROF. T. W. DWIGHT, LL.D.

In'dra. The ancient Hindus, in the Vedic period of their religion, did not worship the Indian Triad or heroes, but deified and worshipped the sky, the sun, the dawn, fire, lightning, wind, and other elements. Indra was the chief of the deities then worshipped. His name is from the Sanskrit root *id*, to "see, discover, or discern." Indra denoted the sky, which, from overhanging the world, was supposed to discern all. It also appears from the name given to the sapphire, *Indra-nila*, or "Indra-blue," and from other considerations, that it was on account of the blue color of the sky that the stone received the name of the Hindu deity. The primitive Aryans of India believed that it was the sky which caused rain, and they therefore regarded Indra, or the sky, as the chief of the gods. From all that we find narrated about Indra, it is evident that his causing rain was regarded by Hindus as the most important evidence of his divine power. Water means wealth in the East, and Indra's compelling the fleeting clouds to pause over the rice-clad country, and drop their precious burdens on the earth, was esteemed as the chiefest of his godlike exploits. In offering him praise as the author of rain, Hindus fancied that the cloud which failed to bring rain was an *asura*, or demon. Such a cloud was particularly a *vritra* (from *vri*, to "hide or envelop"), because it spread over the face of the heaven and tried to obscure the face of the sun. Hindus pictured Indra's undertaking to cause rain as his going forth to do battle with this evil *vritra;* and they represented rain to be caused by his cleaving the demon-cloud with his *vajra*, or thunderbolt, and thereby slaying the *asura.* With reference to this feat, numberless songs were composed in praise of the sky-god; and inasmuch as Indra was completely victorious in every one of his contests with the cloud-demons, he gradually came to be regarded generally as the giver of victory, and in particular as the god who enabled the Aryan invaders of India to conquer the aborigines; and so his worship rapidly became more and more popular. In the epic and Puranic periods of the Hindu religion, Indra enjoyed great legendary fame, but he gradually lost his place in the Indian Pantheon as the chief of the gods. In Vedic times, however, he was supreme, or only shared his throne with *Agni* (fire), *Sûrya* (the sun), the *Maruts* (winds), and *Ushas* (the dawn). The hymns in praise of Indra are amongst the most spirited and beautiful in the *Rig-Veda.* It is impossible to introduce lengthy extracts into this place, but one famous one may be given. In the 32d Sûkta of the 1st Mandala of the *Rig-Veda* it is written as follows:

1. I declare the former valorous deeds of Indra—deeds which the thunderer has achieved. He cast the waters down to earth; he broke a way for the torrents of the mountains.
2. He clove the torrent which sought refuge on the mountain. *Tvashtra* (the smith) sharpened for him his far-whirling thunderbolt; the following waters quickly hastened to the ocean, like cows hastening to their calves.

* * * *

3. Inasmuch, Indra, as thou hast divided the first-born of the clouds, thou hast destroyed the delusions of the deluders, and then causing the sun, the dawn, the sky, to appear, thou hast not left an enemy to oppose thee.
4. With his vast and destructive thunderbolt Indra struck the dark, mutilated *Vritra.* As the trunks of trees are felled by the axe, so lies *Ahi* prostrate on the earth.

* * * *

5. The mother of *Vritra* was bending over her son, when Indra struck her back with his bolt. So they lay, the mother above, the son below; and *Danu* slept with her son, like a cow with its calf.

* * * *

6. Then Indra, the wielder of the thunderbolt, became the sovereign of all that is movable and immovable, of horned and of hornless cattle; and as he abides the monarch of men, he comprehended all things within him, as the circumference comprehends the spokes of the wheel.

As the sky, though changeable, constantly reverts to its perfection of cloudless beauty, so Indra was celebrated as the "ever-youthful" and "the unfading." As he was supposed especially to protect the Aryans, he was praised as "the discomfiter of those who neglect religious rites" and "lord of the devout." But as time went by the worshippers of Indra gradually regarded him as more a god of war than anything else; and so, by a natural transition, they passed on to anthropomorphize their deity, and imagined him at length to be a brave, imperious, impetuous monarch. In the *Aitareya-Brâhmana* (an ancient explanatory commentary on the *Mantras* of the *Rig-Veda*) Indra is regarded as the ruler of the inferior gods, and the

personification of all that a mortal king should be. Indra afterwards became less an object of worship than of admiration, and in the epic and Puranic period of Hindu literature he was made a favorite subject for the elaborate and extravagant eulogies of poets. These gradually invested him with a peculiar splendor, which again attracted to the god the languishing attention of Hindustan, and revived his *cultus*. He was now represented as enthroned in the east as one of the eight guardians of the world. He dwelt in an ineffably luxurious paradise, *Swarga*, the heaven of the inferior divinities, and the final blissful goal of all pious mortals who had attained sanctity by a life spent on earth devoted to the due performance of religious duties. It was here that the *Gandharvas* sang in chorus songs sweeter than any ever heard by man; and it was here that the lovely dancing-girls, the *Apsarasas*, displayed those blushing charms which the austerest of mortal hermits could scarcely resist. Here, too, rose the turrets of the most glorious of cities, *Amâravati*; and here spread that most exquisite of gardens, *Nandana*, with its five all-yielding trees. Surrounded by all this happiness and beauty, Indra still sent the sweet rain upon the earth, and struck the cloud-demons who refused to obey his behests with his unerring *vajra*. We now find him being represented in paintings and sculptures. He possesses innumerable eyes, as the sky-god who discerns all. These eyes are represented as thickly covering his body. He has four arms, perhaps typical of the four quarters of the sky. In one famous painting he is represented as riding on an elephant with three trunks. In another he is depicted as standing on an elephant, whilst a tree grows out of his head and peacocks nestle in its branches. The eyes in the tails of the peacocks may represent the stars of the firmament. Indra figures in four interesting drawings in Moor's *Hindu Pantheon*. Sculptures of the god are to be found in the caves of Elephanta and Ellora. The characteristics and attributes ascribed to Indra in Indian mythology are capitally reproduced by Sir W. Jones in his famous hymn to the god, who is represented as

> "Mounted on the sun's bright beam,
> Darter of the swift blue bolt,
> Sprinkler of genial dews and fruitful rains
> O'er hills and thirsty plains."

The following lines may also be quoted, as they vividly bring before the reader the god himself, his appearance, his "robes of changing dyes" (perhaps the variable clouds), and the deities which act as his servants. The story to which the lines are a sequel is this: Indra on one occasion assumed the form of a shepherd-lad, that he might steal some pomegranate-flowers from a garden "to deck the dark tresses of his charming consort, Indrani." Whereupon,

> "The reckless peasant, who these glowing flowers,
> Hopeful of rubied fruit, had fostered long,
> Seized, and with cordage strong
> Shackled the god who gave him showers.
> Straight from seven winds immortal genii flew:
> Varuna green, whom foamy waves obey;
> Bright Vahni, flaming like the lamp of day;
> Kuvera, sought by all, enjoyed by few;
> Marut, who bids the wingèd breezes play;
> Stern Yama, ruthless judge; and Isa cold;
> With Nairrit, mildly bold;—
> They, with the ruddy flash which points his thunder,
> Rend his vain bands asunder.
> Th' exulting god resumes his thousand eyes,
> Four arms divine, and robes of changing dyes."

These lines allude to a late period of the cultus of Indra, as he is represented as taking the form of a shepherd-boy. Still, the idea of Indra becoming occasionally incarnate is one which does not seem foreign to the spirit of even some of the Vedic hymns, in which he is lauded as the destroyer of certain chiefs who are actually mentioned by name. One feature of his earliest worship was the offering to him, by pious Brahmans, of the juice of the soma-plant. The later legends about Indra are not all creditable to him. The story of his seduction of Ahilya, the handsome consort of Gotama, is narrated in all its coarseness in the 38th chapter of the *Ramâyana*. Indeed, Indra became in Puranic times noted for his profligacy. He constantly sent *Apsarasas* (the beautiful dancing-girls of his paradise) to tempt ascetics. When the holy hermit, Viswamitra, had been engaged for thousands of years in practising the most rigorous austerities, Indra sent the most beautiful *Nenaka* to him. The unfortunate sage was immediately overcome, "for, seeing her bathing, of surprising form, unparalleled in beauty, her clothes wetted by the stream exhibiting her fascinating symmetry of frame, he, subdued by the arrows of *Kandarpa*, approached her, and five times five years spent in dalliance with her passed away like a moment." At length, however, the ascetic exclaimed, "What! are my wisdom, my firm resolution, my austerities, all destroyed at once, and by a woman? Seduced by the crime in which Indra delights, I am stripped of the advantages arising from all my austerities." (*Ramâyana*, section 50.) Indra is also called by the names of *Sakra, Vajrapani, Satakratu, Vritrahan, Vasava*, and *Makendra*. R. C. Caldwell.

Indre, department of Central France, on the Indre, a tributary to the Loire. Area, 2624 square miles. Pop. 277,693. Although a part of the surface is barren or swampy, considerable quantities of wine and wheat are raised for exportation. Among articles of industry are cutlery, earthenware, leather, and cotton cloths. Of 34,000 children between seven and thirteen years, 19,000 did not receive any school education in 1857. Cap. Châteauroux.

Indre, a river of France, chiefly in the department of the same name, flows into the Loire S. W. of Tours, after a N. W. course of 115 miles. It is navigable from Loches to the Loire, 45 miles.

Indre-et-Loire, department of Central France, on the Loire, along which high dykes have been built to prevent inundations. Area, 2332 square miles. Pop. 317,027. Wine and wheat are produced, truffles and fruits are raised, and the culture and manufacture of silk are steadily increasing. Of 39,809 children between seven and thirteen years, 8645 did not receive any school education at all in 1857. Cap. Tours.

Induc′tion and **Abstrac′tion** are the two forms of Generalization (which see), abstraction comparing phenomena with respect to the similarity of their substance, and establishing a class; induction comparing phenomena with respect to the similarity of their cause, and establishing a law as the result of the generalization. As reduction is the opposite to abstraction, deduction is the opposite to induction. By abstraction the definition of a species is established; by reduction a specimen is referred to its species. By induction the law is established which governs certain phenomena; by deduction a phenomenon is explained as governed by a certain law. The establishment of the law of gravitation from the fact that apples fall to the earth is an induction; the explanation of the phenomenon of ebb and flood from the law of gravitation is a deduction. It must be noticed, however, that although these distinctions are of great importance as means of understanding thoroughly the logical operations of the human mind, yet in actual thinking they occur very seldom, if ever, in a perfectly unmixed state. In thinking we generally use the two opposite methods of operation at once, just as in seeing we use both the eyes, in hearing both the ears, in working both the hands, and in walking both the legs. It is true, in general, that inventions are the fruits of deduction, and discoveries of induction; and as it is the natural order that the law shall be found by induction before it can be applied by deduction, we find, as a general rule, that discoveries precede inventions. First came Oersted's discovery of electromagnetism, then Morse's invention of the telegraph. But was the invention of the lightning-rod a mere deduction? or was the discovery of the globular form of the earth a mere induction? With Ptolemy, who after Hipparchus assumed that the earth is a globe from the movements of the heavenly bodies, it is as impossible to reduce the reasoning process to a merely inductive or merely deductive method as it would be to say whether it is the right hand which washes the left or the left which washes the right.

The inductive process of reasoning has received its most thorough analysis from Stuart Mill in his *System of Logic*. He distinguishes between four different methods in which the inductive operation can be carried on—namely, the methods of agreement, of difference, of residues, and of concomitant variations—and he condenses the description of each method into a formal canon or rule of induction. Thus, the first canon, or the rule of the method of agreement, pronounces that *if two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree is the cause of the given phenomenon.* But as in many cases it would be a difficult and laborious, not to say endless and impracticable task, out of the millions of circumstances which may accompany a phenomenon in different instances, to eliminate those which are accidental, because they do not occur in all instances, and single out that one which must be the cause, because it is ever recurring, it is necessary to follow another method in carrying on the operation of induction. In such cases it will be found more expedient to single out that one circumstance by the exclusion of which the phenomenon disappears, and which consequently must be its cause. The rule of this method, the method of difference, is expressed in the following canon: *If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance except one in common (that one occurring only in the former), the circumstance in which alone the two instances differ is the cause, or a necessary part of the cause, of the phenomenon.* There are phenomena,

however—and as our knowledge extends they become more frequent—of which the causes are partly known, partly unknown. In such cases the method of residues must be resorted to, for which the rule is: *Subduct from any phenomenon such part as is known by previous induction to be the effect of certain antecedents, and the residue of the phenomenon is the effect of the remaining antecedents.* Finally, there are phenomena of which the cause cannot be found out by any kind of elimination, because the causal agency is universal. Thus, the laws governing phenomena caused by the earth's attraction or by heat cannot be ascertained by any of the three former methods of induction, because we cannot get out of the sphere of the earth's attraction, and because there is nothing in which heat is absent. In such cases the method of concomitant variations must be applied, the rule for which is: *Whatever phenomenon varies in any manner whenever another phenomenon varies in some particular manner, is either a cause of that phenomenon, or is connected with it through some fact of causation.* The precision and exhaustiveness of these rules are striking, but it is also obvious that real thinking seldom, if ever, follows any of these tracks exclusively. As induction and deduction generally walk together, hand in hand, so also the different methods of induction. CLEMENS PETERSEN.

Indulgence meant originally a release from the temporal penalties which remain due for a sin after the sin itself has been remitted by confession and absolution, and was granted during the first centuries of the Christian Church not only by the pope, but by all the bishops, to infirm persons or to those penitents who showed extraordinary contrition. By degrees, the practice of remitting punishment for money was introduced, the bishops allowing offenders to buy off the canonical penalties by bestowing gifts for some religious purpose; and from this time the popes began to reserve for themselves the right of granting, or rather selling, indulgences. In the fourteenth and fifteenth centuries this right was extended in an enormous degree. After the establishment of the doctrine of OPERA SUPEREROGATORIA (which see) the pope arrogated not only the privilege of releasing from temporal penalties, but the power of forgiving sin; and this enormous extension was accompanied in the fifteenth and sixteenth centuries with the most scandalous practices. (See REFORMATION, TETZEL.)

In'dus, the great river of Southern Asia which separates Hindustan from Afghanistan. It rises in the Himalayas in lat. 31° 20′ N. and lon. 81° 15′ E., on the northern side of the Kailas, at an elevation of 18,000 feet. After receiving the Gartope, it bursts through the Himalayas and flows through the lowland to the Arabian Sea. At Attock, the point where Alexander entered into India, 940 miles from its outlet, and at an elevation of only 1000 feet, it receives the Cabool and becomes navigable; 470 miles from the ocean it is joined by the Punjaub, which is formed by the confluence of five large rivers; but at Migani, 8 miles N. of Hyderabad and 75 miles from the ocean, it divides and forms a delta whose breadth along the coast is 130 miles. It enters the Arabian Sea through a great number of mouths, of which the Koree is the widest and deepest, but even that one is not accessible for vessels of more than fifty tons, the channel being much encumbered by shoals and mud-banks. The Indus abounds in fish, but is much infested with crocodiles.

Industrial Exhibitions. See EXPOSITION, INTERNATIONAL AND UNIVERSAL, by F. A. P. BARNARD; and EXPOSITION, THE INTERNATIONAL UNIVERSAL, by PROF. W. P. BLAKE, A. M., PH. B.

Indus'trial Schools, a term which may have several applications, but of which the strict legal meaning in Great Britain is confined to institutions, established or recognized by the government, to which juvenile offenders may be sent by a magistrate. Attempts to ingraft the industrial feature upon voluntary schools have not been rewarded with much success, at least as regards their usefulness to the lower classes; and in the British revised code the grants formerly made to such schools were discontinued. It seems necessary to the usefulness of industrial schools that the children be wholly withdrawn from the control of parents, and their entire direction assumed by the school authorities, in which case they naturally become assimilated to reform schools or houses of correction, thus suppressing the element of spontaneity which alone can entitle industrial schools to a classification apart from disciplinary institutions. The number of industrial schools in England and Scotland in 1861 was only 39, with 3180 pupils.

Industry, tp. and post-v. of McDonough co., Ill., 8 miles from Macomb City. Pop 378; of tp. 1533.

Industry, post-tp. of Franklin co., Me., 10 miles N.E. of Farmington. It has 4 churches, and manufactures of agricultural tools. Pop. 725.

Industry, a v. of York tp., Belmont co., O., ½ mile from Powhatan Point, on the Ohio River. Pop. 58.

Industry, post-tp. of Beaver co., Pa., on the Ohio River and the Cleveland and Pittsburg R. R. Pop. 796.

Inebri'ety [Lat. *inebriare*, "to make drunk"], in the present acceptation of the term, is used to denote the diseased condition of the system produced by the habitual use of alcohol. Its synonyms are *alcoholism, dypsomania,* and *oinomania.* Alcohol introduced into the circulation acts upon, and to a certain extent destroys, the red corpuscles of the blood, and thus, secondarily, affects all the organs of the body. Its most common mode of introduction into the system is in the form of spirituous and fermented drinks; and in those addicted to its habitual use the principal lesions are chronic hyperæmia and subsequent softening of the brain, cirrhosis and fatty degeneration of the liver, fatty degeneration of the kidneys, and fatty degeneration of the heart. Formerly, inebriety was regarded as a crime, but within a few years science has shown it to be a disease, and institutions have been established for its treatment and cure. Statistics from these institutions have demonstrated—I. Inebriety is a disease, and is curable. II. Relapses may or may not occur. The patients in hospitals for the treatment of inebriates may be divided into three classes—viz. I. Those who by social indulgence, without hereditary taint, have become inebriates. These, as a class, are curable by the aid of an institution. II. Those in whom the disease is inherited, in which cases it manifests itself in paroxysms ("sprees") at variable intervals. These are more difficult to restore to health. III. Those who seem totally depraved in all their instincts, and exhibit no desire for restoration to health. These, as a class, are incurable, and should, for the protection of society, be placed under permanent restraint in institutions distinct from those of a reformatory character. Carefully prepared reports from hospitals for inebriates show that a very large percentage (between 50 and 60) of the patients treated in them are restored permanently. WILLARD PARKER.

Inequal'ity [Lat. *in*, and *æqualitas*]. An inequality is an algebraic expression indicating that one quantity is greater or less than another. The sign $>$ is called the sign of inequality; when placed between two quantities, it indicates that the quantity at the opening is greater than the other. Thus, the expressions $3>2$ and $5<9$ are inequalities; the former is read 3 *is greater than* 2, and the latter, 5 *is less than* 9. The parts connected by the sign are called *members;* that on the left of the sign is called the *first member*, and that on the right the *second member.* Of two unequal quantities, that is algebraically the greater whose value is nearer to $+\infty$. Two inequalities are said to subsist in the *same sense* when the greater quantity is in the first member of both, or in the second member of both; they subsist in a *contrary sense* when the greater quantity is in the first member of one and in the second member of the other. Thus, the inequalities $3>7$ and $4>9$ subsist in the same sense, but the inequalities $3>7$ and $9<14$ subsist in a contrary sense.

Inequalities may be transformed in accordance with the following principles: (1) If we add the same quantity to, or subtract it from, both members, the resulting inequality will subsist in the same sense. (2) If two inequalities subsist in the same sense, and if we add them member to member, the resulting inequality will subsist in the same sense. (3) If both members of an inequality are multiplied or divided by the same *positive* quantity, the resulting inequality will subsist in the same sense. If both members are multiplied or divided by the same *negative* quantity, the resulting inequality will subsist in a contrary sense. (4) If both members of an inequality are positive, and if both are raised to any power, the resulting inequality will subsist in the same sense.

These principles enable us to reduce an inequality to another in which one member is the unknown quantity; the other member is then a *limiting value* of that quantity. W. G. PECK.

Iner'tia, or **Vis Iner'tiæ** [Lat., the "power of inactivity"], a universal property of matter by reason of which if in motion it will for ever continue in motion, or if at rest it will for ever continue at rest, unless operated upon by some external force.

I'nes de Cas'tro, descended from one of the richest and noblest families of Galicia, when her cousin, Donna Constantia, married Don Pedro, the crown prince of Portugal, accompanied her as maid-of-honor. Ines was very beautiful; she was called "Ines with the heron-neck." At the first glance Don Pedro fell in love with her, and when, in 1344, Donna Constantia died, he secretly married her. In 1355, Don Pedro's father, the old king of Portugal, Alfonso IV., had her assassinated for political reasons; and

the passionate depth and wild character of the love which Don Pedro had entertained for her became apparent in his sorrow and in his revenge. When Alfonso died in 1357 and Pedro became king, the corpse of Ines was placed on the throne in royal attire and received royal homage; then it was solemnly entombed under a magnificent monument and with gorgeous processional pomp. Her assassins were put to death in a most cruel manner.

Infal'libilist [Lat. *in*, "not," and *fallible*, "capable of erring"], one who believes in the infallibility of the pope. The term is of recent origin, and was brought into use in 1870, during the Vatican Council, which at first was divided between *infallibilists* and *anti-infallibilists*, but at last decided that the pope was infallible—*i. e.* free from all error—in his official utterances as the head of the Catholic Church on questions of faith and morals. The anti-infallibilists were divided into two parties—those who opposed the doctrine of papal infallibility from principle, as false (Bishops Hefele, Maret, Kenrick, Darboy), and those who opposed it only from expediency, deeming it *inopportune* or untimely and unwise to define and to declare the dogma; hence the latter were called also *inopportunists*, as distinct from the *opportunists*. (See INFALLIBILITY and VATICAN COUNCIL.)

PHILIP SCHAFF.

Infallibil'ity of the Pope. Infallibility [It. *infallibilità;* Span. *infalibilidad;* Fr. *infaillibilité;* Ger. *Infallibilität, Unfehlbarkeit*] is exemption from error (inerrability), and corresponds to *impeccability*, or exemption from sin (sinlessness); the former is the perfection of knowledge, the latter the perfection of will or character; both are united in God and in Christ, but not in any human being in this world of sin and error. The word is chiefly used in connection with the Church and the bishop of Rome. All Christians believe that the word of God in the Bible is inspired, and hence infallible. The Greek Church holds, in addition to this, that the Church universal, as represented in a truly œcumenical council, is infallible, but restricts this to the first seven councils from 325 to 787. The Roman Church goes still farther, and declares the pope, even without an œcumenical council, infallible, not indeed in his individual but in his official character, whenever he speaks *ex cathedrâ*—that is, whenever he addresses the whole Catholic world on a matter touching Christian faith or morals. This view was formerly a disputed opinion, strongly opposed by the Gallicans and all liberal Catholics, but is now by a decree of the Vatican Council a dogma of faith which must be believed by every Catholic on pain of excommunication and damnation. The Vatican decree of July 18, 1870, thus states the new dogma: "Therefore, faithfully adhering to the tradition received from the beginning of the Christian faith, for the glory of God our Saviour, the exaltation of the Catholic religion, and the salvation of Christian people, the Sacred Council approving, we teach and define that it is a dogma divinely revealed; that the *Roman pontiff*, when he speaks *ex cathedrâ*—that is, when in discharge of the office of pastor and doctor of all Christians, by virtue of his supreme apostolic authority, he defines a doctrine regarding faith or morals to be held by the universal Church, by the divine assistance promised to him in blessed Peter—*is possessed of that infallibility with which the divine Redeemer willed that his Church should be endowed for defining doctrine regarding faith or morals;* and that, therefore, such definitions of the Roman pontiff are *irreformable of themselves*, and not from the consent of the Church. But if any one—which may God avert!—presume to contradict this our definition, let him be anathema."

Papal infallibility was the chief topic of the Vatican Council; it was discussed under powerful opposition for several months, and carried at last by the influence of the pope and the Jesuits. When the vote was first taken in secret session (July 13, 1870), 451 bishops voted in the affirmative (*placet*), 88 in the negative (*non placet*), 62 voted with a qualification (*placet juxta modum*), and over 80, though present in Rome, abstained from voting. On the evening of the same day the minority, which included the ablest and most influential prelates (as Darboy of Paris, Schwarzenberg of Prague, Rauscher of Vienna, Dupanloup of Orléans, Förster of Breslau, Ketteler of Mayence, Strossmeyer of Bosnia, Hefele of Rottenburg, Kenrick of St. Louis), sent a deputation to the pope, which begged him on their knees to modify the proposed decree and to make some concession for the peace and unity of the Church; but Pius IX. surprised the deputation with the assurance that the Church had always believed in the unconditional infallibility of the pope. (He claims to be the infallible judge of the Church's teaching, according to the saying attributed to him, "I am the tradition.") In the secret session of July 16, on motion of some Spanish bishop, an addition was inserted, which makes the decree still more obnoxious by declaring the pope infallible *before* and *without* the consent of the Church (*non autem ex consensu ecclesiæ*). On the 17th of July, 56 bishops opposed to the new dogma sent a written protest to the pope, declaring their firm adherence to their conviction, but also their reluctance to vote against him in his face on a matter affecting him personally, and asking leave to return home. On the evening of the same day the signers of this protest, and 60 additional members of the opposition, left Rome (taking advantage of the rumors of war), and by this cowardly act they gave an easy victory to the majority and the triumph of error. In the public session, held July 18, there were but 535 members present, and all voted *placet* except two (Bishop Riccio of Sicily and Bishop Fitzgerald of Arkansas), who changed their vote before the close of the session. After the vote the pope, amidst a fearful thunderstorm and flashes of lightning, read by candlelight in St. Peter's cathedral the decree of his own infallibility. The day after, Napoleon III., his chief political support, declared war against Germany; this war in a few weeks swept away both his throne and that of the pope, and resulted in the prostration of France, the unification of Italy, and the rise of the German empire under the lead of Protestant Prussia. The proclamation of this new dogma is the cause of secession of the "Old Catholics" under the lead of Döllinger (heretofore the pride of the Roman Church in Germany) and other eminent Catholic scholars. It is also the cause of the renewal of the serious conflict between the pope and the emperor, since no independent government can treat with an infallible pope on terms of equality. It may yet lead to a religious war in Europe. The Old Catholic movement would have become much more formidable if some, at least, of the protesting members of the council had remained faithful to their convictions, but all of them submitted, even those who during the council had made an unanswerable argument against papal infallibility. As they all professed to believe in the infallibility of an œcumenical council, they had either to give up this faith and virtually become Protestants, or to admit the infallibility of the pope after it had been so decreed by the Vatican Council, which they admitted to be œcumenical. To a Protestant this very council furnishes the best argument against the infallibility of an œcumenical council, since it solemnly affirms what three other œcumenical councils positively denied—viz. the infallibility of the pope. Either the council is fallible or the pope is fallible, or both are fallible. It is impossible that both are infallible, since they contradict each other.

This new dogma is the apex of the pyramid of the Roman hierarchy. Logically, it is more consistent than the Gallican theory, as an absolute monarchy is more consistent than a constitutional monarchy. It teaches an unbroken and ever-active infallibility, while Gallicanism secures only a periodic and intermittent infallibility, which reveals itself in an œcumenical council. But neither theory can stand the test of history, and is a mere pretension. Papal infallibility especially is unknown to the Bible and unknown to the ancient Church, and was never heard of till the period of the forged decretals in the ninth century. It lacks every one of the three essential marks of catholicity (the *semper*, the *ubique*, and the *ab omnibus*). It is not taught by any of the Fathers, Greek or Latin, nor by any of the œcumenical creeds, nor any of the œcumenical councils. On the contrary, the sixth œcumenical council, which was held in Constantinople 680, and is universally acknowledged in the East and the West, condemned and excommunicated Pope Honorius I. (625–638) "as a heretic (Monothelite), who, with the help of the old serpent, had scattered deadly error." This anathema was solemnly repeated by the seventh and by the eighth œcumenical councils (787 and 869), and even by the popes themselves, who down to the eleventh century, in a solemn oath at their accession, endorsed the sixth œcumenical council and pronounced "an eternal anathema" on the authors of the Monothelite heresy, together with Pope Honorius, "because he had given aid and comfort to the perverse doctrines of the heretics." This papal oath was probably prescribed by Gregory II. at the beginning of the eighth century, and is printed in the *Liber diurnus* and *Liber pontificalis* down to the eleventh century. Even the editions of the Roman Breviary before the sixteenth century reiterated the charge of heresy against Honorius. Pope Leo II. strongly confirmed the decree of the council against his predecessor Honorius, and denounced him as one who "endeavored by profane treason to overthrow the immaculate faith of the Roman Church" ("*qui hanc apostolicam ecclesiam non apostolicæ traditionis doctrina lustravit, sed profana proditione immaculatam fidem subvertere conatus est*"). (See Mansi, *Concilia*, tom. xi. p. 731.) This case of Honorius is as clear as daylight (according to the triumphant argument even of Roman Catholic scholars before the passage of the decree, such as Maret, Gratry, Kenrick, and Hefele), and is alone sufficient to overthrow the colossal

claim as a historical lie ("*si falsus in uno, falsus in omnibus*").

But history knows of other heretical popes: Zephirinus (201–219) and Callistus (219–223) were Patripassians; Liberius (358) signed an Arian creed and condemned Athanasius, "the father of orthodoxy," who mentions the fact with indignation; Felix II. was a decided Arian; Zosimus (417) at first endorsed the heresy of Pelagius and Cœlestius, whom his predecessor, Innocent I., had condemned; Vigilius (538–555) vacillated between two opposite decisions during the Three Chapter controversy, and thereby produced a long schism in the West; John XXII. (d. 1334) denounced an opinion of Nicholas III. and Clement V. as heretical; several popes taught the universal depravity of men in a manner that clearly includes the Virgin Mary, and is irreconcilable with the recent dogma of the immaculate conception; Sixtus V. issued an edition of the Latin Bible with innumerable blunders, partly of his own making, and declared it the only true authentic text. Bellarmin, the great Roman controversialist and infallibilist, could not deny the facts, and advised the printing of a new edition with a lying statement in the preface, charging the errors of the infallible pope upon the fallible printer, though the pope had himself corrected the proofs. The present pope started out as a political reformer and advocate of Italian unity, which he now detests as the worst enemy of the Church.

The Pseudo-Isidorian Decretals first set up the claim of infallibility, and by a monstrous forgery, long since exploded, put it with other falsehoods into the mouths of the oldest popes in barbarous French Latin and with glaring anachronisms. Other hierarchical fictions, as the legend of the donation of Constantine and his baptism by Pope Sylvester, arose in the same uncritical and superstitious age, and were readily believed. But there was no time when these claims were not resisted. The famous œcumenical Council of Constance (1414–18) asserted its superiority over the pope by deposing one pope (John XXIII.) for infamous crimes, and another pope (Benedict XIII.) for heresy, and electing a third one in their place (Martin V.). There is no escape here from the logical dilemma, either to admit the validity of the council or to invalidate the election of Martin V. and his successors; both alternatives are fatal to papal infallibility. After the Reformation the Jesuits became the unscrupulous and untiring champions of this doctrine, but they failed in their effort to commit the Council of Trent. All the Jansenists and the greatest modern champions of Romanism, as Bossuet, Möhler, and the principal popular catechisms used before 1870, deny the infallibility of the pope. The Irish bishops Doyle, Murray, Kelly, affirmed under oath before a committee of the British Parliament in 1825, and openly declared in a *Pastoral Address* to their clergy and laity in 1826, that the infallibility of the pope is "not an article of the Catholic faith." It was on this explicit testimony that the Catholic emancipation bill was carried through Parliament. The Vatican Council was convened chiefly by Jesuitical influence for the purpose of defining this new dogma and killing Gallicanism; but the arguments and facts were on the part of the opposition, which might have triumphed if its moral courage had been equal to its learning and ability. Liberal Catholicism is now crushed by authority. The Vatican system requires the slaughter of private judgment and individual conscience, and divides the allegiance between the pope and the home government whenever they come in collision (as may be the case in the questions of education, marriage, and the restoration of the temporal power). We must indeed respect the higher law and "obey God, more than man," but the pope, far from being God Almighty, is a mortal, sinful man; and the government which the apostles disobeyed was not the state, but the *ecclesiastical* government of the Jewish hierarchy, which forbade them to preach the gospel (Acts v. 29), and set a bad example to the Roman hierarchy.

Literature.—1. In favor of papal infallibility: Archbishop Cardoni, *Elucubratio de dogmatica Romani Pontificis infallibilitate* (Rome, 1870, semi-official); Archbishop Manning, *Petri Privilegium* (London, 1871); also his reply to Gladstone (1874); Archbishop Dechamps, *L'infaillibilité et le Concile Général* (Paris, 1869); Weninger, *The Infallibility of the Pope* (German and French, 1869); J. H. Newman, *Letter to the Duke of Norfolk*, in reply to Gladstone's *Vatican Decrees* (London and New York, 1874), a very qualified defence of infallibility, with a reserve of the rights of conscience. Older champions of infallibility are Bellarmin, Litta, Liguori, and Count de Maistre. 2. Against papal infallibility: (*a*) By members of the Vatican Council—Bishop Maret (dean of the theological faculty in Paris), *Du Concile Général et de la paix religieuse* (Paris, 1869, 2 vols.); Archbishop Darboy, *La liberté du Concile et l'infaillibilité* (in Friedrich's *Documenta*, i. 129–186); Bishop Hefele, the author of the best history of councils, *Causa Honorii Papæ* (Neap., 1870); and *Honorius und das sechste allgemeine Concil* (Tübingen, 1870; trans. by H. B. Smith in the *Presbyt. Quart. Rev.* for Apr., 1872, p. 273); Archbishop Kenrick of St. Louis, *Concio in Concilio Vaticano habenda at non habita* (Naples, 1870; reprinted in Friedrich's *Documenta*, i. 187–226). (*b*) By Catholics not members of the council, now mostly Old Catholic seceders—Janus (pseudonymous), *The Pope and the Council* (German and English, Leips. and London, 1869); Döllinger, *Ueber die Unfehlbarkeits-Adresse* (Munich, 1870); Reinkens, now Old Catholic bishop, *Ueber päpstliche Unfehlbarkeit* (Munich, 1870); A. Gratry, *Four Letters to the Bishop of Orléans* (Dupanloup) *and the Archbishop of Malines* (Dechamps), (in French, German, and English, 1870. Gratry recanted on his deathbed). (*c*) By Protestants—W. E. Gladstone, *The Vatican Decrees in their Bearing on Civil Allegiance* (Lond., 1874), with a history of the council and the text of the decrees, by Philip Schaff (New York, Harpers, 1875); Gladstone, *Vaticanism, an Answer to Reproofs and Replies*, of Manning, Newman, and others (Lond. and New York, 1875). Comp. also the literature on the VATICAN COUNCIL. PHILIP SCHAFF.

In'fant, in law, is a person who on account of youth and inexperience is incapacitated either wholly or in part from entering into contracts or performing specific acts. The incapacity may be natural or artificial, and is affected by rules of positive law. Thus, under some systems of law a person has not full capacity until attaining the age of twenty-five; under the rules of the common law full capacity is attained at the age of twenty-one; though by a special rule a marriage may be contracted by a male at the age of fourteen, and by a female at the age of twelve. Wills of personal property may be made at the same age. These rules were borrowed from the ecclesiastical courts, where questions concerning the validity of marriages and of wills of personal property were disposed of. This matter in the U. S. is to some extent regulated by statute. A promise to marry is not binding unless the promiser is of full age. By an ancient rule which is still law a person becomes twenty-one on the day preceding the anniversary of his birthday. This is on account of the legal proposition that the law recognizes no fraction of a day, and as full majority would be reached at the close of the preceding day, it is attained by this rule at any time on that day. In some states females attain majority at an earlier age than males. This diversity of rules in the different states or nations leads to interesting questions in private international law. (See INTERNATIONAL LAW, PRIVATE.) Thus, if a person not of age in a country where he is domiciled happens to be temporarily in a country where he is of sufficient age to make contracts, and does in fact assume to contract, the question will be whether the validity of his contract is to be tested by the law of his domicile or of the place where the contract is made or to be performed. Under the English and American law the law of the place where the contract is made is assumed to govern. In testing the validity of a will of personal property reference will be had to the law of the domicile, and of a like disposition of land to the law of the place where the land is situated.

The subject may be considered under the following principal divisions: I. The capacity of infants to make contracts, and to do other acts of a civil nature involving judgment and discretion; II. Their liability for wrongs (torts); III. Their responsibility for crimes; IV. Their rights in a court of equity; V. Their liability as property-owners to bear the legal burdens imposed on property.

I. It is a general rule that an infant's contract is not binding upon him. There has been great controversy upon the point whether his acts are void or voidable. The effect of this distinction is, that if the contract is void, it is incapable of confirmation by the infant on attaining majority. On the other hand, if voidable, the infant has the power of confirmation. There is a strong tendency in modern law to construe the act to be voidable rather than void, and there are but few contracts made by infants at the present day which are incapable of confirmation. This rule makes the subject of confirmation of much importance, and frequently questions arise as to the point whether it may take place by implication as well as by express agreement. It has often been decided by the courts that confirmation may be inferred in certain cases from acquiescence for a considerable time after majority, particularly where the fruits of the transaction are still enjoyed by the infant, as in the case of purchase of property or the execution of a lease. In the latter case the reception of rent would be strong evidence of confirmation. This doctrine would not be so readily admitted in the case of the sale of the infant's land, and there are authorities of high respectability which maintain that the title will not be perfect in this case, in the absence of direct confirmation, until there has been pos-

session by the grantee for the time required by the statute of limitations. (See LIMITATIONS, STATUTE OF.) A person will not be liable to pay a debt contracted during infancy without a promise to pay made after majority.

Under these doctrines it is plain that an infant at his majority may, except in special instances to be hereafter mentioned, repudiate his contract at will. In doing this he must, in general, return to the other party what he has received from him. His infancy is to be used "as a shield and not as a sword." Should he repudiate the contract, it would seem that he would be under a legal duty to make restitution only in case the property was under his control. In other words, he must, on rescinding a contract, put the opposite party back in his original position, if that is in his power. If he makes a contract to serve another for a specified time, he may repudiate the contract, and still exact payment for what he may have done under it.

The principal exception to the voidable nature of the infant's contract consists in the fact that he may bind himself for "necessaries." This term refers to contracts for food, clothing, shelter, medical attendance, and proper instruction or education. There will, of course, be a wide range in respect to these articles, depending upon the infant's wealth and position in society. While the judges determine as matter of law the classes of things for which infants are liable, they refer special cases to the jury to decide whether, under all the circumstances, the expenditure was proper. There may, however, be cases of such a glaring character as to show that the goods could not on any theory be necessary, when the judge will dismiss the case. It should be added that while the infant may be bound by his contract in respect to such articles, it does not follow that he will be required to pay the *price* which is charged to his account or which he has agreed to pay. He can only be held for the real value of the goods, without reference to the price fixed, though that be stipulated by his note or bond. Under these rules, if an infant should borrow money with an intention expressed to the lender to purchase necessaries, he could not be made to repay the money unless it were actually used for that purpose. These rules, being designed for the infant's protection, are liberally construed by the courts. The doctrines applicable to necessaries would be extended to his wife and children, and he could contract for their support. There may sometimes be a question whether the price of supplies is to be paid by the infant or his parent. The true line of inquiry in such a case is, To whom *was the credit given?* If given to the parent, the tradesman cannot recover of the infant, though the parent should prove pecuniarily irresponsible.

Without pursuing this branch of the subject further, mention may be made of certain other cases in which the infant will be bound by his acts. It is a general rule that he will be bound whenever he voluntarily does that which he could have legally been compelled to do; *e. g.* if he could have been required, as a trustee, to execute a deed, his voluntary execution of it will be sufficient. The same rule will be applied if statute law gives him in special instances an exceptional capacity to act, as where he is authorized by law to enlist in the army or navy or required to support an illegitimate child.

In the following instances an infant is by the law of this country usually incapable. He cannot hold a public office or act as an executor or administrator until he is seventeen, and in some States until twenty-one (though he may be appointed), nor can the doctrine of estoppel be applied to him in a court of law, though it may be in some instances in equity; nor can he in general appoint an attorney or appear in court by an attorney, though a next friend or guardian may act for him, who may appoint an attorney; nor will the statute of limitations begin to run against him. The explanation of the last branch of this statement is, that if a cause of action should arise during his infancy, neglect cannot be imputed to him for failing to vindicate his rights by action. Accordingly, the statute of limitations, which is framed to prevent undue delay in litigation, will not apply to him until his infancy has ceased. The rule, however, does not extend to the case where the infant takes by succession from another a right which might during the ownership of his predecessor have been enforced by action.

II. *Liability of the Infant for Wrongful Acts* (torts).—In this class of cases the ground of liability is a wrongful act and consequent damage to another. The reason for the infant's exemption from liability here fails. There is no longer any policy of the law to protect him from responsibility. The artificial rule of incapacity is dispensed with, and if an infant having sufficient discretion commits a wrongful act and causes injury, he will be liable to an action as though he were an adult. There will frequently be cases in which it will be difficult to draw the line between liability upon contract and responsibility for a tort. It is in a certain sense true that a wrong may arise out of a contract, and the inquiry must be made as to the rule to be applied in such a case. For example, an infant may hire a horse, and from his youth and inexperience may treat the animal injudiciously by overdriving him or watering him when heated, and thus cause damage. To hold the infant liable in such a case would be substantially to break down all the safeguards which the law has established for his protection. On the other hand, if the infant simply used the contract as an opportunity or an occasion to commit a wrong, or if, in the case supposed, he wilfully abused the animal, the wrong could in no proper sense be said to arise out of the contract, and the infant would be responsible. Owing to this distinction a prolonged controversy has existed among jurists as to the point whether an infant is liable for fraud practised by him in the making of a contract. On the one hand, it is claimed that the fraud is so inseparable from the contract that the right to plead his infancy includes the right to exempt himself from responsibility for the fraud. On this view, the only remedy of the injured party would be to annul the contract on account of the fraud, and to demand a return by the infant of what he had received under it. This is the view prevailing in the English courts. On the other hand, it has been maintained in some of the American courts that the fraud is such a wrongful act as to give a substantive ground for an action of damages. The weight of reason would seem to be with the English view, and the opposite doctrine can scarcely be considered as established in this country. Courts of equity have held in some instances that an infant who has fraudulently represented himself as of full age, and has obtained property on that basis, is estopped from denying that he is of full age, and have thus by this artificial rule indirectly held him responsible for his fraud. This doctrine is not very satisfactory, and rests more upon authority than upon solid principle. The law upon the whole subject of the distinction between the infant's liability for a wrong, whether considered as connected with a contract or as independent of it, is in an obscure and perhaps transitional state, and only general and probable results can be given. A clear instance of liability may be found in the case of the wilful use of a chattel entrusted to him under a contract in a way prohibited by the owner, and consequent damage. An English illustration is the act of hiring a horse, with a prohibition by the owner against using it to jump fences, and the deliberate use of it by him notwithstanding, followed by damage. This is really an exercise of an act of ownership inconsistent with the contract of hiring, and substantially an appropriation of the chattel to the infant's own use, and thus the act is a wrong unconnected with the contract.

III. *Capacity of Infants to Commit Crimes.*—The same act which when regarded from the point of view that an individual is injured constitutes a tort, may in reference to society be regarded as a crime. There is no good reason why if there is sufficient intelligence on the part of the infant he should not be responsible. The arbitrary rule established for his protection in the case of contracts should be discarded, and the sole point of inquiry should concern his actual capacity to understand the nature and consequences of the act done. The criminal law, however, contains the arbitrary rule that under seven years of age he cannot commit a felonious crime. When he is between seven and fourteen years of age there is no presumption either in his favor or against him; his actual capacity is fully open to investigation. When fourteen years of age and upwards he is presumed to be capable, and the burden is cast upon him to produce evidence of incapacity. For physical reasons a male infant under fourteen years of age is conclusively presumed in England to be incapable of committing the crime of rape. This rule has been discarded in the State of New York, and perhaps elsewhere, on the ground that puberty is attained here at an earlier age than in England. The older law-books are disfigured with accounts of children of tender years who have been executed for capital crimes. The more humane policy of modern times is to sentence juvenile criminals to houses of refuge or correction, where educational and disciplinary measures are resorted to with a view to eradicate, or at least to ameliorate, their vicious dispositions.

IV. *The Position of an Infant in a Court of Equity.*—Infants are favorites of this court, and are frequently under its special protection as being its wards. The court has abundant power to protect them by means of its ability to punish for contempt those who interfere with its orders. In that court the authority of a parent is regarded rather as a trust than as a power, and the court may for good reasons withdraw a child from its parent's custody, and give it over to persons deemed capable to train and educate it. (See PARENT AND CHILD.) When the property of an infant is before this as well as other courts, a guardian for the purposes of the litigation (*ad litem*) may be appointed

to look after his interests. He at the same time will not be allowed by his negligence or inattention to affect injuriously the infant's estate, and any untoward admissions in an action prejudicial to his rights will not be regarded. The validity of his marriage settlements frequently come before this court. It is a well-settled rule of the English law that a female infant may on the eve of marriage, by a proper settlement, bar herself of all claim of dower in her husband's land. This may be done under a statute as early as the reign of Henry VIII., known as the "statute of jointures." The same general rule prevails in this country. Her right to part with *her own real estate* in this way is much more restricted, and a settlement having that effect may be avoided by her after attaining majority, and after the termination of the marriage, and, according to the views of some jurists, even during its continuance. The same rule would be applied to the case of a male infant making a settlement of his real estate. The power of both classes of infants in respect to personal property is much less restricted. The whole subject is at present regulated in England by statute.

V. An infant considered as an owner of property is liable to the burdens incident to ownership. Thus, he would be bound to pay taxes or other assessments of a legal nature. His land can be taken under the rules of eminent domain in the same manner as that of an adult. There would be a distinction between property cast upon him by a rule of law—*e. g.* by descent—and that which he has acquired by his own act. In the first case, the law would make him competent to bear the burden, and he could only shift it off by a sale. On the other hand, where he had acquired it by his own act, he could repudiate the transaction, and thus relieve himself from liability. But even in this case, so long as he remained owner his liability to such burdens would continue. (Reference may be had for further information to the treatises of Bingham and Macpherson on *Infancy;* Forsyth on the *Custody of Infants;* Chambers on *Chancery Jurisdiction;* and to the treatises of Reeve and Schouler on the *Domestic Relations*, as well as to more general works, such as Kent's *Commentaries*, and Story on *Equity Jurisprudence.* See also GUARDIAN and PARENT AND CHILD.)

T. W. DWIGHT.

Infanta'do, a district in Spain which formerly constituted the personal domain of the *infantes* or royal princes, and which gave title to a dukedom, created in 1465, which was held by several of the most powerful of the Spanish nobles. It was composed of the four villages of Peñas de San Pedro, Alcocer, Salmeron, and Valdeolivas, situated in the province of Guadalajara, about 50 miles due E. from Madrid.

Infan'te [Lat. *infans*, "an infant"], in Spain and Portugal the official title of the princes of the blood-royal, the princesses being called *infantas*. The heir-apparent to the throne, however, was not called an *infante;* in Spain his title was *principe de Asturias*, or simply *el principe*, "the prince;" and in Portugal, until the separation of the American colony, he was called the prince of Brazil. The name infante was also applied in Spain at an early period to the children of the nobility, and the "seven infants of Lara," who were killed in an attempt to rescue their father, the *señor* or lord of Lara, from Moorish captivity in Cordova, are famous in Spanish ballad-poetry and romance.

Infante (JOSÉ MIGUEL), b. in Santiago de Chili in 1778, was one of the leaders of the revolutionary movement of 1810, which resulted in the independence of Spanish America; a member of several of the *juntas* of government established by the insurgents; was president of the provisional juntas of 1823 and 1825; member of the "congress of plenipotentiaries" in 1831, and chief-justice in 1843. Infante was the founder of one of the earliest political newspapers of Chili, and was prominent in organizing the common-school system of his country. D. in Santiago Apr. 9, 1844.

Infan'ticide, Law concerning. Infanticide, at common law, consists in the doing of any act whereby the death of an infant child is caused after it is fully born alive. It is to be distinguished from the killing of a child within its mother's womb, which is now known as fœticide. When the death of the new-born infant is occasioned by an unlawful act, as distinguished from mere accident or unavoidable casualty, such act will constitute the crime of felonious homicide (see HOMICIDE), and may be either murder or manslaughter, according to the circumstances of the particular case. (See MURDER, MANSLAUGHTER.) In every instance, however, the death must occur after the actual birth of the child, or no crime is committed. If means be used for the procurement of an abortion upon the person of the mother, either by the administering of medicines or by the use of instruments, or in any other way whatever, and the fœtus is destroyed before birth, the act is neither murder nor manslaughter at common law. This defect in the law has, however, been generally remedied in recent times by the enactment of statutes for the prevention and punishment of abortion. (See ABORTION.) The doctrine of the common law is that when a child is fully born he first becomes a human being within the scope of that rule in the law of homicide which requires that the person killed shall be "a reasonable creature in being," in order that the act of killing may be felonious. The infant is said to be actually and fully born when *every* part of it is wholly produced or separated from the body of its mother in a living state. It is not necessary that the umbilical cord be severed, nor that the child should ever have breathed before being killed, if it was fully delivered and alive. On the other hand, if it be proved that the child did breathe before its death, this will not be sufficient evidence that its birth was complete, as breathing sometimes begins during the progress of the delivery. It is only requisite to constitute criminal infanticide that death occur after actual birth. The injuries may have been inflicted previously. Thus, if a child is born alive, but subsequently dies from the effect of bruises which it received while in the womb, the person inflicting the injuries is chargeable with murder or manslaughter. But if the death occur during the progress of the delivery, though a portion of the child's person has been removed from its mother's body, no crime is committed. It is not, however, necessary that the full period of gestation should be completed, for if a person intending to procure an abortion does an act which causes a child to be born before the expiration of the natural time, and it dies in consequence of its exposure to the external world or from the injuries it has received, he will be guilty of murder. (See the works of Bishop, of Wharton, of Russell on *Criminal Law;* Wharton on *Homicide;* Archbold's *Criminal Practice.* For the various medical tests employed to determine the cause of a child's death, and whether it has occurred before or after birth, such works may be consulted as Wharton and Stillé's *Medical Jurisprudence;* Beck on the same subject; and also Taylor.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

In'fant Je'sus, Daughters of the, an order of nuns in the Roman Catholic Church. Founded at Rome by Anna Moroni of Lucca for the industrial instruction of poor girls; it was first acknowledged in 1673 by Clement X. No convent can have more than thirty-three members, that being the number of years Jesus was on the earth. There was also an older order called "Sisters of the Good Jesus," which appears to have been long extinct.

In'fantry [Lat. *infans*, "child" or "servant," applied to servants who went on foot, and *infanteria*, to foot-soldiers generally] is that portion of a military establishment armed and equipped for marching and fighting on foot, in contradistinction to artillery and cavalry. It is the oldest of the "three arms" into which armies are conventionally divided; was the favorite of the Greeks, the Gauls, the Germans, and the Franks, and was that mainly with which Rome conquered the world. Under Grecian and Roman civilization it attained pre-eminence as *the arm of battle*, but fell into contempt and comparative desuetude early in the Middle Ages, and did not emerge from that obscurity till the decline of the feudal system. It steadily increased in power from the first years of the fourteenth century, and is now recognized as constituting the principal strength of military organizations. This importance results from the fact that it can be used everywhere, "in mountains or on plains, in woody or open countries, in cities or in fields, on rivers or at sea, in the redoubt or in the attack on the breach." It is the self-sustaining arm in the field of battle, and is moreover less expensive, man for man, than its auxiliaries.

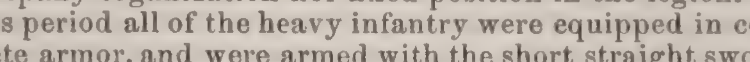
Ancient Infantry.—The primitive formation of heavy infantry was massive, as is shown in the solid squares of 10,000 men portrayed in Egyptian history, and this order was gradually reduced in depth through the Persian and Dorian formations till it reached the phalangial systems of Sparta, Thebes, and Athens. These systems became homologous under the Macedonian empire, and the phalanx as it existed under that domination is now described. The foot-soldiers were divided into three classes—the *hoplites*, or heavy infantry, in complete armor and carrying the sarissa, a spear over twenty feet in length; the *peltastes*, or light infantry, with shorter spears and less complete armor; and the *psilæ*, or sharpshooters, who wore no armor and carried only missile weapons. The *phalanx*, comparable, in size at least, to a modern division, consisted nominally of 4096 hoplites, organized into two *telarchies* (or brigades), each consisting of two *chiliarches* (regiments or battalions), and these in turn divided into four *syntagmata* (battalions or companies). The syntagma combined sixteen files, each file (*lochos*) containing sixteen men; and thus in line of battle the phalanx presented a nominal front of 256 men and a depth of 16 men. In open order, as for the march,

there were intervals of about six feet between the files; in close order, as in advancing to the attack, the spaces between ranks and files were reduced to about three feet; and in the locked, or defensive order, the men closed shoulder to shoulder on the front rank, overlapping their shields; and in this order presented an almost impenetrable hedge of steel to the enemy. The peltastes had a similiar formation, though of less depth and under different denominations, but it is not clear that the psilæ had any systematic organization. Four of these elementary phalanges, with their complement of light infantry and cavalry, formed the grand phalanx, or army corps.

But a rival system, substantially anticipated in the Hebrew armies of Joshua, reappeared in Roman infantry. The *legion* was coetaneous with the foundation of Rome, and, in so far as it combined all the constituent elements, was a prototype of the corps d'armée of to-day. Originally, legionary infantry was massed according to the phalangial method, but as early as 340 B. C. that formation had been superseded by a system of heavy lines so divided into tactical units, called *manipuli*, that while each line and each unit could act separately, they could execute combined movements with celerity and precision. The complement of infantry for each legion gradually increased from 3000 to 6000, and in the details of equipment and organization changes were frequent. As existing in the First Punic war, and consisting nominally of 4200 *pedites*, the heavy infantry was formed in three lines—in the first line 1200 *hastati*, young and inexperienced warriors; in the second, 1200 *principes*, men in full vigor of life; and in the third, 600 *triarii*, the veteran troops. Each line was divided into ten *manipuli* (companies), the first two lines being in ten ranks and the third in six ranks; and in each company the space between ranks and files was about three feet, the men in rear of the front rank standing opposite the intervals of the rank next in their front. To this force was attached a corp of 1200 *velites* (skirmishers), who probably had neither company organization nor fixed position in the legion. At this period all of the heavy infantry were equipped in complete armor, and were armed with the short straight sword; the hastati and principes also carried heavy javelins, and the triarii had long spears. The velites wore no armor, and used none but missile weapons. Prior to this period the long spear had been borne by the hastati, and the *pilum*, a heavy javelin, by the triarii; hence the name of the first line, and the designation of that and the second line as *antepilani*. These misnomers obtained, however, till these classifications of heavy infantry ceased. In the Second Punic war the manipuli of a legion were grouped into ten *cohortes* (battalions), consisting each of a company of hastati, one of principes, and one of triarii, with probably a corresponding proportion of velites. About 100 B. C. the heavy infantry, ceasing to be divided into classes, are armed and equipped alike, the velites disappear from the legion, separate corps of light infantry are formed from the auxiliary forces, and the cohort, becoming the tactical unit, resembles more closely the modern battalion. This was the formation employed by Marius and Cæsar, and maintained till about the time of Hadrian; and subsequent modifications did not destroy the distinctive features of the system.

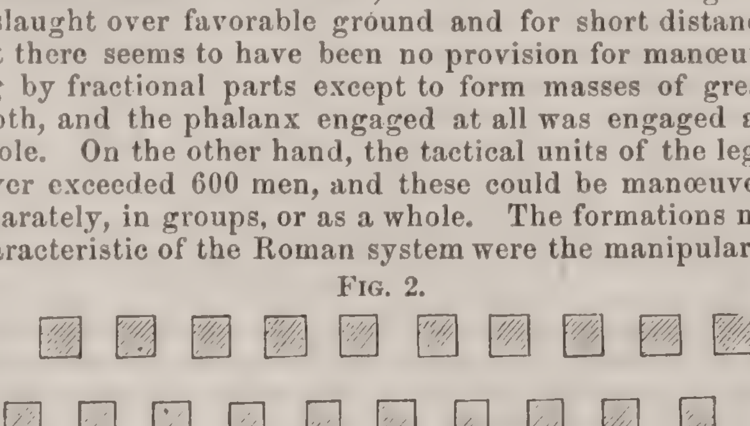
The contrast between the rival systems of antiquity is confined to the heavy infantry, or troops of the line, and is, briefly, that of large masses comparatively inert, with smaller force-units of corresponding mobility. The phalanx, though equal to a modern division in numbers, was, tactically speaking, simply a huge battalion, and its usual figure was that of an oblong rectangle (Fig. 1). This for-

FIG. 1.



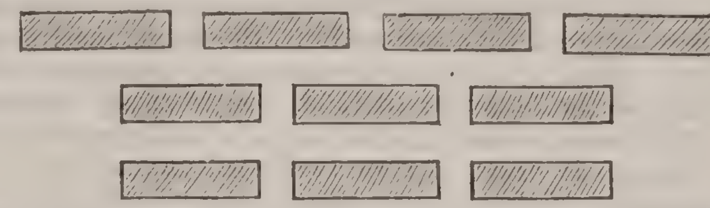
mation could change, and extend or contract its front, and form columns, squares, wedges, etc. It was peculiarly formidable in defensive attitude, and was overwhelming in an onslaught over favorable ground and for short distances; but there seems to have been no provision for manœuvering by fractional parts except to form masses of greater depth, and the phalanx engaged at all was engaged as a whole. On the other hand, the tactical units of the legion never exceeded 600 men, and these could be manœuvered separately, in groups, or as a whole. The formations most characteristic of the Roman system were the manipular ar-

FIG. 2.



ray in quincunx order (Fig. 2), and the later formation in two or more lines of cohorts, with small intervals in each line for the passage of light troops; and from either of these orders, columns, continuous lines, hollow and solid squares, etc. were readily derived. The manipular system gave great flexibility to the legionary infantry, but at the expense of its powers of resistance, and the later cohort formation as arranged by Cæsar (Fig. 3) was a partial reversion to the

FIG. 3.



phalangial order. Modern criticism is pronounced in favor of the Roman cohort, but in its renaissance infantry was again displayed after the rival methods of Alexander and Cæsar; and in comparing the two systems there is danger of overestimating the effect of purely tactical combinations upon the fortunes of ancient armies. At Marathon an Athenian line only four deep and at "double time" successfully charged great odds in dense masses; at Leuctra the Spartan line, eight deep, is pierced by the Theban column; Greeks in phalanx conquer the Persians in like order, but finally succumb to the Roman cohort, but that in turn was annihilated by the barbarian hosts in phalangial array; and it is significant in this connection that while Pyrrhus and Hannibal adopted Roman weapons, they did not discard the massive formation.

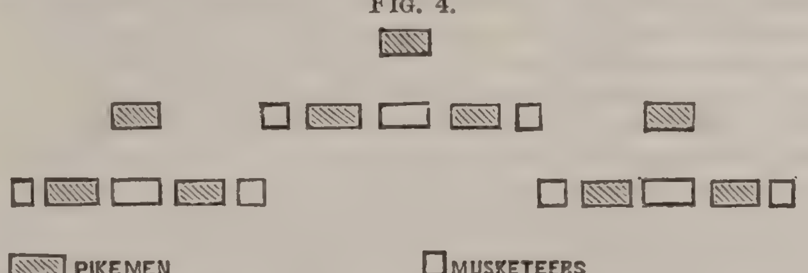
In the Middle Ages infantry continued to constitute the principal strength of the dominant powers of Europe till the feudal system was established. In the seven days' battle of Tours (A. D. 732) we find the heavy battalions of the Franks defying the fury of the Saracenic cavalry, and for ever turning back the northern tide of Moslem invasion; this, however, was its last creditable appearance for several centuries. During the period of its abasement, war was pre-eminently the occupation of mankind, but military science was in abeyance. Armies worthy of the name ceased to exist, and all discipline disappeared; cavalry became the principal arm, and for over 400 years the man-at-arms in comparative security trampled the despised infantry, then a tumultuous mob that pillaged or fled as fortune served their mounted masters. But feudalism forced royalty into alliance with the commons; to curb the noble the king armed and disciplined the peasant. "Communal" militia was organized, and soon proved superior to the baronial followings, and as early as 1214 some of the German infantry is described as "very good, and trained to fight on the level *even against cavalry*." In the next century Flemish infantry with crossbow and partisan overthrows the chivalry of France at Courtrai (1302), the Austrian man-at-arms comes to signal grief on the Swiss pike at Morgarten (1315), Sempach (1386), and Nafels (1388), and the English knight dismounts to fight beside the victorious archer at Cressy and Poitiers (1346–56). The prestige thus re-established, though often challenged, was never lost; corps of pikemen and archers became essential elements in all military organizations; and in the standing armies raised about the middle of the fifteenth century these troops attained such steadiness and dexterity that cavalry, in its last crustaceous security, soon fared but indifferently in disputing precedence with infantry; and when the weapons of the latter delivered missiles through the heaviest plate-armor that man and beast could bear, the issue was decided. Cavalry was still important, but was relegated to an auxiliary position.

From the fall of the Western empire till about the battle of Pavia (1525) details of military formations are exceedingly meagre. While systematic arrangements obtained, there appears to have been adherence to the systems of Greece and Rome. At Casilinum (A. D. 554) the Franks in phalangial wedge are defeated by the cohorts of Narses; at Tours they are victorious in massive square; at Hastings the Anglo-Saxons adopted a similar order; at Bouvines (1214) the Germans were in hollow square; the *début* of Swiss infantry is in Grecian wedges and squares; while the Spanish infantry, equally famous a few years later, first appears in the Roman order, and, like its prototype, exhibits a partial reversion to the Greek method when confronted with the Swiss copy. The principal infantry weapons, offensive and defensive, during this period were straight swords, pikes, axes, spiked clubs, longbows, halberds, crossbows, partisans, helmets, mail-jackets, corselets, and shields. As in former periods, the use of missile arms is almost exclusively confined to light troops.

Modern infantry is conveniently assumed to date from the general introduction of firearms — not because that event at once revolutionized military methods, but because from that period there is authentic record of the gradual revival of military science. Firearms were in general use

when the battle of Pavia occurred, but for many years these weapons were unwieldy, uncertain of aim, and limited in range. They did not entirely supersede the bow till about the middle of the sixteenth century, and the musket did not become the sole arm of civilized infantry till, at the beginning of the eighteenth century, it became, with the socket bayonet, a pyro-ballistic pike. In the infantry "bands" organized by Francis I. in 1534, and promptly imitated by other nations, the arquebusiers and archers, in equal proportion to each other, constituted two-fifths of the entire force; in 1562, "regiments" of about 3000 men become common, and, the bow disappearing, the proportion of firearms is soon increased to one-half. At the beginning of the Thirty Years' war "battalions" of about 500 men had been organized, which in extended order presented a line of contiguous company squares, ten or twelve ranks in depth, with the light infantry (then musketeers) on the flanks. But notwithstanding the steadily increasing destructiveness of artillery and small-arms these battalions were still habitually massed for action into close columns of twenty, and even thirty, files; and these unwieldy imitations of the phalanx suffered an additional incumbrance in the immediate proximity of the enemy from the huddling of their own musketeers within the protection of their pikes. The impotence of this system was rudely exposed by the genius of Gustavus Adolphus, who seems to have been the first to awaken Europe to the value of infantry fire. His innovations consisted simply in so adapting his battalion formation and grand tactical combinations as to develop the full force of his own fire with the least possible exposure to that from the enemy. To accomplish this result, he formed battalions of mobile dimensions, reduced the depth of his ranks to six men, increased the proportion of firearms to about three-fifths, lightened the musket, shortened the pike, discarded useless armor, and introduced the cartridge and cartridge-box. Moreover, his men were taught to use the spade as well as their legs. His usual order of battle was in two lines, resembling the quincunx system of the Romans (Fig. 4). The

Fig. 4.

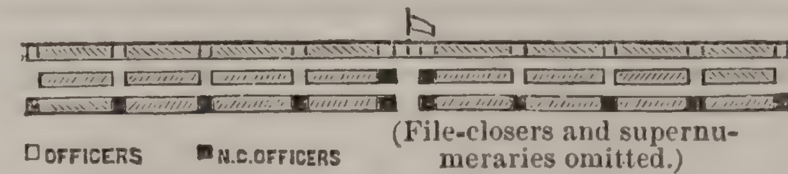


superiority of the Swedish system was so forcibly demonstrated at Breitenfeld and Lutzen (1631–32) as to be generally and speedily adopted.

About 1670 the bayonet was generally introduced, and the proportion of pikemen was correspondingly reduced, till in 1675 it did not exceed one-fourth in any of the principal armies. The socket bayonet appeared in 1699, and within six years the pike virtually disappeared from the battle-field; and while all infantry is armed with the same weapon, the distinction between heavy and light corps, originating in the incompatibility of the ancient wielded and missile weapons, remains nominal. With the discarding of pikes came a reduction of lineal formations to four ranks, but the distance between the ranks was variable; in them the elbow-touch was not preserved, and the cadence step, common from the most remote period of Egyptian history till the extinction of classic civilization, was not yet revived. This contrivance for securing mobility in cohesive order was adopted by Marshal Saxe, whose battalions thereupon astonished both friend and foe by the aggressive use of their legs.

Frederick the Great is generally considered as the next reformer of military methods, and the manœuvering of his battalions and their evolutions in line of battle certainly reconciled celerity with precision of combination to a degree till then comparatively, if not totally, unknown. Attaching greater importance to the fire of his infantry than to their use of the bayonet, he increased the volume of fire by extending the battalion in three ranks, and by thorough drill so accustomed his troops to the use of their weapons and to steadiness in marching that in unwavering lines, advancing or retreating, they could pour well-sustained volleys upon the enemy. His battalion, two of which constituted a regiment, consisted of six companies, five of fusiliers, and one of grenadiers, and its nominal strength was 690 men, rank and file. Each battalion was divided for tactical purposes into eight divisions, and each company into four sections, but, unfortunately, his division embraced sections of three different companies (Fig. 5). A force of supernumeraries accompanied each battalion to fill vacancies in the ranks. The Seven Years' war made the Prussian infantry the archetype for Christendom, and from the Peace of Paris to the present day but trifling differences have existed in the organizations of different nations. The English were probably the first to adopt a habitual forma-

Fig. 5.



(File-closers and supernumeraries omitted.)

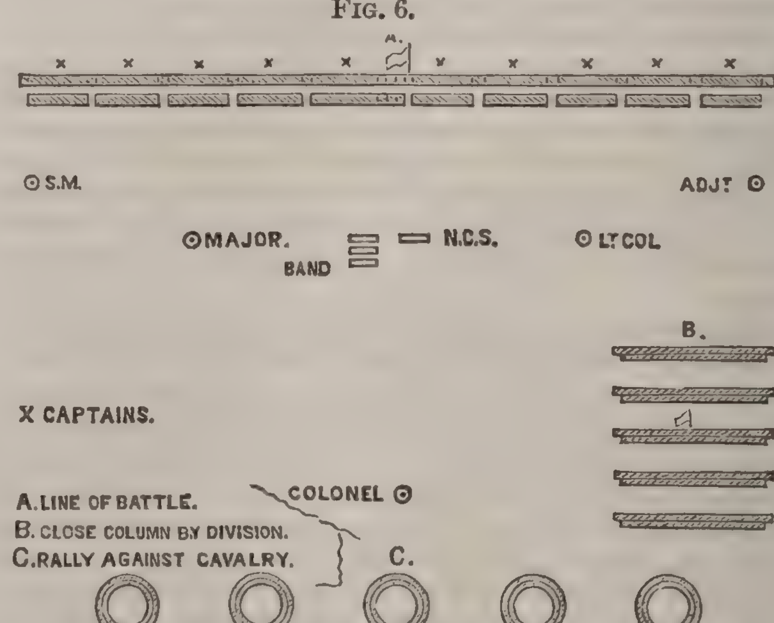
tion in two ranks, and the propriety of reduction to one rank is now seriously discussed, and is provided for in the U. S. tactics.

The division of infantry into light and heavy troops, that had become nominal about the year 1700, was revived, first by placing the new arms, as muskets were improved in range and accuracy, in the hands of picked men from each battalion or in special corps (fusiliers, grenadiers, etc.), and subsequently by the introduction of rifled arms, which as first employed were deemed unsuitable for "troops of the line." Corps of riflemen were accordingly organized under various denominations (chasseurs, tirailleurs, etc.), were trained in gymnastic exercises, and specially drilled for marching and fighting in open order as sharpshooters. But in the present day the distinction is again nominal. The rifle is universal, and all infantry is really light infantry.

The present organization of infantry is in Companies, Battalions, and Regiments (which see); for tactical purposes the companies are generally divided into platoons, the battalions into wings and divisions; and for like purposes the battalions are grouped into Brigades and Divisions (which see). Regimental organizations are purely administrative; in the armies of Europe they generally consist of two or more battalions, and the nominal battalion strength, rank and file, ranges from 500 to 1000 men.

In the army of the U. S. the infantry is organized into twenty-five regiments, each consisting of one battalion of ten companies. To each regiment there is a colonel, lieutenant-colonel, major, adjutant, quartermaster, sergeant-major, quartermaster-sergeant, chief musician, and two principal musicians, and to the two "colored regiments" a chaplain each. Each company has a captain, two lieutenants, five sergeants, four corporals, two musicians, two artificers, a wagoner, and, under the organic law, from 50 to 100 privates, but under temporary restrictions in the annual appropriation for the army the number of privates averages only 34, which gives a regimental strength, rank and file, of about 480 men. The companies are permanently designated by letters of the alphabet, and are so posted in the battalion as to have the senior captain on the right, the next in rank on the left, the third in the centre, and so on. The lieutenants, when not commanding subdivisions, and the sergeants, when not acting as guides, constitute the "file-closers," and are stationed in rear of their respective companies. The various distinctive formations of our battalion and of a company are indicated in Figs. 6 and 7. The individual soldier is armed with a breech-

Fig. 6.

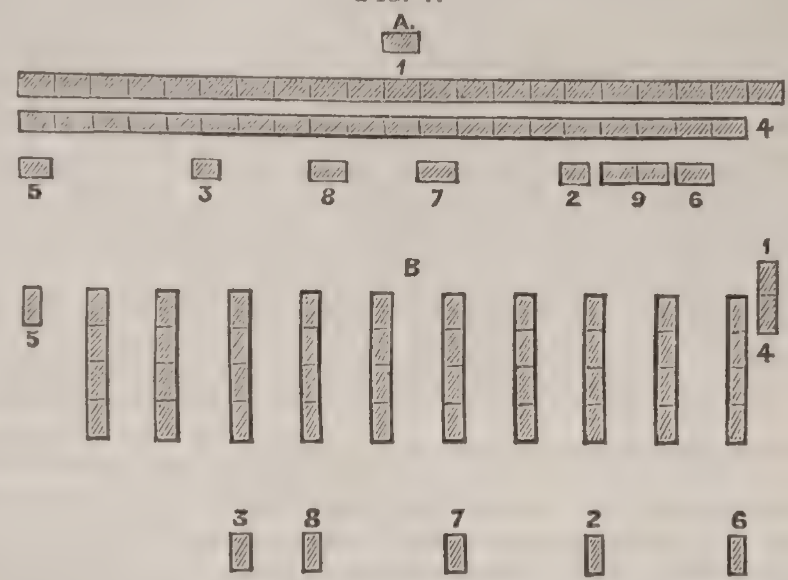


loading rifle and triangular bayonet, and is now experimenting with a contrivance designed to combine the dangerous qualities of the bayonet with the protective virtues of the spade. His uniform is distinguished by light-blue trimmings, and in heavy marching order he carries a knapsack with complete change of clothing, a blanket, great-coat, several days' rations in haversack, a canteen of water, and 60 rounds of ammunition.

Theoretically, the proportion of infantry in all properly organized armies should be from two-thirds to three-fourths of the permanent establishment, but as efficient infantry can be created more readily than serviceable artillery or

cavalry, this proportion is rarely maintained in a peace establishment. In the U. S. service the proportion of the three arms is about—artillery one-eighth, cavalry three-

FIG. 7.



A, in line; B, column of fours. 1, captain; 2, first lieutenant; 3, second lieutenant; 4, first sergeant; 5, second sergeant; 6, third sergeant; 7, fourth sergeant; 8, fifth sergeant; 9, musicians.

eighths, and infantry one-half, but the exigencies of this service demand a constant interchange of duties between the three arms. ROBERT N. SCOTT.

In'fant Schools were originally charitable institutions that sprang up in the early part of the present century, simply to relieve the mothers of the laboring classes of the care of their little children when they are away at day labor. Their value was merely that they kept the children out of the streets and physically comfortable. They got the name of *schools* because among the devices for keeping them quiet by circumventing their spontaneous activity, they were taught to march and some gymnastic exercises, and to sing in rhyme or intone the multiplication table, the names of the days of the week, of the months of the year, and other things of that kind. The best thing taught in the infant schools was to sing hymns, for music is the natural language of piety, and little children thus get the notion of religion and some of its most suggestive symbols into their "chambers of imagery." Some of the disciples of Pestalozzi, and especially Wilderspin, endeavored to develop something educational out of these charitable institutions, introducing some object-teaching. But they were not even the germ of the *kindergarten* (see FROEBEL and KINDERGARTEN), because they were not founded on any study of the nature of childhood, and their method was simply *routine*, which is the opposite of *cultivating;* so far from preparing children for the schools of instruction, as the kindergarten education does, their substitution of memorized words for observed things renders children less susceptible of being taught the way to discover facts and truth. Our countryman, Mr. A. B. Alcott, in articles written in the first *Journal of Education* published in America—which was edited by William Russell in Boston in the years 1826–29—pointed out the radical defect of the infant school method of dealing with children's minds. He made experiments of a more vital one. His wonderful success in touching into activity the moral sense of the neglected children in the cellars of Broad street, gathered by some charitable ladies of Boston into an infant school in 1826, attracted the attention of the cultivated classes, and led to the establishment of a school, of which a volume called the *Record of a School* gives an account, and which contains a genuine study of childhood and a high appreciation of Mr. Alcott. But in the last edition of this book the author is seen to have become the disciple of Froebel's broader and more natural method, whose scope involves all that is good in the infant school, corrects its errors, and supplies its deficiencies. ELIZABETH P. PEABODY.

Infanzona'do, a district comprising 72 villages in the plain-country of the Spanish province of Vizcaya or Biscay; it was considered as the noblest region of the Basque country, and its representatives enjoyed a preference at the *juntas*. The name is supposed to imply that this territory was once the domain of the *infanzones*—literally, the "great infants"—of the royal family. The territory is divided into the five *merindades* of Uribe, Busturia, Arratia, Bedia, and Marquina.

Infection. See CONTAGION.

In'fidel [Lat. *infidelis*, "unfaithful," "unbelieving"], a term applied, usually with something of reproach, (1) to disbelievers in the Christian religion, whether atheists or deists (see ATHEISM, DEISTS); (2) to non-believers, such as Mohammedans and heathens, but this use of the word is antiquated and now unfrequent; while (3) the skeptic or doubter (see SKEPTICISM), as a non-believer, is also to some extent liable to the reproach of infidelity; and in popular parlance the term free-thinker is synonymous with infidel. (See FREE-THINKERS, by O. B. FROTHINGHAM.)

In'finite [*in*, negative, and *finis*, "end"]. In music, certain canonical compositions which have no proper close are called infinite (or without termination), because each part, on arriving at the last note, immediately returns to the first and proceeds as before, the number of repetitions being at the pleasure of the performers and terminated by an arbitrary signal. The real ending should always be on the chord of the tonic or one of its inversions, and this also on a principal accented part of a bar or measure. Sometimes a final cadence is expressly added to the canon, or is a part of its construction, and forms the proper termination. The canon is, in such case, said to be *finite*. Röhner remarks that "an infinite unrestricted canon is easily made finite, and a finite made infinite; it is required only to add a cadence in the one case, and to take it away in the other." WILLIAM STAUNTON.

Infinite, in philosophy. As a philosophical term, "infinite" expresses the form of Being which is self-related and contains no implied contrast to other-being. If the term is used to express a contrast with the finite or indefinite, and the infinite is regarded as a "beyond" to the finite, the thought of the infinite is inadequate, and the conception is really that of one finite over against another. The infinite must be conceived as containing the finite within it as an essential element of its self-relation. There are three significations in which the term "infinite" is employed, corresponding to the three stages of theoretical reflection: (*a*) the dogmatic, (*b*) the skeptical, (*c*) the speculative. I. As merely negative of the finite, in which case the finite expresses concrete reality and fulness of relations, while the infinite expresses a merely abstract and negative notion, "conceived only by thinking away the very conditions under which thought itself is realized." The infinite in this sense is, according to Sir William Hamilton, "the unconditionally unlimited;" the absolute, defined as "the unconditionally limited," being the other species constituting the genus of the "unconditioned." Such an Infinite, being indeterminate, and devoid of all properties or attributes, and without distinction or difference from anything else or within itself, is an empty abstraction. The very thought of it involves self-contradiction; the form of its definition places it in relation or contrast, as excluding the finite, while the content of its definition denies all relation or determination whatsoever. The attempt to conceive such a thought results in a sort of ideal oscillation between the determined and undetermined—the thought of the Indefinite, or Infinite Progress. II. The "infinite progress" is the form under which the infinite is most commonly thought. The infinite divisibility of space, its infinite extent, the infinite regress of causes or conditions in the search of a First Cause, the doctrine of moral perfectibility, etc., furnish practical examples. The mind passes from one phase to its opposite, and returns again only to repeat the process; for it finds in each phase its other, and endeavors analytically to separate them. Each cause, inasmuch as it begins to act, must have another cause to explain the occasion of its action at this particular time; each space divided furnishes two spaces which are in all respects like the first space, and capable of division again; beyond any space which we may conceive or picture in our minds there is still other space; whatever is, is finite and imperfect, and therefore ought to be reformed or improved. In the thought of the infinite as a progress there is an unconscious dual activity in the mind, in which the imagination and reflection take part. The famous "antinomies" of Kant arise in this way. The finite is pictured to the mind, and the pure reflection transcends the picture or image, and defines for itself the logical conditions of the finite, but immediately applies these conditions to a finite realization and renews its mental image. Sir William Hamilton held that "all that is conceivable in thought lies between two extremes, which, as contradictory of each other, cannot both be true, but of which as mutual contradictories one must be true." His proof is "by application to the phenomena." In regard to space, for example, he finds, on the one hand, that we are unable to conceive space as bounded, for then it would be surrounded by space; on the other hand, we cannot conceive it as infinite, for we are unable to "realize in thought" unlimited space by "transcending in fancy" the finite, or even by "exhausting imagination" in the attempt to image it. In this we have the representative faculty failing to produce an adequate picture of infinite space. Since even mental pictures must be finite, a successful picture of space as a whole would prove its finitude, and thus contradict the inference of pure reflection, which pronounces space infinite, on the ground that any limitation of space must be made by

space itself and thus continue it instead of ending it. Since, however, an image or picture of space is impossible, the two results harmonize, and there is no antinomy. III. Under the thought of the "infinite progress" lies, therefore, the thought of the positive infinite. Spinoza called this the *infinitum actu vel rationis*, to distinguish it from the *infinitum imaginationis*, already described. The infinite recurrence of the same limits implies the necessary self-relation of the process. To affirm that beyond every conceivable boundary or assignable limit there is still more space, implies an insight into the self-limiting or self-continuing nature of space. If it related to something else, it were finite; to be infinite, it must be its own limit or *alterum*. The highest example of this is to be found in conscious being, wherein the subject is its own object, knowing and known being identical. Aristotle makes the Infinite and highest truth to be νόησις νοήσεως.—Dr. Noah Porter (*The Hum. Int.*, p. 657) gives this standpoint clearly: "The 'antinomies' of Kant and the 'essential contradictories' of Hamilton, each of which seems necessary to the mind, and each of which excludes the other, are all made by the mind itself in the attempt to illustrate the infinite by the finite. The antinomies of Kant are incompatibilities between *an image* and *a relation* which the image exemplifies, or between two images adduced to illustrate different relations, or between two concepts which are not both necessary to the mind. The solution of them is to be found in the restatement of the conceptions between which these incompatibilities are said to exist." "When Hamilton says we must conceive of space as a bounded or not bounded sphere, he introduces the image of an object existing in space and limited in space, in order to illustrate space itself, and confounds the one with the other. To introduce the image of an extended object to show that space exists and holds some relation to every extended object, is legitimate, but to substitute the limited—*i. e.* an extended object—for the true unlimited—*i. e.* space which makes extension possible—and then to be embarrassed by the incompatibilities of our own creation, is to fall into the very serious error of confounding the image with the notion (*anschauung* with the *Begriff*) against which Hamilton expressly cautions his pupils." While nominalists and materialists have generally denied the possibility of knowing the infinite, for subjective or objective reasons, most realists and idealists have claimed a knowledge of it more or less adequate. W. T. Harris.

Infinites and **Infinitesimals.** In mathematics, an *infinite quantity* is a quantity greater than any assignable quantity of the same kind, and an *infinitesimal* is a quantity less than any assignable quantity of the same kind. To illustrate the meaning of the terms infinite and infinitesimal, let us take the fraction $\frac{a}{x}$, whose numerator is a *finite constant*—that is, a quantity that contains a definite number of known units—and whose denominator is *variable*. As x diminishes, the value of the fraction increases; when x becomes exceedingly small, the value of the fraction becomes exceedingly large; in all cases we can give to x a value so small as to make the fraction greater than any assignable quantity of the same kind. The value towards which the fraction tends as x tends toward 0 is said to be *infinite*, and is denoted by the symbol ∞. Again, as x increases, the value of the fraction diminishes; when x becomes exceedingly great, the value of the fraction becomes exceedingly small; in all cases we can give a value to x so great that it will make the fraction less than any assignable quantity of the same kind. The value towards which the fraction tends when x tends towards infinity is said to be *infinitesimal*, and is often, though not properly, denoted by the symbol 0. These relations are expressed by saying that a finite quantity divided by an infinitesimal is infinite, and a finite quantity divided by infinity is an infinitesimal; that is, $\frac{a}{0} = \infty$ and $\frac{a}{\infty} = 0$. Neither an infinite nor an infinitesimal can be expressed in terms of a finite unit.

The terms infinite and infinitesimal, as above explained, are purely technical, and their signification must not be confounded with their absolute or popular meanings. Thus, the 0 or naught of common language is an absolute negation of quantity, whereas the infinitesimal, or the 0 as we have described it, is a quantity, but it is a quantity so small that it is inappreciable in comparison with any finite quantity.

Infinites and infinitesimals, according to their technical signification, may be compared with each other; that is, they may have definite ratios. Thus, if we take the expressions $\frac{a}{x}$, $\frac{2a}{x}$, $\frac{3a}{x}$, etc., x being the same in all, and then if we suppose x to become infinitely small, there will result a series of infinites of which the second is twice the first, the third three times the first, and so on. Again, if we suppose x to become infinitely great, there will result a series of infinitesimals in which each bears a definite ratio to every other one. The principle here enunciated is the basis of the infinitesimal calculus; thus, the ratio of the infinitesimal increment of the variable to the corresponding increment of the function is a definite ratio, and is called the differential coefficient of the function. The ratio of these simultaneous increments can be found from the relation between the function and its variable, and conversely the relation between the function and variable may be found from the ratio of their infinitesimal increments.

The terms infinite and infinitesimal are purely relative, so that we may have infinites that are infinitely great with respect to other infinites, and infinitesimals that are infinitely small with respect to other infinitesimals. For, let us take the continued identical equation, $\frac{1}{x} = \frac{x}{x^2} = \frac{x^2}{x^3}$, etc.; if we suppose x to be infinitely great with respect to 1, then will x^2 be infinitely great with respect to x, x^3 will be infinitely great with respect to x^2, and so on; if we suppose x to be infinitely small with respect to 1, then will x^2 be infinitely small with respect to x, x^3 will be infinitely small with respect to x^2, and so on. Infinites and infinitesimals may be either positive or negative. Thus, if a divided by x is a positive infinite or infinitesimal, then will $-a$ divided by x be a negative infinite or infinitesimal.

Infinites and infinitesimals are subject to definite rules, and the resulting calculus is as rigorous and true as the calculus of finite quantities. In fact, many of the processes of geometry are based on the ideas of infinites and infinitesimals as above explained. Thus, if we inscribe a regular polygon in a circle, and then bisect the arcs subtended by each side of the polygon, and join the points of bisection with the adjacent vertices of the polygon, there will be inscribed a second regular polygon having twice as many sides as the given one; this polygon will coincide more nearly with the circle than the first. If we form a third regular polygon in the same manner, having twice as many sides as the second, it will coincide still more nearly with the circle than the second, and so on indefinitely. If we conceive this process of bisection and formation of polygons, each having twice as many sides as the preceding one, to be continued, the varying polygon will continually approach the circle, and finally, when the number of sides of the polygon becomes infinite, the polygon will coincide with the circle. Hence, we say that a circle is a regular polygon having an infinite number of sides, and consequently whatever can be predicated of regular polygons can also be predicated of the circle. Thus, the area of a regular polygon is equal to its perimeter multiplied by one-half of its apothem; but the perimeter of a circle is its circumference, and the apothem of a circle is its radius; hence, the area of a circle is equal to its circumference multiplied by one-half of its radius. W. G. Peck.

Inflammable-gas Engine. See Gas-Engine.

Inflamma'tion [Lat. *inflammo*, *inflammatum*, to "kindle," *flamma*, "flame"], a morbid process characterized by heat, redness, pain, and swelling. The predisposing cause may be anything which tends to influence injuriously the animal economy—plethora or anæmia. When a part has once been the seat of inflammation, it is very liable to be affected again under the slightest exciting cause. Age is a predisposing cause of inflammation; in infancy the parts most subject to become inflamed are the bowels, pharynx, larynx, and brain, whereas during adult life these parts are seldom affected, the favorite seat then being the lungs, heart, urinary apparatus, etc. Sex exerts a certain influence; a female is more apt to suffer from peritonitis, phlebitis, or cellulitis in consequence of the parturient act. So the temperament, food, occupation, climate, etc. all influence, to a greater or less extent, the susceptibility of the individual to be attacked by inflammation. The exciting causes may be divided into the constitutional and local; the former includes all those agents which are capable of rendering the blood impure, as poisonous gases, cold, heat, etc. The local cause is generally an injury of some kind, either chemical or mechanical. Every vascular part may be the seat of inflammation, and usually in proportion to the amount of its vascularity. It also seems necessary that nerves should be present. Cartilage contains no nerves and but few vessels, and is therefore rarely the seat of inflammation. Epidermis, hair, and the nails are never inflamed, being destitute of blood-vessels, nerves, and lymphatics. Inflammation may extend from one part to another in one of the following ways: By continuity of tissue; thus we find that in inflammation of the arachnoid the inflammatory action after a few days extends to the brain-substance and causes delirium; through the agency of

the blood-vessels, they carrying the products of the inflammatory action to healthy parts, and exciting therein a diseased action; and through the nervous system; but the last way is probably more theoretical than borne out by fact. The inflammation more likely arises *de novo* than that it is produced through nervous sympathy.

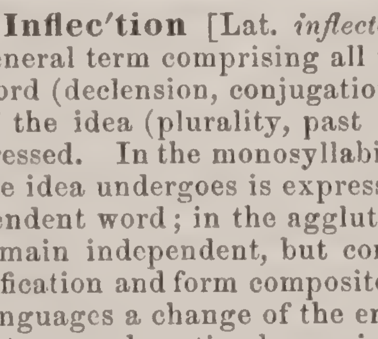
Inflammation is generally divided into the acute and chronic varieties; the former runs a rapid course and is attended by well-marked symptoms—pain, heat, redness, and swelling. These have been given as the symptoms of inflammation from the time of Hippocrates. The swelling is caused by enlargement of the vessels, and more particularly from serous effusion, which takes place into the adjacent tissues; at a later period we have plastic exudation, which in the end tends to lessen the size of a part. The redness is a leading feature, and is due to enlargement of the vessels and an increase of the coloring-matter of the blood. Pain is not essential to the disease—pneumonia and encephalitis are not painful diseases—but external inflammations are always attended with pain, which is due to pressure upon the ultimate sensitive nervous filaments. Serous membranes stand next to fibrous structures of joints in the severity of inflammation, although we may have serous membranes inflamed without pain, as in puerperal peritonitis. The heat is a direct result of hyperæmia. It is chiefly felt in external inflammations; the part receives more blood, and is consequently of a higher temperature than the rest of the surface, but it never rises above the heat of the blood. Acute inflammation is always attended by more or less fever, which may be ushered in by a chill. The pulse runs up to 100–120, the respirations are increased in number to 25 or 30 per minute, and the temperature is raised to 102°–104° F.; the secretions are suppressed, and there is headache and sometimes delirium. Many attempts have been made to ascertain the exact changes which take place in a part attacked by inflammation by artificially producing an inflammation in the web of a frog's foot or the wing of a bat, and closely watching the changes under a powerful microscope; these observations have led to the following conclusions: In inflammation the first change is in the ganglionic system of nerves, but of this system we know nothing except its effects. This nervous system influences the various determinations of blood, as seen in blushing and the local temporary engorgement of nervous women; as also congestions, which are not mechanical in their cause, but occur from a passive state of the vessels. Next we will notice the changes which are seen to occur in the blood-vessels. There is at first active congestion of the part, and this condition is caused by internal or external irritation. Soon stagnation is observed to take place at points. In the natural state the red blood-corpuscles never touch the walls of the capillaries, but in inflammation this rule no longer obtains, and they begin to adhere to the walls and to each other. This is known as the *stasis;* as it increases the vessels continue to dilate, and very soon after the stasis is established the vessels begin to exude their contents, which makes its appearance amongst the tissues. This exudation is not a coagulation of the blood as seen outside the body; it is serous at first, but is soon followed by an effusion of lymph or liquor sanguinis, which, according to the old theory, might be organized into false membrane or degenerate into pus, it depending on the tissues involved and the constitution of the patient. At the present time, however, Cohnheim's theory of the formation of pus is the one generally received—viz. that the corpuscles are identical with the white blood-corpuscles, which are exuded through the walls of the vessels. In process of time the false membrane becomes smooth. It has not yet been ascertained whether nerves are formed in the tissues or not. Two theories are given to account for the formation of vessels in these new productions—viz. Vogel's and Hunter's. Vogel believes that he has seen the membrane itself produce the blood, and afterwards the vessels to contain this blood, and he says that finally these new vessels communicate with the old ones. Hunter believes that the new vessels are given off from the old ones. After vessels have been formed in these new tissues contraction commences, and both the membrane and the vessels become smaller and firmer. This contraction sometimes proves a serious matter, as in the contraction of bands around the intestines, especially in the neighborhood of the rectum; the effects of the contraction are also serious about the pericardium, causing at times hypertrophy of the heart; the pleura suffers least from it.

The duration and character of the inflammation vary with the condition of the part affected and the constitution of the patient. When once fairly established, it may destroy life by exhaustion or by interfering with the function of some important organ, as the lungs or heart. It may also terminate in resolution, suppuration, or mortification. Resolution consists in the restoration of the affected part to its normal condition, without suppuration having taken place. It is by far the most favorable termination of inflammatory action. Suppuration consists of the formation of a fluid called pus, as described above; it is a yellowish liquid, in which float numerous small round granular corpuscles. When the pus is thin, dirty, and acrid, it is called *ichor*. When suppuration continues for any length of time, it gives rise to a fever known as hectic fever. This is diurnal in character, commencing with a chill, followed by a fever, and then sweating. The chill lasts from half an hour to an hour, the fever from one to two hours. In a great many cases the three stages are not well marked, one, or even two, of them being often times omitted. The inflammatory action may be so intense as to deprive the part of its proper supply of blood, and so cause ulceration and mortification (see GANGRENE); this condition is attended by a symptomatic typhoid fever, the symptoms of which are—dry tongue with sordes, trembling, restlessness, delirium, muscæ volitantes, pulse feeble, small, and frequent, involuntary evacuations.

Treatment of Inflammation.—We have local and constitutional means for combating this condition; sometimes one alone will do the work, but generally we employ them conjointly. The first thing to be done is to remove the cause, if discoverable; if not, the bowels should be freely moved once a day, and the skin and kidneys be made to act by the administration of diaphoretics and diuretics. Careful attention should be paid to the diet and regimen of the patient, and heat and moisture applied to the inflamed part, either in the form of poultices or spongiopeline or the hot-water bath. If the patient be plethoric, it will be a great benefit at times to bleed him to the amount of about sixteen ounces. This practice has been greatly decried of late, but practitioners are too apt to swing from one extreme to the other; from the practice of almost bleeding a person to death for the most trivial ailment they have come to discard the lancet altogether. How the benefit arising from the moderate abstraction of blood from a robust, healthy individual who has been stricken down with pneumonia or any acute inflammation, can be questioned, is a mystery. Surgeons, however, are not so averse to local blood-letting, which may be done by scarifications with a lancet, by wet or dry cupping, or leeches. It seems to afford instant relief to the patient by removing pressure and consequent irritation of the inflamed part. Cold evaporating lotions continuously applied are a great relief. They cause the capillaries to contract, and thereby diminish the afflux of blood. EDWARD J. BERMINGHAM.

Inflec′tion [Lat. *inflecto, inflexum,* to "bend"], the general term comprising all the various modifications of a word (declension, conjugation, etc.) by which modifications of the idea (plurality, past and future tense, etc.) are expressed. In the monosyllabic languages any change which the idea undergoes is expressed by the addition of an independent word; in the agglutinative, these additions do not remain independent, but combine with the primitive signification and form composite words; but in the inflectional languages a change of the end of the word—with or without some phonetic change in the root itself—suffices to express the various modifications of the idea. It must be observed, however, that these inflectional endings are not merely arbitrary signs; they were originally independent words themselves. Thus, the ending *s* found in the nominative singular of many nouns in the Greek and Latin languages is a remnant of the personal pronoun of the third person; and the endings forming the oblique cases were originally pronouns indicative of some direction of motion—*where* (dative and ablative), *whither* (accusative), and *whence* (genitive). Or, to take an example from a conjugation, the endings *bat* and *vit*, indicating the past tenses in the Latin language, are simply phonetic modifications of the auxiliary verb *fuat* and *fuit*. But as the laws of phonetic change are very different in the different languages, and imperfectly known in them all, and as a still greater uncertainty prevails with respect to the laws of phonetic decay, the whole subject of inflection is as yet very obscure.

Inflex′ion. A *point of inflexion* is a point at which a curve from being concave in any direction becomes concave in the opposite direction. Thus, in the curve P S Q, the concavity is turned downward from P to S and upward from S to Q; hence, S is a point of inflexion. In passing a point of inflexion the radius of curvature of the curve changes sign by passing through ∞; but this requires that the second differential of the ordinate should change sign



by passing through 0; hence, we may determine the number and positions of the points of inflexion on a curve whose equation is given by the following process: Differentiate the equation of the curve twice; then from these equations and the equation of the curve find the value of the second differential of y in terms of x, and place the result equal to 0; from the resulting equation find the values of x; these will indicate the positions of all the points that can by possibility be points of inflexion. Then test these values of x as follows: substitute each value of x, *first* diminished by, and *secondly* increased by, an infinitely small quantity for x in the second differential of y, and see if the results have contrary signs; if so, the corresponding value is the abscissa of a point of inflexion; if not, it does not correspond to a point of inflexion. W. G. PECK.

Inflores'cence [Lat. *infloresco*, to "begin to blossom"], the term which botanists use to designate the arrangement of flowers upon a plant. Flowers and branches are evolved from buds. These two kinds of buds agree in the positions which they occupy; consequently, flower-buds, like leaf-buds, may terminate the stem or branches or may rise from the axils of leaves. The former are called *terminal*, the latter *axillary*. When one flower only occupies the summit of the stem, it is *terminal and solitary*; when only one occurs in the axil of a leaf, it is *axillary and solitary*. If several flowers are developed near each other on a stem or branch, so as to form a cluster, the contiguous leaves are generally unlike ordinary foliage, and are known as *bracts*. The stalk which supports a flower or a flower-cluster is its *peduncle*, and the stalk of each flower of a cluster, its *pedicel*. When flowers have no supporting stalks, they are *sessile*. The *axis of inflorescence* is the name given to that part of the stalk on which the flowers of a cluster are arranged. When it bears sessile flowers, it is called the *rhachis;* when it is very much shortened and thickened, the *receptacle*. All forms of inflorescence are referred to two types, or to a combination of the two. These plans are known under the following names: (1) *indefinite, indeterminate*, or *centripetal;* (2) *definite, determinate*, or *centrifugal;* (3) *mixed*, in which the main axis develops in one way, and the separate flower-clusters in the other.

1. *Indefinite inflorescence* is characterized by the springing of flowers from axillary buds, while the terminal bud of the stem develops as an ordinary branch, by which the main axis may be indefinitely prolonged. The simplest case is that in which the flowers are axillary and solitary. Many such solitary flowers may appear as the main axis lengthens. If approximated, and the leaves are diminished to bracts, they form a flower-cluster of the indefinite sort. Such clusters are simple when the peduncle is unbranched, compound when the peduncle branches to support smaller clusters of the same kind. Simple, indefinite clusters may have (1) the flowers borne on pedicels along the sides of an elongated axis (*raceme*); (2) along a shorter axis, the lower pedicels lengthened (*corymb*); (3) clustered on an axis which is so short that all the flower-stalks appear to spring from the same point (*umbel*). If the flowers are sessile and arranged along a lengthened axis, the cluster is *a spike;* if the axis is very short, *a head*. The *ament* or *catkin* is a peculiar scaly and usually drooping spike. The *spadix* is a fleshy spike or head with inconspicuous flowers, the whole frequently enveloped by a showy bract, a *spathe*. The raceme, corymb, and umbel may become compound. If the two former branch irregularly, they form a *panicle;* if this is crowded into a compact cluster, it is sometimes called *thyrsus*. The little clusters of a compound umbel are *umbellets*. When several bracts are grouped closely together at the base of a cluster, they constitute an *involucre;* if they occur at the base of partial clusters, *involucels*.

2. *Definite Inflorescence*.—In this the main stem, or each successive independent branch, is terminated by a flower. When a blossom is evolved from a terminal bud, growth of the stem or branch is of course arrested, and all further growth depends upon the development of other axes or branches from axils below, which in turn are arrested in the same way. The simplest definite inflorescence is that of a solitary and terminal flower. When several branches from the axils underneath have been successively terminated by blossoms, the cluster so produced may be distinguished from one of the indefinite kind by the reversal of the order in which the flowers expand. The upper flowers bloom earlier than those which are below. Such a cluster is a *cyme*. Cymes may be simple or compound. The clusters of a compound cyme are termed *cymules*. A very compact cyme is called a fascicle or glomerule. Cymes of an anomalous character result from the suppression of the central flower or one of the side branches.

3. *Mixed Inflorescence*.—Indefinite and definite inflorescence may occur in the same plant, and in two ways: first (as in Compositæ), by centrifugal development of the branches which bear the heads, while the flowers of each head expand centripetally; second, the reverse of this, has the main axis (as in Labiatæ) producing, in centripetal order, clusters which develop centrifugally.

The following table exhibits the principal sorts of inflorescence at one view:

A. *Indefinite*, from axillary buds.
- Simple:
  - Flowers on pedicels:
    - On the sides of a lengthened axis, *raceme*.
    - On a short axis, lower pedicels lengthened, *corymb*.
    - On an extremely short axis, *umbel*.
  - Flowers sessile:
    - On an elongated axis, *spike*.
    - On a very short axis, *head*.
      - With their varieties, *spadix* and *catkin*.
- Compound:
  - Branching regularly, *compound raceme, corymb*, and *umbel*.
  - Branching irregularly, *panicle* and *thyrsus*.

B. *Definite*, from terminal buds:
- Open, mostly flat-topped, *simple* and *compound cyme*.
- Contracted, *fascicle*.

C. *Mixed*. G. L. GOODALE.

Influen'za [It.; as if produced by the influence of the stars], an essential, infectious, epidemic, febrile disease, characterized by a variable degree of constitutional disturbance, especially nervous depression, and having a local expression in irritation and catarrhal inflammation of the air-passages and their appendages. The name "influenza" is Italian, indicating "the influence" of a prevailing atmospheric cause. In France it is termed *la grippe*, from *agripper*, to "seize," indicating the sudden, precipitate onset of the epidemic and of the individual attack. It is also termed epidemic catarrh, epidemic bronchitis, and, better, epidemic catarrhal fever. It is described as first prevailing in Europe in the tenth century, and later in the years 1311, 1387, and 1403. But its certain and undoubted record begins with the epidemic of 1510. Since that time to the year 1875 there have been ninety-two epidemics, of variable severity and at irregular intervals. These epidemics are singularly uniform in identity of characteristics and in obedience to law of origin and diffusion. The disease appears suddenly in the E. or N. E., usually in the N. of Europe, exceptionally in the Indies or Northern Asia, and travels to the W. It travels in cycles, invading the whole of Northern Europe, often extending to America, and exceptionally felt in the equatorial regions and the southern hemisphere. Unlike cholera, its diffusion does not depend on human commerce. Its progress is rapid, a great wave from E. to W. precipitating itself upon communities and countries with a suddenness warranting the names popularly applied to it—"lightning catarrh," "le petit courrier," "la grippe." Less often it appears coincidently at places far removed, as at the Cape of Good Hope and London in 1836. In its zone of progress it often appears simultaneously at many isolated foci, from which it seems to radiate until disseminated over vast areas. Its influence is not confined to the continents, but is immediately exerted at mid-sea upon all who sail into the districts of atmospheric infection. Appearing in a community, it attacks a majority of its members, of both sexes, of all ages and social position, and with a rapidity precluding the idea of communicability. No nationality is exempt, and as a rule only a fractional part of the population escapes its effects. It would appear to attack preferably women, next adult males, and lastly children. In some epidemics children are exempt. During the prevalence of influenza the animal vitality is lowered, the type of other diseases is modified, assuming adynamic or typhoid forms, and tending to a greater general mortality. Influenza is not confined to man, but often extends its epidemic influences to the domesticated animals, especially the horse, and is known as the *epizoötic*. In England the epidemics of 1728, 1732, 1733, 1737, 1743, 1803, 1831, and 1837 were accompanied by the epizoötic among cows, horses, and dogs. The pestilential epizoötic extending throughout the U. S. in 1872–73, attacking in New York 16,000 horses, was an epidemic of influenza, prevailing with less severity among men. The influenza is first recorded in America in 1577. The chief epidemics in Europe have extended to this country. The most noticeable ones are that at the close of the war of 1812, that of 1843, of 1872, and the recent season 1874–75, in which pneumonia has existed as a frequent and fatal complication. Of the intimate nature of the subtle atmospheric or telluric cause of influenza nothing is definitely known. Schönbein regarded an excess of ozone in the air as producing bronchial irritation. Prout attributed the disease to selenuretted hydrogen. Much has been written

of its concurrence with the appearance of comets and meteoric showers, and the opinion is in favor that electrical and magnetic disturbances of the atmosphere are related to the epidemics. The advocates of the "germ-theory of disease" regard influenza as due to the wide dissemination, by air-currents, of animalcula or cryptogamic vegetable products — malarial emanations. Ehrenberg describes "dust-fog currents" in the higher strata of the atmosphere, from which many genera of animalcules may be collected. The epidemic of influenza occurs at all seasons of the year, often in the spring, and in both warm and cold, in dry and damp or foggy weather. The usual duration, in one locality, of an epidemic is from four to six weeks, exceptionally much longer. There may be local recurrences in the same season, but as a rule the victims of the first are exempt from the second attack.

As regards the disease, it is thought that a specific poison is absorbed and circulates in the blood, irritating the nerve-centres, producing prostration and febrile disturbance, and causing hypersecretion and inflammation of the mucous lining of the air-passages. The symptoms vary in severity in different epidemics and in individual cases. The onset is sudden, announced in severe cases by a marked rigor, more often by chill and shivering alternating with flashes of heat. Then follow general lassitude, debility, nervous prostration, soreness and stiffness of the limbs, pains in the neck, back, and loins, headache, frontal oppression, pain in the orbits, cheek-bones, and root of the nose, injection and sensitivenes of the eyes, with copious flow of tears—often heated, the "fiery tears" of the early records—sneezing and tingling, followed by watery and often acrid discharge from the nose, soreness of the tonsils, Eustachian tubes, and ears, experienced in swallowing, hoarseness, a short, frequent, harassing cough, with slight expectoration, and a slight fever of the remittent form, having its exacerbation towards evening. The fever is seldom pronounced, but the restlessness, irritability, exhaustion, and mental depression are marked, and usually disproportionate to the bronchial complication. In other cases there is soreness, tightness, and pain beneath the sternum, dyspnœa, sense of suffocation, and danger of capillary bronchitis or pneumonia. These unfortunate complications are the chief causes of death from influenza, and occur mainly in the aged, in invalids, and in delicate children. The usual duration of mild cases is from three to five days, of grave cases from seven to ten days. The termination of the disease is often as sudden as its onset, and frequently occurs with a critical and profuse perspiration or diarrhœa. The mortality from uncomplicated influenza in healthy persons is very slight. Influenza has no pathology indicative of its specific nature, and presents only the lesions of the associated catarrh—tumefaction and redness of the mucous lining of the nose, the tear-duct, and eyelids, the frontal and maxillary sinuses, of the throat, Eustachian tube, and membrana tympani, of the larynx and bronchial tubes, and the lesions of pneumonia when it exists. The majority of cases are mild and require no treatment. A purge at the outset may shorten their duration. More marked cases require a preliminary purgative, a low diet, the avoidance of exposure to cold, resort to hot draughts, as of lemonade or elder-bloom tea, to stimulating foot-baths, to the use of Dover's powder, Tully's powder, spiritus Mindereri, or other remedies to secure free perspiration, and the relief of bronchial congestion by inhalation of steam, by ammonia, or by stimulating expectorants. Headache and distress in the nose and orbits, due to irritation of the Schneiderian membrane and its processes, may be relieved by the inunction of oil or grease or by the insufflation of warm anodyne solutions. Quinine in doses of five grains three times a day, if taken at the beginning, may cut short the attack. When the bronchitis tends to become capillary, quinine or tincture of bark is indicated to support the strength, ammonia to favor the liquidity and discharge of mucus, and the oil-silk jacket to favor free secretion. The extensions of pneumonia may be limited by arterial sedatives, carbonate of ammonia, quinine, and anodyne poultices or fomentations. It is essential to proper treatment to remember that blood-infection is primary and bronchitis or pneumonia is secondary; the constitutional disease will admit of no depressing remedies, and the speedy termination of the inflammatory complications will follow supporting measures. During epidemics of influenza the aged and feeble should keep within-doors in well-warmed rooms, and partake of quinine, ammonia, and guarded but nourishing diet, as measures of prevention. E. Darwin Hudson, Jr.

Informa'tion, in law, a written charge or accusation made against a defendant in a suit or proceeding which is directly instituted against him in behalf of the state or government by the attorney-general or other proper law-officer representing the government. It is so called because it is founded upon *information* given, or supposed to be given, by the prosecuting officer. This form of legal process is employed in proceedings of various kinds, being used either as a mode of criminal prosecution, a form of civil remedy, or a particular method of instituting a suit in equity in certain cases. These various modes of legal procedure may be considered separately.

I. In criminal prosecutions the proceeding by information at common law is, in cases of misdemeanor (except misprision of treason), a mode of remedy which may be adopted, if deemed desirable, in place of an indictment, which is the usual method of prosecuting in cases both of felony and of misdemeanor. The difference between an information and an indictment is that in the former the accusation or charge is presented directly by the attorney-general or prosecuting officer, while in the latter the accusation proceeds directly from a grand jury, upon whose oath it is based. (See Indictment, Grand Jury.) They do not, however, differ materially in form and substance. There must be the same degree of particularity and precision in stating the offence charged, the same observance of the ordinary rules of pleading. It is only in some merely formal and comparatively unimportant statements at the commencement and the close that a diversity exists in the general nature of the contents; and whether the prosecution be instituted in the one way or in the other, the charge must be tried before a petit jury. Criminal informations in the English law are either such as are partly at the suit of the Crown and partly at that of a subject, or such as are wholly at the suit of the Crown. The former are brought upon certain penal statutes at the instance of common informers. The latter are of two kinds: (1) Those filed *ex-officio* by the attorney-general, or, in the vacancy of his office, by the solicitor-general, solely in behalf of the Crown; and (2) those filed by the king's coroner and attorney in the court of king's bench, usually called the master of the crown office, at the relation of some private person or common informer. These two varieties of proceeding by information in the name of the king alone may be resorted to in all cases of misdemeanor (with the single exception already mentioned), but in practice are commonly employed when the offence is of a particularly grave and serious character, or has an especial tendency to disturb the administration of the government, or when a more speedy mode of prosecution is desired than a proceeding by regular indictment. In both these classes of cases the prosecuting officer in early times possessed authority to file an information at his own option, without obtaining permission from the chief court of criminal jurisdiction, the king's bench; and this independent prerogative is still retained in regard to such informations as are included within the first class, where the Crown is the actual prosecutor. But in relation to informations presented at the instance of some private person, in which the Crown appears only as the nominal prosecutor, the practice has been changed. It had become customary to institute a proceeding of this kind as a matter of course at the application of any one; and, as no penalty was imposed upon the applicant in case the accusation proved groundless, this method of prosecution was often adopted for purposes of vexation and oppression. To remedy this evil a statute was passed in 1692 (4 and 5 Will. and M. ch. 18), providing that informations should not be filed at the suit of a private person except by leave of the court, and on such persons giving security to the party proceeded against for costs.

In this country several of the States have retained the English practice of prosecution by information, though the extent of its application and the mode of procedure are variously modified by statute. Thus, informations may be presented for all offences declared to be misdemeanors, as distinguished from felonies, in New York, Connecticut, Massachusetts, New Hampshire, and a few other States. The officer by whom it is usually provided that the information shall be filed is the attorney-general of the State. This mode of procedure is, however, much less frequent in this country than the proceeding by indictment. In Pennsylvania and a few other States there can be proceeding by information where an indictment lies. In the Federal courts informations have sometimes been resorted to in cases of illegal exportation of goods, smuggling, etc., but have never been especially authorized by any laws of Congress. By the provisions of the U. S. Constitution no offence which is capital or infamous can be prosecuted by information, but only by indictment.

II. The use of an information as a form of civil remedy is most common in the proceeding which is technically known as an "information in the nature of a *quo warranto*." The ancient common-law writ of *quo warranto* has been superseded by this more convenient practice. (See Quo Warranto.) The object of such informations is to inquire by what authority or warrant the defendant exercises certain official or corporate powers, or asserts a right to certain fran-

chises or offices which are alleged to be unlawfully claimed or to have been forfeited. Thus, for example, an information may be presented against an unincorporated association for assuming corporate powers; against a lawfully organized corporation for non-user, long neglect, or misuse of its franchises or powers, or for a violation of its charter or the provisions of any law; against any person for a usurpation of or intrusion into a public office, or for the exercise of any franchise not conferred upon him by law, or for the performance of official duties after his office has been forfeited, or after the term for which he was appointed or elected has expired. This is a common form of procedure against corporations to deprive them of their franchises and obtain their dissolution, on the ground that corporate powers have been forfeited by misfeasance. The remedy by information in these cases was originally a criminal proceeding, in analogy with its use in the prosecution of offences strictly criminal, and it still remains so in form. Its object was to secure the imposition of a fine upon the defendant if convicted, as well as an ouster from the office or franchise unlawfully claimed. But in substance it is a civil proceeding, the purpose of which is to try and determine the defendant's right to the franchise, and to secure its forfeiture if wrongfully exercised. In England, informations in the nature of a *quo warranto* may be presented in three ways: they may be filed (1) by the attorney-general of his own authority, and in the exercise of an independent discretion; (2) by the master of the crown office under the permission or direction of the court of king's bench; and (3) by the proper officer upon leave of the court at the relation of some person or persons who desire to prosecute the defendant. The first two modes of presentation are the same as those which have been already mentioned as appropriate to the prosecution of misdemeanors in criminal procedure. The third is a form of practice established by the statute of Anne, ch. 20. It affords the means of determining controversies between private parties in regard to the right to corporate or other franchises, public offices, etc. The Crown or state, represented by the attorney-general or other officer, is only the nominal prosecutor, the party at whose instance the proceeding is instituted being the actual prosecutor. It is provided by the statute that this party shall be technically designated in the proceeding as the "relator," because from him the relation proceeds upon which the information is based. At common law no such party as a relator is known in a proceeding upon information. This form of practice was originally introduced by the statute. Informations at the suit of a private person can be presented only by leave of the court, which will be granted, not arbitrarily nor as a matter of course, but in the exercise of a sound discretion. Permission will usually be granted when the right upon which the suit is based is disputed or uncertain, or depends upon a point of doubtful law, or where there is no other remedy.

In several of the American States the proceeding by information in the nature of a *quo warranto* is still in use, and corresponds very closely with the English practice. The suit is usually instituted by the attorney-general of the State of his own authority, or by the private prosecutor or "relator," who employs the name of the attorney-general in the proceeding as a matter of form. When the suit is at the instance of a private person the case is regularly entitled "The People" (or "The Attorney-General") "*ex rel.* (*i. e. ex relatione*, "from the relation of") A. B. *vs.* C. D.," A. B. being the relator and C. D. the defendant. The power to file an information of this kind in some States depends upon special statutes corresponding with the English statute of Anne, while in others the same practice is adopted, irrespective of any statute, as part of their common-law system of procedure. It is the usual rule that the leave of the court shall be obtained in cases of this kind, as in England. In New York informations in the nature of a *quo warranto* were in use until 1848, but the Code of Civil Procedure adopted in that year abolished the proceeding, substituting in its place a special form of civil action, which nevertheless accomplishes the same results by a very similar mode of practice.

Another instance of the use of the proceeding by information as a form of civil remedy is found in the common-law practice in England of filing an information in the court of exchequer for the recovery of money or other chattels claimed by the Crown, or to obtain damages for any injury committed upon the lands or the possessions of the Crown. The attorney-general institutes the suit of his own authority and at his own discretion. The most common informations of this kind are the information of intrusion and the information of debt, the former being presented for any trespass upon the lands of the Crown, the latter upon any contract for moneys due to the Crown or for forfeitures under penal statutes. In the U. S. informations are not unfrequently employed in the Federal courts for the recovery of penalties and forfeitures, as, *e. g.*, in cases of violation of the revenue laws. These are usually civil proceedings *in rem*. (See IN REM.)

III. The method of instituting suits in equity by means of an information exhibits much the same form of practice as in the common-law courts. In England the suit may be wholly in the interests of the Crown, in which case it is instituted directly by the attorney-general or solicitor-general of his own authority, or it may concern the rights and interests of other parties than the Crown. In cases of this latter kind the government officer sometimes acts at his own discretion, but generally upon the relation of the party whose rights are involved, who is then termed the "relator." When the interests of idiots or lunatics are concerned the attorney-general may exhibit informations in their behalf *ex-officio*, representing the Crown as *parens patriæ*. It is the common practice in England to regulate the administration of charities by proceedings upon information. As the Crown has the general supervision of charities, the attorney-general may act of his own authority, no relator being necessary. Generally, however, he only proceeds at the instance of some relator, who is made responsible for costs in case the information has been improperly filed. There has been some discussion among jurists upon the point whether the power of the attorney-general to file an information for the purpose of establishing or administering a "charity" was a regular part of English jurisprudence, or was derived from the statute of 43 Eliz. ch. 4, concerning charities. The inquiry has assumed importance in some of the States in which that statute has not been re-enacted or recognized. Careful investigation shows that the information has its roots in equity as well as in strict common law. The authorities are collected in Dwight's *Argument in the Rose Will Case* (New York, 1863), pp. 257–270. Informations were used for this purpose in this country during the colonial period. An interesting illustration is Cullen's charity in the court of chancery in the province of New York Sept. 7, 1707. There was a legacy "to the poor of the city of New York and of Albania" (Albany), which was enforced in their favor by the attorney-general. The proceedings and information are found at length in the same volume (pp. 344–351). In the U. S. informations may be employed as a mode of instituting equitable suits in some of the States, but the practice is not so common as in England. (On this whole subject see Cole on *Informations*, Angell and Ames on *Corporations*, Bishop's *Criminal Procedure*, Daniell's *Chancery Practice*, Tudor on *Charitable Uses*, Boyle on *Charities*.)

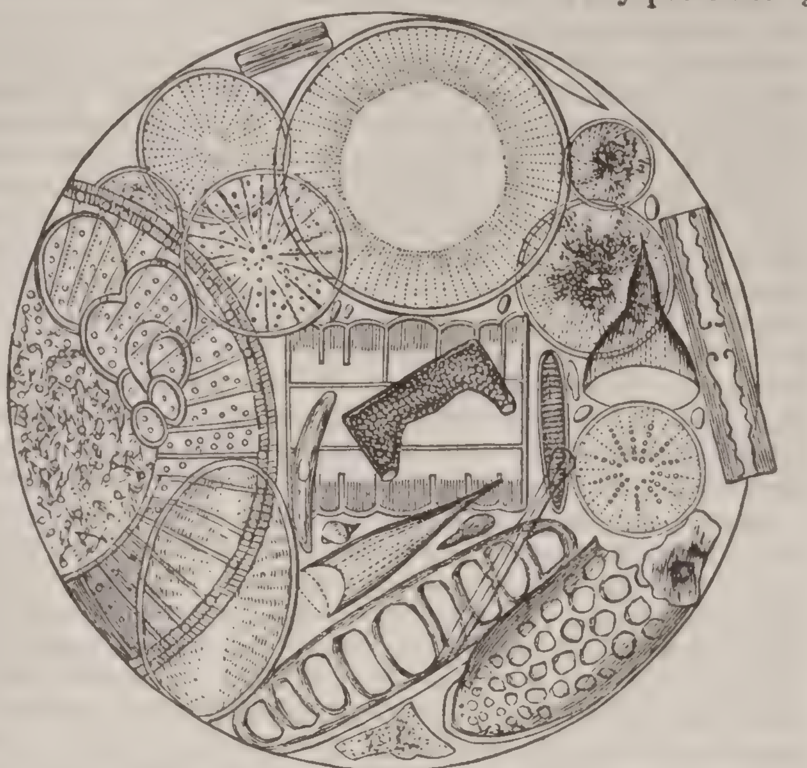
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Inform'er. This word is employed in law as a technical designation, denoting a person who brings suit or prefers an accusation against another for the violation of some penal statute. It is sometimes provided in a statute of this kind that the whole or a certain portion of the penalty recovered from the person who shall be convicted of violating its provisions shall be given to any one who will sue for the same, or who will give information of the offence to the proper prosecuting officer. The party by whom the proceeding may be instigated is sometimes termed not merely "informer," but "common informer," because he may be any member of the community. The object of such legislation is to elicit the active efforts of the people generally in the detection and punishment of wrongdoers by the prospect of a reward. Actions brought by an informer under such a statute, when the penalty is recoverable partly for himself and partly for the benefit of the state, are technically termed *qui tam* actions (*qui tam*, Lat., "who as well"), because the plaintiff is described in the suit as one *who sues as well* for the king or commonwealth as for himself. This peculiar Latin phrase was adopted at a time when legal pleadings were expressed in that language, and these words formed the commencement of the allegation in which the plaintiff described the character in which he appeared in the action. Statutes authorizing *qui tam* actions are more common in England than in this country.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Infuso'ria [Lat. *infundo*, *infusum*, to "pour over," to "make an infusion," because these organisms were first observed in infusions]. If organic substances, either animal or vegetable, are soaked in water, the liquid dissolves portions of the solid matter, forming an "organic infusion." If this be exposed to the air, a scum or pellicle forms upon the surface, which, when examined under the microscope, is found to be composed of minute molecules. Presently these molecules unite to form short filaments called *bacteria*, or, if the segments are of considerable length and jointed, they are known as *vibriones*. When perfectly developed, these two organisms exhibit vibratile movements. After a while they disintegrate, and there result small spherical bodies moving actively through the fluid, which are called *monads*.

These are often ciliated and possess a mouth. Two theories explain this growth: (1) These organisms are produced spontaneously, and are not derived from any pre-existing



Infusoria in mud of the Antarctic Ocean, greatly magnified. (Capt. James Ross.)

germs; (2) they originate from germs of extremely minute size, disseminated through the atmosphere and in various solid substances, which develop into these fungus organisms under favorable conditions. Elaborate experiments have been instituted to show whether these organisms will germinate in infusions which have been subjected to great heat and deprived of air, with results favoring the second theory, though observers are not yet agreed. It is established, however, that the bacteria and vibriones are algæ, or the simplest kind of plant, while the monads are animals, sometimes the larval forms of the higher Infusoria. They are never generated except in organic solutions. Later writers restrict the name of Infusoria to the higher division of the Protozoa, excluding the forms already specified. They possess a mouth, rudimentary digestive cavity, and vibratile cilia or contractile filaments. They are extremely minute, and their bodies consist of three distinct layers. Generally, they have the power of swimming about freely, while some are fixed in the adult period, and others constitute colonies by budding. The outer layer is a transparent cuticle. The central mass is a soft, semi-fluid substance, capable of receiving particles of food, and is known as sarcode. An intermediate layer is of firm and consistent sarcode. The Infusoria are divided into the three orders of Ciliata, Suctoria, and Flagellata. They are most abundant in fresh water in every country upon the face of the earth wherever organic matter is held in solution. They also occur in the ocean. The higher forms are to be sought for on the stems of aquatic plants, not in artificial infusions.
C. H. Hitchcock.

In'galls (Rufus), b. at Denmark, Me., 1820; graduated from the U. S. Military Academy in 1843, and entered the army as brevet second lieutenant of rifles; transferred to the dragoons 1845, and to the quartermaster's department, with the rank of captain, in 1848, rising through successive grades to be (1874) colonel and assistant quartermaster-general U. S. A. From the date of his graduation Ingalls served with his regiment on quartermaster duty almost constantly on the frontier, participating in the war with Mexico and various expeditions, up to 1860, when he was ordered to Washington, D. C., where, on the outbreak of civil war in 1861, he was at once called upon to assume responsible duties as chief quartermaster of the rapidly arriving volunteers, in providing for the embarkation of the Army of the Potomac to the Virginia Peninsula, in transferring the vast supplies of that army from the York to the James River, and as chief quartermaster of that army in the subsequent evacuation of the Peninsula, the establishment of a new base of supplies at Acquia Creek, and, as chief quartermaster of the armies of the Potomac and of the James, of establishing a dépôt of supplies at City Point and supply of those armies. His duties, constantly increasing in magnitude and responsibility, were discharged with great ability and despatch. Brevetted lieutenant-colonel to major-general. At the close of the war served at head-quarters of the army, and in 1867 at New York City as chief quartermaster of military division of the Atlantic.
G. C. Simmons.

Ingau'ni [Gr. Ἰγγαυνοι], a Ligurian tribe inhabiting the sea-coast and mountains W. of Genoa in the first and second centuries B. C. Their capital was Albium Ingaunum, now called Albenga. They bore a prominent part in the long-continued wars between the Romans and the Ligurians, and in the Second Punic war they were effective allies of the Carthaginians. They were routed in a great battle by the proconsul Æmilius Paulus (B. C. 181), losing 15,000 killed. From this time little more is heard of the Ingauni, but they were still recognized as a separate tribe in the time of Strabo and Pliny.

Ing'bert, or **Sanct Ingbert,** town of Germany, in Rhenish Bavaria, on the Rohrbach, has large coal, iron, and quicksilver mines. Pop. 8433.

In'gelmunster, town of Belgium, province of West Flanders, 7½ miles N. of Courtrai, noted for a victory gained by the French over the allied English and Hanoverians, May 10, 1794. Pop. 5900.

In'gelow (Jean), daughter of William Ingelow, b. 1830 at Boston, England; has published several volumes of verse (1863, 1867, 1871), besides prose works of fiction, including *Tales of Orris* (1860), *Studies for Stories* (1864), *Home Thoughts and Home Scenes* (1867), *Off the Skelligs* (1872), etc. Immediately on the publication of her first volume of poems she was recognized as an original poet, and her fame has grown wider ever since. Sometimes her poems have something scattered and romantically vague in the total representation of the idea, as is the case in one of her most celebrated poems, "High Tide on the Coast of Lincolnshire." But the details both of human character and of nature are often painted with a most exquisite delicacy, as, for instance, in "The Letter L;" and there is always in her verses a genuine warmth and noble naturalness, connected with simplicity and grace.

In'gemann (Bernhard Severin), b. May 28, 1789; studied at the University of Copenhagen; travelled 1818–19 through Germany, France, Switzerland, and Italy, and was appointed in 1822 professor of Danish literature and language at the Academy of Soröe, which position he filled till his death, Feb. 24, 1862. In 1811 he published his first volume of poems, and afterwards attempted almost every kind of fiction; his collected works comprise 39 volumes. But he became eminent only in two directions. Inspired by Walter Scott, he treated the most brilliant and romantic period of the history of Denmark in a series of romances—*Valdemar Seier* (1826), *Erik Menved's Barndom* (1828), *Kong Erik og de Fredlöse* (1833), and *Prinds Otto og hans Samtid* (1835); and these romances, though inferior to their model in historical truth and in power of characterization and description, became truly popular. There exists perhaps no Dane who has not read them; they were also translated into German and English, and are frequently found among the Scandinavians in the West. An equal impression he produced by his hymns and religious songs, of which some morning and evening songs were unsurpassable for tenderness and purity of feeling. Clemens Petersen.

In'genhousz (Jan), b. at Breda, Holland, in 1730; studied medicine, and after practising in Holland went to England in 1767; travelled in France and Italy, and returned to London, where he devoted himself to scientific research, and became a fellow of the Royal Society, in whose *Transactions* he published several important essays. To Dr. Ingenhousz is ascribed the first medical use of carbonic acid and the invention of the plate electrical machine; he discovered that plants when exposed to light exhale oxygen, and when deprived of light exhale carbonic acid. He d. at Bowood, the seat of the marquis of Lansdown, Sept. 7, 1799.

In'gersoll, town of Oxford co., Ont., Canada, on the Thames and the Great Western Railway, 19 miles by rail from London, has a heavy trade in grain and lumber, important manufactures of farm implements, woollen goods, cheese, and lumber, 1 branch bank, and 2 weekly newspapers. It has fine public buildings, and is rapidly increasing in importance. Pop. of sub-district, 4022.

Ingersoll, tp. of Midland co., Mich. Pop. 402.

Ingersoll (Charles Anthony), A. M., b. at New Haven, Conn., in 1798; held a high rank at the bar, and after holding various important offices was appointed judge of the U. S. district court by President Pierce. D. Feb. 9, 1860.

Ingersoll (Charles Jared), b. in Philadelphia Oct. 3, 1782, was a son of Jared Ingersoll (1749–1822). He received a collegiate education; became a lawyer, and was a member of Congress 1813–14 and 1841–47; U. S. district attorney 1815–29, and held various important offices. He wrote *Chiomara*, a poem (1800), *Inchiquin's Letters* (1810), *Historical Sketch of the Second War with Great Britain* (4 vols., 1845–52), and several other works, chiefly historical and poetical. D. in Philadelphia Jan. 14, 1862.

Ingersoll (Charles Roberts), LL.D., b. at New Haven, Conn., Sept. 16, 1821; graduated at Yale College in 1840, and at the Yale Law School in 1844, since which time he has been a practising lawyer in his native city, which he

has several times represented in the general assembly of the State. He was elected governor of Connecticut by the Democratic party in 1873, was re-elected in 1874, and again in 1875.

Ingersoll (Jared), LL.D., b. in Connecticut in 1749, and graduated at Yale in 1766. He studied law in London, and settled in Philadelphia, where he became a prominent lawyer. He was a member of Congress 1780–81; a member of the convention which framed the U. S. Constitution in 1787. He afterwards held many important public positions; was often attorney-general of Pennsylvania; and at the time of his death was presiding judge of the district court for Philadelphia co., Pa. D. Oct. 31, 1822.

Ingersoll (Joseph Reed), LL.D., D. C. L., a son of Jared Ingersoll, b. in Philadelphia June 14, 1786; graduated at Princeton in 1804, and became a prominent lawyer of Philadelphia. He was a Whig member of Congress 1835–37 and 1842–49, and U. S. minister to England 1850–53. He published a memoir of Samuel Breck (1863) and *Secession a Folly and a Crime.* D. in Philadelphia Feb. 20, 1868.

Ingersoll (Ralph Isaacs), LL.D., b. at New Haven, Conn., in 1788; graduated at Yale in 1808; studied law, and took high rank at the bar of his native city; was the Democratic leader in the Connecticut legislature in the tempestuous session of 1819, and afterward until 1825, when he was chosen to the lower house of Congress, remaining there four terms, and taking high rank in the practical machinery of legislation. In 1833 he declined a re-election in order to devote himself to his profession, which he continued to do with great ability and success for the remainder of his life, refusing all temptations to accept political appointments, except on one occasion in 1846, when, at the personal solicitation of Pres. Polk, he accepted and filled for two years the post of minister to Russia. D. at New Haven Aug. 27, 1872.

Ing'ham, county of S. Central Michigan. Area, 576 square miles. It is level, fertile, and well timbered, and produces coal and iron ore. Cattle, grain, and wool are staple products. Lumber, carriages, brick, and saddlery are leading articles of manufacture. The county is traversed by various railroads, centring at Lansing, the capital of Michigan, which is in this county. Cap. Mason. Pop. 25,268.

Ingham, post-tp. of Franklin co., Ia. Pop. 293.

Ingham, tp. of Ingham co., Mich. Pop. 1392.

Ingham (Benjamin), b. at Ossett, Yorkshire, England, June 11, 1712; was educated at Batley School and at Queen's College, Oxford, where in 1733 he became associated with John and Charles Wesley, the founders of Methodism. He was ordained and accompanied John Wesley to Georgia in 1735, remaining two years in America, returning with Wesley, and accompanying him in his visit to the Moravians in Germany. So strong was his attraction to that body of Christians that he wished to assimilate the rising Methodism to their type, and he actually founded in Yorkshire several congregations of what might be called Moravian Methodists, otherwise "Inghamites," and in a few years there were in England 84 of these societies. In process of time Ingham, who had married a sister of the earl of Huntingdon, removed to Abberford and evangelized the whole surrounding region, being elected a bishop or *general overseer* by the Church he had founded, which was long in fellowship with Methodism, but in 1759 and the succeeding years three-fourths of the societies, and finally Ingham himself, went over to the Sandemanians (which see). He d. in 1772.

Ingham (Charles C.), b. in Dublin, Ireland, in 1796; belonged to an artistic family, and early developed a genius for painting; gained a prize from the Dublin Academy when only twenty years of age; came to the U. S., and with a brother attained the first rank of portrait-painters in New York City, where he was one of the founders of the National Academy of Design. D. in New York City Dec. 10, 1863.

Inghira'mi (Chevalier Francesco), b. at Volterra, Italy, in 1772, was sent in boyhood to Naples to study at the military school; the examination of the Museo Borbonico determined his vocation for the study of antiquities. His *Monumenti Etruschi*, in 10 vols. (1821–27), is the most complete account of Etruscan antiquities. He wrote also *Galleria Omerica*, in 3 vols. (1827–28), *Museo Etrusco-Chiusino*, in 4 vols. (1833), a *History of Tuscany*, in 16 vols. (1841–45), and numerous other works which gained him a European reputation. D. at Florence May 17, 1846.

In'gleby (Clement Mansfield), b. Oct. 29, 1823, at Edgbaston, near Birmingham, England; studied at Cambridge; became professor in philosophy in 1855 at the Midland Institute of Birmingham, and foreign secretary to the Royal Institute of Literature in 1870. He wrote *The Shakspeare Fabrications* (1859), *View of the Shakspeare Controversy* (1861), *Introduction to Metaphysics* (1869).

In'glis (David), LL.D., D. D., b. June 8, 1825, at Greenlaw, Berwickshire, Scotland; educated in the University of Edinburgh, where he graduated in 1841, and completed his theological studies there in 1844; in 1846 was ordained pastor of the Presbyterian church of Bedford, Westchester co., N. Y.; in 1849 accepted a call to St. Gabriel street church, Montreal; and in 1851 became pastor of the McNab street church, Hamilton, Ont. After a pastorate of sixteen years he removed to Toronto, having been called by the General Assembly of the Presbyterian Church of Canada to the chair of systematic theology in Knox College. From Toronto he removed in 1872 to Brooklyn, L. I., having accepted the pastorate of the Reformed (Dutch) church on the Heights. He is the author of *Tri-Centenary and Thanksgiving Sermons, Righteousness Exalteth a Nation, Systematic Theology in its Relation to Modern Thought*, etc.

Inglis (Henry David), b. in Edinburgh, Scotland, in 1795; travelled extensively in various countries in Europe, and under the pseudonym of "Derwent Conway" published some very entertaining works—*Tales of Ardennes, Solitary Walks through Many Lands, Journey through Norway, Sweden, and Denmark, Tour through Switzerland, etc., Spain in 1830, New Gil Blas, or Pedro of Peñaflor, Journey throughout Ireland in 1834, The Tyrol*, and *Rambles in the Footsteps of Don Quixote.* The works of Mr. Inglis are filled with information which is generally sought in vain in works of travel; they have been frequently reprinted, and have become, in a measure, authoritative. D. in London Mar. 20, 1835.

In'golstadt, town of Bavaria, in the province of Upper Bavaria, on the Danube. Its fortifications, which were destroyed by Moreau in 1800, were rebuilt in 1830, and are considered very strong. It has some manufactures of leather and paper. It was once the seat of a famous university, which was founded in 1472, transferred to Landshut in 1800, and thence to Munich in 1826. Pop. 15,025.

In'graham, tp. of Mills co., Ia. Pop. 318.

Ingraham (Duncan N.), b. Dec. 6, 1802, at Charleston, S. C.; entered the U. S. navy in 1812 as midshipman; rose to the rank of captain, and rendered himself famous in the Martin Koszta affair at Smyrna in 1853; for his conduct in this matter he was voted thanks and a medal by Congress. Afterwards he was appointed chief of the ordnance bureau of the naval department, which position he held until South Carolina passed her ordinance of secession in 1860; he then resigned his commission in the U. S. navy and took service under the Confederate States, in which he rose to the rank of commodore. A. H. Stephens.

Ingraham (Joseph H.), b. in Portland, Me., in 1809; early engaged in mercantile pursuits, but afterwards became an instructor in Washington College, Miss. He published *The South-west, by a Yankee* (1836), which was followed by a considerable number of romances, some of which had a very wide popularity. He afterwards took orders in the Protestant Episcopal Church, and was in charge of a parish at Holly Springs, Miss., where he had also a boys' school. Besides the above works he wrote *The Prince of the House of David* (1855), *The Pillar of Fire* (1859), and *The Throne of David.* D. in 1861.

In'gram Cross-Roads, tp. of Lauderdale co., Ala. Pop. 511.

Ingram's, tp. of Johnston co., N. C. Pop. 1326.

In'gres (Jean Dominique Augustin), b. at Montauban, France, Sept. 15, 1781; d. at Paris Jan. 14, 1867. His father, a painter and sculptor, had him instructed in music, but the passion for painting was early awakened; he studied under MM. Roque and Briant, and at nineteen entered the studio of David; at twenty-one gained the second grand prize; at twenty-two gained the first grand prize for the painting of *Achilles in his Tent receiving the Ambassadors of Agamemnon*, in the École des Beaux-Arts; in 1806 visited Rome, took up his residence there, and sent thence to Paris several canvases, which were not received with special favor. Between 1814 and 1832 many works were finished and sent to the exhibitions at the Louvre, historical pieces mostly from classical and modern story—*Virgil reading the Æneid to Augustus, Francesca de Rimini, Philip V. of Spain bestowing the Golden Fleece on the Marshal de Berwick*—but none of his works had the reputation in Paris that they had in Italy. M. Ingres's fame dated from works executed in Florence—*The Entrance of Charles V. into Paris* and *The Vow of Louis XIII.* The artist received the decoration of the cross from the king, and was made successor of Baron Denon in the Academy of Fine Arts. *The Apotheosis of Homer* (1827) and *The Martyrdom of St. Symphorian* excited much controversy among the critics. Sensitive to assault, the artist left France for Italy, where he

was made director of the Villa de' Medici. In Italy his productive period returned. *The Venus Anadyomene, Jesus among the Doctors, Molière in his Library, Racine in Court Costume, Jean d'Arc at the Consecration of Charles VII.*, were among his more celebrated compositions. Under the Third Napoleon, Ingres painted on the ceiling of the Hôtel de Ville a great picture, *The Apotheosis of Napoleon I.*, with the legend, *In nepote redivivus.* At the Exposition of 1855 the artist's works were displayed in a room devoted exclusively to them. A museum at Montauban bears his name. He received a grand medal from the jury of the International Exhibition, was made an officer in the Legion of Honor (1841), commander (1845), high officer (1855), senator (1862), and was also elected member of the imperial council of public instruction. O. B. FROTHINGHAM.

In'grians, a Finnish or Ugrian race, inhabiting Ingria, or Ingermannland, a portion of Russia now mostly included in the government of St. Petersburg. They are mainly Lutherans, very poor and ignorant, but the process of Russianizing in manners and religion is going on. The true Ingrians (Vod) are estimated to number 17,800, but there are reported in the district 42,979 Savakot and 29,344 Auramoiset—Finnish peoples allied by language with the Karelians rather than with the Ingrians and the true Finns.

Inhamban', Inhamba'na, or **Inhambane,** a Portuguese town of Mozambique, lat. 23° 52′ S., lon. 35° 51′ E., near the mouth of the river of the same name. It has a trade by sea in wax, ivory, etc. Pop. 10,000.

Inheritance. See HEIR.

In'ia, a genus of toothed delphinoid cetaceans of the family Iniidæ, which contains one known living species and several fossil genera. The *Inia Boliviensis*, of the rivers and lakes of the interior of South America, is from seven to fourteen feet long, is carnivorous and gregarious, and is caught for its oil. The females care tenderly for their young.

Injaya, The Logical School. See HINDU PHILOSOPHY, by PROF. JOHN DOWSON.

Injunc'tion [Lat. *injunctio*], in its more general sense, as a law term, is an order made by a court possessing equitable powers, addressed to a designated person, and commanding him either (1) not to commit some act which he threatens to commit, or (2) to desist from the further prosecution of some act which he has already commenced, or (3) to restore to its former condition something which has been interfered with and altered by his act. This judicial instrument for the prevention of wrong was, like many other remedies and forms of proceeding, borrowed directly from the Roman law, in which it was extensively used under the name of "interdict." Interdicts were commands issued by the prætor or other magistrate, in which he ordered something to be done or not to be done. The number of particular instances in which they might be used was very great, and indeed they might be resorted to for the protection of all species of property, public and private. The certainty and ease with which threatened wrongs could be prevented by their means, and a restoration of rights could be effected, raised the remedial department of the Roman law to a high position of practical efficacy which has been surpassed by no modern system of jurisprudence. The primary division of interdicts was into three classes: (1) Prohibitory, which prohibited something from being done; (2) restoratory, which commanded something to be restored; and (3) exhibitory, which directed some person or thing to be produced and exhibited. In this last class was one, *de libero homine exhibendo*, which was used to prevent a freeman from being restrained of his liberty by any person whatsoever, and which therefore bore some resemblance to our writ of habeas corpus.

The only species of injunction for a long time used by the English and American courts as a part of the equitable relief administered by them resembled and was borrowed from the prohibitory interdict of the Roman jurisprudence, since it merely forbade the commission of some act; but a modified form has been recently introduced under the name of "mandatory injunction," which is similar in its design and effects to the restoratory interdict. The ancient common law furnished no remedies which were directly preventive; its reliefs, in all ordinary private controversies, were either (1) the recovery of money as a compensation for the wrong complained of, or (2) the recovery of a specific tract of land, or (3) the recovery of a specific chattel. The court of chancery, untrammelled by the arbitrary and technical forms and doctrines of the law-courts, and administering a remedial system which those tribunals could not or would not administer, was able to introduce a preventive mode of relief, and from the very outset the injunction became the most potent instrument in building up its peculiar jurisprudence. The first important and constant use to which it was put was the restraining the prosecution of suits in courts of law. As the doctrines of equity are often quite different from those which prevail at law, and since from the same facts and circumstances involved in a given controversy it frequently happens that the law would regard one party as possessing the legal right, while equity would look upon the other as the one entitled to relief, it necessarily follows that the courts of law would decide such controversy when brought before them in favor of one litigant, and the court of equity would render its decree in favor of his antagonist. If, therefore, the person who held the legal right should bring an action in a common-law court, he would necessarily recover a judgment, while at the same time if his adversary should prosecute his demand in chancery, a decree would be rendered in his favor establishing his claim in direct antagonism to the decision made by the court of law. In this manner an unseemly conflict might have arisen and been perpetuated between the two classes of tribunals, had the chancellor not possessed the preventive instrument of injunction which enabled him to enforce his own decrees and uphold his own jurisdiction. The prohibition was not, however, directed against the courts of law nor the judges thereof personally, but against the suitors before those courts. The theory of the court was, that it was unjust and inequitable for the suitor in the particular case to make use of his strict legal remedies. The mandate of the court was accordingly addressed to him to refrain from doing an act which in right and conscience he ought not to do. By the use of the injunction the chancellor, when a proceeding was instituted before him to establish an equitable right, forbade the opposing party from commencing or carrying on any action in a court of law based upon the same facts and circumstances, and thus a conflict of jurisdiction in all cases was prevented. In this manner and for this purpose an injunction to stay the prosecution of suits at law became, from the very commencement of his judicial functions, an ordinary remedial instrument in the hands of the chancellor, and by its means alone was he finally enabled to establish his jurisdiction and to create the system of equity jurisprudence as a co-ordinate branch of English law.

The question as to the power to interfere by injunction being decided favorably, the court of chancery at length established the following general principle, which determined the occasions in which it would resort to such preventive remedy. In all cases where the courts of law can furnish an adequate relief for the wrong done or about to be done, equity will not interpose its restraining power, but will leave the injured party to his legal action. By the term "adequate relief" is meant the recovery of a judgment at law which is considered a sufficient satisfaction for the wrong done or contemplated; and it embraces, in general, all those cases in which pecuniary compensation can be awarded in the form of debt or damages, and those in which the thing itself, land or chattels, can be restored to the rightful possessor. The most important occasions to which this principle does not apply, and in which, therefore, an injunction will be granted in order to prevent a threatened wrong or to restrain the further commission of an inequitable act, are the following: (1) To restrain proceedings at law. This general class embraces many particular instances. Among the grounds for such interference, the most important are when the legal right and the proceedings to enforce it are affected by fraud, mistake, or accident; when they require a long accounting; when the litigation is vexatious; when the controversy involves the rights and duties of trustees, partners, executors, administrators, sureties, mortgagors, and mortgagees, or requires the marshalling of assets, or depends upon the effects of an equitable set-off or assignment. In these, and in certain other similar instances, the litigant parties and their attorneys and agents will be restrained from carrying on proceedings not only in courts having full common-law powers, but also in tribunals of an inferior or special jurisdiction. In addition to this use of the injunction, it is also resorted to in certain well-defined classes of cases to prevent the commission of acts which would be so permanently injurious to property that no adequate relief could be given by the common-law remedy of damages. It is true that in all the instances about to be mentioned some pecuniary compensation could be obtained, but from the very continuous and lasting nature of the wrongful act done, repeated and perhaps innumerable suits at law would be necessary, unless it could be stopped at once by some preventive relief. The classes of cases thus described, in which a wrong will be prevented because the law can give no sufficient remedy, are as follows: (2) to restrain the commission of waste, which is necessarily a permanent injury to the land wasted; (3) to restrain continuous or repeated trespasses upon land. Although an injunction will

not be granted to prevent violence to the person nor to chattels, nor single acts of injury to lands, yet if the trespass to land is continuous, so that it becomes analogous in its effects to waste, courts of equity will now interfere, by a liberal use of the injunction, both to prevent the further wrong and to compel a restoration of the premises to their original condition; (4) to restrain the creation and maintenance of nuisances; (5) to prevent the infringement of patents and copyrights, and the unlawful use or piracy of trade-marks; (6) to restrain the breach of covenants or agreements in a few special instances. In general, the breach of an agreement will not be enjoined, but in a few cases, where the injury would be of such a character that damages would be no adequate relief, courts of equity will interfere by injunction. In some cases an injunction is used as a means of enforcing an agreement. Thus, where a party has agreed that he will *not* do a particular thing, an injunction will cause him to fulfil his contract; (7) to restrain a disposition of their property by debtors so as to hinder, delay, or defraud their creditors; (8) to restrain assignments and transfers of property which would interfere with the settlement of bankrupts' estates. These are the most important and usual cases in which the power of equity tribunals to issue an injunction is now firmly established. There are some other special and exceptional instances which it is not necessary to enumerate.

In respect to their effects, injunctions are either prohibitory or mandatory. In the former class the order of the court is negative, and commands the party *not* to do the specified act; in the latter, it is affirmative, and commands the party to *do* the specified act. The object of a mandatory injunction is generally to compel the defendant to remove some structure which he has wrongfully erected, and which is a nuisance or a trespass, and to restore the premises to their original condition.

In respect to their form and the manner of granting them, injunctions are either final and perpetual or interlocutory and temporary. Final injunctions are granted after the hearing and decision of the cause, and form a part of the decree which determines the rights of the parties. Interlocutory or temporary injunctions are orders made at the commencement of the action or during its pendency, on the application of the plaintiff. Their object is to prevent the defendant from so interfering with or disposing of the subject-matter in controversy as to render a final decree against him ineffectual.

The reformed system of procedure which has been adopted in many of the U. S. has to a great extent obviated one most important use of the injunction as above described. According to that procedure, equitable defence can be set up and maintained in legal actions; the whole matter in dispute, the legal and equitable rights and claims of the parties, can be presented and adjudicated upon in one controversy, and the holder of the equitable right is no longer forced to institute a separate suit in chancery and to enjoin the adverse action brought against him in a court of law. Whenever this procedure prevails, therefore, the employment of the injunction to restrain the prosecution of suits at law is in most cases no longer necessary or proper. With this single exception the preventive remedy of injunction is freely used by our courts, although in most of the States the same tribunals are clothed with both equitable and common-law powers and jurisdiction.

JOHN NORTON POMEROY.

Ink [Fr. *encre;* Ger. *Tinte;* Lat. *atramentum*]. Any colored fluid used in writing or printing is an ink. The essential difference in composition between writing inks and printing inks leads to a natural division of the subject. We will consider first writing inks, and subsequently printing inks.

I. WRITING INKS. *Historical.*—Very little is definitely known of the composition of the inks used by the ancients, but it is generally conceded that the use of the stylus indicates the use also of carbon inks, not unlike, probably, the China or India ink which is still the almost exclusive atramental substance used among the Chinese and other Asiatic peoples. The use of iron salts is certainly very ancient. Dr. Blagden (*Phil. Trans.*, vol. lxxvii.) found that the faded characters of very ancient MSS. could be restored by the use of prussiate of potash and dilute muriatic or sulphuric acid, or less perfectly by infusion of galls, redeveloping the iron black. Pliny, Dioscorides, and other ancient writers give evidence, however, that carbon in the form of soot was the essential constituent of ancient ink.

Black Inks.—The black ink in common use in modern times is made from the action of infusion of gallnuts upon green vitriol, exposing the product to the influence of air, and holding the precipitate in suspension by gum, sugar, or mucilage. This fluid, the production of which is more particularly described beyond, is far from being chemically perfect, and is open to the objections that it corrodes steel pens, is prone to mould in warm weather, and to deposit a sediment on standing. The writing is also liable to grow yellow or brown with age, and, when not carefully prepared, to destroy the paper on which it is used. But these difficulties are in great part capable of correction by skilful manufacture and the use of proper precautions. The fact that well-made iron inks stain the substance of the paper with a stain difficult of removal, and speedily growing darker with age up to a certain time, has rendered their use very general in spite of their acknowledged defects. The carbon writing inks are liable also to the objection that they are not true solutions, and usually are wanting in fluidity. The logwood chrome ink is a true solution, but open to some serious objections. Stephens's and Arnold's writing fluids are true solutions with an iron base, pale when first written with, but rapidly growing darker to a fine black, and possessing many excellences. The aniline dyes also afford some good black or blue-black inks, which have many good qualities. Some of these are mentioned beyond.

Nutgall Iron Inks.—Both gallic and gallo-tannic acids, which co-exist in the infusion of galls, especially after considerable exposure to air, produce deep-black precipitates with ferric salts, but with ferrous salts whitish precipitates, becoming black by exposure to air. As gallic acid produces a much deeper black with ferric salts than tannic or tanno-gallic acid, we see why it is advantageous to leave the infusion exposed for many days to air, in order that the tannic may be changed to gallic acid. Gum arabic or gum senegal is added to retain the precipitate in suspension, prevents the formation of a sediment, and adds a certain degree of lustre. To prevent the growth of mould some essential oil, carbolic acid in small quantity, and rarely corrosive sublimate, are used. Other vegetables containing tannin are often substitutes for gallnuts, chiefly from motives of economy, but only with a loss of quality. Logwood is, however, used in certain inks, as giving not only tannin, but a peculiar color. Recipes without number exist in the technical books for the preparation of iron black ink, and each manufacturer boasts his own. Many of them are worthless, as containing too much acid or too little gall-infusion, too much gum or some other objectionable ingredient in excess, or some defect in manufacture. We will select a few only of the best, and such as have been prepared with some regard to the chemical character of the ingredients. Dr. Lewis, at the close of the last century, who seems to have been the first chemist to study ink quantitatively, found that equal weights of galls and sulphate of iron gave an ink which, although of a good color when used, subsequently became yellowish-brown; that as the quantity of sulphate was increased the inks were less durable in color; and that those in which the galls predominated were most persistent. The proportions which he found best by experiment were—

Powdered sulphate of iron	1 ounce.
Ground logwood	1 "
Bruised galls	3 "
Gum arabic	1 "
White wine, or acetic acid	1 quart.

He found that although water answered for all ordinary purposes, white wine gave a deeper-colored product, and the ink made with acetic acid was still blacker. Alcohol was injurious to the color, causing a deposition of the tinctorial precipitate. A decoction of logwood, substituted for water, improved the black both in richness and depth of tint. He directs the materials to be put into a glass, earthenware, or other non-metallic vessel, and the mixture agitated four or five times every day. In ten or twelve days it is ready for use—if placed in a warm situation considerably earlier; but if the ink is allowed to remain on the matériel it continues to improve for a lengthened period. When decanted it may be kept in good order with greater certainty if a few broken—not bruised—galls and two or three fragments of iron are placed in it. (*Muspratt.*) Dr. Ure, who made careful researches upon inks, gives the following directions for the best black ink: To make 12 gallons of ink we may take 12 pounds of nutgalls, 5 pounds of green sulphate of iron, 5 pounds of gum senegal, 12 gallons of water. The bruised nutgalls are to be put into a cylindrical copper of a depth equal to its diameter, and boiled during three hours with three-fourths of the above quantity of water, taking care to add fresh water to replace what is lost by evaporation. The decoction is to be emptied into a tub, allowed to settle, and the clear liquid being drawn off, the lees are to be drained. The gum is to be dissolved in a small quantity of hot water, and the mucilage thus formed, being filtered, is added to the clear decoction. The sulphate of iron must likewise be separately dissolved and well mixed with the above. The color darkens by degrees, in consequence of the peroxidation of the

iron, on exposing the ink to the action of the air. But ink affords a more durable writing when used in the pale state, because its particles are then finer and penetrate the paper more intimately. When ink consists chiefly of tannate of peroxide of iron, however black, it is merely superficial, and is easily erased or effaced. Therefore, whenever the liquid made by the above recipe has acquired a moderately deep tint it should be drawn off clear into bottles and well corked up. Some ink-makers allow it to mould a little in the casks before bottling, and suppose that it will thereby be not so liable to become mouldy in the bottles. The ink made by the recipe given above is much more rich and powerful than many of the inks commonly sold. To bring it to their standard a half more water may safely be added, or even 20 gallons of tolerable ink may be made from that weight of materials, as I have ascertained. Sumach and logwood admit of only about one-half of the copperas that galls will take to bring out the maximum amount of black dye. Watts has tabulated various recipes for the preparation of black ink, calculated for 1000 parts of water, as follows:

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*
Galls	225	187	133	125	66	62	31
Copperas	75	73	55	24	22	31	19
Gum arabic	25	73	55	24	19	31	8

	h.	*i.*	*k.*	*l.*	*m.*
Galls	50	174	50	60	42
Logwood	...	...	100	20	21
Copperas	32	87	16	20	21
Sulphate of copper	...	...	...	...	5
Gum	9	43	47	20	16
Sugar	...	...	23	1000	
Vinegar	125	135			

Of the genuine inks (*a–g*), *a*, *b*, and *c* are too strong for ordinary use; *d*, *e*, and *f* are perhaps the best; *g* would be somewhat too pale. The rest (*h–m*) cannot be recommended, excepting for special purposes. Sulphate of copper deepens the color of the precipitate, but renders it more compact and heavy, and therefore more apt to settle down. A certain quantity of sugar renders the ink more fluid, and permits the addition of a larger proportion of gum. It likewise renders the ink adhesive when dry, so that a copy of the writing may easily be taken off by the copying-press. An ink containing logwood with the galls has been much used in Germany, and is made as follows: 1 kilo. of coarsely pulverized nutgalls and 150 grms. of logwood chips are exhausted with 5 litres of hot water; 600 grms. of gum arabic are dissolved in 2½ litres of water; and 500 grms. of sulphate of iron in some litres of water; each of these solutions being made separately. This done, the gall-logwood infusion is mixed with those of the gum and copperas; a few drops of essential oil of cloves or of gaultheria (wintergreen oil) having been added, there is added as much water as will bring the bulk of the liquid up to 11 litres. While this kind of ink attacks and corrodes steel pens, it has the additional disadvantage that after a time the writing becomes yellow. Booth gives the following formulæ: For superior black ink, take 12 pounds Aleppo galls, 4 pounds sulphate of iron, 3½ pounds of gum, and 18 gallons of water. For a fine exchequer ink, 40 pounds of Aleppo galls, 9 pounds of sulphate of iron, 10 pounds of gum, and 45 gallons of water. In both these cases it is directed that the bruised galls be exhausted by three consecutive boilings, each time diminishing the quantity of water, and supplying by fresh addition any loss by evaporation. The copperas and gum in solution are added to the strained decoction of galls whilst both are yet warm, and the whole is allowed to repose for several weeks, when the fluid is drawn off from the sediment. A few cloves, or some drops of creosote, are added to prevent any parasitic growth. The best fluid to dilute ink which has become too thick for use is a strong decoction of coffee, which improves the lustre and color of ink without decomposing it.

The imperfections inherent in the ordinary black ink from galls and iron salts became more manifest on the introduction of the steel pen, which, aside from its being corroded more or less rapidly, caused the ink to concrete and deposit its coloring-matter. These imperfections have been sought to be avoided by the introduction of various *fluid inks*, which are true solutions. The first of these in order of time was the fluid of Henry Stephens of London, who prepared a blue liquid which possesses the property of turning in a few hours after writing to an intense black. It has the advantage of perfect fluidity, flowing easily from the pen upon the paper, with which it forms a tenacious combination. These properties were imparted to the ordinary gallic ink by adding to it sulphate of indigo, which holds the coloring-matters in solution. The so-called *alizarin inks* (a mere commercial name, by no means implying that they contain the alizarin of madder) consist of common ink mixed with a little free sulphuric acid, which, like other acids, retards the oxidation of the ferrous precipitate (see Iron, Salts of), so that the writing becomes black only after exposure to the air; the change being, perhaps, accelerated by the neutralization of the sulphuric acid by the basic substances contained in the paper; the ink blackens very quickly when exposed to ammoniacal vapors. A certain quantity of sulphindigotic acid or its sodium-salt (indigo-carmine) is usually added, so that the ink may not appear too pale in writing. An ink of this kind may be prepared by exhausting 40 parts by weight of nutgalls with 112 parts water, and then adding 7 parts copperas and ¼ part oxalic acid. At the same time, 1 part of finely pulverized indigo-blue is dissolved in 4 parts fuming sulphuric acid; the solution after twenty-four hours is diluted with water, and mixed with a small quantity of carbonate of soda; the precipitate is collected, washed to remove the saline solution, then suspended in water; and this liquid is added to the former till the whole exhibits a rather deep greenish-blue color. Stark, after manufacturing and testing for fourteen years 229 different kinds of ink, states that he found nothing for durability of writing and general excellence to compare with gallnut-copperas ink, with a certain amount of sulphate of indigo. He gives as his final preference for the best ink: To each 1 gallon, 12 ounces of best gallnuts, 8 ounces of copperas, 8 fluid-ounces of sulphate of indigo, 4 to 6 ounces of gum arabic, and a few cloves. As metallic iron impairs the quality of all iron inks, he recommends that all legal and other important documents be written with a gold or quill pen. (*Civ. Eng. and Arch. Jour.*, Aug., 1855.)

Chrome ink is prepared by adding 1 part of chromate of potassa to 1000 parts of a saturated solution of logwood, made by boiling 22 pounds of logwood in a sufficient quantity of water to give 14 gallons of decoction; to this menstruum, when cold, the chromate is gradually added and the mixture well stirred. The addition of gum is injurious. If care is taken not to permit the proportion of chrome salt to exceed 1 part for 1000 parts of decoction of logwood, a deep blue-black writing fluid is formed which drops no deposit, like the ordinary gallate-of-iron ink. Paper written upon with it may be washed with a sponge or be left twenty-four hours under water without the marks being erased. Weak acids do not destroy the writing, nor do they even change the shade, whilst that made from galls is effaced, and the ink made with logwood and sulphate of iron is turned red. Runge, the discoverer of this ink, used it with steel pens for two years without their becoming rusty or obstructed by solid matter. It is not liable to turn mouldy, but, on the other hand, it is incompatible to use it with pens which are dipped in ordinary ink, and it is prone to gelatinize. A much-esteemed French fluid ink, "the black-violet ink of Rouen," is prepared by boiling 750 parts of logwood with 6000 parts of water, 35 parts of alum, 31 parts of gum arabic, and 15 parts of sugar-candy, leaving the mixture to stand for two or three days, and straining through a linen cloth. A chrome ink unlike Runge's chromate-of-potash ink has been proposed by C. Puscher in Nuremberg, 1867, thus: Take 10 loths of logwood extract with four times its volume of water, boiled till half the water is evaporated; 2 loths of chrome alum are then dissolved in half the same volume of water, and both solutions mixed and boiled for fifteen minutes, in which time it should be in solution. Add further 1 loth of gum arabic, and we have 25 loths of a clear deep violet-blue solution, which soon writes black. To convert this into a good copying ink, add 1 loth gum arabic and ½ loth of glucose or glycerine. (Wagner, *Jahres-Bericht*, xiii. 1867.)

Vanadium Black Ink.—Berzelius advised the use of vanadate of ammonia with infusion of gallnuts. A surprisingly small quantity of the vanadium salt suffices to produce a perfectly black ink—so small, as Berzelius says, it will not be worth considering when vanadium is more generally known. The writing obtained with this ink is perfectly black. No sediment forms from it. It flows readily from the pen, and does not corrode steel; is not attacked by dilute alkalies, but is turned red by acids. Dr. A. A. Hayes (*Proceed. Am. Acad.*, 1875) has lately shown the vanadium compounds to be far more widely diffused than was before known. Although this ink cannot be said to be absolutely indelible, yet it strongly resists reagents which cause common ink to disappear.

An excellent *extemporaneous* ink is made as follows: Take of tannic and gallic acids each 20 grains; dissolve in two fluid-ounces of water; also take crystallized green vitriol (sulphate of iron) and of *dried* sulphate (*sulphas ferri exsiccatum*), of each 15 grains, and dissolve these separately in a like quantity of water (best distilled); mix the two solutions and add of mucilage (*mucilago gummi arabici*) 2½ fluid-drachms, of oil of cloves 2 drops. This is by no means a cheap ink, but is very permanent, and of a beautiful black color.

For travelling expeditions it is convenient to have ink in *cakes* and *ink-powders;* two of the following recipes for these are quoted from Watts's *Dictionary: Ink in Cakes.*—42 parts of good nutgalls and 3 parts of madder are boiled in about six times their weight of water; the filtered decoction is mixed with 5½ parts copperas and 2 parts pyrolignate of iron; 1½ parts solution of indigo (in sulphuric acid, diluted with water) are then added; the mixture is evaporated nearly to dryness at a gentle heat and with constant stirring; and the pasty mass is then made into cakes and thoroughly dried. This ink, dissolved in 6 parts of hot water, is said to make an excellent copying ink, and in 10 or 12 parts water a very fine writing ink. *Portable Ink.*—At a recent meeting of the Polytechnic Association of Frankfort, M. Böttger exhibited a new kind of ink which is convenient for travellers. It is prepared by saturating white bibulous paper with aniline black, and then pressing several sheets together, so as to form a compact block. Other aniline colors may be employed for making red, violet, green, and other inks. A piece of the prepared paper two or three centimètres square will furnish sufficient ink for a long correspondence by simply steeping it in a little water. *Ink Powder.*—A solid chrome ink may be made by triturating together to a fine powder 100 parts extract of logwood, 1 part neutral chromate of potassium, and $\frac{1}{10}$ indigo-carmine; 1 part of this powder, added to 32 parts water, is said to make very good ink. A mixture of 4 parts pounded galls, 2 parts copperas, and 1 part gum arabic is also frequently sold as an ink-powder.

Copying inks are only concentrated common inks, to which more gum and sugar or a portion of glycerine is added. If the body is good, three or four legible copies may be taken from the same writing by the copying-press. A very much esteemed French copying ink is made thus: Take 30 grms. of extract of logwood, 7.5 grms. of crystallized carbonate of soda; boil this with 240 grms. of water, and add, while vigorously stirring, 30 grms. of glycerine. When the fluid has become cold, dissolve in it 1 grm. of neutral chromate of potassa, and add, lastly, 7.5 grms. of gum arabic, previously made into a thick mucilage with water. The paper upon which it is desired to transfer a copy need not be moistened if this ink is used. The following preparation is much recommended: 4 parts by weight of logwood extract are dissolved in a mixture of 60 parts vinegar and 70 parts water; and 3 parts copperas, 2 parts alum, 2 parts gum arabic, and 4 parts sugar are then added. This ink is at first more violet than the Rouen ink, which is also used as a copying ink. Another like preparation of American origin is as follows: Take ½ a pound of extract of logwood (Sanford's is best), 2 ounces of alum, 4 drachms of blue and as much of green vitriol, and 1 ounce of sugar; boil these ingredients with 4 pints of water, filter the decoction through flannel, and add to it a solution of 4 drachms of yellow chromate of potassa in 4 ounces of water, and finally 2 ounces of chemic blue in 2 ounces of glycerine. The chemic blue, also called "blue dye," is the solution of indigo in oil of vitriol, and otherwise used for dyeing wool. Letter-books, with paper kept moist by glycerine, have been prepared which are said to avoid the necessity of using a brush or sponge in copying letters. A good copying ink is said in the *Chem. Cent. Blatt* (for 1863, 352) to be obtained by using 15 grammes of logwood extract, 2 of alum, ¼ each of green vitriol and blue vitriol, and 1 of sugar, boiled in 3 pints of water; strain and add ¼ of chromate of potassa in 4 of water. Then add 2 of sulphate of indigo and 2 of glycerine. The indigo solution is made by treating ½ powdered indigo with 5 Nordhausen acid, and dilute with 3 pints of water.

Native Vegetable Inks.—The juice of *Coriaria thymifolia*, or ink-plant of New Granada, locally called *chauchi*, is at first of a somewhat reddish color, but becomes intensely black in a few hours. This juice can be used for writing without requiring any further preparation. It corrodes steel pens less than ordinary ink, and resists chemical agents better. All the old documents under the Spanish dominion in America were written with chauchi. Sea-water does not affect it. Experiments are being made in Europe to acclimate this ink-plant. The *Sequoia gigantea*, or "big trees," of the Sierra Nevada furnish a peculiar sort of tannin, highly colored and largely soluble in water, furnishing a strong deep reddish-black liquid which I find to be a quite tolerable natural ink when used alone, and with a steel pen the color is rendered much darker. This coloring-matter is found only in the cones, the seeds being implanted in it, and it also fills the spaces between the scales of the cone. A gum resin accompanies the tannin which is quite soluble in diluted alcohol. Boiling injures the color of this natural ink, which cold water suffices to exhaust. It is highly probable that observations to this end will discover other valuable native inks. (See beyond *Indelible Marking Ink* from anacardium nut.) The *Deutsche Ind. Zeitung* gives the following recipe for an old and well-known natural ink: *Black Ink from Elder Berries.*—The bruised berries are placed in an earthen vessel, and kept in a warm place for three days, then pressed out and filtered. The filtered juice is of such an intense dark color that it takes 200 parts of water to reduce it to the shade of dark red wine. Add to the 12½ quarts of this filtered juice 1 ounce of sulphate of iron and the same quantity of crude pyroligneous acid, and an ink is prepared which, when first used, has a violet color, but when dry is indigo blue-black. This ink is superior in many respects to that prepared with galls; it does not become thick so soon, it flows easier from the pen without gumming, and in writing the letters do not run into one another. There is quite a list of plants whose seeds give a lasting black color as inks and dyes of silk and linen fabrics or hair. Such are *Amyris toxifera, Camocladia integrifolia, C. dentata* and *C. punctuata, Cotula alba* (or *Eclipta erecta*), the seeds of which the inhabitants of Cochin-China use to color their hair of a permanent black. *Rauwolfia canescens* bears juicy berries, the juice of which alone can be used as ink, and leaves permanent stains on linen, etc.

Colored Writing Inks.—Ink may be made of almost any desired color, and the variety, richness, and permanence of colored inks have been greatly increased of late by the introduction of aniline colors, many of which may be used with great advantage, and have already a wide circulation under various trade-names.

Red ink is usually made from either cochineal or Brazil-wood, the latter being the more permanent. But some of the aniline reds are rapidly replacing the former sorts. The *cochineal inks* are the brightest, but at the same time the dearest and most fugitive. The best is a solution of pure carmine in caustic ammonia; it must be preserved in well-stopped vessels. Böttger recommends 1 part of good carmine, 120 caustic ammonia, and 1½ parts gum arabic. A cheaper but less brightly colored ink is made by drenching 12 parts of pulverized cochineal and 4 parts of carbonate of ammonia (or pearl-ash) with 32 parts hot water, then digesting and pouring off the clear liquid. Addition of cream of tartar and stannic chloride renders the ink more scarlet; cream of tartar and an equal weight of alum give it a crimson tint. *Brazil-wood inks* are made by boiling the wood in water, adding tin-salt (stannous chloride) or cream of tartar and alum to modify the tint, and thickening with gum arabic; *e. g.* 4 parts Brazil-wood boiled in 60 parts of water, the decoction boiled down to 36 parts, filtered, and mixed with ⅛ part of tin-salt and ¼ part gum arabic; or 8 parts Brazil-wood, boiled with 2 parts alum and 2 parts cream of tartar in 120 parts water; the liquid concentrated to 6 parts by weight, and mixed with 2 parts gum arabic and 2 parts sugar. Reade's patent red ink (1847) is made as follows: Cochineal is first boiled in successive quantities of pure water till it ceases, or nearly so, to afford tinctorial matter. It is then subjected to ebullition with dilute ammonia, which dissolves the remainder of the tint-giving principle, leaving the animal matter nearly white. These aqueous and ammoniacal decoctions are then mixed in an earthenware vessel, and the coloring-matter is then thrown down by means of the double chloride of ammonium and tin. The compound thus formed is subsequently boiled in ammonia, and iodide of tin is then added till the required degree of brilliancy of hue is obtained; this completes the process, the degree of body required in the ink being given by an *ad libitum* addition of water. This ink, says the patentee, is greatly superior to the common solutions from peach and Brazil-wood, not only in permanent richness of color, but also in its freedom from acid, and consequent fitness for use with steel pens.

Blue Inks.—The most familiar blue ink is Stephens's patent blue writing fluid, which is 30 parts of soluble Prussian blue (Paris blue) dissolved in 4 parts of oxalic acid in 1000 parts of water. Common Prussian blue is digested in successive portions of hydrochloric acid until the solution ceases to react for iron with ferrocyanide of potassium. It is then washed completely neutral with water, gently dried, and carefully mixed with oxalic acid in fine powder, drenched with pure cold water added in small portions at a time, making a solution more or less dense according to the intensity of color desired. For a concentrated solution, 6 parts of Prussian blue, weighed before the acid treatment, will after digestion be taken up by 1 part of oxalic acid and a proportional amount of water. Stephens's Prussian blue ink fades in the light, but is restored in the dark—a fact familiarly known to dyers as true of textile fabrics dyed with Prussian blue. This blue ink resists the action of chlorine and strong acids, but it yields to oxalic acid and alkalies. Reade's patent blue ink is nothing more than soluble Prussian blue prepared by a costly reaction between ferric iodide and potassium ferrocyanide. Dr.

Normandy prepared also a blue ink from ferrocyanide of iron macerated in potassium binoxalate, but it is not better than Stephens's. Ohme's blue ink is also soluble Prussian blue. It is curious to see the recent revival of the soluble Prussian blue ink in H. N. Nissen's patent, which was nothing new. (*Wagner*, 1874.) The *aniline blue inks* are not quite equal to the color of a well-made Berlin blue ink, showing usually of a little gray cast. But any one who knows the trouble it costs to make the Berlin blue ink, and how easily this aniline ink is made, will prefer the nearly equal indigo and blue-red aniline ink. To produce it take 1 part of *bleu de nuit* (bleu de Paris) in 200–250 parts boiling water. If it shows the coppery sheen on the paper, add more water. In use this ink holds like the fuchsine ink. The alkali blue (5 B. or 6 B.) furnishes a blue ink of a most delicate shade, but this ink is rather costly. Normandy's *purple ink* is a logwood ink, prepared as follows: To 12 pounds of Campeachy logwood add as many gallons of boiling water; pour the infusion through a funnel, with a strainer made of coarse flannel, on 1 pound of hydrate or acetate of copper (verdigris) finely powdered; at the bottom of the funnel a sponge is placed; then add immediately 14 pounds of alum, and for each 17 gallons of liquid add 4 pounds of gum arabic or senegal; let these remain for three or four days, and a beautiful purple will be produced. The aniline purple and violet inks far exceed all others in brilliancy, are free from corrosive action, quite sufficiently permanent, and may be rendered practically indelible. The same is true of the aniline green. *Violet aniline ink* is most easily made of all aniline inks. Take 1 part of violet blue aniline to 300 parts water. The solution is of a vivid and beautiful violet color, never lets fall a precipitate, flows smoothly, and dries quickly. It is greatly to be preferred to the common copying ink made from logwood, alum, cupric sulphate, sulphate of indigo, and glycerine. A pen that has been used for such copying ink if dipped in aniline violet ink instantly impairs its color and granulates it. *Green aniline ink* is the finest color, but most costly, of all these brilliant inks. Take 1 part of methyl green (methyl iodide), soluble in water, to 100–110 parts of boiling water: this gives a shining blue green; if a yellow green is desired, add a little picric acid. It will by its remarkable beauty displace all existing green inks. *Chrome green ink*, after Winckler: Dissolve 180 grains of bichromate of potassa in 1 fluidounce of water; add to the menstruum, while warm, ½ an ounce of spirit of wine; then decompose the mixture with concentrated sulphuric acid until it assumes a brown color. The liquor is now evaporated till it is reduced in quantity to one-half, when it is diluted with 2 ounces of distilled water, filtered, mixed with ½ an ounce of alcohol, subsequently with a few drops of strong sulphuric acid, and then allowed to rest till after some time it assumes a beautiful green color. It is finally adapted for use by the addition of a small quantity of gum arabic. *Yellow aniline ink* is not to be commended. The mixture of 1 part picric acid in 120–140 parts water is almost never used. Much yet remains to be done to perfect and develop the aniline inks, for which ample materials already exist.

Carbon and other so-called Indelible Writing and Marking Inks.—The resistance offered by carbon to the action of chemical agents is well known, and it is hence the basis of the most permanent and unchangeable inks, chiefly printing inks, as carbon cannot be brought into solution. All inks on this basis must be, like China or India ink, sediments held in suspension by some vehicle, and consequently less fluid than is desirable for easy and constant use with a pen of modern construction. Hence, we find Oriental nations writing chiefly with a pencil of camel's hair, and the ancient nations with a stylus of split reed. The elaborate engrossing on parchment in both ancient and modern times, in inks of all colors and in gold and silver sizing, is performed with like implements and the use of colors held up in vehicles of various kinds, and always of a certain consistence unsuited to use in an ordinary pen. Nevertheless, the ingenuity of practical chemists and manufacturers has devised numerous carbon and other indelible or permanent inks, of which we will mention some of the most important. *Indian Ink or China Ink.*—This well-known pigment is prepared from finely divided carbon, chiefly lampblack or the soot of the oil of sesamé, formed into cakes by the use of some glutinous vehicle or adhesive substance, such as gum-water or glue. Merimée says in his work (*De la Peinture à l'Huile*) the Chinese do not use glue in the fabrication of their ink, but certain vegetable juices, which render it more brilliant and more indelible on paper. Other authentic accounts of the manufacture of this famous ink by the Chinese state in substance as follows: The basis of all the different kinds and qualities of India ink is lampblack, the best of which is obtained from pig's-foot and other oils, and sometimes from resins, while an inferior sort is made from pine wood. The materials are burned in a furnace about 100 feet long, along the sides and top of which the smoke condenses. That most remote from the fire and nearest the top is the finest, and is carefully kept separate from the rest. Glue made from the skin of the buffalo of the country is soaked in water for a time until it is much swollen, and afterwards completely dissolved. The lampblack is then introduced and worked in until it forms a soft paste. When the materials are thoroughly mixed a quantity of the oil of peas is added, and the temperature maintained for a time at from 110° to 140°, until the paste is homogeneous in character. It is then removed and separated into little cakes, which are allowed to remain for some time drying and becoming mellow, after which they are strongly compressed in wooden moulds, on the interior of which are engraved the characters which are seen upon the cakes. The surface of the cakes is finally coated with a kind of animal wax, which gives a polish and prevents the ink from staining the hands. The peculiar odor of India ink is produced by adding to it, during the process of preparation, a mixture of Borneo camphor and musk. Only the finer qualities, however, receive this addition. Merimée (before quoted) gives the following directions for preparing this ink with glue. A concentrated infusion of gallnuts is turned into a solution of glue. The elastic, resinous-looking product (artificial leather) is immediately washed clear of the mother-liquor by hot water, and is then dissolved in a thin solution of clarified glue. Filter this solution, and concentrate to the proper degree for incorporating it with purified lampblack. Infusion of galls renders the ink permanent on paper, otherwise it might be removed mechanically. Provost says that lampblack purified by potash ley, when mixed with a solution of refined glue and dried, formed an ink which was preferred by artists to that of China. Ritfault in his treatise on the *Manufacture of Colors* gives the following formula for the preparation of China ink, by which this color, it is said, is now largely produced in Europe and sold as the original article: Calcined lampblack, 100 parts; boghead shaleblack, in impalpable powder, 50 parts; indigo-carmine, in cakes, 10 parts; carmine lake, 5 parts; gum arabic (first quality), 10 parts; purified oxgall, 20 parts; alcoholic extract of musk, 5 parts. The gum is dissolved in 50 to 60 parts of pure water, and the solution filtered through a cloth. The indigo-carmine, lake, lampblack, and shaleblack are incorporated with this liquor, and the whole ground upon a slab with a muller, in the same manner as ordinary colors; but in this case the grinding takes much longer. When the paste is thoroughly homogeneous the oxgall is gradually added, and then the alcoholic extract of musk. The more the black is ground the finer it is. The black is then allowed to dry in the air until it has acquired sufficient consistency to be moulded into cakes, which in their turn are still further dried in the air out of the reach of dust. When quite firm these cakes are compressed in bronze moulds, having appropriate designs engraved upon them. The moulded ink is then wrapped in tin-foil with a second envelope of gilt paper. The ink which has been prepared in this manner possesses all the properties of the real Chinese article. Its grain is smooth, it flows very well, mixes perfectly with many other colors, and becomes so firmly fixed to the paper that other colors may be spread over it without washing it out. *The indelible ink of the Academy of Sciences* of Paris was prepared in 1835 by a commission called for by the minister of finance, charged with the duty of discovering a truly indelible writing ink for use on the public securities, bank-notes, etc. The result was an ink formed by dissolving China ink *in dilute hydrochloric acid*. It appears, therefore, that the Academy ink described below from Prof. Johnson is in a sense the same as this, substituting an alkaline for an acid vehicle, both very dilute. Either of these vehicles will serve to penetrate the paper and prevent the easy mechanical removal of the coloring-matter. The alkaline vehicle has the advantage of not attacking steel pens, and of overcoming a certain unctuousness of surface found on some highly-finished papers or imparted by the fingers of some persons in the act of writing. I do not find mention of these inks in any of the cyclopædias. The little manual Roret of MM. Champour et F. Malepeyre (*Nouveau manuel complet de la fabrication des encres*, Paris, 1856) gives the report of the commission of the Academy, but it does not speak of the alkaline menstruum. *The Academy ink*, so called, is China ink held in solution by about 1 per cent. of potassic hydrate. Prof. S. W. Johnson, who has used this ink for some time, informs me that it is made either by rubbing up the India cake in potash-water, or more easily by placing a small lump of the India ink in a bottle with less than its bulk of stick potash and a little water. The ink slowly dissolves in the strong potash lye, and is then largely thinned with water. This ink holds up its carbon in the vehicle almost without precipitation, flows freely from the pen, writes perfectly black, and is completely

unalterable by time or chemical agents. A good permanent writing ink may be made extemporaneously by mixing any good ink with a little genuine China ink. It will resist washing with a camel's hair brush and the action of oxalic acid, chlorine, etc. It writes well also with a pen, and may be used on both paper and textile fabrics. The vanadium ink already mentioned is a good indelible ink. Other indelible carbon inks are made as follows: Traill (*Edinbg. Phil. Trans.*) says: Gluten, obtained in the ordinary way, is kept from twenty-four to thirty-six hours in water, and is then digested in acetic acid having the specific gravity 1.033 or 1.034, in the proportion of 3 parts of gluten to 20 parts of the acid. By the aid of a gentle heat a grayish-white, saponaceous fluid, which may be kept for some time, is obtained. From 8 to 12 grains of the finest lampblack and 2 grains of indigo form the coloring-matter for each fluid-ounce of the vehicle, with which it must be thoroughly incorporated. An agreeable aroma may be communicated by digesting bruised cloves, pimento, or cinnamon in a portion of the original acid. This ink may be used with a steel pen, but should not be left in it. It resists water, chlorine, and dilute acids, but it is not calculated for writing on parchment. Henry Stephens's *carbon ink* has become famous, and is made by boiling shell-lac, or common resin, in carbonate of soda, potassa, or ammonia solution, in about equal proportions, until all the resin is dissolved. This solution is then mixed with finely-levigated lampblack until it has the proper consistence. This alkaline liquid may also be mixed with other colors to form an indelible ink. Dr. Normandy has suggested an indelible writing ink which cannot be obliterated or defaced by any known chemical agent: 24 pounds of Frankfort black must be ground with mucilage—formed by adding 20 pounds of gum to 60 gallons of water—and the mixture strained through a coarse flannel, or passed through a funnel the tube of which is closed by a sponge; 4 pounds of oxalic acid are then added, together with as much decoction of cochineal and sulphate of indigo as will give the required shade. Bossin's indelible ink is made of 2 parts of powdered acetate of copper, 4 parts of sal-ammoniac, 1 part of lampblack, and 20 parts of water, well mixed together. They make a good indelible ink, which, however, must always be shaken before using. Scott has patented (1840) an indelible ink in which gas-carbon (*i. e.* carbon from the burning of coal-tar) and indigo or Prussian blue in very fine powder are incorporated in a logwood and gallnut ink.

Indelible Marking Inks.—Dr. Böttger (*Bayerisches Ind. und Gewerb-Blatt*, Dec., 1872) states that the juice of the anacardium nut (*Anacardium Orientale*) contains an oily matter which by exposure to air gradually assumes an intense black color; this color is acted on neither by acids, alkalies, chlorine, nor cyanide of potassium. The powdered nut is treated in a closed glass bottle with gasoline, and after so digesting some time is left exposed to air for spontaneous evaporation. The remaining fluid, which is thickish, is used either by writing or stamping by a die upon linen or cotton. The color is at first dirty brown, but it gradually becomes intensely black—an effect produced instantly by moistening the linen or cotton with liquid ammonia. The same author also gives the following formula for an *indelible aniline black writing ink* (*Dingler*, Jan., 1873): 3.65 grammes of aniline black are rubbed fine in a porcelain mortar with 60 drops of hydrochloric acid and 22 grammes of alcohol. This solution is mixed with a hot solution of 1.82 grammes of gum arabic in 85 grammes of hot water. This ink does not attack steel pens, and is not acted on by strong mineral acids or by alkalies. If the aniline black solution is diluted with shell-lac solution (21 grammes in 85 of alcohol), an aniline black lake is obtained which is suited for coloring wood and leather. An indelible marking ink, described by Jacobson (*Jahres-Berich.* xii. 63), is prepared from aniline by mixing the two following solutions: (*a*) cupreous solution—8.52 grm. of crystallized chloride of copper, 10.65 grm. of chlorate of soda, and 5.35 grm. of chloride of ammonium are dissolved in 60 grm. of distilled water; (*b*) aniline solution—20 grm. of hydrochlorate of aniline are dissolved in 30 grm. of distilled water, and 20 grm. of a solution of gum arabic (1 of gum to 2 of water) with 10 grm. of glycerine are added. By mixing in the cold 4 parts of the aniline solution with 1 part of the cupreous solution, a green liquid is obtained which can be used immediately for tracing characters upon linen; the marks, however, alter after the lapse of a few days. It is necessary to keep the solutions separate until required for use. If the fluid does not flow easily from the pen, it may be diluted without fear of diminishing the intensity of the tint, which, at first green, gradually darkens and becomes black. Heat causes the change to take place instantaneously; a steam heat is sufficient, and is better for the fabric than a hot iron. Afterwards the linen is washed in warm soap and water.

Indelible Blue Molybdenum Ink.—Roder directs (*Polyt. Notizblatt*, 1856, 112) to dissolve five parts of oxide of molybdenum in the smallest necessary quantity of muriatic acid; also dissolve 2 parts of extract of licorice and 6 of gum arabic in 240 parts of water. Mix the solutions, and write with them on the linen to be marked. After writing, moisten with a solution of chloride of zinc in water. This is an ink not only indelible in ordinary washing, but in acids and alkalies. It is said this ink cannot possibly be removed, except by destroying the article written upon. In fact, it is an utterly indelible blue dye, while the so-called indelible silver inks may be removed by cyanide of potassium, and other chemical agents. *Nitrate-of-silver marking inks*, although commonly called indelible, yield readily to the solvent power of cyanide of potassium (ammonia and chlorine). One of the best is *Redwood's*, made as follows: Dissolve 1 ounce of nitrate of silver and 1½ of crystallized carbonate of soda in separate portions of distilled water, and mix the solutions; collect the resulting precipitate on a filter, edulcorate it well with distilled water, and introduce it, while still moist, into a Wedgewood-ware mortar; add 8 scruples of tartaric acid, and triturate the whole until effervescence has ceased: next add a sufficient quantity of ammonia to dissolve the tartrate of silver; mix in 4 fluid-drachms of archil, 4 drachms of white sugar, and 12 of finely-powdered gum arabic; and pour in as much water as will make 6 ounces of mixture. By this process the nitric acid, which is essential to a good marking ink, is retained, and the tartrate of silver formed is soluble in half the quantity of ammonia ordinarily required when nitrate of silver is the basis of the ink. This fluid requires no preparation on the cloth, and becomes instantly dark on application of a gentle heat. It does not attack the most delicate tissues. M. Kuhr (*Cosmos*, June, 1869) recommends the following preparation: 1 part of hypophosphite of soda and 2 parts of gum arabic are dissolved in 16 parts of distilled water. The tissue, linen or cotton, to be marked is thoroughly moistened with this liquid, and then left to dry. After having become well dried, the following liquid, composed of 1 part of nitrate of silver and 6 parts of gum dissolved in 6 parts of distilled water, is used as marking ink with a quill-pen. The mixtures here described are stated to yield an indelible and very deep black-colored ink. Numerous other recipes for indelible ink from nitrate of silver might be cited, but these will suffice, especially as the more modern improvements in this art render them no longer of so much use as formerly. *Gold, platinum, palladium, iridium*, and other metals of the same class are used to produce indelible marking inks by using the chloride solutions. Merget, in his researches upon gases as developers in photographic work, has shown that the salts of this series of metals are reduced by certain gases in presence of moisture, and that vapor of mercury given off at as low a temperature as 40° C. will serve to reduce gold, etc. in the substance of tissues, paper, etc., producing indelible stains of a color corresponding to the metal. The dampness of the tissue must be preserved by a solution of ferric tartrate, ammonic nitrate, or some other hygrosopic salt. (*Comptes Rend.*, xxvi. 1470.)

A good permanent ink may be made by mixing a strong solution of chloride of platinum with a little potash, sugar, and gum to thicken. The writing made therewith should be passed over with a hot smoothing-iron to fix it. An ink for writing on *zinc plant-labels* may be made by dissolving equal parts acetate of copper and sal-ammoniac in distilled water. When characters are written with this solution on a zinc plate the copper is precipitated, forming deep black, very durable marks. Ink for marking *copper* and *silver* vessels may be made by boiling sulphide of antimony in strong potash ley, leaving the liquid to cool and filtering from separated kermes. As this liquid does not act upon iron, steel pens may be used for writing with it on the metal. The characters on copper and silver are black and very durable; on tin, lead, and zinc less durable. *Ink for Writing on Glass.*—A solution of fluoride of ammonia is recommended as furnishing a ready means of writing with a pen of any kind upon glass, and is especially adapted for labelling bottles, cylinder-tubes, etc. in the laboratory, as well as for marking the degrees upon hydrometers and apparatus of similar construction.

Removal of Ink-Stains.—Dilute hydrochloric acid, dilute sulphuric acid, and oxalic acid will destroy and remove the color of most gall and logwood inks. Chlorine in solution or as bleaching-powder acts in a similar manner. Potassic, sodic, and ammonic hydrate attack many colors, and, alternated with the acids, destroy stains which are not removed from paper and tissues by either alone. But the application of chemical agents to paper requires that it should be free from the binding of a volume. Ozone is a powerful bleaching agent, and has been recommended for removing stains from engravings. Böttger recommends the use of

pyrophosphate of soda to remove ink-flecks from colored goods which will not allow the employment of bleaching-powders and oxalic acid.

Sympathetic inks are those fluids which, when used to write upon paper, are invisible until brought out by heat or the influence of some chemical agent. Acetate-of-lead solution leaves no trace of the marks made by the pen until exposed to sulphydric acid vapor, when it suddenly develops an intense brown-black indelible color. A weak *infusion of galls* leaves no sign of the writing until developed by a solution of iron. Even *milk* (mentioned by Ovid) will develop visible characters by gently heating the paper, or even by dusting it over with some dark powder. The same is true of *sugar-water*. Water made acid with *dilute sulphuric acid*, written with a quill or gold pen, is quite invisible till by a slight warming the evaporation of the water leaves the acid in a form sufficiently concentrated to char the paper in black characters. Dilute *yellow prussiate of potash* develops blue with a ferric salt. The metal cobalt is remarkable for the fine blue-green tint it develops on paper written with a solution of its chloride, while the acetate of cobalt develops pink when held to the fire. A winter landscape-drawing may thus be made to show verdure and pink flowers, which disappear again on cooling. Nitrate of cobalt, with oxalic acid as a mordant, develops *blue*. Chloride of antimony develops *yellow* by decoction of galls. Subacetate of lead also develops yellow by hydriodic acid, and a dilute solution of cupric chloride forms a beautiful sympathetic ink, developing a fine yellow color by heat, and fading out again when cooled. Colorless arsenite of potassa solution develops a lively green when washed over with a dilute solution of a cupric salt. Chloride of gold turns to *purple* of Cassius when washed with stannous chloride. An acid solution of ferric chloride, so dilute as to be quite invisible when written on paper, becomes blood-red on washing with sulphocyanide of potassium, and again invisible by vapor of ammonia, and these changes can be alternated at pleasure. Linen stained with nitrate of silver or indelible ink may be bleached by first moistening the spots with tincture of iodine, which is followed soon after with solution of sodic hyposulphite. This removes the silver stain, and also the blue color due to the iodide of starch. Another method is by treating the spot first with cupric chloride (not too strong), and then with hyposulphite of sodium, and in any case washing well after in ample water.

Ink which has become faded out by age may often be redeveloped by tracing the characters with a pencil wet with gallic acid. If the ink was an iron ink, it will be thus plainly developed. Ink which has been too long written to allow of copying by the press may be rendered transferable again by using water slightly acidulated with hydrochloric acid with which to moisten the copy paper. This method, however, fails on very old writing—*e.g.* a century. Such documents, says M. Niépce de St. Victor, may be reproduced by using copy paper wetted with a dilute solution of glucose or honey instead of water. After pressing, this paper is exposed to the fumes of strong ammonia, which brings out clearly lines otherwise quite invisible. The fading out of old MSS. occurs chiefly when the writing is removed from the presence of light into a dark and damp place. An old MS. written in 910 A. D. is now preserved in the abbey of Cluny in France, and is to-day as fine a black color as can be seen, in spite of the ravages of time. An effort has been made by M. Carre to fix the relative age of old MSS. by the use of dilute HCl. (1 : 10), which has the power of changing the color of logwood inks red, and alters also the gallnut inks, while it has no effect on carbon ink. But some of the ancient MSS. of the sixteenth and seventeenth centuries changed red by this treatment. But such methods are very unsatisfactory, and may be completely illusory.

Lithographic Writing Ink.—The lithographic art is described under LITHOGRAPHY. Two kinds of ink are used in this art—one, called lithographic crayons or chalk, forms the pencil with which the artist traces his designs. The composition of these crayons has received much attention, as the success of the art depends upon them. The composition of which they are formed must be firm enough to hold a fine point to secure delicacy in drawing, and yet adhere strongly to the stone. The French crayons of Bernard and Delarue of Paris are made of best quality wax 4 parts, dry white tallow soap 2 parts, white tallow 2 parts, gum-lac 2 parts, lampblack 1 part, copal varnish 1 part. The wax is melted over a gentle fire, the lac broken small, added as it melts, then the soap in fine shavings, the tallow, and lastly the copal and lampblack, stirring all the time with a spatula. It is cast in brass cylindrical moulds. Another preparation is as follows: For 1½ ounces of shell-lac take 2 ounces of soap, 3 ounces of white wax, and about 1 ounce of tallow; add about 3 tablespoonfuls of a strong solution of gum sandarach, and when ready color with lampblack. The lithographic printing ink is described under LITHOGRAPHY; its composition is similar to the crayon ink, but it is made thinner, and acts as an emulsion.

II. PRINTING INK (Fr. *Encre d'imprimière;* Ger. *Buchdruckerfarbe*).—Printer's ink is a carbon ink in an oily and resinous vehicle. The carbon is lampblack, sometimes ivory-black, and with a little indigo or Prussian blue. The oil is generally boiled and burned linseed oil, or in some European countries nut oil. In addition to these chief ingredients, rosin and turpentine are used, more rarely balsam copaiba, and lastly soap (common yellow rosin soap) is a very essential ingredient. The preparation of these ingredients requires care, and every manufacturer has his own methods and technical secrets in the manufacture of his ink, which printers in these days seldom or never make for themselves, The conditions required of a good ink are chiefly—(1) that it distribute itself easily and well over the rollers and type; (2) it must give a sharp and clean impression, without adhering to the type tenaciously or blurring the paper with excess of oil; (3) it must dry rapidly on the paper, but remain soft upon the type and rollers; this is especially important for the rapid-moving printing-machines of modern times and the exigencies of great newspapers, printing 50,000 to 100,000 impressions in two or three hours; (4) it must be black, and not brown in color; and, lastly, it must be proof against all the ravages of time and the power of chemical agents. It is not, however, to be understood that even the best printer's ink is incapable of being removed by means of chemical skill, as such is not the case. The linseed oil is clarified from the fatty matters, and the pure oil is boiled with great care at a carefully regulated temperature; and during the boiling the best pale yellow soap is added to give it consistency, and the required dryers are also now mixed with it. The best black is that obtained from the smoke of naphtha, the combustion being carefully regulated. This black is ground up carefully with the drying oil, which has assumed the character of a varnish, and the ink is complete. The oil demands particular attention. It is clarified from the fatty and useless matters, and is better if old, and must not only be long boiled, but burned by setting fire to the vapors floating over it, the flames being extinguished by a tight-fitting metallic cover shut over the boiler, which should never be more than half full. The following account of Savage's process (of England) is condensed from Ure by Watts: 10 or 12 gallons of the oil are set over the fire in an iron pot capable of holding at least half as much more, for the oil swells up greatly, and its boiling over into the fire would be very dangerous. When it boils, it is continually stirred with an iron ladle; and if it do not itself take fire, it is kindled with a piece of flaming paper or wood; for simple boiling, without the actual inflammation of the oil, does not communicate a sufficient degree of the drying quality required. The oil is suffered to burn for half an hour or more, and the flame being then extinguished by covering the vessel close, the boiling is afterwards continued with a gentle heat till the oil appears of a proper consistence; in this state it is called varnish. Mr. Savage in his work on the *Preparation of Printing Ink* (London, 1832) says that good varnish for printing ink cannot be made without allowing the oil to burn. The German practice appears, however, to be somewhat different; for in the *Handwörterbuch der Chemie* (Bd. vii. p. 391) it is stated that the oil should be heated only till the vapor which rises from it can be set on fire with a piece of burning paper, but will cease to burn of itself after a little while, or at least will be easily extinguished by putting on the cover; further, that if this temperature be exceeded there is great danger of the oil getting into a state of violent combustion, which cannot be extinguished even by covering the vessel, and may occasion an enormous loss of oil. It is necessary to have two kinds of this varnish, a thicker and a thinner, from the greater or less boiling, to be occasionally mixed together as different purposes may require, that which answers well in hot weather being too thick in cold, and large characters not requiring so stiff an ink as small ones. The thickest varnish, when cold, may be drawn into threads like weak glue, by which criterion the workmen judge of the due boiling, small quantities being from time to time taken out and dropped upon a tile for this purpose. It is very viscid and tenacious, like the soft resinous juices or thick turpentine. Neither water nor alcohol dissolves it, but it mingles readily enough with fresh oil, and unites with mucilages into a mass diffusible in water in an emulsive form. The oil loses from one-tenth to one-eighth of its weight by boiling into the thick varnish. For letter-press printing ink the addition of soap to the varnish is indispensable, to enable the ink to be taken up clearly from the types by the moistened paper without smearing. The

soap used for the purpose is yellow resin soap; it is cut into thin slices, well dried, rubbed to coarse powder, and incorporated by small portions at a time with the varnish, which is then once more placed over the fire, to expel any remaining moisture. The coloring-matter of black printing ink is the best lampblack, previously calcined to free it from empyreumatic oils and resins. Its somewhat brownish color is corrected by the addition of a little Prussian blue or indigo.

The ink used by copper-plate printers differs in the oil, which is not so much boiled as to acquire the adhesive quality. This would render it less disposed to enter the cavities of the engraving, and more difficult either to be spread or wiped off. (*Ure.*)* The black is likewise of a different kind. Instead of lampblack or sublimed charcoal, the Frankfort-black is used, which is a residual or denser charcoal, said to be made from vine-twigs. Lampblack is said to give a degree of toughness to the ink which the Frankfort does not, but the goodness of the color seems to be the leading inducement for the use of the latter. One pound of a superfine printing ink may be made by the following recipe of Mr. Savage: Balsam of copaiba, 9 ounces; lampblack, 3 ounces; indigo and Prussian blue together, p. æq. 1¼ ounces; Indian red, ¾ ounce; turpentine (yellow) soap, dry, 3 ounces. This mixture is to be ground upon a slab with a muller to an impalpable smoothness.

Colored printing inks are made by using in place of carbon any desired color to mix with the varnish. Ink of any tint of color may thus be obtained, and by the use of the bronze powders, made now of almost all colors, every metallic effect required by ornamental printing may be readily produced. In the use of bronzes a nearly colorless *size* is used in place of ink, and the bronze powder is dusted on while the size is yet fresh. B. SILLIMAN.

Ink′berry (*Ilex glabra*), the popular name of an elegant shrub, generally from two to four feet high, with slender and flexible stems, brilliant, evergreen leaves, leathery and shining on the surface and of a lanceolate form, and producing small black berries. It is found on the Atlantic coast of North America, and is now much cultivated by florists.

Inkerman′, a small Tartar village in the Crimea, near the E. extremity of the harbor of Sebastopol. It is built on the ruins of an ancient city, supposed to be the *Ctenos* mentioned by Strabo, at the foot of a perpendicular hill, which rises several hundred feet above the valley of the river Tchernaya, and is covered with remains of walls and towers, while in the sides are numerous caves hewn in the solid rock, with traces of altars, chapels, and paintings. The heights of Inkerman opposite to this hill, across the valley of the Tchernaya, are memorable as the scene of one of the most desperate battles of recent times (Nov. 5, 1854), in which 14,000 allied English and French troops (chiefly the former) held their ground for many hours against 60,000 Russians, ultimately driving them from the field with great loss. The action began early in the morning by the Russians attempting to carry the allied positions by assault. The fifth volume of Kinglake's graphic *History of the Crimean War* (third of American edition), recently published (1875), is entirely occupied with the battle of Inkerman, its preliminaries, and immediate results.

In′land, post-tp. of Cedar co., Iowa. Pop. 1112.

Inland, post-tp. of Benzie co., Mich. Pop. 204.

Inland Navigation. See NAVIGATION, INLAND, by HON. W. J. MCALPINE, C. E.

Inlay′ing, the ornamentation of surfaces of wood, metal, shell, stone, etc. with pieces of a different color. Marqueterie, Florentine work or *pietra dura*, damaskeening, mosaic-work, etc. are forms of this art. Italy, mediæval Byzantium, Damascus, Russia, India, China, and Japan have all had schools of these arts, where most meritorious work has been done. Russia, Italy, and the East are the most important seats at present of the inlayer's art.

In′man (HENRY), b. in Utica, N. Y., Oct. 28, 1801; d. in New York Jan. 17, 1846. His earliest inclination was towards a military life; he had already secured a commission to enter the Academy at West Point, when the sight of Westmüller's *Danaë* determined his bent to another career. He studied with John Wesley Jarvis; went to Boston as a portrait-painter in 1822; in 1832 removed to Philadelphia; from thence, chiefly in order to be in the country, he went to Mount Holly, N. J.; returned to New York, but, being disabled by ill-health, was induced to visit England with commissions to paint for American friends portraits of Chalmers, Macaulay, and Wordsworth. In 1845, resisting strong professional and social temptations to remain in England, where his success as an artist and his popularity as a man had been eminent, he returned to his native land, to sicken again and die. Inman's reputation was established early, and continued to increase. Among his sitters were Bishops McIlvaine and White, Dr. Hawks, William Wirt, Nicholas Biddle, Judge Betts, Col. Johnson, Horace Binney, Audubon, Chief-Justice Nelson, De Witt Clinton, Martin Van Buren, and William H. Seward. His portraits were life size, cabinet size, and in miniature. The subjects of his other pieces were various —*Birnam Wood, Rydal Water, Lake of the Dismal Swamp, Trout-Fishing, The Newsboy, Rip Van Winkle Awaking, Scene from the Bride of Lammermoor, Family Groups, Sterne's Maria, Mumble-the-Peg,* and others of unequal merit. He executed a great deal in crayon and with the pen, and did work in lithograph. He was a pleasing writer also of sketches and letters, a man of fine literary taste and poetic feeling. His best works are portraits, in private houses, not easily seen. They entitle their author to a very high rank among artists. O. B. FROTHINGHAM.

*In the *Handwörterbuch der Chemie* (vii. 399) it is stated, on the contrary, that ink for copper-plate printing is prepared with the thickest linseed-oil varnish, which has been allowed to burn.

Inman (J. O'B.), son of Henry, as an artist known chiefly by delicate flower-pieces and genre pictures, pleasing in color and graceful in sentiment; has lived several years in Rome, where his work has elicited praise from critics.

Inman (THOMAS), M. D., a physician and botanist of Liverpool, England, was for some years professor at medical institutions in London; wrote numerous medical works, but is chiefly known as author of a very remarkable and learned but eccentric book, *Ancient Faiths Embodied in Ancient Names* (1869).

Inn. See HOTEL, by C. G. LELAND, A. M., and INNKEEPERS, by J. N. POMEROY.

Inn [Lat. *Œnus*], a river of S. Germany, and the largest Alpine tributary of the Danube, takes its rise in the Swiss canton of Grisons from the Lake of Longhino, nearly 7000 feet above the sea; flows N. E. through that canton, forming the valley of the Engadine; enters the Tyrol at Finstermunz; flows with great violence through Northern Tyrol by Innspruck; flows through Bavaria for about 90 miles to Braunau, whence it continues nearly N., forming the boundary between Upper Austria and Bavaria, and enters the Danube at Passau, after a course of 315 miles. It receives the river Salzach from the S.; is navigable as far as Innspruck for small vessels, and to Hall, 8 miles below, for steamboats. Engadine is the name of the Upper Inn in the Romansch language, spoken by a small remnant of an ancient nation near the head of this river. The Inn is broader than the Danube at their junction.

In′nes (THOMAS), b. in 1662, of a noble Scottish family; was educated in the College of Navarre in Paris; became a Catholic priest, and succeeded his brother Louis as principal of the Scotch college at Paris. He was the author of a highly esteemed ethnological work, *A Critical Essay on the Ancient Inhabitants of the Northern Parts of Britain* (1729), and divides with his brother Louis the reputed authorship of the *Memoirs of James II.*, published in 1816 by Dr. Clarke. D. at Paris Feb. 9, 1744.

In′ness (GEORGE), b. in Newburg, Orange co., N. Y., May 1, 1825; took lessons in art; came to New York at sixteen, and studied engraving; was prevented by ill-health from pursuing his object; returned to his home in Newark, N. J.; emerged four years later; spent a month with Regis Gignoux, and then began his career as a landscape-artist. Inness has been called a disciple of Theodore Rousseau, whose pictures his own in sentiment resemble. His landscapes are touched with imagination and charged with poetic feeling. His themes are imaginative: *Peace and Plenty, The Sign of Promise, A Vision of Faith, The Valley of the Shadow of Death, The Apocalyptic Vision of the New Jerusalem and the River of Life.* His less ambitious works, *A Passing Storm, Summer Afternoon, Twilight, Sunshine and Shadow, Moist Green Level with Trees,* show a tender sympathy with nature. Inness has twice visited Europe, but never studied there with a master. He now (1875) resides at Boston, Mass. O. B. FROTHINGHAM.

Inn′keepers. An innkeeper is one who carries on the business of receiving into his house and entertaining guests. An inn, which is the technical legal name, and includes the tavern and hotel, is the house in which he thus receives and furnishes entertainment. The word "guests" is used in this definition in its technical legal sense, which will be hereafter defined. It is not necessary that a person should confine his entertainment to actual travellers in order that his house should be an inn and himself an innkeeper. It is enough that he keeps a public-house, and holds himself out as ready to receive *all* who come, and to furnish them general entertainment, including lodging and food. Provision need not be made for horses and carriages and cattle, although

this is customary, and probably universal in country taverns. There is a legal distinction between an inn and a boarding-house and a restaurant. A boarding-house is not an inn, because the proprietor does not hold himself out generally to take all who apply, but only receives those with whom he chooses to make an agreement. A special contract is the basis of all the legal relations between the keeper of a boarding-house and his boarder, while a common-law public duty is the basis of all the legal relations between the innkeeper and his guest. Still, an innkeeper may, in the same house in which he entertains guests, also have boarders. As to the one class of persons, he will hold the relation of innkeeper, and as to the other that of boarding-house keeper. The proprietor of a restaurant, like the innkeeper, holds himself out to the public at large, but not as one who furnishes general accommodation and entertainment, for he furnishes only food. A person, however, does not lose his legal character as an innkeeper because he does not actually supply all his guests by a *table-d'hôte*. If he furnishes lodgings to all who come, and means by which they may all obtain meals at his house if they choose, he keeps an inn. In fact, the common-law doctrines in reference to this entire subject grew up at a time when meals were furnished at inns only as they were ordered, and the *table-d'hôte* system was unknown.

Before describing the legal rights and obligations of the innkeeper, it is important to determine who is a "*guest*" at an inn, for it is only towards his guests that the innkeeper's peculiar and severe liabilities exist. All persons who apply for entertainment or refreshment to him *as an innkeeper*—that is, in virtue of his inn—and obtain it, are guests, and his common-law duty to them arises. On the other hand, if an innkeeper has a restaurant also in connection with his inn, and a person only procures refreshment thereat; or if he maintains a stable for public accommodation, and a person simply leaves his horses or cattle to be taken care of, without himself becoming a guest; or, finally, if the innkeeper by a special contract receives a person into his house in the character of a boarder—in neither of these cases do the legal rights of a guest exist in favor of the one party, or the legal responsibilities of an innkeeper devolve upon the other. These propositions may be better illustrated and explained by a reference to the facts of a few judicial decisions than by any general discussion. I purposely select those which are extreme, in order to show the extent to which the common-law obligations have been carried by the courts. There can be no possible doubt or difficulty in respect to the relations of the parties where travellers and others are actually received into an inn, and are entertained in the ordinary manner and under ordinary circumstances; it is the extreme and somewhat exceptional instances which indicate the limits of the legal rule. In an early case decided by the English court of king's bench a person came into an inn situated in a market-town and requested permission to leave a box of goods until the next market-day. The request being refused, he sat down in the public-room and ordered some liquor. This was supplied, and he remained a short time drinking it, having placed the box on the floor behind him. When he arose and was about to go, it was discovered that the goods had been stolen. For this loss the keeper of the inn was held responsible; the procuring and partaking of the liquor in his house made the owner of the box a guest for the time being, and subjected the other, while that relation lasted, to the common-law liability in respect of the property which had been constructively placed in his custody. The facts of an analogous case decided a few years past by the supreme court of New York show that the same severe rule is still enforced. A person came into an inn about seven o'clock in the morning and procured some liquor at the bar for himself and for others in his company. Taking off his overcoat, and directing it to be hung up, he immediately left the house, and was absent the entire day. Upon his return late in the afternoon the coat was gone, and the innkeeper was adjudged bound to make good this loss. The facts of still another case are given to illustrate the distinction already mentioned between the furnishing entertainment by an innkeeper, *as such*, which makes the party entertained a guest, and the furnishing it in some other capacity, which does not give rise to the same legal condition. The owner of a city hotel had in connection with it a saloon or restaurant. On a certain occasion a public ball was given at his house. One of the company in attendance at the ball upon his arrival took off his coat and other outside wrappings and left them in charge of a servant of the proprietor. During the evening he visited the restaurant and obtained liquor and other refreshment. The articles which he had entrusted to the servant were missing, either lost or stolen; but as the facts narrated did not constitute their owner a guest of the inn, he was not able to fix any responsibility for them upon the innkeeper.

The peculiar duties and obligations which are imposed upon the innkeeper in virtue of his public occupation are two in number; the first being in respect of the guests personally, and the second in respect of their goods.

(1) *In Respect of the Guests Personally.*—The keeper of an inn is bound to receive all travellers and wayfaring men and other applicants, and to entertain them for a reasonable compensation if he has room, and if they are well behaved and free from any special personal qualities which might disturb the good order and well-being of his house. The "reasonable compensation" here spoken of means the prices customary at that particular house. A "Fifth Avenue hotel" is not compelled to receive persons at the rates charged by a country tavern. The duty to receive depends also upon the conduct of the applicant and the condition of the inn. If the latter is full, no one has a legal right to be received, and the law does not prescribe the amount or limit of accommodation in this respect. Nor is the landlord obliged to admit a person who is intoxicated or disorderly, or who is inflicted with a contagious or infectious disease which would be dangerous to the health of the inmates, nor, perhaps, a person of notoriously bad character and reputation, whose presence would be highly offensive to other guests. A refusal to comply with the obligation thus described—that is, to receive an applicant against whom no legal objection existed, and when there was room for his accommodation—gives a right of action in favor of the injured party against the innkeeper to recover the damages caused by the unlawful rejection. Such actions are of course very infrequent, but the right to maintain them is recognized by the highest authorities, ancient and modern. At the common law an indictment for a misdemeanor also lay against the innkeeper who should violate this his public duty.

(2) *In Respect of the Guests' Goods.*—The common-law doctrine is well established that the innkeeper is responsible for all the goods received into his custody—or, as it is often said, received within the curtilage of the inn—from a guest; in other words, he is liable for all losses of and injuries to such goods, even in the absence of his own or his servant's negligence or other wrong, except where the loss is directly occasioned by the "act of God," or by the "act of public enemies," or by the fraud or negligence of the guest himself or his servant or companion. He is, therefore, in fact, an *insurer* of his guest's goods, while in his custody, against all losses and injuries whatsoever, unless resulting from some one of the three causes just mentioned. This rigorous rule of the common law, originating at a very ancient period in English history, when all travelling was dangerous, and when it was supposed that innkeepers were often in league with robbers, has been maintained to the present day, and is still enforced in all the States of the Union, with one or two exceptions, unless modified by the legislature. In Vermont, however, a less stringent rule prevails as the result of judicial decision, and the innkeeper is not held responsible for losses occasioned by casualties over which he had no control, such as incendiary fires. The term "act of God" is not synonymous with "inevitable accident." It is an occurrence which arises entirely from natural causes outside of the ordinary course of events, and in which human agency could not by possibility have intervened. The most familiar examples are lightning, storms, unusual freshets, earthquakes, and the like. The term "public enemies" implies actual war, and it does not include mere robbers, rioters, or mobs. If an insurrection should attain such magnitude that it amounted to a war, the rebels would become public enemies within the meaning of the phrase as here used. Applying these explanations, the innkeeper is seen to be responsible for all losses of the goods while in his custody except those which result immediately from extraordinary natural events, such as lightning-strokes, earthquakes, etc., or from the violence of the hostile forces in time of war, or from the fraud or negligence of the guest himself. In order that the liability thus described should arise, the articles must be under the control, actual or constructive, of the innkeeper. In respect to the extent of the liability, and the kind of goods to which it applies, an attempt has been made in a few recent decisions to restrict it to the personal baggage of the guest, including such an amount of money only as may be reasonably necessary for his travelling expenses, and thus to place the responsibility of the innkeeper for his guest's goods and that of the common carrier of passengers for their luggage upon exactly the same footing. This limitation, however, is opposed to the rule as established by an overwhelming array of decided cases. No restriction has been placed either upon the extent of the liability or upon the kind of goods embraced within it. Innkeepers have been held responsible for baggage, for money in large sums whether in trunks or in separate packages, for merchan-

dise of all sorts, for animals, for vehicles; in short, for every species of personal property which can be brought within the curtilage of the inn and left in their legal custody. It will be seen from the foregoing that this stringent obligation imposed upon the innkeeper extends only to the goods of his guests. In respect to those placed in his care and custody by persons other than guests, his legal duty is far less onerous; he is responsible for them only as a depositary or as a bailee for hire—that is, for losses and injuries caused by the wrongful or negligent acts and omissions of himself or his agents and servants, and no further. *Recent Statutory Modifications.*—The common-law liability of innkeepers has been partially relieved by legislation. A statute passed in New York in 1855 enacts that when an innkeeper shall provide a safe for the deposit of any moneys, jewels, or ornaments belonging to a guest, and shall notify him thereof by posting a notice stating the existence of such safe in the room occupied by such guest, and such guest shall neglect to deposit his moneys, jewels, or ornaments in the safe so furnished, the innkeeper shall not be responsible for the loss of such moneys, jewels, or ornaments. A similar statute has been passed in many, and probably in most, of the other States, as well as in England (26 and 27 Vict. ch. 41, § 4). Only one method, it will be seen, is here expressly mentioned of communicating information to a guest that a safe has been provided in compliance with the law—namely, by a written or printed notice posted in the room occupied by him. It is very properly held, however, that in the absence of this constructive mode of imparting the knowledge, a direct, personal notification will answer the same purpose. The relief thus given to the innkeeper extends only to "moneys, jewels, and ornaments." All other articles placed in his custody by a guest are left to the operation of the common-law rules. What "moneys, jewels, and ornaments" are within the meaning of the statute? No exception is made in its language, but some of the courts have attempted to engraft one upon its terms; and there are cases which hold that an amount of money sufficient for daily expenses, and the personal jewels and ornaments ordinarily worn are not included, and need not be deposited in the safe in order that the innkeeper should be responsible for their loss. These decisions have not been generally followed, and the better opinion is, that all moneys, jewels, and ornaments must be placed in the safe or no responsibility for their safety arises, except, of course, the liability which would result from the wrongful acts of the landlord himself. When the provisions of the statute have been complied with by the guest, and the designated articles have been delivered to the innkeeper or his servants in order that they may be deposited in the safe, his common-law obligation in respect to their safety at once attaches to its full extent, and continues as long as the special custody lasts. There is a tendency to relax by legislation the severe responsibilities of an innkeeper. Thus, in New York it is provided by statute that he is not liable for goods destroyed by fire in an outbuilding, where he is not at fault, and the fire is the work of an incendiary. Still broader legislation is to be noticed in England in the statute already cited. The innkeeper has a common-law lien on the goods of his guest, which authorizes him to retain them in his possession until his lawful charges are paid. (See Lien.) It has been held in England that this extends so far as to give the innkeeper a lien in some instances upon the goods of third persons, as where the guest had a hired piano in his room, the innkeeper having no reason to suppose that it did not belong to the guest. The innkeeper has at common law no lien upon the goods of boarders. Such a lien is sometimes given by statute, as in New York. (See Bailment.) John Norton Pomeroy.

Innocent I., Saint, b. at Albano, was elected bishop of Rome (pope) Apr. 27, 402; interceded without success with Arcadius, emperor of the East, in behalf of the patriarch Chrysostom, who was deposed from his see and banished; prevailed on Honorius, emperor of the West, to persecute the Donatists, who were excommunicated by the Council of Carthage (405); made exertions to save Rome from Alaric and his Visigoths, who nevertheless sacked that city Aug. 24, 410; condemned the doctrines of the Pelagians and the Novatians; first practised the system of sending legates to represent the papal see in remote districts; was vigorous in maintaining the right of his see to exercise appellant jurisdiction over other bishoprics, and enforced the celibacy of the clergy. D. Mar. 12, 417. His feast is celebrated.—Innocent II. (*Gregorio Papareschi*), b. in Rome about 1090, was a monk, and afterwards abbot of the convent of St. Nicholas; was legate to France 1124; was chosen pope Feb. 14, 1130, on the death of Honorius II., by seventeen cardinals, but Peter de Leon was put forward as pope by a minority of the electoral body under the title of Anacletus II. Innocent was driven from Rome; went to Cluny in France; was recognized by the monarchs of France, Germany, and England; was supported by St. Bernard and by the Council of Rheims; was forcibly restored to power at Rome by Lothaire, whom he crowned emperor in the church of St. John Lateran 1133; was again driven from Rome the same year; held a council at Pisa and excommunicated his rival; was again restored by Lothaire 1137, and was finally recognized by the rebellious cardinals after the death of Anacletus in 1138. Innocent convoked in 1139 the second Council of Lateran, attended by 1000 bishops; condemned the opinions of Arnold of Brescia and of Abelard (1140); pronounced an interdict upon the kingdom of France, and had his temporal authority overthrown by an insurrection of the Romans, who restored the senate and the tribunes of ancient Rome. D. Sept. 24, 1143.—Innocent III. (*Lotario Conti*), b. in 1161 at Anagni; studied at Rome, Paris, and Bologna; became a cardinal-deacon in 1189; succeeded Celestine III. as pope in 1198; enlarged the papal temporalities; twice dictated the election of the German emperor; greatly diminished German authority in Italy; excommunicated Philip Augustus of France, and placed the kingdom under an interdict 1200, and afterwards visited the same fate upon Spain and Portugal, on account of the illegal marriages of the kings of France and Leon, and in both instances the pope was victorious; compelled King John of England, by the same means, to give up the right of investiture and make his possessions the tributary fief of Rome; caused himself to be acknowledged suzerain of Sicily, Bavaria, and Denmark; proclaimed in 1208 the crusade against the Albigenses; confirmed the Franciscan and Dominican orders; annulled Magna Charta 1215, and excommunicated the English barons; sent out the crusade which founded the Latin empire at Constantinople; convened the fourth Lateran Council 1215; and D. at Perugia July 17, 1216. Innocent was by far the most powerful of the popes in temporal matters, his power being as much the result of favoring conditions as of his own great ability and ambition.—Innocent III., Antipope, called *Landus*, was a Frangipani, who wore the tiara 1178–80, and d. in prison.—Innocent IV. (*Sinibaldo de' Fieschi*), b. at Genoa; became a cardinal 1227; succeeded Celestine IV. in 1243. D. at Naples Dec. 7, 1254. His pontificate was characterized by continual warfare with the Ghibelline party, the pope's chief opponents being Frederick II. of Germany and Conrad, his son.—Innocent V. (*Peter of Tarantasia—Doctor Famosissimus*), b. at Moustier, Savoy, in 1225; became a Dominican; succeeded Aquinas at Paris; was made archbishop of Lyons 1272, and cardinal-bishop of Ostia; was chosen pope in 1276; d. June 12, 1276. Author of numerous scholastic works.—Innocent VI. (*Étienne Auber*), b. at Mont, Limousin; was professor of civil law at Toulouse; became bishop of Noyon and Clermont; cardinal-bishop in 1342; was pope at Avignon 1352–62; was contemporary with Petrarch and Rienzi, and one of the ablest of the French popes. D. at Avignon Sept. 12, 1362.—Innocent VII. (*Cosmo Migliorati*), bishop of Bologna and archbishop of Ravenna, became cardinal in 1389, pope in 1404. D. Nov. 6, 1406; was a man of learning and of many virtues.—Innocent VIII. (*Giovanni Battista Cibo*), b. in Genoa in 1432 of Greek stock; was a man of irregular life, the father of many bastard children, and was married when ordained; became bishop of Savone and Malfi, and cardinal in 1453; obtained the papacy by simony in 1484. His pontificate was characterized by corruption and treachery. D. July 25, 1492, and was succeeded by the depraved Alexander VI.—Innocent IX. (*Giovanni Antonio Facchinetti*), b. at Bologna in 1519; became cardinal 1583, pope in 1591; was a man of learning and wisdom. D. Dec. 30, 1591.—Innocent X. (*Giovanni Battista Panfili*), b. at Rome May 7, 1574; became a cardinal in 1629, pope in 1644; extended the temporal and spiritual sway of the papacy; opposed Jansenism; and d. Jan. 6, 1655.—Innocent XI. (*Benedetto Odescalchi*), b. at Como in 1611; became cardinal in 1647; was elected pope as successor of Clement X. Sept. 21, 1676; undertook to revive the ancient discipline of the Church, and had quarrels with Louis XIV. about the revenues of vacant benefices (1678), in which that monarch was supported by a general assembly of French bishops, who declared (Mar. 16, 1682) the authority of the pope inferior to that of a general council. Innocent thereupon held a consistory, in which he condemned and burned the propositions of the French bishops. In 1687 he published a brief abolishing the right of asylum as formerly exercised by foreign ambassadors; refused to receive the French envoy, who maintained that right and entered Rome with a military escort; sanctioned the condemnation by the Inquisition of Molino's doctrine of Quietism; joined the League of Augsburg, and d. Aug. 12, 1689.—Innocent XII. (*Antonio Pignatelli*), b. at Naples Mar. 13, 1615; became archbishop of Naples; cardinal in 1681, and pope in 1692; was a just man and able ruler of his temporalities.

D. Sept. 27, 1700.—Innocent XIII. (*Michel Angelo Conti*), b. at Rome May 15, 1655; became archbishop of Tarsus in 1695, cardinal in 1707, and bishop of Viterbo in 1712; succeeded Clement XI. in 1721; and d. Mar. 7, 1724. He was virtuous and devout, but not a very capable pontiff, and there is reason to believe that he was poisoned in consequence of his determination to suppress the Jesuits.

Charles W. Greene.

Innocen'tius, a Roman jurist of the times of Constantine the Great and his sons Constantius and Constans, by whom his writings and opinions were invested with a kind of legislative force. None of his works has survived, and their tenor is known only by a few references of later writers.

Innocents' Day [in Old English, *Childermas*], the day on which the Catholic and Anglican churches celebrate the massacre of the children at Bethlehem, who are called the *Holy Innocents* and considered as the earliest Christian martyrs (Dec. 28). The Society of Lincoln's Inn, London, used to choose a *King of the Cockneys* on this day; children were permitted to wear the clothes of their elders and exercise a mock authority; in the convent the youngest nun became lady superior for the nonce, etc. The priest on this day wears a blue gown in church. In some Catholic countries the festival of the Holy Innocents is even now celebrated by playing practical jokes, precisely as in the U. S. the 1st of April is reckoned *All Fools' Day*. In Spanish-American countries, after a practical joke has been played, the expression equivalent to "April fool" is, *Qué la inocencia le valga—i. e.* "May your innocence protect you!"

Inns of Court, colleges in London designed for the education of students for practice at the bar, and having at the same time the right to admit persons to practice. These institutions do not govern attorneys, who are admitted to practice under the direction of the courts. The Inns of Court were situated between the city of London and Westminster. They are four in number, having preparatory schools called Inns of Chancery. At the present time the Inns of Chancery are only used as chambers. The Inns of Court are the Inner Temple, the Middle Temple, Lincoln's Inn, and Gray's Inn. To the first of these are attached the Inns of Chancery, called respectively Clement's, Clifford's, and Lyon's Inn; to the Middle Temple, New Inn; to Lincoln's Inn, Furnival's, Thavies', and Symond's Inn; while to Gray's Inn are added Barnard's and Staples' Inn. The Inns of Court are voluntary societies and unincorporated. They are thus described by Pearce: "They are voluntary societies, for ages submitting to government analogous to other seminaries of learning; from time immemorial enjoying the protection of the Crown; at common law subject to the visitorial powers of the judges of the superior courts, who possess a domestic jurisdiction over these bodies, to whom an appeal lies in every case against orders affecting members of these societies, forming a university with power to grant degrees in the municipal law of England, which constitute indispensable qualifications for practice in the superior courts of law; no corporations, and possessing no charters from the Crown; by the policy of the common law permitted self-government, subject to the qualifications mentioned in order to secure the independence of the bar." They were called inns, or in the Latin records "*hospitia*," as distinguished from public lodging-houses (*diversoria*). The meaning of the term is well shown by an order of the judges issued in the reign of Charles I., wherein it being set forth that as the institution of these societies was chiefly ordained for the profession of the law, and in a secondary degree for the sons and youth of riper years of the nobility and gentry of the realm, and in no sort for lodging or abode of country gentlemen, which if it should be suffered would turn them from *hospitia* to *diversoria*, it was provided that no person who did not belong to the society should be admitted or allowed to lodge in the houses. Being unincorporated, the members have been obliged to resort to special methods to keep the title to the property in the society. The first grant was made to a select number in trust for the society at large. This select number forms the bench. As the members die, others are chosen from the society, and new conveyances are made from time to time, the succession having been thus kept up for hundreds of years. (*Shelford on Mortmain*, p. 33.)

These colleges existed at a remote period in English history. Fortescue, writing in the reign of Henry VI., gives a pleasing account of them as they existed in his time. He says: "The students resorted thither in great numbers to be taught as in common schools. Here they learn to sing and to exercise themselves in all kinds of harmony. On the working days they study law, and on the holy days Scripture, and their demeanor is like the behavior of such as are coupled together in perfect amity. There is no place where are found so many students past childhood as here." The early modes of instruction in these institutions were disputations (or *moots*) and readings or lectures. The members were divided into four grades—benchers, utter barristers, inner barristers, and students. The government of the society was committed to the benchers, or seniors, the discussions and readings appertaining to the barristers. In the course of time the office of reader came to be attended with great expense. Stowe informs us that the reader in his day for upwards of three weeks kept a splendid table, feasting the nobility, judges, bishops, principal officers of state, and sometimes the king himself, insomuch that it has cost a reader above £1000—certainly a large sum of money at that day. Curious details are given by the authors cited at the end of this article as to the masquerades and revellings at the inns, growing more numerous and attractive as the business of instruction declined. The requisitions for admission to the society became nominal. "The applicants were examined in the classics to ascertain how they had spent their time before coming to the inn, and whether they had the manners of gentlemen." After the student period had passed the requisites for admission to practice consisted mainly in the fact that the student had eaten a certain number of dinners in each year for a fixed number of years in the common hall. Until within a few years all instruction was dispensed with. This entire departure from the original theory of the schools attracted until recently but little attention, and where it was noticed only elicited mild expressions of dissatisfaction. Herbert, writing in 1804, says: "It may be worth a question, however, whether the total rejection of every restraint in professed seminaries of instruction is an improvement or a disadvantage." Latterly, the best professional sentiment has strongly tended in favor of making these institutions true seminaries of learning, and ample courses of lectures have been introduced, and opportunities given to those students who may desire careful instruction to receive it. The rules adopted by the benchers provide for a preliminary examination, testing the student's general culture. It is quite certain that the result of the renewed interest in legal education, of which the present lord chancellor is a distinguished exponent, will be to produce a class of lawyers not only versed in the rules of the common law, but well informed as to the principles of the Roman law and the doctrines of general jurisprudence.

The benchers not only have the power of admitting persons to the bar, but also of disbarring those whom they deem unfit to practise. From their decision no appeal lies to any court as such, but only to the judges, exercising a limited power of review in the character of visitors. By this means the general sentiment of the profession, as represented by the benchers, may exercise a most salutary control over delinquent members, while, owing to the supervision of the judges, there is but little danger that so great a power will be wantonly or capriciously exercised. These principles are well illustrated in a recent case (1874), where a barrister brought a suit in equity against his inn, praying, among other things, that he might be adjudged to be entitled to retire from the inn without undertaking not to practise at the bar. The court decided that it had no jurisdiction over the subject; the whole matter was between a voluntary society and a member. The sole question was, whether he had complied with the rules of the society, and that point the court had no power to determine. His appeal was to the judges as visitors. The object of the barrister in bringing this suit was avowedly to obtain a decision that the monopoly enjoyed by the inns to admit barristers was not founded upon any rule of law, but depended solely on the sufferance of the judges. The judgment must be regarded as an emphatic reaffirmance of the authority of the Inns of Court.

The beauty and quiet repose of the grounds where the inns are situated are justly celebrated. Herbert, writing in 1804, gives a pleasing description of them as they appear to one looking from the Inner Temple: "A beautiful garden on the Thames side, chiefly covered with greensward and having a spacious gravel walk or terrace on the water's edge, fronts the hall. This is laid out with great taste and kept in perfect order, and in summer-time forms a crowded promenade; from whence the view up and down the river is extremely rich. Blackfriars bridge, part of Westminster bridge, and the elegant back front of Somerset House, with the winding Thames, the opposite busy shore, and the beautiful swell of the distant Surrey hills, all together form an assemblage of objects unrivalled in variety and magnificence." (Reference may be made for further information to Herbert's *Antiquities of the Inns of Court and Chancery* (London, 1804); Pearce's *History of the Inns of Court and Chancery* (London, 1848); Ireland's *Inns of Court;* Wharton's *Law Dictionary*, title "Inns of Court." For information as to the inns of Ireland see Duhigg's *King's Inns.*)

T. W. Dwight.

Inns'pruck, or **Innsbruck,** town of Austria, the capital of the Tyrol, on the Inn. It is beautifully situated at an elevation of 1800 feet above the level of the sea, and encircled by mountains from 6000 to 8000 feet high. The five suburbs which form the new part of the town are finely laid out and well built. The cathedral contains the celebrated monument of Maximilian I., of marble and bronze, and also that of Andreas Hofer. Innspruck has a well-frequented university and extensive manufactures of cloth, silk, and gloves. Pop. 16,810.

Innuit. See ESQUIMAUX.

Ino, in Grecian mythology, was secretly married to Athamas, king of Orchomenus, to whom she bore two sons, Learchus and Melicertes. Having accepted from Hermes the young Dionysus to nurse, Here visited her and her husband with madness, when Athamas slew Learchus. Ino fled with Melicertes in her arms and leaped into the sea, where she was changed into a sea-goddess, Leucothea. As the myth of Ino was much used by the Greek dramatists, it received many enlargements and augmentations, and exists in many different versions.

Inocar'pus edu'lis, a stately evergreen tree of the Pacific Islands, and of the order Thymelaceæ, producing a nut which after roasting is a palatable and important food. The tree puts out from its trunk curious plank-like buttresses, which are very convenient to the natives for use as natural boards, after peeling off the bark. Some of these planks are four feet wide at the base.

Inocula'tion [Lat. *inoculo*, to "bud"], in general, the intentional or accidental conveyance of disease to an individual by means of the actual application of morbific material to his person, especially upon a wound; in particular, it signifies such a transfer of variola, or smallpox; which proceeding is also known by the more specific term of *variolation*. Inoculated smallpox differs from natural smallpox chiefly in its course being milder and shorter, the mortality of the former being less than 1 per cent., whereas that of the latter ranges from 10 to 50 per cent. This comparatively mild character of the inoculated disease seems to have excited the attention of the Chinese and certain other Oriental peoples at a very early period, and hence they have practised intentional inoculation from time immemorial for the purpose of procuring immunity from the natural smallpox. The practice found its way into Europe by way of Constantinople, where it was openly introduced in the year 1701. The influence possessed by Drs. Timoni and Pylarini overcame the religious scruples of the Turks, and inoculation became a recognized practice. Although it was favorably spoken of in England as early as 1714, it was not until 1722 that the first inoculation was performed in that country—upon the daughter of Lady Mary Wortley Montagu, wife of the British ambassador at Constantinople. At first it met with some opposition in England, but after a few years it was extensively practised, and rapidly spread to France, Germany, and other continental countries. In America it was advocated by the Rev. Cotton Mather, and first practised in 1721 by Dr. Zabdiel Boylston of Boston. The proceeding consisted essentially in the insertion of lymph from a smallpox pustule into an incision or abrasion made for the purpose. In Asiatic countries, however, the practice was somewhat different; for instance, the Chinese inserted a variolous crust or a bit of linen from the clothing of a smallpox patient into the nostrils. This was called "buying the smallpox," and the proceeding was invested with a quasi-religious sort of mystery. Inoculation stood the test of experience as regarded the protection of the individual inoculated, but it proved the source of disaster to the community at large, since inoculated smallpox was found to be as infectious as the natural disease, and therefore served to spread the latter broadcast to a greater extent than would otherwise have occurred. Owing chiefly to this fact, but partly also to other considerations which need not be mentioned here, inoculation was rapidly supplanted by the announcement of Jenner's discovery of VACCINATION (which see), in the year 1798, and has now fallen into complete desuetude. Although perhaps somewhat more efficient than vaccination, it was fraught with such danger that it does not deserve to be revived.

FRANK P. FOSTER.

Ino'sic Acid [Gr. ἴς, ἰνός, "muscle," "fibre"], $C_5H_8N_2O_6$, an acid found in the mother-liquor in preparing creatine from flesh-juice.

In'osite [Gr. ἴς, ἰνός, "muscle," "fibre"], or **Phaseomannite,** $C_6H_{12}O_6$, a variety of glucose found in the heart, lungs, kidneys, liver, spleen, and brain, and in the urine in a case of Bright's disease; also in kidney-beans, common peas, cabbage, potato-shoots, asparagus, etc. It is soluble in water, insoluble in alcohol and ether; is not discolored by boiling with potassic hydrate; does not ferment in contact with yeast; undergoes lacteous fermentation under the influence of cheese, flesh, or decaying membrane and chalk. Evaporated nearly to dryness with nitric acid, treated with ammonia and calcic chloride, and again evaporated, it yields a characteristic rose-tint.

C. F. CHANDLER.

Inowrac'law, town of Prussia, in the province of Posen. It has manufactures of saltpetre and a much-frequented cattle-fair. Here are great beds of rock-salt. Pop. 7429.

In Par'tibus Infidel'ium ("in the regions of the unbelievers"). Since the Church of Rome in theory still holds ecclesiastical sway in those countries whence the Church has been expelled (such as parts of Asia and North Africa), the custom has long prevailed of giving to suffragans, coadjutors, vicars-general, missionary bishops, and other inferior dignitaries the nominal bishoprics of places far remote from their scene of duty. Thus, for example, the two missionary bishops at present (1875) serving in North-western British America are respectively bishops of Satala and Anemurium, cities of Asia Minor. Such prelates are called bishops *in partibus infidelium*, or simply bishops *in partibus*.

In Perso'nam. See IN REM.

In'quest of Of'fice. In English practice this is an inquiry made by the king's (or queen's) officer, his sheriff, coroner, or escheator, *virtute officii* or by writ sent to them for that purpose, or by commissioners specially appointed, concerning any matter that entitles the king to the possession of lands or tenements, goods or chattels. The investigation is made with the aid of a jury, which is not required to consist of any specific number of persons, but may have either twelve or more or less. The most important cases in which inquiries of this kind are instituted relate to the escheat and forfeiture of lands to the Crown, either by reason of the alienage of their owner, who acquired them by conveyance or devise, or because there are no heirs of a deceased person to inherit the land of which he died seized. Upon a finding by the jury that the owner is an alien, or that he has died leaving no heirs, the property vests immediately in the Crown without any further proceeding being necessary. As the inquiry terminates with a *finding* of certain facts by the jury, the proceeding is sometimes termed "office found," which is an abbreviation for the fuller expression, "inquest of office found." Inquests of office were originally devised as an authentic means of giving the king his right by solemn matter of record, and in order that by the intervention of a jury the subject might be protected against arbitrary seizures of his property. In the U. S. this form of procedure is still retained in a number of the States, though it is not uniformly made applicable to the same classes of cases as in English practice. It is only resorted to when real property is to be forfeited to the State and does not apply to personalty. It is a proceeding employed chiefly when lands escheat to the State for want of heirs. In some of the States, also, the common-law rules regarding the right of aliens to hold lands still prevail, and in these an inquest of office would generally be applicable to vest lands acquired by purchase in the State, unless a different mode of procedure has been adopted by statute. In a number of the States, however, statutes have been enacted enabling aliens to hold lands by an indefeasible title. An inquest of office in the States following the New York code of procedure is an action instituted by the attorney-general of the State. (See *New York Code*, § 447.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Inquisi'tion [Lat. *inquisitio*, a "seeking" or "searching for," "inquiring into," "examination;" used in the Vulgate, Acts xii. 19], in law, a seeking for proof in support of an accusation, a legal investigation, involving the examination of the inquisitors and the inquisitorial process. (See Carpzov, *Prac. nov. imperial. Sax. Rer. Crim.*, ed. Quint. 1665, index.) In history, first a process of investigation, then a tribunal under various forms and modifications, then a fixed institution of a twofold type, bearing the names *Inquisitio hæreticæ pravitatis, Sanctum Officium, Il Santo Officio, La Congrégation du Saint Office, Glaubensgericht, Ketzergericht*, established in some parts of the Roman Catholic Church and states to protect the faith by searching out and bringing to penance or punishing heretics, unbelievers, and certain classes of offenders against morals and the canon law. (See Du Cange, *Glossar. Med. et infim. Latinitat.*, iii. 844.) (For the early relations of the Church to errorists see HERESY.)

A careful defining and classification may help us to avoid some of the confusion which marks many of the accounts of the Inquisition.

I. *The Imperial Inquisition.*—This was not a tribunal, but a civil process. The emperor Theodosius the Great (379–395) used inquisitors or inquirers after the heretics for the detection especially of the Manichæans (382). They

were appointed by the prefect of the prætorium. Aggravated cases of leadership in certain specified forms of heresy were punished with death. (Theodorus, *Hist. Eccles.*, v. 16.) Justinian (525–565) employed similar officers to search for heretics in general (529). The Christian doctrine, as defined by the four holy synods general, and the canons framed by them, were acknowledged as part of the law of the empire, and heresy thus became a civil offence, the trial and penal visitation of which belonged solely to the civil magistrate. The whole matter was confined to the ordinary courts, and the bishops exercised for centuries no temporal jurisdiction. The bishop Ithacius reached Priscilian through the civil powers. But the Church had not then learned to make the subtle distinction which afterwards became so general. Though Priscilian was a very dangerous heresiarch, and though his trial and torture were conducted by the prefect, and his beheading was ordered by the emperor (385), the issue was regarded with widespread horror. Ithacius was degraded, excommunicated, and died in exile, and the best men in the Church refused communion with his supporters. (Baronius, *Annales*, ann. 381, 385, 386, 397. See HERESY.)

II. *The Diocesan Inquisition* gradually arose out of the imperial, relieved it of part of its duties, and gave it a subordinate character in the infliction of penalty. This inquisition was not a tribunal, but an ecclesiastical process or function. As the penalties visited upon offenders under the codes of Theodosius and Justinian were largely of an ecclesiastical nature, and the bishops were more and more recognized as governmental aids, the civil powers committed the jurisdiction in inquisitorial cases to the bishops in their several dioceses (about 800). The bishops used for this purpose their synodal courts. There the accused were examined. If found guilty, they were instructed and admonished. If they remained obdurate, they were left in the hands of the secular court to be punished under the common law. This sort of function assumed a far wider significancy in the twelfth century. Pope Lucius III. (1181–85) at the synod of Verona (1184) prepared a decree against the heretics of that time. He puts them under perpetual anathema. Laymen are to be delivered into the hands of the secular judges to be punished unless they abjure at once. The relapsed are not to be allowed a second pardon. The bishops are to make at least an annual visitation to discover such heretics. All the secular authorities are to render every possible aid in the work under pain of excommunication and forfeiture of dignities. "In this decree," says Fleury, "we see the concurrence of the two powers—the ecclesiastical and civil—for the extirpation of heresies." He considers this decree as involving the germ of the Inquisition. (Fleury, *Hist. Eccles.*, iv. 766; Du Pin, *Twelfth Century*, ch. ix.)

III. *The Papal Legatine Inquisition*, for which the way was preparing, became independent of the diocesan, though coexistent in part with it. It was created by special commission, was not permanent, was not an institution. The disaffection toward the Church which marked the close of the twelfth century spread more and more rapidly. In Southern France her opponents had become almost the dominant party. To Innocent III. (1198–1216) it seemed that the bishops were carrying on proceedings against these heretics in quite too languishing a style. Whatever might be the philosophy of it, their lack of success was beyond dispute. He sent, therefore, as papal *legates*, the Cistercians Raineri and Guido into Southern France to give more energy to the repression of the Waldenses (1198), with authority to employ the interdict in coercing the civil powers. Peter of Castelnau was appointed associate inquisitor in Southern France (1200), and was active, in conjunction with other Cistercians, against the heretics, from Toulouse as a centre (1203). The powers of the papal legates were further enlarged, so as to reach the case of non-compliant bishops. To meet the popular aversion created by the dissolute lives of the clergy, Diego, bishop of Osma, and Dominic, by permission of the pope, went on foot and in poverty to preach among the heretics. Peter and Raoul were sent on a mission among the Albigenses (1206). Count Raymond humbled himself before the legate, Peter of Castelnau (1207), and promised to aid in extirpating the heretics he had been protecting. Dominic urged the crusade against the Albigenses (1208). The legatine inquisitors to a large degree acted independently of the bishop of the diocese; they held a court of their own, and by authority of the pope went on to try, to condemn, and to inflict penalties, and, with the concurrence of the magistracy, even death itself. Raoul feigned himself one of the heretics, and got possession of their secrets. Many priests, monks, laymen, and women were thus detected, and condemned in a council at Paris. Ten were burned and four imprisoned for life (1209). Proceedings so crafty, unscrupulous, and vigorous had all the success of which their nature allows. The search was very thorough, and the remedy seemed temporarily almost complete. Peter de Castelnau, by a hand never traced, was murdered near Toulouse (1208). (Guillaume de Nangis, *Chronique*; Guizot, *Coll. d. Mémoires*, xiii. 97.) But his death helped to complete the work of his life. Innocent, exasperated to the last degree by the death of his faithful servant, hurled against the Albigenses a crusade, in part under Arnold (afterwards archbishop of Narbonne) as legate (1209), which after a bloody struggle ended in their extermination.

IV. *Rise of the Inquisition as a Permanent Institution—Acts of the Councils.*—The vigor with which the legatine inquisition had acted, the success of its mission, and the enormous pressure on the Church, which the old mode of procedure had allowed to increase, and of which the new measures had been but a local and temporary palliative, strengthened the tendency to give system and permanence to some institution which should furnish the specific relief required in the time of crisis. The official initiative in this work may be said to have been made by the Twelfth General Council, the Fourth Lateran (1215), Innocent III. presiding. It took the first steps in the direction of a permanent inquisition. It virtually gave something of the character of an inquisitorial tribunal to the synodal courts of the bishops. Provincial synods were to be held annually, and violations of the Lateran canons were to be rigorously punished. The punitive discipline was no longer to be a spontaneous and irresponsible matter, but the courts were to be under Church decree—by pre-eminence, courts for the searching out, trial, and punishment of heretics. The condemned were to be left in the hands of the secular power, and their goods were to be confiscated. The secular powers were to be admonished and induced, and, should it prove necessary, were to be compelled (*compellantur*) to the utmost of their power to exterminate all who were pointed out as heretics by the Church (*universos hæreticos ab ecclesia denotatos, pro viribus exterminare*). Any prince declining thus to purge his land of heresy was to be excommunicated. If he persisted, complaint was to be made to the pope, who was then to absolve his vassals from their allegiance and allow the country to be seized by Catholics who should exterminate the heretics. Those who joined in the crusade for the extermination of heretics (*hæreticorum exterminium*) were to have the same indulgence as the crusaders who went to the Holy Land. Every bishop was to see to the carrying out of these provisions under pain of canonical vengeance (*ultionis*). He was to be deposed for neglect to cleanse his diocese of the leaven of heretical pravity, and his successor was to be one who had both the will and power to destroy it. The method of proceeding against offenders was by accusation, denunciation, and inquisition. (Carranza, *Summa Conciliorum*, Antwerp, 1556, 335, 336; ed. Schram, August. Vindelic., 1778, vol. iii. 36–39; Fleury, *Hist. Ecclesiastique*, Paris, 1840, v. 123.) The Council of Toulouse (1229) adopted a number of canons tending to give permanent character to the Inquisition as an institution. It was ordained that the bishop should make an annual visitation, and see to it that in all parishes one priest and three laymen of good repute should be appointed to devote their entire time to the making the inquisition for heretics. The local magistracy was to unite in this search. Any one permitting a heretic to remain in his country, or who in any way shielded him, was to be punished by forfeiture of land, personal property, and official position. All heretics were to be handed over to the archbishop, bishop, or local authorities. The houses in which they were found were to be levelled with the ground. Heretics, and those under charge or suspicion of heresy, were to be excluded from medical practice (*officio medici non utentur*). Any one could make inquisition and seize heretics in the country of another. Genuine penitents were to be removed from the tainted neighborhood, were to wear two crosses on their clothing, different in color from it, till the bishop allowed them to be laid aside. Their forfeiture of public rights could only be removed by a papal dispensation. Heretics driven to penitence by fear were to be imprisoned, so as to prevent their corrupting others. Men from the age of fourteen, and women from twelve, were to make oath, and renew it every two years, that they would inform on heretics. The laity were strictly prohibited from having the Holy Scriptures. (Carranza-Schram, *Summa*, iii. 70–72; Harduin, *Acta Conciliorum*, Paris, 1714, xii. 173; Mansi, *Collectio*, Venet., 1778, xxiii. 192; Fleury, v. 214; Du Pin, *Thirteenth Cent.*)

The local councils of this era followed up the work of the Fourth Lateran with special provisions in its spirit. Thus, the Council of Château-Gontier (Mayence, 1231), Jews cannot testify against Christians; the Council of Bézières (1233), the laying off of the crosses shall be considered sufficient proof of heresy (Fleury, v. 252); the Council of Arles (1234) convicted heretics to be imprisoned for life,

the heretic detected after death to be exhumed and given to the secular judgment (Fleury, v. 266). The Council of Narbonne (1235), under direction of the pope, laid down rules for the Dominican inquisitors. Prisons were to be constructed for the converts who had not property to support them in jail. Those who relapsed into heresy were, without further hearing, to be left to the secular judges for punishment. No one was to be excused from imprisonment because of old age, of wife, parents, or children; the names of witnesses were not to be made known by word or sign. Even the infamous and convicts were eligible as witnesses. (Carranza-Schram, iii. 83; Fleury, v. 271; Du Pin, *Cent. XIII.*, ch. vi.)

V. *Organic Establishment of the Inquisition.*—Gregory IX. (1227–41) found that not even the multiplication of rigorous canons could overcome the scrupulosity, the mildness, or, perhaps, sometimes, the indolence of the bishops. In Aug., 1231, he placed the Inquisition in the charge of the Dominicans, an order specially founded for the defence of the Church against heresy. Papal inquisitors of that order were appointed for Germany, Aragon, and Austria (1232), and for Lombardy and Southern France (1233). They were made formally free from all restrictive dependency on the bishops (1233), and could in certain cases summon the bishops themselves before them. The Inquisition then became an organized institution, a permanent tribunal, papal in its supreme authority, and administered mainly, though not exclusively, by the Dominican order. Under its jurisdiction persistent heresy was treated with unsparing severity. But "the Church does not thirst for blood." That maxim was too fixed to be disregarded. Blood had to be shed, the Church's need required it, but the Church could not shed it with her own hands. The casuists and divines hardly discuss the question whether the Church, as such, can shed blood; it is agreed that she cannot. That the Church might not even wear the appearance of staining herself with blood it was necessary that the princes should obligate themselves to co-work with her in carrying out the measures designed to repress heresy. Louis IX. of France (afterwards canonized) had shown his willingness, out of a pious mind, to use the powers of the state against the Albigenses (1228). Raymond VII. of Toulouse (1233) and Frederick II. of Germany (1234) followed up the work by the requisite laws, but neither of them with the unsuspected zeal of St. Louis. As these movements in the state followed in a secondary way upon the suggestions of the Church, the Inquisition of this type may properly be called an ecclesiastico-political tribunal. Both Church and state co-operated in it, but the Church was supreme, and used the state. The relation was reversed in the Inquisition as it existed at a later period, especially in Spain: there Church and state still co-operated, but the state was supreme and used the Church.

VI. *Method and Laws of the Ecclesiastico-political Tribunal, the "Ancient" Inquisition.*—We have seen the regulations established by the councils, under which the seizure and trial of persons suspected of heresy and other crimes took place. Their fellows in guilt, and even common convicts, were accepted as witnesses against them. The accused were to know nothing of them. Confession was wrung from them by torture. The torture of those suspected of heresy was sanctioned by Innocent IV. (1252). The torture was at the beginning applied by the civil authorities, but as the requisite secrecy was impossible with this arrangement, the Inquisition subsequently took the matter into its own hands, under direction of Urban IV. (1261–64). The penalties inflicted were penances of various kinds, forfeiture of civil and ecclesiastical rights, confiscation of property, imprisonment or the galleys, sometimes for life, and capital punishment, usually by burning alive. In mitigated cases persons were strangled first and burned afterwards. Rigorous as the Inquisition was even in this form, it was in many respects less arbitrary and severe than the politico-ecclesiastical Inquisition of after times. The bishops were not wholly ignored, the law of secrecy was not as strictly enforced, the means of defence were more ample. In Aragon and even in other countries conviction of heresy was not followed by sequestration of property. In a word, the Inquisition in its prevailingly ecclesiastical form was more dependent, more open to the influence of public sentiment, less compact and centralized, rather local than national, and altogether less terrible.

VII. *The Ecclesiastico-political Inquisition, History of.*—1. *In France.*—The special sphere of the Inquisition in the period of its earliest organization was in Southern France (1229–34). Its proceedings were marked with such severity that an insurrection of the people took place, and it was driven out of Toulouse and Narbonne. Four of the inquisitors were put to death in Toulouse, and the pope was compelled to withdraw the Inquisition from that place. It was again restored, and again fell into its earlier cruelty. It was, however, put under some restrictions by Philip the Fair (1285–1314). In the fourteenth century it died out in France. When, two centuries later, an attempt was made, under cover of the intense passions excited by the Reformation, to bring it in again and use it against the Huguenots, the ministers of Henry II. (1547–59) assured him that persistence in the movement would bring on a civil war. His queen, Catherine de' Medici, and others, zealous Catholics and ardent opposers of Protestantism, resisted the restoration of the Inquisition. But, though the Inquisition was not allowed a formal establishment in France, its influence, though with a certain furtiveness, has been very great there at times. The CHAMBRE ARDENTE (which see) (1535) was associated with an inquisitorial tribunal, of which the pope was a corresponding member. Both were established by Francis I. (1515–47), who more than once, with his mistress, enjoyed the excitement of the public burning of heretics. Several heretics were burned when Henry II. entered Paris in 1549, and the cruelties of the conjoint tribunal aided in bringing on the religious war of 1560.

2. *Germany.*—The Inquisition was introduced into a number of other countries. In some it was unable to obtain a permanent footing, and in all its spirit and history were in some measure modified by the character of the nationality. Conrad of Marburg, a Dominican, was appointed by Gregory IX. grand inquisitor of Germany (1231). He aroused the pope to a crusade against the STEDINGERS (which see), while the Inquisition proceeded with judicial measures against them as heretics. The cruel earnestness of Conrad, which imperilled the lives even of those who gave their souls to his keeping, directed itself alike against the high and the low with an impartiality which intensified the common aversion of people, princes, and bishops toward the Inquisition, and made it for ever impossible that it should find a permanent home in Germany. The pope was appealed to, and, expressing wonder at the long endurance of such atrocities, disavowed the excesses of his official. Before his reply was received Conrad was assassinated by some German nobles (July 30, 1233). Droso, a Dominican, was associated in spirit and work with him. (See Höfler in Wetzer and Weltes' *Kirch-Lexic.*, and Wagenmann in Herzog's *Real Encyklop.*, "Konrad.") For more than a century the Inquisition seemed robbed of its vitality in Germany by its own excesses, but in the fourteenth century the BEGHARDS and BEGUINES (which see) were persecuted with great severity (1367) by Walter Karling and another inquisitor, both Dominicans, sent by Urban V. (1362–70). Their work was legalized and efficiently sustained by three edicts granted by Charles IV. (1369). Gregory XI. enlarged the number of inquisitors for Germany to five (1372), and Boniface IX. sent six for North Germany (about 1399). Toward the close of the fifteenth century it received a new impetus from the bull "Summis desiderantes affectibus," issued by Innocent VIII. (Dec. 5, 1484), in which he alarmed all Germany, and stimulated to the last degree the superstitions of the people, by informing them that their country was overrun with witchcraft, and in the hands of magicians who were in covenant with the devil. For the extirpation of these criminals he appointed two inquisitors, Heinrich Krämer (*Institor*, "merchant," is the Latinized form in which it often occurs) and Jakob Sprenger. Out of the confessions of those charged with witchcraft, aided by suggestive questions and the torture, was built up a complete system of demonology. The processes and results of these examinations were wrought up by Sprenger in the *Malleus Maleficarum*, the "Hammer of Witches," who were assumed to be for the most part feminine (Cologne, 1489). This book long remained an authority in the proceedings against that class of offenders. The repression became the excitant. The temptation of suffering and publicity always swells the number of crimes of the imagination. An epidemical mania swept over Germany. Thousands of women were burned or tortured to death, sometimes confessing, ofttimes boasting, that they were witches. Science, authority, and law made superstition almost invincible, and one of the latest roots of mediæval thinking which clung to the soil of Germany and of other parts of the Protestant in common with the Catholic world was the belief in witches. The Reformation completely broke the power of the Inquisition in Germany. The Jesuits endeavored to restore it in Austria and Bohemia. In Bavaria (1599) it was formally established, but it lacked vitality, and soon vanished from all parts of Germany.

3. *Italy—Rome.*—In Italy its life was protracted, though political complications prevented its assuming the severity of character displayed wherever the government completely controlled it or it controlled the government. It was introduced into Italy by Gregory IX. (1235). Its central tribunal at Rome was employed by Paul IV. (1555–59) against Protestantism. He declared in his last hours to his

cardinals that he found in it the only means of rescuing the Catholic religion and the authority of the apostolic see from destruction. (Onuphrius, quoted in Heidegger, *Histor. Papal.*, 1698, 244.) In conjunction with the Inquisition stood the Congregation of the Holy Office, which a short time before had been established by Paul III. (1534–50), whose action in so doing had been influenced by Cardinal Caraffa, afterwards Paul IV. Sixtus V. (1585–90) enlarged the powers of the Congregation (1588). The Roman Inquisition was composed of twelve cardinals and of officials styled consultors or qualificators. The chief inquisitor was always a Dominican. The pope himself met with the court at least once a week, and confirmed its decisions. Inquisitorial courts, with a general similarity of organization, but with a varying number of members, chosen by the Congregation of the Holy Office, were introduced throughout Italy. The Inquisition in Italy was abolished by Napoleon (1808), was sanctioned again by Pius VII. (1814), but was used after that time mainly as a disciplinary tribunal for the clergy, and was extinguished by the consolidation of the kingdom of Italy, Oct. 9, 1870.

4. *Venice.*—The republic of Venice refused to receive from the pope an inquisition dependent on him, but instituted one under state control (1286). The papal nuncio presided indeed in it, but with him were associated the patriarch, the pater inquisitor, who was always a Franciscan, and three civil judges, without whose concurrence nothing could be decided (1289). The Venetian Inquisition might indeed be classified as politico-ecclesiastical, as the political was in some sense the primary element, and so take its place with Spain. But the Inquisition of Venice was really in the main an ecclesiastical tribunal, kept such by the state. While Spain stimulated the Inquisition, and gave it the largest powers, Venice restrained it, confined its jurisdiction to cases of heresy, did not allow it to deprive the heirs of the condemned of the property, and gave it no censorship of books. The Greeks and Armenians had freedom of worship, the Jews were tolerated, and the University of Padua was not limited to Roman Catholics in conferring its degrees in divinity. The ecclesiastical Inquisition of Venice is not to be confounded with the state Inquisition. (See Fra Paolo, *Marsollier;* Fleury, d. 96; Daru, *Hist. de Venise* (1819), i. 405–412; ii. 532; iv. 342, 460.)

5. *Naples, Sicily, Tuscany.*—The Inquisition was never established in Naples. It was prevented on the one side by the difficulties with the pope, and on the other by the unwillingness of the pope that an Inquisition should be established independent of his own control. The Inquisition which was established in Naples under the control of the general inquisitor of Spain was abrogated 1782. It was restored in Sardinia by Gregory XVI. (1833), and stood until 1848. In Tuscany, the grand duke had reluctantly given up Galileo to the Roman Inquisition (1633). The Tuscan Inquisition was suppressed by the grand duke Leopold II. (1824–59). In the political reaction following the year 1849 the Inquisition exhibited tokens of a revived life in Tuscany. An evidence of this which aroused Christendom was the sentencing of Francesco and Rosa Madiai (which see) to the galleys (1852) for having become Protestants. The incorporation of Tuscany into the united kingdom of Italy under Victor Emmanuel (1859) put an end to its Inquisition.

6. *Other Countries.*—In Poland it was introduced by Pope John XXII. (1327), but was soon abolished. All the efforts of the pope to introduce it as an institution into England were futile. Inquisitors were sent thither, but exercised little influence, as England, with a very decided disposition to exterminate heresy, preferred to do it in her own independent fashion.

VIII. *The Politico-Ecclesiastical Inquisition—the "Modern" or "Spanish" Inquisition.*—1. *Spain.* The ecclesiastico-political Inquisition had been fixed in Spain in Aragon, and to its central inquisitor, Nicolaus Eymeric (d. 1399), we owe the *Directorium Inquisitorum,* which is a voucher for the substantial unity of the spirit and method of the Inquisition under its two forms. But the old Inquisition of Aragon is almost forgotten in the new Inquisition of Castile. The great theatre of the most terrible form of this Inquisition and of its highest activity has been Spain. The whole purpose and strength of the Church and State has never been so centralized as there, in the repression of what was regarded as a common evil threatening the life of both. A vigorous absolutism on the throne found a congenial mind in the Church, for State and Church were welded together in Spain in a theocratic conjunction almost without parallel in modern history. The primary reasons of all these facts are connected with the entire earlier history of that land and with civil and religious necessities, largely real, and always plausible, which rose out of that history. The long struggle with the Moors had been one in which the antagonisms of races had been vivified by the antagonisms of religions. The Moors had been beaten in the field, but their conquerors felt that there could be no abiding security for Spain till the vanquished accepted the faith of the victors. The Jews had from an ancient period been a numerous, active, and influential element in Spain. As between Christianity and Mohammedanism, they had been more sympathetic with the latter than with the former. Jew and Mohammedan had been compelled toward the end of the fourteenth century (1391) to make a profession of Christianity. These reluctant converts, Moorish and Jewish, were more than suspected of clinging in secret to the faith they had publicly renounced. They were charged with atrocious acts and dangerous designs involving the government and the Church. A compulsory fidelity is the natural sequence of a compulsory profession. Of this compulsion the Inquisition became the organ. One of the earliest distinctive movements in this direction was made by Cardinal Pedro Gonzales de Mendoza, archbishop first of Seville, and afterwards of Toledo, who (1470) gathered together the legal maxims and regulations by which a sifting of these pretended converts might be made. This collection was circulated among the clergy to arouse and give precision to their efforts to repress the imminent mischief and peril. As this measure lacked the cogency in which relief alone could be found, the cardinal proceeded (1477) to punish in Seville a number of persons of Jewish origin who were charged with maintaining in secret the laws and usages of their fathers. He then submitted to the government the sketch of a permanent ecclesiastical court, in which the early vigor of the older Inquisition, which had been allowed to languish, should be restored, but which should possess larger powers and more effectual methods. In short, it was to be the Inquisition reformed. The plan met with the approval of Ferdinand and (after a temporary hesitation) of Isabella. At the cardinal's suggestion, which was all-potent (he was called "third king of Spain"), the plan was submitted to the Cortes at Toledo (1480), and, despite the opposition of a number of the states of the kingdom, was adopted. The king and queen loved the Church and loved their people. They meant to strengthen the throne by the altar, and the altar by the throne. They meant to serve the Church and to use the Church. They wished to secure the goodwill of the pope, and to gain by it. In their motives were mingled fear, piety, patriotism, absolutism, and ambition. Heresy was to be repressed; the dangerous races were to be kept under; the arrogance of the hereditary nobility and of the clergy was to be held in check; and the royal wealth and prerogative enlarged and made sure. In no permanent forms of persecution has there ever been a complete separation of political from religious motives. On petition of the sovereigns, Sixtus IV. had issued a bull (Nov. 1, 1478) authorizing them to appoint and depose inquisitors, and to possess themselves of the property of the condemned for the royal treasury. The Inquisition assumed the character of a predominantly, though not exclusively, state institution, in which the throne was largely allowed to define for itself how it would use the Church, yet under such bonds of fealty to the Church as made it questionable which would be master if their councils should ever be divided. The papal permission was not formally acted upon till Sept. 17, 1480, when the king and queen nominated as inquisitors two Dominicans, Morillo (previously inquisitor in Aragon) and St. Martin. With them was conjoined as assessor Medina, the queen's counsellor, and as procurator-fiscal, Lopez, her chaplain. This court began its official work (Jan. 2, 1481) by the publication of an edict which gave directions in regard to the arrest of heretics. These were for the most part the "new Christians," Jews who had professed conversion. The entire body of nobles was threatened with loss of title and estate if they neglected the orders of the Inquisition. Numbers of Jews were accused. Four days after the first edict, 6 of the condemned were burned, 17 more in March, and by Nov. 4, 278 persons had been sacrificed in the autos-da-fé of Seville. The dead were accused and convicted, and their remains dug up and burned. Many of the convicts were of high position. Wealth seemed rather to invite than turn aside the stroke. The plague caused the Inquisition to adjourn to Aracena, but did not relax its energy. In that year (or, according to one interpretation of Mariana (xxiv. 17), within several years) the total number burned alive is computed at 2000. Many more were burned in effigy; 17,000 were reconciled—that is, had the capital sentence commuted to imprisonment for life, confiscation, and other penalties. The Jews fled in great numbers. Some bore their sorrow to the pontiff himself. Sixtus IV. (1481) wrote to Ferdinand rebuking the inquisitors for their severity, and threatened them with deprivation. But in 1483 he quieted the scruples of Isabella and encouraged Ferdinand and her to continue the

good work. In this same year (1483) he appointed Thomas de Torquemada, a Dominican prior, inquisitor-general of Castile and Aragon. This man was confessor of the queen, and had prepared her mind to shake off its womanly aversion to the extirpation of heresy by force. He was now invested with full powers to give the completest unity, method, and efficiency to the Holy Office. The estimate of the number burnt alive—principally nominally Christian Jews—in the eighteen years of his ministry ranges from about 9000 to 10,000; between 6000 and 7000 were burned in effigy. This was not the trifling, the almost ludicrous thing which the words suggest to the modern mind, but involved infamy to the dead, and to the living the loss of all that makes life dear. Nearly 100,000 were punished in other ways. Overawed by the grand inquisitor, the Spanish sovereign signed the edict for the expulsion of the Jews (Mar. 30, 1492). Fearing because he had made himself to be so feared, guarding against poison at home and against assassination when he went abroad, the "confessor of sovereigns" died in quiet at the age of seventy-eight (1498). (See Prescott's *Ferdinand and Isabella*, i. 255–268, and Wetzer u. Welte's *K. L.*, v. 651.) Diego de Dega, a Dominican friar, the friend of Columbus, archbishop of Seville, Ferdinand's confessor, and preceptor of his son John, succeeded Torquemada as grand inquisitor (1499). He issued statutes or instructions for the regulation of the tribunals (1500–04). An insurrection excited by the extreme measures of the inquisitors led to his removal (1506). Under his administration 1664 were burned alive, 832 in effigy, and 32,456 punished in other ways. (Herzog, *Real-Encykl.* xviii. 332.) The third inquisitor-general was Cardinal Francis Ximenes de Cisneros (1507–17). In those ten years Llorente (iv. 255, ed. 1818) computes that 2536 were burned alive, 1368 in effigy, 47,263 were punished in other ways; but in this estimate is included those who suffered in Aragon, whose Inquisition was not subject to Ximenes. (Herzog, *R. E.*, vi. 687; Hefele's *Ximenes*, tr. by Dalton, 399.) The Inquisition in Spain long maintained its original rigor. Philip II. (1555–98) used it with effect to the crushing out of Protestantism.

The style of procedure in the trials of the Spanish Inquisition was very thoroughly methodized. It was the business of subordinate officials, called "familiars," to arrest the heretics and bring them to the place of judgment. The familiars were supposed to take the place of a godfather (padrino) to the accused. As the position had various prerogatives of an ecclesiastical and temporal nature, it was greatly sought for. The various tribunals which were established in the provinces and colonies were formed on the general model furnished in Madrid. They consisted of three inquisitors, three secretaries, an alguazil (constable), three receivers and assessors, together with the familiars and jailers. Every inquisitor was obliged to submit to the test of the *casa limpia* ("pure family"); that is, was obliged to show that he sprang from an old and unsuspected Christian ancestry, none of whom had ever been brought before the Inquisition. He was also sworn to secrecy. In its earlier history, as the "ancient" Inquisition, it had confined itself to charges of heresy or the suspicion of holding or conniving at it, of astrology, fortune-telling and witchcraft, of blasphemy, of offences against the Holy Office itself or its officials. In its later form the civil power, with the concurrence of the popes, extended its jurisdiction over professed converts from the Jews, Mohammedans, and over unbelievers, in as far as any of these classes gave offence to the Holy Office. The immediate process in Spain was as follows: The person suspected or indicted was summoned three times (*edictaliter*)—*i. e.* by a public judicial citation. If he failed to appear, he was, under reservation of a yet severer punishment, excommunicated *in contumaciam* and fined. An opportunity of escape was rarely allowed to those who were criminated. The familiars, the holy *Hermandad* (the government police fraternity), and the Fraternity of the Conciada followed pitilessly on the tracks of all who had been designated by the Inquisition. If the person criminated appeared, he was at once put under arrest. The suspicion of the crime was enough to cause his desertion by kindred and friends. They did not dare even to make their appearance with proof of his innocence, lest sympathy with his person should be construed as evidence of sympathy with his heresy. After the prisoner had been rigorously examined, a list was made of his effects, especially of his books and papers, and his property was confiscated so far as was necessary to cover the preliminary investigation. To render recognition easy in case he should escape, his head was shaven. He was committed to a dark prison. If he promptly confessed his guilt, real or alleged, he was as a penitent spared the penalty of death. But even in that case he and his entire kindred were dishonored and declared incompetent to bear any office of public trust. If he denied the charge, and the proofs were insufficient, he was dismissed, but as a person suspected he remained under the surveillance of the familiars. The ordinary result of this was, that he was arrested a second time, and then began the lingering process of the Inquisition proper. This was conducted in general accordance with the prescriptions which are found in the *Directorium Inquisitorum* of Nicolaus Eymeric (which see). If the prisoner refused to confess at the first hearing, he was remanded to prison, and after the lapse of several months was required to make oath before the crucifix that he would acknowledge the whole truth. If he refused to do this, he was condemned without any further evidence. If he took the oath, leading questions were put to him well calculated to entangle him. The legal counsellor was not to act in the interest of his client, nor see him in private, but was to urge him to the confession of the truth. The accused was not to know who were witnesses against him. Their testimony was received on their unsubstantiated word, and was laid before the accused in such a fragmentary form as was necessary to keep him ignorant who his accusers were. Even in this shape it was frequently postponed for years. Any one was received as witness against him. Two hearsay witnesses counted as one eye-witness. The testimony of the informer himself was admitted. The domestics and the family of the accused were allowed to testify against him, but not in his favor. If, after all this, the attainted one stood firm in his refusal to confess, he was subjected to the three grades of torture—the cord, the water, and the fire—under the direction of the inquisitors and the bishop of the diocese. If the wretched being was brought to confession, he was put to the torture a second time to ascertain his motives. A third time he was tortured to lead him to betray those who were his accomplices and sympathizers. When everything had been extorted from him he was left to his anguish without medical care. After these confessions he was regarded as a penitent, but a solemn abjuration was required of him. If it was his acts which had brought upon him an imputation of heresy, his abjuration was said to be *de levi*—"from a light suspicion." If after the testimony of two witnesses he had acknowledged himself guilty of Judaism or heresy, it was *de vehementi*—of a grave or violent suspicion. If he made his peace with the Church, including a promise voluntarily to subject himself to all the punishments which might yet be in reserve, it was *in forma*. The person convicted was generally condemned to imprisonment or to the galleys for life, his goods were confiscated, and his family stamped as infamous. Any one who both confessed and abjured was punished by being compelled for a fixed period to wear over a black undergarment the *sambenito* (the French form of the word is *san bénito*), a sleeveless coat, with a red St. Andrew's cross (substituted by Ximenes (1514) for the ordinary cross) on its back and breast. The penitent (*sambenitado*) who attempted to lay off this coat before the time appointed was punished as impenitent. When the time of his penance was over the coat was hung up in the church, with his name and a statement of his offences attached to it. Relapse into his crime was punished with death. If the three grades of torture failed to extort a confession, the accused was thrown into a more wretched prison. Of prisons there were three grades—public, intermediary, and secret. If even this produced no results, the opposite policy was tried. Relatives and friends were permitted to see him; the hope was excited in his mind that a penitent confession might yet secure pardon or pity for him. If any one died under suspicion, or if suspicion was first excited after his death, the trial went on as if he were living. If forty years had passed between his decease and his conviction, his heirs retained his property, but were infamous and incapable of bearing public office. If the remains of the suspected dead could be found, they were burned; if not, the burning in effigy was substituted.

When the various formalities had been gone through the Auto-da-Fe (which see) was held. The most appalling feature of this, and the most attractive to the thousands whom it brought together, was the burning to death of the condemned. But the autos-da-fé were not exclusively scenes of death. In some there were no executions. Relief was brought to burdened hearts by the announcement of release or penance, or of punishments short of death, and the tenderer passions, as well as the fiercer, drew crowds together. The autos-da-fé were a climax to the solemn autos of the religious drama. They were dramas of awful realities, and seemed to the people an epitome and anticipation of the terrors and pardons of the Last Judgment. In the seventeenth, and yet more in the eighteenth, century these "acts of faith" became rarer. The material had been relatively burned out. But, more than this, better convictions as to the true mode of dealing with error had become more general. The penalties were executed privately. The tribunal lost more and more of its most dreadful characteristics, and finally came to fight with books rather than with men.

Charles III. (1759–88) imposed legal restrictions on it. No final sentence could be passed without the concurrence of the king, and no new regulations could be established without his sanction. The grand inquisitor was relegated (1762) to a monastery for condemning a book contrary to the wishes of the king. Count Aranda, minister of state, limited the powers of the Inquisition still further in 1770. Though Aranda was overthrown in 1773 by the influence of the clergy, public opinion sustained the spirit in which he had acted toward the Inquisition. The pope himself ordered various restrictions of its powers. By an edict of Joseph Buonaparte, issued from Madrid Dec. 4, 1808, it was abrogated as prejudicial to the civil government. From the period of its introduction in its later form into Spain (1481) to the time of its abrogation (1808) it is estimated by Llorente that the Inquisition had burned alive 31,912 of those whom it had tried, had burned in effigy 17,659, and had inflicted severe punishments of other kinds on 291,456 persons. These direct sufferings involved sorrow and calamity to millions. On the return of Ferdinand VII. to the throne (1814) he restored the Inquisition. In the revolution of 1820 one of the first objects of the popular fury was the Casa Santa, the palace of the Inquisition at Madrid. The tribunal itself was again abolished by the Cortes. The clerical or "apostolic" party considered the restoration of the Inquisition a matter of vital necessity, and labored energetically to bring it about. In 1825 a junta favorable to the Inquisition came in, and in 1826 the Inquisition was re-established in Valencia. After the death of Ferdinand VII. (1833) the law of July 15, 1834, again abolished it, and by a royal edict of 1835 its property was confiscated and devoted to the payment of the public debt. In the new constitution of 1855 the Roman Catholic religion is established by law, private freedom of faith is protected from persecution, but liberty of worship is not granted. In spite of this, in 1857 very active proceedings were entered into against all persons and books suspected of the taint of Protestantism. By the new constitution of 1869 the nation binds itself to sustain in good faith the Catholic worship and the Catholic clergy. Foreigners of other confessions resident in Spain are tolerated in both the private and public rights of religion, limited only by the general rules of morality and law. Spaniards who forsake the Catholic faith are tolerated under the same general provision.

2. *The Netherlands.*—From Spain, where the Inquisition had been so efficient an instrument of the state, Charles V. (1516–56) and Philip II. (1556–93) endeavored to transfer it to the Netherlands, to be used against the Reformation. "The number of Netherlanders burned, strangled, beheaded, or buried alive in obedience to the edict of Charles V. . . . has been placed as high as 100,000 by distinguished authorities, and has never been put at a lower mark than 50,000. Charles was no fanatic. It was political rather than religious heterodoxy which the despot wished to suppress." (Motley, *Rise of the Dutch Republic*, i. 114.) The result of the policy of which the Inquisition was a preeminent part was the revolt of the Netherlands. After an eighty years' war, in the course of which millions of lives were sacrificed, the country almost depopulated by the savagery of Alva, the remnant of the people condemned to death in a mass by the Inquisition, the institution of horror was rooted from the land, and the land itself lost for ever to Spain. The Jew lives, Protestantism lives, free government lives, but the system centring in the Spanish Inquisition, robbing of life all to which it clung, lies, a withered parasite, on the tree it exhausted. (See Prescott, *Philip II.* (1855), and his edition of Robertson's *Charles V.*; Brandt, *Hist. of Reformation in Holland* (1671); Motley, Llorente, Puigblanch.)

3. *America.*—Soon after the discovery of America the Spaniards introduced the Inquisition into it. Mexico, Carthagena, and Lima were the principal seats of its jurisdiction. (See Prescott's *Mexico* and *Peru.*)

4. *Portugal.*—The Inquisition was introduced into Portugal under Spanish domination (1557) after a protracted resistance. Its supreme court was in Lisbon. The grand inquisitor was nominated by the king and confirmed by the pope. John IV. of Braganza, after the liberation of his country from the Spanish "sixty years' captivity" (1640), was anxious to abolish the Inquisition, and withdrew from it the right of confiscation. John himself was put, after his death (1656), under the ban, and not for some time was a solemn absolution pronounced over his body. The Portuguese Inquisition exhibited special severity in the East Indies; Goa was its centre. Pombal (1750–82) repressed or used the Inquisition as might best promote his political reforms. Nevertheless, by his influence the Inquisition was obliged to state the charge and give the names of the witnesses to the accused, who was entitled to the choice of a lawyer as his advocate, and had the right of conferring with him. No sentence could be executed until it was confirmed by the royal council. John VI. (1792–1826) abolished the Inquisition both at home and in the colonies. Don Miguel (1828–34) showed a strong disposition to restore it, but was not able to do so. The world over, the Inquisition, in both its forms, has fallen. Whatever may be the difference in their details, the historical conditions of its life in both forms are substantially the same.

IX. *Defences of the Inquisition.*—Paramo, in his work on the *Sacred Inquisition* (1598), treats of its "dignity and utility," and in 1599 he published an answer to the objections made against it. But the best defences of the Inquisition belong for the most part to the period of its decline and extinction. The two best known are from the hands of Count de Maistre and of Hefele. So far as these defences rest upon the exposure of the confusion in classification and mistakes in facts fairly chargeable upon writers on the Inquisition, they will be found accepted and embodied in this article. Baudri has very compactly and forcibly presented the argument for his Church in these words: "There are three points which we are carefully to hold in view: I. As a distinctly spiritual institution for the preservation of purity of faith and sound discipline the Inquisition needs no vindication. In this aspect it is wholly correspondent with the plan and spirit of Christ. II. When it has been united with the civil power, or has been shaped into a state Inquisition, as in Spain, it was the State, not the Church, which sought the conjunction. III. As to the abuses and abominations of the Inquisition, the reply to be made is, first, that these have sometimes been overstated; further, that what are called the victims of the Inquisition were either common criminals, who would have been punished in accordance with the laws and spirit of the time had there been no Inquisition, or if they were heretics they were punished by civil law as offenders against the public weal." In *Allgem. Kirch. Lexik.*, v. Aschbach (iii. 480, 1850), Hefele has argued on the same general basis, and with great circumstantiality of detail in *Cardinal Ximenes* (Tüb., 1844; 2d ed. 1851, pp. 257–370; Eng. transl. by Dalton, 1860, 276–400) and in his article "Inquisition" in Wetzer and Welte's *Kirchen-Lexikon* (1850). The main points made by him, and the spirit in which they are received by intelligent Protestants, are well presented by Herzog: "Hefele has made the effort to put the Spanish Inquisition in its true light. He has done this partly by showing that its character was rather political than ecclesiastical, partly by exposing unjust crimination of it, and partly by correcting mistaken allegations as to its procedures. Such an effort deserves, in general, a thorough acknowledgment and praise. It is not fair to paint the Spanish Inquisition blacker than it really was. In its very nature, without a single touch of the pencil, its hues are sombre enough. It is especially necessary to bring into relief the influence exercised upon the Spanish Inquisition by the royal authority, and, we might add, by the national character. Hefele begins by carefully showing that the Inquisition was at once the creature and the organ of the royal absolutism. It is undeniable that, at the beginning especially, it was this in a higher degree than it was an ecclesiastical institution. (The conference between the king and the grand inquisitor in Schiller's *Don Carlos* rests, therefore, upon a mistaken impression as to their mutual relations.) On this ground Hefele relieves the Church of all the odious and fearful associations which cling to the name of the Inquisition. He then points out carefully how often and how strongly, though usually without result, the popes endeavored to put a check upon the cruel and iniquitous acts of the Inquisition. There has been, in fact, no other institution of the Catholic Church on which the papal censures have been so earnestly and repeatedly directed. No fact could more strikingly illustrate the spirit of the Spanish Inquisition, and show the pertinacious severity of its procedure; for it will hardly be maintained by Catholics themselves that the tendency of the popes has been toward undue leniency toward those who refused obedience to the Church. Hefele goes on to correct the excessive estimates of the number of the victims of the Inquisition. He corrects the chief mistake which Llorente made on this point when he stated that Torquemada alone, in the first year of his administration at Seville, burned to death 2000 persons, while according to Mariana these 2000 are to be divided among all the years of his rule and the whole body of inquisitorial tribunals under him. The words of Mariana quoted by Hefele do not, however, necessarily bear the sense he puts on them: *A Torquemada memorant duo millia crematos igne*, etc. (Mariana, xxiv. 17.) Hefele further directs attention to the fact that the procedure of the Inquisition, in fact its entire method, was no worse, and indeed was in many respects far milder, than that of the criminal law of the era, whose severity and inhumanity are beyond dispute. True as this is in general, yet we must be careful not too readily to infer

that the course of procedure was always in keeping with special mitigations. It is in this as in other parts of the same system, which in the written account wear a less repulsive air, but in which the contrast is great between theory and practice. The method, for example, by which the rule that forbade more than one application of the torture was evaded, shows of how little value were those mitigations on which Hefele relies. The wretch who had been almost tortured to death was allowed to rest for a couple of days until he was sufficiently recovered to endure new tortures. This was styled the interruption and resumption of the one torture. But why need we argue? Sad as is the theme, yet it is hard to avoid a smile when Hefele treats as if it were made in serious earnest the official request of the inquisitors, when they gave over the condemned to the civil power, that their lives should be spared, and puts it exclusively to the account of the secular power that this petition sank to an empty formality. It seems that even in Germany there is a man who could persuade us that in those days the maxim was held in good faith, *Ecclesia abhorret a sanguine!*—'The Church shrinks from bloodshed.' Hefele further adopts the opinion of Joseph le Maistre that the Inquisition was not detrimental to the intellectual life of Spain—an opinion with which Huber, a Protestant author, has recently concurred. The clumsy manner in which the opposite view has often been maintained gave some color to this opinion. The commission of the Cortes which (1812) introduced the motion to abolish the Inquisition, for example, says, 'From the moment the Inquisition appeared authors vanished.' There is no disputing that precisely at the time at which the Inquisition entered on its work, there began in Spain an active intellectual life, and that even poetry bloomed in new beauty. Hefele of course does not go to the extreme of regarding this as the work of the Inquisition, but he claims that it proves that the Inquisition did not have the repressive effect charged on it. But in the nature of the case it was involved that the fruits of the Inquisition could only ripen at a later period. Is it necessary to say what these fruits are? What has Spain been for the last two centuries? In answering this question we must indeed be careful not to charge all the misery of Spain on the Inquisition. Nevertheless, so much stands fast that the ecclesiastical and political absolutism by which Spain has been sunk so low has been bound up with the working of the Inquisition. But Hefele goes on, and it is impossible to avoid a feeling of profound astonishment when we read that the Inquisition so far wrought beneficently when, as with an inspired vocation, it saved Spain from innumerable errors and heresies, and from the horrors of the religious wars occasioned by the Reformation. Hefele does not indeed put forth these views directly. He urges them not in his own name, but under the authority of the most cultivated, the noblest intellects among the authors of Spain. It is clear, however, that he is not ready unreservedly to contradict them, and though he does not entirely adopt them, yet there is an unmistakable effort on his part to commend them as judgments which carry with them great weight and plausibility. That a German Catholic, who should be familiar, alike from history and personal observation, with the happy influence which Protestantism has exercised on Catholicism itself, should envy Spain the repose of the grave, once deep, but now long broken, proves most clearly that the old spirit of Roman Catholicism is not extinct. This, indeed, is made manifest by many other signs of the times. Hefele also reviews the work of Llorente. That this book is fairly open to many sorts of censure is demonstrated, and yet it may be said that Hefele involuntarily becomes its apologist, for every fact which he adduces to set the Inquisition in a fairer light is drawn from Llorente himself. This shows very clearly that Llorente's work was not written purely for the making out of a case." (*Real-Encyklopädie f. protest Theologie u. Kirche,* 1856, vi. 690–692.)

X. *Bibliography and Literature.*—The bibliography, direct and collateral, of the Inquisition is large. Lists of the most important works will be found in Lipenius, *Bibl. Theolog.*, 1685, ii. 100; ib., *Bibl. Philos.*, 1681, i. 133; ib., *Bibl. Jurid.*, 1679, 234; Walch, *Bibl. Theol. Sel.*, 1758–62, ii. 119; iii. 737; Nösselt, *Anweis zu. K. Bücher*, 1800, s. 350; Fuhrmann, *Handwörterbuch Relig. u. Kirchengeschichte*, 1828, ii. 458; Winer, *Handbuch Theolog. Literat.*, 1838, i. 696; Grässe, *Lehrb. d. Literärgeschichte*, 1840, ii. 1, 3; Danz, *Univers. Wörterbuch*, 1848, 451; Clericus, *Biblic. Student's Assistant*, Edinb., 1844, 48; Poole, *Index to Period. Lit.*, 1853, 240, 457; Denis, Pinçon, Martonne, *Nouv. Man. de Bibliogr. Universelle*, 1857, ii. 39; Pierer, *Univ. Lexik.*, 1859, viii. 928; Pérennès, *Dictionnaire d. Bibliographie Catholique*, 1859, iii. 545, 571; Brunet, *Manuel du Libraire*, 1865, vi. 1164; Malcom, *Theological Index*, 1868, 241; Kurtz, *Lehrbuch d. Kirchengesch.*, 1874, i. 374, 399. Among the most important works may be mentioned: (1) those which are documentary, embracing rules, methods of procedure, and instructions. *Quæstiones* (Fifteen Questions for the Inquisition) prepared by Cardinal Falcodi, afterwards Clement IV. (1265–68), edited with the annotations of Carrera, and his treatise of the mode of procedure in the Holy Office (1641), with the *Praxis inquisitorum* of Pegna, and additions by Carrera (1669). Clement V. (1305–14) presented to the council at Vienne (1311–12) special instructions for the inquisitors. These form a part of the *Clementines*, v. iii. 1, 2, 3 (*Corpus Juris*, Colon. Mun. 1730). Eymeric, for forty-four years inquisitor-general of Aragon (d. 1399), wrote the *Directorium Inquisitorum.* The first part gives the ancient Church laws and decretals; the second part, the papal laws concerning heretics and inquisitors; the third part details the methods to be observed by the inquisitors; first published 1503, with commentary of Pegna, 1578. Simanca, *Praxis hæreseos*, Venet., 1568–73; ib. *De Catholicis Institutionibus*, 1575; Reuss, *Sammlung* (*Collection of Instructions from the Spanish, collected by order* of *Cardinal Manrique*), with a sketch by Spittler, 1788. 2. Histories: *Nigrinus*, 1582; Paramo, 1598; Marsollier, 1613; Limborch (best of the old works), 1692. Mémoires: 1716, Baker, Tiffensee, Baumgarten, 1741; Cramer, 1784; *Raisonn. Erzähl.*, 1784; *Causes Célèbres étrangères*, 1827; Rule's *History of the Inquisition from its Establishment in the Twelfth Century to its Extinction in the Nineteenth*, 1874. The French Inquisition, De la Mothe-Largon, 1829; the Venetian Inquisition, Paul (Sarpi), 1638; the Spanish Inquisition, Gonsalvi, 1567; Arnold, 1609; Ursinus, 1611; Bebel, 1692; *Inquisition in Spanien u. Achtenstücken*, Leipsic, 1810; Puigblanch, *Inquisition Unmasked*, tr. by Walton, 1816; Llorente, 1815, 1818, 1820; De Maistre, *Lettres sur l'Inquis. Espagnole*, 1822; Hefele, *Ximenes*, 2d ed. 1851; transl. by Dalton, 1860. The Portuguese Inquisition, Herculano, 1858; at Goa, Dellon, 1668. The histories of the heretics, councils, martyrs, the papacy, the religious orders, are of importance here. The best general church histories are also useful. Among those of the most importance on the history of the Inquisition are Bzovius, Spondanus, Raynaldus, and Fleury among the Roman Catholic writers, and Mosheim and Schröckh among Protestant church historians. Some of the monographs on special eras and particular nations are also important: Brandt's *Netherlands*, Milman's *Latin Christianity*, MacCrie's *Spain and Italy*, Ranke's *Popes*, the works of Prescott and Motley. Prescott's statements in regard to the Inquisition have been reviewed by Archbishop Spalding, *Miscellanea*, 1866. A thorough history of the Inquisition is greatly needed. Mr. H. C. Lea, of Philadelphia, is engaged upon such a work, which will doubtless prove worthy of the distinguished reputation he has won by his other monographs on ecclesiastical history. C. P. KRAUTH.

In Rem [Lat., "against the thing"], a technical legal term used to designate an action or proceeding directly instituted against the thing or property the title to which is in question, or upon which some lien or claim is made, or to denote the judgment or decree which is the result of such an action or proceeding. It is also applied to decisions directly determining the legal *status* of a party before the court with reference to marriage, divorce, bastardy, settlement, and other similar personal relations. Actions against the person, which are the ordinary forms of suit in courts of general jurisdiction, are termed, by way of contradistinction, proceedings *in personam.* Suits *in rem* frequently occur in courts of admiralty and in proceedings under revenue laws. Of this nature are proceedings for the enforcement of maritime liens against a vessel or cargo, for the recovery of salvage, for the condemnation and forfeiture of property on account of a violation of the revenue laws, or as prize in time of war, and, in general, all actions in admiralty where a claim is made directly against specific property. The title which such an admiralty cause receives indicates that the action is *in rem*, since the property is represented as if it were made defendant in the proceeding, as, *e. g.*, "The U. S. *vs.* The Ship Osprey." The proceedings to enforce the judgment or decree of the court in such cases are confined to the property which is made the subject of the claim in the action. On the contrary, in suits *in personam* the judgment of the court is carried into effect by the levy of an execution, and all the property of the defendant, with the exception of a few classes of articles exempted by statute, may, if necessary, be sold to satisfy the judgment. A judgment or decree *in rem*, whether the suit be against specific property or with reference to personal *status*, is, in general, binding and conclusive, not only upon the parties in the cause, but upon all persons. It will, subject to some exceptions, be deemed valid and binding in foreign countries if the court by which it was rendered had jurisdiction of the proceeding. The judgment may, however, be invalidated unless it were obtained *bonâ fide* and

without fraudulent means, and unless the suit was conducted with an observance of the regular and requisite forms. Whatever disposition, therefore, a court having jurisdiction makes of property by a judgment *in rem*, or whatever determination it makes in regard to *status*, settles the question generally as to all the world. This obligatory force of judgments *in rem* is based chiefly upon considerations of public policy, since it is desirable that the title to property which has been the subject of litigation should not be left doubtful, and also that the personal relations of every member of the community should be definitively settled. (See JUDGMENT.) This doctrine also rests partly upon the ground that in most cases in which judgments of this kind can be rendered all persons who have any interest in the subject in controversy may appear and assert their rights. GEORGE CHASE. REVISED BY T. W. DWIGHT.

Insan'ity* [Lat. *insanitas*, "unsoundness"] is a manifestation of disease of the brain, characterized by a general or partial derangement of one or more faculties of the mind, and in which, while consciousness is not abolished, mental freedom is perverted, weakened, or destroyed. An essential feature of the definition here given is, that insanity depends upon a diseased condition of the brain. It is therefore only a symptom, like paralysis, coma, or any other phenomenon of cerebral disorder; but as we cannot in the present state of our knowledge affirm with any degree of accuracy what part of the brain is affected in any given case of insanity, or even say how it is disordered, we are obliged to take the manifestation for the disease. It is not many years ago that cough was regarded as a disease, and by many paralysis still is. In reality, these are symptoms referable to disease of some part of the respiratory or nervous apparatus, and are not diseases in themselves. But it is questioned by some even at the present time whether insanity may not exist and the brain be in a perfectly healthy condition. The relation of mental aberration to cerebral derangement certainly cannot be invariable, unless the normal mind is directly dependent upon a normal state of the brain. If, however, it can be shown that the mind comes from the brain, or, what amounts to the same thing in physiology, is manifested through the brain, it follows logically, as well as pathologically, that insanity is the result of cerebral disorder. The proofs of this relation are the following:

(1) The action of an organ, even within the limits of health, frequently gives rise to sensations of various kinds, and slight functional derangements are very distinctly felt. Thus, the pain of indigestion is referred to the stomach or bowels, as the case may be; difficulties with the urinary excretion are accompanied by uneasiness in the kidneys; derangements in the secretion of the bile are often only indicated by pain in the liver; loud noises produce unpleasant feelings in the ears, and excessive or improper use of the eyes causes pain in these organs. So it is with the brain. Though ordinarily we are not conscious of any particular sensation when we use it in thinking (and the same is true, *mutatis mutandis*, of the other organs mentioned), yet inordinate mental exertion gives rise to headache, vertigo, and other derangements of sensibility referable to the brain. In some persons even slight mental action invariably produces pain in the head, and it is well known that the brain becomes diseased when it is unduly taxed, just as does the stomach, the eye, or a muscle.

(2) Injury or disease of the brain impairs in some way or other the powers of the mind. A blow on the head causes confusion of ideas, and if hard enough may destroy consciousness or the power of thought altogether. A piece of bone or a bullet pressing on the brain likewise destroys the ability to think; and though examples are not wanting of terrible wounds of the brain in which there is for a time no well-marked impairment of the mind, careful examination will reveal the existence of deterioration from the first, and eventually the patients die with head-symptoms. The various diseases of the brain likewise produce at some time or other of their course derangement in the evolution of mind, and insanity is generally shown after death to have been accompanied by structural changes in the brain.

(3) The action of the brain, like the functionation of other organs, results in the disintegration of its substance, and this destruction of tissue is in direct proportion to the amount of mental work done. We find, therefore, that the alkaline phosphates, which are mainly derived from the destructive metamorphosis of the nervous tissue, and which are excreted by the kidneys, are increased in quantity after severe intellectual labor, and are diminished by mental quietude. In a memoir published several years ago I gave the results of experiments performed upon myself, which show very conclusively that increased use of the brain causes increased decay of its substance.

(4) The size of the brain is well known to have a direct relation to the intelligence of the individual; and when all other conditions are alike it may be said that the largest brain will produce the greatest amount of mental energy. Quality is, however, an important factor, and when with great size there is also a large amount of gray matter, the intellectual capacity is at its maximum. Thus, Dr. Thurnam has shown that the average weight of the brain in Europeans is 49 ounces, while in ten men remarkable for their intellectual development it was 54.7 ounces. Of these, the brain of Cuvier, the celebrated naturalist, weighed 64.5 ounces, Spurzheim's 55.06, and Daniel Webster's 53.5. On the other hand, the brain is small in idiots. Of three idiots whose ages were sixteen, forty, and fifty years respectively, Tiedemann found the weight of their brains to be 19¾, 25¾, and 22½ ounces. Mr. Gore has reported the case of a woman forty-two years of age whose intellect was infantine, who could scarcely speak a few words, whose gait was unsteady, and whose chief occupation was carrying and nursing a doll. After death her brain was found to weigh but 10 ounces and 5 grains. Mr. Marshall has also reported a case of microcephaly in the person of a boy twelve years old whose brain weighed but 8½ ounces. The convolutions were strongly marked, though narrow and few in number.

(5) Experiments performed upon the nerves and nerve-centres show that from the brain proceeds the force by which muscles are moved, and that it is the organ by which sensations are perceived. Thus, division of a nerve supplying a certain muscle cuts off the connection between the brain and that muscle, and hence the will can no longer cause it to contract. Division of the optic nerve prevents the perception of visional images, and so likewise for the other nerves of special sense.

From all of which considerations the connection between the brain and the mind is as clearly made out as any other fact in physiology. The mind differs from forces in general in being compound—that is, in being made up of several other forces. These are perception, the intellect, the emotions, and the will. All the mental manifestations of which the brain is capable are embraced in one or more of these parts. Either one of them may be exercised independently of the other, though they are very intimately connected, and in all continuous mental processes are brought more or less into relative and consecutive action. As constituting the basis of the classification of the several forms of insanity to be considered in this article, it is expedient to describe briefly these four sub-forces of the mind.

1. *Perception.*—By perception is to be understood that part of the mind whose office it is to place the individual in relation with external objects. For the evolution of this force the mind is in intimate relation with certain special organs which serve the purpose of receiving impressions of objects. Thus, an image is formed upon the retina, and the optic nerve transmits the excitation to its ganglion or part of the brain. This at once functionates, the force called perception is evolved, and the image is perceived. If the retina be sufficiently diseased the image is not formed; if the optic nerve be in an abnormal condition, the excitation is not transmitted; if the ganglion be disordered, the perceptive force is not evolved. Like reasoning is applicable to the other senses, hearing, taste, smell, and touch. Perception may be exercised without any superior intellectual act—without any ideation whatever. Thus, if the cerebrum of a pigeon be removed, the animal is still capable of seeing and of hearing, but it obtains no idea from these senses. The mind, with the exception of perception, is lost.

2. *The Intellect.*—In the normal condition of the brain the excitation of a sense and the consequent perception do not stop at the special ganglion of that sense, but are transmitted to a more complex part of the brain, where the perception is resolved into an idea. Thus, the image impressed upon the retina, the perception of which has been formed by a sensory ganglion, ultimately causes the evolution of another force, by which all its attributes capable of being represented upon the retina are more or less perfectly appreciated according to the structural qualities of the ideational centre. To the formation of the idea several important faculties and modes of expression of the

*The writer of this very able article has employed the language commonly used by the school of physiologists who hold the doctrine of the correlation of mental and physical forces. To those who, like the editors of this work, do not entertain that view, the interest of the article will not be impaired by this circumstance; while those to whom the doctrine is acceptable will esteem it on this account as more strictly in harmony with the actual state of advanced physiological science. It is to be observed that the writer, and many others who regard the mind as a function of the brain, disclaim the imputation of materialism cast upon them by some; and this disclaimer should be considered in judging of their modes of speaking.—EDS. JOHNSON'S CYCLOPÆDIA.

intellect contribute. Thus, if we suppose the retina to have received the image of a ball, a higher ganglion converts this into a perception, and a still higher one into an idea; and this idea relates to the size, the form, the color, the material, etc. primarily, and to the origin, uses, ownership, etc. secondarily. In gaining this conception of the thing impressed upon the retina, the memory, judgment, and other faculties of the intellect are brought into action, and the process of reasoning is carried on.

3. *The Emotions.*—An idea in its turn excites another part of the brain to action, and an emotion is produced, or this last-named force may be evolved under certain circumstances without the intermediation of the idea, but solely from the transmission of a perception to the emotional ganglion. An emotion is that pleasurable or painful feeling which arises in us in consequence of sensorial impressions or intellectual action. According to Bain, the word *emotion* is used to comprehend all that is understood by feelings, states of feeling, pleasure, pain, passion, sentiments, affection, etc. Within the limits of health the emotions act powerfully on certain organs of the body, and thus express their own activity. Thus, grief is exhibited by the flow of tears from the over-excitation of the lachrymal gland; extreme joy may also cause weeping; the jaw falls and the angles of the mouth curl downward in mortification or sorrow, while in pleasure the face expands laterally. The eyes, the nose, and the mouth are the three facial centres from which emotional expression is mainly produced. Other organs of the body, as the salivary glands, the heart, the mammary glands, the liver, the kidneys, and in fact nearly every viscus of the body, may exhibit the effects of emotion by the transmission of excitations through the sympathetic nerve. Most of the resulting effects are due to the fact that the sympathetic nerve especially presides over the vaso-motor system, and thus regulates the calibre of the blood-vessels.

4. *The Will.*—By volition acts are performed. Some acts are automatic, but all done in consequence of intellection are the result of willing, and are for some specific purpose connected with an idea. Volition in the series of mental manifestations may precede emotion, but it always follows perception and ideation.

To sum up these outlines: a person walking in the street sees a man on the opposite side of the way—*perception;* he recognizes him as a friend whom he has not met for many years—*intellect;* he determines to go across and speak to him—*will;* he does so, and exhibits joy at the reunion—*emotion.* Or, to alter the sequence somewhat, a person at a theatre sees and hears an actor on the stage—*perception;* the attitudes, gestures, and words of the player call up certain ideas—*intellect;* he is moved to great joy or grief—*emotion;* and determining to recognize the ability of the actor—*will*—claps his hands or throws him a bouquet.

In individuals whose brains are well formed, free from structural changes, and are nourished with a due supply, neither excessive nor deficient, of healthy blood, the perception, the intellect, the emotions, and the will are manifested in a manner common to mankind in general. Slight changes in the formation or nutrition of the brain induce corresponding changes in the several parts of the mind or in it as a whole. As no two brains are precisely alike, so no two persons are exactly alike in their mental processes. So long, however, as the deviations are not directly at variance with the average human mind, the individual is sane; if they are at variance, he is insane. But within the limits of mental health marked irregularities are met with in different parts of the mind. Thus, some persons are noted for never perceiving things as the majority of people perceive them; others have the emotional system inordinately or deficiently developed; others are weak in judgment, defective in memory, feeble in powers of application or vacillating in their opinions; others, again, are lacking in volitional power—in the ability to perform certain acts, to refrain from others, or to follow a definite course of action which the intellect tells them is expedient or wise. Persons whose minds deviate in some one or more notable respects from the ordinary standard, but yet whose mental processes are not directly at variance with that standard, are said to be *eccentric.* It is not always easy to draw the line between strong eccentricity and mild insanity. About the former, however, there is this marked characteristic—that its manifestations are according to a fixed system, are not founded on delusions, and are generally excited by those emotions or desires which are reflected back to the individual, such as pride, vanity, the love of approbation or of notoriety, etc. Eccentric persons stand upon the verge of insanity, with a decided predisposition to mental disease, and ordinarily if they do not pass the limit it is for want of a sufficient exciting cause. Instances of eccentricity passing into positive insanity are common enough, and inquiry will frequently disclose the fact that the insane have been eccentric for several years before becoming affected with cerebral disease to such an extent as to produce decided mental aberration.

Many classifications have been made of the various phenomena met with in insanity. Obviously, the only proper arrangement would be one based on the actual brain-lesions, but in the present state of our knowledge it is impossible to make such a one. We cannot say, for instance, that when an individual has a delusion, such or such a part of his brain is affected, nor that when he is melancholic another part is involved. We are obliged, therefore, either to arrange the symptoms into groups without any philosophical basis, or to classify them according to the relation which they bear to the several parts of the mind. Following this latter plan, we have—I. *Perceptional insanity,* characterized by the tendency to the formation of erroneous perceptions, either from false impressions of real objects (illusions), or from no external excitation whatever (hallucinations). II. *Intellectual insanity,* characterized by the existence of delusions. III. *Emotional insanity,* characterized by the uncontrolled or imperfectly controlled predominance of one or more of the emotions. IV. *Volitional insanity,* in which there is an inability to exert the full will-power, either affirmatively or negatively. V. *Mania,* characterized by the union of two or more of these forms in the same individual. VI. *General paralysis,* a peculiar form of insanity attended with progressively advancing loss of mental and motor power. VII. *Idiocy and dementia,* the first due to the fact that there are original structural defects in the brain; the second resulting from the supervention of organic changes in a brain originally of normal power.

Before proceeding to describe these several types, it is necessary to touch upon certain important symptoms of mental disorder, the character and import of which must be clearly understood. These are illusion, hallucination, delusion, incoherence, and delirium.

Illusion.—An illusion is a false perception of a real sensorial impression. Thus, a person seeing a ball roll over the floor, and imagining it to be a mouse, has an illusion of the sense of sight; another, hearing the pattering of the rain on the roof, and perceiving in this sound the voice of some one calling him, has an illusion of the sense of hearing; another, having some bitter substance placed upon his tongue, and forming the perception of a sweet flavor, has an illusion of the sense of taste; and so on as regards the other senses. In all such cases there is a material basis for the perception, but this latter is not in exact relation with the former. Illusions are not always indicative of cerebral disorder; indeed, they are very common with all of us under certain circumstances. It is, perhaps, never the case that the perception is precisely in accordance with the real properties of the substance making the sensorial impression. We never see, hear, taste, smell, or feel things exactly as they are. This imperfection may be due to surrounding circumstances not being favorable. Insufficient light may thus make our vision imperfect; loud noises may render us incapable of appreciating gentle sounds; a strongly sapid substance previously rubbed over the tongue and fauces prevents our distinguishing delicate flavors; a powerful odor may make such an impression on the Schneiderian membrane that other odors for a long time smell like it; and exposure to very cold weather interferes markedly with the discriminating power of the sense of touch. Imperfect perceptions are often formed in consequence of the perceptive ganglia being otherwise occupied. Thus, if we are looking intently at some object of interest, we are apt not to attend to the sounds which reach our ears, and consequently no clear perception of them is formed. Illusions of all the senses, but especially of sight and hearing, are met with in insanity, and particularly in those acute forms characterized by the presence of delirium.

Hallucination.—A hallucination is a false perception without any material basis, and is centric in its origin. It is more, therefore, than an erroneous interpretation of a real object, for it is entirely formed by the mind. An individual who on looking at a blank wall perceives it to be covered with pictures has a hallucination; another who when no sound reaches his ears hears voices whispering to him also suffers from a hallucination; and such false perceptions may be created as regards all kinds of sensorial excitations. The organs of the senses, in fact, are not necessary to the existence of hallucinations. Thus, if the eyes be closed, images may still be seen; if the hearing be lost, voices may still be heard; and the reason for this is found in the fact that the erroneous perception constituting the hallucination is formed in that part of the brain which ordinarily requires the excitation of a sensorial impression for its functionation. Hallucinations are always evidence of cerebral derangement, and are common phenomena of insanity. They may be excited by emotions of

various kinds, by which the character or quantity of the blood circulating in the brain is changed, by intellectual exertion, by certain drugs, and many other factors to be presently more fully considered.

Delusion.—Illusions and hallucinations may exist, and the individual be perfectly sensible that they are not realities. In such cases the intellect is not involved. But if he accepts his false perceptions as facts, his intellect participates, and he has delusions. A delusion is, therefore, a false belief. It may be based upon an illusion or a hallucination, may result from false reasoning in regard to real occurrences, or be evolved out of the intellect spontaneously by the result of imperfect information or of an inability to weigh evidence or to discriminate between the true and the false. Delusions are not a test for insanity, as most lawyers and many physicians believe. If they were, one-half the world would be trying to put the other half in lunatic asylums. They may be present without coexistent insanity, and many cases run their course without them. To be indicative of insanity a delusion must be in regard to a matter of fact, and contrary to the customary mode of thought of the individual. Thus, a believer in Spiritualism is not necessarily insane because he sees and converses with the spirit of Benjamin Franklin, for his delusion is one not capable of proof or disproof, and it is a part of his mentality to believe in the existence of spirits and in the possibility of evoking them so as to see them and talk with them. But, if a non-believer in Spiritualism should imagine that he was in the habit of seeing Franklin's spirit, and of conversing with it, it would be good evidence of his insanity. And, further, though the Spiritualist might think he had interviews with Franklin, and still be sane, yet if he believed, without foundation and contrary to evidence, that his brother had tried to poison him, he would have a delusion sufficient to indicate insanity.

At a former period of the world's history a belief in the possibility of seeing devils and demons of various kinds, and of suffering from their torments, was commonly entertained. Indeed, it is religiously held now by a great many otherwise sensible people. Such a belief is, according to our mode of thought, a delusion, and probably nine-tenths of those who read this article will agree with me in so regarding it. But it certainly would not be safe to consider every one holding such a creed as insane. A like reasoning applies to the holders of every other form of belief not in accordance with our own. A delusion, to be indicative of insanity, must be such a belief as would not be entertained in the ordinary normal condition of the individual, must relate to a matter of fact, must have been formed without such evidence as would have been necessary to convince in health, and must be held against such positive testimony as would have in health sufficed to eradicate it. Insanity may exist without delusions at any time being present. Thus, there may be emotional insanity, the main feature of which consists of mental depression with an unreasoning tendency to suicide; or there may be volitional insanity, characterized by an inability to refrain from setting fire to neighbors' houses or from committing homicide.

Incoherence.—A person is said to be incoherent when the words he utters are without proper relation to each other, or when his language is not in accordance with his ideas. Incoherence is a prominent feature of delirium, and is sometimes met with in the chronic insane. It is directly due either to the impossibility of keeping the attention sufficiently long on one idea for its full consideration, or to a like difficulty in co-ordinating those parts of the brain which are concerned in the formation and expression of thoughts.

Delirium.—Delirium is that condition in which there are illusions, hallucinations, delusions, and incoherence, together with a general excess of motility, an inability to sleep, and an acceleration of pulse. In acute delirium these phenomena are well marked; in the low and chronic forms they are less strongly indicated. Sometimes one or the other of these elements notably predominates. Delirium is present in the early stages of acute mania, and may exist as an accompaniment of certain diseases of the brain which do not ordinarily cause insanity, such as cerebral congestion or anæmia. It is also common in fevers and in several other disorders of the system.

I. *Perceptional Insanity.* — In uncomplicated perceptional insanity those parts of the brain only are disordered which are concerned in the formation of perceptions. It constitutes the primary form of mental aberration, and of itself is not of such a character as to lessen the responsibility of the individual or to warrant any interference with his rights. It consists entirely in false perceptions, and if the intellect is for a moment deceived, the error is immediately corrected. As already stated, these are either illusions or hallucinations. In some cases the erroneous perceptions may coexist in the same individual. They may be related to all the senses, but are especially common as regards sight and hearing. Illusions, as already mentioned, are not necessarily due to any centric difficulty, though such an origin is common. Thus, it is an illusion if a person on looking at an object sees two images. This result is due to some cause destroying the parallelism of the visual axes, and may be produced by a tumor of the orbit or by paralysis of one or the other of the ocular muscles. Even in such a case, if the paralysis were due to central lesion the higher ganglia of the brain might escape implication. Illusions are often excited by emotional disturbances, and are then probably directly due to some derangement of the cerebral circulation. The false perceptions called hallucinations are of more importance than illusions in the symptomatology of insanity in general. In the purely perceptional form of mental aberration they are also exceedingly interesting, and are very often troublesome symptoms. Thus, a gentleman who had overworked himself in financial business was subject to hallucinations of hearing, which, however, did not in the least impose on his intellect. As he walked through the streets to his place of business he heard a voice continually whispering to him, "Take care! take care!" So strong was the impression made that he often involuntarily turned round to see who was speaking to him. In another case a gentleman saw images of various kinds as soon as his head touched the pillow, though they were never present when he was standing or sitting. The case of Nicolai, the German bookseller of the last century, is well known as remarkable, and others are afforded in the cases of Jerome Cardan, Pascal, and many other noted personages. Like illusions, the immediate cause of hallucinations is generally derangement of the cerebral circulation, either as regards quantity or quality. As is well known, they are frequently produced by alcoholic liquors, opium, belladonna, Indian hemp, and other drugs. They may also result from mental exertion and emotional disturbances, from an overloaded stomach, or may occur in the course of various diseases, especially those of a febrile or exhausting character. Perceptional insanity may make its appearance suddenly, the first evidence of its presence being the illusion or hallucination. Usually, however, there are prodromata indicating cerebral derangement. These are pain in the head, irritability of temper, suffusion of the eyes, noises in the ears, a general restlessness, and some febrile excitement. The skin is generally dry, the mouth parched, the bowels costive, and the urine high-colored and scanty. If not arrested, it may pass into one or the other of the following types of mental aberration.

II. *Intellectual Insanity.*—The essential feature of intellectual insanity is delusion. It may be developed suddenly, or, as is generally the case, is preceded by evidences of cerebral disorder, which, though at the time of their occurrence not attracting particular attention, are called to mind by the observers after the disease has become fully developed. In the first stages of intellectual insanity it is not often that the delusions are fixed, and they may succeed each other with such rapidity that the patient resembles one affected with mania. They may be based on illusions or hallucinations, or may arise from the reasoning of the patient from purely imaginary premises not connected with the senses. Sometimes they are spontaneous, and at others they appear to come from dreams. Thus, a gentleman who had for several days been singular in his behavior awoke in the night and imagined that he saw his wife standing by his bedside with a phial of prussic acid, which she was about to empty into his mouth. The hallucination took such strong hold of him that he went into the adjoining room, where his wife slept, to see if she were there or not, and, though he found her sleeping quietly, he awoke her and accused her of having attempted to poison him. No amount of argument or persuasion could eradicate the false belief from his mind. Another for several days had been spending money very freely in articles of little or no use to him, when one morning he announced to his family that for several days he had been thinking a great mistake had been committed in his conception, and that his soul had got into the wrong body. He was therefore convinced that he was not the man he should have been, and hence he had done a great many things which were altogether repugnant to his physical senses; so long as the antagonism continued between his mind and his body there was no hope of any happiness for him in this world. In this case there had never been any hallucination or illusion of any of the senses. The delusion was therefore entirely the result of the patient's own perverted thoughts. When rapidly following each other, delusions are clearly spontaneous, are not the result of any series of thoughts, but come on the spur of the moment and upon very slight suggestions. As they are readily formed, they are not fixed in character. A lady, for instance, after receiving some very sorrowful

news relative to her husband, imagined that she had lost her eyesight. For a few hours she remained with her eyes shut, alleging that there were two deep cavities behind the lids. Suddenly she opened them, said she saw perfectly well, but that the top of her head had been cut off; and this was almost immediately changed to the belief that she was perishing with cold; and so on, no one delusion lasting longer than a few minutes. In many cases like this the erroneous beliefs are excited by sensations in various parts of the body, but this was not so in the present instance.

The connection between dreams and insanity is very close. Most of us have at times had such vivid dreams that they have been removed from our mind with difficulty. There appears to be no doubt that many of the delusions of the insane have dreams for their cause. The delusions of the insane are in a great majority of cases connected more or less directly with themselves. Thus, a person believes that his leg is made of glass, that his head is reversed on his shoulders, that he is some great personage, that a large fortune has been left to him, or that some misfortune has deprived him of his property or his friends. He will often reason logically and forcibly from the premises he has assumed, and will give no evidence of insanity outside of his delusion. Such cases are embraced under the term "reasoning mania," and the skill and acumen exhibited by persons thus affected are often surprising. When it is important, in their estimation, for them to conceal their delusion, they will often do so for a long time, and stratagems of various kinds are necessary to their speedy detection. Sooner or later, however, the delusion comes out.

The designation monomania can properly be applied to many of the cases of intellectual insanity. In the uncomplicated form of the disease it is rare, after it is fully established, that more than a single object or a small class of objects is the subject of the delusion. The delusions of the insane may be comprehended under two categories—those which are of a pleasant or exalted character, and those which are unpleasant or morbid. These usually leave their impress on the countenance of the patient, and his actions and manner are in accordance with them. It would be strange if this were not the case. The only guide which man has for his actions is his reason. He weighs arguments and motives, and determines according to the bearing which they may have on his mental processes. A delusion is, in many cases, simply a false premise; the conclusions which the individual draws from it are entirely logical. Taking, for instance, the case of the gentleman who had imbibed the idea that his wife had attempted to poison him, and admitting that he was correct in this notion, his subsequent actions—his denunciations, his refusal to live with her, his efforts to have her imprisoned, etc.—are perfectly reasonable. The line of conduct was such as most men would have pursued under like circumstances. In such cases, therefore, there is no fault in the intellectual process after the first step is taken. It is this first step which constitutes the disease; it is the delusion which enslaves the mind.

Intellectual insanity is often uncomplicated by any other form of mental derangement. There are no illusions, no hallucinations, no overpowering influence of the emotions, and no loss of control over the will. Even when the delusion is of such a character as apparently to be connected with some one of the senses, and thus to be based upon a false perception, full inquiry will often show that there is no error of the sensorial processes, centric or eccentric. Thus, a lady had the delusion that she had lost her palate, as she called it. A mirror was held to her face, and while she opened her mouth the fact was pointed out to her that all the parts were present. "Yes," she replied, "I see all that; the form is there, I know very well, but the substance is gone;" and no arguments could convince her to the contrary. A gentleman conceived that his right hand was made of glass, and therefore, to prevent its being broken, he kept it carefully enclosed in a stout case made to fit it accurately. On calling his attention to the physical qualities of his hand, and pointing out how they differed from those of glass, he said, "I once thought just as you do. My brain was then incapable of appreciating minute differences as well as it can now; and though I confess that my senses still convey to me the idea that my hand is like other people's, yet I know the conception is erroneous, and I correct it at once by my reason. My hand looks like flesh and blood, but it is glass for all that. Nothing is more calculated to deceive than the senses." Persons affected with uncomplicated intellectual insanity may go through the world without giving any considerable evidence of mental derangement unless the subject of their delusion be touched upon. Still, there is no telling to what extremes a delusion may carry its subject. Such a person, for instance, imagines that he is the emperor of Russia. At first he does not comprehend the full importance of his supposed position, and if of moderate reasoning power, possessing deficient information, and naturally of a quiet disposition, he may never go further than dressing himself in some tawdry finery and strutting pompously through the wards of the hospital. But under other circumstances he reflects upon the greatness of his station, and thus from time to time conceives new ideas of his powers and importance, and may thus become a very troublesome patient. He comes to believe, perhaps, that he has the power of life and death, and may attempt to exercise his imaginary prerogative. Delusions in regard to relatives and friends are very common, and hence the conduct of the person entertaining them is changed as it relates to the objects of his erroneous ideas. It is a usual thing, therefore, for such an insane person to disinherit those who would naturally be heirs to his property. This point is of importance in its medico-legal relations.

Delusions may be of such a character as to affect the emotions secondarily. A very common delusion is that of having committed the unpardonable sin, and accordingly the patient suffers great emotional disturbance. This influence upon the emotions is perfectly natural and logical, for if the person really has committed a sin for which there is no hope of pardon, and has thus incurred the punishment of eternal damnation, it would be strange if the emotions of sorrow and despair were not excited into activity. Such cases, however, are not to be embraced under the head of emotional insanity; and though at first sight they may appear to be of that type, inquiry will reveal the fact of the pre-existence of the delusion.

III. *Emotional Insanity.*—The emotions are at all times difficult to control, but they may acquire such undue prominence as to dominate over the intellect and the will, and assume the entire mastery of the actions in one or more respects. This effect may be produced suddenly, from the operation of some cause capable of disturbing the normal balance which exists among the several parts of the mind, or it may result from influences which act slowly, but with gradually increasing effect. In either case there is not necessarily either delusion or error of judgment, but it very generally happens that the intellect sooner or later becomes involved. Emotional insanity may be produced without there being any discoverable cause, and without the patient being able to allege a motive. Some emotions are more frequently disordered than others. Those of a sorrowful character are pre-eminent in this respect, and when they are affected the type of insanity called melancholia is the result. This may be either acute or chronic in its course. The first is rarely uncomplicated, and hence will be more properly considered under the head of *Mania*. Homicide, suicide, and other crimes may be the result of emotional insanity as well as of intellectual insanity. The most common of these is undoubtedly suicide, the individual committing self-destruction in order to escape from the depressing influences which act upon him. A person, for instance, to cite the example previously given, imbibes the delusion that he has committed the unpardonable sin or that God has deserted him, and in consequence passes into a condition of settled melancholy, during which he may attempt self-destruction to escape from his harrowing thoughts, or commit a homicide in order that the same end may be accomplished by his being hanged for murder. Other emotions may of course be excited into morbid activity by derangement of the intellect. Delusional jealousy, anger, hatred, or love may thus urge their unfortunate victim to the perpetration of crime, plunge him into a depth of unhappiness from which there is no escape, or lift him into an ecstasy of bliss far exceeding that derivable from the realization of all his wishes.

Under the head of moral insanity, Dr. Prichard several years ago described a form of mental derangement which embraces several species which are now more properly placed under other heads. Several of these are clearly emotional in character, and most of them relate to altered modes of feeling or of the affective faculties, and therefore, in the largest sense of the word, may also be called emotional. Careful and thorough inquiry will, however, often show that the primary difficulty is one of defect, not of aberration or exaggeration, and that, therefore, these instances of deficient moral sense, leading the subjects to the perpetration of crimes of various kinds, should be classed under the head of imbecility. Many cases of what are called temporary insanity, mania ephemera, transitory mania, and morbid impulse are really instances of emotional insanity. That such a condition exists there can be no doubt, and it is important, both as regards the subject and society, to be able to recognize or to disprove its presence. A few words, therefore, on this point will not be out of place. The state with which transitory emotional insanity is most apt to be confounded is that which has been desig-

nated "heat of passion." Passion is emotional activity. It refers to that mode of the mind in which certain impressions or emotions are felt, and which is accompanied by a tendency or impulse, often irresistible, to act in accordance with these impressions or emotions irrespective of the intellect. An act performed in the heat of passion is one prompted by an emotion which for the moment controls the will, the intellect not being called into action. It is an act, therefore, performed without reflection. The passions are, to a certain extent, under the control of the will, and this power of checking their manifestations is capable of being greatly increased by self-discipline. Some persons hold their passions in entire subjugation; others are led away by very slight emotional disturbances. The law recognizes the natural weakness of man in this respect, and wisely discriminates between acts done after due reflection and those committed in the midst of passional excitement.

The acts performed during temporary emotional insanity, in their more obvious aspects and when viewed isolatedly, resemble those done in the heat of passion. But they are so only as regards the acts themselves. Thus, a person entering the room at the very moment when one man was in the act of shooting another would be unable to tell whether the homicide was done in the heat of passion or under the influence of an attack of temporary insanity; he would be equally unable to say whether it was committed in malice aforethought or in self-defence. The act, therefore, by itself, can teach us nothing. We must look to the attending circumstances and to the antecedents of the perpetrator for the facts which are to enlighten us as to the state of mind of the actor. Now, the conditions of temporary emotional insanity are so well marked that the act which indicates the height of the paroxysm may almost be disregarded, for it is always preceded by symptoms of mental aberration, while acts done in the heat of passion are not thus foreshadowed. And as regards the subsequent state of the individual the distinction is equally apparent. The one who has committed a criminal act in the heat of passion soon subsides to his ordinary condition of equanimity, and generally begins to think of his safety. The one who has perpetrated a similar act during an attack of temporary emotional insanity never thinks of escape, nor even avoids publicity. He may even boast of his conduct or deliver himself into the hands of the law. What is, however, of greater importance is the fact that though he may subside into a condition of comparative sanity, the evidences of disease are still present, and remain in him for days, weeks, or even months and years. These symptoms are generally those of cerebral congestion, to which attention has already been directed. In the heat of passion the act follows immediately on the excitation of which it is the logical sequence. In temporary insanity the act is the culmination of a series of disordered physical and mental manifestations, and may or may not be in relation with the emotional cause. The distinction is therefore clear and precise.

IV. *Volitional Insanity.*—In uncomplicated volitional insanity there are no delusions and no emotional disturbances, but solely an inability to exert the will in accordance with the intellect. Many cases of morbid impulse are instances of volitional insanity, in which an idea suddenly flashes across the mind and is immediately carried out by the individual, although his intellect and his emotions are strongly exerted against it. Thus, a person who previously has not exhibited any very obvious symptoms of mental derangement—though careful inquiry will invariably show that slight evidences of cerebral disease have been present for some days—instantaneously feels a morbid impulse to commit a murder or perpetrate some other criminal act, and is forced to yield, notwithstanding all the efforts he may make. Numerous cases of this kind are on record. Thus, Esquirol relates the case of a man thirty-two years old, of a nervous temperament and quiet disposition, who had been well educated and who was fond of the fine arts. He had suffered from a brain disorder, but had been several months cured. After being in Paris for about two months, during which time he led a perfectly regular life, he one day entered the Palais de Justice and attacked an advocate with great fury. The next morning when seen by Esquirol he was perfectly tranquil and composed, showed no anger whatever, and had slept well all night. The same day he designed a landscape. He recollected what he had done the previous day, and spoke of it with coolness. He declared that he had entertained no ill-will against the advocate, had never even seen him before, and had no business with him or any other lawyer. He could not understand, he said, what had actuated him to make the assault. Subsequently he exhibited no indications whatever of being insane. Many instances of so-called moral insanity may properly be placed under the head of volitional insanity, for they are characterized by an inability to so exert the will as to refrain from the perpetration of acts known to be crimes. Of such are cases of kleptomania, dipsomania, pyromania, etc. The will in insanity is often secondarily affected through disturbance originating in the intellect or the emotions, and acts are hence performed which give evidence of the existence of mental aberration. In mania of all kinds, and especially in dementia and general paralysis, there is either a loss of volitional control or an inability to exert the normal will-power.

V. *Mania.*—In mania the mind is affected in several, generally all of its parts. There are illusions, hallucinations, delusions, emotional disturbance, and loss of volitional power or control. The patient is either morbidly excited or depressed, and is often violent in his language and actions. Acute mania is the more common species of mental aberration, and in its two types of exaltation and depression constitutes the form most commonly met with.

Acute Mania with Exaltation has its prodromatic stage, the symptoms of which are very similar to those which precede an attack of fully developed cerebral congestion. These, in the main, are pain and fulness in the head, confusion of ideas, increased irritability of the mind, and, above all, wakefulness. In addition, there are restlessness of body and a singularity of behavior which strikes those thrown into intimate relations with the subject, and causes them to suspect that something is wrong with him. The character and disposition undergo a change, and it is very common for unfounded prejudices to be formed against persons formerly highly esteemed. Before very long there are illusions and hallucinations. At first the patient struggles against them, but eventually he accepts them as true, and hence becomes subject to delusions. These are rarely fixed in the earlier stages, and may not be so through the whole course of the disorder. With these symptoms there are derangements in other organs besides the brain. Thus, the appetite is lessened, the bowels are torpid, the kidneys fail to eliminate the normal quantity of urine, the heart becomes irregular in its actions and beats with increased frequency—a certain sign of a weak and excited nervous system—and the skin is either bathed in perspiration or is dry and hard. With the full development of the disorder the patient becomes incoherent and rambling, showing a great disposition to talk, to laugh, and to sing, and to indulge in antics of various kinds. His delusions mainly have reference to himself; he imagines that he is some great personage, that he has suddenly become very rich, or that he has been specially singled out for some other piece of good fortune. Not unfrequently he is exceedingly troublesome, destroying the furniture of his room, tearing his clothes, attacking those around him, and making all kinds of attempts to escape from restraint; but at the same time there is rarely any serious effort to do great bodily harm either to himself or others. Sometimes, however—and this fact should always be borne in mind by the attendants—there is a disposition to perpetrate acts of extreme violence, and such a tendency, even when not previously manifested, may very suddenly be developed. As a rule, patients with acute mania lose all sense of decency, and become exceedingly filthy in their habits and obscene in their language and conduct. At times such lunatics exhibit a surprising degree of cunning, and are able to exercise great control over their conduct when they have an end to accomplish. They may thus deceive the young and inexperienced physician, and induce him to forego the idea of putting them under permanent restraint, or they may so impose on him as to induce him to relax his vigilance, and thus allow of their committing some outrageous act. It must be remembered that acute mania is not suddenly cured, but runs a definite and allotted course. It is rare that the memory of the patient suffers to any considerable extent in acute mania. The patients are perfectly conscious of their surroundings, and are seldom deceived by the subterfuge so frequently and so unjustifiably employed that they are to be taken to a hotel or a country-seat when about to depart for an asylum. If the stratagem does for a moment impose upon them, they recollect the fraud, and will not again repose confidence in those who have perpetrated it. Their appetites are generally unchanged. If in the habit of smoking or drinking, they still want their tobacco and their wine, and are usually able to eat a full allowance of food. After their entrance into the asylum the main object of their lives is to get out again as soon as possible. They often recognize their condition, and will call attention to any indications of improvement they may exhibit. They are not for a moment deceived by the delusions of their fellow-lunatics. It is rarely the case that the sleep is regular and sound. Often they will lie awake at night talking over their plans, or else will annoy their attendants in every conceivable way. Although having usually uncomfortable feelings in the head, they rarely suffer from acute pain in that part of the body.

Acute Mania with Depression.—The acute melancholia of many authors is a very terrible form of mental aberration. Like that just described, it is generally preceded by prodromata, which indicate by their character the type of insanity which is about to be developed, but it often appears with great suddenness. In the case of a lady the first evidence of mental disorder was a violent scream, due to the fact that an idea had instantaneously flashed through her mind that she had committed the unpardonable sin, and had consequently lost all hope of saving her soul. For several days she continued, with scarcely an intermission, to scream, to cry, and to sob, at the same time showing the greatest terror from apprehension that the devils were approaching her. Gradually this extreme state became less violent, but she still continued to be actuated by intense fear, and paced the floor night and day, wringing her hands, weeping, and exclaiming, "Lost! lost! lost for ever!" In another case of a lady the idea suddenly occurred to her that she was about to be killed. She screamed and begged and prayed to those around her not to allow her to be injured. In the furniture and attendants she saw her murderers, and to escape from them made several attempts to throw herself out of the window. Then she believed that she was to be poisoned, and refused all food with the utmost pertinacity, closing her teeth so firmly together that it was only by the use of great strength that they could be opened. Of all the forms of insanity, this is the one in which illusions and hallucinations of the senses are most common. These are particularly so as regards sight and hearing, and do not, as a general thing, refer to the body of the patient, although generally in direct relation with his delusion. In all cases of acute mania with depression too great care cannot be taken to prevent self-injury or suicide. It must be constantly kept in mind that the idea is a very common one with this class of patients, and that frequently they manifest great astuteness in concealing it till they are ready to make the attempt.

VI. *General Paralysis.*—The affection known as general paralysis was first described by Delaye in 1822, by Bayle in the same year, and, with much more thoroughness and exactness, by Calmeil in 1826. It is a very common form of mental derangement, and, aside from the implication of the mind, presents the very striking feature of a gradually advancing paralysis, which derives its name from the fact that it involves, sooner or later, nearly every muscle of the body. This paralysis may show itself at the same time that the insanity is manifested, it may precede the mental derangement, or it may be subsequent thereto. The latter is much the more usual order. The mental symptoms differ in several important respects from those which occur in other forms of insanity. The first indication of disease is generally an excessive anxiety in regard to matters which are really of no great importance. Of the cases which have come under my care, one was first made apparent by a morbid apprehension on the part of the patient that he was not managing some trust-funds in the best possible way; another, by the idea that he was constantly wounding the feelings of his friends; and another was constantly changing his mind about the most trivial things, and apparently thinking that the world watched with great anxiety all his movements. At first, the general mental type is that of depression. The emotions are easily excited, and the delusions which soon make their appearance are of the melancholic form. The idea of propriety in the every-day acts of life seems to be lost, and the patient will commit all kinds of indecent acts without appearing to be aware that he is doing anything unusual. His memory fails rapidly, and his intellectual vigor declines from the very first. Hence, he is not able to argue in defence of his delusions, but attacks with physical force those who venture to differ with him. His acts are in other respects eccentric and absurd. He spends money in things which are of no manner of use to him, and at the same time refuses to pay his small debts; he harasses in every possible way those who are about him, gives them impossible orders, and then abuses them if they are not at once obeyed; he is whimsical at the table, and drinks voraciously, or declares that nothing is cooked to suit him, and leaves the table in a rage. Gradually the form of his mental aberration changes; he becomes more cheerful, forms all kinds of impossible schemes for suddenly acquiring great wealth, and these are quickly abandoned for others equally impracticable. Thus, delusion after delusion rapidly succeeds each other, and these, in the great majority of cases, relate to the grandeur, the wealth, the physical strength, or some other great quality of the patient, constituting the *délire des grandeurs* of the French. One will tell of his immense palaces built of gold and inlaid with precious stones, and in the next breath will descant on his great weight or his extreme lightness, or on the number of children he has, or on the millions of operas he has composed. Another urges his great importance in the political world—tells us that he has elected all the members of Congress himself, that he has paid off the national debt, and that in consequence he is to be made emperor of the United States, with a salary of a thousand millions a year; that he is going to have a thousand physicians, who are to be clothed in blue velvet uniforms embroidered with gold and diamonds; that he has chartered the Great Eastern for a pleasure-trip, and engaged ten thousand musicians and a similar number of ballet-dancers to go with him. The next day he has forgotten all these fancies, and is off on another series of absurd ideas. In no respect is he restrained in the extent of his delusions. Impossibilities are not regarded. While scarcely able to drag one leg after the other, he will brag of his great fleetness of foot, and in the very death-gasp will mutter about his extreme strength or endurance. The symptoms connected with sensation are equally well marked. In the early stage headache is often very severe—so much so that, as Westphal has remarked in his excellent monograph on the subject of general paralysis, the patient often dashes his head against the wall. At other times the feeling in the head is that of fulness or tightness, and these sensations are often accompanied with vertigo. Neuralgia in various parts of the body is common, and some of my patients have complained of the different degrees of numbness, especially in the hands and feet. But still more strongly manifested are the disorders of motility, due to the progressive paralysis. One which is very often observed before any mental derangement is perceived is a slight defect of articulation, due to paralysis of the lips. At first this is scarcely perceptible; there is merely a little trembling—an action such as that seen in persons who are endeavoring to restrain their emotions—but it is sufficient to give indistinctness to the utterance of those words which contain labial letters. The tongue is the next to be affected. Examination shows that there are fibrillary contractions of the muscles, and the organ is moved with less facility. The articulation is slovenly, words are slurred over, and there are both stammering and stuttering. The patient notices these difficulties, and in endeavoring to obviate them makes matters worse by his inability to be exact, contrasting strongly with his efforts. The paralysis of the tongue gradually becomes more complete, and at last this organ can only be moved with great difficulty. The other facial muscles participate, and a blank, somewhat sorrowful, expression is constantly present. The voice loses its fulness and there is great difficulty of swallowing. The muscles of the eye are also generally involved, producing ptosis from paralysis of the levator palpebræ superiosus, diplopia from implication of the internal rectus, and contraction of the pupil; all of these effects, except the last, being due to lesion existing at the point of origin or in the course of the third nerve. The pupils are often unequal, and Austin declares, with all seriousness, that contraction of the right pupil is associated with melancholic delusions, and contraction of the left pupil with elation. Further investigation has not confirmed this theory. The gait of patients affected with paralysis is very peculiar, and is of two distinct kinds. In the one it is similar to that of a person suffering from sclerosis of the posterior columns of the spinal cord (locomotor ataxia). The feet are lifted high, and are thrown down with a great deal of force, the heel striking the ground first. As Westphal remarks, patients with this gait cannot stand with the eyes shut and the feet close together. In the other kind the feet are scarcely lifted from the ground, but are shuffled over it, and the action is somewhat like that of a person attempting to balance himself on a tight-rope. Patients with this gait can without difficulty stand with the eyes shut. As regards the upper extremities, the fingers lose their strength and delicate coordinating power. The handwriting is shaky, and there is awkwardness in buttoning the clothing. The grip of the hand is still strong, but there is an impossibility, as shown by the dynamograph, of maintaining a continuous muscular contraction for even a few seconds. The senses, with the exception of sight, do not often become materially affected. Atrophy of the optic nerve causes amaurosis or amblyopia. Ophthalmoscopic examination will very generally detect this condition of the papilla at a very early stage of the disease, together with retinal and choroidal anæmia. Convulsive seizures occur, and these are generally epileptiform in character, though occasionally they are of the nature of apoplexy. They vary greatly in character, sometimes resembling the *petit mal* of epilepsy, at others characterized by strong convulsive movements or coma. Besides these, there are attacks of complete paralysis of certain muscles, which, however, rarely leave any permanent effects, the usual degree of power being regained in a few days.

The course of general paralysis is often marked by periods of great improvement, and the patient's friends im-

agine that he is certainly recovering. The symptoms, mental and physical, all abate in violence, and may even disappear to such an extent as not to be evident to general observers. But the physician must not be deceived, for the amelioration is merely temporary, and sooner or later the disease regains its former ascendency. At no time, even during the height of the remission, is the mind of the patient in such a condition as to admit of any considerable intellectual exertion. There may be an absence of delusions, but mental weakness still exists. Progressively, this decline in the force of the mind becomes more strongly marked, until at last a condition of extreme dementia is reached. Simultaneously, the physical power diminishes, until finally the patient, unable to walk, to stand, or even to sit, is confined to his bed for the rest of his existence. Bed-sores form and deglutition becomes more and more difficult. From this cause the food may become impacted in the fauces, and thus death be produced by interruption of the respiratory process, or the food may enter the larynx. The sensibility of the lining membrane of the cheeks and fauces is notably diminished, and hence the patient in eating goes on filling his mouth, not knowing that he is doing so. When he at last attempts to swallow, the mass of food is greater than can pass down the œsophagus, and unless some one is near to assist him he chokes to death. Death may otherwise take place from a gradual cessation of the respiratory process or from sheer exhaustion. The duration of general paralysis is variable. Sometimes death results in a few months, and in others it may be deferred for five or six years. The average period is about three years. General paralysis is not likely to be confounded with any other affection than chronic alcoholic intoxication, from which the history of the case and its general progress will suffice to distinguish it. With lead-paralysis it has scarcely any features in common. General paralysis is almost invariably fatal. A few cases of recovery have been reported, but there is room for doubting that most of them were actual cases of the disease, and the others were probably, as Griesinger suggests, instances in which the remission was long.

VII. *Idiocy and Dementia.*—In idiocy there is such an abnormal organization of the nervous system or arrest of development that deficiency of mind results as a natural consequence. Many idiots are possessed of less intellectual force than well-trained dogs or other animals. Occasionally, idiots show an excessive development of some one mental faculty, which has appeared to grow at the expense of all the rest. This is especially seen as regards the capacity for appreciating and remembering musical tones and for acquiring the ability to perform automatically, as it were, upon some musical instrument. There is scarcely an idiot whose mental status cannot be elevated by systematic and appropriate education, though where the cranial development is small no very material progress is to be expected.

Dementia.—Dementia may be primary, but such is very rarely the case, it being in the vast majority of instances the consequence of an acute attack of insanity or incident to old age. The characteristic feature of dementia is mental weakness, and this is shown as regards the emotions, the intellect, and the will. The former are not held under control; slight matters bring them into inordinate action, and tears are shed and laughter excited when there is no adequate cause for the one or the other. The intellect is affected in all its parts. The power of application or of fixing the attention is materially lessened; and this is doubtless one reason why imperfect ideas are formed of very simple matters, and why it is so difficult to conceive a series of connected thoughts. The memory, especially for recent events, is weakened to an extreme degree, and the delusions of the patient, if still present, are constantly undergoing change from the impossibility of recollecting them. Volition is almost entirely abolished. The patient is altogether controlled by others, the idea of offering opposition to their wishes never entering his mind. The facial expression of a patient affected with dementia is not always characteristic, and this mainly for the reason that the physical health is generally good. The deficiency of mental power is, however, readily perceived in the majority of cases when the attempt is made to excite the brain to action. The failure of the face to respond to the ideas sought to be conveyed becomes very evident.

Causes.—Among the causes inherent in the individual none is so powerful in its action as hereditary tendency. This may show itself not only by the fact that ancestors have been insane, but that insanity in the descendants may have resulted from hysteria, epilepsy, catalepsy, or some other general nervous affection in them. It often happens, too, that the disease, like many others known to be hereditary, skips a generation. Insanity is more common in males than in females, though the difference is not so great as many suppose. The period of life between twenty-five and forty-five is that at which insanity is most liable to make its appearance. Cases are on record of infants having manifested unequivocal symptoms of mental aberration, but the affection is not often met with under the age of puberty. The civil condition of the individual as regards marriage or celibacy exercises an effect over the causation of insanity. Statistics show that celibates of both sexes are more liable than the married. So far as males are concerned, this result is probably due to the fact that in celibacy, as a rule, the mode of life is more irregular. Insanity is assuredly more common among civilized than uncivilized nations, but as regards the different classes of individuals who go to make up a civilized community, it is very certain that the refined, educated, and wealthy classes are not so liable to insanity as the lower orders. The exciting causes are both moral and physical. Of the former, emotional disturbance, grief, terror, disappointed affection, anxiety, great joy, etc. stand first in influence. It is doubtful if moderate intellectual exertion ever, of itself, causes insanity. It is only when the brain is workèd night and day, to the deprivation of sleep and without sufficient change, that insanity results from mental labor. Continual thinking on one subject is the most effectual way of producing insanity by the action of the brain. Among the physical causes, drunkenness, the use of opium and other narcotics, excessive sexual indulgence, blows on the head, exposure to severe heat or cold, the puerperal state, and certain diseases may be referred to.

Other points in the natural history of insanity, such as the diagnosis, the prognosis, the morbid anatomy, and the treatment, would lead too much into the domain of medical science to warrant consideration here.

Prevalence of Insanity.—The question whether insanity is or is not on the increase has for many years been discussed, but with no very definite result. The weight of evidence, however, appears to be to the effect that, although the number of the insane reported in official documents is greater every year, this increase is apparent only, and is due to the facts that the registry is constantly becoming more complete, that cases of insanity are, through the advance of medical science, more readily recognized, and that through the same cause there are fewer deaths, and that hence the same cases are counted every year. Thus, in a paper read before the Medico-Psychological Association of Great Britain by Dr. Maudsley in Dec., 1871, it is shown that in 1844 there were in England and Wales, 20,611 registered insane persons, including idiots, or 1 in 802 of the population; on Jan. 1, 1859, the total number was 36,762, or 1 in 535; in 1865, the number was 45,950, or 1 in 434; and on Jan. 1, 1871, the total number was 56,755, or 1 in 400.

Now, it is very clearly shown, by inquiring as to the number of new cases occurring every year, that the great increase in the number borne on the registers is not the result of any marked increase in the number of persons becoming insane in any one year. Thus, Dr. Maudsley gives the following table, showing the proportion of admissions to the population in each of the twelve years from 1859 to 1870, inclusive:

In 1859, 1 in	2,114	In 1865, 1 in	2,013
In 1860, 1 in	2,092	In 1866, 1 in	2,111
In 1861, 1 in	2,156	In 1867, 1 in	2,015
In 1862, 1 in	2,240	In 1868, 1 in	1,930
In 1863, 1 in	2,307	In 1869, 1 in	1,953
In 1864, 1 in	2,192	In 1870, 1 in	1,901

This table shows a slight increase during the last three years, but it is fully accounted for by the greater diligence exercised in finding cases, and by the fact that many cases of mental disease are recognized and counted as such when formerly they were not.

Upon the whole, Dr. Maudsley draws the following conclusions: "(1) There is no satisfactory evidence of an increase in the proportion of cases of insanity to the population; and no evidence, therefore, of an increased liability to insanity. (2) It is not necessary to assume such an increase in order to account for the undoubted great increase in the number of registered insane persons. (3) The difference between 1 insane person in 812 of the population in 1844, and 1 in 400 in 1870, is mainly, if not entirely, owing to the fact that in the former year the returns included only half the existing insane persons in the country, while in the latter year nearly all of them have been registered. (4) Some part of the difference is owing to the fact that certain patients are registered as lunatics now who would never have been thought so in times past. (5) A lower rate of mortality and a lower percentage of recoveries may account for a part of the increase in the total amount of insanity. (6) The proportion of admissions to the population, which represents approximately the occurring cases of insanity, does not, when the neces-

sary allowances are made, yield evidence of any serious increase."

In the U. S. similar conditions have existed, and like results have been obtained. Thus, in 1860 the total number of the insane, including idiots, was—of males 22,841, and of females 19,983, being a total of 42,824; while in 1870 the numbers were—for males 30,505, and for females 29,772, total 59,677. Now, in 1860 the total population was 31,185,744, giving a ratio of insane to the population of 1 in about 728; in 1870 the population was 38,115,641, or 1 in about every 637. Here the apparent ratio is not to be ascribed to any actual increase, but to the fact that the researches were more thorough in 1870 than in 1860, and that hence a greater number of the insane were discovered than in the previous census. There is no reason for believing that insanity is more common in England than the U. S., though a superficial consideration of the foregoing statistics would lead to this conclusion; but it is very certain that the registry in the former country is much more thorough. But, as will readily be admitted by all neurologists, there are periods during which insanity is more common than at others, and hence it is not safe to take any statistics which do not extend over a long series of years. If, for instance, the number of insane in France for the year before the recent war with Germany be compared with the number existing in the year after the war, the latter will be found to be much the greater; and the like is true of our own recent civil war, and of all other periods of political excitement. Still, taking the civilized world as a whole, it will be found that the exciting and restraining influences about balance one another, and that insanity is not more frequent now than it was at any former period during which records have been kept.

Care of the Insane.—In every State of the Union, with the exception of Delaware, Florida, Nevada, and Nebraska, there are asylums for the reception and treatment of cases of insanity. All the States, with the exception of those named, have one or more public institutions, and in addition there are a number of private asylums in various parts of the country. The U. S. has thus not notably failed in its duty to the unfortunate class of individuals under consideration, and a great deal of the interest which has been manifested, and which has in numerous instances led to the construction of asylums, has been due to the disinterested exertions of Miss D. L. Dix, which have led to the action of State legislatures in the direction mentioned. It is not to be doubted, however, that here, as everywhere else, the provision is not so full as it ought to be, and this is especially to be noted as regards the pauper insane, who in many States are still kept in the county poorhouses or boarded out. The whole question of such provision is still somewhat unsettled in relation to the exact kind of protection and treatment certain of the insane should receive. The advocates of entire non-restraint—which in reality does not exist—have gone so far as to recommend the establishment of colonies of the insane in villages; and one such has been for some time in operation at Gheel in Belgium, with but moderate success.

Whether or not the insane should be treated in separate and distinct institutions, or in general hospitals more or less isolated from the other patients, is a subject well worthy the fullest consideration. At a time when insanity was considered to be a disease of the mind, and not of the brain, asylums were well enough, for the treatment thought to be necessary could be more advantageously carried out by metaphysicians than by physicians. But at the present day more practical and far more scientific notions are prevalent, and it is beginning to be a recognized principle that insanity is not to be treated from any very different therapeutical standpoint than that proper for gastritis or intermittent fever. Hence, the insane require medical treatment; and the more thoroughly educated the physician is in his science as a whole, the higher will be his qualifications for ministering to the unfortunate class of beings under consideration. So far as curative influences extend, it is not to be denied that the insane may be better treated in their own homes than in asylums. But owing to the character of the insanity, or to the impossibility of providing the necessary restraint and care, a certain number of lunatics absolutely require sequestration.

Bibliography.—The number of monographs and treatises devoted to the subject of insanity is very large. The most that can be done here is to cite the more important published during the last 100 years: Crichton, *An Inquiry into the Nature and Origin of Mental Derangement, etc.* (London, 1798); Arnold, *Observations on the Nature, Kinds, Causes, and Prevention of Insanity* (London, 1806); Haslam, *Observations on Madness and Melancholy* (London, 1809); Pinel, *Traité medico-philosophique sur l'aliénation mentale* (Paris, 1809); Rush, *Medical Inquiries and Observations upon Diseases of the Mind* (Philadelphia, 1812); Georget, *Discussion medico-legale sur la folie ou aliénation mentale* (Paris, 1826); Calmeil, *De la paralysie considérée chez les aliénés* (Paris, 1826); Guislain, *Traité sur l'aliénation mentale* (Amsterdam, 1826); Conolly, *An Inquiry Concerning the Indications of Insanity* (London, 1830); Pritchard, *A Treatise on Insanity and other Affections of the Mind* (London, 1835); Broussais, *De l'irritation et de la folie* (Paris, 1839); Calmeil, *De la folie, etc.* (Paris, 1845); Esquirol, *Des maladies mentales, etc.* (Paris, 1838); Kieser, *Elemente der Psychiatrik* (Breslau and Bonn, 1855); Brigham, *Observations on the Influence of Religion upon the Health and Physical Welfare of Mankind* (Boston, 1835); Griesinger, *Pathologie und Therapie des psychischen Krankheiten* (Stuttgart, 1861); Schröder van der Kolk, *Die Pathologie und Therapie der Geisteskrankheiten auf anatomisch physiologisch Grundlage* (Braunschweig, 1863); Bucknill and Tuke, *A Manual of Psychological Medicine* (London, 1858); Winslow, *Obscure Diseases of the Brain and Disorders of the Mind* (London, 1860); Morel, *Traité des maladies mentales* (Paris, 1860); Ray, *Mental Hygiene* (Boston, 1863); also various important papers collected and published with the title *Contributions to Mental Pathology;* also *Medical Jurisprudence of Insanity* (5th ed., Boston, 1871); Leidesdrorf, *Lehrbuch der psychischen Krankheiten* (Erlangen, 1875); Sankey, *Lectures on Mental Diseases* (London, 1866); Maudsley, *The Physiology and Pathology of the Mind* (London, 1867); Blandford, *Insanity, and its Treatment* (Edinburgh, 1871); Dickson, *Medicine in Relation to Mind* (London, 1874); Hammond, *Insanity in its Relations to Crime* (New York, 1873), *A Treatise on Diseases of the Nervous System* (6th ed., New York, 1875), *Morbid Impulse* (New York, 1874), and various monographs in the *Psychological Journal.*

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Insanity before the Law. The term insanity, although unsusceptible of a strict definition, has yet received at law a convenient interpretation in the phrase *non compos mentis.* By this is meant a condition of mind, resulting from the influences of bodily disease, in which the individual has lost control of his faculties. He cannot think as he either wants to or needs to, and consequently as he would think if in the enjoyment of mental health. He is under coercion to a greater or less degree, and cannot, although at times conscious of his infirmity, overpower it by any effort of the will. He is the slave of his mental faculties, whose caprices henceforth rule him and give color to his actions. But however good may be the legal phrase *non compos mentis* when used in its general application to the insane, the attempt to subdivide this class into four categories, as made by Lord Coke, is one resting upon ignorance of the nature of the disease, and therefore confounding symptoms with sources. In his first category he places idiots or natural fools. But, properly speaking, many idiots are teachable, and can use their faculties to the extent of their possession of them, so that they are not necessarily *non compos*, any more than is an infant. Their possibilities are, like his, a question for future demonstration; and while they may always need guardians, this does not *per se* constitute them insane. So with his third category of *lunatics.* Science does not at this day admit that lunar influences can singly or conjointly tend to produce insanity. Speaking with technical accuracy, there are no lunatics, however otherwise insane any person so called may be. So also with Lord Coke's fourth category of *drunkards.* Such people, having voluntarily placed themselves in this condition, are not legally insane, since the law holds them accountable for all acts done while in that state. It is only in his second category that Coke properly describes the insane, according to modern views of the sources of their condition, by describing them as persons who were of good and sound memory, but by *sickness, grief*, or other accident wholly lose their memory and understanding.

The presence of the basic element of disease is, therefore, the indispensable prerequisite to any legal recognition of insanity; and no other form of insanity than that which springs from bodily disease is known to the law. Hence, it can take no cognizance of any forms of moral disorder, regarding them purely as varieties of depravity until they are shown to be the offspring of physical disease. Then, and then only, it considers these in their bearing upon questions of intention and responsibility. It is true that in medical investigations into the symptoms of insanity, moral acts are allowed much weight, as tending to show the progress rather than the existence of the disease; but in medicine no more than in law are such acts, *per se*, considered *primâ facie* evidence of mental disorder. For in all cases the individual must be gauged by his own standard, and questions of mental strength and competency in this direction or that are questions of *degrees* relating to facts. There is scarcely a lunatic to be found who cannot perform some acts in a rational way, and were those acts alone to be ob-

served, nothing would be discovered in them evidencing insanity. It is owing to these varieties in the complexion of this disorder, due to the differing angles under which it is viewed, that the law has recognized the necessity of varying the legal significance of the acts of persons medically adjudged to be insane. They are not to be absolutely disfranchised on this account, but their acts will be weighed apart from their condition, and if found proper and right will be sustained. The scrutiny of such acts is directed to the discovery of how far the actor was at the time an intelligent and free moral agent; and while merely importuning a person would be considered no just ground for invalidating the acts of one who was sane, it would tend to raise a presumption of undue influence in the case of one who was insane. The phrase "mental unsoundness," which is the modern synonym of the ancient term *non compos mentis*, has, therefore, been very generally adopted, because it expresses, like its Latin analogue, the fact that the mind is unbalanced, and the party not possessed of the same power of regulating its functions as formerly. Yet to the extent and within the limits of that power many rational acts may be done.

Under the shadow of these principles it follows that both mental unsoundness and weakness of mind may vary in the degrees of their manifestation to such an extent as to render their border-lines wholly indiscernible. Exactly when the transit occurs from mere eccentricity to loss of mental equilibrium, exactly when weakness of mind passes into confirmed imbecility, are moments not to be ascertained with definiteness from any single act committed. Signs, symptoms, and acts must be grouped, evidence must be cumulative and plenary before any judgment can be safely pronounced, since in no department of human evidence is there such a field for debate and contention over premises, over the relative weight of facts, and over the conclusions which can logically be deduced from them. It is here that most commonly occurs the fallacy of commuting the subjective with the objective, of thinking as we feel, and of reasoning alone from our consciousness; for it is incidental to our nature to believe implicitly the testimony of our senses, and necessarily of discrediting that which contradicts their report. Thus, many persons squander their property through extravagance who are not insane, and many persons legally adjudged insane are disposed to be frugal; the former, so far as property is concerned, need guardians more than the latter, and yet the law cannot interfere with their sovereign rights over their own so long as they are not insane. According to the standard by which the miser regulates his conduct, the extravagant are insane; according to the opinion of the extravagant, the miser is insane. Each judges the other by the rule of his own life and the standard of his own feelings, and thus it is that each may judge erroneously.

The modern phrase "mental unsoundness" is intended to cover the same ground as the varieties of *non compos mentis* did at common law. It is to be distinguished, therefore, from the phrase "insanity," which implies the highest grade of unsoundness as tested in any particular direction. Thus, the term "partial insanity at law" is the equivalent of monomania in medicine, and imports limitation in the *extent* rather than in the *degree* of insanity. It is complete insanity as far as it goes, and as such tends to nullify all civil acts infected by it. In mental unsoundness we have rather an inappetency than a strict disorder of mind founded upon bodily disease. We can apply the term with propriety to any adult mind in which there is present a manifest incapacity to deal with the ordinary contingencies of life. Hence, we may speak of an idiot or imbecile as being mentally unsound, meaning thereby that such person is unequal to the ordinary strains of complex business relations, although able to feed, clothe, and protect himself. In him the incapacity consists in not being able to rise above a fixed plane of action, while in the partially insane the mind can attempt, and does generally, to execute, but does this in a faulty way, obedient to the coercion of some disordered faculty or overpowering delusion. The law, adapting its principles to these varying phenomena of mental action, therefore recognizes *insanity*, *partial insanity*, and *mental unsoundness* as varieties of mental incapacity, passing from simple weakness to complete delirium and incoherence of ideas.

Insanity, or Mania.—Insanity proper is distinguishable, both in law and medicine, from the merely temporary delirium of fever, and is only recognized as a condition of legal incompetency when become an established habit of life. The common law takes no special cognizance of acute stages as set opposite to chronic, the problem to be solved in every inquisition of lunacy being simply that of *compos* or *non compos*. Statutes may, for purposes of hospital classification or equitable regard for individual and pecuniary circumstances, establish special distinctions among the insane, as in the State of New York, where they are classified as either *private* patients, *indigents*, or *paupers.* But the common law knows nothing of this kind, its inquiry being directed to the question of *sane* or *non-sane* as an established condition. Hence, even a habitual drunkard or an imbecile is not considered legally insane, but only weak-minded to the extent that evidence may show him to be unfitted to manage his own affairs. Little need be said, therefore, to show that insanity, under whatever name recognized in medicine, has but one designation in law, and that designation is founded upon the fact that mental incompetency exists in such permanent form that there is continuous enslavement or duress of the reasoning faculties. Consequently, every act performed by such a mind which involves responsibility at law is *voidable*, although not necessarily void. There may be acts which, without injury to other parties, enure to the benefit of the lunatic, and it would be manifestly a wrong to him to set them aside merely because of the condition of mind in which he performed them. Thus, a lunatic may purchase necessaries or employ a physician or any other skilled labor, and his contract would be sustained if otherwise reasonable. The law always permits the exercise of every right which an individual can enjoy without injury to others or himself. Hence, persons legally insane and in charge of committees have been allowed to perform many acts of a character implying the possession of mental competency to a certain degree. Nor is there anything paradoxical in this, since it is simply following the law of our mental constitution, which presents us with great disparities of strength in the faculties of the same mind even in health. In law no person is presumably insane until after office found, and parties may deal with him as though sane, provided nothing in his manner or language be calculated to give warning of his real condition. In such cases, as elsewhere stated, his contracts are not even voidable if their subject-matter has passed into such a condition that it cannot be restored to its previous state. It would be a great hardship and a manifest wrong to a *bona fide* purchaser from a lunatic for a valuable consideration, who had subsequently disposed of the property, to compel him to restore it specifically; and it is difficult to conceive of any principle of equity upon which this could be demanded from the mere incident of the party's lunacy. If the transaction is untainted by fraud, why should it be set aside? If it be a reasonable act reasonably performed, that is all which the law can or does exact. But as the act is always open to suspicion derived from the mental condition of one of the parties, it behooves men to know whom they are dealing with, and to what extent their transactions may be subsequently voidable. Whence it follows that whenever a person is in charge of a committee, this constitutes to the world notice of his mental incompetency, and all persons deal with him at their peril. It is not competent for them to plead ignorance of these facts, because they are barred by a judicial record; and although it may be that nothing in the conduct of the lunatic or the character of the transaction is suggestive of insanity, still courts of equity will readily intervene to annul the contract if the least cloud of suspicion is seen to rest upon it.

Partial Insanity.—It is unquestionably demonstrated in medicine that such a condition as that known under the name of *monomania* or *partial insanity* cannot exist *strictissimis verbis*. "We are mad or not mad; we cannot be half deranged or three quarters, full face or profile." Such is the language of one of the leading European authorities in psychological medicine. These are facts which all experience of insanity certifies to. But, practically speaking, an insane person may do many reasonable things which, having no flavor of insanity in them, the law will not set aside. To that extent, therefore, it legalizes a sane act by whomsoever committed. And if a person being notoriously insane is capable of doing habitually a majority of his acts in a reasonable way, and only a few in a persistently insane way, there seems to be no just objection in law, particularly for convenience of description, to designating such person as *partially* insane. For, after all, insanity is largely a question of *degrees* of more or less mental power, and it cannot be gauged by the same standards which medicine applies to it. Municipal law must rest of necessity very largely upon artificial reasons, including convenience as among its chief ones. And since insanity proper has its varying temperatures and seasons, during which the individual becomes more or less competent to perform ordinary acts in a reasonable way, it follows as a corollary that one who has never exhibited this form of disease in any other than a mild type is entitled to as much more freedom of legal action, as he would be to as much more freedom of personal liberty if in an asylum. The simple question at law is this —viz. To what extent are his acts rational? If they be so in the majority of instances, then in the majority of in-

stances his acts do not differ from those of a sane man, and to that extent they deserve to be sustained. It is only for convenience' sake that the term "partial insanity" is used, for the legal principles governing it are all found applying to insanity in its larger sense, and the latter includes the former both legally as well as medically. Municipal law looks only to the *results* of disease in its psychological inquiries, and does not concern itself with specific names or phases of insanity, both which are often but symptoms of a common disease arrived at different stages of progress. Hence, courts cannot make judicial distinctions in the civil or criminal responsibility of the insane based upon medical designations of the particular form of that disorder under which they may labor. It is sufficient for them that the *result* of such disorder has been to degrade or to overthrow the reason, because the condition of the *reason* and the *will* are the only standards by which the law judges human responsibility. It might happen, indeed, that in a question relating to the existence or non-existence of lucid intervals the predicability of such could not be determined without knowing the degree or form of mental disorder which the party exhibited, but it is clear that even in such cases courts would venture to give no opinions of their own, relying solely upon those of medical experts. Therefore, there are no legal grounds upon which to discuss such topics as *melancholia* or *dementia*, since they are not specific diseases, but only symptoms of insanity, either in its incipient, its middle, or its last stage. Formerly, these were treated as *varieties* of partial insanity; now a better comprehension of the pathology of that disease has classified them where they belong, among symptoms. It is for these reasons that American courts have not followed the dicta of English tribunals in passing upon questions involving partial insanity. All our decisions, whenever this point has been mooted, have reaffirmed the one cardinal principle that the law cannot concern itself with degrees of insanity, and that it is sufficient, in the interests of true equity, to lay down the rule that wherever the subject-matter of the transaction, be it contract or will, is not infected with insanity, the act even of one alleged to be partially insane is only voidable, and not *ab initio* void. In England this was also the rule, repeated and reaffirmed in all those decisions which have immortalized the name of Sir John Nicoll, nor was it ever questioned until the year 1848, when Lord Brougham, in a case before the privy council, ruled that it was erroneous to suppose that a mind shown to be partially insane could be really sound upon any subject, and therefore competent to make a will. This decision was the first introduction of a purely psychological dogma into the elements of a legal judgment, and while abstractly sustainable on the basis of *falsus in uno, falsus in omnibus,* has not, as before stated, secured any favor before our courts. Hence, with us partial insanity does not necessarily invalidate an executed contract, nor testamentary capacity, unless it enters into and infects the subject-matter of the contract or will. Where no evidence of such mental disorder appears upon the face or in the texture of the instrument, the partial insanity of the testator at the time of its execution, although a matter of general notoriety, as where he was in charge of a committee, will not, *ipso facto*, invalidate his will. Nor do defects of the senses incapacitate if the testator possesses sufficient mind to perform a valid testamentary act; but in such cases it must be proved that the mind accompanied the will, particularly where such instrument is neither holographic nor officious. These doctrines of American law, it will be seen, are far in advance of those of the civil law, which rendered the deaf and dumb intestable if the infirmity was congenital, or of British courts, which adopt the rule that every act of an unsound mind is necessarily an irrational one.

So, too, in relation to responsibility for *crimes* committed by persons alleged to be partially insane or temporarily insane, the law has discarded all those terms of medical designation which imputed insanity to the instincts alone. Regarding these, when perverted, as exponents either of voluntary depravity or as states of mental duress and loss of self-control arising from disease, it requires to know simply whether the party is capable of discerning the true nature and consequences of his acts, coupled with the power of acting or abstaining from acting in a particular way. And if not, why not? The true test of criminal responsibility before the law is the possession of reason and free-will. When both these are present the party is responsible; when either is absent, he is not. By reason is meant an intelligent comprehension of the circumstances in the midst of which one is placed; and by free-will is meant the power of doing or abstaining from doing a particular act. No mental duress can be pleaded as insanity which has not its foundation in disease. Hence, drunkenness or heat of blood, both which work loss of self-control and possibly reason, are not bars to criminal responsibility, for they do not, in their uncomplicated form, rest upon disease as their foundation; and yet a case may be imagined where a sane epileptic might become insane through drink or heat of blood to such an extent as to be an irresponsible agent. Here the foundations of mental power are already undermined, and a cause of insufficient magnitude to overthrow a healthy brain becomes the determining factor in the production of insanity; for, after all, the only physiological test of mental power is the ability to bear strain.

Mental Unsoundness.—The condition known as mental unsoundness at law is one which is easily confounded with imbecility wherever the congenital character of this state is overlooked. There are those, too, who may think that the attempt to distinguish them by name is an attempt to establish a distinction without a difference in fact. But it will be seen upon reflection that a born imbecile does not necessarily present us with a case of unsound mind, for every child, if his mind does not develop proportionally with his body, but remains infantile after adult age, represents to a certain extent imbecility in some one of its phases. There may be weakness in intensity or extensity of action in minds otherwise sound, without, however, there being absolute imbecility, for there are as many varieties of original constitution among healthy minds as there are among healthy bodies, and every one must be judged by a standard which is derived from observations made upon the majority of men. What constitutes absolute mental health or absolute mental strength is a very difficult question to answer categorically. Mental unsoundness is frequently used also as synonymous with insanity, and in medicine there is no impropriety in commuting these terms, but at law there is a distinction between them, resting upon the fact that mental unsoundness may be, and frequently is, due to other causes than disease, whereas insanity, whether manifested as *mania, melancholia,* or *epileptic vertigo*, has always a foundation of physical disease to rest upon. Thus, mental unsoundness may arise from age, from habitual drunkenness or other vices producing precocious senility, or from a natural exhaustion of the mental powers as a consequence of inherited weakness, though unaccompanied by appreciable bodily disease. Its subjects not being necessarily dangerous to themselves or the community, it would be wrong to deprive them of their liberty or the control of their property from the simple fact of mental unsoundness, until it was first shown that some form of guardianship was necessary for their well-being. And while in an individual pursuing a mechanical vocation mental unsoundness, to even a very considerable degree, might not impair his usefulness, in a professional man like a judge, a lawyer, or a physician the least dimming of the mental mirror might jeopardize the entire value of his personal services, and require also, from the more enlarged character of his possessions, that their care should be assigned to a guardian or committee. The necessity for thus differentiating men according to the extent of power present in them for self-guidance or the care of property forms one of the most delicate and difficult problems with which courts of equity have to deal; for it is always reducible to a question of plus or minus power, measured both in action and at rest, in the midst of such variable factors as age, health, previous education, habitual employment, future exigencies, and the like, all of which have a disturbing influence in reading the scale of any human being's character and possibilities. Nevertheless, the distinctions between simple mental unsoundness and positive insanity may be drawn with sufficient clearness to enable us to classify an individual with relation to his civil responsibility, because the law will always secure him his personal rights to the fullest extent commensurate with his ability to enjoy them, treating him not as an imbecile absolutely, but as one over whose mind a film has come of unequal density and of varying consequences. His power over property, and much more over his own person, will not be taken from him until it is abundantly shown that its further exercise is incompatible with personal safety or pecuniary welfare.

In determining criminal responsibility in connection with mental unsoundness a different standard has to be employed. The peace and safety of society requiring that every individual should restrain his passions in their tendency to overpower his self-control, the mere fact of mental weakness is not an answer to an indictment for crime unless that weakness or unsoundness be the direct offspring of disease, and the disease overpower the reason and the free-will at the moment of committing the offence. A weak mind is not absolved from the duty of watching over its own conduct and restraining its evil propensities; and while it might not merit the same degree of punishment for offending as a strong one, it would be wrong to assert that it was wholly dispunishable either in law or *in foro conscientiæ.*

JOHN ORDRONAUX.

Insanity before the Law (SUPPLEMENTAL). *Jurisdiction of Courts of Chancery as to the Custody and Control of Insane Persons.*—The court of chancery in England has, from a very early period, exercised a general power of supervision and control in relation to the interests of persons of unsound mind, their custody, and protection. This power, though its origin is somewhat obscure, is generally deemed by writers upon equity jurisprudence to have had its source in the general delegation to the court of the inherent prerogative of the Crown as *parens patriæ* to protect those who are incapable of protecting and caring for themselves. But as the result of legislation in the reign of Edward II. (1301), the authority of the chancellor in regard to insane persons has been in many respects conferred since that time by special commission from the Crown under the king's sign-manual. This warrant gives to the chancellor the right to provide for their maintenance and for the care of their persons and estates. The chief objects for which this special jurisdiction of the court is exercised are the ascertainment of the fact of insanity by a judicial investigation, the placing of a person judicially declared to be insane under the guardianship of one or more persons termed a "committee," and the subsequent control of the committee in the management of the insane person's property and the custody of his person. In making an inquiry in regard to a person's insanity, the practice is to issue a commission out of the court of chancery, upon a proper petition addressed to the chancellor, authorizing the commissioners therein designated to examine into the person's mental condition with the aid of a jury, and commanding them to report to the court the result of the inquisition. This commission is said to be "in the nature of a writ *de lunatico inquirendo*." The commissioners have power to summon witnesses and to examine the person himself who is supposed to be insane, if he thinks fit to be present. The commission may issue even against a non-resident if he have lands or other property within the jurisdiction of the court. The degree of mental unsoundness which will justify the appointment of a committee need not be so great as to amount to idiocy or lunacy. Mental imbecility, resulting from age, infirmity, disease, or the decay of the natural powers, may be sufficient. The finding of the jury, however, must show that the person is to such an extent of unsound mind as to be incapable of governing himself and managing his property and directing his affairs. And this conclusion must be directly stated in the report as the result of the investigation, and appear as a positive verdict by the jury. It will not be enough to state the facts proved which indicate the existence of insanity, leaving it for the court to draw the conclusion that it actually exists, since this is the appropriate province of the jury. If there be any irregularity in conducting the inquisition, or if the return be insufficient in law, or if the verdict rendered be attributable to mistake or partiality, the inquisition may be quashed and a new commission be issued. If the return untruly finds the party insane, it may be traversed (or alleged to be false) by himself or, on proper terms, by any one who has a claim against him upon contract; and the court may in its discretion allow funds out of the estate for the trial of the issue thus formed. In the appointment of a committee, relatives of the person adjudged insane are usually chosen, though this is not necessary. It is the duty of the committee to manage the property entrusted to their charge carefully and prudently, to make such investments as may be necessary to keep the estate reasonably profitable, and to account for the manner of administration when required by the court. All gifts or contracts made by the insane person himself after the actual finding of the inquisition are utterly void. The power of the committee to deal with the property in the exercise of an independent discretion is very limited. In most instances special authority to charge or dispose of the property must be obtained from the court. In the management of the estate under the direction of the court the interest of the insane person is to be regarded rather than the interest of those who are entitled to the succession. An order may be made authorizing a change of personal property into real or of real into personal, if it be deemed for his advantage. So, in making provision for those who are dependent upon him, the same principle is followed, and expenditures may be made out of his property which he is not legally bound to incur if they are substantially for his advantage. Thus, if the father of a family be a lunatic and under the charge of a committee, the mere legal right of his wife and children will not be regarded by the court, but an allowance may be made suitable to their station in life. Provision may even be made in some cases for the support of persons who are not related to the insane person, and have no legal claim upon him for maintenance, as, *e. g.*, persons whom he has adopted as children, or his brothers and sisters. This is on the ground that it is reasonably presumable that the owner of the property would have made a like disposition of the income under such circumstances, and that his interests are promoted by assisting those whom he has made dependent upon himself, or who are intimately related to him. In such cases the court exercises its own discretion in fixing the amount of the allowance which it authorizes to be made. The education of the children of the insane person and a reasonable provision for the ordinary expenditures of his family will be deemed of special importance by the court. After a proper allowance has been made for the maintenance of a lunatic and his family, any surplus remaining will be appropriated to the payment of his debts. Upon a petition by a creditor a reference will be ordered to determine the amount of the debt and its validity, and if a report be made in favor of the creditor, the court will order the debt to be discharged if there are sufficient assets. After the appointment of a committee, suits in behalf of the lunatic must be instituted in the name of the committee, who are responsible for the conduct of the suit. The lunatic, however, is usually joined as a party plaintiff. So suits against the lunatic are brought against the committee. On the death of the insane person the power of administration ceases, though the committee still continue under the control of the court until there has been a final accounting. Should an insane person after being placed under the guardianship of a committee be restored to soundness of mind, the court may either remove the committee altogether, or suspend its authority until it can be ascertained whether the restoration to sanity will be permanent or temporary. The members of a committee are not allowed, as a general rule, any compensation for their services, but are only entitled to receive remuneration for necessary disbursements. The question has recently arisen whether if a person has become permanently insane, but no inquisition has been held and no committee appointed, a suit can be brought in his behalf by his next friend; and it is held that this may be done.

In this country courts of equity in some of the States exercise the same jurisdiction in relation to persons of unsound mind as the English court of chancery. This is the case in New York. In other States such persons are placed under the charge of guardians appointed by courts of probate, as in Massachusetts. The mode of appointing a committee or guardian and the extent of their authority are usually regulated to a great degree by statute. The same general principles prevail in regard to the power of the court exercising such jurisdiction, and its control over the management and disposition of property, as have been established in the English procedure, though minor differences exist which need not be here detailed. In some of the States the same power is exercised in regard to the custody and control of habitual drunkards and spendthrifts as in relation to insane persons. (See Shelford on *Lunacy;* Willard on *Equity Jurisprudence;* Adams on *Equity.*)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Inscrip'tion [Lat. *in*, "on," and *scribere*, to "write"], language inscribed, sculptured, written, or impressed upon clay tablets, metals, wood, stone, or other material except papyrus, paper, or other fragile substances used for books. Stone was principally used for the purpose, and rocks at the very earliest period, some nations, as the Egyptians, Assyrians, Greeks, and Romans, using inscriptions for official and other records. In the East the oldest Babylonian and Assyrian inscriptions, cut in the cuneiform or wedge-shaped characters, date as early as the oldest Babylonian (or Assyrian) reign, being that of Urukh, about 2000 B. C. These were continued as late as the Roman empire, and the most remarkable is that of Darius Hystaspis at Behistun, giving an account of his subjection of the different nations and rivals to his power. It is in three kinds of cuneiform and languages—the Persian, Median, and Babylonian. Another remarkable inscription is that of Hadji Abad, in a character called Pehlevi—which later came into use in Persia—and is supposed to refer to the Parthian monarch Sapor. The inscriptions of the Egyptians are as old as the Babylonian, and are in the hieroglyphic character, the oldest known being a slab of the reign of the monarch Sent of the second dynasty, according to some chronologists above 3000 B. C. In Egypt the use of inscriptions more extensively prevailed than elsewhere, the walls of tombs, temples, and other buildings, besides objects of use or attire, being covered with them. The most remarkable are those recording the working of the mines at Mt. Sinai from the third to the eighteenth dynasty, others detailing the expulsion of the Shepherd rulers or invaders, the wars of Thothmes III. and Rameses II., the invasion of Egypt by the Ethiopian king Pianchi, the tablet of San or decree of the synod of priests held at Canopus 238 B. C., and the Rosetta Stone, or synodical decree of priests at Memphis 196 B. C., both of which are

in three languages, Egyptian hieroglyphic, Demotic, and Greek, and which are keys to the decipherment and interpretation of the hieroglyphs. Amongst the Semitic nations of Palestine inscriptions were more rarely used, and seldom of any length. Of these, the best known are the inscription on the coffin of Asmunazar, king of Sidon, and the Dhiban Tablet or Moabite Stone of Mesha, king of Moab, about 900 B. C., the oldest known in the Phœnician character. Numerous inscriptions are found in the Wady Mokatteb at Sinai, supposed by some to have been the work of the Israelites after the Exodus, but now referred to a later date, about 300 B. C. or later, and attributed to the Nabatheans. Many Himyaritic inscriptions of a still later date have been found at the dyke of Mareb and Sanaa in Southern Arabia, some on bronze plates which have been affixed as votive offerings to the temples of the gods. Beyond the rule of the Egyptians few or no inscriptions have been found in Central and Southern Africa, but at the sites of Carthage and Utica, Punic inscriptions, chiefly votive, in a Phœnician character, have been found, and at Dugga and other places, in a peculiar script called Libyan, one bilingual in both characters. Another remarkable inscription is a bilingual one in the Cypriote and Phœnician character found at Dali, dated in the reign of Melekiathon, king of Cittium and Idalium. The Jews appear not to have used inscriptions at an early period, and none are known earlier than the Christian era. It is in Greece that inscriptions of all classes and on all objects abounded, the oldest to which a date can be given being that of Abusimbel in the reign of Psammetichus I., about B. C. 665. They have continued in use till the present day, and some of the most remarkable have been found at Athens; but on the whole, the Greek inscriptions, although throwing considerable light on the municipal and social life of the Greeks, are not of great historical value. The Roman inscriptions, which commence with the republic about the time of the fall of Corinth, 145 B. C., continues till the extinction of the Latin language. There are also above 2000 Etruscan inscriptions, but the language has not been deciphered. In India no inscriptions have been discovered earlier than the age of Asoka, about 400 B. C., but in China that of Yu has been referred to 2205 B. C., although its authenticity is more than doubtful. Inscriptions of 1200 B C., however, exist. Those of Indo-China and Japan are much more recent. In America the inscribed monuments of Mexico and Yucatan are of an undefined antiquity. For palæography, the verification of history, chronology, geographical sites, the appreciation of the social and municipal condition of nations, and the relative antiquity of monuments, inscriptions are of the highest importance. In numismatics, *inscription* means the letters in the area, not round the device. Inscriptions are more sparingly used in modern times, except for sepulchral purposes, printing having superseded their public employment. They are sometimes found in relief or in bronze letters attached by plugs to marble or other material, and were often painted for greater distinctness. S. BIRCH.

In′sect Fertiliza′tion. One of the most significant modern discoveries in the domain of vegetable physiology is that the services of insects are indispensable for the fertilization of numerous kinds of flowers, which are so constructed that the pollen cannot pass without external aid from the stamens to the pistils of the same plant, much less to those of other plants. Hence, these flowers are provided with a nectar which attracts insects, and is so placed that to reach it they must first come in contact with the stamen, from which the pollen adheres to the insect's body, and is communicated in the same manner to the pistils of the same or of other flowers. The popularization of these facts is chiefly due to Mr. Charles Darwin, who, in his monograph on *Fertilization of Orchids* (1862), has exhaustively traced the operations of insects in relation to a single botanical family.

Insectiv′ora [Lat. *insecta*, "insects," and *vorare*, to "eat"], an order of ineducabilian placental mammals whose anterior as well as posterior limbs are primarily adapted for walking, although they may be secondarily modified for other purposes. The carpal bones of the proximal as well as distal rows, and the metacarpal as well as phalangeal bones, are normally differentiated and developed; the ulna and radius are more or less distinct; clavicles are always present and well developed; the hind limbs are normally related to the pelvis, and their elements to each other; no calcar or spur-like appendage above the ankle is developed; the lower jaw has well-defined condyles, which are more or less transverse, and are received into special glenoid pockets. The teeth are diphyodont, and are of three kinds (*i. e.* canines, molars, and incisors), but are more or less aberrant from the typical forms; the molars in the most familiar types have sharp-pointed cusps. The placenta is deciduate and discoidal. The order is divisible into two sub-orders—(1) Dermoptera, including the Galeopithecidæ; and (2) Bestiæ, including all the other members of the order. These sub-orders are chiefly based on modifications of the anterior members and of the dentition. (1) The Dermoptera are Insectivores with members modified for flight or progression in the air, the limbs being much elongated and very slender, and connected by an extension of the skin which involves the wrists and ankles and advances forward to the neck, and backward inclosing the tail; the condylar portion of the lower jaw extends outward; the incisor teeth of the lower jaw are palmate and deeply pectinated, while those of the upper jaw, as well as the anterior molars of both jaws, are compressed, and have multicuspid crests. (2) The Bestiæ are Insectivores with members modified for walking or progression on the ground, the limbs being comparatively short and robust, and free; the condylar portion of the lower jaw does not extend outward; the incisor teeth of the lower jaw are conical and not pectinated; those of the upper jaw, as well as the anterior molars of both jaws, more or less conic, and with unilobate crowns. The *Bestiæ* are divided into eight families—viz. Tupayidæ, Macroscelidæ, Erinaceidæ, Talpidæ, Soricidæ, Centetidæ, Potamogalidæ, and Chrysochloridæ. These types are limited to the northern hemisphere, Asia, and Africa, only one (Centetidæ) being represented in Cuba and Hayti, and none in South America or Australia. THEODORE GILL.

Insectivorous Plants capture insects and consume them. That some plants capture insects has long been known; that a few might possibly make use of their prey as food was suspected long ago; but it is only of late that the suspicion has deepened into certainty. The clearest case is that of *Dionæa muscipula*. (See DIONÆA.) An allied plant, DROSERA (which see) or Sundew, effects its captures by the aid of bristles which are somewhat sensitive, and have at their glandular tips drops of a glutinous exudation. This insect-lime holds its victim while the surrounding tips converge towards the insect. *Pitcher-plants* (see DARLINGTONIA) of different families attract insects to the open mouth of their hollow leaves. The mouth is guarded by short stiff needles which point downward. Over these the descent of the insect is easy, a return difficult. In the liquid of the hollow leaf insects are drowned, and soon decompose. That the liquid thus enriched serves as food for the plant is not proved, but is probable. Minute animals in water are entrapped by the leaf-appendages of *bladderwort*. The stomach-shaped sacs have a mouth provided with delicate hairs which converge within to form a funnel. Through this guard minute organisms can pass in, but not readily out. The mechanism for entrapping is elaborate; it is unlikely that the captures effected by it are not of service to the plant. Mr. Charles Darwin published an elaborate work on *Insectivorous Plants* (1875). G. L. GOODALE.

Insects. See ENTOMOLOGY, and the names of the orders and of important species of insects.

Insesso′res [pl., the Lat. for "perchers"], a term used by ornithologists in various senses. Some systematists apply the term to a great sub-class, including the order Passeres (Oscines, or "singers," Clamatores, or "crying-birds," etc.), the order Strisores, or "shrieking birds," and the order Raptores, or "birds of prey." Others exclude the Raptores from the order. But most popular authors make the term synonymous with "passerine birds," and consequently make the term a comparatively narrow one.

Insol′vency [Lat. *in*, and *solvere*, to "pay"], the state of a person who is unable to pay his debts as they fall due or in the usual course of trade or business. This is the general and most comprehensive sense in which the term is used, but in the English law until recently it was usually employed in a restricted technical meaning, and was carefully distinguished from bankruptcy. A bankrupt under the English system was a trader or merchant who had become unable to pay his debts. Those only were termed insolvents who were not traders or merchants, and could not meet their obligations. In the legislation regulating the distribution of a failing debtor's property among his creditors the same distinction was preserved, and laws were termed bankrupt or insolvent laws according as they applied to one or the other class of persons. The additional distinction was also established that bankrupt laws operated to relieve a trader absolutely from his present indebtedness, while insolvent laws only discharged a debtor from imprisonment, while they left his future acquisitions still liable to the claims of his creditors. But even in England these precise distinctions are disregarded in recent legislation, and it is declared in the latest bankrupt act, which took effect on Jan. 1, 1870, that all persons may be adjudged bankrupts whether they are traders or not. This statute contains the same general provisions concerning the

adjudication of bankruptcy in reference to all classes of failing debtors, and makes no distinction between them in regard to the right to obtain a discharge and the method of procuring it. In the U. S. the accurate discrimination between bankruptcy and insolvency which formerly prevailed in England has never been observed in legislation. Statutes of the States have been termed insolvent laws which were similar in their objects and the general nature of their provisions to the English bankrupt acts. There has, however, been a somewhat different application of the terms bankrupt and insolvent in actual usage, though this has depended upon other grounds of distinction. By the U. S. Constitution power is given to Congress to establish a uniform rule on the subject of bankruptcies throughout the U. S. In pursuance of the authority given by this provision, statutes have from time to time been enacted by Congress which have been designated distinctively bankrupt acts. Those enacted before the act which is at present in force were repealed within a few years after their passage, and laws passed in the States severally upon the subject took their place. These State statutes were generally termed insolvent laws by way of distinction from the legislation of Congress, even though there was no material difference in the general character of the provisions which they contained. The discrimination, therefore, did not depend upon the diverse nature of the laws adopted, nor upon the different classes of persons affected by their provisions, but upon the circumstance whether the legislature by which they were enacted was a State body or the U. S. Congress. This distinction, however, did not rest upon any substantial basis, and the terms "bankruptcy" and "insolvency" were often employed interchangeably. It was decided that a bankrupt law might contain those regulations which were generally found in insolvent laws, and an insolvent law might contain those which are common to a bankrupt law. The power given to Congress to establish a system of bankruptcy laws causes its legislation upon the subject to supersede that of the States. This was the effect of the present bankrupt act, which went into operation in 1867. It would, therefore, be of little importance to consider the insolvent systems of the several States as they prevailed before the adoption of this act. They were all enacted for the same general purpose, to secure the division of a failing debtor's assets proportionally among his creditors, though the regulations prescribed for the attainment of this object were somewhat diverse. The provisions of the present bankrupt law will be found under the title BANKRUPT. The supersedure of the State insolvent laws by the U. S. system of bankruptcy has been a salutary change, since the regulations thus established by Congress have a uniform effect and operation throughout all the States, and controversies similar to those which previously arose in regard to the effect in one State of decisions under the insolvency laws of another can no longer occur. The operation of the law of each State upon the subject was confined to its own limits, and a debtor's discharge obtained in one State might be of no validity in another.

It is not an uncommon practice for insolvent debtors to avoid the necessity of a resort to the methods of obtaining a discharge from their indebtedness established by bankrupt laws, by a voluntary arrangement with their creditors, who agree to accept a part payment in full satisfaction of their claims, and grant the debtor a complete release. An agreement of this kind is technically termed "an agreement for a composition," or simply "a composition." This is usually made by deed termed a "composition deed," though when the indebtedness is based upon simple contract the agreement may be made by parol—*i. e.* either orally or by an instrument not under seal. The composition must in all cases be founded upon a sufficient consideration or it will have no validity. When the arrangement is made with a single creditor, the agreement which he makes to accept a certain percentage of the debt in full satisfaction, even though it be followed by an acceptance of the amount fixed upon, will not constitute a consideration and the arrangement will be void. Even if a receipt be given which is expressed as being in full discharge of the claim, the debtor will still be liable for the entire debt. That the agreement may be binding in such a case there must be a new and independent consideration, such as the payment of a sum of money by a third person, or an engagement by the debtor to pay the reduced sum in a manner or at a time more advantageous to the creditor than was originally agreed upon, or there must be a release under seal, which imports a consideration. But an arrangement for a composition made with more than a single creditor will be valid, though there be no independent consideration. The benefit which each creditor gains by the engagement of the others to forbear, and the consequent securing of a fund for the mutual benefit of all, is a sufficient consideration to sustain the agreement into which they mutually enter. The composition deed or agreement is not required to be of any special form. It may contain such reservations or conditions as the parties may choose to insert and make binding upon themselves, provided these are not fraudulent nor invalid by general rules of law. Thus, it is sometimes provided that the agreement shall not be binding upon any of the creditors executing it until each and every creditor who has a claim against the debtor shall also enter into the same compromise. So there may be a reservation in the deed preserving the rights of a creditor against the debtor's sureties, though it provides for an absolute release of the debtor himself, and contains a covenant not to sue him. Such conditions will be held valid, and will be enforced according to their terms. If they are not fully complied with, the debtor will be liable to the extent of his original indebtedness. It is not necessary that all the creditors of an insolvent enter into the composition deed. If any less number agree to its terms, they will be bound by it, and will only be entitled to the percentage agreed upon, unless they have qualified their acceptance by the stipulation that the consent of all must be obtained before any shall be bound. One partner may agree to a composition of a partnership debt, and the agreement will be binding upon the firm. A creditor's assent to a composition may be signified as well by surrendering debts and taking composition notes as by executing a composition deed. But after such assent has once been given, in whatever proper mode it may be indicated, it cannot be subsequently withdrawn by the creditor without the debtor's consent if the agreement be originally valid and be properly fulfilled. But if any one of the creditors be afterwards refused the benefit which a faithful performance of the agreement would afford him, it will cease to be binding upon him. So, unless payment of the sum stipulated in the agreement for composition be made at the time appointed, the original debt is revived. Any creditor who joins in a composition is not allowed to include in it only a portion of his claim against the debtor, and sue for the amount of the residue. He must agree to a compromise of the entire claim, or else avoid entering into the composition arrangement. When a creditor signs his name to a composition deed without specifying the amount of the indebtedness, the agreement will be held applicable to the full amount of his existing claim. After a composition has been agreed upon with several creditors, every agreement or arrangement by which an advantage is secretly secured to any one of them which is withheld from the others is a fraud upon the creditors from whom it is concealed, and consequently invalid. No securities given in pursuance of such an agreement will be enforceable. So, when there is an arrangement for a composition it is a fraud in any one creditor to sue the insolvent contrary to the terms of the compromise. Composition deeds and other agreements of a similar nature, if fairly made and executed, and not invalidated by any subsequent fraudulent transactions, will be duly carried into effect by the courts. The validity of such arrangements depends upon the same principles as the legal doctrine of accord and satisfaction. (See ACCORD AND SATISFACTION.) They accomplish practically the same results as bankrupt and insolvent laws, by securing a ratable division of an insolvent debtor's assets among his creditors as a condition of his full discharge.

Another mode by which insolvent debtors are accustomed to secure a division of their property among their creditors, without taking advantage of bankrupt laws, is by making an assignment in trust for the benefit of their creditors. The assignee of the property becomes a trustee, and the creditors are *cestuis que trust.* Such a transaction is governed by the general rules pertaining to all modes of assignment in trust, and the assignee stands in the same position with reference to his rights and defences against third persons as the assignor. He is under the same responsibility as all persons who are authorized to administer a trust fund, and is held to a faithful discharge of his duty. The mode of making the assignment and of distributing the assets received is frequently regulated by statute. It is also sometimes provided that a schedule of the debts payable and the available assets be delivered to some magistrate, with an affidavit as to its accuracy, and also that the assignee shall give a bond with sufficient sureties. If the assignment is fraudulent, it may be set aside. Before the enactment of the U. S. bankrupt law a debtor might make in some of the States what were known as preferential assignments, by which the claim of one creditor might be preferred to that of another; but this act prohibits the making of such assignments within a specified time (two months) before the filing of the petition in bankruptcy. Such an assignment, if made, is void, and the assignee in bankruptcy may recover the property from the party receiving it. The claims of all the creditors must be paid proportionately. GEORGE CHASE. REVISED BY T. W. DWIGHT.

Inspira'tion [from the Lat. *inspiratio;* Gr. ἔμπνευσις or ἐμπνεῖν, to "breathe into" or "upon," to infuse into, to inspire (the soul) from some supernatural source. In the classics it may be the mind under the influence of any divinity, but the New Testament, by the use of the adjective θεόπνευστος (2 Tim. iii. 16), defines this source to be the one personal God], that superintending influence of the Holy Spirit over the minds of Scripture writers which secures such a record as God designs. The subject is important, as attempting to answer the question, Have we in the Bible an infallible guide to religious belief and practice? The method best adapted to an impartial consideration of the moral evidence is—*first,* indications of the superhuman origin of the Bible; *second,* objections to the same; and *third,* specific inspiration.

I. Superhuman Origin of the Scriptures.—Of the lines of argument indicating this, the following may here be given.

1. *The Scriptures of the Old and New Testaments constitute a unique book,* being (*a*) the product of many writers scattered over a period of ten centuries, and so without the possibility of consulting as to the design or character of each other's writings; and yet, (*b*) though independent compositions of many men in different ages, still a self-consistent whole—a *unity* in doctrine and method, in both respects unlike all other books. At the same time, (*c*) it has a thoroughly historic basis and application, thus rendering a unity, on the one hand, more difficult, and affording on the other a valuable test of credibility. "This alone sharply discriminates it from all other so-called sacred books, from which the historic element is almost wholly wanting." (*Rogers.*) (*d*) Through great veneration for it, especially on the part of the Jews, it has been preserved in such marvellous purity that the most careful criticism and collation of manuscripts finds occasion for few important, and very rarely of fundamental, changes. Furthermore, (*e*) that is true of the Bible which has been realized in no other book—it can be translated into all languages and still retain its import, its force, and, to great extent, its beauty.

2. *The Thoroughly Monotheistic Character of the Scriptures is against the Supposition of their Human Origin.*—For (*a*) they were written at a time or times when all nations were polytheists, and yet from beginning to end they assert the existence of *one only* true God. Moreover, (*b*) how is it to be explained that monotheism should be taught by a people whose "fathers worshipped other gods," and who, once reclaimed, were disposed to relapse into idolatry?

3. *The Morality of the Bible shows a Superiority in these respects.*—(*a*) It makes God supreme as *such,* and will not allow human virtue to become separated from him or his honor. Connecting morality with theology, it subordinates virtue to religion. (*b*) In Scripture the *heroic* virtues most highly applauded by men are regarded as inferior to the *passive* ones of forgiveness, patience, and submission. (*c*) Its incentives to virtue are duty, God's will, his holiness, his favor, and blessedness the fruit of holiness—quite unlike those urged in the schools of philosophy. It is to be added (*d*) that its superior morality is nevertheless one which, in its process of *attainment,* is in conflict with the sentiments and current maxims of mankind.

4. *The Religious Teaching and Method of Scripture are Peculiar to Itself.*—If not in making God everywhere supreme, and having for its design to set men right with God, that Christianity, its religion, which is pre-eminently the sum of its teachings, has many things that are *sui generis.* (*a*) Its *author* appears in a character altogether his own—human, divine, man, God, both in one; without beginning of days, yet in time incarnate; sinless, yet dying for sinners. As the infidel Diderot confessed, it lies not within the possibility of human genius to invent such a character. (*b*) The Bible teaches salvation—impossible without him—secured by and in the incarnate Son of God. Hence, both as a possibility and in its method, salvation, as taught in Scripture, is divine and supernatural. (*c*) Notwithstanding this, rather in consequence of it, Christianity is represented to be *exclusive* of all other religions. But (*d*) it allows no coercion, but leaves its claims, though universal and morally inflexible, to the intelligent and voluntary acceptance of all, while yet, (*e*) though allowing no compromise of doctrine or method, and requiring faith as the test of either, it boldly announces a certain and abundant future *success* to the Christianity which it advocates.

5. *Could the Human Intellect Produce such a Book?*—It has, to a greater extent than any other book, held the attention and enlisted the interest of mankind for centuries; has shown itself adapted to the wants of all; "has gone hand in hand with the moral and intellectual cultivation of the species;" and "its very presence as a believed book has rendered the nations emphatically a chosen race." (*Coleridge.*) And if not from God, the Bible presents the fourfold anomaly: (*a*) It would substitute for all human the one God-ordained system, although the tendency of the race has ever been *from* God to man-devised religions. (*b*) Nowhere else is human nature willing to represent itself, as the Bible does, destitute of restorative energy, and requiring a divine interposition to save it from itself. And if produced by men, then (*c*) by a people whose history it condemns, whose belief it opposes, and whose morality was not adapted to receive it; and (*d*) as no other book has been able to do even approximately, it has impressed the different classes of its readers in all ages with a sincere and reverential conviction of its *divine origin.*

II. Objections.—These may be put into three classes:

1. *Those which seem to Invalidate the Claim of the Bible as being from God.*—Examples: Since all from the first needed it, why was revelation delayed so long, and then given to so few? If from God, why has the Bible, on the one hand, so many things insignificant, and, on the other, many that are obscure? And how can a book which is from God sanction cruelty and injustice? This whole class of objections may first be met by analogy, like that of Butler. Similar and equally weighty objections lie against "the constitution and course of nature;" hence, why should those who admit theism object to the *word* of God because of what is found equally in the *system of things* which he has ordained and controls? Analogy, indeed, can only silence objections by showing it *just as* reasonable to admit the Bible as the course of nature to be from God; while the word of God often aids in surmounting difficulties which Nature herself cannot do even in her own sphere. For example: in the course of nature war, famine, and earthquake destroy the good and bad alike, but when God orders Amalek destroyed the judgment is seen to be penal, because that people is declared ripe for destruction. If the innocent Son of God is permitted to suffer for the guilty, this is justified by the work of grace as a whole, which satisfies law and justice, and rises higher than the possibility of pure law. And if it is for man's good that many things lie before him in obscurity, requiring patient study, as nature does, revelation is given, it must be remembered, to those on probation, and that an intellectual is necessary before and in order to a moral probation, and that both are best secured by a communication of God's will neither too clear nor too obscure.

2. *Objections Presumptive against Plenary Inspiration.*—Apparent discrepancies, inaccuracies, seeming conflict with science. The objections cannot be here discussed *seriatim,* but the following remarks may indicate the proper treatment of them: (*a*) The language of sense and sight, not of science, is alone adapted to all peoples and times, and Scripture writers—who are to be interpreted accordingly—have wisely chosen the former. (*b*) If a mistake is really found in the Bible, if a date, a reading, a historic statement, is *proved* to be wrong, the correction is, *in so far,* to be made, and can be, without invalidating other parts. (*c*) Nothing is to be feared from the most thorough scientific inquiry if it be honest, but assumptions and hypotheses should not disturb the biblical student *until* fully verified and accepted in their appropriate field of science. (*d*) As in the past the most careful inquiry has lessened the number of supposed errors, so we have reason to believe it will be in the future, and that science and Scripture will in the end be admitted not to conflict. "With all the pains and ingenuity which have been bestowed upon the subject, no charge of error, even in matters of human knowledge, has ever yet been substantiated against any of the writers of Scripture. But even if it had been otherwise, is it not conceivable that there might be infallible divine teaching in all things spiritual and heavenly, whilst on mere matters of history or of daily life prophets and evangelists might have been suffered to write as men?" (*Prof. Browne* of Cambridge, Eng.) "We have no means of settling definitely whether a *posse peccare* in minor matters may or may not be compatible with a divine revelation communicated through human media; but certainly till inaccuracies, fairly and incontestably proved to be so, are brought home to the Scripture, we seem logically justified in believing that as it is with nine-tenths of the alleged contradictions in Scripture, so it is with the alleged inaccuracy." (*Ellicott.*)

3. *Objections from the Nature itself of Inspiration.*—It has been said that a full inspiration should give *identity* of expression when the same events are narrated by different writers; which is evidently not the case. And again, that inspiration must involve a suspension of the writer's own powers, but that intimation is given that they are still free. Further, that men, being themselves fallible, could not be the media of infallible truth. And, moreover, as by Kant, that the writers could not clearly distinguish a state of inspiration from their own thought. To which class of objections it is replied (*a*) that inspiration must be neces-

sarily a secret miracle, not cognizable by *common* consciousness, but yet clearly so by those made the subjects of it, and to be received on their testimony if credible men. (*b*) No theory of inspiration can be tenable which does not allow freedom and individuality in the writers. At the same time (*c*) it is claimed for the Scripture writers that, though in themselves fallible, they are kept from error *in that for which* they are employed by the divine Spirit. "Human instrumentality . . . has been moulded by the Holy Spirit into the organism of revelation—each ray of the divine light has been borne to mankind through the medium best suited for its transmission; and yet, while borrowing in its course that particular hue which the medium lends through which it passes, it retains, no less sensibly, the purity of the source from which it streams." (*Lee.*) It may be observed that objections to the inspiration of Scripture are raised in one way or another from its *human* element, and that it depends largely on the use made of this what theory shall be adopted—whether the Bible shall be received, and how far, as infallible.

III. Specific Inspiration.—The theories need to be distinguished and the proof given.

A. Theories.—These would group themselves into three classes, according as the Bible is held to be *not at all* from God, *partly* from him, or *wholly* from him.

1. *The Bible is, in no Peculiar Sense, from God.—Naturalism* or *Positivism*, ignoring a personal God, logically rejects revelation; *Pantheism*, regarding everything alike divine and inspired, can admit nothing to be *peculiarly* so; and *Rationalism* finds as much in Homer and Plato to call inspired as in Isaiah or Paul.

2. *The Bible is Partially Inspired, since it* CONTAINS, *but* IS NOT, *a Revelation from God.*—Varieties are—(*a*) *parts* only are inspired; (*b*) the writers possess a consciousness, however high, differing, not in *kind* but in *degree* only, from that of others. (*c*) There must be a "unifying faculty" which is subjective. This class, in all its varieties, finds it not difficult to assume *degrees* of inspiration, but not easy to determine the *authority* for Scripture; while, moreover, the subjective state of the individual becomes the *criterion* in each particular case.

3. *The Bible, being from God, possesses a Full Inspiration.*—(*a*) The *mechanical* theory of dictation, the writers being mere amanuenses, would indeed give plenary inspiration, but not the manifold human element, nor the variety in style and freedom of the writers which everywhere prevail. It is hence to be rejected for (*b*) the *dynamic* theory, which holds to the divine superintendence throughout, but affirms the result to be gained through the free activity of the writers' own minds. "Inspiration is that divine influence under which *all* parts of the Bible have been committed to writing, whether they contain an account of ordinary historical facts or the narrative of supernatural revelation." (*Lee.*) If God communicates his will, it is *through*, as well as *to*, man, and in a genuinely human form. But a distinction is to be made between *revelation* and *inspiration*. The former refers rather to the divine *thought* communicated—not otherwise knowable; the latter, to the *record* of whatever truth God would have recorded. Hence, there may be revelation without inspiration, as to Balaam and Nebuchadnezzar; and inspiration without revelation, as through all parts not directly revealed. The Bible thus *contains a revelation*, and *is an inspiration*.

B. Proof.—1. *Presumptive.*—(*a*) All the lines of argument showing the Bible to be superhuman; *e. g.* its brief, graphic, but unadorned narrative, as in the Gospels; its simple comprehensiveness, as the Ten Commandments, which convinced an able but infidel lawyer that they could not be human. (See under I. of this article.) (*b*) A revelation granted, and this because supernatural instruction is needed, inspiration may be presumed, since a mere human record of whatever truth would not be an infallible guide. (*c*) The doubtful attitude into which we are thrown by denying inspiration favors it, since without this we could have no *objective* standard of religious truth binding on all, and (*d*) inspiration may be presumed from the thoroughly harmonious commingling of the prophetic and miraculous with the historic and didactic portions, which is everywhere found. If Scripture is the divine in the human, the human seems at all points pervaded by the divine like an incarnation. (See T. Lewis, *Divine-Human in Scripture;* also I. Taylor's *Hebrew Poetry*, and H. Rogers's *Superhuman Origin of the Bible.*)

2. *More Direct.*—(*a*) The Scripture writers distinguish between a divine communication and their own subjective state, *false* prophecy being subjective only, "prophets of the deceit of their own heart," the *true* having a valid ground outside of their own mind, like the roll of a book in which was written "the word of the Lord" (cf. Jer. xxiii. 25, 26, and Ezek. ii. 9, 10). (*b*) The writers imply their belief in the *organic unity* of Scripture by quoting and using what others had said, all such utterances being treated as binding; also, by assuming often a pregnancy of meaning in the original words. (*c*) Inspiration of the New Testament writers. [*Note.* Paul, one of the most important writers, was an *apostle miraculously prepared* for this office (Gal. i. 11, 12), which he *claimed* (1 Cor. ix. 1–5), and which was admitted by others (Gal. ii. 9). All other New Testament writers were apostles, save Mark and Luke. Whether they wrote, Mark under the supervision of Peter, and Luke under that of Paul, or were *directly* inspired, their writings certainly have been more readily received than some other portions. Hence, the argument for the inspiration of the New Testament is substantially that for the inspiration of the apostles as such, and is summarily this:] (1) The apostles were promised divine direction when arraigned as witnesses: "Take no thought how or what ye shall speak. It is not ye that speak, but the Spirit of your Father that speaketh in you" (Mark x. 19, 20). (2) And were to be kept from mistakes in their official testimony: "The Spirit of truth . . . will guide you into all truth, and he will show you things to come" (John xvi. 13). Also in respect to the past: "He shall bring all things to your remembrance" (John xiv. 26). And (3) The Spirit was to *coöperate* in their testimony (cf. John xv. 26, 27, with Acts i. 6–8). (4) They *affirm* their own inspiration: "We have received . . . the Spirit which is of God . . . that we might know the things of God, which things we speak, not in words which man's wisdom teacheth, but which the Holy Ghost teacheth" (1 Cor. ii. 12, 13; Eph. iii. 2–5); while (5) They assume without argument that others will *admit* their inspiration: "When ye received the word of God which ye heard of us, ye received it not as the word of men, but as it is in truth the word of God" (1 Thess. ii. 13; iv. 8). Accordingly, (6) they speak and write as *for God* and with his authority: "Maketh manifest the savor of his knowledge by us in every place." (See Rom. xv. 15–19; 2 Cor. ii. 14; iii. 5; iv. 5; v. 20.) (*d*) Inspiration of the Old Testament. (1) The New Testament gives proof of the inspiration of the Old, recognizing the three parts of the Jewish Scriptures—the *Law* or Pentateuch, by referring to or quoting various passages, and saying, "*God* commanded," or "Ye reject the commandment of God;" the *Psalms* (Hagiographa), as in Mark xii. 36, "David said *by the Holy Ghost;*" and the *Prophets*, Luke xviii. 31, etc. Moreover, our Lord speaks of the customary divisions, and then combines the three as "Scriptures:" "All things must be fulfilled which were written in the *law* of Moses and in the *prophets* and in the *psalms* concerning me. Then opened he their understandings, that they might understand the *Scriptures*" (Luke xxiv. 44, 45). (2) The Old Testament contains in itself *corroborative* proof. For example, the prophet *must speak*, though he might die in consequence. (See Jer. xxvi. 11–14.) *Pretenders* were to be severely punished even by death (cf. Deut. xiii. 1–5 with Zech. xiii. 3 and Jer. xxviii. 11–17). It is further suggestive that direction was given to record *historical* events: "Moses wrote their goings out according to their journeyings, *by the commandment of the Lord*" (Num. xxxiii. 1, 2). Finally, the Old Testament writers, like those of the New, affirm that they speak in the name of the Lord: "The Spirit of the Lord spake by me, and his word was in my tongue. The God of Israel said;" "Lest they should hear the law and the words which the Lord of hosts hath sent in his Spirit by the former prophets" (2 Sam. xxiii. 2, 3; Zech. vii. 12).

Such is the outline of proof—necessarily of a moral character, but found to be cumulative—that *in the Scriptures of the Old and New Testaments we have an objective standard provided by God himself as an infallible guide to religious belief and practice.* J. R. Herrick.

Inspired, The, or **The Community of True Inspiration,** a small sect of Christians who trace their origin both to the old German Mystics and Pietists, and through the "French Prophets" to the Camisards of France. They accept the teaching of Böhme and Schwenkenfeld. They reject the sacraments, practise to some extent communism in respect of property, and are evangelical in doctrine. They profess at times to receive divine inspiration, passing into a somnambulistic state. They have communities in Iowa and Canada. From 1844 to 1854 they had a flourishing community at Ebenezer, West Seneca tp., Erie co., N. Y., whence they removed to Iowa.

Installa'tion [Low Lat. *in*, and *stallum*, a "seat"], the ceremonial act by which an ordained minister is formally put in possession of his office and empowered to exercise its functions and receive its emoluments. In the English Church the ceremonial form differs according to the office conferred, and also the name, *inthronization* being the technical term in reference to a bishop, and *induction* for

the lower clergy, while *installation* properly refers to the office of a canon or prebendary in a cathedral church. In the Congregational Church of America the term applies to all ministers, and is distinguished from *ordination* as being the conferring of the pastoral office over a particular church.

In'sterburg, town of Prussia, in the province of Prussia, at the confluence of the Angerap and the Inster. It carries on a considerable industry in weaving, tanning, brewing, and distilling, and a brisk trade in corn and linseed. It owes a great deal of its prosperity to a number of Scottish families which settled here in the seventeenth century. Pop. 7185.

In'stinct [Lat. *instinctus*, "incitement"]. Instinct, in popular language, is generally contrasted with reason. It is spoken of as an entity, a principle controlling the lower animals, and peculiar to them. Instinct more properly implies a peculiar mode of action which may prevail in the lower animals or man. It is a name for a class of impulses and capabilities that give rise to actions apparently connected with voluntary powers—actions for the benefit of the actor, but independent of intelligence. Instinctive acts thus simulate intelligent action, while there is no comprehension by the actor of ends, or of means in relation to ends. Such comprehension, wherever found, is the work of intelligence. But instead of attempting at the outset to frame a concise definition of instinct, we shall give a series of definitions and explanations which will aid us in understanding the nature of instinctive actions, and their relations to functional and reflex action on the one hand, and intelligent action on the other.

1. An *instinct* may be defined as an impulse to a particular kind of action which the being needs to perform as an individual or representative of a species, but which it could not possibly learn to perform before it needs to act. Instinct, as a general term, properly includes all the original impulses (excepting the appetites) and that apparent knowledge and skill which animals have without experience. There are some actions which have been regarded as instinctive that are probably only reflex; that is, actions produced without volition, as the immediate effect of some stimulus. The stinging by a bee is plainly a reflex action, because the abdomen of the bee when severed from the thorax will not only thrust out the sting, but will direct the sting towards the part that is touched. But when the bee flies at an enemy in defence of its nest, the act is instinctive, as that term is generally used. The definition of reflex action has been so extended by some as to embrace all the acts which we term instinctive. (*Descartes, Herbert Spencer.*) We cannot, however, regard the return of fishes to their breeding-places, the migration of birds, or the storing up of food by animals of different kinds as in any proper sense reflex actions. They are so complex, involve so much of time and space for their completion, and so simulate the wisest and most skilful actions of intelligent beings, that they at least deserve a specific name, which we have in the word *instinctive*. The activities properly denominated instinctive may be classified into four groups: (*a*) Impulses arising beyond the sphere of the appetites, or ministering to the appetites, as the impulse to migrate, to store food for winter; also the desires so called in man. (*b*) Ability (knowledge?) without instruction for meeting the demands of the appetites and desires, and for doing those things essential for the continuance of the individual and the species. (*c*) Ability (skill?) without instruction or practice to carry out the plans necessary for the good of the species, as the various methods of securing food, the building of nests, and care of young. (*d*) Ability (knowledge?) arising independently of any demand of the appetites, as recognition of certain enemies without instruction or experience.

Three things are involved in the highest manifestations of those activities which are together labelled INSTINCT—*impulse, knowledge*, and *skill*, or an *ability* that in action simulates both knowledge and skill. In the animal kingdom, as now existing, we find impulses to specific actions, and so much of apparent knowledge and skill belonging to each species as shall enable its members at birth to begin life successfully; just as a certain completeness of organs is given to them at birth that the vital processes may go on to perfection. As the physical system develops, new instincts are developed to secure the proper use of organs and the proper relations of the whole being to the world. However the result may have been secured, we now find, as a matter of fact, that structure, function, and instinct in all species supplement each other in a wonderful manner. The special manifestations of instinctive action illustrative of these general propositions are exhibited by animals, chiefly, in the following manner: (1) By those acts that supplement physiological functions, as in the choice of food, the methods of securing it, and the union of the sexes. (2) By the natural recognition of certain enemies, and by those specific acts to avoid them, common to all members of the same species. (3) By the use of special structures, as the fang of the rattlesnake for defence and the use of the oil-gland by fowls in dressing their feathers. (4) By those acts necessary for the existence of communities of different kinds of individuals, as in the case of bees and ants, where individuals from the same mother have different instincts, but all working together for the welfare of the species. (See BEE and ANT.) (5) By the development of special impulses incidental to the parental relation for providing for and defending the young. (See DAUBER.) (6) By the structure of complicated homes characteristic of different species. (7) By the peculiar impulses of the young, by which they are at once brought into proper relations to their parents and the world. The young of our hoof-bearing animals, for instance, must seek the udder for themselves, as the mother cannot aid them. (8) By the change of impulse and habit in different stages of existence of the same individual for its own advantage, as among insects. (9) By those impulses and actions of animals demanding certain changes in other beings to complete their work, as the formation of oak-galls to complete the work of the insect in providing for its young. (10) By the many cases in which the instinctive act exactly supplements structure and function, as in the honey-bee, which has the function in the rings of its body of secreting wax, and in its mandibles instruments for forming a cell. Instinct prompts the bee to use the instrument and the product of its function to construct its comb. (See BEE.) (11) By the interaction of the instinct of the mother and that of the young, as when the fowl gives the note of warning, and the young instantly scatter from her and hide, because she cannot protect them. (12) By those cases, as among fishes and many insects, in which the young never see the parent, never have an opportunity to learn from one of their kind, and yet instinctive impulse directs them in the same way and in the best way in all the exigencies of life.

A careful study of the subject shows the great difficulty of distinguishing instinctive action from reflex on the one hand and from intelligent on the other. This difficulty arises from the fact that the different kinds of acts are often alike in their results; and in the chief field of their manifestations—that is, among the lower animals—we have no means of determining their nature but observation as to the method and the condition of the action. Whether there is among them conscious relation of the actor to the act it is impossible for us to learn, except by inference. Reflex and instinctive acts are both in the same line, for the benefit of the individual in which they appear, or when against the welfare of the individual they are for the welfare of the species to which he belongs. As both classes of acts are in the same line, and are alike in their results, it becomes difficult, not to say impossible, to apply a satisfactory test for determining the class to which certain acts belong. The young bird just from the egg raises its head and opens its bill to receive food. Whether that act is simply reflex, or belongs to those acts properly denominated instinctive, we cannot certainly determine. But the act is in the same line as the instinctive work of the bird when, becoming older, it seeks food for itself. Instinctive acts commend themselves to reason as the best possible for the being that performs them; and in the lower animals they so simulate intelligent action, and seem to be so intimately joined to it in man, that it is here also very difficult to apply in a satisfactory manner any test for distinguishing one kind from the other. Hence arises the difficulty of proving that the lower animals ever perform any acts higher in kind than instinctive. They plainly learn by experience, and as a consequence of that experience perform acts that they would fail to perform without it. They come to have great power in interpreting the actions and words of men. Many facts seem to imply that there is in some of the higher animals an apprehension of means in relation to ends. As before intimated, such an apprehension is intelligence.

Instinctive impulses appear in man, and the instinctive principle of action plays an important part even in his higher nature. Hamilton says: "We can hardly find a more suitable expression to indicate those incomprehensible spontaneities themselves, of which the primary facts of consciousness are the manifestation, than *rational* or *intellectual instincts*." (*Metap.*, Bowen's ed., p. 205.) Pres. Hopkins says: "What is conscience but a rational instinct, a guide without comprehension, but rational, because it reveals itself as the voice of God, which all instinct is without thus revealing itself?" (*Mor. Science*, 1st ed., p. 244.) The impulse of worship seems to be plainly instinctive. It is sure to appear in some form under proper conditions.

Theories.—The prevailing theories in regard to instinctive action may in the main be reduced to three: (1) That

these impulses and capabilities were the direct gift of the Creator to each species as its essential outfit. This theory would be satisfied with the doctrine of special creations, or the doctrine of evolution according to a plan, by which new organs and new instincts are co-ordinated in the evolution of new species from one form, as the organs and instincts of the individual are co-ordinated in its evolution from the egg. The essential thing in this theory is that each species shall have as an original gift all those instinctive powers and capabilities essential to its existence as a species and the development of its members as individuals. (See EVOLUTION.) (2) That what we call instinct is simply the accumulated results of individual experience, fixed by repetition and received by the living races by inheritance. Every instinct, according to Lewes, is an "organized experience," a "lapsed intelligence" (*Nature*, Apr., 1873); "its genesis [is] from actions that at first were tentative, in other words intelligent" (*Problems of Life and Mind*, vol. i. pp. 208, 209). (3) Mr. Darwin, while allowing that some intelligent actions may become converted into instincts, and be inherited, claims for the greater number of complex instincts an entirely different origin; that is, "through the natural selection of variations of simpler instinctive actions" (*Descent of Man*, vol. i. p. 37)—variations that arise from unknown causes. He thus attempts to explain the most complex cases of instinctive action. The full discussion of his theory as a whole, and the specific cases under it, would require more space than we can give. (See Chadbourne's *Instinct in Animals and Man.*)

The impulses of animal life are functional, as the appetites, or instinctive, as the desires. In the animal kingdom, as it now exists, the impulses find their expression through complex directing powers that supply for these lower animals the place of acquired knowledge and skill in man. In specific simple acts instinctive action depends upon the impression made upon the senses. Instinct may thus be deceived by appearances. In many cases we find instincts the exercise of which immediately after birth is essential to life, as the instinct of the young mammal to seek the udder. We cannot conceive of a time when such an instinct was not essential to all such animals. If we attempt, with Darwin, to explain the comb-making instinct of the honey-bee by the influence of natural selection in preserving those swarms that built best, because they used less honey in making wax (*Origin of Species*), we cannot help asking how we shall account for the similar six-sided cells in the nest of the wasp, where no honey is used for making wax and no food stored for winter. We can only state as a fact that we find each species as it now exists endowed with such instincts as enable it as a whole to hold its place in the world against all ordinary contingencies. We find these impulses and directive powers arising in individuals as naturally as the different organs develop by growth. The young animal comes into the world with a physical organization sufficient for carrying on the work of the physical system to perfection, and with instinctive impulses and capabilities sufficient for beginning and carrying on the same work. While physiological forces carry on the growth within the body, instinctive forces adjust the relations of the animal to the external world. Through these impulses and activities all animals are urged on to their end in that course best for the species as a whole.

In man the instinctive impulses are never wholly self-directive, but are conditional for the action of that rational nature through which man as a free agent seeks his own end. (Consult Kirby's *Bridgewater Treatise;* Wood (J. G.), *Homes without Hands;* Bain, *The Senses and the Intellect;* Lewes (G. H.), *Problems of Life and Mind;* Darwin, *Origin of Species, Descent of Man*, etc.; Wallace, *Natural Selection;* Spalding, *Macmillan's Mag.*, Feb., 1873; Flourens (P.), *De l'Instinct et l'Intelligence des Animaux;* Chadbourne, *Instinct in Animals and Man:*) P. A. CHADBOURNE.

In'stitute of France, The, occupies a unique position amongst the learned societies and academies of Europe. "Many countries," says Ernest Renan (himself a member of the Institute), "have academies which may rival ours by the fame of their members and by the importance of their works. France only has an *Institut* where all the efforts of the human mind are bound together in one sheaf; where the poet, the philosopher, the historian, the philologist, the critic, the mathematician, the physician, the astronomer, the naturalist, the chemist, the lawyer, the sculptor, the painter, and the musician may call themselves comrades."

As early as 1570, France had begun to imitate the Italians in the matter of academies, but it was half a century later before its famous Academy arose. In a time of intellectual activity literary coteries and clubs naturally flourish. To one of these knots of literary men Richelieu made a proposition that they should be converted into a corporate body. With some hesitation the offer was accepted. The king's letters patent were issued early in 1635, and after two years and a half more the sanction of the Parliament of Paris was obtained, and the *Académie Française* came into existence, the first learned society endowed and erected into a corporation. Its chief aim was to fix the standard of the language, and a dictionary was the thing first thought of. This has not advanced very far, and is less likely to be completed now than when it was first undertaken. A less elaborate dictionary was issued under its supervision in 1694, and has since been frequently reprinted. In order to flatter the inordinate vanity of Louis XIV. a committee of the Académie were entrusted with the task of drawing inscriptions for medals, etc. in commemoration of his glories. In this manner commenced the *Académie des Inscriptions et Belles-Lettres*, which afterwards devoted itself with great spirit to the study of antiquities. In 1666, Colbert founded the *Académie des Sciences;* between 1648 and 1671 arose three more academies, sculpture and painting, music, and architecture, which at the last-named date became the *Académie des Beaux Arts.* These learned societies were all dissolved by the National Convention in 1794. The Revolution did not seek to discourage literature and learning, but to break the continuity which bound them to the royal and aristocratic past of French history. For the continuance of their work the same convention in 1795 called into existence the Institut, which was in almost every way the heir of the older associations. The three men who had the greatest share in the framing of its constitution were Lakanal, Daunou, and Carnot. It was divided into three classes, which were respectively charged with the advancement of (1) physical sciences and mathematics, (2) moral and political sciences, (3) literature and fine arts. The Directory nominated 48 persons, a third of the members, and these elected the remainder. Some changes were introduced by the First Consul, who looked with suspicion upon a body which might be expected to unite intellect and independence. The modifications of 1803 were in some respects improvements. They involved, however, approval of the chief of the state for each election, and provided that moral and political sciences should only be studied in their relation to history. Whilst mathematics and physics flourished by the aid of Lagrange, Berthollet, etc., the literary sections displayed comparatively little spirit. In 1807 they undertook the continuation of the *Histoire littéraire de la France*, commenced by the Benedictines. The Restoration was as eager to link the institutions of France with its monarchical past as the Revolution had been anxious to destroy their continuity. The Institute indeed escaped destruction, but a royal *ordonnance* in 1816, after naming the foundation of the old academies as one of the glories of the ancestors of Louis XVIII., declared that it was right and proper (*convenable*) to restore to each class of the Institute its original name, in order to bind together their ancient glory with that which they had since acquired. The opportunity was taken of depriving twenty-two persons of their right of membership. David the painter, Monge, Lakanal, and Sieyès were amongst the illustrious victims of royal spitefulness, and their places were supplied by nominees of the Crown. The unity which had been one of the aims of the Institute was broken. During the Restoration it languished. The revolution of July did something to improve upon the feebleness and intriguing spirit with which it had become infected. Guizot in 1832 restored the class which Napoleon had suppressed. Ten of its old members were found, and they constituted the nucleus of the present *Académie des Sciences morales et politiques.* The fear of socialism, which reigns perennial in the well-to-do Frenchman's breast, led Cavaignac to ask the aid of this Academy in combating the communistic ideas of the wearers of blouses. They complied, and produced a volume of small treatises which, as Renan remarks, probably had not a single reader amongst those whom they wanted to convert.

In its present organization the Institute is made up of five distinct academies, each having its own officers, meetings, publications, etc.: (1) The *Académie Française.* Its origin has already been given. The number of members is restricted to forty. The elections have not always depended upon merit alone. The old Academy rejected Molière, and the influence of Monsignor Dupanloup, bishop of Orléans, sufficed to procure the rejection of Littré on his first candidature. That the Academy which in 200 years has not got past the letter G of its dictionary should blackball the man who single-handed accomplished the neglected labor, is indeed a striking proof that the highest culture is not sufficient to ensure either the presence of justice or the absence of bigotry. A body like the Academy is generally conservative, yet in 1827 it had the courage to address the king in opposition to the laws for the restriction of the press. The Academy has the functions of a high jury. The French, with their passion for liberty, have also a pre-

dilection for authority, and the approbation of the Academy is one of the prizes to which young authors look forward. The Academy is rich. The annual allowance from the state is about 85,000 francs, a good part of which goes in members' allowances. The prizes for eloquence and poetry absorb 4000 francs. Whether any prize poem will ever go down to posterity may be doubted. The Montyon prize for virtue is well known; 20,000 francs are yearly divided amongst poor persons who have distinguished themselves by some specially virtuous act. Montyon also left a yearly prize to reward the publication of the book most conducive to public morality. De Tocqueville's work on American democracy is perhaps the most notable book which has received this distinction. The *prix Gobert*, founded in 1833, is for the most eloquent work relating to the history of France. Thierry and H. Martin have been amongst its laureates. It amounts to 10,000 francs. There are many other prizes. In 1860 the emperor created a grand biennial prize of 20,000 francs to be awarded in turn to the special studies represented by each of the five academies. The first to whom it was awarded was M. Thiers, who immediately presented it to the Academy for the foundation of an annual prize of 3000 francs.

(2) *The Académie des Inscriptions et Belles-Lettres.*—It has 40 ordinary, 10 honorary, 8 foreign associates, and 50 corresponding members. It has the distribution of various prizes, the most important being that founded by Gobert for the most learned work relating to the history of France.

(3) *The Académie des Sciences*, having 65 ordinary, 10 honorary, 8 foreign, and 100 corresponding members. The most brilliant names in French science have adorned the roll of this academy. Arago, Ampère, Gay-Lussac in the new, as Lagrange, Laplace, Haüy in the old, have made it illustrious. The descriptions of French trades, the maps, etc. issued by the old academy were useful in their day, and have still their value. In the new academy associated work has been left aside, and it is the individual labors of its members which are chronicled in the *Comptes rendus*. This, by its frequent publication, is now the most important scientific periodical. The eight foreign members of the academy may be regarded as those whom a competent though not always unprejudiced jury regard as the most eminent men of science out of France. It is related that when Dalton, during his visit to Paris, attended a session (in his capacity of foreign member), those present stood up in his honor, a compliment which was not paid to the emperor when he joined their body.

(4) *The Académie des Beaux Arts* has 40 ordinary, 10 honorary, 10 foreign associate, and 40 corresponding members. It distributes a number of prizes and has published a dictionary of the fine arts.

(5) *The Académie des Sciences morales et politiques* has 40 ordinary, 6 honorary, 6 foreign associate, and 40 corresponding members.

Such is the manner in which the Institute is divided. All the year there are five academies, but on the 14th of August the Institute holds a general meeting of all the sections of which it is composed. There is a fine and rare library attached to the Institut. Each member receives a salary of 1500 francs, and the sécrétaires perpetuels have 6000 francs per year. The Institute is a creation of which France may well be proud. Beyond the personal renown of its members and the value of their labors, the organization of the Institute shows that its founders had a clear sense of the *solidarité* of knowledge—a unity sometimes lost sight of in our own age, when nearly every savant is a specialist. The tradition of the old academies has stereotyped the internal form of the Institute, and probably prevented a growth and classification of its sections more in accordance with the present state of science.

William E. A. Axon.

Institutes (of Justinian). See Law, by Prof. T. W. Dwight, LL.D.

Institu'tion [Lat. *statuere in*, "to establish on"], a word which is especially used in the plural, and applied to a series of doctrines and to some establishments. For instance, there are political, judicial, theological, medical, charitable, and other institutions. It applies more to the immaterial aim than to the material and practical representation of said institutions. A political institution means a whole set of such or such doctrines, rather than the kind of government entrusted with their application. A medical institution applies to the intellectual part of the concern, and not to the building in which the intellectual and medical programme is carried out. When anybody speaks of the "political institutions" of the U. S., he thinks more of the *spirit* of the political principles embodied in the American Constitution than of the letter of that Constitution, which provides for the organization of a Congress, of a supreme court, and other practical applications of the Declaration of Independence. Félix Aucaigne.

Insur'ance [from *in* and *sure*], in its most general definition, is a contract whereby one agrees, for a sum of money, to indemnify another in case the latter shall suffer loss by certain specified risks. It is termed *marine* or *fire* according as it is applied to maritime or fire risks. It was unknown to the ancients, and had its origin in the exigencies of modern commerce. It was first applied to mercantile adventures. The fear of pecuniary ruin by the loss of ship or cargo checked the spirit of enterprise. Few were so wealthy as to be able to bear alone so great a loss, but by dividing the risk amongst many it was seen that the inconvenience to each of the proportion of loss which he assumed might become trivial. Thus originated the practice of insurance, which has for its purpose to break the force of the blow of calamity by increasing the power of resistance. Though known and practised amongst the commercial communities of Southern Europe at a much earlier period, it was a comparative novelty in England in the time of Elizabeth. During the last century, however, it has received an immense development, until now every prudent person who has property at risk takes care to seek shelter under a policy of insurance. The principles which underlie the contract are substantially the same to whatever subject-matter they may be applied, modified only as the peculiarities of the different risks assumed may require. Its fundamental principle is indemnity for loss; and so far as it is made the means of accomplishing more than this it passes over into the domain of speculation and leads to the mischiefs of gambling. It is a personal contract—insuring not the thing, but the person interested in its preservation, against loss to him by reason of injury to it. The person who undertakes to pay in case of loss is termed the insurer; the danger against which he undertakes, the risk; the person protected, the insured; the sum which he pays for the protection, the premium; and the contract itself when reduced to form, the policy. So general, if not universal, was the use of a policy in the early history of the contract that until quite recently it has been doubted whether writing was not essential to the validity of the contract; but it is now conceded that both a verbal agreement to issue a policy and a verbal agreement to insure are valid, even though the contract covers a period of time longer than one year, as the contract may be determined by the happening of the event insured against within a year, and so is not within the statute of frauds. Even corporations, which, under the ancient stringency of the common law, could only bind themselves by a contract under seal, it is now held, may contract verbally by their officers or other agents. All persons competent to make other contracts may be parties to this. Formerly, and to some extent at the present day, as in the case of the "Lloyd's"—a society of private capitalists who meet at Lloyd's subscription-rooms in London, and subscribe to such proportions of the risks there offered as they may feel inclined to—the business was carried on by private underwriters; but the superior advantages of public companies now give them the chief control. Policies are for a sum agreed upon to be paid in case of loss, hence called valued; or for whatever the amount of the loss may prove to be, hence called open; for a fixed time or for the voyage, hence called time or voyage as the case may be. The contract is complete and binding when the parties have agreed upon all its terms, and, if entered into by correspondence, when the letter accepting the terms offered is deposited in the office for transmission in due course of mail. If the terms are agreed upon and the policy is made, it will be valid and binding without delivery if it be the understanding of the parties that it shall become operative from and after a certain act. The law will not permit an illegal business or an unlawful enterprise to be encouraged by insurance. Nor will it permit the insurance of an interest the protection of which would manifestly tend to evils which would more than counterbalance the advantages of insurance. Seamen's wages, for instance, cannot be insured, as this would tend to render them indifferent to the safety of the ship upon which their wages depend. Whatever, however, does not contravene good morals or sound public policy may receive protection. Subject to these limitations, any property or interest in its preservation may be the subject-matter of the contract. Policies without this interest to support them are wager policies, and are prohibited as a species of gambling and a temptation to fraud and crime. The insurance, however, in the same policy of a lawful and a prohibited interest will not vitiate the policy as to the lawful interest if it be separate and distinct. Insurable interests are as manifold as the relations of individuals to property. Whoever owns property, whether by an absolute or qualified, legal or equitable title, or any interest in property, or has upon him the duty or in him the right to protect and preserve it, may insure it to the extent of his interest or liability. The owner of a vessel or house, the

mortgagee or lessee, executors, administrators, and trustees, common carriers and bailees generally, consignors, supercargoes, whose compensation depends upon the success of the voyage, or under instructions to land goods and wait for a market, captors and salvors having a well-founded expectation of an allowance out of the property captured or saved, and sheriffs and other officers of the law having the care and custody of property, may severally insure their respective interests. The insurability of the interest depends not at all upon its value, provided it has some value; nor is it any objection that several interests in the same property are coincidentally insured. The mortgagor may insure to the full value of the property, and the mortgagee or successive mortgagees may at the same time insure to the amount of their several interests, and each may recover, in case of loss, to the extent of the several amounts insured, though the aggregate of these may much exceed the entire value of the property. A partner may insure the entire stock of the copartnership, being interested in the whole, out of which to realize his share, and for the same reason, no doubt, a stockholder in an incorporated company may insure the entire property of the company to the amount and for the protection of his interest. The vendee in possession of real estate under a contract partly performed, but not enforceable at law or in equity, since the vendor may not refuse to perform, an insolvent debtor, in the possible surplus which may come to him after payment of his debts, and the mechanic who has a lien upon the building for labor or materials furnished, have also insurable interests. The interest must subsist at the time of effecting the policy and at the time of the loss, though it need not continue the same in amount or without interruption. If an insured vessel be sold, and repurchased during the time covered by the policy, the policy will cease to protect during the period of alienation, but will reattach and protect after the repurchase. Stocks of goods may be sold and replaced by others under the same policy. The shifting interests of a mortgagee who makes advances and receives payments from time to time may likewise be protected.

The policy is generally issued upon an application containing certain statements descriptive of the property insured and the circumstances affecting the risk. These statements are termed representations, and if by reference or otherwise they are made part of the policy, they are termed warranties. A warranty is an agreement that a fact is as stated, or some future act or omission shall be as promised, upon penalty of forfeiture of all rights under the policy if the statement prove untrue or the promise be not kept; while a representation, being no part of the contract, but only an inducement thereto, need be true only so far as is material to the risk. Untruthfulness or mistake in a representation, unless material to the risk, will not avoid the policy, while either in a warranty, unless imputable to the fault of the insurer, will be fatal, whether material to the risk or not. A warranty that a ship is American, or that she will sail at a given time, will be violated if she be British or sail at a different time. A representation that a building is occupied in its several parts for certain specified purposes will not be vitiated though it appear that one of the apartments be differently occupied, or not occupied at all, if the difference be not material to the risk. Warranties are not favored, because they work forfeitures and sometimes operate very harshly; and for this reason, if from the form of expression or other circumstance there is chance for doubt, a statement will be regarded as a representation rather than a warranty. It is sometimes said that representations should be more full in marine than in fire policies, since in the former there is less opportunity for personal inspection. But this depends upon circumstances, and is no rule of law. That representation is material which induces the insurer to take a risk upon terms less favorable to himself than he would have made had he known the truth. The same test applies to a concealment, which is the withholding a fact which ought to be made known, if such fact be not known or ought not to be expected to be known, to the insurer, and is known, or ought to be known, to the insured. Mere silence about a matter which is unknown, or about which it is not to be expected that the insured would know, is no concealment. Warranties specially stated in the contract are express. There are also implied warranties, as of ownership, seaworthiness at the commencement of a voyage policy, and against deviation—which is a voluntary departure from the usual course of the voyage without necessity or justification, as, for instance, to avoid capture or to save life—and such a substantial alteration as to change the identity of the risk assumed. Seaworthiness is fitness for the particular service, and is one thing at one time and place and another at another, according to circumstances. The voyage commences when the vessel casts loose from her fastenings and moves on her way, and ends, in the absence of express stipulation, when she has been moored in safety at her port of destination. Like a voluntary deviation, a substantial alteration in the property insured against fire, such as to make the risk in kind a different one from that assumed, will avoid the policy. Ordinary and reasonable changes and repairs, however, made in good faith for the due preservation of the property or prosecution of the business, will not vitiate the policy, although alterations increasing the risk are forbidden. If such repairs were deemed alterations, the insured could neither preserve his property from decay nor avail himself of improved methods of business—a result which neither party can be presumed to contemplate. Alterations in the surrounding circumstances, as in the erection of new buildings and changes not under the control of the insured, unless by special stipulation, are not imputable to him. If the insurer will protect himself to this extent, he must so stipulate in clear and express terms. In point of fact, however, the rates of premium are based upon an assumed liability for such risks; nor would any prudent person accept a policy which did not protect him from dangers beyond his control, the most perilous perhaps to which he is exposed. It is common to except from the risk such articles, uses, and trades as are regarded as specially hazardous, and the risk of which the insurer does not wish to assume. This is done by including them in a memorandum of articles excluded, in which case nothing can be claimed as indemnity in case of loss of, or damage to, such excluded articles; or it may be done by a clause in the policy prohibiting the use of the premises for such and such processes, trades, or businesses, or for keeping or storing such and such goods, on penalty, unless specially authorized by the policy, of avoidance of the policy. In this case special authority is deemed to be given if the subject-matter of insurance, by fair interpretation and according to usage, includes the excepted article or use. The insurance of a stock in trade, for instance, "such as is usually kept in a country store," will permit the keeping of all such goods as are usually kept in such stores, although some of them may, by the terms of the policy, be prohibited as hazardous. The insurance of a "furniture business" will likewise permit the use of such oils and varnishes as are customarily used in the manufacture and preparation of furniture for sale, although the keeping and use of such oils and varnishes may be expressly prohibited. And if, during the period of insurance, some new process not used or known before comes into vogue, it may be adopted by the insured without prejudice to his rights, unless it be of such a character as manifestly to make the risk greater than either party could have contemplated. It cannot be supposed that in such cases it is the intention of the parties that the insured shall be tied down to the methods and processes of the date of the policy, and deprived of the right to avail himself of such improvements as may be necessary to the successful prosecution of the business. "Use and keeping" mean habitual use and keeping. A mere casual use of a prohibited article—as, for instance, benzine or naphtha to be mixed with paint while repairs are going on, or the building a fire for the purpose of heating tar to be used in the course of such repairs—does not contravene a policy prohibiting the keeping of fire or the introduction of hazardous articles upon the premises. Nor is the permission by the insured of an unlawful act upon the premises a use of the premises for that purpose. Playing a single game of cards does not make the premises a gambling-saloon. Unless otherwise agreed, houses may be left vacant, tenants may be changed, factories may be worked or shut down, and property may be watched and cared for, heated, and lighted at the discretion of the insured; and stipulations for the use of care and precaution against fire are generally not warranties, but representations to be carried out by substantially doing that which is provided. In such case equivalents will do. Keeping ashes in any receptacle made of equally incombustible material is a fulfilment of an agreement to keep them in an iron receptacle. Notice is frequently required of any changes in the circumstances or surroundings of the insured property affecting the risk, in order that the insurer may have the option to continue or cancel the policy. Under this requirement notice need be given only of such changes as are material; and if within a reasonable time after notice the option to cancel is not signified, all objection to the change will be presumed to be waived, and the policy will remain a valid security. And, generally, it may be said that whenever a condition has been violated, giving to the insurers the right to treat the policy as void, any subsequent recognition by them after knowledge of the breach of the policy as a subsisting and valid contract, as by the acceptance of premiums or the doing of any other act from which it may be fairly inferred that the insurers do not mean to take advantage of

the breach, will be a sufficient answer to any attempt by them to set up the breach against a claim for loss. Alienation or sale of course suspends the operation of the policy, as when the property passes out of the hands of the insured, having nothing at risk he can suffer no loss; and if the alienation continue till the time of loss, nothing can be recovered by the insured. Having lost nothing, he can claim no indemnity. But there is no alienation so long as the insured retains an interest in the subject-matter, although that interest may have undergone a change or even suffered a great diminution. A mortgage is not an alienation, nor is a written agreement, with or without seal, to convey, nor is a descent of property to heirs; and such qualified changes in the title or interest will not work a forfeiture unless specifically so agreed upon. Even an absolute sale by one partner of his interest to his copartner is not to be regarded as an alienation, but rather a shifting of interests among joint-owners, so long as no stranger is admitted. As any substantial change in the relation which the insured holds to the property insured is a matter of consequence affecting the judgment of the insurer as to the quality of the risk and the propriety of continuing it, the character of the person insured being oftentimes an important element in making up the estimation, so it is of consequence to him to know the true state of the title and interest of the insured in the property insured, whether absolute or qualified or incumbered, or how otherwise, to the end that in adjusting the amount to be insured so much in value shall be left unprotected as to make the insured himself also interested in guarding against loss.

The sound principle of insurance is that the insured must be in such position that in case of total loss he must himself necessarily suffer loss. If he be insured to the full value of possible loss, he may be tempted to carelessness, or even fraud and crime. He may not only neglect all precaution to prevent the happening of the peril insured against, but he may be tempted to scuttle his own ship or set fire to his own house. To inquiries made touching these and various other circumstances affecting the judgment of the insurer upon the value of the risk the answers must be with precision and certainty if they amount to warranties, or only with substantial truth if they are representations merely. If no specific title be required, then any form or extent of title or ownership will be sufficient. A declaration of ownership simply is but a declaration that the applicant is in some form or sense an owner. In mutual insurance the true state of the title is more especially material, since the lien which such companies usually have upon the real estate they insure constitutes to some extent the capital of the company. It is therefore of importance that the title should be such that a lien will attach. Hence, a misrepresentation as to the title may be material in a mutual company, while it might be quite immaterial in a stock company. It is also material, and for the same reasons, that the insurer should know not only what insurance may already exist upon the property upon which insurance is applied for, but also whether any and what further insurance may thereafter be obtained. Upon these points, therefore, inquiries and stipulations are usually made. Other insurance is additional, prior, or subsequent insurance effected by the same person, or for his benefit and with his consent, upon the same subject-matter, risk, and interest. Owners of different interests may insure them respectively without violating the condition against other insurance. The additional insurance must also be valid, or it is no insurance. A policy by its own terms void if there be prior insurance without notice, will not be a breach of the terms of a prior policy to be void if other insurance be obtained without notice. When notice of subsequent insurance is required, it must be given within reasonable time, and if the insurers, having the option to cancel the policy upon such notice, neglect so to do for an unreasonable time, or meanwhile recognize the validity of the policy as a subsisting contract, they will be held to have waived the right to insist upon a forfeiture.

Over-valuation of the property insured is another mode in which the insurer may be misled into making a contract which he would not otherwise have made. While intending only to make the prudent contract of insuring one-half the value of the property, he may be led by over-valuation into the risky contract of insuring the property up to, or even beyond, its full value. If this over-valuation be fraudulent, or so gross as to justify the inference of fraud, the policy will be void, whether there be or be not any stipulation therein upon this point of over-valuation.

The assignment of the policy without the consent of the insurers is often forbidden, and is objectionable upon the same grounds as alienation is objectionable. The insurers may be quite willing to insure one person, while they might be quite unwilling to insure another, or that to that other should be transferred the interest in the policy. Strictly speaking, a policy is not assignable or negotiable, so as to give the assignee the right, in his own name, to claim the benefit of the contract. In order to this there must be an assent of the insurers to enter into direct relations with the assignee, as by consenting to the assignment and to pay the assignee in case of loss. In such cases the assignee will be substituted for the assignor, and may recover as he, and only as he, could recover; so that if the assignor after the assignment violate any of the conditions of the contract, this violation will work a forfeiture of the right of both the assignor and assignee to recover under the policy. To avoid this result, the policy and property may both be transferred to the same person with the assent of the insurer, the assignee securing by a new note or other memorandum the obligations of the assignor towards the insurer. The transaction thus becomes substantially a new contract, rather than an assignment of an old one, and is not subject to be defeated by the delinquencies of the assignor, the original insured.

The premium is the consideration which the insurer receives for the risk he assumes, and is greater or less according as experience and observation have shown that the chances of loss upon the particular risk are greater or less. The premium is usually paid when the policy is delivered, but this is not necessarily so. And even though by the terms of the policy it can only become operative on payment of the premium, a delivery of the policy without insisting upon this condition will make it operative. It is a condition for the benefit of the insurer, and like other similar conditions he may waive it if he will. In the absence of express stipulation as to the modes of payment, a note or check sent by mail, if so requested, or any other ordinary mode of payment acceded to by the insurer or his agent having authority in the premises, will be sufficient. Should it so happen that the property insured is never exposed to the perils insured against—in other words, if the risk never attaches—the insurer may demand a return of the premium if he has not been guilty of any fraud. The whole premium, however, is earned if the risk attaches even for a moment.

In marine policies, unless restricted, the risk extends to all losses proximately caused by the perils of the sea—that is, all losses which happen fortuitously from the extraordinary action of the winds and waves, stranding, collision, lightning, and other like natural and unavoidable accidents connected with navigation. Besides these perils, it is usual in marine policies to insure against loss by fire, barratry—*i. e.* the fraudulent misconduct of the master or crew—theft, piracy, capture, arrests, and detentions. As no one can stipulate for immunity from the consequences of his own fraudulent or criminal misconduct, where the master of a vessel is also owner, barratry is not covered by the policy any more than a house is protected to the owner against loss by fire set purposely by himself. But in both marine and fire insurance loss by mere negligence of the owner or of his servants will be covered by the policy. In fact, as it is impossible for any one who has even a moderately extended business to give his personal attention to all the details, one of the prime objects of insurance is to guard against the negligence of servants. And negligence of the insured himself, not so gross as to warrant the inference of fraud, will also be within the risk. All losses directly attributable to the risk insured against come within the sweep of the policy unless there be an exception stated in the policy itself. Damage by fire may happen without actual ignition, as by cracking of glass, or the blistering of pictures, or the scorching of paint, or heating and thus destroying the value of certain articles of commerce. Damage by fire produced by lightning is within the risk, but damage or demolition by lightning without burning is not. To protect in such a case the insurance must be against loss by lightning. So damage by fire resulting from explosion, as of gunpowder, for instance, is within the risk. Explosion is but the burning of the gunpowder by sudden combustion, and if damage results by concussion from such an explosion it is damage by fire. But loss occasioned by the explosion of a steam-boiler, the bursting itself not being occasioned by unusual fire, and no fire supervening, is not a loss by fire. Whether such loss would be a loss by explosion is a mooted question, some holding that explosion is the remote and fire the immediate cause, while others hold that explosion is the immediate cause through fire. Damages and expenses in reasonable efforts to save the insured property from destruction, as by water, removal, covering up, or any other suitable means, are included within the risk of a fire policy. So are damages by falling walls if the walls fall by reason of the fire. If, however, they fall by their own inherent weakness, crushing the insured property in the ruins, whence fire supervenes, this is not a loss by fire, as the property is destroyed by the fall and not by fire. So loss by the bursting of a boiler, where-

by a vessel goes down at once, is not loss "subsequent to and in consequence of such bursting," the bursting and the loss being practically simultaneous. When a vessel sinks till the water reaches her furnaces and drives out the fire upon her woodwork, so that the vessel is burned to the water's edge, the loss is attributable to the fire if, but for the supervention of the fire, she would not have sunk; otherwise not. When there are two concurrent causes to which the loss may be attributed, the predominating and efficient cause where the damage is indiscriminate will be deemed to be the true cause.

If it be doubtful what property is covered by the policy, the doubt will be resolved in favor of the insured. A house or building includes all the appurtenances necessary to the ordinary use of the principal building, and a mill includes the machinery by which it is operated. Property in trust is not limited to property technically held in trust, but includes all such property as the insured may have the custody and care of for special purposes; and a policy may be so worded as to follow and protect property as it passes through divers hands, as by expressly insuring goods "sold, but not removed."

When there is an actual total loss, the insured recovers to the full amount of his insurance if the property be worth so much, and there be no express limitation to a proportion of the loss. In marine insurance there is a constructive total loss whereby, when the property, though not entirely destroyed, is damaged to such an apparent extent as practically to render the voyage worthless as a pecuniary adventure, as where the damage exceeds one-half of the value of the vessel or of the goods, or the vessel be captured or detained by embargo, the insured may abandon the damaged or detained property to the underwriter and claim for a total loss, leaving the latter from that time forth to get what he can by sale or use out of the abandoned property. This rule promotes commerce by reinstating the insured immediately in his capital, wherewith to engage in new adventures, rather than to subject him to delay and possible ruin by further efforts to restore his shattered fortunes. It is at the option of the insurer whether he will abandon, and this option must be made within reasonable time, and notice thereof given to the insurer in order that he may at once avail himself of his right to treat the property as his own and make the most out of it. The abandonment carries with it all rights and claims on account of ship or cargo, so that if the ship be recovered and the voyage completed and made productive, the insurer will have all the benefit both of the property recovered and of the profits in the way of freights earned, or otherwise. In the U. S., however, only so much of freight goes to the insurer as is earned after the abandonment. When the loss is partial the rule in marine insurance is that the cost of repairing the vessel, less one-third for the greater value of the new substituted for the old, may be recovered. But in fire insurance there is no right of abandonment, and no rule of proportionate deduction on account of the greater value of the new, actual indemnity being the limit of the right to recover. In either case, when goods are damaged, the insured recovers the difference between the value of the damaged goods as they are and the market price of sound goods of like kind. The adjustment of marine losses, when all the interests saved are to contribute their proportion of indemnity for those lost, is oftentimes a matter of great nicety, and comes under the head of general average, a peculiar and intricate branch of maritime law. There is less difficulty in adjusting losses under fire policies, where general average contribution is unknown. Under both kinds of insurance, however, there may be divers policies upon the same subject-matter, in which case, if the loss be less than the aggregate insurance, either insurer may be held for the entire loss, unless there be an average clause, as it is called, limiting his liabilities to his proportion of the loss. In case he pays it, he will have his claim over for his indemnity against each of his co-insurers. Only the actual loss can, however, be recovered by the insured from all the insurers. The amount of loss recoverable within the limits of the amount insured does not always depend on the value of the interest to the insured. If the insured has any insurable interest, and that interest attaches to the whole property, he may recover for the whole value. Thus, a commission merchant, actually interested only to the amount of his advances and commissions, may recover to the full value of the goods lost, holding any balance for his consignor. A mortgagor may insure to the full value of the property, and recover the whole loss, although the insured mortgagee may also recover to the full amount of his interest, and thus the insured be compelled to pay much more than the whole value of the property destroyed. The respective contracts are independent, and cover distinct interests, each of which may extend to the whole value of the property. Special and extraordinary circumstances—as that the building insured is on leased land, and must be soon removed at great cost or forfeited, or that a house is about to be sold on execution, or that duties have or have not been paid on imported articles—do not vary the rule of damages. The fair market-value of the property, without regard to such circumstances, is the criterion of the amount of the loss. Sometimes the policy stipulates that the insured, in case of loss, shall recover only a certain proportion—two-thirds, for instance—of the actual damage. In such case the insured will be entitled to the whole amount of his loss if that does not exceed two-thirds of the whole loss. A partner after the death of his co-partner can only recover for loss to the partnership property as it was at the time of the dissolution by death. Goods bought after the dissolution will not be covered unless by special agreement. When the right to repair or rebuild is reserved to the insurer, as it sometimes is, as a mode of payment to which they may resort if they deem the claim for loss exorbitant, it is optional with him whether he will or will not avail himself of his right; and if he do not, the rule of damages is the actual loss, and not the cost of restoration, which may be, as in the case of an old and dilapidated building, greatly above the actual loss. If a new building be erected by the insured, it is not the cost of the new, but the value of the old one destroyed, that is recoverable. And the option of rebuilding must be made known without unreasonable delay. An agreement to replace goods stands upon the same footing. The insured is to be indemnified, and no more. If the insurer be prevented from rebuilding or replacing without the fault of the insured, as by the intervention of the public authorities, that is his misfortune, but no defence against the claim of the insured. When the insured is not designated by name in the policy, but is referred to indefinitely as "the estate of A" or "whom it may concern," the loss will be payable to all such persons as can bring themselves within the scope of the designation; and if the policy be to A for the benefit of whom it may concern, A will take the loss and hold it for the parties in interest. Sometimes disputes arise as to the disposition of the loss after it is paid or as to the right of the several parties in interest. But as a rule neither can claim anything from the other unless by the terms of the policy it appears that it was the intention of the parties that one should be benefited by the payment to another. If the loss be paid to a mortgagee, the insurer can neither require him to assign the mortgage, nor can the mortgagor require the money to be applied towards the reduction of the mortgage or to repairing the damage. Each party stands on his own contract as against the other, unless it appears to be intended that some third party shall have an interest, as where a mortgagee insures at the expense of the mortgagor. But when the insurer pays a loss caused by the wrongful act of some third person, against whom the insured might have brought an action, the insurer is said to be subrogated to the right of the insured against the wrongdoer, and may, in the name of the latter, recover against him whatever sum the insured might have recovered. This right is based upon the ground that it is just that the wrongdoer shall be made to bear the loss which he has occasioned. The liability of the wrongdoer is first and chief; and if the insured insists, as he may, upon proceeding against the insurer, he is in fairness bound to allow the insurer to use his name in proceeding against the wrongdoer. But if the insurer pay the loss, and afterwards the insured proceeds against the wrongdoer, the latter can claim no advantage by the payment. If A sets fire to B's house, and B gets his insurance, A cannot avail himself of this fact as a defence to a suit by B against A for damages. After loss the insurers must be notified, and generally agree to pay in so many days after proof of the loss. If no form of notice be agreed upon, any notice, verbal or written, will answer. Notice "forthwith" is notice without unreasonable delay, and should be given to the person designated in the policy, or, this wanting, to some officer of the insurance company or to some agent acting in its behalf. The proofs of loss must also be such as are required by the terms of the policy, and substantially in the form required and within the time specified. If the certificate of the minister of the parish or of the nearest magistrate to any particular fact, or that the loss is as stated, be required, such certificate must be produced before payment can be demanded; and if the minister or the magistrate in some sense nearest will not so certify, the insured must fail in his claim. It is his misfortune that he cannot comply with the terms of the contract into which he has voluntarily entered, and which seems to be perfectly proper and fair. Such agreements should be avoided, or provision made for some substituted mode of proof; as, for instance, the certificate of some other satisfactory person. In fact, as these arbitrary conditions are made by insurers in their own special interest, they may waive them if they please either in form

or substance; and if they receive notice or proof, however informal or imperfect or out of accord with the requirements of the policy, without objection, and do not give the insured to understand that they are insufficient and unsatisfactory, and in what respect, so that he may have an opportunity to supply the deficiencies, or if the insurers, by silence or otherwise, induce in the mind of the insured the belief that they are sufficient, they will not be permitted to interpose such insufficiency against a claim for loss. If upon the receipt of verbal notice of a loss the insurers declare they will not pay, this will relieve the insured from the duty of further notice or proof. The law does not require a useless formality. If stipulation be made that suit shall not be brought against the insurer unless within a limited time, the insured will be bound by it. It is reasonable to require that disputed claims should be brought to an early trial, while the facts are comparatively fresh and the witnesses are at hand. But an agreement that a suit shall be brought in a certain place or court, or that the whole matter in dispute shall be submitted to arbitration, has no validity. The law determines how and where suits shall be tried, and parties cannot by their agreements settle or unsettle the jurisdiction of the courts. And when to an action to recover a loss the insurers set up in defence any breach of condition, misrepresentation, or other matter, it is always a good reply that such breach or other delinquency is chargeable to the act or omission of the insurers themselves or their agent.

In mutual insurance the holders of policies besides being insured are also insurers. They are members of the company, and by virtue of their membership are obliged to contribute to the losses of their associates, and have the right to claim from them by way of assessment or contribution, in proportion to the amounts for which they are severally insured, indemnity for their respective losses. Rightly managed, it is the safest and cheapest form of insurance, since, whatever be the rate of premium, the associates participate in the profits; and if the premium be fixed sufficiently high the aggregate amount of premiums, paid or promised by deposit notes, will constitute a capital adequate under any but most extraordinary circumstances to meet contingent losses. J. Wilder May.

Insurance, Life. See Life Assurance.

Integral Calculus. See Calculus.

Intellect. See Mind, by Hon. W. T. Harris, A. M., LL.D.

Intemperance. See Inebriety, by Prof. Willard Parker, M. D., LL.D., and Intoxication, by E. J. Bermingham, M. D.

Intercala'tion [Lat. *intercalare*, to "insert"], the insertion of supplementary days or months into the calendar in order to effect an adjustment between the civil and the natural year. (See Calendar, by F. A. P. Barnard.)

In'tercourse, tp. of Sumter co., Ala. Pop. 440.

Intercourse (Right of) between States. This expression can include political and commercial intercourse, together with the right of individuals to pass into or through a given country. No text-writer on the law of nations, so far as we know, maintains that nations are bound to have communication with one another by ambassadors; least of all would the claim to send resident ambassadors be admitted as having the nature of strict right. As for the right of commercial intercourse, it is hard to maintain that a nation may rightfully force another into such a relation. It must begin in a voluntary way, on terms agreeable to both parties. If, now, one of the states wants nothing that the other can furnish, with what right can the other, to satisfy its wants, compel it to take certain products? But if there is a theoretical difficulty in such demands, intercourse is pretty sure to begin whenever an honest, peaceable way of bringing it about be tried, because all men love to exchange, and can be soon made to see the advantages of so doing. As for the right of travelling into or across a country, if this be necessary in order that a nation may have access to the rest of the world, it seems to be a right, subject to such precautions as may prevent dangers from foreigners. T. D. Woolsey.

In'terdict [Lat. *interdictum*, a "prohibition"], in European history, censure pronounced by the pope, by a synod, or by a bishop, withdrawing from particular persons or places, or both, certain religious privileges. It still exists in theory as one of the ecclesiastical censures of the Roman Catholic Church, but is seldom exercised, except towards individuals, who may be, for example, interdicted from entering a church. It is also sometimes pronounced against places where horrible crimes have been committed. In the Dark Ages the interdict was the most terrible of punishments. Every man's hand was against the interdicted person, and even great princes have been humbled by the power of this censure. At one time no bell might ring or organ be played in an interdicted district; the church doors were locked; services were performed without solemnities and in secret; all crosses and ornaments were hidden; Lenten food only could be eaten; no one could give or receive a kiss; the Eucharist was not given except to the dying; no man could shave his beard or brush his hair until the interdict was raised. But few interdicts, however, were so severe as this, though at the best an interdict was regarded as a severe measure. The Church herself from time to time mitigated the terrors of this dreadful visitation. Among the most celebrated interdicts were that laid upon all France by Gregory V. in 998; that laid on England by Alexander III. in 1171 as a punishment for the murder of A'Becket; that laid by the same pontiff upon Scotland in 1180; by Innocent III. on France, 1200; on England in 1209 under King John; on Venice by Paul V. in 1606.

Interesse Termini. See Landlord and Tenant.

In'terest [Lat. *interest* (an impersonal verbal form), "it is of advantage"], the compensation paid for the use of money borrowed. The most convenient form of capital to be loaned, for both lender and borrower, is money. Hence, loans are most commonly made in money, and interest is always reckoned at a certain per cent. of a defined sum of money, which is called the *principal;* the per cent. paid is called the *rate,* and is usually stated as the rate per annum, though often payable at shorter intervals than a year. The compensation for the use of capital in the form of land and fixed improvements upon land is called *rent.* This is determined by other considerations than the money-value of the property loaned or leased. (See Rent.) But in the case of other kinds of property an estimate is commonly made of the value in money, and interest is charged accordingly at the current rate. Thus, one may purchase a steam-engine for a mill, or cotton to be worked up in a mill, and give his note for its value, to be paid at the end of six months, with interest. Or he may borrow of a friend the money with which, as an instrument of exchange, to make either purchase, and give his note on interest. The transactions are essentially the same. The engine or the material is what he wants, and what he actually borrows and uses as a part of the capital of his business.

The rightfulness of interest rests upon two facts: (1) The fact that capital is the result of past labor, preserved by self-denial in saving. One's right of property in that which he has earned and saved is indefeasible, and it is but simple justice that if the owner allows another to use his property instead of using it himself, he should be compensated. This is all plain enough in the case of the engine or the cotton, and the principle certainly holds good when by a simple exchange the property saved takes the form of money. It is the property-right which is to be recognized, the same always, whatever may be the material form in which it is embodied. (2) The fact that in the production of values present labor is crippled, almost fruitless, without the products of past labor—*i. e.* capital—to work upon and to work with. The effectiveness of labor is increased many fold by the capital joined with it. Hence, he who provides the capital may rightly claim to share with the laborer in the profit of the joint result; and the laborer can well afford to pay for the advantage he gains. The loan is made for the sake of bringing present labor into union with past labor, all the same whether it is money or that which money can buy that passes from borrower to lender. The etymology of the term "interest," and its fitness in this application, imply such a mutual advantage to borrower and lender. Where money is borrowed to provide for the immediate support of an individual or a family, or for some present gratification, the property which it represents is consumed at once, without a profit; but the loan is made in some anticipation of means to be realized from labor or other sources at a future day, and the consideration is, even then, a supposed advantage to the borrower as well as to the lender. This *interest* or mutual advantage marks the prime difference between a loan and a gift.

The general rate of interest in a community is determined by three considerations: (1) The average productiveness of industry; (2) the proportion between the supply of capital and the demand for it; (3) the degree of security given to contracts by the protection of law and prevalent moral sentiment. In a new country these considerations combine. Labor is very productive in developing new and rich resources; capital is scarce, because the hardships of pioneer-life repel the rich; and contracts are insecure, because law and social order and mutual confidence are not well established. Hence, the rate of interest in a new country is high. It declines gradually as, in the course of time, population increases, society becomes organized, wealth is accumulated, and the fertility of the virgin

soil and other primitive resources of nature are exhausted. In particular cases, especially of speculation, the rate of interest is affected by risk on the one hand and the expectation of great profits on the other. The general rate of interest is lowest in an old country, where the accumulation of wealth is large, industry is active, exchanges are rapid, and men's integrity and honor are sustained by sound public sentiment and guarded by good laws well executed. Great fluctuations in the rate of interest arise chiefly from the infusion of the element of credit in the currency of a country, and the consequent expansion and contraction of the volume of currency, with the reckless speculations, panics, and commercial crises incident thereto. Whatever imparts instability to the instrument of exchange must cause fluctuation in all prices and uncertainty to all contracts; and to all such influences interest is most sensitive. A. L. CHAPIN.

Interest, History of. From the time of Thespis downward, as has been remarked by Bentham, there is scarcely an instance where a lender and a borrower of money appear upon the stage without the sympathies of the audience being enlisted for the latter. The philosophers of Greece and Rome never emancipated themselves from the current of popular opinion upon this subject, and their extant writings afford abundant proofs of the odium which they contributed to fasten upon the money-lender. Both the philosophers and the common people usually branded the money-lenders as the main cause of the decline of the Roman empire. The laws of Rome expressly authorized the practice, but the legislators were constantly attempting to regulate the terms of interest. The severity of Roman law against insolvent debtors drove men to exhaust every resource to maintain their credit; and the exorbitant interest exacted from the unfortunate confirmed the popular idea that "interest is wealth made from the poverty of others." The evils above indicated had become an important feature of society at the time when the authority of the Christian Church was first brought into the scale. The Christians of the first two centuries were poor, industrious, and of simple tastes and habits; hence they had little occasion for availing themselves of the services of the money-lender. Accordingly, the writings of the Christian Fathers unanimously reflect an intense condemnation of "usury," and when Christian ascendency stamped its image upon the earliest legislative codes of semi-barbarian and mediæval Europe, divine and human anathemas were alike incorporated therein. The "usury" of the Middle Ages was simply what the name implies, the price of the *use* of money at whatever rate; it was strictly synonymous with *interest*. It cannot be doubted that the rates of interest then current would now be deemed exorbitant. The monopoly of usury which the Jews long enjoyed was owing not more to their peculiar genius for monetary transactions than to the fact that they alone had no conscientious scruples against the practice. It was not until the eleventh century that the Lombards, and still later that the Christian merchants of Florence, became the rivals of the Jewish usurers. It was the revival of the commercial spirit among the republics of Northern Italy that initiated that conflict of opinion between the Church and the world which has finally culminated during the present century in a general recognition of the lawfulness and usefulness of money-lending. When the Eastern commercial enterprises of Venice, Pisa, Genoa, and Amalfi proved the possibility of obtaining from capital in legitimate traffic a rich return, it was no longer thought a hardship to pay handsomely for the control of capital for investment. The old idea was that men would only borrow money from usurers under the impulse of hard necessity; thus, when the business was presented in another and an agreeable light, as a means of obtaining a share of the "wealth of Ormus or of Ind," the credit system of the modern world was founded. It is true that the earliest Reformers did not innovate upon the current theological view of usury, and some Protestant writers, like the celebrated secretary of state of Queen Elizabeth, Sir Thomas Wilson, vehemently denounced it as contrary to the law of nature; but the commercial enterprise of Protestant countries silently and speedily produced a healthful change of sentiment. Salmasius and Grotius lent the great weight of their names to the same scale, and by the middle of the seventeenth century the lawfulness of money-lending was generally admitted in Protestant countries. The battle was harder among the Catholics, from the immense mass of theological tradition which had to be overcome. The means finally employed for effecting a change of opinion consisted of subtleties of casuistry as to permissible cases of usury; then a distinction was drawn between a fair and an excessive rate of interest; the former was justified, and the odium embodied in the word *usury* was exclusively attached to the latter. By an easy gradation of thought the modern meaning of the word was ascribed to the Fathers of the Church and to the canons of mediæval councils in their denunciations of usury. Finally, the civil and canon laws were held to imply merely the right to regulate the *amount* of interest, which has accordingly been the sole object of recent legislation thereupon. It was reserved for the economists of the school of Locke, Hume, and Adam Smith to expose, and ultimately to overthrow, a legislative folly which had been current for so many centuries. The final demonstration of the utility of interest was made by Jeremy Bentham in his famous *Letters on Usury* (1787). It only remains to add a few statistical data upon legislative enactments affecting the rate of interest. In the earliest Roman law-code, the *Twelve Tables* (B. C. 450), the rate of interest was established; the restrictions were removed by the Licinian laws 366–365; the former law was re-established 357; the rate was again lowered 347; all interest was prohibited by the Genusian law 341; the Sempronian law extended a uniform legislation to the allied Italian nations 193; the rate was fixed at 6 per cent. by Justinian A. D. 529. In England, the rate was fixed at 10 per cent. by act 37 Hen. VIII. c. 9, 1543–44; the taking of interest was prohibited by acts 5 and 6 Edw. VI. c. 20, 1552; the latter was repealed by 13 Eliz. c. 8, 1570; interest was restricted to 8 per cent. by act 21 Jac. I. c. 17, 1623; to 6 per cent. by act 12 Car. II. c. 13, 1660; to 5 per cent. by act 12 Ann. st. 2, c. 16, 1713; finally, most of the preceding legislation was repealed by act 17 and act 18 Vict. c. 90, of Aug. 10, 1854. (See the works of Locke, Hume, A. Smith, Turgot, Bentham, J. B. Say, M. Chevalier, J. S. Mill, and W. E. H. Lecky.) PORTER C. BLISS.

Interest, Law Concerning. In the comprehensive sense in which the word *interest* is popularly used, it denotes any compensation for the use of money which a debtor pays to the creditor, but in legal usage it has obtained also a technical meaning by which it is distinguished from usury, and denotes such a measure or rate of compensation as is allowed by law. Usury, on the other hand, is an excess of compensation above the rate established by law. This is a distinction whose original introduction into legislation is attributable to the belief which was generally prevalent in the early history of the Christian Church and in the Middle Ages that it was wrongful and contrary to the express teachings of Scripture to receive any payment for the use of money. The necessities of trade caused legal sanction to be given at an early period to the taking of a certain specified percentage upon the sum loaned, but the common conviction that there was an element of extortion and oppression in requiring compensation for money still remained apparent in the stringent laws which were enacted to prevent the taking of higher rates than that which was established as legal. (See USURY.) The results of this theory are abundantly manifest in the law even at the present day. Until within a few years nearly all of the States of this country had laws prohibiting the taking of more than an established rate of interest, and though the prohibition has been removed in a few of them by recent legislation, in the majority of them such laws are still in force. In England there was an established legal rate until 1854, but in that year all the laws against usury were repealed. In the U. S. the lawful rate generally prevailing is 6 per cent. upon the sum loaned, or principal. In New York it is 7 per cent. In some of the States there is a particular rate declared applicable to ordinary transactions in the absence of any special agreement, but the parties are allowed to stipulate for a higher rate if they desire. Laws to prohibit the taking of usury never prevent an agreement being made for a lower rate than that established by law, but only forbid the parties from stipulating for a higher rate. The obligation of a debtor to pay interest upon the sum which he owes may either arise out of contract, in which he expressly or impliedly agrees to its payment, or may be in the nature of a penalty imposed upon him for default in the payment of the principal at the time when it was due, or for the misuse of trust funds committed to his charge. In the one case, interest is said to be payable by contract, while in the other it is given by way of damages, notwithstanding there is no agreement for its payment. A contract to pay interest may be either express or implied. It is *express* when there is a positive stipulation between the parties that the amount payable to the creditor shall bear interest, and the time from which it shall be reckoned, the manner in which it shall be payable, and the rate at which it shall be estimated may be directly specified in the agreement. If no rate is mentioned, the legal rate is understood. No higher rate, however, can be agreed upon than that established as legal unless such an agreement is expressly authorized by statute. If by the terms of the contract the debt is to bear interest, but the time from which it is to be reckoned is not stated, interest will generally be computed from the date of the contract

or the time when it is made. The stipulations of the parties may relate to the computation of interest not only until the time of the maturity of the debt, but after the debt has become due and in case of default in payment. If a rate be fixed upon not obnoxious to the laws against usury, and it is provided by the terms of the contract that interest shall continue to be reckoned at the same rate if the debt be not discharged when payable, the computation will be made at this uniform rate until the time of actual payment. If, however, there is no stipulation as to the rate of interest which the debt shall bear after maturity, it becomes an important question whether the rate agreed upon as computable before maturity shall continue after that time, or the rate fixed by statute. Upon this point the decisions are still in conflict, so that no settled rule can be stated. The prevailing doctrine appears to be that interest shall be reckoned at the statutory rate after the default, since the provision in the contract can have no force after that time in the absence of express specification, and interest must be given, if at all, by operation of law, and by way of damages for the debtor's failure to pay at the time appointed. A contract to pay interest is *implied* when an agreement is entered into of such a nature that an obligation to pay interest is naturally incidental to it, and is to be presumed as within the contemplation of the parties. Thus, it may be inferred from the course of dealing between the parties, as where interest has before been charged and allowed under like circumstances, or where it has been the uniform practice of the creditor to charge interest, and this was known to the debtor at the time of the transaction by which the debt was incurred. So, where there is a general usage in any particular trade or branch of business to charge and allow interest, parties having knowledge of the usage are deemed to contract with reference to it. For example, interest is not usually recoverable on an open running account for goods sold, but if there be a usage in any particular State or locality for merchants to charge interest upon such accounts at the expiration of a certain term of credit, and the purchaser can reasonably be presumed to be acquainted with such usage, he will be chargeable with interest, which will usually be computed at the legal rate.

Interest recoverable as damages is given by operation of law, and does not depend upon contract, express or implied. It is the general practice in the courts of this country to award interest, computed at the legal rate, for default in the payment of any liquidated debt or claim at the time it becomes due. The time from which it is reckoned is the date when payment should properly have been made. This practice depends partly upon the ground that the debtor in retaining the amount due gains the benefit of its use, and should justly reimburse the creditor at a rate of interest which measures the income which might ordinarily be derived from the money, and partly upon the ground that the debtor should be punished for his default by increasing the amount of the debt. The time when the debt becomes payable is frequently fixed upon by the parties when the transaction occurs out of which the debt arises, and the interest will be computed in such cases from the date appointed. Interest will be given as damages whether the debt bore interest before maturity or not. In many instances the time when the debt originally becomes payable does not depend upon agreement, and must be determined by special rules. The general principle is that interest will be computed from the time when the creditor might have brought action to enforce his claim. Thus, when money is lent to another or paid to his use, interest accrues from the time of the loan or payment. When goods are sold, and no time of payment is specified or credit given, interest is computable from the day of the sale. A note payable on demand draws interest from the time of the demand. It should be, however, noted that for some purposes a note on demand is due immediately; *e. g.* for the running of the statute of limitations. (See LIMITATIONS, STATUTE OF.) So, generally, wherever there is an unsettled claim with no determinate time for payment, the creditor may demand payment, and, if it be refused, interest will run from the time of the demand. When credit is given, interest will be calculated from the expiration of the time of credit. Upon a judgment it is reckoned from the time when the judgment was rendered. Judgments did not bear interest at common law, but this rule has been generally changed in this country. Upon unliquidated demands interest is not, in general, collectible, since there is no specific sum upon which it can be reckoned until the amount of the claim is liquidated or ascertained, and usually no definite time at which payment is to be made and from which the interest can be computed. Thus, a debt for board and lodging, where there was no price or time of payment expressly or impliedly fixed, will not draw interest until it is reduced to a judgment, or its amount otherwise liquidated. While, as has already been seen, interest cannot be charged upon the items of a running account for goods sold or services rendered unless there be a particular usage to the contrary, still, after there has been a mutual agreement of the parties upon a balance struck, and the amount due thus ascertained, interest may generally be computed upon this balance. It is a common practice for creditors, when they desire to secure the settlement of an open account, to send to the debtor a statement of the items of the account, and of the amount computed to be payable, and the assent of the debtor to the correctness of the balance may be presumed from his failure to make objection to its accuracy after a reasonable opportunity for examination. This presumption, however, is not conclusive, but may be rebutted. Generally, after the lapse of a reasonable time, interest will commence to run upon the balance stated. In cases where the debt arises from an unliquidated claim, but the time of payment was determinate, and the amount then due could have been ascertained by computation, it is the law in New York, and generally in this country, that interest may be collected upon that amount from the appointed time, upon the principle that that is certain which can be rendered certain. The English courts, however, do not allow interest in such cases. It is on the ground that a creditor's claim is unliquidated that interest is not generally given in actions for damages for tortious injury. In cases of the conversion of personal property, however, interest is usually recoverable upon its value from the time of conversion, since that value is in general readily ascertainable, and the retention of the property is a continued wrongful act from the time it is taken or wrongfully detained. The same rule is also applied in some other cases of injury to property where the amount of the claim can be computed. It is not so general a practice in the courts of England as in this country to award interest as damages for the wrongful detention of a debt. It is only in relation to particular modes of incurring indebtedness that interest is held collectible on this ground.

Interest given by way of damages for the maladministration of trust funds is not grounded upon the detention of a debt after it is regularly payable, but depends, in the main, upon the same principles—viz. that the owner of the property or debt is entitled to the percentage which might be obtained upon it by a faithful administration of the trust, and that interest may be chargeable as a means of punishment. Thus, guardians, executors and administrators, and trustees of every kind will be charged interest upon all trust funds in their hands which it is their duty to invest, upon failure on their part to do so within a reasonable time or with proper precautions against loss. Generally, simple interest will be charged against them, or the rate which would have been obtained by a judicious investment, but in cases of gross delinquency compound interest may even be recovered.

Compound interest, by which is meant interest computed upon a sum consisting of the principal and previously accrued interest, is not in general recoverable at law. To require its payment is thought to savor of usury and to be unduly oppressive upon the debtor. Even though there be an express agreement that compound interest shall be paid, the contract will not be usually enforceable for more than simple interest. When, however, interest has already accrued and become payable, an agreement that it shall be added to the principal, and that interest shall be subsequently computed upon the new principal thus formed, will generally be deemed valid. In like manner, compound interest may be payable in certain kinds of mercantile transactions by virtue of usage. And even where it would not generally be recoverable upon an ordinary contract in which its payment was agreed upon, yet if it is actually paid it cannot be recovered back. When partial payments are made from time to time upon an interest-bearing debt, it is necessary to apply them towards the discharge of the debt in such a way that interest shall never be reckoned upon interest. The following is the rule which has been generally adopted: Compute the interest on the principal from the time when interest became payable to the first time when a payment alone, or in conjunction with preceding payments, shall equal or exceed the interest due on the principal. Deduct this sum, and compute interest on the balance as before. By this rule there is never any balance of interest remaining after deducting a payment upon which subsequent interest can be reckoned.

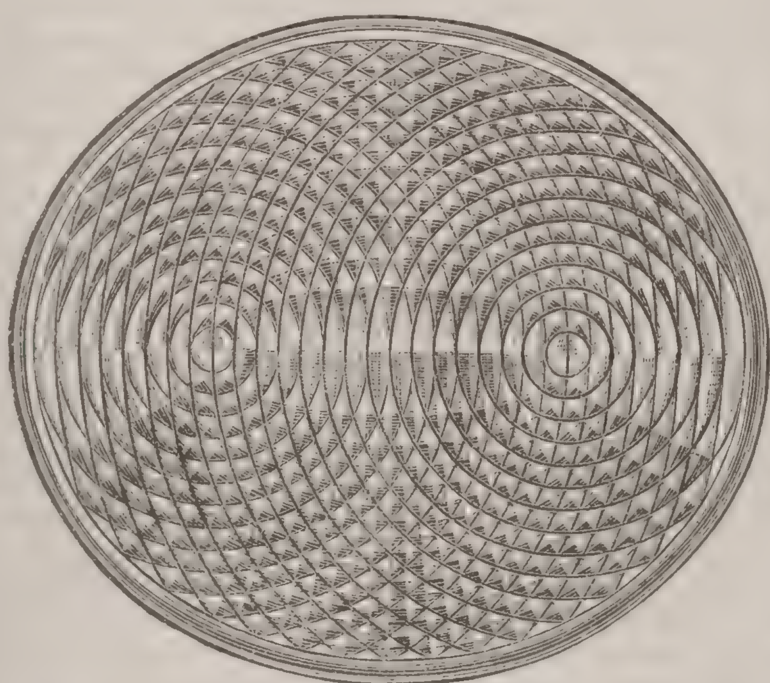
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Interfer'ence [Lat. *inter*, "between," and *ferire*, "to strike"], a term used in hydrodynamics, acoustics, and optics to denote the mutual influence of different undulations which conspire or conflict in consequence of the superposition of one upon the other. A gross illustration often employed in explaining this idea is to refer to the appearances presented by the intersecting rings formed in water into which two pebbles have been thrown. The elevated rings

and their intervening depressions are undulations: the molecular movements are vertical, while the undulation progress is horizontal. When the rings intersect, the points where two ridges cross are doubly elevated; the points where two hollows cross are doubly depressed; while the points in which a ridge in one system crosses a hollow of the other are neither elevated nor depressed. The term applied to this influence of one undulation upon another is *interference*.

The interferences of liquid waves are finely illustrated in the undulations of mercury contained in a vessel of elliptical figure. If a disturbance be produced at one of the focal points of the ellipse, the circular waves proceeding from this will, by reflection from the sides of the vessel, form a second similar system having for its centre the other focus. If the corresponding points of interference be connected, they will form, as the figure shows, two sets of curves, elliptical and hyperbolic, having for their common foci the foci of the original ellipse.

FIG. 1.



The interference of waves of sound is often very perceptible. It is observed only in musical sounds, because it *can* only be observed in those whose undulations are continuous and uniform; and such sounds are musical. It is best observed when the waves are long—as in the case of the grave tones of the heavier organ-pipes. The sinking and swelling of the sound, called by musicians the *beat*, is owing to one of the interfering waves being slightly longer or shorter than the other. In many repetitions this slight difference of length accumulates until it reaches half an undulation; when, if the two waves originally conspired—that is (to borrow again an illustration from the water), if their two crests were originally superposed—they will, after this difference has crept in, be in conflict; or the crest of one will fall upon the hollow of the other. During this interval, a sinking of the sound will have been observed; but immediately after, as the difference of path goes on increasing from a half to a whole undulation, the sound will swell again as the two crests once more approach superposition. It need hardly be remarked that the interference of waves of sound of *perfectly equal length* would not be perceptible to a person standing motionless; for, in that case, the resultant sound would be a *constant*. Should he endeavor, by moving about while two bodies of precisely similar pitch are sounding, to pass from the points of conspiring to those of conflicting undulation, he would not find it easy to detect these points for several reasons. In the first place, when the molecular movements are normal to the wave front, as in the case of sound, there is no *complete* interference, or approach to complete interference, except where the waves are tangential, or approximately so, to each other; except, therefore, in or near the line of the centres; and except, it may be added, when the distance between the centres is an exact number of half undulations. Again, at the *intersections* of sonorous waves, whether the molecular movements conspire or conflict, the resultant of these movements is never so great as the sum, nor so small as the difference, of the two components. The difference of intensity between the maxima and minima of sound in such cases will not be striking, unless they succeed each other with brief intervening intervals of time, as in the case of the *beats*.*

It is, however, by this second method that we detect the interferences of light, and not at all by the first. That is to say, we discover these interferences by moving the eye through the space where they exist, in the course of which movement the points of maximum and minimum brightness are easily observed; or we let fall the interfering rays upon a white surface, when the same points will become manifest by their difference of illuminating power. The first method is best, especially if the eye be assisted by a lens; but the second is that which was used by the earliest observers. We cannot detect the interferences of light by observing periodical maxima or minima, like the beats in music, because of the almost inconceivable shortness of the undulations. But if the waves of light were as long as the waves of sound, interferences might easily be made to manifest themselves in this manner.

The phenomena attending the interferences of luminous waves are such as to compel us to assume that the molecular movements are not, as in sound-waves, normal to the wave front, but are, as in liquid-waves, in the wave front itself, and normal to the direction of progress. In liquid-waves gravity determines the azimuthal direction of these movements, confining them to the vertical plane passing through the wave centre, or origin of molecular disturbance. In the case of luminous waves, there is no such determining or constraining force; and hence it happens that ordinary light has no determinate plane or azimuth of vibration; but its successive undulations assume every variety of azimuth. There is no proof, however, that changes of azimuth are incessant; in other words, that many undulations, in fact many thousands or perhaps millions, do not follow each other, usually, in the same azimuth, between the changes. This, indeed, is probable, since the ethereal vibrations take their character from those of the luminous body; and these may reasonably be presumed to have a certain persistence in their modes of vibration, or at least not to undergo incessant and abrupt changes. Beyond a certain limit, however, this persistency could not continue; nor could there, among the changes which occur, be a predominating disposition to return to one azimuth oftener than to another, or to remain in it longer, without imparting to the light, more or less decidedly, the character of polarization. If five hundred millions of the mean undulations of white light were to follow each other in a single azimuth, they would occupy less than the one-millionth part of a second; and, accordingly, if five hundred millions of such undulations should take place in each of a million different azimuths successively, the whole would be performed in one second, and no instrumental test could detect polarization in the aggregate beam. The polarization of light consists, therefore, in the determination of all its vibrations to a single plane. (See POLARIZATION.)

When two polarized rays follow each other in the same path, or intersect under a very acute angle, it is obvious that, if their planes of polarization agree in azimuth, they are in condition to interfere. If in phase of undulation they are perfectly accordant, the two waves will be superposed, and the molecular velocity of the resultant wave will be equal to the sum of the velocities of the two components; but if there is a difference of phase between them amounting to exactly half an undulation, then the crest of one wave will fall on the hollow of the other, and the resultant molecular velocity will be equal to the difference of velocities of the components. If the difference of phase is any other fraction of an undulation, the resultant molecular velocity, and consequently the resultant intensity of the luminous effect, may be deduced by means of a mathematical formula into which this difference of phase enters as an element. If the azimuths of molecular motion are different, the effect of interference on molecular velocity and luminous intensity will vary with this difference; and the character of the movement itself will change with difference of phase, becoming elliptical or even circular, instead of remaining as originally rectilinear. If the difference in azimuth is 90°, the luminous intensity is not affected by difference of phase, and hence the interference is insensible to direct observation; but on testing the condition of the light by suitable optical methods, the molecular movement may always be resolved into its two component rectilinear movements.

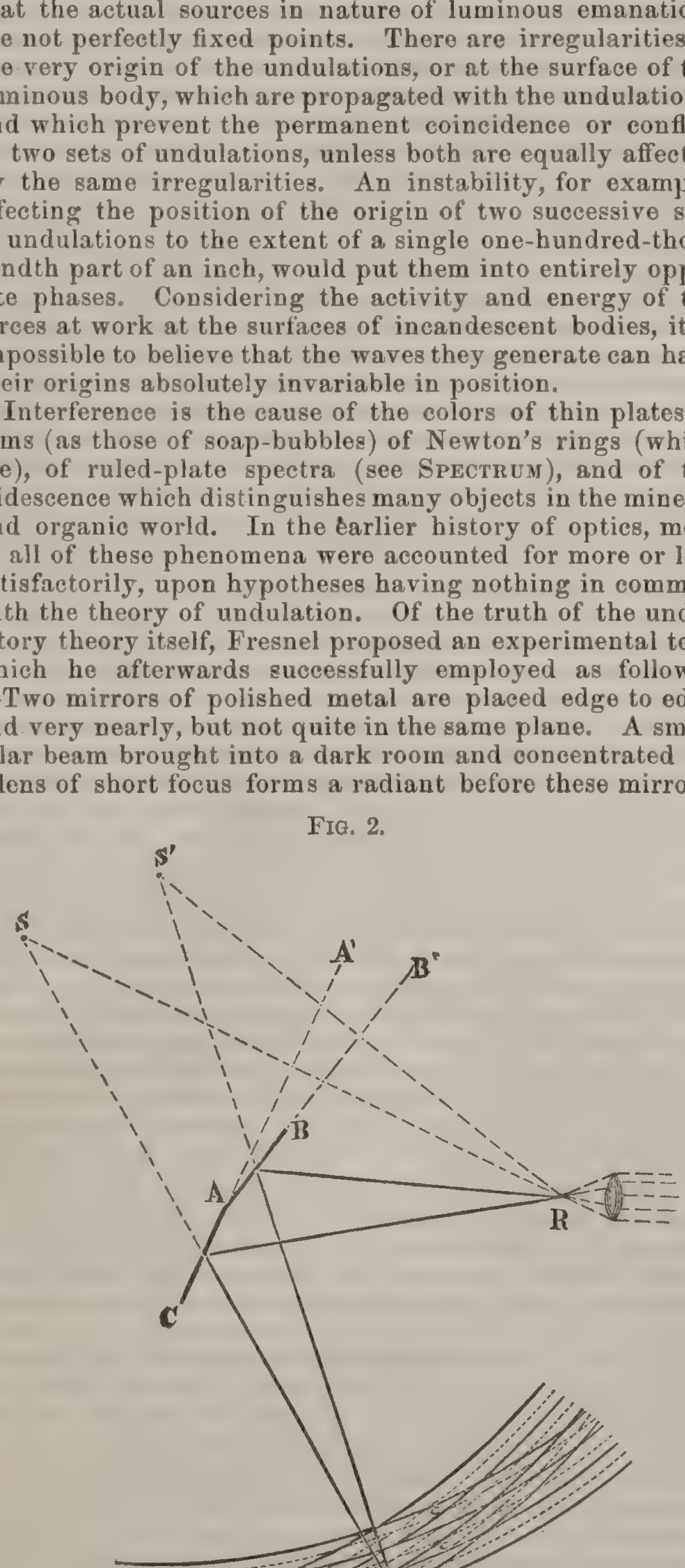
Rays of common light, if the difference of their paths be not very great, will interfere, notwithstanding the fact that their undulations are confined to no determinate azimuth. This fact proves, what has been above assumed, that the changes of azimuth in common light cannot be incessant. But there is one condition absolutely indispensable to produce interference in any case; it is that the rays shall have a common origin. If the light subjected to experiment be unpolarized, the necessity of the condition is easily explained. The changes of the azimuth of vibration in two such rays could not, except upon a supposition which has an infinity of chances against it, take place at the same intervals and in the same order; and if they did, the chances would be equally great against the coincidence of those planes. But as it is true of polarized as well as

* The rather difficult experiment of *localizing* the interferences of sound from two pipes in perfect unison was successfully accomplished by Mr. Despretz.

of ordinary light, we must look for a different explanation, and we find it in the fact that light is not homogeneous but compound; there being present, in every luminous emanation, undulations insensibly differing from each other in length through a range approaching the ratio of 1 to 2. When two minute and isolated portions of a wave thus constituted are brought together by reflection, by refraction, or by diffraction, at a very minute angle and with a very slightly different length of path, interferences of antagonism will take place between some of these elementary movements, and interferences of reinforcement between others. Colored stripes or fringes will therefore make their appearance; but these, owing to the differences of interval between those of different colors, will at each repetition be less and less distinctly separated from neighboring ones, and the whole will soon overrun each other, producing white by the blending of their colors, and uniformity of intensity by the overlapping of the brighter and fainter stripes. Even with wave elements from the same source, sensible interference cannot be produced when the paths of the uniting waves differ by more than a very few units in the number of their undulations. The possibility of their sensibly interfering at all therefore depends on their absolute identity of condition at a distance from the point of interference differing by only this small amount. Such identity will necessarily be found at contiguous points of a wave front from a single centre; but the chances are infinitely against its occurrence in points taken in two wave fronts from different centres. To this it may be added, that the actual sources in nature of luminous emanations are not perfectly fixed points. There are irregularities at the very origin of the undulations, or at the surface of the luminous body, which are propagated with the undulations, and which prevent the permanent coincidence or conflict of two sets of undulations, unless both are equally affected by the same irregularities. An instability, for example, affecting the position of the origin of two successive sets of undulations to the extent of a single one-hundred-thousandth part of an inch, would put them into entirely opposite phases. Considering the activity and energy of the forces at work at the surfaces of incandescent bodies, it is impossible to believe that the waves they generate can have their origins absolutely invariable in position.

Interference is the cause of the colors of thin plates or films (as those of soap-bubbles) of Newton's rings (which see), of ruled-plate spectra (see SPECTRUM), and of the iridescence which distinguishes many objects in the mineral and organic world. In the earlier history of optics, most or all of these phenomena were accounted for more or less satisfactorily, upon hypotheses having nothing in common with the theory of undulation. Of the truth of the undulatory theory itself, Fresnel proposed an experimental test, which he afterwards successfully employed as follows:—Two mirrors of polished metal are placed edge to edge and very nearly, but not quite in the same plane. A small solar beam brought into a dark room and concentrated by a lens of short focus forms a radiant before these mirrors.

FIG. 2.



The light from this radiant reflected by these mirrors, forms, after reflection, two intersecting waves, which, being received upon a screen, produce precisely the series of parallel bright and dark stripes which theory leads us to anticipate.

In the figure, R is the radiant, A B and A C are the mirrors, S and S′ are the apparent sources of the reflected undulations. The circular arcs described with these points as centres represent the intersecting waves, the full lines representing the crests and the dotted lines the hollows. Where two full lines or two dotted lines intersect, as at *a* and *b*, there is reinforcement, and a bright stripe is seen; where the intersection takes place between a full line and a dotted line, there is conflict, and the stripe is dark.

Further and quite conclusive confirmation of the truth of this theory of interference has been derived from the chromatic phenomena of polarized light. (See POLARIZATION OF LIGHT.) F. A. P. BARNARD.

Interfer′ence [Lat. *inter*, "between," and *ferire*, to "strike"], or **Intervention** [Lat. *interventio*, "coming between"]. In international law these words are used of the measures which one state takes to prevent injury to itself arising from the political measures of another state, or growing for some other reason out of the other sovereign's conduct. The principal cases of interference are—first, that for the purpose of preserving the balance of power—that is, of preventing a state from gaining, by political means or by force, an accession of power which would be dangerous to its neighbors. Many alliances and wars have taken place in Europe on this ground within the last four centuries. The plea here is self-preservation. A second class of instances of interference, all or nearly all of a modern age, have grown out of the efforts of nations to right themselves against tyrannical governments by revolution. The plea here also is self-preservation—that no government can stand against the revolutionary fever of neighboring countries. But the plea is made for the benefit of the powers that be, and not for that of the people. As a practical rule, it does not apply to great nations like France, which changes its political forms at will, without standing in fear of other states. It is also a dangerous rule to those who follow it, for it only intensifies revolutions within and without by exciting the feeling that there is a radical, endless antagonism between the interest and will of legitimate governments, so called, and the nations which they try to keep down. A *third* and more righteous kind of interference is that used when a government commits great inhumanity in punishing revolutionists, or great cruelty against rebels in war. On the whole, there is a somewhat vague border-line, beyond which, in extreme cases, nations having common interests and a common civilization will pass, in order to put an end to evil or to avert danger from themselves. T. D. WOOLSEY.

In′terim, the name of certain formulas or confessions of faith adopted by the Reformation in Germany at the instance of Charles V., with the object of maintaining the *status quo* until a general council could decide all questions between Catholics and Protestants. There were three such: the Interim of Ratisbon (1541), of Augsburg (May 15, 1548), and of Leipsic (Dec. 22, 1548), each being the result of conferences between Catholic and Protestant theologians upon the points at issue. These interims were in reality despotic ordinances of Charles V., forbidding the Protestants to innovate upon the doctrines or rites they had once professed or agreed to. No permanent result could be expected from such attempts at compromise; accordingly, the Leipsic Interim was generally disobeyed and resisted by arms, was abrogated by Charles in 1552, and was finally superseded by the Augsburg Confession, confirmed to the Protestant states in 1555 by the diet of Augsburg.

In′terlaken, a v. of Switzerland, in the canton of Berne, on the Aar. It has only 1000 or 2000 inhabitants, and consists mostly of hotels and boarding-houses. As it is beautifully situated, and its surroundings present some of the finest prospects of Switzerland (the Staubbach and the Jungfrau), it is visited during the summer by many thousand tourists.

In′terlude. This term, which originally meant certain short pieces of music inserted between the acts of a drama or in any other intervals of a public performance, is now more commonly applied to the brief strains usually played by organists between the verses of metre psalms and hymns in divine worship. Interludes are now passing out of use as a needless interruption, or are introduced only once or twice in long hymns for the relief of the singers.

Intermit′tent Fe′ver, Ague-Fever, and **Ague,** an essential, periodic fever resulting from infection of the blood by malaria or marsh-miasm. Malaria emanates from decomposing vegetable matter exposed to the action of the air and the sun's heat. It exists in swampy districts and in low, damp, undrained places, upon the banks of rivers, upon inlets of salt water, where variable water-level and tides expose a saturated soil to the atmosphere. Malaria

is most concentrated and intermittent fever most prevalent and severe in the tropics, where vegetation is luxuriant, and a soil enriched by decaying plants and falling foliage is subjected to the extreme influences of alternate seasons of rain and drought. In temperate regions it is present in new districts, disappearing as the land is populated, cultivated, and drained. It may appear in cities by the exposure of marshy subsoil when excavating to build, or by the escape of malarial air from defective street sewers constructed in a swampy substratum or emptying on a malarial water-course, whose tidal changes dam back marsh-miasm to escape in the various quarters from which the sewers extend. Intermittent fever occurs in paroxysms separated by intermissions or non-febrile periods. The paroxysms may recur daily, constituting the "quotidian" form, or on alternate days, the "tertian" form, since it recurs on the third day, including the previous attack. There is also a "quartan" form. Exceptionally, there may be a "double quotidian," with one strong and one mild attack each day; a "double tertian," with a daily onset, that of every second day being relatively weak; a "double quartan," having two attacks in every three days. Febrile paroxysms usually recur at a definite hour each day or alternate day. A recurrence of successive paroxysms at an earlier hour for each attack is termed "anticipating," and indicates an increasing malarial influence. When the paroxysms come at a later period, with successive attacks, it is termed "postponing" or "retarding," and indicates a subsidence of the malarial influence. Paroxysms may occur a few hours after exposure to malaria or after a period of incubation as long as two weeks. A paroxysm has three distinct periods or stages: (1) cold stage; (2) hot stage; (3) sweating stage. The average duration of the cold stage is one-half to three-quarters of an hour; it may be a few moments or two to three hours. It begins with shivering, chilliness in the loins, extending to back and limbs, muscular tremor, the lips quiver, teeth chatter, and the whole body is shaken. The respiration is sighing, the pulse feeble, the face pale or livid, the nails livid, the fingers waxen and cold. The general surface is pale, cold, often shrivelled. The thermometer in the mouth or armpit, however, reveals an increased temperature of the blood even in the cold stage, the blood having been expelled from the skin and extremities by the involuntary contraction of the elastic tissues of the skin. During the first stage there is therefore a determination of blood to internal organs, which may be dangerously congested, constituting the "pernicious" or "congestive" forms. Headache, vomiting, tenderness over the liver and spleen, are symptomatic of such congestion. The transition from the cold to the hot stage is gradual; chilliness ceases, flushings of heat are felt, "the coldness melts away." The skin becomes hot and red, pulse full and bounding, the face flushed, headache increases, the temperature of the surface may be 105° or 106° F. The duration of the hot stage is from three to eight hours. The third or sweating stage at first is gradual; moisture appears on the face, soon on the trunk and extremities. Heat, headache, thirst, and restlessness subside, the temperature falls rapidly, the person is drowsy, falls into long and refreshing sleep, with profuse or slight sweating. The duration of this stage is from three to four hours. During the intermissions or apyrexial periods there may be good health, or in graver cases impaired digestion, debility, pallor, or sallow cachectic complexion. Malaria impoverishes the red corpuscles and lessens the albumen of the blood. Intermittent fever tends to recur when incompletely cured, either in marked paroxysms or in less pronounced "latent," "masked," "concealed" forms, vague symptoms of chilliness and weariness known as "dumb ague" or in periodic neuralgia. The spleen is often permanently enlarged, and is termed "ague cake." The periodical recurrence of the paroxysms is due to successive efforts at elimination, the interval being the time required for the zymotic material of malaria to redevelop and impress the system.

The paroxysms require no treatment other than warm drinks and blanketing during the cold stage, cooling drinks and sponging during the febrile or hot stage. The treatment for the prevention of the paroxysms is to be in the periods of intermission. The chief of remedies is the Peruvian or cinchona bark, and the alkaloids derived from it. Quinine is mostly used in the form of the sulphate and bisulphate, less often the muriate. Cinchonine is an alkaloid resembling quinine, but less powerful. The mother-liquor from which these alkaloids are precipitated is evaporated, and an impure, crude sediment, in part quinine and cinchonine, and mainly quinioidia and cinchonioidia, or amorphous alkaloids, is obtained, and is much used—known as "chinoidine." Salicine, the alkaloid of willow bark, berberine, piperine, apiol, eucalyptus, and other vegetable substitutes are weaker and less efficacious than quinine. Crude or unbleached quinine, an inexpensive article, has recently been ascertained to have the full efficacy. Quinine is given either in one full dose of ten or more grains or in divided doses of five grains three times a day to break the paroxysms, and continued in smaller doses for many days to prevent their recurrence. Fowler's solution of arsenite of potash is second only to quinine in power. Nitric acid, sulphites of soda, ferrocyanide of iron, chloride of ammonium are also used. The patient may be more efficiently and permanently cured by combining cholagogue cathartics, and subsequently employing iron and tonics generally. The prevention of intermittent fever is to be sought by soil-drainage, by avoiding damp night air, and sleeping in closed rooms well above the ground. The sunflower freely planted adjacent to dwellings has been considered protective by absorbing malaria, and more recently the *Eucalyptus globulus*, or Australian fever tree, has been extensively planted in Algiers, at the Cape of Good Hope, and in Cuba, and is asserted to lessen, or even eradicate, malaria by its presence. E. DARWIN HUDSON, JR.

Internal Revenue. See REVENUE.

Interna'tional Law, INTRODUCTION TO. International law is a collection of rules by which nations, and their members respectively, are supposed to be governed in their relations with each other. In its exact sense, law is a rule of property and of conduct prescribed by sovereign power. Strictly speaking, therefore, as nations have no common superior, they cannot be said to be subject to human law. But there is nevertheless a body of rules, more or less generally recognized, by which nations profess to regulate their own conduct towards each other, and the conduct of their citizens respectively. Being rules of property and of conduct, though not prescribed by a superior, they are somewhat loosely designated as laws; and taken together they form what is called international law, and as such are enforced by each nation separately upon persons and things within its jurisdiction. This body of rules is derived from custom or treaty. From the earliest times there must have been some sort of rule, tacit or expressed, for the intercourse, however small, which must have existed between nations, and must have begun with the beginning of nations. No community has ever yet existed, and none could exist, so independent and isolated as to have no communication whatever with its neighbors; and intercourse between communities, as between individuals, necessarily required some kind of regulation. We find, accordingly, in the oldest historical records, mention of messengers or embassies sent by nation or king to another nation or king, and of compacts between them. Treaties followed the unwritten regulations as a matter of course, for the necessity of changing or of adding to existing rules led to express stipulations. These were expressed as stipulations between individuals were expressed; orally before a written language was known, and orally or in writing afterwards. Of these treaties or compacts between nations there are many and multiform records. Various collections of them have been made, the most important and complete of which are those of Domont, Rousset, Martens, Morhard, Samwer, Calvo, and De Clercq. Notwithstanding the treaties of every kind and form that have been entered into, the greater part of international law is to this day customary only. These customs have been declared and enforced by judicial decisions, and set forth in the writings of publicists in all the languages of Europe.

The body of law which we have thus described is sometimes also called public law, or the law of nations. Its formation has been gradual, and its history is curious and instructive. They err greatly who say that it is the sole product of modern times. It is the product of all times ever since there were nations upon the earth, though its greatest development is unquestionably modern. The Amphictyonic Council enforced a kind of international law among the Greeks, by which, among other things, an exchange of prisoners of war and a truce after a battle for the burial of the dead were enjoined. The Romans, improving upon the Greeks, instituted a college of heralds for the declaration of war, and established one important and beneficent rule; that none but a soldier sworn into the service could fight the common enemy. Christianity wrought, with its other changes, a great change in public law. The spirit of Christian brotherhood found its way into cabinets and camps. The citizen of another state or the subject of another king was yet a brother in Christ, and the barriers which separated nations were, in part at least, thrown down. The influence of the Christian Church upon the public law of the world cannot be overestimated. As soon as the brotherhood of man came to be accepted as a religious tenet, it was inevitable that the old doctrine of the natural antipathy of nations should, sooner or later, disappear. In the earliest ages the stranger had been accounted an enemy, and even the victims of shipwreck

might lawfully have been plundered. Such barbarities fell before the gospel; and others (less gross), which kept their hold in spite of the Bible and the Church, gradually lessened in intensity and in number. The laws of states, the ordinances of kings, and the writings of publicists have moderated the severity of earlier times, while every new treaty between nations has been an addition to public law. Starting from the theory of the natural rights of men and the equality of nations, publicists have striven to establish the code of ethics as the law of nations. Montesquieu declared it as a maxim that nations should do each other as much good in peace and as little harm in war as possible without injury to their own interests. The rules of the Hanseatic League, the laws of Wisby and of Oleron, the Consolato del Mare, and the Ordinances of Louis XIV. were all so many contributions to international law. A host of writers have discussed its principles and enforced its precepts. Aristotle, Cicero, Bacon, Grotius, Barbeyrac, Puffendorf, Wolfius, Burlamaqui, Rutherforth, Bynkershoek, and Vattel before our times, and in our own days Kent, Wheaton, Phillimore, Twiss, Lawrence, Wharton, Woolsey, Halleck, Field, Heffter, Bluntschli, Hautefeuille, Cauchy, Parieu, Massé, Calvo, Mancini, Holtzendorf, Giraud, Goldschmidt, Asser, Lorimer, Westlake, Bernard, and Pierantoni are among those who have written on the subject. Of all these writers, Grotius stands as the acknowledged head.

As now existing, international law is a science of which the major part is generally understood and accepted. The residue consists of propositions more or less disputed or unsettled. Regarded as a whole, it consists of two main divisions; one treating of peace, and the other of war, or rather of the relations of nations and of their members to each other, except as they are modified by a state of war, and the modifications of these relations produced by war.

The portion of international law relating to peace is naturally subdivided into two divisions; one public and the other private. Public international law contains the rules respecting the relations of nations to each other, and to the members of other nations; private international law contains the rules respecting the relations of the members of a nation to the members of other nations. Only the briefest possible enumeration of the subjects treated in the various subdivisions of these two departments can here be given. In respect to the first department, they relate to the essential rights of nations, such as their sovereignty, equality, perpetuity, territory, property; to their extra-territorial action in regard to navigation, discovery, exploration, and colonization; to fisheries and piracy; to the intercourse of nations with each other by means of accredited agents; to international compacts, asylum and extradition, national character and jurisdiction, and domicile; and to the reciprocal duties of nations to foreigners, and of foreigners to the nation where they live, in respect of residence, occupation, religion, obedience to the laws, taxation, civil and military service. To the subject of private international law belong provisions respecting private rights and the administration of justice. Here may be grouped together regulations concerning personal capacity, social condition, the validity and interpretation of contracts, the effect of marriages and divorces, the devolution of property at death, the administration of justice, procedure and evidence, as these subjects apply to the persons and property of foreigners.

This brief enumeration shows how vast is the scope, and how varied are the details, of international law. The tendency of the science is strongly towards amelioration. Various causes are working to produce this result, such as increasing intercourse between different parts of the world and the waste and suffering of war. Men are perceiving more and more the need of reforming and of defining clearly the rights and duties of nations, that war may be discouraged, international controversies avoided, and international intercourse increased. The changing circumstances of men always require a corresponding change in the rules which guide and restrain them. The oppression of standing armies, the tyranny of conscriptions, the burden of taxation to meet the interest of debts contracted for war, are all so many motives to modify, if it be possible, and to define with exactness, the rules by which nations are to be guided in their intercourse with each other. Of all the measures taken in our time for the civilization of international intercourse and the settlement of international differences, none is comparable to that of international arbitration. The idea is not new—indeed it is as old as Henry IV. of France—but the practice is modern. America has the honor, on which she may justly pride herself, of having oftenest taught by precept and oftenest adopted in practice the closing of international controversies by the intervention of impartial arbiters. There are many instances of international arbitration, and among them the following: One in 1794, between the U. S. and Great Britain to decide what river is the river St. Croix; one in 1802, between the U. S. and Spain respecting the excesses committed during the previous war; one in 1822 between the U. S. and Great Britain respecting slaves taken during the war of 1812; and another afterwards between the same powers respecting the limits of the State of Maine; then in 1843, between Great Britain and France respecting the capture of British ships on the western coast of Africa; in 1839 and in 1868, between the U. S. and Mexico respecting claims upon the latter; in 1853, between the U. S. and Great Britain respecting certain questions under former treaties; in 1856, the international commission at the mouths of the Danube; in 1857, the arbitration between Prussia and Switzerland in the affair of Neufchâtel; in 1858, between the U. S. and Chili respecting captures by the latter; in 1860, between the U. S. and New Grenada, and between the U. S. and Costa Rica; in 1863, between the U. S. and Peru respecting the vessels Lizzie Thompson and Georgiana; in 1849, between the U. S. and Brazil; and in 1867, respecting the grand duchy of Luxembourg. The most memorable instance is the arbitration of Geneva between the U. S. and Great Britain for the settlement of the dispute growing out of the depredations of the Alabama and other Confederate cruisers built and sent from England during the civil war. This arbitration was preceded by a joint high commission of the two governments, by which a treaty called the Treaty of Washington was negotiated, and an arbitration at Geneva agreed upon, to proceed according to three rules of neutrality then first formally enunciated.

A provision for arbitration has been introduced into several treaties; in one between Spain and the Hawaiian Islands; in another between Spain and Sweden; in another between Spain and Uruguay; and in seven different treaties negotiated by Sir John Bowring.

The arbitration of Geneva was followed by a vote of the British House of Commons on July 8, 1873, by which, on the motion of Mr. Henry Richard, it was resolved: "That an humble address be presented to Her Majesty, praying that she will be graciously pleased to instruct her principal secretary of state for foreign affairs to enter into communication with foreign powers with a view to further improvement in international law and the establishment of a general and permanent system of international arbitration." The measures which have been lately taken for the codification of international law are of much significance. At the meeting of the British Association for the Promotion of Social Science, held at Manchester in Oct., 1866, a motion was made by Mr. David Dudley Field for the appointment of a committee to prepare the outlines of an international code. The proposal was agreed to, and a committee appointed, comprising jurists of different countries. Some circumstances, however, led Mr. Field to prepare and to publish in 1872 a draft of the whole work, which he entitled *Draft Outlines of an International Code.* In 1868 Prof. Bluntschli of Heidelberg published a work (*Modernes Völkerrecht der Civilisirten Staten, als Rechtsbuch Dargestellt*) which has been translated into French under the title of *Droit International Codifié.* On Sept. 8, 1873, eleven publicists assembled at Ghent and founded an institute of international law. The number of members is limited to fifty. The next meeting of the institute was held at Geneva in Aug., 1874, and the following three subjects were there more or less examined, and reports thereon were made: namely, international arbitration; the three rules of the Treaty of Washington; and private international law. On Oct. 10, 1873, upon the invitation of an American committee, a conference was held at Brussels, where was founded an association for the reform and codification of the law of nations. This conference was attended by representatives from America, England, France, Germany, Italy, Spain, Switzerland, Holland, and Belgium, comprising some of the most eminent authorities on international law. The two following resolutions were unanimously adopted: "I. The conference declares that an international code, defining with as much precision as possible the rights and duties of nations and of their members, is eminently desirable in the interest of peace, public order, and general prosperity. It is therefore of opinion that no effort should be neglected to obtain the preparation and adoption of such a code. The conference reserve the question as to how far the codification of international law should be simply scientific, and how far it should be incorporated into treaties or conventions formally accepted by sovereign states. II. The conference declares that it regards arbitration as the means essentially just, reasonable, and even obligatory upon nations, for the settlement of international differences which cannot be settled by negotiation. It abstains from affirming that in all cases without exception these means are applicable, but it believes that the exceptions are rare. It is convinced that no difference

should be considered as insoluble until after a clear explanation of the matter in difference, a sufficient delay, and the exhaustion of all pacific means of accommodation." This association had another meeting in 1874, at which papers were presented on various branches of international law. That the steps thus taken may lead to such a reform and codification of international law as will define, with all the precision possible, the rights and duties of nations, and thus lessen the occasions of dispute and the opportunities of conflict, the wise and good of all countries must devoutly hope. DAVID DUDLEY FIELD.

International Law, SUMMARY OF ITS PRINCIPLES. —I. *Rights and Obligations of Nations, except so far as they are Modified by War.*—1. Here we speak, first, of the essential nature of a state, and of the parties to international law. (*a*) An individual man cannot be a party of this kind, but can only claim, if a stranger, humane treatment. The law of nature will be respected by the courts, but the law of nations is not as broad nor does it cover the same ground as the law of nature. When certain blacks, imported against Spanish law into Cuba, rose on the crew, killed the captain, and came into the waters of the U. S., our Supreme Court held that if not slaves they were not committing piracy in getting the vessel into their own power; and so they were not delivered up. By the same application of the laws of humanity, persons fleeing from cruelty at home, or shipwrecked mariners from a country not under our law of nations, would be treated with the same kindness as those with whose countries we had treaty relations.

None are parties to international law except independent organized communities—that is, nations properly so speaking, communities having the full power of making treaty contracts with other nations. This definition will exclude from active partnership in international law all protected or dependent states, all provinces and colonies, all confederacies, the members of which by their organic law form a close union, and the separate kingdoms which become one by a perpetual compact. Thus, the separate States of the U. S. have no more power than private persons have of making arrangements with foreign nations, unless perhaps that of selling State lands to them for purposes not inconsistent with the Federal Union. On the other hand, no form of government or of religion excludes an independent state from participation in international law; there are examples of all forms of government among the nations which acknowledge this law, and of various forms of a common Christian religion; even Turkey, a Mohammedan state, belongs to this international brotherhood, and there are signs that other states more remote from our civilization will move in the same direction. Although the present international law originated within the circle of Christian nations, there is no reason why it should not embrace heathen states if they could consent to come under its provisions.

(*b*) Independent states are said to be *sovereign* and *equal.* The latter term denotes *equality* in rights and obligations, which is the same as saying that they are all equally states, for a state has certain fixed relations towards the members of it, and towards other states, out of which rights and obligations grow. Size, therefore, and rank or dignity according to the etiquette of courts, have nothing to do with this state equality. *Sovereignty*, again, denotes properly the condition of having no superior in the political sphere, and is inseparable from independence. It is an unfortunate word, especially in the U. S., because we have been in the habit of talking of qualified and divided sovereignty. But as far as international law is concerned, only the Union or state called the United States is sovereign; the separate States in this sense have not a particle of sovereignty. But the States have local powers of great moment, and might commit a crime against the law of nations. Who is responsible? Clearly the U. S. Some one must be, and no one else, under our Constitution, can be called to account.

(*c*) Every state which is capable by its organization of fulfilling the ends for which states exist, and especially that of entering into treaty relations to others, is *legitimate.* International law knows only states *de facto;* it does not pretend to decide that although they exist they have no right to exist, nor does it pretend to deny such right to an organized community that has begun to exist by revolutionary means. In fact, a large part of the states of Europe and America have in violent ways passed through separations or unions or changes of form within the last century. It may happen, however, that an organized community, which has heretofore been a portion or a dependence of another, is acting as an independent body, and resisting efforts to force it back into its former condition. What is the legal attitude of old states toward such a newcomer? They have no relations to it whatever, and have acknowledged the state from which it has separated as one of their body. They can, if they please, aid the parent state to subdue it; against this help from one state to another there is no law. Or they can remain neutral while a contest is going on. But they cannot aid the insurrectionists without thereby engaging in war with the parent state; and if the new community has so far become independent that the parent state gives up endeavors to bring it back into subjection—if, in short, the new state is without question a state *de facto*—they cannot, with any reason or propriety, refuse to concede to the community thus born a place among the parties to international law. A state being a *moralis persona*, capable of taking obligations upon itself, cannot destroy the obligations by any change of constitution. Thus, the U. S. acknowledged that it was bound to pay the debts of the old Confederation, and when Denmark and Norway separated in 1814 they took each an equitable share of the debt of the old kingdom.

(*d*) A state's independence is exercised especially in the free management of internal affairs. The right of interference in the internal policy of a state, or even in its external peaceful policy, is so inconsistent with the end for which separate states exist in the world that such independence is universally acknowledged. Yet there are several exceptions to the rule of non-interference either endorsed or admitted by international law. The first of these that we mention is interference for the preservation of the balance of power. That is, when, by diplomatic means, a state is becoming dangerous to the peace of its neighbors, it is held that they may take combined measures to check such growth. Thus, when by management in 1700 the throne of Spain passed over to a grandson of Louis XVI., a large part of the European powers combined to prevent it, and with this the war of Succession was begun. Intervention for this purpose will not be resorted to unless the aggrandizement takes place by political measures, unless those who are parties to it live near enough to fear each other's increase of power, and unless such increase takes place on the land. Commercial growth, colonial growth in remote parts, furnish little ground for apprehension. The plea for intervention in this case is self-preservation. The same plea, after the French Revolution and the fall of Napoleon, was made for interference in the *internal* affairs of other states. It was urged that the right of a people to alter its government against the will of the reigning dynasty is dangerous, and that revolution is opposed to the peace of all states in the neighborhood. On this plea some of the leading powers of Europe put down revolutions in Italy and Spain, although they did not venture to obstruct the way of revolution in France after the restoration of the Bourbons. The principle has never been admitted by England; it is contrary to the principle of national sovereignty, and it only delays and intensifies revolution. A principle just the opposite of such intervention, and intended to prevent its application to the Spanish South American republics, lay at the bottom of the "Monroe Doctrine"—that is, of the declaration, made by Pres. Monroe in 1823, that the U. S. would "consider any attempt on the part of the allied European powers to extend their system to any portion of our hemisphere as dangerous to our peace and safety." This declaration, highly just and timely, against political interference was made in concurrence with English policy, at a time when Mr. Canning opposed the measures of the leading continental states, and it had a decided effect. Nor has the policy on our part ever been altered. To this righteous ground for interference we add another, dictated by feelings of humanity, when any great cruelty or barbarity is committed. Such was the pretext for interfering on behalf of the Greeks in their struggle for liberty in 1827. The three great powers, Great Britain, France, and Russia, by their effectual aid destroyed the Turkish power in Southern Greece and built up a Greek monarchy. It is held, also, that atrocious barbarities in war, especially in civil war, will justify not only remonstrances, but measures for the protection of the weaker power, to the extent even of an earlier recognition of its independence on that account. But all these instances of interference, so far as they are to be justified at all, are to be regarded as extreme and exceptional cases. The exception must be looked at with severe impartiality, as a measure of necessity, and not be made the rule.

2. Another right of a state is that of *Property and Territory.* A state cannot exist without being sovereign within certain limits. A state may hold property like a private person, such as public buildings, ships and forts, unoccupied lands, etc.; it is the protector of all private property within its limits, and has the right of taxing its citizens or subjects; and it is also territorial sovereign within the same limits, by which is intended that it exercises jurisdiction there over property, territory, etc. to the exclusion of all foreign powers. A state's territory consists of all the surface of the earth, land or water, within such boundaries;

of the sea-line to the distance of a marine league from the shore; and of harbors, gulfs, and straits within certain not very remote headlands. Here observe (*a*) that the claim of control over the sea for a marine league is a rule dictated by self-preservation and the necessities of commerce. If, for instance, war between two other powers could be waged within sight of land, serious evils to the nation inhabiting the land would grow out of it; and if there were no control over the operations of commerce within a moderate distance from the shore, there would be room for many evasions of the laws touching the revenue. The control over such an extent of sea is an *incident* to the occupation of the coast. (*b*) There is no absolute rule as to the remoteness of the headlands within which the waters are subject to territorial laws. It is perhaps enough to say that they ought to be near enough to enable vessels to ascertain when they are within territorial jurisdiction, and that a very considerable interval would obstruct the freedom of the seas and be unnecessary for national self-defence. (*c*) Outside of such limits the sea is free to all nations, so that the right of using it for commerce or for fishing purposes is common. But while fishing—*e. g.* on the banks of Newfoundland, as being a part of the ocean—is free, the power of spreading and drying nets and of curing fish on adjoining coasts can be lawfully exercised by foreigners only under sanction of treaties. (*d*) It was claimed by Hübner and other writers in the interest of neutrals in the last century that *ships* on the high seas were territory. This, however, was an unfounded position, taken for the purpose of preventing, as far as theory could, the exercise of war-rights, such as that of searching neutral vessels. A commercial vessel on the high sea, so long as it retains the national character and commits no piratical act, is under the exclusive jurisdiction of its own courts, but its deck is not properly territory. The vessel is simply private property under the protection of its own country. Hence, when it lies in a foreign port it may be attached for debt, and its crew may be amenable to the laws of the port and of the foreign country. (*e*) Rivers bounding two states, unless treaty pronounces otherwise, are common to both, and the boundary-line passes along the principal channel. (*f*) Rivers rising in one state, and having their entrances into the sea in another, have been treated by international law as subject to the exclusive jurisdiction of the state within whose boundaries they are contained. Thus, the dwellers on the upper waters have no right to descend to the sea through other territory except by concession; and yet there seems to be the highest equity, amounting almost to a right, in their free use of the entire river. The conflict between strict territorial right and this equitable claim has been settled by a succession of treaties, chiefly made within the last sixty years, which have now opened all or nearly all the navigable rivers of the Christian world to those who live in states situated on their upper waters, and some of them to outside nations. The Rhine and the Scheldt were opened at the Congress of Vienna in 1815; the Danube by the Peace of Paris in 1856; the La Plata and its great system of waters by treaties from 1853 onward; the Amazon in 1866; and the St. Lawrence, after varying arrangements, by the Treaty of Washington in 1871, which treaty also provided for the free navigation of the Yukon, Porcupine, and Stikine, rivers of Alaska, as an earlier one had provided for that of a principal branch of the Columbia rising in British territory.

3. *The Relations of Foreigners within a Country to its Laws and Government.*—Here we come to a department of international law where the rules of comity, or of humanity and comity—that is, not of strict right and obligation, but of equity and duty—determine the shape of the science. Of course, these rules express themselves with some differences in a multitude of treaties, but the general tendency of modern times is towards increased privilege, so that all the disadvantages of one foreign nation as compared with another are disappearing with every new treaty. It has been contended that no nation has a *right* to shut its ports to the rest of the world or to prevent their passage through its territory, if this should be necessary for their interests. It has even been said that there is no right of cutting off other nations from the use of necessaries that cannot be obtained elsewhere. But intercourse can hardly be called a right between nations, any more than between individuals of the same nation. I am not bound to trade with any one, but may raise everything which I use. I have the right of contract, but nobody is bound to make a contract with me. The most civilized nations obstruct the way of free trade by highly protective tariffs. The true view seems to be that a nation may shut itself out from the society of the world, and that there is no right to force it from such a position. And in truth intercourse takes care of itself; it is so natural, a savage even is so ready to accept that which he cannot produce in exchange for that of which he has an abundance, that only an opportunity of awakening a sense of want, and fair treatment afterward, are needed. The principal points to be noticed under this head are—(*a*) that aliens entering a country are subject to its laws, unless exempted by treaty or international usage. (*b*) Their condition is not necessarily that of citizens—in fact, ordinarily they cannot vote nor hold real property—but they have a secure enjoyment of their property, subject to ordinary taxation, the use of the courts, and the same rights of contract and communication with others. Sometimes they are called on to aid the country by personal service in time of war, but this, we believe, is not common unless they are domiciled, nor does it seem to be right. They can make wills in favor of heirs abroad, transmit property to their own land, and have consuls as well as ambassadors of their native country as their protectors. (*c*) There are several descriptions of persons who enjoy what is called exterritoriality—that is, they are exempt, in whole or in part, from the action of local laws—such as sovereigns travelling through a foreign friendly country, ships of war in its ports, foreign armies if allowed to pass through its borders, and ambassadors accredited to its government. The crews of ships of war, when on shore, are under the control of the police; and it seems that police power may be exercised when soldiers in transit stray away from the army or from their corps. The exterritoriality of ambassadors will be considered hereafter. (*d*) There are some nations where, by special treaties, the residents from Christian lands are exempt from the local laws, and placed under the protection of consuls or other representatives of their own nation. This practice first arose in the Middle Ages, when there seemed to be a wide gulf between the Turks and the Christians, and when personal, instead of territorial, law did not seem as strange as it does now. Such nations are Turkey, Muscat, Japan, and China. Thus, by the treaty of 1858 criminal acts of Chinese subjects towards citizens of the U. S. are punishable by the Chinese authorities according to the law of China, and "citizens of the U. S., either on shore or in any merchant vessel, who may insult, trouble, or wound the persons or injure the property of Chinese, or commit any other improper act in China, shall be punished only by the consul or other public functionary thereto authorized according to the laws of the U. S." The same provision is found in our treaty of 1858 with Japan, by which also the courts of Japan and the consular courts are respectively opened for the recovery of just claims. (*e*) Foreigners may have privileges in Christian states, if mere residents or travellers. But there is also a condition known to the law called *domicile*, the criterion of which consists in residence with no intention of returning to one's native country or departing elsewhere except for temporary purposes. This status is of importance where the question is, Who is an enemy and who a neutral? It is also of importance in INTERNATIONAL PRIVATE LAW (which see). (*f*) There is still a closer relation which an alien may form with the country of his residence, called *naturalization*. By this process he becomes a citizen, having all or nearly all the rights of native-born citizens. In England it was formerly held that no English native-born subject could expatriate himself, nor could a foreigner be naturalized without a special act of Parliament. But by an act of 1844 a principal secretary of state, on petition from a foreigner desirous of being naturalized, can grant him all the capacities and rights of a natural-born British subject except that of being a member of the privy council or a member of either house of Parliament. The secretary may except other rights also. In the U. S. five years' residence is necessary before naturalization, and three years' residence after a legal declaration of intention to become a citizen and to renounce former nationality. (*g*) As the laws of countries differ in regard to the hold they have upon native-born persons, it may happen that one is legally a citizen or subject of two states, and collisions of jurisdiction can thence arise. Recent arrangements with the North German Confederation, with Bavaria, and with Great Britain have removed a great part of the possibility of such collisions. (*h*) Aliens taking refuge in any country on account of crime form a class by themselves. If the crime is political the freest nations now give to such persons their protection. If it is a gross crime against person or property, treaties of extradition provide for their being delivered up. This subject, which has a connection with international private law, will be considered under that title. (*i*) The rights of copy and patent which persons enjoy in their own country are to a considerable extent granted to them in other countries according to a rule of reciprocity.

4. A. *The Rights of Legation and Representation, or Ambassadors and Consuls.*—Every party to international law is a treaty-making power, and every such power must act by some representative. No inferior community, no body of lower grade than a state, no organization trying to be-

come a state but not yet recognized as such, is entitled to send representatives abroad who have international rights. A province or colony or city may have agents in foreign lands, but such persons have none of the rights of *ambassadors*. This term, *ambassador*, may be used generically to include various grades or kinds of diplomatic ministers, and it is often used also to denote *one*, and generally the *highest*, class of such ministers. Other words are *legates* and *nuncios*, usually denoting representatives of the pope; *chargés d'affaires*, a word for a lower grade of ambassadors; *envoys* and *plenipotentiaries*, which latter term generally means less than its derivation implies. There are again ambassadors sent for a particular object, and others whose functions relate to all the political transactions of a nation with another; there are temporary and resident ambassadors; there are also persons who discharge the office without taking the name, as kings or commanders of armies sometimes negotiate treaties. All ambassadors, of whatever rank they may be, have the privileges which belong to this class of persons by the law of nations.

Ambassadors have had from very early times a sacred character, which has been sometimes accounted for by their being originally persons of a religious order; but it is better to say that the office was protected by religious sanctions on account of its great importance. The ancient herald became a sacred person because he could not otherwise safely mediate between armed men. The ambassador needs for his protection the same sanctions, and, as he represents the highest interests of a state, it is a great crime to treat him with indignity or injury. There is a difference between the ambassadors of ancient and those of modern times, consisting especially in *this*—that the former were sent for a temporary purpose, and returned after completing their work, but the latter, since the time of Louis XI. of France and Ferdinand the Catholic of Spain, have generally resided in the foreign country for a considerable time. The resident minister is now expected to make himself acquainted with the politics of the country where he lives, to calculate the chances of war and peace, to use a constant influence in behalf of his own country; and thus, since this custom began, nations have felt themselves more secure than before. As intercourse is suspended by war, ambassadors, on the outbreak of a war or in expectation of it, are either dismissed or summoned home. When peace returns, the renewal of intercourse is marked by the parties receiving each other's diplomatic representatives.

An ambassador represents the sovereign or the sovereignty of his country. In a republic the power of appointing such officers is determined by the constitution or the laws, but instructions are given by the executive authority. In most monarchies the king or emperor appoints those who represent him in foreign courts, but this he does as the head of the government. Hence, when a sovereign is deposed, and is no longer the actual head of the administration, other countries are not bound to recognize his ambassadors, nor on the other hand are they bound to receive those of a new sovereign *de facto*. The rule here, apart from dynastic and political preferences, is the same which holds good when new states are recognized. When the *de facto* government is acquiesced in by a country, and is in orderly operation, other countries will enter into new diplomatic relations with it. If agents of the old and displaced authority are received also, they will have no rank, and to do this at all after an established state of things exists in the revolutionized country is an unfriendly proceeding, implying a hope that there may be a counter-revolution.

The privileges of ambassadors may be comprised under the terms inviolability and exterritoriality. As the privileges themselves are, in great part at least, due to comity, and as the feelings of men will change from age to age with changes of civilization and greater closeness of intercourse, these terms, especially the second, may vary somewhat in their extent of meaning. It will not be safe to give to exterritoriality the broadest meaning it can bear, and then from that meaning deduce the privileges accorded. We must inquire what is the general understanding of the present age in regard to the position which an ambassador may take in a foreign land, and then perhaps it may happen that his own country will somewhat contract his latitude of privilege. The privileges in question are (*a*) inviolability of person; that is, exemption from all violence, whether proceeding from the public authority or from private persons. The exceptions to this rule are that the public authority, when he has committed a gross crime, may send him beyond the borders, using so much force as is necessary for this end; and that private persons do not lose their rights of self-defence if he is an aggressor. (*b*) He has various privileges, summed up in the word exterritoriality, which amount to exemption from the operation of foreign law. There is no departure from the theory of his office if when he returns home he is called to account for transactions pronounced to be illegal by his country's laws which take place while he resides abroad; but usually he is not called to account. His first privilege—which may be referred to his inviolable character, as well as to his exterritorial—is his *exemption from the criminal jurisdiction* of the country where he is resident. If there he commits crimes, acknowledged to be such by the moral sense of mankind, he cannot be tried nor punished, but can be required to leave the land, and only in an extreme case, if he refuses to do this, can force be applied. He cannot commit treason, but he can abet treason and be a party to revolutionary measures, yet his punishment must be left to his own sovereign and country. Some of the older British lawyers, as Sir Matthew Hale, thought that any capital offence except treason, as rape, murder, or theft, might subject an ambassador to indictment and trial like other aliens; and still later it was held that for crimes committed by them against those moral laws which keep all societies together they might be brought to justice like other offenders. But this opinion would hardly find favor at present. Both the law and the feeling of England have increased in the respect they attach to these foreign representatives. The need of a rule is obvious, for if subject to arrest and trial an ambassador might not be able to discharge his functions. (*c*) The ambassador is exempt from the *civil* jurisdiction of the land where he is resident. This exemption is conceded to him everywhere, although it is not strictly necessary for the discharge of his duties. If he contracts debts, the only remedy is by appeal to his sovereign or by suit in his country's courts after his return home. The laws of the U. S. include distress for rent among other legal remedies which are denied to the creditors of a foreign minister. (*d*) The hôtel also and the goods of the ambassador have the same immunity from local jurisdiction. As far as he himself and his retinue are concerned, his house is a sanctuary, but the immunity will not allow him to defy the law of the land by sheltering transgressors. It is admitted, we believe, at the present day, on all hands, that criminals belonging to the country of his residence, if not his servants at the time of the crime, may be searched for and seized in his hôtel, and that all the force necessary for effecting an entrance for this purpose may be applied. (*e*) By national comity the personal effects of the foreign minister and the articles from abroad which he needs for himself and his family are exempt from duties. He may, however, be required to pay taxes on his hôtel if it belongs to him or to his government, and he is liable to the payment of tolls and postage, but cannot be compelled to have troops quartered upon him. Formerly, ambassadors abused their privilege of having goods passed free of duty through the custom-house, and, as Bynkershoek, near the beginning of the eighteenth century, charges upon them, they imported merchandise which they afterwards sold. The same abuse continued for some time afterward, and was, when discovered, complained of in more than one country. Within a few years a minister of the U. S. in Spain has been charged with making importations for himself on account of certain merchants. It is plain that exemptions from duties were never intended to cover any articles besides those intended for the use of the embassy, and it would be no breach of comity to have even this privilege taken away. (*f*) Liberty of worship. This is allowed in all Christian lands, and even beyond their borders, to ambassadors, their families, and, by a stretch of comity, to other persons belonging to the same nation, but coreligionists with the ambassador, if subjects of the state in whose bounds he resides, are permitted only by sufferance to be present. This exemption, of course, has no significance where, as in the U. S., all religions are free; and it has, at least in one instance, been claimed that, where there was already a church of the religion which the foreign minister professes, the permission to set up another for himself might be denied him. The jealousies of Catholic and Protestant Christians, in times past, have led to the rule that the ambassador's worship must be *private*, and even *house*-worship, without bell, organ, or other sign making it known to the public, and that the chaplain must not appear in his canonicals. The reasons for this freedom of worship are obvious. No state could with any regard for its own dignity consent to send a minister to another court, where he was forbidden to exercise his own or his country's religion, and no honest or honorable man would be willing to represent his government where such prohibition existed. (*g*) That the foreign minister may freely discharge his functions he must have some assurance of having his retinue at command. Accordingly, his family, the secretary of legation, and the other officials who compose his train have the same exemptions which are conceded to him. In this privilege his

servants are included, and as these may be subjects of the country, and "bad subjects" besides, this usage creates some difficulty. If it should appear that he took a knave, or even a political *suspect*, into his service in order to shield him from the law, this would at least be a ground of complaint against him to his own government. A custom formerly observed, then disused, then again brought into vogue in later times, is that of requiring from ambassadors official lists of their servants, to secure to the latter the protection desired. (*h*) If the state itself has no direct control over an ambassador's suite, it is evident that he ought to have, but how much power he may use over them is a matter, in part, for his own country to decide. In former times the jurisdiction of foreign ministers was almost as great as that of consuls from Christian states in Mohammedan countries. When Sully, then marquis of Rosny, represented the French court in England in 1603, one of his train having killed an Englishman in a quarrel, a jury of Frenchmen being called together found the man guilty, and delivered him over to the English authorities for execution. It is evident that the exercise of high justice would not now be allowed in any Christian state, and no notice would be taken of such a procedure. The ambassador now can only collect evidence in criminal cases and send a member of his suite home for trial. Nor has he properly any *civil* jurisdiction except that of a voluntary kind, such as receiving and legalizing testaments and affixing his seal. "The right of contentious jurisdiction is nowhere," according to Heffter (§ 216), "conceded to ambassadors in Christian countries, even over the people of his suite." (*i*) An ambassador can be also a merchant, and merchants in former times not infrequently represented small states, or, it might be, the same person acted for several states. Furthermore, a native of a state formerly acted as the representative of a foreign state in his own country. None of these usages are common now, and some of them are almost unknown. While they existed, the double character of the ambassador gave rise to various questions. Thus, it was asked whether the ambassador had any more rights as a merchant than others of his class. The answer given to this was that as far as his commercial relations were concerned, he stood on the same level with everybody else, although, of course, his person still remained inviolate. Again, if he were an ambassador to his own government, and withal a resident there, while it might be free to refuse him recognition in this capacity, yet, as soon as his own country consented to receive him, it admitted that he had all the rights of other like persons. The case of Wicquefort, the author of *L'ambassadeur et ses fonctions*, was unique. He was not only a native of the United Provinces when he represented the duke of Lüneburg, but he also held an office under the States General, and was accused of betraying state secrets to foreigners. For this he was tried, condemned, and sentenced to confiscation of goods and imprisonment for life. The case so far differed from that of other natives employed by foreigners that, while they are in the act of accepting them in the character of agents clothed with the rights of agents, he could not divest himself of the responsibility which his being a public officer imposed on him. For aught that appeared, the Dutch had as much right to punish him for this crime as the duke of Lüneburg would have had if he had detected him in gross violations of his duty as an ambassador, and had been able to secure his person within the duchy. (*j*) Has the ambassador such a kind of inviolability that third parties—for instance, enemies of his country—are bound to respect his official immunities? The answer given by history is that one enemy has had no scruple at capturing negotiators of the other, and at treating them like every other foe in war. Further, although a friendly power would be regarded as committing a hostile act if it seized or imprisoned such a person, yet it might refuse him transit through its territory, and in the act of transit, if he were found passing into a hostile country, he might be prevented from pursuing his journey. Cases have occurred also where foreign ministers were arrested in a third country on account of pecuniary obligations contracted there. But there is no right to seize even an enemy's ambassador on a neutral ship, much less on neutral soil. (*k*) The ambassador's rights begin when he lands in the country to which he is sent, and continue until he leaves its soil; and this whether he is received or not, and whether peaceful relations continue between his country and that to which he is sent or not. On his arrival at the court to which he is commissioned he is expected to produce his letter of credence—which is sometimes accompanied by one of recommendation—and his *full power*, which indicates the subjects on which he is authorized to treat and the amount of power with which he is invested. According to their rank, some envoys are accredited directly to the sovereign of the country, and some to the minister or secretary for foreign affairs. When his mission, for any cause not involving personal or national misunderstanding, is terminated, according to general usage the ambassador presents a letter of recall, and requests audience in order to take leave. Also when his rank is changed without his retiring from his mission he presents a letter of credence. As for the relative rank of ambassadors, the rules laid down by the plenipotentiaries of the eight leading powers concerned in the Congress at Vienna are generally followed, together with the supplementary rule adopted at Aix-la-Chapelle in 1818. The ranks are—(1) ambassadors, legates, or nuncios; (2) envoys, ministers, or others accredited to sovereigns; (3) resident ministers; (4) chargés d'affaires accredited to ministers of foreign affairs or secretaries of state. In each class or rank the diplomatic employés take precedence among themselves according to the date of the official notification of their arrival. When the ministers of several powers sign acts or treaties in common the order of signature is determined by lot. These rules cut off some of the quarrels between ambassadors of different nations in regard to rank and national honor, which were not infrequent in earlier times.

B. *Consuls.*—These are agents clothed with no diplomatic or political power, residing in a certain district in order to protect the interests, chiefly commercial, of the country which commissions them. Their special duties are determined by their own government, and they receive a permission to perform their duties from the foreign authorities. This is called an exequatur, and may be withdrawn for reasons judged sufficient by the same authorities. Consuls have no exterritoriality unless by special treaty, but are subject to the laws of the country where they reside. A gross insult to the consular flag would be a ground of complaint, and so an insult to the consul's person might be resented as an insult to his country, but in general, and where his representative character is not attacked, he is like other men in his privileges. In Mohammedan lands, however, where for a long time diplomatic intercourse fell into consuls' hands, they have nearly the same rights as ambassadors. The duties imposed by the U. S. on their consuls are principally to receive the protests and other papers of masters of vessels, to aid destitute seamen and reclaim deserters, to act on behalf of the owners of stranded vessels, and administer upon the property of persons who have died within their consular province. The office of consul bears some analogy to that of the *proxenus* in Greek states, whose business it was to aid the citizens and pay attention to the envoys of the city which appointed them. They were, however, always citizens of the place where they acted as *proxeni*, and the office, which was an extension of the relation between host and guest, remained in the same family. But the true origin of the consul, in the modern acceptation of the word, is to be traced to the times when commerce began to be active in the Middle Ages. The merchants of the cities on the Mediterranean had already officers who were called by this name, and who settled disputes that arose in the course of business. It was a short step, when bodies of merchants from the same place went for business purposes to the eastern parts of the Mediterranean, that a consul should go out with them or should be sent to live among them, invested with similar powers. We have spoken in another place of the office of consuls in the East, which much resembles this institution of the Middle Ages.

5. *Treaties.*—There could be no intercourse between nations without some understanding in the form of a contract or treaty, and a confidence that it would be observed. The main work of foreign ministers is to make arrangements of this kind, either temporary or permanent. The history of international law is in great measure to be gathered from such arrangements between nations. The subject of treaties is one attended, in its general principle, with little difficulty, and the interpretation of them follows substantially the rules which settle the meaning of other written contracts. We pass over these points to dwell for a moment on one or two which need some explanation. (*a*) The treaty-making power is determined by the constitution of each separate state. In the U. S. treaties made by the executive and submitted to the Senate need two-thirds of the votes of that body for their ratification, and if the payment of a sum of money forms one of the conditions of a treaty a majority of the House of Representatives must concur. In this way it would be possible, in certain cases, to defeat the action of the Senate; but to do this, except in extreme cases, would oppose the spirit of the Constitution, which evidently intended to invest the President and Senate finally and absolutely with the treaty-making power. A similar conflict might take place when in Great Britain the king's ministers had made similar agreements with foreign powers, for, as money is voted for particular purposes and not in a lump, the Parliament might refuse to sanction a payment to which the treaty had pledged the country. A question has been

discussed as to the extent of power lodged in the hands of the President and Senate by our Constitution, as it respects the cession by treaty of land belonging to a State. Very high authorities on constitutional law have taken ground which would sanction the idea that the treaty-making power is practically omnipotent. But surely no treaty could alter the relations of the general government to the States, and as to cessions of land, the better opinion seems to be that while treaty can determine boundaries and so take away from a State what was *supposed* to be its territory, it cannot dispose of territory admitted to belong to a State without its consent, unless in the extreme case of conquest, when treaty simply admits the fact of actual transfer of territory to the jurisdiction of another power, and declares this to be inevitable. (*b*) The legitimate authorities of a nation may weakly or wickedly make a treaty greatly to its disadvantage. What is to be said of this case, and of treaties obtained by force? The true answer is that, as in the case of agencies, where both parties ought to be supposed to know the extent of the agent's power and the nature of a contract, so here, where a State's representative really transcends his power or acts under compulsion, the agreement is void. It is implied in all agreements that the parties are acting freely; to which we may add, and not under deception for which one of the parties is responsible. But the plea of compulsion must not be used to cover very wrong motives, such as may be supposed to have acted on Francis I. of France, when, to effect his liberation from captivity in Spain, he made a treaty which he renounced after he had procured his freedom. For it was not necessary for the French nation that he should be set free, nor was force, in the proper sense of the word, used upon him. Sometimes a subordinate authority, as a general, makes an agreement without having the requisite authority. A noted case of this kind, often referred to, was the *sponsio*, so called, of the consul Postumius (B. C. 321), when he delivered his army from captivity by a peace, which the senate of Rome afterwards declared null. This declaration was constitutional, but in good faith the whole army should have been given over to the Samnites as prisoners of war. (*c*) It is needless to say that, as an agreement to do a wrong thing can never make it right, a treaty for iniquitous purposes is invalid. (*d*) The term *treaty* includes various transactions, such as treaties of peace or of alliance, truces, conventions. Treaties may be for political or for commercial purposes, in which latter form they are usually temporary. In short, all the relations into which states enter between themselves take this form. Among the forms of treaty we mention only treaties of *guaranty*, in which a third party becomes a pledge for the good faith of one of the contracting powers. This kind of security for the faith of treaties was once much more common than it is now. The party giving this security is not considered as engaging to pay a sum of money, in case of the failure of the contracting party to discharge his obligation, nor as engaging to compel him to do this, unless one or the other of these acts were expressly mentioned, but as using his best endeavors to effect this end by urgent persuasion. He must in general induce the other party to perform his stipulated duty, but is not required to perform it himself. Guaranties therefore may mean comparatively little. They are a way of interesting the honorable sentiment of another state in the fulfilment of an agreement, and possibly the non-fulfilment may be a ground for unfriendly relations or even for force. This last is true when a strong power guaranties the independence of another. We can say as much, at least, as this—that an attempt to destroy the independence thus stipulated gives ground for interference. (*e*) Treaties go into effect when they are signed, unless they contain some other specification of the time when they begin to be operative. In treaties of peace and of truce (to which we shall return when treating of war) it is customary, where the operations of war are scattered over a wide space, to fix on separate dates at which the treaty shall come into effect in different quarters. (*f*) A treaty becomes valid when the constitutional treaty-making power gives its consent. Here we may touch on the question whether, in forms of government where the executive is authorized to conclude a treaty, he is bound by the action of his negotiator, provided the latter proceeds according to instructions. It was formerly held that, if the agent who made the treaty proceeded according to his *full power* but not according to secret instructions, the principal was bound by his action, since the full power, being known to the other party, was the motive in consideration of which he consented to treat. But at present it is held by the best authorities that the principal may withhold his ratification, in certain circumstances, even when the negotiator has followed his private instructions. The refusal is justified in cases like these (see Wheaton, iii. ch. ii., §§ 256–263): (1) "On the ground of the impossibility, physical or moral, of fulfilling the stipulations;" (2) "on the ground of mutual error in the parties respecting a matter of fact, which, if it had been known in its true circumstances, would have prevented the conclusion of the treaty;" (3) on the ground of "a change of circumstances on which the validity of the treaty is made to depend, either by an express stipulation or by the nature of the treaty itself." To which may be added the case where the treaty would involve injury to a third party.

II. *International Relations as Affected by War.*—Almost all the important questions and discussions of international law are connected with a state of war between two or more nations. War, of course, must interrupt intercourse between the belligerents, and it may also prevent neutrals from pursuing the same kind of commerce with either of the belligerents as before. It is thus an act or a state of relation of two nations by which other nations also may be seriously affected. Hence, we have to consider war first as if the belligerents were alone affected by it, and then what other nations must consent to endure, and what they have a right to do. Thus, the rights of war in the limited sense, the rights and duties of neutrals, and how far the belligerents may wage war to the prejudice of neutrals, are the principal subjects of consideration in this part of international law.

War itself is armed contention between two organized communities, and a *just* war is such a contention for the purpose of obtaining justice which has been denied. The power of waging it, and the decision when to wage it, must be left by the nature of the case to each of the independent communities of the world. If a state can wrong another and refuses to redress the wrong, the injured party, having no superior, must decide for itself what it will do. It may decide to take no steps to recover its rights, but to waive them as being trifling in the particular case or as not worth the cost of prosecuting them; or it may ask others, its equals, to interpose by way of mediation, or, if the other state will consent, of arbitration; or it may make use of armed force. The choice belongs to the injured party, just as, in disputes between man and man, if appeal to the courts and single combat were allowed, the offending party might employ either of the alternative methods he thought best. No one therefore can interfere in a just war, otherwise every war might become universal. But, as was said in the case of interference, so we must say here—that in wars judged by third parties to be unjust there may be armed interference in extreme cases on the part of the injured.

The particular causes of war are as many as the rights of an organized community or of the individuals under its protection which have been invaded; and to these must be added that an apprehension of intended injury may be so great as to justify the party concerned in striking the first blow. But war can never be right, although it may be undertaken to vindicate just claims, unless measures have been taken to obtain reparation in a peaceable way. This, of course, applies to the active party, as the passive or defensive party accepts a fact and wards off attempted harm. When two parties are in an alliance involving mutual protection or defence, each must judge whether the *casus fœderis* has occurred—that is, whether the assistance is called for by the other in order to prevent a wrong which the alliance contemplated. All these rules, however, are violated, especially by strong nations; and the most frivolous pretexts for war, for joining others in war, for refusing to abide by treaty-obligation, and in this way or by some other wrong bringing on war, have been employed many times over in the history of nations.

When nations have complaints against one another, there are several summary processes by which justice has been sought without recourse to actual war. These are *hostile embargoes, reprisals, pacific blockades.* (*a*) We say *hostile* embargoes, because there are what may be called peaceful or civil embargoes. An embargo being a stoppage or prevention of a vessel's quitting a port, there may be occasions where such a measure can be adopted in order to prevent war by keeping the vessels of a country safe from collision with the rules of belligerent powers. In this case the complete non-intercourse does not generally begin until vessels, especially of foreign powers, have liberty to leave the ports, laden or in ballast. This was formerly thought to be an unexceptionable measure, but it is not much in use, and apparently will go out of use, for it puts obstacles in the way of commerce which all friendly states feel and must complain of. The *hostile* embargo here contemplated is a detention of the vessels of a particular nation which may happen to be in the ports of the injured country. These are detained by way of offset for a wrong done by the other country, in the hope that this attachment of the property of its subjects may lead to a peaceful settlement and prevent actual war. (*b*) This is a form of

reprisals—a word which, taken in its large sense, denotes any seizure and detention of property for the same purpose, for which ships of a foreign power would be detained in the case already mentioned. Reprisals imply an attempt to obtain justice without having recourse to war, while *retorsion* or *retaliation* is not an attempt to obtain justice, but rather to express wounded feeling by unfriendly treatment similar to that which has been received from the other party. Reprisals have often been made the subject of treaty, and in many instances it has been agreed that a nation will not resort to them until several months—four months are named in a number of treaties—shall have elapsed after the threat to make use of them. The evil of embargo and reprisals consists in this—that an innocent subject or citizen suffers loss for the wrong or pretended wrong of his government. This evil can be prevented or compensated for only by distributing the harm which he suffers over the whole political body, and making him a compensation. (*c*) *Pacific blockades* are an invention of one or two of the leading nations of the present age, the object of which has been to prevent neutral vessels from entering or issuing from certain ports of an offending state just as in war, with the same rules of proclamation and arrest for violation of the rules as in war, while yet war is declared not to exist. The examples of the application of such a pretended rule all occurred between 1827 and 1838; that is to say, two of them continued for some time in or after the year last mentioned, but none began before or since the period mentioned. They may be said to have become obsolete already. Of the writers on international law who mention them at all, most do this to condemn them as an experiment unjust to neutrals. This appears to us to be evidently the correct opinion, because if any measure implies a state of war, blockade does so most decidedly; and no such new measure can be introduced into the law of nations without the consent of all. Neutrals, therefore, would have the right of making complaints against such a principle, which affects their commerce. In fact, when a Brazilian vessel was condemned in a lower French court for breaking such a blockade—France and England being nearly alone in this new experiment—on the ground of attempting to take contraband of war into a blockaded port, the higher court decided that as there was no war there was no contraband of war, and restored the article thus condemned. If a state of war did not exist, there was as much obligation to allow the vessel to go into her port as there was to restore the goods condemned on this ground afterward.

Besides these measures for the purpose of bringing another state to act justly, taken by the injured state itself, there are others attempted by one of the states, or through friends of both parties, the object of which is to commit the difference complained of to some impartial counsellor or judge. These measures are mediation and arbitration. *Mediation* is the intervention of a friend volunteering to pacify the minds of his friends, and offering them his advice towards a settlement of their difficulties. When two nations want a pretext for avoiding a war to which they are tending, this is a way of getting them out of their unpleasant position and yet saving their honor. But mediation binds no one: it is mere advice, without any pledge on either part of listening to it. Such a course was recommended in the protocol of the Congress at Paris, Apr. 14, 1856, in these words, which might include arbitration as well: "The plenipotentiaries do not hesitate to express in the name of their governments the wish that states, between which a serious disagreement might arise, should, before appealing to arms, have recourse, as far as circumstances should permit, to the good offices of some friendly power." *Arbitration*, to which in the introduction to this article reference has been made, is of two kinds—that by means of a permanent international court, and that by the special action of the states which are at variance. The first is a cumbrous, unwieldy thing in the present state of the world, and would hardly work very well if a few of the states governed by Christian international law should hold aloof. The other is simple, easy in its operations, and has often been tried with success. The parties agree on the court of arbitrators, on the points to be submitted, on the place, time, etc., on the law which is to govern the decision, and pledge themselves to abide by the result; it being understood that the decision does not go beyond or aside from the points submitted, and that the arbitrators are honest and impartial. The success of the late arbitration at Geneva between Great Britain and the U. S. has brought this kind of arbitration, by compromise as it is called, into greater notice, and inspired many with the hope that wars will be more frequently avoided hereafter in that method. The Parliament of Italy, on motion of one of the deputies, Prof. Mancini, a distinguished publicist, passed the following resolution in their session of Nov. 24, 1873: "The chamber expresses the wish that the king's government, in its foreign relations, may endeavor to render arbitration an accepted and frequent means of settling, according to justice, international controversies in matters susceptible of arbitration; that it may propose on fit occasions to introduce into the stipulations of treaties the condition of submitting to arbitrators such questions as may arise in the interpretation and execution of the same; and may consent to persevere in the praiseworthy initiative which it adopted a number of years since of promoting between Italy and the other civilized nations conventions for the purpose of making uniform and obligatory, in the interests of the respective peoples, the essential rules of international private law." The unanimous acceptance of this resolution, accompanied by the advocacy of it by the minister of foreign affairs, the vote of the British House of Commons, to the same effect substantially, in the summer of 1873, and the earnest wish still more recently expressed of vast numbers, that arbitration may at length be an efficient and formally adopted way of terminating disputes between nations, make us hope that a better time is coming, when wars shall be less frequent.

War is an *open, public*, not a secret, covert, way of attempting to obtain justice. Not only must a demand have been made beforehand, which the complaining party conceives to be just, and a denial of justice, as he conceives it to be, have come from the other party, but there must be an *open* withdrawal from intercourse, an open commencement of hostile relations. The way of doing this is called a *declaration* of war. In the old times no war was thought to be rightfully commenced without such a declaration on the part of the assailing state. The Greeks made their declaration by a herald or by an ambassador and a herald. The Romans in their early times had a formal and ceremonial way of making complaint and declaring war through a college of *fetiales*. The notice here seems to have been given for the purpose of allowing time for reflection to the enemy. In the Middle Ages the declaration, accompanied, it might be, by challenge to combat, seemed intended to remove all suspicion of cowardly, underhanded conduct. A true knight, according to the ideal rule of knightly feudal honor, could take no advantage of his enemy. Open declarations continued until long after the practice of having resident ambassadors at foreign courts came to be the rule, but in modern times such declarations, formally made to the enemy, have ceased to be accounted necessary, although they have not always ceased to be desirable. Diplomatic correspondence and the increased publicity of political relations make nations aware of each other's intentions; and when two states are at variance, and military preparations are going on in one of them, the other is apt to demand the reason through its ambassador; it is thus possible to have earlier information of hostile intentions than could be obtained by simple declarations, and often the final breach is indicated by the ambassador's demand of his passports. Still, a war begun on slight grounds and precipitated upon the other party, like that of Napoleon III. in 1870, shows an intention to get the start of an enemy and attack him when he is unprepared. But, although declarations of war to an enemy are not now thought to be required by honor between nations, it is a very frequent practice to issue to other courts, or in some more directly public way, a justification of the determination to declare war. It is also common to give notice to one's own subjects in different parts of the world, so that they may protect their commercial interests against the foe, and make ready for a change of affairs. In our country, as war is in the hands of Congress, a resolution of the national legislature is all that is needed.

The commencement of foreign wars is now often notified by a neutral government to its own subjects in documents, to which the name of *proclamations of neutrality* has been given. These papers make known the fact of the foreign war, recite or refer to the laws of the nation made for the purpose of preserving its own neutrality, and warn its subjects of the penalties which they may incur by unneutral acts, and sometimes give notice to belligerent powers what will be allowed and what forbidden in neutral waters. By these proclamations a nation screens its subjects from the penalties for piracy in case they should be found on board of a belligerent vessel engaged in the work of war. It also takes from itself the power of complaining that its ships and goods are visited with the ordinary effects of lawful war, as the declaration of the fact of war is good against itself. Such announcements are of little use comparatively when two states, already long known as within the pale of international law, begin to carry on war against one another, but they are of great use when organizations calling themselves states rise up suddenly by a revolutionary process, because in this case there is generally no definite commencement of war, no point of time when what seemed a sedition blossoms into rebellion, and generally no willing-

ness on the part of the old state, against which the revolutionary proceedings are directed, to acknowledge that war exists. Proclamations of neutrality have not been long in use, nor do they carry with them any especial authority. They may, however, in the case last supposed, be galling to a state attempting to quell a revolt, because, according to the rule now usually adopted by nations—but adopted without necessity, as we think—the flag of the revolutionary organization meets with the same reception in the ports of the nations as any other flag. On the whole, although such proclamations may be issued too soon, and so may encourage a revolt that would otherwise be crushed, they do much more good than evil.

The effects of a state of war next demand our notice. The first of these is *non-intercourse* between the individuals belonging to the two belligerents. That is, all relations of commerce, all rights to reside in a country conceded by treaty—unless in express terms perpetual—every means of communication by direct channels between the subjects of the opposing parties, come to an end. It follows that in strictness houses of business, in which one of the partners is a belligerent enemy's subject, must be suspended or dissolved, and that the portion of profits due to him, or in general debts due to a person pertaining to a hostile country, cannot be paid over. Sometimes slight exceptions are made by the government of a belligerent to this total non-intercourse by granting licenses to trade, which, however, do not make such trade internationally lawful, nor protect it against capture without the other hostile party's consent. There are also permissions, often given and sometimes conceded in treaties, that an enemy's subjects may reside during the war under protection of the other hostile government if conducting themselves peaceably; and generally time is given to them, on the outbreak of a war, to remove with their effects from the country. But this is a concession indicating the progress of humanity, and not a strict right. The strict rule would be that foreign residents, as soon as their hostile character began, were liable to be detained or deprived of their liberty, and their property exposed to confiscation. The Supreme Court of the U. S. decided, in accordance with the prevalent opinion of text-writers, that the property of enemy's subjects and debts due to them are confiscable, but added that an act of Congress was necessary to carry such a measure into effect. And the treaty of 1794 (ratified in 1795) with Great Britain provides that "neither the debts due from individuals of the one nation to individuals of the other, nor shares nor moneys which they may have in the public funds or in the public or private banks, shall ever, in any event of war or national difference, be sequestered or confiscated; it being unjust and impolitic that debts and engagements contracted and made by individuals, having confidence in each other and in their respective governments, should ever be destroyed or impaired by national authority on account of national differences and discontents." This is a permanent article of the treaty, and important as a declaration of what the U. S. regarded to be just. Many similar stipulations are contained in the treaties of other nations, and no example of confiscation of debts occurred for a century and a half before the French Revolution, with the exception of the Silesian loan in 1753. No example, we believe, has ever been known of *public debt*, whether due to the other belligerent or to his subjects, having been confiscated. As for the persons of the subjects of one enemy within the jurisdiction of the other, the treaty just now cited expresses itself to the effect that in case of a rupture merchants and others, subjects of the enemy, may remain and continue their trade so long as they behave peaceably; and in case their conduct should render them suspected, and the respective governments should think proper to remove them, the term of twelve months from the publication of the order should be allowed for that purpose. This provision, however, unlike the other before cited, is limited in its operation to twelve years. A multitude of similar provisions can be found in the treaties of other powers. It may be said, then, that at present—(1) debts and other items of property belonging to an enemy's subjects before the breaking out of a war remain intact; but (2) the owner has no power, while the war continues, of getting at his own by any process of law or in any way permitted by law, unless special treaties grant him the liberty; and that (3) at the end of the war the power is restored to him of prosecuting all claims for property held by him before its commencement. Also (4), that the enemy's subjects are generally allowed to remain in the other enemy's country if there resident before the war; and (5), if thought necessary to require their removal, that ample time be given to them to withdraw, taking their effects with them.

The effect of a war on previous treaties between the two belligerent powers deserves notice. Provisions of treaties, it is clear, which relate to the rules of war to be observed between the parties, cannot be suspended by the fact of war, since only then can they come into operation. It is also clear that certain arrangements in their very nature are perpetual, and so do not terminate at the commencement of a war. Thus, the recognition of a state like the U. S., made by Great Britain in 1783, or of the South American republics by Spain, would not need to be renewed after the war was over, on the ground that such a transaction is in itself final, and that such a state has become an international entity, unless, indeed, conquest or some act of such a state as itself puts an end to its international character. The same may be said of boundary-lines and of rights named in a treaty deducible from the existence of a state as such. But when we depart from these clear cases, we find some diversity of opinion. Kent says that "as a general rule the obligations of treaties are dissipated by hostilities." Halleck says, *inter alia*, that "treaties of commerce and navigation are generally either suspended or extinguished by a war between the parties" to them. Of course they must be suspended at least, or war could not exist. Calvo says that "as for postal and custom-house arrangements, conventions relating to navigation and commerce, agreements relative to private interests, they are generally regarded as suspended until the cessation of hostilities." As commercial, postal, and similar conventions are very often limited in time by their express terms, it seems safe to say that such arrangements, and others, like them, liable to be changed in these particulars in a few years of peace, ought to be regarded as broken off by war, which brings with it new feelings and interests. We add from Calvo that opinions agree "in favor of admitting the *definitive rupture* of conventional obligations entered into expressly in view of a state of peace, of such as have it for their special object to favor the relations of good harmony between nation and nation, such as treaties of friendship, of alliance, and other acts of the same nature, having a political character." A distinction was made by some of the older writers between the effects of a new war arising from a cause independent of a treaty, which they thought would not affect the provisions of a treaty, and a war growing out of the breach of a treaty by which its provisions would be annulled. Hence, in a given treaty, if one of the articles had been broken, and a war arose out of the breach, the rest of the treaty would be unaffected. It is easy to see that this distinction would complicate affairs between parties wishing to make peace. The practical rule suggested by these doubts is, that as silence may be misinterpreted, it is best always to make mention of the old treaties by way of renewing and confirming them. It is said by Dr. Twiss that Great Britain "in practice admits of no exception to the rule that all treaties, as such, are put an end to by a subsequent war between the contending parties." In conformity with this rule, or to prevent doubt, the Peace of Westphalia and the Treaty of Utrecht were renewed a number of times over when the parties to them after war made new treaties with one another. It may be added to what has been said, that private rights, resulting from rules of admitted justice, are not extinguished by a war; and so a debt due by one nation to another, where the same rules of right prevail as are acknowledged in municipal law, survives a war. An interesting discussion arose between Great Britain and the U. S. after the war of 1812–15 whether the colonies, after the recognition of their independence, retained the rights of fishery on British coasts, as a matter of course, which they had had while dependencies of Great Britain. Mr. John Quincy Adams and others contended that they retained these rights, and in the discussion the question of the effect of war on treaties came up. To us it seems that the British side of the question had the soundest arguments in its favor. We placed ourselves on the footing of an independent nation, and had no more rights than others; nay, even if we had been obliged to submit again to the British crown, this right of fishery might have been taken away.

A very important distinction, not always observed, but founded both in justice and in humanity, is that between active and passive enemies, or those who prosecute the war either as the responsible government of a country or as combatants, and those who obey the laws of the land in relation to a state of hostilities without any active participation in them. The latter being by far the most numerous class, and making no resistance to the enemy, can be said to be in a state of non-intercourse only, and are really not enemies. They suffer the ills of war so far as the unity of interests and destinies in a political body makes this necessary, but they are not in modern warfare even expected to annoy an invader, and are secure against devastation, and for the most part against requisition, while they remain in that passive state. The interests of humanity thus require that on the land, the treatment of non-combatants should be such as to interfere, as little as the

necessary measures for prosecuting war will allow, with the occupations of peaceful industry and with the quiet of domestic life. On the sea, however, the rules of war have been much more free: the peaceful use of the sea by enemies' vessels has never yet been permitted. Ships and their cargoes have been lawful plunder until now, although to despoil an unoffending householder of his goods and to burn his house would be considered barbarous. This difference is due partly to the greater suffering of families produced by carrying the rigor of war to an extreme, and partly in this—that capture of vessels and goods weakens the capacity of an enemy to sustain a war. Not a few voices have been lifted up in favor of removing innocent traffic on the sea, whether belonging to friends or enemies, from liability to capture. So many steps have been taken in this direction, that capture of enemies' vessels engaged in innocent trade on the sea will henceforth be hardly worth the expense of employing cruisers for this purpose, and must ere long come to an end.

The *forces* lawfully employed on the land and on the sea in times past have been somewhat alike, with important differences. On land they are national or standing armies, and a militia, as well as volunteers; which latter bodies are often commanded by officers of the regular army. On the sea they are national vessels and privateers. The citizen soldier and the privateer armed vessel are as legitimate forces of war as national armies and navies. In fact, privateers date from a time in Europe when there were few or no navies, except such as were improvised out of merchant vessels. These vessels, with their crews, might be hired by the governments, or impressed into the sovereign's service, whether owned by natives or by foreigners—that which was called the *jus angariæ* or *droit d'angarie*—or they might be vessels owned and manned by private persons, but kept up at the public expense; or public vessels with a crew and outfit provided for by private persons; or, finally, private vessels officered and sent to sea at the charges and risk of private persons under a government's commission. Of these four ways of sending vessels out to sea, the latter only has been in vogue in the most recent times. In commercial states this has been a favorite way of employing sailors and merchant ships when trade was crippled by war, and to a nation, with a small navy but with a large seafaring class, offered the prospect of something like equality on the sea with a nation possessing a good-sized fleet. The plan was for the government to put the owners and captains of such privateers under bonds. A letter of marque is given, which alone entitles a vessel to any share in a capture made from the enemy, and the absence of which exposes a vessel calling itself a privateer, with its crew, to harsh treatment, as almost having a piratical character. Any great irregularity or lawlessness will involve forfeiture of vessels and other penalties. But, in truth, lawlessness and harsh treatment of the enemy could never be prevented. The motive of the expedition being plunder, the captain and officers having no professional honor, the crews being often a motley collection of adventurers, privateering was long felt to be a great evil, and earnest voices were raised against it, especially by enlightened men belonging to our own country. At length, in 1856, the parties to the Declaration of Paris brought about a new era in international law by the four rules relating to warfare on the sea, one of which was that "privateering is and remains abolished." Other nations were invited to give their assent to these rules on the condition of accepting all or none, and nearly all Christian states accepted them. Several of them were such as the U. S. had always contended for, but our government refused to give in its adhesion, on the ground that we should have no adequate force, if we abandoned privateering, to cope with nations possessing a large navy, as our own policy was to have a small one. The offer, however, was made—but without effect—to adopt the rules, provided that the signers of the Declaration of Paris would go further and exempt all innocent traffic of enemies on the sea from capture. In 1861, Mr. Seward, being secretary of state, made offer to two of the principal European powers, on the part of the U. S., to come under the operation of the four rules; but as it was understood that the stipulation would be for the entire republic,—for the Confederate States, as well as for the loyal ones—and as thus these powers would be parties in imposing a rule of warfare on the Confederate States, as, in short, it was a scheme to prevent them from using privateers by the aid of international law, the offer was declined.

The abandonment of the use of privateers by so large a number of states, together with the safety of enemies' goods on neutral vessels provided for in the same document, puts a new face on maritime warfare. At the outbreak of a war, if the risk of capture is great enough, neutral vessels henceforth will take the place of belligerent ones for commercial purposes, and the motive of capture is greatly diminished for public cruisers, the only ones now remaining. Thus, it can be no very great concession that belligerents may safely use their own merchant ships, unless neutrals regard it of importance for them to get the business of times of contest into their hands. We add to this, as a hint in regard to the meaning of the four rules, that the parties to them may still legitimately employ privateers against the U. S. and other non-signers of the rules, the obligation to observe them being only a reciprocal one between the signers.

The General Usages of War, especially on Land, although somewhat vague, and dependent upon the temper of the belligerents, or still more upon the character of the commanding officer, deserve our consideration. We have no space to compare the present manner of conducting war with that of past ages, and to illustrate thereby the increased humanity that has taken possession of the Christian world. The principles of a humane and yet efficient war-code are principally these: that war is a way of obtaining justice when other means have failed; that it is waged between governments; that quiet inhabitants of a country are to be treated with humanity and with as little severity as will allow of the effective prosecution of the conflict; that, as soon as justice can be secured, armed contest ought to cease; and that retaliation, if necessary on account of the inhuman or deceitful conduct of an adversary, cannot go to the extreme of justifying that which is morally wrong. The *causes* which have brought on a more humane mode of warfare are various, such as the increased sway of the Christian spirit; the professional feeling in standing armies, coming down from the officers, which looks on the military forces of the foe rather as servants of the state than as enemies; the general practice of carrying supplies for troops on the march, and the system of commissaries and quartermasters, which prevents recourse to plunder in a great degree; and the use of weapons which do their work at a distance without exciting a feeling of rage between man and man. The rules of warfare have been codified in our country in *Instructions for the Government of the U. S. in the Field*—a manual prepared by the late Dr. Lieber, and which, we believe, is the first war-code, properly speaking, that has ever been prepared. What we aim at here is nothing more than to give a brief summary of the leading provisions for preventing the excesses to which war is liable: (*a*) One of these relates to the weapons to be employed, as well as the other means for injuring the enemy. Here much is vague. On the sea a greater license is allowed than on the land. Torpedoes were used extensively in the late war between France and Prussia to protect the harbors of North Germany. On the land, weapons are to be condemned which merely give a ghastly wound without otherwise adding to the efficiency of war. (*b*) The troops employed in war must be such only as can be under military discipline. Hence, to employ savages, like our American Indians or like the Turcos used by the French, is, to say the least, questionable; and it increases the general ferocity of war, as the opposite party will return to regular soldiers the brutalities inflicted on them by this part of the foe's army. (*c*) Perfidy and solicitations to commit crime are not allowable. Military necessity, as our war-rules express it, admits "of such deception as does not involve the breaking of good faith, either positively pledged regarding agreements entered into during the war, or supposed by modern law of war to exist. Men who take up arms against one another in public war do not cease on this account to be moral beings, responsible to one another and to God" (§ i. 15). And, again (§ i. 16), "military necessity does not admit of cruelty,—that is, the infliction of suffering for the sake of suffering or for revenge—nor of maiming or wounding except in fight, nor of torture to extort confessions. It does not admit of the use of poison in any way, nor of the wanton devastation of a district. It admits of deception, but disclaims acts of perfidy." (*d*) When prisoners of war are made, they must be humanely treated as it respects food and quarters. It is customary to allow officers their liberty, on parole of honor not to serve again until exchanged. Deserters, found among the prisoners taken from the enemy, may be dealt with as having committed a high crime. Escaped prisoners have committed no crime in seeking to regain their liberty, but when retaken may be subjected to more rigorous confinement. The treatment, however, of irregular troops, especially of guerrilla-parties and of "bushwhackers," who lay aside the soldier's character or put it on at pleasure, is much more severe than that of regular troops. (*e*) Of the treatment of non-combatants and of their property we have already spoken in part. We add here, on this most important of all the points relating to the conduct of war, that nothing but military necessity can justify the seizure of private property, that domestic privacy is to be respected, and that the persons of unoffending individuals are to be considered

sacred. The code before referred to speaks thus of private property: "Unless forfeited by crimes or by offences of the owner, it can be seized only by the way of military necessity for the support or other benefit of the army or of the U. S. If the owner has not fled, the commanding officer will cause receipts to be given, which may serve the spoliated owner to obtain indemnity." (*f*) As for property not private, hospitals, even those for military purposes, and other humane or religious institutions, are to be respected. Public buildings and works of art are not to be wantonly destroyed, nor the latter scattered or given away by the captor. Booty taken on the field of battle is generally considered the property of the conquering army; but prisoners, according to our code, are not to be despoiled of valuables found on their persons or of extra clothing. It is, however, added that large sums found on the persons or in the possession of prisoners may be taken from them after leaving enough for their support. (*g*) In storming fortified towns the practice, even under humane commanders, has been to put little restraint on their troops. But nowhere is greater humanity needed, since the inhabitants are liable to a triple curse—to the horrors of bombardment, to the sufferings and discomforts arising from a multitude of troops cooped up within the same walls, and to the final storm. The forces of war can and ought to protect houses and persons from plunder at such a season. (*h*) The rules of war allow of certain communications between hostile countries or hostile armies, such as those by flags of truce, heralds, cartels for the exchange of prisoners. These persons, if admitted within the enemy's lines, have a sacred character, but it may be inexpedient to receive them, and of this the party visited must judge.

A few remarks need to be added here in respect to certain kinds of war, on account of something peculiar in one of the parties. One of these is war with *savages*, where the simple rule of humanity is all that can be required of the civilized combatant. The parties being unequal, and one of them ignorant, distrustful, and perfidious, there can be no law of nations to govern their intercourse. Another is war with *pirates*. A pirate is a sea-rover who preys on the vessels and goods of any nation that he falls in with, or makes descents on the land for a similar purpose of plunder. A privateer exceeding its commission might not be accounted as a piratical vessel, but one with a commission from *the two opposite* belligerents would be obnoxious to this character, since the only motive for such a double commission is plunder of both parties and of vessels bound to the ports of either. The vessel of a part of a state, organized for rebellion and independence, has been held to be piratical, because, although it may have received a commission from the rebel government, it carries a flag unknown to international law, and commits treason against its legitimate country. But the better opinion is that as such a vessel does not scour the sea for the purpose of plunder, and wages war with but one nation, it wants two important characteristics of piracy. Piracy, in the international sense of the word, is a crime against all nations, but each nation in its own criminal code may class other crimes under this head; thus, the U. S. made the slave-trade to be piracy for all citizens on any ship, and for persons not citizens on our vessels; yet, for all that, the slave-trade, though it might be made criminal by the laws of all civilized nations, is not piratical in an international sense. A slave-trading vessel from this country could not be captured by the cruisers of any other country without special treaty to that effect; but an act of strict piracy could be tried everywhere, for a piratical ship, as being at war with the world, could be captured by the vessel of any nation. Still a third kind of war with marked peculiarities is that *between a mother-country and a revolted colony*, or a state and the people of a seceding territory. Here the first question is, Does war exist? for the commencement of such a war is often difficult to be determined. It may be a sedition or an insurrection; it may need only the civil power to quell it or a slight military movement. But organization under a new government, apparent determination to make the secession complete, laws and practical efforts for creating an army or a navy, positive acts of war following all this, can give such an aspect to the movement that other nations will have a right to regard the fact of war as manifest. For, be it observed, other nations have the same right of judging whether civil war or rebellion exists, as they have of judging when it has ceased to exist, and when the independence of the rebels ought to be practically acknowledged. And this judgment of theirs is the more justifiable, if the mother-country sanctions it by belligerent acts, such as proclamations of blockade or levies of troops. When, now, such a kind of war exists, the relation between the parties to it is peculiar in this—that every rebel is technically a traitor, waging war against his own lawful government, giving aid and comfort to its enemies. Those, therefore, who are not killed in war may be hanged by sentence military or civil. But in general, at the present day, when so many revolutions are attempted, such severity would only awaken the spirit of retaliation or of revenge; and so also to act on the principle that rebel cruisers are piratical would only embitter the feelings of the rebels, shock foreigners, and provoke remonstrance, if not interference. The true policy is to treat such rebels as *justi hostes* on land and on the sea, entitled to the same rules of war as other belligerents. A nation can employ also against its rebels the same means of war as if they had been foreigners from the beginning—can obstruct the avenues of trade with them, and, after due notice, seize on foreign vessels attempting such trade. All this being incident to an international war, foreigners are bound to respect such proceedings. Further than this, What is the relation of foreigners to the two contestants? One of these is an acknowledged state; the other has no *international* existence, and so towards the latter foreigners have no *international* obligations whatever. If they give it aid, this is a cause of war for the parent state; if they recognize it, and so concede to it an international *status*, this too is a cause of war; but, on the other hand, they may help in its subjugation if they please, thus rendering service to a friend; they may refuse its ships admittance into their harbors; they may decline to acknowledge title gained by sales made of captured vessels under its authority. All that they are *bound* to do is to exercise towards its troops or ships the same spirit of humanity with which they would treat refugees from a battle or from a storm at sea. The common practice, however, as far as there is any, is to take a neutral attitude; to acknowledge the revolters' vessels as engaged in regular war; to give both parties the same privileges that are conceded to belligerents in any other contest. That such concessions must tend to encourage revolutionary governments, to give them the feeling of having reached the dignity of a world-power, is manifest.

War, whoever the parties to it are, contemplates capture and conquest. These are so far morally justifiable in a just war as they have it for their object to procure the means of compensation for wrong previously inflicted, to pay the expenses of obtaining justice, and to provide some security for the future. But as both belligerents generally claim to have the right on their side, and as there is no arbiter between nations, the facts and results of war are acquiesced in, unless outrages are committed, or wrong done which excites in a high degree the moral sense of the world. As for capture, which has been a title of the law of nations discussed and shaped by the courts more than any other in times past, its importance will be much less in times to come, since now neutral ships may carry enemies' goods with impunity, and therefore to a greater extent than heretofore will be used for that purpose. The motives of governments in sending cruisers out upon the sea for purposes of capture are to distress and annoy the enemy—to produce such derangements in the commerce of his subjects as to make him willing to come to equitable terms of peace. No one, as we have seen, can make captures unless under authority from a government. When a capture is made, a question may arise as to its validity, and then no property can be passed by sale with a good title, unless the proper court of the country to which the captor and his vessel belong, gives a title after examination of the facts. The ship and goods taken, however, belong presumptively to the government or country in the interval between capture and such judicial decision. Hence, if for any reason it is inconvenient for a captor to carry or send his prize into port, a very barbarous usage allows him to burn it. A great deal of destruction of ships and goods took place in conformity with this usage in our late war of secession, as the Confederates had no ports into which they could take their prizes. It has been sanctioned by the English courts under the condition, however, of responsibility of the captor or his government, and was practised by us in the Revolutionary war, and by France in the wars of the first part of this century. It is a dangerous practice if a neutral vessel is so treated. A better way of treating prizes, which it is very inconvenient to convey into port, is to allow them to proceed on their voyage under what is called a ransom contract. That is, as a prisoner of war or his friends formerly paid a sum of money for his liberation, or bargained so to do, so a captured vessel could be redeemed from captivity on similar conditions. The validity of such a contract is recognized by the law of nations, but may be against the laws of particular nations, whose cruisers, therefore, are under especial temptation to burn their prizes. The ransom-contract secures the captured ship against further capture from the vessels of the captor's country or of its allies, provided it goes on a specified course, so far as violence of the weather does not prevent. To secure the payment of the contract a hostage is sometimes delivered

over to the captor. The contract is forfeited if the capturing cruiser is itself taken with that document or the hostage on board. The various questions relating to ransom which may come before courts must be left to larger treatises, especially to such as Wildman's *Institutes*, written especially for lawyers practising in prize-courts. Nor have we any space for the doctrine of salvage or the reward paid for saving a vessel, which, although it comes within the province of international law, is for the most part determined by the law of each particular country, and has little more to do with war than with peace.

Recapture, or the recovery of a captured vessel by a cruiser of the same country or of its ally, has been treated of by most text-writers under the form of the Roman doctrine of postliminy. As, however, the principles of recapture differ almost as much from those of postliminy as they resemble them, we must refer the reader for the meaning of that term to the article on it in this *Cyclopædia*, and content ourselves with giving the briefest explanation possible of recapture. If a vessel, having been taken, is carried *infra præsidia*—that is, to a place where by international law a capture cannot be made—and is condemned as lawful prize of war, its former owner's right of property ceases. If captured again after this, it is like any other property taken from a hostile owner. Recapture, then, holds good only when a prize is on the way to a place of security; if it is effected within these limits, the property reverts to the original owner, subject to the payment of such salvage as the law of the land prescribes. If men are recaptured, there is no salvage or ransom-money, as far as we are aware, that can be demanded for them according to international usage. If prisoners of war in a port of a neutral escape to the shore, they cannot lawfully be surrendered; and this is a point where Roman and modern law agrees. There is also a case bearing analogy to recapture on a large scale where after conquest a government is set up and the country is again recovered by its own troops or those of its ally. The point of difficulty here is, What are the rights of the restored government, and what respect is due to the ordinances of the conqueror during his temporary sway? It is easily seen that some very perplexing political questions may arise in such a state of things; we may refer the reader to Phillimore for the extended consideration of some of them. Supposing the conqueror to have not only occupied, but also politically organized, the land before being driven out, we may say, in general, (1) that whatever in this interim he does by virtue of his political power, legitimately exercised, is valid. Taxes paid to his collectors cannot be recovered from them on the ground of the unlawfulness of the government. Legal acts, done by officials or subordinates of his during his supremacy, are justifiable on their part. If he sells state property or borrows money on the credit of the state, this too is valid if done for ordinary state purposes, and not with a manifestly flagitious object in view. Thus, the acts of Napoleon as head *de facto* of France between his arrival at Paris in Mar., 1815, and his surrender to Capt. Maitland in July, had validity; taxes already imposed, but collected by his officials, were legally collected, and new taxes, if collected in this interval and paid over, could not be recovered by private persons. But (2) none of his changes in the constitution or law have any claim to permanence; and (3) the restored or legitimate government has not the authority of going back of its restoration and claiming whatever services or dues it could have claimed during the intermission. It is manifest that some such rules are necessary to avoid the perplexity of private persons in regard to obedience, and to mitigate the sway of a tyrannical conqueror.

The last point relating to war, as considered in relation only to the belligerents, is its suspension and termination. (1) There are suspensions of war with a special and particular object in view, or having effect only so far as certain individuals are concerned. Here belong licenses to trade, which need no explanation, except the remark that they are of strict interpretation, which is true also of passports and safe-conducts or permissions to enter a hostile territory for certain specific and temporary purposes. Here we may mention also conventions relating to the war, such as a commander is allowed to make, or makes under necessity, arrangements respecting the manner of carrying on war, cartels and ransom-contracts (before mentioned), capitulations, conventions relating to exchange of prisoners or to requisitions. (2) *Truce.*—This is a suspension either of all the operations of war, or of those in a particular quarter or before a particular place. Such agreements are made by a sovereign, or by a military commander so far as he has authority for such a purpose. They commence and terminate at a certain day, and need no notice of their expiration. Or, if the truce is general, different days may be appointed for the beginning and end in different quarters of the world. Truce allows generally a return to peaceful (or rather to non-warlike) relations for a definite period, but does not involve withdrawal of armies from before a fortress or from a special theatre of war. A question on which considerable difference of opinion prevails is, What can be done during a truce, and especially whether a besieged place may repair its walls and construct new works in such an interval? An answer which would perhaps fail of removing all difficulty might be, that anything might be done which would have been directly prevented by war, or which is not in itself a directly hostile movement. Thus, a besieging army cannot lawfully add to its works of siege, and a fortress cannot be repaired—at least in places which would have been commanded by the guns of the enemy. (3) *Treaties of Peace.*—The only rational object of war is to secure a state of justice involving reparation and security for the future. Treaties of peace, being appeals to force, do not always bring the adversaries to just terms, but, whatever their result, they are the most important acts of treaty-making powers; they often form epochs in national or in continental history. To name only one or two: the Peace of Westphalia, those of Nimeguen, Ryswick, and Utrecht-Baden, the Treaties of Paris and of Hubertsberg in 1763, the Peace of Paris and that of Versailles in 1783, the two treaties of Paris in 1814 and 1815 respectively, the Peace of Zurich in 1859 and of Prague in 1866, and the Peace of Paris in 1856 (on account especially of its international character), indicate memorable changes of relative strength, or mark a new policy, or bring in a new dynasty, or are in some way the eras of some kind of progress. They are the hands of a clock, but the war was the moving force.

Treaties of peace are subject to the same rules of interpretation with others made by the constitutional power in the state, etc.—We have already considered the effect of war on previous treaties, and on particular arrangements of those treaties. Only two additional points remain to be considered: (*a*) When do treaties go into effect? They bind the parties, as we have seen, when they are signed or when they are ratified. They bind individuals when they receive news that such treaties have been made. In the interval between ratification and knowledge of the peace by military officers or by cruisers, injuries must be made good by the country to which the party committing the injury belongs. Captures made after a peace, but without knowledge of it, have been held to subject the capturing officer to civil damages, for which he would have a right to demand compensation from his government. Captures, again, made before the time for the termination of hostilities, but with knowledge that peace has been concluded, are held to be invalid and subject to restoration. (*b*) The effect of peace is to put an end not only to a war, but also to all complaints relating to the subject for which war was undertaken. It is an oblivion or amnesty of all past difficulties. A new war can be undertaken for similar causes of complaint, but not for the same. They are forgotten and forgiven, whether mentioned in the treaty or passed over in silence. In regard to the state in which the war leaves the parties, if the treaty makes no mention of this point, the principle of *uti possidetis* is admitted. Territory stays in the actual occupant's hands unless passed over by express agreement, and a strong place must be restored without injury to its works. When a part of a country is yielded up at peace to the enemy, the former sovereign is neither bound to make compensation to those who suffer by the change of jurisdiction, nor to secure the new sovereign against resistance from the inhabitants to his authority. All he does is to renounce his own sovereignty and jurisdiction.

Two topics remain to be considered, both of which are of prime importance—the *rights and obligations of neutral nations, and the liabilities and rights of neutral trade.* In modern times neutral interests have become of such moment that a war between any two states under our modern international law produces wide-sweeping effects such as ancient history never knew. All industry and finance is filled with apprehension; the neutral asks what he can do to avert the effects of war from his borders by changing the course of trade, or how he can interfere by influence to prevent or abridge war. And it may ere long become a serious question whether, considering the increased amount of disaster that war brings on the world in modern times, the nations should have unlimited power to declare war—whether neutrals ought not to have a voice in the matter—whether, in short, as civilized nations are brought by their closeness of interest into something like a confederacy, they ought not to have something like the political authority of a confederacy, so as to have a deciding influence, at least, in all external wars.

A neutral is a state which is a friend to both the belligerents and takes no part in the war. Sometimes, according to an earlier treaty, a power of Europe has been bound, on the breaking out of war, to furnish troops to one of the

belligerents; but it is plain that the other may regard this as the act of an ally if he chooses. There is also a neutrality or *neutralization* now known to public law, by which a certain territory and its inhabitants have put on the character of permanent neutrality, so that no armies can cross the boundaries of such a state, and it can itself engage in no war. Such, since the year 1815, has been the condition of Switzerland and of part of Savoy—which last-mentioned country, so far as it was placed in this condition, continues in it since its cession to France in 1860; such also that of Belgium became, after its disruption from Holland in 1830. And, again, the northern powers of Europe in two instances (in 1780 and in 1800) formed what was called *armed neutrality* for the purpose of maintaining certain alleged maritime rights against both the belligerents; but a league like this might turn into a secondary war. A neutral state must be impartial in rendering the same favors to both belligerents, but this is far from being enough. It must stand aloof, and keep its territory and its subjects aloof from the war as far as possible. Impartiality may, in fact, be a great privilege and assistance to one of the parties, but none at all to the other. For this reason especially the modern idea of neutrality is stricter than that of a century or of two centuries ago. While the neutral state thus stands aloof, it must be humane to both parties, receiving their vessels into its ports when driven in by stress of weather or, as it would receive fugitive troops on the land, admitting them into its waters when escaping from the enemy; yet in such sort that on the land the troops are disarmed, while the vessels can do nothing more than make the necessary repairs and procure provisions. The neutral is not bound to allow cruisers to enter its ports with prizes unless obligated by treaty; and the safest, most neutral course, is not to allow this. Much less can vessels of war of the enemy procure military stores. Coal is an article of use in both war and peace; by modern practice—and there is no other—vessels of war are furnished with enough to take them to the nearest port of their own country; but war-steamers are too modern for any well-understood rule to have grown up in this respect. It was formerly not thought to be unneutral to allow transit to foreign armies in a time of war; and Switzerland supplied by treaty more than one state of Europe with mercenaries, but the age of such concessions has passed.

It has become of far more importance in the present age than it ever was before to decide what neutrals may not do and may allow to be done within their territories that may have a bearing on the fortunes of a war. Looking first at the second point, what neutrals may allow or suffer, we remark that a distinction is to be made between those private transactions and those ordinary proceedings of trade which cannot be prevented without considerable *surveillance,* and those acts of individuals which are open to inspection. If a neutral's subject lends money or goes abroad privately to serve as a soldier, or exports articles to a blockaded port, or such as are contraband of war to any belligerent port, he does these things without sanction of law; and the courts both in Great Britain and in the U. S. will refuse to help him to recover money lent to a belligerent, on the ground that the transaction is contrary to the law of nations. (See Phillimore, iii. § 151.) But hitherto, neutrals, whilst forbidding or warning against most of these things, do not make them punishable. It is otherwise with more public acts, such as building war-vessels for a belligerent or enlisting men for his service. Even here commercial cupidity and the tricks of foreign agents can often prevent the purpose which they are attempting to accomplish from coming to light. A neutral, however, if it be his duty to prevent his territory from becoming the starting-place for carrying on war against friends, can make effectual laws and maintain an active police. It is not the office of foreign ambassadors and consuls, but of the home government, to look into such trespasses, and the more, because they otherwise expose themselves to complaints from the injured belligerent. On the other hand, the conduct of neutral governments themselves is tolerably clear. They cannot lend money or troops to either belligerent, or open their ports for hostile purposes, or permit their courts to be used for deciding questions of prize where either of the belligerents is concerned. To secure the neutral conduct of their subjects, neutrality laws are enacted by several nations, perhaps by all who are under the Christian law of nations. Thus, the U. S. passed one in 1817 which is still in force, and Great Britain one (59 Geo. III. ch. 69) which continued in force until 1870, when a new act was passed, entitled, like the first, a "foreign enlistment act," but far more stringent and conceding far more power to the administration. Under the first British act vessels destined to prey on the commerce of the U. S. in the interest of the Confederates slipped out from British ports and did their work effectually. Great complaints arose on our side, until in May, 1871, the Treaty of Washington was effected, containing three rules which the parties agreed to have applied in deciding their past difficulties, to observe for the future between themselves, and to urge on the acceptance of other nations. These rules are—that "a neutral government is bound, *first,* to use due diligence to prevent the fitting out, arming, or equipping, within its jurisdiction, of any vessel which it has reasonable ground to believe is intended to cruise or to carry on war against a power with which it is at peace; and also to use like diligence to prevent the departure from its jurisdiction of any vessel intended to cruise or carry on war as above, such vessel having been specially adapted, in whole or in part, within such jurisdiction to warlike use; *secondly,* not to permit or suffer either belligerent to make use of its ports or waters as the base of naval operations against the other, or for the purpose of the renewal or augmentation of military supplies or arms, or the recruitment of men; *thirdly,* to exercise due diligence in its own ports and waters, and as to all persons within its jurisdiction, to prevent any violation of the foregoing obligations and duties." In regard to the meaning of these rules, we observe that "due diligence," as well as "reasonable grounds of belief," is necessarily indefinite; only the facts of the case can determine whether one neutral has reason to complain of the other as to these points. A most important question of interpretation is whether "to prevent the departure from its jurisdiction" relates only to the original departure, when the vessel is ready for sea, or to any future departure, if it should enter the ports of the same neutral. We have good reason to believe that the commissioners of the U. S. understood the words in the latter sense, and so also did the judges, or the majority of the judges, at the tribunal of Geneva. In other words, the crime rests on the vessel, and the flag which it floats does not protect it; which is thus true of the vessel of *any established* government, but *much more* of a vessel belonging to an organized revolutionary body, which has no rights or status under the law of nations.

Neutrals, on the other hand, have important rights against belligerents, the principal one of which is that their territory or the sea within their jurisdiction shall not be touched by operations of war. Accordingly, a capture made within neutral waters, even if in hot pursuit and flight the contending vessels pass out of the open sea, is vitiated; and the same is to be said of captures following a contest in neutral waters which is completed on the high seas. The neutral has a right to demand from the belligerent captor satisfaction for such invasion of his rights, to seize the prize if brought within its waters, and perhaps to chase and arrest the captor on his way from the scene of the offence. So any attempt to compromise the neutral's position by enlisting men to serve in war, or by inducing them to go aboard for the purpose of enlisting, is an infraction of the law of nations, connivance at which on the part of the British ambassador in 1856 led the U. S. to demand his removal.—The subject of arresting neutral vessels on the high seas will be considered under the head of *Search and Visitation.*

The Liabilities and Rights of Neutral Trade.—(*a*) Here, when we speak of neutral owners and neutral property, the word *neutral* is taken in a qualified sense. He is a neutral owner who is resident in a neutral country, and that is neutral property which is owned by a neutral and is the product of neutral soil. That, on the contrary, is hostile property which belongs to a person resident in a hostile country, and hostile property is his property or the production of hostile soil. It may happen that one partner is hostile and one neutral; if capture takes place, their respective interests in the concern will decide how much is exempt from, and how much is liable to, the laws of capture. If a person resident in a neutral country has a place of business and capital in a hostile one, he has so far forth a hostile character; but the English courts have ruled that a person domiciled in a hostile country, but having a commercial house in a neutral one, is not neutral, but hostile. To these particulars we add that a hostile flag or license to trade makes a ship hostile; that papers relating to the nationality of a vessel cannot be changed during a voyage without strong evidence of fraud; and that produce of soil which a neutral owns in a hostile country follows the character of the soil.

(*b*) A subject of a neutral may identify himself with one of the belligerents in several ways: he may carry contraband of war, or try to break blockade, or take out a trading license, whether between the belligerent mother-country and a colony or between ports along the belligerent's coast. Most of these actions would be regarded as criminal, and as exposing a vessel to pains and penalties. But the questions arise, What may a neutral vessel do? what may it not do? That it can do unneutral acts is undoubted; that the belligerents ought not to stop neutral trade, unless in

self-defence, will be generally admitted. The great difficulty always was, until the Declaration of Paris, to decide whose goods the neutral trader might take on board of his vessel. Numberless were the contentions, the diverse arrangements by treaty, on that subject. The second and third rules of that Declaration laid the basis for uniformity of practice among the signers; and as they are such as the U. S. always strove to have come into operation, they may be said to be all but universal, although we have never given our adhesion to them. They are, that the "neutral flag covers the enemy's goods with the exception of contraband of war," and that "neutral goods, with the exception of contraband of war, are not liable to capture under an enemy's flag." Enemies' goods on enemies' vessels are still liable to capture, whatever be their quality; but as the cautious trader, to avoid risk, would employ a neutral vessel, the amount of property on the open sea exposed to the vessels of the other enemy will be very small; the number of captures hereafter may be expected to be very small; and as privateers will cease to be employed as an auxiliary to national vessels, it is not unlikely that ere long no goods or ships will be exposed to capture but such as directly aid in war. The law of the future, in short, will provide that there shall be no difference between neutrals and enemies in regard to the right of undisturbed passage over the sea.

(*c*) The history of past rules and opinions touching liability to capture is too large a subject, and withal too antiquated, for us to enter into in an article like this. We will only add on that point one or two sentences which may serve to aid in understanding former practice and historical allusions to it. Two rules, then, may be said to have been in conflict heretofore—one making *capture* to *depend* on the *nationality of property conveyed* over the sea; the other, on the *nationality of the conveying vessel*. By the first rule the neutral's goods were *safe* on any vessel, the belligerent's *unsafe* on any vessel. By the second, the neutral's ship protected the goods, the belligerent's exposed them to capture; or, to put this into another form, free ships made free goods, enemies' ships made goods hostile. As for the last part of this rule, it was of slight importance what usage should prevail in regard to enemies' ships carrying neutrals' goods, for in war the neutral would naturally do more of his own carrying than before. But it was of great importance to the belligerent that the neutral flag should not protect his enemy's goods, while it was of great importance to the neutral that a rich carrying-trade should be opened to him in time of war. In this conflict of practice the belligerent interests, especially those of a nation, like Great Britain, with a naval force strong enough to protect itself and annoy its foe, prevailed; and so, on the whole, the first of these two rules had the most vogue when treaty did not intervene—the rule, namely, that the property of a neutral is safe under any flag, and that of an enemy unsafe under any flag. This rule exposed the neutral to great annoyance, as his cargo might be mainly hostile; but we must regard it, after all, as most just that not the vehicle but the property should determine liability to capture. For the reason for capture is—apart from cases of blockade and contraband—that the thing in question belongs to an enemy; and a neutral certainly has a right to take his friend's goods on his vessels, and to use his friend's vessel for the same purpose. The war-right of his friend's enemy may subject him to inconvenience, but neither his property nor his right of payment for freight ought to be taken from him. The present rules—that is, the rules of 1856—are not more just, but they are more humane, than those which Great Britain and our Supreme Court held to be the true law of nations. (See *Introduction to International Law*, by the author of this article, §§ 169 *b*—171.)

(*d*) When, under the old rules of capture, a neutral ship was found with an enemy's goods on board, freight was paid by the captor for the voyage, capture being considered equivalent to delivery; but when a hostile vessel was captured with neutral goods on board, if the captor conveyed them to their original destination, he was allowed to charge freight, otherwise no freight was due.

(*e*) When a neutral used an armed vessel of the enemy for conveying his goods, he exposed them to capture, according to British doctrine, as thereby showing an intention to resist the inconveniences of search and capture. But our courts held a different language, for why would the neutral run the risk of the total destruction of his goods in consequence of an engagement, as he was safe already from capture? A rule for this case is now of no great importance, whichever way it be decided, since privateering has ceased in great measure, and ships of war are not much in the practice of carrying the goods of private persons.

(*f*) *Contraband of War.*—The word "contraband," originally signifying that which it was against a ban, edict, or proclamation to export or to import, now denotes those articles which a neutral cannot send to a country in a state of war consistently with the neutral character or without violating the law of nations. These are articles which directly aid the operations of war, and to send these to an enemy identifies the neutral with him. I may assist in war as effectually by sending arms or gunpowder as by getting men to enlist in a belligerent's service. What these articles are is, for the most part, pretty generally admitted, although there is a dispute about several of the more important ones. The U. S. have a formula which has been inserted into a number of treaties with South American republics. This list includes—"(1) cannons, mortars, howitzers, swivels, blunderbusses, muskets, fusees, rifles, carbines, pistols, pikes, swords, sabres, lances, spears, halberts, hand-grenades, bombs, powder, matches, balls, and all other things belonging to the use of these arms; (2) bucklers, helmets, breastplates, coats-of-mail, infantry belts, and clothes made up in a military form and for a military use; (3) cavalry belts and horses, with their furniture; (4) and generally, all kinds of arms and instruments of iron, steel, brass, and copper, or of any other material, manufactured, prepared, and formed to make war by sea or land." Besides these, on which there would be a very general agreement, naval stores and materials for ship-building are mentioned in a number of treaties as *having* this character, and provisions may *assume* it, according to some authorities, when there is a prospect of reducing an enemy by famine. Ships made ready for war are not found in some lists, but would probably be regarded as contraband *par eminence*. So the machinery for steam-ships, an article of modern times, might be classed in the same list. Whatever article is of contraband character, thus much may be said—that belligerents have no right to add to the list, nor neutrals to take away from it. To restrict the trade of neutrals, especially by an arbitrary act, is not a thing to be endured in the present age. We are thus prepared to condemn the doctrine of *occasional* contraband,—which has not received the assent, nor been sanctioned by the practice, of all nations,—according to which naval stores, and provisions especially, are declared contraband by a belligerent when the circumstances seem to require it. The fluctuating character of such a doctrine is shown by the rules of the English judges in the early part of this century, as that such articles were viewed with greater indulgence if they were the produce of the country from which they were exported, or if unmanufactured or destined to a commercial port, than if shipped from a country where they were not grown, or in a manufactured state or destined to a naval station. Afterwards the English judge, Sir William Scott (subsequently Lord Stowell), withdrew this indulgence as to the commercial part, on the ground that the articles might there be used to fit out privateers. (See the author's *Introd.*, § 180.) The complaints of neutrals led to a new modification of the harsh practice in regard to provisions and naval stores. Their whole trade might consist in such articles, and the belligerent doctrine be ruinous to them. The rule of *pre-emption*, which had some support from ancient precedents not strictly applicable, was now applied by way of relaxation of the rule, and consisted in this—that a cruiser at sea was allowed to detain vessels laden with provisions or naval stores, and bound for the enemy's ports, and to take them into a port of his own country. The articles thus intercepted were paid for at the market-price, and with a fair profit added, but not at the price which the neutral expected to obtain in the country to which he was conveying them. The U. S. in one treaty, that of 1794, sanctioned this principle. When a vessel is taken with contraband articles on board, the modern very mild rule is to confiscate such articles, and let the vessel with the other goods go free, unless both or either of them belong to the owner of the contraband, in which case, or where false papers show privity in carrying them, the guilt passes over to the remainder of the property of the same owner, or also to the owner of the vessel.

Special cases of contraband trade are the conveyance of ships of war or of transports with their crews, of persons in the military service, and of despatches. All but the last would have been considered by older writers and by courts as highly criminal. Despatches do not seem to have been spoken of before the beginning of the present century. The doctrine, first brought out in the English courts, but now pretty generally accepted, is that a shipmaster who knowingly conveys hostile despatches exposes his vessel and the cargo, if he is the agent of it, to confiscation. But what are hostile despatches? They are in substance defined to be "official communications of official persons respecting the public affairs of government." Such despatches as keep up the intercourse between a belligerent and a neutral country are not hostile despatches, nor has the other belligerent the right to obstruct it. It seems likely that

vessels carrying the public mails, especially if on a certain stated course, would not be exposed to suffer from the operation of this rule.

According to received doctrine, neutral governments are under no responsibility to restrict private persons from conveying any kind of contraband to either or both of the belligerents. The articles are not contraband until they have left the neutral limits, it has been said, and the neutral is not obliged to maintain an expensive police of the sea. If two nations choose to fight, they must guard their own coasts; the world suffers enough from their contests without aiding them in any respect. But there is another side to the doctrine of the responsibility of neutrals. They thrive by the quarrels of their friends; they supply the materials for death; and in so doing they demoralize society almost as much as if they entered upon the slave-trade. Furthermore, the articles that are contraband are in some cases almost indistinguishable from those which could not be sent abroad without exposing the nation itself to charges of unneutral conduct. A ship of war made to be sold in the ports of a belligerent, if without a crew, is contraband, but a ship made by contract for the belligerent government is more—it is something which neutrals must not allow to slip out from their harbors. The difference between the two cases is almost annihilated if the neutral merchant has a secret understanding with the belligerent to make the ship for him while acting as the owner himself. Add to this, that nations rush the more readily into war if they know that a supply of arms and ammunition will be on hand when they want it. For these reasons we think that not only what Dr. Phillimore contends for—the making it unlawful for belligerent private vessels to get materials of war—should come to be a rule of international law, but also that no neutral vessel should be allowed to export such articles to either of the belligerents. This might be effected by requiring sufficient bonds from all vessels before sailing that they have no contraband on board, and imposing a penalty besides in case of transgression. Let all merchant ships of every nation be free to carry innocent articles to the *theatre of war;* let no ships of any kind be allowed to carry articles contraband of war.

(*g*) There was formerly a special prohibition against a certain kind of trade, called the rule of 1756, which England insisted and acted upon, but which never fully passed into international law, and has now become of no significance. It related to trade closed in peace, but open in war. Such trade might be *coasting* or *colonial*, the first of which nations generally do not open to foreigners, while it was for a long time a principle to confine the other to native-born subjects or open it only under limitations. Such trade at first was allowed, we believe, in all cases, only to foreign vessels that had obtained a license. There was reason enough to regard a licensed vessel as identified with the belligerent's interests, and so far the rule was not harsh: but when the trade was opened to all neutral vessels, the same rule was urged with somewhat less of justice; the neutral saved a state from some of the embarrassments into which it might be brought by its enemy. Our government contended against the rule in its application both to coasting and to colonial trade, but some of our publicists were willing to let the rule have force in regard to coasting trade which has an especially national character. Since the Declaration of Paris of 1856, by which the neutral ship has a right to take enemies' goods, this rule has necessarily expired.

(*h*) *Blockade.*—This word might be used of all obstructions put in the way of approach either to a besieged town on the land or to a besieged piece of water; but, as facility of approach is confined chiefly to water, all the questions under this title relate to that element and to neutral vessels upon it. The right of blockade is admitted on all sides; the true ground for defending it is the same that would make it dangerous to bring supplies to a besieged place in the interior. If I allow neutrals to aid my enemy by provisions and military stores, I can never terminate a war. He assists his friend to my injury, and this, if there be any rights in war, I ought to have a right to prevent. Only harbors and mouths of rivers, and perhaps passages through straits, can be blockaded. A stretch of coast does not admit of this unless the number of vessels is augmented in proportion to the local limits of the blockade. Mouths of rivers cannot be so blockaded as to obstruct the commerce of the riparian states that are neutral. A blockade is a fact or event that may begin or end, and therefore there must be *some notification of it* to traders, to neutral governments, or to both. The French rule is to give two notifications—the diplomatic one, and that communicated to the vessel at the mouth of the harbor—and at no stage of the operation to neglect the latter. M. Molé, minister of foreign affairs, writes in 1838 to another French minister of state: "I will not recall here the reasons why, independently of the official and diplomatic notice of a blockade, every ship showing itself before the blockaded port ought to receive the warning from the commanding squadron." The French, however, hold, if we are not mistaken, that at the outset of a war, before notice has had time to travel over the commercial world, a simple warning to a ship is sufficient, and that an attempt to break through into the port after this would expose the vessel to seizure and trial. The English and our own rule does not require the double notice. It is enough to send the diplomatic notice to all neutrals, and only at the very commencement of a war, especially before notice has had time to fly abroad, to warn off any approaching vessel. If, meanwhile, a vessel should seek to enter the blockaded harbor under the plea of ignorance, the length of its voyage and other circumstances must decide whether the plea is just. The diplomatic notice must be sent everywhere, and if only common fame has carried it to a particular country, that is not sufficient to involve in guilt a vessel of that country, when seeking the blockaded port. If we compare the two rules, we shall give the preference to the English. The diplomatic notice is intended to prevent voyages, which may be useless or losing, to places in an actual condition of siege. Should a vessel now appear at the harbor's mouth with the claim of not knowing the state of facts, the presumption is against the story, and she must prove her words as she can. But why give a new warning here, any more than to a burglar at your door? It is highly criminal to break blockade; the purpose to do it is a hostile purpose, and no indulgence is called for by such traffic.

The amount of force necessary to make blockade legal and effective is somewhat indefinite. The fourth rule of the Declaration of 1856 is that "blockades, in order to be binding, must be effective; that is to say, maintained by a force sufficient really to prevent access to the coast of the enemy." It may be asked what "sufficient to prevent access" means. Suppose a number of trim, swift blockade-runners slip through a cordon of ships, does this destroy the effectiveness of the measure? Certainly not. Apparently, as far as its affirmative meaning is concerned, this rule left things as they were before. If there is real danger of capture, and a force is stationed before the harbor intended to create such danger, the blockade would be considered effective. On the other hand, all paper blockades, like those of the Berlin Decrees, the two British Orders in Council, and the Milan Decrees, all of 1807, by which whole coasts for hundreds of leagues were put under a blockade-ban—the two parties concerned, Napoleon and the British government, in turn going beyond each other in their diplomatic war—are entirely forbidden.

A blockade, being a fact, *lasts only so long* as the vessels are on hand to make it such, unless, indeed, a temporary storm drives them from their posts, to which they return as soon as possible. When they are driven off by the *superior power* of the enemy, or *discontinue* their operations by orders of the government or commander of the squadron, the blockade ceases, and needs the same formalities for its renewal as for its commencement.

When a vessel *is taken, and found* by the proper court *guilty* of attempting to enter or quit the blockaded port during the blockade, the penalty is confiscation of the vessel, and the cargo shares the same fate, unless some proof can be given that the breach was against its owner's will. The liability to be tried and condemned rests on the vessel, according to English decisions, until the *end of the return voyage.*

On the doctrine of blockade and of contraband has been engrafted that of *continuous voyages.* The English courts, in order to prevent neutral captains from evading the rule of 1756 in regard to colonial trade by stopping at a neutral port, there landing and relading cargoes, and getting a new clearance, made the decision that if an original intention could be proved of carrying the goods from the colony to the mother-country, the proceedings at the neutral port were to be regarded as a mere sham, and the ultimate destination was to decide in regard to the nature of the trade. In our late war with the Confederates many vessels brought contraband of war or other articles to a port in the West Indies, especially to the port of Nassau, and either took a new start from there or put the goods on blockade-runners better fitted to scud by a squadron that might be upon the lookout. To avoid the mischiefs growing out of these proceedings our government applied the English doctrine just now mentioned to this class of cases. Consignment to some one at Nassau, or any papers making that the destination of the vessel, would not screen it if an original destination could be established of sending the goods ultimately to a blockaded port, or, in the case of contraband of war, of a destination for the hostile coast. Such intention would subject them to capture from the time of setting sail. Still more stringent was the application of the rule to goods

bound up the Rio Grande for Matamoras on the Mexican side of the river, if, when they were intercepted, it could be made to appear that there was an intention after landing them to carry them overland into territory of the U. S. (Comp. note 27 in the author's work, before cited, p. 466, ed. 3.)

(*i*) *Search.*—To carry out the rules of nations respecting contraband goods, blockade, and enemies' goods on enemies' vessels, search is necessary; that is, the process by which it is ascertained in war what is the nationality of the vessel and the nature of her freight. This right is essential to the others, so that if certain writers, as Hübner (1759), could have made it out that a ship on the open sea is under the same law as territory, a great part of the effectiveness of war on the sea would have ceased. Being, however, an acknowledged right, it must be submitted to, and resistance would authorize force on the part of the cruiser: the search, however, must not be made annoying. If the vessel is on an innocent, lawful voyage, she is to pursue her way; if otherwise, she may be seized and taken into a port for the purpose of adjudication. Search being a very irritating process for the neutral, the northern states of Europe around the Baltic attemped to introduce the so-called right of *convoy*, by which a public vessel, escorting merchant vessels and having their papers on board, could be a security for their being engaged in a commerce permitted to neutrals, and thus might free them from the necessity of being visited. This was a rule which the armed neutrality of 1800 endeavored without success to establish. It has hitherto been unable to find a place in the law of nations, although a large number of treaties have provided for it. It is attended with the practical difficulty that a fleet of merchant vessels under escort may often get separated from the convoying ship of war, and thus a belligerent cruiser may meet one of the merchant ships at a distance from such convoying ship.

The right of search is properly a *war-right,* to be exercised in the case of merchant ships only. It is still a war-right, whenever vessels *suspected of piracy* are required to lie to and submit to examination, because pirates are enemies of the human race. It may happen that such suspicion unjustly attaches to a particular vessel. This is like the arrest of an innocent person at night under suspicious circumstances by the police. He is bound not to resist and to give an account of himself for the sake of the peace of society. So the vessel is bound to satisfy those who are engaged in the search, because it is for the good of the world; and if the detention can be shown to be unreasonable, or to have been made annoying without reason, the commander has a right to complain. In one case a small Spanish government ship was stopped in order to ascertain whether she were or were not a pirate, and the court of the U. S., in speaking of this, says that ships of war, acting under the authority to arrest pirates or other offenders, "may approach any vessels descried at sea for the purpose of ascertaining their real character." There is likewise a permissible search on the high seas in peace when frauds are suspected against the *revenue.* This may take effect when a vessel that has committed an offence within the waters of a country flees from justice, in which case the public ship may chase her into the high sea and arrest her there. An English ordinance prohibits the transshipment of foreign goods within four leagues of the coast without paying duties, and a law of Congress of 1799 contains similar regulations. "The exercise of jurisdiction to that distance for the safety and protection of the revenue laws was declared by the Supreme Court to be conformable to the laws and usages of nations." (Kent's *Com.*, i. 31, lect. 2.)

In the early part of this century England claimed the right of detaining and visiting neutral vessels in war, in order to ascertain whether any of her subjects were on board, and, if so, of taking them out, that they might render military or naval service to the British sovereign. This claim was founded on the doctrine that an Englishman owed perpetual and indissoluble allegiance to his country. The evils of such a summary process bore hardest on the U. S., as many emigrants or residents in England were among our sailors. This was one of the causes of the war of 1812. The claim was distinctly stated by Lord Ashburton at the Treaty of Washington in 1842, but since then the supply of seamen for the navy by the impressment of persons on British soil has gone into disuse. As for the right involved, it must be most emphatically denied. A seaman, or even a criminal, can no more be forcibly carried off from a neutral vessel than a similar person could be taken by force from a neutral territory. The fact of war, also, had properly nothing to do with the case. The neutral was not violating a war-right, but had hired a man to be a sailor on his vessel. The rights to require indefeasible allegiance and military duty are as truly such in peace as in war, so that the pleas for their exercise would apply to a state of peace as well. But it is not probable that the English principle in regard to allegiance would be equally rigid now, since a treaty of 1870 with the U. S. allows renouncing allegiance and resuming it, and since an act of the British Parliament, passed in 1844, gives authority to one of the principal secretaries of state to grant to an alien, on his petition, nearly all the rights and capacities of the native-born subject. Moreover, as far as taking a person out of a neutral vessel on the sea is concerned, in the case of the Trent the British government committed itself to the principle, that it is illegal to detain a neutral vessel and take from her even persons at war with their country and liable to the penalties of treason.

A right of search, on suspicion that a vessel was engaged in the slave-trade, was mutually conceded by Great Britain and the U. S. in 1862. The treaty confined the right to certain tracts of the sea near Africa and Cuba; it was carefully guarded; it granted damages for losses incurred by the wrongful detention of vessels; and could be terminated after ten years. Before this there had been several discussions between the governments, the British government claiming that there is a distinction between *visit* and *search,* of which the first relates merely to the nationality of the vessel, the other to the character of the cargo and whatever else needs to be found out. It was said that a British police-vessel on the coast of Africa could not have control over slave-traders breaking the laws of England if the flying of the American flag was a security against visiting any ship that might hoist it. On the American side it was contended that no distinction was made, in text-writers on international law or elsewhere, between visit and search, and that a ship of war stopping a reputed slave-trader of another nationality must do so at its peril. In a certain sense both views can be justified. An innocent vessel detained on the high seas has a claim for any damages arising out of the detention, and its government, on complaint, would naturally inquire into the matter. But the flag that is hoisted is no good evidence of the nationality of the vessel or crew. There is, then, a real distinction, and a necessary one, between visit and search; or, in other words, there is a kind of search, call it what you will, which does its work when the nationality of the vessel is ascertained. Great Britain had treaties with Portugal, Spain, the Netherlands, and Sweden concerning the mutual right of searching vessels suspected of slave-trading. How could a Spanish ship be searched if the hoisting of our flag could prevent it? Then, again, a nation has a right to search its own merchant vessels on the seas in time of peace. Suppose an English ship should grossly break the law just before sailing with the intent to go out on an illegal expedition. The nation must have the right of sending out a cruiser in pursuit of it, and a vessel supposed to be the offending one could be made to lie to until the fact could be ascertained, or else all police over vessels is nugatory. Suppose, again (see the author's *Introd.*, § 201), two nations mutually to give up the right of search in war. Would it not still be necessary for the cruisers of one of them, if war should break out with a third party, to ascertain the nationality of the merchant ships fallen in with, in order to give to the vessels of the other the sole benefit of the provisions of the treaty? Otherwise, such nations would have to abandon the right altogether, as everything afloat would wear the protected flag. We conclude, then, that search, so far as to discover the nationality of the vessel carrying a certain flag, is oftentimes necessary, and is just, but that for mistakes in carrying out this right the government of the cruisers making such a search are responsible.

We have given a brief account of the principal rules of international law, and we close with one or two brief remarks: (1) International law is founded on justice, and contains the noble idea that universal, world-wide justice can be realized. (2) Its principal division is that respecting a state of war, but its whole spirit is to avoid war, both by having fixed rules and by the possibility of arbitration through the help of some impartial power or court. (3) Its progress is greatly encouraging. It has grown in definiteness, in humanity, in justice, in the extent of its sphere of operation. (4) It is, however, destined to become less important with the increasing humanity of the world. As laws and courts would sink in their importance if all men became thoroughly just and unselfish; as law, according to the apostle, "is not made for the righteous man, but for the lawless and disobedient;"—since the love in the righteous man's heart is the fulfilling of the law,—so a day may come when men shall wonder at the mass of controversies between nations, at the numberless treatises on international law—above all, at the prominence given to the laws and usages of war, because in their better age they will look abroad on universal peace and righteousness.

THEODORE D. WOOLSEY.

Interna'tional Private Law is the branch of jurisprudence which regulates the reciprocal relations of subjects (transiently or otherwise) of different states. The notion of such a community of law was foreign to the ancients. To supply its felt need the Roman jurists and their successors fashioned congeries of precepts concerning the conflict of laws, whence the maxims and nomenclature now in use have been largely drawn. Much is indeed still lacking and doubtful in the science, but there is so marked a tendency toward a unity of civil and commercial legislation that certain publicists look for the recognition by all civilized states of a common system, affording all men everywhere liberty and security in private transactions. To this three conditions seem necessary: 1st, every one should be assured of the enjoyment of his civil rights abroad as well as at home; 2d, every one should be able to foresee, with tolerable certainty, what laws will govern the rights attaching his person, his property, and his acts; 3d, the basis of international regulations should be conformable to right, reason, and the nature of things, so as to ensure permanence to the rules themselves, and the rights acquired under them.

The first and most general maxim of international private law results directly from the independence of states, and is—Each state has an exclusive sovereignty and jurisdiction within its own territory. Consequently, the laws of every state govern all persons and all property within its limits. The second general principle is the converse of the former, and—No state can by its laws bind persons or objects outside its own territory. An important consequence of these two general principles, or converse sides of the same principle, is that all deference paid to foreign laws depends upon domestic regulations—upon the consent, express or implied, of the state where the foreign laws are applied. International private law rests, then, for its sanction upon considerations of utility and reciprocal convenience or comity. "It is not a question of the comity of courts, but of states, in that the legislature decrees what effect shall be given to foreign laws, and leaves the courts nothing to do but to carry out the directions of the statutes." When the legislature has supplied a law for the case, the applicability of a foreign statute cannot come in question. Its pertinence can only be assumed by a judge in the absence of express provision, and when conformable to established custom or the analogy of his own jurisprudence.

The applicability of a particular law to a given case mainly depends upon the connection of the person concerned with a certain legal territory. To determine this two *criteria* are contended for—nationality or domicile.

Nationality is the quality attaching by birth in, or formal adoption into, a particular community. It has of late lost so much of its significance (by the adoption of the Roman principle that children follow the condition of their parents, and that adults are free to choose their own country) as to be considered by some solely of political moment. Nationality, however, remains of importance concerning rights not political; *e. g.* claims under treaty stipulations securing special rights to citizens, and the whole category of the disabilities of aliens. The character impressed by birth is so indelible that it, upon a due change of residence and intention, easily effaces the supervening character of domicile. It has also the advantage of being directly ascertainable, while domiciles are divided by very indistinct lines.

Domicile may be defined as "a residence at a particular place, accompanied by positive or presumptive proof of continuing there for an unlimited time." Thus, it answers very much to the common meaning of the word *home*. Where it may be said of a person having two residences that he makes one his home, that is to be taken as his domicile. Intent, the element which determines the question of domicile, may be evidenced in various ways. If such intent be proved, the fact of residence for the briefest time will suffice. A person may elect to regard his place of business as his domicile, and he may even have different domiciles for different specific purposes, but he can only have one principal domicile. This is the accepted test of the general national character of his business relations, and impresses itself upon his affairs and property.

Minor children, if legitimate, take and follow the domicile of their father until competent to choose one for themselves. Illegitimate children generally follow the domicile of the mother. It is usually held on the continent of Europe that the death of the father fixes the domicile of a legitimate child, so as not to be changed by the mother or guardian without act of law. The domicile of a wife generally merges in that of her husband, unless he suffer for a crime or be under restraint for lunacy or like incapacity. Envoys, consuls, prisoners, lunatics, exiles, students, and, in general, officers, acquire no new domicile.

Status is the sum of special rights and duties belonging to a person, over and above the general rights and duties which he shares with all the members of the community. To determine the status of a person outside of the country of his domicile many theories have been proposed. The one most accepted is, that status is determined by domicile, with the qualification that in case of doubt laws favoring capacity are favored, and the contrary disfavored. Laws abridging capacity for rights—*e. g.* concerning slavery—have admittedly no extra-territorial force. Natural incapacity, such as lunacy, accompanies the person everywhere. In other respects, the general tendency is to respect the law of the place of the transaction, as that imposes the least burden upon business.

Ownership and Property.—Whether any particular thing be an object of ownership is admittedly determined by the law of the place of controversy. The capacity of a person to acquire and dispose of property generally depends upon the law of his domicile. A distinction which reconciles many embarrassing contradictions in the books is into a capacity to act and a capacity for rights. The former, proceeding from the personal status, depends upon the law of the domicile; the latter, upon the law of the situation; *e. g.* the inability of aliens in New York to transmit property results from a local incapacity for rights. The elder jurists sharply distinguished immovables from movables and other means of estate. The former, including not only land, but also all dismemberments of the property in land and the rights to their enjoyment, are admitted to be under the domination of the law of their situation, except when massed for purposes of succession and the like. By the tremendous fiction that movables cleave to the person, all personal property, however ponderous and permanent it might be, was subjected to the law of the domicile of the owner. The increase of personal property in comparative value and importance, with other considerations, has, however, led to a rejection of this distinction, so that outside of England and the U. S. the now prevailing rule is that "movables, when not massed for the purposes of succession or marriage-transfer, and when not in transit or following the owner's person, are governed by the law of the situation, except so far as the parties interested may select some other law." Like considerations, particularly those of public interest, are tending to incorporate the same rule into Anglo-American jurisprudence.

Real Rights, or claims upon things obtaining against all persons, are, for the most part, governed by the law of the place where the subservient property, movable or immovable, exists. Implied real rights are not favored internationally, and are not upheld unless recognized by the laws of both places. Thus, the hypothecation of an obligor's entire estate, implied by certain contracts in certain countries, is not recognized in others where such constructive covenants are not known, although such a claim might support an equitable action to compel the obligor to execute a formal hypothecation. Liens on movables are extinguished by removal, though eminent jurists have maintained that real rights should not be so defeated. It is also admitted that a lien unknown at the place of contract cannot be created by a mere removal of a chattel. Whether it may be asserted by special proceedings depends upon whether the lien be regarded as a part of the contract, or as extraneous to it, and simply a matter of procedure. The priority of liens "depends upon the place where the property lies, and where the court sits."

Incorporeal Chattels—*e. g.* letters patent, copyrights, and trademarks—are the creatures of local laws and clearly have no validity beyond the territory of the authority conferring them, unless extended by treaty stipulations. Thus, it has been held in France by the court of last resort that a Frenchman may stamp the unprotected trademark of a foreign manufacturer upon his wares with impunity.

Obligations, in the sense of international jurisprudence, include all legally coercible duties, whether arising by act or accident, voluntarily or involuntarily, conformably to good morals or the reverse. A normal or unilateral obligation restricts the liberty of one party, debtor, obligor, and enlarges the rights of the other, creditor, obligee. While the essential properties of obligations are, from motives of public policy, held beyond the interference of parties making engagements, no small freedom is allowed in the determination of their natural properties. Among the latter is the law by which the obligation is to be governed, and which, under certain restrictions, is left to the choice of the parties themselves. Whenever, therefore, it may be assumed or shown that the parties have chosen a particular territorial law, their obligations are to be determined by that, so far as they are at liberty so to elect, and have their will respected at the place of suit. Two palpable facts are distinguishable in every obligation—inception and fulfilment. The law of the place of inception under most circumstances regulates, according to very gen-

eral agreement, the formal conditions of a transaction. It is commonly said, therefore, that an obligation valid at the place of its origin is valid everywhere. The converse, that a transaction invalid at the place of origin is invalid everywhere, is also asserted, though subject to more exceptions, in that courts are disposed to recognize engagements in accordance with their own laws, even if formally defective under the law where actually entered into. The law of the place of performance governs, according to most jurists, the obligation itself. Plausible and ingenious arguments are put forward for other rules, particularly that of the debtor's domicile, but it is urged in opposition and with reason that the parties presumably purpose, unless stipulating otherwise, to be governed by the law of the place where a specific act is to be done or thing delivered. Where other indications of an intended submission to a particular law are at hand, these are to be respected; thus, the obligations arising out of a continuous course of business are to be determined by the law obtaining at the permanent seat of that business; *e. g.* liabilities under a foreign policy of insurance are subject to the law of the place of the permanent seat or principal office of the company whence it is issued, though the obligation to pay the premium is subject to the law of the domicile of the insured. So, again, an obligation arising under circumstances warranting the expectation that it will be discharged at the same place is governed by the local law; *e. g.* that of a guest to pay his hotel-bill. In other cases the applicatory law is that of the debtor's domicile at the time of contracting the obligation.

Obligations arising from delicts or torts—wrongful acts as connected with private redress—cannot, of course, be considered subject to a certain law because the same has been chosen by the obligor (wrongdoer, *tortfeaser*). The principle of many of the foregoing conclusions is therefore inapplicable to them. Wherever a wrong is done, there the perpetrator of it, whether a transient passenger or a domiciled subject, is justiciable, and must answer for the consequences. The law of the place of commission of an admittedly wrongful act determines the measure of damages. It has been judicially intimated that an act unnoticed by the law of the place of perpetration, but treated as tortious by the English law, would sustain a suit for damages in England. The more approved doctrine is, that what is legally innocent where it occurs cannot be made a delict elsewhere. English and American courts have assumed jurisdiction over torts committed abroad, even where the suitors were non-resident foreigners. There is a growing inclination to disfavor such suits.

The consideration of every valid obligation should be meritorious. To vitiate an engagement on its account the moving cause must offend against universally accepted views of public morals and public safety, and not be illegal only by reason of special statutes. Thus, claims arising from sales of lottery-tickets in Kentucky are enforced in New York, where such sales are contrary to law. Still further, a foreigner, unless he be an accomplice, can recover in England the price of goods sold with the explicit understanding that they were to be smuggled into the latter country. What is intrinsically contrary to public morals is far from well settled. It might be supposed that a polygamous promise would be disregarded throughout Christendom, but a learned and respected judge has said from the bench that the proclivities of a Turk would be protected in North Carolina. The belief as to the best means to attain the same end is as varied as nationality. In this wise the consideration of illicit cohabitation is so variously treated that it has given rise to more conflicts than any other. In France and some other countries regard for decency and morality interdicts all inquest concerning paternity; in others, as Scotland, obligations arising therefrom are considered but "obediential and natural."

In actual practice the application of recognized legal principles is embarrassed by the fact that a majority of obligations are not simple or unilateral, but reciprocal or bilateral. However involved the process, the separation of the latter into the several unilateral obligations of which they are composed will often prove the most convenient if not the sole solution of the problem. Thus, each party to commercial paper is liable according to the law governing his particular engagement; so again, as has been intimated already, premium for insurance may be collectible by a very different law from that deciding claims under the policy—often a vital distinction in states forbidding insurance by foreign companies.

Marriage is so hedged about, from reasons of moral and religious policy, by positive coercitive statutes as to lose much of the nature of a contract, and become an institution differing widely in different states. Admittedly, it must be a conjugal union between competent parties for life. The conditions—or, as they are commonly discussed, the impediments—to it depend, according to the Anglo-American and elder doctrine, upon the capacity of the spouses under the laws of their respective domiciles. On the ground that the bride submits herself to the bridegroom's domicile, this is regarded by the later German opinion as controlling both, excepting where her domicile cannot be changed by her own act. The formal conclusion of marriage is regulated by the law of the place of celebration. The true seat of the relation (wherever contracted) is the domicile of the recognized head of the family, the husband. Mutual rights of property are fixed by the man's domicile at the consummation of the marriage, for it could not be endured that the husband should be able to change the rights of his wife over her own property by a change of residence. Laws restricting liberality during marriage depend upon the domicile at the time of the act; being intended for the protection of moral purity, they are designed to control all persons in the territory. Intestate succession between the spouses is regulated by the last domicile of the deceased.

Divorce is governed by the law of the country where it is sought, in that the law, resting upon the moral nature of the union, is strictly positive and compulsory upon the court, which, too, must be that of the actual domicile, as it alone can have jurisdiction.

Paternal power over legitimate children depends upon the law of the domicile of the father at the time of the birth; over children legitimated by subsequent marriage, upon the domicile of the father at the time of filiation.

Guardianship is to be instituted under the law of the ward's domicile. There is a strong presumption in favor of the competency of an administering court.

Succession, testamentary and intestate, to immovables is governed by the law of their situation. Movables commonly pass by the law of the decedent's last domicile. But the disposition of personalty in a will validly executed under the law of a former domicile is respected in Europe; it is otherwise in most of the U. S.

Civil jurisdiction is called contentious or voluntary according as it is exercised in litigated causes and the execution of decisions, or in affording public authentication to matters not in controversy. Of the voluntary jurisdiction of magistrates and officials the foreigner may commonly avail himself equally with the native, and a compliance with formalities required by local law is accepted every other where as sufficient. In most countries, and saving such restrictions as giving security for costs, an alien can ordinarily contend in the courts on the same footing as a subject. In France, however, non-domiciled foreigners can sue their fellows only for certain causes of action; *e. g.* commercial obligations. Subjection to a certain jurisdiction is a question of territory. Nothing, movable or immovable, can be judicially disposed of unless it lie within the purview of the court. Power to pass upon property abroad has been asserted in England and in some States of the American Union, but such decrees are of no foreign force. Judicial power over persons can be had only through personal service and domiciliation in the country; domicile in the lesser sense of commorancy will suffice. By English law English courts assume jurisdiction over causes of action arising in England, although the assumption is disregarded elsewhere. Procedure is regulated solely by the place of suit; if a particular remedy be essential to the enforcement of a right, resort must be had to a court administering the remedy. Evidence is admissible or inadmissible according to the law of the country of the court, albeit tribunals are prone to admit foreign modes of proof when indispensable to the judicial establishment of facts. Foreign judgments have no effect unless sanctioned by domestic authority. If the competency of the court pronouncing them be unimpeachable, they may, as conclusive upon the merits, be enforced by new judgments of the same tenor or made directly executory.

Criminal jurisdiction depends upon the relation of the government to the place of the offence and to the person of the offender. The former consideration has been magnified in Great Britain and the U. S.—the latter upon the European continent. To meet modern exigencies, both systems have been modified, by statute and interpretation, into a very general approach to the rule that courts of the country of arrest have jurisdiction over all offences committed within its territory, and also over those perpetrated abroad distinctively against its sovereignty. Independent states administer only their own penal laws. They assist the enforcement of others by surrendering foreigners upon presumptive proof of crimes not political. That the obligation so to do does not arise purely from treaty provisions was aptly set forth when an eminent Frenchman said, "*Le principe de l'extradition est le principe de la solidarité, de la sûreté réciproque . . . contre l'ubiquité du mal.*"

CHARLES F. MACLEAN.

International Workingmen's Association, The, was founded Sept. 28, 1864, at a large meeting of workingmen from nearly all European countries, in St. Martin's Hall, London, at which the manifesto and statutes, as drawn up by Dr. Carl Marx, were adopted for publication, and a provisory administration established. It is an association of trades' unions, intended for the defence of the interests of workingmen against the encroachments of the power of capital, and aiming ultimately at the abolition of all labor paid with wages as a form of slave-labor, and the establishment of associated labor on a national scale. The statutes of the association were not finally established, however, until sanctioned by the first general congress, held at Geneva Sept. 3–7, 1866. Here the programmes of Mazzini and Bakunin were rejected, and that of Marx adopted. As reasons for the formation of such an association it was proclaimed that the emancipation of the working classes must be conquered by the working classes themselves; that the struggle for the emancipation of the working classes means not a struggle for class privileges and monopolies, but for equal rights and duties and the abolition of all class rule; that the economical subjection of the mass of labor to the monopolizer of the means of labor—that is, the sources of life—lies at the bottom of servitude in all its forms, of all social misery, mental degradation, and political dependence; that the economical emancipation of the working classes is therefore the great end to which every political movement ought to be subordinated as a means; that all efforts aiming at that great end have hitherto failed from want of solidarity between the manifold divisions of labor in each country, and from the absence of a fraternal bond of union between the working classes of different countries; that the emancipation of labor is neither a local nor a national, but a social problem, embracing all countries in which modern society exists, and depending for its solution on the concurrence, practical and theoretical, of the most advanced countries; and that the present revival of the working classes in the most industrious countries of Europe, while it raises a new hope, gives solemn warning against a relapse into the old errors, and calls for the immediate combination of the still disconnected movements. A constitution was then adopted, and the association was actually started. It held its next general congress at Lausanne, Sept., 1867; the third in Brussels, Sept., 1868; the fourth in Bâle, Sept., 1869; but the fifth, destined to take place in Paris, Sept., 1870, was prevented from meeting by the Franco-Prussian war. Meanwhile, its influence was widely felt. The strikes of the bronze-workers in Paris in 1867, and of the builders in Geneva in 1868, were supported and carried through by English money, and in England, where trades' unions and strikes were institutions of older standing, they were made much more effective, as the association prohibited cheap labor from being imported from France, Belgium, and Germany. In different countries, especially in France and Austria, the government began to interfere, but this only made the association more popular among the workingmen. It received a severe check from the Franco-Prussian war. No general congress has been held since. Many members of the Paris Commune belonged to the association, and the excesses of the Commune were defended by the association, both in a pamphlet written by Marx and published by the general council in London, and in other ways. Nevertheless, in spite of the less conspicuous part which the association has played in public life during the last four years, its importance can hardly be said to have decreased. The number of its members is increasing, and in most countries it has established organs of its own for the diffusion of its ideas. C. PETERSEN.

Interplead'er, in law, is the right which a person who holds a fund, or has possession of any item of property, or owes a duty or obligation, has, when there are rival claimants to the fund, etc., and he cannot determine to whom it belongs, to require them to settle in court their conflicting claims as between themselves, and to be allowed on his part to make over the property, etc. to the court, to abide the events of the litigation or to hold it under its direction. The jurisdiction of courts of law over this subject is very limited and imperfect, and this branch of jurisprudence may now, in practice, in the absence of statutes, be said to be exclusively administered in courts of equity. The method in which relief is obtained is by bill in equity. (See BILL IN EQUITY.) These bills are of two kinds—strict interpleader, and bills in the nature of an interpleader.

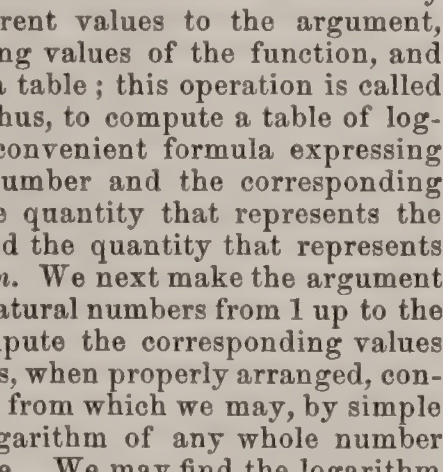
(1) *A Strict Bill of Interpleader.*—The function of such a bill can be most clearly stated by putting the propositions appertaining to it in the form of rules. *Rule 1.* There must be two or more persons claiming from the plaintiff the same debt, duty, or thing. This rule is of easy application when an item of property is in dispute. It is, however, quite difficult in some cases to ascertain whether the same debt or duty is claimed. An illustration may be found in the case where a tenant under a lease is called upon by his lessor for rent, and at the same time a third person asserts that he is the owner, and that the amount of the rent should be paid to him. This would not be a proper case for a bill of interpleader, since the lessor claims under a contract, while the stranger asserts that the tenant is in possession by wrong. Some other method must accordingly be resorted to in order to determine the rights of the parties. On the other hand, if a person is taxed in two different towns for the same property when he is only liable to be taxed in one, and it is doubtful to which town the right to tax belongs, he may file a bill of interpleader to compel the tax-collectors or towns to settle the rights as between themselves. In this case the debt or duty is the same. *Rule 2.* As a general rule, a bill of interpleader will not lie when the holder of a fund stands in confidential relations towards one of the claimants, and the other is a mere stranger, claiming by an independent and paramount title. Thus, if an agent, consignee, or bailee have goods committed to his care, in legal phrase there is a "privity of contract" created, which will prevent him while he retains possession from disputing the title of the person for whom he acts. The agent or bailee must defend himself from conflicting claims as well as he may. *Rule 3.* The second rule must be confined to the case where the agent, consignee, etc. seeks to dispute or test the *original* title of his principal or consignor. It frequently happens that after such a contract relation has been created the title by subsequent acts of the principal or employer becomes complicated. He might, for example, make conflicting assignments of doubtful validity to different persons. So his assignee in bankruptcy might claim the goods as against one to whom it was insisted that the owner had made a transfer in fraud of the bankruptcy act. In such cases as these the holder of the goods might demand an interpleader. It is manifest that he in no respect controverts or denies the fiduciary relation, but, while he admits its existence, asserts that the acts of his principal have *since its creation* so complicated their relations that he is uncertain how to proceed. *Rule 4.* In cases where both claimants assert wholly distinct and independent titles, according to the weight of authorities no interpleader will lie. The ground of this rule appears to be that there is an objection to the interference of a court of equity in trying legal titles upon a dispute between parties where there is no privity of contract. It has been held that a sheriff who seizes property on an execution cannot bring an action of interpleader upon account of an adverse claim existing to the property seized by him; for as to one of the claimants he necessarily admits himself to be a wrongdoer. This rule appears to be highly technical, and the narrow construction put upon the jurisdiction of the court is much to be regretted. This action is plainly a beneficial one, and should have been encouraged rather than discountenanced. There is certainly room for legislation whereby the power of courts to allow an interpleader may be placed upon a more satisfactory foundation. *Rule 5.* It is not necessary that the claims of the respective parties should be both legal in the sense of being recognized in courts of law. One may be legal, and the other equitable, or both may be equitable. *Rule 6.* The rights of the respective claimants must be doubtful. If the case shows no claim of right in one of the co-defendants, there is no ground for an interpleader. *Rule 7.* The holder of the fund, etc. may commence an action, although he has not yet been molested by either of the claimants. It is enough that he is in danger of sustaining injury from conflicting rights. He may, however, wait until an action is brought against him by one of the claimants, and then in turn commence his action of interpleader, making all of the rival claimants parties. *Rule 8.* A matter of detail should be referred to in this connection. There should be in the bill an affidavit that there is no collusion between the plaintiff and any of the other parties; and in the case of money it should be brought into court, or there should be at least an offer to bring it in. (Further details may be found in the books on equity or chancery practice. See Daniell's *Chancery Practice;* Barbour's do.)

(2) *Bill in the Nature of an Interpleader.*—A suit of this kind may be instituted by one who is not strictly a stakeholder. It may be brought by a person who is interested in a fund to ascertain his own rights, and at the same time to settle the conflicting rights of third persons. An illustration is supplied by the case of a mortgagor who desires to pay off a mortgage, while different parties lay claim to the mortgage-money. It is plain that he would naturally seek to accomplish a double result—to redeem his property from the lien of the mortgage, and at the same time to pay the money to the party who was really entitled to it. An

important instance of a bill in the nature of an interpleader is one filed by an executor or trustee to obtain the construction of a will when there is a doubt or uncertainty as to the meaning of its provisions. In this case the provisions of the will are set forth, and the conflicting claims of the parties interested, accompanied by the statement that the executor cannot safely proceed in the matter without the direction and judgment of the court. In these cases the duty of the executor is said to be performed when he has brought the parties in interest before the court, and they may appear by counsel, who represent their respective claims under the will. As a general rule, in a strict bill of interpleader, the stakeholder is entitled to be paid his costs from the fund in controversy as a matter of right; costs in a bill of the nature of an interpleader are discretionary.

By recent legislation in England the courts of law have jurisdiction to a certain extent in matters of interpleader. (See 23 and 24 Vict. ch. 126, § 12.) So, under the New York Code of Procedure, and that of other States resembling it, a defendant against whom an action is pending upon contract or for specific property may at any time before answer, upon affidavit, that a person not a party to the action, and without collusion with him, makes against him a demand for the same debt or property, upon notice to such person and to the adverse party to the action, apply to the court for an order to substitute such person in his place and discharge him from liability on his depositing with the court the amount of the debt, etc. This statute does not supersede the regular jurisdiction in equity, but is an additional remedy given to a stakeholder who has been actually sued, by allowing him to assert his rights *in an answer*, and by way of defence, instead of instituting an action. The rules applied are substantially the same as in the bill of interpleader. T. W. Dwight.

Interpola'tion [Lat. *interpolo*], the operation of inserting a term between two consecutive terms of a tabulated function that shall conform to the law of the function. A table of the kind referred to is generally computed from a formula containing two variables—one of which is *the function*, and the other the independent variable, or, as it is usually called, *the argument*. The table is formed by giving successive equidifferent values to the argument, computing the corresponding values of the function, and then writing the results in a table; this operation is called *tabulating* the function. Thus, to compute a table of logarithms, we assume some convenient formula expressing the relation between any number and the corresponding logarithm; in this case, the quantity that represents the number is the *argument*, and the quantity that represents the logarithm is the *function*. We next make the argument equal to all the successive natural numbers from 1 up to the limits of the table, and compute the corresponding values of the function; these results, when properly arranged, constitute a *table of logarithms*, from which we may, by simple inspection, take out the logarithm of any whole number within the limits of the table. We may find the logarithm of a mixed number, as $2\frac{3}{8}$, by the method of interpolation. The object to be obtained may be illustrated graphically: let $A\,N$ be the logarithmic curve whose equation is $y = \log x$, and let $B\,K$, $C\,L$, $D\,M$, etc. be ordinates corresponding to the abscissas 2, 3, 4, etc. Knowing these ordinates, we have the points K, L, M, etc. of the curve; it is then required to find an ordinate, st, whose abscissa is $2\frac{3}{8}$.



This ordinate might be computed from the formula used in computing the tables, but this would, in most cases, be entirely too tedious. What we actually do is to pass a parabola through a sufficient number of the points K, L, M, etc., and then compute the ordinate of this parabola corresponding to the given abscissa. This ordinate will approximate the more closely to the required ordinate the greater the number of points taken. If we take two points, K and L, the parabola is of the first order—that is, it is a straight line, whose equation is of the form $y = p + qx$; if we take three points, the parabola is of the second order, whose equation is of the form $y = p + qx + rx^2$; if we take four points, the parabola is of the third order, whose equation is of the form $y = p + qx + rx + sx^3$, and so on. By taking a sufficient number of points, as $m + 1$, we have a parabola of the mth order, which may be made to coincide with the curve of the given function to any degree of approximation in the neighborhood of the required ordinate. In most cases a parabola of the third or fourth order is amply sufficient. We can find the equation of the auxiliary parabola by the method of finite differences as follows: Let the successive ordinates, $B\,K$, $C\,L$, etc., be denoted by a, b, c, etc.; then let each be subtracted from the one following; the remainders thus found form a new series called the *first order of differences*. Now, let each term of the new series be subtracted from the following one; the remainders will form a series called the *second order of differences*; and so on, as indicated below:

$$\begin{array}{c}
a, \quad b, \quad c, \quad d, \quad \text{etc.,} \\
b-a, \quad c-b, \quad d-c, \quad \text{etc.,} \\
c-2b+a, \quad d-2c+b, \quad \text{etc.,} \\
d-3c+3b-a, \quad \text{etc.} \\
\text{etc.}
\end{array}$$

If we denote the first terms of each of the orders of differences by d_1, d_2, d_3, etc., we shall have

$$\begin{array}{ll}
d_1 = b - a, & \text{whence, } b = a + d_1; \\
d_2 = c - 2b + a, & \text{whence, } c = a + 2d_1 + d_2; \\
d_3 = d - 3c + 3b - a, & \text{whence, } d = a + 3d_1 + 3d_2 + d_3,
\end{array}$$

and so on. If we denote the ordinate which has n ordinates before it by y, we have, by continuing the above process,

$$y = a + nd_1 + \frac{n(n-1)}{1.2}d_2 + \frac{n(n-1)(n-2)}{1.2.3}d_3 + \text{, etc.}$$

If we now regard n as a variable abscissa, this will be the equation of a parabola of the nth order, passing through the extremities of $n + 1$ of the consecutive ordinates a, b, c, etc. In this case the origin of co-ordinates is at the foot of the first ordinate, and n is expressed in terms of the distance between two consecutive ordinates taken as a unit. By giving a suitable value to n, we may interpolate an ordinate between the first and second, or between any two consecutive ordinates of the series a, b, c, etc. The result will usually be more accurate if we take the values of a, b, c, etc., so that the interpolated term shall fall about midway between the extremes. As an illustration of this mode of using the formula, let it be required to find the right ascension of Venus at midnight between the 2d and 3d days of Nov., 1875, knowing her right ascensions at noon on the 1st, 2d, 3d, and 4th of November, as follows:

		1st diffs.	2d diffs.	3d diff.
Nov. 1......	15*h.* 5*m.* 47.27*s.*			
		5*m.* 0.13*s.*		
" 2......	15 10 47.40		1.23*s.*	
		5 1.36		0.0*s.*
" 3......	15 15 48.76		1.23	
		5 2.59		
" 4......	15 20 51.35			

Finding the successive orders of differences as already explained, we have $d_1 = 5m.\ 0.13s.$, $d_2 = 1.23s.$, and $d_3 = 0.0s.$; since the first right ascension corresponds to noon of Nov. 1, the value of n is $1\frac{1}{2}$; the value of a is $15h.\ 5m.\ 47.27s.$ Substituting in the formula, we have $y = 15h.\ 5m.\ 47.27s. + 1.5 \times 5m.\ 0.13s. + .75 \times 1.23s. = 15h.\ 13m.\ 18.39s.$; which is the required right ascension.

Other formulas for interpolation have been deduced, but the one just explained is, in a majority of cases, the one most readily applied. W. G. Peck.

Interpreta'tion [Lat.], in law, is the application of legal rules to the ascertainment of the meaning of language or other signs of thought. In its ordinary signification it is confined to the meaning of written language; in its legal aspect it is but a branch of a larger subject, since the same general principles must be adopted in every department of literature and science to discover an author's meaning. The subject may be considered under two general divisions: I. The principles of interpretation; II. Their application to particular cases, *e. g.*, statutes, contracts, wills, etc.

I. The great object of interpretation is to ascertain the meaning of a writing, or, in technical phrase, of a "text." This is not to be obtained by conjecture, but only by the application of settled rules. A distinction has been drawn between interpretation and construction. The former word has been taken to mean the sense of the writer as included within his language. Construction, on the other hand, would embrace the inquiry whether topics that were not expressed in the writing were not included within the general intent of the author, or, as is sometimes said, within "the spirit" of the text. So, in some instances, the law forbids the exact accomplishment of the author's intent. It then becomes important to know whether the intent shall be carried out, though not precisely, yet as nearly as the law will permit. There is an important branch of law depending upon this distinction, known as the doctrine of *cy pres*, or of approximation. It is frequently resorted to in the construction of wills or of statutes. Thus, if a person should be prohibited by law from creating a trust in property for a child whereby the income of a fund should be converted into principal beyond the attainment by the child of the age of twenty-one, and the parent should direct the accumulation of the profits until the child reached the age of twenty-five, the last four years might be discarded by the courts, and the direction be sustained until the age of twenty-one. This doctrine requires that the illegal direction should be in its nature capable of separation from that which is legal. Otherwise, the entire pro-

vision will be void. This doctrine has had in England a large application in the construction of wills endowing charitable institutions or creating charitable trusts, *e. g.*, for the support of colleges, hospitals, schools, etc. (See TRUSTS.) The intention of a donor, instead of being carried out, has frequently been perverted by the court; yet when properly applied, the doctrine is both rational and useful. Having pointed out the distinction between interpretation and construction as made by some authors, no further use will be made of it in this article. Text-writers upon this subject enter into various nice and minute distinctions. They speak of interpretation as being either close, or extensive, or free, or limited, or predestined, or extravagant. These terms are used to point out the general difference between correct and erroneous principles. Interpretation cannot properly be "predestined" or "extravagant." In the one case, the supposed interpreter has preconceived views and is laboring under a strong bias, and thus makes the writing subservient to his wishes. In an extravagant interpretation one ceases to follow rules, and, in fact, does not *interpret*, but guesses or conjectures. The distinction, however, between a close and an extensive interpretation is founded in reason. There are cases in which it is proper that words should be taken in their narrowest meaning, while in others a broader and more comprehensive signification should be adopted.

The leading rules of interpretation will now be referred to. *Rule I.* The meaning of a writer is to be ascertained not merely from what he states, but also from all that is implied by usage or otherwise. It would be intolerable if every subordinate proposition included within the written statement were required to be expressed. This distinction frequently becomes of political consequence. A striking illustration is found in the difference between the powers conferred upon Congress by the old "Articles of Confederation" and the present Constitution. In the former instrument it was provided that each State retained every power, jurisdiction, etc. which was not *expressly* delegated to the U. S. in Congress assembled. In the present Constitution (Art. X. of Amendments) the word "expressly" was designedly omitted from the corresponding clause, thus leaving open to the powers expressly conceded the doctrines of implication. In this way the Supreme Court of the U. S., as the final interpreter of the Constitution, has frequently been called upon to decide as to the implications to be derived from the words used in that instrument. *Rule II.* The whole of the writing bearing upon the subject in hand must be taken into account. In other words, the interpreter must have regard to the context. It will not do to wrench a particular sentence from its connections. In this way an author's meaning may be wholly perverted. This rule, as will be seen hereafter, is of great consequence in the interpretation of statutes. *Rule III.* Only the writing and its implications are to be considered. It will not do for the interpreter to go beyond the writing in search of a supposed sense. The true view is that it is of no consequence what the intent was, so long as it is not expressed or reasonably to be implied from the words used. This rule is applied with great inflexibility in courts of law. There is a well-known rule to the effect that oral evidence is not to be resorted to in order to add to or to vary the terms of a written instrument. Accordingly, the courts cannot supply by interpretation an unexpressed intent of the legislature or of a testator. This rule does not prevent the courts in certain cases from correcting mistakes; that is, from supplying or omitting words that were inadvertently inserted or omitted. *Rule IV.* Where there is nothing in the writing or its surroundings to lead to the contrary, the general rule is that words are to be taken in their ordinary and popular sense. On the other hand, if the subject of the writing is a matter of art or of science or other technical nature, the presumption is that the words are used in a special and technical sense. *Rule V.* Good faith is to be observed and sound sense exercised by an interpreter. The great object is to ascertain the intent and to carry it, if proper, into effect. Out of this principle spring a number of subordinate rules; such as, that where two senses are possible, one of which is agreeable to law and the other opposed to it, the former is to be preferred. So inadvertent omissions are to be overlooked; apparent repugnancies, if possible, are to be reconciled; words inconsistent with the main intention are to be rejected; stress is not to be laid on accurate grammar or orthography. It is a further rule that the situation of the writer and the circumstances surrounding him may be presented so as to put the interpreter in the position of the author. For example, if a testator should direct his property to be divided equally "among his children," it would be impossible for a court to carry out his direction without ascertaining from extraneous evidence the number of his children and identifying them. It is plain that this testimony would not alter the instrument, but would enable the court to regard the subject from the testator's point of view. It should be added that in ordinary cases the meaning of a written instrument is a matter of law for the court rather than the jury. In this way fixed rules are established and an erroneous interpretation by a lower court becomes the subject of review by an appellate tribunal. Where the words are technical, it may be necessary to ascertain their meaning through the testimony of experts, and to submit the matter to the jury as a question of fact.

II. *Application of the Rules of Interpretation to Special Cases.*—The leading cases in which the subject is presented to courts of justice are treaties, political constitutions, legislative acts, contracts, and wills. It will not be possible to consider the special rules governing all of these cases. A few will be referred to in connection with the last three of the instances mentioned. (1) *Statutes.*—The intention of a legislature in passing a statute is to be ascertained by the application of the general rules already stated, together with others of a special or subordinate nature. (*a*) It is a general rule that the words of a statute are to be taken in their ordinary and popular sense. This is just, as they are intended to govern the action of the public, who would naturally give them such a signification. Still, if the statute were intended to govern the action of a special class of persons, another rule might prevail. For example, a commercial tariff law, enacted by Congress to prescribe duties to be paid upon imports, would be in the main intended to govern the conduct of importing merchants, and technical words would be used, requiring a corresponding interpretation. (*b*) It frequently happens that a series of statutes is enacted to govern a particular subject. These may be called into existence from time to time during a long period of years. Such statutes are said to be *in pari materia*—upon the same general subject. The ascertainment of the meaning of the latest in the series may require the examination of all. (*c*) The rule that the meaning must be found in the text to be interpreted has its full application in the case of statutes. The courts cannot ascertain the legislative will by conjecture. If not expressed or implied from the words used, the supposed meaning must be discarded. The technical expression is, *voluit sed non dixit*—the legislature may have had an intention, but it remains unexpressed. Where, however, words that are obscure are used, it is a strong argument in favor of a particular signification (if that is possible) that, unless it be adopted, there will be no rational meaning. (*d*) In the interpretation of a statute it is often essential for the court to know the circumstances existing at the time of its enactment, or, in other words, to become familiar with contemporary history, to understand existing defects in the law, and to ascertain what evils the legislature designed to remedy. This rule is well illustrated by the interpretation of the recent suffrage law in England, where the question was, whether the word "man" as used in the act included "woman," so as to give her the right to vote. The court, in deciding the case, had much recourse to the general history of the right of suffrage in England as tending to show the legislative intent. The words in a statute, though of a general character, must be confined in their application to the defects to be remedied. One branch of this rule is referred to by law writers in the technical expression that regard must be paid to the "old law, the mischief, and the remedy." A single illustration may be useful. Suppose that a former law permits the bishop of an established church to lease church-lands for any length of time and any rent that he may see fit. The "mischief" of this rule may be that he may lease them for a very long term and at a low rent, and thus *impoverish his successors* in the bishopric, whose income may be reduced to a minimum. A statute is passed preventing a bishop from making a lease for more than twenty-one years. After this a lease is made for the bishop's own life, which may, of course, exceed twenty-one years. This lease is not within the "mischief" of the statute, as it does not tend to "impoverish his successors." It is thus necessary in many instances to go beyond the letter of the statute and to discern its true intent and spirit. Thus, if a law should prescribe that when two vehicles were passing along an ordinary highway in opposite directions, each should turn to the right with a view to avoid collision, it could have no application to the case of an omnibus and a street-car, as there could be no danger of collision by the non-observance of the rule. Accordingly, the omnibus might pass either to the right or to the left of the car. (*e*) Penal statutes (*i. e.* those which inflict punishment) are to be interpreted with much strictness. This rule was formerly carried to absurd lengths, but in a rational sense still prevails. It is founded in reason, since punishments should not be inflicted unless the transgressor of the law was able clearly to know its meaning and to ascertain the legal consequences of his acts. (*f*) Statutes to prevent

frauds are, on the other hand, interpreted liberally, in order to relieve the injured party from the consequences of the fraud. The same statute may have a double aspect, or be both remedial and penal, when the application of these distinct rules may lead to opposite conclusions derived from the same phraseology. For example, if a statute should provide that if one of two gamesters should win from the other more than fifty dollars at "one sitting," he should not only restore the money won, but should forfeit three times the amount, and afterwards a game should take place which was interrupted by an adjournment for dinner, and subsequently continued, the two periods might be regarded as "one sitting" for the purpose of returning the money, as that would be remedial, while it would not be so considered in reference to the forfeiture. (*g*) It is a cardinal rule of interpretation that a statute shall in general be construed to operate as a rule for the future, and thus not have a retrospective operation. The rule is particularly strong when the retrospective operation would destroy vested rights. In that case the words giving a retrospective operation to the act must be extremely clear. On the other hand, if the words are used to confirm existing rights defective in form or to add to the means of enforcing existing obligations, a retrospective effect will readily be allowed. Under American law, if the words are plainly retrospective and affect vested rights, another question may arise. They may be repugnant to some provision of the U. S. or State constitution, and for that reason be inoperative. (*h*) Another instance of the desire of the courts to protect vested rights is found in the rule that all statutes in derogation of private rights must be strictly construed and their provisions closely followed. This rule finds much practical illustration in the sale, under statutory provisions, of land for the non-payment of taxes. Where the authority is not strictly pursued the sale is void. This rule has been carried to such extreme lengths in some instances as almost to embarrass the operations of government. (See Blackwell on *Tax Titles.*) There is a tendency in some parts of the country, *e. g.*, New York, so to frame the tax laws as to give less practical operation to this rule than formerly. (*i*) A distinction of some importance is taken between words that are simply directory and such as are mandatory. The former class are not obligatory in the same sense as the latter. Thus, if an act is directed to be performed on a given day, it may, in general, be performed on some other day: the words are "directory." On the other hand, when the interests of the public are concerned or the rights of individuals are involved, even permissive words may be regarded as obligatory or "mandatory:" the word "may" will perhaps be construed to mean "must." (*j*) If an unlawful act be committed for which there is, in behalf of the public, an existing remedy, and a new mode of redress be given by statute, the former one will not in general be displaced. The remedies become cumulative, and resort may be had to either. This would not be the case if the new provision were inconsistent with the former law, for the latter would then be repealed by implication. On the other hand, if the act be made unlawful by the statute, and a specific mode of redress be provided, that must be resorted to. (*k*) Where a statute prescribes a penalty for the commission of an act, it is thereby made unlawful, and a contract to perform the act in question will be declared void. A penalty implies a prohibition. (*l*) It is a general remark that the courts strive as far as possible to effectuate the legislative will; discordant clauses or statutes will, if possible, be reconciled. Where there is a plain repugnancy, the later statute, so far as it is inconsistent with an earlier one, displaces or repeals it. The same rule is applied even to inconsistent clauses or sections in the same statute. So a saving clause repugnant to the general scope of the act is void. A repealing statute of course does away with that which it repeals. Where a repealing statute is itself repealed, the former law revives without express words of revival. It may be added that in arriving at conclusions by way of interpretation, the general opinion of the legal profession is considered as of importance. (See also Dwarris on *Statutes.*)

(2) In the case of *Written Contracts*, the court seeks to ascertain the intention of the parties, and, having found it, to carry it into effect if the rules of law and public policy will permit. The intention, however, must be found *in the writing itself* by the application of rules of interpretation. If it is claimed that the intention was really different from that which the words indicate, it is not a case of interpretation, but rather of a mistake, which, if material, must either be corrected or must vitiate the contract. If the mistake be material, a court of equity will "reform" or correct the instrument by supplying or omitting words, so as to make it express the real intention of the parties. If the minds of the parties did not concur in the writing, it will be a case of no contract either through fraud or mistake. Assuming that there is no question of this kind, but that the writing contains what was intended, the court resorts to fixed rules in ascertaining the intent. These rules are numerous and complex in their operation, and cannot be fully stated in an article such as the present. A few of them will be indicated. (*a*) Words are, according to the general rule, to be taken in their ordinary and popular sense. In many cases the contract concerns a particular trade or calling, when the meaning is ascertained through the testimony of merchants who are skilled in it. (*b*) If the contract cannot be carried into effect precisely as the parties intended, the court will strive to uphold it on some other theory which will render substantial justice to the parties. This rule becomes of much importance in the construction of instruments of a technical character, such as deeds. These instruments frequently assume a special form, known as a "bargain and sale," or a "release," or a "confirmation," etc. etc., as the case may be. It is a well-settled rule that if the parties should erroneously resort to one of these instruments when they should have adopted another, the courts will effectuate the intent by construing the instrument wrongly selected as practically amounting to the one which should have been adopted; as, for example, construing a deed of bargain and sale to be equivalent to a release. This rule is one most beneficent in its operation and is highly favored, and tends practically to obliterate, or at least to make harmless, useless legal distinctions. (*c*) It is frequently necessary to determine whether an instrument is executed or executory; as, for example, whether it is a lease or an agreement for a lease, a deed or a contract for a deed. This is ascertained not so much by interpreting particular words as by a view of the entire instrument and of the main intention of the parties. (*d*) An instrument is in some cases of doubt to be taken most strongly against the party who executes it (*contra proferentem*). Not so much use of this rule is made as formerly. Many instruments are of such a mutual character that it is inapplicable. Still, in special cases it may be resorted to. It has never been applied to grants by the sovereign power. Whatever is not contained in the words of such a grant is not conceded by the grantor. It was at one time supposed by some jurists that if a grant was made by the sovereign power of the right to have a public ferry or a bridge, there was an implied contract on its part that it would make no grant of another right of a similar kind that would interfere with the franchise conferred. (See FRANCHISE.) This doctrine is now exploded, and no exclusive right can be claimed unless it is shown by a fair construction of the words of the grant itself. (*e*) Instruments are sometimes partly printed and partly written. If there is a conflict between the two, the written are to be preferred, as being more clearly indicative of the intention of the parties, the printed words being regarded as a general formula, while those which are written are specially employed for the occasion in hand. (*f*) Usage is of much importance in the interpretation of written contracts. Where a contract concerns a matter in any trade or business in which there are known and well-defined usages, there is a presumption of law that the contract was made in reference to the usage. This doctrine has been in some instances carried very far; its exact limits have not yet been fixed by the courts. A well-known English case illustrates the difficulty. There being a written contract for the sale of rabbits at a fixed price per thousand, the court allowed evidence of a custom in the trade that "thousand" meant "twelve hundred." This decision has not met with universal acceptance. There is a disposition in some courts to hold that such evidence is inadmissible to contradict the plain and ordinary meaning of written words, *e. g.*, words of number. Rules are laid down by the courts to test the validity of a custom; such as, that it must be certain, reasonable, established, and undisputed. There is only a presumption that parties intend to follow the custom, and it may accordingly be excluded by sufficient evidence of their intent. The words "usage" and "custom" are often used indiscriminately, but in accurate language the former is rather evidence of the latter. (*g*) There are other presumptions or implications acknowledged by law; such as, that a contract binds the representatives of the parties as well as the parties themselves, or that a contract made by two persons is joint rather than several, or if no time is mentioned for performance that it must take place within a reasonable time. Some of the rules above stated, as is manifest, apply to unwritten as well as to written contracts. (*h*) Reference has already been made to a rule of law that extrinsic evidence of the intent of the parties is not to be allowed to alter the terms of a written instrument. This rule means that the parties are to be conclusively supposed to have merged all their stipulations and propositions anterior to the contract in the instrument itself. That is the final and

sole repository of their intentions. This rule is of great consequence both in the interpretation of contracts and of wills. While, in its correct form, it is inflexibly applied, there are some qualifications or apparent exceptions to it which should be stated. It does not include evidence by way of explanation of obscure or technical terms in the contract. It allows all contemporaneous writing to which the contract refers to be introduced. It does not bear upon clauses which are intentionally left incomplete. It permits evidence of the circumstances surrounding the parties when the contract was executed, so that the court can stand in their position and see with their eyes. Under it there may be evidence offered to show that the supposed contract is wholly void for fraud or other legal ground, for then there is no contract. Nor does the rule interfere with the correction of mistakes, such as the insertion of clauses accidentally omitted. What is really meant is, that one of the parties shall not be allowed as against the other to introduce any evidence by way of interpretation, where a written contract is in its exterior form complete, of clauses which were not intended to be inserted, but to be left to oral understanding. If that were allowed, the certainty and precision which a written contract was intended to secure would be wholly lost. The rule can, however, be pressed no further than its circumstances will warrant. Accordingly, it cannot exclude oral evidence of *subsequent* modifications of or additions to the contract, as these could not possibly have been included in the contract when it was executed. There is an important inquiry applicable both to contracts and wills concerning the explanation of ambiguities and uncertain clauses which can be more conveniently considered under the next head (*Wills*). (*i*) Subject to the rules already stated, there is a strong disposition to effectuate the will of the parties so far as that accords with the rules of law. Incorrect grammar and spelling are but of little importance if the sense is not obscure. Clauses may be transposed in construction, if necessary, and the intent sought as to the most solemn instruments, without reference to regularity of form. Still, it is unwise to draw important instruments in an inartificial manner, as it may lead to obscurity or perversion of the meaning. The courts will prefer a construction that will make the instrument legal rather than illegal, as they will one that will uphold and effectuate it rather than one that will destroy it.

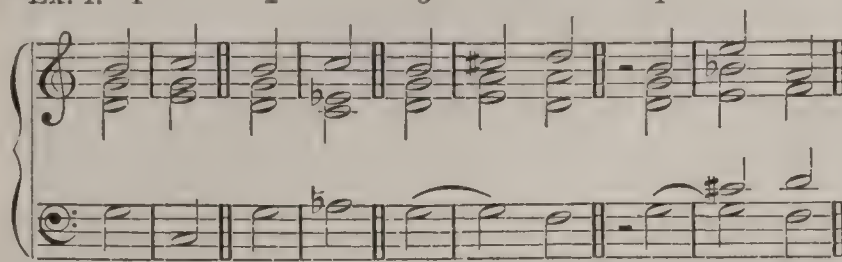
(3) *Wills.*—This is a very important subject for interpretation, and special rules prevail. In executing these instruments the testator is frequently without legal advice, and the courts seek to give scope to his intention, however inartificially it may be expressed. Still, it remains true that the intention must be found in the instrument. Conjecture, no matter how plausible, cannot be resorted to. The rule already referred to in the expression *voluit sed non dixit* has full application. The following among other rules may be laid down as proper to be followed: *Rule I.* Technical words are not necessary to give effect to any disposition in a will. Still, if the testator uses those words, he will be presumed to employ them in that sense, unless there is evidence from the context to the contrary. *Rule II.* Words are in general to be taken in their ordinary and grammatical sense, unless an intention can be shown to the contrary. This rule, where language is unambiguous, is not to be departed from, though it should result in inconvenience or absurdity, or in consequences which the testator did not foresee. Still, where the intention is obscure, it is to be sought in a rational and consistent rather than in an irrational and inconsistent purpose. *Rule III.* All the parts of a will are to be construed in relation to each other, and so as, if possible, to form one consistent whole. Words and limitations may be transposed, supplied, or rejected where that course is warranted by the context or the general scheme of the will. Words obviously miswritten may be corrected. So the word "or" has been made in many cases to read "and," and conversely. Where the intention cannot operate to its full extent, it must be made to operate as far as it can. While a construction is not to be strained to bring a devise within the rule of law, if two constructions are admissible, one of which will render it void and the other valid, that is to be preferred which will make it valid. *Rule IV.* Under the same general view as prevails in Rule III., the following special statements may be made. Words occurring more than once in a will as to the same subject are presumed to be used in the same sense unless there is something to show the contrary. Express and positive devises are not to be controlled by the reasons assigned, nor is a plain devise to be affected by a subsequent inaccurate reference to its contents. Devises not grammatically connected or united by the expression of a common purpose must be construed separately and without relation to each other, unless there is a manifest intention to connect them. *Rule V.* An heir is not to be disinherited without an express devise or necessary implication. Nor can he be disinherited by an expression of an intention that he should take nothing; the estate must be given to some other person. *Rule VI.* A will of real estate, wherever made, must be construed according to the law of the place where the land is situated; one of personal property, according to the law of the testator's domicile. *Rule VII.* A will speaks for some purposes from the time of its execution, but does not take effect until the testator's death. *Rule VIII.* Extrinsic evidence is not to be resorted to for the purpose of adding to or altering the terms of a will, though the court may receive it to show the circumstances under which it was made; such as, the state of the testator's property, his family, and the like. This branch of the law was first reduced to symmetrical form by Vice-Chancellor Wigram in his admirable work on the *Admission of Extrinsic Evidence in Aid of the Interpretation of Wills.* The principles are in a masterly form reduced to a number of leading rules. Without stating them at length, the substance of them is that where words in a will have two senses, a primary and a secondary sense, they are presumed in general to be used in the primary sense, unless there is some evidence in the context to the contrary. If there is no such context, and the testator's words are *sensible with reference to extrinsic circumstances,* the rule is inflexible that no evidence will be allowed to show that the words are used in a secondary sense. On the other hand, if the words are not sensible in reference to extrinsic circumstances, it may be made to appear that the words are used in a secondary signification. A single illustration will show the bearing of these propositions: If a testator should direct his property to be divided among his "children," the primary sense would be intended. If the fact were shown that he had legitimate children, it would be impossible to introduce any extrinsic evidence, no matter how strong, that he intended illegitimate children. On the other hand, if he had none that were legitimate, it might be shown that the illegitimate were intended. While it is proper, and sometimes necessary, to introduce evidence relating to the person claiming to be interested under the will, as well as to the circumstances of the testator and his affairs, yet if after this it is uncertain who was intended (except in special cases, to be hereafter noticed), no evidence of intention will be allowed, and the will is void for uncertainty. The special cases in which the evidence of intention is allowed are where the object of the testator's bounty or the thing intended to be bestowed is described in words which are equally applicable to more than one person or thing. This last proposition leads to the long-recognized distinction between latent and patent ambiguities, on which much stress is laid by Lord Bacon. The characteristic distinction, as he understood it, between the two is that the one appears on the face of the instrument and the other does not. Thus, if a testator should give his property to William Gordon of New York, and extrinsic evidence should show that there were two persons of that name, there would be a *latent* ambiguity not appearing on the instrument. If the will itself should show by its different provisions that there were two such William Gordons, it would be *patent.* Such a distinction is plainly useless and unfruitful. Bacon would hold that extrinsic evidence of the person intended offered in the first case, and not in the last. No such distinction is maintainable in reason, and it is just as proper to *identify* by extrinsic evidence the person really intended in the one case as in the other. The real distinction is between an *ambiguity* as here used and an *uncertainty* appearing on the face of the will. This last admits of no correction. A bequest of a sword to "the bravest general in the American army" would be incurably void, unless the testator on the face of the will supplied the mode of determination.

Under these rules the courts of equity cannot supply an omission in a will as they can in a contract. This jurisdiction has never been assumed, as a will is a mere bounty, and the beneficiary has no claim as a party to a contract would have. It is therefore an important practical remark, applicable to draughtsmen of wills, that the greatest care should be taken to include all the provisions intended by the testator.

It is proper to add, as a general rule applicable to all branches of the law, that the rules of interpretation are the same both in courts of law and equity. While the latter courts assume a special power to correct mistakes, when they are simply engaged in ascertaining the meaning of words used they adopt the same rules as courts of law. (In addition to the works already mentioned in the course of this article, see Lieber's *Legal and Political Hermeneutics;* Sedgwick on the *Construction of Statutes,* etc.; Smith, *Statute and Constitutional Law;* and Chitty or Parsons or Addison on *Contracts,* and Jarman or Redfield on *Wills,* etc. etc. Reference should also be made to approved digests and volumes of law reports for the application of principles to adjudged cases.) T. W. Dwight.

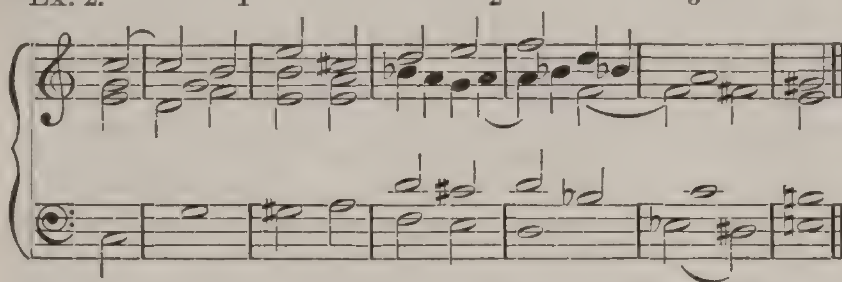
Interrupt′ed. Certain musical cadences are called interrupted when they terminate in a manner foreign to that naturally suggested by the previous harmony. In the following example see the perfect cadence at 1, and several interrupted cadences at 2, 3, and 4:

Ex. 1.—1 2 3 4



The cadences called *deceptive* differ little from the interrupted. They are often found succeeding each other in a flowing movement, and surprising the hearer by the unexpected turns assumed by the harmony. See Ex. 2, at 1, 2, and 3:

Ex. 2. 1 2 3

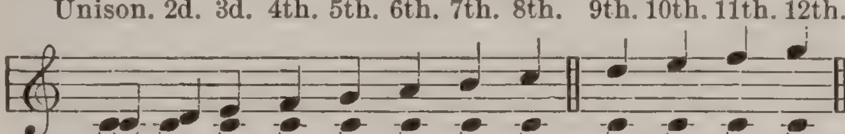


William Staunton.

In′terval, in music, the distance or difference between any two sounds in respect to gravity or acuteness, or of any two notes as measured on the degrees of the diatonic scale, both extremes being counted. Thus, from A to B above is a second; from A to C, a third; from A to D, a fourth, and so on. Intervals are either *simple* or *compound*, the former being those which are comprised within the limits of an octave, as the second, third, fourth, fifth, sixth, seventh, and eighth; and the latter, those which extend more or less into the region of a second octave, as the ninth, tenth, eleventh, etc., as in Ex. 1:

Ex. 1. *Simple Intervals.* *Compound Intervals.*

Unison. 2d. 3d. 4th. 5th. 6th. 7th. 8th. 9th. 10th. 11th. 12th.



In another sense the term "simple" interval is applied to a *semitone*, because this interval is practically indivisible in the modern system of music, and *whole* tones, as thirds, fourths, etc., are said to be "compound," because they comprise two or more semitones. Of semitones also there are two denominations—viz. the *diatonic* and the *chromatic*, called also *major* and *minor*. When the semitone includes an advance from one degree of the scale to another (as from C to D♭ or C♯ to D), it is diatonic, but when the degree on the scale is unaltered (as from C to C♯ or B♭ to B♮), it is chromatic.

In the classification of intervals they are regarded as *perfect, imperfect, diminished*, or *augmented;* to which some add the *double* (or *extreme*) *diminished*. In Ex. 2 the nature of most of these distinctions will be perceived by reckoning the number of tones or semitones comprised in the various thirds, fourths, fifths, etc.:

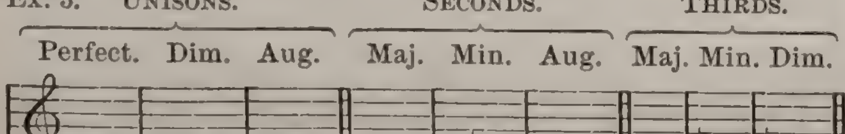
Ex. 2. Unison. Minor 2d. Major 2d. Minor 3d. Major 3d. Perfect 4th. Aug. 4th. Dim. 5th. Perfect 5th. Minor 6th. Major 6th. Minor 7th. Major 7th. Octave.

Of each of these intervals, except the augmented fourth and the diminished fifth, the scale furnishes several instances. Thus, *e. g.*, the perfect fifth is made not only by C—G, but also by D—A, E—B, F—C, and in two other cases.

A more full and accurate view of intervals, as now recognized by all composers and schools of music, we proceed to give in Ex. 3 (in which abbreviations are used for the terms major, minor, diminished, and augmented):

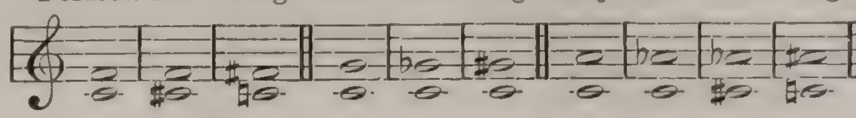
Ex. 3. Unisons. Seconds. Thirds.

Perfect. Dim. Aug. Maj. Min. Aug. Maj. Min. Dim.



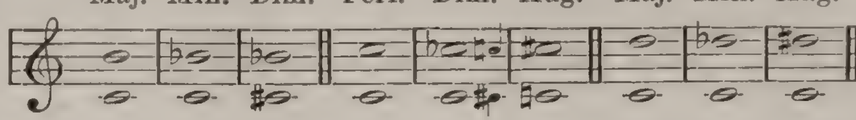
Fourths. Fifths. Sixths.

Perfect. Dim. Aug. Perf. Dim. Aug. Maj. Min. Dim. Aug.



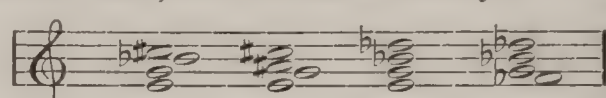
Sevenths. Octaves. Ninths.

Maj. Min. Dim. Perf. Dim. Aug. Maj. Min. Aug.



Intervals larger than these, as tenths, elevenths, etc., are (except in a few peculiar cases) regarded and treated as merely octaves of the third, fourth, etc. The *unison*, though not strictly an interval, being merely the concurrence of two similar sounds, or of two notes on the same grade of the scale, is nevertheless treated in harmony as an interval, because it frequently happens that two parts or voices meet on the same degree, and such cases are subject to certain rules regulating their progression. By a close analysis of Ex. 3 it will be found that several of the intervals are identical in the number of tones and semitones which they comprise, though named and treated as of different magnitude. Thus, the augmented *second* and the minor *third*, or the augmented *fourth* and the diminished *fifth*, are struck upon the same keys on the organ or pianoforte, and appear thus to be identical. But they are not so in reality, because they belong to the scales of different keys, and take their designations from such scales. For the same reason each particular finger-key on the organ, etc. is used for several distinct notes, according as the music performed is in one key or another. Thus, the finger key for F is used also for E sharp, and a D key may become C double-sharp or E double-flat. In Ex. 4 the very same keys are struck for each of the chords, and yet different intervals are made, as is evident to the eye:

Ex. 4.



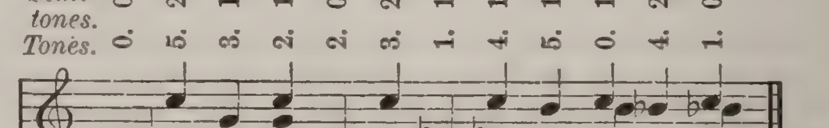
To aid still further in the analysis of Ex. 3, we give in the following table the contents of the principal intervals in tones and semitones. It should be borne in mind that the diatonic scale, whether major or minor, contains in the octave *five tones* and *two semitones*. Consequently, any other interval and its inversion, when added together, will make up the same amount as the octave, because such interval is a *portion* of the octave, and its inversion is the remaining portion or *complement:*

Ex. 5

T. S. 5. 2. = 5. 2. = 5. 2. = 5. 2. = 5. 2. = 5. 2.

Semi-tones. 0. 2. 1. 1. 0. 2. 1. 1. 1. 1. 2. 0.

Tones. 0. 5. 3. 2. 2. 3. 1. 4. 5. 0. 4. 1.



Perfect Unison. Perfect Octave.. Perfect Fifth.... Perfect Fourth. Major Third..... Minor Sixth..... Minor Third...... Major Sixth...... Major Seventh.. Minor Second..... Minor Seventh. Major Second....

A perfect or major interval becomes *augmented* by the *addition* of a semitone, and a perfect or minor interval becomes *diminished* when *reduced* one semitone.

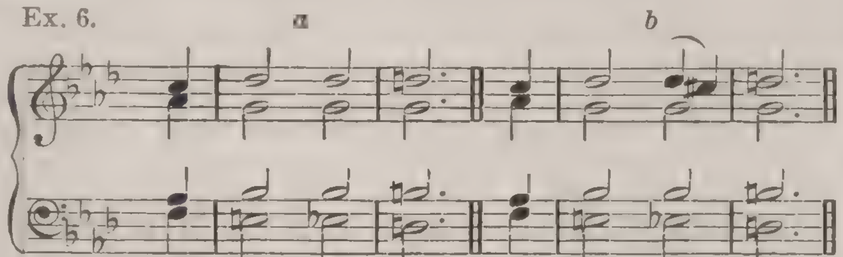
The next distinction of intervals is into *consonant* and *dissonant*. The ear immediately recognizes a difference between one interval and another in regard to their connection and relation. Some are pleasing, satisfactory, and conclusive in themselves; while others, though equally pleasing, are so indefinite as to create a kind of yearning for something further, or rather for a line of progression in a particular direction, forming what is called their *resolution*. Those intervals, then, which are more or less conclusive or independent are said to be *consonances*, while the others are known as *dissonances*. There is also a distinction of consonances themselves into *perfect* and *imperfect*, as already noticed. The former are the perfect unison, fourth, fifth, and octave, which cannot admit of change without converting them into dissonances. The latter, or imperfect, are the minor and major third and the major and minor sixth. Among consonances also are the fifth in the diminished triad, and its inversions. The dissonances are the remaining intervals—viz. major and minor seconds, major and minor sevenths, ninths, elevenths.

and all diminished and augmented intervals. By some theorists, fourths of all kinds are ranked among the dissonances, while by others the *perfect* fourth is treated as a perfect consonance.

Intervals are also either *fundamental* (*i. e.* when the lower term is the prime or root) or *inverted* (when the prime, on which the harmony depends, is moved so far upward as to become the higher term). The fundamental *intervals* are four in number—viz. the unison, fifth, third, and seventh. When inverted, their corresponding intervals will be the octave, fourth, sixth, and second.

Enharmonic intervals, or those which are less than a semitone, are not practically in use, except in the case of organs like those of the Temple church, London, and St. John's, Calcutta, which instruments are specially constructed to express quarter tones, or even smaller divisions of the scale. In point of fact, there is a real difference between C♯ and D♭, G♯ and A♭, etc., but by the modern system of temperament a middle sound (in the way of a compromise) is adopted and used as representative of both those elements, though it is really neither C♯ nor D♭, etc. Theoretically, and in musical composition, the distinction is still observed, as, *e. g.*, in cases of enharmonic changes, where one and the same chord (or component of a chord) is taken in two different relations, thereby serving to effect a transition into some unexpected key. Thus, in Ex. 6 the seventh on the dominant at *a* is assumed to be the *extreme sharp sixth* on E♭ (which it exactly resembles in sound), and the harmony is then suddenly thrown into the key of G major. In this case, the D♭ at *a* is supposed, while sounding, to change into C♯, as explained at *b* :

Ex. 6.



WILLIAM STAUNTON.

Intestacy. See ADMINISTRATION and EXECUTOR, by PROF. T. W. DWIGHT, LL.D.

Intes'tinal Juice, the mucous secretion of the intestinal canal. It contains granulated cells and cell-nuclei, and usually fat and epithelium. When filtered it is a tolerably clear, mucous, alkaline liquid, which does not coagulate by heat. Its constituents are the same as those of mucus. In 1000 parts of the juice from a dog were found —water, 965.3; solids, 34.7; pancreatic and intestinal ferments, with insoluble salts, 9.6; biliary matters, 16.6; tannin, 6.3; fat, 0.7, etc. Intestinal juice converts starch into sugar, and digests albuminous substances, flesh, etc., though much more slowly than gastric juice. (See *Watts's Dict.*)

C. F. CHANDLER.

Intes'tine [Lat. *intestinus*, "that which is within"], that portion of the alimentary canal which extends from the stomach to the anus. It consists of two distinct portions, the small and the large intestine. The former passes from the pyloric orifice of the stomach to the ileo-cæcal fold. The intestine consists of three layers: (1) an outer, serous layer, continuous with the peritoneum by means of the mesentery, a fold of serous membrane which connects the bowel to the spinal column; (2) a muscular coat of pale, non-striated, involuntary muscle-fibre, whose contractions give the small intestine a peculiar movement called "vermicular motion;" (3) an inner or mucous coat, having (*a*) folds called *valvulæ conniventes;* (*b*) the glands called glands of Brunn; (*c*) the follicles of Lieberkuhn; (*d*) the solitary glands; (*e*) the agminated glands called "Peyer's patches;" and (*f*) the intestinal villi. The small intestine is divided into the duodenum, the jejunum, and the ileum; the large, into the cæcum, the colon, and the rectum. The total length in man is not far from 40 feet, three-fifths of which length pertains to the small intestine. The more important of the above-mentioned divisions are described under their alphabetical heads.

Intona'tion. A musical term denoting, in a general sense, the utterance or delivery of any series of sounds formed on the scale. This, when correct in time, accurate in pitch, and refined in taste and expression, is said to be *pure.* The contrary, but more especially a failure in correctness of pitch, is called *false* intonation. In church music the name of "intonation" is given to certain introductory notes in Gregorian chants which are sung to each verse of a psalm or canticle on festivals, but only to the first verse on other days.

Intone'. This word is popularly used for the recital of prayers, psalms, versicles, etc. in monotone, with or without inflections. Properly, it refers only to the recital of a few notes called the "intonation" standing at the beginning of a chant.

Intoxica'tion [Lat. *in*, and *toxicum*, "poison"], the cumulative effect of an acro-narcotic poison on the nervous centres. The term is most commonly used to designate the condition of a person who has been brought under the influence of *alcohol* by successive imbibitions during a short space of time, but should not be confined exclusively to the poisoning by alcohol; opium, stramonium, cannabis indica, and all the poisons belonging to the above-mentioned class, will produce intoxication when taken in sufficient quantity.

Intoxication may be divided into the acute, sub-acute, and chronic varieties. Acute intoxication is a disease very rarely seen, even by the physician. It is produced by drinking a large quantity of some spirituous liquor in a very short space of time. This is followed soon afterwards by sudden coma (loss of sense, sensation, and voluntary motion (*Alonzo Clark, M. D.*)), which may be complete or incomplete. We have present here the symptoms of coma —viz. stertorous respiration, deviation of pupils, frothing at the mouth, etc. Unless assistance speedily arrives these symptoms generally terminate in death in from half an hour to five or six hours. Every endeavor should be made to arouse the patient from his lethargic condition. An active emetic, as sulphate of zinc, may be administered, or, better still, the stomach-pump should be used to evacuate the stomach. Ammonia may be given as an antidote, and if the patient be able to swallow he should take large draughts of tea. The sub-acute form may be seen any and every day in the week. It is the ordinary form of intoxication indulged in by persons either voluntarily, for the pleasant and exhilarating effect on the senses during one of its stages, or involuntarily, in consequence of a depraved appetite growing out of the former method. We see some men—and, unhappily, women also—who are seldom or never in a sober condition; others who imbibe a little at all times, and get intoxicated whenever they are under undue excitement or depression; and still others who "go on a burst" once every three, six, or twelve months, and in the mean time totally abstain from any of the intoxicants. To this last class belong those individuals who inherit the tendency to inebriation. Alcohol, taken to a degree to produce sub-acute intoxication, excites the vascular and nervous systems; all the secretions are at first arrested, and the temperature of the body is lowered, and not, as has been generally believed, increased. If taken by a person who is not accustomed to it, it occasions derangement of the stomach, and nausea and vomiting are the result. The principal effect, however, is noticeable upon the nervous system. There is a general feeling of increased physical power, and the mental faculties are exhilarated. The patient at first talks rationally, but is very verbose and grows confidential. Incoherence follows upon this, and then delirium and sopor. The effect is also seen on the cerebellum by the impairment of the power of co-ordination, causing at first the staggering gait, and ending in complete loss of muscular power. When this stage occurs the individual generally falls into a deep sleep, from which it is almost impossible to waken him. When consciousness is restored there is a feeling of depression, which the patient seeks to relieve by a resort to stimulants. Little can be said of the palliative treatment of this variety of intoxication. With the exception of the employment of emetics to unload the stomach, and the administration of ammonia and tea as antidotes, the patient should be allowed to "sleep it off." (For the chronic effect of acro-narcotic poisons, see INEBRIETY.) EDWARD J. BERMINGHAM.

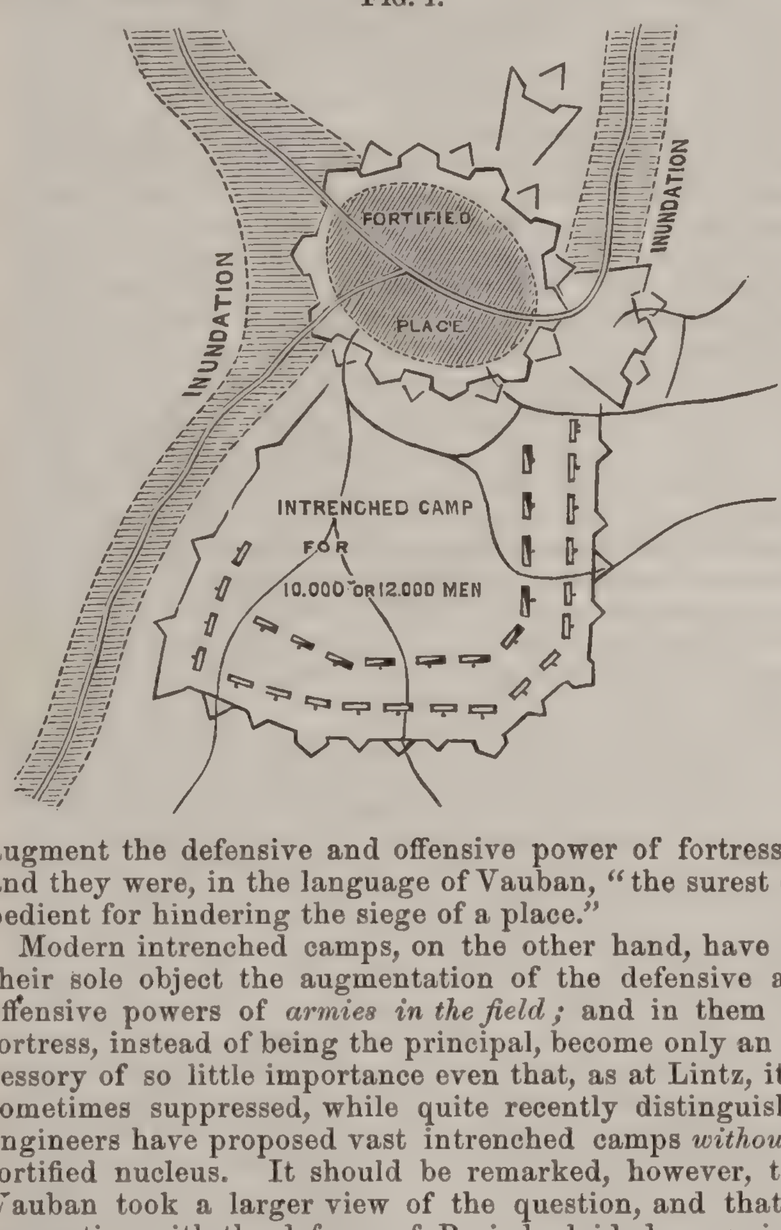
Intrenched Camps. From the earliest times armies have enveloped by intrenchments positions which they defend or which they temporarily occupy. Such camps or such fortified positions, of which the Romans made frequent and remarkable use, do not, however, constitute what are known at the present day as *intrenched camps.* The term was first applied to intrenched areas connected with, and under protection of, fortified places; it has subsequently been extended to large intrenched areas containing in their centre a fortified nucleus. An intrenched position without nucleus, but defended by permanent works, as that of Lintz, takes likewise the designation of an "intrenched camp." Camps which, though intrenched, are to be occupied merely for the period of a campaign, or which serve as refuge for a few days only to an inferior army, are styled "lines" or "temporary positions."* To the camp of Buntzelwitz and the "lines" of Torres Vedras, constructed by order of Frederick II. and of Wellington, these designations apply.

Permanent "intrenched camps," destined to serve as

* "*Camps de séjour*" ou "de passage;" the French phraseology can only be rendered as above.—TR.

pivots of operations or as places of refuge to an army operating in the field, are of modern creation. Not the germ even is to be found in the memoir of Vauban (1696) upon *Les camps rétranchés*. In this memoir the illustrious author advocates small provisional camps for 10,000 or 12,000 men, connected with and auxiliary to fortresses. More recent writers, as Montalembert, D'Arçon, Bonsmard, Carnot, Noizet de St. Paul, Dufour, etc., recognized only in intrenched camps an agency for prolonging the defence of places, and of giving to small fortresses properties inherent to those of the first order. Modern strategy has singularly augmented the importance of intrenched camps. In the time of Vauban what were so styled were merely excrescences, so to speak ("*annexes*"), of fortresses, which consequently played the principal part. "They must," said Feuquiéres, "be protected by the place which they protect, and their flanks must be secured by the artillery of the place and outworks, and under the fire of musketry from the 'covered way.'" Such is exemplified in the typical plan of Vauban in his last work, *Traité de la défense des places*. (See Fig. 1.) The camps of this epoch served to

Fig. 1.



augment the defensive and offensive power of fortresses; and they were, in the language of Vauban, "the surest expedient for hindering the siege of a place."

Modern intrenched camps, on the other hand, have for their sole object the augmentation of the defensive and offensive powers of *armies in the field;* and in them the fortress, instead of being the principal, become only an accessory of so little importance even that, as at Lintz, it is sometimes suppressed, while quite recently distinguished engineers have proposed vast intrenched camps *without* a fortified nucleus. It should be remarked, however, that Vauban took a larger view of the question, and that in connection with the defence of Paris he laid down principles which have since been carried into effect in the construction of intrenched camps destined to serve as pivots of manœuvres or places of refuge to entire armies. These principles are set forth in his remarkable memoir entitled *De l'importance dont Paris est à la France,* in which are found the fundamental ideas which in 1840 received the sanction of the French legislature in its *ordonnances* concerning the then initiated fortifications of Paris. Vauban counted, however, on having for the defence of that capital an army of only 30,000 regular troops and of 10,000 indifferently good auxiliaries raised within the walls, estimating that this force would suffice to render Paris (provisioned for one year) *inexpugnable* even though besieged by an army of 250,000 men. But in 1840 it was assumed that the capital of France would have, in such an emergency, a much larger garrison; hence the substitution for the external enceinte, proposed by Vauban, of a girdle of large forts with free intervals of 1500 to 2500 mètres.

The first engineer to set forth the properties of camps intrenched by isolated works with intervals was the general Rogniat in his work *Considerations sur l'art de la guerre,* published in 1816. "Intrenched camps should be capable," he says, "of containing, at need, 100,000 men, while they demand but few troops for mere defence; they should allow for the army that takes momentary refuge in them perfect liberty of action and free development when it desires to resume the offensive. These conditions are best fulfilled by establishing four forts about each place (fortress), forming an immense square of which the place occupies the centre." "These forts, wholly enclosed, should be established on the most advantageous summits or commanding points, at distances of about 1200 to 1500 toises* from the works of the place, and of 200 to 300 toises from each other." "The interval between one fort and the next would form a position of battle for an army of from 50,000 to 100,000 men, *which may be considered as inexpugnable.*" "The forts armed with heavy cannon would give perfect support to the wings. As to the centre, where, on account of their distance, the aid of the forts would be little felt, it may be strengthened by field-works thrown up for the emergency and supported by the guns of the place. Thus, these four forts would constitute about the place a vast intrenched camp presenting four different positions of battle, in which to confront a hostile army coming from whichever quarter." The ruling idea of this project is the creation of four fields (or positions) for battle around fortresses, having their wings sustained by forts and their front by field-works. That the idea should be realized, it would be necessary that the four positions constituting the "intrenched camp" should be as they are affirmed to be—*inexpugnable;* which is far from being the case. Small forts 2000 to 3000 toises apart and field-works along the interval would doubtless furnish efficacious support to the centre and wings of the defensive army, without, however, rendering the position inexpugnable; especially if the army had fallen back after a reverse, disorganized and shaken in *morale.* The designers of the fortifications of Paris of 1840 have not drawn their inspiration from the ideas of Rogniat; they have preferred rather to improve upon the project of Vauban in substituting a line of forts for the external enceinte of that project. Better advised than the author of the *Considerations sur l'art de la guerre,* they have spaced the forts 1800 and 2500 mètres apart, instead of 2000 and 3000 toises, giving at the same time to the detached works more development and defensive strength.

The only intrenched camps established before the publication of Rogniat, and realizing in some degree the combinations now received as essential for the fortification of great strategic pivots, are that of Ulm, which enabled Kray with 80,000 men to arrest for five weeks the advance of Moreau (with an army equal in numbers, but greatly superior in the *morale* of success) upon the Danube; and that of Genoa,† in which Masséna was able with 15,000 men not only to hold his own for two months against quadruple forces, but to harass them incessantly, to pursue them to considerable distances, killing or making prisoners in his different sorties 18,000 Austrians. These camps, more especially those of Genoa, approximated more to modern intrenched camps than that of Buntzelwitz constructed by Frederick II. upon an eminence two miles distant from the fortress of Schweidnitz; more also than that of Torres Vedras, constructed by Wellington from the Tagus to the ocean, covering Lisbon.

The camp of Buntzelwitz was composed of a line of temporary works skirting the crest of the plateau on which the Prussian army had taken position, making a rectangle of about 3000 mètres base and 5000 mètres depth. Large intervals were reserved in this line to facilitate the exit and entrée of the troops. In advance of all, and upon commanding points, there were lunettes and redoubts for taking in reverse all practicable approaches. This camp, defended by 460 guns, enabled Frederick with 60,000 men to arrest the march of 130,000 Austrians, and finally to compel their retreat (1761). It was, however, rather a *provisional* camp, like those of the Romans, than a *great strategic pivot* in the modern acceptation.

The lines of Torres Vedras approximate more nearly this last type, not only by the disposition of their works, but by the part they played. They were composed of two lines of redoubts. The first had a length of 9½ leagues,‡ and the second, 12 kilomètres in rear, a length of 8 leagues. At 25 kilomètres in rear of the second line was another intrenchment enveloping the Fort St. Julien, destined to cover, if necessary, the re-embarkation of the troops. When Masséna arrived before these lines in 1810, they comprised 126 closed works, defended by 29,751 men and 247 cannon. In 1812, when entirely finished, there were 152 forts, armed with 537 cannon and defended by 34,125 men. The works of St. Julien had an armament of 94 guns and a garrison of 5350 men.

We have deemed it necessary to give a sketch of these camps, all prior in date to the project of Gen. Rogniat, to show that the last is far from constituting a progressive step, and that, though its author may have been instrumental in bringing to notice the tactical properties of intrenched camps, it is the essay of Vauban on the defence

* The French *toise* exceeds slightly 6 English feet.—Tr.

† A chain of forts had been constructed around Genoa in 1747 to prevent the close investment of the place; thus was constituted the *intrenched camp.*

‡ The French league (*lieue*) is about 2½ English miles.

of Paris which more than any other writing has established the principles applied to the construction of modern intrenched camps. The triumph of these principles was the result of long and arduous discussions, in which the most distinguished engineers of Europe have taken part, and by which the arguments adduced in favor of a system of which the works should consist of a single enceinte have been demonstrated to be untenable. At the present day, when the armies of occupation, instead of consisting of 50,000, as Vauban contemplated, reach three or four times that number, and when mortars of 2500 or 3000 mètres range are replaced by rifled cannon of 8000 mètres range, the last-named system is totally out of the question, owing to the enormous development required for the enceinte. It has become now indispensable to constitute intrenched camps of detached works established at distances sufficiently great to shelter the place which they environ from bombardment. "Detached works with large intervals, can alone prevent blockade, prevent offensive returns, and oblige the enemy to abandon the position." On this there is no longer question, but not so as to other conditions to be fulfilled. The questions in controversy are: 1st. Ought intrenched camps to be constituted by a line of forts only, or by a line of forts *and* an enceinte? 2d. What should be the character of the enceinte? 3d. And what that of the intrenched camp? We will examine in succession these questions, which subdivide into several others.

I. Concerning the *first*. Since the time of Vauban to the present the most distinguished generals and engineers have, with rare exceptions, pronounced in favor of the combination of a line of detached forts *and* a continuous enceinte. Nevertheless, the recent investments of Metz and Paris have given rise to indications of opinion, sufficiently marked, in favor of the suppression of the enceinte. We must, therefore, discuss the question from the standpoint of governing principles. When there is *only* a line of forts, or when there is *only* an enceinte, the decisive battle will be waged (after the fall of one or two of the forts or after the assault of the enceinte) in the interior of the place, and always under unfavorable conditions for the defence. To avoid this, Vauban provided his grand enceinte with a fortified nucleus, which would allow the defensive army to deliver battle outside of the place upon ground well adapted to the action of the three arms. The great utility of enceintes was clearly exhibited in 1870 at Metz and at Paris. There is no doubt that if these two intrenched camps had been destitute of a fortified nucleus, the Prussians might, after the battle of Gravelotte and the combat of Chatillon, have at once made themselves masters of the two cities, and forced the beaten armies to capitulate or to evacuate their positions. The intrenched camp of Lintz (now condemned and partially demolished) is the only one which has not a fortified nucleus.

In the work (by the writer) published in 1865, *Études sur la défense des États*, etc., we suggested, in addition to arguments already furnished by Gen. Jomini and others, the following consideration, which alone would decide for the system of Paris in preference to that of Lintz: "After a fatal disaster, such as those of Ulm, Jena, Leipsic, or Waterloo, it may happen that the defensive army falls back, precipitately and in disorder, on one of the places of refuge or on the fortified capital. In such a case it is by no means impossible that an energetic pursuit may enable the victor to penetrate into the intrenched camp before the beaten army can offer effectual resistance. The wider the intervals between the forts the greater this danger. A new battle must be accepted therefore in rear of the defensive envelope, and as the defensive army must necessarily be, physically and morally, inferior to that of its enemy, it cannot be expected that its advantages of position will counterpoise this double inferiority. Suffering another defeat—this time without place of refuge—it cannot fail to become—men, material, everything—the prey of the victor. An intrenched camp without nucleus is only a line of defence returning into itself; now, every line once forced is irretrievably lost. Hence, the duke of Wellington took the precaution to construct behind his first line of Torres Vedras a second line, and in rear of this last the continuous intrenchments of St. Julien, destined to cover a forced re-embarkation."

In writing these lines it could not be foreseen that the disasters of the French army in 1870 would furnish such vivid illustration of the correctness of the ideas expressed. If Metz and Paris had been fortified only by a line of detached forts, the first of the places would not for two and a half months, the second for four months, have held at bay the victorious German armies. These armies, after Gravelotte and Chatillon, must have penetrated within the line of the forts, closely pursuing the defeated forces, and would have compelled them to lay down their arms, or to continue their retreat in abandoning to their fate the great dépôt and capital which these intrenched camps enclosed. The existence of an interior enceinte, armed with cannon and proof against assault, sufficed to render impossible this prompt solution.

II. We have now to consider the character which should be given to this enceinte or nucleus. This enceinte to an intrenched camp, destined to serve as a pivot of manœuvre or place of refuge for the army of a great military power, will fulfil all necessary conditions if it be proof against assault ("*attaque de vive force*"). Such was the opinion of Vauban, of the generals Bernard, Schneider, Paixhans, and Rogniat—of Marshal Soult and of the various "commissions" which since 1818 have been named in France for the study of the defence of Paris. The *actual enceinte* of that capital is on a greater scale ("*a plus d'importance*") than necessary. This is due to the necessity of enlisting in support of the project of the government the advocates of an enceinte *alone* made strong enough for protracted defence. That government might have contented itself with a much simpler and (hence) less costly enceinte. The type which it adopted is not only heavy and costly ("*onéreux*"), but at the same time very defective. In fact, it presents high scarps exposed to plunging fires, flanks subject to ricochet, uncovered guns ("*a ciel ouvert*"), ramparts without traverses or sheltering masses ("*abris*"), and an interior ("*corps de place*") destitute of casemates and bomb-proof quarters. As a mere enceinte of support it would have accomplished its purpose at half the expense if it had been composed of rectilineal fronts, each of about a kilomètre in length, flanked by small caponnieres, and secured against escalade by a detached scarp.

An exception to the principle just laid down for the constitution of the enceinte may be made in the case of intrenched camps destined as the place of refuge for the troops, in field, of small states, and especially when these camps are near the frontiers. Surprised by a sudden invasion in the midst of preparations for hostilities, the sole army may be defeated or cut off from its pivot. In this case an enceinte is desirable which can be held by the usual *garrison* alone till the succor of friendly powers be received. Such are the reasons which have induced the Belgian engineers to provide the intrenched camp of Antwerp with an enceinte capable of sustaining a siege.

III. We have now to consider the manner of constituting the perimeter of the intrenched camp. This problem has received different solutions. At times a system of small forts, reciprocally flanking and defending each other, has been advocated; at others, a system of forts each self-defensive. The towers of Lintz, connected by a palissaded covered way, and the little forts of Gen. Paixhans connected by epaulments, belong to the first system. The forts of Paris, of Verona, Cracow, and Antwerp belong to the second. The best intrenched camp being that which offers the greatest resistance to an assault ("*attaque de vive force*") preceded by a hot cannonade, the system of large forts, self-flanking, is preferable to that of little forts, reciprocally flanking. This last mode of flanking fails to give confidence to the defenders, because it is more distant, more uncertain, and sometimes wholly ineffectual, as at night and in time of fog or snow. The garrison of a little fort will never have a high *morale,* depending as it does on the ability and vigilance of the commanders of the neighboring forts, and being necessarily weak in its own numbers. For such and other reasons it is now conceded that intrenched camps should be constituted of a line of forts of sufficient magnitude to be self-defensive; but there is yet room to discuss—1st, the dimensions of the forts, their tracé, and their internal organization; 2d, the intervals between them; 3d, their distances from the enceinte.

A fort will possess its maximum value when, while occupying a favorable position, the neighboring forts cross their fires before its fronts of attack. The *intervals* of the forts must therefore be regulated by the effective range of artillery; *this* finds a limit in the difficulty of clearly distinguishing troops and works of attack at more than 3000 mètres. Hence, the intervals from fort to fort will be taken at about 2500 mètres, in order to secure a thorough mutual protection; but frequently the nature of the site and the too great multiplication of works justifies a departure from this rule. In this case the following rule is obligatory: *The forts ought not to be so far separated that the guns of the lateral fronts cannot efficaciously sweep the intervals.* Under this rule the forts may have about 5000 mètres distance between their axes. In determining the dimensions of the forts and their internal organization it must suffice here to state in general terms that the greater the distance of a fort from its neighboring works and from the place (or nucleus), the greater the strength (or power of resistance) it should have. In virtue of this principle, to the fort of Mont Valérien—the most remote and the most isolated work of the intrenched camp of Paris—has been given dimensions greatly exceeding those of the other forts. The

distance from the forts to the enceinte must be sufficient to place the enclosed area of the enceinte out of reach of bombardment. Before Paris it proved that the long rifled gun of 15 centimètres (6 inches) calibre of the Prussian system has a range of 7500 mètres (8250 yards), and more recent experimental firings have indicated that still greater ranges must be guarded against. Hence, our intrenched camps should have a depth of 7000 mètres (from enceinte to line of forts), by which there will be about 9000 mètres distance between the enceinte and the enemy's batteries, which cannot be established under favorable conditions nearer than 2000 mètres from the line of forts.*

So far as there may be choice, the more remote points for locations of forts should be preferred, to give more area and to allow of the troops being encamped out of range of shells; but this choice will be especially determined by the necessity of sweeping with fire all the ground in advance of the line to a distance of 2500 or 3000 mètres. The more perfectly this external zone is exposed the greater will be the difficulty of investment or of regular attacks (siege). Hence, sites in rear of ground furrowed by ravines or wooded should be avoided. To sweep portions of the ground which may escape the action of the guns of the forts, temporary batteries may be thrown up in the intervals, or *permanent batteries*, according as they may or may not be near enough to effectually protect them. The enormous depth now required for intrenched camps has this advantage, that it renders more difficult the investment; but it has also the disadvantage of increasing the number of the forts, and of exacting for their ordinary garrison too great a proportion of the defensive army.

To the end of diminishing the cost of construction, the armament, and the ordinary garrison, it has been proposed to substitute for the *grand permanent forts* little forts destined to serve as *réduits* to *grand field* (or provisional) forts, to be thrown up at the outbreak of war. But this solution, so seductive in appearance, is inadmissible, because the time is, in most cases, not allowed for their construction. The experience of erecting such works at Florisdorf, at Dresden, and at Paris in 1866 and 1870 proves that to construct works of the character required ("*bonne fortification mixte*") six to nine weeks are necessary; now, modern wars run their course so rapidly that it would be rash to count upon being allowed such a period of time. Besides, temporary works are ill suited to resisting a regular attack ("*pied à pied*"), or even a prolonged cannonade. Their parapets of fresh earth offer less resistance to projectiles than those of permanent works; their gun-platforms have less stability, their batteries less command above the natural ground, their ditches less depth, their scarps and flanking batteries less resistance against plunging fires; finally, their traverses, covering masses, magazines, and barracks are weak against the action of rifled projectiles, so formidable for blindages and new masonry. Moreover, the weaker a work is in profile and internal organization, the greater number of troops and guns it needs for its defence. The resort to temporary works is therefore not an effectual means of diminishing the pecuniary expenditure for intrenched camps, nor the number of troops for their ordinary garrisons. It will, then, be proper to construct beforehand the forts of the intrenched camp, and to reserve for the moment of war only the batteries and intrenchments necessary to complete the defences of the intervals. With whatever care the forts be constructed, there will always be some external area which their batteries will not see or will but imperfectly sweep. It will, hence, generally be necessary to throw up epaulments between the forts, not only for this reason, but also in order to divide the fire of the attacking batteries, which otherwise will be concentrated on the batteries of the forts, which they will promptly silence. The experience of the siege of Paris has proved that it is a matter of great importance; it has also proved that these low batteries, thrown up during the siege, the tracé and internal organization of which are unknown to the enemy, are more difficult to destroy than the elevated batteries of the forts.

We now consider the principles which determine the disposition of the works, or, in other words, the *form* of intrenched camps.† The application of the foregoing statement of principles leads to the *circular*, or approximately circular, form of these camps. Such are the intrenched camps of Paris, Verona, Cracow, Metz, Portsmouth, and Antwerp; such are likewise to be those which the Germans have, since 1870, decided to construct. The writings recently published in France and England upon the defence of Paris and of London are all based on the same notions. The project of the commandant Ferron, who proposes to surround Paris with a girdle of 37 forts on a perimeter of 32 leagues; that of Gen. Tripier, who proposes for the same capital, with a *tactical line of defence* (a girdle of forts to protect from bombardment) and a *strategical line of defence* (a line of 150 kilomètres, or 30 leagues development), serving as base of operations to the defensive army when it moves outside of the intrenched camp (properly so called); that of Col. Jervois, for the defence of London (50 forts on a circumference of 4 leagues radius); that of Maj. Paliser of 31 forts on an elliptic perimeter (of 20 and 10 leagues, major and minor axes respectively), are all illustrations. The authors of these projects have removed the forts farther than mere security of the enceinte against bombardment absolutely demands. This is to be commended; where it concerns the defence of a great strategical pivot (the political or military capital of a nation), the capture of which marks the termination of national resistance, an excess of precautions can hardly be taken to retard the fall or to render the attack impracticable. Now, the events of the recent war (Franco-German) have proved that the principal if not the only danger to which intrenched camps are exposed is that of investment ("*blocus*"); an operation of which the difficulties are proportioned to the extent of the zone of investment. To successfully defend an investing line against the sorties of an energetic garrison requires, generally stated, four men to every mètre of development. That of the Prussian line before Paris had 83 kilomètres, and the numerical force of the investing army did not exceed 236,000 men, or $2\frac{8}{10}$ men per mètre. At Metz the line of investment was about 50 kilomètres in development, and the besieging army had a maximum effective strength of 200,000 men, or 4 men per mètre. Doubtless, increment of perimeter for the intrenched camp entails increased numbers of inactive troops (for garrisons), but these disadvantages are largely compensated by the obligation imposed on the enemy to increase the numerical strength of his army by 4000 men for every additional kilomètre of line of investment.

Admitting the great depth of intrenched camps as an imperious necessity, and accepting as a consequence the obligation of separating the forts by intervals of 4000 to 5000 mètres, the question has occurred to us whether a better arrangement might not be made than to dispose the forts on a line enveloping the capital to be fortified. Such a line has the disadvantage of offering the enemy a large gap as soon as he has gained possession of one or more of the forts. To remedy that, we proposed as early as 1863 ‡ to construct, in rear of the forts, transversal lines of defence, dividing the intrenched camp into several sectors. These lines were composed of a double epaulment, forming a kind of caponniere, the anterior extremity of which was covered by a fort, and the rear extremity was within range of small-arms of the enceinte. That this line (which would sometimes be 3000 or 4000 mètres long) should be defensible throughout (*pied à pied*), it could be interrupted at intervals by redoubts destined to serve as traverses to the double caponniere and to flank the epaulments of which it is constructed. At the epoch when we wrote it was not admissible to remove the forts more than 3000 or 4000 mètres from the enceinte. At the present day, when double, triple, and even quadruple these distances are allowed, the palliative offered by these lines of double defence can no longer be entertained. For this reason, in generalizing the idea we advanced in 1859, to defend London by means of an intrenched camp at Croydon, and three double *têtes-de-pont* on the Thames at Gravesend, Woolwich, and Kingston, we recently § proposed to fortify great capitals by means of two or three intrenched camps, disposed as indicated by Fig. 2 (abstraction made of topographical features of the ground, which must necessarily influence the form and location of the camps). The three camps would be established with approximate symmetry at such a distance that between the interior forts and the place there would be a zone of 8000 or 9000 mètres (extreme range of the cannons of the place) of width. The movable troops would be encamped or placed in cantonments in this zone, in rear of the camps, or preferably in their intervals. A triple railway and two or three paved roads would unite all these camps. By aid of such dispositions one of the three fractions of the defensive army could, in a single night, be reinforced by the other two, even without recourse to the encircling railways.

The form of these camps, the number, location, and character of the forts, will be regulated by the following con-

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*Peculiar circumstances rendered it practicable to establish the batteries much nearer at Paris, but such will not present themselves in future.

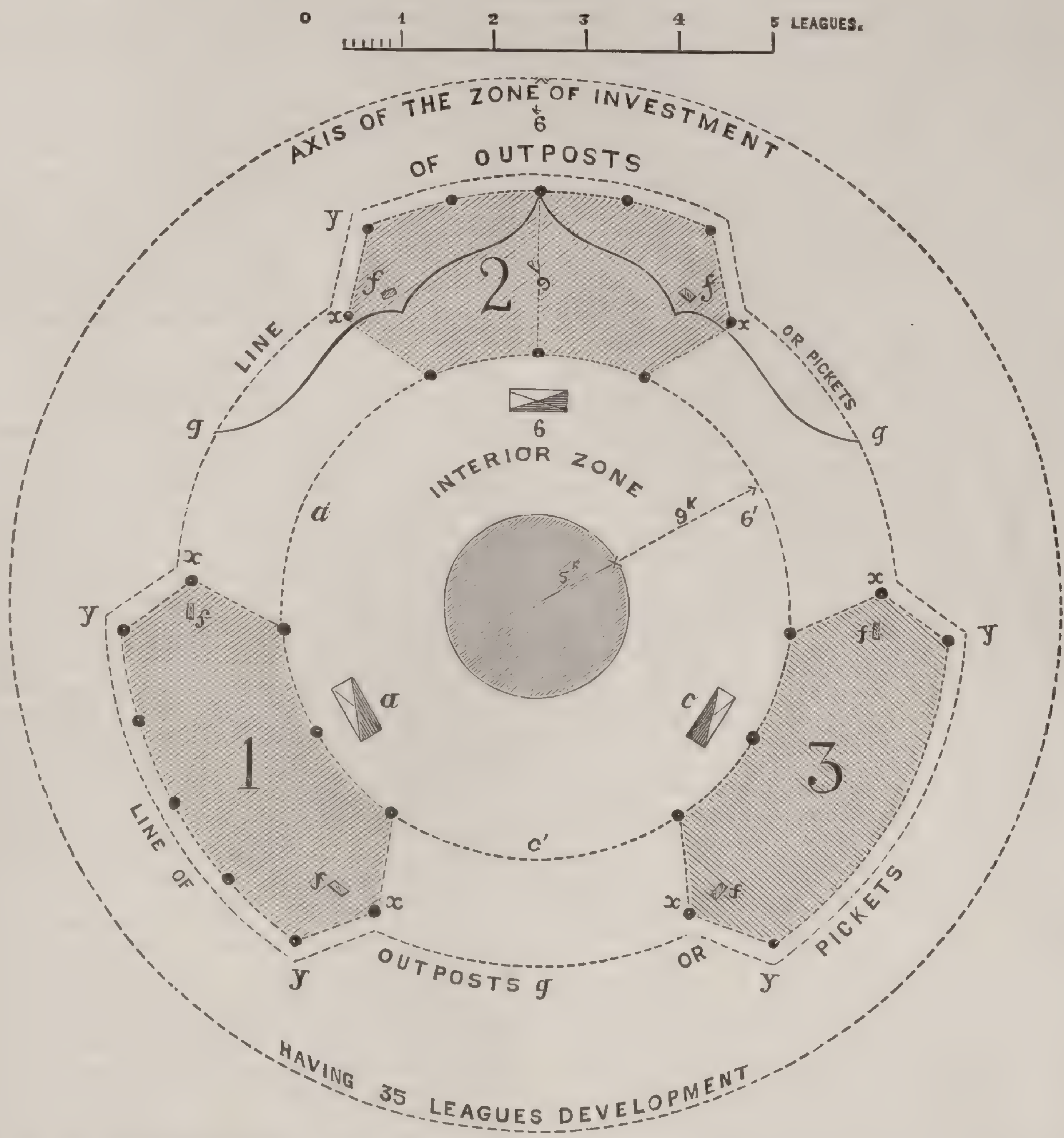
†We necessarily omit here all that concerns the tracé, internal organization, dimensions, profiles, the arrangement of the ramparts and of flanking batteries, and the computation of garrisons, etc., as belonging to a more technical treatment of the subject, and also to that of permanent fortification. (See FORTIFICATION.)

‡ *Étude sur la défense des États*, etc.

§ *Étude sur la fortification des Capitals* (1873).

siderations: A. Each camp will have four sides. The most important, facing the enemy, will be called the *exterior* side; the opposite one, facing the place, the *gorge;* the two others, facing the intervals between the camps, *lateral* sides. B. The exterior side will be longer than the others, and the forts which constitute it will be the most important; the

FIG. 2.



intervals will be about 5000 mètres. If for local causes greater intervals be given, one or two permanent batteries, proof against assault, will be interpolated. C. Besides these batteries, there will be provided, in all the intervals of threatened attack, epaulments for siege and light guns to be thrown up simultaneously with other preparations for immediate defence (*au moment de la mise en état de défense*). We recommend likewise the use of low batteries established on each side of the forts, at the foot of the glacis of the lateral fronts in the prolongation of the gorge front. D. The forts of the gorge will be arranged to serve as dépôts of provisions, arms, ammunition, and supplies of all kinds. On account of this destination, and so that there may be in each camp a zone exempt, by distance, from the fires of the attack, these forts will be placed at more than cannon range from the line of the exterior forts. To these forts of the gorge will be given simply that degree of resistance to exempt them from being carried by *coup de main*. They may be placed 7000 to 8000 kilomètres apart. Let us assume that the capital city has a radius of 5 kilomètres, and the central zone 9 kilomètres of depth. The circumference which defines the position of the "gorges" of the camps will have a development of about 84 kilomètres. Giving to these gorges a length of 14 kilomètres, occupied by three forts, and to the exterior sides a length of 20 kilomètres, occupied by five forts, and supposing that the mean distance between the sides be 9 kilos., we shall have the arrangement shown by Fig. 2. The lateral sides are broken intervals, so that the forts x, x are thrown forward into the intervals, the better to sustain the contiguous forts y, y. The troops of the defence are divided into three armies of two corps each. One of each of the two corps is employed, alternately, on the external line ("*cordon de surveillance*"); the other is established in close cantonments, or in barracks constructed either in rear of the camps (a, b, c, Fig. 2), or in rear of the intervals (a', b', c'). E. If the zone of investment has 7500 mètres of depth, and if it is 2500 mètres beyond the exterior forts, the axis of this zone will have about 35 leagues of development. Suffice it to say, that it would be impossible for the largest army in the world, and even to an aggregate of several allied armies, to invest a place like Paris, London, Berlin, or Vienna to which has been applied the model plan here sketched.

This plan would doubtless require a greater number of forts than that for a single camp constituted by a girdle of forts, and therefore more expensive, more guns, more troops for garrison; but, on the other hand, it would afford much greater certainty to the defence. In the one case the besieging army after having carried two or three of the forts of the single camp, may crush the army within, and commence his approaches upon the interior enceinte if there be one, or if not, penetrate at once into the city. In the other, these operations would be impossible on the hypothesis of a triple intrenched camp; for if the enemy, after taking two or three forts, should seek to penetrate into one of these camps, he would be taken in flank by the forts of the lateral sides and confronted by the forts of the gorge. The defending army may decline battle by withdrawing into the other camps, without detriment to its own safety or that of the place ("*rien dès lors ne serait compromis*"). The besiegers must obtain possession of the lateral forts and of the forts of the gorge in order to make themselves masters of the evacuated camp; then recommence the same operations against the other camps. Such a succession of efforts and of sacrifices would exhaust the most powerful army.

To give the same properties to an intrenched camp constituted by a girdle of forts, it would be necessary—1st, to provide the capital with a safety-enceinte ("*enceinte de sureté*"); 2d, to construct several *radiating lines* of forts from the enceinte to the line of forts, enabling the defensive army to withdraw laterally in order to continue the struggle. These radiating lines, by dividing the single

camp into several intrenched and juxtaposed camps, would realize indeed, though in an incomplete and defective manner, the germinal idea of our model plan. One great advantage of this latter plan is the exemption of the defensive army from the dangerous agitations of the population, and to make its existence independent of the seditions which sometimes break out in the populace before or during the siege; for if there be three camps the capital is not included in any one of them; whereas if there be but one it occupies the centre of that single camp. Finally, when there is only a girdle of forts, the great dépôts of supplies and arms are exposed to the attacks (*coups de main*) of the enemy as soon as the line is pierced by the capture of two or three forts, and to the enterprises of a populace desirous of hastening the surrender by obstructing the defence. On the hypothesis of three isolated camps this double danger is not to be feared, because the dépôts comprised in the forts of their gorges are secured against such enterprises (*coups de main*).

While the armies are operating in open field the garrison of this great central camp (*"pivot central"*) will be made up of the troops essential to the guard of the forts, and of a reserve of three divisions. These divisions will establish themselves in the intervals of the intrenched camps (*a, b, c*, Fig. 2), so that they can be promptly united to confront and repulse hostile corps which might seek to penetrate the capital to lay contributions or to produce a moral effect by a bold dash. The possibility of invading the city after beating the central reserve seems to afford a powerful argument for a safety-enceinte; but there are so many chances against such an enterprise—which, besides, if successful, is so little decisive—that this possibility need not be dwelt upon. It may, too, be guarded against by throwing up intrenchments in time of war covering the most exposed portions of the perimeter, as a substitute for a safety-enceinte. A. Brialmont.

[Translated from the French MS. of Gen. Brialmont by J. G. Barnard.]

Intro′it, in sacred music, a composition for voices to be sung or chanted while the officiating minister is entering within the railing of the chancel.

Intussusception. See Ileus.

In′ulin ($C_6H_{10}O_5$), a substance isomeric with and similar to starch. It is widely distributed in plants, occurring especially in the roots of elecampane, dandelion, chicory, feverfew, meadow saffron; in the tubers of the potato, the dahlia, and the Jerusalem artichoke; in Serp manna, in certain lichens, and probably in the seeds of the sunflower and of mustard, etc. It is prepared by washing the rasped root on a sieve, and allowing the inulin to settle from the liquid, or by boiling the sliced root with water and filtering while hot; the inulin separates on cooling. The juice of dahlia-tubers pressed in the winter becomes semi-solid on standing from the separation of inulin. Inulin is a soft, white, tasteless, odorless powder, resembling starch, which it appears to replace in plants. Unlike starch, it exists in plants in a solution which has the consistence of a thin oil. If a slice of the plant is soaked in alcohol, the inulin separates in spherical granules which can be recognized by the microscope. It is very hydroscopic, and adheres to the teeth and to moist paper. It is but slightly soluble in cold water, freely in boiling water, from which it separates, on cooling, without forming a jelly. It is insoluble in alcohol, which precipitates it from its solution in water. Heated with water, it is changed slowly to lævulose (grape-sugar). Dilute acids change it to sugar even in the cold. Inulin is not altered by diastase nor by other ferments. It is colored brown by iodine, is soluble in cuprammonia and in nickelammonia, and it reduces salts of lead, copper, and silver. C. F. Chandler.

Inunda′tions, Mar′itime. The sea, not content with the sacrifices which it exacts from those who voluntarily throw themselves upon its mercy, often wages battle with man on his own domain. So terrible have been the disasters caused by the unforeseen overflow of the ocean waters that even races of men otherwise most destitute of historical records date their origin from some great flood. The mythic narratives which tell of such show often so curious a conformity to those of the biblical deluge that theologians do not hesitate to receive them as concurrent evidences of the same event. The most noted of these are the floods of Xysythrus, Ogyges, and Deucalion (for which consult those titles). Of the revolutions which have caused the formation of great islands and large seas we know nothing. The evidence adduced in proof of the recurrence of what is called the Cimbric flood (that which is said to have insulated England, and to have considerably changed the condition of the lowlands of Holland) amounts only to a vague statement by Ephorus (B. C. 350) and Clitarchus, that the Cimbrians were driven from their seats by a cataclysm of this kind. As Aristotle mentions that the Celts opposed the floods with arms, and as several ancient historians record the continual encroachments of the sea, this mythic Cimbric flood must be presumed to have been made up of several of greater or lesser magnitude occurring in pre-historic times, by which England was at length severed from France and a communication was opened between the ocean and the North Sea. This channel once established, the tidal currents tended to increase its breadth till natural barriers arrested the process. The Netherlands, presenting no such barriers, would have been totally swallowed up but for the forming of "downs"* from the sand cast by the waves upon the shore. These downs, however, furnish only a partial and temporary protection. The sands, chased by the sea-winds, encroach farther and farther upon the fertile plains, forming new lines of downs, and the sea advances in their rear. Two centuries ago foundations of villages and of Roman castles, laid bare at a time of extreme low water, furnished visible evidence of the magnitude of such encroachments even within the historic period.

Since the coasts of the Netherlands are the most exposed of the Northern lowlands to the predominating north-western winds, it is not surprising that they have suffered most from inundations, or that many of these have effected extraordinary changes in the face of this country, while others, more numerous, though less destructive, have plunged the inhabitants for the time being into inexpressible wretchedness. It is to geology, and not to history, that we must look for information as to the earlier and more formidable of these catastrophes. The map of the Netherlands shows the coast to be sheltered by a line of downs, which also extends along the seaward shores of the islands at the entrance of the Zuyder-Zee. This Zuyder-Zee in pre-historic ages was much larger than at present, but its mouth became gradually obstructed. The existing belt of islands are the remnants of what was then continuous coast; the Zuyder-Zee subsided into a lake, of which the area was rapidly reduced by the deposits of the Rhine, which probably discharged into it the greater part of its waters through the Yssel, and perhaps some other branch (of which only dubious vestiges remain). Thus, this lake, then called Flevo, dwindled rapidly, and would have totally disappeared but for the storms of the tenth and twelfth centuries, which battered large breaches in the line of downs, submerged the greater part of the newly-formed land, and, gradually re-opening the channels between the islands, caused the Lake of Flevo to expand again into the Zuyder-Zee. For though the inhabitants, now considerably advanced in civilization, did their utmost to restrain the waters, they found their toil and skill alike ineffectual, and many towns, villages, and monasteries were swallowed up for ever.

At what period dikes were invented as a protection against floods is not certainly known; the Romans may possibly have learned their use from Egypt; they certainly employed them as causeways over marshy lands. Tacitus informs us that Nero's lieutenant, Pompeius, constructed a dike to prevent the overflow of the Rhine, and the aborigines of Germany sometimes flooded the country by barring the rivers in order to prevent invasion. It appears that the province of Friesland was diked in the seventh century by King Adgillus; the province of Zeeland was diked by the Danes and Goths in the eighth century; while Oldenburg was enclosed about 984 by Count Otho. Earlier, the natives lived on small hills or elevations called "terpen." Such a "terp" offered a place of security for men and cattle, and such exist still in some parts of this country, where recently a certain number have been erected by order of the government to serve as temporary refuges in case of the failure of the dikes.

Of the storms which have caused notable revolutions, the first recorded in authentic history is that of 860, which carried away a great part of the western coast of the Netherlands, and gave a more southern direction to that branch of the Rhine which formerly discharged its waters near Catwyk. On St. Michael's Day, 1014, a great part of England and of the Netherlands was flooded. In 1134 a part of Flanders was swallowed up. Of the coasts of Friesland (which then consisted of the Dutch provinces of North Holland, the Zuyder-Zee, Groningen, Friesland, part of Hanover, and Oldenburg), a certain part disappeared during the St. Juliana's flood of 1164, and all the lowlands of the Elbe and the Weser were submerged. Still more disastrous was the All Saints' flood of 1170, the first of that name. The formation of the Zuyder-Zee and the separation of Texel and Wieringen are erroneously attributed to this calamity, for the Zuyder-Zee had been already formed by more ancient floods, and the islands were more recently severed.

In continuing this enumeration only the more important

* Dutch *duins*, Fr. *dunes*.

of the almost numberless floods mentioned in the annals will receive attention. In 1219 occurred the Marcellus flood, which was only of temporary character; but in 1277 the gulf of the Dollart at the mouth of the Eems was formed, while in 1362 the Mandrankels flood (the "men-drowning" flood) snatched away more than 30 villages on the coasts of Sleswick (Nordstrand). The gulf of Biervliet in Dutch Flanders, then much wider and deeper than at present, was formed in 1377. But the most disastrous flood by which in later times the Southern Netherlands have been visited was the (second) St. Elizabeth flood, which formed the Biesbosch, submerged 72 villages, changed totally the lower course of the Rhine and Maas, and altered so profoundly the conditions of these rivers that its influence is still felt, though modified, and in a measure controlled, by costly engineering works constructed in later years. This disaster resulted from the combination of a maritime and a fluvial inundation. The branch of the Rhine called Waal previously to that event discharged its waters near the town of Brielle, and formed with the other branch, called Lek, the outlet of the Maas. It now took the much shorter direction of the outlets of Brouwershaven and Hellevoetsluis, where, moreover, the tide-range is greater (amounting to $2^{m}\cdot3$, while at Brielle it is only $1^{m}\cdot8$). The fall per mile of the Waal being thus superior to that of the Lek, the Rhine was drained by the former, while the latter grew shallow. On this account the wide outlet of the Maas gradually filled, and the communication of Rotterdam with the sea became seriously impaired. In 1410 a flood occurred which formed in the Zuyder-Zee a practicable channel for vessels of heavy draught between Enkhuizen and Amsterdam, and thus gave to the latter town its commerce and its importance. Till then, the southern part of that sea had been too shallow to allow more than a limited traffic, which was confined to the then flourishing cities of Hoorn, Medemblik, and Enkhuizen.

From this time onward, though the floods increase in number, their violence diminishes and their effects are less disastrous. Thus, the flood of All Saints' Day, 1570, though only surpassed in magnitude by that which occurred in 1170 on the same day, destroyed no land, though it submerged Bruges, Antwerp, almost all the islands which form the province of Zeeland, Dordrecht, Rotterdam, Amsterdam, part of the provinces of Friesland and Groningen, the coast of Oldenburg, Bremen, and the city of Hamburg, and drowned at the lowest estimate 30,000 inhabitants. Before the breaches of the dikes could be stopped new storms flooded the country, and within the eight years ensuing the unfortunate provinces of Groningen and Friesland were not less than six times partially submerged. These continually recurring disasters must be attributed in great measure to the bad state of repair in which the dikes were kept. Notwithstanding its importance, this matter had never been well regulated. Every village being independent, there existed no authority competent to coerce the delinquent, and so the negligence of some proved the ruin of all. Later, the Dutch republic was impotent to establish proper co-operation, and in such a state of affairs the iron hand of a Napoleon was needed to reduce the petty magistracies into obedience to a common superior. The new regulations established by him produced results so satisfactory as to ensure their permanence; and, though there still arise frequent disputes concerning this vital point of Dutch economy, the state usually succeeds in accomplishing the projects of improvement which it proposes.

The Spanish domination, though generally so disastrous to this country, proved in 1578 of singular benefit to the Frisians; for the Spanish governor of Friesland, the eminent engineer Caspar de Robles, lord of Billy, addressed himself with great energy to the repair of the dikes, employing his soldiers in the work, and forcing the Frisians to postpone their differences and ply the spade. Many farmers and landowners pleaded exemption, supporting their claims by ancient titles and patents. Robles took these deeds and cast them into the crevasse, saying, "There they go: if they stop the gap, 'tis well; if they don't, you shall." Robles further increased the strength of the dikes by giving them a height of 12 feet, and a breadth at summit of 6 feet, with slopes of 4 : 1 on the sea-side, and of $2\frac{1}{4}$: 1 on the land-side. As much greater dimensions than these are given at the present day—viz.: a total height of 15 feet, with slopes of 6 : 1 and $2\frac{1}{2}$: 1 respectively, the dikes being also strongly protected at the sea-side by palisades and breakwaters—we can easily account for the comparative immunity from disastrous floods enjoyed by these countries in recent years.

In 1607 the county of Somerset (England) was partially flooded, but a much more serious calamity befel the Danish domains in 1634. Part of the coast, called Nordland and its villages, which, though often destroyed, had as often, with undaunted resolution, been again rebuilt, was swept away, together with the greater part of the population (11,038 people and 66,337 cattle). Hamburg, Bremen, and the coast of Oldenburg were also much injured. More than 10,828 human beings and 90,000 cattle were drowned. In the great Christmas flood of 1717, which covered the whole northern coast, and even some parts of England, 5000 dwellings were totally and 3500 partially ruined. Owing to the prevalent neglect of repairs already mentioned, the years 1718, 1719, and especially 1720, saw these countries flooded again. The most recent inundation of importance was that of 1825, in which the waters reached a height which was not ascertained. This flood in several respects differed from any recently observed before; and on that account it has been ascribed, with a semblance of probability, to a submarine earthquake. Similar particulars had been recorded in ancient chronicles, but as no modern observation had confirmed them, they had passed into discredit. The sea-water was very muddy, and seemed as if boiling; the waves were not high, but short and eddying; the wind, W. N. W., was not violent; and finally the position of the moon was not such as to favor an extraordinary tide. Some days before the event certain springs dried up, and others became muddy, yellow, and brackish. Large fragments of amber were also cast up on the coast of Jutland. Facts corresponding to these had been observed during the floods of 1600 and 1665, during the Christmas flood of 1717, and finally in 1755 during the famous earthquake of Lisbon. The principal effect of this most recent flood was the insulation of the northern part of Jutland.

The floods thus far noticed are such as have been caused by storms and high tides, accompanied usually by wide destruction, in which multitudes perished and other multitudes escaped only with their bare lives, the inundations ordinarily occurring during the night. But, besides these, there are others which, though local, are not unattended with danger, and which deserve a moment's attention. These are the inundations which threaten especially the coasts of the tidal rivers. The powerful streams which separate the islands of Zeeland and of part of South Holland, being connected with the Scheldt, the Rhine, and the Maas, form large estuaries, which at flood-tide are filled with the water of the North Sea, and during ebb discharge the flood-water along with the drainage, the tide-water varying between 3 and 4 mètres. Strong currents, especially during ebb, accordingly prevail in these streams, undermining the southern shores of the islands. By observing the direction of the ebb from N. E. to S. W., while that of the flood is opposite, we are enabled to account for the fact that all the islands are attacked in the same way and exhibit the same form—viz. a concave S. and a convex N. coast, the latter augmenting by the undisturbed deposit of the rivers and the detritus of the southern shores. The W. coast of the province of Holland is attacked in a similar manner, though with less force, the sea-currents not being confined within narrow channels. The system of coast-defence of the Netherlands must therefore embrace two distinct objects — defence against currents, and defence against high seas and storms. The coasts of Friesland, Groningen, and the Zuyder-Zee need only protections of the latter class, while the dikes and downs of the W. coast of Holland and those defending the islands must be considered from both points of view. This portion of our subject is reserved to be treated under the head of LEVEES (which see). P. CALAND.

Inundations and Floods of Rivers. These two terms are often used as synonymous, but they are conveniently distinguishable, thus: an *inundation* is the state of a river when its waters rise to such a height as to spread beyond its normal channel, overflow its banks, and cover the low grounds along them; a *flood* is the condition of a river when its current, though rising above its mean level and filling the canal which it has excavated for itself, still remains within its banks, or, in other words, is "without o'erflowing, full." Perhaps the nearest approach we can make to precision of distinction is to say that a flood becomes an inundation when the stream rises sensibly above its mean high-water level, and spreads in considerable volume beyond the limits of its natural channel as bounded by the growth of spontaneous perennial land-plants. It is, however, impossible to draw any sharp line of discrimination between floods and inundations as applicable to the whole course of rivers, because a river may be confined by high banks at one point, bordered by low flats at another, and these riparian conditions may be alternated many times in the same stream; and hence it may be simply at flood in certain parts of its channel, in inundation at others. Using the words in the general sense we have ascribed to them, a flood is ordinarily a beneficial state of a river, because its supply of water for mechanical power, for feeding canals and aqueducts, and for navigation is then ample, and yet not in excess. The augmented volume and

velocity of the water are, especially in new countries, a considerable advantage to navigation, because they particularly favor the downward trade, which is ordinarily the heaviest, if not the most valuable, and they not unfrequently render a further useful service by preventing the closing of the stream by ice. Hence, measures have often been proposed, and sometimes adopted, for keeping rivers permanently at flood by introducing into them additional supplies of water from lakes or artificial reservoirs, or by the diversion of other water-courses into their bed. Thus, the Illinois Canal, when enlarged, will furnish the means of maintaining at all desirable seasons a flood-level in the Illinois, and even perhaps in the Mississippi; and it is believed that a judicious husbandry of the natural sources of supply of the Hudson and of the waters of some of the Adirondack lakes may be made in the same way greatly to improve the navigation of the upper portion of that important river.

Inundations of great rivers, when they are of regular character both in volume and in periodic recurrence, are often not merely highly advantageous to human interests, but even essential to the permanent occupation of their banks by man. Of such rivers the Nile is the type. The seasons and the height of its rise are approximately constant, and therefore readily foreseen; the inundation saturates with moisture the alluvial plains along its banks, and it deposits on them a supply of organic and mineral sediment abundant enough and fertilizing enough to render the artificial application of manures in general superfluous. But even here nature must be aided by human art, and from the earliest ages the Egyptians have employed dikes and canals for retaining and distributing the waters of the inundation. (See NILE.) The more irregular inundations of smaller rivers sometimes render similar service to man, but with few exceptions river inundations are a highly destructive agency; and it is principally in this light that we shall consider them. The river-inundations of modern times, in both America and the Old World, even if not more frequent or more violent than those of earlier ages, have been more disastrous, because in many cases the beds of the streams have been elevated by sedimentary deposits faster than their banks, and because greatly augmented and more diversified moral and material interests are affected by them. Larger towns, vaster mechanical establishments, as well as agricultural and commercial arrangements, great networks of canal, railway, and telegraphic communication, more numerous common roads and bridges, are now exposed to their ravages, and of course the social interests endangered by them are immensely multiplied. While, then, floods are to be promoted, inundations are to be controlled and as far as possible prevented. The best method of effecting this is a very complicated problem, and for various reasons—among which the fact that the sources of considerable streams are often in one State or Territory, their middle and lower courses in another, is the most familiar—the contrivance of systems applicable to the entire flow of rivers has but recently engaged the attention of engineers, and it is not yet even theoretically completely solved.

The means of defence against river-inundations are divisible into two classes—the preventive and the remedial, the former being designed to operate against their causes, the latter to protect valuable interests against their effects. The immediate cause of river-inundations is the discharge of water into river-channels faster than those channels can carry it off. The insufficiency of the channel for this function may be occasioned—(*a*) by excess of supply; (*b*) by obstructions in its bed; or (*c*) by the reduction of its inclination. (*a*) The excess of supply may be due to abnormal and exceptional causes, such as the bursting of the barriers of natural or artificial accumulations of water, lakes, reservoirs, or mill-ponds, but it is usually derived from rains and melting snows; and as a general rule it may be said that it does not proceed from the down-fall in the great valleys which border the middle course of the stream, but from winter snows or equinoctial rains in the smaller basins of the upland tributaries, whose inclination is more rapid, whose fan-like expansion embraces a wider surface than that of the main valley of the general recipient of them all, and which, moreover, often lie in elevated regions where the precipitation is greater than on the plains. The flow from the uplands is probably in the largest proportion superficial, but it is now known that great quantities of mountain-water sink to a moderate depth into the earth, and then descend, by infiltration or other underground conduction, to lower points in the basins, and are there discharged into the river-channels. High water rarely occurs at the same time in all the tributaries of large rivers, but there are instances, as the Seine and the Po, where the floods of the affluents are usually contemporaneous, not successive, and inundations of rivers are generally destructive in proportion to the degree of coincidence in the floods of their tributaries. (*b*) Obstructions which reduce the capacity of delivery of water-courses may be artificial, as the piers of bridges, dams, weirs, riparian spurs or wing-walls, the waste from mines and metallurgical establishments, or they may arise from the natural deposit of terrestrial sediment in the channel, from the caving-in of the banks, from the accumulation of trunks of trees and other floating matter lodged on shoals, from the growth of aquatic vegetation, or from ice, which sometimes forms almost complete though temporary barriers in both European and American rivers. (*c*) The inclination of the bed of a river may be reduced by geological upheaval of its outlet or its lower course, by the filling-up of its estuary by its own deposits or by sand washed in by the sea, and sometimes by the elevation of parts of its bottom from sand or earth let fall in consequence of the checking of the velocity of its current from changes in the course of the channel, or as a result of artificial processes of improvement.

A *preventive* system applicable to the whole course of a stream would commence its operations at or near the sources of the tributaries, and its general aim in this division of the work would be first to check the discharge of surface-water into those tributaries by planting the declivities of the valleys with trees or shrubs, terracing their hillsides, running low embankments across sloping grounds, collecting the water in small reservoirs, and in short by any measures which tend to detain the water of precipitation a certain time upon the surface. In agricultural and populous districts the adoption of this part of the system cannot be general, because it would conflict with many indispensable arrangements of improved rural economy and civilized life. Agriculture requires a general grading or smoothing of the ground by filling up small depressions of the soil, and the removal of stumps, clumps of shrubs, rocks, little ridges, and other impediments to the plough, and it must be drained by superficial or underground conduits; railways and common roads must be provided with ditches; streets must be paved or otherwise made impervious to water; and habitations and other buildings must be covered with roofs, which shed all the precipitation that falls upon them. All these artificial contrivances tend powerfully to promote the flow of surface and ground water into the natural channels of discharge; and in the opinion of some able inquirers they are the most active of all causes of inundations in highly improved countries. Hence, in such countries there is great difficulty in reconciling the adoption of the measures we speak of with interests not less important than those they are designed to protect; and in most cases we are reduced to a question of choice of evils. Some of them, nevertheless, such as clothing hillsides too steep for cultivation with trees or shrubs, *circling* or terracing rapid declivities, and the temporary flooding of fields by means of low ridges or embankments, are widely applicable not only without injury, but with positive benefit to agriculture. The next step should be to retard the flow of the current in the lesser affluents by dams, barriers or traverses, heaps of rocks, and impediments of every description. Such measures are of course applicable chiefly to the smaller rivulets in upland districts, and at points where, from the character of the channel and other circumstances, no evil consequences are to be apprehended from their adoption.

Thus far, the immediate aim is to retain the water on the surface or in the beds of small affluents, but when we come to larger tributaries bordered by fields, towns, and industrial establishments, and especially to the main trunk, the direct object is reversed, and increased velocity, and of course delivery, quite down to the point of ultimate discharge, is sought to be promoted. This is effected by the removal of rock, sedimentary deposit, and, so far as practicable, all other obstructions in the bed, by confining the channel to narrower limits at convenient points, and by excavating a deeper canal within it, and especially by cutting off loops and bends in its course, and thus at once diminishing the length and increasing the inclination of its bed. (See RIVERS, REGULATION OF.) Although measures are in progress in France and elsewhere for the application of these and other subsidiary processes to the entire flow of rivers, and though there is no doubt that the violence of inundations might be greatly mitigated, if not wholly prevented by such means, yet thus far we do not know that the system has been applied to the whole course of any great river; and in general, effort is directed, not to the prevention of inundations, but to the confinement of their spread within certain limits. Various plans have been suggested for this purpose, among which the creation of great reservoirs for receiving the overflowing waters is one of the most specious, because it is an imitation of the economy of Nature, who so often hollows out great lakes on the upper courses of rivers, and sometimes accumulates within them flood-water enough to drown the whole country

below, but for the check they oppose to its too rapid discharge.

Remedial Measures.—For reasons which cannot be given here, the method of reservoirs is capable of only exceptional application, and in the present state of our knowledge and our means we must, in most cases, content ourselves with such palliatives as are afforded by dikes or embankments high enough and solid enough to protect the grounds they enclose, or rather front, against encroachment by high water. Embankments have been employed from time immemorial in the East, and the recently constructed dikes or levees of the Mississippi are among the grandest modern works of hydraulic improvement. But the *argini*, or embankments of the Po, are perhaps the oldest with which we are thoroughly acquainted, and the theory and practice of embanking as a defence against river-inundations have been more exhaustively considered and more skilfully applied in Lombardy than elsewhere, though in the classic studies of Humphreys and Abbot on the Mississippi we have now a work not surpassed in the whole compass of potamological literature. The embankments of the Po are substantially parallel to each other and to the axis of the river, but they do not follow all its windings, and for the sake of pursuing a shorter course, and at the same time allowing greater space for the swelling waters, they sometimes diverge so far from the channel as to leave a space of three or four miles, often including valuable cultivated land, between them. Their height and thickness are regulated by the varying level of the ground and the force of the current as known by experience; but they are designed to be everywhere sufficiently elevated and sufficiently solid to confine the waters within the limits which they enclose at the highest level to which the river ever rises. They are composed of earth, and with rare exceptions not *revêted* or faced with stone or protected by sheet piling, but simply turfed or planted with willows. In general, they serve as an efficient protection to the land behind them, but there have been numerous cases of breach or crevasse followed by disastrous inundations. (See Po.) This method of defence against inundations is objectionable chiefly on these grounds: The construction and maintenance of embankments involve a great original and annual expenditure; by confining the current they increase its velocity and transporting power, and hence it conveys to the lower course and outlet of the river a larger quantity of sedimentary material, which tends to fill up its estuary and raise the level of its bed; for the same reason, the grounds which skirt the river are deprived of the fertilizing matter which the inundations would spread over it, and which would at the same time raise their surface in proportion to the rise of the river-bed; they interfere with roads and the convenience of navigation; and, in spite of every precaution, they will occasionally burst, and in such case inflict far greater injury on the adjacent country than would be caused by any natural inundation.

Many engineers are now of opinion that the system of high continuous embankments ought to be abandoned, and low dikes, barely sufficient to keep the current from overflowing at every slight elevation of its level, substituted. In great inundations, then, all the lowlands along the banks would be overflowed, and both enriched and gradually raised by the sediment deposited by the water. This plan is recommended by powerful reasons, and where high dikes have not already been constructed and rural arrangements accommodated to them, ought, no doubt, in very many cases to be adopted.

Lombardini, the highest authority on this subject, lays down the following propositions on the subject of river-embankments: The immediate effect of embanking a river is generally an increase in the height of its floods or inundations, but at the same time a depression of its bed; the current, by reason of the increased velocity resulting from its confinement, transports coarse material farther; the embankment of the upper tributaries of a river increases their velocity and delivery, and therefore augments the height of the inundations in the middle and lower course; embankments, before the bed of a river becomes established and constant, ultimately tend to raise its level; the embankment of the lower course of a river causes the elevation of the bed, both as a direct effect of increased deposit and because the deposit at and near the point of discharge into the sea prolongs the course, and consequently diminishes the inclination of the bed and the transporting power of the current.

The literature of this subject is very voluminous. Specially deserving of notice are the many hydrological essays of the eminent Milanese engineer Elia Lombardini, among which we particularize—*Importanza degli Studj sulla Statistica dei Fiumi; Dei Cangiamenti cui soggiacque l'idraulica condizione del Pò; Sulle Inondazioni avvenute nella Francia; Dell' Origine e del Progresso della Scienza Idraulica in Italia; Guida allo Studio dell' Idrologia;* Champion, *Les Inondations en France* (Paris, 1858–64, 6 vols. 8vo); the very valuable *Report* of Humphreys and Abbot *On the Physics and Hydraulics of the Mississippi River* (1861, folio); and *The Earth as Modified by Human Action*, by the present writer (New York, 1874, 8vo); in enumerating which works we refer also to the numerous authorities cited in them. (On the whole subject see RIVERS, REGULATION OF; for historical notices of memorable river-inundations, the articles on the rivers where they have occurred; and on inundations by the sea, and defences against them, see INUNDATIONS, MARITIME.) GEORGE P. MARSH.

Invalides′, Hôtel des, at Paris, was founded in 1671 by Louis XIV., and served until 1775 both as an asylum for maimed and wounded officers and soldiers, and as a refuge for the old servants of the courtiers. At present it affords quarters for some thousands of disabled soldiers. It is a stately building and contains the tomb of Napoleon I., whose remains were placed here in 1840.

Inva′riable Plane, The, a term of theoretical dynamics, used pre-eminently in regard to the solar system. There is in mathematical relation with every system of material particles, subject only to their mutual actions and to forces directed towards a fixed point, or a point in uniform rectilinear motion, a certain plane passing through the point which preserves a fixed direction in space, remaining absolutely fixed if the point remain fixed, and moving parallel to itself if the point move; and which Laplace, who made it the subject of a memoir, named the invariable plane of the system. To obtain an idea of the characteristic property of this plane by which it is determined, suppose lines (called radii vectores) drawn from the point in question to each of the different particles of the system, and then projected orthogonally upon any plane passing through the point. These several projections will vary in length as the direction of the plane on which they are made varies, and the areas described by them on the plane during any given time, in virtue of the motions of the particles about the point, will therefore also vary. Now, attributing proper signs to these areas, according to the directions in which the lines describing them move about the point, there is, among the infinite number of planes passing through the point, *one* for which the algebraic sum of the products formed by multiplying the area described by the projection of the radius vector of each particle by its mass, is greater than for any other, or a *maximum*. This is the invariable plane of the system. On account of the property just stated it is often called the *plane of maximum areas*. Knowing the masses and motions of the particles, the position of the invariable plane relative to assumed planes of reference passing through the origin of radii vectores can be determined at any time by the appropriate mathematical formulæ. If there are no extraneous forces acting on the system, any point in space may be assumed as an origin, and an invariable plane be determined for the system relative to it, in the same manner. The different planes which may thus be determined for the same system with reference to different assumed points are all parallel. The existence of the invariable plane, it will be observed, is independent of the law of action between the particles and of the law of the extraneous forces, and it preserves its constancy of direction whatever changes take place in the system under the action of the specified forces. Theoretically, the particles of the system may be isolated or aggregated, and, if aggregated, in any manner. In a system of natural bodies the rigorous determination of the invariable plane depends upon the figures of the bodies, and the laws according to which their density varies in their interior, as well as upon their masses.

The Invariable Plane of the Solar System.—The theory of the invariable plane derives its chief interest from the application Laplace made of it to the solar system. The fundamental planes to which astronomers refer the positions and motions of the heavenly bodies are subject to slow secular changes; and even the stars, which we ordinarily call fixed, and which would seem to furnish us with natural points to which to refer these changes, have themselves been found to have small "proper motions." Considering these circumstances, and the embarrassment he anticipated astronomers would one day experience in consequence of them in comparing observations made in widely separated ages, Laplace suggested that the invariable plane of the solar system, determined relative to the centre of the sun, might be used as one of reference in ascertaining these changes, and calculated its position with reference to the ecliptic at different epochs. It is implied, in speaking of this invariable plane, that Laplace considered the solar system in his calculation an independent one, subject only to the mutual action of its members; or, in other words, that the action of the stars upon it is in-

sensible. He also neglected the comets, whose masses are unknown, but which he had good reason to believe very small. Lastly, he supposed the masses of the sun and the planets concentrated at their respective centres of gravity—the satellites, with their primaries. This last supposition, though not in strict accordance with the rigorous theory of the invariable plane given above, obviated an insuperable difficulty in applying immediately the latter to the case in question, arising from our ignorance of the laws according to which the densities of the bodies of the system change from their surfaces inward, and was regarded by Laplace as furnishing an adequate approximation. The result of his calculation upon these suppositions places the invariable plane with reference to the ecliptic at the beginning of 1750 as follows:

Inclination of the invariable plane to the ecliptic at this epoch.. 1° 35′ 31″
Longitude of its ascending node...................... 102° 57′ 15″

The results of his calculation for the epoch of 1950 agree very closely with the foregoing.

Since the time of Laplace the planet Neptune has been discovered, and a multitude of asteroids. Different masses have also been assigned to the planets from those he used. Stockwell in his memoir on the secular variations of the orbits of the eight principal planets, recently published by the Smithsonian Institution, adopting masses received at present, including that of Neptune, and using the formulæ of Laplace, makes the position of the invariable plane with reference to the ecliptic at the beginning of 1850 to be as follows:

Inclination .... 1° 35′ 19″.4
Longitude of ascending node....................... 106° 14′ 06″

Stockwell's calculation, it may be added, does not include the asteroids, whose masses are unknown, but believed to be in the aggregate small.

The eminent geometer Poinsot made the formulæ of Laplace the subject of considerable criticism, maintaining that in treating the sun and planets as massive points, and in thus neglecting the areas proceeding from the rotations of these bodies upon their axes, and from the revolution of the satellites about their primaries, he had not only failed to determine a truly invariable plane, but one even whose variations could be neglected in comparison with those which it should make known. Poisson and Pontécoulant, on the other hand, hold that the analysis of Laplace nevertheless determines a plane practically invariable, which was all he had in mind to do. It would require some space to give a just view of this difference of opinion; here, we can only refer to it.

Poinsot gives a rigorous rule for determining the truly invariable plane, if there be one, which he proposes to call the equator of the solar system. But the unknown laws of density previously referred to entering it in the form of the moments of inertia of the bodies of the system, it does not furnish the means of an immediate determination. Poinsot suggests, however, that by forming, at different epochs sufficiently separated, certain equations in which the masses and moments of inertia of the bodies considered appear as unknown quantities with coefficients furnished by observation, these unknown quantities may ultimately be found, and thus the data obtained for the determination desired. This method, if actually applied successfully, would, as Poinsot observes, furnish us the masses of the bodies of our system independently of the Newtonian law of gravitation, from which we derive our present knowledge regarding them. Repeated determinations of the invariable plane made in this way with precision would show by the accordance or discordance of their results whether we were right in our original assumptions regarding the system, or whether we had neglected actions which for long periods ought not to be disregarded.

But if a truly invariable plane were exactly found for our system, in the present state of our knowledge it would after all be of limited utility for the purpose for which it was proposed. For, supposing it actually located in the heavens, it could of itself only serve to verify and determine motions perpendicular to it, or, as we may say, changes of *latitude*. To determine motions parallel to it, or, as we may again say, changes of *longitude*, we should further need to know a right line of invariable direction in the invariable plane whence to estimate the angular value of such motions. To make it truly useful, we should also be able to determine precisely the position at any time with reference to it of the present natural planes of reference, such as the equator and the ecliptic, so that positions referred to these might be reduced to it when desirable. Now, to do this we should equally need the direction of the fixed line named. To determine, for instance, the position of the ecliptic with reference to the invariable plane, we should not only require its inclination—which we may suppose found by the methods previously spoken of—but also the line of intersection of the two planes; and to locate this we should again need the fixed line on the invariable plane to measure from. Poisson has suggested that if it were sufficiently well determined, we might use the projection on the invariable plane of the line which the centre of gravity of the solar system describes in space, which, upon the supposition implied in speaking of the invariable plane, that the system is uninfluenced by the action of the stars, is straight. But while we have an approximate knowledge of the points in the heavens towards which this line appears to be directed, they are by no means determined with sufficient certainty and precision for so delicate a use as the one in question, and it may be doubted if they ever will be. There is no other line in the invariable plane which we can imagine it possible to determine for this purpose. This plane, then, is likely to remain in the future, as it has hitherto been, chiefly a matter of theoretical interest, rather than one of much practical utility. Fortunately, the means of astronomical observation are now so excellent, and the heavens are so faithfully, skilfully, and widely observed, and the resources of astronomical theory already so highly developed, that in all probability the astronomer of the remote future will be able to compare the places of the heavenly bodies with those they occupy now, despite the changes of his fundamental planes, with a precision fully commensurate with all the needs of his time, unless, indeed, these shall augment beyond our present power to conceive.

References.—Laplace, in the *Journal de l'Ecole Polytechnique*, tome ii.; Laplace, *Mécanique Céleste*, liv. i. ch. 5; liv. ii. ch. 7; liv. vi. ch. 17; Poisson, *Mécanique*, ed. 1833, liv. iv. ch. 9; Poinsot, *Mémoire sur la Théorie et la Détermination de l'Equateur du Système Solaire*, appended to the later editions of the author's *Éléments de Statique;* Pontécoulant, *Théorie Analytique du Système du Monde*, 2d ed., liv. i. ch. 4; liv. ii. ch. 8, and note vi. at end of tome i. JOHN E. CLARK.

Inva′riant. A rational algebraic expression of any degree in two or more variables is said to be linearly transformed when for each variable, x, y, z, linear functions of new variables, such as $\lambda_1 X + \mu_1 Y + \nu_1 Z$ for x; $\lambda_1 X + \mu_2 Y + \nu_2 Z$, for y, etc., are substituted. If the expression be homogeneous in the variables, any function of its coefficients is called an *invariant*, if, after such transformation, the same function of the *new* coefficients is equal to the old function multiplied by some power of the *modulus of transformation* (which is a function of the *coefficients of transformation*, only, $\lambda_1\, \mu_1\, \nu_1 : \lambda_2, \mu_2$, etc.). It is an *absolute invariant* when, the value of this power being unity, the function is absolutely unaltered by transformation. The invariance of discriminants* was first pointed out by Dr. Boole (*Cambridge Math. Jour.*, Nov., 1841); and "modern algebra" may be said to have had its origin in this discovery. Mr. Cayley took up the more general problem, *what* functions possessed this property of invariance, and brought to light many others (some of which involving the variables) which are unaffected by linear transformation. Those containing the variables are called *co-variants*, or *contra-variants*, according as the substitution is direct (as above) or *inverse* (a distinction which cannot here be explained). The important uses of these functions can only be briefly illustrated. If, for example, the equations of two conic sections are, by transformation, brought to their simplest (or "canonical") forms, and their invariants (which for these forms are comparatively simple) calculated, any homogeneous relation found to exist between them may be predicted for them, no matter to what axes the equations are referred. By this means we can with facility obtain *general* solutions for—*e. g.* the condition that two conics shall touch each other; that a triangle inscribed in one shall circumscribe the other; the equations of tangents to a conic at its intersection with any right line; the equations of the four common tangents to any two conics, etc. etc. The first-named condition—or, more generally, the condition that any two curves should *touch*—is expressed by the vanishing of an invariant function of the coefficients of the curve-equations, called the *tact-invariant*.

J. G. BARNARD.

In′ver Grove, tp. of Dakota co., Minn. Pop. 971.

Inverness′, town of Scotland, the capital of Inverness-shire, on the Ness, near its entrance into the Moray Frith. It has considerable manufactures of linen and hemp stuffs and extensive shipbuilding docks. Pop. 14,463.

*If a homogeneous function in k variables be differentiated with respect to each, the resultant expression arising from the elimination of the variables from the k differentials is called the *discriminant* of the function; as it is also the *eliminant* of the k expressions, arising from the differentiation. It may be written as a DETERMINANT (which see), of which each row is formed of the coefficients of one of the k differentials.

Inverness, the westernmost co. of Cape Breton Island, belonging to Nova Scotia. It has a fertile soil and beds of good coal. Cattle, produce, and fish are exported. Cap. Port Hood. Pop. 23,415.

Inverness, post-v., cap. of Megantic co., Quebec, Canada. It has a large trade, a tannery, and a weekly newspaper. Pop. of sub-district, 2741.

Inverness, tp. of Cheboygan co., Mich., on the S. side of Mackinaw Straits. Pop. 1293.

Inverness'-shire, county of Scotland, bounded N. and W. by Ross-shire and the Atlantic, and S. and E. by the counties of Perth, Aberdeen, and Nairn. Some of the Western Islands, among which are Skye and Harris, belong to it. Area, 4256 square miles. Pop. 87,480. The western part is wild, rugged, but well-wooded mountainland; Ben Nevis, the highest peak in Great Britain, is 4406 feet high. In the eastern part are extensive tracts of heath, yet about 43,000 acres are under a regular rotation of crops, wheat, barley, and oats, and the county contains excellent pastures, especially for sheep, of which it possessed 452,795 in 1859. Wool and oats are its chief exports. The Gaelic language predominates in this county.

Inverse' [Lat. *inverto*]. If two mathematical operations are exactly contrary to each other, either is said to be the inverse of the other. Thus, addition and subtraction, multiplication and division, differentiation and integration, are inverse operations. If two varying quantities are so connected that either is a function of the other, and if one is called the *direct* function, the other is called the *inverse* function. Thus, if we regard a *sine* as a direct function of the corresponding arc, the *arc* is an inverse function of the sine; this relation is symbolized by the expressions $y = \sin x$, and $x = \sin^{-1} y$. If we denote the form of any direct function by the symbol ϕ, and the form of the corresponding inverse function by ϕ^{-1}, there may be two cases: (1) when both of the equations, $\phi[\phi^{-1}(x)] = x$, and $\phi^{-1}[\phi(x)] = x$, are satisfied; and (2) when both these equations are not satisfied. In the former case the direct and inverse are said to be *convertible;* in the latter case they are said to be *inconvertible*. Every direct function has one convertible inverse, and in addition may have one or more that are inconvertible. Thus, if we have the relation

$$y = x^2 - 2x, \qquad (1)$$

and regard y as the direct function, we have, by solution,

$$x = 1 + \sqrt{1 + y} \text{ and } x = 1 - \sqrt{1 + y}. \qquad (2)$$

Both these values of x, when substituted in equation (1) verify it, but the value of y taken from (1) does not verify both of equations (2); hence, both values of x are inverse functions of $x^2 - 2x$, but both are not convertible. Let us replace y in the second member of equations (2); we have

$$1 + \sqrt{1 + (x^2 - 2x)} = 1 + (x - 1) = x, \text{ and}$$
$$1 - \sqrt{1 + (x^2 - 2x)} = 1 - (x - 1) = 2 - x.$$

The first result shows that the first value of x is convertible, and the second result shows that the second value of x is inconvertible. There is a class of functions each of which is its own inverse, as $1 - x$, $\frac{1}{x}$, $\sqrt{1 - x^2}$. W. G. Peck.

Inver'sion, in music, a term of frequent use to denote certain changes in melodies, chords, or harmonies, by which (1) the motion of an air is reversed, or (2) an interchange is made between the upper and lower terms of single chords, or of voices in a composition consisting of two or more parts. A *melody* is said to be inverted when its *motion* upward or downward is reversed, as if it were turned upside down. This is also called *reversion*. A *chord* is inverted when the lower note is *not* the root or fundamental bass, but is the original third, fifth, or seventh, etc.; just as, in an arrangement of the figures 1, 3, 5, we might "invert" them thus, 3, 1, 5, or 5, 3, 1. A *harmonized theme* or subject is inverted when any two or more of its parts change places, the higher becoming the lower, and the lower the higher.

1. The inversion of a *melody* affects nothing but the upward or downward motion in its progress. Each *upward* step is answered in the inversion by a *downward* step corresponding to it, interval for interval. Of such inversions (or reversions) of melody there are two kinds—viz. the *simple* and the *strict*. In "simple" inversion it is sufficient that the same motion from degree to degree on the scale should be preserved, even though a step of a whole tone in the theme may often become a semitone in the reply, and *vice versâ*. In "strict" inversion the reply is the *exact contrary* of the theme. The whole tones are answered by whole tones, and semitones by semitones, so that the intervals made from note to note in the progress of the inversion are precisely like those of the original theme or subject.

2. *Inversion of Chords.*—The normal or natural position of a chord is that in which the lowest note is its fundamental bass, prime, or root, the other several elements (third, fifth, etc.) being built upon this, and deriving from it their names, uses, and relations. So long as the *actual* bass of a chord is the prime or root, such chord retains its fundamental form, whatever may be the "changes of position" assumed by the upper parts. But when a new form is given to the chord by placing its original third, fifth, etc. in the bass, and putting the fundamental note among the higher parts, the chord is said to be *inverted*.

3. The inversion of a *harmonized subject* consisting of two or more parts or voices is when a higher and a lower part change places—*e. g.* when the bass is so elevated as to become the treble, and the treble so lowered as to become the bass. Inversions of this nature constitute what is called "double counterpoint," and the simplest kind is that in which one of the parts is removed an *octave* towards the other. Of course, in this process all the intervals are reversed, a third becoming a sixth, a fourth a third, and so on. By such inversions major intervals become minor, and minor become major; diminished intervals are changed into augmented, and *vice versâ*.

Another species of inversion is that called *retrograde,* in which a composition is so ingeniously constructed as to be read, first, in the usual manner, and second, in a *backward* direction. *Reverse retrograde* is that in which the parts are not only to be read backward, but are also *inverted*.

There is also a *double reverse retrograde,* in which the construction is such that the copy may be *turned upside down,* and then played with good effect. Under such a process it is evident that not only are the notes read backward, but the upper and the lower parts change places, the order of letters on the stave is changed, the clefs are altered, and the rhythmical movement of the notes exactly reversed. William Staunton.

Invertebra'ta, a term in zoology applied collectively to the various subdivisions of the animal kingdom that differ from the *Vertebrata* in wanting all trace of an osseous (or cartilaginous) spinal column, or back-bone, made up of numerous distinct bones termed vertebræ. Aristotle, 340 years before our era, recognized this distinction in the animal kingdom where he says: "All sanguineous animals have either a bony or a spinous column;" but it was not until the time of Cuvier that the terms *vertebrate* and *invertebrate* came into use amongst naturalists. Cuvier and Lamarck, after introducing these terms, speedily apprehended that the divisions thus designated were by no means of equal value, and that the Invertebrata, as a group, contained animals constructed on several widely different types, any one of which presented distinctive characters equal in importance to those of the Vertebrata. Linnæus had constructed four of his six great classes out of what Cuvier now unified as the vertebrates, the remaining two, *Insecta* and *Vermes,* including the heterogeneous invertebrates. Cuvier, regarding the former as a single sub-kingdom, subdivided the latter into three other sub-kingdoms, which he respectively termed from the arrangements of their parts *Radiata, Articulata,* and *Mollusca.* This triple division of the invertebrates was for a time universally accepted, and is even now, with one modification, very generally received. It was soon noticed that Cuvier's Radiata contained forms that could not be naturally associated together by structural characters; in fact, in many cases the organization was so undefined that the creatures could not reasonably be assigned to any of the sub-kingdoms; a new sub-kingdom was therefore established, to which these lowest of animals were relegated. This fifth sub-kingdom was named *Protozoa.**

But the rapid increase of zoological knowledge, and the desire to arrive at a natural classification, have from time to time suggested the necessity of further essential modifications of the Cuvierian groups. Classes, or groups of classes, have been elevated to the rank of sub-kingdoms (or *branches,* as they are now termed by some authors); and in the course of these changes the Radiata have been broken up and the name expunged altogether from the list of primary divisions. As yet, no one of the new classifications has been found altogether satisfactory, but, being founded on elaborate investigations on the embryology and life-history of the various forms, they are each and all steps in the right direction, since it is only by applying our knowledge of the laws of development that we can hope to attain to classifications that shall express the true relationships of living beings. To enable the inquirer to realize the changes that have been proposed in the classification of the Invertebrata, and to correlate the different arrangements, we append the classification propounded by Prof. Huxley in his *Introduction to the Classification of Animals,* and that given by Prof. Rolleston in his *Forms of Animal*

*Some authors, as Brown, have substituted the terms *Amorphozoa* for Protozoa; *Actinozoa* for Radiata; *Malacozoa* for Mollusca; *Entomozoa* for Articulata; and *Spondylozoa* for Vertebrata.

Life, founded upon the sub-kingdoms of Gegenbaur. The former will serve to show the differences between the modern and the Cuvierian systems, whilst the latter will indicate by means of the connecting lines the affinities that may be supposed to exist between the various sub-kingdoms:

Table of the Primary Groups of the Invertebrata, after Huxley.

II. Mollusca.	IV. Annulosa.
III. Molluscoidea.	V. Annuloida.
VI. Cœlenterata.	VII. Infusoria.
VIII. Protozoa.	

Table of the Classes of the Invertebrata, after Huxley.

(The limits of the Cuvierian sub-kingdoms are indicated by dotted lines; of Huxley's primary groups by brackets with numbers.)

Mollusca, Cuv.	*Articulata, Cuv.*
[II. Cephalopoda. Pteropoda. Pulmogasteropoda. Branchiogasteropoda. Lamellibranchiata.]	[IV. Insecta. Myriapoda. Arachnida. Crustacea. Annelida. Chætognatha.]
[III. Ascidioida. Brachiopoda. Polyzoa.]	[V. Scolecida. Echinodermata.]
[VI. Actinozoa. Hydrozoa.] *Radiata, Cuv.*	[VII. Infusoria.]
[VIII. Gregarinidæ. Rhizopoda. Radiolaria. Spongidæ.]	

Tabular View of the Classification of the Invertebrata (as adopted by Prof. Rolleston; the arrangement of sub-kingdoms after Gegenbaur):

Insecta.
Arachnida. Myriapoda.
ARTHROPODA.
Crustacea.

Holothuroidea. Echinoidea.
ECHINODERMATA.
Crinoidea. Asteroidea.

Cephalopoda.
Pteropoda.
Gasteropoda.
MOLLUSCA. Lamellibranchiata.
Tunicata.
Brachiopoda.
Polyzoa.

Gephyrea. Annulata.
Rotifera.
VERMES.
Nematelminthes.
Platyelminthes.

Ctenophoræ.
CŒLENTERATA.
Anthozoa.
Hydrozoa.

Infusoria. Spongiadæ.
PROTOZOA.
Rhizopoda.
Gregarinæ.

EDWARD C. H. DAY.

Inves'titure [Lat. *investio*, to "clothe"], as a feudal custom, was the open delivery of possession ("the livery of seisin") of a fief by the lord to his vassal. This, in an age when writing was rare, was effected by means of some visible ceremonial and symbol, such as giving the branch of a tree or some material object that would evidence the conveyance to public knowledge and permanent remembrance. In the Church, after the analogy of feudal custom, investiture was an open confirmation in ecclesiastical office by some symbolical act or emblem, such as the bestowment of the pallium or crosier and ring, as ensigns of official honor or of pastoral charge and spiritual espousals. The claim of the prerogative of such investiture of an ecclesiastic by the political ruler was for centuries matter of controversy between the hierarchy and the monarchy—a controversy which interests not only as an important factor in the history of mediæval Europe, but as a reflex of its condition and ideas as respects the relations between the secular and spiritual powers. This right of investiture was claimed in behalf of secular power as an appanage of the monarchy inherited from the old Roman empire, and also on the ground that the episcopal office, with the temporalities attaching in the feudal ages of manorial estates, privileges, honors, and emoluments, was to be regarded in the nature of a fief, and to be bestowed with a like ceremonial by the lord paramount. The claim was resisted on the allegation that laymen could not bestow the authority for priestly functions, as was tokened by the ring and the crosier, and that the degradation and corruption of the Church sprang from this usurpation and the simoniacal practices and oppressive exactions inevitably attendant on lay investiture.

In the early Church, Constantine and the Christian emperors, as inheritors of the pontifical rights of their pagan predecessors, undoubtedly exercised the prerogative of confirmation after episcopal elections. After the fall of the empire of the West the Gothic and Lombard kings claimed the same power as successors to the prerogatives of the Roman empire. After them this claim was exercised by the Frank monarchy—by the Merovingians, the prerogative of even direct episcopal nomination; by the Carlovingians, that of the investiture of the pope himself. It was the aim of Charlemagne to establish a theocratic monarchy, in which the emperor was to be supreme lord so far as earthly organization or administration was required. The successors of Charlemagne claimed, and often exercised, the same rights of suzerainty over the Church. This claim, however, was contested, resisted, or eluded on every opportunity; and such opportunity constantly offered during the dissensions of the descendants of Charlemagne, which often led them to seek the aid of the clergy and to appeal to the Church and the pope as arbiters in their controversies with each other. So for centuries the prerogative of investiture was asserted and exercised, denied and resisted, according to the character and position of individual monarchs and popes. In 875, Charles the Bald formally renounced his claims as superior of the states of the Church and all control of elections to the papacy, and accepted a papal vicar as primate for all Germany. In 983, Otho I. made the Romans swear on the relics of St. Peter they would never afterwards elect or consecrate a pope without the permission and approbation of the emperor. Sylvester II. (999–1003), on the other hand, directly assailed lay investiture as the source of simony and the cancer of the Church, and himself sent the crosier and the ring directly to Arnulf, elected as archbishop of Rheims. Again, Henry III. in 1047 received of the Romans the admission of his perpetual right of choosing the pope, and their oath that they would never consecrate a pope without the emperor's consent. This controversy was brought to a crisis when Hildebrand, as prime-mover of the papacy, or as pope (Gregory VII., 1073–85), developed his policy of making the Church independent of all secular power, and ultimately supreme amid the governments of the world. Under his instigation, Alexander II. (1061–72) issued a decree against all lay investiture. In the Lateran Council, held by himself as Gregory VII. (1075), it was again denounced, and every bishop or abbot accepting it was deposed and those bestowing it were excommunicated. These decrees brought the papal and imperial power at direct issue, and the factions that arose therefrom, the Guelphs and the Ghibellines—the former the party of the pope, the latter that of the emperor—distracted Germany and convulsed and wasted Italy for a long period with civil discord and war. The fortunes of this controversy were various. In its course Henry IV. was reduced (1077) to the humiliation of standing in a cold winter from the 25th to the 27th of January, barefoot and in the garb of a penitent, fasting the whole day, in the open court of the castle of Canopa, before the pope would accept his repentance and submission and give him absolution. Presently, the strife was renewed still more fiercely, and the pope died in exile. The dispute was continued under his successors, until, under Henry V. and Calixtus II., it was settled by the concordat of Worms (1123) that henceforth all episcopal elections should be conducted by the laws of the Church, but in the presence of the emperor, and that spiritual investiture by the crosier and the ring should be bestowed by the pope, but for temporalities, enfeoffment should be by the emperor with the sceptre. In other countries of Europe the controversy respecting lay investiture had like fortunes and results. In France investiture by the ring and crosier was relinquished by the monarchs, and episcopal benefices were bestowed through written instruments or orally. In England, Gregory VII., during the controversy with Germany on his hands, forebore to press the question to an open breach with the iron will of William the Conqueror. It came to open quarrel between William Rufus and Anselm, archbishop of Canterbury, and Pope Paschal II., but was finally adjusted by an agreement that for investiture with the crosier and ring should be substituted the simple oath of fealty. Thus everywhere, in the issue, the symbols of strictly priestly investiture were relinquished by the secular authority, but the feudal obligation was asserted for temporalities attached to ecclesiastical benefices. T. M. POST.

In'volute [Lat. *involutio*]. If we wrap a string around a given curve, and then unwrap it, keeping the string stretched, each point of the string will generate a curve called an *involute* of the given curve. This mode of gene-

ration implies that the given curve is represented by a pattern cut out of some rigid material, as wood or metal. Thus, to draw an involute of a circle, we cut out a circular pattern, around which we wrap a string; we then lay the pattern on a plane surface, attach a pencil or tracing-point at some point of the string, and unwrap the string; the pencil or point will trace out the required involute. It is obvious that the same curve may have an infinite number of involutes; hence, to find any particular involute we must know one of its points. To find the equation of an involute, let the equation of the given evolute be

$$y = f(\alpha, \beta), \qquad (1)$$

and assume the second and third equations of condition for an osculatory circle, which are

$$y - \beta = -\frac{dx^2 + dy^2}{d^2y}, \qquad (2)$$

$$x - \alpha = -\frac{dy}{dx}(y - \beta), \qquad (3)$$

in which α and β are the co-ordinates of the centre of any circle that is osculatory to the required involute. Combining (1), (2), and (3), so as to eliminate α and β, we have a differential equation of the second order, which is common to the whole class of involutes. Integrating this equation twice, and determining the values of the constants, so as to conform to the given conditions, we find the equation of the required involute. W. G. PECK.

In'yo, county of California, lying mostly E. of the Sierra Nevada. It is bounded on the N. E. by Nevada. Area, 4725 square miles. It is a great basin whose waters do not flow into the sea. Owen's Lake is the largest body of water. The valleys contain much fertile land. Gold-bearing quartz is mined and milled. Salt is found in some parts. Wool, grain, and pork are staple products. Cap. Independence. Pop. 1956.

I'o, in Grecian mythology, was a daughter of Inachus, but was transformed into a beautiful white cow by Zeus, who was enamored of her, and wished to conceal the affair from his jealous wife. Here, however, became suspicious, and set Argos with the hundred eyes to watch her; and when Hermes slew Argos, she sent a gad-fly, which pursued Io from place to place all over the earth, until at last she found rest in Egypt. She appears in *Prometheus* and *The Suppliants* by Æschylus. By the symbolical school of modern mythologists she is identified with the moon, as Argos with the starry sky and Hermes with the morning.

I'odine [Gr. ἰώδης, "violet-like," from ἴον, "a violet," and εἶδος, "form"] (atomic weight, 127; symbol I), an element discovered by M. Courtois of Paris in 1812 in the mother-liquor from the kelp or ash of seaweed which had been burned in order to obtain sodium carbonate. It has since been found in many mineral waters, in sea-water, in seaweeds, especially Laminariæ and Fucoids—in sponges, oysters, and other forms of marine life. Cod-liver oil contains from 0.03 to 0.04 per cent. of iodine. It is found also in many land-plants, as tobacco and water-cresses, and even in potatoes, beans, barley, and oats. Certain minerals also contain it, though those containing it as an essential constituent are comparatively rare. Such are iodyrite, or silver iodide, found among silver deposits in Mexico, Chili, and Spain, and coccinite, or mercury iodide, found in Mexico. Iodine also occurs as an accidental constituent in some dolomites, where it is combined with calcium and magnesium; in several deposits of alkaline salts, as Chili saltpetre and rock-salt. In some cases it has been found in the products from gasworks, as the ammonia-liquor. Chatin claimed to have found it in the waters of several rivers, and in the rain-water, and even the atmosphere, of certain localities. It has been claimed, however, that the reagents used by him themselves contained minute traces of iodine.

Preparation of Iodine.—The sources from which the iodine of commerce is derived are kelp and Chili saltpetre. The former contains 0.162 to 0.175 per cent. The carbonization of the seaweed is usually conducted in closed vessels, in order to prevent loss by volatilization. The kelp is lixiviated, and the liquors are concentrated and cooled, in order to crystallize out the sulphates, chlorides, and carbonates of potassium and sodium; and from the mother-liquor the iodine is extracted either by heating with concentrated sulphuric acid, with or without manganese dioxide, or by precipitation as copper subiodide by iron and a salt of copper; from which product the iodine is expelled by treatment with sulphuric acid and manganese dioxide. The use of sulphuric acid without the manganese compound is not advantageous, as sulphurous acid forms, which reacts upon the iodine and causes a loss of iodine. Chlorine is also sometimes used to precipitate the iodine from the mother-liquors. An excess of chlorine must be carefully avoided, since that would cause the iodine to go into solution again as iodine chloride. Washing and a second sublimation of the iodine is usually resorted to in order to purify the product for market. Glasgow is the chief port for the manufacture and export of iodine from kelp. The process of extraction of iodine from the Chili saltpetre is essentially the same as that pursued with the kelp.

Properties.—Commercial iodine, especially when obtained from kelp, often contains cyanogen iodide, sometimes to the extent of 1 per cent; it also may contain up to 15 or 20 per cent. of water. It is sometimes adulterated with coal, charcoal, plumbago, or manganese dioxide. Iodine is a dark crystalline solid, with a color and lustre resembling plumbago. Its odor is like that of chlorine. It fuses at 107° C. (= 224.6° F.), and boils between 175° and 180° C. (347–356° F.). It is volatile at ordinary temperatures, the vapor having a fine violet color, whence the name is derived (Gr. ἰώδης, "violet-colored"). In a state of vapor it is one of the heaviest vapors known, its gravity referred to air being 8.716. It dissolves in alcohol, ether, and carbon disulphide, also in water containing soluble iodides or ammonium chloride or nitrate. In pure water it dissolves only in the proportion of 1 part in 1000. With starch it forms an intensely blue compound, and this is one of the most delicate tests used for the detection of its presence, as the color is apparent when but 1 part of iodine is present in 450,000 of water. It is displaced from its compounds by chlorine and bromine. It destroys vegetable colors but slowly; its action on organized tissue is more rapid. Taken into the stomach in large quantity, it produces ulceration of the mucous membrane, and death. Starch or starchy substances are the usual antidotes.

Compounds.—Iodine combines with hydrogen, forming hydriodic acid, which has very similar properties to hydrochloric (muriatic) acid. It also combines directly with metals, forming iodides. The principal compounds with oxygen and the metals are the iodates and periodates. The oxides corresponding to these salts are I_2O_5 and I_2O_7. These compounds decompose readily, giving up their oxygen, and some explode violently on being struck or heated. With ammonia, iodine forms a compound, NI_3, which when dry explodes violently with the slightest friction. Cadmium iodide is used in photography, usually in conjunction with iodide of potassium, for sensitizing collodion. (See PHOTOGRAPHY.) One of the most important applications of iodine is in the manufacture of some of the aniline colors. (See ANILINE COLORS.) E. WALLER.

Iodine, Medicinal Uses of. Iodine is used in medicine in simple solution in alcohol or dissolved in water by the aid of potassium iodide (Lugol's solution). Locally, iodine is a powerful irritant, and its solutions stain the skin yellowish brown. Inhaled, its vapor is irritant to the mouth, throat, and air-passages, causing coryza, cough, watering of the eyes, and headache. Internally, in single dose, the effects vary according to the quantity swallowed, from mere uneasiness in the stomach to severe gastric pain, with vomiting and purging, headache, giddiness, and, though rarely, even general prostration and death. In continued administration of considerable doses a form of chronic poisoning called *iodism* occurs. In mild cases the effects are more or less gastric disturbance with increase of the secretions, irritation of the mucous membrane of the eyes, nose, and throat, with frontal headache, and sometimes an eruption on the face around the eyes and about the nose and chin. In severe types there may be also a general febrile condition, vomiting and purging with abdominal pain, various nervous disturbances, and, according to some of the continental observers, a tendency to absorption of some of the tissues of the body, shown by emaciation and wasting of certain glands. This latter effect, however, must be very exceptional, as it is seldom seen. Iodine is rapidly eliminated from the body, and the poisonous effects just described speedily cease on discontinuance of the drug. Preparations of iodine are used locally as counter-irritants, and internally they have some unknown influence over nutrition, proving useful in goître, certain forms of scrofulous disease, affections of the fibrous and muscular tissues, etc. For internal administration, however, the alkaline iodides, especially potassium iodide, are now far more frequently used than solutions of iodine. These salts are free from the irritant local effect of iodine, but in continued dose may cause some of the milder symptoms of iodism described above. Medicinally, they are used in the conditions just mentioned under iodine and in tertiary syphilis, chronic mercury and lead poisoning, and indeed in a great variety of diseases. They are often given in very large quantities and with perfect safety. EDWARD CURTIS.

Iod'oform, a methenyl ether, CHI_3, formed by the mixing of alcoholic solutions of potassa and iodine. It is in the form of small glittering, scaly, yellow crystals of a sweet taste, and strong, peculiar, very persistent saffron-

like odor. It is slowly volatile, nearly insoluble in water, but soluble in alcohol, ether, and oils. It is decomposed by alkalies and by a heat of 250°. Iodoform is a valuable medicine, being anæsthetic like chloroform. Unlike the latter, however, it is totally unirritating, even to mucous membranes or abraded surfaces. On account of its solid form it cannot be employed as a general anæsthetic by inhalation, but it is exceedingly useful as a local application to relieve pain, as in painful ulcers, sores, irritated or inflamed mucous membranes. It seems also in many such cases to directly promote healing. EDWARD CURTIS.

Io′la, post-v., cap. of Allen co., Kan., on the Leavenworth Lawrence and Galveston R. R., 78 miles by rail S. of Lawrence. It is in a fine agricultural region; has a bank, 3 churches, and manufactures of furniture and other goods. The Neosho furnishes water-power, and there is an unfailing artesian well which affords a mineral water useful in a wide range of disease, and which also supplies inflammable gas enough to afford light and fuel for a large town. It has 1 weekly newspaper. Pop. of tp. 1759.
L. WALKER, ED. "NEOSHO VALLEY REGISTER."

Iola, post-tp. of Waupacca co., Wis. Pop. 729.

Iola′us [Gr. Ἰόλαος], in Grecian mythology, the charioteer and companion of Hercules, to whom he was the first to pay divine honors after his death. He was said to have been the first victor at the Olympian chariot-races, and to have conquered and civilized the island of Sardinia, where he died and was worshipped as a hero.

I′olite, a mineral crystallizing in the trimetric system, and being essentially a silicate of alumina, magnesia, and protoxide of iron. Its hardness is from 7.0 to 7.5; specific gravity, 2.6; in color it occurs of various shades of blue, and exhibits in a marked manner the property of dichroism, or of presenting, when viewed in different directions, different colors. Hence, one of its synonyms is *dichroite.* It is sometimes used as a gem, being the *sapphire d'eau* of jewellers, obtained from Ceylon.

I′on, in Grecian mythology, was a son of Apollo and Creusa, the daughter of King Erechtheus of Athens, and was brought by Hermes to his father's temple at Delphi, where he was educated. When Creusa married Xuthos, but bore him no children, a false oracle made Xuthos believe that Ion was his son, and he took the youth into his house. Creusa, not recognizing him, tried to poison him, and fled to Delphi, where a priestess told her that Ion was her own son. This myth has been treated by Euripides in his tragedy *Ion.*

Ion, a native of the island of Chios, ranked as one of the five principal tragic poets of the Athenian canon, and was also a composer of other kinds of poetry. He was contemporary with Æschylus, Sophocles, and Pericles, was an intimate friend of Cimon, and on one occasion carried off both the dithyrambic and the tragic prizes. The number of his tragedies is variously stated at twelve, thirty, and forty. A few fragments of eleven remain, also some passages of other poems and prose-writings, preserved chiefly in Athenæus. Nieberding (1836) and Köpke (1836) have edited the fragments of Ion, with notices of his life.

Io′na, or **Icolmkill′,** the most famous island of the Hebrides, 3 miles long by 1½ broad, was colonized in 563 by St. Columba of Ireland with twelve disciples, it having been granted him by the kings both of the Scots and of the Picts. He built there the celebrated monastery, which was regarded by the Picts as their mother-church, and from which Christianity was introduced into Scotland and the N. of England. Iona was ravaged by the Norsemen in 795, 802, 806, 825, and 896, on three of which occasions most of the monks were martyred. In the eleventh century the monastery was repaired by Queen Margaret the Saint, and in 1097 a pilgrimage was made to it by King Magnus of Norway. For two centuries thereafter the jurisdiction was disputed between the bishoprics of Scotland, Ireland, and the Isle of Man. At the end of the fifteenth century it became the seat of the bishopric of the Scottish isles, and was repeopled with monks from Cluny. Many kings of the isles, some of Northumbria, and even of Norway, were buried on this sacred island, which has been long nearly deserted, the present population being less than 300. Of late it has become a resort of tourists. The oldest buildings of which ruins exist appear to be of the eleventh and twelfth centuries. (See Dr. Johnson's interesting account of his pilgrimage to Iona in the *Tour to the Hebrides.*)

Iona Island, in the Hudson River, 47 miles N. of New York. It belongs to Cornwall tp., Orange co., N. Y., has extensive vineyards, and is a favorite point for picnics and excursions from New York.

Io′ne, tp. of Amador co., Cal. Pop. 1779.

Ione, tp. of Nye co., Nev. Pop. 52.

Ione Valley, post-v. of Amador co., Cal., 40 miles S. E. of Sacramento, on Sutter Creek. It has copper-mines.

Io′nia, the ancient name of a portion of the western sea-coast of Asia Minor, upon the Ægean Sea. It derived its name from its inhabitants, the supposed descendants of a mythic hero, Ion, son of Apollo. Ionia extended from the river Hermus to the Mæander, and was the seat of the Ionian league of twelve cities, chief of which were Ephesus, Smyrna, Clazomenæ, Erythræ, Colophon, and Miletus. According to tradition, Ionia was colonized about 1050 B. C. by settlers from Attica; but Dr. E. Curtius in his *History of Greece* has shown reasons for believing that the Ionians had resided there from time immemorial.

Ionia, county of W. Central Michigan. Area, 576 square miles. It is a well-timbered, fertile, undulating region. Cattle, grain, and wool are staple products. Lumber, castings, carriages, and farming implements are leading articles of manufacture. The county is traversed by the Detroit and Milwaukee and the Detroit Lansing and Lake Michigan R. Rs. Cap. Ionia. Pop. 27,681.

Ionia, post-v. of Chickasaw co., Ia., on the Iowa and Dakota division of the Milwaukee and St. Paul R. R.

Ionia, post-v., cap. of Ionia co., Mich., on Grand River and on the Detroit and Milwaukee and the Detroit Lansing and Lake Michigan R. Rs., and on the Stanton branch of the last-named road; has 2 national banks, railroad repair-shops, over 15 other manufactories and mills, 8 churches, 2 newspapers, a public park, free reading-room, good schools, etc. Agriculture and the lumber business are leading interests. Pop. 2500; of tp. 4158.
CLARK TAYLOR, ED. "SENTINEL."

Ionia, post-tp. of Dixon co., Neb. Pop. 334.

Io′nian, in music, the name of one of the ancient ecclesiastical modes. The Ionian scale is usually understood to be that which resembles in form the modern scale of C major.

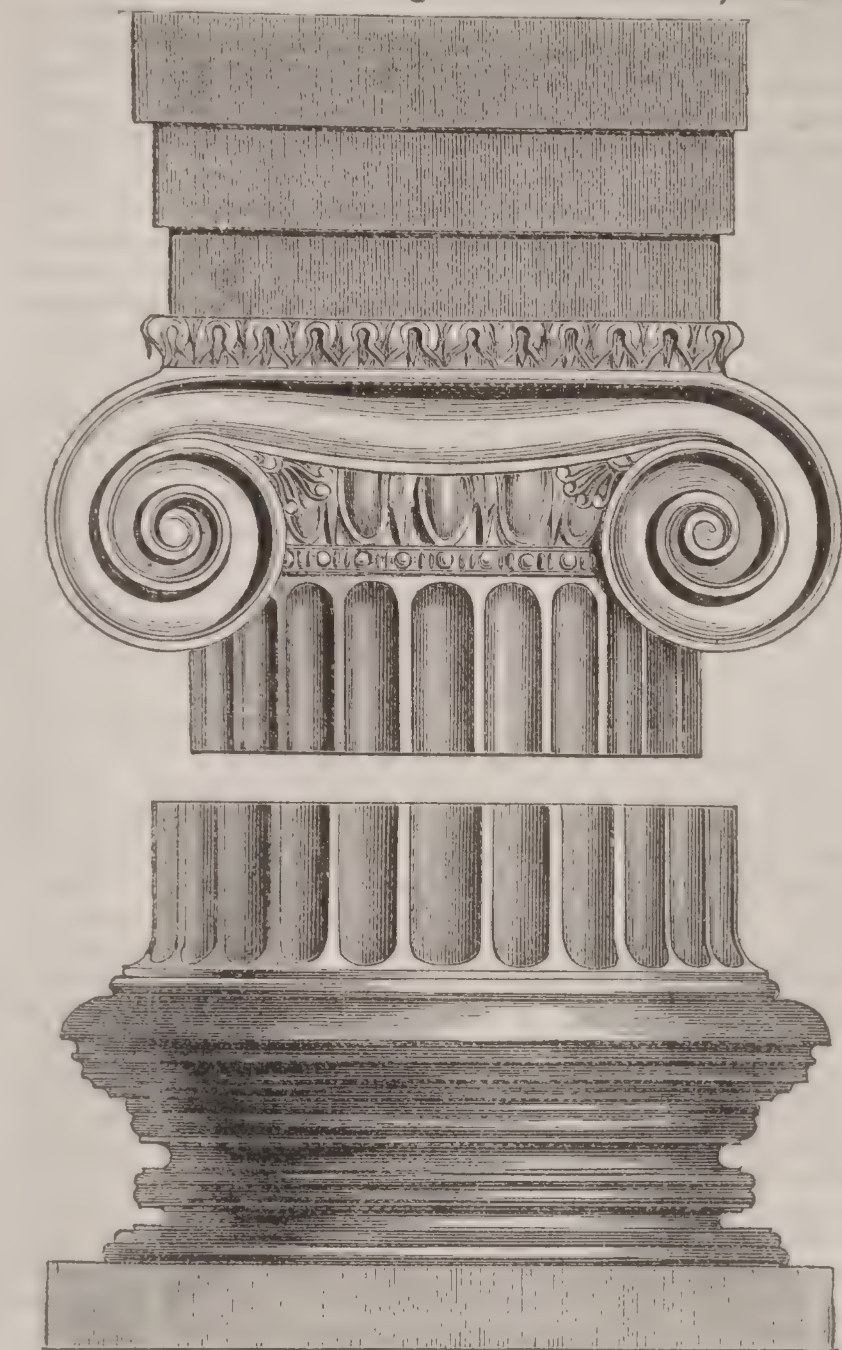
Ionian Islands, a chain of islands extending along the western and southern coast of Greece, of which the largest are Corfu, Paxo, Santa Maura, Theaki, Cephalonia, Zante, and Cerigo. Area, 1041 square miles. Pop. 251,712. From the commencement of the fifteenth century to 1797 they belonged to Venetia. From 1797 to 1815 they changed masters five times, but were then formed into a republic under English protection. In 1864 they were annexed to Greece, the inhabitants being Greeks. They are fertile and well adapted to the cultivation of vines and olive trees. Currants and olive oil are their main exports.

Io′nians [Gr. Ἴωνες, sometimes lengthened into Ἰάονες], a race of Greek descent who resided chiefly in Asia Minor and the adjacent islands, but spread themselves to all parts of the Eastern Mediterranean, to the delta of the Nile, and to India as far as Orissa. According to the prevailing legend, their ancestor was Ion [Ἴων], the son of Apollo and Creusa, who may perhaps be identified with the Javan of the Mosaic table of the founders of nations. The Greek legends speak of the Ionians as migrating from Attica about the eleventh century B. C., and settling in Asia Minor, incorporating with themselves some of the original inhabitants and driving out the others. The Ionians were always a maritime race, and some recent writers urge with much plausibility that they came to Attica from the East, and that their migration to the shores of Asia Minor was a remigration to their original abode; and indeed the Egyptian monuments of the fifteenth century B. C. contain the same group of hieroglyphics by which the Greeks were designated in the time of the Ptolemies. The ancient Sanskrit books speak of the Yavanas, who are supposed to be Ionians who penetrated India from the region of the Euphrates, by way of Cashmere. The Greeks who were left behind by Alexander the Great to hold his fortress on the banks of the Indus were also called Yavanas; and in Northern India all Mohammedans are thus designated. It would thus seem that the Sanskrit term came to be applied in time to all foreign races, of whom the Ionians were the earliest, who reached India from the West, just as throughout the Orient all Europeans are designated as Franks.

Ionian Sea is the name of that part of the Mediterranean which lies between Italy and Sicily to the W. and European Turkey and Greece to the E. It forms the gulfs of Taranto and Patras, and communicates with the Adriatic by the Strait of Otranto.

Ion′ic Order, in Greek architecture, is regarded as of Asiatic origin. It is now conceded that its use was as old as (or even older than) that of the Doric. Its principal seat was in Asia Minor. The temple of Diana at Ephesus, that of Apollo at Miletus, the temple of Wingless Victory and the Erechtheum at Athens, and the temples at Teos, Priene, and Sardis, were among the most famous examples of this style. Its rude beginnings are discernible in As-

syrian and Persian ruins still existing. In its perfect form the Ionic column has a height of nine diameters, a base of



very varied form, twenty-four flutes on the shaft, separated by fillets, and a capital formed by volutes.

Io'nie In'dians, a tribe of the Texas confederation, allied by race with the Caddoes. They removed early from the Hot Spring region of Arkansas to Texas, and their descendants (85 in number in 1872) reside on the Washita River, Indian Territory. They are self-supporting, and have always been a peaceable and friendly race.

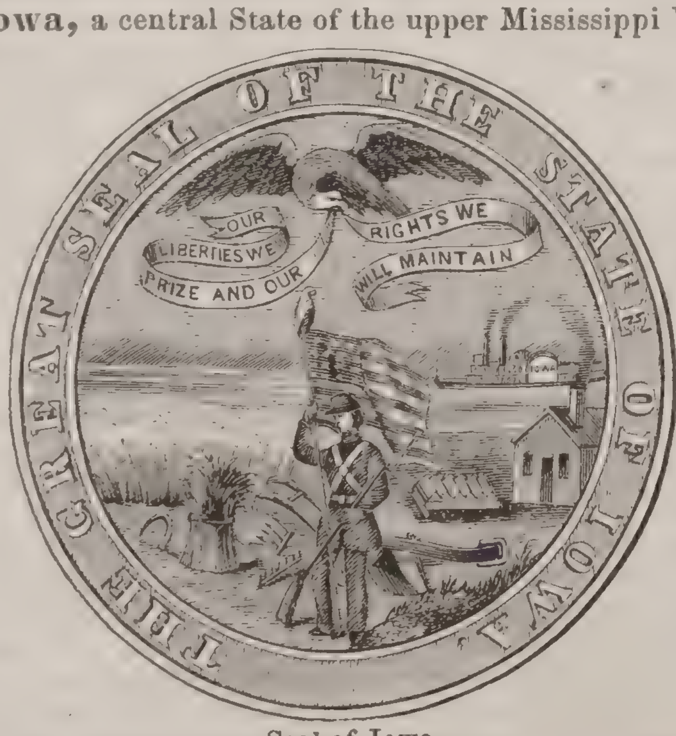
I'os ['Ιος, *Nio*], an island of the Ægean, now, but not anciently, reckoned as one of the Cyclades. It lies N. of Thera and S. W. of Naxos, and is 11 miles long and 5 broad. Area, 20 square miles. It is rough, but quite productive, and has a fine harbor and some 4000 inhabitants.

Ios'co, county of Michigan, bounded on the E. by Lake Huron. Area, 550 square miles. It has large forests of pine, and is generally level. Agriculture is not much carried on. Lumbering is the principal industry. It is becoming a resort of anglers, on account of the presence of the grayling in its streams. Cap. Tawas City. Pop. 3163.

Iosco, tp. of Livingston co., Mich. Pop. 904.

Iosco, tp. of Waseca co., Minn. Pop. 913.

I'owa, a central State of the upper Mississippi Valley,



Seal of Iowa.

lying between the Mississippi and Missouri rivers, between the parallels of 40° 36′ and 43° 30′ N. lat., and between the meridians of 89° 5′ and 96° 31′ W. lon. It is bounded on the N. by Minnesota; on the E. by the Mississippi River, which separates it from Wisconsin and Illinois; on the S. by Missouri, the Des Moines River being the boundary-line for a short distance; on the W. the Missouri River is its boundary, dividing it from Nebraska as far as Sioux City and the mouth of the Big Sioux River, which then becomes its western limit, and separates it from Dakota Territory as far N. as the line of 43° 30′ N. lat. The form of the State is irregularly trapezoidal. Its area is stated at 55,045 square miles, or 35,228,800 acres. Its greatest length from N. to S. is 208 miles; its greatest width from E. to W. a little more than 300 miles.

Face of the Country.—Iowa may be described in general as very level; there are no mountains and no considerable hills in the State. Its average elevation above the level of the sea is between 800 and 900 feet. Yet within the State is the great watershed dividing the streams flowing into the Mississippi from those discharging their waters into the Missouri. This watershed passes through the N. N. W. portion of the State in a direction nearly S. by E., through Dickinson, Clay, Buena Vista, Sac, Carroll, Audubon, Guthrie, and Adair cos., turning in the latter county sharply to the S. E. through Madison, Union, Clarke, Lucas, and Appanoose cos. to the Missouri line. A secondary watershed, somewhat higher at points than this, continues S. from Adair co. through Union and Ringgold cos. There is therefore not only a gradual slope of the whole State from the N. to the S., but eastern and western drainage-slopes from this great watershed toward the Mississippi and Missouri rivers. The rivers have worn valleys sometimes through the earthy material, and sometimes through some of the underlying rocky strata beneath: these valleys have in many places abrupt and rocky bluffs along the river-banks, thus giving an appearance of hills, which, strictly speaking, do not exist, as these steep banks are rather valley-sides than hillsides, being in all cases depressions below the general level. The plain or plateau of which Iowa forms a large portion is at all points considerably elevated above the level of the sea. The surface of the Mississippi at low water at the S. E. corner of the State is 444 feet above the sea, at the N. E. corner of the State it is 660 feet, showing a descent in the river of 216 feet, or about one foot to a mile. The surface of the Missouri at low water at the S. W. corner of the State is 954 feet; of the Big Sioux at low water at the N. W. corner of the State, 1344 feet; the surface of the great watershed at the northern State boundary, near Spirit Lake in Dickinson co., is 1694 feet, and at the southern State boundary, in Ringgold co., about 1220 feet. The descent from the highest point in the State (near Spirit Lake) to the lowest point in the S. E. corner of the State does not exceed 5 feet 7 inches per mile, and in most directions it is not more than from 2 to 4 feet per mile. The whole country is therefore eminently adapted for the construction of good roads and railroads, and, as we shall see, the State, young as it is, is traversed in all directions by railways. Most of the State was originally what the settlers call "rolling prairie"—*i. e.* it had long wave-like depressions and elevations, resulting from the drainage of the surface-water into the upper branches of the rivers. It is now losing much of its prairie character, the prevention of the annual fires having caused the forest trees to encroach upon the prairies, and the settlers also having planted many trees.

Rivers, Lakes, etc.—All the rivers and streams of the State are affluents of either the Mississippi or the Missouri; the former, draining the widest territory in the State, has tributaries of greater length and larger volume than the latter. Among the streams flowing into the Mississippi within the State are the Upper Iowa, a stream of considerable rapidity, and having a deep valley which has eroded the rocky strata to a considerable depth throughout its entire course; Turkey River, which has also high and rocky bluffs along its banks; Maquoketa and Wapsipinicon rivers; the Iowa River, a large and navigable stream; the Cedar River, which has rapids and falls in a part of its course; the Checauqua or Skunk River, a broad but not very deep river; and the Des Moines, a large and navigable river which enters the Mississippi at the S. E. corner of the State. The rivers of the western drainage-slope, falling into the Missouri, are generally small. Several of them, as the Chariton, Grand, Platte, the Nodaway forks, and Nishnabatona rivers, rise in Iowa, but flow southward into Missouri, and enter the Missouri River in that State; the Little Sioux and Floyd are streams of moderate size and with broad fertile valleys, with few or no rocks or boulders in their course. The Big Sioux, which rises in Dakota and forms a considerable portion of the western boundary of Iowa, is a large stream, with high and steep bluffs along a portion of its course, but without rocks. It is navigable to

a point a little above the N. line of Iowa, where there is a series of rapids by which it descends 60 feet in the course of half a mile. The Mississippi has two stretches of rapids opposite Iowa—the lower, called the Des Moines Rapids, from Keokuk to Montrose, 12 miles in length and with a total descent of 25 feet; and the upper, from Davenport to Le Claire, about 15 miles in length, and having a total descent of 26 feet. The lakes are mostly small, and in the Eastern States would be called ponds; the principal are Spirit Lake, in Dickinson co., about 4 miles long, and of the same width. It contains between 10 and 12 square miles. It was the place of a terrible massacre of whites by Indians in 1857. Okoboji Lake in the same county is of horseshoe form, and drains Spirit Lake. It is narrow, but the outside of the horseshoe is about 15 miles in length. Clear Lake in Cerro Gordo co. is 4 miles long and 2 wide. Storm Lake in Buena Vista co. is still smaller, having only 5 square miles, but of great beauty. There are also two or three yet smaller lakes in Wright and Sac cos., which have barriers of boulders, sand, and peat which have given them the name of Walled Lakes.

Geology.—With the exception of the river-valleys and some small tracts, the surface of the State is covered to a greater or less depth with diluvial or drift deposits, and these again in some sections, as in the river-bottoms of the great rivers, with alluvium or loam. But an examination of the bluffs and rocky strata of the river-channels indicates that there are accessible at least twenty different geological formations, all of them, except a small outcrop of Azoic rocks—Sioux quartzite (in the extreme N. W. corner of the State)—occurring in regular succession from the N. E. to the S. W. portion of the State, and being inclined at such an angle or dip that each formation laps over the one next below it in very regular order. In the N. E. there is a tract extending from the sources of the Turkey River to the mouth of the Maquoketa which belongs wholly to the Lower Silurian system; all the formations of this system dip toward the S. W. at such an angle that the Upper Silurian laps over them just S. of the Turkey River. The groups of Lower Silurian here developed are the Primordial, represented successively by the Potsdam sandstone, Lower Magnesian limestone, and St. Peter's sandstone; the Trenton group, represented by the Trenton limestone and the Galena limestone; and the Cincinnati group, of which only the Maquoketa shales are recognizable here. The Upper Silurian system, which follows immediately and overlaps the Lower Silurian, extends on the Mississippi from just above the mouth of the Maquoketa River to Davenport, but, though covering a breadth of two or three counties near the river, narrows as it approaches the upper line of the State into a strip of not more than 6 or 8 miles in breadth. But one group and one formation of this system is represented—viz. the Niagara limestone. A broader band, and one of pretty uniform width, extending on the Mississippi from Davenport to Muscatine, and running diagonally to the northern boundary of the State, consists of the Hamilton limestone and shales, the representative rocks of the Hamilton group of the Devonian system. This, in turn, is overlapped by the Sub-carboniferous group, represented here successively by the Kinderhook beds, the Burlington, the Keokuk, and the St. Louis limestone. This extends from Muscatine to the Des Moines River, and, following the Skunk River valley to the source of that stream, stretches westward from Clear Lake in Cerro Gordo co. through Butler, Franklin, Wright, and Humboldt cos. The Lower and Middle Coal-measures, which come next, occupy a broad belt in the middle of the State, being divided into two nearly equal portions by the Des Moines River. They yield large quantities of bituminous coal of good quality. The Upper Coal-measures occupy the whole S. W. portion of the State except a tract in Montgomery and Cass cos., where there is an outcrop of the Nishnabatona sandstone, the lowest member of the Earlier Cretaceous group. In Woodbury and Plymouth cos. there is also an outcrop of Cretaceous rocks, consisting of the Woodbury sandstone and shales; and in Guthrie and Greene cos. there are two others, in which the chalky beds are very prominent. The remainder of the State, comprising the whole N. W., and including the greater part of twenty-six counties, is covered so deeply with the overlying drift to a thickness of from 150 to 200 feet that it may fairly be considered as belonging to the Post-tertiary group. The Sioux quartzite, a very hard brick-red rock belonging to the Azoic system, is found only in ledges on the banks of the Big Sioux, just before it crosses the boundary. In Dakota and Minnesota this rock is abundant, and some strata of it are used by the Indians for making redstone pipes.

Mineralogy.—The Iowa coal-field contains at least 7000 square miles, and on its S. W. border dips down at a very small angle under the upper or unproductive Coal-measures, and may be mined in the section covered by these. A very large number of coal-mines have been opened, mostly by *drifting* from the valley-side, though in some instances shafts are sunk. The coal is bituminous; cannel coal has occasionally been found, but is too impure to be of any value. Lead, the argentiferous galena ore, found in the galena limestone, is mined in great quantities at Dubuque and its vicinity, and smelted at the mines. There is lead also in the Lower Magnesian limestone on the Upper Iowa River, but not in sufficient quantity to make mining profitable. There are few other metals in Iowa. The iron ore met with in various parts of the State is of good quality, but the quantity is small and the mining unprofitable. Gypsum is found in very great quantities at Fort Dodge and its vicinity in the condition of stratified rock, and quarried like ordinary limestone. It is largely exported. Building-stone of fair quality is found E. of the Des Moines River. The Hamilton limestone, the sandstone of the Kinderhook beds at Burlington, the Keokuk limestone, and the gray St. Louis limestone, all furnish very good building-material. Gypsum is also used for this purpose as it comes from the quarries. Lime is manufactured largely from the limestones and from the chalky beds. Brick-clay, potters' clay, and good building-sand are plentiful.

Vegetation.—The State contains a greater proportion of tillable and fertile soil than almost any other in the Union. With the exception of the small portion occupied by rivers, lakes, ponds, and rocky bluffs, the whole surface is arable and yields everywhere liberal crops. The surface is so nearly level that agricultural machinery can be used everywhere, and the labor of planting and gathering crops is thereby much facilitated. There are three descriptions of soil in the State, all fertile, yet differing somewhat in their characteristics: (1) The drift soil, formed of the surface portion of the drift or diluvial deposit, consists of a dark loam from one to three feet deep, and is found mostly on the prairies. There are no stumps and very seldom any stones in it, and it is very easily ploughed and cultivated by machinery. It is so fertile that in many places, after twenty years' cultivation without manure, it still yields abundant crops; it contains considerable clay, and is therefore classed as a moderately stiff soil. (2) The bluff soil is the surface portion of the bluff deposit; it is very fine, contains less clay than the drift soil, and no stones or boulders. It can be ploughed earlier than the drift, being drier, and is fully as fertile, while it is deeper. (3) The alluvial soil, found in the river-bottoms, consisting of the soil and decomposed vegetable and animal matters brought down by the floods, is the richest and most productive and durable soil in the world. The area occupied by forests and woodland in Iowa is stated by the agricultural department to be 4,985,668 acres, or about one-eighth of the entire surface of the State. The breadth of the State being but about 200 miles from N. to S., and the variations in its elevation so trifling, there is very little climatic difference in the vegetation of the State. The persimmon and pawpaw do not ripen their fruit N. of the parallel of Burlington, but there are few other instances in which trees or plants do not flourish equally well in all parts of the State. The most common forest trees are four or five kinds of oak, the common elm, cottonwood, black walnut, hickory, sugar-maple, soft maple, and linden. The buckeye, aspen, water-birch, wild-cherry, ash, box-elder, white walnut or butternut, sycamore, and slippery elm, though occasionally found, are less abundant. There are a few pine trees in Eastern Iowa on the sandstone bluffs, and some red cedar in similar situations. The chestnut, beech, and tulip tree are not natives of Iowa. The principal native fruits are wild grapes, plums, crab-apples, cherries, blackberries, raspberries, gooseberries, and strawberries, and among the nuts are hickory and hazel nuts, black walnuts, butternuts, and a few pecan nuts in the S. E. counties. The prairie-grass, which is of fair quality, is used not only for pasturage, but to a large extent for hay, and is distinguished from that obtained from the cultivated grasses by the name of *wild hay*. There is also a wild rice, of some value for nutriment, and which is in great demand by aquatic and other birds, which grows in the shallow ponds of Northern Iowa. The cultivated crops are, among the grains, corn, wheat, oats, barley, rye, and buckwheat. Of the first four the State exports very large quantities annually. Hay, principally timothy and red clover, is extensively made and exported, and blue grass and white clover are cultivated for lawns and pasturage. Flax, hemp, and hops are crops of considerable importance. Sorghum is not so largely cultivated as formerly. Potatoes are raised in great quantities both for home consumption and export. Sweet potatoes are grown successfully in the southern part of the State. Garden vegetables of all kinds grow well in all parts. Among cultivated fruits, apples are very abundant and of excellent quality. Three dozen varieties are recommended by the

agricultural society, and largely raised throughout the State. Pears grow well, and are becoming plentiful, but peach trees are liable to be killed by the severe winters. Grapes are grown successfully in all parts of the State, the Catawba and Concord being the most common varieties. Plums succeed well where the curculio does not destroy the fruit. The small fruits, gooseberries, raspberries, currants, and strawberries, are cultivated with great success. Much attention is paid to tree-culture, and many foreign trees have been introduced with excellent result. The Osage orange is much used for hedges in Southern Iowa, but does not succeed so well in the northern counties.

Zoology.—The rapid settlement of the State has driven out most of the larger wild animals; the buffalo and elk, both formerly abundant in Iowa, have now disappeared, though at long intervals a stray elk from Dakota appears in the N. W. of the State. Deer are occasionally found in the wooded districts, but they are not plentiful. The black bear was never very abundant in the State, and both he and the panther have long since disappeared. The large gray wolf and the wild-cat are very rare, and the mischievous coyote or prairie wolf is fast disappearing. There are a very few beavers and otters in some of the rivers, and muskrats, minks, raccoons, foxes, and opossums are not very rare. The birds common in all the Northern States are plentiful in Iowa, and there are a few which are rare in other States. Ravens are occasionally seen in the northern counties, the yellow-headed blackbird in the northwestern part of the State, and paroquets in the southern tier of counties; among the game birds, wild-turkeys and partridges or ruffed grouse are often found in the wooded districts, and prairie-hens in great number in the prairies which are as yet unreclaimed. Quails, snipe, and woodcock are plentiful in their season, and some curlews are found. Geese, swans, and ducks visit the ponds and rivers of the State in spring and autumn in great numbers. The rivers of the State yield great quantities of excellent fish, among which are found the salmon, the lake-trout, whitefish, brook-trout, troutlet, brown and common catfish, perch, roach, etc.

Climate.—The very slight difference of elevation in the surface of the State causes the climate to be very uniform, the variety being only that of the difference in latitude and the small variation in altitude. The growing season of vegetation commences about ten days earlier on the southern than on the northern boundary. The average amount of rainfall does not vary so much as has been supposed from that on the Atlantic coast. Observations continued for thirty-two years make the mean annual rainfall (including the reduction of the snow to water) 42 inches for Iowa, while that of the same latitude on the Atlantic coast is about 45 inches. Less snow falls in Iowa than upon the Atlantic coast, but there is sufficient for several weeks' sleighing every winter. Both the Mississippi and Missouri generally freeze over opposite Iowa, and remain closed for two or three months in the winter. There have been but two winters in the past thirty-two in which they did not freeze over entirely, and in both these they remained open only below Davenport. All the small rivers freeze over solidly every winter. Observations of temperature continued from 1838 to 1870 at Muscatine and Iowa City, both on nearly the same parallel, give the following results: The maximum of summer heat occurred in July, 1870, when it reached 100° F., and the greatest winter cold in Jan., 1857, when the mercury in the thermometer stood at −30° F. The mean average temperature for each month of the year for the whole thirty-two years was as follows: Jan., 20° F.; Feb., 25°; Mar., 35°; Apr., 49°; May, 59°; June, 68°; July, 73°; Aug., 71°; Sept., 63°; Oct., 50°; Nov., 26°; Dec., 24°. The average annual temperature for the whole thirty-two years was 47° 57′ F. The mean temperature of the spring was 47° 44′; of the summer, 70° 37′; of autumn, 44° 52′; and of winter 23° 37′. The following items in regard to the temperature of Keokuk, in the extreme S. E. corner of the State, are for the year from Oct., 1872, to Oct., 1873, and are from the chief signal-officer's report: Monthly range of the thermometer, Oct., 58°; Nov., 63°; Dec., 71°; Jan., 73°; Feb., 60°; Mar., 74°; Apr., 51°; May, 43°; June, 47°; July, 40°; Aug., 46°; Sept., 49°. Mean monthly temperature, Oct., 55.5°; Nov., 34.6°; Dec., 20.5°; Jan., 17.6°; Feb., 26.1°; Mar., 38.7°; Apr., 48.5°; May, 61.5°; June, 77.9°; July, 76.3°; Aug., 78.7°; Sept., 63.9°. Monthly rainfall, Oct., 0.42; Nov., 0.74; Dec., 0.50; Jan., 3.31; Feb., 0.53; Mar., 0.51; Apr., 5.65; May, 3.42; June, 1.21; July, 8.77; Aug., 0.54; Sept., 3.37—annual rainfall, 28.97. Iowa is within the zone of variable winds. In the thirty-two years referred to the wind blew on an average 70 days from the N. N. E.; 76 from the E. S. E.; 105 from the S. S. W.; 114 from the W. and N. N. W., making 219 days of westerly winds and 146 of easterly winds. The average time of the first flowering of apple trees at Muscatine is May 6; at Dubuque, about a degree N., May 12. Iowa ranks high among the healthiest States of the Union.

Agricultural Products.—The amount of land in farms in 1870, according to the census, was 15,541,793 acres. Of this, 9,396,467, or a little more than one-fourth of the area of the State, were improved, and 6,145,326 acres unimproved land. The average size of farms was 134 acres. The value of farms was $392,662,441, and of farming implements and machinery, $20,509,582. The value of all farm productions was $114,386,441; of animals slaughtered and sold for slaughter, $25,781,223; of home manufactures, $521,404; of forest products, $1,200,468; of market-garden products, $244,963; of orchard products, $1,075,169; amount of wages paid during the year, $9,377,878. Iowa was in 1870 the largest wheat-growing State in the Union except Illinois, her wheat crop that year amounting to 28,708,312 bushels of spring wheat and 727,380 bushels of winter wheat. The rye crop amounted to 505,807 bushels; that of Indian corn to 68,935,065 bushels, being second only to Illinois in this crop; the oat crop was 21,005,142 bushels; the barley crop, 1,960,779 bushels; and the buckwheat, 109,432 bushels. In 1872 the production of wheat had fallen off somewhat, and Iowa occupied the fifth place, her wheat product being in round numbers 22,080,000 bushels. Her Indian corn product had increased, but that of other States had increased in a still greater ratio, and she ranked third in that crop, producing 101,989,000 bushels. Of rye the crop of 1872 was 533,000 bushels; of oats, 19,934,000 bushels, a falling off of over 1,000,000 bushels; of barley, 2,194,000 bushels; of buckwheat, 162,000 bushels; the potato crop, which in 1870 was 5,914,620 bushels, had increased in 1872 to 6,631,000 bushels, aside from about 50,000 bushels of sweet potatoes raised in Southern Iowa. The hay crop, which in 1870 was 1,777,339 tons, in 1872 had fallen off to 1,664,000 tons. The value of these products in 1872 was estimated (probably an underestimate) at $53,158,530. Of other agricultural products we have no statistics later than those of the census of 1870, when the State produced 695,518 pounds of flax, 2,967,043 pounds of wool, 171,113 pounds of hops, 71,792 pounds of tobacco, 15 hogsheads of sorghum-sugar, 146,490 pounds of maple-sugar, 1,218,636 gallons of sorghum-molasses (the crop of sorghum-molasses in 1872 was reported at 3,500,500 gallons), 9315 gallons of maple-molasses, 42,313 bushels of peas and beans, 2225 pounds of beeswax, 853,213 pounds of honey, 37,518 gallons of domestic wine, 2475 bushels of clover-seed, 88,621 bushels of flaxseed, 53,432 bushels of grass-seed. The value of all live-stock in the State in 1870 was reported as $82,987,133; the number of horses as 433,642; of mules and asses, 25,485; of milch cows as 369,811; of working oxen, 22,058; of other cattle, 614,366; of sheep, 855,493; of swine, 1,353,908. In 1873, according to the report of the Iowa State Agricultural Society, the following were the numbers and aggregate value of the live-stock: horses, 634,400, valued at $40,506,440; mules and asses, 36,400, valued at $2,654,652; oxen and other cattle, 820,000, worth $19,196,200; milch cows, 537,300, valued at $15,130,368; sheep, 1,768,000, worth $4,278,560; swine, 3,847,700, valued at $17,199,219; making the entire valuation of live-stock in Jan., 1873, of $98,984,439. The dairy products of Iowa in 1870 were 27,512,179 pounds of butter, 1,087,741 pounds of cheese, 688,800 gallons of milk sold. These have been very largely increased within the past four years.

Manufacturing Industry.—The increase in manufactures in Iowa has been very rapid. The very imperfect returns of manufactures in the census of 1870 give the State 6566 manufacturing establishments, driven by 899 steam-engines of 25,298 horse-power, and 726 water-wheels of 14,249 horse-power, employing in all 25,032 operatives, of whom 23,395 were men, 951 women, and 686 children, using capital estimated (very much below the truth) at $22,420,183, paying for wages $6,893,292, using raw material to the value of $27,682,096, and producing goods worth $46,534,322. The probability is that the annual product of the manufactories of the State is now not less than $100,000,000. Of these products, the first in rank are flour and flouring-mill products; in 1870 there were 306 flouring-mills, employing 1298 hands and $4,351,233 capital, using $9,385,363 of raw material, and producing $12,298,882 of flour and meal. Next in importance was the manufacture of lumber, which was conducted in 339 mills, employing 3128 hands, and a capital estimated at $3,711,031, using raw material valued at $3,803,465, and producing lumber valued at $6,237,445. Carriages and wagons were reported made in 449 establishments, by 1662 employés, of the annual value of $1,952,143; woollen goods, in 68 mills, by 1038 hands, to the value of $1,561,341. Cut meats were packed in 10 establishments, by 328 hands, to the value of $1,190,400; saddlery and harness in 325 establishments, by 879 hands, to the value of $1,110,852; clothing, 196 estab-

lishments, to the value of $1,003,732; agricultural implements and machinery in 55 establishments, by 552 hands, to the value of $829,965; malt liquors in 101 breweries, to the value of $992,848; furniture in 223 establishments, by 959 hands, to the amount of $981,691; tin, copper, and sheet-iron ware, in 231 shops, employing 609 hands, to the amount of $758,011; printing and publishing in 67 offices, to the amount of $648,752; 20 machine-shops, employing 506 hands, produced steam-engines, etc. to the value of $647,413; iron castings, to the amount of $532,780; sash, doors, and blinds, 31 factories, producing $467,586; cooperage, 136 shops, producing $452,388; brick, 116 kilns, making bricks to the value of $425,919; and 53 boot and shoe shops, producing goods to the value of $423,283. The only other considerable industries were the bakeries, 58 in number, which produced goods to the value of $315,530, and tobacco and cigar factories, of which there were 71, producing cigars, etc. to the amount of $377,773.

Mining Industry.—Iowa has a considerable mining and quarrying interest, confined almost exclusively to coal, lead, and gypsum. In 1870 there were 131 of these mining establishments, employing 1628 hands and an estimated capital of $756,224, paying wages to the amount of $656,714, and producing the articles mined or quarried to the value of $1,063,484.

Railroads.—At the close of the year 1873 there were 3800 miles of completed railroad in the State, 469 miles having been added since Jan., 1872. The principal railroads are—the Burlington Cedar Rapids and Minnesota, connecting Burlington with Plymouth, 229 miles, and Plymouth with Austin, 32 miles; the Burlington and Missouri River, 349 miles; the Cedar Falls and Minnesota, running from Waterloo to the Minnesota State line, 75.5 miles; the Cedar Rapids and Missouri, connecting Cedar Rapids with Omaha, Neb., 271.5 miles, and Clinton with Lyons, 2.5 miles; the Central Iowa, running from the northern to the southern State line, and forming a portion of the line connecting St. Paul, Minn., with St. Louis, 203 miles; the Chicago Iowa and Nebraska, connecting Clinton with Cedar Rapids, 81.5 miles; the Chicago and Southwestern, from Washington to Leavenworth, Kan., 271 miles; the Des Moines Valley, from Keokuk to Des Moines, 248.5 miles; the Dubuque and Sioux City, 143 miles; the Dubuque and South-western, from Farley to Cedar Rapids, 54.75 miles; the Iowa Falls and Sioux City, 184 miles; and the Sioux City and Pacific, from Sioux City to Fremont, Neb., 107 miles. Besides these there are numerous short connecting lines. With these great highways traversing every part of the State, and her eastern and western boundaries washed by two great rivers, Iowa has excellent commercial facilities, and the value of the freights moved on these rivers and railways is estimated to exceed $500,000,000 per annum. The following table, compiled from Poor's *Railroad Manual for 1874–75*, gives the condition of the railroads of Iowa about the beginning of Jan., 1874:*

Names of Railroads.	Length.		General Liabilities.			Cost of railroad, equipment, etc.	Traffic.		Gross Earnings.				Earnings less operating expenses.
	Main and branch.	All other tracks.	Capital stock.	Funded debt.	Total stock, bonds, and debt.		Passengers carried.	Freight moved.	From passengers.	From freight.	All other.	Total amount.	
	Miles.	Miles.	$	$	$	$	No.	Tons.	$	$	$	$	$
Burlington Cedar Rapids and Minnesota	389.75	14.00	....	7,600,000	7,600,000	7,600,000	......	......	300,000	700,000	59,809	1,059,809	414,415
Burlington and South-western	118.60	40.00	2,000,000	1,800,000	3,800,000	3,800,000	......	......	40,000	69,135	......	109,135	
Cedar Falls and Minnesota	75.60	3.00	1,587,000	1,587,000	3,174,000	3,174,000	......	......	44,675	85,074	......	129,750	112,000
Cedar Rapids and Missouri River	274.00	10.00	7,620,000	3,614,090	11,234,090	11,234,090	......	......	400,000	1,250,000	51,773	1,701,773	559,555
Central (of Iowa)	189.00	15.00	....	5,000,000	5,000,000	5,000,000	87,941	185,148	133,000	441,000	41,053	615,053	
Chicago Clinton and Dubuque	60.00	2.50	960,000	1,500,000	2,460,000	2,460,000	33,315	51,061	39,013	65,103	4,168	108,172	31,312
Chicago Dubuque and Minnesota	134.00	11.00	2,500,000	4,425,000	6,925,000	6,925,000	61,360	114,942	97,020	193,938	22,901	313,859	153,802
Chicago Iowa and Nebraska	81.80	17.90	3,916,200	779,700	4,695,900	4,695,900	......	......	300,000	700,000	56,292	1,056,292	396,110
Davenport and St. Paul	156.00	10.00	....	3,120,000	3,120,000	3,120,000	......	......	50,000	130,000	9,369	189,369	
Des Moines and Fort Dodge	88.00	20.00	4,000,000	2,400,000	6.400,000	6,400,000	......	......	200,000	551,000	......	751,000	149,413
Des Moines Valley †													
Dubuque and Sioux City	142.90	14.80	5,000,000	882,000	5,882,000	5,882,000	......	......	271,199	800,287	......	1,071,486	318,893
Dubuque South-western	55.00	3.70	1,180,805	528,500	1,709,305	1,771,676	40,813	43,559	41,312	73,120	8,529	122,961	28,990
Iowa Falls and Sioux City	184.00	6.60	4,625,000	2,960,000	7,585,000	7,585,000	......	.. ...	146,318	262,250	......	408,568	142,999
Iowa Midland	71.40	......	....	1,314,000	1,314,000	1,467,147	......	......	30,000	50,000	4,781	84,781	1,980
Keokuk and Des Moines	161.50	14.00	3,924,600	2,153,720	6,078,320	6,078,320							
Missouri Iowa and Nebraska	85.00	4.00	1,500,000	2,000,000	3,500.000	2,000,000							
Sioux City and Pacific	107.00	15.00	2,068,500	1,628,000	3,696,500	3,696,500	......	......	73,461	169,507	8,962	261,930	60,766
Total	2,373.55	201.50	40,882,105	43,292,010	84,174,115	82,891,533	......	......	1,145,998	2,790,279	145,422	7,983,988	2,370,235

Finances.—In 1870 the assessed valuation of real and personal estate was $302,515,418, and the estimated true valuation, $717,644,750. The taxation for all purposes, State, county, city, town, etc., was $9,055,614, of which the State received only $832,918, the counties, $3,052,931, and the towns, cities, etc., $5,169,765. The State had no debt, but the debts of the counties were $3,732,929, and of the towns, cities, etc., $3,775,706. The fiscal reports of the treasurer and auditor are made up biennially. The latest is that of Nov. 15, 1873. The treasurer had received during the two years ending with that date, including a balance of $81,740.84 on hand at the beginning of the biennial period, $2,211,318.35, and had disbursed in the same time $2,180,100.69, leaving at the close of the fiscal year a balance of $31,217.66. The estimated receipts for the next two years were $1,973,800, and the expenditures provided for by law amounted to $1,474,000, leaving $499,800 to be applied for special purposes. The amount of taxation for all purposes under the levy of 1872 was $10,711,925.49, or 2.94 per cent. of the valuation. This valuation amounted to $369,849,503.91, which would make the true valuation about $863,000,000. The amount of the permanent school fund is $3,294,742.83, an increase of $133,249.82 since 1871. There were patented in 1871–73, 48,817.08 acres of school lands, 2320 acres of university lands, and 11,643.43 acres of swamp-lands. The selection of swamp-lands made in the several counties under the act of Congress of 1872 amounted to 865,770.46 acres. The entire grants made within the State for railroads and other internal improvements now amount to 4,898,668.88 acres.

Commerce.—The State has no ports of entry, and consequently no direct foreign commerce. Its internal and inter-State commerce has been estimated on good authority to exceed $500,000,000 annually.

Banks, Savings Banks, Insurance Companies, etc.—There are 80 national banks in operation in Iowa. They had, Nov. 1, 1874, $6,261,480 capital paid in, $6,095,000 bonds on deposit, $7,984,805 circulation issued, of which $5,602,869 was outstanding. There were also 20 State banks, having an aggregate capital of $1,200,000, and deposits amounting to $2,898,954.58. There were 18 savings banks, with capital and deposits of $1,247,600. There were also 163 private banking-houses. There were 8 fire insurance companies in the State in July, 1873, 2 of them mutual; the capital of the 6 stock companies was $335,025, and the assets of all about $908,000. During the year ending May 15, 1873, the amount of premiums received by these companies was $362,026.15, the amount of losses paid, $90,016.95. The aggregate expenditures were $273,978.69, the aggregate income from all sources, $425,943.74. Fifty companies from other States received during the same year $1,029,102.94 in premiums, and paid for losses $386,378.14. There is but one life insurance company in the State, organized in 1867 with $100,000 capital, which had $180,650 assets in July, 1873. In the year preceding it had issued 282 new policies and received $45,813.29 in premiums, covering insurances to the amount of $425,021. Forty-one life insurance companies of other States did business in Iowa, receiving $1,037,622.34 in premiums and paying $231,531.09 in losses.

Population.—Iowa has but a brief history, and its record of population dates back but about forty years. The whites were first permitted to settle within the present limits of the State in June, 1833, and very few actual settlements were made before 1834. In 1840 there were 43,112

*In the year 1874 the railroads had increased till their mileage in Jan., 1875, was 4314.43, and the cost of roads, equipment, etc., $142,319,729.

† Operated by the Burlington and South-western R. R.

inhabitants; in 1846, when it was admitted as a State, 97,588; in 1850 the number of inhabitants was 192,214; in 1860, 674,913; in 1870, 1,194,020; in 1873, by State census, 1,251,333. The immigration, except in the new counties, is very nearly balanced by the emigration to Missouri and the States and Territories farther W. The density of the population to the square mile was in 1850, 3.49; in 1860, 12.26; in 1870, 21.69; in 1873, 22.73. The number of families in 1850 was 33,517, averaging 5.73 persons to a family; in 1860, 124,098 families, averaging 5.44 to a family; in 1870, 222,430 families, averaging 5.37 to a family. Of the 1,194,020 inhabitants of the State in 1870, 989,328 were natives of the U. S., and 204,692 of foreign birth. Of those born in the U. S., 416,139 were partially or wholly of foreign parentage, and 360,971 had both father and mother of foreign birth. Of those who were natives of the U. S., 428,620 were born in the State, 126,285 in Ohio, 79,143 in New York, 73,435 in Pennsylvania, 65,391 in Illinois, 64,083 in Indiana, 24,309 in Wisconsin, 19,563 in Virginia, 14,186 in Kentucky, 13,831 in Missouri, 12,204 in Vermont, 8929 in Massachusetts, 8918 in Michigan, 5185 in Connecticut, 5688 in New Jersey, 5090 in North Carolina, 5066 in New Hampshire, 5943 in Maine, 5972 in Maryland, and less than 1000 in any other State. Of the 204,692 persons of foreign birth in the State, 66,162 were from the different German states, 65,442 from Great Britain and Ireland (of whom 40,124 were from Ireland, 17,907 from British America, mostly from Canada), 17,556 from Norway, 10,796 from Sweden, 2827 from Denmark, 6766 from Bohemia, 4513 from Holland, 3937 from Switzerland, 3130 from France, 2691 from Austria, 1344 from Luxemburg, 650 from Belgium, and 598 from all other countries. There were 5762 colored persons (3099 males and 2663 females) in the State. Of the white population, which numbered 1,188,207, 622,786 were males and 565,421 females. Of the native population, 510,864 were males and 478,464 females; of the foreign-born, 115,053 were males and 89,630 females. There were but 48 Indians in the State, of whom 29 were males and 19 females. Of the 625,917 males in Iowa, 240,769 were of military age (between 18 and 45 years); of these, 173,060 were of native and 67,709 of foreign birth; 1425 were colored; 290,717 were of the age of citizenship (21 years old and upward), and of these, 255,802 were citizens. There were 394,696 persons of school age (5 to 18 years), of whom 201,531 were males and 193,165 females. According to the State census of 1873, there were at that time 491,344 persons of school age in the State, but the school age prescribed by the State is between 5 and 21 years.

Education.—In 1870 there were, according to the census, 306,353 persons who attended the schools of the State, public and private, during some portion of the year. Of these, 13,000 were of foreign birth. There were 160,269 white male and 145,421 white female scholars; and 661 colored, of whom 346 were males and 315 females; there were also 2 Indian pupils. The number of inhabitants of all races, 10 years old and over, unable to read and write was 45,671, of whom 20,692 were of foreign birth and 44,145 were whites; of these, 5858 (3401 males and 2457 females) were from 10 to 15 years of age; 3680 (2044 males and 1636 females) were from 15 to 21 years of age; and 34,607 (14,782 males and 19,825 females) were over 21 years of age. Of the 1524 colored illiterates, 70 (32 males and 38 females) were from 10 to 15 years of age; 146 (71 males and 75 females) were from 15 to 21 years of age, and 1308 (635 males and 673 females) were over 21 years. The whole number of educational institutions in 1870 was 7496, having 9319 teachers (3656 males and 5663 females) and 217,654 pupils (105,665 males and 111,989 females). The total income of these was $3,570,093, of which $63,150 was derived from endowment, $3,347,629 from taxation and public funds, and $159,314 from tuition and other sources. There were 7322 public schools, with 8866 teachers (of whom 3381 were males and 5485 females), and 205,923 pupils (100,308 males and 105,615 females). The total income of these public schools was $3,245,352, of which $3100 was derived from endowment, $3,241,752 from taxation and public funds, and $500 from tuition and other sources. According to the census, there were 21 colleges, with 139 teachers (109 males and 30 females) and 3061 students (1685 males and 1376 females). The total income of these colleges was $101,950, of which $54,000 was derived from endowment, $10,000 from taxation and public funds, and $37,950 from tuition and other sources. There were 34 academies, with 103 teachers (46 males and 57 females) and 2333 pupils (1019 males and 1314 females), and an income of $55,880, derived from tuition and other sources. There were also 100 boarding and day schools (private schools), having 136 teachers (64 males and 72 females) and 4872 pupils (1741 males and 3131 females), and an income of $38,550, derived from tuition and other sources. The public-school statistics to the beginning of the year 1873 were: number of ungraded schools, 8163; of graded schools, 400; of persons between 5 and 21 years of age, 474,350 (males 243,522, females 230,828); scholars enrolled in the schools, 349,633; average attendance, 218,131; average time schools are taught, 6 months and 14 days; number of teachers, 15,193 (males 5888, females 9305); average compensation of male teachers, $36 per month; of female teachers, $29.32 per month; average cost of tuition per week for each pupil, $0.42; number of school-houses, 8235; total value of school-houses, $7,460,381.19. By the State census of 1873 the number of persons of school age in the State was reported as 491,344, and there was an increase of 932 school districts. The total amount expended in 1873–74 for school purposes was $4,229,455. There is a State university at Iowa City, which has 32 professors, 263 students, besides the normal class, and 4 departments—collegiate, normal, law, and medical. Its assets are $232,221.50, and its income for the two years ending June 3, 1873, $122,041.29. Its expenses from June 21, 1871, to Oct. 1, 1873, were $103,415.93. There is to be a department of dental medicine established in connection with it. It still holds 7840 acres of its land-grant, which are valued at nearly $30,000. The agricultural college at Ames was organized in 1869. It has 12 professors, 220 students, and has good buildings and the avails of 240,000 acres of government lands, of which, however, 22,765 are not yet leased or sold. It has received considerable appropriations from the State. There are 16 universities and colleges (only 3 of them, however, having post-graduate or professional schools—viz. Iowa Wesleyan University, Cornell College, and Griswold College) which are not State institutions. Of these, 4 are under the patronage of the Methodist Episcopal Church, 3 under that of the Baptists, 3 Lutheran, 2 Congregational, 1 Friends, 1 Episcopal, 1 Christian, and 1 undenominational. Grinnell College, the oldest, dates back to 1848; the others range between 1854 and 1870. These colleges have about 130 professors, and about 1850 students, and libraries containing over 40,000 volumes. There is a scientific department to Cornell College; theological departments to Griswold College and Iowa Wesleyan University, the Wartburg Lutheran Theological Seminary at Casstown, and the German Reformed Theological Seminary of the North-west at Dubuque; law departments to Iowa State and to Iowa Wesleyan universities; a medical department of Iowa State University at Iowa City; a college of physicians and surgeons at Keokuk; and a department of pharmacy of the Iowa Wesleyan University at Mount Pleasant. There are 5 or 6 academies of high grade at Davenport, Dubuque, Denmark, and Irving. Of training or normal schools, there are departments attached to the State University, to Iowa College at Grinnell, and to Whittier College at Salem. In these in 1872 there were 225 students. Of special schools of education, there is the Iowa college for the blind at Vinton, with 112 students and 32 teachers and employés, property of the estimated value of $250,000, and an annual income from the State of $24,000; the institution for the deaf and dumb at Council Bluffs, with 6 instructors and 119 pupils, property valued at $179,000, and an income of $25,000 from the State; the soldiers' orphan homes, three in number, at Davenport, Cedar Falls, and Glenwood, with 508 children in their care and an annual expense of $146,050; a State reform school for boys at Eldora, on a farm of 440 acres, the buildings costing $90,000, and having 145 boys in charge; a girls' reform school near Salem in Lee co., on a small farm, with 11 inmates. The State prison at Fort Madison has 276 prisoners; a new one has been established at Anamara, where there are 25 prisoners. There are 2 insane hospitals in the State; that at Mt. Pleasant had in Nov., 1873, 495 patients, and its expenses for the two years preceding had been $229,441.25. The new hospital at Independence is not yet completed, but at the close of 1873 had 152 patients.

Statistics of Crime.—The whole number of convicts in prison during the year ending June 1, 1870, is stated to have been 615, of whom 397—287 natives (273 white and 14 colored) and 110 persons of foreign birth—remained in prison June 1, 1870. This can only refer to the State penitentiaries, for in these, as we have seen, there were in 1873 over 300 prisoners, or if the reform schools are included, 457 prisoners. The 99 county jails and the several city penitentiaries and police prisons can hardly have been without inmates.

Libraries.—In 1870 there were 3540 libraries, public and private, containing 653,600 volumes, of which 1153 were public libraries, containing 377,851 volumes. Of these, the State library at Des Moines has 11,000 volumes; 23 town and city libraries, 22,808 volumes; 11 court and law libraries, 944 volumes; 15 school and college libraries, 18,747 volumes; 1084 church and Sunday school libraries, with 303,835 volumes; 1 literary society, with 150 volumes; 18

circulating libraries, with 20,367 volumes. The 2387 private libraries had an aggregate of 295,749 volumes.

Newspapers.—In 1870 there were 233 newspapers of all classes in the State, issuing annually 16,403,380 copies, and having an aggregate circulation of 219,090. The number in 1874 exceeds 300, and the circulation has increased correspondingly. Of those published in 1870, 22 were dailies, with an aggregate circulation of 19,800; 3 tri-weeklies, with a circulation of 1650; 1 semi-weekly, with a circulation of 1000; 196 weeklies, with a circulation of 187,840; 3 semi-monthlies, with 3400 circulation; 5 monthlies, with 3950 circulation; 2 bi-monthlies, with 750 circulation; and 1 quarterly, with 700 circulation.

Churches.—In 1870 there were reported by the census 2763 churches, with 1446 church edifices, 431,709 sittings, and $5,730,352 of church property. Of these, the Baptists had 352 churches, 165 church edifices, 50,690 sittings, $668,900 of church property. In 1873, according to the *Baptist Year Book* for 1875, the regular Baptists had 379 churches, 252 ordained ministers, 20,734 members, 254 Sunday schools, 20,541 teachers and scholars, 26,546 volumes in Sunday school libraries, and $126,025 of benevolent contributions, aside from church expenses. There are a considerable number of churches of the minor Baptist denominations, as Mennonites, Tunkers, "Church of God," etc., in the State, enumerated with Baptists in the census, but not in the *Year Book* statistics. The Christian Connection had, including also the "Disciples," in 1870, according to the census, 113 churches, 48 church edifices, 15,750 sittings, and $124,450 of church property. The Congregationalists had 187 churches, 125 church edifices, 33,925 sittings, and $529,570 of church property. In 1874 they had, according to the *Congregational Quarterly*, 224 churches, 198 ministers, and 12,803 communicants. The Protestant Episcopal Church in 1870 had 58 parishes, 36 church edifices, 9584 sittings, and $192,862 of church property. In 1874, according to the *Church Almanac*, there were 57 parishes, 45 clergymen, 2991 communicants, 3220 Sunday school teachers and scholars, and $75,643 of benevolent contributions, aside from church and parish expenses. The Evangelical Association (Albright's) had in 1870, 32 churches, 11 church edifices, 2400 sittings, and $22,800 of church property; in 1873 they had 51 itinerant and 53 local preachers, 70 churches, and 4717 communicants. In 1870 the Friends had 82 meetings, 60 meeting-houses, 17,075 sittings, and $125,800 of meeting-house property. The Lutherans in 1870 had 79 churches, 45 church edifices, 12,285 sittings, and $113,950 of church property. As nearly as can be ascertained, in 1873 they had 122 churches, 79 ministers, and about 15,000 communicants. The Methodist Church, in 1870, had 982 churches, 492 church edifices, 142,655 sittings, and $1,490,220 of church property. In 1873 the Methodist Episcopal Church had 4 conferences within the State, 627 church edifices, 534 itinerant and 868 local preachers, 52,026 members, besides probationers, $1,839,892 of church property, 1035 Sunday schools, and 73,433 Sunday school teachers and scholars. There were also a large number of churches adhering to the Methodist Episcopal Church, South, and many belonging to the different minor Methodist denominations. The Presbyterian Church (including the Northern and Southern and United Presbyterian Churches) in 1870 had 375 churches, 222 church edifices, 64,890 sittings, and $962,325 of church property. In 1873 the Presbyterian Church, North, had 2 synods, 10 presbyteries, 222 ordained ministers, 348 churches, and 16,991 members. The United Presbyterian Church in 1873 had 5 presbyteries, 58 ministers, 91 churches, and 5396 members. The Cumberland Presbyterian Church in 1872 had 4 presbyteries, 20 ministers, about 30 churches, and nearly 4000 members. The Reformed Church (late Dutch) in 1870, had 4 churches, 4 church edifices, 1500 sittings, and $25,000 of church property. The Reformed Church (late German) had 13 churches, 13 church edifices, 3950 sittings, and $46,000 of church property. Owing to the arrangement of synods and classes, the statistics of neither of these churches for the State can be separated. The Roman Catholic Church in 1870 had 216 congregations, 165 church edifices, 57,280 sittings, and $1,216,150 of church property. According to the *Catholic Directory*, in 1874 they had 135 priests, 250 churches, chapels, and stations, but only 108 church edifices, and an adherent population of about 70,000. In 1870 there were 28 Second Advent churches, with 10 church edifices, 2950 sittings, and $13,050 of church property. There were 3 Unitarian congregations, 2 church edifices, 715 sittings, and $19,000 of church property. The United Brethren in Christ (German Methodists) in 1870 had 188 churches, 28 church edifices, 10,445 sittings, and $69,250 of church property. In 1874 they had 4 conferences, 327 churches, 171 ministers, and 7449 members. The Universalists in 1870 had 35 congregations or parishes, 15 church edifices, 4465 sittings, and $99,525 of church property. In 1873 they had 39 parishes, 24 organized churches, 1100 adherent families, and 782 members. There are a considerable number of churches of the minor denominations, such as Christian Union, Christadelphians, New Jerusalem Church, etc., and a body of 4000 or more Mormons, not included in the above statement, but there are not sufficient data for giving any accurate statistics concerning them.

Constitution, Courts, Representatives in Congress, etc.—When Iowa was admitted into the Union as a State, her people had adopted a constitution which remained the supreme law of the State until 1857, when a new constitution was prepared by a convention called for the purpose, and adopted by the people. This constitution remains in force to the present time, except that in the 2d article, on the right of suffrage, the word "white" was stricken out, by vote of the people in 1868, thus giving to colored persons the same privileges and responsibilities as were before granted to whites only. That section now provides that "every male citizen of the U. S., of the age of twenty-one years, who shall have been a resident of this State six months next preceding the election, and of the county in which he claims his vote sixty days, shall be entitled to vote at all elections which are now or hereafter may be authorized by law. All elections by the people shall be by ballot." The legislature consists of a senate of fifty members elected for four years in senatorial districts, and a house of representatives of 100 members elected for two years in representative districts. Senators must be citizens and at least twenty-five years of age; representatives must be citizens and not under twenty-one years of age. The sessions of the legislature are biennial. The executive officers of the State—the governor, lieutenant-governor, secretary of state, auditor, treasurer, superintendent of public instruction, and register of the state land-office—are elected by the people of the State at the general election for the term of two years. The judicial department comprises a supreme court, district court, and circuit court. The supreme court consists of four judges, who are elected by the people and serve for six years, but are so classified that their terms of office close at different dates. Each judge in succession becomes chief-justice before his term expires. The supreme court is both a court of errors and a court of appeal. The attorney-general is elected for two years, and the reporter and clerk of the supreme court for four years each. The State is divided into fourteen judicial districts, and every four years the people of each district elect one judge of the district court, one judge of the circuit court, and one district attorney, who serve for four years each. There are no county courts, but both the district and circuit courts are held successively, but at different times, in each county of the district. Under the apportionment of 1872 Iowa has nine members of Congress.

Counties.—There are 99 counties in the State, and the following table gives their population by sexes in 1870, and total population in 1860 and 1850:

Counties.	Males, 1870.	Females, 1870.	Total pop. 1870.	Total pop. 1860.	Total pop. 1850.
Adair	2,178	1,804	3,982	984	
Adams	2,470	2,144	4,614	1,533	
Allamakee	9,319	8,549	17,868	12,237	777
Appanoose	8,498	7,958	16,456	11,931	3,131
Audubon	659	553	1,212	454	
Benton	11,846	10,608	22,454	8,496	672
Black Hawk	11,381	10,325	21,706	8,244	135
Boone	7,577	7,007	14,584	4,232	735
Bremer	6,647	5,881	12,528	4,915	
Buchanan	8,869	8,165	17,034	7,906	517
Buena Vista	907	678	1,585	57	
Butler	5,268	4,683	9,951	3,724	
Calhoun	834	768	1,602	147	
Carroll	1,332	1,119	2,451	281	
Cass	2,923	2,541	5,464	1,612	
Cedar	10,297	9,434	19,731	12,949	3,941
Cerro Gordo	2,634	2,088	4,722	940	
Cherokee	1,156	811	1,967	58	
Chickasaw	5,228	4,952	10,180	4,336	
Clarke	4,473	4,262	8,735	5,427	79
Clay	868	655	1,523	52	
Clayton	14,455	13,316	27,771	20,728	3,873
Clinton	18,694	16,663	35,357	18,938	2,822
Crawford	1,387	1,143	2,530	383	
Dallas	6,392	5,627	12,019	5,244	854
Davis	7,898	7,667	15,565	13,764	7,264
Decatur	6,197	5,821	12,018	8,677	965
Delaware	8,998	8,434	17,432	11,024	1.759
Des Moines	14,191	13,065	27,256	19,611	12,988
Dickinson	745	644	1,389	180	
Dubuque	20,013	18,956	38,969	31,164	10,841
Emmet	757	635	1,392	105	
Fayette	8,744	8,229	16,973	12,073	825
Floyd	5,705	5,063	10,768	3,744	
Franklin	2,560	2,178	4,738	1,309	
Fremont	5,980	5,194	11,174	5,074	1,244
Greene	2,462	2,165	4,627	1,374	
Grundy	3,472	2.927	6,399	793	
Guthrie	3,758	3,303	7,061	3,058	

Counties.	Males, 1870.	Females, 1870.	Total pop. 1870.	Total pop. 1860.	Total pop. 1850.
Hamilton	3,203	2,852	6,055	1,699	
Hancock	524	475	999	179	
Hardin	7,360	6,624	13,684	5,440	
Harrison	4,759	4,172	8,931	3,621	
Henry	10,964	10,499	21,463	18,701	8,707
Howard	3,399	2,883	6,282	3,168	
Humboldt	1,408	1,188	2,596	332	
Ida	124	102	226	43	
Iowa	8,671	7,973	16,644	8,029	822
Jackson	11,688	10,931	22,619	18,493	7,210
Jasper	11,601	10,515	22,116	9,883	1,280
Jefferson	9,248	8,591	17,839	15,038	9,904
Johnson	12,889	11,999	24,898	17,573	4,472
Jones	10,273	9,458	19,731	13,306	3,007
Keokuk	10,079	9,355	19,434	13,271	4,822
Kossuth	1,824	1,527	3,351	416	
Lee	19,265	17,585	37,210	29,232	18,861
Linn	16,233	14,847	31,080	18,947	5,444
Louisa	6,743	6,134	12,877	10,370	4,939
Lucas	5,368	5,020	10,388	5,766	471
Lyon	131	90	221		
Madison	7.325	6,559	13,884	7,339	1,179
Mahaska	11,490	11,018	22,508	14,816	5,989
Marion	12,579	11,857	24,436	16,813	5,482
Marshall	9,387	8,195	17,576	6,015	338
Mills	4,808	3,910	8.718	4,481	
Mitchell	5,068	4,514	9,582	3,409	
Monona	1,995	1,659	3,654	832	
Monroe	6,671	6,053	12,724	8,612	2,884
Montgomery	3,356	2,578	5,934	1,256	
Muscatine	11,175	10,513	21,688	16,444	5,731
O'Brien	404	311	715	8	
Osceola (new co.)					
Page	5,292	4,683	9,975	4,419	551
Palo Alto	756	580	1,336	132	
Plymouth	1,245	954	2,199	148	
Pocahontas	785	661	1,446	103	
Polk	14,527	13,330	27,857	11,625	4,513
Pottawattamie	9,189	7,704	16,893	4.968	7,828
Poweshiek	8,456	7,125	15,581	5,668	615
Ringgold	2,947	2,744	5,691	2,923	
Sac	775	636	1,411	246	
Scott	20,157	18,442	38,599	25,959	5,986
Shelby	1,358	1,182	2,540	818	
Sioux	320	256	576	10	
Story	6,088	5,563	11,651	4,051	
Tama	8,595	7,536	16,131	5,285	8
Taylor	3,635	3,354	6,989	3,590	204
Union	3,199	2,787	5,986	2,012	
Van Buren	9,059	8,613	17,672	17,081	12,270
Wapello	11.669	10,677	22,346	14,518	8,471
Warren	9,286	8,694	17,980	10,281	961
Washington	9,766	9,186	18,952	14,235	4,957
Wayne	5,853	5,434	11,287	6,409	340
Webster	5,598	4,886	10,484	2,504	
Winnebago	820	742	1,562	168	
Winneshiek	12,424	11,146	23,570	13,942	546
Woodbury	3,477	2,695	6,172	1,119	
Worth	1,518	1,374	2,892	756	
Wright	1,275	1,117	2,392	653	
Total	625,917	568,103	1,194,020	674,913	192,214

Principal Towns.—Davenport and Dubuque are the only cities of from 20,000 to 25,000 inhabitants; Burlington, Keokuk, and Des Moines (the capital) have from 15,000 to 20,000; Council Bluffs is the only city having between 10,000 and 15,000 inhabitants; Muscatine, Clinton, Iowa City, Cedar Rapids, and Ottumwa have from 6000 to 8000; Lyons, Waterloo, Fort Madison, Fort Dodge, Mount Vernon, Cedar Falls, Sioux City, Oskaloosa, and Marshalltown have from 4000 to 6000 each.

History.—The whole region lying between the Mississippi and Missouri rivers in the North-west, as well as much of the country S. of the Missouri, was claimed by the French on the ground of Marquette's discoveries in 1673, and was transferred to Spain by treaty in 1763. In 1800–01, Spain ceded it back to France, and it was sold as part of the Louisiana purchase to the U. S. in 1803. In 1804 the Louisiana district, which included what is now the State of Iowa, was placed under the jurisdiction of Indiana Territory, but the next year it was organized as a distinct Territory with a government of its own. In 1812 the name was changed to Missouri Territory. In 1834 all that part of Missouri Territory N. of the State of Missouri and W. of the Mississippi was placed under the jurisdiction of Michigan Territory. In 1836, Wisconsin Territory was organized, and Iowa made a district of it, with the seat of government for the whole Territory fixed at Burlington. In 1838, Iowa Territory was organized, and in 1839 the capital of the Territory removed from Burlington to Iowa City. The Territory was admitted into the Union as a State, with the boundaries described at the beginning of this article, Dec. 28, 1846. In 1857, at the time of the adoption of the new constitution, the capital was removed from Iowa City to Des Moines, where it now remains. The present Territory of the State was for many years in possession of the Sioux, Sac, Fox, and Iowa tribes of Indians, but by repeated treaties with the Indians their title to the land was extinguished, and they all removed westward, until in 1870 there were but 48 Indians in the State. A few Frenchmen had settled at Montrose and Dubuque before the close of the last century, and some French pioneers and American hunters had long lived among the Indians, but the first settlements of whites permitted by the U. S. government within the present limits of Iowa were made in 1833–34 at Fort Madison, Burlington, and Dubuque. The first counties organized were Des Moines and Dubuque. The first train of cars run in Iowa started from Davenport in 1855 over the Chicago and Rock Island road. Since its admission to the Union the growth of Iowa has been rapid and uninterrupted, and its prosperity steady. At the commencement of the late civil war the State, under the management of the patriotic governor, Kirkwood, made great exertions, and during the war sent 83,000 men, its full quota, into the field. During that period the wives, sisters, and daughters of its soldiers, by the aid of agricultural machinery, planted, gathered, and harvested its crops, and kept the State up to its full measure of productiveness, and when peace returned its prosperity and resources were found to be very slightly impaired.

Governors of the State.—

Territory.	James W. Grimes......1854–58
Robert Lucas..........1838–41	Ralph P. Lowe.........1858–60
John Chambers........1841–46	Samuel J. Kirkwood...1860–64
James Clark...........1846–46	William M. Stone......1864–68
State.	Samuel Merrill........1868–72
Ansel Briggs...........1846–50	Cyrus C. Carpenter....1872–76
Stephen Hempstead...1850–54	Samuel J. Kirkwood...1876–

Electoral and Popular Vote at Presidential Elections.—Iowa was not admitted into the Union as a State until 1846, and her first Presidential vote was at the election of 1848.

Elect. year.	Candidates who received the electoral vote.	Elect. vote.	Pop. vote.	Candidates.	Pop. vote.	Candidates.	Pop. vote.
1848	Lewis Cass P. W. O. Butler V.-P.	4	12,093	Zach. Taylor P. M. Fillmore V.-P.	11,084	Martin Van Buren P. C. F. Adams V.-P.	1,126
1852	Franklin Pierce P. William R. King V.-P.	4	17,763	Winfield Scott P. W. A. Graham V.-P.	15,856	J. P. Hale P. G. W. Julian V.-P.	1,604
1856	John C. Fremont P. W. L. Dayton V.-P.	4	43,954	James Buchanan P. J. C. Breckenridge V.-P.	36,170	M. Fillmore P. A. J. Donelson V.-P.	9,180
1860	Abraham Lincoln P. H. Hamlin V.-P.	4	70,409	S. A. Douglas P. H. V. Johnson V.-P.	55,111	J. Bell P. E. Everett V.-P.	1,763
						J. C. Breckenridge P. Joseph Lane V.-P.	1,048
1864	Abraham Lincoln P. A. Johnson V.-P.	8	89,075	G. B. McClellan P. G. H. Pendleton V.-P.	49,596		
1868	U. S. Grant P. Schuyler Colfax V.-P.	8	120,399	Horatio Seymour P. F. P. Blair V.-P.	74,040		
1872	U. S. Grant P. Henry Wilson V.-P.	11	131,566	Horace Greeley P. B. Gratz Brown V.-P.	71,196	C. O'Conor P.	2,221

We acknowledge our obligations for many facts relative to the physical and political geography and history of Iowa, to Prof. C. A. White's *Manual of the Physical Geography and Institutions of Iowa*, published in 1874.

L. P. Brockett.

Iowa, a river in the State of the same name, rises in Hancock co., near the Minnesota line, flows S. E. for 300 miles, passing by Iowa City, the former capital of the State, and enters the Mississippi 35 miles N. of Burlington. It is navigable for small steamers to Iowa City, 80 miles from the mouth.

Iowa, county of S. E. Central Iowa. It is rolling and fertile; cattle, grain, and wool are staple products. Area, 576 square miles. It is on the Iowa River and the Chicago Rock Island and Pacific R. R. Cap. Marengo. Pop. 16,644.

Iowa, county of the S. W. of Wisconsin. Area, about 750 square miles. It is bounded on the N. by Wisconsin River. The surface is somewhat broken. Timber is not abundant. The soil is very fertile. Cattle, grain, and wool are staple products. Lead is extensively mined, and copper and zinc are found. Carriages and wagons are leading manufactures. Cap. Dodgeville. Pop. 24,544.

Iowa, tp. of Allamakee co., Ia. Pop. 347.

Iowa, tp. of Benton co., Ia. Pop. 2639.

Iowa, tp. of Cedar co., Ia. Pop. 1168.

Iowa, tp. of Dubuque co., Ia. Pop. 878.

Iowa, tp. of Franklin co., Ia. Pop. 125.

Iowa, tp. of Iowa co., Ia. Pop. 962.

Iowa, tp. of Jackson co., Ia. Pop. 1209.

Iowa, tp. of Marshall co., Ia. Pop. 1123.

Iowa, tp. of Washington co., Ia. Pop. 1062.

Iowa, tp. of Winnebago co., Ia. Pop. 436.

Iowa, tp. of Wright co., Ia. Pop. 204.

Iowa, tp. of Doniphan co., Kan. It includes Highland, Iowa Point, and White Cloud villages. Pop. 3531.

Iowa Centre, post-v. of Indian Creek tp., Story co., Ia., 8 miles from Nevada, a station on the Chicago and North-western R. R. Pop. 248.

Iowa City, city, cap. of Johnson co., Ia., at the head of navigation of the Iowa River, and on the Chicago Rock Island and Pacific R. R., 130 miles E. of Des Moines. It was (1839–57) the capital of Iowa Territory and State, and the buildings and grounds of what was formerly the capitol are now occupied by the State University. There are 4 flouring-mills, and manufactures of woollens, flax, oil, etc., 1 monthly, 1 semi-monthly, 1 daily, and 4 weekly newspapers, 15 churches, 2 national banks, good schools, public and private, fine county and other public buildings, hospital, etc. The city has a large local trade. Pop. of tp. outside of city, 2180; of city, 5914, increased since census.
N. H. Brainerd, Ed. "Iowa City Republican."

Iowa College, the oldest college in Iowa, was founded in 1847 by an association of Congregationalists and Presbyterians, and established at Davenport. The latter withdrew in 1852. Like early New England colleges, it is under no ecclesiastical control, and no sectarian influence is exerted. A freshman class was formed in 1850; ladies admitted 1857; a four years' scientific course established 1867. It has graduated 58 young men and 61 young ladies; of the latter, 56 graduated from the ladies' course (three years), and 5 from the college classical course. The scientific course contains some studies usually deemed post-graduate. Preparation for it includes the same Latin and Greek as preparation for the classical course. Civil engineering and surveying are taught with practice; also chemistry and physics in both courses, recitations and laboratory-work occupying alternate weeks. English is taught from the Anglo-Saxon sources on the thorough plan of Prof. F. A. March, LL.D., in Lafayette College, Pa. Normal instruction, a year's course, is contemplated, the special training in methods being open to students in all the courses, and the English department becoming a model or practice school; normal students to teach in its classes one hour a day. Classes in the ladies' course recite with college classes to the college professors. There is a classical academy preparing for both courses. The aim of the founders has been not to compete in mere numbers, but to surpass in standard of scholarship, thoroughness, and discipline ordinary Western institutions. The professors are eagerly sought for their superior qualifications by older Eastern institutions, and the progress of the college has been crippled thereby, as well as by losses by fire. It is supplied with chemical and philosophical apparatus. The new Central College, erected 1872, is the most beautiful and convenient college-building in Iowa. The annual number of students is 250.

In 1860 the college was removed from Davenport to Poweshiek co., in the centre of the State, where Hon. J. B. Grinnell had founded a colony-town bearing his name, composed of Eastern people entirely, in which no intoxicating liquor is sold, and there are no lager-beer saloons, billiard-rooms, or other places of lounging and dissipation. The largest Protestant church W. of Chicago is here —a Congregational church of over 530 members. The religious influences of the college have always been very strong, though unsectarian. Nearly half of its male graduates have chosen the Christian ministry; some are foreign missionaries. Its endowment is less than $100,000, and its two largest benefactions have been—$30,000, for the endowment of the presidency, by Hon. Samuel Williston of Easthampton, Mass., and $20,000, for the Latin professorship, by the late Aaron Benedict, Esq., of Waterbury, Conn. It holds the most central position in the State, at the crossing of the Chicago Rock Island and Pacific R. R. and Central R. R. of Iowa, connecting every section of the State.
Geo. F. Magoun.

Iowa Falls, city of Hardin co., Ia., on the Illinois Central R. R., and 143 miles W. of Dubuque, on the Iowa River, which here has a succession of rapids which give name to the town. The scenery here is remarkably fine, and the city itself is one of the most attractive in the State. It was founded in 1850, and incorporated as a city in 1870. It has a weekly newspaper, a fine graded school, and several churches. O. W. Garrison, Ed. "Sentinel."

Iowa Indians, a tribe of aborigines of the Dakota stock, formerly inhabiting Iowa and Northern Missouri. They were closely allied, not by race, but by association, to the Sac (Sauk) and Fox Indians. They at present number 225 souls. They occupy 16,000 acres of the Great Nemaha reservation; the rest belong to a band of Sacs and Foxes. The Iowas are superior in industry and intelligence to most Indians. They receive a handsome annuity from the government, and sustain an orphan asylum.

Iowa Point, post-v. of Iowa tp., Doniphan co., Kan., on the Missouri River and the Atchison and Nebraska R. R. Pop. 242.

Ipa'va, post-v. of Fulton co., Ill., in Pleasant tp., on the Chicago Burlington and Quincy R. R. (Buda and Rushville division). It has 1 weekly newspaper. Pop. 488.

Ip'ecac, an important drug, the dried root of *Cephäelis Ipecacuanha*, a small shrubby perennial plant, natural order Rubiaceæ, growing in damp, shady forests in Brazil. The root is slender, from four to six inches long, and marked with annular ridges. The stem is also slender, and rises but a few inches from the ground. The plant bears seldom more than six leaves; the flowers are white and very small, and collected into a closely packed group surmounting a round axillary footstalk. The root is gathered by the natives, cleaned, dried, and exported in large bags or bales. It yields a fawn-colored powder of peculiar smell and acrid bitter taste. Its active principle is an alkaloid, *emetia*, which, when pure, is a white uncrystallizable powder, difficultly soluble in water, but soluble in alcohol. The common impure article of the shops is in transparent brownish-red scales, deliquescent, and very soluble in water and alcohol. Ipecac, locally, is mildly irritant, but some persons are so susceptible that merely opening a bottle of the powder will cause sneezing, and even an asthmatic seizure. Taken internally in minute doses, as one-sixth to one-fourth of a grain, ipecac, like other irritants, tends to increase the appetite and promote digestive vigor. In somewhat larger quantities it disturbs the stomach, and causes relaxation of the mucous membrane of the alimentary canal and air-passages, with accompanying increase of their secretions. In large dose it causes speedy vomiting and nausea, and a still greater effect on the mucous membranes just mentioned. Ipecac is accordingly used in small dose as a stomachic tonic, in somewhat larger as a relaxer of the dry and stiffened condition of the respiratory mucous membrane in the first stage of a catarrh, and in still larger doses as an emetic. With certain precautions the emetic effect even of a large dose may be avoided, and thus given ipecac is a valuable remedy in dysentery. Powdered ipecac and opium, 1 part each, and potassium sulphate, 8 parts, form the well-known "compound ipecac powder" or "Dover's powder." Edward Curtis.

Iphic'rates, b. about 419 B. C., was an Athenian general, and distinguished himself greatly in the Corinthian war (395–387 B. C.) by organizing a force of light troops, *peltastes*, with which he routed the Lacedæmonian army near Corinth in 392 B. C. After the peace of Antalcidas he went to Thrace, where he fought in the service of Cotys, whose daughter he married, and where he founded the city of Drys. In 377 he commanded the Greek auxiliaries who followed Pharnabazus, the Persian satrap, on his campaign against Egypt. A disagreement arose between the Greek and the Persian commanders, and Iphicrates fled to Athens, where Pharnabazus tried to arraign him for treachery, but failed. In the social war Iphicrates once more commanded the Athenians, but though successful, was again accused and acquitted. D. about 350 B. C. Cornelius Nepos has given a short sketch of his life.

Iphigeni'a, the daughter of Agamemnon and Clytemnestra. When the Greek fleet lay bound by a dead calm in the port of Aulis, the seer Calchas declared that the wrath of Diana was the cause of the calamity. Agamemnon had offended the goddess in former days by killing a stag in her grove, and in order to propitiate her he had vowed to sacrifice the most beautiful born to him within a year, but as this happened to be Iphigenia, he had not fulfilled the vow. Iphigenia was now brought to Aulis, but when carried to the altar to be sacrificed, Diana herself took her away and brought her to Tauris, where she officiated as priestess to the heaven-fallen image of the goddess. In after years Orestes, her brother, came to Tauris with the purpose of carrying away this image, but was captured and brought to the priestess to suffer death in atonement for his intended crime. The brother and sister recognized

each other, and fled with the divine image. This subject has been used by Sophocles, Racine, and Goethe for tragedies, and by Gluck for an opera.

Ipomœa. See JALAP.

Ipsambul. See ABU SAMBUL.

Ip′sara, or **Psara,** a small island in the Grecian Archipelago, W. of Scio, belongs to Turkey. It is rocky and barren, but was densely peopled and very prosperous before the Greek revolution; but having been taken by the Turks in 1824, its commerce was destroyed, its agriculture fell into decay, and its population decreased very much. At present its inhabitants live mostly by fishing.

Ip′sus [Gr. Ἴψους or Ἴψος], small town of Phrygia, Asia Minor, celebrated for the great battle fought there (B. C. 301) between King Antigonus and his son, Demetrius Poliorcetes, and the combined forces of CASSANDER, LYSIMACHUS, PTOLEMY, and SELEUCUS (see these names), in which Antigonus was slain and his dominions conquered. In the seventh and eighth centuries A. D. Ipsus was the seat of a Christian bishopric. It has been identified with the modern *Ipsili Hissar.*

Ips′wich, town of England, the capital of Suffolk, on the Orwell, which is navigable here for vessels of 200 tons burden. It has many good educational institutions, among which are a grammar school, founded by Cardinal Wolsey, who was born here, a mechanics' institution, and a workingmen's college; large iron and soap factories and extensive shipbuilding docks. Pop. 43,136.

Ipswich, town of Queensland, Australia, on the Bremer, was incorporated into a municipality in 1860, and is a growing and prosperous place. Pop. 5092.

Ipswich, tp. and post-v. of Essex co., Mass., 27 miles N. E. of Boston, on the Eastern R. R. and on Ipswich River, 3 miles from the sea, has manufactures of shoes, soap, boxes, hosiery, isinglass, 2 woollen, 2 planing, 3 saw, and 2 grist mills, a weekly newspaper, a public library, a ladies' seminary, savings bank, 6 churches, an insane asylum, and a house of correction. The taking of clams employs some 200 men. Pop. 3720.

E. L. DAVENPORT, ED. "CHRONICLE."

I′ra, tp. of St. Clair co., Mich. Pop. 1580.

Ira, post-tp of Cayuga co., N. Y. It contains 3 villages and 4 churches. Pop. 2014.

Ira, post-tp. of Rutland co., Vt., 5 miles S. W. of West Rutland. It has manufactures of lime. Pop. 413.

Irak′-Aj′emi, the central province of Persia, traversed by ranges of naked and barren mountains, which from the high Elboorz in the W. by degrees lower down into a desert table-land in the E. The valleys along the rivers, some of which lose themselves in the desert, are fertile, and the province contains several of the largest cities of the empire, such as Teheran, Ispahan, and Koom.

Irak′-Ar′abi, province of Asiatic Turkey, between the Tigris and Euphrates, and westward from the Euphrates to the desert. It contains the ruins of Babylon, Seleucia, and Ctesiphon, and is inhabited by nomadic Arabs. Cap. Bassora or Basra.

Iran. See PERSIA.

Iran′ians [from *Iran,* the native name of Persia], a branch of the Aryan or Indo-European family, now comprising the Persians, Armenians, Afghans, Kurds, and several isolated tribes in Beloochistan and India, the river Indus properly forming their eastern boundary, although the Parsees (so called from their Persian origin) are numerous in Bombay. Their original seat appears to have been near the sources of the Oxus, whence they spread in various directions, especially occupying the great plateau of Persia and the mountainous region of Armenia; they also penetrated Asia Minor, and during the flourishing period of the Persian empire dwelt as far N. as the Caucasus and established colonies in the Crimea. They intermingled with kindred tribes, and the modern Persians have a large infusion of Georgian and Circassian blood, so that their complexion is fairer and their features more regular than are found among the Afghans, who are probably the best type of the purely Iranic race, of which in ancient times the Medes and Persians were the most notable representatives. The Medes are the first Iranic race specially mentioned in history. According to Berosus, they were a powerful people as early as 2400 B. C., when a Median dynasty ruled in Babylonia: but at a later period this was expelled, and the Medes became, at least nominally, subject to the great Assyrian empire, from which they were the first of the subject tribes to revolt; and with this revolt Herodotus begins his history of the Median empire, whose limits do not appear to have been very accurately defined. In general, it may be said to have extended on the N. to the mountains near Atropatene, on the S. to Susiana, on the E. to the Caspian, and on the W. to the river Zagros, which separated it from Assyria and Babylonia. The ancient Persians were essentially identical with the Medes, though somewhat ruder; both were divided into various tribes and clans, the names of which, and little more, have been preserved by Herodotus. For the partial recovery of the ancient Iranic language we are mainly indebted to our knowledge of the Sanskrit. Its oldest phases lie buried in the sacred books of the Parsees and in cuneiform inscriptions of the time of Cyrus, Darius, and Xerxes. The name *Zend* has been improperly applied to this language; this properly belongs to a translation into the Pehlevi of the sacred book of the *Zend-Avesta;* recent German philologists style the language the Old Bactrian. The first attempt at a grammar of this language was made by Haug in his *Essays on the Sacred Language, Writing, and Religion of the Parsees* (Bombay, 1862); in 1864, Justi published a *Handbuch der Zendsprache,* in which he gave a lexicon of the Old Bactrian, to which valuable additions were made by Lagarde in his *Beiträge zur baktrischen Lexicographie* (1868); in 1867 appeared Spiegel's *Grammatik der Altbaktrischen Sprache.* The Pehlevi is Iranic, and was probably used as a literary language from about the third century; it is known through inscriptions, coins, and gems, and the translation of the *Avesta* and a few other religious books; it maintained itself until the development of the modern Persian, which is Iranic in its grammatic structure, but contains a large number of Arabic words. E. of the territory of modern Persia are the more purely Iranic dialects of the Afghans and Beloochees, and W. of these those of Ossetes, Kurds, and Armenians. The Iranians may be considered as the connecting link between the Indo-Europeans of Asia and Europe. A few of them are nomadic, but the majority are agriculturists, craftsmen, and traders. (See Spiegel's *Erânische Alterthumskunde,* Leipsic, 1871–73.)

I′rasburg, tp. and post-v., county-seat of Orleans co., Vt. It has a national bank, manufactures of lumber, and the county buildings. It is 42 miles N. N. E. of Montpelier. Pop. 1085.

Irbit′, town of Russia, in the government of Perm, at the confluence of the Irbit and the Nisa. It is famous for its annual fair, held in the months of February and March, and attended by a great number of European and Asiatic merchants. It is the largest fair in Russia, next to that of Nishni-Novgorod, and goods from China, India, Persia, and Europe to the value of $25,000,000 are brought together and disposed of. Pop. 3400.

Ire′dell, county in the W. of North Carolina. Area, 600 square miles. It is hilly, fertile, and well watered and timbered. Gold is found in some parts. Cattle, grain, tobacco, and wool are staple products. The county is traversed by the Western R. R. of North Carolina. Cap. Statesville. Pop. 16,931.

Iredell (JAMES), b. at Lewes, Sussex co., England, Oct. 5, 1751, and settled in North Carolina in 1768; was admitted to the bar in 1770, took an active part in the cause of independence, was elevated to the judicial bench in North Carolina in 1777, and in 1790 was appointed one of the associate justices of the Supreme Court of the U. S. He was a man of extensive learning and great ability. He published in 1790 the *Laws of North Carolina 17–1590.* D. at Edenton, N. C., Oct. 20, 1799. A. H. STEPHENS.

Iredell (JAMES, JR.), son of James Iredell, b. in North Carolina Nov. 2, 1788, at Edenton; graduated at Princeton; was a member of the State legislature for a number of years, and Speaker of the House part of the time. In the war of 1812 he commanded a company of volunteers who went to repel a threatened British invasion at Norfolk, Va. In 1819 he was appointed to the circuit court bench of his State. In 1827 he was elected governor of North Carolina, and was U. S. Senator from that State 1828–31. After this he was a reporter of the decisions of the State supreme court, publishing thirteen volumes of law and eight of equity reports. D. at Raleigh, N. C., Apr. 13, 1853.

A. H. STEPHENS.

Ire′land [Gr. Ἰουερνία, Ἰέρνη; Lat. *Hibernia, Ibernia, Iverna, Juverna;* Celtic or Erse, *Ierne, Erin*], the second largest of the British isles (see GREAT BRITAIN), lies between lat. 51° 28′ and 55° 23′ N., and lon. 5° 20′ and 10° 26′ W. of Greenwich. It is washed on three sides by the open Atlantic, and separated from Great Britain by the Irish Channel or Sea. Its greatest length is 303 miles, its greatest breadth 177, and it has an area of 32,285 square miles, exclusive of that of 196 smaller islands belonging to it, whose area is 246 square miles.

Relief.—By far the greater portion of the island consists of a level or undulating plain, filling up nearly the whole

centre from sea to sea, and consisting to a great extent of bogs, which are incapable of cultivation and impart a dreary aspect to the country. The most extensive of these bogs is that of Allen. The hills generally rise in isolated groups near the sea. If we assume the waters of the ocean to rise to the extent of only 500 feet, they would cover 77 per cent. of the entire surface, and the hills would rise above them in the shape of more than 100 islands, encircling a shallow central sea. The most elevated of these mountains are in South-western Ireland, where the Carn Tual rises to a height of 3404 feet. The Wicklow Mountains near the E. coast culminate in the Lugnaquilla (3039 feet). In Mayo the mountains attain a height of 2638 feet; in the N. of Ireland they rise to 2228 feet (Mount Sawel), and in the county of Antrim to 1802 feet (Mount Trostan).

Hydrography.—The rivers of Ireland flow for the greater part through plains, enlarging sometimes into lakes, and navigable in several instances almost to their source. The Shannon is the most important amongst them. It rises in the county of Cavan at an elevation of 345 feet above the sea, and enters the sea below the city of Limerick. It forms several lakes, amongst which Loughs Allen, Ree, and Derg are the most important, and is navigable as high up as the former, a small portion above Limerick excepted, where navigation is obstructed by the rapids of Doonass. It frequently inundates the surrounding country, in spite of expensive engineering works erected to regulate its course. The Lee is only a small river, but forms the important harbor of Cork. The Barrow enters the sea at Waterford, and is navigable as far as Athy, whence there is a canal to Dublin. The Liffey is remarkable solely because it enters Dublin Bay. The Boyne is the most important river on the E. coast of Ireland. It is celebrated on account of the battle of the Boyne (1690), but navigable only for 20 miles above its mouth. The Bann rises in the Mourne Mountains, and after a course of 40 miles it enters Lough Neagh. It leaves that lake at the north-western corner, and enters the sea below Coleraine. Owing to its rapid course it is navigable only in parts. The Foyle flows into a bay on the N. coast of Ireland, 6 miles below Londonderry. The Erne forms several important lakes, and is navigable almost throughout its entire length. The Corrib forms the discharge of Lough Corrib, and enters the sea at Galway, on the W. coast of Ireland. A subterranean river, 5 miles in length, connects Lough Corrib with Lough Mask. Ireland abounds in lakes. The most important amongst them are Lough Neagh (158 square miles), in the north-eastern part of the country; the lower Lough Erne (43 square miles); Lough Mask (34 square miles); and Lough Corrib (68 square miles); Loughs Derg (36 square miles) and Ree (50 square miles).

Climate.—The temperature of the central part of the country has been estimated at 50° F., that of the S. at 51.5°, and of the extreme N. at 48.5°, the difference between N. and S. thus only amounting to 3°. The mean temperature in winter is 41.5°, in spring 47°, in summer 60°, and in autumn 51° F. The temperature is thus even more equable than that of the British Isle, a feature to be traced to the influence of the Atlantic, which is likewise answerable for the greater amount of rain which falls throughout Ireland, and for the greater moisture of the air. These circumstances are most conducive to a luxuriant vegetation, and the name "Emerald Isle" is perfectly appropriate; but they interfere to some extent with agricultural operations. The average rainfall throughout Ireland may be estimated at 40 inches annually; in the W. and S., and particularly in the hills of Kerry, it is greatly in excess of this, but on a portion of the eastern coast it hardly exceeds 25 inches.

Geology.—Ireland may be divided geologically into three regions—viz. the great central plain, Northern Ireland, and Southern Ireland. The whole of the former is occupied by Carboniferous limestone, except where older rocks lie on the surface. It is covered with drip, peat-moss, and fresh-water marl, in which the fossils of animals not long extinct have been discovered. In Northern Ireland the Silurian formation is the most prominent. It may be looked upon as a continuation of the same formation in Scotland, and is intruded by granite and basalt, the latter forming the Giant's Causeway on the N. coast. Permian, Cretaceous, and Triassic rocks likewise occur in that part of the country, the latter near Belfast containing beds of gypsum and rock-salt. South-eastern Ireland consists mainly of Cambrian rocks, equivalent to those of South Wales, upon which the lower Silurian strata (flags and slates) rest unconformably. In Kerry and Cork the sandstones and slates of the Devonian age are most prominently represented.

Population.—In no country of Europe has there been exhibited within a recent epoch so vast an increase in the population, succeeded by an even vaster decrease, than in Ireland. In 1750, Ireland had a population of 2,372,634 inhabitants. In 1811 this population had increased to 5,937,856, and it continued to increase until 1841, when it numbered 8,175,124 souls. But then came a potato famine; thousands died of starvation, and an immense impulse was given to emigration. In 1851 there were only 6,552,385 inhabitants; in 1861, 5,792,055; in 1871, 5,412,377. The decrease is still going on at the present time, though at a less rapid rate than formerly. It was due, in the first instance, to famine, but is now brought about entirely by emigration. Irish emigrants not only cross the ocean in search of a new home, but they have likewise invaded Great Britain, much to the annoyance of the native working population, upon whose wages this immense influx of unskilled labor has exercised a considerable influence. (See GREAT BRITAIN.) Between 1851 and 1861, 1,149,118 persons emigrated from Ireland; between 1861 and 1871, 768,859 persons, exclusive of those who merely crossed over to the sister island. The population of the counties of Ireland in 1871 was as follows:

County.	Area, in acres.	Population.
Carlow	221,343	1,339,451
Dublin	226,895	51,650
Kildare	418.497	405,262
Kilkenny	509,732	83,614
King's county	493,985	109,379
Longford	269,409	75,900
Louth	202,124	64,501
Meath	579,861	84,021
Queen's county	424,854	95,558
Westmeath	453,468	79,771
Wexford	576,588	78,432
Wicklow	500,178	132,666
Leinster	4,876,934	1,393,485
Clare	827,994	147,864
Cork	1,849,685	517,076
Kerry	1,185,918	196,586
Limerick	680,842	191,936
Tipperary	1,061,731	216,713
Waterford	461,552	123,310
Munster	5,483,206	1,393,485
Antrim	763,749	420,170
Armagh	328,086	179,260
Cavan	477,394	140,738
Donegal	1,197,154	218,334
Down	610,740	277,294
Fermanagh	457,369	92,794
Londonderry	522,315	173,906
Monaghan	319,742	114.969
Tyrone	806,657	215,766
Ulster	5,483,206	1,833,228
Galway	1,566,352	248,458
Leitrim	392,363	95,562
Mayo	1,367,618	246,030
Roscommon	603,955	140,670
Sligo	461,753	115,493
Connaught	4,392,041	846,213
All Ireland	20,819,903	5,412,377

The following were the towns having more than 10,000 inhabitants—In Leinster: Dublin, 254,808; Drogheda, 14,740; Kilkenny, 12,174; Wexford, 111,734; Dundalk, 10,428. In Munster: Cork, 78,642; Limerick, 39,353; Waterford, 23,349; Clonmel, 10,112; Queenstown, 10,334. In Ulster: Belfast, 174,412; Londonderry, 25,242; Newry, 13,364; Lurgan, 10,632. In Connaught: Sligo, 10,670; Galway, 15,597. The majority of the inhabitants of Ireland are of Celtic race, and the earlier English immigrants have completely amalgamated themselves with them. In the N. E. of Ireland, however, there are numerous English and Scotch settlers, who, being Protestant, exhibit a certain amount of antagonism to the remainder of the population. It is amongst these Irish Protestants that Orange lodges recruit their members, though of late years, and much to the credit of the people, religious animosities appear to be dying out. The English language is spoken throughout the country, but Irish (in 1871) is still spoken by 817,875 persons (330,211 in Connaught, 386,494 in Munster, 84,923 in Ulster, and 16,247 in Leinster). No less than 103,562 persons speak Irish only.

Agriculture.—The climate of Ireland is more favorable to cattle-breeding than to the cultivation of cereals. The system of cultivation leaves much to be desired, though agricultural schools have been established since 1838 in all parts of the country. The Irish generally refer their inferiority in these respects to absentee landlords and the uncertainty of tenure; and although due weight should be given to these causes, there is no doubt that local causes, such as the excess of small buildings as well as difference of race, have had some effect. In these respects the Irish land act, one of the measures for the relief of Ireland passed recently by the British Parliament, should be productive of much good. It places the Irish cultivator in a far better position than the Scotch and English farmers, secures fixity of tenure, provides compensation for inexhausted

improvements, and even facilitates the conversion of leaseholds into freeholds. The following are the agricultural statistics for 1860 and 1873:

	1860. Acres.	1873. Acres.
Wheat	469,642	168,435
Oats	1,961,384	1,510,089
Barley	180,964	230,188
Bere and rye	12,822	9,240
Beans and peas	12,745	12,872
Potatoes	1,171,837	903,282
Turnips	318,091	347,904
Beet and mangold	32,060	38,182
Cabbage, etc	44,362	59,677
Vetches and rape	40,533	23,375
Flax	128,444	129,432
Meadow and clover	1,594,486	1,837,483
Total under crops	6,967,970	5,270,159
Fallow	36,295	13,474
Woods and plantations	319,009	323,783
Permanent pasture	9,490,000	10,420,695
Bog and waste	3,512,428	4,297,582
Water	494,199	494,199
Total area	20,819,892	20,819,892

There can be no doubt that the cultivated land has decreased since 1860, but not in the same rate as the population, whilst not much weight can be placed upon the different areas given for pastures and waste lands, as these are elastic terms. The live-stock of Ireland (in thousands) was as follows:

	1860.	1865.	1870.	1874.
Horses	621	548	533	526
Cattle	3,599	3,498	3,800	4,118
Sheep	3,538	3,694	4,337	4,438
Pigs	1,269	1,305	1,461	1,096

These figures sufficiently attest the general and increasing prosperity of the country.

Fisheries.—The Irish fisheries were far more important formerly than they are now. In 1861 they employed 12,035 boats, manned by 48,000 men and boys; in 1873 only 8450 boats. The decrease is due to emigration and the great demand for seamen. The Irish rivers swarm with salmon, and the surrounding coasts with cod, ling, hake, herrings, pilchards, etc., yet Irish markets are being supplied with cured fish from Scotland and the Isle of Man.

Mining.—The mining industry of Ireland is of very subordinate importance. In 1871 there were only 2852 miners, engaged in coal, iron, lead, and copper mines, and in the salt-works near Belfast. Other metals, including gold and silver, occur.

Manufactures.—Ireland is not a manufacturing country, as may clearly be perceived on referring to the statements given under Great Britain. The only manufacture of any extent is that of linen, of which Belfast is the centre. The whole of the textile industry of the country is carried on in 243 factories, having 1,052,705 spindles and 18,630 power-looms, and employing 61,842 hands (according to the census the textile industries employ 171,526 hands).

Commerce.—Ireland in 1874 had a mercantile marine of 1761 sea-going vessels, of a capacity of 214,302 tons. The direct trade with foreign countries is comparatively trifling, as the greater part of the trade is carried on through English and Scotch ports. The direct imports of foreign and colonial merchandise have a value of about £12,000,000; the direct exports of Irish produce do not exceed £180,000. The principal seaports are Dublin, Cork, Belfast, Waterford, and Limerick. There is no satisfactory record of the trade with England, but the principal exports consist of cattle, sheep, horses, butter, bacon, and other agricultural produce, porter, whisky, and linen goods.

Religion and Provision for its Support.—According to the census of 1871, there were 4,150,867 Catholics (76.7 per cent.), 667,998 Protestant Episcopalians (12.1 per cent.), 497,648 Presbyterians (11.2 per cent.), 43,441 Methodists, 48,218 other dissenters, 3814 Quakers, 285 Jews, and 106 deists, etc. The bulk of the population is therefore Catholic, and the existence of an established Protestant Church in connection with that of England has always been looked upon as a grievance. In 1869 this Church was disestablished and disendowed, but annuities and compensations have been granted on so liberal a scale that only a comparatively trifling sum will remain after all liabilities have been met. After a payment of £500,000 to the disestablished Church in lieu of its private endowment, £372,332 to the Catholic Maynooth College, and £90,000 to nonconformist bodies, there remained, on Jan. 1, 1875, property valued at £16,750,000 and producing £629,622 a year. Liabilities (annuities, etc.) are estimated to swallow up £11,560,000 of this amount, and there will thus remain £5,190,000, which are to be devoted to educational and other purposes.

Education.—A system of national education was inaugurated in 1845, but as these national schools are not denominational, they have never been supported as heartily by the ministers of different religious bodies as they ought to have been, and the education of the people has suffered accordingly. In 1873 no less than 976,696 children attended these schools, but only 355,882 did so more than 90 times during the year. The Roman Catholic pupils constituted 79.5 per cent. of the whole number. There were 9802 teachers and 381 work-mistresses, whose united salaries amounted to £501,054. According to the census of 1871, there were 9495 primary schools, attended by 615,785 pupils, and 587 superior schools, attended by 25,055. Amongst the superior schools Trinity College at Dublin and the Queen's Colleges at Cork, Galway, and Belfast are the most important. These institutions are open to all alike, without reference to religious creed. There is likewise a Roman Catholic university. Maynooth College is the principal institution for the training of priests.

History.—According to tradition, Ireland was inhabited originally by Firbolgs and Danauns, who were eventually subdued by Milesians or Gaels. We know next to nothing respecting Ireland for any period antecedent to the fourth century. At that time the inhabitants of the island were known as Scoti, and they made descents upon the Roman province of Britannia and Scotland, and even upon Gaul. Christianity was introduced in the course of the fifth century, when St. Patrick was the chief apostle of the new faith, and in the sixth century missionaries went forth from the Irish monasteries to convert Great Britain and the nations of Northern Europe. At this early period Ireland appears to have been divided among numerous clans, who owned allegiance to four kings, and to an ard-righ, or monarch, to whom the central district called Meath was allotted. The incursions of the Scandinavians, which began in the eighth century and continued for 300 years, checked the progress of civilization of Ireland. They established themselves on the eastern coast, whence they made predatory incursions into the interior of the country, until they were overthrown at the battle of Clontarf, near Dublin (1014), by Brian Borumha, the "monarch" of Ireland. From the eighth to the twelfth century Irish scholars enjoyed a high reputation for learning, the arts were cultivated, and the round towers are believed to be remains of the architecture of that period. In 1155, Pope Adrian IV. authorized Henry II. of England to take possession of Ireland on condition of paying an annual tribute. In 1172, Henry made his first descent upon Ireland. He received the homage of a number of chiefs, and authorized certain Norman adventurers to take possession of the entire island in his behalf. In the course of the thirteenth century these Norman barons, favored by dissensions amongst the natives, had succeeded in firmly establishing their power, but in the course of time their descendants identified themselves with the natives, even to the extent of adopting their language. At length, the power of England became limited to a few coast-towns and to the districts around Dublin and Drogheda, known as the "Pale." In 1541, Henry received the title of "king of Ireland" from the Anglo-Irish Parliament, then sitting at Dublin, and several of the native princes acknowledged him as their sovereign. The attempt to introduce the Reformed faith led to repeated revolts, which were suppressed, and the lands of the rebellious chiefs parcelled out amongst Protestant Scotch and English settlers. The so-called "Plantation of Ulster" took place in this manner under James I. In 1641 the Irish rose in rebellion and massacred the Protestants, but they were most severely punished by Cromwell, who overran the country in 1649. At the Revolution the native Irish generally sided with James II., the English and Scotch "colonists" with William and Mary, and the war was not terminated until 1692. Penal statutes were then passed against the Catholics, and the general dissatisfaction gave rise to numerous secret societies and to a rebellion in 1798, which was not suppressed till 1800. On the 1st of January of the following year the Irish Parliament was suppressed and incorporated with that of Great Britain. From that year dates the existence of a United Kingdom of Great Britain and Ireland. E. G. Ravenstein.

Ireland (William Henry), b. in London in 1777, son of Samuel Ireland, an engraver and author, who published several works of travel and *Graphic Illustrations of Hogarth* (1794–99). He was apprenticed to a conveyancer, and having accompanied his father upon a visit to Stratford-upon-Avon, he forged a lease containing the pretended signature of Shakspeare, which he said he had discovered among some old law-papers. He afterwards executed other similar forgeries, and produced *Vortigern*, a tragedy purporting to have been written by Shakspeare, which was acted at Drury Lane Theatre, Kemble playing the principal part; this, with *Henry II.*, another forgery, was published in 1799. The fraud was soon exposed, and he abandoned his profession, devoting himself to literary pursuits, writing several novels and *The Neglected Genius*,

a poem (1812). His *Confessions* (1805) contain a full account of his various forgeries: a new edition, with an introduction by Richard Grant White, was published in New York in 1874. D. Apr. 17, 1835.

Irenæ'us, one of the most distinguished of the early Church Fathers, b. in Asia Minor or Syria in the first half of the second century, probably between 120 and 140 A. D., and enjoyed as a young man the instruction of Polycarp, the disciple of John and bishop of Smyrna. He went afterward to Gaul, and was a presbyter at Lyons in 176, in which year he visited Rome. In 177, Photinus, bishop of Lyons, suffered martyrdom, and Irenæus succeeded him in the episcopal office. His energy and zeal in building up the Christian Church in Gaul are highly praised by his contemporaries, but more particular events of his life are not recorded. Some have supposed that he suffered martyrdom in the persecutions under Septimius Severus, but as neither Tertullian nor Eusebius mentions any such event, it must be considered very doubtful. His position in the Church Schaff defines as "the leading representative of the Asiatic Johannean school in the second half of the second century, the champion of Catholic orthodoxy against Gnostic heresy, and the mediator between the Eastern and Western churches. He united a learned Greek education and philosophical penetration with practical wisdom and moderation, and a just sense of the simple essentials in Christianity." Of his writings only the *Adversus Hæreses* has come down to us, and this only in a rather uncouth Latin translation, but, such as it is, it is of great importance for the understanding of the movements in the early Christian Church. The best editions of the book are that by Stieren (Leipsic, 1853) and that by Harvey (Cambridge, 1857).

Ire'ne [Gr. Εἰρήνη, "peace"], an empress of Constantinople, b. at Athens about 752, at seventeen became wife of Leo, son and heir of Constantine V., and upon his death in 780 was named in his testament as ruler during the minority of their son, Constantine VI., then nine years of age. In 786 she called a council at Constantinople to restore the images which had been banished from the churches; but this being interrupted by the soldiery, she in the following year summoned another at Nicæa in Bithynia, at which the veneration of images was declared to be consonant with Scripture, reason, and the Fathers and councils. Her son was induced by his favorites to throw off the maternal yoke and proclaim himself emperor. Irene was secluded in one of her palaces, but conspiracies were formed for her restoration. In 797 an attempt was made to assassinate Constantine, but he escaped to Phrygia, where he was rejoined by his mother, who persuaded him to return to Constantinople, where he was seized by the emissaries of Irene and his eyes put out. She then ruled rigorously for five years, but the eunuch Nicephorus, her grand treasurer, having been secretly invested with the purple, arrested Irene, seized all her treasures, and banished her to the island of Lesbos (802), where she gained a scanty livelihood by spinning. D. Aug. 15, 803.

Ire'ton (HENRY), b. at Attenton, Nottinghamshire, England, in 1610; studied law at Oxford, and took a conspicuous part in the great civil war, becoming one of Cromwell's generals. In 1646 he married Bridget, daughter of the future Protector. Ireton was taken prisoner at Naseby by Prince Rupert, but rescued the same day; he signed the death-warrant of Charles I., and accompanied Cromwell to Ireland in 1649. On the latter's return to England in 1650 the prosecution of the conquest of Ireland was entrusted to Ireton, and prosecuted with vigor, not unmixed with cruelty. D. of the plague before Limerick Nov. 15, 1651, and was buried in Westminster Abbey, whence his remains were exhumed at the Restoration and burned at Tyburn. He left one son and four daughters.

Irida'ceæ [so named from the typical genus, *Iris*], an order of the petaloideous division of monoctyledonous or endogenous plants, distinguished by having only three stamens, alternate with the inner divisions of the adnate perianth and extrorse anthers; and the leaves are almost always equitant. Some have tuberous root-stalks, others solid bulbs or corms. The juice in all is acrid. The principal economical products of the order are orris-root, from one or more species of *Iris*, and SAFFRON (which see), the deep orange-colored stigmas of *Crocus sativus*. The order is mainly notable for the ornamental flowers it furnishes, such as those of *Iris*, *Gladiolus*, *Tigridia* (or tiger-flower), and *Crocus*. Irises are dispersed over the northern temperate zone, crocuses belong to the Old World, but far the greater part of the order, especially those with solid bulbs, belongs to the Cape of Good Hope. ASA GRAY.

Irid'ium [Lat. *iris*, *iridis*, the "rainbow"], one of the rare metals of the platinum group, was recognized as a distinct element by Tennant in 1804. It takes its name from the iridescence of its solutions. It has not been found in a pure state, but is usually combined with osmium, forming the mineral species known as iridosmine, and with platinum giving the species platiniridium, also in small quantity with palladium and with native platinum. It occurs with these metals in varying, apparently indefinite, proportions. It is regarded as isomorphous with osmium, the percentage varying from 43 to 77, and in the platinum alloy to range from 20 to 77 per cent. It is difficult of separation in a pure state from these metals, and processes for its extraction, especially from osmium, have engaged the attention of many of the most distinguished chemists. Persoz (*Ann. de Chimie et de Physique*, lv. 210) converts the metals into sulphide by ignition in an earthen crucible with carbonate of soda and sulphur. Wöhler recommends (*Pogg. Annalen*, xxi. 161) the ignition to redness of the powdered alloy with common salt in a porcelain or glass tube through which a current of dry chlorine gas is passed as long as it is absorbed. The resulting chlorides are dissolved in boiling water; the solution is concentrated and distilled with nitric acid, by which the osmium is removed as osmic acid, leaving the iridium in solution. It is precipitated by chloride of ammonium, and the ignition of this precipitate yields metallic iridium. Fremy roasts the ore in a current of oxygen at a red heat, by which the osmium is partly removed as osmic acid, and the remainder, after fusion with nitre, is distilled with nitric acid. (*Comptes Rendus*, xxxviii. 1008.) Claus (*Beiträge zur Chemie der Platin-metalle*, Dorpat, 1854) fuses 1 part of the ore with 1 part of caustic potash and 2 parts of saltpetre. After pouring out and cooling, the fused mass is digested for twenty-four hours in cold water. Osmate and ruthenate of potash are dissolved, and are drawn off by a syphon. The portions of undecomposed ore are subjected to a second fusion after separation by washing from the insoluble black powder, which consists chiefly of the oxides of iridium, rhodium, and platinum. Prof. Wolcott Gibbs, who has made extended investigations of the chemistry of the platinum metals (*Smithsonian Contributions*, xii., and *Am. Jour. Sci.*, xxix., May, 1860; xxxi. 63; xxxiv. 342; xxxvii. 57), employed this method with several essential modifications. He first fuses the ore with three times its weight of dry carbonate of soda, in order to remove the silica and other impurities. He reduces the osmate of potash obtained by the fusion with nitre and potash to osmite by boiling it in a mixture of alcohol and water. The ruthenate of potash is completely decomposed. The undissolved portions are well washed with a saturated solution of chloride of potassium. The platinum and iridium exist in the mass in the form of bichlorides, and their separation is effected by the employment of the alkaline nitrates, advantage being taken also of the different degrees of solubility of the double chlorides of the platinum and alkaline metals. For the details of this and of the other methods reference is made to the memoirs cited. In all these operations great care must be taken to avoid the poisonous vapors of osmium. Deville and Debray have also published an important memoir on this subject. (*Ann. de Chimie et de Physique*, 3d, lvi. 385.)

Iridium may be fused in the flame of the oxyhydrogen blowpipe or by the voltaic current, giving a hard, brittle, silvery-white metal, with a specific gravity of 21.15. When pure it is not acted on by acids or by aqua-regia, but is readily dissolved by the latter when alloyed with platinum. In its powdered state it is the best material for giving a pure black upon porcelain, and is largely used for this purpose. The black powder known as "iridium-black" is obtained by decomposing a solution of iridic sulphate by alcohol. It is similar to platinum-black in its action upon gases, and will ignite alcohol. An artificial alloy is formed by fusing iridium with platinum, which has valuable properties for many purposes in the arts, but particularly for bushing the vents of heavy ordnance. It is both hard, resisting wear, and indestructible by the gases of the powder. Specimens of this alloy in ingots three inches or more in length were exhibited at Paris in 1867 by Messrs. Johnson, Matthey & Co. of London, known as "Matthey's alloy." One vent shown had fired 3000 rounds from a Whitworth cannon without appreciable wear. WILLIAM P. BLAKE.

Iridos'mine, a native alloy of iridium and osmium, of great hardness and weight. It is usually in irregular flattened grains and scales rarely broader than the head of a pin, and has a tin-white or steel-gray color and metallic lustre. But the grains vary in size and form in different localities, and even from the same locality, to such a degree as to indicate a great difference in the chemical composition. It is also obtained as a heavy gray powder, and some samples resemble a fine gray metallic sand. Hexagonal crystals have been observed. It is as hard as quartz, and its gravity ranges from 19.3 to 21.12. It is found generally with native platinum, and with placer-gold, but usually in small quantity compared with the bulk of the gold. Nearly all of the gold-regions have yielded more or less of

this mineral, it having been obtained in the Urals, California, Australia, South America at Choco, in Japan, and elsewhere. In California it is more abundant in the northern counties than in the middle or southern, and it is most abundant in the beach-sand deposits of the northern coast at and near Port Orford. According to Dr. Torrey, for a year or two after the establishment of the U. S. assay-office in New York the proportion of iridosmine in the gold from California did not exceed half an ounce to $1,000,000. The quantity afterwards increased until the average was seven or eight ounces to the million of gold, but it afterwards fell off, showing great fluctuations, dependent, no doubt, upon the opening of new diggings. In melting large quantities of native gold this heavy mineral settles to the bottoms of the crucibles, and accumulates there. It was the practice at the New York assay-office to separate it from the gold by melting the gold with twice its weight of silver, allowing the iridosmine to settle, then pouring off the gold alloy. A mass containing nearly all of the mineral remained, and was separated by repeated fusions with silver and a final digestion in nitric and nitro-muriatic acid and washing. It has been found to accumulate similarly in the melting-pots used in California, and it is common to obtain it in the gold recovered from old crucibles and sweepings. It has been announced as occurring in the same way in the sweepings of the Japanese mint. It sometimes, however, eludes the care of mint-officers and finds its way into coin. Its presence in gold used by jewellers or in the arts is a great disadvantage, for it cannot be cut by a file or steel tools, and so renders the gold unfit for working. Such gold has to be remelted. The superior gravity of the grains of iridosmine carries them to the bottom. Analyses show that the percentage of iridium in samples from different countries varies from 43 to 77, and of the osmium from 17 to 48. Small quantities of platinum, rhodium, ruthenium, and other metals are usually present. A sample of the mixed metals brought from Port Orford, Cal., separated from the fine scale-gold by amalgamation, was found to contain nearly 49 per cent. of iridosmine and 43.54 of platinum.

The value of iridosmine in the arts is chiefly as a source of iridium and for tipping the nibs of gold pens, for which purpose its great hardness, and the fact that it can be attached to the gold by soldering, makes it peculiarly suitable. Grains of the proper form and hardness are much sought for by gold-pen makers. The flat scales are not so suitable as those which are more round and solid and of great hardness. They differ in appearance, as doubtless in composition, from the tabular crystals, and in the California mixtures of this mineral such grains do not usually constitute more than one-tenth of the whole, but sometimes the amount is as great as one-fifth. The pen-makers carefully select such grains. They are so minute that from 10,000 to 15,000 of them do not weigh more than an ounce. A cubic inch would weigh about eleven ounces, and at the price of $250 per ounce would be worth $2750. After these grains have been attached to the tips of the gold pens they are ground into the proper shape upon emery-wheels, and sometimes with great difficulty owing to their extreme hardness. WILLIAM P. BLAKE.

I′ris [so named from its various colors], in the eye, is a thin contractile curtain, nearly circular in outline, suspended in the aqueous humor between the cornea and the lens. It is perforated by an aperture called the pupil, circular in man and most of the Mammalia, elongated in the cat, the fox, the owl, and some other vertebrates. Its substance is partly fibrous, partly cellular (pigmentary), and partly muscular. The muscle-fibres are involuntary, some of them circular and sphincteric, and some radiating. The former contract, the latter dilate, the pupil under the varying stimulus of light. Opium and Calabar bean contract, while belladonna powerfully dilates, the pupil. In the fœtal state the pupil is closed by the *membrana pupillaris*, a temporary structure.

Iris [Gr. Ἶρις], in classic mythology, the daughter of Thaumas and Electra and sister of the Harpies. In the Homeric poems she appears as a virgin goddess, who acts as messenger of the gods among themselves, as medium of communication between gods and men, and as conductor of female souls to the shades. On vases and bas-reliefs Iris is represented as a youthful winged virgin, dressed in a long tunic, with a herald's staff and a pitcher in her hands. She is the personification of the rainbow as the messenger of peace; the name may be connected with εἴρω, "to join," and with εἰρήνη, "peace." In the later poets Iris appears as wife of Zephyrus and mother of Eros.

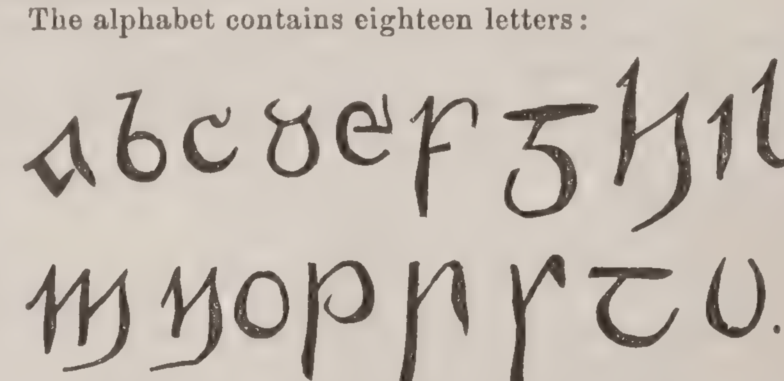
Iris [named for the goddess or the rainbow], the fleur-de-lys or flower-de-luce, the leading genus of the order IRIDACEÆ (which see), consists of numerous species of perennial herbs dispersed over the temperate regions of the northern hemisphere, all with showy flowers, several of them familiar and ornamental in gardens. They spring from root-stocks or tubers, or a few from bulbs. Their leaves are equitant and sword-shaped, and the flower is peculiar in having the three outer divisions recurved, while the three inner are incurved or erect, and the three branches of the style are large and petal-like, overarching the three stamens, which lie hidden underneath them. The violet-scented orris-root, used in perfumery and tooth-powders, is from *Iris Florentina*, and no less from *I. pallida* and *I. Germanica*, common species of flower-de-luce. All three are cultivated in the neighborhood of Florence for this purpose. There are several indigenous species in the U. S., of which *I. versicolor*, the common blue flag, is most abundant from Canada to Florida. ASA GRAY.

Iris (now *Kasalmak* or *Yekil Irmak*), the classical name of one of the largest rivers of Pontus in Asia Minor.

I′rish Cor′ner, tp. of Greenbrier co., W. Va. Pop. 840.

Irish Language and Literature. The Irish or Gaedhilic language is spoken in Ireland, in the Hebrides and Highlands of Scotland, and in the Isle of Man. It belongs to the Celtic group of the Indo-European tongues. Its relation to English is not greater than that of English to Italian, while it is related to Welsh in about the same degree that English is related to German. The word Erse is applied to that dialect of it spoken in Scotland, and is merely a form of the word *Erysche* or *Irysh*. Those who speak Irish, whether in Ireland, Scotland, or Man, call themselves the Gaedhel and their language Gaedhilic. A language spoken throughout a region including so many isolated districts has probably had several dialects from remote times, but these are of small literary importance and differ in no considerable degree. Till within the last 300 years the language of Gaedhilic books, wherever written, was almost uniform. Thus, Bishop Carsuel's prayer-book printed in Scotland in 1567 does not differ from books written at the same age in Ireland. At the present day the most distinct from pure Irish of Gaedhilic dialects is that of the Isle of Man. The Manx has a curious orthography, based upon Bishop Wilson's Bible, printed in 1755, and it contains a good many words borrowed from the Welsh and from the Northmen. The Gaedhilic of the mainland of Scotland differs from that of the isles, and the isles differ among themselves. In Ireland the dialect of the southern half differs from that of the northern; Connaught differs slightly from Ulster; Kerry from the rest of Munster. Underlying these trivial differences is a common grammatical structure.

The alphabet contains eighteen letters:



To these from an uncertain period names taken from trees have been given. Thus, A is *ailm*, the fir; G is *gort*, the ivy; R, *ruis*, the elder. The characters in which these letters are usually written are old forms of the Roman alphabet, and are found in Early Saxon as well as in early Irish MSS. The number of consonantal sounds is increased by aspiration, a process which may be applied to all the consonants but *l*, *m*, *r*. Thus, *t* aspirated becomes a slight guttural, and *c* aspirated a deep guttural. The system of aspiration, combined with that of eclipsis or silence of one consonant when preceded by another (as *ts*, pronounced *t*), affords the basis of the system of inflection so far as consonants are concerned. The vowels *a*, *o*, *u*, are called broad — *e*, *i*, slender. The alteration of broad syllables to slender and of slender to broad completes the means of inflection known to the language. Orthography and pronunciation are based upon a familiar rule, *caol le caol agus leathan le leathan* (narrow with narrow and broad with broad). This means that in the same word vowels of equal sound must be on opposite sides of a consonant. It is illustrated when English proper names are put into an Irish form; thus, Cromwell will not do, because *o* is broad and *e* slender, and it is made Cromaill. Irish has the usual parts of speech. It has two genders. There is one article *an* (the), and it is declinable and of two genders. Nouns when written alone are declined with terminal inflections. When preceded by the article they have also initial changes. Grammarians differ as to the number of declensions. Five are well established. The first is marked by an attenuation of the final syllable in the

genitive, as *bárd* (poet), gen. *báird*. Most of the masculine nouns are of this declension. Most feminine nouns belong to the second, which forms its genitive by the addition of a slender syllable, with consequent attenuation of the preceding syllable, as *cailleach* (hag), gen. *cailligh e*. The third declension forms its genitive by a broad increase, as *cath* (battle), gen. *catha*. The fourth declension has a peculiar plural, but shows no change in the singular, as *easba* (defect), n. pl. *easbaidhe*. The fifth declension forms its genitive by addition of *n*, as *meanma* (mind), gen. *meanman*. Adjectives are declined as nouns, and are compared by use of the genitive singular feminine and a prefix, as *geal* (white), *nios gile* (whiter). The pronouns in themselves have no peculiarity, but their compounds with prepositions form one of the chief idioms of the language. These compounds are used directly, as *Is maith an aire a thug si dhuit* (compound of *do*, to, and *tú*, thou)—"It was good the care which she gave to you"—*i. e.* "she took good care of you." To express possession, as *Leam sa an leabhar* (*le*, with, and *mé*, I)—"With me myself the book"—*i. e.* "the book is mine:" to complete a verb, as *Tá dúil agam an* (*ag*, at, and *mé*, I)—"It is a wish at me in it"—*i. e.* "I wish for it;" and in numerous other ways. There are also regular possessive and relative pronouns. Verbs are conjugated on one main plain. Their tenses and persons are formed by terminal and initial alterations of the root. There are two present tenses and two pasts. The second tense in each case, indicating action in a place, is called consuetudinal. Thus, root *glan-* (cleanse), active voice, pres. (1) *glanaim;* (2) *glanam mé;* past (1) *ghlanas;* (2) *ghlanainn;* future, *glanfad;* infinitive, *do ghlanadh;* passive voice, pres. (1) *glantar mé;* past (1) *glanadh mé;* past (2) *glantaoi me;* future, *glanfar;* conditional, *ghlanfaidhe mé;* past participle, *glanta;* inf. *do bheith glanta*. The imperative active is the root; the imperative passive is the same as the present passive. The consuetudinal present has a distinct form in the active only. There are several irregular or, strictly, compound or defective verbs. The main principle of the syntax is that the verb begins the sentence, as *D' ég ri Seamus agus ro ghab rí Cathal an righeacht i' n' inad*—"Died King James, and took King Charles the kingdom in his stead"—*i. e.* "King James died, and King Charles reigned in his stead." The subject comes next, and then the rest of the predicate. The adjective, with a few exceptions (as *sean bhean*, "old woman"), follows the noun, and its gender is marked by the affection of its initial, as *long mhór*, "great ship" (fem.), *fear mór*, "great man." Here the initial of the adjective is aspirated where the noun is feminine.

Irish prosody comprised several metres. They consist in various combinations of syllables with alliteration and vowel-rhyme, but, except accidentally, they do not show the English syllabic rhyme. The following example is from an ancient MS., and is the original of a well-known modern melody:

O Thoraigh co Cliódhna cais
Is fail óir aice re a hais
I ré Bhriain taoibhghil nar tim
Do thimchil aoinbhen Erim.

"From Tory Island to Cliodhna the pleasant,
And a ring of gold with her,
In the time of Brian, bright-sided, fearless,
Went around Erin a solitary woman."

Irish historians mention works written in pagan times in Ireland, and of these the most famous is the *Saltair of Para* by Cormac Mac Airt, king of Ireland from A. D. 227 to 266. It is stated to have consisted of metrical treatises on the laws and usages of Ireland. Of this and other early works no more than the titles remain. The earliest existing examples of Irish are glosses, chiefly on Latin MSS. of the Scriptures. These are found in codices of the eighth, and possibly of the seventh century. The libraries of Corpus and St. John's Colleges at Cambridge, of Milan and of St. Gall, contain examples. The glosses are sometimes of isolated words, but they are often long sentences, so that they illustrate completely the grammar of the Gaedhilic tongue at that remote period. A large collection of such glosses is to be found in Zeuss, *Grammatica Celtica*, in Nigra, *Milan Glosses*, and in Stokes, *Goidilica*. The writings of this period are marked, among other peculiarities, by the absence of the rule "broad to broad," etc., by indications of a neuter gender and of a dual number, and the language is called Old Irish. The next period is called the Middle Irish. To it the earliest complete works now existing belong. It fades gradually into the modern form of the language, which has been established without material change for about 400 years. It is to be borne in mind that the absence of works altogether in the oldest Irish is shown not to be due to the intellectual torpor of its age, but to the fact that important compositions of Irishmen of that day remain in Latin. Thus, the wonderful life of St. Columb Cille by St. Adamnan exists in MS. dating from the period of its composition, the seventh century. The oldest book altogether in the Irish language is called *Leabhar na h-Uidhri*. The original composition is referred by historians to the sixth century, and to St. Ciaran, abbot of Cluain-mic-Nois, but the MS. now preserved, no doubt a copy from an older one, was written about the year 1100 by Moelmuiri mac Ceileachair. This venerable MS. is in fair preservation, and may be seen in the Royal Irish Academy, Dublin. It is a collection of heroic tales, with a few pieces of other character, such as an account of the royal burying-places of Erin, a sermon on the Resurrection, and one on the day of judgment. From the thirteenth century onward MSS. exist in large numbers. They are usually collections of treatises made by learned individuals or by communities. Divinity, law, physic, poetry, history, romance succeed one another, with no further sign of divission than an ornate initial where each subject begins. The *Leabhar Breac*, or "Speckled Book," written by the Mac Egans, the *Book of Leinster*, and the *Book of Ballymote* are examples. In each case the book is a body of transcription, the editors being merely the copiers of earlier MSS. The period of collections of this kind is succeeded by that of separate works. The *Annala Rioghachta Eireann*, commonly called the "Annals of the Four Masters," Dr. Keating's *History of Ireland*, and the several works of Mac Firbis are examples in the seventeenth century. Printing in the Irish language did not begin till the third quarter of the sixteenth century, and the earliest specimen is a poem preserved in the library of Corpus College, Cambridge. After that time numerous books were printed in Irish in Dublin and on the continent of Europe. All the earlier and most of the later books are printed in the Irish character. The first Irish book printed in English type is a catechism for the island of Rathlin, published about 1730. At the present day, excepting ancient works edited by scholars, the production of books in Irish is limited to a few translations, prayer-books, and now and then a little verse.

Turning from the actual MSS. and printed books to their subject-matter, Irish literature is found to have a wide range. Most works on divinity were written in Latin, but a great collection of sermons and of hymns, some very old and curious, and innumerable lives of saints, exist. In this class two remarkable examples may be mentioned—the *Amhra Choluim Chilli* and the *Félire of Aengus*. The former was composed in the sixth century by Dallan Forgaill, chief poet of Ulster, and is a poem on the death of St. Columb Cille. The latter is also a poem, and is of great length. After a preface explaining its origin, it recounts the saints of Erin and some of the greater saints of the Church at large, and their glories. Its intrinsic merits are the simplicity of its thoughts, the purity of its devotion, and the richness of its imagery; and it is besides valuable from its numerous allusions to historical and topographical points. The old MSS. contain a large number of legal treatises. From the extreme terseness of their style and their frequent use of obsolete words these works are peculiarly difficult to translate. The best known are the *Senchus Mór* and the *Book of Aicill*. These are collections of legal maxims, of illustrative cases, of judgments and of principles on several branches of law, as on land-tenure, on wrongs and their remedies, and on social relations. The committal of the *Senchus Mór* to writing is referred by Irish historians to the fifth century. From the Irish word *breitheamh* (a judge) these treatises are often called Brehon laws. They are of profound interest, as showing the growth and history of a very ancient system of jurisprudence, influenced in no important particular by the Roman code. In historical romance Irish literature is particularly rich. The most famous of the old tales is the *Tain Bo Cuailgne*. It tells of a war originating in strife about the finest white bull in Ireland. The men of Connaught invade Ulster, and the incidents of the war form a large part of the tale, and especially the feats of the great champion of Ulster in the first century, Cuchullain. The tale ends with the bull rushing against a rock and dashing out his brains. Many tales recount the deeds of heroes and saints, the courtships of the beauties of old by rival champions, elopements, wars, travels. The *Voyage of Maelduin's Corach* describes an early voyage and discovery of land in the far West, which some late writers have thought to indicate a discovery of America. Of history one of the earliest and most valuable works is *Cogadh Gaedhel re Gallaibh*—the "war of the Irish with the Danes." This was probably written by one who lived in the last days of the wars, and may have been at the battle of Clontarf in 1014. The *Annals of the Four Masters* is a history based upon ancient records. Michael O'Clery was its chief editor, but several other Franciscans took part in the work. It extends from the earliest times to 1616, and is a vast and, for the most part, reliable source

of information. The earliest translations into Irish are of pieces of the Scriptures. In the fourteenth century the travels of Marco Polo and numerous works on medicine were translated into Irish, and later the English version of the Bible, the *De Imitatione Christi*, and other devotional works, while in this century some of Miss Edgeworth's tales have appeared, and Dr. MacHale has given the *Iliad* and several of Moore's melodies. In the last century and the one before a great many songs were written, and a few novels. Hardiman's *Irish Minstrelsy* contains a collection of such songs. Some are pleasant, but many have more merit in their simple, lovely airs than in their words. The Irish language has for centuries been systematically attacked by the English rulers of Ireland, and these efforts have at length succeeded in putting an end to its production of literature. It is to be feared that its life is almost at an end, and that in two centuries, at the longest, the air of Ireland will no more convey Gaedhilic tones, and her people no longer use the speech which for 3000 years expressed the thoughts of their ancestors.

The best grammar of modern Irish is that of O'Donovan; of ancient Irish, Zeuss. A grammar by John O'Nolloy contains an excellent account of the differences of the provincial dialects. The best dictionaries are those of O'Reilly, O'Brien, and MacCurtin. O'Curry's *Lectures on the MS. Materials of Irish History* is a useful introduction to the literature. On the ecclesiastical literature, Dr. Reeve's edition of Adamnan's *Life* of St. Columb Cille, and the somewhat rare works of Colgan, should be consulted. The publications of the English record-office, of the Irish laws commission, of the Irish Archæological Society, of the Ossianic Society, of the Celtic Society, of the Royal Irish Academy, and of the Royal Archæological Association of Ireland, contain numerous important works in the language, translated and edited by competent scholars. (For the best account of early Irish (Brehon) laws and institutions see Sir Henry Sumner Maine's recent work, *Lectures on the Early History of Institutions*, 1874.)

NORMAN MOORE.

Irish Moss. See CARRAGEEN.

Irish Sea, The, is situated between Ireland and Great Britain, and connected with the Atlantic, S. by St. George's Channel, and N. by the North Channel. Its greatest width is 120 miles. It contains the Isle of Man and Anglesey, besides some smaller islands. The principal inlets are the estuaries of the Dee, Mersey, and Ribble in England, Solway Frith in Scotland, and Dundrum, Dundalk, and Dublin bays in Ireland.

I'risite [Lat. *iris*, "rainbow"], a very singular resinoid substance which is the main constituent of a peculiar American mineral, originally investigated by the writer, and called by him *grahamite*. Grahamite occupies vertical fissures in horizontally-bedded rocks, so far as yet known only in Ritchie co., West Va., and at one other point—in the centre of the continent, 100 miles W. of Denver, Col. A sample from this latter locality, in the possession of Dr. J. S. Newberry, has been identified chemically by the writer as genuine grahamite, containing about the same proportion (80 per cent.) of irisite, the remainder being VISCOSITE (which see), just as in the West Virginia grahamite. [The names originally assigned to the two resinoid constituents of grahamite by the discoverer were *irisine* and *viscosine*. Prof. J. D. Dana has, however, established the terminology in *ite*, and these must therefore be modified to *irisite* and *viscosite*.] The probability is great that other localities will be found. The mean of analyses of grahamite by two analysts is—

Carbon	78.66
Hydrogen	8.57
Oxygen	12.77
	100.00

Density = 1.145.

This is calculated independently of the 2 or 3 per cent. of ash.

Grahamite is black in the mass; of resinoid, but variable lustre; trace, dark chocolate-brown; very soft, fusible under pressure, by reason of the highly fusible viscosite it contains, to a tarry and frothy mass; is *eminently soluble* in chloroform, benzole, bisulphide of carbon, warm oil of turpentine, and some other liquids. The viscosite is readily dissolved out from the irisite by ether or light petroleum-naphtha. The residual irisite may be obtained pure by solution, filtration, and evaporation. Pure irisite is black, brilliant, infusible without decomposition, like ulmine; which last, however, is wholly insoluble. This combination of absolute infusibility with great solubility is characteristic. Its *most* characteristic property is that thin films of its solutions dry on polished surfaces to gorgeous rainbow hues; whence its name. If to its solutions a drop of a mineral acid be added, with slight agitation, the irisite coagulates and totally separates. It is now profoundly altered, having become *insoluble* in all its former solvents. No analyses of pure irisite can yet be reported. The no less singular mineral, *albertite*, from the province of New Brunswick, was found by the writer to contain *a little* irisite and viscosite. The grahamite is claimed by some to be albertite (Gesner, Macfarlane, *et al.*), but C. M. Wetherill found for albertite the following composition—

Carbon	86.14
Hydrogen	8.96
Oxygen	1.97
Nitrogen	2.93
	100.00

Density = 1.097.

—which differs irreconcilably from grahamite. Its relations to solvents and chemical agents generally are also widely different. The trace of albertite is remarkably *black*, surpassing most charcoal in this respect, and nearly equalling anthracite. Both these minerals are believed by some writers (Lesley, Newberry, Fontaine, Macfarlane, Jenney, *et al.*) to be derived from liquid petroleum, and to be strict "asphalts," formed probably *in situ*. The writer, and with him Peckham, believe this impossible, both geologically and chemically, but rather that they have been injected into their fissures in heated plastic condition. Dana also admits this latter view in his later editions. In 1856 the writer suggested that the West Virginia grahamite might be employed in the gas-manufacture. Since that, over 30,000 tons have been mined and used by gas companies throughout the U. S. for enriching coal-gas. (Under VISCOSITE some further information will be given regarding grahamite.)

H. WURTZ.

Irit'is, a frequent and formidable disease of the eye, characterized by inflammation of the iris and the contiguous serous surfaces, by intolerance of light, by adhesions (*synechmata*) to the surrounding parts, and by consequent distortion and immobility of the pupil. The color of the iris also undergoes peculiar changes, so that the skilled diagnostician can usually detect its presence at once. When the iris is at all actively inflamed, it also becomes quite insensible to the action of atropia. Iritis may be traumatic in its origin, or may arise from over-use of the eye or from working in too intense light. It is, however, usually of a rheumatic or syphilitic character. It is often very painful. Local bloodletting, iodide of potassium, mercurials, atropia, and finally tonics, such as iron, quinia, and strychnia, are employed in its treatment.

Irkutsk', government of East Siberia, bordered by the governments of Yeniseisk and Yakutsk and the Chinese empire. Area, 267,555 square miles. Pop. 372,833. It comprises the great Baikal Lake, but it is mostly mountainous, traversed by the Nerchinsk Mountains and the Jablonovy. Large tracts are covered with pine forests; rye and oats are the common crops; rhubarb is much cultivated. Of animals, reindeer, sables, ermines, and foxes abound, and excellent fish, especially sturgeon and cod. Gold, silver, lead, jasper, topaz, emerald, rock-salt, and coal are found. But agriculture and the transit trade between China and Russia are the chief pursuits of the inhabitants.

Irkutsk, town of Siberia, the capital of the above government, at the confluence of the Irkut and the Angara, in lat. 52° 17′ N. and lon. 104° 16′ E. It is the seat of the governor-general of East Siberia and of a Greek archbishop, and has many educational institutions. Its houses are mostly built of wood, and its manufactures of linen, leather, glass, and soap are merely local. But it is the principal station of the trading route between China, Siberia, and Russia, and large quantities of tea, silk, porcelain, rhubarb, and furs are here exchanged for European goods. Pop. 23,856.

Irne'rius, Wernerius, or **Garnier,** b. at Bologna, Italy, in the second half of the eleventh century, became professor of Roman law at the university of that city, in which capacity he discovered and expounded the *Institutes* of Justinian, and other eminent ancient jurists, thus becoming the restorer of Roman jurisprudence. D. at Bologna between 1126 and 1128.

I'ron as a Metal. Iron is the most important metal at the command of man, and the use of it, in its many different forms, has elevated barbarism into civilized society. It may, then, seem strange to say that iron is a rare metal, but such is the fact: for it is almost unknown in a state of chemical purity. It is scarcely possible to obtain pure iron, such is the strength of its combination with certain elements. The metal ordinarily known as iron is virtually a combination of the elements iron and carbon. According to the amount of carbon present the metal is called *wrought iron*, *steel*, *malleable iron*, and *cast iron* or *pig iron*, begin-

ning with the metal containing least carbon. Wrought iron and steel have been known from the earliest times. Iron was used by the Egyptians, it is supposed, anterior to the time of Moses; it was extensively applied by the Assyrians, and Indian steel was largely imported into Persia under the name of Parthian iron, which was steel in its rudest though a valuable form. The first steel produced in Europe was made in the thirteenth century in bars in small open fires, while cast steel was invented by Huntsman little more than 100 years ago. Cast iron was unknown till the fourteenth century, having been made about the same time in England and in Elsass (Alsace).

The *properties* of iron claim our attention in the first place. They are physical and chemical; the physical properties include the mechanical properties of the metal, and the chemical properties include its combinations with various elements and the characteristics of its salts.

Physical Properties.—*Color.* — Pure iron is silvery white, slightly grayish, with a mild but brilliant lustre. The color of the various forms is mainly determined by the amount of carbon present, since other elements, such as manganese, silicon, phosphorus, etc., modify the lustre rather than the color. The color of wrought iron is gray, which is also that of steel, the varieties with most carbon being lightest in shade; in steel the color is darkest in the unhardened state, and when hardened the metal becomes whiter in proportion to its content of carbon. Cast iron varies from deep gray to white as the amount of free carbon (*graphite*) present decreases.

Fracture.—Wrought iron has a fibrous fracture, the fibres being longer and more silky the purer the metal is, the more it has been worked, and the more gradually like a tear the fracture has occurred. Steel is crystalline when broken; when hardened the crystalline character becomes almost imperceptible and the fracture conchoidal. Cast iron is also crystalline, white iron being crystallized in large plates, which decrease in importance as the graphite increases, till in deep gray iron the crystals are indistinct, so far as iron is concerned, but the graphite appears in scales of considerable size.

Specific Gravity.—The specific gravity of electro-deposited iron is 8.139; that of cast-steel bars and plates averages 7.823; that of tilted and hammered iron bars and forgings ranges from 7.76 to 7.798; that of rolled iron plates and bars varies between 7.76 and 7.54; while that of unwrought puddled bar averages 7.40. We find that wrought iron is very bad when its sp. gr. is less than 7.50. The sp. gr. of cast iron ranges from 6.85 to 7.35, that used in construction averaging 7.10.

Conduction of Heat and Electricity.—The conductivity of silver being 100 in each case, that of wrought iron for heat is 11.9, and for electricity 12 to 14.8.

Expansion by Heat.—From the freezing to the boiling point of water cast iron expands in bulk 0.0033, and wrought iron 0.0036; and wrought iron has a linear expansion of $\frac{1}{68100}$ for each degree between 212° and 572° F. Cast iron exposed to continued heat becomes *permanently expanded* to the extent of $1\frac{1}{2}$ to 3 per cent. in length, so that grate-bars, for instance, should have 4 per cent. play. In cooling from a melted state gray cast iron contracts 1 per cent., and white cast iron 2 to $2\frac{1}{2}$ per cent. In a state of fusion the behavior of cast iron is the *reverse* of that of *water*, for the hottest *iron* is the densest and sinks to the bottom. This property enables us to melt it in a reverberatory furnace by a flame applied on the upper surface of the metal, and also to keep it hot when melted. If melted iron acted as water does, it would be practically useless.

Fusibility.—Pure iron is doubtless as refractory as platinum, but its fusibility rapidly increases with the amount of carbon present. Cast steel is estimated to fuse at 4000° F., and cast iron at 2780° F.

Welding.—Iron differs from almost all other metals in the fact that, though nearly infusible, its particles agglutinate at a white heat into a nearly homogeneous mass. All methods of producing wrought iron depend on this principle.

Tenacity.—In this quality iron vastly excels all other metals. The statements respecting the strength of American irons have been, unfortunately, overestimated by 25 to 30 per cent., owing to a defective method of breaking the test-piece at a point where its area was suddenly reduced. Calculated for the *original area* of the test-bars, the following are correct statements of breaking strains:

		Pounds to sq. inch.
Steel	Hard cast steel	132,000
	Medium "	110,000
	Soft "	95,000
	Steel plate (homogeneous metal)	72,000 95,000
	Bessemer steel (rails)	89,500
	Spring steel	72,500
	Puddled steel	62,769 71,500
Wrought iron	Iron wire	86,000
	Bar iron	60,000
	Plate iron	50,000
	Unwrought puddled iron	30,000
Cast iron	Strong cast iron	28,000
	Average "	16,500
	Weak "	13,400

Ductility.—Iron possesses this quality in a high degree, being excelled in it only by gold, silver, and platinum. The tenacity of a metal has a greater effect in producing ductility than has the malleability; hence, the purer kinds of wrought iron can be drawn into wire of excessive fineness, even down to a diameter of 0.01 inch in continuous coils 49,000 feet long.

Resistance to Compression.—Wrought iron under pressure loses shape and proportion like lead, and no definite point is marked at which *crushing* can be said to occur; yet under a load of 38,000 pounds per square inch the metal is too much distorted for practical use. Cast iron, on the contrary, can be *crushed* by a load varying from 44,500 to 140,000, the mean usually assumed being 95,000 pounds per square inch, or about six times the mean of its tensile strength. Wrought iron resists compression with a strength about two-thirds that with which it resists extension.

Hardness.—Iron is relatively one of the hardest of all metals, but there are among the various kinds many degrees of hardness. Hardened steel is the hardest of metals, and some kinds of white cast iron are nearly as hard, while wrought iron and homogeneous metal are sometimes nearly as soft as copper.

Stiffness and Elasticity.—Wrought and cast iron are elastic under a strain kept within certain limits, and both are safe in structures so long as the strain remains within the elastic limit. There are two limits of elasticity—one for compression, the other for extension. Under compression the limit of elasticity of cast iron may be stated as 35,000 pounds per square inch, that of wrought iron about 27,000 pounds, and that of steel say 76,000 pounds per square inch for hard cast steel and 36,000 for soft steel of finest quality. Under tensile strain the limit of elasticity of cast iron is about 8000 pounds per square inch, that of wrought iron about 26,000 pounds, and that of steel varies between one-half and two-thirds of the breaking strains of the various kinds. Bessemer steel, containing about 0.45 per cent. of carbon, breaks under a *minimum* tensile strain of 74,000 pounds, and will bear in tension as well as in compression a *minimum* strain of 38,000 pounds per square inch without exceeding its elastic limit. It is a curious fact that cast iron *yields* at first to a given compressing strain twice as much as wrought iron, yet it will bear without crushing three times as much pressure. Cast iron can be exposed under extension to a strain only one-third to one-fourth as great as that it bears under compression. Wrought iron will bear within elastic limits under extension three-fourths of the force it bears under compression, but in practice it is usually taken the other way, owing to the fact that long struts of wrought iron are very liable to fail by flexure. The limit of elasticity, or the working strain of steel, seems practically equal for compression and extension. Steel is made more uniform than wrought iron, and will therefore gradually supersede wrought iron in most structures, with an increase of safety if not a diminution of weight. The popular term *toughness* means a combination of tenacity, ductility, and hardness happily joined to resist concussions and irregular strains. In judging a metal, tenacity alone would be a false guide, for hard, brittle steel shows the greatest tensile strength. Therefore, it is necessary to see that the metal stretches considerably before breaking; that is, not less than 5 to 30 per cent. for good qualities of the different grades of steel, and from 30 to 60 per cent. for the different grades of wrought iron.

Such is iron as we all of us know it in its various forms and every-day applications. The chemical properties of the metal are not so evident as the tangible physical ones, yet they are the immediate causes of the great variety of characteristics exhibited by the various forms of iron.

Chemical Properties.—Iron differs from all other metals in the fact that it combines at a high temperature with carbon to form fusible compounds; the fusibility of these compounds decreases as the carbon decreases. Iron represents a most important group of metals, distinguished by their capability of combining with oxygen, chlorine, etc. in both *odd* and *even* proportions. These are iron, nickel, manganese, cobalt, chromium, and uranium. The first five are closely allied, have the same atomic volume, and their specific gravities and atomic weights form a regular sequence. The following is a list of the principal salts of iron, the atomic weight of iron being 56:

Ferrous Compounds (even).	*Ferric Compounds (odd).*
Protochloride.......$Fe''Cl_2(FeCl)$.	Perchloride...$(Fe_2)^{vi}Cl_6(Fe_2Cl_3)$.
Protoxide ....$Fe''O''(FeO)$.	Sesquioxide ..$(Fe_2)^{vi}O''_3(Fe_2O_3)$.
Protosulphide.........$Fe''S''(FeS)$.	Hydrated sesquioxide, $\left.\begin{matrix}(Fe_2)^{vi}\\ H_6\end{matrix}\right\} O''_6(2Fe_2O_3,3HO)$.
Protosulphate.....$Fe''(S^{vi}O''_4)''+7H_2O''(FeOSO_3+7HO)$.	
Protocarbonate, $Fe''(C^{iv}O''_3)''(FeOCO^2)$.	Sesquisulphide....$(Fe_2)^{vi}S''_3(Fe_2S_3)$.

In addition to these we have—

Magnetic oxide of iron................$Fe''(Fe_2)^{vi}O''_4(Fe_3O_4)$.
Magnetic pyrites.........................$Fe''_7S''_8(Fe_7S_8)$.
Bisulphide of iron.......................$Fe''S''_2(FeS_2)$.

The old notation with atomic weight 28 is enclosed in brackets. Of the above salts, the protocarbonate occurs in nature as spathic iron ore, and the protosulphate as copperas (Melanterite). The salts of iron possess an inky, astringent taste, but the two classes have marked characteristics by which they can readily be distinguished from each other and from the salts of other metals. (1) *Ferrous Salts.*—These salts have a pale green color. *Alkalies* throw down white or greenish-white precipitates, which quickly oxidize and turn brown on exposure to air. *Potassium ferricyanide* (red prussiate of potash) occasions a bright-blue precipitate in neutral or acid solutions. (2) *Ferric Salts.*—In solution these salts exhibit a yellow or yellowish-brown color. *Alkalies* throw down a reddish-brown precipitate, insoluble in excess of alkali. In neutral or acid solutions *potassium ferricyanide* occasions *no* precipitate, merely imparting a greenish hue to the solution. Solutions of ferric salts, to which an alkali has been added till a permanent precipitate begins to form, are completely decomposed on boiling, the iron being precipitated as an insoluble sub-salt. This property enables us to separate iron from manganese, nickel, and cobalt, which do not possess it. Further, we find that the protoxide of iron and the ferrous salts are magnetic, whilst the peroxide and ferric salts are not.

The salts and compounds of iron are highly useful in the arts. Copperas or green vitriol is a valuable disinfectant and a most important mordant in dyeing. The various sulphides of iron, in their natural state as pyrites, furnish most of the sulphuric acid of commerce. Iron unites with cyanogen and hydrogen to form acids, which in turn combine with iron, making ferro- and ferri-cyanides of iron, both of them brilliant blues, and the latter known as Prussian blue. A neutral solution of a ferric salt treated with tincture of galls yields a bluish-black precipitate possessing the peculiar property of remaining in a state of partial solution, as writing ink. In medicine, iron is an invaluable tonic, ferric chloride especially, while the dried persulphate is a most efficient agent in stanching the flow of blood from wounds.

The *metallurgical chemistry* of iron can be most clearly explained under the following heads:

Iron and Oxygen.—Iron in a compact state suffers no change in dry air or oxygen at ordinary temperatures, but in a spongy state burns readily in air. In pure water iron remains unchanged, but the presence of carbonic acid causes a rapid oxidation, which is counteracted by the presence of the alkalies and of lime, and by a coating of zinc. Sea-water dissolves the iron of cast iron completely in the course of time, leaving the carbon. At a high temperature iron burns vividly in air, and decomposes steam at a red heat, in each case forming magnetic oxide of iron. Welsh nail-makers keep their nails hot during forging by throwing a little blast of air upon them. In the puddling furnace iron burns with great readiness. *Protoxide of iron* is a powerful base, and plays an important part in metallurgical operations. It has a powerful affinity for oxygen, and the power of decomposing water. *Peroxide of iron* is infusible except at high temperatures, when it is converted into magnetic oxide. It has little or no affinity for silica, but is easily reduced to the metallic state by carbon, even without intimate contact. *Magnetic oxide of iron* is an important product and *agent* in metallurgy, particularly in *puddling.* In the course of the oxidation of iron various oxides are formed containing less oxygen than magnetic oxide, the most important being *hammer or smith scale.*

Iron and Carbon.—When metallic iron is heated in contact with carbon, the result is wrought iron, steel, or cast iron, according to the degree of heat applied and the length of time. The influence of carbon in modifying the properties of iron is one of the most extraordinary phenomena of metallurgy, and the variations caused are so great that the compounds are, practically, distinct metals. While there are no characteristic properties which distinguish one metallic compound from the others, and the difference consists mainly in the degree in which particular characters are presented, yet in practice the separation of the compounds is fixed by two striking phenomena—viz. the fact that at a certain point graphite ceases to separate from *cast iron* slowly cooled, and the fact that *steel* hardens on being plunged at a red heat into water. The greatest total amount of carbon pig iron will contain is about 5.9 per cent., but this is only when manganese is present, the ordinary amount being 3.2 to 4.7 per cent. When the percentage of carbon falls to 2.25, the *cast iron* refuses to part with graphite even when slowly cooled for days. Iron with 2 per cent. of carbon is not malleable nor weldable, but falls to pieces on heating. When the percentage of carbon is about 1.75, the metal can barely be welded, but with 1.5 to 1.4 per cent. of carbon the peculiar properties of *steel* are all clearly developed—viz. fusibility, combined with capability of hardening and weldability. As the carbon diminishes the two first qualities decrease and the third increases. With 0.4 per cent. of carbon steel can barely be hardened enough to give sparks with flint, and below this percentage the compound is designated *wrought iron*, but is called *steely* iron or puddled steel till the carbon falls to about 0.25 per cent. Bessemer steel, as now usually made, is a true steel. Soft wrought iron seldom or never contains less than 0.08 per cent. of carbon. Ordinary wrought iron is not homogeneous in composition, but is made up of fibres or masses varying greatly in their percentage of carbon. The presence of other elements, such as silicon, phosphorus, etc., modifies the above boundaries, but not materially.

Carbon exists in cast iron in two states—*combined carbon* and *graphite.* The proof of chemical combination is given by the fact that infusible carbon heated with nearly infusible pure iron forms a fusible compound (cast iron), out of which, when very highly heated, part of the carbon separates as graphite. Iron containing much graphite is called *gray iron;* when, on the contrary, it contains much combined carbon, it is called *white iron,* the total amount of carbon being in ordinary pig irons substantially constant. The two kinds pass into each other by insensible gradations, and at a certain stage are both visible in the same piece, which is then called *mottled iron.* The varieties are often graded by numerals into eight classes, but in this country usually into five, as follows: No. 1 foundry, No. 2 foundry, No. 3 or gray forge iron, mottled iron, white iron. The last two grades are often called forge irons. White iron, containing manganese, is called spiegel iron.

Iron (Carbon) and Manganese.—In cast iron manganese increases the amount of combined carbon and diminishes the amount of silicon. It is chiefly beneficial as a flux in removing sulphur, etc. In cast- and in Bessemer steel it is present in various proportions, 0.1 to 1.0 per cent., and improves the working of the steel. It is seldom found in wrought iron.

Iron (Carbon) and Sulphur.—Iron combines freely with sulphur, the effect of which on cast iron is to diminish the amount of carbon and hinder the separation of graphite. In small quantity it is advantageous for castings like *cannon,* as it makes cast iron stronger. In steel and wrought iron the effect of sulphur is to make both weak and ragged when worked below a *yellow* heat, hence the term *red-shortness.* Steel resists better than wrought iron, but 0.1 is sufficient to injure either. *Copper* acts similarly, but less strongly, than sulphur, and diminishes the weldability of the metal.

Iron (Carbon) and Phosphorus.—Iron is seldom free from phosphorus. In cast iron this element increases the hardness, and makes the metal more fluid when melted, but weakens it when cold. Pig iron contains from 0.5 to 2.25 per cent. of phosphorus. It makes wrought iron easy to work while hot, thus counteracting sulphur, but brittle when cold, and renders steel more brittle than iron. The presence of 0.25 per cent. in iron and of 0.1 in steel is disadvantageous.

Iron (Carbon) and Silicon.—Silicon exists in all varieties of iron, and in gray cast iron in greatest quantity, because the heat causing grayness in the iron also aids reduction of silica, and because silicon aids separation of graphite. White cast iron seldom has more than 1.0 per cent., but gray iron sometimes contains as much as 5 per cent. of silicon. Ordinarily, it does not injure pig iron, but is beneficial when it is converted into Bessemer steel. But the effect of silicon on wrought iron is to make it brittle, rotten when heated, and less ready to weld. On steel the effect is the same, and an amount less than 0.1 per cent. is decidedly noticeable for the worse.

Iron (and Carbon) also combine with *tungsten, titanium, chromium,* and *tin.* They all impart greater hardness, if not brittleness, displace, except tin, carbon in cast iron, and reduce the weldability of wrought iron. Tungsten combines with great difficulty, and titanium scarcely at all; both are probably useful in making the grain of steel finer and increasing its strength and hardness. Chromium combines readily with iron, is said in some respects to be useful, and seems to render steel less liable to injury from overheating. Tin renders wrought iron utterly worthless, even when only 0.2 per cent. is present.

IRON ALLOYS.—All the above compounds are sometimes

incorrectly called *alloys*, but that term denotes the mechanical mixture of two or more metals, either as such or (rarely) holding in admixture a chemical combination of the metals with each other. The term cannot apply to the combinations of iron with metalloids, nor to the combination of metals with carbon and iron. The abuse of the term *alloy* doubtless arises from indefinite use of the term *iron*. Our knowledge of the alloys of pure iron is exceedingly scanty. Iron alloys with copper, nickel, and cobalt in various proportions; with zinc also, but only when zinc is the principal ingredient, the iron not exceeding 11 per cent. The process of *galvanizing* or coating iron with zinc was first practised at Rouen about 1786. Iron alloys with copper, zinc, and tin to form *sterro-metal*, a close-grained alloy of great strength, suitable for hydraulic-press cylinders and for cannon, but the iron present does not exceed 2 per cent. *White brass* is an alloy of 80 zinc, 10 copper, and 10 iron; it has the appearance of zinc, but is much harder, very tenacious, and specially adapted for journal castings. Iron alloys also with tin in various proportions up to 50 per cent., making highly brittle crystalline alloys of little use. When clean wrought iron is dipped into melted tin it becomes firmly coated with tin (*tin plates*), and thereby protected from rusting. Iron alloys with aluminium in all proportions, producing bright and hard but forgeable alloys when the aluminium does not exceed 12 per cent. Aluminium is supposed to cause the *damask* of Indian steel wrought at Damascus into swords. Iron alloys with other metals, but the alloys have no practical importance. *Ferro-manganese*, a combination of manganese iron and carbon, which contains 30 to 60 per cent. manganese and as little carbon as possible, is valuable in steel-making.

Iron, Ores of. The ores of iron consist of the metal in an oxidized state, more or less mixed with clayey or siliceous impurities. Usually the more iron the ore contains the greater its value, but frequently ores of one class are valuable in facilitating the smelting of ores of another class, and sometimes the presence of other oxides—manganese, for instance, in ores for spiegeleisen—or the presence of coal (in black-band ore), is most desirable. Nothing which contains less than 20 per cent. of iron can be considered an iron ore.

Ores of Iron.

Name.	Composition.	Iron in 100 parts.
Magnetic iron ore	Iron and oxygen	$72\frac{41}{100}$.
Red hematite (specular)	Iron and oxygen	70.
Brown hematite	Iron, oxygen, and water	$61\frac{6}{10}$ (water 12).
Spathic iron ore	Iron, oxygen, and carbonic acid	$48\frac{2}{10}$.
Argillaceous iron ore	Iron, oxygen, carbonic acid, and clay	Average 33.
Black-band	Iron, oxygen, carbonic acid, clay, and carbonaceous matter (coal)	Variable, 20 to 35 (10 to 25 coal).

1. *Native Iron.*—This is a curiosity, but not an iron ore. It occurs in minute particles in basaltic rocks, and in situations where it has been reduced from ore by organic matter. It is found also in meteorites, which are malleable and consist mainly of iron, with from 6 to 14.6 per cent. of nickel.

2. *Magnetic Iron Ore* (Fe_3O_4).—Sesquioxide of iron 69, protoxide of iron 31 = 100. This ore is named from Magnesia in Lydia, where its attractive powers were first observed. It is iron black in color, with a specific gravity of 4.9 to 5.2, and leaves a black streak when rubbed on unglazed porcelain. It is often strongly magnetic, sometimes possessing polarity, when it becomes the loadstone (*leadstone*) of yore. It is found massive, in sharp crystalline grains as sand, and ochreous as an earth. It is not changed by exposure to air, and is broken up but not oxidized by roasting. It occurs mostly in primary crystalline rocks, and most abundantly in metamorphic rocks, in which it is found in vast beds. It abounds in Sweden, Norway, Russia and North America, and is almost wanting in England; as sand it is found in North America, New Zealand, and India, but in this state is apt to be made refractory by the titanic acid it contains. Its principal impurities are iron pyrites, copper pyrites, and phosphate of lime (*Apatite*); where the two former or sulphurous impurities abound, the latter is usually absent.

3. *Specular Iron Ore, or Red Hematite* (Fe_2O_3).—Iron 70, oxygen 30 = 100. Anhydrous sesquioxide of iron. Specular ore is dark steel-gray in color, very thin pieces being blood-red by transmitted light, while the earthy varieties (*red hematite*) are red; both varieties leave a red streak. The specular variety is named from its brilliant lustre (*speculum*, "mirror"), and occurs massive and in shining scales (*micaceous iron ore*). It is found in Russia, Spain, Brazil, and in vast abundance in Elba, where it has been mined for 2000 years. The red hematite variety is named from its dark-red color (αἷμα, "blood"). It occurs massive, sometimes highly fibrous, as an ochre, and in an argillaceous form. As an argillaceous ore it sometimes resembles jasper, and in the fibrous form it is very beautiful, on account of the striking internal structure and the high polish of the outside of its rounded masses. Red hematite occurs all over the world in remarkable abundance, being especially noted at Lavoulte in France, Cumberland and Lancashire in England, Bilbao in Spain, Marquette, Pilot Knob, Iron Mountain and other localities in this country, and also in Algeria. This ore occurs in rocks of all geological ages, and at volcanoes as a result of igneous action, but is especially abundant in metamorphic rocks. It has no characteristic impurities, but quartz nearly always accompanies it; it contains usually very little sulphur and little phosphorus.

4. *Brown Hematite, or Hydrated Sesquioxide of Iron* ($Fe_2O_3,3H_2O$).—Sesquioxide of iron 85.6, water 14.4 = 100. The variety Göthite is rather a mineral than an ore, but brown hematite or limonite (from λειμών, "meadow") is one of the most important ores of iron. It is found massive (*pipe ore*, etc.) and earthy, also containing fossils (one kind of *fossiliferous iron ore*); when loose or porous it is called bog ore. Its specific gravity is 3.6 to 4, and it leaves a yellowish-brown streak. It is extensively worked all over the world in secondary or more recent geological formations, and is so widely distributed that no special locality need be mentioned. Beds of it in the compact state have been worked for 150 years at Salisbury and Kent in Connecticut, which are celebrated for the quality of their iron. This ore is the result of alteration of other ores and minerals by air, water, etc., is still being formed, and derives its peculiar character from this origin. It is mixed with clay, sand, wood, etc. Its impurities are, naturally, phosphate of iron, organic matter, and seldom either sulphates or sulphur; it also contains manganese. Interesting instances of its modern formation are the "lake ores" of Sweden and the ponds of Eastern Massachusetts.

5. *Spathic Iron Ore* ($FeCO_3$).—Protoxide of iron 62.1, carbonic acid 37.9 = 100; specific gravity 3.7 to 3.9. Color light yellow, turning to brown when the ore is exposed to the weather; before exposure its streak is white. It is found pure, massive, crystallized in veins and vast beds, also in globular masses, and in an earthy state with clay or sand. Part of the iron is usually replaced by manganese, which often renders the ore valuable for making white iron containing manganese (*spiegeleisen*). In its impure varieties, mixed with clay or sand, it forms the greater part of the *clay ironstone* ores. Spathic ore proper is found in vast conformable deposits in the clay-state formations of Styria and Carinthia, in Westphalia and Nassau in numerous small veins (mostly owned by Krupp of Essen), and in Cornwall.

6. *Clay Ironstone, or Argillaceous Iron Ore.*—Clay ironstone is the miners's name, denoting a distinct class of ores, which singly have little in common except their mixture with clay and sand. We find *brown clay ironstone* in compact masses and nodules, leaving a yellow-brown streak; *argillaceous hematite*, a hard, heavy ore, reddish-brown to dark-red in color, sometimes oolitic in structure, when it is called *fossiliferous iron ore* or lenticular iron ore; and lastly, *spathic clay ironstone*, an earthy or siliceous impure carbonate of iron, which is often called simply *carbonate ore*. The first two kinds are of local occurrence, but spathic clay ironstone is found in all countries, more particularly in the coal formations, of which it is the characteristic ore. In these formations it is sometimes found in continuous strata, sometimes in irregular masses imbedded in and under the shales and limestone rocks (*nodular and buhrstone ore*), and again found loose in clays (Tertiary formations in Maryland, etc.). It often occurs in the coal measures, in beds alternating with limestone and coal, and is always more or less calcareous. In these cases it is particularly adapted for smelting. Its color varies from gray to brown, and its weight is less than that of other iron ores; hence, at first sight, some varieties do not appear to be iron ores, and were till recently thrown away (Wales, Westphalia). This ore is much more uniform in composition than might be expected, its percentage ranging between 30 and 40, with an average of 33. The impurity varies, however; in England clay predominates, but in America sand, especially in the anthracite coal-measures. The Pennsylvania carbonate ore contains an average of 34 per cent. of iron.

7. *Black-band.* — When clay ironstone contains coaly matter in excess of 10 per cent. it becomes dark-brown or black in color and often shaly, resembling cannel or slaty coal. The clay ironstone often occurs along with it, and the Scotch miners call one layer *clay-band*, the other *black-band*. It occurs in all coal-measures more or less—in Westphalia and in Ohio, for instance—but is especially devel-

oped in Scotland. It is a valuable ore, for its coal suffices to roast (*burn*) it, and it is enriched by burning to 50 or 70 per cent. of iron.

8. *Franklinite.*—This is strictly an ore of zinc, but after the extraction of the zinc the residue is smelted to produce spiegeleisen, a peculiar white iron valuable in steel-making from its high percentage of manganese (10 to 24 per cent.) and carbon (4 to 5.5 per cent.). It is found only in New Jersey in compact veins in Silurian limestone. It is iron-black in color and leaves a brown streak; its specific gravity is 5.1. It is composed of peroxides of iron 58.99, manganese 8.32; and of protoxides of iron 7.58, of manganese 3.74, of zinc 21.37 = 100.

Iron pyrites can scarcely be called an iron ore, though it certainly is a most persistent impurity of all iron ores, and is the chief source, rather than coal, of the sulphur in cast and wrought iron. By itself it is useful in furnishing, when burnt, sulphurous gases for sulphuric acid manufacture; but the attempts to utilize its ash have not succeeded, though it is rich in iron.

All ores of iron seem to be benefited by roasting before use in the blast furnace, but it is necessary to roast the carbonates and all sulphurous ores. Roasting is beneficial in removing water and carbonic acid and cracking the lumps, thus enriching the ore and rendering its reduction easy, and also in removing sulphur somewhat, thus rendering the pig iron purer and grayer with a given amount of fuel. The loss in roasting varies from 10 to 35 per cent., the carbonates losing most. When the ore contains no carbonaceous matter the coal required for roasting is 1 to 10 down to 1 to 20 of ore, but coal-slack and waste are used for the sake of cheapness.

Distribution of Iron Ores.—The brown hematites and carbonate ores are worked in all countries in widely distributed localities, while the magnetic and red hematite ores occupy a more limited range. The brown hematites lie sometimes in rock, but mostly in very accessible positions on or near the surface in clay, and are dug and extracted by washing away the clay; the other ores lie *in place* in rock, and must generally be regularly mined. The red hematite, magnetic, and spathic ores, proper, occur by themselves, and bear the whole expense of mining, but some clay ironstones and the black-band occur so near the coal that they are mined along with it. Since the ores except brown hematite occur in distinct geological formations which are highly developed in some countries, while almost absent from others, it is evident there will be great diversity in the ores worked in different countries. In *Russia* the most iron is made from magnetic ores, which occur in great profusion in the Ural Mountains, while in *Sweden* and *Norway* the magnetic ores are substantially the only ones, the limonite lake ores being very limited in quantity. *Austria* possesses vast and extensively worked deposits of magnetic ore in the Carpathian Mountains, in Hungary, and in the Banat; the earthy red hematites are the principal ores mined in Bohemia, with the exception of a remarkable deposit of brown clay ironstone; in Carinthia, in the Eastern Alps, there are most extensive deposits of brown hematite, 18 to 100 feet thick in rock, while a short distance northward, in Styria at Eisenerz, lies the greatest known deposit of spathic iron ore, the stratum of ore being 200 to 600 feet thick and containing 60 to 360 feet of pure ore. *Prussia* (German empire): In Silesia the brown hematites, spathic clay ironstone, and black-band form the principal ores. In Prussia proper bog ore is the only ore worked. In Westphalia, black-band and carbonate clay ironstone are mostly mixed with brown hematite in inconsiderable amount, while in Rhenish Prussia, Siegen, and Nassau spathic ore proper is the ore of the country, with some specular ores. This district furnishes the iron used in the great German steel-works, and also most of the spiegeleisen used. W. of the Rhine the principal ores are the coal-measure ironstones. *Saxony* contains principally magnetic ore and specular ore, apt to be siliceous, but some little bog ore is mined for special purposes. *France* is not rich in iron ores, earthy brown hematites being the main ores smelted; at Lavoulte, however, an extensive deposit of earthy red hematite occurs. France imports ore from Elba, Spain, and Algeria. *Belgium:* The ores chiefly smelted are earthy brown hematite and oolitic red hematites. All are lean (30 per cent.) ores, hence a great deal of ore is imported. *Italy:* In general the country has little iron ore, but remarkable deposits exist at Traversella in the Alps and on Elba. That at Traversella is an irregular mass of magnetic ore 65 to 100 feet thick, worked from time immemorial. On the island of Elba hills of the purest specular ore have been worked equally long, but without energy, producing yearly 100,000 tons, three-fifths of which is exported. *Algeria:* In the eastern part of the province of Constantine great veins of red hematite of high purity occur: they cover a large extent of country, but are worked mainly to supply the French demand. *Spain:* The principal deposits occur near Bilbao, and are mined for English use. They are mainly compact red hematites in deposits of unusual thickness and accessibility, and contain a good deal of calcareous spar, while quite free from hurtful impurities. *Great Britain:* The argillaceous carbonates are by far the most important ores, fully two-thirds of the entire product of the United Kingdom being made from them. They are largely mined in all the coal-fields either as clay-band or as black-band, and are worked on a vast scale in Yorkshire, as the Cleveland ironstone. Brown hematite is extensively worked in the Forest of Dean and in Cornwall, and a sandy oolitic variety in Northamptonshire; and in Cornwall, at Perran, a great vein of spathic ore has recently been opened. In Lancashire and Cumberland there exist very rich deposits of red hematite of great purity, which supply much of the English iron for Bessemer steel, and have been long celebrated for their quality. *Canada:* The principal ore worked in Canada is magnetic ore, and in Nova Scotia the principal ore is red hematite; some brown hematite is also mined. *United States:* In this country large deposits exist of every variety of ore, many of them of surprising extent and purity. It is hard to say which is the principal ore, but it is probable that the magnetic ores supply fully one-third the total product of pig iron; the specular ores are next in rank, with nearly as much; brown hematites and the clay ironstones being as yet comparatively unimportant. The principal deposits of magnetic ores are on Lake Champlain, in New Jersey, and on Lake Superior. The principal deposits of specular ore are on Lake Superior, where beds 150 feet thick are quarried at the Jackson and Superior mines, and in Missouri at the Iron Mountain of massive ore, and Pilot Knob of slaty iron ore like that on Lake Superior. Eastern Pennsylvania is rich in brown hematite in clay, but the greatest deposits of this ore occur in Virginia, Tennessee, and Alabama, vast in extent and in close proximity to coal. Extensive veins of fossil ore (red hematite) occur in Western New York and in Michigan. Bog ore is but little worked, and exists principally along the eastern coast. The carbonate ores amount to nothing in our anthracite measures, and in the bituminous coal-fields are unreliable in thickness, except in Ohio. A carbonate ore (Triassic) occurs in loose masses in clay along the W. coast of Chesapeake Bay. Spathic ore has been mined in small quantities in Connecticut, Vermont, and Tennessee.

Purity of Iron Ores.—They may be impure either in having too much earthy or siliceous admixture, or in having in themselves elements which are difficult to remove and which injure the quality of the iron made from them. All iron ores are more or less impure in the first sense; the furnace-man thinks of them as *argillaceous ores*, *siliceous ores* and *calcareous ores*, and mixes them accordingly with each other and with limestone in the proper proportions to promote fusion. It is seldom that ores yield an average over 50 per cent., and probably the general average of all ores worked will not exceed 42. The lowest limit of economical extraction is 25 per cent. when the ore contains lime or can be enriched by roasting. American furnaces cannot afford to work an average under 35 per cent. of iron. In regard to the other class of impurities, the following general facts may be stated: The brown hematites and clay ironstones, when used alone, make the worst iron—viz. cold-short iron—on account of the phosphorus in the ores. Scotch pig iron contains so much phosphorus that it has special value as a foundry iron from its fluidity. Magnetic and specular ores make the purest iron, with a tendency to red-shortness from the sulphur in the ores. Spathic ores usually make pure pig iron, neither cold nor red short, as do also some of the best kinds of the others. The ores are used to neutralize each other according to the qualities desired in the pig iron. The purity of an ore can be generally predicated as above, but there are so many variations that each individual stratum even of the same mine should be separately examined.

Assaying.—The richness of an iron ore can be readily ascertained by powdering it and mixing it with charcoal to reduce, and a flux to cover the iron when melted. The whole is put into a small crucible lined with charcoal, and subjected for some time to a white heat. On breaking the crucible the iron is found at the bottom in a clean button, and the percentage can be ascertained by weighing it. This is the *dry assay;* its results are somewhat too high, for the iron takes up carbon. The *wet assay* gives more accurate results. The ore is dissolved, and all the iron carefully reduced to the ferrous state, and an oxidizing solution of known strength, usually bichromate of potash, is slowly added till the iron is shown by potassium ferricyanide (red prussiate) to be entirely converted into the ferric state. By measuring the oxidizing solution used the percentage of iron is directly ascertained.

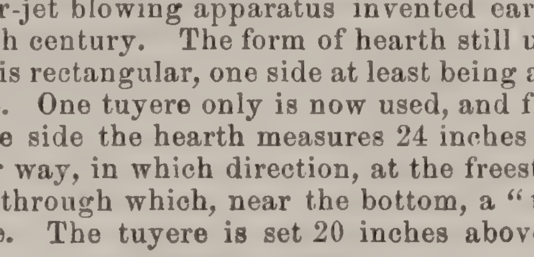
Iron, Manufacture of. We shall describe how

wrought iron is made from ore and from pig iron. When wrought iron is made from ore the process is called the *direct process,* in contrast with the *indirect process,* in which pig iron is first made and afterward converted into wrought iron. (For manufacture of pig iron, see BLAST FURNACE; for manufacture of steel, see STEEL; for apparatus and machinery, see FURNACE, ROLLING-MILL, and STEAM-HAMMER.)

Wrought iron was first made directly from the ore, and is still so made in localities where the ore is rich and quality is the principal object. The fires used are called *bloomery fires* or *Catalan forges;* when the iron was reheated in a similar fire this was called a *chafery* (fire); but the regular reverberatory furnace has long since taken its place except in making iron for tin plate, when a *hollow fire* of partially coked coal is used. When cast iron is the raw material, the fire is called a *forge* (fire), or in England always *finery.*

The *direct processes* are wasteful, but produce superior iron, partly because, the heat being low, impurities are carried off in the slag, partly because the product is usually a low steel. It requires great care to make soft iron direct from the ore by the bloomery processes. The ores best adapted to the bloomery are the compact brown hematites, easily disintegrated by heat; all other ores should be burnt, and the impurities removed by leaching (sulphur) or by mechanical separation (quartz, etc.). The first bloomeries in Asia and India were simply holes in the ground or in a mass of clay, in which charcoal was burnt by a weak blast from a goatskin bellows, ore being added at intervals in small quantities. Similar fires are yet used in India and Africa, and the lumps of iron are extracted by breaking away part of the clay. The lumps weigh from 5 to 30, or even 100 pounds, and 200 pounds may be made in sixteen hours. These old bloomeries were improved in Catalonia, a province of Spain (whence our name "Catalan forge"), and in Ariège in France. The original form, used in the Pyrenees since A. D. 1293, was about 2 feet high, with a small cylindrical hearth about 11 inches deep, flaring out conically at the top. Two tuyeres were used, which were set about 10 inches above the bottom. The lumps of iron weighed some 35 pounds, about 140 pounds being made in five hours. At the end of the eighteenth century the hearth was 20 inches deep, proportionately larger, and the product had increased to 300 pounds in five hours. This increase was due to the stronger blast produced by the *trompe* or water-jet blowing apparatus invented early in the seventeenth century. The form of hearth still used in the Pyrenees is rectangular, one side at least being a heavy cast-iron plate. One tuyere only is now used, and from it to the opposite side the hearth measures 24 inches by 26 inches the other way, in which direction, at the freest end, is the iron side through which, near the bottom, a "tapping-hole" is made. The tuyere is set 20 inches above the bottom; it

FIG. 1.



Catalan forge: A, coarse ore; B, coarse charcoal; C, *masse,* or loup of iron being formed; D, slag or cinder; E, covering consisting of charcoal-dust and fine ore.

inclines at an angle of 40°, and projects about 8 inches into the fire. In this hearth a bottom, made of slag and charcoal, is glazed over at a high heat. The hearth is half filled with charcoal, and on the side opposite the tuyere *coarse* ore is placed, filling not quite half the hearth, charcoal filling the remaining space. The blast is started at

FIG. 2.

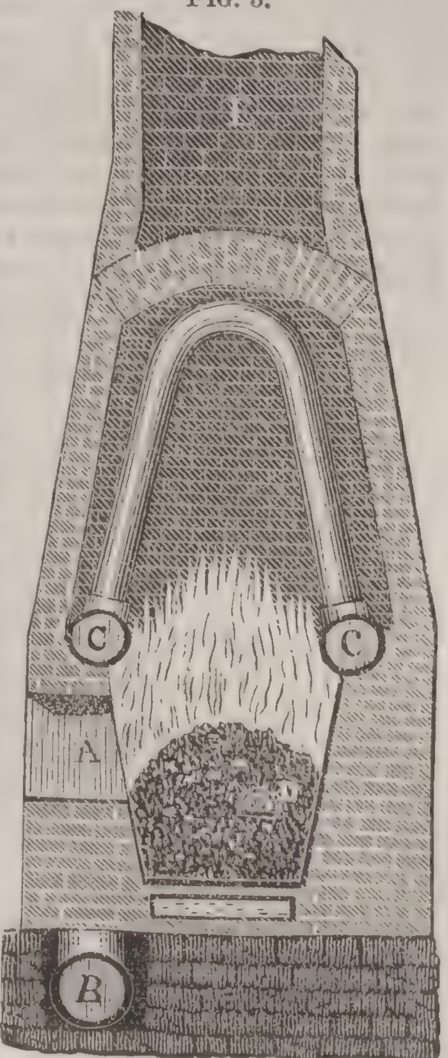
View of a bloomery, showing the mode of raising the lump of reduced iron, or *masse.*

$\frac{3}{4}$-pound pressure; in the course of six hours it is gradually raised to $1\frac{1}{2}$ pounds, while the whole fire, except a small part of the ore, is closely covered with fine ore and charcoal-dust, thus forcing the gases (carbonic oxide) to pass out through the ore and reduce it. The ore gradually sinks down, and the slag is let off (*tapped*) every hour. At the end of the operation a lump of iron weighing about 350 pounds is pried out of the fire, hammered under a 1400-pound helve-hammer, and cut up into three pieces. These are reheated during the next operation, and forged out into bars, making about 330 pounds. Four operations or *heats* are made per day. The slag is kept very rich in oxide of iron, and the blast is turned sharply down on the metal, which thus becomes *wrought iron;* the softness (low percentage of carbon) depends on the skill of the forgeman. In the *Catalan* process 3 tons of ore yield 1 ton of bar iron, for which $2\frac{3}{4}$ to 3 tons of charcoal are required. In the *Genoese* forge, another variety of the Catalan, the waste heat of the fire is used to roast the ore beforehand, and scrap iron is charged along with the ore, thus shortening the time required for a *heat* and increasing the yield of iron. Separate fires are used to reheat the lumps for forging. By these means five heats are daily made instead of four, with a consumption of 30 per cent. less charcoal than the amount required by the Catalan process: the weekly product is about $4\frac{1}{4}$ tons of *bar* iron. The Catalan processes required that the whole fire be remade each time iron was got out. The Germans (Alsace) therefore went back to the old method of putting the ore in a *fine* state *in layers* in the charcoal. This plan permits a fire to be worked without any other interruption than the withdrawal of the lumps as they are formed. The details are substantially the same, except that larger fires can be used, and a greater product made by this method; so that the Germans increased the size and product of their bloomeries at an early date. The means of regulating the quality of the iron made in bloomeries are very imperfect. They consist in varying the angle at which the tuyere is directed on the iron, and the amount and kind of slag kept in the bottom to cover the soft metal in course of reduction. The metal in the Catalan forge is also protected by the charcoal. For the sake of distinction the bloomeries just described are usually called *German bloomeries,* and have reached their highest development in America. It is an interesting fact that the earliest bloomeries were probably Catalan forges, which changed into German bloomeries, and it is equally interesting that in Pennsylvania practically all the bloomeries became forges (fineries) using pig iron as early as 1740. The Catalan process made good iron, but involved too much waste of ore and too much loss of time. There are still a great number of bloomeries in operation in this country, about 37 works in all; of these 28, with 147 fires, are in the State of New York. These American bloomeries have one feature peculiar to themselves—viz. the use (since 1844) of the waste heat to make a *hot blast* (550°), thus saving 20 per cent. of charcoal and increasing the product.

The hearths of the American bloomeries average about 32 inches square by 13 inches deep. The sides and bottom are cast-iron plates 2 or 3 inches thick; the fire is open at the front, but is walled in at the sides and back; the tuyere is at the side, and the oven which heats the blast is placed

over the fire. The ore is thrown on the charcoal, becomes reduced, and with the melted slag goes to the bottom of the fire; thence the slag is run out more or less frequently according to the desired quality of the iron. The iron balls up into a *"loup,"* which is "dug up" or taken out every three hours, and shingled under helve-hammers weighing $1\frac{1}{3}$ to 2 tons. In one day eight heats and 2400 pounds of blooms are made per fire. When *billets* are made, the loop is reheated and forged out, but *slabs* for boiler plate are finished without reheating. No bar iron is made, but the billets are rolled down into bars and wire and converted into cast steel. The New York blooms or billets are usually low steel, resonant, and showing a fine-grained fracture. One ton of blooms requires $1\frac{1}{2}$ tons of dressed ore, or from 2 to $4\frac{1}{2}$ tons of raw ore, and about 270 bushels (or say $2\frac{2}{10}$ tons) of charcoal.

Fig. 3.



Vertical section of bloomery: A, hearth open to front; B, blast-pipe from the bellows; C, hot-air apparatus; E, chimney for leading off waste heat; D, tuyere.

The idea of making iron direct from ore in a single operation, without the blast-furnace, has always been a favorite one, as is evident from the list of processes given below. All except the recent plans of Blair and Siemens have failed on account of excessive cost of reduction, great loss of iron in working up, and the intermittent character of the work—in other words, small product. *Chenot* (France, 1831), rich ores mixed with charcoal treated in a vertical tube externally heated to redness, then passed into an air-tight cooling chamber. The cool sponge treated like puddled iron. Improved by internally heating and also reducing the ore by a current of hot carbonic oxide gas.

Clay (England, 1837, 1840), same method, but reduced iron put directly, while still hot, into a puddling furnace. Also, a mixture of ore, coal slack, and salt reduced with pig iron in a puddling furnace.

Renton (U. S., 1851), a sponge reduced, from mixture of 25 parts ore and 75 parts coal, in a vertical retort, and discharged direct into a furnace to be welded into blooms. *Harvey* substituted inclined soapstone trays for the retort.

Gurlt (Prussia, 1857), used Chenot's improved plan, but mixed air with the carbonic oxide, thus raising the heat; gave the gas, at will, a carbonizing action in order to combine carbon with the reduced iron, and make steel or cast iron by melting the product in a furnace placed under the retort.

G. Hand Smith (U. S., 1855), plan like that of Gurlt, characterized by the substitution of a puddling furnace for a vertical retort, and the use of petroleum or coal-tar gas to carbonize the iron sponge.

Whelpley and Storer, U. S., apply pulverized fuel to the mixture of ore and coal on hearth of a puddling furnace.

Rogers (England, 1862), reduced the mixture of ore and coal in a rotary furnace placed over a puddling furnace, and heated by the flame from the latter.

Dr. Dupuy (U. S., 1874), proposes to reduce a mixture of ore and charcoal in a casing of thin sheet iron, which shall protect the sponge from subsequent oxidation.

Siemens (England, 1870), combined the plans of Clay and Rogers with his open-hearth melting furnace, in which, as in Clay's, the sponge is melted in a bath of pig iron. This process is in successful operation at Landore, Wales, where it is also carried out in a rotary puddling furnace.

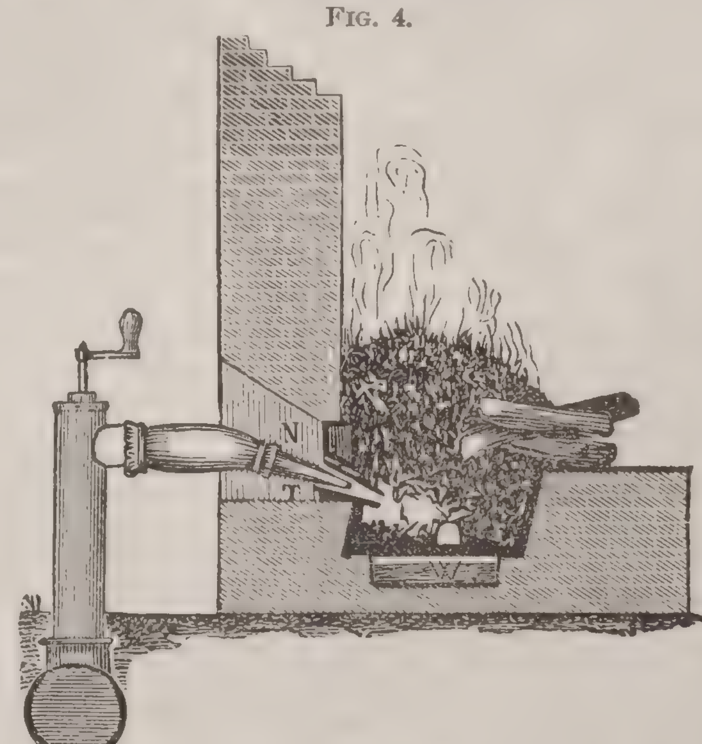
Blair (U. S., 1872), has improved Chenot's process, especially as to cooling the sponge; this he compresses cold by hydraulic power into blooms, which can be welded in a heating furnace or melted into soft steel. This method is in successful operation near Pittsburg.

Blair conducts his process in a circular retort 50 feet high and $4\frac{1}{2}$ feet in diameter. In the upper 10 feet hangs a metal pipe $3\frac{1}{2}$ feet in diameter, so that the ore and charcoal pass down an annular space about $4\frac{1}{2}$ inches across. Heat is applied outside the retort and inside the tube, and the reduced ore remains in the bottom of the tube till cool. One retort gives about 2 tons of sponge in twenty-four hours, which is compressed and melted with half as much pig iron in a Siemens open-hearth furnace. Loss, about 15 per cent.

As early as the end of the sixteenth century it was found better to make cast iron first in a blast furnace, and then convert it into wrought iron in forges. A vastly greater amount of ore can be smelted in this way in a given time than by the bloomery process, which also requires very pure and rich ores. The bloomeries exist to this day, however, in localities where charcoal is as cheap as coal, because the total amount of fuel required to convert ore into bars is about the same as by the indirect processes, and the quality of the bloomery product is superior. When pig iron is the *raw material*, it is advantageous to use none grayer than No. 3, for in general the less carbon the easier the conversion. The removal of carbon is effected in two ways—either, first, by the action of air direct in a blast, or, second, by the indirect action of the air through the medium of melted cinder or ore, parting freely with oxygen and taking it again from the air. The operations of the first class are the forge or finery, the refinery, and the Bessemer process (for latter see Steel); the puddling process is the representative of the second class. It is evident that the burning out of the carbon can be stopped at any point; hence *steel* is actually made by all these processes.

The *operation* of making wrought iron is the same, but the *method* by which it is made in the bloomery is the reverse of that used in the forge. In the former carbon (charcoal) burns out the oxygen of the ore; in the latter, air burns out the carbon of the pig iron. The hearths are substantially alike, but the forge hearth is shallower below the tuyeres—*i. e.* 8 inches deep. One or two tuyeres are used, according to the size of the hearth, and the blast is sometimes hot, but usually cold. There were recently fourteen distinct methods of making wrought iron, and five of making steel in forge fires, depending on the kind of pig iron used, the different ways of working it during the refining, and the ways in which the blooms were made into bars. Swedish iron for conversion into steel is nearly all made in forges by the Lancashire or Walloon process. Since 1840 little or no bar iron has been made in America by means of forges, which now make principally slabs for *best boiler plate;* the description is therefore simplified.

Fig. 4.



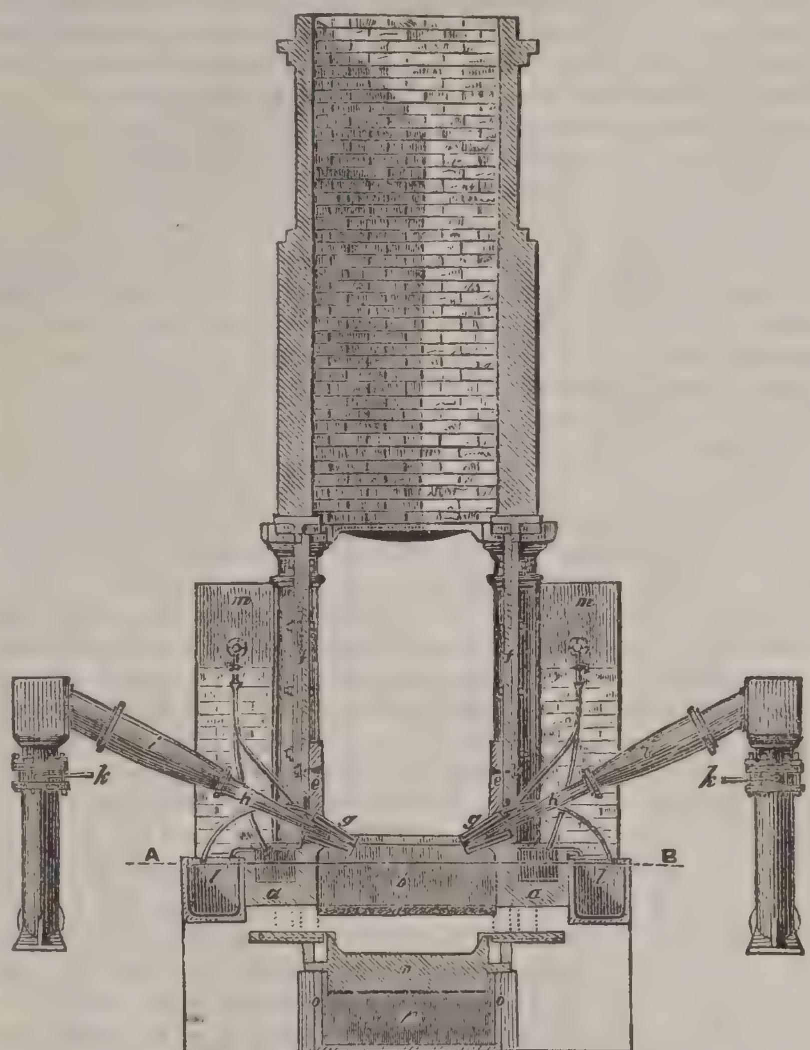
Vertical section of a German forge-fire: T, tuyere; N, nozzle, made of light sheet iron attached to a leather bag, and by that to blast-pipe.

The process consists in carefully melting down about 230 pounds of pig iron at a time, and when melted in keeping it constantly exposed to the blast, both by turning the tuyeres down upon it, and by stirring it up with an iron bar, till the carbon is nearly burnt out and the mass becomes pasty. The fire is then driven, the heat raised, and the metal worked and squeezed with a bar, so as to collect the whole into a ball or *loup*, as free from cinder as possible. The cinder should be rich in iron, and should be frequently let off when wrought iron is desired; for steel the cinder is left over the metal, and the blast is lessened and less sharply directed on the metal, so that its action may be less violent. The loup is raised and welded and forged under a heavy (2-ton) hammer into billets or slabs. The bloom is seldom reheated in the same fire. Forges in Pennsylvania usually work only thirteen hours per day, and make in that time six loups, weighing about half a ton; the product of a fire is therefore about 3 tons per week. When the cast iron is *refined*, as it usually is, a fire makes 1 ton daily. A ton of billets requires about $\frac{9}{10}$ ton of char-

coal and 24 cwt. of cast iron. There are now 46 forge-works in the U. S., of which 31 lie in Pennsylvania with 95 fires.

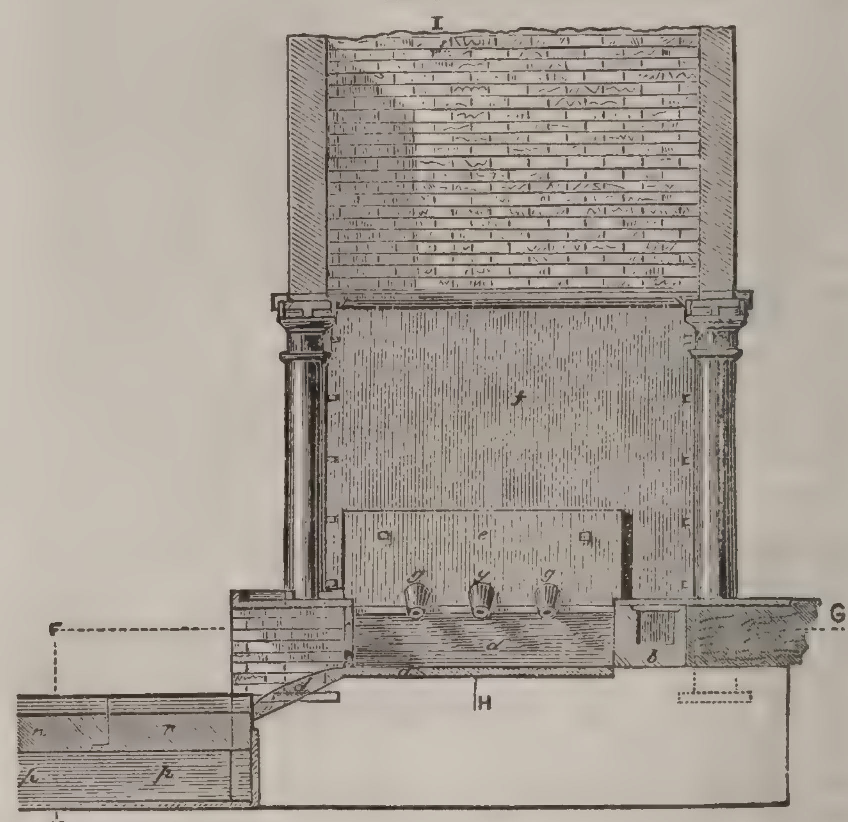
It is therefore advantageous to refine the iron, since the product is increased, but refining also lessens the waste of iron, by removing silicon, and also makes it possible to use poorer and more impure ores in the blast furnace. Pig iron is refined in the *refinery* or *run-out fire*. It is probable that the idea originated in the Eifel Mountains at Eiserfey, where for three centuries the pig iron in the hearth of a charcoal blast furnace has been refined previous to being let out, by turning the tuyeres right down, and blowing sharply into the iron. The modern refinery is a rectangular box 42 inches wide by 66 inches long and 12 to 18 inches deep—that is, large enough to hold $1\frac{1}{4}$ to 2 tons of pig iron and some slag. The sides and one end are of iron blocks, cooled with water, while the bottom and the other end, out of which the iron is tapped, are made of refractory sand. Four to six tuyeres are used, their points being protected by

Fig. 5.



Refinery, Bromford Iron-works, Birmingham, Eng.: vertical cross-section through two opposite tuyeres on the line E, F, G, H, I, Fig. 6.

Fig. 6.



Refinery, Bromford Iron-works, Birmingham, Eng.: vertical section.

Figs.

- 5 & 6, *a, a*, hollow sides of cast iron.
- 5 & 6, *b*, hollow back of cast iron.
- 6, *c*, front or dam-plate of cast iron, containing the tap-hole.
- 5 & 6, *d*, flat bottom of sand, which is continued beyond the tap-hole plate, from which it slopes downward.
- 5 & 6, *e, e*, plate of cast iron screwed on *f*, through which the tuyeres pass.
- 5 & 6, *f, f*, cast-iron plate.
- 5 & 6, *g, g, g*, water-tuyeres.
- 5, *h, h*, blast-pipes.
- 5, *i, i*, leather connecting-pipes between the blast-pipes and the blast-main.
- 5, *k, k*, throttle-valves for regulating the blast.
- 5, *l, l*, water-troughs of cast iron to receive the water from the tuyeres.
- 5, *m, m*, tanks of cast iron for water to supply the sides and back of the hearth and the tuyeres with water.
- 5 & 6, *n, n, n*, long cast-iron or running-out bed, to receive the molten metal from the hearth.
- 5, *o, o*, cast-iron box, forming a channel, *p*, over which the running-out bed is supported.
- 5 & 6, *p*, channel under the running-out bed, through which water is kept in circulation for refrigeration.

water-tuyeres. The iron is sometimes (for *tin plate*) *melted* in the refinery, but is usually run into it melted, as it issues from the blast furnace. The iron is then covered with coke and the blast kept on it, burning away carbon, silicon, and some iron, while the metal boils from evolution of gas, till the desired point of purity and whiteness (low per cent. of carbon) is reached. The refined iron is then let out into a long cast-iron trough, in which it cools in thin plates, which are broken up for subsequent conversion; hence refined iron is often called *plate iron*. One refinery can refine 100 to 160 tons of pig iron per week, with 10 per cent. total loss, most of which can be recovered from the cinder made, and requires about 4 cwt. of coke per ton of iron when the iron is run in melted.

The greater part of the wrought iron used is made by *Puddling;* but before describing the process it is proper to mention the Ellershausen process, a method of *refining* intended to displace puddling. Pure magnetic or specular ore is powdered and mixed with the molten pig iron as it flows from the blast furnace. The heated ore parts with its oxygen, which burns out, more or less completely, the carbon and impurities in the pig iron. The balls or *"pig blooms"* thus made consist of a mixture of wrought iron and oxide of iron, and must be subjected for an hour or more to a high heat in a puddling furnace to separate the superfluous ore before they can be rolled into bars. The process has not met the expectations entertained.

Cort was the first to puddle iron successfully. The reverberatory furnace used by him had a bottom of siliceous sand, which could not resist the action of cinder, and either mottled pig iron or refined iron was used alone, the conversion being effected mainly by the action of the flame. His process is therefore called *dry puddling*, or simply *puddling*. The waste of iron was fully 7 to 10 per cent., and the quality poor. The pig iron laid on the furnace bottom crumbled, as it became hot, into a sandy mass, which gradually melted. By the combined action of unburned air in the flame and of silica in the bottom, enough cinder was formed to convert the mixture of iron and cinder into a pasty mass easily acted on by the flame. Gray iron remains too liquid after melting for use in this method, but refined iron becomes pasty almost immediately. Hence with ordinary ores refining is quite necessary. S. B. Rogers reconstructed the furnace with an *iron bottom* cooled by air, and thus increased the weekly product of one furnace from 8 tons to 20 or 24 tons per week. Hall then introduced the process of *wet puddling*, usually called *boiling*. Here cinder rich in iron and oxygen is charged with the pig iron, which is then, as it were, melted and worked *wet* in a liquid bath of cinder, by the agency of which the carbon, etc. in the iron is burnt out. The boiling process does not require refined iron, and involves no loss of iron, but rather a gain, for the sides of the furnace bed are protected by a thick coating of ore, which is partially reduced. The cinder is a silicate of protoxide of iron, which readily dissolves the ore, forming a new combination containing magnetic oxide; this is constantly reduced by the carbon and silicon in the iron, and by the iron itself, but is reoxidized by the flame till all the pig iron has been converted. The form of the furnace used is such as to furnish a chamber about 60 inches long by 48 inches wide, and 20 to 24 inches high in extreme dimensions. The superficial area of the bed is about 20 square feet, and the grate usually has about one-third this area—more or less, however, according to quality of coal. The bed and grate are covered by an arched roof, highest over the grate and sloping down to the other end of the chamber, so as to *reverberate* the flame strongly down on the bed of the furnace before reaching the exit flue: this is placed low, and its area must not exceed one-fifth that of the grate. The stack is 20 inches square inside, and about 40 feet high; it can be closed at the top by a damper to regulate the heat, but the blast from a fan blown underneath the grate is now generally substituted for natural draft. The grate and puddling chamber

or bed are separated by a brick wall, the *fire-bridge*. An iron frame about 9 inches high rests on the iron bottom plate and forms the sides of the bed; it is hollow, and cooled by water circulating through it or with air, while the bottom is cooled by the circulation of air. The iron bottom consists of plates 3 inches thick; when used it is covered with a thick layer of nearly infusible cinder and ore carefully smoothed and consolidated at a high heat. The sides are covered with lumps of ore or a thick mass of ore and roasted cinder; this lining is intended to waste and be renewed. Access to the bed is had through a hole about 20 inches square closed by a door, lined with firebrick and moving vertically. The door has at its bottom a small hole, the *stopper-hole*, for the insertion of a long bar or *rabble*, as the intense heat must not be lowered by opening

FIG. 7. SINGLE PUDDLING FURNACE.

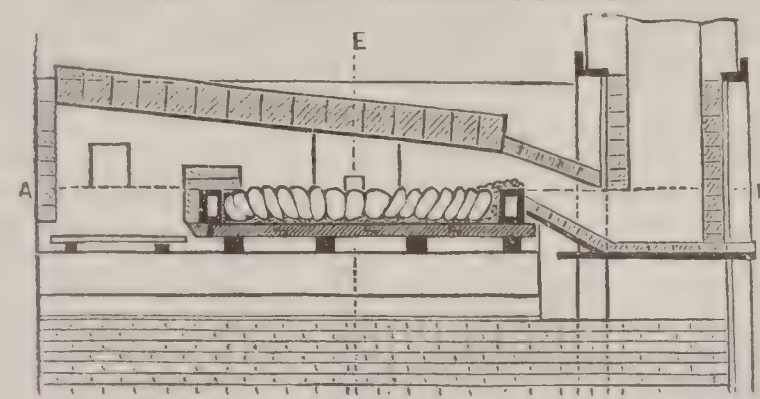


Fig. *a*, longitudinal section on C, D, Fig. *b*.

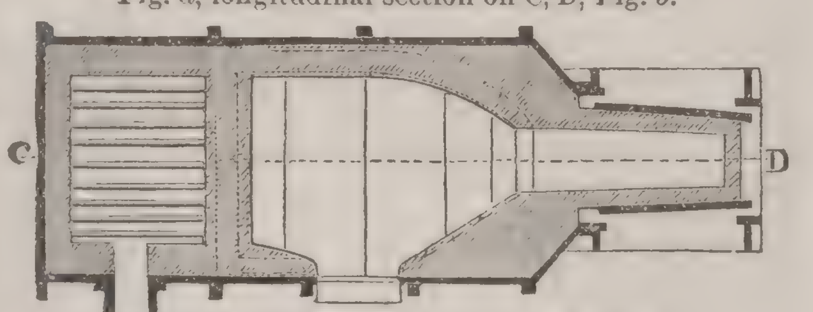


Fig. *b*, longitudinal section on A, B, Fig. *a*.

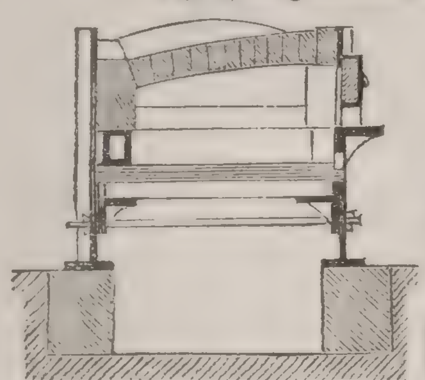
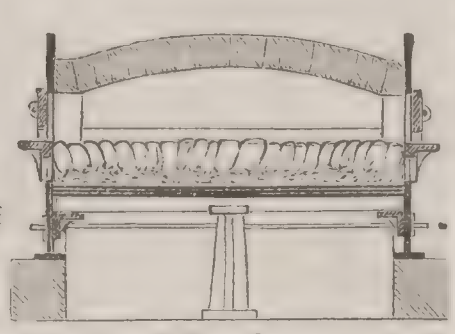


Fig. *c*, cross-section on E, F, Fig. *a*.



Double puddling furnace, cross-section.

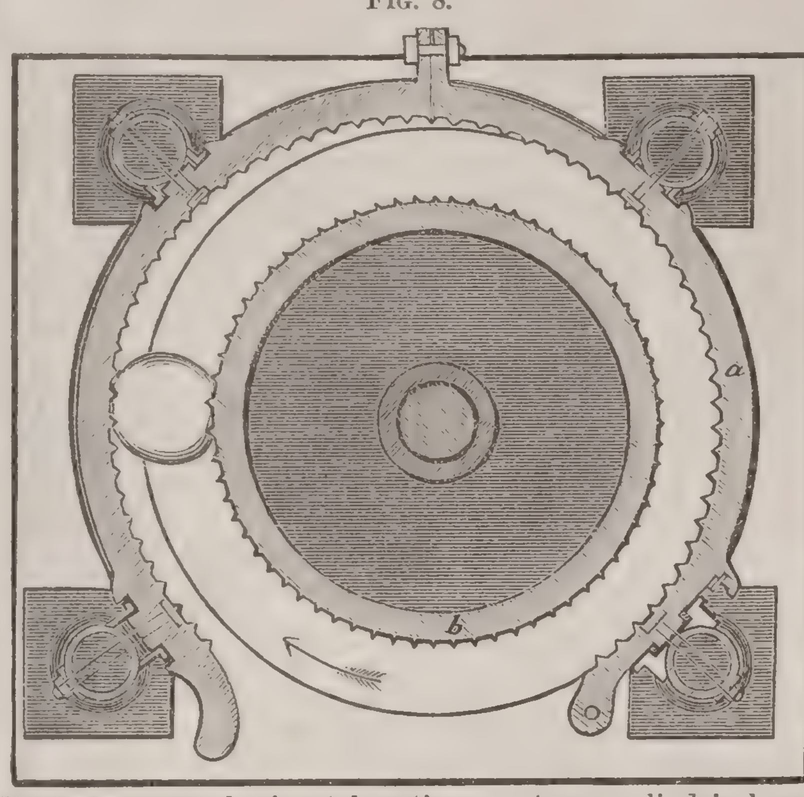
the door. The essence of puddling, as distinguished from other operations, is the refining pig iron on the bed of a reverberatory furnace by means of heat applied by flame.

We have described the *puddling* process, and shall now describe that of *Boiling*. A charge of 500 to 600 pounds of forge iron is laid on the bed of the furnace, often with as much as 100 pounds of cinder and scale. The whole is then quickly melted at a high heat; when fluid, fresh mill-scale or water is thrown in to partially chill the cinder and iron, so that they may be thoroughly intermixed. The heat is then raised again, when the oxides of iron in the cinder react on the carbon and silicon of the iron with such effect as to keep the mass frothing in a state of lively ebullition. During this part of the process the ore lining furnishes oxide of iron to keep the cinder rich, and the yield of iron is increased by the reduction of this oxide, usually the magnetic oxide. The boiling gradually ceases, bright white spots of iron appear, the cinder seems to sink to the bottom, and the whole soon comes into a spongy state, or is *brought to nature*. This sponge is well worked together by means of the rabble, and broken loose from all parts of the furnace, the heat meanwhile being kept high. The puddler (boiler) now separates the whole mass into six or more balls, patting and squeezing them, with the rabble, into shape and firmness. All this is done under a smoky or *reducing flame* to avoid burning the iron. The balls when made are put into the hottest part of the furnace near the bridge, receive a very strong final welding heat, and are drawn out separately with tongs. They are then carried to a *squeezer* or to a hammer, in order that the cinder may be expelled and the iron welded together.

Both processes of puddling are still in ordinary use, that of puddling, however, for inferior iron. In *boiling*, a No. 3 iron is usually used in America, but in England it is customary to use refined iron largely. With gray forge iron six heats of 480 pounds each are boiled in twelve hours, but with white iron (one-half the charge refined) seven heats of 540 pounds are made in the same time. On an average 2436 pounds of pig and 2548 pounds of refined iron make 2240 of puddled bars, wasting, say, 9 to 12 per cent., with a consumption of $\frac{3}{4}$ to $1\frac{1}{4}$ tons of coal. The largest production per furnace is made in Wales; there a single furnace averages eight heats in twelve hours, or 18 tons weekly, and a double furnace 36 tons. *Puddling* requires 2300 to 2400 of refined metal to 2240 of bars. A single furnace using only refined iron averages in Wales about 23 tons per week, and burns per ton $\frac{1}{2}$ to $\frac{3}{4}$ ton of coal. These productions are all those of a low grade of iron; where quality is aimed at, the product per furnace averages 10 to 12 tons per week.

For ordinary iron Burden's squeezer is almost exclusively used in this country, and the hammer, as a rule, for higher grades. The Burden squeezer is a rotary machine, the best form of which consists of a serrated wheel, with a vertical axis or shaft placed eccentrically inside a fixed ring, the inner surface of which is also serrated. The wheel is driven by gearing, and its eccentricity is so gauged that the opening at the starting-point is 15 inches, but diminishes gradually through nearly the whole circumference to about 9 inches. The external diameter of the wheel is 5 feet and the internal diameter of the ring is 7 feet. The puddle-ball

FIG. 8.

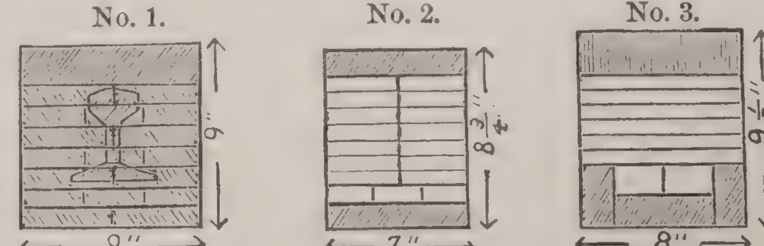


Rotary squeezer, horizontal section: *a*, strong cylindrical cast-iron frame; *b*, strong cast-iron wheel.

is put into the squeezer in a roughly round shape, and is seized, rotated, forcibly compressed, formed into a cylinder, and delivered at the point of entrance still hot enough for rolling. (For the trains of rolls and mechanical appliances for rolling puddle-balls into bars, etc. see ROLLING-MILL.) The puddle or mill bars are usually about $3\frac{1}{2}$ inches wide, and are cut up into pieces 4 to 5 feet long. They cannot, like a forge or bloomery billet, be directly worked into bars, for they are too rough and imperfect. They are therefore piled one on another into a "pile," reheated to a full welding heat in a heating furnace, and rolled again into a square or round bar for ordinary iron, or into a flat bar for further working. The more iron is *worked*, either by hammering or rolling, the more fibrous and homogeneous it becomes. Hence, the best iron is often rolled three or even four times before receiving final shape. In order to economize work

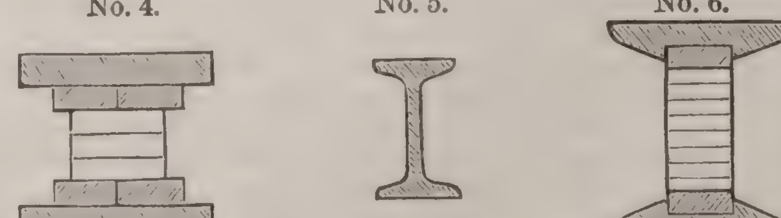
FIG. 9.

No. 1. No. 2. No. 3.



Rail piles.

No. 4. No. 5. No. 6.



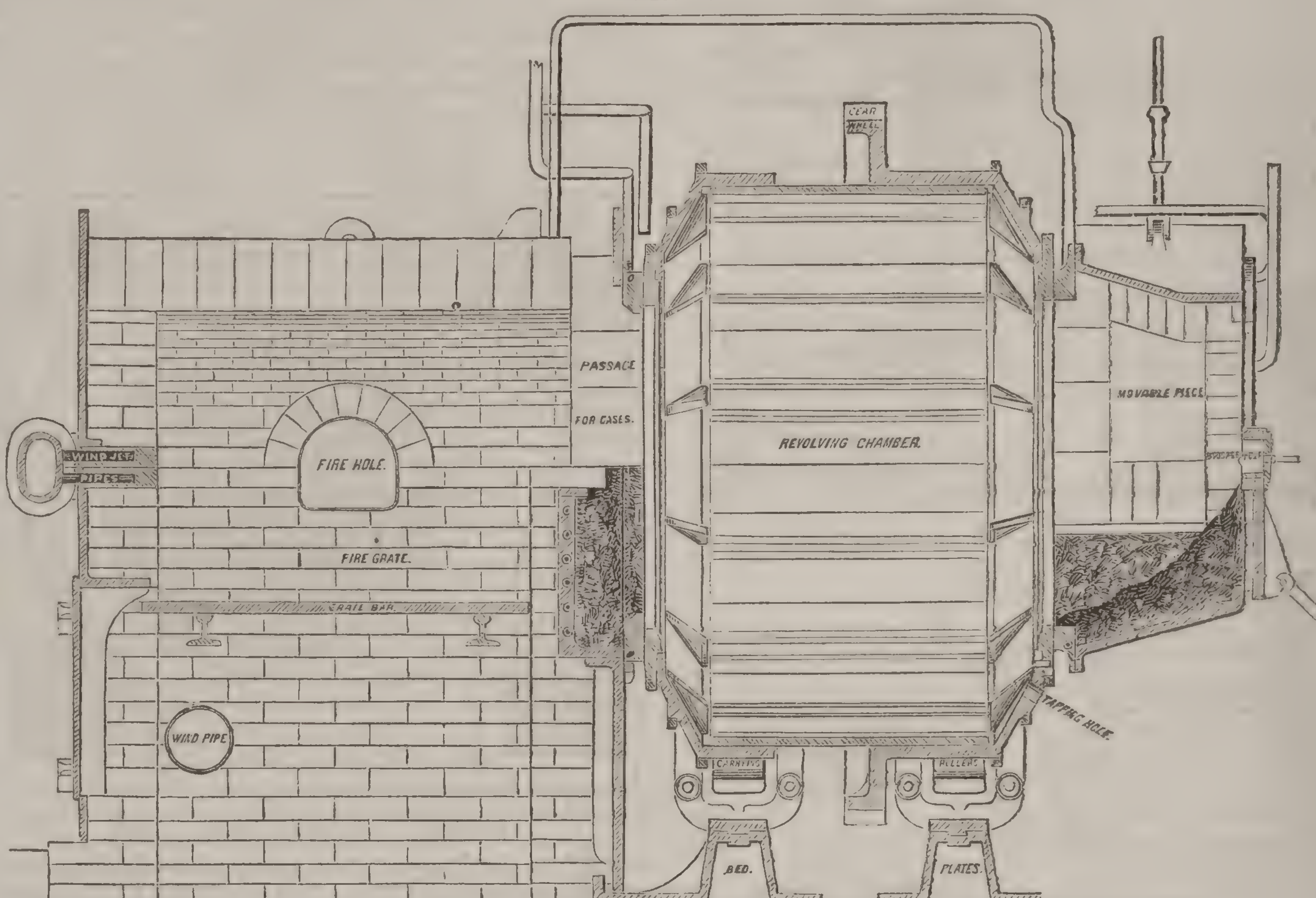
Piles for beams.

several kinds are often used in the same pile, this being especially the case in rail-piles, where different qualities are also desired in the different parts. Nos. 1, 2, 3 are rail-

piles; the first is a good American pile, the top layer being three times rolled, the rest twice; the second is average American, the top and bottom layers being twice rolled iron—the second layers, for top and bottom, old rails, the rest puddled bar; the third is unusually good English, the top layer being hammered iron, the bottom (hatched) layers twice-rolled iron, the rest puddled bar. The average reduction in size from the pile to the rail is about 10 to 1, the finished rail being shown in the centre of pile No. 1. The economy of rail-making depends on these arrangements, and the engineer wants good iron in the head and flange, but allows comparatively poor iron in the rest or stem of the rail. The piles for girder beams like No. 5, Nos. 4 and 6, are similarly made up as to quality of iron, and exhibit expedients to avoid waste of metal (No. 4), and to secure strength (No. 6), the latter pile being also formed as it is because a large beam is to be rolled from it. Round bars if large are often rolled from round piles, and the size of a pile for a square bar is proportioned to the bar to be made from it, so as to ensure soundness. The waste in each heating is 3 to 5 per cent., and the coal required is about 1 ton per ton of iron. Bars are rolled from 30 to 70 feet long, rails usually 25 to 30 feet, but sometimes double these lengths, and other forms as long as their weight allows. The ends of rails, etc. must be cut off to produce a solid end, the waste from this source being 8 to 12 per cent., which is not lost, but must be reworked.

Various machines have been invented to lighten the labor of hand-puddling. These are of two kinds: *first*, mechanical arrangements to move the rabble as is done by hand; *second*, to rotate the furnace itself, and thus cause the whole charge to work itself by the action of gravity. The arrangements of Eastwood, Whitham, and Duméry and Lemut are those most used; they lighten labor, but scarcely increase product, nor do they much diminish wages; hence they can hardly be considered as permanent improvements. But machines of the second class, like those of Menelaus, Danks, and Danks improved by Jones, may be regarded as solving the problem. This furnace has a fan blast under the grate, and also *jets* of blast over the fire. The workmen can thus suit the heat to the requirements of the charge. The ash-pit and fire-hole are closed by doors, the fire-hole casting being cooled by circulation of water in a coil of pipe cast in it. The bridge-plate is also cooled with water, and has a lining of firebrick next the fire and fettling next the charge. Fastened to the bridge-plate is a ring cooled by water, against which the revolving chamber rubs closely. The revolving chamber has two end-pieces hooped with iron and resting on carrying rollers; these ends are connected by a series of stave-plates to form a cylinder. The stave-plates have hollow ribs to hold the lining fast and keep it cool. A movable head-piece connects the revolving chamber with the chimney, and acts both as door and flue. When it is removed balls of great weight can readily be taken out; it is cooled with water and provided with a stopper-hole for observation. The vessel is revolved by a toothed wheel fixed on it and geared to a suitable engine, so that the rotation may be regulated. The chamber is first lined with a thick paste of powdered iron ore and pure lime, which sets hard and about an inch over the ribs. The fettling is then made by throwing in pulverized ore and melting it, thus glazing the lining and leaving a paste of melted ore to hold lumps thrown in all over the surface. For fettling a 700-pound rotary furnace 2 to 2½ tons of ore are required. In working, more scale or cinder than usual is used, and the iron is melted in 30 to 35 minutes, when the furnace is rotated for 5 or 10 minutes to produce a thorough action of the cinder. Water is injected through the stopper-hole, and a portion of the cinder solidified, which carried down into the molten iron combines with the impurities. The heat is then raised, and the cinder liquefied so as to float on the iron, and it is then tapped off. The heat is again raised, and the furnace rotated six to eight times per minute. The charge is thus dashed violently about, and the particles of iron soon begin to adhere; the velocity is now lowered to two or three revolutions per minute, and the ball speedily forms. Loose pieces are moved to the side of the ball, which is made to fall on them. The movable head-piece is then removed, a large fork suspended from a crane is shoved into the chamber, and the ball is rolled on to the fork by a turn of the furnace and removed.

Fig. 10.



Danks' rotary puddling machine, sectional elevation.

The *difficulties* of the rotary mechanical furnaces are the wear of the fettling and frequent break-downs. When, however, the fettling is suited to the metal used and the iron is refined, no difficulty is experienced on that score, and Mr. Jones has overcome the mechanical objections. He constructs the Danks furnace with a *double casing* and a water-jacket, so that all parts are kept perfectly cool (90°) and work easily. This furnace works day and night, while the single cased furnaces usually work only by day. Mr. Jones uses iron in a melted state, and charges 1550 pounds of refined metal, which is puddled in 35 minutes into a single ball 4 feet long by 15 inches in diameter. This ball is cut up while hot, reheated and rolled into bars (Mr. Heath rolls direct into bars). Each furnace makes six heats in eight hours, averaging 50 tons per week, with a consumption of about 1000 pounds of coal for puddling (less than a ton, including reheating), 1000 pounds of fettling per ton, and no loss of iron. Charges of a ton can be puddled in 40 minutes, and thus a furnace can make 85 tons per week.

The rotary furnaces of Crampton are successful at Woolwich. Sir John Alleyne is working well with Maudslay's soup-plate machine, consisting of a rotary horizontal bed and a mechanical arrangement to move a rabble in one di-

rection. He makes five heats per day, each of 675 pounds. M. Pernot uses the original Maudslay rotary bed with inclined axis, so as to work the charge by gravity, and mounts the bed on wheels to facilitate repairs. He puddles 1-ton heats of white iron, making 18 cwt. of bars with 14 cwt. of slack coal and 2½ cwt. of fettling to the ton of bars. Siemens also has in use at Landore a rotary furnace like that of Sellers (see FURNACE), but with the Siemens regenerative system. This furnace is also working the *direct* process, as mentioned above.

Iron, History of. The Scriptures ascribe the discovery of working iron to Tubal Cain, while Egyptian tradition made Isis and Osiris the patrons of metallurgy, but credited the actual discovery to Hephæstus, the king preceding Osiris, who in date would coincide with Tubal Cain and is probably identical with him. Canaan is described in Deut. viii. 19 as "a land whose stones are iron." The books of Moses, written before 1451 B. C., mention iron frequently; the Arundel Marbles fix a date before 1370 B. C., and about 1000 B. C. we find the use of iron recorded in the Scriptures for tools, arms, and cooking utensils (Deut. xxvii. 5; xix. 5; 1 Chron. xxii. 3; Lev. vii. 9). The Philistines on conquering the Jews (about 1050 B. C.) prohibited any "smith in Israel" (1 Sam. xiii. 20). The Egyptians made iron in the district between the Nile and the Red Sea, but imported most of their iron from Assyria. The Assyrians used iron very freely, and before 880 B. C. used it as a core to save brass in articles cast in brass; Layard found at Nineveh Assyrian helmets and chain-armor. Herodotus (i. 25) mentions the vase of Alyattes at Delphi, inlaid with iron by Glaucus of Chios, to whom is attributed the discovery of *welding*. Pliny (vii. 57) credits the Dactyli of Mount Ida in Crete with the discovery of the *magnetic properties* of iron, and ascribes the invention of the blacksmith's forge to the Cyclopes. Lycurgus of Sparta used iron as money (about 850 B. C.). The Hebrews were doubtless familiar with steel, as Jeremiah (xv. 12) says: "Shall iron break the northern iron and steel?" meaning probably the material derived from the Chalybes of Pontus, the blacksmiths of the ancient world, who *hardened* iron instruments for cutting, and first used coal. Their iron was made, according to Aristotle (322 B. C.), from sand ore dug from river banks, washed, and put into the furnace along with the *stone pyrimachus* (*fire-maker*)—that is, coal. The Greeks and Romans supply few facts of interest. Plutarch (A. D. 110) mentions that the Celtiberians "bury iron rods till the rust eats out the weaker parts of the metal," and make their excellent swords out of metal so prepared. Strabo (A. D. 25) mentions the exhaustion of the productive iron ore mines of Chalcis and Eubœa, and states that Great Britain furnished iron to the Romans. The Romans, however, derived their chief supply of iron and steel from Noricum, now Styria. Strabo also ascribes the introduction of iron-making in Great Britain to Odin, perhaps with reason.

The later history of iron may be sketched as follows from authentic data:

A. D.
700. Iron-mines opened on island of Elba.
712. Styrian iron-mines reopened. Bede mentions iron as an important manufacture in Great Britain.
950–1000. High-bloomeries (Stücköfen) general in Elsass and Burgundy.
1160. Iron-works recorded at Kimberworth, Yorkshire.
1365. Bloomeries first used in Silesia.
1370. First foundries in England.
1488. Mines of Dannemora opened.
1490. First foundries and first stove cast in Elsass.
1543. Cannon first cast in England by Ralph Hoge, at Bucksteed, Sussex.
1546. Agricola records three kinds of furnaces: (1) Catalan forge; (2) German bloomeries, 3 feet high; (3) bloomeries 5 to 6 feet high, the product of which was remelted before shingling.
1550. Wooden bellows invented by Hans Lobsinger, Nuremberg.
1584. Severe legislation to protect English forests.
1600 (*circa*). Blast furnace 24 feet high constructed in Harz Mountains with 6-foot boshes.
1612. Sturtevant obtained patent for smelting iron with pit coal, as also did Rovenzon in 1613.
1613. Heating furnace (reverberatory) invented by Rovenzon.
1614. Regular blast furnace introduced by Germans into Sweden, at the instance of Gustavus Adolphus.
1619. Dud Dudley made pig iron with pit coal (coke); 3 tons a week.
1621. Wooden bellows improved and largely made in the Harz.
1622. First bar iron made in American colonies.
1640. Trompes (water-suction blowing-machines) first used in Italy.
1642. First blast furnace built in American colonies.
1650. Coal first used in forge fires for reheating.
1658. Peat used by the Dutch for iron-making.
1674. English blast furnaces (charcoal) make 8 tons in six days.
1681. Tin-plate making introduced into England from Bohemia by Yarrington.
1701. Peter the Great, through Demidoff, establishes charcoal blast furnaces 45 feet high in the Ural.
1720 (*circa*). Rolling plate iron invented by John Harbury.

A. D.
1722. Steel-making by cementation described by Réaumur.
1735. Coal coked by Darby and successfully used in blast furnace.
1760. Cast-iron blast cylinders made by Smeaton.
1760 (*circa*). Cast steel invented by Huntsman.
1769. Watt's single-acting engine used for blowing-engines.
1783. Grooved rolls for bars invented by Cort.
1784. Puddling invented by Onions, who used fan-blast with closed ash-pit.
1784. Puddling made successful by Cort.
1786 (*circa*). Homfray originated modern process of refining.
1791. Cast steel made direct from ore in a crucible by Lucas.
1796. Charcoal furnaces substantially abandoned in England.
1814. Waste gas of blast furnaces applied by Aubertot.
1828. Hot blast invented by Nielson.
1830. Water-tuyere invented by Condie.
1835. Puddled steel first made at Frantschach in Carinthia.
1836. Anthracite first used by Crane in Wales.
1838. Anthracite first used in U. S. at Mauch Chunk by Baughman, Giteau & Co.
1839. First three-months blast with anthracite at Pottsville, by Lyman.
1839. Heath invented the use of manganese in steel manufacture.
1840. Burden invented the rotary squeezer.
1842. Nasmyth invented the modern steam-hammer.
1850. Puddled steel first successfully made by Riepe.
1855. Bessemer decarbonized iron without fuel by blowing air through it; Kelly invented same process in U. S.
1856. Mushet made Bessemer process successful by inventing use of spiegel iron as a recarbonizing agent.
1856. Siemens invented the regenerative system of using gaseous fuel.

We see above that there have been few inventions originating systems, but that from time immemorial one thing has slowly developed into another. The Catalan forge grew into the German bloomery (English, *air-bloomery*), that into the high-bloomery (English, *blast-bloomery*), that into the low blast furnace with cold weak blast; then came stronger blowing-engines, and then the blast was heated, when it was found that the furnace could be enlarged to its present height and size. Here are seven steps to reach one modern result. But it is remarkable that a process once perfected is sacredly retained, and all the early steps are still in daily use. We find, however, that the history of the trade resolves itself into various epochs: (1) The perfection of mechanical art to enable blast furnaces to be used—1580 to 1621. (2) The general use of coke as fuel—1735–50; and the use of cast-iron blast cylinders—1760. (3) Application of steam-engine in iron-works first to blowing-engines—1769. (4) Inventions of rolling and puddling by Cort—1783–84. (5) Use of hot blast and application of waste gases—1828–36. (6) Economy of fuel by improved apparatus and processes, and perfection of works, engineering—1856 to present time: extended use of Steel.

The history of the art in Great Britain and America runs as follows: The Phœnicians seem to have made iron in the British Isles very soon after they discovered them (600 B. C.). A hundred years before Cæsar's invasion (55 B. C.) the Britons exported iron to the Continent (Gaul) in their own ships. Cæsar found, to his cost, plenty of iron in England, both as money and weapons of war. When the Romans secured possession (A. D. 61), they established iron-works; Adrian built (120) a great military forge at Bath, and supplied it with iron from the Forest of Dean, where immense cinder-heaps still exist. The Romans encouraged iron-making till 409, when they abandoned Great Britain. Then all arts were thrust aside, by Saxon and Danish conquest and civil war, till the reign of Alfred the Great. No record is made of iron till the Doomsday Book mentions that William the Conqueror (1066) demanded iron bars as tribute from the city of Gloucester. After the Conquest iron and steel were mostly imported from Germany. Little was made in the N. of England, for raiding Scots in 1317 could find none till they reached Furness, where they seized all they found. In 1355, Edward III. forbade the export of iron from England. During the fourteenth and fifteenth centuries Germany and Spain supplied iron and steel largely, till the importation of articles which could be made in England was forbidden in 1483. In the reign of Elizabeth (1588) severe laws were enacted to prevent the general destruction of the forests by iron-works; these laws were in force till 1756. Charles I. appointed inspectors in 1639 to stamp bar iron according to quality, and see that no woods were cut down contrary to law.

The scarcity of timber and charcoal caused numerous futile attempts to use coal; finally, Dud Dudley succeeded in 1619. He gave in his *Metallum Martis* a sad history of the effects of the envy of importers and fellow-manufacturers. He built five works, was tricked out of three, one was destroyed by riot, and one by flood. He was a royalist, and Major Wildman, with Cromwell as partner, bought his estate to wring his secret from him, but they failed. Vernat, Wildman, Copley, Buck and Blewstone all failed to make iron with coal, though others used coal in forges instead of charcoal. Dudley kept his secret, and left it to his relatives; it lay in his skill in making bellows and in *coking* coal. Toward the end of the seven-

teenth century Dr. Plot stated as the general opinion that "coke was fit for most uses but for melting, fining and refining iron, which it cannot be brought to do." Meantime, early in the eighteenth century, wood grew exceedingly scarce, and about 1740 large importations of iron, mostly pig, came in from Russia and Sweden; American exports were encouraged. England had only 59 furnaces, with a product of 17,350 tons, and depended on foreign countries for pig iron for her fineries. Some English companies had their furnaces in America and their forges in England. Darby, however, had experimented with coke since 1713, and by 1735 was able to use it regularly, while Smeaton erected in 1760, at Carron, a powerful blowing-engine consisting of four single-acting cast-iron blowing-cylinders driven by a water-wheel in the rotation required for a uniform blast. Smeaton applied the cylinder, but Wilkinson, who invented a correct boring-machine for Watt, was the first to apply the steam-engine to blow furnaces. After 1740 iron-making throve with surprising vigor, and 53 coke furnaces were built before 1788. The charcoal furnaces averaged 294 tons yearly in 1740 and 545 tons in 1788, but in that year the coke furnaces made an average of 909 tons. The use of coke and blowing-engines quadrupled the production of pig iron in fifty years. Bar iron, however, was still made in charcoal forges; the British forests were exhausted, and Sweden and Russia rapidly advanced the price of bar iron. Great Britain then laid a heavy duty on bar iron, beginning with £2 16*s*., and rising continuously, till 1825, to £6 10*s*. in English and £7 18*s*. 6*d*. in foreign ships. In 1797, Pitt abandoned his intention of taxing English iron 20*s*. per ton, though he had exhausted his last resources of taxation to carry on the war against Napoleon. In 1783 and 1784 Henry Cort of Gosport obtained patents for puddling iron and rolling it into bars (plate-rolling having been invented by Harbury). At this time the forge-hammers could make no size less than $\frac{3}{4}$ inch square, and all smaller sizes, for nail-rods, etc., were cut in a slitting-mill. The hammers made 1 ton of bars in twelve hours, while Cort's rolls made 15 tons, and 5 tons of the smallest sizes. His puddling furnaces made less than 5 tons a week. The original processes worked well, but were never fairly developed by Cort, though they came immediately into general use. Homfray first refined iron to prepare it for Cort's puddling. The only remuneration Cort ever got was a pension of £160 for six years, and £100 to his widow, renewed by Lord Palmerston to his children. The capital used by Cort came from Jellicoe, a paymaster who defaulted; Cort's patents were then confiscated and locked up by Trotter and Lord Melville, both rascals. The latter a few days after Cort's death got from the House of Lords a release to himself of £25,000, on the score of the *great and uncontested merit of Cort's inventions!* From this point British iron manufacture steadily increased, the charcoal furnaces disappeared, and Gibbons and others largely increased the product of blast furnaces by alterations of form. The hot blast was discovered by Neilson in 1829, the opinion being general that the *colder* the blast was the better. It was successful at the Clyde works, being essentially aided by Condie's water-tuyere, without which hot blast could not be used. At the Clyde, 1 ton of iron required $8\frac{1}{8}$ tons of coal coked, but in 1831 hot blast was used, raw coal was substituted, and only $2\frac{1}{8}\frac{5}{8}$ tons of coal were needed to the ton of iron. Mushet discovered blackband in 1801, and in 1825 used it alone, with a saving of one-quarter the coal and one-third the limestone before required. The great production of Scottish iron dates from this time. In 1844 the wild railroad mania stimulated all production, particularly that of Scotland, and gave rise to speculation on warrants drawn against pig iron in store; the stock then held at Glasgow often reached 430,000 tons. In 1831, Perdonnet in France discovered that anthracite could be used with cold blast by excessive care and in mixture with coke. In 1837, Mr. Crane of Ynescedwin found that with hot blast he could successfully use anthracite coal alone.

Since 1840 wages have gradually increased and improvements made to save labor. The puddling furnace has been the subject of constant attention in a mechanical direction, with the results described above. Iron was applied to a great variety of uses, especially to iron ships in 1834. For these, forgings up to 35 tons weight were required for shafts, which were forged under Nasmyth (1842) or Condie (1843) hammers. Great improvements have been made in rolling-mills, both in strength and design; the rolls were reversed, to save labor, and Ramsbottom adopted Nasmyth's suggestion to reverse the engine itself. These systems are now used in every English works. The enormous consumption of fuel at iron-works led Siemens (1856) and others to seek economical systems, that of Siemens being now in general use for almost every purpose, with a saving of 40 to 60 per cent. The hot-blast stoves have been improved by Whitwell and Cowper on the Siemens principle, and the ordinary cast-iron stoves by Player, Ford, Gjers, and many others. The temperature of the blast has been raised to 1300°, at which a ton of iron has been made with a ton of coke. In a business point of view, England has found since 1840 that joint-stock companies for iron-making were anything but a success.

The period just described is marked by the struggle for economy in all aspects of the trade, but after 1850 invention proper took a new course—viz. in the direction of steel. Steel had been made in bloomeries up to the end of the seventeenth century, when it was found that bar iron could be converted into steel by heating it in large closed chests with charcoal, and the converted bars when sorted, piled, welded, and forged, made excellent *shear* steel for cutlery. But for finer purposes shear steel was defective in temper and on account of seams. Then Huntsman, a manufacturer of watch-springs, discovered in 1740 that the converted or blister steel from the best bars, when sorted and melted in crucibles with bottle-glass, made a faultless material. He built works at Sheffield in 1770, controlled the market, and kept his process secret for many years. Something *cheaper* was needed, and in 1800 Mushet melted bar iron direct with carbon to make steel. Lucas in 1804 tried to decarbonize pig iron by cementing with oxidizing substances, as ore (the origin of *malleable iron*), but without success. Then Heath in 1836 found that the use of 1 to 3 per cent. of a carburet of manganese, or materials producing it, made sound cast steel out of blister steel from cheap British bar, thus saving at least 40 per cent. of the cost. This discovery is the basis of modern steel processes. Heath was betrayed by his agent Unwin, and, as the *third* in our list, got nothing for an invention which established the Sheffield steel trade. By the use of manganese to make a thin slag, and also of spiegel iron added near the end of the puddling process, Westphalian and English firms made good *puddled* steel under Riepe's patent (1850). Want of uniformity has prevented any general use of puddled steel. Uchatius made steel in 1855 by reducing ore in crucibles with coal; Parry (1855) attempted to make steel by *direct action of air* in a puddling furnace, Kelly (1856) in the hearth of a blast furnace, and Bessemer (1856) in a close vessel. Bessemer finally made a peculiar metal by blowing the air in *numerous fine jets* (Martin) through the iron, but did not make a reliable material till he used Mushet's "triple compound of iron, carbon, and manganese," or spiegel iron (1856, date of discovery) to make the steel *malleable*. The Kelly and Bessemer patents are united in America, and Mushet was so unfortunate as to allow his important one to lapse. It is now possible to attain in the Siemens and Eckmann furnaces a heat high enough to melt wrought iron with enough cast iron to convert it into steel (Martin, France, 1866). By the use of these processes steel is now rapidly approximating iron in cost, and is supplanting the best iron for engineering purposes.

We have seen above the development of the art in England; we shall see in American history the course of its application. The Indians had no knowledge of iron. The first iron made in America was forged at a bloomery of the Virginia Company by John Berkeley in 1622, on the James River, 12 miles below the present site of Richmond. The Indians destroyed the forge, and, owing to the lucrative tobacco-trade, no more iron was made in Virginia till 1724. Meanwhile, the people of Massachusetts Bay had built one "iron-mill" at Lynn in 1631, and a London company, represented by John Winthrop, Jr., built in 1644 a blast furnace at Hammersmith and works at Braintree in 1646, and Raynham (Taunton) in 1652, agreeing to erect "an iron furnace and forge, and not a bloomery only," and to sell bar iron under £20 per ton. They cast *iron pots*, etc. in 1646, under the direction of Joseph Jenks, who made our first *saws* in 1652. They exceeded the fixed price for iron, and would not trade in kind, so that complaints of damage, rascality, and want of money on the part of the people brought these works to an end in 1670, during King Philip's war. But the increasing price of iron in England gave profitable occupation to our furnaces after 1702, when the era of regular iron-making in the colonies began. In Plymouth (Mass.) a furnace was built in 1702 by Despard and the Barker family, and was succeeded by many others, working 25 per cent. *pond ore* (limonite), mixed with 35 per cent. bog ore from Egg Harbor, N. J. By 1804 they had seriously injured the forests in that part of the State, and emigration had taken place for want of occupation. They all made *castings* (*not* pig iron) direct from the furnace, at a cost of $49.77 per ton in 1804. New England exported no iron, but obtained pig for her forges from Pennsylvania. Massachusetts bar iron cost in 1727, £12 5*s*. to £12 10*s*. per ton. In Virginia, Col. Spotswood built the first furnace in 1724, and made castings out of an air furnace in 1732. There were four furnaces in 1732 between the Potomac and Rappahannock, each making 20 tons of pig iron per week, or 800 tons a

year, which sold for £6 in England, and netted the producer £3 to £4 per ton. In Maryland, Mr. England and Augustine Washington (father of Gen. Washington) built a forge in 1717 at Principio, where they made excellent iron, which sold in England up to 1770 for £10 to £16 per ton. Maryland and Virginia exported their entire product to England, and Col. Spotswood remarked, that Pennsylvania would do so too had she ships, but failing these must manufacture it herself. John Winthrop, Jr., built iron-works at Pequot (New London) in 1644, and in 1657 a blast furnace at New Haven, which, singularly enough, ran on *English* ore. No great activity was afterwards manifested, though in 1655 the colony granted privileges to John Tucker of Southold, L. I., for steel-making, and in 1727, Joseph Higby made good steel, and exhibited samples of it; both these were probably blister steels. George Eliot made steel in a bloomery from magnetic ironsand in 1761, and also had a cementing furnace, built before 1750. In New York the Stirling furnace and works were built in 1751, and the Ancram works, built in 1740 to use Salisbury ore, made 3318 tons 12 cwt. of pig iron and 1302 tons of bar iron in the years between 1750 and 1756. The great chain weighing 186 tons stretched across the Hudson in 1778 was forged at these works in six weeks. In 1801 the first forges were built in Essex co., at Willsboro' Falls on the Boquet. In New Jersey the earliest works were bloomeries. Col. Morris built works in Monmouth co. in 1685; the Petersburg bloomery, Morris co., was built in 1725, and the Oxford furnace, in Warren co., in 1745; the latter is still running. The principal impetus to iron-making in the State was given by the London Company, Baron Hasenclever and others, who built the Ringwood furnace in 1762, and other works soon after, utilizing the ponds of the region to great advantage as a source of power. The last manager of the original Ringwood works was Robert Erskine, afterwards chief of staff and engineer of the Continental army. In Pennsylvania the first forges were built by Hall, Nutt, and Rutter in 1717 on the Schuylkill, while the first furnace was built on the Christina River, near New Castle, now Delaware, by Sir William Keith in 1726. The Durham furnace was built in 1728, and other furnaces built by the families of Potts and Nutt from 1734 to 1737, and by Grubb in 1742 at Cornwall, followed in rapid succession; 10 furnaces and 9 *finery forges* in all were built before 1750. The furnaces made 20 to 25 tons a week, running about 10 weeks at a blast, and the forges made about 60 tons of iron yearly; both stopped in summer. Pennsylvania exported iron (Grubbs's) to England, the West Indies and New England. Pig iron sold at the furnace in 1731 for £5 10*s.* in Pennsylvania currency; in 1759, for £3 6*s.* 8*d.* to £3 10*s.* sterling. In the latter year bar iron sold for £15. Philadelphians believed in 1750 that when labor became cheaper they could undersell English iron; and this feeling was general in England. When the colonies began to export bar iron in 1717, an agitation sprang up which ended in 1750 with the *absolute prohibition, as a common nuisance,* of the production of bar iron (nail plate) and steel in America. The colonies continued to export pig iron largely. Between 1717 and 1770 a total quantity of about 150,000 tons pig and bar iron was exported to England. The Revolution gave a great impetus to the trade; new works were erected; all were occupied on war material. Congress reopened the steel-works of Philadelphia, and took possession of the Andover iron-works to provide them with pig iron. On the return of peace in 1783 the iron-trade was nearly destroyed. The States became independent sovereignties, with customs regulations often mutually hostile; the machinery of the works had not improved, as might have been expected from the familiarity of Robert Grace and others with British work. The old wooden blowing-tubs furnished blast for charcoal furnaces, and bellows blew the forges, while all works operated on a small scale. Meanwhile, coke had come into general use in England, and the processes of puddling and rolling had superseded the forges in Great Britain. That country shipped iron hither duty free, while she herself levied a duty of £3 19*s.* per ton, and in 1785 prohibited the export of any tools, engines, models, or plans of machinery *used in making iron* under a penalty of one year's imprisonment, £200 fine, and confiscation of the articles shipped or *intended* to be shipped. This state of things led to Hamilton's report in 1790, which caused the adoption of the protective policy to encourage the natural products of our country.

The system of internal improvements inaugurated between 1825 and 1836 by many States marks the real commencement of iron manufacture in this country, for it made the use of coal possible and facilitated large operations. Previous to 1825 the Atlantic coast depended on English mines for fuel. Coke was first used in the blast furnace by F. H. Oliphant of Fayette co., Pa., in 1836, and anthracite coal first at Mauch Chunk by Baughman, Giteau & Co. in 1838, though Mr. Lyman at Pottsville received $5000 offered by Nicholas Biddle and other citizens of Pennsylvania for the *first continuous blast of three months,* which was completed in Jan., 1840. David Thomas came hither in 1839 at the instance of Erskine Hazard of the Lehigh Navigation Co., built the first furnace of the Crane Iron Co. in one year, and started it on July 4, 1840. The Messrs. Reeves built a furnace in 1837, and Burd Patterson & Co., Biddle, Chambers & Co., and George Patterson built in 1838; all started before July 2, 1840. Before 1840 the forges of Pennsylvania had practically ceased to make bar iron—though Gen. Philip Benner made his "Juniata iron" celebrated all over the West—and confined themselves to slabs for boiler plate; the puddling furnace took their place in making bar iron and common boiler plate; and it is probable that the Martin furnace or Bessemer converter will soon do so for best boiler plate. Raw bituminous coal was first used by the Mahoning (now Ada) furnace in 1846 by Wilkeson & Co. The refinery has been neglected in this country, and the yield of puddling furnaces consequently remains small. The quality of our iron has, however, been kept at the highest point. The design of the machinery used at American works steadily improved, blowing-engines were made powerful enough, and rolling-mill engines were soon made sufficiently strong for rolling rails, which were probably first made at the Mount Savage works in 1840 and at the Great Western Works (Brady's Bend) in 1841. Since that time a great deal distinctively American has been done in mechanical improvements of all kinds, such as Thomas's blast furnaces, Burden's squeezer, Lauth's plate-rolls, Fritz's hanging guides and feeding tables for rolls, Holley's improved Bessemer plant, Kent's hot-blast stove, Pearse's cupola; in engines the Corliss and that of Moore have been prominent. Danks, by his improvements in the lining of rotary puddling furnaces, has made them successful, and Kelly divides with Bessemer the credit of perfecting the process of making steel by blowing air through iron, having, it is said, succeeded in doing so in 1851. The vigor and ability displayed in the inventions by which our iron-trade has been supported, and in the Bessemer trade, at least, placed at the head of the world, deserve the highest praise; in fact, the mechanical has overshadowed the metallurgical side of the art. Attention must now be directed to improvement of processes by the universal application of chemistry with a view to economy.

Iron, Statistics of. We find the present annual product of pig iron in the world to be as follows:

	Years.	Gross tons.		Years.	Gross tons.
Great Britain..	1873 ...	6,566,451	Italy	1872 ...	73,709
United States..	1873 ...	2,560,962	Spain...............	1870 ...	54,007
Germany	1871 ...	1,664,802	Norway	....	20,000
France............	1873 ...	1,381,000	South America and Mexico..	....	15,000
Belgium.........	1872 ...	652,565	Japan	1871 ...	9,370
Austria, with Hungary	1871 ...	424,606	Switzerland.....	1872 ...	7,500
Russia............	1871 ...	354,000	Asia	....	40,000
Sweden..........	1872 ...	322,000	Africa.............	....	20,000
Luxembourg ..	1872 ...	300,000	Australia	....	10,000
Canada...........	....	10,000			14,485,972

Gruner estimates approximately the production of wrought iron and steel in 1872 as follows, in gross tons:

	Wrought iron.	Steel.
Great Britain........................	3,500,000	500,000
United States........................	1,905,922	145,000
Germany	1,150,000	200.000
France..................................	883,000	138,000
Belgium	502,000	15.284
Austria..................................	300,000	49,250
Sweden and Norway............	191,800	12.000
Russia...................................	245,000	7,204
Spain	35,000	250
Italy	24,000	
Canada, India, etc................	70,000	
	8,806,722 tons.	1,066,988 tons.

The product of Great Britain may be summed up as follows for 135 years:

Pig Iron.

Year.	Charcoal. No. furnaces.	Charcoal. Tons.	Coke. No. furnaces.	Coke. Gross tons.	Raw coal. No. furnaces.	Raw coal. Gross tons.	Total, gross tons.
1740	59	17,350					17,350
1788	26	14,500	59	55,200	......	....	69,700
1796	......	....	121	125,079	......	....	125 079
1806	11	7,800	222	250,406	......	....	258,206
1823	......	....	259	442,066	......	....	442,066
1830	......	....	370	678,417	......	....	678,417
1839	2	800	323	1,051,021	54	196,960	1,247,981
1847	......	....	493	1,459,640	130	539,968	1,999,608
1852	......	....	511	2,026,000	144	775,000	2,801,000
1854	......	....	568	2,673,234	156	796,604	3,469,838
1857	......	....	*504	2,741,447	*124	918,000	3,659,447
1873	*1	*ca.*700	*557	5,572,751	*123	993,000	6,566,451

* "In blast;" previous figures meaning "total furnaces."

Great Britain produced the following amounts of bar iron and steel in

1869...... 4,734,145 gross tons. | 1871...... 5,566,175 gross tons.

and exported iron, steel, and manufactures thereof—

1871...... 3,169,219 gross tons. | 1872...... 3,388,622 gross tons.

Prices of English Bar Iron at Liverpool.

Year.	£	s.	d.	Year.	£	s.	d.
1806	17	0	0	1837	9	1	3
1807	16	0	0	1838	9	4	7
1808	14	10	0	1839	9	15	0
1809	15	0	0	1840	8	7	6
1810	14	10	0	1841	7	5	0
1811	14	0	0	1842	5	17	6
1812	13	10	0	1843	5	2	6
1813	13	6	8	1844	6	2	6
1814	13	18	4	1845	9	5	0
1815	13	13	4	1846	9	13	4
1816	12	2	6	1847	9	13	4
1817	10	12	6	1848	6	12	6
1818	12	1	8	1849	5	17	6
1819	12	5	0	1851	6	0	0
1820	10	13	4	1853	11	0	0
1821	8	18	4	1854	10	0	0
1822	8	1	3	1855	11	0	0
1823	8	0	0	1856	9	0	0
1824	8	19	2	1858	8	0	0
1825	12	14	2	1859	7	10	0
1826	9	15	10	1862	7	0	0
1827	9	7	6	1864	9	10	0
1828	7	18	4	1865	8	10	0
1829	6	16	8	1867	7	10	0
1830	6	3	9	1869	7	0	0
1831	5	13	9	1870	8	0	0
1832	5	13	4	1871	8	10	0
1833	6	12	11	1872	14	0	0
1834	6	18	9	1873	14	0	0
1835	6	10	0	1874	12	14	8
1836	10	12	6				

In the U. S. the statistics of iron manufacture are as follows, in gross tons:

In 1810.

153 charcoal furnaces........................ 53,908 tons pig iron.
330 bloomeries and forges.................. 24,541 " bar "
34 rolling and slitting mills............. 6,500 " nails, rods, etc.

In 1830.

202 charcoal furnaces...................... 183,343 tons pig iron.
Bar iron made (including 5853 tons "bloomed" from ore)...... 112,866 " "
14 steel-works.............................. 1,600 " steel, all kinds.

In 1840.

450 furnaces (av. product, 772 tons ea.). 347,700 tons pig iron.
797 bloomeries, forges, and rolling-mills.................................... 197,233 " bar, rod, etc.

In 1845.

523 charcoal furnaces........................ 441,000 tons pig iron.
17 anthracite " .... 45,000 " "
954 bloomeries, forges, rolling and slitting mills........................ } 291,600 " bar, plate, etc. 30,000 " blooms.

In 1849.

303 charcoal furnaces.............................. 379,624 tons pig iron.
57 anthracite " .... 151,331 " "
7 raw coal " .... 7,800 " "
10 coke " (estimated)................ 25,000 " "
552 bloomeries, forges, and rolling-mills.... 278,044 " bar iron.

STATES.	1856. Blast furnaces. Charcoal.	Anthracite.	Raw coal.	Coke.	Bloomery forges.	Finery forges.	Rolling-mills.	Steel-works.	1873. Blast furnaces. Charcoal.	Anthracite.	Raw coal and coke.	Bloomery forges.	Finery forges.	Rolling-mills.	Steel-works.	Bessemer steel-works.
Maine	1	...	..	..	...	...	1	..	1	...	...	..	..	2		
New Hampshire*	5	...	..	..	...	1	...	..	...	...	...	..	..	1	1	
Vermont	1	...	..	..	5	...	1	..	2	...	...	2	..	1		
Massachusetts	7	3	..	..	...	5	19	..	5	1	...	..	1	24	3	
Rhode Island	...	...	..	..	...	...	2	..	...	...	...	..	..	2	1	
Connecticut	14	1	..	..	...	6	5	†2	10	...	...	..	..	9	4	
New York	29	14	..	..	42	3	13	..	17	36	...	28	..	26	6	1
New Jersey	6	4	..	..	48	2	10	..	...	13	...	..	3	18	7	
Pennsylvania	143	93	6	21	...	111	91	†8	39	149	74	..	31	131	19	5
Delaware	...	...	..	..	...	...	4	..	...	...	...	..	..	8		
Maryland	21	6	..	3	...	2	13	..	14	4	4	..	1	6	1	
Virginia	39	...	..	..	...	43	12	..	34	1	...	..	5	4		
West Virginia	...	...	..	..	...	...	...	..	4	...	2	..	1	8		
North Carolina	3	...	..	..	36	...	1	..	8	...	...	7	1			
South Carolina	4	...	..	..	2	...	3	..	8	...	...	..	..	2		
Georgia	7	...	..	..	4	...	1	..	8	...	...	..	..	2		
Alabama	3	...	..	..	14	...	...	..	11	...	...	..	..	2		
Tennessee	41	...	..	..	50	9	3	..	17	...	3	..	1	4		
Kentucky	30	...	..	..	...	4	7	..	22	...	3	..	..	11	1	
Ohio	41	...	13	..	...	...	15	..	37	...	51	..	..	44	7	1
Indiana	2	...	..	..	...	...	1	..	...	...	8	..	..	11		
Illinois	2	...	..	..	...	...	1	..	...	...	10	..	..	8	1	3
Michigan	7	...	..	..	3	...	2	..	29	1	3	..	..	4		
Wisconsin	3	...	..	..	...	...	...	..	10	3	...	..	..	1		
Minnesota																
Missouri	7	...	..	..	...	3	4	..	9	...	9	..	..	7		
Oregon	...	...	..	..	...	...	...	..	1	...	...	..	3			
Kansas	...	...	..	..	...	...	...	..	...	...	...	..	..	1		
Texas	...	...	..	..	...	...	...	..	1							
Utah Territory	...	...	..	..	...	...	...	..	...	...	...	..	..	1		
California	...	...	..	..	...	...	...	..	...	...	...	..	..	1		
	416	121	19	24	204	189	209	10	287	208	167	37	47	339	51	10

* New Hampshire ceased in 1865 to make pig iron.
† The figures for the other States are wanting.

Detailed Statistics by States in 1856 and 1873.

STATES.	1856. Pig iron, all kinds.	1856. Wrought iron and steel, all kinds.	1873. Pig iron, all kinds.	1873. Wrought iron, including steel rails, all kinds.
Maine	2,100	4,500	780	21,210
New Hampshire	....	600	....	300
Vermont	2,420	2,150	3,100	6,788
Massachusetts	13,007	57,142	21,136	118,669
Rhode Island	....	4,475	....	11,662
Connecticut	12,876	7,709	26,977	11,409
New York	69,031	75,242	296.818	186,835
New Jersey	28,217	33,561	102,341	77,688
Pennsylvania	451,496	273,211	1,389,573	858,946
Delaware	....	2,211	....	11,617
Maryland	41.718	15,292	55,986	58,025
Virginia	14,828	29,350	26,475	15,608
West Virginia	....	....	23,056	51,796
North Carolina	450	1,397	1,432	110
South Carolina	1,506	1,850		
Georgia	2,807	940	7,501	10,624
Alabama	1,495	252	22,283	500
Tennessee	28,476	10,097	43.134	16,561
Kentucky	36,563	21,376	69,889	39,060
Ohio	87,011	30,980	406,029	272,066
Indiana	1,800	....	32,486	36,006
Illinois	1,900	....	55,796	143,017
Michigan	3,678	2,298	123.506	8,542
Wisconsin	2,500	....	74,148	39,495
Missouri	10,138	5,325	85,552	25,055
Texas	....	....	280	
California	....	....	....	7,420
	814,017	‡587,238	2,868,278	2,029,009

Of the iron made in 1873, 890,077 net tons were rails; of these 129,015 were Bessemer steel, and 26,377 steel-headed rails. Besides these there were imported 159,571 tons steel and 99,202 tons iron rails, making a total consumption of 1,148,850 tons of rails in 1873. There were 875,133 tons of angle, bar, etc., iron, 201,235 tons of cut nails and spikes, and only 32,863 tons of blooms from ore, and 29,701 from pig iron. The manufacture of blooms has remained stationary for many years.

The production of Bessemer steel in the U. S. has been, in net tons, as follows:

Year.	Tons.	Av. price per gross ton.
1867	3,000	$160.00 currency.
1868	8,500	158.50
1869	12,000	132.25
1870	40,000	106.75
1871	45,000	102.50
1872	111,000	112.00
1873	157,000	120.50
1874	175,000 (est.)	94.25

The production of cast steel of all kinds has been as follows:

1865	15,262 net tons.	1870	35,000 net tons.
1866	18,973 " "	1871	37,000 " "
1867	19,000 " "	1872	38,000 " "
1868	21,500 " "	1873	50,000 " "
1869	23,000 " "		

The consumption of pig iron in the U. S., gauged by the population of the country, has risen as follows:

In 1810 the consumption was 16 pounds per head.
1829 " " 25 " "
1832 " " 47 " "
1846 " " 100 " "
1855 " " 117 " "
1873 " " 155 " "

The production per head in the U. S. constantly rises: in 1855 it was 84 pounds, and in 1873 it was 143 pounds. The growth of some districts is so rapid that we may soon expect production to equal consumption in ordinary times. We find, for instance, that Pittsburg, which in 1828 rolled 3291 tons of iron, now makes nearly one-sixth the entire amount produced in the country.

In connection with the statistics of iron, two very striking facts appear. First: that the cost of iron consists almost entirely of wages paid for labor. A ton of pig iron requires 10 to 13 days' labor of one man. Second: that the quantities of raw materials used are so great that the iron trade requires more transportation than any other industry. It is estimated that in 1874 the iron-trade freight of this country amounted to about 37½ out of a total of 175 million tons moved over all our railroads, or more than 21⅓ per cent. More than one-third of all coal mined in the U. S. is required for the manufacture of iron and steel.

I am indebted to the American Iron and Steel Association for recent statistics; the earlier ones relating to America I have extracted from reports of the secretary of the treasury and *Hazard's Register*, while those relating to Great Britain I have compiled from several old authorities.

JOHN B. PEARSE.

‡ Of this total, 7280 tons were steel.

Iron, Medical Uses of. Iron is an important ingredient of the substance of the red blood-corpuscles, and its administration in some unknown way directly induces an increased formation of these bodies. In health this effect takes place only to a limited extent, but in the morbid condition known as *anæmia*, where from any cause the blood is unnaturally poor in red corpuscles, this action of iron is far more striking, and the normal proportion of these elements is often rapidly restored by its influence. On account of this peculiar property, iron is commonly called a blood-tonic, and its preparations thus have a unique medicinal use in curing anæmia. To a full-blooded individual, on the other hand, they are injurious. Locally, the preparations of iron differ greatly in action. Some are powerfully astringent and styptic, and have thus special uses by virtue of this property; others are nearly destitute of this action. The astringent group are also exciters of the digestive faculty, and for some unknown reason also cure anæmia, in some cases more promptly than the bland preparations. Almost all chalybeates tend to cause constipation, and the astringents again more than the others. The "muriated tincture," the most used of the astringent group, has, moreover, a great reputation in some special diseases, notably in erysipelas and diphtheria. The preparations of iron used in medicine are very numerous—indeed, unnecessarily so. They embrace both soluble and insoluble forms, but as the latter are readily dissolved by the aid of the gastric juice, they are as active as the former. The non-astringent preparations are reduced iron (*ferrum redactum*), known also as "iron by hydrogen" or "Quevenne's iron," consisting of the pure metal in a state of fine powder; pills of the carbonate ("Vallet's ferruginous pills"); the so-called sub-carbonate or "saffron of Mars," consisting of the hydrated sesquioxide with a little undecomposed carbonate; and numerous salts, embracing the phosphate, pyrophosphate, oxalate, citrate, ammonio-citrate, citrate of iron and quinine, and of iron and strychnine, and the ammonio- and potassio-tartrates. The astringent preparations are ferric chloride, principally used in alcoholic solution under the name of "muriated tincture of iron;" ferrous sulphate or "green vitriol;" ferric nitrate in solution; lactate, a feebly astringent salt; and the so-called solution of the subsulphate, or "Monsel's solution," chiefly used as a powerful styptic to stop bleeding. Ferrous iodide is used to combine the medicinal effects of iron and iodine; the hypophosphite, to combine those of iron and hypophosphorous acid; iron alum, as a simple astringent; and the hydrated sesquioxide, in the moist state, when freshly precipitated, as an antidote in arsenical poisoning. EDWARD CURTIS.

Iron, county in the S. E. of Missouri. Area, 500 square miles. It abounds in the best of iron ores, and contains lead, gold, and other metals. It is mountainous and heavily timbered. Pilot Knob and Iron Mountain are near its N. E. extremity. Wool and grain are staple products. It is traversed by the Iron Mountain R. R. Cap. Ironton. Pop. 6278.

Iron, county of the S. of Utah, extending from E. to W. across the State. Area, about 7000 square miles. It is largely unexplored. The Colorado intersects the E. portion. The western part is in a basin which has no water flowing into the sea. The staple product is wool. The county is believed to possess great mineral wealth. Cap. Parowan. Pop. 2277.

Iron, tp. of Iron co., Mo. Pop. 1118.

Iron, tp. of St. François co., Mo. (See IRON MOUNTAIN.) Pop. 2555.

Ironclads. See SHIPS, IRON-CLAD OR ARMORED, by ISAAC NEWTON.

Iron Crown, the ancient diadem of the Lombard kings, is a jewelled circlet of gold, containing a fillet of iron said to have been made of one of the nails of the true cross, presented by Pope Gregory I. to Theodelinda, wife of King Antharic, in 590. In 591 it was used at the coronation of Agilulphus; in 774, at that of Charlemagne; and by thirty-four other sovereigns. Henry VII. of Germany was crowned with it in 1312; Frederick IV. in 1452; Charles V. in 1530; Napoleon I. in 1805. In 1866 it was given at the close of the Italo-Prussian war by the emperor of Austria to the king of Italy, Victor Emmanuel.

I'rondale, post-v. of Washington co., Mo., on the St. Louis and Iron Mountain R. R., 6 miles N. of Iron Mountain.

Irondale, post-v. of Saline tp., Jefferson co., O., on the Cleveland and Pittsburg R. R., 8 miles from Wellsville. Pop. 751.

Iron'dequoit, post-tp. of Monroe co., N. Y., having Lake Ontario on the N. and Irondequoit Bay on the E. Pop. 3990. It is very fertile.

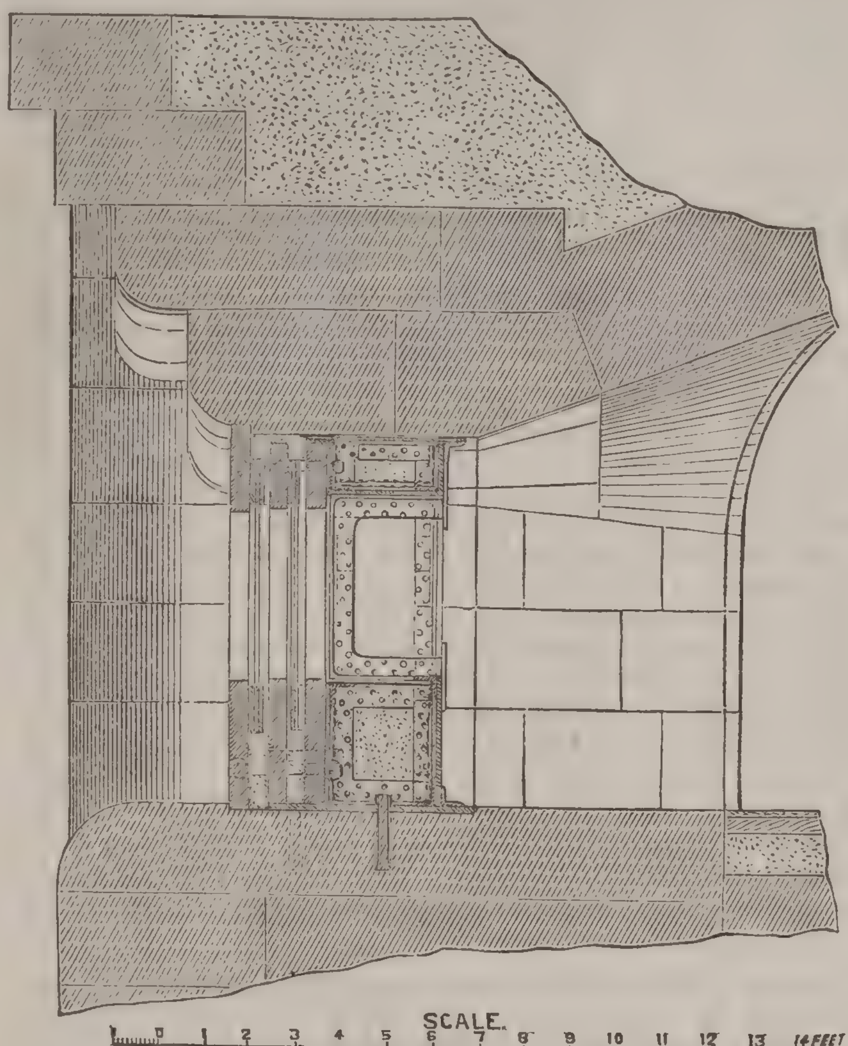
Iron Mask, The Man with the, a mysterious prisoner of state who was in 1679 confined by the French government at Pignerol in Savoy; was removed in 1681 to Exilles; in 1687, to the island Ste. Marguerite in the Mediterranean; in 1698, to the Bastile, in which he d. Nov. 19, 1703. He always wore a mask of black velvet. Much has been written with a view of determining this unfortunate man's identity. He has been in turn held to have been the duke of Vermandois, the duke of Beaufort, the duke of Monmouth, an illegitimate son of the queen, and a twin-brother of Louis XIV.; but it is now generally held that he was in reality the count Matthioli, minister plenipotentiary of the duke of Mantua to France, unlawfully held a prisoner by the French court, or perhaps a chevalier de Kiffenbach, confined for plotting against the king's life.

Iron Mountain, or **Iron Mount,** post-v. of Iron tp., St. François co., Mo., on the St. Louis and Iron Mountain R. R., 81 miles S. W. from St. Louis. Here is the famous Iron Mountain, 228 feet high and covering 500 acres. It is of mammillary shape, and consists chiefly of an iron ore which yields 55 or 60 per cent. of excellent iron. The ore is softer and less siliceous than that of PILOT KNOB (which see). It is very rich and uniform, nearly free from sulphur, and carrying only 0.12 per cent. of phosphorus. It is magnetic, with distinct polarity, and acting in several parts very strongly on the needle. The amount of ore in Iron Mountain seems to be immense, the main body having a thickness of 50 feet, and continuing indefinitely in depth; 262,477 tons of ore were shipped in 1871; 371,474 in 1872. The whole deposit has been described by Dr. Litton in the second annual report of the geological survey of Missouri (1855), and by Prof. Raphael Pumpelly and Dr. Adolph Schmidt in the volume on *Iron Ores and Coal-Fields* of the new geological survey (1873). The village of Iron Mountain has several blast furnaces and other manufactories. Pop. 2018.

Iron Plating for Fortifications. It was an American soldier and engineer, the late Gen. J. G. Totten, who earliest realized the need and predicted the introduction of guns of greatly increased calibres into our sea-coast defences, asserting the desirableness and practicability of a 20-inch gun as early as 1844. It is to the same distinguished officer to whom is due the first introduction of *iron plating* in the surroundings of the "embrasure" (or port) of our masonry casemates. (See "Report to the Secretary of War," 1857, *Prof. Papers Corps of Engineers*, No. 6.) But the 10-inch smooth-bore represented at that date the limit of gun development. The system he skilfully devised, and during the ensuing three or four years caused to be extensively applied to the casemated works then in construction, proved inadequate, simply because this was precisely the era of the commencement of the great changes which have substituted immense calibres and rifled bores for small calibres and smooth-bores in artillery, and which have introduced the "armored" ship and made it an essential and most formidable agent of naval warfare. It was nearly the era, too, when a great maritime nation, England, undertook a revision and reconstruction of her sea-coast fortifications. At a time when "the 68-pounder was the heaviest gun contemplated," and when the introduction of rifled artillery of more than one calibre (the 110-pounder Armstrong) was not anticipated, evidently it was not expected that attacking vessels would bear heavier ordnance or be clad in mail perfectly proof against such guns. Before much advance had been made by the English the necessity of a partial substitution of iron for masonry in the exposed fronts of masonry casemates became apparent, though neither the precise degree of resistance ultimately to be offered, nor the scientific means by which iron could best be made (*if at all*) to yield that measure, were understood. Hence, nearly all the works which had been designed as masonry casemated batteries after the old models were modified by making, in the casemate fronts, openings of 12 feet horizontal dimension, by 8 feet vertical, to be subsequently filled up by an iron "shield," the intervening masonry piers and front wall being *also* modified so as to furnish solid masses or "merlons" of about 15 feet thickness. In adapting and executing this masonry construction the question as to the precise character of the iron shield was left an open one. Experiments to determine the construction commenced as early as 1862, and are fully described in various English publications. (*Prof. Papers Royal Engineers*, vols. xiii., xiv., xvi., xvii., xviii., xix.; *Report of the Special Committee on the Gibraltar Shields; Report of Iron Plate Committee*, etc.) The failure of the "Gibraltar" shields (*i. e.* shields which had been prepared for the new works at Gibraltar and Malta) under the experimental firings (Oct. and Dec., 1867, and Jan., 1868), to give the resistance expected, and the not altogether satisfactory trials of the "Plymouth breakwater" experi-

mental construction (June, 1868), appear to have temporarily arrested progress in the application of iron to the otherwise nearly completed works. Renewed experiments finally led to the adoption of a shield construction (see Fig. 1 for section of shield as fixed in the casemate), described as follows:

Fig. 1.



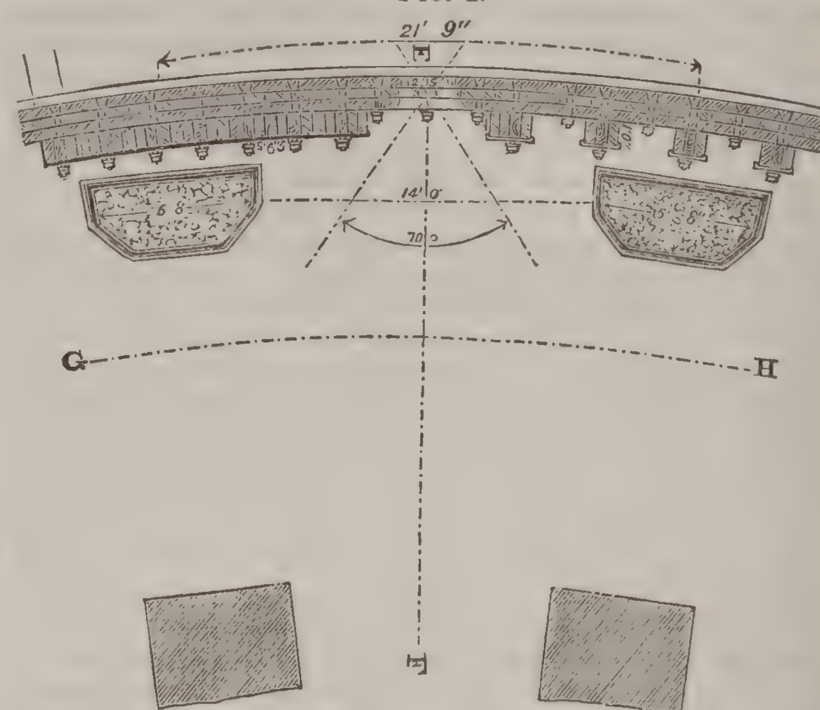
"The armor consists of three 5-inch plates, made to the full size of the shield by a process recently adopted in the fortification branch, with intervals of 5 inches between them, in which a concrete composed of iron turnings and tar mixed hot, and weighing about 240 pounds per foot cube, is introduced. The front plate is bolted to the second by means of ten 3-inch armor bolts with plus threads ($5\frac{1}{2}$ threads to the inch) and spherical nuts at each end, seated in corresponding holes in the armor plates. The second and third armor plates are held back to the supports by eight bolts of similar pattern. These bolts, however, are secured to the skin of the supports by means of spherical nuts in coiled washers of special construction, similar to those used in the two small targets above referred to. The fastenings are so laid out that in no case does an armor bolt appear at the back of the shield. The port opening in the front armor measures 4 feet high, and 2 feet 5 inches wide, and admits of the 10-inch 18-ton gun training 70°, elevating 10°, and depressing 5°. The 12-inch and 25-ton gun would train 60° behind the shield, elevate 8°, and depress 5°. The supporting structure is composed of 1-inch plate, and 6-inch by 6-inch by 1-inch angle-irons, built in the form of a case, to cover the whole of the back of the armor except in the central space required for the working of the gun. The depth or thickness of this case is 2 feet 6 inches. It stands upon a $1\frac{1}{2}$-inch base-plate, the ends of which pass under the piers of the masonry structure in which the shield is fixed. The whole of the case is filled with iron concrete. The shield is held down by means of 2-inch bolts to a 3-inch plate, bedded in the foundation at a depth of about 2 feet below the floor level.

"It will be observed that this shield presents some important points of difference from any that had preceded it: *First.* Each of the three 5-inch thicknesses was *one single* plate. The joints, which had been such a source of weakness in former shields, no longer existed. *Second.* The three plates, instead of being in immediate contact, were separated by intervals of 5 inches, filled with the mixture or concrete of iron filings and tar. *Third.* The three plates are not connected by bolts running through the whole structure. The front and second plates are held together by ten 3-inch bolts, with plus threads and spherical nuts at each end, seated in corresponding holes in the armor plates. The second and third plates are held back to the supports by eight bolts of similar patterns. The fastenings are so arranged that in no case does an armor-bolt appear at the back of the shield. *Fourth.* The bolts used are peculiar."

With some improvement of details the shield described has been applied to the English casemated works and to open batteries, and it is regarded by the English engineers as so satisfactory that were new works to be built but a very slight modification would be made in the arrangement of masonry and iron. An additional iron plate may be added whenever greater thickness may be judged necessary.

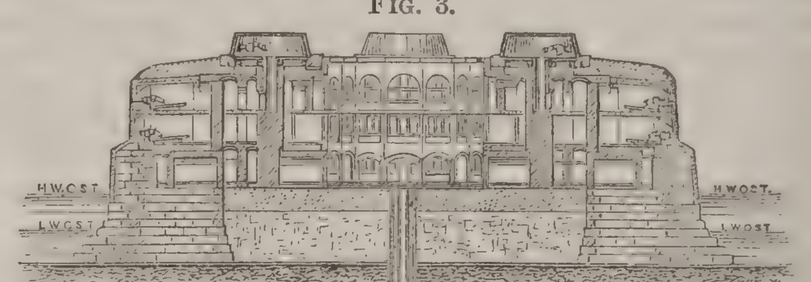
For points of peculiar character and very great importance, the artificial or otherwise contracted sites of which require the greatest possible concentration of guns, and which may be closely approached and enveloped by hostile fire, a type of works like the "Plymouth breakwater fort" has been adopted; the characteristic being a *continuous envelope of iron around that part of the work occupied by gun casemates.* Fig. 2 gives a ground-plan of a casemate

Fig. 2.



of the work at Plymouth breakwater. The iron envelope is, like the shields, made up of three thicknesses of 5-inch plates. In more recent inter-aqueous constructions at Spithead *both* the intervals between the three thicknesses are made five inches and filled with concrete or brickwork, as described for the shields. Fig. 3 shows one of these works as first designed. In actual construction the turrets have been omitted.

Fig. 3.



Barbette batteries—that is, of guns firing *over* a parapet without front protection—are seldom used by the English, but unless in very high positions (100 feet or more) these open batteries are protected with iron shields almost identical with those described for the casemates.

The history of the subject would contain a great variety of designs for the combination and arrangement of iron plates, beams, rails (or channel-irons), timber, rubber, etc., etc., as "shields" or protecting walls for sea-coast guns—some few of which have indeed, in Europe,* been realized in construction—but the English system described is the only one which has been the outcome of long protracted and logically connected experiments, and which too, has been, on a grand scale, carried into actual execution. In this country, though the subject has been much studied (see "Report on Fabrication of Iron for Defensive Purposes," *Prof. Papers Corps of Eng'rs*, No. 21, and *Supplement*), and many experiments made, yet, on account of the costliness, and on account of the as yet unsettled relations between gun-development and shield-resistance, no iron construction for fortifications has been ventured upon.

J. G. Barnard.

Iron Ridge, post-v. of Dodge co., Wis., on the Chicago Milwaukee and St. Paul R. R. (northern division), 47 miles N. W. of Milwaukee. It has abundant iron ores of good quality and extensive iron-works.

I'rons (William Josiah), D. D., b. at Hoddesden, Herts, Eng., Sept. 12, 1812; graduated at Queen's, Oxford, in 1833; became prebendary of St. Paul's in 1860; was Bampton lecturer in 1870, and became rector of Wadingham and rural dean. Author of several volumes of sermons, lectures, etc., and many controversial and other pamphlets.

*Thus, among the numerous recent additions to the maritime defences of Cronstadt is a battery having six iron revolving *turrets.*

His translation of the *Dies Iræ* is considered the best in the language.

I'ronton, post-v. of Arcadia tp., cap. of Iron co., Mo. It has 2 weekly newspapers. Pop. 573.

Ironton, tp. of Lincoln co., N. C. Pop. 2162.

Ironton, city, cap. of Lawrence co., O., on the Ohio River, 140 miles above Cincinnati, at the terminus of the Iron R. R., 13 miles in length. It is the centre of the "Hanging Iron region," and is the head-quarters of business for a large number of iron furnaces; has a large nail-mill, 2 rolling-mills, a stove-foundry, 2 machine-shops, and boiler-yards, 2 planing-mills, 3 English and 2 German newspapers, 2 national banks, 1 private bank, 15 churches, gas and water works; does an annual business in pig iron of $2,000,000; of nails, $600,000; bar iron, $750,000, etc. Capital invested in iron business, $3,500,000. Pop. 5686.
E. S. Wilson, Ed. "Register."

Ironton, tp. and post-v. of Sauk co., Wis., 22 miles W. of Baraboo. It has iron-works and a machine-shop. Pop. 1245.

I'ron-wood, a name given in the U. S. to the two species of Hornbeam (which see). The iron-wood of commerce is from *Metrosideros vera*, a myrtle of Eastern Asia. *Mesua ferrea* and *speciosa* of India (Guttiferæ), *Vepris undulata* (Diosmaceæ), and *Olea laurifolia* (Oleaceæ), the last two from South Africa, and *Siderodendrum triflorum* (Cinchonaceæ), are all called iron-woods, and all have exceedingly hard timber. To these we may add *Sideroxylon* (Sapotaceæ), of which the U. S. have one species, *S. pallida*, a tree of Florida. *S. inerme*, of the Cape of Good Hope, is a valuable timber tree.

Ir'oquois, the name of a confederation of Indian tribes which formerly inhabited the central and western part of the State of New York. The confederation consisted originally only of five tribes—the Mohawks, Oneidas, Onondagas, Cayugas, and Senecas—but in 1712 the Tuscaroras were admitted to the league, which now adopted the name of the "Six Nations." The total number of members was about 15,000. They lived in villages and pursued agriculture. Each tribe was governed by sachems, but affairs concerning the whole confederation were decided upon by general assemblies. On the whole, the Iroquois were of all the Indian tribes of North America not only the most powerful, but also the highest developed, and some of their leaders—as, for instance, Red Jacket of the Seneca tribe and Brant of the Mohawk—were men of valor, understanding, and eloquence. In the Revolutionary war they sided with the English, and in 1778, Brant attacked and nearly destroyed by fire and sword the settlements of Cobleskill, Andrewstown, and German Flats. But in the next year the Americans retaliated, and Gen. Sullivan nearly broke the power of the confederation. The Iroquois present a remarkable exception to the supposed general law of decrease among the American Indians, they having increased at every enumeration since the war of 1812, when they reached their lowest point in numbers. Nearly one-half of the Iroquois have removed from New York to points farther W. The largest reservation is that of the Mohawks, on the Grand River in Ontario, 150 miles W. of Niagara. This was given to the Mohawks by the British government in consideration of their services in the Revolutionary war, and the celebrated chief Joseph Brant resided there until his death. The Mohawks of Grand River number nearly 2000; with them are some hundreds of Tuscaroras and a few individuals of other tribes. Five-sixths of the Oneidas, or about 1200, live on a reservation on Green Bay, Wis., and some 400 Senecas reside in the Indian Territory. The Cayugas are the least numerous of the Six Nations. Having long since sold all their own lands in New York, they are scattered among the sister-tribes, with whom they have intermarried. Their language is consequently nearly extinct, there being now less than a score who speak it. The greatest collective number of Cayugas at one place is 55, now living at the Cattaraugus (Seneca) reservation in Erie co., 20 miles S. of Buffalo. All the Six Nations have enjoyed the benefits of missions from an early period in the century, and for twenty years past their schools have been supported by the State, the teachers being mainly natives. A teachers' institute was organized in 1871 among the Seneca teachers, numbering 15. An annual agricultural fair has for several years existed among the same Indians, and a republican form of government was established in 1850. A president and 18 councillors, with other officers, are annually elected by ballot. The languages of the Six Nations are considered as distinct; they are closely related to each other in grammar, and but little less in vocabulary, belonging to the same linguistic group with the Hurons and Wyandots. Some resemblances to the Cherokee language have been discovered. Special works on their history are—Colden, *History of the Five Nations* (1727); Cusick, an Indian of the Tuscarora tribe, *Sketches of the Ancient History of the Six Nations* (1826); Schoolcraft, *Notes on the Iroquois* (1846); Morgan, *League of the Iroquois* (1851). A grammar and dictionary of the Mohawk language was published by the Jesuit Bruyas in New York (1862).

Iroquois, port of entry of Dundas co., Ont., Canada, on the N. shore of the St. Lawrence, 99 miles above Montreal, on the Grand Trunk Railway and at the foot of the Iroquois Canal. It has large factories and mills. Pop. of sub-district, 781.

Iroquois, county of Illinois, bounded on the E. by Indiana. Area, 12 square miles. It is a fertile prairie, traversed by the Illinois Central, the Chicago Danville and Vincennes, and the Toledo Peoria and Warsaw R. Rs. Cattle, grain, and wool are staple products. The S. part of the county is believed to contain beds of coal. Cap. Watseka. Pop. 25,782.

Iroquois, tp. and post-v. (Concord Station) of Iroquois co., Ill., on the Cincinnati Lafayette and Chicago R. R. Pop. 679.

Iroquois, tp. of Newton co., Ind. Pop. 619.

Irrawad'di, a river of Farther India, rises in Thibet, and flows, after a course of about 1200 miles, into the Bay of Bengal, in lat. 16° N. and lon. 94° E. In lat. 17° N. it separates, and between its easternmost branch, the Rangoon, and its westernmost branch, the Bassain, it forms a delta intersected in all directions by its minor branches, comprising an area of 10,000 square miles and covered with teak forests and inextricable jungles. It is navigable for vessels of 200 tons burden as far as Ava, 400 miles from the sea, even at low tide, and canoes ascend safely 180 miles farther up the river.

Irrel'ative, in music, a term applied to such chords or keys as have no elements in common to produce relation or connection. Thus, the triads of C minor and of C♯ major are irrelative; and a transition from the key of C major into that of F♯ minor would be into an irrelative key.

Irriga'tion [Lat. *irrigatio*]. In the broadest sense of the term, irrigation embraces all artificial modes of using water for agricultural purposes. We shall consider the complex effects of irrigation according to the several media in which they are manifested.

Soil.—The immediate effect of irrigation upon the *consistence* of the soil is to soften it and render it more easily penetrable by the plough and by the roots of plants. Hence, in dry climates water is frequently applied, before ploughing, at the rate of about 400 or 500 cubic yards to the acre, or barely enough to loosen the earth to the depth of a foot without drenching it. But it is most important to observe that the ultimate effect of long-continued irrigation is to condense and harden the surface to a very inconvenient degree. Irrigation affects the *quality* of the soil by introducing into it common air and other gases, and vegetable and mineral matter held in suspension or solution by the water. In most cases the substances so introduced are beneficial to vegetation, but in some they are highly noxious. Even the water of large rivers sometimes, as has been observed in India, deposits on the surface, or introduces into the texture of the soil, salts which in the course of time render it wholly sterile. Irrigation also acts upon arable soil by facilitating the decomposition of soluble organic and inorganic matter contained in it, and carrying off such matter from it. The extent of this latter action is disputed, but it must be considerable, for constituents of vegetable growth have been found in underdrain water from cultivated fields, and large tracts of ground, impregnated with salts to such a degree as to make them incapable of cultivation, have been rendered fertile by washing with fresh water. (See Duponchel, *Hydraulique Agricole.*) Irrigation often injuriously affects the *subsoil* by charging it with water, which stagnates in it and renders it cold and *sour*, as sometimes expressed, to the roots of plants which descend into it. In countries where irrigation has been immemorially practised this effect has not attracted much attention, but in the British Indian provinces watered by the new canals constructed by the government, and elsewhere when irrigation is first introduced, it is very observable. It also exercises an important influence on the *water-supply* of lands lying at a lower level, by diverting from their natural channels streams which originally flowed through such lands; and on the other hand by discharging upon their surface surplus water from irrigated fields, or by saturating them with water conveyed to them from such fields by subterranean infiltration. These effects are seen not only in the soil itself, but in the diminished or augmented volume of spring and well water. Irrigation modifies the *temperature* of the soil beneficially or injuriously by communicating or abstracting heat, and by promoting

evaporation from the surface, which is necessarily attended with some cooling of the ground.

Atmosphere.—Irrigation affects the *humidity* of the atmosphere by increased evaporation from the surface, and its *temperature* by the refrigeration which accompanies evaporation. Scientific observation has been very little directed to this subject, and the measure of the former effect is embarrassed by the constant mobility of the air, which not only may remove from a given locality, but may bring to it, a supply of atmospheric moisture so rapidly as to render the determination of the local effect of irrigation in this respect very difficult if not impossible. But the atmospheric temperature of artificially watered districts is, at certain times, sensibly lower than that in unwatered regions, while at other times the vapor thrown off from an irrigated surface may check radiation from the soil, and thus prevent or compensate the lowering of the temperature by evaporation. Irrigation has also a certain influence on the *chemical constitution* of the atmosphere, by depositing on or in the soil organic or inorganic decomposable substances, and promoting the decomposition of such foreign matter on or a little below the surface of the ground, and thus disengaging gases which may diffuse themselves through the air.

Sanitary Effects.—Humidity, temperature, and the composition of the air we breathe are terms in the equation of health. All these elements are subject to modification by agricultural irrigation, and hence it is evident that water cannot be applied, in considerable quantities, to the soil or to the leaves of plants without exerting some influence on the sanitary conditions of climate. It has been observed that pure water moving freely over the surface or through the texture of the soil is not generally sensibly injurious to health. But when it stagnates on or in the ground it soon becomes a dangerous and often very destructive source of disease. Hence, for sanitary as well as other reasons already alluded to, superficial or underground drainage is an imperious necessity in all irrigated lands where nature has not provided, either in the configuration of the surface or the texture of the soil, sufficient conduits for the speedy discharge of the water applied. Even in India, where the neighborhood of tanks and reservoirs is not unhealthy, fever makes its appearance in the provinces irrigated by means of the new canals, and can be prevented only by underdraining.

Effects on Vegetation.—Watering the soil promotes the germination of the seeds of cultivated plants, and, unfortunately, of weeds, and water is in and of itself a necessary element of vegetable growth. Besides this, it is never quite free from extraneous matter, and it always contains, in solution or in suspension, foreign substances useful or injurious to vegetation. Hence, in climates and on soils where the natural supply of water is insufficient for the normal growth of plants, remunerative agriculture is impossible without artificial arrangements for procuring and administering it. And even where agricultural industry yields fair returns without irrigation, it is generally, if not universally, true that the application of water according to the common methods increases the *quantity*, or at least the *volume*, of leaf, flower, bark, ligneous tissue, root, bulb, edible grain and other seeds, fruits, oleaginous and watery fluids, coloring-matter, aromatic and medicinal substances, produced on a given area of ground. Until lately, this augmented product has been too generally regarded as a positive advantage directly proportional to the increase; and this opinion has done much to promote the extension of the practice of irrigation. But agricultural chemistry and more careful observation have shown that in many cases the increase in quantity is more than counterbalanced by a deterioration in the *quality* of the product; and, further, that on ground of loose and light texture, rich in humus or other partially decomposed organic matter, the hygroscopicity of the soil is often such that it absorbs from the atmosphere, even in dry weather, moisture enough to supply the vegetation upon it, and consequently even the bulk of the crop is little or not at all increased by irrigation. The present opinion seems to be that all the *annual* products of irrigated vegetables, including even the leaves, are inferior in nutritive properties, in flavor, and in all other valuable qualities, except mere bulk, to those of unwatered plants. It appears to be well settled, however, that the *wood* of timber trees is not only much quickened in growth, but improved in quality by judicious irrigation; for, as between trees of the same species, those whose grain shows the largest yearly increment usually furnish the best timber. But, though the annual products of watered plants are generally comparatively inferior in quality, and in some rare instances—as is said to be the case with the yield of olive-oil, for example—even in quantity, there is reason to believe that if cultivators knew enough of the laws of vegetable physiology to be able to apply water always in just quantity and at the right time, irrigation might become universally useful. There is probably *some* period in the lifetime of every plant when it would be benefited by an artificial supply of water, at least for the best development of the special product which alone makes it worth cultivating, if not for its general growth. The formation of all the various tissues, juices, and organs of a plant does not go on *pari passu*, and watering may stimulate some particular vegetable process when it is not necessary, or even advantageous, to the whole organism. Cultivated plants are, in a sense, artificial machines, and we rear them not for the sake of regular, but for *abnormal* products, for the growth of which we can afford to sacrifice the rest of the plant. This subject needs to be specially studied with reference to seasons and quantities in irrigation. The problem of compensation of inferiority in quality by increase in quantity is complicated by the antagonism between the interests of the producer and those of the consumer. It is hard to persuade the producer of a crop which he grows for sale, not for his own consumption, that he ought not to aim exclusively at increase of quantity, and consumers of few agricultural products are supplied with sure tests by which they can readily detect inferiority in quality. Comparative weight is perhaps the most generally accepted standard in this respect, but this is not of universal applicability. The heaviest potatoes, for example, are not the best. The relative quality of watered and unwatered crops is now exciting much attention in Europe, but popular opinion on questions of rural economy is controlled by apparent results, and at present the tendency is strongly towards the extension of a system which offers such tempting visible advantages. The importance of irrigation as a means of destroying noxious insects and small rodents in and upon the soil must not be forgotten.

The growth of large forests may be promoted by irrigation. The grounds which it is most important to clothe with wood as a conservative influence, and which also can best be spared from agricultural use, are steep hillsides. But the performance of all the offices of the forester to the tree—seeding, planting, thinning, and finally felling and removing for consumption—is more laborious upon a rapid declivity than on a level soil, and at the same time it is difficult to apply irrigation or manures to trees so situated. Experience has shown that there is great advantage in terracing the face of a hill before planting it, both as preventing the wash of the earth by checking the flow of water down its slope, and as presenting a surface favorable for irrigation, as well as for manuring and cultivating the tree. But even without so expensive a process very important results have been obtained by simply ditching declivities. "In order to hasten the growth of wood on the flanks of a mountain, M. Eugène Chevandier divided the slope into zones forty or fifty feet wide, by horizontal ditches closed at both ends, and thereby obtained, from firs of different ages, shoots double the dimensions of those which grew on a dry soil of the same character where the water was allowed to run off without obstruction." (Dumont, *Des Travaux Publics*, etc., pp. 94–96.) The ditches were about two feet and a half deep and three feet and a half wide, and they cost about 40 francs the hectare, or $3 the acre. This extraordinary growth was produced wholly by the retention of the rain-water in the ditches, whence it filtered through the whole soil and supplied moisture to the roots of the trees. It may be doubted whether in a climate cold enough to freeze the entire contents of the ditches in winter it would not be expedient to draw off the water in the autumn, as the presence of so large a quantity of ice in the soil might prove injurious to trees too young and small to shelter the ground effectually against frost. Chevandier computes that, if the annual growth of the pine in the marshy soil of the Vosges be represented by one, it will equal two in dry ground, four or five on slopes so ditched or graded as to retain the water flowing upon them from roads or steep declivities, and six where the earth is kept constantly moist by infiltration from running brooks. (*Comptes Rendus à l'Académie des Sciences*, t. xix., Juillet–Dec., 1844, p. 167.) The effect of accidental irrigation is well shown in the growth of the trees planted along the canals of irrigation which traverse the fields in many parts of Italy. They flourish most luxuriantly, in spite of continual lopping, and yield a very important contribution to the stock of fuel for domestic use; while trees situated so far from canals as to be out of the reach of infiltration from them are of much slower growth under circumstances otherwise equally favorable. In other experiments of Chevandier, under better conditions, the yield of wood was increased, by judicious irrigation, in the ratio of 7 to 1, the profits in that of 12 to 1. At the Exposition of 1855, Chambrelent exhibited young trees which, in four years from the seed, had grown to the height of sixteen and twenty feet, and the circumference of ten and twelve inches. Chevandier experimented with various

manures, and found that some of them might be profitably applied to young, but not to old trees, the quantity required in the latter case being too great. Wood-ashes and the refuse of soda-factories are particularly recommended. I have seen an extraordinary growth produced in fir trees by the application of soapsuds. According to *Canevazzi Vocab. di Agricoltura*, now publishing—a high authority—irrigation of trees promotes the growth of foliage and wood, but deteriorates the quality of the other products, whether fruits or juices. Of course it is suited for shade and ornamental trees and shrubs, though not for olive trees, vines, and mulberries, in which latter the leaf becomes abundant, but less nutritious. See MULBERRY.

General Physical and Social Effects.—The diversion of water from its original channels of discharge, which is always a necessity in irrigation, interferes with natural hydrology, though not always injuriously. Its effects on springs and wells at lower levels are among the most important, though habitually least noticed, of these effects. The reclamation of marshes by this process is a familiar example of beneficial results. The reduction of the supply of water for mechanical power, and the obstruction of free communication over the surface by canals of derivation and distribution, are evils too obvious to need to be dwelt upon. The measurement of flowing water, and its apportionment between different persons entitled to use the same source of supply, are very difficult in practice, and when the quantity is not abundant they are occasions of endless contention and litigation. The effect of these embarrassments is to discourage landholding in moderate parcels, to oblige small proprietors to sell their grounds and become day-laborers, and of course to diminish the numbers of rural homesteads and rural inhabitants. This is an evil much to be dreaded in countries with popular institutions, and it ought to engage the earnest attention of American public economists.

Economical Considerations.—The partial grading of the surface of the ground for the reception of water, the construction of reservoirs, aqueducts, canals, and siphons for its supply and distribution, as well as of drains on or below the surface for its discharge, and the care and labor involved in its application, are all expensive. Irrigation ought never to be undertaken on a considerable scale without a certainty that the supply of water is adequate in quantity, and that it is of such chemical composition and such temperature as to be useful to vegetation; and, further, without enough of preliminary experimentation to show that the probable increase of product will warrant the expenditure. The importance of the first of the cautions here suggested is much increased by the fact that the habits of watered plants soon become so modified that a failure of the accustomed supply affects them more severely than almost any merely natural drought does unwatered plants. This modification may become hereditary, and therefore it is prudent to take it into account in employing imported seeds. On most of these points we may observe that European experience, though not to be neglected, is not by any means altogether a safe guide. The difference in soil and climate, in the usual objects of cultivation, and in the cost of labor, is so great between the two continents that we cannot confidently reason from one to the other. Before quitting this branch of our subject it is well to notice that in many localities, *circling* or horizontal side-hill ploughing, which is a cheap method of terracing sloping surfaces, answers most of the purposes of irrigation, and that water enough for crops may often be found by means of small reservoirs for retaining rain and snow water, common wells, cheap artesian borings, or short tunnels into hillsides, which intercept subterranean currents and bring them to the surface as springs.

With respect to the economical aspects of great systems of irrigation, it ought to be observed that unquestionable as are the financial advantages, and even necessity, of the practice in many climates, yet in regions where rural husbandry is possible without it European experience shows that in most cases of costly arrangements for this purpose, as indeed in very many industrial enterprises of other kinds, the original capital is entirely sunk, and a pecuniary return is reaped only by those who acquire the works at a price far below the original cost. Cattaneo, one of the ablest economists of this century, maintains, in reference to Lombardy, that the income from irrigated lands is not proportionate to the entire expenditure incurred in canals, the grading of the soil, and other necessary works, and thinks this observation applicable to Holland and other countries of advanced agriculture. (See Cattaneo, *Memorie di Economia Publica*, Milano, 1860, vol. i. pp. xi. 246; also Baird-Smith, *Italian Irrigation*, vol. i. p. 297.)

Quantity of Water and Method of Applying it.—In Europe the quantity of water supplied during the season to ordinary ploughed or hoed field crops varies from twenty to forty inches, though in the rice-fields, the *mareite* or water-meadows of Lombardy, and many other grass-grounds, this amount is vastly exceeded. Experience alone can determine the proper quantity and seasons on our soil and under our sky. The modes of application are by flowing with running, and flooding with partially stagnant, water; by infiltration from superficial ditches or furrows, and more rarely from underground conduits; and by sprinkling with scoops or other light hand-implements. The evening hours are considered the most favorable time, but this rule is by no means universally observed.

Legislative Action.—The evils we have referred to under various heads are such that legislative measures ought to be taken without loss of time to obviate them as far as possible in the American States. We have space here to indicate but one which is of urgent necessity in all those parts of our territory where irrigation is necessary or probably highly advantageous; and another which is of even greater general importance. The first is the assumption by government of the absolute title to all natural waters of sufficient volume to possess any real importance as sources of supply, and the enactment of codes or the creation of special boards to control the construction of all hydraulic works and the distribution of water from them, including, of course, proper arrangements for disposing of the surplus water from irrigated lands. The second is the adoption of systems of forest economy which shall prevent the destruction and secure the permanence, and where necessary extension, of the woods around the sources and along the upper basins of the rivers.

Literature of the Subject.—The theoretical and practical, juridical and economical literature of irrigation is immensely voluminous, and, cautiously used, of very great value. We have no space for criticism, but we recommend either as easily accessible or as specially important to the American public the following works: Romagnosi, *Trattato della Ragion Civile delle Acque* (Firenze, 1834, 8vo); Romagnosi, *Della Condotta delle Acque* (Firenze, 1833, 2 vols. 8vo); Calandra, *Manuale Idraulico-legale* (Savigliano, 1870, 12mo); Negri, *Idée Elementari per una Legge in Materia delle Acque* (Turin, 1864, pamphlet); Niel, *L'Agriculture des États Sardes* (Turin, 1856, 8vo); Vigan, *Étude sur les Irrigations des Pyrénées Orientales* (Paris, 1867, pamphlet); Cuppari, *Manuale dell' Agricoltore* (Firenze, 1870, 12mo); Boussingault, *Économie Rurale* (Paris, 1851, 2 vols. 8vo); Hervé-Mangon, *Expériences sur l'Emploi des Eaux dans les Irrigations* (Paris, 1869, 8vo); Cosimo Ridolfi, *Lezioni Orali di Agraria* (Firenze, 1869, 2 vols. 8vo); Baird-Smith, *Italian Irrigation* (London, 1855, 2 vols. 8vo, and atlas); A. Vignotti, *Des Irrigations du Piémont et de la Lombardie* (Paris, 1863, pamphlet); G. Tagliasecchi, *Canali dell' Alta Lombardia* (Milano, 1872, 8vo); Duponchel, *Traité d'Hydraulique et de Géologie Agricoles* (Paris, 1868, 8vo); Millet, *Les Merveilles des Fleuves et des Ruisseaux* (Paris, 1871, 12mo); Denton, *Water-Supply for Farms* (London, 1865, pamphlet); Dumas, *La Science des Fontaines* (Paris, 1857, 8vo); Marsh, *Man and Nature* (new edition, New York, 1874, 8vo), and *Letter to Commissioner of Agriculture on Irrigation* (Washington, 1873, pamphlet); Beardmore, *Manual of Hydrology* (London, 1862, 8vo); Dumont, *Des Travaux Publics dans leurs Rapports avec l'Agriculture* (Paris, 1848, 8vo); Passy, *Étude sur le Service Hydraulique* (Paris, 1868, 8vo); Jaubert de Passy, *Voyage en Espagne* (Paris, 1819); Aymard, *Irrigations du Midi de l'Espagne* (Paris, 1864, 8vo, and atlas); C. R. Markham, *On Spanish Irrigation* (London, 8vo), and works there cited. The works of Nadault de Buffon on irrigation and general agriculture are all of great value, and the numerous papers on this subject by the eminent Italian engineer Lombardini, chiefly published in scientific periodicals, are indispensable to a knowledge of the hydraulic system of Upper Italy, which is unrivalled in scientific merit and practical value. GEORGE P. MARSH.

Irrigation, Practical. Irrigating canals are usually derived from rivers. The water is raised to the required level by a weir or dam thrown across the river, and the head of the canal is placed above the dam. In the deltas of rivers, where the ground to be irrigated is little if at all above the level of the water in adjacent portions of the rivers, the problem is solved much more simply, and at a much lessened expense, than in the general case where the river flows along the lowest line of the valley, and where the adjacent lands rise from the river-banks on either side. In this latter case it is necessary to fix the head of the canal at a considerable distance above the land to be irrigated, and consequently a line of canal more or less in length, often making many miles, must be made to bring the water out on the level of the ground. For illustration, let us suppose that the water in the river at the head of the canal is raised by a dam to a level 10 feet below the banks. Give a slope to the bed of the canal of 1 foot per

mile, and assume that the country slopes along the line at a rate of 5 feet per mile; then for each mile the canal-water will gain a relative elevation of four feet, and it follows that the water-level in the canal will emerge from the excavation at a distance of 2½ miles from the head. On the other hand, in deltas the ground falls from the banks on either side, and a command of the land is quickly gained. If this upper and, so to speak, unprofitable section of the canal passes through a broken country, the difficulty and expense of construction are largely increased. In India we find illustrations of both systems. In the Madras provinces the deltas of the Cauvery, Godavery, and Kistnah rivers afford instances of the most successful irrigation at a small outlay, while the Ganges and other large canals in the uplands of Northern India abundantly prove the greater difficulties in their several cases.

In the projection of an irrigating canal intended to water a given area, the first point which presents itself is this—namely, How much water will be required per acre? The answer to this question results from a consideration of a number of circumstances. It will depend upon the amount of rainfall in the irrigated district, and upon its distribution, both as to quantity and as to time; upon the temperature in the growing season; the kind of cultivation, whether of rice, cotton, sugar, cereals, or of vegetables; and finally upon the character of the soil, whether retentive of moisture or sandy and easily drained. Again, if the climate permits cultivation throughout the year, and the water-supply is perennial, irrigation may be continuous, and a part of the land may be devoted to one kind of cultivation in the winter, and the remainder to a different cultivation in the summer. One cubic foot of water supplied each second for twenty-four hours will cover 4 acres with a trifle less than 6 inches of water, and supplied for 100 days, it will cover 400 acres with 6 inches, or 200 acres with 12 inches of water. A cubic foot of water per second throughout the season is sufficient to mature rice in quantities varying from 30 acres to as much as 90 acres; this last case existing in districts of India exposed to heavy falls of rain. In Northern India, where the rivers are fed from the snow-reservoirs, and where there is a heavy fall of rain, with a winter and a summer cultivation, the average area irrigated in some cases rises to 400 acres per cubic foot a second. In most cases, however, it does not much exceed 200 acres per foot. This is for other cultivation than rice, and principally relates to cereals. In California 12 inches of rain, with timely application, suffice to ensure a crop of cereals.

In proportioning the water-supply to the irrigable area, it is usual to make a large allowance for the ground which in a particular season will lie fallow, and for that which will be taken up by roads, fences, forests, and buildings. Having determined, after full consideration, the capacity of the canal, which should exceed by 15 or 20 per cent. the estimate for irrigation, in order to make up for loss by absorption, evaporation, and waste, we may proceed to determine its dimensions and the slope of its bed. Many irrigating canals are arranged for navigation. New conditions, more or less incompatible with those pertaining to mere irrigating canals, are thereby introduced. The ideal canal for irrigation transports the water at the highest velocity which is admissible, for the reason that its section is thereby reduced. The mere navigation canal should have no velocity, as by absence thereof transportation is facilitated. The canal which shall subserve both ends must carry its water at a low velocity to permit navigation, and it must have an increased section to enable it to transport the required volume of water for irrigation. There are cases where the slope of the country compels a low grade for the bed of the canal, and there are soils which will not maintain themselves under any but a very low velocity. In such particular cases the conflicting conditions of irrigation and of navigation are measurably harmonized. The relations existing between the slope of the bed, the mean velocity, and the section are conveniently expressed in this formula, which is sufficiently accurate for the purposes to which it is applied: $v = \frac{92}{100}\sqrt{2ds}$, in which v is the mean velocity in feet per second; s is the slope of the bed in feet per mile; d is variously termed the "hydraulic radius" or "the hydraulic mean depth," and it is obtained by dividing the area of the section of the water-way, expressed in square feet, by the wetted perimeter expressed in linear feet. The velocity of the water ought not to be so great as to cause erosion of the bed and banks of the canal, and it ought to be great enough to prevent the growth of water-plants, which interfere with the service of the canal. A stiff clay soil will stand under a mean velocity of as much as 4 feet per second, and where the bed is of shingle, a higher velocity may be permitted with safety. In a light sandy soil 3 feet per second is a maximum velocity, and in some particular soils disturbance of the bed and banks takes place with a considerable lower velocity. In a hot climate a velocity of 2 feet per second is necessary to prevent the growth of plants in the water-way. If the water derived from the river is laden with earthy particles in suspension, as is often the case, deposits will occur unless the initial velocity is maintained. If the silt is of a fertilizing character, it is desirable that it be transported to the cultivated fields in order to sustain their productiveness. When it is deposited along the line of the canal, periodical closures become necessary to effect clearance, which is attended in many cases with great expense. In order to carry the silt to the fields, it will be necessary to increase the fall of the ditches as their section is diminished. Something is gained by transporting the matter beyond the main channel to the minor ditches, where its clearance will not require the canal to be closed, and from which it can be removed at a lessened expense. In some cases the velocity near the head is slackened by diminishing the slope or by enlarging the section, so that the deposits may be encouraged at this particular section, where the clearance can be more conveniently effected than it would be if the silt is deposited along a larger line.

The English engineers in India have adopted a rule which governs the proportion of width and depth of the canals, the width being made to vary from thirteen to fifteen times the depth. The slope of the bed is variable, depending on the fall of the country and on the character of the soil. The ruling gradient on the Ganges Canal is 15 inches to the mile; in many canals it is less. For illustration, it may be stated that by the formula a fall of 1 foot per mile will give in a canal 90 feet wide at bottom, 6 feet deep, with side-slopes of 2 base to 1 altitude, a mean velocity of 3 feet per second. If the slope of the bed is less than the fall of the country, it will be necessary to provide a series of falls, which may be arranged with dams giving a direct fall, or by rapids. The slope of the bed and the dimensions of the canal will generally be determined, so as to conform to the fall and character of the land traversed, by assuming the quantities which enter the formula in a succession of trial-cases. In this way a close approximation may be made. The alignment of the canal will be most favorable when it can be placed on the watershed or divide. Such a position gives command of the land on either side, and avoids the passage of the drainage-lines of the country. This advantage, however, is one which can seldom be fully secured. It is generally necessary to cross some of these lines, and certain arrangements result which vary with the circumstances of the case. If the level of the canal at the point of crossing is higher than the stream, an aqueduct will be required to carry the canal-water, and in special cases of low lands adjoining the stream the canal must be embanked at one or at both ends of the aqueduct. Where the canal-level is below that of the stream, the latter may be carried over by an aqueduct, or the canal may be carried under the stream through a tunnel or a siphon. If a small stream crosses the line of the canal at a suitable level, it may be admitted into the canal; but if the stream is torrential in character, it may not be safe to admit its water into the canal. Regulating sluices will be necessary in this case to exclude the torrent from the canal, and a dam will be required to maintain the proper level at times when the stream is not full.

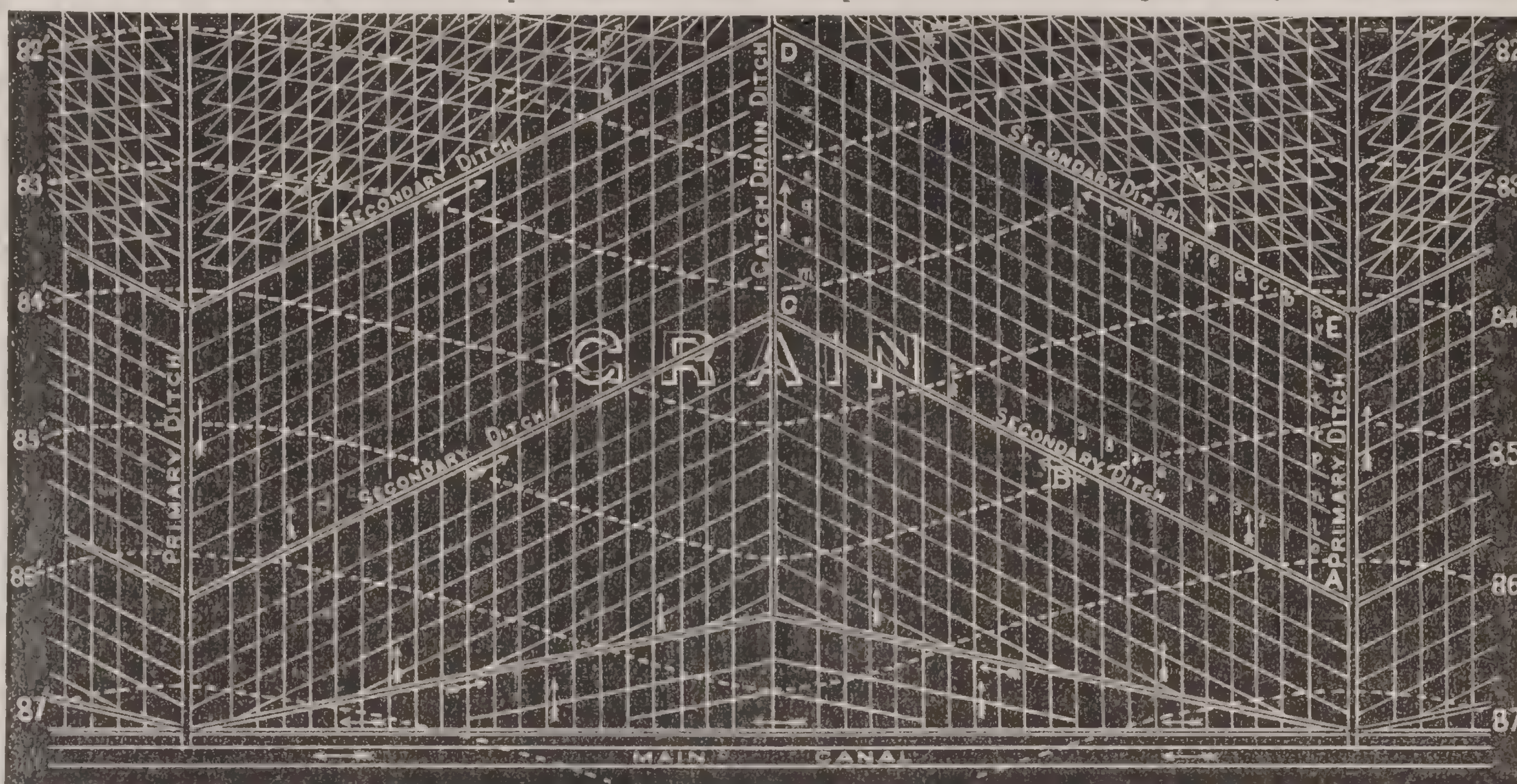
It will readily be understood that these several works may be very expensive in construction. The irrigation-works of Italy and India afford many instances in illustration of this statement. The Solani aqueduct is 920 feet in length, and it carries the Ganges Canal in two channels, each 85 feet in width and 10 feet deep. After crossing the stream the canal is carried in an earthen embankment of 16 feet in depth for three-fourths of a mile across the low lands. At or near the head of the canal a system of sluices or gates admits the water from the river in suitable quantities, and defends the canal from the attacks of the river when it is in flood. In the older canals these constructions are of masonry and of the most substantial character. It is also true that there are canals which have no head-works. In such instances the canal embankments are exposed to great dangers, and there are without these works no means of regulating the supply of water. The position of the head of the canal is a point of great importance. The banks of the river should at this point be of a permanent character, and the regimen of the stream should be well established and not liable to change. If the stream brings down sand or gravel, the bed will in time be filled to the level of the crest of the dam. In such cases it is usual to provide scouring-sluices in the part of the dam adjoining the canal, which may serve to keep a free water-way at the head-works. It is desirable to provide regulating bridges at intervals of a few miles, arranged with

sluices, so that the water may be shut off from the canal in sections for purposes of repairs and for other purposes. At the same intervals escapes should be arranged, by which an excess of water occurring at any time may be thrown into the natural drainage-lines of the country.

The reproach of irrigation is defective drainage. The natural drainage of the country should remain unimpaired. Even when this much is accomplished, stagnant water is very liable to result from irrigating operations. The waste water at the end of the canal or in the minor channels should have free passage into the natural drains, or if none such exist, artificial drainage should be provided. Where the canal is carried in embankments there is great danger of percolation, and hence stagnant pools may result. The cultivation of rice requires pools of water, and its unhealthfulness is everywhere recognized.

For economy of construction the canal should be partly within and partly above the soil, and for facility of irrigation this arrangement is equally desirable.

This sketch of the principles which must govern in the projection and construction of an irrigating canal brings us to the actual operations of spreading the water over the land. The diagram exhibits the system pursued in irrigating the plains of the San Joaquin Valley in California. It will



Irrigating system for grain, as laid out by the San Joaquin and King's River Irrigation Co., Cal.

be seen that the water passes from the main canal into primary ditches, from which it is delivered into secondary ditches, which in turn pass it into irrigating furrows, which are its immediate dispensers to the land; and finally, having done its duty, it is conveyed away by a drain to irrigate again below, or else it escapes into the natural drainage-lines. The main canal has a fall of 1 foot to the mile, while the fall of the primary ditches is 8 feet, and of the secondary ditches from 3 to 5 feet to the mile. The contour-lines of 1 foot difference of level are shown, and they indicate a surface nearly plane and extremely favorable for irrigation. The primary ditches in this case are one mile apart, and the secondary ditches are one-fourth of a mile apart. The irrigating furrows in the grain-field are parallel to the primary ditches, and the "checks" are represented by lines parallel to the secondary ditches. These checks are 50 yards apart, measured parallel to the primary ditches. The irrigating furrows are 40 yards apart. The primary ditches, when full, will carry 50 feet per second, and one primary ditch will supply three secondary ditches. The water passes from the secondary ditches to the furrows by boxes 6×10 inches which pass through the bank. Each box will deliver $1\frac{1}{2}$ cubic feet per second, and each secondary will supply 10 boxes. Each secondary ditch waters 80 acres, within which area there are about 5 miles of furrows and 4 miles of checks. There is a gate at the junction of each primary with the main canal, and one in each primary for every three secondaries, and one in the middle of each secondary; and each box is fitted with its little gate.

With this description we are prepared to trace the course of an irrigation. A C D E contains 80 acres, sown in grain. The gate in the secondary ditch at B being closed, and that at A being open, the first half of the secondary ditch will begin to be filled with water, which will run into the irrigating furrows 0 to 9, inclusive, and will flow until it encounters the dam made by the check *l m*, when it will rise and overflow the strip of land lying between the secondary ditch and the check *l m*. When this strip is sufficiently watered, the cultivator opens with a hoe a passage through the check *l m* for each furrow, and permits the water to flow in parallel courses until it is again checked at the line *n n* for a time sufficient to water the strip lying between the checks *l m* and *n n*; and this process is continued until the 40 acres lying next the primary ditch are completely irrigated. This done, the little gates 0 to 9 are closed, the gate at B is opened, and the same steps are pursued in irrigating the other half of the tract. In the alfalfa field the furrows are multiplied, to ensure a more equal diffusion of the water. In this case the ground falls 8 feet to the mile, and as the checks are 50 yards apart, the fall for this distance is $2\frac{7}{10}$ths inches. When the water is just even with the upper line of one of these strips between two consecutive checks, it will be $2\frac{7}{10}$ths inches in depth along the lowest line of the strip. In this way a secondary ditch with a fall of five feet to the mile, and running full, will spread more than 4 inches of water over 80 acres in twenty-four hours.

It is plain that the successful irrigator must use a level to lay out his ditches, and it will be rare when so favorable a field for irrigation will be found as the one just illustrated. The ditches will rarely present so symmetrical an appearance. In the general case the system will prove to be much more complicated. The primaries, for instance, will follow the minor divides of the plain, and they will seldom be parallel or even rectilinear; and having to supply variable areas, the cross-sections will vary in each case. The variableness of fall to the ditches, and their varying dimensions in a less favorable field, add so many complications that the work of an irrigator demands the acquirements of an engineer. An irrigation of grain usually consists of two or three inches of water, which is repeated as often as the needs of the crop require.

Irrigation has been little practised in the U. S., but it has had more development in the sections of America which were once under the dominion of Spain. Italy and Spain in Europe, Egypt and India, present extensive operations of this nature. The English have been extending irrigating facilities in India for the past few years on a grand scale. The arrangements of the native inhabitants, which have existed for centuries, are also extensive.* They practised irrigation by natural flow of water, but they supplemented their supply of water by raising it from wells by means of various appliances. They made extensive use of reservoirs to collect the water when abundant, and to hold it until the season for its application to the land. The Madras provinces are dotted over with reservoirs in such numbers that the face of the country may be likened to the face of a person badly marked by smallpox. These reservoirs are found of all areas, from that of many miles to that of one or of a few acres. Each inequality of the ground which afforded any facility for storage was utilized, and it was surrounded by an earthen embankment. The water-supply was afforded from the natural drainage of the little basin, or, if this was insufficient, a channel was cut to conduct the flood-waters of the rivers to the storehouses. In the northern provinces of India the reservoirs are the fields of snow on the Himalayas.

It is claimed, with a show of reason, that the water derived from rivers is superior for irrigation to that afforded by tanks or reservoirs. When the water is stored in reser-

*For brief account of which see *Engineering*, vol. xvii., and *Van Nostrand's Eng. Mag.*, July, 1874.

voirs it deposits the fertilizing particles which it has carried in suspension, while the flowing water bears them, in part at least, to the fields, where they renew the productiveness of the soil. Water is generally sold in terms of the area irrigated and the kind of cultivation. There are many objections to this method. It is unequal, and it is wasteful. It pays a premium for careless irrigation. The absorptive capacity of the soil is not considered. The true plan is to dispose of water by the cubic foot. This plan is followed to a considerable extent in Italy. It requires special arrangements for measurement, and those that have been hitherto used are not entirely satisfactory. The Italian module or measuring apparatus keeps the head always the same by passing the water through a sluice-gate into an interior basin, from which it proceeds to the irrigating channels. The gate being capable of adjustment, the water in the basin can always be kept at a constant level, no matter how the level in the channel from which it is derived may vary. As the level of the canal falls, the aperture of the gateway may be enlarged, and conversely a contraction of the orifice ought to follow an increase of head in the canal.

The increase of production which results from irrigation in warm climates, where the rainfall is insufficient to produce a crop, is quite sufficient to justify the large expenditure which is required to put the system into operation. It is estimated that the canals and primary ditches, including dams, head-works, and all necessary arrangements, excepting the secondary and other minor ditches, can be constructed on the plains of California for an expenditure which may vary from $10 to $20 per acre. It must be borne in mind, however, that the features of the country are in general extremely favorable, and that the gates, head-works, and other constructions are made of wood, and that they must be replaced from time to time. The minor ditches, it is estimated, may cost from $5 to $10 per acre, which makes the total probable outlay to vary between $15 and $30 per acre. The simplicity of the irrigating system which is practicable on the plains of California is in strong contrast to the intricacies which have been developed in Italy; but space is wanting for the development of these, and its practical value in our own country is doubtful. Reference is made to the list of authorities appended to the article which precedes this. G. H. Mendell.

Ir′ritants. In medicine all such agents are called *irritant* as by contact with the animal tissues cause one or more of the following effects: pain, increased flow of blood to the part, inflammation, or active excitation of function, as increase of secretion by a gland, involuntary muscular contraction, etc. Such are, in general, mineral astringents; all substances chemically disorganizing to the tissues, as strong acids, alkalies, and caustic salts, like corrosive sublimate or silver nitrate, and certain vegetable substances, containing generally either an acrid resin or volatile oil, such as mustard, jalap, croton oil, oil of turpentine, squills, etc. Agents which excite the "irritability" of nerve-centres, like strychnine, are also sometimes called irritant. Irritants do not thus form a natural group of medicines, but the word "irritant" expresses a certain general property belonging in different modes to many distinct classes of medicinal agents. Edward Curtis.

Ir′tish, a river of Northern Asia, rises in the Altai Mountains, in lat. 47° N., lon. 89° E., flows in a north-western direction through the Chinese province of Songaria and the Russian governments of Tomsk and Tobolsk till it joins the Obi, after a course of about 1700 miles, 180 N. of the city of Tobolsk. Its upper course flows through the best agricultural districts of Siberia, but its navigation is much impeded by shoals and shifting sandbars. It abounds in fish, both salmon and sturgeon.

Ir′vin, tp. of Howard co., Ind. Pop. 1316.

Ir′vine, town of Scotland, in Ayrshire, on both sides of the Irvine, near its entrance in the Frith of Clyde. It has several educational institutions of high reputation, large shipbuilding docks, and some manufactures. Pop. 6866.

Irvine, post-v., cap. of Estill co., Ky., 70 miles S. E. of Frankfort, and on the Kentucky River. It has 1 weekly newspaper. Pop. 224.

Irvine (William), b. at Fermagh, Ireland, Nov. 3, 1741; studied at Dublin University, and became surgeon of a British ship of war during the French war, after which he came to America, and settled at Carlisle, Pa. He was a member of the provincial convention of Pennsylvania in 1774; was appointed colonel of the 6th battalion of the Pennsylvania line in Jan., 1776; was taken prisoner at Three Rivers, Canada, in June of that year, and paroled, but not exchanged until May, 1778. He was a member of the court-martial for the trial of Gen. Charles Lee in July, 1778; appointed brigadier-general in May, 1779; served in New Jersey and at the battle of Bull's Ferry under Wayne. In 1781 he took command of the defences of the N. W. frontier, with head-quarters at Fort Pitt; was State commissioner for the distribution of public lands to the soldiers 1785; member of old Congress 1786–88, and of Federal Congress 1793–95; took part in the campaign against the insurgents in the "Whiskey Insurrection" in 1794; superintendent of military stores at Philadelphia 1801, and president of the State Society of the Cincinnati at the time of his death, which occurred at Philadelphia July 29, 1804.

Ir′vineton (Irvine P. O.), post-v. of Brokenstraw tp., Warren co., Pa., on the Allegheny River, at the junction of the Dunkirk Allegheny Valley and Pittsburg, the Oil Creek and Allegheny River, and the Philadelphia and Erie R. Rs., 51 miles from Oil City. The Brokenstraw Creek affords fine water-power. There is a foundry, a woollen-factory, an oil-refinery, and other manufacturing enterprises, and an excellent sulphur spring.

Ir′ving, post-v. and tp. of Montgomery co., Ill., on the Indianapolis and St. Louis R. R., 72 miles N. E. of St. Louis. Pop. 751; of tp. 1591.

Irving, post-v. of Marshall co., Kan., on the Central branch of the Union Pacific R. R., 90 miles W. of Atchison. It is finely situated, and is the seat of Wetmore Institute (Presbyterian).

Irving, tp. of Barry co., Mich. Pop. 1248.

Irving, tp. of Monongalia co., Minn. Pop. 276.

Irving, post-v. of Hanover tp., Chautauqua co., N. Y., on the Lake Shore R. R., 29 miles S. W. of Buffalo, and on Cattaraugus Creek near Lake Erie. The mouth of the creek constitutes its harbor. Pop. 355.

Irving, post-tp. of Jackson co., Wis. Pop. 828.

Irving (Edward). See Irvingites.

Irving (Peter), M. D., b. in New York City Oct. 30, 1771; studied medicine, but never practised; founded in 1802 the *Morning Chronicle*, a Democratic paper which advocated the presidential candidacy of Aaron Burr; travelled in Europe 1806–08; aided his brother Washington in the earliest part of the *Knickerbocker;* resided in Europe 1809–36; published a novel, *Giovanni Sbogarro* (New York, 1820), and d. at New York June 27, 1838.

Irving (Rev. Theodore), LL.D., nephew of Washington Irving, b. in New York in 1809, and graduated at Columbia College 1837; studied law and literature in Europe; was professor of history and belles lettres in Geneva College 1836–39, and afterwards held a similar professorship in the New York Free Academy; in 1854 took orders in the Protestant Episcopal Church. Author of *The Conquest of Florida* (1835) and *The Fountain of Living Waters* (1854).

Irving (Washington), LL.D., b. in New York City Apr. 3, 1783, was the youngest son of William Irving, merchant, a native of Scotland, who had married an English lady and emigrated to America some twenty years before. His older brothers, William and Peter, were partially occupied with literary pursuits, which naturally inclined him to follow their example. His school education was not protracted beyond his sixteenth year, when he began to study law, but his literary training was acquired by the diligent perusal at home of the older English writers, his favorites being Chaucer and Spenser. In 1802, at the age of nineteen, he made his first literary venture by printing in the columns of the *Morning Chronicle*, then edited by his brother, Dr. Peter Irving, a series of local sketches under the *nom-de-plume* of "Jonathan Oldstyle." In 1804, being threatened with consumption, he sailed for Europe, landed at Bordeaux, and travelled through France, Italy, Switzerland, Holland, and England, laying up a rich store of materials for future use. Returning to New York in Mar., 1806, he quickly completed his legal studies, and was admitted to the bar, but never practised the profession. Early in 1807 he commenced, in connection with his brother William and James K. Paulding, the amusing serial *Salmagundi*, which had an immediate success, and not only decided his future career, but long determined the character of his writings. In 1808, with some assistance from his brother Peter, he wrote *Knickerbocker's History of New York*, a serio-comic narrative, and in 1810 a biography of the poet Campbell, prefixed to an American edition of his works. His attention was much absorbed at this time by the interests of a mercantile business in which he engaged with two of his brothers. It was not until 1813–14 that he reappeared in literature as editor of the *Analectic Magazine*, published at Philadelphia, for which his own contribution was a series of biographical sketches of the naval heroes of the then existing war with Great Britain. In the latter year he was appointed aide-de-camp and military secretary of Gov.

Tompkins, with the rank of colonel—a title, however, which he never used. Early in 1815, upon the conclusion of the war with Great Britain, "Colonel" Irving hastened to make another tour in England, Wales, and Scotland, expecting also to visit the Continent; the anticipated pleasure-trip proved to be an absence of seventeen years from America. For two or three years Irving was engaged in rambling through the United Kingdom, without other object than pleasure, making, however, many literary friends, and accumulating that minute acquaintance with English life which he afterwards turned to so good account. About the close of 1817 the commercial house in which Irving was a partner failed, and he was thrown upon his pen for a subsistence. He sent the essays composing the *Sketch-Book* to New York, where they were printed in pamphlets in 1818, over the signature of "Geoffrey Crayon." Some of them were reprinted by Jerdan in the *Literary Gazette* of London, and were so cordially received that, aided by the recommendation of Sir Walter Scott, the publisher Murray brought out the work in good style in 1820. The *Sketch-Book* laid the foundation of the fortune and the permanent fame of Irving; the legends of *Sleepy Hollow* and *Rip Van Winkle* at once took rank as modern classics, while the pictures of English life and customs were so genial, artistic, and withal so faithful, that they fairly took the reading world by storm. A new phenomenon had appeared in the world of letters—the first American author had gained an honorable name in Albemarle street and Paternoster Row. Henceforth the path of Irving was smooth, and his subsequent writings appeared with rapidity. *Bracebridge Hall* was published in 1822; though rapidly written, and decidedly unequal to the standard of the *Sketch-Book*, it was well received, and brought the author £1000. The *Tales of a Traveller*, published in 1824, brought him £1500. Irving had spent three winters on the Continent, chiefly at Paris and Dresden, when in 1825 his attention was called by his friend Alexander H. Everett, American minister to Spain, to Navarrete's collection of documents upon Columbus and the early explorers of America, then appearing at Madrid. He proceeded to that capital, intending to make a translation of the work of Navarrete, but finding it to be rather a rich mine of materials than a readable book, he fortunately changed his plan and produced his *History of the Life and Voyages of Christopher Columbus* (1828), to which was added (1831) its continuation, the *Companions of Columbus*. The former work is Irving's masterpiece in historical composition; though not exhaustive in its use of the materials at hand, nor characterized by any acute appreciation of the mental, moral, and political world in which Columbus was reared, the work has all the charm of a romance combined with the fidelity of a chronicle. Its reception in England may be inferred from the facts that Murray paid £3000 guineas for the copyright, and a gold medal of fifty guineas was awarded him as a prize given by King George IV. for excellence in historical composition. In 1828–29 Irving travelled through the S. of Spain, and spent three months in the ruined Moorish palace of the Alhambra at Granada. In the latter year he published the *Conquest of Granada*, and in 1832 *The Alhambra*, neither of which was quite as successful as his former works. Irving returned in July, 1829, to London, having received the appointment of secretary of legation in England. In 1831 the University of Oxford conferred upon him the degree of LL.D. In 1832, after seventeen years' absence, he returned to his native land, where all his books had of course been republished, and where to his European fame was added the American element of pride in an author who had done honor to his native land. Irving was now fifty years of age, but he plunged at once into a new series of travels and studies with all the eagerness of youth. The same year he accompanied Commissioner Ellsworth in his journey for removing the Indian tribes to the W. of the Mississippi, and narrated his observations in his *Tour on the Prairies* (1835), published in the series called the *Crayon Miscellany;* to which were added in another volume *Abbotsford* and *Newstead Abbey*. In 1836 he published *Astoria*, a narrative of the exploration of Oregon by American fur-traders; in 1837, the *Adventures of Captain Bonneville;* and in 1839–41 contributed to the *Knickerbocker Magazine* a series of articles afterwards published (1855) in the volume entitled *Wolfert's Roost*. In 1842, Irving received the appointment of minister to Spain, a post which he filled for four years, during which he discontinued authorship, and it was not until 1849 that he reprinted with large additions a biography of Oliver Goldsmith, furnished some years before to a Paris edition of that author's writings. In 1850 he published *Mahomet and his Successors* (2 vols.). He was thenceforth occupied throughout his life in his *magnum opus*, the *Life of Washington*, of which the first volume appeared in 1855, and the fifth, concluding the work, in Aug., 1859. In 1848, at the instance of the enterprising publisher, Mr. G. P. Putnam, Irving had commenced the reissue of his works, with his final corrections, the edition being completed in 1850 in fifteen volumes. The success of this undertaking was instantaneous, and it gave Irving a new lease of literary existence, not less than 250,000 volumes of the republication having been sold during Irving's life. No one was more surprised at this marvellous renewal of old-time popularity than the author himself, who had become in a measure his own literary descendant and the contemporary of a second generation of writers. Irving resided during the closing years of his life at Sunnyside (Tarrytown) on the Hudson, a quaint pre-Revolutionary edifice, which has become one of the shrines of American pilgrimage; here, surrounded by friends, and enjoying the society of a brother, of nephews, and nieces, he passed an active and honored age until his death, Nov. 28, 1859. Washington Irving was never married; an early bereavement was mourned by him through life, and the memory of his betrothed was present on his deathbed. Of the characteristic excellences of style which made Washington Irving the most popular of American authors it would be superfluous here to speak. Though his literary activity was exercised rather in England than in America, and many of his subjects were European, his deserved success is a matter of pride to his countrymen, who will not allow his graceful productions to fall into oblivion. PORTER C. BLISS.

Irving (WILLIAM), b. in New York City Aug. 15, 1766, was brother of Washington Irving; became an Indian trader, residing at Johnstown and Caughnawaga on the Mohawk from 1787 to 1791. In 1793 he married a sister of James K. Paulding, and settled in New York as a merchant, where his extensive observation of the world, combined with geniality and wit, made his house a centre for the best literary circle of the metropolis. His poetical and other contributions to *Salmagundi* would, if separately published, have given him a distinct place among American humorous writers, but he seemed entirely unambitious of literary fame. He was a member of Congress 1813–19, when he resigned on account of ill health. D. at New York Nov. 9, 1821.

Ir'vingites, members of the communion which is called by its adherents the Catholic Apostolic Church. The name "Irvingites" was first given in 1831 to those who shared the opinions of the Rev. Edward Irving, who was b. at Annan, Dumfriess-shire, Aug. 4, 1792, and educated at Edinburgh University for the Scottish Presbyterian ministry. He obtained no church employment until 1819, when he was chosen assistant by the celebrated Dr. Chalmers. Three years later he accepted a call from a Presbyterian congregation in London, where his eloquence, modelled on the writings of Hooker, Bacon, and Jeremy Taylor, attracted crowds of hearers. At that time there was a general religious revival, a remarkable reaction from the religious apathy into which Christendom had gradually fallen after the excitement of the Reformation had died out. Most of the great missionary societies were then founded; ministers of all sects spoke with new earnestness; the Bible was more eagerly read, special attention being given to its prophetical passages. Among students of prophecy Edward Irving was distinguished. In 1825 he published *Babylon and Infidelity Foredoomed*, and in the following year his translation from the Spanish of *The Coming of the Messiah in Glory and Majesty*, written by Manuel Lacunza under the pseudonym of Ben Ezra. In 1828, Irving began to preach the entire humanity of Christ. Our Lord, he declared, took upon himself the body of man as it became after the fall—mortal, corruptible, capable of sin, from which he was kept only by the power of the Holy Spirit dwelling in him. This assertion, which Irving himself regarded not as a new thing, but as the ancient and natural belief of all Christians, provoked many answers and refutations, and caused some stir in the Presbyterian Church. In 1830, Mary Campbell, a young Scotchwoman who had been earnestly praying for the gift of the Holy Ghost, began to prophesy and to speak with fervor in an "unknown tongue." The same phenomenon became manifest in other persons, and in 1831 appeared in some members of Irving's congregation. Irving, at first doubtful as to the origin of these "gifts," soon owned them to be from God, allowed their exercise in his church, and wrote and spoke in their defence. The prophecies, which to us who now dispassionately read them appear nowise remarkable, were in English. The "tongue," which those who uttered it supposed for a while to be the living speech of some far-off country, was pronounced by philologists to be totally unlike any known language. That opinion was speedily adopted even by believers, who came to regard the "tongue" as a supernatural sign of divine power, known in the primitive Church; and spoken of by Paul in his First Epistle to the

Corinthians (xiv. 2). In 1832, Irving, being accused of heresy, was tried by the presbytery of the Scottish Church in London, declared unfit for the ministry, and dismissed from the charge of his congregation. But some of its members still adhered to him, and with them he removed to Newman street, where a room, formerly the studio of Benjamin West, was fitted up as a chapel. There a new ritual was gradually arranged and a new ministry was formed. In 1833, Irving was again tried, this time by the Scottish presbytery at Annan, and was finally cast out from the Presbyterian Church. Shortly afterwards the apostles of the Newman street congregation reordained him as angel or pastor of that church, and there he officiated until a little while before his death at Glasgow Dec. 8, 1834. He was buried in Glasgow cathedral.

The new community continued to prosper. In London alone it soon numbered seven congregations, among which were many persons of wealth and position, and in 1853 the magnificent church in Gordon Square was opened with much religious ceremony. The Catholic Apostolic Church rejects the name "Irvingite," and denies that Irving was its founder, declaring also that it is wrong to call a church after any leader, however excellent. Its special mission, says one of its pastors with whom the writer has corresponded on this subject, is "the gathering and perfecting in one in Christ, the whole body of God's election, living and dead, out of all nations, to reign with Christ in the world to come." It has a fourfold ministry—apostles, prophets, evangelists, and angels or pastors. The apostles, twelve in number, form the chief ruling power, and are appointed to no special churches, but watch over all. They ordain persons called to the ministry, and lay their hands on the people for the purpose of conferring the gifts of the Holy Ghost. Through the prophets God is believed to declare his will to the Church. The evangelists, as the name implies, preach the Gospel of Christ and declare his speedy coming. An angel or pastor is set over each church, and with him are associated elders, prophets, and evangelists, who aid him in governing and ministering to the congregation. There are also deacons, sub-deacons, and deaconesses, chosen by the people. The communion is administered every Lord's day, and also during the week. In large congregations the first and last hours of each day (counting from 6 A. M. to 6 P. M.) are set apart for public worship, and at these services a liturgy is used, taken from the Greek, Roman, and Anglican rituals. But there are also frequent meetings for extempore prayer, when women, and even children, are allowed to speak. Confession, as a means of relieving the mind, is encouraged, but is not obligatory. Sick persons are anointed with oil (James v. 14), but the motive of this ceremony is entirely different from that of "extreme unction," with which some writers have identified it. A lamp, regarded as symbolical of the Divine Presence, is kept always burning before the altar. Incense, candles, and rich vestments are used, also with a symbolical meaning. Each member of the Catholic Apostolic Church devotes to it one-tenth of his income, besides occasional gifts. It has in London seven churches, with several thousand communicants, and others in various parts of the United Kingdom; also in many European countries, the British colonies, and the U. S. The writer has applied to the head of a Catholic Apostolic congregation in London for exact information as to the aggregate number of communicants, but from his reply it appears that no general statistics have been published, though "each angel knows the number of his own flock, and the apostles have full information of everything." (See *The Life of Edward Irving*, by Mrs. Oliphant (2 vols., London, 1862, 8vo); *The Original Constitution of the Church, and its Restoration*, by Rev. Jubal Hodges (London, 1864, 8vo); *The Catholic Apostolic Church*, by Rev. W. W. Andrews (London, 1867, 8vo); *Edward Irving and the Catholic Apostolic Church*, by Rev. J. S. Davenport (New York). JANET TUCKEY.

Ir'vington, post-tp. of Kossuth co., Ia. Pop. 605.

Irvington, post-v. of Clinton tp., Essex co., N. J., on the Passaic Valley and Peapack R. R., 3 miles W. by S. of Newark.

Irvington, post-v. of Greenburg tp., Westchester co., N. Y., on the Hudson River and the Hudson River R. R., 22 miles N. of New York, and nearly opposite Piermont. The residence of the late Washington Irving was in the immediate vicinity.

Ir'win, county of S. Central Georgia. Area, 700 square miles. It is level and sandy, and chiefly covered with pine forests. Some wool and grain are produced, but only a very small part of the land is under cultivation. Cap. Irwinville. Pop. 1837.

Irwin, tp. of Brown co., Kan. Pop. 2300.

Irwin, tp. of Venango co., Pa. Pop. 1489.

Irwin, a b. of Westmoreland co., Pa., in North Huntington tp., on the Pennsylvania R. R. (IRWIN'S STATION P. O.). Pop. 833.

Irwin (JARED), b. in Mecklenburg co., N. C., in 1750; moved with his parents when a boy to Burke co., Ga.; took an active part in the cause of independence during the Revolutionary war; was a member of the first legislature of Georgia after independence was achieved; was a member of the State convention which ratified the Constitution of the U. S. of 1787; was governor of the State 1796–98, and again 1806–09. He was president of the State convention that formed the constitution of 1798. It was his honor as governor in 1796 to sign the act abrogating the famous Yazoo fraud, which had been perpetrated by a previous corrupt legislature. D. at Union Hill, Washington co., Ga., Mar. 1, 1818. A monument to his memory stands in the court-house square at Sandersville, Ga.
A. H. STEPHENS.

Irwin (JOHN), U. S. N., b. Apr. 15, 1832, in Pennsylvania; entered the navy as a midshipman Sept. 9, 1847; became a passed midshipman in 1853, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866. Served in the U. S. frigate Wabash at the battle of Port Royal, and with a detachment of officers and seamen of that vessel took part in the bombardment and capture of Fort Pulaski. Highly commended for "earnestness and bravery." FOXHALL A. PARKER.

Ir'winton, post-v., cap. of Wilkinson co., Ga., 3 miles from McIntyre, a station on the Central R. R. Pop. 241.

Ir'winville, post-v., cap. of Irwin co., Ga., 35 miles S. W. from Chauncey (or Eastmon), a station on the Macon and Brunswick R. R.

Is [Gr. Ἴς, now *Hit*], an important city of ancient Babylonia, eight days' journey N. of Babylon, on the W. bank of the Euphrates. The name signifies *bitumen*, and that material was carried thence to Babylon for building purposes. The site has been identified by cuneiform inscriptions.

I'saac [Heb., "laughter"], the only son of the Hebrew patriarch Abraham by Sarah his wife, b. (2063 B. C.) in the extreme old age of both his parents, in fulfilment of the divine promise. For his sake Ishmael, his half-brother, was thrust out into the wilderness with Hagar, his mother, a bondwoman or slave. Later, the lad Isaac was offered by his father as a sacrifice on Mount Moriah, in obedience to the divine command, but Isaac's life was spared in consequence of a heavenly interposition. When forty years of age Isaac married Rebekah, his kinswoman (2023 B. C.), who bore him twin sons, Esau (or Edom) and Jacob (afterwards called Israel). The former was the first-born and the favorite of his father, but Jacob, by the aid of his mother, obtained the birthright. Isaac d. at Hebron (1883 B. C.), aged 180 years. He was a man of gentle nature, a nomadic herdsman of devout and blameless life.

Isaac I., Comnenus, a Byzantine emperor, descended from the family of Comnenus, but was educated by the emperor Basil II., and raised to the throne in 1057 by a conspiracy. Utterly unable to govern the empire, he abdicated in 1059, retired to a monastery, and d. there in 1061.

Isaac II., Angelus, a Byzantine emperor, descended from the family of Comnenus, and was raised to the throne by a revolution in 1185. In 1195 his brother, Alexis III., compelled him to abdicate and deprived him of his sight, but in 1203 the crusaders once more placed him on the imperial throne, whence he again was driven in 1204 by Alexis Ducas, who put him to death.

I'saac (DANIEL), b. at Caythorpe, Lincolnshire, Eng., July 7, 1778; joined the Wesleyan conference in 1800, and d. Mar. 31, 1834. He was noted as a controversialist, being called "the polemic Daniel," and published many volumes, chiefly on theology. His collected works were issued in London in 3 vols., 1828.

I'saac Levi'ta, b. at Wetzlar, Germany, in 1515; became one of the most celebrated Jewish rabbis of his time, but with his son joined the Roman Catholic Church in 1546; became professor of Hebrew and Chaldee at Louvain, and in 1551 took the corresponding chair at Cologne. Author of *Defensio Veritatis Hebrææ Sacrarum Scripturarum* (1559), *Introduction to the Hebrew Grammar* (1553), *Meditationes Hebraicæ in artem grammaticam* (1558), and other excellent grammatical and philological works, besides translations, etc. After conversion he took the name of John Isaac Levi. The time of his death is not known.

Is'abel, tp. of Fulton co., Ill. Pop. 715.

Isabel'la, port on the N. coast of Santo Domingo, 36 miles W. N. W. of Santiago. It was so called by Columbus, who in 1493 established here the first European settlement in the New World, some ruins of which are still visible.

Isabel′la, county of the N. central portion of the southern peninsula of Michigan. Area, 576 square miles. It is generally level and well timbered. Grain and potatoes are staple products. Cap. Mt. Pleasant. Pop. 4113.

Isabella, post-v., cap. of Worth co., Ga., on the Brunswick and Albany R. R., 18 miles E. of Albany. Pop. 54.

Isabella, tp. of Isabella co., Mich. Pop. 56.

Isabella I., THE CATHOLIC [Sp. *Isabel*], b. at Madrigal, Old Castile, Apr. 22, 1451, daughter of John II., king of Castile, by his second queen, Isabella of Portugal, and sister to Henry IV., who succeeded to the throne in 1454, when she was but three years of age. She was brought up by her mother in the obscure village of Arévalo, receiving an education largely tinged with the ascetic bigotry of the age. The insurrection which broke out in 1464 against Henry, alleging the illegitimacy of his infant daughter Juana (called "la Beltraneja," from the name of her supposed father), and raising to the throne (1465) his brother Alfonso, first gave political importance to the person of Isabella as a not improbable heir to both her rival brothers. On the death of Alfonso in 1468, Henry regained the throne, but experienced armed resistance from the former partisans of Alfonso, who offered to proclaim Isabella queen. She refused the proposal, but consented to allege her claims to the succession against those of the infant princess, and the civil war was terminated, with the sanction of the Cortes, by Henry's promise to repudiate his queen and her offspring, and recognition of Isabella as immediate heir. During this troubled interval intrigues had been rife for the disposal of Isabella's hand, which had first of all been unsuccessfully sought for Ferdinand of Aragon, her destined husband. At the age of eleven she had been betrothed to Prince Carlos of Aragon (brother of Ferdinand), who soon died by poison, and two years later Henry had promised her hand to Alfonso of Portugal. Isabella having energetically refused to sanction this agreement, Henry next endeavored to compel her to marry the marquis of Villena (who d. in 1468), and after the peace of 1468 returned to his earlier project in behalf of the Portuguese prince. While these intrigues were going on overtures had been made directly to Isabella herself by her cousin Ferdinand of Aragon, which she accepted in spite of her brother's threats of imprisonment. The articles of settlement were signed at Cervera (Jan. 7, 1469), guarantying to Isabella the exercise of her sovereign rights in Castile. Henry endeavored to seize upon his sister's person, but she took refuge in Valladolid, under the protection of her staunch and powerful partisans, the admiral of Castile and the archbishop of Toledo, primate of Castile. This prelate, in order to expedite the union, produced a papal dispensation from the impediment of consanguinity (which ultimately proved to have been fabricated by him), and Ferdinand, traversing Northern Castile in disguise, was married to Isabella at Valladolid Oct. 19, 1469. Henry, enraged at this resistance to his mandates, declared that by marrying against his consent Isabella had forfeited her rights, again proclaimed his infant daughter heir to the throne, taking, along with the queen, an oath to her legitimacy, and betrothed the *infanta* to a French prince, the duke of Guienne, brother of Louis XI. The partisans of Isabella in Northern Castile stoutly maintained her claims, and in 1473, Henry again found himself obliged, for his own security, to negotiate with his sister. They were publicly reconciled at Segovia amid great rejoicings, and Henry dying soon after, Isabella was proclaimed queen of Castile Dec. 13, 1474. Most of the nobility at once recognized her, but a few, aided by Alfonso of Portugal, asserted by arms the claims of the *infanta* Juana, now betrothed to that prince. Isabella took an active part in this war, encouraging her troops by her presence and by an unwearied attention to their needs; it was not until 1479 that this source of disquietude was removed by a treaty of peace, in accordance with which Juana, then seventeen years of age, who had retired to Portugal, took the veil at Coimbra, where she survived until 1530. Meanwhile the prince-consort, who had received the honorary title of king of Castile, succeeded to the throne of Aragon as Ferdinand V. in Jan., 1479, thus effecting a virtual union between the two principal states of the Iberian peninsula, which was consolidated in the succeeding reign of Charles V., and laid the foundation of modern Spanish history. One of the earliest acts of the reign of Isabella was the establishment of the Inquisition in Castile (Jan. 2, 1481); in the same year commenced that final warfare with the Moors of Granada which only ended ten years later by the extinction of their sovereignty in 1492. On this occasion Ferdinand and Isabella received from the pope the title of "Catholic sovereigns," by which they are distinctively known in history. The honors of the Moorish war belonged of right chiefly to Isabella, who had personally directed the operations, submitting for years to all the inconveniences of campaign life. Besides the establishment of the Inquisition, another dark stain rests upon the memory of Isabella—the expulsion of the Jews from Castile; both acts may be palliated, but not justified, by the prevailing bigotry of the times and the pressure of the papal court. Isabella's chief title to fame rests upon the well-known part she took in promoting the great project of Columbus, and in the New World, at least, her memory will be immortal. She was beautiful in person, of pleasing manners and kindly heart, though of inflexible will; ambitious and proud, though devout; had considerable learning and political ability; was a loving wife, and is justly revered by Spaniards as the purest glory of their royal annals. She d. Nov. 26, 1504, at Medina del Campo, and at her own desire was buried in the Franciscan monastery at Granada. She had five children—Isabella, who married Prince Emanuel of Portugal; John (Juan), who d. in 1497, aged 20; Juana, afterwards called *La Loca*, or "the Mad," who married Philip of Austria and was the mother of Charles V.; Maria, who married Emanuel of Portugal after her sister's death; and Catharine (Catalina), known in English history as the unfortunate queen of Henry VIII. and mother of Mary Tudor. (For the voluminous literature relating to the reign of Isabella, see Prescott's masterly *History of the Reign of Ferdinand and Isabella the Catholic*, in which copious bibliographical references may be found.) PORTER C. BLISS.

Isabella II., Luisa, of Spain, b. at Madrid Oct. 10, 1830, succeeded her father Ferdinand VII. in 1833, under the guardianship of her mother; but war at once broke out, the followers of Don Carlos asserting that the Salic law, which had been the rule of succession in the Bourbon family in France, also held good for Spain. The first Carlist war lasted till 1840 with varying fortunes. In 1843 she was declared of age; married her cousin, Don Francisco, in 1846, and after a reign disturbed by many violent revolutions she was deposed in 1868, and in 1870 abdicated in favor of her son, who in 1875 succeeded as Alfonso XII., the short reign of Amadeus and the attempted republic having intervened. Isabella was very unpopular in Spain, and was charged with gross immorality in her private life.

Is′abey (EUGÈNE LOUIS GABRIEL), b. in Paris July 22, 1804, son of Jean Baptiste Isabey. He has painted *The Hurricane before Dieppe, The Port of Dunkerke, The Battle of the Texel, View of Boulogne, The Alchemist, Ceremony in the Church at Delft, The Burning of the Steamer Austria* (1859), *The Temptation of St. Anthony*. He has received three first medals, the decoration of the Legion of Honor, and was elected an officer Jan. 22, 1852. O. B. F.

Isabey (JEAN BAPTISTE), b. at Nancy Apr. 11, 1767; d. Apr. 18, 1855; studied under David, but made the painting of portraits a profession; was a favorite of Napoleon I. and court-painter. The marshals, princes, and dignitaries of the First Empire, with the chief personages of Europe, sat to him. At the invitation of the emperor Alexander he visited the Russian court. His pictures had great celebrity. The pieces in which many personages are grouped together, as in the *Tableau des Marechaux* and the *Conference at Vienna*, almost rise to the dignity of historical painting. O. B. FROTHINGHAM.

Isæ′us, b. at Chalcis in Greece, flourished in the first half of the fourth century B. C.; went to Athens while young, composed orations, and founded a school of rhetoric, in which Demosthenes is said to have been a pupil. He was one of the so-called ten Attic orators; 64 orations were ascribed to him, of which 11 are extant, all relating to disputed inheritances; they are given in the *Oratores Attici* of Bekker and others, and separately by Schömann (Greifswald, 1831), and have been translated into English by Sir William Jones (London, 1794).

Isai′ah [Heb. *Yeshayah*, "saved by the Lord"], the Esaias of the New Testament, one of the principal or greater prophets of the Hebrews. According to ch. vi. 1, Isaiah received his prophetical calling in the year in which King Uzziah died (759). He lived at least until after the invasion of Judah by Sennacherib. This event took place, according to the ordinary chronology, in 714, but Assyrian investigations show that it took place in 701–00. (See Lenormant's *History of the East*, Eng. ed., i. 399.) Thus, his activity extended over sixty years. Tradition even asserted that he was sawn asunder in the persecutions under Manasseh (cf. Heb. ii. 37). He was married and had children. During his lifetime he pronounced the word of Jehovah on every important occasion. He was the greatest of all the prophets for the vigor of his eloquence and the strength of his faith. His divine oracles being despised, he reduced them to writing, as probably Hosea, Joel, and Amos had already done. Primarily, they were discourses adapted for immediate and popular effect. Prediction appears in them only as a warning of consequences,

a promise of the favor of God and a secure and happy future if, or when, the true kingdom of righteousness should be established in Israel (Messianic prophecies). A question first raised by Koppe about 100 years ago, respecting the unity and integrity of the book, is still in dispute among biblical critics, many affirming the oneness of authorship of the whole book, and many claiming that chaps. xl.–lxvi. must have been written by another person than penned the preceding chapters. The *unanimous* testimony of Jewish and Christian tradition affirms the former view. So also does the use apparently made of the later chapters of the book by Jeremiah (x. 1–16; v. 25; xxv. 31), Ezekiel (xxiii. 40, 41), and Zephaniah (ii. 15; iii. 10). The decree of Cyrus in Ezra i. 2–4 is plainly founded upon Isa. (xliv. 28; xlv. 1, 13), and accredits Josephus's statement (*Ant.*, xi. 1.2) that the Jews showed Cyrus Isaiah's predictions of him. The New Testament also quotes prophecies found in the latter part of the book, and attaches to them Isaiah's name. J. H. SEELYE.

Isambert′ (FRANÇOIS ANDRÉ), b. at Aunay, France, Nov. 30, 1792; after brilliant classical and legal studies at the Collége de France, became one of the king's counsel in 1818, and gained a great reputation at the bar as the chief defender of the rights of the free people of color of the French West Indies; was a member of the Chamber of Deputies 1830–48; was one of the founders of the French Geographical Society and of the Society for the Abolition of Slavery, of which latter he was long the secretary; edited 1820–27 the annual volume of modern laws; published (with other writers) the vast collection of ancient French legislation (1822 *seq.*, 29 vols.), a *Manual for the Publicist and Statesman* (4 vols., 1826); *The Religious Condition of France and Europe* (1844), a *History of Justinian* (1856); translated the complete works of Flavius Josephus and the *Ecclesiastical History* of Eusebius; and wrote a large work on the *History of the Origin of Christianity*, besides contributing to many periodicals and writing numerous articles for Didot's *Nouvelle Biographie Générale*. D. at Paris Apr. 13, 1857.

Isan′ti, county in the E. of Minnesota. Area, about 430 square miles. The surface is diversified. Grain and potatoes are the staple products. Cap. Oxford. Pop. 2035.

Isanti, post-tp. of Isanti co., Minn., 12 miles from North Branch, on the Lake Superior and Minnesota R. R. Pop. 458.

I′sar, or **I′ser,** a river of Germany, rises in Tyrol, enters Bavaria, and flows after a course of 165 miles into the Danube. Munich is situated on its bank.

I′satin [Gr. ἰσάτις, "woad"], ($C_8H_5NO_2$), an interesting body formed by the action of nitric or chromic acid on indigo. Several other bodies are obtained from isatin by the action of ammonia, potassic hydrate, etc.

Isau′ria, district of Asia Minor, situated between Phrygia, Lycaonia, Cilicia, and Pisidia, was in ancient times in ill repute for the fierceness and daring rapacity of its inhabitants. In 78 B. C. it was conquered by the Romans, but when in the fourth century A. D. the Isaurians united with the Cilicians, they became a formidable enemy of the Byzantine empire, and two of their race occupied the Byzantine throne—Zeno from 474 to 491, and Leo III. from 717 to 741.

Is′chia [Gr. *Pithecusa*; Lat. *Ænaria*], a mountainous island of igneous origin, about 24 square miles in extent, and situated in the Mediterranean, near Naples. This island, originally peopled from Asia Minor, is remarkable for the beauty of its scenery, the fertility of its soil, and the variety and excellence of its fruits. Monte Epomeo, the highest point of Ischia, about 2500 feet above the sea, is a volcano surrounded, like Etna, with small craters, and its eruptions have often caused great damage. The island has also suffered severely from earthquakes. The mineral waters of Ischia are very celebrated, and the perfection of the climate is an additional advantage for invalids suffering from rheumatism and other similar affections. Pop. in 1874, 24,000.

I′schl, town of Austria, in the province of Upper Austria, at the confluence of the Ischl and the Traun. It is a small town, with only 3000 inhabitants, but its charming situation, its saline and sulphur springs, and the presence during several weeks each summer of the Austrian court and a great number of the Austrian nobility, have made it one of the most elegant and aristocratic bathing-places in Europe.

Ischu′a, post-tp. of Cattaraugus co., N. Y. It has valuable quarries of building-stone. Pop. 872.

I′seghem, town of Belgium, province of West Flanders, 7 miles N. N. W. of Courtrai, has a large trade in cattle, manufactures of cotton, linen, hats, thread, ribbons, etc., breweries and tanneries. Pop. 7955.

Ise′o Lake, in Northern Italy, 15 miles long, $2\frac{1}{2}$ miles broad, is celebrated for its picturesque surroundings. It sends its waters to the Po through the Oglio.

Isère, department of South-eastern France, on the Rhone and its affluent, the Isère. Area, 3163 square miles. Pop. 575,784. The northern and western parts are level, but the southern and eastern parts are covered with majestic mountains, of which Mount Olan is 12,664 feet high. The department is rich in minerals. Copper, lead, iron, and coal are mined; gold and silver are found. The wine of these regions is superior. Cap. Grenoble.

I′serlohn, town of Prussia, in Westphalia, on the Kalle. It has large manufactures, especially of iron and bronze ware. Pop. 15,763.

Iser′nia, town of Southern Italy, in the province of Campobasso. It was a Samnite city, and remains of the polygonal walls, as well as of very ancient temples, sepulchres, etc., still exist. The old aqueduct, hewn for the distance of a mile through solid rock, still supplies the town with water and with water-power. Isernia occupies a commanding position on a mountainous ridge about 24 miles W. of the town of Campobasso, and the population (9066 in 1874) is chiefly occupied in the manufacture of hemp, linen, paper, earthenware, etc., and in dressing parchment and other leathers.

Ish′im, or **Ischim,** a large river of Siberia, in the government of Tobolsk, flows N. 700 miles through a sterile region, and enters the Irtish 120 miles S. E. of Tobolsk. On its banks are the important towns of Ishim and Petropaulovsk.

Ish′mael, the son of Abraham and Hagar, the Egyptian handmaid of Sarah, was expelled, together with his mother, from his home when Sarah gave birth to Isaac. The Bedouin tribes of Northern Arabia, occupying the region between the peninsula of Sinai and the Persian Gulf, are said to descend from Ishmael, and possess many Ishmaelitic traditions.

Ishpem′ing, tp. and post-v. of Marquette co., Mich. It has a national bank, and extensive iron-mines, or rather iron-quarries, whose ore is of the very best quality. The inhabitants are mostly Scandinavians. The town is on the Marquette Houghton and Ontonagon R. R., 16 miles W. of Marquette. Pop. 6103.

Is′idore of Charax, a native of Charax on the Tigris, near the Persian Gulf, was a distinguished geographer of the first century A. D. His *Parthian Itinerary*, portions of which are extant, is an important source of information upon Asiatic geography; it was printed by Höschel (1600), Hudson (1703), and Miller (Paris, 1839) in their collections of the minor Greek geographers.

Isidore of Seville, or **Isidorus Hispalensis,** b. at Cartagena between 560 and 570; was appointed bishop of Seville about 600; and d. Apr. 4, 636. By establishing schools, and by harmonizing the moral and doctrinal system of Christianity with the habits and institutions of the various races which at that time composed the Hispano-Gothic kingdom, he became one of the brightest ornaments of the Church of Spain; and his fame and authority were not confined to Spain alone. He presided over the second Council of Seville (619), and over the Council of Toledo (633). His works, which form an encyclopædia of the knowledge of his time, were collected and edited by Perez and Grial (Madrid, 1778), by Arevalo (Rome, 1797–1803), and by the Abbé Migne (Paris, 1862, 8 vols.).

Isidorian Decretals. See DECRETALS, FALSE.

I′singlass, a GELATINE (which see) prepared from the swim-bladder of various sturgeons (*Acipenser*) and other fish, such as the cod, the weak-fish (*Otolithus regalis*), and the hake (*Gadus merluccius*). It is used in preparing jellies, confections, blanc-mange, gum-drops, etc.; in fining wines and liquors; as a test for tannic acid; as an ingredient in court-plaster; as a size for delicate fabrics, etc. The coarser kinds (fish-glues) are used in various cements. "Japanese isinglass" is prepared from a seaweed. Commercial isinglass comes from Russia, Brazil, the U. S., and other countries.

I′sis, an Egyptian goddess named Hes, daughter of Seb or Chronos, and Nut or Rhea, sister and wife of Osiris, and locally one of the tetrad of Abydos, which consisted of Osiris, Isis, her sister Nephthys, and Horus. Her worship is not mentioned at the earliest period, but became universal at the time of the eighteenth and later dynasties. Her name is expressed in hieroglyphics by a seat or throne, and in her terrestrial type she is represented with this ornament on her head. She is styled in the inscriptions the mother-goddess, or great mother, mistress of heaven, regent of the gods, and queen of the upper and lower country. In her celestial character she wears on her head the

disk and horns and the modius or cylindrical head-attire surrounded by twelve uroei serpents, emblems of the twelve hours of the day and night. In the monuments she is the constant companion of Osiris, standing behind him, supporting him, or lamenting at his bier, or else as mother of Harpakhrat, or "the youthful Horus," nursing and suckling that god on her lap. Isis is rarely if ever seen alone, except in votive figure, and if at a later period she is represented winged, such a type appears to have been introduced from Asiatic sources. The legend of Isis is partly confirmed by the accounts of the monuments and papyri. During the absence of Osiris from his kingdom it is stated that she ruled over the state, and her name appears in a cartouche as one of the gods of the second dynasty who ruled Egypt. After the murder of Osiris by Typhon on the 17th of the month Athor, in the twenty-eighth year of his reign, Isis was informed of the death of Osiris, and cut off one of the locks of her hair. She also searched for Anubis, the god of embalming, the son of Osiris and Nephthys. The chest in which the corpse of Osiris was enclosed was carried to Byblos, and lodged in the branches of a tamarisk tree, in which perched the phœnix (*bennu*), the soul of Osiris. The king of Byblos had made the trunk of the tree into a pillar of his house. Ingratiating herself with the queen's women, whose hair she plaited, and subsequently engaged by the queen as wet-nurse for the king's son, she suckled the boy with her finger, and laid him on burning coals to make him immortal, while she herself, transformed into a swallow, hovered round the pillar, and when her proceedings were discovered, obtained it by request from the monarch. Opening the trunk, she took it with her into the desert, and opening the lid, threw herself in grief on the dead body of her husband; and when the king's son approached her she turned round and killed him with a glance. Returning to her son Horus, she left the chest at the city of Butus in an unfrequented place, where, however, it was discovered by Typhon in the moonlight, who tore the body into fourteen or twenty-six pieces, and scattered them about, apparently in the river. These Isis collected, apparently from the river, upon which she went for the purpose, and found all except one piece, which had been devoured by the oxyrhynchus fish. In the war which ensued between Horus and Typhon at Kar (or the Egyptian Babylon) on the 6th of the month Thoth, and which endured for three days and nights, the gods changing during the battle from the human to animal forms, Isis chained both combatants. Subsequently she liberated Set or Typhon from his chains, and Horus, enraged at this act, cut off the head of Isis, which Thoth subsequently replaced by the head of a cow. Another account places this action at Ateh in the oxyrhynchite nome, on the 7th of the month Tybi, when the boat of the Sun was moored at Pakhera. A second battle supervened at Anrutef at a later period. She is said to have founded sepulchres of Osiris wherever she found portions of the body. She appears as goddess of the lower world, for Rhampsinitus (Rameses III.) descended to Hades and played at draughts with her, winning a golden napkin, with which he returned to earth. One of the epagomenæ or intercalary days was sacred to her. She was identified with other deities, as Urhek, Bast, Athor, and even Nephthys, and one of the sacred books was entitled her sighs or respirations. Her worship was introduced into Asia Minor and Greece about B. C. 330, and into the Roman empire in the time of Sylla, and although attempted to be banished at different intervals (B. C. 129–133) by different acts of the senate, and repelled by Augustus, was finally established with the worship of Serapis at Rome, and only disappeared with the fall of paganism, which took place A. D. 391 at Alexandria. Isis was supposed to represent nature, the moon, earth, Demeter, and other elements or powers. S. BIRCH.

I'sis, the classical Latin name for the river Thames in England (Tham-*esis* = "the broad Isis"), still often employed in the same sense in English poetry and belles-lettres. The principal tributary of the Thames which passes by Oxford is also called Isis.

Iskanderoon', Scanderoon, or **Alexandretta,** seaport town of Northern Syria, on the E. coast of the bay of the same name, anciently the Bay of Issus. It is the principal outlet of Central Asiatic Turkey, being the port of Aleppo, and has the best harbor on the Syrian coast. Formerly unhealthy and almost desolate, it has by improved drainage become salubrious, and is destined to acquire great importance whenever a railroad to the Euphrates shall attract to this route a portion of the overland Indian traffic. Several hundred vessels touch here annually. Pop. 2000.

Is'kelib, town of Asiatic Turkey, in Asia Minor, near the Mediterranean, has about 9000 inhabitants, all of whom are Mohammedans. Christians are not allowed to reside there with their families; they can only stop at the khans for a limited time.

Is'la, de (JOSÉ FRANCISCO), b. at Segovia in 1703, entered the order of the Jesuits, was expelled with them in 1767, and d. at Bologna in 1781. His sermons attracted attention as early as 1729, but his fame he principally obtained by his satirical romance, *Historia del famoso predicador Fray Gerundio de Campazas.* The first volume of this work was published in 1758 without the knowledge of the author, but in 1760 its sale was forbidden. The second volume did not appear until 1772, in London and in English, and then in Spanish at Bayonne shortly after. The whole work was published in Madrid in 1813. He also wrote *Cicero*, a satirical poem, of which the manuscript is found in the library of Boston, its publication in Spain having been forbidden.

Is'la de Leon', an island on the S. coast of Spain, in the Atlantic, 10 miles long by 2 broad, on which is the city and port of the same name (also called San Fernando), which was in 1810 the capital of Spain under the regency, and was the scene of the first constitutional movement of 1820. It is strongly fortified, has two hospitals, several convents, and an excellent observatory. Pop. 10,000.

Is'la de Ne'gros, one of the Philippine Islands, in Malay Archipelago. Area, 3800 square miles. Pop. 35,000.

Islam. See MOHAMMEDANISM.

Islamabad', town of British India, in the presidency of Bengal, the capital of the district of Chittagong, is in lat. 22° 20′ N., lon. 91° 54′ E., on the Kurramfuli, 7 miles from its mouth. It has important shipbuilding and a large trade in rice, salt, cocoanuts, and tortoise-shell. Pop. 12,000.

Isl'and, county of Washington Territory, consisting of islands lying in Puget Sound, of which the largest is Whidby Island. Cap. Coveland. Pop. 626.

Island, tp. of Desha co., Ark. Pop. 400.

Island Creek, tp. of Duplin co., N. C. Pop. 1449.

Island Creek, post-tp. of Jefferson co., O., 7½ miles from Steubenville. Pop. 1626.

Island Falls Plantation, tp. of Aroostook co., Me. Pop. 183.

Island Grove, tp. of Sangamon co., Ill. Pop. 1069.

Island Pond, post-v. of Brighton tp., Essex co., Vt., an important station on the Grand Trunk Railway, 149 miles N. W. of Portland, Me., and 143 miles S. E. of Montreal, Canada. It has a custom-house and several manufacturing establishments.

Islands, tp. of Accomac co., Va. Pop. 1122.

Is'lay, an island of the Inner Hebrides, belonging to the county of Argyle, Scotland. Area, 220 square miles. Pop. 10,332. The northern and eastern parts are hilly, traversed by a ridge which at some places rises to the height of 1500 feet; the rest is level. Good crops of rye are raised, and a considerable distilling industry is carried on.

Islay, maritime town of Peru, in the province of Arequipa, distant 50 miles from that city, with which it is connected by a railroad recently constructed. The population is insignificant, but it derives importance from being the seaport of Arequipa and of much of Southern Peru.

Isle'boro', post-tp. of Waldo co., Me., consists of a narrow island of 6000 acres, called Long Island, in Penobscot Bay, 10 miles E. of Belfast. Many of its inhabitants are engaged in maritime pursuits. It has 3 churches. Pop. 1230.

Isle la Motte, an island in Lake Champlain, constituting the post-township of Isle la Motte, Grand Isle co., Vt. It is sometimes called the "Vineyard." It is 6 miles long. Pop. 497.

Isle of France. See MAURITIUS.

Isle of Man. See MAN, ISLE OF.

Isle of Pines. See PINES, ISLE OF.

Isle of Wight. See WIGHT, ISLE OF.

Isle of Wight, county in the S. E. of Virginia, bounded on the N. E. by the James River, and on the W. by the Blackwater. Area, 230 square miles. It contains considerable pine forest, and is generally level. Grain, potatoes, and pork are staple products. It is traversed by Atlantic Mississippi and Ohio R. R. Cap. Smithfield. Pop. 8320.

Isle Royale, county of Michigan, comprising Isle Royale and adjacent islands in Lake Superior. Isle Royale is 45 miles long, 12 miles broad, and abounds in copper and other minerals, and has many lakes, one of the largest of which, Siskowit Lake, has no outlet. Siskowit Bay is the principal settlement. It was formed in 1875.

Isles of Shoals, a group of eight small islands in the Atlantic, about 10 miles S. E. of Portsmouth, N. H. They are barren and almost without vegetation. The 90 inhab-

itants live mostly by fishing. On White Island is a lighthouse, and on Appledore and Star Island there are large hotel accommodations for the great number of tourists who visit the islands each summer to enjoy the sea air.

Is′lip, tp. and post-v. of Suffolk co., N. Y., 40 miles E. of New York City, on Great South Bay and on the South Shore R. R. of Long Island, has 3 churches, 2 academies, 1 weekly newspaper, planing, paper, and flour mills, a marine railway and shipyard, and is the head-quarters of several sporting clubs. Fishing is a leading pursuit, and the rearing of trout and the putting up of canned goods are important interests. The township contains a number of other villages, and has 15 churches. Pop. of tp. 4597.

W. L. Cook, Ed. "Long Island Herald."

Ismaeeliah. See Assassins and Ismailis.

Ismaïl′, town of European Turkey, in the principality of Moldavia, on the Kilia, a branch of the Danube. It is a strong fortress, has important leather manufactures, and carries on an extensive trade in grain, wool, tallow, etc. Pop. 20,869.

Ismail Pasha, or **Ismail I.,** b. at Cairo in 1830, son of Ibrahim Pasha by a Circassian woman. He was educated at Paris; returned to Egypt, and soon after his father's death (Nov. 9, 1848) strongly opposed the new viceroy, Abbas Pasha, who died the next year, and was succeeded by Saïd Pasha, who placed him at the head of the administration while he himself was on a visit to Europe, and in 1862 made him commander of the army. Saïd d. Jan. 18, 1863, and was succeeded by Ismail as fifth viceroy of Egypt. He acquired great wealth by the cultivation of cotton during the American civil war, and was a zealous promoter of the Suez Canal project. In 1866 the sultan made the succession direct in his line, in return for which Ismail increased his tribute and aided the sultan with a large army in the Cretan insurrection. In 1867 he received the titles of highness and khedive, with important additions to his authority; but he demanded still more, and threatened, in case his demands were refused, to seize the island of Crete. Foreign powers, however, interposed, and compelled him to abate his demands. In 1868–69 he extended his sway over the Upper and White Nile, increased his army, proposed the neutralization of the Suez Canal, and conducted himself as an independent monarch. The sultan thereupon ordered him to reduce his army to 30,000 men, recall his orders for the construction of iron-clads and the purchase of breech-loaders and the contraction of loans in Europe. The khedive, not succeeding in gaining the support of Russia, yielded for a time to the demands of the sultan, but by bribery in June, 1873, succeeded in obtaining concessions from the Sublime Porte which rendered him virtually independent, the main restrictions relating to his intercourse with foreign powers. Early in 1874 he gained a decided victory over the sultan of Darfur, and is now busily engaged in extending his authority over the barbarous tribes lying around him. He is the absolute owner of all the land in Egypt, which his subjects cultivate on terms prescribed by him. He is also largely engaged in manufacturing enterprises, the whole industry of the country being under his control, the common people being practically his slaves. He has, in an architectural point of view, considerably improved Alexandria, almost rebuilt Cairo, and has constructed immense public works throughout his kingdom.

Ismail′ia, town of Lower Egypt, on the N. shore of Lake Timsah, on the railroad leading from Alexandria and Cairo to Suez, and on the Suez Canal. It was founded in 1863 to serve as the central point for the construction of the canal, and was named after the khedive, Ismail Pasha. Its situation gives promise of considerable commercial importance. Pop. about 4000.

Ismail′is, a former sect of Mohammedan free-thinkers. They were originally Shiites, but their doctrine spread throughout *Islam*, the Mohammedan world. Their outward practice was very devout, but their esoteric doctrines consisted of various degrees of instruction, finally leading to universal negation, atheism, and indifferentism. Besides this, their morality was of the worst, though cloaked with pious words and acts. They originated in the ninth century, and especially honored Mohammed ben Ismaïl, the seventh of their imams or caliphs. There are even now relics of this old sect in existence.

Ismid′, or **Iskimid** (the ancient *Nicomedia*), town of Asiatic Turkey, in Asia Minor, on a gulf of the same name, in lat. 40° 47′ N., lon. 29° 53′ E. Of the brilliant old city very little is left, and the present town is a dirty, miserable place, with some manufactures of silk and earthware. Pop. 8000.

Isnard′ (Maximin), b. Feb. 16, 1751, at Grasse, in Provence; entered the National Assembly in Sept., 1791, as a deputy for the department of Var. He joined the Girondists, though his ideas were more advanced than theirs, and became conspicuous for his passionate, sometimes even inspired, eloquence. When arrested in June, 1793, he succeeded in escaping, and concealed himself until the fall of Robespierre. He was a member of the Council of Five Hundred, but exercised no influence, and during the Empire and the Restoration he lived in retirement, occupied with literary pursuits, in his native city, where he d. in 1830.

Isocheimal Lines. See Meteorology.

Isoc′rates, the son of Theodorus, a native of Athens, was b. B. C. 436, and d. of voluntary starvation B. C. 338. He was a disciple of Socrates and Theramenes, and subsequently attained considerable popularity as the founder of a school of rhetoric at Athens. Cicero declared him to be the first to perfect the melody of Greek prose. The Alexandrian critics assign him the fourth place in the canon of Greek oratory. His style is ostentatious and elegant, rather than graceful and pleasing. The extant orations are given in the *Oratores Attici* of Bekker, and of Baiter and Sauppe, and separately by Lange (Halle, 1803), by Baiter and Sauppe (Leipsic, 1831), by Benseler (Leipsic, 1851); select orations by Rauchenstein (Berlin, 1855). The *Panegyricus* was edited by Prof. Felton (Cambridge).

Isocrymal Lines. See Meteorology.

Isola Bella. See Borromean Islands.

I′sola del′la Sca′la, town of Italy, in the province of Verona, about 16 miles E. of the city of Verona. This town has a large Gothic church and other good buildings, with an active and laborious population of (in 1874) 5785.

I′sola del Li′ri, town of S. Italy, in the province of Caserta. The immense water-power furnished by the Liri and the Fibreno is here utilized for manufacturing on a large scale, paper, linen, woollens, etc., and also for working metals, including the manufacture of chemical products. The town is charmingly situated, and the trout of the Liri are as famous as in the days of Martial and Appian. Pop. in 1874, 5582.

I′som (Thomas Dudley), M. D., b. in Maury co., Tenn., Sept. 5, 1816; graduated in Jefferson Medical College 1839, and began practice at Oxford, Miss. He was made surgeon during the war, and assigned to the medical board of Gen. Joseph E. Johnston's army; is (1875) a successful practitioner in Oxford, Miss., and is a trustee of the university of that State.

Paul F. Eve.

Isom′erism, Polymerism, Allotropism, Amorphism, Dimorphism and **Polymorphism, Metamerism, Kenomerism.** These words belong, and are necessary, to the language of chemical science, being of highly convenient, indeed indispensable, application in the arrangement of the vast accumulating masses of compounds into groups, and in exhibiting their relations among each other; thus facilitating their study and investigation in a surprising manner. These terms do not, however, all convey actual natural principles, or generalizations; many of the groupings designated by them being in a great degree artificial, or founded on principles rather of a *negative* kind; though others of them are unquestionably natural. The term *isomerism* is generally considered as including, broadly speaking, all the others; and isomeric groups, or groups of isomeres, may be defined broadly as such groups as *happen* to have the same proportional elementary composition, while specifically quite distinct; each member of such a group being distinguishable from the rest by some one or more specific chemical or physical character or relation to other substances.

General Examples.—Diamond and *graphite*, the first the hardest and most limpid known substance, the last one of the softest and most opaque; both being chemically pure carbon. *Calcite* and *aragonite*, differing fundamentally in crystalline form (the first being hexagonal and the last right rhombic), as well as in hardness and density, while both are simply lime-carbonate, $CaCO_3$. *Quartz, tridymite*, and *soluble silica. Olefiant gas* (C_2H_4) and *tetramylene* ($C_{20}H_{40}$), each of which contains in 100 parts by weight exactly 42.857 of carbon and 57.143 of hydrogen; the last, instead of being a permanent gas lighter than air, like the first, is a liquid whose boiling-point is higher than that of mercury, and whose vapor is ten times as heavy as olefiant gas, or half as heavy again as mercurial vapor itself. Common *alcohol* and *methylic ether*, a liquid and a gas, each having the empirical formula C_2H_6O, and the same centesimal composition:

Carbon	52.174
Hydrogen	13.043
Oxygen	34.783
	100.000

Dextrose, or grape-sugar, and *lævulose*, or honey-sugar, both $C_6H_{12}O_6$, but having precisely opposite actions on

polarized light; the first being also a solid and the last a liquid.

1. *Isomeres*, in the restricted sense (Gr. ἰσομερής, adj., "of equal parts" or "equally divided"). Recent writers propose to apply the term *isomerism* narrowly and specially to such groups as really appear to be more or less natural ones; that is, such as not only have the same composition, but similar origin, with identical molecular weights and volumes; which are usually quite similar in their relation to heat and chemical agents, and furnish similar products of decomposition or transformation by like agents. Such groups are found, so far, only among the immediate products of vegetable and animal life; and while among the commonest substances, still remain, as to their molecular constitution, among the least scrutable; no very satisfactory explanations, except of a hypothetical kind, having yet been presented for these kinds of isomerisms.

Examples.—A large, familiar, and interesting group of natural isomeres is that known as the *terpenes*, including the volatile oils of turpentine, lemon, orange-peel, bergamot, neroli, Borneo camphor, juniper, copaiba, nutmeg, and a multitude of others. These are all hydrocarbons of the formula $C_{10}H_{16}$, which, while differing so greatly in odor, and in some cases in their actions on polarized light, and even, within small limits, in densities and boiling-points, yet are notably similar in their general chemical relations—much more so than is usual among the groups of *polymeres* and *metameres* referred to below. It seems certain, however, that in the course of investigation the true constitution and molecular derivation of these terpenes will be arrived at with precision, in which case they will at once take rank but as metameres, and lose in great part their present mysterious interest. Two of the most common, *terebenthene*, from turpentine-oil, and *citrene*, from lemon-oil, are now under active investigation by skilful chemists, and the results seem to point to the constitution of the former being nearly or exactly *dihydruret of isopropyltoluene* (*alpha*-cymene), and to that of the latter as comprising the same molecular groups, with different arrangement among each other.

Other important groups of natural isomeres occur among the proximate constituents or products of living tissues, both vegetable and animal. The *mannite* group ($C_6H_{14}O_6$), comprising three or more isomeres—*mannite* (manna or seaweed-sugar), dulcose or *dulcite* (a sugar from an unknown plant of Madagascar), and *isodulcite*, an artificial sugar. The theoretical views commonly accepted regarding the constitution of the sugars generally, and hence of a very wide and highly important range of organic products, rest upon the views held regarding mannite. (See below.) The *glucose* group ($C_6H_{12}O_6$), including common *grape-sugar*, which is a product both of vegetable and (as diabetic sugar) of animal life, *lævulose*, *inosite* (flesh-sugar), *galactose*, *sorbite*, and several artificial sugars of the same formula. These isomeres are regarded as *aldehydes*, corresponding to certain isomeric (hexatomic) alcohols, of which mannite is one representative. Thus, just as ordinary alcohol may yield ordinary aldehyde by oxidation in contact with platinum-black, mannite yields an artificial sugar isomeric with glucose, called *mannitose*.

$$C_2H_6O + O = C_2H_4O + H_2O; \text{ and}$$
$$\underset{\text{Mannite.}}{C_6H_{14}O_6} + O = \underset{\text{Mannitose.}}{C_6H_{12}O_6} + H_2O.$$

Also, it is stated that glucose, by reduction with nascent hydrogen (as with sodium-amalgam), will yield conversely genuine mannite. A further support for this view is derived from the fact that the action of hydriodic acid on mannite produces the hydrocarbon hexylene, C_6H_{12}. The *sucrose*, or cane-sugar group ($C_{12}H_{22}O_{11}$), which comprises a large class of isomeres, such as *melitose* (eucalyptus-sugar), *melezitose* (larch-sugar), *trehalose* (Turkish manna), *mycose* (ergot-sugar), *lactose* or milk-sugar (as a hydrate naturally), and doubtless a great multitude of other isomeres. To these is to be added *arabine*, the characteristic constituent of gum arabic. These isomeres are formed from the glucoses by the elimination of one equivalent of water from a coupled molecule of the latter group:

$$\begin{matrix} C_6H_{12}O_6 \\ C_6H_{12}O_6 \end{matrix} - H_2O = C_{12}H_{22}O_{11}.$$

They are therefore designated as *diglucosic alcohols*.

Little progress has been made as yet in penetrating the nature of the relations which exist between the several members of the above groups of sugar-isomeres respectively, and no satisfactory reason can be suggested *why* they are isomeres. The same remark applies to another no less important group, comprising *cellulose*, the *starches*, *inuline*, *glycogen* (animal starch, from livers and fœtuses), etc., which are isomeres of the general formula $nC_6H_{10}O_5$, closely related to the sugars. Two other isomeric sugars, of another mode of grouping, may also be mentioned. These are *pinite* and *quercite* (California pine-sugar and acorn-sugar), which are both $C_6H_{12}O_5$, and have been rated as probably alcohols of *pentatomic* constitution.

The Tartaric Acid Group.—This seems a well-characterized group of natural isomeres, not to be classed, so far as known, with polymeres or metameres; comprising ordinary or *dextro-tartaric* acid, *lævo-tartaric* acid, *racemic* acid, and *inactive tartaric* acid; the last three discovered by Pasteur. Action on polarized light and variation of crystalline form are the distinguishing characteristics of these; racemic acid being a compound of dextro- and lævo-tartaric acids, and therefore inactive. Their common formula is $C_4H_6O_6$.

Still another great and important group of *probable* isomeres occurs in nature, distributed very widely both in animal and vegetable life. These are the proteine group, or *proteids*, also called *albuminoids* (for a special account of which see the articles ALBUMEN and ALBUMINOIDS, by Prof. C. F. CHANDLER; also the article ALBUMINURIA). The consideration of the question as to whether this familiar though mysterious group of substances consists really of isomeres, or will ultimately be found to have some other connection, cannot be entered into here. The whole chemical nature of the proteids rests still in obscurity, and the designation of them here as one of the groups of natural isomeres must be admitted as possibly only conjectural.

The narrow acceptation of the term *isomere*, which has been adopted above, can only be regarded as provisional, and likely to be ephemeral. In the due course of chemical research it seems inevitable that the true molecular structure of all these groups will sooner or later be evolved, and they will then, of course—while still remaining isomeres in the broad and general sense—either fall into one or other of the groups below, or become appropriate subjects for new and specific terms, in newer classifications, which will more closely approximate to the true scheme of nature.

2. *Polymeres* (Gr. πολυμερής, "of many parts").—These have also been called *isomerides*, from ἰσομερής, and ἰδέα, "form or aspect," signifying that they simulate in form or formula the isomeres above.* Polymeres constitute groups which owe their similar centesimal composition to the fact that their compound molecules contain the same elemental molecules, condensed or combined in double, triple, or other multiple weights in the same, or in multiple volumes.

2 A. *Organic Polymeres.*—Of these, which are best known, the case above, of *olefiant gas* and *tetramylene*, will serve as an excellent example; and it will be useful indeed to cite here the whole beautiful group of hydrocarbon polymeres to which these two belong. (See table on next page.)

A peculiar theoretical interest attaches to this group, in consequence of the fact that it constitutes not only a group of polymeres, but also a series of homologues, being probably the only extended series of compounds capable of holding among each other simultaneously these two relations. (See article HOMOLOGY.) It is doubtless rather by virtue of their being homologues, and not as polymeres, that they constitute a distinct natural family, being frequently coexistent or congeneric as products of chemical change, and as a series being distinctly *progressive* in their physical and chemical characters and relations. The modes of derivation of some of these polymeres from others are interesting. Amylene is converted into diamylene, from C_5H_{10} to $C_{10}H_{20}$, or twice the number of molecules condensed into the same volume of vapor, by simply dissolving in oil of vitriol. The diamylene soon separates from this solution as an oily layer. Triamylene and tetramylene also, in which a similar condensation to the same vapor-volume of three and four times the weight of matter, are formed by simply heating amylene with chloride of zinc, which latter takes no part in the change.

There is another small but highly interesting group of hydrocarbon polymeres, consisting of the following members:

Acetylene, or ethine	C_2H_2
Benzene, or benzole	C_6H_6
Cinnamene, or styrole	C_8H_8

The first of these is a gas, the other two—which are perfectly entitled to the names triacetylene and tetracetylene—are liquids; and cinnamene occurs also as a solid isomere, called *metacinnamene*, formed by simply superheating the liquid form under pressure. Cinnamene is found also in nature as a constituent of *storax*. Benzene and cinnamene may be formed by direct synthesis from acetylene, by passing the latter through an incandescent tube. These bodies all occur abundantly in the products of the coal-gas retort, and bear the most intimate relations to many others

* There is, however, some confusion of language here—some writers applying the term *isomerides* indiscriminately to polymeres and metameres. The terms *polymeride* and *metameride* have also been employed, simply as synonyms of polymere and metamere—a complication of terms which seems wholly unnecessary.

of its products not polymeric with them. Thus, if diphenyl ($C_{12}H_{10}$), a body found associated with anthracene in coal-tar, is passed in vapor form, with olefiant gas, through a red-hot tube, both benzene and cinnamene result: $C_{12}H_{10} + C_2H_4 = C_6H_6 + C_8H_8$. Naphthalene ($C_{10}H_8$), another most important constituent of coal-tar, and toluene (C_7H_8), still another,

The Known Polymeric Olefines, C_nH_{2n}.

Carbon-equivalents, C = 12.	Names.	Formulæ.	Centigrade points of fusion.	Centigrade points of ebullition.	Densities of vapors.
1	Methene (unknown)	CH_2			
2	Ethene, ethylene, elayl, or olefiant gas	C_2H_4	......	—110°	0.97
3	Propene, or propylene	C_3H_6	......	— 17.8°	1.45
4	Butene, or butylene	C_4H_8	......	+ 3°	1.94
5	Quintene, or amylene	C_5H_{10}	......	35°	2.42
6	Sextene, or hexylene	C_6H_{12}	......	69°	2.91
7	Septene, or heptylene	C_7H_{14}	......	95°	3.39
8	Octene, or octylene	C_8H_{16}	......	119°	3.87
9	Nonene, or nonylene	C_9H_{18}	......	140°	4.36
10	Decene, decatylene, diamylene (or "paramylene" of Balard)	$C_{10}H_{20}$	......	165°	4.84
15	Quindecene, or triamylene	$C_{15}H_{30}$	......	248°	7.60
16	Sexdecene, cetene, or cetylene	$C_{16}H_{32}$	......	275°	7.75
20	Vigintene, tetramylene (or "metamylene" of Balard)	$C_{20}H_{40}$	......	395°	9.70
27	Septemvigintene, or cerotene	$C_{27}H_{54}$	57°	?	13.09
30	Trigintene, or melene	$C_{30}H_{60}$	62°	375°?	11.80?

are also most intimately related to benzene and anthracene. Thus, vapor of toluene in the red-hot tube may be metamorphosed as follows:

$$4C_7H_8 = \overset{\text{Benzene.}}{3C_6H_6} + \overset{\text{Naphthalene.}}{C_{10}H_8} + 3H_2; \text{ and}$$

$$2C_7H_8 = \overset{\text{Anthracene.}}{C_{14}H_{10}} + 3H_2.$$

The consideration of these, with a great many other similar transformations among these hydrocarbons, produced by simple contact with incandescent surfaces, which have been observed by Berthelot and others, throw great light upon the processes that occur within the gas-retort.

Connected with the great isomeric group of the terpenes, which have been referred to above, there are believed to be probably some polymeres, among which are the essential oils of cubebs and copaiba, $C_{20}H_{32}$. The two important substances *caoutchouc* and *gutta percha* have also been held to be terpene-polymeres, but Berthelot's investigations have cast doubt upon this view. Cyanogen, in its compounds, appears to have a peculiar tendency to form polymeric groups. The most remarkable of these is as follows:

Cyanic acid.................................. $CHNO$.
Fulminic acid................................ $C_2H_2N_2O_2$.
Cyanuric acid................................ $C_3H_3N_3O_3$.
Fulminuric acid.............................. $C_3H_3N_3O_3$.

Of these the last, however, is doubtless a metamere of cyanuric acid, as it is bibasic, while the latter is tribasic. From the three strictly polymeric acids above formulated it will be readily understood that there may arise a great number of polymeric groups of salts. Thus, the silver-salts are constituted as follows:

Argentic cyanate............................$CNAgO$.
Argentic fulminate..........................$C_2N_2Ag_2O_2$.
Argentic cyanurate..........................$C_3N_3Ag_3O_3$.

The second of these is the celebrated *fulminating-silver* compound. Other polymeric cyanogen compounds are the two chlorides:

Gaseous chloride of cyanogen...............$CNCl$.
Solid chloride of cyanogen..................$C_3N_3Cl_3$.

The first of these, at ordinary temperatures, may be converted into a liquid by a pressure of four atmospheres, and when then sealed up passes gradually into the solid compound.

The *aldehyde* polymeres are highly interesting illustrations. Strong sulphuric acid, gaseous muriatic acid, chloride of zinc, and other agents, by their mere presence, transform ordinary aldehyde, according to the temperature, into one or the other of two solid polymeres, *paraldehyde* (or *elaldehyde*), and *metaldehyde*. The latter, being very unstable and passing readily back to the form of ordinary aldehyde, is not much known, but the other two have the following properties and composition:

	Sp. gr.	Boiling-points.	Vapor-densities.	Formulæ.
Aldehyde	0.790	22°	1.525	C_2H_4O.
Paraldehyde	0.998	124°	4.516	$C_6H_{12}O_3$.

There is still another polymere of aldehyde, a liquid called *aldol*, which is considered as containing two molecules of the former condensed into one, but is somewhat unstable, and hence not so well known. Anhydrous *chloral* (C_2HCl_3O), which may be considered as a chlorinated derivative of aldehyde, changes spontaneously from a liquid into an insoluble solid substance, most probably a polymere. One more interesting case of probable polymerism may be noticed, occurring in the case of another familiar body, *oleic acid*, which, by the mere presence of nitrous acid, is changed from a liquid into a solid isomere called *elaidic acid*.

2 B. *Inorganic Polymeres*.—There are a few cases known, among compounds of strictly mineral origin, in which well-marked polymerism is recognized. Some of these are as follows: *Peroxide of nitrogen*, or nitrogen tetroxide, which is held by some investigators to be at low temperatures a solid or colorless liquid compound (N_2O_4), which by heat is resolved or *dissociated* into two molecules of a deep-red gas (NO_2), having twice the vapor-volume for the same weight. This, however, has been deemed unsettled by some other chemists. *Metaphosphate of Soda*.—When the amorphous glassy metaphosphate obtained by fusing microcosmic salt is cooled slowly, another modification is crystallized out of it; and a third isomere is obtained by the action of an excess of phosphoric acid on sodic sulphate. It has been considered that these are three polymeres:

$NaPO_3$,
$Na_2P_2O_6$,
and $Na_3P_3O_9$.

Antimonic and Metantimonic Acids, and their Salts.—Two modifications of antimonic oxide (Sb_2O_5) are formed by the action of water on antimonic pentachloride ($SbCl_5$) and by the action of nitric acid on metallic antimony; the last being monobasic antimonic acid, and the first bibasic metantimonic acid. The normal antimonates and acid metantimonates have assigned to them the following general formulæ, which make them polymeres:

$2M_2O, Sb_2O_5$, and
$2M_2O, 2Sb_2O_5$.

The crystalline mineral *stibnite*, lead-gray, with high metallic lustre, and in powder grayish-black, and the artificial brick-red antimonious sulphide, formerly called *kermes mineral*, are isomeric, both being empirically Sb_2S_3, and are readily convertible. The difference of their densities is sufficient (4.15 for the artificial and 4.57 for the natural compound) to suggest polymerism. The differences in density between the three crystallized mineral forms of titanic acid, *octahedrite*, *brookite*, and *rutile*, justifies a belief that they may be polymeres as well as polymorphs. Their densities and hardnesses range as follows:

	Hardness.	Density.
Octahedrite (Arkansite)	5.5 to 6	3.88
Brookite	5.5 to 6	4.06
Rutile	6 to 6.5	4.22

Stannic and *metastannic* acids are well-established polymeres:

Stannic acid.................................SnO_2,H_2O.
Metastannic acid.............................$Sn_5O_{10},5H_2O$.

The first is formed by precipitating a soluble stannate with an acid; the second by the action of nitric acid upon metallic tin. Their salts are, however, not polymeric, being constituted as follows:

Stannates.............................. M_2O,SnO_2.
Metastannates.......................... $M_2O,4H_2O,Sn_5O_{10}$.

The two mineral crystallized zinc-sulphides, *sphalerite*, or blende, and *wurtzite*, have been supposed to be polymeres, ZnS and Zn_3S_3, as well as dimorphs. They do not, however, differ much in their densities, these being 4.05 and 3.98. Among mercury compounds there are two cases of probable polymerism—that of the red (cinnabar) and black forms of *mercuric sulphide*, and the red and yellow modifications of *mercuric iodide*. The latter is also a case of dimorphism. One more case that may be mentioned is that of the two mineral crystallized forms of ferric bisulphide, *marcasite* and *pyrite*—right rhombic and cubical in crystallization, and therefore dimorphous—and having differing densities, 4.76 and 5.1. Berzelius pointed out that a great range of substances undergo, at a certain temperature

approaching ignition, a profound change of state, the point being indicated by a sudden evolution of heat producing a sudden incandescent glow that runs over the mass, and changes being produced in density, hardness, color, and solubility in acids. Among these substances are *zirconia, titanic*, and *tantalic* acids, *chromic oxide, ferric oxide, pyrophosphate of magnesia*, and a great many others. The great changes in properties that occur during this glow would seem to indicate molecular condensations; in other words, polymerism.

3. *Allotropism* (Gr. αλλότροπος, adj., "changeable"). This term was initially applied by Berzelius to cases in which an *elementary* body exhibits two or more forms, distinct in physical and often in chemical characters. As, however, according to our accepted views of the molecular constitution of bodies, no rational explanation of these cases can be assigned except polymeric association of two or more elemental molecules, it follows that this division of our subject is intimately connected with the preceding division. It will be convenient, however, for purposes of classification to retain the term of Berzelius. Some seven or more of the elements are known to assume these allotropic states. *Oxygen, sulphur, phosphorus, carbon, silicon, boron*, and *zirconium* are accepted cases, and to these we believe might be reasonably added *iron* and *aluminum*. *Oxygen* and *ozone* are familiar allotropes. The density of ozone, as now known from the determinations of different chemists made by different methods, shows that it is formed by the condensation of three volumes of ordinary oxygen gas into two volumes. The remarkable and suggestive fact seems also to have been made out by a recent investigator, Hollmann, that during this condensation heat disappears to the amount of at least 355½ thermal units for weight. Our American chemist, Oscar Loew, has also shown that the products of ordinary free flame, as of coal-gas in air, exhibit ozone reactions. Whenever a thorough discussion and generalization shall be made by some competent chemist of our present knowledge of the relations of these two allotropes to each other and to other bodies, we may expect some important new glimpses into the secret system of nature.

Sulphur assumes at least five—some believe six—allotropic forms, two of which are crystalline, crystallizing in different systems, and being therefore dimorphs, and four of which are *amorphous*, or belong also to the next division of our subject. Three of the six forms are soluble in bisulphide of carbon, and the other three are insoluble.

The soluble forms are the right rhombic octahedrons of native sulphur (which crystallize out again in the same form from the solution), and the monoclinic sulphur formed by solidification from fusion; the third soluble sulphur being the substance precipitated as *milk of sulphur* by an acid, from alkaline solutions of sulphur. This last is probably the amorph corresponding to the native crystalline allotrope, as it passes in time into small octahedrons. We find in the two crystalline sulphur-allotropes an illustration of the view thrown out above, that elemental allotropes may be essentially polymeres; for the densities of the two are perceptibly apart, that of prismatic crystals from fusion being about 1.98, while the native transparent crystals are 2.072, nearly 5 per cent. greater. "Flowers" of sulphur (sublimed) consist chiefly of the amorphous soluble modification, passing slowly of course into the crystalline condition.

None of the insoluble modifications are known in crystalline form. One is produced by sudden cooling of melted sulphur, and is transparent, reddish-brown, soft, flexible, and somewhat elastic. In this condition it has a density of 1.96, about the same as the monoclinic soluble crystals, of which it is the amorph, and into which it soon passes. Another is formed by the action of water on the chloride of sulphur, S_2Cl_2; a third by the action of ferric solutions on sulphuretted hydrogen when passed through the same.

Another broad and highly important natural distinction between the sulphur-allotropes was discovered by the great chemist Berthelot. He found that when electrolyzed, basylic compounds of sulphur, or those with the electro-positive elements (including hydrogen), give *soluble* sulphur at the *anode*, while acidic compounds, or those with electro-negative elements, yield *insoluble* sulphur at the cathode; the soluble allotropes being therefore the acidic or *electro-negative* sulphurs, and the insoluble allotropes the basylic or *electro-positive* sulphurs.

Phosphorus forms three beautifully defined known allotropes, almost as well characterized as those of carbon, described below. (*a*) *Brandt's Phosphorus*, the common commercial form—soft, wax-like, yellowish, and translucent; melts at 44° C., and boils at 280°. Crystallizes in regular dodecahedrons. Kindles in air—but not in oxygen—into spontaneous, slow, luminous combustion. Is one of the deadliest known poisons. Is soluble in bisulphide of carbon, and to some extent in petroleums and fatty oils. When purified by sublimation may assume the form of transparent, colorless cubes of adamantine lustre (Blondlot). (*b*) *Schrötter's Phosphorus*, the red *amorphous* allotrope.—Brown-red, opaque, brittle, infusible; does not shine or change appreciably in air under 200° C. (390° F.). Insoluble in everything, and not poisonous. (*c*) *Hittorf's Phosphorus*, the *metalloidal* allotrope.—Violet-black rhombohedral crystals, translucent; conducts electricity feebly. The densities of these three allotropes are as follows:

Common phosphorus	about 1.80 or 1.90
Schrötter's "	" 2.10
Hittorf's "	" 2.30

They must be admitted as most probably elementary *polymeres*.

Carbon.—Of this element there are two crystalline dimorphous allotropes—*diamond* and *graphite*—both of which are too familiar to need special description. Formerly, it was supposed that there was still a third *amorphous* form, exemplified in charcoal, anthracite, gas-carbon, etc.; but it is now known that these all contain hydrogen, and are in reality composed of hydrocarbons of highly condensed molecules. The densities of graphite and diamond are about 2.16 and 3.54, and they are doubtless polymeric. Some have rated the massive or amorphous graphites, like those of Borrowdale, Wunsiedel, etc., as a third modification, but there is no specific difference in density, and the point is still uncertain.

Silicon.—This element is believed to assume three allotropic forms—two crystalline and one amorphous. One of the crystalline forms seems to correspond to the diamond form of carbon, the other to the graphite form. The former is fusible at a high heat, the other infusible.

Boron has but two known forms—one crystalline, closely approaching diamond in hardness, lustre, transparency, and refractive power, while in the other form it is a dull, greenish-brown powder.

Zirconium.—This element is parallel to silicon in its allotropic forms, which are three in number—adamantoid, graphitoid, and amorphous. The adamantoid form has the color and lustre of antimony, but is very hard, like diamond.

Iron.—Some consider the so-called *active* and *passive* states of iron in reference to solvents as indicating two allotropic states.

Aluminum.—This metal, which is ordinarily highly indifferent to oxygen, either of air or water, is so profoundly modified in its attitude thereto by mere *contact with mercury*, that it oxidizes spontaneously in the air, with sufficient rapidity to develop strong heat, with a rapid efflorescence of hydrate of alumina. This was first observed by the present writer in 1867. It is believed by him to indicate an allotropic modification of aluminum.

4. *Amorphism* (Gr. α, privative, and μορφή, "form," meaning "without crystalline form or structure"). *Cryptocrystallization* (Gr. κρυπτός, "hidden," and κρύσταλλος) is also a term often used in this same connection, meaning a crystalline internal structure on a scale so infinitesimal or so confused, or both, as to be beyond the power of our microscopes. *Massive* is another term often applied, particularly to mineral species when crypto-crystalline. Those *inorganic* bodies are called *amorphous* which have never been found to assume geometrical forms externally or to exhibit internal crystalline cleavage. As the evidence of amorphism is usually merely *negative* evidence, there is often much doubt of its reality, and as to whether the amorphous state is not sometimes due to *crypto-crystalline* structure. Internal cleavage is very far from being a constant occurrence in bodies having external crystal forms, and its absence is therefore equally far from being proof of absence of the crystalline condition. It is also known that in numerous cases of bodies which tend to crystallize with ease, the mere presence of some other matter in small proportion may so interfere as to cause an apparent amorphism, which, in some of these cases, may be easily proved to be due only to crypto-crystallization. It is easy to understand that two or more bodies dissolved together in the same menstruum, or dissolved in each other, may possess crystalline forces or tendencies so interfering with, or indeed altogether antagonizing, each other, as to confuse or altogether neutralize that polaric disposition of the molecules which constitutes the crystalline structure. Another range of facts having a bearing here is presented by bodies of a *vitreous* and *resinous* kind—like ordinary glass, for example—which were early assumed to present a *typical* amorphism, but in a great many of which crystalline structure has been since developed, by slow superficial solution or corrosion, and many of which have also been found to become crystalline when kept for sufficiently long periods at temperatures near fusion.

These considerations, with others, have influenced some students of nature to deny the existence of any really

amorphous solid state of matter, and to maintain that solidity is essentially an effect of crystallization; and hence that all solid matter must be crystalline. A question is here involved of great and fundamental importance to science, whose investigation has been much neglected. Among the main products of organic life are many bodies apparently soluble in water—*starch, gelatine, gum,* and *albumen* are familiar examples—which have never been obtained in crystalline forms. Among bodies entirely inorganic there are a few similar examples now known, of which the most familiar is *soluble amorphous silica.* The great chemist Graham discovered that these bodies do not really form true solutions in water, but that they could be separated from the water and from other substances really dissolved therein by straining or diffusion through membranous diaphragms. Graham therefore proposed a new natural classification of all bodies into *colloids* and *crystalloids.* So far as we yet know, the colloid bodies of Graham, if no others, would appear to be true amorphs; and until these can be made to assume crystalline structure, the ancient theory of amorphism, and the ancient classification of solids into crystals and amorphs, must still hold; and we must allow that solidity is not solely a consequence of crystalline cohesion or concretion—that is, of polarization of the molecules—but that there exist other cohesive solidifying forces in nature not yet well defined by science —forces, or modes of force, which, when we consider that all *organic* bodies are substantially based upon colloid or amorphous compounds, would appear to be in the most intimate relations to life, and therefore to call for the most anxious and concentrated study. (See further under the head of SOMATOLOGY.)

Some special cases of amorphism are as follows:

(*a*) *Elementary Amorphs.*—Under the head of *allotropism* most if not all of these have already been referred to. We have, in forms probably, or at least possibly, amorphous, the elements *sulphur, phosphorus, silicon, boron,* and *zirconium.* Carbon, as amorphous graphite, is doubtful. Some chemists have held the view that the known *pyrophoric* forms that some metals are capable of assuming, such as *iron, nickel, cobalt, lead,* and others, are amorphous forms; also that *platinum-black* and *gold* in the black, impalpable form, are amorphs. These views, however, are not yet established.

(*b*) *Compound Inorganic Amorphs.*—Of these, the opaline or amorphous state of *silica* has already been mentioned, but there are other forms of this compound which should be here referred to. Silica assumes two crystalline forms, which, though seemingly of the same crystalline system, are not the same thing, being doubtless polymeres, as the common form, *quartz,* has a density of 2.663, or over 18 per cent. higher than *tridymite,* which is but 2.25, like opal. Now, there is still another form of amorphous and soluble silica, which appears to exist, in admixture with quartz, in flint, chalcedony, etc., and which has the higher density of quartz. Prof. Dana has suggested to call this form jenzschite, after Jenzsch, the mineralogist who first pointed it out. It appears, therefore, that we must now admit four distinct forms of silica—quartz, with its amorph jenzschite, and tridymite, a polymere as well as an isomorph of quartz, with *its* amorph, which is common opaline silica. Another inorganic compound—whose amorph is known to be diffusible throughout water as a perfect transparent colloid or quasi-solution, similar to those of starch, gelatine, etc.—is the *ferric hydrate.* Probably chromic and aluminic hydrates might admit of being handled in the same way. The hydrates of ferric oxide and alumina are moreover found native as minerals which possess crystalline structure. *Arsenious acid,* when fused, has been supposed to solidify to an amorphous mass which is transparent and glassy. It passes spontaneously into an opaque crystalline form, more soluble in water, similar to the crystals which condense on sublimation. Fused *borax* and *boracic acid* and *phosphoric acid* have all been claimed as amorphs. Many crystalline anhydrous mineral silicates which are unacted upon by acids pass when fused, often even when only ignited, with change of density, into what have been supposed to be amorphous states, becoming easily soluble in or decomposable by acids. Among these are some *garnets, vesuvianite, axinite, epidotes, piedmontite, zoisite, danburite, lepidolite, tourmalines,* and others.

(*c.*) *Organic Amorphs.*—These, as already intimated, are numerous. Excluding the bony portions of animal bodies, with their muscular juices, and certain constituents of the sap of some plants, it may be said that almost the whole bulk of both these kingdoms of nature is built up of amorphous or colloid compounds. In the case of plants, even the mineral matter, silica, which seems in many cases to be the analogue of the animal skeleton, is an amorphous body. The crystalline *sugars—sucrose, glucose,* etc.—pass when fused into amorphous forms. Other common organic amorphs are *most resins, caoutchoucs, gallotannic acid, cellulose,* the *proteids* generally, *mucine, pepsine, keratine, bilirubine,* and *biliverdine, ulmic* and *humic* substances, *coaly* matters, etc. etc. Great numbers have not been investigated or isolated, *because* they are amorphous, and hence cannot be purified by crystallization.

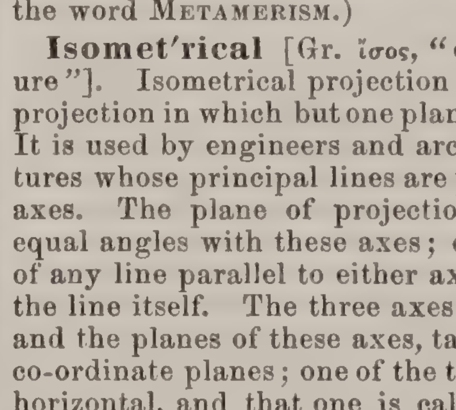
5. *Polymorphism* (including *Dimorphism* and *Trimorphism*), (Gr. πολύμορφος, "having many forms"). When an element or compound forms crystals which belong to two different systems of crystallization (on which subject see CRYSTALLOGRAPHY) it is called *dimorphous;* when to three different systems, *trimorphous.* The only reasonable explanation of polymorphism is *polymerism,* and several of the known cases have been referred to, therefore, in the preceding paragraphs under that head. The elementary bodies known or believed to be dimorphous are *carbon, sulphur, selenium, phosphorus, boron, silicon, zirconium, iridium, palladium, lead, tin, copper, arsenic, antimony,* and *bismuth.* Among compounds some of the more remarkable cases known of dimorphism and trimorphism may be cited as examples: *Dimorphs.*—*Arsenious acid* and *antimonious oxide* (As_2O_3 and Sb_2O_3) both crystallize in the regular and trimetric systems, and are therefore *isodimorphous. Stannic acid* (SnO_2) is said by Dana to crystallize in two of the three forms of *titanic acid* (TiO_2), and therefore to be isodimorphous with the latter. *Mercuric iodide* (referred to above). *Sulphide of zinc,* as the minerals *blende* and *wurtzite* (referred to above). *Pyrite* and *marcasite,* yellow and white iron-bisulphide, monometric and orthorhombic. *Saltpetre* (KNO_3), hexagonal and trimetric. *Lead protoxide* (PbO), monometric and orthorhombic (*Mitscherlich*). *Trimorphs.*—The three forms of *titanic acid* have been explained. Besides the hexagonal and trimetric forms of *calcic carbonate,* calcite and aragonite, Dana considers that the monoclinic form of baryto-calcite, composed of equal equivalents of calcic and baric carbonates, indicates further a case of trimorphism. Moreover, as baryto-calcite is itself dimorphous, having a trimetric form in bromlite, like witherite, this view is thus strengthened. Crystallized *nickel-sulphate* ($NiO,SO_3,7H_2O$) is stated to crystallize in three systems—dimetric, trimetric, and monoclinic.

6. *Metamerism.*—(This important branch of the subject will be discussed under a separate head. See, therefore, the word METAMERISM.) HENRY WURTZ.

Isomet'rical [Gr. ἴσος, "equal," and μέτρον, "measure"]. Isometrical projection is a species of orthographic projection in which but one plane of projection is employed. It is used by engineers and architects in delineating structures whose principal lines are parallel to three rectangular axes. The plane of projection is taken so as to make equal angles with these axes; consequently, the projection of any line parallel to either axis bears a constant ratio to the line itself. The three axes are called co-ordinate axes, and the planes of these axes, taken two and two, are called co-ordinate planes; one of the three planes is usually taken horizontal, and that one is called the *horizontal plane;* a second is taken in front of the point from which the object is viewed, and that is called the *frontal plane;* and the third is taken to the left of the point of view, and that is called the *lateral plane.* The plane of projection is supposed to pass through the point of intersection of the three axes, which point is then called the *centre of projection.* The projections of the co-ordinate axes pass through the centre of projection, and make equal angles—that is, angles of 120°—with each other; these projections are called the *directing lines* of the projection. If we construct a scale of equal parts on either axis, its projection on the corresponding directing line will be a scale of equal parts, which is called the scale of that directing line; the scales of all the directing lines are the same, and may be assumed at pleasure.

To explain the method of projecting points isometrically, let A be the centre of projection, Ax, Ay, and Az the directing lines, and suppose Az to be vertical. Then, to construct the projection of a point whose distance from the frontal plane is 2, whose distance from the lateral plane is 4, and whose distance from the horizontal plane is 5, lay off Ay equal to 2 from the assumed scale of the directing line; from y draw yx parallel to Ax, and on it lay off yx, equal to 4; from x draw xz parallel to Az, and make it equal to 5; then will z be the required projection. In like manner, any point may be projected when we know its distances from the co-ordinate planes. To project a line

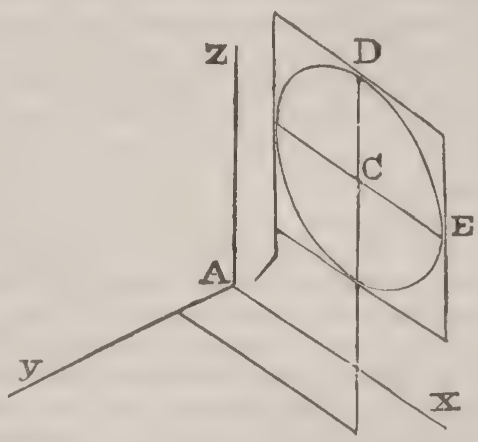
FIG. 1.



which is parallel to one of the axes, construct the projection of one of its extremities as just explained; then from the point thus determined draw a line parallel to the corresponding directing line, and on it lay off, from the scale, the length of the given line. To project a line that is not parallel to any axis, project its extremities, and join the projections by a straight line. To project a curve, project a sufficient number of points, and through their projections draw a curved line. These principles are sufficient to make an isometrical projection of any structure whatever.

In drawings of machinery it is often desirable to project circles whose planes are parallel to one of the planes of projection. Such projections may be made as follows: construct the centre, C, of the projection in accordance with the rule given for constructing the projection of a given point, and suppose the plane of the given circle to be parallel to the frontal plane; through C draw CE parallel to Ax, and make it equal to the radius of the given circle to the scale of the directing lines; also draw CD parallel to Az, and make it equal to the radius of the given circle; on CE and CD, as equal semi-conjugate diameters, construct an ellipse, and it will be the projection of the given circle.

FIG. 2.



W. G. PECK.

Isomorph'ism, Homœomorphism, Isosterism and Parallelosterism, Isotomy, Polymeric Isomorphism, Allomerism, Heteromorphism, Hemimorphism. These terms are all so intimately related to each other in the language of chemistry that they should be explained in connection with each other.

Isomorphism (Gr. ἴσος, "equal," and μορφή, "form"). Isomorphs, or isomorphous bodies, are bodies which crystallize in forms belonging to the same system of crystallization, and having crystalline axes that bear the same proportions to each other. (See article on CRYSTALLOGRAPHY, by PROF. THOMAS EGLESTON.) The Abbé Haüy, the father of crystallography, imagined that every distinct chemical body had a distinct crystal form, specific to itself. Nearly a century since, however, Werner began to throw doubt on this, by demonstrating the precise similarity between the hexagonal prisms of the two native phosphates of lime and lead. Leblanc, Vauquelin, Berthier, Wollaston, and Gay-Lussac followed up the direction thus indicated, until at length Mitscherlich announced, in 1820, as a grand generalization, that correspondence of crystalline form shows parallelism in chemical nature or correspondence in chemical structure, and conversely. The study and development of this principle or general law, and of the perturbations to which it is subject through many influences, has contributed wonderfully to our insight into nature. It may, for example, be said to be the corner-stone of *mineralogy* as a branch of chemical science, and without it chemical science in general would be far behind its present position.

Isomorphism, in the narrow sense of the term, as signifying *exact* equality of form, is found, strictly speaking, only in bodies which crystallize in the regular or isometric system. The term *homœomorphism* (Gr. ὅμοιος, "similar," and μορφή) is much preferable, as a word of more general application. Among the most familiar illustrations of the principle are those constantly occurring cases in which a complex molecular group has one or several of its elemental molecules substituted, either wholly or partially, by other elements. In this case there will be usually found in all the anisometric systems, or those having unequal axes, that variations will follow in the relative lengths or inclinations of the axes, leading to variations of the angles of the crystal; while in regular crystals such variation of equality of axes or of angles, which would be, in reality, a passage to another system, can never, in the nature of things, occur.

It has been inevitable that in the past the study of the relations of crystalline form and chemical composition, including homœomorphism, has been chiefly among crystals found in nature, of which *minerals* furnish almost all the examples. The generalizations, therefore, of the earlier students of this branch of science were unquestionably far too narrow; and even as early as 1832, Von Kobell presented broader views. Not to enter into the history of the subject, which would require great space, its present condition may be summed up by saying that as a result of uniting the modern views, generalized chiefly from the discoveries in organic chemistry, and known as the theory of *equivalence* (see article on CHEMISTRY, by PROF. GEO. F. BARKER), with the facts of homœomorphism in the mineral kingdom, our famous American philosopher, James D. Dana of New Haven, has recently adopted theoretical views which appear to reconcile and to cover most of the facts known, and to furnish a basis for the classification of chemical compounds in accordance with both chemical composition and mineral homœomorphism. Prof. Dana's generalization may be expressed thus: *The weights of the metals or other elements which combine with equal and equivalent weights of oxygen, sulphur, or other electro-negative or chlorous element, are those which replace each other isomorphously or homœomorphously.* While the ordinary modern views of *equivalence* and classification are founded on a comparison of, or reduction to, the types of *hydrogen*-compounds, such as *water, ammonia,* and *marsh-gas,* the wider and more comprehensive scheme used by Dana may properly be considered as a theory of physico-chemical *correlation* of the metallic or basylous elements with oxygen and other acidic elements. Whether the two schemes can be reconciled and made consistent with each other, remains to be seen. Homœomorphism among carbo-hydrogen compounds has been studied as yet comparatively little, and we cannot know how it may yet modify the views of organic chemists.

In reference to this question, it may indeed be very suggestively pointed out that our present prevailing theories of molecular relations in organic chemistry, and the systems of nomenclature, notation, and classification that they have, in a manner, *forced* on the chemical world—arising, as they did originally, from the illustrious Laurent's idea in 1846 of the reduction of alcohols and ethers to the "water-type," followed up by our great American chemist, Sterry Hunt, in 1848, by the reduction of all oxygen-acids theoretically to the same type—are generalized and reasoned *exclusively* from the phenomena and relations of oxygen and hydrogen to each other and to other elements while in one special condition—the *gaseous* condition—of matter; a condition of matter as widely separated as possible from the crystal condition; in which latter certain modes of force must act, that in gases are wholly neutralized or latent. Hence, the belief can scarcely be resisted that the generalizations of the organic chemists can be but partial and imperfect ones, and that they must yet be subjected to the test of comparison with the relations which will be found among the *crystals* of organic compounds.

From Dana's view it follows—or, rather, one of the prominent facts on which the view is based is—that *different* oxides, chlorides, and sulphides of the same metal may all be isomorphs or homœomorphs. For example: Fe_2O_3, Fe_3O_4, and FeS_2 are all found in the regular system. Dana formulates these, hypothetically, as follows: $Fe_{\frac{2}{3}}O$, $Fe_{\frac{3}{4}}O$, and $Fe_{\frac{1}{2}}S$; the weights $Fe_{\frac{2}{3}}$, $Fe_{\frac{3}{4}}$, and $Fe_{\frac{1}{2}}$ being isomorphous, or actually *of the same form in crystals.* He expresses the law nearly thus: *The replacing value in crystals equals the combining power* (with a chlorous element). Besides these, iron combines with oxygen in two other proportions, FeO and FeO_3; and there are therefore five weights of iron, which are equivalent to each other in crystalline form, and should replace each other without change of crystalline system—namely, Fe, $Fe_{\frac{2}{3}}$, $Fe_{\frac{1}{2}}$, $Fe_{\frac{1}{3}}$, $Fe_{\frac{3}{4}}$. Dana calls these (crystallogenically) the *states* of iron, and designates them by the letters of the Greek alphabet, Fe being *alpha*-iron, $Fe_{\frac{2}{3}}$ *beta*-iron, $Fe_{\frac{1}{2}}$ *gamma*-iron, an intermediate state (not known in case of iron) $M_{\frac{2}{5}}$ being the metallic *delta*-state, $Fe_{\frac{1}{3}}$ *epsilon*-iron, and so on. Any metallic oxide of one of these crystal-states should replace any oxide of any other crystal-state of the same metal, or even of any other crystal-state of any other metal, homœomorphously. So of sulphides or of chlorides. The enormous breadth thus given to our views of homœomorphism may probably be somewhat restricted and modified by future investigations, but known cases appear to justify the above statement quite to its fullest extent. In the further extension of these views to the defining of the basic and acidic relations of oxides, etc., we cannot here follow Prof. Dana, but must refer to his magnificent *System of Mineralogy* (ed. of 1869), and to his published papers in the *American Journal of Science.* It should, however, be pointed out that such replacements follow the simple law that the amount of both basic and acidic *oxygen, sulphur,* etc. remains always the same, in such replacements without change of crystal-system; and the principle is thus made manifest that it is the *electro-negative* elements of a molecular group that mainly govern the crystalline or molecular structure assumed. *Hydrogen,* whose combining weight or volume is now made the basis of all classification and speculation in organic chemistry, is on a par with any other electro-positive or basylous element in the illimitable field of inorganic or azoic chemistry—so far, at least, as the eminently specific

character of crystal-form is concerned—and may be replaced or displaced, molecularly or crystallogenically, by iron, for example, in three or four different proportions or "states."

Elemental Isomorphs.—The following, among the elements, have been observed to crystallize in regular or monometric forms, and as such their molecules are therefore absolute isomorphs: *Carbon* (as diamond), *phosphorus, gold, platinum, palladium, iridium, silver, copper, lead, tin, zinc, cadmium, titanium, potassium, sodium.* Probably many more, if not all, will be obtained as monometric crystals; as is readily inferable from many cases of isomorphism of their compounds.

Other Elemental Homœomorphs.—In the hexagonal or rhombohedral system we have *carbon* (as graphite), *phosphorus* (Hittorf's allotrope), *palladium, iridium, osmium, arsenic, antimony, bismuth,* and *tellurium.* The first four of these, being also monometric, are dimorphous. In the trimetric system there are two elemental homœomorphs, *iodine* and *sulphur* (in one of its forms).

Compound Regular Isomorphs.—Very nearly all the known *oxides, chlorides, bromides, iodides, fluorides, sulphides, selenides,* and *cyanides* are isomorphs of Dana's *alpha*-state; also most *three-four* oxides, considered by Dana as compounds of *alpha* and *beta*-oxides, such as *spinels, magnetite, chromite, franklinite, uraninite, linnæite,* etc.; also two *beta*-oxides, *arsenious* and *antimonious* acids; the *gamma*-sulphides, FeS_2, MnS_2, CoS_2, $Co(S,As)_2$, $Ni(S,As)_2$; one *epsilon*-arseniet, $CoAs_3$; the *alums*, the *garnets*, etc. etc.

Compound Homœomorphs.—Of these there are multitudes of groups. A few examples may be cited: Hexagonal *beta*-oxides, *alumina, hematite, chromic oxide, ilmenite* $(FeTi)_2O_3$, *perofskite* $(CaTi)_2O_3$, *tetradymite*, $Bi_2(TeS)_3$; also one three-four compound, $Bi_3(TeSSe)_4$. Hexagonal *alpha*-oxides, sulphides, etc., or polymeres (?), *ice, zinc-oxide,* the zinc-sulphide *wurtzite,* CdS, *argentic iodide* (these are by some, with good reason, believed to be *polymeres* in crystal-form, thus, $H_6O_3Zn_3O_3$, Zn_3S_3, and so on); (PbI2PbO), *cinnabar,* HgSe, NiS, Bi(TeS), NiAs, MnAs, NiSb; with one *gamma*-sulphide *molybdenite,* and one *gamma*-oxide, *quartz* SiO_2. Orthorhombic oxides, chlorides, sulphides, and fluorides: here we have *mendipite* (PbCl,2PbO), *cotunnite* probably Pb_3Cl_3, *chrysoberyl* $BeOAl_2O_3$, *cryolite* ($3NaF,Al_2F_3$), As_2S_3, Sb_2S_3, Bi_2S_3, AgS, AgTe, *brookite* TiO_2,MnO_2, and *marcasite* FeS_2 (the dimorph of pyrite). Tetragonal, SnO_2, TiO_2, as *rutile* and *octahedrite* (PbCl,PbO), and one three-four oxide *minium.* Trimetric, As_2O_3,Sb_2O_3.

Among more complex compounds there are, of the hexagonal forms, many *carbonates,* soda and potash *nitres, tribasic phosphates,* several *hyposulphates;* of the dimetric, Ni and Zn *sulphates* and *selenates* with $7H_2O$, the *arsenites* and *phosphites, ammonia-silver sulphate selenate* and *chromate,* etc.; of the trimetric, the *aragonite* group of *carbonates, plumbic baric* and *strontic sulphates, potassic sulphate selenate chromate* and *manganate,* Mg Zn and Ni *sulphates* and *selenates;* of the monoclinic, Mg Zn Co Ni and Fe sulphates and selenates with $7H_2O$, and another group of the same with $6H_2O$; a great group of *double sulphates* with $6H_2O$; a group of *sulphates selenates* and *chromates* with $10H_2O$, etc.; of the triclinic, a group of *sulphates* and *selenates* of Mn Zn and Co with $4H_2O$, and another group with $5H_2O$.

Homœomorphic Replacements among Mineral Silicates.—This is a branch of the subject of the utmost importance in mineralogy and mineral analysis. (Its discussion will be found in the article SILICATES, CHEMISTRY AND CLASSIFICATION OF.)

Isosterism, Isotomy, and *Parallelosterism* (see under separate heading of ISOSTERISM); *Polymeric Isomorphism* and *Allomerism* (see under separate heading of POLYMERIC ISOMORPHISM); *Heteromorphism* [Gr. ἕτερος, "different," and μορφή]. Heteromorphous bodies are those which, while having similar or symmetrical chemical formulæ—except that they may contain different basic or acidic elements—and even sometimes possessing so-called *isosteric* relations, yet crystallize in distinct systems. The term is convenient for classifying apart these exceptional cases.

HENRY WURTZ.

Isoperim′etry [Gr. ἴσος, "equal," περί, "around," and μέτρον, "measure"], a branch of mathematics that treats of the properties and relations of isoperimetrical figures—that is, of surfaces having equal perimeters, and volumes bounded by equal surfaces. It may be shown by elementary geometry that the greatest plane area having a given perimeter is a circle, and that the greatest volume bounded by a given surface is a sphere. Of all triangles having a given perimeter, the equilateral triangle has the greatest area, and in general of all polygons with a given number of sides and a given perimeter, that has the greatest area whose sides are equal. The principles of isoperimetry are best developed by means of the calculus of variations.

W. G. PECK.

Is′opods [Gr. ἴσος, "equal," πούς, "foot"], an order of tetradecapod crustaceans, characterized especially by the presence of branchiæ to the abdominal segments (although these may be functionally atrophied), and their absence from the bases of the legs, and typically by the approximate conformity in size and functions of their seven pairs of legs. The group embraces numerous small crustaceans, mostly inhabiting salt waters, and is also represented by fresh-water and terrestrial forms, the sow-bugs (*Oniscus*) and pill-bugs (*Porcellio* and *Armadillo*) being well-known examples of the latter.

Isos′terism, Homœosterism, Parallelosterism, Isotomy. These are terms which denote that branch of chemi-physical science which investigates bodies in relation to their *molecular* or *chemical equivalent volumes. Isosterism* is derived from the Gr. ἴσος, "equal," and στεῤῥός or στερεός, "solid, impenetrable;" *isotomy* from ἴσος and ἄτομος, "indivisible." The molecular or equivalent volume of a body is obtained by simple division of the molecule or equivalent by the specific gravity. *Isosteres* are simply bodies which give, in this way, closely equal numbers. *Parallelosterism* is applied to certain cases in which pairs or series of compounds, which are homœomorphous or analogous, show *equal differences* of equivalent volumes. Equivalent volumes are necessarily of three kinds, as applied to the three conditions of matter—solid, liquid, and gaseous; and as the equivalent is a constant factor—subject only to those multiple variations dependent on polymerism—and the density varies usually with the condition, it is necessary to complete knowledge to search for numerical relations throughout all three conditions. The simple laws, however, which govern *gaseous* equivalent volumes have already been explained under the heading CHEMISTRY, by PROF. G. F. BARKER. The term isosterism, in ordinary usage, is not so applied as to include gaseous, but only solid and liquid conditions, though in the widest sense it would cover all. The difficulties in the way of the study of isosterism are very considerable, chiefly from the fact that the cases in which the variable factor, the density, is determinable with certainty and accuracy, and without interfering causes, in liquid and solid bodies, are rather exceptional than otherwise. This drawback is more applicable to solids than to liquids, as in the former case absolute surety is only had when the solid is both chemically pure and homogeneously crystallized. Of real crystallic and chemical homogeneity there can seldom be certainty, for isomeres, polymeres, and metameres, and even allotropes, may often be, and in some cases are already known to be, also isomorphs; and still oftener, and with far greater likelihood, homœomorphs. (See article ISOMORPHISM.) Such will usually crystallize together in the same crystal, even when differing materially in density; and in numerous such cases a knowledge even of the fact of such cryptic heterogeneity will arrive as the result only of a great accumulation of observations, such as exists yet in but few cases. In the case of liquids, also, metameres, of differing densities, may not be separable, by reason of approximation of their boiling-points.

Density being variable with temperature, equivalent volume is therefore a function of the temperature; and the question arises whether there is any *uniform* temperature at which all bodies should be taken in order to discover isosterism? If not, as is almost obvious, could any *relative* temperatures—for example, points equidistant from the fusing-point or boiling-point in each case—be adopted? This latter is yet without proof. It would appear as if proportional relations might be sought for between the coefficients of expansion of bodies by heat—rather than between the volumes at any given temperature—and the equivalent weights. This, however, does not belong to our present subject.

Though the study of molecular volumes is yet in its infancy, the literature of the subject is nevertheless very voluminous, while at the same time scattered through very numerous scientific journals. In Europe the principal authors and investigators have been H. Kopp, Schroëder, Tschermak, Löwig, Filhol, H. Schiff, Safarik, Jungfleisch, Playfair and Joule; in America, Sterry Hunt, F. W. Clarke, Isidor Walz, and, above all, James D. Dana.

The remark made under ISOMORPHISM, that (outside of the regular system) strict crystallic *equality* does not exist, we find still more applicable to this closely-related study of volume-equivalents; and, as in the former case, a term expressing *approximation* only seems preferable—indeed, here almost indispensable. Such a term is *homœosterism.* In tabulating and classifying equivalent volumes, there are several important reasons in favor of adopting, as the *unit* for comparison, that of the crystal of *diamond.* Diamond has the smallest *known* equivalent volume, and its true specific gravity is probably known with greater certainty, in the chemically pure crystalline state, than almost any other elementary body.

Elemental Homœosteres.—In a tabulation of the elements, in the order of their equivalent volumes, commencing with diamond as the lowest, and calculated to the diamond-scale, we almost at once encounter a remarkable group of eight elemental homœosteres—Nos. 5 to 12 inclusive, in the second column below:

	Equiv. vols.*		Equiv. vols.	
1. Diamond	1.	5. Uranium	1.92	Homœosteric series.
2. Boron	1.21	6. Glucinum (equiv. = 13.95)	1.953	
3. Graphite	1.51	7. Cobalt	2.012	
4. Glucinum (equiv. = 9.3)	1.303	8. Nickel	2.03	
		9. Copper	2.117	
		10. Chromium	2.118	
		11. Iron	2.119	
		12. Manganese	2.16	

These eight metals form a strongly-marked *natural* group. Immediately following them comes another, larger series of homœosteres:

13. Palladium	2.653	21. Gold	2.98
14. Iridium	2.66	22. Indium	3.
15. Rhodium	2.71	23. Silver (crystallized)	3.018
16. Platinum	2.73	24. Tungsten	3.075
17. Zinc	2.735	25. Aluminum	3.123
18. Ruthenium	2.74	26. Magnesium (?)	3.15
19. Osmium	2.74	27. Molybdenum	3.291
20. Vanadium	2.743	28. Silver (fused)	3.45

The position of magnesium here is founded on density-determinations of Playfair and Joule, which exceed the mean of other chemists by about 30 per cent. These others bring its equivalent volume up to 4.1. This series includes all the so-called "noble metals," bringing in some, such as V, In, W, Al, and Mo, which other classifications separate widely therefrom: though all these clearly have claims to the title. Zn and Mg, however, have no such claims. One other example may be cited, among those elements (and elementoids), which have the most voluminous equivalents, of a small series of homœosteres: *liquid chlorine*, 7.85; *liquid bromine*, 7.9; *solid iodine*, 8.5; *liquid cyanogen*, 8.79.

Compound Homœosteres.—The new view above propounded, that there is really no true isosterism, but only a progressive homœosterism, is more remarkably exemplified and demonstrated by series of corresponding compounds than of elements. Some oxides of the form M_2O give us the following:

		Densities.	Diamond-scale, volume-equiv.
Water	H_2O	1.00	5.3
Ice (mean of 29 determinations)		0.9191	5.763
Sodic oxide	Na_2O	2.805	6.21
Cuprous oxide	Cu_2O	5.897	7.13
Argentous "	Ag_2O	7.18	9.5
Mercurous "	Hg_2O	10.69	11.44
Potassic "	K_2O	2.656	11.50
Plumbous "	Pb_2O	9.772	12.94

The oxides of the form MO, of the first series of elemental homœosteres, tabulated above, so far as the densities are known, give us—

	Equivalents.	Densities.	Diamond-vols.
Uranous oxide	136.	10.15	3.941
Cobaltous "	75.	5.674	3.888
Nicklous "	75.	6.315	3.493
Cupric "	79.5	6.25	3.741
Chromous "	68.5	Unknown.	
Ferrous "	72.	"	
Manganous "	71.	4.909	4.254

This series furnishes an illustration of the extreme imperfection of many of our data, as yet, for such calculations. The densities of nearly all these most important oxides are imperfectly known, and those on record vary much. For instance, seven figures given for NiO vary from 5.6 to 6.8. The one adopted above is the mean of the seven.

Some *sesquioxides* give the following progressive series of volumes:

Glucina (considered as Be_2O_3)	7.3
Alumina	7.7
Chromic oxide	8.944
Cobaltic "	9.11
Ferric "	9.14
Vanadic "	9.382
Manganic "	10.07
Nicklic "	10.11

A number of other progressive series are readily made out among oxides of other forms. An analogy is strongly suggested in this relation with the *homologues* of organic chemistry (see article HOMOLOGY, by PROF. H. WURTZ), in which there is found a similar progressive increment of equivalent volume. Also among *chlorides* and *sulphides* there are similar serial relations. Of the first elemental homœosteric series the following *monosulphides* are presentable:

CoS	4.9
NiS	5.21
FeS	5.41
MnS	6.40
CuS	6.62

There are apparently no indications of similarity in the *order* of progression in the several cases of the elements, oxides, sulphides, and chlorides; but the densities of many of the compounds are still so uncertain that we cannot decide that such dissimilarity is general.

The most obvious and striking consequence of arranging the elements in the order of their equivalent volumes is that in very numerous cases individual elements, and groups of such, are thus brought into contiguity or proximity, which are known to be allied to each other, but which, in any other mode of classification, fall far apart. This will be further treated of under the head of MOLECULAR VOLUMES.

In chemical textbooks much stress is often laid on cases in which supposed isosteres are also *isomorphs*, generally because found to be alike *isometric*. Almost all the elements may, however, be able to assume isometric forms, and such correspondences therefore do not seem to carry much weight. Attempts, moreover, are made to show numerical relations of equivalent volumes in "simple multiple proportions." (See Watts's *Dictionary*, "Isomorphism," vol. iii. p. 431.) Closer calculations, with better data, are far from bearing out any of these assumed multiple proportions; and indeed it is difficult to see why simple multiple ratios of *volume* should inhere in any case; a *geometrical* ratio, as that of the cube-roots—if there be *any* relation, which is yet to be determined—being more in accordance with the nature of the case. It has been held by high authority that perfect and absolute isomorphism must imply isosterism, or *isotomy*, as some term it. No *a priori* reason is apparent for this, and facts do not bear it out. MnO and Mn_2O_3 are mutually replaceable, for instance, in crystals, in proportions representing equal amounts of oxygen; that is, MnO and $Mn_{\frac{2}{3}}O$; of which the equivalent volumes are respectively 4.254 and 3.36. So also CoO and Co_2O_3 or $C_{\frac{2}{3}}O$, have the respective equivalent volumes, replacing each other crystallogenically, of 3.888 and 2.978.

(For some account of important investigations of Prof. James D. Dana upon this subject, see article on SILICATES, CHEMISTRY AND CLASSIFICATION OF; for others of Prof. F. C. Clarke, see WATER OF CRYSTALLIZATION; and of Dr. Isidor Walz, see SOLUTION and SOLUBILITY. HENRY WURTZ.

Isotheral Lines. See METEOROLOGY.

Isothermal Lines. See CLIMATE, by PROF. A. GUYOT, PH. D., LL.D.

Isotrop'ic [ἴσος, "equal," and τροπή, "turning"]. A homogeneous solid is said to be *isotropic* when any equal or similar (in form) portions cut from *any* relative positions in the body are indistinguishable from one another, or when a spherical portion exhibits uniformity of quality along all its diameters. *Crystalline* substances, *stratified* substances, *fibrous* substances, etc. etc. are not isotropic, inasmuch as their elasticity, tenacity, etc. differ for different directions; and such are called *ælotropic*. If we have reference not only to *mechanical* but to *all* physical properties (*e. g.* absorption and transmission of light, of heat, etc.), a body may be isotropic in one quality or class of qualities, and ælotropic in others. J. G. BARNARD.

Ispahan', city of Persia, the capital of the province of Irak-Ajemi, on the Zendarud, in lat. 32° 39′ N. and lon. 51° 44′ E. From the fourteenth to the beginning of the eighteenth century it was a flourishing and steadily increasing city, and when, in the seventeenth century, Shah Abbas made it his residence and the capital of Persia, it rapidly rose still higher, and became one of the most magnificent cities of Asia. But in 1722 it was taken and sacked by the Afghans, and although it was retaken in 1729 by Nadir Shah, yet Teheran became the capital of Persia, and Ispahan fell into decay. Among its most splendid monuments are the bridge over the Zendarud, 1000 feet long, resting on 34 arches and bearing arched galleries; the palace of Chehel Sittou ("forty columns"), whose front is formed by a double range of columns 40 feet high each, and with a base formed of the united backs of four lions in white marble; the mosque of Mesjid Shah, whose vast dome rises among a forest of spires, towers, minarets, and open galleries. But these and many other wonderful monuments are rapidly decaying, and they are surrounded by ruins. Miles of streets have no inhabitants. The population is estimated at between 60,000 and 100,000. There are signs, however, which indicate that Ispahan may rise once more. Its

* The molecular or equivalent volumes given in this and subsequent articles have all been calculated anew, specially for this work, with the aid of the invaluable Smithsonian Tables of Densities by Prof. F. W. Clarke of Cincinnati. The equivalents used are those adopted by Prof. Barker in his article on CHEMISTRY.

manufactures of gold, silver, silk, velvet, glass, weapons, and earthenware have maintained their high reputation, and its artisans are esteemed the best in Persia. Its situation on the main commercial route between India and Europe is the same as in olden times, and its surroundings are still exceedingly fertile and well cultivated.

Is'rael [Heb. *Yisrael*, "a prince with God"], the name bestowed upon Jacob (which see) when he wrestled with an angel at Peniel (Gen. xxxii. 28), afterward the distinctive name of his descendants, and particularly of the northern kingdom of the ten tribes.

Israel, tp. of Preble co., O. Pop. 1751.

Israelites. See Jews, by Prof. Felix Adler.

Issaque'na, county of Mississippi, having the Mississippi River on the W. and the navigable Yazoo and Sunflower rivers on the E. Area, about 720 square miles. It is partly swampy and covered with dense woods. It is generally level and very fertile. Cotton is the staple product. Cap. Tallulah. Pop. 6887.

Issoire', town of France, in the department of Puy de Dôme, on the Crouse. It has several distilleries. Pop. 6159.

Issoudun', town of France, in the department of Indre, on the Theols. It has extensive manufactures of woollen and linen stuffs. Pop. 14,482.

Is'sue, in the law of pleading. This arises when a proposition of fact or a conclusion of law is directly affirmed by one party to the suit and controverted by the other. It is the point in dispute which is presented for decision to the court or jury. Issues are of two kinds—of law and of fact. The former arises upon demurrer, and presents a question of law, which is adjudicated by the court sitting without a jury (see Demurrer); the latter arises upon a traverse or answer to the allegations of the opposite party, and presents a question of fact, which in a common-law action is determined by a jury, and in an equity case by a judge. In some of the States both classes of issues may by consent of parties be tried by a referee. It is the object of various rules of pleading that the issue shall be upon a point material to the controversy, shall be free from uncertainty or ambiguity, and shall present but a single question for decision upon each separate subject of litigation. (See Pleading.) There is a form of issue termed technically a "feigned issue," from the peculiar manner in which it originates. Such issues occur in the progress of a cause before a tribunal sitting without a jury, when some question of fact arises upon which the decision of a jury is desired. A fictitious suit is framed involving the point to be determined, and is brought to trial before a jury, and carried on to verdict in the usual way. The verdict rendered is then returned to the court in which the cause first arose for its further action. The application of the term "feigned" to the issue is not appropriate, since the fiction is not in the issue, but in the action which is framed and in the state of facts upon which it is founded. Feigned issues almost invariably arise in the progress of suits in courts of equity, and are ordered by the court to be heard before some tribunal proceeding according to the forms of common law with a jury. Sometimes, however, they arise in courts of law. Feigned issues are abolished in New York, and it is only necessary that an order be made by the court for the trial before a jury of the point to be decided, and such order is the only authority necessary for the trial. (For General Issue see that topic.)

George Chase. Revised by T. W. Dwight.

Is'sus [Ἰσσός], an ancient city of Cilicia, near the mouth of the river of the same name, at the head of what is now the Gulf of Scanderoon. In Xenophon's time it was great and prosperous. Here Alexander (333 B. C.) gained a great victory over Darius, whose family was captured. No remains of the town are believed to exist, and it is probable that its site is covered by the sea.

Issy', town of France, in the department of Seine, on the Seine. It has extensive bleaching-grounds. Pop. 6703.

Isthmian Games. See Grecian Games, by Prof. H. J. Schmidt, S. T. D.

Is'tip, town of European Turkey, in the eyalet of Uskiup, on the Istip. It is a well-built town, with a large industry and extensive bazaars. Pop. 18,000.

Is'tria, county of the Austrian province of the coast districts (Küstenland), consists of a mountainous peninsula projecting into the north-eastern part of the Adriatic, and is bounded by the territory of the city of Trieste and the county of Görg. Pop. 240,000. Cap. Pissino.

Italian Architecture. See Renaissance, by Clarence Cook.

Ital'ian Language and Literature. The vernacular speech of the Italian people embraces a great number of provincial dialects, widely differing from each other in articulation, but descended chiefly from a common stock, or, to speak more precisely, from a cognate linguistic group comprising Latin, Umbrian, Oscan, and perhaps Etruscan, as well as other less-known ancient branches of the Italic family of tongues. They all contain more or fewer words of Germanic origin, besides many technical as well as purely local terms derived from other sources; but the proportion of the Italic or indigenous element is everywhere overwhelming, and it is hardly an exaggeration to say that the vocabulary of the Italian language, in all its provincial varieties, is homogeneous. These dialects, except as spoken by the lowest classes in large cities, are not corrupt *patois* confined to the ignorant and the vulgar, but many of them are rich, expressive, and refined, and they are habitually used in familiar intercourse, not only by the middle and inferior ranks, but by persons of social and literary culture, to a very much greater extent than is the case with the provincial dialects of most other European languages. Their diversities of pronunciation, of form, of idiomatic expression, and even of syntactical combination, are such that a stranger who has acquired only Tuscan, or the language of literature and of general Italian society, finds all the vernaculars, including the humble street and household dialect—or what may be called the *cockney*—of Rome, and even of Florence itself, almost wholly unintelligible. Even the native inhabitants of different Italian provinces cannot freely communicate with each other without resorting to Tuscan, which is known by all Italians of the slightest pretensions to education, and is therefore properly characterized as the *lingua comune*, or "common tongue," of the whole kingdom. This dialect, though the common property of the whole Italian people, is the peculiar fireside, field, and market, as well as literary, language of Tuscany and parts of the adjacent provinces; but even within these limits there are in popular use considerable discrepancies both in accent and in vocabulary. The better class of the peasantry in the mountain territory of Pistoja, in the upper Val d'Arno, and in some other localities, speak Tuscan with a beauty of articulation—or, more accurately, of delivery—an elegance of phrase, and a picturesqueness of vocabulary which can hardly be paralleled by the popular discourse, not merely of other parts of Italy, but of any other European country. It is in this perennial "well of language undefiled," not in French or in classical Latin, that Italian literature ought to seek the enrichment and variety of diction, the flexibility and versatility of construction, which the *lingua comune* needs before it can become truly an all-pervading vital medium of national thought and expression.

But though Tuscan may fairly claim to be the sole national medium of exchange of thought, and though the pronunciation of all the provinces tends to assimilate, yet in the different parts of the kingdom there is a wide range of local variation in oral articulation in good social circles, and of literary diction in the dialect of public discussion and of books. The speech of every provincial "bewrayeth" him, not only by his shibboleth, but by his idioms and the general choice and arrangement of his words; and in Parliament the *paese* of every orator is at once recognized by both his accent and his phraseology. The writings of all non-Tuscans are criticised as marked by solecisms, if not by positive *sgrammaticature*. Manzoni, a Lombard by birth and early training, thought it necessary, after the first publication of his *Promessi Sposi*, to reform his style by most minute and careful study of Tuscan models, or, as he, with more force than good taste or grace of expression, phrased it, "to rinse out his rags in the Arno;"* and when that deservedly renowned story had been fifteen years before the world he reissued it in an almost entirely rewritten form. Compare, for example, this paragraph as given in the editions of 1825 and 1840 (*I Promessi Sposi*, cap. xxxiv.):

"Venuto appiè del ponte, voltò senza esitare, a sinistra, nella *via detta la* strada a San Marco, come a quella che gli parve dover menare verso l'interno della città. E procedendo, cercava *cogli occhi* intorno, se potessi scoprire qualche creatura umana; ma altra non ne vide che uno sformato cadavere	"*Arrivato al* ponte, voltò, senza esitare a sinistra, nella *strada di* San Marco, *parendogli, a ragione, che dovesse condurre* verso l'interno della città. E *andando avanti, guardava in qua e in là, per veder se poteva* scoprire qualche creatura umana; ma non ne vide altra che uno sformato cadavere nel *pic-*

* *Risciacquare i suoi cenci in Arno.* Our translation does not give the precise effect of the original, for though names of rivers usually take the definite article in Italian, the Tuscans make their river an exception, and personify it. *Arno* is the name of a being, not of a thing.

nel fossatello che corre tra quelle poche case (che allora erano anche meno) e la via, per un tratto di essa. Passato quel tratto, udì certe grida, *come chiamate che parevan fatte a lui;* e, volto lo sguardo in su a quella parte *donde veniva il suono,* scorse, poco lontano, a un balcone d'una casupola isolata, una povera donna, con un gruppetto di fanciulli dattorno, la quale, chiamando, tuttavia, gli accennava pur colla mano *che si facesse vicino.*"

col fosso che corre tra quelle poche case (che allora erano anche meno) *e un pezzo della strada.* Passato quel *pezzo, sentì gridare: 'o quell'uomo!'* e *guardando da* quella parte, *vide* poco lontano, a un *terrazzino d'una casuccia* isolata, una povera donna, con *una nidiata di bambini intorno;* la quale, *seguitandolo a chiamare,* gli *fece* ceNNo *anche* con la mano."

And yet, after all this painstaking, Tuscan purists find Lombardisms in the style of Manzoni. Some eminent native critics think it impossible, and even undesirable, for the whole Italian people to conform to the Tuscan or to any other universal standard of diction, and they advise provincial writers and speakers to adopt the regular grammatical inflexions of the *lingua comune,* but to continue to employ every one his own native vocabulary and idiomatic phraseology. These local expressions, they say, almost universally belong to the Italic word-stock, and would accordingly be intelligible even where not habitually used. By this method, as they suppose, the provincial would enjoy as much freedom of movement as in the use of his vernacular, and would at the same time be even better understood and appreciated than when under the constraint of employing words and constructions not familiar to him.

Most of the Italian provincial dialects have been reduced to writing; some of them, Venetian and Sicilian, for example, were somewhat largely employed in literature and in official communication before, and even for some time after, the supremacy of Tuscan was generally recognized; there still exists among the peasantry a large stock of old unwritten dialectic prose and verse, which is orally transmitted from generation to generation by popular reciters and story-tellers; new dramatic pieces, generally comic, are constantly represented in *dialetto* in all the great cities, and every year gives birth to a considerable amount of popular, humorous, and satirical poetry in the more important provincial speeches. But the language employed in serious literary composition, in religious teaching, in parliamentary and forensic proceedings, in all branches of the public administration, in journalism, in commercial and private correspondence, and in general social circles is exclusively Tuscan. The early predominance of Tuscan is probably due rather to the political importance of the Florentine republic, and especially to the relations of the old Tuscan capital to the internal commerce and the financial interests of the Peninsula, than to greater antiquity or to any special inherent fitness for literary purposes; for the original intrinsic superiority of Tuscan to some of the other Italian dialects is by no means clear. It has now, however, received a culture which has given it a very decided advantage over all its rivals, and the political unification of Italy has strengthened its position as the national tongue, and secured to it a constantly widening sphere of living energy as a popular speech. Hence, it is no longer as true as it was in Byron's time, that "Few Italians speak the right Etruscan;" and, unfortunately, the Florentine pronunciation, which is characterized by an enfeebled—or, to borrow an expressive term from a great philologist, a *lazy*—articulation of what are elsewhere more masculine and energetic consonantal sounds, is fast spreading. This tendency is aggravated by the predilection of fashionable Italian circles for the habitual use of French, and threatens to become universal.

The critical study of the Italian dialects has until lately been much neglected; and, in fact, the materials for its scientific treatment have hardly yet been brought together. But it possesses great linguistic interest, and it is now zealously prosecuted by able foreign and native philologists. From their researches we may expect important results, but at present we know little of the history and condition of these dialects at any period previous to the thirteenth century. The recorded literature of modern Italy is of later birth than that of Provence and of Northern France. Many of the earliest Italian poets wrote in Provençal, much of the most ancient literature of mediæval Italy was translated from French, and important prose works by Italian authors—the *Tesoro* of Brunetto Latini, the *Chronicle* of Canale, and the *Travels of Marco Polo,* for instance—were composed in that language as late as the latter half of the thirteenth century. Down to that period, with these and other exceptions to be noticed hereafter, Latin was the only *written* tongue employed in Italy, but there is satisfactory evidence that not only at that epoch, but through the whole historical era, there have been great diversities of *speech* in the Italian territory. Even after the subjection of the entire Peninsula to Rome, Greek, Celtic, and Etruscan, as well as Oscan, Umbrian, and other now forgotten languages, were long employed in provincial districts. Centuries must have elapsed before the mother-tongues of the conquered tribes could be stamped out by the iron heel of Roman despotism, and Latin substituted, by the combined influence of civil government and religion, as the only recognized medium of social intercourse. In the mean time, the authoritative introduction of the Latin speech into the domain of these other peninsular languages, and the influx of barbarisms brought in by colonized veterans and other foreigners, could not but have produced the same effects that like causes have occasioned elsewhere. Even where the triumph of Latin was most complete, the hereditary orthoepical habits of the population could never have been altogether extirpated, and the provincial articulation of Latin must have been modified everywhere by local influences, as English has been by the Celtic element and other circumstances in Ireland and Scotland. Diez, indeed—and there is no higher authority—affirms that Italian shows no trace of the vocal system of the Oscan, the most important of the Lower Italic dialects. But we may be pardoned for doubting whether our knowledge of the power of the letters of the Oscan alphabet is such as to authorize so absolute a statement; and the great philologist himself admits a considerable influence of other ancient dialects upon the pronunciation, the idiom, and the vocabulary of the modern speech. The development of the modern Italian dialects is not a parallel case to the formation of the Spanish. The old Hispano-Latin, the parent of modern Spanish, grew up in the presence of an indigenous speech of a totally different linguistic stock, too alien, in every characteristic, to admit of much amalgamation between the native and the intruding ingredient. In its later development it encountered the Arabic, also a wholly unrelated tongue, which, though the language of a conquering race, and possessed of much culture, did not sensibly affect the structure of the Spanish, though it enriched its vocabulary with a few words. On the other hand, Celtic and the Gothic languages with which the Romans came in contact in their Northern conquests, though remote from Latin, were still Indo-European, and therefore at least distantly allied speeches. Hence, it is not surprising that their influence should be clearly traceable both in French and in the modern dialects of Northern Italy or Cisalpine Gaul. The old Italic dialects were much more closely cognate with Latin, and consequently still more readily became fused, or rather confused, with it in vernacular provincial forms, determined by local conditions of which we are almost wholly ignorant. The influence of these dialects, then, on the spoken Latin of the provinces is a question merely of degree, and at present we are quite unable to analyze it quantitatively. But we are authorized to conclude that Latin was spoken with great provincial diversity, and there is no evidence to prove, no reason to suppose, that classical Latin ever became the general language of ancient Italy in any higher sense or to a greater extent than Tuscan is the universal tongue of the Italy of modern times. The Roman writers often allude to the *lingua rustica,* or dialect of the provinces, as distinct both from the classical language of Rome and from the vulgar or plebeian speech of the city and its environs; and because they employ the singular form, and do not distinguish the speech of different provinces, it has been hastily assumed that but one *lingua rustica* existed.* But the Romans were a people of dull ear and of obtuse linguistic perceptions, at least in the appreciation of strange and foreign sounds and idioms. Hence, they would certainly not have discriminated between Latinized Italic dialects sensibly different from the Roman, even if widely discordant from each other; and there is nothing to control the general presumption that every ethnological, if not every geographical and every municipal, district must have developed its own peculiar local speech. These local speeches, we believe, "still live," with more or less vital energy, and in more or less modified forms, in the modern provincial dialects, which are consequently to be regarded as descended not from classical Latin, but from the old rustic jargons which grew out of the clash of more or less conflicting elements. It is proper to observe here that when the primitive Italic tongues ceased to exist as independent languages, and consequently as disturbing forces in the development of the new Latinized dialects, the language of government and religion would naturally acquire a

* The Romans appear to have used *lingua rustica* precisely as *dialetto* is employed at the present day. An Italian, returning from a theatre at Milan or Bergamo, does not say, definitely, that he saw a play *nel dialetto Milanese,* or *Bergamasco,* but simply a play *in dialetto.*

stronger influence over popular forms of speech, and these latter would of course recover some indigenous linguistic traits which they may have lost in the struggle between the aboriginal and the invading elements. These considerations, we think, authorize us to say that neither the *lingua comune* or Tuscan, nor any other provincial dialect of modern Italy, can be correctly described as legitimately and exclusively descended from the majestic speech of Latium. At the same time, Latin remained always the language of the Church, and has continued to be more or less employed by profane writers, in public inscriptions, and for other special purposes, down to our own times. There exists everywhere in Italy a traditional knowledge of Latin as, in a degree, a living tongue; and there can be no doubt that this general familiarity with the forms and vocabulary of the classical dialect has been a constantly acting force on the spoken, and especially on the written, language of the country. Many locutions in the various dialects which have been explained as ancient corruptions or modifications of the speech of Rome are merely comparatively recent draughts from that perennial fountain; and if Tuscan is the nearest representative of the classical tongue of Rome, it is because, in the long course of its literary culture, it has, in the largest measure, borrowed and appropriated, rather than inherited, the voice and accent of the ancient mistress of the world.

The fact that the *lingua comune* is not the general vernacular of Italy, and the almost universal familiarity of Italian writers with Latin models—for almost every reading Italian knows and reads Latin as an ancient and venerable form of his mother-tongue—have protected literary Tuscan from the revolutions, the corruptions, and the debasement which popular use, in the fervent and energetic national life of our democratic age, tends to introduce into language. No one of the great European tongues has changed so little within the last six centuries as Italian. The old translations of the romances of chivalry and other prose tales are intelligible to all. The *Reali di Francia*, described by a late learned editor as at this day the most popular book in the language, is read from the Alps to Sicily in a version somewhat modernized in orthography, but otherwise almost a century older than Chaucer. On the other hand, the very circumstance that to a vast proportion of the people Tuscan has always been a sort of sacred dialect, set apart for elevated and formal uses, combined with the pedantic conservatism of the Della Crusca school, has prevented the enrichment of the vocabulary except in branches in which certain special classes have been interested. As a general rule, agricultural operations, industrial art, and the practical applications of science, descriptive geography, natural history, and physics, commerce, internal improvements, mining, the machinery of representative government, popular institutions, and judicial proceedings have but lately entered deeply into the life and habitual thought of educated Italians, and have scarcely yet exerted a sensible influence on the diction of literature. The literary dialect of Italy, consequently, has not received the breadth of culture and the various wealth of vocabulary which characterize the modern *belles-lettres* productions of the Northern countries of Europe and America. The nomenclatures of many of the arts and knowledges we have enumerated—agriculture and hydraulics, for example—indeed exist in the mouths of the peasantry and of engineers, but they have not been taken up into the language of literature and of refined society by any means as fully as elsewhere. Hence, the dialect of books and of elegant conversation is unpicturesque, or at least undescriptive. Italian translations of such poems as Keats's *Endymion*, or Crabbe's *Tales*, or Mrs. Browning's *Vision of Poets*, or Voss's *Idyls*, or of prose pictures of rural and village life in England, America, and Germany, would not be practicable without the employment of a diction not yet recognized as classical. A foreigner, listening to a discussion between educated Italians on subjects of homely, material interest, hears generic terms where an Englishman would use specific words; and if he has enjoyed only such opportunities as are usually accessible to strangers in Italy, he finds it excessively difficult—as did the old Roman in the poverty of his native Latin, and as does his Italian descendant of to-day—to learn *propriè communia dicere*, and he is constantly embarrassed for want of equivalents for expressions of thought and fact which in his own country make up much of the staple of discourse in cultivated circles.

The beneficent political—and, above all, moral—revolutions of which Italy has been the theatre during the last five-and-twenty years have brought new and more diversified influences to bear upon her language, and have made greatly enlarged demands upon its capabilities of expression. Hence, the *lingua comune* is naturally, and without any conscious, organized general effort for that purpose, undergoing changes visible even to a foreigner. To the improvement of the language from these causes there are various hindrances. Besides the hostility of the clergy to all ameliorations in the fields of both mind and matter, we may mention two leading obstacles. The one is inveterate and slow to yield. The removal of the other, which is accidental, is more hopeful. We refer first to the fact that the Italians are a bilingual people—a people whose spoken tongue differs essentially from the written; an evil the magnitude of which only experience or long observation can make apparent. Eminent provincial or non-Tuscan writers have often lamented the necessity of thinking in one dialect and giving their thoughts an outward expression by a mental translation into another. We have space only to allude to this difficulty, and to illustrate it in passing by comparing it to the embarrassment and constraint we all feel in using a foreign tongue, however well understood; and we pass to the other obstacle, which is analogous in character, but, as we have said, accidental, and therefore not invincible. We mean a predilection for a foreign language and a foreign literature, which interferes, to a deplorable extent, with the cultivation and improvement of the national speech and the national letters, as well as with native originality and independence of thought in Italy. French is far too generally the habitual language of fashionable Italian society, even in intercourse among natives; and when a foreigner addresses an Italian in what, if the compliments of his teacher are sincere, is the choicest Tuscan, his interlocutor, pitying his ignorance of Italian, will almost certainly answer him in French, which he fancies to be a universal medium. We are not here objecting to the disproportionate importance given in Italy to the language and literature in question because they are French, but because they are foreign, alien to the national heart, and disturbing to the movement of the national intellect. The causes which have given this undue predominance to French in the education and social training of the higher classes in Italy cannot here be specified; and it must be admitted that the tongue and letters of France have stronger claims on the attention of the Italians than those of any other foreign country. In our times, unhappily, not merely the closet study, but the far more distracting practical use, of foreign modes of thought and speech, is an indispensable element in comprehensive culture. But, though a necessary discipline, or rather instrument, it is a necessary evil. With rare exceptions no man can freely use more than one language as a medium of intellectual or oral discourse, and what we gain in power over a foreign tongue is compensated by a corresponding loss in the mastership of our own. The mighty intellect of Greece was weakened by no dispersion of linguistic culture, for her strongest sons knew no language but Greek; and though the study of the *exemplaria Græca* by the Romans may for a time have improved their taste, it did not help their Latinity, and in the end it crushed their originality in both literature and art. In one respect, indeed, Italians, as well as ourselves and the Germans, may derive great advantage from the study and critical analysis of the best French literary models. We refer to the surpassing excellence of French writers in rhetorical even more conspicuously than in scientific *method*—in the art, that is, of beginning at the beginning, going straight to the mark, and leaving off at the end, thus avoiding the wordy involution of thought and expression which is the bane of Italian perhaps even more emphatically than of other contemporaneous literatures.

As we have said, every province has still its popular literature, oral and recorded. But there is no provincial Dante, or Petrarch, or Ariosto, or Tasso, or Villani, or Varchi, or Macchiavelli, and the tongue through which the Italian states have acted on each other, and Italy on the world, is exclusively the *lingua comune*, or Tuscan, which alone reflects and represents the mind and voice of Italy in the European republic of letters. The provincial literatures of Italy are not, like those of ancient Greece, component parts of a national whole. They are specialized manifestations of intellect and of speech, and therefore in general have only a provincial interest. Their peculiar characteristics cannot be noticed in a brief comprehensive view of Italian literature. We must confine our sketch to that which has been accepted by the Italian people and presented to the world as the authorized expression of the mind and heart of the nation; and the following remarks must be understood as referring only to writings in the Tuscan or *lingua comune*, unless otherwise expressed. The early history of this literature is obscure, for, though there were Italian bards and *cantastorie*, or saga-men, early in the thirteenth, and doubtless in the twelfth century, yet their works are known to us only as disfigured by copyists of later ages, and we can rarely speak with confidence as to their dates, their dialects, or even their original literary

forms. In many cases, as we have seen, they certainly wrote in French or Provençal, and in so close conformity to French and Provençal models that they are entitled to no place in Italian literary history. In other instances, private letters and other documents written in the thirteenth century are suspected to have been first composed in Latin and translated at a later period; and in several most important cases it is matter of grave doubt whether the reputed works of historical authors of the thirteenth and even the fourteenth century are not comparatively modern fabrications. Into questions of this delicate nature, which native tribunals alone are competent to adjudicate, we cannot enter. We shall accordingly give only the commonly received accounts of the literature of the thirteenth century, subject to allowance for all the causes of uncertainty to which we have alluded; and it is only from the epoch fixed by Dante as the date of his great poem, the assumed "middle point" of his life, or the year 1300, that we feel ourselves to be treading on safer ground. There is no doubt that ballad or narrative poetry existed in Italy in an oral and traditional form before any of the modern dialects were reduced to writing, but the earliest Italian poems which have come down to us, even in a modernized shape, are amatory or religious. In some cases it is difficult to say to which of these two classes they belong, for it is not always clear whether the lady celebrated in them was a real person or only a personification of a Christian idea. We know, from the testimony of Dante and from abundant other evidence, that many of the poets usually believed to have lived in the thirteenth century did certainly flourish in that age, and we have many of their works in copies not very much later than the time of their writers. But we can rarely fix the precise date of these productions, and we can seldom be sufficiently sure of the strict conformity of such copies with their originals to authorize us to regard them as positively genuine exemplifications of the grammatical structure of the dialect in which they were composed, or even of the rhetorical combinations and metrical forms employed by their authors. There are also extant certain prose compositions of the same century, and in some few instances either originals or at least contemporaneous copies of these productions still exist. Even where we possess only transcripts of such writings of somewhat more recent date, we may rely upon their accuracy as copies with more confidence than in the case of poetical compositions, because, though poetic forms, once established, are more enduring than those of prose, yet the diction of verse modelled almost wholly after foreign types, as were the first Italian rhymes of which we have any knowledge, could not so soon have acquired a fixed and settled expression. The earliest prose, on the contrary, consisted simply in reducing to writing popular modes of vernacular speech, and there was no external influence, no motive of taste, which could lead to any rapid change in the style of ordinary written communication. Upon the whole, in the few poetical and the comparatively numerous prose manuscripts of the thirteenth century yet remaining, insignificant as they are in bulk, we have sufficient means of pronouncing, with approximate certainty, upon the general grammatical and lexical character of the Tuscan dialect in the latter half of the thirteenth century. The real importance of this century in Italian literary history is not in the merit of its productions, or in any influence exerted by them on the intellectual culture and products of the age, but in the fact that they prove the existence of the *lingua comune* as a written tongue at that period, and furnish evidence also that the literary supremacy of that dialect was—not universally, indeed, but very generally—recognized in Italy before the beginning of the fourteenth century. Dante, indeed, in his *De Vulgari Eloquentia*, denies, with great acerbity of tone, the identity of Tuscan with the *lingua comune* or *vulgare illustre, cardinale, anticum, et curiale;* and there are not wanting later critics who maintain that Tuscany did not originate, but only adopted, the *lingua comune*, which, in some way not yet explained nor easily conceivable according to the general laws of language, arose and developed itself independently of local influences. Dante defines the *locutio vulgaris*, which, he says, forms the subject of his treatise, as that which is learned, without rule, by imitating the speech of the nurse, and in the dedication of the *Paradiso* to Can Grande della Scala he describes the diction of the *Divina Commedia* as *remissus et humilis in quæ et mulierculæ communicant.* This *locutio vulgaris* he declares to be more noble than the language taught in the schools, and he affirms that it was not used by Guittone d'Arezzo or Brunetto Latini, but was employed by Guido Cavalcanti, Lapo Gianni, Cino da Pistoja, and "one other," meaning, no doubt, himself. What precise distinction Dante would have drawn between the *vulgare illustre, anticum, et curiale* and the language of Caterina da Siena and other illustrious writers of the thirteenth century, which is unequivocally Tuscan, it is hard to see. In fact, Dante's observations on the provincial dialects of his time are to Italian as well as to foreign scholars an enigma which has not found its Œdipus; and until further research shall reveal to us much more than we now know of the actual history of the language of modern Italy, we must content ourselves with the fact that what is now both the Tuscan local and the Italian common speech did substantially exist and acquire its primacy as a literary tongue before the year 1300. Dante has been said to have been the cunning artisan who forged this new literary instrument. But poets are the conservators, not the creators, of language. Dante, therefore, did not invent his diction. He was neither a coiner nor a borrower of words. He took and wisely used what he found—not always, indeed, in books, but oftener in popular speech. As Giuliani and Tommaseo have well observed, many expressions of Dante's, for which even his authority could not secure admission into the general vocabulary, are still current in the mouths of the Tuscan peasantry, where Dante found them, and the discourse of this humble class serves to explain more than one passage in the *Divina Commedia* which is otherwise unintelligible. In point of antiquity, the first place among the Tuscan poets is usually ascribed to Folcacchiero dei Folcacchieri, alleged to have been born at Siena about the year 1150, and many critics have claimed the poems of Ciullo d'Alcamo, the emperor Frederick II. and his sons, Enzo, Enrico, and Manfredi, Pier delle Vigne, Ranieri, Ruggerone, and Inghilfredi da Palermo, Guido delle Colonne (author of several Italian canzoni, and more famous as the compiler of a Latin history of the Trojan war founded on the works of Dares and Dictys), Jacopo da Lentini, and other Sicilian versifiers of the thirteenth century, as properly belonging to the literature of the *lingua comune*, though the diction of all of them is strongly marked by Sicilian provincialisms. The Bolognese Guido Guinicelli (called by Nannucci "il padre della Italica letteratura") and Onesto Bolognese are also ranked with Tuscan writers, though not Tuscan by birth. Guittone d'Arezzo, Guido Cavalcanti, Dino Frescobaldi, Dino Compagni, are Tuscan poets of merit. Jacopone of Todi, in the pontifical territory, wrote much in Tuscan verse, and is supposed to be the author, or perhaps only improver, of the world-renowned Latin Church hymn, *Stabat Mater dolorosa*.

The most important Italian prose works of the thirteenth century, admitting their authenticity, which has been disputed, are the chronicles of Matteo Spinello, of the province of Bari, and of Ricordano and Giacotto Malispini, the first Tuscan annalists. The *Moral Treatises* of Albertano da Brescia, the original of Chaucer's *Persone's Tale*, written in Latin about 1250, were translated into Italian by Andrea da Grosseto in 1268, and less than ten years later by Soffredi del Grazia of Pistoja. The former of these translations, published in the *Collezione di Opere Inedite* in 1873, from a manuscript of the fourteenth century, is pronounced by the editor to be, "in respect to antiquity, the most important document of the language in literary prose." The other, printed in 1832, was considered by Ciampi as an authentic specimen of the language of Tuscany as popularly spoken at its date. But it must be remembered that neither edition is taken from the original manuscript, or even from a contemporary copy. The *Novellino*, or *Cento Novelle antiche*, is believed to belong, in a considerable proportion, to the thirteenth century, though we have the work only in later copies. The *Conti di Antichi cavalieri* is affirmed to exist in a manuscript of the thirteenth century. The *Libro di Cato*, the *Fiore di Rettorica* of Guidotto da Bologna, the letters of Guittone d'Arezzo, translations of the romance of the Round Table and of the treatise of Egidio Colonna, *Del Governamento dei Principi*, Bono Giamboni's translations of the *Tesoro* of Brunetto Latini and of other mediæval Latin works, and various moral treatises and legends of saints, are ascribed to the same period. There are also undoubted municipal statutes, records, and other documents, as well as some private letters, dated about the middle of the century, and of course as old as what some maintain to be the earliest specimen of English, the famous proclamation of Henry III. issued in 1258.

We come now to what the Italians with just pride call the golden age of their literature, the *aureo trecento*, or, in our chronological notation, the fourteenth century—the age of Dante, Petrarch, and Boccaccio. It was in the course of this century that classical literature, though not then first known to Italians, gradually superseded the influence of Provençal and French as an informing element, and furnished an incitement to all, models to many, for literary effort. The Italian poetry of the fourteenth century, exalted as it is in genius and in literary merit, is far from being copious in amount, while the contemporaneous prose literature is voluminous, and, in point of style at least, of almost unsurpassed perfection. In neither form of compo-

sition were the Latin classics of real value, except as a stimulus and a means of culture. Both in form and in substance whatever is excellent in the productions of the *aureo trecento* is, in the highest degree, original and independent. Dante, indeed, ascribes to the study of Virgil "Lo bello stile che mi ha fatto onore;" but if in this expression he referred to the form or diction of his poems, and not to the Latinity of his prose writings, he confounded the *primum mobile*, the first impulse, with the character and direction of the movement, which were controlled and determined by far other agencies. If we remove from the *Divina Commedia* all that can fairly be traced to the influence of the works of Virgil, we shall deprive it of none of its leading characteristics, nothing of its real inspiration. The Muses of Dante are not to be found among the heathen Nine. His highest flights, like Milton's, were prompted and sustained by the spirit of Christian theology as interpreted and understood in his time, and his passion was unhappily in far too great a degree colored by the partialities, rancors, and resentments of his political and civil life. The saving moral influence in Dante's mind was his early love, and when he employs, instead of fierce invective, a tone of milder deprecation, a manner "affettuosamente battagliera," it is because the spirit of Beatrice is pleading for the offender. The Latin works of Petrarch, from which he expected immortality, are deservedly forgotten, and the classic idioms and constructions which Boccaccio thought the chief ornaments of his prose style are not only its greatest defects, but have exerted a very pernicious influence on the diction and manner of later Italian writers. In all incipient literatures, at least, the true bard "singet wie der Vogel singt." Dante's great poem, like all works of high and original genius, shaped itself as it grew, in accordance with the law of his nature, rather than in conformity to principles of conscious art. Its real character and spirit would never be inferred from his own statement of its import in the dedication of the *Paradiso* to Can Grande della Scala. He regarded it as a system of religious philosophy, the motive of which, "literally considered," was "the state of souls after death," the "allegorical subject," "man, as, by good or evil desert in the exercise of free will, he is amenable to retributive justice in the way of reward or punishment." In the whole text of the dedication there is not the remotest trace of the most prominent features of the poem itself—the inspiring passions of life, his pure and ardent love for Beatrice, and his bitter resentment against his political opponents, though he did not disguise this latter feeling in the address of the epistle, where he styles himself "Florentinus natione non moribus." The knowledge of Dante was vast and various for the period, and his influence on the intellect of his age, when he was constantly appealed to as the universal arbiter, the tribunal of last resort on every possible subject, can scarcely be overrated. The prose works of Dante are valuable chiefly as indirectly a commentary on the *Divina Commedia*, and are not otherwise of sufficient interest or importance to require special notice in this place. Dante has been made accessible to English and American readers by Mr. Longfellow in what is undoubtedly the best existing translation of his great poem, and it is only in his works, not in critical treatises, that he can be studied advantageously. The canzoni of Petrarch are too widely known by translations and imitations, and the poems of Boccaccio by the use which Chaucer has made of them, to need to be more than mentioned in what can be little but a list of literary titles. The *Dittamondo* of Fazio degli Uberti, a sort of rhyming chronicle, geography, and natural history, is interesting as a summary of the knowledge of his times, and not altogether without literary merit. Other poets of the fourteenth century are Cecco d'Ascoli, Francesco da Barberino, Cino da Pistoja, and Antonio Pucci. The prose literature of this century deserves a higher reputation than foreign scholars have generally conceded to it. Benvenuto da Imola and other early commentators on Dante have not only furnished explanations and historical illustrations of obscure passages in his works, but they have frequently shown a critical ability rare in that age. The chronicles of Giovanni Villani and his continuators, and the history of Dino Campagni, possibly a later fabrication, are valuable repositories of fact, and important as good specimens of the capabilities of Tuscan for literary purposes, though as histories not on a level with the French, Icelandic, and Catalan chronicles of the thirteenth century, or with Froissart, who flourished at the close of the fourteenth. The saintly legends and romances of chivalry of this period are generally conspicuous for purity and beauty of style. Many of them are included in the *Collezione di Opere Inedite o Rare*, of which more than 30 octavo volumes have already appeared, and the *Scelta di Curiosità Letterarie*, in 16mo, now extending to 140 volumes. Two works of this century, not embraced in these collections, deserve special mention—the novels of Sacchetti, which are believed to contain very faithful pictures of the manners of the age, and the letters of St. Catharine of Siena, of which the manner and style would of themselves justify the epithet that Italian critics so often attach to that age. In point of style, the *Letters* of Catharine of Siena are not surpassed, if equalled, by any other European prose compositions of the fourteenth century. The writer owed nothing directly to classic culture, for it is doubtful whether her "small Latin" sufficed even for reading the Vulgate, with which she shows great familiarity, but which she is supposed to have known only through the quotations of preaching friars or oral translations by other ecclesiastics. It is remarkable that in an age when the *Divina Commedia* was a theme of public exposition, and even of pulpit discussion, the works of St. Catharine neither mention Dante nor quote his poem. Perhaps she found his sombre tone and severe invective too repulsive for her kindly temper; and Tommaseo is hardly extravagant in saying that though there are resemblances of thought and diction in their works, "the likeness is that of a fair and gentle woman to a proudly austere and sullen man, whose brow is wrinkled by wrath, not by years." The writings of St. Catharine are of great importance, as incontestably proving that in her day the *lingua comune* existed in its most perfect form as the common vernacular of Tuscany, for she probably knew, and certainly thought, in no other tongue. Were other testimony in support of our proposition wanting, confirmatory evidence might be found in the *Fioretti di San Francesco*, which competent judges believe to be the truest possible expression of the simple beauty of the Tuscan familiar speech of the period we are considering. The increasing cultivation of classical literature in the fifteenth century produced much the same effect as in England a hundred years later. It absorbed the intellectual activity of the age, and left comparatively little time or taste for original production. In Italy the study of Greek and Latin was general among the better classes, in all ranks and both sexes, to a degree not paralleled even by the learning of modern Germany. Women who were educated at all were taught Greek and Latin, and Italian ladies filled professorships in both native and foreign universities. To Italy belongs the honor of having first acknowledged—what she has since too often forgotten—the intellectual equality, and therefore the equality in rights as well as in duties, of the sexes. She thus anticipated by four centuries the revelation of a truth which has suddenly dawned again upon the civilization of this generation as a principle, the general acceptance of which constitutes the most beneficent moral revolution that humanity has seen since the promulgation of the Christian religion. In this century Italy acquired an intellectual—unhappily not a moral—culture and refinement which gave her an immense, a widespread, and a long-enduring influence over the mind of the rest of Europe. Traces of this influence are abundantly visible in the literature and history of every European state, but it was scarcely fully appreciated or clearly expounded before the publication of Burckhardt's remarkable *Cultur der Renaissance*, which we earnestly recommend to the reader. Still, this century produced great Italian writers in both poetry and prose, as well as great geniuses in politics and art. The most conspicuous poetical works of the age were the *Morgante Maggiore* of Luigi Pulci, the *Orlando Innamorato* of Bojardo, the *Favola d'Orfeo*, a drama, and other small works of Poliziano, lyrical compositions by Gasparo Visconti, Accolti, and others. In prose are the chronicles of Collennuccio Corio and numerous other valuable sources of historical information, many of which, like the writings of Sabellico and Pius II. (Æneas Silvius Piccolomini), are in Latin; others exist only in manuscript or in the voluminous collections of Muratori and other vast repositories of mediæval lore. To the fifteenth century, too, belong the works of Leon Battista Alberti on architecture, sculpture, and painting, and most of the writings of Leonardo da Vinci. Many of these latter unfortunately remain unpublished, but, not less than his material works, they are unequivocally productions of a genius which in universality, versatility, and power has had no superior among men. In this age, too, lived two of the grandest characters and sublimest geniuses in the records of human history—Columbus and Savonarola—both Italians and both martyrs. The intellect of neither is adequately represented by his literary productions, but, though the life of Columbus remains to be written, Savonarola has found a worthy biographer in Villari, whose life of this remarkable man is one of the noblest historical works of our time.

From about the middle of the thirteenth century to the overthrow of the liberties of Florence in 1530 by the unholy league between the emperor Charles V. and Pope Clement VII., Florence was the city of the world most conspicuous for intellectual and physical achievement. Let-

ters, art, industry, and commerce alike were pursued with a genius in conception, a feverish energy in execution, and a splendor of result probably unexampled in ancient or in modern times. In particular branches of art and literature she may have been excelled by Athens and by Rome, but in the combined exercise of the highest faculties, mental and material, in every field of human effort, no three centuries of Athenian or of Roman annals can be paralleled with those of Florence during the period we have mentioned. Most of the great names we have hitherto cited are those of Tuscans, but the political and the intellectual ascendency of Florence fell together, and with some brilliant exceptions her genius was clouded, if not quenched, by the final extinction of her liberties. In narrative and in lyric poetry the most celebrated Italian writers of the sixteenth century are Trissino, Luigi Alamanni, Ariosto (whose *Orlando Furioso* excels all other romantic poems), Tasso (whose *Gerusalemme Liberata*, of all modern poetical compositions, comes nearest to the idea of the classic epic), Berni (the reversifier of Bojardo's *Orlando Innamorato*, and who gave his name to a peculiar class of light satirical verse), Firenzuola, Ruccellai, Tansillo, Davanzati, Pietro Aretino, Bembo, Annibale Caro, Michelangelo Buonarroti, Vittoria Colonna, and Folengo, the writer of macaronic verse. It was in the sixteenth century that the drama first acquired a status in Italian literature. Many plays were written in Latin, many of a popular character were sketched in outline and more or less filled up by improvisation by the actors—an art in which the Italians still show great talent. These, of course, are lost to us, and few if any of the more elaborate dramas of that period still hold their place on the stage. The principal comedies are those of Ariosto, Dovizio da Bibbiena, Macchiavelli, P. Aretino, Grazzini, Firenzuola, Cecchi, Salviati, and Francesco d'Ambra. Niccolo Correggio Visconti produced a pastoral drama, and the *Pastor Fido* of Guarini still has a high reputation. The foundation of the musical drama was laid in this century by Emilio del Cavalieri, and Rinuccini is regarded as the first author of a regular opera. Becchi is said to have produced the earliest opera buffa. Tragedies were produced by Del Carretto, Trissino, Ruccellai, Andrea dell' Anguillara, and Pietro Aretino. Numerous novels and romances appeared in this age. The collection of Bandello is well known. Firenzuola, Parabosco, Giraldi, Grazzini, Macchiavelli, and De Porta distinguished themselves in fictitious narrative. The didactic dialogue of Baldassare Castiglione, *Il Cortigiano*, was translated into most European languages before the year 1600, and is still not forgotten. The political and historical literature of this age is voluminous and highly celebrated. Macchiavelli's fame is universal. Paruta, Guicciardini, Varchi, Segni, Cavalcanti, Bonfadio, Foglietti, and Pietro Bembo acquired great distinction. Vasari's *Lives of the Artists*, though often erroneous, and the works of Borghini and Cellini, are indispensable sources of information respecting the history of Italian art. In philosophy the greatest names are Cardano, and especially Giordano Bruno, both of whom, however, wrote in Latin.

The most eminent Italian poets of the seventeenth century are Boccalini, Marini, Francesco Redi, Graziani, Chiabrera (whose odes are specimens of great elevation of thought and diction), Forteguerri, Tassoni (the author of the mock heroic), La Secchia Rapita, Bracciolini, Lorenzo Lippi, and Filicaja (who is best remembered by his patriotic sonnets). But this century is chiefly remarkable for its successful cultivation of physical science. The great names are those of Galileo (who was compelled by an ecclesiastical tribunal to retract his astronomical theories, if not by actual torture, at least, indubitably, by the threat of torture), Torricelli, Borelli, Cassini, Viviani, Castelli, Riccioli, and Grimaldi. Campanella, who wrote chiefly in Latin, was distinguished as a philosopher. The most important historical works of this century are Paolo Sarpi's *History of the Council of Trent* and Pallavicini's refutation of that history, and the historical writings of the Jesuit Bartoli. *The Civil Wars in France* of Davila and Bentivoglio's *Wars in Flanders* had a considerable reputation, but have been superseded by the researches of later inquirers. Nanni wrote a *History of Venice*, and Capecelatro of Naples.

After the recovery of the Church from the first stunning effects of the Reformation, followed the Catholic reaction of the latter half of the sixteenth century, and the influence of Rome has ever since been steadily hostile to all progress, intellectual, moral, and material. This is plainly seen in the *belles-lettres* literature of the seventeenth and eighteenth centuries, though in other fields of intellectual effort there was in the eighteenth century a revived activity, which at least partially restored to Italy her old position as a power in European letters. In poetry and the drama the most eminent writers were Gozzi, Parini, Goldoni, Maffei, Casti, Metastasio, and Alfieri. The founder of the modern science of historical criticism, Giambattista Vico, the philosophical jurists, Filangieri and Beccaria, and the physicists and naturalists, Volta, Galvani, Scarpa, and Spallanzani, have acquired and deserved the greatest celebrity. The historical writings of Denina and Tiraboschi should also be mentioned. As a means of general culture the Italian literature of the present century has not, for Americans and Englishmen, the importance which special circumstances have given to the contemporaneous productions of German and French intellect, but its deserts are greater than its European reputation. The Italians do not do themselves justice in this as well as in many other respects; and if they have not received justice at foreign hands, it is partly because they have been too modest in claiming it. Another reason why Italian literature is little known and appreciated abroad is that, contrary to the general belief, the literary language, from its great wealth of vocabulary and combination in some fields, its poverty in others, is extremely difficult for foreigners. Manzoni, as we have seen, found it so even for a native. Few strangers ever acquire more than the merest smattering of Italian, or learn enough of it to know how ignorant they remain of its real character and capabilities. Our narrow limits of space permit us to give but a few names in the literature of this century, and in selecting these we must be guided not by the actual merit of the writers, or even by their popularity in Italy, but solely by our view of the interest they may probably possess for those into whose hands this article may fall. Since the year 1800 the Italian press has been fertile in products of perhaps higher average merit than the works of preceding centuries, though in Italy, as elsewhere, comparatively few have risen to such a decided superiority over their contemporaries as to warrant us in predicting for them a lasting place in literary history. With few exceptions, the writers best known abroad have owed their foreign reputation as well as their domestic popularity to the political tendency of their writings, and to the courage they have shown in the avowal of truths unpalatable to their rulers, not less than to the genius by which many of their productions have been distinguished. It is too soon to separate the inherent from the accidental elements of their success, and to assign to them their relative rank as exponents of the national mind and as influential causes in the development of the national consciousness, and consequently as agencies in effecting the astonishing revolutions through which Italy passed in the half century between the years 1820 and 1870. Still, there are unequivocally great names—names which Italy and the world will not "willingly let die"—in the Italian literature of the nineteenth century; and there is abundant room for the hope of continued and even greater literary achievement by the generation which is now coming upon the stage of life and of labor. The Italian writers of this century, in poetry and the drama, best known abroad are Monti (the author of the *Bassvilliana*), Pindemonte, Ugo Foscolo (*I Sepolcri*), Silvio Pellico (*Francesca da Rimini*), Niccolini (*Filippo Strozzi* and *Arnaldo da Brescia*), Leopardi (*Canti*, poems of true genius), Manzoni (*Conte di Carmagnola*, *Adelchi*, *Inni Sacri*, and the famous lyric *Il cinque Maggio*), Berchet (lyrics), Grossi (*I Lombardi alla prima Crociata*), Tigri (*Le Selve*), Spolverini (*La Riseide*), Arici (*La Pastorizia*), Giusti, the genial satirist. Of more purely national reputation, though not always by any means of inferior merit, are the poems of Ricci, Sestini, Bagnoli, Mameli, Aleardi, Prati, Mamiani, Montanelli, Cosenza, Mesdames Savio-Rossi, Colombini, and Fuà-Fusinato, and the *improvvisatori* Regaldi and Miss Giannina Milli. Acting plays have been very numerous, but they have met a discouraging competition in translations from the modern French drama. Nota's comedies, though of little power, continue to be represented occasionally. Ferrari and Gherardi della Testa have met with merited success, and at the present day the plays of De Renzis are deservedly very popular, and give promise of much future excellence. Upon the whole, the Italian prose literature of this century is entitled to rank relatively higher than its poetry or its stage plays. Foremost in narrative fiction stands the *Promessi Sposi* of Manzoni. Rosini (*La Monaca di Monza*), Grossi (*Marco Visconti*), Azeglio (*Ettore Fieramosca* and *Niccolò dei Lapi*), Guerrazzi (*Assedio di Firenze*), are successful authors of historical novels of the same school, all which, as well as Botta's *Storia della Guerra dell' Independenza degli Stati Uniti*, and *Storia d'Italia;* the historical works of Cesare Balbo; Colletta's *Storia del Reame di Napoli;* Farini's *Lo Stato Romano dal 1815 al 1850;* Brofferio's *Storia del Piemonte;* Gioberti's *Primato d'Italia*, *Del Rinnovamento Civile d'Italia*, and other works; Amari's *I Vespri Siciliani;* Cicognari's *Storia della Scultura*, and the archæological works of Micali, Inghirami, Canina, and Fabretti—are well known abroad. The Italian prose work

of this century which has had the widest circulation in Europe is *Le Mie Prigioni* of Silvio Pellico, and we believe that in modern times no single volume has produced a more profound impression in Europe or occasioned more important moral and political results than this. It secured for Italy the sympathies of the civilized world; and, though years of misgovernment were still to be endured, though the concurrence of many other causes was necessary to effect the final liberation of the Peninsula from foreign sway, yet it was the *Prisons* of Pellico which gave to Austrian domination the mortal blow. In politics and political economy Minghetti's *Opuscoli Letterari*, especially his remarkable *Letters on Religious Liberty*. To this period also belong the works of Giordani, criticism and correspondence; Botta, history of Italy and of the American Revolution; Micali, ancient history of Italy; Laura Mancini and Madame Ferrucci, in poetry; Mamiani, in philosophy; Pietro Thouat, education and tales; Litta, family history; Balbo, history and political economy; Aleardo Aleardi, poetry; Montanelli, memoirs; Emiliano Giudici, literary history; Ranalli, æsthetics and criticism; Vannucci, history; Bianciardi, Lozzi, Bon Compagni, political literature; Ausonio Franchi, Spaventa, Scialoja, in philosophy; De Sanctis, Settembrini, Pitré, Comparetti, Salvatico, De Gubernatis, in criticism; Boccardo, Maestri, Errera, political economy; Temistocle, Gradi, tales. The works of Romagnosi and of Gioja, all of which appeared before the great revolution of 1859–60, are entitled to special notice. This auspicious event released the Italian intellect and the Italian press, except in the pontifical states, from shackles which had fettered them for many centuries, and there is now great activity in every department of literature. The most fertile and voluminous, as well as popular, historical writer of the present era is Cesare Cantù. Ricotti, La Lumia, Amari (*Storia dei Musulmani in Sicilia*), Giudici, Azeglio (*Ricordi e Corrispondenza*), Vannucci (*I Martiri della Libertà*), Bon Compagni (*Chiesa e Stato*), Bianciardi (*Storia dei Papi* and *Prior Luca*), Zini (*Storia d'Italia*), Cibrario (*Storia della Schiavitù*), Zamboni (*Gli Ezzelini e gli Schiavi*), Pomponio Leto (a fictitious name, *Il Concilio Vaticano*), are writers of interest and importance. We must here notice the *Spagna* of De Amicio, a volume of travels remarkable for a degree of descriptive talent and easy liveliness of style rare in Italian prose. In political economy the works of Cattaneo, De Rossi (in French), Minghetti (*Economia Politica*), Cibrario (*Economia Politica del Medio Evo*), Celestino Bianchi (*Storia Diplomatica d'Italia*), Boccardo, Lozzi (*Ozio in Italia*), Sclopis (*History of Italian Legislation*), Brofferio (*Storia del Parliamento Subalpino*), and Mazzini are conspicuous. In physical, mathematical, and natural science, Malloni, Plana, Matteucci, Secchi, Schiaparelli, Donati, Menabrea, Sella, Boccardo, Lioy, Parlatore, Delpino, Stoppani, Gastaldi, Cappellini, Negri, are distinguished names, though their labors do not belong wholly to the present generation. In theoretical as well as practical engineering, and especially in hydrology, the Italians have long been very eminent, and Europe has had no abler writers in this department than Mangotti, Paleocapa, and Lombardini. In prose fiction Suñer, Bersezio, Barrili, and Caterini Percoto are distinguished. Linguistic science, new everywhere, and emphatically so in Italy, is ably represented by Peyron, Gorresio, Orcurti, Fabretti Amari, De Gubernatis, Arcoli, Flecchia, Teza, Lignani, Caix. Intellectual and moral philosophy has found an able cultivator in Mamiani.

Many of the ablest Italian writers of the present day—we will mention Bonghi and Messedaglia as conspicuous examples—are known chiefly through essays in periodicals, occasional academical discourses, and parliamentary reports. The periodical literature of Italy has long been very highly respectable, and the *Antologia*, established by Vieusseux, rose even to the rank of a political power, or at least influence, in Italy. The publication has been resumed, and it is ably supported. The *Politecnico*, long under the direction of Cattaneo, has always been a very important scientific periodical. The *Rivista Europea* is also excellent. A vast amount of most important Italian literary and historical material is accessible only in large miscellaneous collections, such as the *Archivio Storico*, the *Relations of the Venetian Ambassadors*, and others to which we have already alluded. An encyclopædic work, historical, descriptive, and typographical, is now publishing under the title *L'Italia*, and will extend to twenty or more large octavos. But no thorough knowledge of Italy, ancient, or modern, can be attained without a constant resort to the labors of foreign scholars. The principal English contributions to our knowledge of Italy are by Roscoe, Napier, Rawdon Browne, and Trollope. The German works of Niebuhr, Mommsen, Ihne, and, for the Middle Ages especially, Burckhardt and Gregorovius (*Geschichte der Stadt Rom*), are indispensable. Recent works useful to foreigners are the literary histories of De Sanctis and Settembrini, Marc Monnier (*L'Italie est elle la Terre des Morts*), and Amedée Roux. For Sicilian literature the writings and collections of Pitré and Di Giovanni are indispensable. There is thus far no grammar or dictionary of the Italian language which at all satisfies the requirements of modern philological science. Many dictionaries are now in course of publication, among which we notice a series of special vocabularies in preparation under government patronage. That of Canevazzi, embracing the nomenclature of agriculture and the subsidiary knowledges, is published as far as the letter C, and is truly excellent. The amount of controversial discussion on the Italian language, and especially on the relations of the Tuscan dialect to the present and prospective *lingua comune* of Italy, is very great. We have space to notice only the labors of Tommaseo, Giordani, Gradi, Fanfani, Giuliani (*Linguaggio Vivente della Toscana*), and especially Manzoni and Bonghi. A work by the latter (*Perchè la Letteratura Italiana non sia popolare in Italia*) is particularly instructive.

George P. Marsh.

It'aly, the central of the three great peninsulas of Southern Europe, lies between 35° 30′ and 47° 6′ N. lat. and between 6° 38′ and 18° 32′ E. lon., projecting into the Mediterranean, between the Tyrrhene and Adriatic seas, from N. W. to S. E., and united to the continent by the basin of the Po, lying between the northern extremities of these two seas and the vast semicircle of the Alps. Its *geographical* boundaries, which do not always coincide with its political limits, are—on the N., the Central Alps, which divide it from the Swiss cantons of Valais, Uri, and the Grisons, as well as from the Austrian Tyrol; on the E., first, the Oriental Alps, which separate it from the Austrian provinces of Carinthia, Carniola, and Croatia, then the river Arsa in Istria, the Gulf of Quarnero, and finally the Adriatic Sea; on the S., the Ionian Sea; on the W., the Tyrrhene and Ligurian seas, the Var, and the Western Alps, the latter of which, together with the lower course of the Var, separate it from France. *Politically*, the western boundary is not the Var, but the Roga. The northern, the precise outline of which should be indicated by the crest of the Alps, falls much lower on their southern slope at the point where the canton Ticino and a part of the Grisons (Swiss) form the frontier for a distance of about 296 miles, and the Tyrol and the Trentino (Austrian) for 250 miles; to the E. a line of 340 miles separates Italy from Goritz, Trieste, and Istria, which also belong to Austria. Geographical Italy is divided into three great sections: (1) Northern Italy, which includes all the strictly continental portion—that is, Venice, Lombardy, Piedmont, and Liguria, with no islands except the small Venetian group in the Adriatic; (2) Central Italy, including about one-half the Peninsula properly so called, with the ancient Etruscan, Umbrian, and Latin territories, with the island of Corsica (politically French), and with the Tuscan and Circean archipelagoes (Elba, Caprara, Gorgona, Giglio, Ponza, Ventotena); (3) Southern Italy, or the remaining portion of the Peninsula, including the Samnite, Apulian, and Calabrian districts, the large islands of Sardinia and Sicily, and the smaller, which compose the Parthenopean and Eolian archipelagoes in the Tyrrhene (Isthia, Procida, Capri, Lipari, Vulcano, Stromboli, etc.), the Calipsean Archipelago in the African Sea (Malta, Gozo, etc.), and the Diomedean Archipelago in the Adriatic. The length of the Peninsula is 831 miles; its mean breadth 138 miles. The total superficies of geographical Italy is 129,570, that of political Italy, about 114,300 square miles. The extreme points of the Peninsula, in the direction of its greatest length from N. W. to S. E., are—Mont Blanc in the Pennine Alps, and Cape Spartivento in Calabria; in the properly continental part, from W. to E., the Cottian and the Julian Alps; and, following the curve of the Alpine chain, Monte dello Schiavo on the Mediterranean, and the Bittoray on the Adriatic; and, finally, in the peninsular portion, the greatest breadth is between Monte Argentaro on the Tyrrhene and the promontory of Ancona upon the Adriatic.

Internal Divisions, their Area and Population.—The territories *geographically* Italian are—

	Surface in square miles.	Population.
The kingdom of Italy	114,290.85	26,801,154
Trieste, Istria, Goritz	3,291.	541,758
Cisalpine Tyrol	6,007.	518,059
Cisalpine Switzerland	1,362.	131,256
Nice	1,065.	122,362
Corsica	3,377.	259,861
Malta	144.	136,339
Monaco	8.88	7,080
San Marino	24.59	7,080
Total	129,570.32	28,525,496

The kingdom of Italy is divided into 69 provinces, subdivided into 197 circuits (*circondari*), and 97 districts (in Venetia), which together comprehend 8382 *communes* or

townships, distributed over the following natural, ethnographical, and historical sections: (1) In Northern Italy—Lombardy, between the Ticino, the Mincio, the Po, and the Alps; Venetia, lying E. of Lombardy, between the Mincio and the Adriatic, the Alps, and the Po; Piedmont, on the W., between the Ticino, the Alps, and the Apennines; Liguria, between the Apennines and the sea; Emilia and Romagna, on the S. of the Po, between Piedmont on the W., the Adriatic on the E. and the Apennines on the S. (2) In Central Italy—Tuscany, between the Apennines and the Tyrrhene Sea; Latium, S. of Tuscany, in the middle and lower basin of the Tiber; Umbria and the Marches, the first in the upper basin of the Tiber, the second between the Apennines and the Adriatic. (3) In Southern Italy, the ex-Neapolitan states, which comprise all the region S. of the Tronto on the eastern coast, and S. of Terracina on the western. The 69 provinces are grouped into 16 compartments, of which the following table shows the population (according to the two latest censuses) and the superficies:

Compartments.	Number of townships.	Population.		Increase per cent. of pop. in ten years.	Superficies in sq. miles.	Inhabitants to sq. mile.
		1861.	1871.			
Piedmont	1487	2,764,263	2,899,564	4.89	11,300.64	256
Liguria	317	771,473	843,812	9.38	2,055.67	410
Lombardy	1965	3,261,000	3,460,824	6.13	9,083.70	380
Venetia	795	2,340,280	2,642,807	12.93	9,059.34	291
Emilia	323	2,005,834	2,113,828	5.38	7,920.87	266
Umbria	173	513,019	549,601	7.13	3,819.47	140
Marches	249	883,073	915,419	3.66	3,746.59	245
Tuscany	278	1,967,067	2,142,525	8.92	9,286.85	228
Latium	227	750,415	836,704	11.50	4,601.20	160
Abruzzi and Molise	456	1,212,835	1,282,982	5.78	6,675.71	192
Campania	614	2,625,830	2,754,592	4.90	6,941.30	399
Apulia	236	1,315,269	1,420,892	8.03	8,539.78	167
Basilicata	124	492,959	510,543	3.57	4,121.99	123
Calabria	410	1,140,627	1,206,302	5.76	6,662.97	181
Sicily	360	2,391,802	2,584,099	8.04	11,290.05	247
Sardinia	368	588,064	636,660	8.26	9,398.46	67
Kingdom of Italy	8382	25,023,810	26,801,154	7.10	114,304.59	234

The following is a table of the population according to the last two censuses (1861–71), of the superficies, and of the number of inhabitants to the square mile in the single provinces, with the number of townships comprised in each, and with the proportionate increase of the population in ten years:

Provinces and compartments.	Number of townships.	Population.		Increase per cent. of pop. in ten years.	Superficies in square miles.	Inhabitants to sq. mile.
		1861.	1871.			
Alexandria	344	645,607	683,361	5.85	1,951.70	350
Cuneo	263	597,279	618,232	3.51	2,755.07	222
Novara	438	579,385	624,985	7.87	2,526.33	247
Turin	442	941,992	972,986	3.29	4,067.52	237
Piedmont	1487	2,764,263	2,899,564	4.89	11,300.52	256
Genoa	210	650,143	716,759	10.25	1,588.58	451
Port Maurizio	107	121,330	127,053	4.72	467.08	271
Liguria	317	771,473	843,812	9.38	2,055.66	410
Bergamo	306	347,235	368,152	6.02	1,087.53	329
Brescia	285	434,219	456,023	5.02	1,643.85	277
Como	518	457,434	477,642	4.42	1,050.12	455
Cremona	135	285,148	300,595	5.41	631.16	183
Mantua	67	262,819	288,942	9.94	950.93	112
Milan	313	948,320	1,009,794	6.48	1,125.58	890
Pavia	263	419,785	448,435	6.82	1,292.74	346
Sondrio	78	106,040	111,241	4.90	1,261.62	88
Lombardy	1965	3,261,000	3,460,824	6.13	9,043.53	380
Belluno	66	167,229	175,282	4.82	1,270.95	137
Padua	103	304,762	364,430	19.58	754.00	482
Rôvigo	63	180,647	200,835	11.18	650.23	308
Treviso	96	308,483	352,538	14.28	941.15	374
Udine	180	440,542	481,586	9.32	2,515.33	191
Venice	51	294,450	337,538	14.63	848.66	368
Verona	113	316,493	367,437	16.10	1,060.60	346
Vicenza	123	327,674	363,161	10.83	1,016.36	357
Venetia	795	2,340,280	2,642,807	12.93	9,057.32	292
Bologna	58	407,452	439,232	7.80	1,390.63	315
Ferrara	16	199,158	215,369	8.14	1,010.33	213
Forli	40	224,463	234,090	4.29	719.06	325
Modena	45	260,591	273,231	4.86	965.82	282
Parma	50	256,029	264,381	3.27	1,250.60	211
Piacenza	48	218,569	225,775	3.30	965.80	234
Ravenna	21	209,518	221,115	5.54	742.57	297
Reggio-Emilia	45	230,054	240,635	4.60	876.11	274
Emilia	323	2,005,834	2,113,828	20.515	7,920.92	268
Perugia	173	513,019	549,601	9.633	3,719.47	147
Ancona	51	254,849	262,349	1.907	736.44	356
Ascoli-Piceno	71	196,030	203,004	2.095	810.25	250
Macerata	54	229,626	236,994	7.736	1,056.61	223
Pesaro and Urbino	73	202,568	213,072	2.964	1,114.24	190
Marches	249	883,073	915,366	9.703	3,717.54	246
Arezzo	41	219,559	234,645	6.87	1,277.60	183
Florence	78	696,214	766,824	10.14	2,367.56	323
Grosseto	20	100,626	107,457	6.79	1,686.78	065
Leghorn	5	116,811	118,851	1.75	108.56	1085
Lucca	22	236,161	280,399	9.46	576.52	486
Massa-Carrara	35	140,733	161,944	15.07	687.22	235
Pisa	40	243,028	265,959	9.44	1,179.95	229
Siena	37	193,935	206,446	6.45	1,465.04	134
Tuscany	278	1,967,067	2,142,525	8.92	9,349.23	229
Latium	227	750,415	836,704	11.50	4,601.10	116
Aquila	127	309,451	332,784	7.54	2,509.65	132
Campobasso	134	346,007	364,208	5.26	1,777.56	205
Chieti	121	327,316	339,986	3.87	1,114.80	305
Teramo	74	230,061	246,004	6.93	1,283.68	192
Abruzzi & Molise	456	1,212,835	1,282,982	5.78	6,685.69	192
Avelino	128	355,621	375,691	5.64	1,408.77	266
Benevento	73	220,506	232,008	5.22	692.22	345
Caserta	185	653,464	697,403	6.72	2,206.86	316
Naples	69	867,983	907,752	4.58	401.41	2261
Salerno	159	528,256	541,738	2.55	2,130.84	254
Campania	614	2,625,830	2,754,592	4.90	6,840.10	402
Bari	53	554,402	604,540	9.04	2,292.24	263
Foggia	53	312,885	322,758	3.16	2,953.04	109
Lecce	130	447,982	493,594	10.18	3,293.33	149
Apulia	236	1,315,269	1,420,892	8.03	8,538.62	166
Potenza	124	492,959	510,543	3.57	4,121.89	123
Catanzaro	152	384,159	412,226	7.31	2,306.98	178
Cosenza	151	431,922	440,468	1.98	2,840.93	155
Reggio, Calabria	107	324,546	353,608	8.95	1,514.95	233
Calabria	410	1,140,627	1,206,302	5.76	6,662.86	181
Caltanisetta	28	223,178	230,066	3.09	1,455.13	158
Catania	64	450,460	495,415	9.98	1,969.95	251
Girgenti	41	263,880	289,018	9.53	1,491.01	193
Messina	99	394,761	420,649	6.56	1,767.95	238
Palermo	76	584,929	617,678	5.60	1,964.07	314
Syracuse	32	259,613	294,885	13.59	1,427.45	206
Trapani	20	214,981	236,388	9.96	1,214.48	194
	360	2,391,802	2,584,099	8.04	11,290.04	229
Cagliari	258	372,097	393,208	5.67	5,256.90	74
Sassari	110	215,967	243,452	12.73	4,141.55	58
Sardinia	368	588,064	636,660	8.26	9,398.45	67

Physical Geography.—A. *Seas and Coasts of Italy.*—That part of the Mediterranean which washes Italy and her islands is divided into five principal arms: (1) The Tyrrhene or Lower Sea, embraced between the Peninsula and the islands of Corsica, Sardinia, and Sicily. This is the greatest expanse of Italian sea, and may almost be regarded as a vast lake nearly everywhere surrounded by Italian soil; (2) The Adriatic or Upper Sea, between Italy and the territory of the Slaves (Illyria, Dalmatia, Albania); (3) The Ionian Sea, between Italy, Sicily, and Greece; (4) The African or Libyan Sea, between Sardinia, Sicily, and Africa; (5) The Ligurian Sea, between Liguria, Corsica, Sardinia, France, and Spain. The greatest depth of the western basin of the Mediterranean is 10,500 feet, between Sicily and Africa. The eastern basin is of much greater depth; according to Capt. Spratt, 15,092 feet between Malta and Crete. The bottom of the Adriatic is a great plain sloping downward from Italy towards the Illyrian, Dalmatian, and Istrian coasts, but the degree of inclination varies greatly, being very slight, almost insensible, near the outlet of the Po, becoming gradually more rapid towards the S. The great Mediterranean current, which carries the waters of the Atlantic from W. to E., creates two minor currents properly Italian: one enters the Adriatic, follows along the coasts of Dalmatia and Istria as far as Trieste, then doubling it sweeps along the Italian coast from Venice to Apulia, and so returns into the great basin from whence it set out; the other, entering through the Straits of Messina, flows into the Tyrrhene Sea, washes the western shore of the Peninsula till it reaches the Ligurian Gulf, then turns towards Provence and Spain in a direction opposite to that of the great current of immission from the Atlantic to the Mediterranean. Besides these two principal currents, other secondary ones exist in the Italian seas: that which, flowing from N. to S., touches the western coasts of the same islands, and finally encounters that before mentioned in the Strait of Bonifacio, which for this reason is dangerous to navigation; that which arises from the change of direction undergone in the African Sea by the general current, which should tend eastward, but, first broken by the Egades, then divided by the western angle of Sicily, separates into two arms, the one directing itself into the channel of Malta; the other, coasting along the promontory of Pachino and the western

shore of Sicily, finally unites with the so-called Ionian current, which enters into the Channel of Faro; the other arm of the Sicilian current diverges from the northern line of the island, barely touching its many gulfs, then bending toward the E., strikes the Eolian Islands, to lose itself in the Tyrrhene shore-current. With regard to the velocity of the Italian currents there are as yet no very positive data. Montanari calculates it at 0.16 of a foot per second. Cialdi estimates it at a mean of half a mile per hour. Minard says that the great Mediterranean current on the coast of Algeria was found to have a velocity of 0.95 foot per second, and in some places even of 1.64 feet per second, but that it diminishes in swiftness during its vast course, and that on the coast of France it is not more than 0.25 foot per second. Marmocchi gives to the proper Italian currents only a velocity from 4 to 6 miles in twenty-four hours; but he observes that in the channels and around the capes it is much greater. In the Ligurian Sea, according to my observations, it is never found to exceed from 1.60 to 2 inches per second; but all the ports on the Tyrrhene coast which open towards the E. have a tendency to shoal up. The number of degrees of longitude included in the Mediterranean is too small to allow this sea to have great tides. They are more sensible in the Straits of Messina (where the flow rises to 26.40 inches), in the Neapolitan waters (from 6 to 8 inches), and in the Venetian gulf (5.40 feet). The water of the Mediterranean is reputed to be more salt than that of the Atlantic; the observations of Borrillon la Grange give it double the quantity of saline matter. But near the shore the saltness is, in many places, diminished either by the action of rivers and torrents, or by that of fountains or springs of fresh water which are thrown up from the bed of the sea by natural siphons; and upon the whole it is impossible to estimate the proportion of saline matter in the waters of this sea with any precision. The most celebrated of these submarine springs is that which wells up in the Gulf of Spezia about a mile from the shore, and with such force that the fresh water rises several inches above the surface of the sea, and forms a convex swell about 20 feet in diameter. With regard to the temperature of the Italian seas, Marsiglia has observed that the mean for the months of December, January, February, March, and April is between 50° and 52° F., while in June it does not exceed 44.6°. Thus, the Mediterranean is a powerful compensatory agent in tempering the severity of winter and the heats of summer. The Italian seas have always been renowned for their azure color, and for a transparency which reflects as in a limpid mirror the beautiful hues of the sky. The phosphorescence of the water is remarkable, and according to an ingenious suggestion of Mr. G. P. Marsh, may have increased during the historic period, since the greater destruction of cetaceans and predaceous fish in modern times favors the multiplication of the lower marine organisms upon which the former feed, and whose bodies produce, in part at least, this phenomenon. The coast of the Italian Peninsula has a linear extension of 3237 miles—960 in the Adriatic, 1030 in the Ionian and Libyan seas, 750 in the Tyrrhene, and 495 in the Ligurian. The coast-line of the larger islands measures 928 miles. Setting out from the extreme W. boundary, we come first to the port of Nice (no longer Italian), a small harbor excavated by Charles Emanuel III. and Victor Amadeus. About a mile to the E. follow the gulfs of Villafranca and of Sant' Ospizio, then the little port of Monaco, between which and the town of Mentone rises Cape San Martino. Still continuing eastward, Capes Bordighera and Borghetto follow successively, then the gulf of the Ospitaletti, the *road* of San Remo, the beaches of Cervo and of Diana, the bays of San Stefano and of San Lorenzo, the landing of Porto Maurizio, the port of Oneglia, the Gulf of Diano Marina. Between Cape delle Mele and the little island of Albenga are the shores of Alassio and Langueglia, which afford good anchorage. A vast gulf, at the bottom of which lies Albenga, extends from the island of Gallinara to Cape Noli; then comes the open bay of Finale Marina. To this succeed the excellent roadstead of Vado, the little port of Savona, and from thence to Genoa a line of coast which the industry of the inhabitants has converted into a continuous shipyard in which hundreds of ships are frequently on the stocks at the same time. The spacious artificial harbor of Genoa (about 320 acres, or one-half a square mile of water-surface) has to the E. a coast-line which, as far as the promontory of Portofino, affords neither roadstead nor anchorage except the landing of Camogli. The Gulf of Rapallo, the little bay of Portofino, that of Carlo Alberto, the not easily accessible landing of Chiavari, the coast of Sestri Levanti, Cape Manara, Cape Rospo, the landing of Framura, the Cape of Montegrosso, the Bay of Bonassolo, the beach of Levanto, Cape Mesco, the landing of Monterosso, the rugged rocks of Vernazza, Corniglia, Manarolla, Riomaggiore, are the principal features until we reach the magnificent Gulf of Spezia, the great naval arsenal of Italy. To this succeed the Tuscan coasts, with the little port of Viareggio, with the shoals caused by the deposits of the Arno, the shallow roadstead of Leghorn, opposite which on a rock rises the historic tower of the Meloria. We shall further notice Cape Cavallo, the mouth of the Cecina, Port Baratto, the promontory of Popolonia, the harbor of Piombino, the large basin of Grosseto, the marshy coast of Pian d'Alma, the Gulf of Castiglione della Pescaja, the headland of Talamone, the fifty-mile basin of Orbetello, the three picturesque rocks called the "Ants" (*Le Formiche*) of Grosseto, the promontory of Argentaro, with the harbors of Santo Stefano and Port' Ercole. Following a monotonous and somewhat treacherous line of coast, we come upon the harbor of Civita Vecchia, then the headland of the Marimella or Cape Linaro, then Fiumicino and the well-known Roman sea-coast formed by the alluvium of the Tiber, the Cape of Anzo, the harbor of Neptune, the little promontory of Astura, Mt. Circello (which, rising from a low isthmus, looks like an island when seen at a distance). From Terracina the Neapolitan coast commences with the Gulf of Gaeta, Cape della Rocca, and 25 miles farther to the S. the Bay of Naples, the islands of Ischia and Capri, Capes Mesa and Miseno, the Gulf of Baia, the port of Pozzuoli, the rocky headland of Algalone, that of Posilipo, the rock of Castel del Novo, the harbor of Naples, Castellamare, and Cape Campanella, where the Neapolitan gulf terminates and that of Salerno begins, itself ending at Cape Licosa. Next at the S. E. we meet Cape Palinoro, the promontory of Falconara, the Gulf of Policastro, which terminates at Cape Servero; passing this, we enter the Gulf of Santa Eufemia, in form a horseshoe, the other extremity of which is Cape Vaticano. Then follows the Gulf of Gioia, to the W. of which lie the Lipari or Eolian Islands. This gulf, measured from Cape Vaticano to the promontory of Bagnara, has an opening of 33 miles. The part of the Calabrian coast most nearly approaching Sicily is the Torre del Cavallo. Crossing the strait, we find ourselves in the Ionian Sea, having first passed the famous rocks of Scylla and Charybdis. Then coasting along Reggio, we round the promontory of Pallaro, Cape dell' Armi, and Cape Spartivento; the latter being passed, the shore curves eastward, forming the Gulf of Squillace, which terminates at Cape Rizzuto. With Cape delle Colonne opens the vast Gulf of Taranto, terminated by Cape Santa Maria di Luca, to the E. of which we enter the Adriatic. In this sea, after passing the deep inland harbor of Otranto, the beautiful Bay of Brindisi opens, and, farther on, the roadstead of Barletta and the great promontory of Gargano, which forms the spur of the Italian boot: then the Gulf of Manfredonia, the port of Viesti, the landing of Santa Croce, the rocks of Cocchiara, the mouths of the Pescara and the Tronto; then the harbors of Ancona, of Sinigaglia, Fano, Pesaro, Rimini, Cesenatico, Cervia, Ravenna, Rimaro—all small and shoaled. The valleys of Comacchio, between the mouths of the Po and the territory of Ravenna, form an immense pool, 164 miles in circuit and from 3 to 6 feet in depth, in which the famous lagoon fisheries are carried on. Having passed the many mouths of the numerous arms of the Po, and afterwards of the Adige, we reach the port of Brondolo, the low shore of Chioggia, the dunes of Palestrina, the island and the port of Malamocco, and then several other small harbors, before coming to the mouth of the Tagliamento. From this point, as far as Port Primaro, the coast-line skirts the morasses of Aquileja and of Grado. The inlet of Idoba is the mouth of the Isonzo, N. of which is the port of Alberoni, and S. E. of this lies the city of Trieste. The extreme southern point of Istria, Cape Promontore, directs us into the Gulf of Quarnero and to the town of Fiume. To complete this rapid circumnavigation of the Italian coast should be added the most noteworthy peculiarities of the coasts of the three principal islands: (1st). *Sicily.* The three angles of the Sicilian triangle are terminated by the same number of capes—that is, on the W. by Cape Boco or Lilibeo; on the S. by Cape Passero or Pachino; on the E. by Cape Faro or Peloro. The most important gulfs are those of Milazzo, Tindaro, Termini, Palermo, Castellamare, Agosta, and Catania. (2d). *Sardinia.* Capes St. Elias, Pula, Tavolaro, Argentara, Asinara are noticeable; the gulfs are those of Cagliari, Palmas, Oristano, Alghero, the Aranei; the Strait of Bonifacio separates it from Corsica. (3d). *Corsica.* Capes Corso, Cannella, Garbo or Calvi, Sanguinara or Ajaccio, Negro, Chizza, and Brogolino; the gulfs of Calvi and Ajaccio.

B and C. *Mountains, Valleys, and Plains.*—The mountains of Italy are co-ordinated into three distinct systems: I. *The System of the Alps.* This forms, beginning near Nice on the Ligurian Sea, and terminating at Fiume on the Quarnero, an uninterrupted line of about 760 geographical miles. It is divided into three main groups and nine sections. 1st Group: the Western Alps, from S. to N. and

N. to E., from the Col di Tenda to Mont Blanc, and comprising (Sec. 1st) the Maritime Alps, which, beginning near the sources of the Tanaro, extend, in a course of about 94 miles, to Monte Viso (12,567 feet). The pass of the Col di Tenda is 5890 feet. Sec. 2d, the Cottian Alps, which extend for a line of 82 miles to Mont Cenis (11,457 feet). The Col of Monginevra is 6119 feet. Sec. 3d, the Graian or Grecian Alps, for a length of 62 miles to the Col du Bon Homme on the Little St. Bernard (7185 feet); the pass of Mont Cenis is 6772 feet. The triangular knot of lofty peaks known as the Grand Paradis group, or the Cogne Mountains, lying between the valley of the Orco, the Val Savarcinche, and the pass of the Col della Nuova, may be regarded as an offshoot from the Graian Alps. It contains the two highest summits lying wholly in Italy—the Grand Paradis (13,300 feet) and the Grivola or Corne de Cogne (13,028 feet), one of the most picturesque and beautiful peaks in the whole range of the Alps. 2d Group: the Central Alps, from the pass of the Bon Homme to the peak of the Tre Signori or Drei-Herren-Spitze; they comprise (Sec. 4th) the Pennine Alps, which include the loftiest summits in Europe, Mont Blanc (15,798 feet), Monte Rosa, (15,210 feet), Mont Cervin, or the Matterhorn (14,833). Along their course of 62 miles open the passes of the Great St. Bernard (8169 feet) and the Simplon (6575 feet). Sec. 5th, the Helvetian or Lepontine Alps, extending from Monte Rosa, for a distance of 55 miles, to the St. Bernardino, with the pass of the same name (7011 feet); that of the St. Gothard (6804 feet); that of the Splügen (6942 feet); and the Maloja, overhung by a peak, 11,476 feet in height. Sec. 6th, the Rhetico-Trentine Alps, which from the St. Bernardino run to the Picco dei Tre Signori (10,118 feet), to the E. of the valley of the Adige, through a course of about 187 miles, including the passes of the Brenner (4659 feet) and of the Stelvio (9095 feet). 3d Group: the Eastern Alps, comprising (Sec. 7th) the Norican Alps, which extend for 35 miles from the Drei-Herren-Spitze to the Gross-Glockner (12,769 feet), but separating from the first of these mountains they turn towards Austria and Hungary, and no longer belong to Italy; the pass of the Sommering is 4287 feet. Sec. 8th, the Carnican Alps, about 70 miles in length, beginning E. of Trent and terminating at the Col di Tarvis. Sec. 9th, the Julian Alps, for a course of about 105 miles, terminating at Fiume. The declivities of the Alps, while they descend gently on the N. side, are rocky and precipitous towards Italy, so that while the Rhone has a fall of 5250 feet in a course of 92 miles, the Po makes an equal descent in 22 miles. From Mont Blanc to the Tyrol 400 glaciers are counted, and the whole of the vast chain abounds in them. There are some not less than from 6 to 15 miles in length and from 1¼ miles to 2½ miles in width, with a mass of ice 1640 feet deep. The valleys of Aosta and the Valtelline only have a longitudinal direction. All the other Italian Alpine valleys are normal to the chain. There are 36 of these valleys, through which flow primary rivers or their affluents. II. *The System of the Apennines.* This system separates itself from the Maritime Alps at the pass of Cadibona; then, after following a line from W. to E., turns S. and S. E., dividing the Peninsula into two great slopes, the eastern and the western. The Apennines are composed of three groups: 1st, the Northern Apennines, 182 miles in length, which, beginning at Cadibona, skirt the Gulf of Genoa, describing an arc; they are steep and rocky towards the sea, but decline gently towards the N. on the side of the valley of the Po, and extend as far as Mont Cimone. Between the sea and the Tuscan Apennines, and between the Magra and the Serchio, N. of the Arno, rises an isolated group of mountains, higher than the principal chain, which are called the Apuan or Panian Alps. The loftiest crests of this section are Monte Corsaglia (6930 feet), and Monte Cimone (6890 feet). 2d, the Central Apennines. These begin at the Cimone and end at the Velino, dividing Tuscany from the Emilia, and crossing Umbria, the Abruzzi, and the Samnite territory, with a precipitous descent towards the Adriatic, but a gentle inclination towards the Tyrrhene, and throwing out two sub-Apennine spurs, the Tuscan and the Roman. The highest peaks are the Gran Sasso d'Italia, or Monte Corno, the loftiest of the Apennines (9312 feet), Mont Amaro or Majella (9131 feet), Monte Velino (8180 feet). 3d, the Southern Apennines, which extend from Monte Velino to the extremity of Italy, dividing themselves into two branches, the western and the eastern. Their highest summits are Monte Meta (7835 feet), Monte Pollino (7070 feet) These mountains are prolonged through Sicily to Capes Lilibeo, Passéro, and Peloro. III. *The Sardo-Corsican System.*—This chain, parallel with the Apennines, culminates in the island of Sardinia at Monte Brunia di Spina (6190 feet), and in Corsica at Monte Cinto (9240 feet). Italy has but a single great plain, enclosed within the southern slope of the Alps and the northern slope of the Apennines, and determined by the course of the Po and of the other rivers which flow into the Adriatic. In fertility of soil, in facility of communication, in wealth, in civilization, and in density of population this plain has no rival in the world. The secondary plains of the Peninsula are the Tuscan, the Roman, the Campanian (Terra di Lavoro), and the Tavoliere of Apulia.

D. *Lakes.*—The lakes are divided into two groups—the Alpine and the Apennine lakes: I. *The Alpine Lakes.*—Supplied by the perpetual snows, the glaciers, and the torrents or rivers of the great chain of the Alps, these long and tortuous basins, if they have not the grandiose and solemn character of the Swiss and Scotch lakes, present a degree of beauty and grace which is not to be met with elsewhere. They are—1st, Lake Verbano or Lake Maggiore, which receives the waters of the Tosa, of the Lake of Orta, of the Maggia, of the Ticino, of the Tresa (which issues from Lakes Ceresio and Lugano), and the small streams of Bardesio and Acquanegra, which are the outlets of the lakes of Varese, etc. It is 36 miles in length and of variable width, being in many places 7 or 8 miles broad. Its greatest known depth is 2624 feet, and as its surface is 640 feet above the sea-level, its bed is 1984 feet below that level. Its abundant waters find their outlet through the Ticino, the richest tributary of the Po. The famous Borromean Islands are in this lake. 2d, Lake Lario or Lake Como: this lake receives through the Adda the waters of the Valtelline, together with those of the Mesa and of the Liro, collected in the little Lake of Mezzola, which once formed a part of the Lario until separated from it by the deposits of the Adda. It has the form of a Y, with the tail turned toward the Alps; its length is 30 miles, with a maximum width of 3½ miles. 3d, The Benaco or Lake di Garda: this lake receives the waters of the Sarca and other small streams; is 45 miles long and from 4½ to 16 broad. The Mincio flows out of it. 4th, The smaller lakes: the Margozzo and the Lake of Orta, those of St. Bernard and of Cenis, that of Varese, the lakelets of Biandrone, Monate, and Comabbio; the Sebino or Lake of Iseo, that of Idro, etc. II. *The Apennine Lakes.*—These are almost all craters of extinct volcanoes, and may be subdivided into, 1st, the upper or central Italian lakes, which are those of Massacinecoli, Bientina, Chiusi, Montepulciano, and the larger ones of Trasimeno or Perugia, of Bolsena, and of Bracciano. 2d, the lower or southern Italian lakes. These are the Lake of Fondi in the Terra di Lavoro, of Celano or Fucino in the Abruzzi (which Prince Torlonia is now draining), Verano or Lesina, Lucrino, Agnano, Averno, Fusaro, etc.

E. *Rivers.*—The rivers of continental Italy are divided into three distinct groups: I. *Tributaries of the Adriatic.*—In the upper basin of this sea we find the Isonzo, which marks the extreme E. boundary between Upper Italy and Istria; the Corno (a name common also to several rivers flowing from the Carnican Alps, and emptying between the Isonzo and the Tagliamento), which, issuing from Monte Piettino, flows seaward from N. to S.; the Lemene and the Livenza, small streams between the Tagliamento and the Piave, the latter of which also rises in the Carnican Alps; the Brenta and the Bacchiglione, which rise in the Trentino and traverse the Venetian lagoons; the Adige, formed by the union of the emissaries of three small lakes at the pass of Finisterre (Reschen), and of many rivulets which descend from the Rhetian, Norican, and Carnican Alps. The Tyrolese call it the Etsch, and it does not take its Italian name until below Botzen, after its confluence with the Isargo (Eisach). The Adige has a course of about 230 miles. The Po (Padus or Eridanus) is the chief of the Italian rivers; its length in a straight line from its source to its mouth is 262 miles, and, including its windings, 330 miles. It takes its rise on Monte Viso at a height of 6560 feet above the level of the sea; it crosses Piedmont, divides Lombardy from Parma, Modena, and Ferrara, then enters Venetia; at Serravalle it divides into two branches; the principal arm (Po Maestro) falls into the Adriatic 28 miles S. of Venice; the other (Po di Goro) enters the sea 15 miles farther to the S. S. W. The two arms are about 20 miles in length, forming a delta furrowed by secondary channels (Po della Tolle, Po Donzella, etc.). By means of some of these streams the Po communicates on the N. with the Canal Bianco, which in its northern part takes the name of Po di Levante, and to the S. with the Po di Volano and with the Po di Primaro. At Turin the Po is still inferior in size to several of its lower affluents, but after its confluence with the Dora Baltea, which brings to it the waters of Mont Blanc, it assumes imposing dimensions. Having received the Sesia, which brings with it the waters of Monte Rosa, the Po begins to spread itself over its own alluvium, branching out between many islands; above Valenza it unites again in a single winding bed, but only to ramify anew and to form new islands after receiving the tribute

of the Tanaro; it again collects itself near the mouth of the Ticino; from the confluence of the Tidone till its junction with the Adda it once more divides into separate channels; below the Oglio its waters are re-collected within narrower limits, and thus it continues its course to the sea. Under ordinary conditions, between the Dora and the Ticino the inclination is from 19 to 32 inches per mile; between the Ticino and the Adda, from 16 to 19 inches; between the Adda and the Oglio, from 10 to 16 inches. Near the mouth of the Panaro it is reduced to 7 inches, and in its extreme lower course from 7 to $3\frac{1}{2}$ inches per mile. At its highest flood the water rises near the mouth of the Ticino 24 feet above extreme low-water mark; near Piacenza, 26 feet; at Cremona, 20 feet; at Casal Maggiore, 21 feet; at Dosolo, 27 feet; at Ostiglia, 31 feet; at Ponte Lagoscuro, 28 feet; and at Polesella, $27\frac{1}{2}$ feet. The width of the Po between the confluence of the Ticino and the Oglio is, at extreme low water, from 328 to 656 feet; in the ordinary state of the water, from 650 to 1300 feet; at the highest flood, from 2600 feet to 9850 feet. In its lower course the width, at low water, is from 328 to 656 feet; in the ordinary state of the water, from 656 to 984 feet; at the highest flood, from 984 to 4920 feet. Between the Ticino and the Oglio the Po is never fordable, the depth of the principal current being, at low water, little less than 5 feet. Below the Oglio the depth of the main current, even at extreme low water, is never less than 5 feet 10 inches. From Turin to Casale the river is navigable for boats of 8 metric quintals burden; from Casale to the Ticino, for those of 20 quintals; from the Ticino to Quatrelle (160 miles), for vessels of 1300 quintals; from Quatrelle to the sea (64 miles), for vessels of 900 quintals. The waters of the Po are always turbid from the great quantity of earth which they transport—an effect especially due to the clearing of the forests and the breaking up of the soil. This earth forms $\frac{1}{360}$th of the flowing mass. The quantity of alluvial deposit at its mouth is an annual volume of 40,000,000 cubic feet, extending the delta at a mean of 230 feet, and forming a flat which, in the progress of centuries, will fill up that part of the sea. The tributaries of the Po are, on the left, in Piedmont—the Ghiandone, Rivosecco, Chisone, Chisola, Sangone, Dora Riparia, Stura, Orco, Dora Baltea, Sesia, Agogna; in Lombardy—the Ticino, Olona, Lambro, Adda, Oglio, Mincio; on the right, in Piedmont—the Bronda, Rivotorto, Vraita, Macra, Stellone, Tanaro, Scrivia, Carone, Staffora; in the Parmesan territory—the Tidone, Trebbia, Nure, Arda, Ongina, Taro, Parma, and Enza; in the Modenese—the Crostolo, Secchia, Panaro; in the ex-pontifical provinces—the Reno, Idice, Sillaro, Lanternio, Senio. Other smaller tributaries of the Adriatic are—the Lamone, Montone, Roneo, Savio, Rubicone, Marecchia, Marano, Conea, Foglia, Metauro, Cesano, Misa, Esino, Musone, Potenza, Chienti, Tena, Tesino, Tronto, Vomano, Pescara, Sangro, Bifermo, Fortore, Ofanto. II. *Tributaries of the Ionian Sea.*—These are the small streams of the ancient Lucania, the Bradano, the Vasente, the Salandrella, the Agri, and the Sinno; and of Calabria, the Crati and the Neto. III. *Tributaries of the Mediterranean.*—Beginning from the W., the Var (swollen by the Tinea and by the Vesubia), the Paglione, the Roja, the Nervia, the Taggia, the Impero, the Andora, the Letimbro, the Polcevera, the Bisagno, the Entella, the Magra, the Serchio, the Arno (swollen by the Chiana, by the Sieve, by the Greve, by the Ombrone of Pistoja, by the Nievale, by the Pesa, by the Elsa, and by the Era), the Cecina, the Ombrone of Siena, the Tiber, the Liri or Garigliano, the Volturno, and other smaller ones. The rivers of the islands are—in Sicily, the Alcantara, Giaretta, Salso, Platani, Belici, Termini, Fiumegrande, Pollina; in Sardinia—the Tirso, Coghinas, Flumendosa, Mannu; in Corsica—the Golo, Tavignano, Lamone, Gravono, Valinco.

Geology and Mineralogy.—Few countries in the world present such interest and variety to the student of geology as Italy. The centre of the Alpine region is generally of granite rock, often intermixed with schisto-micaceous, talcose, and amphibological formations, or with calcareous formations, most frequently saccharoidal, with straws or flakes of mica. The slopes are covered with Tertiary strata. The Apennines, as far as Calabria, are a huge mass of calcareous and serpentine rock and of graywacke, upon which lie deposits, of considerable thickness, from the Jurassic period, composed of gypsum, with beds of sulphur. Farther from the central axis of the chain, upon the opposite slopes, rest vast Tertiary deposits containing many fossil shells, some of which are identical or similar to those now living in the Italian seas. The more southern of the Apennines are composed of granite rock, covered with secondary deposits. The most noteworthy geological feature of Italy is its volcanic system. In the eastern part of the plain of the Po, between the Adige and the Brenta, rises the group of the Euganean hills which, at Monte Berici, reunites itself to one of the principal spurs of the Alps; its highest peak is Monte Venda, 1920 feet. In the S. of Tuscany is the group of Santa Fiora; then that of Viterbo and of Rome; afterwards those of Sant' Agata, of Rocca Morfina, and of Naples. Here towers Vesuvius with its Campi Flegrei (Phlegræian Fields), the only active volcano on the European continent. But the giant of the Italian volcanoes is Etna in Sicily, 10,830 feet in height, with a base 112 miles in circumference. The Lipari or Eolian Islands are also volcanic; among these Stromboli is in perpetual eruption, intermitting once in fifteen minutes. Ancient craters are found throughout the whole chain of the Apennines, and the territories of Arezzo, Perugia, Spoleto, etc. form one of the most notable examples of broken surface which volcanic action has impressed upon the face of our planet. Gaseous, saline, and limous eruptions also abound in Italy, as well as thermal springs. The calcareous and metamorphic rocks of the Alps and Apennines furnish the most beautiful marbles; among these we may mention those of the Vicentino, the sea-green of the Bocchetta, the gold-veined of Porto Venere, the statuary marble of Carrara, the jasper of Barga, the green marbles of Tuscany, the black of Pistoja, the lapis-lazuli and the giallo of Siena, and the broccatello of Piombino. We should notice also the alabaster of Volterra, the porphyries and rock-crystals of Aosta, the agates and chalcedonies of Tuscany, the lavas and basalts of the volcanic districts, the sulphur and the alum. Unfortunately, the best qualities of fossil combustibles are wanting, but lignite and peat are abundant. Pozzolana is found in great quantities near Rome and Naples; iron also in many places, and especially in the island of Elba; lead and galena in Sardinia; fossil salt in various places; also thin veins of gold, silver, mercury, zinc, antimony, etc.

Climate.—Local conditions with regard to altitude, position, and proximity to the sea have more influence than latitude in determining the annual isothermal lines and the range of the monthly means of temperature in Italy. In general, the coldest month is January—the thermometer sometimes falling to 3.2° above zero of Fahrenheit at Moncalieri near Turin, and to zero F. at that city, to 14° above zero at Urbino, to 15.8° at Perugia, to 26.6° at Catanzaro—and the warmest month is July, the thermometer rising to 97° F. at Lugano, to 96° at Moncalieri, to 92° at Urbino, and to 93° at Catanzaro. In Northern Italy the mean temperature of the month of April is a little above the annual mean, and in October a little below, while in Central and Southern Italy the case is reversed—that is, the mean of October is a little above, and the mean of April a little below, the annual mean. If we compare certain extreme points, we shall find at Udine (lat. 46° 3′) the annual mean is about 56° F.; at Syracuse (lat. 39° 3′), about 65°. Observing certain middle stations, we find at Genoa (lat. 44° 25′), as annual mean, 61°; at Florence (lat. 43° 16′), annual mean, 59°; at Bologna (lat. 44° 30′), annual mean, 58°. At intermediate stations between the means and the extremes we have, at Milan (lat. 45° 28′), an annual mean of 56.6°; at Venice (lat. 45° 25′), an annual mean of 56°; at Rome (lat. 41° 53′), annual mean, 60°; at Naples (lat. 40° 52′), annual mean, 61.5°. The isochimenal lines of those stations which, like Alexandria, Turin, Pavia, Milan, Guastalla, and Modena, are situated near the longitudinal axis, and at the bottom of the valley of the Po, are much more depressed than the more northern but better sheltered positions of Aosta, Biella, Lugano, and Udine. Although differing widely in latitude, there is a close approximation in the mean winter temperature between Chioggia and Urbino, between Rome and Leghorn, Genoa and Naples, San Remo and Catanzaro. The isothermal lines of the above-mentioned places, lying along the axis of the valley of the Po, are more elevated than those of the maritime districts of Liguria and Tuscany; Genoa has the summer mean of Naples, Palermo that of Ancona. The barometric pressure is in direct ratio with the latitude. It is at its maximum in winter, at its minimum in the spring, being in summer a little below the annual mean, and in the autumn above it. The maximum of the mean monthly pressure falls in February, and the minimum suddenly follows in March. Except in cases of violent perturbations the pressure continues to diminish from nine in the morning till three in the afternoon; the difference is less in winter than in summer, less in the N. than in the S., less near the sea than inland. The quantity of water falling in the form of rain and snow is greatest in the Præalpine districts—Biella, 41.41 inches; Lugano, 63.2 inches; Udine, 50.78 inches. At the more elevated stations—Urbino, 39.8 inches; Perugia, 39 inches; Mondovi, 34.9 inches; and in some of the bays formed by the lofty chains, where the sea-winds meet and discharge themselves of their vapors—Genoa, 52.8; Florence, 49.2; at Naples, 34.7. The most rainy season is the autumn, espe-

cially October. The driest months are, in winter, January and February; in summer, July. In the N. and in the interior it rains more in the summer than in the winter; the reverse is true on the sea-coast and in the S. In the mountainous regions during October and November heavy rains sometimes fall in the course of a few days, producing disastrous inundations. In Oct., 1872, there was a rainfall at Domodossola of 34.2 inches; at Biella, of 25.5 inches; at Genoa, 28 inches; at Florence, 16 inches. In January, and in the winter generally, the sky is somewhat more covered than in the other months, especially in the valley of the Po and in most of the Apennine valleys. The prevailing direction of the wind, although very variable, is from the seashores toward the interior of the Peninsula. In July, and in the summer generally, the sky is clearer than during the rest of the year; the prevailing winds, always changeable, blow from inland toward the sea-coasts. In April the clearness of the sky is somewhat less than the annual mean, and is still less in the month of October, especially in the great valley of the Po. The direction of the wind is most variable in the spring and in the autumn.

PUBLIC ECONOMY. A. *Agriculture.*—There are three great distinctive agricultural districts in Italy: (1) The plain of the Po—very fertile, with regular and systematic cultivation; (2) the declivities and valleys of the Apennines, on the two slopes of the Peninsula—the region of the olive; (3) the pasture-lands, which, in their turn, are subdivided into alpine pastures and the pastures of the plains; in the latter the grass-lands are often interspersed with rice-fields and marshes, the malaria from which depopulates the country. This is especially true of the rich lands of Lombardy, of the Roman Campagna, the Pontine Marshes, and of Sardinia. The productivity of the soil might be greatly increased if the agricultural methods and tools employed were less antiquated, and if the whole country would keep pace with the progress already made in Lombardy and Piedmont. Of the 71,630,000 acres which form the kingdom of Italy, 59,280,000 are classed as productive, the rest as barren. Two-fifths, or 27,170,000 acres, consist of arable land, with or without the vine; 3,408,000 of natural or artificial meadow; 426,000 of rice-lands; 1,235,000 of the olive; 1,235,000 of the chestnut; 12,350,000 of forest; and more than 12,350,000 of pasture-ground. The annual produce of cereals is about 210,160,000 bushels—wheat, 106,784,000; maize, 49,700,000; rye, 7,952,000; barley and oats, 23,004,000; rice, 4,144,000. In abundant years the supply exceeds the consumption, in average years it is hardly equal to it, and in years of scarcity falls short by about one-tenth. To this, however, should be added 15,336,000 bushels of chestnuts, 27,224,000 bushels of potatoes, and 11,928,000 bushels of vegetables. The products which have the most commercial importance are—silk, valued at about $26,000,000; wine, amounting to about 780,000,000 gallons (in Sicily to 208,000,000; in Emilia, 130,000,000; in Piedmont, 130,000,000; in Venice, 52,000,000; in Umbria, 52,000,000; in Naples, 52,000,000; in Lombardy and the Marches, 65,000,000; in Tuscany, 39,000,000; in the Romagna, 26,000,000; in Sardinia, 26,000,000); oil amounting to more than 30,560,000 gallons (12,224,000 in S. continental Italy; in Sicily, 6,112,000; in Liguria, 5,348,000; in Tuscany, 3,056,000; in the Emilia and the Marches, 1,528,000; in Lombardy, 1,146,000; in Sardinia, 1,146,000). The hemp produced amounts to about 50,000 tons. During the American war of secession the high price of cotton led to its cultivation, and about 325,000 metric quintals were annually produced, but it proved an unsuccessful speculation. Tobacco, cultivated in Sardinia, Sicily, the Marches, and in the neighborhood of Vicenza, yields about 150,000 metric quintals. Oranges, lemons, citrons, and other fruits, both dried and fresh, are exported. Among the animal products, besides the silkworm, the butter and cheese are valued at not less than $15,000,000. Cattle do not abound in Italy. The sheep and goats are reckoned at 12,000,000; the black cattle or oxen at 3,700,000; horses, mules, etc., at 1,400,000; and the swine at 4,000,000.

B. *Manufactures.*—In Northern Italy noteworthy progress has been made in manufactures during the last twenty-five years. The great industries are—(1) silk, which represents a production of $26,000,000 for spun silk alone, independently of tissues, among which velvet is conspicuous, that of Genoa being very celebrated; (2) woollen manufactures, of which there are important establishments in Piedmont (especially at Biella) and in Venetian Lombardy (chiefly at Schio) to an annual amount of $13,200,000; (3) cotton manufactures, very flourishing in Liguria, Piedmont, Lombardy, and Friuli, producing spun cotton to the amount of $7,000,000, and cotton cloth to the amount of $16,000,000. The straw industry (chiefly straw hats) is very prosperous in Tuscany. The agricultural manufactures, the wines above all, admit of much further improvement. The artistic or æsthetic manufactures are those for which Italy is especially distinguished abroad—the filigree of Genoa, the glass and beads of Venice, the coral of Naples and of Leghorn, the wrought marbles of Carrara and of Lucca, the perfumery of Tuscany, paper, hats, gloves, etc. One of the most flourishing industries is that of naval construction, particularly in Liguria, where the traditional skill of the shipbuilders is now aided and improved by good special schools, and above all by the Technical and Nautical Institute of Genoa and the excellent high school of the same city. The number of ships launched in 1860 was 198; in 1870, 803; in 1872, 724; and the average tonnage, which was 99 in 1860, rose to 142 in 1872. There are now (1874–75) in process of construction at 15 shipyards in Liguria 103 large vessels—some for English, French, and Norwegian traders—of a total tonnage of 107,900, the average per ship being 1057 tons.

C. *Commerce and Navigation.*—The balance of trade in Italy, though improving, is not yet what it may and ought to be. With an importation of $187,200,000 in 1869, the exportation was only $174,800,000. Increasing gradually, the exports in 1872 (the date of the latest official statistics) had risen to $281,220,223, but the importation amounted to $237,802,265. The commercial marine in 1868 consisted of 17,845 sailing vessels of all dimensions, with a tonnage of 859,387; 101 steamboats of 23,437 tonnage—total tonnage, 884,814, of which one-half was the property of Liguria. Now (1874–75) Italy numbers 4220 sailing vessels, averaging more than 50 tons each, with a total of 1,126,032 tons, and occupying in this respect the fourth rank, being surpassed only by England, the U. S., and Norway, and being superior to France, whose sailing tonnage is only 868,659. Italy has at present 103 steamers (85,045 tons), occupying the sixth rank.

D. *Canals and Roads.*—The canals of Italy, navigable as well as for irrigation, have been her boast from ancient times. The principal of these are in the valley of the Po. The total length of the navigable canals is 435 miles. The most important are—the Canal Cavour, in Piedmont, which, supplied from the Po, begins at Chivasso and terminates at Turbiga, a distance of 52 miles; in Lombardy, the Grand Canal, supplied from the Ticino near Tornavento, and passing through Abbiategrasso; the canal of Pavia, also supplied from the Ticino, and passing through Binasco; the canal of Martesana, which, from Milan through Gorgonzola, leads to Cassano on the Adda. The province of Polesina in Venice, and that of Padua, have an excellent canal system. The Emilia, too, is well supplied with them. The canal of Pescia, that of Pisa, and the canal of Ombrone are in Tuscany. In Southern Italy the emissary, executed by Prince Torlonia, for draining the Lake Fucino or Celano, and thus restoring to cultivation 42,000 acres of land, is most noteworthy. (See article FUCINO.) The communal high-roads have a total length of 61,221 miles; the provincial roads, 12,373 miles; the national roads, 3970 miles. The total length is 77,590 miles.

Railways.—In 1873 there were in operation 4154 miles of railroad, thus divided:

Piedmont, Liguria, Lombardy, and Venice	1556 miles.
Tuscany, Emilia, the Marches, Umbria, and the Roman provinces	1333 "
Neapolitan provinces	963 "
Sicily	206 "
Sardinia	82 "

In the year 1874 the number of miles of railway had increased to 4372.

Post-Offices and Telegraphs.—Postal activity, a convincing evidence of advance in public instruction, is constantly on the increase. It has more than doubled in ten years. In 1862 the correspondence which circulated in the country amounted to 111,733,319 letters; in 1872, to 232,242,672, an increase of 120,509,358. In the first nine months of the year 1874 the telegraphic despatches numbered 14,605,666.

Government and Public Institutions.—The government of Italy is a constitutional monarchy, with a senate appointed for life, and a chamber of 508 deputies, elected by a free and broad suffrage. The most entire freedom of the press and the right of association is secured. The prefects or governors of the provinces, and the syndics or mayors of the towns, are government appointees; otherwise the elective system generally prevails in all the institutions of the administrative hierarchy, communal as well as provincial. The only hinderance to the perfect working of the political organization has been, thus far, the financial deficit produced by the vicissitudes of the revolution, by military expenses, and by the construction of the railways. But, thanks to the praiseworthy efforts of the government and the country, even this evil is in the way of a speedy cure, and the deficit, which had already amounted to more than $92,000,000, is reduced in the balance for 1875 to about $6,000,000.

Administration of Justice.—At the foot of the Italian

magistracy stand the conciliatory judges, who perform the double office of conciliating litigants and of deciding small disputes involving an amount not exceeding \$6. In 1872 they settled more than 700,000 controversies. The prætors, 1811 in number, have jurisdiction of offences punishable with imprisonment not exceeding three months and by fines not exceeding \$60. In 1872 they tried 299,212 individuals. The prætors also decide civil questions not involving more than \$300, and in 1872 they gave 160,619 judgments of this kind. The tribunals take cognizance, on appeal, of questions civil, commercial, and penal decided by the prætors, and they have original jurisdiction of all matters not belonging to the conciliatory judges and to the prætors (they have, however, no authority in commercial questions in those towns where there is a proper tribunal of commerce), and they also decide questions of correctional police. There are 162 tribunals, which in 1872 pronounced 2146 judgments. From the sentence of the tribunals appeal may be made to the courts of appeal, and from these, when it is a question of law, to the courts of cassation. The system of juries before the courts of assize has not thus far given satisfactory results.

Education and Instruction.—The ministry of public instruction appropriates, for the expenses of the central administration, for university education, for secondary, classical, and technical instruction, for normal schools, and as subsidy for the elementary instruction about \$3,500,000; the communes provide for the primary teaching, the ministry of agriculture and commerce for the higher technical instruction, and the various bureaux for special instruction. The municipal elementary day schools are 34,213 in number (18,243 for boys, 12,732 for girls, 3238 mixed). Adding 9167 private schools, we have a total of 43,380, or of one school to 620 inhabitants. But though that is the general mean, the distribution of the schools is very unequal, they being much more numerous in the N. than in the S. Thus, in the province of Turin there is one school for every 355 inhabitants; in Calabria, only one for 1400. Elementary instruction is obligatory and gratuitous. The pupils inscribed were—in 1861–62, 1,008,674; 1863–64, 1,178,743; 1865–66, 1,217,870; 1867–68, 1,329,367; 1869–70, 1,577,654; 1871–72, 1,745,467, or 6.06 per 100 inhabitants. To these numbers should be added 375,947 attendants on the night schools, and 153,522 on holidays. The proportion of the population, without distinction of age, who could not read, was in 1861, 78.29; at the last census (1871) the proportion was 73.29. The normal schools train, in a course of three years, the masters and mistresses; they are frequented by more than 6000 pupils. The large towns have female high schools, not gratuitous, for the superior education of girls. National boarding colleges, several female conservatories, many private, and not a few clerical establishments, receive boarding pupils. The preparatory classical instruction is given in gymnasiums and lyceums. There are 104 national gymnasiums, with 8268 students; 79 royal lyceums, with 3773 students; besides various communal and private gymnasiums. The government technical schools, in which preparatory professional instruction is given, are 63, with 6188 pupils. Technical instruction of the second grade is acquired in 72 technical institutes, with 4471 pupils. In these, after a biennial course of general culture, there are four sections—the physico-mathematical, the commercial, the agronomical, and the industrial. There are also schools for the arts and trades (designed for the operatives and overseers in manufactories), 10 royal mercantile marine institutes (in which ship-captains, naval constructors, and steam-engineers are trained), and 14 nautical schools. Five high schools—a naval school at Genoa, very flourishing; a commercial school at Venice; an industrial school at Turin; and two agricultural schools, one at Milan and one at Portici—complete the technical instruction. There are 17 universities (not including three free universities), with 6423 students; 3 superior practical institutions for engineers, and 2 for other branches of literary and scientific culture. Besides many town collections, there are 33 public libraries, the most valuable of which is the Magliabecchiana at Florence, with 280,000 printed volumes and 14,000 manuscripts. We have not space to speak of the archives, of the musical institutes, of the academies and galleries of art, so justly celebrated throughout the world.

Charitable Institutions.—There are in Italy 20,123 charitable institutions, representing a total annual expenditure of \$17,175,688. Among these are 955 hospitals, which receive 499,000 persons, at an annual expense of \$5,954,169. The other charitable institutions are—asylums and poorhouses, expending \$5,762,945; loaning institutions, advancing \$831,655; other modes of relief require an annual outlay of \$2,804,882. For religious worship, etc., \$1,822,037.

Army and Navy.—The Italian army, according to the official tables, is composed of 679,877 men, and is thus divided:

(1) The standing army:		
Line infantry	199,886	
District militia	188,774	
Bersaglieri	30,758	
Cavalry	24,355	
Artillery	49,867	
Engineers	6,280	
Carabinieri	20,071	
Special corps and organizations	9,484	
Officers in active service	11.488	
" stationary "	2,080	
" waiting orders or retired	419	543,432
(2) Provincial militia:		
District militia	131,121	
Bersaglieri	3,551	
Engineers	1,033	
Officers	740	136,445
Total		679,877

The navy is in process of transformation, and the present able minister, Saint Bon, has made a proposal to Parliament (which will be probably acceded to) to sell a large number of ships of war now become unserviceable. The navy at present consists of 14 iron-clads, 8 of which are small vessels, altogether of 200 guns and 5700 horse-power; 22 screw steamers; 25 side-wheel steamers; 8 sailing ships and other smaller vessels; the total number being 91, with an armament of 1139 guns. According to the new plan, the naval force will be regulated as follows:

Ships of war.	12 large iron-clads to serve to form squadrons; 6 iron-clad steamers for coast defence; 12 screw gunboats.
Vessels for the protection of trade and other services.	10 station corvettes (also screw); 4 cruising vessels; 8 smaller vessels.
Accessories.	7 lookout and despatch steamers; 6 transport-steamers; 8 tugs.

History.—Of all histories, that of Italy is perhaps the most difficult to compress, every city having its own special and illustrious story, and the histories of all the nations of Europe converging into that of this peninsula. It may be divided into four great periods: I. *Conquest and Feudalism.*—The barbarians, having passed the confines of the empire, had entered into Italy; under Alaric they had sacked Rome; under Attila they had destroyed Aquileia, the fugitives from which founded Venice; under Odoacer they had put an end to the empire (476), but Theodoric, king of the Ostrogoths, came from the Danube (489), vanquished Odoacer in the Isonzo, then at Verona, slew him at Ravenna, and founded (493) a glorious monarchy, although it was stained by the blood of Boetius and Symmachus, and soon broken up by the Greeks under Belisarius and Narsetes (553). Under Alboin the Lombards descended from Pannonia (Hungary), and established the most lasting government which had existed in Italy (568–774). But coming in contact with papal pride, they in vain sought to appease it by concession and largess. Summoned first by Gregory III., then by Stephen II., the French came into Italy under Pepin, who founded the State of the Church (754); then, invited by Adrian I., Charlemagne made war upon the Lombards under Desiderius, and put an end to their kingdom (774). In 800, Charlemagne was elected emperor of the Romans and crowned by the pope. But this restoration of the Roman empire was only apparent, as the vitality of the new Cæsarism was not Roman, but German and theocratic, and, to use the expression of Gregorovius, the Church was the real "kingdom of God upon earth"—the empire was but the civil form; that was the soul, this but the Catholic body. It was no longer Roman laws, but the institutions of the Church, which formed the solid structure and the bond of union between the Western nations, and which constituted them into so many Christian communities, at the head of which there was one mind—that of a single pope; and one sword—that of a single emperor. The idea could not be realized, because the two elements which were to carry it out soon fell into discord. Charlemagne being dead (814), his weak successors were unable to restrain the nobles and the clergy, and the feudal system was allowed to develop itself. Italy was first under the rule of Bernard, nephew of the great emperor, then of Louis, then of Lothair, then of Louis II., then of Charles II. the Bald, then of Carloman, and finally of Charles the Fat (879–888). On the dethronement of this last sovereign five or six Italian feudal lords laid claim to the power, but Berengarius I., marquis of Friuli, prevailed over the rest (894). Under his reign, that of Hugh, duke of Provence (926), and that of Berengarius II., lord of Ivrea, Italy passed through one of the most unhappy periods of her history, being desolated by civil wars, by invasions from Hungary and from the Saracens, by corruption, and by barbarism. II. *The Communes and the Republics.*—Otho I. came to the throne (962) with three great ideas, all favorable to Italy: to reduce the number and the authority of

the vassal nobles; to favor the growth of the cities, the towns, and the municipal authority; to diminish the papal power—not, indeed (as, unhappily, the later Lombards had done), by usurping the territory, but by undermining its moral influence, and by taking part himself in the pontifical elections. The communes profited by this disposition, and first of all the maritime towns (Amalfi, Pisa, Genoa, Venice), to organize a free government. The bitter conflicts between the papacy and the empire having reached their height under Gregory VII. and Henry IV. (1073–85), brought upon Italy the curse of the Guelph and Ghibelline factions, the White and the Black, etc.; as a last consequence, however, they proved favorable to the development of that republican spirit which the two principal rivals could not succeed in dominating. Among other powerful causes of the aggrandizement of the free communes were the Crusades, which, unsuccessful as religious and political enterprises, excited immense maritime and commercial activity. Representing the imperial principle against republicanism, Frederick Barbarossa descended into Italy (1154), besieged and took Tortona, was crowned king of Italy in Pavia, assisted Pope Adrian to crush Arnold of Brescia, received in reward the imperial crown, and returned into Germany. But the pope soon broke away from the imperial alliance, and Frederick crossed the Alps again (1158), took Brescia, besieged Milan for the first time, established his authority under the name of *podestà* in every province, treated Crema with great severity, and besieged Milan anew and razed it to the ground (1162). Against this barbarity the Guelph cities solemnly concluded, at Pontida, the Lombard League. Frederick, returning, assaulted Alexandria, and met the confederates at Lignano, where the Italians (chiefly through the valor of the Milanese, headed by their *carroccio*, or great war-chariot) defeated the imperial host in a great battle. The peace of Constance (June 25, 1183) confirmed the triumph of the free cities, which were thereafter governed by two consuls, who were to receive their investiture from the emperor, and render him feudal homage. But in Southern Italy the republican spirit was overshadowed, first by the Norman monarchy founded by the brave Roger, and then by the Swabian. An illustrious and heroic descendant of this latter house, Frederick II., with the help of Pope Innocent III., wrenched the imperial crown from Otho IV.; but the ambitious pontiff, the founder of the Holy Inquisition, soon after turned against him. At Cartenova, Frederick defeated the new Lombard League formed against him at the instigation of the pope (1239). Frederick dying in 1250, the papal hatred followed his race, and was never appeased until Charles of Anjou, at the invitation of Pope Urban IV., by the battles of Benevento and Tagliacozza, and by the death of Manfred and of Conradine, put an end to the Swabian dominion in Italy (1266–68). The new French rule, however, was of short duration, and was overthrown partly by an insurrection headed by John of Procida, and yet more by the insolence of the soldiers of Charles, who provoked at Palermo the revolution of the Sicilian Vespers (1232). Meanwhile, internal discords were bringing ruin upon the republics in other parts of Italy; and the houses of the Della Torre, and afterwards of the Visconti of Milan, of the Ezzelini at Padua, of the Scaligeri at Verona, of the Pallavicini in other parts of Lombardy, had acquired great power. At Florence, the Buondelmonti and the Amédei, at Bologna the Geremei and the Lambertazzi, at Genoa the Grimaldi and the Fieschi on one side, the Doria and the Spinola on the other, were in continual quarrels, and rivalled each other in their efforts to destroy the liberty of their fellow-citizens. The maritime towns, in their disputes for the dominion of the sea and for commercial superiority, ruined each other by turns. Pisa wasted Amalfi, and in her turn, after the battle of Meloria (1284), was crushed by Genoa; but Genoa atoned for it by her long struggle with Venice, until the war of Chioggia (1369–87) left the two republics completely exhausted. Florence, always torn by factions, was imperilled by the revolution of the Ciompi, headed by the wool-comber Michael di Lando, the precursor of modern Socialism (1378). Everything, in short, was on the decline in Italy; the papacy, which had transferred its seat from Rome to Avignon (1307), the Ghibelline party, headed at first by Matteo Visconti, and then by Castruccio Castracani, was losing its power. Scourged, now by the troops of Philip the Fair, now by those of Louis of Bavaria, Italy had become the battle-field in which foreign ambition exercised its worst passions. In vain Cola da Rienzi struggled for a moment (1347) to rekindle the spirit of a dying civilization. III. *The Decadence.*—The cause and at the same time the consequence of the civil debasement of Italy was the lack of a military spirit in her people, so that she was completely at the mercy of domestic and foreign ambition. Hence the origin of the companies which overran and plundered the country with impunity under the banners of Ladrisio Visconti, of Fra Moriale, of Raimondo da Cordova, of Sir John Hawkwood, of Anichino Baumgarten, of Braccio da Montone, of Giovanni d'Oleggio, of Carmagnola, of Piccinino, of Sforza, etc. The house of Savoy alone, in the midst of all this corruption, maintained itself uncontaminated, and by the valorous enterprises of Amadeus VI. (il Conte Verde) and by those of Amadeus VIII. foreshadowed the glorious days of Emmanuel Philiberto and the three glorious Charles Emmanuels, worthy precursors of that monarchy which in our day has redeemed Italy. It was also a great misfortune that while the Western and Northern nations were shaking off the yoke of the Romish Church by a great reformation, Italy being not yet prepared, suffered the great movement of Savonarola and that of Burlamachi to fail, thus postponing for three centuries that moral regeneration which is the basis of political progress. The most cultivated people in Italy, the Florentines, preferred the splendor of the court of Lorenzo the Magnificent to the austere doctrines of the Reformers, and they allowed the merchant-monarchy of the Medicis—vainly threatened for a moment by the conspiracy of the Pazzi—to take root and thrive until it extinguished in their souls even the very desire of liberty. The old Cosimo assumed the title of "father of his country" (1429). In the mean time, the power of the Turks was increasing in the East, to the injury not only of Italy, but of the civilization of all Europe. Amurat I. threatened Constantinople (1360); Bajazet would have taken it had he not been arrested by the wild meteor Tamerlane and his army (1402). But Amurat II., and then Mahomet II., returned with renewed energy to the enterprise, and the fall of Byzantium (1453) sealed the ruin of the colonial power of the Italians. Not long after, the discovery of the New World, made by the Genoese Columbus (1492), and that of the East India passage round the Cape of Good Hope by the Portuguese Vasco da Gama (1497), then the conquests of Cortez, Pizarro, Almagro, Vasco, Nuñez de Balboa, of Cabot, Verazzani, and of Vespucci in America, together with those of Almeyda and of Albuquerque in India, diverted commerce from its old channels, depriving Italian navigators of the palm, and bestowing it upon more Western nations. Nothing now remained to Italy but the glory of letters, of arts, and of science, but in these she shone without a rival. Meanwhile, the crooked policy of Ludovico il Moro again brought a foreign power into Italy. Charles VIII., king of France, overran the Peninsula from one end to the other (1495). The French under Louis XII., and the Spanish under Ferdinand the Catholic, disputed the dominion of Italy. The papal throne was made infamous by Alexander VI., and Cæsar Borgia, his son, was the complete personification of that base policy which Macchiavelli systematized in *Il Principe*. Almost all Europe united in the League of Cambray against the republic of Venice (1508), whose forces were defeated in the battle of Ghiara d'Adda (1509), and Julius II., who had been the soul of the League, turned against the foreigners with the cry, *Fuori i Barbari!* and formed the Holy League in order to drive out the French (1511), who, in spite of the prowess and the ferocity of Gaston de Foix and the valor of his Bayards, La Tremouille and Trivulzi, were obliged to abandon Italy. But soon after Francis I. descended the Alps, was victorious at Marignano (1515), was defeated and taken prisoner at Pavia (1525). Then followed the great conflicts between this king and Charles V., of which Italy unfortunately was the principal theatre; the pontificates of Leo X. and of Clement VII., the siege of Florence, the valorous enterprises of Giovanni dalle Bande Nere, the exploits and the death of Francesco Ferruccio, the siege and sack of Rome by the imperialists under the constable de Bourbon, who there lost his life (1527); the expedition against Algeria, conducted by Andrea Doria; the Peace of Crespy (1544); then that of Cateau Cambresis, which established despotism rather than peace in Italy and in all Europe (1559); the glorious enterprise of Emmanuel Philibert; the battle of Lepanto (1571), in which the Italian navy shone brilliantly for the last time, and by which the final blow was given to Turkish power. During the seventeenth century, while all the ancient states of Italy were fallen to the lowest point, the house of Savoy arose with new splendor through the deeds of her three Charles Emmanuels and of Victor Amadeus. IV. *The Regeneration.*—To these crowned heroes, as well as to the popular heroes Pietro Micca and Picasso (called Ballilla), who in the wars of succession, and especially in that of the Austrian succession, sustained nobly the honor of Italy, belongs the boast of having given the signal for the uprising of a nation which so many centuries of misfortune had made abject. But a long and stormy period was still to be passed through—the wars of the republic and of the first French empire (the battle of Montenotte (1796), the Treaty of Cherasio,

the battles of Caldiera and of Arcole, the Treaty of Tolentino, the fall of Venice (1797), the battle of Novi, the blockade of Genoa, the battle of Marengo (1800), etc.), and then the Peace of Vienna (1815), which sacrificed Italy to the Holy Alliance. Frequent insurrections, and especially those of 1821 and of 1831, were the forerunners of that great and happy revolution which, begun in 1848, when King Charles Albert granted the constitution, was completed in 1870, when united Italy made Rome the capital of the kingdom. G. Boccardo.

Italy, tp. of Yates co., N. Y. It has 6 churches. P. 1341.

Itamarati′ [Brazilian, "white rock"], a celebrated cascade near Petropolis, the summer capital of Brazil, about 50 miles N. W. from Rio Janeiro. Its height is variously calculated, but is not less than 250 feet, nearly perpendicular.

Itard′ (Jean Marie Gaspard), b. at Oraison in the S. of France in 1775; after studying at Riez and Marseilles entered a banking-house in the latter place, where he remained until 1793, when he eluded the requisition for military service by representing himself as a medical student, though in fact he had never given the least attention to medicine. Nevertheless, he was assigned by the revolutionary committee to a military hospital as assistant surgeon, and by dint of careful observation and study soon became so skilful an operator that he obtained an appointment by competitive examination in the Val-de-Grace Hospital at Paris. Three years later he was appointed physician to the deaf-mutes' institution, where he made a specialty of diseases affecting the organs of hearing, in which department he speedily acquired a European reputation. His experiments in the education of "the wild man of Aveyron," a boy twelve years old captured in the woods, were described by him in two works published in 1807, which excited great interest. Itard wrote an important work on *Diseases of the Ear and the Organs of Hearing* (1821). D. at Paris July 5, 1838, leaving large bequests to the institution for deaf mutes and the Academy of Medicine.

Itas′ca, an unorganized county of Minnesota, bounded on the N. by the Rainy Lake and Rainy Lake River, which separate it from Canada. Area, about 5200 square miles. It is in part reserved for the Indians. It contains much pine and larch timber, and many lakes and marshes, producing wild rice (*Zizania aquatica*), the seed of which is employed as food by the Indians. Pop. 96.

Itasca Lake, in Beltrami and Cass cos., Minn., is regarded as the source of the Mississippi. It receives, however, several streams, one of which is several miles in length. Its elevation is 1575 feet. It is surrounded with pine-clad hills some 100 feet higher than the lake, which is very beautiful. The Mississippi leaves the lake with a breadth of some 12 feet, and is ordinarily less than 2 feet deep at this point.

Itawam′ba, county of N. E. Mississippi, bounded on the E. by Alabama. Area, about 500 square miles. It is a level limestone region, with a rich soil, and not much timber. Corn and cotton are staple products. Cap. Fulton. Pop. 7812.

Itch. See Scabaritic Diseases, by T. E. Satterthwaite, M. D.

Ith′aca, or **Thea′ki,** one of the smallest of the Ionian Islands. Area, 44 square miles. Pop. 11,940. It is mountainous, but fertile, producing olive oil, wine, and currants of a superior kind. It is famous as the dominion and home of Ulysses, and contains some cyclopean ruins, which still are called the castle of Ulysses. The principal town is Vathi, with a good harbor and 2500 inhabitants.

Ithaca, post-v., cap. of Gratiot co., Mich., handsomely situated at the geographical centre of the county, in a fine agricultural region; has a foundry, furniture-factory, saw-mill, planing-mill, a weekly newspaper, 4 churches, 2 hotels, etc. Principal business, farming.

Robert Smith, Ed. "Gratiot Co. Journal."

Ithaca, tp. and post-v., cap. of Tompkins co., N. Y., near the head of Cayuga Lake, on the Delaware Lackawanna and Western, the Ithaca and Athens, the Ithaca and Cortland, the Ithaca and Geneva, and the Cayuga Lake R. Rs. It is an important centre of the Pennsylvania anthracite coal-trade; has 9 churches, 1 daily and 3 weekly newspapers, 2 national and 1 savings bank (aggregate capital and deposits, $750,000), and large manufacturing interests. Calendar clocks, horse-rakes, spokes and hubs, paper, glass, leather, and machinery are manufactured. Ithaca is the seat of Cornell University (which see) and of Sage College for ladies. Ithaca has gas and water works, and a public library costing, with its building, $66,000, the gift of Mr. Ezra Cornell. The scenery here is very fine. Pop. 8462; of tp. 10,107.

J. H. Selkreg, Ed. "Ithaca Journal."

Ithaca, post-v. of Twin tp., Darke co., O., 3 miles from Gordon, a station on the Dayton and Union R. R. Pop. 150.

Ith′ica, post-tp. of Richland co., Wis. Pop. 1266.

Itho′me, a mountain-fortress in Messenia, memorable for the defence there made for many years against the Spartans in the first Messenian war. It was afterward the citadel of Messene when that city was founded by Epaminondas.

It′ius Por′tus, the port on the present French coast, nearly opposite Dover, from which Cæsar sailed on his second expedition to Britain. Its position has been a matter of much controversy; the majority of geographers, however, identify it with Wissant.

I′tri, town of Southern Italy, in the province of Caserta, near Gaeta. Very interesting antiquities abound in the neighborhood. A modern sanctuary on a high point commands a superb view of the sea. Pop. in 1874, 6582.

Itti′ri, town of Southern Italy, in the province of Sassari. Pop. in 1874, 5055.

Itu′, town of Brazil, in the province of São Paulo, on the Tiete, is well built and prospering, and stands in a beautiful and very fertile region, which produces large quantities of sugar and a good breed of horses and mules. It has many religious edifices, two hospitals, a prison, and schools. Pop. about 10,000.

Ituræ′a [Gr. Ἰτουραία], a small district in the N. E. of Palestine, which in the time of Christ formed, along with Trachonitis, the tetrarchy or government of Philip, son of Herod the Great, and brother of Herod, tetrarch of Galilee (Luke iii. 1). The name is supposed to have been derived from Jetur, one of the sons of Ishmael. It was N. of Bashan, and adjoined Auranitis, the modern Hauran, with which it has often been confounded. It is now called *Jedur*, and contains 38 towns and villages. (See Porter's *Five Years in Damascus* and Robinson's *Biblical Researches.*)

Iturbi′de, de (Agustin), b. at Valladolid (now Morelia), Mexico, Sept. 27, 1783; took a distinguished part as an officer of the Spanish army in the war against the Mexican revolutionists of 1810 and subsequent years, rising to the rank of colonel; but in 1820, in consequence of the constitutional revolution which took place in Spain in that year, he decided to make an attempt for the independence of Mexico under a monarchy. Obtaining command of the Spanish forces in the S. of the province of Mexico, he promulgated Feb. 24, 1821, the "Plan of Iguala" at the town of the same name. The essential features of this celebrated plan were known as the "three guaranties"—*i. e.* the maintenance of the Catholic religion; union of Mexicans and Spaniards; independence with a monarchy under a prince of the Spanish Bourbon dynasty. The plan of Iguala had immediate success; it was accepted with enthusiasm not only by the native Mexicans, but by the greater part of the Spanish forces in the country. After several months of nominal hostilities, Iturbide concluded a treaty at Córdoba (Aug. 24, 1821) with the new Spanish viceroy, O'Donoju, by which his "plan" was virtually accepted, and he thereupon made a triumphal entry into the city of Mexico Sept. 27 of the same year. A *junta of government*, and afterwards a regency, was established under the presidency of Iturbide, a constituent assembly was chosen, and negotiations were at once begun with Spain for obtaining a prince who should be crowned emperor of Mexico. Through the fatuity of Ferdinand VII., the treaty of Córdoba was rejected by the Spanish government, and the successful movement for independence was treated as rebellion. After some vacillation and quarrels with the constituent assembly he had convoked, Iturbide, favored by his army, was proclaimed emperor May 18, 1822, and was reluctantly recognized by the assembly. He was crowned July 21, but experienced great opposition, being compelled soon after to dissolve the assembly and imprison fifteen of the deputies. In December, Gen. Santa Anna, then a very young man, and lately a warm partisan of Iturbide, proclaimed the republic in Vera Cruz, and by Apr., 1823, the situation had become so hopeless that Iturbide resigned the crown and made terms with the restored assembly, by which he was allowed to embark for Europe and enjoy a pension of $25,000. He sailed for Italy May 11, resided several months in Leghorn, thence went to England, and in May, 1824, chartered a vessel in which he returned to Mexico, ostensibly to tender his services as general against an anticipated invasion by Spanish forces, but doubtless with the expectation of recovering his throne. Meanwhile, a republican government had been formed in Mexico, which, thrown into alarm by a rumor of Iturbide's intended return, issued a decree that he should be treated as an outlaw should he set foot within the territory of the re-

public. Ignorant of this decree, Iturbide secretly landed at Soto la Marina July 14, was recognized and taken before the state legislature, by whose orders he was shot at Padilla, Tamaulipas, July 19, 1824. His family established itself at Philadelphia, where the ex-empress d. Mar. 21, 1861. Several of the sons of Iturbide were afterwards honored with diplomatic or military posts by the Mexican government, and during the ephemeral empire of Maximilian the survivors were recognized as princes. The elder, Angel de Iturbide, d. in the city of Mexico July 21, 1872; the younger, Agustin, d. in Paris in May, 1873. Prince Agustin, son of Angel, recognized by Maximilian as heir-presumptive, was b. in 1864, and now (1875) resides with his mother, an American lady, at Georgetown, D. C. PORTER C. BLISS.

Itza′ Indians of Central America are of undoubted Maya stock, and by their own traditions must have left Yucatan in the fifteenth century. They were visited in 1525 by Cortez, whom they treated kindly. They valiantly maintained their independence until 1698. They had previously attained some degree of civilization. They are chiefly found in the vicinity and on the islands of Lake Itza, on the boundary between Guatemala and Mexico. They are in name, at least, of the Roman Catholic faith.

It′zehoe, town of Prussia, in the duchy of Holstein, on the Stör. It has distilleries, sugar-refineries, manufactures of chicory and tobacco, and carries on a considerable general trade. Pop. 9111.

Iu′ka, post-v., cap. of Tishemingo co., Miss., on the Memphis and Charleston R. R., 115 miles from Memphis, Tenn., and 8 miles from Tennessee River; has a female institute, a male academy, a planing-mill, a weekly newspaper, and valuable mineral springs. J. S. DAVIS, ED. "HERALD."

Ivan′ the Terrible, the fourth grand duke of Russia having the name Ivan (John), and the first czar of that country (though reckoned as Ivan IV.), b. in 1529; succeeded his father Basil in 1533; put to death in 1543 the triumvirate of regents, and soon after assumed the title of czar; published a new code 1550; carried on wars with the Tartars, capturing Astrakhan, Kasan, and parts of Siberia, but in 1568 acknowledged the sovereignty of Jediguer the Tartar; carried on long and undecisive wars with the Poles and Swedes; introduced civilization and the art of printing in Russia, but ruled with great cruelty and harshness. D. Mar. 19, 1584.

Ivano′vo, town of Russia, in the government of Vladimir, has important cotton spinning and weaving factories and manufactures of chemicals. Its cotton manufactures employ a considerable part of the population of the vicinity and are steadily increasing. Pop. 8000.

I′verson (ALFRED), b. in Burke co., Ga., Dec. 3, 1798; graduated at Princeton in 1820; was admitted to the bar and attained distinction in his profession; was three years member of the House in the State legislature, and one year of the Senate; was elevated to the bench of his judicial circuit, which he filled for seven years; was one of the electors at large for the State on the Democratic ticket in the Presidential election in 1844; was a member of Congress 1847–49, and U. S. Senator from Georgia 1855–61. This position he resigned on the passage of the ordinance of secession by the State convention in Jan., 1861, which measure he ardently advocated. He raised a regiment for the Confederate army, and became colonel and brigadier-general. D. in Macon, Ga., Mar. 4, 1873. A. H. STEPHENS.

Ives (DWIGHT), D. D., b. at Holyoke, Mass., Sept. 20, 1805; graduated at Brown University 1835; was ordained to the Baptist ministry in 1836, and preached in Lower Alton, Ill.; supposed to have been the first Baptist preacher in the State who gave his entire services to one church, receiving from them a salary competent for support. He has been settled also at Suffield, Conn., being both secretary and president of the board of trustees in the Connecticut Literary Institution (Baptist) in that place.

Ives (ELI), M. D., b. at New Haven, Conn., Feb. 7, 1779; graduated at Yale 1799; studied medicine with his father, Dr. Levi Ives; and with Prof. B. Silliman founded in 1813 the medical department of Yale College, in which he was professor of materia medica until 1829, and then until 1853 professor of the theory and practice of medicine. He was at one time president of the National Medical Association; was an advocate of temperance, education, and the abolition of slavery. D. at New Haven Oct. 8, 1861.

Ives (Rt. Rev. LEVI SILLIMAN), D. D., LL.D., b. at Meriden, Conn., Sept. 16, 1797; worked on his father's farm at Turin, N. Y.; served a year in the war with Great Britain 1812–15, and was educated at Lowville Academy and Hamilton College. He was at first a Presbyterian. In 1822 he received deacon's orders in the Protestant Episcopal Church, and in 1825 married a daughter of Bishop Hobart. He held pastoral charges in Philadelphia, in Lancaster, Pa., and in New York, and in 1831 was consecrated bishop of North Carolina. In his diocese he labored much for the good of the slaves and for the cause of education. In 1852, his diocese being alienated from him on account of differing views in regard to questions of doctrine and church polity, he visited Rome, where he joined the Roman Catholic Church. He was afterwards professor in the theological seminary at Fordham, N. Y. He afterwards devoted much attention to the founding of an asylum for destitute children at Manhattanville, New York City, where he d. Oct. 13, 1867. He wrote *Trials of a Mind in its Progress to Catholicism* (1854), and several devotional and other works.

Ivi′za, or **Ivi′ça,** the smallest and westernmost of the Balearic Islands, in the Mediterranean, and belonging to Spain. It is 23 miles long, 12 miles broad, and has 11,000 inhabitants. It is mountainous, but has several fertile valleys producing good wine and olive oil. Timber and salt are the main exports. The principal towns are Iviza and San Antonio.

I′vory [Old Eng. *ivorie*, from the French *ivoire;* Middle Lat. *ebor;* Lat. *ebur*]. The derivation of the Latin from *barrus*, an elephant, so-called from *βαρύς*, "heavy," on account of its great weight, is very doubtful, since there is in Sanscrit *ibha*, in Coptic *obhe*, a "tooth," and in ancient Egyptian *ebou*. Perhaps, says Larousse, this latter had a common origin with the Semitic *habbim*. Ivory has generally been defined as simply the tooth of the elephant, but it is in reality a substance between bone and horn from the teeth or tusks of many animals. Its chemical composition is—

Phosphate of lime	64.00
Organic matter	24.00
Water	11.15
Carbonate of lime	0.10

Ivory is for the most part, however, the material of the tusks of the elephant. The teeth of the hippopotamus give a finer and harder variety, but owing to their hollowness they can only be employed for small objects. The large marine animals, such as the walrus, narwhal, and spermaceti whale, also yield varieties of ivory. That of the walrus was formerly much used by the old Norsemen for making pieces for the game of draughts; several of these, beautifully carved, are in the British Museum. The material is extremely hard, of a dead pearly white, which becomes black, not yellow, with age. The fossil ivory of Siberia, dug from the ground, consists of the tusks of mammoths and elephants of extinct species. It is found in the Laichovian Isles and by the Frozen Sea. The elephant ivory of the present time comes from Africa and Asia; the latter being, with the exception of the small tusks from Ceylon, much inferior to the former, its faults being a tendency to split, an inferior color, and the more rapid deterioration towards yellow. Ivory is difficult to cut, requiring extremely sharp and very hard tools, but yields readily to the saw, lathe, and rasping tools or files, a great variety of which are used to reduce the block to form. Owing to the value of ivory—which is so rapidly increasing that it now ranks as a precious substance—the greatest care is taken to avoid waste, the division into pieces or veneers being effected with thin saws. When finished it is polished with different powders. Its natural whiteness is exquisitely delicate, bearing a great resemblance to the brightest tint of the human skin, which latter presents the most beautiful hue in nature. But it soon assumes a yellow tone. Spangler, a celebrated workman in ivory at Copenhagen, discovered that ivory kept from the air, but not from the light, under a glass, will retain its whiteness for an indefinite time. The yellow tint of old ivory may be removed with finely levigated pumice-stone. It should then be put while wet under a glass and exposed every day to the sun. Ivory is used for piano-keys, knife-handles, billiard-balls, book-covers, combs, and for an indefinite variety of ornaments and works of art, its "fashionableness" and the variety of its application having increased of late years with its value. The drying up and crumbling of ivory is owing to the exhaustion of its gelatine. When the works of ivory dug by Mr. Layard from Nineveh were brought to England, and found to be in a state of rapid decomposition, Prof. Owen suggested that they should be boiled in a solution of gelatine. Under this process they became hard and firm. Elephant ivory in plates presents delicate lines resembling what is called in drawing cross-hatching or cancellation; and this, which disqualifies it for making artificial teeth, adapts it for miniature painting, and in fact increases the beauty of its tone in all works of art.

Ivory was extensively used by Egyptians, Assyrians, and ancient Greeks. Solomon had a throne of ivory inlaid with gold, and the throne of Penelope is described as of ivory and silver. The later Greeks carried this work in

gold and ivory to a degree of splendor which seems incredible. From their extended traffic with Persia and Egypt they obtained immense quantities of both Asiatic and African ivory. Diopene and Scillis, Cretan artists established at Sicyone, were the first to make statues of gold and ivory. The temple of Juno at Olympia contained, among many great works in ivory, the coffer of Cypselus, the table of ivory and gold of the Olympic games, the bed of Hippodamia, the discus of Iphitus, and statues of Juno, the Hours, the Hesperides, and Minerva. Under the influence of Phidias the torentic or *chrysolephantine*, or gold-and-ivory sculpture, became, as befitted its name, colossal. The Minerva of the Parthenon and the Olympic Jupiter evidently surpassed any works of the kind known to the moderns, as may be inferred from this, that the Minerva bore in her hand a Victory 2 mètres in height. The scholars of Phidias made a great number of these gigantic images, in which the nude portions of the human figure were in ivory and the drapery of gold. But the quantity of ivory used in Rome was prodigious. The gates of the temple of Apollo, built by Augustus as a votive offering for the victory of Actium, were of this costly material. It is said that the Romans knew how to soften ivory and mould it as horn is now manipulated. According to Dioscorides, this was effected by boiling in the juice of mandragora-roots; according to Plutarch, in fermented barley. This is now done by immersing articles of ivory in a solution of pure phosphoric acid of specific gravity 1.130, and leaving them there till they lose their opacity. Byzantine art, however, went even beyond Roman in the profuse use of ivory, and there is not a museum of Europe which does not contain diptychs and triptychs (folding tablets with religious images), cups, reliquaries, crucifixes, and arms of this era. Magnificent coffers, many of great size, also abounded. Charlemagne had two *gates* in ivory of Byzantine execution. The episcopal chair of St. Vitalis, a work of the sixth century, now in Ravenna, is a fine specimen of this style. Ivory becoming very scarce in the twelfth century, caskets were made of segments of bone, carved. During the Middle Ages it became again plentiful, and with the Renaissance the art of carving it reached perfection. Florence at first, and subsequently Flanders and Germany, were the great centres of the manufacture. Benvenuto Cellini, Michael Angelo, Dürer, John of Bologna, and Algardi distinguished themselves by their work. In the seventeenth century the most eminent *ivorists* were Copé, Zeller, Augermayer, Duquesnoy, Van Obstal, Kem of Nuremberg, Faidherbe of Mechlin, Bossint, Zich, Berger of Norway, and Troyer. Many others, however, had as great a reputation. Monks in cloisters not unfrequently devoted a life to carving a crucifix; one of the best of these is now preserved at Avignon. Ivory was extensively used in the preparation of arms. Dieppe is regarded at the present day as the most extensive ivory-factory in Europe, but work quite as artistic as any produced in this city is made in Germany, not a little of it consisting of imitations of old goblets, oliphants (or hunting-horns), etc., which are sold as antique. Ivory is imitated by combinations of gelatine and baryta, and it is stated that billiard-balls are made of paper-pulp and gelatine which exactly resemble the ordinary kind, and which may be used to play with. Plaster of Paris in powder, combined with chrome, cast and boiled in milk, stearine, oil, or wax, will in time, if occasionally polished, exactly resemble yellowish ivory. The artificial meerschaum, made of egg-shell and gypsum, with probably some intermixture of magnesia, bears at times a great resemblance to ivory, but is brittle. Considering the near approach which has been made by art to imitating ivory, it does not seem incredible that at some future day it may supply a comparatively perfect substitute for what we are now indebted to nature. In a few years the African supply, and in fact all others, will be exhausted, as every traveller in the country bears witness that the elephants are constantly disappearing before the hunter. It is supposed that at present at least 20,000 cwt. of ivory of different kinds are made up annually in Europe. (See VEGETABLE IVORY.) CHAS. G. LELAND.

Ivory (JAMES), F. R. S., b. at Dundee, Scotland, in 1765; educated at the University of St. Andrew's, along with Sir John Leslie. For many years he superintended a flax-spinning factory, and in 1804 was appointed professor of mathematics in the Royal Military College of Marlow (now at Sandhurst). He was a self-taught mathematician, and spent much of his time in retirement, fathoming the profoundest writings of the most learned continental mathematicians, and adding to their value by original analytical contributions. His most celebrated paper, in which he completely and definitively resolved the problem of attraction for every class of ellipsoidal bodies, was published in the *Philosophical Transactions* for 1809. Besides this paper, Mr. Ivory contributed many others on the subject of the attraction of spheroids and the theory of the figure of the earth, during a period of nearly thirty years; one of the last subjects which occupied his attention was the possible equilibrium of a spheroid with three unequal axes, which Jacobi had discovered. Next to the theory of attractions, that of atmospheric refraction most seriously engaged his attention, its great importance in astronomy, and the curious mathematical difficulties which it presents, rendering it of great interest to analysts. D. Sept. 21, 1842.

Ivory Black. See BONE BLACK, by PROF. C. F. CHANDLER, PH. D., M. D., LL.D.

Ivory Coast, a part of the coast of Upper Guinea, West Africa, between the so-called Grain Coast and Gold Coast. It extends from Cape Palmas to the river Assinie, and has several towns along the coast, which traffic in ivory, gold-dust, and palm oil.

Ivre'a, town of N. Italy, in the province of Turin, picturesquely situated at the mouth of the beautiful valley of Aosta, on the right bank of the Dora Baltea. It was a Roman possession as early as 90 B. C., and many vestiges of that period, such as foundations of theatres and portions of aqueducts, still exist. Ivrea played no inconsiderable part in the mediæval history of Northern Italy, and a castle of the thirteenth century is now used as a penitentiary. The Carnival festivities of Ivrea still commemorate a popular uprising of the city against the marquis of Monferrato in the thirteenth century. The cathedral is reported to have been an ancient temple of Apollo, consecrated for Christian worship early in the fifth century. This town has some manufactories, but the great water-power of the Dora Baltea is but partially employed. Pop. in 1874, 9125.

Ivry', town of France, in the department of Seine-sur-Seine, 4½ miles from Paris. It has manufactures of iron and glass, and a considerable trade in wine. Pop. 7056.

Ivry'-la-Bataille', a v. of France, 40 miles W. of Paris, on the river Eure. Pop. about 1200. It is noted for the decisive victory gained here by Henry IV. of Navarre (Mar. 14, 1590) against the forces of the League under the duke of Mayenne. An obelisk to commemorate this victory was removed during the French Revolution, but renewed by Napoleon in 1809.

I'vy [A. S. *ifig*], the *Hedera helix*, a climbing, shrubby Old-World plant, sparingly cultivated in the U. S., where it nowhere thrives as in Europe, being impatient of the cold of winter and the dryness and heat of summer. It succeeds best in the Middle Atlantic States. It belongs to the order Araliaceæ. It abounds in Europe, growing upon houses, churches, walls, castles, and trees. There are several varieties. The so-called "German ivy," common in house culture, is not an ivy at all, but a Senecio from South Africa. (For the "poison ivy" of the U. S. see RHUS.)

Iwakura Tomomi. See APPENDIX.

Ixcaquix'tla, town in the southern part of the state of Puebla, Mexico, 50 miles S. E. of the city of Puebla. Pop. about 5000. It is the chief town of the Popoloca or Chuchon Indians, who occupy the table-land between Tepéji de la Seda and the frontier of Oaxaca, an indigenous race which formerly extended over much of Southern Mexico, but was conquered and driven into fastnesses, first by the Mixtecas, and afterwards by the Aztecs, remnants of them being found under distinct names in the states of Guerrero, Oaxaca, and Vera Cruz, as well as in Guatemala. Ixcaquixtla is noted in Mexican history as the scene of a sharp battle fought Jan. 1, 1817, between Mexican insurgents under Gen. Mier of Teran and Spanish troops under La Madrid. Within a space of two or three leagues around Ixcaquixtla there still exist hundreds of artificial mounds, mostly of earth, but some of small squared stones, the latter of pyramidal form; they are still used by the Indians, though nominally Christians, as altars on which offerings are placed to the deified Montezuma.

Ixi'on, a mythical character, supposed to have been a Thessalian prince and king of the Lapithæ. He was espoused to Dia, daughter of Hesioneus (or Deioneus), but on his bridal day treacherously murdered his father-in-law, in order to avoid the performance of his contract. Jupiter (or Zeus), however, magnanimously forgave him, but Ixion rewarded his clemency by attempting to seduce Here (or Juno), which attempt was frustrated by Jupiter's substitution of a phantom resembling her, and resulted in Ixion becoming the father of the Centaurs. He was ultimately condemned, as a punishment for his treachery, to be chained to a fiery wheel perpetually revolving and consisting of four spokes in the form of a cross.

Ixmiquil'pan, town and district in the state of Hidalgo, Mexico, about 80 miles N. of the city of Mexico, on the river Montezuma. Pop. about 10,000. In its vicinity are several silver-mines, owned by English companies. It was for some months in 1861 the head-quarters

of Gen. Zuloaga, who claimed to be President of the republic; he had with him two or three cabinet officers and some of the ordinary machinery of a government. The people of the district are mostly Indians of the Otomi race.

Ixo'nia, post-tp. of Jefferson co., Wis., on the Milwaukee and St. Paul R. R., 37 miles W. of Milwaukee. P. 1777.

Ixtacci'huatl [Mexican, *ixtac*, "white," and *cihuatl*, "woman"], a mountain in Mexico, once a volcano, 15,705 feet high, adjoining that of Popocatepetl, from which its summit is distant about 15 miles N. It forms part of the mountain-range separating the valleys of Mexico and Puebla, from both of which cities it is visible. It is covered with perpetual snow, and derives its name from the resemblance of its summit to the reclining figure of a woman.

Ixtapala'pa, town in Mexico, 10 miles S. E. of the capital, within the federal district. Pop. about 5000. At the time of the conquest of Mexico it was a large city on the canal between lakes Texcoco and Chalco, celebrated for its splendid gardens, which belonged to the Aztec emperors. It was the residence of a powerful vassal chieftain, a brother of Montezuma, and was the scene of many of the important incidents of the siege of the capital. Few traces of its former importance now remain. A hill adjoining Ixtapalapa to the S. W., called the *Cerro de la Estrella*, or Star Hill, was the most sacred spot known to the Aztec religion. At the expiration of each *century* of 52 years all the fires throughout the empire were extinguished, and the new fire was obtained by the chief priest by friction of pieces of wood over the body of a human victim placed upon the altar on the summit of this hill. All the Aztec priests and magnates set out from Tenochtitlan (Mexico) at midnight, going in procession to the sacred hill, which they reached before daybreak, and the new fire was carried in every direction throughout the empire by hundreds of swift messengers. Some remains of the ancient altar and temple may still be traced on the summit of the hill.

PORTER C. BLISS.

Ixtlahua'ca, town and district in Mexico, near the N. W. extremity of the state of the same name, 60 miles from the federal capital. There are in the district several silver-mines, most of which, however, have been abandoned in consequence of revolutions or lack of capital to introduce proper machinery for reducing the ores. This region was that inhabited by the Mazahua race of Indians, once so numerous as to have had grammars and catechisms printed in their language in the sixteenth and seventeenth centuries. The language is now fast expiring, but is still spoken in a few villages of the district.

Ixtlán, town and district in Mexico, state of Oaxaca, 40 miles N. E. of the state capital. It is rich in silver-mines; the inhabitants are Indians of the Zapoteco race. One mile from Ixtlan is the village of San Pablo Guelatao, memorable as the birthplace of Benito Juarez, President of Mexico from 1858 to his death in 1872.

Ixtlilxo'chitl (FERNANDO DE ALVA), b. in Mexico or Texcoco about 1568, was a lineal descendant of the ancient emperors of Texcoco, and devoted himself to the collection and translation of hieroglyphical records concerning his ancestors. Scarcely anything is known of his personal history, except that he was interpreter to several viceroys, and in 1602 received from the Spanish king a grant of lands as representative of the former Aztec dynasty. He left numerous writings, which are preserved in the national archives in Mexico, only a portion of which have been printed, though copies were used by Mr. Prescott in his *History of Mexico*. His *History of the Chichimecs* was published by Lord Kingsborough in his *Mexican Antiquities*, vol. ix. D. in 1648.

Izabal', a seaport of Guatemala, on the Golfo Dolce, 123 miles N. N. E. from the capital. It is the only Atlantic port of that republic, and is accessible only to vessels of light draught, for which reason large vessels unlade at Balize and ship their cargo to Izabal by coasting-vessels. Pop. about 1000.

Izal'co, Isalco, or **Ysalco,** town of Central America, state of San Salvador, and situate about 40 miles W. by S. of the city of that name, and at the base of the celebrated volcano from which it takes its name. It is chiefly inhabited by Indians, the population numbering between 4000 and 5000; is possessed of a fertile and plentifully watered soil, but since the earthquake of 1859 has materially diminished in commercial importance and prosperity.

Izalco, Mount, called the "lighthouse of San Salvador," a volcano which burst forth Feb. 23, 1770, in what is now the republic of San Salvador, Central America. It stands very near a large group of extinct volcanoes, and has an eruption every sixteen minutes. It burst out in the midst of a cattle-estate during a great earthquake, and has since grown to a height exceeding 4000 feet. Its light is visible far at sea. It is near lat. 13° 15′ N., lon. 89° 44′ W.

Izamal', city in Yucatan, Mexico, 40 miles E. of Mérida, notable for the ruins of an ancient city, which are fully described by Stephens in his *Travels in Yucatan*. The celebrated bishop of Yucatan, Fray Diego de Landa, built a church and a vast convent in 1553 upon the summit of an artificial pyramid on which was an idol temple; an image of the Virgin Mother was brought from Guatemala, and for its miracles acquired a great celebrity throughout Yucatan, which it still retains.

Iz'ard, county of the N. of Arkansas. Area, 864 square miles. It is traversed by the White River. It is partly mountainous, but is in general fertile and well timbered. Tobacco, cotton, and live-stock are staple products. Lead and other minerals are found. Cap. Mount Olive. Pop. 6806.

Izard (GEORGE), b. in South Carolina in 1777; appointed lieutenant of engineers June 2, 1794; visited Europe and was lieutenant in the French engineers 1796–97; in charge of fortifications in Charleston harbor 1798; promoted to be captain 1799, and served as aide to Gen. Hamilton; resigned 1803; on the outbreak of war with Great Britain he was appointed colonel of artillery; brigadier-general 1813, and major-general 1814; disbanded 1815. In 1825 he was appointed governor of Arkansas territory, which position he held till his death, Nov. 22, 1828.

Izard (RALPH), b. near Charleston, S. C., in 1742, and graduated at the University of Cambridge, Eng. He was a wealthy planter, and after the outbreak of the Revolution was appointed by Congress as commissioner to Tuscany, but he fixed his residence at Paris, where he opposed the policy of Franklin and Silas Dean and favored that of Arthur Lee. He pledged his estate to purchase ships of war; was delegate to Congress 1781–83, and U. S. Senator 1789–95. D. May 30, 1804.

Izcoatl, fourth king of Mexico, and by his superior military and political talents substantially the founder of the Aztecan empire. A natural brother of his predecessor, he reigned from 1425 to 1436, during which he conquered many neighboring states and embellished and fortified the capital. It was he who built the temple to the god Huitzilopochtli and the goddess Cihuacoatl; he also framed a constitution that materially changed and improved the political system.

THOMAS JORDAN.

Izdubar', a mythical or semi-mythical king and hero of the earliest Babylonian annals, who is placed nearly upon the division-line which separates the age of romance from the historical period. His name has become widely known and celebrated since the discovery, made in 1872 by Mr. George Smith of the British Museum, of some fragments of the Chaldæan traditional account of the Deluge, embodied in one of a series of twelve "Legends of Izdubar," so-called from the hero who plays the principal part in them all. By Sir Henry Rawlinson, and the numerous school of comparative mythologists who take their cue from Prof. Max Muller and Mr. G. W. Cox, the Izdubar legends were at once set down as a magnificent specimen of the solar myths—as being, in fact, the prototype of the twelve labors of Hercules. Mr. G. Smith, the discoverer and chief interpreter of these legends, strongly objects to this view, and argues for the historical existence of Izdubar as a Chaldæan monarch (whom he identifies with the biblical Nimrod), his best evidence being the occurrence of the name in a fragmentary canon of the early Babylonian kings, which he believes to be a copy of one of the original authorities used by Berosus. Izdubar appears in the cycle of legends as a giant residing in the country of Accad, a subduer of great animals in the times after the Deluge, a mighty conqueror who acquired the sovereignty, which he exercised in the city of Erech or Uruk, the earliest capital of Babylonia. He was deified after his death, as is shown by the existence in one of the tablets of a form of prayer addressed to him; and in another, relating to witchcraft, he appears as a guardian who watches over the country. (See articles NIMROD, NOAH, and CUNEIFORM INSCRIPTIONS; and for the text and translations of the Izdubar legends, G. Smith's *Assyrian Discoveries* (1875) and *Transactions of the Society of Biblical Archæology*, vol. iii., London, 1874.)

PORTER C. BLISS.

Izu'car, or **Matamo'ros Izucar,** city and district of the state of Puebla, Mexico, about 90 miles S. E. of the federal capital. It is situated nearly at the base of the volcano of Popocatepetl, and is the centre of a rich sugar-region extending along the valley of the river Mescala. It is a well-built and prosperous city of about 12,000 inhabitants, and is the southern terminus of a railroad now (1875) being constructed which will unite it with Puebla. It derives its official name from Gen. Manuel Matamoros, one of the heroes of Mexican independence, who gained here (Feb. 24, 1812) a great victory over the Spaniards.

J.

J, a consonant, another form of *I*, with which it was once interchangeable. *I*, originally and properly a vowel, came in time to stand sometimes for the half-vowel, half-consonant sound of initial *Y*, as now in German. Afterwards it acquired the *zh* sound it possesses in French, and eventually the power it ordinarily possesses in English. In Spanish it is a guttural aspirate, interchangeable with *X*.

Jaafar, one of the BARMECIDES (which see), grandson of the vizier Khaled, son of the vizier Yahya, and himself a favorite of the caliph Haroun-al-Raschid, who gave him his sister Abbasa in marriage, on condition that the connection should be merely nominal. Abbasa having borne a son to Jaafar, the caliph put both him and his father to death, about A. D. 802. It is probable that this account is derived rather from poetry than authentic history.

Jabirú [Brazilian], the name of several birds of the stork family, and of the genus *Mycteria*, found in Australia, Africa, and South America. The species are few. *M. Australis* is the best known. These birds, unlike the storks, have an upturned bill, and one species found in South America has the head and neck bare; those of the Old World have these parts of the body clothed with feathers.

Jabirú.

Jablon'ski (DANIEL ERNST), D. D., b. near Dantzic Nov. 26, 1660; was educated at the University of Frankfort-on-the-Oder, where he distinguished himself in philosophy, theology, and Oriental languages. In 1680 he visited the universities and libraries of Holland and England, remaining a year or two at Oxford. On his return to Germany he soon became famous as a pulpit-orator, and was ultimately appointed court-preacher—at first at Königsberg, and afterwards at Berlin. By request of King Frederick I. he labored earnestly for a union of all the Protestant churches. Dr. Jablonski became a bishop among the Moravians in 1698. In 1733 he was elected president of the Royal Academy of Sciences at Berlin. Among his numerous literary labors he translated into Latin some of the English works of R. Bentley, and published editions of the Talmud and of the Hebrew Bible (1699), the latter being especially valuable for its critical apparatus. D. at Berlin May 25, 1741.

Jablonski (PAUL ERNST), son of the above, b. at Berlin in 1693. He was still more distinguished than his father for his knowledge of Oriental languages, in which he surpassed all the German scholars of his time, his numerous philological works being still quoted with respect. In Oriental history, mythology, and antiquities his writings are equally esteemed, especially the treatises on the gods Remphon (1735) and Memnon (1753). The two most valuable of Jablonski's writings are undoubtedly an Egyptian glossary, not printed until the present century (Leyden, 1804), and the *Pantheon Ægyptiorum sive de diis eorum commentarius*, etc. (Berlin, 1750–52, 3 vols.). The complete works of Jablonski number about fifty. He was long a professor of theology at the University of Frankfort-on-the-Oder, at which place he d. in Sept. (or Dec.), 1757.

Jaborandi' [Brazilian Guarani], a drug recently introduced into medicinal use, consists of the leaves and twigs of *Pilocarpus pinnatus*, a tree (?) of Brazil, and of the order Rutaceæ. Four or five grammes of the bruised drug are infused in boiling water. Soon after this is swallowed, whether warm or cold, a most powerful sialagogue and diaphoretic effect is produced. Streams of perspiration flow from the patient, and so much saliva and mucus are produced in the mouth and air-passages that speech is difficult. It is reported to be useful in the treatment of several diseases.

Ja'ca, or **Xaca,** town of Spain, province of Aragon, at the foot of the Pyrenees. It is situated in a fertile valley, is strongly fortified, and contains a cathedral, a castle, and several convents. The inhabitants are employed in agriculture and woollen weaving; the soil is highly productive of grain, but too cold for the fruits peculiar to Southern Europe. During the Roman empire Jaca was a place of some importance, capital of the *regio Jacatania*. P. 3500.

Jacamar' [Braz. *jacamaricá*], a name applied to a number of South American and West Indian birds, of the genera *Galbula*, *Jacamaralcyon*, and *Jacamerops*, and approximating the character of the trogons and the bee-eaters. They are small, and mostly of bright and quaint but not very handsome plumage. The red-tailed jacamar (*Galbula ruficaudis*) is found in Trinidad, W. I.

Jacaná, the *Parra jacaná*, an abundant South American bird of the rail family, is remarkable for its very long toes, which enable it to walk with ease upon floating water-plants. Other species are found in Asia, Africa, and Australia.

Jacaré, a genus of South American loricate reptiles, resembling the alligator and cayman. The *Jacaré sclerops* (spectacled cayman, common jacaré) is one of the largest of American Crocodilidæ, but though very voracious he rarely attacks man. Four or five other species are reported.

Jach'mann (EDUARD KARL EMANUEL), b. at Dantzic Mar. 2, 1822. He made his first trip as cabin-boy and sailor 1839–44; served four years on board the corvette Amazone; was created a marine lieutenant in 1845; appointed commander of a gunboat squadron in 1849; made in 1853–54, as first lieutenant on board the Gefion, a trip to the West Indies, South and North America; was for three years director of the wharves of Dantzic; became captain in 1855, and made in 1859–62 an important expedition, as commander of the frigate Thetis, to Eastern Asia and China, in order to establish commercial connections between Germany and those regions. On his return received the command of the Prussian fleet in the Baltic, fought, in the war with Denmark, off the island of Rügen Mar. 17, 1864, and was created rear-admiral the next day. In 1864–67 was chief of the naval station of Kiel. In 1867 was appointed president of the naval department, and in 1868 was made vice-admiral. In the war with France was commander-in-chief of the whole naval force. As president of the naval department he has accomplished much, and in many directions, for the development of the German navy. Retired from this office in 1872. AUGUST NIEMANN.

Jacitara' Palm [Brazilian], a South American rattan-palm of the lower Amazon Valley, *Desmoncus macracanthus*, a slender climber, armed with strong thorns. It is used to some extent as the true rattans are used. It is often seventy feet long.

Jack, county of N. Texas. Area, 870 square miles. It is heavily timbered, and contains a great variety of land, chiefly adapted to pasturage. The valleys are very fertile. Cap. Jacksborough. Pop. 694.

Jack'al [Sp. *chacal;* Pers. *shacal*], the *Canis aureus*, a wild dog of Asia, South-eastern Europe, and Africa, which hunts in troops, is a carrion-eater, and is easily domesticated. It is regarded by some authorities as specifically identical with the dog and the wolf. It may not improbably be one of the originals whence the domestic dog has sprung, as the two breed freely together.

Jackdaw. See DAW.

Jack'mantown Plantation, tp. of Somerset co., Me. Pop. 65.

Jack's, tp. of Laurens co., S. C. Pop. 2720.

Jacks'borough, post-v., county-seat of Campbell co., Tenn., 3 miles E. of Careyville Station on the Knoxville and Ohio R. R. Pop. 178.

Jacksborough, post-v., county-seat of Jack co., Tex., 85 miles W. N. W. of Dallas.

Jack's Creek, tp. of Yancy co., N. C. Pop. 946.

Jack'screw, an apparatus for raising heavy buildings and other great weights by means of the screw. The name is, however, sometimes applied to devices for the same purpose which contain no screw. The principle of the hydraulic press is sometimes employed. There are numerous machines of this character.

Jack'son, county of N. E. Alabama, bounded on the N. by Tennessee, and for a short distance on the E. by Georgia. Area, 1150 square miles. It is traversed by the Tennessee River and the Memphis and Charleston R. R. The surface is broken by low mountains. The soil is fertile. Cattle, tobacco, wool, corn, and cotton are staple products. Cap. Scottsborough. Pop. 19,410.

Jackson, county of N. E. Arkansas. Area, 612 square miles. It is traversed by White River and the Cairo and

Fulton R. R. It is very level, except in the N., and is fertile and well timbered. Cotton, corn, hay, fruit, and timber are the chief products. Cap. Jacksonport. Pop. 7268.

Jackson, county of Florida, bounded on the N. by Alabama, and on the E. principally by Georgia. Area, 900 square miles. The navigable Chattahoochee River flows along the E. side, and the Chipola intersects the county. The county is a heavily timbered limestone region, one of the best agricultural sections of the State. Tobacco, cotton, sugar-cane, rice, and corn are largely produced. There are several caves and other natural curiosities. Cap. Marianna. Pop. 9528.

Jackson, county of N. E. Georgia. Area, about 480 square miles. The surface is broken. The county abounds in mineral wealth, as yet undeveloped. Tobacco, cotton, and corn are staple products. Cap. Jefferson. Pop. 11,181.

Jackson, county of S. Illinois, bounded on the W. by the Mississippi River. Area, 645 square miles. It is intersected by the Big Muddy River and the Illinois Central and the Grand Tower and Carbondale R. Rs. Excellent coal is mined. There are productive salt-wells. A part of the county has a hilly surface, and is known as the fruit-region of Southern Illinois. The soil is very fertile. Cattle, grain, fruit, tobacco, timber, and wool are staple products. Cap. Murphysborough. Pop. 19,634.

Jackson, county of S. Indiana. Area, 544 square miles. It is traversed by the Driftwood fork of White River and by the Ohio and Mississippi R. R. The surface is varied, the soil generally fertile. Iron ore is found. Cattle, grain, and wool are staple products. Lumber and carriages are leading articles of manufacture. Cap. Brownstown. Pop. 18,974.

Jackson, county of Iowa, bounded on the N. E. by the Mississippi River. Area, 636 square miles. The surface is broken, the soil fertile. Lead and iron ores are found. Cattle, grain, and wool are staple products. Carriages, cooperage, lumber, saddlery, etc. are among the leading articles of manufacture. The county is traversed by Maquoketa River and the Sabula Ackley and Dakota R. R. Cap. Andrew. Pop. 22,619.

Jackson, county of N. E. Kansas. Area, 684 square miles. It is fertile and diversified. Coal has been found. Live-stock and grain are staple products. The county is traversed by the Kansas Central R. R. Cap. Holton. Pop. 6053.

Jackson, county of E. Central Kentucky. Area, 425 square miles. It is broken by mountain-ranges, but has fertile valleys, and is believed to contain much coal. Corn is the staple product. Cap. McKee. Pop. 4547.

Jackson, parish of N. Louisiana. Area, about 780 square miles. Cotton, pork, and corn are staple products. It is mostly undulating and fertile land. Cap. Vernon. Pop. 7646.

Jackson, county of S. Michigan. Area, 720 square miles. It is a rich, level region, having limestone, sandstone, and some coal and iron ore. Cattle, wool, butter, and grain are staple products. Bricks, carriages, and flour are leading articles of manufacture. The county is traversed by numerous railroads, centring at Jackson, the capital. Pop. 36,047.

Jackson, county of S. W. Minnesota, bounded on the S. by Iowa. Area, 720 square miles. It is undulating, fertile, and abounds in small lakes. It is traversed by the Des Moines River. Grain is the staple product. Cap. Jackson. Pop. 1825.

Jackson, county of S. E. Mississippi. Area, about 1050 square miles. It is traversed by the navigable Pascagoula River, and bounded on the E. by Alabama, and on the S. by the Gulf of Mexico. It is level, and is a part of the great pine-region. Rice is a staple product, and large quantities of lumber are exported to New Orleans. It is traversed by the New Orleans Mobile and Texas R. R. Cap. Americus. Pop. 4362.

Jackson, county of Missouri, bounded on the W. by Kansas and on the N. by the Missouri River. Area, 580 square miles. It is a very fertile, rolling country, with a limestone soil. Cattle, grain, tobacco, and wool are staple products. The manufactures include metallic wares, carriages, clothing, saddlery, furniture, flour, cigars, etc. It is traversed by the Atlantic and Pacific R. R. Cap. Independence. Pop. 55,041.

Jackson, a former county of Nebraska, abolished since the census of 1870. Pop. in 1870, 9.

Jackson, county of W. North Carolina. Area, about 700 square miles. It is very mountainous, but has a fertile soil, beautiful and sublime scenery, and great mineral wealth. Iron, gold, and marble are known to exist. Cattle, corn, tobacco, and wool are staple products. Cap. Webster. Pop. 6683.

Jackson, county in S. Ohio. Area, 378 square miles. It is somewhat hilly, very fertile, and abounds in coal, salt, iron, and marble. Cattle, wool, and grain are staple products. Pig iron is a leading article of manufacture. The county is traversed by a branch of the Marietta and Cincinnati R. R. Cap. Jackson. Pop. 21,759.

Jackson, county of Oregon, bounded on the S. by California. Area, estimated at 11,000 square miles. It is traversed by the Cascade Mountains and other ranges. The soil and climate are varied. The W. part is in the Rogue River Valley, the middle in Klamath Valley, the E. in a basin which does not communicate with the sea. Gold, iron, and lignite are found. Cap. Jacksonville. Pop. 4778.

Jackson, county of Tennessee, traversed by the Cumberland River. Area, about 180 square miles. It has a diversified surface and a productive soil. Tobacco, cattle, corn, and wool are staple products. Cap. Gainesborough. Pop. (in 1870), 12,583, since which time its area has been much reduced.

Jackson, county of Texas, traversed by Lavacca River and its branches, and on the S. W. touching Matagorda Bay. Area, 852 square miles. It is mostly a rolling prairie, with stiff clay soil, but very productive. Cattle, corn, and cotton are staple products. Cap. Texana. Pop. 2278.

Jackson, county of West Virginia, bounded on the W. by the Ohio River. Area, 405 square miles. It is generally hilly and rolling, with a rich soil and abundant pasturage. Cattle, grain, tobacco, and wool are staple products. Cap. Ripley. Pop. 10,300.

Jackson, county of W. Central Wisconsin. Area, 936 square miles. It has a diversified surface and is heavily timbered. The soil is good. Grain is the staple crop. Lumber is extensively manufactured. It is traversed by the West Wisconsin R. R. Cap. Black River Falls. Pop. 7687.

Jackson, tp. and post-v. of Clarke co., Ala., on the Tombigbee River. Pop. 1360.

Jackson, tp. of Boone co., Ark. Pop. 320.

Jackson, tp. of Calhoun co., Ark. Pop. 365.

Jackson, tp. of Crittenden co., Ark. Pop. 316.

Jackson, tp. of Dallas co., Ark. Pop. 637.

Jackson, tp. of Little River co., Ark. Pop. 820.

Jackson, tp. of Monroe co., Ark. Pop. 784.

Jackson, tp. of Newton co., Ark. Pop. 850.

Jackson, tp. of Ouachita co., Ark. Pop. 580.

Jackson, tp. of Sharpe co., Ark. Pop. 275.

Jackson, tp. of Union co., Ark. Pop. 814.

Jackson, tp. of White co., Ark. Pop. 355.

Jackson, post-v., cap. of Amador co., Cal., at the junction of the N., Middle, and S. forks of Jackson Creek, 55 miles S. E. of Sacramento; has 2 weekly newspapers, large quartz-mills, 2 churches, 2 hotels, etc. Farming, gardening, fruit-culture, and quartz and placer mining are carried on. Pop. of tp. 2408.

R. M. Briggs, Ed. "Amador Weekly Ledger."

Jackson, post-v., county-seat of Butts co., Ga., 18 miles E. from Griffin.

Jackson, tp. of Effingham co., Ill. Pop. 1028.

Jackson, tp. of Will co., Ill. Pop. 1485.

Jackson, tp. of Allen co., Ind. Pop. 202.

Jackson, tp. of Bartholomew co., Ind. Pop. 618.

Jackson, tp. of Blackford co., Ind. Pop. 1399.

Jackson, tp. of Boone co., Ind. Pop. 2453.

Jackson, tp. of Brown co., Ind. Pop. 1750.

Jackson, tp. of Carroll co., Ind. Pop. 1301.

Jackson, tp. of Cass co., Ind. Pop. 1519.

Jackson, tp. of Clay co., Ind. Pop. 1711.

Jackson, tp. of Clinton co., Ind. Pop. 3932.

Jackson, tp. of Dearborn co., Ind. Pop. 1366.

Jackson, tp. of Decatur co., Ind. Pop. 1746.

Jackson, tp. of De Kalb co., Ind. Pop. 1141.

Jackson, tp. of Elkhart co., Ind. Pop. 1289.

Jackson, tp. of Fayette co., Ind. Pop. 1037.

Jackson, tp. of Fountain co., Ind. Pop. 1321.

Jackson, tp. of Greene co., Ind. Pop. 1969.

Jackson, tp. of Hamilton co., Ind. Pop. 3724.

Jackson, tp. of Hancock co., Ind. Pop. 1849.

Jackson, tp. of Harrison co., Ind. Pop. 1400.
Jackson, tp. of Howard co., Ind. Pop. 1000.
Jackson, tp. of Huntington co., Ind. Pop. 2257.
Jackson, tp. of Jackson co., Ind. Pop. 1137.
Jackson, tp. of Jay co., Ind. Pop. 989.
Jackson, tp. of Kosciusko co., Ind. Pop. 1043.
Jackson, tp. of Madison co., Ind. Pop. 1344.
Jackson, tp. of Miami co., Ind. Pop. 1645.
Jackson, tp. of Morgan co., Ind. Pop. 1723.
Jackson, tp. of Newton co., Ind. Pop. 766.
Jackson, tp. of Orange co., Ind. Pop. 1148.
Jackson, tp. of Owen co., Ind. Pop. 757.
Jackson, tp. of Parke co., Ind. Pop. 1377.
Jackson, tp. of Porter co., Ind. Pop. 1072.
Jackson, tp. of Putnam co., Ind. Pop. 1498.
Jackson, tp. of Randolph co., Ind. Pop. 1349.
Jackson, tp. of Ripley co., Ind. Pop. 1401.
Jackson, tp. of Rush co., Ind. Pop. 770.
Jackson, tp. of Shelby co., Ind. Pop. 1305.
Jackson, tp. of Spencer co., Ind. Pop. 926.
Jackson, tp. of Starke co., Ind. Pop. 125.
Jackson, tp. of Steuben co., Ind. Pop. 1122.
Jackson, tp. of Sullivan co., Ind. Pop. 1732.
Jackson, tp. of Tippecanoe co., Ind. Pop. 1081.
Jackson, tp. of Washington co., Ind. Pop. 779.
Jackson, tp. of Wayne co., Ind. Pop. 4949.
Jackson, tp. of Wells co., Ind. Pop. 1140.
Jackson, tp. of White co., Ind. Pop. 1358.
Jackson, post-tp. of Adair co., Ia. Pop. 339.
Jackson, tp. of Benton co., Ia. Pop. 963.
Jackson, tp. of Boone co., Ia. Pop. 798.
Jackson, tp. of Bremer co., Ia. Pop. 1131.
Jackson, tp. of Butler co., Ia. Pop. 569.
Jackson, tp. of Calhoun co., Ia. Pop. 367.
Jackson, tp. of Clarke co., Ia. Pop. 798.
Jackson, tp. of Crawford co., Ia. Pop. 246.
Jackson, tp. of Des Moines co., Ia. Pop. 103.
Jackson, tp. of Guthrie co., Ia. Pop. 875.
Jackson, tp. of Hardin co., Ia. Pop. 867.
Jackson, tp. of Harrison co., Ia. Pop. 206.
Jackson, tp. of Henry co., Ia. Pop. 1262.
Jackson, tp. of Jackson co., Ia. Pop. 862.
Jackson, tp. of Jones co., Ia. Pop. 899.
Jackson, tp. of Keokuk co., Ia. Pop. 1528.
Jackson, tp. of Lee co., Ia. Pop. 1460.
Jackson, tp. of Linn co., Ia. Pop. 996.
Jackson, tp. of Lucas co., Ia. Pop. 460.
Jackson, tp. of Madison co., Ia. Pop. 534.
Jackson, tp. of Monroe co., Ia. Pop. 942.
Jackson, tp. of Montgomery co., Ia. Pop. 1109.
Jackson, tp. of Poweshiek co., Ia. Pop. 1629.
Jackson, tp. of Sac co., Ia. Pop. 469.
Jackson, tp. of Shelby co., Ia. Pop. 486.
Jackson, tp. of Taylor co., Ia. Pop. 351.
Jackson, tp. of Van Buren co., Ia. Pop. 1292.
Jackson, tp. of Warren co., Ia. Pop. 639.
Jackson, tp. of Washington co., Ia. Pop. 879.
Jackson, tp. of Wayne co., Ia. Pop. 356.
Jackson, tp. of Webster co., Ia. Pop. 380.
Jackson, tp. of Winneshiek co., Ia. Pop. 668.
Jackson, tp. of Anderson co., Kan. Pop. 539.
Jackson, tp. of Lyon co., Kan. Pop. 1079.
Jackson, tp. of Riley co., Kan. Pop. 1249.

Jackson, post-v., county-seat of Breathitt co., Ky., on the Kentucky River, 55 miles E. by S. from Richmond, Ky. Pop. 54.

Jackson, a v. of East Feliciana parish, La. It has 1 weekly newspaper. Pop. 934.

Jackson, post-tp. of Waldo co., Me. It has manufactures of lumber, and is 8 miles N. of Brooks Station on the Maine Central R. R. Pop. 707.

Jackson, tp. of Frederick co., Md. Pop. 1699.

Jackson, city, cap. of Jackson co., Mich., on the Michigan Central R. R. (main line), 76 miles W. of Detroit, at the junction of a branch of the Michigan Southern R. R., the Fort Wayne Jackson and Saginaw, and the Grand River Valley R. Rs., and the air-line division of the first-named road; has productive coal-mines, large manufactures of sal-soda, the main shops of the Central R. R., extensive foundries, engine-works, flouring and planing mills, fire-clay works, and other important manufacturing interests. It has extensive commercial interests, and is in a prosperous farming region. The city (incorporated 1857) has 5 banks, 13 churches, 2 daily and 2 weekly newspapers, a fine system of public schools, Holly water-works, a trotting park, omnibus lines, a fine passenger dépôt, good water-power, and is the site of the Michigan State prison, a large establishment, carrying on extensive manufactures. Pop. 11,447. CARLTON & VAN ANTWERP, EDS. "PATRIOT."

Jackson, post-v., cap. of Jackson co., Minn., at the prospective junction of the Southern Minnesota and the Des Moines Valley R. Rs., not yet finished to this point. It is on the Des Moines River, 8 miles N. of the Iowa line, in a fertile and well-timbered region; has large grist-mills, great water-power, a weekly newspaper, a church, 2 hotels, a fine court-house, and other public buildings. It is rapidly growing. H. M. AVERY, ED. "REPUBLIC."

Jack'son, city, cap. of Mississippi, and shire-town of Hinds co., on the New Orleans Jackson and Great Northern R. R., 183 miles N. of New Orleans, on the Vicksburg and Meridian R. R., 45 miles E. of Vicksburg, and on the W. side of Pearl River. Among its public buildings are the State capitol and State penitentiary, while within the city limits are institutions for the blind and for the deaf and dumb; and one mile to the N. stands the lunatic asylum. Other institutions are 2 large public schools, a boys' high school, a young ladies' institute, and various other private schools; a large State library, 1 monthly, 1 daily, and 3 weekly newspapers, 10 churches (3 for the colored citizens), 2 foundries, 2 sash, door, and blind factories, 3 banking-houses, 2 hotels, a city-hall, a street railroad, and an efficient fire department with steam and hand engines. During the late war a large part of the city was destroyed, but it has been rebuilt in a substantial manner. Jackson is the place of meeting of the U. S. courts and of the circuit and chancery courts for a portion of the county; and the State supreme court sits here about nine months of the year. Jackson has a good trade in cotton and other commodities. Its population is now (1874) about one-half colored. It is a pleasant and well-built town. Pop. 4234.
J. L. POWER, ASSO. PUB. "CLARION."

Jackson, tp. of Andrew co., Mo. Pop. 2401.
Jackson, tp. of Buchanan co., Mo. Pop. 890.
Jackson, tp. of Camden co., Mo. Pop. 810.

Jackson, post-v., cap. of Cape Girardeau co., Mo., 10 miles N. W. of Cape Girardeau, has a high school, public school, seminary, weekly newspaper, 6 churches, 2 hotels, a flouring-mill, and 6 dry-goods stores. Pop. 459.
MALONE & JOHNSON, EDS. "CASH-BOOK."

Jackson, tp. of Carter co., Mo. Pop. 695.
Jackson, tp. of Clarke co., Mo. Pop. 1472.
Jackson, tp. of Clinton co., Mo. Pop. 1752.
Jackson, tp. of Dallas co., Mo. Pop. 1432.
Jackson, tp. of Daviess co., Mo. Pop. 1059.
Jackson, tp. of Douglas co., Mo. Pop. 330.
Jackson, tp. of Gentry co., Mo. Pop. 1037.
Jackson, tp. of Greene co., Mo. Pop. 1759.
Jackson, tp. of Jasper co., Mo. Pop. 1238.
Jackson, tp. of Johnson co., Mo. Pop. 2200.
Jackson, tp. of Linn co., Mo. Pop. 948.
Jackson, tp. of Livingston co., Mo. Pop. 2603.
Jackson, tp. of Macon co., Mo. Pop. 1755.
Jackson, tp. of Maries co., Mo. Pop. 1419.
Jackson, tp. of Monroe co., Mo. Pop. 4367.
Jackson, tp. of Nodaway co., Mo. Pop. 895.
Jackson, tp. of Osage co., Mo. Pop. 1104.
Jackson, tp. of Ozark co., Mo. Pop. 353.
Jackson, tp. of Polk co., Mo. Pop. 1483.
Jackson, tp. of Putnam co., Mo. Pop. 799.
Jackson, tp. of Randolph co., Mo. Pop. 1175.
Jackson, tp. of Reynolds co., Mo. Pop. 327.
Jackson, tp. of Shannon co., Mo. Pop. 370.
Jackson, tp. of Shelby co., Mo. Pop. 1416.
Jackson, tp. of St. Clair co., Mo. Pop. 411.
Jackson, tp. of St. Genevieve co., Mo. Pop. 1112.
Jackson, tp. of Sullivan co., Mo. Pop. 902.
Jackson, tp. of Texas co., Mo. Pop. 537.
Jackson, post-tp. of Dakota co., Neb. Pop. 668.

Jackson, post-tp. of Carroll co., N. H., 90 miles N. by E. of Concord, among the White Mountains. Pop. 474.

Jackson, tp. of Ocean co., N. J. Pop. 1755.

Jackson, tp. of Washington co., N. Y., abounding in steep mountains, beautiful lakes, and forests and well-cultivated farms. Pop. 1662.

Jackson, post-v., county-seat of Northampton co., N. C., 8 miles from Seaboard Station, on the Seaboard and Roanoke R. R. Pop. 181; of tp. 523.

Jackson, tp. of Union co., N. C. Pop. 1010.

Jackson, tp. of Allen co., O. Pop. 1801.

Jackson, tp. of Ashland co., O. Pop. 1409.

Jackson, tp. of Auglaize co., O. Pop. 1502.

Jackson, tp. of Brown co., O. Pop. 995.

Jackson, tp. of Champaign co., O. Pop. 1831.

Jackson, tp. of Clermont co., O. Pop. 1658.

Jackson, tp. of Coshocton co., O. Pop. 1767.

Jackson, tp. of Crawford co., O. Pop. 4021.

Jackson, tp. of Darke co., O. Pop. 2088.

Jackson, tp. of Franklin co., O. Pop. 1923.

Jackson, tp. of Guernsey co., O. Pop. 867.

Jackson, tp. of Hancock co., O. Pop. 1209.

Jackson, tp. of Hardin co., O. Pop. 1412.

Jackson, tp. of Highland co., O. Pop. 905.

Jackson, tp. of Jackson co., O. Pop. 1532.

Jackson, or **Jackson Court-house,** post-v., cap. of Jackson co., O., on the Marietta and Cincinnati R. R., Portsmouth branch, 7 miles from Hamden Junction. It has 6 churches, a large school building, 2 weekly newspapers, and 6 pig-iron furnaces; has important coal-mines, and a large trade in coal and iron, both of fine quality. The town is rapidly increasing in population. Pop. 2016.

Davis Mackley, Prop. "Jackson Standard."

Jackson, tp. of Knox co., O. Pop. 818.

Jackson (Jacksontown P. O.), a v. of Licking tp., Licking co., O., on the Newark Somerset and Straitsville R. R. Pop. 438.

Jackson, tp. of Mahoning co., O. Pop. 909.

Jackson, tp. of Monroe co., O. Pop. 1354.

Jackson, tp. of Montgomery co., O. Pop. 2170.

Jackson, tp. of Muskingum co., O. Pop. 1174.

Jackson, a v. of Washington tp., Muskingum co., O., 5 miles from Zanesville. Pop. 56.

Jackson, tp. of Noble co., O. Pop. 1190.

Jackson, tp. of Paulding co., O. Pop. 556.

Jackson, tp. of Perry co., O. Pop. 1539.

Jackson, tp. of Pickaway co., O. Pop. 1202.

Jackson, tp. of Pike co., O. Pop. 1840.

Jackson, tp. of Preble co., O. Pop. 1430.

Jackson, tp. of Putnam co., O. Pop. 737.

Jackson, tp. of Richland co., O. Pop. 934.

Jackson, tp. of Sandusky co., O. Pop. 1350.

Jackson, tp. of Seneca co., O. Pop. 1131.

Jackson, tp. of Shelby co., O. Pop. 1461.

Jackson, tp. of Stark co., O. Pop. 1616.

Jackson, tp. of Union co., O. Pop. 935.

Jackson, tp. of Van Wert co., O. Pop. 249.

Jackson, tp. of Vinton co., O. Pop. 1294.

Jackson, tp. of Wood co., O. Pop. 347.

Jackson, tp. of Wyandot co., O. Pop. 771.

Jackson, tp. of Butler co., Pa. Pop. 1137.

Jackson, tp. of Cambria co., Pa. Pop. 906.

Jackson, tp. of Columbia co., Pa. Pop. 565.

Jackson, tp. of Dauphin co., Pa. Pop. 1036.

Jackson, tp. of Greene co., Pa. Pop. 964.

Jackson, tp. of Huntingdon co., Pa. Pop. 1662.

Jackson, tp. of Lebanon co., Pa. Pop. 3437.

Jackson, tp. of Luzerne co., Pa. Pop. 624.

Jackson, tp. of Lycoming co., Pa. Pop. 542.

Jackson, tp. of Mercer co., Pa. Pop. 752.

Jackson, tp of Monroe co., Pa. Pop. 851.

Jackson, tp. of Northumberland co., Pa. Pop. 886.

Jackson, tp. of Perry co., Pa. Pop. 1103.

Jackson, tp. of Potter co., Pa. Pop. 49.

Jackson, tp. of Snyder co., Pa. Pop. 712.

Jackson, tp. of Susquehanna co., Pa. Pop. 1175.

Jackson, tp. of Tioga co., Pa. Pop. 1531.

Jackson, tp. of Venango co., Pa. Pop. 720.

Jackson, tp. of York co., Pa. Pop. 1499.

Jackson, city, cap. of Madison co., Tenn., is near the centre of West Tennessee, at the junction of the Mississippi Central and the Mobile and Ohio R. Rs., 72 miles N. E. of Memphis; has 125 business-houses, 2 banks, 5 hotels, 3 halls, 11 churches, 2 daily and 5 weekly newspapers, 2 railroad machine-shops, 3 planing and 3 flouring mills, 1 foundry, 2 carriage manufactories, besides many small manufacturing interests of various kinds. It has a very important cotton-trade, is the seat of West Tennessee College, and has 2 ladies' seminaries and other schools. Pop. 4119, much increased since the census.

D. M. Wisdom & Co., Props. "Whig and Tribune."

Jackson, tp. of Amelia co., Va. Pop. 2827.

Jackson, post-tp. of Louisa co., Va. Pop. 1525.

Jackson, tp. of Rappahanock co., Va. Pop. 1568.

Jackson, tp. of Adams co., Wis. Pop. 481.

Jackson, post-tp. of Washington co., Wis. Pop. 1978.

Jackson (Abner), D. D., LL.D., b. about 1811; graduated at Trinity College, Hartford, Conn., in 1837; was appointed tutor there, and afterwards professor of ethics and metaphysics. In 1858 he became president of Hobart College, and in 1867 president of Trinity College. D. at Hartford, Conn., Apr. 19, 1874.

Jackson (Abraham Reeves), A. M., M. D., b. in Philadelphia June 17, 1827; educated in the public schools of Philadelphia, and graduated in the spring of 1846 at the Philadelphia Central High School, from which institution he subsequently received the degree of master of arts; studied medicine under Prof. John Wiltbank, and received the degree of doctor of medicine from the medical department of Pennsylvania Medical College at Philadelphia in 1848; practised his profession at Stroudsburg, Pa., until May, 1870, when he removed to Chicago, Ill.; founded the Woman's Hospital of the State of Illinois, of which he became surgeon-in-chief. In the winter of 1872 he was elected to the chair of diseases of women by the faculty of Rush Medical College, who, in the following spring, conferred upon him the honorary degree of M. D.; in the spring of 1874 elected editor of the *Chicago Medical Register* by the Chicago Medico-Historical Society; member of Illinois State Medical Society, Academy of Science, Chicago, Chicago Medical Society, Chicago Society of Physicians and Surgeons, Chicago Medico-Historical Society; corresponding member of the Gynæcological Society of Boston. Author of papers—*Removal of Large Urethro-vesicle Calculus* (1858), *Exsection of Entire Fibula*, etc. (1858), *Obstinate Hæmorrhage from the Frænum Linguæ* (1859), *On the Efficacy of Cold Affusion in Narcotism* (1859), *Hydrocele of the Neck, and its Treatment by Excision* (1861), *Successful Removal of both Ovaries* (1866), *Uterine Fibroid of Posterior Wall Successfully Removed* (1870), *Fibrous Tumor of Bladder Successfully Removed* (1870), *Non-ovarian Menstruation*, etc. (1870), *Some Remarks upon Cases of Obstruction of the Bowels*, etc. (1871), *Vesico-vaginal Fistula*, etc. (1871), *Removal of Fibrous Tumor of Uterus* (1872), *Unsuccessful Attempt to Remove Fibrous Tumor of Womb* (1873), *Treatment of Uterine Fibroids by the Use of Ergotine* (1874).

Jackson (Andrew), LL.D., the seventh President of the U. S., b. at the Waxhaw Settlement, Union co., N. C. (at that time supposed to be in South Carolina), Mar. 15, 1767. His parents were Scotch-Irish, natives of Carrickfergus, who came to America in 1765 and settled on Twelve Mile Creek, a tributary of the Catawba. His father, who was a poor farm-laborer, died shortly before Andrew's birth, when his mother removed to Waxhaw, where some relatives resided. Few particulars of the childhood of Jackson have been preserved; his education was of the most limited kind, and he showed no fondness for books. In 1780, at the age of thirteen, he with his brother Robert volunteered to serve in the Revolutionary forces under Gen. Sumter, and was a witness of the latter's defeat at Hanging Rock. In the following year the brothers were made prisoners, and confined at Camden, experiencing brutal treatment from their captors, and being spectators of Gen. Greene's defeat at Hobkirk's Hill. Through their mother's exertions the boys were exchanged while suffering from smallpox. Robert soon died at Waxhaw, and Mrs. Jackson died not long after at Charleston of ship fever, contracted in attending the American prisoners. Young Jackson, left destitute, worked for some time in a saddler's shop, afterwards taught school, and at the age of eighteen commenced the study of law at Salisbury, N. C. In 1786 he was admitted to the bar, and removed in 1788 to Nashville, in what was then the western district of North Carolina, with the appointment of solicitor or public prosecutor. Two years later

Tennessee became a Territory, and Jackson was appointed by Pres. Washington U. S. attorney for the new district. In 1791 he married Mrs. Rachel Robards (daughter of Col. John Donelson), whom he supposed to have been divorced in that year by an act of the legislature of Virginia. It afterwards appeared that the divorce had not become legal until 1793, when it was formally granted by a jury in Mercer co., Ky., at the application of the husband, who was a resident of that State, and it was not until Jan., 1794, that Mr. and Mrs. Jackson were legally married by a second ceremony at Nashville. Under the circumstances it was not unnatural that the facts of the case were so misrepresented by opponents in the political campaigns a quarter of a century later as to become the basis of serious charges against Jackson's morality; which, however, has been satisfactorily attested by abundant evidence. Jackson was untiring in the exercise of his duties as U. S. attorney, which demanded frequent journeys through the wilderness and exposure to Indian hostilities; he acquired considerable property in land, and obtained such influence as to be chosen a member of the convention which framed the constitution of the new State of Tennessee (1796), and was elected in that year its first representative in Congress. The following year (1797) he was chosen to the U. S. Senate, but resigned in 1798 to accept a seat on the bench of the supreme court of Tennessee, which he held till 1804. He was elected a major-general of the State militia in 1801, and on the acquisition of Louisiana (1803) was an unsuccessful candidate for appointment as governor of the new Territory. In 1804 he withdrew from politics, settled on the plantation which he called the "Hermitage" near Nashville, set up a cotton-gin, formed a partnership, and traded to New Orleans, making the voyages on flatboats. Through his hot temper Jackson was involved in several quarrels and "affairs of honor" during this period, in one of which (1806) he was severely wounded, but had the misfortune to kill his opponent, Mr. Charles Dickinson. In 1805, Aaron Burr had visited Nashville and been a guest of Jackson, with whom he corresponded on the subject of a war with Spain, which was anticipated and desired by them, as well as by the people of the Southwest generally. Burr repeated his visit in Sept., 1806, when he engaged in the celebrated combinations which led to his trial for treason; he was warmly received by Jackson, at whose instance a public ball was given in his honor at Nashville, and contracted with the latter for boats and provisions. Early in 1807, when Burr had been proclaimed a traitor by Pres. Jefferson, volunteer forces for the Federal service were organized at Nashville under Jackson's command, but his energy and activity did not shield him from suspicions of connivance in the supposed treason. He was summoned to Richmond as a witness in Burr's trial, but was not called to the stand, probably because he was outspoken in his partisanship. On the outbreak of war with Great Britain in 1812, Jackson tendered his services, and in Jan., 1813, embarked for New Orleans at the head of the Tennessee contingent. In March he received an order to disband his forces, but in September he again took the field in the Creek war, and in conjunction with his former partner, Col. Coffee, inflicted upon the Indians the memorable defeats at Talladega, Emuckfaw, and Tallapoosa. In May, 1814, Jackson, who had now acquired a national reputation, was appointed a major-general of the U. S. army, and commenced a campaign against the British in Florida, conducted the defence of Mobile (Sept. 15), seized upon Pensacola (Nov. 6), and immediately transported the bulk of his troops to New Orleans, then threatened by a powerful naval force. Martial law was declared in Louisiana, the State militia was called to arms, engagements with the British were fought Dec. 23 and 28, and after reinforcements had been received on both sides the famous victory of Jan. 8, 1815, crowned Jackson's fame as a soldier, and made him the typical American hero of the first half of the nineteenth century. In 1817–18 he conducted the first war against the Seminoles of Florida, during which he seized upon Pensacola and executed by court-martial two British subjects (Arbuthnot and Ambrister)—acts which might easily have involved the U. S. in war both with Spain and Great Britain. Fortunately, the peril was averted (1819) by the cession of Florida to the U. S., and Jackson, who had escaped a trial for the irregularity of his conduct only through a division of opinion in Monroe's cabinet, was appointed (1821) governor of the new Territory. Soon afterward he declined the appointment of minister to Mexico. In 1823, Jackson was elected to the U. S. Senate, and nominated by the Tennessee legislature for the Presidency. This candidacy, though at first a matter of surprise, and even merriment, speedily became popular, and in 1824 the hero of New Orleans received the largest popular vote among the four candidates, though J. Q. Adams was elected by the House of Representatives through the influence of Henry Clay. In 1828, Jackson was triumphantly elected President over Adams after a campaign of unequalled bitterness, which may be considered the point of departure of the modern Democratic party. Inaugurated on Mar. 4, 1829, he at once removed from office all the incumbents belonging to the opposite party—a procedure new to American politics, but which naturally became a precedent. The first term of Jackson was characterized by quarrels between the Vice-President, Calhoun, and the secretary of state, Van Buren, attended by a cabinet crisis originating in scandals connected with the name of Mrs. General Eaton (wife of the secretary of war); by the beginning of his war upon the U. S. Bank, and by his vigorous action against the partisans of Calhoun, who in South Carolina (1832) threatened to nullify the acts of Congress establishing a protective tariff. In the Presidential campaign of 1832, Jackson received 219 out of 288 electoral votes, his competitor being Mr. Clay, while Mr. Wirt, on an "Anti-Masonic" platform, received the vote of Vermont alone. In 1833, President Jackson removed the government deposits from the U. S. Bank, thereby incurring a vote of censure from the Senate, which was, however, expunged four years later. During this second term of office the Cherokees, Choctaws, and Creeks were removed, not without difficulty, from Georgia, Alabama, and Mississippi to the Indian Territory; the national debt was extinguished, Arkansas and Michigan were admitted as States into the Union, the Seminole war was renewed, the anti-slavery agitation first acquired importance, the Mormon delusion, which had originated in 1829, attained considerable proportions in Ohio and Missouri, and the country experienced (1837) its greatest pecuniary panic. Railroads with locomotive propulsion were introduced into America during Jackson's first term (1829), and had become an important element of national life before the close of his second term. For many reasons, therefore, the administration of Pres. Jackson formed an era in American history, political, social, and industrial. He succeeded in effecting the election of his friend Van Buren as his successor, retired from the Presidency Mar. 4, 1837, and led a tranquil life at the Hermitage until his death, June 8, 1845. During his closing years he was a professed Christian and a member of the Presbyterian Church. No American of this century has been the subject of such opposite judgments; he was loved and hated with equal vehemence during his life, but at the present (1875) distance of time from his career, while opinions still vary as to the merits of most of his public acts, few of his countrymen will question that he was a warm-hearted, brave, patriotic, honest, and sincere man. If his distinguishing qualities were not such as constitute statesmanship in the highest sense, he at least never pretended to other merits than such as were written to his credit on the page of American history—not attempting to disguise the demerits, which were equally legible. The majority of his countrymen accepted and honored him in spite of all that calumny as well as truth could allege against him. His faults may therefore be truly said to have been those of his time; his magnificent virtues may also, with the same justice, be considered as typical of a state of society which has nearly passed away. Jackson's life has been many times written: by Eaton (1824), William Cobbett (1834), Amos Kendall (1844), Jenkins (1850), Headley (1852), and with great fulness and completeness by James Parton (New York, 3 vols., 1859 *seq.*). See also Thomas H. Benton's *Thirty Years' View* (1854) for the political history of his administration. Porter C. Bliss.

Jackson (Charles), LL.D., b. at Newburyport, Mass., May 31, 1775, son of Hon. Jonathan Jackson; graduated at Harvard College in 1793; studied law in the office of Chief-Justice Parsons, and, removing to Boston in 1803, soon attained an eminent position at the bar; was judge of the Massachusetts supreme court 1813–24, member of the constitutional convention in 1820, and chairman of a commission to codify the State laws in 1833. Through his labors several important reforms were introduced into Massachusetts legislation, especially in reference to debit and credit. He published a treatise on *Pleadings and Practice in Real Actions* (1828), which is a recognized authority upon the law of property. D. at Boston Dec. 13, 1855.

Jackson (Charles Davis), D. D., b. in Salem, Mass., Dec. 15, 1811; graduated at Dartmouth in 1833, and at Andover in 1838; was for a time professor in Lane Seminary and a teacher in Petersburg, Va., and afterwards in Flushing, N. Y.; in 1842 took priest's orders in the Protestant Episcopal Church; has since held the rectorships of St. Stephen's, N. Y., St. Luke's, Staten Island, and St. Peter's, Westchester, N. Y. He is the author of several volumes of sermons and of works on education. D. at Westchester, N. Y., June 28, 1871.

Jackson (Charles Thomas), M. D., b. at Plymouth,

Mass., June 21, 1805; studied medicine in Boston; took part in 1827–29 with Francis Alger in the geological survey of Nova Scotia; studied medicine and geology in Europe 1829–32, assisting in more than 200 autopsies of cholera victims in Vienna; in 1836 became State geologist of Maine (published three annual reports); in 1837 had a controversy with Prof. Morse regarding the invention of the telegraph, to which he had some claims; in 1839 State geologist of Rhode Island (1 vol. of reports); in 1840 State geologist of New Hampshire (1 report 1844); was 1847–49 U. S. surveyor of mineral lands in Michigan (report 1850). He has also received numerous honors as the discoverer of anæsthetics—a distinction which has found several other claimants. He has published various chemical reports for the U. S. patent-office and a *Manual of Etherization* (1861).

Jackson (Claiborne F.), b. in Fleming co., Ky., Apr. 4, 1807; removed in 1822 to Missouri; was a captain in the Black Hawk war, and was one year Speaker of the House in Missouri. In 1861 he was chosen governor, but was deposed by the State convention in the same year. He became a Confederate general, and d. at Little Rock, Ark., Dec. 6, 1862.

Jackson (Conrad Feger), b. in Pennsylvania; previous to 1861 was engaged in railroad business with the Philadelphia and Reading R. R.; appointed colonel 9th Pennsylvania Volunteers at the outbreak of the civil war, and served in McCall's division of Pennsylvania Reserves at Dranesville, Va., and throughout the Va. Peninsula campaign 1862; appointed brigadier-general of volunteers July, 1862, and commanded a brigade at South Mountain, Antietam, and Fredericksburg, where he was killed, Dec. 13, 1862. G. C. Simmons.

Jackson (Henry), M. D., LL.D., b. in Moreton-Hempstead, Devonshire, England, July 7, 1778; brought to this country in the twelfth year of his age by his brother, Gov. James Jackson of Georgia; thoroughly educated at the Pennsylvania University in Philadelphia, where he first took the degree of M. D., and commenced the practice of medicine in association with Dr. Grimes of that city, then one of the most eminent physicians in the U. S. From this lucrative pursuit he was called to the professorship of natural philosophy in the University of Georgia in 1811. Having more taste for science than desire for the acquisition of fortune, he accepted the tendered position. When William H. Crawford was sent minister to France in 1814, Dr. Jackson accompanied him as secretary of legation. This position he accepted, partly with a view of recruiting his health, but mainly with the view of extending the circle of his knowledge. When Mr. Crawford returned he remained at Paris as American *chargé d'affaires* until 1818. On his return he resumed the duties of his professorship with renewed energy and power of usefulness, but from domestic affliction was compelled to resign in 1827. D. near Athens, Ga., in 1840. A. H. Stephens.

Jackson (Henry R.), b. in Athens, Ga., June 24, 1820; was educated partly at Princeton and partly at Yale College. He entered the latter in 1835, and graduated there in 1839 with the first honor of his class; studied law, and was admitted to the bar in Georgia in 1840; first opened an office in Columbus, but finally located in Savannah; was appointed U. S. district attorney for the State in 1843; served as colonel in the Mexican war in 1846; after that war (in which he gained distinction) he was elevated to the circuit court bench of the State, which position he held 1849–53, when he resigned it to accept the appointment of *chargé d'affaires* to Austria. This mission was raised to the grade of minister resident in 1854, and he was continued in it until 1858. It was while he held this position the interesting *quasi* imbroglio took place between the Austrian empire and the U. S., growing out of the then late Hungarian war and the Khosta affair. His conduct in all these matters received the warmest approval by the authorities at Washington. He, however, resigned the position in 1858, and resumed the practice of law in Savannah. In 1859 he was employed by the Federal government authorities to prosecute the Wanderer, a celebrated slaveship which had recently landed on the coast of Georgia a cargo of Africans. This high duty he performed with unflinching fidelity and distinguished ability. In the winter of 1859 he was unanimously chosen chancellor of the State University, but declined to accept it, except on certain conditions which were not complied with. He was a delegate to the famous Democratic Presidential convention at Charleston in 1860, and though he opposed the extreme views of Mr. Yancey, yet when the delegations from all the other cotton States withdrew, he also withdrew, believing a division of the South under the circumstances would be the greater of two evils. He was afterwards one of the Presidential electors at large for the State on the Breckenridge and Lane ticket put forth in Baltimore after the rupture at Charleston. Soon after the passage of the ordinance of secession by Georgia the governor was authorized to appoint two major-generals to command the military forces of the State. The senior position of these commands was conferred on Col. Jackson, and accepted by him, but was soon after resigned by him, with a request that it should be conferred upon William Henry Walker, a gallant and distinguished officer of the Federal army who had resigned his position in that army with a determination to cast his fortunes with the people of his native State (Georgia), and who was at the time out of service. Col. Jackson's request was complied with. Upon the organization of the provisional government at Montgomery for the Confederate States (1861) he was tendered the office of Confederate judge for the State of Georgia. This position at first he declined, but afterward, by earnest entreaties from all quarters, was induced to accept. He, however, held it for a few months only, when he entered the provisional army of the Confederate States as brigadier-general, and was ordered to report to Gen. Garnett, then in North-western Virginia. Before reaching his appointed destination the news of the disaster which had befallen that commander met him, with a portion of Garnett's army in rapid retreat. By order of Gen. Lee he assumed the command of the shattered forces at Monterey. With these and his own two regiments he organized a force that prevented any further advance of the Federals from that quarter. On Oct. 3 he was attacked by Gen. Reynolds on Greenbrier River, but held his position. For winter-quarters he took position on the Alleghany. He was again appointed by Gov. Brown of Georgia major-general, to command a division of State troops called to the field for the defence of the Georgia coast. This position he accepted, but in doing it was compelled to resign his commission in the Confederate army, and after the passage of the Confederate conscript law in 1862 he resigned his commission as major-general of State forces, as by that law most of his forces were transferred to other branches of the service. He was again appointed brigadier-general in the Confederate army, and assigned to duty in the West. He was under Hood in his famous expedition to Tennessee in the fall of 1864, and acted a conspicuous part in the battles of Franklin and Nashville; in the latter, his entire command, thinned in its ranks to only a few hundred, was surrounded and captured on the field. As a prisoner of war he was first taken to Johnson's Island, then transferred to Fort Warren, where he remained till the close of the terrible conflict of arms. The subject of this sketch, amidst all his various vocations, has ever had a fondness for letters. Early in life he was a valued contributor to the *Orion*, the *Augusta Mirror*, the *Southern Quarterly Review*, and other periodical publications of like character. A volume of his poetic writings was published in 1850. It was entitled *Tallulah, and other Poems*, which met with general popular favor. Since the war he has taken no active part in public affairs, but has confined himself closely to the practice of his profession in Savannah, and is also at this time (May, 1875) president of the Georgia Historical Society. A. H. Stephens.

Jackson (James), b. in Moreton-Hempstead, Devonshire, England, in 1758, and migrated to Georgia in 1772; took an active and zealous part in the war for independence; was made brigade major in 1778, and in 1781 commanded the legionary corps of the State of Georgia. Upon the evacuation of Savannah by the British (July 12, 1782) he received the keys. In consideration of his many gallant and valuable services during the war, the general assembly of the State purchased and presented him with a commodious house and lot in the city of Savannah. After the war was over he engaged in the practice of law, and pursued it with success. He was elected a member of the first Congress of the U. S. which assembled under the new Constitution in 1789. He was soon after chosen one of the Senators from Georgia, which position he held until 1795, and then resigned upon the passage of the famous Yazoo bill, as it was called, by the legislature of his State. He came home to arouse the people to rally at the polls at the next election to put their signal condemnation on what he considered an infamous fraud. His efforts were successful. A large majority of the next general assembly not only repealed, but burnt the iniquitous act. To render the ceremony the more imposing, the fire by which the document was consumed was drawn from heaven through the instrumentality of a huge lens, through which the burning rays of the sun were converged. In 1798 he was elected governor of the State, which position he held until 1801, when he was again returned to the U. S. Senate. D. Mar. 19, 1806, in the zenith of his power and influence. In politics he was of the Jeffersonian school, and he made an impress upon the popular mind in Georgia of his principles unequalled by any man of his day and times. A. H. Stephens.

Jackson (James), b. in Jefferson co., Ga., 1819; graduated at the State University in 1837; studied law, and admitted to the bar in 1840; was elected secretary of the State senate in 1842, and was a member of the State legislature 1845–47; 1849–57 was on the circuit court bench of the State. This position he resigned to become a member of the 35th Congress. He was again elected to the 36th Congress, and resigned his seat in the House when Georgia passed her ordinance of secession in 1861. Since the war he has taken no active part in politics, but confined himself to the practice of law at Macon, Ga. For many years he has been a trustee of the university of the State.
A. H. Stephens.

Jackson (James), M. D., LL.D., b. at Newburyport, Mass., Oct. 3, 1777; graduated at Harvard in 1796; studied medicine in Europe, and began practice in Boston in 1800. He was the first physician of the Massachusetts General Hospital, in 1810 became a professor of clinical medicine in the Massachusetts Medical School, and in 1812 professor of theory and practice. He wrote *On the Brunonian System* (1809), *On the Effects of Dentition* (1812), *Syllabus of Lectures* (1816), *Letters to a Young Physician* (1855), and several other works. D. at Boston, Mass., Aug. 27, 1867.

Jackson (James S.), b. in Madison co., Ky.; educated at Centre College; studied and practised law; in the war with Mexico he served with a regiment of Kentucky volunteers, returned to his native State at its close, and resumed his profession; elected to the 37th Congress, he resigned his seat in 1861, organized the 3d Kentucky Cavalry (Union), of which he became colonel, and with which he was actively engaged during the winter and spring of 1861–62; was appointed brigadier-general of volunteers July, 1862, and commanded a division at the battle of Perryville, where, while endeavoring to rally a wavering body of his command, he was killed, Oct. 8, 1862. G. C. Simmons.

Jackson (John), b. at Lensey, Yorkshire, in 1686; was educated at Cambridge; became rector of Rossington, and in 1729 master of Wigton Hospital. His success in obtaining rank and dignity in the English Church was seriously impeded by the Unitarian (then called Arian) principles which he set forth in many treatises, and defended against such antagonists as Warburton, Whiston, and Middleton. He was also distinguished for his writings against the deists Collins and Tindal, and produced a valuable work on biblical chronology (1752). D. in 1763.

Jackson (John), D. D., b. at London Feb. 22, 1811; was educated at Pembroke College, Oxford, graduating in 1833 with first-class honors. In 1836 he became head-master of the proprietary grammar school at Islington; in 1846 rector of St. James's, Piccadilly; in 1847 chaplain to the queen; in 1852 canon of Bristol; and in 1853 bishop of Lincoln. Dr. Jackson was a select preacher before the University of Oxford in 1845, 1850, 1862, and 1866, and delivered the Boyle Lectures in 1853. He was promoted in 1869 to the bishopric of London.

Jackson (John Davies), A. M., M. D., b. at Danville, Ky., Dec. 12, 1834; graduated from Centre College in 1854; received his medical degree from the University of Pennsylvania 1857; and settled to practise in his native place. In the war between the States he served as a surgeon in the Confederate army. His contributions to medical literature are to be found chiefly in the leading medical journals and in translations—*An Operative Manual, Ligation of Arteries*, by Dr. L. H. Farabeuf (1874), *Trichiniasis* in the *Journal of A. M. Science* (1869), *The Black Arts in Medicine, Medical Office Pupilage, Floating Cartilage in Knee-joint, Gunshot Wounds in Bladder*, etc. J. M. Toner.

Jackson (Jonathan), b. at Boston June 4, 1743; graduated at Harvard College 1761; and became a wealthy merchant at Newburyport. He served as a member of the Provincial Congress of Massachusetts in 1775, as a representative in 1777, a member of Congress in 1782, and State senator in 1789. He was the author of *Thoughts upon the Political Situation of the U. S.* (1788). Three of his sons became men of distinction—Charles (Dr.), James, and Patrick T. (which see). D. at Boston Mar. 5, 1810.

Jackson (Nathaniel J.), b. at Newburyport, Mass.; took part in the American civil war as colonel of the 1st and 5th regiments Maine volunteers; appointed brigadier-general volunteers Sept. 24, 1862; commanded a brigade in the 12th army corps during the McClellan and Pope campaigns in Virginia; was wounded at Gaines's Mill; commanded 1st division 20th corps in Sherman's march to the sea, and was made brevet major-general of volunteers.

Jackson (Patrick Tracy), a brother of Dr. James Jackson, b. at Newburyport, Mass., Aug. 14, 1780; early acquired a large fortune in the East India trade, and with F. C. Lowell, his brother-in-law, engaged in the cotton manufacture, building their first mill in 1813 at Waltham, Mass. In 1821 they established what proved to be the germ of the city of Lowell. In 1837, after severe pecuniary losses, he removed to Lowell, and afterwards to Somersworth, N. H., and was engaged in manufacturing and in zealous and successful labors for the moral and intellectual good of his operatives. D. at Beverly, Mass., Sept. 12, 1847.

Jackson (Robert M. S.), a native of Pennsylvania, distinguished for a knowledge of natural science, rendered great service to the Pennsylvania geological commission, and was thoroughly acquainted with all the aspects of nature in the Alleghanies, having published a remarkable work called *The Mountain*, in which he enunciated bold but reverent ideas in natural theology. He served in the civil war as medical inspector of the 23d army corps and acting medical director of the department of the Ohio. D. at Chattanooga, Tenn., Jan. 28, 1865.

Jackson (Samuel), M. D., b. in Philadelphia Mar. 22, 1787; received his degree from Rutgers College in 1812; was 1835–63 professor of the institutes of medicine at the University of Pennsylvania, and enjoyed a wide reputation as a physician, lecturer, and medical writer. His chief work was the *Principles of Medicine* (1832). D. at Philadelphia Apr. 5, 1872.

Jackson (Thomas), D. D., b. at Willowing, Durham, England, in 1579; was educated at Oxford; became president of Corpus Christi College in 1630, prebendary of Winchester in 1635, and dean of Peterborough in 1638. Dean Jackson was a voluminous and learned writer upon Anglican theology, and ranks high in the roll of the famous divines of the seventeenth century. His *Commentary on the Apostles' Creed* is still highly valued, and his whole works were republished at Oxford in 1844 (12 vols.). D. in 1640.

Jackson (Thomas), D. D., b. at Sancton, Yorkshire, Dec. 12, 1783; was editor of *The Wesleyan Magazine* for twenty years; then theological tutor in the Wesleyan college at Richmond, being twice the president of the Wesleyan conference. His works are standard among Methodists, *The Institutions of Christianity* (3 vols.), *Life of Charles Wesley*, and *The Centenary of Methodism* being among them. D. at Richmond Mar. 11, 1873.

Jackson (Thomas), M. A., b. at Preston, England, in 1812; graduated at St. Mary's Hall, Oxford, in 1834; took holy orders, and after holding several parochial appointments became principal of the Normal College at Battersea and canon of St. Paul's. In 1849 he was appointed bishop of New Zealand, and went thither, but returned without having been consecrated, in consequence of difficulties with Bishop Selwyn. Being preferred to the rectory of St. Mary, Stoke Newington (a district of London), he has built up there one of the most splendid churches in the British metropolis. His educational publications have been numerous and valuable.

Jackson (Thomas Jonathan), ("Stonewall"), b. at Clarksburg, Harrison co., West Va., Jan. 21, 1824. Attracted toward the profession of arms, young Jackson walked from the mountains of Virginia to Washington, invoked the aid of his Congressman, and got the appointment of cadet at the U. S. Military Academy at West Point, where he was entered in the summer of 1842, and was graduated in 1846. Attached to the army as brevet second lieutenant of the 1st Artillery, his first service was as a subaltern with Magruder's battery of light artillery. Present at the reduction of Vera Cruz, and noticed for gallantry in the battles of Cerro Gordo, Contreras, Molino del Rey, Chapultepec, and the assault and capture of the city of Mexico, he received the brevets of captain for conduct at Contreras and Churubusco, and of major for the storming of Chapultepec. Meanwhile, he had been advanced by regular promotion to be first lieutenant on the 20th of Aug., 1847. After the war, on the 29th of Feb., 1852, he resigned from the regular army, having been previously appointed to the chair of natural and experimental philosophy and artillery instructor at the Virginia State Military Institute at Lexington, Rockbridge co., Va., a position which he still filled (Apr. 17, 1861) when Virginia declared for secession, and in which he was chiefly notable for intense religious sentiment, coupled with personal eccentricities. But Letcher, governor of Virginia, a resident of Lexington, had noticed somewhat of the merits of the eccentric professor, and making him colonel placed him in command of a force sent to seize and occupy the U. S. arsenal at Harper's Ferry—which Jackson accomplished on May 3, 1861. Relieved by Gen. J. E. Johnston (May 23), he fell in command of the brigade of Valley Virginians, whom he moulded into that redoubtable corps, baptized at the first Manassas, and ever after famous, as the "Stonewall brigade." In his very first detached service the martial character of the man be-

came apparent in the affair at Falling Waters. The junction of the forces of Johnston and Beauregard having taken place in the rear of Bull Run, Jackson, previously made a brigadier-general, came prominently into public view with the battle of Manassas, where he acquired the sobriquet of "Stonewall." Made a major-general (September, 1861), he was soon placed in command of the Confederate forces in the lower Shenandoah Valley, then menaced with occupation by a Federal army. Some apparently profitless, if not eccentric, marches and movements in that quarter during the next five months brought no material military results, but severely testing the mettle of his troops, somewhat impaired his popularity with them. Confronted finally, early in March, at Winchester, with a largely superior Union force, Jackson fell back with his small corps (3400 men of all arms, with 18 guns) towards Staunton, pursued as far as Strasburg. As his adversary retrograded in turn, the Confederate general swiftly took the offensive and fought the battle of Kernstown (Mar. 23, 1862) in characteristic fashion, after a forced march the same day of from 14 to 25 miles. Worsted, however, in this action, he was forced to retire up the Valley again to a position of observation near Swift Run Gap in the Blue Ridge, on the S. fork of the Shenandoah River, about the 9th of April. Meanwhile, a fresh adversary, Gen. Milroy, was marching across the mountains from the West to unite with Banks, then at Harrisonburg, and Jackson's situation was critical. Reinforcements, however, under Ewell, were approaching, and another Confederate force under Gen. Edward Johnson was at Buffalo Gap, just W. of Staunton. Giving orders to Ewell to hold Banks in check while he, forming a junction with Johnson, should take the offensive against Milroy, Jackson encountered and defeated that officer in a severe action of four hours at McDowell (May 8, 1862), forcing him to retreat with heavy loss in supplies. This achieved, Jackson, retracing his steps, effected a junction with Ewell, and throwing himself into the Luray Valley, by a forced march day and night stole upon the flank and rear of Gen. Banks, capturing detached bodies of Union troops, artillery, and wagon-trains at Winchester, where some sharp fighting ensued, with the result that Banks retreated precipitately across the Potomac into Maryland. This brought the immediate concentration of several strong Federal columns from different quarters in the upper Shenandoah Valley upon Jackson's rear for his destruction. Thus menaced, detaching Ewell to meet Fremont approaching from the N. E., with his own division Jackson took position about the 1st of June to observe Gen. Shields's force, diverted from McDowell's corps at Fredericksburg, and then in the Luray Valley. Encumbered at the time with 2300 prisoners and more than 9000 stands of captured arms, with other valuable stores, but never embarrassed by obstacles nor losing opportunities for strokes, he promptly threaded the Luray Valley to the White House, burned the bridge there, crossed over to the main valley, and passing around Shields took position near Ewell at Port Republic, equidistant between Shields and Banks. On the 8th of June, Ewell became engaged with and beat the latter at Cross Keys, and on the 9th, Shields having advanced to Port Republic, Jackson, after a sharp, well-contested action, defeated him, inflicting the loss of seven guns with other casualties. In this campaign was made manifest his high rare talent for the business of war. Here he gave to a comparatively petty force that astonishing mobility which enabled him to deliver so many opportune blows, with the effect to neutralize an aggregate of nearly 70,000 Federal soldiers, with a highly adverse influence upon McClellan's general plan of campaign, added to the gravest apprehension excited at Washington and throughout the whole Union for the safety of the national capital. Fresh from such successes, Jackson was now called to add his corps to the main Confederate army at the moment crowded back upon Richmond. Then was made that notable flank movement which ended in the decisive stroke upon McClellan's right at Cold Harbor (June 27, 1862), a movement executed under orders, but in its manner Jackson's own. Gen. Pope having been called from the West and placed in command of a large force, which he pushed along the Piedmont region to the Rapidan, while McClellan still threatened Richmond from James River, Jackson was detached by Lee to confront the fresh menace with three divisions. Always bent on the offensive, Jackson immediately resolved upon attack, and encountered Pope's advance corps on the afternoon of Aug. 9, within 6 or 8 miles of Culpeper Court-house. In this action of Cedar Run he was victor at all points. Gen. Lee deciding to take the offensive in the same direction, Jackson was charged with the lead in the operation, which, impressed with his genius, resulted in one of the most brilliant feats of the war, and he was the conspicuous figure in the actions of Aug. 29–30, 1862. In the invasion of Maryland that followed, his troops led the van to Frederick. Here he was detached for a special operation executed in his habitual manner, so that he was soon able to announce to his superior that the fortified position at Harper's Ferry had been surrendered into his hands, "with 11,000 men, an equal number of small-arms, 73 pieces of artillery, and 200 wagons," with large stores of camp and garrison equipage. But this success was dearly gained, for it entailed the inopportune absence of two-thirds of Lee's best troops so much longer than was anticipated, that, thrown meanwhile upon the defensive, his offensive plan of campaign was virtually foiled, while his adversary was enabled to assemble his strength, and force battle at Antietam with the Confederates unready, and therefore unable to push to a decisive close the advantage which they had gained at the end of that day, and their subsequent enforced retreat before their reinforced enemy. In that action, however, Jackson was present with two of his divisions, and his part of the field, the Confederate left near the Dunkers' church, was deeply impressed with his peculiar gift to develop the utmost fighting power of men, both offensively and defensively. In Burnside's attack on Lee at Fredericksburg (Dec. 11, 1862), Jackson held the Confederate right, with no marked opportunity for the display of his always ripening capacity for war. When, on the eve of the operations that ended at Chancellorsville, Gen. Hooker made the strong feint (Apr. 28, 1863) of passing the Rappahannock below Fredericksburg, the movement was confronted by Jackson, but as there was no prompt advance, Lee, forecasting Hooker's real plan, detached Jackson the next night with three divisions in the direction of Chancellorsville. In movement by midnight he found Hooker in a strongly fortified position. At Jackson's own suggestion, he was now entrusted with his last flank operation—a swift march around, and descent upon, the Union right and rear. Executing the operation in his habitual manner, he fell suddenly upon the 11th Federal corps on the afternoon of May 2, and completely routed it. Pressing the advantage as fast as the nature of the densely wooded country would admit, in his martial ardor he was carried far in advance of his men, until urged by his staff to return. Doing so, after nightfall, he and his suite, mistaken for Federal cavalry, received the fire of several Confederate regiments, and Jackson fell with three wounds, one ball having shattered his left arm two inches below the shoulder, another passing through the same arm below the elbow, and the other entering the palm of his right hand; several of his suite were killed outright, and several wounded. These volleys drew an immediate answer from a Federal force in the vicinity, and a sharp conflict was engaged, in the course of which the latter charged over the very body of the Confederate leader. Jackson recovered, however, in a counter-charge, was carried off the field on a litter under a terrible fire, from which one of the litter-bearers was slain, and by the fall of the litter Jackson was grievously contused. Meanwhile, his charge to the surgeon in attendance was, "Do not tell the troops I am wounded." The doubly wounded arm having been amputated, he was left serene, cheerful, and hopeful, talking freely of the battles, of the bravery and deserts of his subordinates, and of his old "Stonewall brigade." But pneumonia supervened, and in his weakened state from great loss of blood, Jackson died (May 10, 1863). An incomparable lieutenant, sure to execute any operation entrusted to him with marvellous precision, judgment, and courage, all his individual campaigns and combats bore the stamp of a masterly capacity for war. The more his operations in the Shenandoah Valley in the spring, summer, and fall of 1862 are studied, the more striking must the merits of this almost uniformly successful soldier appear, with all his intense perception of the value as well as right method of the *active defensive*, of which Jackson may indeed be rightly regarded as the very incarnation.

Thomas Jordan.

Jackson (William), b. in Cumberland co., Eng., Mar. 9, 1759; came to Charleston, S. C., in boyhood; was liberally educated, and served creditably in the Revolution, attaining the rank of major as aide-de-camp to Washington. In 1781 he was secretary to Laurens in his mission to France; in 1782–83 assistant secretary of war; in 1787 secretary to the U. S. constitutional convention; private secretary to Washington during his first presidency; surveyor of the port of Philadelphia 1796–1801, and secretary of the Society of Cincinnati from 1800 until his death, which occurred at Philadelphia Dec. 17, 1828. He pronounced the funeral oration upon Washington at Philadelphia, where in 1801 he started one of the first daily papers in America, *The Political and Commercial Register*.

Jackson Brook Plantation, tp. of Washington co., Me. Pop. 206.

Jack'sonburg, post-v. of Jackson tp., Wayne co., Ind. Pop. 109.

Jacksonburg, post-v. of Wayne tp., Butler co., O. Pop. 127.

Jackson Centre, post-v. of Jackson tp., Shelby co., O. Pop. 60.

Jackson Court-house, post-v., cap. of Jackson co., W. Va. It is called RIPLEY also, and is 16 miles from Ripley Landing on the Ohio River.

Jackson Creek, tp. of Clarke co., Ala. Pop. 393.

Jack'sonport, post-v., cap. of Jackson co., Ark., 80 miles N. E. of Little Rock, at the junction of White and Black rivers, and within 2 miles of the Cairo and Fulton R. R. It has a newspaper, 5 churches, free and select schools, Knights of Pythias, Knights of the Silver Ring, Odd Fellows, and Masonic lodges, and a $40,000 court-house. Cotton is extensively shipped from this point. Pop. 769. JOHN P. FAGIN, ED. "STATESMAN."

Jacksonport, tp. and post-v. of Door co., Wis., on Lake Michigan. Pop. 139.

Jackson's Hill, post-tp. of Davidson co., N. C. P. 637.

Jackson Springs, tp. of Moore co., N. C. Pop. 537.

Jack'sonville, post-v. and tp., cap. of Calhoun co., Ala., on the Selma Rome and Dalton R. R. It contains 1 newspaper, a male college, a female school, fine waterworks, 1 mill, an extensive tannery, 2 hotels, a livery stable, a number of stores, etc. It has a good trade with the surrounding valleys, beautiful mountain scenery, and a delightful climate. Pop. of v. 958; of tp. 1849.
I. F. & L. W. GRANT, EDS. "REPUBLICAN."

Jacksonville, city, cap. of Duval co., Fla., on the river St. Johns, 25 miles from its mouth; is the eastern terminus of the Jacksonville Pensacola and Mobile R. R. It ships annually some 50,000,000 feet of lumber, besides naval stores, cotton, and other commodities, and is the centre of business and travel for this section of the State, many thousands of tourists and others arriving here yearly by rail and river. It has a savings bank, 2 private banking-houses, 1 semiweekly, 1 triweekly, and 2 weekly newspapers, good graded schools, a hospital, 10 churches, a Roman Catholic academy for ladies, etc. It is well laid out, and is a very popular resort for invalids and pleasure-seekers. Pop. 6912, very largely increased since the U. S. census. N. K. SAWYER, ED. "UNION."

Jacksonville, post-v. of Telfair co., Ga., 18 miles from McVille, a station on the Macon and Brunswick R. R. Pop. 40.

Jacksonville, city and tp., cap. of Morgan co., Ill., is favorably situated in Central Illinois in the midst of a fertile prairie, near Mauvaiseterre Creek, an affluent of the Illinois River, 30 miles W. of Springfield, and at the intersection of the Jacksonville division of the Chicago and Alton with the Toledo Wabash and Western, the Peoria Pekin and Jacksonville, and the Jacksonville North-western and South-eastern R. Rs. The streets are wide and adorned with shade trees, cars run on the principal avenues, and the city is provided with gas and a complete system of waterworks and sewerage, all the city improvements being of a substantial character. It has a fine court-house, opera-house, 2 national banks, 2 private banks, a savings bank, 3 hotels, and 22 churches, the architecture of which is generally rich. It is known as "the Athens of the West," and well sustains the title, having State institutions for the insane, deaf and dumb, feeble-minded children, and the blind; of incorporated institutions, the Illinois College (Congregational), Illinois Female College (Methodist), Jacksonville Female Academy, Young Ladies' Athenæum, Illinois Conservatory of Music, and a combined academy and business college; of private institutions, the Lutheran orphan asylum, a retreat for the insane, and a surgical infirmary; and 1 high school, 7 public schools, 1 Roman Catholic parochial school, a free reading-room, and public library of 1600 volumes, all in separate, well-appointed buildings. Its manufacturing interests are rapidly developing, there being 4 flour-mills, woollen-factory, carworks, several foundries and machine-shops, carriage-factories, planing-mills, soap-factories, and gasworks. It has 1 daily and 3 weekly newspapers. Pop. of city, 9203; of tp. 3890.
L. B. GLOVER, ED. "DAILY JOURNAL."

Jacksonville, post-tp. of Chickasaw co., Ia. Pop. 828.

Jacksonville, post-v. and tp. of Onslow co., N. C. Pop. of v. 60; of tp. 1166.

Jacksonville, post-v., cap. of Jackson co., Or., on Rogue River, in a good agricultural and mining region, has 1 bank, 2 churches, 2 hotels, a public school, 2 newspapers and several stores.
H. KELLY, ED. "OREGON SENTINEL."

Jacksonville, a v. of Young tp., Indiana co., Pa. Pop. 141.

Jacksonville, post-v. of Cherokee co., Tex., on the International and Great Northern R. R., 28 miles N. E. of Palestine. It has 1 weekly newspaper.

Jacksonville, post-v. of Whitingham tp., Windham co., Vt., 25 miles W. by S. of Brattleboro', has manufactures of leather, etc.

Jacksonville, or **Floyd Court-House,** post-v., cap. of Floyd co., Va., 22 miles S. of the Virginia and Tennessee R. R., has 2 churches, 6 stores, 3 hotels, 1 foundry, 1 weekly newspaper, and a graded school. Pop. 321; of tp. 2773. JOHN SOWER, ED. "FLOYD REPORTER."

Jack's Springs, tp. of Escambia co., Ala. Pop. 196.

Jack's Valley, tp. of Douglas co., Nev. Pop. 140.

Jack Tree, the *Artocarpus integrifolia*, a tree which originated in the East Indies, and is now naturalized throughout a large part of the tropical world. It produces abundantly a fruit resembling, but much larger than, the bread-fruit, to which it is very nearly related. Though its taste is far from being pleasant, thousands of the lower classes of India eat it as food. Its wood is excellent for many uses, and is extensively employed in Europe for inlaying, carving, and fancy joinery. (See ARTOCARPACEÆ.)

Jacme (Jayme or **Jaume) En I.,** king of Aragon and count of Barcelona, b. in 1207 or 1208 at Montpellier, then belonging to the counts of Barcelona, and d. at Xativa in 1276. To his inherited states he added by conquest the Moorish kingdoms of Majorca, Valencia, and Murcia, and he imposed tribute on those of Grenada, Tunis, and Tlemcen. Hence he is generally styled *the Conqueror.* The title *en* corresponds in signification to the more modern *don*, and though its origin is not clear, it is probably derived from the Latin *sENior*, as in the Castilian *señor.* The life and exploits of En Jacme are recorded in the curious *Libre dels Feyts esdevenguts en la vida del malt alt Senyor Rey En Jacme lo conqueridor.* This work is professedly autobiographic, though its authenticity is disputed; but there exists a manuscript copy of it of the year 1343, and it is probably as trustworthy as any of the mediæval annals. It is, both historically and philologically, among the most valuable and attractive of the old Hispanic chronicles. The portion of it which describes the conquest of Valencia was printed in 1515 in the *Aureum opus Privilegiorum Regni Valentia*, and the entire work in 1557. A beautiful edition is now in course of publication at Barcelona in the *Biblioteca Catalana.* A Castilian translation by Flotato and Bofarull appeared at Barcelona in 1848. (See article CATALAN LANGUAGE AND LITERATURE.)
GEORGE P. MARSH.

Jacme (or **Jayme**) **II.,** called THE JUST, king of Aragon and count of Barcelona, b. about 1259, was grandson of the preceding, and second son of Pedro III., on whose death, in Nov., 1285, he became king of Sicily, and on the death of his brother, Alfonso III., in June, 1291, succeeded him on the throne of Aragon, leaving the government of Sicily to his brother Frederic. He maintained wars with Naples, Genoa, and Pisa (conquering the islands of Sardinia and Corsica), as well as with the Moors of Granada and Tripoli; founded the University of Lérida; expelled the Knights Templar from the kingdom; and d. at Barcelona in 1327, leaving the throne to his son, Alfonso IV.

Jac'mel, or **Jacquemel,** a port and city of Hayti, on the S. coast, 30 miles S. W. of Port-au-Prince, at the head of a bay of the same name. The city is ill built and unhealthy, but the harbor is deep and commodious. Commerce with the U. S. has been carried on for some years, and it is a port of call for mail-steamers. Pop. about 6000.

Ja'cob, or **Israel,** in biblical history the immediate ancestor of the Hebrew nation, being the son of Isaac, grandson of Abraham, and father of the twelve patriarchs from whom the tribes of Israel deduced their origin. The place of Jacob's birth cannot be ascertained from the narrative in Gen. xxv., except that it was in the *Negeb* or "south country" of the land of Canaan, probably near the well Lahai-roi (verse 11), which site has not been identified by modern travellers. In consequence of a quarrel with his twin-brother Esau about the supremacy in the household, Jacob was sent in his early manhood by his parents to his uncle Laban, at Haran in Padan-aram (a region variously located by some to the N. E. of the Euphrates, by others in the vicinity of Damascus), where he married his cousins Leah and Rachel, and resided twenty years, becoming wealthy in flocks and herds. Jacob then returned to Canaan with his family and his riches, not without a serious controversy with Laban. Arriving near home, he became reconciled with his brother Esau in a dramatic personal interview. Both on his journey to Haran and on his return Jacob had had visions (Gen. xxviii. and xxxii.) in which the greatness of his descendants was divinely announced to him, and the later sanctuaries at

Bethel and Penuel commemorated these events. Jacob's old age was embittered by the conduct of his sons, who sold his favorite, Joseph, as a slave to the Midianites, who took him to Egypt. Many years later, when Joseph had become viceroy of Egypt (Gen. xli.), the whole family of Jacob, after a wonderful series of events, recorded in the last ten chapters of Genesis, was established in Egypt, where the patriarch died seventeen years later at the age of 147 years. On his deathbed he pronounced a blessing upon each of his sons (Gen. xlix.), and commanded them to bury him with his fathers in the cave of Machpelah in the land of Canaan, which was accordingly done. The locality of this cave has been much disputed; the present text of Genesis assigns it to Hebron, in Southern Canaan, but as this is difficult to reconcile with the route taken by the funeral procession in crossing the Jordan (Gen. l. 11) and with the express language of the martyr Stephen (Acts vii. 16), placing the tomb of the patriarchs at Shechem or Sychem, it has been concluded by some expositors that *Hebron* is a gloss which has erroneously crept into the text of Genesis. The chronology of Jacob's life is one of the most perplexing problems of biblical criticism. Kitto and others date his birth about B. C. 1985, and his death B. C. 1857. (See Ewald's *History of Israel*, translated by Martineau, vol. i., and Dean Stanley's *Jewish Church*, vol. i.) PORTER C. BLISS.

Jacob (Bibliophile). See LACROIX (PAUL).

Jacob (JOHN), GENERAL, b. at Woolavington, near Bridgewater, England, in Jan., 1812; was distinguished for his gallantry in India as commander of the Scinde cavalry, for the influence he acquired over the natives of the N. W. frontier, whom he prevented from joining the mutiny of 1857, and for the invention of the Jacob rifle, a very popular cavalry arm in India, where it is the rival of the Enfield. D. at Jacobabad, a town founded by him in Scinde, Dec. 5, 1858. His *Views and Opinions* on Indian subjects were published after his death.

Jacob de Voragine, b. at Viraggio, near Genoa, in 1230; was archbishop of Genoa in 1292, and d. there in 1298. He was the author of the very famous *Legenda Aurea*, or *Golden Legend*, a collection of fanciful and fabulous lives of saints, widely read in the Middle Ages.

Jacob of Edessa, one of the most celebrated Syrian theologians, flourished in the second half of the seventh century. About 651 A. D. he became bishop of Edessa, and devoted himself to sacred and classical studies. His annotations upon the Syriac version of the Old Testament, of which some fragments are extant, are considered valuable, while his translations of Greek works into Syriac procured him the honorable title of "interpreter of the books." D. June 5, 708.

Jacob of Hungary, called THE MASTER, was a religious fanatic who played an important part in French history in the time of the seventh Crusade. In his youth he was reported to have been a Cistercian friar, to have learned magical arts from the Spanish Moors, and even to have embraced Islamism; these statements, however, are of doubtful authority. When the news of the surrender of St. Louis to the Mussulmans of Egypt became known in Europe, the "Master of Hungary" went through the provinces of France preaching a crusade for the liberation of the king. He laid claim to divine inspiration, and, appealing only to the poor and lowly, soon gathered about him in Flanders some 30,000 shepherds and peasants, called *Pastourels* or *Pastoureaux*, at whose head he started for Paris. At Amiens the mob obtained arms and recruits, and it numbered 100,000 when it presented itself before the walls of Paris. The Pastourels when admitted into Paris began to commit depredations and to murder monks, while Jacob assumed priestly faculties and officiated publicly in the church of St. Eustache. He divided his followers into several bands, and sent them by different routes towards the Holy Land. At Orléans they massacred the priests, at Bourges the Jews. These excesses caused the *Shepherds*, who had at first been favored by the queen and the magistrates, to be excommunicated, and Jacob their leader was killed by the queen's order while preaching in the midst of his followers, who were then easily annihilated or dispersed. (See the *Chronicles* of Matthew Paris and Matthew of Westminster, and Milman's *Latin Christianity*.)

Jacob of Vitry, b. at Vitry, in France, in the second half of the twelfth century; was first a parish priest at Argenteuil, then became a zealous apostle of Maria of Oignies, a woman who was supposed to possess supernatural gifts. Led by his enthusiasm, he undertook to preach a crusade against the Albigenses, and finally devoted himself to the interests of the Holy Sepulchre at Jerusalem, travelling through France to collect alms. He was appointed by Pope Honorius III. (1217) bishop of Acre in Palestine, where he effected great conversions of Saracen children. He resigned that bishopric in 1225; was appointed by Pope Gregory IX., in 1229, cardinal-bishop of Tusculum, and papal legate of France, Brabant, and the Holy Land, and d. at Rome Apr. 30 (or May 1), 1230. He was the most eloquent preacher of the time, but his fame now rests upon his *Historia Orientalis*, generally called *History of Jerusalem*, which is a valuable source of information upon the Crusades. He also wrote a *Historia Occidentalis*, a *Life of the Blessed Mary of Oignies*, and left an interesting collection of letters.

Jacobæ'an Lil'y (*Amaryllis formosissima*), a beautiful South American flower which has been acclimated in the U. S. Its bulb is large, dark-colored, and long-necked, protruding above the surface of the ground; the flowers, which appear before the leaves, are large, irregular, and of a brilliant crimson color. (See LILY.)

Jaco'bi (ABRAHAM), M. D., b. at Hartum, in Westphalia, May 6, 1830; graduated at Bonn in 1851, and came to the U. S. in 1853 in consequence of political persecutions in Germany. Dr. Jacobi has become a leading authority among the medical profession of America upon the subjects of obstetrics and diseases of women and children, having been professor of these branches at the New York Medical College (1860–69) and the College of Physicians and Surgeons. He has published *Dentition and its Derangements* (1862) and other works, and edited 1868–71 the *American Journal of Obstetrics and Diseases of Women and Children.*

Jacobi (FRIEDRICH HEINRICH), b. at Düsseldorf Jan. 25, 1743, and received a commercial education at Frankfort and Geneva, in which latter city he spent three years. In 1763 he was placed at the head of the paternal firm, and conducted the business of the house for seven years with great conscientiousness and with success. In 1770 he retired from mercantile affairs, having been appointed a councillor of finance for the duchies of Julich and Berg. This office gave him leisure and a superior social position; he was possessed of a large fortune, and had married a spirited and intelligent woman, and soon his literary taste, his philosophical spirit, his talents, and his studies brought him into intimate connection with many of the leaders of the German civilization—Goethe, Wieland, Lavater, Hamann, etc. His country-seat, Pempelfort, near Düsseldorf, was for several years a centre of literary life in Germany. In 1794, on the invasion of the French, he removed to Northern Germany, and lived for ten years mostly in Eutin. In 1804 he was called to Munich as a member of the newly-erected Academy of Science, of which he became president in 1807. In 1813 he resigned this position, and d. Mar. 10, 1819. His talent as a writer was half poetical, half philosophical, and as such it was eminently well suited to the standpoint which he occupied, and from which he exercised no small influence on the course of German civilization. His two romances, *Eduard Allwill* (1792) and *Woldemar* (1799), are now out of date; the exquisite delicateness of Woldemar's feelings is affected, and the subtle analysis to which they are subjected is a mental disease. But in an age whose task was to break through a petrified intellectuality and vindicate the right of the imagination and feeling in human life, the book was of great importance and very beneficial. Of more lasting interest are his *Ueber die Lehre des Spinoza* (1785), *David Hume über den Glauben* (1787), *Sendschreiben an Fichte* (1799), *Von den göttlichen Dingen und ihrer Offenbarung* (1811). Reason, the vital centre of the human mind, is with Jacobi the source of immediate knowledge, of an instinctive intuition, of a kind of revelation divinely safe; while the knowledge with which the understanding furnishes us, and which is derived from the senses by a train of reasoning, always is more or less exposed to mistakes and errors. Furthermore, the organ of this centre of the mind, the foundation on which the reason rests, is with Jacobi the feelings; the feelings stand in the same relation to reason as the senses to the understanding, only they err not. This standpoint, the philosophy of feelings, is not and could hardly be presented in systematic form. It is developed polemically against Spinoza, Hume, Kant, Fichte, and Schelling, and in an aphoristic manner. But the criticism is often very acute and the positive representation always clear and eloquent. His collected *Works* appeared in 6 vols., 1812–24; *Letters*, 2 vols., 1825–27; *Corres. with Goethe*, 1846. (See Kuhn, *Jacobi und die Philosophie seiner Zeit*, 1834.) CLEMENS PETERSEN.

Jacobi (KARL GUSTAV JAKOB), b. at Potsdam Dec. 10, 1804; studied mathematics and philosophy in Berlin; was appointed adjunct in 1825, and professor in 1827 in mathematics at Königsberg; travelled in 1843 in Italy for his health, and lived in Berlin, where he d. Feb. 18, 1851. His principal works are *Fundamenta nova theoriæ functionum ellipticarum* (1829), *Canon Arithmeticus* (1839).

Jacobi (Moritz Hermann), brother of the preceding, b. at Potsdam Sept. 21, 1801; became professor in civil engineering at the University of Dorpat in 1835, member of the Academy of Science in St. Petersburg in 1847, and received the title of councillor of state. D. in St. Petersburg Mar. 10, 1874. He is the inventor of the galvanoplastic art, on which he wrote an essay in 1840, *Die Galvanoplastik*.

Jac'obins [Lat. *Jacobus*, "James"], members of a political society founded 1789 by some deputies from Brittany during the session of the States General at Versailles. This society was at first called the "Breton Club," which name, being regarded as too exclusive, was soon changed to "Société des amis de la Constitution." The king and the Assembly went to Paris Oct., 1789; the club followed, and established itself in an old Dominican monastery in the Rue St. Honoré. The French Dominicans were commonly called Jacobins, from the fact that a church dedicated to St. James had been given to them shortly after their settlement in Paris in the thirteenth century: and before long the name was adopted by the new club. Many distinguished persons were among its members; for instance, La Fayette, Talleyrand, Mirabeau, Robespierre, the duke of Orleans, the poet Chenier, the actor Talma. Its power increased rapidly. Its opinions were disseminated by the *Journal des amis de la Constitution*, which was industriously circulated through the whole country. As its influence spread, its principles became more democratic, so that in Apr., 1790, Talleyrand, La Fayette, and many other moderate members withdrew and founded the "Club of 1789," afterwards styled "les Feuillants." Revolutionary societies on the Jacobin model were established in nearly every town and village of France, and affiliated to the original club, whose orders they implicitly obeyed. The Jacobins dictated every government measure. "They are 'Lords of the Articles,'" says Carlyle, "they originate debates for the legislative; discuss peace and war; settle beforehand what the legislative is to do." Robespierre was their most influential member; through him they ruled during the Reign of Terror, and after his downfall in 1794 they also were overthrown. In Oct., 1794, the affiliation of societies was forbidden by the Convention; in November, the Jacobin club was suspended, and the hall where it had met was closed. Some of its members joined the Electoral Club; others, the section "des Quinze-Vingts," in the Faubourg St. Antoine. Soon afterwards the monastery was destroyed, and upon its site was built the "Marché St. Honoré."

Much Jacobin and anti-Jacobin literature exists in the form of plays, poems, and pamphlets, most of which are rather curious than edifying; for example, *Le Secret des Jacobins, La Jacobiniade, Les Crimes des Jacobins*, published in Paris between 1790 and 1795. The poetry of the *Anti-Jacobin*, a journal edited by George Canning, is, however, one of the best works of humor in the English language. In this collection are to be found the well-known "Knife-grinder," and the burlesque of the "Rovers," in which occurs the song of the "University of Göttingen." The term *Jacobin* is still sometimes applied to persons of extreme revolutionary principles. Janet Tuckey.

Jac'obites. I. An Oriental Christian sect, monophysitic in doctrine, deriving their name from Jacob Baradai, "the ragged," originally a monk and presbyter near Nisibis in Mesopotamia, who became bishop of Edessa 541 A. D., and d. 578. He took upon himself the general superintendence of Monophysites in the East, and brought their number up to about 100,000, mainly in Mesopotamia and Syria. In the time of Gregory XIII. (1572–85) they numbered only 50,000 in Syria, Mesopotamia, and Babylonia. They are now still more reduced. In Syria they are a mere handful in a few villages, and very poor. They are under a patriarch who resides in a monastery near Mardin. In public worship use is made of the ancient Syriac language, which the people do not understand. There are said to be 200,000 Jacobites in India (Malabar and Travancore). Of the United or Roman Catholic Jacobites in Syria we have no statistics. Attempts were made to Romanize them as early as the fourteenth century, but with no considerable success till the seventeenth. About 96,000 Roman Catholic Jacobites are claimed in India.—II. In Great Britain, partisans of King James II., dethroned in 1688. They were strongest in Scotland, rebelling twice (in 1715 and in 1745), and were not wholly extinct as a party till after the death of Charles Edward, the Pretender, in 1788. R. D. Hitchcock.

Ja'cobs (Michael), D. D., one of the founders of Pennsylvania College at Gettysburg, professor of mathematics and of the physical and natural sciences in it; b. near Waynesboro', Franklin co., Pa., Jan. 18, 1808. In early boyhood he was left an orphan; entered the preparatory department of Jefferson College, Canonsburg, Dec., 1824; graduated with the valedictory 1828; taught for five months in a Presbyterian school at Belle-Air, Md.; came to Gettysburg to assist his brother, Rev. D. Jacobs, Apr., 1829; was professor 1832–71; was licensed by the West Pennsylvania synod at Hanover Oct. 11, 1832; ordained at Somerset 1834; president of synod 1849–51; secretary of general synod 1845; received the title of D. D. simultaneously from Jefferson and Wittenberg colleges 1859. D. July 22, 1871. His very valuable *Notes on the Rebel Invasion*, quoted by Everett as the best sketch of the battle; some eight articles in the *Ev. Review*, two in *U. S. Service Magazine*, and a number in *Linnæan Record and Journal* (of which he was for two years editor), comprise all his publications. Among the most important manuscripts left by him are his *Lectures on Meteorology*. In this department he was one of the closest and most reliable observers of his day. His qualities as a man and an instructor were of a very high order. His character was of transparent Christian purity, his mind clear, his scholarship accurate, and his modesty great, almost to a fault. C. P. Krauth.

Jacobs (Paul Emil), b. at Gotha in 1802; studied at the Academy of Munich 1818–25, and in Rome 1825–28; lived in St. Petersburg 1830–34; settled in 1840 in his native city, where he d. Jan. 6, 1866. Several of his pictures, such as *Adam and Eve, Judith and Holofernes, Samson and Delilah*, became very popular.

Ja'cobsburg, post-v. of Smith tp., Belmont co., O. Pop. 89.

Jacob's Fork, post-tp., Catawba co., N. C. Pop. 1106.

Ja'cobson (John Christian), b. about 1785, a bishop of the Moravian Church. After a ministerial service of over fifty years he d. at Bethlehem, Pa., Nov. 24, 1870.

Jacobson (William), D. D., b. in Norfolk in 1803; graduated at Lincoln College, Oxford, in 1827, with high honors; obtained a fellowship at Exeter College in 1829; was vice-principal of Magdalen Hall from 1832–48, when he became regius professor of divinity. In 1865, Dr. Jacobson was appointed bishop of Chester. While at Oxford he edited for the University press the *Remains of the Apostolic Fathers* (2 vols., 1840), Nowell's *Catechism* (1844), the *Collected Works of Bishop Sanderson* (6 vols., 1854), and other works, besides publishing two volumes of his own sermons (1840–46).

Jaco'bus (Melancthon Williams), D. D., LL.D., b. at Newark, N. J., Sept. 19, 1816; graduated at the College of New Jersey in 1834, and in 1838 at Princeton Theological Seminary, where he was assistant teacher in Hebrew 1838–39. In 1839 he was settled in Brooklyn, N. Y.; in 1850–51 travelled in Europe and the East; and in 1851 was made professor of Oriental and biblical literature in the theological seminary at Allegheny, Pa., which office he still (1875) holds. He received the degree of D. D. from Jefferson College in 1852, and of LL.D. from the College of New Jersey in 1867. In 1869 he was moderator of the General Assembly. He has published *Notes on the New Testament—Matthew* (1848), *Mark and Luke* (1853), *John* (1856), *Acts* (1859); also two volumes on *Genesis* (1864–65). R. D. Hitchcock.

Jaco'by (Johann), b. at Königsberg May 1, 1805; studied medicine at Berlin and Heidelberg, and settled in 1830 in his native city as a physician. It was his political activity, however, which made him famous. Four times he was accused of high treason—in 1841, on account of his *Vier Fragen*; in 1845, on account of his *Das königliche Wort Friedrich Wilhelm III.*; in 1849 and in 1866. The three first times he was acquitted, but the last time he was sentenced to imprisonment. He was a member of the German Parliament in 1848, and at different periods of the Prussian Diet. He also wrote *Die Grundsätze der preussich Demokratik* (1859).

Jacoby (Ludwig Sigismund), D. D., b. at Alt-Strelitz, Mecklenburg, Oct. 21, 1811, of Jewish parents. Converted to Christianity when about twenty-one years of age, he came to America some years later and joined the Methodist Episcopal Church, in which he became a preacher about 1840. After being for several years presiding elder of German districts in the Western States, he returned to Germany in 1849 to introduce Methodism in that country. Through his labors missions were established in many places, as well as a publishing-house and a theological seminary at Bremen under his own superintendence. In 1872 he returned to America, and is now (1875) pastor of a church in St. Louis, Mo. Among his writings are a *Concordance of the Bible* and a *History of Methodism in the Whole World down to 1869*.

Jacotot' (Jean Joseph), b. at Dijon, France, Mar. 4, 1770; was appointed professor of Latin and Greek literature at his native place when barely nineteen years of age; entered the army in 1792, becoming captain of artillery in the invasion of Belgium, and assisted the celebrated

board established at Paris for the manufacture of gunpowder by extraordinary methods at a time when the supply of ingredients seemed exhausted. Jacotot soon afterwards was made professor of mathematics at the Ecole Normale; then of Roman law; a director of the Polytechnic, and filled at Dijon the chair of scientific method, in which he introduced an original system of instruction with which his name has become identified. Exiled in 1815 for having supported Napoleon in the Chamber of Deputies during the "Hundred Days," Jacotot retired to Belgium, where he became professor of French at the University of Louvain and director of the military school, introducing and popularizing his new system, which exercised a great influence upon education throughout Europe, it being the precursor of the methods of Hamilton and Ollendorff. Jacotot returned to France in 1830, and d. at Paris July 30, 1840.

Jacquard′ (Joseph Marie), b. in Lyons, France, July 7, 1752, of poor parents, by whom he was first brought up as a weaver, and successively apprenticed to a bookbinder, a cutler, and a typefounder. At the age of twenty he inherited from his father a workshop containing two weavers' looms, but was obliged to sell all his property to meet the expenses he contracted in experiments for improving looms. After a long period of poverty and obscurity, during which he participated in some of the campaigns of the Revolution, he succeeded in inventing the Loom (which see) which has made his name a household word in both continents. He experienced an ill-fortune not unusual in the history of inventors in being mobbed by the operatives of Lyons in 1804, acting under the erroneous belief that the new loom would be ruinous to their class. This circumstance led to the purchase of the invention by the imperial government, and Napoleon, by a decree dated at Berlin Oct. 27, 1806, declared it public property. As a result, the subsequent prosperity of Lyons was largely attributable to the genius of Jacquard, who received during his lifetime the cross of the Legion of Honor, and since his death his statue has been erected (1840) in his native city. D. Aug. 7, 1834, at Oullins, a village near Lyons.

Jacquard Loom. See Loom, by W. E. A. Axon.

Jacqueline′ of Bavaria, b. in 1400, was the only daughter and heir of William VI. of Bavaria, count of Holland and Hainault, and of his wife, Margaret of Burgundy. In childhood she was betrothed to Prince John of France, who, however, d. by poison in 1417, in which year Jacqueline succeeded to her father's estates. The hand of the heiress was a prize destined to be fiercely disputed by the princes of that rude age. After refusing to marry the duke of Bedford, brother of Henry V. of England, Jacqueline wedded her cousin, John IV., duke of Brabant, but soon abandoned him, and in 1420 went to England, where Humphrey, duke of Gloucester, another brother of the king, sought her hand, treating her former marriage as null. After the death of Henry, the antipope, Benedict XIII. annulled Jacqueline's first marriage, and in 1423 Gloucester obtained the coveted prize. He thereupon sailed for Hainault with 5000 troops to reconquer his wife's estates, which had been seized by the dukes of Burgundy and Brabant. After many vicissitudes of fortune, Jacqueline was imprisoned at Ghent, escaped to Holland, repudiated her husband, made war on her own account, and finally ceded her estates to the duke of Burgundy to purchase the liberation of her new husband, Francis of Borselen. D. in 1436, without issue.

Jacquemart′ (Albert), b. at Paris in 1808; filled important financial posts under the French government, and took a leading part in the Universal Exposition of 1867, chiefly in regard to the processes of the arts applied to industry—a subject which he illustrated in his learned works, *Histoire antique industrielle et commerciale de la porcelaine* (Lyons, 1861–62), *Merveilles de la Céramique* (1866), and *Histoire de la Céramique* (1872), the latter of which has appeared in English under the title of *History of Ceramic Art*, translated by Mrs. Bury Palliser, with 1000 illustrations (London, 1873).

Jacquemont′ (Victor), b. in Paris Aug. 8, 1801; studied botany under Adrien de Jussieu, and after visiting the U. S. and the West Indies was appointed by the Museum of Natural History in Paris to conduct a scientific expedition in Eastern Asia. He arrived at Calcutta in 1829, travelled in British India, studying the native languages, crossed the Himalayas into Thibet, and reached Chinese Tartary, returning by Lahore, where Runjeet Singh showed him great favor. Jacquemont d. prematurely at Bombay Dec. 7, 1832. His correspondence and travels have been published, and are very entertaining, as well as valuable for their wealth of scientific observation.

Jacquerie′, Insurrection of the, a war of the French peasantry against the nobles which broke out May 12, 1358, during the imprisonment of John II. the Good in England. The oppressions of Charles the Bad of Navarre and the long and grinding tyranny of the nobles were the causes. For some three weeks the peasants were rapidly successful, and were guilty of every enormity. But on June 9 the count de Foix and Captal de Buch gave them a terrible and final overthrow at Meaux. The name "Jacquerie" signifies the "Jacks" or clowns.

Jacques (Amédée Florent), b. at Paris July 4, 1813, studied at the Collége de Bourbon, and entered the École Normale in 1832. After teaching philosophy at the colleges of Douay, Amiens, Versailles, and that of Louis-le-Grand at Paris, M. Jacques became in 1842 professor of his favorite branch of study at the École Normale. Brought into intimate association with Michelet, Quinet, and the leaders of the "Young France" of that period, he was one of the founders and the chief editor of *La Liberté de Penser*, the organ of the philosophers. He conducted this publication through the stormy years of the Second Republic (1848–51), contributing many remarkable articles to its columns, until the *coup d'état* of Napoleon III. silenced free thought in France, when he was ejected from his professorship. He had published in 1847, along with his colleagues, Saisset and Jules Simon, a *Manuel de Philosophie*, edited the works of Fénelon and Leibnitz, and contributed to the *Dictionnaire des Sciences Philosophiques*. In 1852, M. Jacques went to Montevideo in the republic of Uruguay, bearing the recommendation of Alexander Humboldt, and was appointed by the government to preside over a projected university. But political disturbances and the limited resources of that state interfered with the success of the project, and M. Jacques was then engaged to direct the government land-surveys. After some years, during which he made numerous scientific explorations, M. Jacques removed to Buenos Ayres, where he was entrusted with the management of one of the national colleges, in which capacity he rendered eminent services to the cause of education, being universally esteemed for his profound attainments and his readiness to promote every scientific object. He was a member of the leading learned societies of France and of South America. D. at Buenos Ayres in 1865.

Porter C. Bliss.

Jacques-Cartier′, county of Quebec, Canada, including the W. part of the island of Montreal. Cap. Pointe Claire. Pop. 11,179.

Jacquin′, von (Nicolas Joseph), Baron, b. at Leyden, Holland, Feb. 16, 1727; studied botany under Jussieu at Paris, and settled at Vienna, where in 1753 he was engaged to superintend the planting of the garden at Schönbrunn. Soon afterwards he undertook a voyage of several years' duration in tropical America, collecting rare species of plants, in which he was so fortunate as to discover about fifty new genera. Returning to Europe, the remainder of his long life was devoted to the publication of his numerous researches, and in lecturing upon botany and chemistry at the University of Vienna, at which place he d. Oct. 24, 1817. His son, Joseph Franz, succeeded him in his professional posts; b. 1767, d. 1839.

Jade, a hard green stone, highly prized in the East and by ancient races for ornaments. (See Nephrite, by Prof. W. P. Blake, A. M., Ph. B.)

Ja′de, or **Jahde,** a small river and also a bay in Germany S. W. of the mouth of the Weser. It formerly belonged to the grand duchy of Oldenburg, but was purchased by Prussia in 1853, for the purpose of forming a war-port on the German Ocean. The Bay of Jade covers an area of 74 square miles, which was formerly dry land, but inundated in 1511. (See Inundations, Maritime.)

Jade, a fortified seaport of Germany, on the North Sea, was formed since 1853. At that time Prussia bought the coast district from Oldenburg for 500,000 thalers, and it has since spent much labor and great expense in order to transform the Bay of Jade into a good naval harbor. Since 1869 the place is called Wilhelmshaven. Basins, of which the largest is 420 mètres long and 260 mètres broad, have been dug in the muddy ground of the marsh. These basins were then separated from the Bay of Jade by a dam, and in the beginning of the war with France the dam was finished and the harbor taken into use by the navy. On the western side of the principal basin three parallel dry docks, 160 mètres long, are situated, and the docks as well as the basin are walled with granite. Besides the docks are the wharves. To the E. this basin is connected with the Bay of Jade by a canal walled with granite and provided with sluices. Besides the naval harbor is the commercial harbor, which, however, is rather insignificant; it is not walled, has no sluiced canal, and is separated from the bay only by an earthen dam. The whole harbor is surrounded with fortifications, strongest where they face the sea, and provided with ordnances of the heaviest cal-

ibre in order to prevent any hostile vessel from approaching. Since the French war immense sums have been spent on the building of these fortifications. The town of Wilhelmshaven has grown up here since the harbor has been built; it is chiefly a military colony, and has excellent barracks. AUGUST NIEMANN.

Jaen′, in the times of the Moors, was an independent kingdom, but in 1234 it was conquered by Ferdinand III. and added to the kingdom of Castile. Now it forms a separate province of Spain. Area, 5184 square miles. Pop. 392,100. It is rich in metals and fertile, but thinly peopled.

Jaen, town of Spain, the capital of the province of Jaen, on the Jaen, a tributary of the Guadalquivir. Its walls, surmounted by turrets and pinnacles, and its castle, which still is used as a fortress, were built by the Moors. It has two cathedrals of the sixteenth century, and beautiful promenades, but its silk manufactures, which once made it famous, are now entirely lost. Pop. 22,933.

Jaf′fa, Yafa, or **Joppa,** town of Asiatic Turkey, in the province of Syria, on the Mediterranean, 33 miles N. W. of Jerusalem. In the times of David and Solomon it was the port of Jerusalem, and the cedars of Lebanon of which the temple was built were brought from Tyre to its harbor. During the Crusades it was the landing-place of the Christian armies. Now its harbor is nearly sanded up. Pop. 5000.

Jaffnapatam′, town of Ceylon, situated on the northern extremity of the island. It was originally a Dutch settlement, but most of the Dutch inhabitants have now left for Batavia. Pop. 8000.

Jaf′frey, post-tp. of Cheshire co., N. H., 46 miles W. S. W. of Concord. It has two principal post-villages, Jaffrey and East Jaffrey. The latter is on the Monadnock R. R., has a national bank and a savings bank, and manufactures of cotton drillings, shoes, wooden ware, boxes, etc. Jaffrey Village has a high school and manufactures of chairs, leather, etc. The town has 4 churches and contains the Grand Monadnock Mountains. Pop. 1256.

Jaffrey (GEORGE), b. at New Castle, N. H., Nov. 22, 1682; graduated at Harvard College 1702; became successively councillor, judge, treasurer, and chief-justice of New Hampshire. D. at Portsmouth May 8, 1749.

Jaganâtha. See JAGGERNAUT.

Jagel′lons, the name of a dynasty which reigned from the fourteenth to the seventeenth century in Poland, and during much of the time in Lithuania, Hungary, and Bohemia. The founder of the family was Jagellon or Jagiello, b. about 1354, grand duke of Lithuania, who was a pagan until his marriage (Feb. 17, 1386) with Hedwig, daughter of Louis the Great, king of Poland and Hungary. To this alliance Jagellon owed his election to the throne of Poland as successor to his father-in-law, under the name of Ladislas II. (Uladislas or Wladislas). The sovereigns of this dynasty were the most illustrious of Polish rulers. Sigismund Augustus, who d. in 1572, was the last Jagellon king of Poland in direct succession, but through the female line the family retained the throne until the abdication of John Casimir in 1668. Most of the existing royal houses of Europe (1875) are descended from the Jagellons.

Jä′ger (GUSTAV), b. at Leipsic July 12, 1808; studied at Dresden, Munich, and Rome; settled in 1837 at Munich, but removed in 1847, as director of the academy, to Leipsic, where he d. Apr. 29, 1871. His fresco paintings in Munich and Weimar are his principal works.

Jä′gerndorff, town of Austria, in the province of Silesia. It has four well-frequented cattle-fairs. P. 6618.

Jag′gar (THOMAS AUGUSTUS), D. D., b. in New York City June 2, 1839; was educated by a private tutor; graduated at the General Theological Seminary of the Episcopal Church; was ordained deacon in 1860 and presbyter in 1863; became rector of Trinity, Bergen Point, in 1862, of Anthon Memorial church, New York, in 1864, of St. John's, Yonkers, in 1868 (founding there the St. John's Riverside Hospital), and of Holy Trinity in Philadelphia in 1870. He was made a doctor of divinity by the University of Pennsylvania in 1874; was elected bishop of Southern Ohio Jan. 14, 1875, and was consecrated to that office in May, 1875.

Jaggernaut′, or **Puri,** town of Orissa, on the Bay of Bengal, in lat. 19° 45′ N. and lon. 85° 54′ E. It is an agreeable and healthy place, as the air is kept fresh by the south-western monsoon. Its name is a corruption of the Sanskrit word *Jaganatha*, "king of the world," which it received from an idol of Krishna, the lord of the universe, which it possesses—a wooden block in the shape of a cucumber, whose upper extremity represents a human face of utter hideousness. Around this idol has been erected a most magnificent temple, or rather a city of temples, and hundreds of thousands of pilgrims visit the place every year. On great days of festival the idol is placed on a huge chariot, to which the faithful harness themselves in order to draw the idol from one place to another, and in the enthusiasm of the moment they throw themselves under the wheels of the chariot and give up their lives to the glory of their idol. The gorgeousness and the peculiar beauty of this temple of Jaganatha are described as something unique, and, to increase the wonderfulness of the place, all columns, pinnacles, turrets, and other architectural ornaments are made of the most costly materials and have required centuries of labor to be worked out.

Jag′gery [Hind. *jâkri;* Prakrit, *sakkara;* Lat. *saccharum;* Eng. *sugar*], the sugar obtained in India from various palm trees, notably the cocoanut palm (*Cocos nucifera*), the toddy palm (*Phœnix sylvestris*), and the jaggery palm (*Caryota urens*). The tapping of the trees and the boiling of the sap are carried on by a special caste. The quality of the sugar is very poor, but its quantity is becoming very great, and it is now exported to England, and there refined more easily and cheaply than ordinary sugar. After refining the sugar is identical with cane and beetroot sugar. The *Nipa fruticans* is another valuable sugar-palm.

Ja′guar [Braz. *jagoâra*], the largest of the cat family of America, found from Texas to Patagonia, generally inhabiting forests by preference, and being quite arboreal in its habits. It is exceeded in size by the lion and tiger. Its hide is often of a rich yellow, spotted and ringed with black. The skins are of considerable commercial value. The animal is fierce, and can conquer all the beasts of its native wilds except the great boas of the Brazilian *selva*.

Jahn (FRIEDRICH LUDWIG), generally known under the name of *Turnvater Jahn*, b. Aug. 11, 1778, at Lanz, in the Prussian province of Brandenburg; studied theology at Halle and Göttingen; lived for some time as tutor in a private family at Greifswald, where he made the acquaintance of E. M. Arndt; went in 1805 to Jena to continue his studies, but preferred to enlist in the Prussian army as a soldier. After the battle of Jena, in which he did not partake, however, he fled to Lübeck, but returned in 1809 to Berlin, where he became teacher in a gymnasium in 1810, published his *Das Deutsche Volksthum*, and opened the first turn-establishment in 1811. His ideas of preparing a tremendous uprising of the German nation by a return to the old, genuine German civilization of the times of Hermann, and by a perfect physical training, were utterly fantastic, and his language, costume, and general behavior ludicrously eccentric. But his "turn-art" was, nevertheless, a good thing. It formed immediately numerous centres around which the German patriotism gathered and developed, and later it exercised a salutary influence on the whole system of education. In the war of 1814 he commanded a corps of volunteers, at the head of which he entered Paris, and in the same year he published his *Runenblätter*. But after the war the "turn-places" became the field of demagogical machinations and riots, and in 1818 Jahn was seized by the Prussian government and imprisoned. In 1825 he was liberated, but not allowed to reside in any university town. He settled in Freiburg; became more and more fantastic and eccentric; wrote *Neue Runenblätter* (1828), and *Merken zum Deutschen Volksthum* (1833); was elected a member of the national assembly of 1848, but his appearance here was only a great disappointment to himself and to his former turn-pupils, who loved him passionately. D. at Freiburg Oct. 15, 1852. In 1816 he published, together with Eiselen, *Die Deutsche Turnkunst*. A biography of him was written in 1855 by Pröhle. CLEMENS PETERSEN.

Jahn (JOHANN), b. at Taswitz, Moravia, June 18, 1750; studied at Znaim and at Olmutz, and in 1772 entered a convent at Bruck, where he soon became professor of Oriental languages and of biblical criticism. When (in 1784) this convent was suppressed, Jahn obtained a professorship first at Olmutz, and afterward at Vienna, where he also gave instruction in dogmatic theology. Jahn was the most distinguished representative in his time of Catholic biblical learning and criticism, and his numerous works enjoyed a well-merited reputation. He nevertheless incurred the disfavor of the ecclesiastical authorities for the boldness of some of his opinions, and in 1803 was separated from his professorial chair under pretext of a promotion to a canonry of St. Stephen's. Jahn published grammars, lexicons, and elementary works on the Hebrew, Syriac, Chaldaic, and Arabic languages, an *Introduction to the Old Testament* (1792), *Biblical Archæology* (5 vols., 1797–1805), a *Manual of General Hermeneutics* (1812), an edition of the Hebrew Bible (1806), and other works. His *Archæology* has been translated into English and reprinted in America. D. at Vienna Aug. 16, 1816.

Jahn (Otto), b. at Kiel June 16, 1813; studied in his native city, at Leipsic, Berlin, and Copenhagen; travelled with a stipend from the Danish government in France and Italy; became professor of archæology at Greifswald in 1842, and at Leipsic in 1847. On account of his participation in the revolutionary movements of 1848 and 1849 he was dismissed in 1850, but received in 1855 a chair in ancient literature and archæology at Bonn. D. Sept. 9, 1869. Besides his editions of Latin authors, a number of essays on various philological and archæological subjects, especially on antique vases, he wrote a popular biography of Mozart (4 vols., 1856) and other papers relating to music.

Jail. The words *jail* and *prison* are employed in common usage with but little if any distinction of meaning, and even as applied in law are not infrequently used as synonymous terms. But *jail* had originally a somewhat different sense from *prison* in legal usage, and is sometimes employed technically at the present day with the same distinctive interpretation. In this special meaning it is a place for the confinement of persons arrested for debt or for the commission of minor offences and in the custody of the sheriff, or for the temporary confinement of witnesses or persons awaiting trial. A prison is, on the other hand, a place of permanent confinement and of punishment for crime. A jailer is at common law the servant or deputy of the sheriff of the county, and for any wrongful acts which the jailer commits in the performance of his duty the sheriff is responsible on ordinary principles of agency. Thus, if a person in custody be suffered to escape, the sheriff will be liable. (See Escape.) (For the regulation of jails and the methods of prison management see Prison, Prison Discipline.) George Chase. Revised by T. W. Dwight.

Jail Delivery, Commission of. See Courts.

Jail Fever, a form of Typhus (which see).

Jai'nas, a Hindu religious sect. There are not at the present time many Hindus professing the Jaina faith, as compared with those professing such creeds as the Vaishnuva and Saiva, but the Jainas now in India are remarkable for their respectability, influence, and opulence as a class. They are chiefly to be met with in the N. and W. of the peninsula, although even in the S. groups of Jaina families are not uncommon. Whilst the characteristics of the Jaina religion are thoroughly well known, the date of the origin of the sect and the causes which led to its rise are hotly controverted points. The writer believes the true explanation to be as follows: It is generally allowed that Gotama Buddha (Sakyamuni) died at Gya in Southern Behar in 543 B. C. After this Buddhism quickly sprang up, and overran Hindustan. Brahminism itself was crushed and kept under for ten centuries by that ghastly religion of atheism, nihilism, and despair. But in the fifth century after Christ the old Vedic creed began to revive and Buddhism to fail. Ardent Buddhists noticed the change in the tide of Hindu opinion, and began to tremble at the consequences of a loss of prestige. The Brahmins were still numerous in the land, and the old reverence for their priestly character was regaining ground rapidly in the minds of the multitude. Caste, too, ignored as a religious institution by Buddhism, was beginning more and more to be regarded under its old aspect of an absolutely necessary institution for Hindus. So some of the shrewdest of the Buddhists determined on a compromise. They resolved to invent a religion which would unite in it several of the most important elements of Buddhism and of Brahminism. Thus, about the beginning of the sixth century A. D. Jaina doctrines began to be actively and successfully promulgated. Such, the writer believes, is the true history in brief of the origin of Jainism in India. The Jainas reverenced certain holy mortals who had, they held, acquired by practices of self-denial and mortification a station superior even to the gods worshipped by the Brahmins; and thus they conciliated the Buddhists. Gotama Buddha himself finds a place in Jaina mythology. On the other hand, the Jainas were extremely strict in avoiding the destruction of any animal life whatsoever, and they recognized caste; and thus they conciliated the Brahmins. In the matter of the Vedas, the Jainas tried to steer a middle course. Parts they rejected and parts they accepted as authority. For instance, those parts of the Vedas in which animal sacrifice is enjoined they treated without respect, and they refused to celebrate the *homa*, or burnt-offering, lest insects crawling amongst the fuel, bred by the fermented butter, or falling into the fire, might be accidentally destroyed. But to the parts of the Vedas which could in any way be regarded as favorable to Buddhistic tenets the Jainas paid the greatest reverence, and frequently quoted in their discourses and writings. Besides, the Jainas, whilst doing homage to Buddhas, employed Brahmin priests in their service as the sole ministrants in their temples or *posâlas*.

The term *Jaina* is derived from the Sanskrit *Jina*, signifying "one who is a victor." The saints worshipped by the Jainas were *Jinas*—those who had conquered all human passions, desires, aspirations, and infirmities, and had attained to a state of perfect apathy. Such a saint was regarded as *Jagat prathu*, "lord of the world;" *Sárvajna*, "all wise;" *Kshîna karma*, "one to whom ceremonial acts were not requisite;" *Adhishvara*, "supreme lord;" and *Devâdhideva*, "god of gods." He was one who had crossed the ocean of births (*Tirthakara*), he was the possessor of a spiritual nature (*Kevali*), and he was venerable and worthy of all homage (*Arhat*). The Buddhists, though they had innumerable earthly Buddhas, confined their homage practically to seven; the Jainas venerated seventy-two saints. Twenty-four were of a past age, twenty-four of a present, and twenty-four were to come. The worship, however, of the last two of the "present" era, *Pârsvanâth* and *Mahâvîra*, eclipsed the veneration paid to all other Jinas in Hindustan. As a whole, the Jinas appear to have possessed wonderful attributes. They were all beautiful of form; their bodies were all fragrant; their hair, always the same, curled gracefully; and their blood ran white in all their veins. They knew no hunger or thirst, no infirmity or decay. "He can collect around him," says Wilson, describing the perfect Jina, "millions of beings—gods, men, and animals—in a comparatively small space; his voice is audible to a great distance; and his language, which is *Arddha Magadhi*, is intelligible to animals, men, and gods; the back of his head is surrounded with a halo of light brighter than the disk of the sun; and of an immense interval around him, wherever he moves, there is neither sickness nor enmity, storm nor dearth, neither plague-portents nor war." (H. H. Wilson, *Works*, vol. i. p. 289.) But in some points Jinas differed from each other—namely in color, size, and longevity. For example, some were represented as white, some red, some blue, some black, and a large number saffron. Then, as to the height and longevity of the Jinas, the first of the "present" era, *Rishaba*, was 500 poles tall, and lived 8,400,000 years; the last of that era had only the height of a man, and lived no longer than 40 years. From this fact the great Oriental scholar Colebrooke considered that probably of the Jinas the last two only were historical personages. Jaina legends, with reference to the decreasing longevity and stature of saints, are extremely similar to Buddhist accounts of their Buddhas. For instance, Gotama Buddha is supposed to have lived only 100 years, whilst his predecessor lived 20,000 years.

The Jainas were divided into laymen and clerics—viz. *Sravakas* and *Yatis*. The Yatis received alms from the Sravakas, who assembled in the Jaina temples to worship the *Tirtha Karas*, or perfected *Jinas*. It was the duty of Sravakas to be gentle, pious, honest, chaste, liberal, and, as far as they were able, to practise penitential acts, especially such as fasting at stated times from particular luxuries. In the temples they were enjoined to walk around the images, repeating certain humble salutations to all the saints, and especially to the saint whose image they were encircling. They were also exhorted to observe several stated festivals. The Yatis never actually officiated as priests. That was left to the Brahmins, whom Jainas acknowledged to be the orthodox priestly caste; thereby conciliating Hindus. But the Yatis either congregated together in semi-conventual establishments or engaged in several money-making pursuits. For instance, all over India, even at the present time, they enjoy the reputation of being capital jugglers, necromancers, palm-prophets, and magicians. Many of them are arrant knaves, and earn their livelihood by selling quack medicines and dabbling in alchemy. Others deal in merchandise, and many have been known to amass a good deal of wealth. But one and all, with very few exceptions, pride themselves on their extreme sanctity, and especially evince their holiness outwardly by the absurd length to which they ostentatiously carry their regard for life in all its phases. Wilson, the great authority on the subject of the Hindu sects, thus speaks of the Jaina Yatis: "According to the greater or less degree of sanctity to which they pretend are their seeming purity and outward precision, shown especially in their care of animal life; they carry a brush to sweep the ground before they tread upon it; never eat nor drink in the dark, lest they should inadvertently swallow an insect; and sometimes wear a thin cloth over their mouths, lest their breath should demolish some of the atomic ephemera that frolic in the sunbeams; they wear their hair cut short—strictly they should pluck it out by the roots; they profess continence and poverty, and pretend to observe frequent fasts and exercise profound abstraction."

There are two chief divisions of Jainas—namely, the *Digambaras* and the *Swetambaras*. The Digambaras appear to be the larger as well as the more ancient division of the

two. Their name signifies "sky-clad"—that is, naked. At the present time, however, they do not go about naked, but merely cast off their clothes during their meal-times. The Swetambaras are those who are "clad in white." Not only in matters of dress do these two divisions of Jainas differ, but also in seven hundred points of doctrine and ceremonial observance, eighty-four of which are regarded as of paramount importance. For instance, Swetambaras adorn their images of saints with earrings, necklets, armlets, and tiaras of gold and precious stones—a practice which the Digambaras set their faces against. Swetambaras aver that there are twelve heavens under the rule of sixty-four Indras; the Digambaras assert that there are sixteen heavens and one hundred Indras. Swetambaras allow their Yatis to eat out of vessels; Digambaras use only the hand. Swetambaras make their ascetics carry about with them brushes, water-pots, etc. as essential *insignia* of their vocation; but Digambaras do not. Digambaras assert that no woman can enter *Nirvâna;* the more gallant Swetambaras, however, hold the doctrine which, as Wilson humorously puts it, "admits the fair sex to the enjoyment of final annihilation." Besides these two great divisions of Jainas, there exist several minor schisms, some of which date back to the very dawn of the faith. These are the sects of *Jamali* and of *Gosala.* The *Dravida* or southern sect of Jainas sprang up in all probability about the seventh century after Christ. There is the *Mahanisitha* sect and the *Lampaka;* which latter discard the use of images. The *Mula Sangis* dress in red, and use brushes of peacock's feathers, while the *Kashta Sangis* use yâk-tail brushes and venerate wooden images. There are also the *Terah Panthis,* "followers of thirteen," and the *Bis Panthis,* "followers of twenty." It may here be remarked that the influence of the Digambaras seems to have been very powerful over Jaina art, as the majority of Jaina Buddhas are represented as stark naked. Buddhist Buddhas are nearly always well clothed. The *posâlas,* or *maths,* of Jainas are frequently of considerable architectural beauty. The humblest are so constructed as to be as roomy as possible, in order that the votaries, if numerous, may not be unnecessarily inconvenienced.

Jaina doctrines arrange themselves under nine *Tattwas*—namely, first principles, or necessary verities of the faith. Briefly they are—(1) *Jîva,* life; (2) *Ajiva,* lifeless; (3) *Punya,* good, or merit; (4) *Pâpa,* ill, or demerit; (5) *Asrava,* source of acts; (6) *Samrava,* that by which acts are collected or impeded; (7) *Nirjara,* sin-destroying religious practice; (8) *Bandah,* association of life with acts; and (9) *Môksha,* final spiritual liberation from the bonds of action, exemption from the incidents of existence, and freedom from the necessity of being born again. We cannot in a brief space discuss the very vexed question as to the precise opinion held by the Jainas as to this state of Moksha. Was simple liberation, ceaseless and boundless apathy, or utter annihilation the final goal of Jaina belief? Jainas seem to have believed in the reality of elementary matter; in gods, demons, heaven, and hell; and, whatever else, at least in the final release of the vital sentient principle in man from all suffering. As time passed on, Jainism became, especially in parts of India, grossly corrupted, chiefly because probably of the influence the Brahmin priests must have gradually acquired over those for whom they ministered. For example, in Northern India the most vulgar and repulsive Saivism became gradually mixed up with the observances of Jaina worship. The Jainas then began to worship Devi and Saraswati, and to erect the images of the *Bhairavas* and *Bhairavis,* the cruel attendants of *Siva* and *Kali,* in their temples.

In conclusion, a word or two may be said of Jaina literature. It consists of *Purânas,* histories, legends, books of prayer and ritual, and treatises on medicine, astronomy, arithmetic, and grammar. The chief *Purânas* were probably composed by Jina Sena Achârya in the tenth century after Christ. One of the greatest Jaina writers was Hemachandra, who may have flourished at the end of the twelfth century, about which time the *Kalpa Sutra* is believed to have been written. The earliest Jaina writing of any note cannot probably be assigned an earlier date than the beginning of the tenth century A. D. R. C. CALDWELL.

Jakutsk. See YAKUTSK.

Jal (AUGUSTE), b. at Lyons, France, Apr. 12, 1795, studied at the marine school at Brest, and formed at Lyons in Mar., 1815, a company of cadets who hastened to the defence of Paris against Napoleon on his return from Elba. He afterwards devoted himself to literary and artistic criticism, accompanied as newspaper correspondent the army which in 1830 conquered Algeria, and on his return was placed in charge of the archives of the ministry of marine. M. Jal made several journeys for discovering manuscripts in Italy, Greece, and Turkey, and wrote numerous works of art-criticism, naval and general history, archæology (esp. *Archéologie Navale,* Paris, 1840, 2 vols.), and biography, of which the most important was the *Dictionnaire Critique de Biographie et d'Histoire,* a vast repertory of documents and biographical materials intended to rectify and supplement all previous works of the kind. D. 1873.

Jalabert' (CHARLES FRANÇOIS), b. at Nîmes in 1819; studied under Delaroche and in Italy, and exhibited in 1847 *Virgil reading his Georgics to Mæcenas,* which is now in the Luxemburg. Among his other pictures, *Romeo and Juliet* and *Raphael painting the Madonna di San Sisto* have become very popular.

Jal'ap [Sp. *Jalapa,* from a city of that name, or *Xalapa,* whence first imported in 1610], a cathartic drug, the dried root of *Exogonium purga* (*Ipomœa Jalapa* of Hayne), natural order Convolvulaceæ. This is a climbing plant with large lilac-purple flowers, growing in the mountains above the city of Jalapa, state of Vera Cruz, Mexico. The root is turnip-shaped or radish-shaped, blackish without, gray within, varying in size from that of a walnut to that of a good-sized pear. It dries into a hard brittle mass, and is exported from Vera Cruz in large bags, either whole or cut into slices or pieces. Its active principle is a resin, consisting of a hard and a soft portion, both apparently equally effective medicinally. The percentage amount of the resin varies in different specimens, and since the worms that are apt to attack jalap do not touch this ingredient, worm-eaten roots contain more of it in proportion than the sound. Jalap is one of the milder of the drastic or actively irritating cathartics. It produces watery discharges, gripes, and in overdose may cause dangerous inflammation of the bowels. It is one of the most frequently used of this class of purgatives, but, like other drastics, is generally given in combination to reduce its harshness. The "compound jalap powder" is a mixture of jalap and cream of tartar. Jalap is an ingredient of the "compound cathartic pill" of the Pharmacopœia. EDWARD CURTIS.

Jala'pa, city of Mexico, one of the two capitals of the state of Vera Cruz, is situated on the slopes of the Cordilleras at a height of 4500 feet above the sea, 60 miles N. W. of the port of Vera Cruz and 140 E. of the city of Mexico. Situated within a few miles of the snow-capped Orizaba and the peak of Perote, halfway between the *tierra caliente* of the sea-coast and the *tierra templada* of the central tableland, Jalapa enjoys one of the finest climates in the world. It is the residence of the wealthiest merchants, native and foreign, of Vera Cruz, with which city it will shortly be connected by a railway, now (1875) nearly completed. Jalapa is celebrated for the culture of its inhabitants and the beauty of its females; it is the native place of Presidents Santa Anna and Lerdo de Tejada, and has played a prominent part in Mexican politics. It was founded in the time of Cortes, who had extensive estates in the vicinity, and was occupied in 1847–48 by American troops, at which time a newspaper in English was printed there. The moistness of the climate is favorable to a superabundant vegetation; few spots in the world can more truly be called the botanist's paradise. Sugar-cane and tobacco are cultivated with great success, the silkworm is reared, wild honey, vanilla beans, and the jalap root are found in abundance in the forests. There are several cotton and cigar factories, tanneries and potteries, government buildings and fine educational institutions, with a bishopric and 3 newspapers. It is gradually becoming known as a delightful winter residence for American visitors. Pop. about 15,000. (See Rivera's *Historia de Jalapa,* 5 vols., 1870–71.)

Jaley' (LÉON LOUIS NICOLAS), b. at Paris Jan. 27, 1802, being the son of an engraver of medals, by whom he was guided in the study of sculpture. Entering the École des Beaux Arts in 1820, he twice gained prizes for statuary. Returning in 1833 from a long sojourn in Rome, his works, exhibited in successive annual expositions, were much admired, and he was employed to execute commissions for the Museum of Luxembourg, the Chamber of Peers, the Opera Comique, the Museum of Versailles, and the Palace of Justice. He was a member of the Academy of Fine Arts and of the Institute. D. in 1866.

Jalis'co, the most populous state of Mexico, is bounded by Sinaloa, Durango, Zacatecas, and Aguas Calientes on the N., Guanajuato and Michoacan on the E., Colima on the S., and the Pacific on the S. W. Area, about 50,000 square miles. Pop. 1,000,000. Jalisco was known as the kingdom of Nueva Galicia during the period of Spanish dominion, and was governed by the *audiencia* of Guadalajara as a province distinct from New Spain or Mexico. It was settled soon after the conquest of Mexico by Nuño de Guzman, and was explored by Cortés and Alvarado. It is traversed by the large river Tololotlan or Santiago, and includes the picturesque lake of Chapala and the volcano of Colima, 12,000 feet high. The surface is diversified by rugged mountains, with vast ravines or *barrancas,* the

river-beds sometimes lying between perpendicular walls of nearly 1000 feet in height. The climate varies according to situation, but is adapted to the cultivation of most tropical products, especially the sugar-cane. The harbors are not commodious. Chief towns, Guadalajara, Lagos, Zapotlan el Grande, and Tepic. Precious metals are abundant, but are mined upon a comparatively small scale. The inhabitants are in great part Indians of several distinct tribes.

Jalna′, town of Hindostan, in the dominion of the nizam, has a strongly built fort and some manufactures of silk, and produces large quantities of excellent vegetables. Pop. 10,000.

Jamai′ca, an island of the West Indies, one of the Great Antilles, belonging to England, and lying off the Bay of Honduras, between the Caribbean Sea and the Gulf of Mexico, between lat. 17° 40′ and 18° 30′ N., and between lon. 76° 15′ and 78° 25′ E., 90 miles S. of Cuba. Area, 4473 square miles. Pop. 506,154, of whom 13,101 are white, 101,346 mulattoes, and 391,707 black. The island is traversed from E. to W. by the Blue Mountains, from 7000 to 8000 feet high, which to the N. slope quite gently down towards the coast, while to the S. they present a range of wild and precipitous cliffs along the shore; they send a great number of small, rapid rivers down both sides, of which only one, the Black River, is navigable. The scenery is everywhere beautiful, the slopes of the mountains being covered with pimento groves or immense forests. The south-eastern part of the island is lower and more level, and here are the principal plains, which are mostly occupied with sugar-plantations. The climate of Jamaica is hot and unhealthy along the shores and in the depths of the valleys; yellow fever visits these regions every year. The rainy seasons occur in April and May, and in September, October, and November. They are generally preceded by a stagnation of the atmosphere which is very oppressive, and then ushered in by heavy thunderstorms and hurricanes. Earthquakes are also frequent, and have sometimes been very destructive, as, for instance, in 1692 and 1780. But at an elevation of 1500 feet the climate is healthful and very agreeable. It is so mild that coffee can be cultivated at an elevation of 5000 feet, and sugar, indigo, and other tropical plants flourish in the valleys. The forests are rich in bread-fruit trees, mahogany, and cedar; the principal palms are the cabbage-palm and the cocoanut tree. Of wild animals only the agoutis, iguanas, some species of monkeys, and alligators are numerous. But the domesticated animals of Europe, which have been introduced, thrive well. Since the emancipation of the slaves the productiveness of Jamaica has decreased, and it will probably take many years before the rich resources of this island become fully developed. The following table shows the development of the productiveness of the island, and the influence which the emancipation of the slaves exercised on it in 1833:

	Sugar, hogsheads.	Rum, puncheons.	Coffee, lbs.
1797	85,109	28,746	7,869,133
1805	150,352	53,950	24,137,393
1818	121,758	......	25,329,456
1821	119.560	50,827	16,819,761
1832	98,686	33,685	19,815,010
1838	69,613	25,380	13,551,795
1844	34,444	11,631	7,148,775
1857	30,459	15,992	7,095,623

While the exportation decreases, the importation, particularly of food, increases. In 1870 the value of exports was £1,283,000, and the value of imports £1,340,000. Jamaica was discovered by Columbus May 3, 1494, and the first Spanish settlement was made there in 1509. In 1655 it was taken by the English, who retained it by the treaty of Madrid in 1670. In 1807 the slave-trade was abolished, and in 1833 the slaves were emancipated. The immediate results of this act were not good; several hundred sugar and coffee plantations were left without labor, and went to ruin, and in course of time the general agitation threatened a serious revolt in 1865, which was subdued with severity. Immediately after the emancipation was completed (Aug. 1, 1838) the planters associated and put down the wages to the very lowest, while they increased the rent which the negroes had to pay for their huts as much as possible. The result was that the negroes deserted the plantations and settled in the mountains. Chinese workmen were then imported, but without success. In 1846 the principles of free trade became victorious in the United Kingdom, and in the English sugar and coffee market free labor from Jamaica had to compete with slave labor from Cuba and Brazil. At last a series of bad harvests brought the miseries of the island to their culmination, and a wild race-war began, which was put down by the English governor with great cruelty. Nevertheless, since the emancipation the various missions, formerly annoyed by the planters, have had free scope for their activity, and their exertions have been crowned with great success. Between the old slaves and masters grows up a new population of free citizens, through the agency of the missions and their schools. The island is divided into three counties; its capital is Kingston. It is governed by a captain-general, appointed by the Crown, and an assembly of 47 members, elected by the people.

CLEMENS PETERSEN.

Jamaica, post-v. of Queen's co., N. Y., on the Long Island, South Side, and Brooklyn Central R. Rs., 10 miles E. of New York. It has extensive farming and market-gardening interests, and manufactures of carriages and small wares. Many of its citizens do business in New York and Brooklyn. It has 6 churches, an academy and good public and private schools, gasworks, a public library, a savings bank, 4 weekly newspapers, a fire department, and fine public buildings. The township contains several other villages, has 8 churches, and considerable manufactures. Pop. 3791; of tp. 7745.

JOHN O'DONNELL, ED. "JAMAICA STANDARD."

Jamaica, post-v. and tp. of Windham co., Vt., 18 miles E. of Manchester, has a national bank and manufactures of leather, boots, shoes, chairs, etc. Pop. 1223.

Jamaica, post-tp. of Middlesex co., Va. Pop. 1298.

Jamaica Plain, post-v., formerly in the town of West Roxbury, Norfolk co., Mass., but now, with the rest of that town, included in the 17th ward of Boston. It is on the Boston and Providence R. R., 3 miles from the city proper, to which it was united Jan. 1, 1874. The ward has 11 churches, a savings bank, public library, a weekly newspaper, 2 rubber-mills, 2 carriage-factories, a paid fire department, fire-alarm telegraph, and is connected by horse railroad with the city proper. Most of the inhabitants do business in Boston. C. A. J. FARRAR, ED. "WEST ROXBURY GAZETTE."

Jamalti′ca, an ancient city of Honduras, 20 miles N. of Comayagua, now consisting of ruins similar in character to those of Copan. Many rectangular mounds, like the Mexican *teocallis*, are surmounted by the remains of edifices, and throughout the adjacent valley fragments of sculpture and well-painted vases are found.

James, county of Nebraska, organized since the census of 1870.

James, county of East Tennessee, having the Tennessee River on the N. W. and Georgia on the S. Area, about 200 square miles. It has a fertile soil, well adapted to grain. It is traversed by the East Tennessee Virginia and Georgia R. R. Cap. Ooltewah. It has been organized since the census of 1870.

James, tp. of Bibb co., Ala. Pop. 859.

James, tp. of Pottawattamie co., Ia. Pop. 309.

James, tp. of Stone co., Mo. Pop. 447.

James, the son of Zebedee [Lat. *Jacobus;* Gr. Ἰάκωβος], called THE GREATER, one of the twelve apostles, and brother of John. He was a fisherman on the Lake of Galilee when called to follow Jesus, and with Peter and John formed a group distinguished from the other apostles by being the chosen witnesses of several of the chief incidents in the ministry of Christ. Such were the transfiguration, the restoration to life of Jairus's daughter, and the agony at Gethsemane. James and John, with their mother Salome, appear at one time to have entertained false views of the nature of Christ's kingdom, and to have aspired to a sort of primacy, which was rebuked by Jesus; who on another occasion gave the brothers the appellation of Boanerges ("sons of thunder"), perhaps at the time when they rashly invoked fire from heaven upon a Samaritan village (Mark iii. 17; see also Luke ix. 52). James was the first martyr among the twelve, having been killed by the sword of King Herod Agrippa, A. D. 44 (Acts xii. 1). He is commemorated in the calendar of saints by the Roman Catholic Church on the 25th of July, and by the Eastern Church on the 23d of October. Under the name of SANTIAGO (St. Jago) DE COMPOSTELLA he was venerated from an early day in Spain as the patron of the kingdom.

James, the son of Alphæus, called THE LESS, one of the twelve apostles. His mother's name was Mary (Matt. xxvii. 56; Mark xv. 40), who is called (John xix. 25) "the wife of Cleophas," and is referred to in the same verse as a "sister" of Mary, the mother of Jesus. Whether this James is the same as "James the Lord's brother" spoken of by Paul in Gal. i. 19, has been much discussed, but the title of *apostle* given to him in the passage in question seems decisive. Nevertheless, this view involves grave difficulties, and Dr. Neander (quoted in McClintock & Strong's *Cyclopædia*, vol. iv. 754) pronounces this question to be "the most difficult in the apostolic history." Assuming the affirmative answer, the most consistent solution of the apparent discrepancies

in the New Testament references seems to be that advocated in a learned article in the *Cyclopædia* quoted above—namely, that the two Marys, the mothers of Jesus and of James, are called *sisters* in John xix. 25 by virtue of their marriage with two brothers, Joseph and Cleophas. If, then, Cleophas (otherwise Alphæus) had died without issue, it became the duty of Joseph (according to the law found in Deut. xxv. 5) to marry his brother's widow, and the eldest son by such marriage would be the legal representative of Cleophas or Alphæus, whose name he would bear. James the Less became the head of the Church at Jerusalem, and (according to the above theory) wrote the Epistle known by his name. Early Christian writers (as Hegesippus) give him the name of James *the Just*, and a well-known passage of Josephus (*Antiquities*, xx. 9. 1) describes his martyrdom, to which he attributes the downfall of the Jewish power; but most critics reject this account as an interpolation. Nothing, therefore, can be affirmed of the life of James posterior to the scriptural references. Several apocryphal writings have been attributed to James, of which one only, the *Protevangelium*, derives some importance from having been early known in the Church. It is a mere parody of the first two chapters of Luke, transferring, however, the events to the nativity of Mary. From this source the modern doctrine of the immaculate conception of the Virgin Mary appears to have been ultimately derived.

James, Epistle of, one of the canonical books of the New Testament, the first of the so-called catholic Epistles. It is ascribed to "James, the Lord's brother," who is generally identified with James the Less (which see), though many commentators contend that he was distinct from both the apostles bearing the same name. The Epistle is believed by the majority of critics to have been written several years before the destruction of Jerusalem by the head of the Jewish Church, and addressed to the Christians of Asia Minor. The style is elegant, and the Greek better than that of any other portion of the New Testament. The "doctrine of works," which forms its chief topic, has occasioned more controversy upon this Epistle than upon almost any other book of the canon, it being regarded by some as irreconcilable with Paul's doctrine of faith. Though Luther and his immediate followers rejected this Epistle, modern Protestants think it represents faithfully the practical teaching of Christ, and find many analogies with the Sermon on the Mount. The distinctive doctrines of Christianity are not alluded to, except by implication. The literature of the subject, which is very extensive, is reviewed by Prof. Berschlag in *Studien und Kritiken*, Jan., 1874.

James I. of Great Britain (**VI.** of Scotland), b. at Edinburgh Castle June 19, 1566, was the only son of Mary, queen of Scots, by her second husband, Henry Stuart, Lord Darnley. In the following year, soon after Darnley was assassinated (Feb. 10), Mary was abducted by Bothwell, whom she married May 15; was imprisoned at Lochleven Castle in June by her insurgent nobles, and forced to resign the crown (July 24) to the infant James, who was accordingly crowned at Stirling on July 29. During the stormy years of James's childhood, passed at Stirling Castle, the regency was successively in the hands of the powerful nobles the earls of Murray, Lennox, Mar, and Morton, until, on the overthrow of the latter in 1577, James nominally took the government into his own hands, which was confirmed by Parliament in 1578. His early education had been carefully directed by the famous historian and classical scholar George Buchanan, from whom he probably derived a taste for learning which degenerated into a ridiculous pedantry. Earl Morton regained power for a short time, but was beheaded in 1581 on a charge of complicity in the murder of Darnley, after which Arran and the French favorite whom James had created duke of Lennox ruled until Aug., 1582, when a party of the nobles seized the king at Ruthven Castle, imprisoned Lennox, and banished Arran. The civil war and court intrigues went on with a wearying iteration of similar events for several years, during which James made a treaty with Elizabeth, receiving from her a pension (1585), unsuccessfully interceded for his mother's life (1587), co-operated with England in preparations against the Spanish Armada (1588), went to Denmark, where he married the princess Anne (Nov. 24, 1589), carried on war with varying success against several Catholic lords from 1590 to 1597, and by the death of Elizabeth in 1603 succeeded to the throne of England, being proclaimed Mar. 24 and crowned at Westminster July 25. He presided at the Hampton Court Conferences in Jan., 1604; exiled Jesuits and seminary priests; assumed the title of "king of Great Britain, France, and Ireland" Oct. 24, 1604; discovered the "Gunpowder Plot" Nov. 5, 1605; instituted the order of baronets in 1611; and lavished honors upon the unworthy favorites by whom he was directed, such as Carr, made earl of Somerset in 1613, and Villiers, raised through all the stages of the peerage, from baron in 1616 to duke of Buckingham in 1623. His son Henry, prince of Wales, died in 1612; his daughter Elizabeth, from whom the house of Hanover descended, was married in 1613 to the elector palatine, who became king of Bohemia, but lost his estates in 1620, at the outbreak of the Thirty Years' war, through the failure of James to render his promised assistance. Great efforts were made by James to obtain the alliance of Spain through the marriage of Prince Charles with a Spanish princess, and on the failure of negotiations in 1624, declared war against that power, but d. shortly after at the palace of Theobalds Mar. 27, 1625. The reign of James in England was distinguished by many memorable events; it witnessed the literary and political careers of Bacon and Raleigh, the disgrace of both, and execution of the latter; the dramatic activity of Shakspeare and Ben Jonson; the translation of the English Bible; the colonization of Virginia and New England; the formation of two well-defined schools of English Protestantism; and the genesis of the struggle between king and commons which brought the head of his successor to the block. James was despicable in his personal qualities; was weak, cowardly, passionate, vindictive, cruel, superstitious, fanatical, and prone to fall under the influence of worthless favorites. His learning was varied, though not scholarly; he published several books, which were much praised by his flatterers, but have now only an historical interest; *Essays of a 'Prentice in the Divine Art of Poesy* (1584), *Dæmonologie* (1597), *True Law of Free Monarchies* (1598), *Basilikon Doron* (1599), *Triplici Nodo Triplex Cuneus* (1605), *Remonstrance for the Right of Kings* (1615), and *Counterblast to Tobacco* (1616). (See S. R. Gardiner's able histories of this reign, 1875.) Porter C. Bliss.

James II. of Great Britain, a son of Charles I., b. in London Oct. 15, 1633; became duke of York; escaped in 1648 from the Parliamentarians and fled to the Low Countries; served with distinction under Turenne and Condé; was appointed by Mazarin captain-general in Italy 1656, in which year he entered the Spanish service and fought against Turenne; was appointed in 1660 lord high admiral of England and lord warden of the Cinque Ports; married Anne Hyde, daughter of Lord Clarendon, 1660; commanded against the Dutch 1665–72; avowed himself a Roman Catholic 1669; married Mary of Este 1673; retired to the Low Countries during the unsuccessful agitation for excluding him from the throne; as lord high commissioner for Scotland persecuted the Covenanters 1679, and succeeded Charles II. 1685. The great events of his reign were the insurrections of Argyle and Monmouth (1685); the persistent attempts of the king to overthrow constitutional government and to establish arbitrary royal power and the Roman Catholic religion; the declaration of freedom of conscience as a means to that end; the violation of the privileges of the universities; the imprisonment of the bishops for petitioning to be excused from reading a royal proclamation; the establishment of new and illegal tribunals; and the maintenance of a standing army without legal warrant. The whole nation became aroused; William, prince of Orange, a cousin of the king, and Mary, princess of Orange, the king's eldest daughter, were called by common consent to the throne; James abdicated Dec. 11, 1688, and fled to France, but in 1689 invaded Ireland, besieged Londonderry without success, and July 1, 1690, was defeated at the Boyne; retired to France, and spent the rest of his life in futile schemes for restoration to the throne. D. at St. Germain's Sept. 16, 1701.

James I. of Scotland, son of Robert III., b. in 1394 at Dunfermline; was captured by the English while on his way to France 1406, and imprisoned in the Tower and in Windsor Castle, and wrote the *King's Quhair* and other poems while in confinement; went in 1417 to France with Henry V.; married Joanna Beaufort, granddaughter of John of Gaunt, 1424; was liberated, proclaimed king, and crowned at Scone 1424; restored order to Scotland, and used so much rigor towards the turbulent nobles that he was murdered by their emissaries at Perth Feb. 21, 1437. James was celebrated for his courtly graces, his literary accomplishments, and his excellence in athletic exercises.

James II. of Scotland, son of James I. and Queen Joanna Beaufort, b. in 1430, was crowned at Edinburgh when but six years of age (1437). During his minority the kingdom was distracted by struggles for power between his tutors Crichton and Livingston and the "house of Douglas," represented by three successive earls of that title. James assumed the government in 1444; made war with England 1448; married Mary of Gueldres 1449; murdered William, eighth earl of Douglas, with his own hand 1452; defeated a powerful insurrection headed by the ninth earl; made a treaty with Henry VI. of England in 1459, by which he acquired the counties of Durham and Northumberland, in

consideration of supporting the house of Lancaster in the "war of the Roses," and was killed by the bursting of a gun at the siege of Roxburgh, Aug. 3, 1460.

James III. of Scotland, son of James II. and Queen Mary of Gueldres, b. June 1, 1452, was crowned at Kelso monastery on his father's death (1460). The government, after the death of the queen mother (1463) and of Bishop Kennedy (1466), fell into the hands of the Boyd family, one of whom married the king's sister in 1467, and was at the same time created earl of Arran. Henry VI. of England had taken refuge in Scotland in 1461, and involved the Scotch in the war of the Roses, which led to a league between Edward IV., the new Yorkist king, and the earls of Douglas and Ross and the Lord of the Isles for the partition of Scotland, but the plan proved abortive, and in 1464 a fifteen years' truce was concluded. James married the princess Margaret of Denmark in 1469, thereby acquiring the Orkney and Shetland islands, dismissed the Boyds from power the same year, and came under the influence of the Hamiltons; experienced several insurrections; imprisoned on a charge of witchcraft his brother, the earl of Mar, who soon died (1480); maintained a war with another brother, the earl of Albany, who laid claim to the crown and was supported by Edward IV.; was besieged in Edinburgh Castle, and reconciled to his brother (1482); had to wage another war against the nobles, who had placed at their head his son, Prince James (1487), and was either killed in battle or murdered thereafter at Sanchie, near Bannockburn, in June, 1488.

James IV. of Scotland, son of James III. and Margaret of Denmark, b. Mar. 17, 1472; joined the rebellious nobles against his father in 1487; was crowned at Scone in June, 1488; suppressed an insurrection headed by Lords Forbes and Lyle 1489; favored the impostor Perkin Warbeck, whom he received at his court as king of England (1492), on whose behalf he made war upon England (1496–97), but finally concluded a truce for seven years, and in 1503 married Margaret, daughter of the English king, Henry VII. In 1513 he took offence at a supposed insult from his brother-in-law, Henry VIII., invaded England, and was defeated and slain at Flodden Field, Sept. 9, 1513.

James V. of Scotland, son of James IV. and Margaret of England, b. at Linlithgow Apr. 10, 1512; succeeded to the throne under his mother's regency Sept. 9, 1513; assumed the government 1528; married Madeleine of France 1537, and on her death Mary of Lorraine, daughter of the duke of Guise, 1538; met with signal defeat from the English at Solway Moss Nov. 25, 1542; d. at Falkland Palace Dec. 14, 1542, and was succeeded by his infant daughter, Mary, queen of Scots.

James (Charles T.), A. M., b. at West Greenwich, R. I., in 1804; studied mechanics while working as a carpenter, and became an expert constructor of machinery for cotton-mills, of which he erected many in New England and the Middle and Southern States. He was U. S. Senator from Rhode Island 1851–57, after which time he devoted himself to inventing firearms, and was killed at Sag Harbor, L. I., Oct. 17, 1862, by the bursting of a shell.

James Francis Edward Stuart, b. in London June 10, 1688, being the son of King James II. by Queen Mary of Modena, and natural heir to the throne. In the year of his birth James II. was driven from power, and the rights of the infant prince were ignored by his sisters Mary and Anne, who successively occupied the throne. The exiled family found hospitable asylum at the court of Louis XIV., who, on the death of the ex-king, immediately recognized the prince as king of Great Britain under the title of James III. In 1708, Prince James sailed from Dunkirk in a French fleet, intending to effect a landing in Scotland, but did not execute that intention. Under the *nom-de-guerre* of the Chevalier of St. George the youthful "Pretender" (as he was called in England) took part in the French campaigns of 1708–09 against the English in Flanders, for which reason Parliament set a price of 100,000 crowns upon his head. The prince's sister, Anne, designed to restore him to the order of succession, and numerous statesmen of England, among whom were Bolingbroke and Bishop Atterbury, favored his cause, but his refusal to renounce Catholicism was fatal to his prospects. In 1715 the Pretender was invited to Scotland by the earl of Mar, landed at Peterhead in December, passed through Aberdeen, made a public entry into Dundee, and occupied the royal palace at Scone. The enterprise, however, failed ignominiously, and the next month the Pretender retreated to France. The remainder of his life was passed chiefly in Italy, he having married in 1719 a princess Sobieski of Poland, by whom he had a son, Charles Edward, b. 1720, the "Young Pretender" of 1745. Prince James, after his second failure, declined to make any further armed attempt upon the throne of Britain, ceding his rights to his son when the latter reached maturity; he passed his closing years in pious retirement at Rome, where he d. Jan. 2, 1766.

James (George Payne Rainsford), b. in London, England, in 1801, became in early life, partly through the advice of Washington Irving, a writer of romances; was historiographer of England under William IV.; became British consul at Norfolk, Va., in 1852; British consul for the Austrian ports 1856; d. at Venice 1860. Of his many novels and other works, which once had great popularity, the best are *Richelieu* (1825), *Darnley* (1830), *Memoirs of Great Commanders* (1832), *Life and Times of Louis XIV.* (1838).

James (Sir Henry), F. R. S., b. at Rose-in-Vale, near St. Agnes, Cornwall, in 1803; was educated at the Royal Military Academy at Woolwich; entered the army as lieutenant of engineers; became colonel in 1857, and major-general in 1868. After directing the geological survey of Ireland (1844), and the admiralty engineering works at Portsmouth (1846), he was appointed in 1852 superintendent of the ordnance survey of the United Kingdom, and in 1857 chief of the topographical and statistical departments of the war office. He was knighted in 1860. Sir Henry is principally known for his successful efforts to introduce various applications of photography into the service of the exact sciences. As early as 1855 he reduced the ordnance maps by photography; in 1860 he availed himself of the experiments of M. Poitevin, of Mr. J. W. Osborne of Melbourne, and of Mr. Asser of Amsterdam for applying the new processes of Photolithography (see that article) to the reproduction of improved ordnance surveys. Gen. James has since invented a modification of this process, known as photozincography, and by its means has made a complete fac-simile in 32 volumes of the celebrated *Domesday Book*, as well as of other rare and ancient manuscripts. The principal writings of Gen. James have been *On the Figure, Dimensions, and Mean Specific Gravity of the Earth, as derived from the Ordnance Trigonometrical Survey of Great Britain* (in *Philos. Trans.*, 1856); *Ordnance Survey in Ireland* (1855), *in Scotland* (1861), *in England and Wales* (1861); *On Photozincography and other Photographic Processes* (1862); *Account of the Principal Triangulation of the United Kingdom* (1864); and *Record of the Expedition to Abyssinia* (1870).

James (Henry), b. at Albany, N. Y., June 3, 1811. When twelve years of age he suffered amputation of a leg in consequence of an accident. He studied in Union College and Princeton Theological Seminary; went to Europe, where he acquired Sandemanian and afterwards Swedenborgian views. He resides at Cambridge, Mass., and has published *What is the State?* (1845), *Letter to a Swedenborgian* (1847), *Moralism and Christianity* (1852), *Lectures and Miscellanies* (1852), *The Church of Christ* (1854), *The Nature of Evil* (1855), *Christianity the Logic of Creation* (1857), *Substance and Shadow* (1863), *The Secret of Swedenborg* (1869), and other works.

James (Horace), A. M., b. at Medford, Mass., May 6, 1818; graduated at Yale 1840; studied divinity at New Haven; held pastorates (Congregational) in Wrentham and Worcester, Mass., 1843–63; chaplain 25th Massachusetts Infantry 1861–64; captain and A. Q. M. and commissioner of freedmen in North Carolina 1864–66; pastor of First church, Lowell, Mass., 1867–70; Second church, Greenwich, Conn., 1871; also, since 1867, one of the proprietors and editors of the *Congregationalist*. D. June 9, 1875.

James (John Angell), b. at Blandford, Dorset, England, June 6, 1785, was educated at Gosport College, entered the ministry when seventeen years old, and was (1805–59) pastor of the Congregational chapel, Carr's lane, Birmingham; was an able preacher and writer, and exercised a wide influence in Europe and America by his numerous religious works, of which the best known are *The Anxious Inquirer* (1834), *Christian Fellowship, and Christian Professor*. D. at Birmingham Oct. 1, 1859.

James (Robert), M. D., b. at Kinverston, Staffordshire, England, in 1703; was educated at Oxford; practised as a physician at Sheffield, Lichfield, Birmingham, and London; published, with the aid of Dr. Samuel Johnson, a *Medical Dictionary* (3 vols. fol., London, 1743–45), and invented the celebrated fever-powder known by his name, now called antimonial powder, composed of oxide of antimony and phosphate of lime. "James's powder" was one of the earliest and most successful prototypes of the so-called *patent medicines* which have since acquired so great vogue. D. 1776.

James (Thomas), an English navigator who in 1631 was sent by a company of merchants of Bristol to search for a N. W. passage. He explored Hudson's Bay, and from him the southern portion is still called James's Bay. Capt. James reached lat. 65° 30′ N., when his further progress being stopped by ice, he returned to England. In 1633 he

published a quarto volume entitled *The Strange and Dangerous Voyage of Capt. Thomas James for the Discovery of a North-west Passage to the South Sea.*

James (THOMAS CHALKLEY), b. at Philadelphia in 1766; studied medicine at the University of Pennsylvania. After taking a trip to the Cape of Good Hope as surgeon, he studied at Edinburgh and London from 1790–93, and founded after his return a school of midwifery in Philadelphia; was physician at the Pennsylvania Hospital for twenty-five years, and professor of midwifery at the University of Pennsylvania from 1811 to 1834. He enjoyed a great reputation both as practitioner and as teacher. D. July 25, 1835.

James Bayou, post-tp. of Mississippi co., Mo. P. 361.

James City, county of the peninsula of Virginia, having James River on the S., York River on the N., and the Chickahominy on the S. W. It is undulating, and has a soil adapted to raising grain and garden products. Area, 184 square miles. Cap. Williamsburg. Pop. 4425.

James Creek, post-v. of Huntingdon co., Pa., on the Huntingdon and Broad Top R. R., 12 miles S. of Huntingdon. It derives its principal support from the mining of iron ore. H. B. BRUMBAUGH, ED. "WEEKLY PILGRIM."

James Island, one of the sea islands of Charleston co., S. C., having Charleston harbor and Ashley River on the N. The battle of Secessionville (June 11, 1863), and several other spirited engagements occurred upon this island during the late civil war. Pop. 1808.

Jame'son (ANNA), b. at Dublin May 19, 1797, was the daughter of Mr. Murphy, an artist of merit; was married in 1823 to Robert Jameson, a barrister, from whom she soon separated. Her writings upon Christian art and archæology are of a high order. D. Mar. 17, 1860. Her principal works are *Diary of an Ennuyée* (1826), *Loves of the Poets* (1829), *Lives of Female Sovereigns* (1831), *Characteristics of Women* (1832), *Beauties of the Court of Charles II.* (1833), *Visits and Sketches* (1834), *Tales and Miscellanies* (1838), *Studies and Rambles in Canada* (1838), *Pictures of Social Life in Germany* (1840), a translation of Waagen's *Rubens* (1840), *Handbook to the Public Galleries of Art* (1842), *Companion to Private Galleries* (1844), *Memoirs of Early Italian Painters* (1845), *Memoirs and Essays* (1846), *Sacred and Legendary Art* (1848), *Legends of the Monastic Orders* (1850), *Legends of the Madonna* (1852), *Commonplace Book* (1854), *Sisters of Charity, Catholic and Protestant* (1855), *The Communion of Labor* (1856).

Jameson (CHARLES DAVIS), b. at Gorham, Me., Feb. 24, 1827; removed to Oldtown at an early age, where he subsequently engaged in the lumber business, which he largely extended, and in 1861 was one of the most largely interested dealers in the State. A Democrat in politics, and a Douglas delegate to the Charleston convention in 1860, he volunteered his services in support of the national government on the outbreak of civil war, and was appointed colonel of the 2d Maine Vols., the first to leave the State, which he commanded at the first battle of Bull Run with distinction, leading to his appointment in September as brigadier-general of volunteers. In the Peninsular campaign in Virginia, 1862, he commanded a brigade with great ability, where he contracted the disease which terminated his life at Oldtown, Me., Nov. 6, 1862.

G. C. SIMMONS.

Jameson (JOHN ALEXANDER), LL.D., b. at Irasburg, Vt., Jan. 25, 1824; graduated at the University of Vermont in 1846; was tutor there 1850–53, after which he removed to Illinois; practised law, and became in 1865 judge of superior court in Chicago. He has published several legal works.

Jameson (ROBERT), b. at Leith July 11, 1774; was educated for the medical profession at the University of Edinburgh, but, devoting himself entirely to natural history, explored the Scottish islands as a mineralogist, and published his discoveries in two volumes in 1798 and 1800. Dr. Jameson then studied for two years at Freiberg, under the celebrated Werner, whose geological theories he warmly espoused, and taught for many years from the chair of natural history in Edinburgh University, to which he was elected in 1804, having even founded a Wernerian Society. Later in life he abandoned his favorite dogmas as untenable, and adopted instead those of Hutton. He wrote a *System of Mineralogy* (3 vols., 1804–08), which has passed through many editions; a *Manual of Mineralogy* (1821); numerous papers published by the scientific societies to which he belonged; edited the geological department of the *Encyclopædia Britannica* (4th ed., 1819 *seq.*); founded in 1819, and conducted through life, the *Edinburgh New Philosophical Journal;* and assisted Sir D. Brewster and Hugh Murray in the preparation of many scientific treatises of a popular character. D. at Edinburgh Apr. 19, 1854.

Jame'sone (GEORGE), b. at Aberdeen, Scotland, in 1586; went to Antwerp in 1616, and studied painting under Rubens. Vandyck was his fellow-pupil, and Jamesone has been called the "Vandyck of Scotland" from the delicacy, softness, and clearness of his coloring, though somewhat deficient in vigor. Charles I. sat to Jamesone in 1633, and he was largely patronized by the Scotch nobility, of whom numerous portraits by this artist are preserved. D. at Edinburgh in 1644.

James'port, post-v. of Riverhead tp., Suffolk co., N. Y., on the Long Island R. R., 78 miles E. of New York, and on Great Peconic Bay. Pop. 323.

James River of Virginia, one of the noblest of American rivers, is formed in Alleghany co., by the union of the Jackson and Cowpasture rivers. It passes through the Blue Ridge, and pursues a devious course as far as Scottsville, whence its direction is about E. S. E. At Richmond it falls 100 feet in 6 miles, affording a grand water-power. Above this point the JAMES RIVER AND KANAWHA CANAL (which see) extends, following the course of the river, and embracing extensive reaches of which as slack-water navigation to Buchanan, 196 miles. The tide comes up to the Rocketts, just below Richmond. This is the head of navigation for steamboats and schooners of 130 tons. Shipping of the first class comes up to City Point, 40 miles below, at the mouth of the Appomattox. Below City Point the river is a broad, deep, and never-failing tidal estuary, 66 miles long, and inferior to the lower Columbia and the Potomac only among the rivers of the U. S. in the majesty of its flow. The James River, with the Elizabeth and the Nansemond, flows into Chesapeake Bay through Hampton Roads, the grandest harbor upon our Atlantic coast. The entire length from Covington, Va., to Old Point Comfort is some 450 miles.

James River, tp. of Buckingham co., Va. Pop. 3033.

James River and Kanawha Canal. This route is a project contemplating, besides the existing canal, a continuous line of water-communication from the waters of the Ohio River, at the mouth of the Kanawha River, W. Va., to the waters of the Chesapeake Bay and the Atlantic Ocean at the mouth of the James River. The idea of a water-communication between the valley of the Ohio River and the valley of the James River has for its author no less a distinguished person than George Washington himself, though it is popularly supposed to have originated with Gen. Spotswood, when on Aug. 20, 1716, he set out from Williamsburg on his expedition over the Blue Ridge. Upon the conclusion of the Revolutionary war, Gen. Washington was so impressed with the importance of a water-line across the Alleghanies that during the year 1784 he made a personal exploration of the country, travelling for that purpose many hundreds of miles. It was largely owing to his influence and instrumentality that the legislature of Virginia, on Jan. 5, 1785, passed "an act for clearing and improving the navigation of the James River." By this act the first or old James River Company was incorporated. This company was organized Aug. 25, 1785, and on the next day Gen. Washington was elected its first president, which position he held for some years. Several amendatory acts have since been passed; and the present company was incorporated in May, 1832, and organized in 1835. This company commenced the construction of the present canal from Richmond to Lynchburg in 1836, and the work was completed about Dec. 1, 1840. The part known as the second division of the canal, extending from Lynchburg to Buchanan, was commenced in the mean time, and completed in Nov., 1851. An extension of 47 miles to Covington on Jackson River, a few miles above the junction of Cowpasture River, was commenced in 1853, but remains yet incomplete. As the "central water-line" this route comes prominently before the public as one of the four or five great lines of transportation by which the products of the great West may reach the sea. This, indeed, was a fundamental idea from the beginning, and as early as 1826–28, Capt. McNeil of the U. S. engineers surveyed passages of the Alleghanies and the western extreme *viâ* the Greenbrier, New, and Great Kanawha rivers, and found a location by which the summit was surmounted at a level 1916 feet above tide by a tunnel 2.6 miles long. In 1868, Mr. E. Lorraine, then the engineer of the company, *advised the adoption of a new location,* which was about the same as Capt. McNeil's, except that it pierced the mountains by a tunnel about (estimated) 9 miles in length, and reduced the elevation of the summit-level to 1700 feet, thereby saving 3½ miles in actual length of canal, and 20½ of equated length, considering the saving of time in lockages and cost of working and repairs. The creation by this route of a central water-line involved, besides the mere connection with the great fluvial navigation-system of the Mississippi Valley, an enlargement of the actually constructed portions

of this line. Hence the project involves — 1st, the enlargement of the existing canal from Richmond to Buchanan; 2d, the construction of the projected and definitely-located portion of the canal from Buchanan to the mouth of Fork Run; 3d, the construction of the canal up Fork Run to the summit-level, 1700 feet above tide, under the Tuckahoe and Katis mountains, by a tunnel 7 miles long, and thence down the valley of Howard's Creek to the Greenbrier River; 4th, the slack-water improvement of the Greenbrier, New, and Kanawha rivers to Paint Creek Shoals (with occasional short canals to avoid expensive location of dams); 5th, the open sluice-dam improvement of the Kanawha River from the Paint Creek Shoals to its junction with the Ohio River.

This project was submitted Jan., 1874, by the secretary of war to a board of engineers consisting of Mr. B. H. Latrobe, civil engineer, and J. G. Barnard, Q. A. Gillmore, W. P. Craighill, G. Weitzel, officers of U. S. engineers, who reported favorably as to practicability. Further surveys were suggested, however, before the definite location of the tunnel and the fixing of the plans of utilizing the Greenbrier and New rivers as parts of the line. It is probable that these surveys will, besides determining an improved location of the great tunnel, result in showing that an "independent canal," instead of a "lock-and-dam" navigation, must be resorted to along the Greenbrier and New rivers. The board estimated the cost at $60,000,000. (See *Ex. Doc. 219*, H. R. 1st sess. 43d Cong.; also *Annual Report of Chief of Engineers* for 1874.) J. G. BARNARD.

James's Bay, the southern part of Hudson's Bay, lat. 51°–55° N., lon. 79°–82° 30′ W. It was named from Capt. Thomas James, who wintered here in 1631–32 while attempting to find the N. W. passage. It abounds in shoals and islands. On its S. shores there are extensive marshy plains.

James's Creek, tp. of Marion co., Ark. Pop. 183.

James'town, post-v. of Clinton co., Ill. Pop. 120.

Jamestown, post-v. of Boone co., Ind., on the Indianapolis Bloomington and Western R. R., 28 miles N. W. of Indianapolis, has 3 churches, an academy, 6 benevolent societies and lodges, 22 stores, 2 flouring-mills, 4 manufactories, and a weekly newspaper. It is in a fertile grain-region. Pop. 603. FRANCIS B. RASE, ED. "COMMERCIAL."

Jamestown, tp. of Steuben co., Ind. Pop. 779.

Jamestown, tp. of Howard co., Ia. Pop. 312.

Jamestown, post-v., cap. of Russell co., Ky., 5 miles from Horseshoe Bottom, on Cumberland River. Pop. 138.

Jamestown, post-tp. of Ottawa co., Mich. Pop. 1612.

Jamestown, tp. of Blue Earth co., Minn. Pop. 234.

Jamestown, post-v. of Chautauqua co., N. Y., on the Atlantic and Great Western R. R., 2½ miles from the Dunkirk Allegheny Valley and Pittsburg R. R. It is on the outlet of Chautauqua Lake, on which three steamboats ply hence to Mayville. The outlet affords constant and extensive water-power, which is well utilized. It has 10 churches, 2 weekly and 2 daily newspapers, 3 national banks, a union school with a fine building and a collegiate department, extensive manufactories of alpaca goods and woollens, 3 of chairs and 3 of furniture, 4 saw and 2 grist mills, 3 furnaces, 5 large hotels, besides many smaller manufactories and numerous stores. Manufacturing is the chief pursuit, and dairy business is extensively carried on in the vicinity. Pop. 5336. D. H. WAITE, ED. "JOURNAL."

Jamestown, post-tp. of Guilford co., N. C. Pop. 1539.

Jamestown, tp. of McDowell co., N. C. Pop. 412.

Jamestown, post-v. of Silver Creek tp., Greene co., O., 10 miles from Xenia. Pop. 532.

Jamestown, post-b. of Mercer co., Pa., at the junction of the Erie and Pittsburg with the Ashtabula and Oil City branch of the Lake Shore R. R., 36 miles from Lake Erie, has 2 banking-houses, a seminary, 2 hotels, a newspaper, 5 churches, 1 foundry, 1 machine-shop, 1 flouring and 2 planing mills, shops, large stores, etc. Pop. 572.
D. L. CALKINS, ED. "SUN."

Jamestown, post-tp. of Newport co., R. I., consisting of the island of CANONICUT (which see), in Narragansett Bay. Pop. 378.

Jamestown, post-v., cap. of Fentress co., Tenn., on the Cumberland Mountain, 43 miles W. of Clinton, a station on the Knoxville and Kentucky R. R.

Jamestown, tp. of James City co., Va. It was the first permanent English settlement within the limits of the U. S.; was founded in 1607 on a peninsula 32 miles from the mouth of James River, Va.; it has now become an island by the action of the current, which has carried away a portion of the site of the ancient town. Only the ruins of the church, the fort, and of two or three houses mark the spot which was first occupied by the celebrated band of 107 colonists under Wingfield, Christopher Newport, and Bartholomew Gosnold. Entering the Chesapeake with three vessels Apr. 26, they sailed up the river, to which they gave the name of the reigning sovereign, and on May 13 began to build the town, which also bore his name. Great privations were suffered during the first season, and the settlers were largely indebted for their preservation to the energy and talents of the famous Capt. John Smith, who explored the neighboring country, was captured by the Indians, and saved by the intervention of Pocahontas, conciliated the savage chieftains, and obtained from them supplies of provisions. (See SMITH, JOHN.) A second company of colonists arrived in 1608, a still larger number under Sir Thomas Gates and Sir George Somers in 1609, the charter governor, Lord Delaware, arrived with reinforcements in 1610, Sir Thomas Dale brought 300 settlers and some cattle in the same year, and in 1611, Sir Thomas Gates brought still another company of 350. By this time other settlements began to be made. Jamestown soon became the capital of an extensive colony, and in 1619 (June 29) a house of burgesses, the first legislative assembly ever convened in British America, met here. In the same year 1200 new settlers arrived, and a Dutch trading-vessel brought to Jamestown 20 negroes, who were sold as slaves. After the seat of government was removed to Williamsburg, Jamestown began to decline; it was burned by Nathaniel Bacon during the rebellion of 1676, and never rebuilt. It was the scene of an engagement between the forces of Wayne and those of Lord Cornwallis in 1781. Pop. of tp. 1088.

Jamestown, post-tp. of Grant co., Wis. Pop. 1114.

James'ville, post-v. of Dewitt tp., Onondaga co., N. Y., on the Syracuse Binghamton and New York R. R., has 3 churches and a number of manufactories. Pop. 402.

Jamesville (MIDDLE GROVE P. O.), a v. of Greenfield tp., Saratoga co., N. Y. It has 2 paper-mills, and is 9 miles from Ballston.

Jamesville, post-v. of Martin co., N. C., on the Roanoke River. Pop. 150; of tp. 2530.

Ja'mi (ABDERRAHMAN-BEN-AHMED), one of the most celebrated of the Persian poets, b. early in the fifteenth century at Jami in Khorassan, from which place he derived the name by which he is best known. Jami belonged to the mystical school of poetry, was a favorite with two or three of the sultans of Herat, where he resided and taught, and wrote a large number of learned works in prose and verse, some of which have been so fortunate as to be translated or edited by recent European scholars. D. about 1492.

Ja'mieson (JOHN), D. D., b. in Glasgow Mar. 3, 1759; was educated at the university of that city; became a minister of the Secession Church in Forfar, and was called to Edinburgh in 1797. Besides many theological treatises and several poems, he published a valuable *Etymological Dictionary of the Scottish Language* (1808–09, 2 vols.) and *Supplement* (1825), and other smaller works of philology and belles-lettres. The doctorate of divinity was conferred upon him by Princeton College, N. J. D. in Edinburgh July 12, 1838.

Janauschek' (FANNY), b. in Prague, Bohemia, July 20, 1830; was brought up to the stage, and from an early age began to show a talent for tragic rôles, which she undertook, first at Cologne, then for many years (1848–60) at Frankfort, and later at Dresden and the principal theatres of Germany. Mlle. Janauschek came to the U. S. in 1867, and acquired great popularity, though performing in German only. Returning to Germany in 1871, she devoted herself to the study of English, and in 1873 captivated the American public by successfully representing in English the most difficult rôles of Shakspearian tragedy.

Jane Lew, post-tp. of Lewis co., W. Va. Pop. 2174.

Janes (EDMUND STORER), b. in Sheffield, Mass., Apr. 27, 1807. His family early removed with him to Salisbury, Conn. Having received the usual common-school education of Connecticut, he spent about six years (1824–30) in teaching. He studied law during three of these years, and was about to begin its practice when his father died—an event which led to a change of his whole life. He joined the Methodist itinerant ministry, taking his first appointment in the Philadelphia conference in 1830. He rose rapidly in his new work, and occupied important pulpits in the Philadelphia and New York conferences till 1840, when he was elected financial secretary of the American Bible Society, in which office he distinguished himself by extraordinary energy and success. In 1844 he was elected bishop of the Methodist Episcopal Church. He has been pre-eminent for his episcopal labors and travels, and has contributed much to the remarkable success of his denomination during the period of his episcopate. He resides (1875) in New York.

Janes'ville, post-tp. of Lassen co., Cal., in Honey

Lake Valley, 12 miles from Susanville, the county-seat. Pop. 441.

Janesville, tp. of Greenwood co., Kan. Pop. 259.

Janesville, post-v. of Waseca co., Minn., on the Winona and St. Peter R. R., 116 miles W. of Winona, in the "Big Woods;" has 2 flour and 3 saw mills, 1 chair and 2 steam stave factories, 3 hotels, 3 churches, a weekly newspaper, and a graded school. It is in a fine wheat-region. Pop. of tp. 947. C. E. Graham, Ed. "Argus."

Janesville, city, cap. of Rock co., Wis., on both sides of Rock River, and on the Chicago and North-western and the Milwaukee and St. Paul R. Rs., 70 miles W. S. W. of Milwaukee; has a daily, a monthly, a semi-weekly, and 3 weekly periodicals, 7 churches, a very large reaper-factory, machine-shops, fine public schools, and a very large water-power, utilized to a great degree. Boots, shoes, carriages, etc. are among the manufactures. The town, which is well built, is the seat of the State institute for the blind, and has excellent musical schools, 2 national and 1 savings bank, and fine hotels. The breeding and dealing in horses is an important interest. Pop. 8789; of tp., excluding part of the city, 926. A. H. Seymour, "Gazette."

Janet-Lange′ (Antoine Louis), b. in Paris Nov. 19, 1818; studied painting under Collin, Ingres, and Horace Vernet, adopting the style of the latter, with whom he was associated in producing a series of designs illustrating the history of Napoleon I. He was from about 1846 the artistic editor of *L'Illustration Française*, and successfully executed many battle-pieces. D. at Paris Nov. 23, 1872.

Janet′ (Paul), b. in Paris Apr. 30, 1823; was educated at the Ecole Normale, graduating as doctor in letters in 1848; taught philosophy at Bourges and Strasburg; was appointed professor of logic in 1857 at the lyceum of Louis-le-Grand, of history of philosophy at the Sorbonne in 1864; and was chosen member of the Institute in the same year. M. Janet is a leading representative of modern French philosophy, his doctrine being a reconciliation of the official system of Cousin with that entire liberty of research demanded by the most recent scientific school of psychology. His writings are numerous and learned.

Jane′way (Jacob J.), D. D., b. in New York City in 1776; graduated at Columbia College in 1794; was ordained a minister of the Presbyterian Church in Philadelphia in 1799; was for some time president of the Western Theological Seminary at Allegheny City; afterwards settled at New Brunswick, N. J., as pastor of the Reformed (Dutch) church and vice-president of Rutgers College. Dr. Janeway was one of the early promoters of Princeton Theological Seminary, of which he was for forty years a director. He wrote several esteemed theological works, among which are the *Apostolic Age*, *Exposition of the Acts and of the Epistles to the Romans and the Hebrews*, *Internal Evidence of the Bible*, and *The Abrahamic Covenant.* D. at New Brunswick June 27, 1858.

Janin′ (Jules Gabriel), b. at St. Etienne, Loire, France, Dec. 24, 1804; was educated at the college of Louis-le-Grand, Paris; became a private tutor in the Quartier Latin, and finally became a journalist, feuilletonist, editor, novelist, and critic. He was at one time connected with *Figaro*, and afterwards with the *Quotidienne;* was one of the founders of the *Revue de Paris* and the *Journal des Enfants.* D. June 20, 1874.

Ja′nina, or **Joánnina,** town of European Turkey, capital of the eyalet of the same name (the ancient province of Epirus). It has important manufactures of morocco, leather, silk goods, and gold-lace. On the opposite shore of the Lake of Janina, which has received its name from the town, lay the ancient *Dodona* with its famous temple. Pop. 25,000, mostly Greeks and Jews.

Jan′izaries [Turk., "new troops"], a former corps of Turkish foot-soldiers, first organized in 1329 by Orkhan from young Christian captives, who were compelled to embrace Mohammedanism. For more than three centuries the corps was forcibly recruited from Christian subjects, though many Turks voluntarily joined it on account of the privileges it enjoyed. The Janizaries at first numbered 1000; in 1362, Amurath I. increased them to 10,000, and in the seventeenth century there were about 100,000 of them serving in the line, besides nearly 400,000 Jamaks, or irregular troops, attached to the corps. The number of regular Janizaries was afterwards much reduced. Endowed by Amurath I. with remarkable privileges, they became at one time virtual masters of the empire. In 1512 they deposed Bajazet II.; they procured the death of Amurath III. in 1595, of Osman II. in 1622, of Mustapha I. in 1623, of Ibrahim in 1649; deposed Mustapha II. in 1703, Achmet III. in 1720; slew Selim III. in 1807; deposed Mustapha IV. in 1808. In 1826, Mahmoud II., displaying the banner of the Prophet, led the rest of his army to the attack of the Janizaries. The latter were defeated, 8000 of them were burned in their barracks, and some 15,000 were killed in the streets. Their defence was brave, but fruitless. Over 20,000 were banished during the next few months, and the force was formally dissolved. This force, long the terror of Europe, and under Solyman the Magnificent the best infantry in the world, had so changed as to be terrible only to its own masters and to society at home, and its final overthrow was a blessing to Turkey.

Jankovacz′, town of Austria, in the Temesvar banat, has 10,076 inhabitants, mostly engaged in agriculture. Much wheat, oats, and wine is produced.

Jan May′en's Land, an island in the Arctic Ocean, situated between Iceland and Spitzbergen, in lat. 70° 29′ N. and lon. 7° 31′ W. It is volcanic. Both its two highest points, Beerenberg, 6640 feet high, and Esk, 1500 feet high, are occasionally active. It was discovered in 1611 by a Dutch navigator, after whom it is named.

Jan′ney (Samuel M.), a philanthropist and Hicksite Friend, b. in Loudon co., Va., Jan. 11, 1801. He has published *The Country Schoolhouse* (poem, 1825), *Conversations on Religious Subjects* (1835), *Historical Sketch of the Christian Church* (1847), *Life of Penn* (1852), *Life of Fox* (1855), *History of the Friends* (4 vols., 1867), and other works, both in prose and verse. In 1869 he was appointed one of the superintendents of Indian affairs by Pres. Grant.

Jan′sen, or **Jansenius** (Cornelius), b. at Acquoi, near Leerdam, Holland, Oct. 28, 1585, of humble parentage; received a classical education at the University of Utrecht; studied Catholic theology at Louvain in Flanders; went to Paris in 1604 or 1605, where he formed a close intimacy with Jean Duvergier de Hauranne, afterwards abbot of St. Cyran, whom he accompanied to Bayonne, becoming the head of a college recently founded there. In 1617, Jansen returned to Louvain; was made principal of a college, and subsequently, in 1630, professor of scriptural interpretation. At Louvain, Jansen speedily became (1621) the chief exponent of a system of doctrine which after his death received the name of Jansenism (which see), and became famous in the religious annals of Christendom; but during his life he was chiefly remarkable for polemics and contests, not altogether devoid of worldly rivalry, with the Jesuits, whom he succeeded in expelling from their position as teachers of philosophy in the university. In connection with this quarrel Jansen twice went to Spain (in 1624 and 1625), where he obtained the favor of the Spanish monarch, then the sovereign of Flanders. In 1635 he published a work entitled *Mars Gallicus*, in defence of the rights of Spain against France in the then impending war, and was rewarded by the bishopric of Ypres, at which place he d. of the plague, May 6, 1638. The last ten years of his life were devoted to the preparation of the work by which he is best known to posterity—an exposition of the doctrine of St. Augustine upon grace, free-will, and predestination—which was published at Louvain as a posthumous production in 1640 under the title *Augustinus, seu Doctrina Augustini de Humanæ Naturæ Sanitate, Ægritudine et Medicina, adversus Pelagianos et Massilienses*, and was reprinted at Paris (1641) and at Rouen (1643). Porter C. Bliss.

Jan′senism, the name of a school in the French Church, so called from Cornelius Jansen, who flourished in the early part of the seventeenth century. It represents a controversy the most important occurring in the Romish Church since the Reformation—a controversy which began not with Jansen, but which, existing in its elements and showing tokens of itself at intervals from the time of Augustine, broke out more openly near the middle of the sixteenth century, and continued for a century and a half to agitate the Romish Church; arraying the Augustinians, Dominicans, and the liberals of the Gallican Church on the one side, and the Jesuits, Franciscans, and Ultramontanes on the other. It arose from the difficulty of harmonizing Augustine's doctrine of grace with the Romish and monkish scheme of work-righteousness, and had manifested itself even in the times of the ancient Church. But in 1567 a defence of Augustine by Michael Baius, professor at Louvain, was assailed by the Franciscans and Jesuits, and through their instigation seventy-six propositions gathered from it were condemned by Pius V. as heretical, and Baius was compelled to abjure. In 1583 the agitation was renewed by Louis Molina, a Jesuit in Portugal, who published Semi-Pelagian views on the doctrines in controversy, for which he was assailed by the Dominicans, but defended by the whole Jesuit order. In the following century this controversy culminated in the school of Jansen. A lecturer on Scripture, devout with a tinge of mysticism, addicted to patristic literature, and especially to the study of Augustine, he wrote a work, which was published after his

death, distinctly setting forth the doctrines of Augustine and Pelagius from their own writings, by which it appeared that certain honored scholastic writers and popes approached nearer the heretic than the saint. The Jesuits, alarmed, immediately assailed the work, and secured its prohibition by Pope Urban VIII. (1640). It found, however, many defenders, among whom, distinguished for learning and piety, were Jean Duvergier Hauranne, abbot of the Benedictine monastery of St. Cyran, and Anthony Arnauld, an able teacher in the Sorbonne. The latter soon became involved in an open controversy with the Jesuits, who persuaded Innocent X. to condemn five Jansenist theses as heretical and dangerous. The defenders of Jansenism did not assail the pope's decision, but denied that the theses condemned were found in his book in the sense in which they were condemned. Arnauld was now expelled from the Sorbonne at the instigation of the priests, and took refuge with his sister Angelica, abbess of the Cistercian nunnery of Port Royal, near Paris, a gifted and attractive woman, of gentle spirit and earnest and spiritual piety, and devoted to the monastic life. Through her influence Port Royal became eminently a centre of religious life and thought for France, and gathered at this time around itself a corps—living something in the manner of the old anchorites—of talented and devout young men, who admired Augustine, detested the lax morals of the Jesuits, and were enthusiastically devoted to the liberties of the Gallican Church. In sympathy with these men the profound, witty, and brilliant Blaise Pascal published in 1656 his celebrated *Provincial Letters*, in which, with authentic proofs and with equal earnestness, logic, and wit, he exposed the pernicious moral casuistries and theologic sophisms and infamous confessional of the Jesuits, to the derision and abhorrence of the French public. They avenged themselves by procuring a papal bull declaring that the propositions condemned were found in the sense in which they were condemned in the book of Jansenius. The Jansenists contended in reply that the pope, however rightly authoritative in matters of doctrine, was not infallible in decisions of questions of fact. But Louis XIV. and the pope insisted that all ecclesiastics, monks, and nuns should take the oath of acknowledgment of the bull and of condemnation of the Jansenist heresy (1665). Those refusing were banished, and though subsequently a milder subscription was allowed, the vengeance of the Jesuits pursued Port Royal till in 1709 the institution was abolished, its edifices demolished, and its very graves rifled. Meantime, the Jansenists, though in the Augustinian doctrines of grace in Calvinistic theology and in earnest spiritual piety, manifesting an affinity with the Protestant reform, were ever the more strenuous in repelling all suspicion of union with Protestants, denouncing them for persecution, and asserting their own loyalty to the Catholic Church.

A new measure of violence proceeding from the papal court, but instigated by French influence and the Jesuits, renewed the Jansenist controversy in 1713. This measure was directed against an edition of the New Testament published by Paschasius Quesnel, a man of learning and piety, and accompanying it with evangelical comment—a work much beloved by the people and approved by many bishops; among them commended by Cardinal Noailles, archbishop of Paris, with the approbation of Bossuet. The Jesuits, hating alike the Jansenist book and its commender, contrived to obtain, through the Jesuit confessor of the king, Père la Chaise, a bull from Clement XI.—the so-called constitution "Unigenitus"—condemning as heretical 101 propositions from Quesnel's book. The issuing of this bull, by which Augustine was virtually made a heretic, divided the French Church into two parts—the "Acceptants," or receivers of this "constitution," and the "Appellants," who appealed from it to a general council. Louis and the pope determined on its enforcement and the extermination of the Jansenists; but Louis died in the midst of the attempt. The death of Louis and the indifference of the regent, the profligate and brilliantly gifted duke of Orleans, gave the Appellants free scope for the time, and the bull of excommunication issued against them in 1718 was without effect. Subsequently, however, the duke, under the influence of the infamous Dubois, who sought a cardinal's hat, and afterwards Louis XV., under the instigation of his teacher, Cardinal Fleury, were led to persecute the Appellants and in every way to oppress them. Noailles was compelled to submit, and in 1730 the "constitution" was registered by Parliament as a law of the nation. Under these persistent persecutions a fanatical tendency manifested itself among the Jansenists. A young Jansenist clergyman, Francis, an abbé of Paris, died in 1727, a victim of voluntary penance, holding "appellation" documents in his hand. He was honored by his followers as a saint, and numerous miracles were reported to be effected at his tomb in the graveyard of Medardus near Paris, which became in consequence the resort of a multitude of pilgrims. These were wrought to a wild fanaticism, manifesting itself in convulsions and contortions of the body and in raving prophecies against the Church and State. The contagion seized on even the frivolous and unbelieving. In vain the government in 1732 walled up the churchyard; the earth stolen from the grave of the saint still wrought miracles and convulsions. Thousands of *convulsionnaires* were then thrown into prison, and the sacraments were refused to the dying who were not "acceptants" of the constitution. Under these severities Jansenism, which had passed from a theologic system to a popular fanaticism, gradually declined. The controversy meantime broke out afresh when the archbishop of Paris refused the sacrament to the dying regent as a non-acceptant; but peace was finally mediated by a mild letter of Benedict XIV. (1756).

Since then Jansenism has disappeared as a distinct school or sect in France, though it had many adherents down to the Revolution, and has left permanent results in the French mind, which it has largely imbued. It has propagated itself in a peculiar ecclesiastic organization in the Netherlands in the archbishopric of Utrecht, which embraces some twenty-five congregations, and has lately coalesced with the "Old Catholic" movement in Europe. The element of earnest spirituality in Jansenism has extended widely through various mystical writers and schools, and its freer ecclesiastic and theologic spirit has diffused itself as a liberalizing influence through the clergy of Italy, Germany, and the Gallican Church. T. M. Post.

Jans'sens (Abraham), b. at Antwerp in 1567 or 1569; was a pupil of the painter Jan Snellinck; studied in Italy, and enjoyed considerable reputation at Antwerp for his skill as a colorist, in which he rivalled Rubens. Many of Janssens' works are to be seen in the churches of Flanders and the galleries of Antwerp and Vienna. The torchlight scenes are especially famous. D. about 1631.

Janua'rius, Saint, b. at Naples or Benevento Apr. 21, 272; was made bishop of Benevento about 303, and during the persecution by Diocletian was beheaded as a martyr at Pozzuoli Sept. 19, 305. Two phials filled with his blood were preserved, and the body was ultimately brought to Naples, where these relics are still shown in the church of Santa Chiara. St. Januarius is the patron saint of Naples. On his anniversary (Sept. 19) the relics are brought out, when the blood in the phials suddenly becomes liquid and bubbles up. This is of course esteemed a miracle by the populace, and claimed as such by the clergy, though it has never been formally sanctioned by the Church. Much speculation has been exercised in devising scientific hypotheses to account for the phenomena in question.

Jan'uary [Lat. *Januarius*, from *Janus*, the god who presided over the origin of things], the first month of the year in the Gregorian calendar; according to Roman tradition, first added to the calendar by Numa, along with February. It had originally 29 days, to which two more were added by Julius Cæsar when he reformed the computation of time. It corresponded in the Greek calendar to the latter half of Poseideon and the first half of Gamelion; was known by the Scandinavians as the month of Thor, and in the French Revolutionary calendar it formed part of *Nivose* and *Pluviose*. In England, January was made the first month of the year by act of Parliament of 1751.

Ja'nus [for *Dianus*, from *dies*, "day"], and **Ja'na** [for *Diana*], two gods of ancient Rome, were originally personifications of the sun and moon. The name *Jana* is seldom seen, the form *Diana* being much more common. Janus was early identified with the Etruscan two-faced god. Hence *Janus Bifrons*, "the two-faced Janus," which Niebuhr thinks at first symbolized the union of the Romans and Sabines. Janus presided over the beginning of all things, and was one of the most important of the Roman divinities. There was a famous gateway containing a statue of Janus Bifrons, and leading from the Palatine to the Quirinal Hill. This passage was closed only in times when Rome was at peace with all nations. This closure occurred, we are told, but four times in all the Roman history. First it was closed in Numa's time; next, at the end of the First Punic war; again in the days of Augustus Cæsar; and lastly under Vespasian.

Janvier' (Levi), D. D., b. at Pittsgrove, N. J., Apr. 25, 1816; was educated at Lafayette and Princeton colleges and Princeton Theological Seminary; went to India as a missionary of the Presbyterian Board in 1841; settled in Lodiana in Northern India; soon acquired the Urdu language, and translated books and tracts into it. With Dr. Newton he compiled a Panjaubi dictionary, printed in 1854, and pursued a career of eminent activity and usefulness until he was assassinated, Mar. 25, 1864, by a fanatic Sikh.

Japan. As the marvellous story of the empire of Japan may be traced through more than twenty-five centuries, all that can be done in a single article is to touch upon the more important points of its geography and history. Whilst we look with amazement upon the recent developments in that highly favored land of the Orient, we shall also find that there has always been something allied to the wonderful in its career, whether we consider its physical characteristics, its people, or its government.

This empire lies in the north-western part of the Pacific Ocean, and consists of four large islands and a great number of smaller ones. It is separated on the W. from Corea by a strait which is about 500 miles wide; at its north-western extremity is the island of Tisima, or "the Thousand Islands;" and at the N. is the island of Krafto or Saghalien, which has long been held jointly by the Japanese and Russian governments, but now, according to a recent agreement, is held by Russia alone. The largest of the islands which compose the empire is commonly called *Nipon* or *Niphon*—which name in reality belongs to the whole country—and contains about 95,000 square miles. The second is *Yesso*, with about 30,000 square miles; the third *Kiusiu*, with 16,000 square miles; and the fourth is *Sikok*, with an area of 10,000 square miles. The total length of the empire is 1600 English miles, its greatest breadth a little more than 200, the number of islands 3850, and the entire area is estimated at about 150,000 square miles—all these figures being gathered from the latest official statistics. The sea-coasts are generally bold and rocky, and indented with very numerous bays forming spacious and secure harbors. The poetical title by which the Japanese designate their country is "The Land of the Rising Sun," which well describes its location as the most eastern of all the Asiatic empires, and their national emblem represents the sun rising out of the sea. The theory that America was originally peopled by Japanese, who were driven by stress of weather across the Pacific Ocean, is not only interesting, but claimed by many to be sustained by historical facts and traditions. That much of what passes as authentic history among the Japanese is mythical cannot be questioned, but there seems to be no reason to question the truthfulness of the statements which, with the help of Japanese scholars, the present writer has been able to cull from their history.

The empire is partitioned into five *kies*, or departments, which surround the imperial capital, and eight *dōs* or large divisions. The names of the former are *Yamaciro, Yamato, Kawachi, Idume*, and *Settsu;* while the latter, with the five kies, comprise 84 provinces, and the names of the dōs are *Tokaido*, with 15 provinces; *Tosando*, with 13; *Hokoorokdo*, with 7; *Sanindo*, with 8; *Sanyodo*, with 8; *Nankaido*, with 6; *Saikaido*, with 9; and *Hokaido*, with 11 provinces. In the vicinity of Saikaido are also two islands, each of which constitutes a province. The divisions which in this country are called counties number 1315. In 1868 the empire was divided into 3 political departments, the first of which embraced three *foos*—viz. Saikeo, or the western capital; Tokei or Yedo, the eastern capital, and Osaka; the second consisted of 38 *kens;* and the third of 350 *hans*.

Extending from one extremity of Japan to the other, across all its prominent islands, are mountains, many of them of volcanic origin and of great elevation. The highest of these, called Fusiyama, is about 80 miles from Yedo, is 14,170 feet high, and has a summit covered with perpetual snow. It is an extinct volcano, the last eruption having taken place in 1707. There are also thirteen other lofty peaks, bearing the names of Tookiyama, or "Moon Mountains;" Odaki; Nicquozan, or "Sunbeam Mountain;" Omine, or "Great Peak;" Sirayama, or "White Mountain;" Teteyama, or "Standing Mountain;" Kirisima, or "Fog Island;" Asozan; Tsukoobayama; Onsendaki, or "Hot Spring;" Asawayama; Tourimiyama: and Iwakeyama. The most extensive range, known as the Hakoni, attains an elevation of 6000 feet, and traverses the island of Nipon from E. to W. There are many volcanoes, and earthquakes are of frequent occurrence, but chiefly in the north-eastern parts. The mountains of Yesso rise to a height of 8000 feet, and a large part of the country is unexplored and covered with forests. The rivers of Japan are numerous, but short, on account of the mountains which send the waters in different directions. They are generally shallow, subject to great freshets during the rainy season, and their mouths are frequently obstructed by sand-bars. The three largest are Torregawa, Sinanogawa, and Kisogawa; and next to these come Oyeegawa, Fouzigawa, Sakagawa, and Okumagawa. The only fresh-water lake in the empire of any size or importance is near the city of Miako. It is 10 geographical miles wide and 35 miles long, and is called Biwako or Lake Omi. Small lakes or ponds abound, and hot springs are to be found in various parts of the island of Nipon. The cities of Japan are numerous. Two of them have become famous because selected as capitals—Miako or Saikio, the western capital, and Tokei, commonly called Yedo, the eastern capital. The first, which has never been open to foreigners, lies in lat. 35° 05′ N. and lon. 4° 10′ W., and was the ancient seat of government, dating its origin from A. D. 794. It stands on a plain, is surrounded with mountains, and directly through the centre runs the river Kano, noted for the purity of its water. It contains 374,000 inhabitants, and, though small when compared with the modern capital, is a place of great interest. It is entered by six principal roads. Its streets are clean, its temples, which may be counted by the hundred, are beautiful, and its silk-factories have a wide reputation. The city of Tokei lies in lat. 35° 35′ N. and lon. 139° 40′ E., and in magnitude ranks next to Pekin in China. In 1861 it claimed to have about 1,500,000 inhabitants, but the population is now considerably less. While it has decreased in numbers, it has increased in commerce. Its gardens and open spaces are numerous, and give it an air of comfort and freedom which is unusual. It is intersected by many canals, and its bridges are numerous. As the present capital and residence of the imperial court, it is the meeting-place of the national legislature, called a Parliament; it also has a well-endowed college, a governor and police force of 3000, is supplied with hospitals and asylums for infants and paupers, and by means of railroads and telegraph-lines is daily facilitating its communication with the entire country. It became an open port in 1869. The second largest city in Japan is Osaca, on the island of Nipon. It is both an open port and the one through which Miako communicates with the ocean, from which it is distant 33 miles. Its canals and bridges are very numerous, the latter often very handsome. It has an extensive trade and is well fortified. The next city in size is Yokohama, and is the successful rival of an older place in the immediate vicinity known as Kanagawa. It is on the Bay of Yedo, 20 miles from the capital, and within the last few years has become the most important seaport in the empire. The harbor is spacious and secure, and is supplied with commodious piers, the accommodations being extensive, and the prevailing modes of living and of business giving to it the aspect of a port of the Western World. The next city of importance is Nagasaki, located on the island of Kiusiu. Its harbor is very large and perfectly secure. This was the first port ever opened to foreigners in Japan, and a large trade has been carried on there by the merchants of China and of Holland, where they have for a long time been permitted to locate factories. The other principal cities of Japan are Neigata, an open port, on the N. E. coast of Nipon; Kobe, also an open port, near Osaca; Hokodaté, the open port of the island of Yesso; and Saki, formerly a place of importance and open to foreigners, but now holding no commercial intercourse with the outside world.

The climate of Japan is unequal, but as a general rule the central and most densely populated portion is mild and agreeable. In the extreme S., however, the heat is often oppressive, while in the island of Yesso the mercury occasionally sinks far below zero, and snow falls to a great depth on the mountains and in the valleys. The sun during the hottest days is much less debilitating than on the coast of China or in India, and as to the general conditions of salubrity, the empire is highly favored. The autumn is a kind of second summer, the months of October and November being the most pleasant and genial of the entire year, and amply compensating for the heat and frequent rains of May and June. A marked difference is said to exist between the climates of the eastern and western coasts of Nipon, the latter being much colder, and receiving a greater fall of snow, than the former; and this is attributed to the fact that on the E. there is a broad belt of warm water flowing constantly to the N. E., while the Japan Sea has a cold current constantly setting towards the S. W. from the Sea of Okhotsk. The month of September usually brings with it rough weather and those fearful hurricanes, called typhoons, which do the greatest damage along the eastern coast of the empire; and, as Japan is a land of earthquakes, it is said that they have had a palpable influence on the climate of the empire.

The most ancient name by which the empire was known was *Yamato Zima*, meaning "east of the mountains." Its present name is a corruption of Jipunquo, which is of Chinese origin, and means, as we have already stated, the "Country at the Root of the Sun," or the "Land of the Rising Sun," because, when so named, it was the most eastern in the known world; and Nipon, now used in Oriental countries, is the Chinese pronunciation of the same name. The true origin of its people is lost in tradition or fable—it is claimed that prior to the first emperor it had existed 2479 years—but it dates its chronological

history back to the year 667 before the Christian era. The first man of note connected with the empire of whom anything is actually known was Zinmu, who, after a career of conquest, established himself at the foot of the volcanic mountain called Keresemi in the province of Fuga. From that point he extended his explorations and sway through the entire length of the Japanese territory, and is represented as civilizing the nation and reforming the existing laws and government. The credit is also awarded to him of having divided time into months and years, and in his person was vested the office of high priest, representative of Heaven, and emperor or mikado. He established his capital at Kasiwabara in Yamato, but the location of the capital was frequently changed by the succeeding emperors to the various provinces of Yamato, Omi, Setten, Nagato, and Kawadi, and after 1464 years from the time of Zinmu it was fixed at Saikio, or Miako, in the province of Yamaciro; but after the revolution of 1867 it was located at Tokei or Yedo. The total number of emperors who have reigned over Japan in an unbroken line is 124. From the earliest times down to the present they were called mikados, although for about 600 years the men who actually administered the government were called shiogoons or tycoons; and it was in the year 1867 that the mikado or tenno resumed his ancient privileges. To give a minute account of all the emperors and shiogoons of Japan, and of the deeds which characterized their several reigns, is quite impossible; all that can be done in these pages is to present a summary of the most distinguished persons of the empire, together with a passing notice of the more important events with which their names are associated. One fact which the reader should bear in mind is this—that the position of emperor of Japan has always been hereditary and his person venerated, and while many sovereigns may have been comparatively powerless, the line of descent has been unbroken. In the person of the mikado Zinmu, the founder of the line, vested the office of high priest, representative of Heaven, and emperor, and hence the modern idea of calling him the spiritual head of the nation. Another important fact to be remembered has reference to the title of shiogoon or tycoon. The possessors of this dignity were merely military chieftains who by intrigue or personal prowess acquired sway over the people. They belonged to various families, and the rivalries which naturally existed among them were the cause of the bitter wars which prevailed in Japan for hundreds of years. They never failed, with the people, to respect the office or position of the hereditary monarch, but while they wielded power they inspired fear rather than veneration. From the earliest period in the history of the empire mention is made of three things which necessarily appertained to the person who sat upon the throne—viz. a sword, a mirror, and a ball of crystal. These are known by the name of *Sanjioo no jinji*, and considered as symbols of the imperial power. The emperor Su-jin-tenno, who lived in B. C. 97, was the last ruler of Japan prior to the commencement of the Christian era. He built a Sintu temple in Isse, established an army over which he placed four generalissimos, ordered the first census of Nipon and Kiusiu, levied taxes for the purpose of building large ships, ordered the draining of lakes for irrigation, and was the first ruler to open intercourse with Corea. His successor was Sui-nin-tenno, who ascended the throne in A. D. 6. He acquired distinction by abolishing the barbarous custom which required that on the death of the emperor the empress and all her court should commit suicide by hara-kiri. Although the empress of Sui-nin came to a natural death, the highest of her lady attendants killed themselves by cutting their throats, and then the emperor decreed that this custom should also be abolished. This ruler devoted his attention to agriculture, and during his reign 800 canals and ponds were built in different parts of Japan for irrigation. The next man of note was Keko-tenno, who reigned between the years 71 and 130 A. D. After quelling obstinate rebellions in Kiusiu and the northern part of Nipon, he caused the arable lands of the empire to be surveyed, and, with a view of guarding against famine, caused the establishment of granaries in all the larger towns of the empire. The emperor Senmu-tenno reigned from A. D. 131 to 190, creating the office of daijin, the second position of honor and power in the realm; and the first dignitary of that rank who ever left Japan as an ambassador was Tomomi Iwakura, who visited America and Europe in the year 1872. Among the men who distinguished themselves during the reign of Senmu was Yamato Daki; he held the office of commander-in-chief of the army, and was called the "prince of warriors." His conquests extended as far as the island of Yesso; and because his wife Adzuma threw herself into the sea to appease a terrible storm, her name was given to the region of country which her husband had subdued. Chinai-tenno, who was the son of Yamato Daki, reigned for eight years, from A. D. 192 to 200, and the principal fact recorded of him was that he died from disappointment caused by being defeated in an expedition conducted by himself in person against the rebellion of a tributary prince of the empire named Kumaoso of Kiusiu. The next ruler of Japan was an empress, Jingu Kogu, the wife of Chinai-tenno. She accompanied her husband in his unsuccessful expedition, and after his death assumed the reins of power. She distinguished herself by leading an invading army against the kingdom of Corea, compelling the inhabitants to give up their treasures and to promise an annual tribute to Japan. She had several children, one of whom became a very distinguished emperor. Her various conquests gave her a fame which surpassed all her predecessors, and her life and deeds of heroism are widely commemorated by the painters of Japan and in the popular literature of the country. Osin-tenno, the son of Jingu Kogu, ascended the throne in A. D. 270, and reigned about forty-three years. Although not born when his mother conquered Corea, the honor of that conquest has been given to him. In the second year of his reign the islands of Yesso and Saghalien voluntarily submitted to his rule, and three of the kingdoms of Corea continued to pay him an annual tribute. In 283 he brought a woman from Corea to teach his people the art of working in silk; in 284 an improved breed of horses was also introduced from the same country; in 285 a philosopher from China, named Wonin, introduced Chinese letters into Japan, from which time the works of Confucius became generally known; and in 300 from the wood of an old war-vessel a musical instrument called the *koto* was made, and has been in use down to the present time. In 306, Osin sent an embassy to China for the purpose of obtaining further information in regard to the production and the manufacture of silk. It is related of this emperor that, having been advised by the brother of his prime minister that the latter was conspiring against the throne, he caused them both to plunge their arms into boiling water, when, the ordeal proving favorable to the minister, the informer was executed. After his death the largest temples were erected to his memory, and he received the title of *hatchimang*, or the "god of war," and his reign has always been looked upon with national pride by the Japanese. The next man of note was Jintoku-tenno. During his reign (313–399) extensive inundations led to the construction of dikes along the rivers, and rice-houses and mills for cleaning rice were for the first time built. He also sent an expedition to put down a rebellion in the island of Yesso. Lichu-tenno came to the throne in 400, and was the first to provide for the writing of a history of the empire, for which duty he appointed two scholars; and under the patronage of Yuriyaku-tenno (479) mulberry trees were planted throughout the empire, and special attention was first given to the manufacture of silk. About this time also skilful carpenters were induced to immigrate from Corea, and an embassy was sent to that country to make certain collections of Chinese literature. The first event of importance connected with the era beginning with the year 500 was the introduction of the Booddhist religion into Japan, which was destined to take the place, to a great extent, of the Sintu religion and the moral instructions of Confucius. This occurred in 552, when an embassy was sent over from Corea, and presented to the Japanese emperor a collection of books accompanied by an image of Booddha Sakya, the leading idea of the books being that a pure life was desirable, and that it could only be secured through self-denial. One of the most active converts to the new religion was Moumaya-do-no-wosi, son of the emperor Nakatomi; he was a gentle character and devoted to the new faith, and at the time of his death there were 46 Booddhist temples, 816 priests, and 569 *religieuses* in the empire. The introduction of Booddhism through China and Corea brought with it some of the customs of those countries—the use of the *nengo*, or year-name, for marking events and dates, and also abdication by the emperors after very short reigns, which was followed by the elevation of mere children, whereby the sovereignty was for a time reduced to a name and the power of the nation given into the hands of the ministers. Among these child-rulers were the empress Seiwa, who began her reign at the age of nine; the emperors Yozei, at eight; Daigo, at thirteen; Reizan, at eighteen; Yenwou, at eleven; Goitsi, at nine; Konye, at three; and Rokusio, at two years of age. About this time a man named Nakatomi-Kamatari-ko obtained great influence, and is still remembered as the founder of the laws of Japan. In the middle of the seventh century Ten-si, a real emperor, ascended the throne, and distinguished himself in warlike exploits against Corea and Tartary, and then it was that Yesso was subjugated. In 794, the general government having been divided into eight boards after the manner of the Chinese, the central power of the empire was fixed at Miako; and about this time was published the *Rits Rio*, a code of laws which are partly in force at the present time. An-

other notable event of this period was the introduction of an alphabet, called the Hira Kana, to facilitate the reading of Chinese, the name of the scholar and venerated man who brought about this change being Kobo-dai-si. It now became a custom with the emperors, on abdicating the throne, to adopt the garb and religious life of the Booddhist priests, which did much to perpetuate the prevailing religion. During the reign of the emperor Itsisio (987–1012) two terrible plagues visited the empire. His successor, Go-ri-sen, became famous for his heroism in putting down a rebellion in the northern part of Nipon.

The 500 years which follow A. D. 1000, and now come under consideration, are of greater importance than the preceding era, and may be written in the successive rise to power of individuals connected with the peerage of the realm, and especially the families of Fusiwara, Sungawara, Minnamoto, Tatchibanna, and other names regarded as illustrious and held in veneration to the present day. Among these may be mentioned Ten-mang, the greatest literary character of his country and an able man, who through a rival was banished to the island of Kiusiu, where he was starved to death, and to whose memory many splendid temples were subsequently erected in Miako and Yedo. Another famous personage was Yoshi-iyé, who, as commander-in-chief, subdued the rebellious provinces of Mootz and Kwanto, and because of his bravery and other qualifications was called "the eldest son of the god of war;" and still another celebrity was Kio Mori, descended from the emperor Kwan-mu, who was a prominent actor in the affairs of the nation, and is remembered as the ablest and most unscrupulous minister of his time, when the whole empire was devastated by war, but who at the age of fifty-one shaved his head and nominally became a priest. One of his daughters became an empress, and a grandson an emperor. The opening of the twelfth century was marked by many deeds of rare valor and of cruelty, and the conflicts between rival families were continuous and desperate. In 1164 the ex-emperor Sho-toku was banished to the province of Sanuki, where he wrote a letter to the reigning emperor on a piece of his shirt with his blood, and then died of starvation. In 1170, Tame-tomo became famous for his power in drawing the bow and as a rover on the South seas, and, because he was the original occupier of the Liookioo Islands, came to be considered as a sacred personage. The most famous emperor who reigned during this exciting period was Gozira-kawa, who died in 1192 at the age of sixty-seven. He had taken an active part in the working of the government for forty years, and after abdicating the throne witnessed a part of the reigns of five emperors, his sons and grandsons, and finally died in tranquillity. Two men who are generally regarded as among the greatest of their era were Yoritomo and Yoshitzuné. They were brothers, both attained the position of shiogoon, and were desperate in their rivalry of each other. The first is generally regarded as the greatest hero in Japanese history, and the first shiogoon of the dynasty which ended in 1867. He died in 1199, at the age of fifty-three, from the effects of a fall from his horse. The second man just named is looked upon as the mirror of chivalry, and his conduct is held up for the imitation of the youth of his country. The former conspired to take the life of the latter, and when reduced to an extremity destroyed himself after killing his wife and children. During the twelfth and thirteenth centuries the empire of Japan was almost continually engaged in intestine wars; severe contests occurred between the shiogoons of the North and South; and among the families which now rose to power were Hojio, Ashikanga, Nitta, Hossokawa, and others who occupied prominent positions, and it was during the period in which they lived that the following events occurred: In 1260 the Nitsiren sect of Booddhists was introduced, and it was one of the saints connected with this order, named Saysho-gosama, who subsequently became famous as a persecutor of Christians. In 1276, Corea became tributary to Japan, and an embassy was sent from China to obtain tribute-money from the Chinese. In 1281 the Chinese despatched a naval expedition, with ambassadors, to Japan, when 30,000 of the invaders were taken prisoners and killed, and one of the ambassadors was beheaded. In 1321 the office known as the *Kirokusho*, or "recorder of facts," was established at Miako, and twenty years afterwards an influential minister published a work called *The Red Book of the Court of Miako.* About the year 1367 there was an extensive war on the island of Kiusiu, when the Satsuma family largely increased its power at the expense of Kikootchi. In that year also Ashikanga, when ten years of age, was appointed shiogoon; he died in 1408. He was a man of great ability and influence, was styled by the Chinese Nippon-wo, or king of Japan, and from the reigning emperor received the title of kubosama, having been the first person thus honored. The office of shiogoon became hereditary in his family, and the seat of their power was Kamakura. In 1415 an arbitrary law was passed by which all mercantile engagements were at once ended and all debts cancelled, which was the cause of much trouble and anxiety among the people. In 1466 commenced the war known in history as the "Onin," which lasted more than ten years, and was followed by a famine in 1472, and an earthquake in 1475 destroyed a large part of the city of Osaka. A severe drought occurred in 1496, which was succeeded by another famine and a destructive disease among the forest trees.

From this time forward the leading events in Japanese history multiplied with increased rapidity, and hence, for the sake of convenience, we shall divide the remainder of our chronological record into centuries. The sixteenth century brought no cessation from intestine war and assassination. The year 1510 was signalized by the fact that Nango, a servant and relative of the minister at Kamakura, Ooyay Soongi, rebelled against his master, and took possession of his castle and territory in the province of Etsingo, and became a man of great power. In 1521, for the first time in many years, the emperor made his appearance in public, and his court became impoverished. This condition of affairs lasted for at least fifteen years, when the emperor Go Tsutchi died in such poverty that his body lay unburied for several days for want of money. Two years afterwards an attempt was made to trade with China, but it was unsuccessful, because the Chinese coasts were infested with Japanese pirates. In Nov., 1533, there was observed an extraordinary number of falling stars, and in the following year the country was visited by a fatal epidemic. Three years afterwards there was a bitter quarrel between different sects of the Booddhist priests, one of the results of which was the burning of one-half of the city of Miako. In 1541, according to the best authorities, Antony Mora, Francis Zaimor, and Anthony Pexot, three Portuguese merchants, in their voyage from Siam to China, were wrecked upon the coast of Kiusiu, and the firearms which they had with them caused a profound sensation throughout the empire, and the fact was noted in the national calendars. In 1543 the Portuguese merchants came back again, bringing with them Jesuit missionaries, and from that time the history of the empire was chronicled in the literature of Europe. Francis Xavier visited the country in 1549, and after remaining there two years left it, disheartened with the realities of missionary-work. About 1557 the military chieftain named Nobu Nanga made his appearance on the stage of public affairs, and for more than twenty years was the master-spirit of the empire, wielding the power of a shiogoon. He was descended from Kio-Mori, and his rule was quite as grasping and severe as that of any of his predecessors. In 1557 he put to death, for private reasons, his youngest brother, and seven years afterwards he killed his father-in-law, the lord of Mino, and took all his possessions. He began in 1569 a crusade against the Booddhists, and in a few years succeeded in destroying a large number of their temples and massacred many of their priests; at the same time, for selfish purposes, he encouraged the Jesuits. In 1572 he had a difficulty with the shiogoon, Yoshi-aki, whom he arrested and put in prison, thus bringing to an end the real power of the Ashikanga family. He had many able generals in league with him, the three most famous of whom were Hideyoshi, Akitchi-mitsu-hide, and Iyeyas. Under his encouragement the Jesuits rose to favor and power at court, and in 1581 they claimed to have in Japan 200 churches and not less than 150,000 Christians. He was reputed a brave, ambitious, and able man, and not without many moral virtues, and he laughed at the worship of the gods and considered the bonzes as impostors. In 1582 he was gradually overrunning all Japan, and was liberal in giving to his kindred the property he had acquired by conquest. He built a temple in which he collected idols of all the gods of Japan, and placing in the midst of it a statue of himself called Xanthi, or "supreme ruler," he issued an edict commanding all men to worship that image and no other. The first to obey this order was his oldest son, and the example was followed by the gentry and people in their course. His end was in keeping with his life; after being surrounded in his castle at Miako, he was wounded with an arrow, and then consumed in the building where he was sheltered, in the forty-ninth year of his age. When he died the tide of prosperity turned and ebbed until it gradually swept the whole Jesuit priesthood from the shores of Japan. The immense treasures which he had accumulated in the course of many years in the city of Azutchi-yama were given away and squandered in three days by his late confederate, Akitchi-mitsu-hide. After the death of Nobu Nanga, the man who had once been his servant, and afterwards his chief military assistant, and who had acquired a great reputation as a leader, became the military ruler or shiogoon. His name, which was originally Hideyoshi, was

changed a number of times until he became known as Taikosama. He was of low origin and insignificant in appearance. His chief castle was at Osaka, which he did much to improve by digging canals and perfecting its fortifications. He had six wives. In 1583, with his permission, the Jesuit fathers induced four young noblemen to visit the pope in Rome, which expedition lasted for eight years. In 1585 he received from the emperor the family name of Toyotomi. About that time he became an earnest supporter of the Jesuits, although he would not accept their religion for himself; but when his plans had ripened, and the Jesuits were confident of increasing success, he suddenly gave them notice to quit the country within twenty days, forbidding them to preach their religion on pain of death. In 1586 he took forcible possession of Nagasaki, and made it a government port and property, declaring it to be the only place where foreign trade should be permitted. The threat made by Taikosama was not carried out, and the Jesuits continued in the country, and he was charged with changing his policy because he desired to use their ships in a project to invade Corea. He led an army of 300,000 men against that country, one-half of whom were destroyed, when ambassadors were sent to Japan and the following demands were made: (1) That eight provinces of Corea be handed over to Japan; (2) that the emperor of China give one of his daughters to Taikosama; (3) that there should be free trade between the two countries; and (4) that China and Corea should pay Japan a yearly tribute. In 1592 and the following year two envoys from Manila and the Philippines were received by Taikosama, the first of which brought with them four Recollets of St. Francis to enter the missionary service. Among their presents was a Spanish horse, whose blood has probably affected the breed now known in Japan. About this time events occurred which led Taiko to believe that his nephew intended to usurp his place, whereupon, after many intrigues, he caused him to be put to death, as well as thirty-one women and children, all members of his family. In 1596 a comet was visible in the empire, and on its disappearance a terrible earthquake occurred, which seemed to prognosticate the death of the shiogoon. While winking at the stealthy operations of the Jesuits, he caused twenty-five of them to be punished by the death of the cross. This act, as if in self-defence, he followed up with an order that all the Roman Catholics residing in Nagasaki should be at once sent home in their ships. But notwithstanding this hostility, when he became sick in 1598 he admitted a Romish priest to his bedside, and then died, all his nobility, according to the Fathers, "being much better pleased to see him on the list of dead gods than in the land of living men." In the annals of Japan the year 1599 is given as that in which the English and Dutch ships visited the country, and they are said to have come to the town of Saccai, near Osaka. Dutch pilots had already for several years been navigating the surrounding seas, and William Adams, the English pilot of the Dutch fleet of five sail which left Texel in June, 1598, did not reach Boongo until Apr., 1600, when his crew was found to be reduced to nine or ten men.

The great event which characterized the beginning of the seventeenth century was the accession to power of Iyeyas Mikawa-no-kami. He was born of a good family, but had succeeded as a military man by depending upon himself. At this period the emperor was a mere boy, and although the grandson by marriage of Iyeyas, that man claimed, and for a long time wielded, the sceptre of power. As the friend of the regent-emperor quite a number of the provincial governors formed a league against him; and in Oct., 1600, near Lake Owomi, a battle was fought which has ever been considered one of the most important and decisive connected with Japanese history, and Iyeyas was the victor. His opponents were scattered and he became at once master of public affairs. The most important of his many captives in the late battle was a noted chieftain named Konishi Setsu, who had been viceroy of Kiusiu and commander-in-chief both of the naval and military forces in the Corean war, who was beheaded. But, notwithstanding this act of severity, Iyeyas treated his late enemies with kindness and granted a general amnesty. He acquired great power, one secret of which seems to have been that when he once made a promise he never broke it, the most perfect reliance being therefore placed upon his word. The portion of Japan which held out the longest against the new conqueror was the island of Kiusiu, but its principal ruler, Satsuma, was obliged to yield. Prior to the crowning military achievement of Iyeyas the imperial, ecclesiastical, and commercial capitals of the empire had been Miako, Narra, and Osaka; but he removed the government to Yedo, which at that time was an insignificant place, with only one street, known then and now as Koji Matchi. He was reputed a true lover of his country, and was never accused of being personally ambitious. He was a friend to all kinds of internal improvements, ruled with wisdom and discretion, and was honored with the title of *Se-i-dai-Shiogoon*, or "tranquillizer of barbarians and commander-in-chief." The most important event of his reign was the promulgation of a code of laws, 100 in number, which he bequeathed to his descendants in power as a guide to them in the office he hoped would be hereditary in his family. These laws have had a paramount influence with the rulers of Japan ever since the death of Iyeyas, and to a very great extent his ambitious hopes have been realized by the subsequent fame and power of his immediate family. Between these laws and the writings of Confucius and Mencius the similarity is manifest. Whatever their intrinsic merits, it is certain that their effect upon the nation was most salutary, for it was blessed with an uninterrupted peace for more than 200 years after the death of Iyeyas. So impressed with this fact were the nobles and the people of Japan at a later day that in 1806 they inaugurated a national festival for the sole purpose of commemorating this unprecedented fact. For about twenty years prior to the year 1614 the Jesuits had obtained such a footing in Japan that they claimed to have visited the whole empire, and to have made more than 100,000 converts. Although they entered the country as missionaries, they were subsequently denounced as preachers of sedition and organizers of rebellion. The opposition which they called forth soon became so bitter that in 1636 the government issued an order that the image of the Saviour as it appeared on the copper medals should be periodically desecrated by being trampled under foot; and those orders remained in force until the conclusion of treaties with Christian nations in recent times. After such demonstrations it cannot be thought strange that when the time came for driving the Jesuits out of the country the expulsion should have been attended with many acts of cruelty. The first decree of banishment was issued by Iyeyas in 1614, but some fifteen years elapsed before the movement was in any degree successful. A new edict against the Roman Catholic Church was issued in 1666, and two years afterwards an order was promulgated prohibiting the erection of Booddhist temples, which has remained in force to the present time. In 1720 the Booddhist priesthood held a festival throughout the empire, by which they commemorated the eleventh centenary of the establishment of their religion.

In 1839 the Portuguese and Spanish were finally expelled, but a single Dutch factory was permitted to remain at the island Hirado. In 1709 another attempt was made to regain Japan to the Church of Rome, but it was unsuccessful. Various attempts, at long intervals, were made by different foreign nations to reopen a trade with the country. The Dutch, as well as the Japanese, bitterly opposed all such measures—the former from cupidity, and the latter from a motive of self-defence. According to the native annals, the coast of Japan was visited by foreign vessels in 1637, 1673, 1768, 1791, 1793, 1796, 1803, 1808, 1813, and 1829. American ships first arrived at Nagasaki in 1846 under Com. Biddle, and Com. M.C. Perry made his visit in 1853, made memorable by resulting in a treaty with the U. S. In 1854, Sir James Stirling, an English admiral, visited Nagasaki, and also concluded a treaty with Japan; and in 1858 it was proclaimed by the Japanese that they had concluded treaties with the American, English, Dutch, Russian, and Portuguese nations. The last of the shiogoons who really held the reins of power was Iyaymutchi; he reigned from 1859 to 1866, when he died, having been the leading figure in the late rebellion, which resulted in dissolving the dual government which had existed for 600 years, and in restoring to his proper position the true emperor of Japan. In 1867 an effort was made by Yoshi-hisa to be recognized as the legitimate successor of Shiogoon Iyaymutchi, but it was unsuccessful; and before the close of that year the spiritual emperor, who had just found himself received as the true and only ruler of the empire, died in the thirty-eighth year of his age, and left upon the throne his son, a boy of fifteen years, who is the present emperor of Japan.

As to the events which have taken place in that empire during the last twenty years, they resemble the stories of romance and are among the marvels of the age. Into that subject we cannot fully enter at present, but the following particulars may be mentioned for purposes of reference, and those who may desire more elaborate information will find it admirably set forth in a volume entitled *New Japan*, from the pen of an English diplomat, Samuel Mossman. The treaty with Com. Perry was ratified in 1854 at Kanagawa, and the ports of Hakodadi and Simoda were opened to foreign commerce; in 1855 the Russian government, through Admiral Poutiatine, visited Simoda and secured the ratification of a treaty, which fact was strangely commemorated by the destruction of Simoda by an earthquake;

in 1858 treaties were also concluded by England and France, and the ports opened to them were Kanagawa, Nagasaki, Hakodadi, Hiogo, Osaka, and Neigata; in 1859, British and American legations were established at Yedo; in 1860, Dutch and Prussian treaties were signed at Yedo, and several assassinations occurred in that year, as well as in the preceding and succeeding years; in 1862 a diplomatic mission of about thirty-five members was sent to Europe by way of America, having sailed in an English frigate called the Odin, and the envoy was Takeno Votschie Shemodze; in 1863 the British and American legation buildings were destroyed at Yedo, and a retrograde policy was inaugurated by the Japanese officials, one of the results of whose hostile action was the payment of an indemnity to America and the leading powers of Europe; in 1865 the allied envoys received the consent of the mikado to the treaties; in 1866 and 1867, as already intimated, the imperial government was changed from the old to the new form; in 1868 was commenced the civil war in Japan, and the mikado became the sole monarch; in 1870 the Japanese government resumed with great ardor its work of reform, the prominent ideas being the education of Japanese students in foreign countries and the establishment of diplomatic relations with America, England, Russia, Germany, Austria, and France; and in 1872 the great embassy, headed by Tomomi Iwakura, visited the U. S. and Europe, the calendar of the Western nations was substituted for that of old Japan, and the empire found itself rapidly becoming an important member of the family of nations.

And now for a few remarks respecting the people of Japan as they existed just prior to their new birth. They are divided into eight classes, as follows: the Koongays, or Mikado nobility; the Daimios, or Yedo nobility; the Hattamotos, or lower daimios; the Hiakshos, or farmers without rank or title; the Shokonoris, who are artisans; the Akindos, or merchants; the Kiveiamonos, or actors and beggars; and the Yaytas, who are turners, shoemakers, and manufacturers or dealers in leather. In the island of Yesso are to be found a people called Ainos, who closely resemble the Indians of North America. The religions of the empire are two, Sintuism and Booddhism, while the higher classes seem to be partial to the moral teachings of Confucius. The Japanese language is one of letters, and not of characters like the Chinese, but because of the very frequent use of the latter by people in every sphere a great many difficulties arise both in speaking and writing. The literature of the country is quite extensive, cheap books and instructive art-productions are always in great demand, and a very large proportion of the people are able to read and write, and a love of drawing and painting is very common. The food upon which they subsist is rice, the chief production fish and a great variety of vegetables; and among their leading productions may be mentioned silk, tea, cotton, hemp, salt, gold, silver, iron, copper, coal, and lead. Opium, which is the bane of China, they do not use, but they substitute for it a good quality of tobacco, which they grow and manufacture in large quantities. Their fruits are numerous, and their knowledge of horticulture and the secrets of the soil is so extensive that many of the Japanese in this country have looked upon the agricultural mission of Mr. Horace Capron, who was invited to teach them the science of agriculture, as a most useless enterprise. Their skill in manufacturing is of the highest order, and when they shall have learned the importance of increasing the number of useful articles in every department of labor under the influence of modern improvements, it is likely they will hardly be equalled by any of the nations of the world. It has already passed into history that their display at the great Vienna Exposition was wonderful, and superior to that of any of the Asiatic nations. One of the most striking illustrations of intellectual activity among the Japanese is found in the use they are making of the press; books and newspapers, both in the Japanese and English languages, are multiplying every day, and are universally becoming modelled upon the literary plans of the Western nations. In speaking of the press of Japan, one of the Yokohama papers lately made this remark: "It is now but three or four years since the press sprang into existence in Japan, yet it is already being used for the serious discussion of weighty questions, and certainly by its vigor and earnestness, its candor, fearlessness, and courtesy, puts to shame a large section of the local European press, which seems only to exist to prove how little salt is worth which has lost its savor." In literature and religion, in commerce and education, very great changes have taken place within the last four years; and from a chart of Japan, recently published by authority, we gather the following items of information: The total number of temples in the empire devoted to the Sintu religion was 97, of which 35 were supported by the general government, and the rest by the provincial authorities; the Booddhist temples numbered 296,900, to which were attached 168,654 priests, divided into eleven sects; but all this religious machinery has since been abolished by imperial decree; the population of the metropolis of Yedo had been reduced to 1,194,390; the two colleges in that city contained 563 pupils, but have greatly increased since 1872; there were also thirteen hospitals and almshouses; the imperial army consisted of seven battalions of infantry, four of artillery, and two companies of cavalry; regular army, twenty battalions of infantry; cadets in military schools, 726; ships of war, 16, including one iron-clad, officered by 1307 men; steamships, 69, including 22 iron ships, and the large sailing vessels numbered 18; lighthouses, 16; dockyards, 2—at Yokohama and Nagasaki; mines worked by government, 3; it was also stated that manufacturing establishments were on the increase in Yedo, Yokohama, and Hiogo, and two railroads, between Yedo and Yokohama, and between Osaka and Kobi, were both in partial operation. The working government of Japan, as now organized under the supreme control of the emperor, is divided into ten departments—executive, with 237 officials; public works, 375; department of religion, 138; judicial department, 169; foreign affairs, 116; treasury department, 539; agricultural department, 192; war and navy departments, 891; educational department, 221; and the imperial court consists of 240 officials. The name of the reigning emperor or mikado is Mutsuhito, born in 1852, and recognized as heir in 1860, and he came to the throne in 1867. He is married, the empress being his senior by two years. His six uncles and great-uncles (one of whom was recently in Prussia and another in England), and sister in Yedo, also three brothers (one of whom has been a student at Annapolis), with an aunt in Yedo, constitute the royal family of Japan.

The thinking men of Japan now claim—and the facts support them in their views—that the revolution now going on is needed, stands upon a firm foundation, and will be triumphant. All the officials and the higher classes, and a large proportion of the masses, are anxious to throw aside every impediment calculated to retard their progress in the career upon which they have entered. They would be loyal to the mikado and the empire, but they want more civil if not religious liberty than they have hitherto enjoyed, protection in their commercial interests, and all the advantages resulting from a high order of education. That they are thoroughly in earnest is proven most conclusively by the truly wonderful changes that they themselves have carried out during the last twenty years. The barriers of exclusiveness have been removed, and many seaports, as already stated, opened to the trade of foreign countries; the imperial ruler has thrown aside all the mystery and seclusion which have been held sacred for 1000 years, and with his dynasty has entered the comity of nations; the feudal system has given place to a government allied in character to the enlightened nations of the earth, and the daimios have given up their estates for the benefit of the whole country; foreigners, who were treated as enemies, are now welcomed as friends; customs like those of wearing two swords and committing enforced suicide have been abolished; money has been liberally expended by the central government in sending its youth to be educated in foreign lands; schools, seminaries of learning, scientific and benevolent institutions, all founded upon the models of the Western nations, have been established, and are daily becoming grounded in the elements of prosperity; a free press, as we have seen, has been established and is respected; also a new postal system; the sea and land forces have been reorganized, and placed upon a basis of such stability as to make Japan the most invulnerable nation in the Orient; all the modern helps to a safe navigation of the extensive coasts of the empire have been introduced; the old Japanese calendar has been superseded by that of the Western nations excepting Russia; talented men in literature and science and diplomacy have been invited to take office in the empire for the benefit of their experience; a gold and silver currency similar to that of the U. S. has been established; a system of railroads has been organized and partly completed, which has already added wonderful facilities to travel and commerce; and by a line of telegraph news may now be transmitted from Yedo to London in less than fifty hours. Such are some of the marvels that have actually been accomplished, and they surely prove that the Japanese are not only in earnest in all that they are doing, but that their genius for going ahead is allied to that of the "universal Yankee nation." What they have accomplished in less than one generation has not in any part of Europe been secured in less than a century.

But there is another wonder connected with this great Japanese revolution; which is, that the nation is marching upward and onward without casting a thought upon what the great empires of India and China may think or desire. The nation, like the individuals who have come to the

front, is fearless, proud, delicately strung, and independent. Where can be found a better illustration of lofty courage than was presented by Japan in her recent difficulty with China about Formosa? She felt that she had justice on her side, and looking upon the 35,000,000 of her united and loyal people with perfect confidence, she said, "The 500,000,000 of China shall not frighten us from the path of duty and right." China did the proper thing in submitting, and ought to be applauded for her course; but when the subject of indemnity came up, Japan (unlike certain so-called civilized nations), true to her lofty instincts, asked only that the necessary expenses should be paid, and scorned to manifest a grasping love of gain. The only great questions connected with the prosperity of Japan which are not yet settled are those having reference to taxation and revenue, and the opening of the entire country to foreigners and to religion. The difficulties attending each of them cannot be fully understood by people in other countries; and yet there is nothing singular about them, if we remember that even in the U. S. we have never been free from some sort of excitement growing out of these identical questions. Good men and true are to-day working hard in Japan to perfect a system of taxation and revenue which will help the public purse and make the financial resources of the empire equal to its natural progress; when the European powers, headed by England, shall stop their domineering demands to have the empire thrown open at all hazards, then perhaps the imperial government may listen to reasonable appeals; and when the Japanese are convinced that religious fanaticism is a blessing, even in such countries as England and America, and that by giving the largest liberty they will not be made wretched by the intrigues of the Romish Church, then they may consider the policy of opening wide the gates to all denominations of Christians. With regard to the question of allowing foreigners to trade in all parts of the interior of Japan, a leading Japanese newspaper of Yedo recently made this remark: "The chief reasons why this measure cannot be carried out to-day are—firstly, that we cannot make foreigners submit to our laws; secondly, that the Japanese government is unable to alter the tariff by its sole authority; and, thirdly, that we cannot make them obey the regulations agreed to by the localities." Of the signboards proscribing Christianity which were formerly seen in Yedo, there is not one remaining at this day. But the fact is, that in Yedo and other large towns there are ministers of the gospel representing a number of sects who hold religious meetings regularly, and whose teachings are thankfully received by many of the native inhabitants. The prevailing sentiment towards the missionaries seems to be —"We have no objection to your instructing those who come to you for information, but we must not have any compulsory appeals;" and so we perceive that the hostility to the Christian religion is not by any means as active as it was in former years. Indeed, there is much talk among the Japanese about organizing a "new religion," which would of course be a long step towards recognizing Christianity in all its borders.

And now for a few words upon the prominent characteristics of the Japanese. They do not bestow the same honor upon women that is theoretically shown by the Western nations, but in that particular they are in advance of the other Asiatic nations. As already stated, several of their rulers have been females—8 out of 124, and one of them was the conqueror of Corea—and to-day let any woman manifest a superior mind and she will command the highest respect of her associates. Much has already been done to emancipate woman from her former degraded condition, and the last two ministers accredited to this country had the manliness and good sense to bring their wives with them. The Japanese, like human beings generally, may be fond of indulging their appetites, but drunkenness is not as common as it is in this country, and against the use of opium the most rigid regulations have been established. Although wedded to all kinds of aristocratic notions, they admire and foster intellect wherever found, and in their public offices always endeavor to find the best man for every position to be filled. They are also remarkable for their unsordid ideas of life and duty. They are an intellectual race, and their native education is wellnigh universal; the commonest people, we repeat, can read and write the Japanese language, and all who make any pretension to culture are well founded in the Chinese language, which to them is like Latin to the English scholar. All the writers who have associated with the Japanese in their own country, or while sojourning in America or Europe, coincide in the opinion that they are remarkable for their amiable and agreeable manners; and in this respect the great Iwakura embassy was most conspicuous—to such an extent, indeed, as to have been frequently commented upon both in this country and England. The porcelain, lacquer-work, paper and silk, and the bronzes of Japan have never been surpassed, and in some particulars not equalled, in any other part of the world; and with regard to their pictorial art, their genius has been misapprehended. Contrary to the common opinion, they understand and practise the rules of perspective, and foreigners have made a mistake in judging of their skill as artists by the pictures which in Yedo are sold by the million for the tenth part of a penny. A large proportion of the books are regularly illustrated, and the writer of this paper has in his possession many pictures which display abilities of the highest order for correctness and freedom of handling.

The relations existing between Japan and the U. S. have been, and are now, of the most friendly character. There is not a bone of contention between them, but there is one great fact on the side of the latter which is humiliating to our national honor and pride. We allude to what is called the indemnity fund. In 1864 a noted daimio, who hated the new order of things in Japan, fired upon a foreign vessel in the employ of another daimio. The allied powers thought themselves insulted, and brought the matter to the attention of the imperial government, which disclaimed all intention of doing wrong, and confessed that it could not control the rebel daimio. The powers in question, the British, Dutch, French, and Americans, then formed a little fleet, and inflicted severe punishment on the offending daimio. That done, a convention was called, and Japan was made to promise that she would pay an indemnity of $3,000,000. The sum-total of that indemnity payable to the U. S. is nearly $1,200,000. When more than one-half of the amount due the U. S. had been paid, and which our government was ashamed to put in the treasury, Prof. Joseph Henry took the lead and suggested to Congress that it should be appropriated to educational purposes in Japan. The President was in favor of the proposition, but Congress did not act; and so the question rested for a while. In the mean time, the interested European powers were trying to force the mikado to open his empire to the trade of all nations. His Majesty objected. "Then," said the powers, "you must pay us the money you owe." The Japanese government paid the balance of their debt to the three European powers, and there was another pause. It was soon found, however, not to be diplomatic for the U. S. to refuse the unpaid balance due our government. The arguments were successful, and the American minister had to go up and present his bill, which was instantly paid. For a moment the friendly feelings of the Japanese towards America were slightly abated, but when they saw the diplomatic necessity, and thought of what Prof. Henry and the President had tried to do, the former kindly feelings were restored. And now there is a great—and in some particulars a disgraceful—squabble going on in the U. S. over this pile of ill-gotten gain. One of two things on this subject is true—either that it was right for the U. S. to take that money from a country like Japan when in a state of revolution, or that it was not. If the U. S. have no right to the money in question, then every dollar of it should be returned without any conditions. If, however, there is a bill for actual expenses, that amount (perhaps less than $20,000) ought to be paid, and the very large balance should be returned. But what do we see now going on in the way of schemes for handling this money? (1) The very proper and most wise idea of Prof. Henry, to appropriate the money for educational purposes in Japan under the auspices of the Japanese themselves; (2) a proposition to divide the money among the American officers and sailors who on one steamer did such wonderful work at Simonoseki; (3) the founding of a college in Japan, to be wholly officered and controlled by Americans; (4) to build an American legation in Yedo; and (5) to educate a few dozen boys in the Japanese language for service at the American consulates in that country. Indeed, the preposterous propositions may be counted by the dozen, and the public will be surprised to learn that there was once a scheme suggested for taking this Japanese money to build a new state department in Washington. What will finally be done is doubtful, and we cannot but earnestly hope that the reputation of the U. S. for liberality and fair play will not be tarnished by the selfishness and cupidity of educational leaders or Congressional demagogues.

And now, by way of being a little more explicit on some of the points to which we have heretofore alluded, we submit under appropriate headings the subjoined information.

Commerce of Japan.—The latest complete accounts that have been received in the U. S. respecting the trade of Japan are for the year 1873. The total amount of trade was 50,322,539 yens (*i. e. dollars*); exports, 21,217,481 yens; imports, 29,105,057 yens; and the business of the several ports open to foreign trade was as follows, in yens:

	Exports.	Imports.
Yokohama	15,335,249	20,742,994
Kobe	2,459,869	6,030,988
Osaka	926,371	402,193
Nagasaki	2,347,815	1,888,862
Hakodate	447,610	82,819
Neigata	565,000	7,200

The total amount of duties collected was 1,735,513 yens, of which 1,223,021 yens were paid at Yokohama, and the balance at the five other ports. The imports of gold and silver for the year 1874 amounted to 1,020,065 yens; exports of the same, 13,332,792 yens. Imports of corn for same period, 83,420 yens; and exports, 412,819. Amount of total imports, 22,841,166 yens; amount of total exports, 18,367,259. Duties collected, 1,584,879 yens. Exports to U. S., 7,464,843 yens; China, 3,655,010; Great Britain, 3,232,665; France, 2,759,496; Italy, 647,657; Germany, 62,718; and other countries, 131,774. Imports from China, 8,360,454 yens; Great Britain, 10,149,888; France, 1,683,763; U. S., 1,010,359; Germany, 703,074; Indies, 28,753; and other countries, 180,742,290.

Exports and Imports in 1873.—Silk.—The most important export staple of Japan is raw silk, and for several years, indeed since 1865, a large business has been done in supplying France and Italy with silkworms' eggs to regenerate the diseased breeds of those countries. The effect of this latter trade has been to injure the quality of Japanese silk, and measures have been taken to stop the trade; but these are likely to be futile, for a short time at least, on account of existing treaties. It is claimed that the remedy is in reality with the people of Japan. In Jan., 1875, the prices of silk in Yokohama ranged from $420 to $570 per *picul*, or 120 pounds. The silk exports for 1873 amounted to nearly 11,000,000 yens. *Tea.*—With regard to the tea-trade, it is almost exclusively confined to the U. S., and has been wonderfully developed within the last four years, and there is a prospect of greater extension in the immediate future. Of course, Japan has an imposing rival in China, but the former empire, with its popular brands and reasonable prices, is likely to be eminently successful. The tea exports for 1873 amounted to about 3,400,000 yens. By way of giving an insight into the character of Japanese productions we append the following items: The exports of tobacco amounted to 62,000 yens; of seaweed to 175,000 yens; mushrooms, 33,284 yens; cuttle-fish, 19,000 yens; lackerware, 126,279 yens; earthenware, 48,000 yens; bronze and copper ware, 82,000 yens; copper in ore, slabs, and wire, 200,000 yens; ginseng, 63,641 yens; sunshades and fans, 23,000 yens; screens, 3400 yens; silk clothing, 9000 yens; and chona-root, 3433 yens. The imports from foreign countries have hitherto far excelled the exports, and the articles are too numerous to mention in this place, but the more important articles have recently been as follows: Woollen cloths, cotton satins, de laines, blankets, woollen and cotton mixtures, cotton fabrics, linens, manufactures of iron, sapan-wood, window-glass, cordage, sugars, cigars, paint, oils, steam-engines, printing-machines, machinery, glassware, ironware, copper roofing and sheathing, drugs, dye-powders, tapestry, carpets, tortoise-shells, boots and shoes, watches, clocks, soaps, furniture, stationery, wine, beer and brandy, mirrors, beans, coal, matches, coral, and coal oil. During the late difficulties with China the exportation of rice, the most vital commodity of Japan, was prohibited by the government, but that prohibition was removed early in 1875.

Lighthouses.—As a matter of interest to the commercial world, the following list of lighthouses, lightships, etc. is submitted: *Lighthouses.*—Sinagawa, Yedo anchorage; Yokohama Hatoba; Kanonsaki, entrance to Gulf of Yedo; Tsurugi-saki, do.; Nosima-saki, province of Awa; Inuboy-e-saki, province of Simosa; Iokasima, province of Sagami; Mikomoto, province of Idsu; Iro-o-saki, do.; Omaisaki, Suruga Gulf; Toha, Toba Harbor; Matoya, Southern Head; Kashinosaka, province of Kii; Siwomisaki, do.; Tomangaisima, Isumi Strait; Temposan, Osaka; Wada-no-misaki, Kobe anchorage; Yesaki, entrance to the Inland Sea; Nabaesima, Inland Sea; Tsurisima, Inland Sea; Isaki, entrance to Simonoseki Straits; Rokuren, do.; Iwosima, Nagasaki Harbor; Satanomisaki, island of Kiusiu; Awomori, province of Mutsu; Ishinomaki, province of Rikuzen; Noshiaf-saki, island of Yesso; Nemero, island of Yesso—numbering in all 29. The *Lightships* are two—in Yokohama Bay and the harbor of Hakodate; and the great buoys and beacons number 11. All the lighthouses here mentioned are built and conducted according to the most approved ideas of modern times. Notwithstanding the necessarily heavy cost of maintenance of the lighthouse establishment, no dues are levied on vessels visiting the ports of the empire.

Imperial Mint.—The coinage of gold, silver, and copper, founded on the plan of the U. S., was commenced in 1871, since which time the old and various styles of Japanese money have gone out of existence. The coin called a *yen* is equivalent to the American dollar, and is made of both gold and silver; the *sen* is equal to the American cent; and the *rin* is the same as the American mill. The gold yens are divided into the following denominations: twenty, ten, five, two, and one; the silver coins are for one yen, fifty sen, twenty sen, ten sen, and five sen; and the copper money is for two sen, one sen, half sen, and one rin. Down to Feb., 1875, the number of pieces coined at the imperial mint amounted to 136,885,541, and their value in yens was 64,421,744, or of gold 49,502,492, silver 14,419,411, and copper 499,841. In Mar., 1875, it was stated in the public prints of Yedo that coin to the value of 20,000,000 yens had been exported from Japan. In their general characteristics the coins of Japan are quite equal to those of the U. S. The Japanese historians claim that copper was melted in Japan as far back as A. D. 698 in the province of Suwo, whilst ten years later—in 708—they coined their first copper money. It was called wa-do-kai-zeni, and was cast in the province of Musashi. Prior to that period, however, there had been a silver coin in use, which was prohibited on the appearance of the copper coin; and the first gold used as money was coined about twenty years after the appearance of the copper coin.

Minerals.—The subjoined items of information will illustrate the fact that the mineral wealth of Japan has hitherto been very extensive, and will naturally suggest the idea that the future developments, conducted by modern inventions connected with mining, are likely greatly to increase the wealth of that empire. Copper has been found and smelted in not less than forty provinces. Copper, silver, and gold have been exported on a large scale ever since 1545. There is no mention in any of the Japanese records that any of these minerals had ever been imported, but they do state that within the space of 249 years the copper exported, chiefly through the Dutch merchants, amounted to 4,209,500 piculs. Of this copper there are many kinds, but bar copper is the most valuable. The gold and silver exported by the Portuguese between the years 1550 and 1639 (89 years) amounted in value to £59,500,000 sterling. In 1671 the exportation of silver was prohibited for a time. The Dutch were also large exporters of the same minerals. Prior and subsequent to the year 1830, from 50,000 to 60,000 piculs were exported annually; since then the exportation has reached a total of 40,000,000 piculs. Silver ore was discovered in 667, and in that century the first gold was coined; silver metal first produced in 674. Between the years 1400 and 1600 much larger amounts of the precious metals were smelted than in modern times. Lead ores are abundant, but that mineral has never been popular among the Japanese. Iron ores of many kinds are also found in large quantities; also superior varieties of coal; and within the last few years special attention has been given to the development of these important sources of wealth. Hitherto, the metallurgy of Japan has not been fully described by any author. The work of Von Siebold, *Nipon Archiv*, was never finished, and its information is meagre, and the work of Kæmpfer is not considered authentic. The leading works on this subject by Japanese authors are as follows: (1) *San-kaï-mei-dzu-kuwai*, in 5 vols.; (2) *Hon-zo-ko-Moku-Kei-mo*, 1 large vol.; (3) *Ko-do-Shu-roku*, a manual for the metallurgy of copper, a small volume.

Population.—The last census of Japan was taken in 1872, or the fifth year of Meiji, the 2532d year from the accession of Jimmu Tenno. The number of colonies is 1; organized cities, 3; kens, 73; provinces, 86; koris or departments, 717; kus or city parishes, 6862; muras or rural parishes, 70,443; towns, 12,535; Sintu shrines, 128,123; Boodhist temples, 98,914; and houses, 7,107,841. Total population, 33,110,825; males, 16,796,158; females, 16,314,667.

Ages.	Males.	Females.
14 and under	4,590,915	4,465,393
15–21	2,030,051	6,638,063
21–40	5,605,747	
40–60	3,655,564	5,091,070
60–80	1,435,507	
80 and above	75,530	118,248
Age unknown	1,844	1,890
	16,796,158	16,314,687

Number of maimed, blind, deaf and dumb: males, 63,759; females, 37,828. Criminals in prison: males, 2311; females, 119; in penal settlements, males, 962; females, 26; criminals at hard labor, males, 2726; females, 320. *Trades and Classes.*—Farmers, 14,870,426; artisans, 701,416; merchants, 1,309,191; miscellaneous occupations, 2,129,522; total, 19,010,555. Princes and princesses, 29; nobles, 2666; shizoku (armed class, upper grade), 1,282,167; sotsu (armed class, lower grade), 659,074; chishi (still lower grade), 5316; priests, 211,846; Sintu officials, 102,477; nuns, 9621; common people, 30,857,271; in Saghalien, 2358.

Legislative Information.—National or provincial legislatures, according to the accepted plan of the Western na-

tions, are not known in Japan. What has hitherto been called a parliament was deliberative in its character, but its members were appointed by the government, and not elected by the people. The native press of Japan, however, has lately been discussing the propriety of having a national deliberative assembly, whose members should actually represent the people; and, as a promising beginning in this direction, it was announced in Mar., 1875, that subordinate assemblies had already been established in the kens of Yamaguchi and Hiogo—that they had been unexpectedly successful, and met with the cordial approbation of the people. It was also announced that the members of the council of state had taken a friendly interest in these assemblies, and that the prospect was really encouraging that it would not be long before Japan would have what the natives designate a great house of assembly. Indeed, just as this paper is going to press intelligence has been received that a regular parliament, founded on the model of the British Parliament, has been partially decided upon by the imperial government, and that the *people* of Japan are likely to be heard in a house of commons.

Japanese Literature.—The subjoined summary of the literature of Japan is compiled from a native author, and is reliable. The Japanese possess a copious literature, have a fondness for reading, and indulge themselves in study to a remarkable degree. Their catalogues of published works are numerous and voluminous, and the native books are divided into three general classes, as follows: *Kangaku,* or Chinese classical literature and works on the subject. In this class may be included works on Booddhism, written in Chinese, as well as the commentaries on these, and the form of verse known as *Shi* by native authors; *Wa-gaku,* or native books upon exclusively Japanese subjects, such as history, geography, books upon subjects of local interest, art, and ancient legends written in verse; and *Kesaku,* or novels, tales, and historical events worked up into romances. Of this class they possess an immense variety, and many of the circulating libraries are chiefly composed of these productions. Among the more noted of the older writers may be mentioned Kiosan, Kioden, Sekku, Samba, and Hokuba, whose productions range from romantic history to very romantic fiction. Some of the more popular writers of later times are Bakkin, whose tales embodied real names and descriptions; Tanehiko, who described his own times, just before the advent of Europeans; Tamenaga, a very popular novelist; Rei Sanyow, noted for his histories; Seigan, a poet, writing in Chinese; Motoori, a writer on language; Atstane, an essayist; Oguni Takamasa, a poet; and Nakamura and Fukugawa, both of whom are English scholars, but stand at the head of the more useful writers of the present day, and who have translated into their language selections from the writings of very many of the modern writers of America and Europe. The writers of legends, travels, and romantic tales swell the list of modern Japanese authors to a large number. Unhappily, many of the books of Japan do but little to edify or improve the morals of the people.

With regard to poetry the Japanese are by no means deficient in the true sentiment, but their ideas of metre and melody are peculiar. What is called long poetry is formed of sentences of seven and five syllables alternately. Short poetry consists of thirty-one syllables only—the first sentence comprising five, the second seven, the third five, and the fourth and fifth seven syllables each. These poems are generally written on long and narrow strips of ornamented cardboard, measuring fourteen by about three inches, which are called *Tanzaku.* In the *Honka* poetry the syllables follow in the same order, but are read differently. The *Zootoka* has the same number of syllables, but so formed as to demand a poetical reply of the same order. *Seidooka* possesses a similar syllabic order and formation, but the beginning and ending consist of words or characters of like meaning. The *Kioka* is the ordinary poem of thirty syllables in the same order. The *Omugayashi* is similar to the *Zootoka,* with the exception that the two verses, question and reply, have only one of the thirty-one syllables different. In the change of this the merit of the performance consists. The *Oriku* is an acrostic of thirty-one syllables, divided into lines of five and seven syllables, twice alternating in one of seven syllables. The first syllable or character of each line is given arbitrarily. The *Haikaiku* is of the same number and order of syllables, but is simply a poetical play on words or a proverb. The *Renga* is the *Raminoku* or verse of five, seven, and five syllables, answered by the *Shimonoku,* of seven and seven syllables, the whole forming a poem of thirty-one. The *Haikai* is similar to the *Renga,* though commonly employed upon more trivial subjects. Both are called *Tzukeai* or "joining." The *Hokku* is the five, seven, and five, or poem of seventeen syllables. The *Senriu* has five, seven, and five syllables, and is a *jeu-de-mots.* It only remains to be added that a people who have such a variety of styles in expressing their thoughts cannot but be gifted in the utterance of the most noble and beautiful and inspiring of sentiments and poetical reflections.

The Japanese Language.—Without going into a learned disquisition on this subject, the subjoined general statements may be accepted as correct. Prior to the period, nearly 1200 years ago, when the Japanese imbibed certain ideas from the Chinese in regard to language, their own tongue does not appear to have been reduced to writing. In the earliest known writings, in prose as well as poetry, the square and unabbreviated form of the Chinese characters is used phonetically to represent the sounds of the Japanese syllables. These characters were called *Karina,* or borrowed names, and subsequently contracted into what is now called the *Kana,* which is syllabary, and consists of forty-eight letters; and when more or less abbreviated and simplified in form these characters are called *Hira-kana,* or plain letters, and are at the present time the common symbols used in writing the native Japanese. Another class of characters is called *Kata-kana,* or side letters, which are also derived from the Chinese, but in which only a part of the character is used. These are more ancient than the *Hira-kana,* and are commonly only used by scholars or in dictionaries. Another form of the *Kana* was invented by a Booddhist priest about 1000 years ago, for the purpose of assimilating it to the letters used in the sacred books of the Booddhists throughout the great countries of Asia. The syllables of the Japanese language number 72, and from the fact that the greatest care has to be taken not to write them indiscriminately, and thereby infringe upon ancient usage, the difficulties of uttering and writing them are very great, and not often fully surmounted by English-speaking people. In its sound the Japanese language is soft, and allied to the Italian. The books that have latterly been published upon it are not numerous, but by far the most important and valuable is the *Japanese and English Dictionary,* prepared in 1867 by J. C. Hepburn, and in which that indefatigable scholar has defined not less than 20,000 words. The only works of this character, and of special value, which preceded that of Dr. Hepburn, were published by W. H. Medhurst in Batavia in 1830, and by the Jesuit missionaries to Japan in 1603. In writing, the Japanese begin on the right side of the page, proceed in vertical columns, and make free use of diacritic and punctuating signs.

As no adequate idea of the sound of Japanese words can be obtained without first understanding the alphabet, we submit it to the reader, as follows: *i-, ro-, ha-, ni-, ho-, he-, to-, chi-, ri-, nu-, ru-, wo-, wa-, ka-, yo-, ta-, re-, so-, tsz-, ne-, na-, ra-, mu-, u-, i-, no-, o-, ku-, ya-, ma-, ke-, fu-, ko-, ye-, te-, a-, sa-, ki-, gi-, me-, mi-, shi-, ye-, hi-, mo-, se-, sz-,* and *n-*; in all, forty-eight syllabary letters. The characters represented by the above are written in two ways, and occasionally an extra meaning is given by the addition of marks and signs. In expressing the sound of the Japanese vowels the continental pronunciation has been followed, because of its being more definite than the English; the Japanese have been accustomed to it for two or more centuries, and in all the books written by Europeans it has been regularly adopted.

Dialectic variations are numerous and depend chiefly on modifications of sound. In the Japanese grammar there is no gender, the male sex being indicated by *vo* and the female by *me;* substantives are nearly allied to adjectives; there is no proper article; cases are indicated by suffixes; the plural is formed by suffixes, which signify *all, much, many;* the genitive precedes; the numerals are various; of figures there are three sets of numbers; of pronouns, those of the first and second person have been lost in the words of etiquette; demonstratives are numerous; relatives are wanting; verbs are perfect; certain particles denote the moods; the participles are of extensive application; adverbs are similar to adjectives; the syntax adheres to a strict order; compounds and derivatives are easy and frequent; and many simple words have significations which are discriminated by sinograms.

By way of giving the reader an idea of Japanese when spoken, we submit the following specimens from a standard vocabulary: God, *Kami, Shin, Kotoke;* man, *h'to, nin, ningen otoko;* woman, *ouna, fujio, jo;* husband, *otto teishu, muko, tszma, tonogo;* wife, *tszma, kanai niyōbō, naigi kamisan, okusama, sai;* world, *sekai, chikiu, tenchi tenka, seken, yo sejō, seji;* country, *kuni, koku, tochi, inaka, zaigō, kokka;* rice, *momi;* silk, *kinu, ito;* porcelain, *setomono;* enemy, *teki, kataki ada;* friend, *tomodachi, hōyu, hōbai, mikata, yorube tayori;* and religion, *oshiye, michi hō dō.* It will thus be seen that there are often many ways of expressing the same idea, and that it is not to be wondered at that the natives of one province of the Japanese empire are often unable to understand those of another.

Japanese Students in Foreign Lands.—Among the many remarkable events which marked the advent to power of the present emperor of Japan was that of sending promising young men to foreign countries to be educated. This was done at the expense of the general government, and the idea was, that the persons thus honored should eventually give their services to their country. The largest proportion of these students were sent to America, but many of them went to England, France, and Germany. The total number who came to the U. S. was about 500. Many of them, after their return to Japan, entered the public departments, and all the men who are in 1875 in official positions in the U. S. were formerly government students. In 1873 the Japanese government, for reasons that have not been publicly explained, recalled nearly all the students, so that those who are now studying in foreign lands are, with few exceptions, receiving their foreign education as private individuals. Among the Japanese students sent abroad have been many who displayed very remarkable abilities, and some of their writings, published in 1872, were highly praised both in the U. S. and in England. Among the students who came to America in 1871 were five young ladies, and as they were the first who ever left the empire of Japan for purposes of foreign study, we append their names, as follows: Rio Yoshimas, aged fifteen years; Tei Wooyeda, aged fifteen; Stematz Yamagawa, aged twelve; Shinge Nagai, aged ten; and Ume Tsuda, between seven and eight years of age. The first two, for considerations of a personal nature, were obliged to return to Japan in 1872, but the three others are still in the U. S., and all of them prosecuting their studies in a manner that is considered quite remarkable, even the youngest of them being now able to write a correct and handsome letter in the English language. The *Japan Mail* in an article on the Japanese students made the following observations: "The Japanese students abroad were so earnest, diligent, polite, quick, and eager to learn that they won plaudits even from those unused to praise. The president of a Massachusetts college said he wished to have a Japanese in every college in America to teach the undergraduates good manners. The principal of a Connecticut high school said publicly that a body of young men of such powers of observation as the Japanese students exhibited could not be found in America. The journals of England and Germany, as well as of America, stinted no praise of the graceful Orientals in their schools. Several of the Japanese students won distinctions at English, German, and French universities and at American colleges, and others would have assuredly done so had not the grave come between them and the goal. All these things tended to produce the opinion held by some that the average Japanese is even superior to the average American or European student."

School Statistics.—The following figures are given to represent the educational interests in Japan in 1874: government schools, 7; teachers, 95; Japanese teachers, 51; foreign teachers, 46; public and private schools in the various fus and kens, 6261; teachers, 5856; students, 472,047. To these should be added 3 normal schools. These were all under the immediate control of the educational department, the head of which is the vice-minister of public instruction—a most earnest and competent gentleman—Tanaka Fujmaro. In 1872 a law was promulgated by the imperial government which decreed the establishment of 53,760 schools in Japan, and while some progress has been made, it will be years, probably, before it can be fully consummated. Some of the provisions of the aforesaid law are as follows: Eventually the people will pay all expenses, but for the present the government will assist by paying salaries and expenses of foreign teachers, the cost of building high schools, and providing books and instruments and allowances to foreign students. The annual appropriation for these objects has thus far been about $300,000. The educational establishments which are now in successful operation in Yedo are as follows: The Dai Gakko, or university, which includes several separate colleges for the study of medicine, jurisprudence, philosophy, and mining, as also a polytechnic college. The veterinary, commercial, and agricultural colleges, as likewise the college of arts, have not as yet been opened. The Go Gakko, a school for instruction in foreign languages; several private schools, designed likewise for imparting instruction in foreign languages; the Shi Han Gakko, or normal school for the instruction of Japanese teachers; a principal female school; several preparatory schools; and certain establishments in connection with some of the public departments, which are designed for imparting knowledge of special subjects. The most competent observers agree in the opinion that Japan is in no sense an illiterate nation. The number of persons who cannot read and write is a small minority. Even the more common classes can read the ordinary Kana. CHARLES LANMAN.

Japan Clover (*Lespedeza striata*), a plant introduced in some unknown manner into the Southern States of the U. S. before 1845 from Eastern Asia, and which has spread with wonderful rapidity. It is a low annual, growing to the height of little over a foot on the poorest soils, is readily eaten by cattle, and has become popular with stock-raisers.

Japan'ning. The art of applying a peculiarly durable and beautiful varnish as practised in Japan, from which country the name is derived. The original process in its highest form is very difficult and complicated. If applied to wood, great care is taken to prepare the latter, it being baked for many days and tested to ensure it from cracking. The varnish itself is the resinous product of a bush called the *ourosi no ki*, or varnish-plant (*Rhus vernix*). The Chinese make it, but of inferior quality, from the *Augia Sinensis* or the *tsichon* and *tsatchon* (Canton dialect). According to Fisscher and Tomlinson, the lacker is obtained by incision. It is at first cream-like, but becomes black by exposure. A fine powder of charred wood is added after it has become black, and this being very evenly applied, it is dried in the sun, the charred wood giving it a peculiar body and preparing it for polishing. The reduction of the varnish and the mixing with the powder are very carefully executed by very tedious processes. Five coats of varnish are applied, each being dried with the greatest care. It becomes glass-like in its hardness, and is extremely tough, so as to resist the action of boiling water. It is then polished with a smooth stone and water (according to Fisscher, with reeds or a bamboo, as De Janeïgry understands him, but Fisscher probably means with *Equisetum* or Dutch rush). When applied to papier-maché boxes or cups the varnish forms a *binding* like an enamel, and is no inconsiderable part of the object. Figures are painted on the polished surface with turpentine, or gilding is applied, after which the whole is finished with another coat of varnish. Mother-of-pearl is often set in the varnish. Different methods of *priming* the objects to be varnished are followed; a common one is to apply rotten-stone and ox-gall. Of course the excellence of the coating is improved by multiplying the coats, and in some cases twenty or more are applied. This is the true japanning of the East. In Europe and America the so-called japanning so frequently seen on articles of sheet metal, and which has a rich and peculiar lustre, generally of a warm semi-transparent kind, is effected by applying different varnishes, copal or animé, by the agency of heat. The varnish is colored or qualified with lampblack, asphaltum, white, green, or any other color required. Gold and silver or bronze are also applied with size and powder, and subsequently varnished and polished by a variety of processes. In general, the color is laid on first, and the japanning is effected by laying on several coats of varnish, the lustre and quality of which are increased by their being made without drying-matter. When only a single coat of varnish is used, the object being rather to imitate japanning in its best form, the process becomes lackering (see LACKER); while on the other hand lackering, when very fine varnish is used, and heat is applied, is inferior japanning. Ovens of different patterns are specially constructed for drying in japanning. Japanned or patent leather is made in the greatest perfection in Japan, and next in France. It is effected by applying to good, dry, thin leather a composition of linseed oil and turpentine colored with burnt umber and ivory or lampblack. Several coats are laid on, and each thoroughly dried, the outer or last coats being made quite black. The thinner the coat applied and the more thoroughly it is dried, the more pliable will the leather be, and the more durable the coating. The varnish is made with Prussian blue, or any color deemed suitable to give the tone required, and oil. It is reduced or rendered fluid with turpentine. After several coats are applied and dried, it is scraped and polished with pumice-stone. Great pains should be taken to prevent dust from falling on the leather during the process.

The term japanning is improperly applied not only to simple lackering and varnishing, but also to different kinds of mineral and glass or porcelain glazing, or in fact to vitrification. True japanning consists of the application of several coats of varnish, and of drying and polishing these so as to ensure the peculiar durability and gloss characteristic of the Oriental processes, and not in a superficial imitation of it, much less in effecting results of an entirely different nature, which, as in the case of glazing and vitrification, have already received much better and far more characteristic names. It is to be desired that writers on technology should be more careful in this as in many other cases, and not adopt the errors of merely practical men. We may observe with Tomlinson that in japanning every workman has his own favorite method of preparation and of mixing his varnishes, since the differences of climate,

temperature, and materials in different countries will inevitably compel the intelligent workman to depart more or less from any established formula. Japanning as applied to many fancy articles is a truly elegant art, and so far from being merely mechanical that there is perhaps none in which the results are more indicative of individual skill and intelligence. CHARLES G. LELAND.

Ja'pheth [Heb. יֶפֶת, *Ye'pheth*, "widespreading" or "fair"], one of the three sons of Noah, mentioned last in order, but held by critics (see Gen. x. 21) to have been the eldest—one of the eight persons preserved in the ark, and the progenitor to whom is ascribed (Gen. x.) the peopling of the northern portion of Asia Minor, and perhaps Thrace. Most of the nations of Europe are usually deduced from Japheth, who is supposed to be identical with the Greek Iapetos, the father of Prometheus. The only specific act of Japheth recorded in the Bible is one of filial piety to his father when drunken (Gen. ix. 20–27), which obtained for him the prophecy, "God shall enlarge Japheth, and he shall dwell in the tents of Shem; and Canaan shall be his servant." Japheth seems to have been born 100 years before the Flood (Gen. v. 32); the length of his life is not mentioned, but his brother Shem lived 502 years after the Flood (Gen. xi. 11), which may be conjectured to have been the average period allotted to the sons of Noah. It is noticeable that the Greek mythology makes Iapetos the ancestor of the human race. Nothing is known as to the locality inhabited by Japheth after the Flood, but genealogical reasons would favor the immediate vicinity of Mount Ararat.

Japu'ra, Hyapura, or **Caquet'a,** a river of South America, rises in the Andes of Ecuador, in lat. 1° 20′ N. and lon. 76° 50′ W., runs first between Ecuador and New Granada, then through Brazil, and enters the Amazon at lat. 1° 20′ S. and lon. 72° 20′ W., after a course of about 1000 miles. Its navigation is much impeded by rapids and cataracts.

Japy'gia, the name given by the Greeks to APULIA (which see).

Jardin (KAREL DU). See DUJARDIN.

Jar'dine (GEORGE), b. at Wandal, Lanarkshire, Scotland, in 1742; was educated at Glasgow University; became a licentiate of the Church of Scotland, and in 1774 professor of logic and rhetoric. In this chair he was an able exponent of the characteristic doctrines of the "Scotch philosophy," distinguishing himself by his successful efforts to popularize that study, and publishing in 1818 his *Outlines of Philosophical Education, illustrated by the Method of Teaching the Logic Class in the University of Glasgow.* Prof. Jardine's efforts were mainly directed to the encouragement of accurate investigation upon any given topic, drawing abundant inferences from seemingly isolated facts. He retired from his post in 1824, and d. in 1827.

Jardine (Sir WILLIAM), BART., b. at Applegarth, Dumfriess-shire, Scotland, Feb. 23, 1800; succeeded to the baronetcy in 1821; gave his attention chiefly to ornithology, though a voluminous writer upon all the vertebrate animals. He edited White's *Natural History of Selborne* three times; established the *Magazine of Zoology and Botany;* assisted in conducting the *Annals of Natural History* and the *Philosophical Journal,* besides publishing a *Calendar of Ornithology* (1849). D. in 1874.

Jarnac', town of France, in the department of Charente, 16 miles N. W. from Angoulême. Pop. in 1866, 4243. A battle was fought here Mar. 13, 1569, between the Huguenots under the prince of Condé and the Catholics under the duke of Anjou, afterwards Henry III., in which the former were defeated and Condé lost his life. Jarnac has given the title of baron or count to several celebrated persons, one of whom died in the current year (1875) as French minister to England. It possesses a suspension bridge, and enjoys an active trade in wine and brandy, being only 11 kilomètres from Cognac, where the finest quality of the latter article is produced.

Jaroslav. See YAROSLAV.

Jar'row, or **Yarrow,** town of England, in the county of Durham, is situated on the Tyne, and has extensive shipbuilding yards, manufactures of chemicals, and, in the neighborhood, large collieries. In the church of St. Paul is an oaken chair which is said to have belonged to the Venerable Bede, who was born in the parish and buried in this church. Pop. 18,179.

Jar'ves (JAMES JACKSON), b. in Boston, Mass., Aug. 20, 1818. Weakness of the eyes compelling him to desist from study, he travelled extensively on this continent, visiting California, Mexico, and Central America, and resided for some years at Honolulu, where he published the *Polynesian,* the first newspaper printed there. Soon after his return from these journeyings he went to Europe, where he has since made his chief residence, mostly in Paris and Florence, devoting himself to the study of art and to the collection of a gallery of pictures illustrating the different schools of painting. The collection, a large and interesting one, was exhibited in New York, and after various fortunes (the owner being unable to dispose of it at what he considered a fair valuation) it found temporary refuge in the Fine-Art Gallery of Yale College at New Haven, Conn. It is not, however, what it was, many of the best pieces having been sold to private purchasers. Mr. Jarves has written several books: *A History of the Sandwich Islands, Scenes and Scenery of the Sandwich Islands, Scènes and Scenery in California*—all in 1843–44. Since residing in Europe he has written mainly on European and art themes —*Parisian Sights and French Principles* (1855–56), *Italian Sights and Papal Principles, Confessions of an Inquirer* (1857), *Art Hints, Art Studies, The Art Idea, Art Thoughts* (1870)—works of a blended historical, biographical, critical, and philosophical character, showing a cultivated and thoughtful mind. Mr. Jarves is well known in Italy as a connoisseur, is an honorary member of the Academy of Fine Arts in Florence, and has received other similar marks of respect. O. B. FROTHINGHAM.

Jar'vis (ABRAHAM), D. D., b. at Norwalk, Conn., May 5, 1739; graduated at Yale College in 1761; was ordained deacon and priest in the Protestant Episcopal Church in London in 1764, in which year he became rector of Christ church, Middletown. In 1797 he was consecrated bishop of Connecticut to succeed Seabury, and settled (1803) at New Haven, where he d. May 3, 1813.

Jarvis (EDWARD), M. D., b. Jan. 9, 1803, at Concord, Mass; graduated in 1826 from Harvard University, and from the medical college of the same institution in 1830; practised in Northfield and Concord, Mass., Louisville, Ky., and thirty-two years in Dorchester, Mass.; devoted himself to the study of vital statistics, the laws of life and health, insanity, etc., to which branches of science he has made many and important contributions. His principal writings are—*Physiology and Health, Elementary Physiology, Report on the Number and Condition of the Insane and Idiots of Massachusetts, Report on the Mortality of the U. S. in the Census of 1870,* besides essays in journals and magazines, among which many attracted great attention, such as *The Increase of Human Life, Infant Mortality, Effect of Misdirected Education in the Production of Insanity, Political Economy of Health.* Since 1852, Dr. Jarvis has been president of the American Statistical Association.

Jarvis (JOHN WESLEY), b. at South Shields, on the Tyne, England, 1780; passed his infancy with his uncle, the celebrated John Wesley; came to America at the age of five; his father, a seafaring man, left the lad in Philadelphia, where he obtained such instruction as he could. Stuart discouraged, but Malbone encouraged him; he came to New York as an engraver; executed profiles on glass in black and gold leaf; painted miniatures, but soon undertook portraits in oil, and rapidly rose to eminence by the felicity of his likenesses, the strength of his drawing, and the truth of his color. His rapidity of work was remarkable, but it was based on study and observation. Jarvis painted admirable portraits of the heroes of the war of 1812. His portraits of Hull, Perry, Bainbridge, Swift, Brown, and McDonough are in the City Hall, New York; those of John Randolph, Robert Morris, Daniel Tompkins, and Egbert Benson are in the gallery of the New York Historical Society. Jarvis painted with success in Baltimore, Charleston, Richmond, and New Orleans, where some of his best work is to be seen. His genius was recognized by men like Henry Clay, but he would have done better things had he been less addicted to social entertainment. D. Jan. 12, 1840. O. B. FROTHINGHAM.

Jarvis (SAMUEL FARMER), D. D., LL.D., b. at Middletown, Conn., Jan. 20, 1786, being a son of Bishop Abraham Jarvis. He graduated at Yale College in 1805; entered the Episcopalian ministry in 1810; was professor of biblical criticism (1819) in the General Theological Seminary; rector of St. Paul's, Boston, 1820–26, when he went to Europe, and remained there ten years, six of which were spent in Italy. Returning to America in 1835, Dr. Jarvis became professor of Oriental literature in Trinity College at Hartford, and in 1838 was appointed historiographer to the American Episcopal Church. In this capacity he published in 1844 a *Chronological Introduction to the History of the Church.* Other works were—*A Discourse on the Religion of the Indian Tribes of North America* (1820), *Sermons on Prophecy* (1843), *No Union with Rome* (1843), and *The Church of the Redeemed* (1850). D. at Middletown Mar. 26, 1851.

Ja'sher, Book of, a Hebrew work twice cited in the

Old Testament (Josh. x. 13 and 2 Sam. i. 18), but no longer extant. The former citation is the well-known apostrophe of Joshua to the sun and moon, the latter the beautiful elegy of David upon Saul and Jonathan. The nature and contents of the book of Jasher have been a frequent topic for the ingenuity of biblical commentators. Gesenius conjectured that it was a poetical anthology formed or completed in the time of David or Solomon, and containing the favorite national songs, especially those commemorating the exploits of renowned heroes. The Hebrew name, *Sepher Hayashar*, is interpreted to mean "Book of the Just." Many forgeries have been produced purporting to be the lost book of Jasher, the most notable of which was one brought out in Hebrew in Italy and Poland, and also in German, during the seventeenth century, and was published in English by M. M. Noah (New York, 1840). Dr. J. W. Donaldson, an eminent English classical scholar, made an elaborate attempt to reconstruct the book of Jasher from the Pentateuch (*Jashar, Fragmenta Archetypa Carminum Hebraicorum*, etc., 1854), but his results were received with general incredulity. (See an essay on Jasher in E. Deutsch's *Remains*, 1874.)

Jasmin′ (Jacques), b. at Agen, in Southern France, Mar. 6, 1798, was the son of a tailor, and brought up in utter poverty until his twelfth year, when he was admitted into a priests' seminary; but being expelled two or three years later for some misconduct, he was apprenticed to a barber in his native town. At the age of eighteen he married and commenced business as a barber and hairdresser, but nevertheless allowed his literary instincts such development that he soon became widely famous as a troubadour. His earliest poem was printed in 1825, his masterpiece (translated by Longfellow as the *Blind Girl of Castel Cuillé*) appeared in 1836, and set the seal to his popularity. He was now patronized by king and nobles, but retained his simple mode of life until his death, Oct. 4, 1864. Jasmin received a pompous funeral, and his autobiographical sketches have been frequently reprinted.

Jas′mine, Yellow, an indigenous twining plant (*Gelsemium sempervirens*, natural order Loganiaceæ) growing in rich damp soil in the coast-districts from Virginia to the Gulf. It is a beautiful plant, with large, deep-yellow, sweet-smelling flowers, and climbs trees in the Southern forests. The root is used in medicine under the name *gelsemium*, and contains as its active principle an alkaloid, *gelsemia*. It is a nerve-poison, causing motor and sensory paralysis, and may be fatal in overdose through paralysis of respiration. Edward Curtis.

Ja′son [Gr. Ἰάσων, "healer" or "atoner"], a fabulous hero of the earliest Grecian mythology, whose exploits in the expedition of the ship Argo (see Argonautæ) to Colchis for the recovery of the Golden Fleece were recounted at great length and with infinite variety of adventure by the Greek cyclic poets, and by some of their Latin imitators. Modern inquirers into the origin of this myth have been led to class it as one of the numerous solar myths. (See Cox's *Mythology of the Aryan Nations*, 1869.)

Jason, a tyrant of Pheræ in Thessaly, probably the son of Lycophron, came into power about B. C. 395, and undertook to reduce all Thessaly under his dominion. In B. C. 375 he had succeeded in conquering all the cities except Pharsælus, which was supported by Sparta. Soon afterwards he was chosen dictator of Thessaly, took a prominent part in the wars between the states of Greece, and would probably have anticipated the career of Philip of Macedon had he not been assassinated, B. C. 370.

Jas′per [Gr. ἴασπις], a mineral, of the quartz family, occurring in abundance in veins and large masses, imbedded in rocks, sometimes as a rock itself, and often in the shape of pebbles. It is characterized by opacity and by numerous colors—red, yellow, green, white, blue, black, or brown—generally arranged in stripes and spots, apparently due to iron oxides. It is exceedingly hard, takes a fine polish, and is in request for ornamental objects, such as cameos, rings, and seals. Among the varieties are *Egyptian jasper*, yellow mixed with brown; *ribbon jasper*, so called from the distinctness of the stripes; *porcelain jasper*, full of small holes and much cracked; *Lydian stone*, flinty and black, used as a test of the purity of the alloys of gold; and *bloodstone* or *heliotrope*, deep-green with blood-red spots. The largest mines of jasper are those of the upper Ural in Siberia, especially the Korgon gorge, where this stone is cut out in enormous blocks. Jasper was highly prized by the ancients. It was the twelfth stone inserted in the breastplate of the Jewish high priest (Ex. xxviii. 20), and the first of the twelve used in the foundation of the New Jerusalem; it was also the material of the wall (Rev. xxii. 18, 19), and the glory of the Divine Being is described (Rev. iv. 3) by comparison with a jasper. (Smith, *Dict. of Bible*.)

Jasper, county of N. Central Georgia. Area, 365 square miles. It is hilly, but fertile, producing cotton, tobacco, and corn. It contains iron, gold, and other mineral wealth. Cap. Monticello. Pop. 10,439.

Jasper, county of S. E. Illinois. Area, 484 sq. m. It is a level and very fertile region. Cattle, grain, wool, and tobacco are staple products. Cap. Newton. Pop. 11,234.

Jasper, county of N. W. Indiana. Area, 550 square miles. Its surface is mostly prairie, and a part is marshland. Much of its surface affords excellent pasturage. Live-stock, grain, and wool are largely produced. Cap. Rensselaer. Pop. 6354.

Jasper, county of Central Iowa. Area, 720 square miles. It is largely prairie-land, is very fertile, and yields abundance of coal. Cattle, grain, wool, and butter are staple products. Carriages, wagons, and harnesses are leading articles of manufacture. The county is traversed by the Des Moines Valley and the Chicago Rock Island and Pacific R. Rs. Cap. Newton. Pop. 22,116.

Jasper, county of S. E. Central Mississippi. Area, 650 square miles. It is a fertile and undulating region. Cotton, pork, and corn are staple products. Cap. Paulding. Pop. 10,884.

Jasper, county of S. W. Missouri, bounded on the W. by Kansas. Area, 600 square miles. It is diversified and fertile. Cattle, grain, tobacco, and wool are staple products. It is traversed by the Memphis Carthage and Northwestern R. R. Cap. Carthage. Pop. 14,928.

Jasper, county of E. Texas. Area, 918 square miles. It is heavily timbered, and has coal, iron ore, petroleum, and valuable salt-wells. The soil is productive. Cotton, corn, tobacco, pork, rice, and lumber are produced, the latter very extensively. The navigable Neches River flows along the W. border. Cap. Jasper. Pop. 4218.

Jasper, post-v., cap. of Walker co., Ala., 56 miles N. E. of Tuscaloosa, in a fertile and healthful region abounding in coal. It was twice burned during the war; has a good court-house, jail, church, Masonic hall, and a high school capable of accommodating 300 pupils. It has 6 dry-goods and 4 grocery stores, etc., and is steadily growing. Six miles N. lies the new city of S. Lowell. It has 1 weekly paper.
Anthony & Son, Eds. "Mountain Eagle."

Jasper, tp. of Crawford co., Ark. Pop. 688.

Jasper, tp. of Crittenden co., Ark. Pop. 1416.

Jasper, post-v., cap. of Newton co., Ark., 70 miles N. N. W. of Little Rock. Pop. 72.

Jasper, post-v., cap. of Hamilton co., Fla., on the Atlantic and Gulf R. R., 100 miles by rail from Jacksonville and from Tallahassee. Pop. 138.

Jasper, post-v., cap. of Pickens co., Ga., 30 miles from Resaca, on the Atlantic and Western R. R.

Jasper, tp. of Wayne co., Ill. Pop. 1016.

Jasper, post-v., cap. of Dubois co., Ind., on the Patoka River, at the junction of the Mt. Vernon and Rockport divisions of the Cincinnati and South-western R. R., in the centre of an important block-coal region. It has 2 churches, a weekly newspaper, 5 hotels, 3 lumber and 2 flour mills, manufactures of carriages, agricultural implements, etc. The lumber, coal, and tobacco trade, and the manufactures above indicated, are the leading pursuits. Pop. 547. Clement Doane, Ed. "Courier."

Jasper, tp. of Adams co., Ia. Pop. 438.

Jasper, tp. of Carroll co., Ia. Pop. 157.

Jasper, tp. of Midland co., Mich. Pop. 139.

Jasper, tp. of Camden co., Mo. Pop. 292.

Jasper, tp. of Dallas co., Mo. Pop. 933.

Jasper, post-tp. of Jasper co., Mo. Pop. 758.

Jasper, tp. of Ozark co., Mo. Pop. 618.

Jasper, tp. of Ralls co., Mo. Pop. 1394.

Jasper, tp. of Shannon co., Mo. Pop. 93.

Jasper, tp. of Taney co., Mo. Pop. 615.

Jasper, post-tp. of Steuben co., N. Y., has 6 churches and some manufactures. Pop. 1683.

Jasper, tp. of Fayette co., O. Pop. 1992.

Jasper, post-v. of Newton tp., Pike co., O., 25 miles from Portsmouth, on the Ohio Canal and the Scioto River. Pop. 181.

Jasper, post-v., cap. of Marion co., Tenn., the N. terminus of the Jasper branch of the Nashville Chattanooga and St. Louis R. R., in the fertile Sequatchie Valley, which is well watered, finely timbered, and abounds in waterpower, coal, iron ore, limestone, and sandstone. The town has 2 weekly newspapers, 3 churches, good schools, stores, etc. Pop. 375. A. L. Griffith, Ed. "Union."

Jasper, post-v., cap. of Jasper co., Tex., on a creek near the Neches River, has 2 churches, 3 day and 2 Sunday schools, 3 weekly newspapers, and 3 hotels, and is an im-

portant business-centre for South-eastern Texas. Agriculture and mercantile business are the chief pursuits. It has yearly county fairs. T. J. CARRAWAY, ED. "NEWSBOY."

Jasper (WILLIAM), b. in South Carolina about 1750; enlisted in the 2d South Carolina regiment at the commencement of the Revolution; became a sergeant, and distinguished himself in the attack upon Fort Moultrie by a British fleet, June 28, 1776, by leaping through an embrasure under a galling cannonade to recover the flag of the State, just shot off. In recognition of this act of heroism Gov. Rutledge gave Sergeant Jasper his own sword, offered him a commission as lieutenant, which he declined, and employed him thereafter upon outpost and picket duty, in which he frequently distinguished himself by deeds of eccentric daring. In the assault upon Savannah (Oct. 9, 1779) Sergeant Jasper accompanied D'Estaing and Lincoln in their attack upon the Spring Hill redoubt, and was killed while attempting to fasten to the parapet the colors of his regiment, presented by Mrs. Elliott. A square in the city of Savannah and a county in Georgia bear his name.

Jasper Four-Corners (P. O. JASPER), a v. of Jasper tp., Steuben co., N. Y. It has 3 churches and manufactures of lumber. Pop. 200.

Jas′sy, the capital of Moldavia, which since 1861 forms a part of Roumania, situated on a tributary of the Pruth. It is a large but poorly built and dirty city, in which fine ecclesiastical buildings and splendid palaces belonging to the nobility alternate with the miserable huts of the Jews and the lower population. It has important trade in grain. Pop. 90,000.

Jasz-Bereny′, town of Western Hungary, in the district of Jazygia, on both sides of the Zagyva. It has a considerable trade in corn, cattle, and wine. In the middle of the city stands a monument said to indicate the tomb of Attila. Pop. 17,534.

Ja′tiva, or **San Feli′pe de Ja′tiva,** the ancient *Setabis*, town of Spain, in the province of Valencia. It is a handsome and well-built town, with several monuments from the times of the Moors. Pop. 15,631.

Jats, or **Jauts,** a singular race inhabiting North-western India between the Indus and the upper waters of the Ganges, variously considered by ethnologists as descendants of Getæ, Dacians, Huns, Avars, or other ancient races. They have also been treated as the ancestors of the gypsies. The Jats are tall, well-formed men, addicted to war, but good agriculturists, and are divided in religion between Mohammedanism, Brahmanism, and the Sikh doctrines.

Jaubert′ (CHEVALIER PIERRE AMEDÉE), b. at Aix, in Provence, Southern France, June 3, 1779; studied Oriental languages under Sylvestre de Sacy, and at the age of nineteen accompanied the French expedition to Egypt as interpreter, in which capacity he rendered great services to and gained the friendship of Napoleon. Employed in various official posts in the East, Jaubert was sent to Persia in 1805, was imprisoned several months by the pasha of Bajazid, and became in 1815 *chargé d'affaires* at Constantinople. In 1818, Jaubert travelled to India with the object of bringing to France a herd of Cashmere or Thibetan goats, of which he succeeded in introducing 400. After this he became a professor of Oriental languages at the College of France, member of the Academy of Inscriptions in 1830, peer of France and councillor of state in 1841. Jaubert published his travels in Armenia and Persia (1821), a Turkish grammar (1823), a Berber grammar and dictionary (1844), and a French translation of the famous Arabian geographer Edrisi (2 vols., 1836–40). D. at Paris Jan. 28, 1847.

Jau′er, town of Prussia, in the province of Silesia, on the Neisse. It has large manufactures of linen and gloves, and carries on a very active trade in corn. Pop. 7887.

Jau′ja, town of Peru, department of Junin, 108 miles N.E. from Lima. It is beautifully situated on one of the streams tributary to the Apurimac, was the first capital of Peru under the viceroyalty until 1535, and its name has become a synonym in Spanish America for "Arcadia" or "Utopia." Pop. about 15,000.

Jaun′dice. This is a greenish-yellow color of the skin which is produced by the presence of the coloring-matter of the bile in the blood. It is not a specific disease, as is generally supposed by the laity, but a symptom which, taken in connection with other symptoms, points to the affection which gives rise to it. We might as well speak of vomiting, headache, etc. as diseases: they are not, but merely prominent symptoms of many varied morbid processes. If jaundice occurs in any great abundance, or persists for a length of time, we find all the secretions tinged with the bile, the urine becomes saffron-colored, and the stools, being deprived of their coloring-matter, are whitish. We may have jaundice produced in two ways—either from suppression or retention of bile; the former is due to some disease of the liver which incapacitates it for performing its function; therefore the bile, which in the healthy state of the organ is constantly being filtered from the blood, accumulates in it. Jaundice from retention of bile is produced in this way: The bile, having been already formed, is prevented from making its way into the intestines by some obstruction in the bile-ducts; it is therefore reabsorbed, and again makes its appearance in the blood. The obstruction to the ducts may be either external or internal. Externally, we may have tumors of various kinds pressing on the ducts, as cancer of the pyloric end of the stomach, of the duodenum or the end of the pancreas, or a colon impacted with fæces. Internally the gall-duct may be plugged up by mucus, or, what is far more common, by a biliary calculus passing through it; this is accompanied by a great deal of pain; indeed, it is said to be the most severe pain that could be felt. Some idea of it may be had from a knowledge of the fact that the common bile-duct is very seldom larger than a goose-quill, and the stones which pass through it are seldom smaller in diameter—sometimes attaining the size of a pigeon's egg. Accompanying the jaundice and pain in these cases we have nausea, vomiting, hiccough, flatulence, and in the intervals between the intensity of the pain the patient is exhausted and drowsy. There is generally much more pain felt by the passage of a calculus for the first time than subsequently, as the ducts are generally left distended for its successors. Besides the above forms of jaundice there is also a malignant form, which is analogous to typhoid, yellow, or remittent fever, and is marked by typhoid symptoms from the beginning of the attack, and is accompanied by hæmorrhages from the mucous membranes and skin. It almost always ends fatally. In jaundice from suppression the urine only contains those ingredients of the bile which pre-exist in the blood—viz. the bile coloring-matter and cholesterine; in that from retention we also have the bile-salts which have been formed in the liver, and afterwards absorbed and eliminated by the kidneys. To determine the former, nitric acid is generally added; it produces a bright grass-green color with the coloring-matter of the bile. The bile-salts, however, can only be detected by Pettenkofer's test, which is as follows: To the suspected liquid add a few drops of a solution of cane-sugar, and then slowly, drop by drop, sulphuric acid; at first a red color will be produced, which will afterwards change to a lake, and then to a deep purple.

The technical name of jaundice is *icterus*, from the Greek name of the golden thrush, which, according to Pliny, when seen by a jaundiced person would die and the patient recover. Now, however, we treat the affection more scientifically, looking to its origin. Where it is due to suppression little can be done except in cases of acute inflammation of the liver, but in those cases due to obstruction there is more success with it. The indications are to improve the patient's general condition by a proper and nutritious diet. Fats of all kinds should be avoided, as they cannot be digested without the assistance of the bile. Next, we should attend to the constipation from which these patients almost invariably suffer; for this rhubarb, senna, and aloes are the favorites. Opium should be given to relieve the intense pain. After the removal of the obstruction we may hasten the disappearance of the jaundice, and the annoying itching which accompanies it, by steam and alkaline baths.

EDWARD J. BERMINGHAM.

Ja′va, an island in the Malay Archipelago, the third largest of the Sunda group, belonging to the Netherlands, and bounded N. by the Sea of Java, E. by the Strait of Bali, S. by the Indian Ocean, and W. by the Strait of Sunda, which separates it from the island of Sumatra. Area, 49,730 square miles. In the northern part of the island lie some tracts of low, level land, mostly consisting of mangrove-swamps, and presenting a coast unsafe for navigation, and containing very few landlocked harbors, such as those of Batavia and Surabaya, though affording several good roadsteads, where ships may anchor with safety, as the waters of the Java Sea are calm, hurricanes unknown, and storms rare except at the change of the monsoons. Otherwise, the whole island is mountainous, traversed from E. to W. by several ranges of mountains, of which the southernmost forms a rough and broken coast-line, washed by a heavy surf. The highest points are Semiru, 12,250 feet, and Slamat, 11,320 feet. These ranges are in geological respects of volcanic formation; active volcanoes and violent eruptions are of frequent occurrence, especially in the south-eastern districts. Here the volcano Papandayang covered in one night in 1772 an area of 7 miles radius with a layer of ashes 50 feet thick; and in 1822, Galunggong caused still greater destruction by a single eruption; 20,000 persons are said to have been killed. The mountains are generally clad to their very tops with splendid forests, and enclose beautiful, exceedingly fertile, and well-watered

valleys, numerous rivers flowing down to the sea from both sides, generally rapid and shallow, but sometimes navigable; as, for instance, the Solo, Kediri, and Tjimanoek. Although gold-dust is found in several rivers and coal and rock-salt in some mountain-tracts, and although mineral springs of different kinds abound all over the island, yet the Javanese mountains are devoid of minerals suitable for mining. The volcanoes, however, are remarkable for the amount of sulphur and sulphurous gases they discharge. In a lake near the crater of Taschem, at the E. end of the island, the water is so strongly impregnated with sulphuric acid that fish cannot live in the sea near the mouth of the stream which issues from it; and near Batar, in the Vale of Poison, the exhalations of carbonic acid gas are so strong that birds drop down from the air, killed by them, and the ground is strewed with carcasses of animals which entered the vale unaware of the danger. The climate of Java is unhealthy in the northern marshes, but at a little elevation it is not only healthful, but agreeable. The wet season, with its westerly winds, lasts from October to March, but even during this time dry periods with fair weather occur. At the equinoxes the weather is generally very changeable, with heavy gusts of wind and thunderstorms. But the temperature is remarkably equable; in the lowlands the thermometer seldom rises above 90° or falls below 70°. Vegetable life is developed to an astonishing degree. Rice is the principal cereal, and in places where irrigation can be effected it is raised in two crops annually. Coffee is the staple product of the country, and is cultivated under the supervision of the government in plantations situated at an elevation of 2000 feet. Sugar and spices of superior quality are raised without difficulty. In 1872 the value of the exports of coffee was 38,524,000 florins; of sugar, 43,893,000 florins; and of spices 1,029,000 florins. Cotton is also grown, from which a coarse fabric is made. The largest part of the island is covered with vast forests of the most valuable trees—the fig tree, the dammar pine, and, first among all, the teak tree, which yields the best timber known. Equally abundant is animal life. Buffaloes are generally used in agricultural labor, and are more numerous than oxen and horses. The wild ox and two kinds of wild hogs are common; also the king-tiger, the one-horned rhinoceros, numerous kinds of apes, immense bats five feet across the wings, the peacock, and a great variety of fish.

The inhabitants number 17,298,200, of whom 28,926 are Europeans, 185,758 Chinese, 22,032 Arabs, and the rest natives; the island is thus one of the most densely populated countries in the world. The natives belong to the Malayan race, but in capacity for civilization they surpass all other branches of this family. They are small, yellow, and not very energetic, but patient, cheerful, and endowed with fine sensibilities. They are good agriculturists, probably surpassing all other Asiatic peoples in this branch of industry. They are also skilled in the manufacture of different articles of metal, such as their national weapons and their national musical instruments, being very fond of music. In the fifteenth century they embraced Mohammedanism; before that time Booddhism was their religion, and many Booddhist temples are found in the island, as, for instance, the Boro Buddor (which see). In 1511 the Portuguese first visited Java, and in 1595 the Dutch made the first settlements here. In 1677 the whole island became a Dutch colony, and since 1830 it has been governed as a province of the kingdom of the Netherlands. At the head of the government is a governor-general, residing at Batavia and ruling all the Dutch colonies in the East Indies. The island is divided into 24 residencies, two of which, however, Jokjokerta and Surakerta, have been allowed to retain their native princes, though under Dutch supremacy. The revenues of this island bring annually a surplus of $5,000,000 into the treasury of the Netherlands. The language spoken in the largest part of Java and on some adjacent islands (the Javanese) belongs to the Malayo-Polynesian group of languages, but it is distinguished from the Malay proper and from the Sundese, spoken in the western part of the island. It consists of 20 consonant and 6 vowel sounds, of which latter the *o* is predominant. Its numerous foreign elements, Arabic, Sanskrit, and others, are very freely modified. Its development is rich, but one-sided. It possesses numerous and fine distinctions for real objects, processes, and phenomena, but it has no significations for general or abstract ideas. It has different sets of words, forms, and phrases when used by a superior to an inferior, or by an inferior to a superior, but it has no difference of tone in prose and in poetry. The literature consists of chronicles, religious works, and remodellings of Hindoo poetical creations, but it belongs mostly to a much earlier period, and can be traced back to the first centuries of our era. (See W. von Humboldt, *Ueber die Kawisprache*, Sir Stamford Raffles, *History of Java*, and R. Wallace, *The Malay Archipelago*.) Clemens Petersen.

Java, post-tp. of Wyoming co., N. Y., has 5 churches, some mills, and quarries of fine building-stone. Pop. 1956.

Jav'elin [Fr. *javeline*], a short, heavy spear used for throwing with the hand at an enemy. The Roman *pilum* was essentially a javelin, and was the most formidable offensive weapon of those times.

Jaw'orow, town of Austria, in Galicia, on the Krahowska, has large paper-mills, valuable fisheries, and in the vicinity some mineral springs which are much resorted to for their medicinal powers. Pop. 7209.

Jaxar'tes, or **Sir Daria**, a river of Toorkestan, rises in the Thian Shan Mountains, flows through the valley of Khokan and the Khirgheez dominions, and divides at Otrar into two branches, of which the northern and largest, forming the boundary between Russia and Toorkestan, falls into the Sea of Aral, while the southern loses itself in some small lakes in the steppes.

Jay, a name given to many birds of the family Corvidæ, sub-family Garrulinæ. The typical species is the *Garrulus glandarius*, or common jay of Europe. The blue jay of the Eastern U. S. (*Cyanura cristata*) is a beautiful bird, whose harsh screaming voice is well known. The U. S. have many species representing the genera *Gymnocitta, Cyanocitta, Xanthura, Perisoreus, Psilorrhinus*, etc. Many of them are very beautiful birds.

Jay, county in E. Indiana, bounded on the E. by Ohio. Area, 370 square miles. The surface is somewhat varied, the soil productive, but in part rather heavy. Cattle, grain, wool, and maple-sugar are leading products. It is traversed by the Cincinnati Richmond and Fort Wayne R. R. Cap. Portland. Pop. 15,000.

Jay, post-tp. of Franklin co., Me., on the Androscoggin R. R., 15 miles N. of Auburn. It has 4 churches, 2 free libraries, and some manufactures. Pop. 1490.

Jay, post-tp. of Essex co., N. Y., in the Adirondack region. It has many lofty mountains, large beds of iron ore and small ones of graphite. Iron, nails, and lumber are extensively manufactured. Pop. 2496.

Jay, tp. of Elk co., Pa. Pop. 534.

Jay, post-tp. of Orleans co., Vt., on the Canada line, 55 miles N. of Montpelier. It has 3 churches and manufactures of lumber, leather, etc. Pop. 553.

Jay (John), LL.D., b. in New York City Dec. 12, 1745, of Huguenot stock; graduated at King's (now Columbia) College in 1764; was admitted to the bar in 1768; became law-partner with Robert R. Livingston, and married (1774) a daughter of William Livingston. In the agitations caused by the successive encroachments of the British cabinet upon American liberty, Jay first became conspicuous as a member of the "committee of correspondence" appointed May 16, 1774, by the citizens of New York to represent their views upon the questions growing out of the Boston Port bill; was the supposed author of the suggestion emanating from that committee for the convocation of a Continental Congress; was elected a member of that body, and took a prominent part in its proceedings. He was the author of the address to the people of Great Britain adopted by the first Congress (Oct., 1774), and of that to the people of Canada adopted by the second Congress (May, 1775); was a member of the committee of correspondence "with European friends of American liberty," in which capacity he became the channel of secret negotiations with France; was commissioned colonel of the 2d regiment raised in New York City, and in Apr., 1776, was chosen a member of the Provincial Congress of New York, retiring from the Continental Congress in order to lend his counsels to his native State in that critical juncture. Jay was the leading member of the New York Congress; was author of its chief public documents, including the constitution of 1777; and on its dissolution was appointed chief-justice, which office was confirmed to him by the new State legislature. In 1778 he was again elected to the Continental Congress, became president of that body (Dec. 10), and was appointed in the following year minister to Spain, where he arrived in 1780. He remained at Madrid two years, obtaining from the Spanish government some material and moral aid for American independence; was a colleague with Franklin and Adams in the commission which negotiated peace with Great Britain (Nov. 30, 1782), and on returning to America in 1784 was chosen by Congress secretary for foreign affairs—a post which he held for five years, until the establishment of the Federal government under the Constitution (1789). Jay was one of the writers in the *Federalist* in defence of the Constitution, took a leading part in the New York State convention, which, after much opposition, gave its adhesion to the Constitution (1788), and was appointed by Washington (1789) the first chief-justice of the U. S. In 1792 he was the candidate of the Federalists for governor of

New York; was sent as minister to England in 1794, and signed (Nov. 19) the instrument known as "Jay's treaty." By its provisions the eastern boundary of Maine was determined, American citizens recovered above $10,000,000 for illegal captures by British cruisers, and the western posts held by British garrisons were surrendered; but in consequence of the exclusion of American vessels from Canadian ports, the restriction placed upon the West India trade, and the regulations upon neutrality as between English and French privateers, an unprecedented agitation ensued, and the treaty was violently denounced, but was ratified by Washington, with the approval of the Senate, Aug. 14, 1795. During his absence in England, Jay was elected governor of New York—an office which he held for six years—and in 1801 withdrew from public life, declining a second appointment as chief-justice of the U. S. Supreme Court, for which he was nominated by Pres. Adams and confirmed by the Senate. For the remainder of his life, which extended over more than a quarter of the present century, Jay resided upon his ancestral estate at Bedford, Westchester co., holding aloof from political contests, but taking a lively interest in religious and philanthropic movements. As early as 1785 he had been president of a society in New York for promoting the emancipation of slaves, and it was under his auspices that slavery was abolished in New York in 1799. He was a member of the Episcopal Church, and was widely renowned for strict moral purity, a vigorous and logical intellect, a lofty sense of justice and humanity, disinterested patriotism, and unyielding integrity. D. at Bedford, N. Y., May 17, 1829. (See his *Life*, by his son, William Jay, 1833.) PORTER C. BLISS.

Jay (JOHN), a son of William Jay, b. in New York City June 23, 1817; graduated in 1836 at Columbia College; became a lawyer in 1839. He is a prominent member of the Protestant Episcopal Church, the Union League, and various historical and other learned societies. Author of many anti-slavery, legal, political, ecclesiastical, and other pamphlets and reports. In 1869 he was appointed U. S. minister to Austria. Returned in 1875.

Jay (WILLIAM), b. at Tisbury, England, May 8, 1769. With slight previous education he commenced preaching at the age of sixteen, and before attaining his majority had delivered more than 1000 sermons. When twenty-two years old he became minister of Argyle chapel, Bath, and held that position sixty-one years, until the year of his death. Mr. Jay was a wonderfully eloquent pulpit-orator. His voluminous writings have been collected in 12 vols. (Bath, 1842–44), and reprinted in America in 3 vols. Of these, the *Morning and Evening Exercises* have enjoyed a wide popularity. He left an *Autobiography*, published since his death, which occurred at Bath Dec. 27, 1853. (See Wilson's *Memoir of Jay*, 1854.)

Jay (WILLIAM), LL.D., a son of John Jay (1745–1829), b. in New York City June 16, 1789; graduated at Yale in 1807, and studied law, which he never actively practised. He was prominent in the temperance, anti-slavery, peace, and Bible societies; became in 1818 a judge of the common pleas, and was 1820–42 first judge of Westchester co., N. Y., but lost the place because of his anti-slavery views. He published a *Life of John Jay* (2 vols., 1833), *An Inquiry into the Character of the American Colonization and Anti-slavery Societies* (1835), a *View of the Action of the Federal Government in Behalf of Slavery* (1838), a *Review of the Causes, etc. of the Mexican War* (1849), *War and Peace* (1848), and numerous minor publications. D. at Bedford, N. Y., Oct. 14, 1858.

Jayne, an unorganized county of Dakota.

Jaynes'ville, post-v. of Bremer co., Ia., on the Cedar Falls and Minnesota R. R.

Jeaffreson (JOHN CORDY), b. at Fralingham, Suffolk, England, in 1831; graduated at Oxford; entered Lincoln's Inn in 1852 as a law-student, and was admitted to the bar in 1859. Besides a number of novels, he wrote *A Book about Doctors* (1860), *A Book about Lawyers* (1866), and *A Book about the Clergy* (1870).

Jeannerett', post-v. of Iberia parish, La., on the Bayou Teche, 12 miles from New Iberia.

Jeannin' (PIERRE), b. at Autun, France, in 1540; studied law under Cujas; was counsellor under Charles IX. and Henry III., president of the Parliament of Burgundy in 1579, and of that of Paris under Henry IV.; was the negotiator of the treaty of 1609, which assured the independence of Holland. D. in 1622.

Jeanron' (PHILIPPE AUGUSTE), b. at Boulogne May 10, 1809; studied painting almost without any guidance; obtained a medal in 1833; attracted great attention by his half-touching, half-humorous genre pictures of low life; and was made director of the national museums in 1848. Though he held this office only one year, he made great improvements in the arrangements of the museum of the Louvre. Of his later works is *The Abandoned Port of Ambleteuse*, now in the Luxembourg.

Jeans'ville, post-v. of Hazel tp., Luzerne co., Pa., on the Lehigh Valley R. R. Has mines of anthracite coal.

Jebail', or **Jubeil,** the modern name of *Gebal* or *Byblos*, one of the most ancient cities of Phœnicia, noted in mythology for the birth of Adonis, and in biblical history for having furnished the artificers (Giblites) of Solomon's temple. Gebal is thought to have been the metropolis of the Phœnicians before the rise of Sidon, to have taken an important part in the earliest operations of shipbuilding, navigation, and colonization, having founded commercial and mining settlements throughout the Ægean Islands and the coasts of the Black Sea, as also to have introduced into Greece a knowledge of the alphabet. The Greek name *Byblos* is derived from the Egyptian word for papyrus, and perhaps alludes to the earliest cultivation of writing. The Egyptian myths of Isis, Osiris, and Typhon were partially of Phœnician origin, and some of the incidents are located at Byblos. Jebail is now a small village of 600 inhabitants, on the sea-coast 20 miles N. of Beyroot; it contains a castle which was noted in the annals of the Crusades.

Jebb (JOHN), b. at Drogheda, Ireland, Sept. 27, 1775; studied at Dublin University; entered the Church of England, and became bishop of Limerick in 1823. Residing in a district chiefly inhabited by Catholics, Bishop Jebb was noted for his liberal spirit towards them and his maintenance of their rights. He wrote several works on doctrinal theology, but is now remembered chiefly by his *Sacred Literature* (1820), in which he combated some of the views of Dr. Lowth about Hebrew poetry, and elucidated many obscure or difficult biblical topics. D. at Limerick Dec. 7, 1833.

Jebb (Sir JOSHUA), R. E., K. C. B., b. in England about 1793; entered the British army at an early age, and was brought into public notice when serving with his regiment in Australia through being employed to superintend some of Captain McConochie's celebrated experiments for the amelioration of the condition of convicts, by offering them a shortening of their terms of sentence as a premium upon good behavior. Jebb was so reliable and efficient in the execution of this delicate commission that he was requested to prepare plans for the construction and management of convict prisons which might obviate the practical difficulties encountered under the then existing system. In 1840 the Pentonville prison was built according to the plans of Col. Jebb, thus inaugurating in England the *solitary* or *separate* system of imprisonment. As inspector-general of prisons, enjoying the rank of major-general and the honor of knighthood, Sir Joshua Jebb devoted the remainder of his life to devising improvements in penal law and prison discipline, and d. in London June 26, 1863.

Jebb (SAMUEL), M. D., b. at Nottingham, England, in 1690; studied at Cambridge, and practised medicine at Stratford. He published an edition of Justin Martyr (1719), a Latin collection of writings on Mary, queen of Scots (1725), edited the *Opus Majus* of Roger Bacon (1727), and founded the *Bibliotheca Literaria* (1722–24), a learned magazine to which many eminent classical scholars contributed. D. in 1772.

Jed'burgh, town of Scotland, in Roxburghshire, on the Jed, contains some very interesting ruins of a magnificent abbey erected in the twelfth century and destroyed in the sixteenth, and of a castle which was once the residence of the Scottish kings. Pop. about 4000.

Jeddo. See YEDO.

Jed'do, tp. of Knox co., Mo. Pop. 1134.

Jeddo, post-v. of Orleans co., N. Y. Pop. 124.

Jeddo, post-v. of Foster tp., Luzerne co., Pa., on a branch of the Lehigh Valley R. R. It has splendid beds of anthracite coal.

Jef'fers (WILLIAM N.), U. S. N., b. in New Jersey Oct. 6, 1824; entered the navy as a midshipman Sept. 25, 1840; became a passed midshipman in 1846, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1865, a captain in 1870; served on the E. coast of Mexico during our war with that country, and participated in the capture of Vera Cruz, Alvarado, Tuxpan, and Tampico; commanded the Underwriter during the brilliant operations in the sounds of North Carolina in Jan. and Feb., 1862, and the Monitor in the action with Fort Darling on May 15 of that year. Early in 1873 he received the appointment of chief of the bureau of ordnance—an appointment, it may be said, sealed with the approbation of the whole navy, which had long recognized his marked ability in every

branch of his profession, and particularly in ordnance matters, to which Jeffers had given, for many years, especial attention. FOXHALL A. PARKER.

Jefferson, county of N. Central Alabama. Area, 980 square miles. It is in the Black Warrior coal-field, and will probably become a very important coal and iron region, for excellent hematite ores abound. The surface is hilly and rough, with fertile valleys. Cattle, corn, cotton, and wool are staple products. Iron is manufactured. The county is traversed by the Alabama and Chattanooga R. R. Cap. Elyton. Pop. 12,345.

Jefferson, county of S. E. Central Arkansas. Area, 900 square miles. It is traversed by the Arkansas River. It is a level and very fertile alluvial plain, well timbered. Live-stock, corn, and cotton are staple products. Cap. Pine Bluff. Pop. 15,733.

Jefferson, county of N. Central Colorado, in the foot-hills of the Rocky Mountains. Area, about 800 square miles. It has excellent farm and grazing land, but needs irrigation. Good lignitic coal, bog iron, and fire-clay abound. It is intersected by the Colorado Central and other railroads. Cap. Golden. Pop. 2390.

Jefferson, county of Florida, extending from the Georgia line on the N. to the Gulf of Mexico. Area, 470 square miles. It is well timbered, and has a generous, though varied, soil. Cotton, sugar-cane, corn, rice, and fruit are staple products. The Jacksonville Pensacola and Mobile R. R. intersects the county. Cap. Monticello. Pop. 13,398.

Jefferson, county of E. Georgia. Area, 634 square miles. It is level and fertile, and is traversed by the river Ogeechee and the Central R. R. of Georgia. Corn and cotton are staple products. Cap. Louisville. Pop. 12,190.

Jefferson, county of S. Illinois. Area, 530 square miles. It is partly prairie and partly forest. The soil is productive. Live-stock, grain, tobacco, and wool are staple products. The county is traversed by the St. Louis and South-eastern R. R. Cap. Mt. Vernon. Pop. 17,864.

Jefferson, county of S. E. Indiana. Area, 362 square miles. It has the Ohio River on the S. The country near the river is broken by bluffs, but the remainder is quite level. The soil is fertile. Cattle, grain, and wool are staple products. The manufactures include cooperage, carriages, flour, etc. The Madison and Indianapolis R. R. traverses the county. Cap. Madison. Pop. 29,741.

Jefferson, county of S. E. Iowa. Area, 432 square miles. It has a very fertile soil, is undulating, and abounds in coal and timber. Cattle, grain, and wool are staple products. It is traversed by the Chicago Rock Island and Pacific and the Burlington and Missouri River R. Rs. Cap. Fairfield. Pop. 17,839.

Jefferson, county of N. E. Kansas. Area, 550 square miles. It is a very fertile, high-rolling prairie region, with considerable timber, abundance of limestone, and some coal. Cattle, grain, and wool are staple products. The Atchison Topeka and Santa Fé, the Kansas Central, and other railroads intersect the county. Cap. Oskaloosa. Pop. 12,526.

Jefferson, county of Kentucky, bounded on the N. W. by the Ohio River. Area, 600 square miles. It has a varied surface and a fertile and highly cultivated soil. Cattle, grain, and wool are staple products. The manufactures and commerce of Louisville, the principal city of this county and State, are very extensive. They are treated of under the head of LOUISVILLE (which see). The county is traversed by various railroads centring at Louisville, the capital. Pop. 118,953.

Jefferson, parish of Louisiana, extending from Lake Pontchartrain, near New Orleans, southward to Barataria Bay. Area, about 250 square miles. It is intersected by the Mississippi River, and contains numerous lakes, bayous, and swamps. Rice, corn, and sugar-cane are the staple products. It is traversed by Morgan's Louisiana and Texas R. R. Cap. Carrollton. Pop. 17,767.

Jefferson, county of Mississippi, having the Mississippi River for a part of its western boundary, separating it from Louisiana. Area, 500 square miles. It has a fertile soil. Cotton and corn are staple products. Cap. Fayette. Pop. 13,848.

Jefferson, county of Missouri, bounded on the E. by the Mississippi River. Area, 504 square miles. It is very fertile, excepting some tracts in the western part. It abounds in metallic wealth. Lead is found here extensively. Cattle, grain, tobacco, and wool are staple products. The county is traversed by the St. Louis and Iron Mountain R. R. Cap. Hillsborough. Pop. 15,380.

Jefferson, county in Montana, W. of the Missouri River. Area, 2720 square miles. It contains rich agricultural and pastoral resources, and gold-mines are found on the tributaries of the Missouri and Jefferson rivers. Cattle, grain, butter, and lumber are staple products. Cap. Radersburg. Pop. 1531.

Jefferson, county of Nebraska, bounded on the S. by Kansas. Area, 576 square miles. The county is partly flat and partly high rolling prairie. The soil is fertile, especially along the streams. It is well adapted to wheat and to pasturage. Iron ore is found. Timber is not abundant. The county is traversed by the St. Joseph and Denver City R. R. Cap. Fairbury. Pop. 2440.

Jefferson, county of New York, having Lake Ontario on the W. and the St. Lawrence River on the N. W. It includes a part of the Thousand Islands in that stream. Area, 1868 square miles. Its surface is quite level near the lake and river, but much higher in the eastern part. Much of its diversified surface is very fertile. Cattle, wool, hay, grain, and dairy products are the great staples. Iron ore abounds. The manufactures include iron, machinery, castings, agricultural and other tools, leather, paper, cotton and woollen goods, flour, lumber, malt, cooperage, and many other articles. The fisheries are important. The county is traversed by the Rome Watertown and Ogdensburg, the Utica and Black River, and other railroads. Cap. Watertown. Pop. 65,415.

Jefferson, county of Ohio, bounded on the E. by the Ohio River, which separates it from West Virginia. Area, 350 square miles. It is a pleasant, hilly, and very fertile region, abounding in coal. Cattle, wool, and grain are staple products. Carriages, wagons, clothing, and a great variety of other goods are manufactured. The county is traversed by the Pittsburg Cincinnati and St. Louis R. R. Cap. Steubenville. Pop. 29,188.

Jefferson, county of W. Central Pennsylvania. Area, 500 square miles. It is quite rough and hilly, and abounds in bituminous coal and iron ores. The soil is fertile, especially in the valleys. Timber is abundant. Cattle, grain, and wool are staple products. Lumber and leather are extensively manufactured. Cap. Brookville. Pop. 21,656.

Jefferson, county of E. Tennessee, having the Holston River on the N. W. Area, about 225 square miles. It is traversed by French Broad River and the Virginia and East Tennessee R. R. Iron ore abounds. It is mountainous, with fertile valleys and picturesque scenery. Cattle, grain, wool, and tobacco are staple products. Cap. Dandridge. Pop. 19,476 in 1870, since which time its area has been reduced.

Jefferson, county of S. E. Texas, having Sabine Lake and river on the E. and N. E., and the Gulf of Mexico on the S. Area, 900 square miles. The surface near the coast is open prairie, affording fine pasturage. The rest of the county is in the main heavily timbered. Live-stock, cotton, rice, lumber, and some tobacco are exported. The county is traversed by the Texas and New Orleans R. R. Cap. Beaumont. Pop. 1906.

Jefferson, county of N. W. Washington Territory, having the Pacific Ocean on the W. and Hood's Canal and Puget Sound on the E. Area, some 1500 square miles. It is partly mountainous, and is covered with enormous trees. Lignitic coal is found. Mount Olympus is 8138 feet high. Much of the soil is very fertile. Lumbering and fishing are at present the chief interests. Cap. Port Townsend. Pop. 1268.

Jefferson, county of E. West Virginia, having the Potomac River on the N. E., and bounded on the S. E. and S. W. by Virginia. Area, 260 square miles. It is a part of the Shenandoah Valley, and is a fertile, rolling limestone region. Cattle, grain, and wool are staple products. The county is traversed by the Baltimore and Ohio and the Winchester and Strasburg R. Rs. Cap. Shepherdstown. Pop. 13,219.

Jefferson, county of S. E. Wisconsin. Area, 576 square miles. It has a fertile limestone soil. Cattle, grain, wool, and tobacco are staple products. The manufactures include carriages, cooperage, flour, malt liquors, furniture, lumber, saddlery, etc. The county is traversed by the Chicago and North-western and the La Crosse and Milwaukee R. Rs. Cap. Jefferson. Pop. 34,040.

Jefferson, a v. and tp. of Marengo co., Ala., 8 miles N. W. of Linden. Pop. 233; of tp. 2445.

Jefferson, tp. of Boone co., Ark. Pop. 1649.

Jefferson, tp. of Calhoun co., Ark. Pop. 194.

Jefferson, tp. of Desha co., Ark. Pop. 773.

Jefferson, tp. of Independence co., Ark. Pop. 777.

Jefferson, tp. of Jackson co., Ark. Pop. 1976.

Jefferson, tp. of Newton co., Ark. Pop. 334.

Jefferson, tp. of Ouachita co., Ark. Pop. 782.

Jefferson, tp. of Saline co., Ark. Pop. 169.

Jefferson, tp. of Sevier co., Ark. Pop. 347.

Jefferson, post-v., cap. of Jackson co., Ga., 18 miles N. W. of Athens.

Jefferson, post-v. and tp. of Cook co., Ill., 7 miles N. W. of Chicago, on the Chicago and North-western R. R. Pop. of tp. 1813.

Jefferson, tp. of Stephenson co., Ill. Pop. 546.

Jefferson, tp. of Adams co., Ind. Pop. 494.

Jefferson, tp. of Allen co., Ind. Pop. 1445.

Jefferson, tp. of Boone co., Ind. Pop. 1675.

Jefferson, tp. of Carroll co., Ind. Pop. 947.

Jefferson, tp. of Cass co., Ind. Pop. 1285.

Jefferson, post-v. of Clinton co., Ind. (Washington tp.). Pop. 253.

Jefferson, tp. of Elkhart co., Ind. Pop. 982.

Jefferson, tp. of Grant co., Ind. Pop. 1398.

Jefferson, tp. of Greene co., Ind. Pop. 1348.

Jefferson, tp. of Henry co., Ind. Pop. 1234.

Jefferson, tp. of Huntington co., Ind. Pop. 1227.

Jefferson, tp. of Jay co., Ind. Pop. 1640.

Jefferson, tp. of Kosciusko co., Ind. Pop. 711.

Jefferson, tp. of Miami co., Ind. Pop. 1370.

Jefferson, tp. of Morgan co., Ind. Pop. 1081.

Jefferson, tp. of Newton co., Ind. Pop. 1606.

Jefferson, tp. of Noble co., Ind. Pop. 1293.

Jefferson, tp. of Owen co., Ind. Pop. 2018.

Jefferson, tp. of Pike co., Ind. Pop. 2188.

Jefferson, tp. of Pulaski co., Ind. Pop. 171.

Jefferson, tp. of Putnam co., Ind. Pop. 990.

Jefferson, tp. of Sullivan co., Ind. Pop. 1251.

Jefferson, tp. of Switzerland co., Ind. Pop. 3268.

Jefferson, tp. of Tipton co., Ind. Pop. 1738.

Jefferson, tp. of Washington co., Ind. Pop. 1532.

Jefferson, tp. of Wayne co., Ind. Pop. 1785.

Jefferson, tp. of Wells co., Ind. Pop. 1773.

Jefferson, tp. of Whitley co., Ind. Pop. 1263.

Jefferson, tp. of Adair co., Ia. Pop. 362.

Jefferson, tp. of Allamakee co., Ia. Pop. 1015.

Jefferson, tp. of Bremer co., Ia. Pop. 766.

Jefferson, tp. of Buchanan co., Ia. Pop. 918.

Jefferson, tp. of Butler co., Ia. Pop. 613.

Jefferson, tp. of Clayton co., Ia. Pop. 2245.

Jefferson, tp. of Dubuque co., Ia. Pop. 1550.

Jefferson, tp. of Fayette co., Ia. Pop. 639.

Jefferson, post-v. and tp., cap. of Greene co., Ia., 50 miles N. W. of Des Moines, on the Coon River and the North-western R. R.; has a bank, 22 stores, 4 churches, a fine court-house, a good graded school, and a weekly newspaper. Pop. of v. 779; of tp. 1828.
Swalm & Rhoads, Eds. "Bee."

Jefferson, tp. of Harrison co., Ia. Pop. 694.

Jefferson, tp. of Henry co., Ia. Pop. 1438.

Jefferson, tp. of Johnson co., Ia. Pop. 900.

Jefferson, tp. of Lee co., Ia. Pop. 1059.

Jefferson, tp. of Louisa co., Ia. Pop. 846.

Jefferson, tp. of Madison co., Ia. Pop. 655.

Jefferson, tp. of Mahaska co., Ia. Pop. 1174.

Jefferson, tp. of Marshall co., Ia. Pop. 691.

Jefferson, tp. of Polk co., Ia. Pop. 832.

Jefferson, tp. of Poweshiek co., Ia. Pop. 900.

Jefferson, tp. of Ringgold co., Ia. Pop. 527.

Jefferson, tp. of Taylor co., Ia. Pop. 542.

Jefferson, tp. of Warren co., Ia. Pop. 1012.

Jefferson, tp. of Wayne co., Ia. Pop. 704.

Jefferson, tp. of Jackson co., Kan. Pop. 1542.

Jefferson, tp. of Jefferson co., Kan. Pop. 1680.

Jefferson, post-tp. of Lincoln co., Me., 18 miles N. N. E. of Wiscasset. Pop. 1821.

Jefferson, post-v. and tp. of Frederick co., Md., 8 miles S. W. of Frederick City. Pop. of v. 257; of tp. 1491.

Jefferson, tp. of Cass co., Mich. Pop. 1047.

Jefferson, post-tp. of Hillsdale co., Mich. Pop. 1973.

Jefferson, tp. of Houston co., Minn. Pop. 372.

Jefferson, tp. of Winona co., Minn. Pop. 640.

Jefferson, tp. of Andrew co., Mo. Pop. 1605.

Jefferson, tp. of Cedar co., Mo. Pop. 1040.

Jefferson, tp. of Clarke co., Mo. Pop. 843.

Jefferson, tp. of Cole co., Mo. Pop. 1839.

Jefferson, tp. of Daviess co., Mo. Pop. 1059.

Jefferson, tp. of Grundy co., Mo. Pop. 874.

Jefferson, tp. of Linn co., Mo. Pop. 1810.

Jefferson, tp. of Maries co., Mo. Pop. 1123.

Jefferson, tp. of Monroe co., Mo. Pop. 2147.

Jefferson, tp. of Osage co., Mo. Pop. 1390.

Jefferson, tp. of Polk co., Mo. Pop. 480.

Jefferson, tp. of Saline co., Mo. Pop. 3002.

Jefferson, tp. of Scotland co., Mo. Pop. 3297.

Jefferson, tp. of Shelby co., Mo. Pop. 867.

Jefferson, tp. of Wayne co., Mo. Pop. 371.

Jefferson, post-tp. of Coos co., N. H., in the White Mountain region. It has extensive manufactures of lumber and starch. It is a place of summer resort. Pop. 826.

Jefferson, tp. of Morris co., N. J. Pop. 1430.

Jefferson, post-v. and tp. of Schoharie co., N. Y., 5 miles N. of Stamford, the nearest railroad station. The town of Jefferson is hilly, has 2 churches, a weekly newspaper, various stores, and manufactures of shoes, cabinet-wares, etc. Principal business, farming and dairying. Pop. 1712. A. W. Clark, Ed. "Jeffersonian."

Jefferson, post-v. and tp., cap. of Ashe co., N. C., near New River, 45 miles S. of Marion, Va. Chief business, agriculture and mining. It has 1 hotel, 2 academies (male and female), a weekly newspaper, stores, shops, etc. Pop. 1228. R. M. Dickey, Ed. "Mountain Messenger."

Jefferson, tp. of Guilford co., N. C. Pop. 1045.

Jefferson, tp. of Adams co., O. Pop. 2268.

Jefferson, post-v. and tp., cap. of Ashtabula co., O., 13 miles S. of Lake Erie, on the Oil City branch of the Lake Shore R. R., in a rich grazing and dairy country; has 2 banks, 16 stores, 2 foundries, various shops, a weekly newspaper, 6 public schools, and 2 hotels; was the home of J. R. Giddings, and is (1874) that of B. F. Wade. Pop. of v. 869; of tp. 1712.
W. C. Howells, Ed. "Ashtabula Sentinel."

Jefferson, tp. of Brown co., O. Pop. 1267.

Jefferson, tp. of Clinton co., O. Pop. 1445.

Jefferson, tp. of Coshocton co., O. Pop. 1059.

Jefferson, v. of Neave tp., Darke co., O. Pop. 107.

Jefferson, v. of Bloom tp., Fairfield co., O. Pop. 76.

Jefferson, tp. of Fayette co., O. Pop. 2532.

Jefferson, tp. of Franklin co., O. Pop. 1405.

Jefferson, tp. of Greene co., O. Pop. 1277.

Jefferson, tp. of Guernsey co., O. Pop. 904.

Jefferson, tp. of Jackson co., O. Pop. 3002.

Jefferson, tp. of Knox co., O. Pop. 1308.

Jefferson, tp. of Logan co., O. Pop. 1634.

Jefferson, a v. and tp. (W. Jefferson P. O.) of Madison co., O., on the Little Miami R. R. Pop. 577; of tp. 1888.

Jefferson, tp. of Mercer co., O. Pop. 1557.

Jefferson, tp. of Montgomery co., O. Pop. 3350.

Jefferson, tp. of Noble co., O. Pop. 1278.

Jefferson, tp. of Preble co., O. Pop. 1953.

Jefferson, tp. of Richland co., O. Pop. 2251.

Jefferson, tp. of Ross co., O. Pop. 1013.

Jefferson, tp. of Scioto co., O. Pop. 559.

Jefferson, tp. of Tuscarawas co., O. Pop. 1058.

Jefferson, tp. of Williams co., O. Pop. 1564.

Jefferson, tp. of Allegheny co., Pa. Pop. 2066.

Jefferson, tp. of Berks co., Pa. Pop. 1133.

Jefferson, tp. of Butler co., Pa. Pop. 1234.

Jefferson, tp. of Dauphin co., Pa. Pop. 843.

Jefferson, tp. of Fayette co., Pa. Pop. 1381.

Jefferson, post-tp. of Greene co., Pa. Pop. 1322.

Jefferson, tp. of Luzerne co., Pa. Pop. 776.

Jefferson, tp. of Mercer co., Pa. Pop. 1292.

Jefferson, tp. of Somerset co., Pa. Pop. 706.

Jefferson, tp. of Washington co., Pa. Pop. 889.

Jefferson, a b. of South Codorus tp. (Codorus P. O.), York co., Pa., ½ a mile S. of Jefferson Station, a post-v. on the Hanover branch of the Northern Central R. R. P. 327.

Jefferson, post-tp. of Chesterfield co., S. C. Pop. 1101.

Jefferson, city, cap. of Marion co., Tex., situated at

the head of navigation on the Big Cypress Bayou, which connects with Red River, on a section of the Texas and Pacific R. R., which also forms part of the direct line of the International R. R., which was completed in 1874 from Cairo, Ill., to Hearne in Central Texas. Jefferson is the largest town in North-eastern Texas, being the centre of a river commerce which has acquired considerable importance since the civil war. It now sends to New Orleans 275,000 bales of cotton annually, besides large quantities of hides, cattle, beef in barrels, tallow, wool, and bois d'arc seed. Twenty thousand wagons annually arrive at Jefferson from the interior counties, with which the commerce amounts to more than $10,000,000. Vast beds of iron and coal are found in the vicinity. Jefferson was settled in 1843. It has 7 churches, 3 newspapers, 1 national bank, and numerous manufactories. Pop. 4190 (1870), since largely increased.

Jefferson, tp. of Alexandria co., Va. Pop. 1256.

Jefferson, tp. of Loudon co., Va. Pop. 3355.

Jefferson, tp. of Kanawha co., West Va. Pop. 1635.

Jefferson, tp. of Lincoln co., West Va. Pop. 508.

Jefferson, tp. of Nicholas co., West Va. Pop. 649.

Jefferson, tp. of Pleasants co., West Va. Pop. 407.

Jefferson, tp. of Green co., Wis. Pop. 1673.

Jefferson, post-v. and tp., cap. of Jefferson co., Wis., on the Chicago and North-western R. R., Wisconsin division, 26 miles N. N. E. of Janesville, at the junction of Rock and Crawfish rivers. It has 1 manufactory of furniture, 3 of brick, 1 of woollens, and 1 of flour; 1 weekly newspaper, 2 graded-school houses, 4 hotels, a national bank, a savings bank, a fire department with steam fire-engine, and is the seat of Jefferson Liberal Institute. The town is mainly built of cream brick, made here. It is in a very fertile region. Pop. 2176; of tp. 4408.

A. Sanborn, Pub. "Banner."

Jefferson, tp. of Monroe co., Wis. Pop. 764.

Jefferson, tp. of Vernon co., Wis. Pop. 1108.

Jefferson (Joseph), b. at Philadelphia Feb. 20, 1829, descended from several generations of actors; appeared on the stage in his boyhood in comic parts; has acted in England and Australia with great success. Jefferson produced at the Adelphi Theatre, London, in 1865, his celebrated play of *Rip Van Winkle,* which has kept the stage ever since, and procured him a wide reputation.

Jefferson (Thomas), LL.D., third President of the U. S., b. in Albemarle co., Va., Apr. 13 (n. s.), 1743. His family, of Welch extraction, was settled in Virginia before 1619, in which year his ancestor was a member of the assembly, the first legislative body ever convened in America. His father, Peter Jefferson, a surveyor and planter, was a man of extraordinary physical strength, and sound intelligence, a public-spirited citizen and valuable man, who served his county as public surveyor, as colonel, and as a member of the legislature. Peter Jefferson married, in 1738, Jane, daughter of Isham Randolph, and granddaughter of the founder of the Virginia Randolphs, by whom he had nine children, Thomas being his third child and eldest son. In 1757, Peter died, leaving a widow and eight children, the oldest seventeen years, the youngest twenty-two months, Thomas being a schoolboy of fourteen. The family inherited 1900 acres and 30 slaves, from the product of which Thomas was enabled to attend William and Mary College and study law, thus fulfilling the fondest wish of his father and obeying one of his last injunctions. He loved to think that this was his father's dying command, and he used to say in his old age that if he had had to choose between the estate or the education his father had given him, he would have chosen the education. He entered college in 1760, remained two years, began the study of the law at Williamsburg under George Wythe in 1763, and in 1767, being twenty-four years of age, he was admitted to the bar. As a student he was industrious, resolute, moral, and intelligent. He was fortunate in his mathematical professor, Small, a friend of Erasmus Darwin; also in the learned George Wythe, who directed the legal studies of Chief-Justice Marshall and Henry Clay. Under the influence of these liberal minds he investigated the sources of law, the origin of liberty, and the gradual establishment of equal rights, extending his researches into remote antiquity, and becoming one of the most accomplished young men of his time. He acquired skill upon the violin, sometimes practising three hours a day, and was a close observer and student of nature. He obtained at once a large and profitable practice at the bar, which he held for eight years, until he was drawn into public life by the conflict between the colonies and Great Britain. From 68 cases in his first year, he was employed in 430 cases in his fourth, and his income at the bar is estimated at £500 sterling per annum, by which he increased his estate to 5000 acres of land. He married, Jan. 1, 1772, Martha Skelton, a young, beautiful, and childless widow, daughter and heiress of a leading lawyer of Virginia, John Wayles, whose death the next year doubled Jefferson's estate. Elected a member of the house of burgesses in 1769, he served in that body till the Revolution, a firm supporter of liberal measures, and noted for his disapproval of slavery. With Patrick Henry and the Lees he was a leader of the party in opposition to the British king, though strongly attached to the mother-country. He took his seat as a member of the Continental Congress June 21, 1775, the day on which the news of the battle of Bunker Hill reached Philadelphia and Washington left that city to take command of the army at Cambridge. Seldom joining in debate, for he was no orator, he acquired great influence by his courtesy, his readiness in composition, his knowledge of law and usage, his general information, his moderation of tone, and his warm devotion to the country's cause. After serving on several leading committees and drawing important papers, he was chosen to draft the Declaration of Independence, which, after three days' debate and extensive amendment, was adopted and signed on Thursday afternoon, July 4, 1776. In September of the same year he resumed his seat in the Virginia legislature, where, in conjunction with George Wythe and James Madison, he spent three years in adapting the laws of Virginia to the new order of things, and in other patriotic labors. He effected the abolition of entail and primogeniture, and drew the law—the first ever passed by a legislature or adopted by a government—which secured perfect religious freedom. His scheme for the establishment of common schools and for the abolition of slavery, though warmly supported by the liberal members, failed. June 1, 1779, he succeeded Patrick Henry as governor of Virginia, an office which he resigned after holding it two years, during which he ably co-operated with Washington in defending the country. One of his own estates was ravaged and plundered by Cornwallis, and his house at Monticello was held for some days by Tarleton's cavalry, Jefferson himself narrowly escaping capture. Sept. 6, 1782, his wife died, leaving three children of six to which she had given birth. Distracted with grief, he now accepted an appointment as plenipotentiary to France, which he had declined in 1776. Before sailing he served for some weeks in Congress at Annapolis, where he succeeded in carrying a bill establishing our present system of decimal currency—one of the most useful of his public services. Reaching Paris in June, 1784, he remained until October, 1789. "You replace Dr. Franklin," said the Count de Vergennes to the new minister. "I *succeed,*" was Mr. Jefferson's reply; "no one can replace him." He was filled with horror at the condition of France, and declared that a government of nobles and priests was a government of wolves over sheep. The most miserable person in the U. S. he thought happier than nineteen out of twenty Frenchmen, and he attributed the general misery chiefly to the bad government.

He was an active and vigilant minister. Besides performing the usual duties of his place, he published his *Notes on Virginia,* sent to the U. S. seeds, plants, and shrubs, enriched Buffon's collection with American specimens, forwarded literary and scientific news, and gave useful advice to La Fayette and the other revolutionary leaders. Nov. 18, 1789, he landed in Virginia, having obtained a six months' leave for the purpose of bringing his daughters home, one of whom was engaged to be married to Thomas Mann Randolph, afterwards governor of Virginia. Jefferson was met soon after his arrival by a letter from Pres. Washington appointing him secretary of state. He accepted the place, and entered upon its duties at New York in Mar., 1791, residing at 57 Maiden lane, and held the office until Jan. 1, 1794, when he resigned. During his tenure of this office the two political parties became sharply defined, and Jefferson, who was in the warmest sympathy with the French revolution and strongly democratic in his feelings, was recognized as the leader and candidate of the Republican party. His colleague, Alexander Hamilton, became his decided and aggressive political opponent. "We were pitted against each other," Jefferson once wrote, "every day in the cabinet like two fighting-cocks." In 1796 he was elected Vice-President of the U. S., and was sworn in Mar. 4, 1797. In 1800 he was elected to the Presidency, and being inaugurated Mar. 4, 1801, he entered upon a part of his career which will ever be regarded with interest by republicans of every land. He selected an able and accomplished cabinet: James Madison of Virginia, state; Albert Gallatin of Pennsylvania, treasury; Henry Dearborn of Maine, war; Robert Smith of Maryland, navy; Gideon Granger of New York, post-office. Administering the government in unbroken harmony with his

ministers, he gradually won to his support a majority of the people so great that he deemed the opposition scarcely strong enough to adequately criticise and admonish the party in power. He waged a successful war against the piratical Algerines, in which the navy of the U. S. won great distinction and formed the gallant officers whose exploits in the war of 1812 were so remarkable; Louisiana was purchased of Napoleon; the public debt was greatly reduced; the western country was explored by Lewis and Clark and by Pike; the system of precedence was abolished, and a rational etiquette substituted. He attempted by the embargo to introduce a better method than that of war to enforce the national rights. Having declined urgent solicitations to accept a nomination for a third term, he retired to private life Mar. 4, 1809, and spent the remainder of his days at his beautiful seat, Monticello, cheered by the society of his eldest daughter and a large number of affectionate grandchildren. Many of his later years were employed in founding the University of Virginia, now an important institution. He died on the fiftieth anniversary of the Declaration of Independence, a few hours before his contemporary and friend, John Adams. Mr. Jefferson was tall, well-formed, straight, and uncommonly strong. He had sandy hair, a ruddy complexion, and a tranquil, benevolent expression of countenance. His temper was perfect; his manners were natural and easy. He loved his country and his kind, and spent a long life in honorable and useful labors, public and private, beloved by all who knew him as he was. He was one of the best-informed men of his day, and all his habits and instincts were those of a student and observer. (For fuller information, see his *Works*, 9 vols. 8vo; *Memoirs and Correspondence*, by his grandson, T. J. Randolph, 4 vols., 1829; *Biographies* by George Tucker, 2 vols., 1837, by H. G. Randall, 3 vols. 8vo, 1858, by his granddaughter, Sarah N. Randolph, 1 vol., 1871, and by James Parton, 1 vol., 1874.) JAMES PARTON.

Jefferson Barracks, post-v. of St. Louis co., Mo., on the Mississippi River, 9 miles below St. Louis, and on the St. Louis and Iron Mountain R. R., is the site of extensive U. S. barracks.

Jefferson City, cap. of Missouri and seat of justice of Cole co., on the S. bank of the Missouri River, 125 miles W. of St. Louis, and near the geographical centre of the State. It is on the Missouri Pacific R. R., and by ferry transfer with Cedar City, on the opposite side of the river, it is the S. W. terminus of the Chicago and Alton R. R. Its site is elevated and pleasant, and the town is well built. Among the public buildings are the State capitol, the executive mansion, State armory, penitentiary, 8 churches, 2 public-school buildings, Lincoln Institute, a normal school for colored youth, and a female seminary. There are 2 large flouring-mills, manufactory of farm-implements, a foundry, and many minor industrial interests, 1 State and 2 national banks, weekly newspaper, and a State library. It is the seat of Jefferson City College (Protestant Episcopal). It is in a healthful region, which has great mineral and agricultural wealth, coal, iron, and glass-sand abounding. Pop. 4420, much increased since the U. S. census.
P. T. MILLER, ED. "PEOPLE'S TRIBUNE."

Jefferson College. See WASHINGTON AND JEFFERSON COLLEGE.

Jefferso'nia (*J. diphylla*), a vernal plant of the order Berberidaceæ, popularly known as twin-leaf, from its two-parted leaves, which rise in a tuft from the roots. The flowers are white, resemble those of blood-root, and appear in early spring. The *Jeffersonia* is indigenous to the Northern Central States of the U. S., but is cultivated in England. The root has been recommended as a specific for rheumatism, but the medicinal quality is somewhat doubtful.

Jef'fersonton, post-v. and tp. of Culpeper co., Va., 109 miles N. W. of Richmond, on the Rappahannock. Pop. 400; of tp. 2953.

Jef'fersonville, post-v., cap. of Twiggs co., Ga., 15 miles S. from Gordon.

Jeffersonville, post-v. of Lamard tp., Wayne co., Ill., on the Springfield and Illinois South-eastern R. R., 6 miles N. by W. of Fairfield; founded 1852 in the fertile La Mard Prairie; has 2 churches, a park, a weekly newspaper, 2 hotels, flour and saw mills, etc.
R. A. MOSS, ED. "WAYNE CO. CENTRAL."

Jeffersonville, city and tp. of Clarke co., Ind., on the Ohio River, opposite Louisville, Ky., with which it is connected by a fine railroad bridge. It is the terminus of the Jefferson Madison and Indianapolis R. R., and is on the Ohio and Mississippi R. R., Louisville division; a branch of the former road extends thence to New Albany. The falls of the Ohio here afford a noble water-power. The town has good shipping facilities, 2 large shipyards, 11 churches, locomotive and car works, and the machine-shops of the first-mentioned railroad. It contains the Southern State penitentiary, is the seat of an extensive government dépôt of supplies which cost $200,000, has 2 national banks, 2 large flour-mills, a fine high-school building, a weekly and a daily newspaper. Pop. of city, 7254; of tp. outside city limits, 3042. R. DAILY, ED. "NEWS AND DEMOCRAT."

Jeffersonville, N. Y. See CALLICOON.

Jeffersonville, post-v. of Jefferson tp., Fayette co., O. Pop. 212.

Jeffersonville, or **Tazewell Court-house,** a v. and tp., cap. of Tazewell co., Va., in a mountain-region, 28 miles N. of Marion, has 3 churches, a high school, a weekly newspaper, 2 hotels; is in a fine blue-grass region. Chief business, cattle-raising and farming. Pop. 3682.
J. C. NUTTY, ED. "NEWS."

Jef'frey (FRANCIS), LORD, b. at Edinburgh Oct. 23, 1773; was educated at Glasgow, Edinburgh, and Oxford, and in 1794 was passed an advocate at Edinburgh, but his literary tastes and Whig principles rendered his progress in his profession slow. In 1802 he was one of the founders of the *Edinburgh Review*, of which he became the leading spirit, and was for twenty-six years the principal editor; in 1813 visited New York and married Miss Charlotte Wilkes, his second wife; won wide fame by the ability and severity with which he opposed the new schools of poetry which sprang up in Great Britain. Acquiring a brilliant though tardy reputation at the bar, he was made dean of the Faculty of Advocates 1829; lord advocate, with the title of Lord Jeffrey, 1830; sat in Parliament for Perth 1830, for Malton 1831, for Edinburgh 1832. Regarding Jeffrey's work as a critic, the sentence of time has been adverse; for, though his abilities were undeniable, his judgment was often overmastered by prejudice; but as a jurist he was just and able; as a man he was beloved even by his literary adversaries. D. at Craigcrook Jan. 26, 1850.

Jef'freys, tp. of Marion co., S. C. Pop. 2005.

Jeffreys (GEORGE), BARON, b. at Acton, Denbigh, Wales, in 1648; studied law in the Middle Temple; was called to the bar in 1669; and practised chiefly at the Old Bailey, where he acquired the ferocious brutality which then distinguished that court, and which characterized him through life; was common sergeant of London 1671; affected Puritanism, but was knighted in 1677 and made solicitor to the duke of York; recorder of London 1678–80; king's sergeant and chief-justice of Chester 1680; baronet 1681; was crown counsel against Lord Russell, and became chief-justice of the king's bench 1683; sentenced Algernon Sidney 1683; tried Baxter and Titus Oates 1685; received a peerage 1685, in which year he held the Bloody Assize for the trial of Monmouth's adherents, of whom he caused 320 to be hung and 841 to be sold into slavery in the colonies, for which service he was made lord chancellor; was a party in nearly all the misdeeds of James II.; was seized by a mob and confined in the Tower 1688, and d. there Apr. 18, 1689.

Jef'fries (JOHN), M. D., b. at Boston, Mass., Feb. 5, 1744; graduated at Harvard in 1763; studied medicine at London and Aberdeen; returned to Boston to practise his profession; and, accompanying the British forces on their withdrawal to Halifax in 1776, he was appointed surgeon-general by Gen. Howe. In 1779, Dr. Jeffries became surgeon-major to all the British forces in America, but soon retired to England, where he devoted much attention to scientific experiment, especially upon atmospheric phenomena. In 1785 he crossed the Channel from Dover into France in a balloon, a feat which attracted much attention from the learned societies of Paris. In 1789, Dr. Jeffries returned to Boston, where he resided until his death, Sept. 16, 1819. Dr. Jeffries delivered in 1789 the first public anatomical lecture ever given in New England, but a great popular sentiment existing against dissections, he was compelled by mob violence to discontinue his course of instruction.

Jehosh'aphat, the fourth king of Judah, was the son of Asa, whom he succeeded in 912 B. C., and reigned to 887 B. C. Although he was utterly defeated by the Syrians in the battle of Ramoth-gilead, and although his first expedition to Ophir was foiled by the wreck of his whole fleet, his reign was nevertheless generally very fortunate. He worked energetically and successfully to extirpate idolatry, he kept the nations on the borders in awe, and agriculture and commerce prospered under his rule. The name of Jehoshaphat means "Jehovah's judgment;" hence the figurative expression of the prophet Joel, "the valley of Jehoshaphat."

Jeho'vah [Heb.] occurs only four times in the Authorized Version of the Bible, but the Hebrew word (יהוה) for which it stands is used hundreds of times, being usu-

ally represented in our Bible by "LORD," or "the LORD," printed in small capitals, to distinguish it from other words similarly translated. This singular phenomenon arises from the fact that while the consonants of the name (the Hebrew alphabet having originally had no signs for vowels) have been faithfully preserved by transcription, the Jews for ages have refrained from *pronouncing* the name on account of its sacredness; so that the original pronunciation has been lost. Whenever the word occurs they substitute for it, in reading, אֲדֹנָי (*Adhonai*); and to indicate this the Masoretic punctators connected with the *consonants* יהוה the *vowels* of אֲדֹנָי. But when these two words are found together, יהוה is punctuated with the vowel-points of אֱלֹהִים (God). This practice must be one of long standing, inasmuch as we find in the Septuagint (the Greek translation of the Old Testament dating from the second or third century B. C.), *κύριος* uniformly put for יהוה. This example has been followed in most of the versions. There are now no respectable scholars who suppose that the form יְהֹוָה ("Jehovah") represents the original sound of the name. From Exodus iii. 14, 15, where אֶהְיֶה, the first person imperfect of הָיָה, "to be," is identified with יהוה; from the form which the word assumes in proper names compounded with it (especially יָהוּ at the end of such names); and from ancient testimony respecting the pronunciation, it is now generally conceded by scholars that probably the verb had originally ו (vav) instead of י (yodh) for its second radical, and that the *third* person singular imperfect was יַהְוֶה (Yahveh or Yahweh), and that this is the proper form of the sacred name. As to its significance, since it expresses *existence* emphatically as the characteristic of God, we may say that it denotes the *perfection of existence*. Hence, eternity, self-existence, sovereignty, unchangeableness, and especially personality, are conceptions fairly to be inferred as embodied in the name. In the Old Testament generally יהוה is the term used when God's *personal* relation to his people is emphasized. Jehovah, rather than Elohim, is God as *revealing* himself, as a *lawgiver*, as inspiring *prophecy*, as the *faithful* one, as the object of *worship*, as the *living* God, as the *rewarder* of good and *punisher* of evil. In general, Elohim may be called the God of nature, and Jehovah (Yahveh) the God of revelation. (On this subject the principal writers are Hengstenberg, *Authenticity of the Pentateuch;* Reinke, *Philosophisch-historische Abhandlung über den Gottesnamen Jehova;* Tholuck, in the *Literarische Anzeiger* (1832); Reland's collection of essays entitled *Decas Exercitationum Philologicarum de vera Pronunciatione nominis Jehova;* E. Ballantine, on the *Import of the name Jehovah*, in the *Biblical Repository*, vol. iii.) C. M. MEAD.

Je'hu [Heb. *Yehú;* meaning uncertain], the eleventh king of Israel, and founder of the fourth dynasty in the northern kingdom; reigned 28 years, from B. C. 883 to 855. In his youth, Jehu was one of the guards of Ahab, and in the reigns of Ahaziah and Jehoram had become one of the chief military leaders. In the account of the vision which appeared to Elijah at Horeb in the time of Ahab, that prophet was commanded to anoint Jehu king of Israel as instrument of the divine vengeance upon idolatrous Israel (1 Kings xix. 16, 17). This command was disobeyed, and Jehu did not come to the throne until nearly or quite twenty years later, when he was anointed by one of the prophets under Elisha's directions, and proceeded to the massacre of King Joram, his mother Jezebel, his guest Ahaziah, king of Judah, seventy brothers of Joram, forty-two brothers of Ahaziah, and, in general, of all the prophets, priests, and worshippers of Baal. The reign of Jehu was not marked by any further remarkable events, so far as can be learned from the biblical record, but the name occurs on the black obelisk from Nineveh, now in the British Museum, as one of the tributaries to the Assyrian empire. The dynasty of Jehu occupied the throne of Samaria for four generations.

Jeisk, or **Eisk**, town of Russia, in the territory of the Kuban Cossacks, on the Sea of Azof, was founded in 1848 as a port for the rich produce of the surrounding country, and has grown very rapidly since. Pop. 16,747.

Jejeebhoy' (Sir JAMSETJEE), BART., b. at Bombay, India, July 15, 1783, belonged to that Parsee race which is the present representative of the ancient Zoroastrians and Fire-worshippers of Persia. He commenced life in poverty, made several commercial voyages to China, and succeeded so well as to be able in 1822 to release all the debtors held in prison in Bombay by paying their debts. In recognition of his princely benefactions he was knighted by Queen Victoria in 1842, and made a baronet in 1857. In 1856 a statue was voted to him by the citizens of Bombay. Sir Jamsetjee d. at that place Apr. 14, 1859, and on Aug. 1 after his death the statue was placed in the town-hall. His estate was valued at $4,000,000; his charitable foundations, widely distributed through Western India, were estimated to have cost $1,500,000, most of them set in operation during his life.

Jekaterinburg. See YEKATERINBOORG.

Jekaterinodar. See YEKATERINODAR.

Jekaterinoslav. See YEKATERINOSLAV.

Jelalabad', town of Afghanistan, is situated near the Cabool, on a fertile plain 2200 feet above the sea, in lat. 34° 25' N. It is poorly built; its trade is entirely in the hands of the Hindoos; its population varies according to the season from 3000 to 10,000. A single English brigade under Sir Robert Sale defeated here a large Afghan force in Mar., 1842.

Jelatma, or **Jelatom.** See YELATOM.

Jeletz. See YELETZ.

Jel'lachich von Buzim (Count JOSEPH), b. at Peterwaradin, on the so-called military frontier of Hungary, Oct. 16, 1801, was a son of Baron Franz Jellachich, a field-marshal in the Napoleonic wars; entered the army at an early age; spent many years on the Turkish border in military service; became in 1842 colonel of the first Banat border regiment, and when the Magyar revolution broke out in 1848 threw his great influence with the Slavic populations into the scale in favor of the Austrian empire. At the request of a Slavic committee, Jellachich was appointed to the chief command of the southern districts of the empire, under the mediæval title of ban of Croatia, Slavonia, and Dalmatia. This title theoretically gave him an almost independent sovereignty, which he hastened to use by assembling a Slavic diet, being consecrated in the banate by the bishop, and organizing the southern Slavonians against the Hungarians. The emperor became alarmed at his proceedings, and at the instance of the Hungarian cabinet, which he was still trying to propitiate, issued a decree depriving Jellachich of his new rank, and summoning him to answer for his conduct. But the sagacious ban of Croatia understood the situation; he not only disregarded all inconvenient orders from Vienna, but after a personal visit to the imperial family invaded Hungary in September, effected a junction with Windischgrätz, aided in the reconquest of Vienna, and participated in the important campaigns of the ensuing year. (See HUNGARY and KOSSUTH.) Jellachich gave no proof of great tactical ability, but the weighty influence he exerted upon the events of the time was rather political than military. He was well educated, and had a profound knowledge of the tendencies and aspirations of the heterogeneous mass of nationalities composing the Austrian empire. In 1850, Jellachich published a volume of poems; commanded in 1853 an army of observation on the Bosnian frontier; received the rank of count in 1855; and d. at Agram May 20, 1859.

Jelly-Fish. See ACALEPHÆ.

Jemappes', town of Belgium, in the province of Hainaut. Here the raw levies of the first French republic under Dumouriez won a decisive victory over the Austrian army, Nov. 6, 1792. It has extensive manufactures and large coal-mines in the vicinity. Pop. 11,164.

Jem'ison (ROBERT, JR.), a son of William Jemison, a wealthy planter, b. and bred in Georgia; in early life removed to Alabama, where he was long a prominent Whig member of the legislature. He was made president of the State senate in 1863, and soon after entered the Confederate Senate, though a strong anti-secessionist; was the founder of the financial system of Alabama (1847), of the State insane asylum, and of the Alabama and Chattanooga R. R.; resided in Tuscaloosa, and d. Oct. 16, 1871.

Je'na, town of Germany, in the grand duchy of Saxe-Weimar-Eisenach, on the Saale. Its university, founded in 1558, was 1787–1806 the most celebrated scientific institution of Germany. Schiller, Schlegel, Oken, Schelling, and Fichte were professors here, and more than 1000 students heard their lectures. On Oct. 14, 1806, Napoleon totally defeated the Prussian army on the heights outside of Jena, which battle for many years decided the fate of Northern Germany. Pop. 6984.

Jengis Khan. See GENGHIS KHAN.

Jenisei. See YENISEI.

Jen'kins, tp. of Mitchell co., Ia. Pop. 587.

Jenkins, tp. of Jefferson co., Neb. Pop. 442.

Jenkins, tp. of Luzerne co., Pa. It has mines of anthracite coal. Pop. 2505.

Jenkins (ALBERT G.), b. in Cabell co., Va., Nov. 10, 1830; educated at Jefferson College, Pa., and at the Law School, Cambridge, but without entering upon the practice of his profession directed his attention to agriculture; member of Cincinnati national convention 1856, and member

of the 35th and 36th Congresses; appointed brigadier-general in the Confederate army in 1861, he served with the division of A. P. Hill; subsequently in command of cavalry brigade in the Gettysburg campaign, in the Shenandoah Valley, and West Virginia; in the campaign of 1864 was killed at Dublin, Va., May 7, 1864.
G. C. Simmons.

Jenkins (Charles J.), b. in the district (now county) of Beaufort, S. C., Jan. 6, 1805. His father moved to Jefferson co., Ga., 1816, and Charles, the son, was educated partly at the Georgia University and partly at Union College, Schenectady, N. Y., where he graduated in 1824; studied law, and opened an office in the city of Augusta, Ga. In 1830 was elected to the legislature; in 1831 was elected attorney-general of the State, which position he resigned before the expiration of his term of office, and was again returned to the legislature in 1836, which position he continuously held from 1836 to 1850, ranking amongst the ablest and most eloquent of the House during all that period, and being Speaker thereof whenever his party was in the majority. In politics he was reared in the Jeffersonian State's Rights school, but supported Harrison for President in 1840, and Clay in 1844. He was a member of the Union convention of the State in 1850, and as chairman of the committee on resolutions was the author of the celebrated Georgia platform adopted by that body. In 1860 he was appointed one of the judges of the supreme court of the State to fill the vacancy occasioned by the resignation of Hon. Linton Stephens. This position he held until the close of the war. He was a member of the constitutional convention of the State called under the proclamation of Pres. Johnson in 1865, in which body he acted a prominent part, and in the same year was elected governor of the State without opposition under the new constitution so formed. This position he held until he was superseded by Gen. Thos. H. Ruger of the U. S. army, who was appointed provisional governor of Georgia in 1868 under the reconstruction acts of Congress. He also has been one of the most active and influential members of the board of trustees of the State University since 1839. A. H. Stephens.

Jenkins (Thornton A.), U. S. N., b. Dec. 11, 1811, in Virginia; entered the navy as a midshipman Nov. 1, 1828; became a passed midshipman in 1834, a lieutenant in 1839, and was employed in the office of the Coast Survey from Oct., 1834, to Apr., 1842; promoted to be commander in 1855, a captain in 1862, a commodore in 1866, and rear-admiral in 1870; retired from active service Dec. 11, 1873. Served at sea in the Mediterranean, N. and S. Atlantic, and coast of Africa 1842–45; sent to Europe in 1845, under instructions of the secretary of the treasury, to examine the systems of lighthouse illumination, and the general management of the aids to navigation service in the different commercial nations of Europe; returned in 1846 and submitted an elaborate report; served on the E. coast of Mexico during our war with that country to its end, and took part in the capture of Tuspan and Tabasco. Commanding a hydrographical party of the Coast Survey 1848–51, he framed the organic law which was passed in 1852 under which the present lighthouse establishment has been created and is now administered; Sept., 1858, commanded the sloop-of-war Preble in our expedition against Paraguay, and subsequently (1859–60) on the coasts of Central America and the E. coast of Mexico; commanded sloop-of-war Wachusett in James and Potomac rivers 1862; sloop-of-war Oneida and second division of Admiral Farragut's fleet off Mobile 1862–63; fleet-captain and chief of staff to Admiral Farragut 1863–64; commanded, temporarily, sloop-of-war Richmond under the guns of Port Hudson, and senior naval officer in command at the surrender of that place to the army and navy, July, 1863; wounded on board the sloop-of-war Monongahela in action with the enemy's land forces on the right bank of the Mississippi at College Point, below Fort Donelson; commanded the sloop-of-war Richmond and the second division of Admiral Farragut's fleet blockading Mobile 1863–65; from 1865 to 1869 chief of the bureau of navigation; in 1850–58, 1860–62, and 1869–71, naval secretary of the lighthouse board; from 1871 to the date of his retirement in command of our fleet in the East Indies. The character and services of this eminent officer are best shown by the following extract from Rear-admiral Farragut's official report of the battle of Mobile Bay, dated Aug. 12, 1864: "Before closing this report there is one other officer of my squadron of whom I feel bound to speak, Capt. T. A. Jenkins of the Richmond, who was formerly my chief of staff, not because of his having held that position, but because he never forgets to do his duty to the government, and takes now the same interest in the fleet as when he stood in that relation to me. He is also the commanding officer of the second division of my squadron, and as such has shown ability and the most untiring zeal. He carries out the spirit of one of Lord Collingwood's best sayings: 'Not to be afraid of doing too much; those who are, seldom do as much as they ought.'" Foxhall A. Parker.

Jenks, tp. of Forest co., Pa. Pop. 118.

Jenks (Joseph), b. at Hammersmith, near London, came to Lynn, Mass., about 1645; was the first founder who worked in brass and iron in America, and probably the first inventor. He received from the Massachusetts general court, May 6, 1646, a patent "for the making of engines for mills to go by water," and for making scythes and other edged tools, with a new-invented saw-mill, of which latter process he patented an improvement in May, 1655. Jenks is said to have made the dies for the silver coinage of the colony in 1652; he contracted in 1654 with the selectmen of Boston "for an engine to carry water in case of fire;" and in 1667 asked the general court for aid in wire-drawing. Jenks's works were on the river Saugus at Lynn, where he d. in 1683.

Jenks (William), D. D., LL.D., b. at Newton, Mass., Nov. 25, 1778, graduated at Harvard in 1797, and became a teacher; was pastor of a Congregational church at Bath, Me., 1805–23; professor of English and Oriental literature in Bowdoin College 1815–18; and afterwards became a teacher in Boston, where he founded the Seamen's Bethel; was pastor of the Green Street church, Boston, 1826–45. D. Nov. 13, 1866. He was a member of many learned and benevolent societies, and the author of several works, among which is a *Comprehensive Commentary*, once highly popular.

Jen'ner, tp. of Somerset co., Pa. Pop. 1703.

Jen'ner (Edward), M. D., F. R. S., b. at Berkeley, Gloucester, Eng., May 17, 1749, the son of a vicar; studied surgery at Sudbury and London, where he was a pupil of John Hunter, 1771–73; acquired the friendship of Sir Joseph Banks, who procured him the appointment of naturalist on Cook's second expedition; but he retired to his native town in 1773, and became a surgeon-apothecary; received in 1792 his degree from St. Andrew's, Scotland; sent to the Royal Society a paper on the cuckoo, which gained him a fellowship in the society. In 1796 he made his first successful arm-to-arm inoculation with the virus of cowpox as a preventive to infection with smallpox. The first idea of this measure had been conceived by him some twenty years before, when he learned that the Gloucestershire peasants considered accidental cowpox (acquired in milking cows) a preventive of smallpox. Observation having convinced him of the truth of the popular belief, in 1770 he communicated his opinion to Hunter, who advised him to continue his observations. In 1798 he announced his discovery, now established by abundant observations, but was almost universally denounced by physicians and clergy, often in the severest language. He published a series of *Inquiries* (1798, 1799, 1800) upon the subject. The importance of his discovery was finally conceded, and he received in all some £37,000 in grants from Parliament and other sources as testimonials to the value of his labors. Personally, he was kindly, unselfish, and philanthropic. D. at Berkeley Jan. 26, 1823.

Jen'ner (Sir William), Bart., F. R. S., b. at Chatham in 1815; was educated at University College, London, in which he became in 1848 professor of pathological anatomy, and in 1857 of chemical medicine. In 1861, Dr. Jenner was appointed physician to the queen, and attended Prince Albert in his last illness. He is a member of numerous scientific societies, has contributed largely to medical literature, and was the first to establish the difference in kind between typhus and typhoid fevers. He was created a baronet in 1868, and a knight commander of the Bath in 1872, in recognition of his services to the prince of Wales during a dangerous illness.

Jen'nings, county of S. E. Indiana. Area, 375 square miles. It is hilly and well timbered, but has a productive soil. Cattle, grain, wool, and lumber are staple products. The county is traversed by the Ohio and Mississippi, the Madison and Indianapolis, and other railroads. Cap. Vernon. Pop. 16,218.

Jennings, tp. of Crawford co., Ind. Pop. 2081.

Jennings, tp. of Fayette co., Ind. Pop. 836.

Jennings, tp. of Owen co., Ind. Pop. 801.

Jennings, tp. of Scott co., Ind. Pop. 1278.

Jennings, tp. of Putnam co., O. Pop. 1059.

Jennings, tp. of Van Wert co., O. Pop. 914.

Jennings (Thomas Reed), M. D., b. in Steubenville, O., 1805; graduated at Washington College, Pa., and in medicine in Baltimore. He came to Tennessee in 1828, where, during the invasion of Asiatic cholera in 1833, he obtained a large practice, which he retained till the late war. He opened dissecting-rooms in Nashville 1838, and was the

first who taught anatomy in Tennessee. For three years he was a senator in the legislature of Tennessee, and declined a nomination to Congress. In 1854 he was elected professor of the institutes of medicine and clinical medicine in the University of Nashville, and in 1856 filled the chair of anatomy. The class then increased from 220 to 419, and in 1859 reached to 456, being the largest class ever assembled W. of the mountains. D. suddenly at Narragansett, R. I., July 7, 1874. Dr. Jennings possessed a fine taste for literature; yet he was devoted to his profession, in which few succeeded better. Coming to Nashville a poor boy, he not only kept up an elegant establishment and liberally assisted his immediate relatives, but accumulated a large fortune by his practice. As a physician he had no superior in Tennessee. PAUL F. EVE.

Jen'ny, post-tp. of Marathon co., Wis. Pop. 215.

Jen'yns (SOAME), b. in London in 1704; was educated at Cambridge; entered Parliament for Cambridgeshire in 1742, and was appointed in 1755 one of the commissioners of the board of trade and plantations. Jenyns was a poet, a wit, and a politician, but is now chiefly remembered for his work on the *Evidences of Christianity*, published in 1776, which has been often reprinted, has elicited an unusual amount of criticism, and exerted a considerable influence. Though now obsolete, Jenyns's little work was long reputed the best argumentative presentation of the Christian evidences. D. at London Dec. 18, 1787.

Jeph'thah, the ninth judge of the Israelites, was a natural son of Gilead of the tribe of Manasseh. After the death of his father he was expelled from his home by his brothers on account of his illegitimate birth, and he withdrew to the land of Tob, where he became the chief of a band of brigands. Later on, when the tribes beyond the Jordan resolved to oppose the Ammonites, they invited Jephthah to become their commander, and he received the invitation on the condition that he should remain their ruler if he defeated the Ammonites. The victory over the Ammonites was complete, and hence he ruled the country for the rest of his life—from 1256 to 1250 B. C. But a great sorrow came over his house. When setting forth against the enemy he made a solemn vow to the Lord that if he returned home victorious he would offer up for a burnt-offering whatsoever first "came forth from the doors of his house" to meet him. On his return his daughter, an only child, "came first out of the doors of his house" with her companions to greet him with timbrels and dances. At this sight he rent his robes and cried out loudly in despair, but his daughter, when she heard about his vow, encouraged him "to do with her according to this vow," and so he did. Up to the twelfth century of our era it was universally understood, both by Jewish and Christian commentators, that Jephthah actually sacrificed his daughter, and there was among all readers only one feeling of admiration for the daughter and of horror at the conduct of the father. But since the twelfth century several commentators have attempted to mitigate the tragical impression of the narrative by proving that Jephthah only condemned his daughter to celibacy and perpetual service at the tabernacle of Shiloh. Thus interpreted, however, the narrative does not read quite naturally.

Jequitinhon'ha, a river of Brazil, rises in the province of Minas Geraes, enters the province of Bahia, and falls after a course of about 750 miles, first northern, then northeastern, into the Atlantic in lat. 15° 50′ S., near the town of Belmonte. Its upper course runs through a mountainous region, and its rocky bed is here embarrassed by rapids and cataracts, of which that called Salto Grande, on the boundary of Minas Geraes and Bahia, is one of the most magnificent falls of Brazil. Its lower course is broad and smooth, but rather shallow, and its mouth is obstructed by sandbars. Nevertheless, as the whole lower course from the mouth to Salto Grande is navigable for small steamers, and as one of its arms, the Poassu, communicates by a navigable channel with the river Pardo, the Jequitinhonha will probably become of great importance for the exportation of the rich products of Minas Geraes.

Jer'boa [Arab.], a name of numerous small rodent mammals of the rat family (by many referred to a smaller family, the Dipodidæ), and remarkable for their progression, which is accomplished by long leaps in the air, after the manner of kangaroos. They are all Old-World species, and some of them are very destructive to crops. The Egyptian jerboa (*Dipus sagitta*) is the typical species.

Jer'dan (WILLIAM), F. S. A., b. at Kelso, Scotland, in 1782; studied law, came to London in 1804, and became a writer for the *Morning Post* and other newspapers. On May 11, 1812, he was instrumental in arresting Bellingham, the murderer of the prime minister Spencer Perceval. In 1817 he became editor of the *Literary Gazette*, and remained in charge of that influential journal for thirty-four years. In 1821 he was one of the founders of the Royal Society of Literature. On his retirement from editorship a pension of £100 was granted him, and a flattering testimonial was signed by many of the leading public men of the day. Mr. Jerdan wrote four volumes of biographical sketches for *Fisher's National Portrait Gallery of Eminent Personages of the Nineteenth Century*, wrote for the annuals, reviews, and magazines, published his *Autobiography* (4 vols.) in 1852–53, and a supplement entitled *Men I have Known* in 1866. A judicious selection from his memoirs was edited by Mr. R. S. Stoddard in the *Bric-à-brac Series* (New York, 1874). D. at Bushey Heath, Hertfordshire, July 11, 1869.

Jeremi'ah [Heb., "raised up by the Lord"], the second of the greater prophets of the Hebrew canon, began his work in the thirteenth year of King Josiah (ch. i. 2); *i. e.* about 628 B. C. He survived the fall of Jerusalem (588), so that his work lasted for over forty years. He was b. at Anathoth in Benjamin (ch. i. 1; xxix. 27). His father was a priest. During Josiah's reign occurred the invasion of the Scyths (Herod. i. 103–106; see Jer. v. 6, 8, 9). This prophet's life, therefore, covered the catastrophe of the history of Judah. He had to contend against bigotry, obstinacy, and dogmatism, and to endure persecution. He was imprisoned for speaking words of warning and opposition to the prevailing policy. His warnings fell on ears deafened by fanaticism, and when all was lost, even the hope of retaining some native authority, though under Chaldean supremacy, he fled to Egypt, where he died. The version of his book which appears in the Septuagint differs very much from the Masoretic text. The Hebrew contains one-eighth more than the Greek, and the order of the chapters varies. This fact has excited the interest of biblical scholars, but no explanation has yet been suggested. Jeremiah also wrote the book of LAMENTATIONS (which see).

Jer'emie (JAMES AMIRAUX), D. D., b. in 1800 in England; graduated at Trinity College, Cambridge, in 1824, having obtained the Norrisian, the Hulsean, and the Members' prizes; became a fellow of Trinity; took holy orders in 1830, and was soon appointed professor of classical literature in the East India College at Haileybury, holding that post twenty years. In 1833 he was chosen Christian advocate for the University of Cambridge, in 1849 regius professor of divinity, and in 1864 dean of Lincoln. Dr. Jeremie was considered to be one of the most learned divines of his time. He published a *History of Rome from Constantine to the Death of Julian*, and a *History of the Church in the Second and Third Centuries*, both in the *Encyclopædia Metropolitana; Christianity in the Middle Ages* (1857), and many other occasional productions, besides editing the sermons of the Rev. Prof. William Archer Butler (1855). Dr. Jeremie preached Latin sermons in St. Paul's in 1852 and 1868 before the convocation of the province of Canterbury; also in French in Westminster Abbey in 1862, during the Exposition of that year. He resigned his professorship in 1870, and in the same year gave £1000 to the University of Cambridge to found two annual prizes for the study of biblical Greek.

Jerez' de la Fronte'ra, generally called simply **Jerez** or **Xeres,** is a large, rich, and elegant town of Spain, in the province of Cadiz, on the Guadalete. The plain in which it stands is hilly, extremely fertile, densely peopled, and very carefully cultivated; it produces the celebrated Xeres wine (sherry). The town itself is old and surrounded with walls, but its streets are wide and lined with handsome houses; its public buildings are elegant, and it contains many educational and benevolent institutions. Its trade in wheat and wine is very important, about 16,000 quarters of wheat and 2,000,000 gallons of wine being exported annually. Pop. 38,898.

Jerfalcon. See GYRFALCON.

Jer'icho, one of the most flourishing towns of ancient Palestine, was situated a few miles N. E. of Jerusalem. Its capture and destruction by the Israelites on their conquest of Canaan is related in Joshua vi., and its rebuilding and rapid progress in 1 Kings xvi. 34 and 2 Kings ii. 4. At the time of Christ it was a splendid city, the residence of Herod the Great, but during the Crusades it was completely destroyed, and it was never rebuilt. Its site is now occupied by a small and miserable village.

Jericho, post-tp. of Chittenden co., Vt., 26 miles N. W. of Montpelier. It has 5 churches, and manufactures of pumps, boxes, castings, agricultural tools, and other goods. Pop. 1757.

Jericho, Rose of (*Anastatica Hierochuntina*), a prostrate, branching annual, of the cruciferous family, inhabiting the deserts of Egypt and Palestine. After death the softer green parts disappear, leaving the ligneous frame-

work; this rolls up into a ball in drying, is uprooted by the winds, and rolls away. When wetted the branches expand hygrometrically, so that the plant seems to revive; hence its name, derived from the Greek ἀναστασις, "resurrection."

Jerked Beef [Chilian, *charqui*], a form of dried beef prepared quite extensively in the pastoral regions of North and South America and Australia. The flesh of the ox is taken off in thin strips and dried, either with or without salt. It will keep, when well prepared, for a very great length of time, and if well cooked is very palatable. Cuba is the principal market for jerked beef or *tasajo*.

Jerobo'am, the name of two kings of Israel. JEROBOAM I., the founder of the kingdom, was a son of Nebat. By Solomon he was made superintendent of public works, but having been informed by the prophet Ahijah that according to divine appointment he should become king over the ten tribes, he entered into conspiracies, and was compelled to flee to Egypt (980 B. C.). When Solomon died (973 B. C.) he returned and headed the deputation appearing before Rehoboam; and when the demands of the deputation were refused the ten tribes separated from Judah and Benjamin and chose him for their king. He took up his residence at Shechem, and the most prominent tendency of his government was to make the breach between the two kingdoms as wide and deep as possible. For this reason he forbade his subjects to resort to the temple at Jerusalem, and established shrines at Dan and Bethel, where "golden calves" were set up as symbols of Jehovah. D. 951 B. C.—JEROBOAM II. was the fourteenth king of Israel, the son and successor of Jehoash, and reigned 823–782 B. C. He carried on successful war against the Syrians, from whom he took the cities of Damascus and Hamath; Ammon and Moab were also conquered. But he kept up the idolatry of the golden calves.

Jerome', tp. of Midland co., Mich. Pop. 355.

Jerome, post-tp. of Union co., O. Pop. 1462.

Jerome of Prague, b. about 1375, was descended from a noble Bohemian family of the name of FAULFISCH; studied in his native city, in Paris, Cologne, Heidelberg, and Oxford, and attracted everywhere great attention by his learning and brilliant gifts. While at Oxford he became acquainted with the writings of Wycliffe, and he espoused the ideas of the English Reformer with his whole heart. On his return to Prague he found that these ideas were well known there, and he immediately allied himself to the Bohemian reform party under the leadership of HUSS (which see). In learning and eloquence he surpassed Huss, but he lacked his wisdom; he was violent, and even rude. The relics he threw down to the ground and trod on them, and in a dispute with a monk he once threw his adversary into the Moldau. When he heard that Huss had been imprisoned in Constance he immediately hastened to the rescue of his friend. But having failed in procuring a safeguard, and finding himself unable to do anything to aid Huss, he determined to return home, when (Apr. 25, 1415) he was seized at Hirschau in Suabia, put in chains, and delivered over to the council. The great indignation which the execution of Huss (July 6, 1415) excited made the council hesitate in the case of Jerome. He was kept in a mean dungeon, and received for a long time no other food than bread and water. Thus, worn out both in body and mind, he recanted his opinions on the doctrine of transubstantiation (Sept. 11, 1415); but this did not satisfy the council. He was subjected to new examinations on still more serious accusations, and he declared himself ready to answer any questions on the condition that the hearing should be public. On May 23 and 26, 1416, the examination took place, and he ended by disclaiming in a most passionate manner his former recantation, declaring it the greatest sin he had committed in his life. His condemnation was now sure to follow. On May 30 he was sentenced and burned at the stake, and his ashes were strewn on the Rhine. (See Krummel, *Geschichte der Böhmischen Reformation* (1867); and Czerwenka, *Geschichte der Evangelischen Kirche in Böhmen* (1869).)

Jerome, SAINT (SOPHRONIUS EUSEBIUS HIERONYMUS), b. about 345 at Stridon, a town on the confines of Dalmatia and Pannonia; received a very careful education; travelled in Gaul; was baptized, and lived for some years at Treves and Aquileia; went in 373 to the East, where he visited Antiochia, and retired in 374 to the desert of Chalcis, where he spent four years in ascetic practices and studies, especially of the Hebrew language. Having been ordained a presbyter by Bishop Paulinus of Antioch, he repaired to Constantinople in 379 to hear the celebrated Gregory Nazianzen, and while here he translated into Latin the chronicle of Eusebius and the homilies of Origen on Jeremiah and Ezekiel. In 382 he returned to Rome, where he lived in intimate connection with Bishop Damasus until Damasus's death in 384. In Rome he made a great impression by his passionate praise of asceticism and monastic life. Many became his enemies, but many others, especially among the rich and noble ladies, became his firm adherents; and one of these, Paula, followed him in 384 to Bethlehem, where she built four convents—three for nuns and one for monks, over which latter she placed St. Jerome; he d. here about 420. During his residence in Rome he commenced, at the instigation of Damasus, a critical revision of the Latin translation of the Bible, the Vulgate; and this work, which he finished in Bethlehem, is his chief work and the foundation of his great fame. But besides he wrote a great number of controversial papers against Helvidius, Jovinianus, Vigilantius, Rufinus, and the Pelagians, and several exegetical relating to the Old Testament. The best edition of his works is that by Vallarsi (11 vols., Verona, 1734–42). (See Zöckler, *Hieronymus, sein Leben und Wirken*, 1865.)

Jerôme Buonaparte. See BONAPARTE (JERÔME).

Jerome'ville, post-v. of Mohican tp., Ashland co., O. Pop. 328.

Jer'rold (DOUGLAS WILLIAM), b. in London Jan. 3, 1803, the son of the manager of a theatre; became midshipman in the navy 1813–15, and was apprenticed in 1816 to a printer. His first play, *More Frightened than Hurt* (1818), after some years of neglect, was very successful. He wrote lyrics and criticisms for the journals which attracted much attention. The comedy *Black-Eyed Susan* (1822) established his reputation. *Rent Day* (1830), *Men of Character* (a collection of republished tales, 1838), *Bubbles of the Day* (1842, a comedy), *Time works Wonders* (1845), *The Caudle Lectures* (first published in *Punch*, with which he became connected in 1841), and numerous other plays, sketches, and tales, widely extended his fame as a humorist and a powerful delineator of character. He twice failed as a publisher of newspapers, and once as a theatrical manager, but his connection (1852–57) with *Lloyd's Weekly* was very successful. Mr. Jerrold was a man of great kindliness and generosity, but possessed a gift of repartee which often became terribly caustic. D. in London June 8, 1857.

Jerrold (WILLIAM BLANCHARD), eldest son of Douglas Jerrold, b. in London, England, in 1826; studied for an artist, and illustrated some of his father's articles, but later gave his attention to literature. In 1849 he married a daughter of Laman Blanchard; has long been prominently connected with the London press. Among his works are several comedies and farces, *The Disgrace of the Family* (1847, a novel), *Swedish Sketches* (1852), *Imperial Paris* (1855), *Life of Douglas Jerrold* (1858), *At Home in Paris* (1864), *The Cockaynes* (1871), and other works. Also *London* (1872), illustrated by Doré, and *Life of Napoleon III.* (1874–75). He has given special attention to the condition of the poor in Paris and London.

Jerry (REV. JOHN L.), b. in North Carolina May 11, 1793, the son of a Revolutionary soldier who served under La Fayette, and imbibed his father's spirit. When a missionary in St. Augustine, a priest threatened him with punishment if he did not desist preaching; pointing to the American flag, he said, "No Inquisition where that flag waves!" At one time, when he had no money to pay his fare, he retired for prayer, and on returning to mount his horse and pursue his journey, he found a doubloon, which kept him going till he obtained relief. He entered the South Carolina conference in 1818, and was a revered member of the Florida conference at the time of death, July 11, 1859.

T. O. SUMMERS.

Jer'sey, the largest of the Channel Islands, situated in the English Channel, 13 miles W. of the coast of France and 35 miles S. of the coast of England. Area, 39,580 acres, of which 25,000 acres are under cultivation. Pop. 56,078, of whom 13,000 are English and 2000 French; the natives speak a kind of Norman French, as the island originally belonged to the French province of Normandy. The ground is high and rocky, but presents many fertile valleys, which on account of the fine, mild, and equable climate are well adapted for the cultivation of fruits. Large quantities of peaches, apricots, apples, pears, grapes, and melons are annually exported to London. The oyster fisheries form another extensive branch of industry. Shipbuilding is also important. The island, on account of its climate, is a great resort for people of delicate health. Principal towns, St. Helier and St. Aubin.

Jersey, county of S. W. Illinois, having the Mississippi River on the S. and the Illinois on the W. Area, 350 square miles. It is partly timbered and partly prairie; coal is mined. The soil is fertile; cattle, grain, and wool are staple products. The county is traversed by the Chicago and Alton R. R. Cap. Jerseyville. Pop. 15,054.

Jersey, post-v. and tp. of Licking co., O. Pop. of v. 101; of tp. 1253.

Jersey City, cap. of Hudson co., N. J., on the right or W. bank of the Hudson River, at its entrance into New York Bay, and opposite the southern portion of New York City, with which it is connected by five ferries. Jersey City is the terminus of six railroads—the Erie, the Pennsylvania, the Central of New Jersey, the Northern New Jersey, the New Jersey Midland, and the New York and Newark. The Morris Canal connects it with Eastern Pennsylvania. It is the terminus of the Cunard steamship line, and the seat of considerable foreign commerce, but being a part of the New York customs district, no separate returns are obtainable. At Jersey City are located large stockyards and slaughter-houses for the daily supply of the New York City market; this business, formerly at Communipaw, is now carried on in the N. part of the city, near the river front, where a very extensive abattoir was recently built, and opened in 1874; it is supplied by a branch line from the Pennsylvania R. R., and the offal is drained into the Hudson River. Manufacturing establishments are very numerous, the most important being the U. S. Watch Co., glass, crucible, iron, steel, zinc, tin, and copper, and boiler works, foundries, machine-shops, and locomotive-works, and a large business in soap and candles and refining molasses and syrup. The city is well supplied with water from the Passaic River at Belleville, brought in pipes to two large distributing reservoirs. There are 2 gas companies, 3 national banks, 2 State and 8 savings banks, 4 insurance companies, 5 newspapers (2 German), 44 schools, about 60 churches, and a fair number of religious and benevolent societies and institutions. Jersey City is in reality a suburb of New York City, its population consisting largely of the overflow from that vast metropolis. At the beginning of the century there was no settlement on Paulus Hook, as the locality was then called. A company was chartered in 1804 which laid out the grounds of Paulus Hook into streets and squares, but the growth of the place was insignificant until half a century later. It was but a village in 1820, when it was incorporated as the "City of Jersey," and it was still only a village when it was reincorporated in 1838 as "Jersey City" and provided with the machinery of a mayor and common council. Even in 1850 the population was but 6856. By the annexation of the township of Van Vorst (1851), of the cities of Hudson and Bergen (1870), and of the village of Greenville (1872), the growth of Jersey City during the third quarter of the century (1850–75) was largely assisted. Pop. in 1860, 29,227; in 1870, 82,546.

Jersey Shore, post-b. of Lycoming co., Pa., beautifully situated on the left bank of the W. branch of the Susquehanna, near the Philadelphia and Erie R. R. It has scenery of great attractiveness, is in a fertile region, has 5 churches, graded public schools, a high school, bank, and weekly newspaper. Chief industries, farming, lumber-trade, and tobacco business. Pop. 1394.

S. S. Seeley, Ed. "Herald."

Jer'seyville, city, cap. of Jersey co., Ill., on the Chicago and Alton R. R., Jacksonville branch, 50 miles N. of St. Louis. It has 4 large flour-mills running day and night, 2 foundries, 2 hotels, a large manufactory of ploughs and reapers, besides manufactures of carriages and other goods, 8 churches, and a fine public-school building. The city stands on elevated ground, is handsomely built, and has wide and finely shaded streets. It has much enterprise. It has 2 weekly newspapers. Pop. 2576.

W. H. Edgar, Ed. "Republican."

Jeru'salem. I. The Name.—The name *Jerusalem** is the Greek form (Ἱερουσαλήμ), as found in the Septuagint, of the Chaldee *Jerush*^{e}*lem*. In the New Testament it is written both as in the Septuagint and also *Jerosolyma* (Ἱεροσόλυμα), the evangelists, with the exception of Luke, using almost exclusively this latter form, while in Luke (including the Acts) and in the Epistles the former form is generally preferred. The Hebrew name is *Ierushalaim*, *Yerushalaim*, or *Yerushalayim* (the full form is יְרוּשָׁלַיִם). The dual termination seems to indicate some ancient twofold division of the city, and, from the difficulty in determining any Hebrew root for the word, we may suppose that the name was Canaanitish, or even belonging to a race anterior to the Canaanites, to which the Hebrews added the dual ending for topographical reasons. We may otherwise conjecture that the dual ending is an accident, brought about by the resemblance of the original word to a Hebrew dual, or that the old language had a dual like the Hebrew. That the name should be changed to *Shalem* (Salem in poetry, Ps. lxxvi. 2) is in accordance with the Hebrew love of paronomasia. If Salem in Gen. xiv. 18 be Jerusalem, we may account for the word Salem there in the same way, for verses 18, 19, 20 seem to be a poetic insertion between verses 17 and 21. This poetic use of the word can be no argument for the word Salem or "peace" as belonging to the original name, any more than the fact of the Greek word ἱερός being found in its Greek translations is an argument for the later idea that Hierosolyma meant the "holy Solyma."

II. The History.—*First Period* (B. C. 1450–B. C. 1048).—The first appearance of the place in history (if we leave out the Salem of Melchizedek) is in Joshua xv. 8, where it is called the "shoulder" (*ketheph*) of the Jebusites (as in ch. xviii. 16), an admirable description of the projection of Mount Zion, as it appears from the boundary-line of Judah and Benjamin, there described as running along the S. side of the city. The Jebusites held it as their special stronghold, and hence the name Jebus (*i. e.* the Jebusite city) is given it in Judges xix. 10, 11, and 1 Chron. xi. 4, 5. The Jebusites seem to have been territorially one of the smallest of the Canaanitish nations, but from their position one of the strongest. Their king, Adoni-zedek, was slain by Joshua at Makkedah after the battle of Beth-horon (Josh. x.). After Joshua's death the Israelites made their first assault upon the city. The tribes of Judah and Simeon succeeded in taking it and setting it on fire (Judges i. 8) when on their way to complete the settlement of their lot. This capture of the city must have been but partial (as Josephus says), for the tribe of Benjamin, to which it was assigned, left the Jebusites in quiet possession of a part of the city, the upper city (ἡ καθύπερθεν) on Zion (Judg. i. 21). For nearly four centuries the citadel of Jerusalem remained in the possession of the Jebusites, during which time we may well believe that its Canaanitish inhabitants thoroughly fortified it, adding to its natural strength all that the art of that day could suggest. During those centuries we cannot suppose a state of war to have continued between the Jebusites and the Israelites, but that some sort of peaceful intercourse was maintained, in which Jerusalem, or the chief part of it, was tacitly understood to belong to the Canaanitish tribe. During all this long period the central capital was at Shiloh, except, as in Saul's reign, Gibeah, his residence, may claim the precedence. It may be that the fact of Saul's capital, Gibeah, being only 4 miles N. of Jerusalem was one inducement to David to seek to set up his throne in the Jebusite stronghold. It would be more central than Hebron, where he had begun his reign, and it would also be in the tribe of Benjamin, which had under Saul been the royal tribe, while its strength would make it far more desirable than Gibeah or than Shiloh. Indeed, the latter city was probably already destroyed by the Philistine invasion. (See Jer. vii. 12.) Whatever the motive may have been, David in the eighth year of his reign organized an attack upon Jerusalem when the enthusiastic adhesion of all Israel to his government rendered success most probable. The diversion in the direction of the house of Saul would have seriously interfered with such a project earlier in David's reign. Joab, David's chief captain, took a conspicuous part in the siege (1 Chron. xi. 6), which was marked by self-confidence on the part of the Jebusites and daring valor on the part of Israel. The strong citadel was taken, and called afterward "the city of David." We may be very sure that this citadel was Zion, and that "Millo" was its bluff front on the valley of the Son of Hinnom. From David's conquest of Jerusalem dates its fame. Before that time we have no reason to suppose it of any more consequence than any well-placed stronghold, but now the concentrated royalty of the twelve tribes made it the seat of power and glory, and for 460 years, until Nebuchadnezzar destroyed it, it stood forth as one of the conspicuous capitals of the world, vying at one time, in some respects, with Nineveh, Babylon, Tyre, and Thebes.

Second Period (1048 B. C. to 586 B. C.).—David immediately turned his attention to the reconstruction and strengthening of his new city, and when this work was accomplished had the ark of God, which had been for a century at Kirjath-jearim (ever since the great Philistine invasion of Eli's time and most probably the destruction of Shiloh), conducted with great pomp and jubilation to the royal city and placed in a new tabernacle especially prepared for it, the old Shiloh tabernacle being at Gibeon, 5 miles N. of Jerusalem (2 Chron. i. 3, 4). David may have already had in his mind the construction of a grand temple in place of the old tabernacle, and therefore have preferred to bring the ark to Jerusalem, where the future structure would be reared, rather than carry it to the old tabernacle at Gibeon. The rest of the tabernacle furniture was doubtless at Gibeon. The brazen altar, we are expressly told, was there. This position of the ark on the large citadel-hill (Zion) continued for forty years, making the name Zion a favorite name for the city, especially when viewed as a *holy* city, a centre of worship. The consoli-

* The *J* represents the Greek aspirated *I*. It might be represented by *Hi*; *e. g. Hierusalem*, *Hierosolyma*.

dation and strengthening of the whole Israelitish commonwealth in David attracted the attention of his powerful neighbor, the king of Tyre, who did him the high honor of building the royal palace in Jerusalem with material and workmen from the Phœnician kingdom (2 Sam. v. 11). David's conquests over the Syrians, Moabites, Ammonites, Philistines, Amalekites, and Edomites extended the territory of his empire to the Euphrates on the N. E. and to the Red Sea and Mediterranean on the S. and W., making his dominion the most conspicuous of the world at a time when the Assyrian empire had fallen into feebleness between its exaltation under the first Tiglath-pileser and its renewed glory under Asshur-izir-pal. During this period of David and Solomon, Egypt, the other great monarchy, seems to have been in a like low plight with Assyria, previous to the accession of the new and powerful dynasty of Shishak. From Hiram's conduct we may readily see that the Israelitish kingdom out-topped Tyre, so that the throne of David and Solomon must have represented the grandest empire then existing on the earth. Of this empire Jerusalem was the central seat, which naturally, under such influences, began to assume an extent and grandeur corresponding with its important position. Especially under Solomon, in his peaceful reign, did the city grow into magnificence. What war had before done, commerce now accomplished, and Jerusalem received a vast stream of wealth from its active relations with many rich and distant countries. Egypt, Arabia, Tyre, Ophir (India?), and perhaps Tarshish (Spain?), are especially spoken of as connected with Jerusalem by important commercial ties at this time, by which this capital became an entrepôt of trade for all the subject kingdoms of Syria (1 Kings x. 29). With the enormous wealth thus acquired, and that laid up by his father, Solomon erected the temple on the rocky height opposite Zion, which David had prepared for the purpose, having purchased the site from Araunah the Jebusite.* The sharp ridge of the height was taken off and the surface levelled, vast vaults being erected to support extensions of the level, and on this grand, conspicuous area of nearly 1000 feet square one of the most costly shrines the world has ever seen was erected by the magnificent monarch. With both men and materials from Tyre (the centre of mechanical art) he raised the massive structure (whose wall-stones, still bearing the Tyrian marks, astonish the explorer), completing the work in seven years. He also erected a palace of corresponding grandeur for himself, which occupied thirteen years in its construction. Another superb edifice, erected for state occasions and called the House of the Forest of Lebanon (perhaps because of its many cedar pillars), was constructed at the same time. The walls of the city also received his attention. These were extended around suburbs, increased in height, strengthened with towers, and probably increased into fortresses at such points as Millo and Ophel, where already fortresses existed. A palace was built for Solomon's queen, the daughter of the Egyptian monarch, and doubtless his thousand wives and concubines called for an enormous outlay in architecture. The whole apparatus of the Solomonian court was on a style of unparalleled extravagance and splendor. This grandeur of Jerusalem seems to have been in accordance with man's wish, and not God's appointment, except as God yielded to man. It was man who insisted on the monarchy instead of a theocratic republic, and it was man who conceived the idea of the gorgeous temple. God *permitted* both, but they seduced Israel from its simplicity and destroyed its separateness from the nations, so important for its great spiritual mission. Commercial intercourse with the nations, by which the wealth was secured, and royal pomp which sought the wealth, brought into the country the idolatry and immorality of other lands, with all the recklessness and oppression that follow human aggrandizement, so that just when the nation seemed to be most exalted it was preparing its ruin. It is remarkable that (in accordance with the prophetic declaration, that the Babylonian captivity should last long enough for the land to make up its lost sabbatical years—Lev. xxvi. 34, compared with 2 Chron. xxxvi. 21), if we count backward from the year B. C. 518 (the end of the seventy years), the seventy sabbatical years, or 490 years, we reach B. C. 1008, the period of Solomon's top of glory. Here we see that in the worldliness of this magnificent reign the keeping of the sabbatical year began to be disregarded. Solomon was succeeded by Rehoboam, a foolish *porphyrogenitus*, who soon began to experience the evil results of his father's extravagant policy. The kingdom was divided. Jeroboam, returning from Egypt, where he had been an exile protected by Shishak, the Pharaoh during the later years of Solomon, became king of the northern realm, and Jerusalem was left the metropolis of the tribes of Judah and Benjamin only, and of the subject countries at the S. and E. This fearful schism in the nation and the tempting treasures of Jerusalem brought Shishak (perhaps through Jeroboam's influence) from Egypt against the Holy City. This enterprising and illustrious monarch made his attack upon the kingdom of Judah in the fifth year of Rehoboam with an enormous host of Egyptians and foreign auxiliaries. The glory of Jerusalem had for two generations eclipsed that of Egypt; Egypt would now have its revenge. The fortified cities of the Judæan kingdom fell one after another. Although they are not specified, we may readily suppose that Gath, Mareshah, Lachish, and Bethlehem, among those places which Rehoboam had lately fortified against Egyptian attack (2 Chron. xi. 6–10), were overcome by Shishak to clear his way to Jerusalem. In the city had assembled all the dignitaries of the realm, who, at the word of the prophet Shemaiah, humbled themselves with the king before God, and so averted the evil. The Egyptian seems not to have entered the city,† but a treaty was made, most humiliating to Judah, by which the kingdom became tributary to Egypt, and the treasure accumulated in the temple and royal palace was delivered up to Shishak, who also carried off the 500 shields overlaid with gold which Solomon had placed as ornaments in his stately House of the Forest of Lebanon. The gold of these shields alone represented a sum of $720,000—a sum of vast magnitude in those days. Abijah, the successor of Rehoboam, by his great victory over the kingdom of Israel, helped Jerusalem to recover from this blow, but it was not till the year B. C. 941, more than thirty years after Shishak's disastrous raid, that Jerusalem regained her independence and dignity by the complete overthrow of the Ethiopian Zerah (supposed to be Pharaoh Usarken I.) at the battle of Mareshah, as far as which point he had penetrated, with an army like that of Shishak's, against Asa, Rehoboam's grandson. This great victory filled the kingdom with joy, restored treasure to Jerusalem, drew many Israelites of the northern kingdom to the city, and caused a reform in the religious condition of the people, who had been led astray from Solomon's day. It is sad to see how soon afterward Asa took the new treasure, which he had placed in the temple in lieu of that which Shishak had seized, and gave it as a bribe to Benhadad, king of Syria, that he might attack Baasha, king of Israel. The prosperity which Asa brought to Jerusalem continued for fifty years—a period of national power and dignity that was to be followed by the evils of a close alliance with idolatrous Israel in the union of Jehoshaphat's family with the corrupt family of Ahab and the Tyrian Jezebel. Jehoram, Jehoshaphat's son and Asa's grandson, married Athaliah, daughter of Ahab and Jezebel. Through her the abominations of idolatry again filled the royal city. Jehoram began his reign by murdering his six brothers. He ended it with the successful revolt of Judah's dependencies, and a fearful onslaught of the Philistines and Arabians upon Judah itself, in which the enemy carried off many of the king's wives and all his sons but one, with all the treasure which they found in one of his country palaces.‡ When Jehoram had died, and his son Ahaziah had been slain by Jehu, Athaliah immediately slew her grandchildren (one only, Joash, escaping the massacre), and for six years wielded her usurped authority. Thus, for fifteen years the prevalence of Baal-worship in Jerusalem caused the temple to fall into decay. Indeed, Athaliah's family had even defaced the holy shrine and carried off the sacred vessels for use in the service of Baal's temples. The piety and patriotism of Jehoiada, who had preserved the infant prince Joash, put an end to these enormities by slaying the guilty queen and the priests of Baal, and restoring the worship of Jehovah. But when the old Jehoiada died at the remarkable age of 130 years, and was honored by a burial among the kings, a state policy led King Joash to restore idolatry and to slay Jehoiada's sons (among them Zechariah, the high priest) in the very court of the temple while they were protesting against this fearful apostasy. This event shows how deeply seated in the public regard was the idolatry which first Solomon and then Jehoram had fostered, and which the people doubtless connected with their grandeur before the nations. Not long after, Hazael, the energetic king of Syria, besieged and took Gath, and then turned toward Jerusalem, defeating the Ju-

* He was probably the very Jebusite king whom David had conquered thirty years before. The Hebrew words of 2 Sam. xxiv. 23, literally translated, are, "Araunah the king gave the whole to the king."

† Josephus says that Shishak entered the city without a battle, but if this had been the case we should have expected a more thorough ruin of the city. Where Josephus enlarges on the sacred narrative he is often using his imagination.

‡ No mention is made of their entering Jerusalem (2 Chron. xxi. 17). Hence, we may suppose the royal family were sojourning elsewhere.

dæan army on the way and making havoc everywhere, when Joash purchased deliverance for the royal city only by giving up to Hazael all the sacred vessels which had been accumulated since Asa's day, 100 years before, together with all the ecclesiastical and royal treasure in the city. Although this invasion of Judah was most disastrous to the country, involving immense loss of treasure and the death of all the prominent nobles who attempted to stop the progress of the Syrian king, yet the record gives no countenance to the idea that Jerusalem was captured either by him, by the Philistines in Jehoram's day, or by Shishak in Rehoboam's day. Its capture from the Jebusites by King David was thus far the only seizure of the famous stronghold. The first actual capture of the city after David's conquest was made by the Israelitish monarch Joash, who had been provoked to war by Amaziah, king of Judah, son of the Jerusalem Joash. The king of Israel, after defeating Amaziah at Bethshemesh, appeared before Jerusalem, and probably through the Jewish king, whom he held as prisoner, obtained entrance into the city, which he plundered, and 400 cubits length of whose wall he levelled. This was about the year 826 B. C., more than two centuries after David's conquest of the Jebusite stronghold. Uzziah, Amaziah's successor, in his long and prosperous reign repaired the injury done to the walls of the city and added to its fortifications. It was in this reign that the great earthquake occurred which is referred to as a memorable epoch by the prophets Amos (i. 1) and Zechariah (xiv. 5), and which is by Josephus connected with the king's sacrilege (*Ant.*, 9. 10. 4). If we disregard the statement of Josephus, we may believe that this extensive building of the walls and fortifications may have been suggested by the ruin caused through this grievous visitation. In the reign of Jotham, Uzziah's son, the "high gate" of the temple was built (perhaps the predecessor of the "beautiful gate" of Herod), and the wall of Ophel was erected. If Ophel was the southern spur of Moriah, as seems quite proven, it is hardly possible that it was not fortified to some extent from Solomon's day. Jotham probably added to its fortifications or rebuilt those that had been destroyed. This enterprising king also erected fortresses throughout the kingdom. Ahaz, Jotham's son, sustained fearful defeats from Rezin, king of Syria, and Pekah, king of Israel, so that he called upon Tiglath-pileser, king of Assyria, to come to his aid. This alliance was purchased by despoiling the temple and royal palace in a far more wholesale manner than it had been done by Rehoboam, Asa, or Joash. Ahaz, in his infatuation with the Assyrian alliance, removed the brazen altar, built a new one of heathen pattern in its place, and defiled the temple itself with idolatrous rites. Hezekiah, succeeding his father Ahaz, immediately restored everything to its original service, purified the temple, and celebrated the Passover with unusual solemnity. During Hezekiah's reign occurred the formidable invasion of Sennacherib, king of Assyria, against which Hezekiah prepared the city with wonderful industry and in the most thorough manner. Although the kingdom was devastated, the city was saved, yet with a new stripping of temple and palace as a tribute to the great conqueror. (See Sennacherib's own account in the Nineveh records.) This was the sixth time within three centuries that the treasures of Jerusalem had been seized. Manasseh, Hezekiah's son, had a long and eventful reign. He brought back all the idolatries which his father had removed, even putting an image of Baal in the temple itself. Esar-haddon, king of Assyria, who reigned in Babylon, subjected the kingdom of Judah, as his father Sennacherib had done, and managed to seize the person of Manasseh and carry him captive to Babylon. On humbling himself before God, he was released from his captivity, returned to Jerusalem, and added to the fortifications of the city on the N. W. and S. E. But it was not till the reign of Josiah, Manasseh's grandson, that the idolatrous objects in and around Jerusalem were thoroughly removed. Under an impulse caused by the discovery of a copy of the Mosaic Law (a discovery which shows the lamentable condition of the nation during the preceding reigns), Josiah not only purified the temple precincts, which were filled with vessels consecrated to Baal and Ashtoreth and to the heavenly bodies, and where houses of abomination had been erected, but he also defiled Tophet in the valley of the Son of Hinnom, where the Moloch-worship had been held, destroyed the altars which had been erected in the royal quarters, and made utter havoc of all the idolatrous shrines in the vicinity of Jerusalem which Solomon had erected, and which had been allowed to stand for 400 years, perhaps because of their architectural beauty. At the end of a thirty-one years' reign the body of Josiah was brought from the fatal battle-field of Megiddo (where the king had foolishly met Pharaoh-necho in his march against the Oriental empire), and buried in Jerusalem amid the lamentations of all the nation. Then followed the sad reigns of Josiah's three sons and one grandson. Jehoahaz, the first (though not the oldest), succeeded his father, taking precedence of Jehoiakim, perhaps because of the latter's inclination to an Egyptian alliance. In three months the victorious Necho dethroned him and carried him captive to Egypt, putting Eliakim or Jehoiakim in his place. A few years after, the Oriental empire of Nebuchadnezzar asserted its supremacy over Egypt, and Jehoiakim was obliged to become a vassal to that distinguished monarch. Three years later he rebelled against the Babylonian, and brought upon him the full force of Nebuchadnezzar's fury. The conqueror seems to have seized the person of the king to carry him to Babylon, and then to have permitted him to ransom himself by the delivery of much of the treasure of the temple. At Jehoiakim's death a new siege of the city by Nebuchadnezzar occurred, and the city was saved only by the delivery to Nebuchadnezzar of the young king, Jehoiachin, Jehoiakim's son, with his mother, wives, and court, and all the treasure that could be gleaned from the temple and the palace. At this time also the Babylonian monarch made a vast deportation of the higher classes, as well as the craftsmen, to Babylon. The manner in which this is narrated in the sacred story seems to show that the city was not entered by the victorious monarch. Nebuchadnezzar placed Mattaniah, Josiah's youngest son, on the throne, changing his name to Zedekiah. This weak and foolish king, trusting in an Egyptian alliance, dared to rebel against Babylon, and brought upon Jerusalem its destruction by Nebuchadnezzar in the year B. C. 586. After a siege of eighteen months, famine and superior numbers conquered the holy city. The walls were levelled, the temple and royal palace and the whole city were burned, and everything worth carrying off became plunder to the exasperated Nebuchadnezzar. Zedekiah's sons were slain before his face at Riblah on the Orontes, and then his own eyes were put out, and he was carried away to Babylon to adorn the monarch's triumph. Another deportation marked this epoch, so that only some of the poor of the land were left to be vine-dressers and husbandmen.

Third Period (586 B. C.–70 A. D.).—Jerusalem lay waste until the Persian monarchy absorbed the Babylonian, and the Persian hostility to idolatry produced a friendship between the new empire and the monotheistic Jews. One of Cyrus's first acts was to send back all the Jews who wished to Jerusalem with riches and honor. Less than 50,000 returned, however, an exile of from fifty to seventy years from Palestine having rooted the vast majority to their Oriental homes. This return, under Zerubbabel of the royal house (but not as king) and Jeshua the high priest, occurred probably in the year B. C. 536, and had largely a religious character. The rebuilding of the temple was the first object sought, and the work went on whilst Cyrus reigned. But during the reigns of Cambyses and Smerdis the enemies of the Jews succeeded in obtaining a royal veto on their enterprise. Darius Hystaspis, in his vigorous restoration of the policy of Cyrus throughout the empire, permitted the Jews to finish their temple, and in the sixth year of his reign (B. C. 516) the new structure was completed and dedicated.* It was the Holy City once more. The new temple, somewhat smaller than its predecessor, was also inferior in costly adorning to the structure of Solomon, but still it was a rallying-point for the scattered Jews. We may suppose that many found their way from year to year from their distant places of exile to dwell again by the hallowed precinct, themselves and their city now for ever purged from idolatry. In the year B. C. 457, Ezra the priest brought a train of 5000 Jews (nearly 2000 males) from the land of exile to Jerusalem, and acted as guide and teacher to the feeble restoration. In B. C. 445, Nehemiah visited Jerusalem and aroused the despondent people to build the walls of the city, which had been prostrate for 140 years. With wonderful enthusiasm and rapidity, in the face of threats from the neighboring hostile tribes, the people went to work, and in fifty-two days finished the great undertaking. Nehemiah acted as the Persian governor, and by his earnest piety and fearless conduct did much to establish the purity of the Jewish commonwealth.† The first Persian interference with the Jewish province (for such it now was) arose from the murder of Joshua by his brother Johanan, the high priest, in the temple, in the year B. C. 366. These two were grandsons

* Josephus makes a second return from Babylon under Darius Hystaspis, with Zerubbabel as leader. This return (he says) numbered 4,677,690 souls. He of course considers the Sheshbazzar of Ezra i. 11 as a different man from Zerubbabel.

† Josephus puts both Ezra and Nehemiah in Xerxes' time (B. C. 485–465). But the Artaxerxes of Ezra and Nehemiah could not have been the Xerxes of history, for Xerxes reigned only twenty years, but in Neh. v. 14 we find Artaxerxes' thirty-second year mentioned. Artaxerxes Longimanus reigned forty years.

of Eliashib, the high priest, whom Nehemiah was obliged to rebuke (Neh. xiii. 7), and Johanan,* the murderer, was son-in-law of Sanballat, the Samaritan governor (Neh. xiii. 28). Bagoses (Bagoas), the Persian general, by reason of this fearful murder defiled the temple by entering it, and laid a tax for Johanan's lifetime (which proved to be seven years longer) of fifty drachmas for each lamb used in the daily sacrifice. Johanan's two sons, Jaddua and Manasseh, held jointly the high priesthood after their father's death, until Manasseh was tempted to go off to the Samaritans, who, under Alexander's sanction, erected their own temple on Mount Gerizim, and made Manasseh their high priest. During Jaddua's high priesthood Alexander overthrew the Persian monarchy. His remarkable reception at Jerusalem by the high priest, his entrance into the temple to attend the offering of sacrifices, his delight at finding the record of Daniel predicting the overthrow of Persia by the Greeks, and his confirmation of the Jews in their own peculiar laws, are all graphically recited by Josephus. Alexander's visit was in B. C. 332, and the Seleucian empire dates from B. C. 312. The period between Alexander's death and the settlement of the empires of Syria and Egypt was a chaotic and stormy one. Ptolemy Lagi acquired possession of Jerusalem by a trick, and enslaved many thousands of the Jews, carrying them into Egypt. For more than a century Judæa was a tributary province of Egypt under the high priesthood of Onias, Simon the Just (who extensively repaired and enlarged the temple and the walls), Eleazar, Manasseh, Onias III. and Simon II. In the time of Simon the Just large donations were bestowed upon the temple by Ptolemy Philadelphus, in whose reign and by whose order (according to the received story) the Greek (Septuagint) translation of the Hebrew Scriptures was made for the Alexandrian library. After the battle of Raphia (B. C. 217), Ptolemy Philopator, who had there defeated Antiochus the Great, attempted to enter the *naos* of the temple, but was opposed by Simon II., the high priest; eighteen years after which Antiochus wrested Jerusalem from the Egyptian empire. With a brief exception of a year, in which the Egyptians again held the city, Jerusalem remained a province of Syria until the Maccabean revolt. During these thirty-five years Simon II. (who was grandson of Simon the Just) died, and Onias III. became high-priest, in whose administration the city was greatly disturbed by the quarrels of the Josephine family, a priestly family that had become rich through political favors received from Egypt. In B. C. 175, Antiochus IV. (Epiphanes) succeeded to the throne of Syria, and began deliberately to plan the extinguishment of all the peculiarities of the Jewish people. He was determined to make Jerusalem a Greek town. On the death of Onias he put Onias's brother, Joshua, into the high priesthood, changed his name to the Greek "Jason," introduced Greek games, put the temple service into relation with that of idolatrous shrines, and in every way undermined the integrity of the Jewish character and religion. At length a younger brother, also named Onias, changed in his turn his name to "Menelaus," and persuaded Antiochus (who was ready to sow dissensions) to make him high priest in place of Jason. Dissensions continued between the two Hellenizing brothers till Jason died. Antiochus now came to the city and stripped it of all its treasures and carried away a multitude of captives. In B. C. 168 he followed this by sending an army to Jerusalem, which entered on the sabbath day, made havoc of the inhabitants, and levelled the city walls. The temple was dedicated to the Olympian Jupiter, swine's flesh was offered upon the altar, and the defilement of the temple made complete. All the Jewish ritual was forbidden, and fearful punishments were visited on those who dared to uphold their ancient faith. This extreme policy of the Syrian monarch served to defeat its object. Under the guidance of the Asmonean family (so called from the priest Chashmon, an ancestor) the Jews organized a general revolt. In B. C. 165 they entered Jerusalem and dedicated the temple anew, the citadel being still held by the Syrians. The next year the monster Antiochus died of a loathsome disease. Under his successor fortune wavered between the Jews and the Syrians till the death of Judas called Maccabæus (the "Hammer") in B. C. 161. Alcimus, high priest, was a tool of the Græco-Syrian monarch, and strengthened himself in the citadel of Jerusalem until his death. Jonathan and Simon, brothers of Judas, were now the leaders of the revolt, and, taking advantage of a disputed succession to the Syrian throne on the part of Demetrius and Alexander Balas, Jonathan became high priest by Alexander's appointment, and then received for Jerusalem extraordinary gifts and privileges, including its thorough fortification. After Jonathan's death Simon became high priest, and captured the citadel (B. C. 142), which had held out against the Jews for more than twenty years. The citadel was razed and its hill lowered, and a new fortress, the Baris, built to command its site. The enterprising Asmonean then entered into alliance with the spreading power of the Romans, which had already overwhelmed Macedonia. John Hyrcanus succeeded his father Simon in the high priesthood, and successfully resisted an elaborate siege of the city by Antiochus Sidetes, who was compelled to grant him honorable terms and withdraw his army. Hyrcanus afterward accompanied Antiochus in his war with the Parthians. In B. C. 107, Hyrcanus died, and was succeeded by his son Aristobulus, who assumed the title of king. The history now becomes a series of fierce and bloody strifes. Aristobulus kills his brother. Another brother, Alexander Jannæus, who succeeds Aristobulus, is a cruel tyrant, and reigns for a quarter of a century, engaged equally in fighting the Syrians and destroying the Jews of the Pharisean party. His two sons quarrel for the throne, and this quarrel brings Pompey, the Roman general, into the Jewish history. He takes the part of Hyrcanus against Aristobulus. The latter holds the temple, and Pompey besieges it, capturing it at last by assault and the slaughter of 12,000 Jews. The Roman victor made Hyrcanus high priest (but no longer was the title of king allowed), destroyed the city walls, and carried off Aristobulus to Rome. This occurred in the year B. C. 63. Antipater, an Idumæan, became the chief adviser of Hyrcanus, and this crafty foreigner made such interest with Julius Cæsar that he received the procuratorship of Judæa, while Hyrcanus was allowed to assume the title of ethnarch. In B. C. 43, Antipater was murdered, and great disturbances arose. Antigonus, son of Aristobulus and nephew of Hyrcanus, came to Jerusalem with a Parthian force, and by stratagem brought the Parthians into the city, seized Hyrcanus, cut off his ears that he might be no longer high priest, and imprisoned Phasaelus, Antipater's son, who committed suicide in his prison. Herod, another son of Antipater, who had endeavored to resist the attack of Antigonus, escaped, and soon organized a Roman attack upon the usurper. At this time Herod married Mariamne, Hyrcanus's granddaughter. Herod's siege of Jerusalem lasted five months, when the city was stormed and a fearful slaughter followed; Antigonus was slain. Herod now determined to hold all power in his own hands, his marriage with Mariamne furnishing a slim claim to the Asmonean succession. He put out of the way all Asmoneans who might be claimants of the throne, his own wife Mariamne and her old grandfather falling victims at length to his cruelty; he cultivated the friendship of the Romans, enlarged the Baris into the grand fortress of Antonia, constructed a magnificent palace, built a theatre, and instituted games in honor of Cæsar. He then sought to win the esteem of the Jews themselves by building a new temple, rivalling the original edifice of Solomon in its richness and grandeur. For thirty-two years this extraordinary despot, plausible and politic, though remorselessly cruel, held firm sway over Judæa as king, beautifying the city and restoring its importance—loved by none, feared by all—maintaining peace and thrift in his kingdom, and showing a boldness and strength in his administration seldom equalled. In the year B. C. 4 of the common reckoning Herod died, a few months after the birth of our Lord in Bethlehem. Ten years later his son and successor, Archelaus, was deposed and Judæa made a Roman province. Pontius Pilate was the fifth Roman procurator of the province, under whose administration our Lord was crucified. The Roman government of Judæa was strong, and on the whole peaceful, for many years, except as the Jewish horror of Gentile defilement of the temple and Holy City produced from time to time collisions between the citizens and soldiers. These troubles were generally ended by a prudent yielding on the part of the Romans, until in A. D. 41, Herod Agrippa, grandson of Herod the Great, was made king of all Palestine by the emperor Claudius. This last Jewish monarch † built a strong wall to enclose the suburbs on the N. of Jerusalem, thus more than doubling the size of the city. On his death at Cæsarea (a visitation for his blasphemy), Rome again made Judæa a province, and a list of reckless procurators followed till the final fall of the Holy City. Cumanus, Felix, Albinus, and Florus were conspicuous for their utter disregard of Jewish customs and prejudices. Indignant outbursts, developing into riots and insurrections, occurred constantly, the nation meanwhile becoming thoroughly demoralized,

* Josephus says that Johanan's son, Manasseh, was Sanballat's son-in-law, but this is highly improbable. He also makes Sanballat to be living at Alexander's invasion, 113 years after he opposed Nehemiah!

† His son Agrippa, although made king of Chalcis and the northern tetrarchies, and though exercising influence in Jerusalem, seems never to have used royal power in Judæa.

until, in the year 66, Cestius Gallus, the prefect of Syria, was obliged to interfere and attempt, with the aid of the high priest and a peace party, to put down the insurgents. Gallus was severely beaten, and Rome now began the war in earnest. First, Vespasian, and afterwards his son Titus (both becoming emperors at length), conducted the war. The terrible dissensions among the Jews, the unspeakable sufferings of the besieged, the agony of the nation shut up within the walls of Jerusalem, the destruction of more than 1,000,000 Jews (including all the sick and old), the enslaving of all the youth, the entire demolition of the city, so as to leave no sign of its former occupancy,—all this forms one of the gloomiest pages in the annals of man.

Fourth Period (70 A. D. to this time).—In Hadrian's reign (A. D. 118–138) we next hear of Judæa in an attempt of formidable dimensions to rebuild the city of Jerusalem and establish the Jewish polity. Of this attempt Bar Cochba was the enterprising leader, who for three years kept the power of Rome at bay, until the insurrection was entirely quenched in the blood of hundreds of thousands. Hadrian's exasperation at this event made him first raze everything he could find on the site of Jerusalem, and then build a new city on the spot, which he peopled with Romans and called Ælia Capitolina. On the old temple site he erected a temple to Jupiter Capitolinus, and placed his own statue on the site of the holy of holies. No Jew was allowed to enter the new city, and this prohibition continued in effect till the empire became Christian, when permission was given them to weep by the W. temple-wall (where probably, in spite of the frequent and wholesale destructions, some few stones occupied their old place)—a custom continued until this very day. Constantine restored the old name, *Jerusalem*, although the Hadrianic name of Ælia is found in use for centuries afterward. His mother, Helena, devoted herself to recovering the lost sites of Christian importance in Jerusalem and elsewhere in the Holy Land, and erected costly churches on these supposed sites. Julian (A. D. 363) attempted to rebuild the Jewish temple and restore the Jewish worship as a part of his design against Christianity, but the work was hindered and stopped by subterraneous fires breaking out among the workmen, as Ammianus, an unprejudiced witness, asserts. For the first Christian centuries of the empire Jerusalem occupied the position of a venerable and sacred relic, to which pilgrims constantly found their way. Bishops presided over the Church there, and emperors from time to time built or repaired the holy edifices. The first disturbance of this peaceful condition was when the Persian monarch, Chosroes II., took the city by storm in 614, destroyed the churches, and slew the ecclesiastics. Fourteen years afterward the Greek emperor Heraclius, victorious over the Persians, restored the churches and re-established the Christian dominion in Jerusalem. But it was only for a short period. In 637, Omar made Jerusalem the first grand conquest of the rising Mohammedan power. From that day to this Jerusalem has been a Mohammedan city, except during the brief interval in which the crusaders held it. Ommiades, Abbassides, and Fatimites took their turns in ruling it from Damascus, Bagdad, and Cairo as their capitals; Christians were more or less persecuted from time to time, and the Church of the Holy Sepulchre was repeatedly destroyed and rebuilt; but Christian pilgrims continued to visit the Holy City, paying tribute to the Moslem rulers for the privilege. In 1099, after a Turkish tribe had had a brief possession of the city, and had shown unusual severity to the Christians, but had now been supplanted by the Egyptian khalif, the crusaders appeared before Jerusalem. In six weeks the city was in their hands and Godfrey of Bouillon elected its king. It remained in the hands of the Christians till Salah-ed-din (Saladin), the sultan of Egypt, reconquered it in 1187. Thrice afterward the city was for a short time in Christian hands. In 1517 it fell into the hands of Selim, the Turkish conqueror of Egypt, and remains in possession of his successor, the sultan, to this day.

Jerusalem in her decay.

III. Topography.—From the history of Jerusalem, briefly given above, it may readily be seen that its internal topography cannot be very accurately determined. Especially were the demolitions by Titus and Hadrian so complete that all traces of detail, even in the general surface of the ground, must be well nigh impossible. Hills were lowered and valleys filled up, and buildings reared upon ruins and of material afforded by other ruins. This, with the ordinary changes and decays of 3000 years, must make the internal topography of the city a puzzling problem. With the outer topography of the city the conditions are different. The eastern, southern, and western limits are accurately defined by the deep ravines of the Kedron and the Bene-Hinnom, and beyond these the Mount of Olives, the Hill of Evil Council, and the western heights remain as David must have seen them, so far as their natural features go. On the N. there are no such marked topographical features. From Scopus the descent to the city is gradual, and it was in this direction that the suburb existed which Herod Agrippa enclosed with a wall. The modern city walls, built only 300 years ago by Suleiman (Solyman the Magnificent), probably enclose the area of the ancient city of David's day, with the exception of the southern portion of Zion and Ophel, which are now without the walls. The positions of Zion and Moriah (of which latter Ophel is the southern extension) seem to be thoroughly determined. Mr. Fergusson's startling and ingenious theory that the ancient Zion was the temple hill, where the temple, the city of David, Baris, Acra, and Antonia stood, has too much to contend with it in uniform tradition, in spite of the few problems that this theory solves.* Josephus tells us (*Ant.*, 13. 6. 7)

* The name Zion came in use as the sacred name of Jerusalem in David's day, when the ark was under a tent on Mount Zion, making it the "holy hill," before Moriah received the temple and the title.

that Simon the Asmonean destroyed the citadel (τὴν ἄκραν) to the foundation, and then lowered the hill on which it had stood, so that the temple could be higher than it; and this work, he tells us, occupied three years. As the hill generally known as Zion is higher than the temple hill, this fact recorded by Josephus does not prove that the modern Zion is not the ancient Zion, but that the ἄκρα of Simon was not upon Zion. The citadel, and indeed the main city, when David conquered Jerusalem, was certainly the modern Zion. In later days a new citadel was formed on the northern hill or lower city (Acra), then much higher than now, which was afterwards superseded (when Simon had reduced its hill) by the Baris, and afterwards Antonia, nearer to the temple. Josephus calls the new part of the city enclosed by Agrippa's wall "Bezetha" (ἐπὶ χωρίως δὲ ἐκλήθη Βεζεθὰ τὸ νεόκτιστον μέρος), and yet speaks of it as a λόφος (crest). As a λόφος we should suppose the hill N. of the temple hill was intended—a hill which is high and well defined; but from the other words of Josephus, and the meaning of the word Bezetha (new town), we should suppose all that was encircled by Agrippa's wall from Hippicus to the Kedron was meant. Probably the name Bezetha was given to the whole, and the hill, as being contained within it, was also known by the name.

Such is our best arrangement of the general divisions of the city. Let us now follow the ancient walls. We may suppose that Nehemiah, in restoring the walls, followed the old foundations and rewalled the same area which constituted the city in David's day. In the rebuilding, as recorded by Nehemiah (chap. iii.), Eliashib the high priest is first mentioned as leading the workers at the sheep-gate, and at the wall as far as the Tower of the Hundred (Ha Meah) and the Tower of Hananeel. These places we must, of course, find in the temple region, for there the high priest would be set. Moreover, the passage in Jeremiah (xxxi. 38–40) seems to be a reference to the temple precincts rather than to the whole city, and the Tower of Hananeel is there prominent. The description in Nehemiah follows the wall from the centre of the E. side of the city, northward. The sheep-gate must have been in the centre of the temple-precinct wall, and perhaps derived its name from the sheep brought in by that gate for sacrifice. If the προβατικὴ of John v. 2 be the sheep-gate, and the Pool of Bethesda be the Fountain of the Virgin with its intermittent flow, then we should suppose the sheep-gate to be farther S., but the Pool of Bethesda may have been within the temple-precinct, and the present Fountain of the Virgin may receive to-day the intermittent effects which in former times showed themselves in another pool, now filled up. We are inclined to think that this "sheep-gate" is the same as the Mishneh or "second (gate)" of Zeph. i. 10 and the "college" of 2 Kings xxii. 14, where the prophetess Huldah lived. In this case the "fish-gate" would be the first gate (see Zeph. *l. c.*), and would represent the N. E. corner of the city, opposite the Mount of Olives. Between the "fish-gate" and the "sheep-gate" would stand the Tower of Hananeel and the Tower of Meah (or the Hundred). The "old gate" would be found next, as we follow the N. wall north-westward. The course would be along the "second wall" of Josephus, for the first or old wall seems to have been the northern fortification of Zion. The "old gate" may be really the "Jeshanah gate" (by leaving the adjective untranslated), and may be the gate leading to Jeshanah (2 Chron. xiii. 19, and Joseph. *Ant.*, 14. 15. 12), a town near Bethel. The "gate of Ephraim" comes next in Nehemiah (not in his account of the building, but in his record of the dedication xii. 39), and may have occupied the site of the present Damascus gate. Then follows "the broad wall" (some local peculiarities of the wall, perhaps for defence' sake), and then we reach the "tower of the furnaces," which may have stood over the western valley as the towers of Hananeel and the Hundred overlooked the eastern. The "valley-gate" would correspond with the present Jaffa gate. Near this was the dragon-well (Neh. ii. 13). The "dung-gate" (if our suppositions above are correct) would be a thousand cubits S. of the Jaffa gate (Neh. iii. 13); that is, on the south-western part of Zion over against the Birket-es-Sultan. The "fountain-gate" would lie on the opposite side of Zion, facing the Pool of Siloam. The "stairs that go down from the city of David" would be found between the fountain-gate and the S. W. temple-corner. They were probably an ascent from the king's gardens to the Davidian palace on Zion. The "sepulchres of David," the "made pool" ("king's pool" in Neh. ii. 14), and the "house of the mighty" were probably at the corner of Zion over against the S. W. temple-corner, where the wall crossed the Tyropœon. The "armory" is in this neighborhood, at the very corner where the wall turns abruptly southward to encircle Ophel. The "house of the high priest" and the "house of Azariah" are near this. After turning the extreme corner of Ophel southward we reach "the tower which lieth out from the king's high house," which may be the *extra* tower discovered by Capt. Warren's subterranean explorations (*Recovery of Jerusalem*, p. 229), as he himself suggests. It may have been built out in order to guard the "Fountain of the Virgin." The "water-gate" would be so called in relation to this fountain. By this water-gate on Ophel was a broad street or square where assemblies could be held in the immediate vicinity of the temple (Neh. viii. 1, 3, 16). Near by was the "horse-gate," famous as the spot where Athaliah was put to death. This gate was probably at this division between the Solomonian palace (S. E. of the temple) and the precinct of the temple itself. The gate "Miphkad" may mark some angle of the walls connected with the division, as a special corner is here mentioned (iii. 32) before we reach the sheep-gate again.

This view of the walls of Nehemiah's time will help us in our survey of the city in our Lord's day. Between those periods there had been much demolition and rebuilding in the city, as a glance at the brief history above will indicate, but we may believe that until the destruction of the city by Titus the general outline of the fortifications was the same. It will be seen by our sketch of the walls, as described by Nehemiah, that we find no difficulty in having the "stairs from the city of David" and "the sepulchres of David" mentioned after "Siloam;" an order which Mr. Fergusson thinks quite staggering to the old hypothesis of Zion and the city of David. The difficulty that Mr. Fergusson finds with the places enumerated in the last sixteen verses of the third chapter of Nehemiah arises from his overlooking the wall around Ophel. His own explanation, that the first sixteen verses refer to the city of Jerusalem, and the last sixteen to the city of David (his Zion or the temple-mount), is by no means natural.

The late researches of Capt. Wilson and Capt. Warren have thrown much light upon the question of the original temple-area. The discovery by the latter officer of immense stones *in situ* at the base of the S. E. corner of the present Haram wall, lying in the rocky foundation scarped to receive them, 80 feet below the present surface, and marked with the Phœnician quarry-marks in paint, destroys Mr. Fergusson's theory that the temple-area extended from the present S. W. corner of the Haram but 600 feet E., this S. E. corner being 900 feet E. The vaults under this south-eastern portion of the area seemed to him too slight to have supported the stoa, and Josephus's assertion that the temple-area was only a stade square, and thirdly the apparently unchanged position of the stones at the south-western corner, confirmed his view. But Capts. Wilson and Warren have proved that the south-eastern corner is unchanged, while the south-western has undoubtedly been added, as the real bed of the Tyropœon valley lies nearly 100 feet E. of the S. W. corner and under the Haram, while a new bed for that valley has been cut out of the rock, to prevent the moisture passing under the temple-area. This doubtless was the new portion enclosed by Herod. (Jos. *B. J.*, i. 21. 1.) About 600 feet N. of the S. W. corner is Wilson's arch, the beginning of the causeway across the Tyropœon, and for twenty-three feet S. of this Capt. Warren found the old Haram wall *in situ*. The inference from these discoveries is that the S. W. angle of the Haram wall was built by Herod in his reconstruction of the temple. The temple of Solomon, therefore, in all probability, occupied the site of the mosque of Omar (Kubbet-es-Sukhrah), while the palace of Solomon occupied the south-eastern portion of the Haram, from which was communication by road and bridge (Robinson's arch, or rather beneath Robinson's arch, the valley having been filled up with rubbish twenty feet deep before the new pavement and Robinson's arch were constructed by Herod) to the lower city on the plateau below and E. of the upper city. The causeway over Wilson's arch was of a later date, but doubtless marked the old and direct communication between temple and city. Herod's Stoa Basilica ran along the southern wall, but whether it extended to the S. E. corner of the Haram is uncertain. Perhaps Fergusson's argument is correct there, and the vaults beneath could not have supported it at that corner. However, as Capt. Warren shows, all the vaults known as Solomon's stables at the S. E. of the Haram are of modern construction, and there may have been in Herod's day a substruction quite sufficient for the support of Herod's stoa, so that the "pinnacle" (πτερύγιον) of the temple may have been exactly at the S. E. corner overhanging the Kedron. Beneath the present Haram surface are tanks and subterranean passages and aqueducts in great numbers (see *Recovery of Jerusalem*, ch. vii., and accompanying plan from Wilson and Warren), which at least seem to prove that the present area very largely coincided with the old temple-area;* but a com-

* The fortress of Baris, afterward enlarged to Antonia, stood probably in the north-western portion of the Haram, occupying perhaps about 500 feet square.

plete survey when Moslem fanaticism shall no longer be a hindrance will be necessary for any satisfactory arrangement of details.

The next point of special interest in the topography of Jerusalem is the site of the Holy Sepulchre and Calvary. The commonly received site lies about 400 feet N. of a line running from the Jaffa gate to the mosque of Omar (Kubbet-es-Sukhrah or "Dome of the Rock"), and about 300 feet W. of the street leading N. to the Damascus gate. That this site is the same selected by the empress Helena, although the edifices on the site have been many, is pretty clear, but whether Helena selected the true site three centuries after the crucifixion, and after Jerusalem had been so completely reduced to chaos by Titus, and then by Hadrian, is by no means so clear. The chief objection is, that the site must have been within the walls of the city in our Lord's day. The controversy here depends greatly on fixing the position of the gate Genuath in the first wall (which ran from the neighborhood of the Jaffa gate to the W. wall of the temple), from which gate the second wall (the main city wall) took its course northward. Now, the old arch near the S. end of the bazaars, which has been called the gate Genuath, is proved to be a comparatively recent structure, and the ruins near the present church of the Holy Sepulchre, which have been called fragments of the second wall, are proved to be portions of a church. (See *Recovery of Jerusalem*, pp. 9, 213.) If the Kasr Jalud, which stands on the highest point of the city, and is built of huge bevelled stones, like those of the foundations of the temple, be the ancient Hippicus, then the present site of the Holy Sepulchre is altogether wrongly fixed. But the Kasr Jalud *may be* Psephinus in the Agrippa wall, built after our Lord's day to include the northern suburbs. Another argument against the common theory is the necessity of extending the area of the city as much as possible to give it the size of so renowned a capital. Even by putting the Kasr Jalud in the original wall, we can only make the city to include about 200 acres. Its circumference would be only 2½ miles, and the population of a city of this size could not have been more than 25,000. (*Fergusson.*) The great suburb included in Agrippa's wall was twice the area of the old city, and if we crowd that as much as the old city, we shall have only 75,000 for the population of Jerusalem at its destruction by Titus. These numbers are extreme numbers, and we should probably reduce them largely to reach the truth. They certainly form a strong argument against still further contracting the "second wall" and putting the present site of the Holy Sepulchre outside of the city. And yet the

Jerusalem at the time of King Herod. (Sketch showing approximately the lie of rock.) 1, Temple of Solomon; 2, Palace of Solomon; 3, Added on by Herod; 4, Exhedra (the tower Baris or Antonia); 5, Antonia (the Castle); 6, Cloisters joining Antonia to Temple; 7, Xystus; 8, Agrippa's Palace; 9, Zion and Acra; 10, Lower Pool of Gihon, or Amygdalon; 11, Herod's Palace; 12, Bethesda, or Struthion; 13, Bridge built by Herod; 14, the Lower City, called sometimes Akre; 15, British cemetery, A. D. 1870.

arguments are far from conclusive. If we knew where the gate Genuath was, all would be known. If the present site is erroneously fixed, where are we to find the true site? An ingenious but not convincing argument has been put forth by the late Mr. Fisher Howe of Brooklyn in favor of the remarkable hillock over the grotto of Jeremiah, N. E. of the Damascus gate. The probabilities seem to point to some location on the ledge overhanging the Kedron, outside the St. Stephen's gate, for this has always been a place of graves, is close to the city walls, and is near to the prætorium of Pilate, which was in the fortress of Antonia at the N. of the temple. We have to leave the discussion in this state of incertitude.

The other points of topographical interest are Zion, the Tyropœon, the towers, and the pools. Zion (ἡ ἄνω πόλις of Josephus) is the high broad hill which lifts itself by an abrupt front 400 feet above the southern valley, its plateau extending from this brow 2400 feet to the Jaffa gate road, where a valley ran eastward from the gate to the Tyropœon. Along this northern brow the "first wall" was built. The width of this plateau at its broadest is about 1600 feet from the western valley to the Tyropœon. This height embraced nearly one-half of the ancient city. On the E. of it, beyond the Tyropœon, was the temple mount, 100 feet lower, and on the N. was the part of the city called Acra, which (some think) extended to the N. W. as far as the present Kasr Jalud, where the ground rises to a height of 73 feet above the top of Zion. Although, in that case, this one point of Acra was higher than any other point in the city, yet the main portion of Acra was lower than either Zion or the temple mount (after Simon had reduced its height), and was the "lower city" of ancient times; this latter appellation also including the valley of the Tyropœon. Zion was the seat of the citadel which David stormed, and its broad, elevated summit became the "city of David." Here were the royal palaces and tombs of David's line, connected by a bridge with the Solomonian palace (1 Kings vii. 1) and the temple on Moriah. Here also Herod built his palace, including the magnificent buildings called in honor of his friends Cæsar and Agrippa. On its north-eastern corner was the Xystus, or gymnasium, connected with the temple by another bridge, probably where Wilson's arch now is, the southern bridge being now marked by Robinson's arch. The height of Zion above the Mediterranean is 2537 feet. The Mount of Olives rises only 200 feet higher.

The Tyropœon ("valley of the cheesemongers") ran between Zion and Moriah southward into the Hinnom valley and the Kedron valley at their junction, the junction of the three forming the rich soil of the "king's garden" (Neh. iii. 15; Joseph., *Ant.*, 7. 14. 4). The Tyropœon continued in two branches northward, one toward the present Damascus gate, and the other toward the Jaffa gate. The latter seems to have been the recognized continuation of the Tyropœon. The depth of the valley increased rapidly as it reached southward, and at the south-western corner of the temple-area the bed of the valley was 90 feet below the present surface.

One of the most prominent objects in Jerusalem is the old tower in the midst of the citadel near the Jaffa gate, 56 feet 6 inches on one face, and 70 feet 3 inches on the other. It has been generally supposed to be Hippicus (Joseph., *B. J.*, 5. 4. 3). Whichever one of the Herodian towers this was, its style of building tempts us to believe that Herod only rebuilt an ancient tower, and that we may have here "the tower of David builded for an armory" (Cant. iv. 4). If this be Hippicus, we may suppose Phasaelus and Mariamne lay to the E., and that the Kasr Jalud, 1200 feet to the N., is Psephinus.

The pools (so called) in and by Jerusalem which now attract attention are Birket Mamilla, Birket Sultan, the Pool of Siloam, and the Fountain of the Virgin without the walls, and Birket Israil (or Es-Serain) and the Pool of Hezekiah within the walls. The Birket Mamilla is supposed to be the "upper pool" (Isa. vii. 3; 2 Kings xviii. 17). It lies 2000 feet W. of the Jaffa gate. The Birket Sultan is a section of the great western valley dammed up for more than 500 feet. The Pool of Siloam (Neh. iii. 15; John ix. 7) is in the mouth of the Tyropœon at its junction with the Hinnom and Kedron. It was probably used to irrigate the "king's garden." It is connected by a long, rude, and crooked subterranean passage with the Fountain of the Virgin on the other side of Ophel, from which the water flows "softly" (Isa. viii. 6). This subterraneous aqueduct is connected with extensive rock-hewn caverns, which were doubtless part of the fortifications of Ophel. (See the deeply interesting account of their discovery by Capt. Warren in his *Recovery of Jerusalem*, pp. 190–198.) The Fountain of the Virgin is a pool on the eastern side of the Ophel rock, to which is a descent of twenty-eight steps. The pool is lower than the bottom of the valley without, and is excavated deeply within the rocky wall. The water comes into it from the direction of the temple, but has never been traced. It has a periodic and sudden

rise of a foot in height, the periods varying from two or three times a day to once in two or three days. This periodic troubling of the water seems to mark the Fountain of the Virgin as the Pool of Bethesda, unless we may the rather suppose a pool farther up on the temple mount formerly received this intermittent flow. The requirements of the sheep-gate (as we have seen) seem to put Bethesda farther N. The Birket Israil, just inside of the St. Stephen's gate and N. of the Haram (supposed by Dr. Robinson to be the trench of Antonia), is the damming up of the valley that runs E. of Bezetha in a south-eastern direction, originally under the north-eastern corner of the Haram, into the Kedron. It is 360 feet long, 130 feet broad, and 75 feet deep. The Pool of Hezekiah (*Amygdalon* of Josephus) is N. of the Jaffa gate street and to the S. W. of the church of the Holy Sepulchre. It is supplied by an aqueduct from the Birket Mamilla. It lies among the houses of the Christian quarter. It is 240 feet long and 144 feet wide. It seems to be properly designated. (See 2 Kings xx. 20; 2 Chron. xxxii. 30.) A system of wells and aqueducts in the Kedron ravine below Jerusalem (the En-Rogel of antiquity) presents features of peculiar interest. One of several ancient aqueducts still conducts the water from Solomon's Pools beyond Bethlehem to the city.

For further details of modern discovery in the topography of the city we refer to the reports of Capts. Wilson and Warren, which have settled so many questions and so greatly excited public interest and expectation.

Jerusalem is in lat. 31° 46′ 35″ N. and lon. 35° 18′ 30″ E., lying on the very summit of the great mountain-ridge which extends from the plain of Esdraelon to the southern desert, the ridge itself being higher farther S. near Hebron, where it reaches an elevation of 3000 feet above the Mediterranean Sea. At Jerusalem (Mount of Olives) the elevation is 2700 feet. The highest part of the city itself is 2600 feet (Kasr Jalud). From the Mount of Olives the descent is rapid to the Jordan valley. In 10 miles one descends 3700 feet. Westward the descent is more gradual to the plain along the Mediterranean coast, about 2500 feet in 15 miles. HOWARD CROSBY.

Jerusalem, tp. of Yates co., N. Y., on Keuka or Crooked Lake. It contains 5 churches and several villages. It was first settled by Jemima Wilkinson and her followers, called Wilkinsonians, or Friends, the latter name being employed by themselves. The sect is now extinct. Pop. 2612.

Jerusalem, post-tp. of Davie co., N. C. Pop. 1544.

Jerusalem, post-v. of Malaga tp., Monroe co., O. Pop. 91.

Jerusalem, post-v., cap. of Southampton co., Va., 75 miles S. S. E. of Richmond and 7 miles from Newsom's Dépôt, on the Seaboard and Roanoke R. R. It is on the Nottoway River. Pop. of tp. 2061.

Jerusalem Artichoke, a species of sunflower (*Helianthus tuberosus* of Linnæus, order Compositæ), which bears subterranean tubers of the same nature as potatoes. The tubers got the name of artichokes from a resemblance in taste to the true ARTICHOKE (which see), while the name "Jerusalem" is a curious English corruption of *girasola*, Italian for "sunflower." The plant probably reached England by way of Italy or Spain. The French name is *topinambour*. It has been cultivated in Europe ever since the beginning of the seventeenth century, and doubtless came from America, the native country of the whole sunflower genus. It is generally said to be of Brazilian origin, but there is no historical evidence of it; it is not known to occur either there or in any part of South America, and it has all the characters of a plant of a warm temperate climate. Moreover, it is so much like a species of sunflower (*H. doronicoides*) indigenous to the Valley of the Mississippi, which bears long and narrow tubers, that it may well be regarded as a probable variety of this species, altered and fixed by cultivation. The tubers, boiled or stewed, are of delicate flavor and are much esteemed in Europe. In the U. S. they are more commonly pickled or used as food for swine. A. GRAY.

Jerusalem Cherry, the popular name of two species of *Solanum* cultivated as ornamental house-plants (*Pseudocapsicum* and *Cápsicastrum*), first introduced into England from the island of Madeira about the close of the sixteenth century. It may be propagated either from seeds or cuttings, grows only two or three feet high, and bears berries about the size of cherries. It is uncertain how it came by the name Jerusalem.

Jerusalem Plantation, tp. of Franklin co., Me. Pop. 32.

Jer'vis (Sir JOHN), b. at Meaford, England, Jan. 9, 1734; entered the navy at ten years of age; became post-captain in 1760, rear-admiral in 1787, and admiral of the blue in 1795. He distinguished himself in several naval engagements, chief among which was the celebrated action in which he defeated a Spanish squadron of twice his strength (Feb. 14, 1797) off Cape St. Vincent, in reward of which Jervis was created earl of St. Vincent and received a pension of £3000. He was first lord of the admiralty 1801–04, and d. Mar. 15, 1823.

Jer'vois (Col. Sir WILLIAM F. D.), R. E., K. C. M. G., b. in 1821; educated at the Royal Military Academy at Woolwich. After receiving his commission in the royal engineers in 1839, he served in Africa (1841–48), in the Kaffer war (1846–47), receiving from Sir Harry Smith, governor and commander-in-chief of South Africa, his commendation as "one of the most able, energetic, and zealous officers he had ever exacted more than his share of duty from." Made captain in 1847, he received the brevet of major in 1854; in 1856 he was appointed assistant inspector-general of fortifications, and subsequently deputy director of fortifications. In this capacity he prepared in 1858, by direction of the secretary of state for war, a memoir relating to the general defence of the country, in which a system of fortifications for the security of the vital points was proposed in detail, and a plan for the defence of London was suggested. The commission appointed in 1859, of which Maj. Jervois was secretary, adopted the arguments and principles contained in the memorandum submitted by him to the secretary of state for war in the previous year. The report of the royal commission referred to, and approved by, the permanent defence committee, has since been carried into effect. This report, the first formulated expression in England of principles governing *sea-coast defence*, is not only in its governing principles and details of application, but in the arguments by which they are sustained, in striking harmony with the reports of our own board of engineers which inaugurated our system of defence against maritime invasion. The English discussion was, however, coeval with the introduction of rifled ordnance, the application of iron for defensive purposes both in ships and fortifications, and the subsequent advance in size and power of artillery. The eventful combat between the Monitor and Merrimack in Hampton Roads, Mar. 8, 1862, shook the public confidence in England, and the royal commission was reassembled to report on the defences of Spithead, to which Parliament had made heavy grants of money; and a special committee on the same subject, of which Maj. Jervois was also secretary, reported in 1864. The result of these reports was the adhesion of the British government to the principles contained in the first report. Promoted to be lieutenant-colonel in 1862, he became a full colonel in 1867. As a member of the special committee on the application of iron to defensive purposes (1861–64), he has taken a prominent part in these important questions, and has been active in designing and superintending the execution of works of fortification both at home and abroad. In 1863 he was nominated a companion of the Bath, and appointed knight commander of the order of St. Michael and St. George. In 1875 he succeeded Sir Andrew Clarke, Col. R. E., as governor of the Straits Settlements, comprising Singapore, Penang, and Malacca. J. G. BARNARD.

Jesi, a town of Italy. See IESI.

Jes'samine, the common English name for species of *Jasminum*, a genus of erect or climbing shrubby plants, natives of the Old World, of which several species are cultivated for ornament, the flowers being both beautiful and fragrant. The common species are *Jasminum officinale* (white jessamine) and *J. odoratissimum* (yellow jessamine), and in conservatories *J. Sambac* of tropical India, which exhales a powerful fragrance at evening. The jessamine family is now regarded as a tribe of the olive family (order Oleaceæ), and is distinguished from the other regular monopetalous flowers by having stamens fewer than the lobes of the corolla. The so-called jessamine of the Southern U. S. is of another order. (See JASMINE, YELLOW.) A. GRAY.

Jessamine, county of E. Central Kentucky. Area, 250 square miles. It is a beautiful, undulating region, with a good soil, based upon cavernous limestone. Grain and live-stock are staple products. It is traversed by the Kentucky Central R. R. Cap. Nicholasville. Pop. 8638.

Jes'se (EDWARD), b. at Hutton Cranswick, Yorkshire, England, Jan. 14, 1780; was deputy surveyor of the royal parks and palaces at Windsor, Richmond, and Hampton Court. His fondness for outdoor exercises and for animal life was strongly fostered by the nature of his occupations, and caused him to observe and record many curious facts in natural history. He published a number of very entertaining and popular works, among which were *Gleanings in Natural History* (3 vols., 1832–35), *An Angler's Rambles* (1836), *Anecdotes of Dogs* (1846), and *Lectures on Natural History* (1863). He also published several topographical handbooks upon Windsor and the royal palaces, besides

editing Izaak Walton's *Angler* and Gilbert White's *Selborne.* Mr. Jesse removed to Brighton in 1862, where he became so useful a citizen that his bust was placed in the Pavilion by popular subscription in 1865. D. at Brighton Mar. 28, 1868.

Jesse (John Heneage), b. in England about 1815, was a son of Edward, noticed above; wrote numerous volumes of memoirs illustrating English history during the eighteenth century. D. in July, 1874.

Jesso. See Yesso.

Jessore′, town of British India, the capital of a district of the same name in the presidency of Bengal. The district comprises 3512 square miles of the centre of the Ganges delta, and is as fertile as unhealthy. Its capital is situated 66 miles N. E. of Calcutta, and has a college in which both English and Hindoo literature are taught. Pop. of district, 400,000.

Jes′son Land, tp. of Sibley co., Minn. Pop. 749.

Jessulmeer′, or **Jaysulmir,** one of the Rajpoot states under English protection, in Western Hindostan, situated between 26° and 28° N. lat. and 69° and 72° E. lon. It comprises 9700 square miles of very poor soil, and has 74,400 inhabitants. Its capital, of the same name, is a well-built city with 35,000 inhabitants. Water is very scarce in its vicinity, and must be provided for by immense tanks. The fortress contains the palace, 6 temples, 8 wells, and its walls are ornamented with gilded towers and pinnacles.

Jes′sup, post-v. of Buchanan co., Ia., on the Iowa division of the Illinois Central R. R.

Jessup, tp. of Susquehanna co., Pa. Pop. 804.

Jessup (William), LL.D., b. in Southampton, Suffolk co., N. Y., June 21, 1797; graduated at Yale in 1815; removed to Montrose, Pa., in 1818; was admitted to the bar in 1820; was strongly interested in the missionary and temperance causes and in popular education; was presiding judge of the eleventh judicial district of Pennsylvania 1838–51. D. at Montrose, Pa., Sept. 11, 1868.

Jessup Lake, in Orange co., Fla., 12 miles S. of Enterprise, communicates with St. John's River by a navigable outlet. The lake is clear, has a sandy bottom, and abounds in fish and game birds. The shores are high bluffs. There are good wharves constructed here. It is the seat of Lake Jessup colony. The surrounding region is beautiful, well-timbered, and fertile. There are several medicinal springs in the neighborhood.

Jes′uits, or **The Society of Jesus,** a religious order of the Roman Catholic Church, which, although entirely destitute of any original religious idea, and merely confining itself to practical purposes—missionary, educational, political, commercial, always of a subordinate, often of a doubtful nature—has played a more conspicuous part in the history of the Christian Church than any other religious order, and exercised a most powerful, though only in some cases a beneficial, influence. It was founded by Ignatius Loyola (which see), and established by Pope Paul III. Sept. 27, 1540. Its organization it received from its founder and first general, but its true character from his successor. It was Loyola's idea to form a monastic order with a definite practical purpose. To the vows, common to all religious orders, of chastity, poverty, and obedience, he added that of missionary activity; and as he was a military man by profession, and entirely without originality or spontaneity, he conferred upon the religious order he founded his military ideas of organization, of training, subordination, and implicit obedience. But under its second general, James Laynez (1558–65), the order freed itself to a great extent from its monkish apparel. Its missionary task retreated to the background, and its principal object became the maintenance of the absolute dominion of the pope against Protestantism, kingdoms, universities, œcumenical councils, bishops, or anything which showed an independent tendency. Its position was most exceptional. It enjoyed at once all the privileges of the mendicant orders and the secular clergy. It held its property free of taxes either to king or Church, and its members were independent not only of the jurisdiction of the state, but also of that of the bishops; they acknowledged no other authority than that which emanated from their general. The priestly office was conferred upon them in full, as far as regards its power, but not with all its duties and restrictions. They had unlimited power of dispensation and indulgence, and they could administer the sacraments even in a period of interdict. At the same time, they were not separated very conspicuously from the world either in dress or manners. They had the education of the world, and they took part very freely in the enjoyments of the world; prayer and fasting were not the most striking characteristics of a Jesuit. With this most favorable position with respect to the outside world, the society combined a most rigorous internal organization. The authority of the general was absolute, and the training of the members such as to make the enforcement of this authority unfailing. They were divided into four classes—novices, scholastics, coadjutors, and professed. After a short preparation the novice spends two years in spiritual exercises, in prayers, meditations, fasts, and ascetic practices, in serving the sick and the poor, living all the while under the closest supervision. If after the lapse of these two years he finds himself, and is found by the elder members of the order, capable of becoming a suitable instrument—that is, capable of giving up all individuality of will and all independence of intellect—he enters the class of scholastics, where he undergoes a long and severe training in theology, philosophy, philology, and science. Every advancement from one class to another is exceedingly difficult. Only men of decided talents and rare energy are able to reach the highest class, that of professed, whose members elect the general among themselves. But even with the humblest and least gifted members of the society the moral training is perfect. It is in some respects very simple. It consists in nothing but implicit obedience to the rules of the order and the authority of the general. But it must be perfect or else no membership is granted. Every passion, every sympathy, every talent, every tendency, which possibly could come into collision with the purposes of the society is crushed or burnt out of the soul. The order was thus able to work with the unfailing certainty of a machine, and in a loose and rather disorderly state of society, like that of Europe in the sixteenth, seventeenth, and eighteenth centuries, its power could not but be immense.

At the death of Loyola the society numbered 1000 members in 12 provinces; at the celebration of its first centennial jubilee, 13,112 members in 32 provinces; at the time of its suppression, one century later, 22,589 members, 24 professed houses, 669 colleges, 176 seminaries, 61 novitiates, 335 residences, and 275 missionary stations in heathen or Protestant countries. In Italy, Spain, Portugal, and Austria the order took root immediately. To the higher classes of society the Franciscans had become offensive by their coarseness and vulgarity, and the Dominicans troublesome by their bluntness and rigorousness. The easy and elegant Jesuit was just what was wanted. His eloquent casuistry threw a veil over any vice or crime, and very soon every monarch, prince, and nobleman had a Jesuit for confessor; which circumstance gave the order an enormous social and political influence. In the Thirty Years' war it was Father Lamormain, the confessor of Ferdinand II., who defeated Wallenstein, and it was the Jesuits who kept alive the league between Austria and Bavaria. To the middle classes they recommended themselves by their excellent schools and their learning. In many countries they actually controlled all education; at the Roman Catholic universities of Germany—Cologne, Münich, Treves, Augsburg, etc.—they held chairs a few years after the establishment of the order. Still more decided was their success as missionaries to the pagans. They penetrated into Japan in 1549, and into China in 1584; in the former country they possessed 3 colleges, 8 residences, and 3 professed houses in 1613, and in 1692 the number of their converts in the Chinese province of Kiangsu is said to have been more than 100,000. They had flourishing stations in Cochin-China, Tonquin, Hindostan, Ceylon, Madagascar, and on the coast of Africa. In Paraguay they christianized the whole nation, and formed a civilized society whose prosperity and rapid progress excited general admiration. Brazil, Mexico, and North America are also in debt to them, for they carried civilization with them wherever they went. In the Protestant countries, however, they never got a foothold, though they tried very hard in England and Sweden. In France their situation was generally precarious. The Sorbonne, the bishops, and even the Parliament, were opposed to them, and very slow in admitting them. After the attempt of Chatel, a former pupil of theirs, on the life of Henry IV. in 1594, they were even expelled, though only for a short time; in 1603 they were allowed to return. Richelieu and Mazarin showed them considerable favor, and under the reign of Louis XIV. they gradually grew in power. But just at this time they met with their first heavy reverse of fortune. In their contest with Jansenius they were the losers in spite of their great dexterity in theological dispute, and when, in 1556, Pascal published his *Lettres Provinciales*, a blow was inflicted on them from which they never recovered. The looseness of their morals, the egotism of their aims, the falseness of their actions, were thoroughly unmasked by this book. They became odious and subjects of general suspicion. Under these unfavorable circumstances, and while driven onward in an opposite direction by their own antecedents, they clashed against the general enlightenment of the eighteenth cen-

tury, which they could neither adopt nor suppress; and this became their ruin. An insurrection in Paraguay against Portugal, in which the Jesuits were implicated, gave Pombal an opportunity in 1758 of bringing them before the courts. While the trial was going on an attempt was made to assassinate the king, and (Sept. 3, 1759) a royal decree expelled the society from the Portuguese dominions and confiscated their property. In France not only public opinion, but also the court, especially Madame de Pompadour and the prime minister, Choiseul, were against them, and a scandalous lawsuit in which they became entangled caused a general outburst of indignation. They had a missionary and commercial station on the island of Martinique. Thence their procurator, Father Lavalette, consigned two vessels to a house in Marseilles. The vessels were captured by the English, and when Father Lavalette was unable to meet the bills which he had drawn on the credit of the delivery of the costly cargo, a case was brought into the courts of Marseilles against the order, and decided in favor of the plaintiff. The order tried to escape from paying the debt by appealing to the Parliament of Paris, and pleading that Father Lavalette had acted without orders from the general and against his instructions. In the course of the trial other scandalous affairs became known, and in 1764 a royal decree expelled the society from France. Apr. 2, 1767, all the Jesuits in Spain and in the Spanish colonies were arrested at the same hour and sent to the papal dominions; and July 21, 1773, a papal bull dissolving the whole order, on the request of France, Spain, Portugal, Parma, Naples, and Austria, was issued. Its property was confiscated, but in most countries its members received annuities and were allowed to live as private persons. Frederick II. of Prussia showed them much kindness, and Catherine II. even permitted them to exist as a society in Russia under the head of a vicar-general. In 1801, Pope Pius VII. confirmed this branch of the order, and immediately after the fall of Napoleon (Aug. 7, 1814) he re-established the society in its old form. During the exhaustion and reaction which prevailed throughout Europe between 1815 and 1848 the Jesuits succeeded in penetrating into all countries, with or without the acknowledgment of the governments; but the general conditions of civilized life have so entirely changed character in the last century the order has been compelled to alter its method of proceeding. Science was once its weapon—it now appeals to ignorance; court intrigue was formerly its arena—it now mixes in political party machinations. But although the means are changed, the aim is still the same—to stop the progress of civilization and enslave mankind under the sceptre of the pope; and the Syllabus and the dogma of infallibility are among its latest achievements. CLEMENS PETERSEN.

Jesuits' Bark. See CINCHONA.

Jes'up, post-v. and cap. of Wayne co., Ga., at the intersection of the Macon and Brunswick and the Atlantic and Gulf R. Rs. Pop. about 250. W. G. MCADOO.

Jesup (MORRIS KETCHUM), b. at Hartford, Conn., June 21, 1830; locating in New York City, became member of the Chamber of Commerce in Feb., 1863; president of the Five Points House of Industry since 1870; was president of the Young Men's Christian Association 1871–75; is treasurer of the university and one of its council; vice-president and treasurer of the City Mission, and manager of the Presbyterian Hospital.

Jesup (THOMAS SIDNEY), b. in Virginia in 1788; entered the army in 1808; served as acting adjutant-general to Brig.-Gen. Hull 1812; brevetted colonel for gallantry at Chippewa and Niagara, rose to quartermaster-general, with rank of brigadier-general, May, 1818; took command of the army in the Creek nation, Ala., and in Florida 1836; wounded in action with Seminoles Jan., 1838, and returned to duty in his department. D. June 10, 1860.

Je'sus Christ. This name is not compound, but consists of the proper name Jesus, and the official designation Christ—Jesus the Christ. Jesus is the Greek form of the Hebrew Joshua or Jehoshua, and means Jehovah his salvation, or the salvation of Jehovah. Christ is equivalent to the Hebrew Messiah, and means the Anointed. The name Jesus is applied to several persons in the Scriptures, and was probably not an uncommon one.

Into the theological questions connected with the person of Jesus Christ we do not enter, nor do we attempt any interpretations of his words, nor discuss any disputed points in regard to the relative authority of the several Evangelists. Those seeking information on these points are referred to the special works named at the end of this article. There is, and doubtless will continue to be, much difference of opinion among harmonists in regard to the chronological order of events in his life, but there is general agreement as to the most important facts. Jesus was born in Bethlehem, a small Judæan town already famous as the birthplace of King David, and about 6 miles S. of Jerusalem. The home of his mother, Mary, was Nazareth in Galilee, but she had come to Bethlehem with her husband, Joseph, a descendant of David, in obedience to a decree of enrollment and taxation which seems to have required Joseph's presence at the original home of his family. Mary is thought to have been, like Joseph, descended from the royal house of Judah. The date of the Nativity is uncertain. (See CHRISTMAS.) Jesus was born miraculously of a virgin mother by the power of the Holy Ghost. On the eighth day after his birth He was circumcised, and on the fortieth day he was taken to the temple, when the customary offerings of purification were made by his mother. The visit of certain "wise men," or magians, who came probably from Persia, to the infant at Bethlehem with gifts proper for a king, and the inquiries made by them previously at Jerusalem for a newly-born king of the Jews, excited the jealousy of Herod, then ruling over Judæa and the neighboring territories under the protection of the Romans, and he issued orders for a massacre of young children at Bethlehem. Jesus was taken by divine direction to Egypt in time to escape the destruction which threatened him, and the holy family remained out of Herod's jurisdiction until his death a short time after. Joseph seems to have intended to rear the child at Bethlehem, as the city of David, but another warning from Heaven caused him to return to Nazareth. Twelve years later Joseph and Mary took Jesus with them to Jerusalem to keep the Passover, and he then showed that he was already conscious of a divine mission. He lived at Nazareth, however, for eighteen years longer, and probably assisted Joseph at his trade, that of a carpenter. Joseph is not mentioned again in the Gospels, and is supposed to have died before Christ entered on his public labors.

When Jesus was about thirty years old his kinsman, John, the son of Zacharias, began to announce the near approach of the kingdom of God, and to call his countrymen to prepare for it by a moral reformation, and by accepting baptism at his hands as a sign of the remission of sin. Jesus appeared among the throngs which gathered about John the Baptist at the Jordan, and insisted on being baptized by him. After John had reluctantly administered the rite to one whom he felt by a kind of prophetic instinct, as it would seem, to be holier than himself, he was shown that Jesus was the Messiah, the Son of God. He announced him as such to those about him, among whom were probably some representatives of the Sanhedrim, or ecclesiastical senate of the Hebrews, sent from Jerusalem to inquire into John's own work and claims. After his baptism Jesus withdrew, under a divine impulse, into the wilderness, where he encountered and overcame a series of temptations addressed to him by Satan. A few of John's disciples now attached themselves to Jesus, and accompanied him to Galilee. The first of his miracles was wrought at Cana, a few miles from Nazareth, where water was changed into wine. Soon after he began his public ministry, in the proper sense, in Jerusalem, at the Passover. He announced himself to the heads of the nation there as a messenger of Heaven by expelling from the temple-court those who had been allowed to carry on traffic in it for the convenience of worshippers. One member of the Sanhedrim, Nicodemus, became at this time a secret adherent of the new prophet. For a few months Jesus carried on a work in Judæa similar to that in which John the Baptist was engaged, and seemed to be co-operating with the latter in the effort to bring about a national repentance. Attempts being made to create dissensions between his followers and those of John he retired to Galilee. It is probable that some time was now passed by Christ in comparative seclusion, and that his disciples were for a while dismissed. The latter are not said to have been with him when he next presented himself at Jerusalem, on the occasion of a feast. If, as is probable, though many think otherwise, this feast were the Passover, it marked the close of the first year of Christ's ministry, during which he had constantly in view an impression to be made on the men of influence and authority at Jerusalem. At this visit Jesus raised an issue with the Jewish hierarchy by disregarding the traditional interpretation of the fourth commandment, and offended them still more by the way in which he spoke of his own relation to God. From this time, at any rate, he had a body of powerful and implacable enemies in Judæa, who never ceased to watch and oppose him.

Near the time of this second Passover, John the Baptist was imprisoned by Herod Antipas, whom he had rebuked for his adulterous marriage with his brother's wife Herodias, and John's effort to bring Israel to repentance was at an end. Jesus now entered on a new stage of his work, to be carried on in Galilee. After meeting a repulse at Nazareth, he fixed his residence at Capernaum, on the Lake of Tiberias, and from that point made a series of circuits through

Galilee. His old followers rejoined him, and he at once began to add to their number, while by his discourses and miracles he speedily attracted crowds of more or less appreciative hearers. In close connection with the most famous of the Galilean discourses, the Sermon on the Mount, Jesus chose twelve of his disciples to be, under the name of apostles, his constant companions, and by degrees his associates in labor. Proofs were multiplying of the indisposition of Israel as a whole to profit by the mission of Jesus of Nazareth. Emissaries of the Judæan priesthood were busy in Galilee, and gradually formed a hostile party there. Jewish beliefs and prejudices were also operative in the minds of those who were attached to his person. His own relatives misapprehended him, and even John the Baptist sent a message from his prison which expressed his perplexity at the course which Jesus was pursuing. Nevertheless, the end of his work in Galilee was practically secured. He had a body of faithful adherents, who loved and trusted if they did not understand him, and whom he was educating for future service.

As the next Passover drew near, John the Baptist was put to death by Herod at the instigation of his wife. From this time Jesus began to withdraw as much as possible from public notice in Galilee, and to devote himself to the instruction of the twelve apostles. Entire seclusion was out of the question, and some great miracles were wrought during this period. In the month of October, or about six months after the death of John the Baptist, Jesus began his second and final attempt to gain a hearing from the representatives of the nation at Jerusalem. He appeared somewhat suddenly at the Feast of Tabernacles, and by miracles and discourses, as well as by the angry opposition which he excited, he at least succeeded in awakening new interest in his movements, and in fixing the attention of the nation upon himself during the rest of his career. It may be inferred that he then returned to Galilee, and set about arranging what had in some sense the air of a royal progress to Jerusalem. Seventy disciples were sent, two by two, to the various towns which he designed to visit, and he followed them, preaching and working miracles, as he had been accustomed to do in Galilee. The scene of these new labors must have been Peræa, the country E. of the Jordan, through which lay the longer but safer route from Galilee to Judæa. It bordered on the latter province for a considerable distance, and whatever excited general interest in Peræa would soon be known across the river. That intense excitement did follow Christ's appearance in a region which hitherto, so far as we know, he had scarcely visited, is clearly indicated in the Gospels. In December, at the Feast of the Dedication, Jesus was again at Jerusalem. He was met by questions about his Messiahship, which show that his claims were undergoing eager discussion, but his answers only provoked fresh hostility, and he narrowly escaped being stoned as a blasphemer. His home during these visits to the ecclesiastical capital was probably the house of Lazarus at Bethany, 2 miles E. of the city. Lazarus and his sisters, Mary and Martha, must before this time have become disciples and intimate friends of Christ. On his return to Peræa, Christ, instead of going from place to place as before, fixed his abode at Bethabara (or Bethany), near the scene of his baptism. Hence he was summoned to Bethany in Judæa by the dangerous illness of Lazarus, and arriving after the latter had been four days dead, he wrought the greatest of his recorded miracles by restoring his friend to life. This act led the Hebrew council, or such of them as were under the influence of the high priest Caiaphas, to resolve formally and finally on the destruction of the Galilean prophet. Whatever he was, he could not be the Messiah, and he might become the occasion of popular tumults which would draw upon the nation the vengeance of their Roman masters. Jesus now for a time concealed himself, taking refuge in a town called Ephraim, 20 miles N. E. of Jerusalem.

Another Passover approached, and Jesus prepared to attend it in such a way as to terminate his royal progress royally. He seems to have gone northward and joined one of the companies of Galilean pilgrims then moving eastward near the Samaritan border in order to go to the feast by the ordinary Peræan route. The suburbs of Jerusalem were reached, probably, on the evening before the sabbath. Christ and his followers stopped at Bethany, where more than one house was open to them. On the first day of the week, and evidently in pursuance of arrangements previously made, Jesus entered the Holy City, riding on an ass never before used, and surrounded by an intensely excited throng, composed largely, no doubt, of pilgrims from the N. and E. The multitude hailed him as "Son of David" and "King of Israel," and he distinctly sanctioned their acclamations. On the following day he went to the city again, and repeated the act by which he had announced himself and his mission three years before—the cleansing of the temple. The third day, Tuesday, was also spent in the temple, but was devoted to teaching. As Jesus and his apostles returned each evening to Bethany, they may be supposed to have paused for prayer in the garden of Gethsemane, at the western base of the Mount of Olives. The next day seems to have been passed in retirement. Meanwhile, Christ's enemies, not daring publicly to arrest one who was for the time so popular, resolved to get him into their power in some clandestine manner, and after the feast should be over. An apostle prepared the way for the accomplishment of their purpose. Judas Iscariot bargained with them for the possession of his Master's person, and watched for the opportunity to complete his treachery. On the evening of Thursday, Jesus kept the Passover with his disciples, coming once more to Jerusalem for the purpose. While they were at the table he indicated to Judas, as also to John and Peter, his knowledge of the intended betrayal, and Judas hastened to the priests to bid them act at once. At the close of the paschal supper Jesus instituted the Christian feast of bread and wine commemorative of his own impending death, and the company set out on their return to Bethany. On the way they turned aside to the garden of Gethsemane, where Jesus passed through a fearful inward struggle in view of the sorrows before him. The struggle was scarcely over when the sorrows began. Judas entered the garden, guiding a band of armed men, with some members of the council, and probably a crowd of midnight revellers from the streets of Jerusalem. Jesus was arrested and led back to the city for trial before the Sanhedrim. The charge was blasphemy, but in the absence of trustworthy witnesses, owing, no doubt, to the haste with which the proceedings were conducted, no evidence was produced on which the party of the high priest, themselves wholly unscrupulous, could call for an unfavorable verdict from the majority of the council. The prisoner was then virtually put under oath and required to criminate himself. When solemnly appealed to by the high priest, he not only avowed his Messiahship, but asserted that he was the Son of God and the future judge of the world. The Sanhedrim then unanimously condemned him as a blasphemer, though two members of it, at any rate, Joseph of Arimathea and Nicodemus, were no doubt absent. After the formality of a fresh trial at daybreak, had in order to make the proceedings legal, the priests led Jesus to the Roman procurator, Pontius Pilate, to obtain authority for the execution. Pilate resided at Cæsarea, the political capital of the province, but was now at Jerusalem for the sake of maintaining order at the feast. The procurator made several efforts to rescue Jesus without exasperating the Jews, but he was at last intimidated by the danger of a riot, and the implied threat of accusing him to the emperor as in disloyal sympathy with a pretender to the Hebrew throne. He then gave the order for the death of Jesus by crucifixion, having previously subjected him to scourging. The sentence was promptly executed, and for six hours, or from about nine in the morning until three in the afternoon, Jesus endured the punishment allotted to the worst and basest criminals, and with a convicted felon on either side of him. From time to time he spoke briefly, uttering first his feelings in behalf of others, then his consciousness of his own bodily and spiritual anguish. He died in the act of commending his soul to God. The body was given by Pilate to Joseph of Arimathea, and, aided by Nicodemus, he wrapped it in spices and laid it in a tomb prepared for himself in a garden which he owned outside the walls.

On the day but one succeeding, or Sunday, some of the Galilean women went to Joseph's garden to do their part in honoring the body of their Master. As they approached they saw that the tomb had been opened, and one of them, Mary Magdalene, hurried away to tell John and Peter. These two apostles had probably taken lodgings in Jerusalem, where John had friends. In the mean time, the other women saw a vision of angels, who told them that the Lord was risen, and bade them instruct his friends to meet him in Galilee. It is reasonable to infer that most of the apostles continued to lodge at Bethany, where they would feel far safer than in Jerusalem. While the message was on its way across the Mount of Olives, Mary came with John and Peter. They carefully examined the tomb, and returned, leaving Mary behind them. There the Lord "appeared first" to her, and entrusted her with a message respecting his ascension. As she went to deliver it, her late companions, still on their way to the place where the greater part of the Galilean disciples were to be found, saw their Lord coming towards them. He renewed the charge which the angels had given them. Five distinct appearances are recorded as occurring on this day. Jewish theories about the Messiah had made no provision for what had actually taken place, and the disciples were so far under the influence of those theories as to be hard to convince. The unbelief of the apostle Thomas delayed for a week their

return to Galilee. They did return at last, and there saw their Master more than once. His principal appearance, and that for the sake of which he had summoned them to Galilee, is supposed to have taken place in the presence of the whole body of disciples, more than 500 in number. After a few weeks the apostles went again to Jerusalem, and on the fortieth day after his resurrection, the Lord Jesus, having led them forth, as if for another visit to Bethany, left them for the last time, not vanishing, as before, but passing visibly upward till a cloud concealed him from their sight. While they looked after him, two angels brought them another message—that he should "so come in like manner."

Among the recent works on the life of Christ accessible in English, are those of Neander, *The Life of Jesus Christ;* Lange, *Life of Jesus;* Strauss, *Life of Jesus*, and *A New Life of Jesus;* Renan, *Life of Jesus* (all translations, and the last three by unbelievers); Ellicott, *Historical Lecture on the Life of our Lord Jesus Christ;* Hanna, *Life of Jesus;* Farrar, *The Life of Christ* (the most recent); and (by American authors) those of Crosby, *Life of Jesus;* Eddy, *Immanuel;* Beecher, *Life of Jesus the Christ*, vol. i.; Andrews, *Life of our Lord*. In the last-named work will be found the reasons for the chronological order followed in the foregoing article. S. J. ANDREWS.

Jet, a perfectly black mineral, capable of high polish, is sometimes a kind of pitch-coal or albertite, and sometimes a very black lignite. It comes from various geological strata in the Asturias, Spain, in Aude, France, from Whitby, Yorkshire, from the Baltic regions, etc. It is extensively employed for mourning ornaments for ladies' use.

Je'ter (JEREMIAH BELL), D. D., b. in Bedford co., Va., July 18, 1802; entered the ministry in 1822, and removed to the "northern neck" of Virginia in 1827; 1836–49 was pastor of the First Baptist church in Richmond, Va.; in 1849 of the Second Baptist church in St. Louis, Mo.; 1852–70 of the Grace Street Baptist church in Richmond, Va. Since 1865 he has edited *The Religious Herald* at Richmond, Va. He has published *Memoir of Rev N. W. Clafton, Life of Mrs. Henrietta Shuck, Campbellism Examined*, etc.

Jet'sam [Fr. *jeter*, to "throw"], goods which are thrown into the sea in order to save a vessel and the residue of the cargo from wreck or loss in case of imminent danger, and which sink and remain under water without coming to land. If articles thus thrown overboard float upon the surface of the sea, they are termed flotsam. (See FLOTSAM.) The owner of such goods does not lose his title to them, and may claim them if they are subsequently found. If no owner ever appears to assert his right to the property, it belongs by the English common law to the Crown. (See LIGAN, JETTISON.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Jet'tison [Fr. *jeter*, to "throw"], the voluntary throwing overboard of goods belonging to the cargo of a vessel in order to save the vessel and the residue of the cargo from wreck, capture, or loss in case of imminent peril. If by reason of such sacrifice the threatened disaster is averted and the vessel saved, the owner of the goods lost by jettison has a claim against the owners of the ship, freight, and cargo for contribution, in proportion to the value of their respective interests, to reimburse him for the loss he has sustained, on the theory of general average. (See AVERAGE.) But in order that he may have this claim the sacrifice must have been made by reason of extreme emergency and necessity. If the master makes a jettison in a case of false alarm, there is no contribution. It is not necessary, however, that the anticipated peril should always be proved to have been real. It rests with the master of the vessel to determine whether there is a necessity for jettison; and though it should afterwards appear that the vessel might have been saved without incurring such loss, yet if he acted with prudence and caution in the exercise of a reasonable discretion, and with the intention of performing his duty faithfully, the same results will follow as if there had been an actual necessity for the sacrifice, and a claim for contribution by the owner of the goods will be sustained. The crew have no authority to make a jettison of the cargo without the order of the master, even in a case of actual distress. By the law of England and the U. S. it is not required that the master should consult with the officers of the vessel or the seamen in determining whether a necessity for jettison actually exists, but in cases of doubtful emergency proof that such consultation occurred would be of importance as indicating that the master acted with careful deliberation. The laws of most European nations require that, if practicable, the officers should be consulted, unless the vessel is unmistakably in a situation of great peril. In making the jettison those goods should first be sacrificed which are the least necessary, the most bulky, and the least valuable, if sufficient opportunity is afforded for making the selection. But where there is an immediate necessity for lightening the vessel, any part of the cargo may be thrown overboard as may be most convenient. If goods shipped on deck be taken for this purpose, their owner must bear the loss without contribution, unless there is a general usage to carry such articles on deck, for they render the navigation more difficult, and are particularly exposed to peril. But if the goods were placed on deck without the consent or knowledge of the owner, the carrier will be responsible in such a case for their value. If any injury be done to the vessel or to the portion of the cargo which is saved by reason of the jettison, as if the deck should be cut open to get out the goods which are sacrificed, the loss thus occasioned will also be a subject of general average. If the article sacrificed is the direct cause of the danger, as in the case of cotton taking fire by spontaneous combustion, there will be no claim for contribution to recover its value. The sacrifice must be voluntary in order that it may be a case of jettison, for if goods be swept away by the violence of the sea, the loss falls upon the owner or his insurer. So it must appear that as the result of the sacrifice other property at risk was saved. It is only necessary in order to found a claim for contribution upon general average that there be a rescue from the immediate peril in which the jettison occurred; if the ship is subsequently lost in another disaster, the property saved from this second disaster must contribute to the original loss. (See Parsons on *Maritime Law;* Abbott on *Shipping;* Kent's *Commentaries*.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Jet'ty [Fr. *jetée*, from Lat. *jacere*, to "throw," and implying "projecting" or "jutting"], a *dike*, pier, or embankment projecting into the sea, whether constructed of timber, earth, fascines, stone, etc., or a combination thereof. The most common application is to the mouths of rivers or at the entrance to tidal harbors, whereby to narrow the channel, concentrate the current, and thus increase the depth over the entrance bars.* Most of the HARBORS OF AMERICAN LAKES (see that head) are the mouths of rivers or "creeks" thus treated. In Great Britain the mouths of the Liffey, Blyth (Ireland), Esk, Wear, Dee, Slaney, Ayr, are thus improved, and the tidal harbors of Howth, Kingston, Leith, Donaghadee, Ramsgate, so improved. Also the tidal harbors of Gravelines, Dunkirk, Calais, Boulogne, Dieppe, Fécamp, etc. (France), of Ostende (Belgium), and many others owe their existence to jetties. To the Oder, the Vistula, and many river-mouths of the Baltic, jetties have been applied with more or less success.† The most noted instance, however, is the Sulina mouth of the Danube, which, a permanent depth of 20 feet having been attained where was but an average of 9 feet, instead of being the worst harbor, at once took rank among the best harbors in the Black Sea. Another instance of signal success is the improvement of ship-navigation to Rotterdam by making a new mouth to the Maas through the Hook of Holland, and prolonging the new outlet into the sea by jetties. (See HARBOR; also *Prof. Papers Corps of Engineers U. S. A.*, No. 22.) This great work is a double success, inasmuch not only that the jettied entrance has thus far fulfilled expectations, but that the *method of construction* of fascines and stone, for the first time applied to open sea-exposures, has realized all anticipations and established a certain and economical way of constructing these sea-works on sand-coasts. (See HARBOR.)

A cross-section of one of these jetties is given in Fig. 1. The body of the structure is made up of successive layers

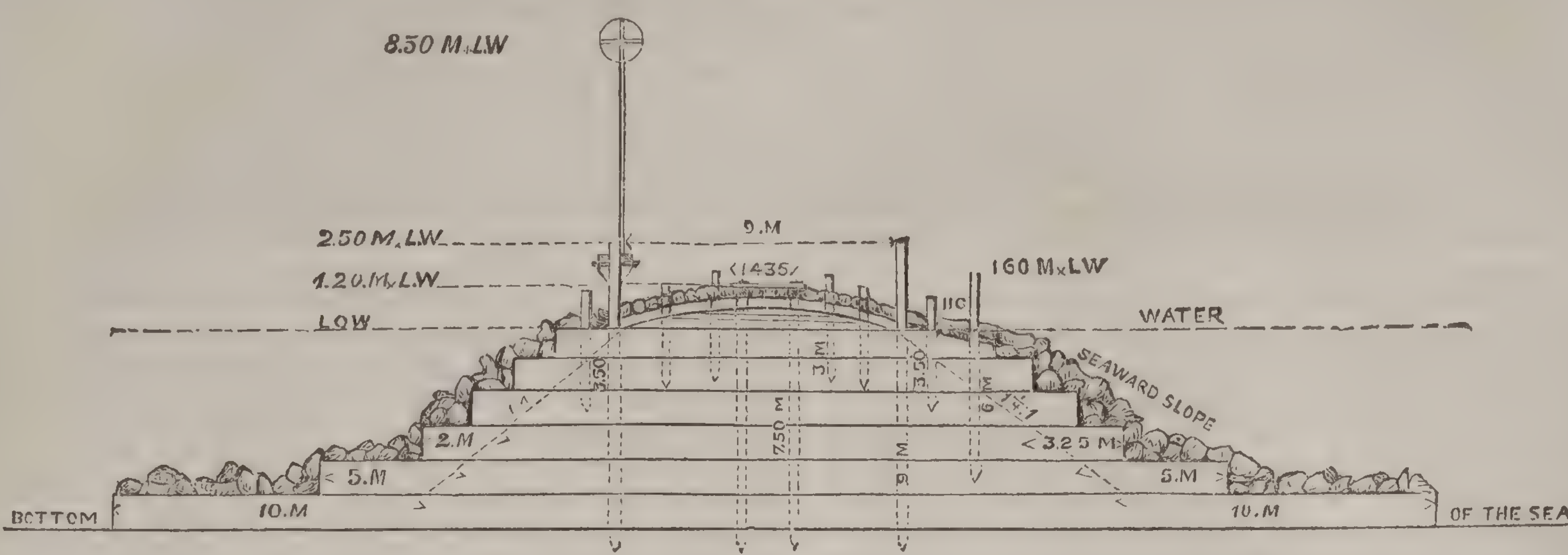
*In this application the term "parallel piers" is commonly used in England for jetties.

†Mr. James B. Eads has furnished, as compiled from authentic sources, the following table of eighteen rivers in Europe where jetties have been effective. At some of the rivers named the jetties, though not yet entirely completed, have already been of great benefit to navigation:

Names of rivers.	Country.	Original depth, feet.	Present depth, feet.
Danube	Roumania, Turkey	7 to 11	20½ to 21½
Maas	Holland (new mouth)	00	17 to 18
Trave	Prussia	7	18
Oder	"	7	23 to 24
Warne or Warnow	"	6	13
Persante	"	4	15
Wipper	"	4	13
Pregel	"	12	20
Stolpe	"	4	14
Niemen	"	10	23 to 24
Libau	Russia	6	16
Dwina	"	6	18
Windau	"	4	9
Pernau	"	3	12
Nissa	Sweden	5	12
Konne	"	6	9
Altrau	"	6	9
Grenaae	Denmark	5	13

of *mattresses* (Dutch, *Zink-stukken*), each overspread by a layer of small quarry-stone. The ground-plan of a *mattress* is shown in Fig. 2, by which it will be seen to be made with a top and bottom *grillage* of fascines, the interstices between the fascines and filling (second layer) between the grillages being bundles or layers of osier. A cross-section

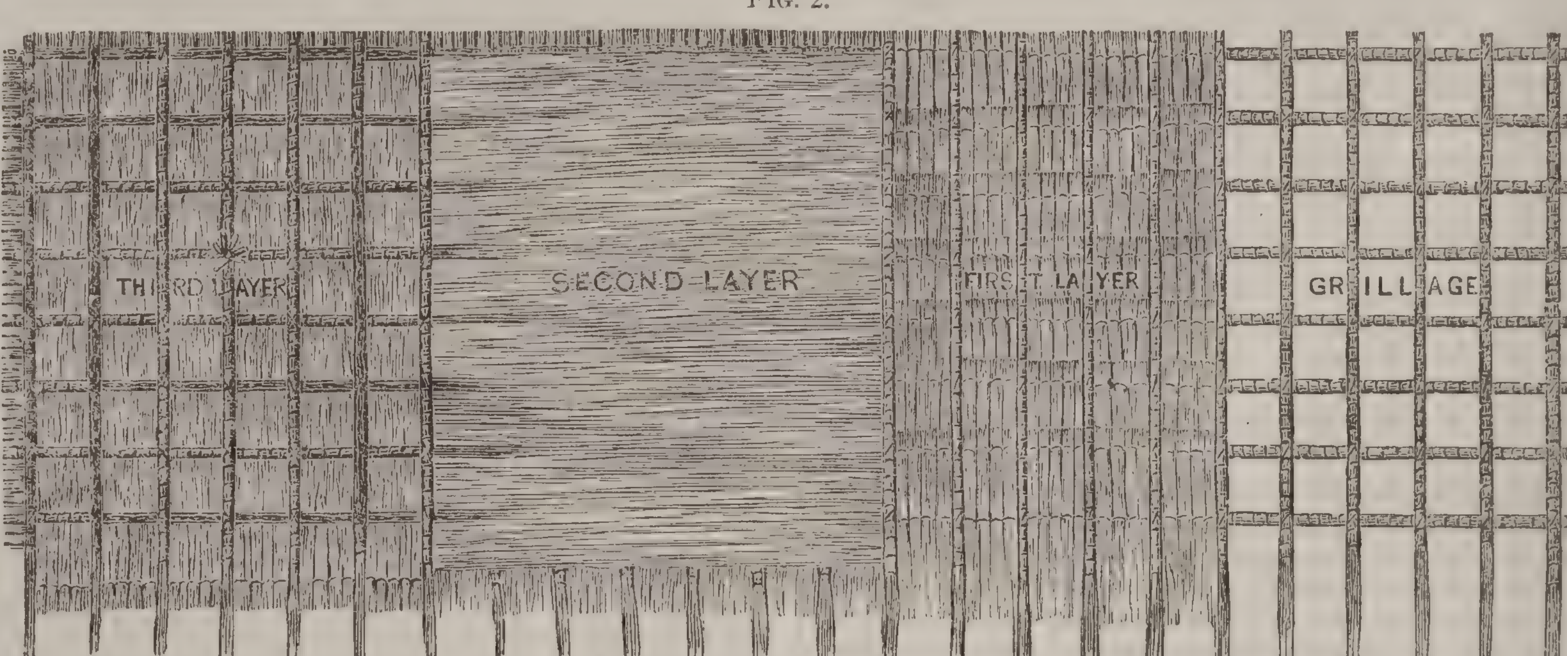
Fig. 1.



Cross-section.

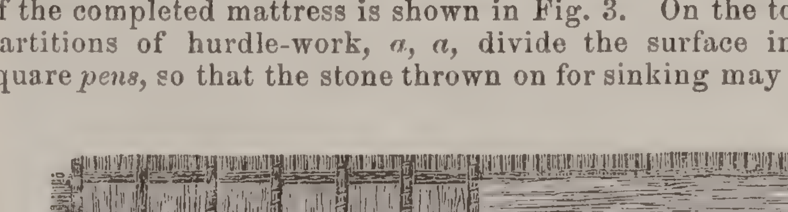
of the completed mattress is shown in Fig. 3. On the top, partitions of hurdle-work, *a*, *a*, divide the surface into square *pens*, so that the stone thrown on for sinking may be retained. Full details of this kind of construction are given in works cited; the following brief notes and above diagrams were kindly furnished the writer by the distinguished engineer (P. Caland, inspector of the Waterstaat) under whose direction the work at the Maas entrance has been executed:

Fig. 2.



Details of a Mattress.

Fig. 3.



Cross-section of a Mattress.

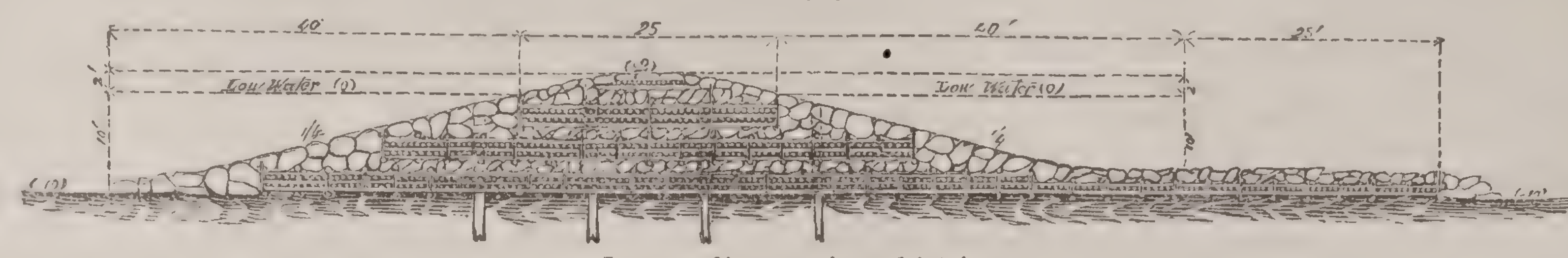
"The thickness of a mattress varies from 0.40^m to 0.50^m (16–20 inches); length and breadth varying according to circumstances. Their breadth is limited to 25 mètres, since otherwise their transportation, sinking, and ballasting would offer too great difficulties. Their length is unlimited. However, as mattresses destined to be sunk at sea must be ballasted with great speed, too great length would be unadvisable. The largest piece sunk at the jetties of the new outlet for the improvement of the navigation from Rotterdam to the sea had a length of 50 mètres and a breadth of 28 mètres, or a superficial area of 1400 square mètres. The courses of mattresses must overlap joints—*i. e.* they ought to be sunk so that the joints of the under course are covered by the upper course. The mattress is made on the sea-beach near the jetty, between high and low water, and when constructed floated to the sinking-place, where it is fastened by anchors and ropes, and placed as exactly as possible above the chosen spot. Then the ballast-stone, weighing on an average 40 to 50 kilogrammes (90 to 112 pounds), from boats or small vessels surrounding the mattress, is to be laid on, first chiefly on the middle and then also proportionally divided over the whole surface, till the mattress immerges. The sinking-lines (with which the mattress is attached to the vessels) are then payed out, at last detached, and in the mean time still more ballast is cast on the mattress; the total quantity amounting to about 700 kilogrammes (1600 pounds) per cubic mètre ($1\frac{1}{3}$ cubic yards) of total volume. When the fascine-work of the jetty is raised above low water, the oak-piles are driven through, as indicated in Fig. 1. The rows of oak piles reaching two mètres above the water-line, and driven into the bottom, consolidate the jetty. Under the track of the rails, laid for conveyance of stone and other material, rows of piles are driven through all the layers into the bottom of the sea. The stakes of the other rows are shorter, and only serve to secure the stone revêtment. Between the rows of piles around the jetty forming the fore-berm, and outside this berm, heavier stone is placed, weighing on an average 500 kilogrammes (1125 pounds).

"From low-water line to the top line the jetty is formed of osier, laid down in layers of 0.25^m thickness, secured by hurdles placed at a distance of 0.60^m. The space between these hurdles is filled up to the top with rubbish or waste stone; the entire top surface of the jetty must be covered with stone weighing on an average 50 kilogrammes. In order to get well-connected joints, stones of a more regular appearance are employed for this pavement. As already stated, experience has proved the stability of this construction, neither heavy storms nor strong currents being able to damage the jetties. Should the bottom along the head and the edges be abraded, those parts of the mattresses protruding from the jetties will by their flexibility conform to the inequalities thus produced, and protect the work from undermining. On a movable bottom the foregoing method of construction offers guaranties of solidity which recommend its employment wherever the materials for fascines can be readily had."

The question of an *adequate navigable outlet* to the Mississippi River has turned attention to the feasibility of an *open river-mouth* by the use of jetties. The recent board of engineers which visited Europe for the purpose of investigating the use and success of the method, recommend "parallel dikes or jetties, constructed of brush, fascines, and stone, in the same general way as used by Mr. Caland at the mouth of the Maas," to be applied to the South Pass of the Mississippi; and in conformity thereto Congress, Mar. 4, 1875, authorized "James B. Eads of St. Louis, Mo., with such others as may be associated with him, to construct such permanent and sufficient jetties, and such auxiliary works as are necessary to create and permanently

maintain, as hereinafter set forth, a wide and deep channel between the South Pass of the Mississippi River and the Gulf of Mexico," etc. etc. Under the stipulations of this grant, construction must be "substantially commenced" within eight months, a navigable depth of 20 feet secured within thirty months, from the approval of the act (Mar. 4, 1875). Moreover, an *additional* depth of two feet per annum is stipulated for until a total depth of 30 feet is attained. Fig. 4 represents a medium section (a modification of Mr. Caland's, Fig. 1) of the jetties proposed by the board already referred to. At the outer ends, where the water is 30 feet deep, the section attains very great magnitude.

FIG. 4.



Intermediate section of jetties.

Other methods of jetty construction are comprised in what has been said under the other heads. (See HARBOR, HARBORS OF THE AMERICAN LAKES, and BREAKWATER.)

J. G. BARNARD.

Jev'ons (WILLIAM STANLEY), b. at Liverpool, England, in 1835, is a grandson of William Roscoe, the historian; was educated at University College, London; held an appointment in the Australian royal mint at Sydney 1854–59; returned to England *viâ* the U. S.; became fellow of his college in 1864, and was appointed in 1866 professor of logic, mental and moral philosophy, and Cobden lecturer on political economy in Owens College, Manchester. He has published a pamphlet on the *Value of Gold* (1863), showing the depreciation of the precious metals; *The Coal Question* (1865), showing the probable impending exhaustion of the English coal-fields, and the expediency of liquidating the national debt in time; *Elementary Lessons in Logic* (1870); *Theory of Political Economy* (1871), and an elaborate treatise on *The Principles of Science* (1874), in which numerous original ideas concerning processes of reasoning are propounded.

Jew'el, or **Jewell** (JOHN), D. D., b. at Buden, Devonshire, England, May 24, 1522; studied at Oxford, and during the reign of Edward VI. became a Protestant minister. In the reign of Mary he was expelled from Oxford by the Romanists; went to Strasburg at the invitation of Peter Martyr, and engaged in teaching. Returning to England after the accession of Elizabeth, he aided in all the measures for the re-establishment of Protestantism, was made bishop of Salisbury in 1560, and was the most eloquent defender both in the pulpit and with the pen of the accomplished Reformation. Besides many controversial pamphlets against the Catholic champion, Dr. Thomas Harding, he wrote in Latin his famous *Apologia Ecclesiæ Anglicanæ* (1562), ever since esteemed a classic of the Anglican Church, a copy of which was placed by order of Elizabeth in every English church. D. at Monkton-Farleigh Sept. 22, 1571.

Jew'ell, county of Kansas, bounded on the N. by Nebraska. Area, 900 square miles. It is a high rolling prairie region, with a good soil, especially near the streams. It affords good pasturage. Cap. Jewell City. Pop. 207.

Jewell (MARSHALL), b. Oct. 20, 1825, at Winchester, N. H.; was bred a tanner, and afterwards was extensively engaged in telegraph construction in the South-western States. In 1850 he began a successful business at Hartford, Conn., where he manufactured leather belting. He supported the Union vigorously during the late civil war; was chosen governor of Connecticut in 1869, 1871, and 1872; U. S. minister to Russia 1873–74; postmaster-general in 1874.

Jewell Centre, post-v. of Centre tp., cap. of Jewell co., Kan.

Jewell City (JEWELL P. O.), a v. of Buffalo tp., Jewell co., Kan., built on a beautiful plain surrounded with timber; has a weekly newspaper, large school-house, 6 stores, 4 churches, large nurseries, various shops, etc. Coal is found in the vicinity. M. WINSOR, ED. "DIAMOND."

Jew'elry and Jewels, terms used in a confined sense for precious stones set in gold or silver and worn as personal ornaments, but more generally applied to ornaments made only of the precious metals.

Paris is in this branch of industry the great factory for the world, and sells to it annually jewelry to the value of nearly 60,000,000 francs, of which about one-half is for gold-work, the other for precious stones. Great pains are taken in Paris to protect purchasers from being deceived in any way. Only three grades of gold are allowed, and these are set forth by official stamps (*poinçons*). In every large French city there is a so-called bureau of guaranty, where all new jewelry is chemically tested with great care. The English also endeavor to secure a standard of value for their jewelry, but recent revelations have shown that the "Hall mark" is not to be depended upon, the evasions having been both flagrant and extensive. For the U. S. the only rule is *Caveat emptor*—"Let the purchaser beware," or look out for himself. There are in Paris 900 manufacturing jewellers (masters), 826 shops, and 77 diamond and gem merchants. In London there are 512 jewellers, 4 wedding-ring makers, 29 gold-chain makers, 11 gold cutters, 2 mourning-ring makers, 39 diamond cutters and setters, 109 diamond merchants, 3 dealers in rough diamonds only, 8 jewel merchants, 25 pearl merchants, 7 dealers in jewellers' requisites, and 33 jewelry-case makers. The boast, however, which a French writer makes of the great *cheapness* with which jewelry is now made, and "the extraordinary degree to which an immense number of tools ingeniously perfected has wonderfully diminished all the difficulty of workmanship," is a proof that in France it has been reduced from an art to a mere manufacture.

Silver jewelry has become of late years a very extensive branch of industry. That of London is the most elegant in the world, being in exquisite taste, simple, and extremely cheap. There are only 33 manufacturers specially devoted to this branch (silversmiths not included), but the quantity which they produce is immense. Most of their work is in strictly antique fashion. Elegant silver jewelry is also made in Scotland, Ireland, Normandy; and that of Russia (inlaid with enamel and chased) is of remarkable beauty. There are in Paris 141 manufacturers of silver ornaments, of whom only 97 make what is strictly jewelry. Two grades of silver only are permitted. Steel jewelry is extensively made both in France and Germany. For this soft or malleable iron is at first employed, the surface of which is case-hardened—*i. e.* the object is worked or filed while red, and steeled after the form is given. Many pieces are made by passing soft iron while red hot between steel rollers in which the pattern is cut in *intaglio*. Polishing is effected by means of wheels of wood or tin with emery and English plate-powder for the portions in relief, and with brushes for the indentations. There are in Paris over 100 manufacturers of steel ornaments, employing 1500 workmen. Ivory jewelry, which was almost unknown till within a few years, is now made in immense quantities in France, Germany, and England. It may be remarked that the raw material has increased in value; the demand for ornaments made from it has also augmented. There are at present in London 30 ivory-carvers, all of whom, in addition to other objects, make brooches and earrings. Tortoise-shell jewelry is generally set off with spots and small plates of gold. Thirty years ago the manufacture was confined to Rome and Naples, and in 1868 there were only six men who made it in Paris; at present there are in that city 42 establishments devoted to this jewelry alone. A singular specialty in personal ornaments is the so-called mourning jewelry, some of which consists of gold and black enamel, the greater part, however, being made of jet, human hair, and vulcanite—the latter an American invention. There are in Paris 60 manufacturers of mourning jewelry, and about 30 more who manufacture hair ornaments only; in London there are 25 of the latter and 13 jet-workers. Jet is, however, made extensively in all the cities of Great Britain, that of Whitby being preferred. This kind of jewelry was very well made in England during the pre-historic Stone Age, and the jet of England was prized of old by the Romans. An old British jet necklace is engraved in Wilson's *Prehistoric Scotland*. Amber has of late, in common with jet, become a fashionable material for personal ornaments. It is principally manufactured in Germany. Old amber beads which have become rich deep brown in color bring a very high price. CHARLES G. LELAND.

Jewelry: Its Manufacture in America. In the colonial period the wearing of jewelry was at first discouraged in the New England colonies; it was regarded as one of the "devices of Satan;" and aside from what was

brought over by the wealthier immigrants there was very little demand for it. Gold beads were handed down from mother to daughter as heirlooms, and as the colonists became prosperous an order was occasionally given to the not over-skilful goldsmiths of the time to make up some of the carefully hoarded guineas or doubloons into beads or massive gold rings or chains. In New York, Maryland, and Virginia there was a greater demand for gold ornaments; gold rings, beads, earrings, watch-seals, and chains were more worn—not that the colonists possessed more wealth than those of New England or of Pennsylvania and New Jersey, but because there were not so many of the Puritan or ascetic ideas controlling their minds. Most of the jewelry used in these colonies was imported, the fine arts being no more cultivated there than in New England. The "watchmakers," or more properly the dealers in and repairers of watches (for no watches were made in the colonies), were also importers of jewelry to a limited extent, and made in many cases the simpler articles mentioned above; but there is good reason for believing earrings, pins, bracelets, watch-seals, and the finer qualities of necklaces and chains were not manufactured in this country, and that the setting of the precious stones for ornamental purposes was not attempted before the Revolutionary war, nor, indeed, till some years after it. The country was left so much impoverished by the war that there was very little demand for luxuries for some years, and the currency was in such a deplorable condition that its purchasing power was almost entirely gone. The first manufacturer of jewelry of whom we can find any account was Mr. Epaphras Hinsdale of Newark, N. J., a man of great mechanical ingenuity and remarkable skill as a workman. He established a manufactory of jewelry in that town, on a small scale, somewhere between 1790 and 1795, and gradually increased it. Mr. Hinsdale died in 1810, but a Mr. Taylor, who had been one of his employés, and perhaps a partner, succeeded him and enlarged the business greatly. Mr. Taylor was a man of genius in the mechanical arts, and invented numerous machines to perfect the manufacture. Both Mr. Hinsdale and Mr. Taylor made earrings, pins, bracelets, chains, and necklaces, all of fine gold, using at that time gold of not less than 16 carats fineness. Their work was all solid, in distinction from the filled work of which we shall speak presently. It was a few years later than Mr. Hinsdale's beginning at Newark, but not after 1800, that two or three manufacturers of jewelry commenced business in Providence, R. I. Very soon, and perhaps from the first, they began to make what has ever since been known to the trade as "filled work"—*i. e.* the design or pattern of the jewel, whether earring, pin, or bracelet, was stamped out from very thin ribbons of gold, usually of 18 carats fine, and this shell was filled with a solder of pewter or lead and tin, and a back soldered on of gold of inferior quality. The thin shell, under well-cut dies, took very beautiful forms, and the fineness of the gold caused it to receive a high polish; and this filled jewelry, which could be offered at lower prices than the solid, found a wide and speedy market. The business has expanded until it has now reached an immense extent. In 1812, Mr. George F. Downing commenced the manufacture of watch-seals at Newark, to which he subsequently added other articles of jewelry, and removed to New York City in 1821. A French manufacturer named La Guerre had established in New York City in 1812 a factory for the production of filigree jewelry, and had brought over several French workmen of remarkable skill. He carried on the business for many years. Mr. Downing, who is still living at the age of eighty-five years, thinks that at the time he came to New York in 1821 there were no other manufacturers of jewelry in that city except La Guerre and himself. The Yankees, he says, flooded the whole country with their "filled work." Very soon after 1820 other manufacturers entered the field, and from 1830 to 1837 the demand increased beyond the power of producers to supply it. Large amounts of jewelry were imported at that time. The terrible financial disaster of 1837 checked for some years the progress of this as it did the production of all other articles of luxury, but with the return of prosperity the demand was renewed, and constantly increased for many years, the discovery of gold in California and Australia adding largely to it. The disasters of 1857 and the severe pressure of the first years of the war diminished the business for a time, but the great abundance of paper money which followed, the large fortunes acquired by contractors and in the shoddy and petroleum speculations, and the reckless extravagance of those who had suddenly acquired fortunes, gave to the jewelry trade a vastly greater impulse than it had ever before received. The use of diamonds as jewelry, previously confined to a very few, became common, and, though unquestionably many spurious gems were sold as diamonds, the demand for genuine stones became so great that a class of diamond-brokers found constant employment, and the cutting and setting of these precious gems, which had previously been carried on mostly in Holland, became a recognized branch of the business here. But this almost insane rage for jewelry had another result; servants and the lower classes of society were infected by it, and as their means were insufficient to purchase the genuine articles, there sprang up a great trade in gilt and imitation gold jewelry—paltry stuff, made often in fine patterns, of brass, copper, or "oroide of gold," and covered with the thinnest possible film of gold by the electro-plating process. This trash was and is sold to the poorer classes, at an enormous profit, to the amount of millions of dollars. In regard to the originality of the designs of jewelry manufactured here there is not much to be said; there have been combinations of the fragments of antique designs, good, bad, and indifferent, occasionally a gleam of something new intermingling with the old; but for the most part the rococo, the filigree, and the Etruscan patterns have been more or less slavishly followed; and it must be confessed that in jewelry, as in furniture and architecture, there are not even the germs of an original American style. The Mexican and the ancient Aztec and Toltec ornaments of gold have more claims to originality, though not to beauty, the gold ornaments taken from the graves of the Chiriqui Indians on the Isthmus of Panama, as well as those found in the pueblos of the Moquis and other remnants of those races, being far from elegant or even graceful in form.

The following statistics will show the progress of this manufacture in this country within the last three decades. In 1850 the manufacture was but moderately developed. The entire production of the year was reported as only about $2,750,000, and this included watch-cases, hair jewelry, and lapidaries' work. In 1860 there were 463 establishments for the manufacture of jewelry alone, employing a capital of $5,180,723, using raw material of the value of $5,102,500, employing 5947 persons (5363 males and 584 females), paying wages to the amount of $2,605,056, and producing goods to the annual value of $10,415,811. The manufacture of hair jewelry was conducted in 8 establishments, having a capital of $27,000, and using raw material to the amount of $15,300; it employed 42 persons (17 males and 25 females), the wages paid were $10,620, and the annual product $45,600. Lapidaries' work occupied 7 establishments, and produced $36,850 annually. The total production of jewelry under these three heads was $10,498,261. In 1870 in the manufacture of jewelry alone there were 681 establishments, employing 10,091 hands (8141 men, 1545 women, 405 children), using capital to the estimated amount of $11,787,956, paying for wages $4,433,235, using raw material valued at $9,187,364, and producing goods annually to the value of $22,104,032. In addition, lapidary-work was conducted in 13 establishments, employing 88 persons, to the annual amount of $107,300. Hair jewelry is included under the general heading of "hair-work," and its amount cannot be ascertained. The aggregate, then, is $22,211,332. The annual product of some of the great centres of the trade in 1870 may be added. Providence produced in 74 establishments $3,086,846; New York City in 198 establishments, $9,595,700; Philadelphia in 53 establishments, $1,583,741; Springfield, Boston, and Cincinnati respectively, $370,000, $338,000, and $338,000; San Francisco, 18 establishments, producing $475,562; Bristol co., Mass. (including Attleborough, etc.), 33 establishments, producing $1,510,925. L. P. Brockett.

Jew'ett, post-v. and tp. of Greene co., N. Y., in the Catskill Mountains. Pop. 1105.

Jewett (Charles Coffin), b. at Lebanon, Me., Aug. 12, 1816; graduated at Brown University in 1835; was for a time student and librarian of the Andover Theological Seminary; in 1843 catalogued the library of Brown University, where he remained as librarian and professor of modern languages until 1848. He became librarian and assistant secretary of the Smithsonian Institution, and was 1858–68 superintendent of the Boston Public Library. D. at Braintree, Mass., Jan. 9, 1868. He wrote a valuable report on the public libraries of the U. S. (1850), and in the same year brought forward an improved plan of cataloguing books.

Jewett (Rev. Charles Raymond), b. July 29, 1824; educated at Emory College, Ga., and joined the Georgia conference (M. E.) in Jan., 1844. He was of a sanguine temperament, a cheerful, zealous, and eminently useful minister. He was distinguished as a model presiding elder, and earnest, bold, eloquent, as a preacher. He was a member of the South Georgia conference at the time of his death, July 10, 1872. T. O. Summers.

Jewett (Luther), b. at Canterbury, Conn., Dec. 24, 1772; graduated at Dartmouth in 1795; was a physician at Putney and St. Johnsbury, Vt.; member of Congress

1815–17; pastor of a Congregational church at Newbury, Vt., 1821–28; published newspapers at St. Johnsbury, Vt., 1828–32; and d. in that town Mar. 8, 1860.

Jewett (Milo Parker), LL.D., b. at St. Johnsbury, Vt., in 1808; graduated at Dartmouth in 1828, and at Andover Theological Seminary in 1833; was a professor in Marietta College, O., 1835–38; left the Presbyterian and joined the Baptist denomination, and became president of Vassar College, Poughkeepsie, N. Y. He is author of a work on baptism.

Jewett City, post-v. of Griswold tp., New London co., Conn., on the Quinebaug River and Norwich and Worcester R. R., 10 miles N. E. of Norwich. It has cotton manufactures and several churches.

Jew′fish, a name given to several fishes of the family Serranidæ, attaining a weight of several hundred pounds; that of Florida is the *Promicrops guasa*, of which a specimen in the Smithsonian Institution weighed 700 pounds; that of California is *Stereolepis gigas.*

Jewish Literature. While Europe claims pre-eminence in the arts and sciences, Asia has been the mother of religions. Among all the religious systems of Asia, that which originated among the Hebrews excels in purity and loftiness. In them the profound subjectiveness of the Semitic character found its noblest expression. Lacking that calmness of spirit which led the Greeks to observe nature and to cultivate the plastic arts, they looked upon the world of phenomena with a human interest, and regarded it solely in its relations to their own consciousness. The external was to them no more than symbol. This idea dominated their history and literature. It *made* them a people. Being in sole possession of monotheism, they became at once united among themselves and exclusive toward their polytheistic surroundings. And since a religious idea was at the very root of their existence as a nation, it is not strange that the interests of religion maintained their supremacy during the whole course of their history. In the Middle Ages, indeed, the Jews, in conjunction with the Arabs, became the mediators of the sciences. But even then those of their productions for which originality can be claimed were more or less intimately connected with the discussion of religious subjects.

The most ancient monuments of Hebrew literature are contained in the Bible. Much, however, that would now be considered valuable was not preserved in the sacred canon, and has been lost in consequence. The nature of the biblical writings at once illustrates the above remarks. Their historical portions are designed to show the workings of Divine Providence in the destinies of men in general, and particularly of the chosen people. Rhetoric becomes in them a vehicle of inspiration. Poetry is devoted to the glorification of God, with the exception of the Song of Songs, perhaps, and is chiefly intended to be sung by sacred choirs. Philosophy, disregarding the problems of the material world, is busy on the questions of good and evil, and labors to reconcile the presence of the latter with the goodness of the Creator, as in Job and Ecclesiastes. The influence of Persian ideas is visible in several of the later writings of the Old Testament. To it has been ascribed the introduction of the names of angels and the doctrine of a resurrection in the body. The contact of the Hebrew and Greek spirit is of profounder interest. It took place both in Palestine and in Alexandria. In Alexandria philosophy and inspiration joined forces on the basis of a modified system of Platonism. A rich crop of apocryphal works in prose and poetry sprang up, the words of the Bible were interpreted so as to express metaphysical tenets, and those anthropomorphisms which it contains, and which had at first sight awakened considerable suspicion, became, in the new light that Philo (the originator of the theory of the Logos) and others shed upon them, transparent to a deeper wisdom. There, also, the first translation of the Bible into Greek, known as the Septuagint, was effected. In Palestine the attitude Judaism assumed against Hellenism was hostile to the last degree. The Hebrew has ever found it a comparatively easy matter to absorb the philosophical teachings of the age in which he lives, from the absence of fixed dogmas in his own religion, but he resists to the utmost any attempt to interfere with the observance of those practical commandments of his faith which he regards as its essential feature. Such an attempt was made by the degenerate Greeks who ruled in Syria in the time of Antiochus Epiphanes. The consequence was that Judaism retired upon itself, that Greek culture and heterodoxy came to be synonymous terms, that the authority of Scripture was more than ever secured in the affections of the people. From that time forth it became the centre of their existence. All their energies seem to proceed from it, all their thoughts return to it. None the less, innovation became a necessity. All the biblical laws were no longer applicable to the altered conditions of a new age. Unavoidable changes were gradually introduced. But such was the reverence now paid to the Holy Writ that no ordinance, however salutary, could enforce obedience unless it had previously received at least the nominal sanction of the great "Book." The teachers of the people thus became doctors of the law. By an ingenious method, which left them the widest latitude of interpretation, they were enabled to read from the letter of the Hebrew Bible whatever meaning they desired to read into it, and to fortify their own injunctions by referring them to a divine origin. The inferences they drew, the analogies they insisted upon, were in a philological sense absolutely reckless. Every letter and word that seemed superfluous, every unusual form of construction, was tortured into some unheard-of signification; nay, they proceeded in defiance of all grammatical construction. The principles of jurisprudence, the ritual and ceremonial laws, even the rules of decorum, were deduced from biblical sentences. Finally, the fiction that an oral law was revealed to Moses on Sinai, which from him had been transmitted to succeeding generations, aided them in establishing the celestial origin of their teachings where they might otherwise have been at fault. A few of the leading rabbins were Hillel, shortly before the birth of Christ, Jochanan b. Sakkai, at the time of the destruction of the temple, Akiba, in the days of Hadrian, Juda the Holy, the compiler of the Mishna, R. Meir, Aba Areka, called Rab, Raba, Rabbah, and others. Of the three Greek translations undertaken in the second and third centuries of our era, those of Aquila, Theodotion, and Symmachus, the first in particular shows signs of having been largely influenced by the rabbinical mode of exegesis. The elaboration of the Talmud continued down to the sixth century. (For an account of that great work see the article Talmud.) The existing stock of tradition was classified at the end of the second century in the six divisions of the Mishna. The bulky commentaries grounded on them are known as the Gemaras of Palestine and Babylon.

The liturgical compositions of the Jews deserve at least a passing notice. Prayer, as distinguished from mere supplication, was the only adequate form of worship which a monotheistic religion could accept. The heathen gods, being dependent on the gifts of their votaries, demanded sacrifice; the God of the prophets was exalted above all human failings and needs. There was nothing which man could do for him. To serve him was to become like him. "Holy shall ye be, for I, the Eternal, your God, am holy." The desire to imitate God, therefore, became the keynote of Hebrew worship. In order to imitate, it is in the first place necessary to regard the object to be imitated with interest and attention. And thus an endless dwelling on the attributes of the Deity became a leading characteristic of Hebrew prayer—a ceaseless heaping of epithets, as if the soul struggled to exhaust an infinite theme. It has been remarked that "the Jews pray metaphysics." The cause of this peculiarity is thus made plain. That admiration of the Divine Being should find vent in praise is natural. The All-Good is the dispenser of all bounties, and has ordained even the seeming ills of life for a wise end. Hence the countless blessings which are interspersed in the Hebrew service, and which accompany even the most trivial occurrences of daily life. Lastly, a comparison between human imperfection and the grandeur of Him whom he is called upon to imitate leads the mind of man to expect only from the mercy of God that power which he lacks to become god-like, and he implores for divine assistance: "I fly from Thee to Thee."

When the Arabs received, through Syrian channels, the treasures of ancient Greek thought, a new spirit of inquiry was awakened among them, and was soon communicated to the Jews. As early as the seventh century works on mathematics, astronomy, and astrology began to appear among them. Exegetical studies received a powerful impetus from the new sect of Ananites or Karaites, founded about 750 A. D. (see Karaites), who, rejecting the authority of tradition as represented by the rabbins, professed to return to the letter of the Hebrew Bible as the sole standard of faith. They did not, it is true, remain faithful to their professions, adopting many principles and practices of post-biblical origin; and it has been conjectured that they ought to be considered the successors of the ancient Sadducees. Anan himself, Benjamin Nahawendi, and Nissi b. Noach may be mentioned among the earliest authors of their sect. The introduction of vowel-signs into the text of Scripture was a result of the increased attention paid to philological pursuits. Two systems were invented. The one originated in Babylonia, the other in Palestine. The latter is the one in common use. The mystical tendencies of this period found expression, notably, in the so-called

Book of Creation, a work of small compass, but of great influence, which is held to be a production of the eighth or ninth century. It employs the method of the Neo-Pythagoreans, seeking to solve the problem of creation with the help of numbers and letters. In the same epoch arose the poetanic school of writers, with Elasar b. Kalir at their head. Their verses were designed for use in the synagogue. But though the *Piutim* multiplied excessively during the succeeding centuries, there are but few of these prayers in rhyme that possess any real poetic value. A remarkable instance is on record of the liberal spirit fostered by the encouragement critical investigation received at this time. The explanation of miracles proposed by a Persian scholar named Chiwi, certainly reminds one strongly of Eichhorn and the Rationalists. In the first half of the tenth century arose the Gaon (a title signifying "His Excellency") Saadias, born in Faium, Egypt. He engaged in bitter conflict with the Karaites, among whom Solomon b. Jerucham was his chief adversary. Saadias's main work is a philosophical treatise entitled *Emunoth we Deoth*—"Faith and Knowledge." In it he seeks to reconcile the commandments of the Bible and the injunctions of tradition with the dictates of reason. He places great emphasis on the doctrine of free-will in opposition to a tendency toward fatalism which had been encouraged by the spread of Islam. He was also the author of a translation of the Old Testament into Arabic, and a commentary on the *Book of Creation*, above mentioned, is said to be from his pen. Another commentary on the same book is ascribed to his contemporary, the celebrated astronomer and writer on medicine, Isaac Israeli of Cairoan. Juda b. Coraish, residing, like Israeli, in the N. of Africa, is distinguished as having been the first to introduce a comparative study of the Chaldæan, Hebrew, and Arabic languages.

In the latter half of the tenth century the supremacy which the high schools of Babylonia were too feeble to maintain longer was assumed by Spain. Moses, a captive Talmudist, having been sold as a slave to Cordova, was ransomed by the Jews of that city, and placed at the head of their Talmudical school. Under the patronage of Chasdai Shaprut, the trusted adviser of Abderrahman III., letters flourished. Menahem b. Saruk was the first of the rabbinist Jews to attempt the preparation of a Hebrew lexicon, and his work shows signs of considerable learning and freedom from prejudice. His opponent, Dunash b. Librat, was among the first to apply the metrical forms current among the Arabs to Hebrew poetry. Chajug, a pupil of Menahem, discovered the system of triliteral radicals which forms the basis of Hebrew grammar, while his successor, Abulwalid, elaborated a complete Hebrew grammar and a lexicon, which is now (1875) being published in the original Arabic. The eleventh century is illustrated by such men as Bachia b. Joseph, whose noble work on the *Duties of the Heart* exalts the claims of the spiritual, moral nature of man at the expense of mere outward formalism; also by the poetic vezir of Granada, Samuel ha Nagid ("the prince"); and, above all, by the profound philosopher and poet, Solomon Gabirol. His system is based on the theory of emanation, and is the product rather of an ardent imagination, thrilling with enthusiasm, than of exact study. His muse is melancholy, and dwells chiefly on the pain and sorrow of existence. Yet his verse is not lacking in power and grandeur of expression. It has been well said of his compositions that the spirit of Faust seems to pervade them. (For an account of his philosophical work, *Fons Vitæ*, see Munk's *Mélanges de Philosophie*, etc.) While Hai, the last of the Gaons whose name is of note (d. 1038), assumed an attitude hostile to all liberal culture, the Talmudists of Moorish Spain were content to pursue their path, without caring to molest those who inclined to studies differing from their own. This is noticeable in the case of Isaac Alfasi, the far-famed head of the Academy of Lucena, whose labors to extract from the interminable mass of discussions contained in the Gemara a clear statement of their final results have secured him high consideration as an authority in his branch down to modern times. In Christian Spain a poet arose in the beginning of the twelfth century (Jehuda ha Levi, b. in Castile 1080 A. D.), whose verse indeed is tender, sweet, full of pathos, but whose thoughts and sympathies are far narrower than those of Gabirol. His philosophical work, the *Cusari*, is written in the form of a dialogue between the king of the Chazares previous to his conversion (the king and his people adopted Judaism in the eighth century) and the representatives of the three great religions, Christianity, Islam, and Judaism. The first two being compelled to own that their religious records are based on the Hebrew Bible, the king confines his conversation to the Jew. In the exposition of his philosophical ideas Jehuda ha Levi makes frequent use of the term *segullah*, which may be rendered "heritage of the Divine Spirit." Though no human being is excluded from the grace of God, there are certain men and places that have been gifted from the beginning with the faculty of becoming peculiar vehicles of his spirit. Adam transmitted this gift to the patriarchs, thence it was obtained by Israel, and among them was accorded in its highest potency to the prophets. The places so selected are the cities and villages of the Holy Land. In accordance with these convictions the poems of Ha Levi are inspired by an intense yearning for Jerusalem and the ruins of its temple, and the "songs of Zion" are the most eloquent productions of his Muse. Geiger, in his lectures on Jewish history (ii. p. 118), has pointed out the connection between the sentimentalism of Ha Levi and the direction given to men's minds by the prevailing doctrines of the Church in his native country. A contemporary of the above was Abraham Aben Esra, born in Toledo in 1093. In the course of his restless life his travels led him to Egypt, Italy, the S. and N. of France, and to England. He d. in Rome in 1167. He wrote several works on Hebrew grammar, of which that entitled *The Scales* is of considerable historical value. His great renown is due to his commentaries on the books of the Bible. His style is brilliant, his observations profound, and often pointed with bitter, cutting sarcasm. In his commentary on the Pentateuch he refers to those passages which appear to preclude the idea of Mosaic authorship; in that on Isaiah he anticipates modern criticism by indicating the distinction between an earlier and later prophet of that name. He believed with the astrologists in the influence of the stars on human destinies, and is supposed to have entertained pantheistical notions concerning the Deity. But he loves to assume the mask of simple credulity, and is fond of displaying an ostentatious deference for the views of the ancients, so that it is a matter of no little difficulty to extract his true opinions.

The high-water mark of Jewish literature in the Middle Ages was reached in the writings of Maimonides, born in Cordova in 1135. He fled with his father from the persecutions of the Almohades, and at last found protection and security in Egypt under the mild sway of Saladin. Among his chief works we mention his commentary on the Mishna and the *Mishneh Thorah* ("Repetition of the Law"), in which it is his purpose to present a complete and systematic code of rabbinic law, and by this summary to supplant the Talmud itself; for he was aware that that work requires a life-study to master, and leaves little or no room for the pursuits of science. The *More Nebuchim* (*Dhalalath al Hajirin* is its title in the original Arabic—"The Guide of Those that are Gone Astray") embodies the philosophical system of its author. In it Maimonides proposes to harmonize the principles of religion as laid down in the Bible with those metaphysical conceptions which the age inaccurately ascribed to Aristotle. The anthropomorphic expressions of Scripture are pregnant with a deeper meaning; the ceremonial observances which it enjoins were largely instituted as a safeguard against heathen practices. The Deity himself can be described by none but negative attributes. Revelation is a union of the individual soul with the Active Intellect. The reward of virtue lies in the high spiritual development which it leads us to obtain. The tendency to systematize which is thus apparent in the works of Maimonides induced him, in one of his earlier writings, to set up thirteen articles of faith, a step which was equally unprecedented and dangerous. The free, pure-minded philosopher might have become the author of mental slavery for his people had not the spirit of Judaism been such from the beginning as to resist all attempts to hamper it with dogma.

Among the Jewish authorities of note at this period in Germany may be mentioned Gershom, surnamed "the Light of the Exile" (end of the tenth and beginning of the eleventh century). He eradicated the last vestiges of polygamy among the Jews, and declared the consent of the wife a necessary condition of divorce. In the second half of the eleventh century lived in Troyes R. Solomon b. Isaac, commonly known as Rashi, a man whose name is familiar to every student of Hebrew literature. His commentaries on the Bible may still be read with interest and advantage. But to the brief explanatory notes with which he has elucidated all the voluminous works of the Talmud we owe in a great measure the possibility of still comprehending the intricate discussions of that difficult work. Samuel b. Meir (Rashbam) followed in the footsteps of Rashi, his grandfather and teacher, and is distinguished for the simplicity and straightforwardness which mark his interpretation of Scriptures. His brother, Jacob Tham, was among the earliest of the so-called Tossafists, a school of casuists who exhausted the power of dialectics in finespun subtleties of little real value, that tended only to make the study of the Talmud still more complex and laborious. Simon Darshan deserves mention as the author

of an oft-quoted compilation, known as the *Jalkut.* In Italy, Shabthai Donolo gained distinction as a physician. He was the author of a new commentary on the *Book of Creation.* At the end of the eleventh century R. Nathan b. Jechiel of Rome prepared a lexicon of the Talmud, Targum, and Midrash, which is still considered a valuable auxiliary to the studies it was designed to facilitate. In the S. of France, the land of heresy and free thought, we find in the twelfth century, besides a number of distinguished Talmudists, such scholars as Abraham b. Chija, the mathematician, the Kimchis, and Thibbons. Joseph Kimchi introduced the current classification of Hebrew vowels. Of his sons, David Kimchi bears a high reputation as a grammarian, lexicographer, and commentator on the Bible. Juda Thibbon translated into Hebrew the philosophical works of Saadias, of Bechai, and of Juda ha Levi. His son Samuel is the translator of the *More Nebuchim.* The devoted industry of these men opened the rich mine of Arabico-Jewish literature to the countries of Christian Europe. Conversely, the Latin works of scholastic authors were now being rendered into Hebrew, and new channels for the exchange of thought were thus opened. In the thirteenth century flourished the poet Charisi, whose spirited imitations of the Arabian Hariri are justly esteemed. Joseph Ibn Aknin, the favorite pupil of Maimonides, did not exert that wide influence which one would suppose his relations to the great master might have given him. At this time the writings of Maimonides became the apple of discord between the friends of liberal culture and the conservatives. The opinions of this philosopher concerning the resurrection, and the doubts he seemed to cast on the "creation out of nothing," proved peculiarly objectionable. Abraham b. David of Posquières and Meir ha Levi of Toledo had already raised their voices against the new opinion during the lifetime of its author. After his death the struggle broke out violently. Solomon of Montpellier, the leader of the anti-philosophical party, went so far as to call in the aid of the Dominicans to crush his opponents. The Spaniard Juda Alfachar took sides with the Provençal rabbi, though urged by David Kimchi to declare in favor of Maimonides. Passions ran high in either camp. A settlement of the questions under discussion could not, however, be reached. The tendency to rationalism as exhibited in the exegesis of the period, continued to grow, until at the beginning of the fourteenth century a new outbreak occurred. The learned, pious, and polished Adereth, the stern and unbending German exile, Jacob b. Asher, were at that time the chief rabbinical authorities of Spain. The authority of the former was invoked by the fanatics of Montpellier to anathematize the party of progress, and, after offering a vain resistance for some time, he was forced to yield to their importunities. But the right of free investigation was too sacred a tradition within the pale of Judaism to give way before the decrees of orthodoxy. The *Milchamoth Adonai* ("Battles of the Lord") by Gersonides, the commentaries of Kaspi and Maestro Vidal on the *More Nebuchim,* show plainly that the spirit of philosophy would not succumb without a struggle. Nay, in the fearless assertion of conviction these works transcend even the speculations of Maimonides. The coeternity of matter with God is boldly asserted, the testimony of miracles denied, etc. For all that, the decline of metaphysical studies could not be arrested. It was brought on not by the machinations of a Jewish priesthood—for nothing of the kind existed—but by the force of adversity and persecution. Philosophy goes out, mysticism steps into its place. Nachmanides, the profound thinker, one of the most esteemed commentators of the Bible, contributed largely to ensure it a favorable reception. It was crystallized into a system by Mose de Leon in the latter half of the thirteenth century. His chief book, the *Sohar* ("Radiance"), is written in Chaldaic, or rather Syriac, and has remained the standard work of the Mystics down to the present day. He ascribes its authorship to Simon b. Jochai, the hero of many legends in the early Talmudic age. Hence the name of Cabbala, or tradition, which is falsely applied to this and similar productions. Though the forgery is sufficiently palpable, it escaped detection. Form and contents of this strange composition equally attest its late origin. The doctrine it inculcates rests on the theory of emanation. God is the *En-sof,* the Endless. From him, in successive gradation, the higher and lower worlds have come, until the world of matter and of evil appeared as the last modification of his Spirit. The sefiroth (originally "numbers," then spheres, then the presiding spirits of the spheres) form the channels between the celestial and the terrestrial. By skilful manipulation of the words of Scripture, especially the letters of the ineffable name of God, man is able to exert a magical influence upon the workings of the Divine. The pernicious tendency of these ideas did not become widely manifest until a few centuries after the *Sohar's* appearance.

In the mean time, it is refreshing to observe how vigorously Jewish writers took part in the popular literature of the different countries to which they belonged wherever their oppressors allowed them a brief repose. We refer to Ibn Sahal, whose erotic poetry was the delight of the Arabs; to Santob de Carrion, the Castilian; to Süsskind of Trimberg, the German Minnesänger; and to Manoello, or Immanuel, who was admitted to the intimate circle of Dante's friends. In the vision of heaven and hell contained in the *Divan* of Manoello, a marked contrast appears between him and his great contemporary. The Jew hails the great and good men of the heathen world, regardless of their belief or unbelief, among the dwellers of paradise. In the beginning of the fifteenth century Chasdai Crescas wrote a philosophical treatise entitled *Or Adonai* ("Light of God"), in which he seeks to show that all human actions are controlled by law, each effect being conditioned by an antecedent cause. He does not, however, deny the freedom of the will. His pupil, Joseph Albo, is the author of *Iccarim* ("Fundamental Principles"). In this work the salvation of the soul is represented as the aim of human existence, and the doctrine of Maimonides that we are to regard a progressive advance toward perfection as the end of our being, declared insufficient. Ibn Shemtob's views, laid down in his *Kebod Elohim* ("Glory of God"), are equally worthy of attention. Among the polemical writers of the Middle Ages, Profiat Duran, called Efodi, takes rank with the highest. The attempt of converted Jews, like Paulus de Santa Maria, Geronimo, and others, to destroy the faith of their brethren, provoked sharp and frequent discussions. The satirical letter of Efodi, addressed to a former friend and coreligionist, is a model of its kind. His most pointed and telling arguments are wrapped in the forms of concession. Simon Duran met the doctors of the Church on their own ground, and endeavored to prove from passages of the New Testament that Christ himself was unwilling to be considered more than man. Toward the end of the fifteenth century, Abrabanel, the exiled minister of King Ferdinand of Spain, wrote his commentaries on the Pentateuch, the books of Joshua, Judges, and Samuel, which contain much valuable information of interest to the historian.

The productions of Jewish literature were at this time more quickly and widely disseminated by means of the new art of printing. The Jew Jerome Soncino is prominent among the early Italian printers for the excellence of his Hebrew and classical publications. It is in Italy, indeed, that the interest of Jewish literature in the sixteenth century mainly lies. The Cabbala, it is true, found devoted adherents in that country, but rather among cardinals and princes than among Hebrew scholars. The two counts of Mirandola are instances in point. It is well known that even Reuchlin, the defender of the Talmud, suffered himself to be tricked by cabbalistic mummery. Of Elias Levita, on the other hand, we know that he devoted his energies to solid study and investigation. He called attention to the fact that the vowel-signs of the Hebrew Bible were added at a comparatively modern period, and that we are free to disregard them in the criticism of the text. Again, Asaria dei Rossi showed that the current chronology of the Jews, dating from the Creation, is utterly untrustworthy and contradicts well-established historical facts. He was also the first to avail himself of the Septuagint as a critical instrument. In other European countries no literary work of any great importance was going on. In Prague, David Gans, himself an astronomer, who corresponded with Kepler and enjoyed the society of Tycho Brahe, wrote the annals of Jewish and universal history. Other books on history appeared about the same time. In the middle of the century the influence of the Cabbala among the Jews was revived by Isaac Luria, the divine Rabbi Isaac (Ari), who closed his brief life in Jerusalem. To Palestine we are also indebted for that renowned code (compiled by Jos. Kara) known as the *Shulchan Aruch,* which, embracing in its provisions the entire life, public and private, of the Israelites, has maintained an infallible authority down almost to the present day.

In the seventeenth century free Holland afforded an asylum to the Jews. But the literature of the German and Portuguese settlers that soon arrived in great numbers, so far as it is distinctively Jewish, is not of any high order of merit. The writings of Manasse b. Israel, his *Address to the Protector,* his *Esperança de Israel,* his *Vindication of the Jews,* are noticeable chiefly for their practical bearings. The congregation of Amsterdam was infected with the spirit of the Inquisition, from which they had suffered so cruelly in their former home. They had become narrow and bigoted, and the best men that arose in their midst, Uriel da Costa, Benedict Spinoza, were bitterly and persistently persecuted. In other countries the interests of culture fared no better. In Poland the attention of scholars was absorbed in fruitless discussions on barren themes,

and high intellectual gifts were wasted on abstruse questions of Talmudical casuistry. Germany was inundated with Polish rabbis, and seemed to have lost all productive power of its own. As a *rara avis* in its day may be mentioned the commentary of Lipman Heller on the Mishna, which, with that of his predecessor, Obadiah di Bertinoro, is commonly printed alongside of the text in the standard editions. Italy alone continues to contrast favorably with the general gloom that had settled on the Jewish world. There we find the forerunners of the reform movement of our own time. Leon Modena attacked the prevailing system of rabbinical Judaism, called for a purification of public worship, and demanded the abolition of the ceremonial observances which the Talmud had enjoined. Joseph Delmedigo, a man of profound and varied learning, the pupil of Galileo, was no less exalted above the bigotry of his age. The end of the seventeenth century was marked by the great Messianic movement, instituted under the auspices of the Cabbala, with the impostor S. Zewi, as its acknowledged leader. The fever spread from the East to the West, and left deep traces in the writings of the time. In the eighteenth century the young poet Ch. D. Luzzato caught the prevailing contagion, and ruined a promising career by his devotion to mysticism. Those dreams of a great glory near at hand not only tended to sow discord in the congregations, as may readily be seen by referring to the controversial writings of Eibeschutz and Jacob Emden (see the article JEWS), but they also loosened the bonds of social order, and, especially in Poland, where they were much encouraged, brought about the complete demoralization of the common people. The evil was at its worst when the time of change was already near. Already, at the beginning of the century, Jechiel Heilprin had written his *Seder ha Doroth* ("Order of Generations"), which showed an awakening desire for the cultivation of historical pursuits. The Protestant Basnage wrote his history of the Jews, which served to give the Christian world some, though indeed a very inaccurate, knowledge of the great theme which it sought to illustrate. Prof. Wolf of Hamburg undertook to do for Hebrew bibliography what the Buxtorfs had done for Hebrew lexicography. At last, with Moses Mendelssohn, the new era fairly began. A translation of the Old Testament in the corrupt idiom then current among the Jews had been attempted before by Jos. Witzenhausen. Mendelssohn, however, was the first to render the Pentateuch into pure German, and thereby, like Luther in his day, created a powerful desire for change among his brethren. Under the influence of his disciples, the "Meas'fim" (so-called from the *Measef* or "Gatherer," a periodical published under their auspices, and of N. Wessely in particular), Hebrew poetry revived, and a due regard for grace and polish of form was inculcated.

But the great benefit which the modern reform movement has conferred on Jewish literature lies in the application of scientific methods to its study. Germany has in our day broken its long silence, and the labors of its scholars have brought order into the chaotic mingling of confused elements which the literature of the Jews presented to the scholar fifty years ago. The true succession of generations has now been, to a great extent, restored, many works that were considered lost have been redeemed, and the past is being reconstructed before our very eyes. Among the illustrious men who have done this work we mention Zunz, the pioneer, Jost, Geiger, Rappoport, Munk, S. D. Luzzato, Steinschneider, Derenburg, Graetz, Frankel. As it was intended in the above summary to indicate merely the direction of the great current of Jewish literature, many names of authors otherwise deserving attention have not been noticed. The reader is referred for full information to the works quoted in the article on JEWISH HISTORY, and to the excellent treatise of Dr. Steinschneider first published in Ersch & Gruber's *Allgem. Encykl.*, and since translated into English under the title of *Jewish Literature*.

FÉLIX ADLER.

Jewish Sects. *Sadducees and Pharisees.* — Until within a very recent period the character of these sects or parties, which divided the Jewish state in the last two centuries preceding its downfall, was strangely misconceived. The Pharisees were represented as having been hypocrites — the Sadducees, libertines. We are chiefly indebted to the brilliant researches of Geiger for a more truthful, if not yet complete, understanding of their principles and tendencies. The Syrian king having attempted to introduce the worship of images in Judæa by force of arms, the Jews became more closely attached to the religion of their fathers, and the Scripture in which it was laid down, by reason of the long struggle through which they were compelled to pass for its preservation. Even before the Maccabean war a party had been formed among them who, to ensure a stricter observance of the Mosaic law, withdrew from the society of the surrounding peoples and their own less scrupulous brethren. These were known as "Nibdalim" (separatists), or, in the Aramaic dialect, Perishin, whence Geiger derives the name Pharisees. In the war of independence the reigning family of priests had lost the confidence of the nation by their subserviency to the invaders, and a new dynasty, that of the Hasmoneans, assumed the tiara, and soon after the crown. The power of the priesthood, however, had been sadly shaken. It was regarded with fear and suspicion. The Hasmoneans, it is true, had headed the war against Antiochus and his successors. But no sooner were they seated on the throne than they allied themselves with the enemies of the separatist party, and incurred its displeasure. This party had in the mean time identified its interests with those of the people, and in opposition to the class-rule of a favored hierarchy began to develop strongly *democratic* tendencies. The whole people are priests, they said, and they attempted to extend the character of sanctity to every member of the community. In this undertaking they were much hampered by that book which they regarded as the very foundation of their faith. The Pentateuch distinctly recognizes the prerogatives of the priesthood. Powerless to abolish them, therefore, they copied the peculiar rites and ceremonies of the priests, and enjoined their observance on all. They could not level the law of Moses; they built up new ordinances of their own of equal height. Like the besiegers in olden times, they raised wall against wall. Thus, if the priests were commanded to perform certain ablutions before an offering, every Israelite was now to do the same before sitting down to his meals; the laws of purity, hitherto incumbent on the servants of the temple only, were declared universally obligatory. The blessing over the wine sanctified it so as to replace the libation; even a substitute for the offering of frankincense was not wanting. The repasts which the Pharisees held in common are in like manner explained as imitations of the customs of the priestly *fratria*. Every house was designed to be a temple, every hearth an altar. The religious equality of all was the watchword of the Pharisaic party. This would aid in explaining the origin of the elaborate code of ceremonies embodied in the Talmud. In the course of time, when the meaning which had inspired them at their inception was lost, they became a heavy burden. We may observe, in passing, that a desire to do away with temple and sacrifice is distinctly expressed in the later prophetic writings of the Bible. Also, a friendly spirit toward the Gentile world, and an effort to establish more intimate relations with them, which was, however, speedily checked.

In the priestly party, in opposition to which Phariseeism arose, Geiger recognizes the Sadducees. Their name he derives from Sadok, a distinguished priest of the first temple. Nor can it be denied that we find the Zadokites in high honor later on, as testified by Ezechiel and Nehemiah. The Sadducees an aristocracy; the Pharisees the champions of popular rights; the former the party of conservatism, the latter that of religious reform—this is, in brief, a statement of the opinion which at the present day largely prevails concerning them. That the leaders of the Pharisees were men of high aims and noble purposes no one can reasonably question, though the means by which they sought to attain their ends were not always wisely chosen. Concerning the Sadducees and their true character, there will still be much discussion. It may be urged that the well-known conservative spirit of the sect is cause sufficient to explain the peculiarities of their doctrines. Without denying the right of "tradition" to amplify the provisions of the Mosaic code, they resisted all far-reaching innovation, preferring to adhere as closely as circumstances would permit to the beaten track. The Pentateuch—and this is of great importance—exalts the descendants of Aaron and Levi above the rest of Israel. A desire to remain loyal to its evident prescriptions may have been the sole motive which impelled them to lean toward the priesthood and watch over its rights. We need not, therefore, charge them with hierarchal tendencies. As to the points of difference between Sadducees and Pharisees, the information we possess is scanty and insufficient. We know that the Sadducees rejected the doctrine of the resurrection in the body. This will hardly surprise us when we recollect that the books of Moses contain no allusion to any such doctrine. It was, moreover, a foreign importation, having probably been carried to Judæa from Persia. The Sadducees declare that holy things communicate their character of sanctity by contact; the Pharisees assert that their touch makes unclean—a declaration which was designed to prevent profane handling. If this is the case, say the Sadducees, then the Bible would cause uncleanness, while the Homeric poems would not. False witnesses are to be punished, according to the Sadducees, only when they have caused the punishment of the accused; according to the Pharisees, as soon as the judge has pro-

nounced sentence. The former seems more equitable. The Sadducees are of opinion that the high priest should kindle the frankincense in his censer before entering the Holy of Holies; the Pharisees command him to desist till he has passed the curtain. The exegesis of Lev. xvi. 2, on which the discussion hinges, is, if anything, favorable to the former. (For an extended account of the differences between the two sects, see Geiger's *Urschrift* and *Jüdische Zeitschrift für Wissenschaft und Leben*, 1863.) The Pharisees explain the word "sabbath" in Lev. xxiii. 11 as meaning, in this connection, feast-day in general. The Bœthusians, whom Geiger considers a subdivision of the party of the Sadducees, and identifies with the Herodians of the New Testament, retain it in its original signification. In this way, counting from "the day after the sabbath," they bring it about that the fiftieth day, the Feast of Weeks, shall always fall on a Sunday. The writer of this article has elsewhere attempted to show that it is erroneous to attribute such an opinion to the Bœthusians or Sadducees. It is well known that the name Bœthusians or Sadducees is frequently used in the Talmud where Christians are really meant. The Sadducees had no motive to prefer the Sunday, but many against such preference. On the other hand, it was of great importance to the Christians that the Feast of Weeks, the Pentecost, the close of the resurrection-period, should fall on the day of the resurrection. We have before us here a conflict not between the Pharisees and Sadducees, but between the Pharisaic Synagogue and the primitive Church. The important bearings of this controversy on the development of early Christianity cannot here be shown. (For a brief statement of the main argument in support of the above theory, see the *Proceedings of the American Oriental Society* for 1874.)

That the first book of Maccabees was written by a Sadducee, the second by a Pharisee, is one of the many interesting points which Geiger has labored to prove in his *Urschrift*. In how far Jesus himself adopted the principles of the Pharisees, made use of their methods, and even of their very words, may best be seen by studying their writings. The necessity of doing this in order to penetrate the obscurity which covers the first century of Christian history, has been forcibly urged by Hausrath in the *Protestantische Kirchenzeitung* (1863, No. 44).

Essenes.—Little is known of this mysterious sect save the few stray data which Josephus has preserved. They lived in communistic societies, led a quiet and secluded life, enjoined celibacy, observed moderation in speech and action, wore garments of spotless white. They shut themselves off from the society of the world, finding it impossible to maintain that scrupulous purity which they aspired to in the midst of social influences that exposed them to constant contamination. They have been considered the extreme right wing of Phariseeism. Popular superstition clothed them with magical powers. It is difficult to arrive at the truth concerning them at the present day. The Talmud does not mention them. (For an account of the KARAITES see the article under that head.)

The *Chasidim*, a modern sect, arose in the last century. It has numerous adherents among the Jews of Poland, Russia, and Hungary at the present day. Their religious practices are said to resemble those of the Shakers. The authority of their rabbis is supreme, the honors paid them amounting almost to worship. They delight in ecstasy and vision; and mysticism, as is everywhere the case, not unfrequently leads to immorality. This sect is an offspring of the Cabbala—a sad sign of the utter demoralization which long oppression has produced in the countries where it prevails. FÉLIX ADLER.

Jews, a people of Semitic origin, known also as **Hebrews** or **Israelites.** The former name is probably derived from their early seats beyond the Euphrates, whence they migrated to Palestine (the word *Eber*, whence *Ibrim* or *Hebrews*, meaning "beyond"); the latter is taken from the surname of the third patriarch, Jacob. With the waning fortunes of the kingdom of the ten tribes and the consummation of its fate Judah became the centre around which the remnants of the people crystallized. It was the foundation on which the polity of the second temple was raised after the exiles' return from Babylon; and from that time to our own day the scattered members of the nation have been known in common by the name of Judah (Jehudim, Judaists, Jews). A complete history of the Jews has not yet been written, and the best attempts that have been made to supply this deficiency only prove by their failure the prematureness of the undertaking. Nor is it likely that a better result will soon be achieved. The various fortunes which the Jews have met with on their journey of 3000 years, the persecutions they have undergone, the all-absorbing devotion with which they have clung to the religious ideal of their past, and which could not but paralyze their interest in the present—their want of appreciation, too, of the importance of historical research, joined to the wanton destruction of precious relics of their literature by the fanaticism of their adversaries—have conspired to make their annals like the torsos of some gigantic group, which the genius of a later age in vain exhausts itself to reconstruct. It is with good reason that this people has been termed a mystery to the nations. It is almost an enigma to itself. In view of these facts we shall do well to content ourselves with directing the attention of the reader to the main events of Jewish history only, which can be established by the records.

At the very outset of our undertaking we are distressed by the almost complete want of contemporaneous accounts. Setting aside for the moment the aid which Egyptologists proffer, and concerning whose value prudence warns us to suspend our judgment, we are dependent exclusively on the scriptural narrative for the source of our information. For, although continued research in Egyptian tombs and Assyrian palaces may reasonably be expected to bring to light some day much that will add to our knowledge, we need have no scruple in at once rejecting the fables of Hecatæus of Abdera and his like. Concerning the manner in which the biblical account itself is to be received, the opinions not only of philosophers and historians, but even of many eminent divines, go far asunder. To us it seems that of all the views that have been advanced on this subject there are only two which can claim the merit of consistency. The one embraces the inspirational theory, and looks upon the sacred writings of the Hebrews as the direct work of God through his instruments the prophets. The other simply regards them as the joint product of many generations of ancient Israel, and, while asserting for them certain distinctive excellences of their own, throws them entirely into the chain of human development, and abandons them, no less than the hymns of the Vedas, the books of Homer, or the narrations of Herodotus, to the analysis of the critic. We think it wisest in what follows to adhere as closely as may be to the very words of Scripture, nor shall we only select from them what, measured by a modern standard, may seem more or less adequate to the demands of reason. The narrowness of our space will excuse the briefness of the sketch.

The Hebrews, inhabitants of Palestine, did not assert the natural claim of being aboriginal. They were the bearers of the monotheistic idea. In the light of that idea their history began with the Creation, their destiny was to embrace the world. They were not to seek others; their duty was to remain true to themselves. In good time all nations would gather to their "holy mountain." Their roots reached backward into antediluvian soil; they had no need of coveting the doubtful honor of having sprung from the soil of Canaan. Abraham came from Ur, in Chaldea, with his wife and nephew. On reaching Palestine he traversed the country in every direction, and, what is worthy of note, erected altars on those spots which in later times became the principal seats of cults not always pure or regarded with favor by the prophets. (See Hosea on Bethel.) A famine drove him to Egypt, where his beautiful wife, Sarah, was taken into the royal harem. This was a consequence of Abraham's previous agreement with her that she should pass as his sister, he fearing that the lust of Pharaoh might otherwise endanger his life, and trusting that Divine Providence would allow no evil to result. Indeed, he does not seem to have explained the true state of things even after the royal order had been executed. But his confidence was justified. Pharaoh was warned by the plague of his misdeeds, and dismissed the pious prophet with many gifts. Almost the very same traits occur in the narrative of Abraham's visit to Abimelech, king of Gerar, in Philistia, and again in the account of Isaac's sojourn at the same court: he likewise introduced Rebecca as his sister to the Philistine. Abraham on his return to Palestine separated from his nephew, allowing him to take the richer fields near Sodom for his share. In a war undertaken by the Sodomites against Chedorlaomer and his allies, Lot was captured, and boldly rescued by Abraham. In a vision, accompanied by fearful signs, God assured the patriarch that his descendants should possess the land in which he dwelt, and these visions and promises were frequently repeated, the whole country from the Nile to the Euphrates being assigned as their future possession. But as yet Abraham is unblessed with offspring. His union with Hagar results in the birth of Ishmael. Before the child has seen the light the Egyptian woman is driven into the desert by Sarah. There an angel finds her by a well, foretells the future greatness of her son, and commands her to return to her mistress. The circumstances of Hagar's flight are related without reference to the first account, and with some divergence in the narrative, in Gen. xxi. To avenge the misdeeds of the Sodomites, God descends to earth. Three men appear to Abraham to acquaint him with the

approaching judgment, and at the same time with the fulfilment of his own darling wish. Sarah will bear him a child who shall be the inheritor of his fortune and his mission. The name Isaac is variously explained in Gen. xvii. 17, xviii. 12, and xxi. 6. After God has left Abraham, and the touching intercession of the prophet in behalf of the doomed city has proved vain, for there are not ten righteous men in its midst, the direful work proceeds. From the ruins of Sodom and Gomorrah, Lot and his two daughters are saved. To one interested in such inquiries it is instructive to compare the manner in which an event somewhat similar to the destruction of Sodom is treated by pagan writers. (See Ovid's *Metamorph.*, x., "Baucis and Philemon.") We would also draw the attention of philologists to the curious coincidence between Gen. xix. 4–9 and Judg. xix. 22–25. In the one hundredth year of the patriarch Isaac is born. Being commanded to sacrifice his son, the father complies without a murmur, but before he can consummate the terrible deed a voice from Heaven checks his hand, and announces to him the reward of God for the steadfast trust which he has exhibited. On the occasion of Sarah's death he purchases a burying-place for his family, and thus secures the right of possession to the land. The exquisite story of Isaac's wooing through his father's faithful servant, the meeting of the gray-haired steward and the bright young girl at the well, his entertainment and departure, is one of the choicest bits of description which the history of the ancients has preserved to us. His favorite son being wedded to his kinswoman, and the danger of intermarriage with idolaters being warded off, Abraham "is gathered to his people," having reached the good old age of 175 years.

The life of the second patriarch is less eventful. After his departure from Gerar, to which we have already referred, Isaac concludes a treaty with Abimelech, on which occasion Beer-Sheba receives its name. (Compare Gen. xxvi. 31 with xxi. 31, 32, where the name seems to be referred now to the word *shaba*, to "swear," now to *sheba*, the numeral 7.) The birth of Jacob and Esau introduces a permanent element of discord into the family of their parents. Their strife begins even in their mother's womb, and, increased by differences of temper and occupation, continues a source of mutual vexation till late in life. Jacob, although a peaceful shepherd, seems to have given the first occasion of their quarrel. It is he who, taking undue advantage of the exhausted hunter, betrays him into bartering away his birthright. It is he who, at the instigation of Rebecca, imposes on his blind old father, and deprives Esau of the blessing which was intended for him. The fond reliance with which the decrepit patriarch leans on his strong elder son, the tender filial love which the rude, generous-hearted Esau returns, the pains he takes to procure his father's favorite delicacies, the eagerness with which he endeavors to make good his faults—above all, the deep pathos of the meeting between parent and son when they find that they have both been overreached by the "man of wiles"—enlists all our sympathy in behalf of Israel's disinherited brother. Jacob flees to Mesopotamia, finding his home no longer a safe place to dwell in, and remains for twenty years in the employ of his uncle Laban. He marries both his cousins, though the first fourteen years of his service were devoted to Rachel alone, and then continues for six years longer to undertake the care of Laban's herds. The manner in which he gains his great wealth during this period reminds us of his earlier dealings in his father's house (Gen. xxx.). In the mean time, his family having largely increased, and his relations with his father-in-law ceasing to be friendly, he determines secretly to depart. Being pursued by Laban, he concludes a covenant of peace with him, and both parties combine in erecting a stone mound as a memorial of their league. On his return to Palestine, Jacob wrestles in the night with a divine being at Penuel (compare Judg. viii. 8 and 1 Kings xii. 25), and there receives the surname by which his descendants prefer to be known. Fearing the wrath of Esau, he now prepares to conciliate his favor, and with every token of submission and humility approaches him. Esau, true to his nature, discards the proffered gifts, embraces and kisses the brother who has so bitterly wronged him, and forgetting the past dismisses him on his way with kind words and offers of protection. We cannot sufficiently admire the truthfulness with which Scripture has drawn the character of Esau, and the unsparing justice with which it exposes the vices of him who is cherished as the father of the chosen people. As Abraham makes the future capital of the prince of Judah his favorite abode, and acquires landed property at Hebron, so Israel chooses the future residence of the kings of Israel, raises an altar, and buys land at Shechem. On reaching Bethel, where he had previously seen the vision of the heavenly ladder on his flight to Haran, the promises then made are repeated, and the name Israel is a second time bestowed on him. Removing thence, his beloved wife Rachel presents him with a son, Benjamin, and dies by the wayside. Jacob has now twelve sons, like Ishmael, and one daughter, Dinah. On account of an indignity offered to her, the two brothers Simeon and Levi take fearful vengeance on the people of Shechem, killing all the males, leading the women and children away captive, and plundering the town.

Joseph, the eldest son of Rachel, was the favorite of his father, who presented him with a tunic of many colors. This and the boy's ambitious dreams arouse the envy of his brothers, and they determine to slay him. Saved from death through the intercession of Reuben, he is sold as a slave to Egypt by the advice of Judah. There, entering the house of Potiphar (the same name occurs Gen. xli. 45, where he is called a priest of Heliopolis, and Joseph marries his daughter), and exciting the passion of his mistress, he saves his virtue at the expense of his liberty. After two years he is taken from prison, and his skill in interpreting the dreams of Pharaoh raises him to the dignity of viceroy of Egypt. His prophecy proves true. The seven years of plenty are devoured by seven of famine, and the wise precautionary measures of the Hebrew ruler alone save the land from overwhelming disaster. Among others who come up at this time from the surrounding districts to avail themselves of the rich granaries of Pharaoh are the sons of Jacob. They are confronted with Joseph, who at once recognizes his brothers, and exposes them to a long series of trials to test their honesty and mutual affection. He dismisses them, with the money they have paid him secretly restored to their sacks, detains Simeon, and commands that their youngest brother be brought before him; then on their return so contrives that Benjamin appears guilty of theft, and claims him for his bondsman. It is at this juncture that Judah, with words of eloquent tenderness, appeals to the seeming tyrant's heart, and offers himself to slavery in his brother's stead. Joseph reveals his true character, sends messages to his father which induce him, though already far advanced in years, to remove his family (about seventy souls) to the district of Goshen, which the bounty of the king has provided for him and his.

In reviewing the lives of Jacob and his sons we cannot but note how the fortunes and rival claims of their posterity are, as it were, visibly foreshadowed in the acts, and even the affections, of these fathers of the tribes. While the birthright incontestably belongs to the son of Leah, the love of Israel goes out to Rachel, and her eldest born, Joseph, is called the "prince of his brothers," a character which he plainly assumes in his dreams (Gen. xxxvii.). We know that later on the tribes that sprang from Joseph did, indeed, assume the sovereignty of the kingdom of the north in opposition to Judah; and if it was the latter, the fourth of Leah's sons, who reigned in the person of David and his house, we find the prior claims of Reuben, Simeon, and Levi already disposed of in the days of their father. The rights of these three were forfeited by their passions. The first was guilty of incest with one of Jacob's concubines; the other two were bitterly denounced for their cruelty to the Shechemites (Gen. xlix.). The prophetic lips of the dying patriarch here curse the wrath of Levi, which proved so valuable in the time of Moses, and the dispersion of that tribe, which is elsewhere characterized as a divine prerogative, is here foretold as the punishment of their guilt. We may also call to mind that as in later times the tribe of Benjamin alone became permanently attached to Judah, so even in the history of their ancestors we find Judah at once the affectionate brother and the bold protector of Israel's youngest son in Joseph's presence.

After Jacob had passed away, and with the death of Joseph the guardian of their interests was removed, the sons of Israel, who had largely increased in the mean time, became the slaves of the Egyptians. Four hundred and thirty years they served their pitiless taskmasters (according to Ex. xii. 40: Gen. xv. 13 gives the somewhat lower estimate of 400 years, while from Ex. vi. 16 it would appear that only three generations, Levi, Kohath, and Amram, the father of Moses, had passed between the first settlement of the Israelites in Goshen and their final deliverance). At length the period of their bondage drew to a close. After Egypt had been visited with nine plagues without the rigor of the king and people being softened—for God had hardened the heart of Pharaoh, that his great miracles might be displayed in the sight of the Egyptians (Ex. vii. 3)—the work of emancipation was consummated. The children of Israel prepared the Passover sacrifice, and in the night, while all the first-born of the land perished, they marched forth laden with silver and gold, and under Moses' guidance turned in the direction of the Red Sea. Pharaoh followed, but was overwhelmed with all his host in the floods that had opened to let Israel pass. Instead of taking the shortest road to Palestine, by way of Phœnicia, Moses now led the people about in the desert for

about forty years. Concerning the first two years of this period our accounts are tolerably complete. The people were weak in faith, and on every occasion when their obedience was tried, failed utterly to meet the emergency. They cried for water—Moses miraculously procured it for them; they demanded bread—the heavens rained it down upon them. The scriptural etymology of the word *manna* is peculiar. The description of its appearance and taste remind us of the virtues of the white and pearly *haoma* of the Persians. Moses had ample reason to say that the load was too heavy for him to bear. The crowning event of the Exodus was the revelation of the Law on Sinai. There Jehovah had appeared in a flaming bush to the fugitive shepherd while tending the flocks of the Midianite priest, and now again, amid the sublime phenomena of the thunderstorm, the "majesty of God" descended in fire (Ex. xix. 18) to the pinnacle of the smoke-enveloped cliff. Concerning the attending circumstances of the revelation, the scriptural account seems open to various constructions. From Ex. xxiv. 2 it would appear that Moses alone was to approach the Divine Presence; in xix. 24, Aaron is commanded to accompany his brother; while in xxiv. 13 the person of Joshua is substituted for that of the high priest. And again, while in Ex. xxxiii. 20 we learn "thou canst not behold my countenance and live," we are informed in xxiv. 9, 10, 11, "and Moses, Aaron, Nadab, and Abihu ascended, and they saw the God of Israel, and beneath his feet; . . . . and they saw God, and they ate and drank." In like manner, Ex. xxiv. 3, 7, would lead us to suppose that Moses himself wrote down the words of revelation in "a book of the covenant," while in xxxi. 18 two tables of stone are spoken of, "inscribed by the finger of God." Let us add that in Ex. xx. the fourth commandment of the Decalogue is referred for its origin to the repose which the Maker of heaven and earth instituted on the sabbath of the Creation, while Deut. v. 15 regards it as a memorial of Israel's redemption from the servitude of Egypt. The new covenant into which they had entered with Jehovah was quickly broken by the people. In Moses's absence they worshipped a golden calf, and Aaron himself was rebuked by the indignant prophet for the readiness with which he had yielded to the popular clamor. Directions were now given for the construction of a tabernacle in which the priests and Moses were henceforth to receive the communings of God. The details of the erection of the sacred tent are twice enumerated at considerable length toward the end of the second book of Moses. There are certain differences in the arrangement of material and the choice of language in the two accounts. (For a learned discussion of the whole subject the curious reader is referred to the excellent treatise of Dr. Popper, *Popper's Stiftshütte,* Leipsic, 1862.) The sacrifices and feasts, the various rites and ceremonies connected with the new sanctuary and its priesthood, are rehearsed in the book of Leviticus. We may claim the reader's indulgence if we forbear to discuss them. With the elevation of Aaron's family to the ministry of the tabernacle the contentious spirit of the people found new cause for discontent. A conspiracy was formed, with Korah, a cousin of Moses, at its head, for the purpose of resisting the divine command that had preferred the Aaronites to the priesthood. But their ambitious designs were thwarted. The earth opened and swallowed up the whole band of conspirators, Korah and his friends, their wives and children, and all that belonged to them (Num. xvi. 27, 32). With regard to the distinguished honors which the descendants of Korah bore in the service of the temple at Jerusalem, see Num. xxvi. 11: "the sons of Korah did not perish."

Having approached the confines of Palestine, Moses sends out twelve spies to the Promised Land to report upon the condition of the country and the strength of its defences. The news they bring so alarms the fears of the people that they desire to be led back to Egypt, and are in consequence declared unworthy of the prize they had scorned, and are doomed to perish in the wilderness. The events of the succeeding thirty-eight years of their wanderings are wrapped in obscurity. We may marvel how so vast a concourse of human beings—600,000 fighting-men alone, besides the women and children—could support life for so long a period in the barren desert; we may invent plausible theories concerning the manner in which they spent the dreary days of that joyless interval; but Scripture gives us no clue to aid our aspiring fancy. When at last a new generation had grown up, the Israelites once more direct their march towards the Jordan. With Moses as their leader, and under the protection of their God, they defeat the armies of Sihon and Og, subjugate some of the most fertile pasture-lands E. of the river, and spread far and wide the terror of their name. The king of Moab (the etymology of the name is curious: his own means "lightning," that of his father, "bird"), alarmed by the advance of so formidable a foe, calls in a sorcerer from the East to blight the fortunes of Israel. (Those who are fond of drawing parallels may compare the incident of Balaam and the ass with the account of the ass who startled Dionysos when he fought with the Titans, of the ass who foretold his imperial honors to Augustus, also of the ass in the story of Priapus, to whom St. Jerome has likened the Baal-Peor of our text.) In the plains of Moab the assembled people receive the parting monitions of Moses. The penalties of disobedience are painted in colors so vivid as to seem the very reflex of present vision, and the rewards of a glorious future are promised if they will be true to the law of which they are the bearers. That law is familiarly known, and the "Book of books" in which it is contained is easily accessible to all. Its provisions are mainly laid down in Exodus, Leviticus, and Deuteronomy, and all of these three must be carefully consulted in order to arrive at correct conclusions concerning the intentions of the lawgiver. This is not always so easy a task as might be wished, as serious difficulties are apt to complicate a harmonious interpretation. Lev. xviii. 16–Deut. xxv. 5 may be mentioned as an instance in point. (The difference in legislation which is here cited has been ingeniously referred by Dr. Geiger to the discrepant needs and interests of the kingdoms of Judah and Israel. The writings of this distinguished scholar are stored with erudition and masterly research on this and kindred subjects. His *Urschrift,* in particular, should be in the hands of every historian who treats of the rise and development of the monotheistic idea.) In passing, we cannot refrain from expressing a just surprise that the law of Moses should have been charged with neglecting the sanctification of the spirit, and placing the religious life of man on a merely legal basis—a law which proclaimed the childhood of man and the fatherhood of God; a law which took for its principle the sanctification of all the people; which devised such tender measures to ensure respect for the feelings of the poor; which commanded the creditor to return the pledge of the debtor before nightfall; which prevented the seducer, in an age when the marriage tie was but loosely knit, from divorcing the victim of his passion! As Moses was not to enjoy the fruition of his work, the beginning of the conquest of the Promised Land set a period to his life. From afar off he was permitted to view the future home of the tribes. Then he died. The circumstances of his life, indeed, are calculated to awaken an interest even in the minds of the skeptical. Cradled amid the waters, a shepherd serving a foreign master, a man of miracles, whose staff changes into a serpent, divides the sea, cleaves the rock, and calls forth the living water—the favored of Heaven, from whose countenance beams of light are shot forth that dazzle the beholder, the bright-eyed prophetic hero who sinks to rest among the mountain-peaks, his history awakens many reminiscences in the minds of those conversant with the early lore of ancient nations.

The work which Moses had left unfinished was taken up by his successor, Joshua. He led the people across the Jordan, and erected a monument of twelve stones in commemoration of their safe passage. (For the locality which was thus distinguished we may choose between Josh. iv. 9, "in the midst of the Jordan," and iv. 20, "at Gilgal.") The narrative of the first victories of the new leader is interspersed with the most marvellous events—the falling of the walls of Jericho, the phenomena at Ajalon, the affair of Achan. In some points we notice a marked resemblance between the incidents of Joshua's life and that of his predecessor and teacher. (Compare, *e. g.,* Ex. iii. 5 and Josh. v. 15.) Before his death, Joshua distributed the conquered and unconquered territory among the tribes, and exhorted the people to choose between Jehovah and the idols. They willingly declared their readiness to follow the pious example of their chief. In the succeeding period, however, we are surprised to find no trace of the fulfilment of so fair a promise. Disorder and distrust prevail. Mutual jealousies excite fierce conflicts among related clans; almost the whole tribe of Benjamin is extirpated; Abimelech kills seventy princes on one stone; lust and treachery run riot. The general darkness is at times illumined by the patriotism of heroic women and herculean men, but the light it spreads is fitful and uncertain. What most distresses us in the account we have of this evil time is the conduct of those whom we are taught to revere as the chosen messengers of Jehovah. Gideon after his victory proceeds to make a golden idol, which he worships (Judg. viii. 27); Jephthah sacrifices his own daughter (Judg. xi. 35); Samson marries a heathen woman (xiv. 1); while a Levite, contrary to both the letter and spirit of the Law, consents to become the priest of an individual and to superintend the worship of images (Judg. xvii. and xviii.). To the question, What had become of the remembrance of Moses and his law in the mean time? we look in vain for a satisfactory answer.

The last of the judges marks an important epoch in Is-

rael's history. Samuel was born of pious parents, and early dedicated to the service of God. (The etymology of the name, given in 1 Sam. i., seems to belong rather to Saul.) Eli and his sons were at that time in charge of the sanctuary at Shiloh. The weakness of the one, the wickedness of the others, brought destruction upon themselves, defeat upon the people. The Israelitish army was routed by the Philistines, and the ark of the covenant became the spoil of the victors. It proved a dangerous possession, and after having brought plague and pestilence in its train wherever it was transported it was finally returned, along with certain strange offerings, to appease "the God of Israel." Samuel now became the acknowledged leader of the people, and during all his lifetime is said to have overawed the Philistines and secured the peace of the land (1 Sam. vii.). The books of Samuel, however, continue to recount renewed conflicts between Israel and Philistia. The sons of Samuel were unworthy to succeed their father, and the people clamored for a king. The political tendencies of monotheism were republican. Samuel resisted their persistent demands to the utmost, but at last gave way, and anointed Saul of Benjamin. (According to 1 Sam. viii., ix., x., it would appear that the elevation of Saul was due to the general desire of the people for a stronger government. Chapters xi. and xii., however, speak of it as occasioned by the attack of the Ammonites, on which occasion Saul, as yet a simple farmer's lad, is suddenly seized by the Divine Spirit, and succeeds in effecting the rescue of Jabesh-Gilead.) The connection between Saul and the prophets gives rise to a popular saying, which is variously explained in 1 Sam. x. 11 and 1 Sam. xix. 24. Saul's hope of founding a dynasty of kings was not to be fulfilled. He was rejected of God (1 Sam. xiii. 13) because he had anticipated the coming of Samuel in an hour of great need, and himself brought the sacrifice before battle; or (1 Sam. xv. 26) because he had failed wholly to extirpate the hated race of Amalek. A new king was now to be chosen. Samuel selected a shepherd-boy, David, the son of Jishai. The manner of the future ruler's introduction to Saul is related in 1 Sam. xvi. 23 and xvii. 57. It is the fame of his skill on the harp which brings him to court, in the former narrative, to soothe the gloomy spirit of the king; in the latter, the attention of Saul is first directed to the young hero after he has slain the Philistine giant (in 2 Sam. xxi. 19, Elchanan is mentioned as the vanquisher of Goliath). The suspicions of Saul were soon aroused against David, but the prowess of the latter repeatedly defeated the schemes that were laid for his destruction. Saul was even compelled to give him his daughter in marriage and to witness the close alliance subsisting between his son and his hated rival. David was at last compelled to flee the court, and thenceforth led the roving life of a fugitive. The jealousy of the king followed him wherever he went, and the repeated proofs which he gave of his respect for the person of "the Lord's anointed" served only to secure an occasional interval of repose. A lasting reconciliation was not brought about. The records of that dismal age are frequently stained with deeds of bloodshed. Eighty-five of the priests of Nob are butchered by command of Saul, and the city itself utterly destroyed. David, to save his life, plays the fool at the court of Achish (1 Sam. xxi.), enters into relations of close intimacy with Ammonites and Moabites—he was himself the descendant of Ruth, a Moabitish woman—and serves in the army of the Philistines (1 Sam. xxix. 2). In the mean time the incursions of the Philistine forces continue to endanger the political existence of Israel. Saul is reduced to utter despair. The weird scene in the house of the Witch of Endor, described in ch. xxviii., where the spirit of him who is "shrouded in a mantle" (comp. xxviii. 14 with ii. 19) rises out of the earth to announce impending doom to the weary king, is a fitting prelude to the tragic close. In a great battle the hosts of Israel are routed by the Philistines, Saul falls on his sword, and his sons perish with him. David was now recognized as king, at first by his own tribe, then, after Ishbosheth's death, by the whole people. He delivered seven sons of Saul into the hands of the Gibeonites that they might kill them, while he supported the son of his friend Jonathan, a poor cripple who was content to live on the king's bounty. The peace of his house, however, was continually disturbed by the misconduct of his own children. The incestuous passion of the one, the boundless ambition of the other, distressed the father's heart. He was forced to flee, an exile, from Jerusalem, the city which he had himself conquered and made the capital of the country. And his victory over the insurgent chief was but a new source of grief, involving as it did the destruction of his beautiful if unworthy son. His victorious arms had, indeed, extended the boundaries of the land and secured its safety. But domestic discord and the rankling consciousness of his own deep guilt clouded the happiness of David's declining years. After a reign of forty years he died. Solomon, the son of Bathsheba, whose husband had been treacherously slain by David, succeeded to the throne. He executed the design which his father had formed, but had not been permitted to accomplish. With the aid of his ally, the Phœnician king, he reared the splendid temple on Mount Moriah, and dedicated it with imposing ceremonies to the service of the God of Israel and of the stranger. Renowned from childhood for extraordinary wisdom, he illustrated his reign with the magnificence of regal display rather than the glory of victorious arms. Trade flourished, his ships returned laden with the treasures of the distant East, and Jerusalem was adorned with palaces. But the people were burdened with taxes, the royal harem was enlarged beyond all precedent, and the heart of the uxorious king was won for foreign gods by the foreign princesses whom he had espoused. Hardly had Solomon breathed his last when the people rose in open revolt. His son, Rehoboam, unwisely provoked the resentment which justice and policy called upon him to allay. Ten tribes under the leadership of Jeroboam seceded from his dominion; Joseph and Judah were thenceforth separated. Jerusalem remained the capital of Judah; Shechem, Tirzah, Samaria became in turn the residence of the kings of Israel. To prevent a return of the people to their old allegiance Jeroboam established new seats of worship, introduced innovations in the celebration of the festivals, and created a new priesthood. His rule was the inauspicious beginning of a long series of disastrous reigns. His son Nadab was slain while besieging Gibthon of the Philistines. Baasha, a successful conspirator, ascended the throne, and ruled twenty-four years. Then followed his son Elah, who was murdered by Zimri. This seven-day king kindled the royal palace above his head when he learned that the army around Gibthon (comp. 1 Kings xv. 27 with xvi. 15) had raised their captain, Omri, to the throne, and were already entering the gates of Tirzah. An unholy distinction belongs to the reign of Ahab, Omri's son. Having wedded the Phœnician princess Jezebel, he introduced the lascivious worship of Baal (the cult of the phallus) into Israel. The bonds of law were loosened, the service of the Deity was degraded to sensual orgies, and the example of the court corrupted the manners of the people. The better and purer spirits reacted against the inroads of a foreign worship which outraged alike their feelings of piety and of patriotism. A more profound conception of the Divine Being was gradually evolved, and the inward and outward struggles of infant prophecy may still be traced in the lives of Elijah and Elisha as they are transcribed in the chronicles of the Kings. The victory of Ahab over the Syrian Benhadad was sullied by the untimely clemency which he extended to his vanquished foe. Soon after, in a war undertaken with Jehoshaphat, king of Judah, for the purpose of wresting Ramoth-Gilead from the power of Aram, Ahab lost his life, and, as Elijah had prophesied, his blood was licked by dogs in the vineyard of Naboth, the same whom he had treacherously murdered. The house of Ahab was utterly rooted out by command of Jehu, whom Elisha had anointed king over Israel. The 70 sons of the Baal worshipper were slain, and his wife, Jezebel, audacious to the last, was cast from the window of her palace by her attendants. The successors of Jehu continued in the evil courses of their predecessors. Jehoash captured Jerusalem and destroyed part of its wall. Jeroboam II. extended the boundaries of his kingdom, but the lustre of his successors was but the last glow of an expiring flame. A new and warlike dynasty possessed the throne of Assyria. Menahem bought a transient peace by the payment of a heavy tribute to the Assyrian king Phul. In the reign of Pekah, however, the whole land of Naphtali was overrun by Tiglath-pileser, and its inhabitants carried away into captivity. It was in vain that the king of Israel united his forces with those of his old enemy, the king of Syria, for mutual protection against the common danger that approached from beyond the Euphrates. The final blow could no longer be averted. Too late his successor, Hosea, implored the aid of the Egyptian Pharaoh. The army of Salmanasar attacked Samaria. A fruitless siege of three years ended in the capture of the capital and the complete downfall of the kingdom of Israel (B. C. 721). The ten tribes were settled in distant districts of the Assyrian empire, and soon lost among its inhabitants. The once mighty people of the N. of Palestine left a lasting monument of its greatness in the inspired writings of its noble prophets, but of the subsequent fortunes of the scattered tribes nothing became known, save to the idle dreamers of a later age.

For more than a century after her sister kingdom had been swept away Judah continued to brave the storms that threatened her own existence. In the reign of Rehoboam, Shishak, king of Egypt, plundered the temple and palace of Jerusalem. (The biblical account is corroborated by

the testimony of the Egyptian monuments.) His successors (comp. 1 Kings xv. 2 and 10) proved little better than the neighboring rulers of Israel. Even the more God-fearing among them would not or could not abolish the idolatrous custom of sacrificing on high places. Jehoshaphat and Ahaziah formed an alliance with the house of Ahab, for which the latter paid dearly with his life. Athaliah, a daughter of Omri, then usurped the sovereign power, and commanded a promiscuous slaughter of the royal family to secure her throne. Joash, a suckling infant, alone escaped. In the seventh year of her reign Athaliah fell before a conspiracy of the priests and captains, with Jehoiada at its head, and Joash was proclaimed king. He was succeeded by his son Amaziah, who defeated Edom, but was himself severely chastised by the king of Israel. Azariah, the son of Amaziah, was afflicted with leprosy, and was forced to leave the care of the state in the hands of his son Jotham. Jotham, in turn, was followed by Ahaz. This king was attacked by the combined armies of Israel and Syria. To save his power he was compelled to call in the doubtful aid of the Assyrian Tiglath-pileser, and purchased his security at the expense of his independence. His son, Hezekiah, is celebrated in history as a prince of distinguished piety, whose virtues arrested for a time the downward course of Judah's fortunes. His court was adorned by the presence of the most magnificent of the prophets, and the king had the rare fortune of listening to the counsels of Isaiah, and the rare merit of deferring to his monitions. The armies of Assyria, which had extinguished the national existence of Israel, passed harmlessly by Jerusalem. The vast host of Sennacherib was struck with a sudden blight; an angel of Jehovah passed through the camp, and in the morning 185,000 corpses covered the field. After the death of Hezekiah, Manasseh and Amon brought back the evil practices of former days. Then came Josiah, celebrated as the restorer of the law. In his day Hilkiah, the high priest, found a scroll in the temple which he sent to the king (this scroll is by many critics supposed to have been the book of Deuteronomy). Josiah, terrified by the announcement of approaching doom contained in it, projected a complete reform in the religious life of the people. He ordered the temple to be purged of its idols, the Passover to be celebrated, and concluded anew the broken covenant with God. When Pharaoh-necho advanced against Assyria, Josiah, true to his allegiance, marched out against him, but was slain at Megiddo. In the reign of his son Joiakim, whom Pharaoh had appointed king in place of Joahash, a change took place in the complexion of the political world. Great Nineveh fell. Upon her ruins rose the empire of the Chaldæans, and as Egypt's strength was paralyzed, the armies of Babylon asserted her undisputed sway over the surrounding nations and cities. Before this new power the kingdom of Judah at last succumbed. Joiakin, a youth of eighteen years, who succeeded his father, was hardly fitted to guide the helm of state at so critical a period. Nebuchadnezzar came upon Jerusalem. The king was carried captive to Babylon, and Zedekiah appointed in his stead. Zedekiah rebelled. For two years Jerusalem withstood the siege of the Babylonians. At last, driven by famine, the besieged endeavored to cut through the lines of the besiegers. Zedekiah was overtaken, brought before Nebuchadnezzar, his children slain before his eyes, and, blinded, he was carried in chains to the capital of the conqueror. Jerusalem was in ashes, its temple a smouldering ruin, and "the paths of Zion were in mourning." The prophecies of Jeremiah had foretold the calamity which he was powerless to avert; his Lamentations sing the dirge of Judah's fallen greatness. A remnant of the people was left in Palestine under Gedaliah as governor. Assassination put an end to his brief reign, and the others, fearing the vengeance of the Chaldæans, fled to Egypt, with Jeremiah as their unwilling companion. The great majority of the people, however, had been led into exile, to recall "by Babel's streams" the sad memories of their native land. (It is worthy of remark that the mother's name of the ruling prince is invariably mentioned in the annals of the Judæan kings, while it is omitted in those of Israel. The high power of the king's mother is also attested by the sovereignty which Athaliah exercised during seven years, and by 2 Kings xxiv. 12, where the mother of Joiakin is mentioned as the most considerable personage of his court.)

Babylonia proved for the Jews the crucible from which they came forth for the first time wholly aglow with the spirit of monotheism. In the year 538, Cyrus, having overturned the empire of the Chaldæans, permitted them to return to their country. About 50,000, with Jeshua, the high priest, and Zerubbabel, of the seed of David, at their head, availed themselves of this permission. Spurred on by the eloquent monitions of such prophets as Haggai and Zechariah, they proceeded to re-erect the fallen temple, though frequently interrupted in their work by the enmity or jealousy of the surrounding nations. Prominent among these were the Samaritans, with Sanballat their chief. These people had been transplanted by the Assyrian monarch to occupy the vacant seats of the ten tribes, and had adopted the religion of Israel. But being still tainted with idolatry, they were not admitted to the share they claimed in the new sanctuary of Jehovah. Their calumnies at the Persian court for a time caused the complete suspension of the work. In the year 515 the building of the second temple was finished. The religious basis of the infant state was fixed by the scribe Ezra, "the second Moses," who, coming from the court of Artaxerxes armed with great powers, used them to secure the general observance of the Law and to purge the people of the heathen elements which had crept into their midst. His measures do not appear to have been quite as effective as they were stern. Nehemiah, the cupbearer of Artaxerxes, followed in his footsteps, forbade the desecration of the sabbath, rebuked the wealthy for their greed and their oppression of the poor, and strengthened the defences of Jerusalem by the erection of a wall. The succeeding period until after the death of Alexander the Great is wrapped in obscurity. Judæa, remaining tributary to the Persian ruler, had no history, and may therefore be supposed to have been happy. After the death of the Macedonian conqueror, Ptolemy Lagi captured Jerusalem, and for almost a century Palestine was held in subjection by the Ptolemies, whose yoke was not, at first, a heavy one. Many of the Jews had settled in Alexandria, where their industry, enterprise, and wide connections soon raised them to the position of merchant princes. A rich, manifold, and widely influential literature arose in the midst of this Egyptian colony, and under the fostering care of scholarly kings a new philosophy was cultivated, destined thereafter in Christian garb to spread over the world. The Septuagint (the Greek translation of the Old Testament) was composed, and a temple, built after the pattern of the one on Moriah, at Heliopolis, became at once a source of pride and distrust to the patriots of Jerusalem. With the decline of Egypt's power and the growing strength of the Seleucidæ, a new danger threatened the existence of the Jewish state and religion. In the beginning of the second century B. C. Judæa had transferred its allegiance to Syria. In return, Antiochus Epiphanes barely three decades after commanded them to abjure their religion, defiled their sanctuary, and erected the statue of the Olympian Jove, to which they were ordered to pay divine honors. This outrage provoked a disastrous "thirty years' war." Antiochus was aided by the party of the Hellenists, friends of the Greeks, at whose head stood the infamous priests Jason and Menelaus. The cause of the people was espoused by the family of the Hasmoneans, or Maccabees, so called from its most valiant member, Judah the Hammer (Maccab). The Maccabean brothers were the main stay of the revolution. Equally great in defeat and success, they achieved victories over Syrian armies that were superior to their own in numbers, equipments, prestige, in everything but devotion to their cause, while they never allowed their courage to sink under the most crushing adversity. Their heroic deeds are related in the works of Josephus and the books of the Maccabees. (For an ingenious argument to prove the Sadducean origin of the first book, the Pharisean of the second, see Geiger's *Urschrift*, p. 200.) The Talmud, strange to say, almost ignores them. Judas Maccabee succeeded in cleansing the temple. He died a soldier's death in a decisive battle fought with the Syrian general Bacchides. Jonathan, his brother, profiting by the disorders that had broken out in the enemy's country, secured his recognition as high priest and ethnarch by the possessors of or pretenders to the throne of Syria, but was finally ensnared by the wily Tryphon, and treacherously slain. The command now devolved upon Simon, to whose prudent counsels the father of the Maccabees had on his deathbed referred the brothers for their guidance. He ended the long war successfully in the year 143 B. C., established the independence of Judæa, and was invested by a grateful people with the chief magistracy. It is probable that in his day the Sanhedrin, the highest tribunal of the state, composed of eminent doctors of the law, first entered upon its duties, though a more ancient origin is ascribed to it by some. Simon was assassinated by his son-in-law Ptolemy, who betrayed at once the sacred trust of hospitality and the confidence of paternal affection. His son, John Hyrcanus, succeeded him. This prince subjugated the Idumæans, and forced them to accept the religion of Moses —a fatal step for his people and his dynasty. During a reign of thirty years (135–105), which was signalized by many warlike achievements, he incurred the hatred of the popular party of the Pharisees by his ill-concealed preference for their Sadducean opponents. His son, Aristobulus, who followed him, added the kingly purple to the high

priest's robe. The brother of Aristobulus, Alexander Jannæus, is remarkable for the rapid succession of his military exploits and the general bad fortune which attended them. On one occasion he was only saved from utter destruction by the intervention of Cleopatra and the Jewish generals that commanded her army. In his lifetime he bitterly persecuted the Pharisees, but on his deathbed he advised his wife, Salome Alexandra, to make her peace with a party whose hostility might ensure her destruction. The bloody feud which began to rage after the death of Jannæus between his sons, Hyrcanus and Aristobulus, was the fatal beginning of a long struggle that ended in the final dismemberment of the Jewish state. The friendship of the Romans had proved valuable in the war of independence. The Roman eagle was now called in, like the fox in the fable, to judge between the hostile brothers. Scaurus at first decided in favor of Aristobulus, but (63 B. C.) Pompey reversed his decision. The temple was stormed, Hyrcanus reinstated, and Aristobulus with his sons carried captive to Rome. The independence of Palestine was thus for ever lost. A native prince was, indeed, still permitted to assume the vain shadow of authority, but the policy or caprice of the Romans thenceforth appointed or dismissed the rulers of the Holy Land. The counsels of the feeble Hyrcanus were directed by Antipater, a statesman of unusual sagacity, an Idumæan by birth. While we cannot but abhor their treachery, we are compelled to admire the subtle craft by which this Antipater and his son Herod contrived to secure the favor of all the great captains who at that time successively swayed the destinies of the Roman world. When the star of Pompey was about to decline, Antipater earned the gratitude of Cæsar by the powerful support which he lent him in the conquest of Egypt. Herod, ruling in Galilee, strengthened the hands of Cassius by the prompt despatch of supplies collected in his district. He enlisted the sympathies of Mark Antony so completely in his behalf that his cause was introduced into the Roman senate by both Antony and his colleague Augustus. Through their efforts the usurper was proclaimed king. Meantime, Antigonus, the son of that Aristobulus whom Pompey had sent to Rome, obtained the aid of the Parthians in an attempt to regain his throne. Jerusalem was taken, Hyrcanus sent captive to Babylon, and Herod forced to flee to Idumæa. With the help of his Roman friends, however, he succeeded in turning the fortunes of the war. After a most sanguinary conflict the capital was retaken (B. C. 37), and Antigonus, at his instigation, shamefully executed. King Herod "did his days in stone." He rebuilt the temple on a scale of great magnificence, erected spacious amphitheatres, and introduced the games of the arena. But this outward splendor could not conceal the real misery of his disastrous reign. The tyrant's fierce passions were quickly roused, and he possessed the fatal power of fulfilling his desires. Among those whom he slew may be named—Hyrcanus, to whom his family owed its elevation; the grandchild of the former, his own beautiful wife Mariamne; her brother, the young high priest Aristobulus; two husbands of his sister Salome; three of his own sons, and others too numerous to mention. After his death the kingdom was divided among his sons, Archelaus, Antipas, and Philippus. By the favor of the emperor Claudius his grandson, Herod Agrippa, once more for a brief time united the divided principalities under one sceptre. But in the days of Agrippa II., in whose reign the destruction of the state was accomplished, the power of the last Jewish dynasty had lost all substance. The extortions of such Roman governors as Antonius Felix and Gessius Florus urged the people to the very verge of despair. A republican party long since subsisted among them, as appears from Josephus (*Antiq.*, xiv. 3), and the Zealots under the leadership of Judah of Gaulonitis were impatient of the Roman yoke. Encouraged by the destruction of the army of Cestius Gallus (A. D. 66), the patriots at last dared to raise their head. The gauntlet was thrown down to Rome, the revolution began, and Josephus, the future historian of the war, was sent to organize the defence of Galilee. The disciplined legions, advancing under Vespasian, the ablest general of the age, were met by rude bands of guerillas, and the arts of war baffled by the obstacles of nature and the frantic courage of despair. The strong fortress of Jotapata successfully resisted every effort of the besiegers, until, covered by the mist of early morning and led on by a traitor, the Romans succeeded in surprising the guards, and the place fell into their hands. Josephus, who commanded in person, was taken prisoner; 40,000 men are said to have fallen in the siege. On Vespasian's departure the completion of the war was entrusted to his son, Titus. In the spring of A. D. 70, Titus opened his works against Jerusalem. The city was torn by dissensions. Famine soon made its appearance, the houses were filled with the dead and the dying, mothers are said to have devoured their own children in the frenzy of hunger. After two weeks the outworks were taken. Upon this the attack was directed against the strong castle Antonia, which was connected by cloisters with the temple. Notwithstanding the repeated sallies of the besieged under their heroic chief, John of Gisoala, the castle was captured. Then began, under the eye of the Cæsar, the last desperate struggle of the defenders for the palladium of the state, the sanctuary itself. Again and again the imperial soldiers were beaten off and dashed from the walls. At last a Roman soldier, rising on the shoulder of his fellow, threw a firebrand through an open casement into the outer halls of the temple. The woodwork caught, the temple stood in flames. The infuriated troops rushed into the holy places, murdering and pillaging, and the arm of Titus himself was powerless to stay the carnage or save the great edifice. Many of those whom the sword spared were carried to distant countries as slaves or saved for the sports of the arena. Jerusalem was an utter ruin; the Jewish state had fallen to rise no more.

With the loss of its political existence the integrity of Judaism as a religion remained unimpaired. The foundations for a new order of things had already been laid. Prayer took the place of sacrifice, the synagogues replaced the temple, and the Beth-Din, noiselessly founded by Rabbi Jochanan ben Sakkai in Jamnia, became a centre of authority to reunite the scattered people. The Beth-Din was presided over by a *nasi* (prince), a descendant of Hillel, the great master of the law, and two other officers (ab-beth-din and chacham). It was composed in the first place of seventy academic members; secondly, of such as had been ordained to act as teachers; and of their disciples, in the third place. The sittings were open to the public. The questions discussed in this and the similar academies at Sepphoris, Tiberias, and elsewhere affected the entire religious, political, and social life of the Jews. Through the agency of such schools the work of extending and modifying the provisions of the law and of ancient tradition (Cabbala) to suit the altered circumstances of the time was successfully carried on. The political position of the Jewish citizens of the Roman empire (they had been admitted to the rights of citizenship by the emperor Claudius) varied with the character of the reigning sovereign. Vespasian seized the tax which the Jews had hitherto remitted to the temple for his own treasury, and thereby set an example to his real or pretended successors down almost to our own day. Domitian displayed his animosity chiefly by the severe treatment of proselytes. The mild rule of Nerva was succeeded by a period of wild disorder in the reign of Trajan. The Jews of Egypt, Cyrene, and the isle of Cyprus rose in open revolt. The barbarous conflicts that ensued have left few traces in history save in the increased legacy of mutual hate between the parties engaged in them, which they transmitted to succeeding generations. At this time the great Proseuche of Alexandria was destroyed. The last powerful insurrection of Judæa followed in the days of Hadrian, and was quelled by Julius Severus. Their Messianic prince, Bar-Cochba, led the insurgents in more than fifty battles against the Romans; half a million of Jews are reported to have fallen in them. With the taking of Betar the war came to an end. Bar-Cochba himself is said to have been found among the dead enveloped in the folds of a serpent. Jerusalem now became a Roman town, under the name of Ælia Capitolina, in honor of Ælius Hadrianus and the Capitoline Jove; the Jews were forbidden to enter its precincts. They were, moreover, disturbed in the practice of their religious rites, and the vital point of their faith was attacked when the teaching of the Law was interdicted. The stubborn resistance of the people must have impeded the execution of these commands, and the more obnoxious of them were soon after abrogated by Antoninus Pius. The close of the second century is rendered memorable by the compilation of the Mishna (see TALMUD) under the auspices of the patriarch R. Jehuda, who is called Ha-Kadosh ("the saintly"). This work was intended to present in an authentic and codified form the decisions of the Beth-Din, which had accumulated during several centuries. Its bulky commentaries, the Gemaras of Babylon and Palestine, explain or amplify its provisions. The successful completion of so difficult a task bears witness to the high authority which the patriarch or nasi must have wielded in the academy, while the willingness of the people to accept the code which the doctors of the Law recommended evinces the respect in which these chaberim or chachamim, this "brotherhood of the Learned," were held. At the same time, the deposition of Gamaliel shows us the firm determination of the Beth-Din to resist all undue exercise of power on the part of its chief officer. The members of the college themselves never aspired to other prerogatives than those which superior wisdom and purity might justly claim. A privileged caste could not arise where merit

was the sole measure of worth. The Pharisaic doctrine that the priesthood belongs to all the people was rigorously maintained, and both in the synagogue and without it the democratic principle of the equality of all was religiously adhered to. This state of things was largely due to the happy example set by the rabbins themselves. Of some of the most distinguished of their number we know that they followed some humble calling to earn their bread, thinking it shameful to coin their teachings into gold. A similar sentiment is echoed in the twelfth century by Moses Maimonides. In paying a passing tribute to the singular disinterestedness of the ancient rabbins, we would briefly advert to the legends with which the stories of their lives are intertwined. These legends are not, as has been supposed, mere fanciful embellishment or exaggeration of historical fact. In the accounts of Oni Ha-Me'aggel, the man of the wheel who was able to produce rain, of Simon b. Jochai, whose fiery glance spread desolation in the fields when he left the cave where he had dwelt concealed, of R. Jochanan (the fabled compiler of the Gemara of Palestine), whose arm emitted a wondrous rosy light, we recognize distinct mythological traits. These legends are contained in the Hagada (the historical and poetical part of the Talmud as distinguished from the Halacha, the discussions and disquisitions on points of religious theory and practice). A careful scrutiny of the legends of the Talmud and its supplementary works would, we doubt not, richly repay the labors of the student of comparative mythology.

In the reign of Diocletian the Jews seem to have been exempt from persecution. Their general condition in the Roman empire at this time was at least tolerable. Their peculiar customs, the dietary laws which prevented them from joining in the festivities of their neighbors, provoked the ridicule or the scorn of the pagans. But their legal status was not thereby affected. All this changed when Christianity in the person of Constantine ascended the throne. The harsh spirit which he infused into the legislation of the empire with regard to the theological opponents of the reigning faith was still further developed by his successor, Constantius, whose measures called forth an unsuccessful revolt in Judæa. The philosophic Julian (361) granted them the full blessings of his favor, but they failed to second his efforts for the restoration of the temple. Theodosius I. was just in his dealings with an oppressed people, in defiance of the vehement reproaches of Ambrosius, the bishop of Milan. In the reign of Theodosius II., Cyril of Alexandria, who has earned an unenviable fame for permitting the murder of the noble Hypatia, expelled the Jews from that city. The emperor himself deprived them of valuable rights, such as the rebuilding of synagogues, the exercise of judicial functions, and the like. The Jewish patriarchate, though its incumbent had but lately been numbered among the "Illustres," about this time (the beginning of the fifth century) expired. In the following century the code of Justinian excluded them from all honorable offices, imposing upon them the duties while depriving them of the privileges of the citizen. Meantime, the centre of authority in what concerned the internal affairs of the Jews had been gradually transferred from Palestine to Babylon, and the latter ultimately assumed many of the peculiar prerogatives of the former. About the time of the compilation of the Mishna, Abba Areka (Rab) and Mar Samuel removed from the land of Israel, and founded schools of learning on the banks of the Euphrates and the Tigris. The most important of the schools that flourished in those regions were those of Nehardea, Susa, Pumbeditha, and Machuza. In them the Gemara of Babylon (compiled about 500) was elaborated. The political representative of the Babylonish Jews was known under the name of "prince of the Captivity" (Resh Gelutha). He was accustomed to live in great state. The office continued to be filled until the tenth century. When in the third century the religion of Zoroaster celebrated a great triumph in the accession of the house of Sassan to the throne of Persia, the position of the Jews remained, on the whole, unaltered. Persecutions were indeed more frequent than they had been, but the yoke of the Magi was light when compared with that of the priests in Christian countries. Shabur II. (313) transplanted a considerable number of the Armenian Jews to Ispahan. Jesdigerd II. forbade the observance of the sabbath and the public reading of the Shema (the proclamation of the unity of God) 455–460. His son Firuz slaughtered many of the Jewish inhabitants of Ispahan, and further extended the stringent measures of his father (471–488). About this time a colony of Jews is said to have landed on the coast of Malabar, a part of whom afterwards settled in Cochin-China. The rise of the sect of the Zendics involved the Persian Jews in the general disasters that then befel the realm. Hormisdas (581), discarding the example of the great Chosru, pursued the cruel policy of Firuz; and it was but natural that the Jews should take sides with his enemy, the usurper Bahram, in the conflict that ensued between the rival aspirants to the throne. Under Chosru II. they joined the Persian troops which invaded Palestine, and avenged the injuries of their brethren by expelling the Romans from the land. While the power of the Sassanidæ visibly declined in the country which we have heretofore designated by the ancient name of Babylon, a new faith rose on the Arabian peninsula whose conquering arms were soon carried over a great part of the civilized world. From a very early time Jews had settled in Arabia, and had assumed the language and manners of its inhabitants, differing from them only in their religion. The Jewish prince Samoel b. Adija is still celebrated as the greatest of all the poets that flourished before the coming of Mohammed; while the Jewish king, Jussuf b. Nowas, became a byword to the credulous superstition of a later age. Powerful Jewish tribes, settled in the neighborhood of Yathrib (Medina), prepared the minds of the Arabs to receive the doctrines of the Prophet, and to Jewish learning he owed the better part of his teachings. (Compare Geiger's prize-essay, *What did Mohammed Borrow from Judaism?*) When Mohammed found the Jews as stubborn to resist his own pretensions as they were ready to aid him in exposing the shams of idolatry, the friendly spirit of his earlier policy toward them changed into bitter animosity. Yet he ever exempted the "scriptural people" from the edicts of proscription with which he pursued the worshippers of images, and the rule of toleration which the founder introduced became a law for his successors. The Persian empire succumbed before Omar, the second of the caliphs. To him are ascribed those well-known enactments which define the status of Jews and Christians in countries subject to Mohammedan rule. They may be compared to the canonical laws of the Christian Church, only that they have less of that spirit of intolerance which is characteristic of the latter. They were, moreover, less frequently and less stringently enforced. By them it is provided that Jews and Christians are not to build new houses of worship, nor repair such as are decayed; they are to prevent no one from conversion to Islam; they are not to sell wine nor wear their hair long; they are not to be considered eligible for office. A Moslem who maltreats an infidel is to pay a fine, etc. etc. The political head of the Jews was treated with sufficient respect by the first caliphs, and Bostanai, the "prince of the Captivity," seems to have been the recipient of the highest royal favors. But a new power, that of the Gaons, gradually eclipsed the importance of these so-called princes. The Gaons were the presiding officers of the learned academies. They succeeded in drawing to their own persons the undivided attachment of the Jewish community, and continued during several centuries to extend their influence to the most distant congregations. The revival of letters that followed in the train of Arabian conquest was felt and hailed with eager joy among the Jews. The critical attention of scholars was turned to the text of the Bible. A simpler method of interpretation obtained. A new sect (see KARAITES) was formed under the leadership of Anan, called from their closer adherence to the letter of Scripture (Mikra) Karaites. Philosophy found an eloquent exponent in the Gaon Saadia (tenth century); and to Sherira Gaon (d. 1000 A. D.) we owe a document of the very highest historical value. When the caliphate of Bagdad succumbed before the advancing Mongols, the Jews shared the general fate of their countrymen. But the religious tolerance or indifference of the conquerors protected them from special acts of hostility. In the year 1288 a Jewish physician, having gained the particular favor of the khan Argim, was appointed minister of finance for the whole Persian empire. The fanaticism or jealousy of the nobility procured his assassination, and his death was the signal of persecution for his brethren. The condition of the Jews in Asia has remained with little variation down to the present day one of utter misery. In the N. of Africa, under the rule of the Fatimites, their position was on the whole hardly more favorable. Turning to Europe, we find, on entering the period of the Middle Ages, that the more or less friendly relations which until then subsisted between the Jews and their neighbors were gradually disturbed by the increased bitterness of religious hate. In France the attempted conversion by Gregory of Tours of King Chilperic's jeweller, the Jew Priscus, and his assassination by a renegade of his own race, give evidence at once of the high consideration which Israelites still enjoyed, and the growing change for the worse that began to appear in their fortunes toward the end of the sixth century. In the beginning of the seventh, Dagobert issued an edict commanding them to choose between baptism and death. In Spain, under the rule of Arian kings, Jews and Christians met amicably in social gatherings, and the bond of friendship between them was strengthened by frequent intermarriage. But when Reccared embraced Catholicism this peaceful state of things came to an end. He was a con-

vert, it is believed, from motives of policy, and, relying on the aid of the clergy, desired to invest the royal office with greater power than the constitution of the Visigoths was calculated to allow. The same motive may have impelled him to curry favor with the clergy by persecuting the Jews. (On this subject see the admirable article on Jewish history by Selig Cassel, in Ersch and Gruber's *Allgem. Encyklopädie.*) About 612, Sisebut banished the Jews from his kingdom. In the next reign, however, they were allowed to return. In 633 the Council of Toledo condemned the system of enforcing their conversion which had been lately inaugurated by the king. But its decrees were very stringent against those who returned to Judaism after they had been nominally received into the Church. An extraordinary severity toward men of this class continued to be a peculiar feature of Spanish legislation in later times. In 638 the Jews were again driven from the realm by King Chintila, and again admitted under his successor. In the reign of Receswinth and of Erwig new laws were enacted to ensure their humiliation. They were entirely deprived of the right of holding office, their testimony was no longer accepted in court, while those who had made the outward profession of Christianity were placed under the strict surveillance of the priesthood to secure their allegiance. The progressive advance of intolerance which marks the seventh century reached its climax when in 694 the Jews of Spain were deprived of the liberty of person and declared slaves. Such being the condition to which Spanish bigotry had reduced them, it is not surprising that Taric on his approach was hailed as a deliverer, and that the Jews became the friends and allies of the Arabs in their conquest of Spain. Under the benign light of the Crescent they entered upon the brightest period of their history since the destruction of Jerusalem. While Christian Europe was sunk in barbarism they joined the Moors in keeping alive the flame of science, and became the mediators between ancient and modern culture. Philosophy, poetry, mathematics, astronomy, medicine, received their attention, and their skill in the arts of diplomacy introduced them to the favor of kings. In the tenth century, Hasdai Ibn Shaprut became the trusted agent of Abderrahman III. at Cordova. He received the ambassadors of foreign monarchs. His knowledge of the Latin language, a rare accomplishment at the court of his master, proved peculiarly serviceable. It is reported that he even corresponded with the chief of the Chazares, an independent Jewish prince, whose country could only be reached by a fifteen days' journey from Constantinople. Jacob Ibn Gau was the recipient of high honors at the hands of the caliph about 985. (See Graetz, *Geschichte der Juden*, v. 398.) In the eleventh century Samuel (called Ha Nagid, "the prince") was raised to the dignity of vezir. His calligraphical skill paved the way to his greatness. But, far from being a mere writer, he was fully conversant with the literature of the age, and himself an author. The friend of the poet and philosopher Gebirol, he showed himself the liberal protector of art and science. His son Joseph succeeded him in his honors, but was murdered in a furious assault of the mob on his palace, which had been instigated by his enemies. Contemporary with Samuel ha Nagid at Granada, Ibn Hassan was raised to high office at the court of Saragossa, and again in Seville Ibn Albalia was appointed astrologer to the king. But the same kindly policy which guided the Arabs in their conduct toward the Jews was now adopted by the rulers of Christian Spain. In Castile they were placed on quite the same level with the nobility and the clergy. They were devoted to their country, and prepared to risk life and fortune in its defence. Alfonso VI. employed them as ambassadors to Moorish princes, and they served with equal distinction in his army and at his court. In 1085 he succeeded in taking Toledo, but soon after was himself totally routed by the Moslems under the leadership of the Almoravide Jussuf. The success of the latter seemed at first likely to bring ruin on the Jews of Moorish Spain. A fabulous story gained credit to the effect that their ancestors had bound themselves to embrace Islam if at the end of the year 500 of the Hedjrah their own expected Messiah had not yet come. Referring to this legend, Jussuf called upon them to fulfil what had been promised. But it was not until the middle of the twelfth century that this demand was seriously pressed. The Almohades, conquering Northern Africa, crossed over into Spain. The power of the Almoravides was broken, and Cordova fell into the hands of the victors. The Jews of Andalusia were forced to follow the example of their African brethren, and either fled the country or acknowledged with the lips the prophetic mission of Mohammed and the inspiration of the Koran. Toledo, the new Christian capital of Castile, now became a refuge to large numbers of the fugitives. Here they increased rapidly in wealth and power, and monuments of both are still extant. Jews occupied high positions at the court of Alfonso VIII. Alfonso X. (1252), it is said, entrusted the work of preparing the celebrated astronomical tables which bear his name to a certain Don Zag, a reader in the synagogue. Nor is he the only Israelite mentioned among the scientists who illustrated Alfonso's reign. The harsh restrictions which this king imposed upon the intercourse between Jews and Christians were not fully observed, even by himself. In Aragon the influence of the Dominican Raymond de Penjaforte was directed to the conversion of "the lost sheep." But the famous disputation of Barcelona between Pablo Christiana and Nachmanides (1263), held in the presence of James I. and his chief dignitaries, did not serve to advance the project. At the opening of the fourteenth century a great danger threatened the Jews of Castile in the person of Gonzalo Martinez, the all-powerful minister of Alfonso XI. He succeeded in bringing about the fall of two of their number who had hitherto enjoyed the favor of the monarch. But his further plans were frustrated in time, and he fell a victim to his own treachery. The civil war between the adherents of Pedro and Henry entailed bitter sufferings on many of the largest congregations of the land. The Jews took the part of Pedro, and were in the main sure of his protection as far as he had the power to extend it. But even the victorious Henry could not entirely dispense with their services. They were in great request as physicians, and the management of the finances of the kingdom continued to be entrusted to their care down to the time of their final banishment. In the mean time, the seeds of hatred, which the Church had long been busily disseminating, took root. Toward the end of the fourteenth and at the beginning of the fifteenth century outbreaks of fanaticism, which had hitherto occurred only at far intervals, became alarmingly frequent. The Jews were henceforth to be confined to narrow Juderias, were to put off their costly robes and wear none but garments of the coarsest kind, on which a patch of red cloth served as a badge of degradation to mark them as fit objects for insult. This latter device owed its origin to the inventive genius of Mohammedan despots, and was borrowed from them at second hand by the popes. A massacre of peaceful Jews had by this time ceased to be regarded as an event of extraordinary interest or importance. The great disputation of Tortosa, held (1413–14) under the auspices of the so-called Pope Benedict XIII., failed entirely to secure its avowed object—the conversion of the Jews *en masse*, and served only to embitter the feelings of mutual dislike that were already sufficiently strong. The sinister influence of the Dominicans and Franciscans, of such men as Vincente Ferrer and Alfonso de Spina, was aided by renegade Jews like Paulus de Santa Maria and Geronimo de Santa Fé. The marriage-bells of Ferdinand and Isabella rang out a funeral dirge for the liberty of the Jews of Spain. In 1480 the tribunal of the Inquisition was established at Seville. Notwithstanding the strenuous opposition of the people in many districts, its power increased with fearful rapidity. Those nominal Christians who still secretly adhered to Judaism were the special objects of its pious zeal, and those who perished in the flames on the Quemadero of Seville and in other towns were soon numbered by thousands. In 1483, Torquemada was appointed grand inquisitor. When Granada fell into the hands of "the Catholic king" the doom of the Spanish Jews was sealed. From the palace of the Alhambra the irrevocable decree of their exile went forth. On Aug. 2, 1492, they left the inhospitable land which yet they had so dearly loved, and while Columbus sailed westward to discover a new home of freedom, they, robbed of their fortunes and cast adrift upon the world, knew not whither to turn for shelter. For a time, indeed, many of them found refuge in Portugal. There the position of their brethren had long been exceptionally favorable. Their chief rabbi (Rabbi Mor) received his appointment directly from the king, and their affairs prospered under the kindly influence of long-continued royal favor. But in the days of João II. all this changed. The brief breathing-spell which the exiles enjoyed in his dominions was quickly at an end. He broke the promises he had made them, and many of them were sold as slaves. His successor, Manoel, at first seemed inclined to adopt a more liberal policy, but the influence of Spain altered his purpose. Amid heartrending scenes of despair Jewish children were torn from the arms of their parents and dragged into the churches; the aid of the rack was called in to enforce the conversion of the adults; and with the close of the fifteenth century the last remnant of the Jews, being at length permitted to escape their oppressors, had disappeared from the soil of Portugal.

The comparative quiet which the Jews of France and Germany enjoyed in the earlier part of the Middle Ages was rudely broken in upon by the Crusades. The spirit of absolute intolerance which the Catholic priesthood inculcated had at last taken firm hold of men's minds, and

while in this period we frequently see the princes and the higher classes—nay, even the popes themselves—anxious to preserve the Jews from the last application of their own previous example and teachings, it is the frenzied populace which with greater consistency now hounds them with relentless fury in every city and village. In the first Crusade the banks of the Moselle and the Rhine were the chief theatres of persecution. The congregation of Treves consented to embrace Christianity in the hope of warding off the calamities that threatened them, and of returning to their faith when the danger had passed off. But instances of such complacency were extremely rare. A tumult occurred in Spires in which a considerable number of the Jews lost their lives. In Worms many of them perished by their own hand. In Mayence the archbishop harbored them in his palace, then opened the gates and gave them over to slaughter at the hands of their enemies. The citizens of Cologne facilitated their flight from that city, where the rabble had already determined on their destruction, but they escaped only to perish miserably elsewhere. The arm of the emperor, Henry IV., was powerless to protect them. In the second Crusade, Peter Venerabilis in France was instrumental in causing the plundering, and in some cases the massacre, of the Jews. In Germany, taught by recent experience, they acquired the protection of strongly-fortified castles by the payment of heavy sums. Those who were not fortunate enough to gain such places of security in time were exposed as before to the fury of the mob. A certain monk, Rudolph, kindled the popular fanaticism by his inflammatory speeches. "You go to Palestine," he said, "to slay the unbelievers; why not begin with the infidel Jews in your own midst?" After incalculable mischief had been done, Bernard de Clairvaux at last succeeded in silencing the dangerous preacher. The third Crusade proved disastrous to the Jews of England. The coronation of Richard Cœur de Lion was the occasion of a terrible outbreak against them in London and other large towns. The fate of the Jews of York was of a peculiarly tragic character. (The reader will find an easily accessible account of this mournful occurrence in Disraeli's *Curiosities of Literature,* ii. p. 240.) In Italy and in the S. of France the Jewish congregations prospered in the enjoyment of an undisturbed tranquillity. In the N. of France Philip Augustus, the fellow-crusader of Richard, drove them from his dominions. In 1198 he reconsidered his decree and suffered them to return. To Frederick Barbarossa, the leader of the German forces in the third Crusade, is ascribed the institution of the *Kammerknechtschaft* of the Jews of the empire. As *servi cameræ* they were supposed to enjoy the inviolate character attaching to imperial property, but the protection which this afforded them proved sadly inefficient when it was most needed. The sovereign claimed, on the other hand, the supreme right of disposing of their persons and possessions. A threefold tax of the most oppressive kind, which they were forced to pay into his treasury, shows how the right was used. The German emperors delighted in the double attribute of the Holy and the Roman. As the successors of the Roman imperator they referred their right of taxation to the example of Vespasian, who appropriated the tax for the temple at Jerusalem to his own fiscus. As the temporal representatives of the Christian faith their good pleasure was held to be absolute in deciding the fate of their Jewish subjects. The Jews having forfeited the right of existence in Christian states by the crucifixion of Jesus—such was the theory propounded by the Church—could find no place within the pale of the feudal system. As foreigners they stood in direct relationship with the head of that system only, and, being themselves utterly powerless, his will was their law. This theory continued to prevail down to the beginning of the present century. In the thirteenth century the war of extermination waged against the Albigenses brought disaster to the Jewish congregations of the Provence. In 1215 the fourth Lateran Council, held under Pope Innocent III., besides repeating former provisions of a hostile character, enacted that no Jew should appear in public without a conspicuous badge attached to his garments. From that time the wearing of the Jew's badge was generally enforced in Christian countries. Even Frederick II., the protector of science, an emperor whose orthodoxy was more than doubtful, did not hesitate to compel obedience to this decree, although among the scholars who graced his court the names of Jews are mentioned with distinction. In the reign of Louis IX. (St. Louis) of France, after a great disputation held under royal auspices, it was decided that the Talmud be condemned for certain blasphemous expressions against the author of Christianity which it was supposed to contain, and copies of the work were publicly burnt by cartloads. St. Louis once more drove the Jews of his realm into exile, but their banishment proved, as heretofore, temporary. In the days of the emperor Rudolph of Hapsburg the Jews of Germany found their condition become so intolerable that numbers of them determined to leave the Fatherland, at their head the celebrated rabbi, Meïr of Rothenburg. Meïr was, however, arrested, and ended his days in prison. King John of England employed the Jews as a convenient instrument for replenishing his exhausted treasury. Stephen Langton, archbishop of Canterbury, insisted on their wearing the badge. Under Henry III. a chief rabbi, appointed by the king, was allowed to exercise considerable power over his people, and a Jewish parliament was convened at Worcester. But they were summoned for no higher purpose than to raise funds for their royal master's benefit. The monks of the Dominican order were here, as everywhere, active in fanning the flame of popular prejudice. The charge of counterfeiting the coinage contributed to increase the suspicions of the king and the hatred of the citizens, and at last, in 1290, Edward I. banished the Jews from English soil. In Germany the end of the thirteenth century is marked by a bloody persecution of the Jews. One Rindfleisch and his followers preferred the ridiculous charge that the Jews had pierced a consecrated wafer until the blood of Christ flowed forth; 100,000 of them are reported to have perished in consequence. In 1306, Philip the Fair decreed the exile of the Jews of France. In 1320, having previously returned to their homes, they suffered from the fury of the Pastoureux. In Italy alone they still enjoyed repose. King Robert of Naples extended his favor to them for their devotion to science, and the great Dante received the poet Immanuel into the circle of his friends. About this time the belief had become general that the Jews not only delighted in profaning the sacraments of the Church, but were commanded by their religion to drink the blood of Christian children, in order properly to celebrate the festival of the Passover. The ignorant clergy were not aware that the same charge of bloodshed in connection with the observance of their religious rites had been brought against the early Christians—nay, that they were only repeating, almost verbatim, the legends which had been invented to bring their own faith into disrepute. Yet we find this preposterous accusation again and again repeated during more than five centuries, and it never failed to bring the most terrible misfortunes in its train. In 1336, 5000 peasants, under the leadership of Armleder, began the sacred work of destroying "the children of Satan" (the Jews) in Alsace and along the Rhine. In 1337 the town of Deckendorf in Bavaria witnessed the massacre of its Jewish inhabitants, and a church built in honor of the event may still be seen at the present day. In the middle of the fourteenth century the Black Death traversed the continent of Europe; 25,000,000 of its inhabitants, it is estimated by Hecker, were carried off by the plague. In addition to the sufferings which they shared with the rest of mankind, a new and more fearful visitation awaited the Jews. They were made responsible for the ravages of the scourge. From Toledo, it was said, a horrid concoction had been distributed among them, with which they were ordered to poison the wells in every county of their abode. At Chillon, on Lake Geneva, the outrageous persecutions consequent on this charge commenced, and soon spread to Berne, Bâle, Freiburg, Worms, and Strasburg. The bravery of the citizens in the town last mentioned, who resisted the frantic mob, only served to secure their own destruction. It was of no avail that the pope himself refuted the cruel and baseless accusation. The fire and the executioner's axe could no longer be checked. It would fill pages to give an account of all they endured. In 1360 the Jews who had been expelled from France received official permission to return. But as they were compelled to resort to usury in order to satisfy the avarice of their rulers, the populace rose against them in 1380. Their houses were plundered, and many of them killed. On Easter Sunday, 1389, in the reign of the emperor Wenzel, the Jews of Prague and the neighboring places were butchered by thousands. Two children had been playing in the Ghetto, throwing sand at each other. A few grains happening to strike a priest who was passing by a tumult ensued with the usual result. In 1394 a general decree of banishment was once more issued by Charles VI. against the French Jews. But the time had now passed by when they could hope for a speedy recall, and they were no more permitted to return.

Whenever Catholicism was forced to contend against the rise of a great heresy in its own midst, the Jews were made to suffer from the religious fervor which the struggle evoked. This was shown in the time of the crusade against the Albigenses. We find it again illustrated in the beginning of the fifteenth century, when the Church mustered her forces to meet the arms and arguments of the followers of Huss. In 1420 the Jews of Vienna were imprisoned; in the next year numbers of them were consigned to the flames. The wild eloquence of the Dominicans did not fail to embrace

the infidel Jews in its denunciations of heretics. The Franciscan monk Capistrano, too, was no less active in using his immense influence for their destruction. In 1454 the bishop of Würzburg expelled them from his diocese. In Breslau they were burnt at the stake. In Poland, Casimir IV. was induced to revoke the humane enactments which he had but lately passed in their favor. Capistrano merited the name which his admirers bestowed on him, "the scourge of the Hebrews." In Italy the bright fortunes of the Israelites had not yet been darkened. There were too many counter-currents in that land to permit the monks to obtain the same absolute power which they did not scruple to assert in other countries. How wretchedly did the position of the German Jews contrast with that of their Italian brethren! In 1476 the rabbi of the oldest congregation in Germany, that of Regensburg, was accused of sacrificing a Christian child, and it required all the influence of the emperor and of the king of Bohemia to ward off from his brethren in that town the terrible fate with which they were long threatened. In the beginning of the sixteenth century we find the Jews of Italy an influential body in many of the large towns, and some of their number occupying positions of trust, especially at the papal court. In Germany they were expelled from Nuremberg and several provinces of Austria. In Greece their numbers had considerably increased, and they appear to have remained, on the whole, unmolested. It was in Turkey, however, that they at this time enjoyed to the full that liberty and security which the bigotry of the Christian nations denied them. In that country many of the exiles of Spain and Portugal had at last found an asylum; they quickly increased in wealth and power, and flourishing congregations grew up in the large cities of Constantinople and Salonichi. In the reign of Selim II., Joseph Nassi was appointed duke of Naxos, and exercised the rights of sovereignty over Andros, Paros, and some ten other islands. His influence in the councils of the sultan was so great that the ambassadors of foreign powers were forced to conciliate his favor. Nor was he the only one of his coreligionists in the diplomatic service of Turkey whose word was powerful in shaping the political affairs of Europe.

The main interest of Jewish history at the commencement of the sixteenth century concentrates upon the great Reuchlin-Pfefferkorn controversy in Germany. John Pfefferkorn, a converted Jew, a willing tool in the hands of the Dominicans of Cologne, declared the Talmud to be the main obstacle to the general conversion of the Jews, on account of the blasphemous utterances contained in it against the Christian religion and its founder. He won the ear of Kunigunde, the sister of the emperor Maximilian, and through her that of the emperor himself for the time being. John Reuchlin, the famous and universally esteemed scholar, was called upon by Maximilian to examine and pronounce upon the charges. An ardent admirer of the Hebrew and of Jewish literature, he declared the accusations groundless, and severely rebuked the accuser. This roused the fury of Pfefferkorn and his supporters against him. A number of inflammatory pamphlets, "mirrors," denouncing Reuchlin and the Jews were issued under Dominican auspices. Reuchlin answered with his *Augenspiegel*. A *Brandspiegel* followed on the part of the fanatical monks of Cologne. They desired every copy of the Talmud and similar "heretical" books to be confiscated and secured with chains in the great libraries, lest the Jews should steal them back. Even the Hebrew Bible was threatened with destruction to make way for the sole supremacy of the Vulgate. Dangers thickened around the bold humanist who had taken up the cause of learning against bigotry. The emperor's protection was not to be relied on, and, indeed, he repeatedly changed sides in the conflict that ensued. At last, Hochstraten, the inquisitor of Cologne, ordered Reuchlin to appear before him in Mayence for trial, or rather for condemnation. The plans of the Dominicans, deeply laid though they were, were foiled at the very last moment by the sudden intervention of Archbishop Uriel. The question of Reuchlin's heresy in defending the Talmud was next referred by the pope to a commission that met at Spires. Their verdict was in favor of Reuchlin, and Hochstraten was condemned to pay costs. Its effect was somewhat weakened by the adverse decision of the University of Paris, which had tried the case of its own accord, without any authority from the pope. A new tribunal, created in Rome, took the part of Reuchlin with such decision that the monks of Cologne were forced with bad grace to give way. In the mean time the *Epistolæ Obscurorum Virorum*, which appeared in two series, had made them the laughing-stock of all Germany. The interest which the controversy excited in Jewish literature proved in the highest degree beneficial to its correct preservation and culture. In 1520, Daniel Bomberg began the publication of the Talmud in an edition which for accuracy has not been equalled. Immense sums were expended on this and other Hebrew works. In several prominent universities professorships for the Hebrew language were founded. The Reformation, though largely indebted to the writings of Jews for its weapons of attack, did not at first lighten the load of their sufferings, and the intolerance of Protestants did not prove less oppressive than that of Catholics. With the loss of the mind's creative power entailed by so many bitter persecutions a tendency toward centralization became apparent among the Jews. In 1567, Joseph Kara, a rabbi of Safet in Palestine, published a digest of the rabbinical laws, which soon came to be looked upon as supreme authority in matters of religion. The same tendency appears in the synods of Poland which began to be held toward the end of this century, and it is further illustrated by the history of the great congregations of Amsterdam and Hamburg in the next. In Spain and Portugal many of the more fainthearted of the Jews had assumed the mask of Christianity to escape the necessity of leaving their country, while in secret they still preserved an unfaltering allegiance to their ancient creed. The position of these miserable ones was truly deplorable. Frequently discovered in the exercise of forbidden rites, they fed the flames of the Inquisition, and, despairing of mortal aid, sought refuge in the illusory promises of mysticism in the vain hope of release. Solomon Molcho, a youth whose fancy was fired by the Cabbala, which for several centuries had slowly been increasing the number of its adherents, created a great commotion among them by earnestly predicting the near approach of the Messianic age. He was burnt at the stake in Mantua (1532) by order of Charles V. The successful revolution of the Netherlands, which Spanish bigotry had provoked, at last opened to them a haven of security. Free Holland invited them to its shores. The city of Amsterdam availed itself of the wealth and industry of the "Judaizing" Christians of Portugal, and to their efforts the rapid extension of the city's commerce was in no small measure due. The Jewish congregation of Amsterdam soon became one of the most influential of all Europe. They cultivated letters and erected an institute (Talmud Tora) for the instruction of the young in Hebrew literature. From their midst Spinoza went forth. Elsewhere their brethren were not so fortunate. In 1614 the guilds of Frankfort, with Vincent Fettmilch at their head, expelled the Jews from their town. In the next year the example of Frankfort was followed by Worms. Both cities were compelled by the emperor to receive the fugitives back into their walls. In the middle of the seventeenth century the Jews of Poland were visited with a calamity from which they have never recovered. The Cossacks, led on by the fierce Chmielnicki, succeeded if not in exterminating, as they intended, yet at least in reducing them to a condition of utter and abject degradation. Chmielnicki and his soldiery are reported to have slain between the years 1648 and 1658 about 250,000 Polish Jews. Those that were spared emigrated in great numbers, and inundated the countries of Central and Southern Europe. They were everywhere kindly received. But from being guests they soon rose to be masters. With great powers of intellect they united, as a body, certain faults of character, whose influence on their new surroundings proved vicious in the extreme. In England the Jews were readmitted after having been banished the country since 1290, mainly through the exertions of Manasseh b. Israel, a rabbi of Amsterdam. In 1655, Cromwell invited him to visit England, and he there found active sympathy among many of the Puritan leaders. Their love for the Old Testament inclined them to look favorably upon the remnant of ancient Israel. Moreover, were not these the people from whom Jesus had sprung?

In 1665 a strange drama was enacted in Smyrna. A native of that town, Sabbathai Zewi, was solemnly proclaimed the Messiah of the Jews. The Cabbala had inspired him—the Cabbala paved the way for his astonishing success. The tidings spread from the Orient to the Occident, and everywhere the new evangile found ardent believers. S. Zewi taught that in him the "God of Israel," the Third Person of the Godhead, had become flesh and blood. He inculcated the doctrine of the transmigration of souls, and, like all mysticism, his teachings were strongly colored with sensualism. He ended his Messianic career by assuming the turban in Constantinople for fear of being put to death. But this did not remove the evils of which he had been the occasion. The contagion of his views spread throughout Europe, and while the outward position of the Jews was now very slowly improving, their mental condition was far inferior to what it had been in the Middle Ages. The great elector of Brandenburg received a number of those Jewish families whom the emperor Leopold had driven from Vienna. In 1700 the Jews succeeded in causing an imperial injunction to be laid on the publication of Eisenmenger's infamous attack on their religion and

themselves. In Hamburg a colony of the mother-congregation of Amsterdam began to rival the glories of its parent, notwithstanding the determined resistance which had at first opposed its progress. In 1751 a conflict arose between Jonathan Eibeschutz, the rabbi of Hamburg, and Jacob Emden, in which the former was charged with Cabbalistic practices, especially the writing of magic talismans in the name of the Messiah, Sabbathai Zewi. Soon after the sect of the Frankists arose in Poland. Frank, their leader, pretended to be the successor of S. Zewi, and, like his model, ended by abjuring his religion. The sect of the Chasidim, which still exists at the present day, may be regarded as the last outgrowth of this deplorable movement.

The modern epoch is marked by the name of Mendelssohn. His German version of the Pentateuch became, like Luther's translation of the Bible, the groundwork of reform. Lessing's *Nathan the Wise* rebuked the time-worn prejudice of the Christian world. Dohm labored to secure the civil emancipation of the Jews. The French Revolution broke down the walls of their ghettos. On Sept. 28, 1791, the National Assembly decreed the complete enfranchisement of the Israelite citizens of France. In the hour of need, when the great struggle with Napoleon was impending, Frederick William III. felt himself constrained to liberate the Jews of Prussia. Other states and cities slowly followed. It cost many a bitter struggle until civil and religious freedom was finally secured. The "Hep, hep" cry raised in Germany in 1819, the bloody persecution in Damascus some thirty years ago, in which French diplomacy was seriously implicated, the Mortara affair in 1858, and recent events in Roumania, have shown that the embers of bigotry have not yet completely died out. But a general conflagration need no longer be feared. Under the benign influence of liberty the Jews have everywhere shown themselves ready and able to advance the interests of civilization. Not only has their own literature been opened to scientific study by such men as Zunz, Geiger, Munk, Rappoport, Luzzato, and others, but they have rendered signal service in almost every department of science and art. I mention among the philosophers M. Mendelssohn, Maimon, Herz; in political economy, Ricardo and Lasalle; in literature, Börne, Heine, Auerbach, Grace Aguilar; in music, Mendelssohn-Bartholdy, Meyerbeer, Halevy; among the prominent statesmen of the day, Disraeli, Lasker, Crémieux. In this country the Jewish population has largely increased during the last three decades. In New York City alone it is now estimated at between 50,000 and 60,000 souls. For 2000 years the world has endeavored to crush out the Jewish race. That spirit of exclusiveness with which it is charged was but the natural result of such relentless hostility. It vanishes wherever confidence is inspired by security. The majority of intelligent Israelites in the present have long since abandoned the wish of building up an independent national existence of their own. Their patriotism has been illustrated on all the great battlefields of this century. The achievement of higher conditions of human life they are disposed to regard as the fulfilment of Messianic prophecy, and the furthering this end in intimate union with their fellow-men as the highest dictate of their religion. FELIX ADLER.

Jews'bury (GERALDINE ENDSOR), b. in Manchester, Eng., in 1821, sister of Maria Jane, wrote a number of novels concerning society life, among which are *Zoe, the History of Two Lives* (1845), *The Half-Sisters* (1848), *The Sorrows of Gentility* (1856), and also minor works for children.

Jewsbury (MARIA JANE), b. in Warwickshire, England, about 1800; resided in Manchester most of her life; was a frequent contributor to the English magazines and to the London *Athenæum.* Wordsworth pronounced her unsurpassed by any writer of her time for the "quickness of the motions of her mind," while the *Athenæum* passed a similar eulogy upon her play of imagination, thirst for knowledge, and elevated purposes. In 1833, Miss Jewsbury married Rev. William Fletcher, a missionary to India, and d. at Bombay in the same year. Her collected works embrace *Phantasmagoria, Letters to the Young, Lays of Leisure Hours,* and *Three Histories,* the last of which was very popular and has been frequently reprinted.

Jeypoor', one of the Rajpoot states under English protection in Western Hindostan. Area, 15,251 square miles. Pop. 1,891,124. Its soil is in most places poor, often barren sand, and its climate is intolerably hot. Its capital of the same name is situated in 26° 56′ N. lat. and 75° 55′ E. lon., and is considered the finest city the Hindoos ever built. It forms a parallelogram divided by straight streets intersecting each other at right angles. It is surrounded by a wall surmounted by towers, and contains a large and magnificent palace.

Jez'ebel [Heb. *Izebel*], daughter of Ethbaal, king of Tyre and Sidon, and wife of Ahab, king of Israel, exercised a great influence upon her husband, leading him into idolatrous worship of Baal, a Phœnician deity, long a formidable rival, especially in the northern kingdom, to the Jehovah-worship established at Jerusalem. Many acts of persecution against the prophets and priests of Jehovah are attributed to Jezebel, and were so successful that at one time there were but 7000 persons in Israel who had not bowed the knee to Baal. The narrative of this momentous controversy is found at length in 1 Kings. Jezebel was murdered by Jehu about 883 B. C., at the same time as her son, King Jehoram. Her daughter, Athaliah, married Jehoram, king of Judah.

Jezi'rah [Heb. *Sepher Yetsirah*], or **Book of Creation,** one of the two chief cabbalistic works of the Jews. Its date is variously assigned to the first and the eighth or ninth century. It was printed in 1562, 1642, and 1830.

Jez'reel, town in Northern Palestine, which was the capital of the kingdom of Israel under several reigns.

Jhy'lum, or **Behut,** river of Hindostan, the westernmost of the Punjaub. It rises in the valley of Cashmere, and after emerging from the Himalayas it joins the Chenaub and forms the Trimah. (See HYDASPES.)

Jid'dah, town of Arabia, on the Red Sea, in 21° 28′ N. lat. and 39° 13′ E. lon., 60 miles W. of Mecca. It is surrounded by a barren desert, so destitute of water that rain-water must be gathered and carefully preserved in cisterns. But it carries on a most important trade, provisions from Egypt, coffee from Arabia, and manufactured goods from India being brought in large quantities to its warehouses and exchanged. Thousands of pilgrims visit yearly the town on their way to Mecca. A curious little building within the walls contains a monument called the tomb of Eve. Pop. variously estimated at from 10,000 to 20,000.

Jika'daze, or **Shikatze,** town of Thibet, the capital of the district of Zang, is in an elevated and very dry plain, encircled by lofty but barren mountains, and contains an immense palace or monastery, in which reside one of the chief lamas and his suite, consisting of above 4000 persons. It consists of a number of palaces, temples, and tombs of a most striking architecture and profusely ornamented with gold and precious stones. Pop. 100,000.

Jime'na, town of Spain, in the province of Cadiz, on the Jogergante, has 6577 inhabitants, mostly engaged in agriculture and horticulture.

Jim Henry, tp. of Miller co., Mo. Pop. 542.

Jinn [Arabic, plural of *jinni*, the "invisible," cognate with the Lat. GENIUS (which see)], among Arabian and other Mohammedan peoples a race of imaginary beings made out of fire and capable of assuming any form at will. They inhabited the earth long before man was created, but for rebellious conduct were finally expelled. They inhabit a world called Jinnistan, but often visit the earth in storms, tornadoes, and earthquakes. Many of their exploits are narrated in the *Arabian Nights.* The good jinn are called *peri* (fairy). Mohammed came to instruct and redeem jinn as well as men. Men are superior in dignity to jinn, but far less powerful.

Jiquili'te, the native indigo of Central America, *Indigofera disperma,* which produces large quantities of excellent indigo. (See INDIGO.)

Jitomir', or **Zytomierz,** town of Russia, the capital of the government of Volhynia, on the Kamenka, which here joins the Teterev and flows to the Dnieper. It is the seat of the governor, of a Greek archbishop, and a Roman Catholic bishop. It has some iron and glass works, four annual fairs, and a considerable trade. Pop. 17,131.

Jo'ab, a son of Zeruiah, the sister of David, distinguished himself as a warrior under the reign of Saul, and was made commander of the whole Hebrew army by David. He was a valiant, talented, and influential man, but violent and unscrupulous. When David tried to rid himself of him by giving the command to Amasa, Joab plunged his sword into Amasa's heart while embracing him. He took part in the unsuccessful demonstration in favor of Adonijah, and although he fled to the tabernacle for refuge, Solomon seized him and put him to death.

Jo'achim, called the PROPHET, b. at Celico, in Italy, about 1145. After being employed at the court of Roger, king of Sicily, and making a pilgrimage to Jerusalem, he became a Cistercian monk, abbot of Corace in Calabria, and finally founder of the monastery of Floris near Cosenza, where he d. Mar. 30, 1202. He left a reputation as a saint and miracle-worker, and his followers made an unsuccessful attempt to canonize him in 1346. He taught a peculiar mystic doctrine, of which the chief tenet was that the Christian era would close A. D. 1260, after which a new

providential dispensation would begin. This doctrine was embodied in his treatise called the *Everlasting Gospel,* which was condemned by the Council of the Lateran in 1215, and by that of Arles in 1260. He left many writings, chiefly commentaries, and prophesied the downfall of the papacy. His followers, called *Joachimites,* were numerous in the thirteenth century.

Joachim, tp. of Jefferson co., Mo. Pop. 1865.

Jo′achimsthal, town of Bohemia, near the frontier of Saxony, is situated in a valley in the Erzegebirge, 2366 feet above the level of the sea, and has 5641 inhabitants, mostly engaged in the working of the neighboring iron, silver, lead, and tin mines.

Joan, Pope, a fabulous personage who was long believed to have occupied the papal chair (853–856) as John VIII., succeeding Leo IV. and preceding Benedict III. The report was that Joan was born in Germany, the daughter of an English priest; falling in love with a monk, she entered a convent in male attire at Fulda, and then went with her paramour to Athens and Rome, where she acquired a high reputation for piety and learning, and was unanimously chosen pope when a vacancy occurred. One day in the street, at the head of a procession, it is said that the pope was unexpectedly delivered of a child, soon after which she died. There has been much speculation as to the origin of this fiction, which acquired universal credence in the Middle Ages; and in the cathedral of Siena a statue of Pope Joan was for a long time to be seen. The fable still occasionally finds a literary defender, but is utterly without historical foundation, its fictitious character having been first conclusively demonstrated by David Blondel, a Protestant, in 1649.

Joan of Arc [Fr. *Jeanne d'Arc,* or, more correctly, *Darc*], the Maid of Orleans, b. Jan. 6, 1412, at Domremy, in Lorraine (now a part of Germany), of parents who, though sprung of wealthy and ancient stock, were reduced to the state of serfdom. The youthful Jeanne was distinguished for a sweet simplicity, piety, and industry in childhood. Her patriotism was early inflamed by the fact that Domremy was of the Armagnac or French faction, rather than of the Burgundian party of those times. When she was thirteen years old France was overrun by the Anglo-Picard troops of the duke of Bedford, regent of Henry VI., and by the forces of Burgundy. Jeanne, impressed by the distressed state of France, conceived that she heard voices from Heaven and saw visions of Sts. Michael, Margaret, and Catharine, calling her to deliver France. Four or five years later (1428) she announced her vision to Baudricourt, governor of Vaucouleurs, and in 1429 gained an audience with the dauphin, who in April gave her command of the French troops, who by this time were fully inspired with belief in her heavenly mission. She assumed male attire, a sword, and a white banner, threw herself boldly into Orleans, of which she quickly raised the siege; beat the English at Meun, Jergeau, Beaugency, and Patay; caused the dauphin to be crowned at Rheims in less than three months after she took the field. She now demanded to be released from further service, the heavenly voices having ceased to be heard, and a dread foreboding taking their place; but the king would not consent. In the subsequent attack on Paris she was badly wounded, and soon after she and her family were ennobled. On May 23, 1430, after having taken part in many successful combats, she was captured by the Burgundians while heading a sortie from Compiègne, and was sold to the English (who feared her as a witch) for 16,000 francs. The University of Paris having pronounced her guilty of witchcraft after a protracted and most unjust trial, she was burned at the stake with every circumstance of indignity and cruelty, May 30, 1431. It may be added that Delapierre and others question, with some show of reason, the story of her death, and state that she married and was alive in 1444, some other woman having, as it is asserted, been tried.

Joa′nes (Vincente), b. in Spain in 1523, and d. in 1579. He studied in Rome, imitated Raphael, and became the founder of a Spanish-Italian school of painters, whose seat was Valencia. He was deeply religious, prepared himself, before he commenced a new picture, by taking the sacrament, and treated exclusively religious subjects. There is a charming expression of innocence and sweetness in his pictures, but not the intellectuality and lofty purity which distinguish Raphael.

Joan′na I., queen of Naples from 1343 to 1382, b. in 1327, a daughter of Charles and granddaughter of Robert of Anjou, was married when seven years old to Andrew of Hungary, her second cousin. The idea of this marriage was to ally the two branches of the family of Anjou together, but the purpose failed, and the contest between the two political parties represented by the two branches of the royal family became only fiercer. In 1345, Joanna had her husband strangled, and when his brother, Louis the Great of Hungary, invaded Naples to avenge him, she had to flee. By the mediation of the pope, to whom she gave Avignon and the sum of 80,000 florins, she returned soon after, and married successively Louis of Tarranto, James of Aragon, and Otho of Brunswick. But in the papal schism between Clement VII. and Urban VI., Joanna sided with Clement, and at the instigation of Urban VI. a rebellion took place in Naples. Joanna was seized, imprisoned in Muro, and delivered over to the king of Hungary, who immediately had her put to death.—Her grand-niece, Joanna II., queen of Naples from 1414 to 1435, b. in 1370, was married first to William of Austria, and after his death to Jacques de Bourbon. She was notorious for her dissolute life, and her government was utterly distracted by the feuds and intrigues between her different favorites.

Jo′ash, or **Jeho′ash** [Heb. *Yoash* or *Yehoash,* "given by Jehovah"], the name of two kings. I. A king of Judah, son of Ahaziah by Libnah of Beersheba, b. about B. C. 884. His father having died in his infancy, all his brothers were massacred by his grandmother Athaliah, who usurped the throne, but Joash was secretly saved by his aunt, the wife of the high priest Jehoiada, who brought him up within the temple until his eighth year, when a successful revolution was made, Athaliah was killed, and the young prince, the last scion of the house of David, was placed on the throne. During his minority, and for many years thereafter, his government was approved by the biblical writer, but at length he fell into idolatry, when his kingdom was ravaged by Hazael of Damascus, and he was besieged in Jerusalem, giving up the treasures of the temple to the enemy. He was murdered in his bed by his servants about B. C. 837, after a reign of forty years.—II. A king of Israel, son and successor of Jehoahaz, and grandson of Jehu, became king about B. C. 838, successfully resisted the Syrians, and defeated Amaziah, king of Judah. Joash is esteemed one of the best of the kings of Israel. D. after sixteen years' reign, about B. C. 823.

Job, The Book of, one of the books of the Old Testament, narrating the story of Job, a wealthy Arabian sheik or patriarch who dwelt in the land of Uz, and a man of benevolent, devout, and blameless life. At an advanced age he is visited with loss of estate, of family, and of health; his wife breaks down under the load of trials, but Job remains true to God, and endures all without a sinful word of complaint, to the discomfiture of Satan, his accuser. And at last his faithfulness receives an ample reward. The doctrine of retribution held a prominent place in Jewish theology. As a popular dogma it amounted to this—that God balances men's sins by adversity in this life with a perfect and inexorable justice. Thus, affliction and adversity came to be regarded as the indices of sin. Nothing less than this dogma is at stake in the poem—or tragedy, as we may well call it, from the intensity of the interests and feelings involved. Job's wife represents the evil spirit of rebellion against God. His friends represent the various shades of the popular dogma. They insist that his adversity is proof of sin, either specifically or in general, and blandly exhort him to humility and submission. Against them he defends his integrity, and it seems to be rather vexation at their platitudes than the actual effect of Satan's machinations which drives Job from his patience and leads him to fail, so far as he does fail, under the test. Finally, this vexation passes away. He turns to God in unaffected humility, which he is able to reach without doing violence to his consciousness of his own integrity, but out of his spontaneous and loving trust in God. Then he wins a new revelation of God, such as he had never had before. He sees that man cannot pretend to fathom or compass or follow the plan and purpose of God. Man's mind would fail if God should make known to him even a part of the many things which must be taken into account in the divine plan. He cannot, therefore, know God's purpose in sending adversity on this man or on that; and, in short, nothing can be more absurd or impious than for man to frame little dogmas by which to pretend to interpret the dispensations of Providence.

This poem is a wonderful specimen of literary art. The characters sustain the parts allotted to them perfectly. The time assigned to the incident is that of Moses and Joshua, and the "historic sense" is admirably displayed. Probably a historical fact lay at the basis, but the writer has used it so independently that it has disappeared. The language is peculiar, and presents numerous difficulties, and the thought is so subtle as to tax the utmost skill of the interpreter. It is almost unanimously assigned to a very early but unknown date.

Jobe, post-tp. of Oregon co., Mo. Pop. 848.

Jobert′ de Lamballe′ (Antoine Joseph), b. at Lam-

balle in 1799; studied medicine in Paris 1819; took his degree in 1828; and became surgeon at the Hospital of St. Louis in 1830; surgeon to the emperor in 1854, and member of the Academy in 1856. His principal writings are—*Traité theorique et pratique des maladies chirurgicales du canal intestinal* (1829), *Traité de chirurgie plastique* (1849), *Traitement des fistules vesico-vaginales* (1852). D. Apr. 22, 1867.

Job's Cabin, tp. of Wilkes co., N. C. Pop. 606.

Job's Tears (*Coix lachryma*), a grass, a native of India, where it often grows to the height of eight feet; it resembles somewhat maize both in appearance and habits. Its name is derived from its "seeds," or rather indurated husks, which are bony, shining, bluish-white globules. In India the seeds are used as an article of food, but outside of India they are used only as ornaments, made into bracelets and necklaces, or as beads for rosaries.

Job′town, former village of Cass co., Ind., now included in the city of Logansport. Pop. 349.

Jo Da′viess, county of N. W. Illinois. Area, 650 square miles. It has Wisconsin on the N. and the Mississippi River on the S. W. It has mines of copper and lead, the latter especially important. Its surface is varied, its soil productive. Cattle, grain, wool, and tobacco are staple products. Carriages and saddlery are among the leading articles of manufacture. The county is traversed by the Illinois Central R. R. Cap. Galena. Pop. 27,820.

Jo Daviess, tp. of Faribault co., Minn. Pop. 477.

Jodelle′ (Étienne), b. at Paris in 1532, and d. there in 1573. He took part very successfully in that movement in the French literature which was started by Ronsard, and by which imitation of the classical models was adopted as an artistic principle. The common *mysteries* and *moralities* he supplanted by regular tragedies, and his *Cleopatre* and *Didon* created a general enthusiasm.

Jo′el [Heb., "The Lord is his God"], one of the minor Hebrew prophets, concerning whom little is with certainty known. He lived at Jerusalem, and his prophecies relate to Judah. The date of his life is very uncertain. He was undoubtedly one of the earliest of the prophets whose works remain to us. Ewald, Hitzig, and Keil think that he lived before 800 B. C. One of the visitations of locusts which occur from time to time in the Orient (see Lepsius, *Briefe aus Ægypten*) occurred in his time, and proved a great national calamity. The prophet called the people to penitence, public fasting, prayer, and righteousness, and turned their attention to God's great day of visitation and judgment.

Jogues (Isaac), b. at Orléans, France, Jan. 10, 1607, became a Jesuit at Rouen in 1624, and came to Canada as a missionary in 1636. After preaching to the Hurons, he founded in 1642 a mission among the Chippewas in Michigan. On a journey to Quebec he was captured by the Mohawks and made a slave, but escaped to the Dutch at Albany, and went to France, whence he soon returned to Canada. In May, 1646, he concluded a treaty between the French and the Mohawks, remained among them as a missionary, and was put to death by them as a sorcerer at Caughnawaga Oct. 18 of the same year. His *Letters* were published in the New York Historical Society's Collection, and his description of the New Netherlands was reprinted in New York in 1862, with a memoir by J. G. Shea. (See his *Life*, by Rev. Felix Martin, S. J., Paris, 1873.)

Jo′hann (Nepomuk Maria Joseph), king of Saxony, b. Dec. 12, 1801, and d. Oct. 29, 1873. He was an erudite and finely educated man, whose inclinations turned towards literary and scientific occupations, but who, nevertheless, devoted himself with conscientiousness to his royal duties. The graver qualities, however, of a ruler, he wanted, and he never became very popular. His youth was wholly devoted to art and science, especially to the study of Italian language and literature; from 1839 to 1849 he published at Leipsic, under the pseudonym of "Philaletes," a translation of Dante with critical and historical notes. His elder brother having become co-regent in 1830, Prince Johann took part very actively in public life as a member of the privy council, as president of the council of finances, in the diet, in military matters, and acquired thorough knowledge of all branches of the administration. At the death of his brother he became king of Saxony, Aug. 9, 1854. He was active and successful in measures referring to the internal development of his country, especially in the introduction of trade freedom, in the extension of railway lines, and in the conclusion of commercial treaties between Germany and other countries. But in the great political questions he was unfortunate. Probably ruled by ecclesiastical and Roman Catholic influences, he showed himself an unconditional adherent of Austria and an adversary of the Protestant and progressive Prussia. This tendency became apparent already during the complications with Denmark concerning Sleswick-Holstein, and at a later period his stubbornness all but cost him his throne. The war of 1866 between Austria and Prussia was brought about, at least to some extent, by King Johann and his minister, Beust. The idea was that by a decisive participation in the humiliation of Prussia, Saxony should further the Roman Catholic Church and extend its own circumscribed sphere of power. But after the defeat of the Austrian-Saxon army the sovereignty of King Johann was saved only by the intervention of Napoleon III. Nevertheless, having concluded peace with Prussia and returned to his country, he was perfectly loyal, and showed himself capable of sacrificing his personal feelings to his political insight. In the difficult time of the war with France, Saxony acted as a true and reliable member of the North German Confederation. King Johann in 1822 married Amalia, a daughter of King Maximilian of Bavaria, who bore him three children. His son Albert succeeded him as king. August Niemann.

Johanna. See Comoro Islands.

Johan′nes Secun′dus, whose true name was Jan Everard, b. at the Hague Nov. 14, 1511; acquired a great fame for learning and genius by his Latin poems; accompanied Charles V. on his expedition to Tunis, and d. at Utrecht Sept. 24, 1536. His *Opera Poetica* were published by his brothers in 1541; some of them—as, for instance, *Basia*—have been translated into nearly all European languages.

Johan′nesberg, post-v. of Washington co., Ill. Pop. 101.

Johan′nisberg, village of Germany, in the duchy of Nassau, contains a beautifully situated castle, which in 1814 was given to Prince Metternich by the allies. The vineyards of this estate produce the best of all Rhenish wines, the celebrated Johannisberger.

Johannot′ (Charles Henri Alfred), b. at Offenbach, Hesse-Darmstadt, Mar. 21, 1800; removed in 1806 to Paris, where he received his education, and d. there Dec. 7, 1837. He attracted great attention in 1824 by his engravings after Scheffer and Gerard; in 1827 by his illustrations of Walter Scott, Cooper, and Byron; and since 1831 by his pictures, of which the two most celebrated, *Mademoiselle de Montpensier* (1833) and *The Battle of Brattelen* (1837), are at Versailles.—His brother, Tony, well known from his illustrations to Molière, Werther, Lamartine, and others, was b. at Offenbach Nov. 9, 1803, and d. at Paris Aug. 4, 1852.

John the Baptist was a son of the priest Zacharias and Elisabeth, a cousin of the mother of Jesus, and was born six months before him. In the fifteenth year of the reign of Tiberius he began to preach in the deserts of Judæa, announcing the coming of the Messiah, admonishing to repentance, and baptizing as a symbol of purification from sin. The wonderful circumstances accompanying his birth and his baptism of Jesus, as well as his relations to Christ and his death, are recorded in the Gospels, and very little is known of him from other sources. He was imprisoned and put to death by Herod Antipas, but his disciples continued to form a separate body long after the rise of Christianity. In the Christian Church the 24th of June is celebrated as the day of the commemoration of his birth.

John the Evangelist. Jesus had parents, brothers, and sisters, disciples, fellow-citizens, but to St. John alone was granted the privilege of being his "friend."

1. *Life.*—John was born on the shores of the Lake of Gennesaret, in Galilee, and probably at Bethsaida (compare Mark i. 16, 19 and John i. 44). According to the first text, he followed the occupation of a fisher, together with his father Zebedee, his brother James, and his two friends and associates Simon (Peter) and Andrew. His mother, whose name was Salome (according to Matt. xxvii. 56, which compare with Mark xv. 40), must have been a pious woman, ardent and filled with the Messianic expectations, though under their most earthly form (Matt. xx. 20 *seq.*). She no doubt poured her own faith, including this alloy, into the hearts of her sons. As soon as John the Baptist, the new prophet who announced the approach of the kingdom of God, called people to prepare themselves by repentance and baptism, John and James hastened to him and remained with him as his disciples; and it was here that Jesus first met with them on his return from the temptation in the desert. The admirable picture drawn in the first chapter of the Gospel by John embodies in traits full of freshness the remembrance of this meeting, which became decisive for the life of John. Having found his first disciples among the followers of his Precursor, Jesus took them back with him to Galilee; and as he himself had not yet separated from his family (John ii. 1–12), he sent them also back to theirs; but on the approach of the next Pass-

over feast he called them definitively to follow him permanently as his disciples, and repaired with them to Jerusalem, where he inaugurated his public ministration by expelling the venders from the temple (Matt. iv. 18 *seq.;* John ii. 14 *seq.*). From this moment John accompanied him through all the incidents of his earthly life, which he has described so dramatically in his Gospel. Together with Peter and James he formed a closer circle around Jesus, and he was present at the most secluded scenes of his life (the resurrection of the daughter of Jairus, the transfiguration, Gethsemane); but of the three he was the friend of the heart of the Lord. It is indeed impossible to doubt that the "disciple whom Jesus loved," which is the expression used in the fourth Gospel, means John himself. It is the phrase which he substitutes for his own name, embracing the gentlest remembrances which ever thrilled through the heart of man. Modern criticism has raised the supposition that either Nathanael or Andrew could have been meant, or even a purely ideal being which never existed in reality. But those two disciples are designated by name in several passages of the Gospel (i. 40; vi. 8; xii. 22; i. 45 *seq.;* xxi. 2), and how could the disciple whom Jesus loved be any other than one of the three intimates with whom he liked best to associate? As for an ideal being, how could the evangelist place him among the twelve, and ascribe to him a decisive part in the scene which brought about the departure of Judas from the Last Supper (John xiii.)? How could an ideal being be the friend to whom Jesus from the cross bequeathed his mother, and who took her into his home from that moment (John xix. 29)? Such traits can be applied only to a being of flesh and bones. Up to the time of the death of Jesus, John lulled himself in the most glorious earthly expectations (Mark x. 35 *seq.*), but the resurrection of Christ then opened his eyes, and at the same time he understood the whole Scripture, and he "believed" (John xx. 8). The New Testament does not mention that there was granted to John, like Peter and James (Luke xxiv. 34; 1 Cor. xv. 5, 7), any appearance of the Lord after his resurrection; but if those appearances of Jesus which are recorded were fictitious, the very first would certainly have been attributed to John. Pentecost accomplished the work commenced by the resurrection. John makes us understand what took place within him on that day, recalling with predilection in his Gospel those promises of Jesus, "When the Spirit of truth is come, he shall glorify me;" "At that day ye shall know that I am in my Father, and ye in me, and I in you" (John xvi. 13 and xiv. 20). In spite of the very particular privilege with which he had been honored, John performed only a secondary part in the foundation of the Church, compared with his associates, Peter and James. Peter was the great instrument for the establishment of the Church in Israel (Acts i.–v.). James died in 44 as the first martyr, a fact which by itself proves the power of his influence on the Jewish people (Acts xii. 2). Of the activity of John we know nothing except the two traits of little importance recorded in Acts iii. 1 *seq.* and viii. 14; and we should have considered his influence on the apostolic Church as very small but for the words of St. Paul (Gal. ii. 9), who ranks him among the three "pillars" of the Church. A modern school has attempted to establish, by the aid of this and some other texts, that John and the other apostles belonged, even after Pentecost, to that narrow Jewish-Christian party which would impose the circumcision and the Mosaic law on the Gentiles as a condition of their entering the Church. But the above text proves exactly the opposite, since Paul here expressly distinguishes between the representatives of the apostolate, James ("the brother of the Lord"), Peter, and John, who would not improve the law (v. 9), and the "false brethren" who had come in privity into the Church in order to establish the principle of the law (v. 4). (1) Compare the "But of these" (v. 6), which plainly indicates an opposition. John himself, no doubt, observed the law, as did his associates, but only from a feeling of national piety and Israelitish fellowship; he would not impose it on the Gentiles who believed, for if so he could not have given "the right hand of fellowship" to St. Paul (v. 9). It was not until after the death of Peter (about 64) and Paul (about 66), and after the destruction of Jerusalem, that the activity of John assumed its grand proportions. According to a unanimous tradition in the churches of the second century, he went to Asia Minor, where Paul had founded a magnificent circle of churches. The truth of this tradition has been disputed, however, quite recently. It has been said that the Church fell into this error by attributing falsely the Revelation to John the apostle, and then inferring that he lived in the centre of the Asiatic churches (Rev. i.–iii.). But the historical testimonies are with respect to this fact so old and so authoritative that to deny it would be to overthrow all history. In his great work, *Against the Heretics* (about 185), Irenæus, who in his youth had been a disciple of Polycarp, speaks frequently of the relations of Polycarp to the apostle during the sojourn of the latter in Asia. He refers to what the presbyters of Ephesus and Polycarp have heard John record of the Lord; and he adds, "There are people who have heard from the mouth of Polycarp how John, the disciple of the Lord, once went to take a bath in Ephesus, but suddenly, on seeing Cerinthus, left the house without taking any bath, exclaiming, 'Let us flee before the house falls down on us, for Cerinthus, the enemy of truth, is here.'" In a celebrated letter he refers to his old friend Florinus, and the time which they, while young people, spent together in the presence of Polycarp, recalling how this bishop taught people and told them of his "connections with John and others who had seen the Lord." In another letter, addressed to Victor, bishop of Rome, he reminds him of his predecessor, Anicetus—how, in spite of certain ritualistic differences, he had celebrated Easter together with Polycarp, and how this latter had defended his form of the celebration by the fact that in this manner he had always commemorated the event with "John, the disciple of our Lord, as well as with the other apostles with whom he had been together." Besides this decisive testimony by Irenæus we have another by Apollonius, a writer from Asia Minor, living about 175, who attributes to John the resurrection of one dead at Ephesus; and a third by Clement of Alexandria, who in his essay, *Who is the Rich that shall be Saved?* (par. 195), records the interesting story of the young Christian from Asia who had become the chief of a band of robbers, but was reclaimed by John, on which occasion he represents the apostle as visiting the churches of Asia Minor for the purpose of appointing bishops and regulating their affairs. And last we have the testimony of Polycratus, seventh bishop of Ephesus, in whose family this office had been, so to speak, hereditary since the times of the apostles, and who in the name of the bishops of Asia reminds Victor of the incontestable fact that among the founders of the Church of Ephesus was John, the disciple "who had leaned on the bosom of the Lord, and that he was buried at Ephesus." Before such testimonies the criticism which denies accuses itself of partiality. Jerome represents how the old apostle, in the last days of his life, was carried into the assemblies of the Church, but confined himself to the repetition of the command, "Little children, love one another;" and how, when asked "Why do you never say anything more?" he answered, "Because when this is done, enough is done." Irenæus states that John lived in Asia in the time of Trajan (97–117), and Jerome adds that he died in extreme old age "in the sixty-eighth year after the death of the Lord" (which, if Jesus died in 30, brings us down to 98), and that he was "buried in Ephesus." These authors ignore entirely a strange story contained in a newly discovered fragment of a chronicle written in the ninth century by a certain Georgius Haumartolos, who says that he has read in a work of Papias, written in the second century, but now lost, that John was "put to death by the Jews." This legend has been used as an argument against the residence of John in Asia, as if there had been no Jews in Ephesus! Even this very day those who visit the tomb of Polycarp at Smyrna, and pass through the Jewish quarter, know what such a boldness may cost. At all events, we attach no importance to this story, since it has never been mentioned by Irenæus, Eusebius, and the many others who were possessed of the work of Papias.

2. *Writings.*—Of the twenty-seven writings of the New Testament, five are attributed to the apostle John by the more or less unanimous tradition of the primitive Church—the fourth Gospel, one large and two smaller epistles, and the Revelation. In the evangelical collection the fourth Gospel shows a character of its own. It is a work composed in one train of inspiration, and not a redaction of a tradition already circulating in the Church, such as are the three others, at least to some extent. It opens with an introduction in which is given the essence of the history that follows: (1) The glory of the creative Word; (2) the crime and misery of the Jews who have rejected it in its humiliation; and (3) the fortune of the Church which has received in faith the incarnate Son of God. These three ideas of the introduction are also the fundamental ideas of the whole Gospel: Jesus makes his glory manifest by his words and acts; presently the world is divided, some taking part against him, others for him. Thus, the *glory of Jesus*, the *unbelief*, and the *faith* are the three facts on which the whole narrative rests. (1) Chs. i.–iv., first revelations of Jesus, and first impressions of unbelief and faith, as yet intermingled; (2) chs. v.–xii., special development of the constant progress of unbelief, both with the chiefs and the mass of the people, as each appearance of Jesus at Jerusalem on the festivals is the signal to a new outburst of hatred; (3) chs. xiii.–xvii., special development of the faith with

the disciples during the last times preceding the death of Jesus; (4) chs. xviii. and xix., the external defeat of Jesus by the Jewish incredulity (his judgment and punishment); (5) chs. xx. and xxi., the glorious victory of Jesus over death by his resurrection, and the consummation of faith with his disciple's by his appearances. Such is the plan of this marvellous work; and thus on a beautiful day in spring, when the sun rises radiant and sending his warm rays to the earth, the last snow melts, life awakens, and nature sets to work. But after a few hours the vapors of the humid soil arise and form dense clouds; the sun hides, the storm threatens, and when the day is at its highest the tempest bursts on the earth and nature seems delivered up to its destructive forces, having lost its life-star. Nevertheless, when evening comes the clouds float away, calm reigns, and, more resplendent and more magnificent than when rising, the setting sun sends a last happy smile to nature before disappearing. But who has composed this work, this unique work? The Church has never hesitated in answering. No other name than that of John has ever been inscribed in the title of this work. It bears a formal testimony of itself in the last words of chapter xxi., affixed by the editors of the book, according to which the author was the disciple whom Jesus loved, and who was still living at the time when the publication took place: "This is the disciple which testifieth of these things and wrote these things" (xxi. 24). The author himself declares that he has been an eyewitness of the events he records (i. 14; xix. 35). Moreover, the whole narrative has an autobiographical character. It does not commence with the history of the ministration of Jesus, but with the first meeting between Jesus and the author—for the second disciple (i. 35 *seq.*) must be the author himself; the anonymity guarded with respect to this disciple, and the picturesqueness of the narrative, prove it sufficiently; and it does not extend to the ascension, but ends at the moment when the author's faith becomes full, when he can exclaim from the depth of his heart, with Thomas after his conviction, "My Lord and my God!" This last word of the Gospel corresponds with its first, "The Word was God." The faith of the disciples has at last reached the height of its object.

In our days the authenticity of this book is attacked with particular eagerness; and this is quite natural. If the divinity of the Lord is the palladium of the Church, the Gospel of John is the palladium of this truth. Matthew has demonstrated the Messianic *office* of Jesus; Mark has described his powerful daily *activity;* Luke has traced the progress of his work of salvation from Bethlehem to Jerusalem, and from Jerusalem to Rome; but it is John who has unveiled the eternal divinity of his person, thus offering at the same time to the Church its most perfect food and to unbelief the heaviest stone of offence. But to whom could such a work be attributed if it were not written by St. John? A great unknown, it is answered, composed it in the first half or in the middle of the second century. But we know the great authors of the second century—Ignatius, Papias, Polycarp, men of deep piety certainly, but of mediocre talent. And this superior genius who should have composed the fourth Gospel, and who surpasses all the known authors, he should have remained completely unknown himself, and passed through the Church of the second century without leaving the smallest vestige of his personal existence! No; here unbelief demands too much belief. Renan himself acknowledges that it is not possible to trace a probable place in the ministration of Jesus without the dates of the fourth Gospel. He points out in this book a multitude of "precise traits" which necessarily indicate an eyewitness. Credner, a critic who by no means belongs to the orthodox school, ends his essay on the fourth Gospel by saying, "If we had no historical dates at all referring to the author of the fourth Gospel, . . . the nature of the language, the freshness and vividness of the narrative, the precision of the dates, . . . the author's love and tenderness towards the person of Jesus, the irresistible charm diffused throughout the whole narrative, . . . would lead us to infer that the author could be no other person than a *native of Palestine*, an *eyewitness*, an *apostle*, one *beloved by Jesus—John*, indeed, whom the Lord had personally captivated by the celestial charm of his teaching, . . . and who, during his residence in a city like that of Ephesus, had become able to vindicate his place among the Greeks, so distinguished for their literary culture." (*Introduction to the New Testament*, § 93.) It seems, indeed, that John wrote the Gospel in Ephesus, and between 80 and 90. This is sufficiently proved by the only contradictions worth mentioning. The Alogians, a small Phrygian sect formed towards the end of the second century, attributed this Gospel to Cerinthus, the adversary of John in Ephesus, and thus they testify themselves to the great antiquity and to the birthplace of the book.

The larger Epistle bearing the name of John is evidently by the same author as the Gospel. Here too he represents himself as an eyewitness to the life of Jesus (i. 1 *seq.*). From the beginning of the second century it has been used by Ignatius, Papias, and Polycarp. It contains the celestial philosophy which the author has drawn from the teaching, the labor, and the person of Jesus. This he opposes to the heresy already breaking in, and he offers it to the Church as the ideal of Christian life; not that he considers this ideal as perfection, as something inaccessible; on the contrary, it is a holiness which the presence of Jesus in the believing soul realizes every moment. The two small Epistles seem to have spread very slowly in the Church, on account of their smaller importance. This explains also why they have not as many testimonies in their favor as the two preceding writings, to which they form a beautiful contrast. In the first, John praises the firmness of a Christian lady called *Kyria* in breaking with the preachers of heresy; in the second he praises the charity of his beloved Gaius, whose house is always open to the preachers of the gospel. It is on the one side the holy exclusiveness, on the other the generous broadness, of the Christian faith. Of the Revelation we do not speak here, as a special article will be given to it.

3. *Character and Influence.*—John seems not to have possessed either the bold initiative of Peter or the penetrating dialectical power of Paul. The part, little conspicuous, which he plays before and after Pentecost, and up to his residence in Asia Minor, indicates a character discreet, reserved, even timid, and which must arrive at a sure feeling of its own maturity before it can act in the external world. But this trait reveals a profound nature, meditative, well balanced, and capable of receiving much. By giving to John and James the surname of "Boanerges" (that is, "the sons of thunder") Jesus has unveiled the mystery of their characters. We understand at once those rare and passionate manifestations. It is they who will command fire to come down from heaven on the Samaritan village which did not receive Jesus (Luke ix. 52 *seq.*). It is also John who silences the disciple who, without following with him, casts out devils in the name of Jesus (Luke ix. 49). Like the electric cloud which gathers silently the lightning within its bosom, and then suddenly lets it flash forth with a crash, the sons of Zebedee accompany Jesus, deeply touched, but generally silent and composed; but suddenly they give utterance to their impressions by an explosion, unforeseen like the lightning and terrible like the thunderclap. We also understand how the John of the Gospel can be the John of the Revelation. Nothing is falser, indeed, than the idea which is generally entertained of the sweet tenderness and feminine softness of John. Such natures generally attach themselves passionately to the object of their love; there is something absolute in their feeling. From the moment St. John met Jesus he belonged to him entirely. Never a soul more longing after the ideal met with an object more capable of satisfying it. The first glance melted the two characters, one in the other. While the other apostles admired the miracles of Jesus, and more especially retained his moral precepts, John contemplated his person, and pondered in his heart over those mysterious testimonies emanating from the consciousness of Jesus concerning his relation to the Father—testimonies which escaped all the others. Renan has said that the Semite proceeds by intuition, not by deduction. This remark is in the highest degree applicable to the intellectual tendency of John. He does not dissect the argument of his adversary, as does St. Paul, dissolving it with his irresistible dialectical power; he crushes it with one blow. He sees the light on the one side, and on the other the darkness, and when he has given each of them its true name, he has said his all. The upright soul cannot hesitate, according to him. Having seen this vision, he who still searches after the way is lost. Thus constituted, St. John was not charged either with the foundation of the Church among the Jews and the Gentiles, such as were the missionary apostles, or, such as Paul, with the emancipation of the New Testament from the Old through a profound and penetrating study. His mission was to place the crown on the work of his two colleagues. He gave to the Church of Asia Minor that powerful organization which enabled it to stand against the floods of heresy in the beginning of the second century, and made this Church the centre of the whole Church during this epoch, on account of the power of its spiritual life. By his writings, more especially, he led the Church to a perfect understanding of the salvation which is in Christ, developing in his Gospel the idea of the *Redeemer;* in his Epistle, that of the *Christian;* and in the Revelation, that of the *Church.* In him the Church of the first century finished its cycle, which is the type of the history of the whole Church. FRÉDÉRIC GODET.

John I., SAINT, POPE, a Tuscan, was chosen pope in 523, and in 525 was compelled by Theodoric the Ostrogoth to

visit Constantinople and intercede for the Arians. On his return he was imprisoned, and d. at Ravenna May 26, 526.—JOHN II., a Roman, was chosen pope by simoniacal means in 532, and was acknowledged by Justinian as the head of the Church. D. May 26, 535.—JOHN III., a Roman, became pope in 560, and d. July 13, 573.—JOHN IV., a Dalmatian, became pope in 640, was distinguished for zeal and doctrinal strictness, and d. Oct. 11, 642.—JOHN V., a Syrian, became pope in 685. D. Aug. 1, 687.—JOHN VI., a Greek, became pope in 701, and d. Jan. 9, 705.—JOHN VII., a Greek, became pope in 705; d. Oct. 18, 707.—JOHN VIII., a Roman, became pope in 872, was zealous for the papal primacy and the extension of the temporal authority of the holy see. His reign was vexed by the incursions of the Saracens into Italy. Was murdered Dec. 15, 882.—JOHN IX., b. at Tibur, became a Benedictine, and was chosen pope in 898, and strove for the reform of many abuses. D. Nov. 30, 900.—JOHN X., bishop of Bologna and archbishop of Ravenna, became pope in 914, and though reputed a man of impure life, was an able prelate. He led in person the armies which routed the Saracens and expelled them from Italy, but was imprisoned by the infamous Marosia, and d. in 929.—JOHN XI., natural son of Marosia, probably by Pope Sergius III., was made pope in 931 by his mother, and is supposed to have d. by poison in 936.—JOHN XII., son of Alberic and grandson of Marosia, became pope in 956 when sixteen years old. His name was Octavian, and he is regarded as the first pope to assume a new name on consecration. He was a man of extreme licentiousness, and was condemned by a council called by Otho I. at Rome for murder, incest, sacrilege, idolatry, and witchcraft. D. May 14, 964. The most important event of his reign was his coronation of Otho I., regarded as the first German emperor.—JOHN XIII., a Roman bishop of Narni, became pope in 965, and after a disturbed pontificate d. Sept. 5, 972.—JOHN XIV. (*Peter*, bishop of Pavia), a native of Pavia, was arch-chancellor to Otho II., who made him pope in 984 in place of Boniface VII., who returned soon after, and John d. in prison, probably of starvation.—JOHN XV. became pope in 986, and was chiefly remarkable for avarice and nepotism. D. Apr., 996.—JOHN XVI. (*Philagathus*), a Greek, and bishop of Piacenza, became pope in 997 in opposition to Gregory V., who mutilated and killed him.—JOHN XVII. (*Sicco*), b. at *Ripa Jani*, in the March of Ancona, of noble family; after a pontificate of four and a half months d. June 9, 1003.—JOHN XVIII. (*Phasianus*) became pope in 1003, and abandoned the papal chair for a monk's cell in May, 1009.—John XIX., a son of the count of Tuscany, succeeded his brother, Benedict VIII., having obtained the election by force and bribes, in 1024; was chiefly remarkable for avarice. D. Nov. 8, 1033.—JOHN XX., usually omitted from the list of popes, was a rival of Gregory VI., Benedict IX., and Sylvester III. There were at one time (1045) three reigning popes at Rome, who divided the revenues and expended them in excesses.—JOHN XXI. (*Pedro*), b. at Lisbon, studied at Paris, and won great applause by his learning. He became cardinal-priest, archbishop of Braga, and first physician to Gregory X.; became pope in 1276. D. May 16, 1277, at Viterbo.—John XXII. (*Jacques d'Euse*), b. at Cahors about 1244, became in 1300 bishop of Fréjus, archbishop of Avignon 1310, in 1312 cardinal-bishop, and in 1316 pope at Avignon. He was learned in the canon law, and was remarkable for avarice.—JOHN XXIII. (*Balthazar Cossa*), b. at Naples, became cardinal in 1402, and succeeded Alexander V. in 1410; convoked the Council of Constance 1413; was deposed in 1415, and d. Nov. 22, 1419. CHARLES W. GREENE.

John I. (JUAN), king of Aragon, b. Dec. 27, 1350; married in 1384 Yolande, daughter of the duke of Bar, granddaughter of John II. the Good of France; succeeded to the throne on the death of his father, Peter IV., Jan. 5, 1387; imprisoned Sibylle, his wife's mother, on the charge of having poisoned the late king, and seized upon her property; recognized Clement VII. as pope at Avignon, and devoted himself to literature and pleasure, leaving the cares of state to his queen. He sent a formal deputation to France to enlist the most famous troubadours, with whose aid he founded at Barcelona an academy of poetry on the model of the Floral Games of Toulouse, much to the disgust of the rude Aragonese. He successfully repelled the invasion of the count of Armagnac, a pretender to the throne, 1390; reconquered the island of Sardinia 1392; and d. May 19, 1395.

John II. (JUAN), king of Aragon and Navarre, b. June 29, 1397, son of Ferdinand the Just; married in 1419 Blanche, daughter of Charles III. of Navarre, and succeeded to the throne of that kingdom in right of his queen Sept., 1425; took an active part in intrigues at the court of Castile against Alvaro de Luna; in 1428 aided his brother, Alfonso V. of Aragon, in a war against Castile, and accompanied him in an expedition against Naples, in which both kings were taken prisoners by the Milanese in the celebrated naval battle of Ponza, near Gaeta, Aug. 5, 1434. Released shortly after, he administered the government of Aragon for many years in his brother's absence, and renewed his attempts to obtain supreme influence in Castile. Queen Blanche having died Apr. 3, 1441, Carlos, prince of Viana, claimed the throne of Navarre in his mother's right, but John refused to surrender it to his son, thereby giving rise to a long and lamentable family feud. John invaded Castile in 1445, and was defeated at Olmedo; married in 1447 Joanna Henriquez, daughter of the admiral of Castile; suppressed a revolt in Navarre in 1452, taking prisoner his son, Prince Carlos; disinherited that prince in 1455 on account of a second rebellion, and defeated him at Estella in 1456; John succeeded to the throne of Aragon July 5, 1458; declared Sicily and Sardinia annexed to Aragon, and soon had new troubles with his son, whom he unwillingly recognized as heir, but afterwards threw into prison (1460), and whose sudden death (1461), attributed to poison, was the pretext for a formidable revolt in Catalonia, lasting eleven years. He had similar troubles with his daughter Blanche, who died in prison at Orthes Dec. 2, 1464; took Barcelona in 1472; made war in Roussillon against Louis XI. of France in 1473; and d. at Barcelona Jan. 19, 1479, being succeeded by his son Ferdinand, known as *the Catholic*. (See Prescott's *Ferdinand and Isabella*.)

John I. (JUAN), king of Castile and Leon, b. at Epila Aug. 20, 1358; married Leonora of Aragon in 1375, and succeeded to the throne on the death of his father, Henry II. (of Trastamara), being crowned July 25, 1379. He immediately convoked the Cortes, who after long deliberation recognized the Avignon claimant to the papacy (Clement VII.). JOHN OF GAUNT, duke of Lancaster (which see), having assumed the title of king of Castile in right of his wife, a daughter of Peter the Cruel, and Ferdinand of Portugal having entered into a secret alliance with the English duke, John attacked Portugal by sea and land, obtaining several victories, but concluded peace by marrying Beatrice, then aged ten years, only child and heir of the Portuguese monarch. Ferdinand, however, dying in 1383, John of Castile had to wage another war in support of the rights of Beatrice against the claim of the grand master of Avis (see JOHN I. THE GREAT, king of Portugal), and would have captured Lisbon (1384) had not the yellow fever driven him away. His defeat next year at Aljubarrota was fatal to the claims of Blanche. After several years' delay the duke of Lancaster invaded Castile in 1386, but peace was made the following year by the marriage of Prince Henry to the daughter of the English duke, who also received an indemnity in money. John created his son prince of Asturias (1388), convoked Cortes, which settled many important constitutional questions (1390), and d. Oct. 9, 1390.

John II. (JUAN), king of Castile and Leon, b. Mar. 6, 1405, succeeded his father, Henry III., in Dec., 1406, under the regency of his mother and his uncle Ferdinand, afterward king of Aragon. The infant monarch was crowned at Segovia Jan. 15, 1407; married his cousin, Mary of Aragon, in 1418 or 1420, and fell under the influence of ALVARO DE LUNA (which see), formerly a page, whom in 1423 he created constable of Castile. Prince Henry of Aragon, grand master of Santiago, brother of the queen, endeavored to gain possession of supreme power (1420) by seizing upon the persons of the king and the favorite. After many alternations of fortune in a struggle for power between Luna and the infantes of Aragon, lasting for many years, the former was beheaded at Valladolid June 7, 1453. John meanwhile had made two wars against the Moors (1431 and 1435), and several against the intrusive princes of Aragon and Navarre, who were constantly inciting the nobles of Castile to revolt. John was a feeble prince, but possessed some literary ability, and his reign was a notable one in the intellectual history of Spain. D. July 21, 1454.

John, king of England, surnamed LACKLAND (*Sans Terre*), either as a younger and portionless son, or on account of his loss of a large part of his French possessions in 1203, b. at Oxford Dec. 24, 1166, the son of Henry II.; declared lord of Ireland by papal authority, his short-lived government of that country was an utter failure; and during the reign of his brother, Richard Lionheart, who made him feudal lord of almost one-third of England, he was guilty of treason and ingratitude. Nevertheless, Richard appointed him his successor, ignoring the claims of his nephew Arthur, the rightful heir. John became king in 1199, and an expensive war with Arthur and Philip Augustus of France ensued, in which John lost the best part

of his French territories. The tale of the king's cruelties to Arthur has been called in question. Soon after followed the controversy concerning investitures with Innocent III., the most powerful of the popes, who excommunicated and deposed John, laid an interdict on England, and let loose the armies of France upon the king, who retaliated, we are told, by an alliance with the Moors of Spain (1212), promising to turn Mussulman. But John, not sustained by his own people, was compelled to yield and become the vassal of the pope, greatly to the indignation of the English. In Wales, Scotland, and Ireland his arms were successful. A rising of his barons compelled him to sign Magna Charta (1215); the aid of the pope and an army of mercenaries enabled him to repudiate that charter and make head against the barons; but during the war he d. at Newark Oct. 19, 1216. John's rapacity and cruelty to Jews and Englishmen alike, his partiality for his Aquitanian and Poitevin subjects, his punishments by mutilation and starvation, his cowardice and impiety, rendered his name odious, but his memory has found recent defenders, and it is certain that nearly all our knowledge of him has been derived from his bitter enemies.

John II., king of France, surnamed THE GOOD (LE BON), b. Apr. 26, 1319, was son of Philip VI., the founder of the Valois line; succeeded to the throne Aug. 22, and was crowned at Rheims Sept. 26, 1350. The chief event of his reign was the war with England, in which he was defeated and taken prisoner by the Black Prince at Poitiers, Sept. 19, 1356. His captivity in Bordeaux and London (1356–60) was brought to an end by the humiliating peace of Brétigny (May, 1360), which surrendered several provinces to the English, in addition to a ransom of 3,000,000 crowns. His son, the duke of Anjou, was left in London as a hostage for the fulfilment of the treaty, but it was rejected by the States General. The prince having escaped from London in violation of his parole, John returned to London as a prisoner early in 1364, and d. there Apr. 8 of the same year.

John II., Casimir, king of Poland from 1648 to 1668, b. Mar. 21, 1609, the second son of Sigismund III. After a somewhat adventurous life he entered in 1640 the order of the Jesuits, and was made a cardinal soon after. Nevertheless, on the death of his elder brother, Ladislas (Nov. 20, 1648), he succeeded to the throne, and married his widow, Maria Gonzaga. His reign was very unhappy. To Sweden he lost, by the Peace of Oliva (May 3, 1660), Esthonia and Livonia, and to Russia, by the Peace of Andrussov (Jan. 14, 1667), White and Red Russia. In the interior his government was utterly distracted by the feuds and intrigues of the nobles; and, entirely unable to master the situation, he abdicated Sept. 16, 1668, went to France, and lived in retirement. D. at Nevers Dec. 16, 1672.

John III., Sobieski, king of Poland from 1674 to 1696, b. June 2, 1624, at Olesko in Galicia; received an excellent education at home and in foreign countries, and distinguished himself so much in the wars against the Swedes, Russians, and Transylvanians that in 1667 he was made commander-in-chief of the whole Polish army. The successor of John II., Casimir, Michael Korybut, having made a humiliating treaty with the Turks, Sobieski had it rejected by the Polish diet, hastened at the head of his army to meet the Turks, and routed them completely at Khotin (Nov. 11, 1673). Shortly after Michael Korybut died, and Sobieski was unanimously elected king of Poland (May 21, 1674). In 1683 the Turks besieged Vienna with an army of 300,000 men. The emperor had fled, and not only was Austria on the very verge of ruin, but Europe was in danger. With an army of hardly 50,000 men Sobieski attacked the Turks Sept. 12, 1683, and after a frightful contest he utterly defeated them and pursued them into Hungary. As a ruler, however, John III. was much less fortunate than as a general, and the latter part of his life was much disturbed by civil and domestic troubles. D. June 17, 1696.

John (JOAM), the name of six kings of Portugal, four of whom require mention.—JOHN I. THE GREAT, b. at Lisbon Apr., 1357, was a natural son of Peter I. and brother of Ferdinand, at whose death, in 1383, he became regent and seized upon the throne, in violation of the rights of the infanta Beatrice, married to John I. of Castile. The war which ensued was decided by the victory of Aljubarotta (Aug. 14, 1385) in favor of the former. He made an expedition into Africa, and took Ceuta (1415) from the Moors. Under his reign the islands of Madeira, Cape Verde, the Canaries, and Azores were discovered, and the coasts of Africa explored as far as the Gulf of Guinea. D. Aug. 14, 1433.—JOHN II. THE PERFECT, b. at Lisbon May 3, 1455; married Leonora of Lancaster in 1471; took part in an African campaign the same year; was conspicuous for bravery at the battle of Toro (1476); succeeded his father, Alfonso V., Aug. 29, 1481; put to death the duke of Braganza and his own brother-in-law, the duke of Viseo, for conspiracy (1483–84). Under his auspices a series of great navigators explored the coasts of Africa, B. Diaz discovered the Cape of Good Hope, and Da Gama visited India. He was unwise enough to refuse the services of Columbus, but after the discovery of America he sent a fleet thither (1493). The conflicting claims of the crowns of Portugal and Castile were decided by Pope Alexander VI. (1493) by establishing the famous meridian line. D. 1495.—JOHN IV., b. at Villaviciosa Mar. 19, 1604, was duke of Braganza, and by a successful revolution overthrew the Spanish usurpation in Portugal (1640), which had lasted sixty years, placing himself on the throne of his ancestors. His reign of fourteen years was entirely passed in hostilities with Spain. D. in Lisbon in 1656.—JOHN VI., b. at Lisbon May 13, 1767; married Charlotte (Carlota), infanta of Spain 1785; was named prince of Brazil 1788; governed the kingdom in consequence of his mother's illness 1789; assumed the title of regent 1799, and after a series of wars with Spain and France removed with his court to Brazil in Nov., 1807, on the approach of the French army of occupation; became king on the death of his mother, Mar. 16, 1816; returned to Portugal 1821; modified the constitution 1823; recognized the independence of Brazil 1825, and d. Mar. 10, 1826.

John of Austria, generally known under the name of DON JUAN DE AUSTRIA, was a son of Charles V. and the beautiful Barbara Blomberg, a daughter of a wealthy citizen of Ratisbon, where he was b. Feb. 24, 1545, but was taken to Spain soon after his birth, and his parentage was kept a secret for many years. He received an excellent education, however, in the house of the imperial steward, Don Luis Mendez Quixada, and after the death of Charles V. in 1559, Philip II. publicly acknowledged him as a brother, and established a princely household for him, first in Valladolid and then in Madrid. He was a brilliant person, gifted with great talents both as a general and as a statesman, beautiful, commanding, chivalrous, and magnanimous. In 1568 he led with great success an expedition against the African pirates. In 1569 he subdued the Moorish rebellion in Granada, and gave striking proofs not only of personal valor, but also of tactical skill. In 1571 he commanded the magnificent Spanish-Italian armament against the Turks, and routed their fleet completely in the battle of Lepanto (Oct. 7, 1571), the greatest military exploit of the century. In 1573 he conquered Tunis, and in 1576 he was made viceregent in the Netherlands. Here he did not succeed in managing the prince of Orange, William the Silent. He was foiled by him in his political measures, but when it came to an open rupture he defeated him at Gemblours (Jan. 31, 1578). In spite of all these brilliant achievements, the final result of his life was nevertheless only a romantic apparition, a poetical dream. He passed through history like a meteor. His half-brother, Philip II., loved him, but was too despotic to allow him an independent career. He used him very freely, but was too suspicious to place full confidence in him. In this ambiguity his own character seems to have suffered. His earlier plans of founding a kingdom in Greece or in Tunis were sensible, but were opposed by Philip. His later plans of rescuing Mary Stuart and becoming king of Scotland were rather fantastical, and the policy which he pursued in the Netherlands was so singularly many-sided that his sudden death in his camp at Namur (Oct. 1, 1578) gave rise to a quite general suspicion of his having been poisoned by the Spaniards. Interesting accounts of his life may be found in Ranke, *Fürsten und Völker von Sud-Europas in XVI. und XVII. Jahrhundert*, and in Prescott, *Philip II.*

CLEMENS PETERSEN.

John (JUAN) **of Austria,** b. at Madrid in 1629, was a natural son of Philip IV. of Spain. He became a distinguished general, having commanded the Spanish army in Naples in 1648, in Catalonia in 1652, in Flanders in 1656, and in Portugal in 1660. He was defeated by Turenne at the Dunes, June 14, 1658; was afterwards viceroy of Aragon and minister under Charles II. D. at Madrid Sept. 17, 1679.

John of Gaunt (*Ghent*), duke of Lancaster and Aquitaine, and titular king of Castile, was the fourth son of Edward III., and was b. at Ghent in 1339; married Blanche, daughter of the duke of Lancaster, 1359; became duke of Lancaster 1362; served with honor under the Black Prince, and in 1370 married the daughter of Peter the Cruel of Castile; served with distinction in various wars in Scotland and France; invaded Castile in 1386 in pursuance of his claim to that kingdom; married his daughter to Henry of Castile 1388; was the friend and defender of Wickliffe, and the ancestor of the Lancastrian and Tudor families of English kings. His mistress and third wife, Catharine Swynford, was the ancestress of the Beauforts and Tudors. D. Feb. 3, 1399.

John of Leyden, whose true name was Johann Bockelson, b. at Leyden in 1510, was a tailor by profession, but a poet and actor by talent and business. Having come in contact with the Anabaptists, he was caught by religious fanaticism, and started as a strolling preacher. In 1533 he came to Münster, and so great was his power over the minds of people that in 1534 he succeeded in overthrowing the constitution of the city and establishing a new one of his own make. He was crowned as king of Zion, appointed ministers, coined money, introduced polygamy, married fifteen wives, lived in royal splendor and luxury, and for more than a year the city was the stage for the most frightful scenes of fanatical cruelty and sensual dissipation. In 1535 it was conquered by the neighboring princes, and again reduced to order. John was tortured to death by hot pincers, and his body was hung in a cage on the tower of St. Lambert's church; many of his followers were also severely punished. John of Leyden furnishes the historical subject of Meyerbeer's well-known opera *Le Prophète*.

John of Salisbury, b. at Salisbury about 1110; went to France in 1136; studied under Abelard; returned in 1151; became secretary to Thomas à Becket, and was appointed in 1176 bishop of Chartres, where he d. Oct. 24, 1182. His theological system he developed in his *Policraticus* and *Metalogicus*, but the most interesting of his writings are his *Vita ac Passio S. Thomæ*, and his letters, numbering 302, edited by Mason (Paris, 1811). A collected edition of his works was published at London (1848, 2 vols.).

John of Swabia, generally known under the name of Johannes Parricida, b. in 1289, a son of Rudolph of Swabia and a grandson of Rudolph of Hapsburg. When he attained his majority he demanded his inheritance from his uncle, the emperor Albert I., but Albert refused to deliver up any of the estates he had taken possession of. John then formed a conspiracy with several nobles, overtook the emperor (May 1, 1308) at Windisch on the Reuss in Switzerland, and murdered him. The impression which this crime produced on the German people was one of horror and revenge. The conspirators themselves escaped, but their families and friends suffered severely. John vanished, and nothing certain is known of his life afterwards.

John, Prester ("Priest John"), a semi-mythical character who figured largely in the geographical romances of the Middle Ages, whose true country and period are difficult to be fixed with certainty. According to general belief, there was somewhere in the interior of Asia or Africa a kingdom which had been converted from Islam to Christianity, governed by a priest-king named John, who was exceedingly anxious to open friendly intercourse with the Church of Rome. Numerous embassies were during two centuries sent to Central Asia, and even to Abyssinia (1481–95), in search of the lost Christian nation, but the search proved fruitless. The origin of the legend appears to date from the Nestorian missions which in the eleventh and twelfth centuries penetrated to Karakorum in Toorkistan, and converted the khan of that district, named *Ung*, who was overthrown and killed by Genghis Khan in 1202. He appears to have authorized the Nestorians to make in his name certain requests of the pope, and to their glowing narratives, sent to the Greek emperor and to the kings of France and Portugal, Europe was indebted for a favorite cycle of legends which may be read in Assemani's *Bibliotheca Orientalis*. Father Rubruquis, sent by St. Louis, king of France (1253), in search of Prester John, penetrated to Karakorum. (See his interesting narrative in Purchas's *Pilgrims*.)

John Scotus. See Erigena.

John the Constant, elector of Saxony, b. June 30, 1467; succeeded his brother, Frederick the Wise, in May, 1525; took part in a war against the Hungarians, and put an end to the Peasants' war in his own dominions. In 1526 he formed an alliance with the landgrave, Philip of Hesse, and with other states and free cities, in support of the principles of the Reformation, lately inaugurated by Luther. He protested in 1529 against the decision of the Diet of Spires adverse to the Reformation, and was influential in causing the proclamation of the Augsburg Confession. Still later, he helped to form the "League of Schmalkald," and d. Aug. 16, 1532.

John Frederick, the Magnanimous, elector of Saxony, b. at Torgau June 30, 1503, son of John the Constant, on whose death, in 1532, he became administrator of the government in the joint name of himself and his younger brother, John Ernest; gave official sanction to the Reformation throughout his states 1533; was recognized as elector by the emperor at Vienna in 1534, and in 1546 was at the head of the armies of the Schmalkaldic League in the contest with Charles V., by whom he was put under the ban of the empire in 1547, and defeated at Mühlberg Apr. 24 of the same year, being taken prisoner and condemned to death (May 10), but his life was spared on condition of renouncing his claims to the electorate. He was liberated in 1552 through the vigorous interposition of his cousin, Maurice of Saxony, who had formerly been his rival for the electoral domains. John Frederick succeeded to the full title by the death of his brother, John Ernest, in 1553, and d. at Weimar Mar. 3, 1554.

John George I., elector of Saxony, b. Mar. 5, 1585; succeeded his brother, Christian II., in 1611; supported the emperor Ferdinand against the Bohemians in 1620, at the outset of the Thirty Years' war; formed an alliance with Gustavus Adolphus, king of Sweden (1631); contributed to the victory of Leipsic, and took Prague (Nov. 11), but lost it, with all Bohemia, to Wallenstein in 1632; made peace with the emperor at Prague (May 10, 1635), and declared war against Sweden; was defeated by the Swedes at Domnitz and at Witstock (1636); aided the imperialists against France in the battle of Dutlingen (1643), and d. Oct. 8, 1656.

John (Johann Baptist Joseph Fabian Sebastian), archduke of Austria, b. at Florence Jan. 20, 1782, the thirteenth child and the ninth son of Leopold II. and Maria Louisa of Spain. When he was very young he was generally believed by his family to be possessed of great military talents, and he consequently commanded the Austrian armies in 1800, 1803, 1805, and 1809. But he was always beaten, and when at the battle of Wagram he failed, for reasons not well understood, to bring his brother, the commander-in-chief, the proper support, he resigned his command and lived during the subsequent years in retirement in Grätz. The ill favor, however, with which he was considered by the court made him very popular, and in 1848 he was generally believed by the people to be possessed of great political virtues. He was chosen Reichsverweser by the Parliament of Frankfort. But once more he had the misfortune of disappointing his admirers. He was a most obstinate defender of the interests of the house of Austria, and as these did not always coincide with the interests of the German people, he resigned his Reichsverweserschaft Dec. 29, 1849. D. Mar. 10, 1859.

John, King of Saxony. See Johann.

John, von (Franz), Baron, b. in 1815 at Bruck, Lower Austria; entered when twenty years old the 52d regiment of infantry as lieutenant. His ability procured him a place on the staff. In the war of 1848 against the revolution in Italy he accompanied Field-marshal Radetzky as a captain, and has ever since been employed in important positions. He was chief of staff (1849–57) of the Austrian army of occupation in Tuscany and the papal states, and received there the command of the regiment Kaiser Franz Joseph No. 1. In 1859 he was chief of staff of the 6th army corps, and in 1861 was created a major-general; in 1866 was appointed chief of staff of the southern army under Archduke Albrecht, and created a field-marshal-lieutenant on the day after the victory at Custoza; and when Archduke Albrecht was appointed commander-in-chief of the whole Austrian force, including the army defeated at Königgratz, John became chief of his staff. After the war he was appointed minister of war, but retired in 1868 from this office, and was in 1869 made commander-general of Styria, Carinthia, Carniola, and Littoral. In 1874 he was made master of the ordnance and chief of staff of the whole army—a position which in Austria has become of great importance since the organization of the Prussian staff has been taken as a model. August Niemann.

John Quincy Adams, tp., Warren co., Ind. Pop. 809.

Johns, tp. of Appanoose co., Ia. Pop. 895.

Johns'burg, post-tp. of Warren co., N. Y. It is traversed by the Adirondack R. R.; is very mountainous; has iron ores and several tanneries. Pop. 2599.

John's Island, one of the sea islands of Charleston co., S. C. Pop. 2016.

Johnson, county of N. W. Arkansas, bounded on the S. by the Arkansas River. Area, about 550 square miles. The soil is partly hilly and partly bottom-land. It is well wooded and generally fertile. Tobacco, live-stock, cotton, and grain are staple products. Excellent semi-bituminous coal and iron ore are found. Cap. Clarksville. Pop. 9152.

Johnson, county of E. Central Georgia. Area, 250 square miles. It has a diversified surface. Cotton and corn are staple products. Cap. Wrightsville. Pop. 2964.

Johnson, county of S. Illinois. Area, 340 square miles. It is quite level and fertile. Tobacco, grain, cattle, and wood are staple products. It is traversed by the Cairo and Vincennes R. R. Cap. Vienna. Pop. 11,248.

Johnson, county of S. Central Indiana. Area, 320 square miles. It is undulating and very fertile. Cattle,

grain, and wool are staple products. Lumber, carriages, flour, and brick are leading articles of manufacture. The county is traversed by the Jeffersonville Madison and Indianapolis and the Cincinnati and Martinsville R. Rs. Cap. Franklin. Pop. 18,366.

Johnson, county of S. E. Iowa. Area, 616 square miles. Its surface is varied, its soil remarkably fertile. Cattle, grain, hay, ~~and wool~~ are staple products. The county is traversed by the Chicago Rock Island and Pacific and the Iowa Central R. Rs. Cap. Iowa City. P. 24,898.

Johnson, county of Kansas, having the Kansas River on the N. and Missouri on the E. Area, 472 square miles. It is well timbered, and has coal and limestone and a deep, fertile soil. Cattle, grain, and wool are staple products. The county is traversed by various railroads centring at Olathe, the capital. Pop. 13,684.

Johnson, county of E. Kentucky, traversed by the W. fork of Big Sandy River. Area, about 375 square miles. It is mountainous, and abounds in bituminous coal. The fertile valleys produce live-stock, grain, tobacco, and wool. Cap. Paintville. Pop. 7494.

Johnson, county of W. Missouri. Area, 790 square miles. It is partly forest and partly prairie, having a good soil, with abundant coal and water-power. Cattle, grain, tobacco, and wool are staple products. It is traversed by the Missouri Pacific R. R. Cap. Warrensburg. Pop. 24,648.

Johnson, county of S. E. Nebraska. Area, 378 square miles. It is traversed by the Great Nemaha River and the Atchison and Nebraska R. R. It has an excellent soil, but is deficient in timber and building-stone. Wheat and corn are staple products. Some coal is found. Cap. Tecumseh. Pop. 3429.

Johnson, county of N. E. Tennessee, bounded on the N. by Virginia and on the S. E. by North Carolina. Area, about 200 square miles. It is mountainous, heavily timbered, and has iron and other mineral wealth. Cattle, wool, and tobacco are staple products. Cap. Taylorsville. Pop. 5852.

Johnson, county of N. Texas, bounded on the W. chiefly by Brazos River. Area, 594 square miles. The soil is excellent. Live-stock, cotton, and grain are staple products. Timber and limestone are abundant. Cap. Cleburn. Pop. 4923.

Johnson, tp. of Greene co., Ark. Pop. 683.

Johnson, tp. of Little River co., Ark. Pop. 274.

Johnson, tp. of St. Francis co., Ark. Pop. 788.

Johnson, tp. of Union co., Ark. Pop. 1309.

Johnson, a v. of Henry co., Ga. Pop. 662.

Johnson, tp. of Christian co., Ill. Pop. 640.

Johnson, tp. of Clark co., Ill. Pop. 823.

Johnson, tp. of Brown co., Ind. Pop. 685.

Johnson, tp. of Clinton co., Ind. Pop. 1666.

Johnson, tp. of Crawford co., Ind. Pop. 652.

Johnson, tp. of Gibson co., Ind. Pop. 2616.

Johnson, tp. of Knox co., Ind. Pop. 1543.

Johnson, tp. of La Grange co., Ind. Pop. 1322.

Johnson, tp. of La Porte co., Ind. Pop. 170.

Johnson, tp. of Ripley co., Ind. Pop. 2409.

Johnson, tp. of Scott co., Ind. Pop. 1454.

Johnson, tp. of Plymouth co., Ia. Pop. 80.

Johnson, tp. of Webster co., Ia. Pop. 402.

Johnson, tp. of Maries co., Mo. Pop. 1257.

Johnson, tp. of Polk co., Mo. Pop. 898.

Johnson, tp. of Ripley co., Mo. Pop. 280.

Johnson, tp. of Scotland co., Mo. Pop. 1219.

Johnson, tp. of Washington co., Mo. Pop. 717.

Johnson, tp. of Champaign co., O. Pop. 2297.

Johnson (Johnstown P. O.), a v. of Monroe tp., Licking co., O. Pop. 241.

Johnson, tp. of Williamsburg co., S. C. Pop. 1218.

Johnson, post-v. and tp. of Lamoille co., Vt., 32 miles N. by W. of Montpelier. It has a State normal school, 4 churches, and manufactures of furniture, lumber, starch, and woollen goods. Pop. 1558.

Johnson (Alexander Bryan), b. at Gosport, England, May 29, 1786; came to the U. S. in 1801, and established himself as a banker at Utica, N. Y. He wrote several works on political economy, language, and education, which have received high commendation. D. at Utica in 1857.

Johnson (Andrew), LL.D., the seventeenth president of the U. S., b. at Raleigh, N. C., Dec. 29, 1808. His father died when he was four years old, and in his eleventh year he was apprenticed to a tailor. He never attended school, and did not learn to read until late in his apprenticeship, when he suddenly acquired a passion for obtaining knowledge, and devoted all his spare time to reading. After working two years as a journeyman tailor at Laurens Court-house, S. C., he removed in 1826 to Greeneville, Tenn., where he worked at his trade and married. Under his wife's instructions he made rapid progress in his education, passing from writing and arithmetic to the higher branches, and manifested such an intelligent interest in local politics as to be elected as "workingmen's candidate" alderman (1828–30) and mayor (1830–32), being twice re-elected to each office. During this period he cultivated his talents as a public speaker by taking part in a debating-society consisting largely of students of Greeneville College. In 1835, and again in 1839, he was chosen to the lower house of the legislature as a Democrat; was a candidate for elector at large in 1840, when he canvassed the State for Van Buren; was elected State senator in 1841, and Representative in Congress in 1843, being re-elected for four successive periods until 1853, when he was chosen governor of Tennessee. In Congress he supported the administrations of Tyler and Polk in their chief measures, especially the annexation of Texas, the adjustment of the Oregon boundary, the Mexican war, and the tariff of 1846. He was re-elected governor in 1855, after an exciting contest with the combined Whigs and "Know-nothings," and in 1857 entered the U. S. Senate, where he was conspicuous as an advocate of retrenchment and of the Homestead bill, and as an opponent of the Pacific R. R. He was supported by the Tennessee delegation to the Democratic convention of 1860 for the Presidential nomination, and lent his influence to the Breckenridge wing of the party. When the election of Lincoln had brought about the first attempts at secession in Dec., 1860, Johnson took in the Senate a firm attitude for the Union, and in May, 1861, on returning to Tennessee, he was in imminent peril of suffering from popular violence for his loyalty to the "old flag." He was the leader of the Loyalists' Convention of East Tennessee (May and June), and was very active during the following winter in organizing relief for the destitute loyal refugees from that region, his own family being among those compelled to leave. By his course in this crisis Johnson came prominently before the Northern public, and when in Mar., 1862, he was appointed by Pres. Lincoln military governor of Tennessee, with the rank of brigadier-general, he vastly increased his popularity by the vigorous and successful manner in which he labored to restore order, protect Union men, and punish marauders. On the approach of the Presidential campaign in 1864, the termination of the war being then plainly foreseen, and several Southern States being partially reconstructed, it was felt that the Vice-Presidency should properly be given to a Southern man of conspicuous loyalty. For no candidate could a juster title be alleged than for Gov. Johnson, who was accordingly elected on the same platform and ticket with Lincoln, and on his assassination succeeded to the Presidency, Apr. 15, 1865. That Pres. Johnson should very soon be involved in bitter feud with the Republican majority in Congress was certainly a surprising and deplorable incident; yet in reviewing the circumstances after a lapse of ten years, it is easy to find ample room for a charitable judgment of both the parties to the heated controversy, since it cannot be doubted that any President, even Lincoln himself had he lived, must have sacrificed a large portion of his popularity in carrying out any possible scheme of reconstruction. Pres. Johnson retained the cabinet of Lincoln, and exhibited considerable severity towards "traitors" in his earlier acts and speeches, but soon inaugurated a policy of reconstruction, proclaiming a general amnesty to the late Confederates, and successively establishing provisional governments in the Southern States. These States accordingly claimed representation in Congress in the following December, and the momentous question of what should be the policy of the victorious Union towards its late armed opponents was forced upon that body. Two considerations impelled the Republican majority to reject the policy of Pres. Johnson: first, an apprehension, certainly exaggerated but sufficiently plausible at the time, that the chief magistrate intended to undo the results of the war in regard to slavery; and second, the sullen attitude of the South, which seemed to be plotting to regain by policy what arms had lost. The credentials of the Southern members-elect were laid on the table, a civil rights bill and a bill extending the sphere of the Freedman's Bureau were passed over the executive veto, and the two highest branches of the government were soon in open antagonism. The action of Congress was characterized by the President in a popular harangue (Feb. 22, 1866) as a "new rebellion;" the cabinet was reconstructed in July,

Messrs. Randall, Stanbery, and Browning taking the places of Messrs. Denison, Speed, and Harlan, and an unsuccessful attempt was made by means of a general convention at Philadelphia (Aug. 14) to form a new party on the basis of the administration policy. In an excursion to Chicago for the purpose of laying the corner-stone of a monument to Stephen A. Douglas (Aug. 28), Pres. Johnson, accompanied by several members of the cabinet, passed through Philadelphia, New York, and Albany, in each of which cities, and at many other places on the route, he made speeches justifying and explaining his own policy and violently denouncing the action of Congress. In the ensuing winter session Congress enacted over the President's veto a series of measures for extending the right of suffrage to the freedmen, dividing the Southern States into military districts, and excluding them from self-government until they should have ratified the late amendments to the Federal Constitution and adopted State constitutions in accordance therewith. An opinion of the attorney-general against the validity of this legislation led to conflicts between the military commanders and the new State governments, and to new acts of Congress defining the powers of the former, making them independent of the President's authority. On Aug. 12, 1867, Pres. Johnson removed the secretary of war, replacing him by Gen. Grant. Secretary Stanton retired under protest, based upon the Tenure-of-office act, which had been passed in the preceding March. The President then issued a proclamation (Aug. 20) declaring the insurrection at an end, and that "peace, order, tranquillity, and civil authority existed in and throughout the whole of the U. S." Another proclamation (Sept. 3) enjoined obedience to the Constitution and laws, and an amnesty was published Sept. 7, relieving nearly all the participants in "the late rebellion" from the disabilities thereby incurred, on condition of taking an oath to support the Constitution and laws. In December, Congress refused to confirm the removal of Secretary Stanton, who thereupon resumed the exercise of his office, but on Feb. 21, 1868, Pres. Johnson again attempted to remove him, appointing Gen. Lorenzo Thomas in his place. Stanton refused to vacate his post, and was sustained by the Senate. On Feb. 24, the House of Representatives voted to impeach the President for "high crimes and misdemeanors" (yeas 126, nays 47, not voting 17), and presented (Mar. 5) eleven articles of impeachment, on the ground of his resistance to the execution of the acts of Congress, alleging, in addition to the offence lately committed, his public expressions of contempt for Congress in "certain intemperate, inflammatory, and scandalous harangues" pronounced in Aug. and Sept., 1866, and thereafter, declaring that the 39th Congress of the U. S. was not a competent legislative body, and denying its power to propose constitutional amendments. The impeachment trial began Mar. 23, the President appearing by counsel, and resulted in acquittal May 16 and 26, the votes on the two leading articles standing 35 guilty to 19 not guilty, thus lacking one of the two-thirds required for conviction. The remainder of Pres. Johnson's term of office was passed without any such conflicts as might have been anticipated. He failed to obtain a nomination for re-election by the Democratic party, though receiving 65 votes on the first ballot. New proclamations of pardon to the participants in the rebellion were issued July 4 and Dec. 25, but were of little effect. On the accession of Pres. Grant, Mar. 4, 1869, Johnson returned to Greeneville, Tenn. Unsuccessful in 1870 and 1872 as a candidate respectively for U. S. Senator and Representative, he was finally elected to the Senate in 1875, and took his seat in the extra session of March, in which his speeches were comparatively temperate. D. July 31, 1875, and was buried at Greeneville. Several biographies of Pres. Johnson have been published, generally with a selection of his speeches, among which may be mentioned those of Savage (1865), Frank Moore (1865), and Foster (1866). (See also the official record of *Proceedings in the Trial of Andrew Johnson,* Washington, 1868.) PORTER C. BLISS.

Johnson (LADY ARBELLA), daughter of Thomas, fourteenth earl of Lincoln, married Isaac Johnson, one of the principal founders of New England, and accompanied him to Massachusetts. In her honor Winthrop changed the name of the Eagle, the principal ship of the emigrant squadron, to Arbella. D. at Salem about Aug. 30, 1630.

Johnson (BUSHROD R.), b. in Ohio Sept. 6, 1817; graduated at West Point in 1840; served in the Florida and Mexican wars; resigned in 1847, and at the outbreak of the civil war was professor in the Nashville Military University. He became a brigadier-general in the Confederate army; was captured at Fort Donelson, but soon escaped; was severely wounded at Shiloh; became major-general in 1864, and commanded a division under Lee at the time of the surrender at Appomattox Court-house.

Johnson (CAVE), b. in Robertson co., Tenn., Jan. 11, 1793; became a lawyer and a circuit judge; was a member of Congress 1829–37 and 1839–45; was postmaster-general during Mr. Polk's Presidency; president of the Bank of Tennessee 1850–59; and during the civil war was elected to the State senate as a Unionist, but on account of feeble health he never took his seat. D. at Clarksville, Tennessee, Nov. 23, 1866.

Johnson (EASTMAN), b. in Lovell, Me., July 29, 1824. Took up drawing regularly at about eighteen; in 1845 went to Washington, had a room in the Capitol, and made many portraits of distinguished men. In 1846 established himself in Boston, and made crayon portraits of Longfellow and his family, Sumner, Felton, Hawthorne, and Emerson. In 1849 went to Düsseldorf; studied a year in the Royal Academy; occupied for a time a studio with Leutze. In 1851 spent a few weeks in London; thence to the Hague to copy a head by Rembrandt; stayed there four years, and sent thence his first pictures of consequence, *The Card-Players* and *The Savoyard.* Went to Paris, but was unexpectedly called home, after six years of absence. Spent two winters in Washington and two summers on Lake Superior among the Indians. Came to New York in the fall of 1858, with his picture *The Old Kentucky Home,* and still resides in New York. Mr. Johnson is a painter of *genre* pictures, but in a broader style than that term indicates. His pieces are all figure pieces, but with a wide range of subject. He views life on the pathetic, humorous, tender, heroic, and even on the comic side, always with keen perception and honest intent. He is a master of drawing and color, and rarely fails to convey effectively his whole thought. He has also been successful in portraits. The civil war furnished him subjects for his best-known works—*The Drummer-Boy, The Pension Claim-Agent, The Boyhood of Lincoln. The Old Kentucky Home* depicts the South as it was before the abolition of slavery. *The Kitchen at Mt. Vernon* is another reminiscence of old times in America. *The Stage-coach, Savoyard Boy, Drop on the Sly, The Little Storekeeper, The Chimney-sweep, The Chimney Corner, Post-boy, Organ-boy, Lady at Prayer, Mating,* illustrate the variety of his themes. Mr. Johnson belongs to no school, native or foreign. His works are numerous, and, though of unequal merit, are highly prized. The *Old Kentucky Home* was sent to the Paris Exhibition in 1867. As a painter of human life as it is before him Mr. Johnson stands foremost among American artists.

O. B. FROTHINGHAM.

Johnson (EDWARD), b. at Herne Hill, Kent, England, in 1599, came to New England about 1630, settled at Woburn, and for many years represented that town in general court, of which body he was Speaker in 1655. He is chiefly known as the author of the curious and valuable historical work, *Wonder-working Providence of Sion's Saviour in New England,* printed at London in 1654, reprinted by the Massachusetts Historical Society, and again edited, with notes, by W. F. Poole in 1867. D. at Woburn Apr. 23, 1672.

Johnson (EDWARD), b. in Chesterfield co., Va., Apr. 16, 1816; graduated at the U. S. Military Academy in 1838, and entered the army as second lieutenant; brevetted captain in 1847 for meritorious services in Florida, and major in 1848 for gallantry at Chapultepec and the city of Mexico; also presented with swords of honor by his native State and native county; commissioned captain in 1851; resigned from the army June, 1861, to join the Confederacy, and was at once appointed colonel of the 12th Georgia Vols.; brigadier-general 1862, and major-general the following year; commanded a division at Gettysburg, and in the Richmond campaign of 1864 taken prisoner, with his entire division, at Spottsylvania Court-house, May 12, as also subsequently at Nashville, Dec., 1864; retired to his farm in Chesterfield co., Va., at the close of the war. D. at Richmond, Va., Feb. 22, 1873. G. C. SIMMONS.

Johnson (HERMAN MERRILLS), D. D., LL.D., b. Nov. 25, 1815, at Butternuts, Otsego co., N. Y.; graduated at the Wesleyan University in 1839; was 1839–42 professor of ancient languages in St. Charles College, Mo.; in 1842 was called to the same chair in Augusta College, Ky.; held the professorship of ancient languages and literature in the Ohio Wesleyan University, Delaware, O., 1844–50, and was for a part of the time its acting president; in 1850 became professor of English literature in Dickinson College, and was its president 1860–68. D. at Carlisle Apr. 5, 1868. Dr. Johnson was an able scholar, and a student of modern Greek, Hebrew, Anglo-Saxon, Gaelic, Irish, Welsh, Ethiopic, Syriac, Arabic, and other tongues. He was an instructive preacher and a careful writer; edited *Orientalia Antiquaria Herodoti;* also an edition of the *Clio* of Herodotus, with notes (1850), and wrote much for periodicals.

Johnson (HERSCHEL V.), b. in Burke co., Ga., Sept. 18, 1812; graduated at the State University 1834; adopted the

profession of law, and in 1840 entered the political arena as the advocate of the principles of Jeffersonian Democracy; was a Presidential elector on the State Democratic ticket in 1844, and was appointed in 1848 to fill a vacancy in the U. S. Senate; was elected to the bench in his judicial circuit in 1849; in 1853 was elected governor of the State, and re-elected to the same office in 1855. In 1860 he was run for Vice-President of the U. S. on the ticket which was headed by Stephen A. Douglas for the Presidency; he was in the State secession convention of 1861, and took an active and prominent part against the policy adopted by that body; he voted against the ordinance of secession, but afterwards, when it was passed by a majority of the convention, he resolved to go with his State and sustain her in the course she had in her sovereign character adopted. Brought up in the State Rights school in politics, he believed his ultimate allegiance was due to his State. In 1863 he was elected to the Confederate States Senate, where he took and held a high position until the close of the war. He was president of the constitutional convention of the State in 1865. After the removal of the disabilities imposed by the fourteenth amendment to the Constitution of the U. S., he was again, in 1873, placed on the circuit bench for a term of eight years. In the mean time (that is, from the close of the war to the removal of the disabilities referred to) he had resumed the practice of law, which he prosecuted with great success. In Jan., 1866, on the restoration of the State to the Union under the proclamation of Pres. Johnson, he was chosen as one of the two U. S. Senators to which Georgia was entitled under the Constitution. The duties of this office, however, he was not permitted to enter upon; his seat was denied him by the reconstruction acts of Congress. As an orator, constitutional lawyer, and jurist Mr. Johnson has few superiors in the U. S. A. H. Stephens.

Johnson (Isaac), b. at Clipsham, Rutlandshire, England, about the close of the sixteenth century; married the Lady Arbella, daughter of the earl of Lincoln, and associated himself with Winthrop in the settlement of New England, being the wealthiest of the colonists and much respected. He is considered one of the chief founders of Boston, where he d. Sept. 30, 1630.

Johnson (James), b. in Robinson co., N. C., in 1811. His father moved to Georgia and settled in Macdonough when he was but a boy. After an academic course in this village he graduated with high honor at the State University in 1832, taught school for a short time, and then commenced the practice of law as a profession, in which he soon attained high eminence; was a member of Congress from Georgia from 1851 to 1853. Being a strong Union man, and opposed to secession, though he went with his State during the war, at its close, in 1865, Pres. Johnson chose and appointed him as provisional governor of Georgia under what was known as the President's policy. This position Mr. Johnson held, and discharged the duties incident to it to the general satisfaction of the people, until the State was restored to the Union on the conditions and requirements then prescribed. In 1866 he was appointed collector of the customs at Savannah, which office he resigned in 1869. Soon after he was placed on the circuit court bench of the State, which position he still (Apr., 1875) holds. A. H. Stephens.

Johnson (Sir John), b. in 1742, was a son of Sir William Johnson; was knighted in 1765, and succeeded in 1774 to his father's great estates and influence in the Mohawk Valley. In 1776 he fled to Canada with 700 followers, raised two battalions called the Royal Greens, was commissioned a colonel, invested Fort Stanwix in Aug., 1777, defeated Gen. Herkimer, and was himself defeated in Oct., 1780. His property was confiscated by the U. S., but the British government made him several grants of lands in Canada, where he became a member of the colonial council and superintendent of Indian affairs until his death at Montreal Jan. 4, 1830.

Johnson (Joseph), M. D., b. at Charleston, S. C., June 5, 1776; studied medicine at the University of Pennsylvania, and practised at Charleston with Dr. Elisha Poinsett. From 1818 to 1835 was president of the U. S. branch bank at Charleston, was active in literary, professional, and political associations, president of the South Carolina Medical Society from 1807 for many years; long mayor of Charleston, commissioner of schools, and leader of the Union party in the nullification troubles. He published in 1851 a valuable work, *Traditions and Reminiscences of the Revolution.*

Johnson (Joseph Taber), M. D., b. at Lowell, Mass., June 30, 1845; graduated A. M. at Columbian University, D. C., in 1864; took his degree at Bellevue Medical College, N. Y., in 1867, and completed his medical studies in Europe in 1871; was professor of obstetrics in the medical department of Howard University, surgeon to the Freedmen's Hospital and St. John's Hospital, and in 1874 became lecturer on midwifery at the medical department of the University of Georgetown, D. C.; wrote *Peculiarities of Parturition in the Negro Race*, and *Angina Pectoris*, illustrated by the case of Hon. C. Sumner.

Johnson (Manuel John), F. R. S., b. in England in May, 1805; studied at Addiscombe Military School; joined the East India Company's artillery at St. Helena in 1821, and remained there eleven years, during which he cultivated astronomy and prepared a catalogue of 606 stars of the southern hemisphere; returning to England, he entered Magdalen College, Oxford, at the mature age of twenty-eight, and graduated in 1839, when he was immediately appointed Radcliffe astronomer. In that capacity he greatly extended the lists of stars by his annual catalogues, and introduced improved astronomical instruments. His observations of double stars with the great heliometer, and his photographic registration of stars, were especially important. Prof. Johnson was president of the Royal Astronomical Society in 1857 and 1858. D. at Oxford Feb. 28, 1859.

Johnson (Mary Anne), first wife of Oliver Johnson, and daughter of Rev. Broughton White, b. in Westmoreland, N. H., Aug. 24, 1808; d. in New York June 8, 1872. For three years (1844–47) she was associated as assistant matron with Mrs. Eliza W. Farnham in the memorable effort to reform the State prison for females at Sing Sing. She subsequently became a lecturer to her own sex upon anatomy, physiology, and the laws of health, travelling extensively in the pursuit of that object in different parts of the U. S.

Johnson (Oliver), b. in Peacham, Vt., Dec. 27, 1809; served an apprenticeship to the printing business in the *Watchman* office, Montpelier, Vt.; Jan. 1, 1831, became the editor of a new paper, the *Christian Soldier*, and was from this time, and up to the year of 1865, busily engaged in the service of the anti-slavery cause as a lecturer and as an editor, manager, and contributor to newspapers. During the next five years and a half he was the managing editor of the *Independent*, resigning at the end of 1870 to become editor of the *Weekly Tribune*. After two years' service at this post he resigned at the end of 1872 to become managing editor of the *Christian Union*.

Johnson (Percival Norton), F. R. S., b. in England about 1793, was the son of a London assayer, and early acquired great skill in the same profession. He was the first to determine with accuracy the exact proportions of gold and silver in bullion. He introduced into England from Germany the alloy known as German silver, extracted palladium and platinum from gold bullion, and manufactured them for commercial purposes. He invented several pottery colors, especially the much-admired "rose-pink." His services were in great request as a consulting metallurgist at the great English mines, and he introduced numerous improvements into the machinery of the Cornish mines. He was elected a fellow of the Royal Society in 1846, and d. in London June 1, 1866.

Johnson (Reverdy), b. at Annapolis, Md., May 21, 1796, son of Chancellor John Johnson of that State; educated at St. John's College; studied law in his father's office, and admitted to the bar in 1815; removed to Baltimore in 1817, and was shortly after appointed deputy attorney-general of Maryland; was a State senator 1821–25, resigning in the latter year to attend to the increasing duties of his profession, in which he gained a leading position in his native State, as well as at the bar of the Supreme Court of the U. S. In 1845 he was elected to the U. S. Senate from Maryland, and in 1849, Pres. Taylor appointed him attorney-general of the U. S., which office he held until the death of Pres. Taylor, when he retired and resumed the practice of his profession; was member of the peace commission in 1861; U. S. Senator 1863–68; succeeded Mr. Charles Francis Adams as U. S. minister to England in 1868, and negotiated a treaty for the settlement of the Alabama claims, which was rejected, however, by the U. S. Senate. Recalled in 1869, he has since resided in Baltimore.

Johnson (Richard Mentor), b. in Kentucky Oct. 17, 1780; was educated at Transylvania University; studied law and was admitted to the bar; in 1823 was elected to the legislature, and was a member of Congress 1807–19; in 1812, after the declaration of war by Great Britain, he raised a regiment of Kentucky mounted riflemen, which he commanded on the Canadian frontier during the fall of that year. After the adjournment of Congress, Mar., 1813, he raised another mounted regiment of volunteers, with which he guarded the Indian frontier during the summer months, and joined Gen. Harrison in time to render brilliant service in the battle of the Thames on Oct. 5. It was by his hand the celebrated Indian warrior Tecumseh is reported

to have fallen. In this engagement Col. Johnson was desperately wounded. He was, however, able to resume his seat in Congress in February ensuing; in 1819 was elected to the U. S. Senate, and remained a member of that body until 1829; after this he was again a member of the House 1829–37; in 1836 was run for the Vice-Presidency of the U. S. in most of the States, on the same ticket which supported Mr. Van Buren for the Presidency. He received 147 of the electoral votes, but this was a few votes short of a majority of the whole, though largely above the number received by any other one of the candidates voted for. In this state of things the choice for Vice-President devolved on the Senate under the Constitution of the U. S. In the discharge of this duty the Senate in Mar., 1837, made choice of Col. Johnson for the office of Vice-President for the four years ensuing. In Mar., 1841, he returned to his home in Kentucky, after having devoted thirty years of his life continuously to the public service. Perfect retirement, however, was not allowed him. He was again returned a member to the State legislature, and while holding this positon d. at Frankfort, Ky., Nov. 19, 1850, at the advanced age of a little over eighty years. He was distinguished throughout his life for kindliness of heart and urbanity of manners. He was the author of the law abolishing imprisonment for debt in Kentucky. A. H. Stephens.

Johnson (Richard W.), A. B., A. M., b. in Livingston co., Ky., Feb. 7, 1827; graduated from the U. S. Military Academy in 1849, and entered the army as brevet second lieutenant of infantry; transferred to the cavalry 1855 as first lieutenant; promoted to be captain 1857, major 1862; engaged in campaigns against Indians in Texas 1849–61; appointed brigadier-general of volunteers Oct., 1861, and in command of a division of infantry at Stone River, Liberty Gap, Chickamauga, Missionary Ridge, and all the battles on the line of march from Nashville to New Hope church, near Atlanta, Ga., where he was severely wounded; subsequently commanded a division of cavalry at the battle of Nashville and the pursuit of the enemy through Tennessee. Received successive brevets from lieutenant-colonel to major-general U. S. A. for gallant conduct; retired on the full rank of major-general Oct., 1867, on account of wounds received at New Hope church; reduced to the rank of brigadier-general under a subsequent law of Congress retiring officers on rank actually held at the time when disabled. Military professor in the University of Missouri 1868–69, University of Minnesota 1869–70. G. C. Simmons.

Johnson (Robert W.), b. in Kentucky in 1814; moved to Arkansas, and was a member of Congress from that State 1847–53; he was then elected to the U. S. Senate, in which body he was an active and distinguished member until Arkansas passed her ordinance of secession in 1861; he was then elected a member to the provisional Congress of the Confederate States; in 1862 he was elected Senator from Arkansas to the Confederate States Senate. He was a leading member of that body to the close of the war; since then he has pursued the practice of his profession, the law, in the city of Washington. A. H. Stephens.

Johnson (Samuel), D. D., b. in Guilford, Conn., Oct. 14, 1696, was the son of Samuel and Mary (Sage) Johnson. His grandfather, William Johnson, who was twelve years old when the family emigrated from England to this country, married, July 2, 1651, at the age of twenty-two, a daughter of Francis Bushnell of Saybrook, whose sister, Sarah Bushnell, was the grandmother of Benjamin Hoadley, the celebrated bishop of Bangor and Winchester. The subject of this notice was in early childhood very much under the training of his grandfather William, a leading man in Guilford, who held, as did his son after him, the office of deacon in the Congregational church. He taught him to read, and stimulated his desire for learning. At fourteen young Samuel joined the infant college at Saybrook, and graduated after a course of four years. He subsequently became a tutor in the institution, and was connected with it in its transition period, and a chief agent in securing its establishment at New Haven as Yale College. He resigned his tutorship in 1719, and was ordained the next year as pastor of the Congregational church at West Haven, a village so near the college that he continued to associate intimately with its officers and to avail himself of a free use of the library. Here he frequently met his literary friends, among them several of the neighboring ministers, and discussed and examined with them the doctrines and practices of the primitive Church, and the form and authority of their own government and worship. The result was that he and Rector Cutler and Tutor Brown declared for episcopacy, and, relinquishing their positions, sailed from Boston Nov. 5, 1722, to obtain holy orders in the Church of England. He returned to Connecticut after a year's absence, and was settled at Stratford as a missionary of the Society for the Propagation of the Gospel in Foreign Parts. For a long time he was the only Episcopal clergyman in the colony, and had strong adversaries around him in those from whose fellowship he had withdrawn. He married, Sept. 26, 1725, Mrs. Charity Nicoll, widow of Benjamin Nicoll, Esq., of Brookhaven, L. I., by whom he had two sons, whose preliminary education, and that of his step-sons as well, he personally superintended. His inquiring mind led him to seek the society of scholars and to read all the philosophical works that came in his way. The residence of Dean Berkeley at Newport, R. I. (1729–31), was an interesting episode in his life. Before that dignitary came to America he had read his *Principles of Human Knowledge*, and was in a measure a convert to his metaphysical opinions. He corresponded with him, visited him at his Whitehall palace, and when the dean was about to return to England, disheartened by the failure of his great scheme, Johnson interested him in American education, and secured from him for Yale College the donation of many valuable books, and a deed of his farm at Newport for the founding of scholarships. He maintained a steady correspondence with Secker and other bishops and divines of the Church of England, and was a profound philosopher for his day, comprehending Berkeley and going deeply into Hutchinsonianism. He wrote numerous controversial pamphlets, and labored earnestly to secure the establishment of an American episcopate. The University of Oxford conferred upon him in 1743 the degree of D. D., and three years later he published a *System of Morality*, in two parts—one treating of ethics in a speculative aspect, and the other of the practical duties that result from established truths. This, again, appeared with additions under the title of *Elementa Philosophica*, which was dedicated to Berkeley and printed by Benjamin Franklin. When the project was entered upon to found a college in Philadelphia, Franklin, one of the gentlemen most interested in it, urged him to assume the presidency, but he finally declined it, and accepted shortly after the oversight of King's (now Columbia) College, N. Y. He guided this institution through its early troubles, and gave shape to its policy and course of study. Subscriptions toward the endowment were obtained at home and abroad through his instrumentality, and when things had been well settled he intimated his desire for retirement, and applied to Archbishop Secker for a suitable person to take his office. The Rev. Myles Cooper, an Oxford graduate, was sent over, and, sooner than he himself expected, Johnson, crushed by the death of his second wife from smallpox —a disease which had been the great bane and terror of his whole life—resigned the presidency of the college Feb., 1763, and retired to Stratford. Here he passed the remainder of his days, resuming the charge of his old parish, and continuing his correspondence upon the affairs of the Church in America. It was in this retirement that he composed an English and Hebrew grammar, the structure of the two languages bearing in his view a close resemblance. A second and revised edition of the work, which was first printed in London, was republished there, and attracted the attention of several Hebrew scholars, among them Bishop Lowth. Dr. Johnson never ceased to plead that one or more bishops might be sent to the colonies, but he did not live to see his desire fulfilled. He had expressed the wish that his death might resemble that of his good friend Bishop Berkeley, and Heaven granted it, for he sank to rest tranquilly, sitting in his chair, on the morning of Jan. 6, 1772. E. E. Beardsley.

Johnson (Samuel), LL.D., b. at Lichfield, Eng., Sept. 18, 1709, the son of a bookseller of limited means; commenced the study of the classics at the age of ten at the Lichfield free school, making great proficiency; spent a year at a private academy at Stourbridge, and two years in his father's shop, during which, by desultory reading, he laid the foundation of that immense store of miscellaneous knowledge for which he was distinguished. His father's poverty seemed to forbid all hopes of a university education, but when nineteen years of age he found an opportunity to enter Pembroke College, Oxford (1728), supporting himself by assisting the studies of a former companion at Lichfield school. He became noted for his proficiency in the classics, and produced a Latin translation of Pope's *Messiah*, which won a high encomium from that poet. In 1731, after three years of assiduous study, he was compelled by want of resources to leave Oxford; was employed for some time as usher in a school at Market Bosworth, Leicestershire, and afterwards lived some time at Birmingham, writing for a newspaper and publishing one or two books translated from the Latin. In 1736 he improved his circumstances by marrying a widow lady nearly double his age who had £800 in the funds, and opened a private academy near Lichfield. After a brief and unsatisfactory experience in teaching, Johnson went to London in 1737, accompanied by his pupil Garrick, and thenceforward devoted himself to literature as a profession. His first

serious employment was on Cave's *Gentleman's Magazine*, for which he continued to write until 1754. The publication of *London*, a satire imitated from Juvenal (1738), and of two or three political pamphlets, brought him into public notice, and procured him the friendship of Pope, Richardson, and other leading authors. In 1740, Johnson undertook to report the debates in Parliament for the *Gentleman's Magazine*, and acquired considerable celebrity by his practice of improving upon the real utterances of the speakers; in 1744 appeared his *Life of Savage ;* in 1749, his poem, *The Vanity of Human Wishes*, and a drama, *Irene ;* and in 1750–52 he wrote the *Rambler*, a semi-weekly series of literary essays which extended to 208 numbers and had great success. From 1747 to 1755 he was chiefly occupied upon his great work, the *Dictionary of the English Language*. His wife had died in 1752, his mother in 1759, and it was to pay the expenses of the latter's funeral that Johnson wrote *Rasselas* within a single week. The *Idler*, an imitation of the *Rambler*, appeared in 1758 to 1760. It was not until about 1762 that Johnson acquired that settled position in the republic of letters which is so familiar to the world in the pages of Boswell—a position apparently dating from the receipt of a pension of £300. He now became an authority on all points of erudition, and his wonderful conversational powers began to attract the attention of an admiring circle, which in 1764 formed the nucleus of the famous Literary Club. It was in 1763 that he first met his future biographer, James Boswell, and in 1765 that he made the acquaintance of the Thrale family. In 1773 he visited Scotland and the Hebrides, accompanied by Boswell, publishing in 1775 the *Journey to the Western Islands*, and a pamphlet against the American rebellion, entitled *Taxation no Tyranny*. His last literary work of any importance was the *Lives of the Poets* (1779–81). D. in London Dec. 13, 1784, and was buried in Westminster Abbey. It is scarcely necessary to say that the character and career of Dr. Johnson are, or may be, better known than those of any other author that ever lived through the incomparable biography in which Boswell has edited his conversations for a series of years. The only complete edition of his works is that in 11 volumes (Oxford, 1825). Johnson's character was pure and devout, but his mind was not free from an unhealthy gloom bred of poverty. He had strange superstitions, inherited from infancy, which colored his life. He was a man of vast learning and of masculine grasp of thought, but his judgment was warped by prejudices. In some respects his taste was singularly unrefined. A pleasing trait in his character was kindness towards the poor and suffering. PORTER C. BLISS.

Johnson (SAMUEL), b. at Salem, Mass., Oct. 10, 1822; graduated at Harvard in 1842 and at the Divinity School in 1843; became in 1853 pastor of a "Free" church at Lynn. A deep thinker, brilliant writer, and eloquent speaker, Mr. J. has written much on subjects of philosophy, religion, and reform. He was prominent in the anti-slavery movement. In 1846 he compiled, in connection with Samuel Longfellow, *A Book of Hymns*, some of the finest of which were his own. In 1868 he published *The Worship of Jesus*. Of his great work, *Oriental Religions*, only the first volume has appeared (Boston, 1872).

Johnson (SAMUEL WILLIAM), A. M., b. at Kingsboro', Fulton co., N. Y., July 3, 1830; studied in the Yale Scientific School and at the universities of Leipsic and Munich. In 1856 he became professor of analytical and agricultural chemistry in the Sheffield Scientific School at Yale College, New Haven, Conn. He is a member of the National Academy of Sciences and of the American Academy of Arts and Sciences, and has published *Essays on Manures* (1859), *Peat and its Uses* (1866), *How Crops Grow* (1868, republished in England in 1869), etc., besides translating Fresenius's *Qualitative Chemical Analysis*, and the same author's *Quantitative Chemical Analysis*.

Johnson (Rev. THOMAS), b. in Virginia July 11, 1802; began his ministry in Missouri in 1825. His greatest and most successful labors were performed as missionary to the Indians, by whom he was much beloved and revered. He belonged to the St. Louis conference of the Methodist Episcopal Church, South, at the time of his death. He was killed by men who hated the cause he was laboring so zealously to promote, Jan. 3, 1865. T. O. SUMMERS.

Johnson (WALTER ROGERS), b. at Leominster, Mass., June 21, 1794; graduated at Harvard in 1819; was for many years a teacher in Framingham and Salem, Mass., and in Germantown, Pa., and the Philadelphia High School; was 1839–43 professor of physics and chemistry in the University of Pennsylvania. He made important researches in physics; made an official report (1844) to Congress on the character of the varieties of coal; was engaged (1845) in examining the proposed sources of water-supply for Boston, Mass.; was the first secretary of the Association for the Advancement of Science; became in 1848 connected with the Smithsonian Institution, and in 1851 with the World's Fair, London. D. Apr. 26, 1852. His principal works are *Use of Anthracite* (1841), *Report on Coals* (1844), *Memoir of L. D. von Schweinitz* (1835), *Coal Trade of British America* (1850).

Johnson (Sir WILLIAM), BART., b. at Warrentown, co. Down, Ireland, in 1715; came in 1738 to America to manage some landed estates belonging to his uncle, Admiral Sir Peter Warren, and settled among the Mohawk Indians, being the earliest white resident of that immense and fertile region, and by his prudence in dealing with the Indians acquired their confidence and esteem. He learned the Mohawk language, and was made an honorary chieftain of that tribe. In 1743 he was appointed superintendent of Indian affairs for the province, and held this post under different titles for the remainder of his life. In the French war of 1755, Johnson was commissioned a major-general and commander-in-chief of the provincial forces in the expedition against Crown Point, in which he defeated Baron Dieskau at Lake George (so named by him), and destroyed his army in Sept., 1755. Johnson was severely wounded in this engagement, which was considered so important that it procured him the thanks of Parliament, a grant of £5000, and a baronetcy. In 1756–57, Sir William was engaged in the expeditions for the relief of Oswego and Fort William Henry, was with Abercrombie at Ticonderoga in 1758, and was second in command under Gen. Prideaux in the expedition against Fort Niagara in 1759. On the death of Prideaux, who was killed before that fort, Sir William prosecuted the siege with great vigor, aided by 1000 Indian allies, defeated a French force sent to relieve the fort, and received its unconditional surrender. In 1760 he participated in Amherst's expedition to Montreal. For all these services Sir William received from the king a grant of 100,000 acres of land N. of the Mohawk, long known as "Kingsland" or the "Royal Grant," and in 1764 he built Johnson Hall, around which soon sprang up the village of Johnstown, the capital of Tryon co., which then embraced all Central and Western New York. Here Sir William passed the remainder of his life, exercising a baronial hospitality to Indians and backwoodsmen, giving great attention to improvements in agriculture, and introducing the first sheep and blood-horses into the Mohawk Valley. He made the Indian treaty of Fort Stanwix in 1768, and d. July 11, 1774. (See his *Life*, by W. L. Stone, 2 vols., 1865.)

Johnson (WILLIAM), LL.D., b. at Charleston, S. C., Dec. 27, 1771, was brother of Joseph; graduated at Princeton in 1790; studied law at Charleston under C. C. Pinckney; was a member of the legislature for three terms, being Speaker the last term; was elected judge of circuit courts, and appointed by Jefferson a justice of the Supreme Court, with jurisdiction in South Carolina and Georgia. He edited for the family of that officer the *Life and Correspondence of Maj.-Gen. Nathaniel Greene* (1822), with copious and learned annotations. He inclined to support the Federal government in the nullification question (1832), and d. in New York Aug. 4, 1834.

Johnson (WILLIAM SAMUEL), LL.D., the elder son of the Rev. Dr. Samuel Johnson, b. in Stratford, Conn., Oct. 7, 1727; graduated at Yale College with great distinction in 1740; studied law, and rose at once, when admitted to the bar, to the highest rank in his profession. He was an eager student of English politics and English literature, and early took an active interest in the relations of the American colonies to the home government. In 1761 he was chosen to represent the town of Stratford in the lower house of the general assembly, and was one of the council or upper house when he was selected to attend the first Colonial Congress, that met at New York in 1765 to consider the Stamp Act. He drew up the petitions and remonstrances which were sent to the king and two houses of Parliament. At the October session of the general assembly of Connecticut in 1766, Dr. Johnson—for by this time the University of Oxford had honored him with the degree of doctor of laws — was appointed to proceed to England and defend in a cause pending before the king and lords in council concerning the title to a large tract of land obtained for the colony from the Mohegan Indians; and those who heard him speak on this occasion were not only astonished but charmed by his eloquence. After the battle of Lexington he and another gentleman were deputed to wait on Gen. Gage, then in command of the British forces at Boston, with a letter from the governor of Connecticut, the object of which was to stay hostile proceedings, and inquire if means could not be adopted to secure peace. The embassy was unsuccessful, the progress of events hurrying on the war. Retiring from the council after the Declaration of Independence, Johnson set himself quietly down to

his studies at Stratford, but when the independence of the colonies was established he resumed the practice of his profession, and was reinstated in his old office as a member of the upper house of the general assembly. He was a delegate from Connecticut to the convention which framed the Federal Constitution, and president of the committee of five appointed to revise the style of the instrument and arrange its articles. He proposed the organization of the Senate as a separate body, and was elected the first Senator from Connecticut, and in concert with his colleague, Oliver Ellsworth, drew up the bill to organize the judiciary. After King's College, N. Y., became Columbia under the new organization of trustees established in 1787, he was chosen to the presidency—an office which his father had filled under the royal charter. After 1800 he lived in retirement at Stratford, and d. there Nov. 14, 1819.

E. E. Beardsley.

Johnson City, post-v. of Washington co., Tenn., on the East Tennessee Virginia and Georgia R. R., 25 miles S. W. of Bristol, Tenn.

Johnson's, tp. of Shelby co., Ala. Pop. 729.

Johnson's Creek, post-v. of Jefferson co., Wis., on the Chicago and North-western R. R., 8 miles S. of Watertown.

John'sonville, post-v. of Pittstown tp., Rensselaer co., N. Y., at the junction of the Troy and Boston and Johnsonville and Greenwich R. Rs., 17 miles N. E. of Troy. Pop. 500.

Johnsonville, tp. of Harnett co., N. C. Pop. 483.

Johnsonville, post-v. of Humphreys co., Tenn., on the Tennessee River and the Nashville and North-western R. R., 78 miles W. of Nashville.

John's River, tp. of Caldwell co., N. C. Pop. 883.

John'ston (formerly Johnson), county of E. Central North Carolina. Area, 670 square miles. It has a varied surface, a good soil, and is reported to contain ores of iron, lead, gold, silver, zinc, etc. Live-stock, corn, and cotton are staple products. It is traversed by Neuse River and the Atlantic and North Carolina R. R. Cap. Smithfield. Pop. 16,897.

Johnston, tp. of Trumbull co., O. Pop. 893.

Johnston, tp. of Providence co., R. I. It contains several manufacturing villages. Pop. 4192.

Johnston, tp. of Scott co., Va. Pop. 1870.

Johnston, tp. of Shenandoah co., Va. Pop. 1889.

Johnston (Albert Sidney), b. in Kentucky in 1803; graduated at the U. S. Military Academy July 1, 1826, and entered the army as second lieutenant 6th Infantry; after serving in the Black Hawk war, he resigned from the army, and, in 1836, emigrated to Texas, arriving there shortly after the battle of San Jacinto. Entering the Texan army as a private, he was soon promoted to succeed Gen. Felix Houston in chief command, in consequence of which a duel occurred in which Johnston was wounded. He held the office of senior brigadier-general till 1838, when he was appointed secretary of war of Texas, and in 1839 organized an expedition against the Cherokees, who were totally routed in an engagement on the Neches. In 1840 he retired from public life and settled upon a plantation. He was an ardent advocate for the annexation of Texas to the U. S., and in 1846, at the request of Gen. Taylor, he took the field against Mexico as commander of the Texan volunteer rifle regiment. Subsequently he served as inspector-general on the staff of Gen. W. O. Butler, and distinguished himself at the battle of Monterey. In 1849, President Taylor reappointed him in the army as paymaster, with the rank of major, in which capacity he served until 1855, when he was appointed colonel 2d U. S. Cavalry. In 1857 he commanded the U. S. forces sent to coerce the Mormons into obedience to Federal authority, conducting the expedition in safety to Salt Lake City, and commanded the department of Utah. For energy, zeal, and prudence displayed in his conduct of this expedition he was brevetted brigadier-general. In 1860 he was removed to the command of the department of the Pacific. In May, 1861, he resigned from the service and travelled overland to the seat of the Confederate government. He was at once appointed a general in the Confederate army, and assigned to an important command in the West. At the battle of Shiloh he was commander-in-chief, and on the first day of that battle was killed, Apr. 6, 1862. G. C. Simmons.

Johnston (Alexander Keith), b. at Kirkhill, Scotland, Dec. 28, 1804; travelled extensively, and studied the principal modern languages to avail himself of their resources in geographical data, and published in 1843 a *National Atlas*, which gained him extensive reputation. His *Physical Atlas of Natural Phenomena* (1847–49; 2d ed. 1854–56) contained important contributions from Sir R. Murchison, Sir David Brewster, Prof. Rogers of Boston, and other eminent scientists. Mr. Johnston was chosen a member of the geographical societies of Paris and Berlin, received the appointment of geographer to the queen for Scotland, and issued numerous educational, manual, and special atlases. D. at Ben Rhydding July 9, 1871. His son, bearing the same name, has succeeded him in his geographical enterprises.

Johnston (Gabriel), b. in Scotland about the end of the seventeenth century; was educated at the University of St. Andrew's, and became professor of Oriental languages in the same institution. He was appointed governor of North Carolina in 1734, and held that office till his death in Aug., 1752. He was esteemed the ablest of the colonial governors, and successfully cultivated literature. He gave the name of Wilmington to the place of that name in North Carolina, in honor of his chief patron at court, the earl of Wilmington.

Johnston (George), b. at Simprin in 1798; graduated at the University of Edinburgh in 1819, after serving a medical apprenticeship with Dr. Abercrombie, and became a physician at Berwick-on-Tweed. He pursued the study of natural history with great enthusiasm and success, and was one of the founders of the Ray Society. He published important works on the *History of British Zoophytes* (1838), *History of British Sponges and Lithophytes* (1842), *Introduction to Conchology* (1850), and *Natural History of the Eastern Borders* (1854). D. July 3, 1855.

Johnston (James F. W.), b. at Paisley, Scotland, about 1796; was for many years a classical and scientific teacher at Glasgow and Durham; went to Sweden in 1830; studied chemistry under Berzelius; became professor of chemistry and mineralogy at the University of Durham, and prepared numerous treatises on agricultural chemistry, most of which have enjoyed a wide circulation in America. Prof. Johnston visited the U. S. about 1848. Among his works are *Elements of Agricultural Chemistry and Geology* (1842), *Catechism and Lectures* (1844) on the same sciences, *Notes on North America* (1849), and *Chemistry of Common Life* (1854–55). D. at Durham Sept. 18, 1855.

Johnston (John), LL.D., b. Aug. 22, 1806, in Bristol, Me.; graduated at Bowdoin College in 1832; after being principal of a seminary at Cazenovia, N. Y., he became connected in 1835 with the Wesleyan University at Middletown, Conn., first as assistant, and subsequently as professor of natural science, where he has since remained. He has published several textbooks on chemistry and natural philosophy, most of which have undergone several thorough revisions, and been extensively used in the colleges and schools of the country. A history of Bristol (his native town) and the adjoining town of Bremen, from his pen, made its appearance in 1873. This work is the result of extended and thorough research, embracing a critical investigation of several important questions relating to the early history of Maine; and is justly regarded as one of the most valuable contributions that have been made to American local history. He has been a frequent contributor to various periodicals, as the *American Journal of Science*, the *National Magazine*, *Methodist Quarterly Review*, and the *New England Historical and Genealogical Register*, and is a member of the historical societies of several of the States and of various scientific associations.

Johnston (John Taylor), b. in New York City Apr. 8, 1820; was educated partly in New York and partly in Edinburgh; graduated at the University of the City of New York in 1839; was admitted to the bar in 1843, and became interested soon after in the control of railroads. He was elected president of the Central Railroad of New Jersey in 1848, which position he now holds. He is president of the council of the University of the City of New York, and also president of the Metropolitan Museum of Art in the same city. J. B. Bishop.

Johnston (Joseph Eccleston), b. in Prince Edward co., Va., Feb., 1807; graduated at West Point, and entered the army as second lieutenant of artillery July, 1829. From the date of graduation until 1837 he served mainly on garrison duty, being, however, actively engaged for some two years in Florida against Seminole Indians, a portion of which time on the staff of Gen. Winfield Scott. In 1837 he resigned his commission to follow the profession of civil engineer, but re-entered the service on July 7, 1838, as first lieutenant of topographical engineers, and for former gallantry in Florida was now brevetted captain. From this time until the outbreak of the war with Mexico he was engaged upon river and harbor improvements, surveys of Texas boundary-line and that between the U. S. and the British provinces, etc. At the siege of Vera Cruz

(Mar., 1847) he served on engineer duty; was appointed Apr. 9 lieutenant-colonel of voltigeurs, and at Cerro Gordo on the 12th received severe wounds while engaged in reconnoitring the enemy's position, and brevetted major and colonel. In the subsequent battles of Contreras, Churubusco, Molino del Rey, Chapultepec, and the final assault of the city of Mexico he participated, and was wounded at the latter assault. Upon the disbandment of the voltigeurs in 1848, Johnston, by act of Congress restoring officers of the old army to their former positions, returned to duty as captain of topographical engineers, serving as such until 1855, when he was appointed lieutenant-colonel of cavalry, and was engaged in frontier duty and on the Utah expedition as inspector-general. On June 28, 1860, he was appointed quartermaster-general with the rank of brigadier-general, which position he resigned Apr. 22, 1861, to follow the fortunes of his native State. At once appointed major-general in the Confederate army, he commanded the force which occupied Harper's Ferry, May, 1861, and which subsequently, in the vicinity of Winchester, held in check the Union force under Gen. Robert Patterson, and which still later reinforced Gen. Beauregard in his position about Manassas. At the battle of Bull Run, Gen. Johnston waived his right to command in favor of Beauregard, the latter being familiar with the ground and troops, while the former was not. In the Peninsular campaign he was in command of the Confederate army, and at the close of the first day's fighting at Fair Oaks (May 31, 1862) was severely wounded and disabled for several months, being succeeded by Gen. R. E. Lee. Upon his recovery he was assigned to command the S. W. department, with the rank of lieutenant-general, and during the siege of Vicksburg made several ineffectual attempts to relieve that place, being finally defeated at and driven beyond Jackson, Miss. In Dec., 1863, Johnston, now a general, succeeded Gen. Bragg in command of the Confederate army of Tennessee; but failing to prevent the invasion of Georgia the following spring by the Union forces of Gen. Sherman, he was superseded (July 17, 1864) by Gen. J. B. Hood, after having been forced to retire from the strong positions at Dalton, Resaca, Kenesaw, etc., and beyond the Chattahoochee. In 1865 Johnston was restored to command in the Carolinas to collect and command an army to oppose the advance of Gen. Sherman, but was defeated at Fayetteville, Bentonville, etc., and upon receiving intelligence of the surrender of Lee entered into correspondence with Gen. Sherman, which led to the surrender of his army at Durham Station, N. C., Apr. 26, 1865. In 1874 he published a *Narrative of Military Operations.* G. C. SIMMONS.

Johnston (RICHARD M.), b. in Hancock co., Ga., Mar. 8, 1822; graduated at Mercer University with the first honor of his class in 1841; studied law and was admitted to the bar, and entered upon the practice at Sparta in 1843. The presidency of Mercer University was unanimously tendered him by the board of trustees in 1857; this he declined, preferring to accept a professorship of *belles-lettres* in the State University tendered him at the same time. This position he held until 1861, after the war broke out; he then established a select classical school at Rockby in his native county, which became famous in the Southern States; in 1867, after the adoption of the reconstruction policy by Congress, he moved his school to Chestnut Hill, 2 miles N. of Baltimore, Md., where it is now known as Pen-Lucy Institute. Hundreds of young men have gone forth into active useful life from the training of this eminent instructor. The labors of Prof. Johnston have not been confined to teaching only; by his pen he has contributed extensively to the literature of the country, his most noted works of this character being his *English Classics* (1859), and the *Dukesborough Tales* (1872). A. H. STEPHENS.

Johnston (SAMUEL), LL.D., b. at Dundee, Scotland, Dec. 15, 1733, nephew of Gov. Gabriel Johnston, was brought in infancy to North Carolina, where his father became surveyor-general and acquired large landed estates. Samuel was admitted to the bar, was chosen to the assembly in 1769, and espoused the cause of resistance to the British cabinet; was an active member of the first two provincial Congresses, and presided over the third and fourth. In 1775 he was chairman of the provincial council, was a member of the Continental Congress in 1781–82, governor of North Carolina 1788–89, presiding over the State convention which adopted the Federal Constitution; was U. S. Senator 1789–93, and justice of the Supreme Court 1800–03. D. near Edenton, N. C., Aug. 18, 1816.

Johnston (WILLIAM FREAME), b. at Greensburg, Westmoreland co., Pa., Nov. 29, 1808, of Scotch-Irish paternity. His father was a prominent iron manufacturer and merchant. W. F. Johnston became a successful lawyer of Armstrong co., Pa., having been admitted to the bar in 1829. In the State legislature he early won distinction by his financial ability. In 1847 he became president of the Senate. On July 9, 1848, Gov. Shunk died, Mr. Johnston becoming governor *ex-officio;* but the statutes and the State constitution being in apparent conflict, he ordered a new election, and was himself chosen governor for three years. He afterwards was an iron and salt manufacturer and oil-refiner of Pittsburg, and was for a time collector of the port of Philadelphia. D. at Pittsburg Oct. 25, 1872.

John'stone, town of Scotland, in the county of Renfrew, has large manufactures of cotton fabrics and of articles of iron and brass. The vicinity contains rich coal-mines. Pop. 6404.

John'stown (or LANG RUN), post-tp. of Garrett co., Md. (formerly in Allegany co.). Pop. 673.

Johnstown, post-tp. of Barry co., Mich. Pop. 1296.

Johnstown, post-v., cap. of Fulton co., N. Y., on the Fonda Johnstown and Gloversville R. R., 4 miles N. of Fonda, and on the Cayadutta Creek; has 2 banking-houses, 10 churches, 3 weekly newspapers, an academy, county buildings, good hotels, gasworks, and various manufactures, prominent among which is that of gloves and mittens. The township of Johnstown includes Gloversville and other villages. Pop. of v. 3282; of tp. 12,273.

W. H. DOUBLEDAY, FOR ED. "FULTON CO. DEMOCRAT."

Johnstown, post-b. of Cambria co., Pa., on the Pennsylvania Canal and R. R., 79 miles E. of Pittsburg; has a rolling-mill and Bessemer steel works (employing 6000 men), a woollen-mill, tannery, mechanical works, cement-works, and other industries, gas and water supply, 1 daily and 5 weekly newspapers, a national and a savings bank. The surrounding mountains are rich in iron, bituminous coal, limestone, cement, and fireclay. The Conemaugh River flows on the N. and Stony Creek on the S. of the town. Pop. 6028, greatly increased since the census.

G. T. SWANK, ED. "TRIBUNE."

Johnstown, a v. of Porter tp., Schuylkill co., Pa. Pop. 70.

Johnstown, post-tp. of Rock co., Wis. Pop. 1299.

John'sville, post-v. of Frederick co., Md., 13 miles N. E. of Frederick City. Pop. of tp. 1642.

Johnsville, v. of Ferry tp., Morrow co., O. Pop. 159.

John'ton, post-v. of Marion co., W. Va. Pop. 55.

Joigneaux' (PIERRE), b. at Varennes, department of Côte d'Or, France, in 1815, agronomist, agricultural writer, and representative. He passed through the Paris École Centrale des Arts et Manufactures, and launched himself in politics, writing for the opposition papers. He was sentenced to prison under the Louis Philippe government, and elected in 1848 representative to the National Assembly, where he took his seat on the extreme Left. After the *coup d'état* of Dec., 1851, Joigneaux was exiled to Belgium, from whence he returned after the proclamation of amnesty to devote himself exclusively to his former agricultural writings. He published many articles, founded agricultural journals, and wrote *The Peasants under Royalty, Dictionary of Practical Agriculture, Counsels to the Young Farming-woman, Culture and Fabrication of Wine in Belgium, Treatise of the Seeds of the Small and Large Husbandry,* etc. FÉLIX AUCAIGNE.

Joigny', town of France, in the department of Yonne, on the Yonne, noted for its fine claret wines. Pop. 5971.

Join'der of Actions in Law is the union of two or more causes of action in the same declaration or complaint. A plaintiff may have several distinct claims against the same defendant, either wholly or partly arising out of contract, or wholly or partly founded upon tort, and in such cases it becomes an important question whether he can unite all these claims and obtain the remedy appropriate to each in a single action, or whether several actions must be brought. At common law the rule was in civil cases that when the same plea might be pleaded and the same judgment given on all the counts of the declaration, or when the counts were of the same nature and the same judgment was to be given on them all, several causes of action might be joined. Thus, in an action on contract, a count for debt upon a bond might be united with a count for debt upon simple contract. So in an action of tort several claims for trespasses might be joined. But a demand upon contract could not be united with a claim grounded in tort. The subject of joinder of actions, particularly in civil cases, is now frequently regulated by statute. There are also special rules as to joinder in criminal cases.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Joinder of Parties in Law. By this expression is meant the collection of rules requiring that persons having a common interest or subject to a common liability should be joined together in an action at law or other legal proceeding. The details of this subject, being of a tech-

nical character, should be sought in the books of legal practice. The subject is one of great consequence to the legal practitioner, and should be carefully understood, as a failure to join the necessary parties is frequently fatal in its consequences.

In contrasting the rules prevailing in courts of law with those adopted in courts of equity upon this subject, it will be found that the latter are much the more liberal. The former are frequently in a high degree technical; the latter, on the other hand, are so framed as to make it proper to bring in all persons whose presence is necessary to a complete determination of the matter in controversy. There is also an important and salutary rule, that when the parties are numerous, and it is impracticable to bring them all before the court, one or more may sue for the benefit of the whole. An illustration of it is found in the case where an administrator is called upon to account in respect to the assets of an estate in his hands. One or more of a numerous body of creditors may sue, not only for himself, but also for the other creditors. Recurring to the rules of the common-law courts, it may be useful to state that the question as to uniting parties arises in the main out of joint contract, ownership, or wrong (tort). It is a general rule that when the interest in a contract is joint the cause of action is of the same nature, and all the parties should be united. A like rule prevails in the case of a joint liability. A distinction must here be made between a "joint" liability and one that is "joint and several." (See JOINT AND SEVERAL.) This rule gives way when one of two *joint* parties dies. The action is then prosecuted by or against the survivor. In a court of equity the representatives of the deceased will still be liable in some instances to the survivor for contribution. (See CONTRIBUTION.) In the case of wrongs it is not necessary, though proper, to join all the wrongdoers, a wrong being regarded in its nature as joint and several. Where two or more persons are jointly injured, they should be united as plaintiffs. Special rules exist in the case of husband and wife, growing out of the technical rule that the legal existence of the wife is merged in that of the husband. These rules, requiring them to be united as parties to actions, give way when one of them dies. The fiction of a merger is then abandoned, and the true owner of the claim or the author of the wrong is recognized as the proper person to sue or to be sued. There is a tendency in modern law to abandon this fiction in many respects. Thus, under the New York code of procedure the wife may sue alone concerning her separate property, and by other statutes to recover for her services or for injuries that she has sustained, or for her profits in trade, etc. A similar rule prevails in many other States. A like tendency is observable in England. It cannot be said that the common-law rule has been wholly abandoned, but only modified.

The penalty in the common-law courts for failure to make the proper persons parties is very severe. Error in this respect is in some instances fatal in every stage of the cause. By modern legislation in some States of this country the general course of the action is unaffected by the presence of too many plaintiffs or defendants. Thus, in New York, where there are defendants in excess the question can only be raised by them, and they may claim that as far as they are concerned there is no cause of action. On this theory, the cause proceeds against those who are properly made defendants. This, it can scarcely be denied, is a very salutary reform. Where the parties are too few, the objection must be raised at an early stage in the cause, or it will be deemed to be abandoned. So now in England errors of this kind may be amended before or at the trial by force of the "common law procedure act" of 1852 and later statutes. (Reference may be made for further information to Dicey on *Parties;* Barbour on *Parties;* Brown, do.; Calvert, do.; and to general works on *Practice.*)

T. W. DWIGHT.

Join′ery differs from CARPENTRY (which see) in the nicer and more exact workmanship required. The house-joiner finishes the work which the carpenter and builder have left. So of the shipjoiner, whose work is sometimes almost a work of art rather than one of artisanship. The making of nice wooden-wares, ornamental boxes, and the like is a still more delicate kind of joinery.

Joint, in anatomy, an articulation, or the connection existing between the several bones of the skeleton. The tissues entering into its formation are bones, the ends of which are covered by cartilage, and bound together by ligaments; in the more movable a membranous sac is interposed, which secretes a lubricating fluid called synovia. The construction of joints differs in various parts of the body, according to the function which they have to perform; and in consequence of this they have been divided into three classes—viz., synarthrosis, amphiarthrosis, and diarthrosis, which have been subdivided as follows:

I. *Synarthrosis,* an immovable articulation: (*a*) *Sutura,* in which the bones are dovetailed into each other, as in the skull. (*b*) *Harmonia,* in which the joints are but slightly marked, as union of superior maxillæ. (*c*) *Gomphosis,* in which a conical point fits into a socket, as the teeth into the alveoli. (*d*) *Schindelysis,* an articulation by furrowing, as it were—vomer.

II. *Amphiarthrosis,* an articulation permitting limited motion: (*a*) *Syndesmosis,* the articulation of two or more bones by means of ligaments, as radius and ulna. (*b*) *Synchondrosis,* the articulation of bones by means of cartilage, as that of the ribs with the sternum. (*c*) *Symphysis,* the union of bones by fibro-cartilage, as the pubes.

III. *Diarthrosis,* a movable articulation: (*a*) *Arthrodia,* a gliding joint, as sterno-clavicular. (*b*) *Enarthrosis,* a ball-and-socket joint, as the shoulder and hip joints. (*c*) *Ginglymus,* a hinge-like articulation, as at the elbow and knee. (*d*) *Diarthrosis rotatorius,* as the atlo-axoid joint.

The diseases to which the joints are most liable are Synovitis, Chondritis, and Osteitis. EDWARD J. BERMINGHAM.

Joint and Several, a legal phrase used to denote that the liability of two or more debtors is of such a kind that they may be sued either collectively or individually. If any one of them, when the liability rests upon contract, is sued and compelled to discharge the entire debt, he has a claim for contribution against the others upon an implied contract, and may recover from them such a portion of the whole amount as they ought justly to pay. And if the debt be a valid and subsisting obligation, a single debtor may pay it in full, even though no suit is brought against him, and will still have a valid claim for contribution. So, if the payment made by one be less than the entire debt, but larger than his own proper share, he will be entitled to receive from the others a proportionate part of the excess according to the extent of their respective liabilities upon the contract. If one or more of the other debtors be insolvent, the one who pays the whole, or more than his share, can recover at law from those who remain solvent only such sums as they would be obliged to pay if all were solvent. In equity, however, those who remain solvent must contribute equally towards the discharge of the entire indebtedness, in accordance with the maxim that "equality is equity." A joint and several obligation may be created by the express language of the agreement, or may arise by implication from its terms. Usually, the words are employed, "We jointly and severally promise (or covenant)," but a contract by two or more persons, in which they agree "for ourselves and each of us" or "for ourselves and every of us," is also an express joint and several contract. A joint and several liability is implied when several persons sign a contract in the obligatory part of which the pronoun *I* is used instead of *we.* Moreover, a joint and several obligation may sometimes arise by reason of the legal relations of the parties by whom a contract is entered into. Thus, in England the liability of the members of an ordinary partnership in regard to the debts and engagements of the firm is joint and several in courts of equity (though not in courts of law), except under special circumstances. If one of several co-contractors upon a joint and several agreement dies, the action may, at common law, be brought either against his personal representative (executor or administrator) or against the survivors. The rule is different, however, in regard to parties who are jointly liable; and if one of them dies the action must be brought against the survivors. When the joint and several contract is for the performance of a single act or duty, a release under seal to one will operate as a release to all. But a judgment recovered against one, if not satisfied, will be no bar to an action against either of the others. A joint and several obligation cannot be treated as several in reference to some of the obligors and joint as to the rest. The creditor must proceed either jointly against all or severally against each. This rule, however, has in some of the States been changed by statute. The phrase "joint and several" is only applied to the liability of debtors, and not to the claims of creditors. There can be no form of contract by which the obligees are entitled to sue either collectively or singly. Their claim can be only joint or only several. There may also be a joint and several liability in cases of tort, as well as in cases of contract. Thus, if two or more persons unite in the commission of a tortious offence, one, any, or all of them may be sued by the party suffering the injury. Full damages may be recovered from the party sued, and there will not, in general, be any claim for contribution against the other wrongdoers. In some cases, however, where the person who is compelled to make full payment was not wilfully nor intentionally a participant in the wrong committed, he will be entitled to recover a proportional amount of the damages from the others. (For an illustration of this kind, see CONTRIBUTION.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Joint Firs (Guetaceæ), a small natural order of exogenous plants (gymnogens) closely allied to the Coniferæ. They are small trees and shrubs of the genera *Guetum* and *Ephedra*, found in tropical and warm countries. Their stems are jointed, their juices not resinous, but very watery, or sometimes even gummy. Several grow in the far West.

Joint Own′ership. As employed in a comprehensive sense in law, joint ownership denotes the ownership of property, whether real or personal, by two or more persons. But it is more appropriately applied to personal property, and is, by this restriction of meaning, distinguished from joint tenancy, which is customarily used with reference to real estate, of which only can tenure be properly predicated. Both these phrases are, however, sometimes loosely employed as synonymous. By a still further qualification of meaning, joint ownership is distinguished from ownership in common, and joint tenancy from tenancy in common, in the accurate technical application of these various terms, the interest of a number of owners being characterized strictly as joint when the property, whether real or personal, is held by them with a unity of interest, of title, of time, and of possession, and with a right of survivorship; while it is termed common when the only unity is that of possession, and there is no survivorship. In this article ownership of personal property will only be considered; that of real property will be considered under the topics JOINT TENANCY and TENANCY IN COMMON; ownership by several persons who stand in the relation of partners will be discussed under PARTNERSHIP. (For ownership by several who form the members of a corporation see CORPORATION.)

There are four unities which, as has just been stated, are necessary to constitute joint ownership. By unity of interest is meant that the interest of each owner in the property should be, by its original limitation, for the same duration and of the same nature and quantity. Unity of title exists when the title of each is derived from the same instrument or from the same act of transfer of interest. That there may be unity of time the interest of each should vest at the same moment; while unity of possession requires that each owner should be entitled to the possession of the whole property and every parcel, and that it should not be divided in separate portions between them. There is an exception, however, to the rule requiring unity of time when the joint ownership is created by will. Thus, if a bequest be made to A for life, and after his death to the children of B, all the children born in A's lifetime will become entitled jointly, though some may not be living when the interests of the others become vested. All property held in joint ownership is subject to the right of survivorship. In the application of this doctrine, whenever one of the owners dies, the survivors take the entire interest, to the exclusion of his personal representatives. Joint ownership always arises by the act of parties, and not by the operation of law. Hence, though it might be created by a transfer of property by deed or by gift, it would not subsist in relation to property which passed after the decease of the previous owner to the next of kin. The creation of a joint interest in personal property may either be by the use of express language to that effect in the instrument of transfer, or it may result from necessary implication, as where chattels are given to two or more persons without the use of any words indicating a severance of interest. But this implication will not be made in relation to stock used in joint undertakings of trade or agriculture. A limitation of this to two or more persons will be held generally to create a tenancy in common. This exception to the general doctrine has been established on account of the effect of the rule of survivorship in interfering with the unrestricted management of property, and with the usual mode of distribution after the owner's death. In courts of equity, moreover, joint ownership is not favored, except in the case of property given in trust, and will not, as a rule, be held to exist unless that be the expressed or clearly presumable intention of the parties. In this country, also, the tendency of legislation is to do away with the incident of survivorship, except in the case of legacies and where persons are appointed co-executors or co-trustees. In regard to legacies limited to several persons, it is a general rule that they take a joint interest. When several executors or trustees are appointed, they are usually deemed to hold in joint ownership, since in these cases it is desirable that the principle of survivorship should apply, and that the property should pass to the remaining executors or trustees to be managed for the purposes designated in the will or in the instrument creating the trust, rather than that others should interfere with its disposition.

Every kind of personal property may be held in joint ownership, whether it be property in possession or property in action. (See CHOSE IN ACTION.) Thus, there may be joint owners of stock, of a legacy, of a promissory note, of a patent right, or of a lease for years, which is termed a chattel real, as well as of a horse, furniture, etc. The interest of any owner cannot be disposed of by will, but will pass to the survivor unaffected by the bequest. Joint ownership in chattels, like a joint tenancy in lands, may be terminated by destroying any one of the four requisite unities, except that of time, and may thus be changed into an ownership in severalty or in common. Then the owners may, by mutual agreement, divide the property among themselves, or sell it and divide the proceeds, thus becoming independent owners of distinct shares. Or the interest of any one may be assigned or transferred to a third person, who will thereupon become tenant in common with the others.

In ownership in common of chattels, as in tenancy in common of real property, there is but a single unity, that of possession, and there is no right of survivorship. Each owner has an undivided share, and upon his death this passes to his executor or administrator, to be administered in the same way as the rest of his personal estate. Ownership in common may arise by a gift or transfer of chattels, which by the terms of the limitation are to be held in common; or, as has been already seen, it may result from the disposal of his interest to a third person by one of several joint owners. By common-law rules, however, the interest of a joint owner in a chose in action cannot be transferred so as to effect an ownership in common, since choses in action are not assignable. But in equity a different rule prevails, and an assignment will be deemed valid. In some of the States, also, choses in action have been made assignable by statute, so that the common-law rules would no longer be applicable. A number of persons may also become owners in common by an innocent admixture of their chattels, which are of such a kind that it becomes impossible to distinguish the particular property of each, as where quantities of grain belonging to different persons are mingled together accidentally, or are mixed in elevators in the course of transportation; so several owners may agree to hold their property in common. This form of ownership may arise by operation of law as well as by the act of parties. Thus, the next of kin of a deceased person, among whom his personal property is distributed, may be said to stand in relation to one another like tenants in common until a distribution is made, since if one of them should die in the intervening time, his personal representatives, and not the survivors, would be entitled to his share. An owner in common may dispose of his interest as freely as an owner in severalty. The purchaser becomes an owner in common with the other owners. Ownership in common may be destroyed by a division of the property among the various owners according to the extent of their respective shares.

There are certain principles applicable to joint and to common ownership which are quite similar, and may therefore be considered together. Thus, both joint and common owners have a right to dispose of their own interests, but not of the shares of their fellow-owners. If they attempt to transfer a larger portion of the property than they are rightfully entitled to, the transaction will only be valid to the extent of their own interests. The share of each owner may also be sold on execution against him by the sheriff. If the sheriff sell the entire chattel, the other co-owners, who are thereby deprived of their property, may sue him for conversion. Each joint or common owner is entitled to the possession of the property, and his possession is deemed to be the possession of all. One co-owner in actual possession even has the right to maintain that possession against the others. The legal remedy of the other co-owners is to take the chattel wherever an opportunity is afforded, but they cannot bring an action for conversion simply on this ground. As a general rule, joint owners and owners in common must unite in all actions for injuries to the general property by third persons, as in actions of trespass and trover. In some instances one co-owner may maintain an action against another for a misuse of, or wrongful interference with, the joint or common property. An intentional destruction or spoliation of the chattel by one will amount to a conversion, for which he will be responsible. In some States it is held that a sale by one owner of more than his share will render him liable to an action of trover. In a few States, also, statutes have been enacted permitting an action to be brought by one co-owner against another merely for the exercise of an exclusive control over the property. A change in the identity of the article which forms the general property, as where iron owned in common is melted together and manufactured into various utensils, would constitute a conversion. A partition of the property held in common cannot be obtained by any form of proceeding at law, though sometimes courts of equity will decree that a division be made. When the property is severable in its nature, and of the same common quality, any owner may separate a portion equal to his share, if it

can be ascertained by weight or measurement, and appropriate it to himself. There is no necessity of obtaining the consent of the other owners in such a case in order that a severance may be made. But when the property is indivisible, as a horse, a partition can only be made at law by obtaining the consent of all the owners to a sale and a division of the proceeds. (For the rules of law relating to part ownership of vessels see PART OWNERS.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Joint-Stock Company, an association of individuals formed for the purpose of carrying on some mercantile, industrial, or other lawful undertaking, and having a capital divided into shares which are transferable by the respective shareholders at their own option, and the ownership of which is a condition of membership. As formed in accordance with common-law rules governing their organization and defining their powers, such associations are unincorporated and constitute a species of partnership. In recent times, however, it has been the tendency of legislation to invest them with corporate powers which they did not possess at common law, and in England statutes have been enacted, the effect of which is to render them actual corporations, provided certain formalities prescribed by the statutes are complied with in the mode of organization. The term joint-stock company, therefore, as frequently employed at the present day, particularly in English practice, would include both incorporated and unincorporated associations. It will be most convenient, however, to employ it in the present article in the restricted distinctive sense prevailing at common law, irrespective of statutory modifications of its extent of application, except when the character and effect of such statutes are specifically considered. In this view a joint-stock company is in the nature of a partnership, though it is attended with different incidents and liabilities, in many respects, from an ordinary partnership. In the early history of the common law the only forms of association of individuals for the accomplishment of any object by a combination of capital and effort, which were known, were partnerships and corporations. Joint-stock companies, as subsequently introduced in mercantile communities and recognized by the law, were intermediate between these modes of association, which had been of earlier origin, and partook to a considerable extent of the peculiarities of both. Like common partnerships, they are formed solely by a voluntary union of individuals, who combine for purposes of mutual profit and benefit, and are not created by legislative authority, nor endowed by legislative act with the powers and functions which they possess and exercise. So a joint-stock company, like a partnership, is not a fictitious person capable of suing and being sued, and of acting generally in legal transactions like a natural person, as is true with regard to a corporation, nor is it regarded as having any distinct legal existence independently of the members who compose it. The members, like partners, must sue and be sued in the same way as all individuals who have engaged in a joint enterprise and have acquired joint rights and incurred joint liabilities. All must regularly be joined as plaintiffs or as defendants, and suit cannot be brought in the name of the company. One or more members of the company may represent it and act in its interests if they are specially appointed as agents, managers, or directors, in much the same way as one or more partners may represent the firm; but in such a case they represent the whole body of the members, not as forming a collective whole and constituting a legal individuality, but merely as a number of persons having common interests.

Again, it is a fundamental peculiarity of a partnership that each one of the partners is responsible individually for the full amount of the indebtedness incurred by the firm in the course of its legitimate business. This is also true of a joint-stock company, however great may be the number of its members. Even though it be stipulated in the articles of association that the members shall only be subject to a limited liability, a creditor who enters into dealings with the company without knowledge of the stipulation may enforce the payment of his entire claim against any one of the associates, leaving him to reimburse himself by contribution from the others. It is, however, competent for any one transacting business with the company, as with a firm, to contract not to hold the partners to an unlimited extent of liability, and he will then be bound by the terms of his contract.

But a joint-stock company differs from an ordinary partnership in several important respects. It is usually composed of a much larger number of members, though this is not an essential diversity, since there is no necessary limit in either form of association as to the number of individuals who may combine. A company also, as a general rule, receives some specific name by which it is known, and is not, like a partnership, designated merely by the names of the members. This is, however, only a nominal and not a substantial difference, since a company cannot sue nor be sued nor be designated in legal proceedings involving its interests by the name which it has assumed, but must in such instances be regarded as simply a partnership, in reference to which proceedings must be instituted in the names of all the partners. The important principle in relation to partnerships, that each partner is the agent of the firm as regards transactions with third persons, and can bind the firm by any contracts into which he enters appertaining to the partnership business, does not prevail to the same extent in respect to companies. If each shareholder in such large associations, into which new members are introduced not by the consent of the others, but by purchasing or otherwise acquiring shares, were allowed to bind the company by any contracts into which he might enter within the scope of the company's business, the continued existence of such societies would be hardly practicable. Men would hesitate to contribute capital towards the support of such organizations when it might be squandered at the pleasure of any shareholder. It is therefore the almost invariable practice to commit the management and direction of the company's business to a board of directors or agents chosen by the votes of the stockholders, and every person who has dealings with the company is presumed to know that the managers appointed alone have power to make binding contracts. A claim against the company on the ground of dealings with an unauthorized member will not be enforceable. It is like the case of a partnership in which a stipulation between the partners limiting each one's capacity to bind the firm has been made known to a person, who transacts business with any one of them upon that understanding. Moreover, in the modes of conducting business and managing the affairs of the association there is an important difference between a partnership and a company. The stockholders, as has just been seen, are excluded from the ordinary management of business, but they control the election of directors, and generally regulate and define to a considerable extent the powers which these agents are permitted to exercise by the adoption of by-laws or the passage of resolutions. In the same way they may appoint the times at which meetings shall be held, determine the manner in which they shall be conducted, provide for the investment of the profits of the business or the declaration of dividends, and adopt various regulations of the same general nature for conducting the affairs of the company, provided these are not repugnant to general principles of law. Each member is entitled to as many votes as he has shares.

The general nature of the association and the object of its formation, together with many provisions for its management, are, however, usually stated in the articles of association which are agreed upon at the time the company is organized. These correspond with the articles of copartnership into which partners enter, and contain stipulations of a similar character. A covenant of this kind is commonly known in England as a "deed of settlement." The articles usually define the amount of the capital stock, and the number of shares into which it is to be divided, state the number of directors or trustees who are to be appointed, regulate to a greater or less degree the assignment and disposal of the shares, provide for assessments upon the shareholders, declare sometimes the way in which they shall be sued by the directors upon their respective obligations to the company, and provide in a comprehensive way for the general direction and control of the interests of the association. Such an instrument is not required to be in any general form, and may contain any stipulations upon which the parties may agree, provided these are not in contravention of established legal rules determining the capacity and liabilities of the shareholders, or do not provide for the prosecution of an unlawful enterprise. But the chief diversity between a partnership and a joint-stock company, and the one upon which the others mainly depend, lies in the fact that the capital stock of a company is divided into transferable shares. As a result of this, the doctrine of *delectus personarum* (Lat., "choice of persons"), which prevails in regard to all partnerships, has no application to a stock company. No partner and no number of partners can introduce a new member into the firm without the consent of the others. If one partner sells out his interest, the purchaser does not become a member of the firm, but the partnership is immediately dissolved. But in a company the purchase of shares makes a person a member irrespective of the consent of the previous shareholders, and the membership may be constantly changing without destroying the existence of the company or interrupting the exercise of its usual functions. Therefore, while a partnership usually consists of a small number of persons familiarly known to one another, and associated in business relations on account of mutual trust and confidence, and taking sev-

erally an active part in the management of the affairs of the firm, a company is generally composed of a large number of individuals, who are, as a rule, little known to each other or entirely unknown, and whose business connection depends upon the circumstance that they have become without agreement owners of stock in the same association. In an ordinary partnership the death, lunacy, or bankruptcy of one of the partners, or an assignment or transfer of his interest to another, effects a dissolution of the firm. If the remaining partners continue their business connection, it is only by forming a new partnership. But in a stock company these are not causes of dissolution. The person to whom the ownership of the shares passes becomes thereby a member of the company, whose existence is continued as long as the stock is held by shareholders, unless it be terminated by a decree of the proper court for the usurpation of illegal powers or other like reasons, or by the mutual agreement of the members. A joint-stock company therefore possesses the attribute of perpetual succession by reason of the transferable nature of its shares, and in this respect resembles a corporation. The other features of similarity to a corporation which it possesses are those already mentioned—the use of a common name other than the names of the members, the appointment of directors or managers to whom the business affairs of the company are entrusted, the power to adopt by-laws and resolutions, the right to vote upon stock, and a large membership. A company therefore possesses some of the attributes of an ordinary partnership and some of those pertaining to corporations. It is sometimes not inappropriately termed a *quasi* corporation. (See CORPORATION.)

Before the year 1700 the formation of joint-stock companies was hardly known in England. But within a few years subsequent to 1711, when the South Sea Company was formed, and largely as a result of its speculative enterprises, a feverish spirit of speculation and adventure was widely prevalent throughout the kingdom, and gave rise to large numbers of private commercial companies for the prosecution of various visionary undertakings. Some of these companies were founded upon obsolete charters, while the larger number were organized without any pretensions of such a nature. These were commonly denominated "bubbles," and were deemed so detrimental to the public welfare that in 1720 an act of Parliament (known as the "Bubble Act") was passed for their repression. This declared such companies illegal and void, and to be public nuisances, principally on the following grounds: the acting or presuming to act as a corporate body; the raising or pretending to raise transferable stock; the transferring or pretending to transfer or assign the shares in such stock without legal authority. This act was not repealed until 1826, so that for more than a hundred years such companies were illegal in England. Since the time of this repeal the tendency of English legislation has been to favor such associations, and to render them more efficient and beneficial by remedying the defects in their organization at common law. The chief legal disadvantages under which these companies labored were the necessity that in actions at law all the members should be joined as plaintiffs or defendants, and the responsibility of each member for the entire indebtedness of the association. The earliest modification of common-law rules was by the enactment of statutes empowering companies of a specified character to sue and be sued by a public officer. Subsequently, the formation of companies was authorized in which the shareholders should only be held to a limited liability, and finally many particular kinds of companies were actually incorporated, though not receiving full corporate powers. The English statutes which now govern this subject are the Companies' act, passed in 1862 (25 and 26 Vict., ch. 89), with the amendatory acts, 30 and 31 Vict., ch. 29 (1867), and 33 and 34 Vict., ch. 104 (1870). The provisions of these acts are applicable to the formation and incorporation of all joint-stock companies, require their registration in proper offices, and permit the shareholders to agree that their liability shall be limited either to the amount unpaid on their shares or to such amount as they may respectively undertake to contribute to the assets of the company in the event of its being wound up. Any seven or more persons associated for any lawful purpose may form such a company, and are required to subscribe a memorandum of association stating the name of the company, the amount of capital, the object of the association, the place of business, and the limit of liability, if any is agreed upon. If there is no declaration that the liability shall be limited, the company is called an unlimited one, and each shareholder is responsible for the entire debt of the company, as at common law. There are also provisions in the act relating to the management and administration of companies, their inspection by boards of examiners, and the method of winding them up. The effect of this legislation has not been, however, to confer upon companies the entire powers which corporations regularly possess, since there is still retained the principle of the individual liability of the members, even though this may be limited in extent. In a true corporation legal responsibility does not attach to the individual corporators as separate persons, but only appertains to the fictitious person or body corporate which they have united to form.

In some of the U. S. joint-stock companies have at certain periods been formed in accordance with common-law rules, but generally at the present day their organization is governed by statutory provisions. Thus, in New York it is enacted that such associations may provide by their articles of association that the death of any stockholder or the assignment of his stock shall not work a dissolution of the association, and may commit to any three or more of the shareholders the sole management of the business; such companies are not to be dissolved except by judgment of a court for fraud or other good cause. They may purchase, hold, and convey real estate for certain specified purposes. If the association consists of seven or more shareholders, it may sue or be sued in the name of the president or treasurer for the time being. If judgment be recovered against the company upon a suit thus instituted, and execution thereon shall be returned unsatisfied, suits may be brought against any or all of the shareholders individually, as at common law. It has been decided that one of the shareholders may, in certain instances, bring an action against the president as representing the company. But such companies are not incorporated, and possess only the corporate powers specially conferred. They are still to be considered a species of partnership. In a number of the States there are no such associations as joint-stock companies distinct from corporations. Provision has been made by statute for the formation of associations of a similar character by modifying the general principles relating to corporations in regard to the personal liability of the members. The practice has been, not as in England to assimilate partnerships to corporations, and to designate the new form of association as a joint-stock company, but to assimilate corporations to partnerships by making the associates personally responsible to a greater or less degree for the common indebtedness, while the associations formed in accordance with such statutory regulations have been still designated as corporations. It is evident, however, that they are in important respects distinguishable from regular and true corporations, and bear a close resemblance to joint-stock companies. (See Wordsworth on *Joint-Stock Companies*, and the works of Lindley, Collyer, Parsons, and Story on *Partnership*.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Joint Ten'ancy, the tenure or ownership of an estate in real property by two or more persons, with the incidents of unity of interest, unity of time, unity of title, and unity of possession. (See these unities explained in the article JOINT OWNERSHIP.) The estate held by joint tenants may be either a fee simple, an estate for life, for years, or at will, but each must have the same quantity of interest. One cannot be tenant for life and the other tenant for years. This rule, however, does not prevent a remainder from being limited to one joint tenant to be vested in possession at the expiration of his joint interest, as where an estate is granted to two persons to be held by them jointly for life, with remainder to one of them in fee. To the rule requiring unity of time there are important exceptions. Thus, it does not apply to estates given to a person's use in accordance with the doctrine of uses (see USES), nor to provisions in a will known as executory devises. An estate granted to the use of a man and such wife as he shall afterwards marry, for the term of their lives, has been held to be a joint estate. The estate of the wife is in abeyance until the marriage, and then it relates back, and is deemed to take effect from the original time of creation. In consequence of the unity of interest and of possession, joint tenants are said to be seized *per my et per tout*—"by the half and by the whole;" *i. e.* each of them is regarded as having the possession as well of every parcel as of the entire estate. By this, however, it is not to be understood that each joint tenant owns the whole estate for every purpose. He is the owner of the whole for purposes of tenure and survivorship, but has only his own particular share for the purpose of alienation or partition. This share to which each co-tenant is specifically entitled separately from his co-tenants is an equal undivided portion of the entire estate. If, therefore, there are two joint tenants, each may convey an undivided half—if three, an undivided third. From the doctrine of union and entirety of interest and possession, the principle of survivorship, which is a distinguishing characteristic of joint tenancy, is a natural consequence. As one of two joint tenants has a concurrent interest in the whole estate, the extinguishment of the

co-existing claim of the other tenant by the death of the latter must necessarily result in leaving the survivor in undisputed ownership of the entire premises as proprietor in severalty, merely by the continuance of his original interest. So, if there are more than two co-tenants, upon the death of each in succession the estate will pass to those who remain until it vests in the last survivor of all. Upon his death the estate would pass, like any estate held in severalty, to his heirs or personal representatives. It is an important result of this theory of survivorship that a joint tenant cannot devise his interest in the land, for the devise does not take effect until after the death of the devisor, while the interest of the surviving tenant is but a continuation of his previous ownership, and suffers no interruption by reason of the death of his co-tenant. The estate passes to the survivor exempt from all charges made by the deceased co-tenant, and is not subject to any claim of courtesy or dower. An estate in joint tenancy can only be created by purchase or the act of the parties, and not by descent or the operation of law. Children of a deceased person who inherit the land of which he was seized in fee are tenants in common, and not joint tenants. (See Tenancy in Common.) The mode of creation of an estate in joint tenancy at common law is either by the use of express words in the instrument of conveyance, declaring that the grantees or devisees are to hold by a joint title, or simply by naming two or more persons as those to whom the property is to be transferred. In the latter case it was a presumption of law that the parties intended to create a joint tenancy; and this construction was also preferred because this mode of tenure was favored on account of the right of survivorship. This was a result of the feudal doctrine that the services due to the lord should be kept entire. But in this country it has been the policy of the law to convert estates which in England would by construction of law be deemed joint tenancies, into tenancies in common. In New York estates granted or devised to two or more persons were as early as 1786 declared to be tenancies in common, except when limited to joint trustees or joint executors, unless the estate was expressly declared, in the deed or will creating it, to be in joint tenancy. Similar legislation exists in a large number of the States. In some States the mode resorted to has been to abolish the right of survivorship. In courts of equity also joint tenancies are not favored except when granted to co-trustees, and a limitation to two or more will sometimes be held to create a tenancy in common. Thus, when two persons purchase an estate, advancing the purchase-money in *unequal* portions, equity regards them as tenants in common. Such is not the case, however, when the money is advanced in *equal* portions. From the principle of identity of title and interest in joint tenants, it results that they all constitute a single owner as to third persons, and that all must be united as parties in suits by or against them in respect to their joint estate. If one tenant purchases in an outstanding adverse claim to the property, it enures to the benefit of his co-tenants if they will contribute towards discharging the expense incurred. For this and other purposes each is deemed to be a trustee for the other. Possession of the premises by one tenant is deemed the possession of all, and no action can be brought against him by the others merely on the ground of such exclusive possession. One tenant, however, may by express and unequivocal acts hold adversely to the other, so as to gain a title in severalty by force of the statute of limitations. (See Limitations, Statute of.) Entry by one joint tenant upon land is deemed the entry of all, and a conveyance to one is a conveyance to all. If one receive the rents and profits of the estate, he may be compelled to account to the others, and pay to them their proportionate shares. One tenant is responsible to the others for the commission of waste upon the estate. If he will not join with them in making necessary repairs to the premises, after having been duly requested to contribute, an action may be maintained against him. At common law the remedy in this case was by a special writ, *de reparatione facienda*. All persons may be made joint tenants who are qualified severally to receive a grant of lands. As husband and wife, however, are considered in law as a single person, an estate limited to them is not a joint estate, but an "estate by the entirety," having peculiar and special characteristics. Two corporations cannot be joint tenants with each other, nor can an individual be a joint tenant with a corporation. A joint estate may be terminated or dissevered by a transfer of the property to one tenant by the application of the doctrine of survivorship or by release, by a destruction of any one of the various unities (except that of time) which are incident to such a tenure, or by partition. If one of two co-tenants conveys his undivided share to a third person, the grantee will become a tenant in common with the other co-tenant. If there be more than two co-tenants, the purchaser would be tenant in common as to the share which he had acquired, while the remaining tenants would still hold the remaining shares in joint tenancy as between themselves. In transferring his interest to a third person a joint tenant must use an ordinary conveyance, but when the transfer is to a co-tenant a release is proper, since the grantee is already seized of the estate as a whole. (For the rules of partition see the topic Partition. See also Estates.) (The following works may be consulted: Washburn on *Real Property;* Kent's *Commentaries;* Cruise's *Digest;* Hilliard on *Real Estate.*)

George Chase. Revised by T. W. Dwight.

Joint'ure, an estate or property settled upon a wife in lieu or satisfaction of dower, to be enjoyed after her husband's death. The origin of the modern English doctrine of jointure is referable to a statute, known as the Statute of Uses, enacted in the reign of Henry VIII. (27 Hen. VIII. ch. 10). Before this period there was no method by which a wife's right of dower could be barred, except by a conveyance of the husband's lands in which dower might be claimed to some third person, to be held for the husband's use. The husband in such a case would retain merely a beneficial interest in the property, and this was a species of equitable estate, in which, by the law of uses, neither courtesy nor dower could be given. (See Uses, Dower.) It had therefore become a common practice for husbands who wished to remove the incumbrance of a claim of dower from their estates, to convey their lands to be held to their own use; and the result had been that most of the lands in the kingdom were held under this form of equitable ownership. In order, however, that a wife might not be left entirely without provision for her support after her husband's death, it became customary to settle lands before marriage to the use of the husband and his intended wife for the term of their lives in joint tenancy. If the wife outlived the husband, the entire estate would be vested in her for life by the right of survivorship. (See Joint Tenancy.) Such an estate was termed a "jointure," on account of the joint nature of the interest created. The statute of uses had the effect to render wives dowable in lands conveyed to uses by uniting the legal and the beneficial ownership in the same person; but in order that some method of barring dower might still exist, and that wives upon whom jointures had already been settled might not receive both dower and jointure, it furthermore provided that if estates had been or should be conveyed by way of jointure, the right to demand dower should, under certain conditions, be extinguished. In pursuance of these provisions, settlements in jointure were frequent in English practice until the enactment of the so-called Dower act in 1834, which introduced other methods of barring dower, which are now more commonly resorted to. The conditions or requisites which must be observed under the statute of uses in order that the settlement in lieu of dower may be valid are the following: (1) The estate must vest in possession immediately after the death of the husband; (2) it must be for the life of the wife at least, though it may be a greater estate, as an estate in fee; (3) it must be given to the wife herself, and not to another in trust for her; (4) it must be given and expressed in the deed to be in full satisfaction of her dower. It is not necessary that the estate should be limited to both husband and wife, in conformity to the mode of conveyance adopted before the statute, but it may be given to the wife alone. The settlement may be made not only by the husband, but by the wife's parents, relatives, or friends, or any third person. The provision must always be an estate in lands in order to be a valid legal jointure, and not a chattel interest or a pecuniary gift. If the settlement be made before marriage, the consent of the wife to accept it in lieu of dower need not be obtained, and whether the estate be of great or little value, the right to demand dower will be extinguished. Even though the wife be a minor, a jointure settled upon her before marriage will be an absolute bar to dower, though neither her assent be given nor that of parents or guardian. It was said by Lord Coke that "the jointure must be a competent livelihood of freehold for the wife," but the law provides no test of competency, nor will the jointure be invalid even though it be insufficient for the wife's support. If the jointure be settled upon the wife after marriage, she has a right of election after the husband's death between this provision and her dower, and may accept either as she may prefer. But after having once made her election and properly signified her choice, she cannot again exercise the privilege, but is obliged to retain the estate which she has determined to accept. Her acceptance of the jointure might be indicated by entry upon the lands given by the settlement and receipt of the rents. Her refusal of it would be shown by accepting the lands assigned in dower, or by bringing an action to have them assigned. If, however, after an acceptance of the jointure, the widow is evicted

from the whole or any portion of the property, she will be remitted to her right of dower *pro tanto*—*i. e.* to an extent equivalent to the loss she has sustained. No act answering to assignment in the case of dower (see DOWER) is necessary in order to place the widow in possession of the jointure-lands after the death of her husband, but she may enter upon them immediately. Under the English law, adultery causes no forfeiture of jointure, though it is a bar to dower.

In courts of law there is a strict adherence to the provisions of the statute of uses, and settlements not made in accordance with its requirements will not be valid in extinguishment of dower. But courts of equity exercise an independent jurisdiction not derived from the statute, and apply different rules in regard to the nature of the provision which may be made and the manner in which it may be conferred upon the wife. A distinction is therefore made between legal jointure and equitable jointure. The doctrines of equitable jointure are only applicable when the forms of legal jointure have not been complied with, and a court of equity is striving to effectuate the intent of the parties. In equity it is not necessary that an estate or provision in jointure should be actually created or conferred upon the wife, but an executory agreement to make such a settlement or provision will be sufficient, and will be carried into effect according to its terms. It is not requisite, moreover, that the provision should be a freehold estate in lands. Any inferior estate, as an estate for years or at will, will be sufficient, or even an interest in personal property or a pecuniary provision. The provision need not be conferred directly upon the wife, but may be given to another in trust for her benefit. It is not possible, moreover, in equity to make a provision for the wife which shall deprive her of her right of dower without her own consent. If she assents to a provision made before marriage, this will bar her dower, but if she does not assent, she will have a right of election between the provision and dower, unless the requisites necessary to constitute a legal jointure have been complied with. If the settlement is made after marriage, she will always have a right of election. If the wife be an infant, the rule in equity is that the consent of parents or guardian must be obtained. But in equity, as at law, the intention that the provision shall be in lieu of dower must be clearly expressed in making the settlement, or it must appear manifestly inconsistent with the intention of the grantor that the wife should have both jointure and dower. If the value of the provision be wholly or partially destroyed, the right of dower will revive so far as is necessary to afford compensation for the loss she has sustained.

In this country the English law in regard to jointures is substantially in force in most of the States, though it has been to a considerable extent modified by statute. The tendency of legislation has been to assimilate the rules in relation to legal jointure to those prevailing in equity. In some of the States the distinction between legal and equitable jointure has been entirely abolished, and the entire subject is regulated by express statutory provisions. Thus, in New York it is provided that either an estate in lands or a pecuniary provision may be given in lieu of dower, and that if the jointure be created before marriage it must be consented to by the intended wife in order to be a bar of dower. Her consent may be evidenced, if she be of full age, by her becoming a party to the conveyance by which the jointure shall be settled—if she is a minor, by her joining with her father or guardian in such conveyance. If the settlement be made after marriage, she will have her choice between jointure and dower. The election is to be made within one year after the husband's death, or she will be deemed to have accepted the jointure. Jointure may, it is also provided, be barred by the same causes as dower.

Another mode by which a wife's right of dower is sometimes barred is by a testamentary provision in the husband's will, which is either expressed to be in satisfaction or lieu of dower, or which cannot, consistently with the other provisions of the will, be received by the wife in addition to her dower. A provision of this kind is not properly a jointure, but is governed by substantially the same principles. The effect of such provisions is usually regulated by statute. The general rule is that the intention to bar the right of dower must be clearly ascertainable from the terms of the will, or the widow shall receive both the devise or bequest and her dower. And even when such intention is apparent, the provision does not bar her right of dower absolutely without her consent, but she has an election between her dower and the provision. When it is expressly declared in the will that the provision shall be "in lieu of dower," an election will unquestionably have to be made. Unless some positive expression of the same purport be used, the inquiry will be necessary whether the receipt of both dower and the testamentary provision would be inconsistent with a reasonable construction of the entire will, or prevent its appropriate and complete legal effect and operation. If there be such an inconsistency, an election between dower and the provision will in this case also be requisite. But the law favors dower, and it will not be readily inferred that a devise is intended to be in lieu of dower if no express declaration to that effect is contained in the will. It has been held that if a provision for the wife is embodied in the will, and a clause is also inserted that the residue of the estate shall pass to a residuary devisee or legatee, the right of dower will not be extinguished, for the phrase "residue of the estate" means the remainder of the estate subject to all legal claims or incumbrances, among which the right of dower would be included. If, however, it be declared that the property shall be vested in trustees to receive the rents and profits and pay a certain portion over to the wife, she will not be entitled to receive the bequest without relinquishing her dower. Her possession of a life estate by her right of dower would be inconsistent with the control and management of the entire property by the trustees. Any kind of property may be given to the wife by will in lieu of dower. In many of the States it is provided that the wife shall signify her election between a devise and her dower within a certain time. If dower be not claimed within that period, it will be presumed that she has chosen the provision in the will. The statutes of the several States must be specially consulted on this subject. (See Washburn on *Real Property;* Cruise's *Digest.*) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Joinville′, town of France, in the department of Haute-Marne. In its vicinity the ancient castle of the dukes of Guise was situated. The title of prince of Joinville is derived from a baronial fief, erected into a principality by Henri II., of which Joinville was the capital. The title is now held by the third son of the late king, Louis Philippe. Pop. about 4000. AUGUST NIEMANN.

Joinville (FRANÇOIS FERDINAND PHILIPPE LOUIS MARIE D'ORLÉANS), PRINCE DE, the third son of Louis Philippe, the last king of the French, b. at Neuilly Oct. 14, 1818. At the age of thirteen he commenced his naval career as pupil on board the frigate Artémise; was appointed a lieutenant in 1836, and in 1838 commanded the corvette La Créole of the fleet of Admiral Baudin before Vera Cruz. In the attack upon Fort San Juan d'Uloa and the city of Vera Cruz he distinguished himself in a shore-expedition against the city, in which in a hand-to-hand combat he captured the Mexican general Arista, for which he was made chevalier of the Legion of Honor and *capitaine de vaisseau*. In 1840 he, in command of the frigate La Belle Poule, was charged with conveying the remains of Napoleon from St. Helena to France. In the same frigate he visited America, and was warmly received in Philadelphia and Boston. In 1843 he married the princess Francesca di Braganza, daughter of Pedro I. and sister of the present emperor of Brazil. Made at the same epoch (1843) *contre-amiral* (rear-admiral), he in 1844 commanded the fleet which bombarded Tangiers and seized Mogador, displaying on the latter occasion conspicuous personal gallantry. The revolution of 1848 found the prince still commanding the fleet off Algiers, near his brother, the duc d'Aumale, governor of the African possessions and commander of the military forces in Africa, numbering 80,000 men. Yielding to what purported to be the popular will, the two brothers relinquished their commands (which *might*, perhaps, had the word been said, have escorted them to Paris), and in company embarked for Gibraltar. For the next thirteen years the prince, banished from France, was an incessant traveller, filling the intervals of time with the occupations of an author or artist. On the breaking out of the American civil war in 1861, he embarked for New York, bringing with him his son, the duc de Penthièvre (who entered as a cadet the U. S. Naval School, then at Newport), and accompanied by his nephews, the comte de Paris and the duc de Chartres. The latter received military commissions from the government, and were members of the personal staff (A. D. C.) of Gen. McClellan during the latter part of the year, and during what is known as the Virginia Peninsular campaign against Richmond (Apr., May, June, 1862), showing on various occasions, and especially at the battle of Gaines's Mill, great efficiency and personal gallantry. The prince himself accompanied the head-quarters of Gen. McClellan, who appreciated and gladly availed himself of his military experience, sound judgment, and statesmanlike qualities. Immediately on his return to France he communicated to the *Revue de Deux-Mondes*, under the *nom-de-plume* of "A. Trognon," an able sketch of the events of the campaign under the title of *L'Armée du Potomac*, etc. Subsequently he collected and published in two volumes, entitled *Études sur la marine et récits de*

guerre, his various contributions to that periodical, among which may be mentioned the one just referred to and *La marine en France et aux États Unis en 1865.* With other members of his family he made urgent but vain appeals to the French government to be permitted to serve France in the war with Germany which broke out in 1870. When the French armies had been almost annihilated, and disaster overwhelmed their native land, the prince and his nephew, the duc de Chartres, disappeared from the family reunion at Claremont to find their way to serve their country. Repelled by the government, which regarded his presence as dangerous, and denied permission to serve even under a borrowed name, he was finally compelled to return to England, where he remained until the edict of banishment resting upon his family was abrogated by decree of the French assembly (1871). By his marriage with the princess of Brazil the prince de Joinville has two children—Pierre Philippe Jean Marie d'Orléans, duc de Penthièvre (b. Nov. 4, 1845), and a daughter, Françoise Marie Amélie (b. Aug. 14, 1844), who married (June 11, 1863) her cousin, the duc de Chartres. J. G. BARNARD.

Joinville, de (JEAN), SIRE, b. at the château of Joinville in Champagne about 1224; was at an early age attached as seneschal to the court of the count of Champagne, and afterwards to that of the king of Navarre. In 1248 he took part with St. Louis, king of France, in his first crusade, having in his train 700 men-at-arms; was a companion of the king in his battles and his captivity, becoming his intimate friend and counsellor. Returning to France in 1254, he was for many years employed at court, but declined to take part in the second crusade (1270), which was directed against Tunis, and proved fatal to that monarch. Joinville was one of the principal witnesses in behalf of the sanctity of Louis in the inquest (Aug., 1282) preliminary to his canonization, and his closing years were employed, at the request of Queen Jeanne of Navarre (1309), in writing his celebrated *Mémoires*, which have ever since been a favorite French classic. He lived to a great age, and d. probably in 1318. The best edition of his *Mémoires* is that of Natalis de Wailly (Paris, 1873).

Jokjoker'ta, the name of a former kingdom of Java, now a Dutch presidency. Its capital, Jokjokerta or Mataram, situated in lat. 7° 47′ S., lon. 10° 21′ E., has 50,000 inhabitants, many European settlers and European institutions, and a most curious palace of the sultan. It is built on a terraced island with entrances under the water, and the heavy gilding of its towers and windows shows that it was once a gorgeous building, though it now is falling rapidly into decay.

Joliba. See NIGER.

Jo'liet, city, cap. of Will co., Ill., on the Aux des Plaines River, and the Illinois and Michigan Canal, 36 miles S. W. of Chicago, on the Chicago Rock Island and Pacific and the Chicago and Alton R. Rs., at the terminus of the Michigan Central R. R. It is also on the Chicago and Illinois River R. R. The town is built mainly in the river-valley, but partly on bluffs on either side. Very fine calcareous building-stone underlies the whole city and vicinity, and is extensively quarried. Cement, gravel, and fireclay are largely obtained, the latter being found in a great mound. Firebrick and drain-tile are made from it. Near the city is the State penitentiary, built of stone. Its wall, averaging 35 feet in height, encloses 16¼ acres. The usual number of convicts is some 1300, employed in making, on contract, boots, shoes, stone-work, cooperage, butts, hinges, harnesses, cigars, etc. It has been pronounced the largest and best conducted institution of the kind in the country. Joliet has a manufactory of iron and steel, built at an estimated cost of $3,000,000; it employs from 2000 to 2500 men, and turns out steel, steel and iron rails, machinery, castings, and the varied products of the blast furnace, converter, puddling-mill, machine-shop, and foundry. Joliet has 12 churches, 2 national and 2 private banks, a public library, 2 convents, 1 semi-weekly and 4 weekly newspapers, a paid fire department, 16 artesian wells, and varied minor industries. Its water-power and the proximity of the Wilmington coal-fields give it great advantages as a manufacturing centre. Pop. 7263; of tp. 2940, greatly increased since the census. JAMES GOODSPEED, ED. "REPUBLICAN."

Joliet (CHARLES), b. at Saint Hippolyte, in the department of Doubs, Aug. 8, 1832; entered literature as a journalist and miscellaneous writer, and attracted great attention both by his *Le roman de deux jeunes mariés* (1866) and *Mademoiselle Cherubin* (1870), and by his novels treating of subjects from the Franco-German war of 1870–71.

Joliet (LOUIS), b. at Quebec in 1645; was educated in the Jesuits' college in that town, but engaged in the Western fur-trade. Commissioned by Frontenac to explore the Mississippi River, he started in 1673 up the Fox River and down the Wisconsin and Mississippi rivers to a point below the mouth of the Arkansas, returning to Green Bay *viâ* the Illinois River. Thence he proceeded alone to Quebec, losing his MSS. on the way; but he prepared a map and narrative of the expedition from memory. He was appointed royal hydrographer, and received the island of Anticosti, of which he was dispossessed by the British. In 1697 the seigniory of Joliet in Canada was granted to him. D. 1700.

Jo'liette, county of Quebec, Canada, extending N. W. from the St. Lawrence River. It has much timber, mines of iron, and stone-quarries; much of the soil is very fertile. It is intersected by the St. Lawrence and Industry Railway. Cap. Joliette. Pop. 23,075.

Joliette, a large town, the capital of Joliette co., Quebec, Canada, has fine water-power, excellent building-stone, large manufactures of lumber, leather, and castings. It has a benevolent society, college, hospital, convent, mechanics' institute, court-house and jail, and 1 semi-weekly newspaper. It has an important trade, and is the N. W. terminus of the St. Lawrence and Industry Railway. Pop. of sub-district, 3047.

Jollivet' (PIERRE JULES), b. at Paris June 27, 1803; studied first architecture, then painting; lived 1822–25 in Madrid; and gained the great medal in 1835. He has painted a great number of subjects of Spanish life and history: *Lara*, in the Luxemburg; *Battle of Aicha*, at Versailles; *Le Massacre des Innocents*, at Rouen. *The Time of Pericles* is one of his latest works.

Jol'ly Boat [*jolly* is kindred to the word *yawl*], a small boat carried on board ships, and used for communicating with shore or with other ships. It is usually propelled by oars, but sometimes a mast and sail are set up. The jolly boat is often short, wide, and capacious, and is particularly adapted to the steward's use.

Jomard' (EDME FRANÇOIS), b. at Versailles Nov. 17, 1777; studied in the École Polytechnique, and accompanied the expedition to Egypt as a member of the scientific committee. After his return to Paris in 1802 he was employed for more than twenty years in the redaction and publication of the celebrated work, *Description de l'Égypte*, of which he wrote 6 volumes himself. In 1821 he took part in the founding of the Geographical Society of Paris, and from 1828 he held a position in the geographical department of the Royal Library. He has aided in the publication of many valuable works concerning Egypt and Africa, and wrote a number of minor essays on different geographical, archeological, and educational subjects. D. Sept. 22, 1862, at Paris.

Jomini' (HENRI), BARON, b. at Payerne, canton of Vaud, Switzerland, Mar. 6, 1779; entered the French army in 1804 with the rank of major; served as aide-de-camp to Marshal Ney in Germany and Spain; was made a brigadier-general in 1808, and distinguished himself on the retreat from Moscow in 1812. But when Napoleon, instigated by Berthier, refused to promote him after the victory at Bautzen, Jomini left the French army and entered the service of the emperor Alexander, who made him his aide-de-camp; he took, however, no part in the campaign against France, and the rumor that he had revealed the French plans of operation to the allies was denounced by Napoleon himself. In the Russian service he distinguished himself in the war against the Turks in 1828, and was very active in the foundation of the Military Academy of St. Petersburg. During the latter part of his life he devoted himself wholly to literary pursuits. D. at Passy, near Paris, Mar. 24, 1869. His principal works are—*Traites des Grandes Operations militaires, ou Histoire critique des Guerres de Frédéric le Grand, camparées au Système Moderne; Histoire critique et militaire des compagnes de la Révolution* (5 vols., Paris, 1806), *Vie politique et militaire de Napoléon* (4 vols., Paris, 1827), *Précis de l'art de la guerre* (Paris, 1838, 2 vols.; with an appendix, Paris, 1849).

Jo'nah [Heb., a "dove"], a Hebrew prophet, b. at Gath-hepher in the tribe of Zebulun. He was no doubt the "Jonah, son of Amittai," who is mentioned in 2 Kings xiv. 25, so that he lived about 800 B. C. The book which bears his name does not contain his prophecies, but a story about him, an incident from his career. Some assert that the story is purely mythical, others that it has a historical foundation, but has undergone the influence of popular tradition; others that it is a poetical invention with a didactic purpose. In any view its didactic purpose is evident. It teaches that man cannot escape from God by flight; that man has only to do what he is called to do, and leave results to God; and that God does not, when he employs a human agent to threaten judgment, bind himself not to show mercy lest he should bring his agent to shame.

Jo'nas (JUSTUS), b. June 5, 1493, at Nordhausen, in the Prussian province of Saxony; studied law, and was pro-

fessor of jurisprudence, first at Erfurt, and then at Wittenberg, where in 1521 he changed his chair for that of theology; became ecclesiastical superintendent at Halle in 1541, and at Coburg in 1546; and d. at Eisfeld Oct. 9, 1555. He was an intimate friend of Luther and Melanchthon, and one of the most prominent among the German Reformers. He accompanied Luther to Worms, aided him in the translation of the Old Testament, and contributed much to the furthering of the Reformation by his preaching and by his powerful translations into German of the Latin writings of Luther and Melanchthon.

Jon'athan [Heb. *Yonathan*], a son of Saul, king of Israel, b. near the close of the twelfth century B. C.; became, on the establishment of the kingdom, a conspicuous leader in the war against the Philistines, which owed its origin to his daring exploit in killing a Philistine general at Geba (1 Sam. xiii. 3, 4). His attachment to David, whom he defended against the jealousy and murderous designs of his father, is the best known feature of Jonathan's career, and has made his name a synonym for disinterested friendship. Jonathan was killed in battle against the Philistines at Mount Gilboa, about B. C. 1053, together with his father and two brothers, and his body was exposed upon the walls of Beth-shan until it was secretly carried away and buried by the men of Jabesh-Gilead, and his remains were ultimately placed in the family sepulchre at Zelah. On the death of Jonathan, David penned an elegy (2 Sam. i. 22 *seq.*) which is one of the most beautiful productions of its kind.

Jonathan ben Uzziel, b. in Palestine in the first century B. C.; was a pupil of Hillel, and became one of the most celebrated expositors of the books of the Old Testament. He was the author of a Chaldee paraphrase or translation of the prophets, and to him is also attributed the authorship of a Targum known by his name, and another called the *Five Megilloth.* The Targum of Jonathan was first printed at Venice in 1590–91, and afterwards at Bâle (1607), Hanau (1614), Amsterdam (1640), Prague (1646), and Vienna (1859). A Latin translation was given in Walton's *Polyglot*, and an English one by Rev. J. W. Etheridge (London, 1862). But recent criticism has decided this Targum to be several centuries posterior to the Christian era, and the genuine works of Jonathan are reduced to the *Paraphrase on the Prophets* (embracing also Joshua, Judges, Samuel, and Kings), first published at Venice in 1494, now found in all rabbinic Bibles, also in Walton's *Polyglot* and Buxtorf's Hebrew Bible. It is especially valuable for its expositions of the minor prophets.

Jonathan Creek, tp. of Moultrie co., Ill. Pop. 1001.

Jonathan's Creek, tp., Haywood co., N. C. Pop. 987.

Jones, county of Central Georgia. Area, 378 square miles. The Ocmulgee washes its S. W. border. It is hilly and fertile. Iron ore and granite exist here. Cotton and corn are staple crops. The S. part is traversed by the Georgia Central R. R. Cap. Clinton. Pop. 9436.

Jones, county of the E. of Iowa. Area, 576 square miles. It is partly forest and partly prairie. It is well watered, and has a fertile calcareous soil. Cattle, grain, wool, butter, and hay are extensively produced. Carriages, wagons, and brick are leading articles of manufacture. The county is traversed by the Iowa Midland, the Davenport and St. Paul, the Sabula Ackley and Dakota, and other railroads. Cap. Anamosa. Pop. 19,731.

Jones, county of the S. E. of Mississippi, drained by the head-streams of the Pascagoula River. Area, 650 square miles. It is partly light pine-land, and has dense forests. It produces some rice, corn, and sweet potatoes. Cap. Ellisville. Pop. 3313.

Jones, county of the E. of North Carolina, traversed by the river Trent. Area, about 425 square miles. It has much pine forest and swamp-land, and is generally level and sandy. Cotton and tobacco are staple products. Cap. Trenton. Pop. 5002.

Jones, an unorganized county of N. Central Texas. Area, about 1200 acres. It is drained by the head-streams of the Brazos River, and is generally a fertile prairie-land adapted to stock-raising. Its principal place is Anson. The county receives its name from Anson Jones, the president of the republic when Texas was admitted to the Union.

Jones, tp. of Winston co., Ala. Pop. 299.

Jones, tp. of Union co., Ia. Pop. 840.

Jones, tp. of Elk co., Pa. Pop. 1091.

Jones (ANSON), b. in Massachusetts Jan. 20, 1798; commenced the practice of medicine in 1820. Being of a migratory disposition, he subsequently resided for a while in Philadelphia and New Orleans; he then visited South America, and finally (in 1833) settled at Brazoria, Tex. When the troubles between Texas and Mexico broke out in 1835, he was a zealous advocate of the independence of the colony. In the war that ensued he acted as a private soldier as well as a surgeon in the Texan army. After independence was achieved he was a member of the Texas Congress. In 1838 he was minister from that republic to the U. S. Subsequently he was senator in the Texas Congress, and then for three years secretary of state. In Sept., 1844, he was elected president of Texas, which office he held until Texas became one of the States of the Union. He was a man of great and varied abilities, and left his impress upon the history of the times. His death, by his own hand, Jan. 7, 1858, was deeply lamented. A. H. STEPHENS.

Jones (CHARLES COLCOCK), D. D., b. at Liberty Hall, Ga., Dec. 20, 1804; studied at Andover and Princeton theological seminaries; was ordained in 1830, and went as a missionary to the negroes in his native county in Georgia. From 1836 to 1838 and from 1847 to 1850 he was professor of church history in the seminary at Columbia, S. C., having in the interval returned to his labors among the negroes. In 1850 he removed to Philadelphia, and became secretary of the Presbyterian Board of Domestic Missions; returned in 1853 to Georgia, where he d. Mar. 16, 1863. He published several catechisms, one of which, on *Scripture Doctrine and Practice*, was translated into several languages as a manual for the instruction of heathen; several pamphlets on the *Religious Instruction of the Negro*, and a *History of the Church of God*, left unfinished at his death.

Jones (CHARLES COLCOCK, JR.), b. in Savannah, Ga., Oct. 28, 1831. His early education was under the instruction of private tutors at Montevideo and Maybank (plantation residences of his father in Liberty co., Ga.); his freshman and sophomore years were spent at South Carolina College, Columbia, where his father, Rev. Charles Colcock Jones, Sr., D. D. (a man of great eloquence), was then one of the professors in the Presbyterian Theological Seminary of that city. The junior and senior years of his collegiate course were passed at Nassau Hall, Princeton, N. J., where he graduated with high distinction in 1852. After this he studied law in Philadelphia one year, and then went to Dane Law School, Harvard University, Cambridge, Mass., where he remained two years more, and took the regular degree in the law department of that institution in 1855. Returning to his native State, he was admitted to the bar at Savannah, Ga., in 1856, and with his natural ability and thorough training rose rapidly to the first rank in his profession. In 1860 he was elected mayor of the city—a position seldom if ever before conferred on one so young by a corporation possessing the amount of wealth, population, and extent of commercial and navigating interests that the city of Savannah then did. Soon after the passage by Georgia of her ordinance of secession in 1861, and the beginning of the late war, he entered the Confederate States military service and became lieutenant-colonel of artillery. This position he held until the end of the war. He was under Gen. Joseph E. Johnston at his surrender in Apr., 1865. After the war Mr. Jones moved to the city of New York, where he resumed the practice of law, and has continued to prosecute it with great success. He has not permitted the calls of his profession, however, to absorb all his time or energy. By a methodical economy in the arrangement of business peculiar to himself, he has, even under the greatest pressure of office duties, found leisure to contribute largely to the literature as well as science of the country by his pen. Several works of unusual merit have been published by him. Among these may be named—his *Historical Sketch of the Chatham Artillery during the Confederate Struggle for Independence* (1867), *Historical Sketch of Tomo-chi-chi-mico of the Yamacraws* (1868), *Ancient Tumuli on the Savannah River* (1868), *Ancient Tumuli in Georgia* (1869), *Antiquities of the Southern Indians, particularly of the Georgia Tribes* (1873). The latter is a work of great interest, and exhibits a vast amount of mental labor and historical research. His published works, already ten in number, place him in style and matter high among American authors. A. H. STEPHENS.

Jones (GEORGE W.), b. in King and Queen co., Va., Mar. 15, 1806; was a member of the legislature of Tennessee (in the house or senate) from 1835 to 1842, and was a member of Congress from 1843 to 1861. Though a Union man of the Jackson school, after the secession of Tennessee he went with his State, and was a member of the Confederate Congress. Since the war he has acted no prominent part in politics. Mr. Jones is a remarkable instance of a self-made man under American free institutions. A poor boy with scanty education, he was brought up to the saddler's trade, but by dint of application and study he acquired extensive knowledge, and during his entire Congressional career was one of the most marked men of the House. A. H. STEPHENS.

Jones (Sir HARRY DAVID), G. C. B., b. 1792; commis-

sioned second lieutenant royal engineers 1808; served in the expedition to Walcheren 1809; in the Peninsula campaigns 1810–14; on special duty in America 1815; engineer in charge of fortifications on Montmartre after the entrance of the British troops into Paris 1815, and commissioner to the Prussian army of occupation 1816; brigadier-general July, 1854, and conducted the siege operations against Bomarsund; promoted to be major-general Dec., 1854; appointed to and continued in command of the royal engineers in Eastern campaign (1855) to fall of Sebastopol; lieutenant-general July 6, 1860, and colonel-commandant of royal engineers Aug. 2, 1860. In 1856 he succeeded to the governorship of the Royal Military College at Sandhurst, where he remained until his death, which occurred at that place Aug. 2, 1866. G. C. Simmons.

Jones (Henry Bence), M. D., F. R. S., an English physician, b. in 1814, was educated at Harrow and Trinity College, Cambridge, studied medicine in London, and in 1846 became physician of St. George's Hospital, London. Has published *Gravel, Calculus, and Gout, Animal Chemistry, Animal Electricity, Life of Faraday* (1869), *The Royal Institution* (1871), and many scientific papers; was a member of many learned societies. D. Apr. 20, 1873.

Jones (Inigo), b. in London in 1572; d. there July 21, 1652. Of humble parentage and poor, he owed to the earl of Pembroke, who was attracted by his taste for drawing, the advantage of travel and study in Europe. He spent several years in Germany, France, and Italy, and received his chief impulse from the works of Palladio in Venice. In 1604 he passed a year in Copenhagen, under the patronage of King Christian IV.; in 1605 returned to England, recommended by the king to his brother-in-law, James I.; in Ben Jonson's prime as poet-laureate was court architect and decorator; showed a talent for mechanical invention and the production of scenic effects; became, in short, a person of importance, a favorite with the court, but not equally popular with artists and men of letters. He maintained his position under Charles I.; was made superintendent of the royal buildings, designed works of importance, and held a high rank among the architects of his generation. The river front of Somerset House, Shaftesbury House, Ashburnham House, the W. front of old St. Paul's, and Covent Garden, were admired examples of his skill. His designs for the palace of Whitehall, the banqueting-house of which only was built, are regarded as his masterpieces. Jones owed his celebrity less to his genius than to the style of building that he introduced into England from Italy. When that style became obsolete his fame passed away. He was an author as well as a builder and designer, an excellent mathematician, a good classical scholar. He wrote an essay on *Stonehenge*, ingenious, but of no value; notes on the architecture of Palladio, essays on miscellaneous subjects, and verses. Volumes of his architectural designs were published by William Kent and Isaac Ware. His biography has been prepared by Peter Cunningham (London, 1848). The fortunes of Inigo Jones were implicated in those of the royal family. The execution of Charles I. crushed him, and he d. poor and wretched.
O. B. Frothingham.

Jones (Jacob), b. near Smyrna, Del., in 1770; entered the U. S. navy as midshipman in 1799; was captured in frigate Philadelphia in 1803 near Tripoli, where he was held a prisoner twenty months; commanded the U. S. sloop of war Wasp in 1812, in its celebrated capture of the British sloop Frolic, and was himself captured the same day with both those vessels by the British ship Poictiers of 74 guns. Released on parole at Bermuda. Jones received distinguished honors for his bravery, was voted a gold medal by Congress, was promoted to post-captain in the squadron under Com. Decatur. After the war Com. Jones commanded squadrons in the Mediterranean and Pacific. D. at Philadelphia Aug. 3, 1850.

Jones (James), M. D., b. in Georgetown, D. C., 1806; d. in 1873 in North Carolina, of paralysis. He received M. D. from the University of Pennsylvania, and became resident physician in the Philadelphia almshouse. Was editor of the *N. O. Med. and Surg. Journal* in 1857; professor of obstetrics and diseases of women and children; and then professor of practical medicine and dean of the faculty in the University of Louisiana 1857–66. Paul F. Eve.

Jones (James Chamberlain), b. in Davidson co., Tenn., Apr. 20, 1809; was elected governor of the State over James K. Polk in 1841 and 1843, and was one of the U. S. Senators from Tennessee from 1851 to 1857. D. at Memphis Oct. 29, 1859. A. H. Stephens.

Jones (J. Glancy), b. in the valley of the Conestoga, Pa., Oct. 7, 1811; was educated for the ministry, but became a successful lawyer and for a time was deputy attorney-general of Pennsylvania. He was three times sent to Congress between 1850 and 1858; was the founder of the court of claims, and for a time chairman of the committee of ways and means. In 1858 he became U. S. minister to Austria.

Jones (Joel), LL.D., b. at Coventry, Conn., Oct. 25, 1795; graduated at Yale in 1817; was a lawyer of Easton, Pa. In 1835 he became judge, and afterwards presiding judge, of the Philadelphia district court. He was (1847–49) the first president of Girard College, and in 1849 was mayor of Philadelphia. He published reports of the revision of the civil code of Pennsylvania, *Pennsylvania Land Law*, and *Jesus and the Coming Glory*, a work in favor of the doctrine of the speedy second advent of the Lord. He was perfectly familiar with several living and dead languages, was an earnest student of theology, and wrote much for the religious press. D. in Philadelphia Feb. 3, 1860.

Jones (John), M. D., b. at Jamaica, L. I., in 1729; studied medicine at Rheims and Leyden; was surgeon to Sir William Johnson's expedition against Crown Point in 1755, and attended the wounded French commander, Baron Dieskau; was professor of surgery at the medical school of the College of New York 1767; published *Plain Remarks upon Wounds and Fractures* in 1776; retired from New York City during the British occupation; was elected to the State senate; served for a short time in the medical department of the army in 1780, where he was chosen physician to the Pennsylvania Hospital, and in 1787 vice-president of the College of Physicians. He was the friend and family physician of Franklin and Washington, and stood at the head of his profession in America. D. at Philadelphia June 23, 1791. A volume of his medical writings was published, with a memoir, by his pupil, Dr. Mease, in 1795.

Jones (John B.), b. at Baltimore, Md., in 1810; wrote a number of descriptive books and character sketches, which have been very popular. *Wild Western Scenes* (1849) had a sale of 50,000 copies. Mr. Jones established in 1857 at Philadelphia a weekly paper, the *Southern Monitor*, devoted to the advocacy of Southern interests.

Jones (John M.), b. in Virginia in 1821; graduated at West Point 1841, and entered the infantry as brevet second lieutenant, second lieutenant 1845, first lieutenant 1847, and captain 1855; served on frontier duty until 1861, and resigned May 27, 1861, to join the cause of the Confederacy; was appointed colonel of Virginia volunteers, and advanced to the grade of brigadier-general; served with Longstreet's corps in Virginia; wounded at Malvern Hill, and severely at Gettysburg; and served in operations about Knoxville, Tenn.; in the Virginia campaign of 1864 was killed at Spottsylvania, May 10, 1864. G. C. Simmons.

Jones (John Paul), whose true patronymic was John Paul, b. at Arbigland on the Firth of Solway July 6, 1747. His father followed the peaceful pursuit of a gardener. The youth became early imbued with the spirit of adventure and desire for a seafaring life, which the scenes of his childhood were calculated to inspire. Accordingly, we find him at the age of twelve apprenticed to a shipmaster engaged in the American trade. His first voyage took him to Virginia, where his brother William had settled and prospered, and under whose care our hero diligently improved his leisure moments, particularly in the study of his newly-adopted profession. The failure of his master liberating him from his indentures, Paul was almost at once engaged as third mate of a slaver, in which traffic he continued until his own sense of the disgrace attaching to such a career induced him to abandon it. Taking passage from Jamaica for Kirkcudbright in 1768, the death of both master and mate occurred on the passage, and Paul was forced to assume command of the vessel, bringing her safely to her destination, and subsequently becoming her master, making several voyages to the West Indies. In 1773 he came to Virginia to arrange the affairs of his brother, who had died childless and intestate. Here he added the name of Jones to his own, and apparently determined to abandon his profession and devote himself to agriculture. The outbreak of hostilities in 1775, however, recalled him to the sea, and his offer of services to Congress being accepted, he was on Dec. 22, 1775, appointed senior lieutenant in the navy, and assigned to the flagship Alfred. On the arrival of the commanding officer on board, Jones with his own hands hoisted the American flag, the occasion being the first on which it was ever displayed. His first engagement was with the Glasgow, soon after which action he succeeded to the command of the sloop Providence (12), in which, during a cruise of little more than six weeks, he captured sixteen prizes, besides doing much damage to the fishery and shipping at Canso and Isle Madam. Appointed to command the Alfred on the completion of this successful cruise, he led an expedition, which sailed Nov. 2, 1776, to break up the Cape Breton fishery and capture the coal fleet, in which he was partially successful, arriving in Boston Dec. 15 with four prizes. He was in Jan., 1777, ordered back to

the Providence. Though in the list of original appointments in the colonial navy he stood sixth from the head, and subsequently received his commission as captain, dated Aug. 8, 1776, a resolution of Congress was passed Oct. 10, 1776, declaring the order in which captains in the navy should take rank, in which list Jones's name was the eighteenth. This supersedure was a constant source of annoyance to Jones, the injustice of which he continued to represent, but without effect. In June, 1777, Congress appointed Jones to the command of the Ranger (18), a new ship, in which he sailed from Portsmouth Nov. 1, arriving at Nantes Dec. 2, 1777. In Apr., 1778, he sailed from Brest in the Ranger, and after burning a brig off Cape Clear made a daring descent upon the town and shipping of Whitehaven, in which he displayed great personal daring; he then conceived the idea of capturing the earl of Selkirk, hoping to make him the instrument of obliging England to agree to a system of exchanges. The absence of the earl from his estate near Kirkcudbright caused the scheme to fail. A quantity of silver plate which was seized on this occasion was subsequently recovered and returned to the earl at Jones's expense. During this cruise he fell in with the Drake, a vessel superior in crew and armament, which he captured and took into the harbor at Brest. The Ranger subsequently returned to America, Jones being retained in France by our commissioners at the request of the French minister of the marine, who made several very gratifying propositions to him, all of which, however, failed of execution, greatly to the disappointment and annoyance of Jones, who was thus without a command until Feb., 1779, when by his urgent applications the French minister appointed him to the command of the Duras, an old merchantman converted into a war-vessel, and which Jones obtained permission to name Bon Homme Richard in honor of Dr. Franklin, whom he greatly respected and by whom he was held in high esteem. The Richard when completed mounted 42 guns, and on the 14th of Aug., 1779, Jones departed from Lorient in command of a squadron of seven vessels, including two privateers. In a month's time they had captured or destroyed twenty-six vessels, this intelligence spreading consternation along the English coast. On Sept. 23 the squadron, consisting of the Richard, the Alliance, the Pallas, and the Vengeance, when off Flamborough Head sighted a fleet of forty-one sail, which proved to be the Baltic fleet under convoy of the Serapis (50) and the Countess of Scarborough (20). Chase was at once given by the squadron, the Alliance, disregarding signals to form in line of battle, at once taking the lead, but after approaching near to the Serapis, stood off again from land. About 7½ P. M. the Richard came up with the Serapis, and a terrible engagement, lasting upwards of three hours, ensued, during all of which time the vessels were in close proximity, and during the latter part of the fight in actual contact. At the commencement of the action two of the Richard's guns burst, disabling their crews and causing the abandonment of the battery. The Countess of Scarborough surrendered to the Pallas after a short action, and the Alliance now approached the scene of conflict between the Richard and Serapis, but, instead of supporting the Richard, her commander, Capt. Landais, an envious Frenchman, actually opened a raking fire on the Richard, which was continued too long to admit of doubt of the Frenchman's intention. Notwithstanding this discouraging circumstance, and the fact that the Richard was in a sinking condition and surrender counselled by many, Jones maintained the conflict until shortly after 10 o'clock, when the Serapis struck. The Richard being on fire in two places and in a hopeless condition, she was abandoned after removing the wounded, and about 10 A. M. of the 25th she went down, bows first. The Serapis was taken into the Texel, and Jones was received in Paris and throughout France with the greatest honors, the king bestowing upon him an elegant sword and the cross of the order of Military Merit, which latter Congress permitted him to accept, and with which he was decorated by the French minister at Philadelphia, where Jones had arrived on Feb. 18, 1781. Congress also gave him a vote of thanks, and by resolution the command of the new frigate America (74); but as this fine ship was subsequently presented to France to replace the Magnifique, Jones never saw active service at sea again. He was subsequently (1783) sent to Paris as agent to recover the moneys due in Europe for prizes taken under his command. In 1787, Jones came to America, and while here Congress voted him a gold medal. He soon after returned to Europe, and in 1788 accepted the appointment of rear-admiral in the service of Russia, and rendered important service against the Turks. He became the object of personal enmity among favorites at court, and was allowed to retire on a pension, which, however, was not paid. He removed to Paris, where he died July 18, 1792. G. C. SIMMONS.

Jones (JOHN TAYLOR), D. D., b. at New Ipswich, N. H., July 16, 1802; graduated at Amherst in 1825, and studied theology at Andover and Newton, Mass.; became a Baptist in 1828; went in 1830 as a missionary to Burmah; was transferred in 1833 to Siam, where he was a successful missionary. He published a Siamese New Testament (1843) and several tracts. D. at Bangkok Sept. 13, 1851.

Jones (JOHN W.), b. in Montgomery co., Md., in 1806; studied medicine, took his degree at Jefferson College, Philadelphia, and moved to Georgia, where, after serving in the State legislature, he was elected to Congress 1847–49; subsequently he became one of the professors in the medical college of Atlanta. D. in 1872. A. H. STEPHENS.

Jones (JOHN W.), b. in Chesterfield, Va.; graduated at William and Mary College in 1803; represented Virginia in Congress 1835–45, and was Speaker during his last term. D. Jan. 29, 1848. A. H. STEPHENS.

Jones (JOHN WINTER), F. S. A., b. at Lambeth, England, early in the present century; was educated at St. Paul's School; studied law, and entered the civil service in 1837. He became assistant keeper of the printed books at the British Museum in 1850, keeper in 1856, and principal librarian on the retirement of Mr. A. Panizzi in 1866. Mr. Jones has edited for the Hakluyt Society several republications of rare works of early travels, has written a guide to the printed books in the Grenville and King's Library, has contributed to the *New Biographical Dictionary* of the Society for the Diffusion of Useful Knowledge, and to the quarterly reviews.

Jones (JOSEPH), M. D., b. in Liberty co., Ga., Sept. 6, 1833; graduated at Princeton College, N. J., and at the medical department of the University of Pennsylvania. His great-grandfather was killed in storming the British works at Savannah when an aide to Gen. McIntosh, Oct. 9, 1779; his grandfather served through the war of 1812; and his father was the distinguished clergyman and professor, Charles Colcock Jones. Joseph Jones was professor of chemistry in the Medical College, Savannah, Ga., 1858–59; professor natural sciences University of Georgia, Athens, 1858–59; professor in the Medical College, Augusta, 1859–60; chemist to cotton-planters' convention, Georgia, 1860; surgeon army Confederate States 1862–65; professor chemistry and clinical medicine Nashville University, Tenn., 1868–69; and at present professor chemistry and clinical medicine University of Louisiana, and visiting physician to its charity hospital. He is the author of several valuable contributions to medical science and its kindred subjects. PAUL F. EVE.

Jones (NOBLE WIMBERLY), M. D., b. near London, Eng., 1724; emigrated to Georgia; a member of the colonial legislature in 1761; was a leading revolutionist in 1774, and was a member of the second Congress of the colonies 1775; afterwards became connected with the army, and was made prisoner at the capture of Charleston in 1780. After being exchanged he was again returned to Congress. He practised medicine during the intervals of public life; was president of the State convention of Georgia by which the constitution was amended in 1795. D. in Savannah, Ga., Jan. 9, 1805. A. H. STEPHENS.

Jones (OWEN), b. in Wales, 1809; best known by his studies of the Alhambra in Granada, to which he devoted much time and labor. He decorated the interior of the Exhibition building in Hyde Park (1851) and of the Crystal Palace at Sydenham, where the Egyptian, Greek, Roman, and Alhambra courts were of his design. In 1852 he was made director of decorations for the Crystal Palace Company. St. James's Hall, Piccadilly, was erected by him. He was the author of *Designs for Mosaic and Tesselated Pavements* (1842), *Plans, Elevations, and Sections of the Alhambra* (1848), *An Attempt to define the Principles which should Regulate the Employment of Colors in Decorative Arts* (1851), *The Grammar of Ornament* (1856). He wrote much on the art of illumination, and designed the illuminations of the Book of Common Prayer. To illustrate his doctrine that ancient sculpture was commonly painted, and the exterior of marble buildings embellished with color, Mr. Jones touched with color statues in the Greek Court at Sydenham, including some of the casts from the Elgin marbles there. His work is familiar through the ornamental title-pages of illustrated books. D. Apr. 19, 1874. O. B. FROTHINGHAM.

Jones (Gen. ROGER), b. in Westmoreland co., Va., 1789; appointed second lieutenant in the marine corps in 1809; transferred to the artillery in 1812, with rank of captain; and assistant adjutant-general, with rank of major, 1813; served with distinction during the war with Great Britain, winning brevet of major for Chippewa and of lieutenant-colonel for gallantry at sortie from Fort Erie; appointed adjutant-general, rank of colonel, Aug., 1818, and retained in the artillery in 1821. In 1825 was appointed adjutant-

general of the army, which position he held until he d. at Washington, D. C., July 15, 1852. In 1832 he was brevetted brigadier-general, and in 1849 major-general.
G. C. SIMMONS.

Jones (SAMUEL), LL.D., b. in 1769, was a son of Chief-Justice Samuel Jones; graduated at Yale in 1790; studied law in his father's office, along with De Witt Clinton; was a member of the New York assembly 1812–14; recorder of New York City 1823; chancellor of the State 1826; chief-justice of the superior court in New York City 1828, and judge of the supreme court of the State 1847–49. D. at Cold Spring, L. I., Aug. 8, 1853.

Jones (Gen. SAMUEL), b. in Virginia in 1820; graduated at West Point July, 1841, and appointed brevet second lieutenant of artillery, receiving his full commission the following September; promoted to be first lieutenant 1847, and captain 1853; 1841–45 was on frontier duty and in garrison; 1845–51 at West Point as professor and instructor; again on garrison and frontier duty 1851–58, when he was assigned to duty in Washington as assistant to the judge-advocate; resigned Apr. 27, 1861, and entered the Confederate service as colonel, rising to the grade of major-general 1862, and in 1864 commanded the department of South Carolina, Georgia, and Florida. G. C. SIMMONS.

Jones (SEABORN), b. in Augusta, Ga., 1788, and was sent to Princeton College for education, but returned before graduation in consequence of the failure of his father in mercantile business; studied law, and was admitted to the bar by special act of the legislature before he was twenty-one years of age; was solicitor-general of his judicial circuit in 1823; was a member of Congress 1833–35 and 1845–47. D. in Columbus, Ga., in 1874. He was a lawyer of great distinction in the State for half a century.
A. H. STEPHENS.

Jones (THOMAS AP CATESBY), b. in Virginia in 1789, was a brother of Gen. Roger Jones; entered the U. S. navy in 1805; was from 1808 to 1812 in the Gulf of Mexico, engaged in suppressing piracy, smuggling, and the slave-trade; was captured with his flotilla by a British naval expedition against New Orleans in 1814; commanded the Pacific squadron in 1842, when he took possession of Monterey in California, upon erroneous information of war existing between the U. S. and Mexico, for which he was temporarily suspended from the service. D. at Georgetown, D. C., May 30, 1858.

Jones (THOMAS RYMER), F. R. S., b. about 1810; educated at London and Paris, and entered on his profession as a surgeon in 1833, but by reason of deafness did not long practise; became in 1831 professor of comparative anatomy in King's College, London, and in 1840 Fullerian professor of physiology in the Royal Institution, and acquired fame as an eloquent lecturer. Author of *A General Outline of the Animal Kingdom* (1838), of papers in the *Cyclopædia of Anatomy and Physiology*, and various monographs.

Jones (THOMAS WHARTON), F. R. S., F. R. C. S., b. at St. Andrew's, Scotland, in 1808; was educated at Edinburgh; became in 1838 a surgeon of London; was professor of ophthalmic medicine and surgery in University College, London; and wrote *Ophthalmic Medicine and Surgery*, the Astley-Cooper prize essay on *Inflammation* (1850), the Actonian prize essay of 1851, *Physiology of Body, Sense, and Mind, Failure of Sight from Railway Accidents* (1869), etc.

Jones (Sir WILLIAM), M. A., F. R. S., b. in London Sept. 28, 1746; was educated at Harrow and Oxford; was tutor to Lord Althorp 1765–70; published a French translation of the (Persian) *Life of Nadir Shah* (1770), a *Persian Grammar* (1771); was made F. R. S. 1772; in 1774 was called to the bar and published *Commentaries on Asiatic Poetry;* became commissioner of bankrupts 1776; translated in 1780 the *Moállakat,* from the Arabic, and published some legal writings; became in 1783 a knight and judge of the supreme court of judicature of Bengal; founded the Asiatic Society of Bengal at Calcutta; wrote largely for the *Asiatic Researches;* published the *Enchanted Ring,* a poem, translations of the *Sakuntála* (1789), a translation of the *Institutes of Manu* (1794), a translation of Isæus; extracts from the Vedas, and tales, poems, legal works, etc. from the Indian languages. A devout Christian, a steady friend of constitutional liberty, a profound jurist and linguist, an elegant poet, Sir William's name is one of the brightest ornaments of English literary history. D. at Calcutta Apr. 27, 1794. (See his *Life*, by Lord Teignmouth, 1804.)

Jones (WILLIAM), F. R. S., generally called OF NAYLAND, b. at Lowick, Eng., July 30, 1726; was educated at the Charter-house and at Oxford, where he became a convert to the Hutchinsonian philosophy (see HUTCHINSON, JOHN); was ordained in 1749; became successively curate of Finedon, vicar of Bethersden, rector of Pluckley, of Paston, and of Hollingbourn, and perpetual curate of Nayland in Suffolk. In 1780 he was elected a fellow of the Royal Society. For many years he labored upon a general system of philosophy, based upon the works of Hutchinson, and he exercised considerable influence by his writings, being endowed with great learning, piety, and versatility, as well as an excellent style. D. Feb. 6, 1800. He wrote, among other works, *The Catholic Doctrine of the Trinity* (1753), *Physiological Disquisitions* (1781), *Art of Music* (1784), *Figurative Language of Scripture* (1787), *Life of Bishop Horne* (1795), and founded the *British Critic* (1793).

Jones (WILLIAM ALFRED), b. in New York June 26, 1817; graduated in 1836 at Columbia College, of which he was (1851–65) librarian. He is the author of many contributions to periodical literature, and has published *The Analyst* (1840), *Literary Studies* (1847), *Essays* (1849), *Characters and Criticisms* (2 vols., 1857), and other works.

Jones's Bluff, post-v. of Sumter co., Ala., on the Alabama and Chattanooga R. R., 10 miles from Livingston. Pop. of tp. 2134.

Jones'boro', tp. of Lawrence co., Ala. Pop. 1087.

Jonesboro', post-v. and tp., cap. of Craighead co., Ark., 49 miles N. W. of Memphis, Tenn. Pop. of v. 155; of tp. 2094.

Jonesboro', post-v., cap. of Clayton co., Ga., on the Macon and Western R. R., 20 miles S. of Atlanta; has manufactures of flour, furniture, etc., an academy, a weekly newspaper, 2 churches, some 35 business-houses, 2 hotels, and considerable cotton trade. Pop. 531.
C. P. VAUGHN & CO., PUBS. "NEWS."

Jonesboro', city, cap. of Union co., Ill., on the Illinois Central and the Cairo and St. Louis R. Rs., 36 miles N. of Cairo, in an elevated, well-timbered and watered region, abounding in good building-stone, and celebrated for its excellent and abundant fruit. It has a bank, 1 weekly newspaper, 3 churches, 2 hotels, stores, mills, and manufactories. Two miles to the N. E. there is a State insane asylum. Pop. 1108; of tp. 1577.
T. F. BOUTON, ED. AND PROP. "GAZETTE."

Jonesboro', post-v. of Grant co., Ind., on the Pittsburg Chicago and St. Louis R. R., 5 miles S. E. of Marion, has 4 churches, 2 hotels, a newspaper, etc. Chief business, agriculture, general trade, milling, and lumber-dealing. Pop. 581. N. W. WEDDINGTON, ED. "HERALD."

Jones'borough, post-tp. of Washington co., Me., 7 miles W. of Machias, at the head of Englishman's Bay. Pop. 522.

Jonesborough, post-v., cap. of Washington co., Tenn., the oldest town in the State, and the first State capital, has 5 churches, a fine court-house, 2 hotels, 3 newspapers, a female college, and a male institute, and is pleasantly situated on the East Tennessee Virginia and Georgia R. R. 100 miles E. by N. of Knoxville.
S. A. BUELL, FOR PUBS. "E. TENN. ECHO."

Jones'burg, post-v. of Montgomery co., Mo., on the North Missouri R. R.

Jones'port, tp. of Washington co., Me., 18 miles S. W. of Machias, on the W. side of Englishman's Bay. It has shipbuilding and lobster fisheries. Pop. 1305.

Jones'town, post-b. of Swatara tp., Lebanon co., Pa., 5 miles N. of Lebanon.

Jones'ville, a v. of McIntosh co., Ga. Pop. 99.

Jonesville, post-v. of Wayne tp., Bartholomew co., Ind., on the Jeffersonville Madison and Indianapolis R. R. Pop. 206.

Jonesville, post-v. of Hillsdale co., Mich., on the Michigan Southern R. R., at the junction of the Lansing division with the main line, and on the Fort Wayne Jackson and Saginaw R. R. It has a weekly newspaper, large woollen and cotton mills in successful operation, and important manufactures of carriages. Its mercantile interests are flourishing. It is 4½ miles N. W. of Hillsdale, the county-seat. JAMES I. DENNIS, PUB. "INDEPENDENT."

Jonesville, post-v. of Clifton Park tp., Saratoga co., N. Y. It is the seat of an academy. It is 3 miles from South Ballston Station on the Saratoga and Schenectady R. R.

Jonesville, post-tp. of Union co., S. C. Pop. 1809.

Jonesville, post-v., cap. of Lee co., Va., 28 miles N. of Rogersville, Tenn., has a flour-mill, steam saw-mill, 2 churches, a weekly newspaper, a male academy, 2 hotels, besides stores and shops. Chief industry, farming and mercantile pursuits. Pop. 274; of tp. 3369.
J. B. WEST, ED. "LEE CO. SENTINEL."

Jön'köping, town of Sweden, beautifully situated at

the southern extremity of Lake Wetter, and surrounded by pine-clad hills. It has large manufactures of arms and muskets. Pop. 11,751.

Jon′quil [Fr. *jonquille*, a dim. of Lat. *juncus*, a "rush"], a name given to *Narcissus Jonquilla* and *odorus* (order Amaryllidaceæ), garden plants blooming in spring. They are natives of the S. of Europe. The flowers of the fragrant sorts are employed in perfumery.

Jon′son (Benjamin), generally known as Ben Jonson, b. at Westminster, probably June 11, 1574, a short time after the death of his father. The details of his life before 1596 are uncertain, but they seem to have been very varied, like his faculties, and somewhat violent, like his passions. His mother married a master bricklayer, and for some time he worked with his stepfather as a mason. Later on he enlisted in the army, and made a campaign in the Low Countries. On his return he entered St. John's College, Cambridge, and studied classical languages and literature. In his twentieth year he went upon the stage, and tried to become an actor. At last his talent found its proper field. In 1596 appeared his *Comedy of Humors*, and in 1598 it was recast, and brought out with great success in the Globe Theatre under the title *Every Man in his Humor*. Then followed in 1599 *Every Man Out of his Humor;* in 1600, *Cynthia's Revels;* in 1602, the *Poetaster*, which involved him in a very sharp controversy with Decker; in 1603, *Sejanus*, a tragedy; in 1604, *Eastward Hoe*, written in connection with Chapman and Marston, for which he was imprisoned and threatened with having his nose and ears cut off; in 1605, *Volpone;* in 1609, *Epicæne, or the Silent Woman;* in 1610, *The Alchymist;* in 1611, *Catiline*, a tragedy; in 1616, *The Devil is an Ass;* in 1629, *New Inn, or the Light Heart;* but the last-mentioned comedy belongs to that part of his works which Dryden called his dotages. After his appearance in literature the life of Ben Jonson is tolerably well known, both in the inns and at court—his tournaments with Shakspeare and the other wits of his age in the Mermaid Tavern in Bread street, where Sir Walter Raleigh had founded the Mermaid Club; his throne-speeches on literary taste delivered at the fireside of the Devil's Tavern in Fleet street, where later on he himself founded the Apollo Club; and his "entertainments" or "masques," a kind of dramatic arrangement interspersed with songs and ballets which he wrote for the court festivals. In 1619, James I. made him poet-laureate, with a pension of 100 marks, and Charles I. increased the pension to £100, and added a tierce of canary. The last years of his life were nevertheless very clouded. He was poor—not because he had less than he needed, but because he used more than he had. He became bitter in spite of the great success he had achieved. He felt wretched. He d. Aug. 6, 1637, and was buried in Westminster Abbey, where his tombstone bears this rather queer inscription, "O rare Ben Jonson!" The *Sad Shepherd*, a poem which he left unfinished, as well as much in his "masques," seems to indicate that in its foundation his genius was not so very different from that of Shakspeare. But its development was another, and thereby it assumed almost an opposite character. While Shakspeare was a man with sporadical and incidental knowledge, but with wonderfully large and striking views, Ben Jonson appears to have possessed a compact mass of systematic knowledge, which led him to rather narrow views. Shakspeare's taste was the natural result of his genius; Ben Jonson's was the product of his learning. Hence the difference between them. It is singularly wrong to say that *Every Man in his Humor* was the first regular comedy in the English literature—exactly as wrong as if anybody would say that *Sejanus* was the first regular tragedy. But it is true that in the English literature Ben Jonson was the first who adopted the ideals of the classical literature with full consciousness of what he was doing, and carried them through with adequate talent. This his standpoint procured for him a great authority in the literary life of his age, but it made his genius declamatory in tragedy and satirical in comedy, thereby vastly diminishing its importance for coming ages. Soon after his death his works ceased to be a living influence; they became literary monuments, historical phenomena, and nothing more. Clemens Petersen.

Jonsson (Finn), b. at Hitardal, Iceland, Jan. 16, 1704; studied at the University of Copenhagen, and was appointed in 1754 bishop of Skalholt, where he d. July 23, 1789. His *Historia Ecclesiastica Islandica* (4 vols., Copenhagen, 1772–79) is a principal source of the history of the island.

Joodpoor′, Joudpour, or **Marwar,** a tributary state of India, the largest of Rajpootana, situated in the N. W. Provinces, between lat. 24° and 28° N. and lon. 70° and 75° E. Area, 35,672 square miles. It is divided into two unequal parts by the river Loonee, which flows into the Great Western Run of Cutch. The larger portion of Joodpoor, N. W. of the Loonee, is chiefly waste, being an extension of the desert of Scinde; the smaller portion, S. E. of that river, is fertile, well irrigated by torrents from the Mairwar Mountains, and produces excellent grain and cotton. Wild beasts and serpents abound; iron, salt, and marble are plentiful. The natives, mostly of the Jaina sect (which see), are skilful in the woollen manufacture and active in trade. Joodpoor is under the government of a native prince called *maharajah*, who pays a considerable annual tribute to the British government, which is virtually the ruler through the agent residing at the court. The population is about 1,800,000; the capital, also called Joodpoor, has a population variously stated at from 80,000 to 150,000. Pallee, 40 miles S. E. of Joodpoor, is the commercial metropolis, the seat of an active trade in opium. There are in Joodpoor several thousand villages of from 500 to 1000 houses each.

Jop′lin, city of Jasper co., Mo., near the S. W. corner of the county, has 2 banks, 2 weekly newspapers, graded schools, 26 smelting furnaces, and produces about 15,000,000 pounds of pig lead and 10,000,000 pounds of pig zinc annually. It is a thriving town; estimated pop., 8500 in 1874. G. D. Jackson, Pub. "Bulletin."

Joppa. See Jaffa.

Jor′daens (Jacob), b. at Antwerp May 19, 1594, was a pupil of Adam van Oort. His style, however, he formed principally after the Italians Paul Veronese and Caravaggio, though he never visited Italy, and after Rubens, with whom he is often compared. He liked to fill a large canvas with mythological and bacchanalian scenes, but his pictures are always less powerful in conception, less vigorous in design, and less brilliant in coloring than those of Rubens, and sometimes they are rather trivial. He worked with astonishing rapidity, and achieved a great fame; he is abundantly represented in all European galleries. D. at Antwerp Oct. 16, 1678.

Jordan [Heb. *Yarden;* Gr. Ἰορδάνης; called by the Arabian geographers *El-Urdon*, and more commonly *Esh-sheriah—i. e.* "the watering-place"], the principal river of Palestine and the most celebrated in biblical geography, takes its rise from the snows of Mount Hermon at the N. extremity of the Holy Land, and flows nearly due S. through the centre of that country to the Dead Sea. It has three principal sources: I. the *Leddan*, called by Josephus the Little Jordan, rising from a great fountain, the largest in Syria, at the base of the hill *Tell-el-Kâdy*, on which are the ruins of the ancient city Dan: II. the *Baniâsy*, rising at Banias (the ancient Cæsarea Philippi), 4 miles E. of Tell-el-Kâdy, from a vast cave now concealed by the ruins of a temple built by Herod; III. the *Hasbany*, rising at Hasbeiya, 12 miles N. of Tell-el-Kâdy, from a pool at the foot of a basalt cliff. The latter is the smallest of the streams, but is the longest and rises from the highest perennial source, 1700 feet above the level of the sea, while the fountain at Banias is 1147, and that at Tell-el-Kâdy but 647 feet above that level. The two higher torrents burst through narrow rocky ravines, and unite with the Leddan 4 or 5 miles below its source, forming the Jordan proper, which, 6 miles below, falls into Lake Huleh, called in the Bible the "waters of Merom." From Lake Huleh the Jordan descends with rapidity and violence in a tortuous channel, over a rocky bed with many cataracts, and falling nearly 800 feet within a compass of 11 miles of latitude, enters the Sea of Galilee, otherwise called Gennesaret and Tiberias, now *Bahr-el-Tubariyeh*. The former lake is 120 feet *above* the level of the sea, the latter 650 feet *below*. In its remaining course from the Sea of Galilee to the Dead Sea the Jordan falls nearly 700 feet more—a strange and almost incredible fact had it not been established by careful measurement, the explanation of which is to be found in the extremely tortuous course of the river, which within 60 miles of latitude traverses at least 200 miles and has 27 considerable rapids. The whole lower stream, or Jordan proper, then, is many hundred feet below the sea-level, which fact alone would make this region unique as a geographical and geological phenomenon. The valley, now called *El-Ghor*, is about 6 miles wide at the northern end, expanding to 12 miles at the southern, is generally level and shut in between steep parallel chains of mountains from 3000 to 5000 feet high. Small portions in the N. are alone cultivated, the rest is desert, "in spring covered with rank grass and thistles, but in summer parched and bare. The southern section, known as the Plain of Jericho, is covered with a white nitrous crust, like hoar-frost, through which not a blade of grass nor green herb springs." In the midst of this plain the Jordan has cut through the chalky strata a winding ravine varying from 200 yards to half a mile in breadth and from 40 to 150 feet in depth. Five miles below the Sea of Galilee it receives its largest tributary, the *Sheriat-el-Mandhur* (Hieromax of the Greek

geographers), a stream from the E. scarcely inferior to the Jordan, 130 feet wide at its mouth; and about halfway between the lakes the Jabbok (Wady Zerka) enters from the mountains of Gilead on the E., being the only other considerable tributary. There are only two bridges over the Jordan now in existence: one, 2 miles S. of Lake Huleh, of the time of the Crusades, called *Jisr Benat Yakub*, "the bridge of Jacob's daughters," has been from time immemorial the leading pass from Western Palestine to Damascus; the other, *Jisr-el-Mejamia*, a quaint Saracenic structure, is 2 miles below the mouth of the Hieromax, and formerly connected the great city of Scythopolis (Bethshean, now *Beisan*) with the Decapolis. The principal fords above the Zerka are one just below the Lake of Galilee, which must have been traversed by Christ, and that of Succoth, 15 miles below the lower bridge. The latter was undoubtedly the ford by which Abraham and Jacob crossed; it was also probably the *Bethabara* of John's baptism and of the slaughter of the Midianites and the Ephraimites (Judg. vii. and xii.). Ten miles below the Zerka is a noted ford on the road from Nablous (Shechem) to Es-Salt, and there are two others near the "pilgrims' bathing-place" in the Plain of Jericho. One of the latter must have been the scene of the miraculous crossing of the Israelites under Joshua and of the similar miracles recorded of Elijah and Elisha (2 Kings ii. 8, 14), and the same spot is traditionally regarded as the scene of Christ's baptism. At its mouth the Jordan is 540 feet wide and 1316 feet below the level of the sea. The valley of the lower Jordan abounds in slime-pits, and thermal springs are frequent, with many other indications of former volcanic or igneous action. Dark basalt is the principal rock in the upper region—trap, limestone, sandstone, and conglomerate in the lower. Cane, oleanders, willows, tamarisks, hollyhocks, and thistles form the most noticeable trees and plants; lions, tigers, and wild-boars formerly made their haunts in the thickets along the river's edge. The course of the Jordan was in 1847 partially explored by Lieut. Molyneux of the British navy (*Journal Roy. Geog. Soc.*, vol. xviii.), more thoroughly by Lieut. Lynch of the U. S. navy in 1848 (see his *Official Report*), and later by MacGregor (1868–69) in his Rob Roy canoe. (The best sources of information are Robinson's *Biblical Researches*, the geographical works of Von Raumer, Ritter, and Petermann, Stanley's *Sinai and Palestine*, and the recent publications of the British Palestine Exploration Society. See also able articles in Kitto's, Smith's, and McClintock and Strong's *Biblical Cyclopædias*, and article PALESTINE in this work.) PORTER C. BLISS.

Jordan, tp. of Whitesides co., Ill. Pop. 1196.

Jordan, tp. of Jasper co., Ind. Pop. 327.

Jordan, tp. of Warren co., Ind. Pop. 448.

Jordan, tp. of Fillmore co., Minn. Pop. 683.

Jordan, post-v. of Scott co., Minn., on the St. Paul and Sioux City R. R., 8 miles S. W. of Shakopee. It has 1 weekly newspaper.

Jordan, a v. of Croghan tp., Lewis co., N. Y., on Oswegatchie River; has manufactures of leather.

Jordan, incorporated v. of Onondaga co., N. Y., on the Erie Canal and New York Central R. R., N. branch, 17 miles W. of Syracuse, in the N. W. corner of the town of Elbridge; has a weekly newspaper, a banking-house, academy, 4 churches, 13 stores, flouring-mill, 2 manufactories which turn out yearly 30,000 wheelbarrows and 15,000 hand-sleds, a straw-board mill, furnace, machine-shop, 2 cooper-shops, pump-factory, 2 wagon manufactories, fine water-power, etc. Pop. 1263.
H. P. WINSOR, ED. "TRANSCRIPT."

Jordan, tp. of Clearfield co., Pa. Pop. 561.

Jordan, tp. of Lycoming co., Pa. Pop. 473.

Jordan, tp. of Northumberland co., Pa. Pop. 924.

Jordan, post-tp. of Green co., Wis. Pop. 1083.

Jordan (CAMILLE), b. at Lyons Jan. 11, 1771, and played a very conspicuous part in French politics during the Revolution and the Restoration. He was a decided enemy of the republican government, and one of the most active promoters of the insurrection of Lyons. After the fall of that city (Oct. 9, 1793) he fled to Switzerland, whence he went to London. Having returned to Lyons in 1796, he was elected a member of the Council of Five Hundred, but had to flee a second time after the revolution of Sept. 4, 1797. He went to Germany, and lived in Weimar. In 1800 he was recalled, and showed himself strongly opposed to the measures of the First Consul. But Napoleon chose not to notice him, and during the Empire he lived in retirement, engaged in literary pursuits. After the restoration of the Bourbons he at first sided with the government, but when in 1820, after the assassination of the duke of Berry, an attempt was made by the ministry to suspend the liberty of the person, to suppress the freedom of the press, and to change the elective system, Jordan became the parliamentary leader of the opposition. He died, however, soon after (May 19, 1821). His writings consist mostly of pamphlets written with great courage and eloquence, and illustrative of the situation of the moment. (See Saint-Beuve, *Camille Jordan et Madame Staël*, 1868.)

Jordan (CHARLES ÉTIENNE), b. at Berlin Aug. 27, 1700, of a French family; studied at Magdeburg and Geneva; was appointed minister to the French Reformed church of Potzlow in 1725, but resigned his office in 1732, after the death of his wife; made a literary journey in Holland and France; accompanied the Prussian crown prince in his exile at Rheinsberg; and continued from that time to his death (May 14, 1745) to be the friend and companion of Frederick II. From this circumstance his *Histoire d'un voyage littéraire* and his *Correspondance avec Frédéric II.* derive some interest.

Jordan (DORA), b. near Waterford, Ireland, about 1762, was an actress in London towards the close of the eighteenth century, when she became the mistress of the duke of Clarence, afterwards King William IV. By him she had ten children, but the connection ceased some time before her death, which occurred at St. Cloud, France, July 3, 1816. Her *Memoirs* were published by J. Boaden in 1831. It has been asserted that Mrs. Jordan did not die in France at the above date, but resided for several years under an assumed name in England.

Jordan (RUDOLPH), b. at Berlin in 1810, and began his artistic studies in that city, but received his style in the school of Düsseldorf. He has painted scenes from the coasts of Normandy, the Dutch islands, Heligoland, Rügen, etc., and one of his pictures, *Marriage Proposal in Heligoland* (1834), has become widely known.

Jordan (THOMAS), b. in the Luray Valley, Va., Sept. 30, 1819; graduated at West Point, and entered the army as brevet second lieutenant of infantry July 1, 1840; second lieutenant Dec., 1840; in the war with the Seminoles (1842) captured their leading chief, Tiger Tail; in the war with Mexico engaged at Palo Alto and Resaca de la Palma; appointed captain and quartermaster Mar. 3, 1847, serving as such on the Pacific coast 1852–60. Resigned May, 1861, to follow the fortunes of his native State, entering her service as lieutenant-colonel, and at once assigned as adjutant-general of Confederate forces assembling at Manassas Junction. As chief of staff accompanied Gen. Beauregard to Tennessee, and was appointed brigadier-general from date of the battle of Shiloh; temporarily on staff of Gen. Bragg, but resumed his position with Beauregard during the defence of Charleston, 1862–64. Immediately after the war published in *Harper's Magazine* a critical review of Confederate operations and administration; subsequently (1866) was editor of the *Memphis Appeal*. Invited to organize the military resources of the Cuban revolution, was made chief of general staff of that army, and second in command (1869), succeeding to chief command Dec., 1869, and fought a largely superior force Jan. 1, 1870, inflicting heavy loss. Seeing no probability of being able to organize an effective force, and the supply of arms and ammunition running low, he resigned Feb., 1870, and returned to the U. S., where he is mostly engaged in literary pursuits. Author of *Campaigns of Lieut.-Gen. Forrest* (1867).

Jordan River, in Utah, flows from Utah Lake, some 45 miles, in a northward course into the Great Salt Lake. It is small and not navigable, but is capable of irrigating a large extent of country. Its waters contain numerous species of small fish.

Jordan's, tp. of Coosa co., Ala. Pop. 568.

Jornan'des, or **Jordanes,** the historiographer of the Goths, was himself a Goth by birth, and lived in the middle of the sixth century. Having been converted to Christianity, he became a monk, and tradition makes him bishop of Crotona. He wrote two historical works which have come down to us—*De regnorum ac temporum successione*, an outline of the history of the world to the time of Justinian; and *De Getarum sive Gothorum origine et rebus gestis*, a history of the Goths from the origin of the people to the fall of the Ostrogothic empire in Italy. The former is of very little interest, but the latter is invaluable. It is the principal, nearly the only, source of the history of the Goths and of the great migration of the nations. The history of the Goths had been written before by Cassiodorus, Ablavius, and Dion Cassius, but these works are lost, and we know them only from extracts made by Jornandes. The best critical edition of his works is that by Closs (Stuttgart, 1861).

Jortin (JOHN), D. D., b. in London Oct. 23, 1698; studied at the Charter-house and at Jesus College, Cambridge, of which he became a fellow after graduating in 1719. While at college he made extracts from Eustathius for the

use of Pope in his translation of Homer, and became noted for his facility in Latin verse, of which he published a volume (*Lusus Poetici*, 1722). Taking orders in the Church of England he was presented to the living of Swavesey near Cambridge (1726), but soon after removed to London, and became a much-admired pulpit-orator, being successively rector of Eastwell (Kent), of St. Dunstan's-in-the-East, domestic chaplain to the bishop of London (1762), prebend of St. Paul's, rector of Kensington, and archdeacon of London (1764). He was author of numerous learned philological, critical, and theological works which have maintained a high reputation, among which were *Truth of the Christian Religion* (1746), *Life of Erasmus* (1758–60), *Sermons* (4 vols., 1771), *Six Dissertations upon Different Subjects* (1772), *Remarks upon Authors Ancient and Modern* (1731–32), *Remarks on Ecclesiastical History* (5 vols., 1751–73), and *Tracts, Philological, Critical, and Miscellaneous* (1790). D. at Kensington Sept. 5, 1770.

Jorul'lo, a volcano of Mexico, in the state of Michoacan, in lat. 19° 10′ N. and lon. 101° 1′ W. From a plain having an elevation of 2890 feet it was suddenly lifted to a height of 4265 feet on Sept. 28, 1759. Several of its cones soon subsided, however, and it is now nearly extinct, discharging only a little vapor, and is nearly covered with forests.

Jo'seph [Heb. *Yoseph*, "increaser"], one of the twelve patriarchs, the elder son of Jacob and Rachel, b. at Haran, in Syria (Padan-Aram), about B. C. 1913; was the favorite son of his father, and envied by his brethren on that account. Their enmity was further excited by two dreams which Joseph related when about seventeen years of age, in which his future greatness was foreshadowed, and this led them to sell him as a slave to some Midianite traders, by whom he was carried into Egypt and sold to Potiphar, an officer of the king. He acquired the confidence of his master, who set him as overseer over all his property, but having repelled dishonorable proposals made to him by his mistress, she accused him falsely to her husband, and caused him to be thrown into prison. Here he interpreted the dreams of two of his fellow-prisoners, the chief baker and chief butler of Pharaoh, and when his predictions had been justified by the result, he was summoned by King Pharaoh, at the instance of the butler, to interpret two dreams which portended seven years of prosperity followed by seven of famine. The king was so much struck by the wisdom of the advice given by the young Hebrew that he adopted all his suggestions for making preparations for the time of famine, and appointed him ruler over the whole land. The measures taken by Joseph as vizier or viceroy resulted greatly to the advantage of the king and of his people, securing an abundant provision for the time of famine. This calamity extended also to the adjoining countries, and led to the brethren of Joseph being sent into Egypt to buy corn. Joseph recognized his unnatural brethren, and after a series of stratagems, by which he reminded them of and punished them for their crime, the whole family was brought into Egypt and established in the land of Goshen. Joseph married a daughter of the high priest of On (Heliopolis), and had two sons, Manasseh and Ephraim, who became the progenitors of the tribes bearing those names, the most powerful of the future kingdom of Israel. Joseph preserved his authority until his death, which occurred B. C. 1802, at the age of 110. His body was embalmed, and at the time of the Exodus was carried to Palestine and buried at Shechem, where his tomb is still shown.

Joseph, the husband of Mary and reputed or legal father of Jesus, was a resident of Nazareth in Galilee, though a descendant of David, and connected by his immediate ancestry, perhaps by birth, with Bethlehem in Judah. His genealogy is given both by Matthew and by Luke, but in the former Gospel he is called the son of Jacob, and in the latter the son of Heli. Various hypotheses have been proposed to reconcile this discrepancy, the most general being that one of the genealogies is really that of Mary. Joseph was a carpenter, and is supposed to have educated Jesus to his own trade. Little can be ascertained of his character or personal history beyond the well-known circumstances of the announcement made to him by an angel in a dream of the miraculous conception of the Christ, his journey to Bethlehem, flight into Egypt, and return to Nazareth. The last glimpse of Joseph is found in the incident (Luke ii. 42–52) of Jesus when twelve years of age being found with the doctors in the temple. He is represented by early tradition to have been an old man at the birth of Jesus, and apparently had died before the public ministry of Christ began.

Joseph, king of Naples and of Spain. See BONAPARTE (JOSEPH).

Joseph (FATHER), b. in Paris, France, Nov. 4, 1577, his original name being FRANÇOIS LECLERC DU TREMBLAY. He belonged to a distinguished family, travelled much in his youth, and served in the army under an assumed name, after which he took holy orders and attained a high position as a Capuchin friar. Attracting the attention of Cardinal Richelieu, that statesman made Father Joseph his secretary and confidential adviser. In this capacity he wielded immense influence and power for many years. He despatched missionaries to Canada and the East, advocated in a Latin poem a crusade against the Turks, and left several volumes of memoirs, which are still in manuscript in the National Library of Paris. A cardinal's hat was solicited and obtained for him by Richelieu, but before it was actually conferred he d. at Rueil Dec. 18, 1638.

Joseph I., German emperor, b. at Vienna July 26, 1678; was crowned king of Hungary 1687; king of the Romans 1690; succeeded to his father, Leopold I., 1705. The great events of his reign were the putting of the electors of Cologne and Bavaria under the ban (1706) and the seizure of their states; the conquest of Naples under Daun, the successful revival (1707–08) of the imperial claims to the great fiefs of Italy, and the victories of Marlborough and Eugene in the war of the Spanish succession. D. Apr. 17, 1711.

Joseph II. of Germany, b. Mar. 13, 1741, was the son of Francis I. and Maria Theresa; was fond of learning, and became a professed philanthropist; succeeded his father in 1765; took part in the first partition of Poland 1772; succeeded his mother in Hungary and Bohemia 1780; attempted the wholesale reformation of all the empire and his kingdom by edicts abolishing serfdom, declaring for religious liberty, the reform of jurisprudence, the abolition of monasteries, etc.; but as the means employed were violent and unusual, and the changes but ill adapted to the state and feelings of the people, nearly all classes, led by nobles and priests, joined in the opposition, and the emperor (who, though theoretically a friend of reform, was not a just man) was compelled to yield (1790) and withdraw his novel measures. D. Feb. 20, 1790.

Josephine', county of the S. W. of Oregon, bounded on the S. by California. Area, about 1100 square miles. Much of its surface is mountainous. The Rogue River Valley is very fertile. Gold, iron, and copper are found. Cap. Kerby. Pop. 1204.

Josephine, empress, first wife of Napoleon I., originally named MARIE JOSEPH ROSE DE TASCHER DE LA PAGERIE, b. at Trois Islets, in Martinique, West Indies, June 24, 1763; was married in 1779 in France to the Vicomte de Beauharnais, in consequence of an early betrothal by her father. The union was not a very congenial one. She became the mother of Eugène Beauharnais and of Hortense, the mother of Napoleon III. The vicomte was executed by the Jacobins in 1794, and Josephine's life was saved with some difficulty by Madame Tallien, who rescued her from prison in 1794. In 1796 she married Gen. Napoleon Bonaparte, then a rising officer, afterwards appointed to the chief command in Italy. The match was prompted by mutual love, and was long a union of great happiness to both. In 1804 she was crowned empress, and both before and after that event Josephine's wisdom and talents, and the affection with which she was popularly regarded, did much to strengthen Napoleon's position in France. But the fact that the union was childless was likely to be fatal to Napoleon's ambition to become the founder of an imperial line; and in 1809 she was divorced, and retired to Malmaison, where she d. May 29, 1814.

Jose'phus (FLAVIUS), b. at Jerusalem in 37 A. D., of a noble and wealthy family; after passing through the schools of the three different Jewish sects, and spending three years in the desert with the hermit Banus, he adopted the views of the Pharisees as most congenial to his shrewd, ambitious, and worldly character, and he soon attained a prominent position in Jewish society. In 63 A. D. he was sent to Rome on a diplomatic errand, and was introduced to the empress Poppœa, who favored the Jews, by a Jewish actor belonging to the troupe of Nero. He accomplished his mission with success, and returned with great honor to Jerusalem. During the Jewish revolution he commanded in Galilee, and escaped the massacre after the capture of Jotapata. He fell, nevertheless, into the hands of the Romans, but saved himself by predicting the future elevation of Vespasian to the imperial throne. He was present in the Roman army at the destruction of Jerusalem, and accompanied Titus to Rome, where he resided for the rest of his life. As long as the Flavian family, in honor of which he adopted the name of Flavius, occupied the throne, he lived in great splendor. Of his life after the death of Domitian (96 A. D.) very little is known, and the date of his own death is uncertain, though it is probable that he was still living in 103 A. D. Of his works the following have come down to us: Περὶ τοῦ Ἰουδαϊκοῦ πολέμου, a history of the Jewish war from 170 B. C. to the destruction of Jeru-

salem, originally written in Syro-Chaldæan, which version is lost, but translated into Greek by himself; Ἰουδαϊκὴ Ἀρχαιολογία, a history of the Jews from the Creation to 66 A. D.; Βίος, an autobiography; and a work against Apion. The best editions are those by Dindorf (Paris, 1845) and Bekker (Leipsic, 1855), and of the *Jewish War* separately by Cardwell (Oxford, 1837). Complete translations into English have been given by Lodge (1602), L'Estrange (1702), Whiston (1737); and of the *Jewish War* separately by Robert Traill (1847).

Josh Bell, south-easternmost county of Kentucky, having Virginia on the E. and Tennessee on the S. Area, about 480 square miles. It is a rugged mountain-region. The valleys produce corn and tobacco. The county is traversed by the Cumberland River, and contains coal and iron. Cap. Pineville. Pop. 3731.

Josh'ua [Heb. *Yehoshua*, "Jehovah his helper"], originally called *Hoshea*, a Hebrew general, the successor of Moses in the leadership of the chosen people and the conqueror and ruler of Palestine. He was the son of Nun, of the tribe of Ephraim, b. in Egypt not far from B. C. 1698, as he was about forty years old at the time of the Exodus. He first appears in the biblical record as commander of the Israelites in their victorious engagements with the Amalekites at Rephidim (B. C. 1658). In the account of Moses' ascent of Sinai for the tables of the law, Joshua appears as his "servant" or "minister," accompanying him in a part of the ascent, and first meeting him on the descent. He was one of the twelve "spies" sent to explore the land of Canaan, and one of the two (the other being Caleb) who reported favorably upon the country, for which reason they alone of all the adult Israelites were spared to enter the Promised Land. Moses was divinely directed shortly before his death to confer upon Joshua the chief authority over the people, and a solemn charge from Jehovah was addressed to him from the lips of the dying founder of the Hebrew commonwealth. In his eighty-fifth year Joshua led the chosen people dry-shod through Jordan (Josh. iii. 17); fortified a camp at Gilgal, where he set up twelve stones from the midst of Jordan as a memorial of miraculous assistance; kept a solemn Passover, on which occasion the daily fall of manna ceased; and received a visit (Josh. v. 13) from a mysterious personage called the "captain of the host of Jehovah," who pronounced the ground whereon he stood holy. Who was this "captain" has been greatly disputed, the most orthodox commentators often identifying him with the second person of the Trinity. Joshua led the Israelites in the taking of Jericho and of Ai, miraculously assisted in both cases, as he was some time later in the celebrated battle with the five kings of the Amorites, when, in the language of the author of the poetical book of Jasher, he commanded, "Sun, stand thou still upon Gibeon, and thou, Moon, in the valley of Ajalon," and was obeyed, giving him time to finish the destruction of his enemies. No miracle recorded in the Bible has occasioned greater diversity of opinion or has been received with greater incredulity. Many modern orthodox writers conclude that it is unnecessary to suppose an actual stopping of the sun's course, and find a sufficient explanation in the fact that the account is quoted from a poetical work not now preserved, and therefore presumably neither inspired nor infallible in matters of fact, even supposing the intention to have been to chronicle an actual occurrence. Joshua inscribed the Law upon Mount Ebal; in six years overran Canaan in its whole length from S. to N., destroying thirty-one kings, but leaving many isolated strongholds in the hands of the Canaanites; divided the land among the tribes; appointed six cities of refuge and forty-eight Levitical cities; set up the tabernacle at Shiloh, and dismissed the trans-Jordanic tribes to their homes. He fixed his own residence at Timnath-Serah in Mount Ephraim, and after judging the people twenty-two years convoked an assembly of the elders at Shechem, delivered two solemn addresses, and caused them to renew their covenant with Jehovah, after which he d. at the age of 110 years (B. C. 1593), and was buried in Timnath-Serah (*Tibneh*), where M. de Saulcy and M. de Guérin have, as they believe, recently discovered his tomb. The career of Joshua has been noticed by many biblical commentators as one of the few recorded in some detail without any blemish being imputed. Many are loath to justify his wholesale slaughter of the Canaanites, but if they believe such action to have been commanded by Jehovah, they cannot logically condemn him for the execution of divine vengeance. Others, disbelieving the reality of such command, may, and perhaps do, upon their own principles, doubt the reality of the acts of extermination imputed to him. The name Joshua is in Hebrew the same as *Jesus* in Greek; in one passage in the New Testament (Heb. iv. 8) he is alluded to by that name, and evidently regarded as a type of Christ. PORTER C. BLISS.

Joshua, tp. of Fulton co., Ill. Pop. 1175.

Joshua, Book of, the sixth canonical book of the Old Testament, immediately following Deuteronomy, so called because it is devoted to the history of the conquest and division of Canaan under the auspices of Joshua, and closes with his death. It may be divided into two equal parts, called respectively the historical and the geographical—the first (chaps. i.–xii.) containing the record of the conquest; the second (chaps. xiii.–xxiv.) the division of the land among the tribes. The second part has been compared to the Doomsday Book of England, from the minuteness of the boundaries laid down, thus affording so exact an account of the principal cities, towns, and villages of Canaan, fifteen centuries B. C., that the researches of the Palestine Exploration Society, now (1875) engaged in a topographical survey of Palestine, are largely and successfully directed to the verification of the data of the book of Joshua. The authorship and date of the book cannot be considered as settled, nor is it probable that they can ever be accurately ascertained. Early commentators, patristic, Catholic, and Protestant, usually assigned the book to Joshua himself, except the last chapter, which records his death, but apparently for no better reason than because no other author could be designated by name and date. By modern orthodox critics it is generally assigned to an unknown writer of a period immediately subsequent to the death of Joshua. The school of De Wette and Ewald is much divided upon the questions affecting the unity and integrity of the book, and a great variety of opinions is still maintained; most of them, however, allege passages which they regard as contradictory, or at least as betraying diversity of authorship. The chief English representative of this view is Dr. Samuel Davidson in his *Introduction to the Old Testament*, who assigns the chief authorship to a writer of the age of Saul. The commentaries on Joshua are numerous; it will be sufficient to name as of special value for geographical data those of Keil (1847, Edinburgh translation 1857), Knobel (1861), and Dr. H. Crosby (New York, 1874) in Lange's series, edited by Dr. Schaff. There is a so-called Samaritan book of Joshua, written in Arabic during the Middle Ages, consisting of a compilation from the canonical book, interwoven with strange legends having Joshua for their hero, forming part of a chronicle of Samaritan history down to the Jewish war of Adrian. It was edited with a Latin translation from the only known manuscript (which once belonged to Joseph Scaliger) by G. J. Juynboll, *Liber Josuæ: Chronicum Samaritanum* (Leyden, 1848). The modern Samaritans are entirely ignorant of this compilation, though it was evidently written in the interest of their religious ceremonials and traditions as opposed to those of the Jews.

Josi'ah [Heb. *Yoshiyah*, "healed by Jehovah"], the sixteenth king of Judah after its separation from the kingdom of Israel, the son and successor of Amon. He began to reign at the age of eight years, about B. C. 640, and, reversing the conduct of his father, "did that which was right in the sight of the Lord." The reign of Josiah was at a critical period in the history of Judæa, and he is expressly said to have attained a higher standard of religion than any of his predecessors or successors. In this he was aided by several prophets, who exercised great influence upon the measures of his government during his minority. At sixteen years of age Josiah began to take vigorous measures against idolatry, then very prevalent in the land, breaking down altars, temples, and images. Especially the ancient idolatrous temple at Beth-El, in the northern kingdom, was thus purified, burning upon the altar the bones of the recreant priests of former generations found there in the sepulchres, in accordance with a prophecy delivered 345 years before (1 Kings xiii. 2). How Josiah came to exercise jurisdiction in the northern kingdom at this time is not known; it has been thought that the Assyrian king, his feudal lord, may have conferred the government of Samaria upon him. Two years later, Josiah undertook the repair and renovation of the temple, which had been so long neglected that the holy books had fallen into oblivion. The high priest Hilkiah (according to some, the father of the prophet Jeremiah) found in the sanctuary the "Book of the Law"—*i. e.* either the whole Pentateuch or the book of Deuteronomy—and the people were convoked to hear it read in the temple, after which the ancient covenant vows were renewed, and a Passover celebrated with such pomp and precision as had not been seen for centuries. During the reign of Josiah a horde of Scythians conquered the Assyrian empire, and a column of their forces penetrated through Palestine on their way to Egypt. In the historical books of the Old Testament no mention is made of this circumstance, but the prophecy of Zephaniah alludes to it, and Ewald thinks the fifty-ninth Psalm to have been written by Josiah during a siege of Je-

rusalem by the Scythians. In the thirty-first year of Josiah, Pharaoh-necho, king of Egypt, landed an army in Northern Palestine to make war against the Assyrian empire on the Euphrates. Josiah rashly attacked him at Megiddo, was defeated with great slaughter, and was himself mortally wounded. D. at Jerusalem about B. C. 609.

Jo'sika (Miklós) was b. at Torda, Transylvania, Sept. 28, 1796; studied law; served 1811-18 in the Austrian army; lived then on his estates, engaged in agricultural, political, and literary pursuits; took part very actively in the Hungarian rising in 1848; fled in 1850 to Brussels, and lived afterwards in Dresden, where he d. Feb. 27, 1865. Inspired by Walter Scott, he wrote a great number of novels treating Hungarian life and history, most of which have been successfully translated into German. Four volumes of memoirs appeared at Pesth shortly before his death.

Josquin' Desprez' (Jodocus Pratensis), b. about 1450; served from 1471 to 1484 in the choir of Sixtus IV. at Rome and then in the choir of Louis XII. at Paris; received a benefice, and d. in 1531 in his native town, Condé. He wrote a great number of masses, motets, and songs, which were highly appreciated, not only at the court of Louis XII., but in the circles of Luther, and he is generally considered as the greatest composer before Palestrina.

Jos'selyn (John), a native of Kent, England, visited New England in 1638, and again 1663, remaining there eight years. Returning to England in 1671, he published three works on America: *New England's Rarities Discovered* (1672), *An Account of Two Voyages to New England* (1674), and a *Chronological Table of the most Remarkable Passages from the First Discovery of the Continent of America to 1673*, appended to the above. The first of these works gives a picture of Boston in 1663; it was reprinted in this country in 1865, with notes by Edward Tuckerman.

Jost (Isaak Markus), b. at Burnburg, in the duchy of Anhalt, Feb. 22, 1793, of Jewish parentage; studied at Göttingen and Berlin; became teacher at a Jewish school in the latter town in 1816, and removed to Frankfort in 1835. D. Nov. 25, 1860. He translated the Mishna into German (6 vols., 1832), and wrote *Geschichte der Israeliten* (9 vols., 1820), besides several other works relating to the history of the Jews.

Jo'tuns, or **Jætten,** form one of the most peculiar but also one of the most interesting elements of the Scandinavian mythology; they were the evil principle. Some of the traits under which they were imagined seem to have a historical origin, and refer to the oldest inhabitants of the Scandinavian countries, the Finns and Lapps, who were driven back by the Teutonic invaders to the northernmost parts of Norway and Sweden. In other respects the Jotuns appear to be mere creations of the imagination, symbolizing in a vague, general way, and under a most fantastic imagery, the dumb powers of nature. They were giants, and immensely strong, yet they could be conquered even by men, for they were only half intelligent. Their intelligence arose from their native malignity, and assumed generally the form of witchcraft. From Jotunheim or Niflheim, the home of darkness and dulness, they waged perpetual war against the Æsir, the bright gods of Valhalla; and although they always were defeated, great calamities to the human race ensued from this warfare. Their part is most conspicuous, however, at the opening and at the close of the world's drama. Odin slew Ymer, the first Jotun, and built the world from his body—the mountains and rocks of his bones, the earth of his flesh, the ocean of his blood, the sky of his skull, and the clouds of his brain. At the end of time Ymer's offspring will take revenge, slay all the Æsir, burn Valhalla, and destroy the earth; after which event the All-father will restore the universe and establish a higher and nobler rule than that of Odin. But the former of these fictions is evidently the work of an individual imagination—it is poetry, and not mythology—and the latter is as evidently a reflex of Christianity.

Clemens Petersen.

Joubert' (Barthélemy-Catherine), b. at Pont-de-Vaux, department of Ain, in 1769; signalized himself by his republican convictions, and was considered as the only man able to counteract Bonaparte's ambition, and to become the chief of a definitely established republic of France. But he was killed at the age of thirty, at the battle of Novi, where his army was defeated by Souvarow. Joubert had enlisted in 1791 as a volunteer, and was promoted on the battlefield, in 1795, to the rank of general of brigade. When he had the command in chief of the French armies in Northern Italy he hastened to proclaim the revolution in Piedmont. He contributed largely to the success of Bonaparte in the battles of Montenotte, Mondori, and Rivoli.

Félix Aucaigne.

Jou'ett (James E.), U. S. N., b. in 1826 in Kentucky; entered the navy as a midshipman Sept. 10, 1841; became a passed midshipman in 1847, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866, a captain in 1874. On the night of Nov. 7, 1861, Lieut. Jouett, in command of the first and second launches of the U. S. frigate Santee, carried, by boarding, the armed schooner Royal Yacht in the harbor of Galveston, Tex., after a very obstinate fight, in which he was twice severely wounded. At the battle of Mobile Bay he commanded the steamer Metacomet, and distinguished himself by his coolness and intrepidity. Rear-admiral Farragut, in his official report of the battle, says: "Our little consort, the Metacomet, was also under my immediate eye during the whole action up to the moment I ordered her to cast off in pursuit of the Selma. The coolness and promptness of Lieut.-Com. Jouett throughout merit high praise; his whole conduct was worthy of his reputation."

Foxhall A. Parker.

Jouffroy' (Theodore Simon), b. at Les Pontets, department of Doubs, France, in 1796; educated at the College of Dijon; initiated into the study of philosophy by Victor Cousin, and held different positions as teacher of philosophy at different educational and scientific institutions of Paris, where he d. Feb. 4, 1842. He translated Dugald Stewart's *Outlines of Moral Philosophy* and all the writings of Dr. Reid into French, and thereby became the medium of a lively intercommunication between the Scotch and the French philosophy. Of his own numerous works, all of which are without any striking originality, but clear and instructive, the *Cours de droit naturel* and some essays have been translated into English.

Jouffroy d'Arbans, de (Claude François Dorothée), Marquis, b. in Franche-Comté, France, about 1751; was in his early manhood (1772) a captain of infantry. During an exile of two years in Provence he studied the navigation of sailing vessels, and prepared notes for a work on that subject. The sight of Chaillot's fire-engine (1775) suggested to him the application of steam to navigation. He developed his idea by consultation with Perier and other men of science, and with the assistance of a village coppersmith made a small steam-propeller, which he placed on the river Doubs in June, 1776, but the experiment had only partial success. Continuing his mechanical studies in spite of ridicule, Marquis Jouffroy constructed another vessel, which had better success, in 1780, and in 1783 he had so far perfected the invention as to place upon the river Saône at Lyons a small steamboat which on July 15, 1783, stemmed the current of the river in the presence of the members of the Lyons Academy. Still, the vessel was too defective to be available for purposes of actual navigation. The inventor solicited a patent, which was refused by the French government (Jan. 31, 1784), in consequence of an adverse report made by the Academy of Sciences after an examination of the vessel. At the outbreak of the French revolution Jouffroy emigrated to England, served in the army of Condé, and took part in political intrigues in favor of the Bourbons. Returning to France under the Consulate, he became acquainted with Fulton, who after some controversy acknowledged the merits of the experiments made in 1783, claiming for himself only an improvement in the engine. In 1816, Jouffroy obtained a patent, formed a company under the auspices of the count of Artois, published his book, *Les bateaux-à-vapeur*, and addressed a memoir to the Academy. On Aug. 20 of that year he launched on the Seine a steamer, the Charles Philippe, but it could not compete with rival enterprises of the same kind. After this the marquis passed the remainder of his life in complete oblivion, dying of cholera at the Hôtel des Invalides, Paris, in 1832.—His son Achille, b. about 1790, was a voluminous political and historical writer of the Ultramontane school. He wrote an account of his father's inventions (1839), and devoted himself to experiments on steamboat and railway propulsion, without practical success.

Jougs, Joggs, or **Juggs,** an instrument of punishment formerly employed in Scotland, the Netherlands, etc., was simply an iron collar placed around the culprit's neck and fastened by a padlock. A short chain ran from the collar to a staple in a tree, wall, or building—often the parish church. The punishment was substantially that of the pillory. The term is allied to the word *yoke* and the Lat. *jugum*.

Joule (James Prescott), D. C. L., LL.D., b. at Salford, England, Dec. 24, 1818, the son of a brewer, and was associated with his father in business until 1854. His scientific education was entirely conducted by himself at home, with the exception of a course of private lessons in physics he received thrice a week for three or four years from Dr. John Dalton, the celebrated author of the atomic theory. He became enthusiastically fond of original research, and at

the age of nineteen had manufactured an electro-magnetic engine, a description of which he published in the *Annals of Electricity* for Jan., 1838. Further research into the phenomena of heat evolved by electricity showed that his engine could not advantageously replace the steam-engine as a motor, and led to the discovery of the laws of the evolution of heat by electric currents, the relations between heat and chemical affinity, and the mechanical nature of the origin of heat. In 1841 he gave in a lecture at Manchester the results of the important experiments made by himself and Jacobi of St. Petersburg into the magnetic forces as a motive-power. These experiments were continued by Joule and by Mr. Scoresby, and led in 1843 to ascertaining the exact proportion between the mechanical powers of steam and electro-magnetism, and the equivalency of heat with mechanical force, ultimately fixed by him, after further experiments with various fluids, at 772 foot-pounds per unit of heat. The scientific applications of this principle were numerous, and Joule soon accumulated data for his important communication to the Royal Society *On the Change of Temperature produced by the Rarefaction and Condensation of Air*, which brought him into prominence as an investigator, and led to his association in further experiments with other eminent scientists, especially Prof. (now Sir William) Thomson of Glasgow and Dr. Lyon Playfair. With the former he commenced in 1852 a series of researches upon the thermal effects of fluids in motion, which were continued for many years, the results of which were communicated to the Royal Society in four memoirs (1853–62) printed in the *Philosophical Transactions*. With Dr. Playfair he made a careful investigation of the volumes of space occupied by the same bodies in a solid and in a liquid state, the results leading to important modifications of the theories of molecular physics. The discoveries of Dr. Joule have been intimately related to the remarkable theories of the correlation of forces developed by Dr. Meyer and Helmholtz of Germany, Seguin of France, Faraday and Grove of England. In recognition of his important services to science, Dr. Joule received the royal medal of the Royal Society in 1852, and in 1860 the Copley medal, besides all the honors which could be conferred by degrees from Oxford, Dublin, and Edinburgh universities, membership of the Institute of France and all the chief scientific corporations throughout the world, and the presidency of the British Association for the Advancement of Science in 1873. His miscellaneous experiments have been very numerous, and he has invented many scientific processes and instruments, especially in relation to a more accurate measurement of forces.

Jounpur′, town of British India, the capital of a district of the same name, in the presidency of Agra, on both sides of the Gumti, which here is crossed by a stone bridge resting on fifteen arches, built in the fifteenth century, and remarkable for its strength. Pop. 27,160.

Jour′dan (Jean Baptiste), b. at Limoges Apr. 29, 1762; after the death of his father was placed in his uncle's silk store in Lyons. In 1778 he left this employment, entered a regiment of infantry, and fought in America under D'Estaing. Having returned in 1784, he settled in his native city, married, and opened a milliner's store, but at the outbreak of the Revolution he became captain of the national guard of Limoges, and thus began his very active and even brilliant military career. As chief of a battalion he distinguished himself under Dumouriez; was made a brigadier-general in 1793, a general of division in the same year, and commander-in-chief of the army of the North. Oct. 16, 1793, he defeated the Austrians at Wattignies, and June 26, 1794, at Fleurus, driving them back to the other side of the Rhine. In the campaigns of 1795 and 1796 he was less successful, and having been defeated by Archduke Charles at Würzburg, Sept. 3, 1796, he resigned his command. Elected a member of the Council of Five Hundred, he was twice chosen its president, and planned and established the system of military conscription. Napoleon never gave him an active independent command, but appointed him governor of Piedmont in 1800, and made him a marshal in 1804. He accompanied Joseph to Naples and Spain, and was a friend of his. Louis XVIII. made him a count in 1815, chief of the seventh military division, and peer of France in 1819. During the July revolution he was charged with the ministry of foreign affairs, but only for a very short time. D. Nov. 23, 1833, as governor of the Hôtel des Invalides. He published *Opérations de l'armée du Danube* (1799) and *Mémoires pour servir a l'histoire de la campagne de 1796* (1819).

Jourdan (Mathieu Jouve), called Coupe-Tête ("head-cutter"), b. at St. Just, near Puy, France, in 1749, and was guillotined May 27, 1794, by the order of the Committee of Public Safety and the Revolutionary Tribunal as throwing discredit on the Revolution by his excesses. He was keeping a wine-shop in Paris when the Bastile was taken, and he prided himself as having killed the governor of the prison. On Oct. 6, 1789, he murdered the two body-guards accompanying the royal family in their memorable ride from Versailles to Paris. Jourdan is historically known as the organizer and leader of the massacre perpetrated in 1793, called the "Massacre of La Glacière," at Avignon.

Félix Aucaigne.

Jour′nalism is one of the prime necessities of modern civilized life. There are now 14,000 periodicals printed in the world. More than 6000 are published in the U. S., and they annually circulate over 1,500,000,000 copies. It is a close approximation to the truth to say that each copy issued averages five readers. If these publications annually circulate 1,500,000,000 copies, the periodicals of the Union are read 7,500,000,000 times. Such is the fact in the U. S., as shown by the census returns; and it is perhaps fair to assume an equal circulation for the periodicals of the rest of the world. It is manifest, therefore, that journalism is a necessity of the age. It is the letter, the pamphlet, the book of the million. Newspapers are read when nothing else is read; newspapers are sent by the thousands through the mails instead of letters, and they are with many, very many individuals, the only medium of intercommunication. Ideas by means of journalism become cosmopolitan. It enables all nations to interchange with each other in a free, easy, cheap, and intelligent manner. None are too poor to obtain a newspaper; none are too poor to know each morning the daily occurrences of the world. Newspapers of to-day, by means of the telegraph, are the reflex of the events of yesterday. What transpires in Paris or New York, London or Washington, St. Petersburg or San Francisco, Berlin or Boston, Vienna or Philadelphia, Liverpool or New Orleans, Canton or Chicago, is known within twenty-four hours to millions of people of all nations and tongues through the press. Napoleon is overthrown at Sedan, and the startling fact is the talk at every breakfast-table the next morning. Some important discovery in science or art is made to-day in Boston or Berlin, and it is practically applied to the business of life to-morrow through the same channel of communication. On all the great subjects that agitate the public mind governments are advised of the public sentiment, and cabinets are guided by public opinion expressed in the public journals. Through this source the *vox populi* has become the voice of warning and influence in the councils of nations, and in the practical details of life everywhere the newspaper is the necessity. All kinds of business, all inventions and improvements in machinery, all changes in trade and finance, all facts and movements affecting the weal or woe of mankind, are daily spread throughout the universe by means of journalism. Whatever is to be bought or sold is advertised; movements of railway-trains and steamships, conveying hither and thither the inhabitants and annual produce of the world, are chronicled. Servants, artisans, the employed and the employers, have their needs made public for a trifling sum in the pages of the daily papers. If a mechanic or a monarch is dead, the fact is announced through the same ubiquitous means. Is it too much to say, therefore, that society is regulated by this great power, and that journalism is one of the prime necessities of the world? Stop all the presses throughout Christendom for one week, or even for one day, and what would be the result?

How did this institution originate? When and where? What is it now?

There were news-sheets long anterior to the discovery of printing in Europe. They were in circulation in China and Rome and Venice, and it is asserted by archæologists that those in China were printed on rude wooden type several centuries before the days of Gutenberg, Koster, and Schöffer; but in Europe the earliest news-sheets were manuscript papers prepared with some regularity, and known in Rome as the *Acta Diurna* and in Venice as the *Gazzetta*. These sheets are interesting to us as indicative of the fact that newspapers were indispensable ages before types were invented in Europe. But we will leave the age of manuscripts and begin with the age of printed newspapers. According to tradition, the first printed news-sheet appeared in Nuremberg in 1457, and was called the *Gazette*. We have no knowledge of the existence in any collection of a copy of that publication. If published, not a copy has been preserved. In 1534 a newspaper was printed in that famous city of which there is a record. There was a copy in the Libri collection, and a description of it appeared in the catalogue of that collection. This sheet was entitled the *Neue Zeitung aus Hispanien und Italien*. When we consider the wonderful enterprise of the inhabitants of that town, it is not improbable that the latter publication was a continuation of the former. Wooden type were invented in 1438–40, and Peter Schöffer first cast metal type in 1452. It is therefore within the range of

probability that, in bringing those type into use, it was easier to print meagre news-sheets than books, and that the *Gazette* was printed in the very infancy of typography. But be that as it may, it is pretty well ascertained that Ulric Zell printed a newspaper in Cologne as early as 1499, called the *Chronicle;* and we also have the fact that in 1598 the *Mercurius Gallo-Belgicus* was printed there. In 1615 *Die Frankfurter Oberpostamts Zeitung,* believed to have been the first daily paper in the world, was established by Egenolf Emmel, and Frankfort claims him as the father of journalism. These are the beginnings, and to Germany the world is indebted not only for the invention of printing, but for the first use of types for the dissemination of news among the people. Now, Germany is full of newspapers of all sorts and shades, and many are of a superior order and ability; and some of those in existence to-day have been continuously published 100 and 200 years, and one even for a longer period.

England followed Germany in journalism. Nathaniel Butters was a writer of news-circulars in London in the early part of the seventeenth century. He is mentioned as early as 1611, occasionally printing a news-slip, and in 1621 he published one or two numbers of *The Courant or Weekley Newes from Forain Parts;* and during this interesting period he was in the employment of several of the nobility and gentry as a gatherer of news, which he regularly despatched in written communications to his patrons in the country. It was not till 1622 that he permanently resorted to the printing-press. With Nicholas Bourne and three or four others, probably printers, he issued the first regularly printed newspaper—the *Weekley Newes*—in the English language. It made its appearance in London on the 23d of May. This was eighty-four years after the discovery of printing, and fifty-one years after William Caxton had established the first printing-office in Westminster. Meanwhile, the manuscript news-circulars and the gossips at the coffee-houses supplied the public with their daily talk. Strange as it may appear to the present age, the playwrights in the infancy of journalism were the influential writers of the time, the men who largely guided the popular mind, the censors of manners and morals. Fletcher and Ben Jonson and Shirley made fun of the newspaper-men on the stage in *The Fair Maid of the Inn,* the *Staple of News,* and other plays; and it was even deemed a piece of journalistic enterprise to obtain the first playbill and other intelligence of theatrical movements. All this, however, has since been changed, and in England the present examiner of plays is a journalist named Pigott. The first daily paper in England, the *Daily Courant,* was issued in 1702; and the first penny or one-cent paper, the *Orange Postman,* was started in 1709. Now, there are 1500 newspapers and periodicals published in Great Britain, with such papers as the *Times,* the *Telegraph,* the *Illustrated News,* and *Punch* as representative papers. The newspaper press of England has long been considered the fourth estate in that kingdom; but as the leading minds of the nation for the last 200 years—Milton, Johnson, De Foe, Swift, Coleridge, Macaulay, Palmerston, Brougham, Disraeli—have written for the journals, and as the daily and weekly papers now represent in various ways the intellect of the country, it takes higher rank than Hunt in his modesty chose to assign to the profession.

France followed England, and established her first newspaper in 1631. Théophraste Renaudot issued the *Gazette de France* on the 30th of May of that year. Official bulletins of the military operations of Charles VIII. in Italy in 1494–95 were printed, and were the conception of *Le Moniteur Universel,* the official organ of France in after years; but these were mere bulletins of the army, not often issued, and there was a sheet called the *Mercure François,* printed in Paris in 1613; yet Renaudot and his *Gazette de France* have always been considered the pioneers of the newspaper press of that country. The *Gazette,* with an occasional interruption, has been published from 1631 to the present day, and is one of the two oldest papers in the world. Renaudot was a remarkable man and a remarkable journalist. He was a physician and a gossip, and in his intercourse with people became one of the best-informed men of his day. Like Butters in England, he wrote news-circulars prior to the establishment of the *Gazette,* and, like Butters, he sold his papers in the streets by news-boys and news-women, who were known as "hawkers" and "Mercury-women." Such men as Richelieu, Mazarin, and Louis XIII. wrote for the *Gazette,* as Guizot, Thiers, Lamartine, and Napoleon have since written for the modern French press. The pioneer daily paper in France, the *Journal de Paris ou Poste au Soir,* did not make its appearance till 1777. The *Journal de la Ville de Paris* was published a century earlier, but only appeared once a week, with the daily occurrences recorded in the style of a diary of events, and hence its name. Now, France can boast of 1600 periodicals, full of ability, but very deficient in enterprise. The French journals depend largely upon their able editorial articles, brilliant reviews, and sensational *feuilletons* for their support. Their advertisements are inserted mostly like handbills, and their columns for business notices are generally farmed out.

Newspapers continued to increase in Europe after these early publications had opened the way. The *Postosch Inrikes Tidning* was founded in 1644 as the official organ of Sweden. The *Haarlemm Courant* appeared in 1656. The *St. Petersburg Gazette* was established in 1703, and printed under the authority of Peter the Great, who took an active interest in its management. The pioneer paper of Spain, the *Gaceta de Madrid,* made its appearance in 1704. There were a *Gazette* and also a *Courant* in Amsterdam in 1705. The first paper in India was issued in 1781, and the first in Turkey was printed in Smyrna in 1827 by M. Blecque, just a century after the introduction of printing in the Ottoman empire. It was called the *Spectator of the East.* Now, there are over 8000 newspapers and periodicals printed in Europe, Asia, and Africa. Those in Australia are as large, as ably conducted, and nearly as well filled with advertisements as those in London. There are several papers printed in English in the seaports of China, and our journalists have frequently been indebted to the *China Mail* and the *China Register* for news from the interior of the Celestial Empire, and entertained with the republication of the vermilion edicts from the *Peking Gazette,* which is claimed to be the oldest government organ in the world. Annexed are the statistics of the periodical literature of Europe, Asia, and Africa, which, if not strictly accurate, are very near the actual numbers:

Newspapers and Periodicals in Europe, Asia, and Africa in 1874.

Great Britain	1456	Denmark	96
France	1668	Norway and Sweden	184
Prussia	809	Netherlands	343
Austria and Hungary	1016	Switzerland	394
Other German states	467	Egypt	7
Russia	337	Africa	14
Italy	723	Asia	30
Spain	306	Turkey	33
Belgium	194	Elsewhere	150
Portugal	26		
Total			8253

All interests and classes, professions and trades, literature and art, politics and religion, are represented in these publications—illustrated, comic, financial, commercial, marine, sporting, dramatic, scientific—a variety the sight of which would fairly stagger Butters and Renaudot were they to reappear on earth and enter into the office of the *London Times* or that of the *Printers' Register.*

There are several newspapers printed in Europe which have lived a great many years, and the files of which, notwithstanding the restrictions of censors, are filled with intensely interesting details of the great events of the last two centuries, of the rise and fall of empires, of national changes and revolutions that were startling to mankind when they occurred. Here are their names:

Names.	When established.
Frankfort Gazette	1615
Gazette de France	1631
Leipsic Gazette	1660
London Gazette	1665
Stamford (Eng.) Mercury	1695
Edinburgh Courant	1705
Rostock Gazette	1710
Newcastle (Eng.) Courant	1711
Leeds (Eng.) Mercury	1718
Berlin Gazette	1722
Leicester (Eng.) Journal	1752
Dublin Freeman's Journal	1755

All the governments of Europe were early represented by newspaper organs. They are an easy means of communicating orders in council, special edicts, proclamations, and laws to the people. The *London Gazette* was the first of these, and was established in 1665, and is still published. It was originally the *Oxford Gazette. Le Moniteur Universel, Journal Officiel de l'Empire Français,* was started in 1789; but Louis Napoleon abandoned the paper in 1869, because it was owned by private individuals, and established another with the simple title of *Journal Officiel de l'Empire Français.* Italy is represented by the *Gazzetti Officiale;* Spain, by the *Gaceta de Madrid,* and Russia by the *Pranitelztaennii Vystaik.* The *Invalide Russe* of St. Petersburg was the organ of the Russian government for many years. It was established in 1813 to raise a fund for the relief of wounded soldiers. It was superseded in 1868 by the new organ. Russia is also represented in Brussels by *Le Nord,* the utterances of which are semi-official, and are intended to explain to Europe any political problem in which the government of the czar may be interested. Austria is officially heard through the *Gazette* of Vienna.

Of all the newspapers now printed in Europe, the *London Times* is the most perfect. It is ninety years old, and has been owned and managed during that time by three generations of one family—the Walters. Its intellectual ability and business enterprise have been remarkable since 1803, when it became the property of John Walter, the father of the present proprietor. He conducted the paper for forty years, and it has a great power in the land; and in order to be entirely independent of government influence the second Walter ran his own special expresses with the news of the battles of Napoleon I., often anticipating the government couriers and official despatches. The *Times* was the first paper printed by steam-power, which was introduced into its press-room in 1814.

The number of daily papers published in Great Britain in 1874 was 131, of which 24 were printed in London. Of the total number, 23 are represented as independent in politics; 59 as liberal; 22 as neutral; 26 as conservative; and 1, the *Morning Post*, the organ of fashion, as High Church. The *Times* is set down as liberal. The prices of these journals range from one farthing, or half a cent, to five pence, or ten cents, per copy. The *London Sun* is sold for a farthing, the lowest-priced paper in the English language, and the *London Times* for three pence for each copy. The price of the *London Telegraph* is one penny, or two cents. Its circulation is said to be 160,000 copies daily, while that of the *Times* is about 40,000. It is perhaps only necessary to mention three or four of the most prominent on the continent of Europe. The *Gazette de Moscou*, edited by M. de Kathof, is one. M. Thiers, in speaking of the press in the Corps Législatif in 1868, said that to have an exact idea of what passes in Russia, of the movements and tendencies of that great power, it was necessary to combine the utterances of the government with the language of the *Gazette de Moscou*. The *Augsburg Gazette* has always been an authority in Germany. It is printed every day in the year, like the *New York Herald*. The *Journal des Débats* is probably the ablest paper in France, and has always given the debates of the Corps Législatif in full, as the *London Times* does those of Parliament. Of course there are others, like *Le Nord* and the *Mémorial Diplomatique*, but space will not tolerate a complete list of them.

The most remarkable field for newspaper enterprise and newspaper literature has been the U. S.; and in giving a sketch of the journals of this country it will be necessary to embrace those that appeared before the colonies became independent of the mother-country, as well as those that appeared subsequently, in order to show the progress of journalism on this continent. In a country where, after 1783, industry and intellect became the most active in the world, the increase and growth of newspapers have been wonderfully great, surpassing every other single nation, and where the aggregate number of journals and their circulation have almost reached in 1874 the number and circulation of those printed in all other parts of the world. There are eras in the history of the periodical press of North America which do not exist in the history of the newspaper press in other parts of the world. This is due to our peculiar political status as a people—first, as a colonial, and, second, as an independent government. Our journals, largely entering into the political controversies of the people, passed through the changes that the country experienced from utter subserviency to the English monarchy to complete independence, and then through the changes growing out of the marvellous progress of the nation. These eras were five in number—namely, first, the colonial press; second, the Revolutionary press; third, the political party press; fourth, the cheap press; fifth, the independent press.

The Colonial Press first appeared in Boston, Mass., in 1690. On Sept. 25 of that year Benjamin Harris published a sheet with the title of *Publick Occurrences both Foreign and Domestick*. It was the intention of the publisher to issue this paper once a month, and the annexed prospectus gives, in the quaintest manner, what the pioneer journalist of America believed to be the duties of an editor:

PUBLICK OCCURRENCES,

Both Foreign and Domestick.

Boston, Thursday, Sept. 25, 1690.

It is designed that the Countrey shall be furnished once a month (or if any Glut of Occurrences happen oftener) with an Account of such considerable things as have arrived unto our Notice.

In order here unto, the Publisher will take what pains he can to obtain a Faithful Relation of all such things; and will particularly make himself beholden to such Persons in Boston whom he knows to have been for their own use the diligent Observers of such matters.

That which is herein proposed, is, First, That Memorable Occurrents of Divine Providence may not be neglected or forgotten, as they too often are. Secondly, That people everywhere may better understand the Circumstances of Publique Affairs, both abroad and at home; which may not only direct their Thoughts at all times, but at some times also to assist their Business and Negöceations.

Thirdly, That some thing may be done towards the Curing, or at least the Charming of that Spirit of Lying, which prevails among us, wherefore nothing shall be entered, but what we have reason to believe is true, repairing to the best fountains for our Information. And when there appears any material mistake in anything that is collected, it shall be corrected in the next.

Moreover, the Publisher of these Occurrences is willing to engage, that whereas, there are many False Reports, maliciously made, and spread among us, if any well minded person will be at the pains to trace any such false Report, so far as to find out and Convict the First Raiser of it, he will in this Paper (unless first Advice be given to the contrary) expose the Name of such person, as A malicious Raiser of a False Report. It is supposed that none will dislike this Proposal, but such as intend to be guilty of so villainous a Crime.

On this basis of truth and justice and conscience was issued the first newspaper on this side of the Atlantic. Its size was three pages of a folded sheet, leaving one page blank, with two columns to a page, and each page was about eleven by seven inches. But the effort of Benjamin Harris failed, in consequence of the opposition of the provincial authorities, who forbade "anything in print without license first obtained from those appointed by the government to grant the same;" and as the first number of *Publick Occurrences* contained "reflections of a very high nature," a second number did not appear. Some have doubted the existence of this publication, but the fact that a copy, and the only one extant, is on file in the state paper office in London is sufficient proof that such a paper was issued. Harris's news-sheet was a veritable newspaper, but there was a reprint of the *London Gazette* in New York in 1696 which gave the news of an important battle in Europe leading to the Peace of Ryswick. This was issued by William Bradford by order of Gov. Fletcher, as an easy mode of reproducing an official account of an affair of much moment to the colonies for the information of the people. It was not intended as a regular newspaper. These two publications were the only attempts of the kind till 1704. Meanwhile, the colonists relied upon a few London papers, received by the few vessels arriving from England, for news from Europe, and on the gossips at the coffee-houses for local intelligence; but meanwhile, also, John Campbell, the postmaster of Boston, became a news-gatherer, and furnished the New England governors and a few friends with periodical news-letters or circulars. Nine of these letters, written to Gov. Fitz John Winthrop of Connecticut, and bearing dates from April to October, 1703, now belong to the Massachusetts Historical Society. These circulars led to the issue of a newspaper by their writer. On Apr. 24, 1704, John Campbell commenced the publication of the *News-Letter*, and it has since been incorrectly stated that this was the first newspaper printed in America. Campbell's prospectus was a brief one. Harris promised to issue his paper once a month. The interim of fourteen years lessened the time to weekly publication. This is Campbell's prospectus:

Advertisement.

This News-Letter is to be continued weekly; and all persons who have any Houses, Lands, Tenements, Farms, Ships, Vessels, Goods, Wares or Merchandizes, &c. to be sold or let; or Servants Run-away, or Goods Stole or Lost; may have the same inserted at a Reasonable Rate, from Twelve Pence to Five Shillings and not exceed: Who may agree with John Campbell Post Master of Boston.

All persons in Town or County may have said News-Letter every Week, Yearly, upon reasonable terms, agreeing with John Campbell, Post-master for the same.

Harris, it will be seen, did not ask for an advertisement. His attention was wholly directed to intelligence and the truth of public reports. Campbell, on the contrary, was wholly devoted to business, and calculated largely on advertisements. He does not allude to news in any way. But very few business notices appeared in the *News-Letter*. It was a novel enterprise, and the merchants and mechanics of Boston did not fully comprehend the advantages of this new mode of making their business known to the public. The *News-Letter*, in its early days, was sometimes printed on a single sheet, foolscap size, but oftener on a half sheet, with two columns on each side. It lived for seventy-two years, and went out of existence when the British troops evacuated Boston in 1776. The *News-Letter* enjoyed a monopoly of journalism in America for fifteen years, and yet had a circulation of only 300 copies. In 1719, William Brooker was appointed postmaster of Boston in the place of Campbell, and in consequence of some difficulty about the *News-Letter* and the mails the new postmaster thought it expedient to establish another newspaper. On Dec. 21 of that year he issued the *Boston Gazette*. The appearance of this sheet, added to the loss of office, fired the indignation of Campbell, and thereupon commenced the "war of editors" on this continent, which has never ceased. In speaking of the *Gazette*, the editor of the *News-Letter* said, "I pity the readers of the new paper; its sheets smell

stronger of beer than of midnight oil. It is not reading fit for the people!" It appears that Brooker was not inclined to carry on the war to the bitter end, for in reply he wished Campbell "all desirable success in his agreeable *News-Letter*, assuring him" that he had "neither capacity nor inclination to answer any more of his like advertisements."

On Dec. 22, 1719, the day after the *Gazette* appeared, the initial paper in Philadelphia, the *American Weekly Mercury*, was issued by Andrew Bradford, a son of the first printer in Pennsylvania—a paper that Benjamin Franklin subsequently characterized as "a paltry thing, wretchedly managed, no way entertaining, and yet was profitable." But the paper that attracted the most attention in the colonies at that early period was the *New England Courant*, established by James Franklin Aug. 7, 1721. Benjamin Franklin commenced his career as a printer's apprentice on this paper. It is stated in the autobiography of the latter that the *Courant* was the second newspaper started in America. It was the fifth. But the *Courant* created a sensation which the others did not do, and its publisher was soon in difficulty. It first had a wordy war with the *News-Letter*. Then James Franklin had a great deal of trouble with the clergy, especially with Cotton and Increase Mather, and finally the journalist and the government officials had their differences. The communications in the *Gazette* produced so much talk and scandal in the quiet town of Boston that its publisher was forbidden to issue his paper except under very arbitrary restrictions, and for attempting to evade these he was thrown into prison. On Feb. 11, 1722, Benjamin Franklin, then only sixteen years of age, was placed in charge of the paper as its editor and publisher, and he remained for several months in this position. There continued to be the same independent spirit in the management of the paper, and its troubles finally induced James Franklin to abandon its publication. He went to Newport, R. I., where he established the *Gazette* in 1732, and where he died three years later.

The next paper that appeared in America was the *New York Gazette*, the first in that province. It was published by William Bradford, and the first number was issued on Oct. 23, 1725. In 1727 the *New England Weekly Journal* was published by Samuel Kneeland, and he made brilliant promises to his readers. On Apr. 8, 1728, he said: "There are Measures concerting for rendering this Paper yet more universally esteemed, and useful, in which 'tis hop'd the Publick will be gratifi'd, and by which those Gentlemen who desire to be improv'd in History, Philosophy, Poetry, &c. will be greatly advantaged." The *Maryland Gazette* also appeared in 1727, the first in that colony. It was published till 1736, and revived in 1749. In 1728, Benjamin Franklin made his reappearance as a journalist. Samuel Keimer had started a paper in that year in Philadelphia, which he named the *Universal Instructor in all the Arts and Sciences, and Pennsylvania Gazette*. Franklin had contemplated such an enterprise, and had confided his intention to a fellow-printer, who treacherously informed Keimer of the plan, and the *Instructor* was the result. Franklin, in order to prevent the success of Keimer's journal, immediately commenced writing "several amusing pieces for Bradford's paper [the *Mercury*], under the title of Busy Body." In less than a year Keimer sold his paper with its ninety subscribers to Franklin, who condensed its name to *Pennsylvania Gazette*, and made it a success. In mentioning this circumstance Franklin said: "Our first papers made quite a different appearance from any before in the province; a better type, and better printed; but some remarks of my writing, on the dispute then going on between Governor Burnet and the Massachusetts Assembly, struck the principal people, occasioned the paper and the manager of it to be much talked of, and in a few weeks brought them all to be our subscribers." On Jan. 8, 1731, the *South Carolina Gazette* was issued, the first in that province. It was printed in Charleston, and lived a year, but was revived in 1734.

But the most important newspaper, politically, in early colonial times was started in New York in 1733. On Nov. 5 of that year John Peter Zenger issued the first number of the *New York Weekly Journal*. It was a rival of Bradford's *Gazette* professionally and politically, and Zenger was a fearless journalist. The *Journal* made war on the administration of Gov. Cosby, and in 1734 its editor was arrested for libel on the government and thrown into prison, and in the hope of crushing the paper the authorities kept him nine months in confinement. This created a great deal of popular sympathy for the newspaper, and neither Zenger nor his friends were to be put down. In spite of the imprisonment of its editor, the *Journal* continued to appear regularly; and finally the case was brought before the court for trial. It was the first action for newspaper libel on the American continent. The court met on Aug. 5, 1735, and Andrew Hamilton of Philadelphia appeared for Zenger. The publication of the alleged libel was admitted, and Mr. Hamilton offered to prove the truth of the statements made. This the court refused to permit. All evidence being thus shut out, it became necessary for Mr. Hamilton to address the jury, which he did with great power. Zenger was acquitted, and the verdict was greeted with the utmost enthusiasm by an immense audience. Mr. Hamilton was conducted in triumph to a splendid entertainment, a salute was fired on his departure for home, and the freedom of the city was presented to him by the common council for "the remarkable service done by him to the city and colony by his learned and generous defence of the rights of mankind and the liberty of the press." In the opinion of Gouverneur Morris the result of this case was "the dawn of that liberty which afterwards revolutionized America."

Other papers made their appearance in Boston and Philadelphia; the *Virginia Gazette*, the first in that province, made its *début* in Williamsburg in 1736; and two newspapers printed in German, the pioneers in any foreign language in America, appeared—one in Germantown, Pa., in 1739, and the other in Philadelphia in 1743.

These were the beginnings in America. Newspapers were published in 1745 in Boston, Philadelphia, New York, Annapolis, Williamsburg, and Charleston. Most of these colonial papers confined themselves strictly to the merest mention of the news of the day. If any opinions were uttered, they were subservient to the authorities. The Franklins and Zenger were the exceptions, and they originated and practised that independent spirit which was infused in a new class of papers that appeared subsequent to 1745. This new class was the REVOLUTIONARY PRESS. It was still of the colonial stamp, because the country was yet composed of colonies, with governments appointed to rule over them by England, but the people and the press had become revolutionary, more self-reliant, and more independent of the colonial authorities. The pioneer of this class of journals was the *Independent Advertiser*, issued in Boston on Jan. 4, 1748, under the inspiration of that ardent patriot, Samuel Adams. One of its contributors was Jonathan Mayhew, who preached a sermon on the occasion of an election strongly advocating the republican form of government. David Fowle, the printer of the paper, having issued a pamphlet which severely denounced the legislature for certain acts, he was arrested and imprisoned. On his release he quitted Boston and went to Portsmouth, N. H., where he started the *New Hampshire Gazette* in 1756, and the young patriots of the *Advertiser* had to bide their time. One or two new papers appeared in Boston and New York, and pamphlets were issued by the opponents of the government in the next year; but the real organ of the Revolutionary party made its appearance on Apr. 7, 1755. It was published by Edes & Gill, and named the *Boston Gazette and Country Gentleman*. All the vigorous writers for the *Independent Advertiser*, with others—Samuel Adams, Jonathan Mayhew, John Adams, James Otis, Joseph Warren, Thomas Cushing, Samuel Dexter, Benjamin Austin, Jr., and Samuel Cooper—contributed to the columns of the *Gazette*. It was a fearless denunciator of the wrongs of the government. The spirit of the paper was indicated in its devices on its title-page. On its first number were two cuts—one representing an Indian with bow and arrow, the other represented Britannia liberating a bird confined by a cord to the arms of France. Five years later (1760) there was a new device: this represented Minerva, in place of Britannia, seated at a pedestal on which was a cage, holding a spear surmounted with the cap of liberty in her left hand. With her right hand she opens the cage and liberates a bird, which is depicted flying towards the tree of liberty. This was fifteen years before the fight at Concord.

It is not to be expected that in an article as circumscribed as this must be all the newspapers springing into life from time to time can be mentioned. Only those that made their mark on the age or were representative in their character can be noticed. All others will be included in the general statistics of journalism. It is necessary to mention the *Newport* (R. I.) *Mercury*, not only because it is still published, but because it enjoys the reputation of having been started on its career by Benjamin Franklin. He had nothing to do with its origin. It was established on June 12, 1758, by James Franklin, a nephew; and all Benjamin had to do with the paper was to present to his nephew, after the *Mercury* had been some time in existence, a font of new type, "as ample amends" to his brother James "for the service he had deprived him of by leaving him so early"—in other words, for having run away before his apprenticeship had expired. The press on which the elder James Franklin and his brother Benjamin so often worked in Boston remained in the *Mercury* office for 100 years. It was then presented to the Massachusetts Charitable Mechanics' Association. On Feb. 16, 1759, the old *Gazette* of William Bradford was revived, and afterwards immortalized by

Freneau. On Oct. 29, 1764, the *Connecticut Courant* was issued in Hartford, and is still published there. Its pages have been of great value to the historians of the U. S. Indeed, all the old papers have been a mine of wealth to these writers and compilers.

The great event which alarmed the colonists, aroused the patriotic indignation of the journalists, and which threw the political clubs into commotion, and did more to precipitate the Revolution than any other single act of the home government, occurred in the following year. It was the Stamp Act of 1765, which required that all instruments in writing be executed on stamped paper to be purchased of government agents only, and all offences against the act were to be tried in any royal marine or admiralty court in any part of the colonies, no matter how distant from the place of offence; thus interfering with the right of trial by jury. The colonists were at once aroused to a sense of the danger impending over them. In May the subject came up in the house of burgesses in Virginia, of which Washington was a member. Patrick Henry introduced his celebrated resolutions that the assembly of that province had the exclusive right and power to lay taxes and impositions upon the people of that commonwealth, and whoever maintained the contrary of this doctrine was an enemy of the colony. It was on this occasion that he exclaimed, "Cæsar had his Brutus, Charles his Cromwell, and George III. [cries of "treason!" "treason!"] may profit by their example. Sir" (bowing to the Speaker), "if this be treason, make the most of it!" The resolutions, with some slight modifications, were adopted. They were immediately published in the *Maryland Gazette*, with an article strongly endorsing them written by Charles Carroll. They were also printed in the *Pennsylvania Gazette* and the *Newport* (R. I.) *Mercury*, and the number of the latter containing them was immediately suppressed as a traitorous publication. The *South Carolina Gazette*, the *American General Gazette*, and the *Gazette and Country Journal*, all published in Charleston, printed them. They were endorsed by the Sons of Liberty in New York and Massachusetts, and were published in the *Boston Gazette* with comments by John Adams, which were subsequently printed in pamphlet form in London. They were deemed traitorous and seditious there, and an unsuccessful effort made in Parliament to have the pamphlet suppressed. The Stamp Act was repealed in 1766, but the effect produced on the minds of the colonists by these few newspapers was prodigious. This act, which created so much enmity to the mother-country, was originally recommended to the authorities as an excellent measure by a journalist, Ellis Huske, postmaster of Boston, who in 1734 started the *Boston Weekly Post Boy*. Several of the publishers suspended the publication of their papers in consequence of this act. On Oct. 31, the day before it was to take effect, the pages of the *Pennsylvania Journal and Weekly Advertiser*, published by a grandson of William Bradford, were enclosed in black lines, with the picture of a skull and cross-bones over the title, with the words, "Expiring: In Hopes of a Resurrection to Life again." On the border of the first page were printed, "Adieu, adieu, to the Liberty of the Press." On the last column of the third page were the words, "Farewell, Liberty." On the fourth page was a cut of a coffin, with this epitaph:

> "The last Remains of
> The Pennsylvania Journal,
> Which departed this Life, the 31st of October, 1765,
> Of a STAMP in her Vitals,
> Aged 23 years."

Such was the spirit of journalism in America ten years before the commencement of the Revolution. Of course the government had its organs. Several of the papers "printed by authority" endeavored to counteract the influence of the patriotic sheets, but where these made any sign others were established in the interest of the people. Such was the case in Virginia. In 1766 a second *Gazette* appeared in Williamsburg, printed by William Rind. In mentioning this paper, Thomas Jefferson said, "Till the beginning of our Revolutionary disputes we had but one press, and that, having the whole business of the government, and no competitor for public favor, nothing disagreeable to the governor could find its way into it. We procured Rind to come from Maryland to publish a free paper." The first printed statement of the adoption of the Declaration of Independence on the 4th of July, 1776, was made in the *Gazette* on the 19th of that month, and the document in full appeared in the same paper on the 26th. While this was being done in Virginia, the patriots in other provinces were doing what they could in the same direction. On May 29, 1767, the *New York Journal, or General Advertiser*, was brought out under the inspiration of George Clinton and Philip Schuyler. It was a revival of Zenger's paper, and was edited by Alexander McDougall. Alexander Hamilton, when only sixteen years of age, was a smart contributor to its columns. It was McDougall who issued a pamphlet in New York in the interest of the Sons of Liberty in 1770, charging the assembly with a betrayal of its trust in its favorable action on the Mutiny Act of 1768–69, for which he was thrown into prison. The assembly voted the pamphlet libellous, and the proceedings were printed on the 45th page of the records of that body. "Forty-five" thereupon became the countersign of the Sons of Liberty. McDougall received many visitors while in jail, and in connection therewith the *Journal* of Feb. 15, 1770, gave the following paragraph: "Yesterday, the forty-fifth day of the year, forty-five gentlemen, real enemies to internal taxation by, or in obedience to, external authority, and cordial friends to Captain McDougall and the glorious cause of American liberty, went in decent procession to the New Gaol; and dined with him on forty-five pounds of beef stakes, cut from a bullock of forty-five months old, and with a number of other friends, who joined them in the afternoon, drank a variety of toasts, expressive not only of the most undissembled loyalty, but of the warmest attachment to Liberty, its renowned advocates in Great Britain and America, and the freedom of the press. Before the evening the company, who conducted themselves with great decency, separated in the most cordial manner, but not without the firmest resolution to continue united in the glorious cause."

Opposite in political sentiment to these patriot journals was the *Royal Gazetteer*, which was established in New York in 1762 by James Rivington. The leading contributors to the *Gazetteer* were Attorney-general Seabury, Myles Cooper, president of Columbia College, the Rev. John Vardill, and the Rev. Samuel Chandler. Major André also wrote for the paper, and his well-known satire, the *Cow Chase*, appeared in the *Gazetteer* on the very day of his capture:

> "And now I've clos'd my epic strain,
> I tremble as I show it,
> Lest this same warrior-drover Wayne
> Should ever catch the poet."

It was subsequently called *Rivington's Royal Gazette*, with the royal arms over the office-door. It was an ably conducted newspaper. Its office was twice mobbed for its zeal for the Crown—once by the Sons of Liberty, and once by a party of Connecticut militia. After enjoying royal favor for many years, Rivington in 1782, who then saw the "end of things," shaped his course to meet coming events. Several years previously Freneau predicted this in some verses which he published in a Philadelphia paper:

> "Says Satan to Jemmy, 'I hold you a bet,
> That you mean to abandon our *Royal Gazette*.'"

On July 10, 1782, the following appeared in the *Gazette*: "The publisher of this paper, sensible that his zeal for the success of His Majesty's arms, his sanguine wishes for the good of his country, and his friendship for individuals, have at times led him to credit and circulate paragraphs, without investigating the facts so closely as his duty to the public demanded, trusting to their feelings, and depending on their generosity, he begs them to look over past errors, and depend on future correctness. From henceforth he will neither expect nor solicit their favours longer than his endeavours shall stamp the same degree of authenticity and credit on the *Royal Gazette* of New York, as all Europe allow to the *Royal Gazette* of London." The title *Royal* was dropped, and the paper was afterwards known as *Rivington's New York Gazette and Universal Advertiser*, and the royal arms were removed from over the door of the office. The circulation of the *Gazette* reached, in its best days, the large number of 3000. Another organ of the Crown was started in Boston in 1767. It was the *Chronicle*, and the handsomest journal, typographically, published in the colonies. It exhibited great pretensions to literature. John Mein, one of its publishers, was a bookseller, and would sometimes fill a page of the *Chronicle* with advertisements of his books for sale. Mein, assisted by a pre-Revolutionary wit of Boston named Joseph Green, and a few others, was very severe on the Whigs of those days. On Nov. 5, 1769, in a public procession, among the effigies displayed was one of Mein, to which was attached the following acrostic:

> "I-nsulting wretch, we'll him expose—
> O-'er the whole world his deeds disclose;
> H-ell now gapes wide to take him in;
> N-ow he is ripe—O lump of Sin!
>
> M-ean is the man—Mein his name;
> E-nough he's spread his hellish fame;
> I-nfernal furies hurl his soul,
> N-ine million times, from pole to pole!"

So inimical to Mein had the popular sentiment become that he was compelled to stop the publication of the *Chronicle* and leave the country.

The *Massachusetts Spy*, "calculated on an entire new

plan," was the next influentially patriotic paper started in the colonies. Its first number came out in July, 1770, under the auspices of Isaiah Thomas, the author of the *History of Printing in the United States.* With the *Gazette*, the *Spy* was a power with the people, and did its full share in bringing on the rupture with the mother-country. The office of the paper was styled "the sedition foundry." Early in 1771 it urged a recourse to arms, and on Oct. 8, 1772, it closed an article in this fearless manner: "Should the liberty of the press be once destroyed, farewell the remainder of our invaluable rights and privileges! We may next expect padlocks on our lips, fetters on our legs, and only our hands left at liberty to slave for our worse than Egyptian taskmasters, or—or—Fight our way to constitutional Freedom." In denouncing Gov. Hutchinson as "an usurper," and showing Lieut.-Gov. Oliver as a "recorded perjured traitor," an effort was made by Attorney-Gen. Sewall to have Thomas indicted for libel, but the grand jury refused to find a bill. More British troops having reached Boston, that city became too warm for Thomas. On the night preceding the eventful day at Concord the material of the *Spy* was conveyed across the Charles River and carried to Worcester, where the paper was ever afterwards printed, and where it is now known as the *Worcester Spy.* On May 3, 1775, it first appeared there with the motto in large type: "Americans! Liberty or Death! Join or Die!" Thomas was famous for these newspaper laconics. He had a fresh one for every new phase and every new movement in the Revolutionary conflict. The government, to stem this Revolutionary tide after the suspension of the *Chronicle*, resorted to the old *News-Letter*, which was then known as the *Massachusetts Gazette and Weekly News-Letter.* All the Tory writers of note—Oliver, Brattle, Leonard, and Sewall—concentrated their power on this paper. There was a sharp contest between Sewall and Leonard as "Massachusettensis" in the *Massachusetts Gazette*, and John Adams as "Novanglus" in the *Boston Gazette.*

After the fight at the Old North Bridge in Concord, Mass., Apr. 19, 1775, there was open war for eight years. In the first year of the Revolution eight newspapers were started —four in Philadelphia, where Thomas Paine and Philip Freneau lived and wrote. The first newspaper in New Jersey, the *Gazette*, was issued on Dec. 3, 1777; the first in Mississippi Territory appeared in 1779, a pioneer among the pioneers; and in 1781 the first, the *Gazette or Green Mountain Post Boy*, was published in Vermont. Forty-nine newspapers were established in the colonies from 1745 to 1783, the Revolutionary period of our history, but of all those publications not one was really a journal—not one appeared daily. While New York was occupied by the British troops four papers were published there, and an arrangement was made in their days of publication by which the public had a newspaper each day. This was the nearest approach to this luxury in that period. The first daily paper in America was not issued till 1784. It was the *American Daily Advertiser*, and was published in Philadelphia by Claypoole, who was the first to introduce reporting on the continent.

The initial newspapers in the colonies made their appearance in the following chronological order:

Name.	Where published.	When published.
1. Publick Occurrences	Boston	1690
2. News-Letter	Boston	1704
3. American Mercury	Philadelphia	1719
4. New York Gazette	New York	1725
5. Maryland Gazette	Annapolis	1727
6. South Carolina Gazette	Charleston	1731
7. Rhode Island Gazette	Newport	1732
8. Virginia Gazette	Williamsburg	1736
9. North Carolina Gazette	Newberne	1755
10. New Hampshire Gazette	Portsmouth	1756
11. Summary	New London	1758
12. Delaware Courant	Wilmington	1761
13. Georgia Gazette	Savannah	1763
14. New Jersey Gazette	———	1777
15. Vermont Gazette	Westminster	1781

Of the 63 newspapers which had been started in America from 1690 to 1783, only 43 were in existence on the conclusion of peace with Great Britain.

The third era of the newspaper in America, embracing the Political Party Press, began in 1783. On the acknowledgment of the independence of the U. S., 3,000,000 of people found it necessary to organize a government on a new basis. All sorts of opinions, notions, and theories prevailed as to the best mode of accomplishing this great end. All thoughts were naturally turned to the subject, and it was very soon apparent that there were two sides to every question, even in a nation which as a unity had just achieved its independence; and these sides became great political parties in the U. S. Alexander Hamilton was the recognized leader of one of these divisions, the Federal party, and Thomas Jefferson the chief of the other, the Republican or Democratic party. Without any exception the 43 newspapers published in 1783 arrayed their columns on either side in the momentous political contests which followed the conclusion of peace. Of this number, the *Massachusetts Spy*, the *Gazette*, and *Independent Chronicle* of Boston, the *Virginia Gazette*, the *Maryland Gazette*, the *Journal*, and the *Packet* of New York, the *New Hampshire Gazette*, the *Salem Gazette*, the *Connecticut Courant*, the *Newport* (R. I.) *Mercury*, the *Pennsylvania Gazette*, and the *Pennsylvania Journal* were the most prominent. The failure of the Articles of Confederation as a perfect system of government for the U. S. brought on the first great political conflict; and when the legislature of Virginia, in Jan., 1786, proposed a convention of delegates from each State for the purpose of revising the Federal system, the real contest began. Out of this convention, which finally met in Philadelphia in 1787, came the Federal Constitution; and in the adoption of this instrument by the several States the most intense excitement prevailed throughout the nation. In the great controversy the newspapers played an important part. The *Packet* in New York strongly advocated the adoption of the Constitution, in opposition to the *Journal.* In Boston the *Massachusetts Centinel*, which was started in 1784, and edited by Major Benjamin Russell, was the leading Federal organ, and from the adoption of the Constitution in the national convention till its acceptance by the State conventions the *Centinel* kept up a vigorous fire in its favor; and there were one or more personal collisions, growing out of the bitterness of the contest, between Major Russell and Benjamin Austin, a writer for the *Independent Chronicle*, which was the organ of the Democratic party. The *Centinel* was one of the most enterprising journals of its day. It did not confine itself wholly to politics, but intelligently gave the fullest marine and commercial reports, and its summary of foreign news was always excellent, especially during the wars of Napoleon. The proceedings of the constitutional convention in Massachusetts were reported by Major Russell, almost the first reporting attempted in America, and he thus described his labors and a scene in the convention: "I had never studied stenography, nor was there any person then in Boston that understood reporting. The presiding officer of the convention sat in the deacon's seat, under the pulpit. I took the pulpit for my reporting-desk, and a very good one it was. I succeeded well enough in this my first effort to give a tolerably fair report in my next paper; but the Puritanical notions had not entirely faded away, and I was voted out of the pulpit. A stand was fitted up for me in another place, and I proceeded with my reports, generally to the acceptance of the convention. The doubts that still existed as to whether enough of the States would come into the compact as to make the Constitution binding, made the proceedings of the convention intensely interesting. When the news arrived of the acceptance of it by the State of Virginia, there was an extraordinary outbreak of rejoicing. It seemed as if the meeting-house would burst with the acclamation." On the final adoption of the Constitution there were celebrations everywhere. There was one in New York in 1788, made up of all the trades. The press-section was headed by two marshals—Hugh Gaine of the *Gazette* and Samuel Loudon of the *Register.* In the procession was a stage drawn by four horses. On this stage was a printing-office—cases and other typographical implements, with compositors and pressmen at work. Many hundred copies of a song and an ode were struck off and distributed along the route. There was a small flag on top of the press bearing the inscription of "Publius" in gold letters. John Loudon, as a herald, was mounted on the back of the press, dressed in a flowing robe, and a cap on which were written the words, "The Liberty of the Press." He carried a trumpet in his right hand, with which he proclaimed, "The epocha of Liberty and Justice." In the left hand he held a parchment scroll representing the new Constitution. With the adoption of the Constitution the Federal party considered itself fully and firmly established; and of course the Republican or Democratic party was also established, although, on the inauguration of Washington and Adams, the *Boston Centinel* formally announced the death of the latter; but on Mar. 4, 1801, on the inauguration of Jefferson and Burr, the *Centinel* published a characteristic monumental inscription, the first part of which was as follows:

Yesterday Expired,
Deeply regretted by Millions of grateful Americans,
And by all good men,
The Federal Administration
of the
Government of the United States;
Animated by
A Washington, an Adams, a Hamilton, Knox,
Pickering, Wolcott, McHenry, Marshall,
Stoddart, and Dexter.
Æt. 12 years.

When the Constitution went into operation in 1789 there were printed in each week, in the U. S., 76,438 copies of newspapers, or 3,974,776 copies during the year, filled with the political excitement of that interesting period of our existence in somewhat of the spirit which animated Major Russell of the *Boston Centinel.* Newspapers continued to increase. Many foreign writers of ability and smartness were employed by both parties on the press, and many of the political chiefs wrote for the journals. There were few or no regular editorial articles—or leaders, as they are now styled—but the topics of the day were warmly discussed in communications over all sorts of signatures. Most of the foreign writers were political exiles, and they naturally fell into the ranks of the Democrats and wrote for the papers of that party, strongly against England and in favor of aiding republican France; and they were very severe on the administrations of Washington and Adams. One of these papers, the *National Gazette,* was established in Philadelphia in Oct., 1791, by Philip Freneau while a clerk under Jefferson in the state department. Freneau was a poet of the Revolution, and accomplished as much with his rhyme as with his prose. In regard to him Jefferson said in his *Anas* that at a cabinet council Washington remarked: "That rascal Freneau sent him three copies of his paper every day, as if he thought he (Washington) would become the distributer of them; that he could see in this nothing but an impudent design to insult him; he ended in a high tone." Jefferson placed a high estimate on the services of Freneau as a journalist. On another occasion Jefferson said, in speaking of Washington, "He adverted to a piece in Freneau's paper of yesterday; he said he despised their attacks on him personally, but that there had never been an act of the government, not meaning in the executive line only, but in every line, which that paper had not abused. He was evidently sore and warm, and I took his intention to be that I should interpose in some way with Freneau, perhaps withdraw his appointment as translating clerk in my office. But I shall not do it. His paper has saved our Constitution, which was galloping fast into monarchy, and has been checked by no one means so powerfully as by that paper. It is well and universally known that it has been that paper which has checked the career of the monocrats." The *Gazette* was published till 1793. In 1797, Freneau started the *Time Piece* in New York, which was afterwards edited by Matthew L. Davis, and subsequently by John Daly Burk, one of the United Irishmen. Two influential journals were established in 1793: the *New England Palladium* in Boston, and the *Minerva* (afterwards and still known as the *Commercial Advertiser*) in New York. Noah Webster, the lexicographer, previously a lawyer in Hartford, was induced to migrate to New York to take charge of the *Minerva,* and thereby strengthen the Federal party. William L. Stone was subsequently and for many years its editor. It is now, as the *Commercial Advertiser,* owned by Hugh Hastings, and is the oldest paper in New York. The *Palladium* was merged with the *Boston Advertiser.* But the newspapers that attracted the most attention in the latter part of the last and the early part of this century were the *Aurora* in Philadelphia and the *Evening Post* and *American Citizen* in New York. The *Aurora* was edited by Benjamin Franklin Bache, a grandson of Benjamin Franklin, till 1798. It contained on Mar. 5, 1797, a very savage article on the departure of Washington for Mount Vernon after the inauguration of John Adams. It was disowned by Bache, who was absent when it appeared, but it is said to have been written by a "public functionary" and a distinguished member of the Democratic party. On the death of Bache the *Aurora* passed under the editorial care of William Duane, who had become very much embittered against England in consequence of his treatment in India. The *Aurora* was a powerful organ of Jefferson's. The *Evening Post* was not so old a paper as the *Aurora.* It was started on Nov. 16, 1801, and was strongly Federal in its politics. Alexander Hamilton, John Jay, and their friends established it, and placed William Coleman in the editorial chair, where he remained for nearly thirty years, and was succeeded by William Leggett and William Cullen Bryant; the latter is still chief editor. It was Democratic in politics for over forty years, and is now independent Republican. The *American Citizen* was a continuation of the *New York Journal and Argus.* James Cheetham became its editor in 1801, and acted with that portion of the Democratic party of which the Clintons were leaders. Violent altercations between some of the leaders of the two sections of that party took place, and the duelling-ground at Hoboken became the scene of several affairs of honor. Matthew L. Davis, armed and equipped, went forth in Wall street one time to shoot Cheetham at sight. The bitterness of these three remarkable journals kept up the political excitement in New York to a high pitch and for a long time. Coleman called Duane "a low-lived foreigner," and he alluded to "the insolent vulgarity of that base wretch," Cheetham. Once he discharged a double shot at his opponents:

> "Lie on, Duane—lie on for pay,
> And, Cheetham, lie thou too;
> More against truth you cannot say,
> Than truth can say 'gainst you."

Another Democratic paper was issued in New York in 1802 by the friends of Aaron Burr, in opposition to the *Citizen.* It was the *Morning Chronicle,* and edited by Dr. Peter Irving. Washington Irving made his first appearance as a writer in the *Chronicle,* over the signature of "Jonathan Oldstyle." Matthew L. Davis was a contributor to its political columns. It was no match for the *Citizen,* and ceased to exist in 1805, the year after the killing of Hamilton by Burr. But before all these papers had commenced their career the violence of several of the organs of the Democratic party, edited largely by foreigners, towards the close of last century, led to the enactment of the Alien and Sedition laws of 1798. The Sedition law, restricting the liberty of the press and of speech, especially aroused the Democrats, and caused great indignation in most of the newspaper-offices, and the journals opposed to the administration of John Adams became more violent than ever. The second clause of this act stated that "if any person should write or publish, or cause to be written or published, any libel against the government of the U. S. or either house of Congress, or against the President, he should be punished by a fine not exceeding $2000, and by imprisonment not exceeding two years." About 200 papers were published in the U. S. at that time, and of these only 20 or 25 were edited wholly or partly by aliens. Nearly all of these were opposed to the leading measures of the administration of Adams, and assailed the President for his opposition to France with the utmost virulence. The laws affected these foreign writers. Among them were James Thompson Callender, William Duane, John Daly Burk, and William Cobbett, and all but the latter were in the interest of the Democratic party and encouraged and sustained by Jefferson and Madison, especially by the former. Cobbett edited the *Porcupine* in Philadelphia. There were many prosecutions under the Sedition law—of natives as well as foreigners. Callender of the *Richmond Examiner,* who wrote the *Prospect before Us,* was tried, convicted, fined, and imprisoned in Richmond. Jefferson subsequently had the amount of the fine refunded to him. Judge Thomas Cooper, tried in Philadelphia, was imprisoned twenty-four hours and fined $1000 for printing a political handbill. On the morning after his conviction, Fenno in the *United States Gazette,* the Federal organ, said: "The Republican party is always committing some act of excess, but what occurred in court on yesterday surpassed anything that has yet occurred. Upon the conviction of Cooper, Stephen Thompson Mason, a Senator from Virginia, shook hands with the culprit in the very face of justice." The *Aurora* the next morning contained the following reply, prepared by Gen. Mahlon Dickinson of New Jersey (it is to be borne in mind that Judge Chase who presided at the trial was a person of rotundity and of a florid complexion): "Mr. Fenno is evermore committing great mistakes, but of all the errors into which he has yet fallen, that in his paper of yesterday is the greatest. He states that Stephen Thompson Mason, a Senator from Virginia, shook hands with the culprit in the very face of justice, mistaking the bacon-face of old Chase for the face of justice." Col. Matthew Lyon, who represented Vermont in Congress from 1797 to 1801, was prosecuted for letters written from Washington to Alden Spooner and published in the *Windsor Journal,* "containing artful and indirect accusations" against the President, charging him with "rejecting men of age, experience, wisdom, and independency of sentiment," and saying that the President exhibited a fondness for "ridiculous pomp, idle parade, and selfish avarice." It was also charged that Col. Lyon had published parts of the Barlow letter "abusing, in the most virulent manner, the President and Senate of the U. S." in regard to France; and that all this was done with the intention "to stir up sedition and bring the President and government" into contempt. Col. Lyon was tried in Oct., 1798, convicted, sentenced to four months' imprisonment and to a fine of $1000. During the pendency of the case he was re-elected to Congress, and went from prison to his seat in the House of Representatives. John Daly Burk, author of the play *Bunker Hill, or the Death of Warren,* and Dr. James Smith, editors of the *Time Piece* in New York, were also arrested under this law, but the case never came to trial. Burk left the country for a time, but returned and was killed in a duel in 1808. Charles Holt, editor of the *New London Bee,* was fined and imprisoned under the same law, but the fine of $1000 with interest was afterwards refunded by act of Congress. Holt in 1808 established the *Columbian* in New York as the

organ of the Clintonians, and was always an ardent supporter of Jefferson and Madison.

These were some of the troubles of the journalists in the early days of the republic; and while these papers and editors were having their joys and sorrows in the cities on the Atlantic coast, the tide of emigration was setting westward and the North-west Territory loomed up before the eyes of the world. With the increase of population in that region, the necessity of newspapers became evident, and on Nov. 9, 1793, the *Centinel of the North-western Territory* was founded in Cincinnati by William Maxwell, the first newspaper and the first printing-office beyond the Ohio. Nathaniel Willis, an old Boston printer, started the *Scioto Gazette* in Chillicothe in 1796, and in 1799 the *Western Spy and Hamilton Gazette* was issued. So the North-western Territory, as it was called, was not without its journals to keep its hardy people posted in the affairs of the rest of the world; and now that Territory and the entire West to the Pacific is covered with numerous States, occupied by millions of enterprising men and women, and supplied with thousands of first-class newspapers—such papers as the *Republican* and *Democrat* in St. Louis, where the first paper, the *Republican*, was established in 1808, when that city was a mere trading-post; as the *Tribune*, *Times*, *Journal*, and *Post*, large flourishing sheets in Chicago, where the first journal was founded as late as Nov., 1833, and in a State where the first newspaper did not appear till 1814; as the *Alta California*, *Bulletin*, and *Morning Call* of San Francisco, enjoying circulations from 6000 to 25,000 daily, where the first journal was issued by our soldiers in camp in 1846–47; and as the *Bulletin* and *Herald* in Portland, and over 30 other papers in Oregon, make money and fame where no paper existed in 1846. So, too, in the South as far as Texas, where the *Civilian*, *Bulletin*, and *News* flourish in Galveston, and more than 100 other newspapers look after the growth of that great border State, destined to be cut up into half a dozen smaller States as the population increases.

Singular as it may seem, journalism made its appearance in the North-west even before it did in the interior of New York. The *Otsego Herald*, or *Western Advertiser* was the first newspaper printed in Western (now known as Central) New York. It appeared (18 by 21 inches in size, each of the four printed pages being 9 by 15½ inches) at Cooperstown Apr. 3, 1795, and was continued until 1821. Elihu Phinney was its founder, editor, and the pioneer journalist in that section of the country. In announcing his enterprise he felt the "highest satisfaction in being honored as the conductor of the first public paper printed in the respectable county of Otsego." William L. Stone, Thurlow Weed, and other distinguished journalists, worked at the case in his office, and J. Fenimore Cooper often "set type" there for amusement, and he thus described the printing-establishment of the *Herald* in its days of infancy, in his charming novel, *The Pioneers*. Speaking of the laying out of the village, and of an effort of the early settlers to start an academy, he said: "Meeting after meeting was held for this purpose year after year. The resolutions of these assemblages appeared in the most conspicuous columns of a little, blue-looking newspaper, that was already issued weekly from the garret of a dwelling-house in the village, and which the traveller might as often see stuck into the fissure of a stake that had been erected at the point where the footpath from the log cabin of some settler entered the highway, as a post-office for an individual. Sometimes the stake supported a small box, and a whole neighborhood received a weekly supply for their literary wants at this point, where the man who 'rides post' regularly deposited a bundle of the precious commodity." This description of the printing-office and the mode of delivery of the *Otsego Herald* in 1795 was true of nearly all the journals of a century ago; and even now the small box on a stake is seen at some cross-roads in the interior of Massachusetts, Vermont, and elsewhere.

But to return to our chronological order. The Alien and Sedition laws led to the famous Virginia and Kentucky resolutions of 1798–99. These became the chief plank in the Democratic platform, and were the basis of many of the Democratic journals which were subsequently established; and those in existence sustained the Democratic doctrine thus enunciated by Jefferson and Madison. The *Richmond Enquirer*, edited for forty years by Thomas Ritchie, started on May 9, 1804, was among the first established on this platform, and became a leading and powerful organ of public opinion for half a century. Among other prominent journals that appeared at that time was the *Albany Register*, established in 1803 or 1804, an influential paper, especially under the care of Solomon Southwick, who was its chief editor in 1808. But, like all political journals, it had, in the overthrow of factions, to succumb to the *Albany Argus*, which was started in 1813, and managed with great ability and skill by Edwin Croswell till the defeat of Martin Van Buren in 1840, and even maintained much of its power till the election of Abraham Lincoln. It was the mouthpiece of the Albany Regency, as the *Enquirer* was of the Richmond Junta. Another paper of note was the *Hudson Balance*, a leading Federal paper in 1804, and edited by Harry Croswell. It had to carry on the contest against the Democratic organs with the *Commercial Advertiser* and *Evening Post* of New York. The *Balance* was made famous in journalism by a libel on Thomas Jefferson, for which Croswell was tried and convicted. On the trial the editor offered to prove the truth of the charges, but such evidence was ruled out as inadmissible. This case changed the law of libel in New York, for in consequence the legislature in 1805 passed an act authorizing the truth to be given in evidence when published with good motives and for justifiable ends; and this principle afterwards became the fundamental law of the land. New party papers continued to make their appearance, and were at that time mostly Democratic. They grew out of the troubles and jealousies of the party-leaders. After the death of Cheetham, the Tammany Hall Democrats, dissatisfied with the course of the *Columbian*, set up a paper to take the place of the *Citizen*. This journal was named the *National Advocate*. Henry Wheaton was its editor for a number of years. It then passed into the hands of Mordecai Manasseh Noah; James Gordon Bennett was also one of its editors; Henry Eckford, the famous shipbuilder, was one of its principal owners. The party press reached its greatest power and influence with the establishment of these papers and others, such as the *Portland* (Me.) *Argus* in 1803, the *New Hampshire Patriot* in Concord in 1808, the *Hartford* (Conn.) *Times* in 1817, the *Charleston* (S. C.) *Mercury* in 1822, the *Globe* in Washington, and the *Post* in Boston in 1831, the *Nashville* (Tenn.) *Union*, and the *Columbus* (O.) *Statesman*. These journals wielded the destinies of the Democratic party from the days of Jefferson to the inauguration of Lincoln. They gave the keynote on all important public questions to the lesser organs scattered over the country. The newspapers in opposition a large portion of this time, although some of these were originally Democratic, were the *National Intelligencer*, issued in Washington in 1799–1800; the *Providence* (R. I.) *Journal*, established in 1820; the *Boston Courier*, started by Joseph Tinker Buckingham in 1824; the *Richmond* (Va.) *Whig*, in 1826; the *New York Courier and Enquirer*, in 1827; the *Albany Evening Journal*, originally established by Thurlow Weed as an Anti-Masonic organ in 1830; the *Louisville* (Ky.) *Journal*, first issued in 1831, and edited for thirty years by George D. Prentice; the *Boston Atlas*, started by John H. Eastburn and the Webster Whigs in 1832; and the *New York Express*, set up by the Clay Whigs in 1836. These journals, with their assistants in the cities and towns of the Union, represented the National Republican and Whig parties, and made their mark on the pages of political history. But these journals were not confined wholly to politics. With the progress of the country, and with the discussions of the great questions that came up before the people, they expanded their usefulness and showed some enterprise. Especially in New York, in order to obtain large circulations, efforts were made to acquire the earliest news in advance of each other. This led to improvement in the columns generally of the chief organs of public opinion. More attention was devoted to commercial and foreign intelligence, and they became large advertising mediums. Other papers were established during this long period which were not strictly party papers, but the number of these was very small indeed. One of the most valuable of these publications was *Niles' Weekly Register*, which was brought out in Baltimore in 1811, and continued till 1848; and a set of this paper contains the fullest and best history of the country during the thirty-seven years of its existence.

While the party press reigned in journalism, a class of papers existed which were deemed, till quite recently, a necessity of the time—an *imperium in imperio*. These were the organs in Washington. The first of this class was the *National Intelligencer and Washington Advertiser*. This paper had been removed from Philadelphia, where it was known as the *Independent Gazetteer*, on the removal of the seat of government from that city. This was in 1799–1800. The *Intelligencer*, then owned by Samuel Harrison Smith, became the organ of Jefferson. In 1810–12 it passed into the hands of Gales & Seaton, and these journalists introduced the full reports of the debates in Congress. On the advent of Jackson on Mar. 4, 1829, the *Intelligencer* ceased to be the organ of the government, and became that of the Whig party, and the *United States Telegraph*, edited by Duff Green, was accepted as the organ of Jackson's administration. But a rupture between Pres. Jackson and

Vice-Pres. Calhoun caused the establishment (in 1831) of the *Globe*, with Francis P. Blair and Amos Kendall as editors, and this journal became the thunderer of the Democratic party. It continued to be the organ till the advent of Harrison in 1841, when the *Intelligencer* resumed its old position, but the early death of Harrison, throwing the Whig party into confusion, led John Tyler to select the *Madisonian*, started in 1841, to be his organ. On the election of James K. Polk in 1844, the *Globe* did not return to power with its party, but a new paper, called the *Union*, was established, with Thomas Ritchie as editor, and that journal became the official organ. On the election of Gen. Taylor in 1848, a new paper was started for his organ, as the *Intelligencer* favored the Webster wing of the Whig party. The new paper, the *Republic*, was edited by Alexder Bullitt and John O. Sargeant. The *National Era* acted in the national capital for the Abolition party from 1847. When Franklin Pierce came into power in 1852–53, the *Union* resumed its position with the government, but with Gen. Robert Armstrong as editor and Caleb Cushing and A. O. P. Nicholson as contributors; and continued, with John Appleton (previously editor of the *Portland Argus*) as conductor, through the administration of James Buchanan. The *Union* was the last of the official organs at the national capital. Neither Pres. Lincoln nor Johnson indulged in the luxury of one, and Pres. Grant follows in their footsteps in having no special journal to speak for his administration. Several newspapers published in Washington have pretended to be such, but have not been officially recognized.

While party spirit prevailed in journalism, class-papers began to show themselves. The pioneers of these were the religious press, and the first appeared in 1814–16. The Rev. John Andrews established in Chillicothe, O., the first religious newspaper in America. It was entitled the *Recorder*, and the initial number was issued in 1814. Nathaniel Willis thought and talked of such an enterprise in Portland, Me., in 1808, but did not receive sufficient encouragement to carry out his plans till 1816. On Jan. 3 of that year he issued the first number of the *Boston Recorder;* and now the nation is full of religious newspapers, many of which are very ably conducted and reach larger audiences than sermons from pulpits can possibly reach. Three or four years afterwards another important class of newspapers was initiated. The *American Farmer* was the first of the agricultural press. It was published in Baltimore by John S. Skinner, and the first number appeared on Apr. 2, 1818. The *Ploughboy*, managed by Solomon Southwick, followed in 1821, and was published in Albany. The *New England Farmer* next appeared in Aug., 1822. These were the pioneers of the hundred useful and valuable publications now in circulation for the benefit of the farmer and stock-breeder. Other class newspapers appeared. Special interests are represented in journalism. The commercial classes were not overlooked. Indeed, as far back as 1795 the *Boston Prices Current and Marine Intelligencer* was published, but in a few years it became a political newspaper. The first successful commercial paper was the *New Orleans Prices Current*, established in 1822. Every city has now one or more commercial and shipping lists. Besides these, all trades, avocations, interests, occupations, professions, amusements, have their organs, in the U. S. as well as in Europe. The *Nautical Gazette*, the *Paper-Trade Circular*, the *Tobacco Leaf*, the *Cotton-Planter*, the *Telegrapher*, the *Railroad Journal*, the *Medical Times*, the *Scientific American*, are names frequently seen, and these publications are a credit to their conductors for the ability and research shown in their management, as well as for the beauty of their typographical appearance. Then, there are the illustrated papers, such as *Harper's Weekly*, *Frank Leslie's Illustrated Paper*, *Harper's Bazar*, the *Aldine*, and *Appletons' Journal*, that favorably compare with anything published in Europe. And comic journalism, what can be said of that? Not much for the U. S., for comic papers have been a failure on this side of the Atlantic. They are a great success in England, France, Germany, Italy, and Spain, and are full of wit and humor, but here not one attempt has been successful. Why? Because there is not a paper of any sort issued in the U. S.—political, religious, commercial, marine, scientific—but what has its joke. Most of the papers indulge in regular departments of wit and fun. There is a daily effervescence of *bonmots* from Canada to Mexico and from the Atlantic to the Pacific. The U. S. are a Vesuvius of wit and humor in a constant state of eruption, and the lava is in perpetual motion down the sides of its mountains. Hence the failure of the two or three dozen or more publications which have from time to time made a specialty of the comic side of human nature on this side of the Atlantic.

While the party papers of the old school, such as we have briefly described, covered with the dust of battle, of the Federal Constitution, the French war, the war of 1812, the old tariff, the U. S. Bank, the Mexican war, and the slavery question, and the class of papers with their specialties were passing on, some to continued prosperity and others to the grave, a more vigorous set of newspapers was coming into existence—namely, the Cheap Press. These papers were the great journalistic event in America. The old order of journals were subscription papers, and, considering size and amount of reading matter given, they were high-priced. The only part really cheap about them were the advertisements in their columns. It was only by becoming annual subscribers that copies could be obtained for less than six cents each; none were sold in the streets, none at news-stands or news-agencies, now so numerous, and very few were disposed of over their own counters. None of these journals had large circulations, none printed as late even as 1835–40 circulated over 5000 copies, and very few over half that number. With all the enterprise that James Watson Webb of the *Courier and Enquirer*, and Hale and Hallock of the *Journal of Commerce* of New York, and Richard Houghton of the *Boston Atlas*, displayed between the years 1830 and 1840 in news-schooners and pony expresses, not one of these journals could boast of a subscription-list of over 5000 names. But with the establishment of the cheap press all this has been gradually and wonderfully changed. Newsboys were introduced in our streets, news-agencies started in all the cities of the country, parcels of city journals were daily sent along the railroad and steamboat routes by express, and the modern newspapers soon had circulations ranging from 10,000 to 100,000, and now as high as 125,000, with an occasional spurt to 150,000 copies. The penny press was established in New York in 1833. The *Morning Post* was started on the first day of that year. Horatio David Shepard was the editor, and Horace Greeley and Francis V. Storey the printers. It was first sold for two cents, and then for one cent. In three weeks it was dead. On Sept. 3, 1833, the *New York Sun* was issued by Benjamin Day, and sold at one cent per copy. Its prospectus was as follows: "The object of this paper is to lay before the public, at a price within the means of every one, all the news of the day, and at the same time afford an advantageous medium for advertising. The sheet will be enlarged as soon as the increase of advertisements requires it, the price remaining the same. Yearly advertisers (without the paper), thirty dollars per annum. Casual advertising, at the usual prices charged by the city papers. Subscriptions will be received, if paid in advance, at the rate of three dollars per annum."

This was the origin of the cheap press in America, and the *Sun* is still published, and is still one of the cheap papers, although not a penny paper. The new class of journals, beginning thus in 1833, has gradually worked a complete revolution in the profession. Most of the cheap papers were established independently of political parties, but politicians were not disposed to lose such an opportunity for publicity, and while the *Transcript* in New York, the *Public Ledger* in Philadelphia, the *Sun* in Baltimore, and the *Herald* and *Mail* in Boston were established as mere local news-sheets, and owned and published by printers, the *New Era* and *Tribune* in New York were started in the interests of politics—the first as a Democratic organ, and the latter as a Whig organ—and the increase of cheap political sheets continued for several years. The conductors of these cheap papers in the early days of their publication confined themselves to local news only. Their means were limited, and they were governed by circumstances. They did not indulge in opinions. But in 1835 the cheap press with opinions was inaugurated. On May 6 of that year the *Herald* was established in New York by James Gordon Bennett with a more comprehensive plan in view. Its founder had been ten or twelve years previously actively engaged as a reporter, a correspondent, and an editorial writer on leading political journals, and he therefore entered on his new duties with considerable ability and experience as a journalist. With these qualities he combined that of great energy and enterprise, and he started on his new career entirely independent of party affiliations. The result is known, and with the issue of the first number of the *Herald* the Independent Press had its origin. With the success of the *Sun*, *Herald*, and *Public Ledger* and their contemporaries of the cheap press, the old class of papers began to pass out of existence, and even the new political journals were subsequently established on the new plan as more effective with the masses and more successful in a business point of view. On Apr. 10, 1841, Horace Greeley started the *New York Tribune*, and by his ability, indomitable industry, and experience as a printer and political writer, as had been illustrated on the *Jeffersonian*, *Log Cabin*, and *New Yorker*, he made that journal the chief Whig and Republican organ, and a power in the politics of the Union. On Sept. 18, 1851, the *New York Times* was founded by Henry J. Raymond, who had graduated in the offices of

the *Tribune* and *Courier and Enquirer.* It was organized as a political journal, and was a Republican organ, but its editor was under the control of no party, although he always acted with the Republicans. On June 1, 1860, the *New York World* was established by a number of religious gentlemen for the purpose of having a newspaper in the metropolis without the prurient police reports and the theatrical advertisements and notices that occupied so much space in the other city journals. After spending a large sum of money the enterprise was abandoned, and the *World* passed into the hands of more secular journalists. On July 1, 1861, the *World* and *Courier and Enquirer* were united. The *World* for the last ten or twelve years has been edited as an independent organ of the Democracy.

These journals are thus particularly mentioned because they fully represent the modern class of papers that now come under the head of the independent press. Others in other cities belong to the same category, such as the *Globe*, started in Boston in Mar., 1872. These papers are quarto or double-sheets; which style is rapidly taking the place of the old folio sheet. Many of the older papers, like the *Boston Transcript* and *St. Louis Republican*, have adopted the modern plan, and are now eight-paged instead of four-paged journals.

This is a brief sketch of journalism in the U. S. Its progress may be indicated by a few facts, as follows:

First printing-office in America.................A. D.	1639
First newspaper..	1690
First political newspaper..................................	1733
First libel suit..	1735
First German newspaper..................................	1739
First daily newspaper..	1784
First religious newspaper..................................	1814
First agricultural newspaper............................	1818
First prices current..	1822
First penny newspaper......................................	1833
First independent newspaper............................	1835
First illustrated newspaper................................	1853
First comic newspaper..	1859

But statistics will exhibit more comprehensively, perhaps, the growth of journalism on this side of the Atlantic, and the figures develop a marvellous result. The census returns, as given in *Journalism in the United States*, show the following as the

NUMBER OF PUBLICATIONS, WITH THEIR CIRCULATION AND ANNUAL ISSUE, IN THE U. S. IN 1870.

Periods of Issue.

	Number.	Copies annually issued.	Circulation.
Daily.................................	574	806,479,570	2,601,547
Three times a week............	107	24,196,380	155,105
Semi-weekly	115	25,708,488	247,197
Weekly	4295	550,921,436	10,594,643
Semi-monthly......................	96	32,395,680	1,349,820
Monthly	622	67,810,116	5,650,843
Bi-monthly..........................	13	189,900	31,650
Quarterly	49	846,680	211,670
Total..................................	5871	1,508,548,250	20,842,475

Classes of Publications.

	Number.	Copies annually issued.	Circulation.
Advertising	79	4,689,800	293,450
Agricultural and horticultural..............................	93	21,541,904	770,752
Benevolent and secret societies..............................	81	6,518,560	257,080
Commercial and financial....	142	31,120,600	690,200
Illustrated, literary, and miscellaneous	503	160,061,408	4,422,235
Nationality, devoted to........	20	4,671,000	45,150
Political	4333	1,134,789,082	8,781,220
Religious..............................	407	125,959,496	4,764,358
Sporting	6	3,222,000	73,500
Technical and professional...	207	15,974,400	744,530
Total	5871	1,508,548,250	20,842,475

What an astounding exhibition! Now let us look at the comparative results since 1704:

Newspaper and Periodical Circulation in the U. S.

Years.	Newspapers and periodicals.	Copies annually printed.	Population.
1704	1	16,000	600,000
1725	4	170,000	1,000,000
1775	37	1,200,000	2,800,000
1810	359	22,321,700	7,239,814
1828	852	68,117,796	12,000,000
1835	1258	90,361,000	14,000,000
1840	1631	195,838,673	17,069,453
1850	2526	426,409,978	23,191,876
1860	4051	927,951,548	31,445,080
1870	5871	1,508,548,250	38,555,753

Statistics of the Daily and Weekly Newspapers in the U. S.

States and Territories.	1840. Daily.	1840. Weekly.	1850. Daily.	1850. Weekly.	1860. Daily.	1860. Weekly.	1870. Daily.	1870. Weekly.
Alabama........................	3	25	6	53	9	82	12	75
Arkansas........................	......	9	......	9	......	36	3	45
Arizona	......	......	......	......	......	......	......	2
California........................	......	......	4	3	22	74	27	162
Connecticut........................	2	31	7	34	14	33	17	53
Colorado	......	......	......	......	......	......	9	13
Delaware........................	......	6	......	10	......	9	1	13
District of Columbia....	3	11	5	13	5	4	8	11
Dakota........................	......	......	......	......	......	......	......	2
Florida........................	......	10	......	10	......	17	......	23
Georgia	5	29	5	40	12	60	13	77
Illinois	3	40	8	88	23	239	26	378
Indiana........................	......	73	9	97	13	160	22	234
Iowa........................	......	4	......	27	9	107	18	204
Idaho	......	......	......	......	......	......	......	7
Kansas	......	......	......	......	3	21	10	55
Kentucky........................	5	33	9	45	4	62	5	74
Louisiana........................	11	23	11	43	4	64	10	80
Maine........................	3	33	4	44	7	43	6	59
Maryland........................	7	35	6	58	6	49	6	93
Massachusetts.............	10	81	22	141	17	109	19	162
Michigan........................	6	26	3	49	8	100	12	152
Minnesota	......	......	......	......	4	44	7	76
Missouri........................	6	29	5	49	15	133	20	211
Mississippi........................	2	29	......	50	5	63	7	68
Montana........................	......	......	......	......	......	......	1	8
North Carolina............	......	27	......	45	8	53	12	48
Nebraska........................	......	......	......	......	......	12	1	24
New Hampshire...........	......	27	......	35	......	18	7	39
Nevada........................	......	......	......	......	......	......	4	12
New Mexico........................	......	......	......	1	......	2	......	5
New Jersey........................	4	32	6	43	15	65	21	86
New York........................	34	211	51	329	68	336	77	535
Ohio........................	9	114	26	211	22	256	33	320
Oregon........................	......	......	......	2	2	12	7	26
Pennsylvania...............	12	175	24	264	28	285	49	406
Rhode Island...............	2	14	5	14	5	12	5	17
South Carolina............	3	14	7	32	2	30	4	62
Tennessee	2	44	8	38	8	61	14	75
Texas	......	......	......	34	3	69	10	102
Utah	......	......	......	......	......	......	1	2
Vermont........................	2	28	2	31	2	28	6	44
Virginia........................	4	47	15	67	15	98	14	79
West Virginia...............	......	......	......	......	......	......	4	46
Wisconsin	......	6	6	39	14	128	14	146
Washington........................	......	......	......	......	......	4	......	14
Total........................	138	1266	254	2048	372	2971	542	4425

It is an interesting fact to note that of all the newspapers published in the world in 1874, there were printed, in round numbers—

In the English language	7500
In all other languages	6600
English over foreign periodicals....................	900

If we make an estimate, based on the returns since 1870, we find the relative position of the U. S. to the rest of the world in periodical literature in 1874, to be as follows:

Periodicals published outside of the U. S..........	8250
Periodicals published in the U. S......................	6500
Against the U. S..	1750

It is safe to say that the number of copies annually printed in the U. S. is fully equal to those annually issued in all the other nations of the world. The highest circulation of any daily paper in London is 160,000, which is that of the *Telegraph.* The highest ever reached in New York has been 156,000, which number has been printed by the *Herald.* The average daily circulation of the *New York Sun* is 120,000; that of the *Philadelphia Ledger*, 85,000; of the *Boston Journal* and *Boston Herald*, in the neighborhood of 60,000. Some of the leading papers in Chicago and Cincinnati range from 40,000 to 50,000. The price of the journals affects the circulation as a matter of course. The *Telegraph* in London sells for two cents, the *Times* for six cents; the *Herald* in New York sells for four cents, and the *Sun* for two cents. The *News* in New York is now the "penny paper" of the American metropolis, which is as low as a paper can be conveniently sold on this side of the Atlantic, while in London the *Sun* is sold for half a cent, or a farthing, which is as low as a paper can be sold in the English metropolis. If the old-fashioned half cents were now in circulation in the U. S., no doubt a paper would be issued for that price, although of course it could not compete with the higher-priced papers in news and other reading matter.

The newspaper press of the U. S. has reached as great perfection as that of any other nation; and in enterprise it far surpasses the journalism of England or of the Old World. There is very little enterprise in newspapers on the continent of Europe. There is almost a superabundance of it in America, and especially in New York. There is no danger too great, no expedition too remote, too costly, or

too extensive, no undertaking too vast, for the American journalist. If it be to the heart of Africa, or to Khiva, or to the North Pole, or in the thickest of the battle in the rebellion, in Cuba, in Spain, in Asia, or in Germany, correspondents are sure to be present preparing history for all time to come; and now these journalistic deeds of daring are rewarded by the Iron Cross from the emperor of Germany, the gold medal from the Royal Geographical Society of England, the order of St. Stanislaus from the czar of Russia, and larger checks on the bankers of the newspaper proprietors. FREDERIC HUDSON.

Joust, or **Just** [Fr. *joute, joust, juste*, from the Late Lat. *juxtare*, to "join" in a fight], in the knightly exercises of the Middle Ages a contest with arms, especially between two single combatants. The joust was either on foot or horse; the pole-axe and sword, but more commonly the lance, was the weapon used. The joust, as a rule, was a friendly contest, and was regulated by very minute and punctilious rules. When more than two engaged in such a contest, it was properly a *tourney.*

Joutel′ (HENRI), the author of *Journal historique du dernier voyage que feu M. de la Sale fit dans le golfe de Méxique*, which appeared at Paris in 1713. He accompanied La Salle on his expedition in 1684 to the mouth of the Mississippi; was left in command of the fort of St. Louis in 1685, but joined La Salle again in 1687, and was present in the camp when La Salle was assassinated. He returned through Canada to France in 1688, and lived in his native city, Rouen. Very little is known about him before and after his participation in the exploring expedition of La Salle.

Jouy′ (VICTOR JOSEPH ÉTIENNE), b. in 1764 at Jouy, near Versailles; entered the army very early, fought in South America, East Indies, and the campaigns of the Revolution, but gave up his military career in 1797, and devoted himself exclusively to literature. He wrote novels, vaudevilles, and opera-texts, of which *La Vestale*, composed by Spontini (1807), was the first, and *Guillaume Tell*, composed by Rossini (1828), the last. He also wrote tragedies—*Tippoo Saïb* (1812) and *Sylla* (1822); and in 1815 he was chosen a member of the Academy. But his sketches attracted most attention: *L'Hermite de la Chaussée d'Antin* (4 vols., 1812–14), *L'Hermite en Province* (14 vols., 1818–27), *Les Hermites en Prison* (2 vols., 1823), and *Les Hermites en Liberté* (1824). They were written in a liberal spirit, and brought him for a short time to prison, a fact which increased his popularity. Louis Philippe made him librarian at the Louvre. D. Sept. 4, 1846.

Jovella′nos, de (GASPAR MELCHOR), b. at Gijon, Spain, Jan. 5, 1744, of noble parentage; studied at the universities of Oviedo and Alcalá, and became distinguished for his researches in natural, moral, and political science. After acting for some years as a magistrate at Seville, Jovellanos was successively appointed to several high posts at court, until his friendship for Cabarrus incurred for him the enmity of Godoy, resulting in his banishment from Madrid under pretext of a commission to explore the mineral resources of the province of Asturias. He had previously written for the stage a comedy, *El Delincuente Honrado*, and a tragedy, *Pelayo*, both of which were successful and made him prominent as an author, and had published an important work on the agricultural condition and the property laws of Spain. In 1797 he was for a short time minister of justice, but, again incurring the displeasure of Godoy, was imprisoned in Majorca for eight years (1801–08), only recovering his liberty in consequence of the French invasion of Spain. He became one of the leading members of the central junta which organized resistance against the French, and of the regency, exercised immense influence by his writings for the same purpose, and d. at Vega Nov. 11, 1811.

Jovia′nus (FLAVIUS CLAUDIUS), a Roman emperor, son of Varronianus, a distinguished general. Jovianus was captain of the life-guards of the emperor Julian in the Persian campaign, in which the latter was killed (June 26, A. D. 363), and was proclaimed as his successor the following day by the choice of the generals. He declared himself a Christian, and extricated himself from a position of great peril in the midst of a hostile country by surrendering to the Persian king Sapor all the provinces beyond the Tigris. During his slow retreat towards Constantinople, Jovianus promulgated edicts re-establishing Christianity as the dominant religion, but protecting the pagans. He restored Athanasius to the see of Alexandria, abandoned Nisibis to the Persians, and admitted his infant son Varronianus as a colleague in the imperial rank. During his journey he was found dead in his bed at Dadastana, a small village in Galatia, Feb. 17, 364. Whether he was the victim of poison or of accidental suffocation by the fumes of charcoal is disputed. His successor was Valentinianus I.

Jow′ett (BENJAMIN), D. D., b. at Camberwell, England, in 1817; was educated at Oxford, where he became a fellow in 1838, while still an undergraduate; tutor in 1842, and regius professor of Greek in 1855. He was ordained in 1842; became in 1849, and again in 1853, examiner of classical schools, and in 1854 a member of the commission on examinations for the Indian civil service, along with Macaulay and Lord Ashburton. Their elaborate report, published in 1855, was written by him. In the same year Prof. Jowett published a commentary on Paul's Epistles to the Thessalonians, Galatians, and Romans, and in 1860 he contributed to the *Essays and Reviews* an article *On the Interpretation of Scripture*, for which he was tried and acquitted before the chancellor's court of the University of Oxford on a charge of heresy. His most important work is *The Dialogues of Plato translated into English, with Analyses and Introductions* (4 vols., 1871). Prof. Jowett became master of Balliol College in 1870.

Jowf, or **Djowf,** province of Jebel Shomer, Arabia, is situated between lat. 29° and 30° N. and lon. 39° and 41° E., and forms a deep depression in the surrounding desert. It is irrigated by running streams, very fertile, and has a temperate climate. The date-palm is largely cultivated, also several kinds of cereals and leguminous plants, and all sorts of fine fruit, especially peaches, figs, grapes, and melons. The whole oasis is about 70 miles long and 10 to 12 miles broad, and is inhabited by about 40,000 souls, belonging to the finest Arabian type, and exhibiting all the best characteristics of the race. The principal towns are Jowf and Sekakah.

Joy, post-v. of Sodus tp., Wayne co., N. Y. Pop. 122.

Joy (CHARLES A.), PH. D., b. Oct. 8, 1823, at Ludlowville, Tompkins co., N. Y.; graduated at Union College 1844; received the degree of LL.B. at Harvard University Law School 1847; appointed in 1847 on the first government survey of the copper-region of Lake Superior; attended the University of Berlin 1849; received the degree of Ph. D. at Göttingen 1852; attended lectures at the Sorbonne, Paris, 1853; appointed same year professor of chemistry in Union College, and in 1857 to the same chair in Columbia College, New York City, where he still remains. His principal contributions to chemistry have been analyses of minerals and meteoric iron, researches into the compounds of glucinum, and papers on the combination of alcohol radicals with selenium. He has contributed largely to scientific journals and newspapers, having been for two years an editor of the *Scientific American* and *Journal of Applied Chemistry*, and the editor of all chemical articles in *Appletons' New American Cyclopædia*. Has been president of the Lyceum of Natural History of New York City, president of the American Photographic Society, and chairman of the Polytechnic Association of the American Institute.

Joy (JAMES F.), b. in Durham, N. H., in 1810; graduated at Dartmouth College in 1833; moved to Detroit, Mich., in 1836; was an industrious and very successful lawyer; organized the Chicago Burlington and Quincy R. R. about 1850; became president of the Michigan Central and its connections in 1866. He organized the company which constructed the St. Mary's Falls ship-canal, and has been a very energetic railroad builder and manager in the Western States. W. S. GEORGE.

Joy′field, post-tp. of Benzie co., Mich. Pop. 130.

Joynes′town, tp. of Wilson co., N. C. Pop. 1271.

Ju′ab, county of Central Utah. Area, about 650 square miles. It is in part mountainous. It is partly in the Salt Lake Valley and partly in the Sevier Basin. Lignitic coal of excellent quality is found. Cap. Salt Creek. Pop. 2034.

Juan′ Fernan′dez, or **Mas-a-Tierra,** an island in the Pacific Ocean, in lat. 33° 37′ S. and lon. 78° 53′ W., 400 miles off the coast of Chili, to which it belongs. It is 18 miles long, 6 miles broad, mountainous, with steep shores, but fertile, producing sandal-wood and other sorts of timber, figs, grapes, and many different kinds of fruit. It is inhabited by a few settlers from the U. S. and Tahiti. The story of Alexander Selkirk, a Scotch sailor who was at his own desire put ashore on this island, and lived there four years in solitude, is supposed to have suggested the idea of De Foe's tale of *Robinson Crusoe.* The island upon which De Foe places his hero is off the coast of Venezuela, near the mouth of the Orinoco.

Juan′ y Santaci′lia (JORGE), b. at Nobelda, Spain, Jan. 5, 1713; studied at Malta and at the marine college of Cadiz, distinguishing himself in mathematics and astronomy; in 1733 commanded a small exploring vessel sent to the coast of America, and in 1734 was associated with Don Antonio Ulloa in the command of a scientific corps sent to South America to measure a degree of the

meridian at the equator in order to determine the true size and figure of the earth. The French academicians La Condamine and Bouguer participated in the expedition, which was completely successful. Juan and Ulloa remained in Peru several years, and accumulated a vast store of observations in geography and physics, which they published in 1748 in 5 folio vols. The work has since been a standard one upon that portion of America. Juan wrote other works on nautical science; was an efficient officer of the Spanish navy, in which he attained the rank of vice-admiral; was elected a member of the chief scientific corporations of Europe, and d. at Madrid June 21, 1773.

Jua'rez (Benito Pablo), b. of pure Indian parentage at Ixtlan, near Oaxaca, Mexico, Mar. 21, 1806. Left an orphan at the age of three years, he received no early instruction, and spoke only the Zapoteco language until his twelfth year, when, taking refuge in Oaxaca from ill-treatment by his guardian, the lad found favor with a Franciscan lay brother, who taught him to read and write, and afterward placed him for several years at an ecclesiastical seminary, where he studied Latin, with a view to the priesthood. But there had been founded meanwhile at Oaxaca an Institute of Arts and Sciences, which Juarez was attracted to enter in 1827. Taking the degree of bachelor of laws, he also became the professor of physics of the school, and in 1834 was licensed to practise law. Having espoused liberalism, he had previously (1831) been elected a member of the city council of Oaxaca, and a deputy (1832) to the state legislature. Charged with revolutionary affiliations, he was imprisoned for some months in 1836, but in 1842 was appointed a judge of the civil court of Oaxaca. When his party triumphed, Juarez in 1845 became secretary to the governor, but soon exchanged the place for that of fiscal (attorney-general) of the superior court, as the governor's views did not square with his own more advanced ideas. In Aug., 1846, Oaxaca resuming its sovereignty, the legislature delegated the executive powers to a triumvirate, of which Juarez was the most relied on. But his party having also gained possession of political power at Mexico, he was soon elected a deputy to the federal congress called to reorganize the government under the constitution of 1824, and to provide ways and means for the war with the U. S. He earnestly supported the measure of Gomez Farias to raise $14,000,000 by sale or loan upon the Church property, which, though carried, was successfully set aside by the aid of Santa Anna. Oaxaca again in revolt, Juarez became governor for several years, making reputation throughout Mexico for administrative capacity. By another turn of the wheel of revolution Santa Anna rose again to power, and Juarez was arrested, imprisoned for a time, and banished. From New Orleans, however, he soon found his way by Panama to Gen. Alvarez, then in revolt at Acapulco; and when Alvarez was proclaimed President (Oct., 1855), Juarez was appointed minister of justice and ecclesiastical affairs. His sweeping measures of reform did not suit Gen. Comonfort, the ruling spirit of the cabinet, to whom the aged Alvarez soon yielded his office; therefore Juarez preferred to return to Oaxaca as governor once more. Again distinguished for executive ability, by his influence the democratic principle was greatly developed in the state, including the direct election of governor by the people, and in 1857 he was the first governor thus chosen. But at the same general election he was also elected president (chief-justice) of the federal supreme court, and in Nov., 1857, was appointed minister of gobernacion. His presence in that cabinet led congress to invest Comonfort with extraordinary powers, which were speedily abused by the President's complicity with the conspiracy of Zuloaga. Again Juarez was imprisoned, but as Comonfort's intrigues fell through, he had the grace to release Juarez before quitting the capital, and the latter retired at once to Oaxaca, whence he was soon summoned to Guanajuato to head the movement of the states against the military party, and under the constitution, as president judge, was proclaimed President Jan., 1858. For lack of resources he had to retire to Guadalajara. There the garrison was divided: Lieut.-col. Landa, with a party of his battalion, pronouncing for reaction, seized and imprisoned Juarez and his cabinet in the palace, menacing them with death—a threat not executed, simply because of the energy with which another field-officer rallied a small force of regulars, the national guards, and people, invested their prison, and forced their captors to surrender them. Meanwhile the liberal army under Gens. Parrodi and Degollado, defeated at Salamanca, had fallen back upon Guadalajara, and Parrodi was made minister of war and general-in-chief. Juarez then retired with the government to Colima, leaving Parrodi to defend Guadalajara, where he soon capitulated. Replacing him by Degollado, Juarez now determined to take position at Vera Cruz, which he reached (May 4, 1858) by way of Manzanillo, Panama, and Havana at an extremely critical juncture, when, with commerce virtually at an end, the whole interior was dominated by his adversaries. But Juarez never lost heart. Ably assisted by some resolute partisans in the field, he published (June, 1859) plans for reform which gave such strength to liberalism in the country that the conservatives invoked foreign aid (France, England, and Spain), upon the basis of a government which should secure reform with conservative rule; and to this scheme they secured the assent of Degollado, whose army, however, repudiated his course. Juarez, resolutely refusing to countenance European intervention, called a general election for President and deputies to congress. Then came the successful battle (Dec. 22, 1860), near Mexico, of Calpulalpam, and immediate entrance of the liberal army into that city, from which Miramon narrowly escaped at night. Juarez, following thither (Jan. 11, 1861), re-established his government, and at an election held in March was chosen President of the republic. Fifty-one deputies in Congress, however, demanded his resignation in favor of Gonzales Ortega, who had been chosen chief-justice (May). But, supported by the state legislatures, the governors, and a majority of the press, Juarez continued in the executive office. At his suggestion, congress having (July 17) suspended payment for two years of all (including exterior) public obligations, a pretext was given for the tripartite alliance, under which an Anglo-French-Spanish force was landed (Dec. 8, 1861) at Vera Cruz. Weakened by more than forty years of civil war and an impoverished exchequer, with aught less than his supreme faith and constancy of purpose, Juarez must have succumbed. But the fortunate early withdrawal of the English and Spanish forces encouraged the states to the most resolute resistance to the French, who were repulsed (May 5, 1862) in their first attempt upon Puebla. With the rich, the clergy, and the remains of the old army in sympathy with intervention, however, Puebla was taken in May, 1863, and in June the French entered Mexico. Retiring to San Luis Potosi, Juarez found himself deserted by many who had hitherto stood steadfast; he therefore proceeded to Saltillo, there to learn that Vidaurri, governor of Nuevo Leon and Coahuila, had already gone over to the French. Deposing him, with the aid of the people he soon forced him to seek refuge in Mexico. But a hostile force under Gen. Quiroga afterwards made him retire to Chihuahua, where the people gave a cordial welcome, and he organized an army under Gens. Ortega and Patoni, which, being poorly equipped and unskilfully commanded, was soon beaten. With other forces, raised in that quarter and Durango, however, Negrete, now minister of war and general-in-chief, recovering Saltillo, Monterey, and Parras (spring of 1865), an unsuccessful effort was made to recover Matamoros, which was soon followed by a counter-French invasion of Coahuila, Nuevo Leon, and even Chihuahua, before which Juarez was forced (Aug., 1865) to recede to the very border at Paso del Norte. It was now that Gen. Ortega, chief-justice of Mexico, claimed that Juarez's term of office having expired, the executive power constitutionally lapsed to him. Juarez, however, determined to hold over until there could be a general election, but for the next year had to remain near the northern frontier of Mexico, exercising little actual influence upon the struggle maintained in the interior by military chiefs with Maximilian and the French. In Jan., 1867, as the French were preparing to quit Mexico, he penetrated to Zacatecas, but after a narrow escape from capture by Miramon, had to retire. But Escobedo, apparently the soul of the military resistance to Maximilian, attacked Miramon in turn, and routed him in several actions (decisively at San Jacinto), and Juarez followed to San Luis Potosi, to hear there of the capture of Maximilian at Queretaro (May 17, 1867), soon after which he repaired to the capital. Maximilian, Miramon, and Mejia were shot, after a protracted trial by court-martial, June 19, 1867, notwithstanding all the efforts of their able counsel, the friendly intervention of the U. S. government, and the appeals of many personal friends of Juarez. A general election was held, and congress meeting Aug., 1867, declared his re-election to the Presidency. He set about the establishment of the government, but was encountered by violent opposition from ambitious or dissatisfied chieftains of his own party, who excited many insurrections, and during this whole term of office (1867–71) he was able to retain power merely because of the utter lack of harmony and concert among his military opponents. With characteristic inflexibility of purpose he pursued his object of consolidating the institutions resulting from the "war of reform," indifferent alike to flattery and to menace. One of the events of his administration was the triumphal procession made by ex-Secretary Seward through Mexico late in 1869. At the general election of 1871, again a candidate, he had a plurality, not an absolute majority, of votes, but was elected by congress. The result was the revolution headed by Gens.

Diaz and Trevino, by whose successes the central power seemed more than once tottering to its fall. The tide was turned in favor of Juarez by the victory of Gen. Rocha at Zacatecas (Mar. 2), but the northern states were still unsubdued when he d. of apoplexy, July 18, 1872. Personally, Juarez was taciturn, self-reliant, and hopeful, but unexcitable, confident in his own resources and of the ultimate triumph of his plans. Unquestionably, however, the downfall of Maximilian was due to the opposition made by military leaders remote from Juarez, and to the immense moral force of the position of the U. S. government at the time, rather than to the positive influence of the Indian statesman upon affairs. THOMAS JORDAN.

Juar'ros (DOMINGO), b. in Guatemala about the middle of the eighteenth century, was an ecclesiastic, who is known only as the author of a learned historical work upon Central America, which is one of the chief sources of information upon the subject—*Compendio de la Historia de la Ciudad de Guatemala*, etc. (2 vols., 1809–18). He is said to have died about 1820.

Ju'ba, king of Numidia, succeeded his father Hiempsal after 62 B. C. The tribune Curio having proposed to make Numidia a Roman province, Pompey opposed the plan, and thus secured the good-will of Juba. In 49 B. C., Juba defeated and killed Curio on the Bagradas, took part in the African war against Cæsar (47), and after the battle of Thapsus took his own life (Feb. 4, 46 B. C.).—His son, JUBA, graced Cæsar's triumph at Rome, 46 B. C.; was well educated, and became the friend of Augustus, who gave him in marriage a daughter of Antony and Cleopatra, and restored him to his kingdom 30 B. C. In 25 he exchanged Numidia for Mauritania, and the former became a Roman province. Mauritania under his tranquil sway, supported by the Roman arms, rose to great prosperity. He wrote grammatical works, histories of Africa, Arabia, and Rome, treatises on painting and the theatre, on certain plants, etc. Fragments of his works are extant, but only as citations in other writers. The time of his death is placed about A. D. 18.

Ju'bilee [Heb. *yobel*, a "glad sound;" Lat. *jubilo*, to "rejoice"], among the ancient Hebrews in Palestine, the fiftieth year, the year succeeding every seventh sabbatical year. During this year all lands lay fallow, all Hebrew slaves were set at liberty, and all lands reverted to the heirs of the original owners, to whom the lands had been parcelled out in Joshua's time. In the Roman Catholic Church, Boniface VIII. in 1300 established a jubilee to be held once a century; Clement VI. (1350) ordered it to be held once in fifty years; Urban VI. (in 1389), once in thirty-five years; Sixtus IV. (in 1475) fixed the interval at twenty-five years.

Jubilee, tp. of Peoria co., Ill. Pop. 837.

Jubilees, Book of, an important pseudepigraphical book, originally written in Hebrew, probably before (but not very long before) the birth of Christ. It was translated at an early date into Greek, was prized by the early Christian Church, but both Hebrew and Greek texts were lost (except fragments of each) before the thirteenth century. In 1844, Dr. Krapf discovered in Abyssinia an Ethiopic version from the Greek. Of this Dillmann published a German translation (1849–51) and the Ethiopic text (1859). This book is regarded as canonical by the Abyssinian Church. It pretends to be a revelation made to Moses. It is named from the fact that it treats of biblical history in *jubilees*, or periods of fifty years. The unknown author's design was to furnish a commentary upon Genesis and Exodus. He has borrowed freely from the Hagadah. The critical value of the work is very considerable. It may be regarded as a part of the Hagadah.

Ju'da, post-v. of Green co., Wis., on the Monroe branch of the Milwaukee and St. Paul R. R.

Judæ'a, or **Judea,** was first used in ancient geography as the name of the kingdom of Judah, in contradistinction to the kingdom of Israel, but after the return from the Captivity, and up to the times of the Romans, it denoted the whole of Palestine. The Romans used it partly in a general sense, signifying the land of the Jews; thus, Herod was styled king of Judæa, though he ruled over countries not belonging to Palestine; partly in a restricted sense, denoting the southernmost province of Palestine, bounded N. by Samaria, E. by the Jordan and the Dead Sea, S. by Idumæa, and W. by the Mediterranean.

Ju'dah [Heb. *Yehudah*, "celebrated"], one of the twelve patriarchs, the fourth son of Jacob by Leah, b. at Haran (Padan-Aram) in Syria, about B. C. 1916; was esteemed the progenitor of the tribe of the same name, which became so predominant in Palestine as to give its name to the kingdom of Judæa, and ultimately to the whole race of the descendants of Abraham (Jews). Judah appears to have exercised a kind of leadership among his brothers; it was he who persuaded them not to kill Joseph, but to sell him to the Midianites, and on the journey to Egypt to buy corn it was Judah who acted as spokesman for the whole company. As such, he offered himself to Joseph as a slave to ransom his half-brother Benjamin. He had married a Canaanite woman, and left three sons, Shelah, Pharez, and Zerah, from the second of whom David, and ultimately Christ, were descended. Of the life of Judah in Egypt nothing is known except that he was still living at the time of his father's death, and received that splendid blessing (Gen. xlix. 8–12) which foretold the glory of his lineage.

Judah ben Samuel, called HA LEVI, or "The Levite," and known among Arabic writers as ABUL HASSAN, b. in Castile about 1080, was one of the most distinguished mediæval Hebrew writers. He excelled as a physician, a theologian, and a poet, his Hebrew sacred songs having been several times translated into German within the present century. His principal work, however, was in Arabic, *Kuzari*, being discourses on religion between a king of the Khazars, a race of the Crimea, and a Jewish rabbi. It was translated into Hebrew, Latin (by Buxtorf), Spanish, and German. Rabbi Judah made a pilgrimage to Jerusalem, and, according to tradition, was assassinated by a Mohammedan in the Holy Land about 1140.

Judah (HENRY MOSES), b. at Snow Hill, Md., June 12, 1821; graduated at West Point in 1843, served in the Mexican war, and for nine years in Indian campaigns on the Pacific coast; was appointed colonel of volunteers in 1861, brigadier-general in 1862, and inspector-general of Gen. Halleck's army of the Tennessee; was actively engaged in pursuit of Morgan during his raid into Ohio and Indiana, and commanded a division under Gen. W. T. Sherman in the Atlanta campaign. D. at Plattsburg, N. Y., Jan. 14, 1866.

Ju'das Iscar'iot [Gr. Ἰσκαριώτης], one of the twelve apostles, and the betrayer of his Master, was a son of Simon, who is by some supposed to be Simon Zelotes, or the Canaanite, who was also an apostle. The surname Iscariot has given rise to many interpretations, but the most usual is "man of Kerioth," a village in Judæa. He was the treasurer of the apostles, participated with the others in the mission to preach the gospel and in receiving power to work miracles, was a witness of the whole career of Jesus up to the Last Supper, in which he took part, and betrayed Christ to the chief priests for thirty pieces of silver, with which he purchased a field, but shortly after hanged himself in remorse for his crime. Opinions have differed for centuries as to the precise nature and motives of the crime of Judas. It is evident that it could not have consisted simply in identifying the person of his Master, which was well known in Jerusalem; the better opinion seems to be that he revealed, or perhaps falsified, some portion of the teachings of Jesus intended only for the immediate circle of the disciples, but which enabled the chief priests, with the aid of hired witnesses, to fasten upon him the charge of blasphemy. As to his motives, the plain inference from the language of the Gospels and the Acts seems to be that he was actuated by avarice, jealousy, and perhaps disappointed ambition. Yet there have not been wanting theologians who have attempted some defence of, or at least apology for, his conduct. An early Christian sect, the Cainites, remarkable for the Antinomian inversions of Scripture which led them to worship Cain and the Serpent, while refusing to worship the Jehovah of the Old Testament, honored Judas as the only true apostle, alleging that he alone perceived the necessity of taking steps for the fulfilment of prophecy and the salvation of mankind by the death of the Messiah. Modern apologists, without going to this extreme, argue that Judas's object was to place his Master in such a conflict with the authorities as would lead him to exert his miraculous powers and establish the "kingdom of the Messiah," in which he of course looked for personal advancement, in accordance with the promise that the apostles should "sit on twelve thrones, judging the twelve tribes of Judah." It is even alleged that by virtue of name and descent (being the only apostle not a Galilean), as well as in reward of his political sagacity, he expected a kind of premiership as judge over the royal tribe of Judah. On this theory his remorse and suicide simply imply that the result of his action, so contrary to his expectations, first opened his eyes to the enormity of his offence. Archbishop Whately has presented a view similar to this in one of his *Essays on some of the Dangers to Christian Faith* (1839). But it must be admitted that this view is difficult to reconcile with the text of the biblical narrative. One of the numerous apocryphal writings of the second century was a "Gospel of Judas," which the Cainites adduced in support of their opinions.

Judas Maccabæus. See MACCABEES.

Judas Tree, of Europe and Asia, is the *Cercis Siliquastrum*, a small tree of the order Leguminosæ, having rose-colored flowers and handsome wood used in joinery. There was anciently a dispute as to whether Judas Iscariot hanged himself on this or on the elder tree. The Judas tree or red bud of the U. S. (*Cercis Canadensis*) resembles the above, but has pointed while the other has round leaves. Its abundant flowers, of a peach-blossom color, are very beautiful in spring. The wood is soft and brittle, but handsome.

Judd (G. P.), M. D., b. Apr. 23, 1803, at Paris, Oneida co., N. Y.; studied medicine, and went in 1828 to Honolulu as physician in the service of the American foreign mission. In 1842 he dissolved his connection with the mission, and became interpreter to the government of Kamehameha III. In 1843 he organized the first ministry which had ever been formed in the state, and he held himself the office as minister of finance, which he filled with great prudence and sagacity till his death, July 12, 1873.

Judd (NORMAN B.), b. at Rome, N. Y., Jan. 10, 1815; was admitted to the bar in 1836, and engaged in successful practice of law in Chicago; was a prominent politician of Illinois, in which State he has held many important public offices. He was U. S. minister to Prussia 1861–65, member of Congress 1867–71, and became a railroad president.

Judd (ORANGE), b. near Niagara Falls, N. Y., July 26, 1822; graduated at the Wesleyan University, Middletown, Conn., in 1847; was for some years successfully engaged as a teacher and lecturer; studied chemistry 1850–53 at Yale; became in 1853 editor of the *American Agriculturist*, which under his supervision has become one of the leading agricultural journals of the U. S. In 1866 he became sole proprietor of the same, and engaged in the publication of books. In 1869 the firm-name was changed to Orange Judd & Co. Mr. Judd has also been a railroad president, and was 1855–63 agricultural editor of the *New York Times*. He was the compiler of the first *Alumni Record* of his *alma mater* (1868 *seq.*), and for a time was publisher of the *Hearth and Home*, a periodical. He has been a liberal benefactor of the Wesleyan University.

Judd (SYLVESTER), b. in Westhampton, Mass., July 23, 1813; graduated at Yale in 1836; studied at the Cambridge Divinity School, Mass., and was 1840–53 pastor of a Unitarian church in Augusta, Me., where he d. Jan. 20, 1853. He is best known by his powerful romance *Margaret* (1845), one of the most noteworthy works of fiction ever written in the U. S. His *Philo*, a poem (1850), *Richard Edney*, a romance (1850), and a volume of discourses on *The Church* (1854), all illustrate the strong purposes of their author's life. He was a hearty opponent of war, capital punishment, intemperance, and slavery. He left a MS. drama, *The White Hills*. (See his *Life*, by Mrs. A. Hall, 1854.)

Jude, or **Judas** (with the surname THADDÆUS or LEBBÆUS), one of the twelve apostles, but it is not agreed whether he is the same as Judas, the brother of the Lord, nor whether he is the author of the Epistle of Jude, one of the canonical books of the New Testament. Of his life nothing is known with certainty; different traditions mention different places in which he is said to have preached and died.

Jude, The Epistle General of St., was written by Judas (Judah), called also Lebbæus and Thaddæus, one of the twelve apostles. It is directed against heretics and false teachers. It is written in impassioned language, recalling that of St. Peter's second Epistle. Its date is quite uncertain. The authority of this Epistle was contested in the early times of the Christian Church, because it contains citations of apocryphal writings, and recent critics have doubted its genuineness. Most commentators, however, maintain that it was written by Judas Thaddæus, and that Judas Thaddæus was the brother of the Lord.

Judge, a public officer who is invested with authority to hear and determine litigated causes, and to administer justice between parties according to law. The term *judge* is sometimes employed to designate any officer or person who exercises a discretion of a judicial nature in the performance of his official duties, as a juror, an arbitrator, or a public inspector, but in ordinary legal and popular usage it bears the sense expressed by the above definition. The judges of the superior courts of England are rarely designated by this name, but receive particular titles according to the court in which they sit. Thus, the judges of the court of exchequer are styled barons, and the principal one is known as chief baron. The chief judge of the king's bench is called the lord chief-justice of England, while the corresponding judge in the court of common pleas is styled the chief-justice of the common pleas. The other judges of these two courts are termed justices, as, *e. g.*, Mr. Justice Blackstone. The highest equity judge is designated lord chancellor. In the U. S. it is usual to apply the epithet "judge" to all officials of this kind, in whatever court they may sit. But the highest judge among the Federal judiciary is known as the chief-justice of the supreme court, as Chief-Justice Marshall. The methods by which judges are chosen, their tenure of office, the rules of law relating to the payment of their salaries, the extent of their legal responsibility, etc. are fully considered in the article JUDICIARY (which see). It will only be necessary to refer here to one or two additional points. It is a maxim of the common law that "no one can be a judge in his own cause." Impartiality in the administration of justice requires necessarily that the judge should be an entirely disinterested party. This disqualification applies not only in regard to cases in which the judge is a party of record, but as well to causes in which he has some private or pecuniary interest. For instance, a judge who is a stockholder in a corporation cannot do any judicial act in a cause in which that corporation is a party. A judgment or decree rendered in a suit in which the judge was interested would be voidable without any proof that he had been prejudiced or misled by considerations of his own advantage. A judge cannot sit under such circumstances, even with the consent of all the parties. In some of the States statutes have been passed embodying this common-law prohibition, and extending the same principle to other analogous cases in which a judge's personal interest in a cause is likely to be aroused. Thus, in New York it is provided that no judge can sit as such in any cause in which he is a party, or in which he is interested, or in which he would be excluded from being a juror by reason of consanguinity or affinity to either of the parties; nor can any judge take part in the decision of any question which shall have been argued in the court when he was not present and sitting as a judge. Moreover, it is declared that no judge shall have any partner practising in his court, and that no judge shall have any voice in the decision of any cause in which he has been counsel or attorney. So no judge of an appellate court is to take part in deciding a cause determined by him in the court from which the appeal is taken. It is further provided that no judge shall act as a counsellor, solicitor, or attorney in the court of which he is a judge, except in those suits in which he shall be a party or in the subject-matter of which he shall be interested. There is also a law of Congress prohibiting any judge of the U. S. courts from engaging in the practice of the law. Any person violating this prohibition is declared to be guilty of a high misdemeanor.

In the trial of a cause it is the province and duty of the judge to decide upon the admissibility of evidence. If his rulings are deemed erroneous, objection may be made to them by counsel, and exceptions taken, upon which a motion for a new trial or an appeal may subsequently be based. The credibility of the testimony is to be determined by the jury. So the judge decides upon the competency of witnesses offered to be sworn. The interpretation and construction of written instruments is also, as a general rule, for the court, and not for the jury. A judge cannot be called as a witness to testify as to what took place before him in the trial of another cause, though he may testify to foreign and collateral matters which happened in his presence while the trial was pending or after it was ended. Moreover, the same person cannot be both witness and judge in a cause which is on trial before him, whether he sits alone or with associate judges. In some cases, however, when a witness who testified in a former trial has since died, the testimony which he then rendered may be proved in a subsequent suit by the judge's notes or minutes when both actions are tried before the same judge. (See EVIDENCE, COURT.) There are some forms of legal business which may be transacted only before a court acting as such, while others may take place out of court, and before an officer acting as a judge. A distinction is that drawn between a *court* and a *judge*, the latter word being used to indicate that business before the officer is transacted out of court. (See CHAMBERS.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Judge (Col. THOMAS J.), a native of Alabama, entered public life in 1843 as a solicitor in a State circuit court, and afterwards became a prominent lawyer and Whig politician; in 1861 was commissioner from Alabama to the U. S. government, but was not received as such by Mr. Buchanan; served in the civil war, first as a private, then as colonel, of the 14th Alabama, and afterwards as judge of a military court 1862–65; was judge of the State supreme court 1865–68, and has since practised law at Greenville, Ala.

Judge Advocate, as the name is most frequently used in the U. S., designates the person (a military officer save

in very exceptional cases) who prosecutes before a general court-martial or military commission in the name of the U. S. He is detailed by the authority which appoints the court. Some of his principal duties are to prepare the case for trial, summoning the necessary witnesses; to see that the accused has the opportunity to exercise his right of challenge; to administer to the members of the court, in the presence of the accused, the oath prescribed by the 84th Article of War; himself to take that prescribed by the 85th; to see that the charges are technically accurate; to arraign the prisoner; to administer the oath to witnesses, and to present the evidence for the prosecution; to consider himself counsel for the prisoner so far as to object to any leading questions, or to any question to the prisoner the answer to which might tend to criminate himself (Art. 90); to give legal advice to the court when called on; to keep an accurate record of the proceedings, and to forward the same, properly authenticated, to the convening authority. The judge advocate has power to compel witnesses to appear and testify, and he may employ a reporter to record the proceedings and testimony.

There is also, in the U. S. army, a corps of judge advocates (reduced to four in number by act of Congress of June 23, 1874). They hold the rank of major, and are required by law to perform their duties under the direction of the judge advocate-general. They are, however, generally stationed at department head-quarters as legal advisers to the department commanders, but are subject to detail by him for court-martial duty.

In the English service the judge advocate has not, since 1829, performed the duties of prosecutor. These devolve upon a staff officer ordered to perform them, or upon the prisoner's commanding officer, or at minor courts-martial upon the adjutant. The principal duties of the judge advocate under the English system are those of the judge or assessor called in (*advocatus*) to advise the court, and that of the clerk or notary who takes down the proceedings in writing.

Judge Advocate-General, in the U. S. army an officer at the head of the bureau of military justice at Washington, with the rank of brigadier-general, whose duties, as defined by sec. 1199 of the Revised Statutes, are to receive, revise, and cause to be recorded the proceedings of all courts-martial, courts of inquiry, and military commissions, and such other duties as heretofore performed by that officer in the U. S. army. The office of judge advocate-general has existed in England since the days of the Stuarts. The Articles of War of James II. prescribed that in all criminal causes which concerned the Crown, His Majesty's advocate-general or judge advocate of the army should inform the court and prosecute on His Majesty's behalf. He is now the legal adviser to the Crown in all cases requiring the sovereign's action as confirming officer of the proceedings of general courts-martial. He exercises the power of a supreme court of review as regards the proceedings of inferior courts. He is the supreme legal authority for the army, except as to questions arising under martial law, with which he has nothing to do. He has the right to appoint deputies, and is responsible for them. He is conservator of the proceedings of military courts, other than those held under martial law, and he is a subordinate member of the administration, and quits office with it.

Jud'ges, The Book of the, a historical book of the Old Testament, the seventh in order of the canonical books. It derives its name from a class of rulers or chiefs who ruled in Israel during the period which its record covers. The twelve tribes after entering Canaan formed only a loose confederation, without unity or national feeling or dignity. They had no head. They were at the same time engaged in such wars as all conquerors must maintain with those whom they displace, and they were also harassed by foreign foes. In emergencies men (or women) of talent and energy took the lead, their only authority being their ability. They were regarded as "raised up" or divinely sent. The name given to them is the same which we meet with in the Phœnician, "suffetes." When one had gained authority by displaying ability in a crisis, he became a "judge" in our forensic use of the term. This time was not one to awaken the national pride out of which history is born, or to produce historical records. In some cases, as in that of Samson, the judge became a popular hero and the subject of song and poetry. Such records of this time as remained are collected in the book of Judges. They are fragmentary and imperfect, as is abundantly shown by the lack of chronology. The book is said, in the Talmud, to have been written by Samuel. He certainly was not the original author of any of the parts, and it is more than doubtful if he was the collector. Some writers refer the authorship to Ezra.

Judg'ment, in law, a determination by a court of the rights of the parties in an action. This term is usually applied to the decision rendered upon a question in litigation in a common-law action, while the corresponding term, "decree," is ordinarily employed to denote the decision given in a court of equity. Both names are, however, sometimes used indistinguishably. In those States where the distinctions between common-law and equitable procedure have been abolished, the term "judgment" is alone generally employed for every form of decision in a civil action. A judgment differs from an order or rule in being the result of an action, while an order or rule is obtained by an application to the court in the nature of a motion. Judgments at common law may be rendered at different stages in the progress of the cause, and are hence distinguished as interlocutory or final. Interlocutory, in legal usage, means intermediate, and judgments of this kind are those which are rendered before the termination of the action upon some issue or litigated point distinct from the principal issue, but collateral or incidental to it, and which therefore do not wholly determine or complete the suit. Of this nature are judgments for the plaintiff given upon pleas in abatement, for they require the defendant merely to "answer over"—*i. e.* to furnish a better plea or answer, free from certain specified objections, and further proceedings are necessary before the final determination of the cause. (See ABATEMENT.) But, as Blackstone says, the interlocutory judgments most usually spoken of are those incomplete judgments whereby the right of the plaintiff is established by a decision upon the entire cause, and not merely upon some collateral point, but the amount of damages to be awarded is not ascertained. The damages payable are subsequently determined by a special jury of twelve men summoned and presided over by the sheriff, and therefore termed a "sheriff's jury." This process is known as a "writ of inquiry," and is necessarily resorted to because these interlocutory judgments are rendered without the intervention of a jury. Examples of such judgments will be given hereafter. A final judgment is one rendered upon the principal issue or entire cause, which determines finally and completely the rights of the parties engaged in the action, as where judgment is entered upon the verdict of a jury, awarding a certain amount of damages to the plaintiff or discharging the defendant. Judgments at common law, whether interlocutory or final, are of different forms, according to the nature of the action, the plea, the issue, and the manner and result of the decision. Thus, there may be a judgment upon demurrer, either sustaining or overruling the demurrer (see DEMURRER); or a judgment by *nil dicit* ("he says nothing"), which is given against a defendant for a failure to plead or continue his pleading until issue is joined; or a judgment by confession, which is given against a defendant when he acknowledges the justice of the plaintiff's claim and agrees to comply with his demand, as by restoring certain property or by paying a certain debt, etc. If any of these various forms of judgment be given for the plaintiff, and the action be brought for unliquidated (or unascertained) damages, the judgment is interlocutory, since the cause has not been referred to a jury, and a writ of inquiry is necessary. If the action be brought for a specific sum of money which is due, as a particular debt, or for the recovery of certain chattels, the judgment is final, since there is no need of ascertaining damages, and the extent of the plaintiff's recovery is determined exactly and completely. Particular forms of judgment at common law against the plaintiff are the judgment of *non prosequitur* ("he does not prosecute"), which is rendered against him for a failure to plead; the judgment of *nolle prosequi* ("unwilling to prosecute"), given when he avers that "he will not further prosecute his suit;" the judgment of nonsuit, which is rendered when he abandons his cause or fails to make out a *primâ facie* case against the defendant. Judgments rendered in favor of a defendant are always final. Judgments entered upon the verdict of a jury are also final, since the jury, at the same time when they try the issue, also assess the damages. A judgment rendered in favor of the plaintiff, except upon a dilatory plea (see PLEADING), is in the form *quod recuperet* ("that he do recover") certain chattels, or a certain debt, or the amount of his damages. A judgment for the defendant (with the same exception) is, in general, in the form *nil capiat* ("that the plaintiff take nothing"). In those States where the common-law practice has been abolished by codes of procedure, these various forms of judgment no longer exist, but forms analogous to the most important of them have still been retained, as, *e. g.*, judgment upon confession, upon default, or by way of nonsuit. There are no interlocutory judgments in these States, but only final judgments. Orders take the place of interlocutory judgments.

Judgments were formerly pronounced in open court, and are still always supposed to be so, but the regular common-

law practice has been for a long period for the party entitled to judgment to obtain the signature or allowance of the proper officer of the court, expressing generally that judgment is given in his favor. This is called "signing judgment," and stands in place of its actual delivery by the judges themselves. The judgment is afterwards entered on record. In some cases, when a verdict has been rendered by a jury, judgment is entered in opposition to it. This is called a judgment *non obstante veredicto* ("notwithstanding the verdict"), and may be obtained by the plaintiff upon motion, when it appears that the defendant, for whom the verdict was given, pleaded in confession and avoidance, and the avoidance is bad in law, though sustained by the jury in point of fact. The confession is therefore left unqualified, and entitles the plaintiff to judgment. After judgment has been entered, proceedings may be instituted in an appellate court for its reversal, if exceptions have been duly taken in the course of the trial, by an appeal or writ of error. (See Appeal.) If this be not done, and the judgment be for the payment of money or the recovery of specific real or personal property, it will be carried into effect by execution. (See Execution.)

A final judgment requiring the performance of a specific act or the payment of a specific sum of money is a peculiar species of contract, termed a contract of record. (See Contract.) If the judgment be not satisfied or discharged, it may itself be made the foundation of a subsequent action in the same way as a claim upon simple contract. It is, however, sometimes provided by statute that the leave of the court in which the judgment was rendered, must be obtained before action can be brought upon it between the same parties; and the provisions of statutes of limitation applying to contracts of record usually specify the same limit of time within which actions upon such contracts must be brought as with reference to contracts under seal, such as bonds. This period is generally twenty years as regards the judgments of the higher courts. In some States, however, domestic judgments are not barred by the statute. Such is the case in England, but actions upon them are not favored there. It is a peculiarity of a contract of record that if it be disputed, its existence must be tried by inspection of the record, and not by a jury. In order that a judgment may be valid, it must be rendered by a competent court, having jurisdiction of the particular cause of action and of the person of the defendant. It matters not what the general powers and jurisdiction of a court may be, if it act without authority in the particular instance, its judgments and orders are regarded as nullities, and all persons concerned in executing them are considered in law as trespassers. They are not voidable, but entirely void, and form no bar to a recovery sought (even prior to a reversal) in opposition to them. The jurisdiction of any court exercising authority over a subject may be inquired into in every court where the proceedings of the former are relied on, and brought before the latter by the party claiming the benefit of such proceedings. There is, however, a difference between courts of general and those of limited jurisdiction—that the jurisdiction of the former is presumed, while that of the latter must be proved. But the presumption in the former case is not conclusive, but open to rebuttal. But where a court has acquired jurisdiction of a cause of action, it has authority to render judgment, and if error be committed, or the judgment be fraudulently obtained, or the proper and legal forms of procedure be disregarded, the judgment is voidable, and not void, and will be binding until vacated on motion to the proper court or reversed on appeal. A judgment rendered by a competent court, and not reversed, operates to extinguish the original cause of action, in accordance with the doctrine of merger (see Merger), and is absolutely binding upon the parties to the action and all who represent them, determining their mutual rights and obligations, upon the principle of estoppel. A cause once decided is said to be *res adjudicata* ("a matter adjudicated or determined"), and cannot therefore be again made a subject of litigation. (This point is considered more fully under the topics Estoppel and Evidence. The rules as to estoppel in relation to Foreign Judgments are stated under that head.)

Judgments requiring in whole or in part the payment of money by a debtor are generally at the present day made to constitute a lien upon the debtor's lands by the force of express statutes, which prescribe certain penalties which must be complied with in order that the lien may attach and be enforced. As this subject is wholly statutory, the provisions in different States must be sought in their various statute-books. In New York the judgment must be docketed—*i. e.* registered in a particular book by the county clerk, known as the "docket-book"—and it then becomes a lien upon all the debtor's real property situated within that county, and upon all that he may acquire within ten years from the time of docketing. A transcript of the judgment may be filed in the clerk's offices of other counties where the debtor has lands, and it will then become a lien on these lands also. Judgments obtained by several creditors take effect according to the time of docketing. The lien may be extinguished by a payment of the amount of the judgment. After the debtor's personal property has been exhausted to satisfy the execution, if the judgment remains unsatisfied, his lands may be sold by the sheriff at any time while the lien continues, in accordance with certain prescribed forms. (See Lien.)

An interesting question has come before the courts for adjudication as to the effect of a judgment for the plaintiff in actions of trespass or trover for the conversion of chattels, in transferring the property in the goods to the defendant. Some decisions have held that the mere rendering of the judgment has this effect, but the generally prevalent doctrine now is that the property does not pass until the judgment is satisfied.

The difference between judgments *in rem* and judgments *in personam* is stated under the topic In Rem. Only domestic judgments have been considered in this article, and the distinctions between these and foreign judgments will be found under the title Foreign Judgment.

George Chase. Revised by T. W. Dwight.

Judicial Committee of the Privy Council. See Courts, I. 5 (*b*).

Judic'iary, that branch of government or collective body of public officials which is invested with the power of hearing and determining litigated causes, of administering justice, and of interpreting and enforcing the laws. In all civilized countries the importance of securing an able, upright, and impartial judiciary, composed of men learned in the law, faithful and disinterested in the performance of duty, and under no subservience to governmental authority by which their decisions may be controlled or influenced, has been recognized; and for the attainment of these ends the judicial department of the government has been separated from the executive and legislative departments, each having mainly, if not entirely, exclusive powers and functions, and its mode of organization, the tenure of office by the judges, the extent of their authority, and their legal responsibility have been, as a general rule, so defined and regulated that judicial independence and integrity may be effectually promoted. In an especial sense is this true of England and the U. S., where the attainment and continued maintenance of civil and political liberty, in which these nations have made the greatest progress, have been recognized as depending fundamentally upon the just administration of the laws, of which the independence and unswerving rectitude of the judiciary alone afford a sufficient guaranty. "There is no liberty," says Montesquieu, "if the judiciary power be not separated from the legislative and executive. Were it joined with the legislative, the life and liberty of the subject would be exposed to arbitrary control, for the judge would then be the legislator. Were it joined to the executive power, the judge might behave with violence and oppression." (*Spirit of Laws*, bk. 11, ch. 6.) In England, as the liberty of the citizen increased, this division of power became more and more complete; and in the U. S., whose political system was, in large measure, a heritage from England, the judicial department of the Federal government was organized from the outset, in pursuance of provisions expressly embodied for this purpose in the U. S. Constitution, with entirely distinct powers from any other branch of the government. The judges cannot occupy any other official position—have no share in legislation or in the execution of the laws. Their functions are exclusively judicial, and are confined entirely to the exercise of the jurisdiction conferred upon the Federal courts by the Constitution or by the laws of Congress authorized by the Constitution. In the several States also similar exclusive functions are conferred upon the judiciary, though with a different extent of jurisdiction. The completeness of the separation between the judicial and the other branches of the government which has been effected in this country has not yet been attained in England. This diversity is attributable to the peculiar historical origin and development of the present system of English courts. In the early periods of Saxon and Norman rule, both legislative and judicial powers were vested in the same public body or assembly—under the Saxons, in the great council or parliament of the kingdom known as the Witenagemote (Sax., "meeting of wise men"), and under the Normans, in a similar assembly, the Aula Regis, or "king's council." The judicial powers exercised by this national assembly were conferred upon the various courts as they were successively formed in later Norman reigns, while the council itself was gradually developed into the modern Parliament, whose powers are almost entirely legislative. But judicial prerogatives have never been wholly trans-

ferred from the legislature to the courts, and the highest appellate tribunal in the realm at the present day is the House of Lords, which is also the highest branch of Parliament. It has, however, been provided by a recent statute, known as the "Supreme Court of Judicature Act," which is to go into effect in Nov., 1875, that a new court shall be formed, to be designated "Her Majesty's Court of Appeal," in which the highest appellate jurisdiction shall be vested, and that no appeal shall afterwards be taken to the House of Lords except from judgments rendered prior to that time. The separation between the legislative and judicial departments will thus be made substantially complete, though it is true that some of the judges of this new court may be members of the House of Lords. (The provisions of the judicature act are stated in the article COURTS.) A union of judicial and administrative or political functions also prevails at present in a few other instances. Thus, the lord chancellor, who is the highest judicial officer in the kingdom, is also a member of the ministry in office for the time being, and loses his position by a change of ministry. He is the prolocutor (or Speaker) of the House of Lords, has the appointment of all justices of the peace throughout the kingdom, and exercises various other powers more distinctively political than judicial. The master of the rolls, also, who is a judge in equity, may be elected to represent a constituency in the House of Commons. But even in these exceptional instances the union of judicial with other diverse functions is but meagre in extent. The jurisdiction of the House of Lords, though in theory vested in the whole body of peers collectively, is in reality exercised by a small number of them, who are designated distinctively the "law lords." The administrative functions of the lord chancellor also appertain, in a large measure, to the performance of his judicial duties. As a result of the division of power among several branches of government, the judiciary occupy a distinct position, are entrusted with duties of a definite and uniform character, are removed to a great degree from political influences which might engender a partisan spirit, and the entire tendency of their official labors is to produce a habit of impartiality in the administration of justice and an especial capacity for judicial investigation.

Reference has already been made to the establishment of methods of court organization, and the defining and limitation of the functions and responsibility of the judiciary as a means of preserving their independence. The most important constitutional or legislative measures of this kind have reference to the methods of choosing judges, the nature and duration of their tenure of office, the payment of their salary, and their liability for judicial or extra-judicial acts. In England—and in the U. S. so far as relates to the Federal courts—judges receive their positions by appointment. In the former country the superior judges are all appointed by the Crown, while certain inferior magistrates are appointed by the lord chancellor or other high officials. In the latter, the Federal judges are appointed by the President "by and with the advice and consent of the Senate"—*i. e.* the Senate may confirm or reject his nominations. In the several States of the Union constitutional provisions of a similar nature were adopted at an early period, and it was declared in many of them that the appointment should be made by the governor, subject to the confirmation of the State senate, while in others power was given to the legislature to elect the judges. But within a comparatively recent period a large number of the States have made the judges elective officers, chosen directly by popular suffrage, in the same way as the members of the legislature or the governor. In Mississippi this change was made in 1833. But it was not till a similar example was set by New York, which adopted a constitution in 1846 providing for the election of judges, that any considerable number of States discarded their previous practice for a system of election. An elective judiciary is now said to exist in a majority of the States. The tenure of office of the English judiciary was anciently at the pleasure of the Crown, but in the time of Lord Coke (about 1600) it became customary to insert in the commissions of the common-law judges that they should hold office during good behavior. It lay, however, in the pleasure of the Crown to determine the form of the commissions until the Act of Settlement in the reign of William III. (1701), by which it was provided that the judiciary should retain their positions during good behavior, though they might still be removed on the address of both houses of Parliament. By an act passed in the reign of George III. (1781) they continue in office notwithstanding the demise of the Crown. These laws apply to all the superior judges, except the lord chancellor, and the tenure of office with this exception is practically for life. In the U. S. it is expressly declared in the Federal Constitution that "the judges both of the Supreme and inferior courts are to hold their office during good behavior." But by a recent act of Congress any judge who has held his commission for at least ten years, and has reached the age of seventy, may resign, and his salary will be continued as a retiring pension during the remainder of his life. In most of the States the tenure of office was originally established as continuing during "life or good behavior," or until the attainment of a certain advanced age, as sixty or seventy years. In New York, for instance, Chancellor Kent was obliged to retire from office in 1823 on reaching the age of sixty, which was the constitutional limit. In those States, however, in which an elective judiciary has been established, the duration of the term of office is generally limited to a few years. Thus, in New York it was declared by the constitution of 1846 that the term of office of the principal judges should be eight years. In 1869, however, it was extended to fourteen years, with the qualification that the term should terminate when a judge reached the age of seventy. This fundamental change in the mode of selecting the judges and in the length of their terms of office which has taken place in so many of the States has given rise to no little controversy between the advocates of the old and those of the new system as to its effect in impairing, or tending to impair, the independence of the judiciary. The natural tendency of the system of appointment and a tenure of office during good behavior is manifestly to relieve the judiciary from all apprehension of losing their positions by failing to consult the interests or favor the wishes of the appointing power or by reason of any fluctuations of party politics. The faithful performance of duty, without regard to ulterior considerations of future advantage, is therefore more likely to be secured. Pre-eminent legal ability is more apt to be regarded than political services or party fealty as the chief qualification in a judge, and the responsibility of a bad appointment is readily fixed upon the appointing power, so that care and deliberation are likely to characterize the selection of the judiciary. The temptation to court popular applause and support, even by a sacrifice of judicial fairness and integrity, the influence of which would naturally be most powerful where an elective system prevailed, is much diminished when the judges feel no dependence upon the people for a continuance of their official position. On the other hand, the adoption of a system of election by so many of the States of this country is but a further extension of democratic principles upon which the structure of the government is founded, and it is mainly upon this ground that its advisability as a matter of public policy has been based. It is urged, moreover, that the uprightness and independence of the judges will be promoted by making them amenable to the popular will, and subject to public disapprobation and a forfeiture of their positions by corrupt conduct. But whatever mode may be established for the selection of the judiciary, only its tendencies can be spoken of with assurance, and not its necessary results. The influence of a healthy public opinion demanding integrity, ability, and a true judicial spirit upon the bench—a public opinion which is sure to prevail in the long run in this country—will be particularly effective in counteracting the evil tendencies which may exist in a system of election. In some of the States, moreover, there has been a return, in some measure, to the former practice by increasing the length of the tenure of office, and it is not improbable that a change of this kind will be generally adopted. But by no system of appointment or election can the absolute purity and impartiality of the judiciary be ensured. The remarks of Hallam upon this point in regard to the English judges are very suggestive: "It is always to be kept in mind that they are still accessible to the hope of further promotion, to the zeal of political attachment, to the flattery of princes and ministers; that the bias of their prejudices, as elderly and peaceable men, will, in the plurality of cases, be on the side of power; that they have frequently been trained as advocates to vindicate every proceeding of the Crown. From all which we should look on them with some little vigilance, and not come hastily to the conclusion that because their commissions cannot be vacated by the Crown's authority they are wholly out of the reach of its influence." (*Const. Hist.*, ch. 15.)

The subject of the salaries of judges is generally regulated by constitutional provisions, in order that they may not be subject to coercion or wrongly influenced in their discharge of duty by a reduction or deprivation of their means of livelihood. By the English Act of Settlement it was declared that the salaries of the judges should be ascertained and established, and by act passed in the reign of George III. it was provided that their salaries should be absolutely secured to them during their continuance in office. The U. S. Constitution provides that the judges "are at stated times to receive for their services a compensation which shall not be diminished during their continuance in office." In some of the States this provision is copied,

while in others there is a constitutional rule that judicial salaries shall neither be increased nor diminished during the term of office. The determination of the amount of salary to be paid belongs to the legislature, subject to these constitutional restrictions. The fluctuations in the value of money and in the cost of living render it inexpedient to specify a fixed salary in the constitution. The American constitutional provisions are more efficacious and salutary in relieving the judiciary from all subordination to the legislature than the laws of England upon the subject, since there the compensation is at all times subject to alteration by an act of Parliament. There has, moreover, been in recent times a growing appreciation of the necessity of providing for the judges sufficiently ample salaries to enable the state to secure the services of the ablest lawyers and jurists upon the bench. In many of the U. S. the salaries have hitherto been so meagre that the tendency has been for men of the highest legal attainments to remain in their lucrative practice at the bar rather than to seek or to accept judicial positions. In some of them, as in New York, the amount of compensation has recently been made more liberal and adequate. An ample salary, whose amount and time of payment are not liable to legislative or executive interference or control, is evidently an important safeguard to judicial independence, since a powerful means of intimidation which would otherwise be afforded is rendered unavailable.

The fearlessness and independence of the judiciary are further promoted by limiting their legal responsibility. It is a principle which has been said to have a "deep root in the common law" that judicial officers shall never be liable to a civil action for acts done in the performance of their legal duties and within the province of their legitimate jurisdiction, even though they act corruptly and oppressively. Nor are they liable, under similar circumstances, to a criminal prosecution. The impartial administration of justice requires that those who dispense it should not be exposed to any influences which would make them timid, hesitating, and over-cautious. "It is better," says an able English judge, "that an individual should occasionally suffer a wrong than that the course of justice should be impeded and fettered by constant restraints and apprehension on the part of those who are to administer it." The regular remedy against a judge who is guilty of criminal disregard or violation of duty or perversion of justice is impeachment. (See IMPEACHMENT.) As this is an inconvenient mode of trial, never resorted to except in the case of grave and flagrant offences, the judiciary are in a very exceptional degree freed from legal accountability. The constitutions of some of the States provide for a removal of judges by concurrent resolution of both houses of the legislature passed by a specified vote, the cause being entered on the journals, and a hearing having been accorded to the party complained of.

There are various other important and interesting questions in regard to the judiciary which might be considered in this connection, but these have been treated of under other topics. Such, for example, are inquiries relating to the position which a judge occupies and the functions he performs in different civilized countries in the conduct of a trial or the decision of causes; to the extent and nature of the jurisdiction which is conferred upon him in different courts; to the diverse character of the proceedings which may come before him for adjudication; to the important jurisdiction which is conferred upon the judiciary in this country of determining the constitutionality of legislative acts, etc. For a discussion of these and analogous topics see COURTS, JUDGE, JURISDICTION, LAW, EQUITY, ADMIRALTY, CONSTITUTION, TRIAL, CHAMBERS, APPEAL, JURISPRUDENCE. (As to the independence of the judiciary, see Story *on the Constitution*; Kent's Commentaries, vol. i.; Lieber's *Civil Liberty*.) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Judic′ium Pop′uli [Lat., "judgment by the people"], in Roman law, an early form of submitting to the decision of a popular vote the differences between high functionaries, accusations against magistrates, and other similar concerns in which the people as a whole was conceived not merely to be deeply interested, but to have a right to pronounce its sentence after due formalities. The *judicia publica* of the later republican period are considered by the text-writers to be substitutes for the *judicia populi*, and indeed it is probable that among all the Indo-European nations the powers of judges and courts of law have been derived from an earlier jurisdiction exercised by the people as judge, by the gradual elimination of those who were less able or less willing to act in such capacity, in the same manner that the powers of a supreme court of appeals, still nominally vested in the English House of Lords, have long been practically exercised only by the half dozen "law-lords," who owe their seats in that house to previous experience on the bench. The same theory will probably account for the formation of all representative legislative bodies, and, still more obviously, for the origin of the modern jury, both these institutions being peculiar to the Aryan or Indo-European family of mankind. Indeed, it is so certain that the powers and faculties of early Greek and Roman judges differed in no degree from those which might be exercised by a popular assembly, that when for convenience it became necessary to entrust special judicial functions to individuals, the latter were neither elected nor otherwise designated with any view to greater individual competency, but were chosen by lot, all the citizens being equally liable to perform this service. As above noticed, it is probable that in the shadowy *origines* of Aryan law all questions affecting either public interests or private rights were equally decided by the popular assembly, from which all forms of authority excepting those resting upon brute force or the religious sanction have been gradually evolved. At the earliest period of which any clear evidence remains, actions brought by individuals in defence of their private rights (*judicia privata*), and resting upon special laws (*privilegia*), had been discriminated from the *judicia populi*, and were determined by special magistrates, while matters of public interest (*judicia publica* or *popularia*) were still decided by the popular assembly. The tendency of all things to progress from the general to the particular is well illustrated by the gradual accumulation of statute law, which had to be interpreted by this assembly, leading to the withdrawal to private tribunals of other large classes of actions, to the substitution of the term *judicia publica* for *judicia populi*, and the final extinction under the empire of this ancient tribunal. In the mythical times of the Roman kings it is alleged that those monarchs presided over the assemblies of the people convened as a tribunal. They were naturally replaced in this prerogative by the consuls; until in B. C. 508 the *Lex Valeria de Provocatione* established magistrates called *quæsitores* or *quæstores rerum capitalium*, who were at first popularly chosen for special occasions, but soon exercised a more lasting authority (*quæstores perpetui*). By the *Lex Calpurnia de Pecuniis Repetundis* (B. C. 149) the prætor became *ex officio* the president of the popular assembly. Other prætors were from time to time added, until in the time of Sulla they numbered nine, each exercising jurisdiction over a distinct class of offences; and this became the origin of the criminal courts, which existed until the fall of the empire. In the normal *judicium populi* any citizen might act as an accuser, while the *judices* (judges) were chosen by lot from among the people. Both accuser and accused had a limited right of challenging the judges so designated. The prætor presided, and, as he was not necessarily acquainted with the technicalities of law, was assisted by one or more assessors or jurisconsults. When a magistrate was accused, the trial could not take place until his term of office expired, but meanwhile he was bound to give security for his appearance. The verdict was given by ballots inscribed upon tablets; they bore the traditional name of *leges* (laws), and were theoretically binding in future cases of the same kind, though the mobility of the Roman people, and their strongly developed fondness for public affairs, made them averse to surrender any real power to the force of precedents. When at length the powers of the popular assembly were lodged in a special body of *judices*, the name and general regulations of the earlier assembly were retained, but a series of conflicts arose as to the designation of the *judices*. By the *Lex Calpurnia* a body of 350 persons was inscribed in tablets (*album*), and from them the *judices* were to be selected by lot as occasion demanded. Before this time they were generally taken from the senatorial class, but during the popular struggle the senators gradually lost their prerogative, and were excluded by the *Lex Sempronia*, enacted B. C. 123, on motion of Caius Gracchus, which limited the choice to the class of *equites* or knights. The *Lex Servilia* of B. C. 104 first defined with some minuteness the personal disqualifications which should exclude a citizen from the exercise of the judicial function. No one who had ever been tribune, quæstor, or triumvir, no senator or near relative of a senator, no non-resident in the city or suburbs, and no person under thirty or over sixty years of age, was eligible. The prætor, at the commencement of each term, was to choose 450 *judices*, from whom the judges in each particular case were taken by lot. There were many subsequent alternations in this regard, and the nature of some of the changes is involved in great doubt. By the *Lex Plautia* (B. C. 89) the judices were to be chosen from the *tribes* without distinction of class; by the *Lex Aurelia* (B. C. 70) they were restricted to the three classes (called *decuriæ*) of senators, equites, and tribuni ærarii; another decuria was added by Augustus. At this time the whole number registered in the *Album judicum* was near 4000, and the ordinary number of judges in each given case was seventy. PORTER C. BLISS.

Ju'dith [Heb. *Yehudith*, feminine form of "Judah"], the heroine of one of the apocryphal books of the Old Testament, in which she is represented as inhabiting Bethulia, a town of Samaria, when it was besieged by an Assyrian army under Holofernes, and as having by stratagem cut off the head of that general and thus delivered her people from destruction. That the book of Judith is historical in its character is maintained by the Catholic Church, it being included in their biblical canon, but has been denied by most Protestant critics, chiefly, it would seem, from the difficulty of making its statements harmonize with any scheme of chronology. The Assyrian king called Nebuchadnezzar in the book of Judith has been identified in turn with almost every one of the Persian monarchs from Cambyses to Artaxerxes Ochus, but there are insuperable objections to each which have taxed the utmost ingenuity of the historical school of commentators. On the alternative hypothesis, that the book is a kind of religio-patriotic romance, intended to raise the courage of the chosen people at some period of grievous oppression by a foreign tyrant, there are two leading views—one, represented by Luther and Grotius, looks upon the book as an allegorical account of the Jewish sufferings under Antiochus Epiphanes. The Tübingen school of criticism and other recent German authorities (Volkmar, Baur, Hitzig) generally regard it as a production of the second century A. D., making Nebuchadnezzar stand for Trajan, Nineveh for Antioch, Assyria for Syria, Arphaxad for the Parthians, Ecbatana for Nisibis, Holofernes for the Roman general Lucius Quietus, and Judith for Judæa. The occasion is assigned to 117–118 A. D., when the Jews and Parthians obtained a victory over Quietus. The book of Judith is not a part of the Jewish canon of Scripture. Lessons from it are read in the service of the Church of England. (See Volkmar, *Das Buch Judith* (Tübingen, 1860); Wolff, same title (Leipsic, 1861).)

Jud'kins, tp. of Warren co., N. C. Pop. 1432.

Jud'son, post-tp. of Blue Earth co., Minn. Pop. 661.

Judson (Adoniram), D. D., b. at Malden, Mass., Aug. 9, 1788; graduated at Brown University, R. I., in 1807, and at Andover Theological Seminary, Mass., in 1810. Teaching a private school in Plymouth, Mass., he published in 1808 and 1809 his *Elements of English Grammar and Young Ladies' Arithmetic.* Feb. 6, 1812, he was ordained as a missionary to Burmah, under the auspices of the A. B. C. F. M. He married Ann Hasseltine, teacher in the academy at Bradford, Mass., and with her sailed for Calcutta Feb. 19, 1812. On the voyage his views regarding the ordinance of baptism underwent a change, and reaching Calcutta he identified himself with the Baptist denomination, giving reasons for his action in *Judson on Baptism,* which was republished in the U. S. This led American Baptists to interest themselves in foreign missions, and to the formation of the society now known as the American Baptist Missionary Union. Under the auspices of this society he became the founder in Burmah of one of the most successful missionary enterprises of modern times. Settling first at Rangoon, Judson labored for nearly forty years in Burmah, two of which he spent in prison, manacled and daily expecting execution. He translated the Bible into Burmese, and at his death had nearly completed a dictionary of that language in two volumes. Before his death he was surrounded by thousands of native converts and by many missionaries, American and Burmese. Mrs. Judson d. Oct. 24, 1826, and in Apr., 1834, he married Mrs. Sarah H. Boardman, who d. Sept. 1, 1845. In June, 1846, he married Miss Emily Chubbuck, who d. June 1, 1854. He d. at sea Apr. 12, 1850. Memoirs of Judson were published by W. Hague (1851), by J. Clement (1852), by F. Wayland (1853), by D. T. Middleditch (1854), and by Mrs. H. C. Conant (1856). (See also the *Memoir of Ann H. Judson,* by Prof. J. D. Knowles—an interesting sketch of an able and devoted woman, which incidentally illustrates, pretty fully, the origin and early growth of American Baptist missions in India; the *Memoir of Sarah B. Judson,* by Mrs. Emily C. Judson; and the *Life of Emily C. Judson,* by Prof. A. C. Kendrick, D. D. Of these three gifted women, the last mentioned (Emily Chubbuck Judson—better known under the *nom de plume* of "Fanny Forrester") attained to considerable literary reputation by a two-volume collection of essays and sketches bearing the name of *Alderbrook,* by a volume of domestic poems called *The Olio,* and by a volume of papers suggested by missionary-life, entitled *The Kathayan Slave.*)

M. B. Anderson.

Judso'nia, post-v. of White co., Ark., on the N. bank of Little Red River and on the Cairo and Fulton R. R., 53 miles N. E. of Little Rock. It is occupied by a colony of Baptists from the Northern States.

Ju'el (Niels), b. May 8, 1629; entered early into the Dutch service, and commanded on several occasions under Tromp and Ruyter. Having been placed at the head of the Danish navy, he gave it a new and thorough organization, and by his brilliant victories over the Swedish fleets in 1677 at Kolbergheide and Kjöge, and by his conquest of Gothland in 1676 and Rügen in 1678, made the Baltic a Danish water. In reward for his great services he received the island of Taasinge as a fief. D. at Copenhagen Apr. 8, 1697.

Juggernaut. See Jaggernaut.

Jug'gling and **Jug'gler** [from the Old Fr., *jonglère;* Middle Lat. (Ducange), *juglator* or *joculator,* literally, a "jester;" also, *jogalour* (Chaucer), *jocular* (J. Leland, *Collectana,* vol. i. p. 235). But it is probable that the word owes as much to an independent Teutonic source as to the Latin *jocus,* as may be seen in the German *Gaucheln-jöcheln,* probably from *ge-wiglian,* to "beguile." According to Larousse, *jongler* means, accurately, "to throw in the air objects which as fast as caught are thrown again." This he illustrates by quoting from Expilly: "The African Psylli *jonglaient* or juggled with serpents." This agrees singularly with the Sanskrit *janguli,* "a snake-catcher, a conjurer." The Teutonic source has its affinity at least in the Sanskrit *jagala,* "fraudulent," "knavish"]. Juggling, which in the early ages of the world was, under the name of thaumaturgia or wonder-working, the principal aid to priests in performing their false miracles, has in modern times degenerated into a source of mere amusement, or one which only provides marvels to mislead the superstitious and ignorant. The principal art in juggling is legerdemain or sleight-of-hand and substitution, technically called among its professors *hanki-panki,* from two gypsy words, which are in the original Hindostani, *hokku bazi,* pronounced "honky bosee," meaning precisely the same thing (in Persian, *'hoko baz*). As the gypsies also call theft by substitution *honki-pokī* or *hukkni-pokī,* it is possible that we have in this the origin of *hocus-pocus.* Many distinguished jugglers have been gypsies, and the Nāts or true gypsies of India are all jugglers, acrobats, or dancers. The juggler among the Romans was called *præstigiator;* with the Greeks he was a *thaumatopoios.* Athenæus in his *Deipnosophistæ* describes an entertainment where naked girls vomited fire and jumped or rolled among swords, and he gives the names of the most celebrated jugglers of his time. From his account it appears that among the ancients, as at the present day in Egypt, drollery and dramatic art formed an important element in such conjuring. The writer has seen in and near Cairo native jugglers who by acting and humorously affecting to be aided by evil spirits very much enhanced the effect of their tricks. Trickery with cups, or thimble-rig, was known to the ancient Egyptians. The old-fashioned thimble-rig, so generally practised at races, which was performed by adroitly taking away the pea with the fingers of the same hand which held the cup, has of late been modified by an improved style of French thimble of vulcanite. The ordinary juggling tricks were common among the Anglo-Saxons. Strutt gives an interesting chapter on the *joculator* or *jongglour* of England in the Middle Ages. From passages in Chaucer, Sir John Mandeville, Froissart, and Benvenuto Cellini it is evident that the jugglers of the fourteenth and fifteenth centuries were familiar with the magic lantern, and were in fact far in advance of the science of the learned of their days. "Sometimes," says Chaucer, "in a large hall they will produce water, with boats rowed up and down upon it. Sometimes they will bring in the similitude of a grim lyon or make flowers spring up as in a meadow; sometimes they cause a vine to flourish bearing red and white grapes; or they show a castle built with stone; and when they please they cause the whole to disappear." The jugglers of old—whether priests or *tregatours,* as they were called in England, or *jogelours*—formed a very close corporation and kept their secrets well. Even King James I. believed that they were aided by the devil. All of the ordinary miracles related of ancient wonder-workers, such as making heads speak, showing men whom no ropes could bind, and the like, are now performed with great ease. Among the Babylonians and Arabs it was usual to make arrows leap up and indicate the direction in which the king should advance against an enemy. "For the king of Babylon stood at the parting of the way, at the head of the two ways, to use divination; he made his arrows bright" (Ezek. xxi. 21). This was done by means of a hair; the Japanese juggler of the present day makes a butterfly flit around him by attaching to it a perfectly invisible silkworm's thread. From the earliest ages to the present day the world has seen pretenders to magic power or to intercourse with spirits performing miracles which after a few years have been retailed by jugglers. The great basis of false miracles, as well as the popularity of juggling itself, consists in the truth of the saying: "*Populus vult decipi*"—"Peo-

ple wish to be deceived." Not many years ago a notorious thaumaturgist proposed to exhibit before a certain royal family a new miracle—a piano should play of itself. The royal family were delighted at the treat in prospect. Unfortunately, a day or two before the proposed miracle was performed a celebrated man of science, having been told what was to be done, did the deed himself very perfectly, and explained the process, the only result being manifest disappointment and annoyance on the part of the distinguished and credulous auditors. There is less novelty in jugglers' feats than is supposed. The sphinx is a very old invention; the feat of the rings, which in 1859 astonished New York, and which was supposed to be entirely new, had been explained years before in a very common little handbook of legerdemain.

A great principle in juggling is to attract the attention of the audience by some trifling movement, and thereby at that instant *distract* it from the hanky-panky or adroit substitution of one article for another. In India a *naked* juggler will produce from a cup or bag several objects. These he has hidden under a false skin, his own having been gradually peeled away, and then laid on in a flap. By snapping his fingers or by pointing to anything the attention even of those forewarned is drawn away. A very trifling deviation of sight suffices for this, and by its aid an object may be brought out and then concealed before the audience perceives it. Cool audacity thus effects incredible marvels. The different juggling devices by which the face of a future husband is shown in a crystal or mirror, in liquids, as an apparition or in other ways, the manufacture of spiritual photographs, and all miracles performed in the dark, have been explained many times, and performed by professional jugglers without apparently making the million much wiser. One of the best juggling feats is that of the so-called second sight, popularized by the late Robert Houdin. The writer, having seen him play it, can testify to the adroitness with which it was done. It consists in one or more persons blindfolded or isolated telling the names of many objects supposed to be concealed from them, or else what is written on a paper. It is varied in many ways, and there are as many methods of performing it, the best consisting of wires with a galvanic battery and plates, by means of which signals are transmitted through the feet of the accomplices. This ingenious device is also used in gambling-houses. Many persons believe that gypsies possess secret arts and can tell fortunes. Among themselves they ridicule the idea of their being able to do anything of the kind, but at the same time no people are more superstitious or more easily imposed upon by the higher class of conjurers who employ mechanical tricks. It is to be desired that a few of the best works on juggling could be read by every one as a means of dissipating superstition, and of setting people on their guard against every variety of practical trickery. When Reginald Scot wrote his celebrated *Discoverie of Witchcraft*, a work which marks an era in humanity, he found it necessary to explain how the juggling tricks were done by which so-called diabolical deeds were effected. Of late years science has not disdained to assist this art, and many of the illusions now shown are really interesting, both as to skill and their association with the pretended miracles of a higher class of wonder-workers.

In ancient times a number of philosophers wrote against the thaumaturgy of the priesthood, and exposed their juggling tricks. Unfortunately, all their books are lost. The principal of these was by Celsus, whose work against the Magi is believed to have been a very able exposure of all the tricks of the ancient conjurers. Other writers of this kind are mentioned by Diogenes Laertius, and Suidas quotes the *Magikon* of Antisthenes. Among the many modern works which treat of juggling and wonder-working of every kind one of the best is *La Magie blanche dévoilée, ou explication des Tours Surprenants, etc.*, par M. Decremps (Paris, 1788). This was followed by a *Supplement*—the *Testament de Jerome Sharp*, the *Codicile de Jerome Sharp*, and *L'Explication des Tours Extraordinaires*, by the same author. Decremps was a gentleman, a scholar, and a diplomatist; his works abound in quaint quotations, and are well written in a pleasant lively style. To these may be added the *Récréations mathématiques et physiques d'Ozanam* (4 vols. 8vo, Paris, 1735); *Les Récréations mathématiques et physiques de Guyôt* (3 vols., 1790). In 1858 Prof. J. N. Ponsin published among the *Manuals* of Roret *La Sorcellerie ancienne et moderne expliquée*, a very excellent work, contemporary with the *Magie Naturelle*, par M. Vergniaud, the *Physique amusante*, par Julia de Fontenelle and Madame Malepeyre, and *Sorciers, ou la Magie blanche dévoilée par les découvertes de la Chimie, de la Physique, et de la Méchanique*, par MM. Comte et Julia de Fontenelle. Reginald Scot's *Discoverie of Witchcraft* (London, 1584) may also be studied, and the *Libretto de Secreti Nobilissimi* (Milan, 1585); also *Breslaw's Last Legacy, or the Magical Companion* (London, 1784); *Natural Magic*, by Philip Astley, riding-master (1785); *Magic*, by J. S. Halle (Berlin, 1783); *Natürliche Magie*, by Funk; K. O. Eckhartshausen, *Ueber die Zauberkräfte der Natur* (Munich, 1819); *The Fashionable Science of Parlor Magic*, by J. H. Anderson, a clever and lively work, which, in addition to exposing the secrets of gamblers, is accompanied in the later editions by a supplement on the magic of spirit-rapping, writing-mediums, and table-turning; *Hanky-Panky, the Conjurer* (London, 1859); *Magic and Pretended Miracles* (London, 1848); and the *Conjurer's Guide* (Glasgow, 1850). CHARLES G. LELAND.

Jugur'tha, king of Numidia, was an illegitimate grandson of Massinissa; was adopted by his uncle, King Micipsa, in 149 B. C., and attracted much attention from the people by his popular qualities. Sent with a Numidian force into the Roman service (134), he gained fresh distinctions, and after the death of Micipsa murdered Hiempsal, the king's oldest son, and put Adherbal, a younger son, to flight. Adherbal appealed to the Roman senate; but the bribes of Jugurtha secured (117) for him the larger and better part of the kingdom. In 112 he captured Cirta and basely murdered his rival. The consul Calpurnius Bestia was sent to attack Jugurtha, who bribed the consul to grant a peace (111 B. C.). Summoned in the same year to Rome under a safeguard, he there murdered Massiva, his enemy, and was expelled from Italy. War with Rome followed; in 110, Jugurtha defeated Aulus Postumius at Suthul, and sent his army under the yoke; in 109 was badly beaten by Cæcilius Metellus; was again defeated by Marius in 107; was taken prisoner by the craft of Sulla 107; was carried to Rome to adorn the triumph of Marius (104), where he was starved to death in prison.

Ju'jube, the fruit of *Zizyphus vulgaris*, order Rhamnaceæ, a small tree of Southern Europe and Africa. Its fruit was formerly used for making "jujube paste," a pleasant confection, but the jujube paste of the shops is now made of gum-arabic, sugar, water, and egg-albumen, without jujubes. Jujube syrup and dried jujubes have useful pectoral qualities, and make a pleasant drink for the sick. *Z. nitida*, *Z. Jujuba*, *Z. Lotos*, and *Z. Spina-Christi* are among the species of this genus which bear pleasant fruits. The jujube is occasionally grown in the Southern U. S.

Jujuy', town of the Argentine Republic, South America, the capital of a province of the same name, has about 7000 inhabitants, who are mostly engaged in agriculture and the rearing of cattle.

Jukes (JOSEPH BEETE), F. R. S., b. near Birmingham, England, Oct. 10, 1811; graduated at St. John's College, Cambridge, in 1836, and devoted himself to geology. In 1839 he was appointed geological surveyor of Newfoundland, and from 1842 to 1846 he was naturalist on board H. M. S. Fly, engaged in the survey of the great barrier-reef along the E. coast of Australia. He published volumes giving the results of these explorations. Having joined in 1846 the geological survey of Great Britain, he wrote for it important memoirs on several districts, especially one on *The South Staffordshire Coal-Field* (1853). In 1850, Prof. Jukes became director of the geological survey of Ireland, and he was for many years professor of geology to the Royal Dublin Society and the Royal College of Science at Dublin. His investigations on coral reefs, the distribution of mollusca, and the formation of river-beds were important contributions to science. He wrote several elementary works on geology, as well as the elaborate article in the *Encyclopædia Britannica* (8th ed.), and contributed largely to the journals of learned societies. D. July 29, 1869.

Ju'lia, daughter of Augustus by his second wife, Scribonia, and his only child, b. in 39 B. C. She was distinguished as much for her intelligence as for her beauty, and was married to Marcellus in 25 B. C., after his death to Agrippa in 22 B. C., and after his death to Tiberius in 11 B. C. But her dissipation and profligacy by degrees assumed such a character and such a publicity that her marriage was dissolved, and she was banished in 2 B. C., first to Pandatoria, an island near Naples, and then to Rhegium, where she d. in 14 A. D. in want. It is probable that her hard fortune was due, at least in some degree, to the hatred of her step-mother, Livia, who struck successively every member of the emperor's family in order to make room for her own son, Tiberius. Of the five children whom Julia bore to Agrippa, only the two daughters survived her; of the three sons, two died young, and the third was put to death by Tiberius.

Ju'lian, post-tp. of San Diego co., Cal., 37 miles N. E. of San Diego. Pop. 534.

Julian, tp. of Dubuque co., Ia. Pop. 1415.

Julian (George Washington), b. in Centreville, Ind., May 5, 1817; received a common-school education; was several years a teacher; admitted to the bar 1840; elected to the legislature in 1845; delegate to the Buffalo Free-Soil convention of 1848; Representative in Congress 1849–51, and nominated for Vice-President by the Pittsburg convention of "Free Democrats" on the ticket headed by John P. Hale. He was in 1856 prominent as a founder of the Republican party, and was again a member of Congress from 1861 to 1869, being during the last two terms chairman of the committee on public lands. He has been one of the most strenuous supporters of female suffrage.

Julian the Apostate (Flavius Claudius Julianus), Roman emperor, b. at Constantinople Nov. 17, 331 A. D., was the son of Julius Constantius. In infancy he was imprisoned by Constantius II., but was well educated and trained in the Christian faith; was allowed in 355 to reside at Athens unconfined, and in the same year was proclaimed Cæsar, married to Helena, daughter of Constantine the Great, and was sent to govern Gaul, where he showed himself a just and wise ruler, an able general, and a virtuous man. In 360 his troops saluted him emperor at Paris; and Constantius beginning to interfere unduly in the affairs of Gaul, Julian marched with strong armies across Europe towards Constantinople. Constantius d. in 361, and Julian was hailed with universal joy as emperor, and soon after this avowed himself a pagan. He did not persecute Christianity, but tolerated all the sects, at the same time decidedly favoring paganism by his edicts and closing the Christian schools. In Mar., 363, he set out upon his Persian expedition, and after defeating the enemy in many engagements was mortally wounded in battle, and d. June 26, 363. This able ruler was in supreme authority only eighteen months, and yet his reign was one of the most memorable of antiquity. Julian was a writer of great talent, and left many writings in the Greek language, including a number of extant letters and orations, valuable to the historian; a satirical work of decided merit called the *Cæsars; Misopogon*, a satire upon the people of Antioch; some unimportant epigrams; and a celebrated work *Against the Christians* (Κατὰ Χριστιανῶν), of which Theodosius II. destroyed all accessible copies, so that the work is lost, excepting some fragments preserved by Cyril and others.

Jü'lich, town of Rhenish Prussia, at the influx of the Ette into the Roer, has some manufactures of leather, soap, and vinegar. Pop. 5244. The districts of Jülich formed an independent dukedom in the fourteenth century, which was united to Berg and Cleves in 1511. In 1609 the ducal line became extinct, and succession disputes began between Brandenburg and Neuburg, which, although settled in 1666 by a division of the country, were not brought to a final conclusion until 1814, when the whole territory was given to Prussia.

Julien' (Stanislas), b. at Orléans, France, Sept. 20, 1799; studied first modern European languages, Latin, and Greek, but was attracted to the study of Chinese by the lectures of Abel Rémusat, whom he succeeded in 1832 as professor in Chinese at the Collége de France at Paris. Besides several grammatical works on Chinese, destined to aid the student of the language, he has translated a great number of Chinese novels, dramas, historical, philosophical, and scientific writings. D. Feb. 14, 1873.

Ju'lius (Nikolaus Heinrich), b. in Altona, Denmark, in 1783; studied medicine, and practised in Hamburg. In 1825 he travelled through England, in 1834–36 through the U. S., and later on through Germany, Poland, Belgium, and France, to study the conditions and management of prisons, on which subject he lectured in Berlin in 1827, published a periodical, *Jahrbücher der Straf- und Besserungsaustalten* (Berlin, 1828–48), and wrote several works: *Vorlesungen über Gefängnisskunde* (1828), *Nordamerika's sittliche Zustände* (1839), *Beiträge zur brittischen Irrenheilkunde* (1844), etc. D. in Hamburg Aug. 20, 1862.

Julius I., Saint, bishop of Rome, was consecrated in 337, and took part with Athanasius in his struggle for the Alexandrian bishopric. D. Apr. 12, 352.—Julius II., Pope (*Giuliano della Rovere*), b. at Albezzola in 1441, became a cardinal in 1471, and succeeded by simoniacal means to the pontificate in 1503. His career henceforth was chiefly military, his principal aim being to drive the foreigners out of Italy and free the Holy See from the domination of the great secular powers. The ambitious pontiff was a liberal patron of Raphael, Michael Angelo, and the other great artists of his time, and laid the corner-stone of St. Peter's church at Rome. D. Feb. 21, 1513.—Julius III. (*Giovanni Maria del Monte*), b. at Arezzo Sept. 10, 1487, became a cardinal in 1536; went as papal legate to the Council of Trent 1545; was chosen pope 1550, and was thenceforth chiefly remarkable for luxurious habits. D. Mar. 23, 1555.

Jul'lunder, town of the Punjaub, in the plain between the Sutlej and the Beas, in lat. 31° 21′ N. and lon. 75° 31′ E. It was formerly the capital of a powerful Afghan principality, and has many magnificent monuments. Pop. estimated at 40,000.

Ju'lus, the typical genus of the family Julidæ, myriapods of the division Chilognatha, including the millipeds or thousand-legs and many other organisms. The true *Juli* are seldom more than three inches long, have numerous small feet, inhabit moist and dark places, such as holes in rotten wood, and are never, like the centipedes, truly venomous.

July' [Lat. *Julius*, named by Mark Antony in honor of Julius Cæsar], the seventh month of the Gregorian, and the fifth of the old, calendar. The ancient Romans called it *Quintilis*—that is, the fifth month.

Jumbuser', town of British India, in the presidency of Bengal. It has a considerable trade in rice and cotton. Pop. 10,400.

Jumet', town of Belgium, in the province of Hainaut, has extensive breweries, glass-works, and manufactures of tiles and nails. Pop. 14,244.

Jumil'la, town of Spain, in the province of Murcia, carrying on important manufactures of earthenware and fireovens. Pop. 9613.

Jum'na, a river of Hindostan, and the principal affluent of the Ganges, rises in lat. 31° N. and lon. 78° 32′ E., at an elevation of 10,849 feet. It flows first S., and then S. E., and after a course of 680 miles joins the Ganges at Allahabad. It is shallow and unfit for navigation, but by artificial means it has in many ways been made available both for agriculture and commerce. Delhi and Agra are situated on its banks.

Jump'ing Branch, post-tp. of Mercer co., W. Va. Pop. 1441.

Junck'er (Henry Damian), D. D., b. in Lorraine (then a part of France) 1810; came in youth to the U. S.; studied at Cincinnati, and in 1834 took priest's orders in the Roman Catholic Church; served chiefly among the German population of Ohio; became in 1857 bishop of Alton, Ill. D. at Alton Oct. 2, 1868.

Junc'tion, post-v. of Carlton co., Minn., at the junction of the Northern Pacific and the Lake Superior and Mississippi R. R.

Junction, post-v. of Hunterdon co., N. J., at the junction of the Delaware Lackawanna and Western and the Central R. R. of New Jersey.

Junction City, post-v. and tp. of Trinity co., Cal., 8 miles W. of Weaverville, the county-seat. Pop. of v. 440; of tp. 570.

Junction City, post-v. and tp., cap. of Davis co., Kan., situated on the crown of a low bluff at the confluence of the Smoky Hill and Republican rivers, which unite to form the Kansas River, and on the Kansas Pacific and the Missouri Kansas and Texas R. Rs. It has many churches and schools, 7 hotels, 1 national and 1 savings bank, 2 flouring mills, manufactories of carriages, agricultural implements, etc., and excellent water-power. There are extensive quarries of magnesian limestone, easily worked and largely used in building. Clark's Creek, in the vicinity of the town, is crossed by three Howe-truss bridges. It is an active business-centre for the surrounding country, and has 2 weekly newspapers. Pop. 2778.

June [Lat. *Junius*, for *Junonius*, because it was sacred to Juno], the sixth month in the Gregorian year; in the old style, the fourth month. During this month the sun reaches the northern solstice, which is marked by the first point of the sign Cancer. Hence the tropic is called the tropic of Cancer.

Juneau', county of S. Central Wisconsin. Area, 825 square miles. The Wisconsin River washes its E. border, and it is traversed by the La Crosse and Milwaukee R. R. It has an undulating surface, a very fertile soil, with abundant timber and water-power. Cattle, grain, wool, and lumber are staple products. Cap. Mauston. Pop. 12,372.

Juneau, post-v., cap. of Dodge co., Wis., on the Chicago and North-western R. R., 145 miles from Chicago. It has 2 weekly newspapers, a grain-drill factory, 2 cheese-factories, churches, stores, hotels, etc. It was founded in 1845, and first named Victory, and then Dodge Centre. The court-house was built in 1848, and the first newspaper started in 1852. Pop. 300. E. B. Bolens,
Ed. and Prop. "Democrat and Granger."

June'-berry (*Amelanchier Canadensis*), a wild shrub or small tree found throughout the U. S. and in Canada, with many varieties, offering considerable differences. It

bears a considerable resemblance in its characteristics to the apple and pear. The june-berry has been cultivated on a small scale for its fruit, which is of purple color, sweet, and about the size of the largest currants. The size of the tree differs greatly in the varieties, from thirty feet high (*botryapium*) down to three or four. Various names are given to the june-berry in different localities, such as shadbush, service-berry, and mountain whortleberry. The flowers are white, early, and abundant, on which account it is valued as an ornamental tree.

Jung (JOACHIM), b. at Lübeck, Germany, Oct. 22, 1587; was professor of mathematics at Giessen 1609–14; studied medicine at Padua, graduating in 1618; settled at Rostock as a physician, becoming a professor there in 1624, and rector of the Johanneum at Hamburg in 1629. He was a very distinguished naturalist, ranked by Leibnitz in the same class of philosophers with Copernicus, Galileo, and Descartes. His researches in physical science incurred for him persecutions, on the supposition that he belonged to the Rosicrucian fraternity. Dr. Jung anticipated Linnæus in proposing a binomial nomenclature for plants, and wrote largely on philosophy, mathematics, mineralogy, invertebrates, and botany, but many of his works were destroyed or rendered extremely scarce by a fire. Those which remained were edited by Albrecht under the title *Opuscula Physica Botanica* (Coburg, 1747). His life has been written by Guhrauer (Stuttgart, 1851) and by Avé-Lallemant (Lübeck, 1863).

Jung-Buns'lau, town of Bohemia, on the Iser, has some manufactures of woollens. Pop. 8695.

Jungerman'nia [in honor of Prof. Ludwig Jungermann (1572–1653), a German botanist], a large and important genus of LIVERWORTS (which see). It gives name to the important sub-order Jungermanniaceæ (scale-mosses), which to the essential characters of the liverworts (Hepaticæ) join a moss-like habit. The U. S. have numerous species.

Jung'frau [Ger. "maiden"], one of the highest peaks of the Bernese Alps, and, on account of the beauty of its outline and the dazzling brightness of the everlasting snow which covers its top, one of the most remarkable mountains of Switzerland. Its height is 13,670 feet. Its top has been reached only by half a dozen persons; among them by Agassiz in 1841.

Jung'huhn (FRANZ WILHELM), b. at Mansfeld, Prussian Saxony, Oct. 26, 1812; studied medicine and botany at Halle and Berlin; served as a physician in the Prussian army, then in the French army in Algeria, and since 1835 in the Dutch colonies of Java. Here he made very extensive studies of the geographical, geological, botanical, and ethnological relations of the country, and his works on these subjects attracted great attention. In 1849 he visited Europe, but returned to Batavia in 1855, and d. at Lemberg Apr. 24, 1864. His chief work is *Java, seine Gestalt, Pflanzendecke und innere Bauart* (1852); besides this he wrote *Die Battalonder in Sumatra* (1847), *Landschaftsansichten von Java* (1853), and in 1851 was commenced a description of the plants and fossils of Java, entitled *Plantæ Junghuhnianæ.*

Jun'gle [Sanskrit, *jangala*], in the East Indies, a name applied to those tracts of land, frequently very extensive, where the vegetation is rank, and often impenetrable. The jungles abound in tigers, elephants, monkeys, serpents, deer, boars, wild cattle, and other creatures, and are often very unhealthy. In the East they speak of "jungle-fowl," "jungle cows," "jungle fevers," etc. The term *jungle* is used with latitude, and much country which is sparsely settled, but by no means a wilderness, is thus designated.

Jung'mann (JOSEF JAKOB), b. at Hadlitz, Bohemia, July 16, 1773; studied at the University of Prague; became teacher at the gymnasium of Leibmeritz in 1799, and professor in 1815 at Prague, where he d. Nov. 14, 1847. In 1825 he published a history of the Bohemian language and literature, and in 1835 a complete Bohemian-German dictionary.

Jung-Stil'ling (JOHANN HEINRICH), b. at Grund, in Hesse Nassau, Sept. 12, 1740, of a poor family, had to fight his way onward through many hardships. He was successively a charcoal-burner, schoolmaster, tailor, private tutor, etc. A Catholic priest gave him a secret remedy for certain eye-diseases, and in 1771 he succeeded in going to Strasburg to study medicine and get a diploma. Here he made the acquaintance of Goethe, who has given a charming picture of him in *Aus meinem Leben.* He now settled in Elberfeld as an eye-physician, a business he never gave up; he always carried his instruments along with him, and he undertook more than 2000 operations. From 1787 to 1806 he held a chair in political economy at the universities of Marburg and Heidelberg, but this part of his activity was not very influential; he had at last no pupils at all. The last part of his life he spent at Carlsruhe, at the court of the grand duke of Baden, who gave him a pension, and thus enabled him to devote himself exclusively to literature. His writings have all a mystic, religious, half-apocalyptic character, even his romances, *Geschichte des Herrn von Morgenthau* (2 vols., 1770), *Florentin von Fahlendorn* (3 vols., 1781), but still more his directly religious writings, *Theobald, Das Heimweh, Theorie der Geisterkunde* (1808), etc. The most interesting of his works is his autobiography, of which the first part, *Heinrich Stilling's Jugend* (1777), is a wonderful book. He was three times married, and d. Apr. 2, 1817. His collected works were published in Stuttgart in 14 vols. in 1838.

Junia'ta, county of S. E. Central Pennsylvania. Area, 350 square miles. It consists, in general, of a long valley, subdivided more or less into minor valleys, and having the Blue Ridge on the N. W. and Tuscarora Mountain on the S. E. It is crossed by the Juniata River and the Pennsylvania R. R. It contains iron and limestone. The soil is very fertile, especially in the valleys. Cattle, grain, and wool are staple products. Carriages, wagons, and leather are leading articles of manufacture. Cap. Mifflintown. Pop. 17,390.

Juniata, tp. of Tuscola co., Mich. Pop. 1042.

Juniata, post-v., cap. of Adams co., Neb., on the Burlington and Missouri River R. R., 24 miles E. of Fort Kearney, in a fine agricultural and grazing region; has some manufactures, a bank, a weekly newspaper, a fine high school, etc.

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Juniata, tp. of Bedford co., Pa. Pop. 1437.

Juniata, tp. of Blair co., Pa. Pop. 621.

Juniata, tp. of Huntingdon co., Pa. Pop. 393.

Juniata, post-tp. of Perry co., Pa. Pop. 983.

Juniata River, in Pennsylvania, rises near Altoona, 1155 feet above sea-level, and flows some 150 miles through the parallel-ridged mountains of Southern Central Pennsylvania, which rise from 800 to 1500 feet above the valleys (the latter often from 200 to 400 feet above the stream). It flows into the Susquehanna at Duncannon, 345 feet above the sea. Its principal affluent, the Raystown branch, is a beautiful and very tortuous stream.

Ju'niper, a genus of Coniferæ, sub-order Cupressineæ (cypress family), characterized by having its small cone transformed into a berry. The common juniper (*Juniperus communis*) is a small evergreen shrub, native of Europe and the U. S., where it grows on dry, sterile, hilly ground from New Jersey to Maine and along the great lakes. It is important for its fruit, which is used in medicine and in making gin. This fruit is a bluish-purple berry about the size of a pea, of a pleasant aromatic odor and sweetish terebinthinate taste, due to the presence of a volatile oil, in which also reside the medicinal virtues. Juniper is a gentle irritant, being in proper dose cordial to the stomach, and specially exciting to the function of the kidneys. It is accordingly used as a diuretic, but generally only to assist the action of more potent drugs of that class. In overdose it may cause great irritation of the urinary organs, with strangury and suppression of secretion. Juniper-berries are largely used in the manufacture of gin, to which spirit they give the peculiar flavor and diuretic action. *Juniperus Virginiana*, or red cedar, is an indigenous and important evergreen tree growing on dry rocky hills in all latitudes of the U. S. EDWARD CURTIS.

Ju'nius. From the middle of the year 1767 to the middle of 1772 the British public was delighted or exasperated by a series of letters on political affairs in the *Public Advertiser* newspaper, displaying a pungency, a vehemence, an intrepidity, and a power of invective such as had never before been shown by any English political writer. The first of these letters (Apr. 28, 1767) appeared under the signature of "Poplicola." "Memnon," "Lucius," "Junius," "Philo Junius," "Brutus," and other signatures were subsequently resorted to, but the celebrity of the collection is concentrated upon the name of "Junius," affixed to the most remarkable letters, and to those which alone (the letters signed "Philo Junius" excepted) the writer authenticated by himself giving them to the world. The identity of the authorship of the rest is indeed a matter of inference, though of inference so irresistible as to be now not disputed by any one. In 1772 the correspondence suddenly ceased.

Subject of the Junius Letters.—This may be briefly defined as the vindication of the public liberties. "The submission of a free people," so begins the first letter published under this celebrated signature, "to the executive authority of government is no more than a compliance with

laws which they themselves have enacted." This strikes the keynote of the whole. Every leading political occurrence of the day is turned to a vindication of popular liberty. It would be impossible in our space to enumerate the whole. It may truly be said that the British constitution never had a bolder champion than Junius, nor in the majority of cases a more learned or discriminating advocate. The amount of his legal and constitutional knowledge is extraordinary, especially if, as there is every reason to believe, he was not a lawyer. The characteristics of his style are energy, brevity, impetuosity, and the striking employment of metaphor. The principal drawback to the enjoyment of such talents applied in so good a cause is the writer's rancor and ferocity, and his incessant aspersions on private character. Yet this indignation, if excessive, may still have been honest. This question, however, depends partly on the solution of another enigma, which, more even than their literary excellence, has contributed to maintain the popularity of the letters. This is the mystery of their authorship.

Authorship.—Junius had apparently no confidants. His visor is never raised. He preserves throughout the same air of haughty superiority and profound, impenetrable secrecy. "My secret," he says, "shall die with me." The only person with whom he entered into anything like confidential relationship was Woodfall, the printer of the *Public Advertiser.* To him he wrote frequently in amicable and condescending terms, but always in the same feigned hand. Woodfall may have guessed the secret; it almost certainly was not entrusted to him. According to one account, the truth eventually became known to the government. "We know," George III. is reputed to have said, "who Junius is. He will write no more." The anecdote, however, is probably apocryphal. The mystery naturally excited intense curiosity in the public mind, and abundant pains have from that time to this been bestowed on unravelling it. The letters have been attributed, among others, to Burke, Dunning, W. G. Hamilton, Lord George Sackville, Dr. Butler, bishop of Hereford, Wilkes, H. M. Boyd, Philip Rosenhagen, Lord Temple, and Gen. Lee. Out of the whole of this list, Burke, Dunning, Lord Temple, and Wilkes are the only persons that can be credited with sufficient intellectual power to have produced the letters of Junius, and the evidence of place and circumstance, of sentiments and opinions, of political connections and of handwriting, seems decisive against them all. It is now generally admitted that either the authorship remains an impenetrable enigma, or that it belongs to one whose name was not mentioned in connection with it for forty years subsequently—Sir Philip Francis. Philip Francis, the son of a clergyman and schoolmaster of some literary repute, was b. in Dublin in 1740, and when the publication of the Junius letters commenced had for some years been a clerk in the war office. This circumstance supplied the clue to the discovery originally announced by Mr. John Taylor in his *Junius Identified*, published in 1814, during Francis's lifetime, and never contradicted by him. So accurate is the knowledge of war-office business betrayed by the writer that the conviction of his having been concerned in that department appears irresistible; nor can any other person in a similar position capable of having written the letters of Junius be pointed out. Many of the letters, in fact, are written on war-office paper. The hand, of course, is feigned; and before Francis's claims can be unreservedly admitted it is necessary to inquire whether the simulated hand can be identified with his. This investigation has been made in the most painstaking manner by Mr. Chabot, the eminent expert in handwriting, who, at the instance of the Hon. Mr. Twisleton, has compared not merely the acknowledged handwriting of Francis, but that of every other claimant of mark, with the hand of Junius. His results, with copious plates, have been published by Mr. Twisleton, and will leave little doubt that, so far as the evidence of handwriting is concerned, the identification of Junius with Francis is tolerably complete. The argument has also received unexpected strength from the discovery that a letter occurs accompanying a copy of verses in the feigned hand of Junius, sent to a young lady at Bath, is itself in the hand of Francis's cousin and intimate friend, Tilghman, with whom Francis is known to have been staying at Bath at the very time.

The external evidence for the Franciscan authorship of Junius, then, appears on the whole as strong as could be reasonably expected. The impression left by the whole investigation cannot be better summed up than in the words of Mr. Merivale: "All the lines of investigation which have been followed in order to trace the authorship of this or that known individual, except Francis, fail at a certain point. They end in impossibilities. The remaining path, to which one clue only leads us, becomes plainer and plainer the farther the investigation is conducted." The ingenuity of most formidable opponents has been exerted to discover some demonstrable incompatibility between the circumstances attending the production of the letters and the authorship of Francis. None such has been adduced. Francis, as was said of Godolphin, is never in the way and never out of the way. The one argument against him is derived from the evidence of style. But the distinction established is rather one of degree than of kind. There is no such incompatibility between the style of his acknowledged writings and that of the Junius letters as to render it morally impossible to attribute them to the same writer. It is not as though a pamphlet attributed to Swift should bear the impress of Bolingbroke. The admitted productions of Francis might pass for the work of a disciple of Junius. The real difficulty is, that Francis should never have equalled himself. This certainly is a difficulty, and is hardly obviated by Lord Macaulay's sensible but somewhat superficial reply, that every work of the same author cannot be the best. It can hardly, however, be held to count for much against the weight of external testimony, especially when the extraordinary moral resemblance between Francis and Junius is taken into account. Whoever Junius was, he must have been in temperament very much such a man as Francis is known to have been—vehement, combative, opinionated, disdainful, sarcastic, enthusiastically and disinterestedly devoted to the public good as he conceived it, but capable of the most unrelenting and unscrupulous animosity to all who crossed his path. To appreciate these characteristics it is essential to follow the next episode in his career. Appointed to a magnificent employment, a seat at the council of the governor-general of India, with a suddenness which certainly suggests the suspicion that his secret had become known, he quitted England for Calcutta in 1774. His official career was a constant series of disputes with the governor-general, Warren Hastings, culminating in a duel, in which he was seriously wounded. It is difficult to pronounce positively as to the merits of the controversy. Infinitely inferior to Hastings in administrative capacity, Francis does appear to have possessed more enlightened views as to the duties of government, and to have wished to introduce a spirit of equity and clemency into the administration of Bengal which would have greatly benefited it. Unable to contend with the genius and fortune of his rival, he forsook India in disgust, retiring, however, with a large fortune, said to have been partly acquired by high play. On the return of Hastings he became the life and soul of the memorable impeachment directed against him, his whole behavior during which, both as regards his unmitigated virulence and his underhand method of action, tends as strongly as any other proof to confirm his identity with Junius. When in his extreme old age the authorship was first publicly imputed to him, he neither denied nor admitted it, but his demeanor showed that he wished it to be believed. D. in 1818.

As the impersonality of Junius added much to his celebrity, so it must be admitted that the moral authority of his letters is impaired by their association with Francis. Much that might otherwise have passed for honest indignation is thus shown to have been prompted by personal rancor. With every deduction on this ground, the letters remain substantially the work of a patriot entitled to the gratitude of his countrymen for his spirited vindication of their liberties and laws. Their rank as a British classic is secure, although, as need hardly be said, their fame is in a great measure due to the scarcity of good political writing in their day. With a multitude of similar productions now forgotten they supplied the place of regular leaders in the newspapers, and would excite comparatively little attention in an age like ours, when so large a proportion of the literary ability of the day is absorbed by the public press.

The best authorities on the question of Junius are Mr. Taylor's *Junius Identified;* Dr. Mason Good's essay, prefixed to most recent editions; Mr. Twisleton's elaborate investigation of the handwritings of the various candidates; and the excellent *Life* of Sir Philip Francis, commenced by Mr. Joseph Parkes and completed by Mr. Herman Merivale. Mr. Parkes leaves no stone unturned to establish Francis's authorship, but attributes to his hero numerous letters and pamphlets which he certainly did not write, including one pamphlet signed "Irenarch," which was in fact written by a connection of the author of this notice. Sir Alexander Cockburn is understood to be preparing a work on the subject. (For the theory which identifies Junius with Lord Lyttelton, see LYTTELTON (THOMAS).)

R. GARNETT.

Junius, post-tp. of Seneca co., N. Y. Pop. 1420.

Junius (FRANCIS), b. at Heidelberg in 1589, a son of Franciscus Junius, went to England in 1620, and became librarian to the earl of Arundel, in whose house he lived for thirty years. He was an enthusiastic student of the Teutonic and Anglo-Saxon dialects, on which he wrote

learned and valuable works. D. at Windsor Nov. 19, 1677. He published an edition of Ulfilas's translation of the Gospels into Gothic, and a *Glossarium Gothicum* in five languages, of which the English part was reprinted at Oxford in 1743 with the title *Etymologicum Anglicanum*, and was the chief authority on etymology used by Dr. Johnson in his dictionary. Junius was an uncle of Isaac Vossius, and bequeathed his MSS. to the Bodleian Library at Oxford.

Junius (Franciscus), otherwise called François Du Jon, b. at Bourges, France, in 1545; studied classical philology and Protestant theology at Geneva; was pastor of a Walloon congregation at Antwerp, and became in 1568 chaplain to the prince of Orange. In 1573 he was called to Heidelberg by the elector to aid in a translation of the Old Testament; he was also professor of theology at Heidelberg, and afterwards at Leyden, where he d. in 1602. His principal work was the translation of the Old Testament into Latin in conjunction with Tremellius (Frankfort, 5 parts, 1575–79), which passed through twenty editions, the best being that of 1724. The other works of Junius were collected at Geneva in 1613—*Opera Theologica*, with an autobiography written in 1595. (See Haag, *La France Protestante*, and Herzog, *Real-Encyklop.*, s. v.)

Junk, a sea-going vessel, such as is built in Japan, China, Corea, Tonquin, and Siam. It has three masts, a high poop and forecastle, a wooden anchor, and usually has a wooden or painted eye on each bow, as if to enable it to see its way. The sails are ordinarily of matting. Junks, though slow and clumsy, are often surprisingly seaworthy. The amount of commerce carried on in them is very great, but vessels built on the European models are gradually taking their places.

Junk-Ceylon′, or **Salang,** an island in the Indian Ocean, belonging to Siam, in lat. 7° 46′ N., lon. 98° 18′ E. It is 20 miles long and 10 miles broad, and exports tin, edible birds' nests and sapan-wood to the British settlements in the Strait of Malacca.

Jun′kin (George), D. D., LL.D., b. near Kingston, Pa., Nov. 1, 1790; graduated at Jefferson College in 1813; studied theology in New York City, and was for many years pastor of churches at Milton and McEwensville, Pa.; was president of Lafayette College 1832–41, and again 1844–48; of Miami University 1841–44, and of Washington College, Lexington, Va., 1848–61, leaving the latter post at the outbreak of the war on account of his loyalty to the Union. Dr. Junkin was a prominent champion of "Old School" Presbyterianism, and wrote several theological and controversial treatises. D. at Philadelphia, May 20, 1868.

Ju′no, the third in order of discovery of the asteroids. It was found by Harding at the Lilienthal observatory, near Bremen, Sept. 1, 1804. It shines as a star of the eighth or ninth magnitude, and is of a whitish color, and not nebulous. Its sidereal revolution is performed in 1592.66 mean solar days. Its orbit is inclined to the ecliptic 13° 1′ 20″. Its diameter and magnitude are not well known.

Juno [Lat., gen. *Junonis*], in the Roman mythology, the queen of heaven and the wife of Jupiter, identified with the Cupra of the Etruscans, and later with the Hera of the Greeks. She presided over womanhood, the marriage-bed, maternity, and chaste wedlock, and over new-born children; and in public affairs she guarded the finances and public justice.

Junot′ (Andoche), duke of Abrantes, b. at Bussy-le-Grand Oct. 23, 1771; studied first law, but entered in 1792 a battalion of volunteers; distinguished himself at the siege of Toulon; accompanied Napoleon as aide-de-camp in Italy and Egypt, and was made general of division and commander-general of Paris in 1800. Somewhat displeased at the prodigality and lack of discretion which he (and especially his wife) showed, the emperor sent him in 1805 as ambassador to Lisbon; but he very soon left his post, repaired to the army in Germany, and distinguished himself in the battle of Austerlitz. In 1806 he was once more made commander-general of Paris, but in the next year Napoleon was compelled to send him and his wife away again. He was placed at the head of a small army corps destined to invade Portugal, and his success was so brilliant in this undertaking that Napoleon made him duke of Abrantes. Having been defeated at Vimeiro by Wellington, he concluded the convention of Cintra with the English, which highly displeased Napoleon, and during the campaign of 1812 he was mentioned as "wanting energy" in one of the emperor's reports. In 1813 he was made governor of Illyria, and his mental derangement now became apparent. He was brought to France, and at Montbard he threw himself out of a window, and d. a few days after, July 22, 1813.

Junot (Laure), duchess of Abrantes, b. Nov. 6, 1784, at Montpellier, France, of a rich merchant family of the name of Permon. Having married Gen. Junot in 1800, she became one of the most brilliant ladies of the French court. She was beautiful, witty, with a great talent for intrigue, and her audacity was as boundless as her prodigality. Napoleon called her *La petite peste*. After the death of her husband and the fall of Napoleon, she still maintained her social position in Paris and Rome, and made in 1831 a great sensation by her *Mémoires sur Napoleon* (18 vols.), which were followed by *Mémoires sur la restauration* (6 vols., 1836), and *Souvenirs d'une ambassade en Portugal* (2 vols., 1837). But she was now poor and sick, and d. in a house of charity in Paris, June 7, 1838.

Jupati′ Palm, the curious *Raphia tædigera* of the lower Amazon valley. Its trunk is barely eight to ten feet high, but it puts up a magnificent crown of pinnately compound leaves, some of which are often sixty feet long. The dried leaf-stalks contain a pith which is used instead of cork, and the hard and light outer crust is very useful in joinery.

Ju′piter, the fifth planet in order of distance from the sun, and far the largest and most massive of all the members of the solar system. Jupiter travels at a mean distance from the sun of 475,692,000 miles. The eccentricity of his orbit is 0.048239, so that the distance of the centre of his orbit from the sun is equal to $0.048239 \times 475{,}692{,}000$ miles, or 22,947,000 miles, and his greatest and least distances from the sun are respectively 498,639,000 miles and 452,745,000 miles. The longitude of the perihelion is 11° 55′, so that the centre of the orbit is in lon. 191° 55′; and in any true delineation of the orbit a distance corresponding to 22,947,000 miles, on the scale adopted, must be set off in this longitude, and a circle struck with this point as centre, and a distance corresponding to 475,692,000 as radius will represent the orbit of Jupiter with sufficient approximation; for, though the eccentricity of the orbit is considerable, the ellipticity is very slight indeed, and on any ordinary scale for drawing the orbits may be left out of consideration. (The semi-minor axis is less than the semi-major axis in the ratio of $\sqrt{1-(0.048239)^2}$ to 1, or approximately as $\sqrt{1-0.0025} : 1$, or about 9988 to 10,000; so that the excess of the semi-major over the semi-minor axis is less than the 830th part of either semi-axis.) It is worth noticing that the earth's mean distance from the sun being 91,430,000 miles, its fourth part, or 22,857,500 miles, differs very little from the eccentricity of Jupiter's orbit measured in miles. The plane of Jupiter's path is inclined 1° 18′ 40″.3 to the ecliptic, the rising node lying in lon. 98° 55½′. The reader must not fall into the mistake, however, of supposing that the most massive planet of the solar system moves in a plane inclined even at this small angle (less than 1⅓°) to the medial plane of the system; for the plane of the ecliptic to which we refer the others is itself inclined to the medial or invariable plane. As the rising node of the invariable plane is in lon. 102° 57½′, less than 5° from Jupiter's rising node, and its inclination 1° 35½′, differing less than 17′ from Jupiter's, we see that the plane of Jupiter's orbit very nearly coincides with the invariable plan of the solar system. Jupiter completes the circuit of his orbit in a mean sidereal period of 4332.5848 days, or 11 years (tropical) 314.92 days, or roughly 11 years 10 months 9 days (counting 30½ days for the month). His mean daily motion in his orbit is 299″.129; and as the earth's mean daily motion is 3548″.193, it follows that his mean daily loss in heliocentric longitude as compared with the earth amounts to 3249″.064; hence, the mean interval between successive conjunctions of the earth and Jupiter (amounting to as many days as this arc is contained in 360°) is equal to 398.867 days—in other words, this is Jupiter's mean synodical period. Jupiter's mean diameter = 85,000 miles; his greatest about $\frac{1}{30}$th more; his least about $\frac{1}{30}$th less; his polar compression being about $\frac{1}{15}$. Thus, his equatorial diameter = 87,800 miles and his polar diameter = 82,200 miles. His volume exceeds the earth's 1233 times, but the mean density of his substance being only equal to about one-fourth the earth's, his mass does not exceed hers more than 301 times. As compared with the sun's mass (regarded as unity), Jupiter's has thus been estimated by various astronomers: by Laplace, $\frac{1}{1067}$; by Nicolay, $\frac{1}{1054}$; by Airy, $\frac{1}{1046.8}$; by Santini, $\frac{1}{1050}$; by Bessel, $\frac{1}{1047.9}$; by Krüger, $\frac{1}{1047.2}$. Taking $\frac{1}{1048}$ as a fair mean of the latest and best values, we see that Jupiter's mass is but a small fraction of the sun's. Nevertheless, as compared with all the other planets, Jupiter is not merely first in mass, but he more than outweighs them taken all together. This will be seen from the following table, representing the masses of the various known members of the solar system, the earth's mass being represented as 1000:

Smaller planets.		Larger planets.		
Mercury	65	Jupiter	300,860	Sun's mass on the same scale = 315,000,000.
Venus	885	Saturn	89,692	
Earth	1000	Uranus	12,650	
Mars	118	Neptune	16,733	
Asteroids together less than	100	Total	419,935	
			2,168	
Total	2168	Grand total.	422,103	
		Jupiter's mass.	300,860	
Mass of all the planets except Jupiter.			121,243	

Thus we see that Jupiter's mass bears to the mass of all the other planets taken together a ratio of nearly 5 to 2; and in passing we may notice that three-fourths of the remaining mass, after Jupiter is removed, appertains to one planet—viz. to Saturn.

Jupiter is surrounded by a system of four satellites. These were discovered by Galileo in the year 1610. Their distances from Jupiter's centre are equal, respectively, to 6.05, 9.62, 15.35, and 26.99 radii of Jupiter, and their sidereal periods of revolution are respectively 1*d.* 18*h.* 20*m.*, 3*d.* 13*h.* 4*m.*, 7*d.* 3*h.* 43*m.*, and 19*d.* 16*h.* 32*m.* Their diameters have been estimated at 2352, 2099, 3436, and 2926, taking them in the order of their distance from Jupiter; so that the third is far the largest, exceeding even the planet Mercury in size. But in mass these bodies are not so great, relatively, as we should judge from their dimensions, at least comparing them with the smaller planets and our moon. The following table presents their masses and densities. (It is to be noticed that the values given in many handbooks of astronomy are incorrect):

	Mass, that of Jupiter = 1.	Mass, that of the earth = 1.	Density, that of the earth = 1.	Density, that of water = 1.	Diameter in miles.
Satellite I.	0.0000173	0.00520	0.198	1.148	2352
" II.	0.0000232	0.00698	0.374	2.167	2099
" III.	0.0000885	0.02663	0.325	1.883	3436
" IV.	0.0000427	0.01285	0.253	1.468	2926
Our moon...	0.0000378	0.01136	0.556	3.373	2164.6

The motions of the satellites of Jupiter have afforded an interesting subject of study to astronomers, and a subject which has been fruitful of instructive results. When they were first discovered it was supposed that by observing their eclipses and occultations astronomers could determine the longitude, and it was even hoped that the difficult problem of determining the longitude at sea might thus be solved. This hope, however, soon proved to be unfounded, since even when observed on land an eclipse or occultation is not found to occur (apparently) at precisely the same instant when observed with telescopes of different powers; and the determination of longitude requires that the exact instant of the occurrence of a celestial phenomenon should be ascertained. But before long a discovery of great importance rewarded the observation of the eclipses of Jupiter's satellites, originally carried on in order to form tables of the motions of these bodies. It was found that an eclipse or reappearance occurred sooner than the predicted time when the planet was in opposition or nearly so, and later when the planet was approaching conjunction with the sun, or had recently reappeared in the twilight skies after conjunction. The explanation of these peculiarities was first perceived by Roemer, who showed that they are due to the motion of light with finite velocity. The light-message conveying to us the news of an eclipse or occultation or reappearance of one of Jupiter's satellites thus takes a longer or shorter time in reaching the earth according as Jupiter is at a greater or less distance. It was thus found that light travels at the rate of about 192,000 miles per second. Another interesting fact revealed by the study of the moons of Jupiter is the relation between the motions of the three inner moons. From the values given above for the sidereal revolution it is easily calculated that the sidereal motions of the three inner satellites respectively are 8″.478706, 4″.223947, and 2″.096567. The sidereal motion of the innermost is not, it will be observed, exactly double that of the second, though nearly so; nor again is the sidereal motion of the second exactly double that of the first. But this relation holds *exactly:* the sidereal motion of the first added to twice the sidereal motion of the third is equal to three times the sidereal motion of the second; or thus:

$$8''.478706 + 2\ (2''.096567) = 12''.671840 = 3\ (4''.223947).$$

Add to this the observed fact that when the first and third satellites are in conjunction, the second is in opposition to them, and we perceive that *for all time* these three satellites circle under the following conditions: starting from the case just described, we have, first, I. and III. in conjunction, II. in opposition to them; when I. has gained three-quarters of a revolution on III., we have

$$\text{Sid. mot. of I.} + 2 \text{ sid. mot. of III.} =$$

$$\text{Sid. mot. of I.} + 2\left(\text{sid. mot. of I.} - \frac{3\pi}{2}\right) =$$

$$3 \text{ sid. mot. of I.} - 3\pi = 3 \text{ sid. mot. of II.}$$ (because of the relation stated above).

Hence, $\text{sid. mot. of I.} = \text{sid. mot. of II.} + \pi$;

i. e. when I. has gained three-quarters of a revolution on III., it has gained half a revolution on II.; but it was in opposition to II. at starting, it must therefore now be in conjunction with II., and III. is in quadrature to both. Proceeding similarly, we perceive that when I. has gained three-fourths of a revolution once again on III., I. is in opposition both to II. and III. Another of these intervals brings I. and II. into conjunction, and III. in quadrature to both. A fourth such interval brings about the same arrangement as at first—viz. I. and III. in conjunction, and II. in opposition to both. It is clear, therefore, that I., II., and III. can never be in conjunction at the same time.

The telescopic study of Jupiter has led to results of considerable interest. It has been found that his globe is surrounded by belts variable in width and color. Usually the equatorial region is occupied by a yellowish-white belt, the bands bordering this belt on either side being darker and usually tinged with brown. Towards the poles the belts are commonly less marked in color, and slightly tinged with a bluish hue. From the movements of spots on these belts it is inferred that the planet rotates on an axis inclined only about three degrees from perpendicularity to the plane of Jupiter's orbit, and that his rotation period is 9*h.* 55*m.* 26*s.* But the marks from which this rotation has been inferred manifestly do not belong to the solid frame of the planet, since they have been found to have a proper motion, resembling that which Carrington discovered in the case of the solar spots. The great depth of the Jovian cloud-layers, their variability in shape and color, the rapid motions implied by their change of aspect, and the small density of Jupiter's vast orb, all suggest the belief that his condition resembles rather that of the sun than that of the earth. Apart from these considerations, it seems impossible to believe that the sun, which pours but one-twenty-seventh part of the heat on Jupiter which he pours on the earth, can be the originating cause of atmospheric disturbances in Jupiter, which manifestly exceed greatly in intensity those which take place in our own air. Prof. Benjamin Peirce has also shown that on the nebular hypothesis both the planets Jupiter and Saturn must still be in an intensely heated condition, and are probably in large part still vaporous. R. A. Proctor.

Jupiter, Juppiter, or **Diespiter** (gen. *Jovis*), in the Italian mythology, the king and father of the gods and the just ruler of men; later identified with that far less noble conception, the Greek Zeus. Jupiter gave the rain, the thunder and lightning, the storm and calm. He was the protector of public justice and private virtue, the leader of armies, and the sender of instructive portents. He was the god of air and light, and the especial patron of Rome and her people.

Jupiter Ammon. See Ammon.

Ju'ra, one of the Inner Hebrides, belonging to the county of Argyle, Scotland. Area, 84 square miles. Pop. 844. The western coast is rugged and precipitous; the eastern, sloping and pleasant. Oats, barley, and flax are raised and black cattle reared. Between Jura and Scarva is the whirlpool of Corrievrekin.

Jura, a department of France, on the frontier of Switzerland. Area, 1943 square miles. Pop. 287,634. The largest part is occupied by the Jura Mountains, which yield excellent timber and extensive pastures, on which large herds of cattle and sheep are raised. The remaining lowlands and the valleys have rich soil, well adapted to agriculture and the cultivation of vines. Iron-mining is the principal industry of the department; wine, cheese, and timber its main products. The inhabitants are thrifty and well educated. Cap. Lons-le-Saulnier.

Jura, the name of a system of mountain-ranges, generally from 5000 to 6000 feet high, which cover parts of France, Switzerland, and Germany. They consist of a peculiar kind of limestone, called the Jura limestone, and are generally covered with fine pine forests. In the Swiss Jura many stalactitic grottoes are found, and caves abounding in bones of extinct animals. In several places large rivers, as the Orbe, the Doubs, and the Creuse, are lost in the ground and their course concealed for some distance. The highest peaks are Molesson, 6588 feet, and Reculet de Toiry, 5643 feet.

Juras'sic, The, is the "Period" in the earth's history that intervenes between the Triassic and the Cretaceous, and thus the second or middle division of the Mesozoic Age. The term is also applied to the group of rocks that were formed during this period, and is derived from the Jura Mountains, between France and Switzerland, in which an extensive series of these rocks occurs and has

been carefully studied by many distinguished observers. The term Oolitic (ὠόν, an "egg," and λίθος, a "stone," in allusion to certain limestones that in texture present the appearance of the roe of a fish) is sometimes used as synonymous with Jurassic, but it is more appropriately restricted to one of the subordinate epochs of the period. Where best developed the rocks of the Jurassic indicate to us repeated recurrences of similar conditions of deposit, accompanied by closely related faunas. Each such group of rocks with its associated fauna forms a natural "formation," and is defined above and below by a "break" in the series, the break being evidenced by an unconformable arrangement of the contiguous strata due to an interval of upheaval and denudation. Such a formation is in fact built up of the successive deposits of one sea or delta, and the entire series represents to us the successive movements of upheaval and depression, and records the accompanying migrations of life that in that area constituted the great geological events of the Jurassic period. In the accompanying table we give the classification of the subdivisions of the Jurassic and its formations, as found developed in Western Europe and Great Britain :

*A Table of the Classification of the Subdivisions and Formations of the Jurassic Period.**

CRETACEOUS.

Age	Period	Epoch	Conditions.	Formations.	Strata.
MESOZOIC, or SECONDARY AGE.	JURASSIC PERIOD.		Fresh water.	Purbeck beds.	
		Oolitic Epoch.	Third Oolitic Sea.	Upper Oolite.	Portland stone. Portland sand. Kimmeridge clay.
			Second Oolitic Sea.	Middle Oolite.	Coral rag and Calcareous grit. Oxford clay. Kelloway rock.
			First Oolitic Sea.	Lower Oolite.	Cornbrash and Forest marble. Great Oolite and Stonesfield slate. Fuller's earth. Inferior Oolite limestone.
		Liassic Epoch.	Second Liassic Sea.	Upper Lias.	Upper Lias sand. Upper Lias clay. Upper Lias limestones.
			First Liassic Sea.	Middle and Lower Lias.	Marlstone. Middle Lias sands. Middle and Lower Lias marls. Lower Lias limestones. (White Lias limestone)?

TRIASSIC.

The detailed history of geological progress thus recorded is, however, due to the peculiar geographical condition, during that period, of the region referred to. During times of upheaval it was a valley bordering the widespread Jurassic seas, and during intervals of depression it became a gulf or limited marine area, overwhelmed by the temporarily advancing waters of the ocean and peopled by successive faunas, each in turn derived from the common source, and each in turn more or less completely cut off from its successor by the recurring movements of upheaval. Outside of this limited area the conditions of the general Jurassic ocean seem not to have been notably affected by the undulations of its bed, and consequently events that were strongly marked in Western Europe were not elsewhere recorded by alternations of the strata or subdivisions of the fauna. Hence, whilst we recognize Jurassic strata by Jurassic fossils in Russia, widely spread over Asia to India, in the Rocky Mountains of the U. S., in the Andes of South America, in the Arctic regions, and in Australia, yet we can hardly expect to be able to subdivide the rocks accurately according to the above classification, or to assign the fossils with any certainty to the subordinate divisions of the period. In the U. S., in addition to strata doubtfully assigned to this period on the Atlantic border, there occur "true Jurassic strata full of characteristic fossils about the Black Hills and the Laramie Mountains, and also at the base of other ridges in the Rocky Mountains." (*Dana.*)

The palæontology of the Jurassic is of exceeding interest to the student, who here finds himself on a border-land, with the palæozoic types of fossils, rapidly disappearing on the one hand, and on the other forms appearing which usher in existing life, and amidst all a fauna thoroughly characteristic of Mesozoic times. Every great group of the animal kingdom is represented—marsupials (in the Stonesfield slate and Purbeck Beds); birds (*Archæopteryx* from Middle Oolite); whilst reptiles at this time attain to their maximum development, Deinosaurians (*Scelidosaurus* and *Megalosaurus*) on the Jurassic lands; Enaliosaurians (*Ichthyosaurus, Plesiosaurus*, and *Pliosaurus*), with crocodiles (*Teleosaurus*) in its waters; pterodactyles flitting through the air. Fishes, too, are abundantly represented by sharks (*Hybodus, Acrodus*, and *Chimeroids*), sturgeons (*Chondrosteus*) and a host of sauroid and other ganoid forms. Amongst Mollusca, the cephalopodous *Ammonites* and *Belemnites* are most abundant, as are also the genera *Terebratula* and *Rhynchonella* amongst brachiopods. Echinoderms abound. Encrinites amongst the crinoids have all but passed away, but their place is well filled by multitudes of *Pentacrinites*, and in certain strata corals are well represented. The most characteristic forms of the period are perhaps to be found in the Ammonitidæ, Belemnitidæ, and Pentacrinites. Upon the whole, the Jurassic fauna would appear to have its nearest existing representative in that of our Australasian lands and seas; such forms as the marsupials, as *Cestracion* and *Callorhyncus*, as *Trigonia* and *Waldheimia*, etc., appearing like the last descendants of Jurassic prototypes. EDWARD C. H. DAY.

* As recorded in Western Europe and Great Britain.

Jurien de la Gravière (JEAN BAPTISTE EDMOND), b. in France Nov. 19, 1812; entered the navy in 1828; became captain of a corvette in 1841; was engaged in the Chinese war in command of the Bayonnaise; was promoted to a full captaincy in 1850; served in the Black Sea during the Crimean war; was made rear-admiral Dec. 1, 1855, and placed at the head of a squadron in the Adriatic. In Oct., 1861, he received the command of the squadron sent against Mexico in pursuance of the triple alliance between France, England, and Spain, and as imperial commissioner adjusted with the government of President Juarez the famous treaty of Soledad, which was repudiated by Napoleon III. He became vice-admiral in 1862, and has written several works, the most esteemed of which is the *Voyage en Chine* (1854).

Jurieu′ (PIERRE), b. at Mer, in Orléanais, Dec. 24, 1637; studied theology at Sedan; visited Holland and England, and succeeded his father as pastor of the Reformed church of his native city. In 1674 he was appointed professor of Hebrew and theology at the academy of Sedan, but when this institution was broken up in 1681 by the Jesuits, and he himself put under persecution for his *La Politique du Clergé de France*, he sought refuge in Holland, and was elected pastor of the Walloon church in Rotterdam, where he d. Jan. 11, 1713. In spite of his restless and irritable spirit, which drove him from one controversy into another, he was of great aid and comfort to the Protestant Church in France, and among his numerous writings there are many of great value, as, for instance, *Histoire Critique des Dogmes et des Cultes* (1704) and *Histoire du Calvinisme et du Papisme* (1682).

Jurisdic′tion [Lat.], in law, is the power possessed by a person or body of men to dispose of a cause or question judicially. It may originate, as it has often done in England, from long usage, or it may be conferred, as it usually is in this country, by statute or by constitutional provision. Jurisdiction may be either *concurrent* or *exclusive*. By this distinction is meant that sometimes two or more courts, indifferently, may entertain a cause, while in other cases it can be disposed of by one alone. Thus, an inferior court, *e. g.*, a justice of the peace, frequently has concurrent jurisdiction with a superior court of minor causes. The action may accordingly be commenced in either. An instance of exclusive jurisdiction is that of a probate court in determining the existence and validity of a will. Jurisdiction is also original and appellate. It is original when a court entertains the cause in the first instance, appellate when it is brought from another court. Again, jurisdiction may be either of the subject-matter or of the person. The court may, for example, have general power over the subject, but it may not be presented in such a way that its authority can be exercised. Where jurisdiction does not exist the act of passing judgment is wholly inoperative and void. Thus, if a State court should pass upon a question which is reserved by the U. S. Constitution exclusively for the Federal tribunals, its judgment would be without effect. An instance would be the assumption of the functions of a court of admiralty. It is not necessary, where there is a total want of jurisdiction, to raise the question by an appeal from the decision. It may be shown to be of no avail in a wholly independent and collateral proceeding. Thus, if a person were sentenced for a criminal offence by a court having no jurisdiction, he might be discharged on a writ of *habeas corpus*.

This power to declare the judgment of a court a nullity is one of great delicacy, and should be exercised with much caution. Still, in a clear case there should be no shrinking

from its use, as otherwise much injustice may be done. A distinction has been taken as to the presumption of jurisdiction between an inferior and a superior court. It has been laid down as a rule that "nothing shall be intended to be out of the jurisdiction of a superior court except that which specially appears to be so; on the other hand, nothing shall be intended to be within that of the inferior court unless it be expressly so alleged." In determining to which particular class a court belongs, it will be necessary to consider the statutes and usages of the particular State in which the case arises, especially as to such courts as surrogates', general sessions, and justices of the peace. A court may have a limited jurisdiction, such as the circuit or district court of the U. S., and not be an "inferior" court within the meaning of this rule. Even as to the superior courts, the presumption of jurisdiction may be rebutted by proof to the contrary, unless, having jurisdiction under a certain state of facts, its record contains a recital of those facts, in which case the record, by a technical rule of law, is not to be contradicted by extrinsic evidence. Wherever the record expressly or by implication shows that the court proceeded without jurisdiction, there is no presumption in its favor, and its acts are plainly void. The rule also fails of application when the court proceeds in the exercise of some special statutory authority; for as to this, it is deemed to be an inferior rather than a superior court. When the case is one of an "inferior court," another set of rules prevails. The court cannot obtain jurisdiction by deciding that the conditions precedent to the rights to hear and determine the matter in hand exist, when in fact they do not. The most that can be said in any case is that its decision is apparently correct, but the facts may be disproved by extrinsic evidence. Thus, a board of assessors having power to tax residents of a town could not gain jurisdiction over a non-resident by deciding that he was a resident, when he was not so in fact. So, in any case where the record of an "inferior" court does not show upon its face the existence of the facts necessary to give jurisdiction, they are presumed not to have existed, though extrinsic evidence may be offered to the contrary, and the jurisdiction thus be upheld under these rules. If a court-martial should assess a fine without giving the accused an opportunity to be heard, the decision will be wholly void; the court would in such a case have no jurisdiction over the person. The same rule would be applied to a magistrate having power by statute to issue a warrant or an attachment under special circumstances that were not complied with. Where a judge acts wholly without jurisdiction, his decision may not only be disregarded by other courts, but he may render himself liable to an action for damages at the suit of the party injured.

This question of want of jurisdiction is frequently presented where an attempt is made to enforce in the courts of one State the judgment or decree of the courts of another State. The U. S. Constitution provides (art. iv., § 1) that full faith and credit shall be given in each State to the public acts, records, and judicial proceedings of every other State, and Congress is empowered to prescribe the manner in which such acts and proceedings shall be proved and the effect thereof. Under this provision the court of the one State may inquire into the jurisdiction of the court of the other State, and refuse to recognize a judgment rendered without jurisdiction. The Constitutional clause assumes that there is a record to which recognition can be given; and a professed judgment rendered without jurisdiction is in fact no judgment. There must be jurisdiction both of the subject matter and of the person. Accordingly, if judgment was obtained against a defendant in one State without notice, it could not be enforced against him as a judgment in the courts of another State, as the court acted without jurisdiction over his person. It would be immaterial though the courts of the State where the judgment was rendered deemed it valid. A judgment of this kind may sometimes, by force of statutory provisions providing notice by means of newspaper publication instead of that which is personal, have a local effect when it is wholly discarded in other States for want of true jurisdiction over the person. This question frequently arises in the case of an action for total divorce. If one of the parties, having become domiciled in one State, obtains a divorce from the other in his absence and without personal notice, the judgment may be valid by the local law of the State where it is rendered, and yet not be recognized in another State, on the ground of want of jurisdiction. If, on the other hand, the absent party had appeared and submitted to the jurisdiction of the court, the judgment might have been valid in both States. A like question may arise as between the courts of different nations. Thus, the English courts will, as a general rule, recognize as conclusive a judgment rendered in the courts of an American State where the latter has full jurisdiction over the subject. Assuming, what is doubtful, that this rule would be applied there to an action in this country for divorce from an English marriage, still, if an Englishman, dissatisfied with his marriage relations, should leave England and acquire a domicile in one of our States, the wife still remaining in England, and obtain a divorce valid by its laws, the English courts would not recognize its existence on account of the defect of jurisdiction. It is scarcely necessary to add that questions of jurisdiction thus become of great practical moment in the administration of justice of various states or nations under the rules of private international law.

Under the jurisprudence of the U. S. government, the judicial power is prescribed in the Constitution. It is, for most purposes, left to Congress to determine in what courts it shall be vested. It is, however, provided that there shall be a supreme court, and that it shall have *original* jurisdiction in two classes of cases—one in all cases affecting ambassadors, other public ministers, and consuls, and the other in which a State shall be a party. In all other cases the court shall have appellate jurisdiction, with such exceptions and under such regulations as Congress shall make. The effect of this provision is that Congress cannot confer upon the supreme court "original" jurisdiction in any other cases than those that are expressly mentioned. This is an instance of an application of the rule that the expression of the power in one case is an exclusion of it in all other cases. "Original" jurisdiction in all other cases to which the judicial power of the U. S. extends must be exercised, as far as Federal tribunals are concerned, by some of the "inferior" courts referred to in the Constitution as within the power of Congress to establish. (See CONSTITUTION, U. S.) It cannot, however, be claimed that the supreme court of the U. S. cannot exercise appellate jurisdiction in the two classes of cases in which its jurisdiction is original. Thus, a State may be a party in a State court to a proceeding in which the validity of the laws of Congress may be involved, and the case may be appealable on *that* ground. The fact that it was a party would be no hindrance to the appeal to the supreme court of the U. S. In fact, there are two general grounds on which a case may be brought before a U. S. court, one being the nature of the case, and the other the presence of a particular party. The fact that the presence of a party makes a case one for original jurisdiction does not prevent the exercise of appellate jurisdiction where that depends on the nature of the case.

The jurisdiction of a State court may or may not be prescribed in a State constitution. Where it is, an act of the legislature extending or abridging its jurisdiction in opposition to the constitutional provisions will be void. Where there is no constitutional direction, the whole matter is within the control of the State legislature, which may in that case erect and abolish courts at will, and parcel out their jurisdiction according to its pleasure. Though such an abolition of a court should displace judges who held office for a specified term, no legal objection would stand in the way, as *no contract* is created between the State and the judges ensuring their continuance in office for the designated period.

Some suggestions may be useful as to the question whether consent of parties will confer jurisdiction. It is manifest that a judicial tribunal cannot be created by consent. If parties should in the most solemn form agree that they would submit a question to a tribunal created by themselves, the most that their unaided act would amount to would be to appoint an arbitrator and to give him authority to make an award. (See AWARD.) Under the same general view it may be shown that it is impossible by consent to extend the powers of an existing court to subjects over which the law gives it no control. While these positions are true as to jurisdiction "over the subject-matter" of a cause, they cannot be applied with the same breadth to jurisdiction "over the person." It is frequently the case that general power to decide a question exists if the parties are properly before the court, and the law prescribes a particular mode of bringing them there. If that mode is not observed, regularly the court has no jurisdiction. In such a case, if a party waives an observance of the prescribed mode, and voluntarily takes part in the action, the court may, upon the consent thus given, entertain the case. This view could not be taken of a case where the court could not, by the most strict adoption of regular forms of procedure, acquire jurisdiction. An illustration is found in the jurisdiction of a State court over a foreign consul. The U. S. Constitution for public reasons withdraws the consul as a defendant from the State courts. He cannot, accordingly, be sued there by his consent. There is here no question of an adoption of regular forms. The State court has nothing to do with the case, and can no more acquire jurisdiction over the person of the consul by his consent than it could obtain the right to dispose of an admiralty cause in the same manner. T. W. DWIGHT.

Jurispru'dence is both the *philosophy* and the *science* of law. *Law*, as the subject-matter of jurisprudence, is the body of rules regulating the relative rights and duties of men in society, declared and politically enforced by public authority. As a branch of *philosophy*, jurisprudence is concerned with the *origin* of law, its nature, and its connection with the other phenomena which make up the universe. As a *science*, it classifies into system the body of our knowledge acquired by a study of its actual development and history, and traces the principles which connect its various results. As *philosophy*, it teaches the theory of all possible law; as *science*, it teaches the facts and principles of all actual law.

Jurisprudence, regarded as a whole, comprises not only a study of what the law is and has been, but of what it would be if the principles to be extracted from it were correctly worked out. It permits us to test those principles themselves by a standard external to them—by our abstract notions of what is right and reasonable, by our observation of what is useful, by the visible wants and tendencies of society. "It may be said of laws, that mankind have but *one law*, though every nation has had its *own system of laws*. For positive law is not essentially a simple collection of isolated rules and ordinances, arbitrary or conventional in their nature, but it is a system, exhibiting, amid all its variations in time and place, invariable and fixed principles and relations, which constitute the foundation or identical part of all laws; that is to say, universal or natural law." (2 *Law Rev. and Mag.* (Lond.), N. S. 548.) "For as reason and reflection are natural to man, and are as important parts of his nature as the highest of its instincts, so laws founded on the right exercise of that reason are natural laws in the best and highest sense of all." (Duke of Argyle, *Reign of Law*.)

The nature of man as a rational and moral creature points out the ends and objects of his existence on earth, and the means furnished by external nature by which, in the exercise of his activities in society, they may be attained, and in the progressive exercise of these activities establishes the various relations which bind together and classify mankind in a social order. Arising out of the nature of men, and its relation to the physical and moral universe, and developed in history in the progressive culture of the race, jurisprudence may be traced and studied both *deductively* and *historically*. The conclusions reached by this double analysis, and reconciled, constitute the science. Law and government appear as facts in human history simultaneously. They never exist apart, and from their nature cannot; it being the very office of government to declare and enforce law, and law, consisting of those rules of conduct which are enforceable and actually enforced by that public authority embodied in government. Law and government are therefore correlates. Each implies the other. From the simplest to the most complex political organizations—the family, the tribe, the nation—as society develops historically, law is always present; but in the logical order its idea is prior, for governments exist in order that law may be declared and enforced.

The study of human nature gives rise to the *conception of a moral order*, the realization of which constitutes man's highest good, and the pursuit of which employs all his activities. It constitutes the *final cause* of man's existence, the purpose and perfection of his being, his end and destiny. Whatever conforms to that moral order is *right;* whatever violates it is *wrong*. Subsidiary to that conception of universal moral order, and forming parts of it, through the medium of which in combination it is to be realized, are subordinate conceptions of the human reason declaring and defining the relations of men with each other in society, of men with each other in relation to external nature, and to the universe of things, material, intellectual, and moral. Illustrations of these are conceptions of the family, the state, of property, of contract, etc. To conform to that universal moral order—that is, to do whatever is *right* and avoid whatever is *wrong*—the nature of man recognizes as his *duty;* which at the same time he is conscious, by virtue of the *freedom of his will*, that he may choose not to perform; the exercise of which, in that way, however, he feels to be the breach of an *obligation*. The conception of this moral order binding him, as a rational free agent, to its observance, is the idea of *morality*, the rules of which, analyzed and classified, constitute the science of *ethics;* and those rules, habitually practised, are named *virtues*, their habitual violations, *vices*. Among virtues we find that of *justice*, which is defined to be *the habitual disposition to render every man his due;* and those claims, whatever they may be, which belong to man as matters of justice are called *rights*. The duties resting on all to render to each his rights are called *obligations*, the violation of them, *wrongs;* the relations between men thus established are distinguished as *jural*.

Rights differ from other *moral claims* of men upon each other in this—that the latter are *duties*, depending for their fulfilment altogether upon the *good-will* of those bound by them; the former carry with them a claim to be *enforced by physical compulsion*. But as the mind of man is not the subject of physical force, the *rights* which are susceptible of being enforced must be such only as constitute claims upon the *external conduct* or *overt acts* of others; but for the purpose of determining the *moral quality* of these it often becomes necessary to investigate the *mental conditions* of the agent at the time of their commission, as in questions of motive, intention, negligence, sanity, intoxication, nonage, etc. And the physical force required for their enforcement is furnished by the *public authority*, representing the *rational will* of the community in the administration of *law*. That *public authority*, organized in every separate, independent community constituting a *state* or *nation*, is its political and civil government; and to it is referred the determination, from time to time, in each successive stage of its history, of the question, What are the *just and natural moral claims* of each member of society upon all which it will enforce as *legal rights?* and its declarations to that effect are the *positive laws of that state*. The supreme public authority inherent in every independent state or nation, whereby it organizes its political and civil government, is called *sovereignty;* and the *mode* in which the government exercises the powers of sovereignty is its constitution. There are no *legal limits* to sovereign power, for it declares what the law is; it is bound only by moral restraints, but the constitution of a state may impose *legal limitations* upon the *government;* and this gives rise to *public or constitutional law*.

There is, however, a *supreme law* which binds and restrains the sovereignty of individual *states*. It is the *law of nations*, or *international law*. It consists of a body of rules regulating the relative rights and duties of independent nations in that mutual intercourse demanded by the progressive advancement of human society. It is the application of the right reason and cultivated conscience of mankind to the relations of men organized into separate and independent communities and as subjects of distinct national sovereignties. It is developed by diplomatic discussions and state papers; by the decisions of judicial tribunals in private controversies, where the litigants have no common municipal superior; by the treatises of philosophical jurists; and is embodied in a traditionary code of international usage and the modifying legislation of treaties and conventions. It is not, as has sometimes been said, without a *sanction;* for, although sovereign nations recognize no common superior with power to prescribe the rules of their conduct, nevertheless each sovereign is a public authority which by resort to the *ultima ratio* of just war, is entitled, according to the public opinion of the civilized world, to enforce the commands of international law; any breach of which, though directly injurious to but one, is also an offence against the rights and peace of all.

Each individual member of human society is under a *moral necessity*—that is, owes the duty by the rational exercise of his will—to conform to the universal moral order by the habitual observance of all the rules of morality and the practice of those virtues which constitute the ideal excellence of life and character; and is therefore not only entitled, but required by the constitution of his nature, to employ the means necessary to enable him to perform that duty. The means to this end are furnished by the organization of mankind in society, and the materials for its development provided by the material universe with which he is placed in contact or connection. But both duties—to attain the end and use the means—rest *equally* on all; and the liberty of each man's will in the pursuit of his highest good is limited by the proper exercise of the wills of all others. The harmony of this coexistence is the establishment of *civil and social order*, which is the sphere and scope of human *freedom*, personal, civil, and political, being *liberty regulated* by law, the principle of which is *equality in right*.

The perfection of civil order, it is manifest, therefore, consists in the largest liberty of *individual action* compatible with the *equal liberty* of all others—that is, compatible with the *general good;* and the question requiring solution in every case as it arises or is foreseen, is, To what extent is the public authority justified in imposing physical restraint upon, or applying physical coercion to, individual action? It has been found impossible hitherto to announce any principle which will theoretically answer that question for all cases. There has been found, indeed, as yet, no common agreement as to the true principle on which the public authority intervenes forcibly at all. Some ground it on the principle of *self-defence;* some, on the preservation of the *status quo;* some, on the abstract nature and quality of rights as enforceable; some, by the application of the

maxim, "Do as you would be done by;" others, by the principle that any one may prevent what will make his physical condition less comfortable than it is by nature; but the opinion most generally received is, that the proper limit of the law, as the applied or threatened public force, is in every case a question to be determined by the *cultivated reason* and *enlightened conscience of mankind*, testing and correcting their conclusions by *progressive experience* as it advances in civilization, resorting to *expediency and utility*, not as the *standard* and *measure* of truth, but as its *evidence and confirmation*, seeking the perfection of man in the historical realization in human society of *ideal justice*.

Consequently, every system of civilized jurisprudence will be found to contain two elements—one deduced by the public reason from the general principles of natural justice; the other dogmatically fixed by recognized custom or by express legislation, and affected by the peculiarities of national character, history, and situation. The latter is arbitrary, accidental, and positive; the former is its rational element and unchangeable foundation. "It would be hard," says Burke, "to point out any error more truly subversive of all the order and beauty, of all the peace and happiness, of human society than the position that any body of men have a right to make what laws they please, or that laws can derive any authority whatever from their *institution merely*, and independent of the quality of their subject-matter. . . . *All human laws are, properly speaking, only declaratory*. They may alter the mode and application, but have no power over the substance of original justice."

Jurisprudence, then, is distinguished from *ethics* as a part is from the whole, being one of the branches of that larger and more comprehensive department of human knowledge. On the other hand, its own province includes—1. *Natural Law*, or that theory of human relations, and the rights and obligations implied in them, deducible from the nature of man and of the things around him, and of which his social and individual advancement require the enforcement, if necessary, by physical power. 2. *International Law*, or that body of rules deducible from the relations of man, organized into separate and independent communities, and which are applied (1) to regulate the intercourse of sovereign states, and of which the ultimate sanction is just war; (2) to determine the rights and obligations arising between individuals considered as subjects of separate sovereign jurisdictions, by judicial tribunals acting and deciding on private controversies. The former is called public international law; the latter, private international law. 3. *Public or Constitutional Law*, or that body of customary or enacted rules which form the frame of political government or constitution of the state, prescribing the divisions of political power, the functions of public authorities, and the relative rights and duties of the national government and the subjects of its jurisdiction. 4. *Municipal Law*, or the domestic law of particular states, prescribing the relative rights and obligations of all persons subject to its jurisdiction as members of that separate community. Examples of this are to be found in the *Roman law*, conspicuously called the *civil law*, which forms the base of the civil rights and duties of a large number of modern states, in which it has been preserved since the days of the supremacy of the Roman empire; and the *common law of England*, which consists chiefly in a body of principles applied in the historical development of the English people, embodied in traditional customs, deduced by judicial practice and decision, by the application of reason to the varied and multiplying relations of men and things in a community remarkable for vigorous and continuous growth, and from time to time supplemented by express legislation. *The canon law* also constitutes part of the municipal law of those states where it is or has been recognized, being originally a body of rules established by the ecclesiastical authority of the Christian Church, acting with civil power over certain matters claimed by it to be, by reason of their spiritual nature, exclusively within that jurisdiction, but since, in accordance with more enlightened views as to the true division of the civil and spiritual authority, adopted by the civil power of the state as part of the body of its municipal law. Under the head of municipal law is to be found the whole body of authoritative rules regulating the *personal status* of the individual members of the state, and the relations annexed to and growing out of it, with the corresponding rights and obligations, such as husband and wife, parent and child, etc.; also the relations of men to one another as constituted by *contract, property*, and all those civil relations which are based on their mutual intercourse. A large part of every such system becomes law by the unconscious operation of social instincts, growing into habitual observances, thus forming what is known as *customary law*, which becomes scientifically developed by a long series of *judicial decisions*, making new applications of recognized principles, discovering new principles by the analogy of reason, and supplied as necessity or convenience requires by the express aid of *legislation*. When the mass and body of municipal law thus built up has grown enormous, confused, and unwieldy, a comprehensive legislation reduces it to the written form of a *code*, such as those of Justinian and Napoleon, on which, as on a new foundation, the work of development begins again.

Consult *Droit Naturel*, Henri Ahrens (Leipsic, 1868); *Philosophie du Droit*, Lerminier (Paris, 1853); *Political Ethics*, Fr. Lieber; *Inquiries, Elementary and Historical, in the Science of Law*, Jas. Reddie (London, 1847); *Principles of Jurisprudence*, D. C. Heron (London, 1873); *Elements of Jurisprudence*, C. J. Foster (London, 1853); *Sphere and Duties of Government*, William Humboldt, Tr. Jos. Coulthard (London, 1854); *Inquiries in International Law, Public and Private*, Jas. Reddie (Edinburgh, 1851); *Principles and Maxims of Jurisprudence*, J. G. Phillimore (London, 1856); *Two Treatises on Government*, John Locke (London, 1821); *Universal Jurisprudence*, J. P. Thomas (London, 1828); *System of Universal Law*, Heineccius, tr. Turnbull (London, 1763); *Doctrina Juris Philosophica*, Warkönig (1830); *Philosophia Juris*, Warkönig (1855); *Vocation of our Age for Legislation and Jurisprudence*, Savigny, tr. Hayward (London, 1831); Lorimer's *Institutes of Law* (Edinburgh, 1872); *Ancient Law*, Sir Henry Sumner Maine; *Province of Jurisprudence*, etc., Austin; *Spirit of Laws*, Montesquieu; *Jurisprudence*, C. S. M. Phillips (London, 1863); Westlake's *Private International Law;* Phillimore's *International Law;* Lawrence's *Wheaton's International Law*. STANLEY MATTHEWS.

Jurisprudence, Medical. This is the name given to a science of comparatively recent origin, and which forms a syncretism of law with medicine. Its boundaries in the physical world are coextensive with the whole field of natural history, while in law, although more largely related to the domain of crime or public hygiene, its assistance is often required in cases involving the application of chemistry to the mechanic arts. It is also designated as *forensic, juridical*, or *state medicine*, and is defined as the *science which treats of the application of the laws of nature to the administration of justice and the preservation of the public health*. Nearly all the physical sciences contribute to the wants of this new sister, while with an equally wide range it enters into the myriad channels of municipal law, and follows human relations in all their phases, whether personal, domestic, or social. The application of medical jurisprudence to the admeasurement of physical facts affecting the civil or criminal responsibility of persons amounts practically to this only, that medicine furnishes the lights of her experience, and law applies them according to the established rules of her tribunals and under the equities of each particular case. Medicine furnishes the principle, law the rule, for its application to the artificial relations of civil life; and thus, without collision or conflict, each science treads its appointed path and performs its required part in human government. Some idea of the range over which experts may have to travel in order to decide problems in medical jurisprudence will be had from enumerating the various sciences into whose fields these inquiries must enter. The first is natural philosophy in its restricted sense, and involving more particularly *meteorology* and its influences upon animal or vegetable life; next, *physical geography and climatology;* following these in all their various divisions and subdivisions come *anatomy, physiology, pathology, therapeutics, surgery, chemistry* in its multiple relations, *botany, hygiene*, and *mental philosophy* or *psychology*. It is needless to say that no one can be equally proficient in all these sciences; and yet without some knowledge of the general principles of each, and of their nomenclature, a medical jurist would fail at the very outset to know in which of all these fields he must look for a rational solution of any problem committed to his judgment.

Although, as before said, medical jurisprudence as a science is of comparatively recent origin, one of its departments, that of public health, has always engaged the attention of lawgivers from the earliest days of established governments. Among the Hindoos, and more lately among the Israelites, we have the best evidence from their religious codes of the important part which it occupied in their ceremonial law. The frequent lustrations and isolations of the person enjoined as part of the habitual duty of all sectaries converted a physiological safeguard into an act of worship, and thus protected the health of the community while ensuring that of the individual. For so urgent is the necessity of personal purification among a people proverbially unclean, and in a climate disposing to pestilence, that Mohammed required his followers to cleanse themselves with sand wherever water could not be obtained. From this incorporation of sanitary observances into the

religion of a country, it followed that priests became the earliest custodians of public health, and, it may be truly said, the first medical jurists on record. The Jews, with all their traditional respect for the teachings of the Pentateuch, and their adherence to the tabernacle ritual of their religion, do not appear to have followed its injunctions as closely in their domestic life as consistency would demand. Much that was commanded by Moses is now practically ignored, and Leviticus has given place to modern science and household convenience. In striking contrast to this is the still enduring imperative of Brahma, for even at this day in India caste is forfeited by touching articles forbidden in the religious code, and the priest among the Hindoos remains in many senses the supreme lawgiver, as in ages past.

It is not difficult to conceive that a people as enlightened as the ancient Egyptians must have had canons of medical police by which to guide their civil life. According to Herodotus, they had laws regulating marriage and the relations of the sexes; distinguishing between mortal and dangerous wounds in order to affix penalties; prescribing modes of embalming and interring the dead; and in other respects maintaining what would now be called a system of sanitary and criminal police. Nor, after reading the ordinances of Lycurgus, or the physical rubrics laid down by Pythagoras and Plato, need we ask whether they had studied the laws of our bodily life. Both these philosophers believed and taught that medicine was a branch of legislation. Beyond this, however, there is nothing to show that anything approaching to a distinct science of forensic medicine was ever conceived by them. No union of the principles of law and medicine appears in the jurisprudence of Greece, for, except in questions of public disease or medical police, medical men were not often consulted by the tribunals of that country. The chief concern there was to secure a robust population capable of bearing arms, and in their prevalent ideas as to the best mode of perfecting the human species they were led to the barbarous practice of abandoning delicate infants and rearing only strong ones. Even Plato advises that children with diseases of inheritance should be left to chance for their future development. To perfect this dogma of their political economy, and to provide for the health of cities and camps, formed about the entire scope of state medicine in Greece. The opinions of Hippocrates and Aristotle on a few subjects relating to the sexes and to wounds express all that was practically used at that day. Nevertheless, so much is there in the authority of a name that many of the principles of the canon law, as formerly recognized in the ecclesiastical courts of Europe, were unquestionably founded upon the teachings of Aristotle, whose *Organon* was the Bible of the schools of philosophy down to the time of Bacon.

In passing to Rome we meet at once a superior character of legislation. A later age and a more advanced knowledge of the duties of municipal government to its citizens placed medical police on a higher plane of action and of authority. As early as the reign of Numa Pompilius a law was enacted which was intended to protect the life of an heir by requiring medical assistance to be summoned in all cases of difficult labor, and forbidding the burial of a pregnant woman until the fœtus should first have been extracted. And such was the controlling influence of Greek philosophy in legislation that in the *Pandects* of Justinian, where various titles are arranged referring to crimes, physical deformities, and questions of legitimacy, courts were instructed not to be guided by the judgment of living physicians, but to form their opinions exclusively "*upon the authority of the most learned Hippocrates.*" Yet the existence of an *archiater* or state physician, who was himself both physician to the court and the acknowledged head of the medical profession, must have imparted to his opinion great weight with the judges, notwithstanding the institutional reverence for Hippocrates. According to Tacitus, the bodies of Germanicus and Agricola were medically examined, and in the former slight traces of poison were found; but as the specific signs thereof are not given, we are left to conjecture how, in the absence of chemical knowledge and familiarity with the characteristic pathology of such cases, any rational judgment could have been arrived at in the premises. Nor, again, are we informed at whose command the autopsy was made, and whether the same was undertaken as part of a judicial inquisition into the cause of their sudden death. Probably, autopsies upon private individuals were not infrequent under similar circumstances of death, but if so, we have no sufficient record to make it the basis of any inference of their judicial character.

In the whirlwind of savage customs which ruled Europe during the Dark Ages legal medicine could hope for no positive recognition. In its stead, ordeals by fire, water, or the judicial combat were introduced as so many direct interrogations of the Deity. Human responsibility was judged, even before courts of justice, by the haphazard results of chance, and superstition usurped the place of reason. But inasmuch as it is easier to adopt a system of laws than to frame one, the wiser conquerors of Rome were not slow in availing themselves of the rules of her jurisprudence. They drew largely from it, nor did they ever cease paying that homage to her laws which they had so emphatically denied to her empire. It would not be difficult to show that the Roman law had authorized the calling of physicians before courts in cases requiring expert testimony; and finding the same rule prevailing in the jurisprudence of the Ostrogoths in Italy and of Charlemagne in France, it is easy to conjecture the source whence the rule was derived. This may be said to include the whole aspect of legal medicine as presented to us in the laws of antiquity, nor is the little progress shown by it there to be wondered at when we reflect, that most of the physical sciences upon which rest its foundations had scarcely risen upon the horizon of human thought. No Harvey had yet shown that blood, instead of air, circulated through the arteries; no Vesalius had established a system of rational anatomy; no Boerhaave or Van Helmont had yet explored the mine of chemistry through which Priestley and Lavoisier were destined to descend into the very storehouses of nature.

It is now generally admitted that the application of medical knowledge to jurisprudence, and the practical recognition of a science of forensic medicine, only commenced about the middle of the sixteenth century. The criminal code of the Germanic empire, originating with Charles V., and enacted by the diet held at Ratisbon in 1532, is the first public recognition and the first legal application of the science with which we meet in modern history. This celebrated code enacts that physicians *shall* be called by courts in all cases where death has been occasioned by violent means, whether accidental or criminal. One of the first and most notable fruits of this new authority given to medicine to enlighten jurisprudence was the speedy overthrow of many dominant superstitions, which had formerly fettered the public mind and cost the lives of hundreds of innocent people. The literature of mediæval Europe on the subjects of witchcraft and demonology forms an instructive chapter in the history of human opinion. Those who are curious to inform themselves in this department will find no richer mine than in the pages of Hallam and Calmeil. Subsequent to the days of Charles V. the ordinances of the kings of France combined in the form of codes what had formerly been only customs, thus engrafting the common law of locality upon systems of positive enactments. In 1606, Henry IV. gave letters patent to his chief surgeon, by which he was authorized to appoint two physicians in each town, who, in the nature of coroners, should investigate and report upon all cases of accidental death. In the English law the office of coroner was not originally given to physicians, this officer being the adjunct simply to the sheriff in the government of counties. In 1667, Louis XIV. decreed by royal ordinance that in all criminal matters requiring reports, courts should be assisted by at least one of the physicians named by his chief surgeon. Of such binding obligation were all these ordinances that a decree of the Parliament of Paris in 1662, and of the Parliament of Dijon in 1680, set aside judgments of inferior courts because they had been rendered without the intervention of medical experts.

As a branch of instruction and a special science, medical jurisprudence is but a new-comer in the schools; and as its first teachers were physicians, so its first altars were erected in medical colleges. Inasmuch also as its first seeds were sown in the bosom of the old civil law, so, too, those countries first cultivated it which had themselves derived the foundations of their jurisprudence from the same source. Haller's lectures on juridical medicine, published in 1782, indicate the establishment of a chair of instruction in Germany at a day when no similar instruction was probably given in any of the European schools. In 1792 the first professorships of the science were created in France, and in 1803 the University of Edinburgh followed the example. In England it would appear that no similar chair was established in any college until the year 1820, although in the U. S. it had been made the subject of lectures as early as 1804. So far as can now be ascertained, the first lectures on medical jurisprudence ever delivered in this country were given to the students of Columbia College, N. Y., by Dr. James S. Stringham, then professor of chemistry, in 1804. This chair he filled until his death in 1817, when he was succeeded by the late Dr. John W. Francis, one of the most eminent physicians which our country has ever produced. Dr. Francis held the chair until 1826. While Dr. Stringham was delivering his lectures on medical jurisprudence in Columbia College, Dr. Charles Caldwell gave a course upon the same subject

in Philadelphia during the winter of 1812–13, and in 1815 Dr. Beck was called to fill a similar chair in the Western Medical College. Since that time, and advanced into prominence by Dr. Beck's encyclopædic work upon the subject, forensic medicine has been considered as part of a regular course of medical study, and many schools have accordingly introduced it into their scheme of lectures, though generally as a subordinate branch and appendant to some established chair. At last, also, the law-schools have recognized it in many instances, and adopted it as an adjunct science, collateral to, and not in the main line of, required studies. Slowly and surely, however, it is working its way to that eminent position which belongs to it in the internal economy of government, since it is truly a part of the *jus gentium* or *necessary* law of every state, whether in its capacity of medical police or of forensic medicine.

The philosophy of medical jurisprudence is founded in the necessity of frequently applying the laws of nature to the administration of justice, no less than in employing them in the preservation of the public health. In a large range of subjects it is occupied, therefore, with the consideration of topics that are, strictly speaking, exclusively medical in character. The law looks to, and in fact employs, forensic medicine as, in every sense, an *amicus curiæ*, and as a counsellor retained not in the interest of one party, but in that of justice generally; and the philosophy of this science, as it has gradually been unfolded, has shown the essentially legal necessities upon which it rests. Its duty, like that of equity, is to soften the rigors of the law wherever particular instances are shown to merit some modification in the application of universal principles to them, or some light not attainable from any other source than nature is needed to determine the just limits of human responsibility whether for crime or private wrong. In this way, forensic medicine forms an auxiliary branch of municipal law, affording both circumstantial evidence and skilled opinions upon the inferences to be judicially drawn from such evidence. While, as we have before seen, it treats of the whole realm of nature so far as it applies to man in society and to government as the arbiter of human differences, it is usual for convenience' sake to classify its subjects into divisions founded upon their practical applications. The following is a synopsis of these topics in their legal aspects and under the complexion they assume before courts. It will be seen that they may all be arranged into distinct groups, belonging either to *Medical Evidence, Medical Police, Legal Chemistry*, or *Psychology*. This differentiation of topics implies also that *general* medical knowledge does not necessarily furnish the special proficiency in each department required to constitute any physician an expert in it. *Specialists* are recognized in all departments of science, and to them exclusively belongs the right of testifying as experts in their own field. Hence, even an eminent physician may be no expert in some branches of surgery, nor in the chemistry of poisons, or the arts, or in psychology; and this without detriment to his general professional standing. And upon these reasons rests the necessity of grouping the subjects with which medical jurisprudence concerns itself into such classes as may render them distinct specialties before courts, with special witnesses to illuminate the topics mooted in issue.

Personal Identity.—This is the birthright mark affixed by nature to all human beings. It is an individual prerogative which can neither be lost nor effaced. Being indelible, it is ineradicable. The philosophy of every age has recognized this as a primordial fact. Horace tells us that we may expel Nature with a pitchfork, and yet she will return; and Lord Bacon asserts that "Nature is often hidden, sometimes overcome, seldom extinguished." The necessity at law of proving personal identity is of such a variable character as to render it impossible to enumerate in advance all the circumstances under which it may become indispensable to establish it. In homicide, burglary, arson, bigamy—in fact, in every variety of crime—the identity both of the perpetrator and the victim must be proved. In heirship, in payments of checks, and in scores of similar civil transactions, the same necessity often arises. The sources whence proofs of personal identity are obtained are such as belong partly to our physical and partly to our mental constitution. They consist of all those physical features, whether congenital or acquired, which can distinguish one body from another; such as *sex, stature, gait, complexion, age, demeanor, voice, mental traits and culture, habits, scars, and deformities.* Identification of the *dead* as well as the living is often necessary. This is of course more difficult in proportion to the length of time the person has been dead. But even skeletons can be and have been identified when a sufficient amount of bones can be found to reconstruct by anatomical theory the missing parts. Great skill is of course required for such an investigation, and in cases of homicide the proof of the *corpus delicti* should rest upon something more than conjecture. Unless an expert can prove the identity of the remains against all objections made thereto, his testimony should not be received as conclusive, since it cannot amount to certainty.

Abortion.—The only significance which abortion has at law is derived from its *intent.* There are occasions when it is lawful to commit it as a medical necessity, to save the mother's life in preference to that of the fœtus. Of this necessity physicians are the only proper judges, and in order to purge the act from all suspicion it should be performed as the result of consultation with and concurrent opinion of others. But whenever it is done without any pre-existing medical necessity, and solely with the intent of destroying the child, it is a crime in the eye of the law. In some States no indictment for abortion will lie previous to quickening, but a better knowledge of the physiology of utero-gestation is undermining these dogmas of the canon law by showing that a child is just as much a living being *before* as *after* quickening; and if the common law regards an infant *in utero* as capable of inheriting an estate, it cannot in consistency refuse to regard its slaughter as the killing of a human being. Not only is abortion when criminally accomplished a crime, but even the administration of drugs to pregnant women with intent to produce it, although unsuccessful, is a high misdemeanor.

Infanticide.—The killing of a new-born child is at law a crime, subject to the same rules of responsibility as belong to any other form of homicide. There are some peculiar difficulties in the way of obtaining precise evidence of live birth as a *sine quâ non* to the fact in issue. But when this is once established, and it is proven that the child had an independent existence of its own, then the crime can be subjected to the rules of ordinary evidence. Infanticide may be of two kinds—viz. either by *omission* to take necessary precautions to protect the child against exposure, hunger, and accidents, or by *commission*, meaning thereby the direct application of means feloniously employed for the purpose of destroying its life. In the former case the mother may herself and singly accomplish it; in the latter, she may similarly act alone or with or through an accomplice. It has also been held that if a child upon whom an act of abortion is commenced dies subsequently to birth from injuries received while in the womb, the act becomes a homicide. Live birth may exist at law without the child having breathed or the umbilical cord being severed, provided only it be completely delivered from the mother's body and have an independent circulation of its own.

Rape.—This crime consists in the carnal knowledge of a female forcibly and without her consent. In law, certain persons have no legal capacity to assent to such an act, and when done to them it is always unlawful in the perpetrator. Thus, children under ten years, idiots, and the insane can have no assenting minds, and assent is never presumed, not even in the unchaste. By carnal knowledge is meant sexual bodily connection. Force may be either *express* or *implied*, the former implying any direct threats or personal violence; the latter, duress, either by moral fear, fraudulent imposition of person, deceitful representation of the nature of the act, magnetic sleep, anæsthesia, or narcotics. Impotence of copula is a good plea in defence, but even a eunuch may commit this crime. So a husband may be an accessary to a rape committed upon his wife, and a man may be indicted for rape upon his own concubine, since at any time she may withhold her assent. But whether it is rape to have carnal intercourse with a demented woman at her own solicitation has been doubted. What constitutes want of will has been variously interpreted. It is agreed by all authorities that the resistance of any woman should be, so far as her condition will allow, sincere and continuous throughout the act.

Impotence and Legitimacy.—Marriage is at law a consensual contract entered into by two competent parties for the purpose of procreating children. The natural basis of this contract is purely physical. Aside, therefore, from statutory regulations relating to evidence of such a contract having been entered into, each party is presumed to guaranty his own physical competency to the other, and the absence of this, if shown to have existed at the time of the marriage, and to have been unknown to the other, constitutes *fraud* to that extent. As fraud vitiates every contract into which it enters, it follows that the marriage of an impotent person is voidable, provided no laches be shown in the party wronged. But inasmuch as impotence is a matter of *experience*, and not necessarily one of inference, the law requires the *triennalis cohabitatio* before it will entertain any suit for a nullity founded upon this fact alone. If one knowingly marries an unfruitful person, he can claim no remedy at law, nor can a party plead his own impotence as a ground for a sentence of nullity. The incurability of the impotence must also be determined before any suit for nullity will lie. And if the impotent party

refuses surgical treatment, the act will be taken as *pro confesso* to the prayer of the petitioner.

It follows from the necessary consequences of marriage that children born in wedlock have a presumed character of *legitimacy* which distinguishes them from bastards, who are in the eye of the law the children of no one, and have no inheritable blood. And so far is this doctrine pushed at common law that every child born in wedlock, no matter how soon after the marriage of its parents, is legitimate. But this presumption may be rebutted by showing either the impotence of the husband or his continuous absence from the country, with the simultaneous *crim. con.* of the wife. A mere probability of non-access by the husband is not sufficient to repel the presumption of legitimacy, nor is his advanced age. It is not necessary for the party objecting to the legitimacy to prove that *access* was impossible, for if the evidence places it beyond all reasonable doubt, it will be sufficient to repel the presumption. Whether, therefore, a child was begotten *in* or *out* of wedlock where the marriage precedes the birth, the presumption of paternity will be the same, and the like evidence is required to bastardize the issue. That evidence is proof of *non-access* by the husband. Parents may testify to children being born out of wedlock, but a wife is not a competent witness to prove non-access of her husband and to bastardize the issue, even after such husband's death.

Wounds.—The only legal aspect under which wounds can be considered is that which connects them with assaults terminating in maiming or homicide. Under the English statutes against *wounding* some very nice distinctions have been made touching the constituents of the offence, but these have not generally been adopted in this country, our courts giving a wider interpretation to the meaning of the term, and treating the subject only in connection with such assaults as are or have been fatal to life. The questions therefore considered by them have been such as tended to show the probable criminal connection of certain wounds with death. To state them briefly, they are these: Did death immediately follow the wound? Was the wound in itself mortal? Was it the probable cause of death? What was the interval of time between the two? Did any disease of a mortal character meanwhile intervene and destroy the life of the patient? and if so, was it induced by the wound? Did the patient refuse medical treatment? or was the medical treatment unscientific? and did it cause death? What was the condition of the patient previous to the wound? All the authorities agree that the party inflicting the wound is responsible for its immediate consequences; and even though a mortal disease was present, and the wound only accelerated the death, the act is still homicidal.

Poisons.—Poisons, in legal significance, are substances which act not *quantitatively*, but *qualitatively*, to the destruction of health or life, by reason of their inherent deleterious properties. They are naturally noxious, and may be classified either chemically into mineral, vegetable, or animal, or physiologically, and according to their effects, into irritant, narcotic, or acrid-narcotic. Restricting ourselves only to their legal aspects, the questions to which they give rise before courts are, like wounds, such as tend to show their criminal connection with a person's death. The evidence in such cases is largely medical, although extraneous circumstances may throw much light upon the problem of the alleged perpetrator; and such moral evidence is allowed, accordingly, its due weight. To constitute the offence of administering poison some portion of it must be taken by, or applied to, the person of the one receiving it, but it need not be swallowed. So if poison intended for one person be accidentally taken by another, it is still murder in the giver, for the *intent* of homicide inheres. Hence, whether the substance be poisonous or not, provided it be given with the *intent* to take life, the act is felonious. And where death ensues from alleged poisoning, it is not necessary to prove the particular substance used, nor the quantity required to destroy life; nor is it necessary to prove that such a quantity was found in the body after death. It is sufficient if the jury are satisfied from all the circumstances, and beyond a reasonable doubt, that death was caused by poison administered by the prisoner.

Malpractice.—It is a time-honored principle of law that every professional man in offering his services as such to the public impliedly covenants to bring to their discharge the ordinary skill of his vocation. The public having no means of ascertaining this in advance of experiment, they may be said to confide in him of necessity, and any want of due qualification on his part is, to that extent, a fraud upon his employers. The errors committed by professional men, whether due to *want of skill* or *negligence*, are termed *malpractice*, and for such they are amenable in damages to any person who has been injured thereby. From the difficulties inherent to the treatment of disease, mere errors of judgment are not considered malpractice in themselves wherever the party has not otherwise offended by either negligence or rash experiments. There may be, thus, malpractice by *omission* as well as *commission*, but both must be proved, for they cannot be inferred from acts turning alone upon diversities of medical practice. The law knows no difference between systems of medicine. All it requires in any practitioner is ordinary skill and a faithful discharge of the duties of such a person when employed to *relieve* the sick, for it does not consider his contract in general as one to cure, but simply to do all that his professional skill can accomplish towards promoting that result.

Medical Evidence or Experts.—In law there are two classes of witnesses—viz. *ordinary* and *skilled*. The former testify to what they know; the latter give opinions upon facts in issue. To these witnesses the term *expert* is applied. An expert being, legally, one instructed by experience, it follows that any person may be admitted to testify as such upon matters belonging to his profession. The range of scientific investigation being so vast in medicine, there has in consequence arisen a necessity for differentiating experts, and limiting the term alone, in any given case, to those who have had special experience in the department of practice under review. Hence, there are *chemical* experts, *surgical* experts, and *specialists* in medical practice, who are better informed and better qualified to testify as such than general practitioners of medicine; and to them courts will give preference as experts. It is of course at times extremely difficult to draw the line of distinction, but wherever it can be it should be; for where men are equally proficient there will be less opportunity for differences of opinion, and positive contradictions of each other will form the *exception* rather than the rule, as they so often do now. Experts may give opinions either upon *direct* or *hypothetical* facts, but not upon conclusions of law. They may refresh their minds from memoranda, but cannot use them as substitutes for memory, nor quote from professional books, nor give opinions upon the merits of any case.

Life Insurance.—The only aspect under which medical jurisprudence considers life insurance is that which springs out of the *suicide* of the party insured. The question there being whether the party intended to take his life in fraud of his contract with the insurers, and was a legally responsible being at the time, the whole problem turns upon the fact of his mental condition. If sane, then the act was felonious and the policy should be avoided; but if insane, then the act was not *his* in legal contemplation, but that of a being under the coercion of disease. All authorities agree that suicide of itself does not prove insanity in the perpetrator. Consequently, we must look outside of the act and to the whole history of its victim to determine the probabilities of his mental state. Decisions have been very conflicting in the conclusions of law to which they have arrived, some permitting the moral responsibility of the suicide to weigh in the balance of justice, and some, again, excluding it. On the whole, however, the current of decisions, both in this country and in England, has been steadily turning towards the exclusion of the element of moral responsibility, and narrowing it down to the simple questions of whether the party knew what he was doing, intended to do it, and was not impelled thereto by disease —meaning insanity.

Survivorship.—Where two persons perish in a common calamity, it is often important to be able to determine which died first, with reference to the rights of succession to an estate. In order to solve such a problem, many circumstances of a purely physical character must be taken into account, relating to sex, age, strength, disease, season, and temperature, not omitting the peculiar form of death to which they were subjected. Many times it is impossible to arrive at any satisfactory conclusion, and courts are driven to the necessity of advising a compromise between the parties, as in the celebrated case of Gen. Stanwix, where Lord Mansfield said that he knew of no principle of the common law by which the issue could be settled. The English law has no provisions upon this subject, and borrows all its light from the civil law. The Code Napoleon has devoted three sections to it, and given us all the modern statutory law which is possessed by any of the continental nations. A very few cases only have been adjudged by our courts as yet, the subject being of infrequent mention even in textbooks. The most extensive comments upon it are to be found in the fourth volume of Mr. Burge's *Colonial and Foreign Law*, and to it we accordingly refer those who desire more information. The following are the two divisions into which all questions of survivorship may be included: viz. 1st, as to the survivorship of mother and child where both die during delivery; 2d, as to the survivorship of persons of different ages and sexes perishing by a common accident.

Insanity.—This topic, under all its various legal aspects, will be found treated in its appropriate alphabetical place.

There are other topics belonging to the domain of medical jurisprudence, like *viability, feigned diseases, the Cæsarian section, hermaphrodism, deaths by heat, sunstroke, lightning, starvation,* and *cold,* and *spontaneous combustion,* which have few if any special legal aspects, and we leave them accordingly to be discussed under their more appropriate physical complexion. The topics we have reviewed in a brief and comprehensive way are those upon which courts are most often called to adjudicate, and whose literature is adorned by authoritative decisions defining the responsibilities of parties raising issues under them. These decisions we have not cited, because out of place in a popular encyclopædia. They may easily be found by referring to digests and works on medical jurisprudence.

JOHN ORDRONAUX.

Ju'ry, Trial by. Jury trial in its modern form is certainly a product of English social and political forces. Although the new codes of several continental states of Europe have professed to borrow it, they have materially modified its form, have confined its use to certain classes of cases, and it is at best an unnatural and sickly excrescence upon their national systems of jurisprudence. In England and the U. S. alone does the jury flourish as an essential part of the social organization—as an institution around which all other means and modes of administration are grouped. The object of this article is briefly to describe the origin of the jury trial, to state the most important steps in its course of development, and to give a general summary of the rules which regulate its use.

The jury trial in its present matured form involves two very different elements, each equally important, but having no historical or theoretical connection. They are (1) the decision of the facts in a judicial trial by a number of individuals distinct and separate from the official judge or magistrate; and (2) the free choice of these individuals from among the mass of ordinary citizens. The Romans possessed the first of these features in their administration of justice; the origin of the second is to be found in the tribal customs of the German peoples who overran the provinces of the Western empire, including the Angles and Saxons who settled in Britain. In the "ordinary" jurisdiction of the Roman magistrates an action was brought before the prætor, the pleadings or allegations of fact were put in according to prescribed forms, the issue was joined, and the rule of law applicable to the case as thus presented was announced by him. With this proceeding the function of the court or magistrate ended. The cause was at that stage referred to another person—sometimes called the *judex* and sometimes the *arbiter*—who heard the evidence, passed upon the issues of fact, and rendered a decision in conformity with the rule of law announced by the prætor. He was not an official magistrate. A limited number of citizens seems to have been annually chosen in some manner to perform this duty, and from the class thus constituted one was selected for each trial. In certain specified actions several triers of the facts were employed instead of the single judex, who were termed *recuperatores,* but in what respect their functions differed from those of the judex is not known with any accuracy and certainty. The analogy between the entire course of proceeding in the "ordinary" actions of the Roman law and the English common-law forms of action and jury trial was very striking; there was the same separation of the questions of fact from those of law, and the decision of the one by an official magistrate, and of the other by a lay tribunal having no official forensic status, but appointed for the very controversy submitted to it. This system of administering justice continued in existence for several centuries, but the "ordinary" jurisdiction of the magistrate gradually gave place to the "extraordinary," in which, like the English chancellor, he decided all the issues of fact and of law in a single decree, without the intervention of any other assistant. Finally, by a constitution of the emperor Diocletian, the "ordinary" jurisdiction was abolished, and the trial of all causes was conducted in every stage thereof before the prætor or other judicial officer constituting the court.

It is evident, therefore, that this important element of the jury trial—the separation of the law from the facts, and the dual tribunal for their decision—was not borrowed from the Saxon ancestors of the English nation. On the contrary, the German tribes which overran the Western empire and settled down in the conquered provinces, had not attained to the conception of any such refinement in the administration of justice. It was the very central principle of their primitive civil polity that the decision of all private controversies, as well as the ordering of everything which pertained to the public welfare, was committed to the collective freemen gathered together in their local assemblies. This system of self-government was carried to an advanced degree of development by the Saxons in England. The folk-courts or *gemotes* of the "shires" were composed of the assembled freemen, presided over by the *ealdorman* or by his deputy, the *gerefa*. Here they determined, according to their rude customs which had the force of law, the disputes between man and man concerning property and other private rights, and also the accusations which at the present day would be regarded as criminal and punishable by the state. The courts of the "hundreds" were gatherings from the smaller districts into which the shire was divided, but with a similar organization and the same functions. In this institution of the early Saxons the modern method of selecting the triers from among the great body of citizens at large had its certain origin. Although the whole course of progress from these rude folk-courts to the completed jury cannot be traced with absolute precision, yet the principal steps of the onward movement, the most important transitions which marked the passage from one epoch to another may be described.

The first of these progressive steps was the employment of *compurgators* or *conjurators,* who by their oaths established the existence or not of the fact in dispute, and thus guided the folk-court to its decision. A judicial trial of that primitive age had no element in common with a trial of the present day. There were no written allegations of the facts; no evidence was offered; no witnesses deposed as to their knowledge of the transaction. A charge was orally made and orally denied. In the place of a trial and of witnesses, each party was accompanied by a number of relatives, friends, or neighbors, who, in the presence of the assembled freemen, joined with him in making oath that his statement—the charge or the denial—was true. These were his *compurgators;* and the early codes of the Germanic nations contain numerous provisions prescribing the number of them requisite to establish or to repel any particular accusation or demand, such number varying according to the rank of the party and the gravity of the offence or the value of the property in controversy. These compurgators were in no sense witnesses, for they might be wholly ignorant of the real facts in dispute; nor were they a jury, for no evidence was submitted to their consideration. They were merely friends of the party who summoned them; they knew his character, and by their united oaths they at once attested that character and their confidence in his truthfulness and in the justice of his cause.

The next step in the progress was a movement far in advance of the rude contrivance last described. Compurgators were no longer used; even the primitive folk-court had become obsolete. The function of deciding a particular case was entrusted to a limited number of freemen taken from the district, which number consisted of twelve or some multiple thereof. This delegated body, unlike the compurgators, acted upon a knowledge of the facts involved in the controversy, but such knowledge was not acquired by means of any evidence laid before them. They were carefully chosen from among the persons familiar with all the circumstances of the case, with the parties, and with the property. To this end they were invariably selected from the inhabitants of the "vicinage"—that is, the district of territory immediately surrounding the lands in question or the residence of the litigants. On being appointed they examined no witnesses, but rendered their verdict, *vere dictum,* on oath based upon their personal knowledge previously obtained either from a sight of the occurrence or from the tradition of the vicinage. These *recognitors,* as they are called, were the undeveloped jury—a jury, as it were, of witnesses. The unwieldy and turbulent assembly of freemen is replaced by a small and compact tribunal; a decision upon knowledge has been substituted for the mere numerical preponderance of oaths. All the subsequent modifications consisted of measures contrived to aid this body of men taken from the vicinage by the testimony of other persons. In the reign of Henry III. the practice was introduced of joining with these recognitors others who were actual witnesses of the transaction, but still all united in rendering the verdict. During the reign of Edward III. a still more important and radical change was effected. Witnesses were added to or connected with the recognitors, who communicated to the latter their knowledge of the facts, but took no part in the decision. In this stage of the progress we find for the first time the feature of testimony communicated to the triers by parties who do not join in rendering the verdict. The innovation once made, the progress was rapid of aiding the recognitors by the testimony of outside parties; but as yet great irregularity prevailed in all parts of the proceeding. There were no rules of evidence; the witnesses instructed the jurors without any oversight by the court; there was in fact no orderly, *public* forensic contest. These defects were remedied in the reign of Henry IV. The trial was from that time conducted entirely in public and in the presence of a presiding judge; all the witnesses were sworn, examined,

and testified under his direction, and pursuant to the requirements of established rules. Thus was finally developed, as the result of a long and continuous progress, the jury trial substantially as it exists at the present day. The ancient requirement, however, still remained operative, that the jury should be summoned from the immediate vicinage. As the original reason for this rule had been abandoned, the rule itself became an anomaly, and a hindrance to a fair and impartial trial. As soon as the sole reliance came to be placed upon the testimony of witnesses, the prior knowledge of the triers themselves was an obstacle rather than a help to an orderly and legal investigation of the facts. It was not, however, until the reigns of Anne and of George II. that Parliament interposed, abolished the old rule as to the vicinage, and provided that jurors should be selected from the body of the county. By a decision of the court of king's bench, made a short time subsequent to these last-named statutes, it was held that if a jury rendered a verdict upon their own private knowledge, it was error—that they ought to have informed the court, so that they might be sworn as witnesses. We have thus traced the jury through all its phases and modifications, and we find that since its introduction it has undergone a complete change from the primitive notion both in form and in principle. The triers were once carefully selected from among those most familiar with the parties and the facts, and they decided the controversy upon that prior personal knowledge. Equal care is now taken to choose only those persons who are absolutely ignorant of the parties and of the facts, and who come to the hearing with their minds a complete blank in respect to the matters in dispute which are to be settled by their verdict.

The jury trial is even more completely wrought into the political organization of the U. S. than into that of Great Britain. It is expressly protected by every constitution, state and national. The most common forms of the constitutional provision are, "In all criminal prosecutions the accused has a right to have a speedy public trial by an impartial jury," and "The right of trial by jury shall remain inviolate." The other forms of the guaranty, which may be more minute and detailed than these, do not differ from them in any substantial manner. The judicial interpretation put upon these clauses in all the States may be summed up and expressed in one comprehensive and fundamental principle—namely, the provisions in question do not create, nor enlarge, nor restrict the right of trial by jury, but retain it and preserve it inviolate in all those classes of cases, civil and criminal, in which it existed by the common law or by any prior legislation of the State itself. In no more emphatic manner could the people have shown their attachment to an institution which secures and maintains all their other civil and political liberties and rights. The jury trial, thus guarantied to the people of the U. S. until they voluntarily discard it, is therefore the common-law trial by jury. All the features and elements of the institution itself which had become settled as a part of the common law, and all the fundamental rules by which its constitution was preserved and its use was controlled, are also incorporated into the organic law of the States and placed beyond the reach of modifying legislation. These essential and unchangeable elements of the common-law jury trial are the following: (1) The jury itself must invariably consist of twelve men. It is useless to ask a reason for this requirement. The old Germanic codes constantly show the number 12 or its multiples or fractions; the recognitors were originally 12 or some multiple; and this number has been handed down to our day. (2) The jury must be drawn from the body of the county in which the trial is had—that is, from among the resident freeholders and taxpayers of the county. The historical and statutory origin of this requirement has been already stated. (3) The verdict must be unanimous. The historical origin of this rule must be found in the early custom of compurgators in a prescribed number agreeing in their oaths, and of recognitors to the number of twelve agreeing in their decision. (4) The jury must be impartial. This most important requisite involves the selection of each jury in some manner by lot from the freeholders of the county. While the principle of a chance selection is undoubtedly preserved inviolate by the constitutions, the particular mode in which that principle shall be made operative, may be regulated by statute according to the discretion of the legislature. There is, in fact, a great diversity in the modes of drawing and summoning the juries among the several States, and the common-law methods have been quite generally departed from. A list of freeholders and taxpayers is prepared at stated intervals and preserved in the clerk's office of each county. From this list certain designated officials choose by lot the names of those who are to serve at each court; the persons thus selected are summoned and must attend unless excused, forming what is termed the "panel;" finally, from this panel the clerk draws by lot the requisite twelve "good men and true" for each case as it is brought on for trial. The impartiality of the jury is also secured by the right of challenge given to the litigant parties. The various classes of challenge are as follows: (1) "*To the array*," by which the party objects to the entire panel for some error of the officer in drawing or summoning them; (2) "*To the polls*," by which the party objects to an individual as he is drawn from the panel. The challenges of this class are of two kinds—namely, "*for principal cause*," and "*to the favor*:" "*for principal cause*" when the objection if it exists would disqualify the person as a matter of law; "*to the favor*" when the objection would simply be a sufficient ground to reject the juror as a matter of fact. The object of these challenges is to secure persons as jurors who possess the legal qualifications, who are not in any degree related to the parties, and who have not formed or expressed an opinion upon the matters at issue. In addition to these challenges, in which reasons therefor must be assigned, there is in criminal trials another species termed "peremptory," by which a juror may be objected to and excluded without the assignment of any cause or ground for the objection. The number of such challenges permitted in each trial varies with the grade of the offence, and differs in the several States. These peremptory challenges are in some instances allowed in civil cases by statute. Trial by jury, as above described, is preserved by the constitutional provisions already referred to in all criminal prosecutions which are cognizable by courts of general sessions and of oyer and terminer, or by courts of whatever name corresponding to these tribunals. The only offences that can be punished without the intervention of the common-law jury are those minor offences that are cognizable by courts of special sessions and by police magistrates possessing the jurisdiction of these last-named tribunals. It is also preserved in all civil causes of a legal nature which are cognizable by common-law courts of a higher jurisdiction than that of justices of the peace. Some of the States provide a mode of waiver of jury trial in civil cases. It follows that all civil causes of an equitable nature, or which are cognizable in courts of equity or of admiralty or of probate, and all causes of a legal nature which require an accounting for their decision or which may be brought before a justice of the peace, may be tried without a jury. (See GRAND JURY.) JOHN NORTON POMEROY.

Jus gen'tium. This is not to be confounded with the more modern phrase, *jus inter gentes*, or "the law of nations," "international law." By the first phrase Gaius understood those rules and usages of justice which all nations use alike, as opposed to *jus civile*, the law of Rome itself, so far as it was peculiar. The *jus gentium* contained many rules of an international code, such as the sanctity of ambassadors, but covered quite a different ground from that of the international science. T. D. WOOLSEY.

Jussieu', de, the name of a celebrated family of French botanists and physicians, the most noteworthy of whom were the following: (1) ANTOINE DE JUSSIEU, M. D., b. at Lyons July 8, 1686, d. in Paris Apr. 22, 1758.—(2) BERNARD, b. Aug. 17, 1699, d. Nov. 6, 1777.—(3) JOSEPH, b. 1704, d. Apr. 11, 1779.—(4) ANTOINE LAURENT, one of the fathers of botanical science, b. at Lyons Apr. 12, 1748; studied medicine in Paris, where he was an academician and botanical professor. Following his uncle Bernard, who had made the sketch, he was the first to introduce the natural system into botany, disposing all known genera in defined natural orders. His *magnum opus* is the *Genera Plantarum* (1789), and he was the author of many botanical papers of great value. D. Sept. 17, 1836.—(5) His son ADRIEN, b. Dec. 23, 1797, succeeded his father in 1826 as professor at the museum; became professor of organography in 1845, and was for many years a brilliant lecturer, an able scientific writer, and one of the first botanists of his time. D. June 29, 1853.

Jussieu (LAURENT PIERRE), nephew of Antoine Laurent, b. in the department of Isère Feb. 7, 1792; was a member of the Chamber of Deputies 1839–42, and wrote many educational and popular works designed for the diffusion of useful knowledge among the masses. One of these, *Simon de Nantua, ou le marchand forain* (1818), passed through more than thirty editions and was translated into eight or ten languages. He received the Montyon prize for the similar work, *Œuvres postumes de Simon de Nantua* (1829), and for many years edited educational journals.

Juste (THÉODORE), b. at Brussels, Belgium, in 1818; is secretary of the Belgian board of education, and a very prolific writer on Belgian and French history. The most prominent of his works are—*Histoire élémentaire de la Belgique* (1838), *Histoire de la revolution Belge de 1790* (1846), *Le soulèvement de la Hollande en 1813, et la fondation du royaume des Pays-Bas* (1871).

Jus'tice. Justice is an attribute of a man in his intercourse with his fellow-men, of the law in relation to those who are under it, of the state toward its subjects or citizens as far as their political position and rights are concerned, and of the judge in his office of deciding between the claims of two private parties or of a person and the state. We also speak of primitive justice, and of just and unjust punishment, in which case the state may be just or unjust in its penal laws, and the judge, in the application of law or evidence which he makes to a particular case. Justice also, as a moral quality, denotes a certain fairness of mind in estimating truth or in weighing the claims of persons to a certain sort of treatment in social intercourse. Finally, God is conceived of, and is represented in the Scriptures, as being just, as when he is said to have no respect to persons, to have a day of righteous justice in which he will render to every man according to his deeds, and as being faithful and just to forgive sins, because he has conferred a right to forgiveness by a solemn promise.

Justice (*justitia* in Latin) comes from *justus*, "just," which is connected with the very important words *jubeo*, "bid," "order," "ordain;" *jus*, "right," "the system of right or law;" and *judex*—*i. e. juridex*, "judge;" and also with *juro*, "swear;" *jusjurandum*, "oath;" and *jurgo* (*jure ago*), "altercate," "quarrel," "scold." Perhaps the original sense of *jus* is "law," that which the community has ordered, but the Romans early introduced a moral element into the word. There was justice according to law, and natural justice. Thus, the Roman lawyers speak of slavery as being contrary to *jus naturale*, although allowed by *jus civile*. The words *just* and *righteous* coincide in part, but *righteousness* has the general moral sense of conformity to the law of right in the moral dispositions of the soul, as well as in outward actions. Justice inclines more towards legality, and towards that which is external.

Greek philosophy, after Socrates began to teach, occupied itself much with discussions touching justice. One of Plato's leading definitions of it is that a person should "do his own things"—*i. e.* mind his own business, keep within his own sphere of action, and not invade the sphere of another. In this definition the question what a man's "own things" are—an expression nearly identical with the apostle Paul's "do his own business" (1 Thess. iv. 11)—must be determined by an enlightened conscience or by an outward rule; and Plato would determine each man's sphere by state authority. Aristotle makes a distinction between political and natural justice. The Stoics carried out the thoughts on ethics of the older philosophers in one direction beyond their predecessors; in their hands the ethical system of classical antiquity bore its best fruits, and their thinking has affected the forms of thought or morals ever since. They conceived of virtue as consisting in a life according to nature—meaning by nature both the law of general or divine and of human nature; and of justice, after a definition of the Platonic school, as that which assigns to each his due or worth. Cicero follows them in calling justice an affection of mind, *suum cuique tribuens* (*De Fin.*, v. § 23, 65); *i. e.* which assigns to each person his own. The doctrine of a law of nature, or a *jus naturale*, having principles which may oppose the laws of the state, was borrowed by the Roman lawyers from the Stoics, and produced in their hands important results: in theory, for instance, as we have already said, slavery became contrary to natural right, although the institution in the empire could not be shaken.

The modern doctrine of personal or subjective rights (for which see the article RIGHT and RIGHTS) helps us to a clearer notion of what justice is. If each person is a centre of power according to natural law and the divine will, for the purpose of developing his manhood, he and his acts impose on others the obligations not to interfere with these powers; and it is one of the offices of the state to decide what these powers or rights are. A just man is one who fully respects the rights of others or fulfils his obligations towards them; a just state, just law, and judges are such because they render to each one his rights; and in the case of the judge not only the rendering to each one of his rights, but such a state of mind as involves conformity to the truth of law and of evidence enters into the quality of justice.

As laws are expressed in general terms, it may be that the "letter killeth" in a particular case. Here, according to the rule, *summum jus est summa injuria*, equity modifies the decision of the judge in accordance with the circumstances. This is really a justice which law in its abstract form cannot reach. Equity is equality, and deciding different cases by the same rule would be inequality, which is injustice.

A word is needed in relation to penal justice or punishment. This consists, and can consist, only in taking away from a man one or more of his personal rights, as life, freedom of motion, property, personal honor, or of his rights granted to him by the political constitution. Is it not strange that whereas justice has been found to be the apportionment to each one of his rights, *here* justice is made to consist in taking away from a person his life or some other right? Yet there is a reason why the two forms of justice, although thus differing, should be called by the same name. Penal justice is such not only because it is according to law, but also because it gives to the transgressor his due according to the law of righteousness. Law would be unequal if it did not recognize the radical difference between the just man and the unjust. It expresses the feeling inherent in the human soul that the wrongdoer ought to suffer, and punishes him in the only way open to the law—that is, by depriving him of his prior rights or place in the state. T. D. WOOLSEY.

Justice of the Peace, a subordinate magistrate appointed or chosen to exercise certain judicial and administrative functions of a subordinate character within the limits of a county, borough, or town. The office of justice of the peace was established at a very early period in the history of the English law. The public officials, however, who anciently possessed similar powers were not designated by this particular title, but were styled *conservatores pacis* ("conservators or preservers of the peace"). The mode in which they derived their authority was also different from that established in later times. Some claimed their power by prescription; some were bound to exercise it by reason of the tenure of their lands; while the larger number were elected by the freeholders of the county. But at the commencement of the reign of Edward III. (1327) the system of election was discontinued, and it was ordained by Parliament that such magistrates should be appointed by the king or under the king's commission. But still they were called conservators, wardens, or keepers of the peace until 1361, when, by statute, as Blackstone states, "they acquired the more honorable appellation of justices." They are now appointed by the lord chancellor by virtue of the king's special commission under the great seal. The form of the commission addressed to the justices was determined in 1590. This is in the name of the king, and directs the person therein appointed to "keep our peace in our county of ——, and to keep all ordinances and statutes for the good of the peace, and for the good rule and government of the people, and to chastise and punish all persons that offend against the said ordinances." It also requires them to inquire of and determine felonies and other misdemeanors. It was the former practice to specify in the commission the names of a few justices who were men of greater competency or distinction than their associates, and to declare that without the presence of at least one of these no judicial business should be transacted. These were said to be of the *quorum*, a term derived from the first word of the clause by which this special privilege was conferred. A Latin term was adopted because legal documents were then expressed in that language. But now all or nearly all of the justices are included in the *quorum* clause, and it is no longer necessary, as it was formerly, to specify in a warrant that the justice who issued it is of the quorum. There are certain property qualifications required at the present day in order that a person may be appointed a justice. Thus, he must have in possession, for his own use and benefit, an estate in lands of the clear yearly value of £100 above all incumbrances, or he must be entitled to the reversion or remainder of an estate of the yearly rental value of £300. The person appointed is obliged to take an oath that he is properly qualified by an ownership of the requisite estate, and if he is not so qualified he forfeits £100 by acting as a justice. As a general rule, the justices serve gratuitously, but in the cities and larger towns there are certain justices appointed, called stipendiary magistrates, who receive a fixed salary.

In the U. S. the institution of justices of the peace has been adopted from England. They are county or town officers, and are in some States elected by the people, in others appointed by the executive. Their terms of office are usually of short duration, rarely continuing longer than three or four years, and as a rule their mode of compensation is defined by law. The rules of law governing their appointment, tenure of office, powers, and responsibilities are generally defined by statute with great fulness, and the extent of their authority made to depend entirely upon statutory provisions. The functions of justices of the peace are very multifarious, and in minor details differ considerably in different States. It will therefore only be practicable to state the general powers which they possess both in England and in this country, so far as these are substantially similar. These powers are either administrative or judicial. Important administrative functions are those which justices exercise as keepers of the peace. Thus, they may arrest without a warrant any person committing a felony or a breach of the peace in their presence, and

commit him to prison. They may issue warrants for the arrest of alleged criminal offenders against whom a charge has been made supported by an affidavit, or search-warrants authorizing a search to be made upon a person's premises for goods which he is accused by complaint under oath of having stolen or embezzled, when there appears reasonable ground for suspicion that they are there concealed. A justice may also bind over to keep the peace any person who engages in an affray in his presence or makes threatening demonstrations of violence against others, or who is brought before him by any other peace-officer, as a constable or a sheriff, after being arrested for a breach of the peace, or who is charged with having threatened to commit a criminal offence against the person or property of another by a complainant who maintains his charge by a sworn affidavit, and who upon examination under oath satisfies the justice that there is reasonable ground to apprehend the commission of the offence by the person complained of. In determining whether such reasonable ground exists, the justice acts judicially, and in like manner many of his administrative functions are incidental to the exercise of judicial prerogatives; as, for example, the issuing of subpœnas for witnesses, binding over witnesses to testify, examining persons accused of crime and committing or discharging them, taking recognizances, committing persons for contempt of court, admitting to bail, etc. As a general rule, also, justices have power to take affidavits and acknowledgments of deeds. In some States they have, besides, a right to celebrate marriages. In the exercise of judicial functions justices of the peace have either a civil or a criminal jurisdiction. In criminal cases they have power to try offenders charged with offences of a minor grade, without the aid of a jury, by what is known as a summary proceeding. Such offences are drunkenness, idleness, vagrancy, profane swearing, mendicancy, keeping disorderly houses, gaming, and other similar practices. Such proceedings must, however, be conducted according to the course of the common law in trials by jury. The defendant must be duly summoned, and must have an opportunity to make his defence. This form of proceeding was introduced into the English law by various acts of Parliament, and was generally adopted in this country as a part of the common law. At the present day, however, the nature and extent of the power to try and convict by summary process are usually defined by statute. It has been decided that such legislation is not in contravention of the common provision in State constitutions that no person shall be deprived of life, liberty, or property except by the judgment of his peers or of the law of the land, although this is interpreted as requiring trial by jury in most cases of criminal prosecution. The power of summary conviction existed previously to the adoption of such constitutions, which must be construed with reference to the previous state of the law. No legislation can, however, be adopted providing for trial without a jury except in regard to offences of the same grade or class as those to which this mode of proceeding was formerly applicable. Justices also have power to make a preliminary examination of all persons arrested upon a criminal charge, and if there is reasonable ground to believe that the offence alleged has been perpetrated, and that the person accused is guilty, he may be committed to prison, or, in a proper case, admitted to bail. If the offence charged be of a minor grade, it may also be tried before justices in a special criminal court with a jury, but if it be a grave and serious crime, the prisoner will be committed for trial before a higher court. All States do not agree in their legislation as to the various offences which may be tried before justices, it being provided in some that all misdemeanors may be thus tried, while in others this is only true of specified classes of misdemeanors. The trial of felonies is almost invariably vested in the higher criminal courts, as, *e. g.*, courts of oyer and terminer where such tribunals exist. (See CRIME.) In England there are four courts composed of justices of the peace—the petty, special, quarter, and general sessions. The general sessions is a court of record, and may be divided into two branches for the despatch of business. By statute it must be held four times a year if occasion shall require. When held at the regular period, it is called the quarter sessions; otherwise, the general sessions. The petty sessions and special sessions are courts of inferior importance. In this country similar tribunals sometimes receive corresponding names, as the courts of special sessions in New York State. In some States, however, they are termed simply justices' courts.

In many of the States of this country justices' courts have received by special legislation jurisdiction in civil cases. The causes declared cognizable in such courts are those which involve claims to property of but little value or demands for small amounts of damages. Thus, in New York the larger number of cases which are declared triable in justices' courts are those in which the sum claimed does not exceed $200. Such courts generally have no power to try causes involving the title to land. The extent of their jurisdiction must be ascertained by special reference to statutes.

A justice of the peace is not liable to a civil action for any injury to another committed in the exercise of his judicial functions if he had jurisdiction of the proceeding or cause of action in connection with which the injury occurs, and acted honestly and in good faith. As he, however, is a magistrate of special jurisdiction, his privilege in this respect is not so extensive as that of judges of superior courts of record. (See JUDICIARY.) If a justice has no jurisdiction of a particular case, and has the means of ascertaining his want of jurisdiction, he will be responsible to any person who suffers damage from his unwarrantable exercise of judicial power. But where the pleadings and allegations of the parties apparently give jurisdiction, the justice will be protected in an honest and faithful exercise of the power to which he believes himself entitled, even though he be chargeable with mistake or error. But even if he has jurisdiction, he will be liable to an action if he acts maliciously, corruptly, or with wilful intent to commit wrong. In case of corruption also a justice may be subjected to a criminal prosecution, either by indictment or information. (See INDICTMENT, INFORMATION.) For any neglect of duty or malfeasance in the performance of ministerial duties he is not protected by his judicial privilege, and is liable in damages for any injury which others may sustain by reason of such neglect. In some States it is provided that justices may be removed from office in a specified manner for a violation or disregard of their official duty, on good cause shown. In New York they may be removed by the supreme court, after due notice and an opportunity of being heard, for causes to be assigned in the order of removal.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Justices, Lords. See COURTS, I. (2).

Justifiable Homicide. See HOMICIDE.

Justifica'tion. I. THE TERM *is theological*—used more prominently at the Reformation period and since. From 1530 to 1541 the Romish Church, through its leaders, was willing to admit justification to be *by Christ*, while the Reformers claimed it to be *by Christ alone*, the little word "only" becoming thus the pivot of Protestantism. Luther's well-known "Articulus stantis vel cadentis ecclesiæ"—justification *the article of a standing or a falling Church*—expresses his conviction of the great importance of the doctrine. The Westminster Assembly, in their elaborate Confessions, followed the Reformers. The more condensed statement, in the *Larger Catechism*, is as follows: "Justification is an act of God's free grace unto sinners, in which he pardoneth all their sins, accepteth and accounteth their persons righteous in his sight; not for anything wrought in them or done by them, but only for the perfect obedience and satisfaction of Christ, by God imputed to them and received by faith." (Ans. to Q. 70.)

II. THE DOCTRINE INVOLVES—1. *The fact that justification is more than pardon.* The latter is, indeed, to the former a condition *sine qua non.* But justification has special reference to the *prescriptive* part of the law, as pardon has to its penalty. It is the official announcement that the subject stands acquitted and accepted before the lawgiver or judge: its *evangelical* sense would be, *God's declaration of the sinner's right-standing in respect to law for the sake of an equivalent substitute for personal righteousness.* "Who was delivered for our offences, and raised again for our justification" (Rom. iv. 25).

2. *The Standard is God's Immutable Law, which Man cannot, but which Christ does, satisfy.*—No inherent goodness, none that human nature, weakened by sin, can present, will satisfy the law, which is not weak in respect to the sinner, although he may be in respect to it. That it remits none of its original claims the fact of a conscious condemnation bears witness. Hence, inasmuch as man's obedience is imperfect, God must either pronounce that perfect which is not, or else a righteousness which is perfect, and can be declared to be so, must be substituted for it. "There is the very same need of Christ's obeying the law in our stead in order to the reward, and of his suffering the penalty of the law in our stead; and the same reason why one should be accepted on our account as the other." (*Edwards.*)

3. *Justification is not an Infused Righteousness, nor the same as Sanctification.*—Sanctification is the development of the new life begun in regeneration, and is progressive. Being, like its germ, a transformation of character, and wrought within, it is, in this sense, infused. But justification, though indeed instantaneous—in which it is *like* regeneration, and *unlike* sanctification—in being "forensic"—*i. e. for the sinner before the law*—is unlike either, indi-

cating a *state* of privilege to which the believing sinner is brought by virtue of what Christ, by his obedience, has done for him. Theologians speak of the *imputation* of Christ's righteousness. Thus, Pres. Edwards: "And by that righteousness being imputed to us is meant no other than this, that the righteousness of Christ is accepted for us, and admitted instead of that perfect inherent righteousness which we ought to have in ourselves." "Even as David also describeth the blessedness of the man unto whom God imputeth righteousness without works" (Rom. iv. 6).

4. *Union with Christ renders such a Method of Justification Possible, and Faith in Him makes it Actual.*—On the part of him who undertakes it a substitution must be voluntary and gratuitous; it must also be according to the will of the lawgiver and judge, so that it can still be said, "It is *God* that justifieth." Furthermore, there must needs be a moral union in which the transaction can be effected. This is provided for in the *incarnation* of the Son of God, whereby he becomes "like unto his brethren." "Of him are ye *in Christ Jesus*, who of God is made unto us wisdom and righteousness and sanctification and redemption" (1 Cor. i. 30). But if Christ's obedience is the *procuring* and *meritorious* cause of justification, faith is its *instrumental* cause, or the condition of receiving it. "Therefore, being justified by faith, we have peace with God through our Lord Jesus Christ" (Rom. v. 1). "But to him that worketh not, but believeth on Him who justifieth the ungodly, his faith is counted for righteousness" (Rom. iv. 5).

III. Additional Remarks and Explanations.—(1) Two points in justification were emphasized by the Reformers: (*a*) *Christ alone*, excluding human merit. "We are brought into peril and exposed to danger," says Melanchthon, "*for this one only reason*, that we believe the favor of God to be procured for us, not by our observances, but for the sake of Christ alone. If the exclusive term *only* is disliked, let them erase the apostle's corresponding terms *freely* and *without works*." (*b*) *Faith only*, to the exclusion of meritorious works. Thus Luther (at the Diet of Augsburg): "Nor can I embrace Christ otherwise than by faith only. Faith *alone*, before works and without works, appropriates the benefits of redemption, which is no other than justification, or deliverance from sin. This is our doctrine; so the Holy Ghost teaches and the whole Christian Church. In this, by the grace of God, will we stand fast. Amen." (2) "The Fathers" are often quoted as holding the same doctrine. For example, Justin Martyr, who says: "In whom could we transgressors and ungodly be justified, but only in the Son of God? O sweet exchange! O unspeakable contrivance! that the transgressions of many should be hidden in one righteous person, and the righteousness of one should justify many transgressors!" (3) When justification is confounded with pardon, or with sanctification, or when a native or infused goodness is made the ground of justification, or, again, when its *forensic* sense is eliminated from the word, and it is interpreted to mean *being made* righteous, instead of *being pronounced* so, the doctrine then held or taught is other than the justification of the Reformation and the Reformed churches. (4) Justification, though of Latin origin, is not classic. The Greek (New Testament) terms are δικαίος (adj.), used ordinarily of personal character, but found in the expression, "the just shall live by his faith;" δικαίωμα and δικαίωσις (of which justification is meant to be an equivalent), "*a justifying act;*" δικαιοσύνη, "righteousness" (but according to Robinson's New Testament Greek Lexicon), "the righteousness which God reckons or imputes to believers because of their faith in Christ" (Rom. iii. 22; Phil. iii. 9); and the verb δικαίοω, to "hold as righteous," to "declare righteous," to "justify:" "God is said to justify a person, to regard or treat him as righteous, by reckoning or imputing to him faith as righteousness."

J. R. Herrick.

Jus'tin I. (Justinus), an emperor at Constantinople, by birth a Gothic shepherd of Tauresium in Mœsia, b. 450 A. D.; went to Constantinople to seek his fortune; enlisted in the imperial guard; acquired fame for valor, and at last became commander of the guard; by craft and skilful management induced the army to salute him emperor after the death of Anastasius (518 A. D.). The emperor could not read or write, but under the advice of the quæstor Proclus his reign was on the whole a just one, and advantageous to the empire. D. Aug. 1, 527, and was succeeded by his nephew, Justinian.

Justin II. (Flavius Anicius Justinus), emperor of the East, succeeded Justinian I., his uncle, in 565. His reign was characterized by the defection and death of Narses and the occupation of nearly all of Italy by the barbarians. In the North the Avars gained great advantages, and in the East a bloody war went on with the Persians. The emperor d. Oct. 5, 578, and was succeeded by the excellent Tiberius II.

Justin (Justinus), the author of a compendium of Roman history, extracted from a vast work by Trogus Pompeius, who lived in the time of Augustus. (See Trogus.) It seems rather to be a collection of extracts than an abridgment, and in it much important information has been preserved from oblivion. Especially in regard to the early wars with the Parthians it is almost the only source of information. Nothing is certainly known of Justin, who is sometimes called Justinus Frontinus, at others Junianus Justinus, but he probably lived in the fourth century A. D. The first edition of his work, *Justini Historiarum Philippicarum Libri XLIV.*, was printed at Venice in 1470 by Jenson; best Venetian edition 1522 (Aldus); most complete by Frotscher (3 vols., Leipsic, 1827). An English version by Arthur Goldinge was printed in 1564, and five other translations have since appeared.

Justin'ian the Great (Flavius Anicius Justinianus), Roman emperor at Constantinople, b. of Gothic peasant ancestry at Tauresium in Mœsia, probably in 483 A. D.; went in youth to Constantinople, where his uncle, afterwards the emperor Justin I., was in high favor; was educated by the latter, to whom Justinian was a faithful and useful servant after the uncle's elevation to the purple. In 520 he was appointed commander of the Adriatic armies, and in 521 consul, and soon after married Theodora, an actress and courtesan, to whom he was always tenderly attached. Justinian's celebrated reign seems to have derived little of its splendor from the ruler himself, whose great talent lay in the selection of able lieutenants. His generals, Belisarius, Narses, and Germanus, carried the terrors of the Roman arms into Africa, where the Vandal kingdom was overthrown; into Italy, where, after long years of warfare, the Goths and Lombards were conquered; into Persia, where, after a twenty years' struggle, Persia obtained a nominal triumph, but Constantinople gained the real victory. Huns, Avars, Arabs, Gepidæ, were repelled, often by setting tribe against tribe, oftener by the direct expenditure of gold. Constantinople and the whole empire was adorned with splendid buildings, of which the present mosque of Santa Sophia is the most famous. Silk-culture was introduced, and manufactures, agriculture, commerce, notwithstanding the fearful burdens of incessant wars, appeared to prosper. The greatest monument to Justinian's fame is the *Corpus Juris Civilis*, the work of Tribonian and his assistants, but one which Justinian planned, and in which he took a profound interest. Justinian is accused of vanity and avarice, and his treatment of Belisarius shows that he was capable of meanness and ingratitude; but his private life was in the main correct. In his later years he was a Nestorian. He persecuted heathenism and certain heretical sects, and d. Nov. 14, 565, leaving no legitimate offspring.

Justinian II., surnamed Rhinotmetus, b. 669, succeeded Constantine IV., his father, in 685, and was one of the worst of the Eastern emperors. Notwithstanding some splendid successes in Syria, Sicily, and among the Slavi, he abandoned the fruits of his victories; in 695 was seized, his nose cut off, and he was banished to the Crimea, whence in 705 he returned and took fearful vengeance upon all adversaries. His reign is a record of shameful excesses. During the insurrection of Philippicus Bardanes the emperor was killed, Dec., 711 A. D.

Justin Martyr (Flavius Justinus), b. at Flavia Neapolis, the ancient *Shechem*, the modern *Nablous*, in Samaria, about 105; studied philosophy in the schools of Asia Minor, Greece, and Egypt. None, however, of the different systems satisfied him, and about 132 he turned away altogether from pagan philosophy and embraced Christianity, of which he became an able and zealous defender. Of his personal life nothing is known with certainty, but it seems probable that he resided at Rome during the latter part of his life, and suffered martyrdom here about 160. Of his writings, the *Liber contra omnes hæreses* is lost; the genuineness of the *Oratio ad Græcos* and *Epistola ad Diognetum* is contested; but his *Apologia prima* and *secunda* and his *Dialogus cum Tryphone Judæo* are among the most important productions which the Christian literature from the second century contains. The best edition of all the works which pass under his name is that by Otto (3 vols., Jena, 1842–46). Translations into English of the *Apologia* by William Reeves (1709), and of the *Dialogus* by Henry Brown (1755).

Jute is the fibre of *Corchorus capsularis* and *olitorius* (order Tiliaceæ), Indian annuals from five to ten feet high, with stalks as thick as a finger. The name is taken from the Orissa *jhot*, which is derived from the Sanskrit *jhat*, to "be entangled." It appears to flourish best in a hot, damp atmosphere, with a heavy rainfall and rich alluvial soil. The acreage under cultivation in 1872 (an exceptionally productive year) was 921,000. The plant is utilized in a variety of ways. The tops serve as potherbs,

the leaves as manure, the stalks for fences, the seed for oil-cake, the root for paper, and the inner bark for fibre. Although India is the great source of jute supply, the plants yielding it have long been cultivated in China and the East. Attempts have been made to acclimatize them on the lower banks of the Mississippi, in England, and in Algiers. The results are said to be satisfactory. The harvest is in July and August. The stalks, cut with a bill-hook, have the fibre (which constitutes the inner bark) separated by maceration. The cultivation is carried on chiefly by the ryots of Bengal, and often by means of co-operative guilds. The commission which has recently reported to the Indian government on the culture, etc. of the jute-plant complains of the extreme carelessness of the cultivators in the selection of the seed. Greater attention to this matter is recommended, and also a more careful rotation in growing the crop and improved methods of cutting and steeping the fibre. There is a general agreement that its cultivation has increased the well-being of the ryots, while the deleterious effects of the manufacture upon health are problematic.

Until 1830 it was practically unknown to Europe, and was only used in the native manufactures as the material for the gunny-bags in which Indian produce was exported. At first only used for cordage and coarse bagging, successive improvements in its treatment have made it also available for other and more profitable purposes. As cordage it is too easily affected by moisture to be considered a success. An immense quantity is used in making coarse bagging. Not only Indian products, but those of nearly every other nation, are transported in gunny-bags of this material. Carpets are now made from it, and it is mixed with cotton and silk for dress-stuffs. As it will serve for every kind of coarse textile fabric, it is manufactured in a variety of forms. It is used as a substitute for hair, and can be made into admirable chignons. Bright-colored stair-carpets can be sold at threepence per yard, whilst "carpet bed-covers" are produced at one-third the cost of wool. Jute is the most important export from Calcutta after cotton, opium, and rice. In 1828 the quantity exported was only 364 cwts., valued at £62. Cheap Russian flax for a time kept down the English demand, but the Crimean war led to increased requirements, and the Bengalee cultivators seized the favorable moment. From 1858 to 1863 the average exportation was 967,724 cwts. In 1872–73 the quantity exported was 7,080,912 cwts., worth £4,142,547. This industry has been created without government aid or encouragement. In 1872 there were 3,955,455 cwts. imported into Great Britain from India, and 69,000 cwts. from other countries. France took 148,876 cwts. from Calcutta and 550,500 from England; Trieste took 9000 cwts. direct; Holland, 5357 from India, and 58,610 from England; Germany had 77,831; Belgium, 31,192; Spain, 20,768; and other countries 16,176 cwts. by re-exportation from England. Factories for the manufacture of jute on modern principles and under European management are springing up in India. Those at Barnagpúr, near Calcutta, employ 4700 natives, who under seventeen European overseers work up yearly about 16,000 tons of jute. The success has been great.

Jute is easily dyed, but the beautiful colors it so readily takes up are fugitive except when carefully executed. It is readily brought to a rich cream-color, either in the fibre, yarn, or cloth, but until very lately it was considered next to impossible to bring it to a full white without injuring the strength of the fibre. Dr. Hodges, in a paper read at the British Association in Aug., 1874, claims that it has been completely obviated by methods patented by his son and then in practical operation at Mile Cross, county Down. In this case the worn-out gunny-bags should furnish plenty of paper material. It is already used for coarse wrapping paper. The jute manufacture has its chief seat at Dundee, and gives employment to more than 20,000 persons. In 1872 the quantity imported into that port direct was 1,828,614 cwts. Since the opening of the Suez Canal the fibre has reached Dundee, been spun and woven, the goods shipped back, and paid for within six months of the date of the bill of lading. It has led to the revival of the whale fishery in Baffin's Bay. The bulk of the whale oil is used in the treatment of jute. The Dundee chamber of commerce has represented that an Arctic expedition is desirable, that new haunts of oil-bearing animals may be explored. Thus, the labors of the scientific discoverers in the frozen North will bring an increase of prosperity alike to the workman of Scotland and the peasant of Bengal.

William E. A. Axon.

Jü'terbogk, town of Prussia, in the province of Brandenburg. It has some manufactures of woollen and linen stuffs, and a lively trade in flax and cattle. Pop. 6093.

Jut'land [Dan. *Jylland*], a peninsula between the North Sea, the Skagerack, and the Cattegat, is the largest province of the kingdom of Denmark. Area, 9697 square miles. Pop. 788,119. It is traversed by a ridge of low hills, to the W. of which the country is heath, lined with a range of sandbanks along the coast. The eastern part is beautiful and fertile, hilly, rich in forests of beech and oak, indented by numerous fjords, dotted with small but thriving towns, and cultivated like a garden. The Jutes formed the nucleus of those swarms which under the name of the Northmen devastated the coast of Germany and France and conquered England, and they have still retained in their characters something shrewd, daring, and indomitable, which distinguishes them from the islanders, who are softer and livelier, but weaker.

Juvena'lis (Decimus Junius) was b. probably in the latter part of the first century of our era at Aquinum; studied rhetoric and declamation; was an intimate friend of Martial, and d. in Rome in the eighty-second year of his age; but any further details of his life are not known. Sixteen satires written in heroic hexameters have come down to us under his name, but most scholars agree that only the first nine and the eleventh are by Juvenalis, and even these seem to have been much interpolated. There is a certain rhetorical coldness about his satires; he lacks the humor of Horace and the elevated moral enthusiasm of Persius. But his descriptions of life and characters are often highly picturesque or cutting. The best editions are by Heinrich (Bonn, 1839) and O. Jahn (Berlin, 1851); best English editions by Mayor (London, 2d ed. 1875), and by Macleane (London, 1857). (See also *Der echte und der unechte Juvenal*, by Ribbeck, Berlin, 1865.)

Ju'venile Offend'ers. The first organized movement for the reformation of juvenile offenders seems to have been made in London, Eng., in 1817. It grew out of the efforts of the denomination of Friends to follow up effectually the work of John Howard in the visitation and the amelioration of the condition of prisoners in public penitentiaries. Howard died in 1790. In the early years of the present century, Elizabeth Gurney, afterwards the saintly Elizabeth Fry, commenced her remarkable work among the female inmates of Newgate prison, London. Her brothers-in-law, Sir T. Fowell Buxton and Samuel Hoare, with her well-known brother, Joseph John Gurney, and several of her personal friends, about the same time formed a society for the improvement of prison discipline and the reformation of the juvenile depredators who then "infested London in gangs." They became particularly impressed with the importance of "taking from the streets boys who were under no parental control, exposed to every temptation, addicted to every vice, ignorant of all that was good, and trained by their associates to the perpetration of every crime." This organization, called "The London Philanthropic Society," soon found, in their examination of the prisons, that nearly every youthful inmate was effectually ruined, and introduced into the permanent criminal class, by the taint of the jail. To prevent this inevitable result they provided in London the first house of refuge, to receive, reform, educate, and train in a useful trade delinquent children, over eight and under twelve years of age at the time of their reception. In 1849 this institution, which had accomplished a great amount of good in the city, was removed into its present rural quarters at Red Hill, Surrey. In its reconstruction it followed the model of the French agricultural colony at Mettray; it has no surrounding walls, and is broken up into separate families. It is here, as it has been doing for the last fifty years, working out very successful and benign results.

On the continent of Europe, the German and Napoleonic wars creating so many orphans and engendering so much poverty and vice, institutions had been formed previous to the English experiment for the rescue of unprotected and wretched children from lives of crime. In 1695, August Herman Francke opened his institution at Halle, Germany, the immense quadrangle of buildings which he ultimately erected still remaining as a monument of his faith and piety. The history of his remarkable success, as preserved in his biography, is full of encouragement to those engaged in the work of juvenile reform. John Falk followed him; and at about the same date that the first English house of refuge was established he organized in Weimar "The Society of Friends in Need," and founded an institution "for the children of criminals and criminal children." His expressive coat-of-arms was a representation of a band of children converting, on an anvil, their chains into useful tools. It is recorded of the success of his refuge that hundreds of respectable tradesmen, clergymen, lawyers, and doctors, schoolmasters, merchants, and artists, dated the commencement of a life of usefulness and honor from their entrance into the reformatory at Weimar.

About the same date (1818) of the English efforts to rescue exposed children, and of the German movement under Falk, a corresponding interest was awakened in the U. S.,

chiefly, at first, in the city of New York, under the auspices of the Society of Friends, through visits and correspondence with their English fellow-Christians. Such men as John Griscom, Thomas Eddy, Mayor Cadwallader Colden, Hon. Hugh Maxwell, and James W. Gerard* were ultimately led to unite themselves in an association for the "prevention of pauperism." As early as 1803, Edward Livingston, the father of penitentiary reform in this country, while mayor of New York City, felt the necessity for some effectual measures to redeem young criminals upon their first arrest from a life of crime, and made in his annual messages suggestions which afterwards were fully developed (1821) in the well-known code which he prepared for the State of Louisiana. In this a house of refuge and industry and a school of reform have conspicuous positions. The Society for the Prevention of Pauperism soon found that the rescue of children from a life of crime and from the poison of the prison was one of the most important and promising features of its work. In 1823, therefore, the society changed its name, and secured an act of incorporation from the State as "The Society for the Reformation of Juvenile Delinquents." Their first school of reform was opened in the old government arsenal, on what is now Madison Square, New York, and has grown during the half century to the immense structures that now raise their fine architectural proportions on Randall's Island. The early superintendents, Curtis and Hart, obtained a very wide reputation for the successful management of their delicate and difficult charge. The first American institutions were patterned after this model. Many changes have been made in the modes and discipline of reformatories during the last twenty-five years, but it has always been found that more depends upon securing reformatory men and women of the right character than upon any particular system of training.

Boston opened her school, under the care of Rev. Mr. Wells, also a man of remarkable reformatory ability, in 1826; Philadelphia in 1828. It was nearly ten years before the next institution, a farm-school, purely a private charity, was opened in the former city, and ultimately located, where it is still accomplishing its benign work, on Thompson's Island in the harbor. Nearly ten years later still (1847) a fresh impulse was given to juvenile reform by the very generous donation of Mr. Theodore Lyman, who was a trustee of the farm-school, to the State of Massachusetts of a large sum of money for a reform school for boys. The well-known institution at Westborough was the result. This was the first purely State institution established in this country; heretofore they had been founded by charitable associations, which held their control, while the State, in most instances, granted annual supplies. The experiment has proved that the latter institutions, as a general rule, are more successful, more economical, better managed, and less liable to frequent and disastrous changes of officers. As it is better for the State and for the individuals interested to develop the benevolence and piety of the citizens, the policy now pursued in Great Britain seems to be the wisest on the whole—by a general law a reasonable sum per capita is allowed by the government to all reformatory institutions for clearly specified juvenile subjects lawfully committed to such custody in establishments accepted by, and open to the supervision of, a state inspector. Smaller schools, other things being equal, give better promise of reforming their inmates than those aggregating large numbers of delinquent or defective youth. These voluntary schools will secure not only better supervision over their subjects in the institution, but a more careful oversight after their discharge, which is an element of reform of almost equal importance with the former. In 1833, Dr. John Henry Wichern, then a young theological student just ordained for the ministry, and engaged in voluntary city missionary services in the city of Hamburg, Germany, opened at the Horn, a short distance from town, in a memorable old cottage, into which he removed with his mother, a school of reform for the worst boys of the city streets. The cottage, which has given a name to what is now a village of plain dwellings in the midst of gardens, with workshops, chapel, and schools, was called very significantly, "The Rauhe Haus." Wichern admitted but twelve boys, who became members of his family, and were in every respect treated as his children. Afterwards he successively built other cottages, each for the same number of boys or girls, and established workshops, calling to his aid a body of theological students, whom he trained, while they became the elder brothers and tutors, as well as instructors in various mechanical and agricultural industries, of his remarkable families of street Arabs. These elder brothers were trained for the "inner" or home missionary work of Germany, and have made admirable superintendents of reformatory institutions throughout Europe and in this country. This experiment proved remarkably successful in its reforming influence over its subjects. In 1837, M. de Metz, a judge of the court of assize of Paris, visited the U. S. as a commissioner to examine and report upon the prison system of this country. He was strongly impressed with the good work done for juvenile offenders in the houses of refuge at New York and Philadelphia, and made to his government a full report of their discipline and efficiency. Immediately upon his return he commenced what, in the end, proved to be his own great life-work—the organization of a general movement for the rescue and reform of young criminals in France. He visited the institution of Wichern in Hamburg, and finally upon the Loire, just out of the city of Tours, he established the great model French reform school, which bears the name of the estate upon which it stands—the "Agricultural Colony of Mettray." It combines the American and German systems. It forms a little village by itself of small, three-story dwellings, each one capable of accommodating forty boys with their instructors, with a church, workshops, and farm-buildings. These institutions are constructed without walls around them or bars upon the doors to retain the *détenus*. The accounts of these institutions, published in this country by Horace Mann, secretary of the Massachusetts board of education, by Dr. Calvin E. Stowe, who visited and carefully examined them, and by Dr. Henry Barnard, secretary of the Connecticut board of education, awakened great interest among philanthropic men. A series of prize essays also, three of which were published, on the subject of juvenile reform, secured by an offer of $100 for the best by the board of managers of the Philadelphia house of refuge (which was awarded to Rev. Edward Everett Hale of Massachusetts, forty having been sent in), tended to add to the growing interest. In 1855, Massachusetts established her Industrial School for girls at Lancaster, following quite closely the French system of M. de Metz, and allotting but thirty girls to a separate house, each home under the care of three matrons. Ohio but a short time after opened her farm-school for boys on the same plan in a town of the same name. Since this time nearly all the later institutions, which have been quite rapidly organized throughout the country, chiefly State establishments, have followed, with more or less closeness, the farm-school system as distinguished from the "congregate" or penitentiary form of discipline.

Many private and voluntary institutions, meeting the wants of special classes, have been established during the last twenty-five years in this country and Great Britain. The most efficient of these is the Children's Aid Society of New York City, of which Mr. Charles L. Brace is the originator and chief manager. It was incorporated in 1853. Its object is to save the vagrant children of the street from becoming even juvenile criminals. By inexpensive night lodgings for little street-merchants and for girls without homes, by encouraging small savings, by establishing industrial schools where sewing as well as the rudiments of knowledge is taught, and where Sunday services for religious training are held, and chiefly by deporting houseless and worse than homeless children from the miserable haunts of poverty and vice in the city to good homes in the country, an inestimable amount of good is done, and an effective preventive agency against crime secured. The State of Massachusetts has connected one feature of this plan with the bureau of her State board of charities. An agency under it assumes the work of finding homes in the State for unprotected children. The multiplication of these voluntary and State preventive agencies in many portions of the country has perceptibly reduced the amount of juvenile crime, and the effect would also soon be made manifest in the decrease of adult criminals, were it not for the large importation from Europe of this class. Several of the great religious sects, particularly the Roman Catholic, have turned their attention and practical energies in this direction. The largest portion of the most exposed and vicious children in our cities has been of foreign parentage, and by birth connected with the Catholic fold. The very vigorous establishment in later years of reformatories, industrial schools, and orphanages by the Catholic clergy has made itself apparent in most beneficial results in some of our cities. Voluntary religious movements, like the ragged schools instituted by John Pounds in England; like the industrial and christianizing scheme of Dr. Chalmers, introduced into the most abandoned parts of the city of Glasgow, Scotland, in 1820, and into the lowest wynds of Edinburgh in 1845; like those of the Methodist ladies and Rev. Mr. Pease in the Five Points of New York, and of their successful imitators in Philadelphia and Boston, have produced marvellous results. The inauguration of com-

* He was the last survivor of the first board of managers of the New York Home of Refuge, dying while this article was in preparation (Feb., 1874).

pulsory education, providing for such neglected classes as the young street-merchants and children employed in factories, and the vigorous use of the facilities offered by the public and private schools of reform, promise very certain and efficient results in the direction of the prevention and cure of juvenile offences. Particular interest at the present hour is drawn to the maturer class of young criminals, from sixteen to twenty years of age. It is very evident that they should not be trained in the same institutions with children. They are just now the most dangerous members of our criminal class, our most violent crimes being perpetrated by them; but they are still amenable to reformatory influences, as has been proved by an interesting experiment of a few late years in the New York house of refuge. They require more restraint than youths, and a broader educational and industrial discipline. They need to be taught a full trade. A portion of their earnings while restrained of their liberty should be credited to them if obedient and diligent. They should be discharged before the limitation of their sentence if there is a good promise of reformation, with power on the part of the managers of the institution with which they have been connected, in their failure upon trial, to return them for further restraint until they show themselves capable of living (and ready to do so) honest and industrious lives in the community. The suspicion that all persons rest under who have been *détenus* renders it necessary that there should be an industrial refuge for them when work cannot be elsewhere obtained. This was really the problem—how to find work for discharged young criminals—that first arrested the attention of Edward Livingston, and turned his thoughts in the direction of the causes and the cure of crime.

It is estimated that there are in this country (1875) some 40 schools of reform, not including those of an educational and preventive character. These institutions have an annual average of about 12,000 children, 1000 of whom are girls. This estimate is rather below than above the actual census. The smaller and purely voluntary institutions would present much larger statistics. In Great Britain there are 65 officially recognized schools of reform, and 95 industrial schools, embracing about 5000 inmates. In the German-speaking countries of Europe there are over 400 establishments for the succor of exposed and criminal youths, with an annual average of 12,000 inmates. Between 40 and 50 have been organized in France. Italy has 33, of which 22 are for boys—all private institutions.

The estimates as to the reforms accomplished in these houses of refuge vary from 60 to 75 per cent. of the whole number received. Many of these young children are not vicious, simply homeless and exposed; so that the actual reformatory power of an institution cannot be measured by the number of inmates that ultimately turn out well. In several instances, however, very thorough and encouraging inquiries have been made, extending over a period of ten and twenty years, and embracing some of the most unpromising subjects when received. Without doubt, every year the class that now enters purely reformatory institutions becomes, in some degree, less promising. They are now the residuum of the streets after orphanages and industrial schools have selected and sifted out their subjects. More care and thoroughness of discipline will be required in their instance, and less pronounced results may be expected.

As disciplinary agencies, education, the cultivation of industrial habits, the learning a full trade if possible, the assimilating and transforming power of a strong, loving, magnetic mind, and positive religious instruction and training, are relied upon. Small institutions bring the children nearer to their officers. It will be seen at once that both the heads and subordinates of these schools must be persons of peculiar adaptation; they must be specially intelligent, unselfish, devoted, fond of children, and of an earnest religious character. These institutions must train their inmates to a plain form of life and to ordinary expectations. Much disappointment and failure results from inattention to this. But few of these youths will be received into families in the position of children; they are to go out into life to earn their livelihood by the sweat of their brows. As farm-labor at the East offers such limited pecuniary returns, boys in these schools, as far as possible, should be taught trades, and placed in a position to earn their living by their work upon their discharge. It is not wise to retain them too long in schools of reform; all institution-life is unnatural, irksome, and in some degree unwholesome. They should be placed in homes and in industrial positions in the country at as early a day as practicable. It is better to have them returned often, and new homes found for them, than to keep them too long under restraint. The great want of the hour is a body of well-trained instructors and officers. The best systems fail for lack of devoted and intelligent trainers. The irreligious and careless tempers and habits of subordinate officers, who, after all, come nearest to the children, will utterly destroy the reformatory influence of the school, the chapel, and an admirable superintendent. European institutions, which have been models of success, have been in the hands of the most devoted and self-sacrificing missionary spirits, men and women who have made the rescue of childhood a life-work of faith and love, as will be seen in reading De Liefde's volumes.

The literature of this question has become very extensive. In addition to the collected reports of the older institutions, like the New York, Philadelphia, Westboro', and Lancaster schools, and the Ohio State Farm, we mention *Juvenile Delinquents* (Eng.), by Mary Carpenter; *The Charities of Europe* (Eng.), by De Liefdie; *Report of Mass. State Board of Charities*, 11 vols., very valuable; *Half Century with Juvenile Delinquents*, by B. K. Peirce; *National Education in Europe*, by Henry Barnard, LL.D.; *Reformation of Juvenile Delinquents*, by L. Bonneville de Marsangy, 1 vol. 8vo, Paris; *Punishment and Prevention*, by Alex. Thomson, 1 vol. 12mo, London; *Social Evils, their Cause and Cure*, by the same author; *Praying and Working*, by Stevenson; *The Complete Works of Edward Livingston*, 2 vols., new ed., New York, 1873. The English Parliamentary reports upon reformatory institutions are very full and of great value, covering every detail of their management. The reports of the Wichern's Roughe Haus and the agricultural colony at Mettray. The published *Proceedings* of the National Prison Congress held at Cincinnati in 1870, and of the International Congress held in London in 1872, contain particularly valuable papers upon preventive and reformatory agencies. B. K. Peirce.

Juvénis (Raymond), b. at Gap, the capital of the department of Hautes-Alpes, France, in the first half of the seventeenth century; held some subordinate position in the civil service of his native city, and d. there Jan. 7, 1705. His leisure hours he used for historical researches, and from old state papers and official documents he compiled a *Histoire séculière et ecclésiastique du Dauphiné et de ses dépendances.* The work was never printed. The manuscript was presented to the library of Carpentras in the department of Vaucluse, where it is still kept. But it is often quoted on account of the curious and generally reliable information it gives concerning life and characters in the French provinces in the sixteenth and seventeenth centuries.

Juven'tas, in the mythology of the Romans, the goddess of youth, corresponding to the Greek Hebe. She was worshipped in Rome at a very early period; her chapel on the Capitol was built before the temple of Jupiter. After the defeat of Hasdrubal, in 207 B. C., the consul, M. Livius, vowed a temple to Juventas, which was consecrated in the Circus Maximus sixteen years afterward.

Juven'tia gens in ancient Rome was a plebeian *gens*, which came from Tusculum, and settled in Rome in the fourth century B. C. The families belonging to this gens were the Celsus, Laterensis, Pedo, and Thalna.

Juventi'nus Al'bius Ovid'ius, the name of the author of thirty-five Latin distichs which have come down to us under the title of *Elegia de Philomela,* and which contains a collection of words expressive of the respective sounds uttered by birds, quadrupeds, and other animals. Of the author nothing is known, but the distichs themselves have some interest as a curiosity.

Jux'on (William), D. D., b. at Chichester, England, in 1582; was educated at St. John's College, Oxford, of which he became president in 1621, and vice-chancellor of the university in 1626. He was made dean of Worcester in 1628, bishop of Hereford in 1633, and of London in the same year, and high treasurer of England in 1635. Bishop Juxon suffered deprivation during the great rebellion and the Commonwealth, but remained faithful to King Charles, whom he attended in his imprisonment, at his trial, and on the scaffold. After the Restoration he was made archbishop of Canterbury (Sept. 20, 1660), and d. at Lambeth Palace June 4, 1663.

Jyn'teah, the name of a district of British India, beyond the Brahmaputra, belonging to the presidency of Bengal, situated between lat. 25° and 26° N., lon. 92° E., and bounded N. by Assam and S. by Sylhet, with which it was incorporated during the Burmese war. The district is mountainous, and rich in iron and coal. Cap. Jynteah.

Jynx, in Grecian mythology, the name of the bird which Aphrodite gave Jason as a symbol of passionate and restless love, and by which he won the love of Medea. According to one version of the myth, Jynx was the daughter of Peitho and Pan, and was transformed into a bird because she undertook, by means of magic, to make Zeus fall in love with Io. According to another, she was a daughter of Pierus, and when she and her sisters presumed to enter into a musical contest with the Muses, she was changed into a bird.

K.

K, a palatal mute, the eleventh letter in our alphabet. It is the Greek *kappa* (Κ, κ), but is very seldom seen in Latin, *C* taking its place. It has but one sound in English, the same as that of *C* hard. As an abbreviation it stands for *king;* in chemistry it is the symbol of potassium (kalium).

Kaa'ba [Arab. *Al-Kaabah,* "square house"], an oblong stone building enclosed in the great mosque at Mecca. At the north-eastern corner of the building, four or five feet from the ground, is a celebrated black stone, of an irregular oval shape, about seven inches in diameter, which received idolatrous worship from the Arabians before the time of Mohammed, and it is still the most sacred object of veneration to his followers. The Sabæans and Guebers also worshipped this stone, which is thought to be of meteoric origin, and to have been first connected with the worship of Saturn. None but Mohammedans are now admitted within the Kaaba, but Burckhardt and Burton succeeded in entering under the disguise of pilgrims. Every follower of Islam is bound, if possible, to visit this sacred spot at least once during his life, and scores of thousands make the pilgrimage each year.

Kaama. See HARTEBEEST.

Ka'ba, town of Hungary, in the county of Bihar, has 5630 inhabitants, who are extensively engaged in the rearing of bees.

Kabbala. See CABBALA.

Kabul. See CABOOL.

Kabyles. See ALGERIA.

Ka'desh [Heb., "holy"], or **Kadesh-barnea,** city and encampment of the Israelites during their journeys in the wilderness, at the S. E. border of Palestine, near Edom. To this point they had penetrated when they were turned back by the hostility of the Edomites, and compelled to seek the circuitous route E. of Edom and Moab. By some biblical geographers Kadesh is distinguished from Kadesh-barnea, and it is held that the people of Israel were twice turned back, once from each place; others consider the two accounts a duplicate narrative of the same event. Dr. Robinson in his *Biblical Researches* identifies Kadesh with the modern *Ainel-Webeh.*

Kad'monites [Heb. *Kadmoni,* "eastern"], the name of a Canaanite tribe which in the time of Abraham inhabited the N. E. of Palestine, near Mount Hermon. The name is thought to be a general one for the dwellers in Eastern countries, and that they are identical with the "children of the East," elsewhere mentioned in the books of Genesis and Job.

Kadom', town of Russia, in the government of Tambov, on the Moksha, has 7173 inhabitants and some trade.

Kaf'fa, or **Ka'fa,** country of Eastern Africa, S. of Abyssinia, consists of an extensive table-land rising about 5000 feet above the sea and covered with immense forests of coffee trees. Coffee is indigenous here, and is said to have received its name from this country. It is largely cultivated, and great quantities are exported to Mocha. The *ensete,* a plant resembling the banana, furnishes the chief article of food. Cereals are not cultivated, and "grain-eater" is used as an expression of contempt. The inhabitants belong to the Abyssinian type, and speak a language classified under the Hamitic group. They profess to be Christians, and are governed despotically by a king. Bonga, situated in 7° 12′ 30″ N. lat., 36° 41′ E. lon., on the Gojeb, is the principal town, but is a poor place, consisting of straggling huts, and comprising only between 6000 and 7000 inhabitants.

Kaffa, or **Feodo'sia,** town of Russia, in the government of Taurida, is beautifully situated on the eastern coast of the Crimean peninsula; it has a good fortified harbor, and was, while in the possession of Genoa, a commercial port of consequence, but lost its importance under Turkish dominion. It is now rising again, and is much visited as a watering-place. Pop. 8435.

Kaf'firs, or **Caf'fres** [Arab. *kefir,* "unbeliever" or "heathen"], first applied by the Arab slave-dealers of the eastern coast of Africa to all the natives. In after years the term was limited to the tribes inhabiting the coast-country on the E. side of S. E. Africa, and recent events have narrowed the designation in a popular sense as applying to the tribes living in the country between the Cape Colony and Natal. The Kaffirs form a very large family of the human race, extending beyond the equator, and are closely allied to a great part of the Central and North African tribes. They are a *modified* negro, being distinct from the negro proper, the Hottentot, and Bushman; for, though their hair is woolly, their color is as a rule deep sepia-brown. They are often intensely black, but many, on the other hand, are coffee-colored, so that these are merely variations from the original complexion. Many are reddish, like the American Indians. In their own language they call themselves *A-bantu,* meaning "people" or "men." Their features are often regular, and instances occur in which but for its color the countenance might be taken for that of a European. Several writers describe their figures as admirable and their movements as graceful and dignified. Their skulls are dolichocephalous and high, or, according to Welcker, hypsistenocephalous. Their language belongs to the so-called prefix-pronominal. The Kaffirs of South Africa are divided into four species—the Kaffir proper, the Sichuana, Tageza, and Otjiherero. The first speak the real Kaffir language; the second, the Se-rolong, Se-suto, and Setlapi; the third, the Mancolosi, Ma-tonga, and Ma-ploenga dialects. The general disposition of the Zulu races, called Kaffirs by the English, is (1) the tribes N. of Natal, Amatabele, Amazulu, etc., and the Amaxoso and Amampondo, in the E., speaking Zulu; (2) Makololo, N., and Bakuku, N. W., speaking Sichuana, and generally known as Bechuanas or Betjuana; and (3) the Ovampos and Otjiherero or O-va-herero. For practical study G. Fritsch reduces all these to the Ama-xosa, the Ama-Zulu, the Bechuana, and the O-va-herero.

The Kaffirs were first made known in 1497, when Vasco da Gama was wounded by them in Helena Bay. Succeeding notices of the country and of the natives occur in Santo's work on East Africa (1506) and that of Lopez (1591). In 1626 the traveller Herbert described them. From 1652, when the Cape of Good Hope was settled by the Dutch, until 1795, when it was passed to the English, and with little intermission almost to the present day, the history of the Kaffirs is that of continual savage warfare with the Europeans, varied by bloody feuds among themselves. Chaka or Tshaka, "the Napoleon of South Africa," b. in 1787, killed 1829, founded the Zulu dynasty. When his mother died this king, to terrify his subjects, caused 7000 of them to be murdered in one day, and continued these sacrifices for three months. The Kaffirs, though not religious, are extremely superstitious. Much has been written in their favor, but even from the testimony of their European friends it is evident that they are greedy, cruel, and expert in poisoning. Owing to the insecurity of life and property among themselves, about 300,000 Kaffirs, or one half the nation, have taken refuge in the British colony. As wives are the most profitable of their possessions, polygamy is so deeply rooted that Christianity makes but little progress among them. The old, the poor, and the sick are treated with incredible barbarity. When a chief's hair turns gray he is often put to death, and Tshaka once entered into a treaty with the English, the secret object of which was to obtain a bottle of hair-dye. The language of the Kaffirs, in common with those of the Bechuanas, Damaras of the Plain, the people of Congo, Suaheli, and many other regions, is what is called alliteral, as contrasted with the tongues characterized by "clicks," such as are spoken by the Hottentots and Bushmen. The Kaffirs are ferocious and passionately fond of warfare, but unless driven to despair are only to be dreaded in ambush or night-attacks. Among the numerous works relating to the Kaffirs may be named *The Kaffirs of Natal, etc.,* by Rev. J. Shooter (1857); *The Record Relative to the Native Tribes of South Africa,* by Lieut. D. Moodie (Cape Town, 1838); *Reports, etc.,* by Col. R. Collins (ib. 1841); *Proceedings of the Commission Relative to the Kaffirs, etc.* (Piet. Maritzburg, 1852); *South African Annals,* by D. Moodie (ib. 1855); *Narrative of the Kaffir War of 1850–52,* by R. Godlenton (Graham's Town, 1852); *Kaffir Laws and Customs,* by Maclean (Mount Cope, 1858); *Past and Future of the Kaffir Tribes,* by Rev. W. C. Holden (London, 1855); *The Orange River,* by C. J. Anderson; *Lake Ngami,* by the same; *The Zambesi, etc.,* by D. Livingstone (London, 1865); *Journal of a Residence at the Cape of Good Hope,* by Chas. J. F. Bunbury (London, 1848); *Travels, etc. in South Africa,* by G. Thompson (London, 1872); *Zulu Legends, etc.,* by Dr. Bleek (an interesting work, indicating great imagina-

tion and even poetic power in the Kaffirs); *Reynard the Fox in South Africa*, by the same. See also other works by Bleek. The titles of nearly fifty works referring to the languages, ethnography, and anatomy of the Zulus and other South African tribes are given in *Die Eingeborenen Sud-Afrikas*, by G. Fritsch. C. G. LELAND.

Kaffra′ria (*Proper* or *Independent*), the name of the eastern coast-region of South Africa, extending N. to the river Umzimkulu, in lat. 30° 26′ S., and S. to the Great Kei or Keiskamma, which separates it from the Cape Colony, to which in 1866 the so-called British Kaffraria was annexed. The distance from N. to S. is about 250 miles, and from E. to W.—that is, from the Indian Ocean to the Kalambi Mountains—about 120 miles; the area of the whole territory about 20,000 square miles. Besides the Great Kei and the Umzimkulu, many other rivers—as, for instance, the Umzimvubu, the Umtata, and the Umbashee—flow through these regions, rising in the Kalambi or Quathlamba mountains at an elevation of about 3000 feet. None of them is navigable, however. They flow in deep beds, and their shores are, like the coast, rocky and irregular. When sufficiently watered, the soil is very productive. Cotton has been grown with success in many places; maize and wheat are easily raised; large trees and watermelons abound. The inhabitants, whose number is estimated to be about 300,000, are Kaffirs, and live as nomades in tribes which bear the names of the chiefs. Their religious and moral ideas are often very low; one Zulu tribe believes that their present chief has created the world. But the Wesleyan Missionary Society has had great success among them, and the whole population is gradually coming under the influence of the Cape Colony.

Kafiristan′, a country of Central Asia, between 35° and 36° N. lat., and between 69° 20′ and 71° 20′ E. lon. It received its name, "the land of the infidels," from the surrounding Mohammedan people, who entertain an inveterate hatred against its inhabitants. As the country is an isolated alpine tract of land, on the declivity of Hindu-Kush, which never was conquered, though often invaded by foreigners, and about which we know very little, the inhabitants form an isolated race, entirely different from their neighbors. They resemble Europeans in their features, and have blue eyes and light-brown hair; in their language, which is of Sanskrit root, and in many of their habits, sitting on raised seats. They are said to be very proud of this resemblance to Europeans, while they consider it the first and most essential part of a man's honor to have slain a Mussulman. We know, however, as little of the inhabitants as of the country.

Kagoshi′ma, or **Kagosima**, town of Japan, situated on the south-western coast of the island of Kiusiu, is the capital of the feudal prince Satsuma. It was bombarded in 1863 by the English, who thus compelled Satsuma to execute the murderers of Mr. Richardson, an English subject, and to pay £25,000 in indemnification.

Ka′hau, or **Proboscis Monkey**, the *Semnopithecus nasalis*, a most grotesque and hideous monkey of Borneo. It is of gregarious habits, and is extremely active, noisy, mischievous, and even savage in character. The native name is derived from the cry of the beast. Its nose is six inches long, and perfectly black.

Kah′lenberg, the last outpost of the Wienerwald, the northernmost spur of the Noric Alps, rises just outside Vienna, on the Danube. From its southern side Sobieski attacked in 1683 the Turks besieging Vienna. On its top, which rises 1100 feet above the river, are some places of amusement, much visited during summer by the inhabitants of Vienna.

Kai′eteur, a celebrated waterfall in British Guiana, on the Potaro River, a tributary of the Essequibo, 822 feet in height. The river is here nearly 400 feet wide, and is 15 feet deep.

Kairwan′, town of Tunis, Northern Africa. It has several magnificent mosques and other monuments of a splendor which has gone. It stands on a sandy plain, has no manufactures and no trade. Pop. estimated at from 10,000 to 50,000.

Kaisari′jeh, town of Asia Minor, situated in lat. 38° 42′ N. and lon. 35° 20′ E., and not to be confounded with Kaisarijeh in the province of Syria, which was built by Herod, bore the name of Cæsarea Palestinæ, and was in the first century one of the most splendid Greek towns in Asia, but which now is wholly in ruins. Kaisarijeh in Asia Minor is decaying too, surrounded on all sides by ruins, but it has still 10,000 inhabited houses, and carries on a very important trade in European and Asiatic products.

Kai′ser [from Lat. *Cæsar*], the German word for emperor, which has been so extensively known and used in every language since the year 1871, when William, king of Prussia, was crowned at Versailles, France, as emperor of Germany. Thus was revived the old Teutonic appellation of kaiser, which applied formerly, and especially in the Middle Ages, to the German emperors, who inherited this title from the Roman Cæsars, themselves succeeded by Charlemagne, who is considered by Germans as the first emperor of the Vaterland, as William is the latest one. FÉLIX AUCAIGNE.

Kai′serslautern, town of Rhenish Bavaria, on the Lauter. It has some manufactures of iron, cotton, and tobacco, and a lively trade in fruit. Pop. 12,029.

Kai′serswerth, small town of Rhenish Prussia, on the Rhine, is noted for the school of evangelical deaconesses which was founded here in 1835 (see FLIEDNER), and which now has branches in most Protestant countries. Pop. 2223.

Kak′odyle (syn. CACODYLE, which see); also **Kakodylic Oxide.** Correctly speaking, the synonym given in the former note under CACODYLE, "*Fuming Liquor of Cadet*," belongs, as it was originally applied by Bunsen, the discoverer of this baneful series of bodies, to the latter compound, which is also called *alcarsine* (arsenical alcohol), though it is now known that the liquor of Cadet is always mixed with kakodyle itself. Cadet's liquor is obtained by distilling together white arsenic and potassic acetate. The mixed product is treated with hydrochloric acid, which gives kakodylic chloride, and this, treated in an atmosphere of CO_2, with metallic Zn, gives pure kakodyle. The formula C_4H_6As also, which was given before, becomes, in the prevailing notation adopted in this *Cyclopædia*, $C_4H_{12}As_2$. Under the view that it is *arsendimethyle*, the rational formula attributed to kakodyle by Woehler is: $\begin{matrix}(CH_3)_2As\\(CH_3)_2As\end{matrix}$; and to kakodylic oxide (alcarsine) he assigns the formula $[(CH_3)_2As]_2O$. The latter is formed, with *kakodylic acid* $(CH_3)_2As.OH$, by the slow oxidation of kakodyle. It is only kakodyle itself which fumes and inflames spontaneously in the air, and it confers these properties on the mixture called "liquor of Cadet."

Humanity revolts from the use of this agent, kakodyle, in human warfare, and it never will be thus employed, as its employers would place themselves without the pale of humanity. The power to prepare such terrific agents has doubtless been conferred upon man to enable him to cope successfully with beasts of prey and deadly reptiles and serpents, which in some countries prove too powerful for the untaught natives, and actually have been known to depopulate large districts of the earth, and render them impenetrable by civilized man under ordinary conditions. H. WURTZ.

Kalafat′, town of Roumania, in Little Wallachia, in a plain on the left bank of the Danube, nearly opposite to Widin. Partly by its natural position, and partly by its artificial fortifications, it commands entirely the approach to the Danube here, and was the scene of very severe contests between the Russians and the Turks in 1829 and in 1854. Pop. about 2500.

Kalakau′a (DAVID), b. at Honolulu Nov. 16, 1836, and descended from an ancient king of the islands of Hawaii. Together with Lunalilo and other hereditary chiefs, he was educated in the royal school of Honolulu, a thoroughly English institution, and in 1860 he visited California. When Lunalilo died (Feb. 3, 1874) without having proclaimed a successor, Kalakaua was elected king (Feb. 12) by the legislature, 39 votes being given to him, and only 6 to the queen-dowager, Emma, his rival to the throne. A riot took place in favor of Emma, but was speedily put down by aid from the British and American ships of war present, and Kalakaua was installed on the same day as the seventh king of the Hawaiian Islands.

Kal′ama, city and tp., cap. of Cowlitz co., Wash. Ter., on the right bank of Columbia River, 45 miles from Portland, Or., and 65 miles S. E. of Astoria, southern terminus of the Pacific division of the Northern Pacific R. R., now completed 105 miles northward to Tacoma. Kalama was first laid out in Feb., 1871, and was incorporated as a city in the same year, in consequence of its selection as the head-quarters of the above-mentioned railroad co., which erected buildings for offices, car and machine shops, a warehouse, and a wharf 700 feet long. It has several large hotels, 2 churches, 1 newspaper, 1 public-school edifice, a jail, and a fire department; and is the highest point on Columbia River to which deep-sea vessels can ascend without lightering cargo. Within a few miles northward are extensive coal-mines, and on every side are forests of fine timber. Kalama Creek, rising at the base of Mount St. Helen, supplies unlimited water-power. Salmon fishing, in the Columbia River, for canning and export, is a profitable industry. U. S. mails received daily from Puget Sound by rail, and twice a day by steamers connecting with overland mail from California.

M. H. & M. L. MONEY, EDS. "BEACON."

Kalama'ta, rising town of Greece, at the head of the Gulf of Koron, and carries on a brisk trade in oil, figs, and cocoons. Pop. 6200.

Kalamazoo', county of S. W. Michigan. Area, 576 square miles. It is very fertile, and diversified with prairies, oak-openings, and forests. It is traversed by numerous rivers, and by five lines of railroad. Cattle, grain, wool, butter, and hay are staple products. The manufactures include carriages, wagons, lumber, cooperage, flour, saddlery, etc. Cap. Kalamazoo. Pop. 32,054.

Kalamazoo, post-v. and tp., cap. of Kalamazoo co., Mich., on the Michigan Central, the Kalamazoo division of the Lake Shore and Michigan Southern, the Grand Rapids and Indiana, and the Kalamazoo and South Haven R. Rs., 40 miles from Lake Michigan and 143 miles from Detroit. Situated on the river of the same name, with a fine location and splendid water-power, Kalamazoo is a beautiful and wealthy place, having 12 churches, 2 fine libraries (one of 5000 vols.), a gallery of art, 2 national and 1 savings bank, 1 college, 2 female seminaries, a fine system of public schools, and several private schools, 1 daily, 2 weekly, and 2 monthly periodicals. Water is supplied on the Holly system by 10 miles of pipes and 100 hydrants. There is an effective fire department with a fire-alarm telegraph; the manufactures are extensive, embracing iron machinery, steel springs, carriages, pianos, billiard-tables, elevators, clothes-pins, woodwork of various kinds, and paper. There is a public park, and a driving-park with a superior track. The Michigan asylum for the insane is located here, accommodating 400 to 600 patients. Kalamazoo is the fourth town of the State in size. Pop. of v. 9181; of tp. 10,447. GEO. TORREY, FOR "TELEGRAPH."

Kalamazoo College, Mich., was incorporated as a college in 1855. It had previously been a branch of the University of Michigan. Its founders were Baptists, and a majority of its board of trustees are of the same body of Christians. But other denominations have always been represented in its board of trustees, and generally in its faculty. It admits both sexes to an equal share in its instruction and to the same courses of study. The buildings are very finely situated, and the campus includes about 25 acres. Rev. Kendall Brooks, D. D., has been since 1868 the president of the college, which embraces (1872) 6 male, 4 female instructors; 98 male, 71 female students.

Kalamazoo River rises in Hillsdale co., Mich., flows generally W. N. W. to Kalamazoo, and thence N. W. to Lake Michigan. It is 200 miles long, 350 feet wide at its mouth, and is navigable 40 miles for boats. It flows through a level and fertile region.

Kal'amo, post-tp. of Eaton co., Mich. Pop. 1363.

Kalb (JOHN), BARON DE. See DE KALB.

Kal'be, town of Prussia, in the province of Saxony, on the Saale. It has considerable manufactures of cotton and paper. Pop. 7386.

Kalb'fleisch (MARTIN), b. at Flushing, in the Netherlands, Feb. 8, 1804; was well educated, and in youth paid special attention to chemistry; went as a supercargo to Sumatra, and afterwards became a merchant in France; in 1826 came to the U. S., where he acquired great wealth as a manufacturer of colors and chemicals, at first at Harlem, N. Y., and later in Connecticut; in 1841 established the same business at Green Point, L. I.; took a prominent place as a Democratic politician, was sent to Congress in 1862, and chosen mayor of Brooklyn, N. Y., in 1867. He was distinguished for mercantile integrity, good judgment in business, and public spirit. D. Feb. 12, 1873.

Kale, a variety of *Brassica oleracea*, the species of cruciferous plant to which the cabbage, turnip, etc. belong. There are many sub-varieties—some biennial, others with a perennial root. Kale is grown in kitchen-gardens for its leaves, which are boiled as potherbs. The plant is often called borecole. In Great Britain the sea-kale (*Crambe maritima*), a plant allied to the above, is extensively raised in gardens. Its leaves are not palatable until after blanching, when they are highly prized as food.

Kalei'doscope [Gr. καλός, "beautiful," εἶδος, "form," and σκοπεῖν, to "see"], an instrument invented in 1817 by Brewster, consists of a tube containing two or more longitudinal stripes of glass mirror, whose reflecting surfaces are inclined to each other at an even-numbered aliquot part of four right angles; that is, at 60°, 45°, 36°, etc., which are respectively one-sixth, one-eighth, and one-tenth of a circle. At one end of the tube is an eye-piece; at the other, two plain glasses, the outer one ground. Between these glasses are bits of bright-colored glass, diaphanous beads, and the like. The reflection of these objects is multiplied by the mirrors, and constitutes a symmetrical image often of great beauty. It is of considerable use in the arts as an aid in devising new patterns for calico-printers and other decorative purposes.

Kaler'gis (DEMETRIUS), b. in the island of Candia in 1803, and educated at St. Petersburg by an uncle. In the war of independence he fought with great valor, but was taken prisoner by the Turks, who cut off one of his ears. Later on he partook with great passion in all political movements in his native country, and from 1843 to 1845 held the office of minister of war; but his influence was nevertheless not great, as he was suspected of receiving pay from Russia. After 1846 he lived partly in London, where he became intimately acquainted with Prince Louis Napoleon, partly in different places in Greece, until he was sent in 1861 as ambassador to Paris. D. at Athens Apr. 24, 1867.

Kalevala. See FINNISH LANGUAGE AND LITERATURE.

Kalgan', an ill-built but large and populous town of China, on the route from Peking to Kiakhta, on the Yang-ho, near the Great Wall, in lat. 40° 50′ N., lon. 115° 3′, and is of great importance for the overland trade between China and Russia.

Kalguev', or **Kolguev,** an island in the Arctic Ocean, belonging to the government of Archangel, Russia. It is inhabited only by a few Samoyed families, but visited each summer by a great number of fowlers on account of the multitude of eider-ducks, swans, and geese which brood here, and whose feathers and eggs are very valuable.

Kali'da, post-v., Union tp., Putnam co., O. Pop. 290.

Kalida'sa, an Indian poet, author of the drama *Sakuntalâ*, translated by Sir William Jones in 1789, and into German by Forster in 1790. Many other poems are attributed to him, but with less certainty. The date assigned to Kalidasa by different scholars ranges from the first to the eleventh century A. D.

Kaliha'ri Desert, the name of a large territory of Southern Africa, of undefined boundaries, but mostly extending between lon. 20° and 30° E., and between lat. 21° and 28° S. It consists of an almost level plain, without springs or streams. The surface is mostly covered with fine sand, resting on a bed of red sandstone, and in many places presenting a striking resemblance to Sahara. Rain is very rare. Grass-plains and groups of acacia trees form the transition from the desert to the fertile tracts. Ostriches, giraffes, and antelopes are met with.

Ka'lisch (DAVID), b. of Jewish parentage at Breslau Feb. 23, 1820; lived, engaged in literary pursuits, first in Paris, then in Leipsic, and at last in Berlin, where he founded *Kladderadatsch* in 1848, and d. Aug. 21, 1872. He also wrote a number of local farces, which were performed with great success on all the stages of Northern Germany. The songs of these farces and from *Kladderadatsch* have been collected under the title *Berliner Leierkasten.*

Ka'lispels, or **Pends d'Oreilles,** a tribe of Indians belonging to the Selish group, living in the Territories of Washington, Idaho, and Montana, and in British Columbia. They have been partially civilized by Catholic missionaries. The Montana band is the largest, numbering 1000; that in Idaho numbers 700, and that in Washington Territory, 400. The latter inhabits the valley of Kalispel, E. of Cascade range, which gives name to the tribe.

Ka'lisz, town of Russia, in the government of Warsaw, on the Prosna. It is one of the oldest Polish towns, situated in a fertile and well-cultivated region, and carrying on quite an extensive trade. Pop. 11,778.

Kalkas'ka, county of the southern peninsula of Michigan. Area, 540 square miles. It is traversed by the Manistee River and covered by dense forests. Pop. 424.

Kalkaska, post-v., cap. of Kalkaska co., Mich., on the Grand Rapids and Indiana R. R., 137 miles N. of Grand Rapids and 58 miles S. of Little Traverse Bay, in the midst of a vast lumber-region; has 1 newspaper and a fair provision of churches, schools, stores, and business accommodations. The streams are noted for a plentiful supply of brook-trout. The county was recently organized, and had but 424 inhabitants in 1870, since which time the village of Kalkaska has sprung up with a present (1874) pop. of about 1700. C. P. SWEET, ED. "KALKASKIAN."

Kalm (PETER), a Swedish botanist, b. in East Bothnia in 1715; was educated at Åbo and Upsal; travelled extensively in Europe; was sent by the Swedish government, at the instance of his friend Linnæus, to North America, where he travelled 1748–51; returned to Åbo, where he was botanical professor, and published (1753–61; in English 1772) an account of his American travels. He also published a large number of works on natural science and other subjects. D. Nov. 16, 1779.

Kal'mar, or **Calmar,** an old but interesting and well-built town of Sweden, is situated on an island in Kalmar

Sound, and communicates with its suburbs on the mainland by a long stone bridge. It has a good harbor, considerable trade, and some manufactures. In its old castle, now decayed, the treaty was signed in 1397 by which Queen Margrethe of Denmark united the three Scandinavian kingdoms, Sweden, Norway, and Denmark, under one crown. The instrument was poorly digested, making minute stipulations for petty affairs, and no provisions for great events. Thus it became a source of calamities to all the three kingdoms. In modern times, however, since the idea of a Scandinavian union has taken hold once more of the minds of the Scandinavian people, the failure of the first attempt has been forgotten, and the old city where it took place has become quite an object of enthusiasm. Louis XVIII. and Charles X. of France lived here during their exile. P. 8813.

Kal'mia [named in honor of Peter Kalm], a genus of shrubs of the order Ericaceæ, evergreens and natives of North America. The U. S. have at least six species, of which the mountain laurel, spoon-wood, or calico-bush (*K. latifolia*) is the best known. It is a large, handsome shrub, with beautiful flowers, highly ornamental in cultivation. The leaves of *K. angustifolia* are very poisonous when eaten by sheep. They have been employed in medicine.

Kaloc'sa, town of Hungary, on the Danube, 70 miles S. of Pesth. It is the see of an archbishop. In its immediate vicinity is Lake Kolon, famous for its delicate fish. Pop. 12,868.

Kalong. See Flying Fox.

Kalu'ga, government of European Russia, bounded by Smolensk, Moscow, and Tula. Area, 12,176 square miles. Pop. 984,255. The ground is low, the surface flat, the soil stony and not very fertile. The largest part of the country is covered with forests. Rye and oats are the common crops; flax and hemp are extensively cultivated; distilling and manufactures of linen are the chief branches of industry.

Kaluga, town of European Russia, the capital of the government of Kaluga, on the Oka. It has very important manufactures of sailcloth and leather, and an extensive trade in corn. Pop. 36,080.

Kalw, town of Würtemberg, on the Nagold, is the principal seat of the lumber-trade in the Black Forest. Pop. 5582.

Ka'ma, a river of European Russia, rises in the government of Viatka, and flows through Perne, Orenbourg, and Kasan, where, after a course of 1100 miles, it joins the Volga. It is navigable 40 miles from its sources, and forms a very important line of traffic.

Kamba'lia, or **Seraia,** a seaport in the Gulf of Cutch, on the W. coast of India, opened to commerce about 1870, and pronounced by the Indian coast survey to be one of the safest and most commodious harbors on the Malabar coast.

Kambalu', the ancient capital of the Chinese empire under Kublai Khan, the founder of the Mongol dynasty, was visited by several Europeans in the thirteenth century, who have described its magnificence. The ruins of Kambalu have recently been found a few miles to the W. of Peking.

Kamee'la, or **Kama'la,** a drug consisting of a red-brown powder from the capsules of *Rottlera tinctoria*, a small euphorbiaceous tree of India, China, and Australia. It is used in medicine for killing the tapeworm, which it usually accomplishes with great promptitude. It is a smart cathartic, and is used for skin diseases. In India it is extensively used as a dyestuff, making a deep red color.

Kameha'meha I., the conqueror and first king of the *entire* group of the Hawaiian (or Sandwich) Islands, at the death of his uncle, Kalaniopu, king of Hawaii, in 1781, inherited the head-chiefship of a part of that island. Of uncommon mental and physical quickness, strength, and courage, and with the advantage of some foreign-built vessels and the aid of firearms in the hands of a few Europeans, he soon conquered the other chiefs of that island, and one after another the other islands fell under his sway, so that in 1811 he was the acknowledged sovereign of the group, and had acquired the sobriquet of "the Napoleon of the Pacific." As a ruler he was vigilant and strict, placing authority only in trustworthy hands, and keeping near his person and under control those conquered and rival high chiefs from whom he had the most to fear. His friends and favorite warriors were liberally rewarded, and his enemies, if spared, closely watched. He valued the superior knowledge and skill of white men, and kept several employed as mechanics, etc. On May 8, 1819, a few months before the first missionaries of the A. B. C. F. M. sailed from Boston for his country, he died. By his queen of highest rank, Keopuolani, he left two sons and one daughter. The eldest son, Liholiho, succeeded him under the title of Kamehameha II. Charles R. Bishop.

Kamehameha II. (Liholiho) did not inherit the best qualities of his father. He was intemperate and given to pleasure; but by abolishing idolatry and the more oppressive tabus he prepared the way for the missionaries, who received permission to land and commenced their labors in Mar., 1820. Fearing that he might not be able to retain control of his kingdom, he desired to secure the friendship and protection of the king of Great Britain. In Nov., 1823, he sailed for England with his favorite queen (Kamamalu), a few chiefs, and servants. They were well received and kindly treated by the sovereign and people, but, taking the measles soon after their arrival in London, both king and queen died in July, 1824, childless. Their remains and their suite were returned to their island-home in H. B. M. ship Blonde, under command of Capt. Lord Byron.
Charles R. Bishop.

Kamehameha III. (Kanikeavuli), brother of Liholiho, came to the throne of the Hawaiian kingdom in 1833 (two of the queens of Kamehameha II., Kaahumanu and Kinau, having ruled successively as regents since 1823). He was educated by the American missionaries. Bright, amiable, wild, and dissipated in his youth, and always careless in the choice of his associates, he yet listened to good advice in affairs of state, and wisely followed it. In 1837 he married much below his own rank. In 1840 he gave his people a written constitution and a simple code of laws, and in 1852 a new and very liberal constitution. The independence of his government was acknowledged by the U. S. in 1842, and by Great Britain and France in 1843. With the concurrence of the chiefs he gave in 1848 lands in fee simple to the common people, so that nearly all heads of families were landholders. Treaties were made with the U. S. and with several European countries, and great progress was made in education, civilization, agriculture, and commerce. The king adopted as his heir and successor his youngest nephew, Alexander Liholiho. On Feb. 28, 1842, Lord George Paulet forced him to cede the islands to Great Britain, but Admiral Thomas, commander-in-chief of the squadron, restored the flag and sovereignty July 31, 1843. In 1846 a new code, establishing a more systematic government, with courts of various grades, was promulgated. The more responsible offices were filled by foreigners, of whom Rev. William Richards, Dr. G. P. Judd, R. C. Wyllie, William L. Lee, and Rev. R. Armstrong were the most prominent and useful. This king, called "Kamehameha the Good," deserved the love and gratitude of his people. D. in Dec., 1854, at the age of forty years, childless, and his adopted nephew succeeded him. Charles R. Bishop.

Kamehameha IV. (Alexander Liholiho) succeeded his uncle in Dec., 1854. He was educated in the Young Chief's School under the care of Mr. and Mrs. Cooke of the A. B. C. F. M. In 1849–50 he and his older brother, Lot Kamehameha, visited the U. S., England, and France. June 2, 1856, he married Emma, adopted daughter of Dr. T. C. B. Rooke, and May 20, 1857, a son, the prince of Hawaii, was born, to the great joy of the whole nation. Kamehameha IV. was a brilliant and agreeable gentleman, in accomplishments and talents superior to any other of his race; handsome in form, graceful, fond of military and civic parade, of sports and society, and generous to a fault. When excited with wine he was passionate and reckless. His love for his country and people was intense; his prospects for a long and prosperous reign seemed fair, and through his son he hoped for the perpetuity of his dynasty; but in Aug., 1862, the young prince died after a short illness. The king never recovered from the effect of the grief and disappointment caused by that loss, and it undoubtedly shortened his life. He took an active interest in the introduction and progress of the "Reformed Catholic Mission." The Queen's Hospital in Honolulu was established in 1860 by the aid of subscriptions solicited by him in person, and he kept up a deep interest in it to the end of his life. The rapid and constant decrease of his people was to him, as it also was to his brother and successor, a depressing and discouraging fact. D. Nov. 30, 1863. Charles R. Bishop.

Kamehameha V. (Lot Kamehameha) succeeded his younger and only living brother in Nov., 1863. He had been minister of the interior and commander-in-chief of the forces. Like his predecessor, he, too, was a well-educated and agreeable gentleman, though less accomplished and more retiring. His experience in public affairs, high rank, firmness, and commanding presence made him eminently fitted to be the ruler of his people, and at his accession he was even more popular with his native subjects than his brother had been. While prince he had been dissipated, but before he became king he reformed, and the change was permanent. On coming to the throne he declined to take the oath to the constitution of 1852, considering it not

binding upon him to do so, and that the constitution was too democratic for the good of his people. In 1864 he called a convention of the nobles and delegates of the people to make a new constitution, but disagreeing with the third estate, and believing the opposition to be factious and unreasonable, he dissolved the convention, granted the present constitution, and took the oath to support it. While the masses seemed to be quite satisfied with the change, by many he was severely censured for this step; but those who knew him the best, though disapproving of the manner in which the change was made, had, and now have, no doubt that patriotism and a determination to promote the interests of his government and people controlled his action. He was too proud to take much pains to disabuse the minds of those who misjudged and blamed him. Want of sympathy between the king and that part of the foreign community who were of radical, democratic, and progressive tendencies had the effect to make him suspicious and exclusive, and to strengthen the influence of those who for various reasons took more pains to agree with and please him—an influence not always wholesome or honorable. His energy and his disposition to engage in trade and speculation, for which he had not been trained, did not increase his estate, and in the latter part of his life he got the reputation of being avaricious and grasping. His character was a strange one. He was strong-minded, fearless, and firm, and yet superstitious; generous even to wastefulness with some, and with others close even to injustice; affectionate and confiding towards those who won his respect, and suspicious and reticent towards others equally worthy. Partly out of regard for the memory of his brother, and also from a real interest in good morals and education, he gave liberal aid to the Reformed Catholic Mission and its schools. He was never married, and left no heir to the throne. On his deathbed he requested his kinswoman, Mrs. Bernice Panahi Bishop, to become his successor, but she declined, and he expired soon after without making any appointment according to law. D. Dec. 11, 1872, that being his forty-second birthday. CHARLES R. BISHOP.

Ka'meke, von (GEORG ARNOLD CARL), b. June 14, 1817; entered the military service in 1834; in 1850 was made a captain in the staff, and from 1856 to 1858 was military attaché to the Prussian ambassador at Vienna. He was then created a lieutenant-colonel, and appointed chief of the engineering department of the ministry of war. In 1861 he received the command of a regiment of infantry, in 1863 became chief of staff of the 8th army corps, and in 1865 major-general and chief of staff of the 2d army corps. In this position he took part in the war of 1866 against Austria, and received the decoration *pour le mérite*. In 1867 he was made inspector-general of the engineering corps and the fortresses, and in 1868 lieutenant-general. In the war of 1870–71 with France he first commanded the 14th infantry division, occasioned the battle of Saarbrücken (Aug. 6, 1870), and took part in the battles of Aug. 14, 16, and 18. After the surrender of Metz he was ordered to take Thionville and lay siege to Mezières and Longwy. Hence he was called to Paris to superintend the works during the siege. After the war he occupied his old position as inspector-general of the fortresses and the engineering corps, and in 1874, when Gen. von Roon retired, he was made minister of war. AUGUST NIEMANN.

Kames (HENRY **Home**), LORD, b. at Kames, Berwickshire, in 1696; was educated at Edinburgh, and passed advocate in 1724; became a judge of the court of session, with the title of Lord Kames, 1752, and in 1763 became a lord of justiciary. He published several legal works, chiefly volumes of decisions and the like, but his fame mainly rests upon the *Principles of Morality and Natural Religion* (1751), and especially on the *Elements of Criticism* (1762), a work which once had a wide influence. As a jurist he was just and able. D. Dec. 27, 1782.

Kamin'etz Podolsk, town of Russia, in the government of Podolia, on the Smotritza, near the Austrian frontier. It is beautifully situated, fortified, and has a Gothic cathedral. Pop. 17,109.

Kamischin', town of European Russia, in the government of Saratov, at the influx of the Kamischinka in the Volga. It has some manufactures. Pop. 7651.

Kamouras'ka, county of Quebec, Canada, extending from the St. Lawrence to the State of Maine. It is traversed by the Grand Trunk Railway. Pop. 21,254.

Kamouraska, post-v. of Kamouraska co., Quebec, Canada, 90 miles below Quebec, on the S. shore of the St. Lawrence. It is a summer resort, and has a nunnery and academy. Pop. of v. 797; of parish, additional, 1484.

Kam'pen, town of the Netherlands, in the province of Overyssel, on the Yssel, near its outlet in the Zuyder-Zee. It was formerly a town of greater importance, but has still considerable manufactures of paper, ropes, bricks, and spirits. Pop. 13,902.

Kampen, van (NIKOLAAS GODFRIED), b. at Haarlem May 15, 1776; was apprenticed in a bookstore, but devoted himself with great zeal to the study of languages and history, and became professor at the University of Leyden in the Dutch language, literature, and history in 1816. He was a very prolific writer, but his principal work is *Geschiedenis der Nederlanden buiten Europa* (Haarlem, 1831–33). D. at Amsterdam Mar. 14, 1839.

Kämp'fer (ENGELBRECHT), b. Nov. 16, 1651, at Lemgo, in the principality of Lippe, Germany; studied medicine at Königsberg; accompanied in 1638 a Swedish embassy to Persia as secretary; went then with a Dutch fleet as physician to the East Indies and Japan; returned in 1692, and d. in his native town Nov. 2, 1716. Of his voluminous writings on the countries he visited, the *History of Japan and Siam* was published in London in 1727, in 2 vols., but most of the rest remain unpublished in the British Museum.

Kamptu'licon, a sort of floor-covering composed of gutta-percha and caoutchouc (or linseed oil), mixed with naphtha and powdered cork, and rolled into sheets, which are calendered, dried, and painted or printed in imitation of floor-cloths. It is expensive, but warm, noiseless, and waterproof. It is, however, not durable.

Kamptz, von (KARL ALBERT CHRISTOPH HEINRICH), b. at Schwerin Sept. 16, 1769; studied jurisprudence at Göttingen, and held from 1790 to 1830 different judicial positions in Mecklenburg and Prussia. From 1830 to 1842 he was Prussian minister of justice, and contributed very much, both by his writings and by his practical measures, to harmonize the different legislation of the several divisions of the Prussian state; but his bearing towards the liberal movements of his time was arbitrary and odious; the students burnt his *Codex der Gendarmerie* at Wartburg in 1815. D. at Berlin Nov. 3, 1849.

Kamtchat'ka, a large peninsula of South-eastern Siberia, 850 miles long, and at its greatest width 250 miles broad, extending between the Sea of Kamtchatka and the Sea of Okhotsk, and terminating in a long, narrow tongue forming Cape Lopatka. It is traversed from N. to S. by a range of volcanic mountains, whose craters mostly are extinct, though Klintchewskaia, 16,152 feet high, was seen in full activity in 1829. The soil is generally stony, though there are fertile valleys, especially that along the river Kamtchatka. But even here the land is unfit for agriculture on account of the severity of the climate. The winter lasts nine months, and frost is not rare in the summer; forests of birch and pine trees grow. The inhabitants, numbering from 5000 to 6000, are mostly Kamtchadales, who live by hunting and fishing. Bears, sable, foxes, otters, beavers, seals, and salmon abound. The only domestic animal is the dog, a peculiar species, large, strongly built, silver-gray or yellowish-brown. These dogs do not bark or howl, and, like the wolves, they see better during the night than in the daylight. They are sagacious and docile; when harnessed, ten or twelve couples, to a sleigh, they are governed by the voice and the whip, without reins. But they are exceedingly wild, attacking every animal they meet, and sometimes even children. They live on fish. The principal town is Petropaulovski, on the E. coast, in lat. 53° N.

Kanabec', county of E. Minnesota. Area, 540 square miles. It is traversed by Snake River, and is largely covered with forests of pine and larch. The surface is uneven. Cap. Brunswick. Pop. 93.

Kanaga'wa, town of Japan, on the Bay of Yeddo, 16 miles from the city of that name. In 1859, Kanagawa was opened to foreigners, and very soon it developed a considerable trade.

Kanai', one of the Hawaiian islands, situated in lat. 22° N., lon. 159° 30′ W. Area, 640 square miles. Pop. 4961. The highest point of the island, Waialeale, situated nearly in the centre, rises about 6000 feet. E. of this point the surface forms a table-land about 3000 feet high, but to the W. the descent is more abrupt to the low regions along the coast. Here are large tracts of arable land. Sugar is much cultivated; all tropical fruits grow abundantly. Koloa is the principal town.

Ka'naris (CONSTANTINE), b. in the island of Ipsara in 1790, and commanded a small merchant vessel when the war of independence broke out. But his exploits soon made his name known to the whole civilized world. June 19, 1822, he burnt a Turkish squadron in the canal of Chios; Nov. 22, another in the harbor of Tenedos; Aug. 17, 1824, a third at Cape Trogilion. In 1826 he commanded the frigate Hellas, and in 1827 a whole squadron, with which he drove the Turkish flag out of the Greek waters. Under King Otho and King George he held the office of minister

of war several times, though generally only for a short time. In 1851, King Otho attempted to buy off his opposition by a pension and the title of admiral, but failed; the captain declined both offers. In 1865 he was appointed inspector-general of the Greek navy.

Kana'wha, county of S. W. Central West Virginia. Area, about 1120 square miles. It is hilly and mountainous, but fertile. Iron, coal, and salt abound. The county is traversed by the Great Kanawha River and the Chesapeake and Ohio R. R. Tobacco, cattle, grain, and wool are the chief staples. Lumber and cooperage are manufactured, and salt is made by boiling natural brines. Cap. Kanawha Court-house, or Charleston, which is also capital of the State. Pop. 22,349.

Kanawha Court-house, the P. O. name of CHARLESTON (which see), the capital of West Virginia and of Kanawha co.

Kanawha River. See GREAT and LITTLE KANAWHA.

Kandahar. See CANDAHAR.

Kandiyo'hi, county of S. W. Central Minnesota. Area, 864 square miles. It is traversed by the St. Paul and Pacific R. R. It contains innumerable small lakes, has an undulating surface and a good soil, well adapted for wheat. Caps. Kandiyohi Station and Lake Elizabeth. Pop. 1760. Since the census of 1870, Monongalia co. has been united with it, so that the total pop. in 1870 was 4921.

Kandiyohi, tp. of Kandiyohi co., Minn. Pop. 558.

Kandiyohi Station, a post-v., one of the county-seats of Kandiyohi co., Minn. It is on the St. Paul and Pacific R. R., 98 miles from St. Paul.

Kan'dy, or **Candy,** town of Ceylon, situated nearly in the centre of the island, on an elevation 1676 feet above the sea. It is the seat of the government, has many Christian churches, Booddhist temples, and Mohammedan mosques. Close by is a beautiful artificial lake, 1½ miles long and from 100 to 500 yards broad. Pop. 7000.

Kane, county of N. E. Illinois. Area, 540 square miles. It is a rolling prairie region, with abundant limestone, some timber, and a very fertile soil. It is traversed by Fox River and numerous railroads. Live-stock, grain, hay, and dairy products are the great staples. Flour, cheese, machinery, and the celebrated Elgin watches (see ELGIN) are made in this county. Cap. Geneva. Pop. 39,091.

Kane, county of S. E. Utah, extending nearly across the Territory from E. to W. Area, estimated at 7550 square miles. It is traversed by the Colorado River, and contains a great variety of lands and much mineral wealth. Cap. Toquerville. Pop. 1513.

Kane, post-v. and tp., Greene co., Ill., situated on Jacksonville division of the Chicago Alton and St. Louis R. R., 25 miles N. of Alton, and 8 miles S. of the county-seat, Carrollton. It has 1 bank, 2 newspapers, several business-houses and 1 large school-house, and is surrounded by a fine farming country. Pop. of tp. 957. ED. "EXPRESS."

Kane, tp. of Benton co., Ia. Pop. 763.

Kane, tp. of Pottawattamie co., Ia. Pop. 1086.

Kane, post-v. of Wetmore tp., McKean co., Pa., on the Philadelphia and Erie R. R., 193 miles W. N. W. of Philadelphia. It is situated on the "Big Level," a fertile plain 2000 feet above the sea-level. It has grand forests of pine and other timber. Here are the repair-shops and round-houses of the railroad. Kane has a public park of 600 acres, besides several private parks and a number of schools and churches.

Kane (ELISHA KENT), M. D., a distinguished explorer, b. in Philadelphia Feb. 3, 1820, was the son of Judge J. K. Kane of that city. He was educated at the universities of Virginia and Pennsylvania; took his medical degree in 1843; entered the navy; was physician to the Chinese embassy; travelled in Asia, the Levant, and Western Africa; served in the Mexican war, in which he was severely wounded; sailed in 1850 under De Haven in the first Grinnell expedition in search of Sir John Franklin; commanded the second Grinnell expedition (1853–55), and discovered an open polar sea. For this expedition he received several gold medals and other distinctions. (See art. POLAR SEARCH, by Dr. I. I. HAYES.) His health, always delicate, was much impaired by the terrible sufferings of this expedition. He published a narrative of his first polar expedition (1853) and of his second (2 vols., 1856). D. at Havana Feb. 16, 1857. Dr. Kane was a man of active, enterprising, and courageous spirit, and of most generous impulses. A volume of his personal letters was published by his wife, Margaretta Fox. (See his *Life*, by Dr. W. Elder, 1858.)

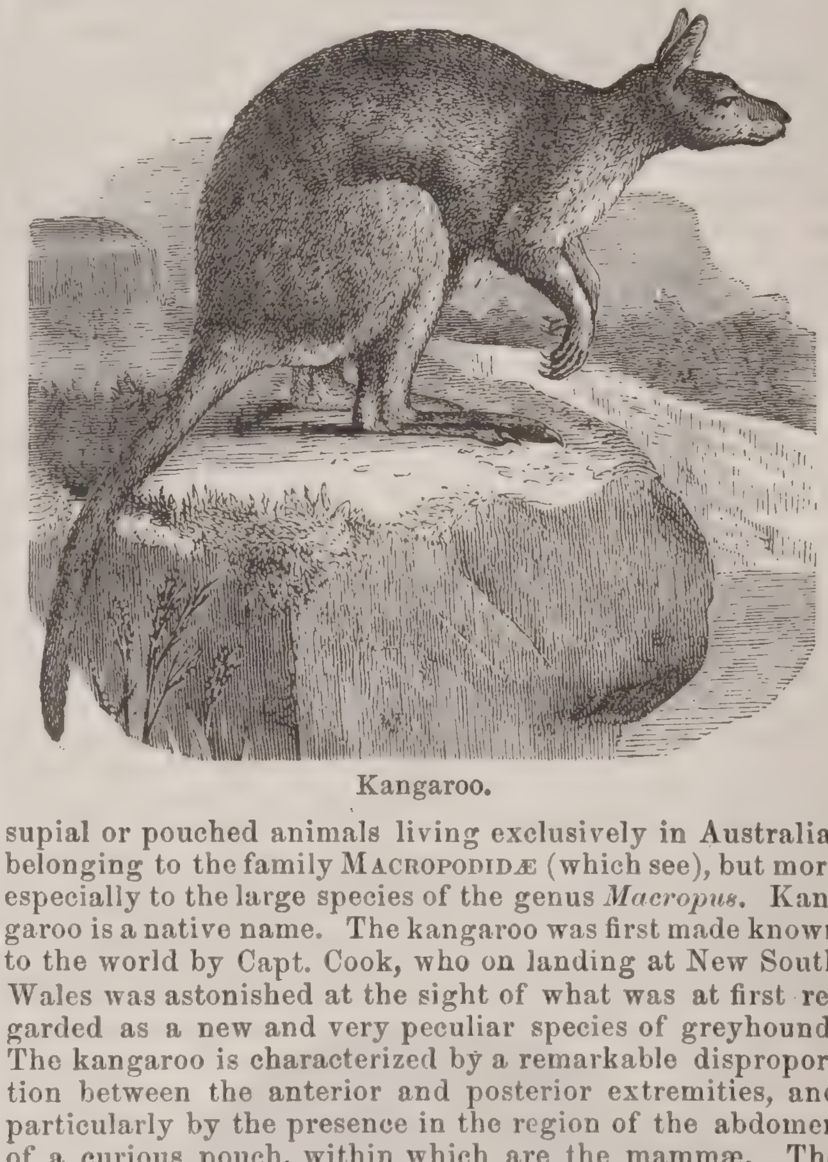
Kane (Sir ROBERT), M. D., LL.D., F. R. S., b. at Dublin in 1810; was long professor of chemistry in Apothecaries' Hall; was founder and (1832–34) editor of the *Dublin Journal of Medical Science;* was 1844–47 professor of natural history to the Royal Dublin Society; was for a time president of Queen's College, Cork; was knighted in 1846. Is a prominent member of many learned societies, and has been the recipient of many honors. Is widely known as the author of the *Elements of Chemistry* (1842) and the *Industrial Resources of Ireland* (1845).

Kane (THOMAS L.), b. at Philadelphia Jan. 27, 1822, brother of Dr. E. K. Kane, noticed above; was educated in Paris, where he was intimate with Auguste Comte and the democratic leaders of the day; was admitted to the bar at Philadelphia in 1846, but abandoned the law for civil engineering; visited the Mormon settlements in 1847, and acquired such influence among them that ten years later (1858) he was sent to Utah by the U. S. government as confidential agent to prevent the outbreak of hostilities. Returning to the profession of an engineer in Western Pennsylvania, raised and commanded in Apr., 1861, the famous regiment of mountaineers known as the Bucktail Rifles; was wounded at Dranesville and Harrisonburg, was taken prisoner at the latter engagement, exchanged in Aug., 1862, and appointed a brigadier-general of volunteers in September. D. 1875.

Kane City, post-v. of Cornplanter tp., Venango co., Pa. It has numerous oil-wells.

Kanes'ville, post-v. and tp., Kane co., Ill. Pop. 999.

Kangaroo', a name given to numerous species of marsupial or pouched animals living exclusively in Australia, belonging to the family MACROPODIDÆ (which see), but more especially to the large species of the genus *Macropus.* Kangaroo is a native name. The kangaroo was first made known to the world by Capt. Cook, who on landing at New South Wales was astonished at the sight of what was at first regarded as a new and very peculiar species of greyhound. The kangaroo is characterized by a remarkable disproportion between the anterior and posterior extremities, and particularly by the presence in the region of the abdomen of a curious pouch, within which are the mammæ. The male is without this development. The head is small and resembles that of the deer, having the same mild and placid expression, as well as delicate shape. The hind feet are provided with four toes, the middle one being much larger than the others, of great strength, and provided with a hoof-like claw. An examination of these stout and extremely long hind limbs shows how well adapted they are to aid the creature in its wonderful leaps. The tail, which is also very stout and strong, aids very materially in the leap. The fore legs are very short, and are provided with bent claws with which they hold food when eating. Kangaroos have no canine teeth; their incisors are six in the upper jaw, and but two in the lower. The molars are ten in number in each jaw, and are separated from the incisors by a long space. They are exclusively herbivorous in diet, associating in small herds under the guidance of older males. They vary in size greatly, some species being about the dimensions of a rat, while others are known to measure eight feet from the nose to the tip of the tail, and to weigh over 200 pounds. The young are produced in a very imperfect state, being in the largest species not more than two inches long at birth. The newborn creatures are conveyed by the mouth to the pouch, where they attach themselves to the teats, which they do not leave until able to walk. These animals are easily tamed, and are harmless



Kangaroo.

and timid, though when brought to bay in the wild state they are said to fight with great power, using their tail and hind feet. The flesh of the kangaroo is esteemed a delicacy in regions where they inhabit. J. B. Holder.

Kangaroo Apple, the *Solanum laciniatum*, a kind of tomato growing in South America, Australia, and some of the Pacific islands. It is useful as food, but not until perfectly ripe. The green fruit has sharply acrid properties.

Ka'nizsa, Gross-Kanizsa, or **Nagy-Kanizsa,** town of Hungary, inhabited partly by Germans, partly by Magyars, manufactures tiles and liqueurs, and carries on an import trade in corn, cattle, and wine. Pop. 11,722.

Kanka'kee, county of N. E. Illinois. Area, 590 square miles. It is bounded on the E. by Indiana, and consists chiefly of flat prairie. Its soil is productive. Live-stock, grain, wool, dairy products, and hay are the great staples. Carriages and wagons are leading articles of manufacture. The county is traversed by the Illinois Central and Chicago Danville and Vincennes R. Rs. Cap. Kankakee. Pop. 24,352.

Kankakee, city and tp., cap. of Kankakee co., Ill., 56 miles directly S. of Chicago, on the Illinois Central and the Cincinnati Lafayette and Chicago R. Rs., on the N. bank of Kankakee River, an affluent of the Illinois, now being improved for purposes of navigation; is situated on rolling prairie-land, with easy communication to extensive coal-fields and beds of bog-iron ore, in the midst of a rich farming and grazing country. Kankakee contains 13 churches, a public-school building costing $60,000, 1 national and 2 private banks, 4 weekly newspapers (1 in French), 1 sock, 1 woollen, and 2 button factories, several tanneries, and wagon and carriage manufactories. Two stone-quarries furnish fine building material, so that Kankakee is one of the best built towns of the State. It has excellent water-power, which is utilized by paper, planing, oil, and flour mills. There is a public library successfully managed by an association of ladies. Pop. of tp. 5189.
Arthur B. Holt, Local Ed. "Gazette."

Kankakee, tp. of Jasper co., Ind. Pop. 215.

Kankakee, tp. of La Porte co., Ind. Pop. 1185.

Kankakee River flows W. S. W. from St. Joseph's co., Ind., through English Lake and through a flat marshy region. Joined in Kankakee co., Ill., by the Iroquois or Des Plaines River, it flows N. W., and pours its sluggish waters into the Illinois.

Kan'kari, the ancient *Gangra*, town of Asiatic Turkey, in Asia Minor, on an affluent of the Halys, at an elevation of 2754 feet above the sea. It has several fine mosques, khans, bazaars, and public baths, and an important trade in salt. Pop. 18,000.

Kano', town of the empire of Sokoto, in Central Africa, situated in lat. 12° 2′ N. and lon. 8° 22′ E. It has large manufactures of cotton goods and an extensive and growing trade. Pop. 30,000.

Kano'na, post-v. of Bath tp., Steuben co., N. Y., on the Rochester division of the Erie R. R. Pop. 190.

Kan'sas, one of the central tier of Western States, and geographically *the* central State of the American Union, ly-

Seal of Kansas.

ing between the meridians of 94° 38′ and 102° of W. lon., and between the parallels of 37° and 40° N. lat. It is bounded on the N. by Nebraska, the 40th parallel forming the line of division; E. by Missouri, the Missouri River forming the boundary from the 40th parallel to Kansas City, and the meridian of 94° 38′ the remainder of the distance; on the S. by the Indian Territory, on the line of the 37th parallel; on the W. by Colorado, the 102d meridian forming the line of division. Its area is stated by the general land-office as 81,318 square miles, or 52,043,520 acres. The form of the State is a nearly perfect parallelogram, only the N. E. corner being clipped, in consequence of following the course of the Missouri River instead of the meridian of 94° 38′. Its length from E. to W. ranges from 391 to 410 miles; its breadth from N. to S. is 200 miles.

Surface, Elevation, Mountains, etc.—The whole State slopes gently from the foot-hills of the Rocky Mountains near its western border to the Missouri River. Along its eastern border, from Wyandotte and Kansas City, the elevation above the sea ranges from 648 feet to 707 feet; at Lawrence it is between 800 and 900 feet; at Fort Riley, 1300 feet; 10 miles W. of Fort Riley, 1459 feet; at the mouth of Saline River, 1592 feet; where the Arkansas River crosses the southern border of the State, about 1800 feet; near Fort Larned, 2004 feet; near Fort Dodge, 2330 feet; near the Arkansas River, at the W. line of the State, 3047 feet; at Pond Creek, on the Kansas Pacific, 3175 feet. The State has no mountains, but, though there are extensive prairies, it is very far from being a monotonous level. There are everywhere low hills or gentle undulations divided by depressed valleys existing, or former river-bottoms, or in some instances ravines or cañons which the streams have cut through the yielding soil.

Rivers, etc.—The Missouri River forms a part of the eastern boundary of the State, but receives no important tributaries from Kansas above the point where it turns eastward to flow through Missouri. At that point it is joined by the Kansas River, one of its largest affluents, which, rising in Colorado, traverses the State almost centrally from W. to E. The principal branches of the Kansas are—from the N., Solomon's Fork, Republican Fork, and Big and Little Blue rivers; from the S. W., Smoky Hill and Saline Forks. The eastern and south-eastern portions of the State are drained by the Osage, an affluent of the Missouri River, and the Neosho, Verdigris, Little Verdigris, and Walnut Creek, tributaries of the Arkansas River; while the southern and south-western portions are watered by the Arkansas and its branches; the principal of these are the Cimarron and its branches; Bear Creek; the Little Arkansas and its affluents; Chicaskia Creek, Ne-ne-scah or Good River, Turk or Salt Creek, and Pawnee Fork. The State is, as a whole, well watered, the eastern and middle portions better than the western, though the streams of that section are increasing in size and permanency with the progress of settlement and tree-planting. There are some marshes, but, we believe, no lakes in the State of any importance; the two or three claiming that name being only deserted river-beds.

Geology.—Eastern Kansas belongs to the coal-measures, which comprise in the State, in one body, a tract 208 miles in length, with an average breadth of 107 miles, and an area of 22,256 square miles. These are the lowest of the geological formations of the State, and are a continuation of the coal-field which covers North-eastern Missouri and Southern and South-western Iowa, and extends into the Indian Territory and North-western Arkansas. The thickness of the strata belonging to the coal-measures in the State varies from 403 feet to about 600 feet, the former being its extent in Leavenworth co., and gradually increasing thence southward. These strata contain two beds of bituminous coal—one of 13 feet in thickness, about 300 feet below the surface; the other, 100 feet lower, of 9½ feet thickness. Both are of good quality, but the lowest is the best. The dip of the coal-measures is very slight. There seems to be an anticlinal axis in Wyandotte co., the dip of the strata N. of it being to the N. W., and S. of it to the S. E. The Permian formation laps over the coal-measures on their western border, and in the valley of Blue River is said by Prof. Swallow to be 567 feet thick. To this succeed the Triassic, and probably the Jurassic formations, covering a triangular tract of territory, the apex of the triangle being at Fort Riley on the Kansas River, where the Republican Fork unites with it, and extending with a broad base through the Indian Territory into Northern Texas. In Kansas it extends from the point where the Arkansas River crosses the boundary into Indian Territory to the 101st meridian. It is not apparently rich in fossils, the few found being mostly ornithicnites and belonging to the Lias. The Cretaceous formation, which extends over the greater part of Dakota, South-western Iowa, and Eastern Nebraska, crosses Kansas from N. E. to S. W in a very irregular tract, pressed upon on the N. W. and on the S. by the Tertiary (Drift and Loess). It joins the Carboniferous formation at the N. E., then separates from it by the interposition of the wedge-shaped Triassic rocks, and about the central line of the State gives place to the Tertiary for a breadth of 140 miles, when it reappears in narrow belts, extending southward into New Mexico and North-western Texas. South-western and North-western

Kansas belong to the Drift period, the larger boulders being found as far S. as 38° 30′, while the deposits of pebbles are mainly confined to South-western Kansas. There are nowhere in the State striated or grooved rocks, or those which show marks of glacial action, and the presumption is that the drift must have been deposited in the geologic periods from icebergs. On the banks of the Missouri, and to some extent of the Kansas River, is found in large quantities the Loess or Bluff deposit, sometimes 100 feet in thickness, and rich in the later fossils, such as the *Mastodon* and the *Elephas giganteus*. The river-bottoms and the high prairies in Eastern and Middle Kansas are covered with heavy deposits of alluvium in thickness varying from 3 to 50 feet.

Economic Geology and Mineralogy.—Kansas contains, so far as is known at present, no valuable mines of the precious metals, and from its geologic formations it can hardly be expected that these will be found. But it has an ample supply of bituminous coal for all the States adjacent, and this of several qualities. Lime and hydraulic lime are abundant, salt springs exist in great numbers in different sections of the State, and salt of excellent quality is made. There are also many surface-deposits of salt of two or three inches in depth, the result of the evaporation of pools or streams flowing from salt springs. Marble and limestone suitable for building and ornamental purposes, and freestone or sandstone for building and other purposes, exist in the coal-measures. Gypsum is found in numerous places; alum and native sulphur, and alum and nitrate of potassa, occur together at several points. Brown hematite and other iron ores are found in considerable deposits, but have not been much worked, the Kansas coal near the surface not being well adapted to smelting purposes. Some lead is found in connection with zinc and manganese, but not in quantities sufficient to make its working profitable. Tin is reported, but its existence in paying quantities is more than doubtful. Petroleum undoubtedly exists, but at present prices its production would be unprofitable. Kaolin or porcelain clay and fireclays are found in extensive deposits. Moss agates, selenite, and other minerals exist in large quantities in Western Kansas. Fossils are found in the Jurassic formation, in the Drift, and in the Loess, some of them of great interest.

Vegetation and Botany.—The number of species of plants indigenous to Kansas is stated by the State botanist to be about 1200. About 600 of these are not in Gray's *Manual*, and are probably not found E. of the lower Missouri River. Kansas is not a State of large or dense forests, and much of its surface is prairie or plain. According to the agricultural report of the State, 95 per cent. is prairie and only 5 per cent. forest, but in the river-bottoms of the eastern and middle sections there is a considerable dense growth of deciduous trees, of the same class as are found in most of this region—the cottonwood, red and white elm, black walnut, some species of oak, sycamore, box-elder, hickory, and ash, hackberry, red, rock, and sugar maple, pecan, mulberry, coffee-bean, cherry, basswood, and occasionally clumps of cedar. The honey-locust, buckeye, and ailanthus have been introduced, and in some sections form considerable breadths of forest. There are few evergreens in the State except those which have been set out by settlers. In Western Kansas tree-planting has been extensively practised, and with great advantage. The Osage orange and osier are considerably used for hedges and fences. The rich prairies of Eastern Kansas are covered with tall and nutritious grasses, and in their season with beautiful flowers. In the W. the grama and buffalo grasses abound; they are well adapted to the dry but fertile soil, and furnish excellent pasturage. In the extreme W. the *Sarcobatis* (or pulpy thorn of Lewis and Clarke), the *Artemisia* or wild sage, and the *Obione* or greasewood grow in clumps.

Zoology.—The wild animals of Kansas are such as are common to the region known as "the Plains," extending from Dakota to Texas, and comprise among the mammals the black and brown bear, the wolf, possibly the lynx, the catamount or panther, the wild-cat, the opossum, raccoon, prairie-wolf, the buffalo in countless herds, the deer, antelope, two or three species of hare, several squirrels, field-mice, wood-rats, etc. The prairie-dog has for some cause nearly or quite disappeared from the State. Of the Reptilia, the number is not large; it includes the rattlesnake, moccasin, and one or more species of the black snake, two or three adders, and ten or twelve species of the innocuous snakes; and among batrachians, the horned frog, as well as several other species of frogs, toads, and lizards. The professor of natural history in the State University reports 290 species of birds belonging to Kansas as already described, and further research will probably increase the list to about 350. The rivers, except the Missouri, the main streams of the Kansas and Arkansas, and perhaps the Republican Fork of the former, are shallow and partly dry in the long hot summers, and are not in consequence so largely stocked with many varieties of fish as those which have a more perennial flow. There are generally the same species of fish found in the other affluents of the Missouri and Mississippi, and some experiments have been made in the way of stocking the larger streams with some of the best fish from the lakes and northern waters.

Climate.—The climate of Kansas is temperate and salubrious; the cold, though sometimes severe in winter, is not

TABLE I.—TEMPERATURES.

PLACES OF OBSERVATION.	Mean annual temp.	Highest temp. of the year.	Lowest temp. of the year.	Monthly Mean Temperatures. Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.	Deg. F.
Burlingame, Osage co., lat 38° 45′, lon. 95° 45′; alt. 900 ft.	52.90	100	—6	32.75	33.08	45.25	49.12	64.90	72.45	77.68	74.	66.	53.75	44.85	20.95
Manhattan, lat. 39° 13′, lon. 96° 39′; alt. 1000 ft.	*52.81	98	—12	18.50	27.70	49.40	46.60	67.00	74.30	80.20	71.10	60.70	53.10	38.10	25.30
Leavenworth, lat. 39° 15′, lon. 94° 52′; alt. 896 ft.	51.05	99	—29	19.	30.	42.10	48.60	63.	75.50	77.50	79.20	65.40	56.40	35.	21.
Lawrence, lat. 38° 58′, lon. 95° 16′; alt. 884 ft.	†54.20	108	—3	28.01	27.50	39.50	48.07	69.76	77.11	83.62	83.45	67.03	56.01	38.76	31.01

TABLE II.

STATIONS.	Lat.	Lon.	Alt.	Years.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Spring.	Summer.	Autumn.	Winter.	Year.
	First, or Eastern Belt.																				
Fort Leavenworth	39°21′	94°54′	896	10	1.22	1.94	2.30	2.67	4.30	3.39	4.94	3.24	3.29	2.16	2.13	2.97	9.27	11.57	7.58	6.13	34.55
Olathe	38 53	94 51	....	9	1.23	2.18	3.65	4.51	6.71	6.22	9.26	6.97	4.67	3.65	2.58	2.25	14.87	22.45	10.90	5.66	53.88
Manhattan	39 15	96 40	1100	9	0.52	1.63	1.36	3.10	2.37	4.86	4.90	3.52	3.35	1.69	1.52	1.06	6.83	13.28	6.56	3.21	29.69
Lawrence	38 58	95 12	850	6	1.34	0.97	2.08	2.72	4.09	3.60	5.16	3.31	3.23	2.61	1.72	1.85	8.89	12.07	7.56	4.16	32.68
Baxter Springs	37 01	94 44	....	6	2.71	1.65	2.51	2.92	3.98	3.62	3.89	5.37	2.56	3.37	2.37	2.94	9.41	12.88	8.30	7.30	37.89
Mean	......	......	....	....	1.35	1.73	2.01	3.15	4.82	4.94	5.03	4.30	3.36	2.56	1.98	1.84	9.99	14.26	7.90	4.92	37.07
	Second, or Middle Belt.																				
Fort Riley	39°03′	96°35′	1300	14	0.77	1.01	0.75	1.74	3.01	3.93	3.00	3.22	3.09	1.21	1.15	0.74	5.50	10.15	5.45	2.52	23.62
Fort Harker	38 44	98 15	....	2	1.67	5.25	2.08	1.93	0.50	2.44	4.81	0.80	4.26	3.15	0.75	3.23	4.51	8.05	8.16	10.15	30.87
Fort Larned	38 10	98 57	1932	4	0.44	0.84	0.22	2.18	2.68	1.05	1.83	1.01	2.11	0.27	0.76	0.23	5.08	3.89	3.14	1.51	13.62
Mean	......	......	....	....	0.79	1.75	1.12	2.12	3.18	2.69	3.40	1.79	3.29	1.38	0.65	1.45	6.42	7.87	5.33	3.99	23.61
	Third, or Western Belt.																				
Fort Dodge	37°30′	100°00	....	3	0.87	0.69	0.17	1.17	0.29	1.85	0.42	3.00	1.78	2.73	0.20	0.73	1.63	5.27	4.71	2.29	13.90
Fort Atkinson	37 47	100 14	2330	1	0.04	0.49	0.96	3.38	9.34	4.35	3.00	2.80	3.85	6.81	1.39	1.60	13.68	10.15	12.05	2.13	38.01
Fort Wallace	38 51	101 50	....	4	0.45	0.14	0.03	2.06	2.60	1.49	3.35	1.34	1.51	0.76	0.14	0.07	4.69	6.18	2.41	0.66	13.94
Fort Lyon	38 08	102 50	4000	1	0.32	0.12	0.16	2.09	4.84	1.40	2.53	0.37	0.04	0.00	0.07	0.15	7.09	4.30	0.11	0.59	12.09
Mean	......	......	....	....	0.42	0.36	0.33	2.17	4.27	2.27	2.32	1.88	1.79	2.57	0.45	0.64	6.77	6.47	4.82	1.42	19.48

* Mean of 23 years. † Mean of 7 years, 53.14.

protracted, and the prevalent dryness of the atmosphere renders it less trying than it would otherwise be; the heat of summer, though at times very great at midday, is always tempered by cool breezes at night. The mean temperature of the year varies with the altitude and the degree of moisture, which is greater in the eastern than in the western portion of the State. The winds are often high, especially in the winter, the southerly winds exceeding those from the N., N. W., or N. E. in the proportion of 11 to 9. The preceding tables give the temperatures at different points in the State, and the rainfall in several localities far apart, for different years and for the several seasons.

The rainfall is best shown by statistics from the three longitudinal belts in Eastern, Middle, and Western Kansas, as in Table II.

Soil and Agricultural Productions.—The soil of Kansas, though of two kinds—the alluvium of the river-bottoms and lower prairies, and the upland or plains—is all of it very fertile. Probably no State in the Union has so little waste or worthless land. The rich and fertile loam of the river-bottoms, from 3 to 50 feet deep, at first attracted the attention of the settlers; but it has been found that even the lands of the western part of the State, forming a portion of what was known as the "Great American Desert," will yield with moderate irrigation, or without it where groves of trees have been planted, from 40 to 60 bushels of wheat to the acre. Table III. gives the amount of the principal crops gathered in the State in 1874, according to the assessors' returns in Dec., 1874. These, being procured for the purpose of taxation, are generally considerably below the truth. It will be remembered that 1874 was the "locust or grasshopper" year, and that Indian corn and some other crops were greatly diminished by these pests. The corn crop of 1873 was in round numbers nearly 39,000,000 bushels, and with the increased acreage that of 1874, but for the "grasshoppers," would have amounted to not less than 46,000,000 bushels if an average crop. There are to be added to this table several other items of statistics, which are most conveniently stated in a different form. Of dairy products, there were produced in the State in 1873, 151,172 pounds of cheese made in cheese-factories, and 143,922 pounds made in families; in 1874

TABLE III.—*Principal Crops grown in Kansas in 1874, with the Acreage in 1873 and 1874, the Quantity and the Value of the Crops of 1874, according to the Assessors' Returns:*

PRODUCTS.	Amount of product in 1874.	Value of product in 1874.	Acreage for 1873.	No. acres cultivated in 1874.
Winter wheat, bushels.	6,870,606	$5,794,008	252,724	438,179
Rye, bushels	421,261	289,117	23,184	30,546
Spring wheat, bushels.	3,010,777	1,837,663	145,566	278,026
Corn on sod, bushels.	15,699,078	12,283,142	112,269	156,239
Corn on old land, bushels.			1,142,070	1,369,182
Barley, bushels	414.188	329,488	22.784	24,115
Oats, bushels	7,700,586	4,064,424	277,729	314.926
Buckwheat, bushels	113,664	170,499	6,405	7,866
Irish potatoes, bushels.	1,072,260	1,247,817	41,653	46,164
Sweet potatoes, bush's.	192,213	249,511	2,237	2,617
Sorghum, gallons	912,125	540,338	9,908	14,103
Castor beans, bushels	123,637	152,005	2,915	8,815
Cotton, pounds	89,655	11,657	810	1,739
Flax, pounds	174,698	265,704	6,462	16,844
Hemp, pounds	2,331,126	116,560	1,643	3,136
Tobacco, pounds	293,828	29,384	3,116	507
Broom corn, pounds	2,677,550	123,317	......	4,176
Millet, tons	67,342	483,312	19.910	40,225
Hungarian, tons	21,069	142,469	12.659	15,101
Timothy meadow, tons.	34,067	252,817	21,616	29,601
Clover meadow, tons	25,381	215,756	13,484	13,967
Prairie meadow under fence, tons	322,984	1,421,746	433.190	433.968
Timothy pasture, acr's.	......	......	1,679	5,016
Clover pasture, acres	......	......	2,948	3,793
Blue-grass pasture, acres	......	......	12,203	13,776
Prairie pasture under fence, acres	......	......	465,793	397,142
Total	......	$29,920,734	3,037,957	3,669,769

the cheese-factories had increased so much that they manufactured 289,401 pounds, and the family product had slightly decreased, being 141,448, the total production of cheese in the State in 1874 being 430,849 pounds against 295,094 pounds in 1873. There were produced in 1873, 6,814,693 pounds of butter, and in 1874, 7,457,110 pounds. The number and value of farm animals, and the number and product of hives of bees, in 1873 and 1874, were respectively as follows:

Year.	Horses.		Mules and Asses.		Cattle.		Sheep.		Swine.		No. of hives or stands of Italian bees. 1874.	No. of stands of native bees. 1874.	No. of pounds of honey in 1873.	No. of lbs. of wax in 1873.
	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.	Number.	Value.				
1873	176,161	$10,393,499	17,816	$1,362,971	634,021	$13,314,441	51,166	$119,728	380,701	$2,093,852	....	....	33,312	1540
1874	202.962	10,391,633	22,034	1,388,142	749,959	13,124,273	84,838	169,676	356,916	2,673,174	2117	9032		

The number of acres of nurseries, of acres and products of orchards and vineyards in 1874, was as follows: acres of nurseries, 5071.74; acres of orchards, 100,839.61; bushels of fruit produced, 124,937.61; acres of vineyards, 5558.87; gallons of wine made from crop of 1873, 13,561.42; pounds of grapes produced in 1874, 2,345,318.

Manufacturing and Mining Industries.—According to the census of 1870, Kansas had 1477 manufacturing and 26 mining establishments, employing together 30,987 persons, of whom 28,038 were men, 1159 women, and 1790 children. The capital employed was estimated at $29,456,939; the wages paid, at $9,572,624; the materials used, at $29,504,085; and the annual product, at $54,800,087. This includes blacksmiths' shops and a great variety of small industries not requiring much machinery or power. The returns to the county boards of assessors include none of these, nor the cigar manufactories, breweries, or machine-shops of the different railroads. The cigar-factories and breweries are, however, returned for internal revenue purposes. The county boards report for 1874, 65 saw-mills (50 steam and 15 water-power), with a capital of $250,794; 139 flour-mills (80 water-power and 59 steam), with a capital of $2,106,105; 27 saw and grist mills (13 water-power and 14 steam), with a capital of $135,392; 13 furniture and cabinet factories, with a capital of $157,820; 5 foundries and rolling-mills, with $195,000 capital; 6 woollen-factories, with $111,600 capital, and 50 miscellaneous factories, embracing oil, cheese, gypsum, soap, and carriage factories, having a capital of $567,916. These returns are obviously very incomplete. There were also 72 cigar manufactories and 1 tobacco-factory reported to the assessors of internal revenue, whose annual product was estimated at about $272,500; and 43 breweries, having an annual product of $274,021.25. The central position of Kansas, its numerous railways, its excellent supply of coal, and its fine water-power, as well as the absence of any great mining interests, indicate that it is destined to become one of the great manufacturing States of the Union.

Railroads.—The entire number of miles of main track of railways completed and in operation on Jan. 1, 1874, according to the assessors' reports for 1874, was 1839 miles and 142 feet. The valuation of this property for purposes of taxation was $14,711,277.92, which was probably a little more than one-fifth of the cost of road, land, and equipment. On Jan. 1, 1875, according to Poor's *Railroad Manual*, there were in the State 2480.88 miles of railway, and the cost of roads, equipment, etc. was $74,617,856. Two of these railways traverse the whole breadth of the State from E. to W.—viz. the Kansas Pacific, extending from Kansas City on the Missouri to Denver and beyond, a distance of about 672 miles; and the Atchison Topeka and Santa Fé, extending from Atchison, also on the Missouri, to Granada in Colorado, 528 miles with its branches, and destined to be speedily completed to Santa Fé. The other important railways are the Missouri Kansas and Texas, 256 miles in the State, including branches; the Leavenworth Lawrence and Galveston, 207 miles, including branches; Missouri River Fort Scott and Gulf, 159 miles; St. Joseph and Denver City, 136 miles in the State; Atchison and Nebraska, about 40 miles in the State; central branch Union Pacific, 100 miles; Kansas City St. Joseph and Council Bluffs, 71 miles in the State; Kansas Central (Leavenworth to Holton), 56 miles; St. Joseph and Topeka, 87 miles; Kansas Midland (Kansas City and Topeka), about 60 miles; St. Louis Lawrence and Western (from Pleasant Hill to Carbondale), about 69 miles in the State; some branches of the Kansas Pacific, as Leavenworth branch, 27 miles, Junction City and Clay Centre branch, 33 miles. The rapid building and completion of so many railways in the State has contributed greatly to its development and increase in population. The *telegraph* lines of the Western Union accompany all or nearly all of the railways, and the Atlantic and Pacific have also lines to most of the towns.

Finances.—The receipts into the State treasury from all sources, exclusive of balances, during the fiscal year ending Nov. 30, 1874, were $995,102.89, and the expenditures, exclusive of transfers, were $976,805.82. The amount received from direct taxes only was $690,253.59; from all other sources, $304,749.30. Of the amount received from taxes, $461,095.59 was for general revenue purposes, $22,988.83 for the sinking fund, $91,715.79 for payment of interest on public debt, and $114,453.38 for the annual

school fund. The receipts from other sources than taxes were credited, with the exception of a very small amount, to the permanent and annual school funds. The bonded indebtedness of the State was $1,341,775, but of this amount $703,825 is held by the sinking fund and other permanent funds in the State treasury, so that the debt of the State, except to its own funds, is only $637,950. There is no floating debt, but there was a balance in the treasury Nov. 30, 1874, of $222,880.05. The permanent school fund on Nov. 30, 1874, amounted to $1,125,309.32. The valuation of all the property of the State, as fixed for taxable purposes for the year 1874, was $128,906,519.80, an increase of $36,780,658.80 since 1870. The true valuation in 1870 was $188,892,014, and would now be probably not less than $260,000,000. The State-tax of 1874 for all purposes was six mills on the dollar. There were in the State 16,996,746 acres of taxable lands, of which 3,669,769 acres were under cultivation, an increase of 633,000 acres over the preceding year.

Commerce.—As an interior State with no large navigable stream except the Missouri, which washes its N. E. border, Kansas can have no foreign commerce except that which is conducted through the ports of other States. But her internal commerce, transacted mainly by means of her railways, is very large. She ships eastward corn, wheat, and other cereals, considerable quantities of cotton, cattle in large numbers, driven from Texas and Colorado to her rich and abundant pastures, broom corn, and moderate quantities of other products. Abilene, Junction City, Salina, Ellsworth, and some of the other southern towns are the centres of the cattle-trade. In 1872 her internal commerce had reached $114,000,000, and since that time, in spite of drought and "grasshoppers," it has rapidly increased.

Banks, Insurance Companies, etc.—There were on Nov. 30, 1874, 26 national banks in the State, having an aggregate capital of $1,983,000, and deposits amounting to $2,994,330. There were at the same time 86 banks other than national (a considerable number being private banks), with an aggregate capital of $1,588,006, and deposits to the amount of $2,399,616; making an aggregate banking capital of $3,571,006, and of deposits of $5,493,946. There are in the State 2 life insurance companies—viz. the Missouri Valley Life Insurance Co., incorporated in 1867, having a capital of $209,452.76, mostly invested in bond and mortgage, and the Alliance Mutual Life Association, organized in 1873, with a capital of $105,506.25, similarly invested. The former reported in 1873 assets to the amount of $871,898. Both are in Leavenworth. There is one fire insurance company, the Kansas, also located at Leavenworth, incorporated in 1864, and reporting in 1873 a capital of $250,000 and assets of $258,960. Both capital and assets consist in part of notes.

Population.—The following table gives the total population of Kansas, by sexes, races, and nativity, in 1860, 1870, and 1874, so far as ascertained:

Years of census.	Total population.	Males.	Females.	White.	Colored.	Indian.	Of native birth.	Of foreign birth.	Of school age, males.	Of school age, females.	Over 21 years, males.	Between 18 and 45 years, males.
1860......	107,206	59,178	48,028	106,390	627	189*	94,515	12,691	18,623	18,800	31,037	27,976
1870......	373,299	202,224	162,175	346,377	17,108	9,814	316,007	48,392	55,669	53,041	105,671	95,002
1874†.....	530,367	246,939	228,875	....	....	....	....	....	101,872	97,138	120,087	

The density of the population of Kansas in 1870 was 4.48 persons to the square mile; in 1874, 7.37 to the square mile. The census of 1870 reported 123,852 persons engaged in all occupations, of whom 73,228 were engaged in agricultural pursuits, being 59.13 per cent. of the whole; 20,736 in personal and professional occupations = 16.74 per cent.; 11,762, or 9.5 per cent., in trade and transportation; and 18,126, or 14.63 per cent., in manufacturing, mechanical, or mining pursuits.

Education.—The following are the statistics of the public schools for the year ending Nov. 30, 1874: number of school districts, 4395; total number of persons of school age in the State, 199,010; total number of persons enrolled in public schools, 135,598 (68,978 males and 66,620 females); average daily attendance in public schools, 77,386; average length of time school is taught, 5.5 months; number of male teachers in public schools, 2360; of female teachers, 2683. Average monthly wages paid—male teachers, $37.24; average monthly wages of female teachers, $28.69; amount paid for teachers' wages for the year, $723,568.63; amount expended for repairs and incidentals, $51,263.70; amount received from semi-annual dividends of State school money, $261,952.62; amount raised by district tax, $895,093.85; total amount derived from various sources for public schools, $1,638,977.99. Number of school-houses—log, 328; frame, 2606; brick, 139; stone, 470; total, 3543, of which 399 were built during the year; total value of school-houses, $3,989,065.87; total value of apparatus, $40,697.06. The public-school expenditure per head of the population of school age (5 to 21 years) is $7.94, and per head of the actual population of school age (6 to 16 years) is $11.31. Twenty-six cities and towns have complete systems of graded schools, comprising primary, intermediate, grammar, and high schools. In these schools in 1874, 232 teachers were employed, 16,760 children were enrolled, and 9018 in daily attendance. Of these, 1064 were pupils in the high schools. There were 70 school buildings occupied by these graded schools, many of them costly buildings, ranging from $7000 to $55,000 each. There are 4 normal schools in the State—at Emporia, Leavenworth, Concordia, and Quindaro. The last named is for the training of colored teachers. The school at Concordia, Cloud co., in the N. W. part of the State, was opened in Sept., 1874. Emporia had 236 pupils enrolled, 191 of them normal; Leavenworth, 235, all normal; Concordia, 66, all normal; Quindaro, about 55. Teachers' institutes are held in the larger counties. The other State institutions of higher education are (1) the State Agricultural College near Manhattan, on a farm of 415 acres, having an endowment valued at $432,506. In 1874 it had 13 professors and instructors, and 112 male and 58 female students—170 in all. The course of study is extensive, but thorough and practical. (2) The University of Kansas, at Lawrence, partially endowed with university lands (about 46,000 acres), and receiving from the legislature an appropriation varying from $23,000 to $30,000 to supplement the present lack of receipts from its landed endowment. In 1874 it had 10 professors and instructors and 173 students—58 in the collegiate and 115 in the preparatory department. The following are the other collegiate institutions in the State in 1874:

Name of institution.	Place.	Date of organization.	Denomination controlling.	Number of instructors.	Students. In preparatory dept.	Students. In collegiate dept.	Males.	Females.	Endowment and property.	Libraries.
Baker University....................	Baldwin City..	1857	Methodist Episcopal..	7	82	19	61	40	30,000	1,000
College of Sisters of Bethany..	Topeka	1870	Protestant Episcopal.	9	48	27	...	75	60,000	1,000
St. Benedict's......	Atchison........	1868	Roman Catholic........	7	95	15	95	...	47,000	2,000
St. Mary's..............................	St. Mary's......	1869	Roman Catholic........	9	121	...	121	...	150,000	1,800
Washburn..............................	Topeka	1865	Congregationalist.....	3	24	6	20	10	101,000	5,000
Highland	Highland	1858	Presbyterian............	6	145	25	103	67	60,000	5,000
Lane......................................	Lecompton.....	1858	United Brethren.......	2	70	11	47	34	26,000	1,000

Ottawa University, under the control of the Baptists, at Ottawa, has suspended operations. There are 10 academies or collegiate schools—5 of them Catholic—and a considerable number of private schools of more or less merit. The institutions of special instruction in the State are—the deaf and dumb asylum at Olathe, incorporated in 1866: it had in 1874, 6 instructors and about 70 pupils; the institution for the blind at Wyandotte, incorporated 1866, and having 6 instructors and 28 pupils in 1874; 2 orphan asylums, both at Leavenworth—the Kansas with 28 orphans, and the St. Vincent's with 52.

Of charitable institutions the State has a State insane asylum at Ossawatomie. This institution is still unfinished, but had under treatment during the year 172 patients, with an average of 115, and on Nov. 30, 1874, 110 present, of whom 58 were males and 52 females; 10 had died during the year, and 52 had been discharged, of whom five were not insane, 23 were recovered, 13 improved, and 9 un-

*Only Indians not in tribal relations were enumerated in 1860. The number was unofficially stated as 8000.

† The enumeration of 1874 is by the township assessors, and is imperfect, 5 counties being omitted, as well as many townships and all the settlers in the unorganized counties. It is believed that the population of the State is nearly 600,000.

improved, while 2 eloped. The home for friendless women at Leavenworth has received aid, and during the year 1874 had 200 inmates.

The principal penal institution of this State is the State penitentiary at Leavenworth, which in 1874 had 40 officers and employés, and an average of 362 prisoners; its annual expenditure was $130,669.86, and the total earnings $23,000; the salaries paid to employés and officers amounted to $77,000. There is as yet no reformatory school in the State, though preliminary steps have been taken looking to the organization of one. The county jails, especially in the new counties, are not generally well managed.

Churches.—We are indebted to the *Third Annual Report of the Kansas State Board of Agriculture for the year 1874* for valuable statistics in regard to the condition of the seven principal denominations in the State for that year (as well as for very much other valuable statistical matter relative to the State). The following are their aggregates: Presbyterians, 161 churches, 74 church edifices, 6604 members, value of church property, $294,855; Congregationalists, 113 churches, 48 church edifices, 3831 members, $238,500 of church property; Baptists, 229 churches, 53 church edifices, 9789 members, $226,900 of church property (the *Baptist Yearbook* for 1875 gives in 1874, 242 churches and 162 ministers); the United Presbyterians reported 39 churches, 14 church edifices, 1313 members, and $49,200 of church property; the Methodists (this probably includes the various Methodist bodies), 621 churches, 96 church edifices, 22,096 members, and $339,400 of church property (the Methodist Episcopal conference reports for 1874 give 160⅔ church edifices, valued at $395,550, and parsonages worth $19,900; 19,162 members, of whom, however, 3458 were probationers; 108 travelling and 147 local preachers). The Protestant Episcopal Church is reported as having 34 parishes, 22 church edifices, 1136 communicants, and $172,000 of church property. The *Church Almanac* for 1875 claims but 30 parishes, 25 clergy, and 1041 communicants. The Roman Catholics are reported as having 191 congregations, 72 church edifices, 32,311 Catholic population, and church property worth $415,200. The *Catholic Directory* for 1875 gives the church edifices (including 7 building) as 62; the number of congregations as 180, of which 117 are very small missions, in most cases not attended oftener than monthly by the hard-working clergy; the whole number of priests (secular and of the religious orders) was but 48, and the Catholic population was roughly estimated at about 35,000. These statistics include also the few stations of the Catholics in the Indian Territory. These statistics show in these seven denominations 1388 churches or congregations, against 530 of all denominations reported in the census; 379 church edifices, against 301 for all denominations; and a valuation of church property of $1,736,055 for the seven denominations, against $1,722,700 for all denominations in 1870. We find further that the Christian Connection, as reported in the census, had in 1870, 35 churches, 16 church edifices, 4550 sittings, and $45,300 of church property; the Evangelical Association (probably included in the Methodists above), 2 churches, 1 church edifice, 300 sittings, $6000 of church property; the Friends, 7 meetings, 7 meeting-houses, 1600 sittings, $13,300 of church property; the Lutherans, 9 churches, 5 church edifices, 1400 sittings, $12,500 of church property; the German Reformed, 1 church, 1 church edifice, 275 sittings, $3000 of church property; the Unitarians, 2 congregations, 1 church edifice, 400 sittings, $20,000 of church property; the United Brethren in Christ (possibly included under Methodists above) in 1874 had 120 churches, 60 ministers, 2173 members, and probably $60,000 in church property; the Universalists had 9 congregations, 10 ministers, 146 members, and probably about 1600 regular attendants. There were also a number of union churches, a few Cumberland Presbyterian, and a few Jewish synagogues.

Newspapers.—There were in 1874, 133 newspapers and periodicals published in Kansas, not counting the weekly editions of the daily papers. Of these, 11 were dailies, with an aggregate circulation of about 28,000, 1 tri-weekly, 118 weeklies, and 3 monthlies. The circulation of the weeklies was a little more than 100,000; that of the monthlies, about 8500. Two were in the German language, 1 was medical, 1 educational, 2 religious, 8 agricultural, and the remainder either political, literary, or miscellaneous.

Counties.—The following table shows the population of the 74 organized counties of the State in 1860, 1870, and 1874, and the date of organization of the counties. The names of the counties are as they appear in 1874; some have been changed since 1860. Besides these, there are 30 counties, named, but not yet organized, several of which have a population of 100 to 200, of which no account has been made in the table. The names of these unorganized counties are—Arapahoe, Buffalo, Clark, Cheyenne, Decatur, Foote, Grant, Graham, Gove, Greeley, Hodgeman, Hamilton, Kansas, Kearney, Kiowa, Lane, Meade, Rush, Râwlins, Sequoyah, Stafford, Stanton, Stevens, Seward, Sherman, Sheridan, Scott, Thomas, Trego, and Wichita:

COUNTIES.	1874.	1870.	1860.	When organized.
Allen	6,953	7,022	3,082	1855
Anderson	6,213	5,220	2,400	1855
Atchison	18,234	15,507	7,729	1855
Barbour *	608			
Barton *	860	2	....	1872
Bourbon	17,231	15,076	6,101	1855
Brown	8,418	6,823	2,607	1855
Butler	9,076	3,035	437	1855
Comanche †	250			
Chase	2,903	1,975	1,046	1859
Cherokee	10,980	11,038	1,501	1866
Clay	4,689	2,942	163	1866
Cloud	7,165	2,323	....	1866
Coffey	6,818	6,201	2,842	1859
Cowley	9,584	1,175	158	1870
Crawford	8,318	8,160	....	1867
Davis	5,079	5,526	1,163	1855
Dickinson	6,407	3,043	378	1857
Doniphan	13,370	13,969	8,083	1855
Douglas	23,262	20,592	8,637	1855
Edwards	632	....	....	1874
Ellis	925	1,336	....	1867
Ellsworth	3,273	1,185	....	1867
Ford	333	427	....	1873
Franklin	11,646	10,385	3,030	1855
Greenwood	6,339	3,484	1,077	1862
Harper †	300	....	....	1873
Harvey *	3,600	....	....	1872
Howard	13,872	2,794	19	1870
Jackson	6,583	6,053	1,936	1857
Jefferson	12,498	12,526	4,459	1855
Jewell	7,674	207	....	1870
Johnson	13,478	13,684	4,364	1855
Kingman †	300	....	....	1873
Labette	13,265	9,973	....	1867
Leavenworth ‡	27,935	32,444	12,606	1855
Lincoln	2,220	516	....	1870
Linn	10,859	12,174	6,336	1855
Lyon *	12,340	8,014	3,515	1858
Marion	4,066	768	74	1865
Marshall	10,122	6,901	2,280	1855
McPherson	4,837	738	....	1870
Miami	12,370	11,725	4,980	1856
Mitchell	5,473	485	....	1870
Montgomery	10,946	7,564	....	1869
Morris	4,306	2,225	770	1858
Nemaha	8,041	7,339	2,436	1855
Neosho	11,324	10,206	88	1864
Ness †	200	2	....	1873
Norton	844	....	....	1872
Osage	10,837	7,648	1,113	1859
Osborne	3,890	33	....	1871
Ottawa *	4,070	2,127	....	1866
Pawnee	710	179	....	1872
Phillips	2,409	....	....	1872
Pottawattamie	10,054	7,848	1,529	1856
Pratt †	300	....	....	1873
Reno	6,467	....	....	1872
Republic	8,020	1,281	....	1868
Rice	2,369	5	....	1871
Riley	6,737	5,105	1,224	1855
Rooks	567	....	....	1872
Russell *	815	156	....	1872
Saline *	8,742	4,246	....	1859
Sedgwick	7,429	1,095	....	1870
Shawnee *	20,916	13,121	3,513	1855
Smith	4,460	66	....	1872
Sumner	5,602	22	....	1871
Wabaunsee	4,663	3,362	1,023	1859
Wallace *	600	538	....	1868
Washington	7,860	4,081	383	1860
Wilson	9,372	6,694	27	1865
Woodson	4,861	3,827	1,488	1855
Wyandotte	11,551	10,015	2,609	1859

Principal Towns.—Leavenworth is the largest town and city in the State, having a population in 1874 of 16,468; Atchison had about 9000 inhabitants; Topeka, the capital, and Lawrence, about 8000 each; Fort Scott and Wyandotte, between 4000 and 6000; Ottawa, Emporia, Wichita, Junction City, and Parsons, between 2000 and 4000; Olathe, Osage Mission, Paola, Hutchinson, and Manhattan, between 1500 and 2000; Troy, Wathena, Osage City, Burlington, Eldorado, La Cygne, and Humboldt, about 1200; while Baxter Springs, White Cloud, Grasshopper Falls, Pleasanton, Oswego, Independence, Council Grove, Seneca, Salina, and Fredonia all exceeded 1000 inhabitants. Marysville, Newton, Oskaloosa, Chetopa, Burlingame, Neodesha, and Abilene are all thriving and growing towns, and some of them incorporated as cities.

Constitution, Courts, Representation in Congress, etc.—The present constitution of Kansas, though the fourth in its history, is the one under which the State was admitted into the Union in 1861. It provides that male citizens of the U. S., or persons of foreign birth who have declared

* Census of 1873; no returns for 1874. † Estimated.
‡ Estimated by county clerk at 30,714.

their intention to become citizens, are entitled to vote after having resided six months in the State and thirty days in the township. No person under guardianship, *non compos mentis*, or insane, nor any person convicted of treason or felony, unless restored to civil rights, nor any soldier, seaman, or marine in the employ of the general government, is allowed to vote. The executive officers of the State are the governor, lieutenant-governor, secretary of state, auditor, treasurer, superintendent of public instruction, and attorney-general, all of whom are chosen by the people for a term of two years. The general election is held on the first Wednesday in November. The legislature consists of a senate of 25 members, elected for two years, and a house of representatives of 75 members, chosen annually. The legislature commences its session annually on the second Tuesday in January. Efforts have recently been made to change the constitution so as to make the sessions biennial instead of annual. The judiciary of the State consists of a supreme court having a chief-justice and two associate justices, elected by the people for six years; and of nine district courts (the State being divided into nine judicial districts), each presided over by a single judge. The district judges are elected by the people for four years. Under the apportionment of 1872, Kansas is entitled to three Representatives in Congress.

History.—That portion of Kansas lying E. of the 100th meridian formed a part of the Louisiana purchase of 1803, and was included at different periods in Louisiana Territory and Missouri Territory. By the Missouri Compromise act of 1820, in all this region lying N. of lat. 36° 30′, excepting only such part thereof as was included within the limits of the State of Missouri, slavery and involuntary servitude, otherwise than in the punishment of crime whereof the party should have been duly convicted, was for ever prohibited. As a result of the Mexican war the territory of the U. S. was extended from the 100th meridian westward to the Pacific as far S. as 32° 30′ N. lat. In 1853 settlers had already entered the territory in such numbers that Congress was called upon to protect them from the Indians. It soon became evident that the fertile lands of Eastern Kansas were to be the objects of contention between the friends and opponents of slavery; the latter contending that by the Missouri Compromise this region was to be exempt from slavery, while the former claimed it on the ground of the partial repeal of that compromise in 1850, and the altered circumstances arising from the accession of new territory in 1848. Both sides were terribly in earnest; in Massachusetts an emigrants' aid society was chartered with ample funds in Mar. or Apr., 1854, to assist emigrants to remove to Kansas, and to furnish them with weapons of defence against those who might attack them; in Connecticut a similar company was chartered in May or June of the same year. In May, 1854, Congress passed the Kansas and Nebraska bill, organizing these two Territories, and expressly declaring that the Missouri compromise of 1820 was inoperative and void in regard to them. As thus organized, the two Territories extended to the Rocky Mountains, taking in a considerable portion of Colorado. The emigrants forwarded by the emigrants' aid companies entered the Territory in very considerable numbers in the spring and summer of 1854, generally resolute men, able and willing to contend for their new homes; but the pro-slavery men of Missouri and Arkansas were as determined to secure the prize for themselves, and a series of raids and conflicts ensued, lasting for four years or more, in which many settlers, as well as considerable numbers of the invaders, were killed. Lawrence was twice besieged and burned, Pottawattamie, Ossawatomie, and Leavenworth were partially destroyed, the polls invaded and broken up, legislatures disturbed, and their members and officers arrested and imprisoned, and the Territory kept in a constant condition of turmoil. Governor after governor was appointed by the Presidents (Pres. Pierce appointing Gov. Reeder, and Pres. Buchanan, Govs. Shannon, Geary, Walker, Denver, Medary, and Stanton), but each in turn became convinced of the justice of the cause of the settlers, and so incurred the displeasure of the "border ruffians," as the invading party was called, and their leader, David Atchison, formerly U. S. Senator from Missouri, had in most cases sufficient influence to cause their removal. Four successive constitutions for the Territory were voted upon between Dec., 1855, and Oct., 1859; the first, known as the Topeka constitution, prohibited slavery, and was adopted in Dec., 1855, with very little opposition, but its authority was never recognized by the pro-slavery men, very few of whom, however, were legal voters. The second, called the Lecompton constitution, was drawn up by a convention never authorized by the people, and composed almost entirely of Atchison's followers, the Free State men refusing to vote, and only 2000 out of more than 10,000 votes being cast for it. The convention met at Lecompton in the autumn of 1857, and the constitution prepared by it had four sections relating to slavery, prohibiting emancipation, conferring upon slaveholders all the immunities of the worst slave codes, and declaring these inviolable, and preventing any change in this constitution before 1864. The only alternative offered to the people was to vote for this constitution (which was otherwise objectionable) *with* the slavery sections or *without* them. The Free State men generally refused to vote, and the constitution was declared to be adopted by about 5600 majority, the greater part known to be fraudulent. On Jan. 4, 1858, the people had an opportunity of voting against it at the Territorial election, and there was a majority of 10,226 votes against it. On Aug. 3, 1858, Congress ordered another vote on this constitution, and it was rejected by over 10,000 majority. Another constitution had been made by a constitutional convention in Apr., 1858, and had been adopted by a small vote. As it was not quite satisfactory, a fourth convention met at Wyandotte July 5, 1859, and adopted the present constitution of the State. This was ratified by the people Oct. 4, 1859, by about 4000 majority. Kansas was admitted into the Union as a State Jan. 29, 1861, and its subsequent history has been one of great prosperity. During the late civil war no State of the Union sent so large a proportion of its male population into the field as Kansas. Its growth since the war has been without parallel for its rapidity. Its population, which in 1860 was but 109,000, is now not far from 600,000; without a mile of railway in 1862, it has now within its boundaries over 2500 miles; it has subdued lands which for thousands of years had lain waste, planted schools and churches all over its territory, and, though in the summer of 1874, it was severely tried by a visitation of grasshoppers or locusts, which destroyed two-thirds of the growing crop of Indian corn (the loss being estimated at 30,000,000 bushels), and reduced the settlers of sixteen or eighteen of the new counties to destitution, so great is its vitality and enterprise, that this visitation will not perceptibly check its growth.

Governors.—

TERRITORIAL.		STATE.	
A. H. Reeder	1854–55	Charles Robinson	1861–61
Wilson Shannon	1855–56	Thomas Carney	1861–65
John W. Geary	1856–57	Samuel J. Crawford	1865–69
Robert J. Walker	1857–58	James M. Harvey	1869–73
James W. Denver	1858–58	Thomas A. Osborn	1873–77
Samuel Medary	1858–59		
Frederick P. Stanton	1859–61		

Popular and Electoral Votes for President.

Elect. year.	Successful Candidates for President and Vice-President.	Elect. vote.	Popular vote.	Opposition Candidates for President and Vice-President.	Popular. vote.	Majorities.
1864	Abraham Lincoln P., A. Johnson V.-P.	3	16,441	Geo. B. McClellan P., G. H. Pendleton V.-P.	3,691	12,750
1868	U. S. Grant P., Schuyler Colfax V.-P.	3	31,048	Horatio Seymour P., F. P. Blair V.-P.	13,990	17,058
1872	U. S. Grant P., Henry Wilson V.-P.	5	67,048	Horace Greeley P., B. Gratz Brown V.-P.	32,970	34,078

L. P. BROCKETT.

Kansas, tp. of Etowah co., Ala. Pop. 481.

Kansas, post-v. and tp. of Edgar co., Ill., on the Indianapolis and St. Louis R. R., 104 miles W. of Indianapolis and 156 N. E. of St. Louis. It has 1 national bank, 1 weekly newspaper, 4 churches, 1 school, 2 hotels, 2 grain-warehouses, 1 agricultural implement manufactory, 3 wagon and carriage-making shops, and 17 stores; is nearly in the centre of a large prairie, 2½ to 5 miles from timber. Principal industry, farming and stock-raising. Pop. of tp. 1618.

W. W. BISHOP, ED. "NEWS."

Kansas, tp. of Woodford co., Ill. Pop. 349.

Kansas, a tribe of Indians in the State of the same name, numbering about 600. They belong to the same family with the Dakotas and Osages, and have decreased rapidly in numbers during the present century, on account of wars with the Pawnees and other Indians of the Plains. By act of May 8, 1862, Congress, with their consent, provided for the sale of their reservation in Kansas and their removal to the Osage country in the Indian Territory.

Kansas City, city, cap. of Jackson co., Mo., on the right bank of the Missouri River, just below the mouth of Kansas River, and 1 mile from the boundary-line between Missouri and Kansas, 235 miles W. of St. Louis. It is situated at the point where the Missouri River finally bends to the E., and is the natural centre of an immense land and river traffic, having nine railroads (1875) centring in a common station, and four or five others in construction. The site was originally very rough and uneven, part of the

city being on a bluff and part on bottom-lands; much has been done, however, to remove irregularities by grading. The streets, though not uniformly laid out, are wide, well lighted with gas, and well provided with sewerage and sidewalks. The Missouri River is spanned by a bridge nearly 1400 feet in length, built at a cost of $1,000,000. There are four lines of street railroad, which also connect with the adjoining town of Westport and with Wyandotte in Kansas. There are 6 daily papers (3 morning and 3 evening), 2 tri-weekly, 6 weekly, and 1 bi-monthly; of the weeklies, 1 is in German, 1 is agricultural, and 1 devoted exclusively to the trade in live-stock. There are 12 banks, 28 churches, 14 schools, 2 medical colleges (with a medical journal), 1 seminary and 1 hospital (both Roman Catholic), a city hospital, orphan asylum, workhouse and woman's home, 2 theatres, an opera-house, an efficient fire department and police force. The surrounding region is one of extraordinary agricultural resources, and is abundant in coal, lead, iron, and other minerals. The chief importance of Kansas City consists in its being the centre of the live-stock traffic for the States W. of the Mississippi—a business which has enormously increased since the completion (in 1873) of the Missouri Kansas and Texas R. R., connecting this city through the Indian Territory with the great stock-raising regions of Texas. The pork-packing business is also rapidly assuming importance, having increased from 13,000 hogs packed in 1868 to nearly 200,000 in 1873. The receipts of cattle in 1873 were 227,669, valued at $3,415,035; of hogs, 220,956, valued at $2,131,178; of horses, 4202; and of sheep, 5975. The sales of merchandise at wholesale in 1873 were $15,695,000, against $13,844,440 in the preceding year. The receipts of grain in 1872 were 1,001,293 bushels, and in 1873, 1,718,280 bushels. Manufacturing industry is as yet small, but with the rapid development of the coal-mines at Fort Scott, may be expected soon to assume importance. The receipts of coal in 1869–70 were less than 1500 carloads; in 1871 they were 5000; in 1872, 9990; and in 1873, 11,022 carloads. Five years ago, the only fuel used in Kansas City and by the railroads centring there was wood, but now (1875) coal has generally taken its place, and the whole Missouri Valley as far N. as Omaha is supplied with coal from this market. The mines are at present mostly in Kansas, the whole E. portion of that State and the contiguous counties of Missouri being underlaid with a soft bituminous coal, which, it is claimed, has from 20 to 30 per cent. more available power for steam-engines than the average Eastern coals. Extensive water-works, combining the reservoir, the standpipe, and the Holly system, were being constructed in 1874, to cost from $750,000 to $1,000,000; there were to be 20 miles of supply-pipes, 300 fire-hydrants, and the 2 reservoirs were to have a capacity for holding 20,000,000 gallons of water. A metropolitan telegraph company was formed in 1873. A board of trade was organized about the beginning of 1872, and has taken important measures for the development and regulation of the commercial interests of Kansas City. It sent representatives to the convention of Congressmen at St. Louis in May, 1873, and presented to the Senate transportation committee, when sitting at St. Louis, an able memorial on transportation facilities for the West and South. It also sent delegates to the national board of trade, and secured recognition as the tenth among the great trade-centres of the country. The river-navigation has naturally decreased in comparative importance through the extension of the railroad system, but a company for barge-navigation was organized in 1873, in which year the arrivals of steamboats were 65. The valuation of real estate in 1872 was $11,993,060; in 1873, $12,687,875. Pop. in 1860, only 4418; in 1870, 32,260. It has increased very rapidly since the war.

W. H. Miller, Ed. "Journal of Commerce."

Kansas, Congressional Legislation of 1854 in Reference to. See Douglas, Stephen A., by Hon. A. H. Stephens, LL.D.

Kansas (or **Kaw**) **River,** in Kansas, is formed by the union of the Smoky Hill and Solomon rivers. Its principal affluents are the Republican, the Big Blue, and the Grasshopper rivers from the N., and the Wakerusa from the S. It has innumerable smaller tributaries. Steamboats have traversed its whole course at high water, but its navigation is not of any practical value. It falls into the Missouri on the Missouri State line, near Kansas City, Mo.

Kan'sasville, post-v. of Racine co., Wis., on the Western Union R. R.

Kansu', province of China, between Thibet in the S. and Mongolia in the N. Its area is estimated at 100,000 square miles; its pop. at 16,000,000. It is covered with mountains, and traversed by the Hoang-ho. Cap. Lan-Chow-Fee.

Kant (Immanuel), b. Apr. 22, 1724, in Königsberg, where his father, of Scottish descent, was established as a saddler. Kant was brought up in strict religious principles. From 1740 to 1746 he studied theology, philosophy, and mathematics in the Königsberg University. From 1746 to 1755 he was engaged as tutor; and subsequently entered upon his career as professor at the Königsberg University, which he kept up till 1797, when old age compelled him to retire. D. Feb. 12, 1804, in the eightieth year of his age. He never married, though he was very fond of society, genial in his manners, and a favorite with all who knew him. It is a rather singular circumstance that he never left his native city of Königsberg except for a few miles' walk out in the country. In his first lectures at the university, Kant followed pretty closely the Wolffian school of philosophy, then prevalent all over Germany. Still, even in those earlier works his dissatisfaction with the existing state of the science of philosophy, and a persistent endeavor to ascertain the source of that dissatisfaction and its remedy, are clearly discernible. The great works of the French and English skeptical writers of that time, and especially the works of Locke and Hume, completed the change that was taking place in his views. The lucidness of their style, too, forbade the employment of the extravagant jargon introduced by Wolff into the philosophical discussion of the German schools in their refutation, and forced Kant, for the satisfaction of his own mind, to enter upon a thorough investigation of all the problems of philosophy in a manner and style altogether new and his own. It was not till 1781, about ten years after he had begun his new researches, that he published their result in the *Critique of Pure Reason*, which was soon followed by the *Critique of Practical Reason* and the *Critique of the Power of Judgment*. These three critiques form, indeed, only one great work, and cannot be understood correctly except when thus studied in their unity. The distinguishing feature of the new system presented by Kant in these works is, that instead of treating philosophy as a transcendent science, it treats it from a transcendental point of view. That is to say, Kant denies that by mere reasoning or argumentation we can discover any new truth or transcend the world of common consciousness, and that hence all the efforts of previous philosophers to discover such new truths have been futile. Philosophy can only explain and prove truth; and its problem is to discover and apply the touchstone by which this proof can be made. Now, all theoretical propositions that may be made are either identical (like $A = A$), and these need no proof, or synthetical (A is A and something else too; for instance, iron is not only a body, but also magnetic). Of these synthetical propositions, again, all those which are empirical can be proved only by experience; and hence pure reason is required only to prove those synthetical propositions which are not empirical—that is, which are *a priori*. For instance, if when the sun shines I observe a stone get warm, and say that the sun is the cause of that warmth, I utter an *a priori* synthetical proposition, because the conception of cause is not any quality of the sun or the stone that I perceive empirically. I perceive only a change from cold to heat in the stone, but a million of such changes would not make the conception of change a conception of cause. It is this class of conceptions which require a rule whereby their proper application can be secured, for it is only by their improper application that disputes have become possible between philosophers. When quarrels have arisen, for instance, as to whether God was the cause of the world, or whether the soul was a substance, etc., the dispute would have been settled at once if a rule had been known whereby it could have been determined whether the synthetical conception of cause could have been predicated of God, or that of substance of the soul. Kant discovered this rule, or the "supreme principle of all synthetical judgments," to be, that synthetical propositions *a priori* are valid only in so far as it can be shown that consciousness could not otherwise be possible. The whole *Critique of Pure Reason* is nothing but an application of this principle to all the various problems that have engaged philosophical speculation, and especially to the antinomies to which it has given rise. By this application, Kant rooted out the entire old science of metaphysics, and established in its place a universally valid critique of reason, or science of knowledge.

But not all the propositions of human reason are of a theoretical character, nor could they well be so, since otherwise human reason itself would remain unexplained. Theoretical reason always explains by the categories of causality, substantiality, and reciprocal relation, but all these categories explain only the *a priori* synthetical propositions or phenomena that occur within reason; not, however, reason itself. If reason itself has an explanation, therefore, it must be of an entirely different character—of an absolute character, in fact. It must be an immediate explanation, having no ground, no cause, no why or wherefore. This explanation, says Kant in his *Critique of Practical Reason*, is the Freedom, the Self-determination, or the Categorical

Imperative, which manifests itself in each individual as the Moral Law. No one can demonstrate to another by argumentation that there occurs within him a phenomenon which tells him at every moment of his life what he ought to do or ought not to do, and impels him to do it or not to do it, no matter what his natural inclinations may be; each one can discover that this phenomenon does occur only in his own consciousness. Freedom, therefore, which is nothing but this categorical imperative or moral impulse, can never be proved by something else, as theoretical cognitions can be proved, but only by practical experience. If, however, this categorical imperative is once admitted, if any individual confesses that he has ever done a moral act, then it can be shown that he also admits a Supreme God and immortality. For no one could rationally perform one moral act if he did not presuppose that he could rise to such a perfection as to make all the acts of his life moral—a perfection to which finite beings can attain only in an infinite life. Nor could he rationally perform such an act did he not presuppose that his act would accord with all the other acts performed by moral beings—an accord which can be realized only by a God. (Compare Leibnitz's *Pre-established Harmony.*) These propositions Kant has further demonstrated in his *Critique of Pure Religion*, published in 1794.

The remaining problem now was: How can reason become conscious of its free acts—*i. e.* of itself as practical reason operating upon an outside world—if that outside world can be cognized only by its theoretical faculty; that is to say, under the categories. This question Kant solved in his *Critique of the Power of Judgment* by showing that we do view the outside world under other forms than those of theoretical reason—namely, under the forms of purposes or designs—forms which can be referred either to the outside world itself, in which case we arrive at teleological views of the world, or to our own reason, in which case we pass æsthetical judgments upon outside objects. In either case, we posit ourselves as free judges; and thus the *Critique of the Power of Judgment* substantiates the immediate fact postulated by the *Critique of Practical Reason*, and completes the whole system of reason.

Having thus finished the work of his lifetime, Kant devoted the remaining years of his life to applying its principles more in detail to the sciences of law, morals, theology, and to natural science. Thus, in 1786 he published his *Metaphysical-Fundamental Principles of the Science of Physics;* in 1795 to 1797, two works, *Eternal Peace* and *Metaphysical-Fundamental Principles of a Science of Law and a Science of Morals;* and in 1798 he concluded his literary labors by his *Anthropology*, a book full of rare knowledge, shrewd observations on men, races, nations, and the sexes, which every one should read who wishes to become thoroughly acquainted with the author of the *Critique of Pure Reason.* It is, moreover, an excellent example of the exquisite clearness of style which distinguishes nearly all of Kant's writings. As an introduction to the *Critique of Pure Reason* scholars might be recommended to read Kant's *Prolegomena*, which is also a marvel of symmetrical arrangement and lucidity of style. Of Kant's many followers, Fichte alone adopted fully, and carried out in his own way, the great discovery of Kant's transcendentalism. At present, however, the study of Kant is again becoming quite general in Germany, and several new editions of his complete works have appeared within the last few years.

A. E. Kroeger.

Kanwa'ka, tp. of Douglas co., Kan. Pop. 913.

Ka'olin [Chin. *Kao-ling*, the name of a hill of porcelain clay], the common name of a hydrated silicate of alumina ($Al_4O_3,2SiO_2 + 2HO$) or clay used for the manufacture of porcelain. Kaolin is supposed to be derived from potash feldspar by the loss of all the potash and two-thirds of the silica, which ingredients are replaced by 2 equivalents of water. The proportions of silica to alumina vary largely in different countries, the kaolins of China and Japan containing twice as much silica as those of Passau and Gutenberg in Germany. Large beds of kaolin are found at St. Austell in Cornwall, England (where it is derived from pure feldspar), in Limoges, France, at Brandon, Vt., Perth Amboy, N. J., Richmond, Va., Aiken co., S. C., near Augusta, Ga., and many other parts of the U. S.

Kaolin, post-tp. of Iron co., Mo., 20 miles from Pilot Knob. Pop. 463.

Kapio'ne, tp. of Atchison co., Kan. Pop. 775.

Kapp (Friedrich), b. at Hamm, Westphalia, Apr. 13, 1824; studied law; came in 1850 to New York; practised here as a lawyer; was a Presidential elector in 1860; then commissioner of emigration; returned to Germany in 1870, and was elected a member of the German diet in 1872. He wrote *Die Sklavenfrage in den Vereinigten Staaten* (1854), *Geschichte der Sklaverei in den Vereinigten Staaten* (1860), *Geschichte der deutschen Auswanderung in Amerika* (1868).

Kap'pel, village of Switzerland, in the canton of Zurich, noted for the encounter which took place here (Oct. 11, 1531) between the Protestants and Roman Catholics, and in which Zwingli was killed. In 1838 a monument was raised to him on the spot where he fell.

Kara (George). See Czerny (George).

Karahissar. See Afium or Afium-Kara-Hissar.

Ka'raites, a Jewish sect. In the early part of the Middle Ages congregations of this name were settled in the region known in Jewish history as Babylonia, in Palestine, Egypt, Syria, in the Crimea, and in Lithuania. It has, however, hitherto been impossible to fix the exact date of their first settlement in these various localities. In 1110 A. D. they appeared in Spain, but soon after (1130) suffer persecution at the hands of their coreligionists, who in contradistinction to them are known as Rabbinites. With the help of the temporal power they were driven from the cities, and thereafter confined to a single insignificant town. In 1150 they endured a second persecution, and after this period we lose sight of them completely so far as Spain is concerned. In 1668, King John III. Sobieski succeeded in drawing a body of Karaites from Lithuania and the Crimea to the neighborhood of Lemberg by granting them special privileges of great value. In proportion to the rest of the Jews, the number of the Karaite settlers was inconsiderable, and since then it has kept on diminishing. At the present day a few feeble congregations in the East, in Poland, and Russia are all that remain of them. Their chief settlement is in the Crimea, in a village among the mountains called Tshufut Kale, where they enjoy the protection of the Russian government. The many excellent traits of character for which they are distinguished have procured their exemption from special enactments of a hostile nature which have been at different times directed against the Jews of Russia.

The name Karaite, or, as they also style themselves, Bene Mikra ("sons of Scripture"), is derived from the fundamental doctrine that marks their peculiarity as a sect. It consists in their acknowledging Scripture, and nothing but Scripture, to the exclusion of the Talmud and the traditions of the rabbins, as the source of their religion. The rise of this sect is wrapped in obscurity. Concerning the time and the occasion of their origin the opinions of scholars—nay, even the accounts of the chronicles—are widely divergent. Rabbi Jehuda ha Levi (1140), in his philosophical work the *Cussari* (3, 65), thinks proper to assign their origin to the age of John Hyrcanus (135 B. C.). The rabbins, he thinks, having incurred the displeasure of the king, his friends seized the opportunity to stir up opposition against them, and a new sect was thus formed. Other authorities, at their head the Gaon Saadia (in his polemical work against Anan), and, following his lead, Sherira (950 A. D.), in his well-known *Iggereth* (a historical document of the highest value), consider Anan, whom the Karaites only regard as the first leader of their sect, as its founder. Anan flourished about 760 A. D., as Rapoport has shown in the Hebrew periodical *Kerem Chemed* (5, p. 203). The chronology of the Karaites inaccurately assigns him a date fully a century too early. A second time the motive of revenge is called in to explain the rise of the sect. Anan, it is said, aspired to the office of *resh gelutha* ("Prince of the Captivity"), but another having been preferred in his stead, jealousy provoked him to institute a division. It is evident, however, that this account is colored by the rancor of enemies. Jealousy may explain the secession of an individual from his party or creed, but it can never bring about a new religious movement; least of all, such a one as gave rise to the sect of the Karaites—a sect whose existence is measured by at least twelve centuries, whose members have ever displayed profound religious conviction and zeal, and have preserved a degree of moral energy and purity which calls forth universal admiration. A third view concerning the origin of the Karaites current among the mediæval rabbins, and represented by such great names as those of Maimonides and Aben Esra, identified them with the ancient sect of the Zedukim (Sadducees), and writers of the class we have mentioned commonly apply the name of Sadducees to them without hesitation or reserve. This view derives its sole support from the fact that the Karaites agree with the Sadducees in certain questions of religious theory and practice; as, for instance, in celebrating the feast of Pentecost on a Sunday. But, on the other hand, we should consider that they hold the most important articles of faith, such as the doctrine of reward and punishment, of the resurrection of the dead, etc., in common with the rabbins, and reject the opinions of the Sadducees. If Geiger's view as laid down in his *Urschrift* and elsewhere be admitted, and it is true, as he affirms, that

the Sadducees accepted tradition in its earliest form, and rejected only its later development by the Pharisees, then the futility of every attempt to identify both sects must be at once apparent. For the Karaites were consistent in discarding tradition in *all* its forms, earlier and later.

The accounts of the Karaites themselves concerning their origin appear to be, so far as their writings have become known, no less untrustworthy. At one time, they acknowledge Jehuda ben Tabbai, an ancient teacher mentioned in the Mishna, as the founder of their sect; again, this honor is reserved for Anan b. David, whom we have already mentioned above; while at the same time they claim that their doctrine is as old as Judaism itself; that the principles they advocate were those of Moses and the prophets; and, furthermore, that they had remained unquestioned until the days of Simon b. Shetach. He, the brother-in-law of King Hyrcanus and president of the Sanhedrin, began to introduce innovations of an arbitrary character and contrary to the established customs of Israel, and by so doing laid the foundations of rabbinism. His measures were resisted by his colleague in the presidency of the Sanhedrin, Jehuda b. Tabbai, who remained true to the ancient law, and who is for this reason called the father of the Karaites. (*Dod Mardechai*, chap. ii.)

Though these different accounts are unclear, contradictory, and without adequate historical basis, they all contain an essential element of truth, or at least indicate the direction in which the truth is to be found. The correct view of things seems to be the following: As compared with the Bible, it cannot be denied that the rabbinic system marks a new departure. Like every innovation, it encountered opposition at the very outset. This opposition was gradually silenced, but could not be completely destroyed. It continued to exist as a strong undercurrent, and when the occasion was presented rose with new energy to the surface. In order thoroughly to understand this process, it will be necessary to define the exact position of rabbinism, and briefly to trace the successive stages of its development.

In the age when rabbinism struck root, shortly after the return of the people from captivity in Babylon, the conditions, both external and internal, amid which the code of the Pentateuch had arisen had materially changed. The demands of life in favor of new laws were pressing, and the leading spirits of the time, recognizing their justice, felt themselves called upon—nay, in duty bound—so to modify the teachings and commands of religion that they should conform to the altered state of affairs. But, holding their own authority to be insufficient to ensure obedience to those new enactments, which, though urgently demanded by the exigencies of life, were contrary to the prescriptions of the Bible and the traditions of the fathers, they resorted to a measure at once thoroughly effective and dangerous. By the aid of a highly artificial and tortuous system of exegesis they assumed the appearance of deducing whatever laws they intended to pass from the very words of Scripture—a measure which they justified on the ground of necessity, and because the means in this case seemed authorized by the good end they desired to reach. A wide field for controversy was thus opened. The Sadducees made excellent use of the opportunity afforded them, and employed as the keenest weapons of attack the revealed word of God himself and the sacred customs of antiquity. But their efforts were vain. In struggling against the innovations of the rabbins they resisted the tendency of the age, and they were at last forced to succumb. But the very success of rabbinism encouraged an altogether unprecedented extension of that vicious method of exegesis by which its triumph had been secured, and became instrumental in rallying anew its defeated and scattered adversaries and arming them for the attack. The new method of the rabbins was too fruitful, and, breaking through all restraints, soon became corrupt. Though at first regarded as a mere makeshift to ensure the acceptance of measures otherwise wholesome and wise, it came to be considered in the later schools of the Talmudists true and valuable on its own account. It was cultivated with exaggerated zeal and dialectical acuteness, and thus became the source of a multitude of legal provisions equally unmeaning and uncalled for. In such a condition of affairs it could not but come about that men of sound judgment and firm will should protest against this corruption of religion. The opposition was at first carried on secretly, then with greater boldness and openness—the hostile band was small in numbers at first, then increased by a large and powerful following—until a bitter conflict ensued, and at last a new sect went forth from the struggle. Already in the Talmud we find a number of ordinances which appear to be directed against those who hold Karaite opinions, and which therefore presuppose their existence. (*Kethuboth*, 62 *b*.) The celebrated teacher of the Mishna, Rabbi Eliezer the Great, admonishes his disciples (*Berachoth*, 28 *b*) to keep their children from "Higaion," meaning, as the commentator explains, from too frequent reading of the Bible. This shows us that even in the days of R. Eliezer the rabbins saw the danger which would threaten their system if an intimate acquaintance with Scripture were to become general. And yet it was impossible to avoid this danger. Within the pale of Judaism the people could not be precluded from studying Scripture, as was done elsewhere. The reading of the "books of Moses" formed an essential element of the sabbath service, and even the Talmudists were forced to declare the study of the Bible a religious duty, though of less importance than the study of the Talmud. (*Baba Mezia*, 33 *a*.) Indeed, the letter of Scripture was the very foundation on which rabbinism had raised its huge edifice. It was thus forced to nourish its foe at its own breast, and, by continually recurring to the Bible for the sanctification of its encroachments, to keep alive and strengthen the spirit of opposition which these innovations tended to develop. After the close of the Talmudic epoch the spirit of opposition was still further encouraged. In Palestine (Tiberias) greater attention began to be paid to the correct preservation of the biblical text. It was supplied with vowel-signs and accents, and an organized Masoretic school devoted care and vigilance exclusively to this task. A similar school arose in Babylonia, where a different system of vocalization was introduced. The scrupulous care with which the Bible was now studied naturally directed the thoughts of many to the wide divergence existing between the real meaning of Scripture and that which passed current in the schools of the Talmudists. Thus the number of those hostile to the Talmud kept on increasing. But when in the eighth century Babylonish rabbinism began to urge new claims to supremacy, the like of which had never been heard of before, the opposition became uncontrollable. So long as the Sanhedrin had remained in existence, there had been at least a senate of seventy persons to limit the sovereignty of the nasi (first president) in matters of religion. During the Talmudic epoch proper great diversity of opinion prevailed among the individual teachers, without there being any central authority of sufficient influence to pronounce final decisions on disputed questions. This state of things continued in the succeeding (the so-called Saburaic) epoch. And it was not till the presidents of the Babylonish academies had assumed the magnificent title of *gaon* (highness) that a desire awoke for greater power than had ever been granted before. A kind of infallibility was assumed by these gaons, and the judgment of an individual was claimed to be binding on all Israel. At that time honest and enlightened men found that the burden of rabbinism had become insupportable. The time for separation was at hand. An impulse from without was all that was needed. This was given by Anan. (Fürst in his *History of Karaism* has *partly* recognized the true relation and succession of events as we have detailed them above; but in this he had been already anticipated by a mediæval writer of note, Rabbi Simon b. Zemach Duran. See Grätz, *Monatsschrift*, 1874, Nov., p. 506.)

Anan ben David, b. 700 A. D. in the town of Bazra, near Bagdad, of noble family, claiming descent from King David, received a thorough education in Jewish theology and in those scientific pursuits which were cherished at the time. He soon acquired a considerable reputation as a scholar, and collected a number of adherents around him, who accepted his independent views. Even thus early he did not scruple to deviate from the beaten track of rabbinic teaching. In 754 he settled in Bagdad, where his uncle, Salomo, the "prince of the Captivity," resided. When the latter died childless (760) the nearest claim to the vacant office was that of Anan, both on account of his eminent learning and high descent. The academical presidents of Sora and Anbar, however, opposed his election, because, as the rabbinical chronicles tell us, "they discovered a defect in him" (in the *Sefer ha Cabbala* ("Book of Tradition") of Abraham b. David of Toledo, 1110–80). What this defect was they do not say, and their silence on this head amply proves that it could have been no moral flaw. It was, indeed, nothing more than his heterodox opinions to which they referred. The party of Anan sought to gain the protection of the caliph Almansur, but their opponents represented them as rebels, and caused their persecution. In consequence, Anan and his adherents fled to Jerusalem, where he openly cut loose from the authority of the Talmud, and founded the first congregation of Karaites. To him and his descendants the title of nasi was applied, as it had formerly been given to the patriarchs of Palestine in the Talmudic epoch. But the "princely" office of nasi was royal only in name, and lacked the substance of power. Its incumbents continued to reside in Jerusalem until 910. Later on they removed to Cahira.

The foundation of the sect of Karaites had thus been

laid by Anan, though he was far from carrying out his principles to their last consequence. Neither he nor his followers were entirely emancipated from those religious views and practices which education and custom had so long contributed to foster. It is true he proclaimed the right of interpreting and applying the words of Scripture independently of all authority, yet, none the less, he clung to many of the ordinances prescribed by the Mishna. Especially was this the case in questions of civil law. A complete reconstruction of practical religion, which at that time included the administration of justice in its sphere, transcended the powers of an individual to accomplish. New congregations were formed, new teachers arose. Questions which Anan had never considered came up for decision. Others which he had adjudged were discussed anew, and conclusions differing from his own not unfrequently reached; for Anan had himself opposed the habit of blind reliance on the utterances of the master, and declared free exegesis his watchword. As the sect grew in numbers, and its rival teachers struggled to fix it securely, each on the basis of his own system, the confusion of conflicting opinions increased, and the new sect was in imminent danger of splitting into numberless minor sects, and thus perishing. In this way the struggle continued until 800 A. D., when Benjamin Nahawendi, from the town of Nahawend in ancient Media, succeeded in gaining universal recognition among the Karaites, and to him the sect owes its perpetuation. In his day the name Ananites was exchanged for Karaites, by which latter appellation they have since been known. His authority was sufficiently great to challenge even that of Anan. His views, laid down in commentaries to the Bible and legal compendia, spread to the East and West, to the congregations of Babylon and Palestine, and were the more readily accepted because they tended on the whole to lighten the load of religious duties. Anan had interdicted the use of fowl at table; Benjamin permitted it. Anan had extended the obligation of the leviratical marriage to all male relatives of the deceased; Benjamin confined it to the brother. Anan had jealously guarded the rigid sanctification of the sabbath. On the sabbath day he prohibited conjugal intercourse, forbade circumcision, and demanded the literal application of the words of Scripture, "No one shall leave his place," thus locking up his people in their houses. Benjamin abrogated all these provisions.

The main principle of Anan, that of free exegesis, remained undisputed, and Benjamin Nahawendi could not check the further development of Karaism, even had he been disposed to do so. And, indeed, after his death we find differences of theory continuing to exist among scholars, and practical differences arising in various congregations concerning important questions of religious law. Thus, for instance, some held with the rabbins that it is permissible to keep a light burning on Friday evening, provided it had been lit before the opening of the sabbath, while others considered it wrong to do so, and were forced to pass the whole night in darkness. In the main, however, the danger of dismemberment was averted by Benjamin, and the unity of Karaism secured.

The essential difference between themselves and the rabbinist Jews had meantime come thoroughly home to the Karaites, and was continually strengthened by the habits of their daily life. Though there was no dogmatic conflict between them, though the same basis of faith was common to both, yet their disagreements in other matters were too important and far-reaching to admit the hope of reconciliation. The common celebration of feast-days is at all times a strong bond of union between coreligionists. This bond Anan had already severed. Ever since his time the Karaites have determined the day of the new moon by direct observation, while the rabbinists continue to guide themselves by the calculations of their received calendar. The Karaites celebrated, and still celebrate, the Pentecost on the fiftieth day counting from the Sunday of Passover Week; the rabbinists, on the fiftieth day counting from the second day of the feast. Also, the rite of circumcision is practised by the Karaites in a way not recognized as valid by the rabbinic law. In respect to dietary laws, the Karaites abandoned numberless restrictions held sacred by the rabbinists. The latter naturally broke off connection with those who habitually transgressed their laws. On the other hand, the Karaites aspired to the most austere purity in the social relations. As early as the days of Anan they, with the help of their peculiar method of exegesis, extended the number of forbidden marriages to such a degree that many matrimonial alliances which pass unchallenged among the rabbinists were by them regarded in the light of crimes. The offspring of such alliances were considered to have sprung from an incestuous intercourse, and intermarriage with them was of course impossible.

The gulf between Karaites and rabbinists could no more be bridged over. The peculiarities of both parties were strongly marked. Both were firmly resolved to preserve their own opinions and institutions intact, and they might have pursued their several ways side by side without interfering one with the other. But this was not to be. It is in the nature of every new sect to seek an extension of its influence by drawing converts from the outside world into its ranks. The leading men of the Karaites being thoroughly familiar with the Bible, admirably skilled in scholarly research, and impelled by holy zeal for their cause, produced a great and varied literature in its interest, and in every way labored strenuously to gain adherents for their doctrines. In the course of the ninth century they sent out missionaries in all directions, and succeeded in founding congregations in Iran, Persia, Media, Armenia, Syria, Palestine, Egypt, and the N. of Africa. Rabbinism witnessed the triumph of its opponent with terror and dismay, but was too feeble effectually to resist it. Its representative men were equally lacking in power of thought and of expression. Even the gaons of the academies, though versed in Talmudic lore, were utterly ignorant of the pursuits of science. In this extremity, the rabbinists, though loath to adopt a measure which seemed so derogatory to their dignity, called a stranger, Saadia ben Joseph (b. 892 A. D.) of Faium, in Upper Egypt, to Babylonia, and appointed him gaon of Sora. His fame as a profound Talmudist, a master of science, and at the same time a bitter enemy of the Karaites, had preceded him. The wisdom of the appointment was proved by the event. Saadia, indeed, was a writer of extraordinary fertility and genius. The reader will gain some conception of the versatility of his mind on learning that this man, apart from his labors on the field of the Talmud, was the author of a Hebrew grammar, a Hebrew lexicon, a book on rhetoric, an Arabic translation of and commentary on the Bible and the Mishna, a work on the philosophy of religion from the Jewish standpoint, and of many minor treatises besides. Not only did he in all his works seize every opportunity that offered a plausible pretext to refute the opinions of the Karaites, but he also directed three separate books —on the marital laws, on the Hebrew calendar, and the divine institutions—expressly against their doctrine, and wrote seven polemical treatises against their most distinguished teachers. The influence of Saadia interposed a barrier to the further spread of Karaism, while at the same time it tended indirectly to strengthen and purify it inwardly. Such attacks as those of Saadia, carried on with the weapons of science and learning, and the keen sword of eloquence, Karaism had never before experienced. They called for counter-efforts on its part, which brought leaders of such high intellectual power to the front as only the hour of danger can awaken. Prominent among these are Joseph el Bazri, the first Jewish writer on the philosophy of religion, and Salmon b. Jerochim. An emulous struggle between the literary rivals of either side began, whose influence was salutary to both parties, encouraging thoroughness and accuracy of investigation. The half century between 900 and 950 A. D., during the lifetime of Saadia and shortly after, is the golden age of the literature of the Karaites. Their principles were then firmly grounded, their theology completely systematized. After the death of Saadia (942) his disciples feebly continued the contest for some time longer; but gradually the cries of the contending champions died out, and when the fight was over the limits of both sects were found to be more strictly defined and closed in than they had ever been previously.

We may say that the rabbinists by their persecutions created Karaism. By their literary opposition they made it strong and enduring. In the following centuries the feeling of hostility between Karaites and rabbinists, which was still at times displayed in their writings, diminished in bitterness. Enlightened men of both parties admonished their friends to practise patience and forbearance toward their opponents, and a distinguished rabbi, Shemaria Icreti (of Crete or Candia, 1290–1320), even attempted, though to no purpose, to reunite the two divisions of Judaism. A similar attempt was made with the same result by Rabbi Gedalia Ibn Jachia of Lisabon in the year 1487. The relations subsisting between the Karaites and rabbinists of Lithuania, Russia, and Poland during the seventeenth and eighteenth centuries were of a particularly peaceful and cordial character, while in our own century of progressive and liberal culture the last vestiges of mutual distrust have completely disappeared. It is worthy of remark in this connection that even at the time when the animosity of the contending sects was most pronounced, no one ever thought of declaring the opposing party without the pale of Judaism. On the contrary, some of the very highest authorities of the rabbinists distinctly affirmed that the Karaites are to be considered and treated as Jews, notwithstanding all their errors. The presence

of ten men is required for public worship, according to rabbinical law. Maimonides, it is true, prohibits the counting of Karaites in the number (*Respons.*, No. 71), but he does this, as he tells us himself, not from any desire to exclude them from the fellowship of Israel, but simply because they do not agree with the rabbinists in requiring the attendance of the number above specified. He does not scruple to permit even intermarriage between Karaites and rabbinists. (See David Ibn Simra, *Respons.*, i. 73.) When we remember that the rite of circumcision is performed by the Karaites, as well as the Mohammedans (see *Appirion*, c. 2), in such a manner as totally to invalidate the ceremony in the eyes of the Talmud, it thus becomes clear to us that according to genuine orthodox rabbinism it is birth and not circumcision which makes the Jew.

As regards the scientific and literary activity of the Karaites during the long period of their existence, numerous works of theirs, some of them of great value, might be mentioned. They are partly devoted to theology in all its different branches, partly to philology, philosophy, mathematics, astronomy, and medicine. It is certain beyond a doubt that the ancient Karaites were the fathers of Hebrew grammar, of lexicography, and of a more liberal exegesis, which from them were transferred to the rabbinical Jews. The number of Karaite authors that have become known to us is very great. We give the names of a few of the most eminent. *Teachers of the Law.*—Besides Anan and Benjamin Nahawendi, to whom reference has been made above, Jeshua ben Jehuda (1050) in Jerusalem. He defined the doctrines of the existence of God, of revelation, and of reward and punishment to be the three main principles of Judaism, long before rabbinical writers arrived at a similar classification. Also, Elijah Bashiatshi (1420–91) in Adrianople, whose decisions are still considered authoritative. *Writers on the Philosophy of Religion.*—Joseph el Bazri, with the Hebrew surname Ha Roeh ("the seer"), b. about 940 in Jerusalem, who was considered the greatest philosopher of his age, and was the first to reduce the religious teachings of Judaism to a philosophical system. Ahron ben Elijah (b. 1300) in Cahira, whose chief work, *Ez Chajim* ("Tree of Life"), on the philosophy of religion, has been edited with many learned annotations and explanatory notes by Prof. Delitzsch (Leipsic, 1841). *Exegetists.*—Ali el Bazri, with the Hebrew surname Jepheth (930–991), whose commentaries have been freely used by the best scholars, even of the rabbinists, and Ahron ben Joseph (b. 1250 in the Crimea), the author of a celebrated work entitled *Mibchar*. He was also the author of a prayer-book for the Karaites, which superseded all previous ones, and is still in use.

The centre of Karaite learning was situated, for several centuries after Anan, at Jerusalem. Later on, it was transferred to Constantinople, and remained there till 1640. Since then the Crimea, and to some extent Lithuania, became the chief seats of Karaite scholarship. The language employed in the earliest writings of the sect, down to the twelfth century, was the Arabic. The most important of these works were afterwards translated into Hebrew, chiefly in Constantinople, for the benefit of those Karaites who lived in countries where the Arabic was unknown. These translations, embracing ranges of thought for which the Hebrew of the Bible afforded no adequate expression, gave rise to a peculiar Neo-Hebraic idiom among the literati of the Karaites, which differed in many respects from the Neo-Hebraic style current among the Rabbinists.

But, however rich the treasures might be that were hidden in the literature of the Karaites, they were not mined, and remained unknown. The learned rabbinists in the latter part of the mediæval epoch had lost all interest in Karaism, and Christian scholars took no notice whatever of its existence. It was not until the seventeenth century that a desire was felt to gain more accurate information concerning the Karaites. A beginning was made by John Rittangel, professor at Königsberg, who travelled to Lithuania in 1641, and there visited the Karaite congregation in order to study the doctrines of the sect at the fountain-head. He was followed by Gustavus Perringer, professor of the Oriental languages at Upsala, who undertook the same journey for the same purpose, at the instance of the Swedish king, Charles XI., in 1690. Six years later, two scholars, Swedes as before, went on a similar mission to Lithuania, and induced the Karaites to send one of their learned men to Upsala in order to supply the scholars of that university with detailed information concerning the history and the essential doctrines of their sect. Salomo Toroki, the author of the *Appirion*, was selected for this purpose. In the following year he came to Upsala, was received with great distinction, and wrote a treatise in answer to the questions which were put to him. In Holland, however, where Hebrew and Arabic studies were cultivated with great zeal and devotion, the desire for a better understanding of Karaism was most ardent, and the measures taken to secure it proved most effective. Among the Dutch scholars who took a prominent part in spreading a knowledge of the history and literature of the Karaites we mention, in the first place, Lewin Warner. He not only collected, but carefully studied and annotated, no less than 64 codices of Hebrew manuscripts, among which were 30 codices, containing 79 works of the Karaites. Then Jacob Trigland, professor at Leyden, who in 1698 addressed an espistle to the chacham of the Karaites in Lithuania, in which he propounded four main questions touching the sect. Having received the celebrated work *Dod Mardechai* in reply, he thereupon wrote his book, *Diatribe de Secta Karæorum*. But of greater value than all these were the labors of John Christopher Wolf, published both in separate treatises and in the fourth volume of his *Bibliotheca Hebraica*. A general interest in the scientific study of this remarkable sect did not manifest itself among Jewish scholars until within the last few decades, after a part of the rich fund of manuscripts belonging to Karaite literature had become accessible. Evidence of the new impetus which these studies then received may be found in numerous articles scattered in various periodicals, and in several valuable special treatises on the same subject, a complete enumeration of which will be found in Fürst's *Geschichte des Karäerthums*, vol. iii. p. 153.

The study of the sect of Karaites is as yet by no means exhausted. The greater part of their literature has been lost in the course of time, in consequence of the wandering life which they were forced to lead and the dismal destinies they met with. What remains is, with few exceptions, buried in the great libraries in the shape of half-faded manuscripts. The library of Leyden was for a long time richer than any other in manuscripts and printed works of the Karaites. It has lately, however, been surpassed by the library of St. Petersburg, which is now in possession of the very large and highly valuable collection that was gathered by the Karaite scholar, Abraham Firkowitsch, in the course of many travels undertaken for this purpose, and which was bought at the expense of the emperor. S. ADLER.

Kara'jitch (VUK STEFANOVITCH), b. in 1787, and educated at Carlowitz; served in the Servian war of independence, but fled to Austria when in 1813 the authority of the sultan was re-established, and devoted himself to literary pursuits. His collection of Servian popular songs (4 vols., Vienna, 1814–33) was translated into German and into English. He also made a collection of Servian proverbs and popular tales, and a Servian grammar and dictionary. D. in 1864.

Karak', a small island in the Persian Gulf, situated in lat. 29° 14′ N., lon. 50° 20′ E. It is of coral formation, without timber, but with fertile soil, good water, and affording safe anchorage. In the eighteenth century the Dutch built a fort here; in this century the English held the island for a short time. It is inhabited by between 2000 and 3000 Arabs.

Karako'rum is used as the name both of the whole western part of the KUEN-LUN MOUNTAINS (which see), and of one of the few passes (18,400 feet high) by which this range can be crossed. It was also the name of the ancient capital of Mongolia, the city of the mythical Prester John, and was for a time the capital of Genghis Khan. Its ruins have been sought in vain by modern travellers.

Karaman', town of Asia Minor, in the eyalet of the same name, at the foot of the Taurus Mountains. It has some manufactures of cotton and woollen stuffs. Pop. estimated at 12,000.

Karamzin' (NIKOLAI MIKHAILOVITCH), b. Dec. 13, 1766; d. June 3, 1826; a remarkable Russian writer and the greatest historian of his country. In early life he was imbued with mystical ideas, and was closely connected with Freemasonry. His first prominent literary production, which gained him great reputation, was his *Letter of a Russian Traveller*, published in 1791–92 in the *Moscow Journal*, the editorship of which he assumed. Until 1803, Karamzin devoted himself entirely to journalism and literature, writing poems, criticisms, and tales, the best known of which are *Poor Liza* and *Natalia*. This was his sentimental period. In 1803 he was appointed by the emperor historiographer, with a salary of 2000 roubles, and withdrew for some years to Moscow and to the country, giving himself up entirely to historical studies. Being led by these studies to extreme conservative or retrograde views, in 1811 he presented to the emperor Alexander a *Memoir on Old and New Russia*, which, being opposed to the spirit of reform then in vogue, was not at first well received. In 1816, Karamzin returned to St. Petersburg, and through the influence of Count Araktcheief, the all-powerful minister of war, was well received by the emperor, who gave to him the ribbon of St. Anne, with increased rank, and set apart

60,000 roubles for the publication of his *History of the Russian Empire*, which was then completed. The history was published in 1818, and the first edition of 3000 copies was sold within twenty-five days, and the fame of Karamzin became for ever established. The rest of his life he passed quietly in St. Petersburg and the vicinity, in intimate relations with the imperial family. At his death the emperor granted his family (he had been twice married) a pension of 50,000 roubles. EUGENE SCHUYLER.

Kara'sov-Bazar', town of Southern Russia, in the government of Taurida, on the Karasov. It has large manufactures of morocco leather and soap, and is the central market of the Crimea. Pop., comprising Greeks, Russians, Armenians, and Jews, 14,397.

Karatchev', town of European Russia, in the government of Orel. It carries on considerable spinning and weaving, has several oil-mills, and manufactures of sailcloth and cordage. Pop. 10,750.

Kardzag'-uj-Szallas', town of Hungary, in the district of Jazygia and Cumania. Its trade in wheat, wine, and fruit is very considerable. Pop. 9545.

Karelians. See FINNS.

Ka'rens, a people of Northern Burmah, belonging to the Mongolian, or perhaps to the Thibetan, family, the independence of whose country was recognized by treaty between England and Burmah in June, 1875. They are chiefly known from the wonderful success among them of the missions established by Messrs. Judson and Boardman of the American Baptist Missionary Society, soon followed by numerous others. In 1868 there were among the Karens 66 native ordained pastors and evangelists, 346 native preachers unordained, 360 native churches, with about 20,000 church members. (See Mason's *Gospel in Burmah* and the *Report of the American Baptist Mission Union* for 1868.) A comparative vocabulary of the two principal Karen dialects, Sgao and Pwo, by Rev. Dr. N. Brown, may be found in *Journal of American Oriental Society*, vol. iv.

Karg (GEORG). See APPENDIX.

Karikal', a French possession in India, on the Coromandel coast, 150 miles S. of Madras, in lat. 10° 55′ N., on the estuary of one of the branches of the Kaveri. Area, 63 square miles. Pop. about 50,000, of whom hardly 1000 are Europeans. The colony is of very little consequence, as the estuary is unfit for navigation.

Kar'kor, city in the desert E. of Palestine, which was the capital of the Midianites in the time of the Judges. Several identifications have vainly been made in modern times; the true site was undoubtedly farther to the S. E. than recent travellers have explored.

Karli', village of British India, in the presidency of Bombay, 40 miles E. of Bombay, is famous for its cave-temple, which, 130 feet long and 40 feet wide, is cut into the rock at a considerable height, and consists of two rows of sculptured pillars, terminating in a semicircular enclosure and bearing an arched roof. The whole structure is well preserved.

Karls'burg, town of Austria, in Transylvania, is the seat of several civil and military authorities, has a fine cathedral and good educational institutions, and manufactures paper and trades in wine. Pop. 6034.

Karl'stadt (ANDREAS RUDOLF), b. at Karlstadt, in Franconia, in 1480; his true name was BODENSTEIN. He studied at different places besides Rome, and was appointed professor in theology at the University of Wittenberg in 1513. He was a learned and eloquent man, and became one of the most enthusiastic and energetic champions of the Reformation, but his temper was vehement, almost violent; and differing from Luther in several points, especially in his views of the Lord's Supper, a disastrous controversy broke out between them. Karlstadt, whose turbulent mind brought him in connection with Thomas Münzer and other fanatics, was twice banished from Saxony, and actually persecuted by the Lutherans. At last he found refuge with the Swiss Reformers, with whom he agreed concerning the Lord's Supper, and he no doubt contributed much to bring about the schism between the Lutheran and the Reformed churches. D. as a minister at Bâle in 1541. His principal writings are *De utraque specie Cœnæ* (1524), and *Auslegung der Worte: Das ist mein Leib* (1525).

Karma'thians [from *Hamdan Karmat*, one of their early leaders], a Mohammedan sect of reformers, who were originally a branch of the Ismailis, and like them became free thinkers. They were at one time very powerful, and held nearly absolute sway over Arabia, Persia, and Syria, everywhere defeating the caliph's armies. In 900 A. D. they made great advances; in 928 they threatened Bagdad; in 930 they attacked Mecca, then full of pilgrims, whom they slaughtered, desecrating the Kaaba, and carrying away the Black Stone, which they kept for twenty years. Their capital was Lahsa, where they were in power in the eleventh century. Relics of them exist to this day. They now reject Mohammedanism and conceal their real doctrines.

Karnak', a modern village of Upper Egypt, on the right bank of the Nile, occupying part of the site of Thebes, renowned for its magnificent architectural remains. Chief among these is the great temple, 1200 feet long, 330 feet broad, with gigantic colonnades, colossal figures, sculptures of various kinds, in colored sandstone, marble, red and dark granite. Fragments have been found bearing the name of Sesortosis (B. C. 2300). The architecture is due in large part to Mœris, who adorned the palace with a list of his royal predecessors. There are memorials of the glory of Amenophis (B. C. 1500) in a body of bas-reliefs of his wars in Asia. The great hall was built by Sethos (B. C. 1340). The chief temple contains sculptures with inscriptions of the time of Rameses the Great, or Sesostris (B. C. 1396–28). The great tablet of Karnak was shown and explained by the priests to Germanicus (B. C. 16). (See ARCHITECTURE, EGYPT, LUXOR, THEBES.) St. John, *Egypt and Nubia* (1844, 355–378); Henry, *L'Egypte Pharaonique* (1846, ii. 205); Bartlett, *Nile-boat* (*Harper's Monthly*, 1850, i. 212); Champollion-Figeac, *Egypte Ancienne* (1858, 310); ib. *Gemälde v. Aegypt* (1852); Lepsius, *Letters from Egypt* (1853, Letter xxx.); W. C. Prime, *From Thebes to the Pyramids* (*Harper's Monthly*, 1857, xiv. 463, 467); Weber, *Welt-Gesch.* (§§ 30, 31, 42). C. P. KRAUTH.

Karnes, county in S. W. Texas. Area, 830 square miles. It is traversed by the San Antonio River. It has a fertile, sandy soil, is one-third timber-land, and the rest prairie. Stock-raising is the chief industry, but cotton and grain are also raised. Cap. Helena. Pop. 1705.

Karoo' Bokadam', the *Cerberus cinereus*, a fresh-water snake of India, nearly four feet long and quite harmless. Other species of the genus are found in the East.

Karpin'ski (FRANCISZEK), b. Oct. 4, 1741, at Holosco, Galicia, and educated by the Jesuits at Lemberg. In 1783 he became secretary to Prince Adam Czartoryski, and lived at the court of King Stanislas; but from 1791 he resided in retirement on his estates in Lithuania, where he d. Sept. 4, 1825. His songs are still very popular among the Poles. His collected works, including a tragedy, *Judith*, a translation of the Psalms, and a number of idyls, were published in 4 vols. at Warsaw in 1804; his memoirs in 2 vols. at Lemberg in 1849.

Karr (JEAN BAPTISTE ALPHONSE), b. at Paris Nov. 24, 1808; was educated at the Collége Bourbon; published *Sous les Tilleuls* (1832), a successful novel; became chief editor of *Figaro* 1839; and founded *Les Guêpes*, a very successful periodical. In 1848 he removed to Nice, where he engaged in gardening on a large scale. He has produced many novels and other works, one of the best of which is the *Voyage autour de mon Jardin* (1845).—His daughter, THÉRÈSE, is a popular writer of books.

Karroo' [a Hottentot term], a name applied to the great barren plateaux of Southern Africa. The soil is shallow, resting upon a rocky bed. In the rainy season they furnish abundant pasturage, and portions of them when irrigated have been found very productive.

Kars, town of Asiatic Turkey, in the province of Armenia, situated on a table-land between 6000 and 7000 feet above the level of the sea. It carries on a lively transit trade. In 1855, its fortifications having been much strengthened, it sustained a long siege by the Russians. Their attempt at taking it by storm (Sept. 29) failed, but it was compelled by famine to surrender Nov. 30. Pop. 12,000.

Kar'sten (HERMANN KARL), b. at Stralsund Nov. 6, 1817; studied botany at Berlin; made two great journeys through Northern South America (1843–47 and 1848–56), and was after his return appointed professor in botany at Berlin. His principal writings are *Die Vegetationsorgane der Palmen* (1847), *Flora Columbiæ* (1857–66), and *Chemismus der Pflanzencelle* (1870).

Kart'haus, post-tp. of Clearfield co., Pa. Pop. 452.

Kasanlik', town of European Turkey, in Rum-elee, is famous for its manufacture of attar of roses. Pop. 10,000.

Kas'chau, town of Hungary, on the right bank of the Hernad. Its church of St. Elizabeth, built 1342–82, is the finest Gothic building in Hungary. Kaschau has a very brisk trade in wine, wheat, and fruit. Pop. 21,742.

Kashan', town of Persia, in the province of Irak-Ajemee, situated 3690 feet above the level of the sea. It is a beautiful city, with a palace, numerous mosques, baths, and promenades, and important manufactures of velvet, gold brocade, and silk stuffs. Pop. 30,000.

Kashgar′, province of East Toorkistan, between lat. 36° and 40° N., and lon. 72° and 77° E., occupies the basin of the Kizil-Darya, along the southern slope of the Thian-Shan Mountains. Area, about 57,000 square miles. In the eighteenth century it was conquered by the Chinese, and they held it to 1863, when, under a general rising of the Mohammedan population, they were driven out, and Kashgar and the adjacent provinces were formed into an independent kingdom by Yakub Beg.

Kashgar, capital of East Toorkistan, in lat. 39° 29′ N., lon. 76° 12′ E., on the Kizil-Darya, in a fertile and well-cultivated plain elevated between 4000 and 5000 feet above the level of the sea. It is surrounded by an earthen wall of considerable height and thickness and surmounted with numerous towers. It has 8 colleges, 11 caravanserais, extensive bazaars, some manufactures of woollens, carpets, gold and silver ware, and a lively trade. The number of its inhabitants is very differently estimated at from 16,000 to 80,000; 60,000 seems the most probable.

Ka′shin, town of Russia, in the government of Tver, on the Kashinka, an affluent of the Volga, has extensive tanneries and manufactures of paper, and carries on an active trade in grain and cattle. Pop. 7639.

Kashmir. See CASHMERE.

Kaskas′kia, tp. of Fayette co., Ill. Pop. 1220.

Kaskaskia, post-v. of Randolph co., Ill., on the W. bank of the navigable Kaskaskia River, 7 miles from its mouth. It was founded in 1682 by the French under La Salle, and was until 1818 the capital of Illinois. Many of its present inhabitants are of the old French stock. The town was once large and important, but it has declined. The surrounding country is very fine.

Kaskaskia Indians, a tribe once living in Illinois. In 1832 they were removed to what is now Kansas, and in 1867 to the Indian Territory. They are intelligent and quite advanced in civilization. They are confederated with the Peorias and others, and are few in number.

Kaskaskia (or **Okaw**) **River** rises in Champaign co., Ill., flows about 300 miles in a generally S. W. course, and enters the Mississippi in Randolph co. In its lower course it is navigable.

Kaskes, tp. of Jackson co., Ala. Pop. 729.

Kaso′ta, post-tp. of Le Sueur co., Minn., on St. Paul and Sioux City R. R., 77 miles S. W. of St. Paul. Pop. 903.

Kassimow′, town of European Russia, in the government of Riasan, on the Oka. It is an old town, with large tanneries and manufactures of sailcloth. Pop. 7781.

Kasson′, post-v. and tp., Leelanaw co., Mich. Pop. 440.

Kasson, post-v. of Mantorville tp., Dodge co., Minn., on the line of the Winona and St. Peter R. R., 50 miles W. of Winona, in a farming region, was first surveyed in 1866; contains 3 churches, 2 banks, 2 weekly newspapers, 2 hotels, 1 flour-mill, and 12 stores. In 1873, 400,339 bushels of wheat were shipped from this point. Pop. (1870), 515.

U. B. SHAVER, PUB. "DODGE CO. REPUBLICAN."

Kasson (JOHN A.), b. near Burlington, Vt., Jan. 11, 1822; graduated at the University of Vermont in 1842; studied law in Massachusetts, and practised at St. Louis until 1857, when he removed to Iowa; was appointed assistant postmaster-general in 1861; elected to Congress as a Republican in 1862; commissioner to international postal congress at Paris in 1863; again elected to Congress in 1864, and again in 1872 and 1874.

Kastamu′ni, town of Asiatic Turkey, the capital of the eyalet of the same name, in Asia Minor. It has 36 mosques, 24 public baths, manufactures of leather and cotton, and the vicinity is rich in copper ore. Pop. 48,000.

Katagoom′, or **Katagum,** town of Central Africa, in Soudan, capital of an independent district of the same name, fortified with walls and ditches. Pop. about 8000.

Katah′din (or **Katadn**), **Mount,** the highest mountain in Maine, reaches 5385 feet above the sea. It stands in a wilderness, is not easy of access, and the view from its top is extensive, but wild and lonely.

Katahdin Iron-works Plantation, tp. of Piscataquis co., Me. Pop. 35.

Ka′ter (HENRY), F. R. S., b. at Bristol, England, Apr. 16, 1777; went to India in 1796, where he was engaged for several years on the trigonometrical survey; rose to the rank of lieutenant in the military service, and retired on half-pay in 1814, after which he devoted himself chiefly to scientific studies. He invented about 1825 the important trigonometrical instrument called a *floating collimator*, experimented on telescopes, writing for the *Philosophical Transactions* accounts of various researches; was principal author of Lardner and Kater's *Treatise on Mechanics* in the *Cabinet Cyclopædia*, and wrote *An Account of the Construction and Verification of Certain Standards of Linear Measure for the Russian Government* (1832). D. at London Apr. 26, 1835.

Kathay′, or **Cathay.** A remarkable phase in the history of intercourse between Europe and farther Asia is best characterized by the name then given in the West to China. Or if China was *discovered*, as books sometimes tell us, in the beginning of the sixteenth century, then the best definition of Cathay will be that it is the name by which China was known in Europe *before its discovery!* That spacious seat of ancient civilization has always loomed so large, however dimly, to Western eyes, and has, in spite of its distance, subtended so large an angle of vision, that once and again we find it distinguished by different appellations, according as it was approached as the terminus of a southern sea-route coasting the great peninsulas and islands of Asia, or as that of a northern land-route traversing the vast longitude of that continent. In the former aspect the name has always been some form of the name *Tsin*, as Chin (Sinim?), Sinæ, Thinæ, Tzinista, Mahá-chín, CHINA. In the latter point of view it was known to the ancients as the Land of the *Seres*; to the Europeans of the Middle Ages, as the empire of CATHAY.

The latter name (*Khitaï* in Oriental form) is still that by which China is styled to this day by all or nearly all the nations which know it from the direction of Inner Asia, including the Russians, the Persians, and the nations of Toorkistan, yet it originally pertained to a people who were not Chinese. The Khitán or Khitát were a nation allied (it is supposed) to the modern Tunguses, whose chiefs, after making themselves supreme over all the tribes from the Sea of Corea to the Altai, in the early part of the tenth century overran the Chinese provinces N. of the Yellow River, and established their empire over them also, under the name of Liao or the *Iron* dynasty. This Khitán empire subsisted for two centuries, terminating in 1123, when it was in turn subverted by a new invasion from the N. And it must have been in those two centuries that the name *Khitaï* became indissolubly associated with China.

The Nyuché, or Chúrché, a tribe akin to the modern Manchus, displaced the Khitán, and reigned under the name of Kin or *Golden* dynasty. They about a century later (1214–34) were displaced by those more famous warriors, the Mongols of Chinghiz Khan. The conquest of the Kin empire was completed by Okkodai, the son of Chinghiz; but not till the third generation, and sixty years after the capture of Peking, was the Mongol conquest extended over Southern China, in the reign of Kublaï. This southern empire, under its Chinese sovereigns holding their royal residence (*King-szé*) at the great city now called Hang-chow, was known to the northern conquerors as *Mantzi*, a name often by the Western Asiatics exchanged or confounded with *Máchin—i. e.* the Hindu *Mahá-Chín* (Great China).

The flood of Mongol conquest spread westward as well as eastward, levelling all political barriers, sweeping over Slavonic Europe, and threatening weak and disunited Christendom with annihilation. And when Western Europe had recovered from the alarm of this brief but terrible invasion (1240–42), Asia lay open as it never did before or has done since, and the accidents of war, commerce, and opportunity carried a number of persons in various ranks of life, and from almost every country in Europe, to its remotest regions. Missions also went to the Tartar courts from the pope and the princes of Europe, and among others John of Piano Carpini (1245–47), a native of Umbria, and William de Rubruquis (1253), a Frenchman, both Franciscan monks of superior intelligence, who have left us narratives of high interest. And these brought to Western Europe the revived knowledge of a great and civilized nation occupying a country in the extreme East, on the shores of the ocean, which bore the name, then first heard in Europe, of CATHAY. Rubruquis was acute enough to discern that these Cathayans must be the Seres of classic fame. But though these travellers saw the people at the Tartar court, and Friar William gives an unmistakable description of them ("Those Cathayans are little fellows, speaking much through the nose, and, as is general with those Eastern people, their eyes are very narrow. They are first-rate artists in every kind of craft. . . . They do their writing with a pencil such as painters paint with, *and a single character of theirs comprehends several letters, so as to form a whole word:*" the last remark, imperfect as it is, shows the intelligence and observation of the writer), neither traveller reached the country itself.

The first actual European visitors to Cathay of whom we know are the Polos (see POLO, MARCO), regarding whom we need say nothing here. But just as they were reaching Venice (1295) after their absence of twenty-six years, the forerunner of a new band of travellers was entering China by the route of the Indian seas. This was John of Monte

Corvino, another Franciscan, who, already nearly fifty years of age, was plunging single-handed into the ocean of paganism to preach the gospel according to the interpretation of his Church. After years of uphill work and solitary labor, others joined him, and the Catholic mission flourished at Cambaluc or Peking, under the patronage of the Great Khan himself. The papal see woke up to the importance of this distant work, made Friar John archbishop in Cambaluc with patriarchal authority, and sent him spasmodically batches of suffragan bishops and missionary friars. The Roman Church spread; churches and houses of St. Francis were founded at Cambaluc, at Yangchow, at the great ocean-port in Fokien which the Westerns called Zayton and the Chinese called T'swanchow, and elsewhere. Among the monks whose duty carried them to Cathay during the interval between 1300 and 1328, when Archbishop John was followed to the tomb by mourning crowds of pagans as well as of Christians, several have left letters or narratives. Among these we have several early letters from the archbishop himself (1305–06); one from Andrew, bishop of Zayton (1326); and the narrative of Friar Odoric, afterwards canonized as a *beatus* of the Church, dictated after his return to his native Friuli (1330).

The narrative of Odoric is the only one that mentions Canton, known to him and the Westerns of that age by the name of Chín-kalán (*i. e.* "Great China," a Persian rendering of the Indian Mahá-chín). He landed there on arriving from India, and describes it as a city as big as three Venices, standing on a great river, one day's voyage from the sea. Thence he travels through Fokien, visiting the cities of Zayton and Foochow, and then to Cansay or Kinsay (*King-szé—i. e.* Hangchow), the vastness of which in extent, population, and wealth made the same extraordinary impression upon him as upon Marco Polo and all the travellers who speak of it.* From this point it is not difficult to trace his journey by Nanking, and across the two great rivers of China, and then by the Imperial Canal to the capital, Cambaluc, where the emperor then reigning was Yesun-timúr, a degenerate descendant of Kublaï, in the fourth generation. This traveller on his homeward journey seems to have passed by Central Asia, and by Kabul, reaching his native land in 1329. Several of the stories told by Odoric that were probably regarded as fictions by his contemporaries are remarkably characteristic of China. Besides many particulars occurring in the larger narrative of Marco Polo, he gives the earliest notice of the now well-known Chinese practice of using tame cormorants in fishing; and he mentions the custom of compressing the feet of girls to prevent their growth.

But the Exchange had its emissaries at this time to Cathay as well as the Church. The record is a very fragmentary and imperfect one, but many circumstances and incidental notices show how frequently the far East was reached by European traders in the first half of the fourteenth century—a state of things which it is very difficult to realize when we see how all those regions, when partially reopened, less than two centuries later, seemed as absolutely new discoveries as the empires which in the same age Cortes and Pizarro were conquering in the West.

This commercial intercourse cannot have commenced till some years after 1300. For Monte Corvino, writing in 1305, says it was then twelve years since he had heard any news from Europe, the only Western stranger who had appeared in all that time being a certain Lombard chirurgeon, who had spread awful blasphemies about the pope! Yet even on his first entrance into China, Friar John had been accompanied by "Master Peter of Lucolongo, a faithful Christian man and a great merchant," who purchased a piece of ground for the mission-church opposite the palace gate at Peking. Twenty-one years later, Bishop Andrew of Zayton (1326) quotes the opinions of the Genoese merchants at that great mart touching a question of exchange value. Odoric, dictating his travels in 1330, refers for corroboration of the marvels of Kinsay or Cansay to the many persons at Venice who had themselves been witnesses of all that he asserted. And a later traveller, John Marignolli, mentions that there was (*circa* 1346), in connection with one of the *three* Franciscan houses at Zayton, a *fondaco* or factory and warehouse for the use of the Christian merchants.

But the most distinct and notable evidence of the importance of European trade with Cathay is to be found in the work of Francesco Balducci Pegolotti, written about 1340. This person was a factor in the Levant and elsewhere under the great Florentine house of the Bardi—the house which gave a husband to Dante's Beatrice, and has given a heroine to George Eliot (*Romola*), and which failed, about the date of the book, in consequence of dealings with Edward III. of England, whose bankers and agents the Bardi were. The book is a regular manual of commerce, giving details of duties, exchanges, and customs of trade at the various marts of Europe and the Levant.† But the first two chapters are devoted to information for the merchant bound to Cathay. The route lay from Tana (or Azov) to Sarai on the Volga (above Astracan), and thence by Organj (Old Khiva) and Otrar (not far from the modern town of Hozrat Toorkistan) to Almalik (near Gulja on the Ili), and thence to Kanchow in North-eastern China, and so forward to the Grand Canal leading to the great marts of Cansay and Cambaluc (Hangchow and Peking). Particulars are given as to the investments and exchanges proper to this journey, and especially as to the paper money then forming the currency of China. The extent of dealings contemplated may be judged from the example, which the author assumes for illustration, of a merchant carrying goods to the value of some 25,000 gold florins (say $60,000). Little was to be taken to Cathay except silver in ingots, and the purchases contemplated there were silk and rich silk textures (damasks, gold brocades, and the like). Silk cost then in Cathay about 5 florins (say $12) for 20 Genoese pounds. The only unsafe part of the road was that between Tana and the Volga, but even there a company of sixty would be "as safe as in your own house."

The picture that we can put together from the notices of mediæval travellers in Cathay is that of the China that we know, but always with a striking contrast as regards the facilities of movement allowed to foreign visitors in the interior. The vast swarms of population and of river-shipping, the great plenty of the necessaries of life, the splendor and magnitude of the cities, the high civilization of this heathen people, the cheapness of silk and porcelain, the use of fossil coal and of paper money, are the features which are constantly prominent in these notices. The free intercourse was not, however, of long duration. As the Mongol chiefs in Central and Western Asia, one after another, adopted Islam, the power of bigotry revived, and with it the old obstacles. Thus, already in 1339 we find a merchant, William of Modena, along with certain friars, put to death for the faith at Almalik. About the middle of the century the house of Chinghiz in China began to totter, and its fall in 1368 closed all communication with the Western World. The last notices we possess are contained in a work (strange to say) on Bohemian history by John Marignolli, a Florentine monk who had been sent as envoy to the last of the Mongol emperors by Pope Benedict XII. He had gone by the usual land-route, and after spending about four years (1342–46) at Peking, returned by the searoute to India, on his way visiting Ceylon, where he was wrecked and robbed. In 1370, the pope, probably in ignorance of the changes in the East, nominated one Friar William of Prato to be archbishop of Cambaluc, but we know not if he attempted to reach his see. He certainly cannot have succeeded. Later prelates appear in some lists, but this has been shown to have arisen from a confusion with another see in Tartar territory, that of Cembalo, otherwise Balaklava, in the Crimea.

Of the same remarkable phase in Chinese history we have also a good many notices in Mohammedan writers. The establishment of a Mongol dynasty in Persia (1258), by which the Great Khan reigning over Cathay was for many years acknowledged as lord paramount, led to a good deal of intercourse. Chinese visitors were by no means unknown at the court of Tabriz, and some of the Persian historians, writing at that court under the patronage of the Mongol princes, have told us much about Cathay, especially Rashíduddín, the great minister and historian of the Mongol rulers of Persia (d. 1318). We have also in the book of the Moorish traveller Ibn Batuta, who visited China about 1347–48, many very curious, and in great part true, notices, though in this part of the work it is not possible to give credence to the whole of the traveller's narrative.

With the downfall of the Mongol dynasty in China, as we have said, this curious phase of history came to a close. The new and native rulers reverted to the old indigenous policy, and kept all foreigners at arm's length, whilst Mohammedanism entirely recovered its grasp over Middle Asia, and the Nestorian Christianity, which had acquired considerable sway, as rapidly dwindled and expired. A dark mist descended on the further East, covering Mantzi and Cathay, with those cities of which the mediæval travellers had told such such wonders, *Cambaluc* and *Kinsay*, *Zayton* and *Chín-kalán*. And when the veil rose, a century and a half later, before the Portuguese and Spanish navigators, those names were heard no more. In their stead men spoke of *Peking* and *Hangchow*, of *Chinchen* and *Can-*

*This great city retained much of its prosperity till destroyed by the Taipings in our own day.

† The MS. of this book is in the Riccardian Library at Florence. It was printed by G. F. Pagnini del Ventura in a work called *Della Decima*, etc. (1765–66).

ton. Not only were the old names forgotten, but the fact that those places had been previously known to Europe was utterly forgotten also. Gradually, new missionary priests went forth from Rome—Jesuits now. New converts were made, and new vicariats were constituted; but the old Franciscan churches, and the Nestorianism with which they had battled, had been alike swallowed up in the ocean of paganism. In time, however, slight traces of the former existence of Christian churches came to the surface; and when Marco Polo's book was read by intelligent men, one and another began to suspect that his Cathay and the new China were identical.

But it was a very long time before this was thoroughly or generally understood. When the new interest in discovery recalled attention to the perusal of old travellers, the Cathay of which they spoke was regarded, except by a sagacious few, as a region distinct from those new-found Indies. Cathay had been the aim of the first voyage of the Cabots in 1496, and it continued to be the object of many adventurous voyages, English and Dutch, to the N. W. and N. E. till far on in the sixteenth century. At least one memorable land-journey also was made by Englishmen, of which the investigation of trade with Cathay was a chief object—that in which Anthony Jenkinson and the two Johnsons reached Bokhara by way of Russia in 1558–59. The country of which they collected notices at that city was still known to them only as *Cathay*, and its great capital only as *Cambaluc*.

Cathay as a supposed separate entity may be considered to come to an end with the journey of Benedict Goës, the lay Jesuit. This admirable person was in 1603 despatched through Central Asia, by his superiors in India, with the specific object of determining whether the Cathay of old European writers and of modern Mohammedans was or was not a distinct region from that China of which parallel marvels had now for some time been recounted. Benedict, as one of his brethren pronounced his epitaph, "seeking Cathay, found heaven." He died at Suhchow, the frontier city of China, but not before he had ascertained that China and Cathay were one.

In briefly recalling one more aspect of Cathay, we close this article. It was Cathay, with its outlying islands of Zipangu, or Japan, that Columbus, penetrated by his intense convictions of the smallness of the earth and of the vast extension of Asia eastward, sought to reach by sailing W.; and to the day of his death he was full of the imagination of the proximity of the domain of the Great Khan to the islands and coasts which he had discovered. And these imaginations are curiously embodied in some of the early maps of the sixteenth century, which intermingle on the same coast-line the new discoveries from Newfoundland to Brazil with the provinces of Marco Polo's Cathay.

H. Yule.

Katif′, town of Arabia, is situated on the Persian Gulf, in lat. 26° 25′ N. The bay on which it stands affords good anchorage, but the town itself, which is fortified, is unhealthy, and its trade is dwindling away. Pop. about 6000.

Katkoff′ (Michael), b. at Moscow in 1820; finished his studies at Königsberg and Berlin, and was for several years professor in philosophy in his native city. Since 1856 he has devoted himself exclusively to journalism, and he has exercised an enormous influence—in a liberal direction by his denunciations of existing wrongs, and in a national direction by the formation of the Old Russian party.

Kato′nah, post-v. of Bedford tp., Westchester co., N. Y., on the Harlem R. R., 42 miles N. of New York. It has 1 weekly newspaper.

Ka′trine, Loch, a lake of Scotland, in the county of Perth. It is 8 miles long and $\frac{3}{4}$ of a mile wide, and remarkable as well for the depth and purity of its water as for the beautiful scenery which surrounds it. Glasgow, nearly 25 miles distant, draws its supply of water from this lake.

Kat′sena, town of the empire of Sokoto, in Central Africa. It was formerly a large and flourishing city, but since its capture in 1808 by the Fulbes, who almost destroyed it, its trade and manufactures have removed to Kano. It has now only 7000 inhabitants.

Kattimandu′, or **Cuttimundoo**, the milky latex or sap of *Euphorbia nereifolia*, an East Indian plant. This substance resembles gutta-percha, and has considerable value in the arts. The leaves are used by the natives for their diuretic, cathartic, and deobstruent powers, and the juice is an ingredient in anti-rheumatic liniments.

Katun′ga, or **Eyeo**, town of Central Africa, the capital of a state of the same name, is in 8° 59′ N. lat., 4° 25′ E. lon., and is, like all towns of these regions, surrounded with walls to protect it against marauding tribes. It carries on some trade, and is said to have 15,000 inhabitants.

Ka′tydid (*Cyrtophyllus concavus*), a large green orthopterous insect of the U. S., belonging to the group Locustariæ, found throughout a great part of the country. It is so called from its note, produced in the early part of the night, somewhat resembling the words "Katy did." This noise is produced by the friction of transparent membranes attached to the wing-covers.

Katz′bach, a river of Prussia, in the province of Silesia, entering the Oder at Parchwitz. On Aug. 26, 1813, the Prussians under Blücher totally defeated the French under Marshal Macdonald on the banks of Katzbach.

Kauai′, one of the Hawaiian Islands, is situated in lat. 22° N., lon. 159° 30′ W. Area, 640 square miles. Pop. 4961. It is high—Waialeale, the highest point, rising about 6000 feet—of volcanic origin, but very fertile. Koloa and Nawiliwili are the principal towns.

Kauff′man (Maria Anna Angelica), b. at Coire, in the Grisons, in 1741. Her father was an itinerant painter of ordinary talents, of whose work nothing authentic remains. His enthusiasm for his art was, however, sincere, and, appreciating the extraordinary gifts of his daughter, he gave her such instruction, opportunity, and stimulus as he could command. Her talent for music rivalled her talent for painting, and for a moment she was tempted to make music her profession, and go upon the lyric stage, as she was urged to do at Milan; but she wisely decided to pursue her first calling. At Como she painted successfully the portrait of the bishop, through whose influence she had many sitters there. At Milan, whither her parents went when she was but thirteen years old, she associated with artists of reputation, studied under competent masters, copied good pictures, and won favor with people of the court. At Schwartzenberg she painted in fresco the twelve apostles by order of the bishop of Constance. In 1761 the father and daughter visited Florence, Parma, Rome, Bologna, Naples, and Venice. In Rome she formed the friendship of Rafael Mengs and Winckelmann, and painted the portrait of the latter to his great satisfaction. In a letter to a friend he wrote of her as "a person of rare merit," "very eminent in portraits in oil." In Bologna she executed what is considered her finest etching, *The Toilet;* in Venice she won praise and patronage from the English there, and in 1766 went to London with Lady Wentworth, who had become interested in her. In London her success was brilliant. The duchess of Brunswick sat to her; she was presented at court, painted portraits of the queen and son of George III., and was overwhelmed by orders from the nobility. She was spoken of as "the beautiful and accomplished Miss Kauffman." In 1768 she was chosen one of the original thirty-six members of the Royal Academy, just started; her pictures held prominent places at the exhibition; she was flattered by the admiration of Sir Joshua Reynolds, and chosen to paint portraits of the most distinguished and beautiful ladies of the court. When the plan of decorating St. Paul's cathedral was entertained, Miss Kauffman was selected, along with Reynolds, West, Bray, and Cipriani, an Italian artist then much in vogue. She lived in England till 1771, when, her father's health failing, she married Antonio Zucchi, a Venetian, and the three left England for Italy. At Venice she lived long enough to paint *Leonardo Dying in the Arms of Francis I.* The latter years of her life were spent in Rome, where Goethe, Herder, and Klopstock were her friends; where she was so much respected that the French general, on taking possession of the city, ordered that her house and property should be unmolested; and where, after a lingering and painful illness, she d. in Nov., 1807.

Angelica Kauffman owed her fame and fortune as much to personal attractions, charm of manner, and social accomplishments as to her art, which was mannered, conventional, and monotonous. Her pictures are graceful and pleasing, harmonious in color, correct in drawing, and sweet in expression, but are not thought deserving of the praise lavished on them by Sir Joshua Reynolds, Rafael Mengs, and Goethe. Her attempts at historical painting were ambitious failures. The galleries of the Louvre in Paris and the Royal Gallery in Dresden contain excellent examples of her work; some of her best pieces are in Russia. In England her compositions are well known. An unfortunate marriage connection, from which she was released by divorce, saddened a portion of her life, but gave to it a romantic interest. Of her later marriage with Zucchi little is known.

O. B. Frothingham.

Kauf′man, county of N. E. Central Texas, in the valley of the Trinity River. Area, 950 square miles. It has a very fertile soil, and is well timbered. Live-stock, grain, and cotton are staple products. Cap. Kaufman. Pop. 6895.

Kaufman, post-v. and tp., cap. of Kaufman co., Tex., near Trinity River, 10 miles S. of the Texas and Pacific R. R., and about 40 miles S. E. of the city of Dallas, on the

dividing-line between the timbered portion of Eastern Texas and the great wheat-belt of Northern Texas. It has 3 churches (1 colored), 2 schools, 1 bank, 2 hotels, 1 newspaper, and 1 sash and door manufactory; is at the intersection of three projected railroads. Principal occupation, farming. Pop., not found in census returns of 1870, estimated in 1874 at 12,000. G. W. CLARK, PUB. "STAR."

Kaufmann, von (C.), Russian general, governor-general of Toorkestan, and adjutant-general to the czar, of German descent, made himself famous by his successful expedition into Central Asia. In 1867 he was appointed governor-general of the vast regions which, partly dependent on Russia and partly inhabited by hostile tribes, formed the provinces of Sir Daria and Semiretschkaia, but which now have been united into the military circle of Toorkestan. His task was to strengthen and extend the influence of Russia in Central Asia, and he soon became engaged in a war with Bokhara. Immediately after his arrival in Toorkestan he took up a position with his troops at Dschisak, on the southern frontier of his territory, and entered on long negotiations with the hostile emir of Bokhara until he received large reinforcements in Mar., 1868. He then commenced to march southward along the river Serafschan. The emir declared war. By prudent and energetic measures Kaufmann succeeded in defeating the force of the emir, though vastly superior in numbers, and in the middle of May he occupied Samarcand. The result of this victory was a peace very advantageous to Russia, by which the emir ceded Samarcand and a large territory, and became a submissive friend of Russia. Kaufmann now used the humiliation of Bokhara for the subjugation of the most dangerous enemy of Russia in Central Asia—the khan of Khiva. Surrounded on all sides by great deserts, Khiva was unapproachable to Russian armies without the aid of Bokhara. After several cautious reconnoitrings, Kaufmann moved in Mar., 1873, three columns, consisting of 12,000 men, from the Caspian Sea, from Orenburg, and from Tashkend, towards Khiva, and after great hardships on the long march he entered the hostile capital June 10. He compelled the khan to a peace advantageous to Russia, and defeated the wild tribes of the Toorkomans and Jomudes, which, although dependent on the khan, would not acknowledge the peace. In consequence of a treaty between the Russian government and England, the Russian army again retired from Khiva, but the unconditional authority of Russia in Central Asia was nevertheless established, numerous military stations, which will prove of great service under future expeditions southward, were established on the Black Sea, the Sea of Aral, and along the Amu-Daria, and the territory of the military circle of Toorkestan was doubled by conquered districts. The residence of the general is Tashkend. AUGUST NIEMANN.

Kaukau'na, post-tp. of Outagamie co., Wis., on the Chicago and North-western and the Milwaukee Lake Shore and Western R. Rs. Pop. 1429.

Kaul'bach, von (WILHELM), b. at Arolsen, in the principality of Waldeck, Oct. 15, 1805. His parents were very poor, and the unfavorable circumstances under which he grew up gave his mind something bitter and sarcastic, at the same time that they strengthened and elevated his character. In 1822 he was enabled by the aid of the sculptor Rauch to frequent the Academy of Düsseldorf, where he studied under Cornelius, and when the latter removed to Munich in 1825, Kaulbach followed him. He remained in this city for the rest of his life, and d. there Apr. 7, 1874. His first pictures, *Apollo and the Muses*, on the ceiling of the Odeon, and the sixteen wall-pictures in the palace of Duke Max illustrative of the myth of Cupid and Psyche, all executed in fresco, were produced under the influence of Cornelius, and are kept in a purely idealistic style. But nearly at the same time appeared his *Lunatic Asylum*, an oil-painting of the most decidedly realistic character, and to the same style belong his celebrated illustrations to *Reineke Fuchs*, a series of sketches as admirable for their striking conceptions of the character and nature of the different animals as distinguished for their humor and satire. But his true genius did not fully reveal itself until 1837, when he finished the *Battle of the Huns* for Prince Raczynsky; next year followed the *Destruction of Jerusalem* for the Pinakothek in Munich. These two pictures, which generally are considered as his masterpieces, are not historical paintings in the common sense of the word. They do not represent facts, but ideas, and the form in which they represent the ideas is thoroughly symbolical or allegorical, in spite of the realistic life and fulness of the details. To this style belong all his largest and most celebrated productions—the decoration of the stairway in the Museum of Berlin, commenced in 1847, *St. Michael, the Patron Saint of Germany*, finished shortly before his death, and others. In Germany these pictures produced a very deep impression; no one here hesitated to set them up as the highest productions of modern art. In foreign countries, however, they did not meet with the same admiration. Their pictorial effect, properly speaking, is not great. They impress principally by their intellectuality, though it cannot be denied that the symbols and allegories are sometimes rather trivial; thus, the *Reformation* is hardly anything more than a clever arrangement of portraits. There is something in Kaulbach's pictures which reminds of Wagner's music. The enthusiasm which they awaken is of a polemical character. They throw down a great mass of modern painting into utter insignificance, but they seem not themselves to satisfy the demands which they raise.

CLEMENS PETERSEN.

Kau'nitz (WENZEL ANTON), PRINCE, count of Rietberg, b. at Vienna Feb. 2, 1711; studied at Leipsic and Leyden; travelled through France and Italy; and entered the diplomatic career in the Austrian service in 1735. By the consummate skill with which he negotiated the Peace of Aix-la-Chapelle in 1748, and still more by his astonishing success in forming an alliance between Austria and France while ambassador in Paris (1750–52), he acquired great fame as a diplomat; and 1753, Maria Theresa made him chancellor and placed him at the head of the Austrian government. This position he held for nearly forty years, and he was generally considered the greatest statesman of his age. Under the reign of Joseph II. his influence decreased, especially after the failure of his negotiations for the annexation of Bavaria to Austria. In 1792 he retired on account of old age. D. June 27, 1794. His policy was exclusively Austrian, and centred in the one idea of making Austria great, but in details, with respect even to some of the most important political transactions—as, for instance, the division of Poland, the church reforms of Joseph II., etc.—it is doubtful whether they were originally planned by him. Personally, he was a man of perfect honesty, with taste for science and art, generous and amiable in spite of his enormous vanity.

Kau'ri Pine, the *Dammara australis*, and other species of the same genus, produced in Australasia and the adjacent regions. They are coniferous trees of noble size, and the best quality as timber. This timber is used for ships' masts and planks. The trees produce kauri gum or New Zealand dammar, extensively used in making varnishes.

Kautz (ALBERT), U. S. N., b. Jan. 29, 1839, in Ohio; graduated at the Naval Academy in 1858; became a lieutenant in 1861, a lieutenant-commander in 1865, a commander in 1868; served in the flagship Hartford at the passage of Forts Jackson and St. Philip and capture of New Orleans, Apr. 24, 1862, and in the various engagements with the Vicksburg batteries in June and July, 1862. Highly commended in the official despatches for "gallantry and ability." FOXHALL A. PARKER.

Kautz (AUGUST VALENTINE), b. Jan. 5, 1828, in the village of Ispringen, near Pforzheim, grand duchy of Baden; emigrated to the U. S. in 1828 with his parents, who settled in Brown co., O., in 1831; graduated at West Point, and appointed brevet second lieutenant of infantry July, 1852; promoted first lieutenant 1855; captain 6th Cavalry May, 1861; appointed colonel 2d Ohio Cavalry Sept. 2, 1862; brigadier-general of volunteers May 23, 1864; served during the civil war in the Virginia Peninsular campaign, 1862; in the Army of the Ohio in pursuit of Gen. Morgan and the siege of Knoxville 1863, and with the Army of the James, commanding cavalry division, 1864–65, participating in the occupation of Richmond, Va., Apr. 3, 1865, commanding 1st division 25th corps; member of the military commission for the trial of the assassins of Pres. Lincoln; appointed lieut.-col. 34th Infantry July, 1866; transferred to 15th Infantry Mar., 1869; col. 8th Infantry June, 1874. Author of *Company Clerk* (1863), *Customs of Service for Non-commissioned Officers and Soldiers* (1864), and *Customs of Service for Officers* (1866). G. C. SIMMONS.

Kava. See AVA.

Kaval'la, small town of European Turkey, in the eyalet of Saloniki, on the Ægean Sea, opposite the island of Thasos, is famous as the birthplace of Mehemet Ali, and carries on an important export trade in leaf tobacco. Pop. about 5000.

Kav'anagh (JULIA), daughter of Morgan Kavanagh, a novelist, was b. in 1824 at Thurles, Ireland, and from childhood resided chiefly in Paris, whence she removed in 1844 to London. She has produced a very large number of novels, tales for children, etc., among which are *Madeline* (1848), *Nathalie* (1851), *Beatrice* (1865), *Sylvia* (1870).

Kav'anaugh (HUBBARD H.), D. D., b. near Winchester, Ky., in 1802, was Methodist local preacher in 1822, joined Kentucky conference in 1823, and for fifty years has been

a successful itinerant; was superintendent of public instruction in Kentucky in 1839, and became bishop of the Methodist Episcopal Church, South, in 1854.

Ka'vi, the ancient sacred language of the island of Java in the East Indies, is based chiefly upon the Sanskrit, a knowledge of which was brought by Brahmanic immigrants from India about the beginning of the Christian era. It gradually became corrupted by the ordinary Javanese tongue to the extent of about two-fifths of its vocabulary. The alphabet is nearly the same as the Devanagari, although the order of the consonants is varied. The name of the language signifies "learned" or "wise," and has been applied only since it began to be distinguished from the aboriginal languages by the composition of a literature. This took place in the early centuries of the Christian era. A considerable number of works is still extant, devoted largely to legends of the Creation and poems concerning mythical heroes. In the fifteenth century the sacred language, as well as the religion taught by it, was driven from Java, and took refuge in the neighboring small island of Bali, where some knowledge of it is still retained by the natives. William von Humboldt has subjected the Kavi language to a searching examination, and has extracted much curious information—*Ueber die Kavi-Spracher.*

Kaw, tp. of Jefferson co., Kan. Pop. 749.

Kaw, tp. of Jackson co., Mo. Pop. 1612.

Kawkaw'lin, post-v. and tp. of Bay co., Mich., on the Jackson Lansing and Saginaw R. R., at the mouth of Saginaw River and the head of Saginaw Bay. Pop. 756.

Kaye (John), D. D., b. at Hammersmith, England, in 1783; graduated at Christ's College, Cambridge, in 1804; became master of his college in 1814; regius professor of divinity in 1816; bishop of Bristol in 1820, and of Lincoln in 1827. He wrote *The Ecclesiastical History of the Second and Third Centuries, illustrated from the Writings of Tertullian* (1826), *Writings and Opinions of Clement of Alexandria* (1835), *Writings and Opinions of Justin Martyr* (1836), *Government of the Church during the First Three Centuries* (1855), several charges to his clergy, and two or three anonymous treatises directed against Catholicism. D. at Lincoln Feb. 19, 1853.

Kaye (Sir John William), b. in England in 1814; served for some years in the army of the East India Company; returned to England in 1845, and devoted himself to literature. In 1856 he entered the Indian home civil service; in 1859 became secretary in the political and secret department of the India office; and was knighted in 1871. He has published a *History of the War in Afghanistan* (1851–53), *History of the Administration of the East India Company* (1853), *Life and Correspondence of Lord Metcalfe* (1854), *Life of Sir John Malcolm* (1856), *Christianity in India* (1859), *History of the Sepoy War* (2 vols., 1866–71), and *Essays of an Optimist* (1870).

Kazan', or **Kasan,** government of Russia, bounded by Viatka, Novgorod, and Astrakhan. Area, 23,650 square miles. Pop. 1,670,337. The surface is flat, but the soil fertile, affording excellent pasture. Cattle and bees are reared, good timber is grown, and the fishing in the Volga is considerable.

Kazan, town of Russia, the capital of the government of Kazan, on the Kazanska, 4 miles from its influx in the Volga. It has a university, a theological seminary, a military school, 2 gymnasia, and several other educational institutions. Its manufactures of leather, soap, hardware, and spirits are considerable and its trade very extensive. It was destroyed by fire twice in this century, in 1815 and 1842, but rebuilt more beautiful each time. In the neighborhood is the magnificent Semiozernoi convent. Pop. 78,602.

Kazbin', or **Casbin,** town of Persia, in the province of Irak-Ajemee, in a beautiful plain covered with orchards and encircled by hills. It manufactures velvet, silk, satin, brocade, coarse cotton fabrics, and articles of iron and brass. Its breeds of camels and horses are very celebrated. The number of its inhabitants is not ascertained. The area it occupies is very large, but a great portion of it is covered with ruins.

Kaz'inczy (Franz), b. at Er-Semlyén, Hungary, Oct. 27, 1759; studied law, and held several minor offices during the earlier part of his life, though literature was always his principal occupation. Being implicated in the conspiracy of Martinovics, he was condemned to death in 1793. He was pardoned, but kept in prison for seven years. After his liberation in 1801 he devoted himself exclusively to literature, and exercised a great influence both by his own works and by his numerous translations from the German, French, and English. He was one of the leaders of the movement by which the Latin language was laid aside and the native tongue adopted as the medium of Hungarian literature. D. Aug. 22, 1831.

Kea'gy (John M.), M. D., b. in Lancaster co., Pa., about 1795; d. at Philadelphia Jan. 30, 1837. He taught chiefly in the public high school at Harrisburg, where he published his *Pestalozzian Primer* in 1827, a book made up largely of "thinking lessons," the modern "object lessons." He advocated, and to some extent practised, the mode of teaching a child to read words "as if they were Chinese symbols." (See Barnard's *Jour. of Education,* 1871, vol. xxii. p. 649.) S. S. Haldeman.

Kean (Charles John), son of Edmund Kean, b. at Waterford, Ireland, Jan. 18, 1811; d. Jan. 22, 1868; was educated at Eton, but was withdrawn before completing his studies there, in consequence of his father's broken fortunes; declined a cadetship in the service of the East India Company, and made his first appearance on the stage at Drury Lane Theatre on Oct. 1, 1827, in the character of Norval. His reception was cold, and success came to him slowly. In 1830 he visited America, and appeared as Richard III. at the Park Theatre; returned to England Jan., 1833, and played in the provincial theatres; made a professional trip to Hamburg; came to London in 1838, and took position, as Hamlet, in the front rank of his profession. In 1839 he visited again the U. S. and Havana; returned to London in 1840; in 1842 married Miss Ellen Tree; crossed the Atlantic once more with his wife in 1846; in 1847 went back, and after playing engagements in Birmingham, Manchester, Liverpool, and Dublin, and at the Haymarket, he identified his fortunes with the Princess Theatre, which he made popular and lucrative. Twice Mr. Kean was entrusted with the management of the Windsor theatricals. His production of *Richard III.* and of *King John,* first attempted in the U. S. on a scale of splendor till then unknown, had great celebrity. Mr. Kean gained his chief reputation in the tragedies of Shakspeare—*Hamlet, Macbeth, Richard II., Richard III., Romeo and Juliet*—but he did not sustain the grand traditions of his father. O. B. Frothingham.

Kean (Edmund), b. in London Mar. 17, 1787; d. in Richmond May 15, 1833; date of birth is not quite certain. His father, it is believed, was connected as a mechanic with the Royalty Theatre; his mother was an actress of little repute. The child was born and reared amid the associations of the stage, and early attracted attention by his aptness in juvenile parts. For fourteen or fifteen years he was connected with strolling companies, played in every variety of *rôle,* and by practice acquired professional facility. His first appearance on the London stage was at Drury Lane Jan. 26, 1814, in the character of Shylock. His success was immediate, and was raised to the highest point by his impersonations of Hamlet, Richard III., Macbeth, Othello, Iago, Lear, Sir Giles Overreach, Sir Edward Mortimer, and other parts then popular. He visited the U. S. in 1820, and again in 1825; his last appearance was in 1833, with his son Charles, as Othello; his strength failed him in the middle of the play, and he was borne out in the arms of his son. Kean was a man of genius and accomplishment, a student in his profession, of extraordinary powers of mimicry and conversation, but irregular in life, capricious in temper, and eccentric in habit. Tradition represents him as one of the greatest actors that ever trod the boards. In moments he was surpassingly great, but his reliance on his genius made him unequal. His biography by "Barry Cornwall" (Mr. Procter) gives an interesting account of the actor and the man. The *Reminiscences* of Mr. Macready contain allusions to him that show how he was regarded from a professional point of view. Mr. Macready speaks of him as "one of the most extraordinary theatrical geniuses that have ever illustrated the dramatic poetry of England." Kean was small of stature, but graceful, and when under the influence of passion effective, and even grand. His countenance was expressive, his eye brilliant, his action free and noble, his voice flexible and strong. His power of impersonation was wonderful; in his best moments "he seemed to clutch the whole idea of his character." The impression he made in the U. S. was impaired by his own waywardness in refusing to complete an engagement in Boston on his first visit there. O. B. Frothingham.

Keane (John), Lord, b. at Belmont, Ireland, in 1781; entered the British army in boyhood; served in Egypt, and in Spain during the Peninsular war, gaining the rank of major-general; commanded the British expedition against New Orleans in 1814 until superseded by Pakenham; was severely wounded at the battle of New Orleans; commanded the West Indian forces 1823–30, and acted for some time as governor of Jamaica. In 1833 he was sent to India, and during the Afghan war (1839) captured the stronghold of Ghuznee, for which exploit he was made a peer and received from the East India Company a pension of

£2000. D. at Burton Lodge, Hampshire, England, Aug. 24, 1844.

Kear'nersville, post-tp. of Forsyth co., N. C. Pop. 995.

Kear'ney, county of Nebraska, bounded on the N. by Platte River. Area, 500 square miles. It is rolling prairie, well adapted to pasturage. Cap. Fort Kearney. Pop. 58.

Kearney, post-v. of Washington tp., Clay co., Mo., on the Kansas City branch of the Hannibal and St. Joseph R. R. It has 1 weekly newspaper. Pop. 396.

Kearney, tp. of Hudson co., N. J. Pop. 974.

Kearney (LAWRENCE), b. at Perth Amboy, N. J., Nov. 30, 1789; entered the U. S. navy as midshipman in 1807; served on the coast of the Southern States during the war of 1812; destroyed pirates in the West Indies, Gulf of Mexico, and in the Levant; commanded the China squadron in 1841, securing American commercial rights; returned in 1844; became commodore in 1866; and d. at Perth Amboy Nov. 29, 1868.

Kearney Junction, post-v. and tp. of Buffalo co., Neb., on the Union Pacific R. R., at its junction with the Burlington and Missouri R. R., 198 miles W. of Omaha. First town-lots were sold Sept. 9, 1872; in June, 1873, it numbered about 600 inhabitants, 200 buildings costing $140,000, 3 hotels, 3 banks, 1 school, 19 stores of various kinds, and a dépôt costing $29,000. It is in the Platte River Valley, in the midst of a fine agricultural region, with deep-black clayey soil, well watered by running streams. It has 2 daily and 2 weekly newspapers.

C. M. CLAPP, MANAGER "KEARNEY TIMES."

Kearny (PHILIP), nephew of Gen. Stephen W., b. in New York June 2, 1815; graduated at Columbia College, and studied law, but in 1837 accepted a lieutenancy in the 1st Dragoons, of which regiment his uncle was then colonel, and soon after visited Europe under orders of the government to examine and report upon the tactics of the French cavalry service. Here he attended the Polytechnic School at Saumur, and subsequently served as a volunteer in the Chasseurs d'Afrique in Algeria, winning the cross of the Legion of Honor. Returned to the U. S. in 1840, and was attached to the staff of Gen. Scott 1841–44, under whom he served with great gallantry in the Mexican war; captain of dragoons in 1846, and brevetted major for Contreras and Churubusco. In the final assault on the city of Mexico he lost an arm at the San Antonio gate; subsequently served in California and in command of an expedition against the Indians on Columbia River. Resigned Oct., 1851, and went to Europe, where he continued his military studies; served in the Italian war of 1859 as volunteer aide to Gen. Maurier of the French army, being engaged at Magenta and Solferino, and for bravery was a second time decorated with the cross of the Legion of Honor. The news of the outbreak of civil war in the U. S. caused his hasty return home, where his proffered services were at once accepted by the government. Appointed at once a brigadier-general of volunteers, he was assigned to the command of a brigade of New Jersey troops. In the Peninsular campaign of 1862 he commanded a division, and at Williamsburg and Fair Oaks his services were most brilliant and valuable, as well as throughout the subsequent hard fighting here. Arriving at Harrison's Landing, he was promoted to be major-general of volunteers, to date July 4, 1862. Subsequently, in the second battle of Bull Run, he was again conspicuous, and at Chantilly, where he was killed Sept. 1, 1862, while reconnoitring in advance of his troops. G. C. SIMMONS.

Kearny (Gen. STEPHEN WATTS), uncle of Philip, b. at Newark, N. J., Aug. 30, 1794; on the outbreak of the war with Great Britain he abandoned his studies at Columbia College, and entered the army as first lieutenant 13th Infantry Mar., 1812; in the following October he was distinguished in the assault on Queenstown Heights, and promoted to be captain Apr., 1813; on the close of the war he was retained in the army, rising through successive grades to be brigadier-general in 1846. In the war with Mexico he commanded at the commencement the army of the West, which made conquest of the province of New Mexico; establishing a provisional government at Santa Fé, he continued his march to California, and Dec. 6, 1846, fought the battle of San Pascual, where he was twice wounded; subsequently commanded the troops of sailors and marines and detachment of dragoons in the battles of San Gabriel and Plains of Mesa, Jan. 8 and 9, 1847. He was governor of California from Mar. to June, 1847; joined the army in Mexico, and was governor of Vera Cruz Mar., 1848, and May, 1848, of the city of Mexico. For his services in New Mexico and California he was brevetted major-general. Author of *A Manual for the Exercise and Manœuvring of U. S. Dragoons*, *Organic Law*, and *Laws for the Government of the Territory of New Mexico*. D. at St. Louis, Mo., Oct. 31, 1848. G. C. SIMMONS.

Kear'sarge, Mount, a conspicuous mountain in Carroll co., N. H.; lat. 44° 6′ 20″ N., lon. 71° 5′ 40″ W., height, 3250 feet. On the suggestion of the wife of the assistant secretary of the navy, a daughter of Levi Woodbury of New Hampshire, the secretary in 1861 named the vessel which sunk the Alabama in 1864 after this mountain. Another one of the same name, in Merrimack co., N. H., formerly called *Kya-Sarga*, by the Indians Cowisséwaschook, height 2950 feet, has been erroneously claimed for this honor. G. V. FOX.

Kea'ting, tp. of Clinton co., Pa. Keating Village (Nasby P. O.) is on the Philadelphia and Erie R. R. P. 439.

Keating, tp. of McKean co., Pa. It includes Smethport, the county-seat. Pop. 1435.

Keating, tp. of Potter co., Pa. Pop. 78.

Keats (JOHN), b. in London in 1796; was sent to a school at Enfield kept by the father of Charles Cowden Clarke; served 1810–15 an apprenticeship to a surgeon, and then studied in London; became the friend of Leigh Hunt, Lamb, and the other authors of the so-called Cockney school; published in 1817 a volume of verses, followed in 1818 by *Endymion*, and another volume of poems in 1820. Keats died of consumption at Rome Feb. 24, 1821. The often-repeated statement that Keats was killed by the bitter attack upon him by Gifford in the *Quarterly Review* was uniformly denied by those who knew him best, and Gifford's criticism was more injurious to its author, and justly so, than to any one else. The fame of Keats as a poet has widened much since his death, and after making due allowance for his youth and inexperience as a writer, his poems certainly display that indescribable quality called genius in an unusual degree.

Keayne (Capt. ROBERT), b. probably in London in 1594 or 1595; was a member of the Honorable Artillery Company in London, and by trade a merchant tailor. He aided Plymouth colony by donations as early as 1624, and became one of the founders of the Massachusetts colony, settling at Boston in 1635. He brought over considerable estate; organized in 1638 the Ancient and Honorable Artillery Company of Boston; was frequently representative for Boston from 1638 to 1649; was a liberal donor to Harvard College, and by legacy founded a free school at Boston, now the Latin Grammar School. He was a brother-in-law of the celebrated John Wilson, first minister of Boston, both having married daughters of Sir John Mansfield, master of the Minories; was an eccentric man, and his singular will (reprinted in part in *N. E. Gen. Reg.*, vol. vi.) covers over 50 pages, being perhaps the longest on record in America.

Ke'ble (JOHN), M. A., b. at Fairford, Gloucester, England, Apr. 25, 1792, passed B. A. at Corpus Christi, Oxford, 1810; became a fellow of Oriel 1811; was public examiner at Oxford 1814–16; took deacon's orders 1815, priest's 1816; was a tutor at Oxford 1818–23; became professor of poetry 1831; was one of the original Tractarians, and a leader of the Anglo-Catholic movement; became vicar of Hursley 1836. D. at Bournemouth Mar. 29, 1866. In 1827 he published *The Christian Year*, a volume of sacred poetry which attained a wide popularity, and upon which his fame chiefly rests; also published *Prælectiones Academicæ* (1844), *Lyra Innocentium* (1847), *The Psalms in English Verse, De Poetica Vi Medica* (1847), some volumes of sermons, and many tracts and pamphlets upon ecclesiastical subjects. (See *Memoir of Rev. John Keble*, by Sir John T. Coleridge, 1869.)

Kecskemet', town of Hungary, the capital of the district of Pesth-Solt. The rearing of cattle and horses is the chief pursuit of the inhabitants, and the annual cattle-fair held in this city is the most important in the whole country. Pop. 42,089.

Kedge, a small anchor used in hauling a vessel from one mooring to another, in pulling off a ship that is aground, etc. Kedges are also useful in preventing ships from fouling with their bower anchor.

Ked'geri, or **Kij'ari,** town of British India, in the presidency of Bengal, at the mouth of the Hoogly. As this river forms the main entrance into the Ganges and the road to Calcutta, the town has acquired considerable notoriety, and the first telegraph-line in India was laid between it and Calcutta, a distance of 40 miles.

Kee'chies, a tribe of Indians residing on the Washita River in the Indian Territory. They are related to the Pawnees and Wichitas, and formerly lived on Trinity River in Texas, but were removed in 1859. They number little over 100.

Keel, in shipbuilding, is the beam which passes under the ship's hull from stem to stern. It is usually made up of several heavy timbers bolted together lengthwise. The ship's ribs, stern, and stern-post spring from the keel, which is external to the hull, as the keelson is internal. Below the keel one or more *false keels* are bolted on.

Kee'ler, tp. of Van Buren co., Mich. Pop. 1303.

Keel'hauling, a punishment formerly employed in the Dutch and other navies. The offender, with suitable ropes attached, was dropped from one yard-arm into the sea, hauled beneath the keel of the ship, and then drawn up to the opposite yard-arm. The culprit was heavily weighted with lead or iron.

Keel'son, or **Kelson,** the beam inside a ship's hull which runs fore and aft directly over the keel. It is made up of timbers scarped, notched, and bolted into one, and the keelson is itself securely bolted to the keel.

Keen (William Williams), M. D., b. Jan. 19, 1837, in Philadelphia; entered Brown University in 1859 and Jefferson Medical College in 1862; studied 1864 at Paris, Vienna, and Berlin; returned in 1866, and began practising in Philadelphia; became proprietor of the Philadelphia School of Anatomy, which he conducted with great success; lectured on anatomy at this institution and on pathological anatomy at Jefferson Medical College, and was appointed trustee of Brown University and Crozer Theological Seminary, and surgeon to St. Mary's Hospital, Philadelphia. His principal writings are—*On Reflex Paralysis* (1864), *Gunshot Wounds* (1864), *Practical Anatomy* (1870), *Sketch of the Early History of Practical Anatomy* (1874), *Diagrams of the Nerves of the Human Body* (1872), *Clinical Charts of the Human Body* (1872), *Gunshot Wound of the Brain* (1871), *Anat., Pathol., and Surg. Uses of Chloral* (1874), etc.

Keene, tp. of Adams co., Ill. Pop. 1283.

Keene, post-tp. of Ionia co., Mich. Pop. 1271.

Keene, city, cap. of Cheshire co., N. H., 92 miles N. W. of Boston and 65 miles N. of Springfield, Mass., on a wide plain surrounded by lofty hills, has broad thoroughfares shaded by stately elms, and claims to be the most beautiful inland city of New England. The public buildings consist of a fine court-house, city hall, high-school building, and 7 well-built churches. Central Square, from which radiate the five principal avenues, is planted with trees, and contains a soldiers' monument erected at a cost of nearly $20,000. The city is well supplied with water brought by an aqueduct from Silver Lake, 3 miles distant. There are 2 weekly newspapers, a large public library, a gymnasium, 3 national and 2 savings banks, 3 hotels, 5 Masonic lodges, 1 lodge and 1 encampment of Odd Fellows. Two railroads centre here; a third (the Manchester and Keene) is about to be built. The city is noted for excellent public schools and for its business prosperity and enterprise. The manufactures are large; there are 3 steam-mills manufacturing furniture, sash and blinds, and machinery. The Cheshire R. R. employs several hundred men in the manufacture of locomotives and cars. There are 3 steam-tanneries, an iron-foundry, a flannel-mill, gas-works, carriage and sleigh manufactories, and granite-quarries affording employment to about 400 men. The valuation of taxable property in Apr., 1874, was $4,500,000. Pop. 5971. Thos. C. Rand, Ed. "N. H. Sentinel."

Keene, post-v. and tp. of Essex co., N. Y. The township contains Mt. Marcy, the highest of the Adirondacks, and has iron-mines and manufactures of iron. Pop. 720.

Keene, post-tp. of Coshocton co., O. Pop. 787.

Keene (Laura), b. in England in 1820; came to the U. S. as an actress in 1852, and had great success in light comedy, as also in Australia in 1854. Returning to America in 1855, she became manager of the Varieties Theatre in New York, and soon afterward inaugurated another theatre, long known by her name, now the Olympic. Here she introduced in 1858 the very successful comedy of *Our American Cousin*. She appeared on the stage with success in the principal American cities until shortly before her death, which took place at Montclair, N. J., Nov. 4, 1873. It was at one of her representations of *Our American Cousin* that President Lincoln was assassinated in 1865.

Keen'er, tp. of Jasper co., Ind. Pop. 71.

Keener (Duncan F.), b. in Maryland or Virginia; removed to Louisiana; was a member from that State to the Confederate Congress in 1861, and to the end of the war he held a high position throughout. He was brief, practical, able, and eloquent in debate. Since the war he has taken no active part in politics, but exerted a great influence in preventing a collision between the Federal troops under Gen. Emory and the State troops under the McEnery officials in New Orleans in Sept., 1874.

Keener (John C.), D. D., b. in Baltimore, Md., 1819; educated at Wesleyan Academy, Wilbraham, Mass., and at Wesleyan University, Middletown, Conn.; was editor of the *New Orleans Christian Advocate* (M. E. Church, South) from 1865 to 1870, and was elected bishop in that year. In 1873 he visited the Southern Methodist missions in Mexico, which were at that time entrusted to his superintendence. He is author of *Post Oak Circuit*.

Keese'ville, post-v. in Chesterfield tp., Essex co., and Au Sable tp., Clinton co., N. Y., lying on both sides of the Au Sable River, which is the boundary between those two counties, 4 miles W. of Lake Champlain and 150 miles N. of Albany. It has 6 churches (2 Catholic), a graded school, a national bank, a public hall, and a weekly newspaper. Iron and nail works constitute the principal industry. The water-power is excellent. A woollen-factory was erected here in 1813, and a rolling-mill in 1816. Three bridges connect the two parts of the village, one being an iron suspension bridge. Pop. about 3000.
W. Lansing, Ed. "Essex Co. Republican."

Keff, or **El-Keff,** the ancient *Sicca Veneria*, town of Tunis, near the Algerian frontier, is beautifully situated among fertile and well-cultivated surroundings, and has a strong citadel. Pop. 6000.

Keigh'ley, town of England, in the county of Yorkshire, on the Aire. Its manufactures of woollen and worsted goods are very considerable. Pop. 15,005.

Keight'ley (Thomas), b. in Dublin in Oct., 1789; graduated at Trinity College in that city in 1808, and devoted himself to the production of a series of classical textbooks and works on history and mythology, by which he became widely known in England and America. His best works were—*Outlines of History, Mythology of Ancient Greece and Italy, History of India*, and *Shakspeare Expositor*. He received a pension from the English government in his later years, and d. at Erith, Kent, Dec., 1872.

Keil (Karl August Gottlieb), b. at Grossenhain, near Dresden, Saxony, Apr. 23, 1754; was educated in theology at the University of Leipsic, in which he became tutor, lecturer on exegesis and hermeneutics, professor extraordinary of philosophy (1785), of theology (1788), and full or ordinary professor in 1793. His writings in German and Latin are especially valuable upon the subject of hermeneutics, in which he is recognized as a master. His *Manual of Hermeneutics* appeared in 1810; his miscellaneous Latin writings were published after his death by Goldhorn, under the title *Opuscula Academica, etc.* (Leipsic, 2 vols., 1821). D. at Leipsic Apr. 22, 1818.

Keim (Theodor), D. D., b. at Stuttgart, Würtemberg, Dec. 17, 1825; studied at the University of Tübingen (1843–48), devoting himself, under the guidance of Baur, to philosophy, biblical criticism, and ecclesiastical history; was tutor in those branches at Bonn (1850) and at Tübingen (1851–55); was ordained deacon (1857) and archdeacon (1859) at Esslingen, and became in 1860 professor of theology at the University of Zurich. He has written volumes upon the history of the Reformation in several parts of Germany; in Ulm (1851), in Swabia until the Diet of Augsburg (1855), in Esslingen (1860), *Ambrosius Blarer, the Swabian Reformer* (1860), *The Human Development of Jesus Christ* (1861), *The Historical Words of Jesus* (1864), and recast the latter two works into *The Historical Christ* (1866), which at once gave him a wide reputation. He now devoted himself to a more biographical work upon the same subject, under the title *History of Jesus of Nazara*, of which two volumes have appeared (1867 and 1871), and have been translated into English (London, 1873).

Keim (William High), b. at Reading, Pa., June 25, 1813; educated at Mt. Airy Military Academy; was chosen Representative in Congress in 1858, and State surveyor in 1859; served as major-general of Pennsylvania volunteers in Patterson's campaign on the upper Potomac (1861), and as brigadier-general U. S. volunteers in McClellan's army. D. at Harrisburg, Pa., May 18, 1862.

Keim'er (Samuel), a printer in Philadelphia in the early part of the eighteenth century, celebrated in the *Autobiography* of Franklin, who was employed in his office. Little is known of Keimer beyond these incidental notices; the place and time of his birth and death are alike undiscoverable. Franklin states that he was originally "one of the French prophets, and could act their enthusiastic agitation," and gives an amusing account of his projects for founding a new religion, the cardinal doctrines of which were never disclosed. Keimer went to Barbadoes, where in 1734 he was printing the *Gazette*, and in 1741 a work of his entitled *Caribbeana* was printed in London.

Kei River, Great, separates the formerly so-called British Kaffraria, which now forms a part of the Cape Colony, from Kaffraria proper, and empties itself into the

Indian Ocean. Like all rivers of Kaffraria, it is unfit for navigation, its bed being very rocky and irregular.

Keiskam'ma, a river in the Cape Colony, rises in Amatola, and flows into the Indian Ocean after a course of 80 miles.

Keith, new county in S. W. Nebraska, adjoining Colorado, intersected by the two forks of the Platte, and traversed by the Union Pacific R. R. Area, 2016 square miles.

Keith (George), b. at Aberdeen, Scotland, about 1640; was educated for the Presbyterian ministry at the University of Aberdeen; adopted Quaker principles about 1664, and in 1675 was associated with Robert Barclay in defending that sect in public discussions with the university students. He was also associated with Penn in similar discussions with the Baptists in London. In 1682 he took charge of a Quaker school at Edmonton, and was imprisoned in Newgate for refusing to take an oath and preaching without license (1684). Soon afterward he came to America; became surveyor-general of East Jersey, and in 1689 took charge of a Quaker school in Philadelphia. Next year he went to New England as a Quaker preacher, and was engaged in disputes with Increase and Cotton Mather. Returning to Philadelphia, he became involved in controversy with his own sect, chiefly about the atonement, and ultimately came into sharp collision with William Penn himself, whom he charged with deism, and by whom he was denounced as an apostate. Keith thereupon founded a sect known as Keithians, Christian Quakers, or Baptist Quakers, but ultimately entered the Church of England, and was employed as a missionary for the conversion of his former fellow-believers. From 1702 to 1705 he made a tour of the Northern colonies, and converted many hundreds of Quakers, who were baptized by him. Returning to England in 1706, he was appointed rector of Edburton in Sussex, where he d. about 1715. He was a man of deep learning, well versed in Platonism, and wrote many theological tracts both for and against Quakerism; also two works of travels in America (1699 and 1705) and a *New Theory of the Longitude* (1709). (See Janney's *History of the Friends*, Philadelphia, 1867, and Watts's *Bibliotheca Britannica.*)

Keith (George), b. at Kincardine, Scotland, in 1685, and received a military education. After the death of Queen Anne he espoused the cause of the Pretender, was outlawed, and his estates were confiscated. For several years he lived in Rome with the Pretender, then in Spain, but entered at last into the service of Frederick II., whose friend he became, and who employed him in several responsible positions—as ambassador to Paris 1751, as governor of Neufchatel 1754, etc. Through the king's mediation his estates were restored to him, but he continued to reside at Potsdam, where he d. May 25, 1778.

Keith (George Keith-Elphinstone), Admiral, Viscount, b. at Elphinstone, Scotland, Jan. 12, 1746; entered the navy in boyhood, and, as post-captain commanding the frigate Perseus, took part in the actions of Bunker Hill (1775) and Fort Mifflin on the Delaware (1777). In 1793 he served with the Mediterranean squadron under Lord Hood at Toulon, and as admiral was despatched in 1795 to operate against the Dutch colonies. He took possession of Cape Colony in South Africa, Ceylon, Cochin, Malacca, and the Molucca Islands, and in Aug., 1796, captured a Dutch squadron near Saldanha Bay, West Africa. For these brilliant services he was created an Irish peer, as Baron Keith of Stonehaven Marischal. In Mar., 1800, he blockaded Masséna in Genoa, co-operating with the Austrians, who besieged and took that city. He co-operated with Abercrombie in the Egyptian expedition, and in 1815 commanded the Channel fleet, which prevented the escape of Napoleon I., and brought about his surrender to Capt. Maitland of the Bellerophon. In 1814 he was created Viscount Keith of the peerage of the United Kingdom. D. at Tullialan, Perthshire, Scotland, Mar. 10, 1823.

Keith (James Francis Edward), brother of George (1685–1778), b. at Kincardine, Scotland, June 11, 1696; took part, like his brother, in the rebellion against the Hanoverian house; was outlawed, and lived for several years at Paris and in Spain. In 1734 he entered the Russian service, and distinguished himself very much in the wars against Turkey and Sweden. In 1743 he was made a field-marshal, but in 1747 he left Russia, went to Berlin, and was one of Frederick's great generals. He was a man of great military talent and much appreciated by the king. He fell at Hochkirch Oct. 14, 1758.

Keith (Sir William), b. in the N. of Scotland about 1680; became surveyor-general of customs in America for the Southern colonies; was governor of Pennsylvania for the proprietors 1717–26; was fond of intrigue, vain, and treacherous, but the colony prospered under his administration. Author of a *History of Virginia* (1738) and a volume of tracts and papers (1749). D. in London Nov. 17, 1749.

Keiths'burg, post-v. and tp. of Mercer co., Ill. It is on the Mississippi River and the Chicago Burlington and Quincy R. R., and has a national bank and 1 weekly newspaper. Pop. of v. 1179; of tp. 1579.

Keitt (Lawrence M.), b. in Orangeburg district, S. C., Oct. 4, 1824; graduated at the State College, Columbia, in 1843; studied law, and was admitted to practice in 1845; was elected to the State legislature in 1848, and to Congress in 1853, which position he held until he resigned it in the winter of 1860–61, after South Carolina had passed her ordinance of secession. He was then elected to the Confederate Congress, which met in Montgomery on Feb. 4, 1861; in this body he acted a conspicuous part in the formation of the provisional and permanent constitutions for the Confederate States. He subsequently entered the military service with a colonel's commission, and gallantly fell at the head of his regiment in repelling the assault at Cold Harbor on the 3d of June, 1864. As an orator and a popular declaimer Mr. Keitt held a high position. A. H. Stephens.

Kelat', the cap. of Beloochistan, in lat. 28° 52′ N. and lon. 66° 33′ E., situated in a narrow valley 6000 feet above the sea. It is surrounded with walls, and has some importance as a fortress, but it is ill built and dirty, and its trade and manufactures are of very little consequence. Pop. 12,000.

Kellermann' (François Christophe), b. at Strasbourg 1735; d. in 1820; was raised slowly, under the old monarchy, to the rank of brigadier-general, when the Revolution of 1789 broke out, and suddenly made general-in-chief. He won the famous battle of Valmy in 1792 against the allies, who were marching on Paris. Kellermann, being a moderate republican, was arrested in 1793, and remained in prison until the Thermidor reactionary revolution in 1794. He commanded in 1795, with success, the armies of the Alps and of Italy, and Napoleon made him duke of Valmy and marshal of France. Kellermann was a soldier, not a politician; he did not stick, therefore, by Napoleon, any more than he had done by the radical republicans who had been the first to discover and employ his rare military genius. On the fall of the empire in 1815, he rallied to the Bourbons, who confirmed his title of duke and made him a peer of France. Félix Aucaigne.

Kellermann (François Etienne), son of F. C. Kellermann, b. at Metz in 1770; received his military education under his father; was aide-de-camp to Napoleon in 1796, and brigadier-general in 1799. He distinguished himself very much in the battles of Marengo, Austerlitz, and Waterloo. After the restoration of the Bourbons he withdrew from the service. D. June 2, 1835.

Kelley, tp. of Ripley co., Mo. Pop. 240.

Kel'ley (William Darrah), b. in Philadelphia Apr. 12, 1814, a grandson of Maj. John Kelley, a Revolutionary officer of New Jersey. He was (1835–39) a jeweller of Boston, Mass.; was admitted to the Philadelphia bar in 1841; became a leading Democrat; was attorney-general of Pennsylvania 1845–46; a judge of the common pleas court 1846–56; and in 1854 became a republican; was a prominent member of Congress 1861–74, and has taken a high rank as an effective public speaker.

Kelley's Island, one of the Wine Islands of Lake Erie, belongs to Erie co., O., and has flourishing vineyards, producing large quantities of wine and grapes. Pop. of Kelley's Island tp. 838.

Kel'logg, post-v. and tp. of Jasper co., Ia., on the Chicago Rock Island and Pacific R. R., 45 miles E. of Des Moines. It has 3 churches, 1 academy, 1 English and 1 German newspaper (weeklies), large pump-factory, and the usual number of stores and shops. It has good water-power and numerous branches of industry. Pop. of tp. 1507. S. U. Mitchell, Ed. "News."

Kellogg (Clara Louise), b. in Sumterville, S. C., July, 1842, of Northern parentage and ancestry. Her father is a man of remarkable ingenuity in mechanical invention; her mother had unusual gifts as a musician, a talent with the pencil, and even skill in the cutting of cameos. Clara was their only child. A year after her birth the family removed to New Haven, Conn., and resided there till 1856, when they went to New York. Here the young girl's musical genius was appreciated, and by help of a friend her musical education was begun under the direction of Millet, Rivarde, Manzochi, and Albites, all teachers of the first rank in their time. She studied with intense industry, ambition, and passion for art, devoting herself wholly to her pursuit, learning along with music the French and Italian languages. Her whole professional education was acquired in New York, the few lessons she received in London from Arditi being scarcely worthy of mention. A

private presentation made so favorable an impression on her auditors that she was brought out in the character of Gilda (*Rigoletto*) at the Academy of Music in the season of 1861–62, and sang that season ten or twelve times. In 1867 she appeared in London at Her Majesty's Theatre under the management of Mr. Mapleson, and was immediately engaged for the following or summer season. Returning to the U. S. in 1868, she made a brilliant tour though the States with Mr. Strakosch, gaining new laurels, till 1872, when she again accepted a London engagement, and sang at Drury Lane with Nilsson under Mapleson's management. Her success was even more signal than before; she sang also at a "private" concert given by the queen at Buckingham Palace. On her return to the U. S. she resumed her professional career, singing in Italian opera till Nilsson and Lucca absorbed the attention of the fashionable world of music; then, about two years ago, she determined to establish in America on a popular basis the English opera. Into this enterprise she threw herself with all her accustomed energy, aided by a deep confidence in the musical appreciation and enthusiasm of the American people, assuming the direction of the pieces, the training of the singers, the translation of the *libretti* from French or Italian, and in general the conduct of the business. Her labors have been severe (in the winter of 1874–75 she sang no fewer than 125 nights), but they have been crowned with complete success. In the Western cities her popularity is immense. She has fairly domesticated opera there. Miss Kellogg has a fine musical organization, great capacity for labor, a retentive memory (she is perfectly familiar with thirty operas—not with her own part only, but with all the parts and with the instrumentation), severe conscientiousness as an artist, an ardent enthusiasm, and a voice of great compass and purity. To these gifts she unites an uncommon talent for business. She is, moreover, much respected as a woman for her blameless life, the perfect decorum of her behavior, and the goodness of her heart. O. B. Frothingham.

Kellogg (Edward N.), U. S. N., b. Dec. 8, 1842, in Maine; graduated at the Naval Academy in 1861; became a lieutenant in 1864, a lieutenant-commander in 1866; served on board the Oneida at the battle of Mobile Bay, Aug. 5, 1864, and was commended for skill and courage. D. of yellow fever at Pensacola in the fall of 1874. Foxhall A. Parker.

Kellogg (Francis W.), b. at Worthington, Hampshire co., Mass., May 30, 1810; removed at an early age to Michigan, and became a lumber-merchant. After serving in the legislature he was elected a Representative in Congress in 1858, re-elected in 1860 and 1862, and appointed in 1865 collector of internal revenue for the district of Alabama; was returned to Congress from Alabama in 1868.

Kellogg (George), the father of Clara Louise Kellogg, b. June 19, 1812, at New Hartford, Conn.; graduated at Wesleyan University, 1837; was principal of Sumter Academy, Sumterville, S. C., 1838–41, but is chiefly distinguished as an inventor and manufacturer. Among his inventions are a jack-chain machine, capable of making a yard of chain a minute; a dovetailing machine; improved surgical implements; type-distributing and other machines. Has introduced into England American machinery for making hooks and eyes, hats, etc. Residence, Cold Spring, N. Y.

Kellogg (Stephen Wright), A. M., b. at Shelburne, Mass., Apr. 5, 1822; graduated at Yale in 1846; became a lawyer of Waterbury, Conn.; clerk of the State senate 1851; was in both houses of the legislature; judge of probate 1854–60; delegate to the Chicago Republican conventions of 1860 and 1868; elected in 1871 as Representative in Congress, and re-elected in 1873, but defeated at the election of Apr., 1875.

Kellogg (William), b. in Ashtabula co., O., July 8, 1814; removed to Illinois in 1837; studied law; acquired an extensive practice, chiefly in respect to land titles; was member of the State legislature 1849–50; judge of the circuit court for three years; elected to Congress in 1856, re-elected in 1858 and 1860; appointed in 1864 minister resident in Guatemala, and in 1866 chief-justice of Nebraska.

Kellogg (William Pitt), b. in Vermont in 1830; removed in 1848 to Illinois; became a lawyer in 1854; was in 1856 and 1860 a Presidential elector; chief-justice of Nebraska in 1861; served as a colonel of volunteer cavalry in the civil war, and became a brigadier-general; was collector of the port of New Orleans; U. S. Senator from Louisiana 1868–71; was in 1872 declared elected governor of Louisiana for the term ending in 1877, which office he still (1875) holds, after the failure of an insurrectionary attempt (Sept., 1874) to displace him in favor of the Democratic candidate—a movement which resulted in Federal military interference, a Congressional investigation (1875), and a finally accepted compromise between the parties.

Kel'loway Rock, The, an arenaceous limestone underlying the Oxford Clay in England, and apparently the lowest member of the Middle Oolite. (See Jurassic.) The term Callovien was applied by D'Orbigny to a geological horizon corresponding to the Kelloway Rock.

Kel'ly, tp. of Warren co., Ill. Pop. 1295.

Kelly, tp. of Cooper co., Mo. Pop. 1372.

Kelly, tp. of Union co., Pa., contains Kelly Point P. O. and West Milton P. O. Pop. 942.

Kelly (Robert), LL.D., b. Dec. 10, 1808, in New York City; graduated at Columbia College 1826, entering and leaving at the head of his class. He then joined his brothers John and William as an active partner in the house of J. & W. Kelly & Co., retiring in 1837 to devote himself to the cause of education and to public affairs. He was regarded as the founder of the Free Academy; was president of the board of education and a regent of the University of the State; also a trustee of New York and Madison universities, and one of the founders of the University of Rochester, presiding over its board. He was identified for many years with the House of Refuge, the president of its board of managers, and actively engaged in many other benevolent, literary, and financial associations in his native city. He was a scholar of rare culture and master of many languages. He held the office of chamberlain of the city at the time of his death, Apr. 27, 1856.

Kelly (William), b. in New York City Feb. 4, 1807. His father, Robert Kelly, d. 1825, leaving three sons, John, William, and Robert, all minors. The two first, the "boy-merchants," as they were called, aided by Robert after leaving college, ably conducted the extensive house until 1837, when, John having d. in 1836, the other brothers retired and gave themselves to promoting charity and education. In 1842, William purchased the estate known as "Ellerslie," near Rhinebeck, and became a leading farmer. President of New York State Agricultural Society 1854; one of the founders of the State Agricultural College at Ovid, president of its board. He was many years president of the trustees of Rochester University, and of the board of Vassar College from its foundation till his death; president of the Baptist educational commission, and active in many other charitable and religious enterprises; a managing director in railroad, steamboat, banking, and trust companies, and working president of several iron companies. A New York State senator 1855–56, and Democratic candidate for governor in 1860. A man of great benevolence, widely but silently diffused. D. at Torquay, Eng., Jan. 14, 1872.

Kelly's Mills, tp. of Madison co., Ala. Pop. 1525.

Ke'loid, more correctly **Che'loid** [Gr. χηλή, a "crab's claw," from some fancied resemblance], a name applied to two apparently distinct skin diseases: (1) A sort of fibroid tumor of the true skin, often appearing on the scar of a cut or burn. It is almost certain to return after excision, is not malignant, and is thus far not curable. This is the keloid of Alibert. (2) A much more general disease, sometimes spreading over the whole body. Congested tubercles, generally originating near the sternum, advance gradually over the body, are very irritable, and cause trouble by itching, especially in warm weather. Cold applications and tonic treatment palliate but do not cure it. Negroes are more subject to this disease than white persons.

Kelp, Barilla, or **Varec,** names applied to the ashes or products of incineration of *seaweeds.* These products were of far more importance to former generations than at present, having once been the sole source of the valuable alkali soda, for making soap and glass, previous to the grand discovery of the French chemist Leblanc, of manufacturing soda from common salt. At present the chief interest that attaches to kelp is as the principal material from which the element *iodine* is obtained. The name for seaweed ashes used in France is *varec.* Weeds are also used, particularly for manufacturing the variety called *barilla,* in Sicily, Spain, and some other countries, which grow on the sea-shore in saline soils, these plants being cultivated in those countries for the purpose, and the ashes used in making soap, even at the present day, though apparently a very poor material for the purpose. Kelp and varec, on the other hand, are made exclusively from the Algæ and Fuci, which grow on rocks in great abundance, between high and low water mark, on the coasts of Ireland, Scotland, Wales, the Orkney Islands and the Hebrides, and on the coast of Brittany.

The seaweeds are dried, and burned to ash in rough stone or brick ovens built on the shore. The ash fuses into a solid mass, which is broken up and sent to market. Twenty-four tons of seaweeds are necessary to produce one ton of kelp. This substance, produced from actual marine plants,

is much poorer in soda-salts (except *chloride of sodium*) than the barilla variety, but contains more potash-salts. The composition of these products varies within wide limits, and the few analyses quoted give scarcely a general idea, being confined to a few special cases.

Seaweed Ashes, Kelp: without Charcoal and Carbonic Acid.

Constituents.	*Laminaria saccharina*, North Sea.	*Fucus digitatus*, Clyde.	*Fucus vesiculosus*, North Sea.	*Fucus vesiculosus*, Clyde.
Potash (as carbonates, the CO_2 omitted)	24.77	22.40	17.68	15.23
Soda (as carbonates, the CO_2 omitted)	1.84	8.29	5.78	11.16
Lime (as carbonates, the CO_2 omitted)	6.50	8.79	4.71	8.15
Magnesia (as carbonates, the CO_2 omitted)	8.13	7.44	6.89	7.16
Chloride of sodium	33.72	28.39	35.38	25.10
Chloride of potassium				
Iodide of sodium	4.70	3.62	.13	.37
Phosphate of lime	8.41	5.63	5.44 (lime and iron)	2.99
Phosphate of iron	.75	....		
Oxide of iron	....	.62	....	.33
Oxide of manganese				
Sulphuric acid	10.60	13.26	23.71	28.16
Silica	.58	1.56	.28	1.35
	100.00	100.00	100.00	100.00
Percentage of ash in the weed, dried at 212° F.	9.78	20.40	20.56	16.39

French and Spanish Barilla, called also Varec.

	Alicante.	Cherbourg.	Spain.
Sulphate of potash	......	22.19	15.85
Chloride of potassium	......	16.00	10.55
Chloride of sodium	65.00	45.78	68.35
Carbonate of soda	2.00	9.53	traces.
Sulphate of lime	......	......	1.10
Insoluble	3.00	1.50	
Iodine compounds	......	traces.	
Sulphate of soda	30.00		
Water	......	5.00	4.00
	100.00	100.00	99.85

(For the preparation from kelp of the iodine of commerce, see under IODINE.) H. WURTZ.

Kel′sey, tp. of El Dorado co., Cal. Pop. 315.

Kel′so, post-tp. of Dearborn co., Ind. Pop. 1908.

Kelso, tp. of Sibley co., Minn. Pop. 442.

Kelso, tp. of Scott co., Mo. Pop. 1000.

Kel′ton, post-v. of Box Elder co., Ut., on the Central Pacific R. R., 89 miles W. of Ogden.

Kem′ble, a name distinguished from first to last in the records of the English stage. The founder of the family, Roger, himself an actor and theatrical manager, b. in Hereford, Eng., Mar. 1, 1721, d. in 1802, had twelve children, the eldest of whom, Sarah, married an actor named Siddons. (See MRS. SIDDONS.) The oldest son was JOHN PHILIP, b. in Prescot, Lancashire, Eng., Feb. 1, 1757. This was the "great Kemble." He was educated partly at the Roman Catholic seminary of Sedgely Park in Staffordshire, and afterwards at the English College at Douay in France; returned to England at the age of nineteen, and made his first appearance at Wolverhampton Jan. 8, 1776, in the character of Theodosius; made his first appearance in London at Drury Lane, in Sept., 1783, as Hamlet; became manager of that theatre in 1790; in 1803 bought a sixth share in Covent Garden Theatre for $24,000, and became manager of it. The theatre was burned in 1808, but immediately rebuilt. An increase in the prices of admission to the new house (from six to seven shillings for the boxes, and from three to four shillings for the pit) caused the O. P. (old price) riots, which lasted for some months and menaced the ruin of the establishment. At this time Mr. Kemble was grossly insulted and abused. In 1817 he took leave of the London stage, retired soon afterward to the S. of France, and finally took up his residence at Lausanne, Switzerland, where he d. Feb. 26, 1823. Mr. Kemble's style of acting was more suited to the lofty and majestic than to the pathetic and tender. In parts like Cato, Coriolanus, Rolla, Macbeth, Hamlet, Lear, King John, he was supreme. His person was of heroic mould, his action was stately, his declamation noble and true. In moments of passion he rose to great power. But his form lacked suppleness, his limbs were rigid, his voice was husky and unmusical, and a constitutional asthma gave a labored character to his utterance. As an artist he had not "the art to conceal his art;" as a scholar he was close and exact; as a companion he was genial; as a man he was held in high esteem. His *Life* was written by his friend, Mr. Boaden, in 2 vols., 1825.—GEORGE STEPHEN, brother of the foregoing, b. in Kingston, Herefordshire, May 3, 1758; made his début in London at Covent Garden in 1783, and was theatrical manager in London, Edinburgh, and Glasgow. D. June 5, 1822.—ELIZABETH (Mrs. Whitlock), sister of the above, b. in Warrington, Lancashire, Apr. 2, 1761; d. Feb. 27, 1836; made her first appearance at Drury Lane in 1783; came to the U. S. in 1792, and played with great success. She performed several times before George Washington. In 1807 she returned to England and retired from the stage. In person and voice she was said strikingly to resemble Mrs. Siddons.—CHARLES, eleventh child of Roger, b. at Brecon, S. Wales, Nov. 27, 1775; d. in London Nov. 12, 1854; was educated at Douay; made his first appearance at Drury Lane in 1794, playing Malcolm, with his brother John as Macbeth, and his sister, Mrs. Siddons. He was an excellent comedian, appearing at his best in characters like Benedick, Petruchio, Charles Surface, very creditably in Cassio, Mark Antony, Edgar, but failing in deeply tragic parts. "A first-rate actor in second-rate parts." He adapted German and French plays for the London stage, and in late life was appointed examiner of plays. He visited the U. S. in 1832 with his daughter, Fanny Kemble, and retired from the profession in 1840.—FRANCES ANNE (commonly called "Fanny"), daughter of Charles, b. in London in 1811. She possessed the family talent for the stage, but not the family passion for it. Her theatrical career was suddenly decided on to relieve the financial embarrassments of her father, and in six weeks after her mind was made up she came out at Covent Garden in Oct., 1829, as Juliet to her father's Romeo. Her success was marked in characters like Juliet, Portia, Bianca, Belvidera, Lady Teazle, Camiola, and Julia in *The Hunchback*. In 1832 she came to the U. S. with her father, and met with enthusiastic applause. In 1834 she married Mr. Pierce Butler, a Philadelphia gentleman of wealth, and retired from the stage. The marriage being unhappy, she left her husband and resided in Lenox, Berkshire co., Mass. In 1846–47 she passed a year in Europe, and on her return, having obtained a divorce in the courts of Pennsylvania, resumed her maiden name. Since 1848 Mrs. Kemble has been known as a reader of Shakspeare in the chief cities of the U. S. and in Great Britain. In 1860 she left America, and from that time her residence has been partly in England and partly in the U. S., with two intervals of continental travel. At present she resides near Philadelphia, wholly withdrawn from public life. Mrs. Kemble is the author of several books in prose and verse: *Francis the First*, a play, written when she was seventeen years old, and performed in London; *A Journal of a Residence in America* (2 vols., London and Philadelphia, 1835); *The Star of Seville*, a play; *A Year of Consolation*, a record of her visit to Italy in 1846; *Residence on a Georgia Plantation* (1863), and a volume of poems.—ADELAIDE, younger sister of Frances, b. in London in 1820. Her talents, both for the dramatic and lyric stage, were brilliant, but her marriage in 1843 to Mr. Edward Sartoris prevented her pursuing a career which, beginning in Venice, had given continued promise of success in Trieste, Milan, Padua, Bologna, and was culminating in London, where she sang in *Norma*, *Figaro*, *Sonnambula*, *Semiramide*, and other operas. She published in 1867 *A Week in a French Country-house*.—Her son, ALGERNON CHARLES, married the daughter of Pres. Grant in May, 1874. O. B. FROTHINGHAM.

Kemble (GOUVERNEUR), b. in New York City Jan. 25, 1786, a son of Peter Kemble, his mother being Gertrude Gouverneur, descended from Jacob Leisler of colonial history, and whose daughter was the wife of Abram Gouverneur; graduated at Columbia College in 1803; became interested in commercial pursuits, and saw much of the leading countries of Europe, then agitated by the wars of Napoleon; subsequently visited the Mediterranean ports, and transacted business for the U. S. in connection with the supply of the squadron at the time of the war with Algiers about 1815; established in 1817 the West Point Foundry at Cold Spring; was member of Congress 1837–41, and of the constitutional convention of New York in 1846; was one of the first and most active advocates of the Hudson River R. R., and an early and efficient friend of the Panama R. R.; to his other qualities he united a love of art, manifested by a rich collection and a kindly regard for artists; was one of the last nine survivors of the Tontine Association of New York, organized in 1790, and at whose death (Sept. 16, 1875) the accumulated profits were divided.

Kemble (JOHN MITCHELL). See APPENDIX.

Kemp (JAMES), D. D., b. in Aberdeenshire, Scotland, in 1764; graduated at Marischal College, Aberdeen, in 1786; came to the U. S. in 1787; took orders in the Protestant Episcopal Church in 1789; held various rectorships in Maryland, in which diocese he became in 1814 a suffragan, and in 1816 the diocesan bishop. He was 1816–27 provost of the State University. D. in Baltimore Oct. 28, 1827, in consequence of an accidental injury.

Kemp (John), Cardinal, b. at Wye, Kent, England, in 1380; was ambassador to Aragon in 1415; bishop of Rochester in 1419, of Chichester in 1421, of London in November of the same year; chancellor and archbishop of York in 1426; resigned the Great Seal in 1432; joint ambassador to France, and made cardinal-priest in 1439; endowed the College of Wye in 1447; again chancellor in 1450; made cardinal-bishop and archbishop of Canterbury by papal bull in 1452, and d. Mar. 22, 1454.

Kem'pelen, von (Wolfgang), Baron, b. at Presburg, Hungary, Jan. 23, 1734, was the inventor of a so-called "automaton chess-player," made for the amusement of the empress Maria Theresa (1769), which was exhibited in Paris in 1784, and afterwards in England and the U. S. It is not properly an automaton, but an ingenious contrivance for concealing a living player, as is fully explained in Tomlinson's *Amusements in Chess* (1845), but its mechanical ingenuity is great. Baron Kempelen also invented in 1778 an automaton speaking human figure, which he explained in an illustrated work, *Le mécanisme de la parole* (1791). He filled several political posts at the Austrian court, published poems and dramatic pieces, and d. at Vienna Mar. 26, 1804.

Kemp'en, town of Prussia, in the province of Posen, on the Schummerwasser, has manufactures of soap, tobacco, and woollens, and an active trade in horses and cattle. Pop. 5822.

Kem'penfelt (Richard), Admiral, b. at Westminster, England, in 1720; became rear-admiral in 1779; captured a French convoy on its way to the West Indies in 1781; drowned at Spithead by the sinking of his vessel, the Royal George, with nearly 900 men, Aug. 29, 1782.

Kemp'er, county of Mississippi, bounded on the E. by Alabama. Area, 775 square miles. It is fertile and somewhat diversified with hills. Cotton, live-stock, and corn are the staple products. Cap. De Kalb. Pop. 12,920.

Kemper (Jackson), D. D., LL.D., Cantab., b. in Pleasant Valley, Dutchess co., N. Y., Dec. 24, 1789, and graduated at Columbia College in 1809. In 1811 he took deacon's orders in the Protestant Episcopal Church, and in 1812 was ordained a priest. After holding rectorships in Philadelphia for twenty years, and one for some time in Norwalk, Conn., he was made missionary bishop of Indiana and Missouri, and was afterwards transferred to Iowa, Wisconsin, etc. In 1854 he became bishop of Wisconsin. D. at Delafield, Waukesha co., Wis., May 24, 1870.

Kemper (James Lawson), b. in Madison co., Va., in 1824; graduated at Washington College, Va., in 1844; studied law; was ten years member of the Virginia legislature, two years Speaker; colonel of 7th Virginia regiment C. S. A. in 1861; brigadier-general 1862; major-general 1864; distinguished himself at most of the battles on the Peninsula; was wounded and taken prisoner at Gettysburg; elected governor of Virginia in 1873 by the Democratic party.

Kemper (Reuben), b. in Fauquier co., Va., was the son of a Baptist preacher, with whom he emigrated to Ohio in 1800. Soon afterward, Reuben and two of his brothers settled in Mississippi Territory, engaged in land-surveying, and conceived the project of stirring up an insurrection in West Florida against the Spanish government. They formed an expedition for that purpose in 1808, which was unsuccessful; attempted with the same result the capture of Mobile (then a part of West Florida), and in 1812 joined the great expedition organized by Gutierrez and Toledo against Mexico. In this campaign Reuben Kemper commanded, with the rank of colonel, a force of several hundred Americans, at whose head he won some brilliant actions in Texas, but the results of victory were neutralized by dissensions between the Mexicans and Americans, and the latter returned in disgust to the U. S. Kemper took part under Gen. Jackson in the defence of New Orleans, afterward settled down in Mississippi as a planter, and d. at Natchez in 1826.

Kem'pis (Thomas à), b. at Kempen, near Cologne, in 1380; his family name was Hamerken (Lat. *Malleolus*). In 1400 he entered the monastery of Mount St. Agnes, near Zwolle, of which his elder brother was prior, and in 1413 was ordained priest; in 1425 was elected sub-prior. D. July 26, 1471. By the other monks of the monastery he was highly esteemed for his deep piety, his untiring industry as a scholar, and his great gifts as a teacher and supervisor of the novices; and his authorship soon spread his fame far outside the boundaries of his personal acquaintance. He wrote several books; among others, a chronicle of the monastery of Mount St. Agnes. A collected edition of his works was given by the Jesuit Sommalius (Antwerp, 1607). But the book which sent his name to the remotest corners of the world is his *De Imitatione Christi*. It has been translated into all languages in which books are printed and read, and it is used as a book of devotion and religious instruction by all Christians, without regard to differences in creed, race, or standpoint of mental development. With the exception of the Bible, it is probably the book most read in the whole of Christian literature. In consequence of his personal humility, and in harmony with the moral maxims of his order (*ama nesciri*), Thomas à Kempis has never mentioned himself directly as author of the book; on the other hand, there exist copies of the work, the oldest of 1441, which ascribe the authorship to the celebrated theologian Jean Gerson, chancellor of the University of Paris. These two circumstances have occasioned a very sharp controversy between French and German theologians, and the question seemed at one time doubtful. (See *Gersen, Gerson oder Kempis*, 1828, Vienna.) Of late, however, it seems to have been decided finally in favor of Thomas à Kempis. He is mentioned by three contemporary writers as the author of the book. There is a perfect harmony in doctrines and in style between *De Imitatione Christi* and other devotional writings of Thomas à Kempis. It can be satisfactorily explained how the copyists could make the mistake and ascribe the authorship to the celebrated chancellor (or to St. Bernard, or an Italian abbot, Gersen, for there are many rivals). A new edition of the book was given, after an autograph by Thomas à Kempis, by Hirsche (Berlin, 1873–74).

Kemps'ville, post-v. and tp. of Princess Anne co., Va., 10½ miles S. E. of Norfolk, and at the head of tidewater on the E. branch of Elizabeth River. Pop. 3100.

Kemp'ten, town of Bavaria, on the Iller. It has some manufactures of cotton and woollen goods. Pop. 10,370.

Kempt'ville, post-v. of Grenville co., Ont., Canada, on the St. Lawrence and Ottawa Railway. It has a good trade and manufactures of lumber. Pop. of sub-district, 872.

Ken (Thomas), b. at Berkhamstead, England, in July, 1637; was educated at Winchester and Oxford; travelled on the Continent as far as Italy in 1674; became in 1679 chaplain to Mary, princess of Orange (the future queen of England); was chaplain to Lord Dartmouth in the Tangier expedition, and subsequently (1684) to Charles II., by whom he was soon after made bishop of Bath and Wells. He attended that king on his deathbed. On the accession of James II. he was one of the "seven bishops" committed to the Tower for refusing to obey illegal commands of that monarch. Bishop Ken, however, refused to take the oath of allegiance to William III., and was deprived of his bishopric in consequence. He passed his declining years at Longleat, engaged in writing devotional works, among which his morning and evening hymns are still popular. D. at Longleat, Wiltshire, Mar. 19, 1711. (See his *Life*, by George L. Duyckinck, New York, 1859.)

Kenai'ans, a branch of the Athabascan family of Indians, living in Alaska, deriving their name from Kenai, the peninsula between Cook's Inlet and Prince William Sound. The Kenaians are held to include all the Indians N. of Copper River and W. of the Rocky Mountains, except the Innuits or Esquimaux and the Aleuts, and are estimated to number 25,000. They resemble in manners, customs, and religion the tribes of Northern Asia, especially in their practices of cremation, infanticide, etc., and their system of caste.

Ken'ansville, post-v., cap. of Duplin co., N. C., 7 miles E. of Magnolia Station on the Wilmington and Weldon R. R. Pop. 2878.

Ken'dal, town of England, in Westmoreland. Certain kinds of cloth are manufactured here, which for centuries have been known under the name of "Kendals." Pop. 13,442.

Ken'dall, county of N. E. Illinois. Area, 324 square miles. It is a fertile rolling prairie, dotted with groves of timber. It is traversed by Fox River and the Chicago Burlington and Quincy R. R. Cattle, grain, and wool are the staple products. Cap. Yorkville. Pop. 12,399.

Kendall, county of S. W. Central Texas. Area, 475 square miles. It is one-third prairie, and the rest is well timbered. Live-stock, wool, grain, and cotton are raised. There are many German settlers. The climate is healthful and pleasant. Cap. Boerne. Pop. 1536.

Kendall, post-v. and tp. (sometimes called Na Au Say) of Kendall co., Ill. Pop. 1445.

Kendall, post-v. and tp. of Orleans co., N. Y. The township lies on Lake Ontario. The village has 4 churches. Pop. 1744.

Kendall, tp. of La Fayette co., Wis. Pop. 1131.

Kendall (Amos), LL.D., b. at Dunstable, Mass., Aug. 16, 1789; graduated at Dartmouth in 1811; in 1814 became a lawyer of Lexington, Ky., where he was for a time

a tutor in Henry Clay's family. He afterwards removed to Georgetown, Ky., where he was postmaster and editor of the *Argus*, an able Democratic newspaper. In 1829, Jackson made him fourth auditor of the treasury. He was 1835–40 postmaster-general. In 1845 he became manager of Prof. Morse's interest in the telegraph business. He was an early friend of public schools in the West, founded the deaf and dumb asylum at Washington, and was a liberal benefactor of Columbian College and of the Baptist church with which he was connected. He wrote a work on his *Life and Times*, and published a *Life of Andrew Jackson* (1843, incomplete). D. at Washington, D. C., Nov. 12, 1869.

Kendall (George Wilkins), b. at Amherst, N. H., in 1807; became a printer, and worked in many places in the South and West at his trade. In 1835 he settled in New Orleans, where, with F. A. Lumsden, he founded the *Picayune* newspaper. He took part in the Santa Fé expedition of 1841, and during the Mexican war was with Gens. Taylor and Scott, and furnished to his newspaper the earliest and fullest accounts of all movements, incurring thereby a large expense. He published *Narrative of the Texan Santa Fé Expedition* (1844), and *The War between the U. S. and Mexico* (folio, 1851, with costly illustrations). In 1862 he removed to Comal co., Tex., where he had a large grazing ranche. D. at Post Oak Springs, Tex., Oct. 21, 1867.

Kendall's Mills, post-v. of Fairfield tp., Somerset co., Me., on the W. bank of the Kennebec River (here crossed by a lofty railroad bridge), and on the Maine Central and the Kennebec and Portland R. Rs. It has a fine water-power and manufactures of lumber, etc.

Ken'dallville, city of Noble co., Ind., at the intersection of the Lake Shore and Michigan Southern and the Grand Rapids and Indiana R. Rs. It is surrounded by a rich agricultural region, and affords an excellent market for all kinds of produce. It has 8 churches, 1 national bank, manufactories, a free-school building, and 1 weekly newspaper. Pop. 2164. C. O. Myers, Ed. "Standard."

Ken'dell, von (Robert), b. at Königsberg Feb. 27, 1824; studied jurisprudence, and held in 1862 a position at the court of Breslau. In 1863, Bismarck gave him an appointment in the ministry of foreign affairs, and from this time he always accompanied the great minister. At all diplomatic negotiations, on travels and in wars, he was always at the side of Bismarck. Sometimes he was sent on independent diplomatic errands; thus, he represented the North German confederation at the opening of the canal of Suez in 1869. In 1871 he was elected to the diet, and in Apr., 1873, he was sent as ambassador to Rome.

August Niemann.

Kendo'ta, tp. of Todd co., Minn. Pop. 94.

Ken'drick, tp. of Greene co., Ia. Pop. 887.

Kendrick (Asahel Clark), D. D., LL.D., b. at Poultney, Vt., Dec. 7, 1809; graduated at Hamilton College, Clinton, N. Y., in 1831; was professor first of ancient languages, and subsequently of the Greek language alone, in the literary and theological seminary at Hamilton (which afterwards became Madison University) from 1831 to 1850. Since then he has been professor of Greek in the University of Rochester. He has published several introductory Greek textbooks; the *Anabasis* of Xenophon, with notes and vocabulary; an edition of *Select Orations of Demosthenes; Echoes*, being poems from the German and French; *Our Poetical Favorites;* a revised edition of Olshausen's *New Testament Commentary; Commentary on the Epistle to the Hebrews* in Lange's *Biblical Commentary;* and *Life and Letters of Mrs. Emily C. Judson* (1861).

Kendrick (Henry L.), b. in New Hampshire; graduated at the U. S. Military Academy, and entered the army as brevet second lieutenant of infantry July, 1835, but was retained at the Academy for twelve years as assistant professor of chemistry, mineralogy, and geology, in the mean time having been transferred to the artillery, and attained the rank of captain in 1846. In the war with Mexico he was engaged in the siege of Vera Cruz, battle of Cerro Gordo, and defence of Puebla, where he gained the brevet of major. From the close of the war he served principally in garrison and on frontier duty, being engaged in frequent expeditions against, and numerous actions with, hostile Indians; and for five years in command of a post in New Mexico, when in 1857 appointed professor of chemistry, mineralogy, and geology at the Military Academy, which chair he has since continued to fill.

Kendrick (Capt. John), b. in Boston; was a resident of Wareham, Mass., and commanded a privateer during the Revolutionary war. In 1787 and 1791 he made a voyage of exploration along the N. W. coast of America and among the islands of the Pacific, and opened up the sandalwood trade with China. Congress gave him a medal for the first of these voyages, in which his second in command, Capt. Gray, discovered the Columbia River. Capt. Kendrick was accidentally killed in a harbor of Hawaii in 1800, by a ball fired in a salute from an English vessel.

Kendrick (Nathaniel), D. D., b. at Hanover, N. H., Apr. 22, 1777; received but a limited early education; was licensed as a Baptist preacher in 1803. After pastorates at Lansingburg, N. Y. (1805), Middlebury, Vt. (1810), and Eaton, N. Y. (1817), he was chosen professor of theology and moral philosophy at Madison University, remaining in that post until his death at Hamilton, N. Y., Sept. 11, 1848.

Kendus'keag, post-v. and tp. of Penobscot co., Me., 12 miles N. W. of Bangor. It has 3 churches, and manufactures of lumber, cooperage, stoves, farming tools, and other goods. Pop. 770.

Kenduskeag River, an affluent of the Penobscot, in Maine, flows S. E. to Bangor, where its mouth affords a tidal basin. The fall of its waters is extensively utilized in sawing lumber and in other manufactures.

Kenea'ly (Edward Vaughan Hyde), D. C. L., b. at Cork, Ireland, in 1819; educated at Trinity College, Dublin; became early celebrated for his knowledge of many languages, having published translations of songs and ballads from and into the Greek, Latin, French, Italian, Portuguese, Dutch, German, Spanish, Swedish, Danish, Romaic, Magyar, and Irish languages. He was a contributor to Dr. Maginn's *Homeric Ballads*, to the *Dublin University Magazine*, and *Fraser's Magazine;* published in 1845 *Brallaghan, or the Deipnosophists;* in 1850 *Goethe, a New Pantomime*, both works abounding in wit and brilliant criticism. Of late, Dr. Kenealy has become widely known as the impassioned advocate of "the Claimant" in the celebrated Tichborne case (1873); founded a newspaper, *The Englishman*, in 1874, which attained an immense circulation; was elected a member of Parliament, and took his seat in Apr., 1875.

Ken'eh, town of Upper Egypt, on the right bank of the Nile, 34 miles N. of the ruins of Thebes, has large manufactures of earthenware, and carries on an extensive trade with Arabia and Central Africa. Pop. 10,000.

Ken'ilworth, town of England, in Warwickshire. It contains some ruins of Kenilworth Castle, which became notable in the history of Queen Elizabeth on account of the gorgeous manner in which the earl of Leicester entertained her here for seventeen days; which entertainment forms the subject of a romance of Walter Scott and a novel of Ludwig Tieck.

Ken'ites [Heb. *Keyni* and *Kayni;* Gr. Κεναῖοι], a collective name for a tribe or race which resided in the Sinaitic desert and other districts adjoining the land of Canaan at the time of the Hebrew Exodus. They seem to have been akin to the Midianites and to the Amalekites, but were distinguished from the mass of those tribes by their steadfast friendship for and alliance with the Hebrews, for which reason they received allotments with the tribe of Judah. Jethro, the father-in-law of Moses, was a Kenite, whence some modern critics have built up a vast fabric of argument to show that the Mosaic ritual was derived from intercourse with the Kenites in the desert; and many theories have been broached connecting the Kenites with *Cain* as their ancestor, and attributing to them an important part in Hebrew history down to a late period. (See E. Bunsen's *Keys of St. Peter*, London, 1867.)

Ken'naday (John), D. D., b. in New York City Nov. 3, 1800; joined the New York Methodist conference in 1823; preached in Philadelphia, New York, Brooklyn, N. Y., and New Haven, Conn. D. Nov. 13, 1863.

Ken'namer's, tp. of Marshall co., Ala. Pop. 412.

Kennebec', county of S. W. Central Maine. Area, about 900 square miles. It is traversed by the navigable Kennebec River, and by the Maine Central and the Kennebec and Portland R. Rs. The surface is diversified, the soil mostly fertile. Live-stock, grain, hay, wool, and dairy products are the great staples. The county has abundant water-power, timber, and building-stone. The manufactures include lumber, carriages, sleighs, leather, saddlery, metallic wares, machinery, agricultural and edge tools, and wooden and other wares. Ice and building-stone are exported. Cap. Augusta. Pop. 53,203.

Kennebec, tp. of Monona co., Ia. Pop. 333.

Kennebec River rises in Moosehead Lake, although its principal head-stream, the Moose River, rises more than 50 miles W. of that lake, of which it is a tributary. The river falls some 1000 feet in 100 miles, reaching tide-water at Augusta, where the river is crossed by a large dam, affording great water-power. Sea-going steamboats and coasting vessels ascend to this point, except at low water,

when they stop at Hallowell or Gardiner, and in winter, when navigation ceases entirely. Above Augusta small steamboats ascend to Waterville, 18 miles farther, where, as at many points above, there is much valuable water-power. The river is navigable for ships to Bath, 12 miles. Its banks are fertile and beautiful, and are the seat of a large trade in lumber, provisions, hay, cattle, etc. It reaches the sea in lat. 43° 44′ 23″ N., lon. 69° 45′ W.

Kennebunk′, post-v. and tp. of York co., Me. The village is on the navigable Kennebunk River, 3 miles from the sea. It has an insurance company, a national bank, 6 churches, manufactures of twine, braid, lumber, shipping, and other goods, and is the seat of a good coasting-trade. Kennebunk Dépôt is a thriving post-village on the Portsmouth Saco and Portland R. R., 24 miles S. W. of Portland. Pop. of tp. 2603.

Kennebunkport′, post-v. and tp. of York co., Me., at the mouth of Kennebunk River, 3 miles below Kennebunk. It has a good harbor, a thriving trade, and manufactures of shipping and ships' furniture, and contains 5 churches. It is a pleasant summer resort. It was permanently settled in 1629. Pop. 2372.

Ken′nedale, post-v. and tp. of Tuscaloosa co., Ala., on the Alabama and Chattanooga R. R. Pop. 1262.

Ken′nedy, post-v. of Poland tp., Chautauqua co., N. Y., on the Atlantic and Great Western R. R. and on Conewango Creek. It is sometimes called FALCONER.

Kennedy (ANTHONY), b. at Baltimore, Md., in 1811; removed in childhood to Virginia; studied law, and became a planter and cotton-manufacturer; served in the legislature of Virginia from 1839 to 1843; returned to Baltimore in 1850; was elected to the Maryland legislature in 1856, and was U. S. Senator from 1857 to 1863.

Kennedy (BENJAMIN HALL), b. at Summer Hill, near Birmingham, England, Nov. 6, 1804; graduated at Cambridge in 1827; took orders in the Church of England; became assistant master at Harrow in 1830, and was head master of Shrewsbury school from 1836 to 1866, becoming in 1867 regius professor of Greek in the University of Cambridge. He has held numerous preferments in the Church, and written many valuable manuals for the study of the classical languages.—His brother, CHARLES RANN, b. at Birmingham Mar. 1, 1808; graduated at Trinity College, Cambridge; became a barrister (1835); published *Poems* (1843), a translation of *Virgil* into English blank verse (1850), a translation of the *Orations of Demosthenes* (5 vols., 1841–63), with notes and appendices; several law-books and miscellaneous verse. D. at Birmingham in 1867.

Kennedy (GRACE), b. in Ayrshire, Scotland, in 1782; resided in Edinburgh, and wrote under assumed names many novels and tales of a moral and religious tendency which had an extensive circulation and were translated into several languages. Among them are *Decision* (1821), *Father Clement* (1823), *Anna Ross, the Orphan of Waterloo* (1823), and *Philip Colville* (1824). D. at Edinburgh Feb. 28, 1825.

Kennedy (JOHN PENDLETON), LL.D., b. in Baltimore, Md., Oct. 25, 1795; was educated at the University of Maryland, where he graduated in 1812. In 1814 he took part as a volunteer in the battles of Bladensburg and North Point. After the war was over he studied law, and was admitted to the bar in 1816; having a taste for letters, he found time in the midst of his professional engagements to devote some leisure hours to a new publication entitled *The Red Book*, of which he became the chief editor. It was issued every two weeks, and was made up of miscellaneous articles in prose and verse. In 1820 he was returned as a member of the house of delegates of the State legislature, which position he held for three years with high distinction. Being more devoted, however, to law and literature than to politics, he resumed his favorite pursuits. In 1832 he published a work of fiction entitled *The Swallow Barn*, which consisted of a collection of sketches of Virginia country life soon after the Revolution. This book was extensively read and became very popular. In 1835 appeared his celebrated *Horseshoe Robinson*, a work that added greatly to his reputation. The hero was a Revolutionary soldier of South Carolina. In 1835 appeared his *Rob of the Bowl*. In this year he was elected a member of Congress from Maryland, which position he held with great distinction for six years. In the Presidential canvass in 1840 he was one of the electors for his State on the Harrison ticket. In this year he published the annals of *Quodlibet*, which was a burlesque or satire on the political issues of the day. In 1846 he was again returned to the house of delegates of the State legislature, of which body he was made Speaker, and took an active part in the measures which were then adopted to resume the payment of the State debt and for the restoration of the public credit. In politics Mr. Kennedy was an ardent and earnest Whig of the Henry Clay school. In 1849 he published the memoirs of the life of William Wirt, which is one of the most finished productions of the kind from any American pen. In the same year (1849) he was chosen provost of his *alma mater*, which position he continued to hold during the remainder of his life. He was also vice-president of the Maryland Historical Society. In 1852 he was appointed by Pres. Fillmore secretary of the navy, which position he held until the close of that administration. It was under his auspices at the head of the navy department that the Japan expedition of Com. Perry and the second Arctic exploration of Dr. Kane were mainly due. During the late war Mr. Kennedy's sympathies were entirely on the Federal side. His antislavery sentiments were very strong throughout his whole life. After the war he made an extensive tour in Europe, chiefly with a view of benefit to his health. He did not long survive his return, but d. at Newport, R. I., Aug. 18, 1870. At his death he was not only provost of the University of Maryland and vice-president of the State Historical Society, but was also chairman of the trustees of the Peabody Academy of Baltimore and a member of the board of trustees of the Peabody Southern Educational Fund. A. H. STEPHENS.

Kennedy (JOSEPH C. G.), LL.D., b. Apr. 1, 1813, at Meadville, Crawford co., Pa., and educated at Allegheny College; was superintendent of the U. S. census of 1850 and 1860, secretary to the National Institute and U. S. Agricultural Society in 1854; sent as commissioner to Europe in 1851 to investigate the administration of census; appointed U. S. examiner into the condition of national banks; wrote *Census of 1850 and 1860; History and Statistics of Maryland;* prepared the law for U. S. census; received a gold medal for his statistical researches from the king of Denmark, and is member of different French, German, and Belgian scientific societies.

Kennedy (JOSIAH FORREST), M. D., b. Jan. 31, 1834, near Landisburg, Perry co., Pa.; graduated at Dickinson College in 1855, and in medicine at the University of City of New York in 1858, and settled at Tipton, Ia.; was commissioned assistant surgeon in U. S. regular army in 1861, which position he resigned in Oct., 1862; settled at Des Moines in 1870, where he now (1875) practises his profession. Dr. Kennedy has published in the medical journals several papers on practical medicine, and is assistant secretary to the State Medical Society.

Kennedy (WILLIAM MCGEE), b. in Tennessee in 1783; joined the South Carolina Methodist conference in 1805, and was a founder of his denomination in North and South Carolina and in Georgia. D. in 1840.

Ken′nedyville, post-v. of Kent co., Md., on the Kent County R. R. Pop. of tp. 3247.

Ken′nekeet, tp. of Dare co., N. C. Pop. 599.

Ken′ner's Prai′rie, a v. of Matagorda co., Tex. Pop. 65.

Ken′net (WHITE), D. D., b. at Dover, England, Aug. 10, 1660; was educated at St. Edmund Hall, Oxford, of which he became vice-principal; was made in 1707 dean, and in 1718 bishop of Peterborough. He was a man of indefatigable industry, and accumulated a vast collection of historical MSS., largely in his own handwriting, which now form part of the *Lansdowne Collection* in the British Museum. Besides more than fifty miscellaneous publications, he wrote a *History of England from the Accession of Charles I. to that of Queen Anne*, forming part of Hughes' collection (1706; 2d ed. 1719); *Bibliothecæ Americanæ Primordia, an Attempt Toward Laying the Foundation of an American Library* (1713); and *A Register and Chronicle, Ecclesiastical and Civil, from the Restoration of King Charles II.* (vol. i. fol., 1728). His American library was collected with a view to writing a work under the title *A Full History of the Propagation of Christianity in the English North American Colonies*, which unfortunately was never executed. D. at Peterborough Dec. 19, 1728. (See his *Life*, by Rev. W. Newton, 1730).—His brother, BASIL KENNET, D. D., b. at Postling, Kent, Oct. 21, 1674; graduated at Corpus Christi College, Oxford; was long chaplain at the English factory at Leghorn, Italy (1706–13), and was elected in 1714 president of his college at Oxford, where he d. in 1714 or 1715. He wrote *Romæ Antiquæ Notitia, or the Antiquities of Rome* (1696), a work which for a century was the standard school-book on the subject; an *Exposition of the Apostles' Creed*, a *Paraphrase on the Psalms*, in verse (1706), and translations of Puffendorf and Pascal.

Ken′nett, post-v., cap. of Dunklin co., Mo., on the St. Francis River, and 28 miles W. of Gayoso on the Mississippi.

Kennett, a b. (P. O. name, KENNETT'S SQUARE) and tp.,

Chester co., Pa., on the Philadelphia and Baltimore R. R., and in a rich agricultural district. Pop of b. 884; of tp. 1308.

Kennett (Luther M.), b. at Falmouth, Ky., Mar. 15, 1807; studied law; removed in 1825 to Missouri, and engaged in mercantile pursuits; settled in St. Louis in 1842; was chairman of the Pacific R. R. convention held there in 1849; was mayor of St. Louis 1850–52; president of the St. Louis and Iron Mountain R. R. in 1853, and chosen Representative in Congress for St. Louis district in 1854.

Ken′nicott (Benjamin), D. D., b. at Totness, Devonshire, England, Apr. 4, 1718, of humble parentage; was aided by a subscription to enter Wadham College, Oxford, 1744; wrote while an undergraduate two dissertations, *On the Tree of Life* and *On the Oblations of Cain and Abel;* became fellow of Exeter College and keeper of the Radcliffe Library, and after many years' labor produced his great work, the *Vetus Testamentum Hebraicum cum Variis Lectionibus* (2 vols., 1776–80), and d. at Oxford Sept. 18, 1783.

Ken′non (Rev. Robert L.), M. D., b. in Granville co., N. C., in 1789; was educated under the Rev. Dr. Moses Andrew, uncle of Bishop Andrew, at Sparta, Ga., and at the South Carolina College. His medical training was begun under Dr. William Lee, Jasper co., Ga., and completed in Columbia, S. C. He entered the itinerant ministry in the South Carolina conference (M. E.) in 1809. On account of ill-health he located and practised medicine for several years in Georgia and Alabama; but re-entered the itinerant ministry in 1824 in Alabama, and exercised his sacred functions with great success till Jan. 9, 1838, when he d. while attending the session of the Alabama conference in Columbus, Miss. His remains were taken to Tuscaloosa, and there interred. A mural monument, bearing an inscription written by his intimate friend, Gov. Collier, placed near the pulpit in the Methodist church of Tuscaloosa, perpetuates his memory. T. O. Summers.

Ken′nonsburg, post-v. of Wayne tp., Noble co., O. Pop. 94.

Kenockee′, post-v. and tp. of St. Clair co., Mich., 15 miles W. of Port Huron. Pop. 1229.

Keno′sha, county of S. E. Wisconsin, bounded on the E. by Lake Michigan and on the S. by Illinois. Area, 276 square miles. It has a fertile limestone soil. Cattle, grain, and wool are staple products. It is traversed by the Kenosha Rockford and Rock Island and the Chicago and Milwaukee R. Rs. Cap. Kenosha. Pop. 13,147.

Kenosha, city, cap. of Kenosha co., Wis., on Lake Michigan, 51 miles N. of Chicago and 34 S. of Milwaukee, almost in the S. E. corner of the State. It is on the Chicago and Milwaukee and Kenosha and Rockford R. Rs.; has a good harbor, 9 churches, 1 bank, 4 hotels, 2 weekly newspapers, several public and private schools, including a high school, a seminary, and 2 Catholic parochial schools, a public library, a reading-room, 3 carriage and 1 wagon manufactory, the latter turning out 5000 per year, numerous manufactories of wooden implements and furniture, several tanneries, lumber-yards, and fisheries, 2 water-cure establishments, numerous stores and shops of every kind, 2 telegraph-offices, 2 foundries, 5 Masonic, Odd-Fellows, or other associations, and 2 parks, whence the name of "Park City." Pop. 4309. Hays McKinley, Ed. "Telegraph."

Keno′za Lake is within the city limits of Haverhill, Mass. Its beauty is celebrated by the poet Whittier. Its area is 238 acres. It is a favorite resort for pleasure-parties.

Ken′rick (Francis Patrick), D. D., b. in Dublin, Ireland, Dec. 3, 1797; studied at Rome, where he was ordained a priest in 1821. He was sent to this country, and was for nine years conductor of the Roman Catholic seminary at Bardstown, Ky. In 1828 appeared his *Letters from Omicron to Omega,* a controversial work. In 1830 he was made bishop of Arath *in partibus,* and coadjutor to Bishop Conwell of Philadelphia, to which see he was translated in 1842. He founded the seminary of St. Charles Borromeo, and in 1851 became archbishop of Baltimore, and in 1852 apostolic delegate; in 1859 honorary primate of the U. S. He published *Theologia Dogmatica* (4 vols., 1839–40), *Theologia Moralis* (3 vols., 1841–43), and several other works, mostly polemical. D. at Baltimore July 8, 1863. At the time of his death he had nearly finished a revision of the English Bible, with copious notes.

Kenrick (John), b. in Exeter, England, about 1803; was for some years classical tutor in the College of York, and became in 1840 professor of history in the New College at Manchester. He translated Zumpt's *Latin Grammar* (1839), published a volume of *Greek Exercises* the same year, *An Essay on Primeval History* (1846), *Ancient Egypt under the Pharaohs* (1850), and *Phœnicia* (1857). The two latter volumes are of considerable value, and have been reprinted in the U. S.

Kenrick (Peter Richard), D. D., a brother of Archbishop Francis P. Kenrick, b. in Dublin in 1806; was trained at Maynooth; became a Roman Catholic priest in Ireland; emigrated to the U. S., and was for a time editor of the *Catholic Herald,* Philadelphia; was also vicar-general to his brother. In 1841 he was made bishop of Drasa *in partibus,* and coadjutor to the bishop of St. Louis, to which see he was translated in 1843. In 1847 he became the first archbishop of St. Louis. He has written *The Holy House of Loretto, Anglican Ordinations,* and some other works.

Ken′sett (John Frederick), b. Mar. 22, 1818, at Cheshire, Conn., d. in New York Dec. 14, 1872; worked as a lad with his uncle, Alfred Daggett, an engraver; went to England in 1840, and began the practice of landscape art in 1845; passed several years in England and Europe, studying nature in Switzerland, on the Rhine, in the mountains of the Abruzzi, in Sicily, by the Bay of Naples, among the Italian lakes, amid the scenery of the Campagna and the associations of Rome, always observing and patiently transferring to the canvas the impressions taken by his eye. In 1848 he returned to America, and was equally faithful in his study of native scenery at Newport, Beverly, and other parts of the Atlantic sea-coast, among the White Mountains, the Adirondacks, the Catskills, on Lake George, the Hudson, the upper Mississippi and Missouri, at Niagara; passing his summers in collecting materials for winter-work in his studio in New York. A facile and diligent artist, well trained, quick in perception and delicate of touch, he executed a great number of pictures singularly equal in merit, and of a very high rank in excellence. His personal qualities of sincerity, modesty, and purity, which made him beloved by many friends, made his pictures dear to lovers of truth and feeling in art. His work commands the best prices. The collection of his sketches, made for exhibition and sale after his death, excited unusual interest. Mr. Kensett belonged to the "realistic school," as it is called, but was polished, harmonious, sweet, and sympathetic. He was made a member of the National Academy of Design in 1849, and was for some years a member of the national art commission formed to superintend the decoration of the Capitol at Washington. O. B. Frothingham.

Ken′sington, post-v. of Berlin tp., Hartford co., Conn., 15 miles S. W. of Hartford.

Kensington, post-v. and tp. of Rockingham co., N. H., 6 miles S. of Exeter. It has 3 churches, and manufactures of leather, etc. Pop. 642.

Kensington, Pa. See Philadelphia.

Kensington Gardens, one of the public parks of London, $2\frac{1}{2}$ miles in circuit and extending along Hyde Park. In its western part stands Kensington Palace, which during the eighteenth and the beginning of this century was the residence of the kings of England.

Kent, county of England, comprising the south-eastern angle of the island between the mouth of the Thames and the Strait of Dover. Area, 1627 square miles. Pop. 733,887. The ground is undulating, traversed by the North Downs; the soil is very fertile and the climate mild and genial. The whole county consists of gardens in which vegetables and fruits are raised for the market of London, and meadows on which a multitude of sheep are reared. Hops are the principal product.

Kent, county of New Brunswick (Canada), bounded on the E. by Northumberland Strait. The soil is generally very fertile. Agriculture, lumbering, fishing, and shipbuilding are carried on. Cap. Richibucto. Pop. 19,101.

Kent, county of Ontario, Canada, extending from Lake St. Clair to Lake Erie. It is intersected by the river Thames and the Great Western Railway. The surface is level and fertile. The W. part is a kind of prairie, sometimes overflowed. Cap. Chatham. Pop. 26,836.

Kent, county of Central Delaware, extending across the State from Maryland eastward to Delaware Bay. Area, 240 square miles. The soil is generally level and quite fertile. Live-stock, grain, wool, and fruit are the staple products. The manufactures include carriages, lumber, etc. The county is traversed by the Delaware and the Maryland and Delaware R. Rs. Cap. of co. and State, Dover. Pop. 29,804.

Kent, county of Eastern Maryland. Area, 318 square miles. It has Chesapeake Bay on the W., Delaware on the E., and the navigable Sassafras and Chester rivers on the N. and S. respectively. The county is nearly level, but not low; its soil is a light, fertile, clayey loam, easily cultivated. Live-stock, grain, wool, and fruit, especially peaches, are largely produced. The county exports large quantities of fish and oysters. It is traversed by the Kent County and the Queen Anne's and Kent R. Rs. Cap. Chestertown. Pop. 17,102.

Kent, county of Michigan, in the S. W. central part of the southern peninsula. Area, 864 square miles. It has a rolling surface and a rich limestone soil. Salt and gypsum are found in the county. Cattle, grain, wool, butter, and hay are staple products. Lumber, carriages, flour, clothing, cooperage, and saddlery are leading articles of manufacture. The county is traversed by numerous railroads, mostly centring at Grand Rapids, the capital. Pop. 50,403.

Kent, county of Rhode Island, extending from Narragansett Bay on the E. to the Connecticut line on the W. Area, 180 square miles. The soil is generally good, the surface uneven. Live-stock, grain, hay, and potatoes are the staple crops. The streams afford good water-power. There are important manufactures of cotton goods, and some lumber is sawed. The county is traversed by the Providence and Stonington and the Hartford Providence and Fishkill R. Rs. Cap. East Greenwich. Pop. 18,595.

Kent, post-v. and tp. of Litchfield co., Conn., on the Housatonic River and R. R., adjoining the W. boundary of the State, 48 miles N. of Bridgeport and 45 miles W. of Hartford. It has 3 churches, 5 stores, a hotel, and a seminary. The principal industry is farming. There were formerly 3 blast furnaces for the manufacture of pig iron, now only one; a newspaper, maintained for several years, was discontinued in 1874. Pop. of tp. 1744, including a few Indians of the Housatonic tribe. W. H. Kirk.

Kent, post-tp. of Stephenson co., Ill. Pop. 1116.

Kent, post-v. of Republican tp., Jefferson co., Ind., 8 miles W. of Madison. Pop. 309.

Kent, tp. of Warren co., Ind. Pop. 601.

Kent, tp. of Putnam co., N. Y. Pop. 1547.

Kent, post-v. of Franklin tp., Portage co., O., 31 miles S. E. of Cleveland, on the Cuyahoga River, which here affords a fine water-power, utilized by extensive cotton and flour mills and by various manufactures. Kent is the geographical centre and divisional terminus of the Atlantic and Great Western R. R., of which the principal car and machine shops are located here. The village is noted for the manufacture of superior window-glass from the pure white sand rock which abounds here, and also as the locality where Capt. Samuel Brady made his famous leap across the Cuyahoga River when pursued by Indians. It has 1 national and 1 savings bank, 1 weekly newspaper, a fine public school edifice, 6 churches, and 30 mercantile establishments. M. Dewey, Ed. "Saturday Bulletin."

Kent (Edward), LL.D., b. at Concord, N. H., Jan. 8, 1802; graduated at Harvard in 1821; attended a course of law lectures by Chancellor Kent in New York, and engaged in legal practice at Bangor, Me., 1825; was a member of the legislature from 1829 to 1833; mayor of Bangor for two years, and governor in 1838 and 1840. In 1843 he was commissioner for settling the Maine boundary-line under the Ashburton treaty; delegate to the national Whig convention in 1848; consul at Rio Janeiro from 1849 to 1854, and in 1859 associate justice of the State supreme court.

Kent (Edward Augustus), Duke of, b. Nov. 2, 1767; was the fourth son of King George III.; joined the army; participated in the capture of some of the French West India Islands; was appointed governor of Nova Scotia and commander-in-chief of the British forces in North America. The island of St. John changed its name to Prince Edward in his honor. On his return to Europe he married (May 20, 1818) a German princess, Maria Louisa Victoria (b. 1786; d. Mar. 16, 1861), widow of the prince of Leiningen, daughter of the duke of Saxe-Coburg. From this marriage the reigning queen of England, Alexandrina Victoria, was born in 1819, and the duke d. soon afterwards, Jan. 23, 1820.

Kent (James), LL.D., b. at Philippi, Putnam co., N. Y., July 31, 1763, was the son of Moss Kent, surrogate of Rensselaer co. He graduated at Yale College in 1781; was a student with Egbert Benson; was admitted to the bar in 1787, and settled at Poughkeepsie; was a member of the legislature in 1790 and 1792. In 1793 he removed to New York, and became a master in chancery, a leader among the Federalists, an associate and friend of Hamilton and Jay, and professor of law in Columbia College. While here he became profoundly versed in the civil law. In 1797 he became recorder of New York, then an officer presiding over a court of civil jurisdiction; in 1798–1804 was a puisne judge of the supreme court of New York, and in 1804–14 chief-justice. In the latter year he was appointed chancellor of New York, which office he held till 1823. He was in 1822 a member of the constitutional convention at Albany; in 1824 resumed his professorship in Columbia College. D. in New York City, Dec. 12, 1847. His legal and chancery decisions are mostly preserved in Caines' and in Johnson's reports. His great work, the *Commentaries on American Law* (4 vols., 1826–30), is one of the greatest and most useful legal works of the age, and its merits have been as freely acknowledged in Great Britain as in this country. Chancellor Kent was one of the fathers of American jurisprudence. His simple style, his abundant learning, his accurate citations, and, above all, his own good sense and conscientious character, have given his writings and decisions a permanent value.

Kent (Joseph), M. D., b. in Calvert co., Md., Jan. 14, 1779; was educated as a physician, combining the practice of his profession with agriculture on an extensive scale—first in Calvert co., and after 1806 in Prince George co. He was a Representative in Congress 1811–15 and 1821–26, governor of Maryland 1826–29, and U. S. Senator 1833–37. D. near Bladensburg Nov. 24, 1837.

Kent (William), b. in Yorkshire, England, about 1685; was apprenticed to a coach-painter, and showed so much talent that he was enabled by the help of patrons to study the fine arts at Rome. In 1716 he was invited by the earl of Burlington to return to England as his guest, and resided with that nobleman for the remainder of his life. He was in some request as painter, sculptor, and architect, but his real importance was as the founder of landscape-gardening in England, the best specimen of the new principles of taste being Kensington Gardens. D. Apr. 12, 1748.

Kent Island, the largest island in Chesapeake Bay, belongs to Queen Anne co., Md. It is 15 miles long, and is very fertile. It has 4 churches and important oyster fisheries. It is the site of the earliest settlement in the State. It was colonized in 1631 by William Claiborne and others. Pop. 1847.

Kent'land, post-v. of Jefferson tp., cap. of Newton co., Ind., on the Pan-Handle (Pittsburg Cincinnati and St. Louis) R. R. It is situated on the Grand Prairie, in the N. W. of the State, in a rich agricultural section; has 1 newspaper, 1 bank, 1 plough-factory, a first-class school building, several churches, hotels, stores, shops, and mills. Pop. 802. John B. Conner, Ed. "Gazette."

Ken'ton, county of Kentucky, having the Ohio River on the N. Area, 150 square miles. It is hilly, but generally fertile, having a good calcareous soil. Tobacco, live-stock, and corn are the agricultural staples. It has manufactures of cigars, tobacco, iron, etc., chiefly carried on at Covington (which see), its chief town and capital. The county is traversed by the Kentucky Central and the Louisville and Cincinnati R. Rs. Pop. 36,096.

Kenton, post-v. and hundred of Kent co., Del., on the Maryland and Delaware R. R. Pop. 2655.

Kenton, post-v. of Pleasant tp., cap. of Hardin co., O., on the head-waters of the Scioto River, near the centre of the State. It has 9 churches, 3 banks, 2 weekly newspapers, 2 hotels, 8 manufactories, 3 mills, and 60 stores. Principal industry, farming and lumbering. Pop. 2610.
A. W. Miller, Ed. "Republican."

Kenton (Simon), b. in Fauquier co., Va., Apr. 3, 1755; went to Kentucky at the age of eighteen in consequence of an affray, and was associated with Boone and other early pioneers. He acted for some time as a spy for Lord Dunmore, the British governor of Virginia; participated in the war of independence W. of the Alleghanies; returned to Virginia in 1784; removed his whole family to Kentucky, and continued to take part in all Indian wars until Wayne's campaign in 1793 established the supremacy of the white race in the Ohio Valley. Kenton "took up" immense tracts of land, but when they became valuable they were invariably lost to him through the invasions of settlers, coupled with his ignorance of law, so that he was ultimately reduced to great poverty. He took part with the Kentucky troops in the Canadian campaign in the second war with England, fought at the battle of the Thames, finally had lands confirmed to him by the legislature of Kentucky and a pension by the U. S. Congress. D. in Logan co., O., Apr. 29, 1836.

Kent's Hill, post-v. of Readfield tp., Kennebec co., Me., is the seat of the Maine Wesleyan Seminary and Female College. The seminary was founded in 1821; the college chartered in 1859.

Kentuck'y, one of the central States of the Mississippi Valley, lying between the meridians of 82° 3′ and 89° 26′ W. lon., and between 36° 30′ and 39° 6′ N. lat. Its extreme length from E. to W. is 308 miles; its greatest breadth from N. to S., 172 miles. The northern and northeastern boundaries of the State are very irregular. The Tug Fork, or main stream, of the Big Sandy River forms the boundary between it and West Virginia on the N. E., from the summit of the Cumberland Mountains, about lat. 37° 33′, to Catlettsburg, where the Big Sandy joins the Ohio. From this point the Ohio River forms its N. N. E., N., and N. W. boundary to Cairo, where that river enters the Mississippi; Ohio, Indiana, and Illinois lying N. of the

Ohio, and the jurisdiction of Kentucky extending to low-water mark on the N. side of the Ohio River. The Mississippi forms its western boundary, and separates it from Missouri. Tennessee bounds it on the S. for the whole distance, the dividing-line being the parallel of 36° 30′ from the Mississippi to the Tennessee River, and that of 36° 38′ thence to the meridian of 83° 40′ W., whence a curved line following the summit-ridges of the Cumberland to the Big Sandy separates it from West Virginia on the S. E. The area of the State, according to the census of 1870, is 37,680 square miles, or 24,115,200 acres. The State lies wholly within the Mississippi Valley, and all but about 1000 square miles of it in the sub-valley of the Ohio.

Seal of Kentucky.

Face of the Country, etc.—Topographically, Kentucky is divided into two unequal areas—the mountain district, in the eastern and south-eastern sections of the State, covering about 4000 square miles; and the table-land, including all the region W. to the Mississippi. Through this table-land the rivers of the State plough deep furrows. The State is emphatically well watered, but most of the larger streams in passing through the table-land have made for themselves valleys of erosion varying in depth at different points from 25 to 600 feet. There are, strictly speaking, very few hills in this table-land, though the bluffs give the landscape the appearance of high hills and abrupt valleys at some points, and the geological structure of the country gives it the aspect of rounded and mammillated slopes at others. With the exception, then, of the mountainous districts of Eastern and South-eastern Kentucky, which have the general characteristics of the Alleghany range, being simple regular curves of great N. and S. extension, but comparatively narrow in an E. and W. direction—Pine Mountain, for instance, having a length of 70 miles, and an average width of not over 5 miles, and rising in the ridges of Pine Mountain and Cumberland Mountain to the height of fully 3000 feet—the topography of the State may be regarded as a succession of river-valleys deeply incised, having a general N. W. and S. E. trend, with considerable stretches of table-land lying between, and having an average elevation of 400 feet above the streams. The river-valleys are rarely more than two miles in width. As we proceed eastward from the Mississippi, the table-lands rise gradually; those between the Mississippi and a line drawn due S. from Louisville are about 600 feet above the sea; between this line and one drawn due S. from Covington they rise to 1000 feet or a little more. Lexington, which seems to be the highest point of the table-lands, is 1070 feet above the sea, and from it the land slopes in every direction, and the decline toward the E. continues till we reach the base of the Pine and Cumberland ridges.

Rivers, Lakes, etc.—About 850 miles of the boundaries of the State are riverine, including the Big Sandy, the Ohio, and the Mississippi. The two largest tributaries of the Ohio (as well as many smaller ones), the Cumberland and Tennessee, have their ultimate sources in the mountain-district of the State, and both, after a wide *détour* to the S., return to the State, and, crossing it, pour their waters into the Ohio. Other affluents of the Ohio are Clark's River, Tradewater River, and the large and important streams, Green, Salt, Kentucky, and Licking rivers, and still farther E. the Little Sandy. The W. Fork of Big Sandy is a considerable stream, as are also several of the tributaries of the Cumberland, Kentucky, Licking, and Green. The Mississippi has a few small tributary streams in the State. With the completion of the slackwater navigation improvements now in progress, Kentucky will have nearly 4000 miles of navigable waters in her bounds, of which more than half will be within regions containing valuable coal and iron deposits. There are no considerable lakes in the State.

Geology.—The geological structure of the State is very simple. Its exposed rocks represent the Upper Cambrian (Lower Silurian), including the Trenton and Hudson River groups, about 700 feet in thickness; the Silurian, thinly developed; the Devonian, consisting mainly of about 100 feet of shale; the Sub-carboniferous, consisting of the Waverley, a thick series of sandstones and limestones (300 to 500 feet); the Sub-carboniferous limestone (10 to 300 feet); and the Carboniferous series (1500 to 2500 feet). In the W., between the Mississippi and the Tennessee rivers, there is a tract of beds of a later Tertiary age, which have a thickness of perhaps 300 feet. Just W. of the Tennessee River, where it re-enters the State, the northernmost point of the great cretaceous rocks which extend through Tennessee, Eastern Mississippi, and Western Alabama, appears at the surface. The beds below the Carboniferous seem to have been deposited in a nearly uninterrupted succession from the lowest to the highest, except in the region from Covington to Casey co., where a strip of about sixty miles wide (directly through the blue-grass country) was lifted above the sea, probably about the time of the Carboniferous era or earlier, thus for a time forming a nearly complete barrier between the eastern and western coal-fields. E. and W. of this the land remained low, and the deposits of the Coal periods were made with from ten to twenty alternations of exposure to the air and submersion beneath the sea. The geology of Kentucky is not at all local or individual in its character; the Tertiary is a part of the great Tertiary deposit of the lower Mississippi River; the western coal-field is a prolongation of that of Illinois, and the eastern of the Appalachian fields; and the Devonian and Silurian stretch southward from Indiana and Ohio.

Economic Geology and Mineralogy.—The most important of the economic mineral resources of Kentucky are its rich and abundant deposits of coal and iron. The whole coal-area is about 14,000 square miles, of which 10,000 are in the eastern and 4000 in the western basin. The coal-beds vary in number and thickness, but will probably average in the eastern section in good exposures about ten beds, aggregating 30 feet; and in the western coal-measures about the same thickness, but fewer beds. Most of this coal, especially in the W., is a soft bituminous coal, though some cannel is found; it resembles the English coal very strongly. The eastern deposits have more splint coals, which are better adapted to smelting and iron-making. The iron district of the State covers about 20,000 square miles, in almost all of which ores of such richness as to pay well for working are found. The best ores are connected with rocks of the Clinton group of the Silurian, where one bed has been discovered having a depth of 20 feet or more. Good ores are also found between the Carboniferous limestone and the upper coal-measures. Some of the upper beds in Edmondson co., in the Green River country, are oolitic in character, and have a thickness of 5 feet or more. Most of the iron is produced in small charcoal furnaces, though no State in the Union is better provided with good coals for smelting and reducing purposes. Lead exists in the Trenton and Cincinnati limestones and in the Carboniferous limestone, but has not been successfully worked. Building-stone of excellent quality exists in several sections, and is exported to some extent. The Sub-carboniferous sandstones of the Waverley group are in considerable demand both in Cincinnati and Louisville, and the oolites of the Sub-carboniferous limestone are unrivalled in beauty and durability. Silver ore has been found near Cumberland Falls. A more remarkable contribution to economic geology is that afforded by the salt springs or licks of the State. The early deposited rocks—the Potsdam sandstone and the oil-bearing sand-rock—were laid down in shallow waters, and absorbed considerable quantities of salt from the brine. In time, springs charged with this saline deposit found their way to the surface, usually in some marshy valley, and thither all the herbivorous mammals naturally resorted to lick the salt which had crystallized around the springs. This practice must have continued for many thousands of years, and hence we find in these swampy licks vast quantities of the remains of these animals. The skeletons of the buffalo and the deer, and below these of the elephant, the mastodon, and mammoth, the fossil elk, and a species of musk-ox, lie in countless numbers. Big Bone Lick in Boone co. has in an area of about 60 acres many thousands of these fossil skeletons. The remains of animals found here indicate very clearly that the elephant period in this region was one of cold and low temperature. There are numerous medicinal springs of great virtue in the State; those of Harrodsburg, Blue Lick, etc. contain considerable quantities of sulphur. Saltpetre, gypsum, and selenite abound

in the caves. The caverns of the State form one of its most remarkable features; the Mammoth Cave, which is the most widely known of the thousands in the State, though possibly not the largest, is very fully described in this volume by Prof. N. S. Shaler, and the caverns of Kentucky are also discussed in the same article. (See MAMMOTH CAVE.) We may say here that they occur throughout the entire range of the Sub-carboniferous limestone, or over a region of 6000 to 8000 square miles. In the region drained by the Green River and its affluents they are very numerous, and the belief is very general that they underlie almost the whole region. In some places there are what are called sink-holes, considerable tracts often containing trees of large size, under which the roof of the cavern has given way and precipitated these patches (which are from 50 to 150 feet or more in diameter) to the floor of the cavern, often 200 or 300 feet below. In some cases these sink-holes become partially filled with water; in others, the trees and shrubs continue to grow and stretch up toward the light. A few of them are funnel-shaped and very deep, having been sounded to the depth of 300 feet without reaching bottom.

Soils and Vegetation.—The last glacial period did not spread its ice-sheet over Kentucky, but stayed its course a few miles N. of the Ohio River. Hence, there are not in the State the gravelly soils which are found wherever the advancing front of the glacier has pushed forward its moraine, made up from the *débris* of widely separated rocks. The soil of the Cincinnati basin, which includes the entire blue-grass region, may properly be called a soil of immediate derivation; *i. e.* it is formed by the disintegration of the rocks of the Cincinnati group, which contain brachiopods in great numbers. This crumbling blue limestone, which falls to pieces on exposure to the air, renders the soil derived from it one of surpassing fertility, and by its constant disintegration restores to it the constituents drawn from it by the crops. Hemp and tobacco, both exhausting crops, can be produced on these lands in undiminished quantities for a score or more of years in succession, and their rich and gigantic growth is nowhere surpassed; and the grasses and grains of the region are remarkable for their luxuriance and their nutritive qualities. The region of the Sub-carboniferous limestone owes its fertility, which is almost as great as that of the blue-grass country, to the same cause, the disintegration of fossiliferous limestone. These two tracts comprise about three-sevenths of the area of the State. The other four-sevenths are less suited to the culture of grain and the best grasses, except the overflowed lands of the river-bottoms, which have soils of remote derivation. The soils underlaid by the beds between the top of the Cincinnati group and the top of the Carboniferous are of fair fertility, and oftentimes rich in materials suited for certain crops. The soils within the Carboniferous areas are admirably suited both for fruit and for tobacco culture, and under proper and skilful tillage will produce any crops adapted to this climatic belt. The great difference between these lands—a part of which have been known as barrens—and the rich blue-grass country is, that the former require a fair and judicious use of manures, while the latter manure themselves through the disintegration of the fossiliferous limestone. There is, however, very little really barren land in the State. The peculiarity of the soils is manifested in the distribution of the forests. On the Sub-carboniferous limestone there are grand forests on the uplands where the blue ash (*Fraxinus quadrangulata*) and the black walnut (*Juglans nigra*) mark the richest tracts. Rich but less fertile soils have extensive forests of beech (*Fagus ferruginea*). On the sandstone soils, especially within the Carboniferous areas, the forests are of oak, of which there are six or seven species, as *Quercus alba, monticola, falcata, rubra, nigra*, etc. In the richer lowlands the tulip tree (*Liriodendron tulipifera*) and the sweet gum (*Liquidambar styraciflua*) form considerable forests. The open parks which form so fine a feature of the blue-grass region are mainly of the sugar-maple (*Acer saccharinum*) and other maples, the tulip tree, blue ash, black walnut, etc. In the swamps of the S. W. the cypress (*Taxodium distichum*) is the principal constituent of the forests. In the mountainous district of Eastern Kentucky there are limited areas of pine (*Pinus mitis*). There are of course other forest trees in the State, but the species named are the most important. When the State was first settled by the whites there was a tract of about 7000 square miles lying between the Ohio River and the Tennessee line, and between the 85th and 87th meridians, embracing most of the Devonian shales and a part of the Carboniferous beds, which was open prairie, having no trees except along the streams; this was due unquestionably to the fires kindled in the grass by the Indians each year. On the suppression of these fires this region immediately sprang up in timber, and is now densely wooded wherever it is not under cultivation.

Zoology.—Very few of the larger surviving wild animals of the Mississippi Valley have now a home in Kentucky. The buffalo or bison, which in the last century roamed in very considerable herds through this State, and perhaps as far E. as the base of the mountains, became extinct in the State before the beginning of the present century. The elk may have disappeared a little earlier; the panther has been seen within fifty years. Bears and wolves are very rare. Deer are still found in considerable numbers in the forests, and the raccoon, the opossum, the badger, and ground-hog are not uncommon. There are at least two species of the hare or American rabbit, and five or six of the squirrel; moles, dormice, rats, field-mice, etc. are sufficiently plenty. Of game birds, the wild-turkey is found in most of the counties of the State, and grouse, partridges, quails, etc. abound. The rivers contain a good supply of most of the fresh-water fish, and fresh-water mollusks, including many species of the Unionidæ, the fresh-water lobster, etc., are found in great abundance. We have spoken already of the fossils found in the swamps; there are very many fossils also in the caves, but except some insects, crustaceans, and fishes, none of them are peculiar to the State. The so-called eyeless fish of the Mammoth Cave is not known elsewhere.

The following paragraphs on the pre-historic remains of man found in Kentucky, from the pen of Prof. N. S. Shaler of the Lawrence Scientific School, State geologist of Kentucky, seem in place here:

Pre-historic Remains of Man.—Two distinct stages are marked by these remains—the first, or most remote, by the mound-builder works; second, the later conditions, during which the common Indian graves are formed. The first of these stages was evidently a period of considerable duration, in which the State was in possession of a people considerably more civilized than the common North American Indians; they built regular fortifications on tolerably uniform plans, and they traded for copper from Lake Superior and shells from the Gulf of Mexico. They seem to have been an agricultural people, their numbers being too great for constant subsistence by the chase, and their fortifications implying fixity. Their general culture and habits would seem to have been as high as that of the Natchez Indians when they were first approached by the whites. Although there are within the State twenty or more forts and many thousand mounds built by these people, they do not seem to have existed within these in such numbers, or for so long a time, as they did in Ohio. The State is also completely wanting in the "picture mounds," or representations of animals, so common in the North-west. This people was probably here before the coming of the buffalo, as its bones are not found among their remains, nor its form on their very numerous carvings and pottery. There are other evidences of the very recent coming of this species into the Mississippi Valley. There is an utter absence of evidence that this people ever came into contact with the earlier fauna of the *Elephas primigenius* and the mastodon; none of the animals of that time figure among their art products. Possibly to the same age we may attribute the cave remains of Western Kentucky, which have not been as yet much examined. They show prolonged occupation of the shallow caverns and "rock-houses" of that region, but they all, so far as examined by the Kentucky survey, show only animals of the present period. Several hundred caverns and "rock-houses" in the western district exhibit signs of occupancy. Sometimes these caverns are combined with fortifications, the caves being used for residence, and stone walls or earthworks for the defence of the hill above.

During the last few centuries of the Indian occupation we find this State apparently used as a hunting-ground rather than as a place of permanent settlement. It seems likely from analogy with other countries that this neutral condition of the area between the Tennessee and the Ohio had been brought about by long conflicts between the southern and the northern peoples of this region. The essential similarity of the customs of the Natchez Indians, especially in the matter of mound-building, to the so-called mound-builders of the Ohio Valley, points to the probable conclusion that this neutral hunting-ground of Kentucky marks the southernmost point of penetration of a distinct warlike race which drove the more ancient people to the southward. These invading peoples are likely to have been the ancestors of the tribes the whites found in residence along the northern borders of the Ohio River.

As a whole, the pre-historic remains of Kentucky point to the conclusion that there was no indigenous man dating farther back than about two or three thousand years. There seems no evidence of succession in the stages of development, such as we find in the European pre-historic records. The oldest remains belong to a state of culture answering, on the whole, to the polished Stone Age of Europe, though

the use of copper for ornaments, and the amount of traffic indicated by the presence of materials brought from great distances, seem to be an indication of an even greater advance in civilization. It seems likely that the highly finished forts, showing a capacity for quite definite measurement, the strongest evidence of culture, came long after the earliest mounds. Despite the fact that mounds perish very slowly, we may trace every gradation, from those nearly blended with the natural surface to those which can hardly have withstood a thousand years. This seems not to be the case with the fortifications; most of them, at least, have still great distinctness of outline, and often could be made tenable by modern troops with a few hours' labor. Some of these forts would require several thousand men for a garrison to make their walls of any utility; this, together with the fact that mound-builders' remains are most numerous where the soil is best fitted for agriculture, seems to show that they must have been in the main agricultural. Some of their pottery shows considerable skill in manufacture, and a nice taste in the use of incised ornaments. The frequent presence of pipes shows the use of tobacco. The great care taken of the dead, and the prodigious accumulations about some of the funeral mounds, seem to point to the conclusion that they were worshippers of ancestors. There is no evidence of phallic-worship in the remains as yet discovered within the State. Their weapons seem to have been the same as those of the North American Indians generally, except that the spear seems to have been more commonly used; their axes are almost always made from materials derived from beyond the great lakes. The buffalo seems to have followed on the footsteps of the vanishing mound-builders; with their disappearance the forests returned, except over the country of the Barrens in the central part of Western Kentucky.

There is no reason to suppose that in its most peopled state, before the coming of the whites, this region ever had anything like its present population; nor are there any reasons for supposing that an antiquity of 3000 or 4000 years would not embrace all the human events of which we have any record here. N. S. SHALER.

Climate.—In general it may be said that the climate of Kentucky is delightful. The mean annual temperature is about 55°, and the extremes, not often reached, are zero and 100°. The winter commences late in December, sometimes not till January, and the cold weather seldom lasts long after the 1st of March. The winter and spring months are the seasons of greatest rainfall, the summer and autumn being usually somewhat dry. The heavy rains of winter and spring, falling on the adhesive red or blue clay of the central counties, makes locomotion somewhat difficult except on the superb macadamized roads of the State. The summers are long and somewhat hot, though the extremes of heat are less than in States farther N. In the southern counties cattle are not sheltered in winter, and very little hay is cut. The blue-grass, falling down as it ripens, protects the lower portion of its stalk, and furnishes as nutritious grazing in winter as in summer. Tables I. and II. give—first, the maximum, minimum, and mean temperatures of each month and the year at five different points; and second, the monthly, quarterly, and annual rainfall at the same points.

Agricultural Products.—The large proportion of exceedingly fertile soil in the State, its capacity for producing a great variety of crops, and its extraordinary facilities for conveying its crops to the best markets, are good and sufficient reasons why, in proportion to its area, Kentucky should be one of the best agricultural States in the Union. That these great advantages have not been so fully developed as they should have been is doubtless true; yet the agricultural position of the State is very creditable to her. The census of 1870 gave the following statistics of the agricultural wealth and productions of the State: Value of farms, $311,238,916; of farming implements and machinery, $8,572,896; of all farm productions, including betterments and additions to stock, $87,477,374; animals slaughtered and sold for slaughter, $24,121,861; of home manufactures, $1,683,972 (decidedly an under-estimate, as few States have manufactured so largely at home jeans, linsey-woolsey, bagging, and other articles used largely on the farms, as Kentucky); forest products, $574,994; market-garden products, $527,329; orchard products, $1,231,385; wages paid to farm-hands, including board, $10,709,382. A more particular statement of the principal crops and the amount of each was as follows: wheat, 5,728,704 bushels; rye, 1,108,933; Indian corn, 50,091,006; oats, 6,620,103; barley, 238,486; buckwheat, 3443; cotton, 1080 bales; flax, 237,268 pounds; hemp, 7777 tons; silk-cocoons, 45 pounds; wool, 2,234,450 pounds; hay, 204,399 tons; hops, 947 pounds; tobacco, 105,305,869 pounds; maple-sugar, 269,416 pounds; maple-molasses, 49,073 gallons; sorghum-molasses, 1,740,453 gallons; common potatoes, 2,391,662 bushels; sweet potatoes, 802,114; peas and beans, 119,926; beeswax, 32,557 pounds; honey, 1,171,500; domestic wine, 62,360 gallons; clover-seed, 2551 bushels;

TABLE I.—*Temperatures.*

PLACES.	Maximum Temperature for the year.	Minimum Temperature for the year.	Mean Temp. for the year.	January. Max. Temp.	January. Min. Temp.	January. Mean Temp.	February. Max. Temp.	February. Min. Temp.	February. Mean Temp.	March. Max. Temp.	March. Min. Temp.	March. Mean Temp.	April. Max. Temp.	April. Min. Temp.	April. Mean Temp.	May. Max. Temp.	May. Min. Temp.	May. Mean Temp.	June. Max. Temp.	June. Min. Temp.	June. Mean Temp.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Cairo, lat. 37°, lon. 89° 10′; altitude, 352.2 ft.	96	−8	55.67	63	−8	30.3	65	10	38.4	72	10	46.5	86	36	55.4	86	44	66.7	94	61	77.5
Clinton, lat. 36° 42′, lon. 89°; altitude, 378 feet.	93	2	53.20	63	20	40.3	63	14	40.8	77	15	42.4	78	33	55.6	87	46	63.1	88	53	70.5
Louisville, lat. 38° 18′, lon. 85° 52′; altitude, 496 feet	95	−4	55.23	64.5	−4	31.1	68	7	36.8	71	3	43.3	87	35	54.6	88	45	67	95	51	78
Lexington, lat. 38° 40′, lon. 84° 33′; altitude, 1070 feet	92	−3	54	63	−3	30.4	64	1	63	72	−1	40.9	84	31	53.1	85	43	64.7	88.5	57	73.7
Danville, lat. 37° 40′, lon. 84° 48′; altitude, about 965 feet	92	−4	55.31	68	23	44	74	12	44.9	75	10	44.6	82	32	56.8	88	52	66.7	90	55	73.7

PLACES.	July. Max. Temp.	July. Min. Temp.	July. Mean Temp.	August. Max. Temp.	August. Min. Temp.	August. Mean Temp.	September. Max. Temp.	September. Min. Temp.	September. Mean Temp.	October. Max. Temp.	October. Min. Temp.	October. Mean Temp.	November. Max. Temp.	November. Min. Temp.	November. Mean Temp.	December. Max. Temp.	December. Min. Temp.	December. Mean Temp.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
Cairo	96	62	78.7	95	60	78.2	93	47	68.9	88	37	57.6	68	7	40.7	58	−7	29.2
Clinton	93	73	82.2	89	59	74.2	88	43	66.2	78	31	55.5	75	21	42.8	55	2	28.8
Louisville	93	58	79	93	59	78	94	44	69.5	85	36	56.6	62.5	45	37.5	61	−4	29.4
Lexington	90	61	76.5	92	57	73.7	92	41	66.8	72	41	52.3	63	2	61	50	−2	27.9
Danville	....	....	....	....	....	....	90	48	68.8	88	35	60.4	79	24	47.3	64	−4	35.4

TABLE II.—*Rainfall and Barometer.*

PLACES.	WIND. Direct'n of winds summ'r.	WIND. Direct'n of winds winter.	RAIN. Winter. Jan.	Winter. Feb.	Winter. Mar.	Spring. April.	Spring. May.	Spring. June.	Summer. July.	Summer. Aug.	Summer. Sept.	Autumn. Oct.	Autumn. Nov.	Autumn. Dec.	Four seasons. Winter.	Four seasons. Spr'g.	Four seasons. Summer.	Four seasons. Autumn.	Year. Total rainfall.
			in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	inches.
Cairo	S.	N. & S.	5.03	6.68	3.27	5.54	5.07	4.45	1.68	2.48	4.09	1.16	0.57	1.56	13.27	13.38	8.61	5.82	41.58
Clinton	S.	S. W.	1.58	3.82	5.69	5.70	1.93	2.38	3.05	3.95	5.89	2.25	1.95	1.60	7.00	13.32	9.38	10.09	39.79
Louisville	S.	N. W.	2.93	4.05	3.33	3.05	5.73	3.87	3.43	3.04	2.50	3.92	0.56	2.58	9.06	12.17	10.34	6.98	38.55
Lexington	S.	S. W.	2.53	5.42	3.73	2.88	6.05	4.54	3.37	2.94	1.60	2.95	1.21	3.53	11.48	12.66	10.85	5.76	40.75
Danville	S.	S. W.	2.89	1.87	3.50	4.35	4.50	4.69	3.20	3.01	9.75	1.53	2.28	4.13	8.89	12.35	10.90	13.56	45.70

PLACES.	BAROMETER. Winter. Jan.	Winter. Feb.	Winter. Mar.	Spring. April.	Spring. May.	Spring. June.	Summer. July.	Summer. Aug.	Summer. Sept.	Autumn. Oct.	Autumn. Nov.	Autumn. Dec.	Year. Mean annual pressure.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	inches.
Cairo	30.13	30.05	30.08	29.90	29.86	29.93	30.00	30.03	30.05	30.16	30.19	30.29	30.049
Clinton													
Louisville	30.05	30.05	30.08	29.92	29.88	29.93	30.07	30.01	30.04	30.08	30.11	30.20	30.060
Lexington	30.05	30.05	30.08	29.90	29.88	29.95	30.03	30.02	30.05	30.07	30.11	30.21	30.048
Danville													

flax-seed, 14,657; grass-seed, 35,896. Dairy products: butter, 11,874,978 pounds; cheese, 115,219; milk sold, 1,345,779 gallons. Of some of these crops we have later statistics from the usually accurate estimates of the agricultural department. If these err at all, it is almost invariably in the way of under-estimate. The following are the figures for the year 1873: Indian corn, 58,451,000 bushels, valued at $25,718,440; wheat, 7,225,000 bushels, worth $8,742,250; rye, 1,107,000 bushels, worth $852,390; oats,

7,037,000 bushels, worth $2,533,320; barley, 218,000 bushels, worth $218,000; buckwheat, 3600 bushels, worth $3096; common potatoes, 1,737,000 bushels, worth $1,076,940; tobacco, 152,000,000 pounds, worth $10,944,000; hay, 337,900 tons, worth $4,392,706. The land under cultivation that year in these crops was reported at 3,732,042 acres. In 1870 the value of the entire live-stock of the State was reported as $66,287,343, and the numbers were—317,034 horses, 99,230 mules and asses, 247,615 milch cows, 69,719 working oxen, 382,993 other cattle, 936,765 sheep, and 1,838,227 swine. The report of the agricultural department for Jan., 1874, estimates the number of horses at 343,900, of mules and asses at 83,600, of oxen and other cattle at 380,400, of milch cows at 229,400, of sheep at 808,100, of swine at 2,008,000, and the aggregate value of the live-stock of the State at $50,950,792. We are inclined to believe that these are under-estimates, both as to number and value. A shrinkage in values of nearly $16,000,000 is hardly probable.

Manufactures.—The latest published statistics of manufactures in Kentucky are those of the census of 1870. The comparatively slow development of manufacturing industry in the State makes this a matter of less moment than in the newer States, where the changes of a single year are marvellous. During the decade from 1850 to 1860 the increase of manufactures was rather from the increase in the price of the articles manufactured than from any addition to the number of establishments or employés. From 1860 to 1870 there was no more advance, especially after the war, but with the best and most permanent water-powers in the world, and an abundance of coal to generate steam, Kentucky is far behind many of the other States in the extent and variety of her manufactures. The discoveries of coal, iron, and petroleum in such extensive deposits may stimulate her citizens to greater activity. The manufacturing statistics of the State in 1870 were—number of establishments, 5390, for which the motive-power was—steam-engines, 1147, with 31,928 horse-power; and 459 water-wheels, with 7640 horse-power. These establishments in 1870 employed 30,636 persons, of whom 27,687 were men, 1159 women, and 1790 children and youth; the estimated capital of these establishments was $29,277,809; the wages paid, $9,444,524; the raw material used, $29,497,535; and the annual product, $54,625,809. The greatest of these manufacturing interests in the State is the production of iron and iron goods, including pig iron, forged and rolled, castings of all sorts, and stoves, heaters, and hollow-ware. In 57 establishments there were produced in 1870 iron and articles of iron to the value of $7,869,653; malt and distilled liquors come next, 176 distilleries and breweries, producing liquors valued at $5,222,089; flouring-mill products, in 190 mills, are made to the extent of $5,093,213; lumber planed and sawed is produced in 278 mills to the extent of $3,748,809; tobacco, as chewing, smoking, snuff, and cigars, in 102 establishments to the extent of $2,097,005; bagging in 11 factories to the amount of $1,752,120; leather, tanned and curried, in 182 tanneries to the amount of $1,693,574; furniture in 90 cabinet-shops to the amount of $1,463,977; wool-carding and cloth-dressing, and woollen goods in 125 establishments to the amount of $1,312,458; machinery of all kinds in 28 establishments to the value of $1,453,426; agricultural implements in 44 factories to the amount of $1,384,917; carriages and wagons in 325 establishments to the extent of $1,339,909; clothing in 167 establishments to the amount of $1,181,158; tin, copper, and sheet-iron ware in 127 shops to the extent of $1,051,026; saddlery and harness in 212 shops to the amount of $1,013,852; printing and publishing in 31 offices to the amount of $842,210. The other more important manufactures were—bookbinding, boots and shoes, bread and other bakery products, brick, bridge-building, cement, confectionery, cooperage, cotton goods, glassware, monuments and tombstones, paints, lead, and zinc, and sash, doors, and blinds. Of these only boots and shoes and bridge-building exceeded in the aggregate $500,000.

Mining.—The census returns for 1870 in regard to the mining interests of Kentucky are singularly imperfect. Only 35 mines are reported, employing 925 persons, with a capital of $761,450, paying $312,486 wages, using $31,083 of raw material, and producing ores, coal, etc. to the value of $509,245. It is hardly beyond the truth to say that single mines produce a larger amount than this. "The coal resources of Kentucky," says Prof. Shaler, "are only exceeded by those of Pennsylvania, and the quantity of iron ore is probably not exceeded by any American State. The coal and iron products of the State already reach several millions in value, and are destined to have a great and rapid development."

Railroads.—Having a larger amount of water-communication in its navigable streams through almost every part of its territory than almost any other interior State (estimated by Prof. Shaler at over 4000 miles), and provided with magnificent macadamized roads to most of its larger towns, Kentucky has not until recently felt the necessity for railroad extension to the same extent as most of the adjacent States. In 1841 there were but 28 miles of railroad in the State, and there was no increase till after 1848; in 1851 there were 94 miles; in 1860, 510; in 1862, 567; in 1872, 1123; and in Jan., 1875, 1519 miles in operation, the cost of the roads, with the equipment, being $62,728,511. The principal roads, beginning on the eastern border of the State, are—the Lexington and Big Sandy, beginning at Catlettsburg, at the mouth of the Big Sandy, where it connects by a bridge with the Chesapeake and Ohio from Huntington, and extending to Lexington, 118 miles (about 73 miles of this are now completed, and the whole will be in running order during the present year); the Eastern Kentucky, Riverton to Grayson, with two branches to coal-mines, in all 28 miles; the Elizabethtown and Paducah, 185 miles (this is to be continued from Elizabethtown to Lexington, to connect with the Lexington and Big Sandy); the Kentucky Central, with branches, 123 miles; the Louisville Cincinnati and Lexington, with the Cincinnati branch, in all 189 miles; the Louisville and Nashville, in all 436 miles; the Paducah and Memphis, 165 miles (of which about 53 miles are in the State); the Evansville Henderson and Nashville, 98 miles in the State to Guthrie; the Madisonville and Shawneetown R. R., about 55 miles; and several short railroads connecting with Southern or South-western lines.

Finances.—The assessed valuation of the State in 1870 was $409,544,244, of which $311,479,694 was of real estate and $98,064,600 was of personal property. The true valuation that year was estimated to be $604,318,552. The total taxation of that year, not national, was $5,730,118, of which $2,254,413 was State, $1,307,833 county, and $2,167,872 town, city, etc. The State indebtedness was $3,076,480, for which bonds had been issued, and $816,000 floating debt. Four years of prosperity have increased materially the valuation of the State and diminished both its debt and its taxation. On Oct. 10, 1871, the entire debt was but $2,720,710, of which $1,652,317 was of bonds issued to the board of education, and not negotiable, and $1,068,394 negotiable. On Oct. 10, 1872, this debt had been reduced to $766,394, but $200,000 in bonds had been authorized to meet a floating debt; the negotiable debt of the State therefore stood at $966,394; the sinking fund at the same time amounted to $1,691,991, or more than $700,000 more than the negotiable debt. For the fiscal year ending Oct., 1873, the receipts from taxes were $1,024,460, and the expenditures $1,476,469, including some payments on the State debt which were ordered paid from the sinking fund. The State bonds are 5 and 6 per cent. bonds, and have commanded a ready sale at good prices.

Commerce.—Kentucky has a small amount of foreign commerce, Louisville, its chief city, being a port of entry, and exporting and importing directly to some extent; but its interior commerce is of great magnitude, variety, and importance. Its numerous navigable rivers, as well as its railroads and its macadamized roads, enable the State to send its products to market with great facility, and the imports rival the exports in quantity and value. The principal articles shipped are: tobacco, whisky, salt, beef, pork, bacon, flax, hemp, and cotton-baling stuffs, ropes and cordage, flour, ale and beer, iron, as pig iron and in castings of all kinds, etc. Horses, mules, and cattle are sent eastward in great numbers, the State maintaining the highest reputation for its horses both for racing and trotting purposes, and for service as carriage and family horses, its mules being of greater size and better quality than those of the other States, and its cattle being of the best breeds and in the best condition from the excellence of its pasturage. There are no statistics accessible which give the amount of this internal commerce at a later date than that of the census of 1870, and these only incidentally, but there can be no doubt that it annually reaches at least $400,000,000.

Banks.—There were Nov. 1, 1874, 47 national banks, 1 of which was closing; the 46 in operation had a capital of $10,018,900 paid in, $9,381,850 of bonds on deposit, $10,264,670 circulation issued, of which $1,299,069 had been redeemed, and $8,335,601 of circulation still outstanding. At the same date there were 45 State banks in operation, having an aggregate capital of about $12,000,000; 3 savings banks, having a capital of $450,000; amount of deposits not stated; and 38 private banking-houses, many of them with very large capital. There were Jan. 1, 1875, 12 fire and marine insurance companies in the State, 2 of them mutual, and the remainder having an aggregate capital of $1,384,000, and assets of the whole (in 4 cases including notes) of $1,889,636.53; liabilities aside from cap-

ital and net surplus, $343,774.88; amount of insurance written during the year, $47,425,263; premiums received during the year, $475,568; losses paid during the year, $244,738. At that time there was but 1 life insurance company in the State, the Southern Mutual Life at Louisville, organized in 1866, with $100,000 capital, $752,005 assets, $629,631 liabilities, $261,653 income, and $201,678 expenditures; 2166 policies for the aggregate amount of $5,820,923 in force at that date.

Population.—We have endeavored to throw into tabular form as many facts in regard to the population of Kentucky, past and present, as possible. The earlier censuses are very defective in regard to the sex and ages of the colored population, whether free or slave, yet the annexed table will be found to contain some interesting statistics not heretofore tabulated. The density of the population to the square mile in 1850 was 26.07; in 1860, 30.94; in 1870, 35.33. The number of families in 1870 was 232,797, or 5.67 to a family; the number of dwellings, 224,969, or 5.87 persons to a dwelling. In 1870 the number of white males of all ages was 557,326, of white females, 541,366; of colored males, 108,304, of colored females, 113,906; of Indian males, 44, of Indian females, 64; the number of native males was 631,020, of native females, 626,593; of males of foreign birth, 34,655, of females of foreign birth, 28,743. The number of males of school age was 230,491, of females of school age, 224,048. The number of male citizens (*i. e.* voters) was 282,305.

Census year.	Whites.	Free colored.	Slaves.	Total.	Males.	Females.	Native.	Foreign.	Of school age, 5 to 18.	Of military age, 18 to 45.	Of voting age, over 21.	Cannot read or write.
										Males.	Males.	
1790	61,133	114	12,430	73,677	*32,211	*28,922						
1800	179,873	739	40,343	220.955	*93,956	*85,915						
1810	324,237	1,713	80,561	406,511	*168,805	*155,432						
1820	434,644	2,759	126,732	564,135	293,192	275,125						
1830	517,787	4.917	165,213	687.917	352,084	335,833	....	....	204,571			
1840	590,253	7,317	182,258	779,828	400,088	379,740	....	....	232,570	....	*119,243	*40,018
1850	761,413	10,011	210,981	982,405	502,730	479,675	949,652	31,420	302,899	....	*176,974	*69,706
1860	919,484	10,684	225,483	1,155,684	592,321	563,363	1,095,885	59,799	†280,466	*131,211	*191,391	*70,040
1870	1,098,692	222,210	none.	1,321,011	665,675	655,336	1,257,613	63,398	454,539	239,483	289,471	332,176

Education.—The interests of higher education were subjects of thought and action very early in the history of the State. Transylvania University at Lexington (now merged in the Kentucky University) was organized and chartered in 1798, and other collegiate schools not long after; but very little attention was paid to free or popular education. Academies and private schools were established all over the State, and to these the sons and daughters of wealthy planters and manufacturers were sent, while a large proportion of the children of the poorer classes were entirely without instruction. There was no provision for common schools until 1821, when one-half of the clear revenue of the Bank of the Commonwealth was set apart for a school fund; and no system of public schools was established until 1838, though a bill for that purpose was passed in 1830. Under the organization of 1838 there was a board of education and a superintendent of public instruction appointed. Under this law each county could at its option vote to organize public schools within its own territory, and then avail itself of the aid of the school fund, which at this time amounted to a considerable sum. In a number of counties no organization took place, owing, it was said, to the impossibility of finding in the county three men who possessed the educational and other qualifications required for school commissioners. In 1854 provision was made by the legislature for the education of 150 teachers in the State University at Lexington. In 1870 a bill was passed for the reorganization of the school system, and in the winter of 1872–73 it was completely reorganized. Its chief executive officer is now the superintendent of public instruction, elected for four years, and having a salary of $3000 besides clerk hire. The board of education, who constitute his cabinet, consists of the superintendent, the attorney-general, the secretary of state, and two professional educators; the State board of examiners consists of the superintendent and two practical educators selected by him. There is also a county commissioner for each county, elected by the presiding county judges and the justices of the peace for two years, and a county board of examiners, consisting of the county commissioner and two well-educated and competent persons to sit with him, who are appointed by him. The school fund consists of the interest at 6 per cent. on $1,327,000, a non-negotiable bond of the State, the dividends on 735 shares of the stock of the Bank of Kentucky, taxes on some other banks, and whatever distinct tax the people of the respective school districts may vote to impose upon themselves. Teachers' institutes are required to be held annually in July and August in each county by the county commissioners. The legal school year is five months of 22 days each; the scholastic age in the State is from 6 to 20 years. Provision was made by the legislature of 1874 for the establishment of schools for colored children, but on a basis so narrow and restrictive that it is doubtful whether it will be enforced very generally. The number of children of school age reported at the close of 1873 was 416,763, the number of schools was 5521, the number of teachers about 6000, the expenditure, aside from the interest on county school-bonds, was $977,425.82. The interest in public school education in the State is evidently increasing. There were but 24 academies and high schools which reported to the superintendent of public instruction in 1873; these had 158 instructors and 2621 pupils. There are normal departments in three of the colleges of the State—Berea, Georgetown, and the Kentucky State University—and normal schools under private or associational control at Carlisle (6 teachers, 75 pupils, 3 years' course), Catlettsburg (6 teachers, 50 students, 3–5 years' course), and Lexington (American Missionary Association, 280 pupils). Besides these there are training-schools at Lexington and Frankfort. There are 12 universities and colleges in the State; the following were their statistics in 1873–74:

Name of university or college.	Place where located.	Number of instructors.	Number of students.		Value of grounds, buildings, and apparatus.	Amount of endowment.	Income of productive funds.	Receipts for last year from all other sources.	Volumes in library.
			Preparatory.	Collegiate.					
Berea College	Berea	5	43	14	$115,000	$91,000	$1,330	$29,000	1,500
Bethel College	Russellville	6	28	52	176,000	20,000	5,460	3,000	1,000
Cecilian College	Cecilian	11	100	...	20,000				
Centre College	Danville	6	75	54	70,000	180,000	11,000	2,800	7,000
Central University	Richmond	5	122	29	16,200				
Eminence College	Eminence	8	45	66	50,000	....	....	15,000	1,500
Georgetown College	Georgetown	7	28	80	80,000	125,000	....	......	3,000
Kentucky Medical Institute	Frankfort	6	17	78	75,000	....	....	......	3,000
Kentucky University	Lexington	8	...	134	100,000	200,000	12,000	1,370	20,000
St. Mary's College	St. Mary	10	...	84	8,000	....	......	......	800
Warrendale College	Bowling Green	3	62	52	15,000	....	......	......	300
Wesleyan University	Millersburg	4	35	13					

There were 11 colleges or seminaries for women, having 75 professors and instructors and 1013 pupils, of whom 742 were in the collegiate and 271 in preparatory studies. In all, music, both instrumental and vocal, is taught. These had libraries ranging from 500 to 3000 volumes; 1 had a gymnasium; 5, chemical laboratories; 4, philosophical cabinets; 2, natural history museums; and 1, an astronomical observatory. There were 10 professional and scientific schools in the State in 1873, as shown in the table of professional schools on the next page.

Libraries.—In 1870, the census reported 5546 public and private libraries in the State, with 1,909,230 volumes. Of these, 1172, having 318,985 volumes, were public. This number included 2 State libraries, with 9200 volumes; 10 town and city, with 13,436 volumes; 218 court and law libraries, with 61,590 (apparently an error); 18 school and college libraries, with 20,675 volumes (the colleges named above have 38,000 volumes, and the professional schools 25,000 more); 717 Sunday schools, with 160,377 volumes;

* Whites only enumerated.
† White children only enumerated.

207 church libraries, with 53,707, and no historical or circulating libraries; while the Public Library of Kentucky at Louisville has 45,000 volumes, the Historical Library in that city over 10,000, the Mercantile Library of the same city more than 20,000, and Lexington and several other towns have circulating libraries. The number of private libraries reported is 4374, containing 1,590,245 volumes.

Newspapers.—In 1872, Kentucky had 105 newspapers, an increase of 16 since 1870. Of these, 10 were dailies, having an aggregate circulation of over 40,000; 2 tri-weekly, circulation about 3000; 5 semi-weekly, circulation about 4500; 76 weekly, circulation about 149,000; 12 monthly, circulation about 33,000. By far the greater part were political, at least four-fifths, but 8 were religious, having a circulation of over 25,000, and 3 professional, with a circulation of over 8000.

Name of professional school.	Place.	Number of instructors.	Students. Prepara-tory.	Students. Full course.	Value of grounds and buildings.	Amount of produc-tive funds.	Income from produc-tive funds.	Receipts for last year from all other sources.	Volumes in library.
I. THEOLOGICAL:									
Bible College, University of Kentucky	Lexington	4	...	88					
Danville Theological Seminary	Danville	4	...	....	$24,000	$189,000	$11,500	....	7,500
St. Joseph's Seminary and College	Bardstown	8	...	....	20,000	1,800	....	$8,000	8,000
Theological School of Bethel College	Russellville	1	...	14					
Western Baptist Theological Institute	Georgetown	2	...	22	....	48,000	....	....	3,000
II. LAW:									
College of Law, Kentucky University	Lexington	3	...	26	....	....	....	....	3,000
III. MEDICAL:									
Louisville Medical College	Louisville	12	...	217	....	1,500			
Medical department, University of Louisville	"	15	...	253	200,000	....	....	15,000	4,000
Louisville College of Pharmacy	"	3	....	25	....	1,000	30	700	100
IV. SCIENTIFIC:									
Agricultural and Mechanical College, Kentucky University	Lexington	11	67	181	275,000	165,000	9,900	7,089	*20,000

Churches.—According to the census of 1870, there were at that time in the State 2969 churches or congregations of all denominations, 2696 church edifices, 878,039 sittings, and $9,824,465 of church property. The following table gives the statistics of the principal denominations, according to the census, and also later statistics, generally of 1874, where attainable, showing in this short time a great increase over the previous numbers:

Denominations.	Census 1870. Churches and congregations.	Census 1870. Church edifices.	Census 1870. Sittings.	Census 1870. Value of church property	Statistics of 1874. Churches, parishes, or congregations.	Statistics of 1874. Church edifices.	Statistics of 1874. Ministers.	Statistics of 1874. Members or communicants.	Statistics of 1874. Adherent population.	Statistics of 1874. Sunday schools.	Statistics of 1874. S.S. teachers and scholars.
Baptists	1004	962	288,936	$2,023,975	1367	1285	723	147,031	588,124	200	13,000
Disciples and Christians†	490	436	141,585	1,046,075	545	502	313	51,372	205,000	300	29,700
Congregationalists	......	......	....	....	5	5	9	369	1,854	......	487
Protestant Episcopal Church	38	35	15,800	570,300	39	37	41	3,927	17,000	......	3,814
Evangelical Association	5	5	3,000	150,000	8	7	6	1,090	5.000	10	1,200
Jewish synagogues	3	3	1,500	154,000	4	4	4	800	2,400		
Lutherans	7	7	1,650	16,000	10	8	5	1,008	5,000		
Methodist (Ch. South, mostly)	978	818	244,918	1,854,565	1097	898	1132	120,303	480,000	400	27,350
Presby'n (Gen. Assembly) " " " South	289	270	97,150	1,275,400	327	301	231	27,188	118,000		
Presbyterian, other	17	15	3,600	17.000							
Roman Catholics	130	125	72,550	2,604,900	203	148	155	....	135,000		
Shakers	2	2	1,600	23,000	2	2	8	500	1,000		
Unitarian	1	1	700	75,000	2	2	2	250	1,200		
Universalist	2	2	400	5,500	4	4	5	175	800		
Union churches	3	15	4,650	28.750	25	20	21	2,500	10,000		

Charitable Institutions.—There is an institution for deaf mutes at Danville, Ky., organized in 1823, being one of the earlier institutions, the fourth organized in this country. In 1873 it had 5 instructors, 87 pupils (48 males, 39 females); the value of its buildings and grounds was $100,000, and its annual expenditure $20,312, of which nearly $18,000 was appropriated by the State. There is an institution for the education of the blind at Louisville, founded in 1842, having 19 instructors and other employés, 59 pupils, property valued at $90,000, and receiving from the State annually $16,000, which covers its expenditures. There are 3 orphan asylums, all at Louisville, having in all 13 teachers, 152 children, and expending annually about $15,000. Of 7 other orphan asylums in the State there is no recent report. There is an institution at Frankfort for feeble-minded children, but we have been unable to obtain any recent report of its condition. The house of refuge at Louisville is a municipal not a State institution; it has 16 teachers, 174 inmates (150 boys and 24 girls), its annual cost is about $20,000, and the inmates earn about $5000 per annum. There are two insane hospitals in the State—the Western, at Hopkinsville, and the Eastern, at Lexington—both well managed. The Kentucky penitentiary is at Frankfort. It has room for about 600 prisoners. It has not the reputation of being a model institution. The penal institutions of the State generally are susceptible of very great improvement. In 1870 there were 603 persons convicted of crimes which are punishable by death or imprisonment in the State penitentiary, and 1067 in prison charged with such crimes and awaiting trial. Of these, 968 were of native birth and 99 of foreign.

Constitution, Government, Representation in Congress, etc.—The present constitution of the State was adopted in 1850. The governor, lieutenant-governor, auditor, attorney-general, and superintendent of public instruction are elected by the people for the term of four years. The governor is ineligible for the four years succeeding the expiration of his term. If a vacancy in the office of governor occur during the first two years of the term, it is filled by a new election; if during the last two years, the lieutenant-governor, and after him the Speaker of the senate, acts as governor. The treasurer is elected by the people every two years. The secretary of state is appointed by the governor, by and with the advice and consent of the senate. Senators, 38 in number, are elected from single districts for four years, one-half every two years. Representatives, 100 in number, are elected from single districts for two years. Sessions of the assembly are biennial, and cannot continue longer than 60 days without a two-thirds vote of all the members elected to each branch. The members are paid $4 a day and 15 cents a mile for travel. Every male citizen who has resided two years in the State, one year in the county, and sixty days in the precinct in which his vote is offered, is entitled to vote. The court of appeals is the supreme court of the State, and has appellate jurisdiction over the final orders and judgments of all other courts of the State in civil cases, except where the amount in controversy is less than $50, or in cases of judgment granting divorce, or on a judgment of an inferior court from which an appeal is given to the quarterly or circuit court. It has appellate jurisdiction in criminal cases where the fine is $50 or more. The circuit courts have original jurisdiction in civil cases where the amount in controversy is $50 and upwards, except where exclusive jurisdiction is given to other courts; appellate jurisdiction in certain cases specified; and criminal jurisdiction for the trial of all offences which may be prosecuted by indictment, and all prosecutions and final actions except where exclusive jurisdiction is given to other courts. There are also county

* The University Library.

† There are no data for making a correct statement of the numbers of these two denominations in the State; the "Disciples" are by far the most numerous, but both denominations have been very negligent in collecting their statistics.

courts and justices' courts. All judges are justices of the peace. Judges of the court of appeals are elected by districts for a term of eight years, one every second year, and the judge having the shortest term to serve is chief-justice. The circuit court judges are elected by districts for six years, and justices of the peace for four years. Under the apportionment of 1872, Kentucky is entitled to 10 Representatives in Congress.

Counties.—Kentucky is divided into 116 counties. The following was their population, divided into white and colored, in 1870, population in 1860, and valuation in 1870:

Counties.	Pop., 1870.	Whites, 1870.	Colored, 1870.	Pop., 1860.	Valuation, 1870.
Adair	11,065	9,229	1,836	9,509	$1,768,973
Allen	10,296	9,192	1,104	9,187	1,818,615
Anderson	5,449	4,751	698	7,404	1,511,100
Ballard	12,576	11,099	1,477	8,692	2,190,588
Barren	17,780	14,157	3,623	16,665	3,353,784
Bath	10,145	8,443	2,702	12,113	2,694,168
Boone	10,696	9,684	1,012	11,196	5,006,925
Bourbon	14,863	8,186	6,677	14,860	11,982,749
Boyd	8,573	8,282	291	6,044	2,239,177
Boyle	9,515	5,836	3,679	9,304	4,123,535
Bracken	11,409	10,773	636	11,021	3,900,888
Breathitt	5,672	5,491	181	4,980	489,848
Breckenridge	13,440	11,758	1.682	13,236	3,584,226
Bullitt	7,781	6,587	1,194	7,289	2,419,859
Butler	9,404	8,761	643	7,927	1,566,207
Caldwell	10,826	8,748	2,078	9,318	2,206,472
Calloway	9,410	8,598	812	9,915	1,976,765
Campbell	27,406	27,123	282	20,909	8,724,696
Carroll	6,189	5,649	540	6,578	2,207,236
Carter	7,509	7,409	100	8,516	1,535,033
Casey	8,884	8,340	544	6,466	1,432,361
Christian	23,227	13,415	9,812	21,627	5,294,945
Clark	10,882	7,167	3,715	11,484	6,296,610
Clay	8,297	7,802	495	6,652	886,808
Clinton	6,497	6,205	292	5,781	870,279
Crittenden	9,381	8,572	809	8,796	1,769,651
Cumberland	7,690	6,181	1,509	7,340	1,254,948
Daviess	20,714	17,111	3,603	15,549	7,825,750
Edmondson	4,459	4,233	226	4,645	874,224
Elliott	4,433	4,411	22	....	363,693
Estill	9,198	8,599	599	6,886	1,520,726
Fayette	26,656	14,142	12,513	22,599	14,790,457
Fleming	13,398	11,842	1,556	12,489	4,337,841
Floyd	7,877	7,706	171	6,388	685,255
Franklin	15,300	10,637	4,663	12,694	4,923,176
Fulton	6,161	5,224	937	5,317	1,434,348
Gallatin	5,074	4,474	600	5,056	1,862,731
Garrard	10,376	6,972	3,404	10,531	3,836,809
Grant	9,529	9,020	509	8,356	2,841,682
Graves	19,398	17,069	2,329	16,233	3,732,053
Grayson	11,580	11,173	407	7,982	1,606,960
Green	9,379	7,442	1,937	8,806	1,219,875
Greenup	11,463	11,002	461	8,760	2,949,187
Hancock	6,591	5,861	729	6,213	1,752,300
Hardin	15,705	13,429	2,276	15,189	3,728,882
Harlan	4,415	4,304	99	5,494	405,596
Harrison	12,993	10,615	2,378	13,779	6,720,070
Hart	13,687	11,495	2,192	10,348	2,535.940
Henderson	18,457	12,467	5,990	14,262	6,454,182
Henry	11,066	8,628	2,438	11,949	5,262,399
Hickman	8,453	6,818	1,635	7,008	1,788,027
Hopkins	13,827	11,958	1,869	11,875	2,477,296
Jackson	4,547	4,496	51	3,087	355,385
Jefferson	118,953	99,806	19,146	89,404	76,414,971
Jessamine	8,638	5,199	3,439	9,465	4,049,576
Johnson	7,494	7,373	37	5,306	684,049
Josh Bell	3,731	3,620	111	....	264,944
Kenton	36,096	34,439	1,657	25,467	14,229,850
Knox	8,294	7,737	557	7,707	905,231
Larue	8,235	7,270	965	6,891	1,542,217
Laurel	6,016	5,872	144	5,488	864,922
Lawrence	8,497	8,376	121	7,601	1,152,310
Lee	3,055	2,924	131	....	395,290
Letcher	4,608	4,479	129	3,904	310,502
Lewis	9,115	8,887	228	8,361	2,349,340
Lincoln	10,947	7,871	3,076	10,647	4,483,920
Livingston	8,200	7,147	1,052	7,213	1,509,182
Logan	20,429	14,706	5,723	19,021	4,269,135
Lyon	6,233	4,814	1,419	5.307	937,574
Madison	19,543	13,271	6,272	17,207	8,177,420
Magoffin	4,684	4,505	179	3,485	559,856
Marion	12,838	9,495	3,343	12,593	3,223,991
Marshall	9,455	9,070	385	6,982	1,487,155
Martin	new	county			
Mason	18,126	14,544	3,582	18,222	8,171,205
McCracken	13,988	10,699	3,289	10,360	5,284,846
McLean	7,614	6,800	814	6,144	1,564,823
Meade	9,485	8,191	1,294	8,898	2,165,548
Menifee	1,986	1,970	16	....	120,773
Mercer	13,144	9,834	3,310	13,701	4,129,231
Metcalfe	7,934	7,073	861	6,745	1,301,095
Monroe	9,231	8,442	789	8,551	1,217,072
Montgomery	7,557	4,858	2,699	7,859	3,546,027
Morgan	5,975	5,931	44	9,237	718,267
Muhlenburg	12,638	11,095	1,633	10,725	2,462,757
Nelson	14,804	10,886	3,918	15,799	5,339,210
Nicholas	9,129	7,885	1,244	11,030	3,090,350
Ohio	15,561	14,168	1,393	12,209	3,343,006
Oldham	9,027	6,217	2,810	7,283	3,194,252
Owen	14,309	13,133	1,176	12,719	2,588,130
Owsley	3,889	3,812	75	5,335	517,691
Pendleton	14,030	13,389	641	10,443	2,894,389
Perry	4,274	4,173	96	3,950	330,033
Pike	9,562	9,460	102	7,384	$910,007
Powell	2,599	2,360	239	2,257	343,819
Pulaski	17,670	16,595	1,075	17,201	2,258,090
Robertson	5,399	5,142	257	....	1,025,147
Rockcastle	7,145	6,776	369	5,343	1,033,551
Rowan	2,991	2,959	32	2,282	388,688
Russell	5,809	5,516	293	6,024	1,057,697
Scott	11,607	7,651	3,955	14,417	6,722,370
Shelby	15,733	10,350	5,383	16,433	8,569,998
Simpson	9,573	7,406	2,167	8,146	2,533,749
Spencer	5,956	4,477	1,479	6,188	2,693,561
Taylor	8,226	6,376	1,850	7,481	1,402,094
Todd	12,612	7,752	4,860	11,575	2,803,846
Trigg	13,686	9,880	3,806	11,051	2,498,423
Trimble	5,577	5,121	456	5,880	1,739,680
Union	13,640	11,066	2,574	12,791	3,396,183
Warren	21,742	15,375	6,367	17,320	7,072,222
Washington	12,464	10,354	2,110	11,575	3,564,004
Wayne	10,602	9,927	675	10,259	1,419,585
Webster	10,937	9,582	1,355	7,533	1,578,643
Whitley	8,278	8,140	138	7,762	988,852
Wolfe	3,603	3,575	28	....	381,325
Woodford	8,240	4,415	3,825	11,219	5,981,130
Totals	1,321,011	1,098,692	222,210	1,155,684	409,544,244

Principal Towns.—Louisville is the chief city of the State, and had in 1870 a population of 100,753; Covington in Kenton co., opposite Cincinnati, has nearly 30,000 inhabitants; Newport, Campbell co., and Lexington, Fayette co., have each between 15,000 and 20,000 inhabitants; Paducah, Frankfort (the capital of the State), Maysville, and Bowling Green have from 5000 to 10,000; Henderson, Owensboro', Versailles, Hopkinsville, Paris, Shelbyville, Danville, and Harrodsburg have less than 5000. Russellville, Richmond, Lebanon, Cynthiana, Columbus, Franklin, Bardstown, and Elizabethtown are thriving towns.

History.—The territory now included in the State of Kentucky was during the greater part of the eighteenth century, and probably for several hundred years previously, the favorite hunting-ground and home of powerful and warlike tribes of Indians, who had given it the name of Kentucky, signifying "the dark and bloody ground." In 1769, Daniel Boone, an enterprising hunter and pioneer, came thither and established himself where now is Boonesboro'. Within the next six or seven years other pioneers settled in the territory, and among them such men as Knox, Bullitt, Harrod, Henderson, Kenton, Calloway, and Logan, all of whom identified themselves with the subsequent history of the State. Virginia claimed this whole region as a part of her territory, and most of the pioneer settlers were from that colony, but they purchased their lands from the Indians. On May 23, 1775, the settlers met at Boonesboro', and in convention organized themselves as the "Assembly of Transylvania." They established courts, enrolled a militia force, and passed laws; but when their doings came to the knowledge of the Virginia legislature they were pronounced null and void, though grants of land were made to these pioneers. In 1776 the legislature of Virginia erected its territory S. of the Ohio into the county of Kentucky, embracing all the country lying between the Big Sandy River and the Mississippi. In 1783 this county was constituted a district, and the decisions of its civil and criminal courts were declared to be subject to appeal to the State courts of Virginia. Harrodsburg had been founded in 1774, and Lexington probably in the autumn of 1775. During the Revolutionary war the number of settlers rapidly increased, although, owing to the continual hostilities of the Indians, they were obliged to go constantly armed, and had numerous and fierce conflicts with the Cherokees and other Indian tribes. On Aug. 19, 1782, a bloody and desperate battle took place between the whites, who numbered only 182, and an Indian force of about 600, near Blue Lick Springs. Col. Boone was prominent in the battle, and lost a son in it. The Kentuckians were finally defeated with the loss of 60 of their number. In 1784 the people of the district urged that they might be recognized as a State and admitted into the Union of States. They held repeated conventions in 1785, 1786, and 1787; and the Virginia legislature passed an ordinance in 1785 granting a separate organization, but with conditions which caused delay and discontent. In Jan., 1787, the people in convention agreed to form a State and adopt a constitution, but there were hindrances on the part of Virginia; and intrigues on the part of the Spanish viceroy in Louisiana and of emissaries from Canada, both trying to draw away the district from its allegiance to the Union, kept it in turmoil, while the Indian hostilities and depredations were making the lives of the settlers wretched. At length, when the difficulties with Virginia seemed about to be settled, the announcement was made that the Constitution of the U. S. had been accepted and ratified, and the whole controversy in regard to the organization of the district as

a State was handed over to the general government. In 1790 it was made a separate Territory of the U. S., and on Apr. 19 the delegates of the people assembled once more in convention (the tenth of these assemblies, we believe) at Danville, and reported a State constitution, which was soon after ratified, and under which Kentucky was admitted into the Union as a State on June 1, 1792. Its population was at that time about 75,000. For the next twelve or fourteen years the young State was often in an agitated condition. She had a vital interest in the free navigation of the Mississippi, and in its being at least in the hands of a friendly power. The treaty with Spain in 1795, and its subsequent violation by that power, and the repeated transfers of the territory bordering on the Gulf to and from France, its final purchase by the U. S., the intermeddling of the British government and the French minister with the matter, and the wild and treasonable schemes of Aaron Burr and his confederates, all tended to keep the people at fever-heat. In the war of 1812, Kentucky bore an honorable part, though she suffered severely at the battle of Frenchtown and in the barbarous massacre which followed it, and some of her best citizens were sacrificed in the unfortunate and ill-managed attempt to relieve Fort Meigs. Somewhat later a civil contest in the State, known as the "Old Court and New Court controversy," which virtually involved the question of the repudiation of a debt of doubtful legality by the State, was decided, greatly to her honor, by the maintenance of all her obligations, though they had been obtained by fraud. In the Mexican war the State sent more than her quota of volunteers to the conflict, and their gallant conduct in the field won them lasting renown. In the late civil war, the State declared at first her strict neutrality in regard to both parties to the war, but as it proved impossible to maintain this condition, the legislature, after the invasion of the Southern troops in Aug., 1861, engaged in correspondence with the opposing forces, and finally, after a very exciting discussion, gave in its adhesion to the Union, Nov. 27, 1861. The State was a recruiting-ground for both armies, and its people were almost equally divided in sentiment. It furnished in several instances the battle-fields in severe and hotly-contested actions, such as those of Mill Spring, Perryville, and Richmond, as well as in the minor conflicts of Cynthiana, Elizabethtown, Greensburg, Lebanon, London, Mount Sterling, Mumfordsville, Pound Gap, Prestonburg, Somerset, and Tobb's Bend, and suffered not only from the passage of large hostile forces across its territory, but from repeated raids to and through the State. It refused to ratify the fourteenth and fifteenth amendments to the Constitution, and is the only one of the border States which has remained constantly under Democratic control since the close of the war.

Governors of the State.—

	Term.		Term.
Isaac Shelby	1792–96	Charles A. Wickliffe (acting)	1839–40
James Garrard	1796–1804	Robert P. Letcher	1840–44
Christopher Greenup	1804–08	William Owsley	1844–48
Charles Scott	1808–12	John J. Crittenden	1848–50
Isaac Shelby	1812–16	John L. Helm (acting)	1850–51
George Madison	1816–16	Lazarus W. Powell	1851–55
Gabriel Slaughter (acting)	1816–20	Charles S. Morehead	1855–59
John Adair	1820–24	Beriah H. Magoffin	1859–61
Joseph Desha	1824–28	James F. Robinson	1861–63
Thomas Metcalfe	1828–32	Thomas E. Bramlette	1863–67
John Breathitt	1832–34	John L. Helm	1867–67
James T. Morehead (acting)	1834–36	John W. Stevenson (acting)	1867–68
James Clark	1836–37	John W. Stevenson	1868–72
		Preston H. Leslie	1872–75

Electoral and Popular Votes for President and Vice-President.

Elect. year.	Candidates.	Elect. vote.	Elect. year.	Candidates.	Elect. vote.	Pop. vote.	Elect. year.	Candidates.	Elect. vote.	Pop. vote.
1792	George Washington P. George Clinton V.-P.	4	1824	Andrew Jackson P. J. C. Calhoun V.-P.	7	6,453	1852	Winfield Scott P. W. A. Graham V.-P.	12	57,068
1796	Thomas Jefferson P. Aaron Burr V.-P.	4		Henry Clay P. Nathan Sanford V.-P.	14 7	16,782		Franklin Pierce P. W. R. King V.-P.	...	53,806
1800	Thomas Jefferson P. Aaron Burr V.-P.	4	1828	Andrew Jackson P. J. C. Calhoun V.-P.	14	39,084	1856	James Buchanan P. J. C. Breckenridge V.-P.	12	74,642
1804	Thomas Jefferson P. George Clinton V.-P.	8		John Quincy Adams P. Richard Rush V.-P.	...	31,172		John C. Fremont P. W. L. Dayton V.-P.	...	314
1808	James Madison P. George Clinton V.-P.	7	1832	Henry Clay P. John Sergeant V.-P.	15	43,396		Millard Fillmore P. A. J. Donelson V.-P.	...	67,416
1812	James Madison P. Elbridge Gerry V.-P.	12		Andrew Jackson P. Martin Van Buren V.-P.	...	36,247	1860	Abraham Lincoln P. Hannibal Hamlin V.-P.	...	1,364
1816	James Monroe P. D. D. Tompkins V.-P.	12	1836	W. H. Harrison P. Francis Granger V.-P.	15	36,955		J. C. Breckenridge P. Joseph Lane V.-P.	...	53,143
1820	James Monroe P. D. D. Tompkins V.-P.	12		Martin Van Buren P. R. M. Johnson V.-P.	...	33,435		John Bell P. Edward Everett V. P.	12	66,058
			1840	W. H. Harrison P. John Tyler V.-P.	15	58,489		Stephen A. Douglas P. Herschel V. Johnson V.-P.	...	25,651
				Martin Van Buren P. R. M. Johnson V.-P.	...	32,616	1864	Abraham Lincoln P. Andrew Johnson V.-P.	...	27,786
			1844	James K. Polk P. George M. Dallas V.-P.	...	51,988		George B. McClellan P. G. H. Pendleton V.-P.	11	64,301
				Henry Clay P. T. Frelinghuysen V.-P.	13	61,255	1868	Ulysses S. Grant P. Schuyler Colfax V.-P.	...	39,566
			1848	Zachary Taylor P. Millard Fillmore V.-P.	12	67,141		Horatio Seymour P. Francis P. Blair, Jr., V.-P.	11	115,889
				Lewis Cass P. W. O. Butler V.-P.	...	49,720	1872	Ulysses S. Grant P. Henry Wilson V.-P.	...	88,970
								Horace Greeley P. B. Gratz Brown V.-P.	12	100,208
								Charles O'Conor P.		2,374

For most of the data concerning the topography, geology, etc. of Kentucky we are indebted to Prof. N. S. Shaler, State geologist of Kentucky and professor in the Lawrence Scientific School, Cambridge, Mass.

L. P. Brockett.

Kentucky, tp. of White co., Ark. Pop. 443.

Kentucky, tp. of Jefferson co., Kan. Pop. 1976.

Kentucky, tp. of Nicholas co., W. Va. Pop. 615.

Kentucky River rises in the mountains of Letcher co., flows in a tortuous north-westerly course some 250 miles, reaching the Ohio at Carrollton. Its middle and S. forks join the main stream in Owsley co. Its head-streams flow through a rough region, abounding in iron, coal, and salt. Great amounts of money have been expended in improving the navigation of this beautiful stream, which steamboats now ascend to Frankfort, 60 miles, and flatboats for 150 miles. At high water cargoes are floated down from its head-streams.

Kent'ville, post-v., cap. of King's co., Nova Scotia, on the river Cornwallis and on the Windsor and Annapolis Railway, 59 miles N. E. of Annapolis. It contains the principal offices, car-shops, and engine-house of the railway, and has 1 weekly paper. The scenery is fine, the soil fertile, the mineral wealth great. Pop. of sub-district, 1779.

Ken'yon, post-tp. of Goodhue co., Minn., 14 miles E. of Faribault. Pop. 633.

Kenyon (John), b. in Jamaica about 1783, son of a wealthy planter; was educated at the Charter-house, London, and at Peterhouse College, Cambridge; cultivated the friendship of Coleridge, Southey, and Wordsworth, and published two or three volumes of verses, not without merit; but will be chiefly remembered for the generosity with which he distributed his large fortune among eighty legatees, many of whom were distinguished in literature. B. W. Procter (Barry Cornwall) received £6500; Dr. Henry Southey, £8000; Robert and Elizabeth B. Browning (the latter his cousin), £10,000. D. at Cowes, Isle of Wight, Dec. 3, 1856.

Kenyon (Lloyd), Lord, b. at Gredington, Flintshire, Wales, Oct. 5, 1732; studied at the Middle Temple; was called to the bar in 1756; was associated in practice with Dunning; became attorney-general in 1782; master of the rolls in 1784; and on the retirement of Lord Mansfield was by Pitt made chief-justice of the king's bench, with the title of Lord Kenyon, Baron Gredington—a post which he held till his death, which occurred at Bath in 1802. He made an immense fortune at the bar, but was disliked for his arrogance. His grandson, George J. Kenyon, published a *Life* (Lon., 1873), for the purpose of justifying his character.

Kenyon College, situated at Gambier, O., comprises three distinct schools—the theological seminary, Kenyon College, and the grammar school. It was founded in 1825 under the corporate name of the Theological Seminary of the Protestant Episcopal Church in the diocese of Ohio, and opened at Worthington, near Columbus, with the purpose of rearing up ministers of the gospel in the midst of the habits and circumstances and with all the facilities of economy of the Western country. As pupils in elementary science and the classics increased, an act of the legislature was obtained by which the president and professors were constituted the faculty of a college by the name of Kenyon College, and the institution, thus modified and enlarged, was transferred to Gambier in 1828. The growth of the institution is shown by the institution of its professorships: Latin and Greek in 1825; intellectual and moral philosophy in 1829; mathematics, natural philosophy, and chemistry in 1830; logic and rhetoric in 1834; mathematics and civil engineering, separate from natural philosophy and chemistry, in 1854; English literature and history in 1856; and in the theological department: systematic divinity in 1830; ecclesiastical polity, pastoral divinity, and sacred literature in 1833; ecclesiastical history in 1837; and pastoral theology in 1860. In 1839 the seminary and college faculties were organized separately by an act of the legislature, which conferred upon the former power to confer degrees in divinity, and upon the latter power to confer degrees in the arts and sciences. The situation of the college is beautiful and healthy, on a headland to the N. of the valley of the Kokosing, and in easy communication with Cleveland, Sandusky, Columbus, and Cincinnati. Its buildings are elegant and comfortable. Its property—real estate, buildings, farmlands, and endowments for professorships—amounts to $450,000. According to the constitution adopted in 1824, recognized by the act of incorporation, and modified in 1870, the board of trustees consists of the bishops of all dioceses which may embrace territory now within the limits of the diocese of Ohio, the assistant bishop of the diocese in which the seminary is situated, the president of Kenyon College, 4 clerical and 4 lay trustees chosen for terms of ten years by the board of trustees, 3 clerical and 3 lay trustees elected for terms of three years by the diocesan conventions, and 2 clerical and 2 lay trustees chosen by the alumni for terms of four years. At the publication of the triennial catalogue in 1873 the number of graduates was 555—namely, from Kenyon College 453, and from the theological seminary 170; 68 were graduates of both schools. ELI T. TAPPAN.

Ke'okuk, county of S. E. Iowa. Area, 576 square miles. It is well watered, and consists of prairie lands with groves of trees. The soil is good. There are productive mines of coal. The county is traversed by a branch of the Chicago Rock Island and Pacific R. R. Cattle, grain, and wool are staple products. Carriages and wagons are leading articles of manufacture. Cap. Sigourney. Pop. 19,434.

Keokuk, city, cap. of Lee co., Ia., on the W. bank of the Mississippi River, near its confluence with the Des Moines, about midway between Burlington and Quincy, 135 miles S. E. of Des Moines, and 200 miles above St. Louis. It lies at the foot of the lower rapids, which are 12 miles long with a fall of 24 feet, and is at the head of navigation for the larger class of steamboat navigation; is a port of delivery, and being in the extreme S. E. corner of the State, has received the name of "Gate City." Keokuk is built on limestone bluffs 150 feet high, overlooking the river, and surrounded by a rich and productive district; is well built, chiefly of brick, Main street, the principal thoroughfare, being 100 feet wide and more than a mile in length. A magnificent iron railroad and highway bridge, 2300 feet in length, spans the Mississippi; 6 lines of steam-packets ply daily to and fro; 6 railroads are completed and 3 others are projected. It has 20 churches, 4 banks, 2 daily and 3 weekly newspapers, 1 religious monthly in Swedish, 1 medical college, 4 large public-school buildings (brick, costing $125,000), a U. S. court-room, a public library, gasworks, a loan and building association, and several large pork-packing establishments. A large wholesale business is done in dry goods, groceries, boots and shoes, and all kinds of merchandise. The U. S. government is constructing a ship-canal, 9 miles long and not less than 300 feet wide, around the lower rapids at a cost of about $8,000,000. By it a first-class water-power will be secured for manufacturing purposes. Pop. in 1850, 2478; in 1860, 8136; in 1870, 12,766.

ERIE J. LEECH, *Sec. of Citizens' Association.*

Keokuk, tp. of Wapello co., Ia. Pop. 700.

Keokuk Junction, post-v. of Adams co., Ill., at the junction of the Galesburg and Quincy division of the Chicago Burlington and Quincy R. R. and the Keokuk branch of the Toledo Wabash and Western R. R.

Ke'osauqua, post-v., cap. of Van Buren co., Ia. It has 1 weekly newspaper. Pop. 869.

Keo'wee, post-tp. of Oconee co., S. C. Pop. 1120.

Kep'ler, or **Keppler** (JOHANN), b. at Magstatt, near Weil, Würtemberg, Dec. 27 (or 21), 1571. His father, Henry Kepler, was a soldier in the Netherlands under the duke of Alva; his mother, Catherine Guldenmann, was daughter of an innkeeper, and was unable to read or write. Johann came into the world by a premature birth, and experienced a severe attack of smallpox at six years of age, and another nearly mortal illness at thirteen, which left permanent traces upon his constitution, so that he was a sufferer through life from fevers and periodical diseases. In early childhood he was taken from school to serve as waiter in a miserable inn his father had set up at Elmerdingen, but as the business did not prosper, the father enlisted as a soldier against the Turks and was never heard from again. Young Kepler, having had to suffer from the severities of his mother, sought refuge with an only sister married to a Protestant minister, and the latter, finding the boy too feeble to work in the fields, obtained for him in 1586 admission to a Protestant monastic school at Maulbronn; and having shown aptness for learning, he was sent in 1588, at the expense of the duke of Würtemberg, to the University of Tübingen to prepare for the ministry, and took his degree of M. A. in 1591. His theses on theological topics exhibited too great freedom to merit the approbation of that faculty, and, abandoning his studies in that department, he turned with eagerness to the astronomical theories of Kopernick (Copernicus) as expounded by Möstlin. His proficiency was such that in 1594, at the age of twenty-two, he was appointed professor of mathematics at the University of Grätz in Styria, where the same year he published an almanac, and in 1596 a cosmographical treatise filled with crude fancies drawn from a mixture of theology with mathematics. In 1597 he married a beautiful widow of noble birth, Barbara Muller von Mulech, and was required by her to produce proofs of his own nobility, which he is said to have done, but the evidences furnished by the innkeeper's son could scarcely have been very satisfactory; at all events, the union was not a happy one. In 1599 a series of religious persecutions began in Styria, and culminated two years later in the expulsion of the Protestant professors from the University of Grätz. Kepler had visited Tycho Brahe, the most eminent astronomer of the time, at Benach, near Prague, in 1600, and joyfully accepted an invitation to aid him in the calculation of a new set of "Rudolphine" astronomical tables ordered by the emperor Rudolph II., who was ambitious of scientific honors and wished to replace the Ptolemaic and Copernican tables by others bearing his own name. Unfortunately, Kepler, who entered upon his new labors in Sept., 1601, as assistant imperial mathematician, found it impossible to live in harmony with Tycho. The latter doled out a niggardly salary florin by florin, and Madame Kepler had to make personal solicitations in order to collect anything. Tycho died the following month (Oct. 24), and Kepler succeeded to his post, with a nominal salary of 1500 florins per annum, but the imperial treasury being low and payments rare and irregular, he had to eke out a livelihood by casting nativities. Astrology was then an admitted branch of astronomy, and in a treatise on that subject, *De Fundamentis Astrologiæ* (1602), Kepler expounded the influence of planetary conjunctions upon human destinies. A treatise on optics, *Paralipomena ad Vitellionem* (1604), exhibited accurate researches into the structure of the eye, and furnished the formulas which have been ever since employed in the calculation of eclipses. In a work published in 1606, *De Stella Nova in pede Serpentarii*, etc., Kepler, besides describing a new star in the constellation of the Serpent, made the correction of four years in the era of the birth of Christ which has since been accepted. In 1609 appeared his greatest work, the *Astronomia Nova*, compiled from the observations of Tycho Brahe, supplemented by his own, in which the motions of the planet Mars were made the basis for two of the important corrections of the received astronomical theories known as Kepler's Laws—namely, the ellipticity of the planetary orbits, and the fact that the RADIUS VECTOR (which see) of every planet passes over equal areas in equal times. These brilliant discoveries were, as Kepler truly said in his title-page, "wrought out by persistent research extending over many years" (*plurium annorum pertinaci studio elaborata*), the mathematical calculations having been ten times repeated for every opposition of Mars, and each filling ten pages of figures. All this was without the aid of logarithms, which were not invented until five years later (by Napier in 1614). Kepler's worldly position was not improved by these wonderful researches; his salary was 12,000 crowns in arrears; the emperor refused him permission to accept a professorship

elsewhere; he lost his wife and three sons by the smallpox; a conflict arose between Rudolph and his brother Matthias for the crown of Bohemia; Prague was attacked by the troops of the former (1611), and was devastated by the plague. Rudolph, having resigned the crown the same year, died at Prague soon after (Jan. 20, 1612), and Matthias having become emperor of Germany, as well as king of Bohemia, confirmed Kepler as imperial astronomer, allowed him to accept the professorship of mathematics at the University of Linz, and in 1613 summoned him to the diet at Ratisbon to persuade the Protestant princes of the necessity of accepting the Gregorian correction of the calendar, for which purpose he wrote a short treatise. In 1615 he married his second wife, Susanna Rettinger, after a careful scrutiny of the comparative advantages of an alliance with no less than eleven ladies, an estimate of whose characters he has left on record in a letter to Baron Strahlendorf. About the same time his aged mother, who still lived in the duchy of Würtemberg, became a victim of her son's scientific reputation. She was formally accused of "having learned magic from an aunt, who was burned as a witch, of having frequent interviews with the devil, of being unable to shed tears, of killing the pigs in the neighborhood by riding them at night, of not being able to look in the eyes of persons with whom she talked, and of having hired the grave-digger to exhume her husband's skull to make of it a cup for a present to her son Kepler." This trial lasted five years, and only a personal appeal (in 1620) made by Kepler to the grand duke saved his mother from the flames. She was released only after every ignominy short of actual torture, though bravely maintaining her innocence, and d. in 1622. At Linz, Kepler was now denounced by the Catholic priests as not only a heretic, but as the son of a witch. During these sufferings he had worked out the third and greatest of his immortal laws—namely, "that the squares of the periods of revolution of any two planets are to each other as the cubes of their mean distances from the sun." This discovery was made, as Kepler was careful to record, on May 15, 1618, after seventeen years of study upon the observations of Tycho; it was published in 1619 at Linz, in a folio volume, *Harmonices Mundi Libri V.*, dedicated to King James I. of England, the father-in-law of the elector palatine, who had just become king of Bohemia, and whose claims to the imperial crown gave rise the same year to the Thirty Years' war. The rival candidate, Ferdinand II., deposed as king by the states of Bohemia in the same month that he was elected emperor of Germany (of the Romans), desired to conciliate the favor of men of science; he offered to pay Kepler's arrears of salary and to enable him to issue the "Rudolphine Tables," but the breaking out of the great war postponed for years the fulfilment of the promise. At last, after a delay of a quarter of a century, they were published at Ulm in 1627. At the invitation of Wallenstein, Kepler removed in 1629 to Sagan in Silesia, and soon after received an appointment as professor at the University of Rostock. Having gone to Ratisbon in 1630 to negotiate in vain for the payment of his long arrears of salary, he d. there Nov. 15, and was buried in St. Peter's churchyard, the spot being now covered by a temple-monument erected to his memory in 1803. He composed his own epitaph in the following striking words:

"Mensus eram cœlos, nunc terræ metior umbras:
Mens cœlestis erat, corporis umbra jacet."

("I have measured the heavens; I now measure the shades of the earth. The mind was of heavenly origin; only the shadow of the body lies here.") Kepler published, besides the works already specified, an abstract of the Copernican system, *Epitome Astronomiæ Copernicæ, in VII. libros digesta*, etc. (Linz, 2 vols., 1618–22); a treatise on *Dioptrics* (Frankfort, 1611; London, 1653), which in the opinion of Sir David Brewster laid the foundation of optics; a small work on *Comets* (1619); several series of *Ephemerides*, and numerous minor productions on astrology or other subjects, written chiefly for bread. His total published works were 33 in number, and he left 22 volumes of MSS., of which those containing the correspondence were printed in 1718, and the remainder were included in a new edition of all his works published at Frankfort in 8 vols. (1858–70).

PORTER C. BLISS.

Kep'pel (AUGUSTUS), VISCOUNT, b. Apr. 2, 1725, was a son of the second earl of Albemarle; entered the navy in 1740; circumnavigated the world with Lord Anson; was made rear-admiral in 1762. For many years he was very successful in isolated naval engagements, commanding a single vessel or a small squadron. In his only general engagement with the French, which took place near Ushant in July, 1778, the victory remained uncertain, and Keppel was tried by court-martial, but acquitted, and his conduct approved. He was several times first lord of the admiralty; was in 1782 made Viscount Keppel of Elvedon, and d. in Suffolk Oct. 2, 1786.

Keppel (Sir HENRY), K. C. B., a younger son of the earl of Albemarle, and an admiral in the English navy, b. June 14, 1809; entered the navy at an early age; was lieutenant in 1829, commander in 1833, captain in 1837, commodore in 1856, vice-admiral in 1867, and full admiral in 1869. His early service was on the East India, Mediterranean, and Cape of Good Hope stations, and on the coast of China, where he commanded the Dido 1841–45; in the Crimean war he commanded the naval brigade before Sebastopol; was again (1856–57) in command on the Chinese waters, and created K. C. B. for the destruction of a Chinese war-fleet; naval commander-in-chief at Cape of Good Hope 1860, from whence he was transferred to the Brazilian station; vice-admiral and commander-in-chief on the China and Japan station 1867–69, returning to England in the latter year as admiral. Author of *Expedition to Borneo* and *Visit to the Indian Archipelago*.

Ker'atine [Gr. κέρας, "horn"] (another name that has been proposed is **Elastine**), a chemical term which has been introduced to designate a supposed specific substance forming the basis of a large class of animal substances, such as *horns, hoofs, nails, claws, wool, hair, feathers, cuticle*, etc. No sufficient correspondence has yet appeared, however, in analyses of preparations made by any of the methods yet tried upon these substances, to justify the establishment of a specific name for all. The entire insolubility of all of them in all solvents yet tried—except alkalies, which show chemical change by evolving sulphuretted hydrogen—has been the obstacle to their purification. After boiling them in fine shavings with water, alcohol, ether, concentrated acetic acid, and dilute soda, until all is removed soluble in these agents, Scherer found mean results about as follows:

	Buffalo horns.	Human nails.
Carbon	51.23	50.94
Hydrogen	6.66	6.77
Nitrogen	17.18	16.80
Oxygen } Sulphur }	24.23	24.99
Ashes	0.70	0.50
	100.00	100.00

Another chemist, named Lear, found, as a mean of two analyses of human hair, calculated without the ashes—

Carbon	50.42
Hydrogen	6.34
Nitrogen	17.33
Oxygen	20.91
Sulphur	5.00
	100.00

Lear made also some examinations of the ashes of hair of different colors:

	Percentage of ashes.	Peroxide of iron.
Brown hair	From 0.32 to 1.10;	from 0.06 to 0.39
Black hair	" 1.02 " 1.15;	0.21
Red hair	" 0.54 " 1.85;	" 0.17 " 0.27
Gray hair	" 0.75 " 1.00;	0.23

Other constituents of the ashes were chloride of sodium, sulphates of lime and magnesia, phosphate of lime, and silica. Comparing the composition of hair with that of the proteids (see article on ALBUMEN), it appears that its carbon and hydrogen are somewhat less, its nitrogen somewhat less, and its oxygen about the same; but the main difference appears to be in the *sulphur*, which is *four or five times as large*. According to some fashionable notions of the day, as that of phosphoretted food to nourish the brain and bones, and so forth, sulphuretted food should possibly stimulate the growth of the hair; but there is as yet little probability, and less evidence, of the validity of such notions.

HENRY WURTZ.

Kératry, de (AUGUSTE HILARION), b. at Rennes Oct. 28, 1769. After the restoration of the Bourbons he was a warm and courageous supporter of liberal measures, and contributed very much to the revolution of 1830. Louis Philippe made him a peer of France in 1837. He opposed Napoleon strongly, and after the *coup d'état* he lived in retirement. D. in Nov., 1859. Besides a great number of pamphlets and minor essays, among which was *Questions à l'ordre du jour* (1837), he wrote several large novels and books of art-criticism: *Frédéric Styndall* (1827), *Saphira* (1835), *Du beau dans les arts d'imitation* (1822).

Kératry, de (EMILE), COUNT, son of Auguste, b. in Paris Mar. 20, 1832. From an old feudal family of Brittany, he abandoned its legitimist traditions, served as a volunteer during the Crimean war, then as a French guerillero in the Mexican campaign 1863–65, and published afterwards in several reviews some articles denouncing the frauds and impolicy of the imperial intervention in Mexico. He thus gained some celebrity, and in 1869 was returned to the Corps Législatif as an opposition deputy by the Brest electoral district. When the revolution of 1870 burst out, Kératry

was made at first prefect of police of Paris; then as general of division he organized nearly fifty battalions in Bretagne; came into conflict with Gambetta and the lawyers, whom he accused of incapacity; and was prefect of Toulouse and of Marseilles under the Thiers government (1871–72). FÉLIX AUCAIGNE.

Kerbe'la, or **Meshed-Hossein,** a city of Asiatic Turkey, province of Irak-Arabi, 50 miles S. W. of Bagdad. Pop. estimated at 20,000. It has five gates, a well-supplied bazaar, and 7 caravanseries, and derives great sanctity in Mohammedan eyes from the magnificent tomb of Hossein, who was killed here. It is a place of pilgrimage, largely inhabited by Persians, and much coveted by Persian monarchs.

Ker'foot (JOHN BARRETT), LL.D., b. Mar. 1, 1816, at Dublin, Ireland, and educated at Flushing Institute and St. Paul's College, N. Y., whence he graduated in 1834; was ordained deacon Mar. 1, 1837; priest, Mar. 1, 1840; and bishop of the diocese of Pittsburg Jan. 25, 1866; received the degree of D. D. from Columbia College, N. Y., in 1850, and from Trinity College, Conn., in 1865; and the degree of LL.D. from the University of Cambridge, England, in 1867; was president of St. James's College, Md., 1842–64, and of Trinity College, Hartford, Conn., 1864–66; and published baccalaureate and other college addresses, sermons, episcopal addresses, and charges.

Ker'guelen Land, an island in the Indian Ocean, taking its name from the French navigator who discovered it in 1772, 100 miles long and 50 miles broad, is situated in lat. 49° 54′ S. and lon. 70° 10′ E. It has many bays and inlets, and a harbor at the northern extremity was one of the stations for American and British observers of the transit of Venus in Dec., 1874. Seals formerly abounded, but are now extinct; large flocks of wild fowl still remain. The island is barren, covered with moss, and has but a few flowering plants, the most important of which is the so-called "Kerguelen's Land cabbage," the *Pringlea antiscorbutica*, a cruciferous plant, having a head somewhat like that of the cabbage. It has pungent qualities, like those of horse-radish and mustard, and abounds in a volatile oil. It is antiscorbutic, and is valued as food by mariners.

Kerkook', a large town of Koordistan, Asiatic Turkey, 100 miles S. E. of Mosul and 130 miles N. of Bagdad. Pop. 13,000. The town stands on a commanding eminence nearly perpendicular on all sides; it has numerous mosques and three Catholic churches. Near by are inexhaustible supplies of naphtha, which is the principal commodity.

Kerlérec, de (LOUIS BILLOUART), CHEVALIER, b. at Quimper, France, in 1704; entered the marine corps at seventeen years of age; was in fourteen campaigns, distinguishing himself on board the Neptune in the memorable combats of Aug. and Oct., 1746, and Oct. 21, 1747, in the latter of which he was in command after his superiors had been killed or wounded. In 1752 he was appointed governor of Louisiana, and remained at that post for ten years, comprising the whole period of the Seven Years' war. Returning to France in 1764, he was charged with peculation and undue severity, and thrown into the Bastile. Sentence of exile was pronounced in 1769, but he was about to submit new evidences to the tribunal when he d. at Paris Sept. 9, 1770. He wrote memoirs upon Louisiana, never published and supposed to be lost.

Kerman', the ancient *Caramania*, a province of Persia, extending along the Gulf of Persia, from Farsistan in the W. to Beloochistan in the E. It comprises an area of about 65,000 square miles, with only 600,000 inhabitants. The northern part is a desolate plain, where no life can exist, and even the southern mountain-land, though interspersed with fertile and beautiful valleys, is mostly barren and rugged rocks. The province is very little known, however, with the exception of the route from Beloochistan along the southern border of the desert, and that from the capital, Kerman, to the sea-coast. The province has a breed of camels and goats which are famous for their long, silky hair.

Kerman, town of Persia, the capital of the province of Kerman, in lat. 29° 48′ N. and lon. 56° 30′ E. It was formerly much more flourishing than now, which is apparent from the fields of ruins that surround it, but its manufactures of shawls and carpets are still celebrated, and it has some importance as a fortress. Pop. 30,000.

Kermanshah', town of Persia, the capital of a district of the same name in the province of Irak-Ajemi, in lat. 34° 30′ N. and lon. 46° 37′ E. It is a flourishing town, with elegant mosques and palaces and beautiful promenades, and is noted for the manufacture of Persian carpets. In the vicinity is the celebrated rock of Behistun, whose trilingual inscription furnished the key to the Assyrian and old Persian languages. It carries on a very brisk trade with Bagdad, Teheran, and Ispahan. Pop. 35,000.

Ker'mes [Arab., "little grub"], or **Scarlet Grain,** a dyestuff formerly once used extensively for producing a blood-red. It is still employed in Spain, Africa, and the East, but is to a great extent replaced elsewhere by COCHINEAL (which see). Kermes is the dried bodies of *Coccus ilicis*, an insect inhabiting the kermes oak, an evergreen shrub-oak of Spain and the Levant. Kermes furnishes a more durable but less brilliant color than cochineal.

Kermes Mineral, amorphous trisulphide of antimony, essentially Sb_2S_3. The preparation used in medicine contains oxide of antimony, and is hence called oxysulphide of antimony. The mode of preparation for this purpose is simply to boil the commercial gray sulphide of antimony with an alkaline carbonate, filter, and cool for twenty-four hours, when a brown-red powder is found to have deposited, which is washed and dried. The pure amorphous trisulphide is obtained by fusion, and sudden cooling in water, of the native crystalline trisulphide, also by dissolving the latter in caustic potash, and precipitating with an acid. It is harder than the native sulphide, and its powder is red-brown, but lighter in color than the impure compound containing oxide used in medicine under the name of *mineral kermes*. H. WURTZ.

Ker'messe [Flem. *kerkmess*, from *kerk*, "church," and *mass*], formerly religious and parochial festivals, but now more exclusively ordinary and secular enjoyments. These are nearly the same in Flemish countries, Belgium and Holland, as in any other country of old Europe; but the kermesses of Flanders are more extensively known, because the custom was more strictly adhered to, and because attention was called to them through some celebrated paintings of Teniers and other great Flemish artists. Dances, banquets, target-shooting, all sorts of comical and even clerical processions, formed the bulk of popular amusement during the kermesses, which were sometimes rather licentious affairs—a motive which induced Joseph II., then ruler of Flanders, to order that they should all of them be celebrated on the same day. That rule disappeared with the Austrian domination. FÉLIX AUCAIGNE.

Kern, county of S. California. Area, estimated at 7800 square miles. It is partly mountainous, being traversed by the Sierra Nevada, and having the Coast Range on the W. On the N. W. of the Sierra Nevada is the basin whence flow the head-streams of the San Joaquin. Here is some tule-land which may be made very productive. S. E. of the mountains there is a basin which has no connection with the sea. Wool is the staple product. Cap. Havilah. Pop. 2925.

Kern, a v. of White Pine co., Nev. Pop. 36.

Kern (JEAN CONRAD), LL.D., b. at Berlingen, Switzerland, in 1808; studied at the gymnasium of Zurich, at the universities of Bâle, Berlin, Heidelberg, and Paris, devoting himself first to theology, and afterwards to law, in which latter branch he took the degree of doctor. He sat in the diet of 1833; became in 1837 president of the supreme court of his native canton, Thurgau; aided in revising the Swiss constitution in 1848; and became distinguished for eloquence as a member of the National Assembly. In 1857 and 1861 he was sent as plenipotentiary to Paris for the management of vital interests, and in 1875 he became president of the Swiss Confederation.

Ker'nan (FRANCIS), b. at Tyrone, Steuben co., N. Y., Jan. 14, 1816; graduated at Georgetown College, D. C., and immediately thereafter began the study of law, entering upon practice at Utica in 1839; was reporter of the court of appeals 1854–57, and in 1862 was elected by the Democratic party to Congress. In 1872 he was the candidate of the same party for governor of New York, but was not elected; in 1875 was chosen U. S. Senator by the legislature of New York. J. B. BISHOP.

Kern Lake, in Kern co., Cal., is connected with Kern River by a slough. It is full of fish, and is in part overgrown with tule (*Scirpus validus*). All kinds of game-birds, otter, beaver, raccoons, and other game, are found in the tule around it. It is in a very fertile region. Its size varies with the rainfall.

Kern River rises in Tulare co., Cal., flows S. and S. W. through a grandly picturesque region, and finally divides into two parts—one flowing N. W. and N. into Tulare Lake, and one into the tule-region about Kern and Buena Vista lakes, with which it is connected. Its upper waters abound in fine trout. Its waters are finally discharged into Tulare Lake.

Kern River Slough, a channel by which at high water the surplus contents of the Tulare Lake in California flow northward into San Joaquin River. At ordinary stages Tulare Lake has no communication with the ocean.

Ker'osene [from Gr. κηρός, "wax," and ἔλαιον, "oil"],

a term applied by Abraham Gesner in 1846 to oil distilled from coal in Prince Edward's Island. It has since become the general term for those hydrocarbon oils which are suitable for burning in lamps, from whatever source obtained. Most of the kerosene now used is refined petroleum. (See OIL FROM COAL, SHALE OIL, and PETROLEUM.)

Kerr, county of S. W. Central Texas. Area, 818 square miles. It is partly mountainous, but has much fertile land. Stock-raising and timber-cutting are the principal industrial pursuits. The cypress timber is of excellent quality. Cap. Kerrsville. Pop. 1042.

Kerr, tp. of Champaign co., Ill. Pop. 361.

Kerr (JOHN BOZMAN), son of John L. Kerr, b. at Easton, Md., Mar. 5, 1809; graduated at Harvard in 1830; admitted to the bar in 1833; was elected a member of the general assembly of Maryland in 1836; Representative in Congress in 1848; and was sent in 1851 as chargé d'affaires to Guatemala, where he was able to save the lives of some prominent citizens during a revolution, for which he received the thanks of the government of that republic. On his return he resumed the practice of law at Baltimore, and was afterwards deputy solicitor of the court of claims at Washington.

Kerr (JOHN L.), b. at Greenbury Point, near Annapolis, Md., Jan. 15, 1780; graduated at St. John's College in 1799; became distinguished at the Maryland bar; was Representative in Congress from 1825 to 1829 and from 1831 to 1833, and U. S. Senator from 1841 to 1843. D. at Easton, Md., Feb. 21, 1844.

Kerr (MICHAEL C.), b. near Titusville, Pa., Mar. 15, 1827; studied law at the University of Louisville; settled at New Albany, Ind.; was elected to the State assembly in 1856; reporter to the State supreme court in 1862, and published 5 vols.; in 1864 was elected as a Democrat to Congress, and re-elected in 1866, 1868, 1870, and 1874, taking rank as one of the most prominent members of his party in Congress.

Kerr's Creek, tp. of Rockbridge co., Va. Pop. 1833.

Kerrs'ville, post-v., cap. of Kerr co., Texas, 83 miles W. by S. of Austin.

Ker'ry, county of Ireland, in the province of Munster, bounded N. by the estuary of the Shannon and W. by the Atlantic. Area, 1853 square miles, with 196,014 inhabitants; 201,800 in 1861, and 238,239 in 1851. The surface is mountainous; the highest mountain of Ireland, Carran Tual, 3410 feet, is found here, and the scenery is often very beautiful, as, for instance, around the lakes of Killarney. But the soil is rather inferior, and still more so is its cultivation. Oats, potatoes, and turnips are the chief crops; dairying and fishing the chief occupations. The population is very poor. The principal towns are Tralee and Killarney.

Ker'seymere [originally the same as cassimere, and probably derived from *Cashmere*], a thin, fine-wool fabric manufactured chiefly in the W. of England, and often called *kersey*, for brevity. Also a coarse-twilled, long-wool fabric for men's wear, made mostly in the N. of England; this also is called *kersey*. The modern *cassimeres* are plain or figured woollen or cotton-and-woollen goods, made in the U. S. and various parts of Europe, and designed for men's wear.

Ker'shaw, county of N. South Carolina. Area, 756 square miles. It is traversed by the Wateree River and a branch of the South Carolina R. R. It has an uneven surface and a soil generally fertile. Cotton, corn, and rice are staple products. Cap. Camden. Pop. 11,754.

Kershaw (J. B.), b. in South Carolina; was a prominent actor in the American civil war from the first battle of Bull Run, July, 1861, where he commanded a regiment of South Carolina volunteers which was raised principally by himself; subsequently, as brigadier-general, he commanded a brigade throughout the Virginia Peninsula campaign of 1862; at the second battle of Bull Run; engaged in the capture of Harper's Ferry, Sept. 15, 1862, and in the battle of Antietam two days later; at the battle of Fredericksburg, where his command held the strong position of Marye's Heights, so fatal to their opponents; at Chancellorsville and at Gettysburg; transferred to the West with the corps of Longstreet, he was engaged in the battle of Chickamauga and the subsequent siege of Knoxville. Returning to Virginia in 1864, now major-general, he commanded a division in the final campaign of Lee's army, terminating at Appomattox Court-house. Since the war he has acted a prominent part in the politics of South Carolina.

Kertch [the ancient *Panticapæum*], town of Russia, in the government of Taurida, on the eastern side of the Crimean peninsula, on the Strait of Kaffa. It was a flourishing town, with an extensive trade and 23,000 inhabitants, when in 1855 it was taken by the allied French and English in the Crimean war, and sacked by the soldiery. *Panticapæum* was founded by the Greeks of Miletus in the sixth century B. C. It was the capital of the ancient kingdom of Bosporus, was annexed to the Roman empire by Pompey 63 B. C.; conquered successively by the Huns (375), the Genoese (1280), the Turks (1475), and the Russians (1771). It is alleged to have been a residence of Mithridates, the ruins of whose palace are found on a hill adjoining Kertch.

Ker'ton, tp. of Fulton co., Ill. Pop. 504.

Ker'vyn de Let'tenhove (JOSEPH MARIE BRUNO CONSTANTIN), b. at St. Michel, Flanders (now Belgium), Aug. 17, 1817; engaged in historical researches in early life, and became one of the most distinguished authorities upon the antiquities of Belgium. Among his works are *Étude sur les Chroniques de Froissart* (1856), *Histoire de Flandre* (6 vols., 1847–50), both which obtained premiums for distinguished merit; *Jacques d'Artevelde* (1863), an edition of the *Lettres et Négociations de Philippe de Commines* (1867), and numerous memoirs published by the academies of France and Belgium.

Keshe'na, post-tp. of Shawanaw co., Wis. Pop. 49.

Kes'trel, called also **Windhover,** from its habit of maintaining itself in one place in the air, with its head to the wind, one of the smallest and most abundant of European hawks, the *Falco tinnunculus*. It is a great devourer of mice and other vermin.

Kes'wick, market-town of Cumberland, England, 22 miles S. S. W. of Carlisle, at the foot of Skiddaw Mountain, and beside Lake Derwentwater, is noted for its picturesque scenery and as the residence of the poet Southey. Pop. in 1871, 2777.

Keswick Dépôt, post-v. of Albemarle co., Va., on the Washington City Virginia Midland and Great Southern R. R., 110 miles S. W. of Washington, D. C., and on the Chesapeake and Ohio R. R., 90 miles W. N. W. of Richmond, Va.

Keszthely', town of Hungary, is situated on the western side of Lake Balaton, on which it carries on a very important fishing business. Its breed of horses is celebrated, and its trade in corn and wine extensive. Pop. 7150.

Ketch'o, or **Cacha'o,** town of Anam, in Farther India, the capital of the province of Tonquin, on the Tonquin. Although this river is navigable only for small craft, the trade of Ketcho is considerable. Bullion, lacquered wares, and fine silks are exported. Pop. 150,000.

Ketch'um (WILLIAM SCOTT), b. July 7, 1813, at Norwalk, Conn.; graduated at West Point July 1, 1834, and entered the army as second lieutenant of infantry; prior to the civil war he served in Florida against the Seminoles, upon the Western frontier, and on the Pacific coast, having in 1860 arrived at a majority in the 4th Infantry. In Nov., 1861, he became lieutenant-colonel in the 10th Infantry, brigadier-general of volunteers the following February, and colonel of the 11th Infantry May 6, 1864. After eight months' service in the West as acting inspector-general, he was in Aug., 1862, placed upon special duty in the war and treasury departments in Washington. Brevetted brigadier-general and major-general Mar. 13, 1865; retired from active service Dec. 15, 1870; d. at Baltimore, Md., June 28, 1871.
G. C. SIMMONS.

Ke'tones, or **Acetones** (see ACETONE). This large class of bodies, though no member of it has as yet obtained any practical application of importance, is of great interest to chemical science and the chemical student; and we may expect to find practical uses for its members in the future if we prosecute their study. The ketones have the same empirical generic formula as the fatty aldehydes, $C_nH_{2n}O$, and each ketone has therefore its metamere among the aldehydes. The view that they are derivable from the aldehydes, by the replacement of hydrogen by an alcohol-radical, does not seem substantiated by synthesis so far; and their relations to the aldehydes, exhibited in the following table, do not appear to lend it any support. Chancel seems first to have hypothetically pointed out that the ketones are *carbonylides*, containing a nuclear molecule of carbonic oxide or *carbonyle*. Gerhardt's and Williamson's researches supported this view, and Wanklyn demonstrated it by showing that carbonic oxide and his ethylide of sodium react as follows, producing the ketone which is called *propione*, from being originally formed by the destructive distillation of calcic propionate:

$\begin{matrix} C_2H_5Na \\ C_2H_5Na \end{matrix} + CO = Na_2 + (C_5H_{10}O = CO,C_2H_5,C_2H_5)$; and we may represent the ordinary method of making ketones, by distilling the fatty acid salts of dyad metals, in the case of propione, as follows:

$$\underset{\text{Calcic propionate.}}{\begin{matrix} C_3H_5O_2 \\ C_3H_5O_2 \end{matrix} Ca''} = \underset{\text{Calcic carbonate.}}{Ca''CO_3} + \underset{\text{Propione.}}{CO,C_2H_5,C_2H_5}.$$

On the homologic theory (see article Homology), the ketones, as a series of homologues, must have a nuclear molecule or radical $\frac{H}{H}CO$ or H_2,CO; and their *homologenic formula* is $H_2,CO_{+n}H_2C$; the consideration of which excites very curious suggestions and speculations.

The last column in the accompanying table shows the system of notation assigned to the ketones here tabulated, by Wanklyn, who has been the most distinguished investigator of this class of bodies. There have been placed at the end of this table two ketones of high equivalents, discovered near forty years ago by Bussy, but which have been so nearly forgotten that they are scarcely mentioned in the textbooks. They were compared by their discoverer to *spermaceti*, and are easily prepared by distilling the crystallized fatty acids with lime. They should be re-examined with a view to determine their practical or economic value for making candles or otherwise. Henry Wurtz.

Fatty Aldehydes: Names and Formulæ.		*Metameric with*	Fatty Ketones.	Wanklyn's Formulæ.
Formic	CH_2O		Di-hydrogen ketone (unknown)	$CO\left\{\begin{matrix}H.\\H.\end{matrix}\right.$
Common	C_2H_4O		Hydrogen-methyle ketone (unknown)	$CO\left\{\begin{matrix}CH_3.\\H.\end{matrix}\right.$
Propionic	C_3H_6O		Common acetone	$CO\left\{\begin{matrix}CH_3.\\CH_3.\end{matrix}\right.$
Butyric	C_4H_8O		Methyle-ethyle ketone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_3.\end{matrix}\right.$
Valeric	$C_5H_{10}O$		Propione	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_3.\end{matrix}\right.$
Caproic	$C_6H_{12}O$		Methyle-butyle ketone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_2,CH_3.\end{matrix}\right.$
Œnanthylic	$C_7H_{14}O$		Butyrone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_2,CH_2CH_3.\end{matrix}\right.$
Caprylic	$C_8H_{16}O$		Ethyle-amyle ketone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_2,CH_2,CH_2,CH_3.\end{matrix}\right.$
	$C_9H_{18}O$		Valerone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_2,CH_2,CH_2,CH_2,CH_3.\end{matrix}\right.$
	$C_{10}H_{20}O$		Di-amyle ketone	$CO\left\{\begin{matrix}CH_3.\\CH_2,CH_2,CH_2,CH_2,CH_2,CH_2,CH_2,CH_3.\end{matrix}\right.$
	$C_{31}H_{62}O$		Palmitone, or margarone	$CO,C_{30}H_{62}.$
	$C_{35}H_{70}O$		Stearone	$CO,C_{34}H_{70}.$

Ket′teler, von (Wilhelm Emanuel), b. at Münster, Westphalia, Dec. 25, 1811; studied first law, and entered the civil service of his native city; then theology, and was ordained a priest in 1844. In 1849 he was made provost of the Hedwigskirche of Berlin, and in 1850 bishop of Mentz. The energy of his character and his talents as a debater and controversialist have made him one of the leaders of the Ultramontane party, and one of the most prominent members of the Roman Catholic Church in Germany.

Ket′tell (Samuel), b. at Newburyport, Mass., Aug. 5, 1800; was an accomplished linguist, and mastered no less than fourteen languages. He assisted Mr. Goodrich in preparing the "Peter Parley" books, and was (1848–55) chief editor of the Boston *Courier*. He was a clever writer, and published a number of works, of which the best known is *Specimens of American Poetry* (3 vols., 1829). D. at Malden, Mass., Dec. 3, 1855.

Ket′tering, town of England, in the county of Northampton. It has some manufactures of silk and plush. Pop. 5198.

Ket′tle River, tp. of Pine co., Minn. Pop. 74.

Keu′per, The, the uppermost of the three groups into which the Triassic or New Red Sandstone period is divided. It is represented in Europe in different localities by two very different sets of strata, supposed to be of contemporaneous origin—the one a series of red and yellow fresh-water marls and sandstones, and the other a more recently recognized series of marine strata, known as the Hallstadt and St. Cassian beds. About the true position of these latter there is still, however, much dispute, and where these are absent the Keuper is capped by a bone-bed of especial interest, as in it have been found the remains of the earliest known mammals (*Microlestes*, etc.). Whether any portion of the American Trias is equivalent to the European Keuper is an open question.

Kew, village and parish of England, county of Surrey, opposite Brentford, in Middlesex, 8 miles from London. Kew Gardens and the pleasure-grounds extend along the Thames from Kew Green to the borders of Richmond. It was in these grounds that Bradley's observations upon the fixed stars were made about the middle of the seventeenth century, with a telescope constructed by Mr. G. Molyneux, then the owner of Kew House, which was leased by the prince of Wales, son of George II., by whom the "pleasure-grounds" were first laid out, and further embellished by his widow. Kew Palace, an unpretending brick house of moderate size, became royal property in the early days of George III., who here played his favorite part of "Farmer George." A cottage, secluded in the upper part of the park or pleasure-grounds, is still preserved with its furniture as it was left by Queen Charlotte. This and the untenanted palace remain in the possession of the Crown. While the life of the royal family at Kew will be remembered through Madame d'Arblay's (Miss Burney's) memoirs, the later interest of Kew centres in its gardens and botanical collections. The large and choice collections of living plants, maintained for 70 or 80 years as the private property of the sovereign, under the administration of the two Aitons, father and son, were of much botanical importance. In 1838 the grounds became national property, under the control of the commissioners of the woods and forests, and the now celebrated establishment was founded. It was placed under the charge of Sir William Hooker, and since his death in 1865 that of his son, Dr. Joseph D. Hooker, now president of the Royal Society. Under these administrators and the liberal support of Parliament the royal gardens at Kew have become the largest and most important, as well as the most popular, botanical establishment in the world, both as respects the conservatories and collections of living plants, and in the herbarium and noble museum of vegetable products founded by Sir William Hooker. The whole establishment is freely open to the public every day after one o'clock. The annual number of visitors, commencing with 9000 in 1841, has risen to nearly 700,000. Asa Gray.

Kewa′nee, post-v. and tp. of Henry co., Ill., on the Chicago Burlington and Quincy R. R., 132 miles W. of Chicago; has 7 churches, 5 public-school buildings, 1 national and 1 private bank, 1 weekly newspaper, 2 flour-mills, 2 foundries and machine-shops, several wagon and carriage shops, manufactories of agricultural implements and of house-heating apparatus, a distillery, and the usual complement of stores. In the immediate vicinity are rich farming-lands and inexhaustible beds of bituminous coal. Pop. 4225. C. Bassett, Ed. "Independent."

Kewas′kum, tp. of Washington co., Wis. Pop. 1309.

Kewau′nee, county of Wisconsin, having Lake Michigan as its eastern boundary. Area, about 340 square miles. It is chiefly covered with forests, and lumber is the principal export. The soil is productive. Grain and potatoes are the staple crops. Cap. Kewaunee. Pop. 10,128.

Kewaunee, post-v. and tp., cap. of Kewaunee co., Wis., on Lake Michigan, at the mouth of the Kewaunee River, 27 miles E. of Green Bay City. It has several churches, hotels, 2 saw-mills, and 1 weekly newspaper. Pop. 1681.

Kewee′naw, county of N. Michigan, consisting of the extremity of the peninsula known as Keweenaw Point in Lake Superior, and of several islands, of which Isle Royale is the largest. Area, about 540 square miles. It is cold, elevated, and unproductive, but abounds in valuable argentiferous copper, the mining of which is the principal employment. Cap. Eagle Harbor. Pop. 4205.

Kew-Kiang, or **Kiu-Kiang** [Chinese, "Nine Rivers"], one of the largest cities of China, situated in the province of Kiang-Si, on the Yang-tze River, near the N. extremity of Poyang Lake, 227 miles S. W. of Nanking. It is the emporium of the great tea-districts S. of Poyang Lake, and the shipments have reached 25,000,000 pounds in a single year. The city has two suburbs nearly as large as itself, the united population of all three being calculated at over 1,000,000, notwithstanding a great loss of population

and partial ruin incurred during the Taeping rebellion. There is an English settlement and several American houses of commerce, one of which, Russell & Co., maintains a large number of steamers on the river, the arrivals of steamers having numbered over 400 in 1871. The trade is chiefly in connection with Shanghai.

Key. In modern music every regular composition is written, or purports to be written, in one or other of the major or minor scales. The scale chosen is said to be the *key* of the piece; and the first or root-note of that scale, from which all its steps or degrees are reckoned and derive their character, is called the *keynote* or tonic. These scales or keys are either major or minor, no other "modes" being recognized in what is distinctively known as modern music. The normal form of a scale in the *major* mode is that of C; and the scale of A gives the normal form of the *minor* mode. But under certain conditions scales similar to those of C and A may take their rise from *any* point or degree of the diatonic-chromatic scale—*i. e.* we may form a scale commencing on D, E, F, etc., or on B♭, E♭, C♯, etc.; and as there are twelve degrees in the original scale (viz. C), the number of possible scales will be twelve in the major mode and twelve in the minor. The composer has therefore a choice of twenty-four keys, differing both in acuteness and in certain peculiarities of expression. It will be found, however, that every one of those additional scales is imperfect in its natural order of tones and semitones, differing more or less in form from the pattern scales of C and A, and therefore requiring an adjustment of certain intervals to render it fit for use. Thus, on comparing a scale commencing on G with that of C, as in Ex. 1, we perceive that the place of the semitone at NB. (as indicated by the slur) does not correspond with that in the key of C; thus rendering the new scale imperfect and practically useless:

Ex. 1. *Scale of C Major.* *Scale of G.* NB.

To remedy this it becomes necessary that the F in the scale of G should be raised a semitone by means of a sharp, by which alteration the two scales will now be brought into agreement. In music written in the scale of G major every F will therefore become *F sharp* (unless when contradicted occasionally by a ♮); and for convenience' sake in writing, a sharp on F is placed once for all near the clef at the beginning, and called the *signature.* The case may be further illustrated by comparing the distances of the letters in the following example:

Ex. 2. *Scale of C.*

C——D——E–F——G——A——B–C.

Scale of G. *a*

G——A——B–C——D——E–F——G.

Now, to bring the latter into correspondence with the former, it is evident that we must move the F at *a* half a space nearer to G, which is the office of a sharp when expressed in notes. In the key of D major there are needed *two* such rectifications of the scale, and accordingly two sharps—viz. F and C—are placed at the commencement. In A major *three* sharps are required; and all the other keys, major and minor, need similar adjustment by the use of sharps or flats, even to the number of seven, the object being simply to bring them into conformity with the established order of the scale. The succession of the keys, both major and minor, with the sharps or flats required for the rectification of their scales, is shown in Ex. 3:

Ex. 3. KEYS WITH SHARPS.

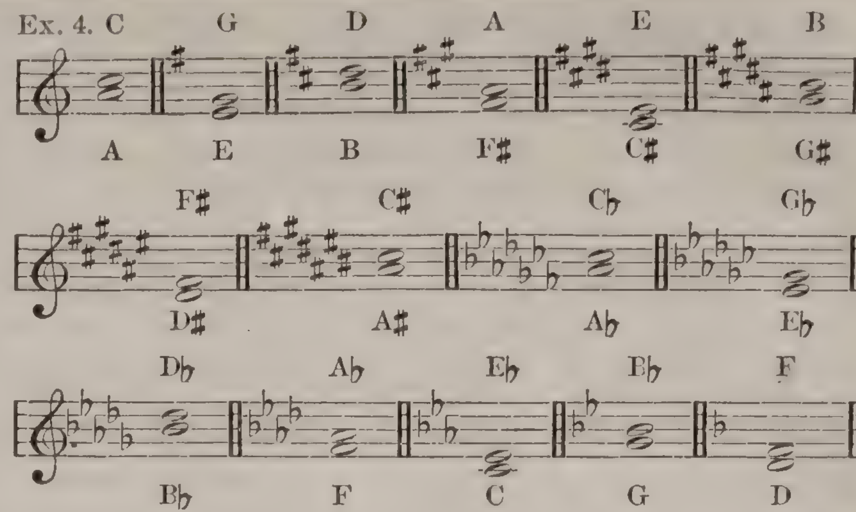
Maj.	*Min.*	*Sharps.*
C.	A.	—
G.	E.	F.
D.	B.	F—C.
A.	F♯.	F—C—G.
E.	C♯.	F—C—G—D.
B.	G♯.	F—C—G—D—A.
F♯.	D♯.	F—C—G—D—A—E.
C♯.	A♯.	F—C—G—D—A—E—B.

KEYS WITH FLATS.

Maj.	*Min.*	*Flats.*
F.	D.	B.
B♭.	G.	B—E.
E♭.	C.	B—E—A.
A♭.	F.	B—E—A—D.
D♭.	B♭.	B—E—A—D—G.
G♭.	E♭.	B—E—A—D—G—C.
C♭.	A♭.	B—E—A—D—G—C—F.

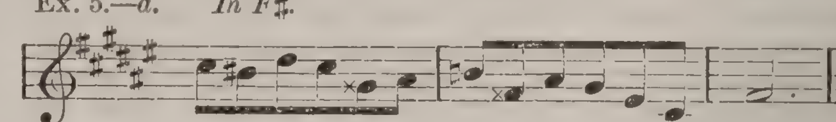
The signatures of these keys or scales are written as in Ex. 4, where the *keynotes* of the respective scales are also added, the upper note being the major, and the lower one its relative minor, or that having the same signature:

Ex. 4.

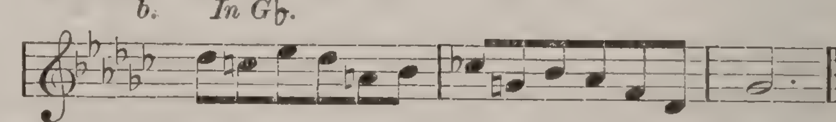


Though there are in reality only twelve major and twelve minor scales, corresponding in number with the degrees of the diatonic-chromatic scale, yet in the example just given it will be noticed that the number is *fifteen* of each mode, or *thirty* in all, instead of twenty-four. This is explained by observing that there are in the example three major and three minor keys or scales which are in *sound* identical with certain others, though they are differently *written.* These are called the "binominous" keys—*i. e.* keys having two names, and written variously or indifferently in sharps or in flats. They are F♯ and G♭, B♮ and C♭, and C♯ and D♭, with their relative minors. It is evident that F♯ and G♭, though different to the *eye*, are the same to the *ear*, when played on ordinary keyed instruments; and therefore the same *sounds* are produced, and the same finger-keys are used on the organ or pianoforte, whether a piece is written and performed in the key of F♯ or in that of G♭. From which it follows that a given strain or movement may be written by a composer in either of those keys at pleasure, the effect on the ear being precisely the same whether written in six sharps or six flats. In Ex. 5, for instance, the notes at *a* are in sound (and under the fingers) identical with those at *b*:

Ex. 5.—*a.* *In F♯.*



b. *In G♭.*

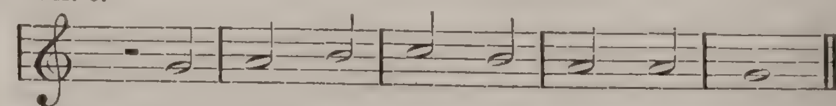


While, therefore, there are in reality (*i. e.* to the *ear*) only twenty-four keys, yet as three of the major and three of the minor keys may be expressed in two ways—viz. in sharps or in flats—it follows that the number of keys when *written* (but not otherwise) is thirty, as shown in Ex. 4.

To find the tonic or *keynote* of any piece or movement, it is ordinarily sufficient to refer to the *last note in the bass* (which is almost always the tonic), and then to ascertain from the *signature* whether the key is major or minor. Should the final bass-note, for instance, be C, and no sharps or flats be found at the clef, the key is that of C *major;* but if we find three flats at the clef, we know from this signature that the key is C *minor.* This, however, is only a general rule, to which there are several exceptions, as when in old music a movement in B♭ is written with the signature belonging to F—*i. e.* with *one* flat only—the second flat being inserted before each E in the piece as an accidental. Also, in discursive pieces, digressions into new keys often occur, including whole movements, without any change of the signature, the necessary flats, sharps, or naturals being inserted before the notes themselves where necessary. Occasionally also in ecclesiastical compositions the last note of the bass is not the *keynote* or tonic, but the *dominant* with its major triad. With these and similar exceptions kept in view, the *keynote* and the scale and mode of a composition may be generally ascertained by reference to the final bass-note and the signature.

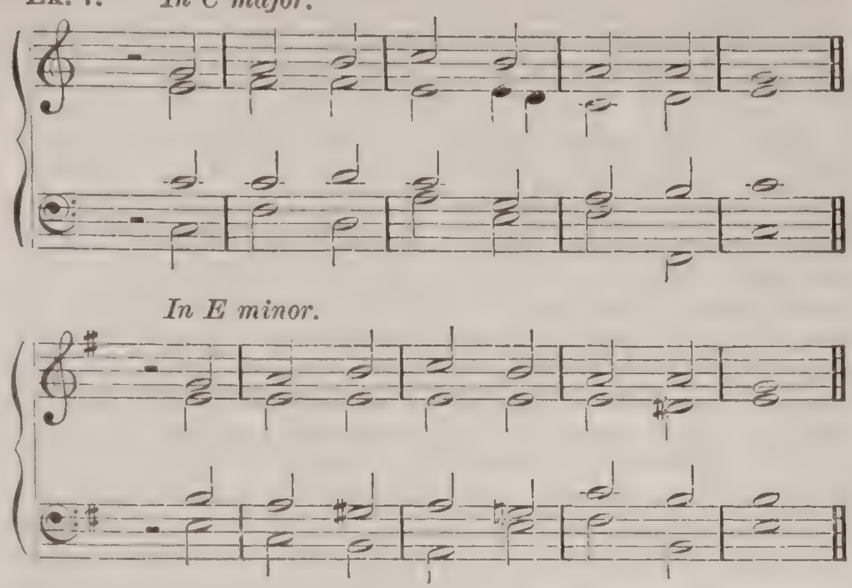
It is far more difficult, however, to find the key of a given *melody* than of a piece comprising two or three parts in *harmony*, because a melody may be founded on certain notes which are common to *several scales* or keys, and will necessarily be equivocal until settled by the addition of harmony. In demonstration of this see the melody or theme in Ex. 6, which at first appears to be in G major:

Ex. 6.



But though this may readily and very naturally be harmonized in G major, yet the key in which the composer conceived it *may* possibly prove to be C major or E minor, as illustrated by the harmony in Ex. 7:

Ex. 7. *In C major.*



The keynote of a given melody cannot therefore be fully ascertained unless that melody includes in its range *all* the notes of a scale, thereby identifying itself with that scale by elements and progressions which would be foreign to any other.

Respecting keynotes, it may also be remarked that in keys with sharps the keynote in major is always on that letter which is *one semitone above the last sharp* of the signature. Thus, if there are two sharps, F♯ and *C*♯, the keynote is *D*. When F, C, and *G* are sharped, the keynote will be *A*, and so on. In keys with flats the keynote in major is on the letter *a fourth below* (or a *fifth above*) *the last flat* at the clef. Thus, in two flats, B♭ and *E*♭, the keynote is B♭. In three flats, B♭, E♭, and *A*♭, the keynote will be E♭, and so throughout. The keynote in *minor* is always a minor third below the major, as A below C, G below B♭, etc. In keys with sharps the minor keynote is also one whole tone below the last sharp of the signature. Thus, in two sharps, F♯ and C♯, it is B; in three sharps, F♯, C♯, and G♯, it will be F♯, and so on. In keys with flats the minor keynote is a sixth below the last flat. Thus, in two flats, B♭ and E♭, it is G, and in three flats, B♭, E♭, and A♭, it will be C. To recollect the *order* of major keys in sharps, reckon *upward by perfect fifths*, as from C to G, then G to D, D to A, and so onward. This gives the succession of major keys in regular order from one to seven sharps. In major keys with flats, reckon *downward by perfect fifths*, as from C to F, F to B♭, etc., and the succession of keys in regular order from one to seven flats will be found. This rule applies also to minor keys. William Staunton.

Key (Francis Scott), b. in Frederick co., Md., Aug. 1, 1779, and was educated at St. John's College. He practised law in Frederick, Md., and in Washington, D. C. He is chiefly remembered as the author of *The Star-Spangled Banner*, which he composed while a prisoner in the British fleet during the bombardment of Fort McHenry. D. at Baltimore Jan. 11, 1843. A volume of his poems, edited by H. D. Johns, appeared in 1857. Mr. Key was a brother-in-law of Chief-Justice Taney.

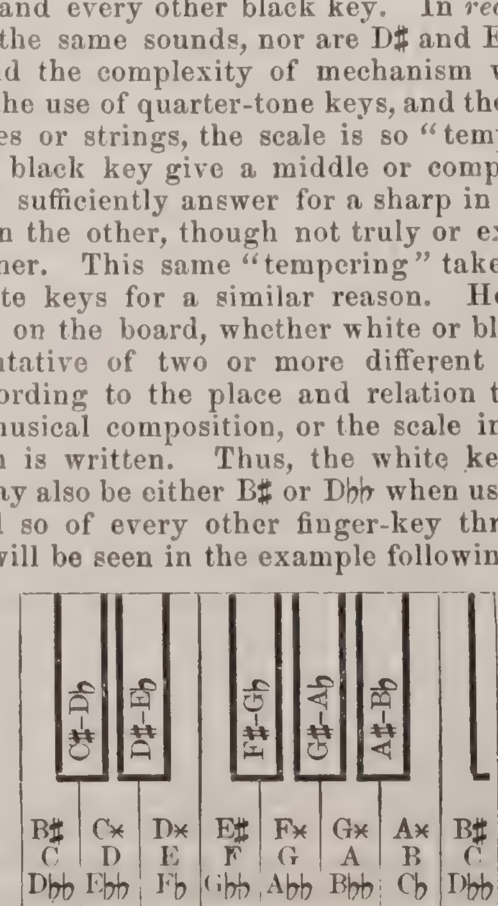
Key (Thomas Hewitt), M. A., F. R. S., b. at Southwark, England, Mar. 20, 1799; graduated at Trinity College, Cambridge, in 1821; studied medicine, and was appointed professor of mathematics in the University of Virginia on the first organization of that institution in 1824. Returning to England in 1827, he was for thirteen years professor of Latin in the newly-organized University of London, after which he became professor of comparative grammar and head-master of the preparatory school, which positions he retained down to the present year (1875). He has published a *Latin Grammar* (1843–46), *Philological Essays* (1868), *Language, its Origin and Development* (1874), and many philological essays in the magazines. His greatest work, a *Latin-English Lexicon*, is still unpublished.

Key (Thomas Marshall), b. in Kentucky about 1818; graduated at Yale College in 1838; studied law; settled at Cincinnati, and took a high position at the bar. He was repeatedly elected to the Ohio senate; was in 1861 sent as commissioner to the government of Kentucky in the interests of the Union; was a member of the staff of Gen. McClellan; author of the first bill passed by Congress for the emancipation of slaves, and also of that for the emancipation of the slaves in the District of Columbia. D. at Lebanon, Ky., Jan. 15, 1869.

Key′-board, or **Finger-board,** in an organ, pianoforte, or other similar instrument the series or range of short levers, usually covered with ivory and ebony, on which the fingers of the performer operate. Each of these levers is called a *key*, the longer or white ones representing the diatonic scale of C major in several successive octaves, and the shorter or black ones furnishing the intermediate sharps and flats requisite for the other scales. The key-board is frequently denominated a *bank*, *row*, or *set* of keys, and in organs of considerable size there are two, three, and sometimes four, such sets. The clavichord, virginal, spinet, and harpsichord of former days were also furnished with keys, the latter frequently having two sets, and in some cases four and even more. Dr. Rimbault remarks that "the author of a rare volume published at Bologna in 1590, under the title of *Il Desiderio*, mentioning some curious instruments in the palace of the duke of Ferrara, says, 'There was a harpsichord invented by Don Nicola Vincentino, surnamed *Arcimusico*, in the year 1555. It had *six* rows of keys, comprehending in their division the three harmonic genera.' He adds that the multitude of strings on this astonishing instrument rendered it very difficult to tune, and more so to play." (*The Pianoforte, its Origin, etc.*) Besides the key-boards for the fingers, organs are usually provided with a set of keys for the feet, the former being distinguished as the *manuals*, and the latter as the *pedals*. The key-board has reached its present perfect form only after several centuries of experiment and improvement. In its rudest elementary form we may trace its existence in the small and roughly constructed organs of the eleventh and twelfth centuries. It appears to have comprised at that period only a few parallel levers of much larger size than our present keys, and requiring a strong pressure to move them. Anterior to that period we have no distinct traces of this mechanical device. "Guido," says the author just quoted, "is said to have invented the *clavier* or key-board, and it is not at all improbable that he was the first to apply it to the mediæval instrument of many strings, . . . which seems to have been the same with the clavichord, and, as such, was the progenitor of the harpsichord, the spinet, the virginal, and the pianoforte of modern times. . . . The first stringed instrument to which the key-board was applied was probably the clavicytherium or *keyed cithara*. In its early stages it was a small oblong box, with the strings arranged in the form of a half triangle." (*Ibid.*, pp. 28–35.)

The structure or plan of the key-board now in use is comparatively modern, and its very outline or conception presupposes such a knowledge of the diatonic-chromatic scale as was not attained till many years after the time of Guido. The probability, therefore, is, that for a long period the early key-boards consisted merely of two or three octaves of short levers operating on pipes tuned in the natural order of the scale, with, possibly, an extra key in each octave for a flat seventh or other needed interval. The adjustment of the key-board so as to comprise *all* the intervals would, from the necessity of the case, be dependent on the regulation of the elements of the chromatic scale; and for this reason we cannot date the formation of our present key-board farther back than about the close of the twelfth century or the beginning of the thirteenth, when the structure of the scale began to be more clearly apprehended.

The ordinary key-board comprises tones and semitones, but excludes all lesser or enharmonic intervals. Each black key is the *sharp* of the white key on its *left*, and the *flat* of the white key on its *right*. From this it follows that every black key serves two distinct purposes, being a sharp in one relation, and a flat in another. This apparently defective arrangement is unavoidable, on account of a certain irregularity in the scale, which if strictly met would require us to have one black key for C♯, and another for D♭; and so with F♯ and every other black key. In *reality*, C♯ and D♭ are not the same sounds, nor are D♯ and E♭ the same; but to avoid the complexity of mechanism which would arise from the use of quarter-tone keys, and the multiplication of pipes or strings, the scale is so "tempered" as to make each black key give a middle or compromise tone, which shall sufficiently answer for a sharp in the one case and a flat in the other, though not truly or exactly representing either. This same "tempering" takes place also on the white keys for a similar reason. Hence, all the finger-keys on the board, whether white or black, come to be representative of two or more different intervals or sounds according to the place and relation they may occupy in a musical composition, or the scale in which such composition is written. Thus, the white key ordinarily named C may also be either B♯ or D♭♭ when used in certain scales; and so of every other finger-key throughout the octave, as will be seen in the example following:



On the pianoforte it would not be possible to express the minute differences here referred to without a multiplicity of additional strings and corresponding changes in the arrangement of the key-board. But several organs have been built with key-boards and extra pipes to give quarter-tones or enharmonic intervals. In those instruments each black key is divided into two portions, one of which is used for sharps, and the other for flats, thereby securing much richer and purer harmony than can be obtained from organs tuned on either the equal or the unequal temperament. Harpsichords, as already noticed, were constructed centuries ago with additional strings and rows of keys, for the purpose of obtaining *without* temperament the advantage of quarter-tones. (See TEMPERAMENT.) WILLIAM STAUNTON.

Keyes (ERASMUS DARWIN), b. at Sturbridge, Mass., May 29, 1811; removed in boyhood to Maine; graduated at West Point in 1832; was instructor at the Military Academy from 1844 to 1848; was engaged in Indian wars on Puget Sound in 1856; commanded a brigade at the battle of Bull Run; was appointed brigadier-general, to date from May 17, 1861; was in the battles before Richmond in command of the 5th corps, and made major-general of volunteers and brevet brigadier-general U. S. army for gallant conduct in the field.

Key Islands, a group of islands in the Malay Archipelago, S. of New Guinea, in lat. 5° 25′ S., lon. 132° E., consists of two large and a number of small islands. Great Key comprises an area of 294 square miles, with 21,000 inhabitants; Little Key, of 283 square miles, with 10,000 inhabitants. They are of volcanic origin, mountainous, fertile, and rich in timber, cocoanuts, tortoise-shells, sago, and different kinds of fruits. The inhabitants, who are partly Christians, partly Mohammedans, are described as hospitable, industrious, and honest.

Keynote. See KEY, by REV. WILLIAM STAUNTON, S. T. D.

Key′port, post-v. of Raritan tp., Monmouth co., N. J., on Raritan Bay, 25 miles from New York City and 13 miles from Freehold. It has 4 churches, 1 graded-school building (costing $30,000), 1 weekly newspaper, 2 saw-mills, 2 flour-mills, 3 large hotels, and numerous boarding-houses for summer visitors. There is a fruit-canning factory, established in 1868, employing 150 hands. Two steamers ply daily between Keyport and New York, connecting with stage-lines to several towns of New Jersey. Keyport is an important centre of the oyster, clam, and fish trade, the oysters being generally brought from Virginia and planted in beds until they attain their growth. Pop. 2366.
McKINNEY & SON, EDS. "WEEKLY."

Keys′burg, post-v. of Logan co., Ky., 6 miles from Allensville, a station on the Louisville and Nashville R. R. Pop. 133.

Key′ser (PETER D.), M. D., b. Feb. 8, 1835, at Philadelphia; studied at Delaware College until 1851; entered the chemical laboratory of Prof. F. A. Genth at Philadelphia; went to Europe in 1854; graduated in the medical department of the University of Jena, Germany, in 1864; returned home same year and entered the army hospitals as acting assistant surgeon U. S. A. In 1868 he became surgeon in charge of the Philadelphia Eye and Ear Infirmary; in 1870 also ophthalmic surgeon to the medical department of the German Society of Philadelphia; and in 1872 one of the surgeons to the Wills Eye Hospital in Philadelphia. In 1853 he published his chemical analyses of the allanites from Reading, Pa., Bethlehem, Pa., and Orange co., N. Y.; also analyses of thalite and of owenite (thuringite) from Harper's Ferry, Va., and in 1854 the analysis of thuringite from Germany, and the analysis of barnhardite from Cabarrus co., N. C. To the medical journals he has contributed *The Use of Calabar (Physostigma) in Paralysis of Accommodation* (1865); *On Persistence of Pupillary Membranes* (1867); *Injury and Destruction of an Eye, with Bone-formation in the Iris* (1869); *Removal of a Cancroidal Tumor from the Surface of the Eye* (1869); *On Impairment of Vision the result of Dental Irritation* (1870); *On the Recovery of Sight after Gray Atrophy of the Optic Disks* (1871); *On the Use of Chloral Hydrate after Eye Operations* (1871); *Report on Operations for Cataract* (1874); *On Congenital Hereditary Dislocations of both Lenses; Ruptures of the Choradix; Phosphatic Degeneration of the Cornea* (1874).

Keys, House of (*Claves Insulæ*), a body of twenty-four members constituting the lower house of Tyndwald Court, the legislature of the Isle of Man. All vacancies are filled by the house itself.

Keys of Florida. See FLORIDA KEYS.

Keytes′ville, post-v. and tp., cap. of Chariton co., Mo., on the St. Louis Kansas and Great Northern R. R., 174 miles W. N. W. of St. Louis; has 3 churches, 2 hotels, a large public school, 1 bank, 1 weekly newspaper, 1 flour-mill, 2 agricultural implement manufactories, and the usual number of stores and shops. Pop. of v. 529; of tp. 1663.
THOMAS D. BOGIE, ED. "HERALD."

Key West [a corruption of the Spanish *Cayo Hueso*, "bone reef"], post-v., cap. of Monroe co., Fla., is the extreme southern boundary of the U. S., and forms the entrance to the Gulf of Mexico, being distant about 68′ from the coast of Cuba. It is situated on an island of the same name, 7 miles long by 1 to 2 wide, of coral formation, elevated only 11 feet above the level of the sea, and covered with a thin layer of soil, on which tropical fruits are successfully cultivated. The town is a naval station, has a large dépôt for U. S. stores, etc.; it possesses a good and spacious harbor; is in connection with the Northern States by Mallory's line of steamers, and with New Orleans by a line of steamers running from that place weekly *viâ* Cedar Keys, where it connects with the railroad. Key West has a fine marine railway, where ships of 300 tons may be hauled out for repairs. There are 7 churches of the various denominations, 2 weekly papers, 2 public and several private schools, a convent, 1 hotel, 3 large and extensive cigar-factories, where about 2500 Cubañ refugees are employed in making cigars. On the S. W. point is a lighthouse, with a fixed light 72 feet above the water, situated in 24° 33′ N. lat. and 81° 47.3′ W. lon. The inhabitants proper are employed in mercantile pursuits, fishing, sponging (which is a source of wealth), and wrecking. The population has increased largely of late by emigration from the Bahamas and Cuba. Pop. about 9000.
E. J. FLEMMING, ED. "KEY WEST DISPATCH."

Khabour′ [Gr. *Chaboras;* Heb. *Habor* or *Chebar*], a river in Asiatic Turkey, tributary to the Euphrates, which it joins at Kerkesieh after a course from N. to S. of 190 miles. It is noted in biblical geography as the river along which the captive Israelites were settled, and is frequently mentioned in the cuneiform inscriptions. Another smaller river of the same name is a tributary of the Tigris.

Khaldun′ (IBN), otherwise called WALY EDDIN ABU ZEID ABDALRAHMAN, b. at Tunis, Africa, in 1332; studied polite letters for some years in Granada; was then employed in the service of his own sovereign, and in that of the sultan of Fez; made the pilgrimage to Mecca in 1382, and settled at Cairo, Egypt, as instructor in several colleges; was sent as ambassador to the conqueror Timour at Damascus about 1400; was chief cadi at Cairo in 1384, and again in 1400, and d. there in 1406. He was one of the most distinguished of the Arab writers, and left a vast *History of the Arabs, the Persians, the Berbers, and the Nations among whom they have Lived*, which is one of the principal authorities upon Oriental annals.

Kha′led (surnamed "The sword of God"), b. in Arabia in 582; commanded the cavalry of the Koreish against Mohammed at the battle of Ohud in 623; was converted to Islam in 629; saved the army of Mohammed at the battle of Muta the same year, gaining the surname by which he was ever afterwards known; invaded Persia in 632; took Bozrah, besieged Damascus, and defeated the generals of the emperor Heraclius at Aiznadin in 633; stormed Damascus in 634; took Aleppo in 638. D. at Emesa 642.

Khalkas′, the name of the northern part of Mongolia, a part of the Chinese empire, and extends between Siberia, the river Amoor, the desert of Gobi, and the Altai Mountains. It consists mostly of vast steppes, where the inhabitants lead a miserable, sluggish, and savage life. Ranges of mountains traverse the country, however, beautifully terraced and well wooded, and here are the seats of the immense Booddhist monasteries. The inhabitants are Mongolian Tartars, and profess Booddhism. The country was the birthplace of Genghis Khan. Cap. Oorga or Urga.

Khallikan′ (IBN), also called SHEMS EDDIN ABUL ABBAS AHMED, b. at Arbela, near the Tigris, in 1211; became profoundly versed in Arabic literature; lived for a time in Cairo, Egypt; was chief cadi at Damascus in 1261, and again in 1277, and d. in that city in 1282. He left a *Biographical Dictionary of the Illustrious Men of Islam*, which contains data upon several thousands of persons, and is invaluable to the student of Oriental history.

Khan [formerly spelled *cham* in many cases], a title given to many Tartar magnates and kings, also to East Indian princes under the Moguls. The old spelling *cawn* (as in Jaffier Ally Cawn) fairly represents the true pronunciation.

Khandeish′, or **Candeish,** a district in the Bombay presidency, British India, E. of Guzerat and N. of the Nizam's dominions. Area, 12,000 square miles. Pop. about 80,000. Formerly a part of the Mogul empire, it was annexed in 1818.

Khang-Hi, or **Kang-Hi** [Manchu, "inalterable peace"], second emperor of China of the present Manchu dynasty, b. in 1654; was originally named *Hiouen-Ye* ("blue spark"); succeeded to the throne in 1662 on the death of his father, Chun-Chi, under the regency of four mandarins; assumed the government in 1667, and immediately put to death one of the regents; introduced the official teaching of the European system of astronomy (1667), studying it himself under the instruction of the Jesuit Father Ferd. Verbiest; suppressed a formidable revolt made by the prince of Yunnan (1673); annexed Kwang-Tung (1680), Fo-Kien (1681), and Formosa to the empire; concluded with Russia a treaty of peace and limits at Nipchow (Sept. 3, 1689); was cured of a fever by Jesuit physicians (by the use of quinine), who thus gained the ascendency at his court; annexed Thibet about 1700; authorized a persecution of Christians in 1717, and d. Dec. 20, 1722. Khang-Hi is esteemed the greatest of the Chinese sovereigns, and through the Jesuits became the best known in Europe; he caused the publication of important works on the language, history, and literature of China, and directed the topographical survey (1708) executed by Jesuits, by which Chinese geography is best known.

Khania. See Canea.

Khanpoor′, or **Khaunpoor′,** town of British India, in the N. W. Provinces, the capital of a district of the same name, on the Ganges, is dirty and poorly built, but has extensive manufactures of jewelry and leather, and carries on an active trade. It is a military station, and the part of the city occupied by the barracks and their gardens has a very fine aspect. Pop. about 50,000.

Kharkow′, government of European Russia, traversed by the Don and its affluents. Area, 20,737 square miles. Pop. 1,681,486. It is low, mostly level, but very fertile. Wheat, wine, and tobacco are raised in great quantities, and large herds of cattle reared. Manufactures are unimportant.

Kharkow, town of European Russia, the capital of the government of Kharkow, on the Kharkowa, an affluent of the Don. It is a flourishing town, with several good educational institutions, and four annual fairs which are much frequented, especially the wool-fair in spring, at which the value of the wool sold generally amounts to £1,150,000. Pop. 59,968.

Khartoom′, town of Egypt, in Upper Nubia, at the confluence of the Blue and the White Nile. It has a considerable trade, being the centre of several caravan-routes, especially in slaves and ostrich feathers. Pop. 30,000.

Khatmandoo′, or **Katmandu′,** the capital of Nepaul, Hindostan, in lat. 27° 42′ N. and lon. 85° 15′ E. It is poorly built, many even of its temples being built of wood; the streets are narrow and dirty. It has no great commercial importance. Pop. 50,000.

Khazars, or **Chazars,** a powerful tribe of Finnic or Magyar stock, settled N. of the Caucasus, near the mouth of the Volga. They had kings of their own, and derived some celebrity by their conversion to Judaism in the eighth century.

Khe′dive, with the predicate of *altesse* ("highness"), is, since 1867, the official title of the viceroy of Egypt. The viceregency is hereditary in the family of Mehemet Ali since 1841, according to the Turkish law of succession, and since 1866 in direct line—that is, from father to son. The first khedive of Egypt is Ismaïl, son of Ibrahim Pasha, b. in 1830; he succeeded his uncle, Saïd Pasha, Jan. 18, 1863. Ismaïl is an energetic and active man, always busy with plans of increasing his power. In 1869 he travelled in Europe like a sovereign prince in order to establish connections with the powers which could help him to acquire a greater independence of the sultan; he especially courted the aid of Napoleon III. But this journey excited great displeasure at the court of Constantinople, which by threats compelled him to deliver up the vessels of war and the guns which he had bought, and to repair personally to Constantinople in order to prove his submission. By judicious bribes, however, the khedive has succeeded in obtaining more influence at the court and greater advantages from the sultan. In 1873 he acquired the right of concluding commercial treaties with foreign powers, and in the internal government of the country he has complete autonomy. He has done much to introduce European civilization into his country. He has not attempted, however, to educate the people and raise it to a higher standpoint; he has only established European institutions in the country, without any preparations, completely, despotically; and thus in Egypt civilization covers barbarism like a varnish. There exists since 1866 a representation of the people, but the khedive rules, nevertheless, absolutely, and the poor representatives are only puppets. Magnificent buildings have been erected at Alexandria and Cairo; the great undertaking of building the canal of Suez received great support from the khedive; French opera is established in a most splendid style; and on different occasions, especially at the opening of the Suez Canal, the khedive received his European guests with brilliant and prodigal hospitality. The army and fleet are in excellent condition, and provided with arms of the latest improvement; different expeditions have been undertaken to the S., in order to extend the authority of Egypt and suppress the slave-trade; but the taxes are very heavy, and are gathered with despotic severity from the poor people, exactly as in the time of the Pharaohs. August Niemann.

Kherson′, government of European Russia, bordering on the Black Sea, W. of the Dniester. Area, 28,666 square miles. Pop. 1,497,995. The northern and eastern parts are hilly, fertile, and often covered with splendid forests; the southern and eastern parts are a saline steppe. Agriculture is often impeded by lack of water, and by the immense change of climate, from the scorching heat of the summer to the piercing cold of the winter. Tobacco is extensively cultivated; cattle, sheep, and silkworms are reared.

Kherson, town of European Russia, the capital of the government of the same name, on the right bank of the Dnieper. It was founded in 1778 by Potemkin; has several good educational institutions, some manufactures of salt, leather, and rope, extensive shipbuilding, and a large trade in timber. Pop. 45,926.

Khi′va, khanate of Toorkistan, in Central Asia, which until recently was held to extend from the Sea of Aral on the N. to the Persian frontier on the S., and from Bokhara on the E. to the Caspian Sea on the W., thus comprising a vast region, mostly desert, with an area variously calculated from 195,000 square miles down to 54,000, and a population estimated with equal uncertainty from 2,600,000 down to 480,000. As the result of a war with Russia in 1873, the limits of Khiva were much reduced, and were in part defined by treaty, while more accurate data were obtained for the population. By the treaty the new E. boundary is the river Amoo, or Amu-Darya (the ancient Oxus), from Kukertli in lat. 40° N. to the Sea of Aral, and thence S. W. along the so-called "ancient bed of the Oxus" to the Caspian, in about lat. 40° N. The Khivan territory E. of the Amoo was ceded to Russia, and a portion was transferred by Russia to the khanate of Bokhara. The area and population of Khiva are still uncertain, owing to a conflict of jurisdiction as to territories claimed by Persia and by Afghanistan on the S., but as Khiva exercises no sovereignty over the disputed region, it may be considered as practically reduced to the oasis N. of the Desert of Toorkistan or Kharesm, and S. W. of the lower Amoo River, a district not exceeding 30,000 square miles in area, with a population of 280,000. The whole region of Toorkistan was probably once covered by a vast inland sea, of which the present Caspian and Aral are the remains. The oasis of Khiva is abundantly watered by irrigation from numerous natural and artificial canals fed by the Amoo, and by the employment of manures produces an abundance of wheat, rice, cotton, apples, peaches, pomegranates, melons, and vines. The climate is variable, frosts prevailing from October to April, while the heats of midsummer are excessive. In December the Amoo and the Aral are usually covered with ice. Manufactures of brass and earthenware, woollen goods, shawls, and silk are carried on to some extent, and domestic animals, especially horses, asses, and camels, are abundant. Trade is carried on by caravans, sometimes of 2000 camels, chiefly with the Russian cities of Orenburg and Astrakhan, the articles of importation including firearms, sugar, muslin, chintz, and fancy goods. A former traffic with Persia and Afghanistan has been interrupted by the hostilities of the Turkoman tribes, but a brisk trade is carried on with Bokhara by exchanging European for Chinese and other Oriental staples of merchandise. The population of Khiva is of several nationalities, representing the results of a long series of wars and irruptions. The ancient population called Sarts or Tajiks still form the large class, furnishing most of the laborers. They are of Persian affinities, and until recently there were many thousands of Persian slaves. The Turkomans or Yomuts, Kirghiz, and Karapalkacs constitute the nomadic population of the desert, and are scarcely to be reckoned as Khivans, though some of them are adopting a more settled mode of life. The dominant race is that of the Uzbeks, of Turkish origin. Khiva in the widest geographical sense comprehends a great part of Chorasmia, Sogdiana, and Bactria, which, as independent kingdoms or as provinces subject to the Persian and Parthian empires, filled a large space in early Asiatic history. During the Middle Ages it became an independent kingdom under the name of Kharesm or Khovaresm; was conquered by Genghis Khan in the thirteenth century, by Tamerlane in the fourteenth, and by

the Uzbeks early in the sixteenth century, the latter being the founders of the existing khanate. A Russian expedition, sent against Khiva by Peter the Great in 1717, was utterly defeated, and another similar undertaking in 1839 was successfully resisted. In 1873, however, the ill-treatment of Russian captives afforded a pretext for a campaign skilfully conducted by Gen. Kaufmann, who invaded Khiva with three corps of 5000 each simultaneously from the E., the N. W., and the S. W., took Kungrad May 20, and occupied the capital June 10. The khan, Seid Mohammed, had fled, but soon returned to tender his submission and arrange terms of peace. The boundaries were defined as before mentioned, slavery was abolished (July 25), and the slave-trade prohibited; an indemnity of 2,200,000 roubles was imposed, payable in yearly instalments for twenty years, the Russians meanwhile occupying Shurakhan and Kungrad; the right of making treaties with foreign powers was surrendered, and the Turkoman tribes were to be punished for their continued hostilities against Russia. The independence of Khiva was recognized, in conformity with promises made to England, but Khiva became really a Russian dependency. More recent events (1874 and 1875) having demonstrated the inability of the khan to comply with some of his engagements, the Russians occupied the capital anew by request of the native ruler, and the region extending from Bokhara to the Caspian, and S. to the Attrek River, was formally occupied as Russian domain under the name of "Trans-Caspian Territory," with the capital at Krasnovodsk, a newly-established port on the Caspian. The inhabitants of Khiva are Soonite Mohammedans; they have some taste in music and poetry, and a considerable literature. The capital is an irregular walled town, with a citadel and four gates, and some 6000 inhabitants. The houses are mud-built, the palace and bazaars are of rude construction, and the few edifices meriting notice are mosques and colleges. (See Spalding's *Khiva and Turkestan*, MacGahan's *Campaigning on the Oxus and the Fall of Khiva*, and Vambéry's *Central Asia and the Anglo-Russian Frontier Question*, all published in 1874.) A work by Hon. Eugene Schuyler, American chargé d'affaires in Russia, who accompanied the Russian expedition, is in the press (1875). PORTER C. BLISS.

Khodavendigh′iar, vilayet or province of Anatolia, Asiatic Turkey, S. of the Sea of Marmora, traversed by the Keshish-Dagh Mountains (ancient *Olympus*), and comprising parts of ancient Bithynia, Mysia, and Phrygia. Pop. about 1,100,000. Cap. Brusa.

Khoi, town of Persia, in the province of Azerbijan, in lat. 38° 37′ N., lon. 45° 15′ E., is one of the best-built cities of the country, with broad and straight streets traversed by canals and planted with trees. It has considerable trade, and the surrounding plain produces much fruit, grain, rice, and cotton; but the locality is somewhat unhealthy. Pop. about 30,000.

Khojend′, or **Kodjend,** the ancient *Jaxartes*, town of Khokan, Independent Toorkistan, Central Asia. It is a populous town, but decaying, important only on account of its transit trade. Duty has to be paid here on all merchandise entering Khokan from Bokhara. Pop. estimated at 30,000.

Khokan′, or **Kokan′,** one of the three independent khanates of Toorkistan in Central Asia, bounded on the S. W., W., N., and N. E. by the Russian province of Sir-Darya, E. and S. E. by Kashgaria or E. Toorkistan, and S. by the Pamir plateau and the Karateghin. The area was formerly calculated as high as 227,000 square miles, and the pop. as high as 3,000,000, but these estimates were much exaggerated. The western part of the khanate, comprising the lower basin of the Sir-Darya, with the important cities of Tashkend and Khojend, was annexed to Russia in 1864, and further annexations have so reduced the khanate that, according to Russian maps published in 1872, the area is only 28,270 square miles and the pop. 800,000. In the present aspect of affairs in Central Asia (1875) its speedy annexation to Russia may be anticipated. Khokan is at present chiefly comprised within the valley of the river Sir-Darya, the ancient *Jaxartes*, forming an almond-shaped district about 165 miles long and 65 miles wide. This was formerly known as the province of Ferghana. The average elevation above the sea is 1500 feet; the climate varies from extreme cold to extreme heat, according to location. The valley is bounded on the S. E. and S. by lofty mountains, the chains of Thian-Shan or Muz-Tagh and Asferah-Tagh forming watersheds between the basin of the Sir-Darya and those of the Kashgar and Amu-Darya rivers, which flow E. and W. from the Amir plateau. The country is abundantly watered by the numerous tributaries of the Sir-Darya, and, aided by an extensive system of irrigation, the fertile soil produces fine crops of rice, wheat, cotton, and barley, as well as hemp, flax, tobacco, sorghum, and madder. Fruits of many kinds abound; silk of excellent quality is grown and manufactured. In 1872, 8,000,000 pounds of cotton and 200,000 pounds of silk were exported to Russia. Domestic animals, especially sheep, are reared in sufficient numbers; turquoise, iron, coal, naphtha, and petroleum are among the mineral products. The population consists of Uzbeks, of Tartar origin; the more numerous Tajiks or Sarts, of Persian or Aryan origin, once serfs, and still the principal agriculturists; and the Kara-Kirghiz and Kiptchak nomadic tribes, of Turkish blood, living chiefly in the eastern districts. The government has been of late years violently disputed between these three races. The present khan, named Khudayar, commenced his reign in 1843, and being by descent a Kara-Kirghiz, the Turkish tribes were in the ascendant during his minority. On succeeding to full power in 1849, Khudayar favored the peaceful and industrious Sarts in preference to the turbulent nomads, until the latter in 1857 made a successful rebellion, raising his brother Mollah to the government. A war with the Russians in 1864 led to the annexation of the greater portion of Khokan to Russia, to the return of Khudayar from exile in Bokhara, and the re-establishment of his government by Russian support. A commercial treaty was negotiated in 1868, but in 1874 the anti-Russian sentiment had gained the ascendant, fomented by a civil war, and furnishing pretexts for a new interference not likely to be neglected. The chief cities of Khokan are the capital, bearing the same name, a handsome place of 50,000 inhabitants; Marghilan, and Andiian.

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Khondistan′, a district in the province of Orissa, India, about 200 miles in length by 170 in breadth, at the sources of the Nerbudda River, embracing the plateaux of the Vindhya and other mountains. The inhabitants, called Khonds, Khoonds, Konds, or Gonds, constitute one of the so-called "hill-tribes," supposed to be remnants of the earliest inhabitants of India, their physique, religion, manners, and customs being entirely non-Aryan and of an extremely low type. They are very black, with thick lips and woolly hair, but well proportioned, strong and athletic, living upon wild fruits and roots and such game as they can snare or kill by their rude devices. Their language is classed with the Uriya; it has many dialects and a "peculiar pectoral enunciation." Human sacrifice was formerly very prevalent, but since the English came in contact with the Khonds (1835) it has been suppressed through the long-continued efforts of the British agent, Col. (now Maj.-Gen.) John Campbell, whose *Personal Narrative* (1864) is a valuable source of information. The Khonds have recently attracted great attention from ethnologists on account of their very peculiar customs. (See the works of Hodgson, McPherson (1842), Tylor, Lubbock, Brace, Hunter, and McLennan.)

Khonsar′, town of Persia, in the province of Irak-Ajemee. It has a large trade in dried and preserved fruits. Pop. 12,000.

Khooloom′, or **Tashkurgan′,** town of Toorkistan, Central Asia, is on a river of the same name, in lat. 36° 40′ N., lon. 68° 5′ E. It consists of about 20,000 houses, one story high, built of clay or sun-baked brick, with conical roofs, and surrounded with walls; it is defended by two citadels. Melons are extensively cultivated in the vicinity.

Khoondooz. See KOONDOOZ.

Khorassan′, the ancient *Bactria*, a province of Persia, situated between lat. 34° and 38° N., and between lon. 53° and 61° E. Its southern part is a desert of shifting sand and salt waste, but in the northern part branches of the Elburz Mountains form beautiful valleys, whose natural fertility is still further increased by irrigation, artificial manures, and a most careful cultivation. Cotton, hemp, and tobacco are grown; wine, fruits, and silk are produced; aromatic and medicinal plants are cultivated, and gold, silver, and salt are found. The manufactures of silk and goat-hair fabrics and sword-blades are celebrated. Cap. Meshed.

Khorsabad′ [corruption of *Khosruabad*, "the abode of Khosru or Chosroes"], a v. of Asiatic Turkey, on the Tigris, 13 miles N. E. of Mosul, occupying the site of one of the royal cities of Assyria, the remains of which were discovered by E. Botta in 1843. The palace of Sargon, excavated at the expense of the French government, afforded the first historical inscriptions in cuneiform characters found in ancient Assyria, and led to the more famous discoveries of Layard on the site of Nineveh. The excavators of Khorsabad erroneously gave the name of Nineveh to that place. (See Botta and Flandin's magnificent publication, *Monuments de Ninevé* (5 vols., chiefly of plates, Paris, 1849–50), and articles ASSYRIA and CUNEIFORM INSCRIPTIONS.)

Khosru′, or **Chos′roes** [Gr. Χοσρόης], the name of two Persian monarchs of the Sassanid dynasty: I. NUSHIRVAN ("noble spirit"), called by historians THE JUST, one of the greatest of Oriental sovereigns, was third son of Kobad or Cobades, by whose will he succeeded to the throne at Ctesiphon Sept. 12, 531, to the exclusion of his elder brothers, whom he is said to have put to death as a measure of precaution. Unreliable legends give different accounts of the birth and education of Khosru. According to Firdousi, his mother was the daughter of a king of the Huns; while Eutychius and many Persian histories assert he was the offspring of a noble lady of Khorassan, born about 500, while his father Kobad was a refugee in that province. The Greek historian Procopius relates that Kobad solicited the Byzantine emperor Justin to adopt Khosru, in order to strengthen his title to the throne, and that the proposal was accepted, and the young prince was on his way to Constantinople, when a sudden rupture put an end to the project and implanted in the prince that hatred of the Greeks which he afterwards displayed. This tale is a puerile invention, though repeated by some modern writers. The hereditary war between Greeks and Persians had broken out afresh in 521, and was carried on languidly in Armenia, Syria, and Mesopotamia until the accession of Khosru. Justinian had come to the throne of Constantinople in 527, and being desirous of concentrating his energies upon the war with the Vandals in Africa, he concluded with Khosru an ignominious peace (533) by agreeing to pay an annual tribute of 440,000 pieces of gold. One of the conditions made by the Persian monarch was that seven Greek philosophers, who had been persecuted as pagans and had taken refuge in Persia, should be allowed to return to their homes and reside there under Persian protection. During the preceding reign a politico-religious sect, called after their founder Mazdak, had arisen in Persia, inculcating communistic or socialistic principles. Kobad had at one time favored, but at a later period endeavored to subdue them, seizing the leaders by stratagem and massacring many of the sectarians. A formidable civil war was the result, continuing into the reign of Khosru, who finally suppressed the sect. The actions of the two monarchs in this respect have been much confused with each other, many events, especially the execution of Mazdak, being attributed to both, and it is now impossible to recover the facts of the case. One of the earlier measures taken by Khosru was the administrative division of his vast empire into four viceroyalties—Assyria, Media, Persia, and Bactriana. He is charged by the Byzantine historians with having incited one of his vassals, Almondar, the Arabian prince or king of Hira, to invade Syria, in violation of the peace. Be this as it may, the war broke out afresh. Khosru marched an army into Syria in 540, imposed enormous contributions upon the principal cities, took Antioch (June) after a gallant defence, and nearly destroyed that Eastern metropolis of the Byzantine empire. Belisarius, the conqueror of Africa, was sent to conduct the war (541), and by a bold irruption into Mesopotamia forced Khosru to return to the defence of his own states. Belisarius being recalled, the invasion of Syria was renewed (542); the return of that general to the field caused the Persians to recross the Euphrates, and his second recall for the Italian campaign (543) again gave the victory to Khosru. After a brief truce the war was renewed in Colchis and Lazica, provinces lying at the foot of the Caucasus, which had revolted from Persia by the aid of Justinian, and continued with numberless alternations of fortune until 562, when the Byzantine emperor consented to pay an annual tribute of 40,000 pieces of gold, and remained in possession of the disputed provinces. Southern Arabia was soon afterwards conquered by Khosru; the Armenians revolted from him in 569 with the support of the emperor Justin II., and the war between the two empires was renewed in 571, with the usual alternations of fortune. Syria was again ravaged by the Persians, but Khosru was completely defeated in a great battle at Melitene in Lesser Armenia in 576, and d. at Ctesiphon in Mar., 579, leaving the throne and the hereditary war to his son Hormuz (or Hormisdas) IV. The reign of Khosru is accounted by the modern Persians the most glorious period of their annals. All the Oriental virtues are ascribed to him, and there can be no doubt that the government was administered with vigor and sagacity. Learning was powerfully stimulated by the translation of the best Sanskrit and Greek works, agriculture and commerce received a powerful stimulus, and many magnificent cities were built. The boundaries of the empire were extended beyond the Indus and the Oxus, and diplomatic relations were maintained with all the realms from Africa to China.

II. PURWIZ OR PERWIS ("the generous"), grandson of Khosru I., succeeded his father, Hormuz IV., who was deposed in 590 by a rebel general named Bahram, who reigned for a year. The young Khosru took refuge with the Greek emperor Mauritius, by whose aid he regained the throne, and in recompense ceded a great part of Mesopotamia, besides paying a large sum of money. On the murder of Mauritius by Phocas (602), Khosru made war upon the usurper, nominally to avenge the death of his benefactor, and within a few years conquered Syria, Egypt, and Asia Minor. He took Antioch in 611, Damascus and Jerusalem in 614, Alexandria in 616, Chalcedon in 618, and Ancyra in 620, thus bringing the war to the gates of Constantinople. Heraclius had succeeded to the throne in 610, but the Persian conqueror was enjoying too great favors from fortune to listen to proposals for peace. With the wealth of so many kingdoms he built a palace of unparalleled magnificence at Dastagerd, 60 miles E. of Ctesiphon, in the midst of a park laid out upon a corresponding scale. After twelve years of defeats, the emperor Heraclius began in 621 a series of campaigns in which he recovered all his lost possessions, reduced Khosru to extremities, and even ravaged his palace of Dastagerd. In consequence of these misfortunes, Khosru was deposed and murdered by his son Shirweh (Siroes) in Feb., 628. It was during his reign that Mohammed proclaimed the doctrine of Islam. He summoned Khosru by letter to recognize him as the prophet of Allah, and when the former tore the letter in pieces, Mohammed predicted, "Thus will God tear his kingdom and reject his supplications." PORTER C. BLISS.

Khotan′, or **Illitsi**, one of the four provinces of Kashgaria, formerly Chinese Toorkistan. The capital city, bearing the same name, is situated on the route between Yarkand and Lassa, in lat. 37° N., lon. 78° to 80° E. It was formerly, according to Abulfeda and other Mohammedan geographers, a city of great importance, and is still a large place, enclosed with earthen ramparts and with broad streets, though ill built. It has manufactures of silk fabrics, leather, and paper, and has a thriving trade in these articles and in *yu*, the jasper of the ancients. The inhabitants are chiefly Uzbek Tartars, and the place is celebrated for its musk and for the beauty of the native population.

Khotin. See CHOTYN.

Khuzistan′, the ancient *Susiana*, province of Persia, bordering on the Gulf of Persia. Its southern part is a low plain, sandy in some parts, swampy in others, but generally affording excellent pastures wherever it is well watered. The northern part is mountainous. Rice, maize, sugar, and indigo are cultivated, and large herds of goats, cattle, sheep, and horses are reared.

Khy′ber Pass, in the Khyber Mountains, a gorge nearly 30 miles long, enclosed by cliffs of slate, rising almost perpendicularly on both sides to the height of 1000 feet. It is the principal, and for artillery the only available, road between Hindostan and Afghanistan.

Khyen′ Country, a semi-independent province of Farther India, N. W. of Burmah and E. of the British provinces of Aracan and Chittagong. It is a narrow strip some 200 miles in length, traversed by the large rivers Khyen-dwem and Khyoung.

Khyerpoor′, town of Sinde, the residence of the ameer of North Sinde, near the Indus. It is an ill-built and insignificant place. Pop. 15,000.

Kiabouc′ca, or **Amboyne Wood**, a very expensive and beautiful wood, imported for veneering purposes. It is richly mottled, and is of a reddish hue. It is sawed in thin slips from knots and wens upon the *Pterospermum Indicum*, a tree of the East Indies. It is chiefly employed in inlaying.

Kiach′ta, or **Kiakhta**, town of Siberia, in the Russian province of Transbaikalia, near the Chinese frontier, 180 miles S. E. of Irkutsk. Pop. 5000. It was established in 1727 as the exclusive mart for the trade between China and Russia, which was chiefly conducted by means of annual fairs. The trade sometimes amounted to $8,000,000 per annum, but has decreased since the treaty of Peking (1860), which permitted commerce along the whole frontier of the two empires. Kiachta has a fortress containing the government and customs buildings, and is the residence of many Russian merchants.

Kiang′-Si, an inland province of China, between lat. 24° and 30° N., and between lon. 113° and 118° E. Area, 72,180 square miles. Pop. 43,814,866. It is mountainous and rich in minerals, gold, iron, tin, lead, and porcelain. Cap. Nan-Chang-Foo.

Kiang′-Su, province of China, between lat. 31° and 35° N., and between lon. 116° and 122° E., bordering on the Yellow Sea. Area, 44,500 square miles. Pop. 54,494,644. The ground is low and level, but the soil is exceedingly fertile. Rice and sugar are the principal products. Cap. Nan-King.

Ki'antone, post-v. and tp. of Chautauqua co., N. Y., 6 miles S. of Jamestown. Pop. of v. 62; of tp. 539.

Kickapoo', post-tp. of Peoria co., Ill., 8 miles N. W. of Peoria. Pop. 1440.

Kickapoo, post-tp. of Leavenworth co., Kan. It contains the village of Kickapoo or Kickapoo City, on the Missouri River and on the Leavenworth Atchison and North-western R. R. Pop. 1855.

Kickapoo, post-tp. of Vernon co., Wis. Pop. 912.

Kickapoos, a tribe of Indians, of Algonquin stock, who in the seventeenth century lived on the Wisconsin River, and hunted, in company with the allied Miamis, over a vast territory. They came in collision with the French explorers in Illinois, whither they had migrated early in the eighteenth century, and in 1763 were found by the English on the Wabash River. They committed hostilities against the settlers in the Pontiac war (1765), and again in 1791, when their Wabash village was taken by Gen. Scott, and another burned by Wilkinson. After Wayne's victory over the allied Western tribes, the Kickapoos submitted, and by the treaty of Greenville (Aug. 3, 1795) they ceded part of their lands. They were again in arms in 1811 at Tippecanoe, and at Fort Harrison in 1812; as a consequence, several of their villages were burned, and by new treaties (1815, 1816, and 1819) they sold most of their lands, removing beyond the Mississippi to Osage River reservation to the number of 1800. Few of them would settle down to agriculture, but roved through what is now the Chickasaw and Creek country, committing depredations in Texas and other frontier states of Mexico, where many of them ultimately established themselves. They now reside in N. E. Kansas, where they are comfortably established, and in the Indian Territory, numbering in all about 1500.

Kidd (William), the "Robert Kidd" of popular tradition, was the son of a Scotch nonconformist preacher. He became a sailor, and in 1691 received an award of £150 from the council of New York for services in behalf of the colony. In 1696 he sailed from Plymouth, England, in command of the Adventure galley, fitted out for the suppression of piracy, but, according to the general belief, he became a pirate himself. He came in 1698 to New York with a large amount of treasure, which was seized by the earl of Bellomont; and an additional treasure which Kidd had buried on Shelter Island was also recovered. Kidd himself was sent to London, where he was hanged May 24, 1701—not for piracy, but for the murder of William Moore, a seaman. The trial was very unfair, and there is some reason for believing that Capt. Kidd was not guilty of the crimes which have made his name so notorious.

Kid'der, county of Northern Dakota, newly formed, crossed by the Northern Pacific R. R., occupied by the Plateau du Coteau du Missouri, and comprising an area of 1700 square miles.

Kidder, post-v. and tp. of Caldwell co., Mo., on the Hannibal and St. Joseph R. R., 163 miles W. of Hannibal. Pop. of v. 195; of tp. 922.

Kidder, tp. of Carbon co., Pa. Pop. 1417.

Kidder (Daniel Parish), D. D., b. at Darien, N. Y., Oct. 18, 1815; studied in Lima, N. Y., and at Hamilton College, N. Y., and graduated at the Wesleyan University, Conn., in 1835. He preached in New Jersey conference 1840–44; was connected with the M. E. Book Concern; was professor of practical theology in Garrett Biblical Institute, Evanston, Ill., in 1855, and afterwards became professor at Drew Theological Seminary, Madison, N. J. *Brazil and the Brazilians, Mormonism and the Mormons, Homiletics*, and *The Christian Pastorate* were published by him.

Kid'derminster, town of England, in the county of Worcester, on both sides of the Stour, near its influx in the Severn. Its carpet manufactures are very celebrated. Pop. 20,803.

Kid'doo (Joseph B.), b. in Pennsylvania; on the outbreak of civil war he enlisted, Apr., 1861, as private in the 2d Pennsylvania Vols., and was engaged at the siege of Yorktown, the battles of Williamsburg, Fair Oaks, Malvern Hill, etc.; promoted to be major 101st Pennsylvania Vols.; subsequently as lieutenant-colonel 137th Pennsylvania Vols. he was engaged in the battles of South Mountain, Antietam, and Fredericksburg; and as colonel at Chancellorsville. In Oct., 1863, he was appointed major 6th, and June, 1864, colonel 22d U. S. colored troops, operating during the siege of Petersburg with the Army of the James, being severely wounded Oct., 1864. For gallant conduct he was brevetted brigadier-general and major-general U. S. volunteers, and colonel and brigadier-general U. S. A. In July, 1866, he was appointed lieutenant-colonel 43d U. S. Infantry, but owing to disability arising from wounds received in service, was retired Dec., 1870, upon the full rank of brigadier-general. G. C. Simmons.

Kid'napping [from Ger. *kind*, Prov. Eng. *kid*, "child," and Prov. Eng. *nap*, to "seize"] is a criminal offence, defined by Blackstone to be the forcible abduction or stealing away of a man, woman, or child from his own country and sending him into another. (*Comm.*, iv. 219.) The term is commonly employed to denote the stealing and carrying away of children, but in law it is applied to all persons. This offence was treated, at common law, as an aggravated kind of abduction or false imprisonment, and was punished by fine and imprisonment. (See Abduction, False Imprisonment.) At the present day the nature of this crime is generally defined by statute, and the carrying of the person taken into another country is not usually made a necessary ingredient in the offence. Fraudulently inveigling, enticing, or decoying a person away, with intent to imprison or secrete him or detain him from his home, is frequently declared to be kidnapping as well as an abduction by the use of force. It is sometimes provided that the consent of a person to his abduction shall not be a defence to the party accused of the offence, unless it appear satisfactorily to the jury that such consent was not extorted by threats or duress. Such is the case in New York. There are frequently special statutory provisions in regard to the kidnapping of children. The consent of a child of tender years has been held at common law to render his abduction none the less a criminal offence. At what age a child would be capable of giving an assent which would be available in defence has never been precisely determined. His capacity in this respect must be ascertained from the circumstances of each particular case. In New York it is declared by statute that every person shall be guilty of kidnapping who shall forcibly seize and confine, or shall inveigle another, with intent to cause him either to be sent out of the State against his will, or to be secretly confined or imprisoned in the State against his will, or to be held in involuntary servitude. The offence is a felony, and is punishable by imprisonment in a State prison for a term not exceeding ten years. The statutes of other States must be specially consulted.

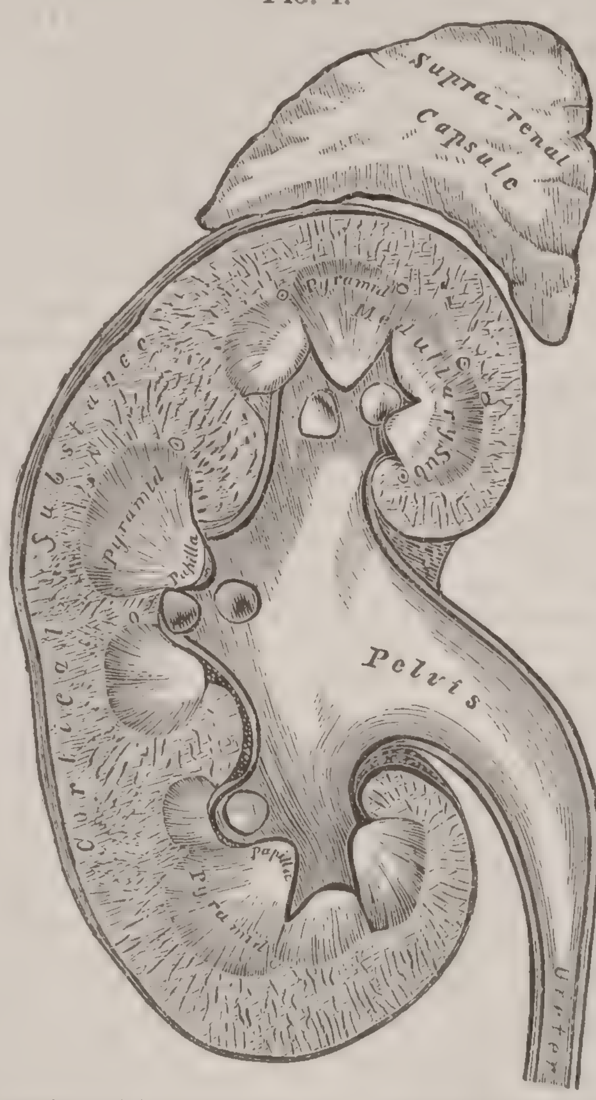
George Chase. Revised by T. W. Dwight.

Kid'ney [from Ang.-Sax. *cynne*, "genitals," and *neah*, "near;" Lat. *renes;* Fr. *rein;* Old English, "the reins"], an excretory organ in the body of vertebrates (an imperfect analogue being found in exceptional invertebrates), whose function is the elimination of the urine, an aqueous solution of various effete organic products and of inorganic salts, the débris of nutrition and metamorphosis of tissues. These excretory products—water, salts, and organic matter—are separated from the blood. In the kidney, therefore, arterial branches elaborately subdivided, their walls attenuated, are brought in close contact with a system of glandular bodies and tubules for the escape of the components of urine by transudation and secretion. In fishes the kidney presents a simple, rudimentary structure—one straight tube or ureter extending the entire length of the body, and giving off at right angles numerous tufts of tubules which interdigitate with blood-vessels. Reptiles have a more definite organ—a localized mass of tubules. Birds have relatively large kidneys. Mammals, especially man, have the most perfect development—namely, the greatest multiplication of tubular surface in a compact form.

The kidneys in man, two in number, are situated in the posterior part of the abdominal cavity, behind the peritoneum, one on either side of the spine in the lumbar region, and extending from the eleventh rib to near the crest of the ilium. The kidneys are retained *in situ* by their blood-vessels and by fat in which they are imbedded. A kidney is "bean-shaped," or ovoid, with a concave depression, notch, or "hilus" on one side; is of a brownish-red or maroon color; in consistency is dense, firm, but fragile; measures four inches long, two in width, and one in thickness; in weight varies from four and a half to six ounces in the adult male, and half an ounce less in the female. Relatively, the human kidneys are $\frac{1}{250}$th of the weight of the body. The kidney is invested by a strong fibrous capsule loosely attached by "areolar" or connective tissue. An organ so small, it contains so compact and elaborate an arrangement of vascular tufts and extensive multiplication of tubular structure, that the surface for excretory work is equal to six times the entire surface of the skin. (*Mapother.*) A vertical section of the kidney (see Fig. 1) displays a hollow organ, consisting apparently of a thick wall folded around the internal cavity at its hilus or concave side. Two distinct structures are noticeable: 1st, the cortex, or external peripheral portion, termed the "cortical substance," dark, homogeneous, granular; 2d, internally a series of pinkish, fan-shaped, or pyramidal masses, their bases towards the cortex, their apices converging upon the

central cavity. In the apparently homogeneous substance or granular matrix minute inspection reveals, imbedded, convoluted masses of capillaries—vascular tufts known as

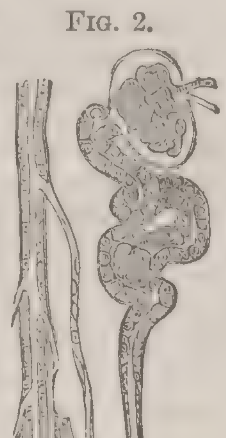
FIG. 1.



Vertical section of kidney, showing granular cortex and pyramids or fan-shaped groups of uriniferous tubules.

Malpighian tufts. These tufts are surrounded by flask-like capsules or membranous expansions of tubules. A tuft and its investing capsule constitute a "*Malpighian body.*" Departing from the capsule of the tuft, the uriniferous tubule is tortuous or "convoluted." The cortex includes in its granular "matrix" or "stroma" the Malpighian bodies, and convoluted tubules which separate urine from the blood circulating in adjacent and intertwining capillaries, as well as from the tufts. The cortex is therefore the secretory or functional portion of the kidney, as distinguished from the pyramidal or medullary portion, which is termed "tubular." The cortex constitutes three-fourths of the kidney, being thin over the bases of the pyramids, but dipping deeply down between them (columns of Bertin), and containing the vessels, nerves, and lymphatics, which, entering at the hilus, ramify towards the periphery of the organ. The pyramids vary in number from eight to eighteen, and collectively constitute the medullary substance of the kidney. A pyramid is a collection of straight urinary tubules, which communicate with the convoluted tubules of the cortex through intermediate "looped" tubules. One straight tubule collects the urine of several convoluted tubules. A pyramid contains about 1000 tubuli recti (straight tubules) converging at its apex, which presents a convex process or elevation on the surface of the cavity, designated a papilla. Several pyramids may coalesce near their apices, presenting a single papilla. The tubuli recti discharge by free apertures into the central cavity or reservoir, termed the pelvis of the kidney. The cavity is of irregular contour, having three sacculated recesses, termed infundibuli. The pelvis, receiving the urine collected by the several pyramids from corresponding sections of the cortex, parts with it through the ureter, a tube communicating between the kidney and the bladder. In the human adult the kidney is a symmetrical organ, but in fœtal life it is divided into distinct lobes, seven or eight in number, each consisting of a pyramid and corresponding section of cortex. The superficial depression and lobulated structure disappear later by

FIG. 2.

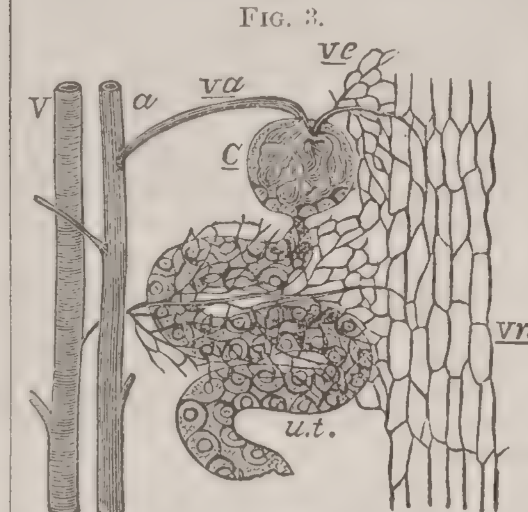


Sketch of the origin, course, and subdivisions of a single urinary tubule. Transition of the convoluted urinary tubule into the system of excretory tubules (tubuli recti) of the pyramids.

the growth of new, intermediate pyramids. In other mammals, the sheep, ox, bear, whale, the kidneys are distinctly lobulated,—externally nodulated. Although the visible distinction between lobules is obliterated in man, disease, as inflammation, is often limited by the primitive boundaries, leaving adjacent healthy parts to vicariously perform the function of the crippled ones. The kidney having but a single function, the excretion of urine, interest centres in the study of the microscopic, exact structure of the glandular apparatus of the cortex, and of the system of minute tubules which conduct the excreted fluid to the central reservoir of the kidney, thence to pass to the bladder and finally be voided from the body.

Our perfect knowledge of the histology of the kidney has resulted in part from the labors of Müller and Bowman in unravelling the tubules of the lower vertebrates, in part from the fine injections of vessels and tubules by Huschke, Gerlach, Henle, Ludwig, and others. The granular stroma, matrix, or substance of the cortex is studded with innumerable Malpighian bodies. The Malpighian body is spheroidal, and measures about the $\frac{1}{100}$th or $\frac{1}{120}$th of an inch in diameter. The renal artery, a branch of the aorta, enters the kidney at its hilus, extends its branches up between the pyramids to the cortex, and having divided and subdivided many times, its ultimate branches suddenly expanding into numerous capillaries rolled in a spheroidal form, a convoluted mass, or plexus, variously designated as a Malpighian (from Malpighi, who discovered it) "tuft," "glomerulus," or "knot." The vessel supplying or bringing blood to the tuft is termed the "*afferent*" vessel, and a companion vessel leaving the tuft, removing the blood which has parted with the urinary products, is the "*efferent*" vessel; it conveys its contained blood to the renal vein. This Malpighian tuft of capillary arteries and veins is surrounded by a spheroidal, flask-shaped, membranous capsule, which is the beginning of a uriniferous tubule. The thin-walled capillaries of the tuft or knot part with blood, serum, or water by simple transudation, and therefore excrete the chief ingredient of the urine, water being from 95 to 98 per cent. of its constituency. The capsule, being a mere receiver of water oozing from the vessels, performs no true secretory or glandular action, and therefore is not lined with epithelial or secretory cells except at its lower third, being merely a thin, translucent, structureless basement membrane. The epithelial cells at its lower third continue to line the uriniferous tubule which departs from it. This tubule is convoluted, at first about $\frac{1}{450}$th of an inch in diameter, later $\frac{1}{500}$th only, and its epithelium is "spheroidal" in shape. The tuft separates water by transudation. These convoluted tubes, by their glandular lining cells, separate or excrete from the adjacent capillary vessels the solid constituents of the urine, rarely as high as 5 per cent. of its entire volume. (In snakes, whose urine is nearly solid, the entire tract of capsule and tubule is lined with cells.) The convoluted tubules were discovered in the eighteenth century by Ferrein. They occupy the cortex between and around the Malpighian bodies, and continue in a transition state, as smaller, translucent, unlined, "looped" tubules, across the boundary of the cortex to the medullary or pyramidal portion, and empty into the larger, straight tubules (tubuli recti) which compose those radiating, fan-shaped masses—the pyramids. These straight tubules, discovered in the seventeenth century by Bellini, merely collect the urine and transmit it to the pelvis of the kidney. They are lined with "tessellated" or pavement epithelial cells, which are flat and polygonal, usually five-sided. These tubules have a calibre of $\frac{1}{300}$th or even $\frac{1}{200}$th of an inch. The pelvis of the kidney is lined with ovoid cells, the ureter with conoidal cells. The presence of epithelial cells of one of the several forms in excess in the urine is of service in indicating what part of the kidney is the seat of disease.

FIG. 3.



Relation of blood-vessels in the kidney to the glandular structure separating the urine: *a*, artery conveying blood by afferent vessel *va* to tuft of capillaries within the capsule *c*; *ve*, the efferent vessel removing blood to network of capillary veins *vn*, and into vein *v*; *ut*, uriniferous tubule.

Early in fœtal life the undeveloped kidneys are surmounted by the Wolffian bodies, having a structure like the kidney, a true urinary secretion, and a common duct. They disappear as the kidneys develop, and replace them. Surmounting the kidneys in adult life are small masses, the

suprarenal capsules, ductless, glandular bodies of unknown function, and chiefly interesting on account of a peculiar pigmentary, granular degeneration they rarely undergo, disseminating pigment throughout the body, impoverishing the blood, and tinging the skin. (See ADDISON'S DISEASE.)

An anatomical anomaly is the "horseshoe kidney," the two kidneys being united by an isthmus of fibrous and granular structure. Exceptionally, the kidney is "movable," and varies its position in the abdominal cavity. The nervous supply of the kidney is rich, derived from the sympathetic system. The nerves may be traced from their entrance at the hilus up to the afferent vessels of the tufts. The kidney is well known to be easily excited to action by emotion and all influences upon the sympathetic nervous system, and to have a direct and complementary relation to the functional activity of the skin.

E. DARWIN HUDSON, JR.

Kid'ron, or **Cedron,** a small stream or "brook" in the valley E. of Jerusalem, and memorable in many scenes of biblical history.

Kiel, town of Prussia, in the duchy of Holstein, on the Kieler Fjord. It is well built and beautifully situated, has a university, some manufactures, and a considerable trade. Its harbor is one of the best on the Baltic, deep and safe, and now very strongly fortified; it will be the station of the German fleet in the Baltic, and the seat of all institutions belonging to the German navy. Kiel communicates daily with Copenhagen, Christiania, and Malmö. Pop. 31,764.

Kiel'ce, government of Poland, adjoining the frontier of Austrian Galicia. Area, 3623 square miles. Pop. 470,300. It is watered by the Vistula, produces good wheat and other grains, and has abundant iron-mines. The capital is a town bearing the same name, 96 miles S. W. of Warsaw, with 7295 inhabitants; seat of a Catholic bishopric and seminary, a mining-school, and a gymnasium or academy.

Kienchow', or **Kiungchow',** city of China, capital of the island of Hainan. Pop. about 200,000. It has a considerable trade with Canton and Macao; the port has been opened to foreign commerce by treaty, but no English traders have yet settled there. The coast is rocky and infested with pirates and wreckers.

Kien'-Lung [Chinese, "celestial blessing"], fourth emperor of China of the present Manchu dynasty, b. in 1709; succeeded his father, Yung-Ching, in 1735; made war upon the Tartar tribes (1754–60) and upon the kingdom of Ava (1768); published an edict against Christianity (1753); received the first English embassy under Lord Macartney (1793); abdicated in favor of his son, Kia-King (1795), and d. Feb. 7, 1799. He was a protector of literature, wrote treatises in Chinese and Manchu, and edited a vast dictionary of the latter language.

Kie'pert (HEINRICH), b. at Berlin July 31, 1818; devoted himself from early age to the study of geography; enjoyed the instruction of Ritter; explored Asia Minor in 1841–42; was director of the geographical institute of Weimar 1845–52; returned to Berlin and became professor at the university in 1859. His *Atlas von Hellas und den hellenischen Colonien* (Berlin, 1840–46; revised ed. 1866), and his maps to Robinson's *Palestina* (Halle, 1843), attracted the attention of the scientific world. His *Historischgeographische Erläuterung der Kriege zwischen dem ost römischen Reiche und den persischen Königen der Sassaniden-Dynastie,* was awarded a prize in 1844 by the French Institute. Of his numerous other publications, *Neuer Handatlas der Erde,* 40 maps (Berlin, 1857–61), is very extensively used and much appreciated; also his *Atlas der alten Welt* (1848), etc.

Kier'kegaard (SÖREN AABYE), b. at Copenhagen in 1813, spent his whole life, almost without any exception, in his native city, living in elegant retirement, at last almost in seclusion, and d. there in 1854. His works are very numerous, some of them also very large, and comprise two series of writings, published simultaneously—one pseudonymously, the other under his name. In the former, *Whether—Or, Stages of Life, Bits of Philosophy, The Idea of Horror,* etc., he gives a sketch and a criticism of those different views of life with which people try to live in our times, and shows that outside of Christianity there is a chance for dazzling heroism, for brilliant vices, for mediocrity, and for nonsense, but none for the deepest impulses of human nature. In the latter, *Exercises in Christianity, Deeds of Love, Sermons,* etc., he develops his own conception of Christianity, partly in positive form, partly polemically, criticising the ruling theological systems. His conception is very austere. Intellectually, Christianity is a *paradox,* which can be grasped only by faith; it is the characteristic of every truly Christian idea that it is a cross to the understanding, and yet absolutely imperative in its form. Morally, it is love—not charity, or benevolence, or honesty, but love. Æsthetically—that is, in its effect on natural life—it is suffering. He was a most powerful stylist, though his style was more seducing than convincing. CLEMENS PETERSEN.

Kie'sewetter (RAFAEL GEORG), b. Aug. 29, 1773, at Holleschau, Moravia; studied philosophy and law at Olmütz and Vienna; held since 1794 different government offices in Vienna; retired in 1845, and d. Jan. 1, 1850. His writings are of great interest for the scientific study of music, especially *Geschichte der europe-abenland: Musik* (1834) and *Derweltliche Gesang von frühen Mittelalter bis zur Erfindung des dramatischen Stils* (1841).

Kies'ter, tp. of Faribault co., Minn. Pop. 61.

Kiev', Kief, or **Kiew,** government of European Russia, bordering on the Dnieper. Area, 1942 square miles. Pop. 144,276. The northern part is low and marshy; the southern, hilly, covered with branches of the Carpathian Mountains. The soil is fertile, and the climate very mild. Wheat, maize, tobacco, hemp, and vines are cultivated; excellent timber is grown and many cattle reared.

Kiev, town of Russia, the capital of the government of Kiev, on the right bank of the Dnieper. It is one of the oldest and most beautiful cities of Russia. It consists, properly speaking, of three towns, each with its own walls and fortifications—namely, Petchersk, with the famous monastery of Petcherskoi, containing the tombs of many Russian saints; Kiev proper, with the celebrated cathedral of St. Sophia, built in 1037; and Podol, which is occupied by the middle and lower classes. Kiev has a university frequented by 1500 students, and several other educational institutions. Its manufactures are not considerable, but its trade is extensive and important. Pop. 70,591.

Kikin'da, Nagy-Kikinda, or **Gross-Kikinda,** town of Austria, in the Temesvar banat, has an important annual fair and a large trade in cattle. Pop. 17,462.

Kilauea, a celebrated volcano in Hawaii, one of the Sandwich Islands, one of the largest in the world. It is in constant activity, and in the eruption of 1840 sent forth for three weeks a river of molten lava which varied from a few hundred feet to 3 miles in width. The crater is 8 miles in circumference, and varies from 800 to 1500 feet in depth. Mauna Loa, another famous volcano, is only 16 miles distant.

Kil'bourn City, post-v. of Newport tp., Columbia co., Wis., on the Wisconsin River and the Chicago Milwaukee and St. Paul R. R., 108 miles N. W. from Milwaukee. It has 8 churches, 1 bank, 4 hotels, 1 newspaper, 33 stores, 3 harness, 5 boot, 4 blacksmith, and 3 wagon shops; also saw and flour mills, sash, door, and blind factories, and a tannery. There are extensive public schools and a fine institute. Kilbourn City is surrounded by a rich farming district, is the centre of the hop-trade of the North-west, and noted as a place of summer resort, being at the foot of the famous "Dells of the Wisconsin." Three elegant little steamers ply on the river for the accommodation of the pleasure-seeker. Pop. about 1100.

FRANK O. WISNER, ED. "WISCONSIN MIRROR."

Kil'bourne (JAMES), b. at Farmington, Conn., Oct. 19, 1770; was a mechanic, a merchant, and a manufacturer; in 1800 was ordained as deacon, and at times officiated in the pulpit. Having attained considerable wealth, he was a liberal benefactor to various public institutions, and in 1802 removed to Ohio with a numerous following, and founded the town of Worthington; was a member of Congress 1813–17, and again 1839–41; was frequently elected to the State legislature; was surveyor of public lands, commissioner to settle the boundary-line between the public lands and the great Virginia reservation; and was colonel of a frontier regiment; president of the board of trustees of Worthington College for thirty-five years. D. at Worthington, O., Apr. 9, 1850.

Kildare', an inland county of the province of Leinster, Ireland. Area, 653 square miles. Pop. 83,614, of whom 28,359 cannot read or write. The ground is mostly level or slightly undulating, consisting largely of reclaimed bog; the soil is a deep and fertile loam; wheat, oats, and barley are the principal crops. The chief towns are Athy, Maynooth, and Kildare. In the centre of the county is the famous *Curragh* of Kildare, consisting of a plain of about 5000 acres, used for military encampments, and famous for athletic sports of all kinds. From 1851 to 1872, 21,614 persons emigrated from this county.

Kildare, market-town and parish in the county of the same name in Ireland, famous as the seat of one of the oldest Catholic bishoprics (said to have been founded about 500), for the Parliament held there in 1309, and for the Curragh races, held in Apr., June, Sept., and Oct. Pop. 2654.

Kildare, post-tp. of Juneau co., Wis., on the La Crosse division of the Milwaukee and St. Paul R. R., 8 miles N. W. of Kilbourn City. Pop. 585.

Kil'deer, the *Charadrius vociferus*, a North American plover, common in summer on the interior plains, and in winter frequenting the sea-coast from Texas to Massachusetts. It is named from its cry, which is constantly repeated. Its flesh is not prized very highly.

Kil'ham (Alexander), b. at Epworth, England, July 10, 1762; joined the Wesleyan Conference in 1785, and in 1796 was expelled for advocating too fervently ecclesiastical reforms, especially a more equal distribution of powers among laymen and preachers. The next year was organized "the Kilhamites" or "New Connection of Wesleyan Methodists." D. in 1798.

Ki'lia, town of European Turkey, in the province of Bessarabia, on a branch of the Danube. It carries on considerable fishing, and its preparation of caviare is celebrated. Pop. 6400.

Kil'ian, Saint, b. in Ireland early in the seventh century; devoted himself to missionary labors in Thuringia, Germany, where he was murdered with many companions in 689, being afterwards canonized. Much of the history of Saint Kilian and his companions is admitted to be legendary, but there seems to be no good reason to doubt the facts above stated.

Kilimandjaro', a mountain of Africa, situated on the western border of Zanzibar, in lat. 3° 40′ S., lon. 36° E., is supposed to be the highest mountain on the continent. Its top is covered with perpetual snow, and its height is estimated at about 18,700 feet above the level of the sea.

Kilken'ny, an inland county of the province of Leinster, Ireland. Area, 796 square miles. Pop. 109,379, mostly Roman Catholics. The surface is undulating, in some places rising to the height of 1000 feet; anthracite coal and black marble are found. The soil is light, but fertile, and crops of wheat, oats, and barley are raised. The only city of any importance is Kilkenny. From 1851 to 1872 the emigration from this county was 48,146.

Kilkenny, town of Ireland, in the county of Kilkenny, on the Nore. It has several interesting buildings, a college, a grammar school in which Swift, Congreve, Farquhar, and Berkeley received the first part of their education. Pop. 15,609.

Kilkenny, post-tp. of Le Sueur co., Minn. Pop. 730.

Killar'ney, market-town and parish of Ireland, Kerry co., 44 miles N. N. W. of Cork, situated in the midst of the most beautiful scenery, and within about a mile of the celebrated lakes to which it gives its name. The town contains several hotels, churches, and chapels, and a magnificent Roman Catholic cathedral, a dispensary and fever hospital, a poorhouse, etc. Pop. 5187. The lakes, three in number, are connected with each other; the lower lake is about 4½ miles long by 2 miles broad; the middle, 1½ miles long by ½ mile broad; the upper, 3 miles long. They receive several streams, and are interspersed with numerous islands. On a projecting peninsula which divides the middle from the lower lake stand the picturesque ruins of Muckross Abbey and Ross Castle. The lovely and picturesque scenery abounding is unsurpassed, and in the summer is a famous attraction to tourists, who resort here in large numbers.

Kill'buck, tp. of Holmes co., O. Pop. 1121.

Killbuck, tp. of Allegheny co., Pa. Pop. 1919.

Kill'er, a name applied to cetaceans of the genus *Orca*, family Delphinidæ, or dolphins, and given in allusion to their sanguinary and ravenous habits. They are noted enemies of the right whales, as well as other delphinoids, seals, fishes. The killer of the Atlantic U. S. coast is *Orca gladiator*, and that of the Pacific coast, *O. atra*.

Killiecran'kie, a celebrated pass through the Grampian Mountains, in Perthshire, Scotland, about 15 miles N. W. of Dunkeld. At the N. extremity the revolutionary army, under Gen. Mackay, was defeated on July 17, 1689, by the royalists, under Grahame of Claverhouse, Viscount Dundee, who was killed at the moment of victory.

Kil'lingly, tp. and post-v. of Windham co., Conn. The township is traversed by the Norwich and Worcester R. R., and contains several manufacturing villages, one of which is the borough of Danielsonville. Killingly has a national bank. Pop. 5712.

Kil'lington Peak, in Sherburne tp., Rutland co., Vt., 9 miles E. of Rutland, is the third in height of the Vermont mountains. It is a noble landmark, and the view from its top is very fine. Its height is 4180 feet.

Kil'lingworth, post-v. and tp. of Middlesex co., Conn., 23 miles E. of New Haven. Pop. 856.

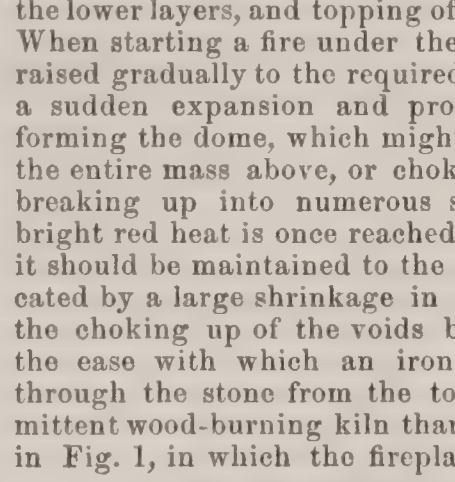
Kil'lon, tp. of Jackson co., Ill. Pop. 959.

Kilmaine' (Charles Jennings), b. at Dublin about 1750; entered the French army in 1765; served under La Fayette in the American war; became brigadier-general in 1792; was distinguished at the battle of Jemappes, in the Vendean and Italian campaigns, and was appointed in 1797 general-in-chief of the army for the invasion of England. D. at Paris Dec. 15, 1799.

Kilmar'nock, town of Scotland, in the county of Ayr. It is famous for its calico-printings, and has some tanneries and distilleries. Pop. 22,952.

Kilns [Ang.-Sax. *cyln*, from *cylene*, "a furnace or kitchen"], a name given to various kinds of furnaces or ovens constructed of brick or stone, in which a high and uniform heat can be applied to bodies for the purpose of drying, baking, or charring them, such as brick-kilns, pottery-kilns, charcoal-kilns, etc. etc. The best kiln for any special purpose is that in which the requisite intensity of heat can be produced and maintained under the most perfect control at the least expense for fuel. *Intermittent* kilns are those in which the fire is allowed to go out after each burning, to be again started after the kiln is recharged. For burning lime with wood-fuel the upright kiln is the simplest. It may be built of brick; if of other masonry, it should have a brick lining. On the inside it is circular in horizontal section, tapering slightly, by a curve both up and down, from the circle of largest diameter, which is from 4 feet to 6 feet above the bottom. A kiln of 10 to 11 feet in largest diameter may be about 25 to 28 feet high, 5 to 6 feet diameter at top, and 7 to 8 feet at bottom. There is an arched opening on one side at the bottom, 5 to 6 feet high, through which the wood is introduced and the burnt lime removed. It is advantageous to have a horizontal grating 1 to 2 feet above the bottom, on which to maintain the fire. These kilns are usually located on a hillside, so that the top is easily accessible for charging the kiln, and the bottom for supplying fuel and drawing out the lime. In charging, the largest pieces of stone to be burnt are first selected, and formed into a rough, dome-like arch, with large open joints, springing from the bottom of the kiln to a height of five or six feet. Above this arch the kiln is filled in from the top, taking the larger stones for the lower layers, and topping off with those that are smaller. When starting a fire under the dome, the heat should be raised gradually to the required degree, in order to prevent a sudden expansion and probable rupture of the stone forming the dome, which might either cause a downfall of the entire mass above, or choke the draught by the stone breaking up into numerous small fragments. After a bright red heat is once reached through the mass of stone, it should be maintained to the end of the burning, as indicated by a large shrinkage in the volume of the contents, the choking up of the voids between the fragments, and the ease with which an iron rod can be forced down through the stone from the top. A better form of intermittent wood-burning kiln than the one described is shown in Fig. 1, in which the fireplace *b* rests on a permeated brick arch, through which there is a sufficiently free circulation of air to secure the requisite draught. The interior should be lined with brick, leaving a thin space between the lining and the outside masonry, to be filled with ashes or other non-conductor. This enables the inside to expand and contract without serious injury to the kiln, and to a great extent prevents the transmission of heat to the outside masonry—an important consideration when the latter is made of stone not able to withstand great heat. In these intermittent kilns one great defect is the enormous waste of heat which takes place at each burning, for the quantity of fuel expended in raising the contents of the kiln, as well as its thick masonry walls, to the degree of heat necessary to burn lime, has to be repeated each time the kiln is charged. Another special defect is, that the stone nearest the dome is liable to become injured by overburning before the top portions become thoroughly caustic.

Fig. 1.



Intermittent bell-shaped kilns, using gas-coke or coal for fuel, are extensively employed in England, France, and Germany for burning Portland cement. The German kiln is usually about 50 feet high and 10 feet in greatest diameter. It is filled, for burning, with alternate layers of the raw cement and coke or coal, in the proportion of about one

part by weight of fuel to two parts of raw cement, and then ignited at bottom. Three to four days are required for burning, and fully five days, and sometimes more, for the kiln to cool off so that the contents can be removed. The burning is always carried to the point of incipient vitrification, and when properly burnt the pieces of cement are of a dark greenish-gray color, are quite heavy, hard to pulverize, and are cracked, contorted, and shrunken. These kilns are usually tapered to a small diameter at top, and have one or two side-openings through which they are charged.

Fig. 2.

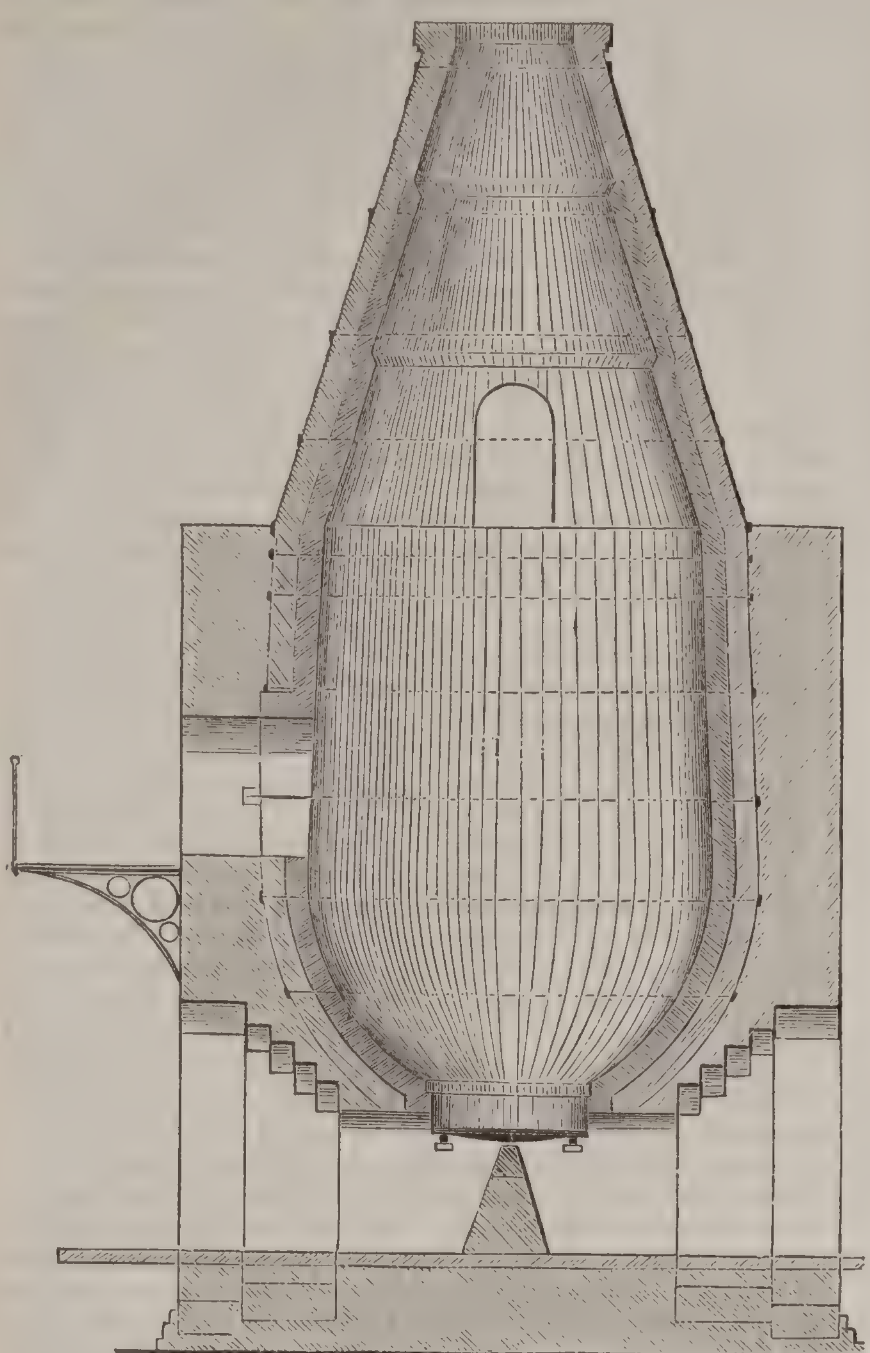
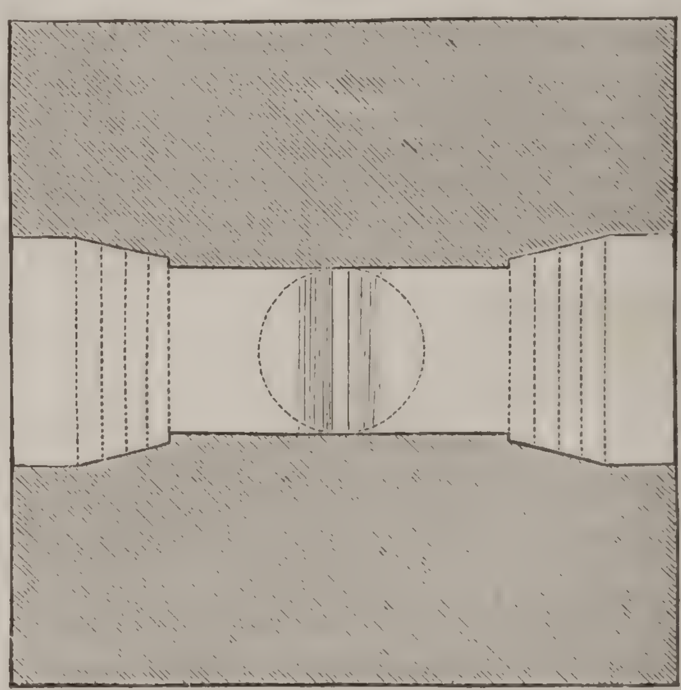


Fig. 2 represents a vertical section and elevation through the draw-pits of a Portland-cement kiln, of the form generally used upon the Thames and elsewhere in England, Fig. 3 being a sectional plan through the draw-pits. These kilns are from 37 feet to 40 feet high from the draw-pit floor to the top of the upper cone, and from 12 feet to 15 feet in largest diameter. They are built of brick, with an interior lining, 9 inches thick, of firebrick, reaching to within 5 feet of the top, properly bonded to the exterior masonry, except in the lower portion to the height of about 12 feet, which is not so bonded, and can therefore be renewed with ease whenever necessary. There are two draw-pits, opening on opposite sides, and separated from each other by a wedge of brick-work, finished in firebricks on top, which divides the descending contents of the kiln when drawing. At the bottom of the kiln, just above the wedge, a number of

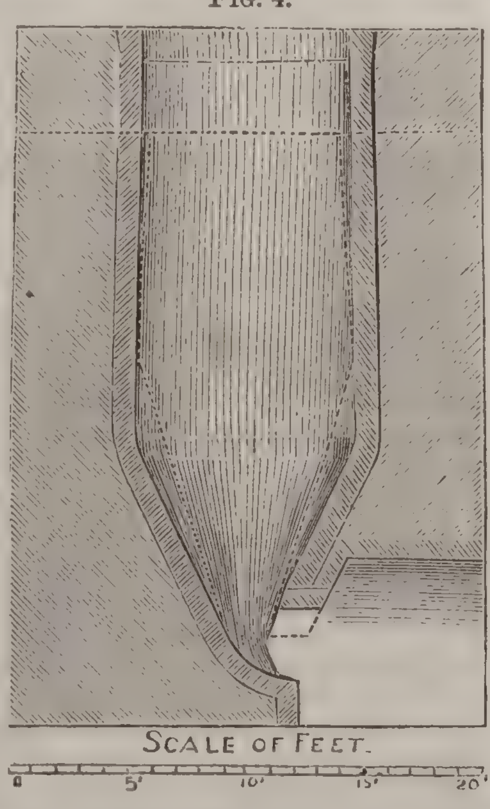
Fig. 3.



single grate-bars rest upon two cross-bars. By knocking out the cross-bars the grate-bars can be removed and the cement drawn. The kiln is charged, for burning, with alternate layers of raw cement and coke or coal—about 2 of cement to 1 of fuel by weight—through two man-holes placed on different levels. These holes are tightly closed during the burning. Sometimes, with a view to increase the draught, the top is carried up higher with a sheet-iron stack. The Coplay Cement Company are beginning to use kilns of this form for making Portland from argillaceous limestone, near Allentown, Pa. The raw stone is first finely ground between millstones, then tempered stiffly with water, and formed into lumps of irregular shape of from 3 to 5 pounds weight. These, after partial drying, are burnt in the kiln in layers, alternating with layers of anthracite coal, about sixteen days being consumed in *charging*, *burning*, *cooling*, and *drawing* a kiln.

Continuous or Perpetual Kilns.—Materials such as common lime, Roman cement, and the argillo-magnesian cements of the U. S., that do not, like Portland cement, require prolonged intense heat, can be burnt in upright kilns (either bell-shaped, cylindrical, or ovoidal) without intermission in the fires. The kiln is filled with alternate layers of coke or coal and the stone to be burned, and then fired from below with light wood. As the combustion is completed in the lower portion, the burnt stone is drawn out from time to time, allowing the entire mass above to settle down. New layers of fuel and stone are then added at top. The layers of stone should not exceed six inches in thickness. It is usual to draw the burnt stone at least twice every twenty-four hours. Fig. 4 gives a vertical section of the kilns in Ulster co., N. Y., for burning Rosendale cement. The fuel (anthracite coal) is broken up very fine. What is technically known as "second screenings" from the mines of the Delaware and Hudson Canal Co. and the Pennsylvania Coal Co. have been found to be entirely suitable. The dotted line shows the interior form of kiln preferred at Balcony Falls on the James River, Va.; 3500 pounds of anthracite or semi-bituminous coal have been found sufficient to burn 100 barrels of cement of 300 pounds each. A continuous kiln of the upright form may be operated with either wood, peat, or coal fuel, without interstratifying the latter with the limestone, by maintaining the fires in furnaces at the side of the shaft. The heat and flame are conducted into the shaft, which contains nothing but the material to be burnt. Indeed, this method is necessary when wood, which cannot be subdivided into convenient size for intermixture with the stone, is the fuel employed. Figs. 5, 6, and 7 represent a flame-kiln of this kind for anthracite coal, in which Q are holes through which the progress of the burning can be watched; R the feed-ovens for heating the coal before it passes through the dampers S into the furnaces T; U the ash-pits; V the draw-pits; W a platform in front of the furnaces; and O a division-wall to prevent the meeting of opposite draughts from the furnaces T. These kilns are sometimes called *water-flame* kilns, from the fact that the fuel before ignition is made wet with hot water, the steam from which, by its decomposition, aids the expulsion of the carbonic acid gas, and therefore, it is claimed, facilitates the burning. When designed for wood-fuel the furnaces are larger and somewhat differently arranged. These kilns are used in the U. S. for burning both common lime and cement, but are not considered adapted to the manufacture of Portland cement. Soft wood is used in them for burning lime in Rockland, Me., about 4 cords being required to burn 100 barrels of 230 to 240 pounds each, at an average saving of about three-sevenths of the fuel that would be necessarily consumed in ordinary intermittent kilns. When first starting the fire in these kilns, the portion below the level of the grate, called the thimble, is filled with light wood. The interior of the kiln, nearly up to the top, is also lined with one layer of wood set on end. The first precaution is neces-

Fig. 4.



sary, because otherwise the stone near the grate would be insufficiently burnt; and the second because the expansion of the stone when heated would injure the kiln if filled to

Fig. 5.

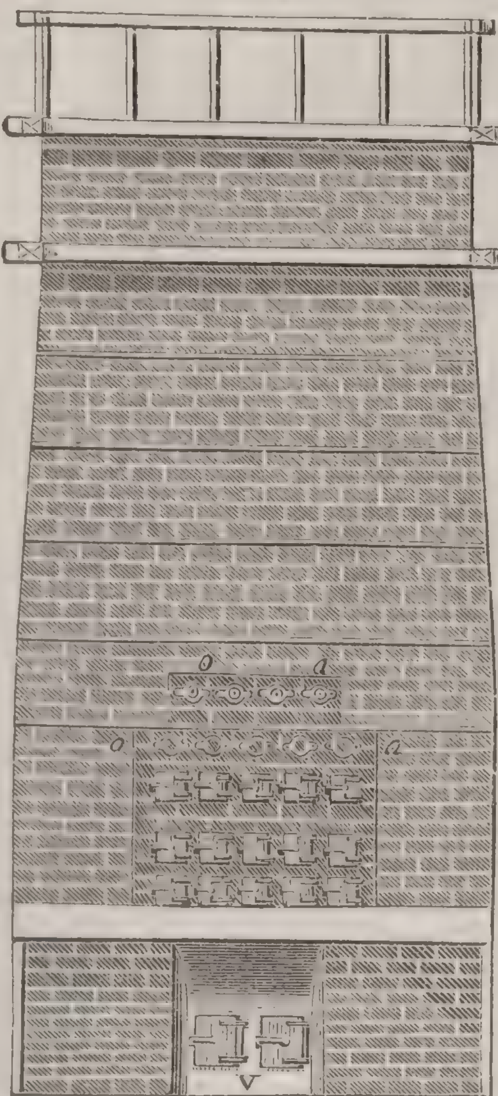
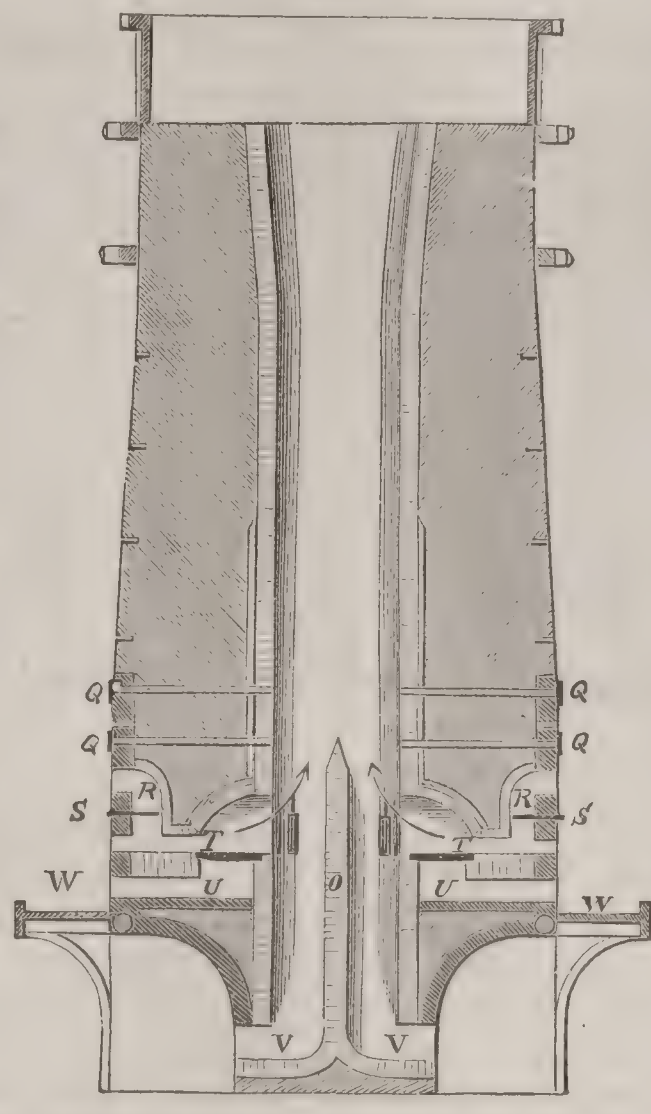
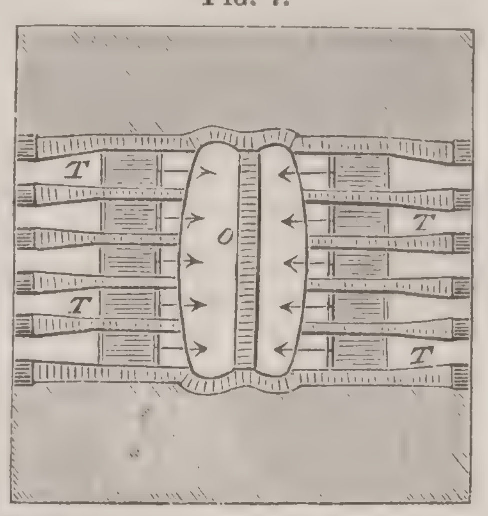


Fig. 6.



its entire capacity. The stone should be broken into pieces not exceeding 8 inches to 10 inches in diameter. In these kilns the stone is exposed to the heat from 42 to 48 hours, and the burnt lime is drawn every 6 or 8 hours, raw stone being added at the top, while the fires are steadily maintained in the furnaces. A kiln holding enough raw stone to make 175 barrels of lime should yield, when well under way, about 100 barrels every 24 hours. When the amount of work to be done is very great, several of these kilns are ranged in juxtaposition side by side, each having its furnaces on one side and its draw-pit on the other. With this arrangement a great deal of masonry is saved, as the walls separating contiguous kilns need not be very thick, and need not be carried as high as the side-walls by several feet. They should, however, terminate in a wedge, so as not to impede the downward movement of the contents of the kiln.

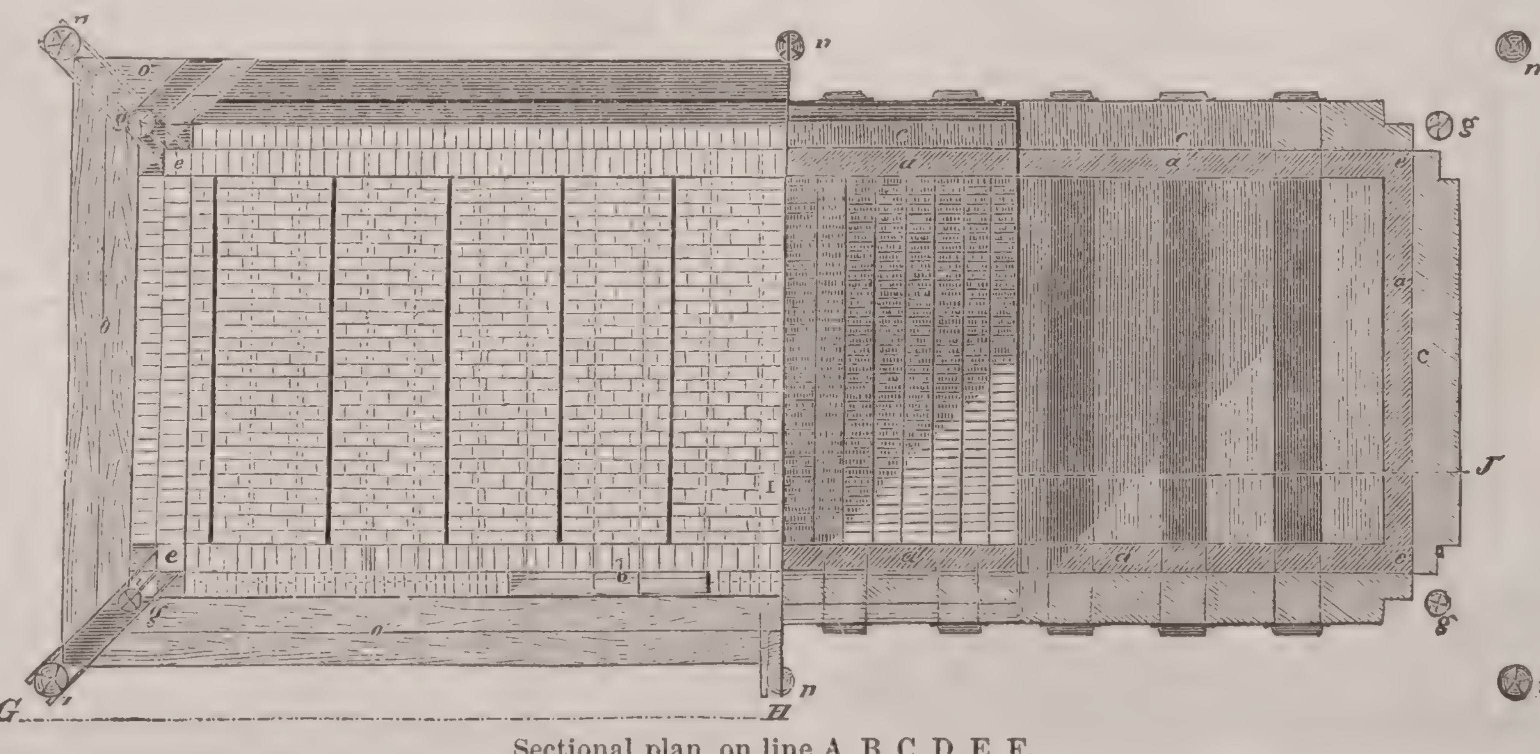
Fig. 7.



Brick-Kilns.—Bricks are burnt either in special permanent kilns, charged with the ware and emptied at each burning, or they are piled up in regular systematic layers, with openings between them, so as to form of themselves a temporary kiln, called a *clamp*. (See article Brick.) Permanent brick-kilns are of various forms, generally rectangular, and they may be arched over on top, when they are termed *close* kilns, or they are left *open*. In *close* kilns the fires are maintained in furnaces at one end, permeate through the bricks in the body of the kiln, and escape through a chimney at the other end. In *open* kilns the fires are maintained under the ware to be backed, and penetrate through the mass upward, escaping on the top. In both kilns the bricks are piled up in courses on their edges, in such manner that the bricks in the different layers cross each other, and are so far separated from each other that the flame finds a free passage between them. In the open kilns, in order better to retain the heat, the entire top of the pile is covered over during the burning with a layer of brick-dust or loam, and while the bricks are cooling off this is further covered with moist clay or sand. Kilns for burning firebrick should have a firebrick lining, and are in all respects constructed and operated with more care than is usual for manufacturing common brick.

The intermittent kiln used by Messrs. A. Hall & Sons, Perth Amboy, N. J. (Figs. 8 and 9), for baking firebrick, is rectangular in plan, about 32 feet long, and 14½ feet wide inside. It is remarkable for the comparative thinness of its walls, and by being open on top. The walls above the level of the fires consist of two distinct shells, not bonded together; the inner one, *a, a*, of firebrick, 9 inches thick and 12 feet high above the fires; and the outer one of common brick, 8 inches thick. In one of the long sides an opening of about 4′ 8″ wide is left for charging and emptying the kiln. Before the baking is commenced this opening is closed with old firebrick put in close-jointed, but dry, its outer surface only being coated over with a layer of fireclay mortar. An air-space, 2 inches wide at bottom, is left between the inner and outer walls, but the walls are gradually drawn together, so that they touch each other at top. The side-walls and end-walls of the outer shell are not bonded together at the corners, and do not overlap each other. The firebrick lining is therefore exposed to view at these points. The outer wall is built with a groove *f, f* about 2 inches deep and 3½ inches high. When the inner wall begins to expand by the effect of the heat, the interior space permits it to do so without hindrance, while it prevents a sensible loss of heat by transmission. As the heat increases the inner wall may exert some pressure against the outer one without any injurious effect on the

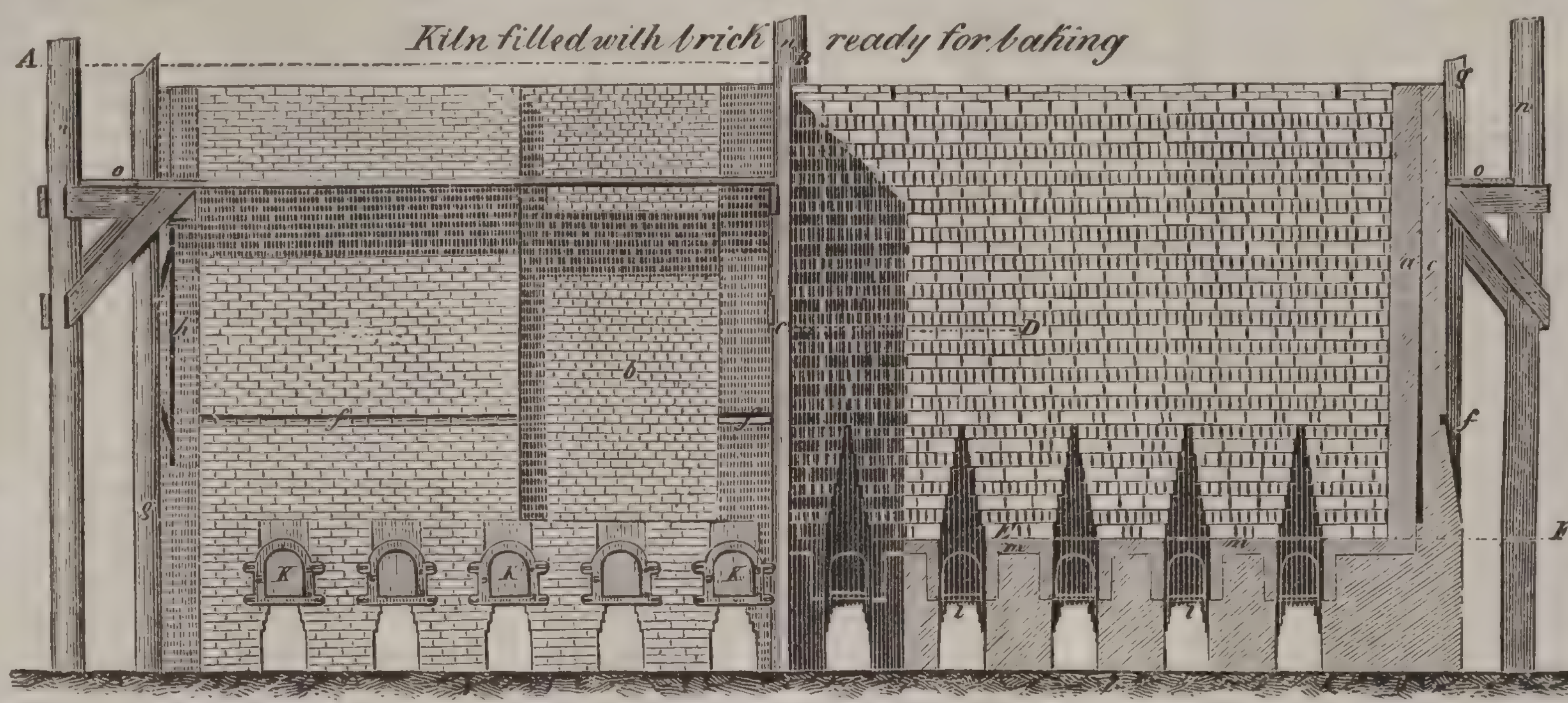
Fig. 8.



Sectional plan, on line A, B, C, D, E, F.

latter, the thin portion of the same (the groove *f, f*) acting as a sort of hinge, enabling the wall to bend outward to some extent under the pressure, and returning to its natural position when the pressure ceases. Close by, and opposite each (exposed) corner of the firebrick wall, a strong wooden post *g, g* is firmly planted in the ground. The

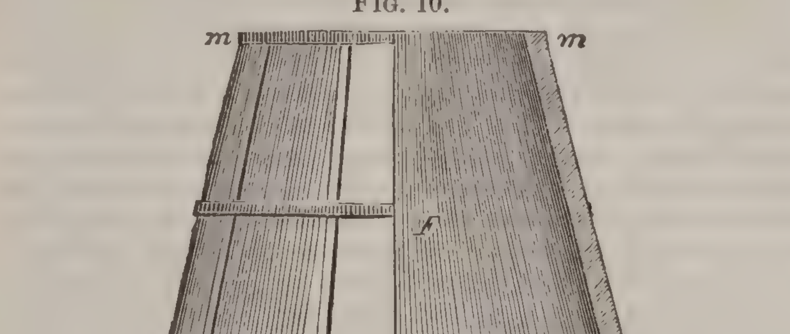
Fig. 9.



Elevation and section, on line G, H, I, J.

corners are reinforced with angle-iron *h*, and a similar piece of angle-iron *i*, bent, rests with its two ends firmly against the angle-iron of the corner, and with its convex back or middle part against the post. When the inner wall expands it tends to flatten the curve of the bent angle-iron; on cooling, the latter, by its spring-like action, returns to its original position. The kiln is heated by ten furnaces, five of which, with their doors and ash-pits, are shown in elevation (*k, k*), and five in cross-section (*l, l*). The grate-bars run across the whole width of the kiln, the furnaces or fire-holes being provided with a door at each end. Between the fire-holes and the benches (*m, m*) upon which the green brick are placed, six heavy posts (*n, n*) are placed as shown; they serve partly to support the roof over the kiln (not shown in the drawing), and partly to carry a scaffolding or platform (*o, o*) running around the kiln for easier access to the upper portions. The green or raw bricks are arranged in alternate courses, the spaces

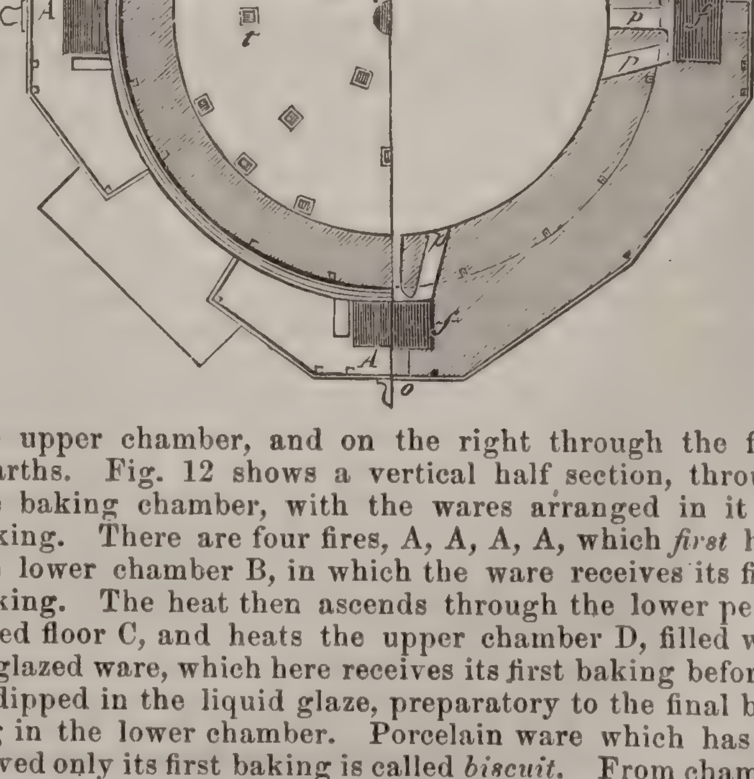
Fig. 10.



between them as nearly equal as possible. The whole pile is finished off on top with two layers of old burnt firebrick laid flat and quite close, but with a 2-inch opening over the centre of each bench and extending across the width of the kiln. The draft of the kiln can to some extent be regulated by opening or closing these 2-inch spaces. A kiln of the above kind holds about 70,000 firebrick of the usual dimensions—*i. e.* $9'' + 4\frac{1}{2}'' \times 2\frac{1}{2}''$. The baking requires about four days' firing, of which the first two days consist in easy firing, and the closing two days in sharp firing. The whole quantity of fuel consumed in one baking is stated to be 40 tons, of which a little more than half is anthracite coal, the balance of a semi-bituminous kind; the latter being used only during the latter stages of the firing. Eight to ten days are required to *charge, burn, cool off*, and *empty* a kiln of this kind.

Pottery kilns are of various forms, but in none is the fuel consumed in the same chamber or in contact with the ware. Porcelain and other finer kinds of clay ware cannot even be allowed to come in direct contact with the flame of the furnace, and are therefore always enclosed in clay boxes called *seggars*, in order that the glaze may receive no injury. The kiln in which the celebrated *Sèvres* ware is baked is a variety of the upright flame-kiln, subdivided into two or more compartments or stories by perforated floors. Fig. 10 represents this kiln, the left half being in elevation and the right half in vertical sectional elevation. Fig. 11 is a horizontal sectional plan, on the left through

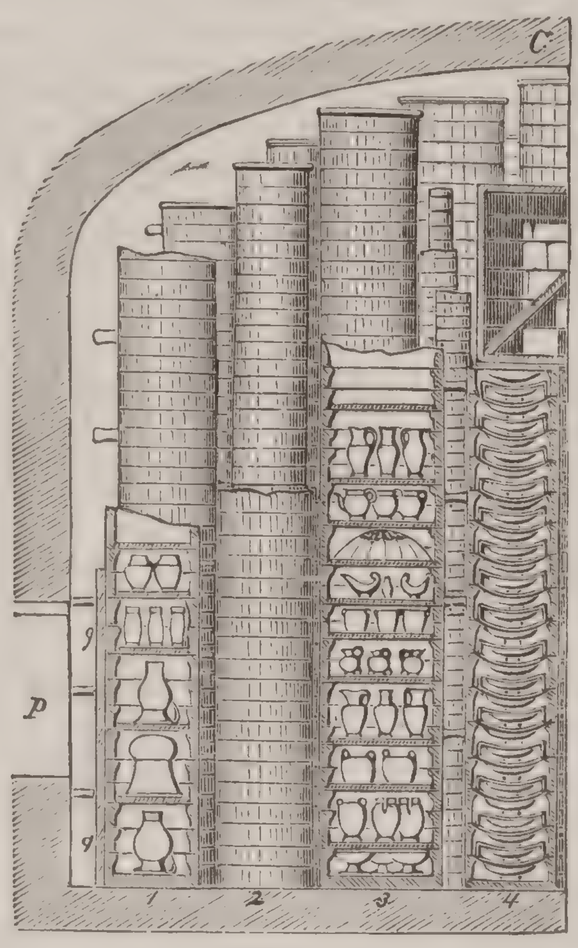
Fig. 11.



the upper chamber, and on the right through the fire-hearths. Fig. 12 shows a vertical half section, through the baking chamber, with the wares arranged in it for baking. There are four fires, A, A, A, A, which *first* heat the lower chamber B, in which the ware receives its final baking. The heat then ascends through the lower perforated floor C, and heats the upper chamber D, filled with unglazed ware, which here receives its first baking before it is dipped in the liquid glaze, preparatory to the final baking in the lower chamber. Porcelain ware which has received only its first baking is called *biscuit*. From chamber D the heat ascends to a third space E, usually used for

baking *biscuit* or *seggars*, and then escapes through the chimney F. G, G are the doors through which the wares are introduced and removed; *t, t, t* are the openings

FIG. 12.



Pottery kiln.

through the floors C, there being only half as many such openings in the upper as there are in the lower floor. The flue from the furnaces to the lower chamber are each divided into three channels, *p, p, p* of plan. Small openings *w, w* are made through the wall of the chamber B for observing the color and intensity of the heat, and for introducing small samples of biscuit covered with glaze, in order to ascertain the progress of the baking. These holes are closed on the outside with a tube-stopper carrying a plate-glass disk or diaphragm, and a sliding damper. These kilns are usually at least 20 feet in interior diameter and 40 feet high. They are built of ordinary brick masonry, with a firebrick lining, and are surrounded by a system of iron bands, *m, m, m*. When starting the fires, coals of burning charcoal are first put into the space *c*, and light wood introduced through the aperture *b* until the space *f* is completely full. The downward draught through *b* creates a long flame in *f*, which reaches through the flues *p, p, p* into the chamber B. The aperture *o*, for stirring the fire, is generally kept closed with a clay stopper; *d* is the ash-pit. The draught is regulated by the movable lid of the aperture *b*. The piling of the seggars one above the other for baking is shown in Fig. 12, some in section and others in profile; *g, g* are plates of refractory clay called fireguards, set in front of the flues to prevent the flame coming in direct contact with the seggars, and to exclude ashes and dust. Light wood-fuel split up small is almost universally used for baking porcelain. Those kinds which burn with a long and vigorous flame, and discharge but little ash and dust into the kiln, are preferred. At Sèvres *poplar* is used, and generally in Germany *pine*. These kilns can be operated at the rate of about one firing per week, and the average endurance of the Sèvres kilns is about 300 firings, or six years. In other places several have been known to last from twenty-five to thirty years. During the baking the heat in the lower chamber reaches from 130° to 160° of Wedgwood's pyrometer (equivalent to from 11,000° to 12,000° C. and from 19,830° to 21,632° F.). On the upper floor the temperature varies from 30° to 60° Wedgwood. Articles of common stoneware and pottery are baked in kilns of much simpler construction than the Sèvres kiln. The ware is not placed in seggars piled up in columns, but the flame is allowed to come in direct contact with it. In form they somewhat resemble the ordinary baker's oven, consisting essentially of an ellipsoidal dome of brick, with a brick or earthen floor, and having at one end a furnace and at the other a chimney-flue. In some cases the floor ascends from the furnace to the chimney-flue, in others it is horizontal. The larger kilns, which are 50 to 60 feet in length, are usually divided into two compartments by a transverse vertical wall constructed with numerous openings to allow the heat to pass freely through. The compartment next the furnace, being the most intensely heated, is used for baking stoneware. In this the heat frequently attains 120° Wedgwood. The other compartment is used for baking common pottery. With the large kilns about five days of preliminary fire and three days of baking fire are required at each burning. The fuel employed, which may be either wood or coal, determines the details of the furnace.

The Hoffmann Kiln (Figs. 13 and 14).—Imagine a railroad tunnel 8 to 9 feet high by 10 to 12 feet span, built of

FIG. 13.
Section on line A, B.

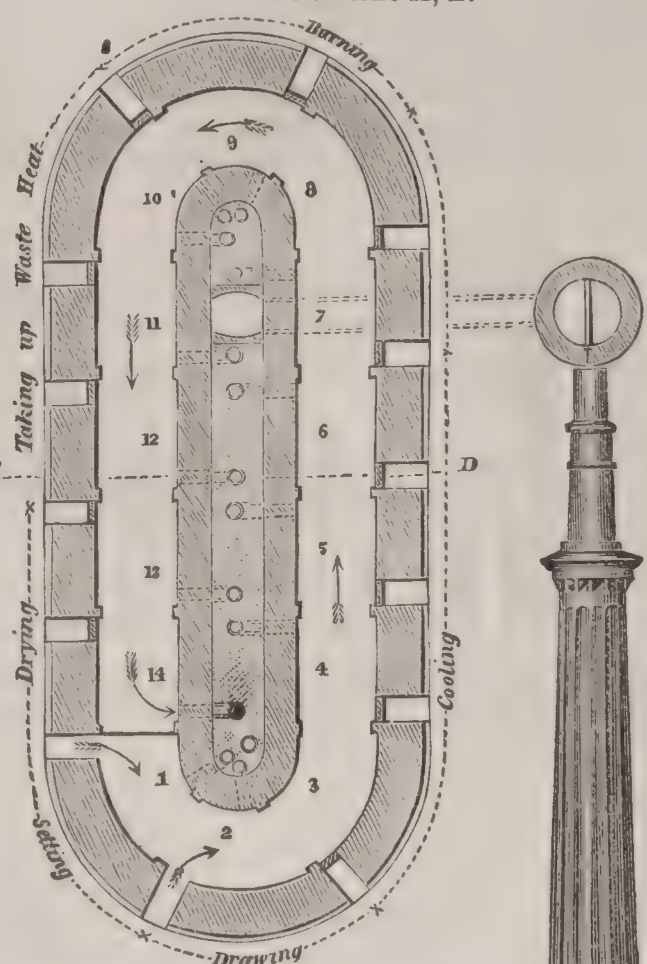
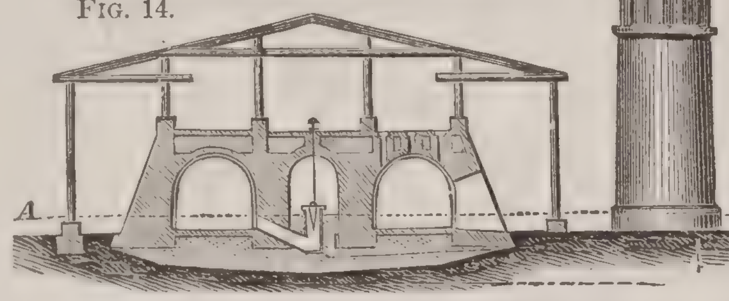


FIG. 14.



Section on line C, D, Hoffman kiln.

brick continuously around a long oval of such dimensions that the central line of the annular chamber thus formed is about 350 feet long. This annular chamber is called the *burning chamber*. In the centre of the narrow space enclosed by the ring is a long *flue* called the *smoke-chamber*, leading to a high chimney. Fourteen flues lead at equal intervals from the lower inner side of the burning chamber into the smoke-chamber, entering it vertically from the bottom, each provided at its end in the smoke-chamber with a damper that can be opened and closed at pleasure by means of a vertical rod operated on top of the arch. There are also fourteen doorways, each about 5 feet high, through the outer wall of the burning chamber, placed at regular intervals. The arched top of the burning chamber is pierced at intervals of 3 to 4 feet each way with vertical holes about 5 inches in diameter, called *feed-holes*, which are used for supplying the fires with fuel and watching the burning. These holes are kept habitually closed with dampers on top. It is customary to call each portion of the burning chamber between two consecutive doorways, including one of them, a compartment, although there is no permanent division of the burning chamber into smaller chambers. Each compartment is therefore 25 feet in length along the axis, and has one doorway at its left-hand outer angle, and one smoke-flue at the floor in the inner angle diagonally opposite to the doorway, the observer being supposed to be entering a doorway.

Manner of Using the Kiln.—Let the compartment, and also the doorways and flues corresponding thereto severally, be numbered from 1 to 14. When the kiln is in operation all the compartments but two or, exceptionally, three, are filled with the material to be burnt. Suppose Nos. 1 and 2 are empty, and all the others filled. All the doorways except Nos. 1 and 2 are temporarily closed with brickwork, and all the flues except No. 14 are closed with their dampers. Workmen are filling compartment No. 1 with raw limestone, and removing burnt lime from compartment No. 2. Compartment No. 3 contains limestone put in twelve days ago. Compartment No. 4 that put in eleven days ago, and so on around to No. 14, which was filled yesterday. A sheet-iron movable partition, called the *cut-off*, separates No. 14 from No. 1. Yesterday it was between No. 13 and

No. 14; to-morrow it will be between No. 1 and No. 2. Yesterday, all the flues except No. 13 were closed; to-morrow, only flue No. 1 will be open. Yesterday, men were setting limestone in No. 14, and removing burnt lime from No. 1; to-morrow they will be filling No. 2, and emptying No. 3. Every day, therefore, the *setting, drawing, cut-off*, and *open flue* advance one compartment. The compartments not yet fired are heated by the hot gases passing through them to the chimney, the stone in the compartment next in advance of the fire being at a full red heat, while that farthest off, in No. 14, which was put in yesterday, is only warm. No fuel is put in with the ware when charging the kiln. It is all supplied through the feed-holes. A serious objection to the Hoffmann kiln is that the force of the draught and the progress of the combustion cannot always be regulated with certainty, even by the most experienced and careful burner. For instance, the draught through the chambers 7 and 8 is longitudinal entirely, and can only be changed by opening the flues in these chambers, giving a cross draught towards the inner wall, which may or may not be desirable. It would operate very badly if the combustion next the outer wall was too slow, in which case a flue in the outside wall would be advantageous.

The Morand Kiln (Figs. 15, 16, 17, 18, and 19), for burning by successive chambers, is an improvement on Hoff-

FIG. 16.

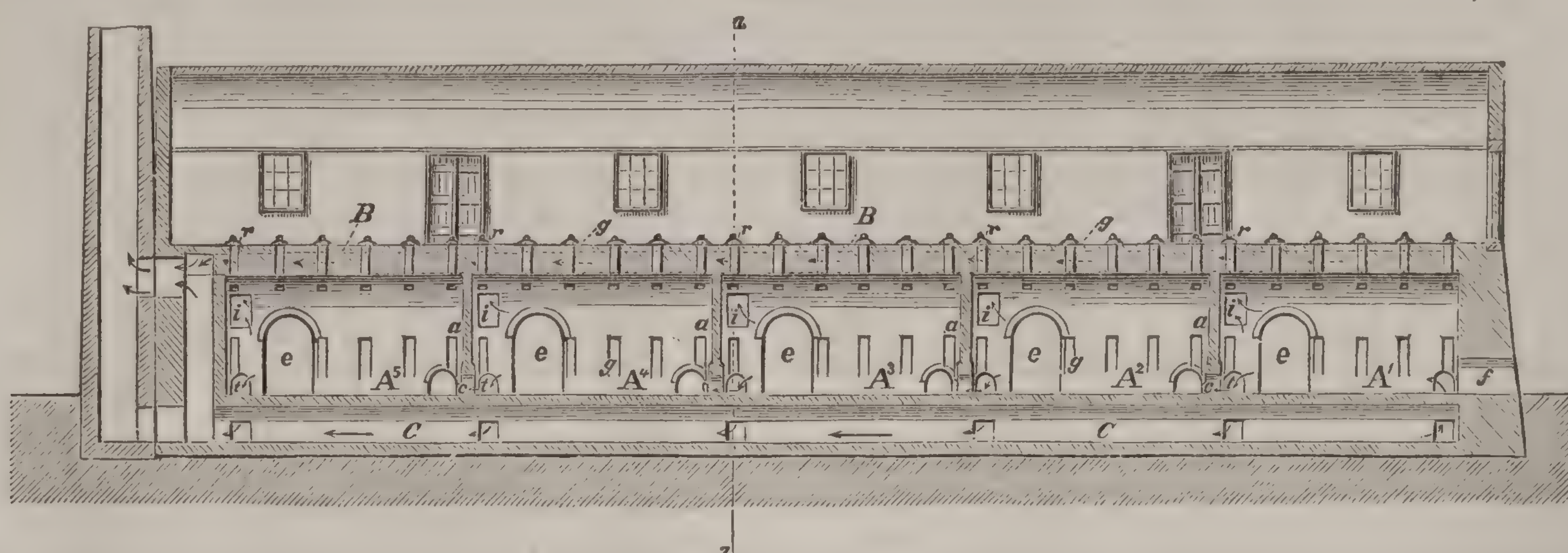


FIG. 15.

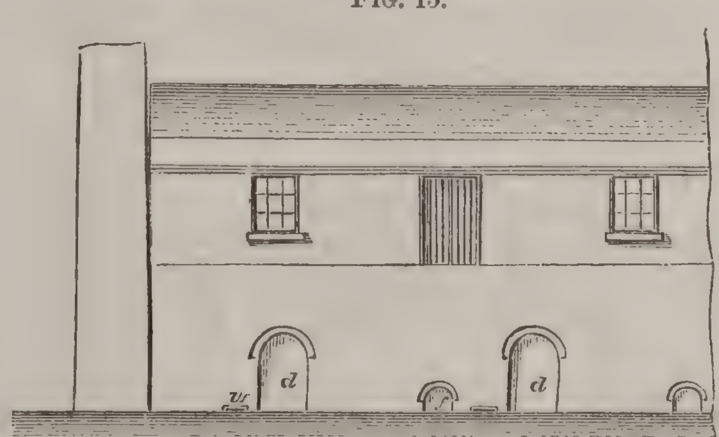


FIG. 18.

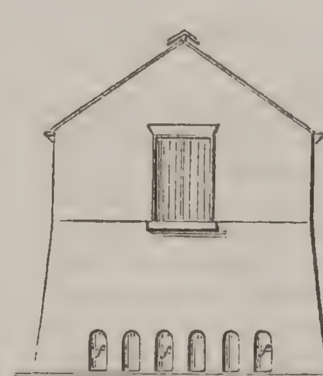


FIG. 17.

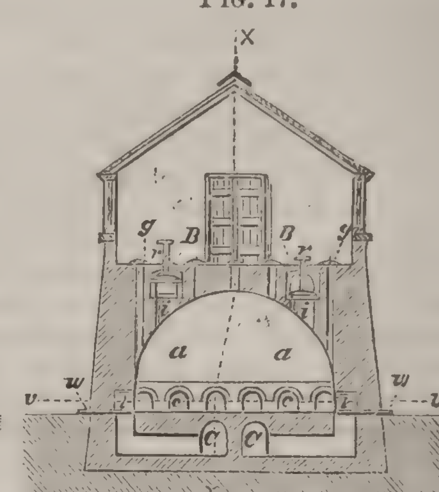
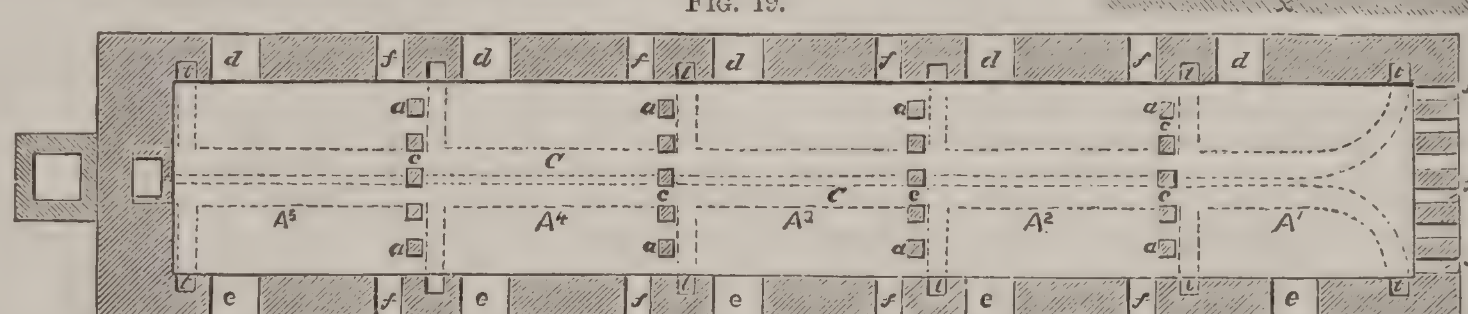


FIG. 19.



Morand kiln.

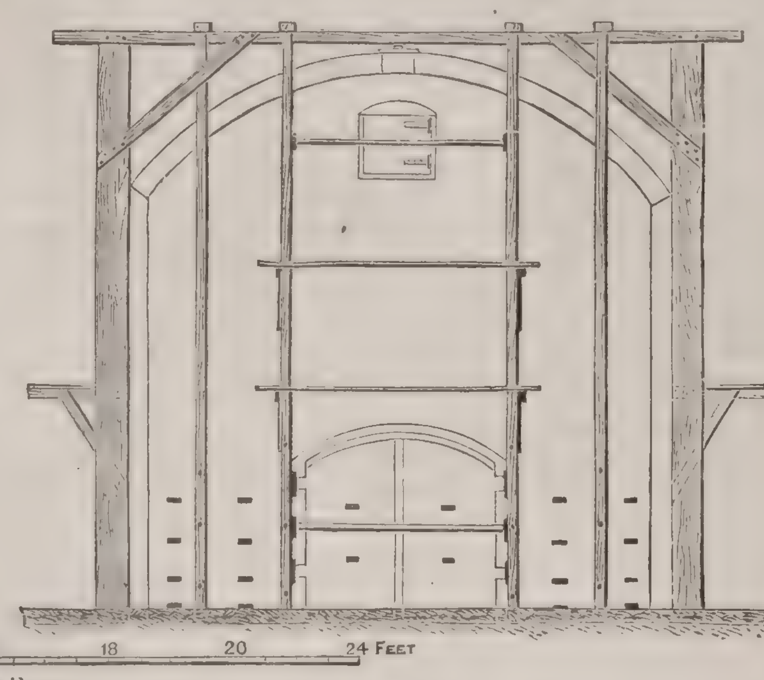
mann's, inasmuch as it has longitudinal flues both above and below the burning chamber, with branch flues fitted with dampers leading into them at the top and bottom of each chamber, so that the direction and force of the draught and the progress of the burning are under better control. Fig. 15 is a side elevation of a portion of a kiln of five chambers built of bricks; Fig. 16 is a longitudinal section and elevation through the dotted line x, x of Fig. 17; Fig. 17 is a transverse section on line z, z of Fig. 16; Fig. 18 is an end elevation; and Fig. 19 is a sectional plan, showing the horizontal bottom-flues in dotted lines. A^1, A^2, etc. are the drying and burning chambers, separated from each other by brick partition-walls, perforated at the bottom with openings c, c. In kilns for burning bricks these walls, except their lower portion to the height of about 2 feet, are usually formed of the green bricks to be burned. Each chamber is provided with doorways, d and e, through which it is filled and emptied, and with small fireplaces, f, f, placed at the floor level. In chamber A^1, where the firing begins, there are six fireplaces in the end-wall of the kiln. In the other chamber there are only two, placed opposite each other in the end of the chamber nearest to chamber A^1. In the haunches of the arch above the chambers there are two longitudinal steam and smoke draught-flues, B, B, and below the chambers there are two others, C, C, called hot-air flues, all four leading from chamber A^1 to the chimney at the other end of the kiln. In each chamber in the end farthest from chamber A^1 there are four corresponding branch flues, two at top, i, i, and two at bottom, t, t, leading respectively into the four longitudinal flues. These branch flues are provided with dampers, r, r, r and w, w, w, for opening and closing them at pleasure. The two lower flues, C, C, may be replaced by a single flue. There are numerous feed-holes, g, g, through the arch for supplying fuel, arranged substantially as in the Hoffmann kiln. This kiln is operated as follows: All the chambers, A^1, A^2, etc., are first suitably filled with the articles to be baked. The doorways and feed-holes are then closed, as are also the branch flues leading to the lower longitudinal flues. The branch flues i, i leading from A^1 into the upper longitudinal flues B, B, are open. Fires are then started in the fireplaces f, f, of chamber A^1. As the wares in this chamber are gradually dried and heated, the steam and vapor which they give off escapes through the flues B, B to the chimney at the far end of the kiln, without passing through and injuring or discoloring the wares in A^2. When the wares are sufficiently dried in A^1 the top branch flues in that chamber are closed, and those in chamber A^2 opened, so that the waste heat from A^1 passes through A^2, and dries and heats the green wares therein before it passes into the upper flues B, B, and thence to the chimney. Or, if chamber A^2 is not charged ready for drying, the surplus heat from A^1 may be carried to A^3, or to any other chamber, through the lower longitudinal flue C, by a suitable adjustment of the dampers; so that the surplus heat from one chamber is utilized in drying and heating the next or any following chamber, until A^5 is reached. When the wares in any chamber are sufficiently dried, fires are started in the fireplaces f, and stoking from the feed-holes at top follows at the proper time, or when there is heat enough in the chamber to ignite the fuel thus supplied. When the wares in A^5 are sufficiently dried, the upper dampers in

that chamber are closed and the lower ones opened, so that the surplus heat, instead of entering the chimney, is thus conveyed back through the flues C, C to A[1], or to any other chamber by a suitable adjustment of dampers, for drying the green wares with which that chamber has in the mean time been freshly charged. The steam and vapor from a drying chamber always pass directly to the chimney through the upper flues B, B, creating a draught quite sufficient to draw the heat through the lower flues C, C from any burning chamber into any drying chamber. It will thus be seen that the operation of this kiln is completely under the control of the burner. The fuel used for stoking from above is finely pulverized coal, such as *smudge* or refuse coal. In the fireplaces either coal or wood will answer. In economy of fuel, simplicity of management, and uniformity of burning, whether for bricks, firebricks, cement, or pottery, this kiln seems to combine every essential feature of excellence.

Charcoal Kilns are of a variety of forms and sizes. Those used in the U. S. for making charcoal on a large scale for smelting-furnaces are made of brick, some being rectangular in plan and covered on top with a flat brick arch, while others, known as the beehive kiln, are circular in plan and dome-shaped. A rectangular kiln 40 feet by 16 feet in plan (Figs. 20 and 21), with side-walls 13 feet high, covered over with an arch of 4-feet rise, will hold nearly 90 cords

Fig. 20.

Fig. 21.



Charcoal kilns.

of merchantable wood. As the side-walls and arch are habitually made only 8 inches (or one brick) thick as a measure of economy, they are always supported by a timber framework on the outside to prevent their being thrown down by alternate expansion and contraction when in use. The end-walls are generally 1 foot thick. The supporting frame consists of upright timbers 4 inches by 12 inches, and 19 feet long, placed about 3 feet apart, with their edges against the side-walls and end-walls. They are tied together at top by 4-inch by 6-inch horizontal cross-ties. For a kiln of the above dimensions fourteen of these frames, each consisting of two uprights and one cross-tie, embrace the kiln transversely, and four of them longitudinally. The transverse frames are stiffened at the angles by diagonal braces, spiked to the uprights and cross-ties. In the side and end-walls numerous vent-holes are left, each of the width and thickness of a brick (about 4 inches by 2 inches). There are 152 of these holes, arranged in four horizontal rows of 38 holes each, the upper row being 4 feet from the bottom of the wall, the next row 2½ feet, the next 1 foot, while the lowest row is placed just about the level of the floor of the kiln. In one end of the kiln there is an opening about 6 feet by 6 feet at the level of the floor, through which most of the wood is introduced and the charcoal removed. Above this, near the crown of the arch, there is a smaller opening, 2 feet by 2 feet, for completing the filling of the kiln. Both openings are fitted with boiler-iron doors, and are tightly closed during the burning. There are three vent-holes on top through the crown of the arch, about 10 feet apart, each 1 foot by 1 foot, closed with iron dampers. The kiln having been compactly filled to the crown of the arch with wood, cut and split into the usual merchantable sizes, the two end-doors are then closed, and fires are then started in the three vent-holes on top. These holes are then at once closed with the dampers, all the small vent-holes below being open. The fire slowly and gradually works its way downward through the mass of wood, its progress being known to a skilful burner by the color and volume of smoke issuing from the lower vent-holes. From 6 to 7 days are required to completely char the contents of a kiln of the dimensions above given. The lower vent-holes are closed from time to time, one after the other, as the burning is completed in their vicinity, and finally, when they are all closed, the kiln is whitewashed all over in order to close all the pores through which the air could enter, and it is allowed to stand four or five days for the fire to go out. When skilfully operated, these kilns will yield 45 bushels of charcoal to the cord of wood. With wood costing $2.50 per cord at the kiln, the cost of the charcoal will not vary much from 9½ to 10 cents per bushel. This covers *filling, coaling, whitewashing,* and current repairs of kiln.

Q. A. Gillmore.

Kilo [Gr. χίλιοι, "thousand"], a prefix used in the French metrical system to denote a thousand times the measure indicated by the word to which it is prefixed; as, Kilogramme, a thousand grammes, the unit of commercial weight, is equal to 2.20462125 pounds avoirdupois; Kilolitre, a thousand litres, a measure of capacity, is equal to 264.18635 gallons; Kilomètre, a thousand mètres, the unit of linear measure, is equal to 0.62138 mile; Kilostere, a thousand steres, a measure of solidity, is equal to 35316.58 cubic feet. The latter term is rarely employed, measures of solidity or volume being expressed in cubic denominations of the linear base. (See Metric System.)

Kil′patrick (Andrew Robert), M. D., b. Mar. 24, 1817, near Cheneyville, Rapides parish, La.; educated in Georgia under the tuition of a Baptist clergyman, Rev. Otis Smith; graduated in the Medical College of Georgia at Augusta in Mar., 1837; practised medicine first in Burke co., Ga., then (1838–43) in Avoyelles parish, La.; but removed to Woodville, Miss., where he passed through a severe epidemic yellow fever in 1844, and published a full report of it in the *New Orleans Medical Journal.* From 1847 to 1863 he resided near Trinity, in Concordia parish, La., during which time he contributed articles to the *New Orleans Medical Journal;* to an annual medical publication, edited by Dr. E. D. Fenner, styled *Southern Medical Reports; Historical Memoranda of Concordia and Catahoula Parishes,* besides other articles in *De Bow's Review,* New Orleans; some articles to *Lippincott's Gazetteer;* a sketch of the early Baptists in Mississippi and Louisiana; and kept meteorological tables for the Smithsonian Institution. In 1863 he removed to Texas, and in 1866 settled in Navasota, Grimes co., where he now (1875) resides. He passed through an epidemic yellow fever in 1867, and published a report of the same in the *Texas Medical Journal.* In 1868 he was chosen professor of anatomy in the Texas Medical College in Galveston; edited the *Navasota Weekly Tablet* in 1870–71; one of the assistant editors of the *Southern Medical Record,* Atlanta, Ga., in 1873–75; also contributing articles to the *Medical and Surgical Reporter,* Philadelphia, the *Richmond and Louisville Medical Journal,* and *The American Medical Weekly* of Louisville, Ky.

Kilpatrick (Hugh Judson), b. near Deckertown, N. J., Jan. 14, 1836; graduated at the U. S. Military Academy, and entered the army as second lieutenant of artillery May 6, 1861; was commissioned captain 5th New York Vols. May 9, and wounded at battle of Big Bethel, June 10. On his recovery was commissioned lieutenant-colonel 2d New York Cavalry Vols., of which regiment he became colonel Dec., 1862. With his regiment he participated in the Rappahannock campaign, in the second battle of Bull Run, and many minor actions, and in the Maryland campaign. During "Stoneman's raid" to the rear of Gen. Lee's army he commanded a brigade of cavalry, and was promoted to be brigadier-general of volunteers June, 1863. At the battle of Gettysburg he commanded a brigade and division. In

Apr., 1864, he was ordered to duty with Gen. Sherman in the West, and at the battle of Resaca, May, 1864, was severely wounded. During Gen. Sherman's march to the sea and subsequent campaign through the Carolinas he commanded the cavalry and was actively engaged. In June, 1865, he was promoted to be major-general of volunteers. He resigned his commission in the regular army Dec., 1865, and his volunteer commission Jan. 1, 1866. In Nov., 1865, he was appointed U. S. minister to Chili; recalled in 1868.
G. C. Simmons.

Kil'ty (Augustus H.), U. S. N., b. Nov. 25, 1806, in Maryland; entered the navy as a midshipman July 4, 1821; became a passed midshipman in 1832, a lieutenant in 1837, a commander in 1855, a captain in 1862, a commodore in 1866; retired in 1868. Commanded the Mound City in the action with the Confederate gunboats off Fort Pillow, May 10, 1862, and with the St. Charles batteries on White River, June 17, 1862. In this latter engagement Commander Kilty was severely injured by the explosion of the steam-chest of the Mound City, which had been pierced by a shell. In his official report to the navy department of June 20, 1862, Flag-officer Davis says: "Commander Kilty is out of danger, but he is severely crippled in his hands and feet, and suffers a great deal. He is a brave gentleman and a loyal officer. He has always been conspicuous in this squadron for acting his part in the best spirit of the profession." Foxhall A. Parker.

Kilwa. See Quiloa.

Kilwinning, a small town in the county of Ayr, Scotland, famous for an ancient abbey, now destroyed, which was the birthplace of Scottish Masonry. Until 1736, when the Grand Lodge of Scotland was formed, all other lodges in Scotland received their charters from "Mother Kilwinning." This prerogative was exercised down to 1807. Eglinton Castle in this town was the scene of the famous "Eglinton Tournament" in 1839. Pop. about 4000.

Kim'ball, tp. of St. Clair co., Mich. Pop. 1091.

Kimball (Heber C.), b. in 1801; joined the Mormons in 1832 at Kirtland, O.; in 1835 became one of the twelve apostles of that sect; in 1837–38 was a missionary in England; in 1838 went to the Mormon colony in Ray co., Mo.; removed thence to Nauvoo, Ill.; and in 1846 became head priest of the order of Melchizedek at Salt Lake City, where he d. June 22, 1868.

Kimball (Richard Burleigh), b. at Plainfield, N. H., Oct. 11, 1816; graduated at Dartmouth in 1834; studied law in Europe; practised at Waterford, Saratoga co., N. Y., and removed in 1840 to New York City. Among his numerous works the most widely known is *St. Leger* (1849); others are *Letters from Cuba* (1850), *Cuba and the Cubans* (1850), *Romance of Student-life Abroad* (1853), *Henry Powers, Banker* (1868), and *To-day* (1870). He has contributed much to periodical literature.

Kim'berley (John Wodehouse), Earl of, b. in England Jan. 7, 1826; graduated at Christ Church, Oxford, in 1847; succeeded his grandfather as Baron Wodehouse in 1846; was under-secretary for foreign affairs from 1852 to 1856, and again from 1859 to 1861, under the administrations of Lords Aberdeen and Palmerston; was ambassador to Russia in 1856; special minister to several states with reference to the Schleswig-Holstein question in 1863, and lord lieutenant of Ireland from 1864 to 1866, in which latter year he was raised to the earldom of Kimberley. Under the second Gladstone administration he was lord privy seal (1868) and secretary of state for the colonies (1870).

Kim'berly (Lewis A.), U. S. N., b. in 1830 in New York; entered the navy as a midshipman Dec. 8, 1846; became a passed midshipman in 1852, a lieutenant in 1855, a lieutenant-commander in 1862, a commander in 1866; served in the flagship Hartford at the capture of New Orleans and in her various engagements on the Mississippi, and was her executive officer at the battle of Mobile Bay. In his official report of Aug. 6, 1864, Capt. Percival Drayton writes: "To Lieut.-Com. Kimberly, the executive officer, I am indebted not only for the fine example of coolness and self-possession which he set to those around him, but also for the excellent condition to which he had brought everything belonging to the fighting department of the ship, in consequence of which there was no confusion anywhere, even when, from the terrible slaughter at some of the guns, it might have been looked for."
Foxhall A. Parker.

Kim'ble, county of S. W. Central Texas. Area, about 1300 square miles. It is a rough, broken region, with good pasturage and timber, and numerous salt-licks. The valleys have a good soil, which, however, requires irrigation, for which there are many facilities. Pop. 72.

Kim'brough, tp. of Arkansas co., Ark. Pop. 611.

Kim'chi (David), Rabbi, b. at Narbonne, Provence, in 1160; was one of the most distinguished Hebrew writers of the Middle Ages. Little is known of his personal history beyond the fact that in 1232 he was designated by the French and Spanish rabbis as arbiter to settle the heated controversies in the synagogues growing out of the doctrines advanced in Maimonides' *More Nevochim.* His works consist of commentaries on nearly all the books of the Old Testament, some of which are given in the rabbinical Bibles; a Hebrew grammar and lexicon bearing the name of *Miklol* ("Perfection"), which have been the basis of all modern works of the same kind; and a *Refutation of Christianity,* based upon the denial of Messianic predictions in the Psalms. D. Kimchi exhibited such hostility to Christianity throughout his commentaries that numerous passages were struck out by the Inquisition as a condition of permitting their publication. Several of his works remain in manuscript. D. at Narbonne in 1240. His father, Joseph, and his brother, Moses, were also distinguished rabbis of Provence, the former having been driven from Spain by Mohammedan persecution. Both left some grammatical and exegetical writings.

Kim'meridge Clay, an important bed of marl in many localities, several hundred feet in thickness, and often very bituminous, is so called from Kimmeridge in Dorsetshire, England. It constitutes the argillaceous member of the Upper Oolitic formation. (See Jurassic.) It contains many distinctive fossils (*Ostrea deltoidea, Exogyra virgula,* etc.), and has yielded the remains of the *Pliosaurus.*

Kim'polung, town of Wallachia, is situated in a mountain-region near the Transylvanian frontier, and carries on a considerable transit trade. Pop. 8695.

Kim'shew, tp. of Butte co., Cal. Pop. 857.

Kin'aston (Sir Francis), b. at Otley, Shropshire, England, in 1587; studied at Oxford and Cambridge; was employed at court, and gained the favor of the king, by whom he was knighted in 1618. He wrote a Latin translation of Chaucer's *Troilus and Cressida,* and several other volumes of verse, but is chiefly remembered as the founder and regent of a sort of university at London called "Minerva's Museum," chartered by the king June 26, 1635. Owing to the civil war it came to a speedy end, and Kinaston d. in 1642.

Kincaid', tp. of Jackson co., Ill. Pop. 1049.

Kincar'dine, port of entry of Bruce co., Ont., Canada, on Lake Huron, ships grain, lumber, salt, bark, fish, wool, and butter. It has some manufactures and 2 weekly newspapers. Pop. of v. 1907; of tp. exclusive, 4097.

Kincar'dineshire, or **The Mearns,** county of Scotland, between the Dee, the North Esk, and the North Sea. Area, 381 square miles. Pop. 34,651. A great part of the country is covered by the Grampian Mountains, of which Mount Battock rises to the hight of 3500 feet. But at the foot of this mountain-range lies the "How o' the Mearns," a low and very fertile tract of land, yielding excellent crops of wheat and oats. Large herds of sheep and short-horned cattle graze on the mountain-pastures. Cap. Stonehaven.

Kind (Karl Theodor), b. at Leipsic Oct. 7, 1799; studied law, and began in 1824 to practise as an advocate. After the Greek war of liberation he contributed very much to spread among his countrymen a fuller knowledge of Modern Greece, its institutions, language, and literature. His most prominent writings are—*Neugriechische Volkslieder* (1827), *Neugriechische Chrestomathie* (1835), *Geschichte der griechischen Revolution* (2 vols., 1833), translations from Alexander Sutso, and a Greek-German dictionary.

Kin'dergarten is the name given by Friedrich Froebel to a company of children between the nursery age and that of the primary schools, who are to be educated according to a certain method. The literal meaning of the word *kindergarten* is "garden of children," and it suggests Froebel's method by speaking of children as if they were plants to be cultivated.

Up to Froebel's time the method of educating had been *to drill,* a process properly applicable only to stone, but which well expressed the hard mechanical method of proceeding from the outward inward, instead of from the inward outward, as the growth of all living organisms must do. As, to prepare himself for his work, the gardener of plants first learns the general laws and conditions of vegetable growth, and next inquires into the special soils, degrees of light, temperature, and moisture necessary to the perfect development of the several species of plants, so Froebel proposed that educators should prepare themselves to cultivate young children—first, by acquainting themselves with the general laws and conditions of human nature, for the purpose of bringing forth the common sense and common conscience; and, secondly, by a careful study of the individual possibilities of beauty and power of the several children committed to their care. Froebel may be

called the Copernicus of education, from the new point of view that he took; or its Newton, from the new character of method that he proposed. Seeing that the child, a mere sensibility, comes into nature from God on the flood-tide of self-activity—not an isolated individual abandoned to the reactions of the inexorable material universe, but in living relation with humanity's heart in the person of the mother, whose duty as well as inmost desire it is to bring him into a joyful sense of his relations to his race, to nature, and to God—Froebel sought and found the clue to the true method of education by analyzing the instinctive play of mother and child, when she studies its instincts and spontaneities in order that she may help him to enjoy his body, which is the first world that circumscribes him. Having found that the child takes possession of his own body and develops his organs of sense by first acting, and then realizing his action as a conscious fact, Froebel discovered that in the same manner he must be brought to take possession in a measure, and gradually, of the universe outside of his body; that is, he must be led to *act* with the purpose of making *orderly* changes (he instinctively makes changes, not with the intention to compass an end, but simply because he *can*). The reaction his activity provokes, gives him impressions which rise into thoughts, by expressing themselves in words that re-echo his impressions, and later, into knowledge, by embodying themselves in transient effects, or productions more permanent, which reflect his inner being to his individual consciousness.

But as the sympathizing mother—not peremptorily, but genially—assisted the child to know and use his organs of sense and locomotion in nursery play till he could run alone and began to speak, so the kindergartners, who take the child from his mother's arms, as it were, must—not peremptorily, but genially—superintend his production of effects, and assist him to express himself freely in conversation, while he is following the laws of order suggested to him in producing objects, whether transient or more permanent, that give him experimental knowledge of the laws and order of nature, making outward things a stepping-stone, not a stumbling-block, of progress.

The Froebel education is not, however, merely organic, or even artistic and intellectual, but moral and religious also, never losing sight of the principle that spontaneous (or at least a willing) *doing* precedes thinking, and thinking precedes knowing, and knowing precedes naming, and naming, or language, is the creative element of human in contradistinction to merely animal intelligence.

As, when the child runs alone and speaks, the nursery education merges in the kindergarten, so, when the child can manipulate cleverly, converse intelligently, and begins to invent, and has come to a sense of moral responsibility by learning "fair play" with his companions, the kindergarten merges in the school. He is then ripe for learning to read and write, to appreciate signs, words having become familiar with things signified, material and mental, as substantial facts. Elementary materials for the child's production, by which he is educated, were gradually elaborated by Froebel in fifty years of experimenting, and consist of a series of solids, round, cubicular, and triangular, divided and subdivided, with tablets, square and triangular, sticks of various lengths, peas or balls of wax representing points, cards for sewing with colored threads, paper for folding, cutting, pricking, and drawing, also for weaving; all to be used under the supervision of the kindergartner to make forms of order and use, but leaving the children a fair margin for their free choice.

Besides these manipulations, which meet and employ instinctive spontaneities, the instinctive desire to work upon the earth is not allowed to die out from want of opportunity to plant and cultivate. The vegetable world is always at hand, and affords subjects for examination and analysis, which engage attention next after the works of his own hands. The latter are the first and best objects for lessons, since what a child has done or made, interests and even commands his attention, and what he has made himself he can exhaustively know—not merely its appearances, but the law and method of its being, which is the child's own thought. If he is allowed to give an account of how he did it, and what he made it for, he will have a pattern, as it were, to follow in analyzing any one of nature's works, learning its law and referring it to its Author; and thus the education of Froebel leads the child to God through his mother, who represents to him infinite Love, and nature, which represents to him infinite Wisdom. In the spirit that makes these one he comes to feel that he "lives, moves, and has his being," for "we are the offspring of God," as heathen poet and Christian apostle agree.

The methods of using Froebel's materials for education are indicated in the manuals prepared for aiding kindergartners, written under the direction of Froebel's ablest disciple and apostle, the baroness Marenholtz-Bulow. There is one in German, edited by Goldammer, and one in French, edited by Jacobs, and named *Le Jardin des Enfans.* Both are amply illustrated by plates—the former published in Berlin, the latter in Brussels by F. Claassen. In the beginning of his career, Froebel published a work under the title *Menschen-Erziehung* ("Education of Man"), in which the word *kindergarten* does not occur, but all the elements of it are manifest. The best edition of it is edited by his disciple and relative, Lange, and it is published in Hamburg. It has been translated into French by the baroness Crombrugghe. Later in life, Froebel published his characteristic and unique work, *Mutter-Spiel und Kose-Lieder*, which has been translated and set to music by Lady Baker, and published in London. The notes to these, with its pictorial illustrations, have been translated by the baroness Crombrugghe into French, and called *Causeries des Mères.* It is a kind of nursery manual. The baroness Marenholtz-Bulow has published many works, among which are eminent *Education by Labor, The Educational Mission of Women, The Child's Workshop,* and a pamphlet translated into English, and published by the National Bureau of Education in their *Circular of Information* for July, 1872, which may be had for the asking by any citizen of the U. S. In America Mrs. Matilda H. Kriege has published extracts, freely translated, from the above works in a little book called *The Child in its Relations to Nature, to Man, and to God;* and W. Hailmann, a small book on *Kindergarten Culture.* There is also a monthly periodical devoted to the interests of this most radical of reforms, published in Cambridge, Mass. ELIZABETH P. PEABODY.

Kinderhook′, tp. of Tallapoosa co., Ala. Pop. 800.

Kinderhook, post-tp. of Pike co., Ill., on the Hannibal and Naples branch of the Toledo Wabash and Western R. R. Pop. 1454.

Kinderhook, post-tp. of Branch co., Mich. Pop. 637.

Kinderhook, post-v. and tp. of Columbia co., N. Y., 20 miles S. E. of Albany and 5 miles E. of the Hudson River, on the Boston and Albany R. R. The township includes the villages of Valatie and Niverville. Kinderhook Village has 4 churches, 1 weekly newspaper, 1 cotton-mill, and 2 national banks. Valatie has 4 churches, 4 cotton-mills, a knitting-mill, and 2 hotels. Lindenwald, the home of the late ex-President, Martin Van Buren, is 2 miles S. of Kinderhook Village. He was a native of this town. Pop. of tp. 4055. WM. B. HOWLAND, ED. "ADVERTISER."

Kinderhook, tp. of Washington co., Va. Pop. 2391.

Kineau, or **Kinau,** queen of the Sandwich Islands, b. in the beginning of this century; reigned from the death of Kamehameha II., in 1823, to the accession of Kamehameha III., in 1833. D. in 1844. She was much opposed to the French Roman Catholic mission, and in favor of the Protestant American Methodist mission.

King, county of Washington Territory, extending from Puget Sound E. to the Cascade Mountains. It is an uneven, heavily-timbered region, with a good soil and a mild climate. Lumbering is the chief pursuit. Excellent lignitic coal abounds. Area, about 1550 square miles. Cap. Seattle. Pop. 2120.

King, tp. of Christian co., Ill. Pop. 413.

King (AUSTIN A.), b. in Sullivan co., Tenn., Sept. 20, 1801; became a lawyer 1822, removed to Missouri 1830; was circuit judge of Ray co. 1837–48, and again in 1862; governor of Missouri 1849–53; member of Congress 1862–64. D. at St. Louis Apr. 22, 1870.

King (CHARLES), LL.D., the son of Rufus King, b. in New York Mar. 16, 1789; educated at Harrow School, England, and at Paris, while his father was U. S. minister to Great Britain, serving afterward in the banking-house of Hope & Co., Amsterdam. In 1806 he returned to New York; entered in 1810 into mercantile business with Mr. Archibald Gracie, his father-in-law; served for a time in 1814 as a volunteer in the war with England; was sent to England as commissioner to investigate the treatment of Dartmoor prisoners; was associate with Verplanck in editing the *New York American* 1823–27; sole editor 1827–47; and afterward associated with Col. Webb in the editorship of the *Courier and Enquirer;* was president of Columbia College 1849–64, and d. at Frascati, Italy, Sept. 27, 1867. He wrote a sketch of the Croton Aqueduct (4to, 1843), *History of the New York Chamber of Commerce,* and published many addresses.

King (HORATIO), b. at Paris, Oxford co., Me., June 21, 1811; learned the printing trade, and published in his native State a newspaper called *The Jeffersonian;* was appointed clerk in the post-office department at Washington in 1839; by gradual promotion became first assistant postmaster-general in 1854; was appointed postmaster-general

in 1861 by Pres. Buchanan; retired from office on the accession of Pres. Lincoln, but remained in Washington; rendered service in various capacities during the civil war, and became especially prominent by his successful efforts to elevate the standard of society life in Washington, by introducing a literary element into social reunions.

King (James Gore), son of Rufus King, b. in New York May 8, 1791; studied in the best English schools, and graduated at Harvard in 1810; studied law; was an adjutant-general in the army 1812–15; became a prominent merchant of New York and Liverpool; member of Congress from New Jersey 1849–51, and president of the New York Chamber of Commerce. D. at Highwood, N. J., Oct. 3, 1853.

King (John Alsop), eldest son of Rufus King, b. in New York Jan. 3, 1788; educated at Harrow, England, and Paris; served as a cavalry officer 1812–15; elected to New York assembly in 1819 and to senate in 1823; was secretary of legation in London in 1826, and afterward *chargé d'affaires* there; was a member of Congress 1849–51, and governor of New York 1857–58; delegate to the "Peace convention" of 1861, and to the State constitutional convention of 1867, besides holding at different times many other important public positions in that State. D. at Jamaica, L. I., July 7, 1868.

King (John Crookshanks), b. at Kilwinning, Scotland, Oct. 11, 1806; educated as a practical machinist; came to the U. S. in 1829; was engaged for several years as superintendent of factories at Cincinnati and Louisville, but in 1834 turned his attention to sculpture, in which he met with great success, having executed busts of Daniel Webster, John Quincy Adams, Agassiz, Emerson, Shaw, and many other prominent men. He has devoted himself especially to cameo likenesses, and resides at Boston.

King (John P.), b. Apr. 3, 1799, near Glascow, Barren co., Ky. His father soon after moved to Bedford co., Tenn., where the son remained until 1815, when he made his way to Georgia; studied law, and was admitted to the bar in Augusta in 1819, before his majority. In 1822 he visited Europe, where he spent two years in completing and perfecting his education. During this period he attended lectures in Edinburgh and Paris; on his return he rose rapidly in his profession amidst the most formidable competition. In a few years he acquired a large estate. In 1833 he was chosen a member of the constitutional convention of Georgia of that year. In this body he greatly distinguished himself. He was a Jackson Democrat, and by his superior talents took the lead of that party in the convention. Before this his reputation had not extended beyond the limits of the county of Richmond, but by his debates in this convention, and especially by his discussion with the late William H. Crawford (who was the Democratic Congressional caucus candidate for President of the U. S. in 1824), he rose in one bound to the forefront of the ablest and most eloquent men in Georgia. The next year he was sent to the U. S. Senate, where he took and maintained a high position; but some of his party presses of the State having censured (unjustly, as he thought) a very notable speech he made against some of the leading measures of Mr. Van Buren's administration, he promptly resigned the trust committed to his charge, retired to private life, and resumed his profession in 1838. No like abandonment of politics from personal disgust has occurred in the history of the U. S. In 1841 he was elected to the presidency of the Georgia R. R. and Banking Co., which position (June, 1875) he continues to hold, and for many years has been regarded one of the first railroad men in the country.

A. H. Stephens.

King (Jonas), D. D., b. at Hawley, Mass., July 29, 1792; graduated at Williams College in 1816 and at Andover Seminary in 1819; preached for a time in South Carolina; was 1823–26 a missionary in Syria, and 1828–69 a missionary at Athens. He was the author of quite numerous writings in the modern Greek language, and by reason of some of his publications was sentenced in 1852 to fifteen days' imprisonment and expulsion from the kingdom, but an official protest saved him from the fulfilment of the sentence. D. at Athens May 22, 1869.

King (Mitchell), LL.D., b. in Scotland June 8, 1783; removed in 1806 to Charleston, S. C., and became a professor in Charleston College, of which he was afterwards for some time president. In 1810 he was admitted to the bar, and began a prosperous law-practice. In 1819, and again in 1842–44, he was judge of the city court. He early attained a wide fame for learning, and for many years was a leader in the cause of education and in many enterprises for the improvement of the public taste and for the diffusion of knowledge.

King (Peter), Lord, b. at Exeter, Eng., in 1669, was a nephew of Locke; studied at the University of Leyden, Holland, and read law at the Inner Temple; entered Parliament in 1699; was one of the managers of the impeachment of Sacheverell in 1709, and in 1712 was counsel for Whiston. By George I. he was made chief-justice of common pleas and privy councillor, and in 1725 was appointed lord chancellor, with the title of Baron King of Ockham. He resigned in 1733, and d. at Ockham, Surrey, July 22, 1734. Baron King wrote several treatises in support of the rights of dissenters, and a *Critical History of the Apostles' Creed* (1702).

King (Philip Parker), Admiral, b. on Norfolk Island Dec. 13, 1793, his father being one of the founders of that colony, and afterwards (1800) governor of New South Wales (Australia); entered the navy in 1807; commanded an exploring expedition in Australian waters in 1817 and on the coasts of Patagonia in 1825, publishing in both cases the hydrographical results of the survey. He afterwards settled in Australia, where he took an active part in politics and other public interests. He was appointed rear-admiral in 1854, and d. at Grantham, near Sydney, in Feb., 1855.

King (Preston), b. at Ogdensburg, N. Y., Oct. 14, 1806; graduated at Union College in 1827; became a prominent lawyer, journalist, and Democratic politician of St. Lawrence co., N. Y., and held various offices; was in Congress 1843–47 and 1849–53; a Republican U. S. Senator 1857–63; became in 1865 collector of the port of New York. He was drowned in New York harbor, Nov. 13, 1865.

King (Richard John), b. in England about 1820; wrote for John Murray his valuable series of *Handbooks to the Cathedrals of England*, and has contributed to *Fraser's* and other magazines some very able topographical and antiquarian sketches of English counties and towns, which were published collectively in 1874.

King (Rufus), Gen., son of Charles, b. New York City Jan. 26, 1814; graduated at U. S. Military Academy; was appointed brevet second lieutenant of engineers July 1, 1833; resigned Sept. 30, 1836, and for two succeeding years was assistant engineer on the Erie R. R., and for four years (1839–43) adjutant-general of the State of New York. Associated during this time and until 1845 in the editorial conduct of the Albany *Evening Journal*, in the latter year he removed to Wisconsin, and assumed charge of the Milwaukee *Sentinel*, of which he was editor until 1861, when he was appointed U. S. minister to Rome; but the outbreak of the civil war caused him to tender his services to the government in a military capacity, and in May, 1861, he was appointed a brigadier-general of volunteers, serving as such in various departments in Virginia until Oct., 1863, when he resigned from the army and assumed his duties at Rome as U. S. minister. Recalled July 1, 1867.

G. C. Simmons.

King (Rufus), LL.D., b. at Scarborough, Me., Mar. 24, 1755, son of Richard King, a wealthy merchant; graduated at Harvard College in 1777; studied law under Theophilus Parsons at Newburyport; was on the staff of Gen. Glover in the Rhode Island campaign of 1778; admitted to the bar; commenced practice at Newburyport in 1780; elected a member of the general court or legislature of Massachusetts in 1782 and succeeding years, and by the legislature chosen in 1784 as delegate to the Continental Congress at Trenton, N. J. One of his earliest acts in Congress was to move a resolution (Mar., 1785) "that there be neither slavery nor involuntary servitude in any of the States described in the resolution of Congress of Apr., 1784 (the North-west Territories), otherwise than in punishment of crime whereof the party shall have been personally guilty; and that this regulation shall be made an article of compact and remain a fundamental principle of the Constitution between the original States and each of the States named in said resolves." This resolution was, by a vote of 7 States against 4, referred to the committee of the whole, and not further acted upon until two years later, when its provisions were embodied in the famous ordinance for the government of the N. W. Territories presented to Congress at New York July 11, 1787, by Nathan Dane of Massachusetts, which became the Magna Charta of five great States. King was one of the commissioners appointed by Massachusetts to settle the boundary of that State with New York, and also empowered, with his colleague Dane, to convey to the U. S. the large tract of land beyond the Alleghanies which was claimed by the State. In Aug., 1786, he was associated with James Monroe as a committee to represent to the legislature of Pennsylvania the necessities and embarrassments of the Federal treasury with reference to the 5 per cent. impost levied by Congress on the States. Elected a member of the convention for framing the Federal Constitution, King took his seat May 25, 1787, participated actively in the debates, and was one of the committee on revision of style and arrangement of the ar-

ticles. After signing the Constitution he returned to Massachusetts, was elected to the State convention for the consideration of that instrument, and was instrumental in securing its ratification, notwithstanding violent opposition. In 1788 he removed to New York City, where two years before he had married Mary, daughter of John Alsop, and in 1789 was elected one of the first Federal Senators for New York under the newly established Constitution, his colleague being Gen. Schuyler. He was re-elected in 1795. On the formation of the earliest national political parties, King ranked as one of the leaders of the Federalists. His ardent defence of Jay's treaty with England (1784), both in the Senate and in the press, under the signature of "Camillus," brought him into conspicuous favor with Pres. Washington, who offered him the secretaryship of state on the resignation of Edmund Randolph, and in 1796 appointed him minister to England. He remained in London eight years, notwithstanding the accession of the opposite party to power in 1801, and discharged the duties of his post during that important epoch of European history with great tact and ability. Returning to the U. S. in 1804, he settled on a farm at Jamaica, L. I., where he remained for some years in retirement, but on the outbreak of the war with Great Britain (1813) was elected for the third time to the U. S. Senate. King was opposed to that war, but aided in passing the measures necessary for its prosecution, and after the Capitol was burned in Aug., 1814, he made a stirring appeal to the country to avenge the outrage. His policy after the war was directed towards the speediest recovery of national prosperity; he was chiefly instrumental in securing the navigation and commercial acts of 1818; took an interest in promoting trade with the West Indies; strongly opposed the establishment of a national bank, and procured the enactment of a general measure regulating the sales for cash of the public lands. In 1816 he was, against his will, nominated by the Federalists as their candidate for governor, but was defeated. In 1819 he was elected to a fourth term in the Senate, during which he was chiefly conspicuous as leader of the opposition to the admission of Missouri as a slave State, and to the extension of slavery generally. His speeches on this subject formed a point of departure for all subsequent Congressional debates on slavery. On Feb. 16, 1825, a few days before his final withdrawal from the Senate, he offered a resolution for devoting the proceeds of the sales of public lands to the purchase and emancipation of slaves and their removal to some foreign country. Later in the same year King accepted a new appointment as minister to England, at the urgent request of Pres. J. Q. Adams, but resigned and returned home the following year (1826), on account of ill-health. D. at Jamaica, L. I., Apr. 29, 1827. He is generally acknowledged to have been an able diplomatist, a wise and liberal statesman, a brilliant orator, a genuine patriot, and a philanthropist of enlarged views and true insight. PORTER C. BLISS.

King (THOMAS BUTLER), b. in Hampden, Hampshire co., Mass., Aug. 27, 1804; was educated at Westfield Academy; studied law, and moved to Georgia in 1823, where he married a lady of wealth and devoted himself to planting. His residence is on St. Simon's Island. He was from 1832 a member of the State senate for a number of years, in which body he greatly distinguished himself by his efforts in the cause of public works for cheap transportation. He was a member of Congress from Georgia from 1839 to 1843, and from 1845 to 1849. While in Congress naval affairs chiefly occupied his attention. Many valuable reports upon these subjects were made by him during his terms of service. In 1849, Gen. Taylor sent him on a special mission to the then Territory of California, where, in connection with Gen. Riley, he rendered important service in preserving law and order where no organized civil government existed; and this was done without any active interference on the part of the military. While in California he established interests of an individual character which subsequently required his attention to the exclusion of politics for several years. In 1860, while he was opposed to the policy of secession (as most of the large slaveholders of the South were), yet when Georgia in 1861 resolved to adopt that measure, he cast his fortunes with those of the State. D. May 10, 1864. A. H. STEPHENS.

King (THOMAS STARR), b. in New York Dec. 16, 1824; d. in San Francisco, Cal., Mar. 4, 1864. His father was a Universalist minister in Charlestown, Mass. Young King had a passion for study, but was obliged from family necessities to forego a college education. From twelve till twenty he labored first as clerk in a store, afterwards as a teacher, preparing himself in leisure hours for the ministry. His first preaching was in Woburn, Mass., his first settlement in Charlestown, over his father's parish. In 1848 he accepted a call to the Unitarian church in Hollis street, Boston, and remained there till the spring of 1860, when he went to California to take charge of the Unitarian church in San Francisco. The outbreak of the civil war roused all his remarkable powers as a writer, speaker, and man, and to his influence is ascribed the change of public opinion in the State from lukewarmness towards the Northern cause to devoted loyalty. Through his exertions the U. S. Sanitary Commission obtained the generous sums of money that enabled it to carry on its work at the critical period of the war. Mr. King's eloquence as a preacher and lecturer, which was familiar throughout the West and North-west, made him equally popular on the Pacific coast. His personal qualities endeared him to all who knew him. But for his incessant labors in the pulpit and on the platform he would have been eminent as a writer. He contributed frequently to the *Universalist Quarterly*, but he published but one book, *The White Hills, their Legends, Landscapes, and Poetry* (1859). A few of his papers were collected after his death—*Patriotism, and other Papers* (1864). The same year Richard Frothingham wrote a brief memoir, *Tribute to Thomas Starr King*. In 1850 Mr. King received the honorary degree of A. M. from Harvard College. O. B. FROTHINGHAM.

King (WILLIAM), b. at Scarborough, Me., Feb. 9, 1768; was endowed with distinguished talents, and with equal educational advantages might have become as prominent as Rufus, his celebrated brother. After residing at Topsham for some years, he settled at Bath as a merchant about 1800; was for several terms a member of the Massachusetts legislature, was one of the leading advocates of the separation of Maine, president of the convention which framed the constitution of Maine, and first governor of the new State. In 1821 he was made U. S. commissioner for the adjustment of Spanish claims, was a general of militia, collector of customs at Bath 1831–34, and a patron of institutions of learning. D. at Bath June 17, 1852.

King (WILLIAM), b. at Antrim, Ulster, Ireland, May 1, 1650; studied at Trinity College, Dublin; entered the Church in 1674; became dean of St. Patrick in 1688, in which year he was twice imprisoned in the tower of Dublin for sympathizing with the English revolutionists. He became bishop of Kerry in 1691, archbishop of Dublin in 1702; was one of the lords justices of Ireland in 1717, 1721, and 1723, and d. at Dublin May 8, 1729. He wrote several controversial works against Catholicism, but is best known by a remarkable Latin treatise on the origin of evil (*De Origine Mali*, 1702), and by a sermon on predestination (1709), in which he maintains that the moral attributes of God are different from the qualities bearing the same name among mankind.

King (WILLIAM RUFUS), b. in Sampson co., N. C., Apr. 7, 1786; graduated at Chapel Hill, University of North Carolina, in 1803; studied law, and was admitted to the bar in 1806. The same year he was elected to the legislature from his native county, and was re-elected to the same position in 1807; this, however, he resigned on the meeting of the legislature to accept the appointment of State solicitor for the Wilmington circuit, which office he also resigned after holding it for two years. In 1809 he was again returned to the State legislature; in 1810 he was returned a member of Congress from his district, and continued by re-elections to hold this position until 1816, when he resigned it to become secretary of legation under William Pinckney, American minister, first to Naples, and then to St. Petersburg. During his Congressional term he was an ardent and able advocate of the war-policy and measures of Mr. Madison's administration. On his return from Europe in 1818 he moved to the then Territory of Alabama, where he established a plantation and devoted his attention to agriculture. In 1819 he was a member of the constitutional convention of the Territory of Alabama; and upon the admission of Alabama as a State into the Federal Union, the same year, under the constitution formed by this convention, he was elected one of the two U. S. Senators, which position he continued to hold from 1819 to 1844. During the whole of his Senatorial career Mr. King was a zealous supporter of the views and policy of Gen. Jackson. He advocated his election to the Presidency in 1824, 1828, and 1832; he also sustained with great ability the policy of Mr. Van Buren, who so closely followed in the "footsteps of his illustrious predecessor." In 1844 he resigned his position in the U. S. Senate, and accepted the appointment of minister to France tendered to him by Pres. Tyler. The special object of this mission was to prevent France from uniting with England in a joint protest against the incorporation of Texas into the Federal Union. Having been successful in this mission, Mr. King returned to the U. S. Nov., 1846, and remained in private life until 1848, when he was appointed by the governor of Alabama to fill the unexpired term in the

U. S. Senate of Arthur P. Bagby, who was sent by Pres. Polk as minister to Russia. This unexpired term was less than a twelvemonth, but before it was ended Mr. King was again elected by the legislature to the U. S. Senate for another full term of six years, beginning Mar. 4, 1849. Upon the death of Gen. Taylor, on July 9, 1850, and the accession of Vice-President Fillmore to the Presidency in consequence of that event, Mr. King was unanimously elected president of the Senate. He presided over this august body during the exciting debates that ensued with great urbanity, dignity, and ability. At the Presidential election of 1852 he was the Democratic candidate for the office of Vice-President of the U. S. with Gen. Franklin Pierce for the Presidency; both were elected by large majorities, but Mr. King did not live to perform the duties of his office. His health began rapidly to fail before the close of the canvass in Nov., 1852. Early in Jan., 1853, under advice of physicians, he went to Cuba, but was not able to return by the 4th of March, the day of inauguration. This being anticipated, a special act of Congress was passed and despatched to him in time, providing for his taking the official oath in Havana. Some weeks afterwards he was able to return to his home in Dallas co., Ala., where he d. in Apr., 1853. A. H. Stephens.

King and Queen, county of E. Virginia. Area, 330 square miles. The Mattapony River flows along its S. W. border. It has an undulating surface, and contains valuable marl-beds. Corn is the staple product. Cap. King and Queen Court-house. Pop. 9709.

King and Queen Court-house, post-v., cap. of King and Queen co., Va., 15 miles from West Point.

King'bird, the *Tyrannus Carolinensis*, a familiar little bird found throughout the North American continent. It belongs to the tyrant flycatcher family, devours considerable numbers of honey-bees, and boldly attacks and drives away hawks, eagles, and crows, flying to great heights in its eagerness for the encounter.

King'-crab, or **Horse-shoe Crab,** the *Limulus Polyphemus*, a remarkable articulate of the Atlantic shores of the U. S., classed by most writers as an entomostracan, but reckoned by others as constituting, with its congeners, a separate sub-class, and by some regarded as an anomalous representative of the class of Arachnoids, which includes the spider-scorpions. It is used in the U. S. as a fertilizer for land, being hardly edible.

King'dom, tp. of Bibb co., Ala. Pop. 835.

King'field, post-tp. of Franklin co., Me., 22 miles N. of Farmington. Pop. 560.

King'fish, or **Opah** (*Lampris guttatus*, Retz), a fish which is the sole representative of a peculiar family (Lamprididæ), said from its beautiful colors to look "like one of Neptune's lords dressed for a court-day." It is widely distributed, being found in European seas, in those of China and Japan, and also, it is said, on the W. coast of Africa.

King'fishers, or **Alcedinidæ,** a family of birds belonging to the order Insessores, and so named from their peculiarly piscivorous habits. This family is represented in North America by the genus *Ceryle*, nearly allied to the typical Old-World *Alcedo*. The common species of the U. S. is the belted kingfisher (*C. alcyon*, Linn.).

King George, county of Virginia, having the river Potomac on the N. and E., and the Rappahannock on the S. W. Area, 176 square miles. It is uneven, and much of the soil is fertile. Corn is the principal product. Cap. King George Court-house. Pop. 5742.

King George Court-house, post-v., cap. of King George co., Va., 19 miles E. of Fredericksburg.

Kingkitao, or **Kienghitao,** called by the Chinese **Hanching** or **Wangking,** and by the French **Séoul** or **Sioul,** the capital of Corea, near the centre of which it is situated. There are no reliable accounts of its population.

King'lake (Alexander William), b. at Taunton, Eng., in 1811; was educated at Eton and at Trinity College, Cambridge, where he graduated in 1832; was called to the bar at Lincoln's Inn 1837, and acquired an extensive chancery practice, but retired from the law in 1856. Soon after finishing his studies Kinglake made an extensive tour in Eastern countries, of which he published an account under the title of *Eothen* (1844), which obtained great popularity. He accompanied Lord Raglan in the Crimean war, and wrote, in great part from the papers of that general, a *History of the Crimean War*, of which the first volume appeared in 1863, and the fifth, devoted to the battle of Inkerman, in 1874. This work, which is not yet completed, is eloquently written, and enters into great detail, but exhibits a bias highly unfavorable to the French, and especially toward Napoleon III. Kinglake entered Parliament in 1857, and became prominent for his anti-Napoleonic attitude upon the Conspiracy bill (1858) and the annexations of Savoy and Nice (1860).—His cousin, John Alexander Kinglake, b. at Taunton in 1805, a lawyer and for many years Liberal member of Parliament for Rochester, has written articles for the reviews, and is often confounded with the historian.

King'lets, The (*Regulus*, Cuv.), constitute a genus of the extensive family of Turdidæ (or thrushes). The common American species are the ruby-crowned (*R. calendula*) and golden-crested (*R. satrapa*) wrens or kinglets, which are both closely allied to the golden-crested wren (*R. cristatus*) of Europe, the smallest of the Old-World birds.

King'man, county of S. Central Kansas. Area, 648 square miles. It is traversed by Good River, and is well adapted to grazing.

Kingman, post-v. of Penobscot co., Me., on Mattawamkeag River and the European and North American R. R.

King of Arms, or in Scotland **King-at-Arms,** a herald of the highest rank. The English kings of arms are Garter, Bath (who is not of the college of arms), Clarencieux, Norroy, and one for the order of St. Michael and St. George (the last not belonging to the heralds' college). Scotland has one, called Lyon, or Lord Lyon king-at-arms. Ireland has one, Ulster king of arms. There have been other English kings of arms, whose offices are now extinct. (For these and some continental kings of arms, see Herald.)

Kings (Books of), First and Second, two of the canonical books of the Old Testament, following the second book of Samuel and preceding the first book of Chronicles. The two books were originally but one, and contain the annals of the kings of Judah and Israel from the death of David to the Captivity. The Septuagint and Vulgate versions call them the third and fourth books of Kings, reckoning the two books of Samuel as belonging to the same work. Ewald and other modern German critics go still further, reckoning Judges and Ruth to belong to the same work, which they call the "Great Book of the Kings," while suggestions have not been wanting that large portions of the Pentateuch and book of Joshua originally belonged to it, constituting an unbroken series of annals from the creation of the world to the dispersion of the Hebrew race. It is certain that the books of Kings are in reality a continuation of those of Samuel—that they are written in the same spirit, with the same style and characteristic expressions; but the identity of authorship cannot be asserted from these premises, as there are numerous minor differences which show at least the hand of another contributor. On the other hand, the contrast in many respects with the books of Chronicles, which narrate substantially the same events, is very marked, showing a considerable priority of time in favor of Kings. By a modern German school of criticism the two works are designated as prophetic and priestly, and this antithesis, which is argued to represent a real and long-continued conflict between the two orders of religious teachers, may be accepted so far as to admit a noticeable distinction in this respect between the two historical works. But the very fact that the books of Kings are largely occupied with the public ministrations of the prophets, while less attention was given to the priestly service of the temple, was a sufficient reason for the writer of Chronicles, himself probably a minister of that sanctuary, to omit to dwell upon the prophetic annals already written, and to bestow greater attention upon matters which might be of greater interest to his own class. The books of Kings have been considered to show a strong bias against the northern kingdom, as all its monarchs without exception are said to have "done evil in the sight of the Lord," but as far the larger number of the monarchs of Judah are charged with like conduct, the argument is not conclusive. A prominent feature of Kings consists of the narratives of the prophets Elijah and Elisha, which occupy fourteen chapters. The Septuagint version exhibits some remarkable variations from the received text of Kings, a considerable number of passages being transposed, while a few are omitted, and several additional fragments of narrative are inserted, chiefly relating to Solomon and Jeroboam. Biblical scholars disagree as to the authenticity and value of these fragments, but they are generally rejected as corruptions of the original text. The sources from which the writer drew his materials are often referred to. They were a series of biographies of individual kings, the writings of several prophets, and a general history called the *Book of the Kings of Israel and Judah*, of which the present work may be considered as a brief compend. All these original works have perished. As to date and authorship, the narrative itself shows that it must have been written during or after the Captivity, and many coincidences of style and matter appear to justify the Tal-

mudic tradition which ascribes it to Jeremiah, which is maintained in recent times by Hävernick and Graf, but opposed by Keil and Davidson. Calmet ascribed the authorship to Ezra. Many critics contend for a still later date on the strength of Chaldaic forms, which might, however, have easily crept into the Hebrew language during the close intercourse with Babylon before the Captivity. (See the commentaries of Keil (1846; Edinburgh trans., 1857), Thenius (1849), Schlusser (1861), and G. Rawlinson in the *Speaker's Commentary* (1873).) PORTER C. BLISS.

King's, county of Ireland, in the province of Leinster, bordering on the Shannon. Area, 772 square miles. Pop. 75,900, of whom 28,383 cannot read or write. Towards the S. runs a small branch of the Slieve Bloom Mountains; the surface is otherwise level. The soil is tolerably fertile. Cap. Tullamore. From 1851 to 1872 the emigration from this county was 35,533.

Kings, county of New Brunswick, intersected by the river St. John. The soil is fertile. Large quantities of lumber are cut and sawed. The county is traversed by the European and North American Railway. Cap. Hampton. Pop. 24,593.

King's, county of Nova Scotia, bordering on the Bay of Fundy. Its shores are bold and picturesque. Its soil is to a great extent of the best description. It is well timbered, and produces iron, copper, manganese, slate, building-stone, etc. The county is traversed by the Windsor and Annapolis R. R. Cap. Kentville. Pop. 21,509.

King's, the easternmost country of Prince Edward Island, Dominion of Canada. It is very fertile and well cultivated. Cap. Georgetown. Pop. about 17,000.

Kings, county of New York, comprising the westernmost part of Long Island, and including some small islands along the coast. Area, 72 square miles. Much of the soil is naturally light, but proximity to markets has caused it to become very productive. Garden products are the staple crops. The county has extensive manufacturing and commercial interests, which are described in the article BROOKLYN (which see). It is traversed by various railroads, centring in Brooklyn, the capital. Pop. 419,921.

Kings, tp. of Williamsburg co., S. C. Pop. 1774.

King's (or **Queen's**) **Bench.** See COURTS, I. (1).

Kings'borough, post-v. of Johnstown tp., Fulton co., N. Y., 1 mile from Gloversville. It has 10 manufactories of mittens.

Kingsborough (EDWARD KING), LORD, b. Nov. 16, 1795. He published a work in 9 large folio vols. upon the *Antiquities of Mexico, comprising fac-similes of Ancient Mexican Paintings and Hieroglyphics, together with the Monuments of New Spain by M. Dupaix, with their respective Scales of Measurement and Accompanying Descriptions; the whole illustrated by many valuable inedited MSS.* (London, 1830–48), at an expense of some $300,000. Only seven volumes had been issued when Lord Kingsborough d. at Dublin Feb. 27, 1837; the two concluding volumes were brought out after a considerable interval. This work is valuable as a collection of materials, but is confused in arrangement and disfigured by uncritical theories.

Kings'bury, an unorganized county of Dakota, traversed by the Dakota or James River. Area, about 750 square miles.

Kingsbury, post-tp. of Piscataquis co., Me., 22 miles W. of Dover. Pop. 174.

Kingsbury, post-v. and tp. of Washington co., N. Y., on the Hudson River. It is traversed by the Champlain Canal and Rensselaer and Saratoga R. R. It contains Sandy Hill, one of the county-seats; has great water-power, 10 churches, manufactures of lumber, paper, machinery, etc., and valuable limestone-quarries. Pop. 4277.

Kingsbury (CHARLES P.), GEN., b. in New York; graduated at the U. S. Military Academy, and entered the army as second lieutenant of ordnance in 1840; served as assistant and in command of various arsenals until the threatened troubles with Mexico in consequence of the proposed annexation of Texas, when he accompanied the army of occupation to Texas; subsequently during the Mexican war was Gen. Wool's chief ordnance officer; was engaged at Buena Vista on the staff of Gen. Taylor. During the civil war he was superintendent of the U. S. armory at Harper's Ferry in Apr., 1861, when the property was destroyed to prevent its falling into the hands of the Confederates; was chief of ordnance (with rank of colonel) of the Army of the Potomac 1861–62, throughout the Virginia Peninsular campaign, on the termination of which he was relieved, owing to ill-health, and subsequently served on important special duty until July, 1865, when he was placed in charge of the U. S. arsenal at Watertown, Massachusetts. In Dec., 1870, he was retired on his application, with the rank which he had attained in his corps, that of lieutenant-colonel. He is the author of various professional works, and has been a frequent contributor to various periodicals. G. C. SIMMONS.

Kingsbury (HENRY W.), COL., b. in Connecticut in 1835; graduated at the U. S. Military Academy, and appointed second lieutenant of ordnance May 6, 1861; first lieutenant of artillery May 14, 1861; was engaged in the first battle of Bull Run on the staff of Gen. McDowell, with whom he continued until Dec., 1861, when he was placed on duty with his battery in the defences of Washington; in the spring of 1862 he accompanied the Army of the Potomac to Virginia, and in April was appointed colonel of the 11th Connecticut Vols., which regiment he led in the battles of Gaines's Mill and Malvern Hill, and subsequently at South Mountain and Antietam, where he received wounds from the effect of which he d. the following day, Sept. 18, 1862. G. C. SIMMONS.

King's (or **Queen's**) **Counsel,** in English practice, are certain barristers or sergeants-at-law who have been specially appointed by letters-patent to be His (or Her) Majesty's counsel. They are entitled to a right of pre-audience in all the courts before other barristers or sergeants, and among themselves usually have precedence according to the date of their appointment. Their rank in this respect is generally defined by the terms of the patent. King's counsel do not, as their name might indicate, render legal services exclusively in behalf of the Crown, but may be retained by ordinary clients. They cannot, however, act for a plaintiff in a suit against the Crown, or engage in the defence of persons prosecuted for crime, without obtaining special license from the Crown. But this is never refused, and may be obtained by the payment of a small fee. King's counsel are appointed for life, but the letters-patent may be revoked for dishonourable practices or unprofessional conduct.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

King's Creek, tp. of Caldwell co., N. C. Pop. 625.

King's Evil (*Scrofula*), a disease which for many centuries was professedly cured by the touch of the kings of England and France. The practice is traced to the times of King Edward the Confessor (1043–66), was employed by Louis XI. of France in 1480, by Charles VIII. at Rome and Naples in 1495, and by Francis I. in 1597. Charles II. of England (1660–84) carried the practice to the greatest extreme of any English monarch, having "touched" nearly 100,000 patients during his twenty-five years' reign. It was last employed in England by Queen Anne (1703–15), Dr. Samuel Johnson having been, when a boy, one of her patients; but on the accession of the Brunswick dynasty was discontinued, and a special service for the purpose omitted from the Liturgy in 1719. The "Young Pretender" attempted to gain adherents by touching for the king's evil at Holyrood Palace in 1775, and Louis XVI. of France performed the same ceremony at Rheims as late as 1775. (For curious data on this subject see Lecky's *History of Rationalism.*)

King's Ferry, post-v. (sometimes called NORTHVILLE) of Genoa tp., Cayuga co., N. Y.

Kings'ley, tp. of Forest co., Pa. Pop. 575.

Kingsley (CALVIN), D.D., LL.D., b. at Annsville, Oneida co., N. Y., Sept. 8, 1812; licensed as Methodist preacher in 1835; graduated at Allegheny College, Pa., in 1841. The same year he was appointed professor of mathematics in that institution, and was afterwards a pastor at Meadville and Erie, Pa. In 1856 was elected editor of the *Western Christian Advocate* at Cincinnati, O., and again in 1860. He took an earnest part against slavery, and was elected bishop in 1864. In 1869 he started on an episcopal tour of the world, and d. at Beirut, Syria, in 1870. He published *On the Resurrection of the Body* (1845), and left a posthumous work on his travels *Around the World.*

Kingsley (CHARLES), b. at Holne, Devonshire, England, June 12, 1819, was the son of Rev. Dr. C. Kingsley, at one time rector of St. Luke's, Chelsea, and afterwards vicar of Holne. His preliminary education was directed by Rev. Derwent Coleridge at Ottley St. John. In 1839 he entered King's College, London, but in the following year removed to Magdalen College, Cambridge, where he graduated with honors in 1842. His first destination was for the law, but after a few months he exchanged that study for theology, and took orders in the Church of England, becoming in 1844 rector of Eversley, Hampshire, where he resided through life. He early devoted himself to the improvement of the condition of the working classes, acquiring thereby the *sobriquet* of "the Chartist parson," and was the chief originator of the school of ethics styled "Christian socialism," with which was closely connected that fondness for manly sports travestied as "muscular

Christianity." His earliest publication was *Twenty-five Village Sermons*, addressed to his rustic parishioners (1846), followed in 1848 by a dramatic poem, the *Saint's Tragedy*, founded on the career of Elizabeth of Hungary, and in 1850 by a novel, *Alton Locke, Tailor and Poet*, the production which first brought him into notice, and by which he will always be best known. It was based upon personal research among artisans and laborers, undertaken in connection with Rev. Fred. D. Maurice, and which led to the establishment of co-operative associations. This work had an immense popularity in America, and contributed much to determine Kingsley's literary career. In 1859 he was chosen professor of modern history at Cambridge; resigned in 1869, in which year he became canon of Chester, and subsequently of Westminster, and chaplain to the queen. Among his works are *Westward Ho* (1855), *Yeast*, a novel (1851), *Phaëthon* (1852), *Hypatia* (1853), *Alexandria and her Schools* (1854), *Glaucus* (1855), *Poems* (1856), *The Heroes* (1856), *Two Years Ago* (1857), *The Roman and the Teuton* (1864), *Hereward* (1866), *The Hermits* (1867), *How and Why?* (1869), *At Last, a Christmas in the West Indies* (1871), *Plays and Puritans, Prose Idyls* (1873), *Westminster Sermons* and *Health and Education* (1874). A collection of poems, chiefly lyric, was published in 1856, and *Andromeda*, a hexameter poem, appeared in 1858. In 1872 he undertook the editorship of *Good Words*, and in 1873–74 visited the U. S. on a lecturing-tour, in which he was received with warmth by the literary classes. D. at Eversley Jan. 24, 1875. PORTER C. BLISS.

Kingsley (HENRY), a brother of Charles Kingsley, b. at Holne vicarage, Devon, in 1824; was educated at Oriel College, Oxford; lived 1853–58 in Australia; has acquired reputation as a reviewer, journalist, and novelist. Author of *Geoffrey Hamlyn* (1859), *Ravenshoe* (1861), *Austin Elliot* (1863), *The Hillyars and Burtons* (1865), *Leighton Court* (1866), *Hetty* (1871), *Old Margaret* (1871), and other novels. He was for some time editor of the Edinburgh *Daily Review*.

Kingsley (JAMES LUCE), LL.D., b. at Windham, Conn., Aug. 28, 1778; graduated at Yale in 1799; was a tutor there 1801–05, librarian 1805–24, and professor of Hebrew, Greek, and Latin, and of ecclesiastical history 1805–51. D. at New Haven, Conn., Aug. 31, 1852. He contributed many valuable articles to periodical literature, and published a *History of Yale College* (1835) and a *Life of President Stiles*, and valuable editions of *Tacitus* and of *Cicero de Oratore*. Prof. Kingsley was master of an elegant style in both English and Latin. He was called by President Dwight the "American Addison," and several Latin compositions on festive or commemorative occasions received the highest praise for purity of Latin style from President Woolsey.

King's Mountain, a mountain-range, some 16 miles long N. and S., with lateral spurs abounding in marble and iron, mostly in Gaston co., N. C., near the E. border of Cleaveland co. Its S. extremity is in York co., S. C. The highest point is Crowder's Knob, some 3000 feet high and very precipitous. Near the S. extremity, in South Carolina, a body of British troops under Lieut.-Col. Ferguson were surprised and attacked (Oct. 7, 1780) by the American militia under Col. Benjamin Cleaveland, and after a most gallant defence nearly all the British troops were made prisoners. The British were in part armed with breech-loading small-arms, then first employed in warfare. On the following day ten of the Tory prisoners were hanged for murder and other crimes. This was one of the most bloody contests of the war in the Southern States, and contributed much to the final success of the American arms.

King's Mountain, tp. of Cleaveland co., N. C. Pop. 1248.

King's Mountain, tp. of York co., S. C. Pop. 1818.

King's Prairie, tp. of Barry co., Mo. Pop. 857.

King's River, tp. of Carroll co., Ark. Pop. 686.

King's River, tp. of Madison co., Ark. Pop. 958.

King's River, of California, rises in the Sierra Nevada, in Fresno co., by numerous head-streams, and flows in a S. W. course into Lake Tulare. Its copious waters divide into numerous channels before they reach the lake.

King's River, in the northern basin of Nevada, is in Humboldt co. It sinks about 50 miles N. W. of Winnemucca. Its valley contains some 75,000 acres of good grazing and tillage land. The bottoms have a heavy growth of blue-joint and red-top grass, and the hills are covered with a fine growth of bunch-grass and white sage. The average elevation is 4850 feet. The river abounds in trout.

King's River, tp. of Tulare co., Cal. Pop. 166.

King's Store, tp. of Pickens co., Ala. Pop. 212.

Kings'ton, the capital of the island of Jamaica, stands on the southern coast, 12 miles from Spanish Town, the former capital, in lat. 18° N., lon. 76° 50′ W. It is situated in a plain at the foot of the Blue Mountains, surrounded by rich sugar-plantations and numerous villas and gardens. In spite of the regular land and sea breezes morning and evening, the climate is very hot, and as parts of the vicinity are marshy, the place is unhealthy; yellow fever is a frequent visitor. Although there is no building of any architectural interest in the city, it is nevertheless well built, with regular and spacious streets, and it has recently been provided with good drinking-water through a magnificent aqueduct. The harbor is enclosed on the S. by a tongue of land, and is defended by several strong forts, and the city derives its greatest importance from its situation as a commercial station on the route between Europe and Central America. The value of exports for the year 1869–70 was $6,315,813, and of imports, $6,600,146. The principal articles of exportation are rum, sugar, tobacco, and dyewood. Pop. about 35,000.

Kingston, post-v. of King's co., N. B., on a neck of mountainous land between the Kennebecasis and the St. John rivers, 19 miles above St. John. It has a court-house, jail, churches, and schools. Pop. about 200.

Kingston, a city, cap. of Frontenac co., Ont., Canada, near the lower extremity of Lake Ontario, opposite the Thousand Islands. It was founded in 1784 on the site of the old French fort Frontenac, lat. 44° 8′ N., lon. 78° 40′ W. It is strongly fortified. Its harbor is sheltered by Wolf and Garden islands. It is connected by steam-ferry with Cape Vincent, N. Y. Its wharves, shipyards, and grain-elevators are well constructed. It has manufactures of locomotives, musical instruments, farming tools, stoves, and many other kinds of goods. It is on the Grand Trunk Railway, 161 miles E. of Toronto. It has 3 banks, a board of trade, and 18 churches, being the seat of a Roman Catholic bishop and the see-town of the Anglican bishop of Ontario. Kingston has water and gas companies, a fire brigade, and a well-organized police. It has a custom-house, a jail, a penitentiary, 10 schools and academies, and is the site of Queen's University and College, including a medical college. It has also an institution called Regiopolis College. It has a library and mechanics' institute, 2 daily and 2 weekly papers, 2 hospitals, 2 orphanages, an insane asylum, and many religious, benevolent, and temperance societies. Kingston is a naval station, and contains the royal dockyards. A long bridge has been built across Cataraqui Bay. The town is mostly built of blue limestone, and its streets cross each other at right angles. It is divided into seven wards. Pop. in 1871, 12,407.

Kingston, post-tp. of Autauga co., Ala. Pop. 1278.

Kingston, post-v. of King's River tp., Madison co., Ark. Pop. 65.

Kingston, post-v. of Bartow co., Ga., at the junction of the Rome R. R. with the Western and Atlantic R. R., 41 miles S. of Dalton. Pop. 402.

Kingston, tp. of De Kalb co., Ill. Pop. 975.

Kingston, a v. of Trimble co., Ky. Pop. 59.

Kingston, post-tp. of Plymouth co., Mass., on the seacoast and on the Old Colony R. R., 33 miles S. E. of Boston. It has a good harbor for light-draught vessels, 3 churches, a high school, and manufactures of lumber, thread, iron-ware, gimlets, rivets, shipping, etc. It has also prosperous agricultural and fishing interests. Pop. 1604.

Kingston, tp. of Tuscola co., Mich. Pop. 324.

Kingston, post-v. and tp. of Meeker co., Minn. Pop. of v. 56; of tp. 530.

Kingston, post-v. and tp., cap. of Caldwell co., Mo., 8 miles from the Hannibal and St. Joseph R. R. and 60 miles from Kansas City. It has a good court-house, jail, and school building, 2 churches, 2 weekly newspapers, a flour-mill, and the usual number of stores and shops. The principal business is wagon-making. Pop. of v. 414; of tp. 1277. MILLS & SPIVEY, EDS. "SENTINEL."

Kingston, tp. of Washington co., Mo. Pop. 1085.

Kingston, post-v. and tp. of Rockingham co., N. H., 38 miles S. E. of Concord. It has an academy, 3 churches, and extensive manufactures of carriages, lumber, and leather. Pop. 1054.

Kingston, city, cap. of Ulster co., N. Y., 90 miles N. of New York City, and 55 miles S. of Albany, on the W. bank of the Hudson River and N. bank of Rondout Creek; E. terminus of the Delaware and Hudson Canal, of the New York Kingston and Syracuse, and of the Wallkill Valley R. Rs., which connect by steam-ferry with the Hudson River R. R. at Rhinebeck, immediately across the river. Kingston was incorporated as a city by act of Mar. 29, 1872, by the junction of the former incorporated villages

of Kingston and Rondout with the small village of Wilbur. It has 24 churches, 1 daily and 5 weekly newspapers, 5 national and 3 savings banks, 13 carriage manufactories, 5 iron-foundries and machine-shops, several hotels, an academy, several private seminaries, an efficient school system with 46 teachers, 6 brickyards, 5 boat-building yards, 3 ferries, 4 lines of passenger steamers, a volunteer fire department, a horse railroad, a handsome city hall and court-house. It is the location of the largest cement manufactory in the country, turning out about 1000 barrels daily; receives 1,500,000 tons of coal annually by the Delaware and Hudson Canal, and annually ships to New York at least 1,000,000 tons of blue flagging-stone, brick, ice, lime, and lumber. It has a wharfage front of 4 miles, and 43 steamboats are owned there; does a heavy business in grain, flour, etc. The city is governed by a mayor and eighteen aldermen. It received a charter from Gov. Stuyvesant in 1661 under the name of *Wiltwick*, was first settled in 1665, and was incorporated by patent in 1667. On Feb. 19, 1777, the first State convention adjourned from Fishkill to Kingston, and the first State constitution was adopted Apr. 20, and, having been printed at Fishkill, was proclaimed in front of the court-house at Kingston Apr. 22, 1777. The legislature met here in September of the same year, but was dispersed by the approach of a British force under Sir Henry Clinton Oct. 7, when the town was burnt. Being afterwards rebuilt, it was incorporated as a village in 1805. Rondout, now a part of Kingston, was incorporated in 1849; it was long the county-seat, and had 2 newspapers. Pop. of city in 1870, 6315; of tp. 21,943.

HORATIO FOWLER, ED. "DAILY FREEMAN."

Kingston, tp. of Delaware co., O. Pop, 587.

Kingston, post-v. of Green tp., Ross co., O., 10 miles N. of Chillicothe. It is the seat of an academy. Pop. 345.

Kingston, post-b. and tp. of Luzerne co., Pa., in the anthracite coal region. The borough is on the Lackawanna and Bloomsburg R. R., and on the N. branch of the Susquehanna, opposite Wilkesbarre, with which it is connected by a bridge. The massacre of Wyoming took place in this township, and is commemorated by an imposing monument. Pop. of b. 1143; of tp. 2825.

Kingston, post-v., cap. of Washington co., R. I., is in South Kingston tp., 3 miles S. E. of Kingston Station, on the Providence and Stonington R. R. It has a national bank.

Kingston, post-v., cap. of Roane co., Tenn., 40 miles W. of Knoxville and 130 E. of Chattanooga, is situated at the junction of the Clinch River with the Tennessee, both of them being here navigable for steamboats. It has 2 weekly newspapers, 1 hotel, 2 iron-furnaces, 2 steam sawmills, foundry and machine-shop, 1 charcoal furnace, 1 steam-distillery, and 10 stores. Pop. 739.

W. B. REED, ED. "EAST TENNESSEEAN."

Kingston, post-tp. of Green Lake co., Wis. Pop. 807.

Kingston (ELIZABETH CHUDLEIGH), DUCHESS OF, b. in England in 1720, was daughter of Col. Chudleigh, governor of Chelsea College, who d. when she was still a child, leaving his family in poverty. Elizabeth was a girl of remarkable beauty, to which circumstance she was indebted for an appointment as maid-of-honor to the princess of Wales, mother of George III., through the influence of Pulteney, afterwards earl of Bath. She was privately married in 1744 to Capt. Hervey, grandson of the earl of Bristol, but immediately separated from him, and for many years led a dissipated life in European capitals. She married the duke of Kingston in 1769, he being ignorant of her former marriage, and on his death in 1773 succeeded to an enormous fortune, which, however, was disputed by the duke's relatives on the ground of bigamy. The duchess was tried by the House of Lords for bigamy in 1776, and declared guilty, but retained her fortune, as being derived from bequest. After a further series of adventures she d. at a château near Paris Aug. 28, 1788.

Kingston-on-Thames, town of England, in the county of Surrey, on the E. bank of the Thames. It has an extensive trade in corn and malt, and many good educational institutions. Coins and other remains from the time of the Romans are often discovered here. Pop. 15,257.

Kings'town, capital of the island of St. Vincent, in the West Indies, at the head of a small inlet which forms a good harbor, is well built and fortified, and has a fine botanical garden. Pop. about 5000.

Kingstown, town of Ireland, on the southern shore of the Bay of Dublin. It has a magnificent harbor, and is the station of the steam-packets to Holyhead and Liverpool. It is one of the most frequented watering-places of Ireland. Pop. 11,584.

Kings'tree, post-v. of Kings tp., cap. of Williamsburg co., S. C., on the left bank of Black River, 65 miles N. E. of Charleston, on the North-eastern R. R., has 2 weekly newspapers, 2 schools (1 white and 1 colored), 3 churches, 2 hotels, 1 livery-stable, 1 hook-and-ladder fire company, 3 bakeries, 2 drug stores, and a number of other business interests. The principal occupation is farming. Pop. of tp. 1774. J. MARION STAGGERS, FOR ED. "STAR."

Kings'ville, post-v. and tp. (otherwise called RAMEY) of Johnson co., Mo., on the Missouri Pacific R. R. Pop. of v. 298; of tp. 1360.

Kingsville, post-v. and tp. of Ashtabula co., O., on the Lake Shore R. R. It has an academy. Pop. 1758.

King-te-Ching', district of the province of Kiang-Si, China, and the seat of the celebrated manufactures of porcelain, in which nearly 1,000,000 persons are engaged.

King Wil'liam, county of Virginia, having the Mattapony River on the N. E. and the Pamunkey on the S. W. Area, 260 square miles. It is uneven, and generally fertile. Grain and tobacco are staple products. The county is traversed by the Richmond and Chesapeake R. R. Cap. King William Court-house. Pop. 7515.

King William Court-house, post-v., cap. of King William co., Va., 27 miles N. E. of Richmond. Pop. 44.

King'-wood, the wood of a species of *Triptolomia*, a Brazilian leguminous tree. The wood is very beautiful, but comes only in small pieces, and is used in ornamental joinery.

Kingwood, post-tp., Hunterdon co., N. J. Pop. 1942.

Kingwood, post-v. and tp., cap. of Preston co., W. Va., is situated in the Alleghany Mountains, 10 miles N. of the Baltimore and Ohio R. R.; has 2 churches, 1 national bank, 2 weekly newspapers, 3 hotels, numerous stores, a fine school building, and several elegant private residences. It is on the line of a proposed railroad, the Iron Valley and Pennsylvania line. Principal industry, farming. Pop. 1581.

WILL. M. O. DAWSON,
ED. "PRESTON CO. JOURNAL."

Kink'ajou, the *Cercoleptes caudivolvulus*, a small bear-like carnivorous mammal of tropical South America, hardly as large as a cat. It is placed in a family, Cercoleptidæ. It is a graceful nocturnal creature, arboreal in its habits, easily tamed, and excessively fond of honey, one of the principal articles of its food. It has many popular names, but the above is the one now generally employed.

Kink'el (JOHANN GOTTFRIED), b. at Obercassel Aug. 11, 1815; studied theology at Bonn and Berlin; became professor first of theology, and then of the fine arts, at Bonn, and published a volume of poems which became popular. On account of his participation in the revolutionary movements in Rhenish Prussia in 1848, he was sentenced to twenty years' imprisonment at Spandau, but escaped, lived for some years in London, and removed in 1866 to Zurich as professor of the history of the fine arts. Of his writings, the most noticeable, besides his poems, are *Die altchristliche Kunst* (1845) and *Nimrod*, a tragedy (1857).

Kin'lock, tp. of Lawrence co., Ala. Pop. 1621.

Kin'mundy, city and tp. of Marion co., Ill., 229 miles S. of Chicago, and 136 miles N. of Cairo, on the Illinois Central R. R., has 1 bank, 1 weekly newspaper, 5 churches, 2 hotels, large school buildings, brick mills, various manufactories, and 12 stores. Principal industry, farming, grazing, and fruit-raising. Pop. 1895.

EDWARD FREEMAN, ED. "KINMUNDY INDEPENDENT."

Kin, Next of, a term employed in law to denote the nearest blood relatives of a deceased person, among whom his personal property is distributed after the payment of debts and legacies, according to the provisions of the statute of distributions. This is the ordinary technical sense of the phrase, though it is sometimes used with a wider extent of meaning, to designate a person's nearest relations by blood, without regard to this statute. The relationship must be by consanguinity, and not by affinity. The next of kin may be either of lineal or of collateral consanguinity, and the nearness of relationship among them is computed according to the rules of the civil law, in accordance with which the degrees between one relative and another are ascertained by reckoning upward from one of the parties to the common ancestor, and then downward to the other party. (The distinction between lineal and collateral consanguinity is explained, and this civil-law rule of estimating relationship illustrated, in the article CONSANGUINITY. See also AFFINITY.) Upon the death of a person intestate who was the owner of personal property, there are two important rights to which his next of kin are entitled: one is to administer upon his personal estate, and the other to share it among themselves, either wholly or partly, according to the statute of distributions. By the

English common law the power to administer upon the goods and chattels of a wife is granted to the husband or his representatives, while, by ancient statutes, if it be the husband that is deceased, administration upon his property is granted to either his widow or next of kin, or both. In case of administration by the next of kin, one or more are selected from among them as administrators, preference being given to those who are most nearly related to the intestate, according to the civil-law method of reckoning above referred to. Of persons in equal degree any one may be taken. Children are preferred to parents, parents to brothers or sisters, brothers or sisters to grandparents, grandparents to uncles, aunts, nephews, and nieces, etc. (See ADMINISTRATION.) In the U. S. the English rules as to the appointment of administrators are substantially adopted in the various States, though more or less modified by statute. After the payment of debts by the administrator, and of various expenses, as funeral expenses, taxes, etc., the residue of the property is distributed among the next of kin and the husband or widow of the deceased. The statute of distributions was enacted in the reign of Charles II. (22 and 23 Chas. II. ch. 10). If the deceased person be a married woman, leaving a husband surviving, he takes, by English law, the entire personal property after the usual necessary disbursements, the statute not applying to husbands. In other cases the statute requires the distribution of the surplus property, after the expiration of one year from the time of granting administration, in the following manner: If the intestate leave a widow and children, the widow receives one-third of the property, and the children the residue in equal proportions. If any child be dead, leaving lineal descendants, they divide equally the share which he would have received. This is called taking *per stirpes*, or by the doctrine of representation. If there are no children or their representatives, one-half goes to the widow and the other half is distributed equally among the next of kin who are in equal degree and their representatives; but no representation is admitted among collaterals after brothers' and sisters' children. If there be no widow, the whole estate is divided among the children. If there be neither widow nor children, the whole is distributed among the next of kin in equal degree and their representatives. Substantially the same preferences exist among the next of kin in regard to their right to receive a share in the property as in regard to the right to be administrators. If children survive or their descendants, these take the property to the exclusion of other relatives. If there be no children or their descendants, the father takes the whole. If he also be dead, the mother and the brothers and sisters, with their descendants, divide the property, and so on. If in any case those who receive the property are related to the deceased in equal degrees, they share equally, or, as it is termed, *per capita*. If there be any personal property of a testator left undisposed of by his will, it is distributed among the next of kin according to the same rules of distribution. Statutes of distribution similar in their general provisions to the English statute have been enacted in the U. S., though with various modifications of the rules just stated.

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Kin'ney, county of Texas, bounded on the S. W. by the Rio Grande. Area, 1400 square miles. It is not generally very fertile, and water is deficient, but it affords good pasturage. Stock-raising is the chief pursuit. Cap. Fort Clark. Pop. 1204.

Kinney (Rev. JOHN W.), b. in 1799; d. in Texas Jan. 9, 1865. He joined the Ohio (M. E.) conference in 1818, and became a member of the Kentucky conference when it was organized; after eight years' labor in Kentucky, located in Illinois, and fought through the Black Hawk war as captain of a company; emigrated to Texas in 1833, and with the Rev. Henry Stevenson held the first camp-meeting in Austin's colony. He possessed great pulpit power. He belonged to the Texas conference at the time of his death.

T. O. SUMMERS.

Kinnickinnick', or **Killickinnick'** [Chippeway, a "mixture"], a name given by the northern Indians to various substances used by them for mixing with tobacco before smoking, such as the inner bark of the red willow and the leaves of the mountain cranberry (*Arctostaphylos Uva-Ursi*).

Kinnickinnick, post-tp. of St. Croix co., Wis. Pop. 628.

Ki'no, an astringent drug, the hardened juice of *Pterocarpus marsupium*, a lofty tree, natural order Fabaceæ, growing in the East Indies, and also of other trees in the West Indies, South America, Africa, and Australia. East India kino is the only variety in general use, most of the others being unknown in America. It is in small shining, brittle fragments, of a deep reddish-black color and bitterish, highly astringent taste. It forms a deep-red solution in water and alcohol. Kino owes its astringency to tannic acid (tannin), and is used in medicine to check morbid discharges in bowel complaints. EDWARD CURTIS.

Kinross', or **Kinross'-shire,** county of Scotland, between the counties of Perth and Fife. Area, 72 square miles. Pop. 7208. The surface is undulating, covered with low hills which enclose Loch Leven. The soil is a mixture of gravel and clay, but fertile and affording good pasturage on the moorlands. Principal town, Kinross.

Kinsale', town of Ireland, in the county of Cork, Munster, stands on the Bandon River, 2 miles from its fall into the Atlantic. It has an excellent harbor, valuable fisheries, and is much resorted to as a bathing-place, but its trade has mostly been transferred to Cork. Pop. 6955.

Kins'ley, post-v. and tp., cap. of Edwards co., Kan., on the Arkansas River, and the Atchison Topeka and Santa Fé R. R., 268 miles W. of Topeka and 34 E. of Fort Dodge, 60 miles N. of the salt-fields on the boundary of the Indian Territory, of which it is the nearest shipping point. The first house was built in Mar., 1873; a newspaper was started the same year; the county was organized in 1874 with some 600 inhabitants. Kinsley suffered much from the grasshopper plague (1874); has fine soil and climate. MRS. C. C. MCGINNIS, ED. "REPORTER."

Kins'man, post-v. and tp., Trumbull co., O. Pop. 1029.

Kin'ston, post-v. and tp., cap. of Lenoir co., N. C., 35 miles W. of New Berne, on the Atlantic and North Carolina R. R., has a high school, 8 churches (3 colored), 1 newspaper, 1 hotel, 40 stores, a carriage and plough factory, and other industries, principally farming. Pop. of v. 1103; of tp. 4604. E. A. WILSON, ED. "GAZETTE."

Kiong-Choo', town of China, the capital of the island of Hainan, on the northern coast, in lat. 20° N., lon. 110° 22′ E., and is surrounded with high walls of hewn stones. It is described by the Chinese as a model of a city, so rich that it has no beggars, so noble-spirited that it needs no police, and it is said to have 200,000 inhabitants. Unfortunately, the Chinese speak in exactly the same terms of another town they have founded on Hainan, and describe it with exactly the same features; which circumstance occasions some mist around the double-star, at least to ordinary minds.

Kioto. See MIAKO and SAIKIO.

Ki'owa, county of South-west Central Kansas. Area, 900 square miles. The N. W. part is traversed by the Arkansas River and the Atchison Topeka and Santa Fé R. R. It is a good pastoral region.

Kiowas, or **Kioways,** a tribe of Indians of the Shoshone family, having a reservation in the S. W. of the Indian Territory, but not yet reclaimed from a nomadic life, hunting and marauding upon the great plains of Kansas, Colorado, and Northern Texas. They have been more intractable than any other Indian tribe except the Apaches, have been often at war with the Pawnees, the Dakotas, and the Mexicans, and have been frequently chastised by U. S. troops. Treaties were made with the Kiowas in 1853, 1865, and 1869, by the latter of which they agreed to settle in the Indian Territory, but the following year they again committed murders in Texas, for which their chiefs, Santanta and Big Tree, were sentenced to death, but ultimately pardoned. They number about 2000.

Kip (Rt. Rev. WILLIAM INGRAHAM), D. D., b. in New York Oct. 3, 1811, of an old family of Dutch descent (originally Kype). He graduated at Yale in 1831; took deacon's orders in the Protestant Episcopal Church in 1835; was rector of St. Peter's, Albany, 1838–53, and in the latter year was consecrated bishop of California. He is the author of many works, among which are *The Lenten Fast*, *Early Jesuit Missions in North America* (1846), *Christmas Holidays in Rome*, *Domestic and Religious Life in Italy*, *The Catacombs of Rome* (1854). He has contributed much to periodical literature.

Kip'pis (ANDREW), D. D., F. R. S., b. at Nottingham, Eng., in 1725; studied theology in Dr. Doddridge's seminary at Nottingham; became in 1746 minister of a dissenting congregation at Boston, Lincolnshire, and in 1753 of a Presbyterian church of Unitarian tendencies in Prince's street, Westminster, where he remained through life. In 1763 he became professor in a theological academy in London for the education of dissenting ministers; wrote much for the *Gentleman's Magazine*, the *Monthly Review*, and the *New Annual Register*; edited Doddridge's *Lectures* and Dr. Lardner's works; published lives of Dr. Lardner and of Capt. Cook, and undertook a new edition of that vast work, the *Biographia Britannica*, but it was projected on too extensive a scale, and only five folio volumes, with part of a sixth, were published, extending to the middle of the letter

F (1778–93). Dr. Kippis published also some sermons and controversial pamphlets on theological subjects. D. at Westminster in 1795.

Kiptchak′, or **Kaptchak′,** a Tartar or Mongolian race which gave name to a khanate founded in the thirteenth century by the Golden Horde, and which extended from the Jaxartes in Toorkistan to the limits of Russia proper, and comprised all the region N. of the Caucasus traversed by the rivers Dnieper, Don, Volga, and Ural. After the career of Tamerlane in the fifteenth century, Kazan, Astrakhan, and Crimea became independent of Kiptchak, and were at length annexed to Russia.

Kir′by, tp. of Northampton co., N. C. Pop. 1844.

Kirby, post-tp. of Wyandot co., O., on the Pittsburg Fort Wayne and Chicago R. R. Pop. 835.

Kirby, tp. of Marion co., S. C. Pop. 1155.

Kirby, tp. of Caledonia co., Vt., 4 miles S. E. of Lyndonville. It has manufactures of lumber. Pop. 417.

Kirby (Edmund), b. in Brownsville, Jefferson co., N. Y., 1840; graduated at the U. S. Military Academy and appointed second lieutenant of artillery May 6, 1861. The stirring time in which he graduated called for the services of every military educated man, and Kirby was at once ordered to Washington, and assigned to the duty of drilling the newly-arrived volunteers; upon the movement of the army he was assigned to Ricketts's battery, with which he served at the battle of Bull Run, assuming command of the same upon the capture of Gen. Ricketts; he was next engaged in the disastrous combat of Ball's Bluff, Oct., 1861; in the Virginia Peninsular campaign of 1862 he commanded a battery at Yorktown, Fair Oaks, Savage Station, Glendale, and Malvern Hill, and in the Rappahannock campaign at Fredericksburg and Chancellorsville, in all of which battles he displayed great coolness, skill, and bravery, and at the latter received wounds from the effect of which he d. at Washington, D. C., May 28, 1863, aged twenty-three. For his gallant services at Chancellorsville he was appointed on his deathbed a brigadier-general of volunteers. Though barely arrived at manhood, the few years of his life were well and honorably filled in the service of his country. G. C. Simmons.

Kirby (William), b. at Witnesham, Suffolk, Sept. 19, 1759; graduated at Caius College, Cambridge, in 1781, took orders in the English Church and obtained the living of Barham, which he held through life. He was widely known by his work on *Entomology*, published in 1815 in conjunction with Spence, and by his Bridgewater treatise on *Habits and Instincts of Animals with Reference to Natural Theology* (1830). D. at Barham July 4, 1850.

Kirby's Mill, tp. of Jackson co., Ala. Pop. 285.

Kirch′bach, von (Hugo Ewald), b. May 23, 1809; educated at the military academy, and entered in 1826 the 26th regiment of infantry. In 1850 he was attached to the staff as major; in 1859 became commander of a regiment; in 1863 of the 19th brigade of infantry, and in the same year was made a major-general. In 1866, in the war against Austria, he led with distinction the 10th division as lieutenant-general; fought at Nachod, Skalitz, Schweinschädel, Gradlitz, and in the battle of Königgrätz, and received the order *pour le mérite*. In 1870, in the war against France, he led the 5th army corps. At its head he opened the war by the attack on Weissenburg, and two days afterwards he took a most important part in the battle of Wörth, Aug. 6. The crown prince, who commanded the army, gave orders to break off the fight which had just commenced, but Kirchbach continued it on his own responsibility, and a few moments later on the crown prince agreed with him. Four days after the battle, in which he received a slight wound, he was made a general of infantry. In the battle of Sedan, when the leader of the 11th army corps was severely wounded, Kirchbach assumed the command of this corps too, and performed the decisive manœuvre by which the French army was completely surrounded. During the siege of Paris he held Versailles and its vicinity.

August Niemann.

Kir′cher (Athanasius), b. at Geisa, in Hesse, May 2, 1602; joined the Jesuits in 1619; was educated at Würzburg, where he was professor of philosophy and the Eastern languages; was in the Jesuits' college at Avignon in 1633–35; was professor of mathematics in the College of Rome 1635–43. D. at Rome Nov. 28, 1680. He wrote much upon physics, archæology, philology, etc.

Kirch′heim, town of Germany, in the kingdom of Würtemberg, on the Lauter, manufactures cotton fabrics, musical instruments, and furniture, and trades in corn, cattle, and wool. Pop. 5435.

Kirch′hoff (Gustav Robert), b. Mar. 12, 1824, at Königsberg; studied mathematics and natural science at the university of his native city; lectured on physics at Berlin in 1848 and at Breslau in 1850, and was appointed professor of natural philosophy at Heidelberg in 1854. His researches concerning heat, elasticity, magnetism, and electricity, communicated in Poggendorff's *Annalen* and in Crelle's *Journal für Mathematik*, attracted great attention. But his most brilliant discovery was that of the spectroscope, made in connection with Bunsen, and its application for the so-called spectrum analysis, which has exercised so great an influence on the study both of chemistry and astronomy. (See his *Chemische Analyse durch Spectralbeobachtung*, together with Bunsen (Vienna, 1861), *Das Sonnenspectraun und die Spectren der chemischen Elemente* (Berlin, 1861), *Vorlesungen über analytische Mechanik* (Leipsic, 1874).)

Kirgheez′, Kirgheez-Kaizaks, or **Cossacks,** the name of a nomadic people of Central Asia, numbering about 2,000,000, and occupying a vast region called the Kirgheez Steppes, of about 850,000 square miles, stretching from the Caspian Sea to the Altai Mountains and from the Sea of Aral to the Tobol and Irtish, traversed by several mountain-ranges, between which extend large barren plains dotted with salt lakes. It is now divided into the three provinces of Orenboorg, West Siberia, and Toorkistan. The climate is exceedingly cold in the winter, excessively hot in the summer, and always very variable. Only a few districts along the rivers are rudely tilled; the remainder is pasture-land. The Kirgheez are divided into the Little, Great, and Middle Hordes, politically distinct from each other. They are of Eastern or Turco-Tataric origin, akin to the Uzbecks in race and language. They are below middle size, but strong and hardy; have the high cheek-bones and small, deep-set, oblique eyes of the Mongolians, but their faces, though generally ugly, are not wholly flat. Their language is a very pure Turkish dialect; their religion, a mixture of Islamism and idolatry. Without being savages, their state of civilization is very low. They know but little of agriculture, and still less of manufactures. The breeding of sheep, horses, and camels is their business, besides occasional robbery. In the beginning of this century they fully deserved their title of the "slave-hunters of the steppes." They attacked the caravans, took the goods, and sold the persons as slaves at the markets of Khiva and Bokhara. But the line of forts which the Russian government has laid through the country has effectually checked this business. The women, who often are quite pretty, do the work. The men spend most of their time on horseback, hunting and sporting, or in sensuous enjoyments. Mutton, horseflesh, and sour mare's milk, from which an intoxicating beverage is distilled, are the principal articles of food; bread is nearly unknown. They are governed by their own chieftains, but since 1860 they have been brought under Russian authority, and great pains have been taken to civilize them. There are no towns among them, and the only remains of cities and temples which have been found are vestiges of an earlier civilized race.

Kir′in, or **Girin,** the largest province of Mantchooria, Chinese empire, bounded N. by the Amoor and Soongaree rivers, E. by the Oosooree River and the Japan Sea, S. by Corea and China proper, and W. by China proper and Mongolia. Area, about 200,000 square miles. Pop. about 500,000. The capital, Kirin, Kirin-Oola, or Girin, is a large town on the Soongaree, and is the residence of a viceroy.

Kirk (Edward Norris), D. D., b. in New York Aug. 14, 1802; graduated at Princeton in 1820, and afterwards studied law and theology; served as agent for the foreign mission board; held 1828–36 a Congregational pastorate at Albany, N. Y., and in 1839 became secretary of the Foreign Evangelical Society. In 1842 he became pastor of the Mt. Vernon church, Boston, Mass., with which he maintained the pastoral relation until his death, Mar. 27, 1874. He was the author of several volumes of sermons and lectures, and many published occasional discourses, besides some translations. Dr. Kirk was an active friend of the cause of Protestant religion in the Roman Catholic countries of Europe.

Kirk (John Foster), b. in 1824 at Fredericton, N. B., and educated in Nova Scotia. In 1842 he removed to Boston, Mass, where for eleven years he was secretary to the historian Prescott. He is the author of a *History of Charles the Bold* (3 vols., 1863–67), and in 1870 became editor of *Lippincott's Magazine*.

Kirkal′dy (Sir William) **of Grange,** b. in Scotland early in the sixteenth century, son of Sir James Kirkaldy, high treasurer in the reign of James V., was one of the earliest Protestants of Scotland; joined a conspiracy against Cardinal Beatoun in 1546; surrendered to the French at St. Andrew's in the summer of that year, and was imprisoned, but escaped to France, where he became distin-

guished in the court and army of Henry II.; returned to Scotland in 1559; took part in the political movement against Mary queen of Scots; narrowly escaped assassination by Bothwell at the battle of Carberry Hill, and pursued that nobleman to the coast of Norway (1567); contributed to the defeat of Mary at Langside, and became governor of Edinburgh Castle (May, 1568); espoused the cause of Mary, and defended the castle for her from 1570 to 1573 against the besieging forces of Marshal Berwick; surrendered May 28, and was hung at Edinburgh, with several of his followers, Aug. 3, 1573.

Kirk'bride (Thomas S.), M. D., LL.D., b. near Morrisville, Bucks co., Pa., July 31, 1809. His ancestry were of the Society of Friends, and he received his early education in the excellent schools of that denomination. He graduated M. D. from the University of Pennsylvania in Mar., 1832, and was immediately appointed resident physician of the Friends' asylum for the insane at Frankford, Pa. In 1833 he was elected resident physician of the Pennsylvania Hospital in Philadelphia, and was for two years in charge of the west wing of the hospital, which was the first hospital department for the treatment of the insane in the U. S. In 1835 he opened an office for general practice in Philadelphia, but in Oct., 1840, just before the completion of the new Pennsylvania Hospital for the insane W. of the Schuylkill, he was elected its superintendent and physician-in-chief. He entered upon his duties at the opening of the hospital, Jan. 1, 1841, and has been at its head for thirty-four years. He was and is firmly convinced that not more than 250 insane patients should be treated at one time in a single hospital; and foreseeing that that number would be reached in his hospital within a few years, he commenced, amid his other cares, in 1853, the effort to raise money for a second institution. The hospital grounds included a tract of 113 acres, and by dividing the pleasure-grounds and placing his new hospital a third of a mile distant from the other, he could keep the two entirely distinct, though under the same general supervision and treatment. He was the first superintendent in this country to separate in entirely distinct institutions the two sexes. In 1859, with the assistance of some friends, he had raised in Philadelphia and vicinity $355,000, and had erected, in accordance with his own carefully prepared plans, a hospital for the insane, which is so perfect in all its appointments that it has been a model for all those since erected. To this hospital he transferred all his male patients, and while retaining the general superintendency over both, placed his most trusted assistant at the head of the male department, and gave most of his personal attention to the female department. To this latter he has since added, through the liberal bequest of a friend, two wards at a cost of about $60,000. In all matters appertaining to mental alienation Dr. Kirkbride ranks as one of the ablest men in the profession. A careful student, thoroughly devoted to his specialty in medical science, of the most gentle and genial manners, and of rare executive ability, he has been remarkably successful in the treatment of the insane, while his writings on the subject have given him a high reputation. His first publication, in 1850, *Rules and Regulations for the Pennsylvania Hospital for the Insane*, had a circulation far beyond that hospital, and his *Propositions Relative to the Construction of Hospitals for the Insane*, first adopted by the Association of Medical Superintendents of American Institutions for the Insane (of which he was one of the founders), have been repeatedly reaffirmed by them, and at their request were published in 1854, with notes and additions, under the title of *The Construction, Organization, and General Arrangement of Hospitals for the Insane.* It is the standard authority on this subject, both in Europe and the U. S. The same year he published an eloquent *Appeal for the Insane.* In his thirty-four years of superintendency of the Pennsylvania Hospital for the Insane, Dr. Kirkbride has taken up, year by year, in his annual reports, nearly every subject connected with the care and treatment of the insane and the provision to be made for them, and has discussed at length all topics connected with the construction, heating, and ventilation of hospitals. These reports are of great value to every student of mental disease. He has also been a member of numerous commissions on the erection and management of insane hospitals, and an active participant in the medical and philanthropic institutions of Philadelphia. The degree of LL.D. was conferred on him in 1874. L. P. Brockett.

Kirkcal'dy, town of Scotland, in the county of Fife, on the Frith of Forth, where it stretches along the northern shore for about 3 miles, which has given it the name of "Lang town." It has large bleaching-fields, flax-spinning mills, and manufactures of linen and canvas, and its harbor, though completely dry at low water, admits large vessels at full tide. Pop. 12,422.

Kirkcud'brightshire, or the **Stewartry of Kirkcudbright,** county of Scotland, bordering on the Irish Sea and the Frith of Solway. Area, 954 square miles. Pop. 41,852. Only one-third of the surface is arable; the rest is granite hills covered with moss, the highest of which are Blacklarg, 2890 feet, and Cairnsmoor, 2329 feet. Cattle of the celebrated Galloway breed are reared here. Principal town, Kirkcudbright.

Kirk'dale, parish of Yorkshire, England, in the Vale of Pickering, remarkable for a cave 245 feet long, discovered in 1821 in cutting through the Oolitic limestone rock. A great abundance of fossil bones of extinct species of animals was found there, and described by Dr. Buckland in his *Reliquiæ Diluvianæ*, as well as in all recent works on palæontology. The most remarkable were hyænas, tigers, elephants, rhinoceroses, hippopotamuses, cave-bears, and horses, all of species not now represented in England. (See *Cave-Hunting*, by W. B. Dawkins, 1874.)

Kirke, or **Kertk** (Sir David), b. at Dieppe, France, in 1596, of English parentage; was engaged in business as a wine-merchant in Bordeaux and Cognac, but went to England in consequence of the persecutions of the Huguenots, and with his father and brothers became connected with Sir William Alexander's American projects. David commanded in 1627 an expedition of three vessels under letters of marque, with which he blockaded Quebec, and in an engagement near Gaspé (July 18, 1628) captured a French squadron commanded by De Roquemont sent for the relief of Quebec. In 1629, Kirke and his brothers again sailed from England against Canada, compelled Champlain to surrender Quebec in July, and also reduced the colony of Cape Breton. Both these conquests, however, were restored to France in 1632. Kirke was knighted in 1633, and with others obtained a grant of Newfoundland, which he colonized, being governor of that island for twenty years, until dispossessed by Cromwell, when he went to England and recovered his property through Cromwell's son-in-law, Claypole. He returned to Newfoundland, and d. at Ferryland in 1656. His *Life* was published by a descendant in 1871 (London).

Kirk'ersville, post-v. of Harrison tp., Licking co., O., 2 miles from Kirkersville Station (Outville P. O.), on the Baltimore and Ohio and the Pittsburg Cincinnati and St. Louis R. Rs. Pop. 295.

Kirkes (William Senhouse), M. D., b. in England about 1820; was physician and lecturer at St. Bartholomew's Hospital in London; published in 1848, with Dr. James Paget, a *Handbook of Physiology*, which became a standard work upon that subject both in England and the U. S.; and with Dr. William Baly, an appendix to Müller's *Physiology*, entitled *Recent Advances in the Physiology of Motion.* Later papers, on the *Detachment of Fibrinous Deposits from the Interior of the Heart*, constitute a remarkable contribution to pathological science. D. in Dec., 1864.

Kirkintil'loch, town of Scotland, in the county of Dumbarton. It has cotton manufactures. Pop. 6342.

Kirk-Kilis'seh, town of European Turkey, in the province of Room-Elee, contains several fine mosques, public baths, and extensive bazaars, but is generally ill built. It is famous for its confectionery, and carries on an active trade in butter and cheese. Pop. 16,000.

Kirk'land, tp. of Adams co., Ind. Pop. 508.

Kirkland, post-tp. of Oneida co., N. Y., on the Utica and Rome division of the Midland R. R. It contains iron-mines, stone-quarries, and several important villages, among which are Clinton (which see), Kirkland (or Manchester), Franklin Iron-works, and Clark's Mills. P. 4912.

Kirkland (Carolina Matilda), b. in New York in Jan., 1801, was the daughter of Samuel Stansbury, a bookseller. She married Prof. William Kirkland of Hamilton College (1800–46), spent some years in Western New York and Michigan, and afterwards in New York City, where for a time she very successfully taught a school for a number of young ladies. Under the pseudonym of Mary Clavers she published several works on Western life distinguished for piquancy and originality, edited the *Union Magazine* (New York, 1847–49), assisted in the management of *Sartain's Magazine* (1849–51), made two short visits to Europe (1848 and 1850), and attained rare popularity and success as a writer. D. Apr. 6, 1864. Her principal works are—*A New Home, Who'll Follow?* (1839), *Forest Life* (1842), *Western Clearings* (1846), *Holidays Abroad* (1849), *The Evening Book* (1852), *Personal Memoirs of George Washington* (1857).

Kirkland (John Thornton), D. D., LL.D., b. at Little Falls, N. Y., in 1770; d. in Boston Apr. 26, 1840, son of Samuel Kirkland, missionary to the Indians; Harvard College 1786; Congregational church in Summer street, Boston, 1794; president of Harvard College 1810–28. He

published occasional pamphlets and a life of Fisher Ames (1809). His name is identified with Harvard College as one of its ablest and most distinguished presidents, equally remarkable for sagacity, kindness, and energy. His administration was effective through the force of his personal qualities; he bequeathed no system of rules or organized methods to his successors, and opened no avenues of future progress, but graced his position and gave great distinction to the college by his intellect and dignity.

O. B. Frothingham.

Kirkland (Samuel), b. at Norwich, Conn., Dec. 1, 1744; graduated at Princeton in 1765. In 1766 he was ordained a Congregational minister. He lived much as a missionary with the Six Nations, and was appointed in 1775 by the Congress of Massachusetts to procure their favor or neutrality. In this attempt he was but partially successful. He was afterwards an army chaplain in the Revolutionary war. He may be regarded as the founder of Hamilton College, since he established the academy from which it sprang. In 1789 he received from the government a grant of land two miles square, now in the town of Kirkland, N. Y. D. at Clinton, N. Y., Feb. 28, 1808. (See his *Memoir*, by Dr. S. K. Lothrop, his grandson, in Sparks's *Amer. Biography*, 2d series.)

Kirk'lin (Kirk's Cross-Roads P. O.), a v. and tp. of Clinton co., Ind. Pop. of v. 141; of tp. 1266.

Kirk'mansville, a v. of Todd co., Ky. Pop. 889.

Kirkpat'rick (Andrew), b. at Mine Brook, N. J., Feb. 17, 1756; graduated at New Jersey College in 1775, and began the study of theology, but soon devoted himself to the law; was admitted to the bar in 1785; practised with distinction at Morristown, and afterwards at New Brunswick; became judge of the supreme court in 1797, and was chief-justice from 1803 to 1824. His decisions are found in Pennington's, Southard's, and Halsted's reports. He married in 1792 a daughter of Col. John Bayard. Kirkpatrick Place in New York City was named from him. D. at New Brunswick, N. J., Jan. 7, 1831. (See *Memoir*, by Gen. James Grant Wilson.)

Kirks'ville, post-v., cap. of Adair co., Mo., 6 miles E. of Chariton River, 65 miles W. of Quincy, and 200 miles N. W. of St. Louis; has 7 churches, 2 weekly newspapers, 2 banks, 4 hotels, a State normal school, a hub and spoke, furniture, woollen, cheese, and plough factories. All kinds of business are well represented. The county has splendid farming-lands and an abundant supply of wood and coal. Principal occupation, farming. Pop. 1471.

S. M. Pickler, Ed. "Journal."

Kirk'ville, post-v. of Richland tp., Wapello co., Ia. Pop. 236.

Kirkville, post-v. of Onondaga co., N. Y. Pop. 150.

Kirk'wall, capital of the Orkney Islands, N. E. of the most northern point of Scotland, formerly an independent kingdom. There is a fine cathedral of St. Magnus dating from about 1138, and close by the ruins called the King's, the Earl's, and the Bishop's palaces. In the latter, Haco, king of Norway, died in 1263. Kirkwall has steamer communication with Leith, Aberdeen, Wick, and Lerwick, has an annual fair of considerable celebrity, a museum, libraries and grammar school, and cultivated society. The vessels registered at the port exceed 70,000 tons burden. Pop. 3500.

Kirk'wood, a villa near Atlanta, Ga.

Kirkwood, post-v. of St. Louis co., Mo., on the Pacific R. R. of Missouri.

Kirkwood, post-v. and tp. of Broome co., N. Y., on the E. bank of the Susquehanna, and on the Delaware Lackawanna and Western R. R. Joseph Smith, the Mormon prophet, was born here. Pop. 1402.

Kirkwood, tp. of Belmont co., O. Pop. 1792.

Kirkwood (Daniel), A. M., LL.D., b. in Harford co., Md., Sept. 27, 1814; was a mathematical instructor in York co., Pa., 1838–43; principal of Lancaster (Pa.) high school 1843–48; of Pottsville academy 1848–51; professor of mathematics 1851–54 in Delaware College; its president 1854–56; became in 1856 professor of mathematics in Indiana University; author of *Comets and Meteors* (1873), and of important astronomical papers, which have given him a high reputation at home and abroad.

Kirkwood (Samuel J.), b. in Harford co., Md., Dec. 20, 1813; educated at Washington, D. C.; admitted to the bar in Ohio in 1843; was for four years prosecuting attorney of Richland co., and a member of the State constitutional convention of 1850; removed to Iowa in 1855; was elected to the State senate in 1856 as a Republican; was governor of Iowa 1860–63, and was honorably distinguished as one of the great "war governors" for his efforts in maintaining the quota of Iowa troops in the field and providing for their comfort and efficiency; was chosen U. S. Senator (1866–67) to fill the unexpired term of James Harlan, vacated by his acceptance of the secretaryship of the interior, and was in 1875 again elected governor of Iowa.

Kirsanov', town of Russia, in the government of Tambov, on the Pursovka, carries on some manufactures and rears a good breed of horses and fine-fleeced sheep. Pop. 5663.

Kirsch'wasser [Ger. for "cherry-water"], often called **Kirsch,** an alcoholic *liqueur* prepared in Europe from cherries. The ripe fruit is first stoned and then fermented. Afterwards the broken pits are thrown into the mash, and the whole is distilled. A fraudulent imitation is made of ordinary spirits flavored with cherry-laurel water. It is a dangerous compound. (See Maraschino.)

Kirt'land, post-tp. of Lake co., O. Pop. 1029.

Kirtland (Jared Potter), M. D., LL.D., b. Nov. 10, 1793, at Wallingford, Conn.; studied medicine 1812–15 at the medical schools of Yale and Pennsylvania universities; began practising at Wallingford; removed in 1818 to Poland, O.; was appointed professor of the Ohio Medical College at Cincinnati in 1837, of the Willoughby Medical School in 1841, and of the Western Reserve College in Cleveland in 1843, which latter chair he filled to 1864. His scientific researches and experiments have principally been engaged in the sexual relations of the naiads, in the rearing of bees, and in the cultivation of fruit trees on his residence at East Rockport, O.

Kir'wan (Richard), b. in Galway co., Ireland, about the middle of the eighteenth century; was educated at Trinity College, Dublin, and at the Jesuit college at St. Omer in France; settled near London in 1779; devoted himself to chemistry and geology, and read valuable papers before the Royal Society, for which he received the Copley medal in 1782. He returned to Ireland in 1789, and became president of the Royal Irish Academy. Among his numerous works were *An Essay on Phlogiston and the Composition of Acids*, *Elements of Mineralogy*, and an *Essay on the Analysis of Mineral Waters*. D. at Dublin in 1812.

Kis'faludy, the name of two brothers who in the beginning of this century exercised great influence on the rising Hungarian literature. They were both educated at the gymnasium of Raab, entered the Austrian army, and made campaigns in Italy and Germany, but retired from the military service into private life and engaged in literary pursuits. The elder, Sándor, was b. at Sümeg, the family estate, Sept. 22, 1772, and d. there Oct. 28, 1844. His poem in twenty songs, *Himfy's Love*, somewhat sentimental in its tone, but of an elegant form, excited general enthusiasm; his ballads also made a great impression; his tragedies were less successful. The younger brother, Károly, was b. at Téte Feb. 6, 1788, and d. at Pesth Nov. 21, 1830. He wrote dramas, took his subjects from national life, treated them with great skill for theatrical effect, and became the favorite of his countrymen on account of his sound and pleasant humor.

Kishenev', or **Kishinef,** capital of the province of Bessarabia, on the Buik, an affluent of the Dniester, and is picturesquely situated on three hills, between which the river winds around, crossed by several bridges. The railway to Odessa has been in operation for several years, and in 1874 that to Jassy was completed; thus new channels have been opened up to the trade of this rapidly growing city. It is the seat of the civil and ecclesiastical authorities of Bessarabia, and has about 20 churches, a synagogue, several magnificent Turkish baths, a gymnasium, a seminary, good schools, and several theatres. It has large markets, especially for cattle and corn. The inhabitants are much engaged in the cultivation of fruit and tobacco. Plums are exported in immense quantities. It is also the centre of a very considerable trade in tallow, wool, wheat, hides, etc., carried hence to Odessa and Jassy. It existed as a small place in the ninth century, was nearly destroyed in the seventeenth by the Tartars, and was transferred in 1812 from Moldavia to Russia. Pop. 120,000.

August Niemann.

Kish'on, a small river of Central Palestine, rises near Mount Tabor, and flows N.W. into the Mediterranean, draining the plain of Esdraelon and the mountains of Carmel and Samaria. It is famous in biblical history as affording the scenes of the defeat of Sisera by Deborah and Barak, and of the slaughter of the priests of Baal by Elijah. Some portion of the Kishon was anciently called the "waters of Megiddo;" it is now known as the *Nahr-el-Mukatta*.

Kiskimin'itas, post-v. and tp. of Armstrong co., Pa., on the Kiskiminitas River, on the Western division of the Pennsylvania Canal, and on the Western Pennsylvania R. R. (North-west Station). Pop. 1728.

Kis-Körös′, town of Hungary, celebrated for its fine red wine. Pop. 6413.

Kiss (August), b. at Pless, in Upper Silesia, Oct. 11, 1802; began his education in the royal iron-foundries at Gleiwitz; pursued his studies at the academy of Berlin, under Rauch, and was first known by bas-reliefs for churches and other public buildings, and by groups of nymphs, tritons, and similar decorations for a fountain at Charlottenhof, designed by Schinkel. The plaster model of his famous group, *The Amazon and the Panther*, was exhibited in 1839, and created such enthusiasm that a public subscription was opened, even on Sundays and in churches, to pay the cost of casting it in bronze. In 1845 this was placed in the Museum of Berlin. The same artist subsequently produced a bronze equestrian statue of Frederick the Great for the city of Breslau, two statues, one colossal in size, of Frederick William III., *St. Michael and the Dragon*, a gift to Frederick William IV., a copy of which in zinc is at Carlsruhe; an equestrian statue of *St. George*, of colossal size, which was sent to the Paris Exposition in 1855. The work of Kiss is marked by grandeur and energy. D. Mar. 24, 1865. He was a member of the Royal Academy of Arts at Berlin. O. B. Frothingham.

Kis′singen, town of Bavaria, on the Saale, has three mineral springs, from which 500,000 bottles of water are annually exported. In summer the place is much frequented, as the water is not only drunk, but also used for bathing.

Kissingen, The Battle of, took place July 10, 1866, between the Prussians and the Bavarians. The latter held the Franconian Saale occupied from Waldaschach to Hammelburg, in order to prevent the Prussian army from crossing the river. Gen. Vogel von Falckenstein, the Prussian commander-in-chief, ordered the Goeben division, with the Manteuffel division as reserve, to advance on the left wing towards Kissingen, and the Beyer division on the right wing towards Hammelburg. The Bavarians defended the defiles at Kissingen very obstinately, yet after a contest of two and a half hours the Prussian artillery succeeded in silencing the Bavarian cannons at Kissingen. At 4 P. M. the town was stormed by the Prussians, and an attack which the Bavarians made with a fresh force at 7 P. M. was repelled. At the other points, Hammelburg and Waldaschach, the Prussians were also victorious, and crossed the river. August Niemann.

Kist′nah, or **Krishna,** one of the largest rivers of Hindostan, rises in the Western Ghauts, about 40 miles from the Malabar coast, flows S. E. across the whole breadth of the peninsula of Deccan for 800 miles, and enters the Bay of Bengal near Masulipatam. Precious stones are found in some portions of its course.

Kit Car′son, post-v., cap. of Greenwood co., Col., on the Kansas Pacific R. R. Pop. 473.

Kit′chel (Harvey Denison), D. D., b. at Whitehall, N. Y., Feb. 3, 1812; graduated at Middlebury College, Vt., 1835; studied theology at New Haven; held Congregational pastorates at Thomaston, Conn., 1839–48; at Detroit, Mich., 1848–64; pastor of Plymouth church, Chicago, Ill., 1864–66; became president of Middlebury College 1866, and resigned that post in 1875.

Kitchen-garden. See Horticulture and the names of the principal garden-vegetables.

Kit′chen-mid′dens are large mounds consisting of oyster-shells, bones, and other refuse. They are found along the coasts of Denmark, and were formed in pre-historic times in places where the pagan inhabitants assembled to celebrate their annual religious festivals. Their character was not fully understood until the middle of this century, but their thorough exploration by Worsaae and Steenstrup has proved of great interest to science, as they contain numerous specimens of weapons and utensils, and also in various other ways give illustrations of the life which at that time was led in these regions.

Kite [Welsh *cŷd*], a toy employed for ages and in many countries by boys as a plaything, and which has also had its scientific uses. Thus, Franklin and others have obtained the electric spark from the clouds by this dangerous means. In engineering, the kite has been employed to carry lines across deep chasms, and in removing the passengers of stranded ships the kite has sometimes been successfully employed. The kite is a light frame of wood covered with strong paper, and held by a string so attached to it that it shall be acted upon by the wind much like a ship's sail when sailing close to the wind. A tail is usually, but not always, added, which gives the kite steadiness in sudden flaws of wind. The Chinese and Japanese construct kites in the form of owls, bats, dragons, etc. These have no tail, but fly low, and well before the wind.

Kite, the *Milvus regalis*, a common bird of prey in Europe, distinguished by the beauty and ease of its rapid flight and the deep forking of its tail. The name is extended to numerous other species of the same and of closely-allied genera. The U. S. have, among others, the Mississippi kite (*Ictinia Mississippiensis*) and the black kite (*Rostrorhamus sociabilis*).

Kit-Kat (or Kit-Cat) **Club,** a society consisting of about fifty gentlemen of ability and rank interested in promoting the Protestant succession in the House of Hanover. It was instituted in 1703, and took its name from Christopher Kat, a pastry-cook who lived near the tavern where they met in King street, Westminster, and supplied the members with pies. The association lasted about twenty years. Sir Godfrey Kneller painted the portraits of the members, 43 in number, among whom were Addison, Steele, Walpole, Marlborough, and himself, three-quarters length, whence the term "kit-kat portraits." The memoirs of the club, illustrated by engravings from Kneller's pictures, were published in 1821. O. B. Frothingham.

Kit′sap, county of Washington Ter., consisting of a peninsula between Hood's Canal and Puget Sound, with some islands in the sound. It is heavily timbered, and has good advantages for commerce and the fisheries. Area, about 500 square miles. Lumbering is the chief pursuit. Cap. Port Madison. Pop. 866.

Kittan′ning, tp. of Armstrong co., Pa. Pop. 1504.

Kittanning, post-b. of Valley tp., cap. of Armstrong co., Pa., on the Allegheny River and Allegheny Valley R. R., 44 miles N. of Pittsburg and 35 miles from Parker City. It has 2 national banks, 3 weekly newspapers, 1 rolling-mill, 1 woollen-mill, several oil-refineries, and various other manufactories. It has a college and other educational institutions. Pop. 1889. M. B. Oswald, Ed. "Free Press."

Kittatin′ny, or **Blue Mountain,** a chain which takes its rise near Shawangunk, Ulster co., N. Y., passes S. W. through a corner of New Jersey, crosses the Delaware at the Water Gap, trends W. S. W. through Pennsylvania, crosses the Susquehanna a few miles above Harrisburg, and the Potomac near Berkeley Springs, and continues with gradually lessening altitude through Virginia, North Carolina, and Tennessee into Alabama, thus having a total length of more than 800 miles. In average elevation and bulk the Blue Mountain range exceeds the Blue Ridge, which has acquired greater prominence on maps on account of its greater definiteness, springing from a narrow base, and the greater height of some of its peaks. The average elevation of the Blue Mountain is from 800 to 2500 feet.

Kit′tery, post-tp. of York co., Me., the south-westernmost tp. in the State. It is on the Piscataquis River, opposite Portsmouth, N. H., with which it is connected by a bridge, and is on the Portsmouth, Saco and Portland R. R., 50 miles S. W. of Portland. The Portsmouth navy-yard is on Continental Island in this township. Kittery has 5 churches. It was settled in 1623, and was the birthplace of Sir William Pepperell. Kittery Point is an important post-village in this township. Pop. of tp. 3333.

Kit′tiwake, a popular name for sea-gulls of the genus *Rissa*. Several species are known. They are rather pretty birds, and are named from their cry, which resembles their name, somewhat slowly pronounced.

Kit′to (John), D. D., b. at Plymouth, Eng., Nov. 4, 1804; lived for years in great poverty, and when eleven years old totally lost his hearing in consequence of an accidental injury; was sent to the workhouse and learned the shoemaker's trade, but devoted all his time to books; published in 1825 *Essays and Letters*, which attracted much attention; learned the printer's art in the Islington College; resided at Malta 1827–29, and at Bagdad; travelled extensively in the East 1829–33; published the *Pictorial Bible* (1838), *Pictorial History of Palestine* (1839–40), another *History of Palestine* (1843), *The Lost Senses* (autobiographical, 1845); edited and largely wrote the *Cyclopædia of Biblical Literature* (1845 *seq.*); founded and edited the *Journal of Sacred Literature* (1848–53), and many other works, of which the most popular was *Daily Bible Illustrations* (8 vols., 1849–53). Kitto received the degree of D. D. from Giessen. D. at Cannstadt, Germany, Nov. 25, 1854.

Kit′tredge (Thomas), M. D., b. at Andover, Mass., in July, 1746. He came of a family distinguished for the eminence of many of its members in the medical profession. He studied at Byfield Academy under Samuel Moody (1725–95), and at Newburyport with Dr. Sawyer; was surgeon of Col. Frye's regiment at Bunker Hill; received his degree from Harvard University in 1811. He held many important public trusts. His practice at Andover began in 1768. D. at Andover in Oct., 1818.

Kit′trell's, post-tp. of Granville co., N. C., on the Raleigh and Gaston R. R. Pop. 1829.

Kittrell's Springs, a place of valetudinary resort in

Granville co., N. C., half a mile from Henderson, on the Raleigh and Gaston R. R. Here are saline chalybeate waters, useful in a considerable range of diseases.

Kiu′-Siu′, Kioo-Sioo, or **Xi′mo,** the southernmost of the three principal islands of Japan, is situated in the Pacific, between lat. 31° and 34° N., and between lon. 129° and 134° E., and is separated from Corea by the Strait of Corea, and from the island of Niphon by the Strait of Sikokf. Nagasaki is situated on this island; otherwise it is entirely unknown to foreigners.

Kiwi-Kiwi. See Apteryx.

Kiz′il-Ir′mak [Turkish, "red river"], the modern name of the Halys, the principal river of Asia Minor, rising nearly in the E. of the peninsula, and flowing circuitously about 500 miles to the Black Sea, near the town of Sinope. It forms the boundary between the Turkish pashalics of Anatolia and Seevas. Its principal affluent is the Kara-Soo or Kastamoonee River, the *Melas* of Strabo.

Kizliar′, town of Asiatic Russia, in the government of Stavropol, on the Terek. Vines are cultivated, and silkworms reared here with great care and considerable success. Pop. 11,000.

Klad′no, town of Bohemia, 13 miles N. W. of Prague, has some iron-works and important coal and iron mines in the neighborhood. Pop. 5500.

Kla′genfurth, town of Austria, the capital of Carinthia, on the Glan. It is fortified, has large manufactures of white lead, an important transit-trade, and good educational institutions. Pop. 13,478.

Klam′ath, county of N. W. California. Area, about 2000 square miles. It is bounded on the W. by the Pacific Ocean. Its surface is generally rugged, its climate much cooler than that of the State at large. Much of the surface has a heavy growth of redwood and other timber. Gold is obtained quite extensively. The county is traversed by Klamath River. Cap. Orleans. Pop. 1686.

Klamath, tp. of Klamath co., Cal. Pop. 278.

Klamath, tp. of Siskiyou co., Cal. Pop. 84.

Klamath River rises in Jackson co., Or., traverses the Klamath Lake, passes S. W. into California, and after joining the Trinity River in Klamath co., turns N. W., and finally enters the Pacific Ocean. It is a rapid stream, and traverses a rocky and well-timbered region; it is navigable for small steamers some 30 miles.

Klam′aths, Hamatl, or **Clamets,** called by themselves **Lutuami,** a tribe of Indians living near the lakes of the same name and on the Klamath and Rogue rivers in Southern Oregon and Northern California. They belong to the tribal group called Northern Californian, sometimes termed the Klamath family, which occupies portions of the region extending from Rogue River, Or., on the N. to the parallel of 40° on the S., and from the W. boundary of Nevada to the Pacific, and comprises, besides the Klamaths proper, the Modocs, Shastas, Pitt River Indians, Eurocs, Cahrocs, Hoopahs, Weeyots, Wallies, Tolewahs, and Tototins or Rogue River Indians, besides several small bands having no distinctive names. These tribes are included in the ordinary name of "Digger Indians," given as a term of contempt to all the aborigines of Northern and Middle California, Nevada, Utah, and Southern Oregon; but the Klamath group of tribes is unquestionably superior to the others thus confounded with them. They are tall, muscular, and well-made, have regular features, the face large and oval, and the cheek-bones slightly prominent; the women are much shorter than the men, but are not unfrequently quite handsome. Tattooing is practised by both sexes to a limited extent; they are fond of nose and ear rings, and paint their bodies. They build conical and sometimes square houses of stone and wood, partly sunken in the ground; have canoes, and are expert fishers, but indifferent hunters, being fonder of using snares and traps than weapons, with which they are ill provided. Berries and roots form a large portion of their food. The women are ingenious in basket-making and plaiting grass into hats, hammocks, and mats. They are fond of traffic, using shell-money; are not addicted to war, but when attacked defend themselves desperately, as was instanced in the "Modoc war" of 1873. Polygamy is common, and morality very low, wives being bought and sold. The chiefs have little more than a nominal authority. The passion for wealth and for gaming is universal; they are superstitious, and their religion is a degrading fetichism. The dead are sometimes burned, but more commonly buried. In 1851 the Klamaths proper numbered 18 villages and about 3000 souls; they have since rapidly declined, partly through conflicts with whites, but chiefly through the vices contracted from contact with "civilization." By a treaty made in 1864 they ceded to the U. S. all their lands except a reservation on the Klamath lakes of 1200 square miles, where they are gradually adapting themselves to the pursuits of agriculture, and especially devoting themselves to lumbering. In 1873 they numbered only 572. (For copious information upon the Klamaths and the allied tribes see H. H. Bancroft's *Native Races of the Pacific States* (1874), vol. i., ch. iv., where all the authorities are indicated.) Porter C. Bliss.

Klap′ka (György), b. at Temesvár, Hungary, Apr. 7, 1820; was educated in the artillery school at Vienna, became an officer in the emperor's life-guards, and in 1847 obtained a command in a border regiment. When Hungary revolted in 1848, young Klapka immediately espoused the cause of his insurgent country, and was made chief of staff of Gen. Kis, and in 1849 commander of an army corps. He led his troops with talent and energy in the battles of Kapolna, Komorn, etc., and was made minister of war by Kossuth. After the defeats experienced by the Hungarians, Klapka shut himself up in the fortress of Komorn, where he heroically repulsed during several weeks the desperate attacks led by the famous Austrian general, Haynau. He surrendered only after having obtained for his army and himself the "honors of war." He spent many years in exile in Germany, England, France, and Turkey, and entering the German service attempted, though unsuccessfully, to raise Hungary against Austria in 1859 and 1866. Klapka was naturalized as a Swiss citizen, and elected a member of the federal council in 1856. In 1867, on the reorganization of the Austro-Hungarian empire, he returned to his native country, and was employed in the army. In 1873 he was in the military service of Turkey, and visited Egypt in 1874. He wrote *Memoirs of the War of Independence in Hungary* (1850), *The National War in Hungary and Transylvania* (1851), and a work on *The War in the East* (1855). Félix Aucaigne.

Klap′roth (Martin Heinrich), b. at Wernigerode, Germany, Dec. 1, 1743; was employed for seven years in an apothecary shop at Quedlinburg, and afterwards at Hanover and Berlin, at which latter places he made a methodical study of chemistry, and published numerous analyses of great value, which obtained for him professorships of chemistry at the Berlin School of Artillery (1787) and university (1789). He was made a member of the French Institute, of the council of public health, and of many scientific bodies. Among his discoveries were the metals zirconium, titanium, and uranium, the sulphate of strontium, and the molybdate of lead. He did much to advance the classification of minerals by chemical analysis; was an early defender and popularizer of the discoveries of Lavoisier. His numerous writings were chiefly published as papers in the *Denkschriften* of the Berlin Academy, the analyses alone constituting five volumes of a collected series published from 1795 to 1810. He also edited a *Chemical Dictionary* (5 vols., 1807–10) and a *Chemical Manual.* D. at Berlin Jan. 1, 1817.

Klaproth, von (Heinrich Julius), son of the celebrated chemist, b. at Berlin, Prussia, Oct. 11, 1783; applied himself by stealth when fourteen years of age to the study of Chinese, and manifested such wonderful talent for languages that he was allowed to devote himself to philology instead of applied science, as intended by his father. He studied at the universities of Halle and Dresden, and finding in the Dresden library a fine collection of Oriental MSS., he established in 1802 the *Asiatisches Magazin,* printed at Weimar, for making known the results of his researches. These achievements of a boy of nineteen years naturally attracted attention in Germany and Russia, and in 1804 the government of the latter country appointed Klaproth interpreter to an embassy already on its way to China. He set out alone, overtook the embassy in Siberia, and accompanied it into Mongolia (Jan., 1806), but the refusal of the Chinese government to receive a Russian envoy prevented his penetrating into China proper. Returning to Europe by a different route, he acquired a knowledge of the geography of Central Asia, and of the languages of the inhabitants, which he turned to good account. In 1807 he was sent to explore the Caucasus, and spent a year in that region, after which he was appointed professor at the University of Wilna. He was made a member of the Russian Academy, had a pension and other honors equivalent to a grant of nobility, but difficulties thrown in the way of the publication of his researches led to a rupture, and when he left Russia in 1812 his titles and honors were revoked. He then published at Halle his *Travels in Caucasus and Georgia* (1812–14), at Weimar his *Geographico-Historical Description of Eastern Caucasus* (1814), and at Berlin his *Description of the Russian Provinces between the Caspian and Black Seas* (1814). He conceived a great admiration for Napoleon precisely at the time when the fortunes of that monarch were most rapidly declining; visited him at

the island of Elba, and was received with honor. On the final establishment of the Bourbons in France, Klaproth settled in Paris, obtaining through the influence of Humboldt a nominal professorship at Berlin with a handsome salary. He spent the remainder of his life in the French capital, engaged in the production of a series of works upon Asia, especially Central Asia and China. Among these were *Asia Polyglottæ* (1823–29), with a linguistic atlas; *Tableaux historiques de l'Asie* (1824), treatises on the Chinese, Corean, Mantchoo, and other Asiatic languages, and very numerous papers in the transactions of learned societies. He left in MS. a geographical and historical work on the Chinese empire, and a *New Mithridates, or Systematic Classification of All Known Languages, with Vocabularies.* The geographical labors of Klaproth in Central Asia have lately been accused of fraud on a colossal scale by Sir Henry Rawlinson (1872). D. at Paris Aug. 20, 1835.

Klat'tau, town of Bohemia, 68 miles N. W. of Prague. It has considerable manufactures of leather. Pop. 7382.

Klau'senburg [Hun. *Kolosvár*], the capital of Transylvania, formerly a separate principality of the Austrian empire, now united to Hungary, situated 225 miles S. E. of Pesth. Pop. 26,382. It has a university established in 1872, a Unitarian college, a fortified castle, manufactories of porcelain, and a considerable trade. The inhabitants are chiefly Magyars.

Kléber (Jean Baptiste), b. at Strasbourg in 1755. Son of a stonemason, he was one of the truest and best representatives of that generation of Frenchmen who started from the then so-called low ranks of society, and demonstrated, through their splendid actions and noble conduct, the necessity of the coming of the Revolution, which erased for ever discrimination between classes. Kléber's military and warlike character caused him to give up his first calling as an architect, and to enlist in the military service of Austria. He was soon tired of that mercenary work, and returned to France, where he was inspector of buildings at Belfort, when in 1792 he volunteered to serve as a private in the republican armies of France, where he rapidly rose to the highest rank. After the glorious siege of Mayence, Kléber was sent to fight against the royalists of Vendée, then to the armies of Sambre-et-Meuse and of the Rhine, with which he crossed the Rhine and won the two battles of Altenkirchen and Friedberg in 1795. As he was a strong republican, the Directory did not want to employ him; but Napoleon gave him a command in the expedition to Egypt, and left him there as general-in-chief. After the departure of Napoleon, Kléber vanquished the Turks at Heliopolis; 1800 again subdued Egypt, which had revolted, and was murdered at Cairo, June, 1800, by a fanatical Moslem. In Strasbourg there is a square called "Place Kléber," adorned with a statue of the great Strasbourgeois republican general. Félix Aucaigne.

Kleene'-Boc [Dutch for "little buck"], the *Cephalopus pygmæa*, one of the smallest of the antelope group, an active little animal of South Africa. It is one foot high at the shoulders, and is of a dark slate-color.

Klein (Johann Adam), b. in Nuremberg Mar. 24, 1792; d. May, 1875. He studied at the art academy in Vienna, and after travelling in Hungary, returned and began work in his native city in 1815; in 1819 was sent by King Louis of Bavaria to Italy; was there two years, and afterwards made Nuremberg his home. Klein was chiefly famous as a painter of battle-pieces, but excelled also in portraiture. He was, besides, an engraver of ability, and reproduced many of his own and other artists' works.

Kleist, von (Heinrich), b. at Frankfort-on-the-Oder Oct. 10, 1776. He never succeeded in giving his life a fixed and practical aim. The military service he left in order to study philosophy and mathematics, and these studies he left in order to accept a position in the Prussian civil service. This he gave up in 1806, and determined to devote himself exclusively to literature, but more than once he abandoned literature too with disgust. The result of a life thus scattered was despair, and the state of degradation in which Napoleon kept Germany, and the personal disappointments and calamities which befel Kleist from this source, added to his misery. It was of no use that moments of the most sublime enthusiasm alternated with his despair. He grew tired of life, and Nov. 21, 1811, he shot himself at Wansee, near Potsdam, having shot first his friend, according to a given promise, Henriette Vogel, the wife of a rich merchant, a spirited and highly gifted woman, but sick in mind like her lover. In 1826, Tieck published a collected edition of his works in 3 vols. His dramas, *Die Familie Schroffenstein* (1803), *Amphitryon* (1807), *Der zerbrochene Krug* (1811), *Kätchen von Heilbronn* (1810), *Die Hermannsschlacht*, and *Der Prinz von Homburg*, belong now to the standard pieces of every stage in Germany; and his novels, among which *Michael Kohlhaas* occupies the first place, have taken rank beside Goethe's and above Tieck's. It is now generally acknowledged that Kleist was one of the richest and most original poetical geniuses which the German people has produced. Other poets have depicted greater characters, but in the life and fulness of the delineation none has ever surpassed him, and the sickliness of his spirit is not so very conspicuous in his works. After his death he became the idol of the romantic school, not exactly on account of the diseased state of his mind, but on account of his absolute contempt for real life.

Clemens Petersen.

Klemm (Friedrich Gustav), b. at Chemnitz Nov. 12, 1802; studied history in Leipsic, Jena, and Dresden; held different positions at the library of Dresden 1831–63, and d. Aug. 25, 1867. His principal writings are *Allgemeine Culturgeschichte der Menschheit* (10 vols., 1843–52), *Allgemeine Culturwissenschaft* (2 vols., 1854), and *Die Frauen* (6 vols., 1854–58).

Klen'ze, von (Leo), b. at Hildesheim Feb. 29, 1784; studied at Brunswick, Berlin, and Paris; travelled through Italy, and settled in 1815 at Münich, where he became architect to the court. He built the whole modern Münich—the Walhalla, Pinakothek, Glyptothek, Odeon, Museum, royal palace, post-office, etc., and a great number of private palaces and houses. Also in St. Petersburg, whither he was invited in 1839, he built a great number of buildings, all of which are distinguished by something magnificent and picturesque; but there is nothing original in them. Of his writings, *Aphoristische Bemerkungen* (1838) is an interesting book. D. Jan. 27, 1864.

Kleptomania. See Insanity, by W. A. Hammond, M. D.

Klias'ma, a river of Russia, rises in the government of Moscow, flows through those of Vladimeer and Nizhnee-Novgorod, and joins the Oka after a course of 327 miles. It is navigable for about 150 miles, and, as it runs through the most densely peopled and industrially developed districts of the country, is of great commercial consequence.

Klike'tats, a tribe of Indians living in Washington Territory, in the region N. of the Dalles, between the Cascade Range and the Columbia River. They belong to the Sahaptin family of the Columbian group, and are therefore akin to the Nez Percés and Walla Wallas, while they seem to be almost identical with the Yakimas, from whom, apparently, they are distinguished only by geographical location. They were formerly quite migratory in their habits of life, but their most permanent abode was in the valleys between Mounts St. Helen and Adams, W. and S. of the Yakimas. The name *Kliketat* means "robber," and was gained by their encroachments upon neighboring tribes, they having for many years overrun the Willamette Valley, until in 1855 they were curbed by forces of the U. S. army. They have since been consolidated with the Yakimas, and placed upon the reservation near Fort Simcoe, E. of the Coast Range, where they have made considerable progress in civilization. They are divided into five bands, and number about 2000. (See Bancroft's *Native Races of the Pacific States*, vol. i.)

Kliki'tat, county in S. Washington Territory. Area, about 5000 square miles. It lies E. of the Cascade Mountains, and is bounded on the E. and S. by the Columbia River. It is generally a good open grazing country. It includes the Klikitat Prairie. Cap. Rockland. Pop. 329.

Kling'er, von (Friedrich Maximilian), b. at Frankfort in 1753, and educated at the University of Giessen; wrote dramas for the Seyler band of strolling actors; took part as a volunteer in the Bavarian war of succession; went to St. Petersburg in 1780; rose there to the highest positions in the military administration; became lieutenant-general in 1811, and d. Feb. 25, 1831. In 1775 he wrote a tragedy, *Sturm und Drang*, a horribly affected imitation of Shakspeare, from which the whole period of fermentation preceding the appearance of Goethe and Schiller received its name. But, with the exception of this one fact, all Klinger's tragedies, comedies, and novels are entirely destitute of interest.

Klipp'springer [Dutch], the *Oreotragus saltatrix*, a beautiful and graceful South African mountain antelope, resembling in its habits the chamois. It is an extremely agile and swift little creature, less than two feet in height.

Klop'stock (Friedrich Gottlieb), b. in Quedlinburg, Prussian Saxony, July 2, 1724. He studied theology first in Jena, where he (1745) wrote the first song of his great epic poem, *Messiah;* then in Leipsic, where he (1748) published the first three songs of that poem in *Bremische Beiträge.* They made a deep impression. Every young man became at once his admirer and his disciple. But, although he had touched the very heart of his nation, he found no support

and little encouragement at home. All literature in Germany was at that time more or less a court affair, and every court was a petty copy of Versailles. Frederick the Great considered the attempt of forming a genuine German literature as foolishness, and even the emperor Joseph, to whom Klopstock dedicated his great drama, *Hermann's Schlacht*, could not be brought to take any notice of him. He was supported by foreigners. The Danish king gave him a pension—small enough—and on this he lived partly in Copenhagen, partly in Hamburg, where he d. Mar. 14, 1803. Even when a boy he entertained the idea of writing a great epic poem, and he certainly succeeded in realizing this idea, though, unfortunately, his poem bears striking, even painful, marks of being the result of great exertions, as much as the product of great powers. Klopstock becomes often forced when he wishes to be strong, and obscure when he tries to be deep. His *Odes* are generally hard to understand, and not always worth understanding. It is impossible, therefore, to explain the impression he made and the influence he exercised from the artistic value of his works; they depended on the peculiar position he occupied in the history of German literature. He is the father of modern German poetry, not because he created it, but because he made it possible—not on account of his genius, but on account of his standpoint. In a moment when the German nation had given up its confidence in itself, and looked to France not only for its literary forms, but for its literary impulses, Klopstock stepped forth and emphasized German character, as revealed in German history and German Protestantism, with such a strength that it echoed through two or three generations, and became a rallying-point for all national aspirations and sympathies. CLEMENS PETERSEN.

Knapp (ALBERT), b. at Tübingen, Würtemberg, July 25, 1798; studied theology; held different positions in the Protestant Church, and was appointed pastor in 1836 at Stuttgart, where he d. June 18, 1864. His *Christlichen Gedichte* (2 vols., 1829) and *Neuern Gedichte* (1834) contain some of the most beautiful hymns produced in our time.

Knapp (CHAUNCEY L.), b. in Berlin, Vt., Feb. 26, 1809; learned the printing-trade at Montpelier; was for some years editor of the Vermont *State Journal;* secretary of state from 1836 to 1840; removed to Massachusetts, and was secretary of the senate in 1851, and was a member of Congress from 1855 to 1859. He had nominated Gen. Harrison for the Presidency in 1836, obtaining for him the electoral vote of Vermont, four years before the campaign in which that President was elected.

Knapp (HERMANN), M. D., b. in Germany in 1832; was professor of ophthalmology in the University of Heidelberg from 1864 to 1868. In the latter year he removed to New York, where he opened the New York Ophthalmic and Aural Institute, and founded the *Archives of Ophthalmology and Otology*, published both in German and English. He is the author of *Intraocular Tumors* and various papers in different ophthalmological periodicals.

Knapp (JACOB), b. at Otego, Otsego co., N. Y., Dec. 7, 1799; was educated as an Episcopalian, but about his twenty-first year joined the Baptist Church; studied at Madison University in Hamilton, and taught school at Springfield, where he entered the ministry in 1822. In 1830 he removed to Watertown, taking an active and very successful part in a revival there, after which he entered upon the wider field of itinerant preaching. His labors now directed him to all the principal cities and towns of the New England and Middle States, thence westward to Chicago and St. Louis, and finally to California, everywhere by his earnest enthusiasm and practical preaching winning multitudes of converts. He published his *Autobiography* a few years before his death on Mar. 2, 1874, in which, among the statistics of his labors, it is stated that about a dozen years after he began independent preaching the number of converts had reached 100,000, and he thereafter refrained from counting them.

Knapp (SAMUEL LORENZO), LL.D., b. at Newburyport, Mass., Jan. 19, 1783; graduated at Dartmouth in 1804; became a lawyer: commanded a militia regiment as colonel in the war of 1812–14; from 1824 to 1828 edited journals in Boston, Mass.—the *Gazette*, the *National Republican*, and others. In 1827 he entered upon the practice of law in New York. Col. Knapp was the author of many works, chiefly biographical, among which are *Travels in North America by Ali Bey* (1818), *Biog. Sketches of Eminent Lawyers, Statesmen, and Men of Letters* (1821), *Genius of Freemasonry* (1828), *Sketches of Public Characters* (1830), *Am. Biography* (1833), *Lives* of DeWitt Clinton (1828), of Daniel Webster (1835), Aaron Burr (1835), and a revision of J. H. Hinton's *History of the United States* (1834). D. at Hopkinton, Mass., July 8, 1838.

Knap'sack [Dan. *knapzak*, from *knappen*, to "eat"], a case, wallet, or scrip of leather or painted canvas carried upon the shoulders. The knapsack is chiefly employed by foot-soldiers for carrying their personal effects.

Knares'borough, town of England, in the county of York, on the left bank of the Nidd. It has some manufactures of linen and cotton goods, and some interesting ruins. Pop. 5205.

Knaus (LUDWIG), b. at Wiesbaden Oct. 5, 1829. His father was an optician. He received instruction from Jacobi, the painter of the grand duke, and was sent, pensioned by the state, to Düsseldorf. There Sohn and Shadow were his teachers, but he struck out an original path for himself in the portrayal of scenes in peasant-life. In 1853 he went to Paris, and remained eight years; returned to Germany; sojourned a while at Berlin, and finally (1866) took up his residence in Düsseldorf. M. Knaus is a member of the Academy of Amsterdam, and has received a gold medal at Berlin. Other medals were bestowed on him in 1853, 1855, 1857, 1859, and a medal of honor in 1867; the same year he was created an officer of the Legion of Honor. The pictures of Knaus represent scenes in German rustic life, and are rich in humor. Good examples may be seen in private collections of New York.

Knee'land (ABNER), b. in 1774; was for a time a Baptist minister, then a Universalist, and finally a deist. He was (1821–23) editor of a Universalist periodical in Philadelphia; in 1828 editor of the *Olive Branch*, N. Y.; in 1832 founded the *Investigator* at Boston, Mass., and in 1836 was tried before the supreme court at Boston on a charge of blasphemy. D. at Salubria, Ind., Aug. 27, 1844. He published *The Deist* (1822), *Lectures on Universal Salvation* (1824), a translation of the New Testament (1823), a *Review of the Evidences of Christianity* (1829), and other works.

Kneeland (SAMUEL), M. D., b. in Boston, Mass., Aug. 1, 1821; graduated at Harvard in 1840, and at the Massachusetts Medical School in 1843; studied in Paris, and practised medicine in Boston 1845–50. He is an active member of many learned societies; served as an army surgeon in the late war. In 1866 he became secretary of the Massachusetts Institute of Technology, and professor of zoology and physiology there. Prof. Kneeland has contributed much to scientific and other literature, and edited (1866–69) the *Annual of Scientific Discovery*.

Knel'ler (Sir GODFREY), b. at Lübeck in 1646; was sent by his father (who intended that he should pursue the military profession) to London to study mathematics and fortification. Having more taste for painting, he went to Amsterdam, and studied, so tradition says, with Rembrandt and Ferdinand Bol; at the age of seventeen went to Rome, and was a pupil of Maratti and Bernini; in Venice gained a reputation by painting the portraits of eminent persons, especially of Cardinal Bassadonna. His fame was earned in London, whither he repaired in 1674. The duke of Monmouth, being attracted by a portrait of his secretary which Kneller had painted, sat for his own, and persuaded the king, Charles II., to sit also. The picture was successful, partly, it would seem, because it was executed with rapidity and boldness, and the artist's fortune was made. He had as much as he could do, and at his own prices. The number of his portraits is as astonishing as the quality of his subjects. He painted the likenesses of ten sovereigns—Charles II., James II., William III., George I., Louis XIV., Peter the Great, Charles V., and queens Maria, Mary, and Anne. William employed him to paint the beauties of Hampton Court, conferred on him the honor of knighthood, and presented him with a gold medal and chain. George I. created him a baronet. Kneller d. in 1723, and had a monument erected to him in Westminster Abbey; he was buried at Whitton. The monument was erected at his own expense, after designs by a sculptor of his own selection. Kneller was vain, and greedy of money and distinction, and is thought to have done less than justice to his real talents. He was a coarse man, and did coarse work; but he had knowledge, judgment, and taste, and when he exerted himself, as in those of his pictures in the Gallery of the Admirals, in which he shared the honor with Lely, showed that he was a man of ability. After the death of Sir Peter Lely he stood at the head of his profession in England. But he owed his fame to the quality of his patrons rather than to the quality of his art. In a better age he might have done better work. The portraits of the Kit-Kat Club are among the best of Kneller's pieces. To him we owe the preservation of Rafaelle's cartoons. Kneller was married, but left no heirs to enjoy the large fortune that he accumulated. He was a wit, highly appreciated by men like Dryden, Addison, Prior, and Steele, and the members of the Kit-Kat Club, to which he belonged. O. B. FROTHINGHAM.

Kniaz'nin (FRANCISZEK DYONIZY), b. Oct. 4, 1750;

educated at Vitebsk, in the school of the Jesuits, which order he entered. After the dissolution of the order in 1773 he became secretary to Prince Adam Czartoryski, but fell about 1796 into a mental derangement from which he never recovered. D. Aug. 25, 1807, at Konskawola, one of the estates of the prince. He translated Horace, Anacreon, Catullus, Ossian, and others, and among his own poetical productions there are many idyls and minor poems of a delicate beauty, both in sentiment and form.

Knight [from Teut. *Knecht,* defined by Grimm as *puer, famulus, servus,* "attendant or servant"]. The word corresponding to our "knight" is in most languages derived from the horse, as, for instance, the French *chevalier,* the Danish *Ridder,* etc. In nearly all nations which have attained any martial renown there has been set apart a body of combatants known by a distinguishing title and performing certain honorable service. Such were those Grecian warriors whom historians call knights, and such also the equites of Rome. (See Equestrian Order.) But knighthood, as associated with chivalry, is of Northern origin. A certain value of land, called in England a "knight's fee," and in Normandy "fief de haubert," was allotted to a tenant, who in return bound himself to follow his lord to battle. Thus, in its earlier days knighthood was but a part of the feudal system, and could boast little of that nobleness which afterwards distinguished it. Its real history begins with the Crusades. During these wars it assumed a voluntary character. The younger sons of noble families enlisted under the banners of wealthy lords, in whose service they might hope to gain such honor, and even riches, as would raise them to an equality with their elder brothers. Barons were glad to take these adventurers into their pay, and it was not long before knighthood won by voluntary service became more esteemed than that feudal sort which was the right of the eldest born; so that in time rich landowners grew ashamed of a title which they had not earned, and refused the honor until they had earned it by some brave exploit. During the Crusades knighthood became blended and almost identified with religion. Every knight pledged himself to aid in recovering the Holy Land. Fighting against infidels was itself a religious service; warriors who died while wearing the cross were assured by priest and pope of a speedy entrance into paradise; chivalry was held to be little lower than the Church itself, and the two were united in the persons of those monk-soldiers who, while under vows of poverty, chastity, and obedience, were also foremost and fiercest in battle. Their deeds, however great, were supposed to increase not their own renown, but that of the order to which they belonged, and it may be that such devotion to a common interest had some influence over secular warriors, and aroused that *esprit de corps* which made knighthood a universal brotherhood. Another peculiar trait of knighthood was the worship of women. Women gave the prize in tournaments; the knight wore his mistress's favor in real as in mimic battle; God and the ladies (*Dieu et notre Dame*) were associated on the lips and in the heart of every true knight. Various manuals were written, especially when chivalry was on the decline, to teach knightly duty, but our most vivid knowledge of knights and their manners is derived from ancient romances and from chroniclers like Froissart and Joinville, whose naively-told stories show us not only the virtues of chivalry, but also its vices. In France, knighthood came nearest to the ideal standard. German knights were wanting in courtesy, and too often regarded noble birth as more important than noble deeds.

During the Middle Ages many orders of religious knighthood were founded for the purpose of helping Christians against the infidels. Their members were bound to poverty, chastity, and obedience, but the first, at least, of these vows was soon broken. The orders became very rich and luxurious, the original motives of their formation were lost sight of, and their power aroused the jealousy of kings and nobles. The chief of those orders were: The *Hospitallers,* or brothers of St. John of Jerusalem, founded 1043 to nurse and care for poor wounded crusaders. After leaving the Holy Land they occupied first the island of Rhodes, and then Malta, whence they were expelled by Napoleon Bonaparte in 1798. The *Templars,* so called from having a house near the supposed site of Solomon's Temple, founded 1118 for the protection of pilgrims. They grew extremely rich, and after quitting Palestine had establishments in several European countries. Having been accused of heresy and other crimes, they were in 1311 suppressed by Pope Clement V., at the instigation of Philip the Fair, king of France, who caused many of them to be imprisoned, banished, or put to death. The *Teutonic* order, instituted during the siege of Acre, at the close of the twelfth century, acquired great power, and in the thirteenth century conquered Prussia, Livonia, and Courland from their heathen chiefs. The Spanish order of *St. James of Compostella* was founded for the defence of pilgrims to the shrine of that saint, and the knights were continually engaged in warfare with the Moors. Janet Tuckey.

Knight, tp. of Vanderburg co., Ind. Pop. 1342.

Knight (Charles), b. at Windsor, Eng., Mar. 19, 1791; studied at a classical school at Ealing, and served an apprenticeship with his father, who was a bookseller at Windsor. After a brief residence in London, occupied in gaining a practical insight into journalism, he established, in company with his father, a newspaper, the *Windsor and Eton Express,* which he edited from 1812 to 1826. During this period he also published the *Etonian* (a magazine edited by Praed, and of which Macaulay and Nelson Coleridge, then "Eton boys," were leading writers), and the *Plain Englishman,* a cheap literary miscellany in 2 vols., chiefly written by himself (1820–22). Removing to London in 1820, Knight purchased the *Guardian* newspaper, which he edited for two years, when he sold it in order to commence business as a publisher in Pall Mall. The most important venture of the new house was *Knight's Quarterly Magazine* (1823–24), which contained some brilliant articles by Macaulay, Praed, and other Cambridge students, but came to an end after six numbers. About this time (1824) he brought out a newly discovered work by Milton on *Christian Doctrine,* which gave occasion to the remarkable article on Milton with which Macaulay commenced his triumphal career in the columns of the *Edinburgh Review.* Shortly afterward Knight conceived the plan of a national library, "a cheap series of books which should condense the information contained in voluminous and expensive works," for which he selected the subjects of about 100 volumes in history, science, art, and miscellaneous literature. The scheme being too large for a single publisher, a part was given to other houses, and it was adopted by the Society for the Diffusion of Useful Knowledge, then just formed. As a consequence of the commercial crisis of 1826, Knight's publishing-house went down like so many others, but in the following year he commenced business again as superintendent of the publications of the U. K. Society. His connection with that association lasted nearly twenty years, and was the central incident in his career. He displayed great enterprise and mental activity in projecting many of the most popular and useful works of a series which was practically the continuation of his own early scheme. The *British Almanac* and *Companion to the Almanac* were commenced in 1828, edited by Knight for forty years, and still continued as an indispensable handbook and work of reference. In 1829 he recommenced business as a publisher in his own name for the purpose of bringing out the *Library of Entertaining Knowledge,* a series for which he wrote the volumes on *Menageries* and *The Elephant.* In 1832 he commenced the *Penny Magazine,* which had an unprecedented success, reaching a sale of 200,000 within a twelvemonth, and led to the *Penny Cyclopædia,* commenced in 1833 by the U. K. Society, but of which Knight was the publisher. Originally intended as a popular manual of reference in eight handy volumes, it grew into twenty-seven bulky volumes, forming a learned and original digest of universal knowledge. With the coöperation of John Kitto and other able writers Knight next brought out a series of illustrated works, the *Pictorial Bible, Prayer Book, History of Palestine, Pictorial History of England, London, Old England, Shakspeare, The Land We Live In,* etc., which had a deservedly great success. In 1854 he commenced the *English Cyclopædia,* in four divisions, according to the subject, a work of still greater value than its predecessor, the *Penny Cyclopædia.* Besides editing the *Weekly Volume* and the *Shilling Volume* series, Knight compiled *Half Hours with the Best Authors, Half Hours of English History,* and other works on the same plan, prepared a valuable biography of Shakspeare, and wrote a *Popular History of England* in 8 vols. (1856–62), which occupied his declining years, and may be considered his greatest original work. After 1862 he revised and reissued his earlier productions, and wrote an interesting autobiography entitled *Passages of a Working Life during Half a Century* (3 vols., 1864–65). D. at Addlestone, Surrey, Mar. 9, 1873. Knight may fairly be esteemed one of the greatest benefactors of the English-speaking public of the nineteenth century, as the founder of that system for the generalization of knowledge which was so successfully carried into effect for many years by himself and his younger rivals, the Messrs. Chambers. His original productions, too numerous to be here mentioned, are all characterized by a vigorous style and a high degree of adaptation to the wants of the class of readers addressed. His pecuniary success was not in proportion to the enormous circulation of his works, and on some of the best of them, like the *Penny Cyclopædia,* he lost heavily. In consideration of this fact he was in 1860 appointed by the government publisher of the *London Gazette,* a sinecure post with

£1200 a year. His statue was erected in 1874 in his native city of Windsor. PORTER C. BLISS.

Knight (HENRY COGSWELL), b. at Newburyport, Mass., about 1788; spent his childhood at Rowley; graduated at Brown University in 1812; was ordained in the Episcopal Church, and published two volumes of sermons, but was never settled over a congregation. He published a volume of verse in 1809, and another, *The Broken Harp*, in 1815, both which were republished with additions in 1821. D. 1835. He left an amusing autobiography, extracts from which were given in a volume entitled *Thorn Cottage, or the Poet's Home* (1855), which chiefly consists of sketches and verses written by his younger brother, Frederick (b. in Hampton, N. H., Oct. 9, 1791; d. at Rowley Nov. 20, 1849). The poems of Henry C. Knight are full of fine touches of character and sportive satire, which make them worthy of remembrance. (See Duyckinck's *Cyc. Am. Lit.*, vol. ii. p. 158.)

Knight (JONATHAN), b. in Bucks co., Pa., Nov. 22, 1787; removed at the age of fourteen, with his parents, to East Bethlehem, Washington co.; received only a limited common school education, but by close application at home made much progress in the study of mathematics, of which he was very fond. At the age of twenty-one he was engaged as a teacher, at the same time pursuing his occupation as a surveyor; in 1816 he made for the State a survey of Washington co.; was elected county commissioner 1817–20; in 1822 he was elected to the State legislature, and for six sessions was re-elected to the senate or house of representatives; U. S. commissioner (1825) for extending the National Road from Wheeling to Illinois, and for many years chief engineer of the Baltimore and Ohio R. R. D. at E. Bethlehem Nov. 22, 1858.

Knight (JONATHAN), M. D., b. at Norwalk, Conn., Sept. 4, 1789; graduated at Yale in 1808; studied under Dr. Rush at the medical school of the University of Pennsylvania 1811–13, became professor of anatomy and physiology at Yale College in 1813, and in 1838 was transferred to the chair of surgery; was president of the American Medical Association in 1853; was a skilful operator and an effective lecturer, but wrote little. He obtained in 1862 the establishment of a U. S. military hospital at New Haven. D. at New Haven Aug. 25, 1864.

Knight (RICHARD PAYNE), b. at Wormsley Grange, Herefordshire, England, in 1750; came in 1771 into possession of a handsome fortune, which he liberally employed in the formation of a unique collection of ancient coins, bronzes, and objects illustrating the pagan religions of antiquity. He wrote a curious work entitled *An Account of the Remains of the Worship of Priapus lately existing at Isernia in the Kingdom of Naples, to which is added a Discourse on the Worship of Priapus, and its Connection with the Mystic Theology of the Ancients,* which he privately printed in 1786, and for which he was severely criticised on the score of delicacy, though at the present day the same branch of inquiry has assumed great importance, and Knight's treatise was reprinted in elegant style in New York in 1874. He was for many years a member of Parliament and trustee of the British Museum, to which he bequeathed his collection of antiques. He published several volumes of poems, which were little esteemed, a successful work on the *Principles of Taste* (1805), and an edition of Homer, with the digamma restored and supposed interpolations suppressed, which created considerable interest, but was not accepted as authoritative. D. in London Apr. 24, 1824.

Knight (THOMAS ANDREW), F. R. S., brother of Richard Payne Knight, b. at Wormsley Grange, Herefordshire, England, Oct. 10, 1758; graduated at Baliol College, Oxford, and devoted his attention to vegetable and animal physiology and horticulture, of which sciences in their modern form he may almost be considered the founder in England. He contributed forty-six papers to the *Transactions* of the Royal Society, in some of which he came near anticipating the characteristic doctrines now known as *Darwinian.* His studies on the propagation of fruit trees, made public about 1795, attracted deserved attention. In 1797 he published a *Treatise on the Culture of the Apple and the Pear,* and in 1809 *Pomona Herefordiensis, or Natural History of the Old Cider and Perry Fruits of the County of Hereford.* He succeeded Sir Joseph Banks as president of the Horticultural Society, and d. at London May 11, 1838. After his death his *Physiological and Horticultural Papers* were collected and published (1841), with a sketch of his life, in a volume which well deserves the study of country gentlemen. "Few men," says Allibone, "have done so much to promote the science of horticulture as Mr. Knight has effected, both by precept and example."

Knight-Service. See TENURE.

Knight's Ferry, post-v., cap. of Stanislaus co., Cal., in a fertile wheat-region, once celebrated for rich placer gold-mines.

Knights Templar. See TEMPLAR.

Knights'town, post-v. of Wayne tp., Henry co., Ind., on the Pittsburg Cincinnati and St. Louis R. R. and on Blue River, 34 miles E. of Indianapolis. It has several churches, a national bank, an academy, machine-shops, and 2 weekly newspapers, and is situated in a fine farming district. Pop. 1528.

Knights'ville, post-v. of Van Buren tp., Clay co., Ind., is situated on the Terre Haute and Vincennes R. R., 16 miles E. of Terre Haute and 56 W. of Indianapolis. It has 3 churches, 3 schools, 3 lodges, 1 newspaper, 1 large planing-mill and sash and door factory, 2 blast furnaces with a capacity of fifty tons per day, and 1 rolling-mill giving employment to 150 men, 3 coal-shafts, 3 drug stores, and 8 other stores. It is the centre of the block-coal region of Indiana, is one of the largest shipping-points for freights between St. Louis and Indianapolis, and the N. terminus of a projected railroad to Bowling Green, Ky. It was first laid out in 1865, and is surrounded by a fine timbered and agricultural country. Pop. 1071.

LUTHER WOLFE, ED. "CLAY CO. ENTERPRISE."

Knip'perdolling (BERNHARD), b. in Münster, Germany, near the end of the fifteenth century, adopted in Sweden the doctrines of the Anabaptists, one of the wild fermentations of the Lutheran reform, and, returning to his native province, was associated with Matthias, Johann Boccold or Bockelson (called John of Leyden), and other fanatics in the celebrated socialistic crusade proclaimed in Münster in 1534. Knipperdolling was elected burgomaster, and subsequently stadtholder, John of Leyden being proclaimed king. Equality of property and community of wives were among the cardinal doctrines of this mad effervescence, which startled Luther, and was by him denounced in the strongest terms. On the suppression of the movement, Knipperdolling was taken prisoner and put to death, after frightful tortures, Jan. 23, 1536.

Knit'ting [Ang. Sax. *cnyttan* or *knittan;* Ger. *knutten, knot;* Hind. *ganth;* Sans. *gnanthi*, a "knot"], a manner of weaving or twisting a single thread into a kind of cloth by means of steel, ivory, or wooden implements called knitting-needles, which are made of various sizes, according to the fineness of thread used and the tightness of stitch required. For *flat* or straight knitting two needles are employed; for *round* knitting, such as stockings and cuffs, three, four, or even five, are needed. Steel needles are used with silk, flax, and cotton thread; wood, bone, or ivory for most kinds of woollen yarn. As knitting consists of loops or meshes made without knots, it is easily undone, the slipping of one loop frequently causing the destruction of the whole fabric. It is extremely elastic, and therefore very suitable for gloves, stockings, and other articles in which an exact fit without compression is desirable. The work is easily learned, and by a skilful knitter, whose fingers have acquired delicacy of touch, can be carried on almost or altogether without using the eyes. It is for this reason specially adapted as an employment for the aged, and is practised with much success by the blind.

Knitting is a far more modern invention than its kindred art, netting. The exact period when it was first practised is not known, though at the time of the Rowleyan controversy much information on the subject was collected by antiquaries. Chatterton, in the poems written by him, pretending that Thomas Rowley, who lived in the fifteenth century, was their author, mentioned knit stockings:

> "She said, as her white hands white hosen were knitting,
> What pleasure it is to be married!"—*Ælla*, xxxvii.;

and his antagonists used this as an argument against his veracity, asserting that knit hose were not known until the sixteenth century. (For particulars of this controversy see the *Gentleman's Magazine*, 1782–83.) Many antiquaries affirm that knitting was invented in Scotland, and thence introduced into France; others say that it is of Spanish origin, and was first known in England in the reign of Henry VIII. But in a rare collection of the acts of Edward VI. is one specifying, among other woollen articles, "knitte hose, knitte peticotes, knitte gloves, knitte slieves." In 1527 the French knitters formed themselves into a corporation, styled "Communauté des Maîtres Bonnetiers au Tricot," choosing for their patron St. Fiacre, who, according to legends, was the second son of Eugenius, a Scottish king in the seventh century. St. Fiacre became a hermit, and lived at Meaux in France. Wherever and whenever knitting was invented, it is certain that German women of all ages and classes excel in the art those of other nations. Very young German children are sent to knitting-schools, and stockings are knitted by little creatures who have

hardly learned how to wear out those articles by walking in them. Such schools have been established in Ireland and Scotland, but only for the children of the poor. Excellent directions for both knitting and netting will be found in Madame Goubaud's work on those subjects (London, 1870, 8vo). JANET TUCKEY.

Knob Creek, post-tp., Cleaveland co., N. C. Pop. 638.

Kno'bel (KARL AUGUST), D. D., b. near Sorau, Silesia, Aug. 7, 1807; studied at the University of Breslau, where he became a professor of theology in 1831, and at Giessen in 1839. His work on *Ecclesiastes* (1836), *Hebrew Prophecy* (1837), and his *Commentaries on Isaiah* (1843), *Genesis* (1852), *Exodus and Leviticus* (1857), *Numbers, Deuteronomy, and Joshua* (1861), and *Genealogical Tables of Genesis* (1850), are among the most learned productions of the rationalistic school of theology. D. at Giessen May 25, 1863.

Kno'belsdorff, von (HANS GEORG WENZESLAUS), BARON, b. at Kuchädel, in the Prussian province of Brandenburg, Feb. 17, 1697; entered the Prussian army, and was a captain when in 1730 he left the military career in order to study art, especially painting and architecture. After travelling through France and Italy, he joined the crown prince at Rheinsberg, and soon became a favorite of his. On the accession of Frederick II. to the throne in 1740, Knobelsdorff was made superintendent of all the royal buildings, and planned the Thiergarten at Berlin, and built Sans Souci at Potsdam and the opera-house in Berlin, besides other minor buildings. D. Sept. 16, 1753.

Knob Nos'ter, post-v. of Washington tp., Johnson co., Mo., situated on the Missouri Pacific R. R., 208 miles W. of St. Louis and 78 miles E. of Kansas City, has 6 churches, 1 national bank, 1 weekly newspaper (agricultural), 1 flour-mill, 3 hotels, a fine public-school building, and the usual number of stores, built mostly of brick. Pop. 914. J. R. CORDELL, ED. "MISSOURI FARMER."

Knobs, tp. of Yadkin co., N. C. Pop. 1451.

Knob View, post-tp. of Crawford co., Mo. Pop. 515.

Knol'lys (HANSERD), b. at Chalkwell, Lincolnshire, England, in 1598; was educated at Cambridge University, and became an Anglican priest, but was ejected for nonconformity, and compelled in 1638 to flee to New England. In Boston he was early involved in a controversy with the authorities, and was afterwards named by Cotton Mather "Mr. Absurd Knowless." Knollys was (1638–41) the first minister of Dover, N. H. Thence he went to Long Island, and in 1641 returned to London, where he was for a long time a successful Baptist pastor. D. Sept. 19, 1691. He was a man of bold, generous, and liberal spirit, an accomplished scholar, and an able preacher and teacher of youth. He wrote *A Flaming Fire in Zion* (1646), a small Hebrew grammar (1648), and an autobiography, finished by Kiffin (1692). The Hanserd Knollys Society of London, formed in 1845, reprints early Baptist writings.

Knollys, or **Knolles** (RICHARD), b. at Cold-Ashby, Northamptonshire, England, about 1543; graduated in 1565 at Lincoln College, Oxford, of which he was chosen fellow; was appointed head-master of the Free Grammar School at Sandwich, Kent, where he spent a useful life, and d. in June, 1610. He wrote a *Compendium of Lat., Gr., and Heb. Grammar, with Roots* (1600), and translated Camden's *Britannia* into English, the MS. of which is preserved at the Ashmolean Museum at Oxford; besides several other books on Oriental subjects. But the only work for which Knollys is now remembered is the *Generall Historie of the Turkes, etc.* (folio, 1603), which was reprinted in 1610, 1631, and 1638. The best edition is the 6th, in 3 vols. (1687–1700), with a continuation by Sir Paul Rycaut. This book was commended by Dr. Johnson in the *Rambler* (No. 122) as "displaying all the excellence that narration can admit."

Knot, a twisting or entwining of one or more pieces of cord, or the looping of such cord around some other substance, in such a way that the two parts shall be held together. Knots are of special importance on shipboard, and the number of them in use among seamen is very great. To these a great number of names are given. Much skill is required in the adjustment of some of the kinds.

Knot, in measuring a ship's speed, represents a nautical mile. On the ship's log-line there are 120 knots to the mile; consequently, the number of knots which run out in a half minute represent approximately the number of geographical miles per hour in the ship's rate of speed.

Knot, Grayback, or **Robin Snipe,** the *Tringa canuta,* a sandpiper of the Atlantic States and of Europe. It is some ten inches long, and is a good game-bird. The young birds in season are delicious for the table. The place of breeding of this bird is unknown.

Knott (J. PROCTOR), b. in Marion co., Ky., Aug. 29, 1830; studied law; removed to Missouri in 1850; was attorney-general of that State in 1860; returned to Kentucky in 1862, and was a Democratic Representative in Congress from 1867 to 1871, and again elected in 1874. He won a national reputation as a humorist by several of his speeches in Congress.

Knout [Russ. *knut*], an instrument of punishment in Russia, varying in form, but often consisting of a wide and pointed piece composed of thongs of leather braided with wire, soaked in milk, and dried hard. This is swung by a handle, and when applied to the back of a culprit cuts like a knife. Criminals were often scourged to death by this instrument, which at present is less frequently used.

Knowl'edge. This term includes the possessions of the mind derived through its several activities of sensuous perception, reflection, understanding, and speculation, in so far as the same relate to truth. It should be distinguished from mere feeling and from opinion or impression. Knowledge implies the exercise of discrimination and comparison in regard to ideas, noting their agreement and disagreement. Feeling is limited to the subjective, and relates only to modifications of the feeling subject, there being no antithesis of subject and object in it. When the Ego *perceives* itself as feeling, it becomes conscious, and cognition takes the place of simple feeling. Inference accompanies all grades of knowing, although it is merely implicit in the lowest stages. Hence, all knowledge contains the results of inference, and is based upon it to some extent. The realm of truth which knowledge has for its object includes three departments: I. Nature; II. Spirit or Human Mind; III. Pure Ideas or General Principles. Knowledge implies conviction reached by the perception of sufficient grounds. Certitude must be distinguished from truth, as a mere phase of it. It appertains to the immediate or external, and hence to the phenomenal or transitory. Such knowledge as is derived from certitude or immediate knowing lacks, therefore, the unity of system, and is partial, needing modification in each particular through other particulars and through the whole. Inasmuch as there is unity in existence, natural and spiritual, an isolated knowledge of particulars is not a true or adequate knowledge. Since existences are interdependent, each one being conditioned by all others, a true knowledge can exist only in a systematic form—that of science. In science each thing or province of things is treated in its relations to the others and to the whole. Thus, by reason of the relativity of particular existences, a true knowledge of them must deal with relations, and in this sense knowledge may be called relative, not on account of its inadequacy, but rather on account of its truth. The "relativity of knowledge" is a doctrine that has been quite well known since the time of the Sophists of Greece. It has taken a subjective direction in modern times. It has been held (*a*) that knowledge is relative, because we cannot cognize existence in itself absolutely, but only in its modes; (*b*) that it is relative, because we can know only what stands in relation to our faculties; (*c*) because the subjective constitution of our faculties adds elements and modifications to the matter derived from sensation. These positions have been generalized in the doctrine of the relativity of knowledge based on the tenet that we know only phenomena, and not "things in themselves." Knowledge has been further classified according to its origin in the psychological activities: (1) the intuitive—sensuous perception, or consciousness; (2) the discursive—inference and generalization; (3) the speculative—synthetical and analytical processes combined in one. Thus arise various distinctions, such as a priori, a posteriori, abstract, mediated, intuitive, representative, empirical, apodictic, etc. etc. (See MIND.) W. T. HARRIS.

Knowles (JAMES DAVIS), b. at Providence, R. I., in July, 1798; graduated at Columbian College, D. C., 1824. In Oct., 1825, he became pastor of the Second Baptist church in Boston; in 1832 was appointed professor of sacred rhetoric at Newton Theological Institute in Massachusetts. He published memoirs of the first Mrs. Adoniram Judson (Ann Hasseltine) and of Roger Williams; edited the *Christian Review*, and d. at Newton, Mass., May 9, 1838.

Knowles (JAMES SHERIDAN), b. at Cork, Ireland, in 1784. His father, James Knowles, a cousin of R. B. Sheridan, was a schoolmaster and teacher of elocution, enjoying a high reputation, and was editor of an improved edition of Walker's *Pronouncing Dictionary*. In 1792 the family removed to London. At the age of twelve young Knowles composed a play, which was represented by an amateur company of schoolboys. In 1806 he made his first appearance as an actor at Dublin, and afterward taught elocution at Belfast and Glasgow, without attaining eminence in either profession. He had written four or five dramas which have not been preserved, and had published a small volume of fugitive poetry, when in 1815 he met with his first success by the production of *Caius Gracchus* at Belfast. In 1820 *Virginius* was produced at Drury Lane, with Macready in the leading part, and Knowles was thenceforward

recognized as one of the chief dramatic authors of England. He produced fourteen other dramas, some of which were undoubtedly among the best "acting plays" of the time, though none displayed any exceptional poetic genius, and all were justly amenable to the charge of systematic violation of the "unities." The plots were so involved in their construction as to require a great effort for their comprehension. Knowles sometimes took part in representing his own dramas, and made a successful theatrical tour in the U. S. In 1843 his *Dramatic Works* were collected into three volumes (revised ed. 2 vols., 1856), and in 1845 he abandoned the stage from conscientious scruples, devoting himself to literature, and in 1849 a pension of £200 was granted him. In 1852 he joined the Baptist denomination, and became a preacher distinguished for religious fervor. His last years were passed in retirement, on account of ill-health, at Torquay, Devonshire, where he d. Nov. 20, 1862. His dramas, besides those already mentioned, are—*William Tell* (1825), *The Beggar's Daughter of Bethnal Green* (1828), *Alfred the Great* (1831), *The Hunchback* (1832), *The Wife, a Tale of Mantua* (1833), *The Daughter* (1836), *The Love-Chase* (1837), *Woman's Wit* (1838), *The Maid of Mariendorpt* (1838), *Love* (1839), *John of Procida* (1840), *Old Maids* (1841), *The Rose of Aragon* (1842), and *The Secretary* (1843). He also published two novels—*Henry Fortescue* and *George Lovell* (1847), and two controversial works against Romanism, *The Rock of Rome, or the Arch-Heresy* (1849), and *The Idol Demolished by its own Priest* (1851), the latter volume being a reply to Cardinal Wiseman's *Lectures on Transubstantiation*. PORTER C. BLISS.

Knowles'ville, post-v. of Ridgeway tp., Orleans co., N. Y., on the New York Central R. R. and the Erie Canal.

Knowl'ton, post-v. and cap. of Brown co., Quebec, Canada. It is the seat of an academy. Pop. about 500.

Knowlton, post-tp. of Warren co., N. J. Pop. 1691.

Knowlton, post-tp. of Marathon co., Wis. Pop. 166.

Know-Nothings, the name assumed by a secret political society in the U. S. first organized in 1853, and which appeared in the elections of 1854 as a well-disciplined party, and swept several of the Northern States, including New York. The cardinal idea of the society was opposition to foreign citizenship. In the Presidential campaign of 1856 the Know-Nothings appeared as the "American party," presenting Millard Fillmore as its candidate, but the growth of the slavery issue extinguished the question of foreign citizenship, and the party speedily died a natural death.

Knox, county of N. W. Central Illinois. Area, 840 square miles. It is fertile and undulating, and contains abundant supplies of coal, with considerable timber. Cattle, grain, wool, and hay are staple products. The manufactures include carriages, clothing, flour, saddlery, furniture, brick, and metallic wares. The county is traversed by the Chicago Burlington and Quincy and the Peoria and Oquawka R. Rs. Cap. Knoxville. Pop. 39,522.

Knox, county of S. W. Indiana, bounded on the E. by the W. fork of White River, on the S. by White River, and on the W. by the Wabash, which separates it from Illinois. Area, 516 square miles. It is partly level and partly rolling, and is very fertile. Cattle, grain, and wool are staple products. The county is traversed by several railroads, centring at Vincennes, the capital. Pop. 21,562.

Knox, county of S. E. Kentucky. Area, about 340 square miles. It is a mountain-region, with iron, coal, salt, and limestone. Live-stock and corn are staple products. The county is traversed by the Cumberland River. Cap. Barboursville. Pop. 8294.

Knox, county of Maine, bounded on the S. E. by Penobscot Bay and the Atlantic Ocean, and including numerous islands. Area, about 350 square miles. It is uneven, but generally fertile. Wool, potatoes, and live-stock are staple products. The manufactures include shipping, ships' furniture, cooperage, lime, and lumber. The fisheries and foreign and coastwise commerce employ a considerable part of the population. The county is traversed by the Knox and Lincoln R. R. Cap. Rockland. Pop. 30,823.

Knox, county of N. E. Missouri. Area, 504 square miles. It is very fertile, and is generally undulating. It is in part timbered land. Cattle, grain, tobacco, and wool are staple products. Carriages, wagons, and brick are leading articles of manufacture. It is traversed by the Quincy Missouri and Pacific R. R. Cap. Edina. Pop. 10,974.

Knox, county of Nebraska, formerly called L'Eau qui Court. Area, 1008 square miles. It is separated from Dakota on the N. by the Niobrara and Missouri rivers. It has a good soil, and is adapted to grain and stock-raising. Cap. Niobrara. Pop. 261.

Knox, a central county in Ohio, traversed by the Baltimore and Ohio (Lake Erie division) and the Cleveland Mt. Vernon and Delaware R. Rs., intersected by the Vernon Walhonding and Licking (N. fork) rivers. The surface is undulating and the soil rich. The chief agricultural products are Indian corn, wheat, oats, potatoes, tobacco, and hay. Nearly 700,000 pounds of wool are annually clipped, 600,000 pounds of maple-sugar and 800,000 pounds of butter are produced. It has 10,000 horses, 8500 milch cattle, 150,000 sheep, and 30,000 swine; 24 carriage-factories and a considerable number of manufactures. Cap. Mt. Vernon. Area, 525 square miles. Pop. 26,333.

Knox, county of E. Tennessee. Area, 510 square miles. It is in the beautiful and fertile valley of the Holston River, which traverses it. It has several mountain-ridges, and contains abundant iron ore and marble. Cattle, grain, tobacco, and wool are staple products. The county is traversed by the various railroads centring at Knoxville, the capital. Pop. 28,990.

Knox, an organized county of N. Texas, traversed by the Brazos River. Area, 1275 square miles. Its surface is hilly and broken, and partly of undulating prairie-land, with little timber. It is attached for judicial purposes to Montague co.

Knox, tp. of Knox co., Ill. Pop. 2881.

Knox, tp. of Jay co., Ind. Pop. 685.

Knox, post-v. of Centre tp., cap. of Stark co., Ind., on the S. bank of the Yellow River, 7 miles S. of the Pittsburg Fort Wayne and Chicago R. R. It has a good court-house and school-house, 2 hotels, 1 newspaper, and a number of stores and shops. Lands in the vicinity are cheap and well adapted to stock-raising, as also to wheat, corn, and potatoes. Pop. 244.

O. MUSSELMAN, ED. "STARK CO. LEDGER."

Knox, tp. of Clarke co., Ia. Pop. 777.

Knox, tp. of Pottawattamie co., Ia. Pop. 961.

Knox, post-tp. of Waldo co., Me., 12 miles N. W. of Belfast. It has manufactures of lumber and carriages. Pop. 889.

Knox, post-tp. of Albany co., N. Y. It has 6 churches and several small villages, and is on the Albany and Susquehanna R. R., 17 miles W. of Albany. The village has an academy, 4 churches, and a woollen-mill. Pop. 1656.

Knox, tp. of Columbiana co., O. Pop. 2151.

Knox, tp. of Guernsey co., O. Pop. 810.

Knox, tp. of Holmes co., O. Pop. 964.

Knox, tp. of Jefferson co., O. Pop. 1301.

Knox, tp. of Vinton co., O. Pop. 559.

Knox, post-tp. of Clarion co., Pa. Pop. 656.

Knox, tp. of Clearfield co., Pa. Pop. 587.

Knox, tp. of Jefferson co., Pa. Pop. 863.

Knox (HENRY), GENERAL, b. in Boston, Mass., July 25, 1750; received a common school education; became a bookseller in Boston and an officer in a militia body of grenadiers, having devoted much study to military tactics. When the battle of Bunker Hill was impending he made his way secretly out of Boston, offered his services to Maj.-Gen. Artemus Ward at Cambridge, and acted as a volunteer aid to that general during the battle. In the siege of Boston he was engaged as engineer and artillery officer in Gridley's regiment, and attracted the attention of Washington by his skill in fortification. He was soon after placed in command of the artillery in New York, took a brilliant part in the battles of Trenton and Princeton, and was thereupon elected by Congress brigadier-general of artillery, and sent to New England to raise a battalion of that arm. In the battles of Brandywine, Germantown, and Monmouth the artillery under Knox bore a leading part. He was a member of the court-martial for the trial of André; was repeatedly sent to New England as commissioner to obtain money and recruits; was at the battle of Yorktown, after which he was made major-general, put in command at West Point, and appointed to superintend the disbanding of the continental armies, and commissioner to arrange with Sir Guy Carleton the terms of the surrender of New York City. In 1785 he succeeded Gen. Lincoln as secretary of war and of the navy, retaining that post for six years of Washington's administration. In 1795 he removed to St. George's in Maine, where he acquired an enormous landed estate, and finally settled at Thomaston, Me., where he d. Oct. 25, 1806. (See his *Life and Correspondence*, by Francis S. Drake, Boston, 1874.)

Knox (JOHN), b. at Gifford, in East Lothian, in 1505. His education began at Haddington. At the University of St. Andrew's (1524) he learned from John Major, and never forgot, that councils are above popes, and that nations give authority to kings, can depose kings, and put them to

death. Before 1530 he was ordained priest, in advance of the canonical age. From his favorite Fathers, Jerome and Augustine, he went to Holy Scripture, and the progress of his investigation into those questions which were then convulsing Europe became very marked about 1535. The result was, that he made a distinct avowal of his Protestant convictions in 1542, withdrew from his position as teacher at St. Andrew's, and sought a covert from the wrath of Cardinal Beaton. The shelter needed he found in the house of Hugh Douglas (1643–45). This was at Longniddry, the ruins of whose chapel are still known as "Knox's kirk." Wishart, his dear friend, was tried for heresy Mar. 1, and burned to death Mar. 28, 1545. Cardinal Beaton was assassinated May 29, 1546, and the castle of St. Andrew's was held by Norman Leslie and the other conspirators. Knox took refuge in the castle at Easter, 1547, acted as its faithful chaplain, and when it was surrendered to the French, July, 1547, was among the prisoners. Under the charge of being concerned in the death of the cardinal he was condemned to the galleys and chained to the oar. Sickness was added to his trials (1548). The "sobs of his heart" were heavy when the galley lay tossing in sight of the white steeple of St. Andrew's, "where God first in public opened his mouth to His glory;" yet that heart was strong in the uttered assurance, which became prophecy, that Knox should glorify God's name in the same place. He was liberated in Feb., 1549, went to England, was recommended to the English council, and, though unordained as a Protestant minister, was sent by Cranmer to preach at Berwick—out of Scotland, but barely out of it. There he battled with popery, and made many converts. Cited by Tonstall, he defended the cause of the Reformation with such ability that he was appointed one of Edward's chaplains (Dec., 1551). He was consulted about the Book of Common Prayer and the Articles. He was summoned to London Apr., 1553, and was in full royal favor at the time of Edward's death, July 6, 1553; he had declined a bishopric. He was married 1553 to Marjory, daughter of Richard Bowes (brother of Sir Robert) of Berwick. The accession of Mary (1553) made England a dangerous place for Knox. He had wisdom as well as bravery. He landed at Dieppe Jan. 20, 1554. In February he went to Switzerland, and was everywhere cordially received by the Reformed divines. In Geneva he found a congenial friend in Calvin. He took temporary charge (Nov., 1554) of the church of English exiles at Frankfort-on-the-Main. His *Faithful Admonition unto the Professors of God's Truth in England* appeared this year. He recrossed the Channel Aug., 1555, saw his wife, preached, and dispensed the Lord's Supper. He returned to the Continent July, 1556, accompanied by his wife. The clergy of Scotland adjudged his body to the flames and burned him in effigy. For the next two years, the most peaceful of his life, he was pastor of the English church at Geneva. The Genevan New Testament (1557) and the Bible (1560) were influenced by him. In 1558 appeared his *First Blast of the Trumpet against the Monstrous Regiment of Women*. The women specially aimed at were Mary of Guise, queen dowager and regent of Scotland, the princess Mary, then heiress, afterwards occupant, of its throne, and Queen Mary, Knox's "Jezebel," of England. The prospects of the Reformation seeming brighter, Knox was recalled, and (Jan., 1559) for the last time left Geneva for Scotland. He was refused passage through England, whose "secret and assured friend he had been in cases which herself could not have remedied"—refused under the regiment of Elizabeth, who had just come to the throne, and who was yet to owe as much to Knox as perhaps to any man of the time. Knox in his *Blast* had made too sweeping generalities from particular cases, and Elizabeth stood up for her sex. Knox landed at Leith May 2, and was at once proclaimed an outlaw and rebel. His preaching at Perth was followed by an insurrection, in which the "rascal multitude" committed a number of acts of violence. He was forbidden to preach at St. Andrew's June 9, and preached there with the greater zest June 10–13, and the officials and people destroyed the images and pictures and pulled down the monastery on the 14th. Though the direct personal influence of Knox produced a relatively peaceful abolition of the old worship, the storm against "idolatry" involved the destruction of many precious works of art. "The rooks' nests were pulled down." Knox was formally ordained at Edinburgh in 1560. The Confession of Faith, mainly his work, was adopted by the Parliament Aug. 17. The Reformation was officially established Aug. 24. The first General Assembly of the Kirk was held Dec. 20. Of the forty members, there were but six ministers, of whom Knox was one. Private sorrow came fast on public joy, for this same month he lost his wife. The clouds which had been swept away in 1560 began to gather again in the following year. The young queen of Scotland had returned from France (Aug. 21, 1561). Never was there a less congenial conjunction between the throne and the people. The first interview of Knox with her took place early in Sept., 1561, and another May 2, 1562, after the queen had been told of a sermon in which he condemned the festivities in the palace, believed to have been prompted by the massacre of the French Protestants in March at Vassy. He did much to preserve the peace in the South while the rebellion of the earl of Huntly was crushed in the North (1562). At Lochleven, Knox again saw the queen (May 2, 1563), who exerted on him all her powers of pleasing. Her success with Knox was little, but it was great with her Protestant nobles at the Parliament May 20, and Knox came to an open rupture with the earl of Murray, whom he had regarded as one of the greatest pillars of the truth. In political sagacity and insight into character Knox took rank with the greatest statesmen of his time. He now spoke in the pulpit with freedom of the apostasy of the nobility, and of the reputed marriage of the queen to a papist. Universal terror and offence followed. Knox was deserted by some of his nearest friends. The queen, whose hand had almost grasped the triumph for which she labored, was overwhelmed with anger that this man should defy and thwart her and the nobles she had won to her side. She sent for him, but she was now too much wounded and angered to dissemble. "I cannot get quit of you," she cried: "I vow to God I shall be once revenged!" and could speak no more for weeping. The moral trial of the position of Knox at such a time is almost inconceivable. It was beyond any mere test of courage. In personal matters Knox was of a loving nature. But as the face of angry men could not move him, neither could the beauty of the young queen charm him, nor her tears melt him. At this time powerful efforts were made to crush Knox. A calumny against his personal purity was set afloat, but was promptly met and exposed. In December he was accused of high treason, and the queen thought she should now "make him weep" whom her tears could not move. But the majesty of Knox's heroic nature made itself felt in the council of the nobles. Knox was not only acquitted, but commended, and "that night was neither dancing nor fiddling in the court." The same year he published an account of his disputation of the year previous with Kennedy, abbot of Cromaguel. Knox married a second time (Mar., 1564). His wife was Margaret Stewart, daughter of Knox's friend, who stood by him when all other men forsook him—Lord Ochiltree, who was of the blood royal by the second son of Robert II. Alliance with kings did not make Knox more courtly. He was brought before the privy council for a sermon preached in St. Giles's (Aug. 19, 1565) in the presence of Darnley, in which he had quoted certain texts which the new-married king, not without good reason, applied to himself and the queen, and was violently offended. Knox was prohibited from preaching while the royal pair remained in the city. They left before Sunday, and when they returned they wisely let the matter drop, for the pulpit of Knox had grown mightier than the throne. Mary entered the Catholic League for the extirpation of the Protestants Feb. 2, 1566. Rizzio was assassinated Mar. 9. On the return of the queen, Knox left Edinburgh. In December he visited his son in England. Knox's prophecy was fulfilled. The queen became the instrument of Darnley's overthrow; he was murdered Feb. 10, 1567. The queen married Bothwell May 15, and one month later, forsaken by her husband, was a prisoner at Lochleven Castle. Ten days later (June 25) Knox was present at the General Assembly in Edinburgh. He preached at the coronation of James VI., an infant thirteen months old (July 29). Knox urged the capital arraignment of Mary on the charge of adultery and murder. The assassination of the regent Murray (Jan. 23, 1570) by a man whom he had pardoned on the persuasion of Knox, and the civil troubles which followed it, greatly depressed him. In October he had a stroke of apoplexy, which left him weak, but did not long keep him from the pulpit. He had enough of his old vigor and his old mode of using it to give such offence to Kirkaldy, governor of the castle, as to make it prudent to retire (May 5, 1571) to St. Andrew's. Here he published his answer to Tyrie. He returned to Edinburgh Aug., 1572. The tidings of the massacre of St. Bartholomew (Aug. 24) helped yet further to break his declining strength. He made his last appearance in the pulpit Nov. 9, and preached with no abatement of intellectual power. Sick and exhausted, leaning on his staff and the arm of an attendant, with a loving multitude crowding around him, he crept to his home, and there, when speech failed him, with his hand uplifted in token of the faith for which he had fought, he breathed his last in perfect peace, Nov. 24, 1572—one of the most heroic men of a heroic race. Two days later he was buried at St. Giles's. He was followed to the grave by an immense body of mourners, nobles and people, and then were uttered by

Morton, the new regent, the words "he neither feared nor flattered any flesh," which the world has accepted in its later, more graceful phrasing, as the epitome of Knox's character: "There lies he who never feared the face of man." The precise spot where he was buried is no longer known. It is said the highway came to pass over it. Knox was physically small and feeble. His voice was weak. It was its moral power, by which, as the English ambassador wrote to Cecil, "the voice of one man is able in an hour to put more life in us than six hundred trumpets." Knox was profoundly pious, indomitable in purpose, yet not without geniality and humor, not without sensibility and tenderness, and that vein of melancholy which so often attends them. He hated bad things rather than bad men. His animosities were the animosities of principle. None feared him but the enemies of truth. He was above all pettiness. He was a man of thought and a man of action, a statesman as well as a divine, with an acuteness of insight into character and a comprehension of the movements of Providence which gave him almost a prophetic forecast. He abhorred every species of tyranny, and roused a spirit in his native land which broke violence with violence. He had the roughness needed for a rough time and a fierce people. He was intolerant to the intolerant, and, exacting in his conception of his own duty, he was exacting of others. His writings are full of vigor, originality, and simplicity. In his intellectual tone and theological opinions he was in affinity with Calvin, in his personal heroism he resembled Luther; and next to Luther's his story stirs the soul in this great battle-roll of the Reformation. He wanted nothing but a wider sphere to take rank in the first order of the historic men of his age. Perhaps a wider sphere could not have been given him, for as none but Scotland could have produced a Knox, none but Scotland would have endured him. Such a direct and daring conflict as Knox waged with the great would hardly have found out of Scotland such a support; but not in Scotland itself could any man but Knox have developed it. The estimates of so strong a man in so stirring a time, in which the political and religious antagonisms were so violent, vary, of necessity, very much. Hume: "His political principles were as full of sedition as his theological were full of rage and bigotry." Whitaker: "A holy savage." "I happened to ask," says Boswell, "where John Knox was buried; Dr. Johnson burst out, 'I hope in the highway.'" Robertson: "Zeal, intrepidity, disinterestedness, were virtues which he possessed in an eminent degree." Melville: "That most notable prophet and apostle of our nation, John Knox." Bannatyne: "The light of Scotland, the comfort of the Church, the mirror of godliness." Smeton: "I know not if ever so much piety and genius were lodged in so frail and weak a body." Froude: "No grander figure can be found, in the entire history of the Reformation in this island, than that of Knox. But for him the Reformation would have been overthrown among ourselves. . . . He raised the poor commons of his country into a stern and rugged people, who might be hard, narrow, superstitious, and fanatical, but who, nevertheless, were men whom neither king, noble, nor priest could force again to submit to tyranny." Carlyle: "The most Scottish of Scots. . . . Nothing hypocritical, foolish, or untrue can find harbor in this man; a pure and manly silent tenderness of affection is in him; touches of genial humor are not wanting under his severe austerity. A most clear-cut, hardy, distinct, and effective man; fearing God without any other fear. There is in Knox throughout the spirit of an old Hebrew prophet—spirit almost altogether unique among modern men. A Heaven-inspired seer and heroic leader of men."

Knox's *History of the Reformation in Scotland* appeared in 1586. His entire works have been edited by Laing (1846–55). The older sketches of Knox are by Beza, Adam, and Verheiden. The best *Lives* are by McCrie (1814), Niemeyer (1824), and Brandes (1862). The general histories of Great Britain and of England covering Knox's time touch upon him with more or less fulness—Hume, Lingard, Froude. The general histories of the English Reformation and Church of England—Burnet, Short; of the Protestant Church and sects of Great Britain—Weber (1845–53); more particularly the histories of Scotland, general—as Robertson, Tytler, Von Raumer, Burton; or special—Thomas McCrie, Jr., *Sketches of Scottish Church History* (1841–46), D'Aubigné's *Three Centuries of Struggle* (1850); Rudloff (2d ed., 1854), Köstlin (1852), are of value. Carlyle has an article in *Fraser's Magazine* for Apr., 1875, on the portraits of John Knox, published by Harper & Bros., 1875. Lorimer, *John Knox and the Church of England* (Lond., 1875), has used important papers to illustrate his work in her pulpit and his influence in various respects.

C. P. Krauth.

Knox (William), b. in Ireland in 1732; went to Georgia in 1756 as provost-marshal of that colony; returned to England in 1761, and presented to Earl Bute a memorial recommending the creation of a colonial aristocracy and the granting of parliamentary representation to the American colonies. He became agent for Georgia and East Florida, wrote in favor of the Stamp Act, and in 1768 published in the same interest a work called *The Present State of the Nation*, to which Burke replied. In 1770 he was appointed under-secretary of state, and held that office until 1782, taking an important part in drawing up Lord North's "project of conciliation" of 1776. Through his influence the province of New Brunswick was erected in 1784 as a home for the loyalists of the Northern States, and he acted as agent for Georgia loyalists in demanding compensation for losses, obtaining also for himself and wife pensions of £600 each, as American sufferers. In 1789 he published a valuable collection of *Extra-official State Papers.* D. at Great Ealing Aug. 25, 1810.

Knox (Loren L.), D. D., b. in Nelson, N. Y., Jan. 8, 1811; graduated at Wesleyan University 1838; tutor 1838–40; held numerous pastorates and several principalships of seminaries of the Methodist Episcopal Church; was professor in Lawrence University, Appleton, Wis., 1858–64, and was placed on the superannuated list of his Church in 1871.

Knox Corners (Knoxborough P. O.), a v. of Augusta tp., Oneida co., N. Y. Pop. 208.

Knox'ville, post-tp. of Greene co., Ala. Pop. 1032.

Knoxville, post-v., cap. of Crawford co., Ga., 15 miles from Fort Valley Station on the South-western R. R.

Knoxville, city of Knox tp., Knox co., Ill., 50 miles W. of Peoria and 50 E. of Burlington, Ia. It has 1 newspaper (established 1856), 1 national bank, 6 institutions of learning, 7 churches, 4 hotels, 7 wagon and carriage shops, 2 flour-mills, and 1 woollen-mill. It is largely engaged in coal-mining and wagon manufacturing; is the seat of the Episcopal diocesan school of Illinois for girls, with an attendance of over 100 pupils. Pop. 1883.

O. L. Campbell, Foreman "Knox Co. Republican."

Knoxville, post-v. and tp., cap. of Marion co., Ia., 40 miles S. E. of Des Moines. It has 2 national banks, 2 weekly newspapers, 6 churches, 3 hotels, 3 steam-mills, 2 woollen-factories, an iron-foundry, more than 20 stores of different kinds. It is situated on the line of the A. K. and D. R. R. Pop. of v. 800; of tp. 4750.

J. L. McCormack, Ed. "Marion Co. Democrat."

Knoxville, post-v. of Frederick co., Md., on the Potomac River, the Chesapeake and Ohio Canal, and the Baltimore and Ohio R. R. Pop. 320.

Knoxville, post-v. and tp. of Ray co., Mo. Pop. 2469.

Knoxville (Stockbridge P. O.), a v. of Stockbridge tp., Madison co., N. Y. It has 3 churches. Pop. 241.

Knoxville, a v. of Corning tp., Steuben co., N. Y., on the Chemung River, opposite Corning, with which it is connected by a bridge. Pop. 785.

Knoxville, post-v. of Knox tp., Jefferson co., O. Pop. 165.

Knoxville, post-b. of Deerfield tp., Tioga co., Pa. Pop. 400.

Knoxville, city, cap. of Knox co., Tenn., is situated at the head of navigation on the Tennessee River, on the East Tennessee Virginia and Georgia R. R., and on the projected road from Cincinnati to Charleston, the latter road being completed 40 miles N. to Careyville coal-mines, and 16 miles S. to Maryville. It has 17 churches, 5 banks, 2 daily and 4 weekly newspapers, 3 hotels, an opera-house, numerous and enterprising wholesale houses, a rolling-mill, 3 foundries, a paper-mill, a carriage-factory, sash and blind factories, extensive railroad car and repair shops, several fine flour-mills, and many other industrial establishments. Knoxville is the third city of Tennessee in size, the centre of the great valley of East Tennessee, one of the most beautiful and fertile regions of the U. S., and is noted for the number of its public establishments, which include a marble U. S. court-house (and post-office) recently completed at a cost of $400,000, in which the Federal courts and the State supreme court meet; the East Tennessee University, the State Agricultural College ($500,000 endowment), a female institute, and several fine city free schools, free public library, State deaf and dumb school and insane asylum, and an orphans' home. Knoxville University, well endowed by the M. E. Church, is to be erected here, as also a city hospital. It is one of the most important commercial and manufacturing centres in the South. Pop. 8682.

Rule & Ricks, Eds. "Daily Chronicle."

Knoxville Mines, a v. of Lake co., Cal. Pop. 164.

Knyphau'sen (Dodo Henry), Baron, b. in Alsace in 1730; entered the military service of Prussia at an early

age, and took part in the campaigns of Frederick the Great against Austria; became lieutenant-general, and was second in command of the Hessian and Waldeck troops sent to America during the Revolutionary war; was engaged in the battles of Long Island, White Plains, Fort Washington, Brandywine, and Monmouth, and was temporarily in command of the forces in New York City in June, 1780, when he made two raids into New Jersey, with but slight advantage beyond the sacking of Connecticut farms and the burning of Springfield. He was an excellent commanding officer, and notable for taciturnity. D. at Berlin, Prussia, May 2, 1789.

Koa'la, the *Phascolarctos cinereus*, a syndactyl marsupial mammal of Australia and of the family Phascolarctidæ. It is ursine in its general appearance, nocturnal and arboreal in its habits, and extremely slow in its movements. It is a marsupial sloth, but we are told that it sometimes comes to the earth and digs up succulent roots as food. The female carries her single whelp for a time in the pouch, but soon transfers it to her back, where it clings by the long coarse hair.

Ko'bell, von (Franz), b. at Munich July 19, 1803, and became professor of mineralogy at the university of his native city in 1834. Of the *Geschichte der Wissenschaften in Deutschland*, a work which was undertaken under the auspices of King Max of Bavaria, he wrote *Geschichte der Mineralogie von 1650 bis 1860;* he also published several popular papers on mineralogy.

Ko'bold [Ger.], in German legends, a kind of elf which in some places was believed to be attached to some particular house or place. In general the kobolds were beneficent, but some were malicious. They particularly haunted the mines; they were little, decrepit old men and women, dressed generally in miners' clothes. They heaped up precious stones and valuable metals; and though they dreaded to be seen by men, they were fond of doing mankind favors in secret.

Ko'brin, or **Kobryn,** town of Russian Poland, in the government of Grodno, on the Machazica, has some trade and 7550 inhabitants.

Koch'ville, tp. of Saginaw co., Mich. Pop. 1070.

Kock, de (Charles Paul), b. in Paris in 1794, was the son of the celebrated banker Kock, who conspired under the Revolution and was guillotined. Paul de Kock published his novels during the Restoration and the reign of Louis Philippe. These works are all of a very comical turn and of a light character, sometimes bordering on license. Among the most popular were (for they are now somewhat out of fashion), *M. Dupont, Gustave ou le Mauvais Sujet*, and *Les Demoiselles de Magasin.* Paul de Kock also wrote many *vaudevilles* for the stage. D. at Paris Aug. 29, 1871.—His son, Henri, b. in Paris in 1821, follows the literary path trodden by his father, and he has already published many light novels and several *vaudevilles* and comedies.

Félix Aucaigne.

Kœchlin' (André), b. in Alsace in 1785, the most celebrated of the Kœchlin family, which has established and rendered the print trade of Mulhouse in Alsace so prosperous. Jacques and Nicolas Kœchlin were the first to engage in that industry, but it reached its highest degree through the efforts of André Kœchlin, who can be considered as the head of this family, which does not count less than seven branches, and some members of which are still the greatest manufacturers of Mulhouse prints.

Félix Aucaigne.

Koek'koek (Bernard Cornelius), b. at Middleburg in the Netherlands Oct. 11, 1803; studied the art of painting under his father and at Amsterdam, and settled in 1841 at Cleves in Rhenish Prussia, where he d. Apr. 5, 1862. He painted landscapes, and his pictures are prized very highly. He had three brothers, who all are painters of note.

Kohat', town of the Punjaub, in a district of the same name. In its vicinity are rich springs of naphtha and extensive beds of sulphur. It forms an important station for the trade between India and Persia.

Koh-i-noor' (the "mountain of light"), a famous diamond which for many centuries was in the possession of the monarchs of India, and now in that of Queen Victoria. Successive cuttings reduced its weight from 900 carats to 792, then to 279, next to 186.6, and at last in 1852 to 103.75, being rose-cut, and valued at about $600,000.

Kohl (Johann Georg), Ph. D., b. at Bremen, Germany, Apr. 28, 1808; studied law at the universities of Göttingen, Heidelberg, and Munich; resided for five years (1832–37) as a private tutor in Courland, Russia, and after visiting a great part of that empire settled in Dresden in 1838, where he prepared three works on Russia, all published in 1841. Their success led him to make a similarly careful series of journeys in the Austrian empire, and afterwards in Great Britain, Denmark, the Netherlands, and the Slavonic portion of Turkey, of all which countries he furnished excellent accounts in his popular books of travel. His writings on Denmark and Sleswick-Holstein (6 vols., 1846–47) were published opportunely just before the political questions regarding the Danish duchies sprang into importance (1848), and they therefore obtained a wide publicity. From 1854 to 1858, Dr. Kohl travelled or resided in North America, and as a consequence prepared several valuable works—*Travels in Canada* (1855), *Travels in the North-western Parts of the U. S.*, and *Kitchi-Gami, or Tales from Lake Superior* (1857). He also communicated to the Smithsonian Institution two essays on early maps and charts of America, and prepared a catalogue of them as a supplement to Hakluyt's great work. In 1861 he published a *Hist. of, and Commentary on, two Maps of the New World made in Spain at the Commencement of the Reign of the Emperor Charles V.*, and almost at the same time a *Hist. of the Discovery of America.* Dr. Kohl resided after his return from America at Bremen, and d. there June 6, 1871. Shortly before his death he communicated to the Maine Historical Society important data respecting the early annals of discovery, exploration, and attempted colonization of the coasts of Maine by French navigators.

Kohl'-rabi [Ger., perhaps originally meaning "rape cabbage" or "beet cabbage"—*Kohl-rübe*], a variety of the *Brassica oleracea*, the species which includes the cabbage, turnip, etc. The thickened edible portion is the leafy stem, and above ground, instead of the root beneath, as in the turnip. It is cultivated in the U. S., but much more extensively in Europe, and is prized for cattle and for table use. Its cultivation is precisely that of the cabbage.

Ko'komo, post-v., cap. of Howard co., Ind., 54 miles N. of Indianapolis, on the Pittsburg Cincinnati and St. Louis, the Indianapolis Peru and Chicago, and the Frankfort and Kokomo R. Rs., being the terminus of the latter. It has 5 churches, 1 national and 2 private banks, 2 weekly newspapers, a high-school building (cost $40,000), machine-shops, hub and spoke, door and sash, chair, furniture, and other factories, 1 woollen and 2 flouring mills. Pop. 2177. T. C. Philips, Ed. "Tribune."

Ko'kra, or **Cocus-wood,** the *Aporosa dioica*, a rather small tree of the East Indies, order Euphorbiaceæ. The timber is very hard and of a rich handsome brown color. It is imported, and used in making flutes and for ornamental joinery.

Ko'la, town of Russia, in the government of Archangel, is the northernmost town of European Russia, situated at the confluence of the Kola and Tuloma, 36 miles from the Arctic Ocean, in lat. 68° 50′ N., lon. 33° 15′ E., and has a good harbor. It was bombarded by the allied powers Aug. 23, 1854. Pop. about 1000.

Kolapoor', an independent state under English protection, in the presidency of Bombay, partly occupied by the Western Ghauts, partly situated on the table-land of Deccan, bordering on the Kistnah. Area, 3445 square miles. Pop. 500,000. Cap. Kolapoor.

Kolb (Georg Friedrich), b. Sept. 14, 1808, at Spires, where in 1830 he founded a liberal journal, which he conducted for more than twenty years, though under many difficulties from the government. As a member of the Bavarian diet he compelled King Louis I., in 1849, by his report on the Greek loan, to repay to the state treasury out of his private means the money which had been lent to his son, King Otho of Greece. Shortly after the reactionary party came into power, and Kolb had to retire to Zurich to escape from the persecutions of the government. He lived here from 1853 to 1860. On his return he became editor of the liberal journal, *Frankfurter Zeitung.* Besides being a journalist and politician, he has acquired a great name as a statistician. He wrote *Handbuch der vergleichenden Statistik* (1858) and *Grundriss der Statistik* (1862).

Köl'csey (Ferencz), b. Aug. 8, 1790, at Szö-Demeter, in Transylvania; studied law, but allied himself very early with that literary movement at the head of which stood Kazinczy. His poems and tales were much appreciated; he exercised the greatest influence, however, by his clear and vigorous criticism. Having been elected a member of the Hungarian diet (1832–36), he showed himself to be one of the most brilliant orators of the country, and a great political career was opened for him when he suddenly d. at Pesth, Aug. 24, 1838. His collected works were published after his death; his *Diary*, during the diet in 1848.

Koliazin', town of Russia, in the government of Tver. It is famous for its shoe-factories. Pop. 5895.

Kolin', town of Bohemia, on the left bank of the Elbe. Here the Austrians under Daun defeated the Prussians under Frederick the Great, June 18, 1757. Pop. 7727.

Kollar' (Jan), b. July 29, 1793, at Mossocz, in North-

western Hungary, of Slavic descent; studied theology at Presburg and Jena; was appointed minister to the Slavic congregation at Pesth in 1819, and removed in 1849, as professor of Slavic archæology, to Vienna, where he d. Jan. 29, 1852. His poems and his edition of the Slavic popular songs exercised a great influence on the development of the Bohemian literature. But a still more intense and much wider attention was attracted by his ideas of Panslavism, which pervade his poetry, his sermons, and his archæological writings, and which were openly set forth for the first time in his *Ueber die literarische Wechselseitigkeit zwischen den Stämmen und Mundarten der Slawischen Nationen* (1831), written in German.

Köl′liker (Rudolf Albrecht), b. at Zurich, Switzerland, July 6, 1817; studied at Zurich, Rome, and Berlin; became distinguished for knowledge of histology and skill in microscopical anatomy; was made an instructor at Zurich in 1842, and in 1845 adjunct professor of comparative anatomy and of physiology; received the full professorship of the same branches at Würzburg in 1847, and in 1849 became professor of anatomy there. Author of a series of very valuable works on histology, physiology, and other departments of biology, several of which have been translated into the principal European languages.

Kolmar, tp. of Olmsted co., Minn. Pop. 972.

Kolome′a, town of Austria, in the province of Galicia, on the Pruth, at the foot of the Carpathian Mountains. It is famous for its pottery. Pop. 14,839.

Kolom′na, town of European Russia, in the government of Moscow, on the Moskva, near its confluence with the Oka. It has large silk manufactures and a considerable trade. Pop. 13,703.

Koloshes, the Russian name for the Indians of the coast of Alaska. (See Koniagas.)

Kong Mountains, the name of a mountain-range of Central Africa, commencing in lat. 9° N. and lon. 9° 20′ W., at a distance of about 200 miles from the Gulf of Guinea, and forming the northern frontier of Ashantee. The height of these mountains is not more than 2500 feet, but very little is known about them. The Kong district is remarkable for its trade in gold, and the town of Kong is quite celebrated for its manufactures of cotton cloth, in which it carries on an extensive trade, being itself a centre of several caravan-routes.

Kongs′berg, town of Norway, in the province of Christiania, has a mining school, and in its vicinity silver-mines, discovered in 1623, and still worked with profit. Pop. about 5000.

Konia′gas, Ka′diaks, or **Southern Eskimos,** a great family of aborigines inhabiting the sea-coast of Alaska for more than 1500 miles from Kotzebue Sound, N. of Behring Strait, across the peninsula of Alaska to the mouth of the Atna or Copper River, and extending inland 100 to 150 miles. They derive their name from the large island of Kadiak, the inhabitants of which called themselves *Kanagist.* They are divided into fourteen tribes—the Koniagas proper, who inhabit Kadiak and the neighboring islands; Chugatshes, on the islands and shores of Prince William Sound; Aglegmutes, on Bristol Bay; Keyataigmutes, on the river Nushagak and the coast as far as Cape Newenham; Agulmutes, on the coast between the Kuskoquin and Kishunak rivers; Kuskoquigmutes, on the river Kuskoquim; Magemutes, near Cape Romanzoff; Kwichpagmutes, Kwichluagmutes, and Pashtoliks on Kwichpąk, Kwichluak, and Pashtolik rivers; Chnagmutes, near Pashtolik Bay; Anlygmutes of Golovnin Bay; Kaviaks and Malemutes of Norton Sound. All these tribes speak dialects of the same language. (For an elaborate account of these little known races see H. H. Bancroft's *Native Races of the Pacific States,* vol. i., 1874.)

Ko′nieh, the ancient *Iconium,* town of Asiatic Turkey, the capital of the province of Karamania, Asia Minor, situated in lat. 37° 51′ N. and lon. 32° 40′ E. It has some manufactures of carpets and morocco, but it is mostly in a decaying state, although its walls, surmounted by square towers, its many mosques and minarets, give it an imposing appearance at a distance. Pop. between 40,000 and 50,000.

Kö′nig (Heinrich Joseph), b. Mar. 19, 1790, at Fulda, in the former electorate of Hesse, held different small offices in the civil service at Hanau; retired in 1847; lived for some time at Wiesbaden, and d. Sept. 23, 1869. He wrote a great number of novels and so-called historical romances—*Hedwig, die Waldenserin* (2 vols.), *William Shakspeare* (2 vols.), *Die Clubbisten in Mainz* (3 vols.), etc.—which were eagerly devoured by that kind of people who have time to read many novels, but not taste enough to read the good ones.

Kö′niggrätz, a fortified town of Bohemia, on the Elbe. The Austrians under Gen. Benedek were completely defeated here by the Prussians under Gen. Moltke, July 2, 1866. Pop. 5061.

Kö′niginhof, town of Bohemia, on the Elbe. It has some manufactures. Pop. 5370.

Kö′nigsberg, the capital of the province of Prussia and a fortress of first rank, is situated 20 miles from the Baltic on both sides of the Pregel, whose two arms, the old and the new Pregel, unite within the city. Pop. Dec. 1, 1871, 112,092. It is the seat of a university, of the provincial government, of the staff of the 1st army corps, and has a numerous garrison. It consists of three former towns, Altstadt, Löbenicht, and Kneiphof, which in 1724 were united into one city. It is not a handsome place; the streets are narrow and there are few conspicuous buildings. Altstadt is the oldest part, and contains the palace and the town-house. The palace, with a tower 87 mètres high, forms an oblong square, and stands nearly in the centre of the city. It is rich in historical recollections. It was founded in 1257 by King Ottokar of Bohemia; became the residence of the grand master of the German order in 1466, and in 1525 the residence of the dukes of Prussia. The eastern wing was built in 1532 by Duke Albrecht, the southern in 1551. In the chapel, occupying the western wing, the elector of Brandenburg, Frederick III., crowned himself, Jan. 18, 1701, as the first king of Prussia, under the name of Frederick I. In the same place William I., afterwards German emperor, was crowned as king of Prussia Oct. 18, 1861. Over the church is the large Moskowitersaal, which is used for great festivals. In front of the eastern gate stands the statue of Frederick I., erected in 1801, of life-size. Other remarkable buildings are—the cathedral, 92 mètres long, situated on an island formed by the Pregel, a Gothic structure commenced in 1335, and containing several interesting monuments; the old university building, Collegium Albertinum, founded in 1544; the new university building, on the parade-ground to the N. of the palace, finished in 1862, with a hall frescoed by Rosenfelder, Gräf, and Piotrowsky. On the parade-ground stands also the theatre, and in the centre of the place rises the equestrian statue of Frederick William III. by Kiss. The museum, the royal library, the observatory, the monuments of the philosopher Kant and the minister Schön, are also interesting. Excellent scientific and benevolent institutions are the botanical garden, the zoological museum, the seminary, three gymnasiums, a mercantile school, an academy of art, asylums for the deaf and dumb, for the blind, lunatics, and orphans, and several hospitals. The manufacturing industry is considerable. Iron-foundries, machine-shops, breweries, and dyeworks are in operation. Iron goods, chemicals, soap, paper hangings, leather, and tobacco are manufactured. To the city belonged in 1872, 15 sea-going vessels, besides 8 river steamboats. At Pillau, the port of Königsberg, entered in 1871, 1322 vessels, with cargoes of 110,050 tons, and 388 vessels without cargoes; and cleared, 1566 vessels, with cargoes of 135,068 tons, and 84 vessels without cargoes. Among the imports were 218,076 cwts. tea, 140,465 cwts. pig iron, 348,493 cwts. rails, 131,238 barrels of herrings, 1,018,255 cwts. coal, 323,485 cwts. salt. Among the exports were 204,808 cwts. tea to Russia, 138,247 cwts. rails, 263,696 cwts. flax and hemp, 997,006 cwts. wheat, 2,130,929 cwts. rye, 401,891 cwts. barley, 433,607 cwts. oats, 310,500 cwts. beans, 700,412 cwts. oil-seeds, 104,833 cwts. rags, 175,230 cwts. salt.

Königsberg was built by the Teutonic order of Knights in 1255 as a fortress against the pagan Samlænder, and rose to importance through its corn-trade. In 1626 its fortifications were reconstructed, and again in 1843. About 1523 it became the capital of the duchy of Prussia. In 1758 it was occupied for a short time by the Russians, in 1807 by the French. The philosopher Kant taught here from 1755 to his death, Feb. 12, 1804. August Niemann.

Kö′nigsmark (Maria Aurora), Countess, b. at Stade, Hanover, in 1666. Her father was a Swedish general, and fell in the Dutch service at Bonn in 1673; her mother was a daughter of the Swedish field-marshal Wrangel. She received a brilliant education at the courts of Stockholm, Hanover, and Brunswick, and she was moreover exceedingly beautiful. In 1694 she went to Dresden, where August II. had just ascended the throne, and in 1696 she bore him a son, the famous Maurice, marshal of Saxony. In 1702 the king, whose friend she became after being his mistress, sent her to the camp of Charles XII. in Courland to persuade him to make peace, but Charles XII. declined to see "the most famous woman of two centuries," as Voltaire calls her. The rest of her life consists merely of anecdotes and gossip more or less credible. She d. poor and suffering at Quedlinburg Feb. 16, 1728.

Kö′nigstein, small town of the kingdom of Saxony, on the left bank of the Elbe. Behind it rises a huge rock,

878 feet above the river and 1111 feet above the sea, and entirely inaccessible except through a narrow passage to the N. W. On the top of this rock is built the famous fortress of Königstein with bombproof casemates, and a well 1172 feet deep, to which the crown jewels and the treasury of the kingdom are brought in times of war.

Kö'nigswarth, town of Bohemia, has iron and tin mines and mineral springs. Pop. 7494.

Koobetch'i, town of Russia, in the government of Daghistan, Caucasus, manufactures cloth, shawls, and arms. Pop. 6000.

Koo'doo, a splendid antelope of South Africa, the *Strepsiceros koodoo*, one of the largest of the family. It has an extensive range in the wooded regions, is easily domesticated, and its flesh is highly esteemed. Its large and spirally twisted horns are characteristic of the species.

Koo'fa, or **Kufa,** town, or rather the ruins of a town, of Asiatic Turkey, in the province of Koordistan, on an affluent of the Euphrates, was founded by Omar, who made it his residence, and who was murdered here. It soon became the seat of Arabic learning, and the ancient Arabic characters called *Cufic* received their name from this place. When, at the end of the eighth century, the residency was removed to Bagdad, Koofa declined, and sank into ruins.

Kool'fo, or **Kulfo,** town of Western Africa, in the dominion of Gando, stands on the Mayarrow, in lat. 10° 10′ N., lon. 6° 45′ E., and is surrounded with high walls. It has an important trade, and about 12,000 inhabitants.

Koom, or **Kum,** town of Persia, in the province of Irak-Ajemee, is partly in ruins since its destruction by the Afghans in 1722, but is at present rising once more. The district in which it stands is very fertile, and its position on the road between Teheran and Kasbin gives it considerable commercial importance. Pop. about 12,000.

Koondooz', **Khoondooz,** or **Kunduz,** a small province of Northern Afghanistan, lying between the frontier of Bokhara and the Bolor Mountains, formerly an independent khanate of Tartary, but now owning allegiance to the Ameer of Cabool. The greater part of the province is mountainous, but there are some fertile valleys where excellent grain is raised. The capital, Koondooz, has a population of 2000.

Koordis'tan, or **Kurdistan,** the name of an extensive region of Western Asia, situated between lat. 34° and 38° N., and between lon. 42° and 47° E. It forms no independent political unit, but is divided between Turkey and Persia, though its relations to both of these two powers are somewhat loose. Its area is estimated at 100,000 square miles; the number of its inhabitants at 3,000,000, of whom four-fifths are Koords. The country is mountainous, some of the peaks rising to the height of 13,000 feet, intersected by beautiful valleys along the rivers, which in great number flow down to the Euphrates and Tigris. The Koords, who are Mohammedans, live mostly as nomades. They are a proud and fierce race, engaged in the rearing of cattle, sheep, goats, and horses, of which great numbers are annually exported both to Turkey and to Persia, where they are highly esteemed—the goats for their silky hair, the horses for their strength and fieriness. Generally, their looks, characters, and habits correspond perfectly with the description Xenophon gives of them.

Koorile Islands. See Kurile Islands.

Koorsk, or **Kursk,** government of European Russia, between the Don and the Dnieper. Area, 17,385 square miles, with 1,866,859 inhabitants. The surface is mostly low but undulating, and the soil very fertile. Large crops of wheat are raised, besides hemp, tobacco, and fruit.

Koorsk, or **Kursk,** town of European Russia, the capital of the government of Koorsk, on the Seim. It is a flourishing town, with an extensive trade in tallow, rope, and fruit, and many good educational institutions. In the neighborhood of Koorsk is held an annual fair in the month of July, which is one of the greatest fairs of the country. Pop. 28,921.

Koo'tenais, Kitunaha, Coutanies, Cottonois, or **Flatbows,** a tribe of Indians in British Columbia, Washington, Idaho, and Montana Territories, called by themselves Skalzi. They are classed by H. H. Bancroft (*Native Races of the Pacific States,* vol. i., 1874) in the Shushwap family of the Columbian or Nootka-Columbian group; by others they are placed in the Salish or Flathead family, and are sometimes considered a family by themselves, though closely allied to the Atnas and Okanagans. Amid a multitude of authorities, frequently at variance with each other or defective upon essential points, the tribal distribution of this entire group is still problematical. The original *habitat* of the Kootenais is in British Columbia, in the space bounded by the Columbia and Clark rivers and the Rocky Mountains, where about 400 still remain upon the Kootenai or Flatbow Lake. Some hundreds now live in Washington Territory, on the great reservation bounded N. by the U. S. frontier, E. and S. by the Columbia, and W. by the Okanagan River; 400 live in Idaho, near the Cœur d'Alêne mission; and 320 are settled with the Kalispels, on the Jocko reservation in Montana. They are generally peaceable and self-sustaining, hunting the buffalo with bows and arrows, and have had little dealing with the government. They have made some progress in civilization under the auspices of Father de Smet and other Catholic missionaries.

Koo'tenay, county of N. Idaho, bounded N. by British Columbia, E. by Montana, S. by Cœur d'Alêne River, and W. by Washington Territory. It is partly mountainous, but contains large and fertile prairies. It is traversed by Clark's River, and contains several large lakes. Gold is reported to be found.

Ko'pel, a v. of Marion tp., Mercer co., O. Pop. 305.

Kopp (Joseph Eutych), b. in 1793 at Münster, in the canton of Lucerne, Switzerland; was director of the Lyceum at Lucerne from 1819 to 1841, and president of the board of education to 1845, in which position he became conspicuous by his opposition to the Jesuits. His principal works are—*Urkunden zur Beleuchtung der Geschichte der eidgenossischen Bünde* (2 vols., 1835–51) and *Geschichte der eidgenossischen Bünde* (5 vols., 1845–62), by which he threw new light on the relation between the house of Hapsburg and their possessions in Switzerland, and dissolved the story about Tell into a myth. D. at Lucerne Oct. 25, 1866.

Kop'parberg, or **Stora-Kopparberg,** the name of a political division of Sweden, situated on both sides of the Dal River, and comprising those regions which formerly were so celebrated in the history of the country under the name of Dalarne (Lat. *Dalecarlia*). It is a wild but beautiful mountain-region, covered with forests of fir and birch, and rich in copper and porphyry, but ill suited for agriculture. The inhabitants, numbering about 180,000, form one of the finest types of the Scandinavian race. They are valorous, hardy, ingenuous, and trustworthy, and nearly in all crises in the Swedish history the *Dalecarlier* have make the decision. As the country is unable to support them, they spread over Southern Sweden and Denmark seeking for work, but they always return to their native vales with their earnings. Cap. Falun.

Köp'pen, von (Peter), b. at Kharkow, Russia, Feb. 19, 1793; studied at the university of his native city, and devoted himself throughout life to researches concerning the ethnology, archæology, and history of Russia. His principal works are—*Materialien zur Culturgeschichte Russlands* (1827), *Die Geschichte des Weinbaues und Weinhandels in Russlands* (1832), *Taurica* (1840), *Ethnographische Karte des europæischen Russland* (1851), and an exhaustive memoir on the census of 1850. The Russian government presented him with an estate in the Crimea, Karabagh, where he d. June 4, 1864.

Ko'ran, the book of the Mohammedan religion and the foundation of the Mohammedan literature. It may be also regarded as the conservative power of the widely-spoken Arabic language and the source of its refined system of grammar. Its religious and intellectual influence extends from India to Morocco, from Turkey and the borders of the Russian empire to the central and southern parts of Africa. In comparing it with the Bible, it may be said that the latter differs from it, and from every other book called sacred, in having been, so far as its human production is concerned, a growth of many ages and of many minds. It lies in history as a stream of supernatural influences, events, and teachings, extending from the patriarchal times to the complete introduction and establishment of Christianity upon the earth. In this respect the Bible differs wholly from the Persian, Indian, Boodhist, and Chinese books with which it is so often ignorantly compared. So the Koran is also the product of one mind and of one age. In certain features, however, it bears a much closer relation to the Jewish and Christian Scriptures than the other writings referred to. It may be regarded, in fact, as a lateral wave from that great tide of religious thought and feeling which came down from the earliest times of human history, bearing in its mid-channel the Jewish theocracy, and culminating in the Christian Church. In other words, the Koran may be regarded with some reason as an apocryphal book of the Bible, bearing to it a relation similar to that of the weird visions of the Second Esdras, the Wisdom of Solomon, or the sententious book of Sirach. It is still the heaving of the ground-swell from that old fountain-flood of religious power. Without Judaism and Christianity, Mohammedanism and the Koran would never have had an existence. Without Abraham and Moses and Christ the Arabian prophet would never have made the appearance he presents in history as the reaffirmer of the Divine Unity, the

rebuker of idolatry, and the restorer of the primitive patriarchal or Abrahamic religion.

The name Koran (*Al Koran*, with the article, *The Koran*) is derived from an Arabic verb *qarā*, to "read," and this from the older Shemitic, meaning to "cry aloud" (κράω, κράζω), to "pronounce," "utter," "dictate." It is in this respect like the name *Miqra* (מִקְרָא), from the cognate Hebrew root, and which the Jews gave to their Scriptures. This probably suggested it to Mohammed, though the application he makes of it is somewhat different. The Jewish name was from the public reading—the Koranic, from the idea of recitation or *dictation* to Mohammed himself. Sometimes a word expressly denoting this is used for the purpose; as in Sura xxv. 6, 7: "And the unbelievers say, This is a lie which he hath contrived; they are traditions of the ancients which he has caused to be written down, saying that they were *dictated* (*tumla*) to him, morning and evening. Say unto them, He hath revealed it who knoweth the secrets of heaven and earth; He the Gracious, the Merciful." The medium of this dictation was the angel Gabriel, who is elsewhere called, in the Koran, *Ruhu-'lkudus*, the Holy Spirit (see xvi. 104, etc.), and sometimes simply *Ruh*, The Spirit, as in lxx. 4. Hence also the Koranic name *Tanzil*, or the "descent," defined in the book *Tarifat* as "the declaration or revealing of the Koran by means of the angel (or spirit) *descending* on the heart of the Prophet." Some regard the word *Tanzil* as denoting the literal descent of the book in successive folios or portions from the heavens; but the other view is most in accordance with the spirit of the passages in which the term is used.

This has been commonly treated by the earlier Christian writers as all a designed imposture, very much as it was viewed by the scoffing Arabian Kafirs whom Mohammed pathetically rebukes. Later German authorities, on the other hand, especially Sprenger in his *Leben und Lehre des Mohammad*, go to the other extreme in ranking the Arabian reformer with the prophets and apostles of the Christian Scriptures, and even with the Founder of Christianity itself. This, however, is evidently done not so much in honor of Mohammed as for the disparagement of Isaiah, Paul, and Christ. There is unquestionably a deep conviction of truth, a strong sense of some destined mission, and a fervent enthusiasm prevailing throughout this remarkable work. No man can carefully study it without feeling its subjective truthfulness—that is, without being impressed by the thought that the writer, or the preacher, is delivering what he believes to be a true message from a superhuman sphere, whatever may have been the mode and influences through which that conviction was produced. The explanation which would so easily resolve it all into a studied deception comes from a shallow overlooking of well-established facts in the human psychology. The earnestness and strong devotional spirit manifested in the Koran repel the idea. There is, moreover, a tenderness of conscience in respect to his supposed mission which one guilty of a long and studied imposition would seem incapable either of feeling or affecting. There is a striking instance of this alluded to in Sura xvii. 75, where there is related a rebuke Mohammed had received for seeming, on a certain occasion, to have swerved from his instructions under the temptation to palliate some forms of idolatry among his followers. It was at this time that he offered the touching prayer recorded by Al Zamakhshari in his commentary on the passage: "We have it from the Prophet, Allah bless him! that when this weakness was revealed to him, he prayed and said, 'O Allah, never again leave me to myself for the twinkling of an eye.'" It is not easy to reconcile such emotion as this, and such utterances, with a protracted scheme of hardened and deliberate lying. To a similar end may be cited the instances of tender and charitable feeling that characterize the earlier parts of the Koran, though in the later chapters strife and oppression had tended to make his utterances more fierce and fanatical. See Sura ii. 59: "Verily they who believe, and those who are Jews, and the Christians, and the Sabæans, yes, every one who believes in God and in the day of judgment, and who does that which is right,—to all such is there recompense from their Lord; they have nothing to fear; they shall not be grieved." A different language is found in some other parts, which commentators, Christian as well as Mohammedan, have labored to reconcile; but it is better to admit the inconsistency. A deliberate deception would have avoided or suppressed it. As having the same bearing, may be mentioned the places where he speaks not only reverently but tenderly and lovingly of Jesus, or "'Isa 'benu Maryama (son of Mary), Word of truth," as he calls him, Sura xix. 35, acknowledging him as one greater than himself—a reverence which he also pays to Abraham and Moses. Passages elsewhere which are interpreted as teaching persecution, or the enforcement of religion by the sword, are to be regarded in the same light as coming from a change of temper, and as having been still further perverted by the fanatical bigotry of his immediate followers. It may be doubted, however, whether they were ever meant to be applied to Jews and Christians, of whom Mohammed speaks so charitably in the passage cited. Throughout the better part of the book the Kafirs, or *unbelievers*, who are to be forced into truth and purity by the *cleansing* sword of Islam, are the unclean and bloody pagan idolaters whom he regards as in alliance with Sheïtan (Satan, Eblis) and the Jins.

As the idea of crude imposture is untenable, so also does the more plausible explanation of an excited enthusiasm fail to remove all the difficulties of this remarkable literary and religious phenomenon. The Koran is a book which can only be interpreted on the ground that the author himself strongly believed in it as coming from some other source than his own conscious and voluntary mental exercises regarded in their normal condition. There have been, even in modern experience, too many well-attested cases of the ecstatic trance, of abnormal visionary states, of clairvoyant and somnambulic utterances, to warrant the summary rejection of such explanations. Mohammed's epileptic condition of body made him a fit subject of such influences, from whatever sphere we may regard them as coming. His high genius gave them a more intensive form and a more elevated character than ordinarily characterize such utterances in our own times. We know, too, that similar claims have been put forth by men characterized not so much by imagination as by the loftiest reason. The δαιμόνιον of Socrates, so solemnly asserted by him in his last moments, belongs to this class of psychological phenomena. The power and value of the utterances produced are to be judged by the evidence they give of the genius and mental rank of the one from whom they proceed, and the coloring received from the outward influences of the age in which they appear. They may be trifling, they may be unmeaning, or they may rise to an eloquence and a dignity producing, as in this case, the mightiest effects, and demanding, therefore, our awed respect, though higher evidence may be required to certify them as an actual and direct revelation from the Divine sphere. The careful and intelligent reading of the Koran furnishes the best proof here. Let a man carry steadily along with such reading the thought of cold artifice, of deliberate lying, or studied imposture, and the idea is continually refuting itself. It would have been a very different book produced in that way. Its very extravagances, its rhapsodies, its sudden emotional transitions, its weird pictures, mingled at times with the sublimest ideas, give conclusive proof of a deeper and more mysterious origin.

There are other names for the Koran to be found in the book itself, such as *Al Kitab*, "the Scripture," *Dikr*, "memorial" (used like the Hebrew *zeker, zikkaron*), *Al Furkan*, etc., which are of little significance in determining either its form or the nature of its contents. The latter would strictly mean, the book divided into sections, as the Hebrew *perek* is used for the shorter divisions of the Talmud. Regular division, however, is very far from being a feature of the Koran. Its one hundred and fourteen chapters vary greatly in their length, from forty octavo pages, which is the length of Sura ii. in Flügel's edition, to a short paragraph containing a verse or two, which is the extent of a large number towards the end. Besides this, there is an artificial division, subsequently made, into sixty-five equal portions, called *Ahzab*, and each of these again subdivided into four equal parts. Another makes thirty portions, but all these are simply for the use of readers, and made in imitation of the synagogue sections for the worship of the Jews. There are mentioned seven principal editions or ancient copies—two named from Medina, one from Mecca, one from Cufa, one from Basra, a sixth called the Syrian, and a seventh styled the common or vulgate edition. They differ slightly in the reckoning of the whole number of the verses, a variation arising from a few differences of division; but they all agree in the same total of words, which they make to be 77,639, and the same total of letters, 323,015; the Mohammedans, as Sale says, having imitated in this respect the superstitious carefulness of the Jewish Masorites. There can be no doubt of a very ancient writing, whether made by Mohammed himself, or by some of his devoted followers, but the principal means of promulgation in the beginning was most probably by oral recitations made by those who had committed to memory particular Suras, and in some cases the entire Koran. That this is by no means incredible appears from the same fact and the same practice as now exhibited in the Mohammedan schools in India, and even in the interior of Africa. The solemn recitation of Mohammed, believed, as it was, to have come from the angel, must have made a deep impression upon the minds of his early disciples, thus aiding the memory in receiving and retaining the remarkable words. The

belief in this is also aided by the fact of a class of men in after times professionally devoted to this practice, and deriving from it a special name. They were called *huffadzun, custodes, conservatores, qui Coranum memoria tenent;* resembling in some respects the old Homeric chanters. They are referred to in Ahmed's *History of Timur* (Manger ed.), p. 871, where the names of a number of them are given. (See also Herbelot, *Bibl. Orient.*, 202, and Pocock, *Specim.*, 378.) So the Koran itself is called *Mahfudz*, "the book preserved." The term is used Sura lxxxv. 22, though there applied to a tablet, whether literal or as figurative of the memory: "Nay, it is a glorious Koran, preserved (in memory) as on a tablet;" though some would interpret it as meaning a tablet kept in heaven—the original in the Divine mind.

The Koran, as has been said, is a reflection from the Bible, however distorted and apocryphal the image it presents to the Christian mind. It admits the divine authority of the Jewish Scriptures. It may be said, too, that its influence as a book gives a more encouraging basis for Christian missionary effort than can be found in the worn-out religions of Booddha, Brahma, and Confucius. In distinction from them it is a live book and the text of a living religion. It belongs to the side of positive theology, having for its ground, like the Jewish and Christian, the *yirath Yehovah*, "the fear of God"—of a personal God—instead of the empty theosophy or mystic nature-worship that characterizes those systems of the remoter East. In opposition to their materialistic dualism, their elusive pantheism, their cold subjectivity, stand out the glowing devotion, the sublime earnestness, the pure, distinct, and lofty theism of the Koran. Its doctrine of Allah's sovereignty, of his immovable throne, of his eternal decrees, of his continual personal providence, is the antithesis of their physical fate. So, too, does its teaching in respect to a great judgment to come, a resurrection-day of final account, "the book" in which each man shall read the true value of the life lived by him in this preparatory world, the "meeting of his sins that have gone before him," and above all, its sublimely rigorous doctrine of prayer, place it in direct contrast with the poor, barren worldliness which is all that we get from the best selections made from the writings of Confucius. In view of these facts we cease to wonder at its triumph wherever it has met those lifeless creeds. It is all the more hopeful for Christianity that it should have had such a pioneer or forerunner in India and China. Better to contend with Mohammedanism itself, when the time comes, than with those dead systems, whose inertia or want of religious susceptibility presents a harder and more hopeless antagonism than the vitality of even Mohammedan error. The very fact that the Koranic religion is sharply controversial gives all the more encouragement. It is evidence of some kind of life; it shows that it has something to contend for. It is better to meet the zealous Islamite in this way than to encounter the meaningless pantheism of the Hindoo or the stolid indifference of the Chinese. With the first there is a common ground, giving hope of ultimate agreement. The Koran has all those grand theistic elements of religion that demand the Christian *specialty*—that is, the doctrine of *the cross*, or that mediatorial idea which may be said to be the great lack of Islamism. When other enemies are slain, clear discussion may bring that mediatorial idea to light, and thus show that the Arabian enthusiast had really something which may be called a mission for that dead Eastern world.

Neither can it be denied that the Koran produced a most salutary reformation in its own times. Neither the Ishmaelite nor the Joktanite Arabians had wholly lost the old patriarchal or Shemitic monotheism. But it had become much darkened and corrupted by Sabæanism, and some still grosser forms of creature-worship that had come in. The Koranic name for this, *Moshre kuna* ("who make sharers, partners"), is suggestive of Paul's description of the beginnings of idolatry—"The worship of the creature *along with* the Creator, or *beside* the Creator (παρὰ τὸν κτίσαντα, Rom. i. 25. See especially Koran, Sura xvi. 102). Some had gone farther than this, even to what might be called demon-worship, accompanied with the foulest practices. The change in this respect produced by the promulgation of the Koran was sudden and extensive. It was also the means of a reformation of morals, and the putting away of some exceedingly barbarous and revolting customs. Thus, infanticide was very commonly practised, especially the putting to death of female children, and even burying them alive. There is a most touching allusion to such a horrid custom in Sura lxxxi. The passage is given at some length, as a specimen also of the peculiar Koranic rhythm, and of the weird style that especially characterizes some of these later chapters. It is entitled *Takwir*, or the "Folding up," from the verb in the first verse, *Idh' ash-shamsu kowwerat*. It is a description of the day of judgment, and we have rendered it almost word for word, with a few slight freedoms in the use of the active for the passive, in order to preserve something like the rhyming cadence:

"When the sun [its face] is shrouding,
When the stars are downwards gliding,
When the hills are lightly moving (Jer. iv. 24; Ps. cxiv. 4),
When the camels ten months gone,
Uncared for now, are left alone;
When the rabid beasts are gathering,
When the seas are hotly boiling,
When [to bodies] souls are joining,
When the buried babe is asking
For what crime its ruthless slaying;
When the sealed books are opening,
When the heavens are departing;
Then when hell is fiercely burning,
And when Paradise draws near,
Knows each soul what to the presence it hath sent before."

The Koran abolished the cruel practice alluded to in the verse above, and others of a similar kind. This was done, not in a cold humanitarian way, which is seldom long or intensely efficacious, but by an appeal to the deepest religious feeling.

Personifications of nature are not frequent in the Koran, but there are some examples that present a striking combination of the moral and physical sublime. Thus, in Sura xxxiii. 72, God is represented as offering "the faith" (truth, law, conscience, accountability) to nature, to the heavens, the earth, the mountains. They are "afraid of it;" they "shrink away from the tremendous charge." But man undertook it—presumptuous man, "ignorant and unjust (to himself)." Hence his peril and his woe. It is, however, in its descriptions of the Divine justice, the Divine unity, the *Throne of Allah*—an expression Mohammed so frequently uses—and the Divine majesty generally, that the Koran is especially magnificent. See, among other similar examples, Sura lix. 22: "God, beside whom there is no God, who knoweth the future (the hidden), as he knows the present—God most merciful, God the King, the Holy, the Giver of peace, the Ever-to-be-trusted, the Keeper, the Almighty, the Great, the Most High; God the Creator, the Maker, the Former, exalted above all idols, all partners of His throne. Whatever is in heaven and in earth, let it praise Him, the Strong, the Wise."

Aside from the great defect before referred to, there are two things in the Koran which may be regarded as positive deformities. One is its doctrine of polygamy, and the other the too sensual aspect it gives to the happiness of Paradise. In regard to the second, however, it may be said that the representation of the beautiful females was adapted to the Arabian ideas, and is therefore adopted among the other symbols of spiritual joy, such as "the gardens, the fair rivers, the perennial fruits," which enter also into the biblical pictures. There is an evident intention to make it as pure as the human conception will allow. That a degree of spirituality is intended is shown by the Arabic words which the Koran brings into use respecting the two worlds. The great idea in the one is *certainty, assurance, eternity*. Hence the phrase that occurs so frequently in connection with the "garden and the fair rivers," *Chalidina fiha abdan*—"they abide there for ever." In contradistinction to this there are two names for the present world that are most expressive. They are *Dunya* and *Al-ajelat;* the first denoting the *near* world, the world of sense, the common, and sometimes the *mean* world, in distinction from the glorious and the strong; the second is literally the *rolling* or *hastening* world, the transitory, quick-vanishing world, the failing world, *mundus caducus*, in distinction from the permanent and the immutable. (See Sura xvii. 19, 20, and many other places.) Besides these, there is the general term for the other or after-life, *Acherat*, corresponding to the Hebrew אחרית, as we may suppose it to be used in the prayer of Balaam (Num. xxiv. 14).

For the fullest details respecting the Koran, see Sprenger's *Leben und Lehre des Mohammad;* Freytag, *Einleitung in das Studium der Arabischen Sprache;* Herbelot, *Bibliothèque Orientale*, arts. "Koran" and "Mohammed;" and Sale's *Introduction*. The last is especially to be commended for candor and fidelity. Much valuable information, especially in regard to the influence of the Koran in Central and Western Africa, may also be obtained from an article by Prof. Blyden of Liberia College in the *Methodist Quarterly Review* for Jan., 1867. Among native Arabian authorities that give the fullest information may especially be mentioned the two great commentators, Al Beidawî and Al Zamakhshari. The former is the better known and the most frequently referred to. The latter (see the latest edition, published by W. Nassau Lees, Calcutta, 1856, in 2 quarto vols., pp. 1647) is an immense mine of theology, philosophy, Arabic grammar and lexicography, besides abounding in copious citations from Arabic poetry and general literature.

Tayler Lewis.

Korat′, a small independent territory lying between Siam and Cambodia, situated on an elevated table-land. Copper-mines are worked by the natives, and the sugar-cane is cultivated. Pop. about 60,000; of capital, also called Korat, 7000.

Kordofan′, a territory of Soodan, Central Africa, belonging to Egypt, and situated between lat. 11° and 15° N. and between lon. 28° and 32° E., bounded on the E. by Sennaar, from which it is separated by the White Nile, and on the W. by Darfoor. Area, 12,000 square miles. Pop. 500,000. The inhabitants are a mixture of negroes and Arabs professing Mohammedanism. Kordofan is a savanna, dry in the hot season, but covered with luxuriant verdure during the rainy season. The breeding of horses, cattle, and camels is the chief pursuit of the inhabitants. Cap. El Obeid.

Kornegal′, or **Koornagal′lee**, town of Ceylon, 55 miles N. E. of Colombo, beautifully situated. It is a resort of pilgrims, on account of an ancient temple where a footprint of Booddha is adored.

Kör′ner (Karl Theodor), b. at Dresden, Saxony, Sept. 23, 1791; fell in a skirmish at Wöbbelin, in Mecklenburg, Aug. 26, 1813. His whole life was consecrated to the one idea of rousing his countrymen against the humiliating and almost infamous despotism which Napoleon exercised over them; and although he died in the twenty-second year of his age, he saw the idea of his life realized, and he heard the world say that this great result was in no small degree due to him. Even when a very young man, studying in Freiberg and Berlin, he spoke with such a vehemence against the French that it was considered necessary for the sake of his safety to send him to Vienna. Here he began to write for the stage, and was very successful, but of his dramas *Zriny* is the only one which deserves attention. After the disastrous issue of Napoleon's campaign in Russia, Körner left Vienna and volunteered as a private in the Prussian light-horse of Lützow, and his great personal valor in connection with his inspiring war-songs made him in a few months the pride and the enthusiasm of his countrymen. After his death his songs were collected under the title *Leier und Schwert*, and several of them are as thrilling with their genuine beauty as exciting with their wild inspiration. Clemens Petersen.

Körös. See Kis-Körös and Nagy-Körös.

Kortetz′, or **Cortitz**, an island of Russia, in the government of Yekaterinoslav, is formed by the Dnieper, and rises 165 feet above the river, framed in on all sides by granite cliffs. It was one of the strongholds of the Cossacks, but after their removal in 1784 by Catharine II. it was settled by German Mennonites.

Kort′right, post-tp. of Delaware co., N. Y. Pop. 1812.

Kor′vey, or **Corvey**, village of Westphalia, on the Weser, is celebrated for its Benedictine abbey, founded in 816 by Louis the Pious. It was during the Middle Ages a famous centre of learning, and from it issued Ansgarius, Bruno, Wittekind, Wibald, and others. The massive buildings of the former abbey are now occupied by the prince of Hohenlohe-Schillingsfürst as a residence.

Koscius′ko, county of N. Indiana. Area, 558 square miles. It is very fertile, and is generally undulating. Cattle, grain, wool, and lumber are staple products. The county is traversed by the Pittsburg Fort Wayne and Chicago and the Cincinnati Wabash and Michigan R. Rs. Cap. Warsaw. Pop. 23,531.

Kosciusko, post-v., cap. of Attala co., Miss., the present northern terminus of the New Orleans Jackson and Great Northern R. R., is situated nearly at the geographical centre of the State; has 3 churches, 2 hotels, 25 stores, 15 shops, and 2 weekly newspapers. Principal business, raising cotton, of which 25,000 bales are shipped yearly. Pop. 577. R. Walpole, Ed. "Central Star."

Kosciusko (Thaddeus), [*Tadeusz Kosciuszko*], b. Feb. 12, 1746, at Mereczowszczyzna, in Lithuania, of an ancient princely race. Educated in Warsaw, Paris, and other European capitals, he was made an officer in a regiment; but having sued in vain for the hand of a daughter of the vice-grand-general of Lithuania, and the king of Poland himself being unable to forward his suit with the unwilling father of the young lady (to whom Kosciusko had been a tutor), the young soldier sailed in 1775 from Dantzic for the U. S., by way of Martinique. In 1776 he was made colonel of engineers. He served gallantly through the war of the Revolution, was made a member of the Cincinnati, a brigadier-general by brevet, and received the thanks of Congress. Returning to his native land, he fought for his country in the wars of 1792–94 against the partitioners of Poland; but, notwithstanding the prodigies of valor performed by the unhappy Poles, with Kosciusko at their head, they were totally overpowered at Macieowice, where their commander fell covered with wounds. Imprisoned at St. Petersburg, he was set free in 1796 by the emperor Paul, from whom he refused the offer of a sword. He revisited the U. S., where he received a pension and a grant of land, but in the following year he retired to France, displeased, we are told, by the passage of the Alien law. In 1816 he fixed his residence at Soleure, Switzerland, and in the following year set free the serfs on his paternal estate. D. at Soleure Oct. 16, 1817. The statement very often made with regard to Kosciusko (that he exclaimed "*Finis Poloniæ!*" as he fell wounded in his last fight) he always indignantly denied. (See J. L. Chodzko, *History of Kosciusko, Military, Political, and Private.*)

Kosciusko, Mount, the highest peak of the Australian Alps, 7176 feet high, is situated nearly in lat. 36° 30′ S. and lon. 134° 30′ W., on the boundary between the provinces of New South Wales and Victoria, about equidistant between Sydney and Melbourne. The chain of mountains to which it belongs affords the most picturesque scenery on the Australian continent. The great Murray and Murrumbidgee rivers take their rise nearly at the base of Mount Kosciusko.

Koshkonong′, tp. of Jefferson co., Wis. It includes Fort Atkinson (which see). Pop. 3202.

Köslin′, town of Prussia, in the province of Pomerania, on the Mühlenbach. It has considerable manufactures of ribbons, stockings, tobacco, paper, and soap. Pop. 10,848.

Koslov′, town of European Russia, in the government of Tambov, on the Voronezh. It has large manufactures of woollen and linen fabrics. Pop. 28,613.

Kosse, post-v. of Limestone co., Tex., on the Houston and Texas Central R. R., 13 miles N. of Bremond.

Kos′suth, county of N. Iowa. Area, 432 square miles. It is traversed by the Des Moines River and the Iowa and Dakota division of the Chicago Milwaukee and St. Paul R. R. The soil is fertile. Grain is the staple product. Cap. Algona. Pop. 3351.

Kossuth, post-v. of Des Moines co., Ia., 2 miles from Kossuth Station (Mediapolis P. O.) on the Burlington Cedar Rapids and Minnesota R. R.

Kossuth, post-v. of Salem tp., Auglaize co., O., on the Ohio Canal. It is also called Six-mile Aqueduct. Pop. 112.

Kossuth, tp. of Manitowoc co., Wis. Pop. 2186.

Kossuth (Louis, or, strictly, Lajos), b. at Monok, Hungary, Apr. 27, 1802, of a family originally Slavic, and not Magyar, but of noble rank and of the Lutheran faith. Louis was carefully educated, and in 1822 became a successful advocate of Monok; removed in 1831 to Pesth; was a member by proxy of the upper house of the diet of 1832–36; and by his ceaseless activity as a writer and journalist did much to disseminate liberal principles; was imprisoned at Buda 1837–40 as a political offender; was editor of the *Pesth Journal* 1841–44; entered the lower house of the diet in 1847, and became the leader of the liberals; headed the deputation of 1848 demanding a new ministry, in which he became minister of finance; proposed in 1849 the independence of Hungary; was during the Hungarian war for liberty provisional governor of Hungary, Apr.–Aug., 1849, and was succeeded by Görgei; escaped to Turkey, where he was protected, notwithstanding the demands of Austria and Russia for his extradition. In 1851 he was allowed to go on board the U. S. steamer Mississippi, which had been sent out for him by the U. S. government; visited England; made the tour of the U. S. 1851–52, and delivered many eloquent though fruitless appeals for the influence of the U. S. in behalf of the principle of non-intervention, believing that if Russia had not assisted Austria in 1849, Hungary would have become free; has since 1852 resided chiefly in London and Turin, engaged in political projects, in public speaking, in writing for liberal journals, and latterly in scientific observations. During the wars of Austria against France (1859) and Prussia (1866) he was actively engaged in preparing for insurrections in Hungary, but the speedy termination of both wars frustrated his hopes. He has been several times elected in his absence to the diet of Pesth, and since the reorganization of the Austro-Hungarian empire (1867) has been free to return to his native land, but has declined to do so, condemning the arrangements which were accepted by the Hungarian liberals. Kossuth in his best days was one of the most impassioned and effective of public speakers, and possessed a marvellous capacity for the acquisition of languages.

Kostro′ma, government of European Russia, situated nearly in the centre of the country, and traversed by the Volga. Area, 30,834 square miles. Pop. 1,101,099. The surface is low and flat, dotted with lakes, and covered with dense forests. The climate is severe, yet good crops

of grain are produced. Tar, pitch, and potash are manufactured, and much timber is exported.

Kostroma, town of European Russia, the capital of the government of the same name, on the Kostroma, near its influx into the Volga. It has 40 churches, 2 monasteries, a seminary, a gymnasium, and several other educational institutions, large manufactures of leather and linen, and an important trade in corn and timber. Pop. 24,419.

Ko'tah, one of the independent Rajpoot states, under English protection, in Hindostan. Area, 4400 square miles. Pop. 440,000. Its capital, Kotah, is situated on the Chumbul, in lat. 25° 9′ N. and lon. 75° 5′ E.; it is fortified, and is a town of some importance, having good bazaars, many temples, and substantial houses.

Kö'then, town of Germany, in the duchy of Anhalt, has a handsome ducal palace with several fine collections, is the seat of civil and military authorities, has good educational institutions, breweries, tanneries, iron-foundries, and manufactures of tobacco, vinegar, carriages, and brass articles. Pop. 10,593.

Kot'zebue, von (Augustus Friedrich Ferdinand), b. in Weimar May 3, 1761; studied law at Jena, and after finishing his studies he went in 1781 to St. Petersburg, where he was introduced to the empress. From that time he was always more or less intimately connected with the Russian court. Catharine nominated him a counsellor, and gave him a pension. Paul sent him to Siberia, but recalled him and gave him an office. Alexander used him first to stir up the popular hatred against Napoleon, and then after the Restoration he kept him in Germany with a salary of 15,000 roubles a year to report on the liberal movements. This was by the Germans considered as a sort of espionage, and under the general excitement a young student, Sand, broke into his study and stabbed him at Mannheim, Mar. 23, 1819. Even before he went to St. Petersburg the first time, in the twentieth year of his age, he had written quite a number of tragedies, comedies, dramas, and farces, and he continued during his whole life to evince the same versatility and prolificness. He wrote about 100 plays. He attempted every description of drama and every style, and, in a certain sense of the word, he succeeded in them all. His plays were translated into every language which had a stage, and for more than a generation they reigned absolutely in the whole theatrical world. But between 1820 and 1830 they disappeared, succeeded by those of Eugène Scribe, and now only a very few of them—as, for instance, *The Stranger*, *Pizarro*, *The Indians in London*, *The Two Klingsbergers*, etc.—can be met with, and even these only in the suburbs of their native country. Clemens Petersen.

Kou'ba, town of Southern Russia, at the foot of the Caucasus, on the Kouban River. It has considerable trade with Astrakhan and Persia, and some silk manufactures. Pop. 9405.

Kouban', a river of Southern Russia, rises in the Elbrooz Mountains, flows between the governments of Stavropol and Circassia, and empties itself partly into the Black Sea, partly into the Sea of Azof.

Kouli Khan. See Nadir Shah.

Kou'miss, Kumys, or **Kumiz** [Russ. *kumys*, of Mongolian origin], a fermented beverage made from mare's milk in the steppes of Russia by the Kirgheez, Tartars, Bashkeers, Calmucks, etc. The alcohol is derived from the milk-sugar, which is present in mare's milk in larger quantity than in the milk of other animals, as is seen in the following table by Jagielski:

Composition of Milk.

	Mare.	Ass.	Woman.	Sheep.	Goat.	Cow.
Sugar	7.3	6.4	4.8	5.4	4.3	4.6
Butter	2.1	1.3	2.9	2.4	3.4	3.6
Caseine	} 1.5	1.9	2.9	4.8	4.4	5.1
Salts		....	0.2	0.9	0.8	0.6
	10.9	9.6	10.8	13.5	12.9	13.9
Water	89.1	90.4	89.2	86.5	87.1	86.1
	100.0	100.0	100.0	100.0	100.0	100.0

The fresh milk is diluted with one-third to one-sixth water, and placed in a sack of goat skin or the skin from the entire hind quarter of a horse, the wider end serving for the base, and the leg portion for the neck. There is generally added some yeast, the sediment from a previous brewing, called *kor*, to induce fermentation. Frequent stirring or shaking is essential to success. In from twelve to twenty-four hours the fermentation is complete, the product being known as "young koumiss" or *saumal*. Fresh milk is added daily, and as the product is concentrated by the evaporation of water from the surface of the hide, the old koumiss is much stronger than the new. Koumiss is an acid liquid of a not unpleasant pungent taste and an ethereal bouquet. It effervesces when poured into a glass. It is very intoxicating to persons not accustomed to its use, and produces drowsiness. Besides alcohol and carbonic acid, it contains the other constituents of the milk, except the sugar, and is consequently very nourishing. It is easily assimilated, even by invalids, and the hardy vigor of the Tartars is attributed to its general use among them. Koumiss yields by distillation a strong liquor called by the Calmucks *arraca*, *rack*, or *racky*. From the residue in the still they make a kind of hasty-pudding.

Beverages somewhat similar to koumiss have long been made in the Orkney and Shetland islands, in Arabia (called *leban*), and in Turkey (called *yaoust*).

Koumiss has recently attracted much attention among European physicians, and its manufacture has been introduced at Moscow, St. Petersburg, Vienna, and London. It may be made from the milk of any animal. The following analysis was made by Wanklyn of the contents of a bottle of koumiss, twelve days old, made from cow's milk at the establishment of E. Chapman & Co. in London:

Water	10,662	grains.
Alcohol	192	"
Caseine and albumen	128	"
Sugar (lactose)	582	"
Lactic acid	130	"
Fat	36	"
Ash	90	"
Carbonic acid	180	"
	12,000	grains.

It is claimed that koumiss is most valuable for the treatment of extreme debility and all the phases of impending marasmus. It is said to have specific action in diabetes. (For further information consult Johnston's *Chemistry of Common Life;* Wagner's *Jahresberichte*, vol. ii. 243, and vi. 421; *The Milk Journal*, i., 64; *British Med. J.*, Feb. 21, 1874; *Pharm. J. and Trans.*, Feb. 28, 1874; *The American Chemist*, vol. v., June, 1875.) C. F. Chandler.

Kous'so, or **Cusso** [an Abyssinian term], a drug consisting of the flowers and unripe fruit of *Brayera anthelmintica*, a small rosaceous tree of E. Central Africa. It is an efficacious and safe remedy for tapeworm, but costly.

Kouznetsk, town of Russia, government of Saratov, has large tanneries and trade in timber. Pop. 13,107.

Kov'no, government of Western Russia, bounded by Prussia and Poland, and watered by the Niemen and its tributaries. Area, 16,115 square miles. Pop. 1,131,248, most of whom are Roman Catholics, many Jews. The surface is low and flat, and more than two-thirds of it are covered with lakes and dense forests. Besides rye and wheat, flax and hemp are extensively cultivated.

Kovno, town of Western Russia, the capital of the government of Kovno, at the confluence of the Vilia and the Niemen. It has many good institutions for military, theological, and scientific education, but its manufactures and trade are insignificant. Pop. 34,612.

Koyl'ton, tp. of Tuscola co., Mich. The principal industries are farming and cattle-raising. Pop. 422.

Kozelsk', town of European Russia, in the government of Kalooga, on the Jizdra. It has large manufactures of sailcloth and trade in flax and hemp. Pop. 8387.

Krackowizer (Ernst), M. D., b. in the duchy of Styria, Austria, in 1822; studied medicine at Vienna and Padua; as captain of the Students' Legion was involved in the insurrection of 1848, and finally came to America; practised at Brooklyn, N. Y.; removed to New York City; established the German dispensary; was member of the committee of seventy during the municipal reform; assisted in reorganizing the Bellevue Hospital Medical College in 1874, and contributed to several medical periodicals. D. Sept. 23, 1875.

Krajo'va, the capital of Little Wallachia, on the left bank of the Schyl. It has several good educational institutions and a beautiful public park. Pop. 25,000.

Kra'ken [Norse], a fabulous sea-monster described first under this name by Pontoppidan, although Olaus Magnus, Gesner, and other old writers have substantially the same accounts. The tales of the kraken seem to have been exaggerated reports of large cephalopods and whales. Stories of its devouring ships, of its back being taken for an island and men landing upon it, etc., recall similar fables in Lucian's and Pliny's works and the *Arabian Nights;* but Lucian's narrative is a witty satire on the credulity of other writers, who in all ages have seriously recorded these monstrous fables.

Krasic'ki (Ignacy), b. at Dubiecko, Galicia, 1734; studied theology in Rome; was made bishop of Ermeland in 1767, archbishop of Gnesen in 1795, and d. at Berlin Mar. 14, 1801. As Ermeland was annexed to Prussia in 1772,

Krasicki became a Prussian subject, and his talents and elegant attainments soon made him a favorite of Frederick II. His writings, which were collected in Warsaw in ten volumes in 1803, are mostly satirical, and procured for him the name of the Polish Voltaire. His *Monomachia* ("War of Monks"), a satirical epic, and his fables have been translated repeatedly both into German and French.

Krasin'ski (Zygmunt Napoleon), Count, b. in Paris Feb. 19, 1812, a son of Count Wyncenty Krasinski, who after the fall of Napoleon held the highest position in the Russian government. The son, however, declined all offers from Russia. When he became of age he left his native country, lived in different European capitals, and d. in Paris Feb. 24, 1859. But his poetical productions were received by all Poles with the greatest enthusiasm, and caused now and then considerable excitement. His principal works are—*Nieboska Komedya*, a drama in three parts (1837–48), *Przedswit* ("Before Dawn"), and *Psalmy przysztosci* ("Hymns of the Future"), lyrical poems in which a glowing patriotism is combined with a deep piety.

Krasnoslobodsk', town of Russia, in the government of Penza, on the Moksha, carries on an extensive trade in corn. Pop. 7762.

Krasnovodsk', a Russian fortress, on a bay of the same name, on the south-eastern shore of the Caspian Sea, in lat. 40° N., is an important starting-point for scientific and military expeditions to Central Asia. Peter the Great understood the importance of the point, and used it in an undertaking against Khiva, but afterwards it fell into decay, until it was once more occupied and fortified in Nov., 1869. From here the savants Kadde and Siewers explored the flora and fauna of the adjacent steppes; fifteen meteorological stations were established in Toorkistan; and the engineer Koschkul made a geological map of the vicinity. In connection with a military expedition against the Toorkoman fortress Kisyl-Arwat, about 150 miles to the S. E. of Krasnovodsk, important geodetic labors were undertaken under the leadership of Col. Stebnitzky, purporting to re-establish the old water-road between the Caspian Sea and the Sea of Aral by employing the old bed of the Oxus. During the great expedition against Khiva, led by Gen. Kauffmann in 1873, one of the three advancing columns started from Krasnovodsk. August Niemann.

Krasnoyarsk', town of Siberia, in the government of Yeniseisk, on the Yenisei. It is a neat town, with considerable trade in fur and leather, and important gold-mines in the vicinity. Pop. 7628.

Kraszew'ski (Józef Ignacy), b. at Warsaw in 1812; studied at Vilna; settled in Volhynia; went in 1860 to Warsaw as editor of *Gazeta Polska*, and removed in 1863 to Dresden. He is the most prolific writer in the modern Polish literature, and he has both talent and education. He has written a large epic, *Anafielas* (3 vols., 1840–43), treating a subject of the history of Lithuania; a great number of novels and romances depicting Polish life; several historical works; and a multitude of monographs, travelling sketches, critical essays, etc., the whole comprising over 300 volumes.

Krause (Karl Christian Friedrich), b. at Eisenberg, in the duchy of Saxe-Altenburg, May 6, 1781; studied at Jena; lectured on philosophy at Berlin, Göttingen, and Munich, but lived for the most time at Dresden as a private man, and d. at Munich Sept. 27, 1832. His views of the human race, as forming part of a higher and more spiritual realm, led him to peculiar ideas concerning the destiny of mankind, the development of human life, and the organization of human society; and these ideas brought him in connection with the Freemasons. His writings in this line, *Die drei ältesten Kunsturkunden der Freimaurerbruderschaft* (1810), *Höhere Vergeistigung der echt überlieferten Grundsymbole der Freimaurerei* (1810), and *Urbild der Menschheit* (1811), attracted much attention.

Krauth (Charles Philip), D. D., b. in Montgomery co., Pa., May 7, 1797; received a thorough education at home, and early showed a talent for philology. At the age of eighteen he commenced the study of medicine, but a change in his religious views led him to enter the ministry of the Lutheran Church. He was licensed 1819, and became pastor in Martinsburg, Va.; went to Philadelphia in 1827; was president of Pennsylvania College 1834–50; professor of biblical and Oriental literature in the theological seminary of the General Synod at Gettysburg 1833–67; d. May 30, 1867. Dr. Krauth had every quality which ensures a large distinction, except ambition. His mind was of a very high order; his learning extensive and exact; his power of moving men as a preacher extraordinary; and his character one of the most exquisite purity and completeness. He wrote much, but published comparatively little. His theological position was that of uncompromising adherence to the doctrines of evangelical Protestantism, of great moderation on points in dispute, and of cautious adjudication between the claims of conservatism and progress. A very complete sketch of his life and labors was given in the *Evangelical Review*, Jan., 1868, by Prof. M. L. Stoever. (See also McClintock and Strong's *Cyclopædia*, v. 160.)

Krauth (Charles Porterfield), S. T. D., LL.D., son of Charles Philip Krauth, b. Mar. 17, 1823, at Martinsburg, Va.; graduated at Pennsylvania College, Gettysburg, 1839; became a licentiate in 1841; labored at Baltimore, Md., 1842–47; ordained 1842; pastor in Winchester, Va., 1848–55; in Pittsburg, Pa., 1855–59; in St. Mark's, Philadelphia, 1859–64; had temporary charge of St. John's 1864–65 and 1874–75; labored in mission churches at Canton, Md., 1841, and in St. Stephen's and St. Peter's, Philadelphia. He spent ten months, 1852–53, in St. Thomas and Santa Cruz, D. W. I.; for nearly three months during the prevalence of yellow fever officiated as pastor in St. Thomas; subsequently published *Sketches of a Winter and Spring in the Danish West Indies.* He became editor of the *Lutheran* 1861; in 1864, Oct. 4, was inaugurated as Norton professor of systematic theology and ecclesiastical polity in the Lutheran Seminary in Philadelphia, and is the author of its constitution. In 1868 the chair of intellectual and moral philosophy in the University of Pennsylvania was offered to Krauth; he was chosen its vice-provost in 1873; in 1874 the department of logic was attached to his chair. He is a member of the Historical Society of Pennsylvania; of the Philosophical and Oriental Societies; of the American committee (Old Testament Company) co-operating with the British revisers of the authorized version; and of the American Bible Society's committee on versions. Besides numerous translations from different languages, and many critical and annotated editions, he has written in the line of practical theology—*Pastoral Office* (1845), *Chrysostom* (1849), *Transfiguration* (1850), *Popular Amusements* (1851), *The Bible a Perfect Book* (1852), *The Old Church on the Hill* (1854), *Poverty*, three essays (1858), *Christ and His Kingdom in Shadows* (1874). His published sermons on national occasions are—*The Former Days and These Days* (1856), *The Altar on the Threshing-Floor* (1857), *The Two Pageants*, on the death of Pres. Lincoln (1865). In illustration of the doctrines, history, and usages of the Lutheran Church he wrote *The Torgau Articles* (1850), *The Lord's Day*, *Theological Encyclopædia from the Seventeenth to the Nineteenth Century* (1857), *Christian Liberty* (1860), *The Evangelical Mass and the Romish Mass* (1860), *The Lutheran Church, Her Glory, etc.* (1863), *The Augsburg Confession*, translated and annotated (1869), *The Conservative Reformation, and its Theology as represented in the Augsburg Confession and in the History and Literature of the Evangelical Lutheran Church* (1871, 8vo, pp. 858). Dr. Krauth has been a constant laborer in the liturgical movements in the Lutheran Church, and written in this line *Sunday Services of the Churches of the Reformation* (on the basis of Alt's *Cultus*, 1853), *The Jubilee Service* (1867), *Common Prayer, arranged from the Collects in Ancient Use in the Lutheran Church; The Church Book of the General Council* (1869); *The Liturgical Movement in the German Reformed and Presbyterian Churches.* He has been associated with the organization of the general council of the Lutheran Church in America; wrote the *Reply to the Pope's Letter*, adopted Nov. 6, 1869; the *Theses on Justification* (1870–74); was elected president of the council 1870, has held that office to this time (1875), and is chairman of its committee for the preparation of a constitution for congregations and synods.

Dr. Krauth's library is one of the most carefully selected in our country, and contains about 13,000 volumes, largely of the class of books which are the primary sources of information in the departments of his investigations. He has published a number of papers on "the internal history and relations of the Authorized English Version of the Scriptures, and of the Translations and Texts which have influenced it."

Krebs (John Michael), D. D., b. at Hagerstown, Md., May 6, 1804; graduated at Dickinson College in 1827 and at Princeton Theological Seminary in 1830; was 1830–67 pastor of the Rutgers street church, N. Y., and held many prominent positions in the Old School branch of the Presbyterian Church. He was the author of several devotional and other works, chiefly of a religious character. D. in New York Sept. 30, 1867.

Kremenets', town of European Russia, in the government of Volhynia, on the Irwa, which, however, is not navigable. It has seven annual fairs. Pop. 10,486.

Krementchoog', town of European Russia, in the government of Poltava, on the Dnieper. It has manufactures of rope, leather, tallow, and a brisk trade. Pop. 25,848.

Kremlin. See Moscow.

Krem'nitz, town of Hungary, situated in a deep valley among barren mountains, and provided with water by an aqueduct 50 miles long. Its gold and silver mines are the richest in Europe. Pop. 6339.

Krems, town of Lower Austria, on the Krems, at its influx into the Danube. It is famous for its mustard and wine. Pop. 5300.

Krem'sir, town of Austria, in the province of Moravia, is beautifully situated on the March; it is well built, the seat of several civil and ecclesiastical authorities, and has good educational institutions, many fine buildings, and an active general trade. Pop. 9110.

Kreutz'nach, town of Rhenish Prussia, on the Nahe, at its influx into the Rhine. It has celebrated salt springs, much used for bathing, and large manufactures of brandy, champagne, chocolate, and tobacco. Pop. 10,935.

Kreuz'er, the name of a small coin which originated in the Tyrol in the thirteenth century, and became very common all over Germany since the fifteenth. At present, since 1858, it is made only in the South German states of copper, 100 to a gulden. It received its name, *cruciatus, crucifer*, from a cross imprinted on it.

Kris, or **Crease,** the dagger of the Malays, often curiously twisted, the more seriously to mangle those who are wounded by it. It is of native manufacture and extremely well tempered.

Krishna. See Hindu Religion, and Mahabhârata.

Krishna River. See Kistnah.

Kroe'ger (Adolph E.), b. in 1837 at Schwabstadt, near Friedrichstadt, in the duchy of Sleswick, where his father was a minister. In 1848 the whole family emigrated to America, and settled at Davenport, Ia., and soon after young Kroeger entered into business life as clerk in a banking-house. From 1857 to 1860 he was engaged as translator on the New York *Times*. During the war he served on the staff of Fremont. After the war he settled at St. Louis, Mo., where he is still residing. Both by his translations of Fichte and by numerous essays in different periodicals he has contributed much to a better understanding of and a more widely spread interest in German literature and philosophy. He is a steady contributor to the St. Louis *Journal of Speculative Philosophy*. In 1873 he published *The Minnesingers of Germany*, containing translations of Walter von der Vogelweide, Ulrich von Lichtenstein, etc.

Krolevets', town of European Russia, in the government of Tchernigov. It has a much-frequented annual fair. Pop. 6317.

Kro'nenberg, town of Rhenish Prussia, on the Wipper, has manufactures of silk and of iron and steel goods. Pop. 7874.

Kron'stadt, town of the Austrian empire, in Transylvania. It is an old city, consisting of an inner town surrounded by walls, its three suburbs respectively inhabited by Germans, Szeklers, and Wallachs. It is a thriving and very neatly built town, with many beautiful gardens and promenades. Pop. 28,014.

Kroos. See Liberia.

Krotoszyn', or **Krotoschin,** town of Prussia, in the province of Posen. It has manufactures of tobacco and linen, and a large trade in wool. Pop. 7688.

Krozet' (or **Crozet**) **Islands,** a group of four small islands in the Indian Ocean, between Kerguelen and Prince Edward islands. They are uninhabited, and visited only by sealers. The easternmost, situated in lat. 27° S., lon. 48° E., was selected in 1874 as a station for the observation of the transit of Venus by the American astronomers; but owing to tempestuous weather the party were unable to land, and the station was unoccupied.

Krü'dener, von (Juliane), b. at Riga Nov. 21, 1764, a daughter of Baron von Wietinghoff, one of the wealthiest Livonian noblemen, and a granddaughter of the famous Russian field-marshal Münich. In 1783 she married Baron von Krüdener, whom she accompanied to Venice and Copenhagen, and to whom she bore two children. In 1789 she made a journey to France, from which she sent her husband a milliner's bill of 20,000 francs for the first three months, and from which she returned in 1791 with M. de Frégeville, a young lieutenant of hussars, disguised as her footman. After that time the couple lived separated. The fame of Madame de Staël tempted her into literature. *Valérie, ou lettres de Gustave de Linar à Ernest de G——*, was produced, corrected, read aloud in the salons, and at last published at Paris in 1803, after the most careful preparation. The result was a perfect success, quite a sensation, which, however, did not satisfy the authoress. Her connections with Jung-Stilling and the Moravian Brethren had now the ascendency over her mind, and she appeared in the world as a Sister of Charity, a preacher, a prophetess. In 1815 she held a sort of religious reunions in her hôtel in Paris, and people of the highest rank crowded her salons; the emperor of Russia, Alexander, was among her visitors. He invited her to the grand review over the Russian troops in the plain of Châlons, and the sight inspired her as the beginning of the "reign of Christ on earth." From Bâle, where she attempted to continue her religious assemblies, she was expelled; also from Baden, Würtemberg, Bavaria, Saxony, and Prussia. In 1818 she was escorted by the Prussian police to the Russian frontier, and on entering her native country she was forbidden to preach and to appear in St. Petersburg and Moscow. She found, nevertheless, an opportunity of visiting St. Petersburg, and attempted to renew her friendship with the emperor. But her enthusiasm for the Greek revolution, and her indiscretion in working for her ideas, were too great for the Russian diplomacy. She was banished from St. Petersburg, and went in 1824 to the Crimea in order to found a colony in accordance with her own ideas of human society. On this expedition she d. at Karassubasar Dec. 25, 1824. Her life and character have been subject to much curiosity and speculation; at present, however, most critics agree in considering her a specimen of a not uncommon kind of female character, only that peculiar circumstances forced her gifts and her weaknesses into caricature.

Krug (Wilhelm Traugott), b. at Radis, in Prussian Saxony, June 22, 1770; studied at Wittenberg, Jena, and Göttingen; was appointed professor in philosophy at Frankfort-on-the-Oder in 1801; at Königsberg in 1804, as the successor of Kant; at Leipsic in 1809; resigned in 1834, and d. Jan. 13, 1842. He took part with great eagerness and with a certain adroitness in all literary and political movements in his time. He was president of the Tugenbund, formed after the Peace of Tilsit for the regeneration of Germany. He joined a Saxon regiment in the campaign of 1813. In politics he stood foremost among the liberal agitators; in theology he wrote *Briefe über die Perfectibilität der geoffenbarten Religion* (1795); in philosophy he pretended to have found the true reconciliation between idealism and realism, which he presented in a quite popular form, *Fundamental philosophie* (1803), and afterwards in a more scientific form in his *Allgemeines Handwörterbuch der philosophischen Wissenschaften* (4 vols., Leipsic, 1827–28). His writings are very numerous and varied; they were popular in their time, but are now superseded.

Kru'mau, town of Bohemia, on the Moldau, consists of Krumau proper, Latron, six suburbs, and an immense palace or castle with five courtyards. Krumau has large breweries, and a famous beer-vault excavated in a solid rock. Pop. 6600.

Krum'macher (Friedrich Adolf), b. at Tecklenburg, in Westphalia, July 13, 1768, and d. as minister of the Reformed congregation at Bremen, Apr. 14, 1845. His *Parables* (1805) became a very popular book, ran through many editions, and was translated into English. He wrote several other works, poetical and religious, none of which attained great popularity.—His son, Friedrich Wilhelm, b. at Duisburg, in Rhenish Prussia, Jan. 28, 1796, and d. as chaplain of the court at Potsdam, Dec. 10, 1868, was a rather harsh opponent of the rationalistic school of theology, but he was a very eloquent preacher. Of his writings, *Elijah the Tishbite, The Last Days of Elisha, Solomon and the Shulamite, Glimpses into the Kingdom of Heaven, David, King of Israel*, and his *Autobiography* have been translated into English.

Krupp (Friedrich). The Krupp cast-steel works at Essen, in Rhenish Prussia, were founded in 1810 by Friedrich Krupp. After his death, in 1826, his widow and sons took charge of the establishment in company until 1848, since which time one of the sons, Alfred Krupp, carries on the business alone under the firm-name of Friedrich Krupp. Like his father, he had many difficulties to overcome before he achieved any signal success, but the introduction of steel for cannons exercised a decisive influence on the prosperity of the works. At present the establishment covers an area of more than 400 hectares and employs over 12,000 hands, besides about 5000 men engaged in the mines and smelting-houses, 2000 in the building department, and 739 in the administration. The quantity of steel produced and consumed for casting amounted in 1872 to more than 125,000,000 kilogrammes; the articles manufactured comprised axles, tires, wheels, etc. for railways; rails and springs for railways and mines; axles for steamboats; different parts of machinery, rollers, etc., and cannons, gun-carriages, and guns. In 1873 there were 1100 furnaces of different kinds in operation; 275 coke-ovens, 264 smiths' forges, 240 boilers; 71 steam-hammers, of which 3 were of 100 cwts., 1 of 200, 1 of 400, 1 of 1000; 286 steam-engines,

of which 5 were of 150, 1 of 200, 1 of 500, 3 of 800, and 1 of 1000 horse-power; and 1056 machine-tools. In 1872 500,000,000 kilogrammes of coal, 125,000,000 kilogrammes of coke, 3,500,000 cubic mètres of water, and 5,000,000 cubic mètres of gas were consumed. Of means of communication the establishment possesses 52.9 kilomètres of railway, 15 locomotives, 800 cars, and a complete system of telegraph; 206 dwelling-houses for officials, 2948 for workingmen, several hospitals, a chemical laboratory, a photographic and a lithographic establishment, etc. belong to the works; 414 mines and several smelting-houses, with 11 blast furnaces, produce annually about 10,000,000 kilogrammes of pig iron. Rich deposits of iron ore in Northern Spain belong to Mr. Krupp.

Most artillerists consider the Krupp cannon to be the best in the world. They are most extensively used; more than 13,000 pieces have already been produced. Since 1872 the whole German army has been provided with a new field-gun invented by Mr. Krupp. The system of his cannon is the breech-loading; their peculiarity consists partly in the appropriateness of the metal, partly in the construction. At the Vienna Exposition he exhibited the following cannons: I. 30½ cm. cannon; calibre, 305 mm., length of tube 6.7 m.; length of bore, 5.77 m.; weight of tube, 36,600 k.; of the filled steel grenade, 296 k.; of charge, 60 k.; of cast-iron long grenade, 257 k. II. 28 cm. howitzer; calibre, 280 mm.; length of tube, 3.2 m.; length of bore, 2.5 m.; weight of tube, 10,000 k.; of filled grenade, 199 k.; of charge, 20 k. III. Short cm. ship cannon; calibre, 260 mm.; length of tube, 5.2 m.; weight of tube, 18,000 k.; of grenade, 184 k. IV. Long 24 cm. cannon for casemate ships; calibre, 235.4 mm.; length of tube, 5.23 m.; weight of tube, 155,000 k.; of steel grenade, filled, 135 k.; of cast-iron grenade, filled, 118.5 k. V. Long 21 cm. cannon; calibre, 209.3 mm.; length of tube, 4.708 m.; weight of tube, 10,000 k.; filled steel grenade, 95 k. VI. 21 cm. siege cannon; calibre, 209.3 mm.; length of tube, 3.400 m.; weight of tube, 3900 k.; filled grenade, 79 k. VII. Long cm. cannon; calibre, 172.6 mm.; length of tube, 4.250 m.; weight of tube, 5600 k.; filled steel grenade, 55 k. VIII. 15 cm. siege cannon; calibre, 149.1 mm.; length of tube, 3.44 m.; weight of tube, 3000 k.; filled grenade, 28 k.; charge, 6 k. IX. Long 15 cm. cannon; calibre, 149.1 mm.; length of tube, 3.85 m.; weight of tube, 4000 k.; filled steel grenade, 35 k.; filled cast-iron long grenade, 28 k. X. 12 cm. cannon; calibre, 120.3 mm.; length of tube, 2.925 m.; weight of tube, 1400 k.; filled steel grenade, 17.5 k.; filled cast-iron grenade, 15.5 k. XI. 9 cm. field cannon; calibre, 91.5 mm.; length of tube, 2.04 m.; length of bore, 1.819 m.; weight of tube, 425 k.; filled grenade, 6.9 k.; charge, 0.6 k. XII. 8 cm. field cannon; calibre, 78.5 mm.; length of tube, 1.935 m.; weight of tube, 295 k.; filled grenade, 4.3 k.; charge, 0.5 k. XIII. 6 cm. mountain cannon; calibre, 60 mm.; length of tube, 1.25 m.; weight of tube, 107 k.; filled grenade, 2.3 k.; charge, 0.2 k. August Niemann.

Kru'senstern, von (Adam Johann), b. Nov. 19, 1770, at Haggud, Esthonia, and educated at the naval academy of Kronstadt; served 1793–99 in the British navy, and undertook, from Aug. 7, 1803, to Aug. 19, 1806, a scientific and commercial expedition at the expense of the Russian government to the northern coasts of the Pacific. The expedition was a great success, and has been described by Krusenstern himself in his *Reise um die Welt* (3 vols., 1810–12, translated into English by Hoppner in 1813). From 1824–27 he published *Atlas de l'océan Pacifique* (2 vols.) and *Recueil de mémoires hydrographiques, pour servir d'analyse et d'explication à l'atlas de l'océan Pacifique.* In 1829 he was made a vice-admiral, in 1841 an admiral, and d. Aug. 24, 1846.

Krylof' (Ivan Andreivitch), b. Feb. 14, 1768, d. Nov. 21, 1844; passed the early years of his boyhood in the distant province of Orenburg, where his father was serving against the rebels of Pugatcheff, and subsequently in Tver. His father died when he was fourteen, and he was then obliged to enter the government service in Tver, and afterwards in St. Petersburg, at a salary of two roubles a month. He received a good education from his mother. His first production, at the age of sixteen, was *Cofeinitsa.* In 1788 he entered into journalism, in which he continued until 1796, when all the private printing-offices were closed by the emperor Paul. For some years after he resided on the estate of Prince Galitzin, teaching the children and acting as a friend to the family. On the accession of the emperor Alexander in 1801, Prince Galitzin was made governor of Livonia, and appointed Krylof his secretary. His passion for cards caused him to leave the service and to wander about Russia for two years. In 1805 he wrote his first fables, which had a great success, and from this time on his literary activity was entirely confined to fable-writing. His first essays were chiefly adaptations and translations of La Fontaine, but he afterwards wrote wholly in the national vein, touching sometimes on politics, especially on the stirring events of 1812, though principally on moral and social topics. From 1812 to 1841 he occupied a position in the imperial public library. He never married, and particularly in his latter days led an almost solitary life, confining himself to occasional visits at the houses of one or two friends. Eugene Schuyler.

Ku'blai Khan, the founder of the twentieth or Mongol dynasty of emperors of China, was a grandson of Genghis Khan, b. early in the thirteenth century in Tartary, of which country he was the reigning sovereign, when about 1250 his aid was invoked by Li-Sung, emperor of China, against the Oriental Tartars. This task having been successfully accomplished, Kublai Khan remained in China with his large and well-disciplined army. After the death of Li-Sung and of his imbecile successor, Kublai Khan assumed the title of emperor of China, excluding the infant claimant of the throne. His undisputed reign dates from 1279, after which he extended his empire by the conquest of Tonquin, Cochin China, and other adjoining countries, until his limits reached the Arctic Ocean, the Straits of Malacca, and the Euxine. He sent a naval expedition for the conquest of Japan, but it was partially destroyed by a tempest, and the remainder easily defeated by the Japanese. Under his reign the celebrated Venetian traveller Marco Polo resided many years at the imperial court, of which he has given so vivid a description. (See Kathay, by Col. Henry Yule.)

Kuenlun', or **Koulkoun,** the name of a mountain-range of Central Asia, which commences near the point of lat. 35° N. and lon. 75° E., from which the Himalayas, the Hindoo-Koosh, and the Bolor-Tagh radiate in three different directions, and stretches eastward, forming the northern boundary of Thibet. The eastern parts of this mountain-range, which extends into China proper, are almost unknown to us, but the western part, generally known by the names of Karakorum and Mustagh, rises to a height of 21,000 feet, is covered with tremendous glaciers, which sometimes descend to 10,000 feet, and forms deep, wild, but beautiful and exceedingly fertile valleys. Karakorum is properly the name of a pass, 18,000 feet high, leading from Thibet into Chinese Toorkistan.

Kufic Writing. See Cufic Writing.

Kug'ler (Franz Theodor), b. at Stettin Jan. 19, 1808; studied history, philology, and art in Berlin, Heidelberg, and Italy, and was appointed professor in the fine arts at the University of Berlin in 1833. His *Handbuch der Geschichte der Malerei von Konstantin der Grosse bis auf die neuere Zeit* (2 vols., Berlin, 1837), and his *Handbuch der Kunstgeschichte* (2 vols., Stuttgart, 1841–42), are excellent productions—clear, comprehensive, and very instructive: the former of them has been translated into English. His *Kleinen Schriften und Studien zur Kunstgeschichte* (3 vols., Stuttgart, 1853–54) contains many valuable essays on the history and philosophy of the fine arts. Very little interest, on the contrary, have his dramas and poems, and his *History of Frederick the Great,* though the latter is very much read in Germany. D. at Berlin Mar. 18, 1858, in the midst of a large work on the *Geschichte der Baukunst,* of which he finished only the three first volumes.

Kuhn (Adalbert), b. at Königsberg-in-der-Neumark, in the Prussian province of Brandenburg, Nov. 19, 1812; studied philology at the University of Berlin since 1833, and became teacher at the gymnasium of Cologne in 1841, and in 1856 professor. As editor of *Zeitschrift für vergleichende Sprachforschung* and *Beiträge zur vergleichende Sprachforschung* he has contributed much to the growth of comparative philology, and by his *Die Herabkunft des Feuers und des Göttertranks* (Berlin, 1859), as well as other researches in the same line, he inaugurated the new science of comparative mythology.

Kuhn (Franz), baron von Kuhnenfeld, b. in 1817; entered in 1837 the 1st regiment of infantry as a lieutenant; distinguished himself in 1848 and 1849 in the war in Hungary and Italy; was employed on the staff and as teacher of strategy at the Military Academy of Vienna, and occupied in 1859, in the war in Upper Italy, the important position of chief of staff to Gyulay. After this unfortunate war he received the command of the 17th regiment of infantry, and in the war of 1866 he was made a major-general and charged with the defence of the Tyrol against Garibaldi. He was successful in the performance of this task, and was promoted to be field-marshal-lieutenant. In 1868 he was appointed minister of war for the whole empire, and devoted himself with great energy to the reorganization of the army, managing with delicacy and prudence the many difficulties which arose from the discrepancies between Austria and Hungary. In June, 1874, he retired from this

position, in consequence of one of those fluctuations so common with the Austrian government, and assumed the command of Grätz. AUGUST NIEMANN.

Küh'nöl, or **Kuehnoel** (CHRISTIAN GOTTLIEB), b. at Leipsic Jan. 2, 1768; studied theology in the university of his native city, where he began to lecture on biblical exegesis and hermeneutics at the age of twenty; became professor of philosophy in 1790, and preacher in 1796. In 1801 he accepted a professorship at Giessen, and remained there until his death, Oct. 15, 1841. His earliest original work was on *Messianic Prophecies* (1792), in German, after which he published (in 1794) *Notes on the New Testament, from the Apocryphal Books of the Old Testament*, in Latin, and in 1799 *The Psalms in Metre*, in German. The great work of his life was his Latin *Commentary on the Historical Books of the New Testament* (Leipsic, 4 vols., 1807–18; 4th ed. 1837), which had great popularity, and was reprinted in London (1837, 3 vols.), with the addition of the Greek text. Kühnöl is credited with many of the best qualities of a biblical interpreter, and held a middle ground between orthodoxy and neology.

Ku'ka, or **Kukawa**, town of Central Africa, the capital of Bornoo, in lat. 12° 55′ N. and lon. 13° 26′ W., on the western shore of Lake Tchad. Pop. 8000.

Ku-Klux Klan, or **Ku-Klux** [named, we are told, in imitation of the click heard in cocking the rifle; *klan* is the word *clan* in a new orthography], a former secret association of ex-Confederate soldiers, first heard of in Tennessee in 1868. The society soon spread into several other States of the South, and many murders and other crimes were committed by its members, who were dressed in fantastic disguises. The victims were chiefly freedmen, persons of Northern origin, and Southerners accused of favoring the reconstruction acts of Congress. The great body of the Southern people never approved of this method of settling the questions involved, and greatly deplored the crimes of the Ku-Klux. In Apr., 1871, Congress made these offenders punishable in the Federal courts, and authorized the President to suspend the habeas corpus act when necessary to the preservation of order. These measures, and the employment of U. S. troops in the troubled districts, soon brought the disturbances to an end.

Kula', town of Austria, in the province of Serbia, with some manufactures and a lively trade. Pop. 6908.

Kul'ja, or **Kuldscha**, province of Asiatic Russia, in the government of Toorkistan. Area, 25,500 square miles. Pop. in 1871, 114,337. It was formerly Soongaria, the extreme N. W. province of the Chinese empire, but a few years since it declared its independence under a native sultan, and in May, 1871, the Russian government seized and annexed the country in accordance with a previous agreement with China. The capital, Kulja, called also *Eelee*, is situated on the Eelee River, and has considerable trade. Pop. 30,000.

Kulm [Bohemian *Chlumn*], village of Bohemia, 8 miles N. E. of Teplitz, is noted for the battle which took place here Aug. 29–30, 1813, and in which a French corps under Vandamme was surrounded by the allied Russian-Austrian army, and compelled to surrender after a desperate resistance, with 80 pieces and 10,000 men, having lost 5000 men.

Kulm, town of Prussia, in the province of Prussia, on the Vistula. It has some manufactures of linen and some trade in corn. Pop. 7263.

Kumaon', territory in the north-western part of Hindostan, forming a province of the presidency of Agra, British India, and situated between 29° and 31° N. lat. and between 78° and 81° E. lon. Area, 11,000 square miles. Pop. 605,910. It is mostly covered by the Himalaya Mountains, with the exception of a belt of lowland from 2 to 15 miles broad extending along the foot of the mountain-range. Two crops are gathered here yearly; rice, sugar, and indigo form the one—wheat and European fruits and vegetables the other. The tea-plant has been introduced with success. The capital is Almora, situated 5337 feet above the sea.

Kumquat, the *Citrus Japonica*, a variety of the orange which is perfectly hardy in Japan and China, and would probably succeed in many parts of the U. S. The shrub and its fruit are both very small, but the fruit is of excellent quality.

Ku'nersdorf, village of Prussia, in the province of Brandenburg. Here Frederick the Great was utterly defeated by the combined Russian and Austrian forces, Aug. 12, 1759.

Kung, PRINCE, b. in 1835, was uncle of the late emperor of China, and as regent became the virtual ruler of that country at the accession of the former in 1861. In 1860, at the time of the capture of the Peï-Ho forts and of the summer palace of Peking, he advised the emperor to sign the peace with the French and English. Prince Kung is the leader of the small party in China which advocates friendship with Christian nations, and the introduction in the Celestial empire of their industrial, scientific, and manufacturing processes. He agreed with Anson Burlingame, then American minister at Peking, to send him in 1868, as envoy extraordinary of China, to the U. S. and European powers, in order to form with them all alliances on a very enlightened basis. He became afterwards prime minister, and concluded peace with Japan, after the Formosan troubles, Nov., 1874. On that occasion he was accused of having given way to foreign influence, and was even condemned to death, but on the following day an imperial decree reinstated him in all his offices, which he retained until the death of the young emperor, Jan. 17, 1875. FÉLIX AUCAIGNE.

Kungur', or **Koongoor**, town of European Russia, in the government of Perm. Its manufactures of Russian leather are celebrated as the best in the world. Its vicinity has very rich iron-mines. Pop. 8298.

Kun-Hegyes', town of Hungary, on the Theiss, has 7113 inhabitants, mostly Calvinists.

Kunnonj', town of British India, in the presidency of Agra, on the Kali Nuddi, 3 miles from its junction with the Ganges, was at one time a flourishing town, but is now only a vast field of ruins, of which some Mohammedan tombs are interesting, and bear witness to the former splendor of the place. Pop. 15,000, who live miserably.

Kun-Szent-Martony', town of Hungary, on the Körös, has 9091 inhabitants.

Kun-Szent-Miklos', town of Hungary, on the Danube, has 5751 inhabitants, chiefly Protestants.

Kunth (KARL SIGISMUND), b. at Leipsic June 18, 1788; studied natural science at Berlin; lived 1813–19 at Paris, engaged in the editing of Humboldt's and Bonpland's botanical collection; was appointed professor of botany at Berlin in 1820, and d. Mar. 22, 1850. His principal works are — *Enumeratio plantarum omnium hucusque cognitarem* (5 vols., Stuttgart, 1833–50) and *Lehrbuch der Botanik* (1847).

Kunze (JOHN CHRISTOPHER), D. D., b. in Saxony about 1740; studied at Leipsic and Halle; entered the Lutheran ministry, and came to Philadelphia in 1770 as associate pastor of the German churches in that city. For several years he was a professor in the University of Pennsylvania. In 1784 he accepted a pastoral call to the city of New York, where he resided for twenty-three years, until his death, July 24, 1807. He added to his pastoral duties those of the professorship of Oriental literature in Columbia College. He was celebrated as a Hebrew scholar, being consulted even by the rabbins upon the philological interpretation of their Scriptures. He published several works, among which were a *History of the Christian Religion and of the Lutheran Church*, a *Catechism and Liturgy*, and a Lutheran *Hymn and Prayer Book*.

Kuper (Sir AUGUSTUS LEOPOLD), K. C. B., G. C. B., b. in 1809; entered the royal navy in 1823; served on South American and Mediterranean stations and in China, attained the rank of rear-admiral in 1861, and was appointed commander-in-chief on the East India and China stations, conducting with success the operations in 1864 on the coast of Japan, and for which services was created a K. C. B.; subsequently promoted in the navy to be full admiral.

Kupperwunje', town of British India, in the presidency of Bombay, in lat. 23° 3′ N., lon. 73° 9′ E., is fortified and has some trade. Pop. 13,000.

Kur, or **Koor**, a river of the Caucasus, rises in Turkish Armenia and flows to the Caspian Sea. Its course is so irregular and its currents so rapid that it is entirely unfit for navigation. In most places it is even impossible to bridge it.

Ku'rile (or **Koorile**) **Islands**, a group of twenty-six islands in the North Pacific Ocean, near the Asiatic coast, forming a chain 700 miles in length, from Kamtchatka to Yesso, the northernmost island of Japan. Estimated area, 3000 square miles. Pop. uncertain, but very small. The surface is irregular and mountainous, with eight or ten active volcanoes, one of which is from 12,000 to 15,000 feet high. The inhabitants of the northern islands resemble the natives of Kamtchatka; those of the southern are chiefly Ainos, a race found also in Yesso. These islands are divided into Great and Little Kuriles, the former belonging to Japan, and the latter to Russia, but by a treaty signed June, 1875, Japan has acquired sovereignty over the whole group. There are iron and copper mines; the seal-fishery and fur-trapping is of some value.

Ku'rische-Haff, a lagoon on the northern coast of Prussia, extending from Labian to Memel, separated from

the Baltic by a narrow belt of land called "Kurische-Nehrung," and communicating with it through a channel of hardly 1000 feet width, called "Memel Deeps." Its water is fresh and in most places shallow.

Kurnool′, or **Kurnul**, town of British India, in the presidency of Madras, the capital of a district of the same name. It is situated on the Tambudra, is strongly fortified, and has about 20,000 inhabitants.

Kurrachee′, town of Sinde, on an inlet of the Arabian Sea, 18 miles N. W. of the mouth of the Indus. As all the branches of the Indus are barred by sandbanks, Kurrachee is the only seaport on these coasts, and as it has railway communication both with Hyderabad and with Lahore, it carries on an important trade. Pop. 22,000.

Kur′shee, town of Central Asia, in the dominions of Bokhara, has some fine mosques, bazaars, and public baths, and carries on a considerable trade in cattle, carpets, and horsecloths. Tobacco is extensively cultivated in the vicinity. Pop. about 10,000.

Kurtz (Benjamin), D. D., LL.D., b. at Harrisburg, Pa., Feb. 28, 1795; was at fifteen years of age an assistant teacher in the Harrisburg academy, and afterwards gave private instruction in ancient and modern languages; studied theology at Lebanon, Pa., under the direction of Rev. Dr. George Lochman, and was licensed to preach in 1815 by the Lutheran synod of Pennsylvania. He was successively assistant at Baltimore to his uncle, Rev. Dr. J. D. Kurtz, pastor at Hagerstown, Md., and at Chambersburg, and in 1833 settled at Baltimore as editor of the *Lutheran Observer*. He conducted that paper for twenty-nine years, making it a leading representative of the Lutheran culture in America. Dr. Kurtz took an active part in founding the theological seminary of his denomination at Gettysburg, spending two years in Germany (1825–27) seeking aid for it; he was also a leading manager of the Lutheran Book Company established at Baltimore in 1840, and was the chief founder of the Missionary Institute at Selinsgrove, Pa. He wrote several theological books, was an eloquent speaker, and was recognized as a leader and a great power in the Lutheran Church. D. at Baltimore Dec. 29, 1865.

Kurtz (John Daniel), D. D., b. at Germantown, Pa., in 1763; studied Lutheran theology under the direction of his father, Rev. John Nicholas Kurtz, and subsequently under that of Rev. Dr. H. E. Mühlenburg of Lancaster, and was licensed to preach by the synod of Pennsylvania in 1784. In 1786 he was ordained pastor of the principal Lutheran church at Baltimore, Md., and held that post for nearly half a century, until in 1832 he resigned on account of advancing age and infirmity. He was one of the founders of the General Synod of the Lutheran Church, a director of the theological seminary, and closely identified with all the benevolent institutions of his Church. D. at Baltimore June 30, 1856.

Kurtz (John Nicholas), b. at Lutzelinden, Nassau, Germany, about 1720; studied theology at Giessen and Halle, and in 1745 came as a missionary to his countrymen in Pennsylvania. He was the first Lutheran minister ordained in the British colonies in America, labored successively at New Hanover, Tulpehocken, Germantown, and York, Pa., and spent much time in perilous missionary journeys through the frontier settlements, exposed to the tomahawk and the scalping-knife. He was pastor at York when the Continental Congress held its sessions there during the Revolution, and gave evidence of his patriotism by his solicitude to relieve the sufferings of the soldiers. At the age of seventy he retired from the ministry, and spent his remaining years with his son, Rev. Dr. J. D. Kurtz, at Baltimore, where he d. in 1794.

Kuskoquim′, a river of Alaska, rises in the Chigmit Mountains at about lat. 64° N., and flows S. W. more than 500 miles into Kuskoquim Bay. Its course has never been explored by white men, and its valley is occupied only by a few wandering Indians and Esquimaux, the former being Kenaians, and the latter a sub-tribe of the Koniagas, called Kuskoquigmutes.

Kuss′nacht, a v. of Switzerland, in the canton of Schwytz, on an arm of the Lake of Lucerne, at the foot of the Rigi. Here is Tell's chapel, and many localities relating to the myth of Tell are shown in and around the village. Pop. 2500.

Kustend′ji, or **Kistendjeh**, small town of European Turkey, on the Black Sea, near the termination of Trajan's Wall. It carries on some trade in corn. Pop. about 5000.

Küstrin′, town of Prussia, in the province of Brandenburg, at the confluence of the Warta and the Oder. It is a fortress, but only of the third rank, and has 9554 inhabitants.

Kutai′eh, or **Kutaya**, town of Asiatic Turkey, in Asia Minor, on the Pusak. It has many mosques, palaces, public baths, and promenades, and a considerable trade in meerschaum, opium, tobacco, and goats' hair. Pop. 28,963.

Kutais′, government of Asiatic Russia, in Caucasia, is bordered W. by the Black Sea, S. by Asiatic Turkey, and E. by the government of Tiflis. Area, 8000 square miles. Pop. 605,000. The surface is mountainous. The capital, Kutais, is situated on the Rion (the ancient *Thasis*), and has 8263 inhabitants. It stands on the site of the ancient *Cutatisium* or *Cytæa*, the capital of Colchis, is fortified, and carries on some trade in corn, wine, and cattle.

Kutchin, an Indian nation of Alaska, occupying the upper valley of the Yukon (or Kwichpak) River through a great part of its course. They are found as far E. as Mackenzie's River, and are divided into a large number of petty tribes.

Kut′tenberg, town of Bohemia, has large cotton manufactures, and in its vicinity important copper and lead-mines. Pop. 12,727.

Kutu′soff (Mikhail or Michael), b. 1745; entered the Russian army at the age of sixteen; became major-general in 1784; was the leader under Suvaroff in the memorable assault and capture of Ismail; became lieutenant-general in 1791; was ambassador to Constantinople in 1793, and filled other diplomatic posts up to the Russian war against Napoleon, when his services were put in requisition. In 1805 he entered Germany at the head of 50,000 men, defeated Mortier at Dürrenstein, and disapproved of the plan followed by the allies at the battle of Austerlitz. His greatest title to glory is in the final results which he obtained in the Russian campaign. In Aug., 1812, he was appointed general-in-chief, and though he lost the battle of Borodino, and could not prevent the capture of Moscow, still, his energy caused the Russians to recover confidence, and he received the baton of a field-marshal. After the evacuation of Moscow, Kutusoff hotly pursued the French, inflicted on them great losses in the battles of Malo Jaroslavatz, Krasnoë, and Smolensk, for the latter of which he was created prince of Smolensk, and while pursuing the French in Prussian Silesia, d. of a malignant fever at Bunzlau, Apr. 28, 1813. Félix Aucaigne.

Küt′zing (Friedrich Traugott), b. at Ritteburg, in Thuringia, Dec., 1807; studied at Halle; travelled in Southern Europe, especially exploring the flora of the coasts of the Adriatic, and was appointed in 1835 professor of natural science at Nordhausen. His principal works are *Die Umwandlung niederer Algenformen in höhere* (1839), *Phycologia generalis* (1843), *Phycologia germanica* (1845), *Species Algarum* (1849). His researches have principally concerned the Algæ, and led him to the same fundamental ideas as those of Darwin.

Kutz′town, post-b. of Berks co., Pa., on the Allentown branch of the Philadelphia and Reading R. R., has 2 weekly newspapers, an iron-foundry and furnace, and a coachmaking establishment. It is the seat of the Keystone State Normal School, which has 400 students. Pop. 945.
Rev. A. R. Horne, Ed. "National Educator."

Kwang-See. See Quang-See.

Kwang-Tung. See Quangtung.

Kwei-Chu, Kweichow, or **Queichow,** province in the S. W. of China, lying between Se-Chuen, Hu-Nan, Quang-See, and Yun-Nan. Area, 64,547 square miles. Pop. 5,228,219. It is a rugged, mountainous country, of which copper, iron, lead, and quicksilver are the most valuable products. Cap. Kwei-Yang.

Kwichpak River. See Yukon.

Ky′anite [Gr. κύανος, "blue"], a natural silicate of alumina, crystallizing in the triclinic system, commonly of a pale-blue color (whence its name), but occasionally white, gray, or black, and generally occurring in long-bladed crystallizations.

Kyanizing. See Timber, Preservation and Fire-proofing of.

Kyle's Springs, tp. of Jackson co., Ala. Pop. 467.

Kymul′ger, tp. of Talladega co., Ala. Pop. 1615.

Kyr′ie, the first word in Greek of "*Kyrie eleison*," "Lord, have mercy," a petition often occurring in the liturgies, masses, and other offices of the Catholic Church. Hence the name *Kyrie* is used to designate the opening movement of musical masses, requiems, and various services which commence with the words *Kyrie eleison, Christe eleison*. For this reason the term is applied in the Anglican Church to the responses between the commandments in the Communion office, "Lord, have mercy upon us."

Kythul′, town of British India, in the presidency of Bengal, the capital of a district of the same name. It is a well-built city, with a magnificent palace and 50,000 inhabitants.

L.

L, one of the consonants called liquids, representing a sound found in almost every language. It quite constantly stands for the same sound in all languages using the Roman alphabet; although *ll* in French (*mouillé*) undergoes a peculiar softening in certain situations, while *ll* in Spanish (*lh* in Portuguese) has a sound like *l* followed by *y* as a consonant. *Ll* in Welsh has a peculiar aspirated sound not found in English. *L* is to some extent interchangeable with other consonants, particularly with *R* and the mutes. As a numeral, *L* stands for fifty; as an abbreviation, it represents the Latin proper name Lucius.

Laa'land, or **Lolland,** an island of Denmark, in the Baltic, separated from Falster by Guldborgsund. Area, 452 square miles. Pop. 56,000. It is low and flat, but fertile and well cultivated. Large crops of wheat are raised; fine forests of oak and beech cover a large part of the island. Principal towns are Maribo and Naskov.

Labadie' (Jean), b. Feb. 13, 1610, at Bourg-en-Guienne, and educated at Bordeaux by the Jesuits, in whose order he became a distinguished professor. In 1639 he left the Jesuits, and commenced preaching peculiar doctrines of his own, having considerable success at Paris, at Amiens, at Bazas, and at Toulouse. He obtained many followers through his eloquence and learning, claimed to have received the spirit of John the Baptist, and predicted the end of the world in 1666. Finding no rest in the Roman Catholic Church, and being subject to persecutions, he publicly embraced the Reformed creed in 1650 at Montauban, where he preached for several years a return to apostolical religion on pietistic principles. In 1657 he became pastor at Orange, and in 1659 at Geneva, where he gained many proselytes, but created such disturbances that he soon withdrew, and for several years travelled through Germany and Holland. In 1666 he became pastor of a Walloon church at Middelburg, Holland, where several persons of importance embraced his doctrines. His most celebrated disciples were two ladies, Anna Schurmann and Antoinette Bourignon, the former distinguished for her learning in the Oriental languages, the latter as authoress of many devotional publications. In 1669 he removed to Amsterdam, and formed a body of followers known as Labadists. Expelled from Holland in 1670 as a dangerous sectarian, he went to Erfurt, where the princess palatine Elizabeth protected him and became his disciple. He afterwards went to Bremen, and finally to Altona, where he d. Feb. 2, 1674. His disciples settled in the duchy of Cleves, where they existed for nearly a century. Early in the eighteenth century some Labadist missionaries settled on the banks of the Hudson in New York, but do not seem to have founded any churches. Labadie's doctrines were a combination of mysticism with Calvinism; he held to illumination by the Holy Ghost as the means of salvation superseding the Bible, rejected infant baptism and the observance of the Sabbath, and taught communism in property. The Catholics circulated many charges of immorality against his teachings, but without reason, his practices having been ascetic in the extreme. He left numerous writings, now extremely rare.

Lab'aree (Benjamin), D. D., LL.D., b. at Charlestown, N. H., June 3, 1801; graduated at Dartmouth in 1828, and at Andover Theological Seminary in 1831; was ordained at Bradford, Mass., 1831; was professor of Latin and Greek in Jackson College, Tenn., 1832–36, its president 1836–37; president of Middlebury College, Vt., 1840–66; held a pastorate at Hyde Park, Mass., 1869–71.

Labarraque's' Solution (*Liquor Sodæ Chlorinatæ*), a solution of chlorinated soda formed by mixing the solution of sodic carbonate with that of the best quality of bleaching-powder (the so-called chloride of lime). It is very valuable, both as a remedy and as a general disinfectant. Its chemical constitution is indefinite. See Sodium.

Lab'arum [etymology doubtful], the name of the principal standard of the Roman armies after the conversion of Constantine. It was a banner borne upon a cruciform standard, and had the monogram of Christ, with the letters alpha and omega. It was designed to commemorate the conversion of Constantine, and was an object of adoration to the troops.

Labat' (Jean Baptiste), b. at Paris in 1663; entered the order of the Dominicans in 1685; was appointed professor in mathematics and philosophy at Nancy in 1687, and went in 1693 as a missionary, first to Martinique, and then to Guadeloupe, where he remained till 1705. He worked not only as a missionary, but also as a scientist, besides being a man of great practical ability. He founded the city of Basse-Terre and took part with great energy in the defence of the island against the English. On his return to Europe he lived for some years in Spain, then in Italy, and afterwards in Paris, where he d. Jan. 6, 1738. His principal writings are *Nouveau voyage aux iles de l'Amérique* (6 vols., 1722), *Voyage en Espagne et Italie* (8 vols., 1730), *Relation historique de l'Ethiopie occidentale* (5 vols., 1722).

Lab'danum, or **Lad'anum,** the resin of *Cistus creticus, laurifolius,* and *ladaniferus,* small evergreen shrubs of the order Cistaceæ, growing chiefly in the Levant. It is combed from the beards of goats and the fleece of sheep that browse upon the hills where it grows, and is also collected by drawing a rake over the plants. Leathern thongs are attached to the rake, and to these thongs the resin adheres. It is used as an incense and as a fumigation; also sometimes in plasters. It was formerly valued as a stimulant and expectorant.

La Bédollière, de (Émile Gigault), b. at Paris 1814. He is especially known as one of the most assiduous contributors to the journal *Le Siècle,* which he recently left for *Le National,* another republican paper of Paris. La Bédollière began his literary life by writing the *Political Life of the Marquis de La Fayette* in 1833, which work attracted public attention to him. He has translated many English and American books—*Uncle Tom's Cabin,* the novels of Fenimore Cooper, etc. He has written also *History of the National Guard, History of the Manners and Private Life of the French, The New Paris, History of the Mexican War,* etc. All these works are animated with a high spirit of liberalism. Félix Aucaigne.

La Bédoyère, de (Charles Huchet), Count, b. at Paris 1786; shot there Aug. 19, 1815. His historical fame is due to the fact that he was the most exact personification of the persecutions which the Bonapartists had to suffer at the hands of the Bourbon restoration after Waterloo. La Bédoyère, though of an ancient legitimist family, had become the admirer of Napoleon and taken service in his armies. He did not resign his military functions on the first fall of Napoleon in 1814, and was colonel of an infantry regiment when the emperor landed in France from the island of Elba in 1815. La Bédoyère, like the whole army and the whole of France, joined Napoleon at Vizille, who, on arriving in Paris, made him his aide-de-camp, general of division, and senator. On the return of the Bourbons after the "Hundred Days," La Bédoyère was arrested, tried by a drumhead court-martial, and shot.

Félix Aucaigne.

La'bel [Lat. *labellum,* "lip" or "tassel"]. In its original sense *label* meant a narrow strip of paper or parchment used in affixing a leaden seal to a deed or other instrument of writing. Verification is still the intrinsic idea of the label, although its mechanical function has disappeared, and in its legal sense it has been justly termed a *quasi* trade-mark. Like the trade-mark, it implies proprietary rights defensible both by common law and statute (see Trade-marks), but differs from it in including proper names, descriptive terms, etc., and in excluding merely arbitrary symbols. Although the distinctions between a label and a trade-mark may appear at first glance shadowy and uncertain, they are substantial and readily deducible from the ethics of the numerous judicial decisions on record; provided always that the *character* of the specific matter decided upon be considered without regard to the terms used by the court in its designation; for the word "trade-mark" has been frequently applied even by learned judges to indicate a label, and hence the confused ideas current as to the true nature of the latter.

In the U. S. previous to the act of Congress approved June 18, 1874, and which went into effect Aug. 1 of the same year, no provision existed for the registry of labels, and infringements were tried in equity under rulings similar to those governing trade-mark cases, but based more upon the substantial justice of each suit, as in cases of unfair competition in trade, than upon the clearly defined axioms that govern the disposal of trade-marks. The act just mentioned, however, although faulty in many respects, affords a basis for the building up of a system of law and practice which will undoubtedly ensure to labels a defined status and value which the isolated and to some extent

discordant decisions of different State courts have failed to give them. As officially stated, the scope of this act is as follows: "*Sec. 3.* That in the construction of this act the words 'engraving,' 'cut,' and 'print' shall be applied only to pictorial illustrations or works connected with the fine arts, and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the patent office. And the commissioner of patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright of prints, except that there shall be paid for recording the title of a print or label, not a trade-mark, six dollars, which shall cover the expense of furnishing a copy of the record, under seal of the commissioner of patents, to the party entering the same. *Sec. 4.* That all laws and parts of laws inconsistent with the foregoing provisions be and the same are hereby repealed. *Sec. 5.* That this act shall take effect on and after the first day of August, eighteen hundred and seventy-four. Approved June 18, 1874."

"By the word 'print,' as used in the said act, is meant any device, picture, word or words, figure or figures (not a trade-mark), impressed or stamped directly upon the articles of manufacture, to denote the name of the manufacturer or place of manufacture, style of goods, or other matter. By the word 'label,' as therein used, is meant a slip or piece of paper, or other material, to be attached in any manner to manufactured articles, or to bottles, boxes, and packages containing them, and bearing an inscription (not a trade-mark), as, for example, the name of the manufacturer or the place of manufacture, the quality of goods, directions for use, etc. By the words 'articles of manufacture'—to which such print or label is applicable by said act—is meant all vendible commodities produced by hand, machinery, or art. But no such print or label can be registered unless it properly belongs to an article of commerce, and be as above defined; nor can the same be registered as such print or label when it amounts in law to a technical trade-mark."

It will be seen that the act in question excludes trade-marks *per se*, together with matter relating to the fine arts and belles-lettres. In addition to these, it also excludes designs or articles the form and configuration of which are intended for the decoration or artistic improvement (as distinguished from the mechanical or functional) of manufactured articles.

The registry of a label is specially desirable in those cases wherein business interests are identified with the sale of an article known by the term by which it would naturally be designated, as, for example, the word "Akron," for a material produced at Akron, an illustration taken from the noted case of Newman *vs.* Alford (49 Barbour's Reports, p. 588), in which the cement obtained from a bed in the village of Akron, Erie co., N. Y., was designated as Akron cement. Any one could quarry and prepare cement in the village, and sell it as Akron cement, for such is the proper term to indicate the article. But parties in Syracuse, N. Y., made a cement obtained from another locality, and sold it as Akron cement. The court enjoined them. It was shown that the plaintiffs had made known to the world the merits of the cement-bed in Akron, and the market of the product depended essentially upon the title given it. The sale of another article under the name, therefore, not only defrauded plaintiff of the profits that would otherwise accrue, but deluded the public into purchasing what it did not wish. The label, therefore, although lacking the inherent characteristic of a trade-mark, that of exclusive proprietorship, excludes competition from all except those in co-equal possession. The question as to whether the registry of the term as a label would exclude another in the same locality from using it has never yet been decided, but in all probability a decision would be in the negative. If, however, the party registering owned the entire source of supply, as of cement, iron, or other product, in the locality, the term, under the practice of the patent office, would become a trade-mark, and would be registered as such, and not as a label.

As with a geographical, so with a proper name; for although the arbitrary form of a person's signature may constitute a trade-mark, his name alone cannot. Any one named Holloway has a right to make Holloway's pills, but one Holloway must not so frame his labels as to deceive the public with the idea that the articles vended by him are the wares of another. This was decided in the rolls court in England about twenty-five years ago, and the principle holds good in American practice. The master of the rolls declared that "the defendant's name being Holloway, he has a right to constitute himself the vender of Holloway's pills and ointment. . . . But he has no right to do so with such additions to his own name as to deceive the public, and make them believe that he is selling the plaintiff's pills and ointment." In Burgess *vs.* Burgess, in chancery, 1853, another English case, the court affirmed the right of any one bearing the name of Burgess to make and vend "Burgess's Anchovy Sauce," but compelled the defendant to remove certain accessories from his store which tended to mislead the public into the belief that they were purchasing from another person of the same name. But had some person, not of this name, adopted the term, there is no doubt that a permanent injunction would have issued. And could it have been shown that a person named Burgess had used the label, not in the *bona-fide* pursuit of a legitimate business, but with intent to trade on the reputation of another dealer, an injunction would have issued as a matter of course. As the law concerning labels, although now embodied in statutes, rests fundamentally upon commercial equity, the jurisprudence of different countries shows, in the main, great uniformity in the drift of decisions. For instance, the view just previously expressed is sustained by a noted French case, in which an association organized by one Th. Roederer was enjoined, with especially humiliating conditions, from using the name Roederer except in a manner so conspicuously distinctive as to show at a glance that the article sold was *not* that of the celebrated wine-merchants of the name. An action brought in a U. S. court would, so far as the above points are concerned, be decided in accordance with the above acknowledged principles; in other respects the analogies of the law of trade-marks would prevail. In some of the States local laws provide for the punishment of infringers upon a label, and in such instances the courts of the State are the proper tribunals. Even where no such laws exist, an action under the common law may be maintained, the choice of courts resting with the lawful owner of the label. But registry in the U. S. patent office is always desirable, not only as bringing the matter within the scope of the U. S. courts, but for the reason that it defines the precise character of the label, and because it is notice to the public that it is claimed, so far as his option and volition can secure it, exclusively by the party registering the same.

Strictly speaking, the so-called copyrighting of labels never gave any security or protection to them in point of law, although to a certain extent useful in advising the public of the asserted proprietorship. But as this is now forbidden by law, no further consideration need be given it. Pictures, engravings, etc. relating to the fine arts, and printed matter considered apart from a commercial product or article to which it is attached, are subjects for copyright, and no matter embraced within either of these divisions can be protected either under the act of Congress or by State or common law. A "design" being in the nature of things arbitrary, and distinct in configuration from any other, may be used as a trade-mark, provided that its use for this purpose is by its originator, patentee, or owner as a design, but as for trade purposes it may thus be brought within the scope of a trade-mark, it cannot properly be registered as a label. JAMES A. WHITNEY.

Laberge′ (CHARLES JOSEPH), b. in Montreal in 1827; was educated at the college of St. Hyacinthe, and became a lawyer in 1848; in 1854 he entered the Canadian Parliament as a liberal; in 1858 he was solicitor-general for Canada East. He was an able public speaker, and was for a time editorially connected with the *Franco-Canadian* of St. John's, Quebec, and was later chief editor of *Le National*, Montreal. He was for a time a lieutenant-colonel of volunteer troops. D. in Aug., 1874.

Labette′, county in the S. E. of Kansas, bounded on the S. by Indian Territory. Area, 624 square miles. It is drained by the Neosho and its branches, and by affluents of the Verdigris. Valuable coal is found, and the county is generally level and fertile. Grain and stock are staple products. The county is traversed by the Missouri Kansas and Texas R. R. Cap. Oswego. Pop. 9973.

Labette, post-v. and tp. of Labette co., Kan., on the Labette River and the Missouri Kansas and Texas R. R., 9 miles S. of Parsons City. Pop. 282.

Labia′tæ [Lat. *labia*, "lips," from the two-lipped corolla], one of the larger of the monopetalous orders of phænogamous plants, well marked by the opposite and mostly aromatic leaves, square stems, bilabiate corolla, four didynamous, or only two stamens, and a four-parted ovary, forming four seed-like millets (naked seeds of the old botanists) around the base of a single style. No plants of the order are known that are in the least degree hurtful. The essential oils which give an aromatic character to many of them are separated by distillation for medicinal purposes or for use in perfumery. Several, such as thyme, summer-savory, and the like, are the "sweet herbs" of kitchen-gardens. *Lavandula vera*, a shrub cultivated throughout

Germany, and widely in England, has fragrant flowers, from which the officinal oil of lavender is produced. *Rosmarinus officinalis* is an evergreen shrub of the S. of France and the contiguous coast of Italy, the leaves and flowering tops of which yield the volatile and fragrant oil of rosemary. It is believed that the essential oils just referred to are constituents of eau-de-cologne. *Mentha piperita* is the well-known peppermint. It is cultivated on a vast scale in Southern Michigan, Western New York, and Ohio. In St. Joseph co., Mich., there were in 1858, 2000 acres devoted to its growth. A ton of dried peppermint yields about 3 pounds of the essential oil. Spearmint is a closely allied species, cultivated for its aromatic oil. Many other plants of the order are widely known and safely used in domestic medicine—pennyroyal, American pennyroyal, hyssop, horehound, and the like. A few are cultivated for ornament, such as Chinese *Perilla,* several scarlet and blue sages, and *Coleus,* with richly-colored and often variegated leaves.

ASA GRAY.

Labie′nus (TITUS), b. about 98 B. C.; tribune in 63 B. C., when Cicero was consul; accompanied Cæsar as his lieutenant to Gaul, and distinguished himself in 54 B. C. by his two victories over the Treviri, and in 52 in the campaign against Vercingetorix. Although he entered public life under the auspices of Cæsar, and served him for many years, he nevertheless sided with Pompey when the civil war broke out, and made himself conspicuous by the meanness and cruelty with which he treated those of Cæsar's soldiers who fell into his hands at the battle of Dyrrhachium. After the defeat of Pharsalia he fled to Africa, and thence to Spain after the defeat at Thapsus. In Spain he fought against Cæsar at Munda, and by his mistakes the battle was lost. D. 45 B. C. He was not without literary ability, but he was a loose and vain character, and his blunders and crimes have thrown his successes into the shade.

Labienus, Les Propos de, the title of a bitter satirical invective against the second French empire, and personally against Napoleon III., which appeared in Paris in 1865, immediately after the publication of the first volume of Napoleon's life of Julius Cæsar. Labienus is represented to be a soured, disgusted, and obstinate republican living under Augustus, against whose usurpation and tyranny he perpetually chafed. He is represented to have written a history of his country, of which he read passages in secret to his friends. His grandfather is said to have served under Julius up to the crossing of the Rubicon, and his father to have joined the Parthians rather than support the triumvirate. This was supposed to point to Victor Hugo, whose father was a general under the first republic; but as this latter also served the empire the coincidence is not complete. The duc d'Aumale wrote a life of the great Condé which was printed privately for his friends, and was seized and confiscated. This was a point of similarity with Labienus, who, however, by hypothesis, could not have been of royal extraction. The author probably did not mean to point definitely to any individual. The appearance of a volume of *Memoirs* by Augustus is the occasion of a special outburst of the spleen of Labienus, with which the satire concludes. The author was M. A. Rocheard, an ex-professor in a provincial college. His name was on the title-page, and he was condemned for his pains to four or five years' imprisonment, but escaped by taking refuge in Brussels.

F. A. P. BARNARD.

La Billardière, de (JACQUES JULIEN), b. at Alençon Oct. 23, 1755; studied medicine and botany at Montpellier; travelled in France, England, and Italy; made in 1786–87, at the expense of the government, a journey in Syria and Palestine; accompanied the expedition of D'Entrecasteaux in 1791; was taken prisoner in 1793 by the Dutch at Java, while his botanical collections were carried to England; was liberated in 1795, and resided afterwards in Paris, where in 1800 he was elected a member of the Institute. D. at Paris Jan. 8, 1834. He wrote *Icones plantarum Syriæ variarum* (1791–1812), *Novæ Hollandiæ plantarum specimen* (1804), *Relation du voyage à la recherche de La Pérouse* (1800), besides a great number of monographs and essays.

Lablache′ (LUIGI), b. at Naples Dec. 17, 1794; made his début as a basso in 1812 in his native city; achieved his first great success in Vienna in 1824, and sang from 1830 to 1857 alternately in Paris and London, making occasional trips to St. Petersburg and Naples. D. at Naples Jan. 23, 1858. His principal performances were Figaro, Leporello, Dulcamara, Don Pasquale, etc., but he also sang Henry VIII. in *Anna Bolena,* and Giorgio in *I Puritani,* making a most powerful impression.

La′bor [Lat.], in political economy, denotes one of three great agencies by which wealth is produced, the others being land, or nature, and capital. A celebrated German economist divides industrial history into three periods, in the first of which nature is the chief productive agent; in the second, labor; in the third, capital. In the first of the three periods wealth consists mainly of natural produce, as in the hunting and pastoral stages, and likewise in the early stage of industrial progress in new and prolific regions, where wealth lies, as it were, on the surface. In the second period—the later centuries of the Middle Ages, for example—agriculture progresses, handicrafts multiply, considerable manual skill is developed, and labor plays the principal part. In the third period production takes place on a large scale, machinery supersedes handicrafts, as in the case of the handloom, and labor and land become the ministers of the mechanical powers, materials, money, and credit, at the command of the capitalist. This generalization, though rough and needing some qualification, puts in a strong light one truth in particular which it is of great importance to the working classes to recognize—namely, that labor is not the only productive agent, that capital gains ground with industrial progress in respect of the contribution which it makes to production, and that all theories on behalf of labor which omit to take this fundamental economic fact into account are fallacious. Thus, the leading doctrine of some German Socialists, that all wealth is the product of labor, capital itself only accumulated labor, and that the working classes are therefore entitled to the whole produce of every country, is unsound and delusive. The steam-engine is the typical feature of modern industry, and it was mainly the product, not of manual laborers, but of the genius, enterprise, perseverance, and command of funds of two employers of labor, Watt and Boulton. With the steam-engine came production on a great scale and for distant markets, needing large advances of capital and new powers of direction and enterprise. Yet, although capital has become the dominant element in most of the chief departments of industry, both labor and the powers of nature do absolutely much more in our day, though relatively less, for the production of wealth than formerly. Watt complained that the main difficulty of constructing his steam-engine arose from the unskilfulness of his workmen; workmen now easily and rapidly make far more perfect machines. Again, wealth increases fastest, and both profits and wages are highest, in the civilized world where natural resources and advantages, such as fertile soils, mines, water-communication, are greatest. Coal and iron, for example, played an insignificant part in mediæval industry; the natural riches of whole continents lay idle; and numerous products of nature which were then unknown or valueless are now sources of wealth. A still more important consideration in reference to the three great productive agents, land, labor, and capital, is that their separate ownership is not an essential or a universal condition of things. A peculiar course of national history and a peculiar legal system led to a separation of society in Great Britain into three great classes—landlords, capitalists, and laborers; and English economists, with the tendency to premature generalization which characterizes infant philosophy, were led to reason as though this were the natural and necessary consequence of industrial progress, and as though rent, profit, and wages must belong everywhere and always to different classes. But the severance of the laborer from landed property is an exceptional fact in the modern world, being peculiar to British industrial economy. And although co-operation is in its infancy, it has succeeded in several forms; and in Great Britain itself the recipients of wages are in a considerable number of cases partners also in profits.

There is, however, in all civilized countries—and there must for generations to come, if not always, be—a large class living by manual labor and in the receipt only of wages. The causes which determine the material condition of this class and their real income must long retain the highest importance. These causes are not to be summed up, as some eminent economists have supposed, in any single law or formula, such as the proportion of capital to laborers; they vary in different circumstances, in different places, and in different stages of economic progress. Thus, the effect of an increase of population on wages is very different in different regions. In Flanders, for example, wages are kept down by excessive population, but in new countries, such as the Western States of America and in Australia, an increase of laborers may raise in place of reducing wages, by rendering possible a better division of industry and the development of the immense resources of nature. In such regions, too, wages are often paid chiefly not out of capital, but out of the ultimate produce. Even in old countries, where they are paid chiefly out of capital, it is an error to suppose that the rate of wages is absolutely fixed by the ratio of the amount of capital to the number of laborers. (See STRIKES, TRADES UNIONS, WAGES.) What it is desirable to draw particular attention to here, however, is that the rate of wages, or the price of

labor, does not in the majority of cases by itself determine the amount of the real income of the working classes, though it is one of the conditions which do so. Where the laborer is paid altogether in food and other commodities, his wages and his real income are identical. In mediæval Europe this was for the most part the case. And in many parts of Germany to this day, and in some parts of England, the farm-laborer receives part of his wages in kind. In the U. S., likewise, and in Australia, board or food sometimes forms part of the price of labor. Nevertheless, the decided tendency of modern industrial economy is to substitute money payments for wages in kind; and wherever this change takes place, or in so far as it does so, the real income of the laborer becomes subject to more complex conditions, and ceases to depend solely on the rate of wages or on the terms of the exchange between employer and employed. For the workman then makes not one exchange only—namely, the sale of his labor for food and other articles—but a number of exchanges, by means, first, of the sale of his labor, and subsequently of the purchase of the various commodities which he consumes. The term "real wages," which is still sometimes employed, is in this case inappropriate and misleading, as tending to shut out of consideration some most important elements of the real income of the working classes. Two workmen may be earning exactly the same wages, yet the real income of the one may be increasing, that of the other decreasing, because the articles which the former buys are falling, those on which the latter spends his wages rising in price. There are places where the laborer contracts to work for a year at a fixed rate of monthly or weekly wages; here the amount of commodities constituting his real income depends partly on the seasons, on taxation, and on various circumstances quite independent of his wages, some of which were not even in existence when his wages were fixed. It is one of the most important results of the introduction of money as the medium of exchange that the working classes have become directly and deeply concerned in matters—improvements in production, tariffs, taxes, laws, forms of association, investments for savings—which otherwise would only remotely affect them, or not at all. That admirable modern institution for the economical purchase of commodities, the co-operative store, owes its origin to the change in industrial economy which substituted payments of wages in money for payments in kind. The immense purchases of land which the working classes have made in France and other parts of the continent of Europe are among the results of money-wages. The legal system which has excluded the British laborer from the ownership of land has led some British economists to look to co-operative association, by which the workman becomes a partner in capital, as the only mode by which any considerable number of the working class can be raised from the condition of living from hand to mouth, and the only solution of the labor question. But in France there are 4,000,000 land-owners cultivating their own ground, besides many more whose land is farmed by tenants, and the number yearly increases by the purchase of little plots; in Germany, Switzerland, and Belgium the number of small proprietors, who would otherwise be only laborers for hire, is very large, and land in those countries is the favorite investment for savings from wages. In the U. S. there are now probably 3,000,000 farms, and the rapidity with which the number increases is shown by the following figures: in 1850, 1,449,073; in 1860, 2,044,077; in 1870, 2,659,985. Even in England a great number of working men are owners of house-property, and hundreds of thousands of the English working classes of both sexes have invested savings in building, benefit, and friendly societies. The insecurity, indeed, of many of these investments shows the loss which the laborer in Great Britain sustains from the inaccessibility of land. In countries, moreover, in which land is accessible to the working classes, it not only provides a healthful occupation and a secure investment for those who acquire it, but also raises the standard of wages in other occupations. An American employer pointed out to the English trades-union commission that in the States the price of labor is in a great measure regulated by what a man can make out of land, which there competes with capital in the labor-market. What is called the labor question is not, however, susceptible of any single solution, be it co-operation, a good land system, secure savings banks, or any other method. All the methods, moral and intellectual as well as material, which benefit and elevate all classes, and not the working classes alone, must concur in the solution of the problem. The advantages which the laborer derives from education, newspapers, books, cheap postage and locomotion, sanitary improvements, medical science, show how his condition depends on the general progress of civilization; and the future doubtless has in store additions to his welfare undreamt of at present. T. E. Cliffe Leslie.

Lab'oratory, Physical and Chemical. For the first fourteen or fifteen hundred years of the Christian era the grand sciences now known as physics and chemistry, so far as they had advanced, were known under the names of the "Egyptian art" or the "black art" (whence the word "Chemistry" or "Chemie," from *Chem*, Egypt), and were chiefly cultivated in secret, being condemned as shameful and illegitimate by the State, and as impious and dangerous by the Church. The amazing power and progress lying here in latent forms were no doubt instinctively felt and recognized; and from the element in human nature which holds *omne ignotum pro terribile*, these studies were rightly regarded as fraught with peril to all existing institutions and authorities, and to the perpetuity of the prevailing ideas that had been carefully inculcated in the minds of the illiterate mass of men—ideas which were naturally contrived with the most anxious care to assist in upholding those authorities and institutions. Thus it was that the laboratory—which in our day is claimed to be the fountain-head of our greatest arts of civilization, and which is the sphere that now absorbs many young men who feel within them the God-implanted ambition to add something to the sum of *real* knowledge, and to die that death which comes to all with a consciousness that life has not been spent in vain,—thus it was that philosophical and chemical labor of all kinds, during all these centuries, was driven into holes and corners, and classed with astrology, alchemy, jugglery, diabolism, spiritualism, and all that genus of mysticism, quackery, trickery, and fraud. Thus, as we recede, in trying to trace the past history of civilization, before the present epoch of printed books, we find it almost or quite impossible to obtain satisfactory ideas of laboratories or of their occupants antecedent to this epoch. The records of those days, consisting of manuscripts and pictures, are both rare and inherently defective. The true students of science then rarely wrote books, and still more rarely painted pictures. The only branches of chemistry and natural philosophy which received any countenance from the powers that were, and any aid from the possessors of the existing wealth, were such as presented the promise of immediate and direct additions to that power and wealth. The only natural science held to be "practical" in its character—as held even now by many—was such as would help to *make money* for individuals; additions to the sum of human knowledge, involving the greatest good to the greatest number, being as dust in the balance.

Naturally and necessarily, such books as may have been written by true men of science were not valued, copied, or preserved; probably not sought after for public libraries, nor even admitted thereinto, unless they bore the stamp and held the jargon of mysticism of some sort—astrology, gold-making, miracle-mongery, or the preparation of nostrums and specifics. Paintings—of engravings there were none—were founded almost wholly upon the popular ideal of the haunts of these popularly-reputed mystics, and are not, of course, to be fairly or justly accepted as representing the real science of those days. The engraving we present with this, therefore, of a mediæval laboratory of a date nearly 300 years ago, must be viewed with due allowance, no doubt, for the necessary coloring of the mind of the artist with the prevalent idea of such places and such pursuits. The artist in this case was the elder Teniers, and the date of the original painting—in the Gallery of the Louvre in Paris—somewhere about the close of the sixteenth century. Students of the history of science will remember that this was a generation previous to the birth of Becher, and two generations before that of Stahl, the two chemists who were the founders of the first scientific system of chemistry, the phlogistic system; which, with the substitution of the idea of *vis viva* for that of phlogiston, may be held as still standing at this present day. The art of printing was then a century and a half old, and printed books appear in this painting, prominently exhibited. We know, from very numerous facts on record, that the chemists of the day of this painting, the sixteenth century—many of whose names even are uncertain or unknown—made great discoveries—discoveries which we are sure could not have been made without long, exhaustive, and unselfish labor and research. In spite of the assertion—oft repeated, but not by those who *make* discoveries—that they are "mostly made by accident," we do not find at the present day that accident plays any important part in the progress of human discovery. All new methods, materials, arts, theories, generalizations, and principles, all that is entitled to the rank of a discovery, come in these days to men in the laboratory, as the sequences of indefatigable study and labor, inspired by a patient enthusiasm, devoid of all tincture of sordid calculation, and certainly conducted with as great an avoidance of the element of accident or random-work, as in any human pursuit whatever. Those who pursue science consider themselves justified in

believing, therefore, that it has always been thus; and that the many fundamental discoveries, the new materials, methods, and arts which came from the laboratory during the so-called alchemical times, were neither accidental nor the results of empirical work, but arose from the same identical sort of research, by the same sort of men, as in our own day.

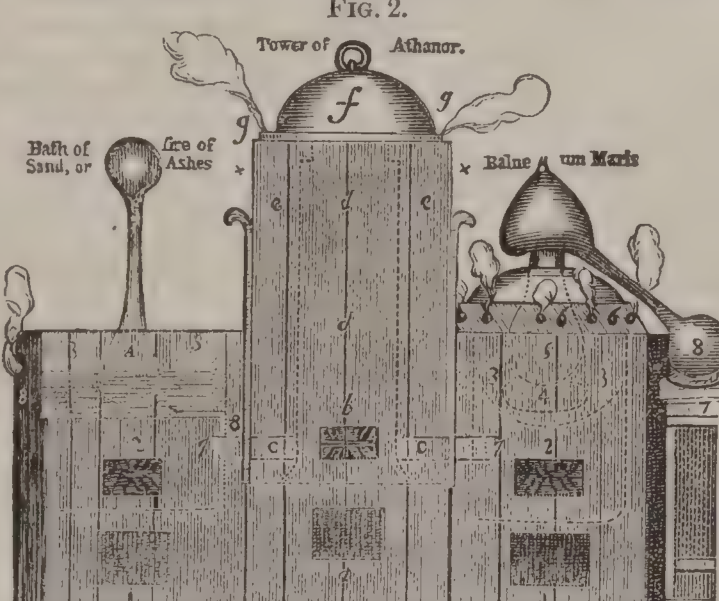
To illustrate this assertion, the cut is presented of the

Fig. 1.

A chemist's laboratory of the sixteenth century, from a painting by the elder Teniers.

ancient laboratory furnace of the famous Geber, 1100 years old. It will be observed that this apparatus involves a number of inventions and principles often supposed to be of modern origin, among them that of the so-called "base-burning" stoves. The name *Athanor* was derived from this feature, meaning "deathless" or never-expiring.

Fig. 2.



Geber's Tower of Athanor (about A. D. 790).

1, the ashe hole; 2, the focus or fire-roome; 3, the place where the ashes or Sand for the Bath are placed; 4, a Mattrasse; 5, a glasse dish; 6, the Register of fire; 7, the entrance of the fire or heat from the Tower of Athanor; 8, the Iron plate or Vessel containing the Sand or ashes.

a, the ashe hole; *b*, the focus or fire-roome; *c*, the passages made for communication of the fire; *d*, the empty place of the Tower; *e*, the solid part of the Tower; *f*, the cover of the Tower: *g*, two severall circles wherein the cover is inlayd.

1, the ashe hole; 2, the focus; 3, the kettle where the water of the Balneum is put; 4, a round (of wood, hay, or some other soft matter) to keepe vp the Limbeck body; 5, the curcubite, with its Limbeck head; 6, the Registers of fire; 7, the stoole or table to keepe up the Recipiem; 8, the Recipiem.

Chemical Laboratories are at present too numerous and too easily accessible to make it necessary to illustrate their arrangements by a graphic representation. In well-appointed institutions, as at the School of Mines of Columbia College, distinct laboratories are now provided for each kind of study and investigation. Thus, there is a qualitative laboratory, a quantitative laboratory, an assay laboratory, a photometric laboratory, a photographic laboratory, a laboratory for gas analysis, and a blowpipe laboratory, each of which is provided with the apparatus and fixtures required for the work for which it is designed.

A Physical Laboratory, as its name would indicate, is an establishment provided with all the appliances needed in the prosecution of research in subjects of physical investigation, such as those of heat, light, electricity, etc. Such an establishment may moreover be specially adapted to each or all of the following objects: 1st, The instruction of students in such general methods of accurate measurement in the various subjects as lie at the foundation of all researches in each of these departments. 2d, The prosecution of original investigations by which new facts and laws may be discovered, and additions made to the general stock of human knowledge in these directions. 3d, The application of scientific methods to the examination of commercial products or materials, to test their value, efficiency, or improvement under treatment by new processes.

To present an interesting and instructive contrast with the laboratory of mediæval times, above depicted, and to furnish an index of progress in this regard, an interior view of the physical laboratory of the Stevens Institute of Technology, prepared at our request by President Henry Morton, is given here. The space occupied by this department in the Stevens Institute is as follows: 1st, A large room 40 by 60 feet, illustrated on the next page, and which is used as a general laboratory for such work as can be pursued under ordinary conditions. 2d, An optical room, containing a large collection of rare instruments, especially for polarization, and used chiefly by students engaged on problems in that subject. 3d, An optical room, especially arranged for observations in diffraction, spectrometry, and the like. 4th, A large room employed chiefly for investigations in acoustics, although used also from time to time as a lecture-room. 5th, A photometric-room, provided with a complete set of photometric apparatus by Sugg of London. 6th, A photographic-room, with dark closet, cameras, and lenses of various sorts. 7th, An elec-

trical measurement-room, containing a complete set of instruments for this purpose, including Thompson's astatic galvanometer of high resistance and a water-battery of 550 cells.

The large room represented in the cut is divided by double cases into ten alcoves on the sides, each devoted to the use of special instruments, and each occupied by an appropriate table. The middle of the room is occupied by a series of tables and of large pieces of apparatus, such as the great induction coil in the foreground, the large electro-magnet in the distance, etc. etc.

FIG. 3.

The new Laboratory for research and instruction in Physics or Natural Philosophy at the Stevens Institute of Technology, in Hoboken, N. J.

At the present day, so many different branches of applied science are undergoing rapid development that specific kinds of *technical* laboratories exist in considerable variety, in which the analytical and experimental researches are carried on exclusively that pertain to special technological arts. These special laboratories are so numerous that we can do little more than mention some of the more important.

Metallurgical Laboratories.—These are of several kinds. Attached to our mints and assay-offices are special assay laboratories, in which immense numbers of delicate assays of gold and silver bullion are continually conducted; and in the same establishments are melting and refining laboratories, in which vast quantities of gold and silver are parted, refined, melted, cast, and prepared for the coining departments by methods of high interest. Other metallurgical laboratories are specially devoted to the assaying of iron and steel, and their ores, slags, etc., by methods chiefly volumetric, for the sake of rapidity.

Gas Laboratories, such as *should be* attached to all our gasworks, the operations of photometry and endiometry being specially carried on in these, with many others.

Agricultural Laboratories, as in our agricultural schools, and in the agricultural department at Washington.

The *sugar-refining* art requires at the present day laboratories in which peculiar operations are carried on, as, for instance, with the polariscope.

The arts of *dyeing*, *calico-printing*, and *bleaching* require also chemical and analytical investigations of various kinds, so that many special laboratories exist devoted to these. The same may be said of *soap* and *candle making*.

In England, at the present time, many special and very important government laboratories are being organized and perfected—which it is to be hoped will be imitated soon among us—to prosecute continual and special analyses of all articles of *food* and *medicine*, to ensure purity and detect fraud.

We may add to these *pharmaceutical* laboratories, in which medicines are elaborated; *electro-metallurgical* laboratories, in which electro-plating and electrotyping are prosecuted; and *telegraph* laboratories, in which numerous special arts are practised, arising out of the great development of electro-telegraphy. HENRY WURTZ.

Laborde′ (Maximilian), M. D., b. in Edgefield, S. C., June 5, 1804; graduated at the College of South Carolina in Columbia in 1821; took the degree of M. D. in the Medical College of Charleston in 1826. His tastes, however, led him more toward the pursuits of literature and science than to the practice of medicine. He soon became a distinguished contributor to *Russell's Magazine*, the *Southern Quarterly Review*, and other like periodicals. In 1842 he became professor of logic and belles-lettres in his *alma mater*. This position he held until the close of the late war. In the reorganization of that institution subsequently to the war, whereby it is no longer styled the College (but the University) of South Carolina, Dr. Laborde was assigned the chair of rhetoric, criticism, elocution, and English language and literature. This position he assumed, and filled with great ability. He also wrote several books of merit, especially the *History of South Carolina College*. In conjunction with other labors he had for a number of years performed the high trusts of the office of president of the board of regents of the State lunatic asylum. D. at Columbia, S. C., Nov. 6, 1873. A. H. Stephens.

Laborde, de (Alexandre Louis Joseph), Count, b. at Paris Sept. 15, 1774; served in the Austrian army in the first campaign against the French republic; returned to France after the peace of Campo Formio; filled several diplomatic missions under Napoleon; was elected a member of the chamber of deputies in 1822; took part with great energy in the revolution of 1830; was made a brigadier-general and aide-de-camp to Louis Philippe, and d. at Paris Oct. 24, 1842. His *Voyage pittoresque et historique en Espagne* (4 vols. fol., 1807–18, with 900 engravings) is a work remarkable for its learning and accurateness, and unique in its elegance. It was followed by *Itinéraire descriptif de l'Espagne* (5 vols., 1809–27). He also wrote *Les monuments de la France* (2 vols., 1832–36, with 259 plates), *Versailles, ancien et modern* (1839–40), etc.

Laborde, de (Henri), Viscount, b. at Rennes, France, May 2, 1811; studied under Delaroche; exhibited in 1836 *Hagar in the Wilderness*. His *Capture of Damietta* (1841) and *Knights of St. John of Jerusalem* (1845) are at Versailles. He wrote *Ingres, sa Vie et sa Doctrine* (1870).

Laborde, de (Léon Emmanuel Simon Joseph), Marquis, a son of Count Alexandre, b. at Paris June 12, 1807; studied at Göttingen; travelled in the East; held several diplomatic positions; was curator of the antiquities of the Louvre from 1848 to 1854, and director of the archives of the empire from 1856 to his death, Mar. 30, 1869. He wrote *Voyage de l'Arabie Pétrée* (1830–33), *Voyage en Orient* (1837–64), and several other works relating to archæology and art.

Labouchere′ (Henry), Baron Taunton, b. in London, England, Aug. 15, 1798; was educated at Oxford; travelled in the U. S. with Mr. Stanley (afterwards Lord Derby), making the acquaintance of the leading members of the government and Congress at Washington; entered Parliament in 1826, and soon became recognized as one of the Liberal leaders; was member for Taunton from 1830 to 1859, when he was made a peer; filled many administrative posts, having been lord of the admiralty (1832), chief secretary for Ireland (1846), president of the board of trade (1847), and colonial secretary (1855–58). D. July 13, 1869, leaving no male heir.—His nephew, Henry du Pre Labouchere, b. at London in 1831, served ten years in the diplomatic service; became a member of Parliament in 1865, and attracted attention by his able letters written from Paris to the *Daily News* during the siege of that capital by the Germans. They were published in a volume with the title *Diary of a Besieged Resident in Paris* (1871).

Labouchère (Pierre Antoine), b. at Nantes Nov. 26, 1807, pursued a mercantile career till 1836; then studied painting in Italy and under Delaroche, and became known especially by his representations of subjects from the time of the Reformation. *Luther at the Diet of Worms* (1857) and *Luther's Death* (1866) became very popular.

Laboulaye′ (Édouard René Lefébure), b. at Paris, France, Jan. 18, 1811; studied law while following a mechanical trade, and astonished the literary world in 1839 by publishing a learned *History of Landed Property in Europe from the Time of Constantine to the Present*, on the title-page of which the author announced himself to be a type-founder. The book was *couronné* (crowned) by the Academy of Inscriptions. In 1842, after being admitted to practise before the royal tribunal at Paris, he published an *Essay on the Life and Doctrines of Savigny*, and in the following year *Researches on the Civil and Political Condition of Women from the Times of the Romans to the Present*. In 1845 he wrote an *Essay on the Roman Criminal Legislation respecting the Responsibilities of Magistrates*, which again won the crown of the Academy of Inscriptions, and procured for its author an election as one of the members of that body. In 1849 he became professor of comparative legislation at the Collége de France, and distinguished himself by the clearness with which he expounded the principles of legal science. He also began from this time to take a prominent part in politics as an ardent republican, and during the eighteen years' existence of the Second Empire there was in France no more able, active, and vigilant worker in the committees and public meetings of the Liberal opposition than M. Laboulaye. His attention was attracted to the institutions of the U. S. as affording some useful models for introduction in France, and he devoted much time for several years to their careful study. He published a valuable *Political History of the U. S. from the First Attempts at Colonization to the Adoption of the Federal Constitution*, of which vol. i. appeared in 1855, and vol. iii. and last in 1866. He translated W. E. Channing's works on social topics (1854), prefixing a life of Dr. Channing and an essay on his doctrines, and brought out in 1855 that author's work on slavery. He wrote largely for several years in the *Revue de Legislation* and other periodicals, from which he collected in 1855 a volume of *Contemporary Studies on Germany and the Slavic Countries*, and in 1856 another on *Religious Liberty*. In 1862 he rendered a vast service to the U. S. by an exposition of the causes of the American civil war in the work entitled *The United States and France*, and lost no opportunity to inculcate his opinions by speeches. In 1863 he published perhaps the most popular of his works, *Paris in America*, an amusing study of American characteristics, which has been republished in eight or ten editions in the republics of Spanish America, where it now forms one of the principal sources from which opinions are formed about the U. S. In 1865 he wrote the *Programme of the Liberal Party*, and edited in 1866–67 the *Memoirs and Correspondence of Franklin*. He was many times an unsuccessful candidate for a seat in the National Assembly. In 1870 he inclined to favor the reforms proposed by Napoleon and É. Ollivier, and from his professional chair advocated an affirmative vote in the plebiscitum of May. He was elected to the National Assembly in July, 1871, was made chairman of the committee on the higher education, and in 1874 secretary of the committee of thirty on the (republican) constitution, in which capacity he maintained (1875) a prolonged battle with the monarchists of every type. In 1873 he was made director of the Collége de France. Of all living Frenchmen, he is perhaps the best entitled to the admiration and gratitude of Americans. Porter C. Bliss.

Labourdonnais′, de (Bertrand François Mahé), b. at St. Malo, France, Feb. 11, 1699; entered the navy early, and became a captain in 1724. Having served for some time in the Portuguese navy, returned to France in 1733, and was made governor in 1734 of Isle de France and Bourbon, which colonies prospered much under his rule through the introduction of cotton, sugar, and indigo culture, and the building of fortifications, canals, aqueducts, hospitals, and shipyards. His administration has become celebrated through St. Pierre's romance, *Paul and Virginia*. During the war between England and France was very successful in his undertakings against the English in the East Indies. In 1746 bombarded and took Madras, and levied a war contribution of 9,000,000 francs. But the French governor-general, Dupleix, became jealous, and discharged him. On his return to Paris in 1748, was thrown into the Bastile, where he lay for three years. In 1751 a commission declared him innocent of all the charges brought against him by Dupleix. Liberated, but broken in spirit, he d. Sept. 9, 1753. His widow received a pension. In 1859 a statue was erected to him in the Isle of Bourbon, now Réunion.

Labrador′ [Port. *Labrador*, "laborer," or possibly Fr. *la bras d' or*, "the golden arm"], a name vaguely applied to that part of the peninsula lying between the Atlantic Ocean and Hudson's Bay, of which the waters flow neither into Hudson's Bay nor Hudson's Strait. The land whose waters flow into the bay and strait above mentioned was for two centuries the property of the Hudson's Bay Company, and was (1869–71) sold by them to the Dominion of Canada. Labrador proper consists of two parts. That part whose waters flow into the Gulf of St. Lawrence formerly belonged likewise to the Hudson's Bay Company, and now constitutes the district of Labrador, in Saguenay co., province of Quebec, Canada. This coast is inhabited chiefly by Indians and by Canadians, mostly of French descent. In 1873 the country was reported to be in a prosperous condition. The catching of seals, herring, codfish, mackerel, salmon, trout, halibut, and fur-bearing animals is the principal industry. The population is increasing, the houses generally neat and comfortable, and the prices of goods very moderate. The eggs and feathers of wild fowl are gathered to some extent. At Moisie there are

quite extensive iron-works. The Indians have been partly civilized by the efforts of Roman Catholic missionaries. They are of the Micmac, Mingan, Seven Island, Betsiamite, and other tribes. Pop. in 1871, exclusive of Anticosti Island (pop. 102), and inclusive of the three last-named tribes of Indians, 3597.

That part of Labrador whose waters flow directly into the Atlantic, and which lies between Cape Chudleigh on the N. W. and the Straits of Belle Isle on the S. E., is the region more generally called Labrador. It belongs, like the former region, to the British empire, but not, like it, to the Dominion of Canada. It is at present under the jurisdiction of Newfoundland. It is governed by a summary court of civil and criminal jurisdiction, whose judge is also magistrate and coroner. There is a bailiff attached to the court, and there are several justices of the peace. The court is held upon a revenue cutter. The revenues are in the care of a collector and his deputy, whose principal office is at Blanc Sablon. There are usually but one or two government mails despatched to Labrador during the summer. The people are not litigious. Most of the cases before the court arise from disputes with regard to the herring fishery. This coast is rocky and precipitous, much broken by bays and inlets. Small islands abound. The native inhabitants are mostly of the Esquimaux race. Nearly all of them have been converted to Christianity by the labors of Moravian missionaries. The principal mission-stations are Nain, Okkak, Hopedale, Hebron, Zoar, and Rama. There are other missions, Roman Catholic and Protestant, the former among the Indians of the interior, who are very few in numbers. The country is so rocky and rough, and the climate so intensely cold in winter (when the temperature averages lower than that of Greenland), that Labrador would be worthless were it not that its coasts abound in the harp and hooded seals (whose fur and oil are very valuable), and that the sea is abundantly stocked with codfish and herring of the best quality. The streams, too, abound in salmon-trout, which are extensively taken and salted. Furs and feathers are collected to some extent. Seal and fish-offal are beginning to be exported for fertilizers. The land-products are few in number. The flora is limited. The forests consist of stunted birch, willow, juniper, and poplar trees. The interior is rough and barren, having a rocky surface, with sandy valleys and numerous swamps and lakes. Near the settlements a few potatoes and other vegetables are raised. During the short summer the coast is visited by great numbers of vessels, mostly from Newfoundland, England, Jersey, and the U. S. The Newfoundland seal fisheries employ numerous sailing vessels and quite a number of steamers. The population of that part of Labrador under the jurisdiction of Newfoundland in 1869 was 2479, exclusive of the aborigines. Disease and famine have greatly reduced the numbers of the latter. In 1870 the mission-station of the Moravians numbered only 1201 souls. This gives for this whole peninsula, with 500,000 square miles of area, a population, exclusive of a few wild aborigines, of only 7277 souls; 3597 of whom, on the S. coast, belong to the province of Quebec (1871); 2479 to the Newfoundland settlements (1869), and the remainder (1870) to the Moravian missions. (See Hind's *Explorations of the Interior of the Labrador Peninsula*, 1863.)

CHARLES W. GREENE.

Lab′radorite, a soda-lime feldspar (see FELDSPAR) crystallizing in the triclinic system, and originally obtained from the coast of Labrador. Some specimens when turned in different lights display to perfection a "change of colors."

Lab′rador Tea (*Ledum latifolium*), an evergreen shrub of the heath family found in marshy soils from Pennsylvania northward. The natives of Labrador use the leaves as a substitute for tea.

Labran′da, in classical geography, a city of Caria, Asia Minor, near Mylasa, celebrated for its temple of Jupiter (Zeus Stratios). The ruins found at Iakli, near Kizeljik, where sixteen columns of an Ionian temple are still standing, were identified by Chandler and by Sir Charles Fellows as those of Labranda, but Leake believes the true site of the city to have been in the hills N. E. of Mylasa.

Lab′ridæ [from *Labrus*, the typical genus, and *idæ*], a family of acanthopterygian teleocephalous fishes, having the lower pharyngeal bones united in a solid mass, and the upper chiefly or wholly represented by the third bone, which is fixedly articulated to the fourth superior branchihyal; the form is oblong or elongated; the scales cycloid; the upper maxillary bones articulated in a complex manner; the teeth conic or confluent into an osseous ridge, the dorsal entire and with its spinous portion generally larger than the soft, and the ventral fins jugular. The family is a large one, embracing our blackfish (*Tautoga onitis*) and burgall (*Tautogolabrus adspersus*). THEO. GILL.

La Bruyère, de (JEAN), b. at Dourdan, in Normandy, probably in 1646, and held a little office in the civil service at Caen, when Bossuet called him to the court of Versailles as teacher to the prince of Condé. The rest of his life he spent at Versailles, Chantilly, and Paris, always belonging to the court, where he enjoyed a pension of 1000 francs a year, but occupying a retired though dignified position. D. May 11, 1696. In 1688 he published his *Caractères de Théophraste, traduits du grec, ou les mœurs de ce siècle.* Two more editions followed in the same year, nine during the lifetime of the author, and a great number in the next century. It has been translated into most European languages—into English by Rowe in 1709—and its reading is still found both interesting and instructive. It is a work of insight, not of inspiration. There is nothing in it of a creative imagination which reveals the depths of human nature through immediate intuition. But it contains much of that fine and acute observation which arrives at a full understanding of human characters through actual experience. Its style is elegant and its tone noble. After his death was published, under the title of *Dialogues posthumes sur le Quiétisme,* a work which he left unfinished.

CLEMENS PETERSEN.

Labuan′, an island in the Malay Archipelago, or rather in the China Sea, 60 miles from the N. coast of Borneo and 600 miles N. E. of Singapore. Area, 45 square miles. Pop. 4893. The island was ceded to Great Britain in 1846 by the sultan of Brunai (Borneo), and a settlement called Victoria has been made at the S. E. extremity. Its chief importance is derived from its central position with regard to Borneo, Anam, the French colony of Cambodia, and the Spanish colony of the Philippines. There is a fair port, a good supply of water, and abundant mines of coal, for conveying which a railway 5 miles long has been built. Sago, camphor, birds' nests, and pearls are the chief exports. Labuan is the seat of a colonial bishopric; it had in 1872 a tonnage of 7000 and an export trade of £135,000.

Labur′num [Lat.], the name of the *Laburnum vulgare* and *alpinum,* two highly ornamental European small trees or shrubs of the order Leguminosæ, cultivated in shrubberies in the U. S. They have abundant yellow flowers in early summer. The wood is hard, heavy, dark-colored, and valuable to the carver and turner. The bark, leaves, and seeds are poisonous. The first-mentioned species is called English, the other Scotch laburnum.

Lab′yrinth [Gr. λαβύρινθος], in Greek archæology, a subterranean cavity, natural or more frequently artificial, with intricate passages. The most famous, that of Egypt, one of the Seven Wonders of the World, was near Arsinoë and beyond Lake Mœris. It had 1500 subterranean rooms, and as many above ground, and had a wall around it. It is believed to have been a royal sepulchre. The Cretan labyrinth, where the Minotaur was kept, is believed to be mythical. Samos, Lemnos, and other ancient places had labyrinths in imitation of that of Egypt.

Labyrinth′odon [Gr. λαβύρινθος, "labyrinth," and ὀδούς, "tooth"], a gigantic fossil reptile, so called by Prof. Owen on account of the convoluted arrangement of the cement and dentine of the teeth, and forming the type of the genus *Labyrinthodontia.* It is the same species named *Cheirotherium* by Kaup, from the resemblance of the tracks to the form of the human hand, and *Mastodon-saurus* by Pictet (1853), who classified it as a saurian on account of its scaly skin. In its anatomy, however, it resembles more closely the tailless batrachians, with which it has generally been grouped. Its footprints and bones are found throughout the Carboniferous, and especially in the Triassic, formations of England and Germany. According to Prof. Owen, the animal was an intermediate between the crocodile and the frog, and was ten or twelve feet long. The shape of the head, the conformation of the jaws, and the fore limbs resembled the frog, while the facial and nasal parts of the skull, the maxillary tusks, the conformation of the ribs, and the bony plates of the skin showed a decided affinity with the crocodile. The hind foot was three times as large as the fore foot; the former averaging twelve and the latter four inches in length, each having five toes. The American cheirotherium was probably of a distinct genus, as it made a double series of tracks. (For an interesting account of the scientific construction of this reptile from the scattered remains, see the *Proceedings of the Boston Society of Natural History,* vol. v., 1856.)

Lac [Fr. *laque;* Ger. *Gummilack*], **Stick-lac, Seed-lac, Lump-lac, Shell-lac,** and **Lac-dye,** a resinous substance produced by the puncture of the female insect of *Coccus lacca* or *C. ficus* upon branches of several plants, as the *Ficus religiosa* (the banyan or religious tree of the Hindoos), the *Rhamnus jujuba,* the *Croton lacciferum* (or bihar tree), and the *Butea frondosa* (or the pepel tree), which grow in Siam, Assam, Pegu, Bengal,

and Malabar. The female insect is of the size of a louse —red, round, flat, and wingless. The male is twice as large as the female, and has four wings. Soon after it is punctured the twig becomes incrusted with a mammillated resinous substance, red, hard, and nearly transparent. It serves the double purpose of protecting the eggs and of supplying food for the young maggots in a more advanced state. The mothers are held by the adhesive fluids which exude from the punctures, and contribute their substance to the mass. The characteristic constituents of the incrustation are the lac-resin, derived from the tree, and the lac-dye, analogous to that of the cochineal, *Coccus cacti*, contained in the insects. The most valuable product is obtained by breaking off the twigs before the brood escapes, and drying them in the sun.

Stick-lac.—These dried twigs are called stick-lac, and from them the other products are prepared. That from Siam is the best, the incrustation being often a quarter of an inch thick all around the twig; that of Assam ranks next. Dr. John gives the following analysis of stick-lac:

An odorous resin	66.65
Resin insoluble in ether } " laccin }	16.75
Coloring-matter (analogous to that of cochineal)	3.75
Laccic acid	0.62
Extractive	3.92
Skins of insects	2.08
Wax	1.67
Salts	1.04
Sand	0.62
Loss	2.90
	100.00

It is insoluble in water, to which it, however, imparts its red coloring-matter. It is partially soluble in alcohol, coloring it red; is insoluble in fatty and essential oils.

Seed-lac is the resinous concretion separated from the twigs, coarsely pounded, and washed with water, by which much of the coloring-matter is removed. When it is desired to secure the lac-dye also, hot water is used, to which a little soda is often added.

Lump-lac is simply seed-lac melted into lumps.

Shell-lac is prepared from seed-lac by placing it in bags of cotton, about 4 feet long and 6 inches in circumference, and warming it over a charcoal fire. When the resin begins to melt the bag is twisted, and the clear resin is allowed to flow over the smooth stems of the banyan tree or planks of fig-wood, when it cools in thin layers or scales. Hatchett has published the following analyses of these different forms of lac:

	Stick-lac.	Seed-lac.	Shell-lac.
Resin	68.0	88.5	90.9
Coloring-matter	10.0	2.5	0.5
Wax	6.0	4.5	4.0
Gluten	5.5	2.0	2.8
Foreign bodies	6.5	0.0	0.0
Loss	4.0	2.5	1.8
	100.0	100.0	100.0

Lac-resin is very valuable, much harder than colophony, and easily soluble in alcohol. It may be obtained pure by treating shell-lac with cold alcohol, and filtering the solution in order to separate a yellow-gray pulverulent matter. When the alcohol is again distilled off, a brown, translucent, hard, and brittle resin, of specific gravity 1.139, remains. It melts into a viscid mass with heat, and diffuses an aromatic odor. Anhydrous alcohol dissolves it in all proportions. According to John, it consists of two resins, one of which dissolves readily in alcohol, ether, the volatile and fat oils; while the other is little soluble in cold alcohol, and is insoluble in ether and the volatile oils. Unverdorben, however, has detected in shell-lac—(1) a resin soluble in alcohol and ether; (2) a resin soluble in alcohol, insoluble in ether; (3) a resinous body little soluble in cold alcohol; (4) a crystallizable resin; (5) a resin soluble in alcohol and ether, but insoluble in petroleum, and uncrystallizable; (6) the unsaponified fat of the *Coccus* insect, as well as oleic and stearic acids; (7) wax; (8) the *laccine* of Dr. John; (9) an extractive coloring-matter. Dilute hydrochloric and acetic acids dissolve shell-lac readily; nitric acid slowly; strong sulphuric acid not at all. Like most other resins, it has a strong affinity for bases, with which it forms definite compounds. It dissolves in aqueous potash, soda, carbonate of soda, etc. It deprives the caustic alkalies of their alkaline taste. The solution in caustic potash is of a dark-red color, and dries into a brilliant, transparent, reddish-brown mass, which may be redissolved in both water and alcohol. Borax renders five times its weight of shell-lac soluble on boiling with water. This solution is equal for many purposes to spirit varnish, and is an excellent vehicle for water-colors, as when once dried water has no effect upon it. India-ink rubbed up with this liquid forms a most valuable *label-ink* for the laboratory, as it is not affected by acid vapors. Sal-ammoniac is also a solvent for shell-lac, and the solution has been suggested as a substitute for the alcoholic solution.

Bleached Shell-lac. — By passing chlorine in excess through the dark-colored alkaline solution the lac-resin is precipitated in a colorless state. When this precipitate is washed and dried, it forms with alcohol an excellent pale-yellow varnish, especially with the addition of a little turpentine and mastic. By exposure in thin shreds to the sun's rays or in a finely-divided state to chlorine-water, or by reducing it to a fine powder, suspending in water, and passing hydrochloric acid vapor into the menstruum, the dark-colored varieties are bleached. When this is done, however, the resin loses many of those qualities that so admirably recommend it for some kinds of varnishes, but it answers well for making sealing-wax.

Uses of Shell-lac.—In India lac is fashioned into rings, beads, and other trinkets. It is the material of which the best modern sealing-wax is made. Turpentine is added to promote fusibility and prevent brittleness. Earthy matters are added to increase weight and to prevent too rapid fusion. For red and other light-colored sealing-wax very pale or even bleached shell-lac is used, while for black and dark colors the darker-colored shell-lac is equally suitable. The following are common proportions, the first being the best, Venice turpentine being used in it:

	1.	2.	3.	4.
Shell-lac	500	300	340	330
Turpentine	125	400	370	330
Chalk or magnesia	...	140	110	
Gypsum or zinc-white	...	95		
Sulphate of baryta	...	...	60	160
Vermilion	375	65	120	165
Oil of turpentine	...	...	...	15
	1000	1000	1000	1000

The materials are melted together in an iron pan, with constant stirring. The cool but still soft mass is rolled on a slab of marble and shaped into sticks, or the fluid mass is poured into brass moulds. The various colors are imparted by cobalt blue, chrome yellow, bone-black, etc. Perfumed sealing-wax contains gum benzoin, storax, or balsam of Peru. Inferior sealing-wax is colored red with oxide of iron instead of vermilion, or it is even made of common rosin with gypsum or chalk. New Zealand resin, from the *Canthorrhœa hastilis*, is frequently used in place of shell-lac. Mediæval sealing-wax was a mixture of bees-wax with turpentine and coloring-matter.

Shell-lac is used for the preparation of varnishes and for japanning, the ordinary shell-lac varnish being a simple alcoholic solution. It is used for stiffening hat bodies and many other purposes. Its solution in sal-ammoniac and water has been suggested as capable of numerous applications. It is made by placing 3 parts white shell-lac, 1 part sal-ammoniac, and 6 to 8 parts water in a close vessel for twelve hours, then boiling with constant stirring till the shell-lac is dissolved. The solution may be used as a stiffener, waterproofer, or vehicle for pigments and dyes, as paint or varnish.

Lac-dye and *lac-lake* are the secondary or by-products of the purification of stick-lac. The coarsely-powdered stick-lac is macerated with hot water, to which a little soda is sometimes added. The red liquid thus obtained is strained through canvas and evaporated over a charcoal fire or in the sun. The residue is made into little cakes, which are known as *lac-dye*, and, as they appear in commerce, contain about 50 per cent. of coloring-matter, 25 of resin, 25 of earthy impurities. *Lac-lake* is obtained by precipitating with alum the decoction from stick-lac, prepared with weak caustic soda. The precipitate is pressed, moulded into cakes, and dried. It contains coloring-matter 50, resin 40, alumina 9, impurities 1. Messrs. Brooke, Simpson & Spiller of Manchester, England, have introduced into commerce a lac-dye superior to that imported from India. They treat stick-lac with weak ammonia, and precipitate the solution with chloride of tin. The coloring-matter of lac-dye is analogous to that of cochineal, carminic acid, but its absolute identity has not been established. The shades produced by it are less bright, but more permanent. Lac-dye and lake are chiefly employed for dying woollen fabrics scarlet; 2 or 3 parts produce the same effect as 1 of cochineal. The solvent for the dye is either sulphuric or hydrochloric acid; the mordant is chloride of tin and tartar. The following processes for preparing the dye for use are given in Watts's *Dictionary of Chemistry:* (1) A mixture of 4 parts of lac with strong sulphuric acid is allowed to stand for 24 hours in summer and 48 in winter, then diluted and stirred with $3\frac{1}{2}$ parts of water, and again left to clarify. The clear liquid is poured into an iron pot, and mixed with the wash-water of the previous residue; the solution is mixed with a quantity of lime sufficient to neutralize four-fifths of the sulphuric acid, and the precip-

itate of gypsum is removed: the liquid is then ready for use. This is the mode of preparation chiefly adopted in England. (2) 32 parts of lac-dye are triturated with 10 to 12 parts of sulphuric acid of specific gravity 1.85, or hydrochloric acid of specific gravity 1.13, each diluted with three times its weight of water. The mixture is left to itself for 48 hours in winter or 24 hours in summer, and then mixed with the requisite quantity of river-water. (3) 32 parts of lac-dye are triturated with 12 parts of hydrochloric acid of specific gravity 1.148, diluted with an equal weight of water; the mixture is left for 24 hours, and frequently stirred, and then diluted with water. To dye with the color thus prepared, each pound is mixed with three-quarters of a pint of so-called lac-spirit, a solution of stannous chloride prepared by dissolving 1 pound of tin in 20 pounds of fuming hydrochloric acid, the mixture being left to itself for 6 hours before use. C. F. CHANDLER.

Lac [Hindostanee], the sum of 100,000 rupees, worth about $50,000. The term is used in East Indian commerce. One hundred lacs make one *crore* of rupees.

La Caille, de (NICOLAS LOUIS), b. Mar. 15, 1713, at Rumigny, in Champagne; studied mathematics and astronomy; made himself known by his participation in the survey of the French coast between Nantes and Bayonne, and in the measurement of the arc of the meridian, and was appointed professor in astronomy at the Collége de Mazarin at Paris in 1741. In 1750 went to the Cape of Good Hope, and in 127 nights determined 9800 stars hitherto undetermined; and in connection with Lalande in Berlin he established the distance of the moon, Mars, and Venus. He evinced the same energy in his literary activity, which comprises, besides his *Astronomiæ Fundamenta* (1758), *Tabulæ Solares* (1758), *Observations sur 515 étoiles du zodiaque* (1763), several elementary handbooks, and a number of essays which have been of great influence on navigation. D. at Paris Mar. 21, 1762.

Lacando'nes, an Indian tribe of Central America, inhabiting an extensive unexplored region of Northern Guatemala, near the frontier of Belize, on a river of the same name tributary to the Usumasinta. They formerly extended into Chiapas and Tabasco, but are now found only in the region of the Chiche Mountains. They, like the neighboring Itzaes of Lake Peten, belong to the Maya stock, and do not differ in point of actual civilization from the other fractions of their race in Yucatan. They for more than three centuries kept up a warfare with the Spaniards, but have generally been pacific of late years, and, though allowing no whites to visit their settlements, sometimes traffic a little on the frontiers, giving tobacco and sarsaparilla in exchange for trinkets and firearms. They are nominally subject to Guatemala, but are in fact entirely independent, never having received laws from or paid tribute to the whites. They still practise their ancient religious rites, and have towns of some extent, though the magnificent description of their cities told to Mr. John L. Stephens by the cura of Quiché is but a romance. (See Stephens's *Travels in Central America*, and Morelet's do. (trans. by Mrs. Squier, New York, 1870).)

Lac'cadives [Sans. *lakke*, "a hundred thousand," and *dive*, "island"], a numerous group of small islands in the Indian Ocean (Arabian Sea), consisting of twenty clusters, 100 miles from the Malabar coast. Area, 744 square miles. Pop. 7000. They are of coral formation, the largest being only 7 miles in length, and most of them are mere barren rocks. From the dangers of the surrounding reefs the Laccadives are little frequented by navigators. The natives are called Moplays, are Mohammedans of Arabian descent, and live in stone huts. The only commerce is in cocoa-fibre and betel-nuts. The islands pay tribute to Cananore in the presidency of Madras. They were discovered by Vasco da Gama in 1499.

Lace [Old Fr. *lacis, lacez*, from Latin *lacinia*, the guard-hem of a robe; in Early English *lace* meant simply a fastening or to fasten, in common with the Ang.-Sax. *laecc-an*, to "catch, to hold," probably allied to the Greek λέγω and Latin *ligare;* Sanskrit, *lagati*], an ornamental open-work of thread, twisted, plaited, or woven into patterns. Itself comparatively modern, lace is derived from two most ancient kinds of work, netting and embroidery, the former of which was used by the Egyptians to ornament the borders of some festival garments; indeed, the network of blue beads found on mummies may, as it was made with the needle, be regarded as a sort of lace. The Greeks and Romans bordered their robes with embroidery, called, when of superior quality, *opus Phrygianum*, from the skill with which it was executed by Phrygian workers. Among early Christians it was customary for women to wear veils during public worship, and writers of the second century complained that too often those coverings ministered rather to vanity than to modesty, being frequently of netting interwoven with gold or silver, through which the face was visible. Anglo-Saxon embroidery, known as *opus Anglicanum*, was esteemed even in Rome; the cope and maniple of St. Cuthbert, found in his coffin, and still preserved at Durham, are good specimens of this work.

Lace may be divided into two principal classes—point and pillow lace, the former being of much the greater antiquity. We cannot decide when point was first made, so very gradually was it evolved from netting and embroidery, with which it is often confounded in old records. The Italians probably derived it from Byzantium, since its earliest development may be traced to Venice, Genoa, and other towns engaged in commerce with the Greek empire. The oldest point is of two kinds—*lacis*, or *point compté* ("counted stitch"), and cut-work (*point coupé*). Lacis usually consisted of netted squares, made in the ordinary way on a mesh, then joined with the needle, and darned or embroidered in a pattern, like the modern "guipure d'art;" or designs cut out of linen were laid on the netting and secured to it by embroidery. The open ground, again, was sometimes formed by drawing threads in a piece of linen and fastening them with the needle where they crossed each other. For cut-work, threads were stretched netwise across a piece of linen, called *quintin* from the place of its manufacture, and a pattern was made by sewing round with buttonhole stitch those parts of the linen intended to remain, and cutting the rest away. By degrees, skilful workers arrived at making the thick part entirely with the needle, using variations of two stitches (Figs. 1 and 2),

FIG. 1.

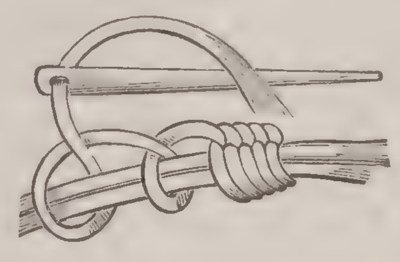
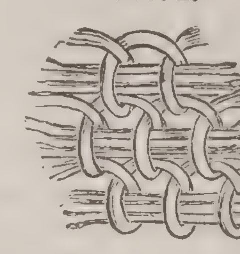


FIG. 2.



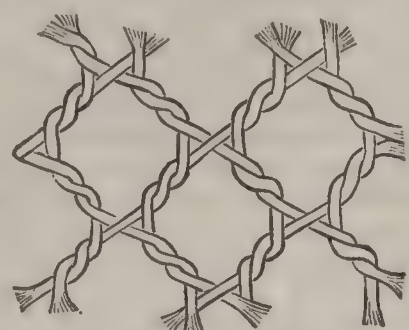
similar to those in modern point. The name "cut-work," though inappropriate, was long retained, and as late as 1640 we find it applied to Italian lace by John Taylor, the Water Poet, in his *Prayse of the Needle*. Embroidery, lacis, and cut-work were often combined in one piece, squares of darned netting alternating with squares of cut and embroidered linen; and this work, which was used chiefly for large articles, such as coverlets and altar-cloths, was sometimes white or unbleached, sometimes varied with gold, silver, or colored threads. The earliest pattern-books extant date from the sixteenth century, and are extremely rare, most of them having been worn out in the using. The best known is that of Vinciolo, a Venetian (about 1612), who gave new designs, besides republishing many from older books. Among those we may notice *Le Livre nouveau des Patrons de Lingerie* (Berlin, 1525); *Knitting and Lace Patterns*, Hans Sibmacher (1597, reprinted at Vienna 1866), having a curious frontispiece representing a work-room where an aged female is directing several young pupils; *La Pratique de l'Aiguille industrieuse*, M. Mignerak (1605). The designs in these and contemporary works on the same subject are either geometrical or attempts at depicting sacred, historical, or allegorical scenes. Sibmacher gives St. George and the Dragon to be worked in lacis; Mignerak shows how the seasons, the elements, the death of Lucretia, etc. may be more or less adequately represented with the needle. In the South Kensington Museum, London, a large piece of lacis in many compartments contains in each a Bible picture wrought on a netted ground. As pattern-books were expensive and easily damaged, it was usual for ladies, in the times when needle-industry ranked as a cardinal female virtue, to preserve designs and stitches by working lace-samplers or "sam-cloths," which are still kept as heirlooms in many families.

In the sixteenth century lace became a very general ornament of both male and female dress, and we find it frequently mentioned in royal edicts and accounts: "8 peces of yolowe (yellow) lace were bought for Henry VIII. at a cost of 5*s*. 4*d*." A sumptuary law of Queen Mary forbade the wearing of "white woorkes, alias cut-woorkes, made beyonde the seas." Stubbes, in his denunciation of "ruffes," declares them to be "clogged with gold, silver, or silk lace of stately price, wrought all over with needle-work, speckled and sparkled here and there with the sonne, the moone, the starres, and many other antiquities straunge to beholde." For those much-reviled yet long-triumphant articles of dress, pillow-lace, being lighter than point, was a favorite edging. This work, usually supposed to have been invented by Barbara Uttmann, wife of a master-miner of St. Annaberg, in Saxony, is by Joseph Séguin pronounced of Italian origin. "From Italy," says he, "a knowledge of the art passed into France, whence it was acquired by

the lace-makers of Flanders." Be that as it may, Belgium is now the special home of this beautiful fabric. The lace-pillow is a round or oval board forming the base of a hard cushion; the worker places it upon her knees, lays on it a strip of parchment pricked with holes which indicate a lace-pattern, and sticks a pin through each hole so that its point enters the pillow. The thread for making the lace is wound on bobbins, small pieces of wood, bone, or ivory about the circumference of an ordinary lead-pencil, having round their upper ends a groove or neck to receive the thread; by the twisting and crossing of these the lace is formed. The ground or "mesh" is made by plaiting (Fig. 3) or

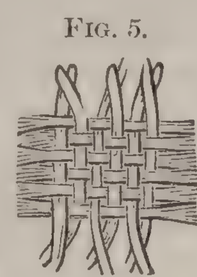
FIG. 3.

FIG. 4.



twisting the threads (Fig. 4); the pattern, technically called "gimp," by weaving or "clothing" (Fig. 5. These figures, as also 1 and 2, represent the stitches considerably magnified). A large number of bobbins is needed, as many as 1200 being sometimes employed on one cushion. Those not immediately in use hang over the front of the cushion, each by its own thread, which is so looped as not to become unwound. The leading lines of the pattern are sometimes marked by pins with colored heads, and the "gimp" threads are wound upon colored bobbins. Early pillow-lace, like contemporary point, was of stiff design, and may be compared to the more formal of modern crochet edgings. But towards the close of the sixteenth century lace of all kinds changed from the geometrical to the flowing style, as may be seen by comparison of Holbein's pictures with those of Vandyke. And every year it was more generally and profusely worn. At Queen Elizabeth's death 3000 lace-trimmed habits were found in her wardrobe. Charles I. wore hunting-dresses adorned with rich point. In France, and all countries where French fashion-laws were obeyed, lace during the seventeenth and eighteenth centuries was used lavishly for nearly all articles of dress. The falling collars and cravats which succeeded ruffs were either made of lace or deeply bordered with it. Ladies wore lace head-dresses, lace flounces, ruffles of lace at the elbow, aprons frilled with or composed entirely of lace. Gentlemen had lace cuffs or ruffles (called *pleureuses*, "weepers") which fell over the hand, and thus, it was said, facilitated cheating at cards; they wore lace-trimmed garters, deep frills of lace at the knee, lace roses in shoes, even quillings of lace to fill up the wide boot-tops that were fashionable about 1662. Infants' robes, caps, and cradle-furniture were made of rich lace, and it was used for curtains, for coverlets, even for bathing-wrappers. Drayton's pretty conceit for a head-dress which the shepherd Lalus promises to his mistress must have been inspired by the sight of some beautiful lace of flowery pattern:

FIG. 5.



"For thy head Ile have a Tyer
Of Netting made of Strawbery wyer,
And in each knot that doth compose
A mesh, shall stick a halfe-blowne Rose
Red, damaske, white, in order set;
About the sides shall run a fret
Of primroses; the Tyer throughout
With Thrift and Daysyes frindged about."
(*The Muses' Elizium*, Nimphall ii.)

Great sums were spent upon lace, and as it was nearly all brought from Italy, Venice and Genoa were enriched with the fortunes of French nobles. For this reason its importation was, between 1620 and 1660, forbidden by many edicts, which, however, had little effect except to inspire numerous satires: of these, *La Révolte des Passements* ("The Rebellion of the Laces") is specially valuable, since it names every kind of lace known at the time. Soon after the edict of 1660 the minister Colbert, resolved that France should have a lace manufacture of its own, sent to Italy for workers, and established them near Alençon, where they instructed a number of French girls in the art of making point. Alençon lace, which, though derived from that of Venice, differed considerably from it, was by Louis XIV. called *point de France*, and being patronized by that monarch, soon became indispensable to all his courtiers. In 1665 a company was organized with the monopoly of its sale for ten years, during which time the shareholders received over and over again the amount of their original investments. The manufacture of "point de France," though affected, like every kind of French industry, by the Revocation of the Edict of Nantes, flourished until the Revolution, when nearly all demand for lace ceased, and many Alençon workers, having ministered to aristocratic luxury, shared the fate of their high-born patrons. It was revived by Napoleon I., and there exist here and there fragments of a suite of bed-furniture powdered with the imperial bees, which was made for him at immense cost. Venice point is no longer worked, except by skilful reproducers of old lace. The raised kind was especially beautiful, and had the appearance of carving or bas-relief, the outlines of the patterns being worked over thick rolls of cotton. The flowers were filled in with delicate lace-stitches (technically called *modes*) and connected by *brides*, or bars, of exquisite lightness varied by little stars and picots, or pearl loops. A similar lace was made in Spanish convents and devoted to church purposes, such as altar-furniture, vestments, and the dresses of images. In the island of Cephalonia much Italian point of geometrical design has been found in tombs and sold under the name of "Greek lace." Point d'Alençon, the most costly and complicated of needle-laces, is made in small segments and by twelve different workers, each of whom has her special province. The pattern is printed off on pieces of green parchment about ten inches long, each segment numbered in its order; the pattern is then pricked upon the parchment, which is stitched to a piece of coarse linen folded double. The outline of the pattern is traced out by two threads fixed by small stitches passed with another needle and thread through the parchment and its linen lining. The ground is next worked in fine *réseau* ("net") backward and forward at right angles to the border; the flowers are worked in, and the various "modes" or "fillings" are introduced. The threads which unite lace, parchment, and linen are next cut by passing a razor between the folds of the linen, and the many segments are joined by an invisible stitch called "assemblage." Point d'Alençon is the only lace in which horsehair is introduced along the edge to give firmness to the "cordonnet." The horsehair has the disadvantage of being apt to shrink in washing, and thus impair the beauty of the point. Until the Revolution there was made at Argentan a point resembling that of Alençon, but with heavier flowers and a "bride" ground of large hexagonal meshes worked over with button-hole stitch. The art of making this lace, which was very strong and effective, is entirely lost. Pillow-lace is either worked in one piece on the cushion, in which case it cannot be of any great width, or is made in separate flowers, afterwards connected by "brides" or applied on net. Of the latter kind are Brussels, Honiton, and guipure de Bruges. The best Brussels lace is made of wonderfully fine thread, the flax for which is grown in Brabant and steeped at Courtrai, the Lys water being very clear. This thread is spun in cellars, since contact with dry air causes it to break; a ray of light is thrown on it, but the spinner is guided chiefly by touch, and stops her wheel when she feels the slightest unevenness. The number of expert spinners being small, and their work tedious and unhealthy, real Brussels thread is very expensive, costing from 20,000 to 50,000 francs per pound. Machine-made thread is therefore generally used, but it has never attained the fineness of that spun by hand. The most costly Brussels lace has a fine needle-made ground, called *point à l'aiguille*, rarely used except for royal trousseaux; the pillow-made ground, though much less expensive and durable, is also of great value, and is commonly replaced by fine machine net made at Brussels for the purpose. The flowers are sometimes worked with the needle, but more frequently on the pillow; a fine "cordonnet" marks the outlines of the pattern, which is formed with a variety of beautiful "modes." A piece of Brussels lace passes through seven different hands, each worker having her own department, and knowing nothing of the intended effect, which is decided by the head of the establishment. Lace-making is taught in schools, of which there are over 900 through Belgium, many being attached to convents. Brussels flowers coming soiled from the lace-makers' hands are too often prepared for sale by means of white lead; this process, besides being injurious to health, renders the lace liable to turn black on exposure to heat or sea-air, in which case it can never be cleaned. Honiton, the most valuable English lace, is made along the Devonshire seacoast. The flowers, now generally copied from nature, are of fine woven or cloth-stitch, a thicker thread marking the outlines. They are either "applied" on net or connected by "brides," which, like the pattern, are worked on the pillow; needle-stitches are occasionally introduced. Guipure de Bruges, sometimes called "duchesse" lace, resembles Honiton, its sprigs being united by "brides."

Of the many laces made in one piece on the pillow, Valenciennes is the most esteemed. Before the French Rev-

olution it was worked chiefly at Valenciennes, and was called, on account of its durability, "everlasting." It was made in cellars, the damp air of which favored the use of extremely fine thread, and was ruinous to the sight, many women becoming blind before thirty. At present it is manufactured only at Bailleul in France and in several Belgian towns, Ypres furnishing the widest kinds, which cost sometimes as much as £80 per mètre. It is a very even lace, one-sized thread forming both ground and pattern, and as it bears washing remarkably well, is a suitable trimming for white garments. Mrs. Palliser pronounces Mechlin (*dentelle de Malines*) "the prettiest of laces." Somewhat resembling Valenciennes, it is also used for trimming white articles, but its ground is lighter, and the flowers are outlined by a flat shiny thread which looks like embroidery. Pillow-lace less expensive than Valenciennes is made at Lille and Arras, and large quantities are manufactured in Normandy, Lorraine, and Auvergne. According to M. Audry, the number of French lace-makers in 1851 was 240,000. Coarse pillow-edgings, used chiefly by peasant-women for their costume head-dresses, are manufactured in Holland, Sweden, Denmark, and some parts of Germany; more delicate kinds are also made in those countries, but not in very great quantities. In England the counties of Bedfordshire, Buckinghamshire, and Northamptonshire were formerly celebrated for edgings resembling those of Lille, and called "baby lace" from being used chiefly for infants' caps, but various causes having lessened the demand for this fine lace, the workers now generally make Maltese or Cluny guipure. The term *guipure*, now used for any rich lace, was anciently applied only to a kind made of *cartisane* (thin strips of parchment or vellum), round which gold, silver, or silk thread was twisted. It was worked either with a needle or on a pillow, the pattern being outlined with "cartisane" and filled in with stitches, and was very perishable, as the vellum was affected by damp. Thread guipures, resembling the modern Cluny, Maltese, and Russian, were made in Italy and Flanders. Some specimens of Russian lace, now in the South Kensington Museum, are remarkable for bold and correct design.

Blonde lace, both black and white, is either worked entirely on the pillow, like Chantilly, or has pillow flowers applied on silk net. Black Chantilly lace is now made chiefly at Bayeux. Grammont, in Belgium, produces black lace, and large quantities are manufactured in Spain, particularly at Almagro, where 12,000 workers are employed. White blonde mantillas are worn by Spanish ladies at bull-fights. Irish lace comprises crochet guipure, very fine tatting, Carrickmacross, a kind of cut-work, and embroidery upon machine net, called "Limerick lace." The last-named variety is suitable for large articles, such as veils and flounces. Worsted, mohair, and "yak" lace, used of late years for dress-trimming, are made chiefly at Le Puy. Greek and Italian peasants work aloe-fibres into a lace which, though pretty, has the disadvantage of not washing; sometimes, however, it is dyed black, and thus rendered more useful. A natural lace is furnished by the *Lagetta lintearia*, a lofty West Indian tree with white flowers and large smooth leaves; its inner bark may, after maceration in water, be separated into fine layers resembling net. Gold and silver laces, employed for uniforms and court dress, are made either of very fine wire, or silk covered with a fine flat thread of gold, silver, or silver gilt. Machinery is now generally used in the manufacture, which is carried on in London, Belgium, Italy, and France.

The first machine net, made at Nottingham about 1760 upon the ordinary stocking-frame, was a looped fabric, woven with a single thread, and resembling an open knitting both in appearance and liability to ravel. Improvements in its manufacture were introduced by Hammond, Robert Frost, Flint, and others, but the object of inventors—namely, an imitation of the firm three and six-sided meshes of pillow-work—was not attained until 1809, when Heathcot, after long watching a woman at her pillow, and carefully unravelling some pieces of pillow lace, found out how to make twist bobbinet. (See NETS.) Lace patterns are worked in bobbinet either in a frame by hand, like Limerick lace, or by an adaptation of the Jacquard apparatus to the net-machine. When the machine-worked pattern consists of separate sprigs, stars, or dots, the thick pattern thread (called "gimp") is carried from one to the other, and afterwards cut away by children. Net which has been torn in the working is confided to lace-menders, who exactly replace the damaged meshes. In Nottingham, the chief seat of the English machine-lace trade, in 1864 there were 250 lace manufacturers, employing machinists and engineers, lace-dressers, starch-makers, designers, and draughtsmen, besides 135,000 female operatives. The materials used cost about £1,715,000; the wages and profits came to £3,415,000, and the net returns to about £5,130,000.

English machine-net was formerly smuggled into France, but the French now excel in the finer kinds, and show special taste in their patterns. Their principal lace-making towns are Calais, Cambrai, Lyons, St. Omer, Lille, St. Quentin, and Caen. Embroidery on machine-net is done in Paris. Every kind of pillow-lace is imitated by machinery, and so accurately as to deceive a superficial or ignorant observer. But in this, as in all work, that done by hand, even though faulty, has a *character* which no machine can supply; and the very evenness and flatness of "imitation" lace make it of little value from an artistic point of view.

J. Séguin's new work, already cited, contains fifty beautiful photographs of old and modern hand-made lace. *History of Lace*, F. Bury Palliser (London, 1865, 8vo); *Designs for Lace-making*, Mrs. Hailstone (1870, fol.); V. Touche, *The Handbook of Point Lace* (1871); *Guipure d'Art*, Madame Goubaud (1870). JANET TUCKEY.

Lace-Bark Tree, the *Lagetta lintearia*, a large tree of the order Thymelaceæ, growing in the West Indies. Its white inner bark, after maceration in fresh water, is stretched out into a material curiously resembling coarse lace.

Lacedæmon. See LACONIA and SPARTA.

Lacedo'nia [Lat. *Aquilonia*], town of Southern Italy, in the province of Avellino. This town is beautifully situated, and is of much historical interest. Like so many other places in Italy, its neighborhood abounds in Roman antiquities. The cathedral was originally a temple of Castor and Pollux. Pop. in 1874, 6132.

Lacépède, de (BERNARD GERMAIN ÉTIENNE DE LA VILLE-SUR-ILLON), COUNT, b. at Agen Dec. 26, 1756; early showed great fondness for music and for physics and natural science; went to Paris in 1776 under the patronage of Buffon and the musician Gluck; became sub-demonstrator in the Royal Cabinet 1785; member of the Institute and professor of herpetology at the Museum of Natural History 1796; president of the senate 1801; was grand chancellor of the Legion of Honor 1803–14; re-entered the chamber of peers in 1819; d. at Épinay Oct. 6, 1825. His earlier works on science and music are unimportant; his best works are *Histoire naturelle des quadrupèdes ovipares et des serpents* (1788), *Histoire naturelle des reptiles* (1789), *Histoire naturelle des poissons* (1798–1803), *Histoire naturelle des cétacés* (1804).

La'ceyville, post-v. of Braintrim tp., Wyoming co., Pa., on the E. branch of the Susquehanna River and on the Lehigh Valley R. R., 23 miles N. W. of Tunkhannock.

Lachaise' (FRANÇOIS D'AIX), b. Aug. 25, 1624, at the Château of Aix, France. He was grand-nephew of the celebrated Father Coton, confessor of Louis XIII. and of Henry IV. after the latter's abjuration. Lachaise had therefore rapidly risen to be "provincial"—that is, a high functionary of the Jesuitical order. In 1675 he became confessor of Louis XIV., tolerated the many mistresses of this king, was concerned in the Revocation of the Edict of Nantes, in the persecution of Protestantism, and of Fénelon and other liberal prelates of the Gallican Church. Louis XIV. caused to be built for Father Lachaise a splendid mansion in one of the eastern suburbs of Paris. In 1804 the grounds were chosen as a fit place for the largest cemetery of Paris, which is known as the "Cimetière du Père Lachaise." D. Jan. 20, 1709. He wrote in Latin a book on philosophy, *Peripateticæ quadruplis philosophiæ placita rationalis, naturalis, supernaturalis et moralis*, being an abstract of a course of lectures, and some academical essays. FÉLIX AUCAIGNE.

Lachambeaudie' (PIERRE), b. at Sarlat, department of Dordogne, in 1806, would have not been much known if he had not been mixed up, though in a quite secondary degree, with revolutionary movements in France, and if his fables had not reflected some of the socialistic ideas current in 1830 and 1848. Lachambeaudie only received a primary instruction; he joined the St. Simonians, and, thanks to their chief, M. Enfantin, he was able to publish his *Popular Fables* in 1839. Though very liberal in their teachings, their morality was so appropriate and so *moral* that they received the annual prize of the French Academy. In 1848, during the Revolution, and at the time of the *coup d'état* of Dec., 1851, Lachambeaudie associated with Esquiros, Blanqui, and other ultra radicals. In June, 1848, after the insurrection of June, he was released through the efforts of Béranger; and in 1851 he was prevented from being transported to Cayenne, thanks to the duke of Persigny, who had been twenty years ago his friend and co-writer for a poetical review then published (1829) in the department of Loire. Lachambeaudie was, for the French generation under Louis Philippe, the republic of 1848, and the empire, what Béranger had been for Frenchmen under the Restoration. FÉLIX AUCAIGNE.

Lach'es [Old Fr. *lachesse*, from Fr. *lache*, "negligence;" Lat. *laxus*, "loose," "lax"], a term employed in law to denote negligence, remissness, or unreasonable delay in enforcing or attempting to enforce a legal or equitable right or claim. It is most commonly used with reference to claims arising in a court of equity which are not affected by an express statute of limitations. (See LIMITATIONS, STATUTE OF.) It is a rule of equity not to encourage stale demands or give relief to parties who sleep upon their rights. A claim must be asserted with reasonable diligence, in order that the interests of other parties may not be unduly prejudiced by the difficulty of procuring the necessary evidence after a long interval has elapsed. In the case of legal titles and legal demands, however, courts of equity usually act in obedience to the statute of limitations, in conformity with the practice of courts of law. In some States, also, there are special statutes of limitations applying to equitable causes of action. But where this is not the case, and a demand is strictly of an equitable character, the statute of limitations applying to legal actions is not an absolute bar in equity as at law, though it is frequently followed in analogous cases. But where the analogies of the law do not apply, a court of equity is governed by its own inherent doctrine of discountenancing stale demands. What shall be deemed an unreasonable delay is not determined by any precise and definite rule, but must depend upon the circumstances of each particular case. A long delay which would ordinarily be deemed laches may be excused when a party is in ignorance of his rights, without any fault or remissness on his part; when a transaction is involved in obscurity, so that information in regard to it cannot be obtained; when he was under duress or undue influence which prevented him from asserting his rights; or where he labors under a legal disability, as insanity, coverture, infancy, and the like. Poverty or pecuniary embarrassment, however, is not a sufficient excuse for delay. (See Kerr on *Fraud and Mistake*, pp. 303–312, Am. ed.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lach'esis [Gr., the name of one of the Fates], the *Craspedocephalus Lachesis* or *Lachesis mutus*, one of the most dreaded of the venomous serpents of tropical America, called bushmaster, curucucu, and couanacouchi. It has been known to exceed twenty feet in length, is partly arboreal in its habits, and often attacks man with the greatest fury. Its poison is very deadly, and when greatly diluted constitutes a favorite remedy with homœopathists.

Lachine' [Fr. for "China," so named by the early explorers, who hoped to reach China by passing up the St. Lawrence], a v. of Jacques Cartier co., Quebec, Canada, on Montreal Island. A ship-canal 8½ miles long extends from Lachine to Montreal harbor, and surmounts the Lachine Rapids. It is connected by rail with Montreal, 9 miles distant, and by steam-ferry with Caughnawaga across the river. It is a thriving place. Pop. 1696.

La'chish, a city in Southern Palestine, among the mountains separating the territory of Judah from the *Shephelah*, or plain of the Philistines. It was an almost impregnable hill-fortress, as its name probably signified, but was taken and partially destroyed by Joshua and fortified by Rehoboam. It resisted for a long time the assaults of the Assyrian army under Sennacherib, and the biblical accounts afford no indication that it was taken; but among the cuneiform inscriptions discovered by Layard at Kouyunjik several were carved on large slabs representing the siege and capture of *Lakhisha*, giving a ground-plan of the fortress, and a picture of a procession of Jewish captives from the same place appearing before Sennacherib. This interesting discovery has given rise to much discussion. Lachish was afterwards taken by Nebuchadnezzar at the downfall of the kingdom of Judah. Its ruins have been identified by Raumur, Van de Velde, and Thomson with the modern village *Um-Lakis*, on a round knoll covered with heaps of stones, on the left of the road between Gaza and Hebron. Other geographers, however, question the correctness of this identification.

Lach'lan, a river of East Australia, rises in New South Wales, joins the Murrumbidgee in 34° 30′ S. lat. and 144° 10′ E. lon., and after 400 miles enters the Murray.

Lach'mann (KARL), D. D., LL.D., b. at Brunswick, Germany, Mar. 4, 1793; studied at the universities of Leipsic and Göttingen; founded at the latter a philological society in union with Bunsen and Schulze; entered the army as a volunteer in 1813, and served in the Waterloo campaign; became professor extraordinary at Königsberg in 1818 and at Berlin in 1825; ordinary professor in 1828, and member of the Academy of Sciences in 1830, remaining at Berlin until his death, Mar. 13, 1851. His life was chiefly devoted to the preparation of critical editions of the classics, of the New Testament, and of the masterpieces of early German literature. He published an essay *On the Primitive Form of the Poem of the Niebelungen Noth* (1816), translations of Shakspeare's *Sonnets* and *Macbeth* (1820), critical editions of the *Niebelungenlied* (1826), *Walter von der Vogelweide* (1827), *Catullus, Tibullus, and Propertius* (1829), *Wolfram von Eschenbach* (1833), *Ulrich von Lichtenstein* (1841), *Caius* (1841), *Labrius and Avianus* (1845), *Studies on the Iliad* (1847), *Lucretius* (1850), and edited Lessing's complete works (13 vols., 1838–40), besides numerous studies upon classical and early German philology and literature. His great work, however, was his edition of the Greek text of the New Testament (1831), the first which had any pretensions to be called critical, and which is not yet entirely superseded by the labors of Tischendorf. His readings were taken from a limited number of the earliest codices, from the citations of Origen, Irenæus, Cyprian, and the earliest Fathers, from the fragments of the Latin versions previous to the Vulgate text, which was reprinted at the foot of the page. (See his *Biography*, by Herz, Berlin, 1851.)

Lach'rymæ Chris'ti [Lat., "Christ's tears"], a sweet but very spirited wine of the group called muscatel, has a fine bouquet, is produced chiefly upon Monte Somma, near Naples, in Italy. It is white (sometimes red), and of medium alcoholic strength. Large quantities of wine from the Levant and Southern Italy are sold as Lachrymæ Christi.

Lach'rymal Gland, or **Tear Gland**, the organ in man and other animals which produces tears. In man it is of the shape and size of an almond, and is found above the outer angle of the eye. Its secretion is discharged by some seven ducts into the space between the eyeball and the lid. At the inner angle of the eye may be seen two small apertures through which the supply of lachrymal secretion is taken up by the lachrymal canals, passed into the lachrymal sac, and thence, through the nasal duct, into the nose.

Lach'rymatory [Lat. *lacryma*, a "tear"], a popular name for the supposed "tear-bottles" of the ancients, small glass or earthen vessels found in ancient Greek and Roman tombs. That they ever really contained the tears of mourning friends is probably fabulous.

Lack, tp. of Juniata co., Pa. Pop. 1290.

Lackawan'na, or **Lackawannock**, a small river in Pennsylvania, rises in Susquehanna co., near the N. E. corner of the State, flows S. W. through Luzerne co., and enters the Susquehanna River at Pittston. Its lower course for 30 miles passes through the largest and most abundant anthracite coal-basin in America, to which it gives name, though it is sometimes called the Wyoming basin. The chief emporium of this basin is Scranton, formerly called Lackawanna. A large portion of the anthracite coal used in New York City and in the New England States is furnished by this coal-field, which has an area of 198 square miles, and a thickness of from 5 to 14 feet at a depth varying from 100 to 400 feet beneath the surface. The annual production, including the Wyoming Valley as a part of the same field, is over 10,000,000 tons, and furnishes constant freight to several railways, with very numerous branch lines. Next to Scranton, Wilkesbarre, Pittston, and Carbondale are the chief seats of the mining industry.

Lackawanna, post-v. and tp. of Luzerne co., Pa., 3 miles S. W. of Hyde Park. Pop. 5133.

Lackawan'nock, former tp. of Mercer co., Pa., now called West Lackawannock. Pop. 1079.

Lackawax'en, post-v. and tp. of Pike co., Pa., on the Erie R. R., at the junction of the Honesdale branch, and at the confluence of the Lackawanna River with the Delaware, here crossed by railroad and canal, the latter being carried over by a suspension aqueduct. Pop. 1757.

Laclede' (formerly KINDERHOOK), county of S. W. Central Missouri. Area, about 690 square miles. It is a rough, broken region, with fertile valleys and deposits of iron and lead. It is traversed by the Atlantic and Pacific R. R. Tobacco, cattle, and grain are leading products. Cap. Lebanon. Pop. 9380.

Laclede, post-v. and tp. of Fayette co., Ill., on the Illinois Central R. R., 34 miles N. E. of Centralia. Pop. of v. 159; of tp. 1242.

Laclede, post-v. of Linn co., Mo., at the junction of the Hannibal and St. Joseph and the Burlington and Southwestern R. Rs., 97 miles E. of St. Joseph, has 2 churches, 3 hotels, 1 flouring-mill, a fine brick school-house, 1 weekly newspaper, and 20 stores, is surrounded by a rich farming country, and ships large quantities of grain. Coal is abundant in the vicinity. Pop. about 1000.

W. J. PORTER, FOR ED. "LACLEDE REPUBLICAN."

Laclède (PIERRE LIGUESTE), the founder of St. Louis, Mo., a native of France, was in 1762 a resident of New Orleans, when he established the Louisiana Fur Company under a charter from the director-general of the colony,

giving it the exclusive right of trading with the Indians on the Missouri. The pioneers under his direction made the first settlement on the site of St. Louis Feb. 15, 1764, erecting a large house and four stores, and named the place in honor of Louis XV., then king of France.

Lacmus. See LITMUS.

La'con, post-v. and tp., cap. of Marshall co., Ill., on the Illinois River and a branch of the Chicago and St. Louis R. R., 130 miles S. W. of Chicago, has 7 churches, 1 bank, 1 weekly newspaper, a court-house and jail, a shawl-mill, 3 flouring-mills, a distillery, and several hotels, stores, and shops, and is the head of steam-navigation on Illinois River, shipping large quantities of grain. Pop. of v. 2105; of tp. 2440. SPENCER ELLSWORTH, ED. "HOME JOURNAL."

Laco'na, post-v. of Sandy Creek tp., Oswego co., N. Y., near Lake Ontario, is the N. terminus of the Syracuse Northern R. R., and is on the Rome Watertown and Ogdensburg R. R.

Laco'nia, or **Lacedæmon,** the southernmost division of the ancient Peloponnesus, was bounded W. by Messenia, N. by Arcadia and Argolis, and E. and S. by the Argolian Gulf, the Myrtoan Sea, the Laconian and Messenian Gulfs. To the S. it ended in the two promontories of Tænarus and Malea, the present Cape Matapan and Cape Malio. To the Laconian Gulf flowed the Eurotas, on whose banks was the capital of Laconia, SPARTA (which see).

Laconia, post-v. and tp., cap. of Belknap co., N. H. (partly in Gilford tp.), 28 miles N. of Concord and 102 N. of Boston, upon the Winnipiseogee River, between the lake of that name and Grand Bay, and on the Boston Concord and Montreal R. R., is a flourishing manufacturing village, having 7 hosiery-mills, 1 flannel-mill, an extensive car manufactory, 1 weekly newspaper, 6 churches, 2 hotels, 3 banks, numerous stores, and various minor industries. The views of lake and mountains are picturesque. Pop. of tp. 2309. O. A. J. VAUGHAN, ED. "DEMOCRAT."

Lacordaire' (JEAN BAPTISTE HENRI), b. May 12, 1802, at Recey-sur-Ource, in the department of Côte d'Or; studied law at Dijon, and went in 1821 to Paris, where a brilliant career seemed to open for him as an advocate. But suddenly he entered the seminary of St. Sulpice; was ordained a priest in 1827; became preacher at the Collége de Henri IV. in 1830; and founded the journal *L'Avenir* in connection with Lamennais and Montalembert. His standpoint was a most singular combination of ultramontanism in religion and radicalism in politics, and the tone of his sermons and articles was extremely violent. Summoned before the civil court, he was acquitted, but when the pope in 1832 denounced his ideas, he immediately retracted and submitted. In 1835 he began his celebrated *conférences* in Notre Dame, which drew immense audiences, and in 1842 he entered the order of the Dominicans. In 1848 he was a member of the Constituent Assembly, though without exercising any influence, and after 1853—in which year he was ordered to leave Paris on account of one of his ultramontane-radical sermons—he lived in retirement at Sorèze, where he d. Nov. 22, 1861. Besides his *Conférences de Notre Dame de Paris* (4 vols., 1844–51), he wrote *Vie de St. Dominique* (1840; new ed. 1858), *Lettres à un Jeune Homme* (1858), *Discours sur le Droit et le Devoir de la Propriété* (1858), etc.—His brother, JEAN THÉODORE, b. at Recey-sur-Ource Feb. 1, 1801; studied law at Dijon; afterwards devoted himself to natural science; made four voyages to South America between 1825 and 1832, exploring Brazil, the Argentine Republic, and Chili; travelled in Senegal; became editor of the *Temps* (1832), in 1835 professor of zoology, and in 1838 of comparative anatomy in the University of Liége, Belgium; wrote several valuable works on natural history and entomology, and d. at Liége Aug. 31, 1870.

Lac'quer [from LAC (which see)], a varnish, transparent or colored, for covering wood, papier-maché, leather, or metal. It is of many kinds. In most of them lac is an important ingredient. Annotto and dragon's blood give red tints, and gamboge, aloes, etc., yellow. Lacquers, well made and skilfully applied, will take a high polish and withstand hot and cold water, and even alcohol. The Japanese and Chinese excel in the art.

Lac qui Parle, county of Minnesota, bounded W. by Dakota and N. E. by Minnesota River. It is traversed by Lac qui Parle and numerous other streams, and is adapted to grain-culture. Cap. Lac qui Parle. Pop. 145; it has greatly increased since the census.

Lac qui Parle, post-v. and tp., cap. of Lac qui Parle co., Minn., on the N. side of the Intpah or Lac qui Parle River, about 2 miles above its confluence with the Minnesota. The first house was built in 1870; it now (1875) has a newspaper and all the usual accompaniments of a growing town. It is on the line of the projected Hastings and Dakota R. R., midway between the St. Paul and Pacific R. R. on the N., and the Winona and St. Peter on the S. It has a large school, 1 hotel, and 1 weekly newspaper. Pop. of tp. 307. C. J. COGHLAN, ED. "PRESS."

La Crescent', post-v. and tp. of Houston co., Minn., on the Mississippi River, opposite La Crosse, Wis. It is the E. terminus of the Southern Minnesota R. R. Pop. of v. 380; of tp. 961.

Lacretelle' (PIERRE LOUIS), b. at Metz in 1751; practised law, first at Nancy, and then, from 1778, at Paris, where he lived in intimate connection with Malesherbes and Laharpe. Under the Revolution took part, though with great moderation and cautiousness, in all the principal political movements, but after 1804 lived in retirement. Under the Restoration belonged to the opposition, and his *Mercure de France* and *Minerve Français*, published in connection with Ségur and Benjamin Constant, were successively suppressed. D. Sept. 5, 1824. Besides a number of juridical and political works, he wrote *Portraits et Tableaux*, *Études sur la Révolution Française*, and *Mes Soirées à Malesherbes*, which are of great interest to the student of the history of that period.

Lacretelle, de (JEAN CHARLES DOMINIQUE), b. at Metz, France, Sept. 3, 1766; studied at the College of Nancy; was admitted to the bar at the age of eighteen; wrote at Nancy a tragedy and several academic essays; went to Paris in 1787; assisted his brother Pierre in writing for the *Encyclopédie Méthodique*; became an editor of the *Journal des Débats*, for which he reported the sessions of the National Assembly; became in 1790 secretary to the duc de Rochefoucauld-Liancourt, with whom he was associated in the project of favoring the king's escape; made himself popular as an advocate of the constitution at the Club des Feuillants; wrote the most extensively circulated account of the execution of Louis XVI.; was associated with André Chênier in editing the *Journal de Paris*; exerted himself in speeches and with the pen to save the Girondins from the popular wrath; was accused of being a royalist, arrested after a long residence at Epinay, and kept in prison two years (1797–99); became professor of history in Paris 1809, imperial censor 1810, was admitted to the Academy in 1811, and ennobled by Louis XVIII. in 1822. He remained professor of history for thirty-six years, and wrote eight valuable histories, covering all the period from the outbreak of the Revolution to 1846, and several earlier periods. D. at Mâcon Mar. 26, 1855.

La Croix, tp. of Emmet co., Mich., on Lake Michigan. Pop. 663.

Lacroix' (PAUL), b. at Paris, France, Feb. 27, 1806; was educated at the Collége Bourbon, and has written, under the pseudonym of "Le bibliophile Jacob," a vast number of romances and works of curious learning about the books, the history, manners, and customs of the Middle Ages; distinguished himself by his efforts to improve the Bibliothèque du Roi; was appointed in 1855 conservateur of the Arsenal Library, and has edited since 1854 the *Revue Universelle des Arts*. His best works are probably the *Arts au moyen âge et à l'époque de la Renaissance* (1868), *Mœurs, usages et costumes au moyen âge*, etc., with 441 plates (1871), and *La vie militaire et la vie religieuse au moyen âge* (1872), which have all been translated into English.—His wife, APOLLINE BIFFE, has written some popular novels; and his brother, JULES, b. in Paris May 7, 1809, has had success as a writer of dramas and as a translator, imitator, and critic of Shakspeare. His *Œdipus Rex*, a translation from Sophocles, was successfully produced on the stage in 1858, and received in 1862 from the French Academy a grand prix of 10,000 francs.

Lacroix (SILVESTRE FRANÇOIS), b. at Paris in 1765; became professor of mathematics at the marine school of Rochefort in 1782, held subsequently the same position at the normal school, the École Polytechnique, Sorbonne, and Collége de France, and d. at Paris May 25, 1843. His noble character, instructive lectures, and very useful handbooks, besides *Traité du Calcul différentiel et integral*, made him quite a popular man, and on the re-establishment of the Academy under Napoleon he was one of the very few of the original members living.

La Crosse, the "national sport" of Canada, a field-game of Indian origin. The players have a *crosse*—a hickory rod some six feet long, bent in the shape of a bishop's pastoral crook; across the crooked part leather thongs are stretched in a network. There is a rubber ball some three inches in diameter. The object of each of the two parties in the game is to send the ball over the goal of the other party. The ball is not thrown, but carried on the *crosse*. It may, if necessary, be thrown from one player to another, but is not to be touched by the hand.

La Crosse, county in the W. of Wisconsin, bounded

on the W. by the Mississippi River. Area, 450 square miles. It is diversified, generally fertile, and is traversed by the Milwaukee and St. Paul R. R. (La Crosse division). Cattle, grain, and wool are leading products. Cap. La Crosse. Pop. 20,297.

La Crosse, post-v. of Izard co., Ark., 30 miles N. W. of Batesville, has one weekly newspaper.

La Crosse, city and cap. of La Crosse co., Wis., 190 miles W. of Milwaukee, is finely located on the E. bank of the Mississippi, at the mouth of the Black River from the N. and the La Crosse River from the E., the former tributary having an annual lumber product of 250,000,000 feet, and the latter draining one of the finest farming valleys of the State. Opposite in Minnesota is the Root River Valley, a large and rich agricultural section, which is pierced for 200 miles by the Southern Minnesota R. R., of which La Crosse is the eastern terminus. The main commercial support of La Crosse is derived from the Black River lumber and wholesale trade with Southern Minnesota. The Chicago Milwaukee and St. Paul and the Chicago Dubuque and Minnesota R. Rs. connect with the East, North, and South. La Crosse has 15 church buildings (worth $300,000), 3 banks, 2 daily, 5 weekly (1 German and 1 Norwegian), and 3 monthly newspapers, 3 school-buildings worth $15,000 each, and 4 others of wood, a library association with 2500 volumes, a fine court-house (cost $40,000), where the U. S. courts for the western district of Wisconsin meet twice a year, an opera-house, a custom-house with the largest registry of tonnage between St. Louis and St. Paul, 9 steam saw-mills, 2 steam flouring-mills, an extensive machine-shop (cost $60,000) and several smaller ones, 3 agricultural implement factories, the largest yard above St. Louis for building steamboats, 5 large breweries, and 20 wholesale firms. The assessed valuation is $3,000,000. Pop. in 1870, 7785; by State census of 1875, 11,012.

E. B. Usher, Ed. "Liberal Democrat."

Lac Sulphu'ris (*milk of sulphur*), finely divided sulphur, precipitated by acids from solutions of alkaline and alkaline-earthy persulphides. (See Sulphur.)

Lactan'tius (Firmianus), one of the Christian Fathers, b. about the middle of the third century, either at Firmum, Italy, or in Africa; studied rhetoric at Sicca in Proconsular Africa; became a distinguished orator, and one of the most learned men of his time. At the invitation of the emperor Diocletian he settled at Nicomedia as professor of Latin eloquence (301), became a Christian, and having been a witness of the persecutions of the times, wrote his works in defence of the new religion. He was called by the emperor Constantius to Treves as tutor to his son Crispus, and is supposed to have d. there about 325. Lactantius was called the "Christian Cicero;" he wrote an important work, *Divinarum Institutionum, libri VII.*, and smaller treatises, *De Ira Dei* and *De Opificio Dei, vel Formatione Hominis.* The famous work on the death of persecutors (*De Mortibus Persecutorum*), attributed in the only existing manuscript to a Lucius Cœlius or Cæcilius Lactantius, is now generally thought to belong to a later date, perhaps to another Lactantius, as the best authorities never give those names to Firmianus. The first edition of Lactantius was printed at the monastery of Subiaco in 1465, being one of the first specimens of the typographical art. The best editions are those of Le Brun and Lenglet du Fresnoy (2 vols., 4to, Paris, 1748), and by Fritzsche (Leipsic, 1842–44, 2 parts). Two other editions were printed at Rome in 1468 and 1470.

Lac'teals [Lat. *lac, lactis,* "milk"], the lymphatic vessels of the small intestine, a part of the general absorbent or lymphatic system, pervading all parts of the body, distinguished as lacteals, since they imbibe from the glandular mucous surface of the small intestine, following the ingestion of fatty food, a milky, white, opaque fluid, "the chyle." The chyle is fat digested by the pancreatic and biliary fluids, reduced to an emulsion, molecular particles of fatty matter suspended in an albuminoid liquid. The lacteals take up the chyle, traverse the mesentery, and terminate, by two or three small trunks, in the thoracic duct. Here the chyle mingles with the more watery, opalescent lymph, and with it passes up to enter the left subclavian vein, and becomes a nutritive element of the blood. (See Lymphatics.)

E. Darwin Hudson, Jr.

Lac'tic Acid [Ger. *Milchsäure;* Fr. *acide lactique*], *acide nanceique* of Braconnot; the acid which is formed in milk when it turns sour, and which exists therefore in buttermilk. It is $C_3H_6O_3$, and is formed from lactose or milk-sugar, as follows:

$$C_{12}H_{20}O_{10} + 2H_2O = 4C_3H_6O_3.$$

The souring of milk is not therefore a process of oxidation, but, like the vinous fermentation of sucrose or glucose, a molecular breaking up into simpler molecular structures; lactic acid, like alcohol in the other case, being an intermediate product of decay or dissolution. Sucrose undergoes the lactic fermentation like lactose, under the influence or impulse of the same special ferments.

The names of Scheele, Braconnot, Berzelius, Liebig, and other great chemists are associated in the early history of the discovery of lactic acid and the extended controversies that grew out of it. Braconnot found it in sour beer, sour meal, sour beet-juice, fermented rice, and many other places, and, supposing it new, called it *nanceic acid*, after his birthplace, Nancy. Berzelius appears first to have announced that it occurs as a normal constituent of *flesh*, deducing important physiological conclusions. Liebig denied its occurrence in flesh, but afterwards found therein *sarcolactic acid*, an isomere or metamere of lactic acid, which Strecker found to be convertible into ordinary lactic acid by heat. Mitscherlich first prepared *pure* lactic acid by decomposing lactate of zinc with sulphuretted hydrogen. A colorless syrupy liquid; deliquescent; does not freeze at 12° below zero F.; density = 1.215. It appears strangely like *glycerine*, $C_3H_8O_3$, in its properties, though intensely sour, while the latter is intensely sweet.

Lactic acid has been produced by many artificial chemical transformations; probably the most interesting being that of Lippmann, who formed it by synthesis, by combining olefiant gas and oxychloride of carbon, which gives *paralactylic chloride:*

$$COCl_2 + C_2H_4 = C_3H_4Cl_2O.$$

This, with alkalies, gives salts of paralactic or Liebig's sarcolactic acid, which then, by heat, as aforesaid, will give us the ordinary lactic acid of buttermilk.

Several methods of manufacture are given. One is to mix 6 pounds of cane-sugar with one half ounce of tartaric acid (to convert it into glucose), and after forty-eight hours to add 3 pounds of prepared chalk and 4 ounces of *rotten curd*, which latter ferments the glucose to lactic acid. Stir the mass daily in a warm place (90° F.). In a week or so it becomes a paste of lactate of lime, which is dissolved by boiling in water with some hydrate of lime. The lactate must be evaporated, pressed, washed with cold water, and pressed repeatedly for purification, then decomposed by sulphuric acid. A crude lactic acid thus cheaply prepared might probably be used as a condiment or ingredient of food, confectionery, etc. To get it pure, it is further converted into zinc lactate, which is then decomposed by sulphuretted hydrogen. Lactic acid has a great solvent power over *phosphate of lime*, and to this some attribute its known medicinal virtues.

The lactic fermentation of sugars is referred by Pasteur and others to the action of the common yeast-fungus *Penicillium glaucum*, as the alcoholic fermentation to that of *Torulæ*. It is said that filtering common *brewer's yeast* through paper will separate it into two portions; that which passes through containing the smaller *Penicillium* cells, and therefore inciting lactic fermentation, while the larger cells of *Torula* will remain on the filter, which will therefore cause a saccharine liquid to enter into vinous fermentation. (See Fermentation.)

Lactates.—Some of the salts of lactic acid are used in medicine.

Henry Wurtz.

Lactin and **Lactose.** See Milk-sugar.

Lactom'eter [Lat. *lac*, "milk," and Gr. *μέτρον*, "measure"], a graduated cylinder for roughly estimating the amount of cream in milk. The term is often applied to the *galacometer*, which is a hydrometer for showing the specific gravity of milk. (See Milk.)

Lactuca'rium [Lat. *lactuca*, "lettuce"], a drug consisting of the dried milky juice from the mature stem of different species of *Lactuca* or lettuce. It is in reddish-brown lumps, masses, or cakes, of an opium-like smell and bitter taste. It was introduced into medicine in 1799 as having the property of allaying pain and procuring sleep, like opium, but its powers are exceedingly feeble, and it cannot be relied upon.

Edward Curtis.

Lacustrine Villages, or **Lake Dwellings.** See Palefits and Pre-historic Man.

La'cy (Luis), b. in San Roque, Spain, in 1772; distinguished himself in the war of independence against Napoleon, in which he was one of the earliest leaders, with the rank of lieutenant-general. On the establishment of absolutism by Ferdinand VII., Lacy was at the head of a conspiracy for the restoration of the constitution, which was to have broken out Apr. 5, 1817, in Catalonia, but the plot having become known, he was seized, tried by court-martial, and condemned to death, the sentence being secretly pronounced and executed at the castle of Bellver, Majorca, some time in the same month.

La Cygne, post-v., cap. of Linn co., Kan., on the Missouri River Fort Scott and Gulf R. R., 63 miles S. of Kan-

sas City, has a fine public school, 3 churches, 2 banks, 2 hotels, 1 weekly newspaper, and superior water-power, making it a desirable location for manufactures. There are 4 lodges, 1 grange society, a public library, and a number of grocery, hardware, and drug stores. Town-site was laid out in 1870. Pop. about 1400.

ALBERT GORE, ED. "JOURNAL."

Ladakh′, or **Middle Thibet,** an independent territory in Central Asia, extending from 32° to 36° N. lat., and from 76° to 79° E. lon., between Great Thibet in E. and Little Thibet in W., and separated N. from Toorkistan by the Karakorum, S. from Cashmere by the Himalaya. Area, estimated at 30,000 square miles. Pop. 150,000. It is a wild mountainous region along the upper course of the Indus, mostly of a sterile soil and with a severe climate. But it is well cultivated, and its inhabitants, who are Mongolians, professing a kind of Lamaism and governed by a theocratical despotism, raise large crops of wheat, barley, and buckwheat, besides rearing immense herds of sheep, which supply most of the wool used in Cashmere. The mountains contain iron, copper, and lead, and a very important transit-trade between China and Hindostan is carried on by mules and sheep. Cap. LEH (which see).

Ladanum. See LABDANUM.

Ladd (WILLIAM), b. at Exeter, N. H., May 10, 1778; graduated at Harvard College in 1797; was for some years a captain in the merchant marine, and was one of the principal founders of the American Peace Society, of which he was for many years the president. He edited in behalf of that society the *Friend of Peace,* and afterwards the *Harbinger of Peace,* and published many occasional writings upon the same topic, of which the most important was *An Essay on a Congress of Nations* (1840). D. at Portsmouth Apr. 9, 1841.

Ladi′ga, post-v. and tp. of Calhoun co., Ala., on the Selma Rome and Dalton R. R., 35 miles S. W. of Rome, Ga. Pop. 1665.

Lading, Bill of. See BILL OF LADING, by PROF. T. W. DWIGHT, LL.D.

La′dislas, or **Lancelot,** king of Naples, surnamed THE LIBERAL and THE VICTORIOUS, b. about 1375; succeeded his father, Charles III., under the regency of his mother Margaret, in 1386; was driven from Naples in July, 1387, by his competitor, Louis II. of Anjou, whom Pope Clement VII. (of Avignon) had invested with the crown; was reinstated by Otto of Brunswick the same year; repulsed two invasions made by Pope Urban VI. in 1388; was crowned at Gaeta May 29, 1390, by a legate of the new pope, Boniface IX.; maintained a war for several years in the heart of his kingdom against his rival, Louis II., who was in possession of the capital; recovered that city July 9, 1399; was a candidate for the throne of Hungary, and actually crowned Aug. 5, 1403, but soon withdrew his claims; attempted to seize Rome in Aug., 1405; was excommunicated and deprived of his kingdom by the pope June 18, 1406; entered Rome in 1408, retiring in a few months; after a long series of alternations of fortune again took by surprise and plundered that city June 8, 1413, and d. at Naples Aug. 16, 1414. He was perhaps the earliest modern Italian ruler who conceived the project of the unity of Italy; was also a claimant of the throne of Provence and a candidate for the imperial crown of Germany.

Ladislas I. (LOKTEK), king of Poland, b. in 1260; succeeded to the dukedom of Poland in 1296; was deposed in 1300, in which year he attended the jubilee at Rome; was restored in 1304; carried on a long war with the Teutonic Knights; assumed the title of king of Poland in 1320 by permission of Pope John XXII.; defeated the Teutonic Knights at Plowce Sept. 27, 1321, and d. at Cracow Mar. 10, 1333.

Ladislas II., king of Poland. See JAGELLON.

Ladislas III., king of Poland. See LADISLAS V., king of Hungary.

Ladislas IV., king of Poland, b. at Cracow June 9, 1595; succeeded his father, Sigismund III., Nov. 13, 1632; compelled the Russians to raise the siege of Smolensk (1632); defeated the Turks in Moldavia (1634), and the Tartars of the Crimea; made a truce for twenty-six years with Sweden (1635); began a war with the Cossacks (1637); married a daughter of the German emperor Ferdinand (1637), and d. in Lithuania May 19, 1648. He was an able and energetic prince, sprung in the female line from the Jagellons, and had such a reputation for valor that in his early youth a party among the Russians wished to make him their czar.

Ladislas, or **Ladislaus,** the name of seven kings of Hungary: LADISLAS I., THE SAINT, called also LANCELOT, b. about 1041; succeeded his brother, Geysa I., in 1075; was victorious over the Wallachians, Bohemians, Russians, Cumans, and Poles; conquered Croatia and Dalmatia (1087) for the crown of Hungary; promulgated a new code of laws at the diet of Zablon (1092); stimulated commerce; aided Boleslas II. in obtaining the throne of Poland; projected the delivery of the Holy Land from the Moslems; erected many churches and monasteries, and favored the clergy in their efforts to civilize the Hungarians. D. July 29, 1095. He was canonized by Pope Celestine III. in 1192.—LADISLAS II., b. about 1134; crowned July 15, 1161, and d. Jan. 14, 1162.—LADISLAS III., b. about 1185; was elected in 1204 to succeed his father, Emerich, but d. May 7, 1205.—LADISLAS IV., surnamed THE CUMAN, b. about 1250; succeeded his father, Stephen IV., in 1272; made war upon and at first defeated the Cumans (1282), but the latter, reinforced by vast hordes of Nogai Tartars or Mongols from the plains N. E. of the Black Sea (the empire of Kiptchak), overran and ravaged all Hungary (1285). He then made terms with the Cumans, adopted some of their customs, repudiated his wife, and married one of their princesses, whence his surname, but was finally assassinated by them July 19, 1290.—LADISLAS V. (III. of Poland), b. Oct. 31, 1424; succeeded his father, Ladislas II. (Jagellon), as king of Poland in 1434; was elected king of Hungary in 1440 by the influence of the famous John Huniades, vaivode of Transylvania, by whose aid he defeated the invading Turks in two great battles (1442–43); made a ten years' truce with the sultan Amurath II. at Szegedin in June, 1444, acquiring thereby the sovereignty of Wallachia, but at the instigation of Cardinal Julian obtained a papal dispensation from his oath, and invaded Bulgaria, where he was defeated and killed in battle, with a great part of the Polish nobility, at Varna, Nov. 10, 1444.—LADISLAS VI., THE POSTHUMOUS, son of Albert of Austria, emperor of Germany and king of Bohemia and Hungary, b. Feb. 22, 1440, several months after his father's death, when Ladislas V. had already been placed upon the throne; was elected king in 1445; assumed the government in 1451; was crowned king of Bohemia Oct. 28, 1453, and d. at Prague Nov. 23, 1457. He was cowardly and cruel, and persecuted the followers of John Huss.—LADISLAS VII., eldest son of Casimir IV. of Poland, b. about 1456; was designated as his successor by George Podiebrad, king of Bohemia, July 19, 1469; crowned at Prague Aug. 16, 1471; entered Hungary with an army on the death of Mathias Corvinus in 1490; was proclaimed king and crowned Sept. 21; fought against the Turks, and repulsed the army of Bajazet in 1501; made peace at Buda Aug. 20, 1503; permitted the proclamation of a crusade against the Turks in 1514, and d. at Buda Mar. 13, 1516. PORTER C. BLISS.

Ladmirault′, de (RENÉ PAUL), distinguished himself in the war with Germany (1870–71); commanded the 4th corps in the battles of Courcelles, Aug. 14, Vionville, Aug. 16, and Gravelotte, Aug. 18, 1870; on the capitulation of Metz became a prisoner of war, but on his return after the conclusion of peace received, in recognition of his brilliant services, the command of the territorial division of Paris, and was appointed governor of the capital. When in 1873 the arrangement of territorial divisions was abolished, Ladmirault retained his position of military governor of Paris. AUGUST NIEMANN.

La′doga, the largest lake of Europe, comprising an area of 6804 square miles, situated in Russia, between the governments of Viborg, Petersburg, and Olonetz. It receives the water from the lakes of Onega, Saima, and Ilmen, and sends it through the Neva to the Baltic. On account of shallows, sandbanks, and sunken rocks navigation is very dangerous on this lake, and canals have been constructed connecting the Neva with those rivers which flow into the lake, and thereby establishing a water-communication through the Volga between the Baltic and the Caspian Sea.

Ladoga, post-v. of Montgomery co., Ind., on the Louisville New Albany and Chicago R. R., 11 miles S. E. of Crawfordsville, is a thriving mercantile and manufacturing town.

Lado′nia, post-v. of Fannin co., Tex., 13 miles S. E. of Bonham, on N. fork of the Sulphur River. It has 1 weekly newspaper. Pop. 516.

Ladore′, post-v. and tp. of Neosho co., Kan., on the Missouri Kansas and Texas R. R. Pop. 839.

Ladrones′, or **Marianne Islands,** a group of twenty islands in the Pacific Ocean, belonging to Spain, and situated between 13° and 21° N. lat., and between 144° and 146° E. lon. They are of volcanic origin, have a warm but not unhealthy climate, and comprise an area of 1254 square miles of fertile land, but only two of them, Guguan and Rota, are inhabited. They were first discovered by Magelhaens in 1521, and called Las Islas de los

Ladrones (the Thieves' Islands) on account of a strong propensity to theft observed in the natives. In 1667 the Spaniards established a regular settlement on Guguan, and called the islands Marianne Islands, after Queen Maria Anna. At the time of this settlement the islands had about 100,000 inhabitants, who received the settlers well, and made great progress until the Spaniards began to attack their independence, when a war broke out which ended nearly with the extermination of the natives. The present number of inhabitants is not more than 6000, and of these many have been transferred by the Spaniards from Luzon. Principal town, San Ignazio de Agaña, situated on Guguan.

La'dy [Ang.-Sax. *hlafdige*, probably originally meaning "bread-keeper"], a woman of good social standing; a term correlative with *gentleman*. In Great Britain the wife of a nobleman is legally styled "lady," and the title is by courtesy given to daughters of nobles and the wives of knights and baronets. The Virgin Mary is often designated "Our Lady."

La'dy-bird [Ger. *Marienkäfer*, "Mary-bug"], a common name for coleopterous insects of the family Coccinellidæ, of which there are more than 1000 species and many genera. They are extremely useful to farmers, destroying vast numbers of aphides or plant-lice; but are the objects of many popular superstitions, and are by many viewed with a vague and unreasonable dread. They are usually of an elongated hemispherical shape, frequently having bright colors, and are often spotted. The species are quite difficult to distinguish.

Lady Day, the 25th of March, the feast of the Annunciation of the Blessed Virgin Mary. In England it is one of the quarter days upon which rent is usually payable.

Lady's Slipper. See CYPRIPEDIUM.

Læ'laps [Gr. λαίλαψ, a "storm"], a genus of fossil saurians found in the cretaceous strata of various parts of the U. S. The creature was carnivorous, some twenty-five feet in length, and doubtless walked upon its immense hind legs like a bird, for its fore legs were very small. It must have obtained its prey by leaping. *L. aquilunguis* is the largest known species.

Laen'na, tp. of Logan co., Ill., traversed by the Gilman Clinton and Springfield R. R. Pop. 691.

Laennec' (RENÉ THÉODORE HYACINTHE), b. at Quimper, Brittany, Feb. 17, 1781; studied from 1800 medicine in Paris; obtained the degree of M. D. in 1804; became principal physician at the Necker Hospital in 1816, and professor of medicine at the Collége de France in 1822. In 1824 retired, on account of his health, to his native town, where he d. Aug. 13, 1826. Was the inventor of the STETHOSCOPE (which see). Besides articles in different medical journals, he wrote *Traité de l'auscultation médiate et des maladies des poumons et du cœur* (1819).

Læstrygones, the name of a race of giants mentioned by Homer (*Odyssey*, x. 80–132). Homer, however, does not know anything about their abode, as little as about that of the Cyclops and other fabulous nations, but later traditions assigned Leontius in Sicily or Formia in Naples as the homestead of the Læstrygones.

Laet, de (JAN), b. at Antwerp; was in 1633 a director of the Dutch East India Co., and was an intimate friend of Saumaise (Salmasius). Published nearly twenty learned geographical works in Latin, several of which formed part of the miniature series of *Republics* issued by the Elzevirs of Leyden. Maintained a sharp literary controversy with Grotius about the origin of the American Indian tribes (1643–44). His most important works were *Novus Orbis* (folio, Leyden, 1633) and *Historia Naturalis Brasiliæ* (1648). D. about 1649.

Læta're Sunday, Mid-Lent, or **Dominica de Rosa,** the fourth Sunday in Lent, the day on which the pope blesses the GOLDEN ROSE (which see). *Lætare*, "rejoice," is the first word of the introit in the missal for this day (Isa. lxvi. 10). On this day only is the organ played during Lent.

La Farge'ville, post-v. of Orleans tp., Jefferson co., N. Y., on the Chaumont River. It has an academy.

La Fari'na (GIUSEPPE), b. at Messina in 1815; d. in 1863. At the age of eleven he composed a hymn to Italy which excited great admiration. In 1837, after an ineffectual attempt to detach Sicily from the dominion of the Bourbons by heading a popular insurrection, he fled to Tuscany. The following year he was amnestied and returned to Sicily, but after about three years he was once more forced to retire to Tuscany. Here for several years he occupied himself with literary pursuits and in efforts to promote Italian independence. The revolution of 1848 took him back to Sicily; he was elected deputy to the Sicilian Parliament, then appointed commissioner to the courts of Turin, Florence, and Rome, and in August of the same year he became minister of war and of the marine. In the spring of 1849 he took command of the University Legion against the Bourbons, and when the liberal cause was lost he escaped to Paris, where he continued in relations with Daniel Manin and other patriots till 1853. After a few months' stay at Tours he established himself at Turin in 1854. Here he made great efforts to strengthen the political party in favor of a united constitutional monarchy under the house of Savoy. He co-operated with Cavour in the war of 1859, and with Garibaldi in organizing the numerous volunteers. In 1860 he was elected deputy to the Italian Parliament from six districts. Among the many historical works of La Farina, *La Storia d'Italia* may be specially recommended for the warmth and patriotic eloquence with which it is written. Two volumes entitled *L'Epistolario di Giuseppe La Farina* were published at Milan in 1869.

Lafave', tp. of Scott co., Ark. Pop. 175.

La Fayette', county of S. W. Arkansas. Area, 1060 square miles. The soil is generally level and very fertile, but requires drainage. It is partly prairie and partly hardwood timber, and is traversed by the navigable Red River and by the Cairo and Fulton R. R. Cotton and corn are leading products. Cap. Lewisville. Pop. 9139.

Lafayette, county of Florida, bounded on the E. by the navigable Suwanee River, and on the S. W. by the Gulf of Mexico, is extensively covered with forests, and is quite level. Corn is the principal product. Area, 925 square miles. Cap. New Troy. Pop. 1783.

La Fayette, parish of S. Louisiana. Area, 230 square miles. It is level, very fertile, and is traversed by the navigable Vermilion Bayou. Cattle, corn, rice, and cotton are leading products. Cap. Vermilionville. Pop. 10,388.

La Fayette, county of N. Mississippi. Area, 607 square miles. It is generally level and highly productive. Live-stock, maize, and cotton are leading products. It is traversed by the Tallahatchie and Yockeney rivers and the Mississippi Central R. R. Cap. Oxford. Pop. 18,802.

La Fayette, county of W. Missouri, bounded on the N. by the Missouri River. Area, 585 square miles. It is generally level and highly fertile, partly timber and partly prairie. Coal, limestone, and sandstone are found. Cattle, grain, tobacco, and wool are staple products. Flour and lumber are leading manufactures. It is traversed by the Lexington branch of the Missouri Pacific R. R. Cap. Lexington. Pop. 22,623.

La Fayette, county of S. W. Wisconsin. Area, 630 square miles. It is bounded on the S. by Illinois. The surface is diversified, the soil fertile. Cattle, grain, and wool are staple products. Wagons and carriages are leading articles of manufacture. Lead and zinc are found. The county is traversed by the Mineral Point R. R. and the Pecatonica River, which affords good water-power. Cap. Darlington. Pop. 22,659.

La Fayette, post-v. and tp., cap. of Chambers co., Ala., 80 miles N. E. of Montgomery, on the East Alabama and Cincinnati R. R., has 4 churches, 3 hotels, 1 weekly newspaper, a male high school, and a female college. In 1874 it handled 5000 bales of cotton. Pop. of v. 1382; of tp. 1694. W. C. BLEDSOE, ED. "CLIPPER."

Lafayette, tp. of Crawford co., Ark. Pop. 902.

Lafayette, tp. of Ouachita co., Ark. Pop. 1131.

Lafayette, tp. of Scott co., Ark. Pop. 400.

Lafayette, post-v., cap. of Walker co., Ga., 16 miles S. W. of Tunnel Hill, a station on the Western and Atlantic R. R. It is in a beautiful mountain-region. Pop. 251.

Lafayette, tp. of Coles co., Ill. Pop. 1265.

Lafayette, tp. of Ogle co., Ill. Pop. 467.

Lafayette, post-v. of Goshen tp., Stark co., Ill., on the Peoria and Rock Island R. R. Pop. 284.

Lafayette, tp. of Allen co., Ind. Pop. 1471.

Lafayette, tp. of Floyd co., Ind. Pop. 1576.

Lafayette, tp. of Madison co., Ind. Pop. 1452.

Lafayette, tp. of Owen co., Ind. Pop. 1071.

Lafayette, city, cap. of Tippecanoe co., Ind., on the Wabash River and Wabash and Erie Canal, at the intersection of the Louisville New Albany and Chicago and the Toledo Wabash and Western R. Rs., and terminus of the Indianapolis Cincinnati and Lafayette, the Cincinnati Lafayette and Chicago, and W. division of the Lafayette Muncie and Bloomington R. Rs. The E. division of the latter road is graded and ready for equipment. Lafayette originally derived its chief importance from being the head of navigation on the Wabash River, and then received an

impetus which has sustained its growth since the abandonment of the upper Wabash as a channel of commerce. Lafayette has 25 churches, 1 (Sunday) weekly, and 3 daily newspapers, 9 public-school buildings, besides several denominational academies, street railroad, gasworks, paid fire department with fire-alarm telegraph, an elegant opera-house, State agricultural college (Purdee University), and a large number of manufactories of different kinds. There are 5 national, 4 private, and 2 savings banks, with an aggregate capital of nearly $3,000,000. The wholesale trade is heavy, especially in groceries and boots and shoes, while the retail traffic finds abundant supplies in the rich agricultural region of which Lafayette is the centre. The scenery in the vicinity is very beautiful. Pop. 13,506.

S. Vater, Pub. "Daily Journal."

Lafayette, tp. of Allamakee co., Ia. Pop. 1120.

Lafayette, tp. of Bremer co., Ia. Pop. 867.

Lafayette, tp. of Keokuk co., Ia. Pop. 959.

La Fayette, tp. of Story co., Ia. Pop. 401.

Lafayette, a v. of Centre tp., Doniphan co., Kan., on the Missouri River. Pop. 54.

Lafayette, post-v. of Christian co., Ky., 22 miles S. W. of Hopkinsville, the county-seat. Pop. 215.

Lafayette, a v. of Metcalfe co., Ky. Pop. 53.

Lafayette, post-v. and tp. of Gratiot co., Mich., 10 miles E. of Ithaca, the county-seat. Pop. 288.

Lafayette, tp. of Nicollet co., Minn. Pop. 594.

Lafayette, tp. of Clinton co., Mo. Pop. 2007.

Lafayette, tp. of Nemaha co., Neb. Pop. 618.

Lafayette, post-v. and tp. of Sussex co., N. J., on the Sussex R. R. Pop. 884.

Lafayette, post-v. and tp. of Onondaga co., N. Y., on the Syracuse and Binghamton R. R. The township is hilly and fertile, and is in part occupied by the Onondaga Indian Reservation. Pop. of v. 135; of tp. 2233.

Lafayette, a v. of Jackson tp., Allen co., O. (Herring P. O.), on the Pittsburg Fort Wayne and Chicago R. R. Pop. 337.

Lafayette, tp. of Coshocton co., O., traversed by the Pittsburg and Cincinnati R. R. Pop. 920.

Lafayette, post-v. of Deer Creek tp., Madison co., O., 4 miles N. E. of London, the county-seat, and on the National Road. Pop. 143.

Lafayette, a v. (Whittlesey P. O.) and tp. of Medina co., O. Pop. 1109.

Lafayette, post-v. and cap. of Yamhill co., Or., 32 miles S. W. of Portland, on the Yamhill River and near the Oregon Central R. R., has a church, a hotel, a weekly newspaper, an academy, a flouring-mill, 2 drug-stores, and a number of mercantile and manufacturing establishments. It is situated in a fine agricultural district. Pop. about 655.

Dorris & Hembree, Eds. "Courier."

Lafayette, v. and tp. of McKean co., Pa., on a branch of the Buffalo Bradford and Pittsburg R. R. Pop. 591.

Lafayette, a v. (Rossville P. O.) of Fayette co., Tenn., on the Memphis and Ohio R. R.

Lafayette, post-v., cap. of Macon co., Tenn., 22 miles N. of Carthage. Pop. 161.

Lafayette, tp. of Pleasants co., W. Va. Pop. 397.

Lafayette, post-v. and tp. of Chippewa co., Wis., 6 miles N. E. of Eau Claire. Pop. 970.

Lafayette, a v. (Sparta P. O.) and tp. of Monroe co., Wis., on the La Crosse division of the Milwaukee and St. Paul R. R. Pop. 492.

La Fayette, tp. of Walworth co., Wis. Pop. 1032.

La Fayette, de (Marie Paul Jean Roch Yves Gilbert Motier), Marquis, b. at the château Chavagnac, Auvergne, Sept. 6, 1757, of an ancient family. His father was killed at Minden, and on his mother's death in 1770 he fell heir to large estates; married in 1774 a granddaughter of the duc de Noailles; entered the guards, and while a captain of dragoons in 1776 determined to join the American Revolutionists; fitted out a yacht at his own expense, and landed Apr. 24, 1777, near Georgetown, S. C.; served as major-general 1777–83 without pay, furnishing also clothing and camp equipage at his own expense to the needy patriots; was wounded at Brandywine, and fought with great honor at Monmouth; was in France 1779–80, where he induced the king to send Rochambeau to America; conducted the campaign in Virginia, which ended so brilliantly in the siege and capture of Yorktown; and then returned to France; visited the U. S. again in 1784; exerted himself to procure the abolition of slavery in the French colonies, and freed and educated his own slaves at Cayenne; was in the Assembly of Notables, Paris, 1787; demanded the convocation of the States General, to which he was a deputy, 1789; became vice-president of the National Assembly, commandant of Paris, and chief commander of the national guards, which he organized, 1789; founded the clubs of Feuillants 1790; protected the king and queen from the mob of Oct. 5 and 6; commanded successfully the army of Flanders 1792; denounced the Jacobins, from whom he escaped to Flanders, but was imprisoned for five years by the Austrians at Olmütz; was liberated by Napoleon, and returned to France in 1799, but would never become a partisan of Napoleon; lived principally upon his estate of La Grange; was in the French House of Representatives 1815; in the Chamber of Deputies 1818; visited the U. S. in 1824–25, and received a grant of $200,000 and a township of land; was chosen to the Chamber of Deputies 1827; took part in 1830, and commanded the national guard, but not in person. La Fayette d. at Paris May 20, 1834. It would be hard to overestimate the services done by La Fayette to the cause of American liberty. In France he was an ardent and consistent democrat, but he was ready to sacrifice his own preferences for the advantage of the public. Even his enemies admitted his perfect honesty, his courage, and his ability.—His son, Georges Washington La Fayette (1779–1849), and his grandsons, Oscar (b. 1816) and Edmond (b. 1818), have figured in French politics as republicans.

Lafayette College at Easton, Pa., at the junction of the Delaware, Lehigh, and Bushkill rivers, and of many canals and railroads—a site known from the earliest times as a centre of Indian occupation, and of missionary-work by David Brainerd and others—was chartered in 1826. Rev. George Junkin, D. D., was the first president. It has been from the first distinguished for cheap living and thorough study, especially for students preparing for the ministry, and at first undertook to find manual labor for students who wished it. Since 1855 it has also been known for its course of Anglo-Saxon and English in connection with comparative philology under Prof. F. A. March, LL.D., in which it has been a pioneer, and trained many teachers and professors in other American colleges, and has now a European reputation. It is also known to the scientific world as in some sense the head-quarters of meteorology in America, for here, since 1853, the observations of the government officers and the collections of the Smithsonian Institution, supplemented by the world-wide correspondence of Prof. J. H. Coffin, LL.D., have been reduced and prepared for publication under the direction of that eminent meteorologist. Under the presidency of Rev. W. C. Cattell, D. D., and since 1865 it has still further become a centre of scientific and technical instruction for the coal and iron regions of Pennsylvania and New Jersey, in the midst of which it is situated. It has received nearly $1,000,000 of new endowment, of which about one-half has been given by Mr. A. Pardee of Hazleton, Pa., and $300,000 has been expended in the buildings and apparatus for scientific and technical teaching and investigation. The flora of Pennsylvania, in charge of Prof. T. C. Porter, D. D., is the most complete in existence. The Anglo-Saxon and Early English department of the library is probably the best in the country. The college now offers five schools or courses of study of four years each, leading to degrees; two of general culture—the classical and the scientific; and three technical—mining engineering, civil engineering, and chemistry. In the classical school there are two parallel courses—one the common college course in heathen authors; the other in the Latin and Greek of Christian authors, the latter established in 1872, and sustained by the munificence of B. Douglass, Esq., of New York City. Special courses of two terms each are given on iron, road engineering, and chemistry; and any person prepared to do so may devote his whole time to any branch of learning or science taught in the college, either in an under-graduate or post-graduate course. A law school has been organized, and will open in October of this year (1875). There are 28 resident professors and tutors, 4 non-resident lecturers, and 319 students, nearly equally divided between the old and new courses. Traill Green.

Lafitau' (Joseph François), b. at Bordeaux in 1670; became a Jesuit priest; came to Canada as a missionary in 1712; was stationed at the Iroquois mission at Sault St. Louis, and studied closely the Indian character. Discovered also the ginseng-plant. Returning to France in 1717, wrote his two esteemed works—*Mœurs des Sauvages Amériquains* (1724) and *Histoire des découvertes des Portugais dans le Nouveau Monde* (1733). D. at Bordeaux July 3, 1746.

Lafitte' (Jacques), b. at Bayonne, France, Oct. 24, 1767, was the son of a poor carpenter; went in 1787 to Paris; became in 1788 a bookkeeper in the banking-house of Perregaux; was soon admitted to the firm by reason of his financial ability; became a regent of the Bank of France 1809, and in 1814 its governor; was in the Cham-

ber of Deputies 1816–17; acquired great reputation by his patriotic management of the public finances; became banker to Napoleon and Louis XVIII.; was widely beloved for his generosity, honesty, and constant devotion to the cause of good government, his own preferences being democratic; supported the revolution of 1830; was minister of finance 1830–31, soon after which he suffered great pecuniary losses. D. in Paris May 26, 1844.

Lafitte* (JEAN), b. in France about 1780. He has been made the subject of Ingraham's romance, *The Pirate of the Gulf*. According to (what appears most authoritative) writers in *De Bow's Review*, vols. xii. and xix., the former of whom refers to the late John R. Grymes, who he says was once Laffite's counsel, he came from Bordeaux or Marseilles, and was, "within the recollection of old citizens now living," a blacksmith, "who kept his forge at the corner of Bourbon and St. Philip streets." This is, in a subsequent volume (xxiii.), referred to as an "idle story" by a writer who styles him one of three brothers whose privateering operations led him to Galveston Island, and then to Barataria, "keeping as agents in New Orleans his two brothers," etc.

The cession to the U. S. of Louisiana was followed by events—especially the war between France and Spain—which made the Gulf of Mexico "the arena of the most extensive and profitable privateering" depredations upon the rich commerce of Spain. At the period of the taking of Guadeloupe by the British (1806), most of the privateers commissioned by the government of that island, and which were then on a cruise, not being able to return to any of the West India islands, made for Barataria, there to dispose of their prizes, which could not be admitted into any of the ports of the U. S., we being at that time in peace with Great Britain. Most of the commissions granted to privateers by the French government at Guadeloupe having expired some time after the declaration of the independence of Colombia, many of the privateers repaired to her port of Carthagena for the purpose of obtaining from the new government commissions for cruising against Spanish vessels. Having duly obtained their commissions, they in a manner blockaded for a long time all the ports belonging to the royalists, and made numerous captures, which they carried into Barataria. (See BARATARIA BAY.) It is asserted by Latour, from whom we have quoted (*Hist. of the War in E. Florida and Louisiana*), that public auction-sales were made of the cargoes of their prizes. "From all parts of Lower Louisiana people resorted to Barataria, without being at all solicitous to conceal the object of their journey. In the streets of New Orleans it was usual for traders to give and receive orders for purchasing goods at Barataria with as little secrecy as similar orders are given for Philadelphia or New York." While Latour denies that these men were really pirates, he admits that they audaciously infringed our laws, and committed a great offence in smuggling into the territory goods captured from nations with which we were at peace.

Preparatory to the expedition against New Orleans, Lt.-Col. Nicholls, commander of the British forces in the Floridas, made overtures by letter, dated Pensacola, Aug. 31, 1814, to Laffite, "with his brave followers, to enter into the service of Great Britain;" he is offered the rank of captain, and lands are to be given to "all in proportion to respective ranks." The letter was delivered by Capt. Lockyer, R. N., commanding an armed brig which Sept. 2d visited Barataria for that purpose, and who *personally* offered him, according to Latour, besides the rank of captain, the sum of $30,000. These offers he communicated to the governor of Louisiana by letter couched in language which gives evidence of a cultivated mind and of elevated sentiments. "I offer (writes he) to you to restore to this State several citizens, who perhaps in your eyes have lost that sacred title. I offer you them, however, such as you could wish to find them, ready to exert their utmost efforts in defence of the country. This point of Louisiana which I occupy is of great importance in the present crisis. I tender my services to defend it; and the only reward I ask is that a stop be put to the conscription against me and my adherents by an act of oblivion for all that has been done hitherto. I am the stray sheep wishing to return to the sheepfold. If you were thoroughly acquainted with the nature of my offences, I should appear to you much less guilty, and still worthy to discharge the duties of a good citizen. I have never sailed under any flag but that of the republic of Carthagena, and my vessels are perfectly regular in that respect." No answer appears to have been given, and, indeed, an expedition already in preparation under Commodore Patterson to break up the association at Barataria (where, however, Laffite and his men were not found) was carried out. Subsequently (about the middle of December), when the invasion of New Orleans was imminently pending, the governor of Louisiana issued a proclamation inviting, and Gen. Jackson accepted, the services of Laffite and his men, a portion of whom formed a corps under Capts. Dominique and Beluche, and were employed on the lines, where with distinguished skill they served two twenty-four pounders in batteries Nos. 2 and 3. Others enlisted in one or the other of the companies of mariners, under Capts. Songis, Lagaud, and Colson, and served at Forts Petite Coquille (now Fort Pike) and St. Philip, and Bayou St. John.†

On the 6th of Feb., 1815, Pres. Madison issued a proclamation stating that "it had been long ascertained that many foreigners, flying from the dangers of their own home, and that some citizens forgetful of their duty, had co-operated in forming an establishment on the island of Barataria, near the mouth of the river Mississippi, for the purpose of a clandestine and lawless trade. . . . But it has since been represented that the offenders have manifested a sincere penitence; that they have abandoned the prosecution of the worst cause for the support of the best, and, particularly, that they have exhibited in the defence of New Orleans unequivocal traits of courage and fidelity;" and granting full pardon for acts therein defined, provided that certificate in writing be produced from the governor of Louisiana stating that the person "has aided in the defence of New Orleans." The subsequent career of Laffite is involved in uncertainty. J. G. BARNARD.

La Flêche, town of France, in the department of Sarthe, on the left bank of the Loire, has manufactures of paper and leather, and a brisk trade in grain, wine, wax, cattle, and fowls. The palace, which was built by Henri IV., and which for some time belonged to the Jesuits, who here had a celebrated school, is now used for a school of artillery. It contains a picture-gallery and a library of 20,000 vols. Pop. 9292.

Laflin (ADDISON H.), b. in Lee, Mass., Oct. 24, 1823; graduated at Williams College in 1843; removed to Herkimer co., N. Y.; elected in 1857 to the New York senate; in 1864 to Congress as a Republican; re-elected in 1866 and 1868, and appointed in 1871 naval officer of the port of New York.

La Fontaine', de (JEAN), b. at Château Thierry in 1621; d. 1695. Was protected at first by the duchess of Bouillon, then by the prince of Condé, Fouquet, Henrietta of England; but was too frank, too open-spoken, ever to succeed in securing the favors of Louis XIV. Had for friends Molière, Racine, Boileau, and was member of the French Academy. Wrote at first his *Contes*, a set of short, lively, but rather licentious novels; but his great and classical work, known throughout the world, is his *Fables*, some of them taken from Æsop and Phædrus, which have been translated into every language, and of which many have been committed to memory by children in every school. La Fontaine, like Molière, had a larger and better heart than most of the French writers of the Louis XIV. period; he held fast by his protector, Fouquet, even after the ruin inflicted, through a personal jealousy, on handsome and kingly-looking Fouquet by the *roi soleil* (Sun King), as Louis XIV. liked to be called. FÉLIX AUCAIGNE.

Lafontaine (Sir LOUIS HIPPOLYTE), BART., b. at Boucherville, Lower Canada, in Oct., 1807; became a prominent advocate and politician; accused in 1837 of sympathy with the insurgents, a reward was offered for him, and he escaped to Europe, but was recalled, and became premier of Canada for some time, resigning his office in 1851. In 1853 he became chief-justice of the queen's bench, a baronet in 1854, and d. in Montreal Feb. 26, 1864.

La Fourche, parish of S. E. Louisiana, bounded S. and S. E. by the Gulf of Mexico and Barataria Bay. The surface is flat, and abounds in lakes and bayous, often navigable. Along the Bayou La Fourche are some of the best lands in the Attakapas region. Rice, sugar, molasses, and corn are leading products. Area, 1025 square miles. Cap. Thibodeaux. Pop. 14,719.

La Fourche, a bayou in S. E. Louisiana, an outlet of the Mississippi, which begins at Donaldsonville on the right bank, and flows S. E. through the parish of La Fourche Interior to the Gulf of Mexico, with a total length of 150 miles. It is navigable by steamboats for about 100 miles from its mouth, and is one of the principal channels of communication between the Gulf and the interior.

* The name is thus most commonly spelt, and is so in Latour's *History*; but in the appendix to that work the signature to the several letters there published is printed J. *Laffite*; and it is so spelt in the heading to the letter of Lt.-Col. Nicholls; hence this was probably his own and the correct spelling.

† Fortifying Barataria (Grand Terre Island) or the passes of Barataria Bay formed no part of the services rendered by these men. When the writer, twenty-one years after the battle of New Orleans, visited Grand Terre Island, scarcely a trace of Laffite's occupation remained.

Lafuen'te (Modesto), b. at Revanal de los Caballeros, near Cervera, Spain, May 1, 1806; studied philosophy and theology at Leon and at the University of Santiago Compostella; became in 1830 professor of rhetoric, and afterwards of philosophy, at Astorga; began in 1844 to publish under the pseudonym of "Fray Gerundio" a series of satirical essays, and in 1850 issued the first volume of an elaborate *History of Spain*, completed in 1862 in 26 vols.

Lager Beer. See Beer, by Prof. C. F. Chandler.

La'go Maggio're, the longest of the lakes of Northern Italy, situated between Piedmont, Lombardy, and the Swiss canton of Ticino, and traversed, or rather formed, by the river Ticino, which carries its waters to the Po, is 40 miles long and 2 miles broad, and remarkable for the beauty of its scenery, wild, rugged granite mountains alternating with vineclad hills.

Lagomy'idæ [from *Lagomys*, λαγώς, "hare," and μῦς, "mouse," and *-idæ*], a family of mammals of the order Glires or Rodentia (which see), and sub-order Duplicidentati, externally resembling a guinea-pig (*Cavia aperea*) and to some extent a rabbit, having a squat body, with the hinder limbs not very greatly exceeding the fore ones, the back arched, and the buttocks projecting backward; the head is deep, but the profile scarcely arched backward; the eyes small, the snout hare-like, the ears short, and the tail almost wanting. The skull is depressed, the rostral portion moderately produced and narrow, and the interorbital area narrow and without well-defined supraorbital processes; the orbits are oval and rather small; the nasal processes of the supramaxillary bones have each a single large aperture, and are not perforated in a sieve-like manner; the lower jaw has the ascending rami nearly vertical and the condyles correspondingly advanced, and the angular processes extend very little forward. The teeth have the four upper and two lower incisors ($\frac{2}{1} \times 2$) characteristic of the Duplicidentati, and five molars in each jaw (M. $\frac{3}{3}$; P. M. $\frac{2}{2} \times 2$); the upper are (as in the Leporidæ) mostly (M. 2; P. M. 1) provided with vertical grooves on the outer as well as inner surface, and three transverse ridges of enamel, but on the last "a small extra loop" is developed; the molars of the lower jaw have each the groove on the outer surface, as well as inner, very strong. The clavicles are wanting. This family includes a few species combined in one genus (*Lagomys*, Cuv.), which was formerly associated with the hares and rabbits in the same family; but the numerous differences between the two groups have caused modern mammalogists to separate them. The Lagomyidæ are of smaller size than most Leporidæ, the largest not exceeding the guinea-pig in size: they inhabit cold mountain-regions, and species are found in Northern Asia and Eastern Europe, as well as the Himalaya Mountains and the Rocky Mountains, the latter being the *Lagomys princeps* of Richardson, or the "little chief hare." Theodore Gill.

Lagoon' [Lat. *lacuna*, a "hollow;" Sp. *laguna*], a shallow lake, usually communicating with the sea or with some river. The name is also given to the water enclosed in the atolls or circular coral islands.

La'gos, a British colony on the coast of Dahomey, W. Africa, extending from the river Yerewa to Ode. Pop. about 60,000, of whom less than 100 are whites. The principal settlement is on the island of Lagos in the Bight of Benin, at the mouth of the Ikorodu Lagoon, from which it derives its name. The territory under British protection extends only 10 or 12 miles inland. The trading-posts are Badagry, Palma, and Leckie, the exports being palm oil, cotton, indigo, and groundnuts. The town of Lagos has a population of 36,000, is the seat of Catholic and Wesleyan missions. Was once famous for the slave-trade, but was conquered in 1851, and ceded to Great Britain in 1861.

Lagos, town of Portugal in the province of Algarve, on the western side of a large bay. The harbor, however, is not fit for large vessels. Pop. 8340.

Lagos, city, capital of a canton of the same name in the state of Jalisco, Mexico, near the frontier of the state of Guanajuato, noted for its fine churches and factories, and for the abundant deposits of iron ore in the vicinity. It is a central point in Mexico, and as such has been designated as the place of junction of the three principal railroads to be built by government aid, and which will connect Lagos respectively with the city of Mexico, with the Rio Grande, and with the Pacific. Pop. about 25,000; of canton, 90,000.

Lagosto'minæ [from *Lagostomus*, λαγώς, "hare," and στόμα, "mouth," and *-inæ*], a sub-family of the family Chinchillidæ, whose only known species is distinguished by a rat-like form, but with a bushy tail, a broad muffle, upper lip with a vertical groove like a hare's (and hence the name), moderate ears, and imperfect feet—*i. e.* the anterior with four toes, and the posterior with three, the former having comparatively short and pointed nails, and the latter long, compressed, and acutely-pointed ones; the molar teeth have mostly only two narrow lamellæ, but in the hindermost upper ones are three. But one species is known—the viscacha or *Lagostomus trichodactylus* or *maximus;* it is a characteristic animal of the Pampas of South America, where it burrows in a clayey or sandy soil; it has the singular habit of bringing to the mouth of its burrow every hard object which takes its fancy, such as bones and stones. Theodore Gill.

Lago'tis, or **Lagidium,** a genus of the chinchilla family of mammals, with two species, *L. Cuvieri* and *L. pallipes*, is the mountain viscacha, inhabiting the western slope of the Andes in Chili, Peru, and Ecuador, and must not be confounded with the viscacha of the plains (*Lagostomus*). It is about the size of a hare, and burrows in the rocks. The fur is long and soft, and falls out as soon as the animal is dead.

La Grande, post-tp., cap. of Union co., Or., on the S. side of Grande Ronde Valley, 80 miles S. E. of Walla Walla, and on the line of the projected Portland Dalles and Salt Lake R. R., has Federal and State land-offices, is supported by its proximity to the mines of Eastern Oregon and Idaho, and is celebrated for the even temperature and healthfulness of its climate. There is a weekly newspaper. Pop. 640. E. S. McComas, *Register State Lands.*

La Grange, county of N. E. Indiana, bounded N. by Michigan. Area, 384 square miles. Its surface generally consists of level and productive oak-openings. Cattle, grain, wool, and lumber are leading products. It is traversed by the Grand Rapids and Indiana R. R. Cap. La Grange. Pop. 14,148.

La Grange, a v. of Colbert co., near the N. W. corner of Alabama, seat of La Grange College, a thriving Presbyterian institution founded in 1830.

La Grange, tp. of Lafayette co., Ark. Pop. 2784.

La Grange, post-v. of Richland tp., Phillips co., Ark., 15 miles N. W. of Helena. Pop. 62.

La Grange, post-v. and tp., cap. of Troup co., Ga., 71 miles S. W. of Atlanta, on the Atlanta and West Point R. R., has 5 churches, 2 banks, 2 hotels, 2 female colleges, 1 male high school, 1 steam grist-mill, 1 furniture manufactory, 34 stores, some of the finest flower-gardens in the South, and 1 weekly newspaper, the oldest in the State, which won the $50 gold medal at the Georgia State fair in 1873. Pop. 2053. J. T. Waterman, Ed. "La Grange Reporter."

La Grange, tp. of Bond co., Ill. Pop. 1060.

La Grange, post-v., cap. of La Grange co., Ind., in the centre of the county, on the Grand Rapids and Indiana R. R., 45 miles N. W. of Fort Wayne, has 4 churches, 2 banks, 1 weekly newspaper, 2 school-houses, 1 large hotel, and the usual number of stores and shops. Pop. 1038. John H. Rarick, Ed. "Standard."

La Grange, tp. of Harrison co., Ia. Pop. 308.

La Grange, post-v., cap. of Oldham co., Ky., on the Louisville and Cincinnati R. R., near the junction of the Lexington and Louisville R. R. Pop. 612.

La Grange, post-tp. of Penobscot co., Me., on the Bangor and Piscataquis R. R. It has good water-power and manufactures of lumber, etc., and is the site of a remarkable ridge, the result of glacial action. Pop. 622.

La Grange, post-v. and tp. of Cass co., Mich., 4 miles N. W. of Cassopolis. Pop. 1884.

La Grange, city of Lewis co., Mo., on the Mississippi River and Mississippi Valley and Western R. R., 175 miles above St. Louis, 11 above Quincy, Ill., and 30 below Keokuk, Ia., has 11 churches, 2 hotels, 1 national bank, 1 savings bank, 1 weekly newspaper, a chartered college, tobacco manufactories, several large flouring and planing mills, a mammoth rolling-mill for turning out railroad iron, and considerable river trade. Incorporated as a city in 1853. Pop. 1576. R. M. Wallace, Ed. "Democrat."

La Grange, tp. of Dutchess co., N. Y. It is traversed by the Dutchess and Columbia R. R., and contains several villages. Pop. 1774.

La Grange, post-v. of Lenoir co., N. C., on the Atlantic and North Carolina R. R., 14 miles from Goldsborough, has 2 churches, 2 carriage-shops, 4 secret societies, 1 female high school, 1 weekly newspaper, and ships annually 3600 bales of cotton. Pop. about 300. B. W. Nash, Ed. "Baptist Review."

La Grange, a v. of Wells tp., Jefferson co., O., on the Ohio River and on the Cleveland and Pittsburg R. R. (Phillipsburg P. O.). Pop. 228.

La Grange, post-v. and tp. of Lorain co., O., on the Cleveland Columbus and Cincinnati R. R., 24 miles S. W. of Cleveland. Pop. 1309.

La Grange, post-v. of Bell co., Tenn., on the Memphis and Charleston R. R. Pop. 760.

La Grange, post-v., cap. of Fayette co., Tex., on the E. bank of Colorado River, 25 miles from Columbus, 20 miles S. of the Central R. R., and 14 miles N. of the "Sunset Route," has 4 churches, 4 schools, 2 weekly newspapers, a public hall, and 20 or more business-houses. Pop. 1165.

J. J. GOSSLER, ED. "NEW ERA."

La Grange, post-v. and tp. of Walworth co., Wis., 8 miles E. of White Water, a station on the Milwaukee and Mississippi R. R. Pop. 1039.

Lagrange′ (JOSEPH LOUIS), b. at Turin Jan. 25, 1736; d. at Paris Apr. 10, 1813. He was, by the rivalship of Laplace only, says Prof. Nichol, prevented from "being held, by common consent, the most illustrious geometer of modern times." Though born in Italy, as his name indicates, he was of French extraction. At the age of nineteen he was made a professor of geometry in the Royal School of Artillery. In 1766 he was invited to Berlin by Frederick II. (who as the "greatest king" expressed the desire to have the "greatest mathematician" of Europe at his court) to succeed Euler as mathematical director of the Academy, of which he was made president. Here he wrote his *Mécanique Analytique.* After the death of Frederick (1786) he received invitations from the sovereign of his native Sardinia, as well as those of Naples and Tuscany, but ultimately accepted one in 1787 to take his residence at Paris (receiving a pension from the Academy, of which he had been elected in 1772 a foreign associate), where the rest of his life was passed.

The method of the Variation of Parameters, expounded to a certain point by Euler, but perfected by Lagrange, is one of his important contributions to analytical mechanics. The ellipse which a planet *would* describe around the sun were there no *other* attraction undergoes fluctuations of form by attractions of other heavenly bodies. The essence of the method in question is that, holding fast to the idea of the simple curve—the ellipse—though it be never realized, the actual motion of the body is conceived to be on an elliptic curve, the *parameters* (or elliptic elements) of which are ever varying through the disturbing action of foreign attractions. To subject this motion, which under the name of "revolving orbits" had its origin with Newton, to analytical calculation, and to determine the influence of each planet in disturbing the elliptic motion of others, was the problem the solution of which is in great degree due to Lagrange. As a natural sequence to this problem arising out of this perpetual change in the planetary orbits comes the greater problem of the *stability and permanence of the solar system,* the establishment of which is Lagrange's greatest achievement. The orbits being thus in constant fluctuation, it is of the highest interest to know whether the resulting changes be necessarily *limited* in amount, or whether they will progressively increase until the *stability* of the solar system shall be destroyed.

Lagrange demonstrated (though Laplace had preceded him with a partial demonstration) that the fluctuation of the orbital elements is *limited* to small amounts, and is periodic, extending, however, through long periods of time. Thus, *e. g.*, the eccentricity of the earth's orbit, now diminishing, will continue to do so for 24,000 years, and then begin to increase. At the same time the apsides and nodes are in motion. The grand cycle of the earth's perihelion, which coincided with the vernal equinox 4089 years B. C. (about the date chronologers assigned to the biblical account of the Creation), will be completed in 110,000 years.

"Some of the (orbital) ellipses," says Prof. Forbes (6th Dissertation, *Encyc. Brit.*), "will elongate, whilst others tend to become circles; their planes will vary in inclination, but ultimately be stayed within the limit which human sagacity had predicted myriads of years before. 'These,' says a French analyst, 'are the pendulums of eternity, which beat ages whilst ours beat seconds.' And amidst all these variations, subject to law and to impassable limits, the Major Axes of the orbits preserve a steadfast uniformity, or are subject only to transient fluctuations; and thus permanence arises in the midst of change, and the perfection of the system is demonstrated by the very nature of the disturbances which seemed at one time inevitably to limit its duration." "These results may be considered as among the most astonishing with which science brings us acquainted. The range of insight which man has acquired into the past and future history of the universe throughout periods compared to which the whole existence of his species is but a span, enhances our admiration of the reasoning power which can attain to knowledge so high and excellent."

Laplace had asserted the invariability of the major axes of the planetary orbits, which involves the *fact* of stability. But Lagrange, says Prof. Nichol, "from a higher flight, showed the *necessity* of that stability;" and that it results from the *dispositions* of the elements in nearly the same plane—the almost circular form of the orbits, and the uniform direction of the motions therein. The importance of such assurance is enhanced when one is reminded that Newton believed that our system contained the seeds of dissolution.

After the mention of these two *opera magna* of Lagrange, his minor works, though there is scarce a topic in physical astronomy or in mechanics or pure mathematics which he has not touched and shed light upon, must be passed by without notice. (A very complete enumeration and analysis of his writings is attached to his biography in the 8th ed. of the *Encyc. Brit.*) Happy in the affectionate attachment of the young wife he at the age of fifty-six had married (his first wife dying soon after marriage, twenty years before), living in intimate relations with Laplace, Euler, D'Alembert, and other renowned contemporaries, escaping the misfortunes to which the French Revolution subjected nearly all his contemporaries, and retaining throughout his scientific appointments, Lagrange's residence in Paris was tranquil, and he died universally respected and regretted. "Take him as a whole," says Prof. Nichol, "abstract science has in modern times possessed no other servant so great." J. G. BARNARD.

La Gran′ja, or **San Ildefon′so,** town of Spain, in the province of Segovia, with a magnificent palace built in 1724 by Philip V., and situated about 4000 feet above the sea. Here Maria Christina was surprised (Aug. 13, 1836) by a number of conspirators and compelled to restore the constitution of 1812. Pop. 3850.

La Greux, tp. of Arkansas co., Ark. Pop. 355.

La Gro, post-v. and tp. of Wabash co., Ind., is on the Toledo Wabash and Western R. R., Wabash and Erie Canal, and Wabash River. Pop. of v. 519; of tp. 4066.

La Guay′ra, town of Venezuela, South America, the harbor of Caraccas, on a narrow strip of land between the sea and the wall of the inland plateau, which rises at once to a height of about 3000 feet. It is one of the hottest places on earth, very unhealthy, and often visited by earthquakes. Its harbor is an entirely open roadstead, where the water is always agitated, and where loading and unloading are very difficult. It is nevertheless the principal port of Venezuela, and the importation of manufactured goods and the exportation of coffee, cacao, cotton, sugar, indigo, and hides are extensive. Pop. about 8000.

La Guéronnière, de (LOUIS ÉTIENNE ARTHUR DUBREUIL HELION), VISCOUNT, b. in Poitou, France, in 1816. In 1850 he became chief editor of the *Pays,* and attracted great attention by his *Portraits politiques* of Louis Napoleon and the count of Chambord. After the *coup d'état* of Dec., 1851, he became a decided supporter of Napoleon, was elected a deputy, became a member of the *Conseil d'Etat* (1853), and took charge in the ministry of the interior of the delicate relations of the government to the press and to literature, in which capacity his conciliating manners enabled him to discharge his functions with advantage. In 1861 he was made senator, and became one of the most popular orators, especially on the questions relating to Italy and to home government. In 1868 he was made ambassador to Belgium. As a writer, M. de La Guéronnière became the most trusted organ of the Napoleonic policy, and his pamphlets (*brochures*) were often the first indication of coming events.

La Harpe, post-v. and tp. of Hancock co., Ill., on the Toledo Peoria and Warsaw R. R., at the junction of the Burlington branch. It has 1 weekly newspaper. Pop. 1741.

La Harpe, de (FRÉDÉRIC CÉSAR), b. at Rolle in the canton of Vaud, Switzerland, in 1754; studied law at the University of Tübingen; became tutor to a young Russian nobleman, with whom he travelled through Italy and France, and was recommended by Baron Grimm to Catharine II., who appointed him tutor to her two grandsons, Alexander and Constantine. His enthusiasm for the French Revolution made his stay in Russia somewhat difficult, and in 1793 he left the country, but received a pension for life, and resided partly in Geneva, partly in or near Paris, until 1814. On his visit to Paris the emperor Alexander received his former tutor with great esteem, made him a Russian general, and exercised through him considerable influence on the political reorganization of Switzerland. In 1817 returned to Lausanne. D. Mar. 30, 1838.

La Harpe, de (JEAN FRANÇOIS), b. at Paris Nov. 20, 1739; made his début as a poet in 1759 with a volume of *Heroïdes,* wrote *Warwick* (1763), *Timoleon* (1764), and two other tragedies; was in 1768 literary critic on the *Mercure de France;* gained several prizes from the Academy; obtained applause by a drama, *Melanie, ou la Religieuse* (1776); was elected member of the Academy, and in 1786 appointed professor of literature at the newly-established

Lycée. Here large audiences gathered year after year to hear his lectures on literature, from which originated his best work, *Cours de la littérature ancienne et moderne* (16 vols., 1799–1805). Embraced the Revolution with great enthusiasm, and lectured with the red cap on his head. Was nevertheless arrested and kept in prison for some time, and this incident wrought a singular change in him; the philosopher of the school of Voltaire became a fervent Catholic. As a poet, La Harpe is entirely forgotten, but his *Cours de la littérature* is still an interesting and instructive book, in spite of the superficiality and harshness with which some parts are treated. D. Feb. 11, 1803.

Lahas′ka, post-v. of Buckingham tp., Bucks co., Pa., 6 miles N. E. of Doylestown.

Lahijan′, town of Persia, in the province of Ghilan, near the Caspian Sea. It has some silk manufactures. Pop. 7000.

La Hontan′, de (Armand Louis de Delondarce), Baron, b. near Mont de Marsan, Gascony, France, about 1667; came to Canada, probably as a private soldier, in 1683, in one of the companies of marines sent by Gov. de la Barre against the Iroquois, and was afterward in Denonville's expedition against the Senecas, being stationed successively at Chambly and at Forts Frontenac, Niagara, and St. Joseph's. In 1668 he was sent to Michilimackinac and Sault Ste. Marie, was at Green Bay in 1669, and pretended to have explored the head-waters of a branch of the Mississippi. Returning to Quebec, he sailed for France in 1690, came back the following year, and was sent by Count Frontenac with despatches to the French government announcing the failure of Sir William Phipps' expedition against Quebec. The vessel put in to Placentia, Newfoundland, and La Hontan rendered such good service in defending that port from an attack by the English that he received a command as lieutenant in Newfoundland and Acadia. In 1693 he became involved in difficulties with the governor, made his escape to Portugal in a merchant vessel, and thence passed to Spain, Denmark, and England. Having been dismissed from the French service, and being unsuccessful in his endeavors for reinstatement, he published at the Hague in 1703 his adventures in America under the title *Nouveaux Voyages de M. le baron de Lahontan dans l'Amérique Septentrionale* (2 vols.), and added a third volume, *Dialogue de M. le baron de Lahontan et d'un sauvage dans l'Amérique, avec les voyages du méme en Portugal* (Amsterdam, 1704). These volumes were widely circulated, but are entirely untrustworthy for details of fact, the geography and ethnography of the upper Mississippi being completely fictitious, though long relied upon by compilers. D. in Hanover in 1715.

Lahore′, the principal city of the Punjaub, British India, situated on the western bank of the Ravee, in lat. 31° 36′ N. and lon. 74° 18′ E. The city itself is surrounded with a high brick wall, and consists mostly of narrow, dirty, and overcrowded streets between high houses, which present only bare walls toward the streets. But it has many magnificent Mohammedan mosques and Hindoo temples, and its extensive bazaars are well stocked. Outside the wall are other fortifications, stretching 7 miles in circuit, enclosing the most beautiful and luxuriant gardens and promenades, interspersed with large monuments and ruins of the former splendor of the city, when it was the residence of the Mogul emperors and had 1,000,000 inhabitants. Since 1849 it is a British possession, and it is said to be rising again. Its present pop. is estimated at about 100,000.

Lahr, town of Germany, in the grand duchy of Baden, on the Shulter. It has some manufactures of sailcloth, vinegar, tobacco, and paper. Pop. 7103.

Lah′sa, or **El-Ah′sa** (which latter word in the Arabic language means a tract of land where the water sinks through the surface, but is retained by a lower layer), the name of an independent dominion, situated on the eastern shore of Arabia, 90 miles S. W. of Katif, in lat. 25° 25′ N., lon. 49° 45′ E., and comprising an extensive valley, fertile and well watered, and a large capital, flourishing and well built. Wheat, millet, and all kinds of fruits and vegetables are cultivated, and horses and sheep are extensively reared, but dates and camels are the two principal items of the wealth of the country. The population of the district numbers about 50,000; of the town, about 10,000. The former name of the tribe and its abode was Hedjaz. A small tribute is annually paid to the Turkish sultan.

Lai′bach, or **Laybach,** town of Austria, cap. of duchy of Carniola, beautifully situated on a plain on a river of the same name, on the road from Vienna to Trieste, is an old town, with some manufactures, a considerable trade, many good educational institutions, and several interesting buildings; as, for instance, the cathedral of St. Nicholas, the Gothic town-house, the castle, and the palace of Count Auersberg. Pop. 23,032.

Laid′lie (Archibald), D. D., b. at Kelso, Scotland, Dec. 4, 1727; graduated at the University of Edinburgh; was ordained in 1759, and was for four years pastor of the Scotch church at Flushing, Holland, where he acquired a knowledge of the Dutch language and the theology of the Reformed (Dutch) Church, with which he was thenceforth connected. As a consequence of a sharp controversy in New York as to the language to be used in preaching to the churches founded by the Dutch colonists, Dr. Laidlie was called to the pastorate of the Collegiate church, and on Apr. 15, 1764, preached at the Middle Dutch church the first English sermon addressed by a regular pastor to an American Dutch congregation. His ministry was marked with great popularity and success. Early in the war of the Revolution he retired from New York to Red Hook, N. J., where he d. in 1778.

Laing (Alexander Gordon), b. in Edinburgh, Scotland, Dec. 27, 1794, entered the British army; served some years in the West Indies, and was in 1820 aide-de-camp to the governor of Sierra Leone. Was employed in negotiations with African chieftains for the suppression of the slave-trade, and explored the upper course of the Niger. Returning to England, was promoted to the rank of major, and in 1826 undertook an overland journey from the Mediterranean to the Gulf of Guinea. Setting out from Tripoli in July with a caravan of native traders, reached Timbuctoo in August, but was soon after murdered near that city. Had published an account of his earlier explorations, *Travels through the Timannee, Kooranko, and Soolima Countries to the Sources of the Rokelle and Niger* (London, 1825).

Laing (Malcolm), b. on the island of Mainland, Orkneys, in 1762; studied at the University of Edinburgh, and was called to the bar in 1785, but devoted himself chiefly to literature. Wrote a continuation of Henry's *History of Great Britain* (1785), and a *History of Scotland from the Union of the Crowns to the Union of the Kingdoms* (1800), with dissertations on the Gowry conspiracy and on the Ossian poems, adding in the second edition an essay arguing the guilt of Mary Queen of Scots in the murder of Darnley. Was elected a member of Parliament in 1807, and d. in the Orkneys in Nov., 1818.

Laing (Samuel), of Rapdale, Orkney, brother of Malcolm, was author of several of the most instructive works of travel published in the present century. Among them are books on *Norway* (1834), *Sweden* (1838), *Notes of a Traveller in France, Prussia, and Switzerland* (1841), *Social and Political State of the European People in 1848 and 1849* (1850), and *Observations on the Social and Political State of Denmark* (1852).

Laing (Samuel), b. at Edinburgh, Scotland, in 1810, son of Samuel Laing the traveller; graduated at Cambridge (1832), and at Lincoln's Inn; was admitted to the bar in 1840; became private secretary of Mr. Labouchere, president of the board of trade, and afterward a member of the railway commission, and had much to do with the relations of the government to the railways, then being rapidly extended. To his efforts the public were indebted for the convenience of "parliamentary trains" at a minimum rate of payment of one penny per mile. In 1848 he became chairman of the Brighton Railway Company, in 1852 chairman of the Crystal Palace Company; entered Parliament in 1852 for his native district; was financial secretary to the treasury in 1859, and went to India in 1860 as minister of finance. Returning in 1865, he again entered Parliament, and resumed in 1867 the chairmanship of the Brighton Railway Company.

Laings′burg, post-v. of Shiawassee co., Mich., on the Jackson Lansing and Saginaw R. R. It has manufactures of castings and lumber.

Laird (John), b. at Greenock, Scotland, in 1805, was the first builder of iron steamships in 1829, and was for many years head of the great firm of John Laird & Sons, iron shipbuilders and engineers at Birkenhead, near Liverpool. As builder of the Confederate privateer Alabama his name has become a part of the history of the American civil war. Mr. Laird filled many posts of responsibility in connection with commerce and public works, and was a member of Parliament from 1861 until his death at Birkenhead, Oct. 29, 1874.

Lair's Station, post-v. of Harrison co., Ky., on the Kentucky Central R. R.

La′ity [remotely from the Gr. λαός, the "people"], a term chiefly used to distinguish the unordained people from the clergy. The term is also sometimes employed by persons in the professions of medicine and law to distinguish non-professional from professional persons. So also members of certain voluntary associations speak of the uninitiated as the laity. Convents have lay brothers and lay sisters and lay elders, lay preachers.

Lajard′ (Jean Baptiste Félix), b. at Lyons, France, Mar. 30, 1783; accompanied as secretary a mission to Persia in 1807; became interested in the study of Oriental religions and Oriental influences upon ancient Greece, and made a fine collection of cuneiform cylinders, which were obtained by the Imperial Library. By the aid of the labors of Bopp and Schlegel in the young science of comparative philology, as well as by his own researches, Lajard was enabled to broach a theory of the common origin of the races now called Aryan, which has since been confirmed in most points. He filled diplomatic posts in Greece, Russia, and Denmark until the fall of Napoleon I.; was afterward employed in the financial department; was elected in 1830 a member of the Academy of Inscriptions, and wrote most of vols. xviii. and xix. of the vast work edited by that body, *Histoire Littéraire de la France*, his contributions being upon the early rabbins, scholastics, and jurisconsults. Of his numerous and learned miscellaneous writings, the most important is the *Recherches sur le Culte public et les Mystères de Mithra en Orient et en Occident* (Paris, 1847–48). D. at Tours in Sept., 1858.

Lakanal′ (Joseph), b. at Serres, France, July 14, 1762; studied theology; became professor of rhetoric at Bourges, and of philosophy at Moulins; was elected to the National Convention; distinguished himself by his solicitude for the interests of the sciences and of literature; was the principal founder of the Museum of Natural History, of the Academy of Sciences, and other institutions of higher education; entered the Council of Five Hundred (1795); was professor at the Lycée Charlemagne under the consulate and empire; was a refugee in 1815, as having voted for the death of Louis XVI.; settled in the U. S.; was favored by Jefferson; received from Congress a grant of 500 acres of cotton-land in Alabama, and became a planter; was chosen president of the University of Louisiana; returned to France after the revolution of 1830; was re-elected to the Academy of Sciences in 1834, and d. at Paris Feb. 14, 1845.

Lake [Lat. *lacus*], a body of water nearly or quite surrounded by land. Lakes derive their forms and character from the nature of their basins and the region in which they are found. Mountain-lakes, being valleys filled by running streams, are long and narrow, rarely of great size, but often of great depth. Lake George and Lake Champlain in the Appalachian Mountains, the lakes of Constance, Zurich, Lucerne, and Geneva on the N. side, Lago Maggiore and Lago di Como on the S. side of the Alps, all renowned for the beauty and loveliness of their shores or the grandeur of the surrounding scenery, are fair examples. Their length exceeds their width twenty or thirty times. The depth of Lago Maggiore, which is hardly 3 miles wide, reaches, according to the Italian engineers, 2613 feet below its surface, or more than double the depth of Lake Superior, and 1926 feet below the level of the ocean. Sometimes their forms are very irregular, for the water of a mountain-lake often covers several contiguous valleys, as in the Lago di Como, with its two long branches, and the lakes of Lucerne and Lugano, which owe their strange and crooked form to the fact that each fills four distinct valleys, crossing each other almost at right angles.

Lakes in plains and plateaus, being simple depressions in a uniform surface, are generally of larger size, and wider compared to their length, but relatively of no great depth. The largest lakes of the globe, the so-called Caspian and Aral seas in Asia, the equatorial lakes of Central Africa, the great North American lakes, and Lake Titicaca in South America, all belong to this class. Their vast expanse and the tameness of their shores deprive them of the picturesque beauties which adorn the mountain-lakes.

Most lakes receive and send forth large rivers, of which they seem to be an expansion. In their basins the wild alpine torrents spend their force, and their muddy waters flow out purified and transparent. The lakes are thus the regulators of the mountain-streams, preventing destructive freshets; they perform the same office in the low plains.

Salt Lakes.—Numerous lakes, however, in the interior of the continents, though receiving affluents, have no outlet, some of their water losing itself in the sandy ground, but the greater portion passing into the atmosphere by evaporation. These are usually filled with salt water. All the surface of the continents being an old sea-bottom, the presence of salt is very natural. Fresh-water rivers and lakes can only be found after the surface has been thoroughly washed and the salt carried away by streams having access to the ocean. The Caspian and the Aral seas, at the bottom of the vast depression which lies between Europe and Asia, are the most extensive salt lakes. The Caspian Sea, though receiving the Volga, the largest river of Europe, and many others of considerable size, evaporates so much water that its surface has been found by the Russian academicians to be 83 feet below the level of the Mediterranean, and varying with the seasons. Many lakes in the neighborhood ooze away during the summer, leaving a pure, white crystalline crust of salt. One of them, the Elton Lake, between the Volga and Ural rivers, furnishes thus an annual crop of over 100,000 tons of salt.

More remarkable than all is the Dead Sea, which lies in the deepest part of a long valley, sunk from 4000 to 5000 feet below the surrounding country, its surface being 1286 feet, and its bottom over 2500 feet, lower than the level of the Mediterranean. Its feeder, the river Jordan, alone among the streams of the earth, accomplishes nearly its whole career below the level of the sea. When expanding into the Lake of Tiberias, the beautiful sheet of water whose shores witnessed so many of Christ's miracles, it is nearly 620 feet below the surface of the Mediterranean. By another long step of over 640 feet downward its fresh waters mingle with the bitter floods of the Dead Sea. In this last reservoir the salt has accumulated so as to transform the water into a heavy brine, which may be the remnant of an ancient sea of much larger extent, gradually reduced by evaporation to its present size. The other continents have also their salt lakes, and North America can boast of the Great Salt Lake of Utah as one of the finest specimens of its kind.

Geographical Distribution of Lakes.—Lakes are not uniformly spread over the continents. They are most numerous in the northern regions of Asia, Europe, and North America, but more thinly scattered farther S. and in the southern continents. Asia is pre-eminently the land of the salt lakes. Both in its north-western steppes from the Caspian to Lake Balkash, and in its vast central highlands, they occur in countless numbers. The Altai and Daourian mountains, however, contain the largest alpine lakes, among which the kingly Baikal, nearly 500 miles long, holds the first place.

In Europe the most characteristic and celebrated are the mountain-lakes which adorn the Alps of Switzerland and Scandinavia, and the more modest chains of the British Isles. But the greater number and the largest are found on the slight swells and in lowlands which surround the Baltic Sea in Northern Germany, Western Russia, Finland, and Sweden. The lakes of Ladoga and Onega in Russia, and those of Wener and Wetter in Sweden, are the most extensive among the European lakes.

In Africa the great plateau-lakes are typical of the continent. The majestic Ukerewe, or Victoria Nyanza, and the Albert Nyanza at the sources of the White, the Tzana at the head of the Blue Nile, Lakes Bangweolo and Tanganyika, probable head-waters of the Congo, Lake Nyassi in the Zambese basin, are all crowning the table-lands of Central Africa.

But North America is peculiarly rich in this respect. No continent presents a more remarkable chain of large lakes than that which stretches from N. W. to S. E. in the Arctic plains, along the line of contact of the oldest geological formations, to the Appalachian Mountains, comprising the Great Bear and Great Slave lakes, Athabasca, Lake Winnipeg, and the five great lakes from Superior to Ontario, forming together the largest extent of fresh water on the face of the earth. This abundance of lakes in the northern part of the continent renders their almost complete absence in the basin of the Mississippi the more remarkable.

Arnold Guyot.

Lake. This term is applied to pigments prepared by combining animal or vegetable dyes with metallic oxides, usually alumina or oxide of tin. Almost all coloring-matters may be made to produce lakes, but in practice a few only are found available for this purpose. Lakes are used as pigments for painting, for wall-paper, and in calico-printing.

Red Lakes.—(1) Carmine lake, called also Florentine, Vienna, Munich, and Paris lake. This has a beautiful red color, and is the finest of all lakes. It is made by adding an alkali to a decoction of cochineal mixed with alum. Inferior cochineal, and the residues and mother-liquors from the preparation of carmine, are employed for carmine lake. This lake was manufactured at Florence from kermes before cochineal was known in Europe. A finer lake may be made by adding freshly precipitated alumina to the mother-liquor from carmine. (2) Madder lake (Ger. *Krappcarmine*) is extensively prepared. It has a more or less deep rose-color, with a bluish tint. The following is Persoz's process for preparing it: Madder is washed with cold water wherein some sulphate of soda is previously dissolved, and boiled for about twenty minutes, with ten times its weight of a 10 per cent. solution of alum free from iron. The liquid is filtered and cooled to 40° or 35°. The red-colored solution is then treated either (*a*) by saturating cautiously with carbonate of soda equal to from one-tenth to one-eighth the weight of the alum used, so as to cause the formation of a basic alum, which remains in solution, and which is pre-

cipitated on boiling, as an insoluble basic sulphate of alumina, holding all the coloring-matter in combination. Or (*b*) by adding a solution of acetate of lead, containing 78 parts of the salt for every 100 of alum used, filtering from the precipitated sulphate of lead, and boiling to precipitate a colored basic acetate of alumina. This is much finer than that precipitated by carbonate of soda. Flowers of madder, garancine, or other preparations of madder may be used in place of the root. The coloring-matter of madder may be extracted by an alkaline solution, and precipitated by alum. (3) Brazil-wood lake, known also as Vienna ball-lake, Florentine, Berlin, new lake, etc. The wood is boiled with water, and the solution should be left some time to permit certain impurities to settle. The addition of a little glue or skimmed milk is advantageous. A solution of alum and tin crystals is added, and precipitation effected by caustic potash, taking care not to add an excess, or by carbonate of soda. A slight excess of potash gives the lake a violet tint.

Violet and Purple Lakes.—(1) Logwood gives a violet lake on the addition of an alum solution to its decoction, and precipitation cold by carbonate of potash. (2) Alkanet yields a purple lake when the finely-cut roots are boiled with potash, and the solution is precipitated by alum.

Yellow Lakes.—(1) Persian or French berries furnish a yellow lake called *Dutch pink*. Potash or soda is added to the decoction, and then a solution of alum is poured in as long as a precipitate occurs. The color is brightened by treating the moist precipitate with a tin solution. (2) Fustic lake: the decoction of the wood is treated with a little glue or skimmed milk to remove tannic acid, then made alkaline, and precipitated with alum. (3) Quercitron lake is made in the same manner. (4) Weld lake is made in the same manner. (5) Annotto lake: the aqueous solution of annotto is mixed with carbonate of soda, heated to boiling, and precipitated by an excess of alum.

Orange Lakes.—(1) Annotto: by boiling annotto with carbonate of soda, and precipitating by alum or salt of tin, an orange lake is obtained. The color is still deeper if the annotto is first boiled with water and the solution rejected. (2) Turmeric boiled with potash and precipitated with alum gives an orange lake.

Blue Lakes are seldom prepared. (1) Logwood solution mixed with sulphate of copper, and precipitated cold with potash, gives a blue lake. (2) Sulphindigotic acid mixed with alum, and precipitated with carbonate of potash, gives a peculiar blue lake.

Green Lakes are usually prepared by mixing blue and yellow lakes, or blue pigments, such as Prussian blue, ultramarine, indigo, etc., with yellow lakes. (1) Coffee lake: a very good green lake is made by exhausting 1 pound of bruised coffee-berries with 1 gallon of water, adding 2½ to 3 pounds of sulphate of copper, and precipitating with caustic potash, avoiding an excess. By moistening the precipitate with vinegar and exposing it to the air, its color is heightened. (2) Weld yields a green lake by similar treatment; and by adding alum to the sulphate of copper, and precipitating by cold carbonate of potash, various tints can be obtained.

Other Colors.—Lakes of other colors can be prepared in a similar manner, but true lakes are rarely made except those of cochineal, madder, and Brazil-wood. Lakes of great variety of shades may also be obtained by the substitution of bismuth or antimony solutions for those of alum and tin.

Adulteration of Lakes.—Starch, gypsum, China clay, barytes, etc. are extensively used to adulterate lakes, increasing the yield at the sacrifice of brilliancy. To secure thorough mixture with the lake, they are often added to the solutions before precipitation.

Aniline Lakes, so called, are not true lakes. They are made of all colors. They are easily prepared by dissolving 1 gramme (15 grains) of the aniline color in ½ kilo. (½ pint) of 95 per cent. alcohol, adding 10 grammes (⅓ ounce) gum copal, and when all is dissolved mixing in dry starch to a uniform mass, which when dry is reduced to powder. Aurine produces a variety of beautiful precipitates if mixed with metallic or earthy solutions, and thrown down by the cautious addition of an alkali. These are merely hydrated oxides or sub-salts, with which the aurine is mechanically incorporated; on washing with distilled water they lose their color. C. F. Chandler.

Lake, county of California, consisting of the valley of Clear Lake, which is some 80 miles N. of San Francisco. It is enclosed by the Bear Mountains on the E. and Mayacannas Mountains on the W., both of which are arms of the Coast Range. Area, 830 square miles. It contains much excellent farming land. Cattle, wool, and dairy products are the agricultural staples. Sulphur and borax abound, the latter especially in Borax Lake. Cap. Lakeport. Pop. 2969.

Lake, county of Colorado, extending W. from the Rocky Mountains to the E. border of Utah. Area, 1600 square miles. In the E. part the Arkansas River rises, and also the Gunnison, one of the head-streams of the Colorado of the West. It abounds in timber. There are many lofty mountains in the county. Gulch-mining for gold is a leading pursuit. Cap. Dayton. Pop. 522.

Lake, unorganized county of S. E. Dakota. Area, 576 square miles.

Lake, county of N. E. Illinois, having Wisconsin on the N. and Lake Michigan on the E. Area, 390 square miles. It is level and fertile, the soil being a clayey loam. Cattle, grain, and wool are largely produced. The county is traversed by two divisions of the Chicago and Northwestern R. R. Cap. Waukegan. Pop. 21,014.

Lake, county of N. W. Indiana, having Lake Michigan on the N., Illinois on the W., and Kankakee River on the S. The extreme N. is sandy and the S. part marshy, but the rest is very fertile. Cattle, grain, and wool are staple products. The county is traversed by several railroads, mostly centring at Chicago. Area, 480 square miles. Cap. Crown Point. Pop. 12,339.

Lake, county of Michigan. Area, 576 square miles. It is very level, and generally has a good soil, but is mostly covered with forests. Pop. 548.

Lake, county of N. E. Minnesota, bounded N. by Canada and S. E. by Lake Superior. Area, 3000 square miles. The lake shore is abrupt, and characterized by numerous short, rapid streams. The interior is a succession of pine-covered ridges, diversified by numerous lakes and flat, boggy tracts covered with small larch trees. Cap. Beaver Bay. Pop. 135.

Lake, county of N. E. Ohio, bounded N. W. by Lake Erie. Area, 220 square miles. It is undulating, and has a productive clay soil. Iron ore is found. Live-stock, grain, wool, and fruit are leading products. Carriages, brick, and lumber are important manufactures. The county is traversed by the Lake Shore and the Painesville and Youngstown R. Rs. Cap. Painesville. Pop. 15,935.

Lake, county of N. W. Tennessee, bounded W. by the Mississippi River, N. by Kentucky, and E. by Redfoot Lake and River. Area, 150 square miles. It is level, well wooded, and fertile, but partly subject to overflow. Indian corn is the staple product. Cap. Tiptonville. Pop. 2428.

Lake, tp. of Cook co., Ill., contiguous to Chicago, on the S. of that city. Pop. 3360.

Lake, tp. of Allen co., Ind. Pop. 1309.

Lake, tp. of Newton co., Ind., lying N. of Beaver Lake. Pop. 378.

Lake, tp. of Cerro Gordo co., Ia. Pop. 1164.

Lake, tp. of Monona co., Ia. Pop. 178.

Lake, tp. of Muscatine co., Ia. Pop. 843.

Lake, tp. of Dorchester co., Md. Pop. 1409.

Lake, tp. of Berrien co., Mich., on Lake Michigan. Pop. 1002.

Lake, tp. of Huron co., Mich. Pop. 325.

Lake, tp. of Lake co., Mich. Pop. 28.

Lake, post-v. of Scott co., Miss., on the Vicksburg and Meridian R. R.

Lake, tp. of Buchanan co., Mo. Pop. 297.

Lake, tp. of Humboldt co., Nev. Pop. 117.

Lake, tp. of Ashland co., O. Pop. 701.

Lake, tp. of Logan co., O. It contains the city of Bellefontaine. Pop. 3753.

Lake, post-v. and tp. (the former also called Uniontown), Stark co., O., 12 miles S. E. of Akron. Pop. 2113.

Lake, tp. of Wood co., O. Pop. 1120.

Lake, post-tp. of Luzerne co., Pa. Pop. 597.

Lake, tp. of Mercer co., Pa. Pop. 524.

Lake, tp. of Williamsburg co., S. C. Pop. 873.

Lake, tp. of Milwaukee co., Wis., on Lake Michigan, just S. of Milwaukee. Pop. 2974.

Lake (Gerard), Viscount, b. in England July 27, 1744; entered the army in 1758; served in the closing campaigns of the Seven Years' war, in the American war (1781), and in Holland under the duke of York in 1793–94; rose to the rank of general; was commander-in-chief in Ireland during the insurrection of 1797–98; defeated the rebels and recovered Wexford June 21; defeated the French troops under Humbert at Killala Sept. 8; was made commander-in-chief in India in 1800; conducted the Mahratta war (1803) with brilliant success, taking Delhi (Sept. 12), Agra (Oct. 17), and winning the decisive victory of Laswaree (Nov. 1), which brought the Mogul emperor into vassalage

to England, for which he was made (Sept. 1, 1804) Baron Lake of Delhi and Laswaree. He defeated Holkar near Bhurtpoor Apr. 2, 1805; returning to England in 1807 was made viscount (Oct. 31), and appointed governor of Plymouth, where he d. Feb. 20, 1808. The title became extinct by the death of the third viscount, June 24, 1848.

Lake Belt, tp. of Martin co., Minn. Pop. 296.

Lake Butler, post-v., cap. of Bradford co., Fla. It is 11 miles S. from Olustee, a station on the Jacksonville Pensacola and Mobile R. R.

Lake Charles, post-v., cap. of Calcasieu parish, La., situated on Lake Charles and Calcasieu River, 50 miles N. of the Gulf of Mexico, 30 miles E. of Sabine River, and 200 miles W. of New Orleans, on the (unfinished) New Orleans and Texas R. R. It has 11 steam saw-mills, 1 weekly newspaper, 4 churches, 7 orange-groves, 11 stores, 80 lumber-schooners making voyages from Calcasieu River to Galveston, Tex., chiefly for the transportation of lumber, which constitutes the leading industry. Pop. about 500.
J. W. Bryan, Ed. "Weekly Echo."

Lake City, post-v., cap. of Columbia co., Fla., 60 miles W. of Jacksonville and 105 E. of Tallahassee, on the Jacksonville Pensacola and Mobile R. R., has 5 churches, 3 schools, 3 weekly newspapers, and the usual number of stores and hotels. It is surrounded by bright silvery lakes abounding in the most delicious fish. Pop. 964.
E. G. Johnson, Ed. "Herald."

Lake City, post-v. of Calhoun tp., cap. of Calhoun co., Ia., on Lake Creek, 27 miles S. W. of Fort Dodge, has 2 churches, 2 hotels, 1 weekly newspaper, a fine brick schoolhouse, with the usual proportion of stores and shops. Situated in the midst of a rich farming country. Pop. 103.
Earl Billings, Pub. "Pioneer."

Lake City, post-v. of Missaukee co., Mich., on the E. shore of Wintergreen Lake, was laid out in 1873 in the midst of a lumbering and farming region; has a weekly newspaper, stores, and saw-mills.
S. W. Davis, Ed. "Missaukee Reporter."

Lake City, post-v. and tp. of Wabasha co., Minn., on the Lake Pepin and Chicago and the Milwaukee and St. Paul R. Rs., 93 miles below St. Paul, contains 4 large steam-elevators, several saw and flouring mills, a large foundry and machine-shop, a plough and 2 wagon manufactories, several churches, Masonic and other lodges, 2 banks, 2 weekly newspapers, a public library and 10 or 12 stores. The town is handsomely laid out, is the market of a thickly settled and productive wheat-region, and the scenery on Lake Pepin is admitted to be the most beautiful on the upper Mississippi, and for grandeur to vie with any other region in America, resembling that of Lake Geneva. Pop. 2608. E. C. Spaulding, Ed. "Leader."

Lake Crys′tal, post-v. of Judson tp., Blue Earth co., Minn., on the St. Paul and Sioux City R. R.

Lake Dwellings. See Palefits and Pre-historic Man.

Lake For′est, post-v. of Shields tp., Lake co., Ill., on Lake Michigan and on the Milwaukee division of the Chicago and North-western R. R., 8 miles S. of Waukegan, and 28 miles from Chicago, is laid out in curvilinear form. It is the seat of Lake Forest College, and has a female seminary.

Lake Fork, tp. of Logan co., Ill. Pop. 398.

Lake George, the P. O. name of Caldwell (which see), the cap. of Warren co., N. Y.

Lake Haus′kah, tp. of Brown co., Minn. Pop. 215.

Lake Hen′ry, tp. of Stearns co., Minn. Pop. 159.

Lake Johan′na, post-tp., Pope co., Minn. Pop. 219.

Lake′land, post-v. and tp., Washington co., Minn., on St. Croix Lake, almost opposite Hudson, Wis. Pop. 595.

Lake Land′ing, post-v. and tp. of Hyde co., N. C., on Mattamuskeet Lake and Canal. Pop. 2235.

Lake Lil′ian, post-tp. of Kandiyohi co., Minn. Pop. 238.

Lake Marme, tp. of Monongalia co., Minn. Pop. 196.

Lake Ma′ry, tp. of Douglas co., Minn. Pop. 244.

Lake Mills, post-v. of Winnebago co., Ia. It has 1 weekly newspaper.

Lake Mills, post-v. and tp. of Jefferson co., Wis., 9 miles N. W. of Jefferson. It has an extensive trade in lumber. Pop. of v. 590; of tp. 1509.

Lake of the Woods, a large lake on the boundary between Pembina co., Minn., and the Dominion of Canada. A small detached portion of Minnesota lies on its N. W. side. Its principal affluent is the Rainy Lake River, and its waters flow N., through the Winnipeg River into Lake Winnipeg. It contains many small wooded islands, a part of which are in Minnesota and a part in Canada. It is but 977 feet above the sea-level, being 598 feet lower than Lake Itasca. Wild rice (*Zizania aquatica*) grows along its shores abundantly.

Lake Pleas′ant, tp. of Hamilton co., N. Y., in the Adirondack region. It contains Sageville, the county-seat, and the beautiful Lake Pleasant. It is a place of summer resort, and has manufactures of lumber. Pop. 318.

Lake Poets, a name given by the *Edinburgh Review* to a number of English poets, of whom Coleridge, Wordsworth, and Southey were the most important, who at the beginning of the present century lived in the lake region of Westmoreland and Cumberland, England. They had little in common except the desire to break away from the conventionalities of the literature of that day.

Lake′port, post-v., cap. of Lake co., Cal., 28 miles N. E. of Cloverdale, the terminus of the San Francisco and North Pacific R. R., on the shore of Clear Lake, has 1 bank, 1 weekly newspaper, 2 churches, 2 hotels, 1 flour-mill, 7 stores, numerous mineral springs, and 2 steamers plying on the lake. Principal business, farming. Pop. 248. J. B. Baccus, Jr., Ed. "Lake Co. Bee."

Lakeport, post-v. of Sullivan tp., Madison co., N. Y., on the S. shore of Oneida Lake. Pop. 134.

Lake Prai′rie, tp. of Marion co., Ia. It includes Pella and several other villages. Pop. 4958.

Lake Prairie, tp. of Nicollet co., Minn. Pop. 828.

Lake Prov′idence, post-v., cap. of Carroll parish, La., on the W. bank of the Mississippi, 60 miles above Vicksburg, has 5 churches, 2 machine-shops, and 1 weekly newspaper. It is located in the heart of a fine cotton-growing section, and ships annually 7000 to 8000 bales. Pop. 320. B. H. Lanier, Ed. "Lake Republican."

Lake Survey. The U. S. shore-line of the great lakes and their connecting rivers, if measured in steps of twenty-five miles, is about 3000 miles, but if the indentations of the shore and the outlines of the islands are included, the developed shore-line is about 4700 miles in length. Where a lake is narrow and along rivers it is necessary for navigation that both shores be surveyed. This increases the actual shore-line to be covered by the survey between St. Regis and Duluth to about 6000 miles—a dimension which gives some idea of the magnitude of the work. The necessity of accurate soundings and accurate charts for the commerce of these lakes is evident on remembering that in the frequent storms and fogs on these lakes, vessels are never many hours from shore, and that during the summer, commerce, as shown by entries and clearances, is equal to that of all the rest of the U. S.

The first appropriation of $15,000 was made in 1841; none was made in 1847, and previous to 1862 the largest annual appropriation was $75,000. Since that time it has varied between $50,000 and $175,000. At first, the survey was confined mainly to special localities, but, progressing, the work was made continuous, and one lake after another was taken up and its American shore completed. The first chart was published in 1852. It was not till 1852 that work on a larger scale was begun, a copy of the Bache-Wardemann base apparatus being then obtained, making greater precision in the triangulation practicable.

The work has been under the secretary of war, at first under the direction of the chief of topographical engineers, and since the junction of the two corps under the direction of the chief of engineers, U. S. army. The following officers have been in immediate charge of the work: Capt. W. G. Williams, T. E., 1841–45; Lt.-Col. J. Kearney, T. E., 1845–51; Capt. J. N. Macomb, T. E., 1851–56; Lt.-Col. J. Kearney, T. E., 1856–57; Capt. G. Meade, T. E., 1857–61; Col. J. D. Graham, T. E., 1861–64; Col. and Brevet Brig.-Gen. W. F. Raynolds, engineers, 1864–70; Major and Brevet Brig.-Gen. C. B. Comstock, 1870. They have been aided from time to time by such other officers of their corps as could be spared for the work, and by civil assistants, until a body of men has grown up thoroughly competent for such duty.

The normal plan for the survey of a lake is the following: (1) The establishment of a primary triangulation, the average probable error of whose angles shall not exceed $\frac{4}{10}$ths of a second, the probable error of its bases not exceeding $\frac{1}{300000}$th part of their lengths. (2) The determination from the primary triangulation of secondary points along the shore-line to be surveyed, not more than ten or fifteen miles apart, these distances being much less when a secondary or tertiary triangulation can be carried along shore. (3) A detailed topographical and hydrographical survey along the shore based on these points, extending inland about three-fourths of a mile, and lakeward for half a mile, or to the four-fathom curve. (4) A belt of off-shore hy-

drography done with a steamer, and extending from the four-fathom curve to eight or ten miles from land. (5) Lines of steamer-soundings across the lake. (6) Precise determinations of latitude, longitude, and azimuth at several primary stations. (7) Reduction of field-work and construction of the maps.

In some cases, on account of special difficulty or cost, the primary triangulation has not been carried along the lake shore. Thus, on the American shore of Lake Huron points were determined by a combination of astronomical work and triangulation. On the E. and a part of the W. shore of Lake Michigan the positions of points needed for the maps were obtained by carrying lines of azimuths and latitudes southward from known points, the longitudes being computed from their azimuths and latitudes. The field-work for Lakes Superior, Huron, Michigan, St. Clair, and about one-half of Ontario, for the rivers St. Mary, St. Clair, Detroit, St. Lawrence, is now (July 1, 1875) completed. Lake Erie remains to be done. Forty-two charts, on scales varying from $\frac{1}{5000}$th to $\frac{1}{400000}$th, have been published, and about 6000 are issued annually. The pressure for the general charts (scale $\frac{1}{400000}$th) has been so great that few of the shore-charts on a larger scale have yet been published.

The primary triangulation is completed from Duluth to Chicago, a distance, measured along its axis, of 700 miles, and depends on four bases, of which one is yet to be measured. When the triangulation at Chicago is connected with that of Lakes Erie and Ontario, the length of the chain will be increased to 1300 miles, with three more bases, of which one is measured. Incidentally, this triangulation will give an arc of the meridian running N. from Chicago for 450 miles, an arc of a parallel running W. from the E. end of Lake Ontario for 600 miles, and an oblique arc from the same point to Duluth, 800 miles long. These, in connection with those of the Coast Survey, will, in combination with the long European and Indian arcs, finally give a more precise determination of the form and dimensions of the earth, which, so far as this continent is concerned, now depends on the Peruvian arc, a short one, and therefore of little value.

As connected with the lake survey, determinations of the magnetic elements are made at various points, the heights of the lakes above the sea are being determined, and their fluctuations are observed. The existence of solar and lunar tides in Lakes Michigan and Superior has been established, and their values determined. Aid has been rendered to the State surveys of Michigan and Wisconsin, and the positions of many hundreds of points near the lakes have been precisely determined, which will serve as starting-points for State surveys in all the future. C. B. Comstock.

Lake'ton, tp. of Muskegon co., Mich., on Lakes Muskegon and Michigan. Pop. 1039.

Lake'town, tp. of Allegan co., Mich., on Lake Michigan. Pop. 660.

Laketown, post-v. and tp. of Carver co., Minn. Pop. 1039.

Lake Val'ley, post-tp., El Dorado co., Cal. Pop. 246.

Lake Valley, tp. of Douglas co., Nev. Pop. 11.

Lake View, post-tp. of Cook co., Ill., on Lake Michigan, is contiguous to Chicago on the N. It contains many fine suburban residences, and a marine hospital, and is the site of several beautiful cemeteries. Pop. 1841.

Lake Vil'lage, post-v., cap. of Chicot co., Ark., on Old River Lake, part of a former channel of the Mississippi River.

Lake Village, post-v. of Belknap co., N. H., at the outlet of Lake Winnipiseogee in Gilford and Laconia tps., on the Boston Concord and Montreal R. R., 27 miles N. of Concord. It has 4 churches, 1 hotel, 1 weekly newspaper, railroad repair-shops, several hosiery-mills, foundry and machine-shops. Pop. in village limits, about 2300.
M. A. Haynes, Pub. "Lake Village Times."

Lakeville, post-v. of Salisbury tp., Litchfield co., Conn., 5 miles E. of Millerton, N. Y. It is a romantic place of summer resort, is the seat of the Connecticut institution for feeble-minded children, and has a public library.

Lakeville, post-v. and tp. of Plymouth co., Mass., 35 miles S. of Boston. It is traversed by the Old Colony and Newport and the Taunton and New Bedford R. Rs., contains several beautiful lakes, large forests and valuable granite ledges, and has 2 churches and a public library. Pop. 1159.

Lakeville, tp. of Dakota co., Minn. Pop. 780.

Lakeville, post-v. of Livonia tp., Livingston co., N. Y., at the foot of Conesus Lake. It has 4 churches. Pop. 130.

Lakeville Plantation, tp. of Penobscot co., Me. Pop. 108.

Lak-Nagy, town of Hungary, on the Maros, has 9502 inhabitants, mostly engaged in agriculture and the rearing of cattle and poultry.

Laksh'mi, a goddess of the Hindu Pantheon. Throughout the whole range of Oriental mythology no creation is to be met with more pleasing than that of Lakshmi, at once the Ceres and the Venus of India, the bride of the Preserver Vishnu, who sprang in the full perfection of maidenly beauty from the foam of the sea, as Homer and Hesiod sing of Aphrodite. According to the *Vishnu Purana*, "The goddess *S'ri*, seated on a full-blown lotus, and holding a water-lily in her hand, radiant with beauty, rose from the waves. The great sages, enraptured, hymned her with votive song. *Viswavasu* and the celestial choirs sang before her, whilst *Ghirtachi* and the heavenly nymphs danced. The Ganges and other holy rivers followed her, attending on her ablutions. The elephant of the skies, taking up pure waters in vases of gold, poured them over the goddess, the queen of the universal world," etc. Lakshmi, it has been observed, is also represented as the counterpart of Vishnu, the beneficent protector and preserver. Vishnu is meaning, Lakshmi is speech. She is intellect, he is understanding. He is righteousness, she is devotion. He is Creator, she is creation. He is the male energy, she is the female, and *Sakti* of Vishnu. (See Sakti.) Her complexion of skin is delicate saffron. Her attendant, like that of Minerva, is the owl. This is a curious circumstance, but difficult of satisfactory explanation. The simple fact appears to be that Lakshmi has always been such a popular deity in Hindustan that gradually her true character was lost sight of, and the attributes and attendant emblems of other divinities were ascribed to her. Thus, some Hindus have confounded her with Saraswati, the true goddess of learning of the East, who as such might, like Minerva, be fitly attended upon by the owl. However, in the early times of the epic period of Sanskrit literature Lakshmi was simply known as the queen of loveliness and good-luck, also called *Padma, S'ri, Kamala, Varahi*, etc. (See Sir William Jones's *Hymn to Lakshmi*, wherein she is addressed as "the world's great mother.") Hindus, when they perform solemn obsequies in honor of deceased ancestors, almost invariably invoke the consort of the Preserver. As the goddess of fertility she is widely worshipped by agricultural laborers. Balfour states: "The Mahratta cultivators are attentive to her worship, and when the *rabhi* crops are well above the ground they proceed to their fields, where they place five stones round a tree, on which they set pots of vermilion and some wheaten flour, which they worship as the *Pauch-Paudu*." In all of the ordinary worship paid to Lakshmi throughout India it is sufficient to state that the ceremony principally consists of offerings of flowers and grain. The goddess is a very favorite subject of Hindu art. In painting and sculpture she is represented as a very young girl, with the full breasts of a mature matron, thus typifying budding beauty conjoined with full fertility. She is frequently represented as reclining at the feet of Vishnu. A huge lotus supports them as they ride upon the silver foam of the churned ocean of milk. R. C. Caldwell.

Lalande', de (Joseph Jerome le Français), b. at Bourg-en-Bresse, department of Ain, July 11, 1732; educated at Lyons by the Jesuits; at Paris studied mathematics and astronomy, and in 1751 was sent to Berlin to make observations complementary to those made by La Caille at the Cape of Good Hope concerning the distance between the earth and the moon. In 1762 was appointed professor of astronomy at the Collége de France, and director of the observatory of Paris. He conducted the *Connaissance de Temps* from 1760 to 1775, and from 1794 till his death. His lectures were exceedingly attractive, not only to the student, but to educated people in general, and his success in diffusing astronomical knowledge and interest was very remarkable. His most prominent writings are *Traité d'Astronomie* (2 vols., 1764), *Abrégé de Navigation* (1793), *Astronomie des Dames* (1785). D. Apr. 4, 1807.

Lalemant' (Charles), b. in France Nov. 17, 1587; became a Jesuit in 1607; went to Canada in 1625 as superior of the missions; opened the first school in Quebec in 1634; attended Champlain on his deathbed; returned to France in 1638; became rector of colleges of his order at Rouen, La Flèche, and Paris, and vice-provincial. D. at Paris Nov. 18, 1674. He wrote several letters on the missions of Canada, reprinted at Albany in 1870.—His brother Jerome (1593–1673) was superior of the Canadian missions 1644–50, and again for several years from 1659, and wrote 6 volumes of the *Jesuit Relations*.—His nephew Gabriel, b. 1610, a missionary to the Hurons, was put to death by torture by the Iroquois Mar. 17, 1649.

Lali'ta-Patan', town of Nepaul, Northern Hindostan. It has many elegant buildings. Pop. 24,000.

Lallemand′ (Gen. Charles François Antoine), Baron, b. at Metz June 23, 1774; entered the army in 1792; distinguished himself in the campaigns in Egypt, Portugal, Prussia, Spain, and Russia; was brigadier and baron in 1811, and was made lieutenant-general and member of the chamber of peers on Napoleon's return from Elba. He accompanied the emperor in the Waterloo campaign, and was sent as commissoner to Capt. Maitland to treat for his surrender to the English navy. He was sent a prisoner to Malta, and on his release went to Turkey, Persia, and Egypt in an unsuccessful search for employment, after which he made his way to the U. S., where he proposed to found a colony of French imperialist refugees. A first attempt had already been made in Alabama, but as it proved a failure, he, with his brother, Baron Henri Lallemand, located a *Champ d'Asile* on the Trinity River in Texas, then belonging to Mexico, where in 1817 he assembled 150 colonists. Driven from Texas by the Spanish authorities in Mexico, Lallemand and his companions fell back upon the project of a colony in Alabama, and, aided by a bountiful subscription opened in Paris, lands were again obtained and the so-called *state* or *canton* of Marengo was founded on the banks of the Tombigbee River. A city was laid out, and named *Eagleville;* the streets were denominated from the victories in which the refugees had participated under Napoleon. Lallemand, however, took no personal part in the Marengo colony. After devising many wild projects, he settled in Louisiana in 1819, and opened a correspondence with Napoleon, whom he proposed to carry away from St. Helena. The ex-emperor, dying in 1821, bequeathed 100,000 francs to Lallemand, but the French government opposed obstacles to his receiving it on account of his having been tried and condemned to death in France during his absence. In 1823 he fought in the Spanish war; went afterwards to Brussels; entered France without molestation; returned to the U. S., and established a successful school in New York. After the revolution of 1830, Lallemand was restored to his military and political honors (1832), took his seat in the chamber of peers, and was for two years military commander in Corsica. D. in Paris Mar. 9, 1839.

Lally′-Tollendal′ (Thomas Arthur), Count, b. at Romans, in France, in Jan., 1702, of Irish descent, his father having come to France with James II.; received a military education; fought with distinction at Kehl in 1733, at Fontenoy in 1745, at Falkirk in 1746, and received in 1757 the command of an expedition against the French possessions in the East Indies. He was very successful at first; conquered the Coromandel coast and laid siege to Madras, but being left unsupported by the other French commanders, he was compelled to surrender at Pondicherry in 1761, and was brought to England as a prisoner. Having heard that his personal enemies accused him of various crimes, he went to Paris on parole and demanded a trial. But by infamous intrigues he was thrown into the Bastile, and after nineteen months' imprisonment placed before a court, which, after a kind of mock trial, condemned him to death as a traitor and defaulter. He was executed May 9, 1766. By the indefatigable exertions of his son, Trophime Gérard, supported by Voltaire, a revision of the proceedings was ordered in 1778, which ended with the complete reversion of the sentence.

La′ma, or **Llama,** the *Auchenia glama*, a quadruped of the family Camelidæ, an artiodactyl ungulate mammal of the Andes of South America. It is believed to be specifically identical with the Guanaco (which see). The lama is domesticated, and employed as a beast of burden, though to a much smaller extent than in the age of the old Peruvian incas. In fact, it is believed to be the only domestic animal known upon the American continent before the advent of Europeans. The old Peruvians employed immense numbers of lamas. Besides its use as a beast of burden, its flesh is eaten, though it is not highly esteemed. Its wool is employed as a textile material, but is inferior to that of the alpaca. It is of brown or variegated color, slenderly built, and carries about 100 pounds.

Lama, or **Lamas** (Grand). See Lamaism, by Janet Tuckey.

La′maism [from Thibetan *lama*, "priest" or "lord"], the present religion of Thibet, Mongolia, and a great part of Tartary, is Booddhism, modified by Shamanism and Sivaism (which see), and containing some relics of the ancient Thibetan faith. Its chief characteristic is the worship of grand lamas, in whom Booddha is supposed to be incarnate. These priest-gods are very numerous, every lamasery or monastery of note having one at its head. The most important are: the *rGyelva Rin-po-chhé*, or *Dalai Lama*, at Lhassa; the *Pan-tchen Rin-po-chhé*, at bKra-Shiss-Lhun-po, in Further Thibet; the *Guison Tamba*, at the lamasery of the Great Kouren, on the river Toula; the *Tchang-Kia-Fo*, at Peking; and the *Sa-Dcha-Fo*, at the foot of the Himalayas. After the grand lamas rank the *khutuktus*, or incarnations of celebrated Booddhistic saints; and next to these in the lamaic hierarchy come the *khubilghans*, in whom dwell the souls of former patrons or founders of lamaseries. The lower classes of lamas are incarnations of nobody in particular, and gain consideration only by superior learning or talents; among them, therefore, are found scholars, scribes, artists, physicians and sorcerers (which two terms are in Tartary frequently synonymous), prayer-makers, and artisans. They form a large proportion of the population—about one-third, according to M. Huc. "In most Tartar families," says this writer, "all the sons except the eldest become lamas, and at the age of seven enter a monastery as *chabis* (novices or disciples). This state of things is favored by Chinese rulers, as it keeps down the population of Tartary and Thibet, all classes of lamas being vowed to celibacy." The history of Thibetan Booddhism may, according to Csoma de Körös, be divided into two distinct periods. The first began in the seventh century A. C., when King Srong-Tsan-Gambo married two princesses from Nepaul and China. Both ladies brought to their new home images of Booddha and works on the Booddhistic faith, to which the king became a willing convert. He encouraged the building of temples and colleges, and sent to India his minister Thumi Sembhota, who there learned Sanskrit and arranged a Thibetan alphabet after Cashmerian characters. Srong-Tsan-Gambo wrote a historical treatise on Booddhism, called *Mani-Kabum*, or "The Hundred Thousand Precious Commandments," and obtained the name of *Chakravartin* ("wheel-turner," or "circulator of doctrine"). Many sacred works were translated from the Sanskrit, and Booddhism continued to flourish until the close of the tenth century, when King Langtarma or gLangdar, opposed and nearly extirpated it. In the eleventh century it was revived by Atisha, hBrōmston, and other learned Thibetans, and from this second period dates its division into sects. "Those persons who still adhere to the ancient forms of worship are called *nyigmapa*, and are most numerous in the parts of Thibet nearest India."

In the fourteenth century, Tsong-Kaba, a native of the province of Amdo, effected a revolution in Thibetan Booddhism. This reformer's birth was caused and accompanied by miraculous circumstances. He came into the world with a long white beard; his countenance was grave and majestic; he spoke from the moment of his birth, all his utterances showing a knowledge of the mysteries of existence. At the age of three years he desired to lead a religious life, and his mother, favoring such early devotion, herself cut off his hair and flung it outside the tent. From it sprang a marvellous tree, having fragrant wood and leaves inscribed with sacred characters. Tsong-Kaba withdrew to the mountains, and spent his time in prayer and contemplation, but seldom returning to his parents' tent. During one of his visits thither he met a wandering lama from the West, who remained with him and instructed him in religion. When the teacher died the pupil, eager for further knowledge, travelled westward to seek it, and at last reached Thibet. There he was stopped by a spirit (*lha*), who told him that in that country he was destined to teach prayers and rites. Tsong-Kaba remained at this meeting-place, to which was given the name *Lha-Ssa* ("land of spirits"), and applied himself to reform the worship of Booddha. He gained a reputation for sanctity, and in spite of opposition from the priests of higher rank was joined by many lamas, who were called Yellow Caps to distinguish them from the Red-Cap lamas, or adherents to the old forms. The new sect soon spread over all Thibet and Tartary. Its founder died in 1419 at the lamasery of Kaldan, near Lhassa, which he had established, and there, according to Lamaic belief, his body still remains, unchanged in appearance, and miraculously supported above the earth. He left various writings, of which the most important is *Lam-Rim-Tsien-Bo* (the "Progressive Path to Perfection").

The title of *rGyelva Rin-po-chhé* ("precious" or "holy majesty"), proper to the grand lama of Thibet, was given toward the end of the fifteenth century. The Mongols call him *Dalai*, or *Talé Lama*, by which name he is generally know to Europeans. His territorial power dates from 1640, when Nag-dvang-bLo-bzang-rgya-mtsho was made temporal lord of Thibet by the Mongol conqueror of that country and China. There has since then been a constant succession of Dalai Lamas, none of whom has made any mark in history. These Thibetan sovereigns have no share in secular business, which is transacted by a viceroy called *nomekhan* ("spiritual emperor") and four ministers chosen from the lama class. The Dalai's office, like that of all other living Booddhas, is to sit cross-legged in his temple and silently receive the adoration of the faithful, towards whom he occasionally extends his hand in token of blessing. An incarnate Booddha never dies. He quits his body only, after

a brief period, to enter that of a young child. Therefore when a grand lama departs no grief is shown—merely an anxiety to know where he may be found in his new form. Sometimes he tells this before his withdrawal, or after it sends a sign, which is interpreted by the augurs. He commonly transmigrates in Thibet, so that long and dangerous journeys must often be undertaken in search of him. When the young living Booddha has been found he must, before his recognition, answer many questions about the lamasery of which he in his former state was head, and identify among various articles those belonging to the late grand lama. This examination, it would appear, is always passed with credit, which fact M. Huc, while owning that deception may sometimes be used, gravely attributes to the possession of the child, not by Booddha, but by Satan. The little grand lama having been joyfully acknowledged, is conducted to his lamasery, where, placed upon an altar, he is worshipped by believers. The Dalai Lama is chosen by lot from three chaberons or living Booddhas of tender age; at least such a form of election is gone through, but its result is determined by the emperor of China or his ministers. Like the Thibetan sovereign, the living Booddha of a lamasery has no real power, that being in the hands of a non-incarnate lama-chief, assisted by subordinate officers.

A lamasery (*dGon-pa*) or monastery is very unlike our idea of such an establishment. It consists of numerous houses or huts built around a temple (*Lha-Khang*, "spirit house"). The lamas have no common refectory, but live according to their wealth, which, as they are not under vows of poverty, is sometimes considerable. Those who have reached a certain rank as theological scholars receive an allowance from the endowment. Some are paid liberally by the faithful for their services as physicians, exorcists, or intercessors for departed souls. Others engage in trade or transcribe the sacred writings. Each lama has under him one or more chabis, who act as his servants, and are instructed by him in religion and the Thibetan language, a knowledge of which is as necessary for a lama as that of Latin for a Roman Catholic priest, or of Hebrew for a Jewish rabbi. Lamai temples are built in the Indo-Chinese style, and are profusely adorned with paintings and sculpture. Opposite the principal entrance is a broad flight of steps surmounted by an altar, upon which are the Booddhic images. In front of the chief idol, and hardly more life-like than it, sits the living Booddha. The lamas are called to prayer by a blast blown upon a sea-shell. They enter in procession, bow before the incarnate Booddha, and place themselves in a circle according to their rank. The service is chanted; a bell is rung at intervals, and there is loud and (to European ears) discordant music. Incense is used, the most esteemed being brought from Thibet, the Holy Land of Lamaism. There the incarnate Booddhas transmigrate; the lamaseries there are larger and better endowed, the lamas more learned than those of Tartary and Mongolia.

Besides the *charmanas*, or monk-lamas, there are hermits (*galpos*) who inhabit cells or caves and spend their time in contemplation. Also a large class of wandering lamas, who travel from tent to tent and from lamasery to lamasery, receiving everywhere a welcome as ready as that given in Europe to the itinerant friars of the Middle Ages. Female lamas, or nuns, form a part of the Thibetan-Booddhic system; their number, however, is comparatively small. Clerical assistance is not necessary at weddings and funerals, but the lamas are generally employed to foretell the most fortunate day for a marriage; to facilitate the passage of a departing soul and pray for its happy transmigration; and to specify the best manner for disposing of the dead. Cremation is usual, but bodies are frequently exposed in lonely places, where they are devoured by beasts of prey.

As a rule, Lamaists are devoted to their religion, and give generously for the building of lamaseries and other pious objects. They are fond of going on pilgrimages to holy places, such as Lhassa; the lamasery of the Five Towers (*Ou-Tay*), near which Booddha is said to dwell within a mountain; and Tsong-Kaba's birthplace, where is a famous lamasery called *Kouna boum* ("Ten Thousand Images"). There grows the tree sprung from the reformer's hair, all efforts to propagate which have, says M. Huc, been unsuccessful. Penance forms a part of the pilgrim's duties. The more zealous penitents make the circuit of the lamasery, prostrating themselves at each step, with their foreheads touching the ground. Or they carry a heavy load of prayer-books, and thus gain credit for having repeated all the prayers therein contained. Lighter forms of penance are—walking round the lamasery while telling the beads of a rosary, or turning a wheel called *Tchu-Kor* ("revolving prayer"). This devotional machine is usually a sort of barrel, moving upon an axis and inscribed all over with Booddhistic petitions. The worshipper sets it going, and it turns prayers for his benefit while he pursues some more mundane occupation. The most common rosary-prayer is that called the *Mani*, consisting of six syllables: "*Om Mani Padme Houm*" ("Oh, the gem in the lotus! Amen"). According to Klaproth, this is the Thibetan translation of a Sanskrit formula brought from India by Thumi Sembhota. Volumes have been written commenting on it, and ascribing to it various meanings. It probably expresses a desire to attain the gem perfection, and be absorbed into Booddha, of whom the lotus is an emblem.

Even a casual student of Lamaism must observe the similarities between its ceremonial and that of Roman Catholicism. These were pointed out by M. Huc, for which frankness his interesting book was placed in the *Index Expurgatorius*. To account for them, he premised that the wandering lama, Tsong-Kaba's instructor, was in reality a Christian missionary. The canonical books of Tibet exceed in length those of every other country. They are comprised in two collections, the Kan-jur (*bKaah-hgyur*), consisting of 108 volumes, containing 1083 distinct works; and the Tan-jur (*bsTan-hgyur*) of 225 volumes, each weighing from four to five pounds in the Peking edition. A large proportion of both collections is translated from the Sanskrit, but they contain also many original treatises by Thibetan and Tartar authors. (See *Travels*, by E. R. Huc; the works of Alexander Csoma de Körös; *Die Lamaische Hierarchie*, K. Fr. Köppen; *Recherches sur les Langues Tartares*, P. A. Rémusat.) JANET TUCKEY.

Lamaline′, port of entry of Burin district, Newfoundland, 40 miles by land from Burin, situated on low ground, which is destitute of trees. Very large codfish are here taken. Pop. 310.

Lamantin. See MANATEE.

Lamar′, county of N. Texas, bounded N. by the Red River. Area, 1015 square miles. It is half prairie and half timber-land, very fertile, producing tobacco, cotton, live-stock, and corn. Cap. Paris. Pop. 15,790.

Lamar, post-tp. of Randolph co., Ala. Pop. 617.

Lamar, post-v. and tp., cap. of Barton co., Mo., 20 miles from the Kansas line in an open prairie country; has a bank, a steam flouring-mill, a saw-mill, 3 churches, 2 weekly newspapers, 3 hotels, a large graded school edifice, and the usual number of stores and shops. Pop. 1611.

EDWARD BULER, FOR EDS. "SOUTH-WEST MISSOURIAN."

Lamar, post-v. and tp. of Clinton co., Pa., 8 miles S. of Mill Hall. Pop. 1391.

Lamar (LUCIUS QUINTUS CINCINNATUS), b. July 15, 1797; studied law at Judge Gould's Litchfield school, Conn., the most famous institution of the kind then in the U. S.; admitted to the bar, removed to Milledgeville, Ga., in 1819, and soon attained high position in his profession. He was chosen by the legislature to compile the statutes of the State from 1810 to 1820. In 1830 he was elevated to the circuit court bench. The duties of this office he discharged with great dignity and ability; his decisions were considered of the highest authority, not only in Georgia, but in the adjoining States. Universally beloved and esteemed, surrounded by a happy family, with the brightest prospects of a high career, and without any known cause, he fell, at his home in Milledgeville, by his own hand, on July 4, 1834. Without any collegiate training, Judge Lamar from boyhood was a lover of books, became distinguished for his attainments in *belles-lettres* and for the classic purity of his composition, and in forensic eloquence stood among the first orators of his day. A. H. STEPHENS.

Lamar (LUCIUS QUINTUS CINCINNATUS), son of L. Q. C. Lamar, b. in Jasper co., Ga., in 1826; was educated and graduated at Emory College, Oxford, Ga., with the highest honors of that institution; studied law, was admitted to the bar, and rose rapidly in his profession; subsequently moved to Mississippi, and settled at Oxford in that State; was elected to Congress in 1856; was re-elected to Congress (the 36th), and resigned his seat in that body after Mississippi passed her ordinance of secession in 1861. At the outbreak of the war he accepted a colonelcy in the provisional army of the Confederate States, but was afterwards sent on a European mission. On his entrance into Congress in 1857, Mr. Lamar took a very high position as a debater and orator. Before his retirement he stood among the first in the House. In 1872 he was again elected a member of the House from Mississippi to the 43d Congress. In this body his position was amongst the foremost in logical argument, scholarly acomplishments, patriotic fervor, and forensic display. His speech upon the death of Mr. Sumner was considered one of the most eloquent ever delivered upon the floor of the House. A. H. STEPHENS.

Lamar (MIRABEAU B.), b. at Louisville, Ga., Aug. 16, 1798; became a merchant and planter; established in 1828 a State Rights' newspaper, the *Columbus Inquirer*; removed in 1835 to Texas, where he was distinguished at the

battle of San Jacinto; became a major-general, attorney-general of Texas, and secretary of war; in 1836 was chosen Vice-President, and was (1838–41) President of Texas. In 1846 he fought at Monterey and on the Comanche frontier. He was appointed in 1857 U. S. minister to the Argentine Republic, and in 1858 to Costa Rica and Nicaragua. D. at Richmond, Tex., Dec. 19, 1859.

Lamarck′, de (Jean Baptiste Pierre Antoine de Monet), Chevalier, b. at Barentin, France, Aug. 1, 1744; studied at the Jesuits' College at Amiens; entered the army at the age of seventeen, serving in the Seven Years' war, and at its close devoted himself to medicine and physical science at Paris, and in 1776 published a paper on atmospheric vapors, followed by the *Flore Française* (1778). In 1779 he was chosen to the Academy of Sciences; became botanist of the Jardin du Roi 1788; edited the *Dictionnaire de Botanique* (15 vols., 1785) for Panckoucke's *Encyclopédie Méthodique*, and was professor of zoology at the museum 1794–1818. His principal works are *Système des animaux sans vertèbres* (1801); *Philosophie Zoologique* (1809), in which he announced substantially what is now called the law of evolution, together with some rather fanciful speculations; *Histoire naturelle des animaux sans vertèbres* (1815–22); *Tableau encyclopédique de la Botanique* (1791–1823), and other works. D. at Paris Dec. 8, 1829.

La Mard, tp. of Wayne co., Ill. Pop. 1349.

La Mar′mora (Albert), Count, elder brother of Alfonso, b. at Turin in 1789; d. in 1863; received his military education at Fontainebleau, and in 1808 served in Calabria, then in Lombardy, afterwards in Austria; at Bautzen was decorated by the hand of Napoleon I.; fought at Leipsic; was made prisoner at Torgau, and released only in time to join the Sardinian forces at Grenoble in 1814. Having taken part in the revolutionary movement of 1821, he was banished to Sardinia, where he spent nine years in studying the island, especially its geology. In 1826 appeared his first volume of statistics of Sardinia, reprinted at Paris in 1839. After traversing the island nineteen times, he described it minutely in a work which does him the greatest honor, and which may well serve as a model for the scientific illustration of any country. He was recalled in 1831 by Charles Albert, his military rank was raised, and he was made member of the Turin Academy of Sciences. In 1848 he went to Venice to assist Manin. After being named to the senate he was sent to Sardinia as royal commissioner, and by his earnest and friendly councils he calmed the passions of the Separatist party. In 1857 he published the third and last volume of his *Viaggio in Sardinia*. In 1860 appeared his *Itinerario*.

La Marmora (Alfonso), Marquis, b. at Turin in 1804, of an old and noble family; left the military academy in 1823 with the rank of lieutenant of artillery; while in Germany in 1830 was greatly struck with the Prussian military system; reported upon it with a view to the reform of the Piedmontese light artillery; and on the accession of Charles Albert was entrusted with the formation of mounted batteries. In 1831, La Marmora established a school for non-commissioned artillery officers and soldiers, and between that time and 1848 he visited almost every country in Europe for purposes of military study. He took an active and important part in the battles of 1848; saved the life of the king in the insurrection at Milan; was sent on a mission to France, and on his return was made minister of war. In 1849 he was sent to Tuscany to restore the grand duke; then to Genoa to suppress the republican insurrection there —an event which he describes in his recent work, *Un Episodio del Risorgimento Italiano*. In Oct., 1849, being again minister of war, he established the system of obligatory instruction in the regiments, purged the army of incompetent officers, reduced the number and improved the quality of the troops, enlarged the *bersaglieri* corps, etc. In 1854 he organized and took command of the 15,000 troops sent to the Crimea, led them to the victory of the Tchernaya, and returned to Piedmont to resume his post as minister of war. In 1859 he accompanied Victor Emmanuel to the field, and after the peace of Villafranca he became president of the council. In 1861 he was sent as minister to Prussia, where he laid the foundation of the Italo-Prussian alliance, which he concluded in 1866, and by means of which, notwithstanding the defeats of Custoza and Lissa, Venice was restored to Italy. He now lives in retirement at Florence. (See his *Quattre Discorsi, etc.*, and *Un po' di luce*, which has given rise to much recrimination.)

Lamarque′ (Maximilien), Count, b. July 22, 1770, at St. Sever, in the department of Landes; entered the army in 1791, and distinguished himself in Spain by the capture of Fuenterrabia in 1794. In 1801 he was made a brigadier-general; took part in the battle of Austerlitz; accompanied Joachim Murat to Naples in 1808; put down the rebellions in Calabria; captured the island and fortress of Capri from the English, and was made a general of division. On his return from Elba, Napoleon made him governor of Paris, and later on he sent him to put down the insurrection in the Vendée, which task he fulfilled with as much forbearance as firmness. On the second return of the Bourbons he left France, being exempted from amnesty, and lived at Amsterdam, but was allowed to return in 1818. In 1828 he was elected a member of the Chamber of Deputies, where he sided with the opposition, and exercised some influence by his peculiar eloquence and disinterested character. D. at Paris June 1, 1832. His funeral, June 5, occasioned an insurrection in Paris, which cost many lives.

Lamartine′, post-v. and tp. of Fond du Lac co., Wis., 7 miles W. of Fond du Lac. Pop. 1367.

Lamartine, de (Alphonse Marie Louis), b. at Mâcon, Burgundy, Oct. 21, 1790; d. at Paris Feb. 28, 1869. His name is popular and classical, not only in France—where for nearly thirty years he held the sceptre of poetry, and during four months the sceptre of power—but also throughout the world, for his works were translated into every language. Lamartine was for a few months the real dictator of France, but he was a poetical statesman, like Castelar of Spain, and no practical results came out from his tremendous political power. Still, he left as a statesman a memory as highly honored as his memory as a poet and historian is elevated and unsullied. He was brought up by his mother with a delicacy and tenderness of sentiment which is reflected in the *Méditations*, the first poetical production of Lamartine. After the first fall of Napoleon I., whose rigid and rough rule disagreed with Lamartine, he took service, being a nobleman by birth, in the body-guard of Louis XVIII. in 1814. When Napoleon came back from Elba, Lamartine, instead of following Louis XVIII. to Ghent, travelled for four years in Italy and along the shores of the Mediterranean Sea. In 1820 he published his first volumes of poetry, *Les Méditations, Le Lac*, etc., more than 45,000 copies of which—a large number for that time—were immediately sold. He acted afterwards as attaché to the French legation at Naples, London, and then as chargé d'affaires in Tuscany, always thanks to the protection of Chateaubriand, who had become the admirer and the friend of the young poet. A young English lady, possessed of a very large fortune, became at the same time enthusiastic of Lamartine, and he married her. In 1832 he made his famous "journey in the East," the description of which he published under that title. From that time (1834) Lamartine, having been elected deputy to the French Assembly, divided his life between politics and literature. His *History of the Girondists*, published in 1846, built up his reputation as a liberal; and in 1848 he acted as the leader of the provisional government of the French republic, in the capacity of minister for foreign affairs. But he was too much of an aristocratic gentleman, of a genuine *grand seigneur*, not to oppose the daily increasing torrent of revolutionary passions. He had prevented France from adopting the red flag as its national banner by his eloquent apostrophe to a Parisian deputation: "The red flag has only gone around the Champ de Mars, while the tricolor has made the tour of Europe." After the insurrection of June, 1848, Lamartine sank entirely into political oblivion, and he retired into private life. But he had lost his poetical and literary strength; he wrote hastily some works, with the expectation that their sale would pay up the tremendous debt which he had incurred, principally through a generosity of heart. But all his efforts were fruitless to fill up the abyss; he lived almost in poverty, when in 1867 the Corps Législatif voted him a large annuity, which softened his last days, for he died two years after having received this testimonial of the gratefulness of France towards one of her greatest poets, historians, and most honest statesmen. A public subscription was started after his death, and in 1874 a statue was erected to Lamartine near Mâcon, at Milly, a village where he had spent his youth, and which he has so often celebrated in his books. To the list of his works already mentioned above can be added among the most remarkable *History of the Revolution of 1848, The Confidences, Toussaint L'Ouverture*, a drama, *Geneviève, Graziella*, and the numbers of two kinds of periodical reviews exclusively edited by him—*Le Conseillier* and *Cours Familier de Littérature*. Félix Aucaigne.

La′mas (Andrés), b. at Montevideo, Uruguay, about 1817, received an excellent education in his native city, and at an early age became distinguished both in literature and politics, founding the Historical Institute of Montevideo, and filling successively several important offices. He was prefect of Montevideo during a portion of the celebrated nine years' siege; minister of finance, and several times plenipotentiary to Brazil and Buenos Ayres to negotiate the most important concerns of the republic. It is, however, for his vast knowledge of South American history

that he is best known, his private collections of manuscripts being perhaps the most important materials extant upon the subject. He has published several volumes of a vast *Collection of Memoirs and Documents relative to the History and Geography of the Rio de la Plata*, and numerous poems and historical treatises.

Lamb, tp. of Dickinson co., Kan. Pop. 462.

Lamb (CAROLINE). See MELBOURNE.

Lamb (CHARLES), b. in London Feb. 18, 1775. His father, who was a servant to one of the benchers of the Inner Temple, had some literary taste and a rare fund of humor, and was author of a small volume of verse. Charles was educated at the school of Christ's Hospital from his seventh to his fifteenth year, Coleridge being a fellow-pupil and friend, and in 1789 obtained a clerkship in the South Sea House. In 1792 he became an accountant in the office of the East India Company, and remained at this post until 1825, when he retired on a pension. There was a tendency to insanity in the family, which manifested itself in Charles for a short time in 1795, and in his sister Mary the next year, when she killed her mother with a knife. In 1797, Lamb printed a small volume of verses written by himself, Coleridge, and Charles Lloyd. He devoted much attention to early English literature; published in 1807 *Tales from Shakspeare*, and in 1808 *Specimens of English Dramatic Poets who lived about the time of Shakspeare.* He twice appeared as a dramatic author, having printed in 1801 a tragedy, *John Woodvil*, and in 1806 a farce, *Mr. H——*, which was brought out at Drury Lane. Neither of these plays had the slightest success, and the author wisely devoted thereafter his occasional literary efforts to the field in which he is best known and most universally appreciated. Several brilliant *Essays* appeared from time to time in Leigh Hunt's *Reflector* (1810) and in other periodicals, but it was not until 1820 that he began the *Essays of Elia* in the *London Magazine*. They were collected in 1823, and established his reputation as one of the most brilliant and thoughtful of humorists. In 1833 he added the *Last Essays of Elia*. After his retirement in 1825 from the drudgery of office-labor the remaining years of his life were passed in the companionship of a host of literary friends, to whom he was much attached. Among them were, besides Coleridge and Lloyd, Southey, Wordsworth, Godwin, Talfourd, Procter, Leigh Hunt, Hazlitt, De Quincey, and Hood, and their Wednesday evening sessions at Lamb's house in Inner Temple lane were for several years a marked feature of literary life in London. Lamb, though painfully modest and somewhat hesitating in his speech, was an admirable entertainer, and his table-talk, of which fragments have been preserved by his biographers, abounds in the rarest wit. His sympathy with the literary labors of others, even in spheres far removed from his own, was an admirable trait of character, surpassed only by his absolute freedom from exclusiveness in regard to opinions, religious or philosophical. His feeble and delicately strung physique was too susceptible to the effects of liquors and tobacco, which he nevertheless craved, this being his only frailty. He was never married. D. at Edmonton Dec. 27, 1834. An admirable biography and selection from his letters was published by T. N. Talfourd in 1840, and his *Final Memorials* in 1848. The poems of Lamb, though graceful, were never popular, but his reputation rests securely upon his criticisms and the *Essays of Elia*, acknowledged to be one of the most exquisite volumes in the whole range of English literature.—MARY ANNE LAMB, b. in London in 1765, sister of Charles, was a woman of considerable literary talent, and took part in some of her brother's works, especially the *Tales from Shakspeare*. She resided through life with Charles, who was tenderly attached to her; received a pension after his death from the East India Company, and d. at St. John's Wood May 20, 1847. PORTER C. BLISS.

Lamb (Gen. JOHN), b. in New York Jan. 1, 1735; assisted his father at the business of optician and maker of mathematical instruments; took a distinguished part in Montgomery's expedition against Quebec, in which he was wounded and taken prisoner; became major and colonel of artillery under Gen. Knox; and did good service throughout the war, closing his career at Yorktown. He was afterwards a member of the New York legislature, and was appointed by Washington collector of customs for the port of New York, which post he held the remainder of his life. D. in New York May 31, 1800. (See *Life of Lamb*, by Leake, Albany, 1850.)

Lamballe', de (MARIE THÉRÈSE LOUISE DE SAVOIE-CARIGNAN), PRINCESS, b. at Turin Sept. 8, 1749, and married in 1767 the prince of Lamballe, son of the duke of Bourbon-Penthièvre, who died next year. Between Marie Antoinette and the princess, who was as much distinguished by her intelligence as by her beauty, arose a friendship which proved true to the last. When the royal family attempted to flee (May 29, 1791) the princess, who was mistress of the royal household, preceded them, but when the attempt failed returned from England to stay with the queen, whose humiliations and sufferings she shared with genuine heroism. Murdered in the massacre of Sept. 8, 1792.

Lambaye'que, town of Peru, South America, on the Lambayeque, 5 miles from its mouth into the Pacific, is beautifully situated and well built. It has manufactures of woollen and cotton fabrics, and carries on some trade, though its roadstead is over a mile distant from the shore, and very bad. Pop. 10,000.

Lam'bert (DANIEL), b. at Leicester, England, Mar. 13, 1769; was remarkable for his great size, and for some years exhibited himself to visitors in London and the large cities of England. Previous to the age of nineteen he had not been noted for corpulency, but owing perhaps to a sedentary life as keeper of a prison, he attained in 1793 a weight of 448 pounds, and ultimately 739 pounds. He was only 5 feet 11 inches in height, strictly temperate in habits, and distinguished for health, activity, good-humor, and polished manners. D. at Stamford June 21, 1809.

Lambert (JOHANN HEINRICH), b. Aug. 29, 1728, at Mülhausen in Alsace, in humble circumstances, but succeeded by industry and perseverance in developing his natural talent for mathematics and natural science; travelled much as private tutor to two young Swiss noblemen, and came in 1764 to Berlin, where Frederick II. made him a member of the Academy of Science and superintendent of the *Astronomical Almanac*. His *Photometria, sive de mensura et gradibus luminis colorum et umbræ* (1760) contains the first scientific representation of the measurement of the intensity of light; and his *Insigniores Orbitæ Cometarum Proprietates* still occupies an honorable place in the history of astronomy. His metaphysical writings, on the contrary, have become entirely forgotten. D. at Berlin Sept. 25, 1777.

Lambert (Gen. JOHN), b. at Kirkby Malhamdale, Yorkshire, England, Sept. 7, 1619; studied law, and on the outbreak of the great rebellion entered the Parliamentary army as captain under Lord Fairfax. He was conspicuous in the principal battles of the war; was colonel at Marston Moor (1644) and major-general in the Scots war (1650), in which he gained the actions of Hamilton and Inverkeithing; was appointed lord deputy of Ireland in 1652; was a member of Cromwell's council and Parliament (1654); and aided Cromwell to become Protector, but opposed his assumption of sovereign power in 1657, refusing to take the oath of allegiance, and was dismissed from court with a pension. On the accession of Richard Cromwell in 1658, Gen. Lambert headed the confederacy of military commanders which deposed that feeble ruler, and aspired to the Protectorate. In May, 1659, he was chiefly instrumental in the reinstallation of the "Rump Parliament;" defeated the royalists at Chester in August, came into conflict with and forcibly dispersed the Rump in October, thereby becoming head of the committee of safety and virtual ruler of England. Lambert started with an army to oppose Monk (Nov.), but the troops deserting in great numbers, he was soon seized by order of Parliament (Jan., 1660) and cast into the Tower, whence he escaped and reassembled forces against Monk; but being captured a second time, he was tried and condemned to death (June, 1662) by the new court of king's bench under Charles II. His sentence was commuted to banishment, and he d. on the island of Guernsey in 1692.

Lam'bertville, post-v. of West Amwell tp., Hunterdon co., N. J., on the Delaware River and the Belvidere division of the Pennsylvania R. R., 14 miles above Trenton, 44 miles from Philadelphia, and 71 from New York. It has 5 churches, 2 weekly newspapers, 5 hotels, 1 national bank, a rubber-factory, iron-foundry, railroad construction and repair shops, a cotton, 2 paper, 2 spoke, and 2 twine mills, with excellent water-power. Pop. 3842.

HAZEN & ROBERTS, EDS. AND PROPS. OF "BEACON."

Lambèse, small town of Algeria, in the province of Constantine, is used by the French as a penal colony. It stands on the site of the ancient *Lambessæ*, one of the most important cities of Numidia and the station of a Roman legion. Ruins of an amphitheatre, a temple of Æsculapius, and a magnificent wall with forty gates are still extant.

Lam'beth, one of the suburbs of London, on the S. of the Thames, opposite Westminster, with which it is connected by the Waterloo, Westminster, and Vauxhall bridges. Pop. 379,112. Lambeth **Palace**, an edifice of the Middle Ages, has been for centuries the principal residence of the archbishops of Canterbury, and has a fine library.

Lambruschi'ni (RAFFAELLO), ABBÉ, b. at Genoa in 1788; d. in 1873; passed some years at Rome in the study of theology, after which the young abbé returned to his father, then living in Tuscany, to devote himself to agricultural and philanthropic pursuits, going from time to time to

Florence for the benefit of scientific lectures. At the age of forty, Lambruschini published his first work—a work which proved him an elegant, careful, and thoroughly instructed writer, anxious to promote all real progress. The habit of training plants suggested to him the true method of training men; Vieusseux entrusted to him the education of his nephew, and he afterwards established a boarding college for boys at his villa of San Carboni. In 1836 he took the direction of *La Guida dell' Educatore.* In 1848 he, with Ricasoli and Salvagnoli, wrote political articles for *La Patria*, and was elected deputy to the Tuscan assembly. In 1849 he published his *Libri della Educazione*, then his *Dialoghi sulla Istruzione*, enlarged and reprinted in 1871. In 1859 he was made inspector-general of the schools in Tuscany, afterwards of all the elementary schools of the kingdom, besides being entrusted with the superintendence of the Istituto di Studii Superiori, in which he was professor. He was a member of the senate at the time of his death.

Lamb'ton, county of Ontario, Canada, bounded on the N. by Lake Huron and on the W. by the St. Clair River. Petroleum is produced to some extent. The soil is very fertile. The county is traversed by the Grand Trunk R. R. Cap. Sarnia. Pop. 31,994.

Lame'go, town of Portugal, in the province of Beira. It is beautifully situated at the foot of the Penude Mountains, on an affluent of the Douro, is surrounded by walls, has an ancient castle, an episcopal palace, a college, a fine Gothic cathedral, and many other ecclesiastical monuments. It has been the seat of a bishopric since the fourth century, and was the residence of the early Moorish kings of Portugal. Pop. 9000.

Lamellibranchiata, or **Acephala** (a class of mollusks). See CONCHOLOGY, by G. W. TRYON, JR.

Lamennais', de (HUGUES FÉLICITÉ ROBERT), ABBÉ, b. June 19, 1782, at St. Malo, Bretagne; acquired very early, through passionate application to studies, a comprehensive knowledge of theology, philosophy, and history; adopted, though only after some hesitation, the ecclesiastical career; received the tonsure in 1811, and took holy orders in 1817. It struck him that lack of true religion was the real cause of all the mental and moral troubles from which the age suffered; and although he moved along through many and very singular windings, and changed his standpoint and allies more than once, at the bottom of all his different views of the world lies the idea that the regeneration of the time depends on a religious revival. The first work in which he set forth his idea with full power was his *Essay sur l'indifférence en Matière de Religion* (4 vols., 1817–20), a brilliant apology for the Church and the monarchy, hailed with enthusiasm by the Ultramontane clergy and the old-conservative statesmen, but offensive to the Gallican party in the French Church, and hateful to all the different shades of democracy and liberalism. It awakened a certain suspicion, however, even among its best friends. The monarchy was not based on its legitimacy, but on its usefulness to the Church, and in the Church the highest authority was not sought for in the infallibility of the pope, but in the universal consent of all Christians. In his next following works, *La Religion considerée dans les Rapports avec l' Ordre civil et politique* (2 vols., 1825–26) and *Progrès de la Révolution et de la Guerre contre l'Eglise* (1829), this idealization of the existing Church and monarchy developed into a tendency towards reform of both; and after the July revolution in 1830 he openly broke with the old monarchy, and tried in his journal, the *Avenir*, to establish an alliance between the Church and the free constitutional government. He was immediately denounced at Rome, and the pope condemned in 1832 the views set forth in the *Avenir.* Nor was he accepted by the doctrinaires, who felt that his present standpoint was only an intermediate station from which he soon would pass into radicalism. At the first moment he submitted completely to the papal condemnation: the *Avenir* was suspended. But after a year's silence and meditation he published in 1834 his *Paroles d'un Croyant,* which made an unexampled sensation; it ran through 100 editions in a few years, and was translated into all European languages. The pope condemned it, and Lamennais answered by his *Affaires de Rome* (1836). By these two books he broke absolutely with the Church, and in his subsequent works, *Le Livre du Peuple* (1837), *Esquisse d'une Philosophie* (3 vols., 1841–43), *De la religion* (1841), *Du Passé et de l'Avenir du Peuple* (1842), he appeared as the apostle of the democracy, as the prophetic expounder of the alliance between Christianity and radicalism. In 1849 he was a member of the Constituent Assembly; after the *coup d'état* he lived in absolute retirement. D. Feb. 27, 1854. In accordance with his will, his corpse was brought to Père la Chaise and deposited among the poor and unknown, without any funeral rites; not even a simple stone marks his grave.

Lamenta'tions, Book of, a canonical book of the Old Testament, following the book of Jeremiah, and generally attributed to that prophet. It consists of five chapters, each composed of twenty-two verses (except the third, which has sixty-six), according to the number of letters in the Hebrew alphabet, and is an acrostic, each verse beginning with a distinct letter. The contents are, as indicated by the title, a series of dirges or threnodies upon the downfall of Israel. Some have found the occasion of its composition in the defeat of Josiah at Megiddo, and regard the references to the ruin of Jerusalem as prophetic; but the internal evidence is decisive that it must have been written after the event it commemorates. Little opposition has been made by modern critics to the tradition derived from the Septuagint text and supported by the Talmud, which refers its authorship to Jeremiah, treating it as an appendix to the prophecies.

Lameth', de (ALEXANDRE THÉODORE VICTOR), COUNT, b. at Paris Oct. 28, 1760, descended from a noble family of Picardy; was one of three brothers who figured largely in French politics during and subsequent to the Revolution, after having rendered services in the American war of independence on the staff of Count Rochambeau. Alexandre became a colonel in 1785, and was elected a deputy to the States General in 1789, taking an active part in the destruction of the privileges of the nobility and clergy. He was chosen president of the National Assembly Nov. 20, 1790; afforded protection to Louis XVI.; tendered him counsels which were disregarded; was a member of the constitutional committee; had frequent conflicts with Mirabeau, and opposed Robespierre and the Jacobins. On the outbreak of war with Austria (1792), Lameth served as field-marshal in the army of the North; was accused by the Assembly (Aug. 10), together with La Fayette; escaped from France, was seized by the Austrians, and imprisoned three years at Magdeburg; repaired to England in 1795; was well received by Fox and the Whigs, but being ordered by Pitt to leave the country, joined his brother Charles at Hamburg, opening there a commercial house. Under the consulate and empire Lameth was prefect of several departments; was appointed lieutenant-general by Louis XVIII. in 1814, and during his reign was for four sessions a leader of the opposition in the Chamber of Deputies. Lameth wrote much on politics, his most important work being *Histoire de l'Assemblée constituante* (2 vols., 1828–29).

Lameth, de (CHARLES MALO FRANÇOIS), COUNT, b. at Paris Oct. 5, 1757, brother of Alexandre; served as captain on the staff of Count Rochambeau in the American Revolutionary war; was wounded at the capture of a British redoubt at Yorktown, and promoted to be colonel. During the Revolution his career was singularly parallel to that of his brother Alexandre; like him, he was at one time (July 5, 1791) chosen president of the National Assembly, served as field-marshal, had to flee after the events of Aug. 10, 1792, and settled at Hamburg. From 1809 to 1814 he served in the army under Napoleon, obtaining the rank of lieutenant-general. After the Restoration he lived in privacy until elected to the Chamber of Deputies in 1829; cooperated in the revolution of 1830, and d. at Paris Dec. 28, 1832.—His elder brother, COUNT THÉODORE, b. at Paris June 24, 1756, also served in America, was a deputy and a field-marshal, but took little part in politics. He wrote a biography of his celebrated brothers, whom he survived many years. D. at Busagny Oct. 19, 1854.

La Mettrie', de (JULIEN OFFRAY), b. at St. Malo Dec. 25, 1709; studied medicine, and was appointed physician in the army of the duke of Gramont, but was discharged on account of his *Histoire naturelle de l'Ame* (the Hague, 1745), which book was publicly burnt for its materialism and atheism. After the publication of *La Politique du Médecin de Macchiavel* (Amsterdam, 1746) he was compelled to leave France, and sought refuge in Holland, but he was expelled also from this country on account of his *La Faculté vengée* (1747) and *L'Homme-machine* (Leyden, 1748). He removed to Berlin on the invitation of Frederick II., with whom he lived in great intimacy. Here he wrote *L'Homme-plante* (1748), *Art de jouir*, etc., and d. suddenly Nov. 11, 1751, from over-eating. Frederick II. wrote his *éloge;* Voltaire called him a "fool;" and this different impression which his writings made on his time gives them a certain historical interest; else they are entirely destitute of scientific or literary value.

Lamina'ria [Lat.], a genus of seaweeds, of which *L. digitata, bulbosa,* and *saccharina,* all deep-sea plants, are prized in Europe for the rich supply of iodine afforded by them when burned as kelp. The stem of *Laminaria digitata* (sea-tangle, girdle) is manufactured into bougies and uterine tents for surgeons' use. In some cases these tents are superior to tents of compressed sponge. It is remarkable that the sea-tangle of the American coasts, specifically identical with that of Europe, is unfit for this use.

La Mine, post-v. and tp. of Cooper co., Mo., on La Mine River, 7 miles W. of Booneville. Pop. 1088.

Lam'mas Day, the festival of St. Peter's chains (Aug. 1), probably so called because it was an ancient practice on this day to make an offering of bread as the first fruits of the year; hence "loaf-mass," corrupted to Lammas.

Lam'mergeyer [Ger., "lamb-vulture"], called also **Griffon** and **Bearded Vulture,** the *Gypaëtos barbatus,* one of the largest, perhaps the largest, of the birds of prey (since the condor has by recent authors been described as rather inferior to the lammergeyer in size), an Old-World bird, a vulture in anatomy, but an eagle in habits, rarely feeding upon carrion. It is a strong and bold hunter, sometimes reaching ten feet in expanse of wing.

Lammermoors', a range of hills, 1732 feet high, forming the boundary between East Lothian and Berwickshire, Scotland, and covering the south-eastern part of the latter county, where it presents a bold, rocky, and dangerous coast to the North Sea.

Lam'nidæ [from *Lamna,* the typical genus, and *-idæ*], a family of sharks, with a fusiform body; the caudal fin with the lower lobe a little smaller than the upper; with a keel on each side of the tail; and two dorsal fins, the first of which is behind the pectorals. Head with a pointed snout; mouth large, inferior; teeth large; the nostrils not confluent with the mouth; the spiracles obsolete or entirely wanting; the branchial apertures very wide. The family thus defined embraces several genera, including the mackerel shark and the formidable "man-eater" of the American waters. The row of teeth on the upper jaw in all these forms exhibits a break a short distance from the symphysis on each side, where the teeth are much smaller than the others. Two well-defined groups represent the family—viz. Lamnæ, in which the teeth are lanceolate or sigmoidally curved, and not serrated; and Carcharodontes, in which the teeth are triangular and serrated. The two groups are represented in the Atlantic as well as Pacific waters of North America, the Atlantic species being *Isuropsis Dekayi* and *Carcharodon Atwoodi.* The family was well represented in past geological epochs, and enormous teeth of *Carcharodon* are found in Tertiary beds. THEODORE GILL.

Lamoille', county of N. Vermont. Area, 450 square miles. It is quite mountainous, but generally very fertile, affording fine pasturage. Cattle, grain, wool, potatoes, hay, and dairy products are the agricultural staples. Lumber, leather, and starch are manufactured. The county is traversed by the Lamoille River and by the Portland and Ogdensburg R. R. Cap. Hyde Park. Pop. 12,448.

Lamoille, post-tp. of Bureau co., Ill. Pop. 1408.

Lamoille River rises in the mountains of Vermont, and flows westward into Lake Champlain, through Lamoille, Franklin, and Chittenden cos. It furnishes extensive water-power.

Lamoille Valley, a v. of Elko co., Nev. Pop. 134.

La Moin, tp. of McDonough co., Ill. Pop. 1167.

Lamoine', post-tp. of Hancock co., Me., on the seacoast, N. of Mt. Desert Island. Pop. 612.

Lamont', post-v. of Ottawa co., Mich., on Grand River.

Lamonte', post-v. of Elk Fork tp., Pettis co., Mo., on the Missouri Pacific R. R. Pop. 184.

Lamoricière, de (CHRISTOPHE LOUIS LÉON), b. at Nantes Feb. 6, 1806; was a pupil of the Polytechnic School; entered the army, took part in the campaigns against the Arabs of Algeria, and captured Abd-el-Kader in 1847. After the revolution of Feb., 1848, he was elected representative in the National Assembly, and as a general fought against the Paris insurgents. As soon as they were defeated he was appointed minister of war June 28, 1848, but resigned on the election of Louis Napoleon as President, and in the Assembly opposed the Bonapartist policy. On the night of the *coup d'état,* Dec. 2, 1851, he was sent as prisoner to the fortress of Ham, and thence exiled from France. In 1860 he took the command of the papal troops, but was defeated at Castelfidardo by Victor Emmanuel's generals. He returned to France, thanks to a pardon already granted to him in 1857 by Napoleon III., and d. in his château of Prousel near Amiens Sept. 10, 1865. FÉLIX AUCAIGNE.

Lamotte', tp. of Sanilac co., Mich. Pop. 94.

Lamotte, de (ANTOINE HOUDARD), b. at Paris, France, in 1672; studied in a Jesuit college; obtained success in writing operas of the pastoral type, and also with four tragedies, one of which, *Inez de Castro* (1723), has maintained a place on the French stage. He became blind at the age of forty; was admitted to the Academy in 1710; was dramatic censor, and was noted for the literary paradoxes he maintained in his critical essays. He wrote many fables, odes, and eclogues, depreciated Homer, and brought out an "improved and corrected" *Iliad* in French verse, reduced to ten books, which involved him in a violent controversy with Madame Dacier. D. at Paris in 1731. His complete works form 10 vols. (1754).

Lamotte, de (JEANNE DE LUZ DE SAINT RÉMY DE VALOIS), COUNTESS, b. at Fontète, in Champagne, July 22, 1756, of a noble but degenerated family; educated by the countess of Boulainvilliers, and received a pension of Louis XV. on account of her descent from the house of Valois. After marrying the count de Lamotte, a penniless adventurer, she settled in Paris about 1780, and soon began the intrigue with Cardinal Rohan which has become famous under the name of the "necklace story." It ended with her conviction May 31, 1785. She was whipped, branded, and put in the Salpetrière. In 1787 she escaped, came to London, and d. there Aug. 23, 1791, falling during a night revel out of a window. The best accounts of the necklace intrigue are found in Louis Blanc's *Histoire de la Révolution française,* and in Campardon's *Marie Antoinette et le Poies du Collier* (1864).

Lamoure', county of E. Central Dakota, traversed by the Dakota River. Area, 1800 square miles. It is almost entirely uninhabited by white men.

Lamp [Fr. *lampe;* Lat. *lampas;* Gr. λαμπάς, from λάμπειν, to "shine"]. Defined till within a few years as a receptacle for oil with a wick for illumination, the inventions of the past and present generation have made it impossible to distinguish between the *lamp* properly so called and any other artificial means of giving light. Known to the Egyptians, Hebrews, and Greeks, lamps were originally simple flat vessels of oblong or round shape, at one end of which was a small handle, at the other a little projection with a hole forming a nozzle, and with a larger opening on the back and in the centre into which the oil was poured. The oil used was generally vegetable, but, according to Pliny, sometimes of liquid bitumen. These lamps, of terra cotta or metal, many of very elegant form, were placed on or hung with chains to bronze candelabra. Tarentum and Ægina were famed for making the latter of great elegance. But though the ancients confined their ingenuity to the ornamentation of the lamp and its stand, Hero of Alexandria (B. C. 221), in his *Treatise on Pneumatics,* details four inventions, by one of which "oil can be raised by water within its stand," and by the other "raised by means of air." All the older lamps formed a crust on the wick, which was removed by a needle or picker; none of them gave a good light, and the majority of the poorest persons of the younger generation, especially in our cities, have literally no idea of the limited artificial illumination, even of the rich, before the days of gas, camphene, lard oil, and hydrocarbons.

From the earliest times until within a century the lamp remained the same, consisting simply of oil and a wick in a receiver. In 1784, M. Ami Argand (or, according to some, M. Quinquet) produced an entire revolution in artificial light by the invention of a burner with a circular wick, the flame being thus supplied with an outer and inner current of air, the effect of which was increased by means of a glass chimney. Argand was also the inventor of the chimney itself as applied to other lamps. Soon after Argand, Peter Keir (1787) made the great invention—which was only fully developed of late by Aronson—of raising the supply of oil by means of another fluid whose specific gravity is greater than that of oil, this being generally salt in water. The principal inventions since his are as follows: John Miles (1787) invented a portable carriage-lamp, also one with a reservoir on the same principle as "a birdcage water-fountain," and a burner of twisted wire. Th. H. Stokes (1787) patented a new and peculiar method of raising oil in lamps to supply the wick, and J. Smethurst (1791) and J. Lucas, with W. Baylis (1793), made ingenious applications of lenses to light. Eckhardt and Morton (1797) set forth a "method of making lamps and candlesticks by means of sliding pillars, so that they may be raised or contracted." M. Carcel in 1798 invented a lamp in which the oil was raised by clockwork. This and Stokes's lamp are the parents of the moderator lamp. About seventy varieties of this or the pressure lamp have been patented in England. A modification of the Carcel lamp known as the Diacon was long popular in America. In 1849 an American named Wood wrote a singular novel, consisting of the adventures of a lady in search of a really good lamp, in which the successful end was the attainment of the Diacon. James Smethurst and Michael Paul (1802) patented the register tube, air-tubes, and a readily removable burner, with reflectors. Porter's "automaton" (1804) was very ingenious, "the lamp being suspended on an axis counterbalanced by a weight, so as to make it hang level when full and at an angle of 45° when empty, so as to feed itself evenly by the gradual ascent of the burners." G. B. Alcock (1806) supplied oil by means of a piston and tube, also with a tube and syringe, which forced the oil up by compressed air "or

any heavier fluid than oil." Elizabeth Perryman (1809) invented an improved street and hall lamp. J. Smethurst (1811) offered several improvements, one of a spiral burner with screw-valve; also the double-cone globe. Peter Durand (1811) attempted to "render illumination more soft and agreeable to the eye." Lord Cochrane (1818) invented lamps for burning the "spirit" or "oil of tar," and made an arrangement for allowing the direct rays of light to fall perpendicularly on the ground beneath the flame. Samuel Parker, Jr. (1822), made the important improvement of fixing French chimneys upon burners by means of metal supports affixed to the turning adjuster of the lampwick. J. C. Haddan and J. Johnston (1838) invented an ingenious candle-lamp with a spring, the candle being made without a wick, the wick being in a short tube above, up to which the candle rose as it melted. Robert Rettie entered (1845) an improved method of signalizing on sea or land with colored glass lamps, shades, and reflectors, also an excellent arrangement of reflectors for lighthouses. W. C. Wilkins (1846) devised a number of inventions connected with raising oil by atmospheric pressure, with gas-burners and heating gas. Robert Hesketh (1852) claimed the invention of the combination reflector, also that of glass in corrugated sections, every alternate face being silvered. Edwin Whale (1852) invented candle-lamps which did not require snuffing, and candle-clocks. Abel Easton (1853) patented a self-generating gas-lamp, the gas being made from spirits of wine. Edward Maneire (1854) patented lamps in which the oil-reservoir was raised above the surface of the burner, and so placed that its inner surface acted as a reflector. Ed. Simons (1855) invented an apparatus for condensing and absorbing the smoke, etc. arising from gas and other flames, and increasing the light. Theodule Cavé (1856) suggested a "continual lamp" to burn twenty-four hours without requiring attention, by means of a plunger and elastic India-rubber tube. John Macdonald (1856) presented improvements for regulating the supply of oil to lamps, or of liquids of any kind for any useful purposes, by means of air-tubes and valves. Charles E. Heinke (1856) contrived an improved apparatus for illuminating objects beneath the surface of the water, or lighting mines where explosive gases exist. This was another form of safety-lamp, originally invented by Dr. Clanny of Sunderland in 1813, and perfected by Humphry Davy and George Stephenson in 1815, the former receiving all the credit of the invention. A much better lamp of the same kind was patented by J. Roberts and George Upton (1827). A. V. Newton (1859) made an improved construction of lamp for burning hydrocarbons without the aid of the usual glass chimney. M. A. F. Mennous (1859) invented a very curious apparatus for the distribution of heat as evolved by lamps, and the application of it to heating and cooking. A. V. Newton (1860) suggested an improved lamp for burning hydrocarbons without a chimney; and again, in the same year, for smokeless lamps, the principle being that of a blower supplying enough oxygen to cause complete combustion. H. R. Fanshawe (1862) patented a submerged light, or reflectors for the purpose of alluring fish. Solomon and A. J. Grant (1864) invented several improvements in lamps for burning magnesium and other metallic substances, the wire being fed by clockwork. W. Ryder (1864) suggested burning paraffin, etc. in lamps by means of an inconsumable *metalikos* wick or burner—*i. e.* a wick of glass fibres in metal tubes. E. J. C. Welch (1865) offered an improved clockwork apparatus for supplying with a regular pressure air to burners of hydrocarbons. W. B. Dalston (1865) improved an atmospheric-pressure lamp for burning hydrocarbons, in which the oil was consumed in the form of gas. The apparatus comprised an air-pump, a cup of alcohol, tubes, a copper coil or cylinder, and a regulator. C. Rahn (1865) invented an improvement for concentrating light, applicable to dental and other operations, by means of a combination of lenses. Giacomo Felice Marchisio (1865) recorded improvements in apparatus for obtaining light without danger of explosion, by the use of air which has been rendered inflammable by admixture with the vapors of petroleum and other hydrocarbons. The apparatus consisted of a mechanical motor, a circular chamber and drum in compartments, with openings for the inlet and outlet of air, the chamber being half filled with air, upon which the hydrocarbon floats. The count De Fontaine Moreau (1865) invented an illuminating apparatus for burning petroleum in the open air without the use of a chimney. Count de Moreau also suggested a number of improvements in the Carcel or moderator lamps for burning mineral oils. Though elaborate and complicated, his inventions are ingenious and suggestive. C. T. Möller also made improvements for burning hydrocarbons and turpentine, by which atmospheric air was mingled with the gas. It may be remarked that the difficulty of distinguishing between inventions relative to *lamps* and those referring to general illumination does not appear before so recent a period as 1865, when the introduction of petroleum into England greatly stimulated studies in all practical methods of generating light. Thus, the apparatus of William Clark (1865) for lighting and heating, by combining air and gas from hydrocarbons by means of a simple reservoir and tubes, with diaphragms of wire-gauze to prevent explosion, is as applicable to gasworks or cooking as to a hand-lamp. H. A. Bonneville (1865) invented a safety-lamp in which the flame must be extinguished before the gauze cylinder can be removed. J. Maublanc (1865) attempted what has since been perfected by J. Aronson—a kerosene lamp which can be lighted without removing the shade. The force of the old Hindoo proverb, that "it is always dark under the lamp," was attempted to be removed in the same year by Levi Hewitt, who invented a contrivance to remedy the inconvenience caused by the extensive shadow cast under ordinary illuminators, by means of horizontal burners of paraffin. D. Gallafent (1856) attempted to adapt the Argand principle to paraffin. Louis Pebyre (1865) suggested an improved apparatus for burning hydrocarbon oils in the open air without a chimney. It consisted of a cap and two wick-tubes, the former having two air-holes in its top or sides, with an opening below, putting it in communication with the oil-vessel, the wick-tubes extending above and below the cap. Eliz. Leichenstadt (1866) patented an ingenious lamp for the purpose of burning a mixture of crude benzole, camphor, and aconite root. Alexandre Magnin (1866) offered an improved lamp containing in a reservoir a sponge filled with petroleum, in which was a tube of wire-gauze through which a wick passed. This wick absorbed only the vapor of the petroleum, forming a gas-lamp. William James Current (1866) invented a system of telegraphing with colored lights, and devised a lamp for the purpose. Charles Brown (1866) offered a very valuable invention for consuming smoke from lamps. Edward Howard (1866) attempted to make a non-explosive lamp for all kinds of highly inflammable oils. The principle was ingenious, but the application was imperfect. (See PETROLEUM.)

The chief improvements in lamps of late years have been, with few exceptions, modifications of the foregoing. It is remarkable that the first specific invention of the kind ever made, that of Hero of Alexandria, in which the oil was raised by water, involves the pressure principle since developed as the *moderator* in nearly a hundred forms, the last of which is that of Joseph N. Aronson, applied to burning kerosene and other inflammable fluids, though it may be used for any oils. In this the reservoir and tube for oil are accompanied by another containing water, their connection being such that by the least deflection of the lamp from the perpendicular, the oil supply is cut off near the burning point. While burning, this lamp may be rolled on the ground, upset, or reversed for any time, without danger. Its blaze is remarkably steady and clear, and from the great simplicity of its principle the lamp is not likely to get out of order. The gas-sunlight apparatus of R. G. Berford is intended to concentrate light for work or reading. It consists of a hemispherical cup made of glass, filled with water, and placed beneath a horizontal burner. It is especially adapted for reading, engraving, writing, or sewing. The lamp-burner of J. Aronson (1875) is a simple but effective invention by which a lamp may be lighted, trimmed, or filled even in the dark, without removing the chimney, globe, or shade, the latter remaining stationary. Capt. Doty, an American, has invented a lamp for lighthouses, signals, etc., which has been extensively adopted in France. The most important recent inventions in lamps are chiefly American. CHARLES G. LELAND.

Lampa'sas, county of Central Texas. Area, 835 square miles. It is mostly rolling prairie, with some hills and fertile wooded valleys. It is bounded on the W. by the Colorado River. Live-stock and grain are staple products. The county abounds in mineral springs. Cap. Lampasas. Pop. 1344.

Lampasas, post-v., cap. of Lampasas co., Tex. It has 1 weekly newspaper.

Lamp'black. This term is applied technically to carbonaceous pulverulent matters deposited during the imperfect fuliginous combustion of carburetted gases or vapors, in the presence of inadequate supply of air or oxygen. The quality, both as regards fineness and color, for use in pigments, blacking, and printing inks, varies greatly with the materials burned in the manufacture and with the methods employed. For the cheaper commercial qualities the materials employed are *gas-tar, wood-tar, petroleum,* soft resinous woods like *pine, pitch, rosin,* and even *bituminous coals*. In making ordinary lampblack several qualities are obtained at the same time in the same apparatus, by means of the following arrangement, which is here de-

scribed in but a general way: The fireplace is connected with the soot-chambers by means of a brickwork gallery or horizontal flue at least 14 feet long, in which inferior *tarry* material deposits. A series of chambers or condensers then usually follows, in which the successive deposits increase in fineness and value successively. The last chamber has suspended over it a loose conical hood, of coarse woollen material, through which the draught percolates, and which of course collects the finest black of all. As the pores of this hood become clogged it is shaken or tapped. Its contents are reserved for fine printer's ink and similar uses.

For special uses lampblacks of special kinds are sometimes prepared from costly oils and resinous substances, for which extravagant prices are required. For instance, it is said that the finest *genuine* India inks are made of soot obtained by burning the costly material *camphor*. It would appear as if the very finest blacks ought to be now made very cheaply by proper manipulation of our cheap American mineral oils. It is also stated that the natural gas of the gas-wells in different sections of the U. S. may be converted into fine qualities of lampblack on a large scale.

Lampblack in crude form always contains some oily, tarry, or resinous matters, and sometimes, according to Reichenbach, a little naphthaline. Braconnot found in lampblack from resinous wood—

Carbon	79.1
Moisture	8.0
Resin	5.3
Tar	1.7
Ulmine	0.5
Sulphate of ammonia	3.3

with some other small impurities. When printer's inks or oil colors are to be prepared, these impurities are immaterial, but when water-colors are wanted, as when to be ground with gum-water to make imitation India inks, etc., the resinous and tarry matters must be removed beforehand. This may be done by careful calcination, but not without detriment to the quality of the finer blacks. A better way, therefore, is to work into a paste with heated *oil of vitriol*, which chars and destroys the hydrocarbonaceous matters. Thorough washing with water yields then a very superior material for India ink. HENRY WURTZ.

Lamperti'co (FEDELE), b. at Vicenza in 1833, of a wealthy commercial family; received his earliest instruction from his mother, a lady of intelligence and of a strong will; pursued his classical studies as a day pupil in the seminary of Vicenza; his other studies preparatory to a legal course were prosecuted at home. At this time he formed relations with Pasini, Messedaglia, and Luzzati. In 1854 he published an article on the advantages which economical science may derive from poetry. In 1859 the Institute of Venice honored with a prize his memoir *Sulle conseguenze del taglio dell' Istmo di Suez.* His other principal works are a memoir *Della Vita e delle Dottrine di Gian Maria Ortes; Sulla Statistica Teorica in generale e en Melchiorre Gioia in particolare; Studii sulla Legislazione Mineraria; Introduzione ad un corso di Scienza Economica; Il Lavoro.* Since his twenty-first year he has continued to occupy positions of the highest trust in his native town. In 1866 he was elected deputy to Parliament, was re-elected in 1867, and was named to the senate by the minister Minghetti when he had scarcely attained to the required age.

Lamporec'chio, town of Italy, in the province of Florence. It contains a remarkable work of Luca della Robbia, and is known as the birthplace of Berni, the author of *Orlando Innamorato.* Pop. 8293.

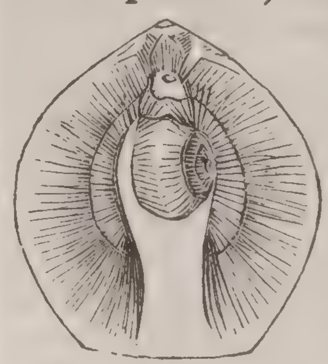
Lam'prey, or **Lamper Eel,** the common name of the Petromyzontidæ, cartilaginous fishes of the group Hyperoartia, class Marsipobranchii, having an eel-like body, a round sucking mouth with numerous teeth, and having seven round gill-holes on each side of the neck. Europe has two abundant species, the *Petromyzon marinus* and *Lampetra fluviatilis;* the U. S. have a number of species, among which are *P. Americanus,* very nearly related to the *P. marinus,* and species of *Lampetra* and nearly allied genera. They are prized as food by some. The lampreys are represented in Australia by the pouched lamprey (*Geotria Australis*), which has an enormous pouch upon the throat. (See PETROMYZONTIDÆ.) THEO. F. GILL.

Lamprid'idæ [from *Lampris,* the type of the family, and *-idæ*], a family of acanthopterous teleocephalous fishes of the mackerel group, characterized by the much compressed body, small deciduous scales, small mouth, absence of teeth in adults, six branchiostegal rays, long undivided dorsals, multiradiate thoracic ventral fins, numerous pyloric cæca, and large posteriorly-bifurcate air-bladder. A single genus (*Lampris*) is known, whose representatives (probably belonging to but one species, the *Opah* or *L. luna*) are found in the northern Atlantic and Mediterranean. The *L. luna* has been recorded as an inhabitant of the eastern American coast, but is doubtless a mere straggler. THEO. F. GILL.

Lamprid'ius (ÆLIUS), one of the *Scriptores Historiæ Augustæ,* lived at the time of Constantine the Great. Four biographies are inscribed with his name—namely, those of Commodus, Antoninus Diadumenus, Elagabalus, and Alexander Severus—but there is good evidence, both internal and external, for his identity with Ælius Spartianus, to whom the biographies of Hadrianus, Verus, Julianus, Severus, Piscennius Niger, and Geta are ascribed.

Lamp'sacus [Λάμψακος], a Greek city on the Hellespont, in Mysia, opposite Callipolis, was anciently called *Pityusa,* and was famous for its wine and its phallic-worship. Near its site stands the village of Lamsaki.

Lamp'-shell, a name applied in a large sense to all



the BRACHIOPODA (which see), but especially to those of the family TEREBRATULIDÆ (which see). The valves are united, and the pedicle for attachment passes out through a foramen of the projecting one, as the wick passed out of an ancient lamp; hence the name. Shells of several species of mollusks are also used as lamps (as the *Fusus antiquus* in Shetland). THEO. F. GILL.

Lamp'son (Sir CURTIS MIRANDA), BART., b. in Vermont Sept. 21, 1806; went in 1830 to England, where he was naturalized in 1848; became a wealthy merchant of London, a Hudson's Bay director, a trustee of the Peabody fund, and rendered important services in laying the Atlantic cable, for which in 1866 he was made a baronet. He is deputy governor of the Hudson's Bay Company.

Lamps, Safety. See SAFETY LAMPS, by MRS. S. B. HERRICK.

Lan'ark, town of Scotland, the capital of the county of Lanarkshire. The beautiful scenery in its vicinity attracts many tourists. Pop. 5099.

Lanark, county of Ontario, Canada. Area, 1180 square miles. It is traversed by the Ottawa and St. Lawrence Railway. It abounds in lakes and streams. There are two ridings. Cap. Perth. Pop. 33,020.

Lanark, post-v. of Rock Creek tp., Carroll co., Ill., 21 miles S. W. of Freeport, on the Western Union R. R., has 1 national bank, 1 weekly newspaper, 6 churches, 2 hotels, several warehouses and elevators, 24 stores, and a flouring-mill. Pop. 972. J. R. HOWLETT, ED. "GAZETTE."

Lanark, tp. of Portage co., Wis. Pop. 471.

Lan'arkshire, or **Clydesdale,** county of Scotland, comprising the upper basin of the Clyde, between Edinburghshire on the E. and Ayr and Renfrew on the W. Area, 889 square miles, of which only one-half is under cultivation. Pop. 765,279. Along the Clyde the surface is level and well adapted to agriculture, but the southern part is mountainous and the soil sterile. It is rich, however, in coal, iron, and lead—richer perhaps than any other region in Great Britain; 150 collieries and 13 iron-works are worked, and 90 furnaces in blast. Almost every kind of manufacture is carried on in or about GLASGOW (which see).

Lanc'ashire, or **Lancastershire,** county of England, bordering on the Irish Sea. Area, 1905 square miles. Pop. 2,818,904. The northern and western parts are covered with ranges of hills which separate Lancashire from the county of York, and of which the highest point, Coniston Fell, is 2577 feet. The rest is low and level, consisting of a sandy loam, watered by the Lune, Wyre, Mersey, and Irwell, and generally fertile. Manufactures, however, and not agriculture, are the chief interest of Lancashire, and its manufactures depend mainly on its immense coal-beds, covering nearly 400 square miles. Although almost everything is manufactured in or around Manchester, Liverpool, Hamilton, and Preston, yet cotton goods form the principal item, and in 1860 no less than 315,630 persons were engaged in this branch of industry, consuming 2,392,000 bales of cotton and producing goods to the value of £80,000,000.

Lanc'aster, county of S. E. Nebraska. Area, 864 square miles. It has a highly fertile soil, productive of grain. The county contains several salt-basins which yield considerable salt. There are also quarries of fine building-stone. The county is traversed by Salt Creek, whose waters are brackish, and by the various railroads centring at Lincoln, the capital of the county and State. Pop. 7074.

Lancaster, county of S. E. Pennsylvania. Area, 920 square miles. It is a beautiful region, diversified with low hills, and is one of the most fertile districts in the world. Live-stock, tobacco, grain, hay, and dairy produce are the principal staples. The manufactures are very important, and include flour, carriages, tobacco, clothing, saddlery, furniture, metallic wares, cooperage, leather, iron, lumber, agricultural implements, and many other kinds of

goods. The county is traversed by the Reading and Columbia and the Pennsylvania R. Rs. and their branches. The county has much water-power, an abundance of micaceous roofing-slate and blue limestone, and some marble. Cap. Lancaster. Pop. 121,340.

Lancaster, county of South Carolina, bounded on the N. by North Carolina and on the W. by Wateree River. Area, 600 square miles. It is uneven in surface and generally fertile. Corn and cotton are staple crops. Cap. Lancaster Court-house. Pop. 12,087.

Lancaster, county of Virginia, bounded S. E. by Chesapeake Bay and S. W. by the navigable Rappahannock River. It is level and naturally fertile. Corn and wheat are staple products. Area, 108 square miles. Cap. Lancaster Court-house. Pop. 5355.

Lancaster, town of England, the capital of Lancashire, on the Lune, near its mouth. It is a neatly-built town, with an old castle, a fine aqueduct, which carries the Lancaster Canal across the Lune, and manufactures of furniture, leather, and cast-iron work. Pop. 17,248.

Lancaster, post-v. and tp. of Cass co., Ill., on the Springfield and Illinois South-eastern R. R. (Philadelphia Station). Pop. 1239.

Lancaster, tp. of Stephenson co., Ill. Pop. 986.

Lancaster, tp. of Huntington co., Ind. Pop. 1492.

Lancaster, post-v. and tp. of Jefferson co., Ind. The township is traversed by the Madison and Indianapolis R. R. (Bright's Station). Pop. 1442.

Lancaster, tp. of Wells co., Ind. Pop. 1381.

Lancaster, post-v. and tp. of Keokuk co., Ia. Pop. of v. 135; of tp. 1525.

Lancaster, post-v. and tp. of Atchison co., Kan. Pop. 909.

Lancaster, post-v., cap. of Garrard co., Ky., 112 miles S. E. of Louisville, on the Louisville Nashville and Great Southern R. R. (Richmond branch), has 6 churches, 3 hotels, 1 weekly newspaper, 1 national and 1 deposit bank, 2 high schools, a planing-mill, a tobacco-factory, a wheat-fan factory, 4 society lodges, and about 70 business-firms. There is a company of U. S. troops in garrison. Lancaster is in the "Blue-grass region," and is noted for its fine corn and wheat. Pop. 741.

Jos. B. Rucker, Ed. "Central Kentucky News."

Lancaster, a thriving and beautiful town of Worcester co., Mass., on the Worcester and Nashua R. R., 19 miles N. by E. of Worcester. It has a fine memorial hall, a public library, a national and a savings bank, and is the seat of the State industrial school for girls. Its streets are shaded by noble elms. It is the oldest town in the county, and was incorporated in 1653. Pop. 1845.

Lancaster, post-v. of Liberty tp., cap. of Schuyler co., Mo., on the Missouri Iowa and Nebraska R. R., 2 miles E. of the St. Louis Kansas City and Northern R. R., 226 miles N. W. of St. Louis, has county buildings, 3 hotels, 2 churches, 1 national bank, 1 weekly newspaper, a fine seminary building, and a number of stores and shops. There is abundance of coal in the vicinity. Principal industry, farming and dairying. Pop. 427.

Henry A. Miller, Ed. "Excelsior."

Lancaster, post-tp., cap. of Coos co., N. H., 137 miles N. of Concord, on the Boston Concord and Montreal R. R., has 5 churches, 2 weekly newspapers, an academy, a savings bank, a paper-mill, a foundry, 50 stores and shops. Pop. 2248. W. F. Williams, Ed. "Coos Republican."

Lancaster, post-v. and tp. of Erie co., N. Y., on the New York Central and the Erie R. Rs., 10 miles E. of Buffalo. It has 6 churches, a number of manufactories, and a bank. Pop. 1697. The township contains several other villages, and has a pop. of 4336.

Lancaster, city of Hocking tp., cap. of Fairfield co., O., on the Hocking River, at the intersection of the Cincinnati and Zanesville with the Hocking Valley R. R., 21 miles N. E. of Circleville and 30 S. E. of Columbus. It has 10 churches, 1 private and 2 national banks, a magnificent court-house (cost $150,000), 2 weekly newspapers, several foundries, flouring-mills, and manufactories, 2 new public-school buildings (cost $30,000 each), a good city hall, and several wine-cellars, one of which will hold 40,000 gallons. The State reform farm for boys is located near by, and maintains 400 boys. There are few cities in the U. S. more beautifully situated than Lancaster. Pop. 4725.

T. Wetzler, Ed. "Eagle."

Lancaster, tp. of Butler co., Pa. (P. O. Middle Lancaster). Pop. 1053.

Lancaster, city and tp., cap. of Lancaster co., Pa., on the Pennsylvania R. R., 68 miles W. of Philadelphia, was in 1818, when William Cobbett visited it, the largest "inland" town in the U. S. It is located in the centre of the largest and most productive limestone region in the State, if not in the U. S. It was at one time the capital of Pennsylvania, and when the British troops occupied Philadelphia the Continental Congress met here. It is laid out regularly, the streets crossing each other at right angles; the principal streets are macadamized, and the houses almost invariably of brick. There are 14 macadamized roads leading to the city. The city is lighted with gas, has a neat theatre, 3 daily and 7 weekly (2 German) newspapers, and 7 monthly publications, fine free schools, and free night schools during the winter months, 33 churches and chapels, 4 handsome cemeteries, a volunteer fire department with 7 steam-engines, 3 national banks with a capital of over $1,000,000, 5 other banks, waterworks on a vast scale, extensive foundries, and iron manufactures of the most varied kind. There is invested here in the manufacture of cotton goods over $1,500,000, employing 1700 hands and paying to them annually $450,000 in wages. It is the centre of a large seed-leaf tobacco business, nearly 20,000,000 cigars being annually manufactured. At least 25,000 barrels of lager beer are brewed here annually, most of which finds its market elsewhere. Lancaster has a court-house erected in 1853 at a cost of $160,000, a hospital, almshouse, and prison, all of approved modern construction, and a home for friendless children. It is the seat of Franklin and Marshall College and Theological Seminary, under the control of the German Reformed Church, and was the residence and place of burial of Pres. James Buchanan and of Thaddeus Stevens. Pop. of city, 20,233; of tp. 1062.

John A. Hiestand, Ed. "Daily Examiner."

Lancaster, post-v., cap. of Lancaster co., S. C., 28 miles E. of Chester, has 3 churches, 1 weekly newspaper, a high school, a hotel, and several stores and shops. Principal industry, farming. Pop. 591.

D. J. Carter, Ed. "Ledger."

Lancaster, post-v. of Dallas co., Tex., has some manufactures.

Lancaster, post-tp., cap. of Grant co., Wis., 25 miles N. W. of Galena, Ill., and 20 miles N. of Dubuque, Ia., is a thriving inland town, located in the midst of a rich agricultural and lead-ore region. It has 1 bank, 2 weekly newspapers, 6 churches, 4 hotels, a large woollen-mill, and a sash and door factory. Pop. 2716.

John Cover, Ed. "Grant Co. Herald."

Lancaster, Duchy and County Palatine of, a territorial division of England nearly corresponding to the county of Lancashire, but distinguished from it in law as a separate administrative entity. It derives its origin from a royal charter of Edward III., by which it was conferred upon Henry, earl of Derby, Mar. 6, 1351, and on his death in 1362 it was granted to John of Gaunt and his heirs for ever; received a grant of a chancery and palatine privileges in 1377; became a Crown possession on the accession of Henry IV. to the throne in 1399, at which time the order of succession to the duchy was declared to be independent of the succession of the Crown, so that should the house of Lancaster lose the latter, it might still retain the former. This expectation was not met, for on the accession of the house of York in 1461, Edward IV. confiscated it to the Crown, and in turn attempted to make it a private appanage of his descendants. The result has been that down to the present time the government of the duchy has been vested in the sovereign, not as king of England, but as duke of Lancaster. The county palatine is a portion of the duchy, and is governed by a separate court, presided over by a chancellor, who is usually also chancellor of the duchy, an officer who of late years has been a member of the cabinet. The duchy court is held at Westminster.

Lancaster (Sir James), b. in England about 1550; commanded two naval expeditions to the East Indies in 1591 and 1601, which opened trade with Ceylon, Sumatra, Java, and other islands, and was largely concerned in promoting the search after a N. W. passage to Asia. Lancaster Sound was named from him. D. in 1620.

Lancaster (Joseph), b. in London Nov., 1778, opened a school for children in Southwark in 1798 on the principle of mutual instruction, and having achieved a brilliant success, numerous schools on the same plan were speedily established by him in other cities, and he devoted himself to the popularization of his method. He came to the U. S. in 1818, where he had some success, and obtained from the legislature of Canada a grant for the purpose of establishing his system of instruction. He was a Quaker. D. in New York Oct. 24, 1838. His family removed to Mexico, where several of his grandchildren, under the name of Lancaster-Jones, have figured in politics, and where his system is now (1875) in full operation, supported by legis-

lative grants under the management of a national Lancasterian society. The same system has also been largely adopted in Colombia and other parts of South America.

Lancaster Court-house, post-v., cap. of Lancaster co., Va., 60 miles E. by N. of Richmond.

Lancaster Gun, a system of artillery devised by Mr. Lancaster, an Englishman. The gun had a twisted elliptical bore and an elongated elliptical shot, but no grooves. The plan has not been adopted to any extent.

Lancaster, House of. See ENGLAND, JOHN OF GAUNT, HENRY IV., etc.

Lancaster Sound leads from Baffin's Bay to Barrow Strait, between the island of North Devon on its northern side and several minor islands on its southern. It is 250 miles long, forms the entrance to the N. W. passage, and was discovered in 1616 by Baffin.

Lancelet. See AMPHIOXUS and LEPTOCARDIA.

Lancelot' (CLAUDE), b. in Paris in 1615; was educated under the influence of the Abbé de Saint-Cyran, who brought him into connection with the religious association of Port Royal, in Paris. In the schools of this association he taught mathematics and Greek, and wrote for the use of his pupils a *Grammaire général* (1660), *Le Jardin des Racines Grecques*, a Greek dictionary (1657), *Nouvelle méthode pour apprendre la langue Grecque*, a Greek grammar (1655), and several other works. After the suspension of the school in 1660, he was tutor to the princes of Conti till 1672, when he retired first to St. Cyran, and then to Quimperlé, where he spent his time in prayers, meditations, and penitence, and d. Apr. 15, 1695. He was neither a great philologist nor a great grammarian, though his books are remarkable for clearness and precision; but he was a great pedagogue. His method of instruction and education was in strong opposition to the barbarous pedantry of the Middle Ages, and exercised great influence on the method adopted by the eighteenth century.

Lan'cers, a name given to such cavalry regiments as are armed with lances. The Cossacks, the Polish lancers, and the Uhlan (lancer) regiments of various armies are among the most celebrated corps of cavalry. Most of them carry a lance or spear of ash, eight, ten, or sixteen feet long, armed with a steel point and decorated with a pennon. The 5th, 9th, 12th, 16th, and 17th British light cavalry are lancers. There is a wide difference of opinion among military critics as to the value of the lance in the warfare of the present day.

Lan'cet Win'dow, in Gothic architecture, is a narrow window with a sharply pointed head. Lancet windows generally appear in groups. The lancet window is one of the characteristic marks of the Early English or First Pointed Style and the French Ogivale Primitif; hence these are often called the Lancet styles of Gothic building.

Lance'wood, the wood of *Gualteria virgata* and *laurifolia*, used (especially the former) for the shafts of carriages. The tree is tall and very straight. It is of the order Anonaceæ, and grows in the West Indies.

Lancia'no [Lat. *Anxanum*], town of S. Italy. This is one of the most beautiful towns in the Abruzzi. It has many fine public buildings, among which the cathedral should be first named. This church, "Our Lady of the Bridge," stands high above the river-valley on grand and lofty Roman bridges of the time of Diocletian, and from some points of view seems to be suspended in the air rather than resting on the earth. Its architecture, both external and internal, is striking. Lanciano is in railway communication with Ancona and with Naples, and good common roads connect it with the neighboring towns. It manufactures linen on a large scale; also silk, wool, and various chemical products. Pop. in 1874, 17,340.

Land. See REAL PROPERTY.

Landaff', post-tp. of Grafton co., N. H., 85 miles N. N. W. of Concord. It has extensive manufactures of starch, lumber, etc. Pop. 882.

Lan'dau, town of Rhenish Bavaria, on the river Queich. It was from olden times a fortress. In the Thirty Years' war it was taken eight times. It is still a fortress, and has considerable tobacco manufactures. Pop. 12,305, besides a garrison of more than 6000 persons. In 1684 it was fortified by Vauban, and was supposed to have been made impregnable, but in 1702 Louis of Baden took it.

Land'-crab, a name applied to a rather large number of crabs, remarkable as being gilled animals, which in the perfect state are air-breathers. One of the best known species of the U. S. is the *Gelasimus vocans* or fiddler. (See CRAB.)

Lan'denburg, post-v. of New Garden tp., Chester co., Pa., on the Wilmington and Western R. R., 20 miles N. W. of Wilmington.

Lan'der, county of Nevada, bounded N. by Oregon and Idaho. Its surface is broken by numerous N. and S. mountain-ranges and valleys. Some of the latter are fertile, and are especially adapted to stock-growing. The county is traversed by Humboldt River and the Central Pacific R. R. Silver and lead are mined and smelted, and some gold is obtained in the N. Cap. Austin. Pop. 2815.

Lander (Gen. FREDERIC WEST), b. at Salem, Mass., Dec. 17, 1822; studied at the Military Academy at Norwich, Vt., and conducted two perilous surveys for a railroad to the Pacific, being the only survivor of the second expedition. In May, 1861, he was appointed a brigadier-general; distinguished himself for daring in the Virginian campaigns, and d. of congestion on the brain at Paw Paw, Va., Mar. 2, 1862.—His wife, JEAN MARGARET DAVENPORT, b. in Wolverhampton, Eng., May 3, 1829, was a distinguished actress previous to her marriage in 1860; acted as a hospital nurse during the war; and in 1865 returned to the stage.

Lander (LOUISA), b. at Salem, Mass., about 1835, early manifested her genius for sculpture by modelling likenesses of members of her family and executing cameo heads; went to Rome in 1855; became a pupil of Crawford, and soon after finished in marble her two earliest statues, *To-Day* and *Galatea*, which obtained her considerable celebrity. Among her later works are busts of Hawthorne and Gov. Gore of Massachusetts, statuettes of *Virginia Dare* and *Undine*, a life-size statue of *Virginia*, a reclining statue of *Evangeline, Elizabeth, the Exile of Siberia*, a statuette of *Ceres mourning for Proserpine, A Sylph Alighting*, and several portrait busts.

Lander (RICHARD), b. in Truro, England, in 1804; accompanied Capt. Clapperton on his second African expedition, and published the narrative from Clapperton's papers (1829–30). In 1830 he and his brother John made a successful expedition, descending the Niger to its mouth. In 1832 he returned to the upper Niger in two steam-vessels, on a commercial expedition, was mortally wounded in a conflict with the natives, and d. at Fernando Po Feb., 1834.

Landernau', town of France, 14 miles E. of Brest, in the department of Finistère. It manufactures good leather and paper, has a considerable trade in wine and iron, a good harbor, a fine Gothic church, and extensive marine barracks. Pop. 7893.

Lan'dersville, post-v. and tp. of Lawrence co., Ala. Pop. 631.

Landes, department of France, bounded N. by the Gironde, S. by the Basses-Pyrenées, and W. by the Bay of Biscay. Area, 3590 square miles, with 300,528 inhabitants. The eastern and southern parts are hilly and fertile, and well adapted for agriculture; much and excellent wine is produced. But the western part, bordering on the ocean, consists only of desolate tracts (*landes*) of sandbanks, marshes, and swamps, covered with heath and dwarf shrubs, and inhabited by a few scattered families, whose members stalk along on stilts in the sand, herding their sheep and swine. On the downs are planted forests of pine and cork trees, and these plantations afford some resources to the inhabitants in cork-cutting and charcoal-burning. In 1861, out of 38,005 children, 18,590 received no school information at all. Cap. Mont de Marsan.

Land'grove, post-tp. of Bennington co., Vt., 12 miles N. E. of Manchester. It has manufactures of lumber and chair-stock. Pop. 302.

Lan'dis, tp. of Cumberland co., N. J. It contains the town of VINELAND (which see). Pop. 7079.

Lan'disburg, post-b. of Tyrone tp., Perry co., Pa. Pop. 369.

Lan'disville, post-v. of E. Hempfield tp., Lancaster co., Pa., 12 miles N. W. of Lancaster, at the crossing of the Reading and Columbia and the Pennsylvania R. Rs.

Landit', a celebrated historical *foire*, or fair and market, which was the type of those of the same kind so numerous in the Middle Ages, and which are now continued in France only by the famous *foires* of Beaucaire and the ham and gingerbread fairs held in Paris during the weeks preceding and following Easter. The name *landit* is a corruption of *Lundi*, Monday; for the Landit fair opened both in Paris and in St. Denis on the first Monday after the 11th of June, St. Barnabas's Day. The tales and books of the Middle Ages are filled with allusions to the Landit, which lasted for one week, and which was much frequented by the university students. It was both a festival, a kind of French kermesse, and a market. It is said that Charlemagne instituted the Landit, which was solemnly opened every year by a procession in which attended the bishop

of Paris, with the rector of the university, all the priests and officials, and the students. The Revolution put an end to the Landit, and now it is no more than an ordinary market for sheep, which are allowed to be brought to St. Denis and sold there between the 11th and 19th of June of each year. FÉLIX AUCAIGNE.

Land'ivar (RAFAEL), b. in Guatemala Oct. 27, 1731; graduated at the university of that city; entered the order of Jesuits in 1750 in Mexico, and rose to be the head of the seminary of San Borja. Expelled as a Jesuit on the suppression of that order in Spain and America (1767), he passed his remaining years at Bologna, Italy, and acquired distinction by his elegant Latin poetry, descriptive of tropical life in America. Besides miscellaneous verses, he published in 1782 *Rusticatio Mexicana*, in fifteen cantos, in which he describes the lakes of Mexico, the volcanoes, the mines of gold and silver, the wild animals, birds, and plants of New Spain, upon the model of Virgil's *Georgics*. D. at Bologna Sept. 27, 1793.

Landlord and Tenant in Law. This phrase is used to express a relation between the owner of land and one to whom he transfers it for such a period or in such a manner as to leave an interest still remaining in himself, technically called a reversion. The more common mode of transfer is to create an estate in the land for a fixed period, called an estate for years. It is not necessary that the time should be measured by years, the leading thought being that the time for the commencement and the termination of the estate is certain. Thus, an estate for a month, or even for a day, is of the same grade as one for a thousand years, unless there is some statute to the contrary. The common law makes a principal division of estates into those of freehold and less than freehold. An estate for years belongs to the latter class, and is thus inferior in dignity to an estate for life, which is a freehold. An estate for years is ranked as a chattel, no matter how long it may last. Partaking to some extent of the nature of land, it is called a chattel real. The reason of this rule is of a historical nature. When these interests were first introduced into the law, they belonged to the sphere of contracts. They were granted to husbandmen, whose only remedy in case of a violation of right was derived from the law of contracts. The right itself was of a personal nature. Although a tenant for years is now regarded as having an estate in the land, it partakes to some extent of its original character. Accordingly, if an owner of it dies, his unexpired interest does not descend to his heirs as land, but passes to his administrators or executors as a chattel. An owner of such an interest is said to have a *term* for years. The word "term" is here used to point out the fact that the estate has a fixed and definite termination. A distinction is thus drawn between the meaning of the words "term" and "time." Thus, if one should grant an estate for three years to A, and at the end of his *term* to B, the estate of the latter would begin whenever A's interest might terminate, whether by surrender of his estate or by lapse of time. If, on the other hand, the word "time" had been used, B's estate could not commence in possession until three years had actually elapsed.

An estate for years usually commences by means of an instrument called a *lease*. The person making it is called a *lessor*, and the person receiving it is termed a *lessee*. It frequently becomes important to distinguish between a lease and an agreement for a lease. One of these creates an estate, and is "executed" in its nature; the other confers a right to an estate, and is "executory." The rights and remedies in the two cases are quite different. In the case of a strict lease, the lessee may insist on possession when the proper time arrives, and to that end, if possession be refused, may bring an action of ejectment; in the case of an agreement for lease, his regular remedy would be to bring an action in a court of equity to obtain a lease, and subsequently he might, by means of the lease thus obtained, acquire the possession. To which class any particular instrument belongs depends mainly upon the intention of the parties as derived from the terms of the contract. Entry by the lessee is an essential element in constituting an estate for years. A distinction is thus taken between the strict estate and an *interesse termini* (or a mere interest in a term). This phrase is applied in two ways. Its first signification has reference to the interval between the execution of the lease and the time fixed for the estate to commence. Thus, if a lease were executed in February, and the estate was to commence in possession on May 1st, during the intervening period the lessee would have an "interesse termini." This expression also applies to the case where the time for taking possession has arrived, and yet there has been no entry. The lessee cannot avoid responsibility by refusing to enter, though the remedies of the lessor would not be the same as if an entry had taken place. Nice distinctions, which need not here be discussed, are derived from the doctrines of *interesse termini*. One important difference between the first form of it and that of an actual lease may be noted. If a lessee has actually taken possession of a house and lot, and the house be destroyed by fire wholly without his fault, the lessee, in the absence of an agreement or of a statute to the contrary, is liable for rent. This would not be the case if he had but an *interesse termini*. When the relation of landlord and tenant has been fully constituted, there is a twofold relation, or so-called "privity," between them—privity of contract and privity of estate. Privity of contract is derived from the terms of their agreement; "privity of estate" partakes of a feudal origin, and expresses all the relations springing up between the parties from the fact that one of them has a temporary interest, and the other is the ultimate owner. This is a very important distinction, and will be again recurred to in the course of this article. These observations are preliminary to a discussion of the main subject, which is very complicated and forms the topic of extended treatises. It will only be possible to give a cursory view of the rights and relations of the parties. The subject will be considered under the following principal divisions: I. The creation of the relation; II. Its termination or destruction; III. The respective rights and obligations of the parties; IV. Assignment and sub-letting.

I. It has been already observed that the common course is to create this relation by a written instrument. By the rules of the common law an estate for years may be created orally. The statute of frauds (see FRAUDS, STATUTE OF), however, applies to the case, and the estate, unless the term be short, must be created by writing. The terms of the statute vary in the different States as to the estates which may be created without writing. The general fact remains that oral leases are only allowed where the term is short. In some of the States the name of the lessor must be subscribed; in others, it may appear anywhere in the instrument. An agent may act for the lessor, but where the latter must execute a written lease the agent should have written authority, and should sign the principal's name, adding his own as agent. It is prudent, in most cases, though not usually necessary, to attach a seal to the instrument. The rules as to parties are substantially the same as in other contracts. The presumption is that an owner may lease; incapacity is the exception. The principal classes of incapacitated persons are the insane, intoxicated persons, such as are under duress, infants, and married women. The latter may in some States by statute make leases; the transactions of infants are in general voidable, rather than void, and may be ratified upon attaining majority. The same general rule applies to persons mentally unsound, who may ratify on the recovery of their reason, unless they were at the time of entering into the lease under judicial guardianship. In that case, by a technical rule, the lease is wholly void. Trustees may, acting within the scope of their trusts, make leases, and so also may corporations under like limitations. The capacity to take a lease which is clearly beneficial to a lessee may exist even where he could not be a lessor. Thus, a young child or a person bereft of reason may be presumed to accept a benefit when he could not be allowed to assume a burden. As a general rule, a lease can only be made of such an interest as a lessor may have at the time of its execution. Thus, if a person having a life estate in land should purport to lease it for twenty-one years, and should die within a few days afterwards, the lease would terminate at the moment of his death. Owing to this fact, life tenants are frequently unable to make advantageous leases. To remedy this defect it is not uncommon for one who creates a life estate to confer upon the life tenant a *power* (see POWERS) or authority to create a lease commencing during his tenancy, and continuing for a moderate period—viz. twenty-one years. If this power is executed, the result is, that while the life tenant lives the rent is payable to him; after his death, to the next owner (or so-called reversioner). Should his death occur during the currency of a quarter, the rent belongs as a unit to the reversioner, unless there is some clause in the instrument or a statutory provision to the contrary. Should the life tenant live till after the expiration of the lease, he may execute another under the power, etc.

Should a party having no interest whatever in land purport to make a lease of it, he would of course convey nothing. Still, should he afterwards acquire it, the instrument might operate, on the theory of an estoppel (see ESTOPPEL), to prevent him from setting up a title as against his lessee. This would only be where he had *no estate whatever* when he made the lease. If he had some estate, though less than what he purported to convey, the lease would pass what he had, and would spend its force. If he had, for example, an estate for ten years, and made a lease for twenty, the lease would pass the ten years, and would have no further operation.

II. *The Dissolution or Destruction of the Relation.*—The leading modes in which the relation of landlord and tenant may be broken up or dissolved are—(1) by eviction, (2) by surrender, (3) by merger, (4) by destruction of the subject-matter of the lease, (5) by forfeiture, including the act of disclaiming the relation on the part of the tenant.

(1) *Eviction.*—By this term is meant the act of depriving the tenant of the estate. It may be either by some person having a superior title, or by the landlord. A mere stranger or wrongdoer cannot legally cause an eviction. Should such a person turn the tenant out of possession, he would still be liable to pay rent. But in the case of a true eviction the tenant is discharged. An eviction may either be partial or total. The former does not necessarily discharge the tenant absolutely. He may still be liable to perform in part the obligations of the lease. Thus, if a landlord should lease two houses for a gross rent, and the tenant should be evicted from one of them by a person having a better title, rent would still be due for that portion of the premises actually enjoyed by the tenant. This rule does not apply to a partial eviction by the wrongful act of the landlord. In this case the entire rent is suspended while the eviction continues, as he is guilty of a breach of his portion of the contract. The doctrine of "constructive eviction" should be referred to. This is a modern principle, allowing the tenant, in case the landlord renders the occupation of the premises practically valueless by his own wrongful act, to abandon them, and make use of this theoretical eviction as a defence to the payment of the rent. This ground cannot be taken unless the tenant vacates the premises. The mere deterioration of the premises in value is no eviction. Accordingly, if one hires a house and lot, and the building is accidentally destroyed by fire, the tenant cannot, by the rules of the common law, leave the premises and cease to pay rent. The land still remains, and by legal theory the rent is indivisible and cannot be apportioned. So far is this doctrine extended that if the landlord insures with his own funds, the tenant cannot insist that the insurance-money be applied to rebuild the house, though he might if the premiums of insurance had been paid by himself, as he would in that case practically be the insurer. There may be a clause inserted in the lease that on the buildings becoming untenantable the tenant may abandon the premises and be relieved from liability. The same result is attained in some of the States by statute modifying the common law. The rule itself is not to be extended to the case where the subject-matter of the lease has wholly ceased to exist. This is not properly a case of eviction, but rather of a want of material for the contract of the parties to operate upon. The doctrines of eviction sometimes work a hardship, as where a landlord who has failed to receive rent ejects a tenant for that reason during the currency of a quarter. He may thus lose his rent for the portion of time which has elapsed since the last rent-day. This result, however, may be avoided by the insertion of appropriate clauses in the lease.

(2) *Surrender.*—By this word is meant the act of the tenant yielding up his estate to the landlord. It requires the assent of both parties. A surrender may be made either by words or acts. When made by words, the statute of frauds as to the necessity of writing may be applicable; when made by acts, no writing will be necessary. This is called a surrender by "act and operation of law." Such a surrender will only take place where the act on which reliance is placed is *inconsistent* with the continuance of the tenancy. Thus, if the landlord should substitute a new tenant in the place of the former one with his consent, or should himself take possession in the same manner, a surrender might be presumed, as there would be a plain inconsistency between the new state of things and the continuance of the tenancy. However, if the landlord should merely assent in words to the tenant's leaving the premises, without taking any step on his part, there would be no surrender by means of an *act* of which it could be affirmed that there was an inconsistency between it and the continued enjoyment by the tenant of the premises; and if the statute of frauds were not complied with as to writing, there would be no valid surrender. The delivery and acceptance of the key have in many instances been held to be evidence from which an intent to surrender might be inferred. The effect of a surrender is to break up the relation of landlord and tenant. Accordingly, if it should take place during a quarter, no rent could be collected for that portion of it which had elapsed. This remark, of course, could not be applied to rents which had actually become due before the surrender. Nor can a surrender be held to affect the previously acquired rights of third persons. An instance of the application of this rule is found in case the tenant has made a sub-lease of which the landlord is cognizant. The landlord could not accept a surrender so as to impair the rights of the under-tenant without his consent.

(3) *Merger.*—This topic resembles that of surrender. It, however, proceeds upon a different theory. It depends upon a rule of law founded upon public convenience, preventing a person from holding inconsistent rights and interests in the same property. In the case now under consideration it might be applied to the act of the tenant acquiring the estate of the landlord, as well as to that of the landlord in becoming owner of the lease. In either case the estate of the tenant would in general merge in that of the landlord. Another form of statement is that the prior estate merges in that which is future and reversionary in its nature where the latter is of a superior or of an equal grade. Thus, an estate for years may merge in a life estate, or even in an estate for years reversionary in its nature. The subject of merger is full of thorny distinctions, for a full account of which Mr. Preston's treatise on the subject may be consulted. It is not necessary or expedient to present them here. It may be much controlled by the intent of the parties wherever any good reason can be found for keeping the two estates distinct and separate in the same person.

(4) *Destruction of the Subject-matter.*—The rights and obligations growing out of the contract are reciprocal. They depend upon the existence of property to be leased. If that is totally destroyed, the contract is at an end. An illustration may be found in the lease of a room in a building which is totally destroyed by fire. The room having ceased to exist, the relation of landlord and tenant is terminated.

(5) *Forfeiture.*—There are various grounds on which a lease may be forfeited. They depend in general upon clauses found in the instrument of demise. Forfeiture may also be caused by a violation of the implied obligations growing out of the contract, as by disaffirming the landlord's title, and transferring the performance of the tenant's obligations to another. Spoil or destruction of the premises, termed waste (see WASTE), is also a ground of forfeiture, as being a breach of the tenant's duty. It is, however, a general rule that a mere wrongful act or breach of contract does not of itself cause a dissolution of the tenancy. It rather gives the landlord an option to uphold or to overturn the estate. Accordingly, if no affirmative steps are taken by him the estate will continue. He may also waive his right to enforce the forfeiture, either by express words or by implication. An instance of the latter is an acceptance of rent with full knowledge on his part of a breach of contract. This subject will be again referred to in connection with *Conditions*. Forfeiture when enforced terminates in eviction. It is, however, a lawful act, and the result of a right exercised under the contract, while eviction, as ordinarily understood, is either an act performed by a stranger having a superior title, without reference to the contract, or is a wrongful act on the landlord's part.

III. There are certain rights and obligations implied by law from the relations of the parties. These may be increased, modified, or diminished by special clauses in the lease. The parties may make any agreement not inconsistent with law or with the rules of public policy. It will not be possible to arrange, or even to state, the special provisions thus resorted to. They assume two general forms: they are either conditions or covenants. The main distinction between these is that the office of a condition is to enable the lessor to declare the lease forfeited; that of a covenant is to confer a right of action in case of its breach. This action will sometimes be in a court of law for damages; at other times, in a court of equity for an injunction or a specific performance of the covenant. A clause may be drawn both as a condition and a covenant, when the lessee will have his choice of remedies. The rules of law governing conditions are more strict than those which prevail concerning covenants, since a forfeiture is frequently very severe. The distinction may well be illustrated in the case of non-payment of rent. Where there is a condition in a lease entailing a forfeiture for its non-payment, it is necessary for the landlord to demand the exact rent on the day it is due at a specified hour at the front door of the house, etc., otherwise the forfeiture could not take place. If his object were simply to collect the rent by action, this precision would not be necessary. If the tenant did not pay promptly an action could at once be maintained. Another instance may be alluded to. There is frequently a condition that a lessee shall not assign without the consent of the lessor. A consent to assign to one person dispenses with the condition altogether. The doctrine of waiver is also readily applied, and the courts infer that a forfeiture is waived by any act on the landlord's part inconsistent with it, such as acceptance of rent with knowledge of the act of forfeiture.

Independent of express clauses in the lease, the law will in general impose upon the tenant the following duties: (1) to pay rent, (2) to render fealty or to be faithful to the lessor, (3) to refrain from committing acts of waste, (4) to make ordinary repairs, (5) to render up possession at

the end of the term. (1) The duty to pay rent is fairly to be implied from the enjoyment of the premises. There is usually an express covenant to this effect. Where there is none, the tenant may be liable to a reasonable amount for "use and occupation." Rent until it is due is deemed to be real estate; after it is payable, even though not paid, it becomes a debt, and is a mere right of action, and is regarded as personal property. The landlord's right to rent is of a different nature from the tenant's estate; the former is incorporeal, the latter is corporeal; the former is real estate, the latter is personal property (chattel real). (2) Fealty is a word of feudal origin, and expresses the duty of the tenant to be faithful to the landlord. The leading rule in modern law, derived from this view, is, that the tenant cannot dispute the title of the landlord. Practically, the rule amounts to this, that so long as a tenant remains in undisturbed possession he cannot set up as a defence to an action for rent by his landlord that the latter has no title. On similar principles, all encroachments made by the tenant on the land of others enure to the benefit of the landlord as between him and the tenant. In other words, the latter is not permitted to deny that he was acting for his landlord. The rule ceases to prevail as soon as the tenant is evicted by some person having a superior title. So, if he be threatened with an eviction by such a person, he may yield the possession to him or become his tenant, and set up these facts as a defence to any action by his lessor. It may be further stated that the tenant, while he cannot deny his landlord's original title, may show that it has expired or has been subverted. Thus, if the lessor has fallen in debt, and his estate is sold on an execution, the tenant may purchase it and himself become owner. The effect of such a transaction would be to destroy the claims of the lessor under the lease. (3) The subject of waste will be treated separately. (See WASTE.) It is enough to say here that it is an act on the part of the tenant to the injury of the landlord, and leading to a forfeiture. It is either negative or positive, "permissive or voluntary." Under this doctrine it is the duty of the tenant to refrain from cutting down timber trees, or destroying or impairing buildings, or opening mines, or from acts of neglect tending to injure the estate. He is to use the property as a prudent owner would, without doing injury to the reversioner. As he is in possession, he is bound to see that others do not commit similar acts. He is in some sort an insurer, though his liability is not extended in this country so far as to make him responsible for accidental fires, though he might be for such as were caused by his negligence. There may be clauses inserted in the lease permitting him to commit waste, either in an unlimited way or under restrictions. These will not be extended so far by the courts as to allow mere wanton destruction, and acts of that kind will be restrained by courts of equity. (4) The tenant is also bound to make ordinary repairs. He must, for instance, keep roofs and windows tight. Accordingly, in the absence of special agreement, he cannot call upon the landlord to make repairs. This matter is frequently regulated by special agreement, the landlord assuming more or less fully the duty of making the repairs. If a tenant agrees to make full repairs, he will, in general, be liable to replace buildings destroyed by an accidental fire or otherwise, the word "repair" being construed as equivalent to "rebuild." A duty sometimes springs up as between the tenant and third persons or the public to keep the premises in good order. Thus, if he should allow them, being on a public street, to become dilapidated and to cause injury to persons passing by, he might be liable to an action for damages. (5) When the tenant's term ceases he should render up possession to the landlord. At this point a question frequently arises as to his right to remove such improvements as he may have made for the purposes of trade or manufacture, or for other reasons. This topic has been fully discussed in the article on fixtures. (See FIXTURES.) If the tenant continues in possession after his term expires, legal proceedings to eject him may be resorted to. The regular course is to bring an action of ejectment against him. This remedy is expensive and dilatory, while despatch is frequently of great consequence to the landlord's interests. Statutory remedies of a summary nature are resorted to in a number of the States. These provide in substance that the tenant may be summoned before a magistrate—*e. g.* a justice of the peace—and required to show cause why he does not leave the premises. This summons is speedily returnable; it may be within a few hours. If no good cause for the delay is shown, a mandate is addressed to an officer of the court requiring him to dispossess the tenant. In some instances the landlord takes the law into his own hands, and by his own act dispossesses a refractory tenant. This course is to be discouraged, particularly in those States where the summary proceedings prevail, and may lead to a breach of the peace, and may transgress statutes to prevent forcible entry, and may, perhaps, be regarded in that case as nugatory by the courts. Should the landlord permit the tenant to hold over for a considerable period of time beyond his term, he may become a "tenant at sufferance." (See TENANT AT SUFFERANCE.)

Thus far, the duties of the tenant have been considered. Those of the landlord may be briefly referred to. They are principally to secure the tenant in quiet enjoyment of the premises, and to discharge all taxes upon the land unless there is some agreement to the contrary. In every sealed lease there is an implied covenant by the landlord for quiet enjoyment. This means such enjoyment as against persons having a paramount title. The tenant must defend himself against strangers. It is the better opinion that if the State takes the land under the right of eminent domain, the landlord is not responsible, nor has the tenant any defence for that reason to an action for rent. This is not deemed to be a paramount title, and the tenant must look to the State for indemnity.

IV. *Assignment and Sub-tenancy.*—Either of the parties may assign or transfer his interest, either in whole or in part. This fact greatly increases the complexity of the interests and rights connected with this subject. The transfer of interests may be considered under two principal divisions: (1) By the tenant; (2) by the landlord.

(1) A distinction must be taken in the outset between assignment and a sub-tenancy. In a complete assignment the tenant parts with his entire interest; in a partial assignment he transfers all his interest in a portion of the premises. The case may be illustrated by a lease of two houses for a specified time and for an entire rent. Should the tenant sell all his interest in one of the houses, there would be a partial assignment. In a sub-tenancy the tenant still retains some interest. The importance of the distinction between the two transactions is very great, as an entirely different set of rules is applied in the two cases. In order to understand the effect of an assignment it is necessary to recur to the subject of "privity," which has already been referred to. It was stated that there is between a landlord and tenant a twofold privity—that of contract and of estate. When an assignment takes place there is privity of estate between the lessor and the assignee; the privity of contract between the lessor and the lessee remains as before. The result of this theory is that the lessor has his choice of remedies. He may either pursue the lessee upon the "privity of contract," or the assignee upon the "privity of estate." This proposition involves the doctrine of covenants "running with the land." By this technical phrase is meant that there are or may be two classes of covenants in a lease, some of which may bind an assignee, and others not, since they solely affect the lessee. Those which will bind an assignee are said "to run with the land." It is frequently a question of much nicety to determine whether a covenant has this characteristic. As a general rule, in order that a covenant may bind an assignee it must concern the property embraced in the lease. Instances are promises to pay rent, to keep a house insured, to cleanse a sewer upon the premises, etc. etc. In some instances a covenant which would not regularly "run with the land" is made to do so, because the assignees of the lessee are referred to in the lease. When the promise has nothing to do with the land, or is "collateral," it will not be binding upon the assignee. The details of this subject are well stated in a note to Spencer's case in *Smith's Leading Cases*. The lessee, in any event, remains liable during the entire tenancy, or until the contract between the parties has spent its force. The assignee, on the other hand, being liable to the lessor only on the ground of his relation to the estate, may terminate all responsibility to him by making an assignment to a second assignee. He may even assign to a beggar to relieve himself from liability. There may thus be an indefinite series of assignees, any one of whom will be liable for a breach of covenant occurring during his ownership, but not for any transpiring after he has parted with his estate. However, if the lessee is made liable, he will in general have a remedy over as against the assignee who was owner when the breach of covenant took place. The lessee is on this view deemed to be a surety for the assignee. Similar principles will be adopted in the case of a partial assignment. Such an assignee will be liable to the landlord in proportion to the interest which he has acquired. None of these rules will be applied to a sub-tenancy. Assume, for example, that a lessee has taken a lease for five years, and then sub-lets the entire premises for four years, retaining one year at the close of the term to himself. He has thus become landlord to his own lessee. There is now no "privity of estate" between the original landlord and the sub-lessee. The latter does not claim the estate of the original lessee, but holds under a new and derivative contract. It is, however, true that the sub-lessee can have in general no greater rights than the lessee. His interest

being derived from that person's estate, must stand or fall with it. If, therefore, the lessee fails to perform his covenants, so as to be liable to eviction, the sub-lessee may also be deprived of his estate. If threatened with an eviction for that reason, he may by agreement with the original lessor become his tenant, and relieve himself from obligation to his own immediate landlord, the original lessee.

A word should be added as to the effect of a mortgage of a lease. This is properly to be regarded as an assignment. A lease being a chattel interest, a mortgage of it must, according to the usual rules prevailing in mortgages of chattels, be regarded as a sale or assignment. Still, it is not in general deemed to be such an assignment as to render the mortgagee liable upon the covenants in the lease binding upon the lessee, and "running with the land," unless the mortgagee goes into possession. In that case he would be liable.

(2) *Assignments by the Landlord.*—For the sake of clearness, the only case that will be considered is that of an owner in fee parting with a smaller estate than he possesses. In such a case he has a reversion to which rent and fealty are incidental. If he assigns his reversion, the rent goes with it, though it is not expressly mentioned. This remark would not be applicable to rent then due, which is a mere debt, and in legal contemplation separated from the land. The rent, even when not due, may be assigned by express words without the reversion, or the reversion without the rent. There were some difficulties in the common law attending an assignment both of the lease and the reversion. These were removed in England during the reign of Henry VIII. by a well-known enactment by Parliament, sometimes called the statute of monasteries. If there are any covenants in the lease binding on the landlord, these, if they are of a nature to "run with the land," will attach to the purchasers of the reversion. There may be a partial as well as a total assignment of the reversion. The same general rules as to proportional rights and liabilities will be applied as in the case of a partial assignment of a lease. The reversion may be apportioned by operation of law, as where the owner dies leaving several heirs who take undivided interests as tenants in common. In order to render the lessee liable to the assignee of the reversion, notice of the assignment must usually be given. If not, any payment of rents made to the lessor before notice of the assignment must be allowed to the lessee. Registration of the assignment will not be notice to the lessee, as he could not be expected to examine the public records to see if an assignment has taken place. He may assume, until he has notice to the contrary, that the original state of things continues. (See REGISTRATION.) (Further information upon the general subject may be sought in the works on real property, such as Cruise's *Digest;* Washburn on *Real Property;* Hilliard on do.; Kent's *Commentaries;* Platt on *Leases,* also on *Covenants,* etc. etc.) T. W. DWIGHT.

Lan'do, POPE, b. at Sabina, succeeded Anastasius III. in 913; d. in 914.

Landon (LETITIA ELIZABETH). See MACLEAN.

Lan'dor (WALTER SAVAGE), b. at Ipsley Court, Warwickshire, England, Jan. 30, 1775. Being the son of wealthy parents, he was intended for the army; received a careful early training from private tutors and at Rugby School (1785); entered Trinity College, Oxford, in 1793; was rusticated in the summer of 1794 for a breach of discipline, and never returned; printed in 1795 a small volume of poems, which attracted no attention; studied law, though never called to the bar, and issued in 1798 a poem (*Gebir*) of considerable length, which in 1802 he published in a Latin translation (*Gebirus*), and which Jeffrey declared to be equally unintelligible in both languages, while Southey and De Quincey prided themselves upon being its only readers. Landor visited Paris in 1802, succeeded soon after to his patrimonial estates, spent immense sums in improving them, in buying others in Monmouthshire, and in building a palatial mansion; but in 1806, in a moment of irritation, sold all his lands, ordered his magnificent house to be torn down, and prepared to live abroad. In 1808 he raised a body of troops at his own expense, joined the Spanish general Blake in defending the Peninsula against the French invasion, and contributed a large sum to the Spanish military treasury, receiving the thanks of the supreme junta and a commission as colonel. Landor married in 1811; resigned his commission on the return of Ferdinand VII. to Spain, and in 1815 settled in Florence, Italy, where for seven years he occupied the palace of the Medicis, and afterwards bought the celebrated villa Gherardesca at Fiesole. In 1812 he published *Count Julian, a Tragedy,* which elicited the warmest praise from Southey; in 1820, *Idyllia Heroica,* in Latin (published at Pisa); in 1824, another volume of *Latin Poems,* and in the same year the first series (2 vols.) of his most celebrated work, *Imaginary Conversations of Literary Men and Statesmen,* of which the second series appeared in 1829. This work in its best passages rises to a sublimity rarely equalled in English literature, while there is an abundant display of cynicism, ill-temper, and worse logic. A passionate enemy of conventionalism and of tyranny, whether political or social, he indulged in startling paradoxes, defending Tiberius and Nero, and advising the Greeks in their struggle with the Turks to discard firearms and employ only the weapons of their classical forefathers. After thirty years' residence in Italy, Landor took up his residence at Bath in 1835, published in 1836 one of his best works, *Pericles and Aspasia,* followed by *A Satire on Satirists* (1836), *Pentameron and Pentalogue* (1837), and the dramas *Andrea of Hungary and Giovanna of Naples,* all written in Italy; *The Hellenics* (1847), *Popery, British and Foreign* (1851), *Last Fruit off an Old Tree* (1853), *Antony and Octavius* (1856), and *Dry Sticks Fagoted* (1858), besides some minor works and a voluminous literary correspondence in the columns of the *Examiner.* The last-named volume contained some poems satirizing a lady at Bath, who obtained a verdict against the poet for libel, with a judgment of £1000. It was evident to his admirers that the great poet was in his dotage, but the public refused to accept such a doubtful excuse, and amid a storm of obloquy Landor retired to Florence, where he d. Sept. 17, 1864. A collective edition of his works appeared in 1846 (2 vols.), and a complete edition, to be contained in 7 vols., was commenced in 1874. His biography was written by John Forster (1869; new ed. 1874). Landor's writings have never been popular, but they all contain unmistakable evidences of a high order of genius, which is best appreciated by the "fit audience though few" of poets possessing kindred gifts. PORTER C. BLISS.

Lands'berg, town of Prussia, in the province of Brandenburg, on the Warta. It has large breweries and celebrated nurseries of fruit trees. Pop. 18,531.

Land'scape Gar'dening. Landscape gardening is a branch of horticulture, the highest results of which may be attained by processes of a comparatively simple character —simpler, for instance, than those of kitchen or of floral gardening. Failure of success in it being oftener due to a halting purpose than to lack of science, of means, or of skill, this article will be chiefly given to establishing the definition and limitation of the general end proper to the art; some indications being incidentally presented of the manner in which, under the requirement of different individual tastes and different local conditions, it may be judiciously pursued.

There are two other branches of horticulture, which in ordinary practice are often so much confounded with that of landscape gardening that the reader may find it convenient to have them set apart from it at the outset. One of them is the cultivation of plants with special regard to an interest in their distinctive individual qualities. The other is the cultivation of plants (trees, shrubs, perennials, and annuals) with a view to the production of effects on the principles commonly studied in the arrangement of precious stones, enamel, and gold in an elaborate piece of jewelry, or of flowers when sorted by colors and arranged for the decoration of a head-dress, a dinner-table, or a terrace. Whether, in any undertaking, one of these two leading motives or that of landscape gardening be adopted, it may be presumed that the result will satisfy that motive in proportion as it shall be followed to the end with singleness of purpose. We now turn, therefore, from the two which have been defined to consider what, in distinction from them, the leading motive of landscape gardening may be.

Derivatively, the word "landscape" is thought to apply only to such a scene as enables the observer to comprehend the shape of the earth's surface far before him, or, as we say in common idiom, "to get the lie of the land," the land's shape. Consistently with this view, it will be found, on comparing a variety of scenes, that those which would be most unhesitatingly classed as landscapes are distinguished by a certain degree of breadth and distance of view. Looking at the face of a thick wood near at hand or of a precipitous rock, we do not use the term. Pursuing the comparison farther, it will be found that in each of those scenes to which the word more aptly applies there is a more marked subordination of various details to a characteristic effect of the scene as a whole. As Lowell says, "A real landscape never presents itself to us as a disjointed succession of isolated particulars; we take it in with one sweep of the eyes —its light, its shadow, its melting gradations of distance." But there are many situations in which plant-beauty is desired where the area to be operated upon is so limited, or so shaped and circumstanced, that the depth and breadth of a landscape scene must be considered impracticable of attainment. In America gardening is required for the decoration of places of this class many thousand times for one

in which such restraining conditions are not encountered; and the question may be asked whether they must all be excluded from the field of landscape gardening, and if not, what, in these cases, can be the significance of the prefix "landscape"? As a general rule, probably, so many purposes require to be served, and so many diverse conditions to be reconciled, that the only rule of art that can be consistently applied is that of architecture, which would prescribe that every plant, as well as every moulding, shall bear its part in the "adornment of a service." To this end, parterre and specimen gardening are more available than landscape gardening. But it may happen that where, with due regard to considerations of health and convenience, there would be scant space for more than two or three middle-sized trees to grow, there will yet be room for a great deal of careful study, and, with careful study, of success in producing effects the value of which has nothing in common with either of the objects of horticulture thus far defined.

As an example, suppose a common village dooryard, in which are found, as too often there may be, a dozen trees of different sorts planted twenty years before, and that, by good chance, among them there is one, standing a little way from the centre, of that royal variety of European linden called *Alba pendula*. Trampled under by its coarser and greedier fellows, and half starved, youth and a good constitution may yet have left it in such condition that, all the rest being rooted out, sunlight given it on all sides, shortened in, balanced, cleaned, watered, drained, stimulated, fed, guarded from insidious enemies, its twigs will grow long, delicate, and pliant; its branches low and trailing, its bark become like a soft, finely-grained leather, its upper leaf-surface like silk, and its lower leaf-surface of such texture and tint that, with the faintest sunlight and the softest summer breeze, a constant wavering sheen, as of a damask hanging, will be flowing over the whole body of its foliage. While it regains its birthright in this respect it will also acquire, with fulness of form and moderate play of contour, a stateliness of carriage unusual in a tree of its age and stature. If landscape gardening is for the time to take its order from this princess of the fields, and all within the little court made becoming with her state, the original level surface of the ground need be but slightly modified, yet it may perceptibly fall away from near her, dipping in a long and very gentle wave to rise again with a varying double curve on all sides. There cannot, then, be too much pains taken to spread over it a velvet carpet of perfect turf, uniform in color and quality. Looking upon this from the house, it should seem to be margined on all sides by a rich, thick bank, generally low in front and rising as it recedes, of shrubs and flowering plants; the preparation for which may have required for years a clean-lined border, curve playing into curve, all the way round. A very few plants of delicate and refined character may stand out in advance, but such interruptions of the quiet of the turf must be made very cautiously. Of furniture or artificial ornaments there must be none, or next to none, for even bodily comfort may willingly defer a little to the dainty genius of the place. They may well walk, for instance, a few steps farther who would take a lounging seat, put up their feet, and knock the ashes from their pipes. Yet a single Chinese garden-stool of a softly mottled turquoise-blue will have a good effect if set where a flickering light will fall upon it on the shady side of the tree. The rear rank of shrubs will need to stand so far back that there will be no room to cultivate a suitable hedge against the street. The fence will then best be a wall of cut stone, with decorated gate-piers; or with a base of stone it may be of deftly-wrought iron touched with gilt. By no means a casting with clumsy and overdone effort at feeble ornament—much better a wooden construction of less cost, in which there is a reflection, with variety, of the style of the house if that is of wood also, or if it is not, then something like a banister-rail of turned work, but with no obviously weak parts. The gateway being formed in a symmetrical recess of the fence nearly opposite the tree, the house-door being on the side, the approach to it will bend, with a moderate double curve, in such a way as to seem to give place to the tree, and at the same time allow the greatest expanse of unbroken lawn-surface. Near the gateway, and again near the corner farthest from it, there may be a small tree or a cluster of small trees or large shrubs, forming low, broad heads (dogwood grown in tree-form, sassafras kept low, or, to save time, the neat white mulberry), the tops of which, playing into that of the loftier linden on the right, will in time give to those sitting at the bay-window of the living-room a flowing sky-line, depressed and apparently receding along the middle. If there is a tall building over the way with signs, or which otherwise offends, and the sidewalk space outside admits, we will plant upon it two trees only, adjusting them, as to both kind and position, so that they will almost repeat the depressed line of the nearer foliage, at no greater distance than is necessary to obscure the building. Quite hidden it need not be, lest, also, there should be some of the sky lost, banishment from the lower fields of the sky being a punishment that we should strive not to need. But let us hope that at the worst we have but our neighbor's stable opposite, and that the tops of more distant trees may be seen over it; we shall then still be glad to have the chance of bringing up two trees, set somewhat farther apart than before, on the roadside, as their effect will be to make an enlarged consistency of character, to close in and gather together all that makes up the home-scene, and to aid the turf in relieving it of a tendency to pettiness and excitement which lies in and under the shrubbery.

Let a different theme be sung on the same ground. Suppose that it is an aged beech that we have found, badly used in its middle age as the linden in its youth—storm-bent, lop-limbed, and one-sided, its veteran trunk furrowed, scarred, patched, scaly, and spreading far out to its knotted roots, that heave all the ground about like taut-set cables. If we had wanted a fine dressy place, this interesting object would have been cut away though it were the last tree within a mile. Accepting it, nothing would be more common, and nothing less like landscape gardening, than to attempt to make a smooth and even surface under it. Let it be acknowledged that fitness and propriety require that there should be some place before the house of repose for the eye, and that nowhere in the little property, to all parts of which we may wish at times to lead our friends in fine attire, can we risk danger of a dusty or a muddy surface. Starting from the corner nearest the tree, and running broader and deeper after it has passed it and before the house, there shall be a swale (a gentle water-way) of cleanly turf (best kept so by the cropping of a tethered cosset and a little play now and then of a grasshook, but if this is unhandy we will admit the hand lawn-mower). Now, to carry this fine turf right up over the exposed roots of the beech would be the height of landscape gardening indelicacy; to let it come near, but cut a clean circle out about the tree, would be a landscape gardening barbarism. What is required is a very nice management, under which the turf in rising from the lower and presumably more humid ground shall become gradually thinner and looser, and at length darned with moss, and finally patched with plants that on the linden's lawn would be a sin—tufts of clover and locks and mats of loosestrife, liverwort, and dogtooth-violets; even plantain and sorrel may timidly appear. The surface of the ground will continue rising, but with a broken swell towards the tree, and, in deference to its bent form, hold rising for a space on the other side; but nowhere will its superior roots be fully covered.

Suppose that we are to come to this house, as it is likely we may, three times out of four from the side opposite to where the beech stands; our path then shall strike in, well over on that opposite side and diagonally to the line of the road; there will be a little branch from it leading towards and lost near the tree (the children's path), while the main stem bends short away toward a broad bowery porch facing the road at the corner nearest the gate. The path must needs be smooth for ease of foot and welcomeness, but if its edges chance to be trodden out a little, we will not be in haste to fully repair them. Slanting and sagging off from a ringbolt in the porch there is to be a hammock slung, its farther lanyard caught with two half-hitches on an old stub well up on the trunk of the beech. A strong, brown, seafaring hammock. There shall be a seat, too, under the tree of stout stuff, deep, high-backed, armed, and, whether of rustic-work or plank, fitted by jointing (not held together by nails, bolts, or screws). It may even be rough-hewn, and the more checked, weather-worn, and gray it becomes, without dilapidation or discomfort to the sitter, the better; here you may draw your matches and clean out your pipe, and welcome. We will have nothing in front to prevent a hedge, but must that mean a poor pretence of a wall in leafage? Perhaps it must have that character for a few years till it has become thick and strong enough at bottom, and always it may be a moderately trim affair on the roadside, otherwise we should be trespassers on our neighbors' rights. But its bushes shall not be all of one sort, and in good time they shall be bushes in earnest, leaping up with loose and feathery tops, six, eight, and sometimes ten feet high. And they shall leap out also towards us. Yet from the house half their height shall be lost behind an under and out-growth of brake and bind-weed, dog-rose and golden-rod, asters, gentians, butter-cups, poppies, and irises. Here and there a spray of low brambles shall be thrown out before all, and the dead gray canes of last year shall not be every one removed. There will be coves and capes and islands of chickweed, catnip, cinquefoil, wild strawberry, hepatica, forget-me-not, and lilies-of-the-valley, and, still farther out, shoals under the

turf, where crocuses and daffodils are waiting to gladden the children and welcome the bluebird in the spring. But near the gate the hedge shall be a little overrun and the gateposts overhung and lost in sweet clematis; nay, as the gate must be set-in a little, because the path enters sidewise, there shall be a strong bit of lattice over it, and from the other side a honeysuckle shall reinforce the clematis; and if it whirls off also into the thorn tree that is to grow beyond, the thorn tree will be none the worse to be held to a lowly attitude, bowing stiffly towards the beech. Inside the gate, by the pathside, and again down by the porch, there may be cockscombs, marygolds, pinks, and pansies. But nothing of plants tied to the stake, or of plants the names of which, before they can command due interest, must be set before us on enamelled cards, as properly in a botanic garden or museum. Above all, no priggish little spruces and arborvitæs, whether native or from Satsuma; if the neighbors harbor them, any common woodside or fence-row bushes of the vicinity may be set near the edge of the property to put them out of sight; nannyberry, hazel, shadbush, dogwood, even elder, or if an evergreen (conifer) will befit the place, a stout, short, shock-headed mountain-pine, with two or three low savins and a prostrate juniper at their feet. Finally, let the roadside be managed as before. Then, if the gate be left open not much will be lost by it; not all the world will so much as look in, and some who do will afterwards choose to keep the other side of the way, as it is better they should. Yet from the porch, the window beyond, or the old seat under the tree there will be nothing under view that is raw or rude or vulgar; on the contrary, there will be a scene of much refinement as well as of much beauty, and those who live in the house, especially if they have a way of getting their work or their books out under the beech, will find, as the sun goes round and the clouds drift over, that taking it altogether there is a quality more lovable in it than is to be found in all the glasshouses, all the ribbon borders, all the crown jewels of the world.

The same will be equally true of the result of the very different kind of gardening design first supposed. We come thus to the question, What is the distinctive quality of this beauty? In each case there has been an ideal in view, and in each element introduced a consistent pursuit of that ideal, but it is not in this fact of consistency that we find the beauty. We term it landscape beauty, although there is none of the expanse which is the first distinguishing quality of a landscape. This brings us to the consideration that from the point of view of art or of the science of the imagination we may ask for something more in a landscape than breadth, depth, composition, and consistency. A traveller, suddenly turning his eyes upon a landscape that is new to him, and which cannot be directly associated with any former experience, may find himself touched as if by a deep sympathy, so that in an instant his eyes moisten. After long and intimate acquaintance with such a landscape it will often be found to have a persistent influence which may be called its charm—a charm possibly of such power as to appreciably affect the development of the character and shape the course of life. Landscapes of particular type associate naturally and agreeably with certain events. Their fitness in this respect is due to the fact that, through some subtle action on the imagination, they affect the same or kindred sensibilities. If in these dooryards there is something to which every element contributes, comparable in this respect to a poetic or a musical theme, as well, in the one case, of elegance and neatness, carried perhaps to the point of quaint primness, as in the other of homely comfort and good-nature, carried close to the point of careless habits, then the design and process by which it has been attained may lay some slight claim to be considered as a work of art, and the highest art-significance of the term landscape may properly be used to distinguish its character in this respect.

In the possibility, not of making a perfect copy of any charming natural landscape, or of any parts or elements of it, but of leading to the production, where it does not exist, under required conditions and restrictions, of some degree of the poetic beauty of all natural landscapes, we shall thus find not only the special function and the justification of the term landscape gardening, but also the first object of study for the landscape gardener, and the standard by which alone his work is to be fairly judged.

There are those who will question the propriety of regarding the production of the poetic beauty of natural landscape as the end of landscape gardening, on the ground that the very term "natural beauty" means beauty not of man's design, and that the best result of all man's labor will be but a poor counterfeit, in which it is vain to look for the poetry of nature. Much has been written to this effect; with what truth to the nature of man it will be well cautiously to consider.

It is to be remembered, however, with reference to landscape effect, that nature acts both happily and unhappily. A man may take measures to secure the happy action and to guard against the unhappy action in this respect with no more effrontery than with respect to the production of food or protection from lightning, storm, frost, or malaria. He need not wait for the slow and uncertain process by which in nature a certain position would be adapted for a certain tree. He may make the soil fertile at once. He need not take the chance that a certain thick growth of saplings will be so thinned by the operation of what are called natural causes that a few of them may yet have a chance to become vigorous, long-lived, umbrageous trees. Knowing how much more valuable a very few of these will be in the situation, with the adjoining turf holding green under their canopy, than the thousands that for long years may otherwise occupy it, struggling with one another and barring out the light which is the life of all beneath them he may make sure of what is best with axe and billhook. The ultimate result is not less natural or beautiful when he has done so than it would have been if at the same time the same trees had been eaten out by worms or taken away, as trees sometimes are, by an epidemic disease.

On the other hand, there are several considerations, neglect of which is apt to cause too much to be asked of landscape gardening, and sometimes perhaps too much to be professed and attempted. The common comparison of the work of a landscape gardener with that of a landscape painter, for example, easily becomes a very unjust one. The artist in landscape gardening can never have, like the landscape painter, a clean canvas to work upon. Always there will be conditions of local topography, soil, and climate by which his operations must be limited. He cannot whenever it suits him introduce the ocean or a snow-capped mountain into his background. He cannot illuminate his picture with constant sunshine nor soften it by a perpetual Indian summer. Commonly, he is allowed only to modify the elements of scenery, or perhaps to bring about unity and distinctness of expression and suggestion in a locality where elements of beautiful landscape already abound, but are partly obscured or seen in awkward, confusing, and contradicting associations. This is especially likely to be the case in undulating and partially wooded localities, such as in America are oftenest chosen for rural homes. Again, the artist in landscape gardening cannot determine precisely the form and color of the details of his work, because each species of plant will grow up with features which cannot be exactly foreknown in its seed or sapling condition. Thus, he can see his designed and imaginary landscape only as one may see an existing and tangible landscape with half-closed eyes, its finer details not being wholly lost, yet nowhere perfectly definable. Still, again, it is to be remembered that works in landscape gardening have, as a general rule, to be seen from many points of view. The trees which form the background, still oftener those which form the middle distance, of one view must be in the foreground of another. Thus, the working out of one motive must be limited by the necessities of the working out of others on the same ground, and to a greater or less degree of the same materials. Finally, the conditions of health and convenience in connection with a dwelling are incompatible with various forms of captivating landscape beauty. A house may be placed in a lovely situation, therefore, and the end of long and costly labors of improvement about it prove comparatively dull, formal, and uninteresting. What is lost is a part of the price of health and convenience of dwelling. The landscape gardener may have made the best of the case under the conditions prescribed to him.

It has been said that landscapes of a particular type associate naturally and agreeably with certain events. It is to be added that the merit of landscape gardening consists largely in the degree in which their designer has been inspired by a spirit congenial to elements of locality and occasion which are not, strictly speaking, gardening elements. The grounds for an ordinary modest home, for instance, may desirably be designed to give the house, gardens, and offices an aspect of retirement and seclusion, as if these had nestled cozily down together among the trees in escape from the outside world. The grounds of a great public building—a monument of architecture—will, on the other hand, be desirably as large in scale, as open, simple, and broad in spaces of turf and masses of foliage, as convenience of approach will allow, and every tree arranged in subordination to, and support of, the building. The grounds of a church and of an inn, of a cottage and of an arsenal, of a burying-place and of a place of amusement, will thus differ, in each case correspondingly to their primary purpose. Realizing this, it will be recognized that the choice of the site, of the elevation, aspect, entrances, and outlooks of a

building for no purpose can be judiciously determined except in connection with a study of the leading features of a plan, of its approaches, and grounds. Also, that in the design of roads, walks, lakes, and bridges, of the method of dealing with various natural circumstances, as standing wood, rocks, and water; in a determination of what is possible and desirable in respect to drainage, water-supply, distant prospects to be opened or shut out, the avoidance of malaria and other evils,—all these and many other duties are necessarily intimately associated with those of gardening (or the cultivation of plants) with a view to landscape effects. FREDERICK LAW OLMSTED.

Land'seer (CHARLES), son of John and brother of Edwin, b. in 1799; received instruction from his father; studied in the schools of the Royal Academy, and exhibited in 1828; was chosen an associate in 1837, a member in 1845, and keeper in 1851. He is a painter of historical pieces. His *Plundering of Basing House*, an incident of the civil war in England, is well known. Other pictures are—*Clarissa Harlowe in Prison, The Departure of Charles II. in Disguise, The Monks of Melrose, The Return of the Dove to the Ark.* O. B. FROTHINGHAM.

Landseer (Sir EDWIN), younger brother of Charles, b. in London in 1802; excelled while a boy in the painting of animals; became a student of the Academy in 1816; began to exhibit when only fourteen years old. Sketches made when he was but five years old are in the South Kensington Museum. In 1820, at the suggestion of Haydon, he took advantage of the death of a lion at Exeter Exchange to study the anatomy of the animal, and subsequently he painted several pictures introducing the lion—*The Lion Reposing, The Lion Disturbed, Van Amburgh and the Lions.* The four bronze lions at the base of the Nelson Monument in Trafalgar Square were his work; they were done by order of the government (1859), and uncovered Jan. 31, 1867. Landseer is beyond question the greatest animal painter of his time as respects anatomical truth, vigor of treatment, and power of characterization; he treats his subjects suggestively, often with humor, and excels equally in producing comic and tragic effects. His pictures, which are very numerous and of great variety, are too well known through engravings to need mention. Some of his best originals may be seen in the Vernon Collection (National Gallery) and the Sheepshanks Collection at South Kensington. His subjects were taken from animal life in all regions—deer of the Scottish Highlands, polar bears from the Arctics, and dogs of every breed. Edwin Landseer was elected an associate of the Royal Academy in 1826, and a member in 1831. In 1850 he received knighthood from the queen. On the death of Sir Charles Eastlake in 1866, he was elected president of the Royal Academy, but declined the honor. O. B. FROTHINGHAM.

Landseer (JOHN), b. in 1761; d. Feb. 29, 1852; was the son of a jeweller; received his earliest instruction from Wm. Byrne. His first productions were vignettes for Maclin's Bible and Bowyer's *History of England* (1793); in 1799 was engaged on a series of views in the Isle of Wight for J. M. W. Turner and J. C. Ibbetson; afterwards published engravings of animals, after Rubens, Snyders, Rembrandt, and others; in 1806 gave lectures on engraving at the Royal Institute, which were published; in 1807 was chosen associate engraver by the Academy; in 1814 began a series of line engravings illustrating the antiquities of Dacca (British India), 20 plates; in 1817 read a paper to the Society of Antiquaries on *Engraved Gems from Babylon*, and later gave a course of lectures on *Engraved Hieroglyphics;* in 1823 published *Sabæan Researches*, a volume, and in 1834 a catalogue, descriptive, explanatory, and critical, of the earliest pictures in the National Gallery. As late as 1851 exhibited at the Royal Academy views of Druidical temples in the islands of Guernsey and Jersey. One of his early pictures, *Dogs of Mt. St. Bernard*, was finely engraved by his father. O. B. FROTHINGHAM.

Landseer (THOMAS), A. R. A., elder brother of Edwin and Charles, an engraver of ability and repute. His best work is the reproduction of his brother's pictures, which he has executed with spirit and delicacy. The plate of Rosa Bonheur's *Horse Fair*, published in 1861, gave him celebrity. He wrote the *Life of William Bewick* (artist), in 2 vols. (1871). O. B. FROTHINGHAM.

Land's End. See CORNWALL.

Lands'ford, post-v. and tp. of Chester co., S. C. Pop. 2400.

Lands'hut, a quaint old town of Bavaria, capital of the district of Lower Bavaria, on the Isar. It has large breweries and manufactures of tobacco, and many interesting buildings, among which are St. Martin's church, built in 1450, with a tower 454 feet high; the old castle, built in 1232; a royal palace, with beautiful frescoes. From 1800 to 1826 it was the seat of a university, previously located at Ingolstadt, and subsequently removed to Munich. In the fifteenth century it was the capital of the duchy of Bavaria-Landshut. Pop. 14,141.

Landshut, town of Prussia, in the province of Silesia, at the confluence of the Zieder and the Bober, has some linen and woollen manufactures, and is noted for the victory which the Austrians gained here over the Prussians, June 23, 1760. Pop. 5673.

Lands'krona, town of Sweden, in the province of Malmö, on the Sound, has a good harbor, and some manufactures of leather and tobacco. On the island of Hven, a mile distant, was the residence and observatory of Tycho Brahe, the celebrated astronomer, of which nothing now remains. Pop. 7323.

Land'slip, a sort of avalanche of earth and rocks from the sides of mountains or hills. Earthquakes, frost, and especially the action of water, are frequent causes. Soils resting on inclined planes of smooth rock or upon beds of loose gravel are liable to slide *en masse* during long-continued rains. Elevated peat-swamps have been known to absorb so much water as to burst and deluge lower regions with torrents of mud. Underlying strata of clay may become liquefied and gush out, leaving the surface to topple in. A remarkable land-slide occurred near Nice, France, when the castle and village of Roccabruna, surrounded by orange and lemon groves, moved for some distance down the mountain without disturbing the houses. One of the most famous land-slides was that in which Goldau in Switzerland was destroyed. In 1826 there was an extensive land-slide 2 miles from the Notch in the White Mountains of New Hampshire, which destroyed the Willey family, choked up the Saco River, and flooded the surrounding country.

Landsturm. See GERMAN EMPIRE—*Army and Navy.*

Land Tax, a revenue derived by a government from an assessment on land. (See TAXATION, by Rev. A. L. CHAPIN, S. T. D.)

Landwehr. See GERMAN EMPIRE—*Army and Navy.*

Lane, county of W. Kansas. Area, 720 square miles. It is a prairie region, watered by tributaries of Walnut Creek.

Lane, county of Oregon, extending from the Cascade Range W. to the Pacific. Area, 1500 square miles. Its E. part is in the Willamette Valley, and is highly fertile. Cattle, grain, and wool are leading products. The county is traversed by the Oregon and California R. R. Cap. Eugene City. Pop. 6426.

Lane, tp. of Warrick co., Ind. Pop. 870.

Lane, tp. of Greenwood co., Kan. Pop. 320.

Lane (EBENEZER), LL.D., b. at Northampton, Mass., Sept. 17, 1793; graduated at Harvard in 1811; studied law with Matthew Griswold, his uncle; removed in 1817 to Ohio, and in 1822 became a resident of Sandusky. He was 1824–30 a judge of the common pleas; of the State supreme court 1830–37; chief-justice 1837–45, and afterwards a railroad manager. D. at Sandusky, O., June 12, 1866.

Lane (EDWARD WILLIAM), PH. D., b. at Hereford, England, in 1801; was educated for the Church, but never took orders; went to Egypt in 1825, and resided there three years, studying the Arabic language and literature, and making two voyages up the Nile; again spent two years there (1833–35), preparing, at the request of the Society for the Diffusion of Useful Knowledge, his popular and entertaining work on the *Manners and Customs of the Modern Egyptians*, which was published in 1836: made a translation of the *Arabian Nights*, with notes (1841); went to Egypt for the third time in 1842, and has ever since resided in Cairo, principally engaged in the preparation of an Arabic lexicon, under the patronage of the duke of Northumberland, and since the death of that nobleman with the support of the British government. The first part appeared in 1863, the second in 1865, and others more recently, but it is not yet finished. Mr. Lane has also published *Selections from the Kur-an* (1843) and *Arabian Tales and Anecdotes* (1845); was in 1864 made corresponding member of the Institute of France, and in Feb., 1875, received the degrees of master of philosophy and doctor of literature from the University of Leyden.

Lane (Rev. GEORGE W.), b. in Wilkesbarre, Pa., Jan. 15, 1815, a son of the Rev. George Lane; was licensed to preach in Georgia in Mar., 1834; was classical teacher in the manual-labor school near Covington, Ga., and then, for ten years, professor of languages in Emory College. He was a man of large attainments and indomitable energy, zealous and successful as a minister, and belonged to the Georgia M. E. conference. D. Sept. 21, 1848. T. O. SUMMERS.

Lane (HENRY S.), b. in Montgomery co., Ky., Feb. 24, 1811; was early in life admitted to the Indiana bar; was in Congress 1841–43; lieutenant-colonel of volunteers in the Mexican war; chosen U. S. Senator in 1859, but unseated; elected governor of Indiana 1861; U. S. Senator from Indiana 1861–67.

Lane (JAMES HENRY), b. at Lawrenceburg, Ind., June 22, 1814, was a son of Hon. Amos Lane, an able lawyer and politician. J. H. Lane was admitted to the bar in 1840; enlisted in the 3d Indiana Vols. in 1846 as a private, but became a colonel, and at Buena Vista commanded a brigade with great credit; was 1847–48 colonel of the 5th Indiana. In 1848 he was chosen lieutenant-governor; was in Congress 1853–55, and voted for the Nebraska bill; removed in 1855 to Kansas; was a prominent member of the first Free State government; was president of both the Topeka and the Leavenworth (1857) constitutional conventions, and major-general of the Free State forces. In 1856 he was chosen by the Free State legislature as U. S. Senator, but was not allowed a seat, and in the same year was indicted for high treason by the enemies of the Topeka constitution, and compelled to flee. In 1858 he was indicted and tried for the murder of a neighbor whom he had killed in a quarrel, but was acquitted. In 1861, and again in 1865, he was sent from Kansas to the U. S. Senate. He served efficiently for some time during the civil war as a brigadier-general of volunteers. In 1866 he received a paralytic stroke, and on July 11, 1866, took his own life, at Leavenworth, Kan.

Lane (Rev. JOHN), b. in Virginia Apr. 8, 1789; entered the ministry in the South Carolina M. E. conference in 1814, and in 1816 became a pioneer of Methodism in Mississippi. He was present at the first session of the Mississippi conference, in which for many years he was a standard-bearer. He was also a probate judge in Warren co., where he exercised a wide influence, having married a daughter of Mr. Vick, after whom Vicksburg was named. D. at Vicksburg, Miss., Oct. 10, 1855. T. O. SUMMERS.

Lane (JOSEPH), b. in Buncombe co., N. C., Dec. 14, 1801; removed in youth to Indiana, where he engaged in mercantile pursuits and in politics; served as colonel of the 2d Indiana Vols. in the Mexican war, and was made a brigadier and brevet major-general for gallantry at Buena Vista and in many minor actions; became in 1848, and again in 1853, governor of Oregon Territory; was a delegate in 1851–59; U. S. Senator 1859–61; and in 1860 was nominated for Vice-President on the Breckenridge ticket.

Lane (Sir RALPH), b. in Northamptonshire, England, about 1530; entered the service of Queen Elizabeth in 1563 as equerry; served with credit in the rebellion of 1569, and in Ireland in 1583–84, and was appointed by Sir Walter Raleigh in Feb., 1585, governor of Virginia. He abandoned the province in the following year, returning to England with Sir Francis Drake; was colonel in Drake's expedition against Portugal in 1589; wounded in an Irish campaign in 1591, knighted in 1593, and d. in Ireland in 1604.

Lane Prai′rie, tp. of Otter Tail co., Minn. Pop. 80.

Lane's, tp. of Morgan co., Ala. Pop. 722.

Lanes′boro′, post-v. and tp. of Anson co., N. C., on the Carolina Central R. R. Pop. 1293.

Lanes′borough, a pleasant post-tp. of Berkshire co., Mass., on the Pittsfield and North Adams R. R., 5 miles N. of Pittsfield. It has quarries of marble and limestone, and mines of iron and glass-sand, a literary association, 4 churches, a public library, and manufactures of iron, glass, lime, etc. It is widely known for its scenery, at some points wild and grand, at others remarkably beautiful. Pop. 1393.

Lanesborough, post-v. of Carrollton tp., Fillmore co., Minn., on the Southern Minnesota R. R., 50 miles W. by S. of La Crosse, Wis., has 1 weekly newspaper. Pop. 655.

Lanesborough, post-v. of Harmony tp., Susquehanna co., Pa., on the Erie R. R., 1 mile N. E. of Susquehanna Dépôt, and on the Susquehanna River.

Lanes′burg, tp. of Le Sueur co., Minn. Pop. 1123.

Lane's Creek, post-tp. of Union co., N. C. Pop. 1575.

Lanes′ville, a thriving post-v. in the N. E. part of Gloucester tp., Essex co., Mass., 5 miles from Gloucester Village, on the N. shore of Cape Ann.

Lane′ville, tp. of Hale co., Ala. Pop. 2560.

Lan′franc, b. at Pavia, Italy, about 1005; studied at Bologna, and taught jurisprudence and dialectic at Pavia with applause; removed to France, and, probably in 1039, settled at Avranches; entered the Benedictine abbey of Bec 1042, which soon became a renowned school of theology, patristics, and dialectic; was made prior in 1046; took part 1050–69 in the controversy with Berengarius; became abbot of Caen 1066, and was appointed archbishop of Canterbury by William the Conqueror 1070—a position which was rendered a trying one by the self-will of the Conqueror and his successor, the refractory conduct of some of the clergy, and the unsettled relations of the pope to the king in regard to church preferments. Lanfranc was one of the founders of scholasticism. His most important existing works are *De corpore et sanguine Domini* and commentaries on the Pauline Epistles. D. at Canterbury May 24, 1089.

Lanfrey′ (PIERRE), b. in 1828 at Chambéry, Savoy, then a part of the kingdom of Sardinia. His father was a Frenchman who had been a military officer under the empire. Pierre entered the Jesuit college at Chambéry, but left on account of having written a pamphlet against his reverend instructors, and completed his studies at the Collége Bourbon in Paris, where he qualified for the bar, but afterwards turned his attention to philosophical and historical studies. His first work, *The Church and the Philosophers of the Eighteenth Century* (1857), made a considerable sensation, which was deepened by *An Essay on the French Revolution* (1858), *The Political History of the Popes* (1860), *Political Studies and Portraits* (1863), and *The Restoration of Poland* (1863). In 1867, M. Lanfrey commenced the publication of his most important work, a *History of Napoleon I.*, of which the sixth volume appeared in 1874, the ablest and most complete arraignment of the First Empire at the bar of history that has appeared. M. Lanfrey served in the *mobiles* of Savoy during the Franco-German war, was elected to the National Assembly in Feb., 1871, and in October of that year was appointed by Thiers minister to Switzerland, which post he still fills (1875).

Lang (JOHN DUNMORE), D. D., b. at Largs, Ayrshire, Scotland, about 1800; emigrated to Sydney at an early age, and became principal of the Australian College. In 1834 he published *The History of New South Wales, both as a Penal Settlement and as a British Colony*, the first historical work on that colony possessing any claims to fulness and authority. It has passed through several editions. Dr. Lang wrote briefer works upon other separate colonies, including New Zealand (1840), Philipsland (1847), Cooksland (1847), and *Freedom and Independence for the Golden Lands of Australia* (1853), republished in 1870 under the title *The Coming Event.*

Lang (LOUIS), b. at Waldsee, Würtemberg, Mar. 29, 1814; became noted at an early age for skill in painting likenesses in pastel; resided at Constance (1830–34) and at Paris (1834–37); came to the U. S. in 1838; went to Italy in 1841, studying at Venice, Bologna, Florence, and Rome; then spent two years in the U. S. (1845–47), engaged in the artistic decoration of houses, and after another visit to Rome (1847–49) made his permanent residence in New York City, where he occupies a high rank among artists.

Lang′dale (Sir MARMADUKE), b. in Yorkshire, England, about 1590; was sheriff of that county in 1642; embraced the Royalist cause, and became one of the most valiant generals of Charles I., defeating the Scotch at Corbridge and raising the siege of Pontefract Castle (1644); commanded at the battle of Naseby, June 14, 1645, which was lost through the imprudence of Prince Rupert; joined Montrose; was defeated; escaped to the Isle of Man; went thence to the Continent; joined the Scotch royalist army in 1648; took Berwick by surprise (May); defeated by Cromwell at Preston (Aug. 17); captured and imprisoned in Nottingham Castle; escaped to Flanders; was made baron by Charles II.; was lord lieutenant of Yorkshire on the Restoration in 1660, and d. at York Aug. 5, 1661. Clarendon in his *History of the Rebellion* gives him a high reputation for courage and skill.

Lang′dell (CHRISTOPHER COLUMBUS), A. M., LL.B., A. B., dean of the law faculty of Cambridge University, Cambridge, Mass., b. in Hillsborough co., N. H., May 22, 1826; entered Phillips Exeter Academy in 1845, and Harvard College in 1848; left college to pursue teaching in 1849, and decided not to return, hence did not graduate with his class; in 1850 began the study of law, and attended Harvard Law School in the subsequent year. At the annual commencement in 1853 he received the degree of LL.B., and at the following commencement the honorary degree of A. M.; removed to New York, where he practised law until he was appointed Dane professor of law in Cambridge University. At the annual commencement in 1870 he received the degree of A. B. as a member of the class of 1851, and was appointed to the position he now holds at the beginning of the academic year of 1870–71. J. S. GIBBONS.

Lang′don, post-tp. of Sullivan co., N. H., 56 miles W. of Concord. It has manufactures of lumber. Pop. 411.

Langdon (CHARLES C.), of Northern birth; emigrated about 1836 to Alabama, and became a merchant of Perry

co.; was afterwards editor of the Mobile *Register*, a Whig paper; was mayor of Mobile, and in 1861 opposed secession; chosen in 1865 to Congress, was not allowed to take his seat; was the founder of Citronelle, Mobile co., Ala., where he has since resided.

Langdon (John), LL.D., a patriot of New Hampshire, b. at Portsmouth in 1741, became a successful merchant of that town. In 1774 he assisted in securing for the colonies the ordnance stores in the fort near Portsmouth. In 1775 he was sent to the Congress. In 1776 he became navy agent, Speaker of the New Hampshire assembly, and judge of the common pleas. He gave the money with which Stark's famous brigade was equipped, and in person commanded a company at Bennington, Saratoga, and elsewhere. In 1779 he was president of the New Hampshire convention and Continental agent. In 1783 he was sent to Congress, and was afterwards more than once Speaker in the New Hampshire legislature. He was president of New Hampshire in 1785, and in 1787 was in the convention which drafted the Federal Constitution. In 1788 he was governor, and again in 1805–09 and 1810–12. He was a U. S. Senator 1789–1801, and declined the secretaryship of the navy and the Vice-Presidency of the U. S. D. Sept. 18, 1819.

Langdon (Samuel), D. D., Aberdeen, b. in Boston, Mass., Jan. 12, 1723, and graduated at Harvard in 1740. He became master of a grammar school at Portsmouth, N. H.; was a chaplain in the Louisburg expedition 1745; assistant minister, and afterwards (1747–74) pastor, of the First Congregational church at Portsmouth; president of Harvard College 1774–80, and afterwards a minister at Hampton Falls, N. H. He was prominent in the public affairs of the State. Published many sermons, and several volumes upon theological and religious subjects. D. Nov. 29, 1797.

Langdon (Woodbury), brother of John Langdon (1741–1819), b. at Portsmouth, N. H., in 1739; served in Congress 1779–80; a judge of the New Hampshire supreme court 1782, and again 1786–90, and held other public offices. D. at Portsmouth Jan. 13, 1805.

Lange (Johann Peter), b. Apr. 10, 1802, at Sonnborn, near Elberfeld, in Rhenish Prussia, in humble circumstances; acquired his first education by his own energy; attended for a year and a half the gymnasium of Düsseldorf; studied theology at Bonn; preached in several places, and was appointed professor of theology at Zurich in 1841, and in 1854 at Bonn. His *Leben Jesu* (3 vols., 1844–47), translated into English by Sophia Taylor and J. E. Ryland (Philadelphia, 1872), *Christliche Dogmatik* (3 vols., 1849–52), and *Apostolische Zeitalter* (2 vols., 1853–54), exercised a widespread and highly beneficial influence; of his *Theologisch-homiletische Bibelwerk* an English edition has been prepared under the title of *Lange's Commentary*, by Philip Schaff, and published at New York (1865, *seq.*).

Lang′eland ("long land"), an island of Denmark, in the Baltic, between Funen and Laaland. It is 33 miles long and 3 miles broad. Area, 106 square miles. Pop. 18,399. It is exceedingly fertile, producing wheat, apples, good timber, and excellent cattle. Principal town, Rudkiöbing.

Lan′gemarcq, town of Belgium, in the province of West Flanders, has extensive manufactures of lace and linen. Pop. 6158.

Lan′genbielau, a number of villages in Silesia, Prussia, on the Peila, consisting of Upper, Lower, Great, Little, New, and Old Langenbielau, which together form a town of 12,700 inhabitants. Many kinds of manufactures are carried on, especially cotton.

Langensal′za, town of Prussia, in the province of Saxony, numbering about 10,000 inhabitants; was several times the theatre of battles. On Feb. 15, 1761, the allied Prussians and Englishmen, under Sydow and Spöreken, defeated the German imperial army under Steinville; Apr. 17, 1813, the Prussians defeated the Bavarians; June 27, 1866, a bloody contest took place between the Prussians and the Hanoverians. Under the command of King George, who had allied himself closely to Austria, the Hanoverian army, numbering about 20,000 men, broke up from Göttingen and moved southward in order to join the Bavarians, who stood on the other side of the Thüringer Wald. A Prussian corps under the command of Gen. von Fliess, reinforced by troops from Saxe-Gotha, and numbering about 10,000 men, pushed forward from Gotha in order to detain them. At Langensalza an encounter took place, in which the Hanoverians, although victorious, suffered so much that they were unable to continue their march. They lost 102 officers and 1327 men; the Prussians, 846 in all. As a superior number of Prussian troops came on from other sides during the next days, the Hanoverians had to capitulate; the army became prisoners of war, and soon after the kingdom ceased to exist. August Niemann.

Langeron′, de (Andrault), Count, b. at Paris Jan. 13, 1763; served in America as sub-lieutenant during the closing year of the war of the Revolution; rose to be colonel in 1786; emigrated from France at the outbreak of the French Revolution; took service in Russia in 1790, first against Sweden, and afterwards against Turkey (1790–91); was with the Austrian forces in the invasions of the Low Countries and of France (1792–94); returned to Russia, and rapidly rose to the rank of lieutenant-general and count (1799); commanded a Russian division at Austerlitz, and on the Danube in the Turkish war from 1807 to 1812; bore a distinguished part in resisting the grand army of Napoleon in the invasion of Russia (1812–13), in the victory of Leipsic (Oct. 18), and the advance upon Paris (1814); was governor-general of New Russia in 1822; served in Turkish war 1828–29, and d. at St. Petersburg July 4, 1831. He left MS. memoirs which were used by Thiers in the *History of the Consulate and Empire.*

Langevin′ (Hector Louis), C. B., b. at Quebec Aug. 15, 1820; was educated at the Quebec College and in Montreal; became an advocate in 1850; was for a time a journalist in Montreal, and afterwards in Quebec; was mayor of Quebec 1857–60, and a member of the Provincial Parliament 1858–66. In 1864 he became solicitor-general, and in 1866 postmaster-general. He was (1866–69) secretary of state in the Dominion cabinet, and 1869–72 minister of public works. He sits (1875) in the House of Commons for Dorchester, Quebec; was made C. B. in 1868. Author of *Droit Administratif des Paroisses* (1862), and is a conservative in politics.

Lang′ham, de (Simon), Cardinal, b. probably at Langham, Rutlandshire, England, about 1310; became a monk in Westminster in 1335, prior and abbot in 1349, high treasurer of England 1360, bishop of Ely 1362, chancellor 1363, and archbishop of Canterbury by papal provision July 22, 1366. His most noted action was the removal of Wycliffe from the wardenship of Baliol College, Oxford, in which he was supported by Pope Urban V., who signalized his approval by making Langham a cardinal-presbyter (1368), while the king, Edward III., was favorable to the Reformer. The new cardinal was forced to resign his archbishopric (Nov., 1368), and retired to Avignon, where he became a trusted counsellor of Pope Gregory XI., and d. July 22, 1376. After the accession of Richard II. his remains were removed with great pomp to Westminster Abbey in 1379.

Lang′horne (John), D. D., b. at Kirkby-Stephen, Westmoreland, England, in Mar., 1735; entered Clare Hall, Cambridge, in 1760; became curate of St. John's, Clerkenwell, and of Blagden, Somersetshire, and was some time assistant preacher of Lincoln's Inn. In 1768 he removed to Folkestone, where his brother William (1721–72) was perpetual curate, and with him made a translation of Plutarch's *Lives* (6 vols., 1770), which still holds its position as one of the most widely-read of any translation from a classic author. He published many poems, tales, and sermons of little value, and in 1777 became prebend in the cathedral of Wells, Somersetshire. D. at Blagden Apr. 1, 1779.

Lang′land, Langelande, or **Longland** (Robert), b. probably at Cleobury Mortimer, Shropshire, about 1332; was educated at Oxford; became a fellow of Oriel College, and a monk at Malvern. His *Vision of Piers Plowman*, in alliterative verse, written about 1362, was a satire upon the clergy, and is one of the earliest works written in the English language; first printed in 1550. The best edition is that of Thomas Wright (London, 1856). Langland d. about 1400.

Langlès (Louis Mathieu), b. at Perenne, Haute-Loire, Aug. 23, 1763; studied Oriental languages at Paris, and attracted considerable attention in 1787 by his translation into French from the Persian of Tamerlane's *Institutes*. In 1789–90 he edited Father Amiot's Mantchoo-French dictionary, and in 1795 he induced the French republican government to establish a special school of Oriental languages, of which he himself became the first administrator and professor in the Persian. Through this school, and through the Geographical Society of Paris, of which he also was the founder, he exercised a large and beneficial influence. He was also the author of numerous works relating to Oriental languages and literature. D. at Paris Jan. 28, 1824.

Langlois′ (Victor), b. at Dieppe Mar. 20, 1829; studied Oriental languages, and travelled in 1852–53 in Cilicia and Armenia, where he discovered over eighty new Greek inscriptions, and undertook excavations at Tarsus, from which he brought many interesting antiquities to Paris. In 1867 he published *Le Mont Athos et ses Monastères*, containing a photo-lithographic reproduction of the geographical work of Ptolemy. In 1868 he began the publication

of *Collection des Historiens anciens et modernes de l'Arménie*, which was unfinished when he d. May 14, 1869.

Lang'nau, town of Switzerland, in the canton of Berne, has iron-foundries, tanneries, manufactures of tobacco and watches, and an active trade in linen and cheese. Pop. 5860.

Lango'la, post-v. and tp. of Benton co., Minn., on the Mississippi River. Pop. 85.

Lang Plantation, tp. of Franklin co., Me. Pop. 36.

Langres, town of France, in the department of Haute-Marne, situated on the left bank of the Marne, on a plateau at an elevation of 1460 feet. It is an old town, with a cathedral of the eleventh century, a college, and theological seminary. Large trade in grain and cattle, and celebrated manufacture of fine cutlery. It is the birthplace of Diderot, to whose memory a monument was erected here. Pop. 8320.

Lang's, tp. of Darlington co., S. C. Pop. 1214.

Langs'ton, post-v. of Montcalm co., Mich., 10 miles from Greenville Station, which is on the Detroit Lansing and Lake Michigan R. R.

Langston (John Mercer), LL.D., b. at Louisa Courthouse, Louisa co., Va., Dec. 14, 1829. By birth a slave, he was emancipated when six years old; educated at Oberlin College, where he graduated in 1849, and from the theological department of the same college in 1853; studied law, being admitted to the Ohio bar in 1854; pursued his profession for thirteen years in Ohio, when he was called to a professorship in the law department of the Howard University at Washington, D. C.; became dean of the faculty, and in 1873 vice-president and acting president of the university. Was appointed in 1871, by the President of the U. S., a member of the board of health of the District of Columbia, of which in 1875 he was elected secretary. Author of various addresses and papers upon political, biographic, literary, and scientific subjects, and is distinguished as an orator and scholar.

Lang'stroth (Lorenzo Lorraine), b. at Philadelphia Dec. 25, 1810; graduated at Yale 1831; tutor there 1834–35; pastor of the South Congregational church, Andover, Mass., 1836–39; principal of Abbott Female Seminary, Andover, 1838–39; of Greenfield (Mass.) High School 1839–43; pastor of Second Church, Greenfield, Mass., 1843–48; principal of a young ladies' school, Philadelphia, 1848–52. Since 1858 has resided at Oxford, O. Mr. Langstroth is famous as the inventor of the movable-comb hive, which has wrought a revolution in bee-keeping. Author of the *Hive and Honey-Bee*, etc.

Lang'toft (Peter), b. in the second half of the thirteenth century, was a canon of the order of St. Augustine at Bridlington, Yorkshire, and derived his name from a parish of the same county, perhaps his native place. He translated from the Latin into French verse Herbert Bosenham's *Life of Thomas à Becket* (1300?), and wrote, also in verse, a French *Chronicle of England* from the siege of Troy to the reign of Edward I., translated into English verse by Robert de Brunne, and edited by Hearne (Oxford, 1725).

Lang'ton (Stephen), Cardinal, b. in Devonshire, Lincoln, or Sussex, Eng., about 1160; was educated at Paris, taking degrees in philosophy and theology; became a professor and chancellor of the university and canon of Notre Dame; was a fellow-student with Lothario Conti, who became pope in 1198, and was named in the same year a member of the papal household. In 1206, Langton, while on a visit to Rome, was made a cardinal, and in December of the same year was by express order of the pope elected archbishop of Canterbury in opposition to the will of King John. Though consecrated by the pope at Viterbo in June, 1207, Langton was not permitted to take possession of his see until the submission of King John to the papacy in 1213, when he immediately joined the insurgent barons in their conflict with that monarch, assisted them at Bury St. Edmund's (Nov. 20, 1214) in drawing up the basis of Magna Charta, and headed the list of baronial signers of that instrument at Runnymede (June 15, 1215). For this conduct he incurred the censure of the pope, and notwithstanding a visit to Rome was suspended from his functions in December of that year, but restored Feb., 1216. He returned to England in 1218; crowned Henry III. in 1220; presided at the Council of Osney in 1222, which drew up a code of canon law; watched over the observance of Magna Charta; and in 1223 again placed himself at the head of the barons to demand its confirmation from Henry III. The division of the Bible into chapters has been commonly attributed to him. He is represented as having been a man of great learning and author of numerous theological works, none of which, however, is extant. D. at Slindon, Sussex, July 9, 1228. (See Hook's *Archbishops of Canterbury*.)

Lan'guage. The word *language* comes from the Latin *lingua*, "tongue," through derivative forms represented by Fr. *langage*, It. *linguaggio*. It signifies, then, primarily, utterance by the tongue, that being the most active and essential of the articulating organs. It is in accordance with this that we use the word; it denotes articulate utterance for the expression of thought. But this also in two ways. First, we mean by *language* the general power or faculty of expression of thought by articulate utterance, a power possessed and exercised by all normally constituted and circumstanced human beings (not by the deaf nor by the solitary); in this sense, *speech* is its common synonym. Secondly, we mean a particular body of articulate utterances, signs for thought, used in some definite community, present or past, as their means of expression; intelligible between members of that community, but not to outsiders. It is of the highest importance to hold these two senses clearly apart, for upon their confusion depends no small part of the false views of language more or less commonly held.

We shall begin by considering the external body of language, the audible sounds. These are produced by an apparatus located in the throat and mouth, supplied with material by the lungs. The lungs send forth a current of air through the throat and mouth. This receives tone and pitch in the larynx by the action of the vocal cords, which are the membranous edges of a pair of half-valves, capable of being brought close together and made tense across the passage of the throat, so that the expelled air causes them to vibrate like the tongue or reed of an organ-pipe; and this vibration, transmitted to our organs of hearing by the sympathetic movement of the air, is cognized by us as sound. Above this vibrating apparatus is set the cavity of the pharynx, the mouth, and the nose, in the manner of a sounding-box; and voluntary changes made in the walls and apertures of this box differentiate the sound, giving rise to a great variety of distinguishable products, which are our alphabetic sounds. That branch of linguistics which concerns itself with the physical character of alphabetic sounds, as dependent on the voluntary movements of the organs, is called phonetics or phonology: it involves something of acoustics, and something of anatomy, but is quite distinct from either. A very brief consideration of its leading principles will be all that is needed here.

The number of distinct articulations capable of being produced by the organs of utterance is indefinitely great. Nearly 300 have been represented separately by Ellis in his "Palæotype" (first chapter of *Early English Pronunciation*). But many of these are variations, hardly perceptible to any but skilled and observant ears, of what is practically the same sound; and no single language uses for purposes of speech more than a fraction of this number. The most important division of the system is into vowels and consonants. The vowels are the opener sounds, those in which the modifying action of the mouth-organs on the intonated currents of breath is least, which are therefore mainly tone; the consonants are the closer sounds, those in which the element of oral action prevails more or less over that of tone. Upon the antithesis of vowel and consonant, the succession of alternately opener and closer sounds, depends what we call the *articulate* character of our utterance; the stream of audible sound, consisting especially of the vowels, is narrowed or cut off from point to point by the consonants, and so broken into *articuli*, "joints," being thus made both distinct and flexible to a degree that would be attainable in no other way. There is a class of consonants—*p b*, *k g*, *t d*—in which the interference of the mouth-organs with the stream of breath is carried to the extreme of complete stoppage: these are called mutes (stops, checks). There is another in which the organs are so closely approached that a rustling or buzzing is heard at the orifice, and is the conspicuous element in the sound produced: these are called fricatives; they are conveniently divided into sibilants—such as *s z*, *sh zh* (of *azure*)—and spirants—such as *f v*, the two *th*-sounds (*thin*, *then*), and the German *ch*. Another very distinct class is that of the nasals or resonants; in these there is a complete closure of the mouth-organs at the same points as in the utterance of the mutes, but the nasal passage is unclosed, so that the sounds are sonorous and continuable—as *m*, *n*, *ng* (in *singing*): in the nasal vowels (*e. g.* of French) there is an unclosure of the nasal passage along with ordinary vowel utterance, giving an added twang to the product. One more class of consonants remains, the semi-vowels *y*, *w*, *l*, *r*—sounds which stand on the line between vowel and consonant, *y* being only infinitesimally different from the *i* of *pique* (the *ee*-sound), and *w* from the *u* of *rule* (the *oo*-sound): and *l* and *r* being convertible, and by many languages converted, to vowel uses.

In English, and in the majority of other languages, there are in the mouth three places of complete closure, produ-

cing mutes—a front, or labial, at the lips, giving *p* and *b*; a back, or palatal, between the back of the tongue and the soft palate, giving *k* and *g*; and an intermediate, or lingual, between the tip or front part of the tongue and the roof of the mouth at or back of the upper front teeth, giving *t* and *d*. The last two pairs may vary in character according to the place on the palate and the parts of the tongue used; and different *t*'s and *k*'s are sometimes found side by side in the same language. Usually there is, as in English, a corresponding nasal to each mute closure. But the other consonants also tend toward the same organs of production: thus, the *f* and *v* and *w* are more labial; the *th*, the *s*, and *z*, and the *r* and *l*, are lingual; and the *ch*, the *sh*, and *zh*, and the *y* are more palatal. And even the vowels show the same tendency: from the *a*-sound of *far*, which is the purest alphabetic tone, most unmodified by the mouth-organs, the tongue approaches the palate, toward the *k*-position, more and more in the *a* of *pan*, the *e* of *pen*, and the *i* of *pin*, giving thus a palatal series of vowels; and the lips are more and more rounded and approached in the *a* of *all*, the *o* of *pole*, and the *u* of *rule*, giving a labial series.

There is one more principle of relationship to be noted: that of sonant to non-sonant or surd sounds. The *s* and *z*, for example, are uttered with the same articulating position of the mouth-organs, but the former with simple breath, the other with intonated breath or sound; the former a hiss, the latter a buzz. And the difference of *t* and *d* is the same, sound beginning in the former only immediately after the breach of mute contact, which is made with breath alone, but in the latter before the breach, by forcing air enough to support for a moment the sonant vibration of the vocal cords up into the closed cavity of the mouth. Thus, the mutes and fricatives go usually in pairs, of surd and sonant. But in the opener positions the mere breath is not sufficiently characterized to give an alphabetic constituent for each position, and we throw all the different products together as *h*.

The principles, then, which determine the system of the alphabet are: (1) the degree of approach of the organs, between the absolute openness of *a* (*far*) and the absolute closure of *k, t, p*; (2) the particular organs or parts of the mouth brought toward or against one another; and (3) the kind of material furnished to the mouth-organs by the throat, whether breath or sound. Annexed is a sample alphabet thus arranged, containing (with neglect of some minor distinctions) the simple sounds of the English language:

sonant.		*a*		vowels.	
		æ A			
	e	*ə*	*o*		
	i		*u*		
	y	*r, l*	*w*	semi-vowels.	consonants.
	ng	*n*	*m*	nasals.	
surd.	*h*			aspiration.	
sonant.	*zh*	*z*		sibilants.	fricatives.
surd.	*sh*	*s*			
sonant.		*dh*	*v*	spirants.	
surd.		*th*	*f*		
sonant.	*g*	*d*	*b*	mutes.	
surd.	*k*	*t*	*p*		
	palatal series.	lingual series.	labial series.		

In this scheme, *æ* represents the *ă*-sound in *pan*, A the sound in *all*, and *ə* the "neutral" vowel-sound in *hut, hurt*.

The spoken alphabet of every language may be reduced to a systematic form resembling this. Alphabets are, however, of very different character as regards both the number and the identity of the sounds composing them. And languages differ not only in their sounds, but in the combinations of sounds allowed in forming syllables, and in the combinations of syllables allowed in forming words. Some have hardly more than a dozen articulations, all told; while the Sanskrit and English each possess near fifty; some allow only one consonant in a syllable, and that always before the vowel, while the English makes such intricate and difficult combinations as *strands, twelfths;* some (as Chinese) admit only words of one syllable, while American Indian languages sometimes count the syllables of a word by the score. And as they differ in these respects, so also, and much more, in the combinations of sounds by which they represent any given conception; whence the diversity and mutual unintelligibility of human languages. This diversity, which is very different from what we might feel ourselves authorized to expect, considering the fundamental unity of the human mind and its operations, is one of the problems which the science of language has to explain.

We have said that articulate sounds are produced by the voluntary action of their utterers. Of course this does not imply that the speaker understands at all the mechanism which he sets in motion, or commands it otherwise than as he commands the mechanism of locomotion or of gesture. Each human organ is capable of making all the sounds that are found in any human alphabet, and a great many more; and (apart from special individual disabilities) any sound is equally easy at the outset, before habits are formed, to all human beings; there is nothing characteristic of race in the alphabets of different races. But each person grows up to produce by imitation just those sounds which he hears others make about him. Some sounds, however, are easier and sooner learned than others; the norm in every language is given by the practised adult speakers, and the child, beginning by reproducing only imperfectly what he hears, gradually acquires the same facility and accuracy as his fellows possess. Just so, every well-endowed child is capable of gaining the skill of eye and hand required for any one of an indefinite number of trades; and he actually gains that to which he is made to apply himself. Without such application he would learn none; and so he would acquire no language if he were not taught it. There are, we shall say, a thousand different languages in the world, and each of them has a different word for "hand," or "green," or "run;" there is no reason why any human being uses one of these thousand words instead of another, except that he hears it used by others, and then himself learns to reproduce it by imitation, and to associate it with the same idea which it represents in their use. There is no such relation between the articulating apparatus and the apparatus of mental action, of perceiving, and comparing, and judging, that anywhere in the world a human being produces a series of articulate sounds by an internal and natural impulse as representative of a conception. The relation of uttered signs for ideas is precisely what that of acted signs would be; the hands and arms are capable of making an infinity of combinations of motions, and, as the experience of the deaf-mute shows us, a person is capable of associating conceptions with these motions to such an extent as to make them a full apparatus for the expression of thought. We see clearly enough that the tie between such signs and the movements of the mind is an external and artificial one; but it is not less the case with our own signs. That is to say, every uttered word is an arbitrary and conventional sign—arbitrary, because any other could have been made to answer the same purpose; conventional, because the selection of this one has its sole ground in the accordant usage of a community. It was learned by the direct instruction or from the example of others who used it already; it has no tie with its inner content or meaning save that of a mental association. He who has acquired and learned to use one set of signs may add another and another, and use them also with readiness, even forgetting, if the shift be made early enough, his first acquired set, or "native language," in their favor.

We see, then, clearly, what the "gift of language" is to man. It is a general power of expression. It consists in such gifts of mind and of body, and in such command over them, that any human being can possess himself of any of the systems of expression established and current in the world, and make use of it, more or less perfectly, for communication and for the operations of his thought. It places all existing languages within his reach, but puts none into his possession; he can learn to speak anything, but can speak nothing without learning. But the power to use implies also, at least to a certain extent, the power to produce. If there could be such a thing started as a speechless community of human beings, it would, by the exercise of its gift, make a beginning of supplying itself a language, which would become increased and extended and perfected until, after generations enough had made their contributions to it, it would compare with some of those now current. Of what kind the beginnings would be we shall see better after considering the main facts relating to the life and growth of the existing tongues.

Men are, even now and everywhere, makers as well as learners and users of language. If the whole life of language consisted in simple teaching and learning, every language would continue the same from age to age. But not one does in fact continue the same: all are changing, some more and some less rapidly. The English has changed so that the form of a thousand years ago, which we call Anglo-Saxon, is as a wholly strange tongue to us. Latin changed into Old French, and this into modern French; old High-German changed into Middle, and this into New; and so on. This is simply the effect of the collective mind of the speaking community working underneath its apparatus of expression, and adapting the latter to its changing needs and shifting preferences. Nothing is plainer than that whatever new knowledge and altered conceptions may arise in a community must somehow find expression in its speech —that the passing out of mind of old conceptions is accompanied by the oblivion of their signs (if not transferred to new uses); and then there is, besides, a kind of wear and tear of words, by which they change shape or disappear, and a constant production of new material to take the

place of what is lost, and to extend and improve the means of expression. To understand these changes is to understand the growth of language; and in order to be understood, in themselves and in their causes, they need to be studied in their detail; the general effect is only the sum of details, each of which has its own history and occasion.

The changes of language may be best grouped under three heads: (1) alterations of old material; (2) loss of material; (3) additions of new material. Alterations of old material, again, are made either in the external audible form of words or in their internal content, their meaning. Each kind of alteration is independent of the other; and for the reason that the tie between form and meaning is, as pointed out above, only one of the convenience of use; otherwise the two could not be divorced. Each is determined by the requirements of the convenience of the users; and this, so far as alteration of outward form is concerned, makes towards ease of utterance, economy of the muscular effort of enunciation. The principle of ease is that which underlies the whole department of phonetic change. It shows itself most obviously in the constant abridgment which words undergo by the loss of initial, and especially of final, sounds and syllables, and the omission or contraction of interior elements. Thus, *bear* in "we bear" is from *bharamasi*, *bore* in "we bore" from *babharmasi*, *had* in "had we" from *habaidedeima*; *alms* is from *eleêmosunê*; and so on. We may follow the gradual reduction of a word like *bharamasi* through such forms as *pheromes* (dial. Greek) and *ferimus* (Lat.), and *bairam* (Goth.); and so in innumerable similar cases. By this means especially the endings which once showed the grammatical forms of words are worn out and lost. As is well known, no language shows the results of this abbreviating process in such a degree as the English. The monosyllables which form two-thirds to three-quarters of our language as spoken or written were all of them words of two or three or more syllables in its earlier condition. But also the constituent elements of words that are spared become variously altered. The character and extent of the spoken alphabet are all the time slowly changing. Old sounds go out of use; new ones are introduced; both vowels and consonants are shifted to other places and modes of utterance. Thus, the old Indo-European aspirates (mutes with a puff of *flatus*, a kind of *h*, following the breach of their contact) have long since disappeared in Europe, becoming variously altered; the root *bhar*, instanced above, is in ancient Greek *pher* (*p'h*), in modern Greek, as in Latin, *fer* (the *f* a sound not found at all in the original alphabet); in Germanic, *ber*; the *hab* of *haban* (our *have*) is Latin *cap* (*capere*); and so on. All such transitions of sound are more or less strictly reducible to rule, being governed by the physical relations of sounds and by the general tendencies of language, as modified by the special tendencies and habits of each particular community. To trace them out, and, so far as is possible, explain them, is the task of phonetic science. Assimilation is the head under which the larger part of them fall; both on the smaller scale, making difficult combinations more pronounceable, and on the larger scale, approximating the whole vowel and consonant systems to one another, making the vowels closer and the consonants opener, and thus filling up the alphabetic system with intermediate, more slightly differentiated, sounds. In Indo-European, *s* was the only fricative consonant, and *a* (*far*), *i* (*pique*), and *u* (*rule*) the only vowel-sounds, and *a* formed a quarter to a third of the whole utterance, while with us *a* has sunk to much less than a hundredth. There are examples of the opposite principle, dissimilation, and more difficult and anomalous cases; of which the most noted and intricate is the so-called Grimm's law of the rotation of mutes in Germanic language, whereby, of the original surd, aspirate, and sonant mutes (in this order) each is by the majority of Germanic dialects pushed around one step, and in the High-German two steps; thus, Sans. *tad*, Eng. *that*, Ger. *das* (the sibilant replacing the aspirate).

The changes of internal content or meaning of words are quite as indefinitely various as those of form, and even more irreducible to systematic order. There is hardly a conceivable transfer of use which may not be found exemplified in the history of words. But much the greater part of them may be rudely classified under two great heads—restriction and extension. By restriction or specialization is meant the taking of a general word expressive of quality or action, and making of it the specific appellation of some thing or class of things possessing that along with other qualities. Thus, the *sun* is named from its "shining," the *moon* from her "measuring" of time; a *planet* from its "wandering" motion; the *electric* force from its displaying itself in "amber" (when rubbed); a *crescent* from the shape of the "growing" moon; a *board* from its being "broad" in proportion to its thickness; and so on. This is one of the earliest, most constant, and most fruitful methods by which names of things have been won. But a name, once won, becomes the appellation of a class of related things, and the limits of classes are constantly shifting and spreading by direct and indirect means. Even *sun* and *moon* become class-names when the progress of astronomy discloses other bodies of analogous character with them; *planet* is, by the same means, both changed in application (made to exclude *run* and include *earth*) and widened (to take in Uranus and Neptune and the asteroids). But not ties of scientific classification alone, ties of analogy, of every kind and degree, are used to extend the sphere of application of words. *Board* is made to signify the "table," and then the food set on it, and the body of men that sit round it (*board* of directors, etc.). *Post*, literally "put, placed," gets a whole scheme of meanings, seemingly of utter diversity, although each is really fastened to some one of the others by a traceable tie of association. Thus, a great part of our words come to have a variety of senses more or less remote from one another—senses which it is the office of the lexicographer to place in their right mutual relations, but which the ordinary speaker would often be puzzled to explain. But there are two special departments of this change which require a word or two of additional notice. In the first place, all our expressions for intellectual and moral conceptions and relations are obtained thus from terms originally indicative of what is physical and sensible: thus, *right* is "straight," and *wrong* is "wrung" or "twisted;" *understand* is "stand in the midst" of anything; *imply* is "fold in," *apply* is "fold to," *reply* is "bend back," *comply* is "bend along with;" *develop* is "unwrap;" *occur* is "run against;" *apprehend* is "take hold;" and so on. In the second place, words indicative of relation, form-words, connectives, auxiliaries, are made from words formerly of more definite and material meaning by a gradual extension so wide that it results in a complete effacement, by attenuation, of that meaning. Thus, the verb *be*, the copula between subject and predicate, is made up of roots signifying originally "grow," "dwell," "sit," "stand," and the like. The auxiliary *have*, now a sign of past time (*I have done*), of future obligation (*I have to go*), and so on, is from a root meaning "seize," "grasp;" *will* comes from "enclose," *shall* from "offend," *may* from "be strong." The articles are from demonstratives and numerals; relatives, from demonstratives and interrogatives; conjunctions, from adverbs and other parts of speech.

By both these methods the material of a growing and cultivating language is constantly undergoing conversion to finer, more formal, more conceptual uses, and this is perhaps the grandest general movement that goes on in it. There are minor movements of every kind, many of which are made the subject of exposition and illustration in such works as Trench's *Study of Words* and *English Past and Present;* there is no space to dwell upon them here.

The second general division of linguistic change is that of loss. It is a comparatively simple subject. As language is maintained and kept in existence only by use, disuse causes disappearance of any of its elements. A word is lost when the conception for which it stood dies out of men's knowledge and remembrance; so, for example, the phraseology of ancient religion and ancient arts, when these are superseded by new, unless, indeed, some of the old words should take on new and changed meanings; then we have only that minor kind of loss which consists in the disappearance of an internal content. But words are also crowded out of use by the uprisal of new terms which come into fashion and make them dispensable. When, for example, the flood of words of Latin origin was brought in upon English, it caused the obsolescence of many an equally good term of Saxon origin; and sporadic cases are always liable to happen of words being allowed by carelessness, as it were, to die out, which we afterwards regret.

A more important department of loss consists in the disappearance of the signs of grammatical distinctions, and with these of the consciousness of the distinctions themselves, chiefly as a result of the wearing-out processes of phonetic decay. As already noted, no modern language offers such abundant exemplification of this as our English. Thus, the seven original cases of our family have been reduced to two (in certain pronouns, three); the five original tenses, to two; the agreement of the adjective with its noun, in two forms of declension is entirely lost; the scheme of artificial or grammatical gender is obliterated; the subjunctive mood is nearly gone. But the same thing is true in less degree of all the languages akin with ours, and in all others which have any grammatical structure at all. The law of abbreviation is inexorable in its working, and, along with what can well enough be spared, takes away what is valuable.

The third division of change includes additions to the material of language. Of the addition of new meanings to old words, sufficient notice has already been taken; and it

is evident that by this means the resources of expression of a language may be very much increased without any corresponding outside show. It is possible, too, to no small extent, to pile away the results of new knowledge in the old words: however much we may come to know more than of old about the *sun, heat, rising* and *falling*, and innumerable other subjects, it does not disturb our employment of the traditional names. These are just as real parts of the growth of language, produced by the same forces and for the same purposes, as the more external additions. External additions are of two kinds: those made by borrowing from abroad, and those made by the development of native material. Borrowing is a wellnigh universal process of language-making; there is hardly one unmixed tongue in the world, unless here and there a dialect which never comes into contact with any other. But only these languages borrow on a large scale of which the speakers have derived to a large extent their culture, knowledge, institutions, from other communities. The Persian in this way gets material of expression indefinitely from the Arabic; the Turkish, from the Persian and Arabic; the modern dialects of India, from the Sanskrit; the Japanese, from the Chinese. And so all the peoples who inherit Greek and Roman civilization have taken abundantly from the Greek and Latin vocabularies. And our English has borrowed more than any other language that is not descended directly from the Latin; partly because the forcible fusion of a Germanic and a Romanic dialect which was the result of the Norman Conquest opened the door to such borrowing and made it easy; and partly because the native processes of composition and derivation in English had become so inactive that not much growth could be accomplished by their aid. As our vocabulary presents itself in the dictionaries, about five-sevenths of it are of classical origin. Of course, in actual use, in speaking or writing, the proportion is very different, because the core of the language, embracing the words of most frequent use, is almost exclusively Germanic; the Germanic part is 60 to 90 per cent. Names of things are most easily and directly borrowed, connectives least easily, grammatical apparatus, endings of derivation and inflection, almost not at all. The foreign material is stripped of its native grammatical form, and often shaped over a little to assimilate it to the native stock of the borrowing language; and it is prepared for free practical use by means of the grammatical apparatus of the latter, each borrowed element thus often becoming the nucleus of a little family of derived and inflected words. What thus comes into a language is to a very great extent only words of learned use, employed almost exclusively by those who know it as of foreign origin and recognize its source; but more or less of it, according to circumstances, works its way down into popular use, and is then in no way distinguishable from that which is of ultimately native growth: the mass of speakers use their words simply because they are in use, neither knowing nor caring whence they came.

For obtaining new resources of expression out of the old material of a language, the methods cannot, of course, be very various. In the course of the phonetic changes of language a single word sometimes divides into two or even more forms, which then go on to lead an independent life; so Anglo-Saxon *of* has separated into *of* and *off*, Anglo-Saxon *ân* into *one* and *an* or *a*, *ealswa* into *also* and *as*; and we have such doublets as *minúte* and *mínute, cónduct* and *condúct, gentle* and *genteel* and *gentile*, and so on; but such a method operates only on a very restricted scale. A process of much wider reach and greater importance is that of the formation of compound words, which is very extensively and fruitfully resorted to by all the tongues of our family, although much more by some than by others. We have in English, for example, combinations of every grade—from such loose ones as *book-cover, chair-back*, through closer, like *tablecloth, inkstand, homestead, railroad, steamboat*, to such as have been so far altered in pronunciation or meaning, or both, that we do not ordinarily think of them as compound at all, like *breakfast, forehead, boatswain*, or such as have their origin wholly concealed from all but learned eyes, like *such* and *which* (from *so-like* and *who-like*). Many a seemingly simple word of ours is proved by historical inquiry to be put together, no great way back, from two or more others. For we are always ready to forget the origin of the terms we use when they are once made and put to use; and then the processes of phonetic change seize upon them and alter and disguise them past recognition.

Very frequently these processes act only upon one, the latter, of two members of a compound, converting it into a dependent addition to the other. Thus, our *ly* in *godly, manly, homely*, etc. is to us a mere suffix, forming adjectives from the nouns *god, man, home*; or, in other words, as *freely, truly*, it makes adverbs from adjectives; but in Anglo-Saxon it was an appended adjective, *lic, lice*, our *like*. The *d* which makes the past tense of our "regular" verbs is similarly traceable to the verb *did*, added as an auxiliary in early German language to some verbal word. The *ai* of French *chanterai* is an auxiliary—*j'ai*, "I have." The *bam, bo*, and *vi* of Latin verbs are of the same origin; so is the σω (*sô*) of the Greek future. These are but examples of a large number of endings or suffixes which come demonstrably from independent words, at first compounded with other words, then disguised in form, and finally coming to be felt as mere modificatory appendages, and extended in use in that office. No other method of producing such elements of expression is known through all the historical epochs of language. It is true that by no means all suffixes admit of this explanation; but that is because the evidence which would constitute an explanation is no longer attainable. The facts in our language which seem to make against it—especially the instances of internal change like *man men, lead led, give gave*—are capable of easy explanation as inorganic or accidental results of phonetic change, and traceable to original external addition like the rest. In short, we have here a method of linguistic growth which is in complete accordance with the facts and tendencies of known linguistic history, and which, in the opinion of the best modern students of language, is capable of having produced the whole structure of speech. It works very slowly, indeed, as compared with wholesale borrowing, but its effects are infinitely deeper and more important.

All these methods of change are carried on, it will be observed, in the interest of convenient expression. There is new knowledge of every kind to be provided for—new facts, new classifications, abstractions, deductions; and there are, not so indispensable, but as inevitable, changes of the instrument of expression itself in its uttered form, in its apparatus of connection and relation. As a whole, the process seems a highly intricate one, but in its details it is perfectly intelligible. It is a constant name-making, a never-ending satisfaction of the individual needs of expression, as suggested by and built upon the already subsisting uses of a language, as governed in the mode of satisfaction by the existing habits of speech, and by the circumstances of the case. The idea being conceived, the mind reaches after the means of its signification, and finds this wherever it lies most ready at hand. The mind is easily content: no nicely adapted sign, essentially bodying forth the conception, is required; only a representative which shall be henceforth associated with the conception, and one having such relation to antecedent expression that it shall commend itself to the acceptance of the community. For this is an ordeal which everything in language must pass. Nothing is language until it is adopted by a community as its means of communication. Though every individual change proceeds from individual action, and has its own time and place and occasion of origination, the common action is equally a factor in its history.

It is easy to find, in the antithesis of individual action and that of the community, the explanation of dialectic variation. Every language is all the time changing; it changes by specific items, which begin with individuals and spread by communication, by imitation, through the whole mass of the community. So long as they do thus spread, the language of the community, however rapidly it may change, remains homogeneous throughout its whole territory, with the exception of those minor local and class differences which prevail within the limits of every existing tongue without disparagement to its unity, because those who speak it can all understand one another in reference to the most necessary subjects. But if the parts A and B and C, and so on, become separated from one another, so that the changes initiated in A do not spread into B and C, nor those made in B or C into the rest, then the local differences begin at once to be multiplied and deepened; mutual intelligence becomes more and more difficult, and finally impossible; and different languages are the result. All, then, that makes for unity of community represses dialectic growth. And the forces of culture are those which work most efficiently toward this result. A literature, writing, instruction, tend to check the rate of change of a language, and to efface local and class differences already existing. Ignorance and barbarism both encourage rapid alteration, and, by favoring the isolated and antagonistic position of districts and tribes, make for divarication also. The maintenance of wide-extended unity of speech, because of wide unity of other institutions, is possible only under civilized conditions.

The state of language throughout the earth is precisely what the principles here laid down would lead us to expect. The world is full of dialects, some closely and obviously akin with one another, others having resemblances discoverable upon closer examination, others apparently unrelated. If speech began to exist along with a single race or a limited number of races of human beings, and

spread with them from land to land and from continent to continent, ever altering and divaricating dialectically with every new division of a race or community, the result would finally be what we see it to be. In the long ages of barbarism the growth of dialects was the prevailing tendency; since civilization has become the overwhelming force in the history of the world, the tendency is the other way: the cultivated dialects of the leading nations are extending, and crowding out diversity, and even encouraging men to look forward to a time when one or two languages shall prevail universally.

Such being the case, it is evidently one of the first objects to be aimed at by the students of language to make a classification of all human dialects according to their relationship and its degrees: only thus can the way be prepared for the historical research of language in general. And this work has been accomplished, so far as the assemblage of materials has made it possible—provisionally, that is to say, and with full acknowledgment of the probability of amendment and improvement hereafter. And at least the main outlines of the classification we have here to review. In imitation of genealogical phraseology, the dialects regarded as demonstrably descended from a common ancestor are called a "family," each family being then divided into branches, sub-branches, etc., as may be found convenient.

Indo-European Family.—This is sometimes also called Aryan, or, by the Germans, Indo-Germanic. It is the family to which our own tongue belongs, with most of the other languages of Europe, and with those of South-western Asia; and it is by far the most important of all. It is divided into seven principal branches. There is (1) the *Indian*, or Sanskritic, an intruder into India from the N. W., probably not more than 2000 to 3000 years B. C., and gradually filling all the northern country, with a part of the southern peninsula, the Dekhan; the rest remaining in possession of the more aboriginal Dravidian tribes. Its oldest language is the Sanskrit, the earliest parts of the literature of which, the hymns of the Veda, go back probably to near 2000 B. C., the remotest date anywhere reached among Indo-European records. The language is also less altered, by changes either of form or of meaning, from the original common speech than is any other; and hence the Sanskrit takes the leading place in all researches into the oldest language-history of the whole family. The great groups of varying dialects known as Hindî, Bengâlî, Mahrattî, are the modern representatives of the branch; and between them and the Sanskrit lie the Prâkrit dialects and the Pâlî, the sacred language of Southern Buddhism. (2) The *Iranian* branch, occupying the great Iranian plateau between the borders of Mesopotamia and of India. It is nearly akin with the Indian, and the two are often, and very properly, combined together into a single "Aryan" branch; their oldest dialects are hardly more unlike than, for example, some of the Germanic languages are unlike one another. The oldest records of the branch of definite date are the cuneiform inscriptions of Darius and his successors (from about 500 B. C.); in part, probably older is the Bible of the Zoroastrian religion, the Avesta; its language is called the Zend, or Avestan, or Old Bactrian. Of considerably later date is the problematical Huzvâresh, or Pehlevî; and the Pârsî but little precedes the Modern Persian, which has a great and valuable literature, beginning from about 1000 A. D. To this branch belong also the Kurdish, the Ossetic in the Caucasus, and probably the Afghan; also the Armenian, which has a literature going back to the fifth century of our era. (3) The *Greek* branch. Of this the history is too well known to require more than a word here. It has in the poems of Homer the oldest monuments of the family outside of India. What were the relations, to it and to the family, of the languages on the N., and of those on the E., in Asia Minor, is very uncertain, and will perhaps never be determined. The present Albanian, or Skipetar, regarded as modern representative of the ancient Illyrian, is of disputed character, but more probably Indo-European. (4) The *Italic* branch. This included a considerable number of the languages of Italy; and of some of them, especially the Oscan and the Umbrian, considerable remains are left; of others, as Volscian and Sabine, the merest fragments. All were wiped out by the Latin dialect of Rome, which also extended itself, along with Roman dominion and institutions, in both directions through Southern Europe, giving rise to the modern group of the Romanic languages, embracing as its principal members the Italian, French, Provençal, Spanish, and Portuguese, Rumansh, and Wallachian, each including a great variety of dialects. The literatures of these modern languages commence between the tenth and thirteenth centuries; fragments of Latin come down from the third century B. C. (5) The *Celtic* branch. The Celtic languages formerly occupied a very broad space in Europe, but they have been continually encroached upon by both Romanic and Germanic, until now they survive only on the farthest western edges of their old territory. The Welsh, the Cornish (extinct since the end of the last century), and the Armorican of Brittany constitute the Cymric division of the extant dialects; the Gadhelic includes the Irish, the Gaelic of Scotland, and the Manx of the Isle of Man. Irish and Welsh monuments go back to the eighth and ninth centuries. (6) The *Slavonic*, or *Slavo-Lettic* branch. The seat of the Slavonic languages is in Eastern Europe. The important members of the eastern subdivision are Russian, Bulgarian, and Servian; of the western, Polish and Bohemian. The earliest Slavonic record is a Bible version made in the ninth century. The branch is a double one, in virtue of being made to include the more remotely but still specially kindred Lettish dialects—namely, the Lithuanic, Livonian, and (extinct) Old Prussian. These have no records older than the sixteenth century, but the Lithuanian especially is distinguished by the primitiveness of some of its forms. (7) The *Germanic* (or *Teutonic*) branch. This is divided into four sub-branches. The Mœso-Gothic, or dialect of the Goths of Mœsia, is long since extinct, and is represented only by parts of a Bible version made by Ulfilas in the fourth century. It occupies, as both oldest in time and most primitive in structure, much such a position in the branch as the Sanskrit occupies in the family. The Scandinavian sub-branch fills Denmark, Sweden, Norway, and Iceland. It has its oldest living representative in the Icelandic, and its oldest and most original monuments also come from Iceland in manuscripts of the twelfth and thirteenth centuries. The more proper German is divided into the High-German of the central and southern region, and the Low-German of the northern lowlands. The High-German begins its Old period in the eighth century, its Middle in the twelfth, and its New in the sixteenth; what we call the German language is its only cultivated dialect. A great part of the Low-German territory in Germany now acknowledges the supremacy of the literary High-German; but the Netherlandish or Dutch has an independent culture and literature, and the English is its colony, brought to Britain by the Angles and Saxons in the fifth century and later. The oldest Anglo-Saxon remains are from the seventh century.

Respecting all this great and important body of languages is to be held, in conformity with the principles laid down above, that they are descended from the tongue of a single community which lived somewhere, within narrow limits, at some remote period, and by spread and emigration broke up, over and over again, into separate parts, with the inevitable consequence of the breaking up of its speech into dialects. Where and when that original community lived it is wholly impossible to determine from any evidences as yet brought to light; certainly, language does not give, and cannot be expected ever to give, any definite information about it. The question of the time depends wholly upon the grander and now much mooted question of the antiquity of man on the earth; the historical linguist will only say that he does not know well how to compress all the events of Indo-European language-history into the brief space of 6000 years, and will welcome an extension of the period; but what extension to ask for he does not at present know. As for the place, the popular impression which fixes it about the Hindu-Kush or in Bactria has no defensible basis whatever; the facts of language admit of being reconciled with almost any theory that can be suggested. It is now prevailingly held by linguistic scholars that the European branches must have constituted a community together for some time after their common separation from the Asiatic or Aryan branch; but that proves nothing. The Slavonic and Germanic branches are also believed to be of especially near kindred; whether the Celtic branch shall be reckoned as independent, or more closely connected with the Italican, is a disputed point, as is also the special relationship of the two classical languages. While language is thus silent as to place and time, it gives some definite information respecting the condition of the primitive community, showing it to have been not merely nomadic, but of settled and agricultural life, with well-developed family organization, with domesticated animals, with some of the arts of life, and with knowledge of a metal or two.

The history of development of Indo-European language is better understood than that of any other family, the materials being exceptionally abundant, and having received an amount of study which has been bestowed upon no other; its main features are pretty clear, though there remains abundance of obscurity in its details. The language began in a condition of monosyllabic "roots" (analogous with those of which, for example, the Chinese language is even down to the present time composed), utterances which were

neither noun nor verb, nor any other "part of speech," but were as ready to turn to the uses of one as of another. They were of two classes—verbal roots, expressing material, sensible act or quality; and a small number of pronominal or demonstrative roots, indicating position and direction. That the distinction of these classes is primitive is by no means certain; but it is at any rate earlier than the growth of Indo-European structure. The first important step of growth, it seems, was the making of a predicative or assertive form—a verb; it was done by combining with verbal roots certain affixed pronominal elements, and "understanding" the copula between them; thus, *dâ-mi*, "giving-I," to be used henceforth only in the sense "I [am] giving" (or, "a giver;" or "giving-mine"). Thus were made the three persons of a verbal form, in three numbers, singular, dual, and plural; and the addition of a preterit "augment"-tense, *a-dâ-mi*, "then-give-I"—*i. e.* "I gave," a reduplicated preterit or perfect *dâ-dâ-mi*, "give-give-I"—*i. e.* "I have given," and a future, *dâ-syâmi*, probably "I am going to be giving," left to this simpler form the character of a present. More or less of an imperative, optative, and subjunctive, and of a middle or reflexive voice, also were products of the original tongue before the separation of the branches. The establishment of a verb left the remainder of linguistic material in the condition of noun, noun substantive, and noun adjective; for these two parts of speech were at first not held apart. A system of inflection was by similar means (very hard to understand in their detail) created for these also, indicating case, number, and gender. Of cases there were seven, besides the vocative—namely, nominative or subject-case, accusative or *to*-case (also direct object), ablative or *from*-case, locative or *in*-case, instrumental or *by*-case, dative or *for*-case; and genitive, case of general relation or appurtenance. Of numbers, there were the same three as in the verb; and the distinction of gender, which, founding itself on the natural differences of sex, extends itself to all objects of thought, being only in small part governed by sex, is something very characteristic of our family; much the smaller number of human languages make any account of such a distinction. The pronouns are a class of words inflected like nouns and adjectives, but coming from pronominal instead of verbal roots. From the same roots come naturally the first adverbial words, indicators of position and direction; the other particles, prepositions, and conjunctions are yet later to arise. The interjection is no "*part* of speech," but rather an unanalyzed, holophrastic utterance, analogous with the undeveloped root. Thus, by combination of element with element, and the assignment of the combinations to specific uses in definite connections, this language arose from a mere indefinite intimation of intended meaning, such as our exclamations give, to orderly and distinct statement—first in single clauses, then in elaborate combinations of clauses, in periods. How much time the process occupied it is impossible to say, but it must have been a long time; and before the separation of the branches took place a height of synthetic development was reached from which, although every branch has more recent synthetic formations to show, there has been on the whole a recession, by the substitution of more "analytic" means of expression of relation, of form-words, and auxiliaries—our own English being, as in other respects, the most marked and extreme example of the new tendency.

The importance to us of the study of Indo-European language lies partly in the fact that it is our own family, and that also to which belong the tongues of the founders and leading representatives of our civilization, so that the study is connected in its bearings with a variety of other inquiries in which we are especially interested. It has also been the principal foundation, and almost the initial phase, of the general science of language, because there was nowhere else in the world so large and varied a body of related linguistic phenomena, by the examination of which the general laws of linguistic life could be deduced, and methods of research worked out which might be fruitfully applied where the material was less abundant, and exhibited a less length and breadth of development. Hence, and not from any over-estimate of this language, as alone worthy of investigation, or as furnishing the norm of human speech, comes the conspicuous absorption of linguistic students thus far in Indo-European studies. At the present time the profounder comparative study of other families also is well prepared for, is becoming more and more urgent, and is engaging more and more labor; although none has yet received anything like the same degree of comprehensive and penetrating examination as the Indo-European family. We shall, accordingly, review the others much more briefly.

The Scythian or Ural-Altaic Family.—This group of languages, widely coterminous with the Indo-European, is often also called the Turanian, and is generally reckoned to contain five great branches: (1) The Finno-Hungarian, chiefly European in locality, including, besides Finnish and Hungarian or Magyar, the Lappish and the dialects of a host of unimportant tribes stretching through Northern and Eastern Europe across the Ural chain. (2) The Samoyed, along the shores of Siberia, from the White Sea to the Yenisei, and up that river to the Altai Mountains, probably its original seat. (3) The Turkish, recent occupants of Asia Minor, and overlapping the border of Europe, extending over a vast tract of Central Asia, and having an important branch, the Yakut, even on the Lena, to its mouth. (4) The Mongolian, yet farther East, but nowhere reaching the ocean. (5) The Tungusic or (from the name of the principal people) Manchu, beyond in the north-eastern end of Asia, save its peninsulas and islands; the Manchus have also held China in their grasp during the past two centuries. The languages of the first or westernmost branch do not differ remarkably in their general character from the Indo-European, but have more of what is called the "agglutinative" type: that is to say, root or theme and ending are less intimately united, rather "stuck together" than fused together, the ending retaining a more independent character: this results both in a greater regularity and a greater intricacy of formation. But the two easternmost members are of a much less developed and more jejune character, verging on the stiff inexpressiveness of monosyllabism; and this, in connection with other peculiarities, linguistic and physical, casts some doubt on the coherence of the family. There is neither abundance nor antiquity of literary productiveness among the Scythian races; their main part in history has been war and devastation; the wild and curious mythic popular poetry of the Finns (the *Kalevâla*) is their most original work. Unless, indeed, it shall turn out to be true, as is claimed of late, that the "Accadian" people, who laid the foundation of Mesopotamian civilization, and invented the cuneiform writing which was afterwards borrowed and adopted by both Semitic and Indo-European peoples, was Scythian, of the Ugrian branch. This would carry the antiquity of Scythian language back to a point fully as remote as that reached either by Indo-European or Semitic. It cannot be long now before this question is settled.

Of the various and diverse languages of the North-eastern Asiatic waters, the *Japanese* is the only one that deserves mention. It is, though highly polysyllabic, of an exceedingly simple structure, phonetically and grammatically, much like the Mongol and Manchu, and may perhaps yet be proved of one family with them. Its culture is derived from China.

The S. E. of Asia is filled with languages which have monosyllabism as their distinctive characteristic. The *Chinese* is by far the most prominent and important among them. This is a language in the highest degree remarkable for the paucity of its resources and the exceeding deftness with which they are used, so as to perform the duties of a highly cultivated speech during an unprecedentedly long period. The Chinese literary monuments go back to nearly 2000 B. C., and are of great variety, extent, and merit. The language is composed of only some 500 different words, as we should write them; but their number is raised to about 1500 by the tones of utterance, this element having been pressed into the service of intellectual distinction in the scanty monosyllabic tongues, both Chinese and Farther Indian. The means of formal distinction are in part form-words, particles, and auxiliaries, and in part position in the sentence. The intelligibility of the literary language is much aided by the mode of writing, which is to a great extent indicative of meaning, instead of pronounced form. The popular dialects are numerous, and so diverse as to be like so many independent languages. Some of them are said to make a degree of approach to an agglutinative structure.

The only tie to connect the Farther Indian and the Himalayan (at least in part) with the Chinese dialects is their common monosyllabic structure. The Burmese, Siamese, etc. have literatures of as great antiquity founded on that of India, whence comes their religion (Buddhism) also; and nearly the same is the case with the Thibetan. A vast deal has still to be done to make clear the character and relations of this great and perplexing confusion of little-known and unimportant dialects.

Off this corner of Asia lies the vast and scattered array of the isles of the Pacific. They are occupied by at least three independent and wholly insular races and language-families. Australia and Tasmania are the home of one, the *Australian*. New Guinea, part of Borneo, and the more inaccessible parts of several other islands and groups, are inhabited by a black race with frizzled hair, the *Papuan* or Negrito; its dialects are almost entirely unknown, but are believed to be unrelated with any others. But the great islands nearest Malacca (and Malacca itself by recent im-

migration), and the shores of the others just mentioned, and the scattered groups within the limits marked by Formosa and New Zealand, by Madagascar and Easter Island, are the home of an immense and well-defined family, the *Malay-Polynesian*, in three branches—Malay, Melanesian, and Polynesian. Several of the dialects of the Malay branch have literary culture, derived from the mainland; that of Java and Bali, coming from India, has records going back even to the first centuries of our era. The Malay has adopted Islam, and with it the Arabic alphabet. These languages, though not monosyllabic, are nearly bare of structural development, not having even a clear distinction of noun and verb, nor anything that could fairly be called inflection. Their phonetic form is also simpler than that of any other known tongues.

The *Dravidian* group of languages, of Southern India, is of an agglutinative type, somewhat resembling the Scythian, and some linguistic scholars have been overhasty to pronounce it a branch of the Scythian family. Its principal members are the Tamil, Canarese, and Telugu. They have literatures of some antiquity, founded on the Sanskrit, their culture having been derived from the Aryan races of the North.

The Caucasus region is filled with a medley of peculiar dialects, apparently akin with no others in the world, and for the most part unrelated even with one another.

The Semitic Family.—This is the only Asiatic family remaining to be considered. Its home is in the great but barren and thinly populated peninsula of Arabia, with its border-lands—Palestine and Syria on the N. W., Mesopotamia on the N. E.—and with an outlier in Africa, across the Straits of Babelmandeb. It is usually divided into three branches—Syriac, Canaanitic, and Arabian—but the recent resurrection of the Assyrian language from the cuneiform inscriptions of Nineveh and Babylon has brought to light so peculiar a dialect as to make it better to rank the Syriac or Aramaic with the Canaanitic, leaving the Assyrian alone as third division. The members of the central branch would be, then, the Hebrew with the other related Palestinian dialects, the Phœnician with its Carthaginian colony, and the Syrian or Chaldee. The sole surviving literature of the Hebrew, written during the life of the language (it became extinct as a vernacular four centuries before Christ), is our Old Testament; its oldest parts come from near the middle of the second thousand years B. C. Neither Phœnicia nor Carthage has left any literature; their language, very closely like the Hebrew, is known only from inscriptions. Of the Moabitic, a remarkable monument, from 900 B. C., was discovered a few years ago; the language was almost pure Hebrew. The Hebrew has been kept in artificial learned existence, like the Latin, and has an immense literature as such. Apart from an Aramaic passage or two in the Old Testament, the abundant Syriac literature commences in the second century with a Christian Bible version. The Assyrian literature, inscribed and impressed on alabaster and on clay tablets, is now coming rapidly to light, and furnishing and promising information of the highest interest, especially in its bearing on biblical history; its records are perhaps as old as the biblical. The Arabic proper makes its appearance only recently, possessing but few records which are older than Mohammed (seventh century); but there are in the south-western corner of the peninsula remains of a wholly independent and much older civilization, and of dialects, called Himyaritic, very different from the classical Arabic. The Semitic dialects of Abyssinia are a colony from these, and nearly akin with them; the Ethiopic, or Geëz, has a Christian literature dating from the fourth century; the Amharic, which has crowded the other out of cultivated use, does not appear until the twelfth or thirteenth. This is the ancient distribution of Semitic dialects: since the rise of Mohammedanism the Bedouin Arabic has spread itself over nearly the whole Semitic territory, extinguishing the other dialects, has taken possession of Egypt, now its main seat of literary cultivation, and of the whole northern border of Africa, and has influenced, and more or less filled with its material, the Persian, Turkish, and Hindustani, and even the widely sundered Spanish and Malay, thus winning a sway comparable to that of the Latin, though falling far short of the Latin in the importance of the derived languages to which it has given birth.

The Semitic race has played a far greater part in history than any other, save only the Indo-European, and its languages possess a corresponding degree of importance. Their range of dialectic differences is much less than that prevailing in our family; they are closely kindred forms of speech. Not, apparently, because they have been more recently separated than the Indo-European dialects, but because their structure has been especially rigid and unchanging. The Semitic structure is more peculiar and problematical than that of any other family of languages. Its striking characteristics are its tri-consonantal roots and its internal flexion. The roots, namely, have not, like the Indo-European, each a constant vowel, which is, even if more variable than the consonants, an integral part of it; the vowel or vowels in Semitic have a formative value, are indicative of relation, not less than the vowels of *man* and *men*, of *bind* and *bound*, and *band* and *bond*. And (with insignificant exceptions) the radical consonants are three, no more and no less. Suffixes and prefixes—and even infixes, elements inserted within the body of the root—are not unknown, but the sphere of their application is limited, because so much of what is done in Indo-European by affixes is here accomplished by internal change of vowel. Thus, for example (in Arabic, which is by far the most primitive and transparent in its structure of all the dialects), all that we can call the root corresponding to "kill" is *q-t-l*: *qatala* is a third person, singular, meaning "he killed," and *qutila*, its passive, "he was killed," *aqtala* its causative, "he caused to kill," *qâtala* its conative, "he tried to kill," *inqatala* its reflexive, "he killed himself," and so on. Then (*u*)*qtul* is imperative, "kill!" and a second set of verbal persons (hardly to be called a tense) has this form of the root: *yaqtulu*, *taqtulu*, *aqtulu*, and so on. The active participle is *qâtil*, "killing," the intensive *iqtâl*, "causing to kill," the passive *maqtûl*, "killed." The infinitive or verbal noun is *qatl*, "act of killing;" and *qitl*, "enemy," and *qutl*, "murderous," are specimens of derivative words. These examples are sufficient to bring out the remarkable features of Semitic speech. We have paralleled above the internal flexion with the Germanic *ablaut* of *bind* and *bound* and their like; but the essential difference between the two cases is, that what in Indo-European is rather a sporadic phenomenon, and capable of easy explanation as the *quasi*-accidental result of phonetic change consequent upon external additions, in Semitic is the very life and soul of the language, irreducible to anything different. It is, however, the prevailing belief among linguists that this condition of Semitic language must be the result of a very peculiar history of development out of beginnings more analogous with those found in other families of speech; and attempts are constantly making to penetrate the secret of the development, but as yet without any considerable measure of success. It is very certain, meanwhile, that there can be no proof of any relationship between the Semitic and any other family until the attempts prove successful. It is a favorite subject of effort with some philologists to demonstrate the primitive unity of the Semitic and Indo-European races; and there are many indications outside of language which favor the conclusion; but thus far, at any rate, the language is an impassable barrier.

The other peculiarities of Semitic structure are of small account as compared with those already noticed. The verb tends more to conjugational distinctions, such as were illustrated above, than to distinctions of tense and mood. It marks the difference of gender in its personal inflection. The noun is almost destitute of case variation; it and the verb have the three numbers found in early Indo-European. Secondary derivation, or the forming of derivative from derivative, is almost unknown, as is also the formation of compounds. Connectives of clauses are few and simple.

Among the languages of Africa, those nearest to Asia, grouped together as the *Hamitic family*, are often claimed, but on grounds which must be pronounced thus far insufficient, to be akin with the Semitic. The family is reckoned to comprehend three branches—the Egyptian, the Libyan or Berber, and the Ethiopian; the most conspicuous members of the last are the Galla and Somali. The Egyptian of the modern period is the Coptic, which has a Christian literature beginning early in our era; it was overpowered by the Arabic, and became extinct several centuries ago. The ancient Egyptian is the language of the hieroglyphs, and has older records than any other form of human speech, reaching, in scanty measure, probably into the fourth millennium before Christ. The Egyptian is a tongue of the simplest possible structure, with deficient distinction of its parts of speech, and with very little flexion; so entirely lacking the characteristic features of Semitic that, in spite of apparent coincidences in their pronouns, the two cannot well be brought together until the riddle of Semitic structure is solved.

The extreme south of Africa is occupied by the Hottentot and Bushman dialects, which have been recently claimed, though probably without good reason, to be connected with the Hamitic family. N. of them, and up to the equator, are found the branches of a well-defined family, the *South African* (or Bantu, Kafir). The marked peculiarity of its structure is its use of prefixes, instead of suffixes, as principal inflectional apparatus. Those of its languages which border upon the Hottentot share with the latter (from whom they are believed to have derived the pecu-

liarity) the possession of clicks, or smacking and clucking sounds, in their alphabetic system.

Between the South African languages and the Great Desert lies a perfect Babel of languages and races, into the little-understood classification and characterization of which we cannot here enter. Even the best authorities are greatly discordant in their treatment of it.

The Basque, on the border between France and Spain, by the Bay of Biscay, is the only other language of the Old World which calls for mention. It is unrelated with anything else in the world, and perhaps a relic of a family which occupied at least some part of Western Europe before the intrusion of the Indo-European peoples. It is of an intricately agglutinative structure, commonly styled polysynthetic.

The same polysynthetic structure characterizes the languages of the New World, in the main, and is the only tie by which, if at all, they are to be connected together as a single family. The peculiarities of its manifestation, and the classification of the American dialects, are fully discussed in the article on the INDIAN LANGUAGES of this continent.

The classification here given is strictly a linguistic one, making no account of the ethnological division of human races. Between the two there is not a necessary accordance. Every language, as we have seen, is an institution, kept in existence, like all the other parts of our acquired and accumulated culture, by a process of teaching and learning; it does not go down by descent. Just as any individual can, if circumstances favor or require, learn as his first language or "native tongue" a dialect which is not that of his ancestors, so a community—which in this respect is only an aggregate of individuals—can do the same. And such cases have occurred, over and over again, in the history of the world. Like the useful arts, the sciences, art, religions, a language may be abandoned by a race which had produced it, or assumed by one which had no part in its production, because nature makes all men capable of speech, but prescribes to no one what speech he shall use. Yet, while a language is a traditional institution, it is the most clinging and persistent of institutions, and also the one running out into the greatest infinity of detail and possessing the most notably objective character. Words, sentences, grammatical structure, can be recorded and turned over and compared almost as if they were real substances like fossils or archæological remains. These qualities make language, beyond any other human product, of value in tracing out the relations of the different sections of the human race anterior to the epoch where trustworthy historical record begins. Its evidence yields no certainty, but only a probability. Human communities have been influencing one another since the beginning of time; and it is not possible to say absolutely of any race on earth that it has not obtained its speech somewhat as the French got their Romanic, or the Normans their French, or the Irish their English. But it is only the forces of a highly-developed civilization that give a language the power to propagate itself widely beyond its natural limits—that enable a minority of a mixed community to determine the speech of the whole; the ruder the people, the greater the probability that its linguistic relations represent its ties of blood. Hence, the trustworthiness of linguistic evidence is greatest where it is most desired, among wild and primitive races, as to whom recorded history is silent. The ethnological problem is doubtless too difficult to be ever completely solved by us; the mutual encroachments and superpositions of races, with consequent mixture of blood and of speech in every degree, the dwindling and disappearance of one race, and the expansion of another to greatness, form a web so intricate that it will never be unravelled. But in the present condition of ethnology, language is the richest and most reliable source of information. There are ultimate questions which it cannot decide, and as to which zoology and biology will probably some day show a higher authority. Such, for example, is that of the unity or variety of the human race; here linguistic science can only say that there are, on the one hand, no differences between human languages which might not be the result of later divergence from a common nucleus; and that, on the other hand, there are a great many languages so unlike that they can never be proved descended from the same ancestor, since they show no correspondences which might not be the result of accident. Linguistic material is not, like physical, analyzable to its minutest elements; creation, annihilation, transmutation, are the commonest of processes within it; it yields its results only to historical methods of investigation. Thus far, it has been found possible even to unite into families only languages which had the bond of a common structure; correspondences of material, of radical elements, anterior to the growth of structure, have not been available; and although it need not be declared impossible that they may yet be found available between certain families, it is absolutely impossible that they should be so between all. Root-comparisons, among families of unrelated structure, are in the very highest degree precarious; none yet made are to be approved as sound.

The question of the origin of language has assumed an entirely new aspect in consequence of the recent progress of linguistic science. It is clearly seen that language as a concrete possession, a stock of words and phrases used for the communication and elaboration of thought, is in no proper sense of the word a gift, a natural capacity, a faculty, but rather an accumulated acquisition, the outcome of certain faculties and tendencies which belong to man and are a characteristic part of him. To maintain the divine origin of language now is simply to hold that man was endowed by his Creator with those faculties and tendencies, with the foreseen and intended purpose that he work them out to the possession of language; as, in a different but still essentially similar way, with the capacities that have brought him to the possession of his other institutions—of regulated society, of art, of the arts of life. To hold that he was put in possession at his birth of a developed speech is analogous to holding that he was provided with houses and clothes and instruments and machines. The formal structure of language, even the more formal part of its vocabulary, we see to have been developed by degrees out of a simple body of formless roots, indicative of external, sensible acts and qualities—in the same manner, and for the same reason, that instruments and machines have been developed out of simple sticks and stones and flakes of flint, that architecture began with caves and huts, and dress with skins of animals and fig leaves. To investigate the origin of language is to inquire how these rudiments of speech were produced. The inquiry is not a part of the historical science of language, because history brings us only to the recognition of these, and to the recognition of them only in their kind, not in their concrete identity as such and such utterances. But it is an essential and prominent part of linguistic philosophy as a branch of anthropology, and can only be properly treated by one who understands the facts of later language-history, and can read their meaning.

To express himself is natural to man, and he has for that purpose a variety of instrumentalities—namely, gesture, grimace, and utterance. All are capable of being put to use, apart from anything conventional, between human beings anxious to understand one another; and all are, under determining circumstances, so put to use. That any one of them should be employed with the intent to communicate is enough to constitute an act of language-making. It is by the addition of this intent that they pass over from the condition of natural to that of conventional expression. The sphere of natural, instinctive expression is limited to the feelings or emotions of the expresser; it is purely subjective, and, so far as the action of the voice is concerned, it extends only to tones; it does not include articulations, specific combinations of vowel and consonant. There is nowhere, in the whole domain of language, anything going to show that a sound or combination of sounds is ever produced as the natural representative of an act of the intellect, a conception, or a judgment. While human expression remains instinctive and emotional, it is not language, any more than that of the lower animals, with which it is analogous. But when, for instance, a cry which was at first the direct outburst of pain or pleasure or disgust or warning is repeated or imitated for the purpose of giving to another an intimation of pain, etc., then the making of language is begun. The lower animals, some of them, are able to make a beginning here; if a dog stands at a door, and scratches or barks in order to attract attention and be let in, waiting for the opener who, he knows, will answer his call, that is an act of language-making as genuine and perhaps as good as the earliest attempts of a human being would be. There is, to be sure, an essential difference between the two cases: but it lies only in this: the dog, with his limited powers, can go no further; he is incapable of a continuous progressive development; but the man sees and appreciates what is gained by his linguistic act, and tries it again, and tries others; and so, by a gradual process of accumulation, he arrives at a body of expressions which use by and by renders conventional; and by manipulation of them he comes to linguistic structure, and finally, in races more gifted or more favored by circumstances, to vocabularies and grammars like our own. Then, by a process of development showing the most striking analogies with that just described, he adds the art of writing, a mode of record of speech which continues and completes its value both to the individual and to the race.

This exposition shows the true ground on which the different relation of men and of the lower animals to language

is to be put and argued. Usually, the great and ruinous error is committed of assuming that at the beginning certain combinations of sounds must have naturally signified something to man, and then of searching anxiously for similar phenomena among the animals also. This can never lead to any valuable result. The true point for the attention of naturalists is this: What signs are to be discovered in animals below man (like that quoted above of the dog) of the power to adapt means to ends in the way of expression, with more or less of free consciousness and intelligence? That their power is extremely limited is clear enough from the fact that no race or community of animals, so far as we know or have reason to suspect, possesses any conventional language kept up by teaching and learning. It is here just as in the case of instruments: the power to use a stick or a stone as tool or weapon cannot be absolutely denied to certain animals; and men began with nothing better; but, except in man, it is not a growing and developing power. With the animals it remains a natural gift; with man it becomes by degrees an institution, and leads to the possession of ships and steam-engines and cannon. To ascribe the lack of language in animals to the want of some specific mental power is an error, like the error of ascribing its possession by man to the addition of some specific mental power, some linguistic faculty or language-sense. The lack and the possession are both alike the results and indications of a whole cast and grade of mental capacity, of combinations of faculties which show themselves abundantly also in other ways. No animal below man has any accumulated results of the exercise of his natural powers, any institutions—any civilization, in short. To make language dependent on a power of forming general ideas or concepts is least of all to be approved; for it is past all reasonable question that the lower animals do form such, in their degree and within their limits; nothing like intelligence is possible otherwise. The power of the dog in this respect is not sensibly different from that of the wholly undeveloped and speechless man; but the acquisition of language, impossible to the dog, trains and equips the power in man, and makes it capable of vastly higher and more abundant work.

The prominence in existing language everywhere of the voice as means of expression has its ground, not in any especial nearness of the organs of utterance to the movements of the soul, but only in a kind of natural selection and survival of the fittest. The voice is, for obvious reasons, the most available instrumentality, in the infinite variety and rapidity of its apprehensible combinations, in the small expenditure of muscular effort which they cost, in their power to command attention from any direction, and in the dark as well as in the light, and in the liberty afforded the hands for other work at the same time. Experience brought all this to light, even as it has brought to light the various availabilities of wood and stone and metal. That we find every part of the human race, at the very beginning of our knowledge of it, in possession of a spoken language, a more or less complete system of vocal signs for ideas and their relations, means no more than that the whole race had lived long enough to have worked out its natural gifts to their necessary and intended results. It by no means proves that there was not a time when gesture, more than utterance, was the principal means of expression, or even that for a period, of duration impossible to determine, men may have had no expression different from or higher than that of the animals next beneath them in the scale of creation. The natural (as distinguished from the conventional) means of expression still continue most important auxiliaries to language; for anything but the driest scientific statement, tone and gesture and posture and facial expression are requisite; they are the subjective means whereby the personality of the speaker is impressed upon the hearer—whereby he moves, excites, persuades. And their power is greater and their aid more indispensable the lower the grade of the language and of those who use it. In the highest elaboration of speech, and with those trained to employ and interpret it with the keenest sensibility, even the written page shows the reader the very tone and action of the writer—seems to smile or scowl or weep or excite.

Out of the leading part assumed by the voice grows the importance of onomatopœia, or the vocal imitative principle, in the earliest history of language. The intent being to make an intelligible sign, and the voice the instrument, audible sounds are the matters most easily signified. This is just as natural and necessary as that in a written system of signs the outlines of visible objects are most easily, and therefore earliest, signified. A hieroglyphic mode of writing, intended for the eye to understand, begins with pictures of things that strike the eye, and proceeds from them, in various ways, to indicate matters of more varied and even of subjective knowledge. A system of audible signs begins in like manner with a rude, sketchy depiction, as it may be called, of audible sounds, and arrives, by figurative transfer and by various ties of association, at the intimation of other classes of acts and qualities. The sphere of imitation is by no means restricted to the actual sounds occurring in nature, though these may well enough have been the first subjects of reproduction. What its limits are may be best seen from the range of onomatopoetic expression in existing languages. There is a figurative imitation, whereby rapid, slow, abrupt, repeated movements are capable of being signified by combinations of sounds which make through the ear upon the mind somewhat the same impressions as the movements themselves through the eye. And while this was a principal suggester of the means of mutual intelligence, it may well enough have been found even more fertile than we now regard it as being. Our recognition of the value of the imitative principle is thus founded upon our general theory of language, in combination with the fact that the same principle continues efficient, in greater or less degree, through the whole history of language; it does not depend upon our ability to trace the main mass of material in any existing language to an onomatopoetic origin. For, the intent being simply to provide by the most available means for communication between man and man, onomatopœia would be gradually crowded out, after the provision of a certain quantity of intelligible signs, by the later and now almost exclusive method of the combination and variation of those signs; and, with that readiness to forget derivations and disguise etymologies which is a leading and most valuable feature in universal language-history, the signs of imitative origin would be hidden and disappear.

If by such methods as those here described there could be made a sufficient working provision of signs, to be developed by degrees into such languages as we now find in the world; if these methods are in harmony with the known history of language, the one stage passing into the other without a break or a change of governing principle; if, from what we know of man and of his linguistic capacities and activities, these are the methods by which a new language would be created if it were possible that a community of human beings should begin life again without any,—then this is such a solution of the problem of the origin of language as science demands.

It may be briefly pointed out, in conclusion, that there is no relation whatever between the development of language and any development of man himself out of a lower type of animal. Man was man in endowment when the production of his present speech began; its acquisition, like that of the other parts of his civilization, has only helped in the development of his powers, raising him higher and higher in the scale of manhood, and being, of all his acquisitions, the one most fundamentally important, most needful and helpful to everything else that he possesses.

The view of the history, nature, and origin of language here compendiously presented will be found worked out in much greater fulness in the writer's works, *Language and the Study of Language* (New York, 1867), *The Life and Growth of Language* (1875), and *Oriental and Linguistic Studies, I.* (1872). Other general works on the subject in English are M. Müller's *Lectures on the Science of Language;* H. Wedgwood's *Origin of Language* (London, 1866); F. W. Farrar's *Chapters on Language, Families of Language,* etc.; A. H. Sayce's *Principles of Comparative Philology* (London, 1874).

To trace the history of the study of language, from the often surprisingly acute but crude and narrow speculations of the ancients down to and through the remarkable collections, comparisons, analyses, deductions, of the great linguistic scholars (especially in Germany) of this century, constituting the vast and rich department of "comparative philology," is a task by itself, and will not here be attempted. The best authorities for it are L. Lersch, *Sprachphilosophie der Alten* (1840); H. Steinthal, *Geschichte der Sprachwissenschaft bei den Griechen und Römern* (1863); T. Benfey, *Geschichte der Sprachwissenschaft und der Orientalischen Philologie in Deutschland* (1869). J. Jolly has added a general sketch of the history to his German translation of the writer's *Language and the Study of Language* (Munich, 1874), and some interesting details are given in the first series of Müller's *Lectures.* W. D. WHITNEY.

Language of Flowers, a sentimental system of floral symbols by means of which it is intended that the more tender feelings and passions should be expressed. Among the Turks and Persians we are told that the language of flowers has received much attention, and is carried to great refinement and expressiveness; but in other countries it is chiefly used by young persons of both sexes. The literature of the subject is extensive, but not important.

Languedoc′, one of the old provinces of France, bounded S. by the Mediterranean and E. by the Rhone; it

bore while a Roman province the name of *Gallia Narbonensis;* passed from the Romans to the Goths, from the Goths to the Saracens, and from the Saracens to the counts of Toulouse; in 1361 it was finally annexed to the French crown. In the Middle Ages it received the name of Languedoc (*langue d'oc*), from the circumstance that its inhabitants expressed "yes" by *oc*, while in the northern part of France it was expressed by *oil*. It is now divided into the departments of Ardèche, Aude, East Pyrenées, Upper Garonne, Gers, Hérault, Lozère, Tarn, and Tarn-et-Garonne.

Languidic′, town of France, in the county of Morbihan, has 6382 inhabitants.

L'Anguille′, tp. of Phillips co., Ark. Pop. 800.

L'Anguille, post-v. and tp. of St. Francis co., Ark., on the Memphis and Little Rock R. R., and on the L'Anguille River. Pop. 306.

Lanier′, tp. of Preble co., O. Pop. 1634.

Lanjuinais′ (Jean Denis), b. at Rennes Mar. 12, 1753; studied law; practised for some time at the bar; was appointed professor of ecclesiastical law in his native city in 1775, and became conspicuous as a man of superior talent, when in 1789 he was elected a deputy to the States General. As a member of the Convention he sided with the Girondists, and opposed all extreme measures. On June 2, 1793, he was arrested, but escaped to Rennes, and resumed his seat in the Assembly in 1795, after the fall of the Terrorists. During the Directory he was a member of the Council of Five Hundred, and of the senate during the consular rule, in which latter position he led the opposition against the monarchical tendencies of the government of Napoleon, who nevertheless made him a count on the establishment of the Empire. He voted for the deposition of the emperor in 1814, was made a peer of France by Louis XVIII., and advocated liberal principles during the Restoration, in opposition to the reigning political and ecclesiastical reaction. He was a man of great literary attainments, and after his death (Jan. 13, 1827) his son published a collected edition of his writings (4 vols., Paris, 1832), containing valuable contributions to the sciences of politics, archæology, and language.

Lank′ester (Edwin), M. D., LL.D., F. R. S., b. at Melton, Suffolk, England, Apr. 23, 1814; studied medicine at University College, London, 1834–37; graduated at Heidelberg 1839; became lecturer at St. George's school of medicine 1843; secretary of the Ray Society 1844; professor of natural history at New College, London, 1850; president of the Microscopical Society 1859, and elected coroner for Central Middlesex (city of London) 1862. He acquired wide fame as a lecturer and writer upon sanitary and social science, physiology, botany, zoology, foods, microscopy, etc.; was author of many valuable reports and scientific papers, and of various books upon the above subjects, mostly designed for popular use, and since 1866 edited the *Journal of Social Science.* D. Oct. 30, 1874.

Lan′man (Charles), b. in Monroe, Mich., June 14, 1819, the son of Charles James Lanman; received an academical education in Plainfield, Conn.; was a clerk in New York from 1835 to 1845, when for a few months he edited the Monroe *Gazette;* was associate editor in 1846 of the Cincinnati *Chronicle,* with E. D. Mansfield; and after making a canoe-tour of the Mississippi and through Lake Superior, returned to New York, and was associated as a writer with the *Daily Express.* In 1848 he became a correspondent of the *National Intelligencer*, travelling extensively through the U. S.; settled at Georgetown, D. C., and held at Washington the positions of librarian of the war department, librarian of copyrights in the state department and private secretary of Daniel Webster, librarian of the interior department, and librarian of the House of Representatives. In 1857 he became the American correspondent of the *Illustrated London News,* and in 1869 of the *London Athenæum.* He has published *Essays for Summer Hours,* 3 eds.; *A Summer in the Wilderness; A Tour to the River Saguenay,* republished in England; *Letters from the Alleghany Mountains; Occasional Records of a Tourist; Private Life of Daniel Webster,* republished in England: *Adventures in the Wilds of America,* made from previous publications, in 2 vols., and republished in England, with introductory letters from Washington Irving; *Dictionary of Congress,* 6 eds., three of them published by the general government; *Life of William Woodbridge;* edited *Prison Life of Alfred Ely,* and two volumes of *Sermons* by Rev. Octavius Perinchief. Since 1871 he has been American secretary of the Japanese legation, and has published *The Red Book of Michigan* and *The Japanese in America,* the latter reprinted and very successful in England.

Lanman (Charles James), b. at Norwich, Conn., July 5, 1795; graduated at Yale in 1814; was admitted to the bar at New London, Conn., in 1817; removed to Frenchtown, now Monroe, Mich., and held various public offices, such as judge of probate and U. S. receiver of public moneys (1823–32). He was one of the most prominent and public-spirited of the early citizens of Michigan; returned in 1835 to Norwich, Conn.; lost much of his property in the financial crash of 1837; was mayor of Norwich in 1838; removed to New London, Conn., in 1862. D. July 22, 1870.

Lanman (James), b. at Norwich, Conn., June 14, 1769; graduated at Yale in 1788; was admitted to the bar in 1791; held numerous important State offices; was a U. S. Senator 1819–25; held judgeships in the State courts 1826–29; was mayor of Norwich 1831–34. He was the step-father of Park Benjamin. D. Aug. 7, 1841.

Lanman (Joseph), U. S. N., b. July 11, 1811, in Connecticut; entered the navy as a midshipman Jan. 1, 1825; became a passed midshipman in 1831, a lieutenant in 1835, a commander in 1855, a captain in 1861, a commodore in 1862, a rear-admiral in 1867. Commanded the Minnesota at the attack upon Fort Fisher, Jan. 15, 1865, and is thus commended by Rear-admiral David D. Porter in his official report of that action: "Commodore Joseph Lanman, commanding the Minnesota, was selected to lead the line, his vessel being the slowest and least manageable. I recommend him to the consideration of the department as one on whom they can place the utmost reliance, place him in any position." D. Mar. 13, 1874. Foxhall A. Parker.

Lanner. See Falcon.

Lannes (Jean), b. at Lectoure, in Guienne, Apr. 11, 1769, of poor parents, and apprenticed in his fifteenth year to a dyer; in 1792 left this occupation and enlisted in the army, where he soon rose to the rank of a colonel; was nevertheless discharged in 1795, at the reorganization of the army, but in 1796 followed Napoleon to Italy as a volunteer, and very soon attracted his attention by his boundless audacity; distinguished himself in every battle by some daring feat, and was made a brigadier-general in 1797; in 1798 accompanied Napoleon to Egypt, returned with him in 1799, and rendered him great services by his faithful adherence on Nov. 9, 1799, in reward for which he was made a general of division in 1800, and commander of the consular guard; led the vanguard when in the same year the army crossed the Alps at St. Bernard, and gained a brilliant victory over the Austrians at Montebello. On the establishment of the empire he was made a marshal. He led the memorable siege of Saragossa, and compelled the city to surrender Feb. 21, 1809, and at Ratisbon he was the first who put the scaling-ladder to the ramparts. When he grew older his judgment developed rapidly with his courage, and Napoleon considered him one of his best generals, when his career was cut off suddenly in the battle of Essling, being mortally wounded, and d. a few days after in Vienna, May 31, 1809.

Lannion′, town of France, in the department of Côtes-du-Nord. It manufactures several kinds of coarse woollen and linen goods, and has some general trade. Pop. 6598.

La Noue, de (François), b. in 1531, in the vicinity of Nantes, of an old noble family of Brittany; embraced the Reformed creed, and distinguished himself in the army of the prince of Condé as one of the most valiant Huguenot soldiers. At the siege of Fontenay-le Comte, in 1570, he lost his left arm, and had it replaced by one of iron, whence he received his surname, *Bras de Fer.* In 1572 he went to La Rochelle, trying to bring about a reconciliation between the city and the king. Having failed in this, and seeing that there was no other means of safety for his party than open war, he took the command of La Rochelle, and defended the city for four years with great success. After the conclusion of peace in 1578 he went to Flanders, entering the service of the Low Countries; was taken prisoner by the Spaniards, and retained at Madrid for five years, but at last exchanged in 1585 for Count Egmont. Under Henry IV. he again fought for the cause of his religion, and d. Aug. 4, 1591, from a wound he received at the siege of Lamballe. During his several imprisonments he engaged in literature, and his *Discours politiques et militaires* (Bâle, 1587) have been often republished. His correspondence was published in 1854.

Lans′dale, post-b. of Gwynedd tp., Montgomery co., Pa., about 25 miles N. of Philadelphia, on the North Pennsylvania R. R., at its central point and junction with the Doylestown and Stony Creek branches. It has a church, 3 hotels, 1 national bank, 2 weekly newspapers (1 German), agricultural machine-works, foundry, carriage manufactories, telegraph-office, planing-mills, a number of stores, etc.

F. Wagner, Prop. "Lansdale Reporter."

Lans′downe (Henry Petty-Fitzmaurice), third Marquess of, b. in London, England, July 2, 1780, second son of William Petty, first earl of Shelburne (which see),

who in 1784 was created marquess of Lansdowne; educated at Westminster School and at Edinburgh under the tutorship of Dugald Stewart; graduated at Trinity College, Cambridge, in 1801, and under the name of Lord Henry Petty was chosen as a Whig in 1802 to a seat in Parliament for the borough of Calne. He distinguished himself in debate, giving his chief attention to finance; was elected member for the University of Cambridge in 1806 on the death of Pitt, and in the same year became chancellor of the exchequer in the ministry of Grenville and Fox, retiring from office in 1807. On the death of his elder brother in 1809, he succeeded to the title, and became one of the heads of the Liberal party in the House of Lords, being an early advocate of Catholic emancipation, the abolition of slavery, parliamentary reform, and free trade. On the return of the Whigs to power in 1827, he became secretary of the home department under Canning, secretary of foreign affairs under Lord Goderich (1828), lord president of the council under Earl Grey from Nov., 1830, to Nov., 1834, under Lord Melbourne from Apr., 1835, to Sept., 1841, and under Lord John Russell from July, 1846, to Feb., 1852. For many years he had been the Liberal leader in the upper house, when he resigned that position in 1852, not intending to return to office, but in December of the same year, on the formation of the Aberdeen ministry, he consented to take a seat in the cabinet without a portfolio, and again in the first Palmerston ministry, Feb., 1855, to Feb., 1858. He was a man of cultivated taste, formed a splendid library and collection of art-treasures, was a generous patron of literature, and made Lansdowne House the centre of polite society in England. He was a trusted adviser and friend of the queen, but refused a dukedom and the premiership. After the death of the duke of Wellington he was the patriarch of the House of Lords, and perhaps the most universally honored statesman of the realm. D. at Bowood House, Calne, Jan. 31, 1863.—His son HENRY, fourth marquess, b. in 1816, d. in July, 1866; his grandson, HENRY CHARLES KEITH FITZMAURICE, fifth marquess, b. Jan. 14, 1845, was lord of the treasury (1868–72) and under-secretary of state for war (1872–74), in second Gladstone ministry.

Lansdowne (WILLIAM PETTY), MARQUESS OF. See SHELBURNE, EARL OF.

L'Anse, post-v. and tp. of Houghton co., Mich., on Keweenaw Bay, Lake Superior; is the N. W. terminus of the Marquette Houghton and Ontonagon R. R., and has a line of iron steamers running to the ports of the copper-region. Pop. 33.

Lan'sing, post-v. and tp. of Allamakee co., Ia., on the Mississippi River and the Chicago Dubuque and Minnesota R. R., 81 miles N. of Dubuque, has several churches and hotels, 1 national and 1 savings bank, 3 weekly newspapers (1 German), 2 steam saw-mills, a furniture factory and flouring-mill (both steam), an agricultural implement factory, a large school building, and numerous business-houses, has daily ferry connection with Wisconsin, and handles annually 750,000 bushels of grain. Pop. of v. 1755; of tp. 2519.

JAMES T. METCALF, ED. "MIRROR AND CHRONICLE."

Lansing, city and tp. of Ingham co., cap. of the State

New State Capitol, Lansing, Mich.

of Michigan, is situated on Grand River, about 100 miles from its mouth, at its confluence with the Cedar, and on the Chicago and Lake Huron, the Detroit Lansing and Lake Michigan, the Lake Shore and Michigan Southern, and the Michigan Central R. Rs. It has two other less important lines of railroad, and others are projected. Lansing was laid out by the State as a capital in 1847, and was projected on a liberal scale, with avenues seven and five rods in width; is situated on high land on both sides of the river, is 84 miles W. of Detroit and 60 S. W. of Saginaw. It has 2 national and 2 private banks, a gaslight and a fire insurance company, 16 churches, 3 hotels, an opera-house, 3 weekly newspapers, iron-works, superior common and high schools, a female and a commercial college, State Agricultural College, State Reform School, State Library of 20,000 volumes, several private literary and library associations, and a young men's lecture society. Grand River is spanned by 4 iron bridges and 1 wooden one. There is a noted mineral spring. The fine water-power has made Lansing an important manufacturing centre, and it has a large complement of mercantile houses and of professional men. The State capitol is on high ground, fifty feet above the river; an appropriation of $1,200,000 was made in 1874 for a new building. A city government was organized in 1859. Pop. of city, 5241; of tp. exclusive of city, 823.

W. S. GEORGE, ED. "STATE REPUBLICAN."

Lansing, post-v. and tp. of Mower co., Minn., on the Milwaukee and St. Paul R. R. (Iowa and Minnesota division). Pop. 773.

Lansing, tp. of Tompkins co., N. Y., on the E. shore of Cayuga Lake. Pop. 2874.

Lansing (JOHN), b. at Albany, N. Y., Jan. 30, 1754; studied law with Robt. Yates in Albany and James Duane in New York; served in the Revolutionary war as military secretary to Gen. Schuyler; was for seven years a member of the legislature, for four years mayor of Albany; member of the Old Congress 1784–88; member of the State convention for considering the U. S. Constitution, which he opposed, leaving the convention; commissioner in 1790 to settle the Vermont controversy; appointed judge of New York supreme court Sept. 28, 1790, chief-justice Feb. 15, 1798, and chancellor of the State from Oct. 21, 1801, to 1814. D. Dec. 12, 1829.

Lan'singburgh, post-v. and tp. of Rensselaer co., N. Y., 3 miles N. of Troy, on the Hudson River, nearly opposite the confluence of the Mohawk, has 6 churches, 6 hotels, 1 weekly newspaper, established in 1798, 1 savings bank, an academy, 3 public schools, 25 brush-factories, 2 oilcloth and 2 cracker factories, 5 malt-houses, a fire and a police department, and is connected with Troy by a street railroad. It is perhaps the chief point in the U. S. for the manufacture of brushes, oilcloth, and crackers. It has considerable river trade, and is connected with Waterford by a bridge across the Hudson. Named from the founder, Abraham J. Lansing, who settled here in 1771. Pop. of v. 6372; of tp. 6804. J. G. SCOTT, ED. "GAZETTE."

Lan'singville, a v. of Hamden tp., Delaware co., N. Y., on the S. side of Delaware River. Pop. 110.

Lansingville, post-v. of Lansing tp., Tompkins co., N. Y. Pop. 67.

Lanta'na, a genus of mostly tropical shrubs of the order Verbenaceæ. Many have stimulant and aromatic qualities. *L. pseudothea* is highly esteemed in Brazil as a substitute for tea. A number of the species are beautiful greenhouse shrubs, notably *L. camara* and *mixta* of tropical America. The U. S. have at least two species native to the Gulf States, *L. camara* and *involucrata*. Some have square stems. The flowers are mostly showy and of changing colors.

Lan'tern [Lat. *lanterna, laterna*], a portable or fixed artificial light, enclosed in a suitable case to protect it from the action of air-currents. Ancient Rome, Greece, and Carthage employed lanterns. The lantern also appears, but not frequently, on Egyptian monuments. Thin layers of horn, oiled or waxed paper, or linen, bladder, and other translucent substances were used. Aldhelm, bishop of Sherborne in England, mentions glass lanterns in 705 A. D. The Eastern nations, and especially the Chinese, excel in the making of ornamental lanterns.—On the evening of the 15th of January the Chinese celebrate the Feast of Lanterns. Sometimes the wealthy Chinese spend thousands of dollars on a single lantern, whose sides are often of silk, and which may have a diameter of twenty-five feet. It contains usually a great number of wax candles. The origin of the lantern-festival is variously stated.

Lan'tern-fly, a name given to several insects of the family Fulgoridæ, some of which are reputed to emit a brilliant light from the forehead. Of these, *Fulgora candelaria* of China and *F. lanternaria* of Guiana are the best known species, but it is doubtful whether they really emit any light. They are nearly three inches long, and are the largest of the Hemiptera. Some of the genera produce a fine white wax, utilized in the S. E. of Asia.

Lan'thanum [Gr. λανθάνειν, "to escape notice"], an elementary metal of rather rare occurrence, to which Mosander, its discoverer, in 1839 gave this name, because it had remained concealed, in combination with cerium, for thirty-six years. Mosander also found in 1842 in oxide of lanthanum another rare metal, *didymium*, which he named from the Greek δίδυμος, "twofold" or "twin," from its congeneric association with lanthanum and difficulty of distinction therefrom. Didymium gives rose-colored salts and solutions, while those of lanthanum, when pure, are white. These three rare and curious metals, cerium, lanthanum, and didymium, are usually found in combination in the minerals *cerite, allanite, muromontite, mosandrite*, etc.; but the one here under consideration, lanthanum, occurs by itself, as the beautiful mineral *lanthanite*, in at least three American localities—in the zinc ores of Saucon Valley, Lehigh co., Pa., at the Canton mine in Georgia, and at the Sandford ore-bed, Moriah, Essex co., N. Y. Lanthanite is *carbonate of lanthanous oxide*, or *lanthana*, $La_2CO_3,3H_2O$, containing 55 per cent. of lanthana. It is sometimes pink in color, from the presence of its roseate twin-sister, didymia. *Lanthana* is a white oxide, like lime or magnesia, very heavy, density about 6, which absorbs carbonic acid and water from the air, and slakes with water, like lime, to a hydrate.
HENRY WURTZ.

Lan'thopine [Gr. λανθάνειν, "to escape notice," and ὀπός, for "opium"], a base homologous with papaverine, contained in opium. (See Watts's *Dict., Supplement.*)

Lanu'vium, an ancient city of Latium, 20 miles S. S. E. of Rome, where now stands the hamlet Cività Lavigna. It was anciently a place of much importance, famous especially for its temple and sacred grove of Juno Sospita. It was one of the members of the Latin League, and the birthplace of the emperor Antoninus Pius. Few remains of the old town now exist.

Lan'za (GIOVANNI), b. in 1815 at Vignala, Piedmont; studied medicine at Turin, and practised in his native city; in 1848 was elected a member of Parliament, and espoused the policy of Cavour; in 1855 entered the cabinet of Cavour as minister of public education, and in 1858 exchanged this office with the ministry of finance; in 1859, after the Peace of Villafranca, resigned, together with the whole cabinet of Cavour, and then worked simply as a member of Parliament, of which he was elected president several times; in 1864 took charge of the ministry of the interior under La Marmora, but retired in 1865. Once more entering Parliament, and having been elected president in Sept., 1867, he opposed the financial policy of the ministry of Menabrea, and resigned his presidency when the ministry triumphed. His re-election in 1869 caused the dissolution of the ministry, and he now undertook to form a new cabinet himself. He occupied the ministry of the interior, and the other members belonged mostly to that section of the Right which had supported Menabrea's internal policy, but opposed his financial measures. Lanza endeavored to introduce the greatest possible parsimony to bring order into the internal affairs of the kingdom. Nevertheless, as the annexation of the papal states in 1870 took place while he held office, large expenses for the army and navy were necessary. The peculiar tendency of the Italian Parliament to grant the expenses, but to reject the taxes, overthrew the cabinet of Lanza in 1873. June 23 he gave in his resignation, as the Parliament would even not allow Sella's tax-bill to be discussed. AUGUST NIEMANN.

Lanzaro'te, the most N. E. of the Canary Islands, comprises an area of 325 square miles, with a population of 17,500. It rises to the height of 2000 feet, and contains several active volcanoes. It is very fertile, and produces the finest grapes and wines on the Canaries, but it is much exposed to drought. Teguise is the capital; Arrecife, the principal port.

Lan'zi (LUIGI), b. at Monte dell' Almo, Italy, June 14, 1732; entered the order of the Jesuits in 1749, and became, after its dissolution in 1773, assistant director of the gallery of Florence. He now devoted himself much to the study of art and archæology, especially Etruscan language and antiquities, and his two works on these subjects, *Saggio di lingua etrusca* (3 vols., 1789) and *Storia pittorica dell'Italia* (6 vols., 1792), attracted great attention—also in foreign countries; the latter was translated into English by Thomas Roscoe. D. Mar. 30, 1810.

Laoc'oön [Gr. Λαοκόων], a Trojan patriot and priest who opposed the introduction of Sinon's wooden horse into the city of Troy, and was, with his two sons, slain by two great serpents from the sea. His myth is variously given, but the account in Virgil's *Æneid* is the best known. The death of Laocoön and his sons is the subject of a noble group now existing in the Vatican. It is described by Pliny, and was rediscovered on the Esquiline Hill in 1506. It was executed by Agesander, Athenodorus (his son), and Polydorus, Rhodian artists who probably lived in the time of Titus. The Laocoön has been made the subject of Lessing's masterly criticism. (See his *Laocoon*, translated by Ellen Frothingham, 1875.)

Laodice'a [Gr. Λαοδίκαια], the name of six Greek cities built by the Seleucidæ, monarchs of the Syrian empire, who after the death of Alexander the Great were the chief representatives and inheritors of his Eastern conquests, five of them having been named in honor of Laodice, wife of Seleucus Nicator, and one in honor of the wife of Antiochus Theos. Of these, one in Media, one in Mesopotamia, and another on the Orontes in Phœnicia (called *Cabiosa* by Ptolemy and *ad Libanum* by Pliny), have not been identified in modern times. I. LAODICEA COMBUSTA [Gr. Κατακεκαυμένη, the "burned"], now *Ladik*, situated to the N. W. of Iconium on the highroad from Greece to the Euphrates, and variously assigned to Lycaonia, Pisidia, and Galatia, as the boundaries of those provinces were changed. Strabo derived the name from the volcanic nature of the surrounding country, but Hamilton (*Researches*, vol. ii.) asserts that there is not a particle of volcanic or igneous rock in the neighborhood, and proposes to derive the name from some conflagration. Leake (*Asia Minor*, p. 44) found at Ladik

more numerous fragments of ancient architecture and sculpture than at any other place visited by him in that country. Imperial coins of the reigns of Titus and Domitian show that it must have been a large city.—II. LAODICEA AD LYCUM, now *Eski-Hissar*, a city in the S. W. of Phrygia, sometimes reckoned to Caria and to Lydia, near Colossæ, 40 miles E. of Ephesus and 6 miles W. of Hierapolis, situated on the spur of a hill between the valleys of the Asopus and Caprus rivers, which here fall into the Lycus, was originally called *Diospolis* and afterwards *Thoas*, and having been rebuilt by Antiochus II. (Theos), 260 B. C., was named from his wife LAODICE, by whom he was poisoned B. C. 246. From the Syrian monarchs it passed to the kings of Pergamus, and was annexed to the Roman empire on the death of Attalus III., 133 B. C., when it became the capital of the vast province of Greater Phrygia, and rapidly took position as one of the most populous, splendid, and wealthy cities of Asia Minor, distinguished also in literature, noted as the seat of a great medical school, and was the official residence of Cicero during his proconsulate in Asia (49–50); and very interesting accounts are to be found in the great orator's correspondence. It became the residence of great numbers of Jews; was one of the earliest seats of Christianity in Asia Minor, the church having been founded by Paul, who wrote an epistle to the Laodiceans (now lost), mentioned in the Epistle to the Ephesians. According to the superscription to 1 Timothy, Paul wrote that epistle from Laodicea, called "the chiefest city of Phrygia Pacotiana," but there is no further notice of his visit. The terrible threat conveyed by the author of Revelation to the "angel of the church of the Laodiceans," one of the seven churches of Asia (iii. 14–22), will readily occur to mind, and has rendered the term *Laodicean* a synonym for *lukewarm*, "neither cold nor hot." The city was nearly destroyed by earthquakes in the reign of Tiberius, but quickly restored, and was the seat of two important general councils of the Christian Church: the first, whose date is variously placed from 363 to 372, enacted sixty canons, one of which defined the books (thence called *canonical*) of Scripture; the second in 476 condemned the Eutychians. It was again overthrown by an earthquake in 494, was captured by the crusaders in 1199, by the Turks in 1255, and finally destroyed by Tamerlane in 1402. Its splendid and widely scattered ruins, including a stadium, gymnasium, aqueduct, and three theatres, have been frequently described by modern travellers. (See good account in Smith's *Dict. Geog.* ii. 122.)—III. LAODICEA AD MARE, a city of Syria, founded by Seleucus Nicator, now LATAKIA (which see). PORTER C. BLISS.

Laon' [Lat. *Landunum*], town of France, the ancient *Lugdunum Clavatum*, the *Bibrax* of Cæsar, capital of the department of Aisne, is situated on the top of an isolated hill with steep declivities, and surrounded with a wall flanked with towers. Its Gothic cathedral, built 1114, crowning the top of the hill, adds much to the picturesqueness of its appearance. This ancient city was the scene of an ecclesiastical council in 948, was taken by the English in 1429, was memorable in the wars of Napoleon I. and in the Franco-German war of 1870, having capitulated to the Germans Sept. 9. It has a palace, often the residence of French monarchs, and a famous library. Pop. 10,268.

Lao'na, post-tp of Winnebago co., Ill. Pop. 742.

Laona, post-v. of Pomfret tp., Chautauqua co., N. Y., on Saw Creek, and on the Dunkirk Warren and Pittsburg R. R. It has 2 churches and several manufacturing establishments. Pop. 218.

La'os, country of Farther India or Indo-China, nearly in the centre of the vast peninsula S. of China, bounded N. by the Chinese province of Yun-nan, E. by Tonquin and Anam, S. by Siam, and W. by the Shan states. Area, entirely uncertain, as well as pop., which is estimated at 1,500,000. The Shan states on the N. W. were formerly a part of Laos, but are now separate. Laos is traversed by the great Me-kong or Cambodia River, and consists chiefly of the fertile valley of this river, which is very productive of sugar, rice, tobacco, gums, betel-nuts, and other fruits, which with teak, sandal-wood, and gold-dust form the chief exports. Formerly independent, the tribes of Laos have since the eighteenth century acknowledged a nominal dependence upon Siam. The people are related to the Burmese in blood, language, religion, and customs; they are ingenious artisans, and trade with Tonquin and Siam. Cap. Lanchang.

La'ou-Tsze, otherwise **Lao-Tseu, Lao-tsée,** or **Lao-kiun,** a Chinese moral philosopher whose teachings have many points in common with those of Sankhya Booddha, of whom he was contemporary. Lao-tse means in Chinese "ancient sage." His family name was Li-pé-yang, and he was born in the third year of the emperor Ting-ouang, of the dynasty of Tscheū, near Läï in the principality of Thsou. This would be, according to Reinold von Pläncknor, at the end of the seventh century, but another account places the year of his birth about 604. Little is known of Laou-tsze except that he was state librarian and keeper of the records at the imperial court of Tscheu, and that having resolved in advancing age to retire from China, probably to India, he remained for a short time on the border, Han-kow, where he was persuaded by the general Yūn-hi to at least leave some record of his doctrines in a book. He did so, the result being the *Lao-tse Táo-tĕ-king* ("The Road to Virtue"), a small collection of aphorisms which probably contain more deep philosophy set forth in a spirited and genial form than can be found in any other work of the same size. It has within a few years been translated into the principal European languages, and extensively commented on. Laou-tsze makes all things proceed from and live in an infinite First Cause, which he calls *Tau*, and which John Chalmers thinks best to leave untranslated, because neither "Way," "Reason," nor "The Word" gives it exactly. He placed moral perfection in the individual, in independent realizing of truth, and in self-discipline, being in all respects the opposite of Confucius, who exhorted blind obedience to old customs and the doctrines of the ancient sages. Confucius is said to have taken a long journey to visit Laou-tsze. They met and interchanged their views, until Laou-tsze, probably wearied by the narrow scope of the opinions of Confucius and his frequent quotations of the ancients, sharply exclaimed, "Why talk for ever on of men who are long dead, and whose very bones are dust? Only their words remain and are heard. When the wise man meets with opportunity, he rises with it; if he does not, he lets the weeds grow, goes his way, and follows his destiny. I have heard that a shrewd merchant conceals his opulence, and the sage of perfect virtue loves to seem simple. Put away your pride and your many desires, with the endless ambition which is manifest in your manner. It is all folly; and that is all I have to say." This was a cut direct, but it was natural. Confucius followed the ancients, and aimed at establishing society upon conventional rules, while Laou-tsze, a rationalist, yet a mystic, despised glory, the world, the flesh, and (as a writer in *Larousse* adds) the devil as known to Christianity. Confucius is said, on returning to his scholars, to have remarked, "Birds, I know, can fly, fish can swim, and beasts run. The running ones may be snared, the swimming hooked, and the flying snared. But I know not how the dragon rises on the wind and clouds to heaven. I have seen Laou-tsze, and he is like the dragon." Tradition states that Laou-tsze when last seen was mounted on a black ox, and rode away into the western wilderness of Thibet. Bronze figures representing him thus riding may be seen in every shop of Chinese and Japanese goods. From his disquisitions on Tau, the great cause and spring of life and morals, or that which with him takes the place of the Deity or the Absolute, Laou-tsze became the head of one of the great religions of China, known as the Tauist. He did not distinguish between spirit and matter, being, in fact, a pantheist, and, like Booddha, he seems to identify pure existence, devoid of passion and earthly emotions, with a state which is not to be separated from non-existence. His philosophy embraces much that resembles the *Identitätslehre*, a doctrine of identity, of Schelling, and still more the bold paradoxes of Hegel as to the logical sameness of "Being and Not-Being." Yet from this mysterious unknown Being of nature he deduces a vigorous and beautiful moral creed. The water that bubbled up in the spring of the valley came from he knew not where, and so it came from *nowhere*, from nothing. That spring flows on for ever—a symbol, he thought, of all existence, which continually flows from non-existence. And yet the eternal *Tau* is neither one of these nor the other, but the slumbering possibility of both. The following extracts give an idea of the style of Laou-tsze: "The reason (*Tau*) which can be reasoned is not the eternal Reason—the name which can be named is not the eternal Name." "When in the world beauty is recognized to be beautiful, straightway there is ugliness. When in the world goodness is recognized to be good, straightway there is evil. And thus in like manner existence and non-existence mutually originate each other; so also difficulty and ease, long and short, treble and bass, before and after." Laou-tsze often suggests Emerson, and the latter in his essay on *Compensation* has extended the idea of the former, that "an inevitable *dualism* bisects nature." "It is after wisdom has conferred renown that there are great shams. And it is not until a nation has got into a disordered state that there are patriots" (*i. e.* faithful ministers).

Laou-tsze lived in a great age. "He was contemporary with Booddha in India, with Jeremiah, Habakkuk, Daniel, and Ezekiel in Judæa, with Thales, Anaximander, Pythagoras, Heraclites, and Xenophanes in Greece, while at the

same time an immense reformation of the doctrines of Zoroaster took place in Persia." It seems impossible while studying his sentences, so full of sagacity and deep wisdom, to doubt that some of this Western influence had reached him.

The principal works on Laou-tsze, in the order of merit, are as follows: *Laò-tsè's Taò Tĕ Kīng, aus dem Chinesischen ins Deutsche übersetzt, eingeleitet und commentirt*, von Victor von Strauss (Leipsic, 1870); *Le Livre de la Voie et de la Vertu*, traduction de M. Stanislas Julien (Paris, 1842), to which may be added *The Speculations of the Old Philosopher Lau-tsze on Metaphysics, Polity, and Morality*, by John Chalmers, apparently in great part a translation from the version of Julien (London, 1868). *Le Tao-te-king, ou Le Livre révéré de la Raison suprême et de la Vertu*, par Laotseu, traduit par G. Pauthier (only the first part of this published); *Mémoires de l'ancienne Académie des Inscriptions* (vol. xxxviii.), by Deguignes; *Mémoires sur la Vie et la Doctrine de Lao-tseu*, by Abel Rémusat; the German version by Reinold von Pländckner (*Lao-tse Táo-tĕ-king*, Leipsic, 1870) is rather an extravagant paraphrase than a translation, it being difficult, or often impossible, to reconcile any of its phrases with those of the other versions. The remarks of the early Jesuits on Laou-tsze are as absurd as they are contradictory, Père Couplet (1667), in common with Montucci (1808), seeing in him almost a Christian Trinitarian, while Père du Halde (1736) abuses him as an atheist and destroyer of all morals, in which opinion he was followed and outdone by the Fathers Bouvet, Fouquet, Prémare, and Amiot. A good English translation of Laou-tsze's work is desirable. C. G. Leland.

La Pa'la, tp. of San Diego co., Cal. Pop. 120.

Lapat'cong, tp. of Warren co., N. J., on the Delaware River, opposite Easton, Pa. Pop. 1150.

La Paz, seaport of Mexico, cap. of the territory of Lower California, on La Paz Bay, W. coast of the Gulf of California, is the seat of a declining pearl-fishery; exports to San Francisco tropical fruits and hides. Pop. about 1000.

La Paz de Ayacucho, city of Bolivia, the capital of the department of La Paz, and one of the capitals of the republic, in lat. 16° 30′ N. and lon. 68° 10′ W., at an elevation of 12,226 feet, on both sides of the river Chuqueapo. Well built, with an agreeable climate, and beautifully situated, its promenade or *alameda* presents a splendid view of the Illimani, and is said to be the finest in Bolivia. It was founded in 1548; is the chief commercial city of Bolivia, transacting a large foreign trade with the Peruvian ports of Arica and Islay, with the latter of which it has been brought into close connection by the completion of the Arequipa Railway to Puno on Lake Titicaca. It has a beautiful cathedral, 14 other churches, a university, schools of law, medicine, theology, and science, and has frequently been the seat of the national government. Pop. 83,000.

Lapeer', county in the E. of the southern peninsula of Michigan. Area, 630 square miles. It is undulating and fertile. Cattle, grain, and wool are staple products. Lumber and flour are leading articles of manufacture. It is traversed by the Detroit and Bay City and the Port Huron and Lake Michigan R. Rs. Cap., Lapeer. Pop. 21,345.

Lapeer, city and tp., cap. of Lapeer co., Mich., 60 miles N. of Detroit, at the junction of the Detroit and Bay City with Chicago and Lake Huron R. Rs. A branch of the former railroad, 6 miles long, connects with Fish Lake. Lapeer has 1 national bank, 2 weekly newspapers, 9 churches, 7 hotels, several large mills and shops, and many stores. It is in a fine farming region, and is the headquarters of a large business in pine lumber and shingles. Pop. of city, 1772; of tp. exclusive of city, 1092.
S. J. Tomlinson, Ed. "Clarion."

Lapeer, post-tp. of Cortland co., N. Y. It contains the beautiful cataract called Hunt's Falls, on Fall Creek, 71 feet high. Pop. 735.

La Pérouse, de (Jean François de Galaup), Count, b. at Guo near Albi, France, Aug. 22, 1741; entered the navy in 1756; served in the American war of independence, and was placed at the head of an exploring expedition which Louis XVI. fitted out, and which left Brest Aug. 1, 1785. Doubling Cape Horn, La Pérouse followed the American coast to Monterey, California, crossed then the Pacific, and followed the Asiatic coast from Manila to Petropaulovsk. From this place he sent his journals and charts to Paris, and in Sept., 1787, he started southward. A letter was received from him dated Botany Bay, Feb. 7, 1788, and from this place it was his intention to go to the Isle de France by way of Van Dieman's Land, but nothing more was ever heard of him. It is probable, however, according to researches made in 1791 by Admiral d'Entrecasteaux and Dumont d'Urville in 1828, that he was shipwrecked in 1788 at Vanikoro, in the New Hebrides group of islands.

Lap'ham (Increase Allen), LL.D., b. at Palmyra, N. Y., Mar. 7, 1811. Was a civil engineer; was employed on the Miami, Welland, and Louisville canals. Was secretary of the Ohio canal commission 1833–35, and early won a wide fame as a botanist and geologist. In 1836 he removed to Milwaukee, Wis., where he has held many public offices. In 1862 he became president of the Wisconsin Historical Society. He published valuable papers and works on the geography, geology, mineralogy, and history of Wisconsin, was a careful observer of the meteorology of the region, and prepared a memorial to Congress showing the necessity of storm-predictions for the benefit of commerce, and how they could be secured, the suggestions of which were subsequently carried out. All branches of physical science engaged his attention, and he did more than any other man in the State to develop and stimulate scientific investigation for practical ends. In 1873 he was appointed to take charge of a geological survey of the State. He organized the survey, and conducted it with great efficiency for two years, until, in consequence of a political revolution, he was superseded. He had prepared two able reports which are yet unpublished. He d. suddenly at Oconomowoc Sept. 14, 1875.

Lap'idary [Lat. *lapidarius*, a "stonecutter," from *lapis*, a "stone," but limited to one who works in precious stones]. By some writers a distinction is observed between the engraver of *gems* and cameos and the lapidary, the latter being supposed to merely prepare precious stones for jewelry by cutting and polishing them. Of late years, since a great demand has sprung up for imitations of ancient Scotch jewelry and for German beads, all of agate, carnelian, and other third-class stones, the lapidary has been chiefly devoted to this class of work. The first step in polishing a stone is to slit it. This is effected by means of a circle or disk of thin sheet iron placed horizontally, and made to revolve by very simple machinery. Diamond-dust is applied to the edge of the iron plate, and sperm oil drops upon it from a can. A raised edge around the table is provided to prevent the loss of the dust. A small quantity on the disk will, if properly managed, last all day without appreciable loss. When cut, the stone is ground on horizontal wheels made of lead, brass, iron, or alloys, and sometimes of wood of different degrees of hardness. The wheels of metal are called *laps*. On these is spread emery, diamond, or corundum powder, and sometimes the powder of agates and other gems. For the last polish, wheels are used covered with cloth, leather, or hard brushes. The powders of diamond, etc. gradually imbed themselves so firmly in the lead or other soft metal of which the wheels are made that the stone yields to them. It is held either with the fingers or by wax in a hollow at the end of a stick, and pressed against the wheel. The *facets*, or flat surfaces which give brilliancy to transparent stones, are cut by a very simple contrivance. By the side of the horizontal grinding-wheel is placed an upright heavy, club-like piece of wood, resembling a long-necked, very narrow bottle reversed. Into this, in different places, a rod is stuck, at one end of which the gem is affixed with cement. The gem presses on the wheel as it revolves, and the surface is cut away. To make a new facet the rod holding the gem is simply stuck into another hole, which gives a new inclination or a new angle. The diamond-powder used is made from *bort*, or cheap coarse diamonds, and sells at from £1 to £2 per carat. The workmen acquire wonderful facility in shaping and polishing stones, and from a given pattern will produce any object required with great rapidity. Certain gems, such as the cairngorm, are very elegantly cut in Scotland, but the great mass of beads, bracelets, and inferior "Scotch" jewelry comes from Oberstein in Germany. (See Gems.) (For further information consult the works of Dr. A. Billing, Dr. Feuchtwanger, King, and Holtzapfel.) Charles G. Leland.

Lapidary. In writing, this word is applied to a style peculiar to inscriptions, and which derives its name from *lapis*, a "stone," from being commonly applied to monuments. As it was developed at a time when Latin was principally used for such purposes, its rules are in reference to that language. It has, says Larousse, its special rules, its consecrated abbreviations, its ready-made formulas, and its conventional archaisms. It affects to be ancient and unchangeable by perpetuating words no longer in common use, and exerts itself chiefly to be concise, without neglecting great words or pompous forms. It is very difficult to write well, and in ancient forms is much more difficult to read, owing to the abbreviations, by which words are often represented by single letters. The commonest abbreviations in Latin inscriptions are the following:

A. B., *Artium Baccalaureus*, Bachelor of Arts.
A. M., *Artium Magister*, Master of Arts.
A. U. C., *Anno Urbis Conditæ*, or *Ab Urbe Condita*, "Year of the building of the city" (Rome), or "from the building of the city."
COSS., *Consules*, consuls.

CS., *Consul.*
C. VIR., *Centum vir*, a magistrate.
CC. VV., *Clarissimi Viri*, very illustrious men.
D. M., *Diis Manibus*, "To the Manes."
D. M. S., *Diis Manibus Sacrum*, "Altar of the Manes."
D. S. P., *De sua pecunia*, "At his own expense."
F., *Filius*, son.
FS., *Fratres*, brothers.
G. D. N., *Genio Domini nostri*, "To the Genius (or tutelary spirit) of our Master."
H. F. C., *Heres faciundum curavit*, "Executed by the heir."
H. M. H. N. S., *Hoc monumentum heredem non sequitur*, "This monument does not follow our inheritance."
I. O. M., *Jovi Optimo Maximo*, "To Jove, the best and greatest."
K., *Kalendis*, "At (or in) the Kalends."
L., *Libertus*, a freedman.
N., *Nepos*, nephew.
O. T. B. Q., *Ossa tua bene quiescant*, "May your bones rest well!"
P. M., *Pontifex Maximus*, the great pontiff.
S. C., *Senatus consulto*, "By a decree of the Senate."
S. P. Q. R., *Senatus populusque Romanus*, "The Senate and the Roman people."
S. T. T. L., *Sit tibi terra levis*, "May the earth be light to (on) thee!"
V. F., *Vivus fecit*, "He did it while alive."
V. P., *Vivus posuit*, "He erected it while yet alive."
V. S. L., *Votum solvit libens*, "He did it to accomplish a vow."

Among the peculiarities of lapidary style is that by which a date was expressed by making the numeral letters prominent in an inscription. Of this kind is the following, which was formerly on the face of an old clock before a tavern in Paris:

"AV teMps dV roI CharLes Le hVIt
Cest VI hosteL fVt constrVIt."

By adding these capitals the date 1465 is obtained. (See CHRONOGRAM.) CHARLES G. LELAND.

La'pis Laz'uli [Lat. *lapis*, "stone," and Arab. *azul*, "heaven"], a natural silicate of lime and alumina, with a small amount of sulphurets, crystallizing in the monometric system, and of a beautiful Berlin-blue color. It is highly valued for the manufacture of ornamental articles, and was formerly the sole source of the rich paint ultramarine, which is now chiefly manufactured artificially.

Lap'ithæ [Λαπίθαι], in the Greek mythology, a race of Thessalians, the descendants of Lapithes, a son of Apollo, whose king was Pirithous, son of Ixion. They overcame the Centaurs in a bloody war, but were in turn humbled by Hercules, as related in Hesiod and Ovid. They were probably an early warlike race of the Pelasgian stock.

Laplace' (CYRILLE PIERRE THÉODORE), b. Nov. 7, 1793; entered the French navy early; was made captain in 1834, rear-admiral in 1841, vice-admiral in 1853, and retired in 1858. He commanded in two expeditions of circumnavigation, which he described in *Voyage autour du Monde* (5 vols., Paris, 1833–39) and *Campagne de Circumnavigation* (4 vols., 1845–48).

Laplace, de (PIERRE SIMON), MARQUIS, b. at Beaumont-en-Auge, in Normandy, Mar. 23, 1749, of poor parents; he was indebted to the interest of wealthy friends for admission to the College of Caen and the military school of Beaumont. Brought to the notice of D'Alembert, who procured him the mathematical mastership of the military school at Paris, that city became his residence at the age of eighteen. Two papers on the Theory of Probabilities printed at the Academy during the ensuing five or six years are mentioned by the Academy as chosen for publication among many, with the eulogy, "This society has never known so young a person to furnish in so short a time so many important memoirs on subjects so diverse and so difficult." He was elected an associate, and in 1785 a member. His political career during the Revolution and under Napoleon has been much commented upon, but neither space nor adequate data allow its discussion here.

Laplace is styled by Prof. Forbes (6th Dissertation, *Encyc. Brit.*) "a sort of exemplar or type of the highest class of mathematical natural philosophers of this, or rather the immediately preceding, age;" by Mr. Airy, "the greatest mathematician of the past age;" and by Prof. Nichol, "the titanic geometer." It may be added that the present age has produced no recognized rival; that to Newton alone, as a "mathematical philosopher," is, in any age, superiority conceded. His more important investigations are—his improvements of the lunar theory; his discovery of the cause of the great inequality of Jupiter and Saturn's motions; his theory of the tides; his work on probabilities. Newton's newly discovered law of gravitation had been so successfully applied to the lunar motions as with one important exception to reconcile them to the requirements of the theory; the unexplained exception was "that the *mean motion* of the moon has been accelerated from century to century by a minute quantity, which, in the lapse of thousands of years, has become recognizable." The earliest authentic observations of eclipse, made at Babylon in the years 719, 720, 721, show that they occurred 1¾ hours *sooner* than if the present mean motion of the moon then obtained. The interval has been *longer* than it should have been found to be, and hence the motion *less* rapid in former centuries. As regards the moon's orbit, "the effect has been that at each lunation she approaches nearer to the earth than during the last by *one-fourteenth* of an inch! thus describing a spiral of almost infinitely slow convergence."

To understand the solution of this apparent anomaly as finally given by Laplace, it must be remembered that under the action of central forces the angular velocity of a satellite about its primary will be increased by an increase of the central force; that the effect of the sun's attraction on the moon and earth is, on the whole, to diminish the central force between these bodies by a minute quantity proportional to the inverse cube of the sun's distance.* The disturbing effect, therefore, of the sun's attraction is to make the moon's motions less rapid than they otherwise would be; and whatever diminishes *this* disturbing effect accelerates the moon's motion. Now, though the earth's *mean* distance from the sun has not varied, the eccentricity of its orbit has been diminishing from the earliest historic times, and with it the *average* inverse cube of the distance. Hence, the secular *acceleration* of the moon above described; which, however, as also its approximation to the earth, must cease with the attainment of minimum eccentricity by the earth's orbit, when the reverse effects will ensue. The *amount* of acceleration is now about 10″ of longitude in a century.

A comparison of ancient observations with modern revealed an acceleration of the mean motion of Jupiter and a retardation of that of Saturn, whereas modern observations alone show a contrary effect to be in progress. The revealing after many years of study of the source of the resulting discrepancy between astronomical tables and observation is regarded as one of the proudest achievements of its author, though Mr. Airy regards his theory of the tides as furnishing a "greater claim for reputation."

Analytical expressions for celestial phenomena can, in general, be but approximations, in which terms considered insignificant, as involving the square, cube, or higher powers of minute quantities, are discarded. Laplace demonstrated that among those which had been thus neglected in the expansions of the mutual perturbations of Jupiter and Saturn were some multiplied by sines or cosines of angles rendered small by small multipliers. Mathematicians are familiar with the fact that, subjected to integration, such terms, by making the small multiplier a *divisor*, produce quantities of appreciable magnitude. The effect of this discovery and the restoration of such terms was a complete reconciling of ancient and modern observations. Thus were removed from the theory of gravity the two most formidable obstacles to its acknowledged adequacy to explain celestial phenomena—the anomaly of the lunar acceleration and the great inequalities of Jupiter and Saturn.

Tidal theories, previous to Laplace's investigations, presumed the earth to be at rest, and the waters of the ocean to be in motionless equilibrium between the forces of gravity and the solar and lunar attractions. Laplace had the boldness to attempt the solution of a problem in which account is taken of the *motions* (relatively to the earth) which the fluid particles must receive in order to produce the tides; in other words, of the forces required to produce them. Although this theory, in the writer's opinion, no more really grasps the actual tidal phenomena of the existing seas of the earth than the equilibrium theory, it *would* solve the problem did the ocean cover the whole of the earth's surface with uniform or nearly uniform depth, or did it so occupy a canal continuous between parallels of latitude around the globe; and it furnishes highly interesting and even important results.

In another paper (*Amer. Jour. of Science*, 1859) the writer remarked: "If the *actual configuration* of the ocean's

*The sun's *attraction* varies as the inverse *square* of the distance; but (if the moon be new or full) it is by the *difference* only of its attractions on the earth and moon, by which one is *drawn away* from the other, and so much of the mutual attraction of earth and moon neutralized. Now, if S be the sun's mass, and D be its distance from the earth, and d that of the moon, this difference at time of new moon will be $\frac{S}{(D-d)^2} - \frac{S}{D^2}$. Since d is but $\frac{1}{380}$th of D, this difference will reduce (nearly) to $\frac{2Sd}{D^3}$; and the same for full moon. But on the contrary, when the moon (in first or last quarter) and earth are equidistant from the sun, it *draws them together*, owing to the slightly convergent directions of its attraction, though by *half* only of the above expressed force. The result, on the whole, is a decrement of the gravitating force between the earth and moon, which may be roughly assumed as a mean between the above effects, and computed as about $\frac{1}{360}$, and by which the period of a lunation would be lengthened $\frac{1}{480}$, or about $1\frac{1}{2}$ hours. It is not, however, the *total* amount of the sun's effect, but its excessively minute (now) *waning* fluctuation (owing to the minute increase in the *average* value of D^3, through the progressive diminution of eccentricity), that causes the moon's "acceleration."

bed is the very basis of a dynamic theory of the tides, then a theory which is obliged to reject entirely this actual configuration, and instead of ocean-beds of *limited* areas, isolated from each other by dry land in those parallels where the tidal effects are the greatest, substitutes an imaginary ocean covering the *whole globe*, and of the *same* depth following each parallel of latitude, the problem can be only a mathematical one of more or less interest, from which nothing of any practical value, as to the *actual* phenomena of the tides, can be expected;" and Mr. Airy, who speaks of Laplace's investigation as "one of the most splendid works of the greatest mathematician of the age," in almost the same breath says, "As it is, Laplace's theory fails totally in application, from the impossibility of introducing in it the consideration of the boundaries of the sea;" and Prof. Forbes (6th Dissertation) fully sustains the writer when he says, "It is, in fact, like many other productions of the same age and school, a great display of ingenuity and mathematical skill, which hardly yields a single result worthy of confidence or agreeing with nature, except by the abandonment of its deductive rigor, or a concealed induction backward from the phenomena to be accounted for."

The doctrine of Probabilities—the subjecting to the rigor of mathematical methods subjects which *know no law* (*i. e.* of chance)—furnishes the most subtle and at the same time the most fascinating of problems, occupying as it were a borderland to Metaphysics, Logic, and Mathematics. The *Théorie analytique sur les Probabilités* of Laplace is regarded as quite the ablest specimen of mathematical writing of his age; but one which cannot here be discussed. (See PROBABILITIES.)

In this brief notice it would be in vain to discuss Laplace's distinctive claims to greatness as a mathematician and a philosopher. His mastery of mathematical analysis was perhaps unsurpassed, and he has contributed greatly to the development of this powerful agent of human reason, especially in its application to physical problems. He is the inventor of the most powerful calculus (since generalized and enlarged as the *Spherical Harmonic Analysis*) known generally as that of LAPLACE'S COEFFICIENTS. (See that head.) It is due, however, to *Legendre* to say that he (according to Dr. Forbes) "was the first to imagine and employ those artifices of calculation known as 'Laplace Functions.'" His longest and most systematic work, the *Mécanique Céleste*, is a compendium of the problems of physical astronomy which had been accumulating for a century, but which are treated by methods mainly original with himself. This work, though written with entire disregard to preserving the order and connection which would enable the reader to follow him, is justly considered his most imperishable monument. Dr. Bowditch, whose voluminous explanatory notes appended to his translation are almost an indispensable aid, was accustomed to remark, "Whenever I meet the words of *il est facile de voir* (*i. e. it is easy to see*), I am sure that hours and perhaps days of hard study will be necessary for me to discover *how* it plainly appears." It is certainly a disparagement to the work that it should be so, for I think mathematicians will admit that a little more regard to order and connection, and a slight condescension to furnish explanation or clue, would make the work more useful, certainly more easily read.

For a short time Laplace was one of Napoleon's ministers. The cause of disagreement is unknown, but his was not the character of mind best fitted for politics or diplomacy, and he was evidently out of his element. No more infelicitous or unjust characterization than that applied by Napoleon, "the infinitesimal philosopher," could have been made. No modern mathematician has exhibited greater powers of generalization; and in his *Nebular Hypothesis* we have one of the grandest conceptions of the origin of the actual *Cosmos*, as the result of continuous action of physical "laws," and one which has anticipated modern thought in relation to *development*. Laplace has been censured for "meanly" suppressing in the second edition, published after the emperor's fall, the dedication, "*A Napoléon le Grand*," which had been given to the first edition. Mr. Todhunter (*Hist. of the Theory of Probability*) thinks that "the fault was in the original publication, and not in the final suppression;" and that it would have been "almost a satire to have repeated it when the tyrant of Europe had become the mock sovereign of Elba or the exile of St. Helena." He has, too, on very inadequate grounds been charged with atheism. His last words (he died in Paris Mar. 5, 1827, exactly a century after Newton), so similar in sentiment to language attributed to his great predecessor, prove that, like that great philosopher, insight into the mysteries of nature deeper than other men's nourished in him not arrogance, but humility: "*Ce que nous connaissons est peu de chose; ce que nous ignorons est immense.*"

J. G. BARNARD.

Laplace's Coefficients. The properties of these important analytical expressions were discovered by Laplace while investigating the attractions of bodies nearly spherical in figure. The total attraction of any body upon a material point is the resultant of the attraction of all its elementary particles; or, to state in different form, the total effort of the attraction in any given direction is the integral of the components in that direction of the attractions of all the elementary particles. If x, y, z be the rectangular co-ordinates of any elementary portion dm ($=\rho dxdydz$, ρ being the density) of the attracting body, and x', y', z' the co-ordinates of the attracted point, the attraction exerted by dm (varying inversely as the square of the distance) will be

$$\frac{\rho dm}{(x'-x)^2+(y'-y)^2+(z'-z)^2};$$

and the component of this parallel to the axis of x will be

$$\frac{\rho(x'-x)dxdydz}{[(x'-x)^2+(y'-y)^2+(z'-z)^2]^{\frac{3}{2}}}; \qquad (1)$$

and the component of the attraction exerted by the entire body upon the attracted particle will be the triple integral of this last expression. Now, if we put

$$V=\iiint\frac{\rho dxdydz}{[(x'-x)^2+(y'-y)^2+(z'-z)^2]^{\frac{1}{2}}} \qquad (2)$$

(that is, V is the sum of the quotients of the elementary masses, each divided by its distance from the attracted particle), it will be found that (1) is simply the partial differential (with sign changed) of V taken with regard to the variable x'. Hence also $-\frac{dV}{dy'}$ and $-\frac{dV}{dz'}$ give the components of attraction parallel to the axes of y and z; or, more generally, $-\frac{dV}{ds}$ is the component of attraction parallel to any line of which ds is an element of length.

The function V, first introduced by Laplace for gravitation, is of great importance in physics, and the name of *potential* has been given to it by the English mathematician the late George Green, who (taking his clue from the use of it made by Laplace) may be said to have created the theory as we now have it. In reference to gravitation, not only does the amount of attractive force depend upon it $\left(\text{being, in any direction, } -\frac{dV}{ds}\right)$, but the *work* which that attraction is *potent* to do along any path is evidently the integral $\int -\frac{dV}{ds}\,ds$, or, $-V$; hence the name of *potential*.

A property of V, easily verified, is that the sum of the second partial differentials with respect to each of the co-ordinates of the attracted point is zero, provided it be not a part of the attracting mass. In the latter case (demonstration cannot be here given) the sum is $-4\pi\rho'$. Hence, the property in question is expressed by

$$\frac{d^2V}{dx'^2}+\frac{d^2V}{dy'^2}+\frac{d^2V}{dz'^2}=0\,[\text{or } -4\pi\rho'], \qquad (3)$$

ρ' being the density at the attracted point of the mass. Hence, if we know the potential V with reference to any point included in its *own* mass of which the co-ordinates are x', y', z', the variable density will be expressed by

$$-\frac{1}{4\pi}\left(\frac{d^2V}{dx'^2}+\frac{d^2V}{dy'^2}+\frac{d^2V}{dz'^2}\right).$$

The determination of V leads at once to the determination of the attraction upon any point. V is the integral of $\rho dxdydz$ multiplied by

$$[(x'-x)^2+(y'-y)^2+(z'-z)^2]^{-\frac{1}{2}}, \qquad (4)$$

the reciprocal of the distance between the element dm and the attracted particle. If we transform x', y', z' into polar co-ordinates r', θ', ω', and x, y, z into r, θ, ω, we have the usual expressions (the angle θ being measured from the axis of z),

$$x'=r'\sin\theta'\cos\omega': \quad y'=r'\sin\theta'\sin\omega': \quad z'=r'\cos\theta',$$

and corresponding ones for x, y, z.

If, with Laplace, we represent $\cos\theta$ and $\cos\theta'$ by μ and μ', the above reciprocal will be converted into

$$\left[r^2+r'^2-2rr'\left\{\mu\mu'+\sqrt{1-\mu^2}\sqrt{1-\mu'^2}\cos(\omega-\omega')\right\}\right]^{-\frac{1}{2}};$$

which may be expanded into converging series (according as $r'>$ or $<r$),

$$\begin{aligned}&P_0\frac{1}{r'}+P_1\frac{r}{r'^2}+\ldots\ldots P_i\frac{r^i}{r'^{i+1}}+\ldots,\\ \text{or}\quad &P_0\frac{1}{r}+P_1\frac{r'}{r^2}\quad\ldots\ldots P_i\frac{r'^i}{r^{i+1}}+\ldots,\end{aligned} \qquad (5)$$

in which $P_0\ P_1\ \ldots$ and P_i are rational and entire func-

tions of μ, $\sqrt{1-\mu^2}\cos\omega$, $\sqrt{1-\mu^2}\sin\omega$; any coefficient P_i is of i dimensions in these quantities (and the same is true with regard to the variables μ' and ω'), and its numerical value has plus or minus unity for maximum and minimum.

If we style the expression (4) Q, it will be found to satisfy the condition (3) (with zero for second member).

In polar co-ordinates this condition becomes

$$(6) \qquad r\frac{d^2rQ}{dr^2}+\frac{d}{d\mu}\left\{(1-\mu^2)\frac{dQ}{d\mu}\right\}+\frac{1}{1-\mu^2}\,\frac{d^2Q}{d\omega^2}=0,$$

and if we substitute for Q the developments (5), it will be found that P_i satisfies the condition

$$(7)\ \frac{d}{d\mu}\left\{(1-\mu^2)\frac{dP_i}{d\mu}\right\}+\frac{1}{1-\mu^2}\,\frac{d^2P_i}{d\omega^2}+i\,(i+1)\,P_i=0.*$$

The functions P_i possess remarkable properties discovered by Laplace. Hence their name, *Laplace's Coefficients.* As resulting from the developments (5), they are determinate, and hence involve only numerical quantities with μ and ω, μ' and ω'. Other expressions derived from the integration of (7), and containing, of course, but one set of variables with arbitrary constants, share in the same properties, and are designated as *Laplace's Functions* to distinguish them from the Coefficients. These properties (proofs of which cannot be here given) are the following:

1. If Q_i and S_i be two Laplace's Coefficients or Functions, then $\int_{-1}^{+1}\int_0^{2\pi} Q_i\,S_i\,d\mu d\omega=0$, when i and i' are different integers, the sum of which be *not* minus unity.

2. A function $F\ (\mu,\omega)$ of μ, $\sqrt{1-\mu^2}\cos\omega$, and $\sqrt{1-\mu^2}\sin\omega$, which does not become infinite between the limits -1 and $+1$ of μ, and 0 and 2π, of ω, can be expanded in a series of *Laplace's Functions* (which is equivalent to saying that any function of x, y, z can be thus expanded); that is,

$$F(\mu,\omega)=F_0+F_1+F_2\ .\ .\ .\ +F_i+\ .\ .\ .\ , \qquad (8)$$

in which F_i is a Laplace Function of the order i, and is equal to

$$\frac{2i+1}{4\pi}\int_{-1}^{1}\int_0^{2\pi}F(\mu',\omega')P_i d\mu' d\omega'. \qquad (9)$$

That is, P_i (which contains symmetrically μ and μ', and also ω, ω'), by being multiplied by *any* function, $F(\mu',\omega')$, of μ', $\sqrt{1-\mu'}\cos\omega'$, $\sqrt{1-\mu'}\sin\omega$, and integrated as above, is converted into the Laplace Function of i order, of the development of $F\ (\mu,\omega)$.

The general expression for these coefficients, P_i, is exceedingly complicated. We give here, as examples, expressions for P_1 and P_2 only.

$$P_1=\mu\mu'+\sqrt{1-\mu^2}\sqrt{1-\mu'^2}\cos(\omega-\omega').$$

$$P_2=\tfrac{9}{4}\left\{(\mu^2-\tfrac{1}{3})(\mu'^2-\tfrac{1}{3})+\tfrac{4}{3}(1-\mu^2)^{\frac{1}{2}}\mu(1-\mu'^2)^{\frac{1}{2}}\mu'\cos(\omega-\omega')\right.$$
$$\left.+\tfrac{1}{3}(1-\mu^2)(1-\mu'^2)\cos 2(\omega-\omega').\right.$$

The Laplace *Functions*, F_i (the sum of which from $i=0$ to $i=$ to the order of the given function, F, constitutes the development of the latter), may be obtained from F by the indicated process (9), involving the use of the "Laplace Coefficients" P_i;† but when the function F is rational and integral, the development is more readily made the method indicated by Laplace, having recourse to the *general* forms of Laplace Functions (or *Spherical harmonics*), *i. e.* to the general solutions of differential equation (7).

I shall not attempt to indicate the processes by which these general forms are determined, but give those of 0, 1, 2, 3d orders with the general expression for a harmonic of *any* order i, calling S_i the general solution of (7) with regard to variables μ and ω:

$$S^0=B^0_0$$

$$S^{(1)}=B^{(0)}_1\mu+(1-\mu^2)^{\frac{1}{2}}\left\{A^{(1)}_1,\ \sin\omega+B^{(1)}_1\cos\omega\right\}$$

$$S^{(2)}=B^{(0)}_2\left\{\mu^2-\tfrac{1}{3}\right\}+(1-\mu^2)^{\frac{1}{2}}\mu\left\{A^{(1)}_2\sin\omega+B^{(1)}_2\cos\omega\right\}$$
$$+(1-\mu^2)\left\{A^{(2)}_2\sin 2\omega+B^{(2)}_2\cos 2\omega\right\}$$

$$S^{(3)}=B^{(0)}_3\left\{\mu 3-\tfrac{3}{5}\mu\right\}+(1-\mu^2)^{\frac{1}{2}}\left\{\mu^2-\tfrac{1}{5}\right\}\cdot\left\{A^{(1)}_3\sin\omega\right.$$
$$\left.+B^{(1)}_3\cos\omega\right\}+(1-\mu^2)\mu\left\{A^{(2)}_3\sin 2\omega+B^{(2)}_3\cos 2\omega\right\}$$
$$+(1-\mu^2)^{\frac{3}{2}}\left\{A^{(3)}_3\sin 3\omega+B^{3}_3\cos 3\omega\right\}$$

and in general

$$S^{(i)}=\Sigma^{n=i}_{n=o}(1-\mu^2)^{\frac{n}{2}}\left\{\mu^{i-n}-\frac{(i-n)(i-n-1)}{2(2i-1)}\mu^{i-n-2}+,\right.$$
$$\left.\text{etc.}\right\}\left\{A^{(n)}\sin n\omega+B^{(n)}\cos n\omega\right\}. \qquad (10)$$

In the foregoing the capital letters, with super and sub fixes represent arbitrary constants.

To develop any rational integral function F of x, y, z, of degree i, these variables must first be transferred into polar co-ordinates.

The general Laplace Function (10) of the same order i will be subtracted from it, and the arbitrary constants determined by the condition that the remainder $F-S_i$ shall contain no powers or products of μ or $\sqrt{1-\mu^2}$ of higher than the $i-1$ order.

This determines F_i of (8). From that remainder (of degree $i-1$), the general expression (10) of next lower order $i-1$, is subtracted; and the constants again determined by the condition the new remainder shall contain no powers or products of μ or $\sqrt{1-\mu^2}$ of higher order than $i-2$; by which F_{i-1} of (8) is determined; and so on.

First invented for expressing the attraction of a body of nearly spherical figure, its first application may here be illustrated. It is well known that, except for spherical or ellipsoidal figures the integration of V, (2), is impracticable by direct process.

Transposed into the variables r, μ, and ω, $\rho dxdydz$ becomes $\rho r^2drd\mu d\omega$. The denominator of V develops, for an external attracted point, into the first of the series (5). If we suppose the *mean* radius of the body to be a, and variable radius to be $a\ (1+y)$, in which the greatest value of the variable, y, is supposed to be but a small fraction, and if we integrate V with reference to r, from $r=a$, to $r=a\,(1+y)$, we shall get (supposing the density ρ to be constant, and neglecting powers of y above the first),

$$(11)\ \rho\int_{-1}^{1}\int_0^{2\pi}\left\{\frac{a^3}{r'}P_0+\frac{a^4}{r'^2}P_1+\dots\frac{a^{i+3}}{r'^{i+1}}P_i+,\ \text{etc.}\right\}yd\mu d\omega$$

for that part resulting from the stratum of small variable thickness (positive or negative) $a\,y$, by which the given body varies from true sphericity of form. This function y must, of course, be *given*, in terms of μ, $\sqrt{1-\mu^2}\cos\omega$, and $\sqrt{1-\mu^2}\sin\omega$; and can be developed in Laplace Functions,

$$Y_0+Y_1+Y_2+\ .\ .\ .\ Y_i+\ .\ .\ .$$

But by (9) $\frac{2i+1}{4\pi}\int_{-1}^{1}\int_0^{2\pi}y\ P_i\,d\mu\,d\omega=Y_i$; hence the terms of the integral (11) become, severally,

$$\frac{4\pi\rho}{(2i+1)}\ \frac{a^{i+3}}{r'^{\,i+1}}\ \ Y_i;$$

and hence (since that part of V belonging to the sphere of radius a is easily found to be $\frac{4\pi\rho a^3}{3r'}$),

$$(12)\ V=\frac{4\pi\rho a^3}{3r'}+\frac{4\pi\rho a^3}{r'}\left\{Y_0+\frac{a}{3r'}Y_1+\dots\dots\frac{a^i}{(2i+1)}Y+\dots\right\}.$$

Thus the potential V (from which can by differentiation be derived the attraction) is determined.

If, on the other hand, the body (*e. g.* the earth considered as a fluid enveloping a spherical nucleus) be such that a foreign attraction *produce* a slight distortion or deviation from perfect sphericity, many important problems (*e. g.* the tides) depend on the determination of this distortion. The *direct* effect of the foreign attraction would be determined with comparative ease; but the problem is very much complicated by the fact that this directly produced stratum of distortion *itself* reacts upon the particles of its own substance; which secondary action must be taken into account. The potential of that reaction, in terms of the sought quantity, y, can by aid of (12) be *expressed analytically*, and combined *with* the potential of the foreign attraction in expressing the conditions of equilibrium, and thus the *actual* tidal distortions determined.

The discovery of the remarkable functions of Laplace (whose own demonstration of their properties was regarded as inconclusive, or at least incomplete) was followed by a controversy among eminent mathematicians, the substance of which is given by Bowditch in his voluminous notes to book iii. chap. ii. § 15 of the *Mécanique Céleste.*

The method has since been generalized, and, under the designation of *spherical harmonic analysis*, greatly developed (see Thomson and Tait, *Natural Philosophy*, where its object is defined to be "the expression of an arbitrary

* In relation to those peculiar quantities, P_i, this equation holds for *either* of the two sets of variables μ, ω, or μ', ω'.

† It is not unusual to style the development (8) as a series of "Laplace's *Coefficient*;" but I believe it more correct to confine that designation to the quantities P_i, which appear as actual "coefficients" in the development (5). These quantities are indeed Laplace Functions or "*Spherical harmonics*," but of very marked peculiarity of form; being *biaxial* or double (*i. e.* possessing the essential properties, in *each* of the two sets of variables μ, ω and μ', ω') and destitute of arbitrary constants; and through this double form, instrumental in converting $F(\mu',\omega')$ into a Laplace Function F, and, thus, to the development of F (μ,ω) in Laplace Functions, or Spherical harmonics.

periodic function of two independent variables in the proper form for a large class of physical problems involving arbitrary data over a spherical surface, and the deduction of solutions for every point of space.")

In investigations of the distribution of electricity and magnetism—of the conduction of heat, etc.—its power alone can cope with the difficulties of the problems. The most important application involving gravitation is to the theory of the Figure of the Earth, the attraction of the mass on each of its particles being that of approximately spherical layers of matter equally dense through each, but varying in density from layer to layer. Besides the works above mentioned, reference may be made to the late Archdeacon Pratt's *Figure of the Earth*, in which there is a chapter devoted to "Laplace's Coefficients."

A simple harmonic function is defined under the head *Harmonic Motion.* A combination of such produces a complex harmonic function. "Fourier's Theorem" (which is not only "one of the most beautiful results of modern analysis, but may be said to furnish an indispensable instrument in the treatment of nearly every recondite question in modern physics") amounts to this—viz. *Any* function whatever between definite values of the variable may be expressed as a complex harmonic function. The "spherical harmonic analysis" is but an extension (whence, probably, its name) of this principle to the expression of quantity arbitrarily distributed over a *spherical surface.*

J. G. Barnard.

Lapland and the Lapps. Lapland ("the land of the Lapps") is the name generally given to an extensive territory of Northern Europe stretching along the Arctic Ocean, from the Atlantic to the White Sea. It does not form an independent political unit, but is divided between Norway, Sweden, and Russia, and inhabited, besides the Lapps, by Finns, Norwegians, Swedes, and Russians. The general aspect of the country is rather forbidding. A long, severe winter of nine months, during which the sun does not rise for two months; a short, extremely hot summer in July and August, during which the sun does not set; a spring and a fall of a couple of weeks,—such is the climate. The forests of pine and birch which cover the southern parts of the country soon cease; barley and potatoes may be raised as far as 70° N. lat., but only in a few valleys. On the large table-land nothing grows but lichens and mosses, on which the large herds of reindeers feed, which, together with hunting and fishing, afford the inhabitants their sole resources of life. The Lapps belong to the Lapponian subdivision of the Tschudic races, which are referred by the philologist Castren to the Finnic group of the great Turanian family. This gives them the position assigned to them by Rask and Max Müller, excepting that the names "Tschudic" and "Finnic" change places in their classification. Latham gives the Lapps (or Sabme, as they call themselves; Lopari, as the Russians call them) a separate place among Ugrian peoples. (See Finns, *Race Tables.*) They entered Europe from the S., with other Finnic tribes, before its occupation by Aryans, and therefore before the European historical period. Their dwellings on the E. side of the continent extended as far S. as the lower Volga, but they were long ago driven from their old home by the steady pressure of Finns, Slaves, and others, laterally and from below, until they have been crowded into their present seat. Now and then, however, their frontier has been able to maintain itself, or even advance upon that of their neighbors. They have always been closely connected with the Finns, possibly even confounded, by early observers, both ethnically and geographically, especially in Lapland. The ancient Fenni, mentioned by Tacitus as settled in the N. of Europe, were probably the ancestors of the Lapps, not of the Finns. They have a tradition of their former occupancy of Sweden or Finland. "The Swedes and Lapps," they say, "were originally brothers. When a storm came on, the Swedes put up a board and took shelter under it, the Lapps took to a tent; and ever since the latter have lived in tents, the former in houses." The primitive wanderings of the ancient Sabme are scarcely distinguishable from those of the Finns. Their later history, too, is only incidental to that of their Aryan conquerors, who have either reduced them to the condition of serfs, or forced them into sterile and icy regions, where they could never develop an independent nationality.

The Lappish countries now are Lappmark in Sweden, Russian Lapland to the White Sea, and Finnmark, or the March of the Finns, in Upper Norway, where many of them live. The Lapps subject to Russia are—(1) those of the duchy of Finland, N.; (2) those of the government of Archangel. Lallerstedt, in *La Scandinavie,* counts in Finnmark 13,000 Lapps to 6000 Finns and 25,000 Norwegians. Friis estimated 1556 Lapps to 1749 Norwegians in 1865. Since then the Lapps seem for a long time to have increased as the Norwegians decreased; then those were stationary and the Norwegians increased up to 1835, though it should be remembered that the Lapps, having been to a great extent absorbed, are reckoned as Norwegians. But this author considers them as dying out in Finnmark. At the last census, in 1859, the population of Russian Lapland was 9134, of whom 2207 were Lapps, 1956 were Karelians, 4971 Russians. To these might be added a few Norwegian and Finn emigrants. Brace in 1863 counts 28,000 Lapps under Sweden and Russia.

The Lapps of the Russian empire, Gurowski says, have as *inorodets—i. e.* provincial natives of non-Russian stock—an organization and rights distinctly recognized by the government. But a narrow policy is exercised towards them, and less done for their improvement than in Norway, and more especially in Sweden. The Norwegians, having hitherto regarded them as hopelessly debased and ignorant, neglected them greatly, but latterly both Swedish and Norwegian missionaries have much enlightened and softened both Lapps and Finns—Stockfleth particularly, and Lestadius, a dissenting missionary who died in 1841.

The Lapps seem to be physically inferior to the Finns, probably because less comfortably housed, fed, and clothed, though they are wonderfully hardy, and quite as courageous. There is much intermixture of these races at the Finland frontier and at the copper-mines. Friis thinks the mixed race best able to withstand the rigorous climate of the far North. The Laplanders are wild, savage, and dull, small of stature, with large head, short neck, small gray-reddish eyes, hair dark brown, beard short, hands long, legs thin, abdomen projecting, the result of improper or insufficient food, complexion light, chin protruding, cheek-bones prominent. In disposition they are peaceable, but too slavish, and stubborn withal. They appear frank and simple, but are really knavish and treacherous. The Lapp, though he as well as the Finn lives partly upon fish and game, is a herdsman. Like the Finn, he catches the fish of the lakes, the salmon, the cod, cod-bait, herring, and other fish of the fiords and outer coasts, where permitted, but his reindeer is his principal means of subsistence, and he follows him to the coast or to the interior, according to the season, in search of reindeer-moss. In winter the mountain Lapp of Finnmark hunts or fights the wolf. In the summer the reindeers go by habit or instinct to the coast, each owner marking his own herd in the ears, and hastening their transportation by the middle of May, before the roes calve, and while the snow-covered ground and ice-bound lakes render sled-travelling possible in a region without roads. The reindeer has been called the "camel of the North," but settlers cannot keep these animals, for they will not thrive if stalled or confined in pastures and not allowed to wander freely over large spaces. Latterly, steam communication between Bergen, Trondheim, and Hammerfest has given a new impulse to trade, and begun somewhat to develop the resources of the country. But from Hammerfest N. and N. E. reindeers complete the line of communication. The Lapps of Finnmark, Lapland, and Norway have enough reindeer meat and skins for themselves and the settled population, many thousands of these animals being killed every year. They also furnish the Norwegians with game, sometimes as many as 10,000 grouse in a day. The Lapp of Lapland hunts in winter the squirrel, sable, ermine, otter, and bear, and in summer seeks the fisheries of the coasts, lakes, or rivers, dwelling in huts of bark or turf. In winter he retires to more substantial quarters in the small villages, each house being a rude, low wooden structure, with two rooms—one a store-room for skins—containing no table, benches for beds, very few and simple utensils, a piece of wood for a dish, but always a picture of the Madonna. The rich Lapps have a few Russian dishes of stone or copper. They dress in skins, or warm and coarse homespun clothing, sometimes in the Russian peasant costume. Tobacco and coffee are scarcely known, but much brandy is drunk. When the reindeer-moss is exhausted in the neighborhood of a village, the inhabitants remove to another site, transporting their little Greek chapel, houses, etc. as best they can, and setting them up again with religious ceremonies.

Between 1855 and 1865 these people lost 14,944 reindeer, either by death on the fields or by confiscation, since which misfortune their owners have been lost sight of. Many, losing heart, became drunken and shiftless, and some 200 emigrated to Sweden with 20,000 reindeer. The favorite amusements of the Lapps are ball-playing, and, on the N. coast, monotonous singing, sledging, dancing or marching in a peculiar manner, and skating down hill with the skide, a snow-skate over six feet long.

The Lapps of Lapland resemble those of Scandinavia, but are much behind them in education, being unable to read and write. Their language, too, differs more and more from the Lappish of Norway and Finland, the extreme Lapps scarcely understanding each other. There is much

heathenism among them. Their Christianity, nominally Greek, consists in little more than mumbling the prayer "Lord Jesus, Son of God, have mercy upon me!" The Swedish and Norwegian Lapps are Lutherans, and of these all the adults are able to read. The Lapps formerly worshipped a deity called the Storjunker ("great noble"), to whom they sacrificed a full-grown reindeer. Tiermes was the divinity next in rank, and Baiwe, or the Sun. But the god most venerated by them was Jubmel, worshipped also by other peoples akin to them, under the name Jumala, Jumara, or Num. Their rude wooden or stone idols, often only grotesque unhewn logs or blocks, stood within an enclosure of boughs, and were honored with simple rites. Like all Turanians, the Lapps believe in supernaturally wise men. Their noaids or magicians are both their oracles and physicians, the medium, in short, between the human and the divine, able to control the spirit world in a degree to make it favorable to mankind. Some ancient famous noaids were mentioned by name in the Sagas. These clever medicine-men are often selected for their office while children, on account of some marked nervous susceptibility, and trained to throw themselves into real or pretended frenzies, followed by fainting, preparing for such occasions by fasting or stimulants. In these fits or trances the noaid is supposed to be transported by his bird-familiar to heaven, earth, or the realm of the dead, at pleasure, and, being awakened by a brother magician, relates his visions to his superstitious and ignorant followers. Like all polar people and those inhabiting desolate regions, the Lapps by organization and habit are subject to nervous excitement; their old women especially start and scream at the slightest disturbance of fear or disgust, rush frantically about, striking insanely at every one near, and then faint and doze for a while. In church a contagious furor sometimes takes place, many striking each other or moving violently about and falling into fainting-fits. In their sicknesses, too, these people are liable to delirium. So that there are many noaids, who find it easy to impose upon a ready credulity by their air of mystery, their superior knowledge of formulas, song, sleight of hand, hieroglyphics on the rune-drum, and even a certain empiric skill in medicine which some of them acquire. There are those among them who profess to have the power of selling favorable winds to sailors, and this superstition is believed in by the Swedish, Norwegian, and Russian peasants, as well as by the Lapps. (For references see FINNS.) E. TORREY.

La Plata. See ARGENTINE REPUBLIC.

La Pla'ta, county of S. W. Colorado, bordering on Utah and New Mexico. Area, about 7000 square miles. It contains the Sierra San Miguel Mountains and part of the Sierra La Plata range, is well watered, and the S. W. portion is occupied by the Ute Indian reservation. Gold-mines have been discovered here. Cap. Howardsville.

La Plata, post-v. and tp. of Macon co., Mo., on the St. Louis Kansas City and Northern R. R. It has 1 weekly newspaper. Pop. of v. 546; of tp. 1566.

La Plata, Rio de. See PLATA, RIO DE LA.

La Pointe, post-v. and tp., cap. of Ashland co., Wis., is a fishing-station at the S. end of Madeline Island, one of the Apostle group in Lake Superior. It was settled by French missionaries in 1680. Pop. 221.

La Porte, county of Indiana, bounded N. W. by Lake Michigan and N. by Michigan. Area, 450 square miles. A large portion of the soil is very fertile, but there are some barrens, and on the banks of the Kankakee there are extensive marshes. Cattle, grain, and wool are largely produced, and lumber is manufactured. The county is traversed by numerous railroads. Cap. La Porte. Pop. 27,062.

La Porte, post-v. of Plumas co., Cal., 20 miles S. of Quincy. It is the business-centre of a large mining region.

La Porte, post-v., cap. of Larimer co., Col., on both sides of Cache à la Poudre Creek, 19 miles N. W. of Greeley, in a fertile region.

Laporte, city of Kankakee tp., cap. of Laporte co., Ind., at the intersection of the Lake Shore and Michigan Southern with the Indianapolis Peru and Chicago R. R., 59 miles E. of Chicago and 12 miles S. of Lake Michigan, has 15 churches, 5 banks, 3 weekly newspapers, 2 hotels, Holly waterworks, public library of 3000 volumes, an academy, fine schools, numerous mercantile houses and manufactories, and is the seat of Indiana Medical College. Laporte is handsomely situated on a high plateau on the edge of the rich prairie of the same name, is surrounded with fine drives and promenades thickly skirted with maple and other shade trees, and is close to a chain of seven clear and beautiful lakes, which are traversed by steamers and constitute one of the attractions which annually draw hundreds of summer visitors from Chicago, Indianapolis, Cincinnati, and the South. Pop. 6581.
C. G. POWELL, ED. "HERALD."

La Porte, post-v. of Carlisle and Eaton tps., Lorain co., O., 4 miles S. E. of Elyria.

Laporte, post-b. and tp., cap. of Sullivan co., Pa., 26 miles N. E. of Muncy, on the line of the projected Sullivan and Erie and Muncy Creek R. Rs., has 2 churches, 2 weekly newspapers, and one of the largest tanneries in the U. S., using from 6000 to 8000 cords of bark annually. Lumbering and mining are important industries. Eaglesmere Lake, noted for its beauty, is 5 miles distant, the brooks are filled with trout, and deer abound in the forest. Pop. of b. 145; of tp. 530.
J. K. PRYOR, ED. "SULLIVAN CO. DEMOCRAT."

La Porte City, post-v. of Big Creek tp., Black Hawk co., Ia., on Wolf Creek, 1 mile above its confluence with Cedar River, on the Burlington Cedar Rapids and Minnesota R. R., 15 miles N. of Vinton, 15 S. of Waterloo, and 40 N. W. of Cedar Rapids, has 4 churches, 2 hotels, 1 weekly newspaper, a bank, a large flouring-mill, a wagon and carriage manufactory, and a fair number of business-houses. It is surrounded on all sides by a fine agricultural country, and was laid out in June, 1855, by the subscriber. Pop. about 1500. J. WASSON, ED. "PROGRESS."

La Porte du Theil (FRANÇOIS JEAN GABRIEL), b. at Paris July 13, 1742; received a military education, and served in the campaigns of the Seven Years' war, but devoted all his leisure hours to the study of the Greek language and literature, and published in 1770 a translation of Æschylus's *Orestes*, and in 1775 of the *Hymns* of Callimachus. From 1776 to 1786 he resided in Rome, and having received admittance to the Vatican library, which at that time was generally closed to foreigners, he brought back to Paris a great number of historical documents illustrative of French history. Three volumes of these documents were published in 1791, containing among other things the letters of Pope Innocent III.; but the further publication was interrupted by the Revolution, and the materials were placed in the National Library. In the latter part of his life he was occupied with a translation of the *Geography* of Strabo, of which, however, only nine books were finished, when he d. May 28, 1815.

Lap'penberg (JOHANN MARTIN), LL.D., b. at Hamburg July 30, 1794; studied medicine at Edinburgh and law at London, Berlin, and Göttingen, receiving the doctorate in 1816; was for a time minister resident for Hamburg at Berlin; became in 1823 keeper of the archives at Hamburg, and was in 1850 plenipotentiary in the Frankfort conference. His best work is *Geschichte von England* (1834–37); he also wrote valuable histories of the German Hanse Towns, of Heligoland, etc. His *History of England* relates to the Anglo-Saxon period, and is the standard authority for early English history. It has been translated into English, with notes and additions, by Benjamin Thorpe. The *History of England under the Normans*, commenced by Lappenberg and finished by Pauli, was also translated by Thorpe. Lappenberg d. Nov. 28, 1865.

La Prai'rie, a fertile county of Quebec, Canada, on the S. side of the St. Lawrence, directly S. of Montreal. Cap. La Prairie. Pop. 11,861.

La Prairie, post-v. of La Prairie co., Quebec, Canada, on the S. side of the St. Lawrence, 9 miles above Montreal, has an academy and a convent. Pop. 1259.

La Prairie, tp. of Marshall co., Ill. Pop. 1400.

La Prairie, tp. of Rock co., Wis. Pop. 867.

Lapse [Lat. *lapsus*, from *labor*, to "glide," to "fall"]. A devise of real property or a bequest of personal property is said in law to lapse when the devisee or legatee dies after the making of the will and before the death of the testator. The effect of this at common law is that in the case of a devise the property devised passes to the heir-at-law of the testator, while in the case of a legacy the property bequeathed passes to the residuary legatee if one be named in the will, and if not to the next of kin. (See KIN, NEXT OF.) The reason why this disposition is made of the property, instead of its passing to the representatives of the deceased donee, is that a will takes effect only from the time of the testator's death, and the donee can acquire no title unless he is in being at that time. There is a distinction between a lapsed and a void devise or bequest. The gift is void when the person specified as donee is dead or incompetent to take the property at the time when the will was made. The general rule is, that the same disposition shall be made of the property included in the terms of the gift as in the case of a lapsed devise or bequest. It seems, however, to be the English rule that a void devise passes to the residuary devisee. These common-law rules have

been to some extent changed by statute. By the English statute of wills (1 Vict. ch. 26) the real estate comprised in a lapsed devise shall, unless a contrary intention appears in the will, pass to the residuary devisee, if any there be, instead of to the heir-at-law. It is further provided that a devise or legacy to a child or other descendant shall not lapse if issue of the devisee or legatee survives the testator, but shall take effect as if the devisee or legatee had died immediately after the testator, unless a contrary intention appears by the will. A change similar to this second provision has also been made by statute in New York, and also in several other States of this country.

A legacy is also said in some cases to lapse even though the legatee dies subsequently to the testator. This happens when the vesting of the legacy depends upon a future contingency, and the legatee dies before the contingency occurs. Thus, if a legacy be given to one *when* he attains, or *if* he attains, the age of twenty-one, and he dies before that time, it is a lapsed legacy. (See LEGACY.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lapwai′, post-v. of Nez Percé co., Id., 12 miles S. E. from Lewiston. Pop., including U. S. troops, 91.

Lap′wing [so called from the flapping of its wings in flight], or **Pee′wit** [named from its note], the *Vanellus cristatus*, a game-bird common throughout a great part of the Old World, but unknown in America. It is referred to the plover family. Its flesh is excellent. It strives with great ingenuity to conceal its nest, which is greatly sought for the eggs, which are sold in quantities as plovers' eggs.

Lar, town of Persia, cap. of the province of Laristan, 60 miles from the Gulf of Persia. It is famous for its manufactures of sword-blades, muskets, and silks, and has fine bazaars. Pop. 12,000.

Lar′amie, county of Wyoming Territory, bounded N. by Montana, E. by Dakota and Nebraska, and S. by Colorado, extending N. and S. the whole length of the Territory, 4 degrees of latitude by ½ a degree in width, and includes the Wyoming portion of the Black Hills, belonging to the Ogallalla Sioux, where gold was found in 1874, and which were explored in the summer of 1875 by hundreds of miners. Area, about 14,000 square miles. It consists largely of the elevated Laramie Plains, well adapted to sheep-raising, and is broken by the Laramie range of mountains. The county is traversed by the North Platte, the N. and S. forks of the Big Shyenne, and by the Union Pacific R. R. Cap. Cheyenne City. Pop. 2957; in 1875, 6000.

Laramie, city, cap. of Albany co., Wyoming Ter., on the Union Pacific R. R., 57 miles by rail N. W. of Cheyenne, and 7122 feet above the level of the sea, laid out in Apr., 1868, when the railroad reached this point, lies in the midst of the Laramie Plains, is regularly built, chiefly of wood, with a few structures of stone, has 5 churches, 2 daily newspapers, 1 national bank, a court-house and jail, several hotels and schools, and numerous stores. The railroad company has established here extensive machine-shops. A stream of clear cold water passes through the city, and is fed by a spring at the foot of the Black Hills, a few miles E. Laramie is the second town in the Territory in point of population, which is rapidly increasing; it is noted as the first place in America where a female jury was empanelled. Pop. about 3000.

Laramie, a river in Wyoming Territory, formed by the union of two branches, the Big and the Little Laramie, which rise in the Medicine Bow Mountains, and flow N. E., skirting on the E. the plains of the same name. It enters the N. fork of the Platte at Fort Laramie, and is much used for floating lumber from the mountains.

Laramie Mountains, a range rising at the Red Buttes, near the Sweetwater River, Wyoming Ter., and extending in a curve southward to the Arkansas River, near Long's Peak in Colorado, forming a wall which closes in the Laramie Plains to the N. E. and E. Geologically, it is composed of a nucleus of red syenite, with margins of fossiliferous formation, Carboniferous, Triassic, Jurassic, Cretaceous, and in some places lignite Tertiary, the beds inclining from a central axis at different angles. This range is connected with the Big Horn Mountains and Black Hills by low anticlinals extending across the prairie, the most complete and beautiful to be found in the Rocky Mountain region. The numerous branches of the Platte rise in this range, of which the principal summit is Laramie Peak. Coal has been found in them in considerable quantities.

Laramie Peak, the loftiest summit of the Laramie Mountains, in Albany co., Wyoming Ter.

Laramie Plains, an elevated table-land in Wyoming Territory, lying in Carbon and Albany counties, S. of the N. fork of the Platte, between the Laramie Mountains on the N. E. and the Medicine Bow spur of the Rocky Mountains on the S. W., watered by the Big and Little Laramie and Medicine Bow rivers. The tops of some of the surrounding mountains are covered with perpetual snow, and the mean altitude of the plain being above 7000 feet, the summer is always short and the winter severe. The principal cereals can be raised, but the soil is more suited to potatoes, turnips, beans, peas, and other vegetables, which have been successfully cultivated at Fort Sanders, a military post on the S. W. margin of the plains. Grazing will be an important industry, and vast beds of iron and coal of good quality have been found.

Larash, or **Larache.** See EL ARAISEH.

Larceny [contracted from *latrociny*, from Lat. *latrocinium*, "theft"], the wrongful or fraudulent taking and carrying away by any person of personal property belonging to another, with a felonious intent to convert it to the taker's own use, without the consent of the owner. When the property is taken directly from the house or person of the owner the offence is termed mixed or compound larceny; in other cases it is called simple larceny. Simple larceny was further distinguished at common law as grand or petit larceny, the former being the theft of goods above the value of twelve pence, the latter the theft of goods below this value. But the distinction between grand and petit larceny has been abolished in England and in many of the States of this country by statute. While in some of the States it is still retained, the value of the property upon which the distinction depends has been generally changed by legislation. In New York, for instance, the property must have a greater value than $25 in order that the stealing of it may be grand larceny. If it be worth this amount or less, the theft is petit larceny. At common law the only importance of the distinction was that the severity of the punishment inflicted differed in degree according to the grade of the offence. Both forms of the crime were felonies. (See FELONY, CRIME.) But in those States where the distinction is retained, grand larceny is sometimes declared to be a felony, while petit larceny is made simply a misdemeanor. This is the case in New York. The taking and carrying away, which are necessary elements in the offence of larceny, are also technically termed caption and asportation. It is not requisite, in order that the crime may be complete, that the property should remain permanently in the thief's possession or be removed to any considerable distance from the position which it previously occupied. It is a sufficient asportation if every part of the thing stolen be removed from the place which that part occupied, even though the entire article is not wholly removed from its receptacle or the place where it had been put. On this ground it was adjudged larceny where a person lifted a bag which he was intending to steal partly out of the boot of a coach, but was detected before its complete removal. So if a sword be drawn partly from a scabbard, or if goods be removed from one part of a wagon to another by one who intends to commit a theft, the larceny designed is sufficiently perpetrated, though the thief had only momentary possession. But, on the other hand, if a bale of goods resting upon its side be merely lifted and set upon end, there is no complete asportation, since some small portion of the goods still retains its former position. The strictness with which the rule is adhered to that every particle of the property stolen must be taken from its former position thus results in very nice distinctions, since the determination of the question whether a certain act of attempted larceny was criminal or not criminal may turn upon the point whether an insignificant part of the goods was moved a very small distance from the place which it previously occupied. The rule is more practical of application than efficacious as a means of determining with reasonable accuracy the various degrees of moral turpitude in acts of intended theft. It is further necessary, in order that larceny may be committed, that the property should be *entirely* in the possession of the thief, though but for a moment. Thus, where goods were fastened by a string to a shop-counter, and a thief, in attempting to carry them away, removed them only as far as the string would permit, it was held that the owner was not completely deprived of his possession, and that consequently the intended larceny had not been fully perpetrated. But where a ring was snatched from a lady's ear, but fell immediately afterwards from the thief's hand into her hair, where it was subsequently found, the entire possession which the thief had had, though only instantaneous, was deemed sufficient to warrant his conviction for larceny. On account of this rule, that the briefest interval of complete possession is sufficient, immediate restitution by the thief after taking the property will not lessen nor do away with the criminality of the offence.

It is a fundamental legal principle in regard to this crime

that there can be no larceny committed without an act of trespass. Trespass, as the term is used with reference to personal property, is an injury to or violation of a person's title and possessory interest in chattels, and consists in wrongfully depriving him of possession against his will. Hence, larceny may be committed not only by taking goods away from one in whom the absolute title to them is vested, but also by taking them from any one who has a temporary ownership and an immediate right of possession. The ownership of the property may be either general or special, and the possession may be either actual or constructive. A person is said to have a general or absolute title when he has an exclusive right of permanent ownership, while one has a special title or special property in chattels when he has them in his possession, and retains them for a limited period, subject to the claims of the absolute owner. A bailee, for instance, would have a special property in goods entrusted to his charge, and a person would be guilty of larceny from him who took the goods from his possession. In all cases of simple bailment, where the absolute owner is entitled to resume possession of the goods at any time at his own option, if they are stolen by a third person while in the custody of the bailee, they may be described in the indictment against the thief as the property of either the bailor or the bailee. The former has the constructive and the latter the actual possession. A general owner may even be adjudged guilty of larceny if he takes his own goods away from the person who has the special ownership of them for the time being, with a felonious intent to charge the latter with their value. But there can be no theft from a person who has not a legal right to the possession of the goods taken. A servant is never deemed in law to have the possession of the goods committed to his charge by the master, but only the custody. He has neither the general nor the special ownership, and the possession is constructively in the master. If, therefore, the property is stolen while in the charge of the servant, the theft is committed against the master, and not against the servant. But goods in the possession of a thief are regarded in law as his property to such an extent that a person who steals them from him will be guilty of larceny. In like manner, a finder of property has a special right of ownership in it as against all the world but the true owner, and a wrongful deprivation of his possessory interest would constitute an act of larceny against him.

As larceny involves an act of trespass, it cannot be committed by any one who has himself a right of property and of immediate possession in the goods taken. If, therefore, a bailee converts to his own use the property entrusted to him during the continuance of the bailment, he is not guilty of larceny. But if the bailment has terminated when the goods are taken, as if they are taken by a carrier after they have been transported by him to the place of destination and there delivered, a trespass is committed, and the act is therefore the offence of larceny. The relation of bailor and bailee may also be terminated before the natural expiration of the time for which the contract was formed between the parties, by a wrongful act of interference with the property on the part of the bailee, who will subsequently be guilty of larceny if he appropriate the goods to his own use. If, for instance, a carrier of goods "breaks bulk," as it is termed, by wrongfully opening a box or bale or package which he has received for transportation, he ceases immediately to have any right of ownership in the goods as a bailee, and if he abstracts and carries away any portion of them he is chargeable with larceny. This rule leads to the peculiar result that if a bailee takes the entire package entrusted to him, he commits no crime, but only a breach of trust, while if he breaks it open and takes a part of the contents, he perpetrates larceny. The principle already stated, that a servant has the custody and not the possession of his master's goods, renders it an act of larceny for him to convert to his own use the property which he has received from the master. But if the property was received from some third person for delivery to the master or to be held for his use, the servant would not be guilty of larceny in appropriating it, for the reason that it had never come into the master's possession, and therefore no act of trespass could be committed against the master by permanently retaining it. This defect in the common law, which declared such an act of conversion by a servant no crime, but only a breach of trust, has been remedied by legislation in recent times, by which such acts of wrongful appropriation have been declared criminal offences, and have received the name of embezzlement. (See EMBEZZLEMENT.)

Finders of lost goods have no right to detain them from the possession of the true owner if he is known; and if they appropriate the property to their own use when they know to whom it belongs or have reasonable means of ascertaining the true owner, they are guilty of larceny. If, for instance, carriers of passengers find in their vehicles packages of goods upon which the name of the owner is marked, they cannot retain and dispose of them as their own property without committing this offence. But if articles be found, and there is no means of discovering the owner, there will be no larceny though the finder subsequently applies them to his own use. This is true even though the owner may have been discovered in the mean time.

It is a general principle that larceny must be committed against the will of the owner of the property. If the goods are taken by his consent, which has been fairly obtained, no wrongful act of any kind is committed. But if his consent be procured by fraud or stratagem, the asportation will in some cases constitute larceny. It is necessary at this point to distinguish between that fraudulent acquisition of the chattels of another which will constitute larceny, and that fraudulent taking which constitutes the criminal offence of obtaining goods by false pretences. (See CHEAT.) When the owner intends, in consequence of the fraudulent devices by which he is influenced, to part with the absolute property in the goods, retaining no interest in himself, the person who receives the goods is guilty of the crime of using false pretences. But when he intends merely to part with his possession of the property for a certain interval, instead of his entire ownership, but the person who by artifice obtains his consent takes the goods with the secret design of appropriating them to his own use, larceny is committed. The act of taking another's property is deemed to be a trespass unless the consent of the owner is given with a full comprehension on his part of the receiver's intent with reference to the transfer of ownership. In case of fraudulent larceny the *possession* of the goods is given willingly, but the owner is still deprived of his *property* in them against his will. If, for example, a person hires a horse and carriage for a limited time, but appropriates them to himself, he commits larceny, because the owner only intended to give him the *use* of the property and not the title. But where one obtains a payment of money by presenting a letter falsely purporting to be an order from the creditor, and appropriates the funds to himself, he is guilty of obtaining property by false pretences. If property be obtained by fraud from a servant, it will be larceny when the servant is merely entrusted with the possession of the goods for a special purpose, and has no authority to part with the property in them except to fulfil the special purpose for which they were entrusted to him. But when he has a general authority to dispose of his master's property, a person may procure a transfer of ownership from him by fraud, and will then be chargeable with false pretences.

The trespass committed in taking the property must also be accompanied by a felonious intent to deprive the owner of his entire ownership, and convert the property to the taker's own use or dispose of it for his benefit. The goods must be taken, as it is expressed in technical legal phrase, *animo furandi*—with a design of stealing. Thus, if property be taken upon a claim of title or merely by mistake, or if the intent is simply to use the articles and afterwards to return them to the true owner, no larceny is perpetrated, because the felonious intent is wanting. The wrongful purpose must also exist at the time of the taking. If the property be acquired rightfully, and with no design of misappropriation at the time it is received, a subsequent conversion of it with felonious intent by the person having it in his possession will not constitute larceny. If, for example, a person should find an article, and take it with the intention of restoring it to the owner when discovered, but should afterwards appropriate it to himself, he would be chargeable merely with an act of trespass and not of larceny. The same rule applies when property is taken at first in the commission of a trespass, but with no design of depriving the owner of it permanently. It is sometimes stated in treatises upon criminal law and in the reports that there can be no larceny unless property be taken *lucri causa*—for the sake of gain or profit to the thief. This doctrine is only sustainable at the present day by giving to the term *lucri* ("gain") a much more comprehensive meaning than it was formerly held to bear. It must be used to denote not merely pecuniary profit to the thief, but any advantage, whether pecuniary or otherwise, which he obtains by the acquisition of the property, whether this be a direct or indirect result of the taking. Thus, it has been adjudged larceny to take an article with intent to present it to a friend; or to intercept and burn a letter to suppress inquiries it may suggest concerning the thief's character; or to take and kill a horse, that his existence might not furnish evidence against a third person who had been accused of stealing him. Some cases have denied the doctrine of *lucri causa* entirely.

It is only personal property which is the subject of larceny at common law. Anything which is deemed in law to be real property, or to savor of the realty, cannot there-

fore be stolen. If soil be taken from a person's land, or apples from his fruit trees, or grass and grain be cut down and carried away, no larceny is committed. Those classes of articles which, in themselves personal property, have become so attached to land as to form a part of the realty, and are denominated fixtures, are not subject to larceny. (See FIXTURES.) But when things which once belonged to the realty have been severed from it, and subsequently carried away with felonious intent to appropriate them to the taker's own use, the act will amount to larceny, because by reason of the severance the articles become personal property. The severance may be made either by the thief or by some third person, and it is not necessary that any particular interval of time should intervene between this and the asportation. The two acts need only be so much separated as not to constitute one transaction in order that the taking may be larceny. Otherwise, it is only an act of trespass. At common law, also, choses in action are not the subjects of larceny, since they are regarded as mere evidences of a right, without intrinsic value in themselves. (See CHOSE IN ACTION.) There can be no larceny, moreover, of animals *feræ naturæ* (*i. e.* of a wild nature), so long as they are unreclaimed or unconfined. (See FERÆ NATURÆ.) If such animals are reclaimed from their wild state by being tamed, they become the subject of this offence, provided they are fit for food, but not otherwise. Thus, pigeons, hares, deer, swans, etc. may be stolen when reclaimed, but dogs, cats, bears, foxes, squirrels, etc. cannot. If an animal is dead, it is of course subject to larceny if it be suitable for food. The same is true if an animal be confined. These common-law rules in regard to the kinds of property which may be stolen have been much changed in modern times by statute, and it is now generally provided, both in England and in this country, that choses in action and a large variety of articles which savor of the realty, but are readily detached from the land with which they are connected, may be the subjects of larceny or its equivalent. Various other important changes of the common-law principles applying to this crime have also been made by legislation, which must be ascertained by special reference to the statutes of different States. (Consult the works of Bishop, Wharton, Russell, Chitty, and Colby on *Criminal Law*. See also ROBBERY.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Larch [Gr. λάριξ], applied to trees of the genus *Larix*, conifers with deciduous leaves. The *Larix Europæa*, called "Scotch larch" in this country, is not a native of Great Britain, though very extensively grown there. Its wood is valuable for a great variety of purposes. In Russia, "Orenburg gum," a wholly soluble and edible product, is obtained from the charred trunks of this tree, as is Briançon manna in France. The Himalaya larch is *Larix Griffithsii*. (For the American larch, see HACKMATACK.)

Lar'com (LUCY), b. at Beverly Farms, Mass., in 1826; was for a time a teacher in Illinois. She compiled *Breathings of the Better Life* (1866), and is author of *Poems* (1868). Her literary career began while she was an operative in a Lowell factory. She has been an editor of *Our Young Folks*, a children's periodical.

Larcy', de (CHARLES PAULIN ROGER DE SAUBERT), BARON, b. Aug. 20, 1805, at Vigan, in the department of Gard, France; studied law, and was admitted to the bar in 1826; became a member of the Chamber of Deputies in 1839, and being a legitimist and liberal took part with great energy in the opposition against Guizot. After the fall of the July monarchy in 1848, he accepted the Republic, and sat in the Constituent and again in the Legislative Assembly, but retired into private life after the *coup d'état*. Elected a member of the National Assembly in 1871, he was appointed minister of public works by Thiers in February of the same year, and held the position to June, 1872; voted for the preliminaries of peace, the validity of the elections of the Orleans princes, the dissolution of the national guard, and against the maintenance of the commercial treaties. His pamphlet, *La Révolution de la France*, made great sensation in 1831; in 1860 he published the first part of *Des Vicissitudes politiques de la France*.

Lard [Fr. *lard*, from Lat. *lardum*], the oily part of hog's fat, extracted by melting at the temperature of boiling water, extensively used for culinary purposes and for the manufacture of candles, illuminating oil, pomades, unguents, and soaps. The ordinary lard of commerce is obtained from the entire fat of the animal; the best quality is that derived from the fat which surrounds the kidneys. It is often adulterated to the extent of 25 per cent. or more by the addition of alum, lime, mutton suet, starch, potato flour, or other farinaceous substance, while water may be employed for the same purpose up to 12 per cent. The presence of water is detected by the loss of weight under moderate heat; that of starchy substances by changing to a blue color in a solution of iodine. The composition of lard is 62 parts oleine to 38 of stearine and palmitine, the former, called *lard oil*, being used for lubricating machinery and for illumination, while the latter is chiefly employed for the manufacture of hard candles. Lard is one of the chief products of the Central States of the U. S., Chicago and Cincinnati being largely engaged in this industry, which has reached nearly 250,000,000 pounds per annum, as shown by a comparison of the statistics of several years. Lard is the chief material employed in pharmacy, in combination with vegetable balsams and oils, for the preparation of unguents and cerates, for which purpose, however, only the best quality can be advantageously used. Lard oil is exported from the U. S. in immense quantities, chiefly to France, where it is largely used for the adulteration of olive oil. Lard oil is often mixed with 25 per cent. of rosin, the latter substance forming an acid which protects the oleine from its tendency to rancidity when exposed to dampness, and also increasing its power of illumination. The melting-point of pure lard varies from 78° to 87° F.

Lardiz'abal y Uribe (MIGUEL), b. in the province of Tlascala, Mexico, in 1744; studied at Puebla and at the University of Valladolid in Spain; obtained high scientific employments at court, but, incurring the displeasure of the favorite Godoy, was exiled in 1785 to the Basque provinces, where he became the head of the seminary at Vergara. In 1808 he was restored to favor by Ferdinand VII., and appointed a member of the council of the Indies; retired to Cadiz before the French invasion; was elected representative for New Spain (Mexico) in the central junta (Sept.), and became a member of the regency; came into conflict with the Cortes in 1811, by whose order he was imprisoned at Alicante; was exiled from Spain in Aug., 1812, proceeding to England; returned to Spain in 1814 as councillor of state and universal minister of the Indies under the absolutist government of Ferdinand VII., exercising immense power; again fell into disfavor a year or two later, and was imprisoned in the castle of Pamplona, and passed his last years in honorable exile at the head of the seminary of Vergara, Biscay, where he d. Dec., 1823.—His brother, MANUEL, b. at Tlascala Dec. 22, 1739, was a learned magistrate at the Spanish court, and perpetual secretary of the Spanish Academy. D. about 1818.

Lard'ner (DIONYSIUS), LL.D., b. at Dublin Apr. 3, 1793; graduated at Dublin University 1817; remained in his college, of which he was for a time chaplain, until 1827, and received many honors, mostly for excellence in mathematics and physics; abandoned the clerical profession; became in 1828 professor of astronomy and physics in the University of London; resided 1840–45 in the U. S., and afterwards in Paris, where he d. Apr. 29, 1859. The greatest of his works was the publication of the *Cabinet Cyclopædia* in 134 vols., 12mo (1830–44), composed of a series of treatises, partly written by himself; also produced an *Algebraic Geometry* (1823), a work on *Calculus* (1825), on the *Steam-Engine* (1828), a series of *Handbooks* upon science (1851–56), the *Musæum of Science and Art* (1854), and other works.

Lardner (JAMES L.), U. S. N., b. Nov. 20, 1802, in Pennsylvania; entered the navy as a midshipman May 10, 1820; became a lieutenant in 1828, a commander in 1851, a captain in 1861, a commodore in 1862, a rear-admiral on the retired list in 1866; commanded the U. S. frigate Susquehanna at the battle of Port Royal, where he distinguished himself by his skill and bravery, Rear-admiral Dupont characterizing his "close support" of the flagship as "a very gallant thing." FOXHALL A. PARKER.

Lardner (NATHANIEL), D. D., b. at Hawkshurst, Kent, June 6, 1684, an English Presbyterian minister of Unitarian proclivities; studied at Utrecht and Leyden 1699–1703; was long minister of Crutched Friars, London; is chiefly remembered as author of *The Credibility of the Gospel History* (5 vols., 1727–43), first delivered as a series of lectures at the Old Jewry, and still a standard work; published also a *History of the Apostles and Evangelists* (3 vols., 1756–57), *Letter on the Logos* (1759, distinctly Socinian), *Jewish and Heathen Testimonies* (1764–67), a *History of Heretics of the First Two Centuries* (1780), etc. D. at Hawkshurst July 24, 1768.

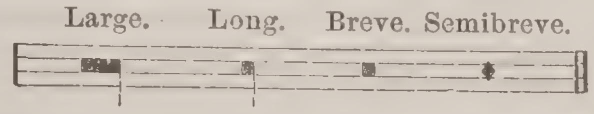
Lare'do, post-v., county-seat of Webb co., Tex., on the left bank of the Rio Grande, 200 miles above its mouth, at the crossing of the high-road between San Antonio, Tex., and Saltillo, Mexico, 400 miles S. W. of the former city, was founded by Spanish settlers in the latter part of the eighteenth century as a frontier town of Mexico, and suffered much then and since from Indian inroads. On the annexation of Texas to the U. S. many of the Mexican inhabitants moved across the river and founded Nuevo Laredo. The town is the American terminus of the chartered

International R. R., which is to unite the U. S. with Mexico. It has a considerable trade with Mexico. Pop. 2046.

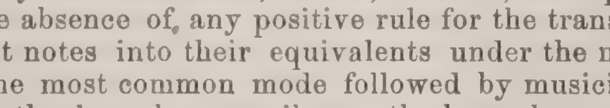
La′res [pl. of *lar*, Etruscan for "lord"]. In the religion of ancient Rome the Lares were tutelary spirits, public or private. The domestic Lares appear to have been originally the spirits of the departed members of the family, and were worshipped with simple but very devout services. The Lares differed from the Manes, which were spirits that were supposed to hover near the tomb. The Penates included other domestic spirits, not ancestral. Public Lares had care of highways, ships, fields, etc. The images of the Lares were also worshipped.

Large, one of the characters or notes in ancient music, and the longest in point of duration. The notes formerly in use were, in the order of their respective time-values, the large, the long, the breve, and the semibreve. They were commonly written thus:

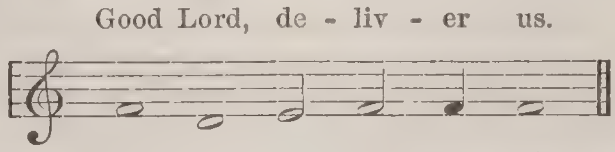
Large. Long. Breve. Semibreve.



The relative duration of these notes was, theoretically considered, equivalent in proportion to 8, 4, 2, and 1, the "large" being equal in time to two longs, or four breves, or eight semibreves; the "long," to two breves or four semibreves; and the "breve," to two semibreves. It may be considered certain, however, that these ratios were not very accurately observed in the *practice* of music, but were regarded only as approximate measures of slowness or rapidity, subject always to such variations and irregularities as might take rise from the feelings of the performer, or (in vocal music) from the accentuation, purport, and proper expression of the words. The actual length of time represented by each of these ancient notes was also much less than would be inferred from the names of the first two, which suggest a highly prolonged duration. It will be observed that while in modern music the "breve" is the longest note in use, yet in ancient music its duration was short, as indicated by its name and by comparison with the "large" and the "long." A note such as the "large," equal in length to four breves, eight semibreves, or sixteen minims, would, of course, be impracticable if the old time-table were not essentially different from our own as a measure of rapidity. Some idea of the rate or speed of the old notation may probably be derived from the hearing of Gregorian music as still in use in the Church of Rome, where the mode and velocity of chanting, as handed down by tradition, may be taken as a sufficiently correct representation of the time-value of the ancient note. Judging by such a standard, the ancient large, long, breve, and semibreve would, at the longest, be only equivalent to our present breve, semibreve, minim, and crotchet; while this relative proportion might probably be still better represented by our semibreve, minim, crotchet, and quaver. But in the absence of any positive rule for the translation of ancient notes into their equivalents under the modern system, the most common mode followed by musicians is to render the long by a semibreve, the breve by a minim, and the semibreve by a crotchet, as in the example following:

Ancient. 

Good Lord, de - liv - er us.

Modern. 

(See NOTATION.) WILLIAM STAUNTON.

Lar′go [It.], in music, a term denoting a slow and rather heavy movement, with a rate of progress somewhat faster than "grave" or "adagio." *Larghetto,* the diminutive, and *larghissimo,* the superlative, indicate respectively a decrease or increase of slowness, the latter being hardly distinguishable from "grave," "adagissimo," and other terms implying extreme slowness.

La′ri, town of Italy, in the province of Pisa, about 18 miles S. of the city of Pisa. Its old fortifications and castle are still in good condition. Pop. in 1874, 10,081.

Laric′io, or **Corsican Pine** (*Pinus Laricio*), a large pine of the S. of Europe, esteemed for its timber and its resin. It grows well in the most barren sands, and, with other species, has been extensively planted in the Landes of S. W. France, thus transforming a waste of worthless land into valuable plantations, and preventing the destruction of fertile regions by the moving of sand-dunes.

Lar′idæ [from *Larus,* "gull," and the family termination *-idæ*], a family of birds distinguished by the schizognath palate, lateral open nostrils, feet completely webbed between the three anterior toes, hallux or posterior toe rudimentary (and free) or obsolete, and wings elongated and pointed. These are the chief and superficial distinctive characters of the family, which embraces several well-marked minor groups, distinguished by most recent authors as sub-families —viz. (1) the jægers (Lestridinæ), (2) the gulls (Larinæ), (3) the terns (Sterninæ), and (4) the skimmers (Rhynchopinæ). These groups are very trenchantly distinguished from each other, but the first two and last two are contrasted with each other, the jægers and gulls on one hand being closely allied, and on the other the terns and shearwaters. The sub-families themselves are very homogeneous, the various members of each differing very little from each other. Representatives are found in every sea, and sometimes wander far inland. A *Monograph of the North American Laridæ* has been recently (1874) published by Dr. E. Coues in his *Birds of the North-west* (pp. 589–717). THEODORE GILL.

Lari′got. The name of one of the stops in an organ, otherwise known as the "nineteenth." It consists of a single rank of metal pipes, and is tuned an octave above the twelfth stop, or two octaves and a fifth (*i. e.* a nineteenth) above the diapasons. It occurs also as one of the ranks of the sesquialtera and mixture stops.

Lar′imer, county of Colorado, bounded W. by the Medicine Bow Mountains and N. by Wyoming. Area, 2000 square miles. It is watered by Cache la Poudre and Big Thompson creeks, which afford irrigation and water-power. It is a fertile region, producing grain, hay, butter, and wool extensively. Lignitic coal and silver are found. Cap. La Porte. Pop. 838.

Larimer, tp. of Somerset co., Pa. Pop. 951.

Lar′inæ [from *Larus,* a "gull," and the sub-family affix *-inæ*], a sub-family of Laridæ, characterized by a well-developed beak, whose upper mandible is hooked and projects downward in front of the upper, and has no cere at the base. In this are included the birds familiar to every one who has been along the shore as "gulls," but under this common designation are embraced many species. In the most recent general catalogue of birds (*Hand-list of Genera and Species of Birds,* by George Robert Gray) 76 species are enumerated under five genera—viz. *Rhodostethia,* with 1 species; *Larus,* with 18 sections and 68 species; *Xema,* with 2 sections and 2 species; *Pagophila,* with 2 species; and *Rissa,* with 3 species. Many of these, however, are undoubtedly varieties. Dr. Coues recognizes ten American species, and in addition two varieties—viz. *Larus,* with 5 sub-genera (including *Pagophila* and *Rissa*) and 7 species; *Rhodostethia,* with its single species; and *Xema,* with 2 sub-genera and species. *Larus* has a square tail, and includes the largest and most common species; *Rhodostethia* has a wedge-shaped tail; and *Creagrus* a forked tail. The species of the last two genera are inhabitants of the arctic regions, and (except *X. sabinei*) are very rare.

THEODORE GILL.

Laris′sa, town of European Turkey, in the province of Salonica, on the Salembria. It has extensive manufactures of cotton and silk goods, and a large trade in wine besides a very important transit-trade. Pop. 25,000.

Laristan′, district of Persia, part of the province of Farsistan, and bordering on the Persian Gulf. It is mostly an arid sandy waste, and the guinea-worm is so frequent as to become a perpetual plague.

La Rive, de, the name of two celebrated Swiss physicists, father and son.—CHARLES GASPARD, b. at Geneva, Mar. 14, 1770; resided from 1794 to 1799 at Edinburgh on account of the political disturbances in his native country; returned in 1799 to Geneva, and took charge of its insane asylum; founded a museum of natural science and a botanical garden, and delivered annual courses of lectures on medicine and chemistry. D. at Geneva Mar. 18, 1834.—AUGUSTE, b. at Geneva Oct. 1, 1801; studied chemistry and natural science under his father; was professor at the Academy of Geneva, and since 1864 one of the eight foreign members of the French Academy. D. at Marseilles Nov. 27, 1873. Electricity, its theory as well as its practical applicability, formed the principal subject of their investigations, and both of them communicated to different scientific papers—*Bibliothèque Universelle, Annales de Chimie,* etc.—a number of valuable essays relating to this branch of natural science. The principal work of Auguste de la Rive is his *Traité d'Electricité théorique appliceé* (3 vols., Paris, 1854–58).

Larix. See LARCH.

Lark [Ang.-Sax. *laferc;* Scotch, *lavrock*], a popular name of several passerine birds of the group Oscines (singers). The true larks are of the family Alaudidæ, of which the skylark of the Old World (*Alauda arvensis*) is the typical spirit. This most interesting bird is a great favorite, from its sweet song, which it sends forth while soaring

aloft in clear weather. It is a fine cage-bird, and is now to some extent naturalized in the U. S. by the laudable efforts of the acclimatization societies. Europe has several other species of *Alauda*. The horned skylark (*Eremophila cornuta*) is one of the most familiar birds of the great Western plains of the U. S. The shorelark (*Otocoris alpestris*) is a very sweet singer. The well-known meadow-lark of the U. S. (*Sturnella magna*) is of the oriole family. There are two varieties, the eastern and the western, which differ entirely in their song.

Larkha'na, town of British India, in the presidency of Bombay, in the district of Sinde, 7 miles W. of the Indus. It is fortified, has a large trade in grain, and manufactures of cotton and silk goods. Pop. 9000.

Lark'insburg, post-v. and tp. of Clay co., Ill., on the Springfield and Illinois South-eastern R. R. Pop. 976.

Lark'insville, post-v. and tp. of Jackson co., Ala., on the Memphis and Charleston R. R. Pop. 2098.

Lark'spur, a popular name of the herbs of the genus *Delphinium* (order Ranunculaceæ), which are found in the cool regions of both continents. The U. S. have eight or ten native species, and Europe as many. They are poisonous herbs, and have a limited use in medicine. Several of these, with some Asiatic species, are favorite garden flowers.

Lar'ned, post-v., cap. of Pawnee co., Kan., on the Atchison Topeka and Santa Fé R. R. and the Arkansas River, is the station for Fort Larned. It has 1 weekly newspaper. Pop. about 300.

Larned (Benjamin F.), b. in Massachusetts in 1791; entered the U. S. army as ensign of the 21st Infantry in Oct., 1813; served with distinction throughout the war, and for gallant conduct in the defence of Fort Erie, where he commanded a company, was brevetted captain; retained as regimental paymaster on the reduction of the army in 1815; during the Mexican war was made deputy paymaster-general, and on the death of Gen. Towson succeeded him in 1854 as paymaster-general of the army, with the rank of colonel; from that date until his death discharged the responsible duties of his office with rare integrity. The outbreak of civil war largely increased his labors, and called for a reorganization of his department, which he thoroughly accomplished, but at the expense of his life, for his overtasked powers gave way, and he d. at his residence in Washington, D. C., Sept. 6, 1862.

Larned (Simon), b. in 1754 at Thompson, Conn.; was a Revolutionary officer who settled at Pittsfield, Mass., in 1784. He was a member of Congress 1804–05; colonel 9th U. S. Infantry 1812–15, and afterwards sheriff of Berkshire co., Mass. D. at Pittsfield Nov. 9, 1817.

Larned (Sylvester), son of Col. Simon Larned, b. at Pittsfield, Mass., Aug. 31, 1796; graduated in 1813 at Middlebury College; studied theology at Princeton, and in 1817 was ordained to the Presbyterian ministry. He went to New Orleans, where he was distinguished for the rare eloquence and power of his preaching. D. of yellow fever Aug. 31, 1820. (See his *Life and Sermons*, by R. R. Gurley, 1844.)

Larned (William Augustus), A. M., b. in Thompson, Conn., June 23, 1806; graduated at Yale 1826; taught in Salisbury, N. C., 1826–28; tutor and theological student at Yale 1828–31; was ordained 1834–35 pastor of a Congregational church at Millbury, Mass.; was instructor in Hebrew and Greek in a theological school at Troy, N. Y., 1835–37; professor of rhetoric and English literature in Yale College 1839–62. D. at New Haven, Conn., Feb. 3, 1862. Prepared an edition of Demosthenes *On the Crown*; editor of the *New Englander* 1854–55.

Lar'nica, town on the southern shore of the island of Cyprus, Turkey, in a fertile but very unhealthy plain. It has no harbor, but a good roadstead, and carries on an extensive trade, exporting silk, wool, and oil, and importing iron, paper, and colonial products. It is annually visited by 600 or 700 vessels of 50,000 tons burden. Pop. about 10,000.

La Rochefoucauld', de (François), Duke, prince of Marsillac, b. at Paris Dec. 15, 1613; received a military education, and served for some time in the army, but the element in which he felt perfectly at home was the court intrigue. While yet a young man he took an active part in the contest between Anne of Austria and Richelieu, which ended with his banishment from Paris. On the death of the cardinal in 1642, he immediately returned to the court, but being poorly rewarded by the queen, he sought an alliance with the leaders of the Fronde; and in order to acquire influence and become of importance he established and carried through a love-intrigue with Madame de Longueville, a sister of the prince of Condé. This time too, however, his political enterprises brought him nothing but trouble, and after 1660 he gave up all ambitious plans and lived solely for literature and social enjoyment in intimate intercourse with Mesdames de Sablé and Sevigné, and with Boileau, Racine, and others. In 1662 appeared his *Mémoires*, and in 1665 his *Réflexions*. The latter made a great sensation, as well on account of its elegant style and acute observations—for which reasons it is still considered a classical work in France—as on account of its philosophy, by which the difference between virtue and vice is reduced to a mere conventionality, and egotism is established as the principal if not the only spring in the human will. D. at Paris, Mar. 17, 1680.—Another member of the same family, François Alexandre Frédéric de la Rochefoucauld-Liancourt, b. at Paris Jan. 11, 1747; lived mostly on his estate of Liancourt; was president of the National Assembly in 1789; emigrated in 1792; lived in England and the U. S.; returned to France in 1799; was much in public life under the Restoration as an advocate of liberal measures, and d. at Paris Mar. 27, 1827. He was a very voluminous writer on different social topics, but his name is best known as that of a great practical philanthropist. He established the first model-farm in France, introduced vaccination, founded at Liancourt a school for industry and art, which developed into the celebrated École des Arts et Métiers of Châlons, brought the method of mutual instruction into use, and established the first savings bank in France.

La Rochejacquelein', de (Henri du Verger), Count, b. Aug., 1772, at the château of La Durbellière, in Vendée; did not emigrate when the Revolution broke out, but joined Lescure, became for a short time the distinguished leader in the first Vendean War (which see), and was killed Mar. 4, 1794, at the battle of Nouaillé, near Chollet. La Rochejacquelein is the noblest personification of those royalists who thought sincerely that only the return of France to the legitimist monarchy could give the country peace and happiness. He was a reactionary La Fayette, and when he was chosen as general-in-chief of the Vendéans, he said to his soldiers, "If I fall back, kill me; if I go forward, follow me; if I die, avenge me!" He took part in all the early battles fought in Vendée against the republicans, and after he had been chosen chief of all the royalist armies he defeated twice the army of the National Convention around Autrain, and occupied Le Mans, La Flêche, Laval, and other cities.—His nephew, Henri de la Rochejacquelein, the latest celebrated representative of that historical family, gave up its ultra-legitimist opinions, rallied to the imperial régime, was made a senator by Napoleon III., and d. in 1867. Félix Aucaigne.

La Rose, post-v. of Marshall co., Ill., on the western division of the Chicago and Alton R. R., has 1 weekly newspaper.

Larousse' (Pierre), b. in 1816 at Toucy, department of Yonne; began to be known as partner of Boyer, a celebrated Paris publisher of books for primary education. Many of these books are used now in French schools, and were written by Larousse himself. In 1863 he conceived the idea of his universal dictionary (*Dictionnaire du XIXe siècle*), and set at work surrounding himself with the best writers. The work was published by subscription, and had an immense success, though it slowly appeared periodically in small *fascicules* in a pamphlet form of about fifty pages each. Larousse exhausted his strength in this stupendous work, and he d. Jan., 1875, leaving his encyclopædia at the letter M. He was a moderate but strongly-convinced republican. Félix Aucaigne.

Lar'ra, de (Mariano José), b. at Madrid, Spain, Mar. 24, 1809; known under the pseudonym of "Figaro" as the most popular modern satirist, dramatist, and critic of his country, after a short career abounding in tumultuous adventure, d. by his own hand at Madrid Feb. 13, 1837. His works have been many times reprinted in Spain, Mexico, and South America.

Lar'rabee, tp. of Waupacca co., Wis. Pop. 362.

Larramen'di, de (Manuel), b. in Biscay about 1690; was a Jesuit, and became the principal authority upon his native language, the Basque, of which he prepared a grammar and dictionary, and maintained it to have formerly been universal in Spain. The titles of his works are *El Imposible Vencido* (1719), *Antiguedad y Universalidad del Bascuence en España* (1728), *Diccionario trilingue del Castellano, Bascuence y Latin* (1745). D. in Biscay about 1750.

Larrey' (Dominique Jean), Baron, a famous military surgeon, b. at Baudéan, Hautes Pyrenées, in July, 1766; studied surgery with his uncle, Oscar Larrey, a successful surgeon of Toulouse, under whose care the baron's elder brother, Charles François Hilaire Larrey, M. D. (1774–1819), an able surgeon and writer, was also trained. The younger Larrey went in 1787 to Paris; entered the navy;

returned to Paris; studied under Dessault and Sabatier; joined the army in 1792; invented the *ambulance volante* 1793, and was made surgeon-in-chief; served in Egypt, Germany, Spain, everywhere displaying the grandest courage and perfect devotion to the comfort and health of the troops, and especially to the wounded, whether friends or enemies; was made a baron on the field of Wagram 1809; was wounded at Austerlitz and Waterloo; made countless and exceedingly important improvements in operative and clinical surgery, and made important observations in general medicine. D. of pneumonia at Lyons July 25, 1842.

Larrey (FÉLIX HIPPOLYTE) M. D., BARON, son of the great Baron Larrey, b. Sept. 18, 1808; entered the army, and in 1832 received his degree at Paris; became professor of pathology at Val de Grâce 1841; became sanitary inspector of the army 1858; was chief surgeon in the Italian campaign 1859, and the author of several medical and surgical books and of many professional papers.

Lartet′ (ÉDOUARD), b. at St. Guérand, France, in 1801; has been one of the most distinguished promoters in France of researches in fossil palæontology and pre-historic anthropology, having been for many years professor of the former science in the Museum of Natural History at Paris. Among his numerous discoveries may be mentioned the mammalian remains in the Miocene deposits of Gers (1837), including entire skeletons of *Mastodon angustidens*, and affording the first proof of the existence of fossil monkeys in Europe. Subsequently he worked with Gaudry in developing the palæontological results of excavations in the Miocene beds of Pitermi, and aided Christy in exploring the caves of Périgord, as well as in the publication of the results in the *Reliquiæ Aquitanicæ* (1867–71), a work on the pre-historic ethnology of Périgord.

Larue′, county of Central Kentucky, bounded N. E. by Salt River. It is undulating and fertile. Cattle, tobacco, and grain are staple products. Area, 400 square miles. Cap. Hodgensville. Pop. 8235.

Larue, post-v. of Montgomery tp., Marion co., O., 13 miles W. of Marion, on the Scioto River and Cleveland Columbus Cincinnati and Indianapolis R. R., has 1 weekly newspaper, 2 hotels, flouring and saw mills, a factory, a union school, various stores and warehouses. Principal business, farming and lumbering.

J. A. MOUSER, M. D., FOR ED. "LARUE CITIZEN."

Lar′va [Lat. for "mask," so called because it was once believed to conceal a perfect insect], in the life of most insects and of many inferior invertebrate animals the condition or stage of development which follows the hatching of the egg, and which in most insects is succeeded by the pupa or chrysalis state. The larvæ of flies (Diptera) are called maggots; those of coleopterous insects are grubs; those of moths and other Lepidoptera are caterpillars. A *scolex* (plu. *scolices*) is the larval condition of a trematode worm. There is really no one stage of development in the larval state, for it is usually one of most active progress. In some cases another condition, the semi-pupa, precedes the pupa form into which the larva is changed.

Lar′will, post-v. of Whitley co., Ind., on the Pittsburg Fort Wayne and Chicago R. R.

Laryngi′tis [from Gr. λάρυγξ, "larynx"], an inflammation of the mucous membrane lining the larynx. It may first be divided into acute and chronic varieties, and the chronic subdivided into simple chronic catarrh of the larynx, laryngeal phthisis, and syphilitic laryngitis. The first of these, acute laryngitis, generally commences as an inflammation of the pharynx, which is afterwards communicated to the larynx, although it does occur independently in the larynx itself. The cause is generally "a cold," or exposure to sudden changes of temperature, or it may be traumatic; and the symptoms consist of hoarseness, a sensation of tickling and dryness in the throat, and more or less cough and expectoration. With ordinary care it subsides in a couple of days without any medical interference, or at most a warm bath followed by gentle diaphoresis. In very severe cases inhalations of infusion of hops may be used every two or three hours with decided advantage, but we should be very wary about making astringent local applications with a sponge or brush. Simple chronic catarrh of the larynx is usually a sequela of the acute form, or arises by extension of a similar inflammation of the pharynx and posterior nares. The symptoms are somewhat similar to those of the acute form, though not as well marked, and in addition there is an almost constant hawking and hemming kept up by the patient to clear his throat from the continually accumulating mucus. In the treatment of this, as in that of all inflammations, the first indication is to remove all irritation, and the patient should be cautioned against swallowing large masses of food at a time, or, what is a very common practice in this country, partaking of very warm dishes, followed by large draughts of ice-water. All the food taken should be of equable medium temperature, neither too hot nor too cold, and the inhalation of hot and cold air and noxious vapors, dust, etc. should be avoided as much as possible. Besides all this, the general health should be by no means neglected, and local medication seems to be very beneficial. Standard solutions of nitrate of silver, sulphate of copper, perchloride of iron, iodine, etc. are those most commonly used; they seem to produce a better result when changed from time to time, and the application should be made by means of a camel's-hair brush from twice to five or six times weekly.

Laryngeal phthisis occurs in connection with pulmonary phthisis; the symptoms differ little from those of an ordinary laryngitis, but upon examination the cartilages are found thickened, and often there is ulceration affecting both them and the cords. Syphilitic laryngitis exists as a manifestation of that dire affection, syphilis. It is principally from the previous history of the case and an exploration of the chest that we differentiate it from laryngeal phthisis. Sometimes the destruction of tissue is appalling. In the latter two varieties the chief reliance must be placed on the constitutional treatment of the disease of which they are but symptoms; but still, local medication should not be ignored. In ulcerative laryngitis, from whatever cause, powdered iodoform seems to have the most beneficial effect.

EDWARD J. BERMINGHAM.

Laryn′goscope [Gr. λάρυγξ, "larynx," and σκοπεῖν, to "examine"], an instrument proposed, and in part introduced, by Mr. Liston, and employed by other eminent surgeons of his time; but greatly improved and first systematically used by the late Prof. Czermak. It is employed for examining the condition of the diseased larynx, and also for observing the action of the vocal cords during phonation. It consists of two mirrors; the larger one, concave, throws light upon the smaller, which is held in the throat of the patient and illuminates the interior of the larynx, at the same time presenting a reversed image of the glottis, vocal cords, and surrounding parts. The laryngoscope is of great value in treating local diseases of the throat.

Lar′ynx [Gr. λάρυγξ], the organ of voice, situated at the upper part of the windpipe. The lower part of it is cylindrical, and scarcely wider than the windpipe, but above it widens out and forms a triangular-shaped box, which is attached to the hyoid bone by various muscles. It is situated in front of the œsophagus, and immediately beneath the integument on the front of the neck, where it forms a projection known as the *pomum Adami*, which is very prominent in males. The larynx is composed of various cartilages, nine in number, the most important of which are the thyroid, cricoid, two arytenoid, and the epiglottis. It is moved by a number of muscles, and lined with mucous membrane, which in places is thrown into duplicatures or folds, constituting the ary-epiglottic folds, the ventricular bands, and the vocal cords.

The function of the larynx is twofold—the production of the voice, and protection to the lungs and bronchi during respiration. The manner in which the voice is produced is as follows: The vocal cords, which are stretched across the laryngeal tube, are relaxed when the voice is at rest, but as soon as there is a desire to produce a sound, they are put on the stretch, and approximated by certain muscles connected with the larynx, and at the same time the air is driven forcibly through them from the lungs. The quality of the sound is regulated by the degree of tension and approximation of the cords, and the force with which the column of air is driven through the aperture. This has nothing to do with articulation, which is produced by the lips and tongue. The movements of the larynx during respiration are as follows: At each inspiration the vocal cords are separated and the larynx freely opened, but in expiration it is partially closed by the relaxation of the vocal cords. The larynx further protects the lungs from the invasion of any foreign body. We are all acquainted with the violent coughing produced by a crumb of bread which has been drawn in by a sudden inspiration. The larnyx is subject to many affections, the most common of which are laryngitis, or inflammation of its lining membrane; paralysis of some of its muscles; growths on the cords; ulcerative and laryngeal phthisis.

EDWARD J. BERMINGHAM.

La Salle, county of N. Central Illinois. Area, 1040 square miles. It is level and very fertile. Cattle, grain, wool, and hay are largely produced. Bituminous coal and sandstone are obtained extensively. Carriages, harnesses, and flour are the chief manufactures. The county is traversed by the Illinois and Fox rivers and by numerous railroads. Cap. Ottawa. Pop. 60,792.

La Salle, county of S. W. Texas. Area, 1470 square miles. It consists of extensive and rather dry undulating prairies, watered by the Frio and Nueces and their branches. It is a great stock-range, where cattle and sheep are pastured. Pop. 69.

La Salle, city and tp., cap. of La Salle co., Ill., on the N. bank of the Illinois River, at the intersection of the Illinois Central R. R. with the Chicago Rock Island and Pacific R. R., 99 miles S. W. of Chicago and 1 mile E. of Peru. It is situated at the head of navigation on the Illinois, and is connected with Chicago by the Illinois and Michigan Canal. The adjoining city of Peru is practically a suburb of La Salle, which will undoubtedly soon absorb it in the same municipal organization. Zinc-smelting establishments, four in number, one being the largest in the country, form an important feature of business; a glass-factory is in successful operation; hydraulic cement is produced upon an extensive scale; and 200,000 tons of ice are annually sent down the river to a Southern market. It has gasworks, and a street railroad connecting La Salle with Peru was completed in 1874. The canal connection between the Mississippi and the great lakes has recently been greatly improved in the vicinity of La Salle. There is a good supply of bituminous coal within the city limits, and the place offers great inducements to manufacturers. There are 3 weekly newspapers. Pop. of city, 5200; of tp. 5452.
R. C. STEVENS.

La Salle, post-v. and tp. of Monroe co., Mich., on the Michigan Southern R. R. (Detroit division). Pop. 1392.

La Salle, de (JEAN BAPTISTE), D. D., b. at Rheims, France, Apr. 30, 1651; became a cathedral canon at Rheims when seventeen years old; received the doctorate after studying at the Sulpitian school, Paris; became a priest 1671; devoted himself to the instruction of the poor; founded the Brothers of the Christian Schools, an order which received papal approval in 1725. D. Apr. 7, 1719. Numerous miracles are credited to him, and in 1840 he was declared "Venerable" by Gregory XVI.

La Salle (RENÉ ROBERT CAVELIER), SIEUR DE, b. at Rouen, France, in 1643; became a Jesuit, but, renouncing his profession, embarked for Canada in 1666; became a fur-trader; in 1669 set out to find the N. W. passage by way of the great lakes; explored Lake Ontario, and in 1671 discovered the Ohio; went to France in 1674; was ennobled and received important grants in Canada. Returning in 1678 from another voyage to France, he explored the great lakes, and attempted to colonize their shores; descended the Illinois and the Mississippi, reaching the Gulf of Mexico Apr. 9, 1682, and named the region Louisiana. In 1683 he went to France, and, having received a commission, endeavored in 1684 to plant a colony in Louisiana, but the voyage was disturbed by dissensions, and he landed in Mar., 1685, in Matagorda Bay, Tex., and built a fort. His followers were much reduced in numbers, and having decided to go by land to Canada, he was murdered by his own men on the banks of a branch of Trinity River, Mar. 19, 1687.

Las An'imas, county of S. E. Colorado, extending W. to the Rocky Mountains. Area, 7000 square miles. The W. part is mountainous, the E. part a grassy plain. The Cimarron and Purgatory are the principal rivers. The county contains coal, iron, gypsum, fireclay, marble, and considerable timber. It has good grazing and farm lands. Grain and wool are staple products. Pop. 4276.

Las Animas (WEST), post-tp. and cap. of Bent co., Col., situated on Arkansas River at its crossing by the Arkansas Valley branch of the Kansas Pacific R. R., 2 miles above the mouth of Las Animas River; it was laid out in 1873; has a newspaper and all the usual accessories of a rising town. It is the government freighting-point for New Mexico, and has a large cattle-trade. Pop. 500.
CHARLES W. BOWMAN, ED. "LEADER."

Las'car [Hind. *lashkar*, an "army"], properly, an East Indian camp-follower, but the name is now applied in the East Indies to boatmen, sailors, and other low-caste menials. The lascars are able seamen, but cruel and treacherous. There is a company of gun-lascars at Hong-Kong in the British colonial service. They are Malays, and number 176 men.

Las'caris, the name of two celebrated Greek grammarians who took refuge in Western Europe after the final overthrow of the Greek empire by the Turks, and contributed very much to the introduction of the study of the Greek language, literature, and philosophy into Italy and France. ANDREAS JOANNES, b. about 1445, at Rhyndacus in Phrygia, whence he received the surname RHYNDACENUS. He lived in Italy and France at the courts of Lorenzo de' Medici, for whom he published his celebrated *Anthologia Græca;* of Louis XII., who used him in several diplomatic missions; and of Leo X. and Paul III. D. in Rome in 1535.—Of the life of CONSTANTINE LASCARIS very little is known. He lived mostly at the court of Francesco Sforza in Milan, where he wrote his famous *Grammatica Græca*, but he also taught in Florence and Naples. D. in 1493.

Las Casas, de (BARTOLOMÉ). See CASAS.

Las Cases, de (EMMANUEL AUGUSTIN DIEUDONNÉ MARIE JOSEPH), MARQUIS, b. at Las Cases, in Languedoc, in 1766; entered the navy; emigrated in 1791; served for some time in the army of the prince of Condé; lived later on in London, where he published his *Atlas historique* (1803); returned in 1805 to France; held several offices in the civil and military service during the empire, and accompanied Napoleon to St. Helena in 1815. A letter he wrote to Lucien Bonaparte (Nov. 27, 1816), and in which he spoke freely of the manner in which Napoleon was treated, caused him to be arrested and transferred to the Cape of Good Hope. After thirteen months' imprisonment he was liberated; resided in Belgium, and returned after the death of Napoleon to France, where, in 1824, he published his *Mémorial de Ste. Hélène*, containing a record of the remarks which Napoleon had made to him in their conversations. D. May 15, 1842.

Las Cru'ces, post-v. of Doña Aña co., N. M., on the Rio Grande, 3 miles above Mesilla. It has 2 weekly newspapers.

La Sieur, tp. of New Madrid co., Mo. Pop. 2004.

Las'ker (EDWARD), b. Oct. 14, 1829, at Jarocin, in the Prussian province of Posen; studied jurisprudence and mathematics; spent three years in England studying English constitution and law; and received in 1856 an office in the Prussian government. His creed, however, and his constitutional views, which he set forth in several excellent papers, prevented him from advancing in the service; in 1870 he was appointed an attorney-at-law in Berlin. Since 1865, in which year he was elected a member from Berlin to the Prussian house of deputies, Lasker has devoted himself with great energy and steadily increasing influence to his parliamentary career, regardless of his practice as an attorney and of other personal interests. Until 1868 he represented in the house of deputies a district of Berlin, and then Magdeburg; in the North German and in the German diet he represented first a district of Berlin, and then one of Saxe-Meiningen. At first, his political conviction allied him with the progressive party, but when it became evident that Bismarck's policy aimed at the establishment of a united Germany, Lasker became one of the founders of the national liberal party, which still has the majority in the Parliament. In the internal development of the empire he always stands for that which is right, for the strict fulfilment and judicious development of the law; and in pursuing this aim he pays regard to none, to no powerful party, to no powerful person, not even to the government itself, with which he agrees in other questions; as, for instance, with respect to foreign policy. On all important laws of a more recent date, especially on those concerning trade and traffic, usury, imprisonment for debt, loans with premiums, etc., he has exercised a decisive influence. What has made him most popular, however, was his attack on the ministry of commerce (Feb., 1873); he attacked directly one of the highest officials in the ministry of state, and several princes. AUGUST NIEMANN.

Las Pal'mas, town on the north-eastern coast of Gran Canaria, one of the Canary Islands. It is beautifully situated at the feet of lofty hills, with a spacious and good harbor. It is also well built, with a fine old cathedral and many beautiful promenades. It has some manufactures of glass, leather, woollens, and hats. Pop. 11,400.

Las Pi'las, an extinct volcano in Nicaragua, forming one of the chain called Los Marrabios, extending across the plain of Leon. Nearly at its foot a new volcanic cone several hundred feet high was formed in 1850 by an eruption which lasted a month.

Las'sa, Lhassa, or **H'Lassa,** the capital of Thibet, situated in lat. 29° 30′ N. and lon. 91° 40′ E., on a plain 9500 feet above the sea and encircled by lofty mountains. It is a very lively and well-built town, with a population estimated at 50,000, and an extensive trade in precious stones, gold, velvet, silk, and cashmere. Its principal importance, however, it derives from the Booddha-la, a temple, with adjoining palaces, monasteries, and schools, situated on the top of a hill close by the city, with which it is connected by a magnificent road. The Booddha-la, or "mountain of Booddha," is the residence of the Dalai Lama, the pope of Booddhism. Thousands of pilgrims come annually to visit it; hundreds of them stay there to complete their theological and philosophical education; and all of them leave behind them a present to the Dalai Lama. The temple and palace, which cover many acres of land, glitter with

golden domes and minarets and columns, and it is said that few places on earth contain such enormous treasures of gold and precious stones as the Booddhala. But foreigners—that is, all who are not Booddhists—are forbidden to enter not only the Booddhala, but also the city.

Las'sen, county of N. California, bounded E. by Nevada. Area, 4432 square miles. It consists of arable valleys, dry sage plains, alkali flats, and rough mountains. The greater part has its drainage into lakes with no outlet. Grain and live-stock are the chief products. Cap. Susanville. Pop. 1327.

Lassen, tp. of Tehama co., Cal. Pop. 240.

Lassen (CHRISTIAN), b. at Bergen, in Norway, Oct. 22, 1800; studied at Christiania, Heidelberg, Bonn, Paris, and London; attracted great attention by his *Essai sur le Palí*, written in connection with Burnouf (Paris, 1826), and his edition of *Hitopadesa*, a collection of Indian fables, made in connection with A. W. Schlegel (Bonn, 1829); and became professor in Indian languages at the University of Bonn in 1830. By his critical editions of *Institutiones linguæ Pracriticæ* (1837), *Anthologia Sanscrita* (1838), etc., and by his numerous linguistic, archæological, and historical writings he became the founder of the study of Indian language, literature, and history in Europe. His principal work is his *Indische Alterthumskunde* (4 vols., Bonn, 1844–62).

Lassen's Peak, in the Sierra Nevada, Shasta co., Cal., rises 10,571 feet above the sea.

Las'sile, tp. of Union co., Ark. Pop. 782.

Las'so [Sp. *lazo*, kindred to the word *lace*], or **Lariat'** [Sp. *la riata*], a long thong of ox-hide or rope of horse-hair used by Spanish-American herdsmen and hunters for catching cattle, horses, or game. A running noose at the end is dexterously cast over the neck or legs of the beast, the other end of the lasso being fastened to the saddle, from which the lasso is thrown.

L'Assomption', county of Quebec, Canada, bounded on the S. by the St. Lawrence. It lies directly N. of Montreal. Cap. L'Assomption. Pop. 15,473.

L'Assomption, post-v. of L'Assomption co., Quebec, Canada, on L'Assomption River, is the seat of a college and convent. Pop. 1210.

Las'tra a Sign'a, town of Italy, in the province of Florence, on the left bank of the Arno, about 8 miles S. W. of the city of Florence. It is well built, and was a fortified town under the Florentine republic. Pop. in 1847, 10,276.

La'sus [Λᾶσος], son of Chabrinus or (according to Schneidewin) Charminus, a Greek dithyrambic poet and hymn-writer of Hermione in Argolis, flourished about 510 B. C. He was a contemporary and rival of Simonides, and the reputed teacher of Pindar. Of all his poems, only a fragment of a hymn to Demeter remains, which is given in Bergk's *Poetæ Lyrici Græci*. H. DRISLER.

Las Ve'gas, post-v., cap. of San Miguel co., N. M., 70 miles E. of Santa Fé, on the Pecos River, has 2 churches, 2 weekly newspapers, 2 hotels, a public school, 2 denominational schools, a door and sash factory, mineral hot springs, and a large number of stores. Within a few miles are 6 grist-mills and 8 saw-mills. The Atchison Topeka and Santa Fé R. R. will, when completed, pass a few miles to the N. of Las Vegas. Cattle-raising and farming are the chief industries. Pop. about 1500.

LOUIS HOMMEL, ED. "GAZETTE."

Lataki'ah, or **Ladiki'yeh,** the ancient LAODICEA AD MARE (which see), town of Asiatic Turkey, in the province of Syria, on the Mediterranean. It has many mosques, among which are several beautiful ones, and a considerable trade with Egypt, especially in tobacco; yet it bears a general aspect of dilapidation and downfall. Pop. 10,000.

Lateen' Sail [It. *latina*, "large or broad"], a triangular sail, used mostly upon small vessels in the Mediterranean. The anterior and superior edge is fastened to a long yard which is crossed at about one-third of its length by a short mast. The yard inclines about 45° to the horizon.

Latent Heat. See HEAT, by PROF. W. P. TROWBRIDGE, A. M.

Lateral Pressure of Liquids. See HYDRODYNAMICS and HYDROSTATICS, by J. P. FRIZELL, C. E.

Lat'eran is the name of a place in Rome occupying the site of the estates of the ancient Roman family *Lateranus*. The two principal buildings situated in the place are the church of S. Giovanni and the palace. The old Lateran palace became imperial property under Nero, who put Plautius Lateranus to death and confiscated his estates. Constantine the Great presented it to the pope, and it was the pontifical residence until in 1309 the Holy See was transferred to Avignon. On the return of Gregory XI. to Rome in 1377, he took up his residence in the Vatican. Having been burnt down under the reign of Clement X., the Lateran palace was rebuilt in 1558 under Sixtus V., but it remained unoccupied until Innocent XII. in 1693 made it an orphan asylum. In 1843, Gregory XVI. established here the Museum Gregorianum Lateranense for antiquities, the Vatican and Capitoline museums affording no more space. The church, S. Giovanni in Laterano, was founded by Constantine the Great, overthrown by an earthquake in 896, rebuilt by Sergius III. 904–11, burnt down in 1308, restored by Clement V., and subsequently much altered and modernized by Martin V., 1430, Pius IV., 1560, Borromini, 1650, and Galileo, 1734. For centuries it was the principal church in Christendom—*Omnium urbis et orbis ecclesiarum mater et caput*. Five great œcumenical councils were held in its vaults. The popes are still crowned here, and from the balcony of its front façade the Holy Father blesses the people on Ascension Day.

Lat'eran Coun'cils—thus called because they were held in the church of St. John Lateran in Rome—comprise, besides six minor, five great œcumenical councils—namely, (1) that convened by Calixtus II., and opened Mar. 18, 1123, by which the long strife between the popes and the German emperors concerning investiture was ended on the following terms: "The emperor surrenders to God, to Sts. Peter and Paul, and to the Catholic Church all right of investiture by ring and staff. . . . The pope agrees that the election of German prelates shall be had in the presence of the emperor, provided it is without violence or simony." (2) That convened by Innocent II., and opened Apr. 20, 1139, by which the anti-pope, Anacletus II., and all who had received office under him, were deposed. (3) That convened by Alexander III., and opened Mar. 2, 1179, by which it was established that henceforth "the election of the popes shall be confined to the college of cardinals, and two-thirds of the votes shall be required to make a lawful election, instead of a majority only, as heretofore." (4) That convened by Innocent III., and opened Nov. 11, 1215, by which a crusade was determined upon for the liberation of Palestine from the infidels, the heresy of the Waldenses was condemned, and the doctrine of transubstantiation established as an article of faith. (5) That convened by Julius II., and opened May 3, 1512, by which the acts of the Council of Pisa were annulled, and the concordat concluded in 1516 between Francis I. and Leo X., who succeeded Julius II., and closed the council in 1517, was substituted for the Pragmatic Sanction of Bourges.

Later'za [Lat. *Fratuertium*], town of S. Italy, in the province of Lecce, about 35 miles S. W. of Taranto. Pop. in 1874, 5318.

La'tes [properly *lato* or *latus*, Gr. λάτος], a genus of large Percidæ, of which is *Lates niloticus*, the famous fish from which Latopolis in Egypt took its name. This fish is the largest in that stream. It is three feet long and of fine flavor. *L. nobilis* is an excellent food-fish of the tidal parts of the Ganges.

La'tex [Lat. for "juice"], the thick, milky juice of certain plants, as the milk-weed, celandine, etc. It is distinct from the true sap, and is contained in a set of tubes called "laticiferous vessels." Many important products, such as opium and caoutchouc, are the dried latex of some one or more species of plants. In some plants the latex exhibits the phenomenon called cyclosis.

Lath, a thin strip of board used to nail upon the uprights of house-walls. Upon the laths the plaster is laid by the trowel. Laths are now sawed out complete by machinery. Formerly, a wide and thin board was split into laths. Laths are generally made of small sticks; any kind of wood which will not warp will serve for laths.

La'tham (JOHN), b. at Eltham, Kent, England, June 27, 1740; studied medicine and natural history; established himself in 1763 as a physician at Dartford; aided Sir A. Lever in forming his museum, and was one of the founders of the Royal Society and of the Linnæan Society. Besides papers on medicine and natural history, he was the author of a *General Synopsis of Birds* (8 vols., 1781–1801) and of an *Index Ornithologicus* (1791), both which were combined in a new edition under the title *A General History of Birds* (10 vols., 1821–24). D. at Romsey Feb. 4, 1837.

Latham (MILTON S.), b. at Columbus, O., May 23, 1827; graduated at Jefferson College, Pa., in 1845; became a lawyer of Alabama, and was clerk of the courts in Russell co. 1848–50; clerk of the recorder's court, San Francisco, Cal.; a district attorney 1850–51; a member of Congress from California 1853–55; collector of the port of San

Francisco 1855–57; governor of California 1860; U. S. Senator 1861–67.

Latham (Robert Gordon), M. D., F. R. S., b. at Billingsborough, Lincolnshire, Eng.; was educated at Eton and Cambridge, where he became a fellow of King's College and received degrees in arts and in medicine; became a lecturer at Middlesex Hospital; published *Norway and the Norwegians* (1834); translations from the Swedish, etc.; became in 1841 professor of English literature in University College, London; published a work on *The English Language* (1841), a series of English grammars (1843–50), *History of the English Language* (1849), *Handbook of the English Language* (1851), a translation of Sydenham's *Works* (1848–49), *Natural History of Man* (1850), *Man and his Migrations* (1851), a series of works on ethnology (1850–59), *Comparative Philology* (1862), a thoroughly revised edition of Johnson's *Dictionary*, in 36 numbers (1857–70), and other works.

Lathe [Fr. *tour;* Ger. *Drehbank*], a machine for shaping materials by the process called turning. It has a great variety of forms, as the "foot-lathe," the "engine-lathe," the "lathe for turning irregular forms," or as classified by reference to the art to which the tool is peculiarly adapted. In the lathe the material to be shaped is sustained by two "centres," between which it is given a motion of revolution, while a turning-tool, held by the hand of the workman or by a tool-holder attached to and moved by a "slide-rest," cuts away the exterior, and gives the mass the shape required in the finished piece.

The lathe was known in very early times. Its invention is claimed by Diodorus Siculus for Talus, the grandson of Dædalus; Pliny ascribes it to Theodore of Samos (740 B. C.), and states that Phidias and Pericles were very expert in its use. Cicero called the workmen using the lathe "*vascularii.*" Phidias is supposed to have been the first to adapt the machine to turning wood. It had previously been used in turning vases and other forms in clay; and the potter's wheel, which is a kind of lathe, was in use among the ancients. It is mentioned in the Bible as used by the Hebrews. Very rude lathes were used in Europe at a period which antedates history, and they are still met with in some parts of the country. Turned objects in wood were exhibited at the international exhibition at Vienna in 1873, made by the peasantry of Galicia, among the Carpathian forests, on these old lathes. Fig. 1 represents this tool. The workman goes into the forest, selects two trees growing side by side, and close by a young maple or beech. Two maple cones inserted in the trees serve as centres, and the block to be turned is fixed between them, the end being first trimmed to cylindrical shape to take the "bight" of the rope, one end of which is attached to the end of the sapling, and the other to the treadle seen below. The crossbar, *d*, is a rest to support the turning-tool. The treadle being worked by the foot, the piece revolves, and the turning is readily performed.

Fig. 1.

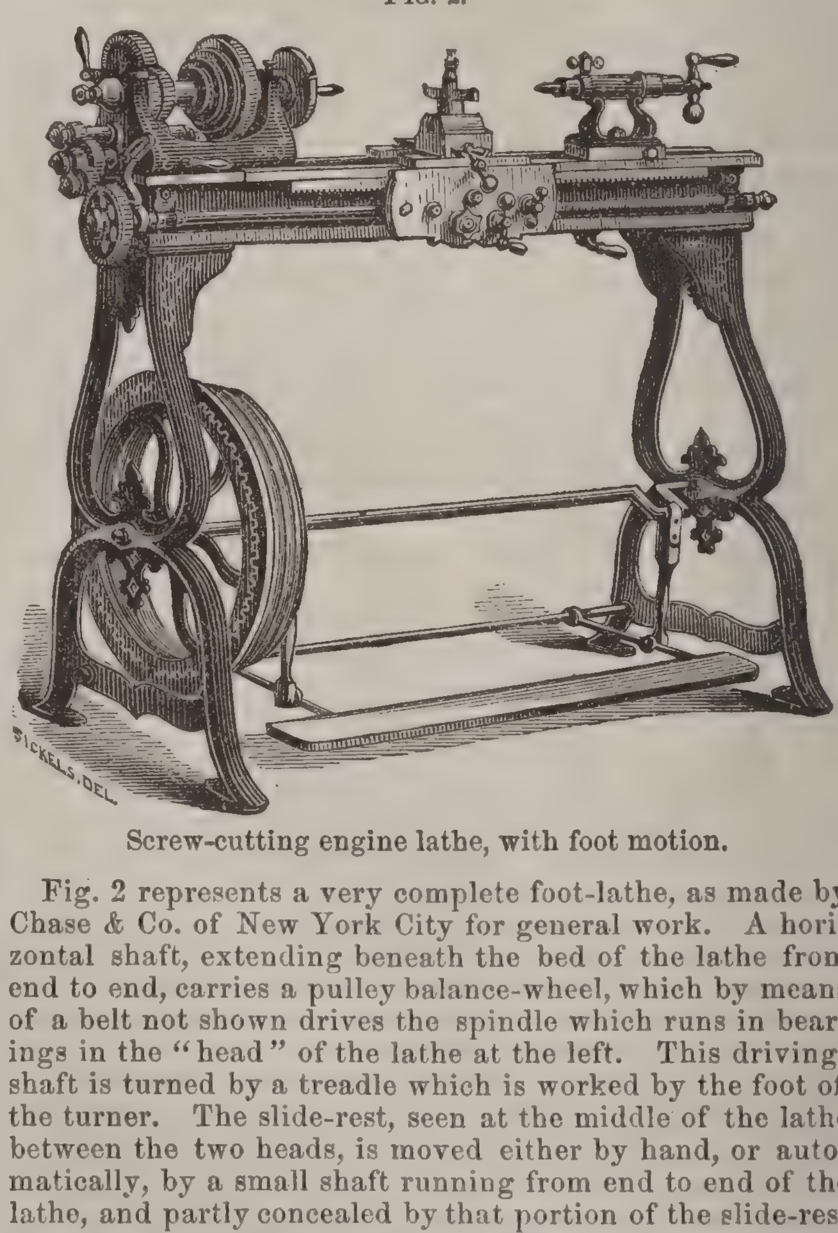
Lathes were adapted to other than cylindrical forms of revolution in comparatively modern times. Leonardo da Vinci, Jacques Besson, Salomon de Caus, and Jerome Cardan produced modifications and improvements, having for their object the production of oval and other geometrical figures. The engine-lathe, with its slide-rest, was the invention of Joseph Bramah, an English mechanic, in 1794. The lathe for turning irregular forms was invented by an ingenious American mechanic, Thomas Blanchard, about 1820, and was by him applied to turning gun-stocks and shoe-lasts.

The metal-worker's engine-lathe has been variously modified by many inventors. The most efficient and perfect machines of this class are built by the leading manufacturers of machine tools in the U. S. This is the most generally useful and most indispensable tool of the whole collection of the metal-worker, and it is hardly less important in wood-working.

The art of turning is often made an independent industry. It employs large numbers of workmen, and some of the finest illustrations of manual dexterity and of artistic skill are produced by the use of this tool. (See Turning.) The lathe is usually so constructed that the work may be placed between two conical pointed "centres," one of which is stationary, and the other of which revolves, driven by the foot or by other power, and communicates its motion to the work. While the piece is thus rotating about the line joining the centres, the cutting edge of the tool is brought against the exterior or the projecting portions, and it is gradually worked into the required shape. When the axis remains constant in position, the tool being moved inward and outward, or laterally as required, the surface becomes that of a solid of revolution, composed, usually, of cylindrical combined with spherical, spheroidal, or other geometrical forms. The axis is sometimes changed in position during the operation of turning, as in the "rose-engine," by which oval and many intricate combinations of regular figures are produced. Hand-turning is usually adopted in working wood and ivory. The tool is carried in the hand of the operator, a rest being provided to support it beneath while it is moved in the horizontal plane by the turner. In the engine-lathe used for working metal the tool is secured in a tool-post erected upon a slide-rest, which latter is moved horizontally by suitable mechanism, worked either by hand or by the automatic "feed-motion" of the lathe. In the "chuck-lathe" the work is carried in a chuck mounted on the end of the rotating spindle, which in the first described or centre lathe carries the live or rotating centre. The chuck grasps the work firmly, and thus enables the dead centre to be dispensed with when turning short pieces.

The foot-lathe is driven by the foot of the workman, operating a treadle beneath. When the tool is larger, and is driven by steam or water power, it is called a power-lathe. Nearly every trade uses some form of lathe, which by some peculiarity of detail is especially fitted for its work. The forms of the lathe are therefore numerous, while the variety of attachments is enormous.

Fig. 2.



Screw-cutting engine lathe, with foot motion.

Fig. 2 represents a very complete foot-lathe, as made by Chase & Co. of New York City for general work. A horizontal shaft, extending beneath the bed of the lathe from end to end, carries a pulley balance-wheel, which by means of a belt not shown drives the spindle which runs in bearings in the "head" of the lathe at the left. This driving-shaft is turned by a treadle which is worked by the foot of the turner. The slide-rest, seen at the middle of the lathe between the two heads, is moved either by hand, or automatically, by a small shaft running from end to end of the lathe, and partly concealed by that portion of the slide-rest which carries the handle for attaching and detaching it. The tool is shown in its place in the tool-holder, which is mounted upon and carried by the slide-rest. The back centre is shown at the right, and the back-head, in which it is carried, is adjustable in position at any distance from the fixed head, and is clamped by the nut and handle seen beneath it. The centre is moved backward and forward by the handle at the right, which turns a screw within the shell, and when in adjustment it is clamped by a smaller set-screw or clamp, seen above it. The train of gearing at the end of the lathe adjacent to the driving-head is used to determine the relative motion of the tool and the work, when it is desired to secure an exact velocity-ratio, as in cutting screws. The gearing seen behind the driving-spindle takes its motion from the pinion on that spindle at the left, and, turning with the belt-cone, transmits it, with a reduced velocity-ratio, to the gear on the driving-spindle at the right. This gear drives the live spindle to which it is keyed. With this arrangement the driving-pulley and its attached pinion turn loosely on the driving-spindle.

A rapid motion of the driving-wheel is thus converted into a slow, strong movement of the live centre, and the lathe is thus adapted to turning metals. Throwing the back-gearing out of gear, the largest gear can be clamped to the belt-cone, and the driving-spindle then partakes of the rapid motion of the latter, turning with the higher velocity required in working wood and other soft materials.

Both the back-gearing and the screw-cutting attachment are usually dispensed with in lathes intended for turning wood only. Fig. 2 represents a large foot-lathe, capable

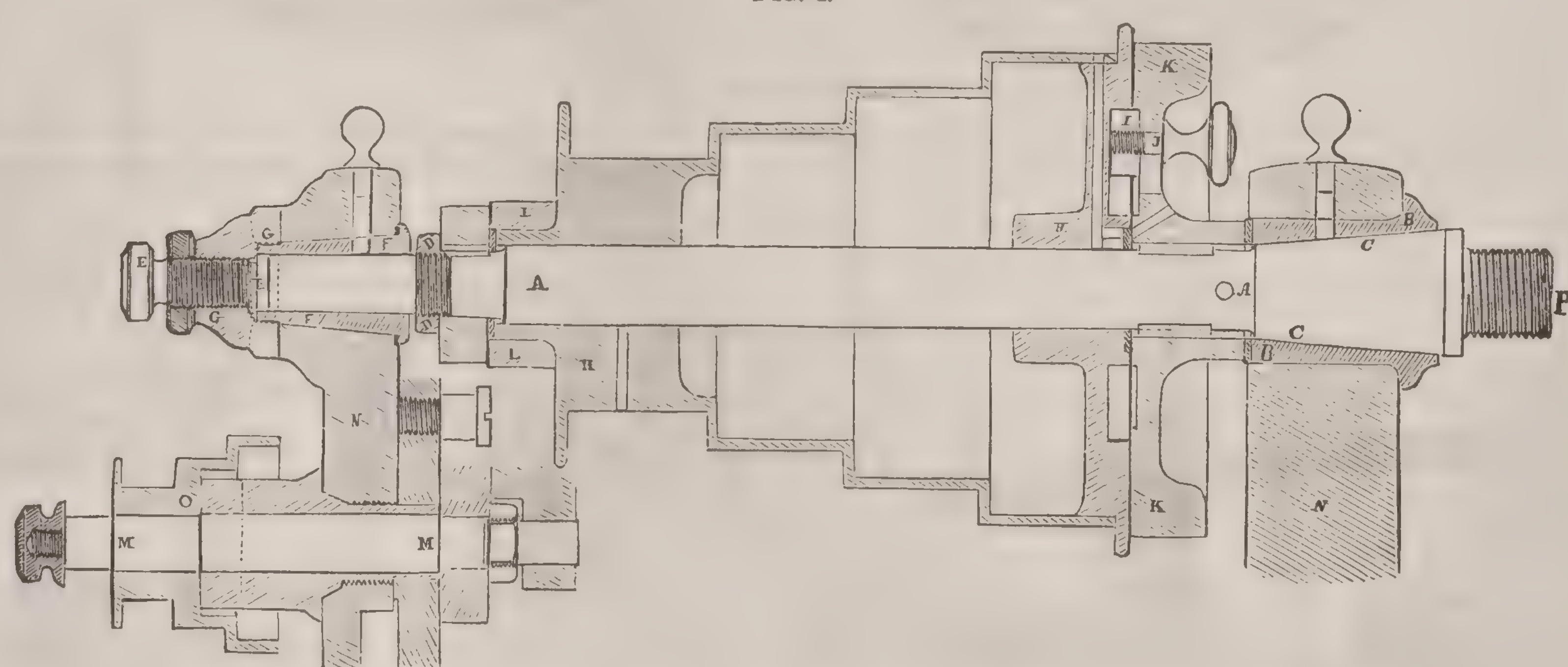
FIG. 3.

Jeweller's lathe.

of taking pieces 10 inches in diameter and 40 inches long. A more usual size turns pieces 6 or 8 inches in diameter and about 2 feet long. The jeweller's lathe, shown in Fig. 3, illustrates this style.

The finest fitting and the best workmanship is expended upon the head-stock of the lathe. Fig. 4 is a sectional drawing of this part of the tool, as made at the Free Institute of Industrial Science at Worcester, Mass. It represents the best of practice. This lathe resembles in general structure that shown in Fig. 2. The foot-motion is omitted, this being a power-lathe. It is 8 feet in length, "swings"—*i. e.* it can turn a piece of the diameter of—16 inches, and weighs 1500 pounds. The spindle A, A is of hardened cast steel, ground perfectly cylindrical, *after having been hardened*, to avoid danger of change of form in the process of hardening, to secure absolute truth in size and shape, and to obtain perfect smoothness and the desired hardness. The box, B, carrying this spindle is subjected to all the strain thrown upon the latter, whether by the weight of the piece or by the force exerted by the tool. Here it is made of a single piece of steel, fitted approximately to finished size, hardened, and finally ground to exact form and to fit. The spindle-bearing, C, C, where it turns in the box, is conical, and capable of adjustment longitudinally to take up the looseness occasioned by the wear which takes place even with hardened steel journals running in hardened steel bearings. End-play is prevented by the nut, D, D, and the set screw, E, E, which hold the spindle snugly in a position such that it may turn freely without either side or end play. The back end of the spindle is carried in the journal, F, its box being held by the cap-screw, G, G. The cone-pulley, H, H, turns loosely on the spindle when the back-gear is in action, and is clamped by the sliding-block, I, and screw, J, when the spindle and the cone are to move together, the cone driving the gear, K, K, directly, and the latter carrying the spindle, to which it is secured by keys. The pinion, L, L, on the cone-pulley, drives the back-gear. A spindle, M, M, carried on the rear plate of the head-stock, N, N, carries the feed-cone pulley, O. The belt-cone, H, H, and the back gearing are given broad bearings.

FIG. 4.



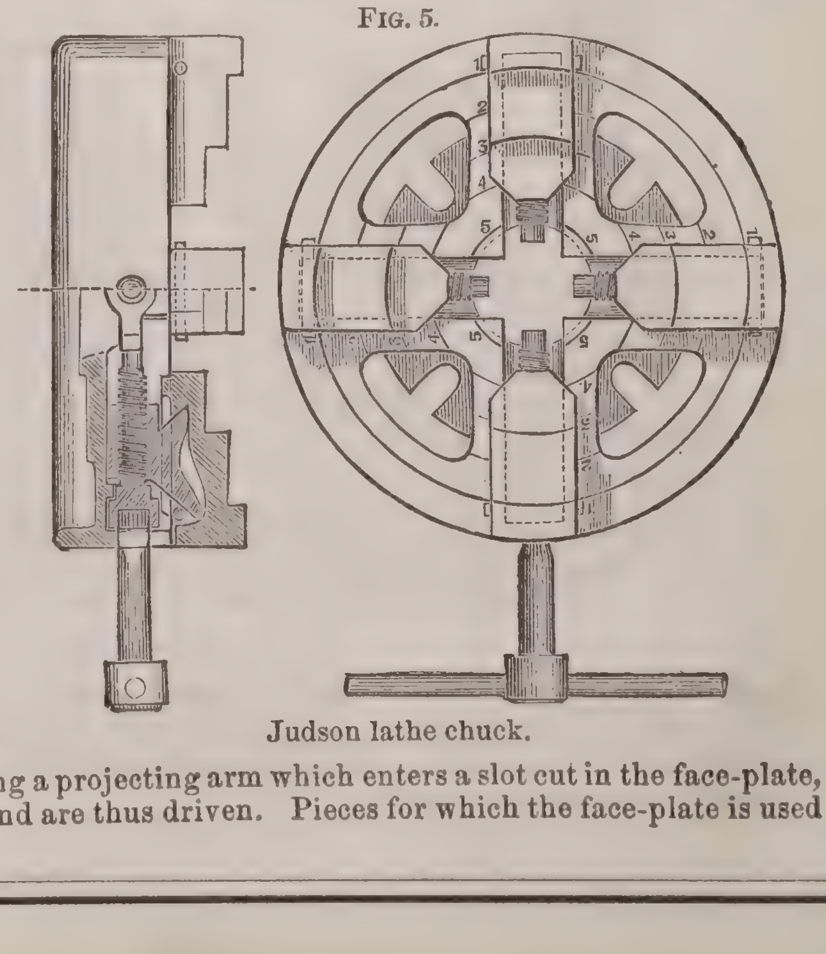
Head-stock, 16-inch engine lathe, made at Free Institute of Industrial Science, Worcester, Mass.

A good lathe must be capable of turning a truly cylindrical surface, and of producing a perfectly plane face upon the end of the cylinder, or of any piece secured in the lathe in such manner that the face to be finished shall lie in the transverse plane. These requirements are attained by skilful design and careful fitting. Lathes used in screw-cutting are driven by an arrangement of belting which permits them to be turned in either direction at pleasure. As the reversal of motion usually occurs very suddenly, "friction-pulleys," which are not affected by shocks, are generally used. Lathes for turning metals are driven at speeds much less than those adopted in working wood. These speeds are:

Material.	Feet per minute.
Iron, chilled white cast	5
" soft gray	15
Steel	15
Iron, wrought	20
Brass and bronze	50–60
Wood	1500–4500

Pieces to be turned are frequently of such shape that it is more convenient to bolt them upon a "face-plate" than to hold them between centres. Disks, pulleys, wheels, and similar pieces are thus held. The face-plate is a strong disk of metal of convenient size, having a hub on the rear face, bored and having a screw thread cut inside it to fit the thread cut on the end of the spindle P, Fig. 4. The dead centre and poppet-head are drawn back entirely out of the way when using it. Pieces carried between the centres are connected with the face-plate by a "dog," a clamp hav-

FIG. 5.



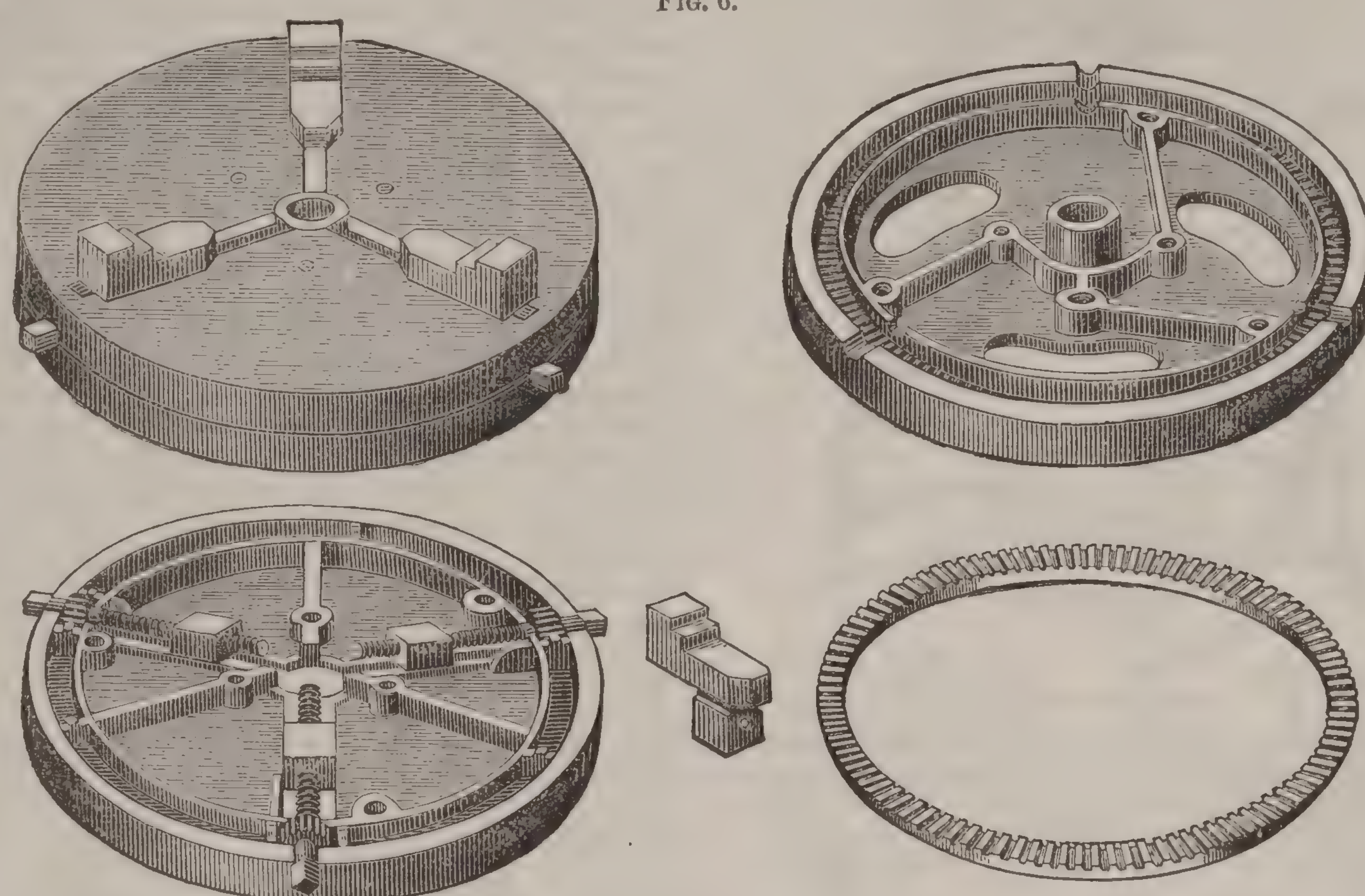
Judson lathe chuck.

ing a projecting arm which enters a slot cut in the face-plate, and are thus driven. Pieces for which the face-plate is used

may be sometimes more conveniently held by a "chuck." This consists of a face-plate carrying on its face a set of projecting pieces, movable in radial lines by means of screws, cams, or other mechanism, either together or independently. The piece to be turned is placed between these jaws, and they are forced together, seizing the work firmly, and compelling it to turn with the face-plate.

Fig. 5 represents the Judson chuck in elevation and in part section. The jaws are forced together or separated by the screws shown, which screws are turned by a wrench, shown in use on the lower one. Circles 1, 1, 1, 2, 2, 2, scored on the face, enable the workman to secure a symmetrical adjustment when it is desired. The jaws being independently adjustable, unsymmetrical pieces may be chucked readily and accurately. The wedge-shaped lug which connects the nut of each screw with its jaw causes the same force which drives the jaw against the work to press the former more firmly against the face-plate, thus holding the work firmly and snugly. The shell of this apparatus is usually of iron; the jaws should be of steel; the screws are of wrought iron. A "scroll-chuck" has a similar form, but the jaws are moved simultaneously by a spiral feather on the face of a disk within the casing. These chucks, if accurately made, always place the piece symmetrically on the axis, but they cannot be used for unsymmetrical work.

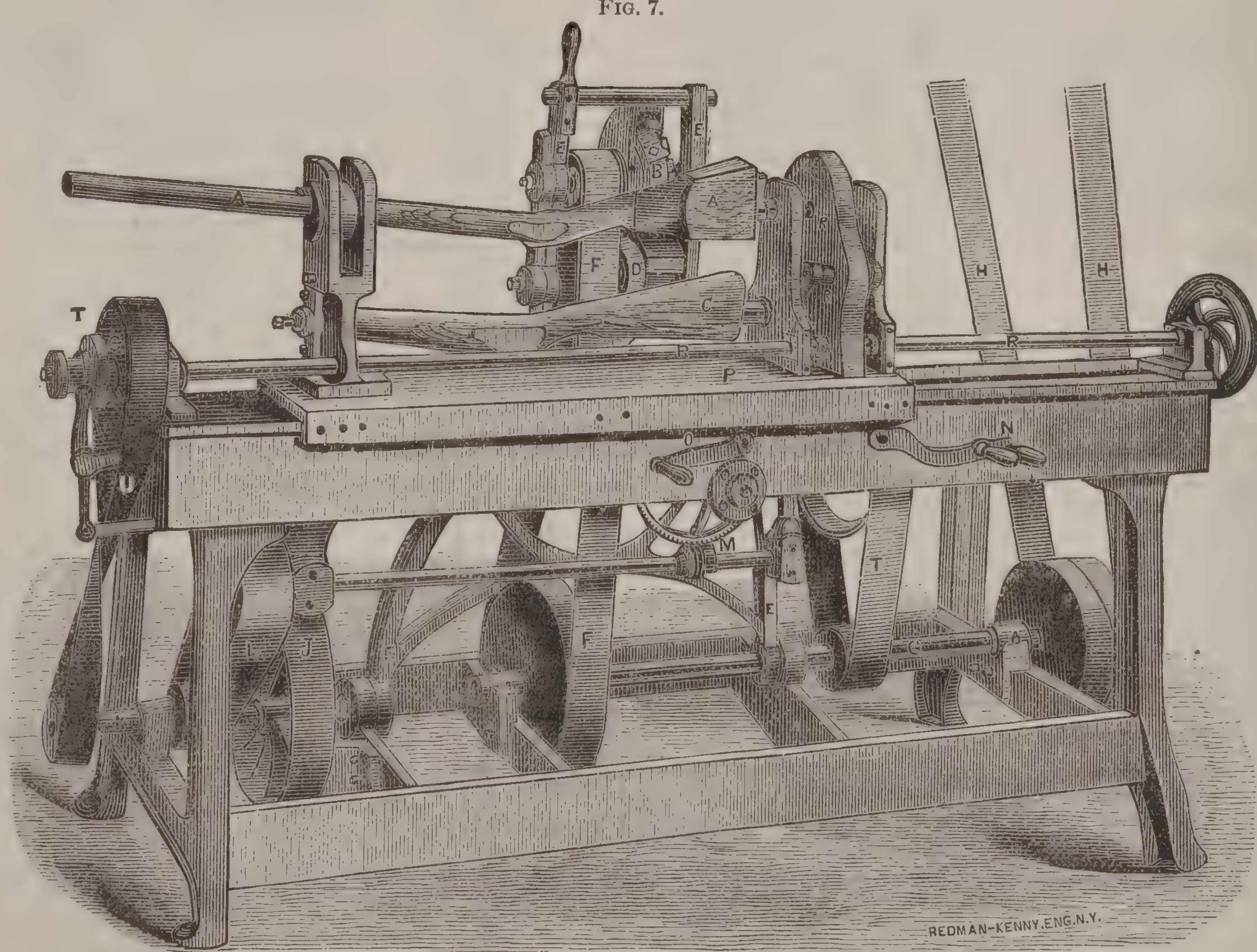
Fig. 6.



Horton's chuck.

The Horton chuck, Fig. 6, combines the distinguishing features of both the forms just described. The jaws are moved by a set of geared screws turned by a circular rack, of wrought iron, sliding in the circular groove cut in the

Fig. 7.



The lathe for turning irregular forms.

A, gun-stock; B, cutter-head; C, former; D, guide-wheel; E, E, E, E, swinging frame holding cutter-head and guide-wheel; F, F, cutter-head belt; G, driving-shaft; H, driving-belt; I, belt to first counter-shaft; J, belt from first counter to second counter-shaft K; L, belt to feed-shaft; M, feed-motion; N, shipper for feed-motion M, and revolving motion T; O, hand-feed; P, sliding table; R, R, R, R, shaft and connecting gears for revolving the stock A and former C; S, hand-wheel; T, clutch on revolving shaft R; U, revolving stop-belt.

back-plate. The front and back plates are nicely fitted together, so that no dust or dirt can get inside. Taking out the rack, the jaws are movable independently. The face of the jaw has a slightly raised portion, and a groove is cut at the corner where it meets the "bite," to allow of accurate regrinding.

Fig. 7 represents the lathe for turning irregular forms originally invented by Blanchard, and as now used at the U. S. arsenal at Springfield, Mass., of which drawings are kindly furnished by the commanding officer.

In this beautiful machine the pattern or former, C, is mounted between centres parallel with the piece to be made its duplicate, and is revolved at precisely the same rate of speed. A cutter-head, B, carrying several knives and driven by the belt, F, swings in the frame, E, E, E, on the centres at the base. A guide-wheel, D, bearing against the former, C, throws the frame and cutter-head in and out as the guide-wheel and the gun-stock revolve synchronously, making the latter a fac-simile of the pattern. A slow, uniform motion is given the frame in the longitudinal direction, thus shaping the piece from end to end. Many modifications of this copying tool are now made for special uses.

In the "rose-engine lathe" the spindle carrying the work is movable, and is vibrated by a guide-wheel or pattern-wheel turned at a fixed rate of speed, and having an outline which is determined by the shape of the design to be cut. Several wheels being used in succession, intricate and beautiful geometrical combinations are obtained. (See Holtzapffel's *Mechanical Manipulations; The Lathe and its Uses; Manuel du Tourneur.*) R. H. THURSTON.

La'throp, post-v. of San Joaquin co., Cal., on the Central Pacific R. R., 9 miles S. of Stockton.

Lathrop, post-v. and tp. of Clinton co., Mo. It has 1 weekly newspaper. Pop. of v. 523; of tp. 1782.

Lathrop, post-tp. of Susquehanna co., Pa. Pop. 983.

Lathrop (JOHN), D. D., b. in Norwich, Conn., May 17, 1740; graduated at Princeton in 1763; taught for a time in the Indian school, afterwards Dartmouth College; was (1768–1816) a Congregationalist minister of Boston, first over the Old North, and then over the Second church. His degree of D. D. was conferred first by Harvard, and then by Edinburgh University. D. Jan. 4, 1816.—His son, JOHN (b. Jan. 13, 1772; d. Jan. 30, 1820), was a famous wit, poet, and orator of the early years of the republic.

Lathrop (JOHN HIRAM), LL.D., b. at Sherburne, N. Y., Jan. 22, 1799; graduated at Yale in 1819, and was a tutor there 1822–26; became a lawyer in 1826, and afterwards taught in Norwich, Vt., and Gardiner, Me.; professor of mathematics and natural philosophy in Hamilton College 1829–35; of law, history, etc., 1835–40; president of the University of Missouri 1840–49; chancellor of the University of Wisconsin 1849–59; president of Indiana University 1859–60; professor of English literature in the University of Columbia, Mo., 1860–62, and its president 1865–66. D. at Columbia, Mo., Aug. 2, 1866.

Lathrop (JOSEPH), D. D., b. at Norwich, Conn., Oct. 20, 1731; graduated at Yale College in 1754; became pastor of the Congregational church in West Springfield in 1756, and retained that position sixty-four years, until his death, Dec. 31, 1820. His published works in 7 vols. (1796–1801) are composed almost entirely of sermons, several of which, entitled *Wolves in Sheep's Clothing*, elicited by troubles in his parish, had a wide celebrity. The last volume contains an autobiography.

Latia'no, town of Southern Italy, in the province of Lecce, about 14 miles S. of Brindisi. Pop. in 1874, 5953.

Latil'idæ [from *Latilus*, a typical genus, and the termination *-idæ*], a family of fishes of the order Teleocephali and sub-order Acanthopteri, distinguished by sub-jugular ventral fins, each of which has a spine and five branching rays; a more or less elongated body (the vertebral column having more than ten abdominal and fourteen caudal vertebræ), covered with scales, and with the lateral line submedian along the tail; an elongated dorsal fin, of which the spinous portion is shorter than the soft; and a compressed head, with a snout truncated or moderately produced. These are the principal diagnostic characters of a group of fishes which have been variously placed by different naturalists, Cuvier having referred some forms to the Percidæ, and others to the Labridæ; and Günther having referred all to the family Trachinidæ, except *Malacanthus*, for which he framed a peculiar family—Malacanthidæ. It embraces not many genera, but combinable under several groups of genera, or possibly sub-families—viz. LATILI, with three genera, *Latilus, Caulolatilus*, and *Prolatilus;* MALACANTHI, with the *Malacanthus;* and PINQUIPIDES, with the genus *Pinquipes*. All the genera are tropical, the *Pinquipedes* being peculiar to America, and the others tropicopolitan. THEODORE GILL.

Lat'imer (HUGH), D. D., b. at Thurcaston, Leicestershire, England, in 1491, was the son of a thrifty yeoman; was educated at Clare Hall, Cambridge, where he was chosen a fellow 1509; passed a bachelor 1510, and a master 1514; was cross-bearer to the university, and in 1516 became Greek professor; was ordained a priest at Lincoln; became a Protestant by reason of the labors of Bilney; was dismissed from the university as a heretic by Wolsey 1527; became chaplain to Henry VIII. 1530; became rector of West Kingston, Wilts, 1531; was excommunicated, but absolved on his submission, 1532; chaplain to Anne Boleyn 1534; became bishop of Worcester 1535; resigned his office 1539, not being able to accept the Six Articles (31 Hen. VIII. c. 14), and was imprisoned in the keeping of the bishop of Chichester; was afterwards silenced by authority and shut up in the Tower 1546–47; declined his former bishopric 1548; was preacher to Edward VI. 1549–50; imprisoned in the Tower by proclamation of Queen Mary 1553; transferred to the Bocardo of Oxford, with Ridley, 1554; tried and condemned by order of Cardinal Pole 1555; and burned at the stake with Ridley in the ditch near Baliol College Oct. 16, 1555. Latimer was one of the most influential and fearless of the English Reformers, and his admirable *Sermons* (4 vols., London, 1845) are models of forcible and witty speech. (See his *Life*, by Rev. R. Demaus, 1869.)

Latimer (JAMES ELIJAH), A. M., S. T. D., b. Oct. 7, 1826, at Hartford, Conn.; graduated in 1848 at the Wesleyan University; entered the Methodist Episcopal ministry; was for many years an instructor in the seminaries of his Church, and held pastorates in the State of New York 1861–69; became in 1870 professor of systematic theology in Boston University.

Lat'imore, post-tp. of Adams co., Pa. Pop. 1230.

Lat'in Church, a name applied to the Roman Catholic, the Occidental, or Western Church. It is antithetical to Greek Catholic, as the title of the Oriental or Eastern Church. After the separation of the Greek Church from the Roman (ninth to eleventh century) the Catholics of the West were called Latins, because of their retention of the Latin language in the church service. In association with this distinction we speak of the Latin Fathers after (not before) the separation, the Latin ritual, the Latin clergy. A Greek latinized is a convert from the Greek to the Roman Church. (See Aschbach, *Allg. K. L.* (1850), iv. 12; Bergier, *Théologie*, in *Encyclop. Méthodique* (1789), ii. 408; Milman, *Latin Christianity* (1854).) C. P. KRAUTH.

Lati'ni, in the government of ancient Rome, were inferior citizens of a class superior to the Peregrini. The term originally designated the people of Latium; these after the Social war attained an inferior kind of citizenship, the nature of which is not clearly known. The *jus Latii, Latinitas*, or *Latium* (Latin privilege) was afterwards extended to many cities, towns, and colonies in foreign parts, and the Latini and their descendants, even though living at Rome, possessed only the Latin and not the full Roman citizenship.

Latini (BRUNETTO), b. at Florence in 1230; belonged to the party of the Guelphs; was exiled in 1264; lived for several years in Paris; returned after the overthrow of the Ghibellines to Florence, where he d. in 1294. He is better known as the teacher and friend of Dante than on account of his own writings, the most remarkable of which is his *Livre de trésor*, written in French, translated into Italian in 1474, and containing a compendium of the whole wisdom of his time.

Latin Language. Latin is a member of that great family of languages called Indo-European, and also, but less properly, Indo-Germanic or Aryan. This family embraces the Sanskrit, Persian, Lithuanian, Greek with its modern representative Romaic, Latin and its modifications the Romance tongues, Celtic, German, and English. These languages, for the most part, present striking resemblances in words, in inflections, and in general grammatical structure. The Sanskrit is the oldest of them all, and throws more or less light on the obscurities of all the rest. The Sanskrit has prevailing usages which pass away in its descendants, as the ending *-mi* of the first person present indicative, which appears in a limited number of words in Greek, in a modified form in two in Latin (*sum* and *inquam*), in only one in English (*am*), further modified in the German *bin*, and utterly disappearing in other tongues; it has a dual as well as singular and plural for its nouns, pronouns, adjectives, and verbs, which the Greek possessed, but was little inclined to use, which the Latin retained only in *duo* and *ambo*, and confused in *nos* and *vos*, and which the English and German have retained in only one word, *twain, zween;* it had both augment and reduplication, in which the Greek nearly followed it, while the Latin retained only

reduplication, and that in certain verbs, the German an augment in the past participle of simples, the last faint trace of which appears in some old forms in English, as *yclept;* it had eight cases, which kept certain relations distinct which were afterwards confused, as the genitive, dative, and ablative, which last was lost in Greek, and in Latin also was mostly lost as a separate form, and in use became very complicated and irregular; in making its reduplicative syllable it illustrates, with one exception only, the order of the development of the Latin vowels, *a, o, u, e, i;* and in its words, as will be seen below, it is sometimes more closely allied to the Celtic or Germanic than to the Greek or the Latin. In former times it was customary to regard the Latin language as descended, and that very directly, from the Greek, and real or fancied connections were traced out between nearly all the Latin and Greek words. Others, who discovered in the Latin language words and forms which occur in the German and the Celtic, were led to believe that the Latin was largely derived from the Celtic. But in resolving such a question there are very great difficulties. How are we to know whether the Celtic or the Latin form is the older? We may generally receive the statements of the Romans themselves as to the origin of certain words which they discussed, but as we have no monuments of Celtic earlier than the seventh century of our era, how is modern research to decide whether the Celtic word is an old collateral form of the Latin, or was actually carried by the Romans in their conquests and deposited among the strange people? Was the Celtic *tir*, for instance, an original word with this people, or only the barbaric form of the Roman *terra?* While in some cases one of these views might be correct, and in other cases the other, we can only assert with confidence that the Latin belongs to the same family as the above, but more closely resembling the Greek in its oldest elements than any other member, and afterwards, in historic times, following the development of the Greek, adopting words from it with no change of form, or only such as convenience or regard for analogy required, imitating its construction, as in modern times English and French have imitated each other, and first translating and then imitating its literature, as Early English dealt with French and with Italian.

To show how far this resemblance extended in some of the most ancient forms, and with what remarkable exceptions, we subjoin four comparative tables of groups of words, putting the Latin words in italics only when they are identical with the Greek or closely allied to it, and enclosing in parentheses such words as are more remotely connected in the group, or changed in meaning, or both:

I. The names of the human body and its parts:

English.	*Latin.*	*Greek.*
body,	corpus;	σῶμα.
skin,	*cutis;* (G. *Haut* = hide),	χρώς (σκῦτος or κύτος = hide).
bone; G. *Bein* (= leg, bone),	*os,*	ὀστοῦν; St. *asthi.*
hair; G. *Haar,*	crinis,	θρίξ.
head; G. *Haupt,*	*caput;* G. *Kopf,*	κεφαλή.
back,	dorsum,	νῶτον.
neck,	collum; G. *Hals;* Goth. *hals,*	αὐχήν.
shoulder,	*humerus, umerus,*	ὦμος; Goth. *amsa;* St. *amsa.*
arm; G. *Arm,*	*brachium,*	βραχίων.
breast; G. *Brust,*	pectus,	στῆθος.
heart; G. *Herz* · St. *hrid,*	*cor* (core),	καρδία, κραδία, κῆρ.
face,	facies,	πρόσωπον.
brow; St. *bhru,*	*frons,*	(ὀφρύς = eyebrow).
eye; Goth. *augo;* G. *Auge;* St. *akshi,*	*oculus,*	ὀφθαλμός.
ear,	*auris;* G. *Ohr,*	οὖς ὠτός; Goth. *auso.*
nose,	nasus; St. *nas;* G. *Nase,*	ῥίς.
mouth; Goth. *munths;* G. *Mund,*	os,	στόμα.
tongue; Goth. *tungo;* G. *Zunge,*	lingua; archaic dingua,	γλῶσσα.
tooth; St. *dat danta,*	*dens dentis;* G. *Zahn,*	ὀδούς ὀδόντος.
lip; G. *Lippe,*	labium,	χεῖλος.
hand; G. *Hand;* Goth. *handus,*	manus; arch. *hir,*	χείρ.
fist; G. *Faust,*	*pugnus,*	πυγμή.
elbow; G. *Ellenbogen,*	*ulna;* Goth. *aleina,*	ὠλένη.
finger; G. *Finger;* toe, G. *Zehe,*	*digitus;* Fr. *doigt,*	δάκτυλος.
nail; G. *Nagel;* St. *nakha,*	*unguis,*	ὄνυξ ὄνυχος.
leg,	crus,	σκέλος.
knee; Goth. *Kniu;* G. *Knie,*	*genu,*	γόνυ; St. *ganu.*
foot; Goth. *fotus;* G. *Fuss,*	*pes pedis,*	πούς ποδός; St. *pad.*

II. The names of the Deity and of human relations:

English.	*Latin.*	*Greek.*
God; G. *Gott;* Goth. *Gud* or *Guth,*	*Deus, Divus;* St. *deva;*	Θεός, (Ζεύς) Διός.
man; G. *Mann;* Goth. *man,*	homo hominis; Goth. *guma,* vir; A.-S. *wer;* Celt. *fear,*	ἄνθρωπος. ἀνήρ; St. *nri.*
father; Goth. *fadar;* G. *vater,*	*pater,*	πατήρ; St. *pitri.*
mother; G. *Mutter,*	*mater,*	μήτηρ; St. *matri.*
son; G. *Sohn;* Goth. *Sunus;* St. *sunu,*	filius,	υἱός.
daughter; Goth. *dauhtar;* G. *Dochter;* St. *duhitri,*	filia,	θυγατήρ.
brother; Goth. *brothar;* G. *Bruder;* St. *bhratri,*	*frater,*	ἀδελφός (φράτηρ = clansman).
sister; Goth. *svistar;* G. *Schwester;* St. *svasri,*	soror,	ἀδελφή.
uncle; G. *Onkel,*	patruus, avunculus,	θεῖος.
aunt; G. *Tante;* Fr. *tante,*	amita, matertera,	τηθίς.
nephew; G. *Neffe,* niece; G. *Nichte,*	nepos, neptis, in their later meaning,	ἀδελφιδοῦς, ἀδελφιδῆ.
boy (G. *Bube,* provinc.), girl,	*puer, puella,* (St. *putru* = son),	παῖς.
maid; G. *Magd;* Goth. *magaths,*	virgo,	παρθένος.

III. Pronouns:

I; G. *ich;* Goth. *ik,*	*ego;* C. *me, mi,*	ἐγώ, ἐγών; St. *aham.*
me; G. *mich;* Goth. *mik,*	*me,*	ἐμέ, μέ; St. *mâ.*
thou; Goth. *thu;* G. *du,*	*tu,*	σύ, τύ, τύνη; St. *tvam.*
thee; G. *dich;* Goth. *thuk,*	*te,*	σέ, τέ; St. *tva.*
we; Goth. *veis;* G. *wir,*	*nos;* C. *ni,*	ἡμεῖς (νώ, dual); St. *nau.*
ye; St. *yuyam;* G. *ihr,*	*vos;* Goth. *jus,*	ὑμεῖς (σφώ, dual); St. *vam.*
he, she; G. *er, sie;* Goth. *sah, is, so,*	hic, *sui* (reflex.),	(ἵ obs.) ὅυ.
it; G. *es;* that; Goth. *thatu,*	id.	
who, what (G. *wer, was*),	*qui, quod,*	ὅς, ὅ; St. *yah.*
who? what? G. *wer? was?* Goth. *was? wa?*	*quis? quid?*	τίς; τί; St. *kah.*
whether? (obs.); Goth. *wathar?*	*uter?*	πότερος; St. *katara.*

IV. Cardinal numbers:

Gothic.	*German.*	*English.*	*Latin.*	*Greek.*	*Sanskrit.*	*Etruscan* (from Corssen).
ains,	*ein,*	one,	*unus,*	εἷς ἑνός,	*eka* (Heb. *echăd*),	*eca* or *un-.*
tvai,	*zwei,*	two,	*duo,*	δύο,	*dva,*	*teis.*
threis,	*drei,*	three,	*tres,*	τρεῖς,	*tri,*	*tri-.*
fidvor,	*vier,*	four,	*quatuor,*	τέτταρες,	*chatur,*	*chuar-.*
fimf,	*fünf,*	five,	*quinque,*	πέντε,	*pañchan,*	*cain-* or *cvin-.*
sáchs,	*sechs,*	six,	*sex,*	ἕξ,	*shash,*	*secs-* or *ses-.*
sibun,	*sieben,*	seven,	*septem,*	ἑπτά,	*saptan,*	*setu-* or *sehtu-.*
ahtan,	*acht,*	eight,	*octo,*	ὀκτώ,	*ashtan*	*uhtar-uthtar-.* *utar-* or *utan-.*
niun,	*neun,*	nine,	*novem,*	ἐννέα,	*navan,*	*nu-.*
taihun,	*zehn,*	ten,	*decem,*	δέκα,	*dasan,*	*tecu-.*
ainlif,	*eilf* or *elf,*	eleven,	*undecim,*	ἕνδεκα,	*ekadasa,*	*tesne-eca.*
tvalif,	*zwölf,*	twelve,	*duodecim,*	δώδεκα,	*dvasada,*	*tesns-teis.*

Interesting facts may be gathered from these tables, and from similar ones which our space does not allow us to introduce here; as that a generic word in one language may become specific in another; as Gr. θήρ, Eng. *deer;* G. *Hund,* Eng. *hound;* Lat. *digitus,* Fr. *doigt,* Eng. *toe;* that in some instances the English or the English and the German retain an old form lost to the Latin; as Gr. ὄροφος, *roof;* Gr. πάτος, *path;* G. *Pfad;* that in some cases, where the word is generally preserved, the modern form may be nearer to the Sanskrit than to the classical form; as Gr. ὄνομα; Lat. *nomen;* G. *Name;* Eng. *name;* St. *nâman:* Gr. ἡδύς; Lat. *suavis;* Eng. *sweet;* St. *svâdu;* and that there are interesting cases of change of meaning; as Gr. πόντος = sea; Eng. *pond;* Lat. *mare* = sea; Eng. *mere,* a lake; Heb. *eleph* = an ox; Gr. ἐλέφας = an elephant; Gr. κάπρος = a wild-boar, which seems to be the Lat. *caper,* a goat, as well as *aper,* a wild-boar; and that pronouns and numerals are the least variable elements in language.

Certain languages of Italy, the Oscan, Umbrian, Celtic, Messapian, and Etruscan, have affinities to the old Latin more or less close, and probably in this order, and these languages have substantially the same alphabet with it.

The remains of the Sabine and Oscan belong to a period when the Sabines had mixed themselves up with the conquered Ausonians, and had learned their language; of this we have certain specimens, therefore properly called Sabello-Oscan. The most important of these are the *Bantine Table,* the *Cippus Abellanus,* and the *Tablet of Agnone.* The Bantine Table, now in the Museo Borbonico, is a bronze tablet found in 1793 at Oppido, on the borders of Lucania, and called *Tabula Bantina* from the name *Bansæ* in the inscription, which seems to refer to the neighboring

city of *Bantia* in Apulia. The Cippus Abellanus, a stone tablet, was moved from Avella Vecchia to the modern village of this name in 1685, and there used as a doorstep till in 1745 it was noticed and removed to the museum of Nola. The bronze tablet of Agnone was so called from the place near which it was found in 1848. Among these remains we find the following: *aasai* = aræ, *ammai* = matri (comp. Heb. *êm*), *aut* = at, *anter* = inter, *com* = cum (præp.), *deketasioi* = dictario, *diovei* = Jovi, *diumpais* = lymphis, *ehtrad* = extra, *estud* = esto, *horto* = hortum, *ist* = est, *keus* = civis, *ligatois* = legatis, *likitud* = liceto, *mais* = magis (comp. Fr. *mais* and It. *mai*), *nep* = nec, neque, *ni* = ne, *paterei* = patri, *pon* = cum (*i. e.* quum), *pos* = que, *pru* = præ, *pruter* = præter, *saahtom* = sacrum, *senateis* = senatus, *svai* = si, *terom* = terra, *viam* = viam.

The relics of Umbrian are contained on seven tables in a state of perfect preservation. They were discovered in 1444 in a subterranean chamber at La Schieggia, near the ancient city of *Iguvium*, now *Gubbio* or *Ugubio*, and hence styled the *Iguvine* or *Eugubine* Tables. Iguvium lay at the foot of the Apennines, near the Via Flaminia, and is known to have been an old Umbrian town; this circumstance is the foundation of the belief that these tables are specimens of the Umbrian tongue. They relate chiefly to matters of religion, and are written, some in Umbrian or in Etruscan, and others in Roman characters. Lepsius infers that the former were written not later than A. U. C. 400, and the latter cir. A. U. C. 550. The Umbrian, being subjected to disturbing causes not unlike those which at a later period affected the Latin, exhibits some of the characteristics of the Romance tongues. We find the ending *-o* for *-um*; *s* and *d* final are constantly dropped; there is a tendency to substitute liquids for mutes; and *o* is softened to *u*. Examples of Umbrian words are: *ager* = ager, *ahtu* = actutum, *alfa* = albus, *ander* = inter, *asa* = ara, *aveis* = avibus, *benes* = venies, *dicom* = dicere, *est* = est, *estu* = esto, *far* = far, *fato* = fatum, *ferine* = ferina, *fetu* = facito, *frater* = frater, *pater* = pater, *ife* = ibi, *kvestur* = quæstor, *manu* = manus, *mestru* = magister (comp. It. *maestro*), *mais* = magis, *nep* = nec, neque, *numen* and *nome* = nomen, *numer* = numerus, *ose* = ore, *pir* = πῦρ, *fire*, *puplus* = populus, *res* = res, *sakre* = sacrum, *sent* = sunt, *sif* = sues, *sesna* = cena, *tafle* = tabula (comp. Fr. *table*), *tra* = trans, *uvikum* = cum ore (with this *kum* enclitic comp. *mecum*, etc.; It. *meco*, etc.).

While the relation of the Celtic to the early Latin is very obscure, yet there is reason to believe that the relation was important in earlier, as we know it to have been in later, times. The Celts had preceded all other races in the westward movement: they are mentioned even by Herodotus as living beyond the Pillars of Hercules, and they had filled the Transalpine plain probably soon after the time of the Tarquins. There must have been a substratum of Celts in Italy at a very early period; for ancient authorities assert their connection with the Umbrians, and this fact is indicated by the name of their country, *Umbria*, and of their chief river, *Umbro*, compared with *Humber*, *Cymri*, and the like. The Celts are known also to have occupied the neighboring Liguria. A great authority, Schleicher, is of the opinion that the Celtic and the Latin were more closely connected in pre-historic times than the Latin and the Greek. We subjoin a comparative list of a few out of the many Celtic words connected with the Latin; and though, as we have said above, the priority of the one to the other cannot be made out, they present an element sometimes only obscurely related to the Greek, and sometimes quite independent of it: *aile* = alius, *ar* = ad (cf. *ar* in arbiter, arcesso, etc.), *arbha* = arvum, *arch* = arca, *arm* or *arv* = arma, *caint* = cantus, *caneri* = cantor, *car* = amicus (comp. *carus*), *caus* = caseus, *claideb* = gladius, *cru* = cruor, *cust* = cutis, *dant* or *dent* = dens dentis, *diu* = deus, *die* or *dia* = dies, *faith* = vates, *fear* or *gur* = vir, *fin* = finis, *forch* = furca, *garw* = gravis, *laden* = latro, *laha* = lex legis, *lachd* or *lait* = lac lactis, *loch* = lacus, *me* or *mi* = ego, me, *monadh* = mons montis, *mor* or *muir* = more, *nead* = nidus, *ni* = nos, *noeth* or *nochd* = nudus, *numerus* = nuimhir, *ober* = operari, *oi* = ovis, *ors* = ursus, *our*, *aur*, or *or* = aurum, *ubh* = ovum, *pain* = panis, *pan* = quando, *plom* = plumbum, *por* = puer, *rig* or *ruy* = rex regis, *roith* = rota, *sacc* = sacer, *stain* = stannum, *tarbh* = taurus, *te* or *ti* = tu, te, *tir* = terra, *tra* = trans, *tug* = duco.

The Messapians or Iapygians were settled in the S. of Italy. Scanty fragments of their dialect are found pretty frequently in the Terra d'Otranto; they are in Greek letters, and almost always written from left to right. This dialect seems to have preserved the Lithuanian elements with little change; and subjected to no influences but that of the Greek colonists, into whose idiom it was rapidly absorbed, it may be regarded as a pure remnant of the old Italian. Some Messapian words that have come down to us with their meanings are: πανός = panis, βρένδος (whence *Brundisium*) = cervus (comp. Lith. *brêdis* = elk), βαυρία = domus (comp. G. *bauen* = to build, and Eng. *bower*); and among the words in the inscriptions we find ΙΝΘΙ = inde, and ΜΟΡΚΟΣ = Marcus.

The Etruscans were called, by the Greeks, Tyrrheni and Turseni; by the Romans, Tusci and Etrusci; and by themselves, Rasēna or Rasenna. According to Herodotus, the Tyrrheni were originally Lydians, who during a grievous famine sought a new home, and under Tyrsenus came to the country of the Umbrians (Ὀμβρικοί), which was thence called after him *Tyrsenia*. All that modern research is as yet able to say of their origin is, that they were a foreign people that came by sea, and that they were akin to nations of Greece and Asia Minor. Their language, which has been preserved in a great number of inscriptions on monuments and fictile vessels, has exercised the ingenuity of scholars with small results as yet. The longest of these inscriptions is one of forty-six lines from Perugia. Their alphabet is the medium through which the Oscans and Umbrians seem to have derived their characters. The inscriptions are written in almost all cases from right to left, according to the Semitic and the most ancient Greek custom. Various theories on the origin of the Etruscan language have been propounded. Dr. Donaldson has attempted to prove its Scandinavian or Low German character; Padre Tarquini and others, its Semitic affinities; but at present all that can be asserted with confidence is the Pelasgic or old Greek character of the language. What was wanting to enable scholars to form a certain or highly probable judgment was a critical examination of all the remains of the language; and this the learned Corssen has happily now furnished us in his great work *Ueber die Sprache die Etrusker* (Leipsic, 1874–75). We give the following specimens of Etruscan words: *achr* = ager, ἀγρός, *antes* = ventus, ἄνεμος, *auk* = ac, *atrium* = atrium, *avil* = ævum, αἰών, *baltea* = balteus, belt, *cana* = cantor, *capra* = capra, *cassis* = cassis; *ceer* = mors (comp. κήρ), *clan* = filius vel filia (comp. Gael. *clan*), *damnus* = equus (comp. the Homeric ἱππόδαμος), *esmi* = sum (comp. St. *asmi* and Gr. εἰμί), *hister* = histrio, *itus* = idus, *lar* = dominus (comp. *lar*), *mala* = malus, *nepos* = nepos, spendthrift (*Festus* 9, 14), *usil* = sol (Sabine, *ausel*), *verse* = πῦρ, Umbr. *pir*; and the following proper names: *Alpnas* = Albinus, *Aplu* = Apollo, *Caiia* = Caius, *Menrva* = Minerva, *Hercle* = Hercules, *Tite* = Titus, *Vipia* = Vibia.

The Alphabet.—The Semitic alphabet had originally 16 characters; the Oscan and the Umbrian had 20 each; the Etruscan 19; and the old Latin, 21. The Etruscan letters seem to be a modification of the Greek, with some new characters. The Italian alphabets from the first contained Υ, Ξ, Φ, X, which were invented, or at least newly applied, by the Greeks. But beside this Greek alphabet borrowed from the earliest Hellenic settlers, there was a later set of Greek characters, which the Latin derived from the Greeks of Cumæ, probably under the Tarquins, when there were special relations between Rome and Cumæ. But the Romans, showing in this their practical tendency, suppressed letters for which they had no sounds, as Θ, Φ, X (ch); they mostly dropped K as unnecessary, altered the shape of C for convenience, added Y and restored Z. For some time C represented both the medial (*k*) and the tenuis guttural (*g*), and then G was introduced by the freedman Sp. Carvilius (cir. A. U. C. 523), though Gaius and Gnæus were to the last indicated by the abbreviations C. and CN. In Cicero's time the number of letters was 21 (*De Deorum Natura*, 2, 93), but before his death Y (*y*) was introduced to transcribe Greek words, and Z was restored, and classical Latin confined itself to the use of the following 23 letters: A B C D E F G H I K L M N O P Q R S T V X Y Z, J and U being mere modern devices to discriminate between the powers of I and V respectively as vowels and as consonants. The Greeks retained the names of the old Phœnician hieroglyphics, but the Romans dropped them, and named the signs, much as we do, by their sounds.

The Old Latin.—We have some interesting remains of the old Latin, considered as contemporary and akin to the old Italian dialects, such as it was before Greek civilization and culture had begun seriously to work upon it. For the earlier centuries we have only a few brief inscriptions of religious and legal import. As we approach the Punic wars the inscriptions become more numerous and complete, but we are here near the time when the Latin language began to be modified or to lose its proper characteristics under the pressure of Greek influence, and to be transformed into the idiom of the Augustan age.

One of the most important and ancient specimens of the genuine Roman language is the *Carmen Fratrum Arvalium*, the Song of the Arval Brothers, discovered on marble tablets in 1777, while workmen were digging out the foundations of the sacristy of St. Peter's at Rome. These tablets are probably not older than A. U. C. 535 (B. C. 219), but there is every reason to believe that the song itself is the

same that was sung in the earliest ages of Rome. Every word of this ancient hymn can be made out with a high degree of certainty. We here find *enos* (acc.) = nos, with which we may compare the G. *uns; Lases* = Lares; *sins* for sinas; *advocapit* for ad vos capite, which may be illustrated by the usage of comedy in after times; *berber* for verbere or verbera; and *salis* for solis, with which we may compare σέλας, ἥλιος. Two relics of a similar character have been preserved by Cato. Further discoveries relating to the *Fratres Arvales* were made in 1866 at the fourth milestone of the Via Portuensis, consisting of 72 lines containing the acts of the order (A. U. C. 754). Several fragments of the Salian Hymns also have been handed down by Varro. Fragments of the oldest Roman laws have been preserved by Varro, Pliny, and Festus, but the most copious as well as the most important are the remains of the *Duodecim Tabulæ*, the Twelve Tables. These were engraved on tablets of bronze, and publicly set up in the Comitium, A. U. C. 304 (B. C. 449); and it may be added here that the Romans had no other body of codified law till the time of Justinian, in the sixth century after Christ. Beside the tablets just mentioned, they have been preserved chiefly by Cicero, Varro, Livy, Pliny, Festus, Aul. Gellius, Gaius, and Ulpian. *The Epitaphs of the Scipios* (A. U. C. 456–588) are very important and interesting specimens of early Latin. They are examples of a custom introduced from Greece, are the earliest dated inscriptions of any considerable length, and are very useful in settling points of archaic quantity. In these documents, *m* in the accusative and *d* in the ablative singular are generally wanting, but each occurs once; *s* in the nominative is sometimes added, sometimes omitted; and *consul* is written both *consol* and *cosol*. Some words are spelt indifferently with *o* and *u*, but the use of *r* between two vowels, for the earlier *s*, is invariable. The inscription of the *Columna Rostrata*, contained on a bronze tablet found at the foot of the Capitol in 1565, commemorates the naval victory of C. Duilius, A. U. C. 494 (B. C. 260). This preserves many archaic forms, such as *d* in the ablative, C for G, and single instead of double consonants. Ritschl, however, suspects that this inscription suffered a restoration, and that with forms that did not belong to the period of the victory. To these may be added the *Senatus Consultum de Bacchanalibus*, belonging to A. U. C. 568 (B. C. 186), and found in Calabria in 1640; and the *Lex Thoria de Agris*, or Agrarian Law of Sp. Thorius, passed, according to Rudorff, A. U. C. 643 (B. C. 111), which presents a specimen of the formal written language of the age immediately preceding that of Cicero.

CHARLES SHORT.

Latin Literature. The literature of Rome is less original and complete than that of Greece, with which it stands most closely connected, but it can hardly be said to be less important. For Roman law everywhere underlies the constitutions of Europe; the language of Rome is the parent of several of her chief tongues; her literature has always been the chief study of the schools; she has given to Christianity its nomenclature; and from her great power of assimilation and adaptation she has preserved to us whatever was most valuable of the Greeks, and probably of all other nations with which she came in contact.

The literary life of the Romans may be divided into three periods: (1) The Archaic Period, beginning A. U. C. 514 (B. C. 240), when Livius Andronicus exhibited the first regular drama in Latin at Rome; (2) the Middle Period, the Ciceronian and the Augustan age, which begins A. U. C. 671 (B. C. 83); (3) The Imperial Age, beginning A. D. 14.

The Archaic Period.—The earliest literature proper of the Romans, as of other nations, was poetic, and the earliest author Livius Andronicus, A. U. C. 470–550. He translated the *Odyssey* of Homer into Saturnians, and also rendered from the Greek tragedies, imitating the easier Greek metres. Cn. Nævius began to exhibit plays A. U. C. 519, and with more originality than Andronicus. T. Maccius Plautus (c. A. U. C. 500–570) was a prolific writer of comedy. Of the plays ascribed to him, twenty-one were considered certainly genuine, of which we have twenty, more or less complete, and nineteen others were probably genuine. He borrowed his plots from the Greeks, but worked them up and with great ability. His measures are skilfully handled, and sometimes with harmonious effect; his diction is of great importance in the history of Latin. His plays long maintained their popularity, and have been extensively studied and imitated in modern times. Q. Ennius (A. U. C. 515–585) had a higher social and political position than the literary men that preceded him, and was the first to attain the full privileges of a Roman citizen. Cicero was very fond of him, and largely quoted him in his writings, and Horace styles him *Pater Ennius* as the founder of Latin poetry. His greatest work was the *Annales*, or history of his nation, from the arrival of Æneas in Italy down to the poet's own time. He also wrote tragedies, mostly after Euripides, and *Saturæ*—that is, probably, miscellaneous poems in various measures. We possess them only in fragments. M. Pacuvius (c. A. U. C. 534–622), the nephew of Ennius, was a painter and a poet. There are extant fragments of his tragedies imitated from Sophocles; we have the titles of twelve of his plays. To this period belong Statius Cæcilius, an able imitator of the Greek New Comedy, and Luscius Lavinius, the rival of Terence, against whom all the Terentian Prologues are directed except that of the *Hecyra*. P. Terentius (A. U. C. 569–595) at an early age came from Carthage to Rome, where he was a slave of the senator Terentius, by whom he was educated and set free. He was intimate with Scipio Africanus the Younger, and hence the rumor that Scipio was the author or elaborator of the plays of Terence. We have of him six comedies, and probably these are all that he wrote. They were great favorites with the ancients, as they have been with the moderns. He has not the versatility of Plautus, neither has he his extravagance; his verse is not so varied, but it is more melodious; his language is truly Roman, and his phrases often reappear in the best works of the best period of the literature. His plays also have often been imitated in the modern drama. Roman prose, like English, was reached by an intermediate step, the earliest Roman historians employing the Greek language. These were Q. Fabius Pictor (c. A. U. C. 525) and L. Cincius Alimentus. M. Porcius Cato (A. U. C. 520–605) was the first real Latin prose-writer. His writings were numerous and various. He wrote *Origines* in seven books, an account of the Italian tribes, and published instructions on agriculture, health, and eloquence, but only his *De Re Rustica* has been preserved entire. There were orators of this period, as Fabius Maximus, M. Cornelius Cethegus, the Gracchi, and others; and also jurists, as Sextus Ælius, who wrote the first Roman treatise on law. L. Attius or Accius (A. U. C. 584–c. 650) wrote tragedies after the Greek, and dealt also with pure Roman subjects. He wrote other works, and resembled Ennius in the varied character of his writings, but he was more polished and accurate in style. L. Afranius (b. c. A. U. C. 605) wrote *Fabulæ Togatæ*, of which we have the titles. He combined the popular manner of Plautus with the elegance of Terence. C. Lucilius (c. A. U. C. 606–651) was the father of satire proper (*Hor. S.* ii. 1 and 10). His writings of this class were numerous, of which we now have upwards of 800 fragments, very valuable in the study of early Latin. An important literary work of Sulla's time, and one much copied and used in the Middle Ages, has come down to us in the *Rhetorica ad Herennium*, a complete manual adapted from Greek sources. It is by an unknown hand.

The Middle Period.—This is the Golden Age of Latin literature, and may be subdivided into two periods, in the first of which, the Ciceronian, prose culminated; and in the second, the Augustan, poetry was pre-eminent.

The Ciceronian Age. — M. Terentius Varro (A. U. C. 638–727), styled by Quintilian *vir Romanorum eruditissimus*, of ancient family and senatorial rank, was an extensive writer, versatile in matter and in form. The total number of his works was seventy-nine, of which four were written in verse. His prose writings embraced literature, eloquence, history, jurisprudence, grammar, philosophy, geography, husbandry, and other subjects. M. Tullius Cicero (A. U. C. 648–711) was born near Arpinum in Latium; his father was a Roman knight. He was endowed with great talents, had iron industry, was kind and generous in his disposition, and cherished the loftiest aims. His tone of mind qualified him to become the interpreter and transplanter of Grecian culture and refinement. He was a true patriot and full of good intentions, but was without calmness and that courage which might have carried him safely through all the dangers and distractions which beset him. Cicero possessed, to a marvellous degree, that Roman power of appropriating and assimilating foreign ideas to which we have adverted. He thus enriched Roman literature by introducing into it several new departments not previously attempted. He became the creator of a standard prose so refined and so suited to the genius of the Latin language that it was never afterwards surpassed. The real business of Cicero's life appears in his legal and political speeches, and here his ability shows to the greatest advantage; the knowledge and experience gained in this career were turned to the highest account in the rhetorical treatises which he composed toward the end of his life. His later compositions also included political science, ethics, the philosophy of religion, and theoretic philosophy. Beside all this, his extensive personal connections and his social disposition led to a voluminous correspondence. Of his speeches, fifty-seven have come down to us; we have twenty in fragments, and we know of thirty-three more delivered by him, making in all 110. Of these, the most famous are those against Catiline, for Milo, against Verres, and the second against

Antony (*Tac., Dial. de Or.*, 37; *Juv., Sat.* 10, 125 *seq.*). In the case of Verres, Cicero prosecuted, and Hortensius, his great rival, defended; and Cicero by his success became head of the bar, *rex judiciorum.* The extant rhetorical works of Cicero are—*Rhetorica*, or *De Inventione*, an immature work; *De Oratore*, written A. U. C. 699, composed, after the manner of Plato, in a dialogue, and between the two greatest orators of the preceding period, L. Crassus and M. Antonius, and several others; this work is one of the most elaborate productions of Cicero, varied in its contents and grand and eloquent in style; *De Claris Oratoribus*, or *Brutus*, a history of Roman eloquence; *Orator ad M. Brutum*, Cicero's *last word* on rhetoric, giving his ideal of an orator; *Partitiones Oratoriæ*, a sort of catechism of rhetoric; *Topica ad C. Trebatium*, an explanation of Aristotle's Τοπικά, written down from memory during a sea-voyage—a marvellous feat; *De Optimo Genere Oratorum*, forming the introduction to his translation of Demosthenes' and Æschines' speeches for and against Ctesiphon, which translation is lost. The four collections of letters that have come down to us, if we count in ninety addressed to Cicero, contain altogether 864, and are a treasure of contemporaneous history, and on some matters the sole authority extant. They consist of—*Ad Familiares*, 16 books (A. U. C. 691–711); *Ad Atticum*, 12 books (A. U. C. 686–711); *Ad Quintum Fratrem*, 3 books (A. U. C. 694–700); *Ad M. Brutum*, 2 books (questioned by Markland, Lond., 1745; defended by C. F. Herman, Götting., 1844). Cicero studied philosophy originally to perfect himself as an orator, and in his later years wrote on the subject partly as a matter of ambition, and partly as a solace amid his troubles and in the thoughtfulness of declining life. Admirable as the matter sometimes is, and important as it sometimes is from the circumstance that it is our only means of knowing the system or view in question, the form is scarcely less admirable or important. Being the first Roman writer who treated philosophical subjects in a clear and elegant manner, he created the philosophical style in Latin. The following is a list of his extant works in this department: *De Republica*, 6 books, of which scarcely a third has reached us; *De Legibus*, probably in 6 books originally, of which we now possess only three and some fragments; *Paradoxa*, an exposition of six striking maxims of the Stoics; *Consolatio*, on his daughter's death, of which only fragments exist; *Hortensius*, on the praise of philosophy, now fragmentary; *De Finibus Bonorum et Malorum*, in 5 books, a compilation on the doctrines of the Greek sects concerning the Supreme Good and Evil, perhaps the most carefully elaborated of all his philosophical works; *Academica*, or doctrines of the Academy, originally in 2 books, afterwards rewritten in 4 books; we have now the second book of the 1st ed., and of the 2d ed. the first part of the first and some fragments; *Tusculanæ Disputationes*, in 5 books, on certain metaphysical and moral points; *Timæus*, a free rendering of Plato's dialogue of this name; *De Deorum Natura*, in 3 books, mainly excerpts from the Greek philosophers on this subject; *Cato Major*, or praise of old age, containing materials drawn from Plato, Xenophon, and others, with a careful delineation of Cato's character, finished in style and important in matter; *De Divinatione*, in 2 books, a supplement to *De Deorum Natura; De Fato*, now in mutilated form, attacking the views of the Stoics and defending those of the Academics; *Lælius*, or praise of friendship, largely drawn from Greek sources, composed in a highly interesting manner; *De Gloria*, in 2 books, read by Petrarch, but since lost; *De Officiis*, in 3 books, addressed to his son to form his morals, hastily written and practical, containing some just and profound views and enlivened by illustrations from Roman history. In the department of jurisprudence he wrote *De Jure Civili.* He made some attempts in history, as *Commentarius Consulatus Sui* and *Admiranda*, which are lost. In poetry this great prose-writer, like our Jeremy Taylor, was little more than a versifier, and only subjected himself to the ridicule of the great poets, as Juvenal (*Sat.* 10, 124 *seq.*) and Martial (2, 89, 3 *seq.*). Cicero's freedman and friend, Tiro, survived him, and published his orations and letters. C. Julius Cæsar (A. U. C. 654–710) had the most varied talents; he was second as an orator only to Cicero—was a historian, a grammarian, a great statesman and general. Of his literary works the most important has come down to us, *Commentarii de Bello Gallico*, in 7 books, and *De Bello Civili*, in 3 books; and after his death the last year in Gaul and the Alexandrine, African, and Spanish wars were narrated by his friends, the first two by A. Hirtius, and the last two by some unknown hand. Cæsar's style is a model of simplicity, precision, and directness, with little rhetorical ornament. Cornelius Nepos (c. A. U. C. 660–730), the friend of Cicero and Atticus, and also of Catullus, was a somewhat voluminous writer of history and biography, but only a portion of his *De Viris Illustribus* is extant. His style is graceful, but deviates in some points from classic usage. T. Lucretius Carus (c. A. U. C. 656–699) in his *De Rerum Natura*, in 6 books, treated of physics, of metaphysics, and the Epicurean ethics, in imitation of Empedocles and Ennius. This work is important as being the fullest exponent of the doctrines of Epicurus, and though written in an archaic style, it was composed with great mastery of thought and expression. He received little attention in his own age, but the Augustan poets admired and copied him. He has been fortunate in his treatment in modern times, having been edited by the great Lachmann (Berlin, 1850–66) and by a consummate English scholar, Mr. Munro (Camb., 1860–73). C. Sallustius Crispus (A. U. C. 667–720) devoted the last years of his life to history. Of his works we have *Bellum Catilinarium* and *Bellum Jugurthinum* complete; of his *Historiæ*, in 5 books, we have only fragments. He was the first Roman historian who wrote according to fixed rules. Like his great model, Thucydides, he was sententious and concise, sometimes even to obscurity. He deviated from the usages of his time, perhaps largely through hatred of Cicero, and affected archaic diction. C. Valerius Catullus (A. U. C. 667–700), called by Teuffel the greatest lyric poet in Latin, and by Niebuhr the greatest poet Rome ever possessed, except perhaps some few of the earlier ones, followed at first the track of the Alexandrine poets, but afterwards developed rich lyrical talent which was ripened by love and a bitter experience of life. The 116 pieces that have come down to us refer to such a variety of topics, are composed in so many different styles and metres, that it is hardly possible to classify them. Some are strictly lyrical, one is a legendary heroic, four may be called elegies, and several epigrams. His genius adorned whatever it touched, but it is every way to be a matter of profound regret that many of his poems are defiled by gross coarseness and sensuality. P. Vergilius Maro (A. U. C 684–735), by way of eminence the Roman poet, was alike distinguished for ability, learning, delicacy, and amiability. His extant poems are, ten *Eclogæ* or bucolics, imitations and partly translations of Theocritus; *Georgica*, in 4 books, in which he partly availed himself of his own experience in youth and partly drew on the Greek writers, especially on Xenophon and Hesiod, and partly on the Roman writers *De Rebus Rusticis;* the masterly diction of this work makes it the most perfect Roman poem as a work of art; the *Æneid*, in 12 books, on which Vergil spent the last ten years of his life, and dying regarded as in an unfinished state. In this poem, which has taken its place among the great epics of the world, Vergil partly availed himself of Greek models, and partly relied on his extensive studies in Italian legends, history, and localities. Beside these undoubtedly genuine works, we have several *Carmina Minora*, perhaps wrongly attributed to him. As to the form of his name, the inscriptions of the time of the Republic and of the first centuries of the Christian era are in favor of *Vergilius;* the earliest dated instance of the use of the form *Virgilius* belongs to the fifth century after Christ. Q. Horatius Flaccus (A. U. C. 689–746) has shared with Vergil the greatest popularity among all the Roman poets. The branch of poetry he first cultivated was satire; of this we have two books or eighteen pieces; his *Epodon Liber*, of about the same date, a sort of satire of a more special character, contains seventeen pieces. He afterwards resolved to transplant Alcæus and Sappho into Roman soil, and the result is the three first books of the *Carmina* or odes, to which he added a fourth after an interval of about six years. These are the most elaborate of all his works. The *Epistulæ*, 23 in number in 2 books, are of the same general character as the *Satiræ*, but being written in the maturity of his learning and ability, have higher qualities and are in a more perfect form; the third of the second book, the *Ars Poetica*, treating of æsthetic questions in the Greek style, is the most famous of the Epistles. Albius Tibullus (c. A. U. C. 700–735) followed the Alexandrine poets in his choice of amatory subjects; his representations are natural and his style very simple. We have four books of *Elegies* under his name, of which the third is by an imitator of Tibullus; Lygdamus is his real or fictitious designation. Sextus Propertius (c. A. U. C. 705–739) was also an elegiac poet, and a disciple of the Alexandrines, learned and often obscure, but lively and original. He has left five books of *Elegies.* P. Ovidius Naso (A. U. C. 711–770), the most prolific of the great poets of Rome, was carefully bred as a pleader, but from natural bent turned off into the path of poetry. The following are his works now extant: *Heroides*, 21 letters in elegiac verse, feigned to have been written by ladies or chiefs in the heroic age; *Libri Amorum*, 49 elegies, chiefly amatory pieces; *Ars Amatoria*, a didactic poem in elegiac verse; *Remedia Amoris*, of the same character and form; *Metamorphoseon Libri XV.*, a collection of the most remarkable fables of classic mythology, in dactylic hexameters; *Fastorum Libri VI.*, an exposition in elegiacs of the festivals in

the Roman calendar; *Tristium Libri V.* and *Ex Ponto Libri IV.*, the former consisting of 50 elegies and the latter of 46, describing his sufferings on his way to exile and while he was in exile; *Ibis*, a poem in elegiacs written against an enemy whose name is concealed; *Halieuticon*, a fragment in hexameters on fishes. Ovid had a most fertile mind, possessed great mastery of form, and treated his subjects with inimitable ease and grace, and had he been as refined as Vergil, he would have rivalled him in fame. T. Livius of Patavium (A. U. C. 695–770) was the most important prose-writer of the Augustan age. He wrote on philosophy and on rhetoric, but his great work was his *Ab Urbe Condita Libri*, or history of Rome from the foundation of the city to A. U. C. 745, in 142 books, of which only 35 are extant, being the first decade and books 21–45; but we have a summary, *Periochæ*, of most of the lost portion. For his matter he drew especially on Polybius and the later annalists; but his manner, eminently natural and lively, of relating events and of depicting moods and characters, was his own. His diction was wanting in strict classical Latinity, and its provincial characteristics were designated as *patavinitas* (*Quint.* 15, 55). Justinus, who, with Florus, probably lived in the age of the Antonines, abridged the *Universal History* of Trogus, a work in 44 books, written in the age of Livy. Vitruvius Pollio composed (c. A. U. C. 740) *De Architectura Libri X.*, and dedicated it to Augustus.

The Imperial Age, the Silver Age of Roman Literature. The First Century, A. D. 14–117.—M. Velleius Paterculus (A. D. 30) treated the history of the Empire in his abridgment of Roman history in two books. His words are classical, but his style is affected and pompous. To the same period belongs Valerius Maximus, whose *Factorum et Dictorum Memorabilium Libri IX.*, addressed to Tiberius, is a compilation made without taste or discrimination. A. Cornelius Celsus, of the time of Nero, wrote on various practical matters, and composed an encyclopædia, of which the eight books treating of medicine alone have reached us. Phædrus, partly under Tiberius and partly under his successor, published his book of *Æsopean Fables* in good iambic senarii, and in good literary style. L. Annæus Seneca (c. A. U. C. 750–A. D. 65), the most brilliant figure of his time, in genius and culture may be compared with Ovid. His works were on a great variety of subjects, but composed with an aim to brilliancy rather than accuracy. Many of them are known only in fragments or by quotations. Among those extant may be mentioned *Epistulæ ad Lucilium*, *Apocolocyntosis*, a satire upon Claudius, and *De Beneficiis*. We have also as attributed to Seneca certain epigrams and tragedies. The latter, eight in number, agree in the main with one another and with the prose works of Seneca. Q. Curtius Rufus, under Claudius, wrote *Historiæ Alexandri Magni*, in 10 books, the two first of which are lost. He is rather a rhetorician than a historian, and in his style somewhat resembles Seneca. Contemporary with Seneca was Columella of Gades, who wrote *De Re Rustica*, in 12 books. Under Caligula or Claudius, Pomponius Mela wrote his *De Chronographia*, in 3 books, the earliest geography we possess. A. Persius Flaccus (A. D. 34–62) wrote some compositions that have been lost, and six satires, which are mostly reflections on tenets of the Stoics, with extensive employment of Horatian words and phrases. M. Annæus Lucanus, a friend of Persius and nephew of Seneca (A. D. 39–65), wrote on various subjects in prose and verse. We have his *Pharsalia*, in 10 books, an unfinished epic on the civil war between Pompey and Cæsar. It is historically accurate, but the style is artificial and pathetic, possessing great beauties and great defects. In Nero's time arose that ethical novel which we have under the name of Petronius Arbiter. Originally a large work, it is now a heap of fragments, the largest of which is the *Cena Trimalchionis*. C. Plinius Secundus, Pliny the Elder (A. D. 23–79), an officer and inspector of finance, was also a person of great and diverse literary activity. Of his works there is extant only his *Naturalis Historia*, in 37 books, a sort of encyclopædia of natural science. It was compiled from a great number of authors, and is admirable for its extent, but bears marks of haste, and is composed in an uneven style. It long enjoyed great authority. The only poet of the time of Vespasian that has come down to us is Valerius Flaccus, whose *Argonautica*, in 10 books, is an imitation of Apollonius of Rhodes. The style is pretentious and the phraseology mostly derived from Vergil. Under Domitian wrote C. Silius Italicus (A. D. 25–101), originally a politician, then a literary man. He wrote the *Punica*, a poem in 17 books, deriving his matter from Livy and Polybius, and in style imitating Homer and Vergil. At the same period (c. A. D. 45–96) lived P. Papinius Statius. His earliest and largest work was the *Thebais*, in 12 books, drawing on Antimachus for material and following Vergil in form; he left his *Achilleis* unfinished; his *Silvæ*, in 5 books are very interesting, forming valuable sketches of the time. Mostly under Domitian also lived M. Valerius Martialis (c. A. D. 42–102); we have by him fifteen books of epigrams, turning on the social life of Rome in those days, with all its grossness and servility. Martial appears in these writings almost equal to Ovid in ease and elegance of poetic form, but sinks quite below him in moral degradation. M. Fabius Quintilianus (c. A. D. 35–95) holds a high place among the prose-writers of this period. Educated at first for the bar, he afterwards became the most distinguished teacher of eloquence in Rome. He composed a work on the causes of the decay of oratory, which is lost; we happily still possess his great work *Institutio Oratoria*, in 12 books, on the complete training of the orator. This work is very valuable for its matter, and treats the subject in an interesting and judicious manner. Quintilian was sensitive to the faults of the diction of his period, and continually reverts to the earlier and better usage, never wearying of praising and recommending Cicero; but Quintilian's own style seems artificial and ungraceful to the admirers of that consummate writer. Sextus Julius Frontinus (c. A. D. 40–103), a distinguished engineer, has left records of his experience and studies; we have extant *Stratagemata*, a work on tactics, and *De Aquis Urbis Romæ*, in 2 books, written in a concise and refined style. The most eminent poet of the time of Trajan is D. Junius Juvenalis (c. A. D. 47–130), who turned from the study of oratory and the pursuits of war to the study of poetry. We have by him sixteen satires, the last of which betray the infirmities and faults of age. The earlier satires depict the vices of Roman society in a manner always interesting, and sometimes horribly vivid. His style is concise, energetic, and always suited to his theme, only he indulges now and then in a flash of sarcastic wit even in his most grave passages. Among the prose-writers of the time of Trajan, the first place has been conceded to C. Cornelius Tacitus (c. A. D. 54–119). His extant works are *Dialogus de Oratoribus*, composed with a fulness and grace not found in Tacitus's other writings; *Agricola*, a valuable biography of his father-in-law, reminding us by its manner now of Sallust, now of Cicero; *Germania*, written in a sympathetic spirit and with a high rhetorical coloring; *Historiæ*, a narrative chiefly of the Flavian dynasty (A. D. 69–96), originally in fourteen books, of which only the four first and the first half of the fifth have come down; *Annales*, or *Ab Excessu Divi Augusti*, in 16 books, a history of A. D. 14–68, of which we now have only the first and the last third. His style is very peculiar; it is concise often to harshness, audacious in its irregularities, and withal of a poetic coloring; it is commonly sententious, but on special occasions grand and sonorous, and then reminds us of the best periods rounded by the hand of Cicero. C. Plinius Cæcilius Secundus, Pliny the Younger, nephew and adopted son of Pliny the Elder (A. D. 62–113), was a fluent, smooth, and interesting writer. We have of him the speech in which he returned thanks to Trajan for the consulate, commonly called *Panegyricus; Epistulæ*, composed with a view to publication, in 9 books; and *Epistulæ Plinii et Trajani*, in an unfinished state.

The limit assigned to this article allows us to add scarcely more than the chief names of the rest of the Imperial Period.

Of the *second century* of our era are Suetonius, the author of the *Lives of the Twelve Cæsars*; Florus, who wrote an abridgment of Roman history; Terentius Scaurus, the grammarian; the historian Appian, who wrote in Greek; the jurists Ulpius and Gaius; the critic Aulus Gellius, author of the *Noctes Atticæ*; Appuleius, author of the *Metamorphoses*; Minucius Felix, whose *Octavius* is the earliest extant work of Christian Latin literature; Tertullian, a defender of Christianity; Acron and Porphyrion, the classic commentators; the *Versio Vetus* of the Bible, afterwards revised and called the *Vulgata*. In the *third century* we find the jurists Ulpian and Julius Paulus; Cyprian, bishop of Carthage, chiefly an apologist; Nonius the lexicographer; Terentianus Maurus, a writer on metres; Arnobius, a Christian apologist, and Lactantius his pupil, the most elegant of all the Christian Latinists. To the *fourth century* belong the grammarians Victorinus and Donatus; Eutropius the historian; the theologian Hilary; the poet Ausonius; Damasus, one of the earliest writers of Christian hymns; Ammianus the historian; the grammarian Servius; St. Ambrose, whose hymns approach classical perfection; St. Jerome, the translator of the Bible and reviser of the earlier version; Prudentius, the greatest of the Christian poets; Claudian, the last classic poet; and St. Augustine, the theologian, the greatest of the Latin Fathers. This period, the period of decay, cannot well go beyond the time of the philosopher Boethius, c. A. D. 500, and certainly not beyond the age of Justinian, under whom the great *Corpus Juris* was drawn up, in the middle of the sixth century.

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Lati'nus, a king of Latium, was, according to the common tradition, a son of Faunus and the nymph Marica, and the father of Lavinia, whom he gave in marriage to Æneas. But besides this there were many other different traditions concerning his descent and history.

Lat'itude, on the earth, is the distance of a place from the equator measured on the meridian passing through the place, and expressed in denominations of circular measure. To the ancient geographers the largest dimension of the known world was that which lay in the direction E. and W. Hence distances measured E. or W. from a meridian assumed as an axis of reference were called longitudes (Lat. *longitudo*, "length"), and those measured in the transverse direction, latitudes (Lat. *latitudo*, "breadth"). Geographical latitude is the angle made by the vertical (or perpendicular to the horizon) at the place and the plane of the equator; but as the earth is not truly spherical, this vertical is not usually coincident in direction with the radius drawn to the place from the earth's centre. The angle made by this radius with the plane of the equator is called the geocentric latitude. Geographical latitude is also the angle made by the horizon of the place (which is the plane touching the earth at the place) and the horizon or tangent plane of that point of the equator in which the meridian of the place cuts it; and as this last plane is necessarily parallel to the earth's axis, it follows that the latitude of a place is equal to the angle which its horizon makes with the earth's axis, and that the elevation of the pole above the horizon is equal to the latitude of the place. Hence, if there were a star situated truly in the pole of the celestial sphere, the latitude of any place at which such star could be seen could be determined by the simple observation of that star, correction having been made for the effects of refraction, aberration, and nutation. As the star called the pole-star is not truly in the pole, when it is observed for latitude further and more important correction is necessary for its position at the time of observation relatively to the true pole. A meridian observation of any star or other celestial body, whose declination (distance from the equinoctial or celestial equator) at the time of observation is known, affords an easy means of determining latitude. Meridian observations of stars passing near the zenith furnish the most satisfactory results, being hardly perceptibly affected by refraction. Observations of celestial bodies out of the meridian may also, with proper auxiliary data, be used for ascertaining latitudes, the varying conditions presenting several distinct problems in spherical astronomy.

Latitude in the heavens is the distance, in angular measure, of any celestial object from the ecliptic, or plane of the earth's orbit, measured on a secondary (that is, a circle perpendicular) to the ecliptic. The latitude is geocentric if given as it would seem if observed from the centre of the earth, and heliocentric if given in like manner as if observed from the centre of the sun. F. A. P. BARNARD.

Latitudina'rians, a former Broad-Church party in the Church of England. Their chief seat was Cambridge, and the reign of Queen Anne was their most flourishing period. The Latitudinarians attempted to unite the Puritan and Presbyterian elements with the national Church. They were strongly Protestant and Low Church in their feelings, and generally Arminian or indifferent in doctrine. Burnet, Whiston, Tillotson, Chillingworth, Cudworth, More, Gale, and Wilkins were among their greatest names. The modern Broad-Church party is also called Latitudinarian.

La'tium, during the Roman empire the most fertile and most densely peopled province of Italy. Its undulating plain, rising from the Mediterranean to the Apennines, produced the choicest wines, and contained, besides Rome, the capital of the empire, many populous and flourishing towns; as, for instance, Alba Longa, Tusculum, Ardea, Lavinium, Antium, and Corioli. By neglect the water-courses and the whole draining system of the plain fell into disorder, and thus the whole coast-district between Antium and Terracina was transformed into an unproductive and pestiferous swamp, known as the Pontine Marshes.

Lato'na [Gr. *Leto*], in Grecian mythology, the mother of Apollo and Diana (Artemis) by Jupiter (Zeus). Pursued by a serpent sent by Juno (Hera), she fled from place to place, until at last she found rest on the floating island of Delos, which Jupiter fixed firmly for her, and where she bore him two children. Although the myths relating to her were much enlarged by later writers, no special worship was ever instituted for her, and she had no temples of her own.

Latour' d'Auvergne', de (THÉOPHILE MALO CORRET), b. at Carhaix, Brittany, Nov. 23, 1743; educated at the college of Quimper; entered military service in 1767; served for some time in the Spanish army, and distinguished himself in 1782 at the siege of Port Mahon; was a captain at the outbreak of the Revolution; fought with brilliant success in the republican armies of the Alps and the Pyrenees, and became the commander (although still retaining the simple title of captain) of a vanguard of 8000 men, composed of all the companies of grenadiers, which soon became famous as "the infernal column," and more than once decided the battle by its irresistible impetuosity. In 1795 he retired from service on account of ill-health, and making a sea-voyage he was taken by an English cruiser and held as a prisoner of war till 1797. He re-entered the army as a substitute for the last son of one of his friends; fought under Massena in Switzerland, and then at the head of his own company in Germany, where he fell at Oberhausen, Bavaria, June 27, 1800. His indomitable courage, his noble pride, and the generosity and simplicity of his character made him the idol of the soldiers. After his death his heart was embalmed and carried in a silver vase by his company, and his name continued to be called at roll till 1814, the oldest sergeant answering, "Died on the field of honor." He had a passion—not unsuccessful—for linguistical studies, and published in 1792 *Nouvelles Recherches sur la Langue, l'Origine et les Antiquités des Bretons*, which was reprinted in 1802 under the title *Origines Gauloises*.

La Trappe, a retired valley in the department of Orne (Normandy), France, 8 miles N. of Mortagne, where in 1140 a Cistercian abbey was founded under very severe rules, from which originated the celebrated religious order known as the TRAPPISTS (which see).

Latreille' (PIERRE ANDRÉ), b. at Brives, in the department of Corrèze, France, Nov. 29, 1762; studied first theology, and was ordained priest in 1786, but devoted himself afterwards to the study of entomology; became superintendent of the entomological division of the Museum of Natural History at Paris in 1798, member of the Academy of Sciences in 1814, and professor of zoology after the death of Lamarck in 1829, and d. Feb. 6, 1833. The most prominent of his numerous and voluminous writings are—*Histoire naturelle des Crustacés et des Insectes* (14 vols., 1802–05), *Genera Crustaceorum et Insectorum* (4 vols., 1806–09), *Cours d'Entomologie* (1831). He also wrote parts of Buffon's *Natural History* and the entomological part of Cuvier's *Règne animal*.

La'tro (M. PORCIUS), of Spanish birth, flourished in Rome in the time of Augustus. He is highly spoken of by Quintilian, and also by the elder Seneca, who had known him from boyhood, and who has given in his *Controversiæ* interesting details of his personal and professional character, and specimens of his declamations. Among his pupils was the poet Ovid. He d. B. C. 4, having taken his own life, according to Jerome, while suffering from a severe fever. His writings have perished; for the *Declamatio in C. Sallustium Crispum* and the *Declamatio in Ciceronem* have been ascribed to him without sufficient reason. (See Bähr's *Gesch. d. Röm. Lit.*, vol. ii. p. 488; Lindner, *De M. Porcio Latrone Commentatio*, Breslau, 1855.)
H. DRISLER.

Latrobe', post-b. of Westmoreland co., Pa., 41 miles E. of Pittsburg, on the Loyalhanna Creek, at the junction of the Ligonier Valley and Pennsylvania Central R. Rs., has 1 weekly newspaper, 7 churches, 2 hotels, 2 banks, 1 college, and 1 convent (St. Vincent and St. Xavier), 3 large coal and coke companies, a paper-mill, 2 planing-mills, several large flouring-mills, carworks and machine-shops, and the usual number of stores and shops. Pop. 1127.
CHARLES B. FINK, ED. "ADVANCE."

Latrobe (BENJAMIN HENRY), b. in Yorkshire, England, May 1, 1767; was educated at the University of Leipsic; served in the Prussian army (1785); returned to England; studied architecture; became surveyor of public offices of London (1788); came to the U. S. in 1796, built the bank of Pennsylvania, the Schuylkill waterworks, the cathedral and exchange at Baltimore, completed the Capitol of the U. S., and rebuilt it after its destruction in 1815; built steamboats at Pittsburg in the same year, and d. at New Orleans in Sept., 1820.

Latrobe (BENJAMIN H.), b. in Philadelphia, Pa., Dec. 19, 1806; graduated at St. Mary's College, Baltimore, 1823; studied law, and was admitted to the bar; after practising his profession in New Jersey and Baltimore for a few years, abandoned it to become a civil engineer, and in 1830 was appointed assistant to Jonathan Knight, then chief engineer of the Baltimore and Ohio R. R. Co., as such locating the Washington branch of that road and that between Point of Rocks and Harper's Ferry, and many other important divisions; was chief engineer of the Baltimore and Port Deposit R. R., locating and completing it; succeeded Mr. Knight on his retirement in 1842, and finished the road to Wheeling, Va.; has been chief engineer and president of various railroad companies, besides consulting engineer for various State governments, and is frequently consulted

by the general government on important works of internal improvement.

Latrobe (Charles Joseph), b. in England early in the nineteenth century; author of several works of travel of high merit, among which are *The Alpenstock, or Sketches of Swiss Scenery and Manners* (1829), *The Rambler in North America in 1832–33* (1835), and *The Rambler in Mexico in 1834* (1836). Mr. Latrobe accompanied Washington Irving in his "tour on the prairies."

Lat'ten [Fr. *laiton*], a kind of sheet bronze used in the Middle Ages for making church ornaments, monumental brasses, and the like. In later times latten denotes simply sheet brass or other sheet metal.

Latter-Day Saints. See Mormonism.

Lat'timore (Samuel Allan), Ph. D., LL.D., b. May 31, 1828, at Liberty, Ind.; graduated in 1850 from Asbury University, Greencastle; became professor of Greek at the same university in 1852, of natural science at Genesee College, Lima, N. Y., in 1860, and of chemistry at the University of Rochester, N. Y., in 1867.

Lat'ty, tp. of Paulding co., O. Pop. 294.

Latude', de (Henri Masers), b. Mar. 23, 1725, near Montagnac, in the department of Hérault, France; received a military education, and went in 1748 to Paris to study mathematics. Anxious to make himself conspicuous somehow, he obtained an audience with Madame de Pompadour, and told her that a conspiracy had been formed against her life, and that a box containing a subtle poison would be sent to her through the post. The box came, but its contents were found to be ashes only, and it was discovered that Latude himself had sent the box. He was thrown in the Bastile, and as he escaped, but was caught again, his term of punishment was prolonged. Three times he escaped, and three times he was caught again, and thus it happened that he was kept in prison for thirty-five years as a punishment for a mere foolishness. In 1784, Madame Legros, who incidentally became acquainted with his history, procured his liberation, a pension was given him, and the whole unfortunate affair—for it was hardly anything more—was forgotten. But when the Revolution broke out the case was brought before the public with all its details, and used as a means of exciting the revolutionary hatred against the old régime—a purpose for which the story was eminently well suited. Latude published his *Mémoires* in 1789; his advocate Thierry, *Le Despotisme dévoilé* (3 vols., 1791–92), and in 1793 a court awarded him 60,000 livres in damages, to be paid by the heirs of Madame de Pompadour. Thus, the French people made a similar mistake to that which the mistress of Louis XV. had made. She took Latude for a criminal; they made him a hero; both forgot that he was a fool. A later world has been more just; it pities him. D. Jan. 1, 1805.

Lau'ban, town of Prussia, in the province of Silesia, on the Queiss. It has a bell-foundry, several breweries, and manufactures of cotton and linen goods, cloth, and tobacco. Pop. 6610.

Lau'be (Heinrich), b. at Sprottan, in Silesia, Sept. 18, 1806; studied since 1826 theology at Halle and Breslau, and settled in 1832 in Leipsic, devoting himself exclusively to literary pursuits. He travelled much in Germany, France, and Italy; was often persecuted, and several times imprisoned, for his participation in the revolutionary movements of his time; sat in the German Parliament of 1848; was director of the Burg theatre of Vienna from 1849 to 1867, and of the theatre of Leipsic in 1868–69. His writings are partly historical—*Das neue Jahrhundert* (2 vols., 1833), *Modernen Characteristiken* (2 vols., 1835), *Geschichte der Deutschen Literatur* (4 vols., 1840), *Das erste Deutsche Parlament* (3 vols., 1849), *Das Burgtheater* (1868), etc.; partly travelling sketches and novels—*Französische Lustschlösser* (3 vols., 1840), *Das junge Europa* (4 vols., 1833–37), *Der deutsche Krieg* (9 vols., 1863–66), etc.; partly dramas—*Monaldeschi* (1845), *Die Carlsschüler* (1850), *Graf Essex* (1856), etc. He is a man of enterprise, of practical ability, and of some talent, but he has no genius, and his studies were superficial. As a writer of fancy his mastership of all the technicalities of art often enabled him to produce striking effects, but he never made a lasting impression. As a historical writer his mental vivacity and varied personal experience make him very entertaining, but he never instructs. Clemens Petersen.

Laud (William), b. at Reading, Berkshire, Oct. 7, 1573, was the son of a rich clothier; entered St. John's College, Oxford, in 1589; became a fellow in 1593; took his degree as master of arts in 1598; and was ordained a priest in 1601. From 1601 to 1621, in which latter year he was consecrated bishop of St. David's, he held several minor positions. In 1607 he was appointed vicar of Stanford, Northamptonshire; in 1609 rector of West Tilbury, Essexshire; in 1611 president of St. John's College, Oxford; and in 1615 archdeacon of Huntingdon. In all these positions he plainly showed his character, and by degrees he attracted the attention of James I. He was a learned man and a liberal supporter of learning; an exemplary clergyman, energetic, dignified, and benevolent to the poor; but he hated the Puritans, and the fearlessness and consistency with which he resisted, and, later on, even persecuted them, made the hatred reciprocal. He was a churchman, rather than a theologian. His religion had a color of sacerdotalism. He understood the Church better as a worldly institution than as a spiritual necessity, and its rites and ceremonies were to him of paramount importance. In 1617 he accompanied King James to Scotland, and an attempt was made to introduce episcopacy into the government of the Scotch Church, but it failed. After the accession of Charles I., Laud was removed to the see of Bath and Wells in 1626, and in 1628 to that of London. In 1624 he was made a member of the court of high commission, in 1627 a privy councillor, and after the assassination of Buckingham he actually became prime minister. In 1630 he was chosen chancellor of the University of Oxford, and in 1633 he was made archbishop of Canterbury. These powerful and influential positions he used with more passion than prudence, and more energy than justice, to carry through his ecclesiastical views. The Puritans were everywhere and in every way repressed. People who would not conform to the Established Church were fined, imprisoned, branded on the forehead, and exiled; in some cases they even had their ears cut off and their noses slit open. His spies were everywhere. The smallest congregations of Separatists were broken up, and even the devotion of private families did not escape his control. But if the exertions were great, the purpose was rather small. Besides these harsh and tyrannical measures in order to compel people to conform to the Established Church, that which the archbishop did to perfect the institution itself was rather of a petty character—regulations with respect to the proper place of the altar, the due manner in which the altar ought to be railed in, "Sunday sports," etc. The result was a deep and implacable hatred. In 1635 a new attempt was made to introduce the episcopacy into the Scotch Church, and this time it led to the Scotch rebellion, which ushered in the English revolution. When in 1640 the Long Parliament met, the archbishop was impeached for high treason, and by order of the Commons brought to the Tower. There he remained three years, exposed to many indignities. At last his trial came on, and although he defended himself admirably, and was not found guilty by the Lords, the Commons sentenced him to death and gave order to his execution, which took place June 10, 1644. A complete edition of his works was published in London 1857–60; his *Diary* and his letters are of great historical interest. Clemens Petersen.

Lau'danine [from *laudanum*], a base homologous with morphine and codeine, contained in opium. (See Watts's *Dict., Supplement.*)

Lau'danum [probably from *Ladanum* or Labdanum (which see)], the tincture of opium, made by soaking the dried and powdered drug in alcohol. It is a valuable opiate, though of variable strength. It ought never to be given to young children as a domestic remedy. It has a more stimulant and astringent effect than morphine, and frequently causes headache.

Lau'da Si'on Salvato'rem ("Praise the Saviour of Zion"), a sequence sung in the Roman Catholic churches on Corpus Christi Sunday. It is a rhymed Latin hymn by Thomas Aquinas, in twelve stanzas—nine having six lines each, two having eight lines each, and one, the twelfth, having ten lines.

Lau'der (Robert Scott), R. S. A., b. at Silver Mills, near Edinburgh, Scotland, in 1803; studied painting at Edinburgh and London under the patronage of David Roberts and Sir Walter Scott; spent five years in Italy; resided from 1838 to 1849 in London, and for the remainder of his life in Edinburgh, where he d. Apr. 21, 1869. He was a *genre* painter of great merit, his best works being scenes from Scott's novels. His *Christ teaching Humility* was purchased by the Scottish Association for the Encouragement of Art, and presented to the Scottish National Gallery at Edinburgh.

Lauder (Sir Thomas Dick), Bart., b. near Edinburgh, Scotland, in 1784, only son of Sir Andrew Lauder, sixth baronet of Fountainhall, Haddingtonshire; was a contributor to *Blackwood's Magazine* from its commencement, and so successfully rivalled Sir Walter Scott in his peculiar department of historical fiction that several of his tales were attributed to the author of *Waverley*. Among them were *Lochandhu* (1825), *The Wolfe of Badenoch* (1827), *Highland Rambles, with Long Tales to Shorten the Way* (1837), and *Legendary Tales of the Highlands* (1841). He was an active member of scientific and antiquarian societies, edited

several works on natural history, and was a contributor to the *Edinburgh Encyclopædia*. D. near Edinburgh May 29, 1818.

Lauder (WILLIAM), b. in Scotland early in the eighteenth century; educated at Edinburgh University; published in 1739 a collection of modern Latin verse; and becoming a teacher of Latin in London, contributed to the *Gentleman's Magazine* in 1747 a series of articles attempting to prove that Milton had in his *Paradise Lost* borrowed largely from modern Latin poems by Grotius, Masenius, and others. These essays were reprinted in a volume in 1751, with a preface by Dr. Samuel Johnson, but it was soon ascertained that the work was an imposture, the parallel passages quoted being either forged or taken from a Latin translation of the *Paradise Lost*. Lauder confessed his offence, and went to Barbadoes, where he d. in 1771.

Lau'derdale, county of N. W. Alabama, bounded N. by Tennessee and S. by the Tennessee River. The W. end touches Mississippi. Area, 650 square miles. It is generally very fertile. The N. part is a rolling plateau. Cotton, pork, and corn are the chief products. Cap. Florence. Pop. 15,091.

Lauderdale, county of Mississippi, bounded E. by Alabama. Area, 720 square miles. It is generally level and extremely fertile. Corn and cotton are staple products. It is traversed by the Mobile and Ohio and the Vicksburg and Meridian R. Rs. Cap. Meridian. Pop. 13,462.

Lauderdale, county of W. Tennessee, having the Mississippi River on its western boundary, which separates it from Arkansas, the Forked Deer Creek partly on the N., and the Big Hatchie River on the S. Area, 350 square miles. The surface is level and the soil fertile. Corn, cotton, and wheat are the chief productions. Cap. Ripley. Pop. 10,838.

Lauderdale, post-v. of Lauderdale co., Miss., on the Mobile and Ohio R. R., 19 miles N. of Meridian, has a church, a semi-monthly newspaper, an orphans' home, and a large business in shipping cotton. One mile S. E. are the Lauderdale Springs, a favorite watering-place. Pop. 250. WM. H. HOGAN, MANAGER "ORPHANS' HOME BANNER."

Lauderdale (Col. JAMES), b. in Virginia about 1780; removed early in the present century to West Tennessee; bore a distinguished part in the Creek war under Gens. Coffee and Jackson, and was killed while fighting with great gallantry at the first battle of New Orleans Dec. 23, 1814. Several counties and towns in the Southern States were named for him.

Lauderdale (JAMES **Maitland**), EIGHTH EARL OF, b. in Scotland in 1759; entered Parliament in 1780; was one of the managers of the impeachment of Warren Hastings in 1788; succeeded to the title in 1789, and was elected one of the sixteen representative peers of Scotland; favored the French Revolution; visited France, and formed an intimacy with Brissot and the leading Girondists; energetically opposed all the war-measures of Pitt; resigned his seat as representative peer; became a citizen of London, and ran unsuccessfully for sheriff; wrote much upon finance and Indian affairs, and on the accession of the Whigs in 1806 became a baron of the United Kingdom, privy councillor and chancellor of Scotland. In Aug., 1807, he was charged with an unsuccessful mission to France to treat for peace; resigned the chancellorship the same year; continued in the House of Peers to oppose the war-policy; in 1816 endeavored to obtain the release of Napoleon from St. Helena by act of Parliament. He published in 1804 a very popular work, *An Inquiry into the Nature and Origin of Public Wealth,* and in 1809 a treatise on the system of government for India. D. Sept. 13, 1839.

Lauderdale (JOHN **Maitland**), DUKE OF, b. at Lethington, Scotland, May 16, 1616; educated as a rigorous Covenanter; was commissioner to treat with Charles I. in his prison in the Isle of Wight, and obtained the signature of the treaty known as the "Engagement" (Dec. 26, 1647), by which the king was again recognized in Scotland; was the chief favorite of Charles II. during his brief rule in Scotland (1649–51); was taken prisoner at the battle of Worcester (Sept., 1651), and remained nine years in the Tower and other prisons; was made secretary of state and high commissioner in Scotland by Charles II. in 1660; received in rapid succession all the highest posts in Scotland, of which kingdom he was the virtual ruler for many years; was created duke of Lauderdale in 1673; raised to the English peerage in 1674 as Earl Guilford, and sworn of the privy council, forming a member of the celebrated *Cabal* ministry. He was a flatterer of Charles, and has been painted in the darkest colors by Macaulay in his *History of England*. D. at Tunbridge Aug. 24, 1684.

Lau'don, von (GIDEON ERNST), BARON, b. at Trotzen, Livonia, Oct. 10, 1716, of a Scottish family, and entered in his fifteenth year the Russian military service, but was dismissed after the Peace of Belgrade (1739) with the rank of a lieutenant. He now offered his services to Frederick II. of Prussia, but was not accepted, because the king disliked his face. He then went to Vienna, was employed as a captain, and fought in the Bavarian and in the second Silesian war, not without distinction, but without promotion. After the peace he was removed to a regiment stationed on the Turkish frontier, and here he was nearly forgotten. In the first year, however, of the Seven Years' war he distinguished himself as colonel of a regiment of Uhlans—so much that in 1757 he was made a general. His commission came to him through the hands of the Prussians, accompanied by a congratulatory letter from Frederick II. At Kunersdorf (Aug. 12, 1759) he decided the battle and turned the victory which the Prussians had gained over the Russians into a complete rout of the Prussian army. Having been made a field-marshal and placed at the head of an independent corps of 30,000 men, he defeated the Prussians once more at Landshut (June 29, 1760), and took Schweidnitz (Oct. 1, 1761). After the Peace of Hubertsburg he lived in retirement on his estates, engaged in studies, until Joseph II. placed him at the command of the whole Austrian army in the war against the Turks. The campaign was a most brilliant one; the Turks were repeatedly defeated and Belgrade was taken. In the Bavarian war of succession he commanded the Austrian army, and succeeded in placing the Prussian armies in a very difficult position when peace was concluded. The Austrian empire gave him the title of generalissimo, which none but Eugène had ever had, and overloaded him with dotations and honors. D. suddenly at Neutitschein July 14, 1790.

Laudonnière, de (RENÉ GOULAINE), b. in France early in the sixteenth century; was sent by Admiral Coligny along with Jean Ribault to found a colony in Florida; sailed from Dieppe Feb. 15, 1562, and left the colonists at Port Royal; returned with three ships to their relief in 1564; found the settlement abandoned; entered the river St. John's, called by him the river May, and built Fort Caroline. In the surprise and massacre perpetrated there by the Spaniards under Menendez (Sept. 20, 1565) Laudonnière escaped with but a few followers; arrived in France in Jan., 1566; was coldly received by the court, and spent the remainder of his life in obscurity. He published in 1586 an account of his adventures, *Histoire notable de la Floride, contenant les trois voyages faits en icelle par des capitaines et des pilotes français.* (See also T. Irving's *Conquest of Florida.*)

Lau'enburg, duchy of Northern Germany, bounded by Holstein, Mecklenburg, Hamburg, and Hanover. Area, 454 square miles. Pop. 49,546. Cap. Ratzeburg, the only other towns being Lauenburg and Mölln. Important in the Middle Ages, Lauenburg has during the present century become of so little value as to have several times served as a make-weight in treaties. It was taken by France from Hanover 1803, incorporated with the French empire 1810, regained by Hanover 1813, ceded to Prussia 1815, and transferred to Denmark the same year. In 1864, after the Danish war, it was ceded to Austria and Prussia, and by the convention of Gastein (1865) it was acquired by the king of Prussia for the sum of 1,875,000 thalers, paid from his own pocket, whereupon he became its duke, and has conducted the administration separately from that of Prussia.

Lauenburg, town of Prussia, in the province of Pomerania, on the Leba, has manufactures of linen and woollen fabrics and valuable fisheries. Pop. 6530.

Laugh'ery, tp. of Ripley co., Ind. Pop. 1874.

Laughing Gas. See NITROGEN.

Laugh'ter [Ang.-Sax. *hleahtor,* from *hleahhan,* to "laugh"] consists of convulsive, and to a certain extent involuntary, actions of the muscles of respiration, by means of which the air, being expelled from the chest in a series of jerks, produces a succession of short, abrupt sounds, variously modified according to individual peculiarities: at the same time the angles of the mouth are drawn backward and upward; the upper lip is elevated; the nostrils are expanded; the lower eyelid is slightly raised, and the external angles of the orbital openings thrown into wrinkles by the contraction of the lower part of the orbicularis palpebrarum muscles, while the eyes assume a peculiarly bright appearance. If the action be sufficiently intense or prolonged, tears are shed through the compression exerted on the lachrymal sacs, the brows are elevated, and other muscles of the body may participate to such an extent that the head, trunk, and limbs are thrown into movements, and even the contents of the bowels and bladder may be evacuated by the expulsive efforts of the abdominal muscles overcoming the normal contractility of the sphincters.

This remarkable category of actions, which in its entirety we call *laughter*, may be originated in various ways. In children and weak-minded persons, and in certain animals, it is, as Darwin asserts, the expression of pure pleasure, but in the normally constituted adult the most intense pleasure unmodified by other emotions does not appear to be capable of exciting laughter. At the same time, it must be admitted that, no matter how induced, laughter is always indicative of a certain amount of high spirits and self-satisfaction, combined sometimes with a sense of superiority. The exciting causes of laughter are, as a whole, not thoroughly understood, and have been the subject of very diverse opinions from physiological and psychological writers, none of which appears to be entirely correct or to include all the emotional or other excitations. Thus, Hobbes asserts that "laughter is a sudden glory arising from sudden conception of some eminency in ourselves by comparison with the infirmity of others, or of our own formerly." But this explanation by no means covers the ground, for we very frequently laugh at matters that in no way concern ourselves, as, for instance, at a humorous remark made by another, or at some striking incongruity of action in an individual which cannot by any means be connected with our own being. As Bain remarks, Hobbes's definition will only apply to the laugh of victory, ridicule, derision, or contempt against persons whom we ourselves have humiliated. Bain has very well shown that mere incongruity is not of itself always sufficient to excite laughter, although such is the generally received opinion. There are many incongruities which, as he says, may produce anything but a laugh. A little reflection will enable any one to call up hundreds of such without there being developed the slightest disposition to laughter. It would seem, however, that the incongruous in certain forms is capable of causing laughter. Thus, upon one occasion the writer witnessed the fact of a whole congregation of devout worshippers thrown into paroxysms of the most intense laughter by the attempt of a dog which had entered the church to pass through the chancel-railing to reach his master, the officiating clergyman. When half through he stuck fast, and by no effort could he either advance or retreat. His cries drowned the voice of the minister, and he was finally with difficulty extricated by the senior warden and the sexton, and carried howling out of the church. In this instance the incongruity was of the most marked character, and there was in addition the sudden revulsion of feeling which so frequently excites laughter. To use the language of Herbert Spencer—who lays great stress on this sudden interruption of the course of one emotion by the instantaneous development of another—the channels through which the discharge was about to take place were closed, and a new channel opened. In another instance which came under the writer's notice the incongruity and revulsion were still more evident—more even than in the case given by Spencer of the tame kid snuffing at a pair of devoted lovers in the most highly wrought part of a sensational drama. Two lovers on the stage had reached the culmination of their fate, and were dying in each other's arms. The interest of the audience was worked up to the highest pitch; many were in tears, and then the curtain slowly descended. But the dead lovers had fallen too far to the front, and when the curtain reached the stage they were between it and the footlights. In an instant the idea of the ludicrous was aroused, and amidst peals and shrieks of the most convulsive laughter from the audience the two actors had to get up and walk abjectly from the presence of the crowd.

True wit does not excite laughter, for the reason that in true wit there is the very reverse of incongruity; but the attempt at wit, being incongruous, does give rise to the idea of the ludicrous, and laughter is produced. This is well shown in the following lines from the signboard of an inn kept by one Littlejohn:

> "Ye who love old wine and good,
> Come in and drink with Robin Hood:
> If Robin Hood is not at home,
> Come in and drink with Little John."

There is nothing incongruous in this; it is witty, but though it causes pleasure and may excite a smile, it does not cause laughter. In the course of time, however, the inn came into the possession of Jacob Snodgrass, who, ignorant of the relation between Robin Hood and Little John, but knowing the persuasive power of the old sign, and wishing to continue it as far as truth would allow, left it intact with the exception of erasing the name of Little John and substituting that of Jacob Snodgrass. Nobody had ever laughed at the old sign, but every one laughed at this, for the incongruity between Robin Hood and Jacob Snodgrass was so palpable that the impulse to laugh was irresistible.

The incongruous, to be capable of exciting laughter, must be of such a character as to produce no other strong emotion. If this latter occurs, the sense of the ludicrous is overwhelmed by the more powerful feeling which the event occasions. Thus, if in the instance cited of the dog sticking fast in the chancel-railing the struggles of the animal to get free had ignited some lucifer matches accidentally near him, the emotion of fear would have arisen in the minds of the congregation, would have overwhelmed all idea of the ludicrous, and cries of fright, not laughter, would have been the result.

The theory of Dumont is, when analyzed, not materially different from that which ascribes laughter to a perception of incongruity. According to this author, we laugh when the mind is concerned with facts of such a nature as to cause us to think at one and the same time that a thing is and is not. In other words, when we are forced to affirm and deny the same thing—when, in short, the understanding is obliged to conceive simultaneously two contradictory relations of one thing or circumstance. "It is certain," he says, "that we can no more succeed in uniting two contradictory elements in a single conception than we can cause two bodies to occupy the same space at the same time. But two distinct forces can so act upon two bodies as to push them towards the same space, and thus to cause a shock or a succession of shocks. In like manner, diverse circumstances can prompt the understanding to attempt to make two contradictory ideas enter into the same conception. From this attempt a kind of intellectual contest results, of which laughter is the expression." This contest between contradictory ideas is nothing more than the sense of incongruity to which, as a cause of laughter, the attention of the reader has already been directed.

But besides those causes of laughter which are entirely intellectual in character, there are others which are sensational, others which are partly sensational and partly intellectual, and again others which are pathological. As an instance of a sensational cause (classed erroneously by Bain as mechanical), tickling may be mentioned. Among the pathological causes hysteria plays an important rôle, and the abnormal condition of the mind from which laughter is evolved as an expression of grief (sardonic laughter) may be placed in the same category. Among the mixed sensational and intellectual is the fact that individuals, especially children, laugh when the motion of tickling is made towards them. Here the laughter is the result of the perception of the approaching finger performing the motion of tickling, evoking the recollection of previous ticklings. According to Darwin, the anthropoid apes utter a reiterated sound when they are tickled under the armpits. The laughter from tickling is of reflex character, and scarcely if at all under the control of the will, though such control may be acquired by repeated efforts.

But there is frequently another governing factor in the laughter from tickling, besides the mere sensational excitation. We laugh when we are tickled by others, but we do not laugh when we tickle ourselves. This is especially the case when the motion is made on the skin covering the sides of the chest. The fact appears to be that in order for laughter to result from tickling we must be in ignorance of the exact spot which is to be tickled. When we know it, as we do when we are about to tickle ourselves, laughter does not result.

Bain asserts that cold and some kinds of acute pain cause laughter, but this is probably erroneous. The laughter of young infants in their sleep, commonly ascribed by mothers and nurses to colic, is more likely due to pleasant dreams.

The mechanism of laughter, so far as the muscles of the face are concerned, has been admirably studied through the agency of electricity by Dr. Duchenne (de Boulogne), and previously, very philosophically, by Moreau (de la Sarthe) and Sir Charles Bell.

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W. A. Hammond.

Laugier' (André), b. at Paris Aug. 1, 1770; was employed by the Convention during the French Revolution in collecting the bells from the churches of Bretagne to be melted into cannon; was afterwards at the head of the office for the manufacture of powder; served in the medical corps of the army; became professor of pharmacy and chemistry at several institutions, assistant professor at the Museum at Paris in 1802, and professor in 1810, on the death of Fourcroy, who was his relative. Laugier made numerous important chemical discoveries, recorded chiefly in the *Annales* of the Museum; he was long a member of the department of public instruction, and along with Fourcroy was the organizer of a large number of colleges and lyceums. He published a *Cours de Chimie générale* (3 vols, 1828). D. at Paris Apr. 18, 1832.

Laugier (Auguste Ernest Paul), son of André, b. in Paris Dec. 22, 1812; studied astronomy under Arago; obtained a post in the observatory at Paris; made important discoveries in regard to magnetism, comets, eclipses, meteors, and solar spots; made improvements in astronomical clocks; determined the exact latitude of the Paris observatory (1853), correcting previous errors, published a catalogue of 53 nebulæ, and another (1857) of the declination of 140 stars, and contributed many astronomical papers to the *Connaissance du Temps*. He was long associated with Arago in researches on terrestrial physics, and was for some years president of the Academy of Sciences. D. at Paris Apr. 5, 1872.

Launce, a species of sand-eel. See Ammodytes.

Launces'ton, parliamentary and municipal borough of England, formerly cap. of the county of Cornwall, on the Kensey River, a tributary of the Tamar, 22 miles N. E. of Plymouth, with which it is connected by railway. It is situated on a steep hill, at the top of which are the ruins of Castle Terrible, built by the ancient princes of Cornwall; has elaborately carved gates, several public buildings, and a grammar school founded by Queen Elizabeth. Pop. 5140.

Launceston, the second town of Tasmania or Van Diemen's Land, cap. of the county of Cornwall, situated on the river Tamar at its confluence with the Esk, 32 miles S. E. of Port Dalrymple, has 22 churches, 36 schools, 5 banks, 3 newspapers, commodious government buildings, and a considerable trade with South Australia and Victoria, exporting wool, timber, and fruits, and importing manufactured goods. Pop. 10,688.

Launch, the principal boat attached to modern ships. Ships of the largest size sometimes have steam launches, and these in the naval service frequently carry a piece of artillery, and are very serviceable in shallow waters and rivers.

Launch'ing [Fr. *lancer*, "to hurl out"], the removal of a new ship from the shipyard to the water. Ships are usually built upon inclined wooden ways, and when the hull is finished the vessel is allowed to slide stern foremost into the water. The spars are usually set up after launching. The Great Eastern was launched sidewise into the Thames (1858), powerful hydrostatic pressure being required to force her into her proper element.

Laun'dale, tp. of McLean co., Ill. Pop. 835.

La Union. See Union.

Lau'nitz (Robert Eberhard), b. at Riga, Russia, Nov. 4, 1806; studied in Rome under Thorwaldsen, and settled in 1828 at New York, where he d. Dec. 13, 1870. The battle monument at Frankfort, Ky., the Pulaski monument at Savannah, Ga., the monument to George H. Thomas at Troy, N. Y., were executed by him.

Lau'ra [Gr. λαύρα, a "defile," or, as some say, a name taken from a district in ancient Alexandria], in former times, and especially in the Levant, a collection of hermits' cells, each of whose occupants either provided for himself alone, or at most passed but two days in the week in the community of his brethren. The tenants of the laura were subject to severe rules. Solitude, silence, and a most meagre diet were the lot of all.

Laura'ceæ [from *Laurus*, the typical genus], a natural order of exogenous plants, chiefly trees, often of great size. This order is mostly tropical, and produces many trees of great economic value. Among its products are cassia, cinnamon, camphor, and many valuable drugs and timber-woods. The sassafras, bay, and a few other shrubs and trees of the U. S. are lauraceous.

Lau'ramie, tp. of Tippecanoe co., Ind. Pop. 2444.

Lau'ra Town, tp. of Stokes co., N. C. Pop. 1117.

Laurea'na di Borel'lo, town of S. Italy, in the province of Reggio di Calabria, about 20 miles E. of Palmi. Pop. in 1874, 5807.

Lau'rel [Lat. *Laurus*], a name properly belonging to the *Laurus nobilis* or bay tree of Europe, Asia, and Africa. In the warmer parts of Europe it becomes a large tree. Its wood has a limited use in the arts; its essential oil is employed in perfumery; its fruit yields a fixed oil, used in veterinary medicine; its flowers afford rich bee-pasture; its leaves were the material of the laurel crown of victors in war and of successful poets and artists. The name is often loosely extended to all the Lauraceæ, to which this tree belongs. Shrubs of the genus Kalmia (which see) are called laurels in the U. S. Some of the larger rhododendrons of our country are called mountain-laurels. The evergreen cherry trees are called Cherry Laurel (which see). In Great Britain they are often simply called laurel. The Portugal laurel is one of the cherry laurels. Several kinds of magnolia are known locally in the U. S. as laurel trees. In England the *Daphne laureola* is called spurge laurel. It is a handsome European evergreen shrub, sometimes planted in the U. S., and is of the order Thymelaceæ. It has a poisonous bark.

Laurel, county of S. E. Kentucky. Area, 430 square miles. It is hilly and mountainous, but much of the soil affords fine pasturage. The grain crop is the most important. The county is traversed by the Knoxville branch of the Louisville and Nashville R. R. Cap. London. Pop. 6016.

Laurel, post-v. of Little Creek hundred, Sussex co., Del., on the Delaware R. R., 7 miles N. of Delmar, and on the navigable Broad Creek. Pop. 1080.

Laurel, post-v. and tp. of Franklin co., Ind., on White Water River and White Water Valley R. R. It has 1 weekly newspaper. Pop. of v. 741; of tp. 1942.

Laurel, a v. (Laurel Factory P. O.) and tp. of Prince George's co., Md., on Patuxent River and on the Washington branch of the Baltimore and Ohio R. R., has a large cotton-mill. Pop. of v. 1148; of tp. 1684.

Laurel, tp. of Ashe co., N. C. Pop. 456.

Laurel, post-v. of Monroe tp., Clermont co., O., 15 miles S. of Batavia. Pop. 126.

Laurel, tp. of Hocking co., O. Pop. 1343.

Laurel Creek, tp. of Watauga co., N. C. Pop. 585.

Laurel Factory. See Laurel, Md.

Laurel Fork, tp. of Carroll co., Va. Pop. 2197.

Laurel Hill, tp. of Lincoln co., N. C. Pop. 430.

Laurel Hill, tp. of Richmond co., N. C. Pop. 2127.

Laurel Hill, a beautiful cemetery within the limits of the city of Philadelphia, on the left bank of the Schuylkill. The grounds comprise more than 20 acres, picturesquely situated upon several hills, are ornamented with great taste, and have a fine Gothic chapel. (See Philadelphia.)

Laurel Hill, a range of mountains in Western Pennsylvania, rising in Cambria co., and running S. W. as the boundary between Somerset co. on the E. and Westmoreland and Fayette cos. on the W.

Laurel Junction, post-v. of Wood co., West Va., at the junction of the Laurel Fork and Sand Hill R. R. with the Baltimore and Ohio R. R. It is an important point in the trade in petroleum, which is obtained in large quantities in the vicinity, and brought here by pipe and rail to be tanked. It is called also Laurel Fork.

Laurell, tp. of Madison co., N. C. Pop. 992.

Laurel Ridge, a range of mountains rising on the S. bank of the Youghiogheny River, in South-western Pennsylvania, and trending S. W. to Cheat River, through Taylor, Marion, and Monongalia cos., West Va.

Lau'rence (Richard), D. C. L., b. at Bath, England, in 1760; graduated at Corpus Christi College, Oxford, in 1782; took orders in the Church of England; preached the Bampton lectures 1804; appointed soon after to the rectory of Mersham, Kent; became regius professor of Hebrew and canon of Christ Church, Oxford, 1814; archbishop of Cashel 1822, and d. at Dublin Dec. 28, 1838. Archbishop Laurence was one of the restorers of Oriental studies in England, and perhaps the only high dignitary of his times who cultivated the dialects of the Semitic languages. His most important service to theology was the recovery from Ethiopic manuscripts of several interesting apocryphal works, often quoted by the early Fathers, but supposed to have been lost. These were the *Ascension of the Prophet Isaiah*, edited with Latin and English versions in 1819, and *The Book of Enoch the Prophet* (1821; 3d ed. 1838). He brought out a new version of Fourth Esdras (1820), also from the Ethiopic; published *A Dissertation on the Logos of St. John* (1808), *Critical Reflections on the Unitarian Version of the New Testament* (1811), *On the Existence of the Soul after Death* (1834), and numerous occa-

sional essays and sermons.—His elder brother, FRENCH LAURENCE, LL.D., regius professor of civil law at Oxford (d. 1809), was author of *Critical Remarks on Detached Passages of the New Testament* (1810) and other works, but is best known for his interesting *Correspondence with Edmund Burke*, published in 1827.

Lau'rene, or **Laurol** [Lat. *laurus*, "laurel"], $C_{11}H_{16}$, a hydrocarbon homologous with benzol. (See Watts's *Dict., Supplement*, p. 304.)

Lau'rens, county of S. Central Georgia. Area, 759 square miles. It is generally level and has a good soil. Cotton and corn are staple products. The county is traversed by the navigable Oconee River, and has extensive forests. Cap. Dublin. Pop. 7834.

Laurens, county of N. W. Central South Carolina. Area, 600 square miles. Its surface is varied, its soil well cultivated and productive. Cotton and corn are staple products. Flour is the chief article of manufacture. Cap. Laurens Court-house. Pop. 22,536.

Laurens, post-v. and tp. of Otsego co., N. Y. The village has manufactures of importance, and there is a sulphur spring in the vicinity. Pop. 1919.

Laurens, tp. of Laurens co., S. C., containing the county-seat. Pop. 4289.

Laurens Court-house, post-v., cap. of Laurens co., S. C., on the Laurens R. R., 31 miles N. W. of Newberry. It has 1 weekly newspaper.

Laurens (HENRY), b. at Charleston, S. C., in 1724, of Huguenot stock; was well educated in Charleston and London; acquired an ample fortune in mercantile business, and was conspicuous in the contests with the Crown admiralty judges, whose injustice was then great. He served as a major against the Cherokees; went to England in 1771, and while there strove to avert a war; became in 1774 president of the South Carolina congress; in 1776 was sent to the General Congress, of which he was president 1777–78. In 1779 he was sent as U. S. minister to the Netherlands, but was made a prisoner by the British while at sea, and kept a close prisoner in the Tower for fifteen months. In 1781 he was released, and appointed by the Congress one of the commissioners to negotiate a peace, with Franklin and Jay as his colleagues. D. Dec. 8, 1792, at Charleston, S. C., and by a direction in his will his body was burned and the bones afterwards buried. Many of his pamphlets and other papers have been reprinted.

Laurens (Col. JOHN), "the Bayard of the American Revolution," b. in 1753, a son of Henry Laurens; educated in England, and in 1777 joined the army, and was placed upon the staff of Washington, who loved him as a son. From Monmouth to Yorktown he was in all of Washington's battles, and in all displayed the utmost valor, so that Washington is reported to have checked him for rashness. He wounded Gen. Charles Lee in a duel, and the latter declared he "could have hugged the boy" for his handsome behavior on that occasion. Laurens was badly wounded at Germantown and Coosahatchie. In 1780 he went as a special minister to France, and successfully negotiated a loan. Returning, he served with great and even unnecessary activity under Greene, and was killed in the contest on the Combahee, Aug. 27, 1782. (See his *Life and Correspondence*, by W. G. Sims, 1867.)

Laurent' (FRANÇOIS), b. in Luxemburg July 8, 1810; studied law at Louvain and Liége, and was appointed professor in civil law at the University of Ghent in 1835. His historical essays have been collected under the title *Études sur l'Histoire de l'Humanité* (14 vols., 1860–68).

Lauren'tian Mountains, the principal range of British America, forming the watershed between Hudson's Bay, the St. Lawrence, and the great lakes, and between the same bay and the Mackenzie River. It rises near the Atlantic sea-coast of Labradòr, sweeps S. W. across the Ottawa River to Lake Ontario at its outlet, thence curving N. W. skirts Georgian Bay, Lakes Huron and Superior, and thence N. to the Arctic Ocean, with a total length of 3000 miles. The fundamental series of rocks, called the Laurentian System by Sir William Logan, consists of highly metamorphosed sedimentary deposits of hornblendic and micaceous gneiss, alternating with mica schist, and abounding in beds of crystallized limestone and of magnetic oxides of iron, as well as vast masses of granite, syenite, and greenstone. This system is believed to be older than any of the Silurian strata in Great Britain, and even to be the oldest on the globe. Indications of organic life have been detected and classified by Dr. J. W. Dawson as *Eozoon Canadense*, it being still uncertain to what groups they should be referred.

Lauren'tius, SAINT, was, according to tradition, a pupil of Sixtus II., who made him deacon, and afterwards archdeacon and treasurer, at Rome. In 258 A. D. the magistrate, during the Valerian persecution, commanded Laurentius to reveal the treasures of the Church; accordingly, the saint collected a company of poor, sick, lame, and blind persons and presented them as the required treasures; for which act he was condemned to be broiled alive. He underwent martyrdom with great courage and resignation Aug. 10, 258.

Laurenza'na, town of S. Italy, in the province of Potenza, situated in a mountainous and not very fertile district. It is not on the line of any railway, and is even without carriage-roads, but by means of mules it carries on a considerable trade with the neighboring provinces. Pop. in 1874, 6965.

Lau'restine, or **Lauresti'nus,** the *Viburnum Tinus*, an Old-World shrub, one of our finest cultivated evergreens, belonging to the order Caprifoliaceæ. It has somewhat poisonous qualities.

Lau'ria, town of S. Italy, in the province of Potenza, on the high-road from Naples to Calabria. It has fine churches and other good buildings, and was the birthplace of the celebrated admiral Ruggiero di Lauria. Pop. in 1874, 10,696.

Lau'ric Acid [Lat. *laurus*, "laurel"], **Laurostearic Acid** (Marsson), **Pichuric Acid,** or **Pichurimtalgsäure** (Sthamer), $C_{12}H_{24}O_2$. This fat acid belongs in the fatty group of monatomic acids, $C_nH_{2n}O_2$, and was first described by Marsson (*Ann. Pharm.*, xli. 43, 1842) from the fat of the bay tree (*Laurus nobilis*), and by Sthamer (*l. c.* liii. 393) from the fat and the volatile oil of the pichurim bean (*Fabæ Pichurim maj.*). Gideon E. Moore also found it in the wax of *Myrica cerifera* (*Sill. Jour.* [2], xxxiii. 313). It exists as a glycide (laurostearine or laurine), from which it is prepared by saponifying these fats or the wax by caustic alkaline solutions, and after the soap is separated by common salt (Marsson), decomposing the soaps thus formed by hydrochloric or tartaric acids. Lauric acid also exists in other like vegetable bodies, sometimes in connection with myristic acid ($C_{14}H_{28}O_2$), as in *Myrica cerifera* and the so-called Dika bread (*Mangifera Gabonensis*), and in a salve-like fat obtained from *Coccus Axin*, the *Age* or axin of the Mexicans. In connection with many other fatty acids, it exists in spermaceti and in the oil of the cocoanut. It fuses at about 43° C. to a colorless oil, and solidifies to a scaly crystalline white mass, and crystallizes from its alcoholic solution in white tufts and silky needles, or sometimes in nearly translucent scales. It dissolves readily in alcohol, and yet more freely in ether. Its alcoholic solution has a feebly alkaline reaction. It is quite insoluble in water, but when boiled in it volatilizes with the vapor. The sodium, potassium, and barium salts of lauric acid are soluble in water. The salts of the heavy metals with lauric acid are insoluble, or sparingly so. The calcium salt $Ca''(C_{12}H_{23}O_2)_2$ obtained by mixing the solutions of laurate of sodium and calcium chloride is resolved by distillation into calcium carbonate and laurostearone $= Ca''CO_3 + C_{23}H_{46}O$. B. SILLIMAN.

Lau'rine [Lat. *laurus*, "laurel"], or **Bayberry Camphor,** $C_{22}H_{30}O_3$, a crystalline body obtained from the berries of the bay tree.

Lauriston', de (JACQUES ALEXANDRE BERNARD LAW), MARQUIS, b. in Pondicherry, India, Feb. 1, 1768; was a companion of Napoleon at the military school of Paris, and distinguished himself in war and diplomacy during the Revolution, the Consulate, and the Empire. His defence of Ragusa against the Russians was a brilliant exploit, and the battle of Wagram was decided by his valor and judgment; and he was the negotiator of the marriage of Napoleon with Maria Louisa. He was favored by Louis XVIII., being made a marquis in 1817 and marshal of France in 1821. D. at Paris June 10, 1828.

Lau'rite, a sulphide of ruthenium and osmium, which occurs in small, iron-black, lustrous crystals, associated with native platinum, in Borneo and Oregon. It contains sulphur 31.79 per cent., ruthenium 65.18, and osmium 3.03, agreeing nearly with the formula $OsS_4,12Ru_2S_3$. It was discovered by Wöhler, and named in honor of Mrs. C. A. Joy. (See *Ann. Ch. Pharm.*, cxxxix. 116, and *Zeitsch. f. Ch.* [2], vi. 85.)

Lau'rium, a range of hills in Attica, Greece, famous in ancient times on account of its rich mines of silver, lead, zinc, and antimony. At the beginning of our era these mines were deserted, being generally considered exhausted, but in 1863 they were reopened, and are now worked again with great profit.

Laur'vig, town of Norway, on an inlet of Christiania Fiord, has a good harbor, large distilleries, some trade in timber, and very important iron-works in its vicinity. Pop. about 5000.

Lausanne' [anc. *Lausanium*], city of Switzerland, capital of the canton of Vaud, on the northern shore of the Lake of Geneva, built on two hills, connected by a splendid bridge of granite, has a beautiful Gothic cathedral, commenced about 1000, completed in 1275, a library of 90,000 volumes, many good educational institutions, and several manufactories of tobacco, leather, and gold and silver ware. On account of its beautiful situation on the southern slope of the Jura Mountains, and near the Lake of Geneva, it attracts yearly a great number of tourists, who generally reside here for some time. Lausanne is famous in literary annals from having been the residence of Haller, Voltaire, and Gibbon. The house occupied by the latter while writing his celebrated *History* is still shown, and visited by multitudes of travellers. Byron wrote here his *Prisoner of Chillon*. An ecclesiastical council was held here in 1449, a conference between Calvin, Farel, and Viret in 1536, leading to the adoption of the creed of the Reformed faith, and in modern times it has been the scene of a noted peace congress (Sept., 1871) and a Masonic universal convention (1875). Pop. 26,520.

Lausanne, tp. of Carbon co., Pa. Pop. 1416.

Lauzun', de (Armand Louis de Gontaut), Duke, b. in Paris, France, Apr. 15, 1747; commanded a naval expedition which captured Senegal and Gambia from the English (1579); took part in the American war (1780–83) at the head of "Lauzun's Legion;" afterwards succeeded to the title of duc de Biron; was a deputy to the States General; a confidant and secret agent of the duke of Orléans; appointed general-in-chief of the army of the Rhine July 9, 1792, of the army of the coasts of La Rochelle May 15, 1793; took Saumur, and defeated the Vendeans at Parthenay. He then tendered his resignation, but being accused by Carrier before the Committee of Public Safety of too great lenity to the Vendeans, he was deposed, thrown into the Abbaye prison, tried for conspiracy before the Revolutionary tribunal Dec. 31, 1793, and executed the same day, meeting his fate with cynical courage. Lauzun had great ability, but was dissolute and unprincipled. His *Mémoires* were published at Paris in 1822.

La'va [Lat. *lavare*, to "wash"], the material, fused or solidified after fusion, which has escaped from a volcanic crater. The term is, however, applied generally to those volcanic rocks which are filled with ragged cellules. If extremely light and loose, it is called scoria or slag. There are several varieties of lava. Molten lava flows like molten glass or iron, a portion being usually unfused and held in suspension in the fused portion, which is, indeed, a native glass. The boiling motion sometimes observed in hot lava is due to the escape of steam, sulphur-vapor, carbonic acid, air, etc. Lava-beds, after cooling, sometimes exhibit great caverns, which are ascribed to the flowing off of the lower strata of the lava after the cooling of the surface. (See Volcano, by Prof. Arnold Guyot, Ph. D., LL.D.)

Lava Ornaments (so-called) are made of iron slag, which is melted and manufactured into vases and other small ornamental and useful articles.

Lavac'a, county of S. Central Texas. Area, 926 square miles. It is partly timber-land, and has considerable areas of prairie. Nearly all the soil is very productive. Live-stock, corn, cotton, wool, and fruit are important products. The county is well watered by the Navidad and the head-streams of the Lavaca River. Cap. Hallettsville. Pop. 9168.

Lavaca (Port Lavaca P. O.), seaport of Calhoun co., Tex., on the W. side of Lavaca Bay, an arm of Matagorda Bay. It is the S. E. terminus of the Mexican Gulf and San Antonio R. R., and has an extensive coastwise trade. Pop. 768.

Lavagn'a, town of Italy, in the province of Genoa, famous for its excellent quarries of slate (Chiappami). This slate is extensively used for roofs, pavements, and other domestic purposes, and is largely exported to various European countries, and also to America. The public buildings of the town are imposing, especially the churches. Pop. in 1874, 6888.

Laval', town of France, the capital of the department of Mayenne, on the Mayenne River. It is noted for its linen manufactures; linen goods to the value of half a million francs are sold at each of its monthly markets. Among its other manufactures are paper and earthenware, and it has a brisk trade in grain, timber, and cattle. Pop. 22,892.

Laval, county of Quebec, Canada, consisting of the Isle Jésus, an island 23 miles long and 6 miles broad, lying between the Ottawa River on the N. W. and the Rivière des Prairies on the S. E. Pop. 9472.

Laval, de (François de Montmorency), b. of an ancient and noble family, at Laval, France, Mar. 23, 1622; became a priest in Paris 1645; declined the bishopric of Cochin China in 1651; became archdeacon of Evreux in 1653; bishop of Petræa *in partibus* and vicar-apostolic of New France in 1658. In 1663 he founded the seminary of Quebec, and in 1666 consecrated the parish church of Notre Dame. In 1674 he was bishop of the new see of Quebec, from which he retired in 1688 to his seminary, to which he gave his worldly possessions. He was *de facto* ruler of Canada, in civil as well as ecclesiastical affairs. The Laval University at Quebec commemorates his name. D. at Quebec May 6, 1708.

Lavalle', post-tp. of Sauk co., Wis. Pop. 881.

La Vallière, de (Louise), b. in 1644 in the province of Touraine; was one of the "filles d'honneur" of the duchess of Orléans (Henrietta of England), when she became in 1661 the mistress of Louis XIV., whom she loved sincerely and for himself, not for his royal title, as did afterward Montespan, Maintenon, etc. She represented the only poetical ray which brightened the life of the man who was called the "sun king" (*roi soleil*). Mlle. de la Vallière never used her influence except for doing good to everybody, and she was so much ashamed of her equivocal situation that she entered a convent as soon as the passion of Louis XIV. for Mademoiselle de Montespan and others allowed her to bury herself in a religious life. The king took her forcibly once from the convent in 1670, but at last, in 1675, she took her religious vows under the name of Sister Louise of Mercy (*Sœur Louise de la Miséricorde*). D. at the Paris Carmelite convent in 1710. She left *Letters* and *Reflections on the Mercy of God*. Félix Aucaigne.

Lavandu'la Spi'ca, the broad-leafed lavandula, yields oil of spike (the true but not the common commercial article), which is valued by painters and artisans, and is used in farriery.

Lavater' (Johann Caspar), b. at Zurich, in Switzerland, in 1741; studied theology, and in 1764 was appointed preacher, first of the orphan house, then of St. Petri church in his native town, which position he held till his death, in 1801. The most prominent trait in his character was his absolute veracity. Truth was with him not a duty, but a passion—not the honor of his soul, but the necessity of his nature. Wherever he found truth, with Christ or Cagliostro, with Spinoza or Mesmer, he acknowledged and accepted it unconditionally. But the consequence was, that his adversaries took the opportunity of accusing him of almost every kind of heresy which ever had appeared in the history of Christianity. With his character corresponded his talent. As his veracity was a passion, and not a pedantry, his conceptions of truth and falsehood were intuitions, and not products of analysis. Rapt in enthusiasm or struck by horror at what he saw, he painted his visions with a love or hatred which generally commanded the feelings of his audience, but which often gave his views a distasteful one-sidedness. His friendship with Goethe is one of the most beautiful instances on record of mutual sympathy, and its elevating and expanding influence on human character. But when in 1785 he wrote his *Pontius Pilatus* he gave such a picture of a no-Christian that Goethe literally shrank from him with all the aversion and antipathy of which his nature was capable. Lavater came to his door and wrote his name on the tablet, but Goethe remained unmoved, and would never see him any more. There was always a tendency towards mysticism in Lavater, but in his earlier days he was conscious of this tendency, and—for instance, in his *Aussichten in die Ewigkeit* ("Peeps into Eternity")—the reader is charmed without being duped by his mysticism. But when he grew old he became visionary, a prey to the obscurity of charlatanry, and his fervor and zeal turned into fanaticism. He hailed the French Revolution with unbounded enthusiasm, but when the king was beheaded he at once turned around and became one of its bitterest opponents. Even his life was often in danger, and when, in 1799, Massena took Zurich he was fired at in the streets, where he administered help to the wounded and dying, and he d. two years after from a wound he received on that occasion. His poetical writings are entirely without interest, and his religious writings are so interwoven with the interests of the moment that they cannot be appreciated, hardly even understood, without a thorough knowledge of the state of the German civilization at the end of the eighteenth century. But his *Physiognomische Fragmente*, which he published 1775–78 in four large volumes, profusely illustrated and very expensive, will never cease to interest mankind. That book started a new idea, or, rather, it described a natural and necessary process which takes place whenever man meets man, with such exactness and felicity as to raise this process from a dull and sluggish practice to a conscious and free mental activity. Where there is combination there is significance, where there is movement there is character. Consequently,

the human figure, which is the finest combination known, must signify something of its nature, and the motion of its parts, the play of its features, must express something of its character. But before Lavater this had never been said. The impression made by the outward appearance had been overlooked. People had judged one another from their clothes. And when Lavater demonstrated that the soul, the character, the history of an individual, was painted on his face, that a human face might be read like a printed leaf, he produced the profoundest sensation. People were panic-stricken. They began to wear masks. They left the drawing-rooms when a person entered who believed in Lavater. No less was the enthusiasm. People felt that a new signification had been added to beauty, a new charm to life, a new sensibility to the soul. It has been argued against the *Physiognomische Fragmente* that the author has tried to make physiognomy a science, but the criticism is hardly just. Lavater knew very well that physiognomy is a talent and not a science; and although he is very anxious to establish rules and show how a certain vice, for instance, always affects a certain feature in the same way, he is as anxious to impress upon his readers that the rules are subordinate to the total impression, and the single features must be interpreted by the view of the whole. His rules are to him a convenience, and hardly anything more. CLEMENS PETERSEN.

Lavaur′, town of France, in the department of Tarn, on the Agout. It is the entrepôt of the silk produced in Upper Languedoc, which is spun here, and then sent to Lyons or Paris. Pop. 7438.

Laveleye′ (ÉMILE LOUIS VICTOR), b. at Bruges, Belgium, Apr. 5, 1822; studied at the Athenæum of his native city, and at the Collége Stanislas in Paris, and took high honors in the law course at the University of Ghent. From 1848 onward he has been entirely occupied with those economical studies which have given him so great a reputation. At first he wrote in the Belgian periodicals, defending liberal principles against the Ultramontanes; became from 1858 a constant contributor to the *Revue des Deux Mondes;* was in 1864 appointed professor of political economy at the University of Liége, and in 1867 represented Belgium as member and secretary of the international jury upon paintings at the Paris Universal Exposition. He has been honored with membership in the Royal Academy of Belgium and the French Academy of Moral and Political Sciences. Among his numerous works, that on *Property and its Primitive Forms* (1874) has already become a classic. In June, 1875, he published a small volume on the *Religious Conflict in Europe,* with a preface by W. E. Gladstone.

Lavel′lo, town of Italy, in the province of Potenza, of ancient origin. It suffered severely from an earthquake in 1851. Pop. in 1874, 5709.

Lav′ender, the *Lavandula vera,* a labiate shrub, a native of the S. of Europe, very extensively cultivated for its fragrant flowers, which yield a volatile oil much used in perfumery. Lavender-water, spirit of lavender, etc. are of considerable service in pharmacy and medicine.

La′ver, a name applied to several edible seaweeds, such as *Ulva latissima, Porphyra laciniata,* and *P. vulgaris.* These are quite commonly eaten as luxuries in Europe, either pickled or stewed.

Laverdière (CLAUDE H.), b. at Château-Richer Oct. 23, 1826; was ordained a Catholic priest in 1851; became a professor in the seminary and librarian of Laval University. He took part in the publication of three volumes of *Jesuit Relations* (1858) concerning early missions in Canada, edited the voyages of Champlain (5 vols., 1870), with notes and a biography, the *Journal des Jésuites* (1871), wrote a *Histoire du Canada* for schools, and several smaller treatises upon subjects connected with early Canadian history. D. at Quebec Mar. 27, 1873.

Lavialle′ (PIERRE JOSEPH), D. D., b. at Mauriac, France, in 1820; came when twenty-three years old to the U. S.; was ordained a Roman Catholic priest; served for a while in New York, and then became president of St. Mary's College, Ky., and was its president 1855–65. In the latter year he was made bishop of Louisville. He founded a number of schools and charitable institutions. D. near Bardstown, Ky., May 11, 1867. Bishop Lavialle was a man of extraordinary energy and ability, and was highly esteemed by Protestants, as well as by those of his own faith.

Lav′ington (GEORGE), D. D., b. in Wiltshire, England, in 1683; became canon of St. Paul's, London, in 1732, and in 1747 bishop of Exeter. Becoming involved in a controversy with Wesley and Whitefield, he wrote in 1749 *The Enthusiasm of the Methodists and Papists Compared,* an amusing and well-written work, not without some passages of a too broad raillery, and very defective as a statement of facts. In 1755 he published a work of similar character respecting another sect of dissenters, *The Moravians Compared and Detected.* Bishop Lavington partially retracted his language towards Wesley, and partook of the communion with him as late as 1762, in which year he died.

Lavin′ium, now *Pratica,* an ancient city of Italy, in Latium, was situated 17 miles S. of Rome, near the sea. It was founded, according to tradition, by Æneas, on his arrival in Italy, and named after his wife Lavinia, and was in early times the sacred metropolis of the Latin cities, but never acquired any importance, political or commercial. The name was often confounded by classical writers with that of another ancient Latin city, *Lanuvium.*

Lavoisier′ (ANTOINE LAURENT), an illustrious savant, one of the fathers of modern chemistry, b. at Paris of wealthy parents Aug. 16, 1743; studied at the Collége Mazarin; pursued astronomical knowledge under La Caille; learned botany under Bernard de Jussieu; worked in Rouelle's chemical laboratory in the Jardin des Plantes; became an associate of the Academy in 1768; obtained a farmer-generalship in 1769, in order to increase his income, his expenditures in chemical research requiring a large outlay of money; took a prominent part in public affairs, writing numerous and able papers on state questions; discovered the composition of water in 1783; and made many important researches in physics. In chemistry, the science to which his attention was chiefly directed, he made not only important discoveries and great inventions in apparatus and in methods of work, but he was one of the first and ablest of philosophical chemists, the destroyer of the false theories of Stahl and Priestley, and was the principal inventor of the system of chemical nomenclature which prevailed exclusively for more than fifty years after his death. Lavoisier was guillotined by the Jacobins May 8, 1794, on account of his former connection with the farming of the taxes. The most important of his works are *Traité de Chimie* (1789) and *Mémoires de Physique et de Chimie,* which includes his principal occasional scientific papers.

Law. When the magnitude of any quantity is altered by changes of any other quantities, the statement of the relation existing between them is known as a law of nature. Thus, the fact that the force of gravity is inversely as the square of the distance is known as the law of gravitation, and the equality of the angles of *reflection* and *incidence* is the law of reflection. Generally, laws may be expressed by equations, and the highest aim of scientific investigation is to determine the form of these equations, and to show that they follow from simple well-established laws. Laws seldom seem exact, owing to various disturbing causes, but if these are properly allowed for, the true law is never deviated from in the ordinary course of nature. The failure of one or more of these laws in a particular case constitutes a miracle. The term "law" is also applied, but less properly, to the statement of any general fact, as that all bodies possess mass or that matter is impenetrable. E. C. PICKERING.

Law [Lat. *lex;* Ang.-Sax. *lag*]. When taken in its widest and most comprehensive manner, without limitation to any particular subject-matter, certain essential and elementary notions are implied in the term Law, all necessary to its complete and accurate meaning. These essentials are (1) a lawgiver; (2) an inferior subject; (3) a command; (4) power in the lawgiver, resulting from some organic relation between himself and the subject, to enforce the command. As the utterance of a command implies the formation of a wish and an act of the will, it follows that the lawgiver must necessarily be a rational, intelligent being, and, so far as we are acquainted with existences, must be either God or man. The authors of all law, then, in a true sense of the term—the only lawgivers possible—are the Divine Ruler of the universe, and men who may be clothed with authority over individuals or over that organized aggregate of individuals which forms the state. The commands which God issues in reference to material objects, whether animate or inanimate, and which prescribe rules concerning all the movements and processes of the physical creation, fall under our general definition, and are truly *laws.* They certainly differ in a most important feature from the commands addressed to rational beings, since they are wholly without any moral quality; but it is only upon the assumption that the invariable order and sequence of acts and events in the material universe are the results of commands uttered and rules set by a conscious and intelligent lawgiver that the phrases "*laws* of nature," "physical *laws,*" "*laws* of natural science," and the like, become at all proper and admissible; without this assumption such forms of speech are self-contradictory and unscientific. The other and more perfect class of the divine laws embraces those set by Him

to rational beings, to mankind. Here the inferior subjects are endowed with a free will, are clothed with an ability to choose between an assent and a refusal to comply with the command. The command to do or to forbear, which is only the expressed will of the lawgiver, in itself creates in the rational subject a corresponding duty or obligation to do or to forbear; he is bound to obey. When, therefore, the subjects of God's laws are intelligent beings, a fifth essential element is involved in the general conception of law, and that is the notion of duty or obligation. Again, as the choice exists between obedience and disobedience, as the inferior subjects may violate the duty which has arisen from the promulgation of the command, the power of enforcement residing in the lawgiver is exercised by the threat and imposition of some evil as a consequence of the violation. Hence we find a sixth essential element involved in the general conception of law when addressed to rational beings—that of compelling obedience by the danger or fear of suffering evil in the event of disobedience; which evil, thus imposed as a penalty, is termed the *sanction* of the law. Such is the nature of God's law, which is addressed to rational beings, and which may be collectively designated the "moral law," since its commands necessarily create an obligation resting upon those to whom they are addressed, and obedience or disobedience is therefore always a moral act.

Human laws, or those which are set by human lawgivers, are all of the same essential nature as those which have collectively been designated the moral law of God. The differences are plainly those of degree, and not of kind. The object of all human law—or, in other words, of all commands uttered by the constituted lawgiver—is to prescribe and impose duties, to create and define rights, and to enforce the observance of both. A brief analysis will disclose the general nature of all such jural rights and duties, and will explain their genesis, or how they arise from the commands of the lawgiver. I select for the purpose of this analysis the highest type of human legislation—namely, the municipal law, or that of independent sovereign nations, in which all commands are uttered by the supreme power of the state, whatever be the form of the government, or whatever department thereof possesses this legislative function. The object of every command is to impose a duty and to create a right, and its effect is thus necessarily twofold: the duty rests upon some person or class of persons, and a corresponding right is given to another person or class of persons. Two distinct individuals or groups are thus necessarily affected by every command, and they are placed by it in a relation of dependence, or even of antagonism. All rights created by the law are correlative to duties, and all duties are correlative to rights. The supreme power in the state issues a command, the effect of which is to clothe a given person with a certain right. Now, a legal right in its highest and widest sense is nothing but a claim that another person or class of persons shall do some act or forbear from some act respecting the individual who holds the right. We could have no legal rights were there not other persons whom these rights obliged to do or forbear towards us. Every right, then, residing in one person corresponds or correlates to a duty devolving upon another person or class of persons. All possible rights and duties thus created or imposed by the commands of the supreme power in the state belong to one or the other of two classes: they are either private or public. In the first class the duties rest upon persons, and the corresponding rights are held by other persons, so that the command always and necessarily affects two different sets or groups of individuals, both standing in the same subordinate relation to the state. In the second class the duties also rest upon persons, but the corresponding rights are held by that organic aggregate or community of persons which constitutes the state. This capital line of distinction in reference to the holders of rights not only separates all the primary rights and duties into two grand departments, but it also divides the remedies for their violation into the corresponding classes of civil and criminal. These duties are either positive—that is, obligations to do some act; or negative—that is, obligations to refrain or forbear from some act. When the determined person upon whom the duty rests, or any one of mankind where the duty rests upon all, neglects to do the act which his positive obligation requires of him, or does the act which his negative obligation forbids him to do, he commits an injury, offence, or delict. A delict, injury, or offence is, therefore, at once the violation of a duty resting upon the offender and the infringement of a right possessed by some other person. Such violations of duty must be redressed, and for this purpose the law is provided with sanctions. Injuries themselves are divided into two general classes, exactly corresponding to the distinction of rights into private and public already stated—namely (1) those which primarily affect the rights of private persons, and are redressed by private remedies pursued by the injured party; and (2) those which primarily affect the state, and are redressed in its name by means of punishments inflicted upon the wrongdoer. It sometimes happens that the same physical act is both a public and a private injury, and exposes the offender to both a criminal punishment and a private remedy. It is plain, however, that in such cases two distinct rights are invaded and two distinct duties are violated by the same physical act. How far this double nature of wrongs and this double redress therefor shall be allowed, greatly varies in different systems of national law, according to their notions of public policy.

The essential elements which enter into the conception of law set by human authority having been thus determined, I proceed to describe its grand divisions or departments and the general nature of its subject-matter, without reference to any particular national forms, or to any special modes of enactment or distribution of governmental functions. The law, considered both objectively and subjectively—that is, both as a system of rules creating rights and imposing duties, and as a method and a power of establishing further rules—consists of two distinct departments, two sciences—jurisprudence and legislation. Jurisprudence in its primary signification denotes the laws which have been enacted, either the entire body of existing legal rules which prevail in any particular state, or the features which are common to all the national systems as they have been established in different countries and at different times. As a science it is occupied with the study and investigation of these laws. It is naturally separated into two divisions, which may appropriately be called general and particular. General jurisprudence is employed in the discovery, examination, and arrangement of institutions, principles, and rules which are found as parts of all existing legal systems, and especially of those which have far advanced in the march of civilization. It does not represent the whole law of any country, but rather the similitudes between the laws of different countries. Particular jurisprudence is concerned only with the whole existing law of a specified country, in whatever form this may have issued from the hands of the legislator who had called it into being as a collection of positive rules—that is, with the municipal law. In determining the exact import of this term, another conception is introduced and joined with that of the law—the conception of the state. The state or nation—for the words are in this respect synonymous—is an independent, separate, and sovereign political society, with its own organization and government. The conception of the state may be summed up in the single but most comprehensive term, political sovereignty; but this includes the attributes of political independence, political equality, and absolute power within the domain of legislation. From the union of the notions involved in the terms "law" and "the state" we complete the description of the complex result which is denominated the "municipal law." It is the entire body of positive jurisprudence which belongs to a separate and sovereign political society, a state; which is promulgated in its name and by its authority, in whatever manner that authority may be exercised; and which is absolutely binding, throughout the territorial jurisdiction of that state, to the exclusion of all and every other law.

While jurisprudence is conversant only with laws which have been enacted, legislation has to do with laws which should be enacted, and with the process of enactment, with the discovery and statement of what the law as a whole ought to be, and with the bringing of it into an agreement with that perfect standard. Jurisprudence and legislation are therefore, in respect to their ultimate objects, separate, but in their study as sciences, and in the actual operations by which their objects are attained, they must necessarily be combined. JOHN NORTON POMEROY.

Law, Canon. The term "canon law" designates the body of rules and regulations which were primarily established by the Christian Church and enforced by ecclesiastical authority, but which in the course of time became extended to many matters purely civil, and were recognized and sanctioned by the tribunals of the state. After the Roman empire became Christian, and the Church became in part identified with it, there arose a threefold jurisdiction of the ecclesiastical tribunals—that is, of the bishops in their various degrees of dignity and administrative authority. (1) This jurisdiction was exercised in respect of any subject-matter whatever, civil or otherwise, over all the clergy, over all persons in holy orders. (2) The jurisdiction extended over laymen in relation to all matters strictly ecclesiastical—questions pertaining to the internal order, discipline, doctrines, and observances of the Church. (3) It also extended over laymen in relation to certain special subjects, which, although strictly civil, and in modern systems of national jurisprudence universally regarded as such, were claimed by the Church to have a peculiar religious

aspect and to nearly concern the soul's welfare. The most important of these special subjects were marriage and divorce and the succession to the personal estates of decedents. The term canon law has a direct and primary relation to the creative source by which the rules that compose it are uttered—namely, the law-making power of the Church considered as an organic and independent society capable of legislating within a certain domain and upon a certain class of subjects. It is broader than the ecclesiastical law, for while it embraces within its scope everything that pertains to the organization, order, doctrine, and discipline of the Church, it also extends to many other topics which have only a very indirect connection with these purely ecclesiastical matters. In short, it is to be regarded as a comprehensive system of regulations, primarily established by the legislative authority residing in the Church, relating to subjects both spiritual and temporal, and administered by both spiritual and temporal tribunals.

The canon law as a separate and completed system is, and for several centuries past has been, contained in collections of digests and codes which taken together are denominated the *Corpus Juris Canonici.* The Roman law, by the orders of the emperor Justinian, had been arranged in three separate compilations—the Pandects or Digest, the Code, and the Novells—and in this compact form was known as the *Corpus Juris Civilis.* In direct imitation of this proceeding, both as respects name and method, the *Corpus Juris Canonici* is composed of three distinct parts—"The Decree," "The Decretals," and "The Extravagantes"—which have some correspondence with and analogy to the Pandects, the Code, and the Novells. I. "*The Decree.*"—This work was composed and published about the year 1140 by Gratian, a Benedictine monk of Bologna, who undertook the task at the request of St. Bernard, with the immediate object of furnishing a treatise for use in the university at that city. It is based upon all the previous legislation of the Church, which was treated as authoritative, and which was scattered through numerous compendiums, acts of councils, and decretals of popes; and it is, in fact, a complete collection or epitome of the canon law as it then existed and was in force throughout the Western Church. The name given to it by the author was *Concordantia Discordantium Canonum,* but it is generally known and cited as the "Decree of Gratian" (*Decretum Gratiani*), or more often as the "Decree." It consists chiefly of extracts taken, as above stated, from all other writings that contained the law in a scattered and confused shape, and these citations are arranged and classified according to their subject-matter, being connected by a text which the author himself composed. In other words, these extracts do not, as in the Pandects, make up the entire work; the legal principles, doctrines, and rules are given by the author in his own language (technically, *dicta Gratiani*), and the citations are annexed thereto as proofs or illustrations. The whole body of the jurisprudence as it then existed is thus presented in an orderly and scientific method. The "Decree" is divided into three parts. Part First contains 101 sections or paragraphs—technically called "distinctions" (*distinctiones*)—and the important subjects of which it treats are the nature and sources of different kinds of law, and especially of the ecclesiastical law, persons in holy orders, and the bishops and other higher ranks of the clergy. Part Second is quite different in its external form, and consists of thirty-six "causes" or cases (*causæ*), which are first stated, and under each are placed the legal questions that arise therefrom (*quæstiones*), which questions are then solved by appropriate extracts similar to those in the first part. The thirty-second "cause" and third "question" is a special treatise on the subject of penance (*De pœnitentia*), and is separated into seven "distinctions." Part Third, which has for its title "*De Consecratione,*" is divided, like the first, into "distinctions." It treats of the consecration of churches, of the sacraments, and of the performance of divine service. The work in all its parts contains about 3000 extracts, each being indicated by the letter C, which signifies "*caput*" or "*capitulum,*" and not, as has generally been supposed, "canon." Although the "Decree" was the compilation of a private person, its substance was taken from the existing law; it was at once sanctioned and approved by the highest authority in the Church—by popes themselves—and thus acquired all the force of original legislation. Its text has been the object of numerous commentaries, or, as they are technically termed, glosses, the most important of which, the *Glossa ordinaria,* is usually printed with it. Many editions have been issued from time to time; and in consequence of a decree made by the Council of Trent a revised and corrected edition was prepared by papal command under the care and direction of several learned doctors, and was finally published A. D. 1580. II. The second part of the *Corpus Juris Canonici,* called "The Decretals," consists of three distinct subdivisions: (1) "The Gregorian Decretals," or decretals of Pope Gregory IX., in five books; (2) the "*Liber Sextus*" or the "*Sextus,*" being a collection of decretals prepared by order of Pope Boniface VIII.; and (3) the "Clementine Constitutions," or decretals published by Pope Clement V. The following is a brief description of these compilations. After the great work of Gratian was completed, numerous collections of subsequent decretals were made by private persons, which possessed a greater or less amount of authority, but which, on the whole, tended to produce confusion and uncertainty in the study and administration of the canon law. To remedy this evil, Pope Gregory IX. directed his chancellor, Raymond, a Benedictine monk, to prepare a new compilation, which should be based upon and should take the place of all those to which reference has been made. Raymond accordingly in 1234 published his *Quinque Libri Decretalium Gregorii Noni,* which was at once approved and ordered to be used in the courts and the universities. It contains not only the decretals which had appeared since the "Decree of Gratian," but also some of a more ancient date which had been omitted from that work, together with extracts from the Fathers and from acts of councils, the whole being arranged in five books and distributed into titles, and again into chapters. The principal subjects of which it treats are the organization and jurisdiction of the spiritual courts, the proceedings therein and their sentences, the clergy, betrothal and marriage, and crime. The same condition of affairs again arose at a subsequent period; the same need was felt, and the same remedy was adopted. Pope Boniface VIII. caused another compilation to be made, containing all the decretals which had been issued since that of Gregory. It was published in 1298, and follows the same order of arrangement as its immediate predecessor; and under the notion that it was the supplement to that work it was called *Liber Sextus.* Pope Clement V. in the year 1318 issued a collection of his own decretals and of the decrees of the Council of Vienne, over which he presided, which is known as the "Clementine Constitutions." To the text of all these decretals commentaries or "glosses" have been added, which have acquired a certain authority from long-continued usage, from the judgments of courts, and from the teachings of universities. III. *The "Extravagantes."*—This third part of the *Corpus Juris Canonici* consists of two divisions—the "Extravagantes of John XXII." and the "Extravagantes Communes." The former contains certain decretals of the pope whose name it bears, collected by an unknown author, and published without official sanction in 1325. The latter is a collection of decretals by various popes from Urban VI. to Sixtus IV., A. D. 1483. Neither of these compilations was made with authority, nor did they originally form a part of the *Corpus Juris Canonici,* but in 1582 they were incorporated into it, and placed upon the same footing as the other decretals by Pope Gregory XIII. JOHN NORTON POMEROY.

Law, The Civil. The "civil law" (*jus civile*), in its strictly technical import, denotes the body of Roman jurisprudence collected by order of the emperor Justinian, arranged and digested in the compilations which taken together bear the name *Corpus Juris Civilis.* In this form it became to a great extent the basis of the municipal laws of the continental states of Europe. The term is not, therefore, exactly synonymous with "Roman law," and does not describe that system in its condition as the actual jurisprudence of the Roman empire; it was first used in its present special sense by the jurists of the Middle Ages, and was applied to the collections made by Justinian to distinguish them from the "canon law." The civil law of the Roman state and the canon law of the Roman Church thus stood side by side, and were the two great sources from which the jurisprudence of modern Europe has been largely derived. A description of the civil law, therefore, requires some account of the Roman law, of which it was in fact the final stage. The Roman law, as a national jurisprudence from the foundation of the city to the death of Justinian, in whose reign it was fixed in its present shape and ceased to be a growth, extended through a period of about 1300 years, and from an archaic state of barbarism it was transformed through progressive stages into an enlightened and philosophic code, so wise and just in its principles, and so lofty in its practical morality, that it is susceptible of little improvement from the culture of the present age. So far as the narrow limits of this article will permit, I shall sketch in a very general manner (1) the external history of its development—that is, the forms, means, and modes by which the law was created, and the process of growth from its primitive rudeness to its final perfection; and (2) the more important and characteristic features of the law itself, the principles, doctrines, and rules which were at length gathered into the compilations of Justinian. This latter account must necessarily be exceedingly imperfect,

and is given simply to illustrate the spirit of the Roman jurisprudence and its method of development.

Historical Sketch.—Little is known with absolute certainty of the law in the earliest centuries of the Roman state, during the period of the kings. The political organization was in the highest degree aristocratic, and all power was held by the superior orders, the patricians (*populus*). The commons (*plebs*), though free, had substantially no voice in the management of public affairs, and even the private law discriminated harshly against them. It is inferred upon general principles—that is, from the general nature of barbarous societies—that the laws, or what were called the laws, consisted almost entirely of tribal customs, which were handed down by oral tradition, and the knowledge of which was possessed exclusively by the ruling classes. It is certain that for several centuries the law largely partook of a religious character, was intimately connected with religious observances, and enforced by religious sanctions. After the overthrow of the kingly power, and as the result of a political revolution in which the commons (*plebs*) acquired an accession of authority, in the year 452 B. C. and 302 of the city a partial code was prepared and adopted, which became, and ever after was, the basis of the Roman jurisprudence—that is, all future growth of that jurisprudence was actually or fictitiously constructed upon it as a foundation. This code was the celebrated Law of the XII. Tables, or the XII. Tables. The contents of this statute as a whole, and even its order and arrangement, are unknown. Certain extracts from it have been preserved in the writings of various authors, and from them modern jurists have attempted to reconstruct the entire text, but the result is of course conjectural. It seems to be established, however, that among other subjects the first, second, and third tables treated of judicial proceedings; the fourth of the paternal power, the power of the *paterfamilias* over the family; the fifth of heirs and persons under the care of tutors, and doubtless of the whole subject of succession; the sixth of property and possession; the seventh of buildings and fields; the eighth of delicts—that is, of injuries to person or property from which a right of compensation arose; the ninth of public and political law; the tenth of the law relating to sacred rites and observances; and that the eleventh and twelfth were supplementary to the others. A part of this code was certainly political; that portion which related to the private law was probably an enactment in a statutory form of the pre-existing customary regulations, without substantial change. For a long period subsequent to the epoch of the XII. Tables, the public history of Rome was a continuous conflict between the aristocracy (*populus*) and the commons (*plebs*), which resulted in the latter's obtaining complete political equality with the former; but this struggle has no interest for us except in its effect upon the actual law-creating power of the state. In England and the U. S. the law-making power is conferred upon two distinct departments, the legislature and the higher courts, the authority of the legislature, however, being supreme. In other words, the actual law of England and of this country was partly made by the legislature in the form of statutes, and partly made by the courts and promulgated in the form of judicial decisions, the latter being so far inferior that it can be altered by statute. The law of Rome grew up in exactly the same method, by a process exactly the same in its essential nature, although differing somewhat in its external form. A portion of it was statutory, and a portion—and during a long period of its history by far the greater portion—was the law of judicial decision, or what Bentham sneeringly called "judge-made law." I will briefly describe the modes in which these two species of the legislation were effected prior to the time when the legislative function became possessed exclusively by the emperor. The political constitution of the state provided three different official assemblies of the citizens—that by the centuries (*comitia centuriata*), which consisted of both patricians and commons; that by the curies (*comitia curiata*), which was composed of the patricians alone; and that by the tribes (*comitia tributa*), which was confined exclusively to the commons. The resolutions of the centuries were termed "laws" (*leges*), statutes, and were always binding upon the whole state; those of the other assemblies were originally binding upon their respective orders alone, but in the year 465 of the city, in consequence of a statute (*lex Hortensia*), they were clothed with all the efficacy of laws. The assemblies of the patricians soon lost their legislative function, and were long retained for certain formal purposes only, while those of the tribes greatly increased in importance, and their ordinances (*plebiscita*) became a common form of legislation. During the republic the senate did not possess the power of law-making, but upon the establishment of the empire the popular assemblies were abandoned, and their function was transferred to the senate; its resolutions (*senatus consulta*) for a while thereafter took the place of both the "laws" and the "plebiscites"—that is, became the only species of statutes. The law of judicial decision, on the other hand, was created by the magistrates, by far the most important of whom was the prætor. This office was first instituted soon after the inauguration of the republic. Its term was but one year, so that the changes in the actual incumbents were very frequent. The law-making function of the prætor was exercised in the preparation and promulgation of an official declaration or document termed the "edict." Upon entering on the duties of his office each prætor issued a statement of the legal principles, doctrines, and rules by which he should be guided in administering justice during his term. Each new magistrate would adopt the whole or the greater part of his immediate predecessor's work, and annex such improvements, amendments, or additions as he thought proper. In this manner the edict became a continuous and, to a certain extent, systematic body of jurisprudence, based upon the XII. Tables as its foundation, and increasing each year by the work of successive magistrates. That portion of it which, once established, was continued from year to year without change was termed *edictum perpetuum*, and since it was borrowed by each prætor from his immediate predecessor and incorporated into his own, it was also named *edictum translatitium*. The new portion which a magistrate added was called *edictum novum*. It must not be supposed that the prætorian edict bore any resemblance to a modern statute or to a decision of a modern court, much less to a modern code or digest. It did not contain a statement of principles in a general and comprehensive form, nor of abstract rules of conduct defining the primary rights and duties of citizens. Like all legislation in a certain period of social development, it was almost entirely a mere announcement of the remedies which would be allowed by the magistrate under specified circumstances, and which had not been provided for by the pre-existing law. The law as created by the edict was in substance the enumeration of remedial rights, remedies, and actions, rather than the utterance of general rules of conduct. About the year 508 of the city, after the conquests of Rome had been widely extended, and its relations with foreigners had become constant and intimate, they not being regarded as amenable to or governed by the law pertaining to its citizens (*jus civile*), a special prætor was constituted with jurisdiction over legal controversies in which both or one of the litigants were foreigners. He was called the *prætor peregrinus*—that is, the prætor for strangers (*peregrini*)—to distinguish him from the ordinary magistrate, who then took the name *prætor urbanus*. As the prætor peregrinus was not in any manner restricted by the Roman law pertaining to the citizen (*jus civile*), but could without limitation invoke the rules of law common to all nations (*jus gentium*), which in time came to be considered as identical with the general principles of abstract justice and equity, his edict was the most important instrument in shaping the entire jurisprudence of the state, in freeing it from its primitive technicality and barbarism, and in bringing it to an agreement with the essential rules of right. The principles which he announced were in time adopted by the *prætor urbanus*, and thus the Roman law in all its departments was brought under the influence of the same legislative forces. The process of judicial legislation which has been thus described seems on the surface to be very different from that pursued in the courts of England and of the U. S., but it is essentially the same. The Roman magistrate attempted to anticipate all the facts, events, and transactions that might arise during his official term, and to lay down a previous rule applicable to them; while the English and American court waits till the acts and events have happened, and have been brought before it in a forensic dispute, and then for the first time declares the rule which determines the rights and obligations of the parties. Our judges legislate *ex post facto*, in the form of single decisions; the Roman magistrates legislated before the fact in the form of a more general edict; both plainly accomplish the same purpose in the political organization of the state. Certain inferior magistrates of the city, and especially the judicial officers of the provinces, possessed the power of issuing an edict, and that of the provinces (*edictum provinciale*) was of great importance. The constructive and legislative labors of the prætors—for their number was largely increased—continued through the republic, and reached their height during the early period of the empire, but declined and finally ceased after the law-making function of the emperor had been firmly established. The edict itself had grown to be long, and doubtless unwieldy. At length (A. D. 130), by command of the emperor Hadrian, it was entirely rearranged and put into a permanent form by Salvius Julianus, a professional jurisconsult. Under the name *edictum perpetuum* it remained

from that time unchanged, the official code of the "judge-made law," and upon it the succeeding race of jurists expended their labors and their learning in the form of commentaries and treatises; it was separated into titles according to the subject-matter, following the order of the XII. Tables. It has been suggested by some modern writers that in this work of redaction the three great edicts—that of the prætor urbanus, that of the prætor peregrinus, and that of the provinces—were consolidated into one. If this was so, the process was the same which would take place in this country or in England if the rules of equity and of the common law should be combined and reduced into a simple harmonious system by rejecting from the one all that was in conflict with the more just and moral doctrines of the other. Another force which was greatly efficient in promoting and guiding the development of the law through the formative period I have not as yet mentioned; namely, the opinions of learned jurists (*responsa prudentium*). It has sometimes been said that these utterances of the jurisconsults always had an absolute authority and were binding upon the courts, and that the jurists themselves were thus actual legislators, recognized as forming a part of the law-making machinery of the state. This is a mistaken theory, and presents a very erroneous view of the Roman legislation. As has been already described, the only constituted means for the creation of law were the statutes passed by the citizens in their assemblies, or afterwards by the senate, and the edict of the prætors. Whatever part the jurisconsults as a class played in the great work of legal development—and it was a most important one—was by way of influence, was moral, and chiefly consisted in advising and assisting the magistrates in the performance of their legislative work, and in aiding the courts in the decision of causes. Beyond a doubt, the aid was great, the advice and guidance were powerful and effective, but they were not compulsory. During the flourishing period of the republic, and down to the time of Cicero, many of the ablest, best, and most learned citizens devoted themselves to the study of the law as a science and as an art. They were not advocates like Cicero; they formed a distinctive class, to whom, on account of their special knowledge, the names "jurisconsults" and *prudentes* were given. They publicly instructed students; they were consulted by litigants, to whom they gave legal opinions. During the earlier period to which reference is now made they did not compose systematic treatises upon the law, but contented themselves with answering the cases, actual or hypothetical, which were presented to them. These answers, technically termed *responsa prudentium*, when cited to the courts would undoubtedly be used with much effect in determining the decision, and the effect would depend upon the reputation of the person whose opinion was quoted. It cannot be doubted also that in preparing his edict each prætor availed himself of all the aid he could obtain from the learning and wisdom of these professional experts; and this is the more probable from the fact that the prætor himself was often, if not generally, chosen from the same class, and he would naturally be anxious that his legislative work should meet the approval of all his fellow-jurisconsults. After the empire was established the position of these jurists was somewhat altered. Augustus accorded to their opinions a certain legal authority, but required an imperial sanction or appointment for those who desired to exercise the function. Hadrian afterwards ordered that their juridical opinion should have the force of law, provided they all agreed, but if they differed the judge should be at liberty to follow whatever one he pleased. The character of the jurists themselves was also greatly changed. In the second and third centuries of our era a class of juridical writers arose far surpassing the earlier *prudentes*, whose labors brought the law to the highest condition which it reached. They introduced the philosophic element; they created the system of classification, which has remained substantially unchanged to the present day; they composed elaborate treatises either upon the law as a whole or upon some special department, and it was from these treatises that the material was taken which formed the *Digest* afterwards compiled by the command of Justinian. Finally, most of them occupied high official positions under the various emperors, and thus took an active part in the work of legislation, either by framing the "constitutions" issued in the name of the emperor, or by rendering the decisions in his supreme court of appeal. Of these illustrious men, whose labors have influenced the jurisprudence of the entire civilized world, five stand in acknowledged pre-eminence—Gaius, Papinian, Paul, Ulpian, and Modestin. Gaius, who wrote in the time of the Antonines, held no office, but was a private teacher of the law. Of his works, the *Institutes* has been preserved almost entire, and its discovery in 1816 marked an era in the study of the Roman jurisprudence. Papinianus was the prætorian prefect, supreme judge of appeal, under Septimius Severus, and was murdered by his son and successor, Caracalla. He was universally regarded by all writers who succeeded him as the foremost and greatest of the Roman jurists. Nothing remains of his numerous works except the extracts found in the *Pandects*, of which there are a great number. Paulus was prætorian prefect under Alexander Severus, A. D. 222. Besides the quotations contained in the *Digest*, one of his treatises, *Receptæ Sententiæ*, still survives. Ulpianus wrote during the reigns of Septimius Severus and Caracalla, and was killed by the soldiery (A. D. 228) while prætorian prefect of Alexander Severus. The *Pandects* contain a greater number of extracts from his works than from those of any other jurist. Fragments of a separate treatise are also extant. Modestinus lived and wrote in the reign of Alexander Severus, and was a member of his council. He is only known to us by his contributions to the *Digest*. At the final overthrow of the republic the popular assemblies lost the power of enacting statutes, which was for a while transferred to the senate; it soon, however, became practically, and ere long openly, the attribute of the emperor alone. Finally, when the peculiar function of the prætor had ended, the whole legislative authority was centred in the supreme head of the empire, and there remained as long as there was any life or creative force in the law itself. The official declarations by the emperor were generically termed "constitutions," and were of three species—edicts, decrees, and rescripts. "Edicts" were legislative in their character, addressed to the whole empire, and in every respect the same as the "*leges*" of the earlier form of the government, and as the statutes of the present day. "Decrees" were judicial decisions rendered in causes brought before the emperor on appeal; while "rescripts" were official answers made to those who consulted him whether as public functionaries or as private persons. Decrees and rescripts had not the force of general statutes, but were used as precedents, and are found in the collections of imperial constitutions. It must not be supposed that the emperor personally prepared and issued the constitutions. Although done in his name and by his command, they were usually the work of professional jurists who filled high offices of state, and who were often the ablest, purest, and most learned men of the empire. It thus happened that some of the best examples of philosophical legislation appeared during the reigns of the very worst of emperors, such as Commodus, Caracalla, and Nero. From the time of Alexander Severus, which may be regarded as its culminating epoch, the Roman law rapidly declined; all power of progress had gone; and at length the appeal was constantly to the past and to the writings of the dead jurists. As an illustration of its condition, of the loss of all intellectual vigor, and of the blind reliance upon authority, an imperial constitution made A. D. 426 by Theodosius II. and Valentinian III. ordered that in the decision of causes the judge should always follow the opinion expressed by a majority of the five jurists whose names have already been mentioned; but if there was an equal division among those of the five who had expressed an opinion on the particular point, that of Papinian should prevail; and if he was silent, then the judge could exercise his own discretion. Some attempts were made at a partial codification during this final period of decadence. Two collections of imperial rescripts were prepared by private jurists—one by Gregorianus (A. D. 306) and the other by Hermogianus (A. D. 365). The emperor Theodosius II. (A. D. 438) published a code containing the general constitutions (edicts) issued since the conversion of Constantine to Christianity, which was during the same year adopted by Valentinian III. in the Western empire. Although superseded in the East by the compilations of Justinian, it long continued to be used in the West, and was the collection of laws chiefly known to and employed by the Germanic tribes which overran the Western empire. A portion alone of this code has been preserved, somewhat condensed, in the *Breviarium* of Alaric.

The emperor Justinian commenced his reign A. D. 527. In 528 he appointed a commission of ten jurisconsults, among whom were Tribonian and Theophilus, with directions to select from all the existing imperial constitutions those which were operative, and to arrange them in a systematic order. They were permitted to change the words, to combine several constitutions into one, and to make other modifications that would better express the sense, but were forbidden in any manner to alter the law itself. Their work was completed in one year, and published with the title *Codex Justinianus*, but was soon supplanted by another. After the compilation of the *Digest* this original code was revised by a different commission, a considerable number of new constitutions which had been issued by the emperor was added, changes thus rendered necessary were made, and the new edition was published A. D. 534, under the name *Codex Repetitæ Prælectionis*. This work, known

as *The Code* (*Codex*), has been preserved to the present day, the earlier edition being entirely lost. It contains the imperial constitutions from Hadrian to Justinian; it is divided into twelve books, each of these into titles; each title contains a number of constitutions arranged in a chronological order, with the names of the emperors who were their authors and their dates. In the year 530 the emperor created another commission of sixteen, at the head of which was Tribonian, and entrusted to them the task of compiling a body of the existing law from the writings of the great jurists. According to the general plan which he prescribed, all the juridical works of authority were to be consulted and extracts made from them; these quotations, with such modifications as should be necessary to explain the meaning and harmonize the whole result, were to be collected into fifty books, and arranged according to the order of the edict after it had been revised under Hadrian (*edictum perpetuum*). The commission finished their labors in three years, and in 533 published the result under the name of *Pandects* or *The Digest*. In compiling the *Digest* selections were made from more than 2000 different treatises written by thirty-nine jurists, most of whom flourished within the period of about 100 years from the formation of the perpetual edict in the reign of Hadrian to the death of Alexander Severus. Following the plan proposed by the emperor, the *Digest* is divided into fifty books; each book, with the exception of three, is separated into titles; and each title into sections, which consist of the extracts from various authors. The internal arrangement and classification of the material itself which forms the body of the *Digest* are universally admitted to be very defective. Having provided for these great compilations of the law, Justinian ordered an elementary work to be composed and entitled *The Institutes*. It was prepared by two jurists, Theophilus and Dorotheus, under the supervision of Tribonian, and was published about the same time as the *Digest*. Chiefly based upon the *Institutes* of Gaius, it is separated into four books, and these into titles, and deals alone with the private law. *The Institutes* was written principally for use in the law-schools as an introduction to the study of jurisprudence, and this use has continued unchanged to the present day; no other elementary work has superseded it. It was the design of Justinian that the entire body of the Roman law should be comprised in the *Code* and the *Digest*, and to that end he forbade any reference to or citation of the ancient jurists either in the courts or the schools, and abrogated all the constitutions which were not found in his collection; he even prohibited all commentaries upon the *Pandects*. The emperor, however, did not restrain himself from making additions to the law which he had codified, but he issued from time to time new constitutions (*novellæ constitutiones*), the number of which exceeded 150, some of them relating to very important points of the private law. They were officially published after his death, and are known as *The Novells*. The four works thus described, *The Pandects* or *Digest*, *The Code*, *The Institutes*, and *The Novells*, constitute the *Corpus Juris Civilis*.

These law-books of Justinian were not immediately introduced into the West, and in fact the Roman law was for a long time perpetuated among the barbarian invaders of the Western provinces by means of very inferior and imperfect compilations, and not by the *Corpus Juris Civilis*. From A. D. 415 the Visigoths had established themselves in Southern Gaul. About the middle of the same century the kingdom of the Burgundians was founded on the Rhone. In 493, Italy was subjugated by the Ostrogoths. For these three kingdoms three different codes were formed, by which, rather than by those of Justinian, the Roman law was kept alive among all the Germanic peoples. The first of these was the *Edict* of Theodoric (*Edictum Theodorici*), prepared in 500 for the Ostrogoths. It contained extracts from the sources of the Roman law, freely treated; it was very short and incomplete, but it left the existing law in full force in all cases for which it did not expressly provide. The second was the *Breviarium*, composed by Alaric in 506 for the Romans within the kingdom of the Visigoths. It contained a part of the Theodosian code, and extracts from the novells annexed thereto, from two works of Gaius and Paulus, from the Gregorian and the Hermogenian codes, and from a treatise of Papinian. The third and least important of these compilations was that made for the Burgundians, about 517—*Lex Romana Burgundionum*, sometimes though erroneously named *Papianus*. Upon the defeat of the Ostrogoths in 554 under Justinian his collections were introduced into Italy, but they retained their position of authority for a short time only. In 568 the Lombards subjugated the greater part of Italy, and the Germanic tribes from that time were established in permanent supremacy over the entire Western empire. (See Falck, *Encyclopédie Juridique*, § 80.) This political revolution did not blot out the Roman law, which continued to exist as an actual jurisprudence, but under a very peculiar form, utterly unknown to modern usages and opposed to modern conceptions. The Germanic invaders wherever they spread did not destroy the Romans nor impose upon them a new law. Each race, living upon the same soil, preserved and obeyed its own laws, which were thus no longer territorial, as are laws at the present day, but were *personal*, in that they applied to different classes of persons dwelling in the same country. According to the general rule, each person was subjected to the law of his birth—Roman to Roman, Frank to Frankish, or Burgundian to Burgundian. Wherever, therefore, the province had become thoroughly Romanized, wherever the Roman dominion had been fully established, as in Gaul, Spain, and Italy, there were left, even after the supremacy of the German invaders, the remains of Roman institutions, laws, and modes of thought. The codes above mentioned, compiled after the conquest, although exceedingly imperfect, were vastly superior to the Germanic laws and customs with which they were contrasted, and as society gradually became settled they were taken as the basis of the legislation that was created for the nations which finally came into existence from the united populations. In this manner the Roman law was historically, and as it were unconsciously, incorporated into the jurisprudence of the continental nations, and was the great storehouse of principles, doctrines, and rules whence the material of that jurisprudence was drawn during its process of development. The important influence exerted by the ecclesiastics in this work has already been described in the article upon the Canon Law, and the explanation need not be repeated. The reason is plain why the like effect was not produced in the legislation of England. The Saxon invaders of Britain found but few traces of the Roman institutions; there was no opportunity for a "personal" law with them; all was territorial. The Saxon customs prevailed to the exclusion of all others throughout the kingdom; the Roman law was not left side by side with them, to grow up, and finally to overshadow them. The only influence which it exerted upon the legal development during the Saxon domination was through the ecclesiastics and the canon law which they administered. In addition to the foregoing silent, unconscious, historical method by which the law of the dead empire was perpetuated and made dominant over modern states, there was another open, external, conscious, and intentional cause which exerted a powerful aid in producing that result. About the beginning of the twelfth century a spirit of free inquiry was suddenly awakened throughout Europe, and one of its earliest and most remarkable manifestations was shown in the scientific study of the Roman law, which, commencing in Italy, soon extended to France, Spain, and even to England. A school was founded at Bologna in which Irnerius commenced to lecture upon the *Corpus Juris Civilis* (A. D. 1120). The professors at Bologna, as a part of the instruction which they gave to their students, composed short notes upon the text of the *Digest* and the *Code*, explanatory of obscure and doubtful passages. To these notes the name "glosses" was given, and the entire school of early commentators have been denominated "glossators." The glosses themselves were collected and revised by Accursius (A. D. 1220–60), and form the earlier body of commentaries upon the books of Justinian. From Bologna the study of the law rapidly spread over Europe, and lectures were even delivered at Oxford in 1149. The effect of this movement upon the local jurisprudence of the Continent was immediate and profound. From the universities the influence extended at once to the tribunals, and the Roman law was thenceforth acknowledged to be the common law of Europe.

The Substance of the Roman Law.—The limits of this article will not permit even an outline of the law itself, and I shall merely attempt to explain and illustrate its internal growth and gradual transformation. In the primitive period, although even then showing the wonderful capacity of the Roman people for legislation, the law as a whole was exceedingly arbitrary and technical, dealing in external symbolic acts, demanding a strict observance of prescribed formulas, and without a single element of abstract morality and justice. The Romans conceived of their law as applying only to the citizen, and thence termed it *jus civile*. Its rules coerced none but citizens, and while strangers and foreigners, even when permanent inhabitants of the territory, could obtain none of the advantages which it conferred, they were at the same time free from its peculiar burdens. Side by side, however, with this strictly national law of the state and the citizen, the Romans from an early day conceived of another system of jural rights which they regarded as common to all nations, and therefore termed *jus gentium*—the law pertaining to all nations. Whenever a judicial controversy arose in which a foreigner

or stranger was a party, since the law for the citizen did not apply to him, the magistrate fell back upon the rules which he found prevailing among all the peoples with which he was acquainted. As these regulations were thus common, and not local and particular, it necessarily followed that they were based upon some universal principles, and were not as arbitrary and technical as the corresponding rules of the Roman civil law. The notion thus introduced from an actual observation of the neighboring peoples was greatly extended in subsequent times, until at length, under the philosophical jurists of the early empire, the *jus gentium* came to be considered as synonymous with absolute right, justice, and equity. Again, it frequently happened, especially after trade and commerce had sprung up, that in controversies between citizens questions would arise that were not covered by any existing rule of the Roman civil law, and the magistrate would be required to exercise his legislative function. Here also in creating the new rule he naturally invoked the broader and juster doctrines which he had introduced while adjudicating upon the rights of strangers. There thus existed in the administration of justice two widely different systems: (1) the original civil law of Rome, which was enforced against the citizen in all cases that were expressly provided for by its rules or that could be fairly brought within their operation; and (2) a body of regulations contained in the prætorian edict, primarily applicable to persons who were not citizens, but afterwards extended to citizens, and enforced in all cases where the former system was silent. The internal growth of the Roman jurisprudence as a whole, as a single municipal law for the Roman state, consisted in the steady expansion and development of the latter branch under the edictal legislation of the prætors and the scientific labors of the later jurists, until it finally displaced and completely absorbed the original civil law, of which no traces are left in the compilations of Justinian. This statement may be illustrated by a reference to a few of the most important divisions. So far as it is concerned with primary rights, the Roman law is separated into three grand departments: (1) the status of persons; (2) things as the objects of rights; and (3) obligations. In the primitive period the status of persons formed by far the most important department of the national jurisprudence. The peculiar feature of the early society around which all rights and duties were grouped was the family. Its head was the *paterfamilias*. It included his wife, all of his descendants who had not been emancipated or transferred to another by marriage, the wives of his male descendants, all persons incorporated into it by adoption, and the slaves. The legal authority of the paterfamilias was prodigious, and embraced three distinct branches—the paternal power (*potestas*), the marital power (*manus*), and the power over things (*dominium*). He was thus the legal representative head of his wife and children, and other descendants; all their labors and acquisitions within the sphere of private affairs belonged to him. Even the ties of relationship, and the rights and capacities incident thereto, were not determined by the common descent and a common blood, but by the subjection to a common paternal power. This primitive condition of the family, of which a slight outline only has been given, was gradually changed; the paternal and the marital powers diminished, and finally disappeared, and the family as exhibited in the books of Justinian is substantially the same as in the modern law. The early rules of property were to the last degree arbitrary and unjust. The strictly legal property in things, the only one recognized by the civil law (*dominium ex jure quiritum*), could only be acquired, held, or transferred by a citizen. Things as the subjects of property were separated into two classes —*res mancipi* and *res nec mancipi*, the former embracing land in Roman territory, slaves, horses, cattle, and beasts of burden, and the latter all other things. To constitute a valid transfer, even between citizens, of articles belonging to the first class, required the observance of certain exceedingly technical formulas termed "mancipation," or a constant possession for one year called "usucapion." A stranger could acquire legal property (*dominium*) in no manner. These unjust and arbitrary rules of the civil law were utterly abrogated by the prætorian legislation. By inventing, protecting, and enforcing a species of property denominated *in bonis*, which was based upon principles of justice and equity, and which could be held in things of all kinds, and acquired and transferred in simple and natural modes, this entire department of the law was revolutionized, and became the comprehensive and complicated system suited to a wealthy and commercial people. In the primitive condition of the law obligations resulted either from contracts or from delicts. The rudeness and technicality which characterized other parts of the system were especially prominent in all that related to contracts. Four classes alone were recognized as binding—that is, as raising any obligation—and these did not depend upon good faith, or a valuable consideration, or any other element of right and equity, but upon a compliance with the prescribed forms. These four classes were—(1) Those made by the thing (*re*), which became binding by a delivery of the thing to which they related; of which class there were four species—loan (*mutuum*), where the same amount was to be returned; *commodatum*, where the very thing loaned was to be returned; deposit (*depositum*), and pledge (*pegnus*). (2) Those made by words (*verbis*). These were executory agreements, which became binding by the use of certain specified words put in the form of a question and answer. (3) Those made by letters (*literis*), which became binding by the entry of a memorandum in the domestic books of account of the parties. (4) Those made by consent (*consensu*), which became binding by the mere consent of the parties, without any formalities. Of this class four species alone existed—sale, hiring, partnership, and a kind of bailment. The changes wrought by the prætorian legislation in the law of contract were more numerous and important than those made in any other department. In the place of these few and arbitrary rules a system was built up which, with a few special additions, is sufficient for all the business and commercial transactions of modern society. JOHN NORTON POMEROY.

Law, Municipal. See MUNICIPAL LAW, by PROF. T. W. DWIGHT, LL.D.

Law (ANDREW), b. in Connecticut about 1748; graduated at Brown University 1775; became a clergyman, and was for forty years a teacher of music; published a *Collection of Hymn-Tunes* (1782), *The Rudiments of Music* (1783), *The Musical Magazine* (1792), and *The Art of Singing* (3 parts, 1803). He was author of the well-known tune "Archdale," invented four characters to express the four syllables of music, and was one of the earliest American musical composers. D. at Cheshire, Conn., in July, 1821.

Law (EDMUND), D. D., b. near Cartmel, Lancashire, England, in 1703; was educated at St. John's College, Cambridge, of which he was chosen fellow upon graduation in 1723; obtained the rectory of Graystock, Cumberland, in 1723; became archdeacon of Carlisle in 1743, master of Peterhouse College, Cambridge, in 1754, librarian of the university, professor of casuistry, and archdeacon of Lincoln soon afterward, prebendary of Durham in 1767, and bishop of Carlisle in 1768. D. at Rose Castle, Carlisle, Aug. 14, 1787. Bishop Law was one of the most learned and liberal prelates and acute metaphysicians of his age; translated from the Latin Archbishop King's *Essay on the Origin of Evil* (1731), with copious notes; wrote an *Enquiry into the Ideas of Space and Time* (1735), *Considerations on the Theory of Religion* (1745), and *Reflections on the Life and Character of Christ* (1749). He published an edition of the *Works* of John Locke (1777), with a biography of that philosopher, of whom he was an admirer and follower. His *Considerations*, "a work of singular beauty," was often reprinted, and was edited in 1820, with a *Life* by Dr. Paley.—His eldest son, EDWARD, was the first LORD ELLENBOROUGH (which see); another son, GEORGE HENRY (1761–1845), became bishop of Chester in 1812 and of Bath and Wells in 1824; and a third son became bishop of Elphin.

Law (JOHN), OF LAURISTON, b. in Edinburgh, Scotland, Apr. 21, 1671, eldest son of a goldsmith and money-changer who accumulated a fortune and bought the large estate of Lauriston, which John inherited, deriving from it his title. At the age of twenty Law settled in London, and soon became prominent in financial circles, though addicted to gambling and dissipation. Having killed an antagonist in a duel (1694), he was condemned to death, but escaped from prison and took refuge in France, travelling thence into Italy and Holland, and was for some time connected with a banking-house in Amsterdam. Returning to Scotland in 1700, he published a pamphlet advocating a state bank, but as the project met with no favor at home, he presented it to the French government, with the same result. Another pamphlet was issued on the same subject in 1705. For several years Law led a wandering life in European capitals, gaining large sums at the gaming-table, until the death of Louis XIV. in 1715 opened a field for his grand scheme. The kingdom was burdened with an enormous debt, and the regent caught at a plan which promised unlimited gain to the state. A private "general bank," with a capital of 6,000,000 livres, was chartered under letters patent of May 2, 1716, and began to emit vast quantities of notes, redeemable in specie, discounting bills of exchange, and accepting at par the government paper, then at 80 per cent. discount. The national credit and the general prosperity immediately received an immense stimulus; the vicious principles involved were not at first detected. Law was hailed as a national benefactor, and in a few months had issued notes for

nearly 20,000,000. But their circulation was limited to a few large cities, until in Apr., 1717, the government decreed that Law's notes should be accepted in payment of imposts. Another feature was added to the scheme in Aug., 1717, by the formation of the celebrated Mississippi or West India Company, with a capital of 100,000,000 livres, a monopoly of trade with Canada, and sovereign rights over the territory of Louisiana, which was to be colonized upon a vast scale. Parliament was hostile, and in Aug., 1718, prohibited the receipt of Law's bank-notes in payment of taxes; D'Argenson, president of the council of finances, lent his patronage to a rival Western company called the *Anti-System*, but Law's star was still in the ascendant, and the decree of Parliament was declared invalid by judicial interposition. By royal edict of Dec. 4, 1718, the "general bank" was transformed into a *royal bank*, with Law as director and the king as security. Another edict of May, 1719, conferred a monopoly of East Indian and African trade upon the favored organization, which now absorbed the East India Company, took the name of "Company of the Indies," augmented its capital, and undertook to pay the national debt, agreeing to lend the king 16,000,000,000 livres at 3 per cent. An unexampled fever of speculation now carried the shares to 30 or 40 times their original value, and nearly 20,000,000,000 in notes were issued. On Jan. 5, 1720, Law received the appointment of controller-general of the finances, and in March he united the royal bank to the Company of the Indies. It was in the conversion of paper demanded by this colossal operation that the utter bankruptcy of the company was first perceived. The government, becoming alarmed, issued an edict deposing Law from the controllership, abolishing the bank, and depriving the company of its home monopolies and its connection with the state revenues. As a commercial corporation the company struggled for existence during several months, and disappeared in November. In December, Law quitted France, carrying with him only a few hundred louis-d'or, and loaded with the public execration. He travelled on the Continent for some time, returned to Great Britain by permission of the ministry, received a pardon for his early crime, was presented at court, and entertained illusive hopes of repairing the disasters of the "system," in which he preserved a genuine confidence. A friend in France, the marquis de Lassay, gave him for some years a pension of 20,000 livres. He gradually fell into obscurity, and d. in poverty at Venice Mar. 21, 1729. His remains were buried in the church of San Gemiano, from which they were transferred in 1808 to that of San Moise by the celebrated Marshal Law, a grandson of his brother, who founded in France a noble family, still flourishing under the name of LAW DE LAURISTON. The complete works of John Law were translated for the first time into French in 1790. They were reprinted in 1842, and have since been inserted in the great collection of the writings of the principal economists and financiers of the eighteenth century, published by M. Guillaumin. (See Thiers's *Histoire de Law* (1858); John P. Wood's *Memoirs of the Life of John Law* (1824); and Mackay's *Memoirs of Extraordinary Popular Delusions* (1850).) (See MISSISSIPPI SCHEME.) PORTER C. BLISS.

Law (JOHN), b. in New London, Conn., in 1796, was son of Lyman; graduated at Yale College 1814; admitted to the bar in 1817; emigrated to Indiana and located at Vincennes, where he was successively elected prosecuting attorney, member of the legislature (1823), and judge, holding the latter office eight years. In 1838 he was appointed receiver of public moneys; in 1855, judge of the court of land claims; removed to Evansville; was elected in 1860 a member of Congress, and re-elected in 1862. He drew up and reported the bill assigning a pension to the surviving soldiers of the Revolution, and has been president of the State Historical Society.

Law (JONATHAN), b. at Milford., Conn., Aug. 6, 1674; graduated at Harvard in 1695; studied law, and practised at Milford, and was a magistrate for more than thirty years, having been chief-justice from 1725 to 1741, and governor from 1741 until his death in May, 1741.

Law (LYMAN), b. at New London, Conn., Aug. 19, 1770; graduated at Yale College 1791; studied law with his father, Richard; served in the State legislature, of which he was at one time Speaker, and was a Representative in Congress 1811–17. D. at New London Feb. 3, 1842.

Law (RICHARD), LL.D., b. at Milford, Conn., Mar. 17, 1733, son of Gov. Jonathan; graduated at Yale College in 1751; studied law, and practised at New London, where he became chief judge; delegate to Continental Congress 1777–78 and 1781–84; mayor of New London for more than twenty years; justice and chief-justice of supreme court of State, and district judge by appointment of Washington. He aided Roger Sherman in revising the Connecticut code of statute law. D. at New London Jan. 26, 1806.

Law (WILLIAM), b. at King's Cliffe, Northamptonshire, England, in 1686; was admitted into Emmanuel College, Cambridge, 1705; became a fellow of that college 1711; graduated as M. A. 1712; took orders in the Church of England, and preached for a time in London, but on the accession of the house of Brunswick to the throne (1714) forfeited his fellowship and his prospects of advancement in the Church by refusing, as a Jacobite, to take the oath of allegiance. He never again officiated in public as a clergyman. In 1717 the bishop of Bangor, Dr. Benjamin Hoadley, having in a sermon before the king given rise to the famous "Bangorian controversy" by attacking the non-jurors, Law wrote in reply *Three Letters to Bishop Hoadley*, remarkable for their close reasoning and command of language, which placed him at once in the front rank of the defenders of authority both in Church and State. In 1724 he wrote one of the best of the numerous replies to Mandeville's *Fable of the Bees* (republished with introduction by Rev. F. D. Maurice, 1844), and in 1729 his masterpiece, the *Serious Call to a Devout and Holy Life*—a work to which Dr. Johnson attributed his conversion, which had great influence upon the brothers Wesley, and which elicited the warmest praise even from the pens of the historians Gibbon and Macaulay. Shortly before this time Law became tutor to Edward Gibbon, father of the historian, accompanied his pupil to Oxford, and was for several years a member of his family at Putney. Between the years 1733 and 1736 he became acquainted with the writings of the German mystic Jakob Böhme, and adopted his teachings, which influenced the treatises *On the Sacrament* (1737), *Christian Regeneration* (1739), and his numerous other tracts. In 1740 a wealthy widow lady, Mrs. Hutcheson, and Miss Hester Gibbon, sister of his pupil, resolved to spend their lives in a quasi-conventual manner, devoting their fortunes to charity, and engaged the services of Law as chaplain and almoner. The three thenceforth resided at King's Cliffe, and Law now prepared a series of works expounding the doctrines of Böhme; these were *The Way to Divine Knowledge* (1746), *The Spirit of Prayer*, and *The Spirit of Love*. He also wrote some illustrative materials for a translation of the works of Böhme executed by the ladies above named, but published after his death under the name of Law (4 vols., 1764–81). He d. at King's Cliffe Apr. 9, 1761. In the following year his collected works were published in 9 vols. (See his *Life*, by R. Tighe (1813), and a volume of *Notes and Materials* for his biography, printed for the Theosophian Library, 1856.)

Lawes (HENRY), b. about 1600 at Salisbury, England, where his father, Thomas Lawes, was vicar-choral in the cathedral. Educated as a classical musician under the instructions of John Cooper, he became about 1625 one of the "gentlemen of the royal chapel" to Charles I., and acquired celebrity as a composer of music for masques and songs. Milton's *Masque of Comus* was set to music and brought out under his personal direction at Ludlow Castle in 1634, and the great poet, probably a pupil of Lawes in music, bestowed upon him extraordinary eulogies in several of his poems. Waller, Herrick, and Phillips wrote of him in a similar strain, and were indebted to him for the popularization of many of their songs. The music of Lawes was of the Italian style, and was of very unequal merit. He was a royalist; remained in the service of the king as "clerk of the cheque" until 1649, and composed the anthem for the coronation of Charles II. He published in 1653 *Ayres and Dialogues, for One, Two, and Three Voices*, comprising 150 pieces. D. at London in Oct., 1662, and was buried in Westminster Abbey.—His elder brother, WILLIAM LAWES, also a gentleman of the chapel, and killed at the siege of Chester, was associated with Henry in several of his musical undertakings, composed the music for Sandys's version of the Psalms (1648), and for many songs of that period.

Lawler (JOAB), b. in North Carolina June 12, 1796; was educated for the ministry, and became a Baptist clergyman; served from 1826 to 1831 in the lower house of the Alabama legislature; was elected State senator 1831; was receiver of public moneys 1832–35, treasurer of the University of Alabama 1833, and elected to Congress in 1834. D. at Washington, D. C., May 8, 1838.

Law'ler, post-v. of Chickasaw co., Ia., on the Chicago Milwaukee and St. Paul R. R. Pop. about 400.

Lawn, from the Old English *lawnd*, an open clear place, meant formerly an open space between woods, but is now mostly restricted to a space of ground covered with grass for ornamental purposes. In order to produce a thick-turfed, dark-green, velvety lawn, the soil, especially if light, should be well provided with manure, and worked so deeply as to allow the plant to extend its roots below the stratum generally reached by a surface-drought. The seed used should be a mixture of red-top and white clover, in the proportion of three parts of the former to one of the

latter; but it is not recommended to mix the grass-seed with that of some grain, which is often done. The idea is to produce shade for the young grass-plant, but the effect really is that it is starved. A third and indispensable condition is frequent mowing—once a week, at least once every two weeks, and each spring a little top-dressing, especially on any poor spot.

Law of Nations. See International Law.

Law of Storms. See Storms.

Law'rance (John), b. in Cornwall, England, in 1750; came to New York in 1767: was admitted to the bar in 1772; was aide-de-camp to Washington in 1777, and judge-advocate at the trial of Major André; member of old Congress 1785–86, of the new Congress 1789–93; U. S. district judge 1794–96; U. S. Senator 1796–1800; presiding over the Senate in 1798. He was a zealous defender of Washington and Hamilton. D. at New York Nov. 10, 1810.

Law'rence, county of N. W. Alabama. Area, 830 square miles. It is bounded N. by the Tennessee River. The S. part is a high plateau. As a whole, it is a very fertile county. Cotton, corn, and live-stock are largely produced. The county is traversed by the Memphis and Charleston R. R. Cap. Moulton. Pop. 16,658.

Lawrence, county of N. E. Arkansas. Area, 540 square miles. It is a fertile wooded plateau, with ridges and rich alluvial valleys. Cotton and grain are produced. The county has rich ores of iron, copper, zinc, and lead. It is traversed by Black River and by the Cairo and Fulton R. R. Cap. Powhatan. Pop. 5981.

Lawrence, county of S. E. Illinois, bounded E. by the Wabash River, which separates it from Indiana. Area, 306 square miles. It is partly uneven and partly level, with considerable timber and some swamps. It is traversed by the Embarras River and by the Ohio and Mississippi and the Cairo and Vincennes R. Rs. The soil is fertile. Cattle, grain, and wool are staple products. Cap. Lawrenceville. Pop. 12,533.

Lawrence, county of S. Central Indiana. Area, 444 square miles. Its surface is broken and well timbered. The soil is productive. Cattle, grain, and wool are staple products. Coal is found in some places. The county is traversed by the E. branch of White River and by the Ohio and Mississippi and the Louisville New Albany and Chicago R. Rs. Cap. Bedford. Pop. 14,628.

Lawrence, county of E. Kentucky, bounded E. by West Virginia. Area, 642 square miles. It is mountainous, with fertile valleys. Corn is the chief farm product. Coal is found in great quantities and of superior quality. The navigable Big Sandy River washes its E. border. Cap. Louisa. Pop. 8497.

Lawrence, county of S. Central Mississippi. Area, 580 square miles. It is generally fertile. Corn, rice, and cotton are staple products. The county is traversed by the Pearl River. Cap. Monticello. Pop. 6720.

Lawrence, county of S. W. Missouri. Area, 576 square miles. It is undulating and in part hilly, with a large area of timber-land. Copper, lead, and iron ore have been found. The soil is good. Live-stock, grain, tobacco, and wool are staple products. The county is traversed by the Atlantic and Pacific R. R. Cap. Mt. Vernon. Pop. 13,067.

Lawrence, county of S. Ohio, bounded S. E. and S. W. by the Ohio River. Area, 400 square miles. It is uneven, but fertile. Grain and tobacco are staple crops. Coal and iron are mined, the latter very extensively. Iron, charcoal, and cooperage are leading manufactures. The county is traversed by the Iron R. R. Cap. Ironton. Pop. 31,380.

Lawrence, county of Pennsylvania, bounded W. by Ohio. Area, 425 square miles. It is uneven, but fertile. Cattle, grain, and wool are staple products. Lumber and flour are leading manufactures. Coal and iron ore are mined. It is traversed by Beaver River and its affluents, and by the Erie and Pittsburg and the Pittsburg Fort Wayne and Chicago R. Rs. Cap. Newcastle. Pop. 27,298.

Lawrence, county of Tennessee, bounded S. by Alabama. Area, 630 square miles. Its surface is mostly high, healthy, and productive. Grain and tobacco are staple products. There is abundant water-power. Iron is mined to some extent. Cap. Lawrenceburg. Pop. 7601.

Lawrence, tp. of Sanford co., Ala. Pop. 537.

Lawrence, tp. of Lawrence co., Ark. Pop. 244.

Lawrence, tp. of Lawrence co., Ill. Pop. 1492.

Lawrence (Sedan P. O.), a v. of Richland tp., De Kalb co., Ind., on the Michigan Southern R. R. (Air-line division). Pop. 176.

Lawrence, post-v. and tp. of Marion co., Ind., on the Cleveland Cincinnati and Indianapolis R. R. Pop. 2360.

Lawrence, city, cap. of Douglas co., Kan., on both sides of the Kansas River, at the junction of the Kansas Pacific with the Leavenworth Lawrence and Kansas R. R., 38 miles S. W. of Leavenworth, has 17 churches, 2 national and 3 other banks, a public library, 3 daily, 2 tri-weekly, and 4 weekly newspapers, and is the seat of the State University. Lawrence is the second city of the State, both as to population and wealth; has a dam across the Kansas River nearly completed, which will afford 3000 horse-power, the largest pork-packing establishment in the State, a woollen-factory, iron-foundries, machine-shops, planing and flouring mills, tanneries, and a large number of mercantile houses. Six railroads centre here, affording low freights and easy communications in all directions. Lawrence has had an eventful history. It was founded in 1854 in the midst of the struggle for a free State, and was the head-quarters of John Brown, Lane, Robinson, Conway, and other noted leaders. It was burned in 1863 by the Quantrell raid, but has been rebuilt, and is now one of the most beautiful and enterprising cities of the West. Pop. 8320. T. D. Thacher, Ed. "Daily Journal."

Lawrence, city and one of the caps. of Essex co., Mass., on both sides of the Merrimack River, 26 miles N. W. of Boston, on the Boston and Maine, the Lowell and Lawrence, and the Manchester (N. H.) and Lawrence R. Rs., was until 30 years ago an almost uninhabited waste, forming portions of the towns of Andover and Methuen. The river in its natural condition flowed over a bed of rocks at this place, having a descent of 26 feet, without any sudden fall, for the distance of about half a mile, affording unrivalled water-power, which in 1845 led to its selection for a manufacturing centre. By the efforts of Abbott Lawrence, Nathan Appleton, and other enterprising capitalists of the State, the Essex Company was incorporated in that year, proceeded to construct a dam of solid granite across the rapids, and opened a canal 90 feet wide and 1¼ miles long for the utilization of the water. This dam, 900 feet long and 40 feet high, one of the most substantial constructions in New England, was completed Oct. 14, 1847, at a cost of $250,000, and on Feb. 24, 1848, the first wheel was set in motion by water from the canal, since which time the industries of the place have acquired a rapid and almost unexampled development. A second canal has recently been built, on the opposite side of the river. The most important establishments are the Atlantic cotton-mills, capital $1,500,000, employing 1800 looms and 1400 operatives; Pacific Mills, capital $2,500,000, employing about 5000 operatives; and the Washington Mills, capital $1,650,000, 1265 looms, and 2900 operatives. Other prominent establishments are those of the Lawrence duck and woollen mills, Headley steam-engine works, the Everett and Pemberton mills (cotton and woollen), Arlington woollen, Russell, and other paper mills. The Pacific mills occupy a vast area; their buildings are of colossal dimensions and considerable architectural beauty, this company being noted for the educational and social advantages it offers to its operatives with its fine library (6000 volumes), reading-room, relief societies, and hospitals for the sick and aged. The original Pemberton mill, a brick structure, suddenly fell Jan. 10, 1860, burying 700 persons in its ruins, of whom 91 were killed or mortally injured. The new building is very strongly built. The city received its name in honor of the Lawrence family, its principal founders; was incorporated as a town Apr. 19, 1847, and as a city Mar. 21, 1853; has 21 churches, 3 national and 3 savings banks, 2 daily and 4 weekly newspapers, 59 public schools (graded), a public library (14,000 volumes), very fine high and grammar school-houses, a beautiful common (17 acres, with miniature lake) and park, excellent water-works and fire department, court-house, city-hall, Masonic temple, Odd Fellows' and music hall, several institutions of public and private beneficence, numerous manufactures of machinery, carriages, hardware, and flour; an assessed valuation of $24,117,373, a large proportion of which consists of capital invested in manufactures, which afford employment to nearly 15,000 operatives. The prosperity and enterprise of Lawrence are notable phenomena of America. Pop. in 1850, 8282; 1860, 17,639; 1870, 28,921.
George S. Merrill, Ed. "Daily American."

Lawrence, post-v. and tp. of Van Buren co., Mich., 9 miles W. from Paw Paw. It has 1 weekly newspaper. Pop. of v. 555; of tp. 1927.

Lawrence, tp. of Mercer co., N. J. Pop. 2251.

Lawrence, tp. of St. Lawrence co., N. Y. It is level and very fertile, contains several flourishing villages and 7 churches, and is traversed by the Ogdensburg and Lake Champlain R. R. Pop. 2577.

Lawrence, tp. of Lawrence co., O. Pop. 1245.

Lawrence, tp. of Stark co., O. It contains Canal Fulton (which see). Pop. 3366. Lawrence Station (N.

Lawrence P. O.) is on the Pittsburg Fort Wayne and Chicago R. R.

Lawrence, tp. of Tuscarawas co., O. Pop. 1479.

Lawrence, post-tp. of Washington co., O. Pop. 2860.

Lawrence, tp. of Clearfield co., Pa. Pop. 1720.

Lawrence, tp. of Tioga co., Pa. Pop. 957.

Lawrence, tp. of Brown co., Wis. Pop. 750.

Lawrence, SAINT. See LAURENTIUS, SAINT.

Lawrence (ABBOTT), LL.D., b. at Groton, Mass., Dec. 16, 1792. His father, Samuel Lawrence (1754–1827), was a Revolutionary officer. Abbott Lawrence studied in the academy at Groton, and became in 1808 a clerk, and in 1814 a partner in the dry-goods business of his brother Amos in Boston. In this business he often visited Europe. He was an early advocate of the protective tariff, engaged largely in manufacturing, and was one of the principal founders of the city of Lawrence, Mass. He was a member of Congress 1835–37 and 1839–41; was in 1842 a commissioner to settle the Aroostook boundary question; U. S. minister to Great Britain 1849–52. He founded the Lawrence Scientific School of Harvard University, founded scholarships and prizes in public schools, and was a liberal benefactor of the Groton Academy, now known by his name. He was liberal in all philanthropic and charitable causes. He received in 1854 the honorary degree of LL.D. from Harvard University. D. at Boston Aug. 18, 1855.

Lawrence (AMOS), b. at Groton, Mass., Apr. 20, 1786, and studied in the academy of his native place. In 1807 he set up a mercantile business in Boston, and in 1814 his brother Abbott became his partner. He acquired a large fortune, which he freely and unostentatiously employed for the good of the public and of individuals, bestowing in the most unobtrusive and noiseless way hundreds of thousands of dollars for benevolent uses. D. in Boston, Mass., Dec. 31, 1852. (See *Extracts from his Diary and Correspondence, with Memoir* by W. R. Lawrence, his son, 1855.)

Lawrence (EUGENE), b. in New York Oct. 10, 1823; graduated at New York University in 1841; has written *Lives of British Historians*, and is a voluminous contributor to Harpers' periodicals, chiefly upon subjects connected with the political influence of the Roman Catholic Church, of which he is an earnest opponent.

Lawrence (GEORGE ALFRED), b. in 1827 in England; was educated at Rugby and Baliol College, Oxford, where he graduated with honors in 1848; was admitted to the bar; best known as author of *Guy Livingstone*, *Sword and Gown*, *Barren Honor*, and other popular novels.

Lawrence (Sir HENRY MONTGOMERY), b. at Matura, Ceylon, June 28, 1806; studied at the Military College at Addiscombe; went to India in 1821 as a cadet in the Bengal artillery; took part in the Afghan war in 1843; was sent in the same year as British resident to Khatmandoo; participated in the Sutlej campaign; was resident at Lahore from 1846 to 1849; then chief of the board of administration in the Punjaub, agent of the governor-general in Rajpootana (1852), and in 1857 commissioner in Oude. He conducted the memorable defence of the British residency at Lucknow against the mutineers, until on July 2 he was mortally wounded, and d. at Lucknow July 4, 1857. (See his *Life*, by Edwardes and Merivale, London, 1872.)

Lawrence (Capt. JAMES), b. at Burlington, N. J., Oct. 1, 1781; entered the U. S. navy as a midshipman in 1798; became lieutenant in 1802; took part in the war with Tripoli (1804–05); was appointed in 1810 to the command of the Hornet (18), with the rank of master-commandant; cruised in Com. Bainbridge's squadron on the South American coast at the close of 1812, and on Feb. 24, 1813, captured, near the mouth of the Demerara River, the British sloop-of-war Peacock (18), after an engagement of fifteen minutes. The Peacock had six feet of water in her hold when she surrendered, and went down immediately after with a number of men of both crews. Returning to New York with these prisoners, and those of several other prizes, Lawrence received from Congress a gold medal, was promoted to be captain (Mar. 4), and commander of the frigate Chesapeake. On June 1, while he was lying in Boston harbor, the British frigate Shannon (38), Capt. P. V. Broke, came in sight with the express design of fighting the Chesapeake. Capt. Lawrence accepted the implied challenge, but both he and his principal officers were soon mortally wounded, and the Chesapeake, being much disabled, was taken by assault, and carried into Halifax, where he d. July 5, 1813. His exclamation on being carried below, "Don't give up the ship!" became a household word in the U. S.

Lawrence (JASON VALENTINE O'BRIEN), M. D., b. in New Orleans, La., in 1791; graduated in medicine at the University of Pennsylvania in 1815, having previously for some time been house-physician to the Pennsylvania Hospital. After securing a lucrative practice in New Orleans he returned to Philadelphia, where in 1822 he gave a six months' course of lectures on anatomy and surgery, and prepared for the press a work on morbid anatomy. D. Aug. 19, 1823. His papers were published in the Phila. *Jour. of Med. and Phys. Sciences.* PAUL F. EVE.

Lawrence (JOHN LAIRD MAIR), D. C. L., BARON, b. at Richmond, Yorkshire, England, Mar. 4, 1811; was educated at Haileybury College, where he became proficient in Oriental languages and laws; went to India in 1829 as a cadet in the Bengal civil service; filled various subordinate administrative and judicial posts, and in 1846, after the first Sikh war, was called to the responsible office of chief commissioner of the Punjaub, becoming lieutenant-governor in 1849. In this post, which he retained many years, Lawrence displayed rare talent in the government of a naturally turbulent race, and with such perfect success that the Punjaub, far from joining the mutiny of 1857, as was anticipated, was able to send forces of Sikhs and Punjabees to the relief of Delhi. His co-operation with Canning, Havelock, Outram, and Clyde for the suppression of the mutiny was of inestimable value, and gave him popular fame as "the saviour of India." Having returned to England in 1858, the last special court of directors of the East India Company, on the eve of its abolition, conferred a pension of £2000 upon Lawrence, who also received a baronetcy, and was sworn of the privy council. He was viceroy of India from 1863 to 1868, and was created a baron in 1869.

Lawrence (Sir THOMAS), b. in Bristol, England, in 1769; d. Jan. 7, 1830. His father was a tavern-keeper. When a mere child he made sketches in chalk; at ten he used the crayons with skill; at seventeen he painted in oil; he was but thirteen when he received a silver palette and five guineas from the Society of Arts for a copy of *The Transfiguration;* at the age of twenty-two, being younger than the rules required, he was made a "supplementary associate" of the Royal Academy, and painted portraits of the king and queen; in 1794 he was elected an academician; in 1815 he was knighted; in 1820 he became president of the Academy. Lawrence came to London in 1789. Reynolds befriended him with counsel and influence, and so diligent was he that during his first year in London he exhibited at Somerset House seven portraits of women. Flattered by his success in portraits, Lawrence was moved by an ambition to attempt historical painting, and produced *Satan Summoning his Legions*, the subject taken from Milton; but, though the picture was praised by his admirers, its reception did not justify his abandonment of the department in which he so far excelled all others. The most distinguished men and women of the time sat to him; his prices were high, rising in 1810 to 100 guineas for heads and 400 for full-lengths—more than thrice his earlier charges. In 1814 the prince regent commissioned Lawrence to paint the sovereigns, generals, and statesmen who were in league against Napoleon. The famous Waterloo gallery at Windsor is the result. In Vienna he painted the emperor of Austria; in London he painted Blücher and Platoff; in Rome he painted Pius VII. and Cardinal Gonsalvi. Honors were showered on him at home and abroad; foreign academies elected him to membership; he was made a chevalier of the Legion of Honor. A handsome person and elegant manners aided Sir Thomas in his profession with the nobility and people of wealth. His pictures are remarkable for richness of color, a mingled softness and splendor that was of great effect, particularly in the portraits of women, which are preferred to those of men. So great was the fame of Lawrence that a school of art was formed after his example, but of late years his fame has been declining. (See *Memoirs and Correspondence*, by D. E. Williams, London, 1831, 3 vols.) O. B. FROTHINGHAM.

Lawrence (TIMOTHY BIGELOW), b. in Boston, Mass., Nov. 23, 1826, a son of Abbott Lawrence; graduated at Harvard in 1846; was an attaché of the American legation in London during his father's residence as minister at the British court, and remained in that position until 1855; was U. S. consul-general in Italy 1862–69. D. in Washington, D. C., Mar. 21, 1869.

Lawrence (Sir WILLIAM), BART., F. R. S., b. at Cirencester, England, July 16, 1783; studied surgery for five years as apprentice to Dr. Abernethy; became in his twentieth year demonstrator of anatomy at St. Bartholomew's Hospital; professor of anatomy and surgery at the College of Surgeons (1815–19), and director of St. Bartholomew's (1819), which position he retained until 1865. His name is intimately connected with the progress of practical surgery in England, to which he made brilliant contributions, described in a long series of papers in the *Transactions* of the Medical and Chirurgical Society. He was re-

markable for varied attainments beyond the line of his profession; possessed an elegant literary style; was unrivalled as a lecturer; was twice president of the College of Surgeons, member of a host of scientific societies, and surgeon extraordinary to the queen, by whom he was made a baronet. His most important works were the *Lectures on Physiology, Zoology, and the Natural History of Man* (1819; 9th ed. 1848), the *Treatise on Hernia* (1807), and the *Treatise on Diseases of the Eye* (1841), edited in the U. S. by Dr. Isaac Hays (1847; new ed. 1853).

Lawrence (WILLIAM), b. at Mt. Pleasant, O., June 26, 1819; graduated at Franklin College, O., in 1838, and at the Law School of Cincinnati in 1840; settled at McConnellsville, and afterwards at Bellefontaine, O., and engaged with success in law-practice; edited (1845–47) the *Logan Gazette*, and at one time the *Western Law Monthly;* was often in the senate and lower house of the Ohio legislature; was the founder of the reform school and of the free banking law of the State; a judge of the common pleas 1856–64; for some time colonel of the 84th Ohio in the civil war; a member of Congress 1865–71 and 1873–74. Author of a work on the *Ohio Civil Code, The Law of Interest and Usury,* and compiled vol. xx. of the *Ohio Reports*.

Lawrence (WILLIAM BEACH), LL.D., b. in New York City Oct. 23, 1800; graduated at Columbia College in 1818; studied law in Europe; admitted to the New York bar in 1823; secretary of legation in London 1826–27; chargé d'affaires *ad interim* 1827–28; resided for some time in Paris, where he made a translation of Barbé Marbois's *History of Louisiana, and its Cession by France to the U. S.* (1830), adding an introduction and notes. Returning to the U. S. in 1832, he delivered a course of lectures on political economy at Columbia College, published in 1834; gained a prominent position in his profession; was influential in promoting the Erie Railway enterprise; was vice-president of the New York Historical Society 1836–45, to whose *Proceedings* he was a frequent contributor; wrote a *History of the Negotiations in reference to the Eastern and North-eastern boundaries of the U. S.* (1841), a brief *Memoir of Albert Gallatin* (1843), a small volume on the *Colonization of New Jersey* (1843), and numerous articles in the quarterly and monthly reviews. In 1850 he became a resident of Rhode Island, where he became lieutenant-governor and acting governor in 1851, and member of the constitutional convention in 1853. He was a member of the Social Science Congress which met at Bristol, England, in Oct., 1869, and lecturer on international law (1872–73) at the law school of Columbian College at Washington, D. C., in which city he has been employed for several years as an advocate in cases of international claims, especially those arising from the Treaty of Washington of 1871, and has published several arguments and *brochures* upon that subject. His most important original works have been *The Law of Charitable Uses* (1845), *Visitation and Search* (1858), a *Commentary on the Elements of International Law* (in French, 3 vols., Leipsic, 1868–73), *Disabilities of American Women Married Abroad* (1871), and *Administration of Equity Jurisprudence* (Boston, 1874). He is, however, best known by his valuable edition of Wheaton's *Elements of International Law*, with an introduction, memoir, and copious notes (1855; revised ed. 1863).

Law'renceburg, city and tp., cap. of Dearborn co., Ind., on the Ohio River, 20 miles below Cincinnati, on the Ohio and Mississippi and the Indianapolis Cincinnati and Lafayette R. Rs., has 2 national banks, 2 weekly newspapers, 7 churches, the usual number of stores, several hotels, and a large number of furniture manufactories. It is the terminus of the White Water Canal, which affords excellent water-power. Pop. 3159; of tp. exclusive of city, 1708. E. F. SIBLEY, ED. "DEMOCRATIC REGISTER."

Lawrenceburg, post-v. and cap. of Anderson co., Ky., 10 miles S. of Frankfort, on the line of the proposed Frankfort and Harrodsburg R. R., has 3 churches, a national bank, and a seminary. Pop. 393.

Lawrenceburg, post-v., cap. of Lawrence co., Tenn., on the projected Memphis and Knoxville R. R., 20 miles W. of Pulaski and 80 S. W. of Nashville, on Shoal River, 40 miles above its confluence with the Tennessee, has 4 churches, a Catholic convent, 1 weekly newspaper, 3 hotels, 4 large cotton-factories, and the usual number of stores. There are fine beds of iron in the vicinity. Pop. 351.

THOMAS B. MALONE, ED. "JOURNAL."

Lawrence University of Wisconsin, an institution of learning in Appleton, Outagamie co., Wis. It was founded in 1847, the Hon. Amos A. Lawrence of Boston, Mass., offering to give $10,000 towards the establishment of a collegiate school, provided an additional $10,000 should be raised by the Methodist denomination. This was done, and the first classes were formed in the preparatory department in the fall of 1849. In 1852, Rev. Edward Cooke, D. D., was elected president of the college, and entered upon the duties of his office with the collegiate year beginning in 1853. According to the catalogue of 1873–74, the number of different students in attendance during the year was 377, of whom 85 were in the regular college classes. The whole number of graduates up to 1873 was 148, of whom about one-third were ladies. The library of the institution was founded by the Hon. Samuel Appleton of Boston, Mass., by a donation of $10,000; it now comprises 7000 volumes. The property of the university amounts to about $180,000. Besides the original donation of Mr. Lawrence to the foundation of the institution, he has favored it with several additional gifts. Dr. Cooke resigned the presidency about 1860, and was succeeded by R. Z. Mason, LL.D., who resigned in 1865, and was succeeded by Rev. G. M. Steele, D. D., the present incumbent. The courses of instruction in the college are two, classical and scientific. There is also provision for instruction in civil engineering. In the academical department the facilities for a broad English culture and business education are ample. J. H. WORMAN.

Law'renceville, tp. of Henry co., Ala. Pop. 1194.

Lawrenceville, post-v., cap. of Gwinnett co., Ga., 15 miles N. E. of Stone Mountain, beautifully situated in the centre of a fine cotton-producing district, has 2 churches, 2 academies, 1 weekly newspaper, a handsome court-house, and considerable trade.

Lawrenceville, post-v. of Lawrence tp., cap. of Lawrence co., Ill., on the Embarras River, at the junction of the Ohio and Mississippi with the Paris and Danville R. R., 9 miles W. of Vincennes, has 3 churches, 2 weekly newspapers, 2 hotels, and a number of stores. Principal business, farming. Pop. 455.

MARY BUNTIN, ED. "RURAL REPUBLICAN."

Lawrenceville, post-v. of Lawrence tp., Mercer co., N. J., 6 miles N. of Trenton. It has a boys' high school and seminary for young women.

Lawrenceville, post-v. of Lawrence tp., St. Lawrence co., N. Y., on the Ogdensburg and Lake Champlain R. R., and the seat of a fine academy. Pop. 350.

Lawrenceville, post-b. of Lawrence tp., Tioga co., Pa., on Cowanesque Creek, at the junction of the Corning Cowanesque and Antrim and the Tioga R. Rs. Pop. 478.

Lawrenceville, post-v., cap. of Brunswick co., Va., 20 miles W. of Hicksford Station. It has 1 weekly newspaper.

Laws, tp. of Williamsburg co., S. C. Pop. 1274.

Law'son (JOHN), a native of Scotland, who in 1700 became surveyor to the province of North Carolina, and in 1709 published a valuable work, *A New Voyage to Carolina, containing the Exact Description and Natural History of that Country*, etc., with a good map and accurate illustrations. In 1712, while engaged in prosecuting his surveys, he was taken prisoner by the Tuscarora Indians, and burned at the stake as a supposed usurper of their lands. His *New Voyage* was reprinted at Raleigh, N. C., in 1860.

Lawson (L. M.), M. D., b. in Nicholas co., Ky., Sept. 10, 1812; graduated in 1837 at Transylvania University, where he became professor of anatomy in 1843. He subsequently filled the chair of materia medica in the Medical College of Ohio (1847), occupied similar posts in the Kentucky School of Medicine at Louisville (1854), the University of Louisiana at New Orleans (1860), returning to the Ohio College in 1857 and in 1861. He conducted the *Western Lancet* from 1842 to 1864, edited Hope's *Morbid Anatomy* (1844), and published his best work, a *Practical Treatise on Phthisis Pulmonalis*, in 1864. D. at Cincinnati, O., Jan. 21, 1864.

Lawson (THOMAS), b. in Virginia; entered the navy in 1809 as surgeon's mate, which position he resigned in 1811 to take a similar position in the army; in 1813 was promoted to be a full surgeon, and after serving in this capacity for twenty-three years was appointed surgeon-general of the army, with the rank of colonel. This responsible position he ably filled for a quarter of a century, during which time he labored incessantly to improve the condition of his corps, and it was under his direction that the publication of statistics and reports by the medical officers of the army was inaugurated. Of a fiery, chivalric nature, he acted as colonel of a regiment of Louisiana volunteers in the Florida war, and as chief medical officer accompanied the general-in-chief throughout the war with Mexico, gaining the brevet of brigadier-general for bravery. D. at Norfolk, Va., May 15, 1861.

Lawson (Sir WILFRID), BART., b. in Cumberland, England, in 1829; became at an early age an enthusiastic advocate of the temperance movement; elected to Parliament for Carlisle in 1859, and introduced in Mar., 1864, the mea-

sure well known as the Permissive Bill, the main principle of which is the giving to two-thirds of the inhabitants of any parish or township an absolute veto upon all licenses for the sale of intoxicating liquors granted within their district. Defeated at the election of 1865, he was returned at the head of the poll in 1868 as a supporter of Gladstone, and again elected in Feb., 1874. He is the leader of the United Kingdom Temperance Alliance, and its spokesman in Parliament, where he figures also as a frequent opponent of Disraeli upon other subjects.

Lawson's, tp. of Somerset co., Md., on Tangier and Pocomoke sounds, traversed by the Eastern Shore R. R. Pop. 3349.

Law'ton, post-v. of Antwerp tp., Van Buren co., Mich., 16 miles S. W. of Kalamazoo, at the junction between the Michigan Central and the Paw Paw R. Rs., has a large blast furnace, a foundry and machine-shop, a plough-factory and planing-mill, 2 wagon-shops, 1 weekly newspaper, several churches and schools, and the usual number of stores, shops, and smaller manufacturing establishments. The principal industries are farming and fruit-raising. Pop. 1081. E. V. Hayden, Ed. "Tribune."

Lawton, tp. of Beaufort co., S. C. Pop. 3905.

Lawton (Gen. Alexander R.), b. in Beaufort dist. (now co.), S. C., about 1820; graduated at West Point in 1839, when he was commissioned as second lieutenant in the 1st Artillery, and stationed on the northern frontier until 1841. Then resigned; studied law at Harvard Law School, Mass., and commenced the practice in Savannah in 1842. Soon rose rapidly in his profession, and was repeatedly elected to the State legislature, first to the house and then to the senate, where he achieved great distinction. Upon the organization of the Savannah and Augusta R. R. in 1849, he was chosen its first president. In Apr., 1861, he was appointed brigadier-general in the provisional army of the Confederate States, and was put in command of the coast of Georgia. This position he held until June, 1862, when he was transferred to Virginia, where he served with Stonewall Jackson in his several campaigns; received the command of a division, and was severely wounded at Sharpsburg, disabling him for a year, after which he served as quartermaster-general until the close of the war. After the surrender in 1865 he resumed the practice of law in Savannah, which he still pursues with eminent success. He is also at this time (1875) a distinguished member of the legislature from the county of Chatham. A. H. Stephens.

Lawyer. See Attorney, Barrister, King's Counsel, Advocate, Solicitor, Proctor, Sergeant-at-Law.

Lay (Benjamin), b. at Colchester, England, in 1681; settled at Barbadoes in 1710; became obnoxious on account of abolition principles, and being a Quaker removed to Abington, Pa., where he was one of the earliest and most zealous agitators against slavery, in which connection he was an associate of Franklin and Benezet. He separated from the Society of Friends in 1717 on account of slave-holding being permitted to its members, but had the pleasure at a later day to see that body assume an attitude similar to his own. In 1737 he wrote a pamphlet, *All Slavekeepers that keep the Innocent in Bondage, Apostates,* printed by Franklin. He opposed tea-drinking, distributed religious books as prizes in the schools, and manufactured his own clothing, so as not to avail himself of the products of slave-labor. D. at Abington in 1760.

Lay (Henry Champlin), D. D., LL.D., b. at Richmond, Va., Dec. 6, 1823; graduated at the University of Virginia in 1842, and at the Theological Seminary of Virginia; ordained deacon July 10, 1846; was minister in Lynnhaven parish, Va., until June, 1847, when he removed to the church of the Nativity, Huntsville, Ala.; ordained priest July 12, 1848; consecrated missionary bishop of the South-west Oct. 23, 1859, and translated to the diocese of Easton Apr. 1, 1869.

Lay'amon, a priest at Ernely on the Severn River, Worcestershire, England, flourished in the second half of the twelfth century as the author of the *Brut,* a rhyming chronicle of English history from the time of the fabulous Brutus of Troy to the death of King Cadwallader (689 a. d.). His work is an amplified translation of the *Brut d'Angleterre* of the Anglo-Norman poet Wace, the additions being derived chiefly from the writings of Bede and St. Augustine of Canterbury, while Wace's work is itself little more than a translation of Geoffrey of Monmouth's Latin *Historia Brittonum.* The value of Layamon's chronicle is mainly philological. It contains 32,250 lines, some alliterative, but more imitating the imperfect rhyme of its Anglo-Norman original. The best edition is that of Sir Frederic Madden, with a literal translation, notes, and a grammatical glossary, published by the English Society of Antiquaries (3 vols., 1847).

Lay'ard (Austen Henry), D. C. L., b. of English parents at Paris, France, Mar. 5, 1817; spent several years of his youth in Florence, Italy, and commenced the study of law in England. In 1839 he undertook a course of Eastern travel extending over several years, chiefly within the Turkish empire; learned Persian and Arabic; was for a time correspondent at Constantinople for a London paper; spent many months in 1842 in exploring the antiquities of Susa and S. W. Persia; and passing through Mosul, became deeply interested in the excavations then being made by the French consul, M. Botta, at Khorsabad, the supposed site of Nineveh. After consultations at Constantinople, the British minister, Sir Stratford Canning, offered to assume a portion of the expenses of similar excavations, and Layard, returning to Mosul in 1845, began that series of wonderfully successful researches which has made the British Museum the richest Oriental museum in the world, and laid the foundation for the reconstruction of ancient Oriental history by means of the copious cuneiform inscriptions. Accounts of these discoveries were given by Layard in *Nineveh and its Remains* (1849). The British government in 1849 appointed him attaché to its legation in Constantinople, and he undertook for the British Museum a second series of excavations in Assyria and Chaldea, which resulted in another work, *Discoveries among the Ruins of Nineveh and Babylon* (1853). He also published 2 vols. of engravings of the *Monuments of Nineveh* (1849–53), and a volume of inscriptions (1851). In 1852, Layard was elected to Parliament for Aylesbury, and for a few weeks was under-secretary of state for foreign affairs in Lord John Russell's administration. He was again on duty in the legation at Constantinople for a short time in 1853, and took an active part in the House of Commons in the debates on Eastern questions, advocating a vigorous policy against Russian aggression. He visited the Crimea in 1854, witnessed the battle of the Alma, and examined the condition of the army, concerning which he soon afterward gave testimony before a parliamentary committee, the appointment of which he was instrumental in procuring. In 1855 he became one of the leaders of the Administrative Reform Association; was chosen lord rector of Aberdeen University in 1855 and 1856; was defeated at the election of Mar., 1857; spent some months in India during the great rebellion of 1857–58; was elected to Parliament for Southwark in 1860, and appointed by Lord Palmerston in July, 1861, under-secretary of state for foreign affairs, holding that post until the fall of the Russell ministry in July, 1866. In that year he became a trustee of the British Museum; was chief commissioner of works and privy counsellor in Gladstone's administration (Dec., 1868) until in Nov., 1869, he accepted the post of envoy at Madrid, where he still remains (1875), having rendered important services, both to England and incidentally to the U. S., during the troubled period of his diplomatic life in Spain.

Lay'cock (Thomas), M. D., b. Aug. 10, 1812, at Wetherby, Yorkshire; was educated at London, Paris, and Göttingen, where he received degrees; became professor of the practice of physic and of clinical medicine at Edinburgh 1855; physician to the queen in Scotland 1869; has written and observed much upon sanitary science, physiology, mesmerism, insanity, etc. Author of *The Nervous Diseases of Women* (1840), *Mind and Brain, or the Correlations of Consciousness and Organization* (1860; 2d ed. 1869), *Methods of Medical Observation,* and of many valuable papers.

Lay Days, a term used in the law of shipping to denote the days allowed to the charterer or freighter of a vessel by the terms of the charter-party for loading and unloading. For detaining the vessel during this stipulated time no expense is incurred by the charterer, but if this time is exceeded he is obliged to pay to the master or owner a certain sum for the additional detention, the amount of which is usually determined beforehand by a provision in the charter-party. The sum to be paid is technically termed demurrage. (See Demurrage.) Lay days for unloading, as a rule, commence when the vessel has arrived at the usual place for discharging the cargo. When such place is a dock, they commence when she enters the dock, and not when she reaches the wharf. The parties may, however, make a special agreement as to the time when they shall begin. Sometimes this depends upon usage. (See Charter-Party.) In the absence of custom to the contrary, Sunday is included in the computation of lay days at the port of discharge. George Chase. Revised by T. W. Dwight.

Lay'ering, or **Laying,** the propagation of herbaceous plants by pegging down branches and covering the portion to be rooted with earth, or of trees by bending down a low branch, pegging it to the ground, and partly covering it with earth. The covered part takes root, and as soon as the roots are well developed the layer may be cut off and planted as a new tree. It is thought that a notch cut in

the branch between the trunk of the parent tree and the covered part favors the early development of the new roots.

Laynez′ (Diego), b. in 1512 at Almazan in Castile; studied at Alcala and Paris; became the general of the Jesuits on the death of Loyola in 1556, and d. at Rome Jan. 19, 1565. He was a man of great natural gifts, and still greater attainments; played a conspicuous part in the debates of the Council of Trent and at the assembly of Poissy; and left several theological works in manuscript, which, however, no one has been able to read on account of the bad handwriting. His labor in the service of the order was very successful, and his influence on the members was decisive. It is generally acknowledged that the peculiar spirit which characterized the Jesuits issued from Laynez.

Laz′arists, a body of Roman Catholic missionary priests, founded by St. Vincent de Paul in 1624. The name is derived from the College of St. Lazare at Paris, their original house given them in 1632, but their proper title is "Priests of the Mission." They are engaged in foreign, and especially in domestic missions, and in the teaching of theology. They are found in most civilized and in several barbarous countries, and have fourteen establishments in the U. S., including three colleges.

Laz′ulite [Arab. *azul*, "heaven," and Gr. λίθος, "stone"], or **Azurite,** a mineral composed of phosphate of alumina, magnesia, and iron, and bearing some resemblance in color to lapis-lazuli.

Lazzaro′ni [It. *lazzaro*, "a leper"], formerly the popular name for the lower classes of Naples, so called from the hospital of St. Lazarus, their customary place of refuge. The name is ultimately derived from that of the beggar Lazarus in the parable. The lazzaroni of Naples numbered at the close of the eighteenth century nearly 40,000 persons, who had no fixed employment or home, but were by turns porters, boatmen, or peddlers, besides their constant recourse to begging. From the Middle Ages they derived the obligation to wear a peculiar dress of the simplest description, were treated by the government as a separate class, electing annually a chief called *capo lazzaro*, and often took part in political revolutions. They upheld Masaniello in 1647, and fought bravely against the French during the siege of Naples in 1799. During the republican agitations of the present century they generally sided with the Bourbon monarchy. They are no longer recognized as a separate class, and their condition has much improved under the government of Victor Emmanuel.

Lea (Henry Charles), son of Isaac Lea, b. in Philadelphia Sept. 19, 1825; early displayed a talent for science, and at the age of fourteen wrote for *Silliman's Journal* a paper on the salts of manganese. He gave much attention to conchology, publishing *Description of new Species of Shells*, and at a later period to the organization of society in the Middle Ages. He has published a remarkable work, *Superstition and Force: Essays on the Wager of Law, the Wager of Battle, the Ordeal and Torture* (1866; 2d ed. 1870), a *Historical Sketch of Sacerdotal Celibacy in the Christian Church* (1867), and *Studies in Church History: The Rise of the Temporal Power, Benefit of Clergy, and Excommunication* (1869). Mr. Lea early became a member of the important publishing-house of Lea & Blanchard, of which he was long the head, and is now the sole representative. He was prominent during the civil war in organizing the system of municipal bounties, has written much on political subjects, and has been for years engaged on a work on the history of the Inquisition with special reference to America (Mexico and Peru).

Lea (Isaac), LL.D., b. of Quaker stock at Wilmington, Del., Mar. 4, 1792; was engaged in mercantile pursuits in his early youth, and devoted his spare time to the study of natural history, especially geology, making collections of fossils, minerals, and shells in the vicinity of Philadelphia. In 1815 was elected a member of the Academy of Natural Sciences, and began to contribute papers to its *Journal*. From 1821 to 1851 was a partner with his father-in-law, Matthew Carey, in what was then the principal publishing-house in the U. S., and in 1827 commenced a remarkable series of memoirs upon fresh-water and land mollusks, which were continued for nearly fifty years, and form the materials for a great work upon American Unionidæ on which he has long been engaged. In 1828 was elected a member of the American Philosophical Society, was chosen president of the Academy of Natural Sciences in 1858, and is connected with the chief societies of natural history throughout the world. His private collection of Unionidæ is the richest in existence, embracing nearly 10,000 specimens, and his memoirs, read chiefly before the Philadelphia societies, number more than 150. He made important discoveries of saurian remains in the red sandstones of Pennsylvania below the coal-measures, published *Contributions to Geology* (1833), *Fossil Footmarks in the Red Sandstones of Pottsville* (folio, with colored plates, 1853), and, besides other works, collected into 13 vols. (1827–73) his miscellaneous papers with the title *Observations on the Genus Unio.*

Lea (Matthew Carey), b. in Philadelphia in 1823, son of Isaac Lea; studied chemistry under Prof. James Booth; has printed in the *Am. Jour. of Science* many analyses of minerals and chemical compounds; has given special attention to photography, and published on it an important work, *A Manual of Photography* (1868; 2d ed. 1871).

Lea (Thomas Gibson), b. in Wilmington, Del., Dec. 14, 1785, a brother of Isaac Lea. His *Catalogue of Plants Collected near Cincinnati, O.*, was published in 1849 by the late Dr. W. S. Sullivant. D. Sept. 25, 1844.

Leach (William Elford), b. at Plymouth, England, in 1790; became in 1809 a pupil of Dr. Abernethy at St. Bartholomew's Hospital; became an enthusiastic investigator in zoology and curator of the natural history department of the British Museum. In his work on *Crustaceology* (1813) he was the first to separate the *Insecta* of Linnæus into *Myriopoda, Arachnida, Insecta*, and *Crustacea;* he published a *Zoological Miscellany* (3 vols., 1814–17), and commenced a *History of the British Crustacea*, of which 17 parts appeared, when an affection of the eyes forced him to resign the curatorship, and abandon in great degree his favorite studies. D. at San Sebastiano, Piedmont, Aug. 25, 1836.

Lea′cock, post-tp. of Lancaster co., Pa., 7 miles E. of Lancaster. Pop. 1906.

Lead [Ang.-Sax.], a plummet used on shipboard for taking soundings or measurements of the depth of the sea. The ordinary lead is attached to a line of twenty fathoms; the deep-sea lead weighs some twenty-five pounds and has a much longer line. (For improved methods of deep-sea measurements see art. Deep-sea Soundings, by Prof. W. P. Trowbridge, A. M.)

Lead [Ger. *Blei;* Fr. *plomb;* Saxon, *læd;* Dutch, *lood*, also meaning a "ball" (suggesting "load," as of a gun); Lat. *plumbum*, also *Saturnum:* to the modern word is assigned a kindred with "clod" and "clot"]. Lead is one of the metals mentioned in the book of Job, and known therefore in the earliest times. In Numbers, also, among the spoils of the Midianites, lead occurs. It has been maintained that Solomon's verse in Proverbs—"Burning lips and a wicked heart are like a potsherd covered with silver dross"—refers to the glazing of pottery with litharge made from lead. In the hanging gardens of Babylon lead existed largely as a building material.

1. *Occurrence in Nature.*—Lead is known in nature as a constituent only of solid rocks and soils. It has not been discovered in mineral waters or in the ocean, nor in vegetable or healthy animal bodies. On life it acts as a poison. Its ores are numerous. It is found as sulphide, chloride, and iodide, as oxides and oxychlorides, selenides and tellurides, as sulphate, carbonate, chromate, phosphate, molybdate, vanadate, tungstate. Its commonest metallic *chemical* associates are *silver, gold, antimony*, and *arsenic.* Though in its veins in the rocks it is commonly found associated with *iron* and *copper* sulphides and other compounds, yet it is almost never found crystallized together in the same mineral species with these two latter metals.

Native Lead.—Metallic lead, as a mineral, has been reported at many localities, widely distributed over the earth, but occurs in such minute quantities that it is one of the rarest of all minerals, and difficult to find in mineral collections. Though other native metals, such as gold, silver, platinum, mercury (and copper, in a smaller degree), have a great tendency to alloy with lead, yet there are scarcely any well-ascertained cases, among the great number of analyses of these native metals on record, of the detection of the slightest traces of lead. This alone is proof positive that these native metals have not been formed by igneous processes, but rather by chemical precipitation at temperatures below that of the fusion of lead and its alloys. This argument is strengthened by the fact of the common natural association of silver and gold with lead *in its ores*, especially in galena. Two localities of metallic lead in minute quantities on the American continent are a point in the country immediately N. of Lake Superior, called Dog Lake, where Prof. Chapman of Toronto recognized it forming a small string in white quartz; and in an argentiferous galena of the Zomelahuacan district of Vera Cruz in Mexico.

2. *Metallurgy of Lead.*—In the consideration of the extraction of lead from its ores, by far the most important ore is galena, from which very nearly all our lead comes. Galena, or galenite (the word being the Greek γαλήνη, "serenity," from imaginary medicinal virtues early attributed to it), is *sulphide of lead*, PbS, and is the only known

compound of this metal with sulphur, containing 86.6 per cent. of lead and 13.4 of sulphur. There are few metallic ores more easily and simply reducible to the metallic or "regulus" form than common galena, and hence, no doubt, the very ancient knowledge of lead possessed by man. Simple roasting of galena in an ordinary fire will drive off the sulphur and furnish melted lead. Nevertheless, as lead is a metal required by man in enormous quantities, extreme economy is needed in its metallurgical manipulation, and hence this branch of technology is practically by no means so simple and obvious a business as might be supposed.

Lead-smelting furnaces are of two classes, reverberatory and blast furnaces, corresponding to two very different modes of smelting. We shall speak first of the operation with the *reverberatory furnace.*

It has been stated that simple roasting eliminates metallic lead from galena. It has been no unusual occurrence, indeed, in the early history of different countries, and particularly so in America, for hunters and pioneers, and even for the aborigines after instruction by the former class, to procure their bullets by smelting down galena broken by themselves from the rocks. Some mines of this metal are said to owe their discovery to this need on the part of the primitive explorers. The ability to accomplish the reduction so simply proceeds from the following chemical facts. The first effect of a preliminary roasting upon sulphide of lead—in a reverberatory space, for instance—at a comparatively low heat, for about two hours, is to oxidize portions of the mass into both oxide of lead and sulphate of lead. On then raising the heat for about half an hour to a bright red, the following reactions take place:

$$PbS + 2PbO = 3Pb + SO_2, \text{ and}$$
$$PbS + PbSO_4 = 2Pb + 2SO_2,$$

the products in each case being simply metallic lead and sulphurous acid gas. This is a general description of the most essential steps in the simplest kind of lead-smelting, which requires, however, many further precautions and operations, to detail which would carry us too far. These two successive steps of oxidizing-roasting and smelting are sometimes conducted in separate furnaces. In the case of argentiferous galenas, when their lead is to be subsequently treated to separate the *silver* it carries with it (see SILVER), much more knowledge and skill than are usually exercised in the smelting operation are called for to avert loss of silver by volatilization. It appears to have been proved by chemists that certain chemical reactions occur in the mass, accompanied probably by intense temperature *locally*, which cause much loss of silver unless the heat be regulated carefully, and not continued unnecessarily long. The subject is, however, not well understood. In another process, in use in France, metallic *iron* is employed with ores containing much quartz to reduce the lead, and prevent its being converted into a fusible silicate, which would be difficult or impossible to reduce. The charge of the furnace is 800 pounds of the silicious ore, with from 200 to 240 pounds of scrap iron, excluding cast iron, which is less suitable in this case.

Lead-smelting with a Blast.—This is accomplished in two classes of apparatus—the "cupola furnace" and the "ore-hearth." The cupola is the apparatus most used throughout the continent of Europe, being adaptable to poorer ores, while the simple ore-hearths are adapted only for very clean and pure galenas, producing at the same time, however, the purest and softest lead, which brings the highest prices. The smelting with a blast in a cupola furnace is sometimes practised upon the raw ore—as by what is called the *Silesian* process—in which case waste metallic iron is employed, as in the French method above, to take up the sulphur of the galena. Six parts of galena require one part of cast-iron scrap; and to flux out the silica, etc. of the ore, about 1¼ parts of *forge cinder*, a highly basic fusible silicate of iron, are added. This mixture and coal in equal parts are thrown separately into the top of the furnace. The lead fuses down into a cavity in the hearth below the tuyere, and a *matt* is also formed of mixed sulphides of lead and iron (usually with silver also), which requires subsequent separate treatment. The action of the fusible lead-slags on the walls of the furnace is terribly destructive, and a furnace will run but about *eight days* before requiring a new lining.

The commonest practice in Prussia, Sweden, France, and Belgium is to roast out the sulphur from the ore before smelting with a blast. In Prussia a large part of the sulphur is even saved in this operation, by forming cavities in the upper parts of the heaps of ore and wood, in which it condenses. The expense of the roasting operation is thus nearly covered. Such roasted ore is then fluxed in the blast furnace with silicious slags from previous operations. A matt is the product, which goes through subsequent complex operations to separate the copper, lead, and silver it is liable to contain.

Ore-hearths are much more primitive contrivances, used where ore is pure and abundant, and economy of the same less important than cheapness of plant and saving of labor. Without cuts but an imperfect idea can be conveyed. For the "Scotch hearth" the ore is now usually roasted, though formerly worked raw. This is a very simple apparatus—little more than a rectangular chamber, with opening in front and tuyere entering at the rear. The lead drains off through a channel in front. In the case of the "American hearth"—which has been used, among other places, at Rossie in St. Lawrence co., N. Y.—the hearth is sometimes surrounded with a hollow iron casing, through which the blast passes on its way to the tuyere, thus attaining a high temperature. Great rapidity and cheapness of working are thus attained. Even this simple apparatus of the ore-hearth requires much special skill and many precautions in its management on the part of the workmen, which cannot be entered into here.

Fumes from Lead-smelting.—In all furnace operations with lead much smoke and fume result, chiefly mechanical, but partly through volatilization. Some compounds of lead—pre-eminently the *chloride* of lead—are very volatile at high temperatures. Even metallic lead volatilizes rapidly at a high red heat, and boils at a white heat. If any common salt or chlorides are present, great loss may result in the furnace. In all cases where economy is an object measures must be taken to catch and save the fumes. The condensing flues or chambers through which the draft or blast is caused to pass have sometimes an immense length. In one case in England a flue *five miles long* and eight feet wide by six feet high saved *fifty thousand dollars'* worth of lead per annum. Other arrangements are chambers furnished with filters of pebbles kept constantly wet with running water, through which a powerful blower forces the fumes. By means of exhausters in other plans the fumes are drawn through a series of water-seals under diaphragms which dip thereinto. Dr. Thomas Richardson, one of the most distinguished of the British metallurgists, relates that the purification of lead-furnace gases by this latter plan was so complete that he *walked through the exit-flue* without perceiving any fume—an experiment which should not be rashly emulated.

Refining of Lead.—Two metallurgical operations coming under this head are of especial interest and importance—the extraction of the silver often contained in it, and the converting of hard into soft lead. The former subject will be treated of under SILVER. Hardness in lead is due to several causes, presence of *antimony* being the commonest. Exposure of the lead in a fused state on the hearth of a furnace to continued currents of air over its surface will gradually remove the antimony and other metallic impurities, and yield a soft or softer lead. Such a hearth, it is found, must have an impervious metallic lining, as otherwise the very fluid alloy will leak through like water and be lost. This operation is stated to be carried on on an enormous scale in England, on hard, antimoniferous Spanish lead. Chinese *tea-chest lead* is one of the hard alloys (with tin) that is thus susceptible of being refined, yielding over 75 per cent. of soft refined lead, tin being separated by this method as easily as antimony. The dross that forms in this process, containing usually lead with tin or antimony, is utilized best, according to Richardson, by treating it with acetic acid, which converts the lead into commercially valuable acetate, and the residue on smelting yields good antimony or tin.

3. *Chemical Constitution and Properties.*—Lead is one of the softer and more plastic and sectile of the metals, being only approached in these respects, among the metals in common use, by *pure* gold. Color, when fresh cut, bluish-gray, with beautiful lustre, but a dull film of an oxygen-compound quickly forms over the surface. The malleability of lead is great, and its ductility also, but its tenacity is so small that it is drawn into fine wire with great difficulty. It has so little strength that a wire one-twelfth of an inch in diameter breaks with a weight of 20 pounds. It melts at about 635° F., beginning to soften and become pasty, however, at about 617°. Its specific gravity is certainly somewhat variable, being but 11.07 by the lowest determination of Playfair and Joule, and 11.445 by the highest figure given, attributed to no less an authority than the great Berzelius; and for chemically pure lead Herapath gives 11.352, and Karsten 11.3888. It is probably *compressible* to some degree, which may account in part for the diverse densities. Playfair and Joule found its density in *melted* form to be 10.563. Its crystals are isometric. Fresh-cut lead does not tarnish in perfectly dry air, nor in pure water entirely free from dissolved oxygen, showing that the tarnish is due to conjoint action of oxygen and water. If exposed to both water and air, or immersed in *pure* water exposed to the free air, it is rapidly corroded, and a portion *dissolves.* If the water contains carbonic acid or carbonates, however, or, according to some,

also sulphates and phosphates, there is formed over the metal a film of an insoluble salt of lead, which retards further action. As these insoluble compounds, particularly the carbonate of lead, are somewhat soluble in water containing free carbonic acid, some slow action often still continues, and no prudent person will venture to use habitually, for drinking or cooking purposes, water that has stood for any appreciable time in leaden pipes or tanks, or even in a well or cistern into which a leaden pipe has been inserted for connection with a pump—a practice extremely common with plumbers. Waters containing *nitrates*, not uncommon in well-waters, are believed to dissolve lead with especial rapidity.

4. *Uses of Lead.*—In metallic form lead is used for many purposes too familiar to need enumeration. The principal compounds of lead that have known uses are *litharge*, the protoxide; *minium*, or red lead, the three-four oxide; the carbonate, or *white lead;* the *nitrate, chromate*, and *acetate* of lead, all of which will be referred to again; and the several alloys with other metals, which will be treated of first.

5. *Alloys of Lead.*—Few metals form alloys so easily and in such number as lead; and to this fact, together with the great cheapness of this metal, is due to a large extent its high value to the human race. In an alloy may frequently be combined the chemical and physical properties of each of its metallic constituents, and the cheap metal, lead, may thus, to a very important extent, be endowed with strength, hardness, whiteness, brilliancy, and resistance to oxidation, while retaining its easy fusibility, and even gaining in this latter respect. Lead alloys readily, permanently, and in various proportions with the metals *potassium, sodium, arsenic, antimony, tellurium, bismuth, tin, cadmium, manganese, mercury, silver, gold, platinum, palladium*, and *iridium*, but apparently not easily or readily with *aluminum, iron, cobalt, nickel, zinc*, and *copper*. With some of these latter metals it may be mixed mechanically when both are in fusion, but on standing more or less separation, sometimes nearly complete—as in the case of lead and zinc, for example—will be found to occur, owing to differences of density. The alloys of lead will be taken in the order in which they are above enumerated.

Alloys with Potassium and Sodium.—The salts of potash and soda with organic acids, if fused with litharge, yield these alloys. Serullas prescribes for the lead-sodium alloy, to fuse together at a high temperature 100 parts of litharge and 60 parts of cream of tartar. Two parts of sodium to one of lead give a brittle alloy, but with less sodium the compound is malleable. The curious classes of organic compounds containing lead, ethylides, methylides, and amylides of lead, are prepared with the help of the lead-sodium alloy.

With Arsenic.—This alloy is white, brittle, and crystalline, and very fusible. It is of practical interest in connection with the manufacture of *lead shot*, which are formed of a true alloy of lead with metallic arsenic, containing some 2 per cent. of the latter, held by the shot-manufacturers to be absolutely essential to success in the manufacture.

With Antimony.—Here we have alloys of eminent importance, *type-metal* being the chief. The alloys of these two metals are harder and more fusible than either metal, while endowed with peculiar qualities adapting them for making fine and sharp castings. Common type-metal contains 17 per cent. of antimony, the remainder being lead, sometimes with a little zinc. Common stereotype metal varies from these proportions within small limits, sometimes a little tin being added. *Music plates* are chiefly tin, being about 60 per cent. of this metal to 35 of lead and 5 of antimony. Some of the various alloys used for machinery-bearings, called "Babbit metal" and the like, contain lead and antimony. Emery-wheels, in Europe at least, are made of an alloy of lead and antimony mixed with emery. A large proportion of this brittle metal, antimony, even 75 per cent., may be added to lead without making the mass brittle, great whiteness, hardness, and capacity for polish being thus attained. Keys of musical instruments, such as flutes, etc., are made of such an alloy, containing two-thirds of antimony.

With Tellurium.—With this metal, and with its related metalloid *selenium*, lead forms definite crystallized compounds, occurring in nature as crystallized mineral species. *Altaite* is the telluride of lead; *clausthalite, zorgite*, and *lehrbachite* are selenides of lead.

With Bismuth.—Malleable alloys when the bismuth is small, but when equal to the lead they become brittle. The most useful alloy with bismuth is one also containing antimony, 70 of lead, 15 of antimony, and 15 of bismuth, which expands on solidifying, and hence has been used for stereotype metal, but from the present high price of bismuth is costly.

With Tin, etc.—Here we have some of the most valuable alloys of lead, including hard and soft *solders, pewter*, and with bismuth also the common *fusible alloys*. Three grades of solder are in common use: common solder, of equal parts of tin and lead; fine solder, of 2 parts of tin to 1 of lead; and a cheaper article, of 2 of lead to 1 of tin. The following figures are the fusing-points of the different alloys, in Fahrenheit degrees:

Tin 1 to lead	25,	558°	Tin 1½ to lead	1,	334°
" 1 " "	10,	541°	" 2 " "	1,	340°
" 1 " "	5,	511°	" 3 " "	1,	356°
" 1 " "	3,	482°	" 4 " "	1,	365°
" 1 " "	2,	441°	" 5 " "	1,	378°
" 1 " "	1,	370°	" 6 " "	1,	381°

Common pewter contains 4 of lead to 1 of tin. The following are the best-known fusible alloys:

	Lead.	Bismuth.	Tin.	Fuses.
Homberg's alloy	1	1	1	252° F.
Krafft's "	2	5	1	220° F.
Newton's "	5	8	3	202° F.
Rose's "	1	2	1	201° F.

The last two will of course melt in boiling water. These fusible alloys are of great value in taking anatomical casts and impressions of delicate and combustible objects, or those which will not stand a heat above the boiling-point. By adding mercury, their fusing-points may be lowered still further. Such an alloy with mercury will adhere to glass, and is much used for coating the interior of glass globes, tubes, etc. The alloy called in England *Queen's metal* contains of antimony, lead, and bismuth 1 part each with 9 parts of tin. Teapots, spoons, etc. are made of it.

With Cadmium, fusible alloys of tin and lead similar to those with bismuth may be made, which fuse at even lower temperatures still. This fact was discovered by an American chemist named Wood. (See FUSIBLE METAL.)

With Silver, Gold, Platinum, etc.—Lead has a great affinity for the noble metals. It is stated that if a thin sheet of one of these metals be held horizontally, and a drop of melted lead be let fall on it, it will make a perforation and pass through, in consequence of the great fusibility of the alloys formed. In the process of assaying, when litharge is reduced to metallic lead in admixture with an ore of gold or silver for subsequent cupellation, the lead takes into alloy with itself every trace present of the precious metals, the success of assaying as an art being dependent on the completeness of this combination. In the chemical laboratory, if any substance containing lead is incautiously heated in a platinum or silver crucible or other vessel, a perforation is the certain consequence.

6. *The Useful Compounds of Lead.*—*Litharge*, PbO, the protoxide of lead, also called *massicot*. This is chiefly a product of a special cupellation of metallic lead, carried on for the purpose of its manufacture. Some of it is sent to market in scaly or flaky form, as it cools quickly from fusion; but the more compact, lumpy portions are ground and constitute *levigated litharge*. The color of the scales is sometimes yellow and sometimes reddish, but there has not been found any chemical difference between the two varieties. Protoxide of lead is also obtainable by igniting the nitrate, carbonate, or oxalate of lead. Its density is about 9.15. It is dimorphous, crystallizing in the regular system as cubes and dodecahedra, and also in the trimetric system. *Minium, Red Lead*, the 3-4 oxide, Pb_3O_4. This is a fine-colored red substance, familiar to all from being used extensively as a pigment and for coloring paper. It is poisonous, of course, and should therefore be employed and handled far more circumspectly than is customary. Minium occurs as a native mineral in many European localities, and in one known place in America—Austin's mine, Wythe co., Va. It is a product of the continued action of a low red heat upon litharge while exposed to the air. Its density when pure is about 8.8. Besides its use as a pigment, etc., it is employed as one of the most important materials in the manufacture of lead or flint glass. *White Lead, Carbonate of Lead, Ceruse.*—This highly important compound, PbO,CO_2, is found native, sometimes in very beautiful transparent crystals, as the mineral *cerussite*. There are several American localities of fine varieties—at Phœnixville, Pa.; in Wythe co., Va.; at King's mine, Davidson co., N. C., and other places. The crystals are right rhombic. White lead is prepared commercially by two methods, the older of which, called the "Dutch process," is somewhat curious and complex in its character. Sheet lead is rolled into loose rolls, each of which is placed in an earthen jar containing a little vinegar at its bottom, the lead not touching the vinegar. These jars are piled up in alternate layers with some material which is fermenting and evolving carbonic acid gas, spent tan-bark being preferred, though formerly stable manure was used and thought essential to success. A large building is thus filled with jars and closed. Basic acetate first forms on the surfaces of the

sheets, which is decomposed by the atmosphere of carbonic acid, forming carbonate and free acetic acid, which latter then acts again on fresh portions of lead; so that but little vinegar is needed to keep the process going on continuously. The heat of the fermentation helps; and in due time, the jars being opened, the lead sheets are found encrusted with white lead, which is beaten off, ground, and washed. The product thus obtained is deemed superior in "body," or opacity in mixture with oil, to that of any other method yet discovered, and brings therefore a higher price. Much white lead is made, however, by simpler and more speedy operations, as by boiling solutions of the nitrate or acetate of lead with litharge, which dissolves to form a basic salt. Carbonic acid gas then precipitates a very good quality of white lead, not generally accepted, however, as equal in body to that of the old Dutch process. The liquid drained off from the precipitate is boiled again with litharge, and so on. *Nitrate of Lead.*—This is used as a material for the preparation of the carbonate and chromates, and is therefore, in crystallized form, a regular article of commerce. *Acetate of Lead, Sugar of Lead.*—This familiar article has well-known uses in medicine. It is manufactured by dissolving litharge in wood-vinegar or other cheap form of acetic acid. It crystallizes very beautifully, few objects being more beautiful than a mass of fresh crystals of acetate of lead; but on exposure to the air acetic acid is lost, with formation of a basic acetate, with a little carbonate also in time. Hence sugar of lead has an odor of acetic acid, and the transparent crystals gradually fall down to a white powder, to dissolve which in water requires an addition of acetic acid to replace that which has been lost. It is from this circumstance that the *nitrate*, which undergoes no such spontaneous change, but remains clean and uniform, is largely supplanting the acetate in commerce of later years. *Chromates of Lead: Chrome-Yellow and Chrome-Red.*—These are two brilliant and valuable pigments, chrome-yellow being especially so. The latter occurs naturally as an elegant crystallized mineral called *crocoite*, of which an American locality is at Congonhas-do-Campo in Brazil. It was in crocoite that Vauquelin first discovered the metal *chromium* in 1794. *Chrome-yellow* is, however, prepared artificially by precipitating a solution of the nitrate of lead with chromate of potash. The brilliant yellow precipitate that falls, after thorough washing and drying at a low heat is ready for grinding with oil for pigmentary purposes. If the heat in drying much exceeds that of boiling water, the color will be liable to injury from reducing action of traces of organic matter always present. In calico-printing chrome-yellow is formed on the tissue itself by successive application of the above specified compounds of lead and chrome in appropriate ways. This color, however, does not attach itself so well to silken and woollen fabrics. Chrome-yellow as a pigment is liable to be much adulterated with cheaper substances. As most of these are insoluble in nitric acid, they may generally be detected by heating a little of the color with diluted nitric acid, which should dissolve it wholly to a clear yellow liquid. *Chrome-red* is a chromate containing twice as much lead as the yellow chromate:

Chrome-yellow is........................ PbO,CrO_3.
Chrome-red "........................ $2(PbO),CrO_3$.

The red pigment is produced from the yellow by several different methods—either by boiling with lime or an alkaline solution, which takes out half the acid; or by digesting with levigated litharge; or by boiling it with neutral yellow chromate of potash, which forms bichromate of potash with half its acid; or by fusing it with saltpetre. Its color is very fine, considered equal in tint to vermilion, but, like all lead-colors, it becomes dingy in the air in time, through the action of sulphur, forming black lead-sulphide. *Chrome-green* should strictly be the green oxide of chromium, but most of what passes under that name commercially at the present day is a mixture of chromate of lead with some blue pigment—prussian blue or ultramarine. A dilute acid will quickly distinguish such mixtures from true chrome-green, which latter should be totally unacted on.

Henry Wurtz.

Lead [Ang.-Sax.; Dutch, *lood*]. After iron, this is the most abundant and widely distributed of the metals. It is bluish-gray in color, very soft and ductile, but without elasticity. Its specific gravity is 11.35. It fuses at 612° F., and when raised to a white heat in the open air it volatilizes, burning with a blue flame and leaving an oxide known as litharge. Its uses in the arts are very varied, such as for roofing, for lining sinks, cisterns, etc., for shot and balls for firearms, and for the manufacture of lead pipe. This latter is formed by mechanical pressure, the softness of the lead permitting of its being forced out in tubes of indefinite length without welding. From the facility with which lead pipes are manufactured, and afterwards bent, cut, and united, they are almost universally employed as conduits for the distribution of water through buildings in cities; and the employment of lead in this connection has created the plumber's trade, which takes its name from *plumbum*, "lead." Type-metal is formed of an alloy of lead and antimony, and the alloys which go by the name of pewter or solder are composed of lead and tin.

Lead has apparently been in use among civilized nations from the dawn of the historic period. Among barbaric races it seems to have been but little used, its softness making it of little value to the savage man, whose only use for metals was for the manufacture of offensive and defensive weapons and for tools—purposes served much better by bronze and iron. Lead is found in all the geological formations except the igneous rocks, and deposits of it are known to occur on every considerable portion of the earth's surface. In China lead-mines have been worked from remote ages, the metal being there chiefly employed for the production of sheet lead used to line the chests in which tea is stored and transported. Among the nations of Western Europe lead was apparently first brought into general use by the Romans, who derived a large part of their supply from Spain, where the remains of their smelting-works are still to be seen. Lead occurs as a component element in many minerals, but the lead of commerce is almost exclusively obtained from the sulphide, or galena. This consists of lead 86.55, and sulphur 13.45. Near the outcrops of lead-deposits this ore is sometimes extensively decomposed by oxidation, and the carbonate (cerussite) and the phosphate (pyromorphite) are formed in such quantities as to have an economic value. The other ores of lead which deserve to be mentioned are *bournonite*, antimonial lead ore; *memetesite*, the arseniate; *anglesite*, the sulphate; and *crawfordite*, the chloride. There are also vanadates, chromates, etc., which have only interest to the mineralogist. Nearly or quite all galena contains some silver, and often so much that it is called argentiferous galena, and is one of the most important ores of Silver (which see). Lead occurs in three distinct classes of deposits—viz. what are known as gash veins, segregated veins, and fissure veins. Of these the first class is confined to the sedimentary rocks, and consists of fissures or crevices filled or lined with galena. These are generally vertical, though sometimes horizontal, when the ore which they contain is said to form *floors*. Gash veins are usually restricted to a single stratum of limestone, and have apparently been produced by the formation of cracks and joints by shrinkage. These joints have been subsequently enlarged by the solvent power of atmospheric water, which has flowed through them and filled or lined them with galena deposited from a solution issuing from the adjacent rock. Segregated veins are sheets of mineral matter found in metamorphic rocks conformable to their bedding. Galena rarely occurs in large quantities in deposits of this kind. Those of Spain are the only ones known which have economic value, and they may perhaps belong to a different category. In fissure-veins lead occurs, frequently in large quantities, associated with copper, silver, zinc, antimony, and many other minerals. It is an important fact that highly argentiferous galena is mostly confined to fissure veins traversing crystalline rocks. By far the greater portion of the lead of commerce is obtained from rocks of sedimentary origin, especially the limestones of the Silurian and Carboniferous ages. These are the calcareous sediments of ancient seas, the waters of which contain lead in solution, part of which was sparsely distributed through the materials that accumulated at the bottom. Subsequently, it was leached out and redeposited when the sea-bottom was raised, hardened into limestone, and was traversed by fissures which became channels of drainage. Deposits of this class are typified by the lead-mines of Wisconsin and Missouri, which will be described in another paragraph.

Among the lead-producing nations of the globe, England is the first. The product of her mines in 1872 was 60,450 tons. This was obtained chiefly from the Cambrian and Silurian rocks of Wales, and from the Carboniferous limestones of Devonshire, Cumberland, Northumberland, and Durham. The next largest producer of lead is Spain, in which the mines worked from the remotest ages have been recently reopened and largely multiplied. The production of lead in Spain was at one time over 40,000 tons per annum, but it has now fallen to less than half that amount. The deposits which have been the most productive are those of the Sierra Gador, where the lead occurs in Lower Silurian limestones, much in the same way as in the Mississippi Valley. The third in the list of lead-producing nations is the U. S., in which the annual product is from 12,000 to 15,000 tons. Though widely distributed throughout the country, the mining of lead is now almost exclusively confined to the "lead-region" of the upper Mississippi and that of the State of Missouri. Throughout the Alle-

gheny belt and the metamorphic region of New England galena occurs in numerous localities. Most commonly it is contained in segregated veins, but is occasionally found also forming part of true fissure or cross-cut veins. Nearly all the galena of this region is argentiferous, but the quantity is generally small; and with one or two exceptions all the mines which have been opened here have failed to be remunerative. The exceptions referred to are the Washington mine of Davidson co., N. C., and the Wheatley mine, situated at Phœnixville, Pa. In Eastern New York there is a group of lead-mines which at one time produced large quantities of metal, but which have of late years been abandoned. These are the Ancram mine in Columbia co., the mines near Ellenville in Ulster co., and that at Rossie. The Ellenville mines were opened in vertical-veins in the Shawangunk grit which lies at the base of the Upper Silurian series of rocks. In 1853 the Ellenville mines yielded over half a million pounds of lead. The lead-mine at Rossie, St. Lawrence co., N. Y., was at one time very productive, and famous not only for its yield of lead, but for the beautiful crystallized minerals with which it was associated. It ceased to be remunerative some years ago, and has now been for a long time unworked. The lead occurs here in a well-defined vein cutting gneiss rocks. It has an average width of about two feet, half of which in places was solid galena. The vein-stone is chiefly calc-spar. The mines of Phœnixville, Pa., are located in veins which penetrate the gneiss and Triassic sandstones. Here the lead is associated with considerable copper, and is remarkable for the occurrence of a large quantity of phosphate of lead (pyromorphite), which has been extensively worked as an ore. In East Tennessee and Virginia considerable quantities of lead were produced in former years, but the mines in this region have been for some time abandoned. This has been for the most part due to the abundant production of the lead-mines of the Mississippi Valley; and it is highly probable that hereafter, when the means of transportation shall be improved and the collateral industries are introduced into this region, the working of some of these mines will be resumed with profit. In Central Kentucky, near Lexington, a group of lead-veins is found traversing the Lower Silurian limestones. These are fissure veins, of which the vein-stone is chiefly sulphate of baryta. Though containing so much galena as to convey the impression of great richness, it is a question whether any of these veins can be profitably worked. The lead of this region is argentiferous, and a continuous sheet one inch in thickness would abundantly pay for mining, but it is doubtful whether this quantity can be depended upon in any vein yet opened. It is a matter of no little interest in connection with the Lexington lead-veins that at least one of them was quite extensively worked by the ancient inhabitants of the Mississippi Valley. Galena seems to have been highly prized by this ancient people, as it is frequently found in their mounds. It is, however, always in the condition of the ore, and it is doubtful whether they made any use of the metal itself. Probably the brilliant ore was valued for ornamental purposes, as was the mica of North Carolina, also mined by the same people. The only lead-producing districts of the U. S. at the present time are those of the upper Mississippi and the State of Missouri. Of these, the first covers the contiguous angles of Wisconsin, Iowa, and Illinois, by far the larger part of the district lying within the first-mentioned State. Lead is here found in gash veins, contained in the Galena limestone, a portion of the Lower Silurian system, and the equivalent in part of the Trenton group of New York. This formation has been extensively eroded by atmospheric action, and forms broad valleys and plains, where the soil, derived entirely from the decomposition of the underlying rock, contains many masses of galena, which in these circumstances is known as "float mineral." These scattered masses frequently lead to important deposits in the rock itself, and they are therefore sought in the "diggings" with which the region is dotted over, both for their own sake and because they so often lead to something still more valuable. In the Galena district there are two sets of fissures which traverse the limestone, and run, one imperfectly N. and S., the other nearly at right angles to this. These fissures are sometimes as much as 500 feet in length, and they have been known to expand into caves thirty or forty feet wide, and of equal or greater height. The walls of these fissures are frequently lined with the sulphides of iron, lead, and zinc, and with masses and crystals of calc-spar. These sometimes form stalactites and incrustations in such a way as to show distinctly that they have been deposited from solution in water which continually percolates through the soil and subjacent limestone. Everything indicates that the lead of this region is indigenous to the Galena limestone, as it is restricted to it, and all explorations of the underlying and overlying rocks have failed to detect any continuation of the lead-veins above or below. It is also apparent that the deposit of lead in the cavities which now contain it is a phenomenon of comparatively modern date, as it could only have taken place when the Galena limestone was raised above the sea-level, and was traversed by a flow of surface water which drained through its fissures, and more or less completely filled them with ore. It may be even said that the lead is being deposited there at the present time, for the bones of the elephant and mastodon have been found at the "diggings," in which the cavities were filled with crystals of galena. Such being the nature of the deposits of the upper Mississippi, it may be predicted that they will never be worked over a much larger area than that now covered by the mines, for the twofold reason—that in the district where the Galena limestone is deeply buried it has never served as a channel through which surface drainage has passed, and it is therefore probably without any considerable fissures; and even though the Galena limestone should contain important deposits of lead where covered by the Hudson River group, its lead-veins would there give no sign at the surface.

The production of lead in the Galena district was in 1825, 664,530 pounds. From this date it rapidly increased, and in 1845 it was 54,494,856 pounds; since when it has gradually, though somewhat irregularly, declined, and it will probably never again reach the figures quoted. The lead-mines of Missouri are like in all essential particulars to those of Wisconsin, except that the formation which contains them is older—the equivalent of the Calciferous sand-rock of New York—and the fissures which contain the lead are somewhat more continuous, giving more system and certainty to mining operations. Among the Missouri lead-mines the "Mine La Motte" was first worked 150 years ago, and is now valued at more than $500,000, although it has at times yielded more than 1,000,000 pounds of lead per annum. Vallé's and Perry's mines in St. François co. have been scarcely less productive. In these mines the ore is found in a system of inosculating veins, forming a network of which the limits have not yet been reached. The production of the Missouri mines could apparently be not only largely increased, but maintained at a much higher than the present yield for an indefinite period.

In the far West lead occurs in a great number of localities, but has nowhere been the object of special search or mining enterprises, as its value is too low to pay for the necessarily great expense of mining and transportation in that region. It is abundant in the silver districts of Colorado and Utah, nearly all the silver ores there having the character of argentiferous galena, and their treatment being greatly facilitated by the lead they contain. In Nevada and California lead is comparatively rare.

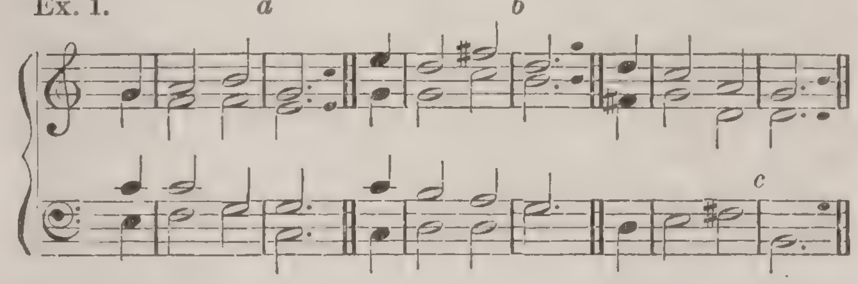
The ore from which lead is almost always extracted fuses at nearly the same temperature as the metal itself; hence it would seem that the metallurgy of lead would be very simple; but the facility with which it is oxidized and dissipated by heat makes it a matter of no little difficulty to avoid serious loss in the process of reduction. The different varieties of ore which are met with also require very considerable diversity in their method of treatment. Where the galena is mixed with much silicious matter it has been found most profitable to smelt it in a cupola; but where it is purer, or the foreign matter it contains is calcareous, the Scotch hearth or some form of reverberatory furnace is used. In the valley of the Mississippi, where the ore contains very little mineral matter, and the galena contains little over an ounce of silver to the ton, the processes adopted in the reduction of the ore are quite simple. A reverberatory furnace is usually employed. This has a sloping hearth to carry off the fused metal as fast as it is produced. The ore is charged into the hot furnace, and is permitted to remain for a time at a low temperature, undergoing a kind of calcination. Subsequently, a higher heat is applied for a time, to be followed by another "firing," so that by alternations of smelting and roasting the ore is ultimately deprived of its metal. Argentiferous galenas require a special and somewhat elaborate treatment, for the details of which, as well as for further information on lead-smelting proper, the reader is referred to the articles METALLURGY and SILVER, and the previous article, LEAD.

The salts and oxides of lead are quite numerous, and are somewhat extensively employed in manufactures and medicine. Of these one of the best known is the protoxide called litharge, used as a drier with oils and varnishes and in the manufacture of glass. Red lead, or "minium," is a compound of the protoxide with the peroxide. It is very generally employed as a pigment, either in oil paints or in the coloring of wall-papers, sealing-wax, etc. It is also employed, like litharge, in the manufacture of glass. Perhaps the most important preparation of lead is that of the carbonate of the protoxide. This is commonly known as

WHITE LEAD (which see). Some of the salts of lead are highly poisonous, and, since the quantity of lead used by every civilized community is great, grave accidents are not uncommon from this cause. The carbonate, the oxide, and the acetate of lead are the most active poisons. They are introduced into the system both by the lungs and the digestive organs. With those who work much in the preparations of lead, as painters, plumbers, and those employed in glazing cards, earthenware, etc., cases of lead-poisoning are constantly met with. One of the most striking symptoms of the disease is what is called "lead colic," or *colica pictonum.* It also produces local or general paralysis or other symptoms, which are always grave and difficult of cure. The use of lead pipe must be regarded as the source of many cases of lead-poisoning. It has been proposed to avoid this danger by lining lead pipe with tin, and pipe of this kind is now coming into general use. It is but little more expensive, and is certainly far safer, than that made from pure lead. (See POISON.) J. S. NEWBERRY.

Lead'ing-Note, in music, the seventh degree of the major scale, or the semitone next below the octave. In the scale of C the leading-note will thus be B; in that of B♭, it will be A, and so in the other keys. In major keys with sharps the *last* sharp of the signature is always on the leading-note. From a certain natural tendency to resolve itself upward into the octave, the major seventh of the scale is said to *lead* the ear in that direction, or cause it to expect that the next progression will be to the octave, and hence its name of *leading*-note. In *minor* scales the seventh in its natural form is not properly a leading-note, being a minor seventh above the tonic. It is thus a whole tone below the octave, and does not possess any special upward or leading tendency. This defect, however, is removed by the use of an accidental sharp, which brings the seventh into the same relation to the octave as in the major mode, and makes it equally characteristic. The leading-note is considered as the most sensitive interval of the scale, because (as already stated) it creates in the mind of the hearer a peculiar longing or desire for an ascent into the octave above, which it already seems almost to touch. In the majority of cases, especially in cadences, the ear feels disappointed and baulked when the leading-note takes any other direction, and particularly so when the progression is a downward one. Instances of this are given at *a*, *b*, and *c* in Ex. 1, and these may be compared with the true progression as represented in each case by the black dots:

Ex. 1.



Exceptions to this general rule, however, occur in good compositions when special effects are to be produced, or in flowing melodies where the leading-note is not prominent *as such*, or when by an upward spring the leading-note in its resolution passes over the octave and takes the third or fifth above. Some cases of this kind will be seen in Ex. 2 under the asterisks:

Ex. 2.

The leading-note, as third in the chord of the seventh on the dominant, is subject also to the rules relating to the resolution of sevenths. But in this case the rule of the leading-note as such, and that affecting it as third in the chord of the seventh, are coincident in requiring that the progression should be one semitone upward—*i. e.* into the tonic. WILLIAM STAUNTON.

Leading Question, a phrase used in the law of evidence to denote a question put to a witness which is so framed as to suggest or indicate the answer desired. Thus, for example, if a witness were asked, "Did he not do a certain act?" or "Did he not carry a pistol?" an affirmative answer would be plainly suggested. It is a general rule in regard to the taking of testimony that leading questions are not allowable in the direct examination of a witness; by which is meant an examination by the party producing him. The object of the rule is to prevent a witness from being a facile instrument in the hands of skilful counsel for the introduction of testimony, artfully colored or fabricated, or presenting the facts of the case in a distorted or inaccurate form, and to obtain a version of the circumstances of the case which shall depend entirely upon his own recollection. There is particular danger that a witness will be *led* upon a direct examination, because he is likely to favor the cause of the party for whom he appears, and to desire that he may succeed in the action. Leading questions are, however, permitted even upon a direct examination when the witness appears to be hostile to the party producing him, or in the interest of the other party, or unwilling to give evidence. They are also allowed where an omission in testimony is evidently caused by a want of recollection, which a suggestion may assist, as where a transaction involves numerous items or dates. The same is true when a particular specification of a matter of inquiry is necessary, in order that a witness's attention may be directed to it. The prohibition of leading questions only applies to material subjects of inquiry, and not to that part of the examination which is merely introductory to the principal points in controversy. Such questions are allowed at the preliminary stage of the examination for the sake of convenience and expedition. Upon cross-examination, or examination by the opposing party, there is no restriction upon inquiry by leading questions. The object in this case is to expose the inaccuracies in the witness's direct testimony, and as he appears in opposition to the counsel then examining him, there is no danger of his being influenced to subserve their designs. (See EVIDENCE.) The whole subject is peculiarly within the discretion of the judge presiding at the trial, subject to review by an appellate court in a plain case of an abuse of the discretion. GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lead, Medicinal Uses of. In this relation the local and constitutional effects of lead compounds have to be considered. *Locally, soluble* salts of lead are astringent and irritant, but the latter property is much less marked in proportion to the astringency than in the case of salts of mercury, silver, copper, and zinc. Indeed, weak solutions of lead-salts are positively soothing. Taken internally in large dose, however, these salts are powerful irritant poisons. Solutions of lead-salts are used in medicine as local applications in catarrhs of mucous membranes and in many inflammations of the skin, especially where attended by much heat and pain. They should not, however, be used in inflammations of the eye, except by physicians' prescription, as if there be any ulceration of the cornea an indelible white opacity will be produced at the spot by chemical decomposition of the lead-salt. The preparations used as lotions are solutions of lead acetate, nitrate, and subacetate. Two officinal solutions of the latter are directed by the U. S. Pharmacopœia, the stronger being commonly called "Goulard's extract," and the latter "lead-water." From the former are also prepared a cerate ("Goulard's cerate") and a liniment. Internally, lead-acetate is alone used, its employment being as an astringent in diarrhœas and in bleeding from the stomach. *Insoluble* lead compounds, like the carbonate, are simply soothing to moist surfaces, but as, if applied in quantity, they may be rendered soluble, and thus irritant, or become absorbed, and thus induce lead-poisoning, other insoluble powders, like zinc-oxide or salts of bismuth, are safer. The *constitutional* effects of lead are wholly poisonous, and are brought on by a slow and steady impregnation of the system with the metal. (See LEAD-POISONING.) EDWARD CURTIS.

Lead Plaster, Diachylon, or **Emplastrum Plumbi.** This familiar plaster of lead is a lead soap (see SOAP), formed by the action of litharge or plumbic oxide on olive oil in presence of water. These materials are boiled together in the proportion of 6 pounds of plumbic oxide in fine powder, 1 gallon of olive oil, and water 2 pints, supplying more water as it evaporates, until the oil and lead oxide unite into the consistence of a plaster. The glycerine of the oil, set free by the basic power of the plumbic oxide, remains in aqueous solution, the fatty acids of the oil forming with the lead the lead plaster, which is made up in cylindrical sticks of a yellowish-white or gray color, brittle when cold, but softening and melting by a gentle heat, when it is readily spread upon leather or cotton cloth for use. It is quite insoluble in water, and nearly so in alcohol. It is without taste, but has a faint peculiar odor. This preparation of lead was well known in ancient surgery. Pliny (*Hist. Nat.*, xxxiv. 53) gives a formula for its preparation almost identical with the one now in use.

The nature of the reaction which occurs is explained by the following formula:

$$\underbrace{2C_3H_5(C_{18}H_{33}O_2)_3}_{\text{Oleine.}} + \underbrace{3PbO}_{\text{Litharge.}} + \underbrace{3H_2O}_{\text{Water.}} =$$

$$\underbrace{Pb_3(C_{18}H_{33}O_2)_6}_{\text{Plumbic oleate.}} + \underbrace{2C_3H_5(OH)_3}_{\text{Glycerine.}}.$$

Lead plaster may also be prepared by double decomposition, precipitating a solution of acetate of lead by one of soap.

It is employed in surgery on account of its adhesiveness, and for this purpose a portion of resin is added while the diachylon is in a fused state. In this way it is used to hold together the edges of wounds in persons of delicate skins. It is also used, spread on cotton bandages, as a strapping for giving support and causing pressure, as in ulcers of the leg.

In the large way, this important preparation is made in a steam-jacketed copper holding fifty gallons or more, and capable of standing a pressure of about 10 pounds per inch, giving a temperature slightly above boiling-point. Lard and lard oil may be substituted for olive oil in the preparation of lead plaster, but by no means will all kinds of animal and vegetable fats answer this purpose. Logan's plaster is made by boiling together litharge, 16 ounces; carbonate of lead, 16 ounces; Castile soap, 12 ounces; butter (fresh), 4 ounces; olive oil, 2½ pints; mastic (powdered), 2 drachms. By a high heat lead plaster is decomposed, giving off irritating vapors of acroleine from the decomposition of the glycerine, and leaving a blackened residue, with oxide of lead. Diachylon or diachylum is a derivative of far-fetched meaning, from the Greek διάχυλος, "very juicy," or "prepared with the juices of plants," such having been the ancient practice in preparing this plaster, vegetable juices supplying the place of water. Its chief use in pharmacy is in the preparation of other plasters. Made from the refuse oleic acid of stearic acid candle-factories, and mixed with a certain quantity of oil or tallow, it has been used as a wheel grease. A compound of lead oxide with the acids of linseed oil, prepared by decomposing the potash soap of linseed oil with solution of acetate of lead, serves, when dissolved in oil of turpentine, for printing on wall-paper previous to gilding it with gold-leaf or Dutch metal, or dusting it with wool-shearings for the production of flock patterns. B. SILLIMAN.

Lead'-Poisoning, a diseased condition resulting from the presence of a considerable amount of lead in the system. This condition is induced in various ways: (1) By the use of lead pipe for the conduction of drinking water. Happily, a large proportion of the waters used for drinking and cooking have not the power to take up lead in solution; but there can be no doubt that a very great number of cases of lead-poisoning are induced in this way. (2) By the use of lead pipes in racking off wines, cider, and beer; by the use of lead-lined chambers in soda-water apparatus and the like. It is very certain that the use of leaden siphons for drawing cider and vinegar from the cask is a very common practice among farmers and dealers in the U. S.; and a dangerous, senseless, and even criminal, practice it undoubtedly is. (3) By the use of lead-paints; hence the name "painter's colic" applied to one symptom of lead-poisoning. *Symptoms.*—These are (1) pain, often intense in the abdominal region, with constipation, sometimes, though rather rarely, accompanied by acute inflammatory symptoms; (2) a blue line visible on the gums near the roots of the teeth; the gums and teeth often foul and tender; the breath offensive, the mouth having a metallic taste; (3) sometimes icterus or jaundice—the skin dark rather than yellow; the patient usually looking pinched and haggard; (4) there is a certain proportion of cases which have "lead-palsy," affecting primarily the extensors of the wrist. This is the affection called "wrist-drop," though wrist-drop is sometimes seen with no other indication of lead-poisoning. Lead rheumatism sometimes occurs, and disease of the brain from lead-poisoning, while delirium, convulsions, and coma are not unknown, but these forms are rare. *Treatment.*—Opium is the sheet-anchor in ordinary lead-poisoning. It relieves the pain, and even at times the obstinate constipation of this disease. Cathartics are extremely useful, except when there is much tenderness of the bowels. In such cases their use should be deferred for a time. Iodide of potassium is prescribed in chronic cases, and is believed to assist in the elimination of the metal. Sulphuric acid and the sulphates are administered with a view to precipitating lead from the circulation, and fixing. REVISED BY WILLARD PARKER.

Leaf [Ang.-Sax.; Gothic, *lauf;* Ger. *Laub;* denoting something broad and thin], in botany, one of the pieces which make up the expanded portion or green foliage of a plant. Being the essential organs of vegetation, leaves are the most important part of a plant. In them actual assimilation, or the conversion of the plant's inorganic food into organic matter, only takes place. This, accordingly, may be taken as the primary function of the leaf, which may be defined as being, physiologically, an arrangement for the exposure of a large green surface to the light and air; of "*green* surface," because it is only in the presence of the green matter of vegetation (called *chlorophyll* or leaf-green) that assimilation takes place; and "to the light," because this takes place only under solar radiation. The green rind of shoots subserves the same purpose, so far as it goes; but the expansion of definite portions of the green surface of the shoots in the form of foliage vastly increases the amount of working surface, and therefore the power of vegetation.

Considered even as foliage, the word *leaf* is naturally and almost inevitably used in more than one sense, both popularly and in descriptive botany; as (1) for the expanded green blade alone (the *lamina* of the leaf); and (2) for this and its supporting footstalk (petiole), and whatever else is normally connected with it. A complete leaf, in the botanist's sense, consists of blade, footstalk, and a pair of stipules (lateral appendages at the base of the latter); but these three parts are very commonly reduced to two, the stipules being wanting or fugacious, and not rarely to one, the footstalk being absent, and so the blade growing directly out of the stem. Indeed, sometimes the blade is wanting, while the footstalk remains, with or without the stipules, or only the stipules are produced, or there is in the place of the leaf a body not distinctly answering to either of these three constituent parts. This leads us to the botanist's idea of—

A Leaf Morphologically considered.—As leaves are produced on the stem at definite points (called *nodes*), and in a fixed arrangement and order, and as they appear under most diverse forms, and either with or without all the parts which a leaf may have—the deprivation or transformation sometimes being such that the organ fulfils little or no function as foliage—so the botanist has come to regard the leaf generically, as being whatever body occupies the place of a leaf, however unlike a foliage-leaf it may be either in appearance or function. The intermediate gradations between ordinary leaves and these various representatives of leaves, both as regards office or structure and appearance, compels this view, irrespective of other considerations. In the absence of any generic name for this protean organ, which takes almost all forms and functions, the botanist, from the morphological point of view, extends the signification of the term *leaf* to cover them all. Leaves as foliage are the typical leaves. Of these the diversity is great, and the nomenclature correspondingly extensive. The details of structure and terminology need not here be entered upon; they have a place in every elementary treatise on botany. Suffice it to say, that a foliage-leaf is either simple or compound—*simple,* when there is a single blade, with or without its footstalk; *compound,* when the footstalk divides or branches, or bears distinct partial blades, called *leaflets.* Of specialized leaves, a series of the more important modifications will serve to illustrate the plan upon which, in the plant, one and the same organ, fundamentally, is modified and made subservient to wholly diverse offices. Some are storehouses of food, in which organic vegetable products for future use are deposited and concentrated. To this use the first leaves (namely, the cotyledons in the seed of a large proportion of phænogamous plants) are wholly or partly devoted. So are the bud-scales of bulbs, which are modified leaves or bases of leaves; while the fleshy leaves of houseleeks, of the century plant, aloe, and such-like succulent plants, serve at the same time as ordinary foliage for the production of food, and as magazines for its storage. So bud-scales represent leaves devoted to the use of protection; the tendrils of the pumpkin are probably leaves transformed for the purpose of climbing; and in the pea-plant some of the leaflets of a compound leaf are tendrils for climbing, while the rest serve as foliage. In the barberry some of the leaves are branched spines; in Sarracenia and some other plants they are pitchers or tubes in which insects are caught; and in the Venus's flytrap (*Dionæa*) a part of the leaf, endowed with a special sensitiveness, power of rapid closing, and a digestive apparatus, is clearly carnivorous. (See PHYSIOLOGY, VEGETABLE, DIONÆA, etc. Also, Darwin, *Insectivorous Plants,* 1875.) The "leaves" of a flower—of the corolla no less than the calyx—afford another instance so obvious that this name has always been applied to them in common language; and to the morphological botanist the essential organs of the blossom (stamens and pistils) equally represent leaves, more completely transformed and specialized, and devoted to sexual reproduction. They conform to leaves in situation, arrangement, etc. (For the arrangement of leaves upon the stem, and the laws governing it, see PHYLLOTAXY. Their anatomical structure, behavior under light, action upon the air, and general functions are considered in the article PHYSIOLOGY, VEGETABLE.) ASA GRAY.

Leaf'-cutter Bee, a name given to several solitary bees of the genus *Megachile,* which construct, or sometimes merely line, their cells with bits of leaves cut out by their scissor-like jaws. *M. centuncularis,* our most common species, is found also in Europe. It cuts out pieces of rose-

leaf for its cells, which are of a very neat and curious structure. The cell it stuffs with pollen, in which it deposits an egg.

Leaf River, tp. of Ogle co., Ill. Pop. 1057.

Leaf River, a v. of Perry co., Miss., near the S. W. bank of Leaf River, 10 miles S. E. of Augusta. Pop. 720.

Leaf-Rollers (Tortricidæ), an important family of small lepidopterous insects, characterized by short beak-like palpi. They are mostly nocturnal, and take their name from the fact that many species make a rude tent by rolling up the leaves of trees, often fastening them with siken threads. The number of genera and species is great, and as a rule the insects are great destroyers of useful vegetation. The genus *Tortrix* is the typical one.

Leaf Valley, post-tp., Douglas co., Minn. Pop. 232.

League [It. *lega;* Span. *legua;* Fr. *lieue*, from the Gaelic *leac* or *leachd*, "a stone," as the Gauls used to mark distances by stones] is a measure of length, used in America mostly for distances at sea, but in Europe also upon land. The nautical league is $\frac{1}{20}$th of a degree, or 3 geographical miles, or 3.457875 statute miles. In England the land-league is 3 statute miles. In France the legal post-league is 2.42 English miles; in Spain, 8000 *varas*, or 7418 English yards.

League, Achæan. See Achæan League.

League, Anti-Corn Law, a name taken by a famous association of Manchester manufacturers, founded in 1839, for abolishing all fiscal imposts on corn. The first Manchester election of members of Parliament, which took place in 1832, carried free-trade candidates, that electoral issue being then raised at the hustings for the first time in England. In 1834 the first meeting of Manchester merchants was called to consider the question of corn-law repeal. In 1836 a miscellaneous anti-corn law society was formed in London, which included 22 members of Parliament. Among the names of the adherents were those of Grote the historian, Hume the economist, Sir William Molesworth, and J. A. Roebuck; Ebenezer Elliott, the corn-law rhymer; W. H. Ashurst, a leading promoter of the penny-postage system; Francis Place, the chief of working-class agitators; William Weir, subsequently editor of the *Daily News;* Col. Thompson, the great expositor of free trade. But no intellect, however eminent and various, could avail against monopoly without money and popular opinion, and of these forces the precursor was W. A. Paulton, a young surgeon of bright, elastic enthusiasm, with a genius for agitation. In 1838 a Dr. Birnie had announced, at the theatre, Bolton, Lancashire, a lecture on the corn laws. The doctor was laden with notes, in which he got so entangled that he could not tell what he had to say. Mr. Thomas Thomasson, afterwards the executor of Cobden, a man of striking energy of character and commercial sagacity, being among the auditors, said to Paulton, who was near him, "You can speak; go down on the stage and deliver the doctor." The spontaneity and capacity which Paulton showed on that occasion led to his being invited to lecture himself, and ultimately he delivered 300 lectures against the corn laws throughout Great Britain. He became the private and confidential secretary of the future League, which his eloquence and thoroughness mainly instigated. At a dinner given to him at Boston, Mr. Bright made the first public speech delivered out of his native town, Rochdale. Later in the same year Dr. Bowring, then of free-trade repute, being entertained at a dinner in Manchester, Mr. James Howie cried out, on Mr. Paulton's health being drunk, "Why could not we have a free-trade association?" A week later one was formed, consisting of seven persons, of whom the chief was Mr. Archibald Prentice, founder of the *Manchester Examiner*, who had himself, as early as 1828, advised the formation of such a society. A subscription of five shillings each was adopted; £5000 each was wanted before corn-law repeal was carried. In 1838, Mr. Cobden first became prominent in the Manchester Chamber of Commerce for resistance to the restrictive commercial policy of the manufacturing trade of the country. In 1839 delegates from the manufacturing districts were appointed to proceed to London to press their opinions upon the legislature. Mr. Charles Pelham Villiers, who ten years later became president of the Poor Law Board, undertook to represent the free-trade question in the House of Commons. On Feb. 19, 1839, Mr. Villiers moved that certain manufacturers be heard by counsel before the bar of the House of Commons, against the corn laws, as injurious to their private interests. The motion was rejected by an overwhelming majority. On Mar. 12 following, the day on which the Anti-Corn Law League originated, Mr. Villiers again moved "that the House resolve itself into a committee of inquiry on the corn laws," when only 195 members could be found to vote for inquiry, while 342 voted against it. Discouraged and dismayed, the partisans of inquiry, who had come up from Manchester to await the result of the motion, rushed over to Herbert's hotel, then standing in Palace Yard, opposite the House of Parliament, to consider what could be done. It was in that crowded room that Cobden, leaping on a chair, reminded the delegates of the victorious efforts of the Hanseatic League, which three centuries previously had freed the trade of the Hanse Towns from the imposts of German princes. "Let us," cried Cobden, "have an Anti-Corn Law League, which shall free corn and trade also." It was then and there that the League originated. Cobden proposed that a fund of £50,000 be raised, and a considerable portion of that sum was subscribed in the room. The chief Manchester commercial houses followed with subscriptions of £50 and £100 each.

The English corn laws, which had for their object the restriction of the trade in grain, date as far back as 1360. At that time the prohibition was against exportation. It was not until 1462 that an act was passed prohibiting its free importation. The object of the Anti-Corn Law League of 1839 was stated by the chairman (Mr. J. B. Smith), on the occasion of Paulton's first lecture in the Manchester Corn Exchange, "to be the same righteous object as that of the Anti-slavery Society, which sought to obtain for the negro the right to dispose of himself; and the object of the League was to obtain for the people the right to dispose of their labor for as much food as could be got for it" in whatever market the exchange could be made. The Leaguers little foresaw at the time the formidable work they had undertaken, and only gradually learned themselves, as the great agitation proceeded, the principles they had to establish. What they discovered was that monopoly always had advocates ready made, who, sharing in its exclusive advantages, had reasons for being enthusiastic in its defence. Any tradesman would profit could he exclude from the market rival articles of those in which he dealt. His profits would increase at the expense of the purchaser. The monopolist dealer considers this protection, but the public, who are the customers of the market, find it to be but protection on one side—the protection of the seller while he has his hands in the pocket of the buyer. What the public want is free purchase in a free market, the power to procure what they want from whoever has it to offer. Free buying—that is protection to the customer. The doctrine of the purchaser is as much food as a man can buy, for as much wages as a man can earn, for as much work as a man can do; and is the natural, and ought to be the inalienable, birthright of every man who has the strength to labor and the will to work. On other things besides corn, protection was always on the side of the seller until the Anti-Corn Law League freed all English industry from restrictive imposts. These "free traders," as the Leaguers were styled, were opposed by an organized party who took the title of "protectionists," who maintained (1) that protection was necessary to keep certain lands in cultivation; (2) that it was desirable to cultivate as much land as possible in order to improve the country; (3) that if improvement by that means were to cease, there must be dependence on the foreigner for a large portion of the food of the people; (4) that such dependence would be fraught with immense danger. In the event of war supplies might be stopped, for the ports might be blockaded, the result being famine, disease, and civil war. (5) That the advantage gained by protection enabled the landed proprietors and their tenants to encourage manufactures and trade; so much so that were the corn laws abolished half the country shopkeepers would be ruined; that would be followed by the stoppage of many mills and factories; large numbers of the working classes would be thrown idle, disturbances would ensue, capital would be withdrawn, and no one could venture to say what would be the final consequences. By this formidable enumeration it was made to appear that the end of England was certainly at hand if the corn monopoly was disturbed. No country in the world can hope to put on record a more appalling set of consequences if protection is menaced. In England they exercised a commanding influence even over the working people, who were induced to believe that it was for their interest that bread was made dear. The learned as well as the ignorant, the aristocracy as well as the small-town shopkeeper, were under the same uninstructed terror. Even Sir James Graham declared in Parliament, when a fixed duty on corn instead of a fluctuating one was proposed by Lord John Russell, that "it would not be the destruction of one particular class in the state, but of the state itself." Sir Robert Peel at first met the efforts of the League by a sliding scale, varying with the price of wheat. This was a thoroughly English device, worthy the genius of a people who never precipitate themselves even into the truth. Had Moses been an English premier, instead of making the Commandments absolute, he would have proclaimed a slid-

ing scale of violation. The struggle of the League lasted seven years, and cost half a million of money. In the fourth year of their activity Mr. Paulton stated that the League employed upwards of 300 persons in making up electoral packets of tracts, and 500 other persons in distributing them amongst the constituencies. In England and Scotland alone they distributed to electors 5,000,000 tracts and stamped publications, while to non-electors of the working class they distributed 3,600,000 publications. In addition, the League had stitched up in monthly magazines and other periodicals 426,000 tracts. The entire number of tracts and stamped publications issued by the League in the single year 1843 was 9,026,000, weighing upwards of 100 tons. Such were the business features of this famous association. But its success came from its inspiration, and its inspiration came from its remarkable leaders. Ebenezer Elliott wrote fiery rhymes for it; Col. Thompson wrote its *Catechism;* George Wilson, the chairman of the League, admittedly the most efficient public chairman who appeared in England during his day, organized its popular action; James Noland, a vigorous speaker, acquainted with the people, was a sort of outrider to the League, going into market-towns on market-days on a white horse—perhaps as a pacific emblem, partly a means of conspicuousness. He took the fighting among the belligerent farmers, so that when Bright and Cobden came the strength of the enemy was known, and the local stock of turbulence being expended the great orators obtained a hearing. There was one R. R. R. Moore, with a voice that fell on a meeting like the bursting of a reservoir. It was not what he said, but the sound it made, that produced the effect. The maddest clamor was not hushed; it was overwhelmed by the new roar, which was always reserved to the end of the meeting. His function was to appeal for subscriptions, and he exactly answered that end, for when his astounding voice fell upon the meeting no one seemed to have the power of going away. In the hours of argument Mr. Villiers's mastery of the question was ever heard, and his high character lent influence to the cause. Mr. Milner Gibson, another Parliamentary voice, had a graceful and cogent eloquence which always commanded attention. Mr. W. J. Fox, a Unitarian minister, and subsequently M. P. for Oldham, surpassed all the orators of the League of that day in brilliance of speech. Shorter and more rotund than Charles James Fox, he notwithstanding produced effects of rhetoric transcending those of his great namesake, and which "brilliance" but weakly describes. Above all in renown were the great names of Cobden and Bright. Mr. Cobden, the "pale-faced manufacturer," whom the landowners believed, and the farmers were persuaded, was a Manchester enemy of all agriculture and paid emissary of the Socialist insurgents of the Continent, was himself the son of a Sussex farmer, and whose ambition was to die one of that class; and did, seeking and accepting no other distinction than that which his genius cast around his name. He was the logician of the League. As a master of lucid statement on the platform or in Parliament he left no equal at his death. When he had made a statement he looked at it and around it, as though he saw it in the air before him. What was deficient he supplied, what was redundant he withdrew, by putting the question in another way, in which he omitted any mischievous word or qualified any phrase he had used which might mislead, so that he could not be misunderstood by accident nor his meaning perverted by design. This contributed to give the League great ascendency, since all its adherents could quote without fear of contradiction what he said, and his speeches of one day became the authority of the next. Mr. Bright's was a grander and more imposing order of eloquence, at once impassioned and colossal. Cobden presented the facts, Bright put fire into them. With the finest voice of any European orator, he displayed a measured vehemence on the platform which gave the impression of unknown power. He was the Vulcan of the movement, who forged at red heat and hurled the burning bolts which finally set protection in flames. These were the great propagandists of political economy who made conquest of the premier, Sir Robert Peel, who won for himself an imperishable name by repealing in 1846 the corn laws, thus "giving the people bread, no longer leavened," as he proudly said, "by a sense of injustice." Never was such a wreck of political reputations as took place within a few years of the abolition of protection in corn. Nothing happened which had been predicted by the prognosticators of disaster. Poor lands were more cultivated than before; no stoppage of imports by war has occurred; manufacturers and shopkeepers have thriven beyond all the dreams of prosperity; instead of rents of land falling, the aristocracy, the chief owners of it, have grown rich while they slept, and farmers have found "ruin" a very pleasant thing to them. The working classes have been better instead of worse employed, and their wages in large districts now excite the jealousy of curates, while the agricultural laborers are at last able to insist upon improved provision for themselves. A stimulus, inconceivable heretofore, has been given to trade; fluctuations in the price of corn have decreased; apprehensions of insufficient harvests no longer excite dread, and the British race are physically much improved since the days before Cobden and Bright arose. The victory of the Anti-Corn Law League was the greatest ever won by reason in the history of human agitations. Neither in piety nor morals nor trade are men for trusting one another. Everybody is for protecting his neighbor from benefiting himself. Nobody is for leaving freedom free. The principle of progress in commerce and social life is not to limit liberty, but to limit injury. It was the establishment of this principle in trade that caused this League to be regarded as one of the historic forces of British civilization. GEORGE J. HOLYOAKE.

League, Holy [Fr. *La Sainte Ligue*], called The League *par excellence*, was entered into in 1576 at Péronne, by the heads of the Catholic party under the leadership of Guise, for resistance to the spread of Protestantism and opposition to the succession of the Calvinistic princes to the French throne. This led to the renewal of the bloody civil wars, which were not ended until 1590, when Henry IV. won the battle of Ivry.

Leake, county of Central Mississippi. Area, 576 square miles. It is undulating and fertile, and is traversed by Pearl River and its affluents. Cotton and corn are staple products. Cap. Carthage. Pop. 8496.

Leake (Sir JOHN), b. at Rotherhithe, England, in 1656; distinguished himself in the naval service during the war of the Spanish succession by taking Newfoundland from the French (1702), for which he was made admiral and knighted; relieved Gibraltar in Oct., 1704, and Mar., 1705, forcing the French and Spaniards to abandon the siege; took part in the reduction of Barcelona the same year; captured Carthagena and Majorca in 1706; became commander-in-chief of the fleet in 1707; took Sardinia and Minorca in 1708; became rear-admiral of Great Britain and lord of the admiralty in 1709; represented Rochester in Parliament for some years, and d. at Greenwich Aug. 1, 1720.

Leake (STEPHEN MARTIN), F. S. A., b. in England in 1702; was an eminent authority upon heraldry and numismatics; became Clarencieux Herald in 1741, Garter Herald in 1754; published a manual of British coins, *Nummi Britannici Historia*, in 1726, and a *Life* of his uncle, Sir John Leake, in 1750. D. in London Mar. 24, 1774.

Leake (WILLIAM MARTIN), b. in London, England, in Jan., 1777; educated at the Royal Military Academy at Woolwich; obtained a commission in the artillery in 1794; served in the West Indies; sent in 1799 to Constantinople to instruct the Turks in the use of artillery; appointed in 1800 to advise the Turks in resisting the French, and proceeded through Asia Minor and Syria to Egypt; and in 1801 was engaged with William Hamilton in making a general survey of Upper Egypt. In 1804 he was appointed to survey the coasts and fortresses of European Turkey, and made a careful exploration of Greece. For many years he was frequently employed upon government commissions in the East, and gave the result of his researches in the learned works *Researches in Greece* (1814), *Topography of Athens* (1821), *Journal of a Tour in Asia Minor* (1824), *Travels in the Morea* (1830), *Travels in Northern Greece* (1835), *Peloponnesiaca* (1846), *Numismata Hellenica* (1854), *Disputed Questions of Ancient Geography* (1857), and *Historical Outline of the Greek Revolution* (1826), and other minor political works. He attained the rank of colonel; retired from the army in 1823, and devoted himself thenceforth chiefly to geography. In 1838 he married Mrs. Marsden, widow of the historian of Sumatra and daughter of the learned Orientalist Sir Charles Wilkins, and she rendered him valuable assistance in his literary tasks. Filling important posts in the geographical and antiquarian societies of London, he was for many years a leading authority upon Eastern questions. He was an ardent sympathizer with the Greeks in their struggle for independence. D. at Brighton Jan. 6, 1860.

Leakes'ville, post-v., cap. of Greene co., Miss., on Chickasawha River.

Leaks'ville, post-tp. of Rockingham co., N. C. Pop. 2031.

Leam'ing (JEREMIAH), D. D., b. at Middletown, Conn., in 1719; graduated at Yale in 1745; was ordained to the Episcopal ministry in 1748; preached eight years at Newport, R. I., twenty-one years at Norwalk, and eight years at Stratford. During the Revolutionary war he was imprisoned as a Tory, contracting a disease of the hip which rendered him a cripple. On account of infirmity he declined in 1783 an election as first bishop of the American

Episcopal Church. He wrote a *Defence of the Episcopal Government of the Church* (1766), a *Second Defence* (1770), *Evidences of the Truth of Christianity* (1785), and *Dissertations on Various Subjects* (1789). D. at New Haven, Conn., Sept. 15, 1804.

Leam'ington, or **Leamington Priors,** town of England, 2 miles from Warwick, on the Leam, celebrated for its mineral springs, saline, sulphurous, and chalybeate, which attract a large number of fashionable guests during the season from October to May. It is wholly of modern growth, and is one of the handsomest places in England. Pop. 22,730.

Leap Year. See CALENDAR, by F. A. P. BARNARD.

Lear (TOBIAS), b. at Portsmouth, N. H., Sept. 19, 1762; graduated at Harvard University in 1783; became private secretary to Washington in 1785; was consul-general at Santo Domingo (1802) and at Algiers (1804); was in 1805 commissioner to negotiate peace with Tripoli, and returning to the U. S. became accountant in the war department. D. at Washington, D. C., Oct. 11, 1816.

Lear'ned (Gen. EBENEZER), b. in Massachusetts about 1728; was a captain in the French war (1756–63); raised the 3d Massachusetts regiment at the outbreak of the Revolutionary war; was appointed brigadier-general in Apr., 1777; took part in the relief of Fort Schuyler (Aug., 1777), and commanded the centre at the battle of Stillwater (Sept. 19, 1777); was at Valley Forge the ensuing winter, and was forced by broken health to retire from service in Mar., 1778. A pension was granted him in 1795. D. at Oxford, Mass., Apr. 1, 1801.

Leas'burg, post-v. and tp. of Caswell co., N. C. Pop. 1461.

Lease. See LANDLORD AND TENANT IN LAW, by PROF. T. W. DWIGHT, LL.D.

Lease and Release. See BARGAIN AND SALE, by PROF. T. W. DWIGHT, LL.D.

Leather [Sax. *lether*, from *lithe*, "soft;" Ger. *Leder*; Fr. *cuir*], the skins of animals prepared by processes which protect them from putrefaction and render them soft, pliable, tough, and non-transparent.

History.—Skins constituted the first clothing of man, and have been more or less perfectly prepared from the earliest times. Persian and Babylonian leather was long celebrated, and during the first centuries of the Christian era the Russians and Hungarians were most skilful tanners. The earliest method consisted undoubtedly in cleansing and drying the skins. Then fat, smoke, urine, sour milk, brains, etc. were in time found to be efficacious. Later, astringents—nut-galls in the East and oak-bark in the West—were introduced, giving rise to the process of *tanning*, and alum to *tawing*. It was not till the close of the eighteenth century that the true nature of the processes began to be understood, when the structure of the skin and the chemical nature of the agents employed had become known. In 1778, Macbride proposed raising skins with dilute sulphuric acid; in 1793, Deyeux recognized tannin as a peculiar body, and in 1795, Seguin showed that leather tanned with oak-bark was a compound of tannin with the animal tissue, and proposed his process of quick tanning. Banks in 1801 discovered the tanning properties of terra japonica, and Pelouze in 1834 investigated nut-galls and showed the acid character of tannin. Davy, Proust, Vauquelin, Chaptal, F. Knapp, Rollet, and many other chemists contributed important investigations on the subject. Mechanism has done much more than chemistry to expedite the operations and improve the appearance of leather. It is an unfortunate fact, however, that in most cases the quality of the leather has deteriorated in proportion as the processes have been quickened.

The Manufacture of Leather is conducted in three entirely distinct ways: I. *tanning* by the aid of bodies containing tannin; II. *tawing* with alum and common salt; III. *tawing* with oil. The whole skin is not converted into leather, but only that portion known as the *corium* or *derma*, which possesses a fibrous texture. This is covered on the hair or bloom side by the epidermis, consisting of nucleated cells, and on the flesh side by a fatty tissue, both of which are removed by the tanner.

I. *Tanning.*—The skins of almost all quadrupeds may be converted into leather. In practice, the hides of bulls and oxen yield the best leather for soles, harness, and for belting; calves' skins furnish the best upper leather for boots and shoes; lamb, sheep, goat, and buck skins are generally tawed with alum or oil for the preparation of glove, wash, or bookbinders' leather. Most of the so-called *buckskin* is now prepared by tawing the skins of wild hogs from Africa. Alligators' hides have recently been introduced for boots and shoes. Horse, ass, pig, and seal skins are tanned for trunks and saddlery purposes.

Preparation of the Skins.—(1) Steeping or macerating in water is resorted to in order to soften the skin and to remove blood and dirt. Fresh hides are macerated two or three days, dried or salted hides eight or ten days. They are taken out of the water twice daily and put back again. (2) Cleansing the flesh side is effected by supporting the hide on a "tree," or "beam," a stout semicircular plank, and scraping it with a dressing-knife to remove the fatty tissue, etc. (3) Loosening the hair is effected by sweating, liming, or treatment with depilatories. Sweating is a putrefactive fermentation which is often resorted to for sole leather, as lime tends to render the leather brittle. The hides are piled up with the flesh side inward in a tank which can be closed to retain the heat generated by the fermentation. Some salt or wood vinegar is generally rubbed on them beforehand. When the smell of ammonia is perceptible the operation is completed. Similar results are obtained by hanging the hides in rooms heated to from 86° to 122° F., the air of which is kept moist by steam. Liming consists in placing the hides in vats with milk of lime, frequently transferring them from one vat to another, or taking them out and replacing them, to allow the lime to act equally on every part. When the hair is found to be properly loosened the hides are withdrawn. Depilatories are used for skins of the smaller animals, which will sustain neither sweating nor liming. Rhusma, a mixture of orpiment and two or three times its weight of slaked lime, has long been used. It is rubbed on the hair side of the skin, and allowed to remain in contact till the hair is sufficiently loosened. Sulphide of calcium, which is the active agent in the rhusma, has of late been substituted for it. The refuse lime of gasworks contains a considerable proportion of this compound, and may be used with advantage. In Germany sulphide of sodium is now used, either in solution (1 part to 100 of water), or as a paste with three times its weight of lime and a sufficient quantity of water. The paste is applied with a brush to the hair side, and the hides are then covered with damp matting, to prevent the drying of the paste; the process is complete in fifteen or twenty hours. Acid liquids possess some depilatory power, and are sometimes used. The Calmuck Tartars employ sour milk. The acid liquid resulting from the fermentation of barley or rye meal in water has been used. (4) Removing the hair is effected by scraping on the beam with the dressing-knife. The skins are then washed in water. (5) *Bating* is next resorted to for the purpose of removing the lime and the lime soaps which have been formed in the skin. The material employed is the dung of pigeons, fowls, or dogs, mixed with water. The skins are placed in this, and frequently handled to secure uniform action. The dash-wheel is used in large establishments to keep the contents of the vat in constant motion and save handling. Bating is very effective, but it is attended with some disadvantages. The putrefaction of the bate during the steeping injures the skins, renders them lighter, and diminishes their strength. The process must therefore be carefully watched and interrupted at the proper moment. Dilute hydrochloric acid, and even sugar solutions—4 or 5 pounds of sugar or molasses to 60 gallons of water—have been recommended as substitutes for dung. (6) Swelling or raising the hides is resorted to in order to swell the fibres, and make the skins more susceptible to the action of the tanning solutions. The swelling-bath may consist of (*a*) barley meal and one-tenth its weight of sour dough diffused in water, which yield by fermentation lactic and other acids; (*b*) of spent tan-liquor, which contains considerable lactic and butyric acid; (*c*) dilute sulphuric acid, 1 part of acid to 1000 or 1500 of water. Considerable prejudice exists against sulphuric acid, on the ground that it injures the quality of the leather, but it is still extensively used. (7) *Tanning.*—The tanning materials are various astringent vegetable products which contain tannin (tannic acid). Those most used are oak, fir, and hemlock bark, sumac, divi-divi, Valonia nuts, myrobalans, cutch, gambia, catechu, and kino. (See article TANNIC ACID.) The impregnation of the hides with tannin is effected by (*a*) placing them between layers of coarsely crushed bark in a vat, which is then filled with water or old liquors; (*b*) immersing them in first a weak aqueous infusion of the tanning material, and afterwards in a stronger; (*c*) sewing two hides together into a sack and filling this with the tanning solution. The progress of the operation can be ascertained by examining the hide on a freshly cut edge, which shows the depth to which the tannic acid has penetrated. When the appearance is uniform throughout the thickness the tanning is completed. Quick tanning may be accomplished by various means, some good, others objectionable. (*a*) The application of hydrostatic pressure to force the liquor through the hides; (*b*) circulation of the liquor among the hides; (*c*) sewing the hides into sacks, filling with oak-bark chips and water, and immersing in vats of

catechu infusion made dense by molasses; (*d*) motion of the hides in the liquor; (*e*) frequent withdrawal and working of the hides on rollers; (*f*) puncturing the hides with sharp needles to produce artificial pores; (*g*) treatment of the hides in vacuo. (8) Currying is the process by which the tanned skins, after being converted into leather, are prepared for use. For sole leather it consists in merely hammering the dried hide to render it more compact. For upper leather, used for boots and shoes, it consists of (*a*) paring with a knife to secure uniform thickness; (*b*) scraping for a similar purpose; (*c*) graining with the pommel or graining-board; (*d*) finishing off with a flattening iron or horn to remove creases, etc.; (*e*) greasing, which consists in rubbing in a mixture of oil and tallow: the skins are previously moistened, and after the application of the grease are hung in warm rooms to dry it in; (*f*) blackening, which is effected by an application of a fresh solution of oak-bark, and then of copperas (ferrous sulphate) solution, to which some blue vitriol (cupric sulphate) has been added; (*g*) greasing again; (*h*) applying a solution of glue and tallow; (*i*) polishing with glass. (For details with regard to special varieties of leather see below, and also MOROCCO LEATHER.) Lacquered leather, commonly called patent leather, is made by applying a varnish to the leather, and then placing it in a stove heated to about 120° F. This causes the varnish to become thin, to spread out evenly, and dry to a smooth, polished surface. Cow or split skins are generally used for this purpose.

Cordovan differs from morocco in being prepared from heavy skins, and by retaining its natural grain. It is a soft, fine-grained, colored leather, usually dyed red, yellow, or black. It was originally prepared by the ancient Orientals. It was first introduced into Europe at Cordova in Spain, whence the name. The French name for shoemaker, *cordonnier*, is probably derived from this leather. The manufacture of this leather was established at Cordova, and for a long time European markets were chiefly supplied from this city. The best qualities of cordovan are now made at Constantinople, Smyrna, and Aleppo; Bremen supplies the best German.

Yufts or Russia Leather is a very strong, pliant, and watertight leather, usually colored red or black, which has a peculiar penetrating odor, due to the oil of birch with which it is impregnated. It was invented by the Bulgarians. The best is made in various Russian and Lithuanian provinces. The name yufts is derived from the Russian *jufti*, signifying a pair, and probably due to the fact that two hides are sewed together in the form of a sack for the dyeing operation. The hides of young cattle are generally employed, but sometimes horse, sheep, goat, and calf skins are employed. The hides are cleansed with lime in the usual manner. They are swelled in an acid bath prepared with malt, exhausted tan-liquor, or *kaschka*, the dung of dogs rubbed up with water. Willow, fir, and birch bark are employed in the tanning. The hides are first submitted for some days to the action of partially exhausted bark; they are then placed in vats with fresh bark, or a warm infusion made from it. The tanning requires five or six weeks. The tanned hides are next impregnated with *diggut* or *elachert*, the oil of birch obtained from birch-wood by dry distillation. It is rubbed in on the flesh side, and when the hides are thoroughly impregnated, they are stretched till soft and supple. They are then rubbed on the hair side with alum solution, grained, and dried. The dry hides are sewed together in pairs, forming sacks which are filled with the dye-liquor, which for red is a decoction of sandal-wood. The dyed leather is dressed by the usual mechanical operations. Russia leather is specially useful for bookbinding, the oil of birch repelling insects.

II. *Tawing with Alumina Salts* ("white tanning") is generally resorted to for sheep and goat skins, though it is also applied to cow and ox hides for moccasin and lace leather. The thick skins are prepared as for tanning; sheep and goat skins are more carefully cleansed and freed from hair and wool. Lime and fermented bran-liquor are used, however, as already described. The skins are then immersed in a solution of common salt and alum. After removal from the solution and drying the skins appear shrunken and stiff. In order to restore suppleness and flexibility they are dampened with water, and subjected to mechanical operations which stretch and knead them. If thin they are stretched on a frame to dry. Thick hides are greased as described under *Tanning*. Fine glove-leather is tawed by a different process. The skins of kids or lambs are most carefully handled to avoid abrading or staining them. They are cleansed and unhaired by lime and bran-liquors as for ordinary tawing. The tawing is effected by applying a paste composed of wheat flour, yolks of eggs, alum, common salt, and water. As the yolks of eggs aid by furnishing the oil which they contain in the state of emulsion, which gives the kid leather its highly prized suppleness and softness, they may be replaced by an emulsion of almond, olive, or fish oil. The skins are thoroughly soaked and kneaded in the paste, to which 2 or 3 per cent. of carbolic acid is often added to prevent putrefaction, and packed in heaps. They are then stretched by hand and rapidly dried in the air. They are then dampened, placed in linen cloths, and trodden to render them soft. They are then planed, dried, and planed again, polished by rubbing with a heavy glass disk or by the appreteur, simultaneously with the application of some white of egg, gum, or fine soap, to give a gloss to the hair side, which is afterwards dyed.

Shagreen.—Genuine Oriental shagreen (*saghir, sagri, sagre*) is a variety of tawed leather which has long been celebrated for its hardness and strength. Its appearance is very peculiar, the grain side being covered with globular granules, which are produced by stamping the hard seeds of the wild orach (*Chenopodium album*) into the wet hide, and afterwards knocking them out. This leather originated in the East, and the best is now brought from Persia, Constantinople, Algiers, and Tripoli. The name shagreen is also applied to fish-skin prepared for covers and for polishing wood.

III. *Tawing with Oil* ("Samian tawing"), for the preparation of shammy (chamois) or wash-leather. For this leather the upper or exterior layer of the corium of the thick skins is cut away, as it is too compact and prevents the ready absorption of oil. Thin skins, as those of lambs and goats, are not deprived of the exterior layer. The skins are prepared with lime and the subsequent bran-bath, as in alum-tawing. They are then stretched and rubbed with oil, which is worked in by the fulling-machine. They are then hung in the air. Oiling, stamping in the fulling-machine, and exposure to the air are repeated till a sufficient quantity of oil has been worked into the skin. The skins are then heaped together in a warm room to produce a kind of fermentation, which must be carefully watched, and occasionally interrupted by airing to prevent overheating. The oil becomes rancid by these operations, and appears to combine with the animal fibres of the skin. The uncombined oil is then removed by a tepid bath of potash solution, and the skins are wrung out and dried. The softness and suppleness are restored by dressing. Cordovan or Turkey leather is oil-tawed, without having the hair side removed, while the flesh side is blackened in the usual way.

Stearic Acid Tawing.—According to Knapp's researches, a very good white kid leather is obtained by tawing the epidermis (*blöss*) from lamb or goat skins in a saturated solution of stearic acid in alcohol. The leather thus obtained is very soft, has a whiter color than ordinary glacé leather, and a beautiful gloss.

Statistics.—According to the report of the ninth census there were in 1870 in the U. S. 4237 tanneries, with a capital of $42,720,505, employing 20,784 hands, and paying $7,934,416 in wages per annum. The bark employed amounted to 1,255,346 cords, valued at $9,089,303; 8,788,752 hides, 9,664,148 skins, and other materials of a value of $1,631,234, were used, the total value of the materials being $63,069,491. The products were 17,577,404 sides of leather and 9,794,148 skins, of an aggregate value of $86,169,883. There were also 3083 establishments for currying leather, with a capital of $12,303,785, employing 10,027 hands, and paying $4,154,114 in wages. These consumed—

9,133,330 sides, value	$33,784,271
4,084,980 skins, value	6,833,215
2,089,754 gallons oil, value	1,642,495
Other materials, value	1,305,612
Cost of all materials	$43,565,593

and produced 9,133,330 sides of leather and 4,084,980 skins, the total value of which was $54,191,167. New York and Boston are the great markets for all sorts of leather in this country.

Literature.—*The Arts of Tanning and Currying*, by Campbell Morfit; *A New and Complete Treatise on the Arts of Tanning, Currying, and Leather-Dressing*, by H. Dussauce; C. H. Schmidt's *Handbuch der Lohgerberei; Handbuch der Weissgerberei; Die Saffianfabrication; Die Lederfärbekunst; Die Kürschnerkunst;* and Knoderer's *Neue Wichtige Erfindung in der Lohgerberei; Die Fabrikation des Lohgaren Leders in Deutschland*, by F. A. Gunther; *Lehrbuch der Sohlledergerberei*, by Von Bichon; *Natur und Wesens der Gerberei*, by F. Knapp; *Die Deutsche Gerberzeitung; Neues Journal der gesammten Gerberei; Gerber Courier; Cuirs et Peaux*, by H. Villain; *Matériel des Industries du Cuir*, by J. P. Damouretti; *Cuirs et Peaux*, by M. Fauler, *Rapports du Jury International Exp. Univ. 1867;* Ure's *Dictionary of Arts, Manufactures, and Mines;* Wagner's *Technology;* Watts's *Dictionary;* Muspratt's *Chemistry*, especially last German edition.

C. F. CHANDLER.

Leather'-wood, Moose-wood, or **Wic'opy,** the *Dirca palustris*, a shrub of the order Thymelaceæ, is abundant in the northern parts of North America. Its tough bark was used by the Indians for thongs or cordage. The bark has irritant cathartic properties, and its decoction in small doses is recommended for the cure of sick headache. Its wood is very white, soft, and brittle.

Leatherwood, post-tp. of Henry co., Va. Pop. 3673.

Leathes (STANLEY), D. D., b. at Ellesborough, England, Mar. 21, 1830; educated at Cambridge; served as curate in several churches in London; became in 1863 professor of Hebrew in King's College, London, and has especially devoted himself to Christian evidences. He was Boyle lecturer from 1868 to 1870, Hulsean lecturer at Cambridge in 1873, and Bampton lecturer at Oxford in 1874; is a member of the Anglican commission for the revision of the translation of the Old Testament, and was one of the delegates to the Evangelical Alliance in the session of 1873 in New York. His best known work is the *Witness of St. John to Christ.*

L'Eau qui Court, a former county of Nebraska, now called KNOX (which see).

Leav'el (Rev. HADEN), M. D., b. in Madison co., Ky., May, 1812; graduated at the University of Pennsylvania in 1833; practised medicine in Kentucky and Mississippi for several years, and in 1847 entered the ministry, in which he rose to eminence. He was pastor of the Methodist Episcopal Church, South, in Vicksburg, at the time of his death, Sept. 11, 1847. T. O. SUMMERS.

Leav'en [Fr. *levain*, from Lat. *levare*, to "raise"], a piece of sour dough used for raising bread. The principle of its action is the same as that of YEAST (which see).

Leav'enworth, county of N. E. Kansas, bounded E. partly by the Missouri River and S. by the Kansas River. It has a rich and well-cultivated soil. Coal is found. Cattle, grain, and wool are staple products. Tobacco, carriages, and clothing are the most important articles of manufacture. The county is traversed by several railroads. Cap. Leavenworth. Pop. 32,444.

Leavenworth, post-v., cap. of Crawford co., Ind., on the Ohio River, 60 miles below Louisville, Ky. It has a graded school, a newspaper, and is a good shipping-point. The Great Wyandotte Cave is situated 5 miles E. of the town. Pop. 567.

Leavenworth, city and cap. of Leavenworth co., Kan., on the W. bank of the Missouri River, 39 miles from Kansas City, Mo., and 312 miles by land above St. Louis; E. terminus of the Kansas Central (narrow gauge) and the Kansas Pacific R. Rs.; N. terminus of the Leavenworth Lawrence and Galveston, and the W. terminus of the S. W. line of the Chicago Rock Island and Pacific R. R., which latter road crosses the Missouri at this point over a magnificent iron bridge constructed at a cost of $1,000,000. The Atlantic and Pacific, known as the Missouri Pacific, and the Kansas City St. Joseph and Council Bluffs R. Rs., also pass through the city. Leavenworth contains 27 churches, 9 commodious school-buildings, several private seminaries, State normal school, the St. Mary's (Catholic) Academy, 2 orphan asylums, 4 daily and 6 weekly newspapers, 4 monthly periodicals, 2 insurance companies, 6 banks, a paid fire department, and 4 miles of street railway. The Kansas State penitentiary is situated 4 miles S. of the city. Fort Leavenworth military reservation adjoins the city on the N., and has a military prison. Leavenworth derives its chief importance from the manufacture of carpets, furniture, stoves, engines, mining machinery, and iron bridges. It is the largest city in the State, a great centre of trade with the Territories, and is noted among Western cities for its elegant residences and its many miles of shaded thoroughfares. The first house was built in 1854. Pop. 17,873. J. W. ROBERTS, ED. "COMMERCIAL."

Leavenworth, post-v. and tp. of Brown co., Minn., 17 miles S. W. of New Ulm. Pop. 433.

Leavenworth (ELIAS WARNER), LL.D., b. at Canaan, Columbia co., N. Y., Dec. 20, 1803; spent his childhood and youth at Great Barrington, Mass.; graduated at Yale College in 1824; began the study of law the same year in the office of William Cullen Bryant at Great Barrington; spent 2 years at the Litchfield (Conn.) law-school; admitted to the bar in Jan., 1827, in which year he removed to Syracuse, N. Y., where he practised law with success for many years until forced by ill health to abandon it. He was mayor of Syracuse in 1849 and 1859; member of assembly in 1850 and 1857; secretary of State 1854–55, to which office he was again nominated in 1859; president of the board of quarantine commissioners 1860; elected regent of the university Feb., 1861; appointed by President Lincoln in Mar., 1861, commissioner under the convention with New Granada; was in 1865 president of a board of commissioners to locate the State asylum for the blind, and in the same year trustee of the State asylum for idiots, to which post he was twice reappointed; member for the fifth district of the constitutional commission 1872; published in 1873 the *Genealogy of the Leavenworth Family in the U. S.*, an elaborate work, the result of years of research and correspondence, and was elected 1874 a representative in the U. S. Congress. He is now (1875) president of the Syracuse savings bank, of the gaslight and waterworks companies of that city, and holds numerous other posts of trust and responsibility.

Leavenworth (Gen. HENRY), b. in Connecticut Dec. 10, 1783; studied and practised law; entered the army in Apr., 1812, as captain of the 25th New York Infantry; was made major of the 9th Infantry in Aug., 1813; commanded his regiment at the battles of Chippewa (July 5) and Niagara Falls (July 25, 1814), being wounded in the latter engagement; made lieutenant-colonel and brevet colonel for bravery in the above engagements; lieutenant-colonel 5th Infantry of the regular army in Feb., 1818; commanded expedition against Arickaree Indians on the upper Missouri River; made brevet brigadier-general in July, 1824; colonel 3d Infantry in Dec., 1825. He founded several military posts on the Western frontier, one of which, Fort Leavenworth, was the nucleus of the present flourishing city of Leavenworth, Kan. D. at Cross Timbers, Indian Territory, July 21, 1834.

Leaves. See LEAF, by PROF. ASA GRAY, M. D., LL.D.

Leav'itt, tp. of Oceana co., Mich. Pop. 316.

Leavitt, post-v. of Monroe tp., Carroll co., O., 7 miles W. S. W. of Carrollton. It has 1 weekly newspaper.

Leavitt (JOSHUA), D. D., b. at Heath, Franklin co., Mass., Sept. 8, 1794; graduated at Yale in 1814; studied law, and in 1819 was admitted to the bar; practised law in Heath, Mass., and Putney, Vt.; graduated in 1825 at the Yale Divinity School; was the highly successful pastor of a Congregational church at Stratford, Conn., 1825–28; editor of the *Sailor's Magazine* 1828–31; of the *New York Evangelist* 1831–37; of the *Emancipator* 1837–47; and in 1848 became connected with the *Independent*, which connection he retained till his death. Mr. Leavitt was always active in the cause of Sunday schools, temperance, seamen's aid, and the abolition of slavery. He was a zealous free-trader, and greatly influenced the political opinion of his time. D. Jan. 16, 1873, in Brooklyn, N. Y.

Lebade'a [Λεβάδεια], now LIVADIA, an ancient town of Bœotia, at the northern foot of Helicon, noted for the cave of Trophonius and a famous oracle.

Leb'anon [Heb., from *labnan*, "to be white;" Assyrian *Labnana;* Gr. Λίβανος; Lat. *Libanus;* Arabic *Jebel Libnan*], a celebrated range of mountains in Syria, extending about 110 miles along the sea-coast from the Nahr-el-Kibir (Eleutherus) River on the N. to the Nahr-el-Litany (Leontes) on the S.; *i. e.* from the great pass opening into the valley of Hamah (Hamath), lat. 34° 40′, to the vicinity of Tyre, in lat. 33° 20′, and separated by the elevated valley of El-Bukaa (Cœle-Syria), 10 to 20 miles wide, from the parallel range of ANTI-LEBANON (which see), similarly extending from near Homs (Emesa) on the N. to the peak of Jebel-esh-Sheikh (Hermon), a few miles S. of Damascus. In the centre of the valley of El-Bukaa are the majestic ruins of BAALBEC (which see), the ancient Heliopolis, near which rise the Aasy (Orontes) and Litany rivers, the former flowing N. to the Cilician Gulf, the latter S. to the Mediterranean, above Tyre. Physically, the mountains of Lebanon are connected northwards through their prolongation, the Jebel Nusarieh, with the great chain of Taurus in Asia Minor, and southward, through the lower mountains of Palestine and Moab, with the Sinaitic group and the coast range of W. Arabia; and some modern geographers employ the name in this wider sense. Lebanon was at the earliest recorded period the chief geographical feature and eastern limit of PHŒNICIA (which see); it was alternately subject to Assyria and Egypt, whose monarchs often employed its celebrated cedars to supply timber for their edifices, and was included within the boundaries of the Hebrew "land of promise" (Num. xxxiv.; Deut. xi. 24; Josh. i. 4), though it never came into their possession, unless in a very limited sense for a brief period, and may properly be considered as the northern boundary of the Holy Land. The books, prophetic, poetic, and historical, of the Old Testament abound in references to Lebanon, which supplied the timber for Solomon's magnificent temple and palaces; and the term usually, though not uniformly, includes both ranges. Lebanon proper was called by the early Arabian geographers Jebel-Libnan, and by later writers Jebel-el-Ghurby, "the west mountain," in distinction from Anti-Lebanon, called Jebel-esh-Shurky, "the east mountain."

These names, however, are now seldom heard in Syria, where, besides local names, the northern section is called Jebel-Akkar, the central Sunnin, and the southern Jebel-ed-Druze. Between the mountains and the sea the plain of Phœnicia is of varying breadth, but never more than 10 or 15 miles, while spurs are several times thrown off which jut precipitously into the sea. The base of the range has an average breadth of 20 miles; the peak of Jebel Timarun attains a height of 10,533 feet, that of Dahar-el-Kudib 10,051, and Sunnin 8500 feet. The elevation decreases towards the S., and falls rapidly from the "twin-peaks" of Tomat-Niba (6500 feet) to the wild, abrupt ravine of the Litany, whose banks sometimes rise perpendicularly 1000 feet. The mass of Lebanon is a hard, partially crystallized Jurassic limestone, surmounted in many places by a grayish white cretaceous deposit, whence perhaps the name, more usually derived from the snows, which cover the main ridge from December to March. The southern section exhibits traces of violent volcanic action, and earthquakes are still frequent, that of 1837 having buried thousands of persons in Safed beneath the ruins of their homes. The inhabitants are chiefly Maronites, a Christian sect, in the N., and Druses, professing a corrupted Mohammedanism, in the S. These races are rivals, and have for centuries been at feud; a terrible massacre of Christians in 1860 resulted in European intervention. The district is subject to a Maronite governor, depending upon the pashalic of Damascus. There are more than 30 ruins of ancient temples within this region, which has still a considerable population. Cap. Nahr-ed-Dammur, formerly called Deir-el-Kamr. PORTER C. BLISS.

Lebanon, county of S. E. Pennsylvania. Area, 300 square miles. It consists in the main of the very fertile Lebanon Valley, and is bounded N. W. by a range of the Kittatinny Mountains. Its soil is a rich reddish clay loam. Live-stock and grain are staple products. Clothing, metallic wares, tobacco, furniture, carriages, flour, etc. are largely manufactured. The county is traversed by the Lebanon Valley, the North Lebanon, and the Lebanon and Fremont R. Rs. Cap. Lebanon. Pop. 34,096.

Lebanon, post-v., cap. of De Kalb co., Ala., on the Alabama and Chattanooga R. R. (Brandon's Station).

Lebanon, tp. of Sharpe co., Ark. Pop. 509.

Lebanon, post-tp. of New London co., Conn., contains several villages, and has important manufacturing interests. Pop. 2211.

Lebanon, post-v. of St. Clair co., Ill., 24 miles E. of St. Louis, on the Ohio and Mississippi R. R., has 7 churches, 4 hotels, 1 bank, 1 weekly and 1 semi-monthly newspaper, 1 machine-shop, 2 large mills, and a great variety of stores. It is noted for its educational advantages, being the seat of McKendree College (Methodist, founded 1835), the oldest institution of the kind in the West, and is quite a summer resort for residents of St. Louis. Pop. 2117.
T. W. ECKERT, ED. "JOURNAL."

Lebanon, post-v. of Centre tp., cap. of Boone co., Ind., at the junction of the Indianapolis Cincinnati and Lafayette with the Anderson Lebanon and St. Louis R. R., 26 miles N. W. of Indianapolis, has 2 weekly newspapers, 5 churches, 3 banks, 4 hotels, 3 mills, 3 stave-factories, an academy, and 47 stores. Pop. 1572.
T. H. HARRISON, ED. "PIONEER."

Lebanon, post-v., cap. of Marion co., Ky., 67 miles S. E. of Louisville, on the Knoxville branch of the Louisville Nashville and Great Southern R. R., at its junction with the Cumberland and Ohio, has 2 national banks, 8 churches, 2 hotels, 2 weekly newspapers, 3 high schools, 1 carriage and 1 furniture manufactory, and is the shipping-point for the productions of several counties. Pop. 925.
JAMES W. HOPPER, ED. "STANDARD."

Lebanon, post-tp. of York co., Me., on the New Hampshire line and on the Portland and Rochester R. R. It has 3 churches. Pop. 1953.

Lebanon, tp. of Clinton co., Mich. Pop. 1119.

Lebanon, tp. of Dakota co., Minn. Pop. 216.

Lebanon, tp. of Cooper co., Mo. Pop. 3316.

Lebanon, post-v. and tp., cap. of Laclede co., Mo., on the Atlantic and Pacific R. R., 185 miles S. W. of St. Louis. It is very pleasantly situated, contains 5 churches, 2 newspapers, a first-class seminary and a number of stores, and is the business centre of a large tract of surrounding country. Pop. of v. 1090; of tp. 3358.
J. G. LEMEN, ED. AND PROP. OF "ANTI-MONOPOLIST."

Lebanon, post-v. and tp. of Grafton co., N. H., on the Connecticut River and Northern R. R., 65 miles N. W. of Concord, directly opposite White River Junction, Vt., has 3 churches, 1 national and 1 savings bank, 1 weekly newspaper, numerous stores, a fine park, extensive manufactures of furniture, agricultural implements, iron castings, etc., and the only elastic sponge manufactory in the U. S. The West Village has a church, a hotel, railroad shops, and the Tilden Ladies' Seminary. Water-power is afforded by the Muscoma River, which falls 400 feet within the town. Principal industries, farming and wool-growing. Pop. 3094. E. H. CHENEY, ED. "FREE PRESS."

Lebanon, tp. of Hunterdon co., N. J. Pop. 3561.

Lebanon, post-v. of Clinton tp., Hunterdon co., N. J., on the New Jersey Central R. R. It has important manufactures and trade.

Lebanon, post-tp. of Madison co., N. Y., on the Syracuse and Chenango Valley R. R. The Midland and the Utica Clinton and Binghamton R. Rs. also traverse the town. Pop. 1559.

Lebanon, tp. of Meigs co., O. Pop. 1823.

Lebanon, a v. of Bethel tp., Monroe co., O. (P. O. name, MASTERTON). Pop. 124.

Lebanon, post-v. of Turtle Creek tp., cap. of Warren co., O., 5 miles from the Little Miami R. R. and 30 m. N. E. of Cincinnati, has 7 churches, 2 weekly newspapers, 3 hotels, 2 planing-mills, a new town-hall, a public library, a national normal school with 1600 students, a county infirmary and orphans' home. Principal industry, farming. Pop. 2749. WM. C. MCCLINTOCK, PUB. "WESTERN STAR."

Lebanon, post-b., cap. of Lebanon co., Pa., beautifully located on the Lebanon Valley and the Philadelphia and Reading R. Rs., 25 miles E. of Harrisburg and 5 miles N. of the great Cornwall iron-hills. It has 15 churches, 1 daily, 1 semi-monthly, and 7 weekly (2 German) newspapers, and is well provided with banks, hotels, schools, factories, machine-shops, and stores. Copper, marble, and anthracite coal abound, the latter supplying 8 large furnaces. It is regularly laid out, well built of stone and brick, has a fine water and gas supply and other modern improvements. Situated on the Swatara Creek and Union Canal, it is the centre of an active trade. The original settlers were Germans, but English is now generally spoken. Pop. 6727.
T. T. WORTH, ED. "COURIER."

Lebanon, tp. of Wayne co., Pa. Pop. 628.

Lebanon, post-v., cap. of Wilson co., Tenn., 30 miles E. of Nashville, and 6 miles S. of the Cumberland River, at the E. terminus of the Tennessee and Pacific R. R. and of the Lebanon and Nashville telegraph line, has 7 churches, 2 national banks, 4 hotels, a large woollen-factory, flouring and other mills, a market-house, town-hall, Masonic and Odd Fellows halls, a business and telegraph college, 2 female seminaries, several public schools, 1 weekly newspaper and 1 quarterly (educational) periodical. It is the seat of Cumberland University, founded in 1842 by the Cumberland Presbyterian Church, which is now fully organized with six departments (including law, theology, and engineering), a library of 6000 volumes, 12 professors, and an average of 300 students, including the preparatory department. Pop. 2073. R. L. C. WHITE, ED. "HERALD."

Lebanon, post-v. and tp., cap. of Russell co., Va., in Clinch River Valley, 15 miles N. of Abingdon and 21 miles from the Atlantic Mississippi and Ohio R. R., has 2 churches, 1 weekly newspaper, a male and female academy, and several hotels, stores, and shops. Principal business, farming. Pop. of v. 209; of tp. 2246.
J. B. JONES, ED. "RUSSELL PROGRESS."

Lebanon, tp. of Dodge co., Wis. Pop. 1621.

Lebanon, tp. of Waupacca co., Wis. Pop. 657.

Lebanon Springs, post-v. of New Lebanon tp., Columbia co., N. Y. It is a place of summer resort. Here is a copious mineral spring, having a constant temperature of 70° F. The waters have nearly the taste of pure water, and are so abundant as to furnish a valuable motive-power. The hotel accommodations are ample, and the waters have a good reputation in many diseases. In the vicinity there are large manufactories of thermometers and of pharmaceutical preparations. (See NEW LEBANON and MOUNT LEBANON, N. Y.) Near at hand are several communities of Shakers. The scenery is delightful.

Lebanon Valley College, located at Annville, Lebanon co., Pa., on the Philadelphia and Reading R. R., 21 miles E. of Harrisburg. It was organized and chartered by the State legislature in 1867. From this time until 1871 it was under the supervision and jurisdiction of T. R. Vickroy. In June of this last-mentioned year the board of trustees assumed the control and reorganized the faculty, with L. H. Hammond, the present incumbent, as president. The growth of this institution has been gradual and constant, and though young it now has a respectable number of students in each of the college classes. Young ladies are admitted, and have equal advantages with young men. They may pursue the same course of study or the one es-

pecially arranged for them. In this institution the joint education of the sexes proves not only successful, but in many respects advantageous. There are cabinets of minerals and a museum well begun, and the trustees have ordered the procuring of a library and complete apparatus during the present year. L. H. Hammond.

Lebas′ (Jean Baptiste Apollinaire), b. in a village in the department of Var, France, Aug. 13, 1797; studied at the École Polytechnique; was employed since 1823 as an engineer in the French navy; became keeper of the naval museum in 1839, and d. in Paris in 1873. His name became quite famous on account of his success in transporting the obelisk of Luxor, weighing 506,000 pounds, from Thebes in Egypt to Place de la Concorde in Paris, which he has described in his *L'Obélisque de Luxor, histoire de sa translation à Paris*, etc. (1837).

Le Bas (Philippe), b. at Paris June 18, 1794; served first in the navy, then in the army, at last in the office of the prefect of the Seine, and was appointed by Queen Hortense governor to Prince Louis Napoleon in 1820. In 1827 he returned to Paris; was appointed professor in Greek at the Lyceum in 1829; and made a scientific journey in Greece and Asia Minor in 1842 at the expense of the government. His principal writings are *Explication des Inscriptions grecques et latines recueillies en Grèce* (1835), and *Voyage archéologique en Grèce et en Asie Mineure* (1847). D. at Paris in 1861.

Lebeau′ (Jean Louis Joseph), b. Jan. 2, 1794, at Huy, in the province of Liége, Belgium; studied law, practised as an advocate with great success; founded in 1824 the *Journal Politique de Liége;* brought about that alliance between the clerical and liberal parties which made it possible for the Belgian provinces to dissolve the union with the Netherlands; opposed, as member of the congress of 1830 and minister of foreign affairs 1831, the annexation to France and the election of the duke of Nemours as king; served under King Leopold as minister of justice to 1834; was called once more in 1840 to the ministry of foreign affairs, but retired before the violent opposition of the clerical party. D. in his native city Mar. 19, 1865. He wrote *Observations sur le Pouvoir Royal dans les Etats Constitutionels* (1830). (See *Les Fondateurs de la Monarchie Belge*, by Juste, 1865.)

Lebedin′, town in Russia, in the government of Kharkov, with considerable local trade and manufactures. Pop. 13,377.

Leblanc′ (Urbain), b. at La Commanderie, Deux-Sèvres, France, Nov. 26, 1796; studied veterinary science at the school of Alfort, where he afterward became professor; was appointed surgeon to the prefecture of police at Paris in 1832, and elected member of the Medical Academy. Besides a great number of minor essays, communicated to various medical periodicals, he published, together with Trousseau, *Atlas du Dictionnaire de Médecine et de Chirurgie vétérinaires*, and, together with Follin, *Traité de pathologie comparée* (2 vols., 1855).

Le Bœuf, post-tp. of Erie co., Pa., on a branch of the Philadelphia and Erie R. R. Pop. 1748.

Le Bœuf (Edmond), marshal of France, b. at Paris Dec. 6, 1809; received his military education in the École Polytechnique; entered the artillery in 1822, and distinguished himself as officer in the staff during the expedition against Constantine. From 1837 to 1840 he served in Algeria; returned then to France; became second commander of the École Polytechnique in 1848, and went in 1854 to Crimea as colonel and chief of the staff of the artillery. Here he distinguished himself greatly, both in the battle of Alma and at the artillery attack on Sebastopol, which he partly led; in Nov., 1854, he was made a brigadier-general. After the close of the Crimean campaign he was sent to Kinboorn as commander-in-chief, and remained there to 1856. He then received the command of the artillery of the guard; was made a general of division in 1857, and took an important and brilliant part in the Italian war of 1859. In 1869 he was commander of the 6th corps, stationed at Toulouse. Unfortunately for him, Niel d. Aug. 14, 1869, and he was called upon to succeed him as minister of war, for, although an excellent officer, he was unable to master an administration of such dimensions. Mar. 24, 1870, he was created a marshal, and four months afterward the war with Germany began. Since the last victorious wars the organization of the French army had made great progress under the talented and energetical government of Niel; thus Le Bœuf believed that the army was fully prepared for war. But he had not been able to understand how much superior was the organization of the German army. He received the eminent position as chief of the staff of the emperor—that is, of actual commander of the army, as the emperor, even bodily, was unable to command in person. But this task was too heavy for the marshal. The dispositions of the French army at the end of July, 1870, and the first strategical measures against the invading German army, showed the greatest lack of preparation and a fatal weakness in the command. A short time after (Aug. 12, 1870) Bazaine was made commander-in-chief, and Le Bœuf received the command of the 3d corps. In this position he took an active and brilliant part in the battles of Vionville and Gravelotte (Aug. 16 and 18), and fought at Noisseville (Aug. 31 and Sept. 1) with such a furious stubbornness that the French army probably would have succeeded in breaking through the German lines if the other generals, and especially Bazaine himself, had shown an equal valor. At the surrender of Metz he became a prisoner of war. He lived in Cassel, where Napoleon resided, and after peace was concluded went to the Hague. August Niemann.

Lebon′ (Joseph), b. at Arras in 1765, was curate of Neuville when the Revolution broke out, and in 1792 was elected representative. Soon after he was chosen commissioner in his own department of Pas-de-Calais, and displayed an energetic violence against the reactionary party. When, after the 9th Thermidor, this party came into power, Lebon was tried for his alleged revolutionary excesses, sentenced to death, and guillotined Oct., 1795. His son published in 1861 a book, *J. Lebon in his Private and Political Life*, which attempts to exonerate his father from some of the atrocities attributed to him. Félix Aucaigne.

Le Breton′ Flats, an important suburb of Ottawa, the capital of Canada, is situated on Chaudière and Victoria Islands and on the Canada Central Railway. It manufactures immense quantities of lumber, flour, castings, and other goods. Pop. about 2000.

Lebri′ja, town of Spain, in the province of Seville, manufactures woollen cloths, hempen fabrics, pottery, brick, tiles, glass, and soap, and is celebrated for the excellent oil produced in its vicinity. Pop. 10,338.

Le Brun (Charles), b. at Paris Mar. 22, 1619; studied under Nicolas Poussin in Paris and Rome; was made a member of the Academy of Painting and Sculpture in 1648; first painter to Louis XIV. in 1661; director of the manufacture of Gobelins tapestry and president of the Academy, and d. at Paris Feb. 12, 1690. The most prominent of his works are a series of pictures of the history of France during the reign of Louis XIV., at Versailles, and another series of pictures illustrating the life of Alexander the Great, in the Louvre; but besides these a great number of historical, religious, and allegorical pictures is scattered through other French and European galleries. They represent in the art of painting the same taste, the same æsthetical ideal, as that which is represented in poetry by Corneille, Racine, and Boileau. They contain much which deserves to be admired—an inexhaustible invention, a refined sense for effect, perfect elegance in forms and arrangement, etc. But the feeling is generally tame and shallow, the allegories are often very superficial, and the inconsistencies of the costume are sometimes irresistibly ludicrous. In his time he exercised an enormous influence. Not only the painters and sculptors, but all artists, from the vase-maker and jeweller down to the sign-painter and job-printer, followed his taste, which for a generation or more was reigning absolutely.

Lebrun (Charles François), duke of Piacenza, b. at St. Sauveur-Lendelin, Normandy, Mar. 19, 1739; was for several years secretary to the chancellor, Maupeou. After the accession of Louis XVI. and the downfall of Maupeou he lived in obscurity until 1789, when his pamphlet, *La voix du citoyen*, attracted considerable attention. He was elected a deputy to the States General, and as a member of the Constituent Assembly he acquired both influence and authority by his moderation and by his insight in financial matters. Having been imprisoned during the Reign of Terror, he entered, under the government of the Directory, the Council of Five Hundred, and was chosen its president Feb. 20, 1796. He allied himself very closely to Gen. Bonaparte, and was made third consul by him Nov. 9, 1799. On the establishment of the empire he became minister of finances, or arch-treasurer, in 1806 governor of Liguria and duke of Piacenza, and in 1810, on the abdication of King Louis, governor of Holland, whence he was driven by the allies in 1814. After the first restoration he was made a peer of France by Louis XVIII., but having during the Hundred Days received the title of grand master of the university from Napoleon, he was excluded from the Chamber of Peers on the second restoration. In 1819, however, he was allowed to take his seat, and in the debates he sided with the constitutional opposition. D. June 16, 1824. His *Mémoires* were published in 1829 by his son.

Lec′ce, the former *Terra d'Otranto*, a province of Italy, belonging to the division of Apulia. Area, 3293 square

miles. Pop. 493,594. It is traversed by the Apennines, and produces corn, tobacco, wine, olives, and in some places cotton, but often suffers from severe droughts.

Lecce, the ancient *Lycia* or *Lupia*, one of the most beautiful towns in S. Italy. It is situated in the province of Lecce, lat. 40° 42′ N. and lon. 36° 40′ E., on a plain between the Adriatic on the N., the Gulf of Taranto on the W., and the Ionian Sea on the S., precisely at the point which forms the heel of the Italian boot. The town is regularly built of a remarkably fine white stone, and has many interesting edifices, especially churches and convents, some of which contain admirable works of art. At the gate of St. Biagio stands a grand triumphal arch erected in commemoration of the entrance of Charles V. The royal manufactory of tobacco is an old establishment, but has recently been provided with the best modern machinery, and the first quality of Leccese tobacco is said to be equal to that of Seville. The public library contains 10,000 volumes, both day and evening schools are established, and the charitable institutions are numerous and well sustained. Lecce (probably of Cretan origin) was very flourishing during the Roman period, escaped the barbarians, and in 1000 A. D. was governed by its own counts, among whom were Tancred and Bohemond. Pop. in 1874, 23,247.

Lec′co, town of N. Italy, in the province of Como. It is delightfully situated on the Adda, near the point where it flows out from the S. E. arm of Lake Como, at the foot of the Resegone. Lecco already existed under the Romans, and continued a town of considerable importance through all the vicissitudes of the Middle Ages. It is now one of the most industrious and prosperous of the small towns of Lombardy. Its iron and silk manufactories are extensive. In its neighborhood stands the pretty villa in which Manzoni wrote a part of his remarkable romance *I Promessi Sposi*. A picturesque road on the E. bank of the lake connects it with Colico, while it has direct railway communication with Bergamo. Pop. in 1874, 7040.

Lech, a river of Southern Germany, rises in the Vorarlberg, runs N. through Tyrol and Bavaria, and joins the Danube after a course of about 140 miles. A little below Füssen it becomes navigable for small boats, and for larger from Augsburg, but it has generally no great commercial importance on account of the irregularity of its course, bottom, banks, etc. Many mills are worked by its waters.

Lechevalier′ (Jean Baptiste), b. at Trelly, Normandy, July 1, 1752; studied theology at the seminary of St. Louis in Paris, but did not take orders; accompanied in 1784 the count of Choiseul-Gouffier as secretary to Constantinople, and participated with great energy in his explorations of the plain of Troy; travelled much in Spain, England, Germany, and Scandinavia, and was appointed director of the library of Ste. Geneviève in Paris in 1805, which position he held to his death, July 2, 1836. His *Voyage de la Troade* (1797) and *Voyage de la Propontide et du Pont Euxin* (1800), in which he pretended to have made many great discoveries concerning the geography of the Homeric epics, made a great sensation at their first appearance, but are now generally put in the same class as his *Ulysse Homer* (1829), in which he proves that Ulysses wrote the *Iliad* and the *Odyssey*.

Lech′ford (Thomas), a lawyer from London who settled at Boston, Mass., in 1638, the first to practise that profession in New England. He returned to England in 1641, much dissatisfied with his experience; published in 1642, *Plaine Dealing, or Newes from New England's Present Government*, etc., and in 1644 *New England's Advice to Old England*. He is said to have d. soon after. A new edition of the *Plaine Dealing*, with introduction and notes by J. Hammond Trumbull, was published in 1867. Though written in a spirit of hostility to New England, it contains valuable information.

Lec′ithine [Gr. λέκιθος, "yolk of an egg"], the *matière visqueuse* of Gobley, a phosphuretted fatty body found in the yolk of eggs, the brain, bile, blood, and in the roe of fish. Diakonow gives it the formula $C_{44}H_{90}NPO_9$; Strecker, $C_{42}H_{84}NPO_9$. (See Watts's *Dict.*, iii. 566, and *Suppl.*, 778.)

Leck′y (William Edward Hartpole), b. near Dublin, Ireland, Mar. 26, 1838; graduated at Trinity College, Dublin, in 1859; published anonymously in 1861 *The Leaders of Public Opinion in Ireland* (new ed. 1872); travelled extensively on the Continent; settled in London, devoting himself to historical and philosophical researches; and surprised the learned world in 1865 by the *History of the Rise and Influence of the Spirit of Rationalism in Europe*, a work which united to an elegant style a judicial impartiality and a more than German erudition. It was speedily republished in the U. S., as was also his next work, a *History of European Morals from Augustus to Charlemagne*, which displayed the characteristics of its predecessor in a still higher degree. All these works were translated into German by Dr. H. Jolowicz, and the *History of Morals* has become a text-book in more than one German university. Lecky is not known to have published anything else except a lecture before the Royal Institution on the *Influence of the Imagination in History*. He is represented as a gentleman of considerable fortune, tall and commanding figure, a bachelor of recluse habits, and the possessor of a fine library.

Le Claire, post-v. and tp. of Scott co., Ia., on the Mississippi River, 15 miles below Clinton, and midway between St. Louis and St. Paul. It is at the head of the Upper Rapids, which extend 15 miles to Rock Island. It is a place of active trade. Pop. of v. 1093; of tp. 1940.

Le Clear (Thomas), b. at Oswego, N. Y., Mar. 11, 1818; attempted at the age of nine years to execute a portrait on a pine board with lamp-black, Venetian red, and white-lead, and at twelve created a sensation by a St. Matthew, for which he filled several orders at two dollars and a half each. In 1832 his father removed to London, Upper Canada, where he took some portraits, and two years later was employed at Goodrich on Lake Huron to decorate the panels of a steamboat. He afterwards visited Green Bay, Wis., painting portraits of the Indians in that vicinity; returned to London, and after exercising his improvised art for brief periods at Elmira and Rochester, in the midst of privations and discouragements, made his way to New York, where in 1839 he opened a studio in Broadway, and soon gained an honorable position in the artistic fraternity, his picture of *The Reprimand* having been purchased by the Art Union during the palmy days of that institution. From 1844 to 1860 he successfully practised his art in Buffalo, and painted, among others, the admired pictures *The Marble-Players* and *Young America*. Returning to New York, he has since enjoyed popularity as a colorist, and exhibits great power over details. He has produced striking portraits of ex-President Fillmore, Hon. D. S. Dickinson, T. B. Thorpe, and Booth as Hamlet; his *Itinerants*, exhibited at the National Academy in 1862, was praised.

Leclerc′ (Jean), b. at Geneva Mar. 19, 1657; studied theology, and accepted the Arminian doctrines; travelled much in France, England, and Holland; was appointed professor of ecclesiastical history at the Remonstrant college of Amsterdam in 1684; retired in 1728, and d. at Amsterdam Jan. 8, 1736. The most prominent part of his comprehensive and varied literary activity was his editorship of *Bibliothèque Universelle et Historique* (26 vols., 1686–93), *Bibliothèque Choisie* (28 vols., 1703–13), and *Bibliothèque Ancienne et Moderne* (28 vols., 1714–27).

Leclerc (Victor Emmanuel), b. at Pontoise, near Paris, Mar. 17, 1772; enlisted in the army in 1791; distinguished himself at Toulon in the armies of the Ardennes and the Alps; was appointed military commander of Marseilles in 1795, and made a brigadier-general in 1797; married in the same year Napoleon's eldest sister, Pauline, and went in 1801, with a large fleet and an army of 30,000 men, to Santo Domingo to vindicate the authority of France over the colony. After a contest of some months a truce was made, but when Toussaint l'Ouverture was sent as a prisoner to France, a new rising of the colored population under Dessalines took place, and at the same time the French army was attacked and more than decimated by yellow fever. Leclerc himself fell a prey to the disease Nov. 2, 1802. His wife, who had accompanied him to Santo Domingo, and behaved with great courage and fortitude, married in 1803 the Prince Borghese.

Leclercq′ (Michel Theodore), b. at Paris Apr. 1, 1777; held from 1810 to 1819 a subordinate place in the civil service, but lived else on an independent fortune. D. at Paris Feb. 15, 1851. His works consist, besides a couple of novels, of 8 vols. of *proverbes dramatiques*, small dramas not destined for the theatre, but for private performance in the salons. They are rich in the finest and most striking psychological observations, and many of them belong, on account of their humor and elegance, to the most exquisite productions of French literature. They were received with extraordinary applause, and exercised great influence on the development of the French drama.

Lecocq′ (Charles), b. in Paris, France, about 1835, is regarded as the best successor of Auber in comic operas, of which the most successful have been *Fleur de Thé*, *La Fille de Madame Angot*, and *Giroflé-Girofla*, each in three acts. *Les Prés Saint Gervais*, with libretto by V. Sardou and Gille, was brought out in Paris and London in Nov., 1874.

Lecomte′ (Louis), b. at Bordeaux, France, about 1655; was one of the six Jesuits selected for their mathematical attainments to undertake a semi-scientific mission in China. They embarked at Brest Mar. 3, 1686, with the Chevalier de Chaumont, ambassador to Siam, where they arrived in September, and were detained two years by the reigning monarch, Phra Narai, who prided himself upon his knowledge of mathematics. Arrived at Pekin in Feb., 1688,

they made astronomical observations in various parts of the empire for several years, and became well acquainted with the condition of the country and people, and had considerable success in making proselytes to Catholicism—a success much facilitated by their tolerance of many pagan ceremonies which the missionaries of other orders condemned as idolatrous. Lecomte was sent to Rome in 1692, became soon afterward confessor to the duchess of Burgundy, and wrote a work, *Nouveaux Mémoires sur l'État présent de la Chine* (3 vols., 1696–97–1701), combining much information with an exaggerated panegyric upon the Chinese, who were represented as having always retained a knowledge of the true God. This work, together with *Sur les Cérémonies de la Chine* (1700), was censured by the faculty of theology at Paris and by the Congregation at Rome. Lecomte d. at Bordeaux in 1729.

Lecomp'ton, post-v. and tp. of Douglas co., Kan., 10 miles N. W. of Lawrence. It is on the S. bank of the Kansas River, opposite Perry Station on the Kansas Pacific R. R. It was for a time the Territorial capital of Kansas. It is the seat of Lane University (Presbyterian). Pop. 971.

Le Conte (John), M. D., son of Lewis, b. in Liberty co., Ga., Dec. 4, 1818; prepared for college under the tuition of the undersigned; graduated in 1838 with high honors at Franklin College, Athens (now University of Georgia); studied medicine, taking his degree in 1841 from the New York College of Physicians and Surgeons; married the same year, and in 1842 began practice at Savannah; Ga., and from that time forward contributed largely to the prominent medical journals of the U. S.; elected in 1846 to the chair of natural philosophy and chemistry in Franklin College, and resigned in 1855 to become lecturer on chemistry in the College of Physicians and Surgeons, N. Y.; accepted in 1856 the new professorship of natural and mechanical philosophy in the South Carolina College, Columbia; in 1869 became professor of physics and industrial mechanics in the new University of California at Oakland, and president after the resignation of Pres. D. C. Gilman in Apr., 1875; is a member of the leading American scientific societies, to whose proceedings and various scientific journals he has contributed important papers on physical science; has published his addresses of *Philosophy of Medicine* (1849) and *Study of the Physical Sciences* (1858); and contributed *The Nebular Hypothesis* to the *Popular Science Monthly* for Apr., 1873. In Dec., 1857, delivered a course of lectures on the "Physics of Meteorology" at the Smithsonian Institution, Washington, and in Nov., 1867, one of four lectures on the "Stellar Universe" at the Peabody Institute in Baltimore. By the burning of Columbia, S. C., in Feb., 1865, he lost the nearly completed manuscripts of a treatise on *General Physics*. A. H. Stephens.

Le Conte (Maj. John Eaton), brother of Lewis, b. near Shrewsbury, N. J., Feb. 22, 1784; entered the engineer corps of the U. S. army in 1813; was long employed in surveys and fortifications, and retired with the rank of major in 1831. He was a successful cultivator of natural science, especially botany and zoology. He published *Monographs of the North American Species of Utricularia, Gratiola, and Ruellia, Observations of the North American Species of Viola,* and *Descriptions of the Species of North American Tortoises* in the *Annals of the New York Lyceum of Natural History,* vols. i., ii., iii.; *A Monography of North American Histeroides* in the *Boston Journal of Natural History,* vol. v., and *Descriptions of three new Species of Arvicola, with Remarks upon other North American Rodents,* in the *Proceedings of the Academy of Natural Sciences of Philadelphia,* in several of which he had the benefit of the scientific observations of his brother Lewis. D. at Philadelphia Nov. 21, 1860.

Le Conte (John Lawrence), M. D., son of John E. Le Conte, b. in New York May 13, 1825; graduated in 1846 at the New York College of Physicians and Surgeons; made several scientific excursions in the Western States while a student, and subsequently extended his travels to Central America, the results of which were communicated to scientific societies and journals. His specialty is the study of North American Coleoptera, on which subject he is recognized as a high authority. The Smithsonian Institution published in 1861–62 his *Classification of the Coleoptera of North America,* and in 1863–66 his *List of the Coleoptera of North America.* Dr. Le Conte entered the army in 1862 as surgeon of volunteers, and became a medical inspector of the regular army. He is a member of the National Academy of Sciences, and was in 1873 elected president of the American Association for the Advancement of Science.

Le Conte (Joseph), M. D., son of Lewis, b. in Liberty co., Ga., Feb. 26, 1823; studied at a private school under the charge of the undersigned; graduated with distinction at Franklin College, Ga., in 1841, and in medicine in New York in 1845; settled in 1848 as a physician in Macon, Ga.; studied natural history under Agassiz at Cambridge in 1850; became in 1853 professor of natural history at Franklin College, and of chemistry and geology in the University of South Carolina from 1856 to 1869, accompanying his brother John in 1869 to California, where he took the chair of geology in the University of California. Besides numerous scientific papers, he has written on art and education, and published a work on *The Mutual Relations of Religion and Science* (1874). A. H. Stephens.

Le Conte (Lewis), M. D., b. near Shrewsbury, Monmouth co., N. J., Aug. 4, 1782; descended from a French Huguenot family that settled about the close of the seventeenth century at New Rochelle, N. Y.; graduated in 1799 at Columbia College; studied medicine in the office of Dr. David Hosack, but never practised, and soon settled in Liberty co., Ga., taking charge of his father's estate, establishing a botanical garden, especially rich in bulbous plants from the Cape of Good Hope, where he produced large camellias and the hybrid *Amaryllis Johnsonii.* In his laboratory he tested the discoveries of chemists, the fruits of which, averse to publishing, he communicated to his friends. Stephen Elliott and other botanists acknowledged their obligations to him, and by his observations he enriched the monographs of his brother, Major John E. Le Conte. Besides occasional rambles in the adjoining counties, he made two scientific excursions to the region of the Altamaha River, the earlier in company with the botanist Dr. William Baldwin, U. S. N., and the later with Mr. Gordon, the Scotch collector and botanist, who gave an account in *Loudon's Gardener's Magazine* of the result of many months' residence with him. Dr. Le Conte devoted much attention to mathematical studies, and manuscripts on this subject and on native animals and birds, which were in the custody of his son, Prof. John Le Conte, were lost by the burning of Columbia, S. C., in Feb., 1865. His death, Jan. 9, 1838, resulted from poison taken into his system by dressing a wound for a member of his family. By his wife, Ann Quarterman, whom he married in 1812, and who died in Dec., 1826, he had four sons and three daughters, of whom two sons, the scientists Profs. John and Joseph Le Conte, still survive (1875), as well as one daughter. A. H. Stephens.

Lecourbe' (Claude Joseph), Count, b. at Lons-le-Saulnier, France, in 1759; spent eight years in the army in early life, without securing any advancement, but at the organization of the National Guards at the outbreak of the French Revolution became commander of those raised at Lons-le-Saulnier, and soon after joined the army of the Upper Rhine at the head of a battalion from the Jura. He distinguished himself repeatedly in the battles in the Netherlands, especially at Fleurus (June, 1794), where he had command of a brigade, and held his position for seven hours against 10,000 Austrians. The same qualities were displayed in the campaigns on the Rhine, the Danube, and in Switzerland, and made him general of division in 1796. For partisanship in favor of Moreau, Napoleon struck his name from the roll of officers (1801), and he lived in retirement at Bourges during the Empire. Louis XVIII. restored him his rank, and made him grand officer of the Legion of Honor and count in 1814. He opposed Napoleon on his return from Elba, but finally accepted a command under him in the Jura, with head-quarters at Befort, where he d. Oct. 23, 1815. His statue was erected at Lons-le-Saulnier in 1857.

Lecouvreur' (Adrienne), b. at Damery, near Epernay, France, Apr. 5, 1692. In 1702 her parents settled at Paris, and after receiving some instruction from the actor Legrand, she entered the stage at Strasbourg in 1716. Next year (May 14, 1717) she made her début at the Théâtre Français in Paris, where she very soon attained the first place both in comedy and tragedy. Her character as an actress was not so much the grand as the touching, and her principal power was a most wonderful mimicry. Her death was very sad. Maurice of Saxony was her lover; not the only one she ever had, but she loved him deeply, and when he was made duke of Courland she sold her diamonds in order to furnish him with the money necessary to take possession of the country. It was alleged that another of his mistresses, the duchess of Bouillon, poisoned her from jealousy, and she d. Mar. 20, 1730. Her remains were not allowed to rest in consecrated ground, but were buried secretly in a private place. Roused by indignation, Voltaire wrote an ode on her death, but public opinion was so fixed on this point that he had to leave the city. In modern times her tragic history was made the subject of one of the most successful dramas of Scribe and Legouvé, in which Rachel achieved celebrity in the *rôle* of Adrienne.

Lec'tionary [Lat. *lectionarium*], a service-book containing the lections (lessons) of Scripture to be read in the church, or in other cases a list indicating what lessons are appointed for different days in the calendar.

Lectoure′, town in France, in the department of Gers, on the right bank of the Gers. It has a brisk trade in grain, wine, brandy, mules, and cattle. Pop. 6122.

Lec′turn [Lat. *lectrum*, from *legere, lectum*, "to read"], or **Ambo,** the reading-desk of a church; the stand at which the lesson for the day is read. These names are used in Roman Catholic and in some Protestant churches. The form is various, and the lecturn itself is either fixed or movable.

Le′da, in Grecian mythology, was the wife of Tyndareus, king of Sparta, and by Zeus, who surprised her in the shape of a swan, she was the mother of Castor and Pollux. There are many versions of the myth, but the above is the most common.

Led′erer (John), known only as an early explorer of the mountain-region of Virginia, wrote in Latin an account of his travels, which was translated and printed in 1672 by Sir William Talbot, Bart., under the title *The Discoveries of John Lederer in three several marches from Virginia to the West of Carolina and other parts of the Continent, begun in March, 1669, and ended in September, 1670* (quarto, 27 pp., with a map). Sir William states in the preface that Lederer was driven out of Virginia by ill-treatment from the populace—that he made his acquaintance in Maryland, and induced him to write this treatise as a vindication. He was probably a German.

Ledg′er-Lines, in music, short lines added above and below the five regular lines of the stave. As the stave affords room only for a limited number of the notes now in use, the ledger-lines, with the spaces between, are equivalent to a temporary extension of the scale, thereby furnishing as many new degrees above and below as may be required. These short additional lines are also a convenience to the eye of the performer, as the notes placed on or between them can be read with great facility; whereas, if the lines were continuous and permanent (forming a stave of eight or ten lines), the same notes could not be read without difficulty and constant risk of error. (See Notation and Scale.) William Staunton.

Ledochow′ski, de (Cardinal Miecislas Halka), Count, b. Oct. 29, 1822, at Ledochow, Galicia; studied theology at Warsaw, Vienna, and Rome; became domestic prelate and prothonotary apostolic to Pope Pius IX.; and entering the papal diplomatic service was auditor of the nunciature successively at Madrid, Lisbon, Rio de Janeiro, and Santiago de Chili, nuncio at Brussels, and archbishop of Thebes *in partibus infidelium* in 1861; and at the request of the king of Prussia appointed in Jan., 1866, archbishop of Gnesen and Posen, becoming thereby *ex officio* primate of Poland. On May 26, 1873, he led in the protest signed by the clergy against the new Prussian ecclesiastical laws, which placed the choice of bishops and priests in the hands of the people of the diocese or parish. Persistently refusing to appear before the courts to justify his action, his property was taken in payment of fines, and he was confined in prison at Ostrowa, where he has since remained, having been exhorted to constancy by a papal brief of Nov. 3, 1873, and elevated to the cardinalate in the secret consistory celebrated Mar. 15, 1875.

Ledru′-Rollin′ (Alexandre Auguste), b. at Paris Feb. 2, 1807, began to be known soon after the revolution of July, 1830, by acting as an "avocat" for the political men prosecuted by the government of Louis Philippe, or by writing pamphlets and memoirs in which he indicted in a legal and technical argumentation the repressive measures ordered against individuals or public liberties. He was at the same time a favorite and celebrated lawyer in ordinary lawsuits, and published dogmatic works and periodical reviews on jurisprudence. In 1861 he was elected member of the Chamber of Deputies, and upheld openly the pure doctrines of republicanism in the chamber. In 1848 he was, as minister of the interior, one of the provisional government of the republic, and put in practice his theory of universal suffrage. When Cavaignac, and afterwards Louis Napoleon, took the power into their hands, Ledru-Rollin continued to fight for liberty as a member of the National Assembly. On June 13, 1849, he was the leader of an insurrection attempted to prevent Louis Napoleon from sending the French troops to help in the re-establishment of the pope at Rome. The insurrection collapsed, and Ledru-Rollin escaped to England. There, though he kept quiet and exclusively busy with writing books, his extradition was asked by Napoleon III., under the pretext that he had been participant with Mazzini in the insignificant plot of Tibaldi against the life of the emperor. But the extradition was not granted, and Ledru-Rollin returned to France in 1870. He did not wish to enter again the political arena; still, the republicans elected him deputy in 1873, and he was one of the members of the extreme Left in the Versailles Assembly. He only delivered one speech, in favor of universal suffrage, which was worthy of the great orator, and was his "chant du cygne," for he d. soon after (Jan. 1, 1875), and was accompanied by thousands of Parisians to the cemetery of Père la Chaise.
Félix Aucaigne.

Le′dum, Oil of [Gr. λῆδον, the "ledum"], an essential oil obtained by distilling the leaves of marsh tea, *Ledum palustre*. It is reddish-yellow, has an acid reaction, smells like the plant, and consists of a hydrocarbon isomeric with oil of turpentine, and an oxygenated oil having the composition of ericinol, $C_{10}H_{16}O$.

Le′dum Palus′tre [Gr. λῆδον] (*Marsh Tea, Rosmarinus Sylvestris*), a small evergreen shrub growing in swamps and other wet places in the northern parts of Europe, Asia, and America, and in mountainous regions of more southern latitudes. The leaves have a balsamic odor and an aromatic, camphorous, bitter taste, and contain, among other ingredients, a volatile oil and tannin. They are thought to possess narcotic properties, and have been employed to allay irritation in whooping-cough, dysentery, leprosy, and scabies. (*U. S. Disp.*) They are said to protect clothes from moths, are sometimes used as a substitute for hops in beer, and are employed in Russia to tan goat, calf, and sheep skins into a reddish leather of an agreeable smell, as also in the preparation of oil of birch, for making what is generally called Russia leather. C. F. Chandler.

Led′yard, post-v. and tp. of New London co., Conn., on the E. side of the navigable river Thames, 8 miles S. of Norwich. The township is traversed by the Norwich and Worcester R. R., and has a public library and important manufactures. Pop. 1392.

Ledyard, post-tp. of Cayuga co., N. Y., on the E. shore of Cayuga Lake. It contains the village of Aurora (which see). Pop. 2221.

Ledyard (John), b. at Groton, Conn., in 1751; lived for a time among the Six Nations, to whom he intended to become a missionary, and studied in Dartmouth College with a view to that work; but his restless spirit prompted him to embark alone in a log canoe upon the Connecticut River and leave college for ever. He shipped as a sailor to Gibraltar; enlisted as a British soldier, but was soon discharged; returned to America during the Revolutionary war; went to London, and sailed as a corporal of marines under Capt. James Cook on his last voyage, of which Ledyard kept a diary, an abstract of which was published at Hartford, Conn., 1787. In 1782 he deserted from the British service when off Long Island. Assisted by Sir Joseph Banks and others, he started, after many vexatious hindrances, from St. Petersburg (whither he had walked from Stockholm, through Lapland and Finland) for the Pacific Ocean. At Irkutsk in Siberia he was arrested, and was hurried back to the Polish frontier and expelled from Russia for some unknown reason. In 1788, immediately after his return from Russia, he started under the auspices of Sir Joseph Banks and others for the exploration of Africa, but was attacked at Cairo, Egypt, by an acute febrile disorder, of which he d. Jan. 17, 1789.

Ledyard (Col. William), b. at Groton, Conn., in 1738; was in Sept., 1781, commander of Fort Griswold, near New London, which he defended with great courage against an overpowering British force until it was taken by storm, when, with more than 100 of his soldiers, he was massacred by the exasperated enemy, Sept. 7, 1781. A monument now commemorates the event.

Lee, county of Alabama, bounded E. by Georgia. Area, 620 square miles. It is hilly, but fertile. Cotton and corn are staple products, and flour is the leading article of manufacture. The county is traversed by the East Alabama and Cincinnati and the Savannah and Memphis R. Rs., and branches of the Western R. R. of Alabama. Cap. Opelika. Pop. 21,750.

Lee, county in Eastern Arkansas, formed in 1873 from portions of Crittenden, Monroe, Phillips, and St. Francis, bounded on the E. by the Mississippi and traversed by the St. Francis and L'Anguille rivers. The surface is for the most part level, well timbered, and fertile, and yields very abundant crops, chiefly of cotton and corn. Cap. Mariana.

Lee, county of S. W. Central Georgia. Area, 350 square miles. It is level and fertile. Cotton and corn are the staple products. It is traversed by the South-western R. R. of Georgia. Cap. Starkville. Pop. 9567.

Lee, county of N. Illinois. Area, 792 square miles. It is level and very fertile. Cattle, grain, and wool are the staple products. The county is traversed by Rock and Green rivers, and by various railroads, centring at Dixon, the capital. Pop. 27,171.

Lee, county of S. E. Iowa. Area, 500 square miles. It is bounded E. by the Mississippi and S. W. by the Des

Moines. It is extremely fertile, rolling, and well cultivated. Cattle, grain, and wool are staple products. Carriages, furniture, harnesses, tobacco, metallic wares, cooperage, lumber, brick, etc. are among the leading articles of manufacture. The county is traversed by the Burlington and South-western and the Des Moines Valley R. Rs. and a branch of the Chicago Burlington and Quincy R. R. Cap. Fort Madison. Pop. 37,210.

Lee, county of E. Kentucky. Area, 300 square miles. It is mountainous, with fertile valleys. Corn is the staple product. The county is traversed by the Kentucky River. Caps. Beattyville and Proctor. Pop. 3055.

Lee, county of N. E. Mississippi. Area, 520 square miles. It is undulating and very fertile. Live-stock, corn, and cotton are leading products. The county is traversed by the Mobile and Ohio R. R. Cap. Tupelo. Pop. 15,955.

Lee, county of S. W. Virginia. Area, 375 square miles. It is bounded N. W. by the Cumberland Mountains of Kentucky and S. E. by Powell Mountains. The surface is high and partly mountainous. Coal is found. The soil is excellent. Live-stock, grain, and wool are leading products. The county is traversed by Powell's River, and contains much fine scenery. Cap. Jonesville. Pop. 13,268.

Lee, tp. of Fayette co., Ala. Pop. 389.

Lee, tp. of Sacramento co., Cal. Pop. 376.

Lee, tp. of Brown co., Ill. Pop. 1560.

Lee, tp. of Fulton co., Ill. Pop. 1296.

Lee, tp. of Buena Vista co., Ia. Pop. 302.

Lee, tp. of Madison co., Ia. Pop. 426.

Lee, tp. of Polk co., Ia. Pop. 729.

Lee, post-tp. of Penobscot co., Me., 60 miles N. E. of Bangor. Pop. 960.

Lee, post-v. and tp. of Berkshire co., Mass., on the Housatonic River and R. R., 99 miles N. of Bridgeport, Conn., and 10 miles S. of Pittsfield, E. terminus of the Lee and Hudson R. R. (in construction) and N. W. terminus of the Lee and New Haven R. R. (surveyed); has 1 national and 1 savings bank, 1 weekly newspaper, 7 churches, 3 hotels, a public library, excellent schools, 25 paper-mills, 2 iron-foundries, 3 machine-shops, extensive woollen-factories, a trotting park, and fine marble-quarries which supplied materials for the Capitol extension at Washington and for the Catholic cathedral in New York. First settled in 1760, incorporated in 1777, and named for Gen. Charles Lee; first paper-mill erected in 1806 by Samuel Church. Pop. 3866. (See *History of Lee*, by Amory Gale, 1854.)

J. A. Royce, Ed. "Valley Gleaner."

Lee, tp. of Allegan co., Mich. Pop. 249.

Lee, tp. of Calhoun co., Mich. Pop. 1123.

Lee, tp. of Platte co., Mo. Pop. 2290.

Lee, post-tp. of Strafford co., N. H., 33 miles E. by S. of Concord, has manufactures of leather and lumber. Pop. 776.

Lee, post-tp. of Oneida co., N. Y. Pop. 2656.

Lee, post-v. and tp. (the former called also Albany) of Athens co., O. It is the seat of Atwood Institute (Free Baptist). Pop. 1146.

Lee, tp. of Carroll co., O. Pop. 901.

Lee, tp. of Monroe co., O. Pop. 1114.

Lee, tp. of Williamsburg co., S. C. Pop. 1181.

Lee, tp. of Accomac co., Va. Pop. 6183.

Lee, tp. of Fairfax co., Va. Pop. 1346.

Lee, tp. of Shenandoah co., Va. Pop. 2698.

Lee, tp. of Calhoun co., W. Va. Pop. 608.

Lee, tp. of Clark co., Wis. Pop. 203.

Lee (Rt. Rev. Alfred), D. D., b. at Cambridge, Mass., Sept. 9, 1807; graduated at Harvard in 1827; was admitted to the bar in 1830, and practised law at Norwich, Conn, 1831–33; studied in the General Theological Seminary, N. Y.; was ordained a deacon of the Protestant Episcopal Church in 1837, and a priest in 1838; rector of Calvary church, Rockdale, Del., 1838–41; consecrated bishop of Delaware in 1841, and became also rector of St. Andrew's, Wilmington, Del. He is author of *Life of St. Peter* (1852), *Life of St. John* (1854), *Treatise on Baptism* (1854), *Memoir of Susan Allibone* (1856), *Harbinger of Christ* (1857).

Lee (Ann), b. at Manchester, England, Feb. 29, 1736; worked in a cotton-mill, and afterwards became a cook; was married to a man named Stanley, and soon began to take part in the conventicles of John and Jane Wardley, the original "Shaking Quakers," whom she succeeded as the leader of the sect in 1771, soon after which she was for a time confined in a jail, and then in a mad-house. After her release she was acknowledged as a "mother in Christ," and assumed the title of "Ann, the Word." In 1774 she went with a few followers to New York, and in 1776 settled at Watervliet, near Albany. Here she was charged with high treason and witchcraft, and imprisoned for some time at Albany and Poughkeepsie. This imprisonment, regarded as a persecution, brought her many followers. (See Shakers.) D. at Watervliet, N. Y., Sept. 8, 1784.

Lee (Arthur), M. D., LL.D., b. in Westmoreland co., Va., Dec. 20, 1740, son of Thomas Lee; educated at Eton and Edinburgh, where he graduated as M. D. in 1765, and practised at Williamsburg, Va.; returned to Europe; studied law, and was admitted to the bar in 1770; became prominent in public affairs in London, and in after years served as commissioner of Massachusetts, Virginia, and finally of the General Congress, in London, Paris, Madrid, and Berlin successively. While in Paris he and Mr. Izard were involved in serious differences with Franklin and Silas Deane. In 1781 he was in the Virginia assembly; was in Congress 1782–85, and held other positions of importance. D. Dec. 14, 1792. Mr. Lee's mission in Europe was very fruitful of good to the U. S. Personally, he was a truthful, straightforward, and decided man, a hearty lover of freedom, and was never married. (See his *Life*, by R. H. Lee, 1829.) He was a brother of Francis Lightfoot, Richard H., Thomas L., Philip L., and William Lee, all eminent patriots.

Lee (Charles), b. at Dernhall, Cheshire, England, in 1731, and was the son of a colonel in the British army. When eleven years old he entered the service; was in Braddock's expedition, and was wounded at Ticonderoga in 1758; distinguished himself in Portugal, but never rose higher in the British service than a half-pay lieutenant-colonel, his meddlesome disposition, quarrelsome temper, and sarcastic speeches about his superiors interfering with his promotion. He became later a soldier of fortune; aide-de-camp to the king of Poland and a major-general; entered the Russian service against the Turks, and became notorious as a duellist. In 1773 he came to America, purchased an estate in Berkeley co., Va., and became an ardent Whig. In 1775 he was chosen major-general of the Continental army; took part in the defence of Charleston; and in 1776 was taken prisoner at Baskingridge, N. J. While in prison it is now considered certain that Lee made treasonable propositions to the enemy. In 1778 he was exchanged, and at the battle of Monmouth his insubordination nearly lost the day. He was court-martialed, and suspended for one year from command, and soon after was wounded in a duel by Col. John Laurens, who challenged him in consequence of disrespectful language used to Gen. Washington. He then retired to Virginia, where he led the life of a hermit; and a disrespectful letter sent by him to Congress caused his dismissal from the service. D. while on a visit to Philadelphia Oct. 2, 1782. (His *Life* has been written by Sir H. Bunbury, by Edward Langworthy, by J. Sparks, and by G. H. Moore, 1861.)

Lee (Charles Alfred), M. D., b. at Salisbury, Conn., Mar. 3, 1801; graduated at Williams College, and took his medical degree at Pittsfield, Mass., in 1825; settled in 1826 in New York, where he was one of the founders of the Northern Dispensary. He held at various times professorships in no less than ten medical schools, and aided in founding the medical college of the University of New York City and that of Buffalo, N. Y. He wrote much on medical and other subjects, and was at one time editor of the *N. Y. Journal of Medicine*. He bestowed much attention upon the colonization or Gheel-system of the treatment of the insane. D. at Peekskill, N. Y., Feb. 14, 1872.

Lee (Eleanor Percy), b. near Natchez, Miss., in 1820, was the daughter of Maj. N. A. Ware; resided in Philadelphia and Cincinnati, and became the wife of H. W. Lee of Vicksburg, Miss. With her sister, Mrs. C. A. Warfield of Kentucky, she published *Poems by Two Sisters* (1843) and other works. D. in 1850.

Lee (Eliza Buckminster), b. in Portsmouth, N. H., about 1794, daughter of Rev. Dr. Joseph and sister of Rev. J. S. Buckminster, married Mr. Thomas Lee of Boston; wrote *Sketches of a New England Village* (1837), a *Life of Richter* (1842), translated from the German; *Walt and Vult* (1845) from the German of Richter; *Naomi, or Boston Two Hundred Years Ago* (1848), *Memoir of Rev. Dr. Buckminster and Joseph S. Buckminster* (1849), *Florence, the Parish Orphan* (1850), *Parthenia, or the Last Days of Paganism* (1858), and *The Barefooted Maiden*, from the German of B. Auerbach. D. in Brookline, near Boston, June 22, 1864.

Lee (Francis Lightfoot), son of Thomas, b. at Stratford, Westmoreland co., Va., Oct. 14, 1734; received a careful classical and English education from a private tutor; inherited an ample estate; served in the house of burgesses

from 1765 to 1772, and four terms as delegate in the Continental Congress from 1775 to 1779; was a signer of the Declaration of Independence; member of important committees, and frequently chairman of the committee of the whole. He rendered important services in framing the old Articles of Confederation, and insisting, as conditions of peace with England, upon the right to the navigation of the Mississippi, and to the Newfoundland fisheries, thereby justly earned the gratitude of New England. He seldom spoke in Congress, but exercised great influence, and was a consistent friend and supporter of Washington in the most critical times. Retiring from Congress in 1779, he resumed the life of a country gentleman, distinguished for geniality and wit, but averse to politics, in which he did not again figure except by a brief service in the Virginian senate. D. at Monocan, Richmond co., Va., in 1797.

Lee (Frederick George), D. C. L., b. at Thane Vicarage, Oxfordshire, England, Jan. 6, 1832; graduated at Oxford with high honors in 1854; took holy orders in 1856; was successively curate of Sunningwell, assistant minister of Berkeley chapel, incumbent of St. Mary's, Aberdeen, and vicar of All Saints', Lambeth, which post he now fills (1875). Dr. Lee was from 1857 to 1869 a secretary of the Society for the Promotion of the Union of Christendom, founded the *Union Review* in 1863 and conducted it until 1869, and has been a frequent contributor to the *Church Magazine;* has written several volumes of poems and many theological essays, of which *Glimpses of the Supernatural* and *Lyrics of Light and Life*, both published in 1874, attained considerable popularity. Dr. Lee is a writer of undeniable ability, but his avowed belief in the ecclesiastical miracles of the fourth century and in many modern marvels has exposed him to sharp criticism.

Lee (Frederick Richard), R. A., b. at Barnstaple, England, in June, 1798; served in the Netherlands at an early age as an officer of the 56th Foot; studied painting and acquired a high reputation for landscapes, especially of English and Scotch scenery, his pictures having been purchased for the most celebrated private galleries of England. He began exhibiting at the Royal Academy in 1824; was elected Associate in 1834 and Academician in 1838. He has executed notable joint works with Thomas Sidney Cooper, R. A.

Lee (Hannah F.), b. in Newburyport, Mass., in 1780, daughter of Dr. Sawyer, and became the wife of George G. Lee of Boston, Mass. She was the author of many excellent books, among which are *Three Experiments of Living* (1838), *The Old Painters* (1838), *The Huguenots in France and America, History of Sculpture and Sculptors* (1854), *Memoir of Pierre Toussaint* (1853). D. in Boston, Mass., Dec. 28, 1865.

Lee (Harriet), b. in London, England, in 1756; published in 1786 a novel in 5 vols., *The Errors of Innocence*, and in 1787 a drama, *The New Peerage;* followed at much later dates by two other dramas and another novel. She is best known as associated with her sister (see Lee, Sophia) in the authorship of the *Canterbury Tales* (5 vols., 1797–1805), once extremely popular, and reprinted in New York in 1857. Eight of the ten tales were from Harriet's pen, the most remarkable being *The German's Tale;* and *Kruitzner*, which supplied Byron the plot, the machinery, and some of the language of *Werner*. D. at Clifton Aug. 1, 1851.

Lee (Gen. Henry), the father of Robert E. Lee, and a relation of R. H. Lee, b. in Westmoreland co., Va., Jan. 29, 1756; graduated at Princeton in 1773; in 1776 entered the army as a captain of horse, and served afterwards both in the North and South in command (as major and afterwards as lieutenant-colonel) of a partisan corps known as "Lee's Legion," while Lee himself was familiarly known as "Lighthorse Harry." He became renowned for boldness, activity, and efficiency. He retired from the army soon after the battle of Eutaw, in which he distinguished himself greatly. He was in Congress in 1786; was governor of Virginia 1792–95; commander-in-chief of the expedition against the whisky insurgents 1794; and again a member of Congress in 1799. In his celebrated eulogy on Washington, prepared by direction of Congress, occur the words, "First in war, first in peace, and first in the hearts of his countrymen." In 1809 he was confined for debt in Spottsylvania co., Va., and wrote his *Memoirs of the War in the Southern Department* (1809). In 1814 he was in Baltimore, the guest of Mr. Alexander C. Hanson, at the time when the house of that gentleman was attacked by a mob. Gen. Lee took part in the defence of the house, and was afterward put into the city jail for safety, but the mob entered the jail, and killed or cruelly maimed the whole party. Gen. Lee never recovered from his injuries. He went for his health to the West Indies, and d. on the return journey, on Cumberland Island, Ga., where he was the guest of Mrs. Shaw, a daughter of Gen. Greene, Mar. 25, 1816. He was frank, generous, and impulsive; and in the opinion of Gen. Greene did more than any other man to bring about the triumph of the American arms in the Southern department.

Lee (Henry), a brother of Gen. R. E. Lee, b. at Stratford, Westmoreland co., Va., in 1787; graduated in 1808 at William and Mary College; became major 36th Infantry in 1813. He was author of *The Campaign of 1781* (1824), *Life of Napoleon* (vol. i., 1835), *Observations on the Writings of Thomas Jefferson* (1832). D. at Paris Jan. 30, 1837.

Lee (Henry W.), b. at Hamden, Conn., July 26, 1815, and d. in Davenport, Ia., Sept. 26, 1874; received deacon's orders in 1838; in 1840 became rector of a church which he had built up at Springfield, Mass.; in 1848 received charge of St. Luke's church at Rochester, N. Y., where he remained till 1854, when he was chosen bishop of Iowa, which position he held at his death. J. B. Bishop.

Lee (Jesse), b. in Prince George's co., Va., Mar. 12, 1758; joined the Methodist Church in 1773; in 1783 was received into the conference; in 1787 penetrated New England, and preached from the Connecticut to the farthest settlements in Maine. He formed the first Methodist "class" in New England at Stratfield, Conn., Sept. 26, 1787, and the first in Boston, Mass., July 13, 1792. He was three times elected chaplain to the U. S. House of Representatives and once to the Senate. In 1807 he published at Baltimore, Md., his *History of Methodism in America*. D. Sept. 12, 1816. Abel Stevens.

Lee (John), LL.D., F. R. S., b. in London Apr. 28, 1783; graduated at St. John's College, Cambridge, in 1806; became fellow, and travelled extensively in the East, making collections of antiquities. In 1815 he took the name of Lee (his original name having been Fiott) upon inheriting the property of an uncle, and devoted himself to science. He was a member of fifteen or twenty learned societies, and was for two years president of the Royal Astronomical Society. He erected a magnificent observatory at his residence near Aylesbury, Bucks, and engaged competent astronomers to conduct the observations. D. at Hartwell House Feb. 25, 1866.

Lee (Leroy Madison), D. D., b. in Petersburg, Va., 1808; joined the Virginia Methodist Conference in 1828; in 1836 was appointed editor of the *Richmond Christian Advocate;* in 1859 resumed the pastoral office. He has published *Life and Times of Jesse Lee, Advice to a Young Convert*, etc. Abel Stevens.

Lee (Luther), D. D., b. at Schoharie, N. Y., Nov. 30, 1800; became a Methodist travelling preacher of the M. E. Church in 1827; lectured in favor of temperance and the abolition of slavery, being mobbed several times; seceded on account of slavery from the M. E. Church in 1842; joined the new body of "Wesleyan Methodists," became pastor of a church in Syracuse (1843); president of the first Wesleyan Methodist general conference in 1844, and editor in New York of the organ of that Church, the *True Wesleyan*. In 1856 he was chosen president of Michigan Union College at Leoni, Mich.; resigned and spent several years in Ohio; became in 1864 professor at Adrian College, Mich.; returned to M. E. Church in 1867, and has since been a member of the Michigan conference. Dr. Lee has edited several papers and written various religious and controversial works.

Lee (Mary Elizabeth), b. at Charleston, S. C., Mar. 23, 1813, was a niece of Judge Thomas Lee. She contributed much prose and verse to periodical literature, and was author of *Tales from History*. D. at Charleston Sept. 23, 1849. (See a *Memoir*, with selections of her poetry, by S. Gilman, D. D., 1851.)

Lee (Nathaniel), b. at Hatfield, Hertfordshire, Eng., about 1657; educated at Trinity College, Cambridge; became an actor and afterwards a dramatic author, producing a new play every year from 1675 to 1681; was several years confined in an insane asylum; aided Dryden in writing *Œdipus* and the *Duke of Guise*. He was killed in an affray in London in 1690. Two of his eleven tragedies, *Theodosius* and *Alexander the Great*, were successful acting dramas throughout the eighteenth century.

Lee (Richard Henry), signer of the Declaration of Independence, son of Thomas, b. at Stratford, the family-seat of the Lees, in Westmoreland co., Va., Jan. 20, 1732. He was educated in England, and after his return marched with a company to join Braddock, who rejected his services with an ill-judged expression of contempt for the "provincials." He was early chosen to the house of burgesses, where he at once took a commanding position on the side of popular rights. He was in Congress 1774–77, 1784–85, and 1786–87. He was the author of the famous motion of June 7, 1776, "That these United Colonies are, and of right ought to be, free and independent States," etc., and advocated the Declaration of Independence in a bold and

brilliant speech. During 1780 he was for a portion of the time in the field at the head of the militia of Westmoreland co. He was a Senator from Virginia 1789–92, and, though not a Federalist, supported the administration of Washington with zeal. D. at Chantilly, Va., June 19, 1794. He was a man of amiable and noble character, of commanding presence, excellent abilities, and self-sacrificing patriotism. (See his *Life and Correspondence* (1825), by R. H. Lee, his great-grandson.)

Lee (Robert), D. D., b. at Tweedmouth, North Durham, Eng., Nov. 11, 1804; entered the University of St. Andrew's in 1824; was ordained in the Church of Scotland in 1832; was minister at Arbroath (1833) and at Campsie (1836), and in 1843, on the disruption of the Scottish Church, was appointed by the town council of Edinburgh to the pastorate of the Old Grey Friars' Church. In 1844 he published a translation, with a preface, of *The Theses of Erastus touching Excommunication*, as a reply to the writers of the "Secession Church," who charged the adherents of the establishment with "Erastianism." In 1846 he became regius professor of biblical criticism in the University of Edinburgh, and devoted himself at once to a course of minute investigations upon the text of the Bible, which resulted in the great work of his life, *The Holy Bible, with about 60,000 Marginal References and Various Readings, revised and improved*, published at Edinburgh, Glasgow, and London in 1854. He was charged by the *Witness* newspaper with inculcating heresy in regard to universal salvation, and vigorously defended himself in the columns of the *Scotsman*. In 1858, Dr. Lee was a member of a deputation sent to London to appeal before a parliamentary committee on the subject of university reform, and his suggestions were embodied in the measure as finally passed. In 1857 he published a volume of *Prayers for Public Worship*, and having employed them in his own parish, was arraigned in 1859 before the presbytery of Edinburgh, and later before the General Assembly, on a charge of introducing into public worship a liturgy and certain forms and postures unknown to the Church of Scotland. Dr. Lee argued his own case in a speech of great eloquence, and obtained a verdict in his favor. In 1860 he published *The Reform of the Church of Scotland in Worship, Government, and Doctrine*, in which he discussed liturgy, postures in worship, instrumental music, and the propriety of observing certain festivals and fasts, with a tendency towards bringing the Church of Scotland into greater harmony with the age. The General Assembly of 1863–64 reported favorably upon these views, and on the 22d of Apr., 1865, an organ was first opened in his church of Grey Friars—an event which marked an era in the national Church, and has been frequently imitated. The action of 1864 was, however, reversed by the General Assembly of 1865, and Dr. Lee was preparing to contest his favorite views before the civil courts when he was attacked with paralysis, and d. at Torquay Mar. 12, 1868. Dr. Lee was the acknowledged leader of the liberal party in the Scottish Church. (See his *Life and Remains*, by Rev. R. H. Story, 1870.)

Lee (Robert Edward), b. at Stafford House, Westmoreland co., Va., on Jan. 19, 1807. Having been entered as a cadet at the U. S. Military Academy at West Point in 1825, he was graduated, second of his class, in 1829, and attached to the army as a second lieutenant of engineers on the 1st of July of that year. Habitually employed upon the most important duties of his corps in time of peace, he had also, previously to 1846, been specially detailed to aid in establishing the boundary-line between Ohio and Michigan, and from 1837 to 1841 was superintending engineer of the improvements in the harbor of St. Louis and of the Missouri and upper Mississippi rivers, to which was added, from 1840 to 1841, the supervision of the improvements in the navigation of the Ohio below Louisville, and of the lower Mississippi. Already a captain of engineers since July 9, 1838, he first saw field-service in the war with Mexico as chief engineer with Gen. Wool. But when Gen. Scott took command for the principal operation against the Mexican capital in Mar., 1847, he called Capt. Lee to his side. In that brilliant campaign he was conspicuous for professional ability as well as for gallant and meritorious conduct, winning in quick succession the brevets of major, lieutenant-colonel, and colonel for his part in the battles of Cerro Gordo, Contreras, Churubusco, Chapultepec (in which latter action he was wounded), and in the capture of the city of Mexico. By the close of the war he had come to be generally regarded in the army as the one officer best fitted ultimately to succeed Gen. Scott in the chief command. Called to Washington for a time as assistant to the chief engineer of the army, he resumed his place on the board of engineers charged with the defence of the Atlantic coast. From Sept. 1, 1852, to the end of Mar., 1855, he was superintendent of the Military Academy, a position which he gave up to assume the duties of lieutenant-colonel of the 2d Cavalry, to which he had been appointed on Mar. 3, 1855, at the formation of that regiment. For several years he now served on the Texas border; but happening to be on leave of absence, near Washington, at the time of the raid of John Brown (Oct. 17 to 25, 1859), Col. Lee was placed in command of the Federal forces employed in its repression. Having soon after returned to his regiment, he fell in command of the department of Texas during the greater part of 1860. On Mar. 16, 1861, he became colonel of his regiment by regular promotion, but resigned that commission three weeks later (Apr. 25) upon the secession of Virginia. Repairing to Richmond, he tendered his services to the governor of the State, and by acclamation was appointed commander-in-chief of its forces, with the grade of major-general. Extracts from his letters at the time show the character of the man. Writing to Gen. Scott, he said: "Since my interview with you on the 18th inst. I have felt that I ought not longer to retain my commission in the army. I therefore tender my resignation, which I request you will recommend for acceptance. It would have been presented at once, but for the struggle it has cost me to separate myself from the service to which I have devoted all the best years of my life and all the ability I possessed. . . . Save in defence of my State, I never desire to draw my sword." To his sister the same day he wrote: "I am grieved at my inability to see you. I have been waiting for a more convenient season, which has brought to many before me deep and lasting regret. Now we are in a state of war which will yield to nothing. The whole South is in a state of revolution, into which Virginia, after a long struggle, has been drawn; and though I recognize no necessity for this state of things, and would have forborne and pleaded to the end for redress of grievances, real or supposed, yet in my own person I had to meet the question whether I would take part against my native State. With all my devotion to the Union, and the feeling of loyalty and duty of an American citizen, I have not been able to make up my mind to raise my hand against my relatives, my children, my home. I have therefore resigned my commission in the army, and *save in defence of my native State*, with the hope that my poor services will never be needed, I hope I may never be called on to draw my sword. I know you will blame me, but you must think of me as kindly as you can, and believe that I have endeavored to do what I have thought right." Entering upon the duties of his new position, he set to work to organize and develop the defensive resources of his State, having assumed "command of the military and naval forces of Virginia" on Apr. 23, 1861. A month later he directed the occupation in force of the important strategic position of Manassas Junction, which he visited about the 1st of June and gave special directions for its defence. Meanwhile, Virginia having entered the Confederacy and Richmond become the capital, Lee was appointed third in rank of the five generals by virtue of an act of the Confederate Congress creating that grade—Samuel Cooper, lately adjutant-general of the U. S. army, and Albert Sidney Johnston, a brigadier in the same service, being his seniors. For the time he remained at Richmond, generally consulted by Mr. Jefferson Davis concerning military affairs, until the early autumn, when he was assigned to command the forces confronting Gen. Rosecrans, his former junior in the engineer corps. But practically reduced to inaction on that field, Gen. Lee was transferred to the command of the coast of North and South Carolina and Georgia about Dec. 1, 1861, with impaired reputation, which was not retrieved, in public estimation, on that theatre of operations. So the notion grew widespread that, wanting in decision and not a man of action, he was unfitted for practical warfare. The Confederate Congress, however, having created the office of commander-in-chief, Mr. Davis, regarding it as an encroachment upon the executive power, vetoed the law, but not long after, or about the end of Mar., 1862, called Gen. Lee back to Richmond, and nominally invested him with the functions in question, which were exercised without material influence or control over either the organization or operations of Confederate armies. It was in this posture of affairs that Gen. Joseph E. Johnston was wounded at the battle of Seven Pines or Fair Oaks, May 31, 1862. Lee the following day was appointed to succeed him in the direct command of the army assembled for the defence of Richmond, and his first act was to draw all his troops back to their encampments near the city. Their casualties in the late engagements had been rising 6000, and their material gains some 10 pieces of artillery, 6700 rifles and muskets, with considerable subsistence and quartermaster's, medical, and ordnance stores; but Lee wisely stood, as yet, upon the defensive, while gathering all possible reinforcements from the southward, which Johnston declares had, in like need, been withheld from him. In this way, by the night of June 25, 1862, Lee

had added from 23,000 to 25,000 men to his forces, including Jackson's and Ewell's veterans, fresh from their recent successes in the Shenandoah Valley, and had at his disposition an army 80,000 strong, which he soon infused with the belief that he was equal to every emergency in the business of war, and that it was invincible under his lead. McClellan's position, meanwhile, was peculiarly strong; his left and centre, covered by a great morass (White Oak Swamp), extending southward from the Chickahominy nearly to James River; only his right (some 35,000 men) was at all exposed to attack, but well protected by intrenchments and artillery. Thus disposed, there was an army of at least 100,000 men, admirably equipped. His new adversary, now ready for the offensive, put Jackson in motion with three divisions (16,000), by a wide circuit around the Federal right to fall upon its rear with his now well-known vigor, and leaving Magruder with barely 25,000 men to shield Richmond from the mass of McClellan's force, Lee threw Longstreet with 40,000 men forward to a direct attack upon the Union right under Fitz John Porter, late in the afternoon of June 26. Under this attack Porter's corps was pressed back behind Beaver Dam Creek, where he found stable standing-ground; but retreating that night to the stronger position about Cold Harbor, where, reinforced, he successfully withstood all assaults until the full weight of Jackson's turning movement fell upon and overpowered him, driving his shattered divisions across the Chickahominy, with the loss of twenty cannon and many small-arms. The wise audacity of Gen. Lee's plan of attack gave him the field, but the nature of the ground enabled McClellan, in spite of the extreme demoralization of his troops following the disaster, to effect a consummate retreat, though hard pressed at every step in the several affairs of June 28, 29, and 30, to the shelter of naval support in James River and the almost impregnable position of Malvern Hill, the attack upon which was repulsed on July 1 with a heavy Confederate loss. But Richmond was now virtually relieved from the risk of an attack from McClellan and the quarter of James River. A fresh Federal army having been massed soon after in the vicinity of Culpeper Court-house, under Gen. Pope, in menace of an attack from that direction, Jackson was at once detached to confront and stay this fresh danger, and the battle of Cedar Run was won by him on Aug. 9. Ten days later, leaving a force to secure Richmond from a *coup de main*, Lee was in movement with his main army for a stroke at Pope—a movement of signal audacity in execution that ended in the complete discomfiture of his opponent in the notable actions of Aug. 29 and 30, 1862—or second battle of Manassas—with the loss of 30 pieces of artillery and large stores of war material. Following this brilliant success, Gen. Lee threw his victorious corps swiftly across the Potomac into Maryland as far as Frederick Town—an operation more boldly and skilfully conceived than thoroughly carried out in accordance with the offensive objects for which it was undertaken. For while the detached operation entrusted to Jackson resulted in the important capture of Harper's Ferry, so much of Lee's army was diverted to that end for so long a period that in the interval, thrown virtually on the defensive, the Confederate general gave McClellan time to concentrate his masses upon and fight him at Antietam (Sept. 17, 1862) when separated from a material part of his army, and with Jackson present, with two of the previously detached divisions, only under the stress of a severe forced march. Under these circumstances Lee was, therefore, unable to profit decisively from the advantage he gained at the close of that combat, and after standing in position awaiting attack from his now strongly reinforced opponent, he found it expedient to abandon the campaign and retire into Virginia, the major object of his movement having unquestionably been sacrificed to the minor. The Union army having been reorganized during the next month, and a new commander (Gen. Burnside) given it on the 7th of November, he took the offensive with Richmond again as the objective, but Aquia Creek as his base, and reached the N. bank of the Rappahannock at Fredericksburg on the 17th of that month, to find Gen. Lee in due season ready to dispute his further march. Then came the 13th of December, with the bloody conflict of Fredericksburg, which afforded another illustration of the high capacity of the Confederate general as a defensive soldier. With another change of Federal commanders came the battle of Chancellorsville (May 2–4, 1863). Lee, as habitual to him, forecasting his adversary's plan, was now able to give another victory to his supremely confident, trustful army, even though his strongest corps, or one-third of his force, was detached at the time. As the whole field or theatre of war stood, after that battle, for the Confederates in all quarters of their territory, it would seem clear that a comprehensive strategy must have indicated the employment of their available resources in a different operation from that which Lee next essayed, as is alleged, entirely against his own judgment and advice, under the orders of his political superior—that is to say, the campaign ending in mortal disaster to the Confederate cause on the field of Gettysburg (July 1–3, 1863), from which he withdrew shorn of some 27,000 of the very élite of his army, as well as of its prestige of habitual success, which had made it wellnigh invincible. But, though beaten and foiled, he withdrew and repassed the Potomac with consummate method and skill, leaving his opponent wholly unwilling to seriously adventure the offensive in turn for ten months. By that time, however, Lieut.-Gen. Grant, made commander-in-chief of the armies of the U. S. with absolute powers, took the field against Gen. Lee with an army of over 140,000 men, thoroughly inured to war. To meet this formidable general and army Lee stood as resolutely ready as on all previous occasions, but his redoubtable corps were reduced to within 55,000 infantry and artillery. The object of Grant was to turn his adversary's position, and reaching an open field beyond the Wilderness, upon Lee's communications, force him to fight for their integrity at mortal disadvantage. But altogether too wary and far-sighted to be thus out-manœuvred, Gen. Lee became himself the assailant at the threshold of the operation, when his adversary was entangled and his corps dangerously separated in the dense recesses of the Wilderness, on May 5, 1864, and inflicted a loss of 20,000 men. On the next day, Grant essaying to move, Lee was again the assailant, with the advantage of the affair on his side. Assailed in turn, however, on May 7, 10, and 12, in tentative operations, Lee's position was found impregnable, so that at the close of the third week of the campaign the aggregate of Federal losses rose above 40,000 officers and men. Grant having skilfully crossed the North Anna on May 21, the gain was immediately so neutralized by the position in which he found his adversary awaiting his further march that the Union army had to retrace its steps, and, led by a wide circuit, was carried to the scene of McClellan's disaster at Cold Harbor within ten miles of Richmond. There, reinforced by Smith's corps, 16,000 strong, making the sum-total of reinforcements 97,000 men added to his army between the 12th and 31st of May, 1863, while the Confederates had been strengthened, all told, by less than 20,000 men, Gen. Grant on June 3 adventured a direct assault upon Lee's intrenched lines, and it may be said that the annals of war record no more sanguinary repulse than that which was then inflicted. It is noteworthy that by this time the casualties of the Union army reached 60,000, including 3000 officers; and it remained for Gen. Grant to seek a new line of approach to his objective; that is to say, throwing his army across the James and S. of the Appomattox on June 14 and 15, 1864, he opened a new campaign at Petersburg of 300 days. Looking at the force employed against him during all that period, and his own comparatively petty resources, Lee's stand at Petersburg has no parallel in war, and the details of that masterly defence, properly related, will form one of the most instructive lessons in the art of war. From the very outset, notwithstanding his great advantages in all war-resources, in the presence of such an adversary as Lee, Gen. Grant found it expedient to shelter his forces behind strong intrenchments. In the course of the ten months of struggle and combat which ensued, from a concurrence of adverse circumstances elsewhere than at Petersburg, Lee, foreseeing the ultimate issue, would have evacuated that position early in 1865, but his political superiors were unwilling to give up Richmond until forced away by Federal arms. Reduced to about 40,000 rifles in his trenches, on Mar. 25, 1865, the Confederate general, with that astute audacity which had come to be characteristic, essaying the offensive, delivered a strenuous, skilfully-aimed stroke in his finest manner at a vulnerable point in his opponent's lines; but at the critical moment the supports quailed, and the enterprise miscarried, with a loss which he could ill afford. Now Grant in turn massed two corps and all his cavalry for a counter-stroke at Lee's right flank. But before the blow fell, the Confederate general, concentrating 15,000 men, again smote his menacing adversary with wellnigh "his wonted success," Swinton states, as also that a Federal disaster was barely escaped. But the terrible blow fell soon after upon the Confederate lines at Five Forks, which made them untenable. So Lee, retreating, was pressed with such vigor and skill that his surrender at Appomattox was the absolute necessity of the campaign. And although that capitulation embraced only some 27,000 men, but 8000 of whom were armed, it brought the war of secession in all quarters to an immediate close so soon as the event was known.

Judged critically, it may be said that rarely has a commander been so sharp-sighted and quick to detect the purposes of an opponent as was Gen. Lee. Never surpassed,

if ever equalled, in the art of winning the passionate, personal love as well as admiration of his troops, he acquired and held an influence over his army to the very last instant, founded on a supreme trust in his judgment, prescience, and skill, coupled with his cool, stable, equable courage, which enabled him to make it relatively the incomparable instrument of his plans. In the crisis of disastrous battle, as at Gettysburg, and also on that day at Petersburg when the whole Federal army seemed surging in upon him through the breach in his lines opened by the exploded mine, Gen. Lee was seen to be as placid and cheerful, as free from anxiety and clear-headed, as at the close of a day of victory. Strategically defective and ill-conceived, yet the Gettysburg campaign was executed by Lee with a masterly knowledge of the theatre of operations, unsurpassed celerity, and secrecy of movement, and with all possible care of his communications; but it must be added that in that battle, as also previously in the sanguinary assault upon McClellan in 1862 at Malvern Hill, there was a serious lack of that tactical concentration of his masses on the part of the Confederate general which was essential to success. It is also apparent that he was wanting in the talent of administration which distinguished Wellington; unlike whom also, with all his military virtues, Lee was careless of the discipline and training of his army. From temperament, likewise, he gave way, as no general so placed ever should consent to do in matters of supreme military concern, to his political chief, and hence not only undertook false campaigns, like that of the second invasion, and maintained too long a position, like that of Petersburg in 1865, but he failed to throw the decisive weight of his great personal and professional authority against that settled policy of wide dispersion of its forces which proved so fatal to the Confederate cause. For the proper measure of Gen. Lee's rank among the soldiers of history, however, seeing what he wrought with such resources as he had, under all the disadvantages that ever attended his operations, it were fair to suppose what he might have achieved in campaigns and battles with resources at his own disposition equal to those against which he invariably contended.

In person, Robert E. Lee was of remarkable manly beauty, with a distinguished martial appearance and carriage. Left at the close of the war without estate or profession, he accepted with alacrity the presidency of Washington College at Lexington, Va., to which simple employment he gave the same devotion, with the like high sense of duty, which had distinguished the captain of engineers and the commander of the chief army of one of the belligerents in a mighty civil war. At the same time, not unmindful of the large influence he had acquired over his section, he lost no opportunity to use that influence to soften and assuage the passions and animosities of his people. "Madam, do not train up your children in hostility to the government of the U. S.," are authentic characteristic words which he uttered to one widowed by the war, who in bringing her son to him for education had spoken bitterly. But sixty-three years of age, with apparent promise of prolonged health and a life of usefulness and influence, he was taken suddenly ill, and in a fortnight d. Oct. 12, 1870, at Lexington. THOMAS JORDAN.

Lee (SAMUEL), D. D., b. at Longnor, Shropshire, England, May 14, 1783; received his first instruction at a charity school, and was at the age of twelve apprenticed to a carpenter. While laboring at this trade he acquired the chief classical, Oriental, and modern languages, and at the age of thirty was enabled to enter Queen's College, Cambridge, as a student, graduating in due course, taking orders in the Church, becoming in 1819 university professor of Arabic, and regius professor of Hebrew in 1831. He published a *Hebrew Grammar*, which had a wide circulation in England and America (1830), translations of the *Travels of Ibn Batuta* (1833), and of the *Book of Job* (1837), and a *Hebrew and English Lexicon* (1840). D. at Barley, Hertfordshire, Dec. 16, 1852.

Lee (SAMUEL PHILIPS), U. S. N., b. Feb. 13, 1812, in Virginia; entered the navy as a midshipman Nov. 22, 1825; became a passed midshipman in 1833, a lieutenant in 1837, a commander in 1855, a captain in 1862, a commodore in 1866, a rear-admiral in 1870; retired from active service Feb. 13, 1873. Commanded the Oneida with distinguished gallantry at the passage of Forts Jackson and St. Philip and capture of New Orleans, "driving off the assailants of the Varuna, and preventing her officers and crew from being captured by the Confederates." From 1862 to 1864 commanded the North Atlantic blockading squadron, and from 1864 to 1865 the Mississippi squadron. From 1866 to 1867 president of the board to examine volunteer officers for admission into the navy; 1868 to 1870 chief signal-officer of the navy; 1870 to 1873 in command of the North Atlantic fleet. FOXHALL A. PARKER.

Lee (SARAH WALLIS), b. in Colchester, England, in 1791; married Thomas Edward Bowdich, whom she accompanied to the Gold Coast of Africa in 1814, residing there until 1822. Mr. Bowdich was employed as a commissioner to conclude a treaty with the king of Ashantee in 1815, and with the aid of his wife published in 1819 a work entitled *A Mission to Ashantee.* He d. at Bathurst, Isle of St. Mary, Jan. 10, 1824. Mrs. Bowdich published in 1825 *Stories of Strange Lands*, in which she narrated with great effect her observations in Africa, edited three illustrated works on mammalia, birds, and shells, written by her late husband, and prepared other original works of the same character, which gave her an honorable name in the annals of British science. Mrs. Bowdich resided many years in Paris, where she enjoyed the friendship of Baron Cuvier and other distinguished naturalists, and married her second husband, Mr. Lee. D. in 1856.

Lee (SOPHIA), b. in London in May, 1750, daughter of an actor, and in 1780 wrote a comedy, *The Chapter of Accidents*, which was brought out with success at the Haymarket Theatre. The profits of this play enabled Miss Lee to establish at Bath (1781) a seminary for young ladies, which was for many years conducted by her along with her sister (see LEE, HARRIET), with whom her name is inseparably connected in the authorship of the celebrated *Canterbury Tales.* Two only of these tales, and the introduction, were written by Harriet. She wrote two novels and a tragedy, which were moderately successful, and another comedy, which proved a failure. D. at Clifton, near Bristol, Mar. 3, 1824.

Lee (THOMAS), b. in Virginia about the beginning of the eighteenth century; was third son of Richard Lee, a member of the council and grandson of Richard Lee, the founder of the family in America, who as a Cavalier played a distinguished part in Virginia along with Berkeley in securing the allegiance of that colony to the Stuarts. Thomas Lee succeeded to the ancestral estate at Stratford, Westmoreland co., on the "Northern Neck;" became president of the council; and his commission as governor had just been made out when he d. in 1750. He had married Hannah, daughter of Col. Philip Ludwell, a member of the council, and by her had six sons, all of whom were distinguished for their public services during the Revolution: Philip Ludwell, a member of the council; Thomas Ludwell, b. about 1730, member of the house of burgesses, of the conventions of 1775 and 1776, of the Committee of Safety, and one of the judges of the supreme court, d. soon after, aged 47; RICHARD HENRY, FRANCIS LIGHTFOOT, and ARTHUR (see those names); and William, the fifth son, b. about 1737; was agent of Virginia in England; elected sheriff of London in 1773 and alderman in 1775; afterwards diplomatic agent of the U. S. at the Hague, Vienna, and Berlin; recalled in 1779, and d. at Greenspring, Va., June 27, 1795. In the third and fourth generation from Thomas this family, allied by descent and intermarriage to the Lees of military celebrity, has produced several influential citizens.

Lee (WILSON), b. in Sussex co., Del., in 1761; became an itinerant Methodist in 1784; travelled and preached in Kentucky, and after 1794 went to New England, and shared with Jesse Lee in the founding of Methodism there. D. in Anne Arundel co., Md., Oct. 11, 1804. ABEL STEVENS.

Lee Centre, post-tp. of Lee co., Ill. Pop. 1028.

Lee Centre, post-v. of Lee tp., Oneida co., N. Y., 9 miles N. W. of Rome, has some manufactures. Pop. 355.

Leech [Ang.-Sax. *læce*], a name vaguely applied to various representatives of the order Bdellodea or Sanguisugaria, but especially employed for the species of the family Hirudinidæ. This group has a number of genera and species, and all of them have in common an elongated, flattened, and transversely annulate body, which is narrowed anteriorly and obtuse posteriorly; the anterior extremity has an oval sucker, and within the mouth are three jaws converging backwards and denticulated in their margins; ten inconspicuous eyes are developed on the upper lip; the posterior extremity has a large round, obliquely-inserted sucker. The sexes are united in one individual. The best-known species are the officinal leeches (*Hirudo officinalis*, *H. medicinalis*, and *H. troctena*). Leeches afford the least painful means for the local abstraction of blood. They take from three to five times their weight in blood, six generally being applied for every fluid ounce of blood to be lost. To disgorge the blood, apply salt or squeeze them. The medicinal leech is cultivated in Europe, being kept in ponds in natural meadows, and increase rapidly, horses, cows, etc. being driven in to feed them, or the leeches immersed in warm blood deprived of fibrine. They are kept in clear soft water in jars, and are sensitive to change of weather. THEODORE GILL.

Leech (JOHN), b. in London in 1817. His father for many years kept the London Coffee-house on Ludgate Hill.

Leech was educated at Charter-house, and was a student at the Royal Academy. As an artist he was neglected. His genius appeared in sketches of character for *Bell's Life in London;* in 1847 he began to work as a designer for *Punch,* and for eighteen years made that journal famous among journals by the wit, originality, versatility, and humor of his pencil. In 1861 a rich Manchester firm enabled the artist to reproduce many of his drawings by a newly-invented mechanical process in large size and colored. These were exhibited at Egyptian Hall. Leech d. Oct. 30, 1864. O. B. FROTHINGHAM.

Leech, tp. of Wayne co., Ill. Pop. 1258.

Leech'burg, post-b. of Armstrong co., Pa., on the Pennsylvania Central R. R. and Pennsylvania Canal, 35 miles N. E. of Pittsburg, has 4 churches, 2 hotels, 1 weekly newspaper, 1 bank, an academy, a flouring-mill, 8 stores, a wagon and carriage manufactory, tin-factory and rolling-mill; the two latter use for fuel a natural gas obtained from a well 1200 feet deep. A fine school-building is now (1875) being erected at a cost of $20,000. Pop. 368.
J. F. ROBERTSON, ED. "ENTERPRISE."

Leech Lake, in Cass co., Minn., is 20 miles long, 16 miles wide, and discharges its waters into the Mississippi by the Leech Lake River. Elevation, 1330 feet. It is in a well-timbered region, inhabited by the Leech Lake Indians, a band of Chippewas.

Lee Creek, tp. of Crawford co., Ark. Pop. 654.

Leeds, municipal and parliamentary borough of England, and one of its leading manufacturing cities, situated in the West Riding of Yorkshire, on the northern bank of the Aire, here crossed by two stone and four iron bridges, which connect the city proper with its two large suburbs, Hunslet and Holbeck, situated on the southern bank of the river. Most of the streets are narrow and crooked, though generally well paved and well lighted. The western part of the city, however, contains several fine streets lined with elegant houses. The most remarkable of the public buildings are—St. Peter's church, rebuilt in 1838, and the largest of the thirty-six churches of the city; the town-hall, with several fine statues; the grammar school, the corn exchange, the cloth hall, the borough jail, etc. The city has many benevolent and educational institutions, such as the Mechanics' Institute, founded in 1824, with a library of 13,000 vols.; the School of Art, which annually gives instruction in drawing to 3000 persons; the Workingmen's Institute, numbering about 2000 members, etc. As a manufacturing place Leeds was conspicuous already in the sixteenth century, and the products of its industry were at that time nearly the same as now—namely, woollens, linens, and leather. But at first it was only the coarser kinds of woollens which were manufactured at Leeds, while now its cloths can compete in fineness and elegance with those of any other place. About 12,000 hands are employed in this kind of manufacture, and a similar number in that of linens. Of late the iron manufactures have grown very considerably; machinery is annually made to the value of about £2,000,000. Near the city are the beautiful ruins of Kirkstale Abbey. Pop. 151,850 in 1841; 171,805 in 1851; 207,153 in 1861; 259,212 in 1871.

Leeds, county of Ontario, Canada, bounded on the S. E. by the St. Lawrence River. Area, 805 square miles. It is in part united for judicial and other purposes with Grenville co. It is traversed by the Grand Trunk and the Brockville Railways. Cap. Brockville. Pop. of Leeds and Grenville cos., including Brockville, 57,918.

Leeds, post-tp. of Androscoggin co., Me., on the Maine Central and the Androscoggin R. Rs. It has 5 churches, good water-power, and some manufactures. Pop. 1288.

Leeds, post-v. of Northampton tp., Hampshire co., Mass., on Mill River and on the New Haven and Northampton R. R., 5 miles N. W. of Northampton. It was the seat of important manufactures, but was almost entirely destroyed, with several other villages, May 6, 1874, by the bursting of the Williamsburg reservoir.

Leeds, post-v. of Catskill tp., Greene co., N. Y., at the falls of Catskill Creek, which furnishes water-power. It has 2 churches and various manufactures. It is 4 miles N. W. of Catskill. Pop. 847.

Leeds, post-tp. of Columbia co., Wis. Pop. 1098.

Leeds (JOHN), b. in Bay Hundred, Talbot co., Md., May 18, 1705; was for forty years a clerk of the county court and a judge of the Provincial Court; received in 1760 a commission to supervise the returns of Mason and Dixon of the boundaries of Maryland and Pennsylvania; published in 1769 in *Philosophical Transactions, Observation of the Transit of Venus,* and while surveyor-general of Maryland d. at Wade's Point Plantation, in Mar., 1790.

Leek [Ang.-Sax. *leac*], the *Allium porrum,* a liliaceous plant of the onion genus, the mildest in flavor of that whole group of plants. It is extensively cultivated in the kitchen-gardens of Wales, Scotland, and other parts of Europe. There are many varieties, some of which are much esteemed. The lower part of the stem is the part eaten. The juice made into a syrup is a good diuretic and stimulant expectorant medicine, valued in domestic practice.

Leek, town of England, in the county of Stafford, on the Churnet. It has some silk manufactures and many good educational institutions. Pop. 10,045.

Lee'lanaw, county of Michigan, bounded W. by Lake Michigan and E. by Grand Traverse Bay. Area, 310 square miles. It is very level, and abounds in lakes and forests. Grain and potatoes are the chief products. Cap. Northport. Pop. 4576.

Leelanaw, tp. of Leelanaw co., Mich., on Lake Michigan. Pop. 830.

Lee'mans (CONRADUS), b. at Zalt Bommel, in the province of Gelderland, Apr. 28, 1809; studied from 1826, first theology and then archæology, at the University of Leyden, and was appointed first conservator at the Museum of Antiquities of that city in 1835. He was eminently successful in gathering together all the archæological treasures which the city possessed, and arranging them in proper order, and in 1839 he was made director of the museum. In 1859 he was furthermore commissioned by the government to found an ethnographical museum, with which Siebold's celebrated Japanese collection was incorporated. Most of Leemans's writings are critical and historical descriptions of objects of the museum, but more especially on Egyptian antiquities; among which are his critical edition of the *Hieroglyphica* of Horapollo (1835), and his *Ægyptische Monumentens van het Museum van Andheden te Leyden* (1835–65).

Lee'pertown, tp. of Bureau co., Ill. Pop. 387.

Leer, town of Prussia, in the province of Hanover, on the Leda, near its junction with the Ems, has several sugar-refineries, cotton-weaving and printing establishments, tobacco manufactories, breweries, distilleries, and a considerable boat-building business. Pop. 8932.

Lee's, tp. of Columbus co., N. C. Pop. 631.

Lees (FREDERICK RICHARD), b. at Meanwood Hall, near Leeds, England, Mar. 15, 1815; devoted himself from an early age to the temperance cause, and worked with success both by lectures and writings. He published *The Metaphysics of Owenism Dissected* (1838–39), the *History of Alcohol* (1843), and a *Treatise on Logic, or the Method, Means, and Matter of Argument.* In 1845 he started the *Truth-Seeker in Literature, Philosophy, and Religion,* a periodical which continued for several years. In 1853 he represented the British temperance associations of the N. of England at the world's temperance convention in New York, and in 1860 he was presented with a testimonial of 1000 guineas by the friends of temperance in Great Britain.

Lees'burg, post-v. of Plain tp., Kosciusko co., Ind., on the Cincinnati Wabash and Michigan R. R. It has an active trade. Pop. 320.

Leesburg, post-v. of Harrison co., Ky. Pop. 144.

Leesburg, post-v. of Highland co., O., on the Marietta and Cincinnati R. R., 64 miles N. E. by E. of Cincinnati. Pop. 508.

Leesburg, tp. of Union co., O. Pop. 1410.

Leesburg, post-v. and tp., cap. of Loudon co., Va., on the Washington and Ohio R. R., 38 miles N. W. of Washington, D. C., lies in a fertile agricultural district near the E. base of the Kittoctan Mountain and 3 miles from the Potomac River; has 6 churches, 1 national bank, 2 hotels, 2 weekly newspapers, 1 male and 1 female seminary, several fine schools, a steam saw and planing mill, and the usual number of mercantile and industrial establishments. The streets are well paved and lighted, and the court-house square is a large and beautiful enclosure, laid out with walks and shade trees. There are numerous and flourishing lodges of benevolent societies. The battle-field of "Ball's Bluff" lies 2 miles from the town. Pop. of v. 1144; of tp. 4075. B. F. SHEETZ, ED. "MIRROR."

Lee'ser (ISAAC), b. in Neukirch, Westphalia, Dec. 12, 1806; came to Richmond, Va., in 1824; was at first engaged in commerce, but in 1829 became rabbi of the principal Jewish synagogue in Philadelphia, and wrote several works relating to Jewish history and doctrine, among which are *The Jews and the Mosaic Law* (1833), *Discourses, Argumentative and Devotional* (1836), *Portuguese Form of Prayers* (1837), *Descriptive Geography of Palestine,* from the Hebrew of Rabbi Joseph Schwartz, and a *Translation of the Holy Scriptures* (Old Testament) *from the original Hebrew* (1853). In 1843 he established a monthly maga-

zine, *The Occident and American Jewish Advocate;* retired from the ministry in 1850. D. at Philadelphia Feb. 1, 1868.

Lee's Mill, tp. of Washington co., N. C. Pop. 1522.

Lees'port, post-v. of Ontelaunee tp., Berks co., Pa., on the E. side of the Schuylkill River, 8 miles N. of Reading. Its railroad station (Reading R. R.) is across the river in Bern tp.

Lee's Summit, post-v. of Jackson co., Mo., on the Missouri Pacific R. R., 259 miles W. of St. Louis and 24 miles S. E. of Kansas City, has 5 churches, 1 weekly newspaper, 1 hotel, 1 graded school, 1 grain-elevator, and 20 business-houses. It is one of the garden-spots of Missouri. Pop. about 1000. L. D. CARMELY, PUB. "LEDGER."

Leet, tp. of Allegheny co., Pa. Pop. 629.

Leete (WILLIAM), b. in England early in the seventeenth century; came to New England in 1637; was an early settler of New Haven, Conn.; a founder of the town of Guilford in 1639; was for many years chosen assistant and deputy governor, and was governor of Connecticut from 1661 to 1665. He was frequently a commissioner of the colonies between 1655 and 1679; befriended and entertained the regicides Goffe, Whalley, and Dixwell in Mar., 1661; was again chosen governor in 1676, and annually re-elected until his death, at Hartford Apr. 16, 1683.

Leeto'nia, post-v. of Salem tp., Columbiana co., O., at the junction of the Pittsburg Fort Wayne and Chicago and Great Western R. Rs., 65 miles N. W. of Pittsburg, has 5 churches, 1 bank, 1 weekly newspaper, 3 hotels, numerous stores, 1 rolling and 1 planing mill, 4 blast furnaces, extensive coal-mines and coke-ovens, a nail and bolt mill, boiler-works, a foundry and machine-shop, lumber-yards, and a fine school building. It is situated in a rich farming country, and was incorporated in 1865. Pop. 1200.
W. HARRY WATSON, ED. "REPORTER."

Leeu'warden, town of the Netherlands, in the province of Friesland. It is 10 miles distant from the sea, but in the fourteenth century it lay on the shore of a deep inlet of the sea, which by degrees has been filled with banks of sand and mud and become solid ground. The city is intersected by canals, and is neatly built, with many elegant houses. Among its educational institutions and scientific societies is particularly notable its society for Frisian history and language. Its trade in cattle, swine, butter, flax, and spirits, and its manufactures of linen and paper, are quite considerable. Pop. 25,450.

Leeu'wenhoeck, von (ANTONIUS), b. at Delft, Netherlands, Oct. 24, 1632; went in his sixteenth year to Amsterdam, and entered a merchant's office, but returned after the lapse of a few years to his native city, and devoted himself exclusively to the study of natural science. He manufactured optical instruments, especially microscopes, and these he applied with the most brilliant success to his researches in physiology. His principal discoveries were that of the red globules of the blood in 1673, that of the infusorial animalcules in 1675, and that of the spermatozoa in 1677. By these discoveries he attracted general attention, and established connections with all learned men and learned societies of his age, such as Leibnitz, the Royal Society of London, and others. His writings were published partly in book-form at Leyden, partly as communications to scientific journals, *Acta Erudita, Philosophical Transactions,* etc., and collected in 1724 in 4 vols. under the title *Opera omnia, sive arcana naturæ ope exactissimorum microscopiorum detecta.* D. at Delft Aug. 26, 1723.

Leeward Islands. See ANTILLES.

Lefebvre' (FRANÇOIS JOSEPH), duke of Dantzic, marshal of France, b. at Ruffach, Alsace, Oct. 25, 1755; enlisted Sept. 10, 1773, in the French guard, and distinguished himself greatly by courage and resoluteness on several occasions during the Revolution. In 1792 he was made captain of the 13th infantry regiment, and his talents now developed very rapidly; in 1794 he was made a brigadier-general. Having been appointed commander of the 17th military division, to which Paris belonged, he supported Napoleon on Nov. 9, 1799, and was made a marshal of France at the establishment of the empire. In the war against Prussia he also distinguished himself, especially by the siege and capture of Dantzic (May 26, 1807), whence he derived his title of duke. But his most brilliant exploit was his campaign in Spain in 1808. He took Bilbao, and defeated the English under Blake, Nov. 7. In 1814 he commanded the left wing of the army opposing the invation of the allies, but after the abdication of Napoleon he submitted to the Bourbons and was made a peer of France by Louis XVIII., June 4, 1814. D. at Paris Sept. 14, 1820. He had twelve sons, who all died before him.

Lefebvre'-Desnouettes' (CHARLES), COUNT, b. at Paris, France, Sept. 14, 1773; served in the French army in Belgium under Dumouriez in 1792; was aide-de-camp to Napoleon at Marengo; distinguished himself at Austerlitz; became brigadier in 1806, and general of division in 1808; began the siege of Saragossa in Spain; was taken prisoner by the English; escaped from England; took a prominent part in the Austrian (1809), Russian (1812), and German (1813) campaigns, and in the defence of France from invasion (1814); was made a peer by Napoleon in 1815; fought at Fleurus and at Waterloo; was condemned to death by the royalists, but escaped to the U. S.; joined with Baron Lallemand in the attempt to found a colony of French refugees in Alabama; was in correspondence with Napoleon for the purpose of effecting his rescue from St. Helena, and received 150,000 francs by the will of that monarch, and while returning to Europe was lost at sea near Kinsale, Ireland, Apr. 22, 1822.

Lefèvre (PETER PAUL), D. D., b. at Roulers, in Belgium, Apr. 30, 1804, and educated in Paris; came to the U. S. in 1828; was ordained a Roman Catholic priest at St. Louis in 1831; was stationed at New Madrid, Mo., and afterwards became a travelling missionary in the Northwest. In 1844 he became bishop of Zela *in partibus* and coadjutor of Detroit. He was active in the establishment of charitable, religious, and educational institutions. D. at Detroit, Mich., Mar. 4, 1869.

Lefèvre (TANNEGUI) (commonly known as **Tanaquil Faber,** from the Latinized form of his name), b. at Caen in 1615; educated at the Jesuit College at La Flèche, where he devoted himself especially to philosophy and classical literature. Cardinal Richelieu appointed him inspector of the press of the Louvre. After the death of Richelieu his salary was irregularly paid, and he was obliged to sell his library. Having resigned his position, he retired to Langres, afterwards to Preuilly, where he embraced Protestantism; was soon after appointed professor in the Reformed academy of Saumur. His works were chiefly annotated editions of the classic authors, *e. g.,* of Longinus, Ælian, Lucretius, Horace, Phædrus, Terence, Anacreon, Sappho, and several others. He translated also into Latin iambics the *Fables of Lokman* (Saumur, 1673), and wrote *Vies des Poëtes grecs* and *Méthode pour commencer les Humanités grecques et latins.* D. Sept. 12, 1672. He left one son and two daughters, one of whom was Madame Dacier. H. DRISLER.

Lefkosi'a, or **Nicosia,** the ancient *Leucosia,* the capital of Cyprus, and situated nearly in the middle of the island. It is surrounded with walls, and has many interesting and elegant buildings, chiefly Christian churches transformed into mosques. It has some manufactures of silk, cotton, and leather. Pop. 18,000.

Le Flô (ADOLPHE CHARLES EMMANUEL), b. at Lesneven, France, Nov. 2, 1804; received his military education at St. Cyr; distinguished himself at the siege of Constantine in 1837, and on the expedition against Medeah in 1840; was made a brigadier-general after the February revolution, and sent as the ambassador of the republic to St. Petersburg. Sept. 7, 1848, he was elected a member of the Constituent Assembly; returned in the beginning of 1849 to Paris, and was at first an adherent of Louis Napoleon, but became later on one of his adversaries. He was one of the members who in Nov., 1851, proposed that the command of the army should rest with the Constituent Assembly. The proposition was not adopted, and shortly after the *coup d'état* he was arrested. By a decree of Jan. 9, 1852, he was banished, but in 1859 he was permitted to return to France, where he lived in retirement till the fall of Napoleon, Sept., 1870. During the Revolution he became minister of war, and sat as a member for Brest in the National Assembly at Bordeaux, but resigned in June, 1871, his office in the ministry, and went again to Petersburg as ambassador. In spite of the high positions which he has held since 1870, the part he has played in public life is nevertheless not very important. AUGUST NIEMANN.

Le Flore, county of Mississippi, traversed by the navigable Yazoo River. Area, 615 square miles. Much of the surface is subject to overflow, but it is very fertile. It has been formed since the census of 1870. Cap. McNutt.

Lefort' (FRANÇOIS), b. at Geneva in 1656, of Scottish descent, and was early placed in a merchant's office in Hamburg. Thence he ran away in his fourteenth year, came to Marseilles, and enlisted in the Swiss guard in the French service. In 1674 he left France on account of a duel; entered the service of the Netherlands; distinguished himself at the siege of Audenarde, but, tempted by the golden promises of a Russian recruiter, he went in 1675 through Archangel to Moscow, where he first held a position as secretary to the Danish ambassador, and then became a captain in the Russian army. In 1682 he became acquainted with the czar, Peter the Great, at that time only ten years old. He became his teacher, soon also his friend, and after

the revolution of 1689, which made Peter the Great sole ruler of Russia, and in which Lefort had done the czar great service, his influence became almost unbounded. To some extent the whole direction of Peter's remarkable reign was given by Lefort, and his influence can be distinctly traced out in many of the most important military and civil measures which the czar carried through. But he d. early, Mar. 12, 1699, in consequence of the frightful dissipations which formed the czar's daily habits.

Left'wich (Gen. Joel), b. in Bedford co., Va., in 1759; was a soldier of the Revolution; fought at Germantown and Camden, and was severely wounded at Guilford; commanded a brigade under Harrison at Fort Meigs in the war of 1812; became a major-general of militia, and was often a member of the Virginia legislature. D. in Bedford co. Apr. 20, 1846.

Leg'acy [Lat. *legare*, to "bequeath"], a bequest or gift of personal property by will or testament. A legacy is to be distinguished from a devise, which is a gift or conveyance by will of real estate. Legacies are of three kinds—general, specific, and demonstrative. A legacy is said to be general when it does not amount to a bequest of any particular portion of, or article belonging to, the personal estate of the testator, as distinguished from all others of the same kind. A specific legacy, on the contrary, is a bequest of specified property, which is particularly designated or described, so as to be definitely distinguished from the rest of the testator's estate. Thus, a bequest of a sum of money, the amount of which is named, is a general legacy, while a bequest of all the money which is contained in a certain box or other particular receptacle is specific. A bequest of a horse, of silver plate of a certain named value, of a library, of clothing, or of any article described in this indefinite way, would be a general legacy; but a bequest of the horse in the testator's stable, of all the plate which should be in a certain house, of a library which the testator had in a particular room, of the clothing which he had worn, etc., would be a specific legacy. If there were a general legacy of a chattel, as of a horse, it would be valid, even though the testator had no property of the sort, and the executor would be obliged, if there were sufficient assets, to procure an article of the kind mentioned, in order to meet the bequest. But when a legacy is specific, only the particular property designated is to be given to the legatee, and if the testator owned no such property the legacy fails. General legacies are sometimes termed pecuniary legacies, but the designation is inaccurate, as specific legacies may also be pecuniary, as the examples already given indicate. A bequest of money will not, however, be a specific legacy because it is directed to be applied to a specific purpose, as for the purchase of particular articles for the legatee. That it may be specific there must be a sufficiently particular description in the will, so that the exact fund shall be given to the legatee or applied to his use which the testator allots to him. A demonstrative legacy is a bequest of a certain amount of money to be paid out of a particular fund; as, for example, a bequest of $500 payable out of the proceeds of the sale of certain property. This form of legacy is intermediate between a general and a specific legacy, and partakes of the legal characteristics of both. The importance of distinguishing between these various kinds of legacies is principally with reference to the doctrines of abatement and ademption which are applicable to the subject of legacies. By *abatement* is meant a proportional reduction of the bequests to various legatees when there are not sufficient assets to make full payment. It is the duty of an executor under a will to discharge all the testator's lawful debts before paying the legacies, upon the principle that "a man must be just before he is generous." All the personal assets may be applied, if necessary, to the payment of debts, even though property bestowed in specific legacies be used for this purpose. But if there be any residue after the indebtedness is satisfied, it is to be first applied to the payment of the specific legacies, then the demonstrative legacies are to be satisfied, and finally the general legacies. If there be insufficient assets to satisfy the legacies in either of these three classes successively, those in the same class will be reduced proportionally by the law of abatement. But the specific legacies are to be paid, even though other legatees are entirely or partly deprived of a share in the assets. Neither specific nor demonstrative legacies will abate with general legacies, unless the testator particularly directs that certain general legacies shall have precedence of those which are specific. In some cases general legacies of a particular character will be preferred to others of the same class. Thus, if there be any valuable consideration for the testamentary gift, as where a general legacy is given in consideration of a debt owing to the legatee or of the relinquishment of any right or interest, as of her dower by a widow, such legacy will be entitled to a preference of payment over the other general legacies. After all the general legacies are paid, any residue of assets will pass to the residuary legatee, if one be named in the will, and if not will be distributed among the next of kin. (See Kin, Next of.) A residuary legacy is so termed because it is a gift or allotment of this remainder by the will to some designated person. General legacies are never subject to abatement for the benefit of residuary legatees, and are to be paid in full if there are sufficient assets, even though they exhaust the entire residue of the personal estate. *Ademption* is an extinguishment or destruction of a legacy as a result of some change or loss of the property bequeathed, or of its non-existence, or it is the substitution of some other provision for the person named as legatee which is deemed a satisfaction of the legacy. The first part of this definition applies more appropriately to specific, the latter to general legacies. Thus, if the subject-matter of a specific legacy were never in the possession of the testator, or were not owned by him at the time of death, the legacy fails entirely, and the legatee has no claim against the testator's estate. A legacy of this kind is also adeemed when the specific property designated, though it formed a part of the testator's estate at the time of making the will, was subsequently sold or otherwise disposed of by him, or so altered by him in form as to change its identity. Thus, if the thing specified were a gold cup, and the testator should have it made into jewelry, or if a piece of cloth were made into a garment, the gift to the legatee would be extinguished. So if a debt specially bequeathed be received by the testator, the legacy is adeemed because the subject of it is extinguished. Ademption may also occur as a result of a removal by the testator of the articles bequeathed from one place to another. Thus, if the testator should bequeath all his furniture as being situated in a particular house, and afterwards remove it to another house, the legacy would fail. This would not be the case, however, if the goods were removed by reason of a sudden emergency, as to save them from fire, or if the removal were effected by fraud or without the knowledge or consent of the testator. An ademption may be partial, as where a portion of the property bequeathed is found among the assets of the deceased, but not the whole. A pledge or mortgage of the property by the testator is generally held not to occasion an ademption. In regard to the rule of ademption, demonstrative legacies differ from those which are specific. If the fund out of which a demonstrative legacy is to be paid is not in existence at the testator's death, the legatee will have a valid claim for satisfaction out of the general fund of assets, and the bequest to him will rank among the general legacies. Demonstrative legacies therefore resemble specific legacies by not being subject to abatement with the general bequests, while they are distinguished from them by not being subject to ademption. The doctrine of ademption is applied in courts of equity to general legacies when a parent or other person *in loco parentis* (*i. e.* standing in the place of a parent) bequeaths a legacy to a child or grandchild, and afterwards in his lifetime gives a portion or makes a provision for the same child or grandchild, without expressing it to be in lieu of the legacy. If this portion or provision be equal to or exceed the amount of the legacy, be certain and not merely contingent, and be a gift of the same general nature as the legacy, it will be deemed a satisfaction or extinguishment of the legacy. This is on the ground of the presumed intention on the part of the testator to substitute one portion for another which he has already made.

Legacies are further distinguished as vested or contingent. A legacy is said to be vested at the time of the testator's death, when the legatee acquires an absolute present right of present or future enjoyment. It is said to be contingent when the right of enjoyment depends upon the happening of some contingency. Thus, a legacy given to a man *if* he reaches the age of twenty-one will not vest until he attains that age; but if it be given *to be payable* when he becomes twenty-one, it vests at the testator's death, the right being absolute, though the time of enjoyment is deferred. A conditional legacy is a bequest whose existence depends upon the happening or not happening of some uncertain event by which it is either to take place or be defeated. (See Condition.) A contingent legacy is one form of a conditional legacy, the condition being that the legatee shall be alive at a particular period. (See Williams on *Executors*, ii. 903.) A cumulative legacy is one additional to a previous legacy given in the same will. It is sometimes an important question of construction, in determining the effect of a will, whether a second legacy is intended to be cumulative, so that the legatee is entitled to both, or is merely a repetition of a previous bequest, so that only a single gift is bequeathed. The general rule is that when the testator has not plainly declared a different intention, two or more legacies of the same article or the same amount of money given to

the same person in the same instrument amount to but a single gift. But bequests of different articles or of different amounts of money, or of the same amount in different instruments, will be generally considered cumulative legacies. Other distinctions between legacies are not of sufficient importance to require specific mention.

As a general rule, all classes of persons may be made legatees. But in England and in several of the States of this country it has been provided by statute that a legacy given to any subscribing witness to a will shall be void. This enactment has been made on account of the danger of permitting a will to be supported by persons who are beneficially interested in its contents. In New York this rule is modified by the provision that if the witness would have been entitled to a share in the estate in case the will was not established, he shall receive so much of this share as does not exceed the value of the legacy. Alien enemies also, at common law, are incapable of taking legacies. In England bequests to uses declared by statute to be superstitious are void; as, for example, to maintain a chantry priest or to pay for the saying of masses for the testator's soul, etc. But bequests for "charitable uses," as for the endowment of hospitals or the foundation of institutions of learning, and for like purposes, are generally favored, and will be deemed valid. But if such bequests are charged upon land, in opposition to the policy of the statute of 9 Geo. II., ch. 36, they will be void. In the U. S. the right to make bequests for charitable uses in general exists, unless controlled by statute. (See TRUSTS.) In this way legacies may be given to trustees, though not incorporated for charitable uses. Corporations may take property by bequest, so far as is consistent with the general purposes for which they were formed and the provisions of their charters. The right of a corporation to take personal property by bequest must not be confounded with the power to take land by will. (See WILL, CORPORATION.) In New York it is declared that no person, having a husband, wife, child, or parent, shall bequeath to a corporation more than one-half of his personal estate after the payment of his debts. (In regard to capacity to make a will and convey legacies, see WILLS.)

At common law, legacies are not payable until the expiration of a year from the time of the testator's death. This period is allowed to the executor to ascertain the nature and value of the property, to collect the assets, to determine the extent of the testator's indebtedness, to satisfy charges against the estate, etc. In this country, where the subject is frequently regulated by statute, the same limit is generally adopted. As a general rule, interest is to be reckoned upon the amount of the legacy, for the benefit of the legatee, from the end of the year when the legacy becomes payable. But where the legacy is given in payment of a debt due, it will bear interest from the death of the testator. So when a bequest is given by a parent to his child by way of maintenance, or by a husband to his wife in lieu of dower, interest will run from the time of death. If a legacy be given to an infant, the executor will not be justified, by the rules of common law, in paying it to the infant, or to the father or to any other relative of the infant, without the sanction of a court of equity. If payment should be made without such sanction to the father or relative, the executor might be compelled to pay the legacy again to the infant when he became of age. But in England it is now provided by statute that the executor may relieve himself from responsibility in such a case by paying the legacy into the Bank of England for the benefit of the infant. In this country it is sometimes provided by statute that legacies to a minor, if not of greater value than a certain specified sum, may be paid to the father for the minor's use. Such a statute exists in New York when the bequest is of less value than $50. When it is of greater value, there are provisions for its payment to the general guardian or for its investment. A legacy given to a married woman must at common law be paid to the husband, unless it be given for the wife's separate use. This is true, even though the husband and wife are divorced *a mensa et thoro*. But courts of equity may compel a husband, on receiving a legacy given to his wife, to make a suitable provision for her support. Until such support is provided the executor may decline to pay him the legacy. In a number of the U. S. it is provided by statute that married women may take property by bequest in the same way as if they were single. Legacies given to one person in trust for another should regularly be paid to the trustee. When a legacy is bequeathed by a testator to his creditor, it is a general rule in equity that it is to be deemed as given with a view to the satisfaction of the debt, if the bequest be equal to or greater than the amount of the debt. This rule, however, is not favored, and will not be applied except under these special circumstances, and when the legacy is of the same general nature as the debt.

It is a general principle applicable to all legacies that the legatee does not become fully entitled to the bequest, so as to obtain a right of action in a court of law, until the assent of the executor is obtained. He cannot, accordingly, take possession of the legacy without such assent, and if he does, may be sued by the executor, who may recover the value of the property. The assent of the executor may be express or it may be implied; as, *e. g.*, where he acquiesces in the taking of the property by the legatee. This rule, however, does not affect the right of a legatee to proceed to recover his legacy before a court of equity or a probate court.

It sometimes happens in the administration of estates that legacies are paid by executors before all the debts are satisfied. Debts may subsequently be proved of which the executor had no knowledge, and if there are no assets remaining to discharge them, he may bring a suit in equity to compel the legatees to refund to an amount equal to this indebtedness if he acted prudently in paying the legacies. The residuary legatee would first be compelled to refund, and next the general legatees. They would refund proportionally so far as was necessary to satisfy the debt. So if one legatee received full payment of his share, and it afterwards appeared that there was an original deficiency of assets to pay all the legacies in full, the other legatees may compel him to refund, so that all in the same class may receive proportional amounts upon their respective shares. This would not be the case, however, if the insufficiency of assets were attributable to the negligence, default, or misconduct of the executor, and the executor would himself be solely liable to make up the deficiency. If there be a contingent claim against the testator's estate, the executor may retain the assets from the legatees, if necessary, to meet the demand when the contingency occurs. If, however, the legatee offers to indemnify the executor against the future claim, the indemnity must be accepted and the legacy paid over. If payment be made without requiring a bond of indemnity, the executor will be liable for the satisfaction of the demand, when it becomes due, out of his own estate. But it is frequently provided by statute in the States of this country that claims against the estate of a deceased person must be presented within a short period after the issue of letters testamentary, if the executor give due notice of his appointment. The effect of such a notice varies in the different States. The statutes must be consulted.

Jurisdiction in regard to legacies is vested in general either in probate courts or in courts of equity. The jurisdiction in equity, independent of statute, is exclusive where the bequest involves the execution of trusts charged upon land, or where remedies of a peculiarly equitable nature are sought. No suit will be maintainable in a court of law, as has been seen, to recover a legacy unless it has been assented to by the executor. But in all cases where actions at law may be brought upon legacies the jurisdiction of equity is concurrent. (For the rules of law in regard to *lapsed legacies*, see the article LAPSE. In regard to the interpretation of bequests, see INTERPRETATION AND CONSTRUCTION. See also WILLS, EXECUTOR. The following treatises may be consulted on this subject: Williams on *Executors;* Jarman on *Wills;* Redfield on *Wills;* Roper on *Legacies;* Redfield on the *Law and Practice of Surrogates' Courts.*) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Legaré (HUGH SWINTON), b. in Charleston, S. C., Jan. 2, 1797; educated at Rev. Dr. Moses Waddell's famous Willington School; graduated at the College of South Carolina at Columbia in 1814; went to Europe to further prosecute his studies, chiefly law and literature; returned in 1820, and practised law in Charleston. In 1830 he was honored with the office of attorney-general of the State, and at the same time had charge of the *Southern Quarterly Review*, published at Charleston, of which periodical he was chief editor, and by the contributions of his pen elevated it to the first rank of publications of its character in the U. S. In 1832 he was chargé d'affaires from the U. S. to Belgium, and from 1837 to 1839 was member of Congress from South Carolina; in 1841–43 filled the office of attorney-general of the U. S., and also part of the time was acting secretary of state. D. suddenly at Boston, Mass., June 16, 1843, where he had gone in company with the President to attend the Bunker Hill celebration. His fine taste as a writer, his eminent acquirements as a scholar, and his learning and eloquence as a lawyer, were known and appreciated throughout the Union. His writings were collected and published in 1846 in 2 vols. 8vo.—His sister, MARY SWINTON LEGARÉ (Mrs. Bullen), b. about 1800, attained considerable success as a painter. She removed in 1849 to West Point, Lee co., Ia., where she founded and endowed Legaré College for women. A. H. STEPHENS.

Leg'ates and **Legation.** The Latin word *legatus* was used of persons commissioned or acting as delegates, and

especially of ambassadors, of adjutants or deputy commanders of an army usually appointed by the senate, occasionally by commanders themselves, and of the emperor's provincial governors. In international law "legation" denotes embassy, the right of legation, the right to send an ambassador, or the whole subject of the nature and powers of public envoys; and "legate," the envoy or minister himself. The popes, borrowing the word from the old Roman state, called their principal envoys to the Catholic nations legates *a* or *de latere*. These were cardinals, but nuncios (from *nuntius*, a "messenger," an "envoy") were not, and thus were a lower grade of papal envoys. T. D. WOOLSEY.

Lega'to [It.], in music, signifying a gentle, smooth, and graceful movement, in which the notes are sustained to their full length, and connected with each other by a uniform and gliding motion. *Legatissimo* is the superlative—very compact and graceful, the opposite of "staccato," in which the notes are distinctly separated.

Le'gend [Lat. *legendum*, from *legere*, to "read"] appears to have been originally applied in the ecclesiastical dialect to portions of Scripture, and at a later period also to other writings of religious instruction or edification, appointed to be not chanted, intoned, or recited, but *read* in church services, and it therefore nearly corresponded in signification to the modern *lesson*. The primitive Christian community consisted of two classes of persons—the ordinary or secular clergy, whether parochial or missionary; and the laity or people. The Scriptures, including many books now regarded by all sects as apocryphal, together with exegetical and doctrinal essays and narratives of the lives and deaths of saints, sufficed for the instruction of both classes alike. But besides the clergy and the laity there were, in the earliest ages of the Christian Church, as in most other Oriental religions, a certain number of anchorites or hermits living in seclusion not only from the profane world, but from each other, who do not, however, appear to have been usually consecrated to a religious life by clerical ordination, but self-devoted to mortification of the passions, penance, and ascetic exercises. When these recluses became sufficiently numerous to attract attention as a peculiar class, they acquired the name of *monachi* (Gr. μόνος, "single" or "alone"), whence our word *monk*. For the sake of mutual supervision and discipline, and for greater security from persecution and disturbance, the monks gradually abandoned their individual solitudes, gathered together in small communities, and became *cœnobites*, or "livers-in-common" (Gr. κοινός, βίος), dwelling apart from the world, at first in desert retreats, and afterwards in cloisters or habitations in which each had his separate cell for repose and private discipline and meditation. A new literature, designed primarily for the instruction of persons thus severed from the general body of the faithful and devoted to a religious life, sprang up, and this literature was greatly enlarged in extent and modified in character after the establishment of regular orders or monastic institutions organized each under its own special rules, and recognized by the Church as permanent bodies corporate. This is the literature of the *legend*, the signification of which term was gradually changed, and the compositions embraced under it variously named according to their different purposes and character. Thus, there were the *lectiones*, collectively *legendarium*, *lectionarium*, or *liber lectionarius*, consisting of lives of saints and confessors, read at their festivals, and *passiones*, collectively *passionale* or *liber passionalis*, containing the passions of martyrs, read on the anniversary of their deaths. This latter term was sometimes applied exclusively to histories of the passion of the Saviour. There were also numerous treatises on *clean* or monastic life—such, for example, as the old English *Ancren Riwle* for the instruction of nuns—which, though not now called legends, were sometimes included in that designation, because, like religious narratives, they were read aloud to the monks and nuns assembled for refection and on other special occasions. The nomenclature of all this literature is somewhat confused. The distinctions between its branches, which do not seem to have ever been very sharply marked, gradually become obsolete in common usage, and centuries before the invention of printing "legend" had come to signify any religious narrative not taken directly from the Old or New Testament, even if not designed for public reading, but rather for private study; and it was applied indiscriminately both to prose and to poetic compositions. There is, indeed, no critical distinction between the prose and the poetic legend, except in literary form, and it may be added that many mediæval narratives usually ranked with romances of chivalry—the *Holy Grail*, for example—are as truly religious in spirit and historic in character as most of the ecclesiastically accepted legends of the same period. Very many legends exist in both forms, but the Church does not favor verse except when employed for strictly devotional purposes, as hymns and the like, and therefore the authorized legendaries embraced prose narratives alone.

As a general rule—subject, indeed, to some few exceptions—it may be said that even the most credible legendary annals now extant were not the work of eye-witnesses to the events they describe, or even of contemporary writers, but were compiled from popular narratives orally handed down, or from other sources now quite unknown. Hence, upon the whole, we cannot perhaps better define the legend of the Romish and other churches than as a professed history of sacred persons or miraculous events founded upon tradition, but practically or formally recognized by the Church as authentic, and entitled, if not to be received as matter of faith, at least to reverence. Legends are, therefore, to the churches which accept them what mythology was to the old pagan, and still is to many non-Christian religions.

At the first awakening of the spirit of historical criticism the palpably unhistorical character of the religious legends, and the intrinsic improbability, not to say absurdity, of very many of them, threw a shade of suspicion which soon ripened into utter discredit on this whole branch of ecclesiastical literature, and the term "legend" acquired the signification of superstitious tale or fictitious narrative, the adjective "legendary," that of fabulous, imaginary, or at best traditional. At present these words are frequently applied to the fragmentary annals and fantastic tales which make up the body of unwritten popular literature, or what is called the folk-lore, of European and Oriental nations. These latter legends are too diversified in origin and critical character to be considered under a single head, and for notices of them we refer to titles FAIRY and FOLK-LORE, confining ourselves in the present article to the religious legends of early and mediæval Christianity and of the modern Romish Church.

Apart from the few well-authenticated ancient ecclesiastical annals which have come down to us, the oldest extant legends which can with any confidence be affirmed to be genuine—that is, not spurious, however little entitled to credit—are some of the sketches of hermit-life in the *Vitæ Patrum*, which are referred, with reasonable probability, to known authors, though other parts of that collection are certainly later fabrications. The old Roman martyrologies, though often ranked among legends, and truly legendary or unhistoric in character, are catalogues rather than narratives. They were condemned by some of the early popes, and even by Gregory I., notwithstanding his appetite for the marvellous, as of totally unknown origin and unworthy of credit; and they may safely be rejected as of no historical authority whatever. The legends accepted by the early Church very generally have monks and monastic life for their subject and their object. They were composed for the purpose of holding up that life as the true Christian ideal, the type for the imitation of the aspirant to sanctification, and of guiding the votary to perfection in the realization of it. They were not intended for the world, but for those who had retired from it, or who were preparing to renounce it. Hence, in them the monkish virtues alone, not the social, are exemplified and exalted. In short, they were professional, not popular, didactic writings. Though the personal authorship of most old legends is unknown, they were evidently in general the work of monks, to whom the retirement and leisure of monastic life gave both opportunity and encouragement for this species of literary occupation. In their departures from historical fact they were by no means always intended to be received as true, and therefore to deceive, though numbers of the most extravagant have been accepted by the Church as authentic. They were sometimes, doubtless, honest statements of what was believed to be the literal truth, sometimes mere literary exercitations, and sometimes religious romances exhibiting the writer's spiritual ideal in the form of an imaginary history. Writers actuated by these various motives would naturally take their images and illustrations from the most convenient sources. Hence heathen divinities, demigods, and heroes figure in them under various Christian disguises, and the legend of Barlaam and Josaphat, who to this day retain the place as saints in the Romish calendar, has been unequivocally traced to a Sanskrit religious romance as its original, and its heroes identified with Sakya-Muni, the founder of Booddhism, and one of his disciples. The early legends are often rich in poetical imagery, and even thought, and distinguished by an apparent truth of local color and an air of probability scarcely inferior to that of De Foe's apparition of Mrs. Veal. They are therefore of value as illustrations of contemporary life and opinion, notwithstanding the uncertainty of the periods to which they belong and of the extent to which they have been disfigured by later recensions.

But with the growth of the temporal power of the

Church, and more especially with the increasing influence of monastic corporations, the aim and character of the legend underwent an important change. Monachism had diverged more and more from the typical form of ordinary social life, and given birth to new and special interests peculiar to large, opulent, and powerful bodies of men, practically independent of the civil power, living in isolation from the pursuits and cares, the duties, the hopes, and fears of common humanity, and constituting a third estate which aimed at establishing a supremacy over the other two. For this new institution and its objects new instrumentalities were required, and the legend, as modified and adapted to a new public and to new purposes, became one of the most efficient of these. Legends began to be addressed not only to the regular but to the parochial clergy and to the laity, whom the dawn of intelligence which preceded the revival of classical learning was rendering accessible to literary influences. The simplicity and true-heartedness which, in spite of exaggeration and absurdity, make them attractive even in an age of culture and religious light, disappeared. They became what the Germans call *Tendenzromane*—tales designed for the diffusion and inculcation of particular doctrines or maxims, the catch-words or symbols of this or that party in the Church, and more especially for the glorification of particular religious orders, in whose hands they are at this day among the most potent means of action on the unreasoning classes which unhappily form a large proportion of the highest as well as the lowest circles in modern society.

Under the influence of the Reformation the legends of the Church were superseded by translations of the Scriptures in the popular reading of Protestant countries, and their circulation was much diminished even in those which continued to adhere to the Church of Rome. In the Catholic reaction which followed the triumphs of the Reformers strenuous and successful efforts were made to rehabilitate the old legendary literature by remodelling the ancient traditions through discreet omissions and the infusion of new elements into their composition, and to strengthen its influence by reports of modern miracles duly authenticated by ecclesiastical authority. These endeavors have been stimulated to new activity in the present generation, and in no age have supernatural wonders been more abundant, in no age have bolder experiments on popular credulity been tried, in none have more determined efforts been made to eliminate the spiritual and magnify the material element in religion, than in our own. The legends which have been rewritten or composed within the last three centuries, and especially in the present, are almost uniformly destitute of all merit except those of style and dexterous adaptation to purpose, and have rarely any literary or historical interest, unless as monuments of the aberrations of the human intellect.

A question of great and growing importance to the doctrine, the discipline, and the ethics, theoretical and practical, of the churches and peoples who accept religious legends is, Whether and to what extent they are binding on the faith of believers? This question has been incidentally much discussed in reference to legends connected with the lives and miracles of modern saints in treatises on canonization, which rite bears upon it in this way. The evidence of miracles wrought on the intercession of the candidate is submitted to a board of cardinals specially named for the occasion, and reported on to the pontiff, who finally adjudges upon its sufficiency, and in the affirmative case pronounces the alleged facts established, and decrees the enrollment of the new saint upon the calendar. The whole inquiry is in the nature of a judicial proceeding, and it conforms so closely to the forensic practice of civil tribunals that counsel are heard for and against the claims of the aspirant, the opposing counsel being complimented with the title of *advocatus diaboli*, "the devil's advocate." Now, if the pope is to be considered as acting *ex cathedrâ* in rendering sentence, then his judgment is infallible, and of course belief in the evidence on which that judgment is founded becomes obligatory. Upon the character of the pontiff's action in this case the weight of the numerous authorities cited by Benedict XIV., *De Servorum Dei Canonizatione* (see proto-ed. of 1839, lib. i. cap. 42, 43, 44, 45), is decidedly in support of its infallibility, and the personal opinion of Benedict himself, though he does not give a formal decision upon it, is evidently favorable to that doctrine. In many cases, indeed, if not in all—as, for example, in that of the canonization of the saints Isidore, Ignatius Loyola, Francis Xavier, Teresa à Jesu, and Filippo Neri, by Gregory XV.—the decree expressly recites that the pope *Divino Numine instinctus, ex altissimâ hac Christianæ sapientiæ cathedrâ quam divinæ veritatis oraculum Deus ipse constituit, . . . decernit*, etc. etc. Here the assertion of infallibility is unequivocally implied.

The literature of the legend is of vast extent. The most conspicuous collections are the *Vitæ Patrum, de Vitâ et Verbis Seniorum, seu Historia Eremitica* (best edition, that of Rosweyde, 1 vol. fol., Antwerp, 1628); the *Legenda Aurea*, or *Historia Lombardica*, compiled by Jacobus de Voragine in the thirteenth century, and first printed in 1470, perhaps the most widely circulated and at the same time intrinsically among the most worthless of all; the *Flos Sanctorum* of the Jesuit Ribadineira, commonly known as the *General Legend* (first published in Spanish in 2 vols. fol., Madrid, 1599–1610): this has been augmented by supplements, and printed in many languages and in hundreds of editions, and is the source from which most smaller collections of legends have been drawn; and, finally, the *Acta Sanctorum*, edited by a Jesuit association known as the Bollandists, from the name of its founder. Of this vast collection, begun in 1643, about 60 folio vols. have appeared, and it will probably extend to 100. There is, moreover, an immense number of legends of individual saints, and especially of the Virgin Mary. Of these the most extensively known is the *Glorie di Maria* of Liguori (1st ed. 2 vols. 8vo, Venice, 1784). One of the most remarkable is the Portuguese *Santuario Mariano* (in 10 vols. 4to, Lisbon, 1709–23), containing the legends of more than 2000 miraculous images of the Virgin in the Peninsular possessions of Portugal alone. (On this whole subject consult Maury, *Les Légendes pieuses du Moyen Age* (1843); Milman, *History of Latin Christianity* (4th ed., 1867); and Lecky, *History of Rationalism in Europe* (4th ed., 1870).) GEORGE P. MARSH.

Legendre′ (ADRIEN-MARIE), b. in Paris in 1752; d. at his suburban residence Auteuil Jan. 9, 1833. A mathematician who, says Prof. Nichol, "would have been at the head of the most illustrious school of modern Europe, had he not possessed as compeers Lagrange and Laplace." He early distinguished himself as a successful teacher of mathematics in the military school at Paris, and before attaining the age of thirty made his début in the world of science by one of his finest memoirs—that on *The Attraction of Spheroids*—by which he gained admission to the Academy of Sciences (1783). His equally important investigations of the *Figure of the Planets*, considered as made of spheroidal strata whether homogeneous or otherwise, soon followed, and in 1805 his *New Method for determining the Orbits of Comets*. His *Elements of Geometry* has been translated into all languages, and has become a classic in that species of literature. He assisted De Prony in the calculation of his great logarithmic tables; invented the rule of the *least squares of errors;* was author of a work, the *Exercices sur le Calcul intégral*, and of researches on the *Eulerian integrals;* both of which were subsequently developed into the great work of his life—the *Traité des Fonctions elliptiques*.

A funeral discourse was pronounced by Poisson in which he says: "In common with the geometers who have preceded him, the labors of Legendre ended only with his life. . . . Only a short time preceding his death he procured the most recent observations of comets of short periods, for the purpose of applying and perfecting his methods. . . . The history of science offers many such examples. At an age nearly equal to that which Legendre attained, Lagrange died while publishing an enlarged second edition of his *Mécanique Analytique;* Laplace in finishing the 5th volume of the *Mécanique Céleste;* Euler while finishing an investigation of the ascensional force of balloons." (See *Mémorial Encyc.* of Bailly de Merlieux; and Verhulst, *Des Fonctions elliptiques.*)

Legendre, though inferior in range and power of intellect to either of his three great contemporaries—Laplace, Lagrange, and Euler—was nevertheless *only* inferior to them; and was one of that age who most powerfully contributed to the advancement of mathematical science. According to Prof. Forbes, he was the first to imagine and employ those artifices of calculation known usually by the name of "Laplace's functions." When towards the close of his life the discoveries by Abel and Jacobi of the *really* distinctive characteristic of elliptic functions—their periodicity—gave an unlooked-for extension and generalization to the applications of these functions, he welcomed them with a liberality (says Prof. Forbes) "worthy of all commendation." Legendre's life, spent in privacy and strenuous devotion to science, was uneventful. (Consult Verhulst, *supra*, and Briot and Bouquet, *Théorie des Fonctions doublement périodiques.*) J. G. BARNARD.

Légèrement [Fr.], in music, a term indicating a gay, light, and airy movement.

Le Gett, tp. of Marion co., S. C. Pop. 1365.

Leg′gett (MORTIMER D.), b. at Ithaca, N. Y., Apr. 19, 1831; removed to Ohio in 1847; studied law; practised, and was superintendent of schools at Zanesville in 1861, when he raised the 78th Ohio Infantry, of which he was appointed colonel in Jan., 1862, and which he led at Fort Donelson, Pittsburgh Landing, and Corinth; commanded at the capture of Jackson, Tenn.; defended Bolivar, Tenn., against a largely superior force; appointed brigadier-gen-

eral of volunteers Nov. 29, 1862; was severely wounded at Champion Hills, and again before Vicksburg; was in the Atlanta campaign; commanded a division in Sherman's march to the sea; brevetted major-general for this latter campaign, he was in Aug., 1875, promoted to be full major-general, which office he resigned the following month, and was appointed commissioner of patents Jan. 13, 1871.

Leggett (William), b. in New York City in 1802; graduated at Georgetown College in 1822; was midshipman in U. S. navy from 1822 to 1826; published in 1825 a volume of poems, *Leisure Hours at Sea;* wrote for the *Mirror* his *Tales by a Country Schoolmaster*, and established the *Critic*, a weekly newspaper, in 1828; was associated with W. C. Bryant in the editorship of the *Evening Post* from 1829 to 1835; edited the *Plain Dealer* in 1836; was appointed in 1839 diplomatic agent to Guatemala, but before going to his post d. suddenly at New Rochelle, N. Y., May 29, 1839. Two volumes of his political essays were published by Theodore Sedgwick, Jr., in 1840.

Legg's, tp. of Limestone co., Ala. Pop. 1216.

Leg'horn [It. *Livorno*], a large maritime town in Central Italy, in the province of Leghorn, lat. 43° 32′ N., lon. 10° 18′ E. It stands on a tongue of land between the mouth of the Calambrone on the N. and the lowest spur of the Tuscan Apennines on the S., 62 miles W. S. W. of Florence and 12 miles S. S. W. of Pisa. A navigable canal connects it with the Arno, which enters the sea 7 miles N. of the town, and smaller canals intersect it in various directions. There are two harbors, the old and the new, the latter—S. of the former and overlooked by the large lighthouse—being capable of receiving vessels of heavy tonnage, and even ships of war. More than 11,000 ships of various sizes entered the harbor in 1873, the import and export trade of that year amounting to above $35,000,000. The import trade embraces cotton, wool, cutlery, hardware, etc., and colonial products generally. The export trade is in silks, straw hats, borax, coral, and many of its own manufactures. These are very extensive, and consist of oil, soap, tobacco, salt, etc. The port of Leghorn was for a long time free, except for government monopolies, but since 1867 it no longer enjoys special privileges. Notwithstanding this change, the port of Leghorn is one of the most frequented in the Mediterranean, and the commerce and general prosperity of the town are constantly increasing; fine public and private buildings are being erected; facilities for communication between its different quarters are multiplying; its suburbs are being extended and embellished; and it is every year more and more resorted to as a fashionable bathing-place. The churches and public edifices generally are very respectable, and the Jewish synagogue is the second in Europe in size and richness. The monument to Ferdinand I., near the port, is a work of merit, without being pleasing. The aqueduct and great reservoir which supply the city with water are remarkable constructions. The first notices of Leghorn are of the ninth century, and relate to the building of a church there, but it had little importance for a long time. At the close of the fourteenth century we find it under the protection of the French king, who in 1407 sold it and its territory to Genoa for 26,000 gold ducats. Genoa ceded it in 1421 to Florence for 100,000 gold florins, and this republic, aware of the value of her new possession, spared no pains to increase its prosperity. Under the Medici the harbor was improved, the fortifications were strengthened, and exceptional privileges and immunities granted to the inhabitants; religious toleration was also established, so that merchants of all nations flocked thither. Towards the end of the last century Leghorn fell into the hands of the French, who impoverished it by forced contributions and forced loans, from which it recovered but slowly. The population, consisting of various nationalities, was in 1874, 97,096, among whom were 8000 Jews.

Le'gion [Lat. *legio*, from *legere*, to "gather," "collect"], a military organization of the ancient Romans, combining all the constituent elements of an army, and numbering from about 3000 to about 6000 men. Originally, service in the legion was a privilege reserved to the Roman citizen of property, the slaves, *proletarii* (mere children-begetters), etc., being excluded from its ranks, and the allied forces being separately organized under the distinctive denominations *socii* and *auxilia;* but the distinction between the *socii* and *Romani* disappeared when all the Italian states were admitted to full citizenship with the native Romans, and under the exigencies of the civil war all classes were enrolled in the legions, and the employment of mercenary soldiers became common. The horse and foot of the legion have already been described (see Cavalry and Infantry), the artillery seems to have had no distinctive *personnel*, and the prototypes of the modern "staff departments" have not been minutely described. In imitation of the Romans the armies of France in 1534 and 1557 were organized into legions, and in 1792 our own army was officially designated as "the legion of the U. S.," the infantry regiments were styled "sub-legions," and the major and brigadier general were called respectively the legionary and sub-legionary general; but in neither of these cases was the resemblance to the original organization more than nominal. Robert N. Scott.

Legion of Honor, Order of the, a French order of merit instituted May 9, 1802 (19 Floréal, an 10), by the First Consul, Napoleon Bonaparte. The order has received several modifications since then. It consists of several ranks—viz. grand officers, grand crosses, commanders, and knights. Its distinctions are conferred for civil, but more especially for military achievements. The order possesses considerable wealth, of which the proceeds are paid out in pensions to wounded and disabled members and some others. Their house at Paris was burned by the Communists May 24, 1871.

Legna'go, town of N. Italy, in the province of Verona, on the Adige and on the high-road between Mantua and Padua, about 23 miles S. E. from the city of Verona. This town has much strategic importance, and formed one of the four angles, though not the strongest, of the famous *quadrilateral.* Pop. in 1874, 13,355.

Legna'no, town in N. Italy, in the province of Milan, about 17 miles N. W. of the city of Milan. It contains some interesting churches, and, among other fine pictures, an invaluable one by Luini. Pop. in 1874, 6685.

Legouvé, the name of two French poets of some note. —Gabriel Marie Jean Baptiste, b. at Paris June 23, 1764, and d. there, insane, Aug. 30, 1812. He wrote tragedies, of which *Epicharis et Néron* (1794) made a great sensation on account of Talma's performance of Nero and the allusions of the part to Robespierre; and elegies, of which *Le Mérite des Femmes* (1800) proved a great success.

Legouvé (Gabriel Ernest Wilfrid), son of the preceding, b. at Paris Feb. 14, 1807, made his début in literature with a poem, *Découverte de l'Imprimerie* (1827), for which he received a prize of the Academy; wrote, in company with Scribe, *Adrienne Lecouvreur* (1849), *Les Contes de la reine de Navarre* (1850), *Bataille des Dames* (1851), and *Les Doigts de Fée* (1858). His tragedy, *Médée*, in which Mademoiselle Rachel refused to play, though the refusal cost her a fine of 5000 francs, was translated into Italian, and performed with great success by Madame Ristori. He is also the author of the *Histoire morale des Femmes* (1848), which made a success similar to that of his father's poem.

Le Grand, post-v. and tp. of Marshall co., Ia., on the Chicago and North-western R. R. (Iowa division). Pop. 1537.

Legu'mine [Lat. *legumen*, "pulse"]. This is one of the vegetable *proteids*, or, as they are sometimes called, *albuminoids.* (See article Albuminoids, by Prof. Chandler.) It is so extremely similar in its chemical properties and composition to animal caseine, the substance of cheese —that is, of curd of milk—that several distinguished chemists, among them Liebig and Braconnot, have been unable to find any difference, and concluded that they were identical. Other equally distinguished analysts, however, Dumas and Cahours, have maintained that there is an appreciable difference in composition and in chemical nature. Whether the vegetable caseine, plant curd, or legumine passes directly, in solution through the blood, into the milk of lactiferous mammals, is a question to be worked out by physiological chemists. Legumine occurs extensively throughout the vegetable kingdom, but is more especially found in various kinds of seeds and nuts. It derives its name from the fact that, with starch, it makes up almost the whole substance of the seeds of leguminous plants, such as peas and beans. Hence, the powerfully nutritious character of these as food—that is, for those possessed of powerful digestion, for vegetable caseine is far from being as readily soluble in the gastric liquids as animal caseine or curd of milk. Peas and beans contain about one-quarter of their weight of this plant-curd, and are comparable, therefore, so far as richness in nitrogen is concerned, to eggs or to milk when condensed. Ordinary cow's milk, according to the highest determinations on record, contains not more than $5\frac{1}{2}$ per cent. of dry caseine by weight; woman's milk contains less than 4 per cent.

One remarkable point connected with the chemical composition of legumine is a large proportion of *phosphorus* in organic forms of combination. Voelcker found in legumine precipitated from its solutions by acetic acid, and thus freed from all mineral matters, from 1.88 to 2.18 per cent. of absolute phosphorus. The believers in the virtues of phosphuretted foods as *nerve* and *brain* nourishers should by this have their attention directed to leguminous aliments.

Legumine was prepared in pure state by Dumas and Cahours from milk of sweet almonds. They are bruised, soaked in warm water for three hours, crushed to pulp, and an equal weight of cold water added. In an hour the mass is pressed through a cloth. The liquid deposits its starch, and is then filtered. Acetic acid (avoiding excess) now precipitates or curdles the legumine as a white coagulum or curd, which is washed on a filter with water, then with alcohol, dried, pulverized, and treated with ether to remove fatty substances. It is more difficult to obtain the vegetable curd pure from beans, as these contain mucilaginous matters which render the filtration troublesome. This might probably be overcome, however, by some experiment, should it be desirable to obtain cheaply a concentrated "brain-food." The legumine thus prepared is stated by other chemists still to retain in admixture some albumen, to separate which requires re-solution in ammonia and re-precipitation with acetic acid. H. WURTZ.

Legumino'sæ [Lat. *legumen*, a "pod"], or **Fabaceæ** [Lat. *faba*, a "bean"], a large and most important natural order of plants, equalled by no other of the dicotyledonous class, except, possibly, by the related order Rosaceæ. Its distinguishing marks are the papilionaceous corolla and the legume (*i. e.* a solitary and simple 2-valved pod, of which the pea-pod is a familiar representative), along with alternate leaves furnished with stipules. Yet no one of these characters is without exception, and the papilionaceous belongs to only one of the three great sub-orders, one of which, the Mimoseæ, has wholly regular flowers. Among the food-plants of the order, beans, pease, and clover, also peanuts, are the most important representatives. But there are also many poisonous or very active plants or products, among which the Calabar or ordeal bean, now turned to useful account in medicine, is remarkable, inasmuch as the plant is nearly related to the common bean. Moreover, both in Australia and California plants of the pulse family, which would be supposed to be innocent and nutritious, prove to be sheep-poisons. Among plants or products of the order with active properties, senna, indigo, copaiva, tolu, kino, and catechu may be specified. Other drugs and dyes of large use are gum-arabic, tragacanth, liquorice, copaiba, tolu, tamarinds, sanders-wood, logwood, Brazil-wood, etc. Among timber trees, the locust and rosewood. ASA GRAY.

Leh, city of Cashmere, India, capital of the province of Ladakh, is situated in lat. 34° 8′ N., lon. 77° 40′ E., in a valley of the Himalayas, at an elevation of 11,500 feet above the sea, and forms a station of some importance on the commercial road between Central Asia and India. It is surrounded with a wall of sun-dried brick, surmounted with turrets, and contains a great palace of the *rajah*. Its population is variously estimated at from 5000 to 12,000.

Le'hi City, post-v. of Utah co., Ut., on the Utah Southern R. R., at the junction of the American Fork R. R., and on the N. shore of Utah Lake, near the river Jordan. The people profess the Mormon faith.

Le'high, county of E. Pennsylvania. Area, 350 square miles. It is bounded N. E. by the Lehigh River and N. W. by the Blue Mountains. The soil is generally very fertile. This county contains mines of zinc and iron. Live-stock and grain are staple products. Carriages, tobacco, brick, clothing, flour, leather, furniture, iron, lime, metallic wares, and agricultural implements are leading articles of manufacture. Many of the people are of German descent. Cap. Allentown. Pop. 56,796.

Lehigh, tp. of Northampton co., Pa. Pop. 3496.

Lehigh River, in Pennsylvania, rises in Pike co., and traverses a region remarkable for its beauty and famous for its great production of anthracite coal. It passes the Blue Ridge at Mauch Chunk, and at Easton unites with the Delaware. It is nearly 100 miles long, and for 70 miles has been fitted for slack-water navigation.

Lehigh'ton, post-b. of Carbon co., Pa., on the W. bank of the Lehigh River, and on the Lehigh Valley R. R. and the Lehigh and Susquehanna division of the New Jersey Central R. R. It has 3 churches, 5 hotels, a fine public school, and 1 newspaper. Pop. 1485.

H. V. MORTHIMER, ED. "CARBON ADVOCATE."

Leh'man, post-v. and tp. of Luzerne co., Pa. Pop. 799.

Lehman, tp. of Pike co., Pa. Pop. 832.

Leh'mann (CHARLES ERNEST RODOLPHE HENRI), b. at Kiel, in Holstein, Apr. 14, 1814, and received his first instruction in the art of painting by his father; but settled early in Paris, where he studied under Ingres, and began to exhibit in 1835. His pictures excel in brilliancy of coloring, and are generally distinguished by a peculiarly romantic and dream-like feeling, even when the subjects have been chosen from the Bible or the Greek literature. He has also painted many excellent portraits, such as those of Liszt, Alphonse Karr, and Baron Haussmann.

Lehmann (RODOLPHE), a brother of Charles Lehmann, b. at Kiel, in Holstein, Aug. 19, 1819; studied under his father and brother, but resided later on for the most part in Rome, and painted mostly scenes of Italian life and nature. *Le pape Sixte-Quint bénissant les Marais Pontins*, now at the museum of Lille, is one of his most celebrated pieces.

Le'ia, town of British India, in the Punjaub, in lat. 31° N. and lon. 71° E. It carries on a considerable trade in sugar, cotton, silk, indigo, copper, iron, and wool. Pop. 15,000.

Leib'nitz (GOTTFRIED WILHELM), b. June 21, O. S., 1646, in Leipsic, where his father was established as a notary public and actuary of the university. The father died when Gottfried was six years old. His mother sent him to school, where he evinced a remarkable love of study and unusual talent. He learned Latin without the aid of a grammar, simply by reading and re-reading Livy and the *Chronological Thesaurus* of Calvisius, and acquired such fluency in that language that at the age of thirteen he wrote for a wager 300 faultless hexameters within six hours. A large number of his works are composed in Latin. He took chief delight in logic, and thus was led to the study of the scholastics and of metaphysics in general. At the age of fifteen Leibnitz entered the Leipsic University to prepare himself for active life by the study of law. He excelled there, as everywhere; read in 1663 his dissertation *De Principio Individui*, and in 1666 published his work *De Arte Combinatoria*, which really contains the germ of all his future achievements in the fields of mathematics and philosophy. In the same year he left Leipsic, because his age was urged as a barrier to his obtaining the degree of *doctor juris*, and went to the university at Altdorf, where he obtained it by his dissertation *De Casibus Perplexis*, and elicited such general admiration that he was offered a professorship at the university, which he, however, refused. During the winter he remained at Nuremberg, studying the works of Kepler, Galileo, Bacon, Gassendi, and Descartes, also continuing his law-studies. Here he made the acquaintance of the celebrated statesman Baron Boineburg, the former prime minister of the elector of Mentz, and accompanied him to Frankfort, where he began to prepare himself for a political life. He there wrote his famous essay, *Nova methodus discendæ docendæque jurisprudentiæ* (1668), which he sent to the elector of Mentz, accompanied by the sketch of a chart "which would enable any judge or lawyer to decide immediately any given case of law according to the fixed principles of jurisprudence." This so pleased the elector that he appointed Leibnitz assistant to Dr. Lasser in the elaboration of a reformed code of Roman law. He soon distinguished himself by his various literary labors—so much that within a few years, when barely twenty-four years of age, he was appointed by the elector a member of the court of appeals, the highest judicial tribunal of the electorate. His official labors did not in the least disturb his other studies. He was specially interested at that time in effecting a reconciliation between the Protestants and the Catholics, and kept up an extensive correspondence with prominent members of both churches (with Bossuet among others), having discovered, as he thought, a basis on which the theories of both churches on the subject of transubstantiation, their main point of dispute, could be harmonized. The preparations made by Louis XIV. for a war against Germany at the same time led him to enter deeply into politics. To the German electors he submitted a memorial, counselling a friendly feeling towards France and the establishment of a united Germany, which, he said, would alone give peace to Europe. To Louis XIV. he submitted a memorial, through Boineburg, which counselled an expedition of France against Egypt, which was so well received by the French king that Louis XIV. expressed his desire for a personal interview with the author. Accordingly, Leibnitz left Mentz in Mar., 1672, for Paris, where he submitted a memorial to the king, which, however, has only recently been made public. He pointed out the conquest of Egypt as the key to India and the humiliation of Holland. Napoleon afterwards carried out the scheme in order to threaten England's power in the East. Leibnitz's main object was to divert the king's mind from a war with Germany by a foreign enterprise; and probably this object was soon discovered, and caused the rejection of his scheme. He made diligent use of his stay in Paris, however, to study its libraries and become acquainted with its men of science. News of his friend Boineburg's death compelled him to visit London for a short time, where he made the acquaintance of Newton, Boyle, and others, and was chosen fellow of the Royal Society. Here the report of the death of his other friend, the elector of Mentz, reached him. When he returned from England he did not

go to Mentz, therefore, but to Paris. Here he soon formed an extensive acquaintance, became intimate with Cassini and Huyghens, and was admitted to the highest circles of society. In 1676 he accepted the third offer made him by the duke of Brunswick-Lüneburg of a position at his court, having just then made his immortal discovery of the differential calculus, which he did not make public, however, until 1684. In 1678 the duke of Brunswick-Lüneburg, in recognition of his many labors in the interest of science and of the country, conferred the rank of counsellor upon him, which made him a member of the supreme court. Besides his judicial duties and other scientific labors, Leibnitz took charge of the duke's mines in the Hartz Mountains, utilizing the opportunity to study mineralogy, and kept up unremittingly his labors in behalf of a union between the Protestant and Catholic churches. In 1679 the duke died, and was succeeded by his brother, Ernst August, subsequently elector of Hanover. When, some years later, the princess Sophia Charlotte of Hanover, Leibnitz's pupil, married the prince of Brandenburg, future king of Prussia, it was deemed advisable in 1687 to send Leibnitz to Italy on a political expedition, but chiefly with a view to collect materials for a history of the house of Brunswick (the Guelph family) from its earliest origin. Leibnitz made this the great literary work of his life, though, like most of his works, it has been printed only recently. His stay at Rome was one prolonged ovation. Every learned society elected him a member. The appointment of custodian of the great Vatican library was offered him, with prospects of a cardinal's hat, if he would join the Catholic Church. But, favorably disposed as he was to Catholicism, he never could be brought to join that Church. He did his best to enlist the Church in behalf of science, and arranged a permanent correspondence with the famous Jesuit missionary Grimaldi, then leaving for China, through whom he also sent his *Science of Dyadics* to the emperor of China, so arranged as "to prove the creation of the world out of nothing." After his return to the Hanoverian court, Leibnitz was appointed custodian of the Wolfenbüttel Library. His patron, Ernst August, who in 1692 had become elector of Hanover, died in 1698, and although his successor, George, future king of England, retained Leibnitz in his position, Leibnitz no longer felt comfortable under a prince who took no interest in matters of science and art. He therefore accepted a call to Berlin from his former pupil, the princess Sophia Charlotte, and there established the scientific society which has since grown into the Berlin University. In 1700 he was sent on a political expedition to Vienna, and made another attempt to unite the Protestant and Catholic churches. On his return to Berlin he found that the English skepticism of the Lockian School had made its way there, and at the solicitation of Sophia Charlotte, now queen of Prussia, wrote his celebrated *Théodicée* to combat it. The death of the queen in 1705 was a severe blow to Leibnitz. More than ever he devoted himself to science. When in 1711 he met Peter the Great at Torgau, he induced him to found libraries, observatories, etc., and so interested that monarch that he was invited to another personal conference at Carlsbad. In 1714, Leibnitz visited Vienna for the last time, and there wrote for Prince Eugène his *Monadology*, the work by which he is most widely known as a philosophical writer. Soon after it was finished, the elector George, being about to leave for England, ordered Leibnitz home to attend to his duties. Leibnitz went back, finished his history of the house of Brunswick, and plunged into other scientific labors, in the midst of which death overtook him, Nov. 14, 1716. Only one person, his secretary, Eckhart, followed him to his grave. Protestant and Catholic clergy both refused to attend his burial.

It is almost impossible to convey an idea of the multitude of Leibnitz's writings and the variety of subjects upon which they treat. His unpublished manuscripts fill the whole side of one of the rooms of the Hanoverian library, and range over the various subjects of law, history, theology, speculative philosophy, mathematics, and all the natural sciences. There is scarcely a branch of human knowledge which his wonderful mind has not explored and enriched; and in this universality of his knowledge he stands unrivalled in history. Neither Aristotle nor Kant, probably the other two most universal minds, reach Leibnitz in the extent of their knowledge. And with all this devotion to science he was never forgetful of practical affairs. An accomplished statesman and politician, he was an untiring correspondent, and in society brilliant and interesting as few men even of his time, when society made great demands. Though he never married, he enjoyed the society of ladies, and fascinated them by his courteous manners and conversational powers. During the reign of the late king of Hanover a beginning was made to publish the complete works of Leibnitz, a literary undertaking of unparalleled magnitude. A few volumes were issued in truly royal style, but the expulsion of the king and the absorption of Hanover into the German empire unhappily put a stop to the enterprise. The chief points of his philosophical system are three in number: (1) *The Principle of the Sufficient Reason.*—In human knowledge, says Leibnitz substantially in explanation of this principle, we meet with two different classes of knowledge—one which is based on the formula $A = A$, and which is self-evident, needing, therefore, no further explanation; and one which says of a thing (A) that it is not only this (*i. e.* A), but also something else. Kant subsequently called the former class analytical and the latter synthetical propositions. Now, of this latter class, adds Leibnitz, it will not do to assert merely that they are true, but a sufficient ground must be shown why they must be true; and if we cannot show the ground, they are not proved true. By strictly separating this class of propositions from those that are merely analytical or identical, and applying to all synthetical assertions the crucial test of the sufficient reason, Leibnitz contends that the higher sciences of physics, metaphysics, etc. can be as conclusively established as those sciences that rest merely upon the analytical principle. Leibnitz neglects, however, to state what is the sufficient reason which is the basis of all synthetical propositions, and it was reserved for Kant to complete the work of Leibnitz in this respect. It appears, however, from all of Leibnitz's writings whenever he had to apply that principle, that he was quite well aware of the nature of that sufficient reason. (See KANT.) (2) *The Doctrine of Monads.*—At an early period of his life, Leibnitz, who till then had accepted in explanation of the universe the then generally received theory of atoms, convinced himself of the insufficiency of this theory, in that it could not explain the activity reigning in the universe. By the two conceptions of motion and a world of atomic matter, Descartes had tried to explain, in his famous *Principia*, all the phenomena of the universe, from the position and course of the stars down to the construction of the smallest plant, and again up to the highest functions and passions of rational human beings. But as this theory was defective, in Leibnitz's opinion, in that it showed no sufficient ground for the motion which vitalizes the universe, he proposed to substitute for the material atoms spiritual atoms. He made public his discovery at an early day, and it excited an extensive discussion amongst the scientific men of his age. In his first announcement of his new theory, Leibnitz calls "spiritual atoms" what he subsequently termed monads. "Supposing," says he in substance, "that we look upon this universe as an infinite number of spiritual activities, each again containing within itself an infinite number of activities, and each thus limiting the other; then every such monadic activity must be limited or influenced in a more or less degree by all the others, so that even the smallest monad, if it could become conscious of all the impressions directed upon it, would become conscious of the whole infinite world. This limitation appears to each monad as something foreign to itself, and where this limitation ceases there is itself in its own body. Each monad having clearest consciousness of what passes within itself, and increasing that consciousness only as it learns to unravel the impressions produced upon it by the other monads, it is simply by the grade of consciousness attained that the monads are distinguished from each other. From the smallest speck of dust to the highest seraph this distinction rules; and as each monad carries within itself the power to reach the highest degree, there can be no creation and no death in the world; everything must be steady, progressive development or evolution. Matter must be always the same, since the monads are always the same; and force can never be destroyed, since the monad can never be destroyed. The whole interchange of forces is simply the result of a greater or less degree of movement on the part of the universal force which every atom possesses, and all forces are therefore correlated with each other through motion." Leibnitz's theory of nature, in its fundamental principles, is thus the same that has recently been adopted by the natural scientists of England. (Translations of several short articles written by Leibnitz in exposition of this theory can be found in the *Jour. Spec. Phil.* (St. Louis), vols. i. (containing the *Monadology*), ii., iii., v.) (3) *Pre-established Harmony.*—There remained, however, one great problem to explain, which was how one monad can influence another one, and which also involves the question how communication between body and soul is possible. This puzzled Leibnitz for a long time, until he was insensibly led to an idea which, he says, "surprised me, but which seemed inevitable. This was that the soul or every other real unity must have been created in such a manner as to have everything arise in it from its own proper nature, with a perfect *spontaneity* in relation to itself, and yet at the same time with perfect *conformity* to

the outside things. That thus our internal perceptions—that is, those in the soul itself, and not in the brain or in the subtle parts of the body—being nothing but phenomena related to external things or true appearances, and like well-regulated dreams,—that these internal perceptions, therefore, in the soul itself come to the soul through its own original constitution; that is to say, through that representative character (capable of expressing outside things by relation to its organs) which was given to it at its creation, and which constitutes its individual character. Thus it is that each of these substances—each representing precisely the whole universe in its own way and according to a certain point of view, and the perceptions or expressions of the external things reaching the soul in this point by virtue of its own laws, as of a world in itself, and as if nothing existed but God and itself (to use the mode of expression of a certain person of elevated mind, and whose sanctity is everywhere recognized), must be in perfect accord with all others, whereby the same effect is produced as if they all communicated with each other by a transmission of species or of qualities, as the vulgar philosophers imagine. Moreover, the organized mass, wherein the point of view of the soul exists, being expressed more nearly, and finding itself reciprocally ready to act of itself according to the laws of the bodily machine in whatever moment the soul wills it—neither one interfering with the laws of the other—the intelligence and the blood have precisely those movements which are necessary to respond to the passions and perceptions of the soul. It is this mutual *rapport*, regulated in advance in each substance of the universe, which produces what we call their communication, and which alone constitutes the *union of body and soul*. It is thus that we can understand how the soul has its seat in the body by an immediate presence—a presence that could not be greater, since the soul is there just as the unity is in the result of the unities, which is the multiplicity."

This is the celebrated theory of a pre-established harmony, upon which Leibnitz also built his religious system, as indeed none of his discoveries stand apart, but each is closely connected with all others, and the result of the same original view of the universe. His mathematical discoveries were the outgrowth of his purely philosophical apperceptions, no less than his religious convictions, and it was his discovery of the monad theory which made him so sure that by its means he could reconcile Protestants and Catholics on their main point of dispute, the doctrine of transubstantiation. (See Kuno Fischer, *Leibnitz und seine Schule*, in vol. ii. of his *Gesch. der Neuern Phil.;* also Erdmann's ed. of his works, 2 vols. (Berlin, 1840); Foucher de Careil's ed., 6 vols. (Paris, 1859); G. H. Pertz's ed. (with Grotefend and Gerhardt), 12 vols. (Hanover, Berlin, and Halle, 1843–63); Onnot Klopp's ed., 4 vols. (Hanover, 1864–66); Guhrauer's *G. W. F. Leibnitz* (2 vols., and ed. of Leibnitz's German writings, Breslau (1837–46).) A. E. Kroeger.

Leices'ter, or **Leicestershire,** county of England, situated nearly in the middle of the country, bounded N. by the river Trent. Area, 803 square miles. Pop. 237,412. The ground is hilly; some coal and lead mines are worked; granite and freestone are quarried. But the rearing of sheep and cattle gives the country its industrial character; 250,000 acres of land are in grass; and the long-horned cattle and long-woolled sheep are celebrated breeds. The so-called Stilton cheese is chiefly made in this county, which also is the principal seat of the English manufactures of hosiery.

Leicester, town of England, the capital of Leicestershire, on the Soar, whose ancient name was Leire, whence the name of the city. Its manufactures of woollens and hosiery are very important, employing more than 25,000 hands; also lace is made here to a considerable extent. The city was known to the Romans under the name of *Ratæ*, and Roman remains are found. Pop. 95,084.

Leicester, post-tp. of Worcester co., Mass., 6 miles W. of Worcester. The Boston and Albany R. R. traverses the S. part. The town has a fertile soil, well adapted to grazing, here a leading pursuit. There are several villages, 7 woollen and 11 card factories, 1 national bank, a public library, an academy, a town-hall, 8 churches, a memorial hall, and good water-power. Pop. 2768.

Leicester, tp. of Livingston co., N. Y. It contains several manufacturing villages. Pop. 1744.

Leicester, post-tp. of Buncombe co., N. C. Pop. 2180.

Leicester, post-tp. of Addison co., Vt., 5 miles N. of Brandon, on the Central Vermont R. R. It has manufactures of lime and paint. Pop. 630.

Leicester (Robert **Dudley**), Earl of, a son of the duke of Northumberland, who was executed for trying to make Lady Jane Grey queen in 1553, b. Sept. 7, 1533; married Amy Robsart 1550; was condemned as a traitor 1554; pardoned 1555; became the favorite of Queen Elizabeth, who made him K. G. and master of the horse 1558. The sudden death of his wife in 1560 aroused strong suspicions that he was aspiring to the hand of the queen. Created earl of Leicester in 1564; in 1566, Elizabeth proposed his marriage with the queen of Scots, and somewhat later his secret marriage with the widow of Essex aroused the anger of the queen; was sent to the Low Countries as captain-general in 1585 and 1587, but displayed no capacity; was in 1588 generalissimo of the troops raised against the Spaniards. D. in Oxfordshire, Sept. 4, 1588.

Leicester (Simon **de Montfort**), Earl of, founder of the English House of Commons, b. 1206 in France, and was a son of Simon de Montfort, the vanquisher of the Albigenses. In 1231 his brother, the Count Amaury de Montfort, gave him the honor of Leicester, inherited from his maternal grandmother, an English lady; for this title Simon did homage to Henry III. in 1231, and in 1239 it was formally granted by the king after his marriage with the king's sister; was for many years employed as governor of Gascony, where he conducted many wars with advantage, and twice refused the French regency; in England, unlike most other French adventurers of that period, he took the part of the barons against the king in the wars of Henry III.'s reign; compelled the king to sign the provisions of Oxford 1268, and after Gloucester's death (1262) became the leader of the baronial party; dictated terms at the Mise of Lewes 1264; summoned the Parliament of 1265, at which knights of the shire and representatives of the boroughs were admitted—the germ of the future House of Commons; became justiciary of England. Long the virtual master of the realm, he was attacked by Edward, prince of Wales, at Evesham, and there defeated and slain, Aug. 4, 1265.

Leich'hardt (Ludwig), b. at Trebitsch, in the Prussian province of Brandenburg, Oct. 23, 1813; studied philology, medicine, and natural science at Göttingen and Berlin; travelled through Italy, France, and England, and went in 1841 to Australia, where he made a great name for himself as an explorer. The results of his first minor travels were published in *Beiträge zur Geologie von Australia* (Halle, 1855). His large tour from Moreton Bay on the E. coast to Port Essington on the N. coast (1844–46), he described in his *Journal of an Overland Expedition in Australia from Moreton Bay to Port Essington* (London, 1847). In Dec., 1847, he started on a still greater expedition across the continent from E. to W., but the last report which came from him was dated Fitzroy Downs Apr. 8, 1848, and later researches have confirmed that he perished on the trip. His biography was written by Zuchold (Leipsic, 1856).

Lei'dy, post-tp. of Clinton co., Pa. Pop. 515.

Leidy (Joseph), M. D., b. at Philadelphia Sept. 9, 1823; graduated in medicine at the University of Pennsylvania in 1844; devoted himself to biological researches, especially comparative anatomy and vertebrate palæontology, on which papers were published in *Proc. of Acad. Nat. Sciences* of Phila., *Trans. of Am. Philos. Soc.*, and *Smithsonian Contribs. to Knowledge;* in 1853 was chosen professor of anatomy in the medical department of the University of Pennsylvania, and in 1871 professor of natural history in Swarthmore College, both which positions he still fills. During the civil war Prof. Leidy rendered important service as surgeon at Satterlee Hospital, Philadelphia. His contributions to scientific periodicals number some hundreds. Among his more important works are *Flora and Fauna within Living Animals, Memoir on an Extinct Species of American Ox, Ancient Fauna of Nebraska, Memoir on the Extinct Sloth Tribe of N. A.*, and *Cretaceous Reptiles of the U. S.*, all published by the Smithsonian Institution, and *Contributions to the Extinct Vertebrate Fauna of the Western Territories* (1873), published by U. S. Geol. Survey of the Territories. (See an interesting notice of his life and earlier writings in *N. J. Med. Reporter* for Sept., 1853.)

Leigh, town of England, in the county of Lancaster, 13 miles W. of Manchester. It has large manufactures of cambrics, muslins, and silk and cotton goods. Pop. 10,621.

Leigh, tp. of Amelia co., Va. Pop. 3454.

Leigh, tp. of Prince Edward co., Va. Pop. 3391.

Leigh (Benjamin Watkins), LL.D., b. in Chesterfield co., Va., June 18, 1781; graduated at William and Mary College; practised law at Petersburg, and afterwards at Richmond; was reporter of the court of appeals; often chosen to the legislature; was appointed a commissioner to revise the statutes, and again to adjust land questions with Kentucky; and was in 1835 elected to the U. S. Senate, and took a prominent part in the debates, but resigned in 1837, and passed the rest of his life in retirement. He published 12 volumes of *Reports of Court of Appeals and Gen. Court of Va.* (1833–44). D. at Richmond Feb. 2, 1849.

Leigh (Hezekiah G.), D. D., b. in Perquimans co., N. C., Nov. 23, 1795. For thirty-five years he occupied responsible positions in the Virginia and North Carolina M. E. conferences. He was one of the founders and principal supporters of Randolph-Macon College. He had a powerful intellect and great executive ability. D. in Mecklenburg co., Va., Sept. 19, 1853. T. O. Summers.

Leigh'ton, tp. of Lawrence co., Ala. Pop. 1283.

Leighton, tp. of Allegan co., Mich. Pop. 1206.

Leighton (Alexander), M. D., b. at Edinburgh, Scotland, in 1568; educated at the university of that city, in which he was professor of moral philosophy from 1603 to 1613, when he became a Presbyterian preacher at London, where he also practised medicine; wrote *Speculum Belli Sacra; or the Looking-Glass of the Holy War* (1624), and an *Appeal to the Parliament; or Sion's Plea against the Prelacie* (1628). For the latter publication, deemed libellous with respect to the king, queen, and bishops, Leighton was sentenced by the Star Chamber to be twice publicly whipped, to lose both ears, to stand twice in the pillory, to be branded on the cheek with the letters S. S. (sower of sedition), to pay a fine of £10,000, and to suffer perpetual imprisonment in the Fleet. After eleven years' imprisonment he was released by order of the Long Parliament in 1640, received pecuniary indemnity, and in 1642 was made keeper of Lambeth Palace as a state prison, where he d. in 1644.

Leighton (Frederick), A. R. A., b. at Scarborough, England, Dec. 3, 1830; received his first instructions in drawing at Rome; entered as student the Royal Academy of Berlin in 1843, and finished a general education at Frankfort; went to Brussels, where was produced in 1848 his first painting, *Cimabue finding Giotto Drawing in the Fields;* studied at Paris and Frankfort, and again went to Rome, where he executed the *Cimabue*, which, exhibited at the London Royal Academy in 1855, and being by a hitherto unknown native artist, was so favorably received that it was eagerly purchased by the queen. In rapid succession he produced many fine paintings, classical, scriptural, and dramatic; especially noticeable are his *Triumph of Music* (1856); *Scene from Romeo and Juliet* (1858); *Star of Bethlehem*, and *Michael Angelo nursing his Dying Servant* (1862); *Helen of Troy* and *David* (1865); *Syracusan Bride leading Wild Beasts to the Temple of Diana* (1866); has also executed designs for literary works, among which is *Romola.*

Leighton (Robert), D. D., son of Alexander, b. in Edinburgh in 1611; graduated at the university of that city (1631), of which he became principal in 1653; appointed bishop of Dunblane in 1661, in pursuit of the plan of Charles II., Sharpe, and Lauderdale to Anglicize the Church of Scotland; accepted it with reluctance; appealed twice to the king to adopt milder measures in the attempted reform (1665 and 1669); accepted the archbishopric of Glasgow in 1670 upon liberal conditions, which were not fulfilled, and he therefore resigned in 1673 and retired to Broadhurst, Sussex. D. at London June 26, 1684. His works, all posthumous, are highly esteemed for their broad and liberal views; they include *Sermons* (1692); *Prelectiones Theologicæ* (1693); *Commentary on the First Epistle of Peter* (1693); and *Posthumous Tracts* (1703), and have been often reprinted. See his *Life* by J. N. Pearson, accompanying the *Works* (4 vols., 1825).

Lei'ningen, former principality of Germany, was erected in 1779, comprised an area of 250 square miles, and was situated between the Lower Palatinate and the bishoprics of Speyer and Worms. By the Peace of Lunéville in 1801 it was divided between Baden, Bavaria, and Hesse, and the prince was deprived of his sovereignty.

Lein'ster, province of Ireland, comprising the southeastern portion of the island, bordering on the Irish Sea and St. George's Channel. Area, 7619 square miles. Pop. 1,982,169 in 1841; 1,682,320 in 1851; 1,457,635 in 1861; 1,335,966 in 1871, of whom 1,141,401 were Roman Catholics. Before the English invasion this province formed two kingdoms, those of Leinster and Meath; now it is divided into seven counties—namely, Dublin, Meath, Louth, Kildare, Carlow, Kilkenny, and Wexford.

Leipo'a ocella'ta, the "native pheasant" of Australia, a gallinaceous bird of the family Megapodidæ, somewhat smaller than the turkey. Its flesh is good and its eggs are excellent. The nest is a mass of leaves, dirt, and sticks, the heat of which, produced by fermentation, hatches the eggs. The leipoa is a swift runner, but is very stupid, and often tries to escape the hunter by hiding her head in a bush.

Leip'pa, or **Böhmisch Leipa,** town of Bohemia, on the Pulsnitz, is the seat of several civil and ecclesiastical authorities, and has good educational institutions, extensive breweries, and manufactures of articles of steel, guns, and glass. Pop. 9244.

Leip'sic, city of the kingdom of Saxony, with 106,925 inhabitants according to the census of 1871, is situated in an extensive plain (which often was the theatre of great battles) on the Pleisse, which here receives the Parthe and flows into the Elster. It is one of the most important commercial towns of the German empire, the centre of the German book-trade, and the seat of a celebrated university. The inner town, consisting of old, tall houses, one looking very much like the other, presents the aspect of industry, enterprise, and solid wealth; it is encircled by five regular and modern-looking suburbs, and in a still wider circle the whole is surrounded by a number of villages, which join the town like a sort of second-grade suburbs. The inner town is separated from the suburbs by the Promenaden, a circle of beautiful gardens and walks, which occupy the place of the old fortifications, and contain the most important public places of the city, such as the Augustusplatz, on which the new theatre and the museum stand; the Rossplatz, and the Fleischerplatz. In the inner town is the market-place, which contains the town-hall, erected in the sixteenth century, and several other fine buildings. The most important streets are the Grimma, Brühl, Peter, and Katharinen-strasse. The streets of the suburbs are longer, broader, and more regular, but much more quiet; Elster, König, and Nuremberger-strasse are noteworthy. In spring and fall a Messe takes place at Leipsic—that is, a market in which merchants from all countries come together in order to do business. As the improved means of communication which modern times afford makes such gatherings less necessary, the Messe has, of course, lost some of its importance. Nevertheless, it still attracts about 40,000 foreign merchants, often from distant countries, and the aspect of the city is much changed during this time, partly on account of the multitude of shops which fill the market-place, the Augustusplatz, and all surroundings, partly on account of the bustle in the streets. The principal articles in which bargains are made at the Messe are—fur (6,000,000 thalers annually), leather, cloth, woollens, linens, and glass. The most remarkable buildings are—the new theatre, built from 1864 to 1867, after plans by Langhaus, in Renaissance style, with a porch on Corinthian columns in the front and a magnificent veranda in the rear; the museum, opposite the theatre, finished in 1858, after plans by Lange, and containing on the ground floor a not very important collection of plaster casts, on the middle floor a large collection of pictures, among which are four celebrated landscapes by Calame, and on the upper story a large collection of engravings; the university or the Augusteum, frequented by about 2000 students, and built by Geutebrück in 1836 after plans by Schinckel; the Pleissenburg, formerly a citadel, now used as barracks, a large structure, though without any artistic interest, commenced in 1549 by the elector Maurice of Saxony. The most remarkable among the churches are—the Nicolaikirche, built in Gothic style in the twelfth century, and the Thomaskirche, built in the fifteenth century, and containing a beautiful marble altar. The Gewandhaus, built in 1481, is now used as a conservatory of music, and is the home of classical music in Germany.

Leipsic appears as a town for the first time in history in 1015; before that time it was an insignificant village, in which Henry I. built a castle in 922. During the Middle Ages the fortifications of the city protected its commerce, and Charles V. increased the liberties of its Messe. In the time of the Reformation it supported the new doctrine, but suffered much from the war; and afterwards felt more severely the Thirty Years' war. Tilly took it in 1631; later the Swedes and the imperials held it alternately; its prosperity was entirely destroyed. Since 1667 it attracted the book-trade, and since the beginning of the eighteenth century it became the centre of the same in Germany. The Seven Years' war destroyed its enterprise once more, but its favorable location enabled it to recover quite rapidly. During the wars of Napoleon new calamities came over it. From Oct. 16 to 18, 1813, the great battle in which Napoleon was defeated raged in and around it, and all great movements in Germany have affected it more or less on account of its central position. August Niemann.

Leipsic, post-v. of Liberty tp., Putnam co., O., near Dayton and Michigan R. R. (Roanoke Station). Pop. 200.

Leis'ler (Jacob), b. at Frankfort, Germany; came to America in 1660 as a soldier in the service of the Dutch West India Co.; was some time stationed at Albany, where he engaged in trade with the Mohawk Indians, and acquired some wealth. While on a voyage to Europe in 1678 he was taken prisoner by Moorish corsairs, obtained liberty by paying a ransom, returned to America, settled in New York, and in 1683 became one of the commissioners of the court of admiralty. On May 31, 1689, Leisler headed an

insurrection "for the preservation of the Protestant religion," took the fort, declared for the prince of Orange, and planted within the fort a battery of six guns, which gave origin to that name as still applied to the public park at the lower end of Manhattan Island. The deposed lieutenant-governor, Francis Nicholson, and Mayor Cortlandt tried in vain to restore authority, and retired, the former to England, the latter to Albany. In August, the "committee of safety" appointed Leisler commander-in-chief with the powers of a governor, and he made unsuccessful efforts to be recognized as such at Albany. In December he dissolved the committee of safety, appointed a council, and assumed the style of a royal governor, on the strength of a despatch addressed "to such (person) as for the time being takes care for preserving the peace and administering the laws in His Majesty's province of New York." Early in 1690 he sent a small fleet against the French at Quebec. On the appointment of Sloughter as governor, Leisler refused to surrender the fort and the government (Mar., 1691) until convinced of the former's identity and authority. For this constructive treason Leisler was soon after imprisoned, with his son-in-law and secretary, Jacob Milborne, and both were condemned and executed May 16, 1691. At a later period the memory of Leisler was rehabilitated by an act of Parliament (1695), an indemnity was given to his heirs (1698), and the bones of Leisler and Milborne were honorably buried in the Dutch church. One of the acts of Leisler during his brief authority (1689) was the purchase of lands at New Rochelle as a place of refuge for persecuted Huguenots.

Leis'nig, town of Germany, kingdom of Saxony, on the Mulde, manufactures woollen and linen stuffs. Pop. 5770.

Leitch (William), D. D., b. at Rothesay, Scotland, in 1814; graduated in 1836 at the University of Glasgow; studied theology in the Divinity School; was ordained in the Presbyterian Church in 1838, and from 1843 to 1859 was parish minister at Monimail. In the latter year he was chosen principal of Queen's University at Kingston, Canada, in which office he was installed Nov. 8, 1860, and for the remainder of his life was actively engaged in organizing that institution upon a large basis of modern culture. Principal Leitch was an enthusiastic scientific observer, especially devoted to animal physiology and astronomy. In 1863 he published an esteemed work, *God's Glory in the Heavens, or Contributions to Astro-theology*. D. at Kingston May 9, 1864.

Lei'tersburg, post-v. and tp. of Washington co., Md., 6 miles N. E. of Hagerstown. Pop. 335; of tp. 1673.

Leith, town of Scotland, in the county of Edinburgh, on the Frith of Forth, 2 miles from Edinburgh, whose port it is, and with which it is connected by continuous rows of houses. Its streets are narrow, tortuous, and filthy, but its harbor is excellent, 25 feet deep, provided with a breakwater, and containing two wet docks and three dry docks. Its shipbuilding, both in wood and iron, and its manufactures of rope, sailcloth, soap, etc., are considerable, and its trade extensive, importing large quantities of grain, wine, hemp, timber, and tobacco. Pop. 44,277.

Lei'tha, or **Leytha,** a river of Austria, rises in Lower Austria, forms for some distance the boundary between the two divisions of the Austro-Hungarian empire, called, after the river, Cisleithania and Transleithania, breaks through the Leitha Mountains, which rise from 1500 to 2000 feet, into Hungary, and joins the Danube at Altenburg.

Leit'meritz, town of Bohemia, is beautifully situated on the right bank of the Elbe; contains a splendid cathedral, founded in 1054, and many other remarkable buildings, among which are the episcopal palace, surrounded with walls, the town-hall, and several monasteries; has a theological seminary, a gymnasium, and other educational institutions, important salmon fisheries, and straw hat manufactures, and carries on an active trade in corn, wine, and fruit. Pop. 10,023.

Lei'tomischl, town of Bohemia, on the Lautschna, has a fine palace and park, a beautiful church, and several good educational and benevolent institutions. Pop. 7087.

Leit'ner (Gottlieb William), Ph. D., b. at Pesth, Hungary, Oct. 14, 1830. His father, a German physician, left Hungary in consequence of the revolution of 1849, and settled in Turkey, where Gottlieb, already acquainted with the classical languages, became proficient in Turkish, Arabic, and modern Greek, studying under the best native professors at Constantinople and Brusa; learned English, French, and Italian at the British College at Malta; became interpreter to the English commissariat during the Crimean war, after which he went to London, was naturalized as a British subject, and became professor of Oriental languages and Mohammedan law in King's College. In 1864 he was appointed director of a college at Lahore, in the Punjaub; founded numerous societies, schools, colleges, and free public libraries in India; established several newspapers in Arabic and Urdu; promoted the study of the Aryan languages, and succeeded in organizing the Punjaub University upon a broad basis. From 1866 to 1868 he was engaged in an exploration of Thibet and other countries N. of the Himalayas, and was the first to make known the remarkable country of Dardistan, with its interesting group of languages. At a later date he extended his philological researches to the languages of Cabool, Cashmere, and Badakhshan, excavated an important series of Græco-Booddhist sculptures, and exhibited at the Vienna Exposition of 1873 an extensive collection of Central Asiatic antiquities. He has published a *Philosophical Grammar of Arabic* in the English, Urdu, and Arabic languages; *The Races of Turkey*; a *Comparative Grammar of the Dardu Languages*; *Dialogues* in those languages; *History, Songs, and Legends of Dardistan*, and *Græco-Booddhist Discoveries*, besides numerous contributions to the *Proceedings* of learned societies in London and on the Continent.

Lei'trim, county of Ireland, in the province of Connaught, bordering N. on Donegal Bay. Area, 613 square miles, or 392,363 acres, of which 115,869 are uncultivated, and 23,748 under water, covered by lakes, of which Lough Allen, traversed by the Shannon, is the largest. The ground is hilly, very irregular, and rugged; coal, iron, and lead are found. The soil is cold, stiff, and retentive, except in the valleys, where it is very fertile. Rye, potatoes, and oats are the common crops, some cattle are reared. Pop. 155,297 in 1841; 111,915 in 1851; 104,744 in 1861; 95,562 in 1871. The principal town is Carrick-on-Shannon, with only 1568 inhabitants.

Le'land, post-v. of Adams tp., La Salle co., Ill., on the Chicago Burlington and Quincy R. R., 67 miles S. W. of Chicago.

Leland (Charles Godfrey), b. at Philadelphia Aug. 15, 1824; graduated at Princeton College in 1846, after which he spent two years travelling in Europe, and studying at Heidelberg, Munich, and Paris, devoting himself especially to æsthetics and the philosophy of modern civilization. Returning to Philadelphia in 1848, he studied law, but abandoned its practice in favor of the literary vocation, to which he addressed himself particularly through the magazines, and acted occasionally as editor of more than one of the periodicals of that day. While well versed in graver subjects, and well acquainted with all branches of *belles-lettres*, Mr. Leland achieved his greatest popularity by productions of a humorous or burlesque character. He has passed several years in Europe, and now resides in London, where he is well known in literary circles. Among his works are *The Poetry and Mystery of Dreams* (1855), *Meister Karl's Sketch-Book* (1855), *Sunshine in Thought* (1862), *Legends of Birds* (1864), *Hans Breitmann's Ballads* (5 parts, 1867–70), a volume of poems (1871), *Egyptian Sketch-Book* (1873), *English Gypsies and their Language* (1873), *Fu-Sang* (1874), besides translations from Heine and Scheffel. In 1875 he published a volume of *English Gypsy Poetry* with the assistance of Miss Janet Tuckey and Prof. E. H. Palmer. As a writer of dialect poetry Mr. Leland has shown a considerable mastery of the quaint speech of the "Pennsylvania Dutch," and his "Breitmann" ballads are as highly appreciated in England as in America.

Leland (Henry Perry), brother of Charles G. Leland, b. in Philadelphia Oct. 28, 1828; was a frequent contributor in prose and verse to the *Knickerbocker*, the *Spirit of the Times*, and other magazines and periodicals. He was endowed with large powers of observation, cultivated by travel, and a keen sense of humor, which would have given him eminence in American literature. He published two books—a volume of travel, *Americans in Rome*, and a collection of humorous sketches entitled *The Gray Bay Mare* (1856). During the civil war he was a lieutenant in the 118th Pennsylvania Vols., and was prostrated by a sunstroke, from the effects of which he never recovered. D. at Philadelphia Sept. 22, 1868.

Leland, or **Laylonde** (John), b. in London, England, about 1500; was educated at St. Paul's School and at Oxford; took holy orders, and devoted himself to the study of English antiquities. He was appointed by Henry VIII. one of his chaplains, rector of Popeling near Calais, and royal antiquary (1533). In the latter capacity he was commissioned to make a survey of England, a task which occupied him six years, and was so thoroughly performed that the mass of materials gathered was more than he could arrange, much less prepare for publication. After eight years' solitary labors of classification, he became insane in 1550, and d. at London Apr. 18, 1552. His account of British authors, entitled *Commentarii de Scriptoribus Britannicis*, was published in 1709 by Dr. Anthony Hall, his

Itinerary of England in 1710–12 (9 vols.), and his *De Rebus Britannicis Collectanea* in 1715 (6 vols.), the two latter works being edited by an eminent scholar, Thomas Hearne. Leland's manuscripts were deposited in the Bodleian Library at Oxford, and were largely used by Stowe, Camden, and Dugdale in their respective antiquarian works.

Leland (John), D. D., b. at Wigan, Lancashire, England, Oct. 18, 1691; educated at the University of Dublin; was for 50 years pastor of a Presbyterian church at Dublin, where he d. Jan. 16, 1766. His polemical and apologetical works were highly esteemed and widely circulated. The best known was *A View of the Principal Deistical Writers in England in the Last and Present Century* (1754), often reprinted.

Leland (John), b. at Grafton, Mass., May 14, 1754; was 1775–91 a Baptist preacher in Virginia, and 1792–1841 a pastor in Cheshire, Mass., though in fact he was an itinerant, visiting often places remote from his residence. D. at North Adams, Mass., Jan. 14, 1841. His *Life* and writings have been twice published since his death.

Leland (Thomas), D. D., b. at Dublin, Ireland, in 1722; educated at Trinity College, Dublin, where he became fellow and professor of poetry. His translation of the *Orations of Demosthenes* (1756–70) was long a standard work; also published a *History of the Life and Reign of Philip, King of Macedon* (1758), and a *Dissertation on the Principles of Human Eloquence* (1764), a controversial work directed against Bishop Warburton; a *History of Ireland* (1773), and several volumes of *Sermons* (1769), besides numerous other works. D. at Dublin in 1785.

Lel'eges, was the name of an ancient race which was widely spread over Greece, the western coast of Asia Minor, and the intermediate islands, but which, like the Pelasgians, became incorporated with the Hellenes and disappeared as an independent people. Herodotus says that Leleges was the ancient name of the Carians; a later Greek writer places them in the same relation to the Carians as the Helots to the Lacedæmonians. In the Homeric poem both Leleges and Carians appear as equals and auxiliaries of the Trojans. Thus it appears that there existed a close relation between the Leleges and Carians, but about the character of this relation, and about the origin of the people, nothing is known. What the later Greek literature contains concerning this subject is evidently invention.

Leleux' (Adolphe), b. at Paris Nov. 15, 1812, and began his artistic career as an engraver and lithographer; in 1835 commenced to exhibit, and soon gained great reputation as a genre painter, representing with much humor and grace scenes of life in Brittany, Northern Spain, Algeria, and the streets of Paris during the revolution of 1848. His pictures are very common in French galleries.—His brother, Armand, b. at Paris in 1818, studied for some time under Ingres and in Italy, but turned also to the genre. He seems to have a finer sense for the strictly picturesque than his elder brother, but less humor and character.

Lele'wel (Joachim), b. at Warsaw Mar. 21, 1786; studied in his native city and at Vilna, and became professor of history at the Lyceum of Kremenets in Volhynia in 1809, and at the University of Vilna in 1814, but was dismissed in 1824, being suspected of participating in secret revolutionary associations. Next year he was elected a member of the Polish diet, and became one of the most energetic and influential agitators, and one of the most prominent leaders of the Polish rising of 1830. After the failure of the revolution he fled to France, and lived partly in Paris, partly at Lagrange, the villa of La Fayette; but in 1833 he was banished from France on account of his participation in different Polish conspiracies. He went to Brussels, where he resided for the rest of his life, wholly devoted to science. D. May 29, 1861. His writings are very numerous, but they are all of the highest order. His knowledge is always ample, and generally exhaustive; his views are large and elevated; his style is pure and very impressive. Besides his *Numismatique du Moyen Age* (Paris, 1835), *Pythéas de Marseille et le Géographie de son Temps* (Paris, 1836), *Géographie des Arabes* (2 vols., Paris, 1851), *Géographie du Moyen Age* (4 vols., Breslau, 1852–57), all of which are scientific contributions of the highest value, he wrote several works relating to the history of his native country which contain some of the most brilliant pages of modern historiography, and which generally are as reliable as they are interesting. The principal of these works are —*History of Poland* (Warsaw, 1829), with a continuation (Brussels, 1843), *Considérations sur l'Etat politique de l'ancienne Pologne, et sur l'Histoire de son Peuple* (2 vols., Paris, 1844), *La Pologne au Moyen Age* (3 vols., Posen, 1846–51).

Lelong' (Jacques), b. at Paris Apr. 19, 1665; received his first education at Malta, having been destined for the order of St. John, but separated therefrom; studied in Paris, and in 1699 was appointed librarian at the *oratorium* of St. Honoré in Paris, where he d. Aug. 13, 1721. His *Bibliotheca Sacra*, a catalogue of all editions and translations of Holy Scripture (2 vols., 1709), and his *Bibliothèque historique de la France* (1719), a catalogue of all French historians and their works, are regarded as model works of bibliography.

Le'ly (Sir Peter), b. at Soest, Westphalia, in 1618; d. in London in 1680. His father, whose family name was Van der Faes, took the name Du Lys or Lely from the circumstance of having lived over a perfumer's shop, which bore the sign of a lily. Peter studied at Haarlem with Peter Grebber, but came to England in 1641 as a historical painter, and soon devoted himself to portraits, at first copying those of Vandyke, who had died the year before his arrival. Through the influence of William, prince of Orange, he was introduced to Charles I., whose portrait he executed, along with those of William and Mary. Lely succeeded Vandyke as court-painter, and rose rapidly to fame and fortune. It was he who painted the portrait of Cromwell, and who was bidden by his sitter to put in all the pimples and warts. Charles II. conferred on him the honor of knighthood, and commissioned him to paint the "beauties" of his time for Hampton Court. In the same place are several of the portraits of admirals which the duke of York, afterwards James II., engaged this artist to paint. Most of his portraits are of women, and are of a showy and meretricious character. The artist painted to suit the taste of an abandoned age. His historical pieces are in private collections. The *Susanna and the Elders* is in the gallery of the marquis of Exeter. Lely was buried in Covent Garden. There is his monument with bust by Gibbon and epitaph by Flatman. O. B. Frothingham.

Lemaire' (Nicolas Éloi), b. at Triancourt, France, Dec. 1, 1767; studied at the College of St. Ménehould and afterwards at Sainte-Barbe in Paris; was appointed professor of Latin poetry in the College of France, afterwards in the same department in the faculty of letters in Paris (1811); became dean of the faculty (1825); in 1810 Murat named Lemaire as head of his projected University of Naples, but Napoleon was not willing to let him leave France, and settled a pension upon him. After the Restoration, Louis XVIII. favored the publication of a complete series of the Latin authors, of which Lemaire was constituted chief editor. From the list of writers, made by Louis himself, Lucretius was omitted for political considerations. The series was completed in 142 volumes, to which Lucretius was subsequently added by P. A. Lemaire, nephew and assistant of the editor. D. Oct. 3, 1832. (See *Notice sur N. E. Lemaire par J. L. Gillon*, in appendix to the *Bibliotheca Latina.*) H. Drisler.

Le Mars, post-v. and tp., cap. of Plymouth co., Ia., at the junction of the Iowa division of the Illinois Central and the St. Paul and Sioux City R. Rs., 25 miles N. E. of Sioux City. It has a State bank, 2 newspapers, a variety of stores, workshops, and a flouring-mill, 3 churches, 3 hotels, etc. It is the centre of a fertile farming district. Pop. 152. J. C. Buchanan, Ed. "Sentinel."

Lem'berg, city of Austria, the capital of Galicia, situated on the Peltov in a narrow valley surrounded by forest-clad hills. It is the seat of the government, and of a Roman Catholic, an Armenian, and a Greek archbishop. It has a cathedral, built in 1370 by Casimir the Great, two beautiful synagogues, many splendid palaces, and other magnificent buildings. Its university is attended by about 1400 students and has 35 professors. Its manufactures are not important, but its trade, though to a great extent merely transit, is very extensive; it is mostly in the hands of Jews, who number about 25,000. Pop. 87,105.

Lémery (Nicolas), b. at Rouen Nov. 17, 1645; studied pharmacology in his native city, at Montpellier, and at Paris, and gave lectures on chemistry which attracted great audiences, and gained the applause of all truly scientific men, as he kept closely to facts, and abandoned all mystical dreams of a sympathy between the metals and the planets, of an elixir for the prolongation of human life, and other such things. He belonged to the Reformed Church, and from this circumstance severe troubles arose. In 1683 he left France and went to England, where he presented a copy of the 5th ed. of his *Cours de Chimie*, published in 1675, to Charles II., and was well received. Soon after, however, the political troubles in England caused him to return to Paris, and after the Revocation of the Edict of Nantes in 1685, by which he lost his right of practising as an apothecary and physician, he joined the Roman Catholic Church, and continued his activity as a lecturer and writer unmolested till his death, June 19, 1715. The most prominent writings, besides his *Cours de Chimie*, are *Pharmacopée universelle* (1697) and *Traité des Drogues simples* (1698).

Lem'hi, county of Idaho, bounded E. by the Bitter Root Mountains. It has several fertile valleys, but is generally mountainous. It has important gold-mines. Cap. Salmon City. Pop. 988.

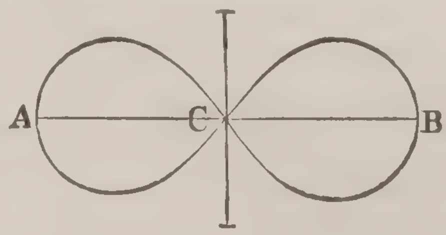
Lem'ington, post-tp. of Essex co., Vt., on Connecticut River, 67 miles N. E. of Montpelier. Pop. 191.

Lem'ley's, tp. of Mecklenburg co., N. C. Pop. 971.

Lem'ma [Gr. λῆμμα], an auxiliary proposition demonstrated out of its regular order to facilitate the demonstration of some other proposition. The conclusion of the lemma is needed in the demonstration of the main proposition; and rather than encumber that proposition, a separate demonstration is introduced. The eleventh, twelfth, and thirteenth propositions of Book viii., Davies's *Legendre*, are lemmas. W. G. PECK.

Lem'ming, a name applied to rodents of the family Muridæ and sub-family Arvicolinæ (field-mice), belonging to the genus Myodes. Some species are very abundant in the high northern regions of both continents. They are very prolific, and in Scandinavia are at times extremely destructive. They are remarkable for their occasional great migrations in search of food. *Myodes Norvegicus* is the typical lemming.

Lemnis'cate [Gr. λημνίσκος; Lat. *lemniscatus*], a curve of the *fourth order*, shaped somewhat like the figure 8, as shown in the diagram. It is the locus of the points of intersection obtained by drawing perpendiculars from the centre of a hyperbola to the tangents drawn to that curve.



If the equation of the hyperbola is

$$a^2y^2 - b^2x^2 = -a^2b^2,$$

the equation of the corresponding lemniscate is

$$(x^2 + y^2)^2 = a^2x^2 - b^2y^2.$$

If the hyperbola is equilateral, that is, if $a = b$, this equation becomes

$$(x^2 + y^2)^2 = a^2(x^2 - y^2).$$

The curve is quadrible; in the latter case the entire area included within the two branches C A and C B is equal to the square of the semi-transverse axis, that is, to a^2. In the figure A and B are the vertices of the hyperbola, and C is its centre. At A and B tangents to the curve are perpendicular to A B; the point C is a multiple point, at which tangents to the curve coincide with the asymptotes of the given hyperbola. W. G. PECK.

Lem'nos [Λῆμνος, now *Limni* or *Stalimni*], an island in the Ægean, belonging to Turkey, 40 miles S. S. E. of Athos. Area, 150 square miles. It is of very irregular outline, is rocky and hilly, and bears strong marks of volcanic action, but the valleys are fertile, and the ancients relate that the mountain Mosychlus was sometimes an active volcano. This island, so famous in history and mythology, now contains some 12,000 inhabitants, mostly Greeks. Its chief town, Castro, is the seat of a bishop.

Lem'on [Hindostanee, *limbu*, *limu*, or *nimbu*, from which the Arabian *limun*; Sp. *limon*, etc.], the fruit of *Citrus limonium*. The *Citrus* genus, of which the orange and lemon are the familiar representatives, constituted a natural order, Aurantiaceæ, which of late is merged in the large order Rutaceæ. The leaves of these trees are noted for the translucent dots appearing like punctures when held between the eye and the light, these dots being oil-glands and giving the fine aroma which characterizes the genus; also for the joint below the blade, which shows the leaf to be a compound one reduced to the terminal leaflet; and the petiole below is usually more or less winged, with leafy borders. The lemon tree does not form the close head of deep green foliage which is so striking in the orange tree, but is of irregular growth, with paler and sparser leaves. The young shoots are dull purple; the corolla externally purplish and internally white; the delicate aroma distinct from that of the orange-blossom. The fruit is pale yellow, ovoid or oblong, usually crowned by a nipple; the rind firm and adherent to the pulp; the juice sharply acid, but in some varieties sweetish. The roughness of the surface of the lemon is owing to the imbedded oil-cells. These furnish the oil and essence of lemon, obtained either by expression or distillation. Lemon-peel is a well-known flavoring ingredient. Lemon-juice is not only largely used for acidulated drinks and for effervescing draughts, but also for the preparation of citric acid, its important ingredient. This is used in medicine for febrile and rheumatic diseases, and in the arts for certain processes of calico-printing, to discharge colors and deepen the white parts of fabrics dyed with ferric salts. Concentrated lemon-juice is largely employed on shipboard for the prevention of scurvy in long voyages. The commercial article is derived from the lime and bergamot, as well as from lemons.

The lemon is of Indian origin; the tree, which probably represents the wild state of both the lemon and the citron, is a native of the forests of Northern India. The introduction of the tree to Europe is due to the Arabians. Its chief cultivation as an object of industry is on the Mediterranean coast between Nice and Genoa, in Calabria, Sicily, etc. It endures less cold than the orange, and wherever it well succeeds is a more profitable culture. ASA GRAY.

Lemon, tp. of Butler co., O. Pop. 5242. It includes Middletown (P. O.) and other villages.

Lemon, post-tp. of Wyoming co., Pa. Pop. 531.

Lemon (MARK), b. in London, Eng., Nov. 30, 1809; was author of more than sixty plays and farces, many of them highly successful, and of several novels, but will be chiefly remembered for his long connection with *Punch*. From the establishment of that paper in 1841 he was assistant editor, and in 1843 assumed the chief management, which he retained through life. He was also for many years literary editor of the London *Illustrated News*, for which he wrote about 100 songs, and assistant of Charles Dickens in the management of *Household Words*. He was distinguished for his generous sympathies and his hatred of shams. D. at Crawley, Sussex, May 23, 1870.

Lemond', post-tp. of Steele co., Minn. Pop. 417.

Lem'on, Oil of (*Oleum Citri*), the volatile oil of lemon-peel, extracted from the grated rind by pressure or by distillation with water. It may also be obtained by putting the grated peel in hot water and skimming off the oil which rises to the surface. That obtained by pressure has more of the peculiar flavor of the fruit, but contains mucilage, etc., which make it more liable to change on keeping than that which is prepared by distillation. Oil of lemon is a volatile liquid, generally yellow, having the peculiar odor of the fruit and a pungent, aromatic taste. Its sp. gr. is 0.8517. It is sparingly soluble in water; dissolves in 7.14 parts alcohol of sp. gr. 0.8317; in 10 parts alcohol of sp. gr. 0.85; in any quantity in absolute alcohol; mixes with both fixed and volatile oils. It dissolves sulphur, phosphorus, resins, and fats. Exposed to air and light, it absorbs oxygen, with the formation of ozone, becomes darker and more viscid, and evolves a little carbonic acid. It consists almost entirely of two hydrocarbons, $C_{10}H_{16}$, isomeric with each other and with oil of turpentine, differing from each other in optical rotary power, and in their behavior with hydrochloric acid.

Oil of lemon is largely used in perfumery and as a flavoring for ice cream and syrups; has the stimulant properties of the aromatics, though in pharmacy it is chiefly used to impart flavor to other medicines. It should not be dark-colored or viscid, and should not leave a permanent stain on paper. It is often adulterated with oil of turpentine, lavender, alcohol, etc. The presence of cheaper oils may generally be recognized by the odor. Turpentine may be detected by noting the behavior of the oil with regard to polarized light before and after heating. With pure oil little or no change will be noticed, but when turpentine is present the dextro-rotary power will be considerably increased by heating. C. F. CHANDLER.

Lemont', post-v. and tp. of Cook co., Ill., on the Chicago and Alton R. R., 26 miles S. W. of Chicago. Pop. 3573.

Lemontey' (PIERRE ÉDOUARD), b. at Lyons Jan. 14, 1762. Deputy in the National Assembly, Lemontey soon turned against the revolutionists, and he fought at Lyons during the siege of the city by Couthon. He escaped alive, and fled to Switzerland. He returned to France in 1804, and was elected in 1817 member of the Academy. His principal works, which were held in high repute, are *Essay on the Monarchical Establishment of Louis XIV.* and *History of the Regency*. D. at Paris June 26, 1826. FÉLIX AUCAIGNE.

Lem'onweir, post-v. and tp. of Juneau co., Wis., on the Milwaukee and St. Paul R. R. Pop. 1947.

Le Moyne, a Canadian family of eleven brothers, seven of whom acted prominent parts in advancing French explorations, conquests, and settlements in America.—Their father, CHARLES LE MOYNE, b. in Normandy, France, in 1626, came to Canada in 1641; lived some years among the Hurons; obtained extensive land-grants; was distinguished in wars against the Iroquois under Courcelles and Tracy; was held a prisoner by those Indians several months in 1665, and was created in 1668 Seigneur de Longueil, to which title that of Châteauguay was afterwards added. He was for some time military commander of Montreal, where he d. in 1683.—Of his sons, PIERRE and JEAN BAPTISTE were distinguished in Louisiana, gaining the titles of Sieurs DE BIENVILLE and D'IBERVILLE (which see).—The eldest

brother, I. CHARLES, Baron de Longueil, b. in Montreal Dec. 10, 1656; served in his youth in the French army in Flanders; promoted colonization to Canada; built a stone fort on his estate at Longueil; was wounded in the repulse of Sir William Phipps's assault upon Quebec in 1690; was made governor of Montreal and baron in 1700; commander-in-chief of the colonial forces; fought against the English expedition of Walker and Nicholson in 1711; was in command at Three Rivers in 1720, and at Montreal from 1724 to 1726; rebuilt Fort Niagara in the latter year; was made chevalier of the order of St. Louis, and d. at Montreal June 8, 1729.—II. JACQUES, Sieur de Sainte Hélène, b. at Montreal in Apr., 1659, was sent in Mar., 1686, with his younger brothers, Pierre and Paul (afterwards Iberville and Maricourt), in an expedition under the command of Chevalier de Troyes against the English on Hudson's Bay, where they had built Forts Monsipi, Rupert, and Kichichouanne. These three forts were captured, as well as a vessel of war having on board the English governor-general of Hudson's Bay, Sainte Hélène having borne a leading part in each action. He was second in command of the expedition which took Fort Corlear (Schenectady) Feb. 9, 1690, and in the same year commanded the batteries which repelled the English squadron at Quebec, on which occasion he was mortally wounded.—III. PAUL, Sieur de Maricourt, b. at Montreal Dec. 15, 1663, participated, as above mentioned, in Troyes' expedition against Hudson's Bay, being wounded before Fort Monsipi (June 20, 1686); remained with his brother Iberville in command of that district up to 1690, when he aided in the defence of Quebec; took part in Frontenac's expedition against the Iroquois, with whom he negotiated peace in 1701, and in Apr., 1704, lost his life, with forty others, in a stockade burned by those Indians.—IV. JOSEPH, Sieur de Serigny, b. at Montreal July 22, 1668; became an officer in the French navy, and in 1694 and 1697 commanded vessels in Hudson's Bay in co-operation with the land operations of his brother Iberville. Subsequently he commanded a squadron; brought to Louisiana some of its earliest settlers, and in 1718–19 surveyed the coast of that colony. He was engaged in the capture of Pensacola from the Spaniards (May 14), and repulsed them from Dauphin Island, near Mobile (Aug. 19, 1719), after a siege of a month; was made captain of a ship of the line in 1720, and in 1723 rear-admiral and governor of Rochefort, France, where he d. in 1734.—V. ANTOINE, Sieur de Châteauguay, b. at Montreal July 7, 1683; became an officer of the French army; brought a body of colonists to Louisiana in 1704; served under Iberville against the English in 1705 and 1706; was royal lieutenant in Louisiana in 1718; was engaged in the Florida campaign against the Spaniards in 1719; taken prisoner at Pensacola Aug. 7, and commanded at Mobile from 1720 to 1726, when he was removed from office and recalled to France; sent as governor to Martinique in 1727, and afterwards to Cayenne; returned to France in 1744; was made governor of Cape Breton in 1745; successfully defended Louisburg against the New England forces under Pepperell, and d. at Rochefort, France, Mar. 21, 1747. He inherited the title of Sieur de Châteauguay from his brother LOUIS, b. in Jan., 1676, who was mortally wounded in the attack on Fort Nelson, Hudson's Bay, and d. Nov. 4, 1694.—Another brother, FRANÇOIS, b. Mar. 10, 1666, killed in battle with the Iroquois at Repentigny June 7, 1691, was the first Sieur de Bienville, the title having passed on his death to his brother, Jean Baptiste. Sauvolle, the first colonial governor of Louisiana, has often been incorrectly included as one of the brothers Le Moyne. PORTER C. BLISS.

Lem'pa, a river of San Salvador, Central America, rises in Lake Guija, near the Guatemala boundary, flows E. S. E. nearly 150 miles through the departments of Sonsonate, Cuscatlan, and San Vicente, then bending S. forms the E. boundary of the departments of San Vicente and La Paz and the W. boundary of San Miguel, and falls into the Pacific after a total course of 210 miles. The Lempa is the largest stream of the Pacific coast of Central America, and is navigable for a large part of its course. The valley of the Lempa is broad and well settled, and one of the most productive agricultural regions within tropical America.

Lemprière (JOHN), D. D., b. in the island of Jersey about 1750; studied at Westminster School and at Oxford; took orders in the Church of England; was head-master of classical schools at Abingdon and Exeter; became rector of Meath and Newton-Petrock, Devonshire, in 1811, and d. Feb. 21, 1824, at London. He published in 1788 a small *Bibliotheca Classica*, or "Classical Dictionary," much enlarged in the 2d ed. of 1792, and which has since been many times reprinted in England and the U. S. It was based upon Sabbathier's *Dictionnaire des Auteurs classiques*, published at Châlons-sur-Marne in 36 vols. (1766–90), and was in turn the basis of Anthon's well-known classical dictionary. Dr. Lemprière published also a volume of *Sermons* (1791), the first volume of a translation of Herodotus (1792), and a *Dictionary of Universal Biography* (1808) in a single volume, which was reprinted in New York in 1825 (2 vols.), with additions by Eleazar Lord.

Lemp'ster, post-tp. of Sullivan co., N. H., 40 miles W. of Concord, has 3 churches and manufactures of lumber. Pop. 678.

Lemur [Lat. *lemur*, "spectre"], the name of a genus of mammals, bestowed on it on account of the appearance of the animal, and especially its large staring eyes and its nocturnal habits. By the late Dr. Gray the genus was split into three—viz. *Varecia*, *Lemur*, and *Prosimia*. (See LEMURIDÆ and LEMURINÆ.)

Le'mures, in Roman mythology, was by some writers used as the general name for all spectres or spirits of the dead, of which the good ones were called *lares* and the evil *larvæ*. More commonly, however, *lemures* was used synonymously with *larvæ*, denoting only those spirits which returned to the upper world with the purpose of injuring the living. In order to propitiate them an annual festival called *Lemuria* was held to their honor, and certain ceremonies were performed on the nights of the 9th, 11th, and 13th of May. The days on which these rites were performed were considered unlucky, and the temples remained closed during the festival. A description of the ceremonies is found in the fifth book of Ovid's *Fasti*.

Lemur'idæ [from *Lemur*, the typical genus, and the family termination *-idæ*], a family of the sub-order Prosimiæ and order Primates, whose teeth are of three kinds—viz. incisors ($\frac{0}{1}$—$\frac{2}{2} \times 2$), canines ($\frac{1}{1} \times 2$), and molars (P. M. $\frac{2}{2}$—$\frac{3}{3}$; M. $\frac{3}{3} \times 2$); the incisors of the upper jaw small (sometimes deciduous), and separated into two groups by a symphysial interspace, and those of the lower jaw larger, contiguous, and proclivous; the canines of the lower jaw proclivous, parallel with and resembling the incisors (and hence sometimes mistaken for them); leg with the fibula and tibia distinct from each other; hind foot with the second toe armed with a subulate claw, and the other toes provided with flattened nails. This family includes the lemurs, or, as they are sometimes called, half-monkeys, and is confined to the island of Madagascar, the equatorial parts of Africa, and India. A considerable range of variation is exhibited by its several constituents in the general form and proportions, the shape of the head, the development of a tail (which in some is very large, and in others wanting), the size of the ears, and the length of the tarsus; the modifications in these respects have caused the differentiation of the family into four sub-families—viz. Indrisinæ, Lemurinæ, Nycticebinæ, and Galagininæ. The peculiar relations of the family will be more appropriately considered under the head PROSIMIÆ, and the minor groups under their titles. THEO. GILL.

Lemur'inæ [from *Lemur* and the sub-family ending *-inæ*], the chief sub-family of Lemuridæ, in which there are 36 (exceptionally 32) teeth—viz. I. $\frac{2}{2}$ (sometimes lost from the upper jaw), C. $\frac{1}{1}$, P. M. $\frac{3}{3}$, M. $\frac{3}{3} \times 2$; the neural spines of the posterior (last dorsal and lumbar) vertebræ inclined forward; the tail elongated, and generally exceeding two-thirds the length of the body; the hind limbs considerably longer than the fore ones, and with the tarsus of normal proportions, or moderately elongated; and the ears moderate, with the anterior portion of the helix well developed, folded over the fossæ of the concha and antihelix, and with the tragus and anti-tragus distinctly developed. The group includes the typical lemurs, which are readily recognizable by their external appearance; the head is produced into a more or less elongated snout, and somewhat resembles that of the raccoons or foxes. All the living species are confined to the island of Madagascar. Exclusive of *Chirogaleus* (which rather belongs to the Galagininæ), they are grouped in four genera—viz. *Lemur*, *Hapalemur*, *Lepilemur*, and *Mixocebus* (Peters, 1874). They are chiefly nocturnal animals, live in the forests of Madagascar in the trees, feed on insects and fruit, and associate together in troops. In repose they roll themselves up in the form of a ball, and wind their tail around the body. Their elongated hind limbs enable them to leap with agility. THEO. GILL.

Lemuroidea, a name applied by some to the sub-order PROSIMIÆ (which see).

Le'na, one of the principal rivers of Siberia, rises near Irkootsk, in the mountains N. of Lake Baikal, and enters the Arctic Ocean through several branches between lon. 125° and 130° E. It receives the Vitim, Olekma, and Aldan from the right, and the Viliooi from the left, passes by Olekminsk and Yakootsk, and is navigable from May to November.

Lena, post-v. of Stephenson co., Ill., on the Illinois Central R. R., 132 miles N. W. of Chicago. It has a bank, a weekly newspaper, steam flouring and planing mills, an

iron-foundry, several carriage and wagon manufactories, and other shops, 1 very fine and 2 smaller public-school buildings, a school library, 2 hotels, a steam-elevator, 4 grain-warehouses, and the usual number of stores. Grain, stock, dairy products, tobacco, etc. are the chief articles of export. Pop. 1294. J. W. NEWCOMER, ED. "STAR."

Lena, a v. of Brown tp., Miami co., O. Pop. 144.

Le'nau (NIKOLAUS), whose true name was NIEMBSCH VON STREHLENAU, b. at Csatad, Hungary, Aug. 15, 1802; studied philosophy, jurisprudence, and medicine at Vienna, travelled much; visited in 1832 the U. S.; resided after his return to Europe alternately in Vienna, Ischl, and Stuttgart, but became insane in 1844, and d. Aug. 22, 1850, in a lunatic asylum at Oberdöbling, near Vienna. He published his first volume of poems in 1832; in 1838 followed a second; in 1835, *Faust*, in 1837, *Savonarola*, in 1842, the *Albigenses*, and after his death, *Don Juan*. A collected edition of his works was published at Stuttgart in 1855, in 4 vols. It is unquestionable that Lenau was an original poetical genius, and the great impression which he produced in Germany was not only natural, but just. The extraordinary brilliancy and variety of his imagery might be the product of study and labor, to some extent at least; but there is, especially in his Polish and Hungarian songs, a fresh gush of genuine feeling, and in his verse a full, round melody which belongs to the genius alone. Nevertheless, even in his earlier productions, it is evident that he endeavors to raise, by the aid of the speculative philosophy, his poetical foundation above that standpoint which he actually occupies as a living personality; and this attempt at making the poetry bigger than the poet by help of an artificial substruction—an attempt frequently met with in the latest period of German literature, but which by itself is as impossible as climbing the moon—resulted with Lenau first in forced ideas, unsound excitement, and obscure expressions, and then in the total destruction both of the genius and the personality. CLEMENS PETERSEN.

Len'awee, county of Michigan, bounded S. by Ohio. Area, 720 square miles. It is undulating, very fertile, and well watered. Cattle, grain, and wool are staple products. Lumber, carriages, cooperage, metallic wares, saddlery, furniture, clothing, cheese, flour, machinery, and brick are leading articles of manufacture. The county is traversed by the Michigan Southern R. R. and its branches. Cap. Adrian. Pop. 45,595.

Len'cas, a tribe of Indians in Honduras, Central America, speaking a language called *Chontal*, a Mexican term signifying "barbarian." They are industrious and peaceable mountaineers, numbering some 40,000, and occupying the table-lands of Otoro and Intibucat, near Comayagua, the capital of the republic. There are Chontal Indians in Nicaragua and in the Mexican states of Oaxaca and Tabasco, but their languages are probably distinct from each other and from that of the Lencas.

L'Enclos' (ANNE, called NINON DE), b. at Paris in 1615. Possessed of a small fortune, which she managed very shrewdly, and which enabled her to make love the pursuit of her life without making it a business, she left early the parental roof and established an independent household. She was beautiful, she was spirited; Scarron, Saint-Evremond, Molière, Fontenelle, Larochefoucauld, and others read their works in her salon; but, above all, she was fascinating, and it soon became indispensable for all young men of birth, wealth, and elegant ambitions to be introduced to her. One lover followed the other in rapid succession, and this life went on uninterruptedly for more than half a century. She was the mistress of the marquis of Sevigné; in the next generation his son was her lover, and in the third she seduced his grandson. Her own son, who had been educated by the father and kept in ignorance of the mother, fell desperately in love with her, and when, in order to prevent a horrible crime, she was compelled to reveal the secret suddenly to him, the young man blew out his brains in her presence, but she herself remained comparatively cool at the affair. At last a change came. She was now over seventy. Young men began to call her "Mademoiselle de L'Enclos," and not, as formerly, simply "Ninon." Ladies, even of the highest position and of the finest education, now began to crowd her salon, and for many years longer her social position was very brilliant. She felt sad, however, as her letters to Saint-Evremond. who wrote her biography, show, but there was no remedy, To the student her character does not seem to be of any great interest, but her life is exceedingly characteristic of the age in which she lived. Her salon and the Revocation of the Edict of Nantes prepare the feeling very well for the scenes of the French Revolution. She attained a great age, dying at Paris Oct. 17, 1705. CLEMENS PETERSEN.

Lenc'zy, or **Lenczyc'a,** town of Russia, in the government of Warsaw. It has some linen manufactures. Pop. 5338.

Lendina'ra [Lat. *Lendenariæ*], a small town of N. Italy, in the province of Rovigo, about 25 miles S. W. of Padua. This very ancient town was the subject of much contention during the Middle Ages. It now contains some handsome churches, with fine pictures by Paul Veronese, Sebastiano del Piombo, etc. Pop. in 1874, 6909.

Le Neve (JOHN), b. in England about 1679; was educated at Trinity College, Cambridge, and became rector of Thornton-le-Moor, Lincolnshire. D. about 1741. He was a zealous collector of biographical materials; wrote *Fasti Ecclesiæ Anglicanæ* (1716), *Monumenta Anglicana* (9 vols., 1700–19), *Lives of the Protestant Bishops* (1720), *Lives of the Archbishops* (1723), and other minor works. A new edition of the *Fasti* was published in 1854 (3 vols.) by T. Duffus Hardy, assistant keeper of the public records, with a continuation down to that year. While the original edition contained only 11,000 entries, Hardy's edition contained data respecting more than 30,000 clergymen of the Church of England.

L'Enfant' (PIERRE CHARLES), b. in France in 1755; came to America with La Fayette in 1777, and served in the Revolution as an officer of engineers; became captain in 1778; was wounded at the siege of Savannah; promoted to be major in 1783; was engineer at Fort Mifflin in 1794; drew up the plan for the city of Washington, and was architect of some of the public buildings at that capital. In 1812 he was appointed professor of engineering at West Point Military Academy, but declined. D. in Prince George's co., Md., June 14, 1825.

Len'itives [Lat. *lenire*, to "soften"], in medicine, substances which, without specially active virtues of their own, possess by reason of viscidity the power to mechanically sheathe mucous membranes or raw surfaces from the action of irritants. Such are the bland fixed oils, glycerine, and solutions of gummy and starchy substances.

EDWARD CURTIS.

Lenkoran', town of Russia, in the government of Baku, on the Caspian Sea. In its vicinity are many hot sulphur springs of great medicinal repute. Pop. 5644.

Len'nep, town of Rhenish Prussia, on the Lennep, an affluent of the Rhine, has extensive manufactures of linen, woollen, cotton, and silk fabrics, especially of ribbons. Pop. 7653.

Lennep, van (JACOB), b. in Amsterdam Mar. 25, 1802; studied law at the University of Leyden; practised with great success as an advocate; was appointed attorney-general for the province of North Holland, and d. Aug. 26, 1868. He made his début in literature with a volume of poems, *National Legends*, and shortly after, under the Belgian revolution of 1830, his two comedies, the *Frontier Village* and the *Village beyond the Frontier*, were performed with great success. He wrote about thirty more dramas, some of which were received with great applause. But it was chiefly as a novel-writer he gained his fame. Inspired by the example of Walter Scott, he treated the history of his fatherland in a series of romances, about 50 in all, and several of these acquired a great reputation and were translated into German, French, and English; as, for instance, *The Rose of Dekama* and *The Adopted Son*.

Lenni-Lenape. See DELAWARES.

Len'ni Mills, post-v. of Middletown tp., Delaware co., Pa., on the West Chester and Philadelphia R. R.

Len'nox, county of Ontario, Canada, bordering on Lake Ontario, includes Amherst Island in that lake. It is traversed by the Grand Trunk Railway. The county of Addington is joined to it for judicial purposes. The soil is fertile. Cap. Nepanee. Pop. 16,396.

Lennox (CHARLOTTE RAMSAY), b. in New York in 1720, her father, Col. James Ramsay, being lieutenant-governor of the province; went to London at the age of fifteen; devoted herself to literature, and wrote novels which obtained great popularity. She enjoyed the friendship of Richardson and Dr. Johnson. Among her works were a volume of *Poems* (1752); *The Female Quixote* (1753); *Shakspeare Illustrated* (1753–54), a collection of tales used by Shakspeare in his plots; *Henrietta, a Novel* (1758); *Philander, a Dramatic Pastoral* (1758); *Sophia* (1763); *Father Brumoy's Greek Theatre;* and a translation of the duke of Sully's *Memoirs* (1761). D. in London Jan. 4, 1804.

Lennox (EARLS and DUKES OF). See STEWART and RICHMOND.

Lennox (Lord GEORGE HENRY), GEN., b. in England Nov. 27, 1737, was second son to Charles Lennox, second duke of Richmond; entered the army in 1751; distinguished himself in the German campaigns as aide-de-camp to the duke of Cumberland (1757) and to the king (1762); entered

Parliament in 1761; attended his brother, the third duke of Richmond, in his embassy to France in 1765; became lieutenant-general in 1777; constable of the Tower of London and governor of Plymouth in 1784; general and member of the privy council in 1793. D. at Stoke Park Mar. 25, 1805.

Lennox (Lord WILLIAM PITT), b. in England Sept. 20, 1799, the fourth son of the fourth duke of Richmond, and godson of William Pitt; educated at Westminster; entered the army; was for some years attached to the staff of the duke of Wellington; has been a voluminous contributor to the *Sporting Review* and to several magazines and newspapers. Among his works are *Compton Audley* (1841), *The Tuft-Hunter* (1843), *Percy Hamilton* (1852), *Philip Courtney* (1857), *Merrie England* (1857), *Recreations of a Sportsman* (1862), *Fifty Years' Biographical Reminiscences* (1863), *Adventures of a Man of Family* (1864); and *Drafts on my Memory* (1865).

Len'noxville, post-v. of Compton co., Quebec, Canada, at the junction of the Massawippi Valley and the Grand Trunk Railways, 3 miles from Sherbrooke; is the seat of Bishops' College, a flourishing institution. Pop. about 900.

Lenoir', county in E. North Carolina. Area, 400 square miles. It is traversed by the Atlantic and North Carolina R. R. and the navigable Neuse River. It is level and fertile. Rice, cotton, and corn are staple products. Cap. Kinston. Pop. 10,434.

Lenoir, post-v. and tp., cap. of Caldwell co., N. C., 15 miles N. of Morganton. It is the seat of Lenoir Female College. Pop. of v. 446; of tp. 2054.

Lenoir (Gen. WILLIAM), b. in Brunswick co., Va., May 31, 1751; removed in childhood to North Carolina; took an active part in the campaigns against the British and Tories in North Carolina and South Carolina; was for sixty years justice of the peace; often a member of both branches of the legislature; president of the senate for five years; then president of the council, and for the last eighteen years of his life major-general of the State militia. D. at Fort Defiance, N. C., May 6, 1839.

Lenormand' (MARIE ANNE ADELAIDE), b. in Alençon May 27, 1772; came in 1790 to Paris as saleswoman in a linen shop, and appeared in 1793 as a fortune-teller. She was several times arrested—in 1794, 1809, and 1821—but this circumstance only contributed to make her more popular. During the empire her rooms were visited by people of the highest rank, even by the empress Josephine, and when, after the fall of Napoleon, she went to Aix-la-Chapelle, she attracted the attention of the assembled monarchs, especially of Alexander of Russia. After 1830 she was nearly forgotten, and d. in obscurity June 25, 1843, but her life, and even her writings, *Mémoires historiques et secrets sur l'imperatrice Joséphine* (1829), etc., are not without interest for the mental physiognomy of those times.

Lenormant' (CHARLES), b. in Paris, France, June 1, 1802; studied law; travelled in Italy, where he gave special attention to archæology; became in 1825 inspector of fine arts; accompanied Champollion the younger to Egypt in 1828; took an active part as a member of the commission for exploring the Morea; became after the revolution of 1830 chief of the section of fine arts at the ministry of the interior, keeper of books and antiquities at the royal library, professor at the Sorbonne (1835), and professor of Egyptian archæology at the College of France. He wrote numerous treatises on art, numismatics, ceramics, and Egyptology, as well as on religion and history, and was editor for many years of the *Correspondant* magazine. D. at Athens Nov. 24, 1859.—His wife, AMÉLIE, a niece of Madame Récamier, edited the correspondence of that celebrated lady (1859), besides writing works on *Madame de Staël* (1862) and the *Women of the Revolution* (1865).

Lenormant (FRANÇOIS), son of Charles, b. at Paris in 1835; was educated by his father, following his footsteps as an archæologist, to which he added a thorough study of the languages of the cuneiform inscriptions, in which department he has become a leading authority. He is especially prominent for his important researches in the Accadian language; and after travelling in Egypt, Turkey, and Greece became in 1874 professor of archæology at the Bibliothèque. His *Manual of the Ancient History of the East* (3 vols., 1868–69; Am. ed. 2 vols., 1869–70) is the best modern compendium of the results of Egyptian, Phœnician, and Assyrian researches. Other important works are *Lettres assyriologiques et épigraphiques* (3 vols., 1871–72–73); *Études accadiennes* (1873–74); *La Magie chez les Assyriens* (1874), and *Les premières Civilisations* (1874). From none of the recent workers in the field of the cuneiform monuments have greater results been obtained.

Len'ox, tp. of Warren co., Ill. Pop. 948.

Lenox, tp. of Iowa co., Ia. Pop. 445.

Lenox, post-v. and tp. of Berkshire co., Mass., 5 miles S. of Pittsfield. It was long the county-seat. It is traversed by the Housatonic River and R. R., and has manufactures of iron, plate glass, lime, lumber, flour, brick, etc. Iron ore and limestone are obtained here. The town has 4 churches, a public library, and a good high school. It is a favorite place of summer resort. Pop. 1965.

Lenox, tp. of Macomb co., Mich. Pop. 2134.

Lenox, post-tp. of Madison co., N. Y., on Oneida Lake, has several mineral springs and beds of iron and gypsum. It contains Canastota, Oneida, and many other villages. Pop. 9816.

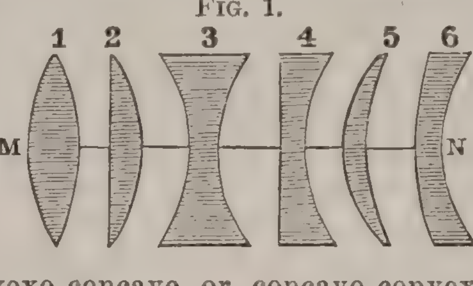
Lenox, post-tp. of Ashtabula co., O. Pop. 752.

Lenox, tp. of Susquehanna co., Pa. Pop. 1751.

Lens, town of France, in the department of Pas de Calais, on the Souchez, an affluent of the Scheldt, has important coal-mines in its vicinity. Pop. 5738.

Lens [Lat. *lens*, a "lentil"], in optics, a transparent substance bounded by opposite curved surfaces, or by one plane and one curved surface, the curvature being usually spherical. The property of a lens is to refract or bend the rays of a pencil of light transmitted through it symmetrically toward or from a fixed line called the axis. The axis is fixed by the condition that the tangents to the opposite surfaces at the points where it meets them are parallel to each other and perpendicular to this axis. Lenses are called converging or diverging lenses according to the effect produced by them upon parallel rays. They are of several kinds, distinguished by the character of their curvatures. Six forms are shown in the figure, the first a double convex, the second a plano-convex, the third a double concave, the fourth a plano-concave, the fifth a meniscus, and the sixth a convexo-concave or concavo-convex, receiving the one or the other of these names according as the incident light falls on the convex or the concave side. The use of lenses in optical instruments is to aid vision by forming images of objects, to be viewed instead of the objects themselves; which they do by causing pencils of light from the several points of such object to converge toward or diverge from corresponding points, in the first instance on the opposite side of the lens, and in the second on the same side. These points are called *foci.* The image is positive and real when formed by converging rays; negative and imaginary when without being actually formed it seems to exist to the eye receiving the diverging rays. Only one of the pencils from the object can have its axis coincident with the axis of the lens; but every oblique pencil has, nevertheless, an axis passing through the optical centre of the lens; and the focus of each pencil will be found in the axis of that pencil or in the axis prolonged. It is unfortunately true, however, that the rays refracted from the border of a lens of spherical curvature meet the axis at a point less distant from the lens than that in which those nearer the centre meet it. Hence, the focus of a simple lens is not a single point; or rather, every elementary ring into which the lens may be supposed to be divided produces its own focus; and the distance on the axis between the focus of the extreme border and that of the rays indefinitely near the centre is called the spherical aberration. It is furthermore true that inasmuch as the rays of the different colors of light are unequally refrangible, these different colors have foci differently distant from the lens; the focus of the red being most distant, and that of the violet least. This separation of the different colors is called dispersion, and the distance along the axis between the foci of the rays of greatest and least refrangibility is called the chromatic aberration. Spherical lenses would therefore be of little use in optics if it were not possible so to combine them as to neutralize the effects of both these two kinds of aberration. Chromatic aberration may be corrected by using a convex lens formed of a material of low dispersive power in combination with a concave in which this power is higher. Two such lenses placed in contact may be so adjusted to each other that their absolute dispersions shall be equal and opposite, while there is a predominance of refracting power in the converging glass by which it may form an image. In such combinations the converging lens employed is usually of crown glass and double convex, its diverging mate being plano-convex and of flint glass. The convexity of one side of the double convex is in this case made of exactly the same curvature as the concavity of the plano-concave, and the two are usually united with Canada balsam or other transparent cement; by which means the loss of light in

FIG. 1.



consequence of reflection at the surfaces of contact is almost wholly prevented. Chromatic aberration cannot be perfectly corrected by a combination of two glasses only, because it is not true that the dispersive powers of different media are in precisely the same ratio for each of the elementary colors. Combinations of three different lenses have therefore sometimes been used in telescopes, in order to correct the very small secondary dispersion which is left in any combination of two. But this is a refinement which is in general hardly necessary. A combination of glasses for the correction of color is called an achromatic combination. A combination designed to destroy the effect of spherical aberration is called aplanatic. The spherical aberration of a single lens can never be less than 1.07 times the thickness of the lens. This is the amount of aberration in a lens made of glass having an index of refraction of 1.5, of which the two opposing curvatures have radii in the ratio of one to six, the incident rays falling upon the more convex surface. If the index is greater, the disproportion of the radii of curvature must be greater also. For the index 1.6, it is one to fourteen. For the index 1.686, it is one to infinite—*i. e.* a plano-convex. By a combination of a double convex and a meniscus (whose radii of curvature may be calculated when the index of refraction of the glass is given) the spherical aberration in the axis may be completely corrected. Such a combination was first described by Sir John Herschel. But this is a fact of no practical value, because the aberration of oblique pencils in such combinations is very great. A meniscus having the curvature of a prolate ellipsoid, and an opposing spherical concave surface whose centre of curvature is the more distant focus, will concentrate rays falling parallel to its axis upon its convex surface truly into that more distant focus; provided the index of refraction of the material is equal to the semi-axis major divided by the eccentricity. A plano-convex lens of which the convex side has the curvature of a hyperboloid will, on a like supposition as to the index, cause rays incident on the plane surface parallel to its axis to converge truly into the more distant focus of the hyperboloid. In these cases, however, the oblique pencils suffer aberration; and though probably for celestial objects, in which the extreme obliquity of the pencils is very small, they might be useful, the difficulty of constructing glasses of such curvature prevents their being used. An achromatic combination of two lenses like that shown in Fig. 3 is aplanatic also for two points on the line of its axis; but the oblique pencils still have aberration at these distances. These points are indicated in the figure at *a* and *b*. It was discovered, however, in 1829, by Mr. J. J. Lister of London, that the aberrations of oblique pencils from radiants at these distances are contrary to each other, and also that the focus conjugate to a radiant at the shorter of these distances, *b*, is negative, while that conjugate to a radiant at the longer distance, *a*, is positive; so that if an object be placed at the nearer aplanatic focus of a given combination, its image is a virtual image formed behind itself; and if the place of this virtual image be at the distance of the remoter aplanatic focus of a second combination, a positive image will be formed beyond this second combination which will be free from both spherical and chromatic aberration, as well in oblique axes as in the principal axis. In Fig. 3 the line *ml* shows the direction of a ray from *b*, and the line *fg* that of a ray from *a*. The first produced toward the right would meet the axis behind *b*. The second continued to the left would meet the axis beyond the lens. In Fig. 4, *b* is the nearer aplanatic focus of the lens *B*; and its conjugate *a* is the remote aplanatic focus of the lens *A*. By the use of both lenses, therefore, an object at *b* will form an image beyond *A* which will be free from aberration both of color and of sphericity. This discovery of Mr. Lister was the foundation of the wonderful improvement introduced into the compound microscope about forty years ago. Besides the evils of aberration attendant on the use of spherical lenses, there is another which consists in the fact that the images formed are not plane, but curved, even after aberration has been corrected. This defect has, however, been also removed in the MICROSCOPE by combinations explained in the article on that instrument (which see).

FIG. 2.

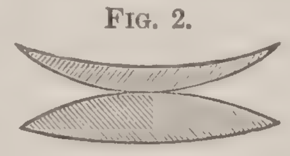


FIG. 3.

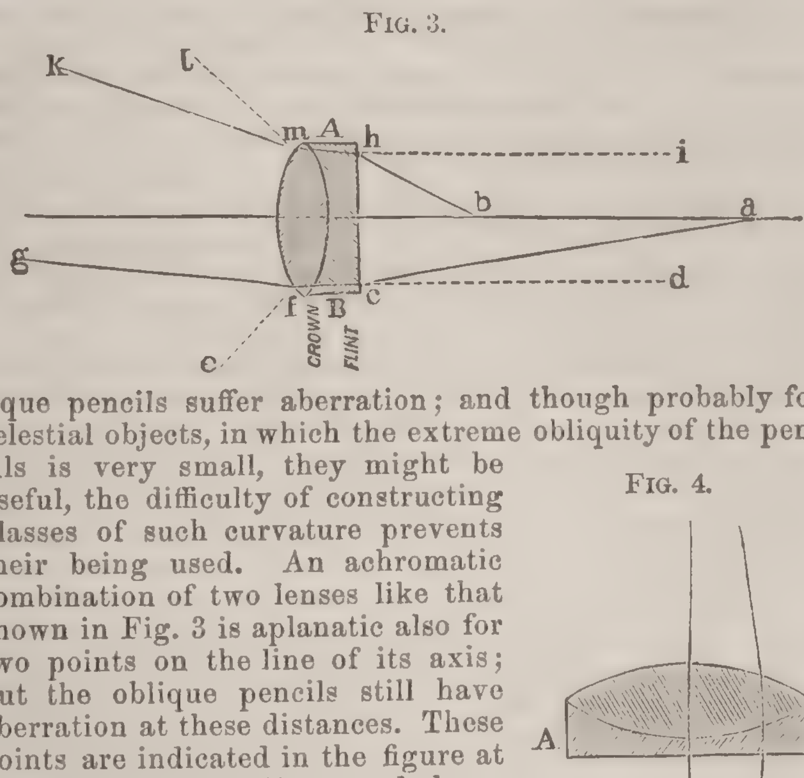
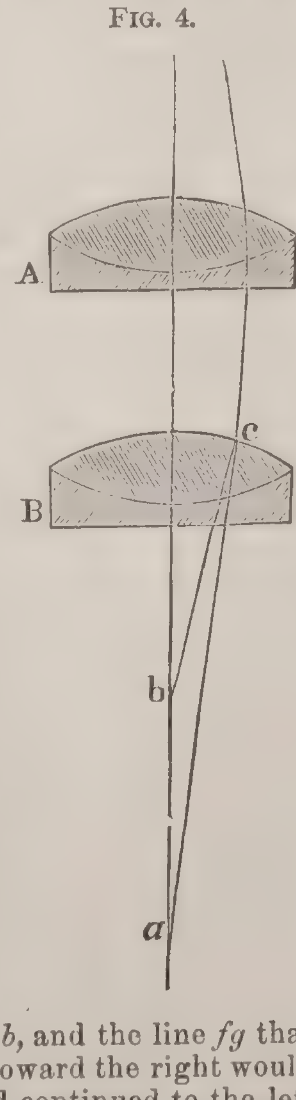


FIG. 4.



F. A. P. BARNARD.

Lent [Ger. *Lenz*, "spring;" according to some writers because the days *lengthen;* others derive it from *lens*, a "lentile," that food being largely eaten during the Lenten season], the fast of forty days (not counting Sundays) which begins with Ash Wednesday and ends with Easter Sunday. It is observed by the Eastern, Roman, Anglican, Lutheran, and some other churches. It commemorates the forty days' fast of our Lord in the wilderness. The Greek Church lengthens it to forty-eight days.

Lentan'do [It.]. In music, this term, when applied to a series of notes, signifies a gradual and regular decrease of rapidity. It frequently occurs in connection with medial and final cadences, and in passages marked as expressive, where it has the effect of a gradual dying out or melting away of the sound into comparative stillness.

Len'tile [Lat. *lens*], the *Ervum lens*, an annual leguminous herb of the Old World, resembling the vetch or pea, and extensively cultivated as food. The seed is the part employed. It is smaller, more nutritive, and more digestible than the pea. There are many varieties. It grows well on the poorest lands, and might be cultivated in the Southern U. S. Lentile flour is used for invalids, and is palatable and excellent. The vine is small, but affords excellent fodder for sheep, horses, and cattle. Fresenius found in 100 parts of air-dried seed—starch 35.5, gum 7, sugar 1.5, legumine 25, fat 2.5, cellulose, pectine, etc. 12, ash 2.3, and water 14. Lentiles have recently been introduced into England.

Lenti'ni [Lat. *Leontini*], town of Sicily, in the province of Syracuse, about 23 miles N. W. of the city of Syracuse. Interesting vestiges of the ancient city, such as remains of aqueducts, cisterns, tombs, etc., still exist, and vases, coins, and inscriptions are found in abundance. In its neighborhood may still be seen the ruins of the castle of Bricinia, mentioned by Thucydides. In 426 B. C. Leontini sent to Athens for help against Syracuse. In 214 B. C. it fell into the hands of the Romans. The present town is composed of respectable buildings, and the streets are commodious. Its trade and industry are considerable. Pop. in 1874, 10,578.

Len'to [It.], one of the terms used in music to express a slow and sombre species of movement. Lento is very slightly quicker than "large" and "adagio." The superlative, *lentissimo*, implies a further retardation of time.

Len'tulus was the name of a celebrated patrician family of ancient Rome, belonging to the *gens Cornelia.* One of the most conspicuous members of this family was Publius Cornelius Lentulus Sura. He was consul in 71 B. C., but in the following year he was ejected from the senate, together with sixty-three others, on account of the open scandals of his private life. This event brought him in connection with that party in Rome which wished to overthrow the republican institutions; and after Catiline left the city in 63 B. C., Lentulus was actually at the head of the conspiracy. The undertaking failed, partly on account of his irresoluteness and weakness, and it was wholly his awkwardness and utter lack of cautiousness in his relations to the ambassadors of the Allobroges which furnished Cicero with evidences on which he could arrest the leaders of the conspiracy and bring them before the court. Lentulus was strangled in the prison of the Capitol.

Lenz (JAKOB MICHAEL REINHOLD), b. at Sessweyen, Livonia, Jan. 12, 1750; studied at Königsberg, and went in 1771 as tutor for two young noblemen to Strasbourg, where he associated much with Goethe and Jung-Stilling. After Goethe left Strasbourg, Lenz fell desperately in love with Frederica Brion of Sesenheim, and seems to have led a rather wild life. In 1776 he went to Weimar; but unable to bring his life into harmony with the demands of good society, he soon left again, roved around from place to place, half insane, and d. in utter misery at Moscow May 24, 1792. His works, mostly consisting of dramas, were collected in three volumes in 1828 by Tieck. Like his life, they present only a loose series of impulses, incoherent and

often repulsive. But just as his life derives a certain interest from his connection with Goethe, so his works are of value to the student of German literature as illustrations of the character and tendencies of the so-called *Sturm und Drang* period.

Le′o, a sign of the zodiac, which the sun enters about July 22 and leaves about Aug. 23. The constellation of the same name, one of the finest in the heavens, occupies the zodiacal region corresponding to the sign Virgo, and contains many remarkable nebulæ.

Leo, the name of six emperors of the Byzantine empire: Leo I., the Thracian (457–474), b. in Thracia about 400, was only a military tribune when the emperor Marcian died in 457. But Aspar, the commander-in-chief of the army, dared not grasp at the crown himself, as he was a foreigner by birth, of the nation of the Alani, and an Arian by creed. He raised Leo to the throne, persuaded that he was too indolent to care for anything more than the attributes of power. Leo, however, soon emancipated himself from the influence of Aspar, and even seized the very first opportunity of getting entirely rid of him. A magnificent expedition was undertaken in connection with Anthemius, emperor of the West, against Genseric, king of the Vandals in Africa. The expedition failed utterly, and the odium of the failure was thrown on Aspar. The Vandals being Arians like the Byzantine minister, a rumor of treason arose, and under the riots which ensued Leo had Aspar killed in the interior of the palace. In the beginning of his reign several successful campaigns had been made against the Huns, but in the latter part military calamities were added to inundations, earthquakes, and conflagrations. Leo I. was the first Christian king who at the ceremony of coronation received his crown from the hands of a bishop—an ominous precedent; he favored the clergy much, and is generally called the Great by the orthodox party; the Arians called him *Macella*, the "butcher."—Leo II. (from Jan. to Nov., 474) was a grandson of Leo I., and only four years old at the death of his grandfather.—Leo III., the Isaurian (717–741), b. in Isauria about 680 of poor parents, enlisted in the army, where he rose rapidly, and was commander-in-chief of the Eastern army against the Saracens in 716, when Theodosius III. deposed and exiled Anastasius II. Leo chose not to acknowledge Theodosius III., marched his army against him in the name of Anastasius II., defeated him, and seized the crown for himself. The Saracens followed him, and besieged Constantinople for two years, but having been routed several times, they were at last repelled with great loss. In 726 he issued an edict ordering all images to be removed from the churches of the empire, and thus began the memorable contest between the iconoclasts and iconolaters which disturbed the empire for more than a century. The immediate result of the edict was a general commotion, especially in the western provinces, and in 728 the exarchate became lost to the Byzantine crown.—Leo IV. (775–780), b. in 750, a son of Constantine V., whom he succeeded. He was mild and tolerant, but weak; his generals, however, were very successful against the Bulgarians and Arabs.—Leo V., the Armenian (813–820), arrived from the commandership of the army to the throne through a long series of despicable treasons; but having once established himself firmly on the throne by his brilliant victories over the Bulgarians and Arabs, he showed himself an administrator of uncommon ability. Reforms were introduced, and the whole administrative system placed on a footing of honesty and justice. He was violent, however, even cruel, and utterly intolerant. He persecuted the worshippers of images with great severity. At last a conspiracy was formed, and he was murdered on Christmas Day in the church, before the altar.—Leo VI., the Philosopher (886–912), b. in 865, a son of Basil I., whom he succeeded. He was a writer. His *Oracula* is a poem in iambic verses, prophesying the fate of the Byzantine empire; there are several editions of it. His *Orationes*, numbering thirty-three, are composed mostly on theological subjects; there is no collected edition of them, but some are found in Baronius's *Annales*, others in *Bibliotheca patrum*, etc. More important was his treatise on military affairs, mostly consisting of extracts from other writers. There exist many editions of this work, as well as an English translation by John Cheke (1554), and a French by Joly de Mezeray (1771). The reign of this ruler was one uninterrupted series of stupidities and failures.

Leo I., Saint, Pope, regarded by many Protestants as the first real pope, and surnamed the Great, b. about 390, probably at Rome; in early life displayed uncommon zeal, knowledge, and capacity, and was often employed by the popes upon important ecclesiastical and political duties; was chosen pope in 440, though only a deacon. Leo opposed the Pelagian, Manichæan, Priscillian, and Eutychian heresies; labored with great ability for the extension of the Roman primacy; visited Attila in person (452), and induced him to spare Rome, but in 455 the city was sacked by Genseric. Leo d. Nov. 10, 461. Of the many editions of his writings, the best is that of the Ballerini (Venice, 753–757).—Leo II., Saint, became pope in 682, and d. in 683.—Leo III., a Roman, became pope in 795; crowned Charlemagne emperor of the West, and freed Rome from Byzantine domination. D. June 11, 816.—Leo IV., a Roman, became pope in 847; built the Leonine wall about the Vatican suburb, which is hence called the Leonine City; restored the town of Porto, which he colonized with Corsicans, and founded Leopolis (now deserted), 12 miles from Civita Vecchia. D. July 17, 855.—Leo V., a Benedictine and cardinal, became pope Oct. 28, and d. in prison Dec. 6, 903.—Leo VI., a Roman, became pope July 6, 928, and d. Feb. 3, 929.—Leo VII., a Roman, became pope in 936, and d. in 939. Little is known regarding him.—Leo VIII., a Roman, was made pope by Otho I. in 963, in place of the infamous John XII. Benedict V. was his rival. D. 965.—Leo IX. (*Bruno*), an Alsatian, cousin-german to Conrad the Salic, b. June 21, 1002; became bishop of Taul in 1026; was celebrated for learning; was nominated pope at Worms in 1048, and recognized at Rome in 1049; was largely under the influence of Hildebrand, afterwards Gregory VII. The great events of his pontificate were the Berengarian controversy and the great exertions of Leo and Hildebrand for the extension of discipline. D. Apr. 13, 1054.—Leo X. (*Giovanni de' Medici*), son of Lorenzo the Magnificent, b. at Florence Dec. 11, 1475; received the tonsure and was made abbot of Fontedolce and of Passignano when but seven years old; became cardinal *in petto* when thirteen, and full cardinal-deacon when seventeen (1492); was exiled with the other Medici in 1494; served under Julius II. against the French as legate and field-marshal, but was taken prisoner at Ravenna 1512; by the aid of the emperor, the pope, Venice, and Spain restored the Medici to Florence 1512; succeeded Julius II. as pope 1513. His pontificate is memorable for the splendor of the papal court; his extensive patronage of learning and art; the reorganization of the University of Rome, and the establishment of a committee under the presidency of Lascaris for the publication of Greek manuscripts; the scandalous and open sale of indulgences in order to procure the necessary means of building St. Peter's church; the origination of the Reformation under the influence of Luther, at which he at first laughed as a ludicrous monkish quarrel; the confirmation and extension of the Spanish power in Italy; and the final suppression of the Florentine republic. As a prince, Leo had illustrious qualities; as an ecclesiastic, he certainly failed, as much from a lack of the ecclesiastical spirit as from a want of knowledge of the tendencies of the critical times in which he lived.—Leo XI. (*Alessandro Ottaviano de' Medici*), a grand-nephew of Leo X., b. at Florence 1535; became bishop of Pistoia 1573; archbishop of Florence 1574; cardinal 1583; pope 1605; d. Apr. 27, 1605, after a pontificate of twenty-six days.—Leo XII. (*Annibale della Genga*), b. Aug. 2, 1760; became archbishop of Tyre 1793; cardinal in 1816; pope in 1823; extended papal authority, and reformed some points of the temporal and spiritual administration. D. Feb. 10, 1829.

Leo (Heinrich), b. Mar. 19, 1799, at Rudolstadt, the capital of the German principality of Schwartzburg-Rudolstadt. His life and his writings present three different phases under the influence of Turnvater Jahn, of the philosophy of Hegel, and of the theology of Hengstenberg. Under the influence of Jahn he changed from medicine to history, took part in Jena and Göttingen with great energy in all the agitation of the young students, and wrote *Ueber die Verfassung der lombardischen Städte* (1820). But suddenly he broke off all these connections, went to Italy with a stipend from the princess of Rudolstadt, and became on his return an enthusiastic admirer of Hegel. Having settled in 1828 as professor in history at the University of Halle, he developed a great productivity, following more or less closely the tracks of Hegel's ideas in his *Handbuch der Geschichte des Mittelalters* (1830), *Geschichte der italienischen Staaten* (5 vols., 1829), *Zwölf Büchern niederländische Geschichten* (2 vols., 1832–35). But once more he suddenly and harshly turned against his own former standpoint, attacking the Hegelian philosophy in a rather curious manner in his *Dr. Diesterweg und die Deutschen Universitäten* (1836), *Sendschreiben an Görres* (1838), and *Die Hegelingen* (1839). Hengstenberg had now become his idol. Under his influence, and in the service of ultra-reactionary tendencies, he wrote *Lehrbuch der Universalgeschichte* (6 vols., 1835–44) and *Leitfaden für den Unterricht in der Universalgeschichte* (4 vols., 1838–40), and a number of articles in the *Evangelische Kirchenzeitung*.

Leo Africa′nus (Joannes), originally named Al Hassan Ibn Mohammed, b. at Granada, Spain, about 1485, of

Moorish parents, who emigrated to Fez in Morocco after the capture of Granada by the Spaniards. At the age of sixteen he accompanied an uncle on an embassy to Timbuctoo, and afterward travelled through several countries of N. and Central Africa, penetrating through Bornoo to Nubia, descending the Nile, and extending his explorations into Persia. Returning from Constantinople by sea in 1517, he was captured by corsairs and taken to Rome, where he became a Christian, was patronized by Pope Leo X., whose name he took, learned Italian and Latin, and taught Arabic. D. at Tunis in 1562. His great work, the *Description of Africa*, was written in Arabic, published in Italian by Ramusio (1550) and in Latin by Elzevir (1632).

Le′o Alla′tius [Latinized form of LEONE ALLACCI], b. of Greek parents in the island of Chios in 1586. He was taken when nine years old to Calabria in Italy, and thence in 1600 to Rome to complete his studies; was employed in 1622 by Pope Gregory XV. to superintend the transfer to Rome and the incorporation in the Vatican of the Heidelberg library, which had been given to the pontiff by the elector of Bavaria; was appointed by Pope Alexander VII. in 1661 librarian of the Vatican, which office he held till his death in 1669. Leo was a prolific writer; his works were partly editions and elucidations of the classic and ecclesiastic writers and notices of authors, and partly treatises on the history and doctrines of the Roman Church and on the differences between the Eastern and Western churches. Though the son of Greek parents, he was an extreme partisan of the Roman Church. A complete list of his productions (50 enumerated by Fabricius) is added to his *Exercitatio de Mensura Temporum Antiquorum* (Cologne, 1645), and is also given by Fabricius in his *Bibliotheca Græca*, vol. xi. 437 *sqq.*, ed. Harles. (See Creuzer, *Zur Gesch. der Class. Philologie.*) H. DRISLER.

Le′oben, town of Austria, in the province of Styria, on the Mur, is beautifully situated, well built, and fortified. Here a preliminary treaty was concluded (Apr. 18, 1797) between Austria and France, which was followed half a year later by the Peace of Campo Formio.

Le′obschütz, town of Prussia, in the province of Silesia, on the Zinna. It has a large trade in wool, flax, and corn. Pop. 8274.

Leoch′ares, an Athenian sculptor of the middle of the fourth century B. C., belonged to the second Athenian school. Pliny mentions several of his works, and speaks with enthusiasm of them. Of one, *Ganymede carried off by the Eagle,* which originally was cast in bronze, there are marble copies in Rome and Venice.

Le′o Diac′onus, b. about A. D. 950 at Caloë in Ionia; was sent to Constantinople to pursue his studies, and was present (966) when the populace broke out in revolt against the emperor Nicephorus Phocas; accompanied Basil II. in the war against the Bulgarians, though filling the office of deacon; wrote a history of the events that took place in his own time from A. D. 959 to 975, valuable for its information, though faulty in style. This work was first published (Paris, 1818) by Hase, who has collected in his preface the chief facts of his life; reissued in the *Corpus Historiæ Byzantinæ* (Bonn, 1828). H. DRISLER.

Le′o Grammat′icus, of whose life scarcely anything is known, and whose date even is doubtful, wrote, probably at the beginning of the eleventh century, under the title *Chronographia* (Χρονογραφία), a narrative of Byzantine events from 873 to 949 A. D. The work is extant, and was published along with *Theophanes* by Combéfis (Paris, 1655). H. DRISLER.

Leo′la, tp. of Adams co., Wis. Pop. 185.

Leom′inster, town of England, in the county of Hereford, on the Lugg. It is the centre of the most celebrated cattle-breeding district of England. Pop. 5865.

Leominster, post-v. and tp. of Worcester co., Mass., on the Nashua River and on the Boston Clinton and Fitchburg and the Fitchburg R. Rs., 18 miles N. of Worcester and 40 miles W. N. W. of Boston. It has a national and a savings bank, a newspaper, 5 churches, a large public library, a high school, 2 hotels, and a number of stores. The principal manufacturing business consists of horn goods, furniture, pianos, children's carriages, tanning and currying, paper, woollen, linen, leather-board mills, and fork-works. The village is supplied with aqueduct-water at a cost of about $150,000, and with gasworks. It is surrounded by some of the best farming land in the county. Pop. 3894. F. N. BOUTWELL, ED. "ENTERPRISE."

Le′on, province of Northern Spain, comprising an area of 6166 square miles, with 350,092 inhabitants. It is covered with mountain-ranges, which, especially in the northern part, enclose beautiful, well-watered, and fertile valleys, while the eastern parts are more level and afford excellent pasturage. Large flocks of merino sheep are reared; flax, hemp, maize, and fruits are raised, and many medicinal herbs are gathered. Together with the provinces of Salamanca and Zamora it formed the former kingdom of Leon, founded in 746 by Alfonzo the Catholic, who conquered it from the Saracens, and was united to Castile by Ferdinand III. in 1230. The inhabitants of this province, who generally are uneducated and lazy, but honest and noble, boast much of the purity of their blood and the antiquity of their Christianity.

Leon, town of Spain, the capital of the province of Leon, at the confluence of the Bernesga and the Torio. Since the annexation of the old kingdom of Leon to Castile the city has lost its importance, and although it has a large market for wool and horses, and many beautiful churches and magnificent palaces, its general character is decay. Its cathedral, built in the fourteenth century, is perhaps the most elegant specimen of Gothic architecture extant. Pop. 10,040.

Leon, city of Mexico, state of Guanajuato, near the boundary of Jalisco. It was founded in 1576, but did not acquire importance until the middle of the present century. It now claims to be second only to the capital of the republic in point of population, which is generally estimated at 100,000. The chief industries are tanning, saddlery, and manufactures of cotton and woollen stuffs. There are abundant iron-mines at Comanja, a few miles to the N. Leon is well built, has a large and beautiful square, with several fine public buildings and churches, and has become the commercial emporium for an extensive region, especially for the rich plain or *bajio* of Guanajuato, famous for its thriving cities and its prosperous agriculture. Leon has for years aspired to become the capital of a new state (*Estado del Centro*) to be formed of parts of Guanajuato and Jalisco, and is not without hopes of becoming the capital of Mexico. A railroad is now (1875) contracted for by a Mexican company from Mexico to Leon, and another by an American company from Leon to the Rio Grande, which will vastly increase the importance of this city.

Leon, town of Nicaragua, and the capital of the department of Leon, is situated in lat. 12° 25′ N., lon. 86° 57′ W., in the centre of a well-watered and well-cultivated plain, 200 feet above the sea, and numbers 24,000 inhabitants, creoles and mestizoes of different grades. It is divided into six quarters (cantones)—Sagrario, San Felipe, San Juan, Calvario, Zaragoza, and Laborio y San Sebastian, and separated only by a street from the Indian town of Subtiaba. The city was originally founded by Francisco Fernandez de Cordova in 1523, on the western border of Lake Managua in Imbita, but on account of various embarrassments of the location the inhabitants removed in 1610 the city, together with the large Indian town Subtiaba, to the present place. Good water was found here, which now is led from different springs through the city. Formerly the capital of the province of Nicaragua, and the seat of a bishop and of the Spanish government, Leon has developed into the best built city of the republic. In its central part the streets are paved and lighted. The finest building is the cathedral, commenced in 1746 by Bishop Marin Bullon y Figueroa, and finished in 1774 by Bishop Vinches y Cabrera. It belongs to no particular style, but is of immense dimensions, though too low in proportion to its length and breadth. The front façade is ornamented with a large quadrangular tower, whose platform offers a most splendid view. In the neighborhood of the cathedral stands the old episcopal palace, and connected with it the college of San Ramon, the university of Nicaragua. Both buildings were founded in 1678 by Bishop Andrés de las Navas y Quevedo. The new episcopal palace, situated at the southern corner of the plaza and close to the cathedral, was not finished in 1873. At the northern corner of the plaza stands the old government building. But none of these structures are distinguished by architectural beauty. The ten or twelve other churches of Leon are rather commonplace, though two of them possess interesting peculiarities; thus, the front façade of the church Del Calvario is ornamented with bas-reliefs representing scenes of Holy Scripture, which are not without artistic merit, and in the interior of the church De la Merced several good pictures are found and a beautiful altar. Several former monasteries have been taken into public use; thus, the monastery of San Juan de Dios has been transformed into a hospital, which serves as a practical school for medical students. Leon has no industry, but some trade through the port of Corinto. The surroundings are very beautiful, and mineral springs are found on many points at the foot of Sierra de los Marrabios. The town of Subtiaba, situated close by, has a large church, almost as large as the cathedral of Leon, but no other structure of any importance. It is divided into two quarters, San Pedro and Puebla Grande. At the time of the conquest it had 100,000 inhabitants; the pres-

ent number is not known. The inhabitants are engaged in some small Indian industry. AUGUST NIEMANN.

Leon, county of Florida, bounded N. by Georgia. Area, 600 square miles. It is undulating in the N. and level in the S. It is very fertile, and abounds in heavy forests and beautiful lakes and streams. Corn and cotton are staple products. It is traversed by the Jacksonville Pensacola and Mobile R. R. Cap. Tallahassee. Pop. 15,236.

Leon, county of E. Central Texas. Area, 1100 square miles. It is bounded E. by Trinity River and W. by the Navasota. The county is fertile, and contains extensive timber-lands. Iron ore and lignitic coal abound. Live-stock, corn, and cotton are staple products. The county is traversed by the International and Great Northern R. R. Cap. Centreville. Pop. 6523.

Leon, post-v. of Centre tp., cap. of Decatur co., Ia., 21 miles S. of Osceola. It has a national bank and 1 weekly newspaper. Pop. 820.

Leon, tp. of Goodhue co., Minn. Pop. 970.

Leon, post-tp. of Cattaraugus co., N. Y. Pop. 1204.

Leon, post-tp. of Monroe co., Wis. Pop. 1241.

Leon, tp. of Waushara co., Wis. Pop. 869.

Leon'ard (DANIEL), b. at Norton, Mass., May 29, 1740; graduated at Harvard College in 1760; became a prominent lawyer; was frequently chosen to the legislature, and at first supported the Whig cause with great energy and eloquence, but at the outbreak of hostilities adhered to the royal cause, losing thereby a considerable estate. He undertook to reply to John Adams's arguments against the colonial measures of Lord North, and his letters, signed *Massachusettensis*, have been pronounced the best defence of the English government that appeared in America. Leonard left Boston with the British forces (1776); resided for a time in London; was many years chief-justice of Bermuda, and d. at London June 27, 1829. The polemic between Adams and Leonard was reprinted in 1819, with a preface by the former, who employed the *nom de plume* of *Novanglus*.

Leonard (JAMES), b. at Pontypool, England, about 1618; settled at Taunton, Mass., in 1652, and established there the first iron-works in the British colonies of America. D. at Taunton in 1691.

Leonar'do da Pi'sa, or **Leonardo Bonacci,** b. at Pisa in 1170 or 1180; spent a great part of his life in travelling through Egypt, Syria, and Greece in order to study the different systems of arithmetic, and acquired a great reputation as a mathematician. He was the first to introduce algebra in Europe, and he contributed much to the full understanding of the Arabic system of arithmetic. His principal work, *Liber Abaci*—which latter word, originally the name of an instrument of calculation, he uses as the general designation of arithmetics—was written in 1202, and published in a splendid edition in 1857 at Rome by B. Boncompagni.

Leonardo da Vinci. See VINCI.

Leon'ardsville, post-v. of Brookfield tp., Madison co., N. Y. It has a church, a national bank, and manufactures of importance.

Leon'ardtown, post-v. and tp., cap. of St. Mary's co., Md., on Briton's Bay, a tributary of the Potomac River, has 2 churches, a court-house, a jail, a town-hall and library, a weekly newspaper, 2 hotels, 6 stores, 2 wheelwright and blacksmith shops, etc. It is quite popular as a summer resort. Pop. of v. 485; of tp. 2957.

B. HARRIS CAMALIER, FOR ED. "ST. MARY'S BEACON."

Leon, de (Fray LUIS PONCE), b. at Belmonte near Granada, Spain, in 1527; entered the University of Salamanca at an early age, distinguishing himself in classics and philosophy; entered the order of St. Augustine at Salamanca in 1543, devoting himself to a profound study of sacred literature; became in 1560 a licentiate in theology and doctor of divinity, and in 1561 obtained the professorship of St. Thomas Aquinas (theology) by competition with seven candidates, and in 1571 obtained in addition the chair of sacred literature. He had become known as the most elegant poet of Spain, when, on account of a spirited translation of the Canticle, to which, in opposition to the received teachings of the Church, but in conformity with the conclusions of modern scholarship, he gave the form of a pastoral eclogue, he was thrown into prison by the Inquisition (1572), upon the double accusation of Lutheranism and of disobedience to the decrees of the Council of Trent in having translated a book of Scripture into a modern tongue. He was brought before the high court more than fifty times, easily vindicated himself from the first charge, and presented an elegantly-written defence, which is one of the admired monuments of Spanish prose. It was of no avail that he proved the translation to have been made at the request of a friend, and without intention of publication; the Dominicans, who controlled the Holy Office, were jealous of his fame as the most distinguished theologian of a rival order, and he was condemned to the rack; but, fortunately, this sentence was revoked by the higher court at Madrid, and by the urgent efforts of powerful friends he was liberated after five years' confinement, during which he had written his classic treatise *On the Names of Christ* ("De los Nombres de Cristo"), and commenced other works, some of which his broken health prevented his completing. The university remained faithful to its greatest name, and Fray Luis resumed his lectures with applause Dec. 30, 1576, on which occasion he commenced his address with the words, "As we remarked in our last lecture," thus seeming to forget the long and painful interval of silence. In 1580, Fray Luis published a Latin *Commentary on the Canticle*; in 1583 *The Perfect Wife* ("La Perfecta Casada"); wrote soon after a poetical paraphrase of the book of Job, and translations of Virgil's *Eclogues* and *Georgics* and some of the *Odes* of Horace, which were not published during his life. His lyric poems, the finest in the language, shared the same fate, as also his translations of forty of the Psalms. He rose to be general and provincial vicar of his order, passed the remainder of his life in perfect tranquillity, and d. at Madrigal Aug. 23, 1591. His poems and miscellaneous works were first published by his friend Quevedo in 1631, since which time they have been recognized as Spanish classics. (See Ticknor's *Spanish Literature* and A. Arango y Escandon's *Proceso de Fray Luis de Leon* (Mexico, 1871), an elegant and scholarly production.) PORTER C. BLISS.

Leones'sa, town of S. Italy, in the province of Aquila degli Abruzzi. This town, consisting of several small villages, was given in dower by Charles V. to his daughter Margaret, and rich mementoes of that period are still preserved. Pop. in 1874, 5451.

Leonfor'te, town of Sicily, in the province of Catania. This town is situated on the skirts of a mountain about 33 miles S. W. of Catania. It is surrounded by a wall, and in the churches may be seen some very good pictures. It has an active trade in grain, oil, almonds, sulphur, wines, etc. Pop. in 1874, 12,010.

Le'onhardt (GERHARD ADOLPH WILHELM), b. at Neuhaus in Hanover June 6, 1815; studied jurisprudence at Göttingen and Berlin; entered the service of the Hanoverian government in 1837, and was appointed minister of justice in 1865. For fifteen years he was president of the committee of examination in jurisprudence. When (in 1866) Hanover was annexed to Prussia, Leonhardt was first made president of the court of appeal at Celle, and then chief-justice for the new provinces, Nov. 16, 1867; the king gave him a seat in the Prussian Herren-haus ("House of Lords"), and shortly after he was appointed Prussian minister of justice. Both in Hanover and Prussia many important and excellent laws are due to him, and as a member of the federal council and president of the standing committee on justice he has created a new criminal code for the German empire. AUGUST NIEMANN.

Le'onhard, von (KARL CÆSAR), b. at Rumpenheim, in the electorate of Hesse, Sept. 12, 1779; studied political economy at Marburg and Göttingen, and held several important positions in the Hessian government from 1800 to 1816. At Göttingen the lectures of Blumenbach led him to the study of mineralogy and geology, and he continued to cultivate these sciences with great energy and success, even while in office. In 1816 he was made a member of the Academy of Sciences at Munich, and in 1818 he accepted the chair as professor in geology at the University of Heidelberg, where he d. Jan. 23, 1862. From 1807 to 1829 he edited the *Taschenbuch für Mineralogie*, and from 1830 to 1858 the *Jahrbuch für Mineralogie*. His writings, the most prominent of which are *Naturgeschichte der Erde* (4 vols., 1836–45), *Grundzüge der Mineralogie* (2 vols., 1860), etc., are not so much distinguished by original discoveries and independent researches as by a clear and comprehensive representation of what was already known.

Leo'ni, post-tp. of Jackson co., Mich. Pop. 1376.

Leon'idas, post-tp. of St. Joseph co., Mich. Pop. 1463.

Leonidas, king of Sparta, succeeded his half-brother, Cleomenes, about 490 B. C., and was sent in the spring of 480, when the Persians had conquered Macedonia, to defend the defiles of Thermopylæ, between Mount Œta and the Maliac Gulf. With the co-operation of a fleet in the gulf, the defiles could be defended by a comparatively small army, but the Greek fleet was unfit for battle at the moment the Persian attack began, and, what was still worse, they had forgotten to occupy a practicable pathway which led across Mount Œta, and which was shown to the

Persians by a traitor, Ephialtes. For two days the Greeks resisted the barbarian host with great valor; the Persian losses were enormous. But at daybreak on the third day Leonidas learned that the Persians had found the pathway and were coming in masses across the mountain. There was still time to retreat. But having sent away his auxiliary troops, Leonidas with his 300 Spartans remained in the defiles, and, occupying a small hill in the centre of the position, they fought to the last man.

Leonidas [Λεωνίδας or -δης], the name of two poets whose remains are preserved to us in the Greek *Anthology*. The former, a native of Tarentum, flourished about B. C. 276. He composed over 100 epigrams in the Doric dialect. —The other, of Alexandria, lived in the reign of Nero at Rome. In the *Anthology* there are 43 epigrams ascribed to him, some of which are probably not his. They are less highly esteemed than those of Leonidas of Tarentum. The poems of both are edited by Jacobs in the *Anthologia Græca*, and by Meineke (Leipsic, 1791). H. DRISLER.

Le'onine Verse [from Pope Leo II., or from one Leoninus, Benedictine canon of St. Victor, Paris, in the twelfth century], the rhyming hexameter, pentameter, or elegiac verse, especially in Latin. Traces of this rhyming practice appear in Ovid, and even in earlier poets, but the custom prevailed extensively in the Middle Ages, the rhyme being often barbarously imperfect, and the metre not much better.

Leonowens (ANNA HARRIETTE CRAWFORD), b. at Caernarvon, Wales, Nov. 5, 1834, daughter of a British officer, Thomas Maxwell Crawford, who while acting as aide-de-camp to Sir J. Macnaughton was cut in pieces by the Sikhs on the frontiers of Lahore. She married an officer, Thomas Leonowens, upon whose death in India she was left in that country with two children dependent upon her own exertions, and resided for some time at Singapore. Through the recommendation of the English consul at that port she was selected to fill the post of governess in the family of the late first king of Siam, who, having learned English from American missionaries before coming to the throne, desired his numerous children to be educated in that language, of which he was an enthusiastic admirer and cultivator, having even established a printing-press within his palace. Arriving at Bangkok in 1863, she filled for four years not only the position of instructress to the royal household, but of secretary to the king in his extensive English correspondence, and exerted a considerable influence as a mediator with the king in behalf of the victims of arbitrary oppression, whether natives or foreigners. The present first king of Siam, then a boy, was the special object of her careful and successful training, and shortly after his accession to the throne in 1868 abolished slavery throughout his dominions. (See SIAM.) Mrs. Leonowens on retiring from her post in July, 1867, settled in the U. S. and engaged in literary pursuits, being now a resident of New York. She has published two interesting volumes upon her Siamese experiences—*The English Governess at the Court of Siam* (1870) and the *Romance of the Harem* (1872).

Leontini. See LENTINI.

Leon'tius, or **Leo Pilatus,** a native of Thessalonica, according to Hody, but Hallam makes him (on the authority of Petrarch's letters) a Calabrian; came to Florence about 1360 A. D., and was employed by the republic at the request of Boccaccio to teach his native language. He was the first who publicly lectured on Homer in Western Europe, and the first who translated that poet into Latin. Leaving Florence, he visited Venice, where he met Petrarch, who had studied Greek under Barlaam. Thence he went to Constantinople, intending to return to Italy, but d. while crossing the Adriatic. Gibbon describes his appearance and manners as repulsive. (*Decline and Fall*, vol. viii. p. 148.) From him Boccaccio collected the materials for his treatise on the genealogy of the heathen gods. (See Gibbon, *l. c.;* Hody, *De Græcis illustribus*, pp. 1–11.) H. DRISLER.

Leop'ard [Lat. *leo*, "lion," and *pardus*, a "panther," it having been anciently believed to be the offspring of the lion and panther], the *Felis leopardus* or *Leopardus varius*. The leopard, though not the largest, is one of the most active and bloodthirsty of the cat family. Found throughout a large part of Africa and of Asia and its islands, it is of even wider distribution than the lion. It rarely assails man, but among animals, wild and domestic, it is extremely destructive. Its beautifully spotted fur gives it a readily distinguished character. The black leopard is a variety brought from Java. The "hunting leopard" belongs to a very distinct genus of the cat-family (*Gueparda*), and is more properly known as the CHEETAH (which see).

Leopar'di (GIACOMO), b. of a noble family at Recanati, not far from Ancona, in 1798; was taught the rudiments of Latin and of philosophy by two ecclesiastics; at the age of eight began Greek by himself, and after his fourteenth year pursued his studies without master, or even guide, making unrestricted use of his father's large and choice library. "At sixteen," says one of his biographers, "his learning was so vast that it is impossible to speak of it without seeming to exaggerate." He was completely master of the Greek and Latin languages and classical literature, was familiar with the Fathers of the Church and other later Greek and Latin writers, had a scholarly knowledge of English, French, Spanish, and Hebrew, and was profoundly versed in his own language. Notwithstanding acquirements so disproportionate to his years, his faculties were not in the least clogged by them, and his reason and imagination lost nothing of their astonishing power and individuality. His physical strength, however, gave way, and there were already symptoms of the complicated and cruel malady which finally ended his life. At the age of nineteen, conscious of his great genius and burning with a lofty ambition, he longed for the resources of a larger town; but his father, a zealous Catholic, and already alarmed at the skeptical tendencies of his son, refused to consent to his wider contact with the world; and the obedient son reluctantly remained at home until 1822. As it is impossible in this brief notice to enumerate his works in the order of their production, the reader is referred to the biographies of Leopardi for a list of the brilliant results of his labors during these years. The splendid success of the three poems entitled *All' Italia, Sopra il Monumento di Dante, Ad Angelo Mai*, etc. induced him to brave all opposition and go to Rome, which he did in 1822. Here he was enthusiastically welcomed, and soon made the acquaintance of Niebuhr, who expressed to Bunsen and other eminent Germans the liveliest admiration for the learning and genius of the pale, bent, and emaciated young Italian. He even procured for him the offer of the chair of Greek philosophy in the University of Berlin, but the wretched health of the poet forced him to decline this flattering offer. His small pecuniary means were soon exhausted, his views on the subject of religion prevented him from accepting employment at the papal court, and he was obliged to return, in the spring of the same year, to Recanati, where he remained, with occasional long visits to Milan and Bologna, until 1827. In that year he went to Florence, where he lived—with now and then a visit to his family—until 1833, in close friendship with Capponi, Niccolini, etc. The joyousness which had marked the first boyhood of Leopardi had faded early away, and was succeeded by an ever-increasing sadness, which had now darkened into the deepest melancholy—alike the cause and the consequence of his hopeless philosophy. No doubt his physical sufferings largely influenced his philosophical beliefs, though he protested vigorously against this apology for them, and insisted that his absolute denial of a beneficent Providence, and his assertion that *pain* was the only reality, were the results of a free and earnest exercise of his reason and of the courage which he had to proclaim his conclusions. In 1833 his devoted friend Ranieri took him to Naples in the hope of alleviating at least his terrible physical sufferings. The effect of the change was at first beneficial, and even Leopardi began to regard life as a thing to be desired; but neither the climate nor the tenderest care on the part of his generous friend could save him, and he expired on June 14, 1837. Leopardi has been compared with Byron, but there is little in common between the selfish bitterness of the great English poet and the profound melancholy of the Italian—the former a natural outgrowth of unbridled passions, the latter of acute and incessant physical suffering. The student of Leopardi will be likely to find a stronger parallel between his character and genius and those of Pascal, widely different as were their philosophical and religious convictions. Though it is not improbable that had his life been prolonged this earnest seeker after truth would have ultimately rested in a less despairing creed, yet the miserable attempts to make it appear that Leopardi in his last days sought for a reconciliation with the Church have been most thoroughly exposed and confuted. (See Marc Monnier, *L'Italie est-elle la Terre des Morts;* also Montanari, *Biografia del Conte Leopardi;* the works of Louis de Sinner, Sainte-Beuve, Schulz, Ranieri, Giordani, Gioberti, etc.) The most complete collection of Leopardi's works yet published was issued from the press of Le Monnier at Florence between 1845 and 1851, under the supervision of different editors. ANGELO DE GUBERNATIS.

Le'opold, post-tp. of Perry co., Ind. Pop. 862.

Leopold I., emperor of Germany (1658–1705), b. at Vienna June 9, 1640, the second son of Ferdinand III. and Maria Anna of Spain. He was educated for the Church, but at the death of his elder brother in 1655 he became king of Hungary, and in 1658 he succeeded his father as

king of Bohemia and emperor of Germany. He was a man of small stature and feeble health, with a sour and melancholy face, and the lip of the Hapsburgers extraordinarily developed. He had some interest for linguistic studies and a fine ear for music, but he was reticent and stiff in his behavior, a man of regular and simple habits, but ceremonious, proud, bigoted, and hard. Although he was very industrious, he left the administration in utter confusion, and in spite of his peaceableness, or rather timidity, his reign was one long series of wars with Louis XIV., the Turks, and the Hungarians. Of his three wars with France, the two first, which ended by the Peace of Nymwegen in 1678 and of Ryswick in 1697, are described in the articles on LOUIS XIV. and WILLIAM OF ORANGE, and the last one, the SPANISH WAR OF SUCCESSION, in a separate article. The point at issue between Austria and Turkey was Transylvania. The Turks held it, and the Hungarians demanded it. In 1662 the war began, and the Turks broke into Hungary. But in 1663, Leopold received troops from the German empire, Sweden, and France, and money from the pope and the Italian states, and Aug. 1, 1664, Montecuccoli succeeded in routing the Turkish army at St. Gothard on the Raab. On Aug. 10 an armistice of ten years was concluded, in which, however, the Turks retained Transylvania, to the great indignation of the Hungarians. Soon after disturbances arose in Hungary from the contest between the national Protestant and the Austrian Catholic parties. Leopold treated his political adversaries with the utmost harshness, and the result was a formidable insurrection under the leadership of Tökölyi in 1682. The Hungarians called the Turks to aid, and on July 14, 1683, an army of 200,000 men laid siege to Vienna. Leopold had fled, and in spite of the valorous resistance of the citizens and the garrison the city would have fallen, and with it the power of the house of Hapsburg, if the Polish king, John Sobieski, had not arrived before its walls (Sept. 12), and completely routed the besieging army. In 1687, Archduke Charles of Lorraine defeated the Turks at Mohacs; in 1697, Prince Eugene defeated them at Zenta; and in 1699 peace was concluded at Carlowitz, by which the Turks ceded Transylvania, Slavonia, etc., and retired behind the Danube, never to endanger Europe again. The Hungarians also submitted, and at the diet of Presburg (1687) the Hungarian crown was declared hereditary in the family of Hapsburg. Nevertheless, they rose once more, and when Leopold d. at Vienna (May 5, 1705) insurrection raged in his Hungarian countries, and war with France in his Belgian, German, and Italian possessions.

Leopold II., emperor of Germany (1790–92), b. at Vienna May 5, 1747, the second son of Francis I. and Maria Theresa. In 1765 he succeeded his father as grand duke of Tuscany, and proved himself a liberal and enlightened ruler. But, like his brother, Joseph II., and like Pombal in Portugal and Struensee in Denmark, he was a despotic reformer, and his reforms caused great annoyances and disturbances. In 1790 he succeeded his brother in Austria and Germany, and found on his ascension to the throne the vast empire in a critical state. With great tact, however, he managed the difficult situation. He pacified Hungary, quelled the insurrection in Belgium, concluded peace with Turkey at Sistova in 1791, and re-established the friendly relations with Prussia by the congress of Reichenbach in 1790. Just as he had entered a confederation with Prussia and Saxony for the support of Louis XVI. against his rebellious subjects, he d. suddenly at Vienna Mar. 1, 1792.

Leopold I., king of Belgium (1831–65), b. Dec. 16, 1790, the youngest son of Duke Francis of Saxe-Coburg; received a very careful education, was made a general in the Russian army after the marriage of his sister to the grand duke Constantine, accompanied Alexander I. to Vienna and Paris in 1814, and was married in 1816 to the princess Charlotte Augusta, heir-apparent of Great Britain. After her death in 1817 he lived in retirement in London or travelling. In 1830 he refused the crown of Greece, but in 1831 he accepted that of Belgium, and married in 1832 a daughter of Louis Philippe, who bore him three children. His reign was calm and undisturbed. He was firm, discriminating, and progressive in his interior policy, and he represented his people with tact and dignity among other sovereigns. D. at Leaken, near Brussels, Dec. 10, 1865.

Leopold II., king of Belgium, b. Apr. 9, 1835, a son of King Leopold I. and Queen Louisa, a daughter of Louis Philippe of France; was married (Aug. 22, 1853) to Marie Henriette, a daughter of the archduke Joseph of Austria, and ascended the throne Dec. 10, 1865.

Leopold I., prince of Anhalt-Dessau, generally known as the OLD DESSAUER, b. June 3, 1676, and evinced even as a boy a strong passion for military business. In 1688 the emperor Leopold I. made him a colonel and chief of a regiment of horse, but in 1693, at the death of his father, who was a Prussian general-field-marshal, he entered the Prussian service and received his father's regiment. He was at once passionate and shrewd, domineering and kind, utterly rough in his manners and often sublime in his feelings. As a youth he fell in love with Anna Luise Föse, the daughter of a druggist, and in spite of all remonstrances, as soon as he was of age (in 1698) he married her, induced the emperor to raise her to princely rank, and led a noble and happy married life with her. He served from 1698 to 1713 with great distinction and in high and responsible positions under Engene and Marlborough in the Netherlands, on the Rhine, and in Italy, and on the accession of Frederick William I. to the Prussian throne he actually became the head of the Prussian army. He was a master in military training. He invented the equal step, and formed those armies with which Frederick II. founded the political power of Prussia. He was at once despotic and inspiring, and that spirit—a spirit of discipline—before which the Austrians broke down at Sadowa and the French at Sedan, descends from the Old Dessauer. He was, however, not only a drill-sergeant, like his royal friend, Frederick William I.; he was also a general. His conquest of Rügen and the capture of Stralsund in 1715 in the war against the Swedes were brilliant exploits. Frederick II., who disliked him because he smelt of the *tobacco collegium*, valued his capacities as a commander very highly. In the first Silesian war he placed him in command of the army on the Hanoverian frontier, and in the second he sent him to invade Saxony, where he won the brilliant victory at Kesselsdorf which ended the war. After the death of his wife, in 1745, he retired from all participation in public life, and d. on his estate at Dessau Apr. 7, 1747.

Leopold II., grand duke of Tuscany (1824–59), b. Oct. 3, 1797, a son of the grand duke Ferdinand III. He ruled in the same spirit as his grandfather, Leopold I., emperor of Germany, under the name of Leopold II. In 1847 he granted a free constitution, and although in 1849 he had to flee to Naples, he was recalled shortly after by his own subjects. Thus he weathered the liberal storm, but the national, which soon followed, was too powerful for him. In 1859 he fled with his family to Vienna. No regard was paid to his abdication in favor of his son. His dominions were incorporated with the kingdom of Italy in consequence of a popular vote, and he d. an exile at Brandeis, in Bohemia, Jan. 29, 1870.

Leos'thenes, an Athenian general of whose earlier life nothing is known. In 324, when Alexander the Great ordered all the Greek states to recall those citizens who had been exiled for political reasons, several of the states rose in rebellion. Alexander dying shortly after, a league was formed for the purpose of driving the Macedonians out of Greece, and Leosthenes was placed at the head of the confederate army. His career was short but brilliant. He routed the Bœotians, who sided with the Macedonians, and then defeated Antipater, the Macedonian general, and shut him up in Lamia. But while besieging this city he was wounded mortally in the head by a stone thrown from the ramparts, and d. two days after, 322 B. C.

Lepan'to, Gulf of, also called the **Gulf of Corinth,** an inlet of the Mediterranean, 75 miles long and about 16 miles wide, between Peloponnesus and the mainland of Greece, terminates to the E. in the Gulf of Patras, connected with it by the Strait of Lepanto, not more than a mile wide. In this gulf was fought (Oct. 7, 1571) the celebrated battle between Don John of Austria, commanding the allied Spanish, Venetian, and papal fleet, and Ali Pasha, commander of the Turkish fleet, from which battle may be dated the decline of the Turkish power in Europe. (See the elaborate and very impressive description in Prescott's *History of Philip II. of Spain.*)

Lep'idine [Gr. λεπίς, "scale," or "bark"], $C_{10}H_9N$, a volatile, oily base, homologous with chinoline, obtained with that and other bases on distilling quinine or cinchonine with water and potassic hydrate. Its sp. gr. is 1.072, boiling-point between 266° and 271° C. The isomeric base iridoline, formerly supposed to be identical with lepidine, is found in the oil of coal-tar. C. F. CHANDLER.

Lepidoden'dron [Gr. "scale tree"], a genus of fossil trees, usually referred to the Lycopodiaceæ, but was once thought to be allied to the coniferous araucarias. Their remains are found in the Devonian rocks and the Lower Coal-measures, and they are believed to have contributed largely to the production of coal. Their surface is marked with scale-shaped spaces, which are the scars of fallen leaves. Many of them were of great size—40 to 80 feet high and 3 to 6 feet through. Remains of many species are known, partly American, partly European, and partly common to both continents.

Lepid'olite [Gr. λεπίς, "scale," and λίθος, "stone"], a species of mica, crystallizing in the trimetric system, and in composition a silicate of alumina, etc. with lithia. It is generally met with in granular masses, consisting, as its name implies, of foliated scales.

Lepidop'tera. This term [Gr. λεπίς, "scale," and πτερόν, "wing"] was applied to the butterflies and moths by Linnæus, in allusion to the fine powdery scales which clothe their wings. But this is a character of secondary importance, as certain Diptera (*Culex*, etc.) and Coleoptera, as well as Neuroptera, have the body slightly scaled. The Lepidoptera are better distinguished by the long, slender larvæ (caterpillars), which have usually from two to five pairs of soft, fleshy, unjointed abdominal legs, besides the three thoracic pairs. They are active, and eat vegetable food; the pupa (chrysalis) is inactive, the limbs being soldered to the body, the whole integument forming a solid case; while the adult (imago) is distinguished from all other insects by the want of mandibles fitted for mastication (as they exist in a very rudimentary state), and by the maxillæ being united and forming a sucking-tube called the "tongue." Other essential characters are the small head with its large clypeus, the minute labrum, the large globular compound eyes, the large, scaled labial palpi held up in front of the face and protecting the tongue, and by the usually broad wings densely covered with minute scales. The Lepidoptera are essentially flying insects; the broad wings are strengthened by hollow rods (the so-called veins, containing an air-tube around which the blood flows), which are placed nearest together on the front or costal edge of the wing. The normal number of these veins is six; they are variously branched, affording characters for distinguishing families and genera. As they rarely walk, only using their legs as supports while at rest, these appendages are slender and weak, and very uniform in appearance, but frequently the foremost pair of legs are aborted or rudimentary. The head is small, the masticatory muscles being slightly developed, since these insects take little food, and then only by sucking up dew or honey through their tongue. The thorax, however, filled with the large, powerful muscles of flight, is very large in proportion to the head, and more or less spherical, due to the small size of the prothoracic segment and the rather small third (metathoracic) segment. The abdomen, or hind body, is cylindrical, about twice as long as the thorax, with no true ovipositor or other appendage, except two valve-like pieces in the female, representing the ovipositor of other insects. In the male there is a pair of hooked forceps adapted for clasping the abdomen of the female during copulation. Returning to the head, besides the two large compound eyes, are two simple eyes (ocelli) situated behind the former. The most interesting organs are the antennæ, which vary greatly in the different groups. In the butterflies they are knobbed, in the Sphinx and its allies they are fusiform, in the silkworms (Bombycidæ) they are beauti-

Caterpillar, chrysalis, and butterfly, male and female, of the pine silkworm moth (*Bombyx dispar*).

fully pectinated, the branches being especially long and well developed in the American silkworm (*Telea Polyphemus*) and Cecropia, Luna, and Promethea moths. These branched organs are undoubtedly provided with the sense of hearing, as are the knobbed feelers of the butterflies, which have scattered over the knob little auditory sacs connecting with the antennal nerve. The hairs clothing the body of a butterfly or moth are simply modified scales, as can be demonstrated by comparing a number under the microscope with the scales taken from the base of the wings, where the hairs gradually pass into scales. These scales are inserted by a sort of ball-and-socket joint to the wing, the points of attachment being arranged in irregular raised lines. They are more or less notched at the end, and beautifully ornamented with microscopic lines. Under the microscope they are colorless, and the varied and rich colors of the wings of butterflies and some moths are, like those of pearl, due to the interference of light.

Regarding the internal anatomy of the Lepidoptera, we may say that the nervous system is, in its general form, much as in other insects. There are seven ventral ganglia in the adult and eleven in the larva. This decrease in their number is due to the fusion during the pupa state of the first, second, third, and fourth ganglia of the larva, exclusive of those situated in the front part of the head. The two thoracic ganglia or nerve-centres resulting from this fusion distribute nerves to the legs and the muscles of the wings. Meanwhile, the fifth and sixth ganglia of the larva have either disappeared entirely, or been united with the others. (*Newport.*) In connection with the tongue is a sucking stomach, which opens into the posterior end of the œsophagus. The silk-glands of the larva are very large, consisting of two long, flexuous, thick-walled glands situated on the sides of the body, and opening by a common orifice on the under side (labium), usually at the extremity of a short tubular protuberance. They are most developed when the caterpillar is about to transform into the pupa state, and is about to spin a cocoon. The silk is a glutinous secretion which solidifies and assumes a thread-like texture on exposure to the air. There are six long urinary tubes which open into the posterior or pyloric end of the stomach. The ovaries consist of four very long tubes; the copulatory pouch is a remarkably large pyriform reservoir. The testes form two round or oval follicles.

The metamorphoses of the Lepidoptera are "complete," the larva being worm-like, the pupa inactive and closely resembling the adult, except that the limbs are soldered to the body. The eggs of butterflies and moths are more or less spherical, sometimes flattened, usually ribbed, and forming beautiful objects for the microscope. The young caterpillar on hatching often eats up its shell and embryonal membranes before partaking of its true vegetable food. It is then much like the adult, but with the head larger in proportion to the body, and usually without the hairs, spines, and warts characteristic of the older individuals, and which are acquired during the subsequent moults. There are four or five of these changes of skin or moults. Previous to moulting the caterpillar stops eating, the old skin, now hardened and tense, splits asunder on the back, and the caterpillar draws its new body out of the rent, and then considerably exceeds its former size. This is a critical period with the insect, and many through weakness and disease die during the process. Mr. Trouvelot tells us in his account of the Polyphemus silkworm (*American Naturalist*, vol. i. p. 30) that when the silkworm is hatched it weighs one-twentieth of a grain, when ten days old one-half a grain, and when it has attained its full size, which it does in fifty-six days, it weighs 207 grains, or 4140 times its original weight. By the time the caterpillar has become fully grown it will have consumed not less than 120 oak-leaves, weighing three-quarters of a pound; besides this, it will have drunk not less than one-half an ounce of water. "So the food taken by a single silkworm in fifty-six days equals in weight 86,000 times the primitive weight of the worm. Of this about quarter of a pound becomes excrementitious matter, 207 grains are assimilated, and over 5 ounces have evaporated."

Before entering upon the pupa state the caterpillar grows restless, stops eating, deserts its food, and spins a silken cocoon, or, if not a silk-producing worm, constructs a rude cocoon of particles of dirt, or, if a borer, in the stems of plants or trunks of trees, of chips made by the larva, fastened together with silk. Here it remains for two or three days. Meanwhile, its body contracts in length, and the skin of the pupa grows beneath that of the larva. While the body of the wormlike caterpillar exhibits no difference between the thorax and abdomen, the muscles of the growing pupa variously contract and enlarge beneath the caterpillar skin until the pupa form is complete, when it works its way out through a rent in the back. This pupa-skin is developed from the *hypodermis* or inner layer of skin, as shown by Weissman, and the rudiments of the pupa and imago exist as small disks of cells attached to fine tracheæ or nerves in the very young caterpillar, so that Swammerdam's idea that the skin of the pupa and imago existed in the larva is partially correct. The different forms of cocoons are very varied and often beautiful objects. Those of the geometric or measuring moths are thin, and often consist simply of a network of threads suspended among the leaves of the plants on which the caterpillar has fed. The cocoon of the *Ctenucha* moth is made out of the hairs of the caterpillar, which are finely barbed and adhere together without

any silk thread. The most complete cocoons are those of the silkworms. Our native silkworm (*Telea Polyphemus*) constructs a very perfect cocoon, a continuous thread composing it. Mr. Trouvelot states that the Polyphemus larva, when about to spin its cocoon, draws the leaves together as a support for the threads, forming the foundation of the cocoon. "This seems to be the most difficult feat for the worm to accomplish, as after this the work is simply mechanical, the cocoon being made of regular layers of silk united by a gummy substance. The silk is distributed in zigzag lines of about one-eighth of an inch long. When the cocoon is made the worm will have moved his head to and fro, in order to distribute the silk, about 254,000 times. After about half a day's work the cocoon is so far completed that the worm can hardly be distinguished through the fine texture of the wall; then a gummy, resinous substance, sometimes of a light-brown color, is spread over all the inside of the cocoon. The larva continues to work for four or five days, hardly taking a few minutes of rest, and finally another coating is spun in the interior, when the cocoon is all finished and completely air-tight. The fibre diminishes in thickness as the completion of the cocoon advances, so that the last internal coating is not half so thick and so strong as the outside ones." The cocoon of the Chinese silkworm (*Bombyx mori*) is white or whitish yellow, and is over an inch long and nearly half as broad; 360 cocoons weigh a pound and a half.

It has long been known that the females of the *Bombyx mori* and a few other moths have in one or more instances been known to lay eggs which without being fertilized by the males have hatched out. *Psyche helix* was for a long time supposed to reproduce solely in this way, but lately Claus has found the males, which, however, are exceedingly rare. Connected with this subject of parthenogenesis among the Lepidoptera is the occurrence of two forms of the sexes, or dimorphism. Mr. Wallace has discovered two forms of females of *Papilio Memnon;* one form is normal, having its wings tailed, as usual among the swallow-tailed butterflies, while the second form is tailless, resembling the tailed male. *Papilio Pammon* has three sorts of females, and may be said to be trimorphic. *Papilio Ormenus* is trimorphic. Our *Papilio Turnus* is dimorphic, the Southern dark form having been described as a distinct species under the name of *P. Glaucus*. *Papilio Ajax* is polymorphous, the same batch of eggs having given rise to *P. Ajax* and varieties *Walshii, Telamonides*, and *Marcellus*. Lepidoptera in the larva state are much exposed to disease, especially those kept in confinement. Pebrine, a disease due to a very minute fungus, has threatened to exterminate the silkworm in Southern Europe. Another disease, muscardine, is due to the attacks of another fungus, the *Botrytus Bassianus*. Fossil Lepidoptera have occurred in the Jurassic formation; a sphinx-like moth has been found in the Tertiary beds of Europe, and an unknown moth in the Tertiary rocks of the Rocky Mountains. A few minute forms have occurred in amber. About a thousand species of butterflies alone inhabit this country, and about 5000 species of Lepidoptera in all are known to exist.

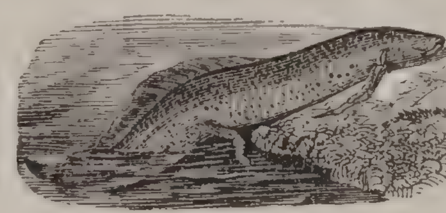
The following synopsis of the different families begins with the lowest and ends with the highest:

Synopsis of the Families of Lepidoptera.

1. Wings variously fissured; larva either hairy and pupa naked (*Pterophorus*), or naked and spinning a cocoon (*Alucita*): *Pterophoridæ* (plume moths).
2. Wings very narrow, more or less pointed; fringe very long; larva very slender, often mining leaves: *Tineidæ* (clothes moth, etc.).
3. Wings oblong; larva naked, rolling up leaves: *Tortricidæ* (leaf-rollers).
4. Palpi very long; larva often glassy green: *Pyralidæ* (snout moths).
5. Wings broad, triangular; larva with only two pairs of abdominal legs, and consequently a measuring gait: *Phalænidæ* (geometrids, measuring-worms).
6. Wings rather narrow; larva smooth, cylindrical, tapering towards both ends: *Noctuidæ* (owlet moths, cutworms, etc.).
7. Head unusually small, sunken; antennæ pectinate; body hairy; larva hairy, spinning a thick cocoon: *Bombycidæ* (silkworms).
8. High-colored moths, with large heads; antennæ either simple, sub-fusiform, or slightly pectinated; larva naked, and humped at the end, or with radiating tufts of hairs: *Zygænidæ*.
9. Wings very long and narrow, semi-transparent; larva boring trees: *Ægeriadæ* (borers).
10. Large moths with large heads, narrow wings; a long tongue; larva with a horn on the end of the body; pupa often with a free tongue-case: *Sphingidæ* (hawk moths).
11. Antennæ knobbed, wings broad; larva often spined; chrysalis naked, often with protuberances and golden or silvery spots: *Papilionidæ* (butterflies).

A. S. PACKARD, JR.

Lepidosi'ren [Gr. λεπίς, "scale," and σειρήν, "siren"], the typical genus of the family Lepidosirenidæ, distinguished by its very elongated eel-shaped body (it having about fifty-five pairs of ribs); the pectoral and ventral "fins" or filaments are plain and tapering, and are entirely destitute of rayed fringes; there are five branchial arches, with four corresponding intervening clefts; no external branchial appendage is developed; and the cusps of the dental plates of the palate, as well as lower jaw, are well developed. The genus is represented by only one well-distinguished species (*Lepidosiren paradoxa*, Fitzinger), although two or three have been thought to exist by some. The species occurs quite generally apparently in the Amazon River, as well as its tributaries, but is rare: if popular reports are to be credited, this or a species of the same genus sometimes attains a gigantic size, though the length of those obtained rarely much exceeds three feet. (See LEPIDOSIRENIDÆ.) THEODORE GILL.



Lepidosiren.

Lepidosiren'idæ [from *Lepidosiren*, the typical genus of the family, and the termination *-idæ*], a family of fishes of the order Sirenoidea, with an elongated and eel-shaped body covered with moderate cycloid scales; the dorsal and anal are united with the caudal, and form a continuous homogeneous border for the tapering tail; the pectoral and ventral fins are developed as articulated filaments; the upper labial cartilage has a median pair of conical teeth; the palatine dental plate on each side is elongated and oblong, and has several strong cuspidate vertical ridges; the labial plate is of similar form, and has also several transverse cuspidate ridges; the air-bladder is represented by two lung-like sacs slightly connected together and communicating by a duct, provided with a glottis opening in the floor of the œsophagus. This family is of extreme interest, as it was for a long time a matter of dispute whether its members were fishes or amphibians. Fitzinger (1837) and Natterer (1839), who first described the American type (*Lepidosiren paradoxa*), referred it to the amphibians next to *Siren*, from which they differentiated it chiefly by the scales, and hence gave the name *Lepidosiren* —*i. e.* "scaly siren." Owen (1839), who first made known the African type, on the other hand contended that it was a fish. After much discussion they were and are now conceded to be true fishes, representing a peculiar family (Lepidosirenidæ), order (Sirenoidea), and super-order or sub-class (Dipnoi) of the class of FISHES (which see). The family is also interesting, as being (next to the related Ceratodontidæ) the most nearly allied to numerous extinct fishes which flourished during Palæozoic and Mesozoic times, and which until lately were much misunderstood. The two recent genera (LEPIDOSIREN and PROTOPTERUS) are alone known, and will be noticed under their respective names. (See also SIRENOIDEI.) THEODORE GILL.

Lepidoste'idæ [named from the typical genus *Lepidosteus* (λεπίς, scale, and ὀστέον, bone) and the family termination *-idæ*], the only existing family of the order Rhomboganoidea, distinguished by the elongated and sub-cylindrical body covered with rhomboidal scales; the head elongated, and terminating forwards in a long beak-like snout; the upper jaw projecting beyond the lower, and with the nostrils near the end of the snout; the fins are provided with fulcra; the short dorsal situated far behind, and just above the anal fin; the stomach is simple in form, but with numerous pyloric appendages; the intestine has a rudimentary spiral valve. This family, although the only living type of the order to which it belongs, had numerous relations in the Mesozoic and Palæozoic epochs. The skeleton has many peculiarities, among which is the composite structure of the upper jaw, as well as the character of the vertebræ, which are convex in front and concave behind. There are but few representatives, which are divisible into three groups, by some entitled genera, viz.: *Lepidosteus, Cylindrosteus*, and *Atractosteus*. The genera are regarded by some as monotypic; *i. e.* all the forms belonging to each are considered to be members of a single species; while others, *e. g.* Agassiz, admit as many as eighteen or twenty undefined species in the family. The species are found chiefly in the waters of northern America, but representatives of one group, *Atractosteus*, descend as far southwards as Central America and Cuba; a species has also been recently discovered in China. In the Tertiary epoch the family was represented by forms closely related to the living American species in Europe. THEODORE GILL.

Lep′idus, the name of an ancient patrician family of Rome belonging to the Æmilian gens. The most conspicuous member of the family was MARCUS ÆMILIUS LEPIDUS, the triumvir. He was a weak, vain, and avaricious man, destitute of any talent or any superior quality, but twice—and both times in moments of the utmost consequence—chance placed the decision of affairs in his hands. He was prætor in 49 B. C., when the war broke out between Cæsar and Pompey. He sided with Cæsar, was made his *magister equitum* in 47 B. C., consul in 46 B. C., and in 44 received as his provinces Spain and Gallia Narbonensis. He was just organizing his proconsular army at Rome, and was thus at the head of the only armed force in the city, when Cæsar was murdered. He used his position to get himself elected *pontifex maximus*, and having brought about a reconciliation between Antony and the senate, he proceeded to his provinces, flattered and coaxed by both parties. The agreement between Antony and the senate did not last long, however, and after the defeat at Mutina, Antony took refuge with Lepidus, and was well received. Octavianus, who up to this time had acted simply as the general of the senate, saw that in a contest with Lepidus and Antony the cause of the aristocracy was a lost cause, and commenced immediately negotiations which led to the formation of the famous triumvirate in 43 B. C. By the partition of the provinces, Lepidus received Spain and Gallia Narbonensis, and was left as governor of Rome while Antony and Octavianus proceeded against Brutus and Cassius. But by the second partition, after the battle of Philippi in 42 B. C., he was treated rather slightingly, and received only Africa. This province he held till 36 B. C., in which year Octavianus ordered him to join him at Sicily against Sextus Pompeius. Lepidus came, and believed the opportunity favorable for an attempt at throwing off the authority of Octavianus. At the decisive moment, however, his soldiers deserted him, and on his knees he had to beg for mercy. Octavianus treated him with great contempt, deprived him of his province, though not of his private fortune or of his dignity of *pontifex maximus*, and banished him to Circeii, where he lived in retirement till his death, 13 B. C.

Lepor′idæ [Lat. *lepus*, "hare," and *-idæ*], a family of duplicidentate glirine mammals, readily recognizable by the external appearance of the body, as well as by the structure of the skeleton. The hind legs being much more developed than the fore (although not so disproportionately as in the kangaroos and jumping mice), the animal progresses by a series of running leaps or short jumps, in which latter case the back is crooked and arched backward, and gives the characteristic physiognomy; the head is high, arched backward, and compressed; the eyes lateral and prominent; the snout rounded, and with the nostrils converging downward to a median furrow which divides the lips; the ears are more or less elongated, and the tail is short and bushy, and turned up. The skull is high and compressed, the rostral portion much produced and broad, and the interorbital area widened by the development of enlarged and expanding supraorbital plates or processes separated generally by narrow fissures from the body of the frontal bones fore and aft; the orbits are ample; the nasal processes of the supramaxillary bones are perforated in a sieve-like manner; and the lower jaw has the ascending rami very oblique, and the condyles consequently far backward, and the angular process extensive forward. The teeth, besides the four incisors of the upper and two of the lower jaw ($\frac{2}{1} \times 2$), consist of six molars in the upper and five in the lower jaw on each side (M. $\frac{3}{3}$, P. M. $\frac{3}{2} \times 2$); those of the upper jaw have mostly (M. 2, P. M. 2) a vertical groove on the outer as well as inner surface; the crowns are broader than long, and have three transverse ridges; those of the lower jaw are broader, and the grooves are much stronger. Imperfect clavicles are developed. Such are the most important characters common to the hares and rabbits. The species are quite numerous, between thirty and forty species being generally recognized, and are most abundant in the arctogæan regions (North America, Europe, and Northern Asia) and the temperate zone; representatives are found, however, far N. and S., one (*Lepus glacialis*) extending to the Arctic regions, and others are found as far S. as Brazil, India, and the Cape, but scarcely or not at all in the lowlands of the torrid regions. Though thus widely diffused and numerous in species, they agree so closely in structure as to render it doubtful whether there is more than one generic type among them, although as many as four have been proposed by the late Dr. J. E. Gray.

The Rabbit.

There is a remarkable difference in habits between the hares and rabbits. The hares never burrow, but simply compose a "form" or nest, in which they rest and bring forth their young, and the young are born covered with hair and with the eyes open. The rabbits, on the contrary, burrow in the ground, and often make extensive tunnels, and in these burrows they live and bring forth their broods; the young are brought into the world naked and blind. Notwithstanding such differences, however, there are no corresponding structural characters, and the different animals are closely related. All the American species are "hares" in the sense thus understood. THEODORE GILL.

Leporide′ [Fr.], a name applied to a remarkable fertile hybrid between the common European hare and the rabbit. Leporides are now extensively bred in France, where they are esteemed for the table.

Lepo′rius, a native of Gaul; entered in the beginning of the fifth century a monastery in the vicinity of Marseilles, and acquired a great reputation for learning and holiness. He afterwards fell into the heresy of Pelagius, and maintained that man has no need of the grace of God, and that Christ was born with a human nature only. He was excommunicated, and went to Africa. Here he met with St. Augustine, and so great was the influence of this powerful man on Leporius that in 425 he retracted, and was ordained a presbyter by Augustine. His retraction, which was addressed to Proculus, bishop of Marseilles, and Cyllinnius, bishop of Aix, and published in 1630 under the title *Libellus emendationis sive satisfactionis ad episcopos Galliæ*, was much appreciated by the old Church.

Lep′ra [Gr. λέπρα, "leprosy"], a disease of the skin, in which scaly patches, concealing a red and inflamed surface, are seen, particularly upon those parts of the limbs where the bones are but thinly covered. It is not contagious, may last for many years or may be spontaneously cured, and does not usually affect the general health. Arsenical medicines, with applications of tarry compounds and iodide of sulphur, are recommended in its treatment.

Lep′rosy [Gr. λέπρα, "leprosy"], "an incurable constitutional disease of adult life, which is especially prevalent in tropical and sub-tropical climates." (*Robert Liveling.*) It may be divided into three forms, as follows: "*First.* Macular leprosy, characterized by an eruption on the skin, accompanied by anæsthesia. *Second.* Anæsthetic leprosy, of which the chief features are anæsthesia and discolorations of the skin and atrophy of the muscles, with ulceration and mutilation of the hands and feet. The *third* form, or tuberculated leprosy, is characterized by a bronzing and tuberculated thickening of the skin, especially of the face, ears, hands, and feet, followed by similar changes in the mucous membrane of the upper part of the alimentary and respiratory tracts, ending fatally in from two to fifteen years, by intercurrent disease in some vital organ." (*Liveling.*)

Leprosy, or *elephantiasis Græcorum*, is a disease which has been known and justly dreaded from the earliest ages. We find frequent mention of it in the Bible, but the disease as there spoken of evidently included many other skin affections, which at that time they were unable to differentiate. The proof of this is that the cases are there mentioned as having recovered, which we now know would

have been impossible had they been true leprosy. The leper has always been an outcast from society, both on account of the loathsomeness of his disease, and the idea which has prevailed of its contagiousness. During the Middle Ages numerous leper-houses were established in various parts of Europe, where those suffering from the disease were confined, and prohibited by law from appearing in the streets. Now, however, that it is known that the disease can only be transmitted from parent to offspring, the laws are more lax on this point, and a leper-house is a thing seldom heard of. At the present time leprosy is most prevalent in Syria and Egypt, and the cases met with throughout Europe and America are rare. Almost every drug in the pharmacopœia has been used in the treatment of this disease, but without avail, and now the treatment is principally palliative. Good food, clothing, and the prevention of marriage amongst lepers are the only means we possess to better their condition and decrease their number. EDWARD J. BERMINGHAM.

Lep′sius (KARL RICHARD), PH. D., b. at Naumburg, Prussian Saxony, Dec. 23, 1810, the son of K. P. Lepsius (1775–1853), an able archæologist; studied at Leipsic, Göttingen, and Berlin under Bopp's instruction, graduating at Berlin with a thesis on the EUGUBIAN TABLES (which see), which obtained his degree; went to Paris in 1833, and for his *Palæography applied to Linguistic Researches* gained the Volney prize; in 1835 made researches in the libraries of Italy; devoted his attention to languages, especially to Ægyptology, and wrote *Letter to M. Rosellini on the Hieroglyphic Alphabet* in 1837; went to England in 1838; projected an expedition to Egypt, which left England in 1842, and with success returned to Germany in 1845; became professor at Berlin in 1846; again went to Egypt in 1866, and discovered at Tanis a bilingual inscription of the time of Ptolemy Euergetes; has published a valuable work on the Nile, translated into English; and was placed over the Prussian state library in Berlin in 1874. Among his works are *Das Todtenbuch der Aegypter* (1842), *Die Chronologie der Aegypter* (1849), *Denkmäler aus Aegypten und Aethiopien* (1849–59), *Ueber den ersten ägyptischen Götterkreis* (1851), *Briefe aus Aegypten* (1852), *Königsbuch der alten Aegypter* (1858), *Die ägyptische Elle* (1865), *Ueber einige ägyptische Kunstformen*, etc. (1871), etc.

Leptan′dra [proposed for its generic name by Nuttall], the pharmaceutical name of the Culver's physic (*Veronica Virginica*, order Scrophulariaceæ), a tall perennial herb of the Atlantic U. S. which has decided cathartic powers. Its impure resinoid is extracted and sold as *leptandrin.* It is an agent of considerable value, and is believed by many practitioners to act decidedly upon the liver; but this is very doubtful.

Lep′tis [Phœnician for "naval station"], or **Great Leptis,** so called to distinguish it from another and less important Leptis, an ancient Sidonian colony and seaport in what is now Tripoli in Barbary, between the two Syrtes and near the modern Tripoli. It had a fine roadstead and an artificial harbor, long since choked with sand. At this point are very extensive ruins, in great part buried in the sand. Leptis once had a large trade, but is now almost without inhabitants. It was one of the three cities which gave the name *Tripolis* to this region.

Leptocar′dia [Gr. λεπτός, "slender," and καρδία, "heart"], the class of vertebrates containing the lowest organized forms of the branch, and formerly confounded with the class of fishes. Only a single genus (*Branchiostoma*, Costa, or *Amphioxus*, Yarrell) is known, and this is believed to be the surviving type of a class which must have been rich in representatives in the distant past, but which, on account of the easy destructibility of all its parts, has left no recognized remains in the rocks. The brain is of the most rudimentary character and not developed into enlarged lobes, as in all other vertebrates; the skull is also undeveloped, nor are there any rudiments of auditory organs; the skeleton is represented by a simple notocord or embryonic backbone, which is not divided into vertebræ, and has no ribs or other appendages, no scapular or pelvic arches, and consequently no pectoral or ventral fins being developed. The circulatory system is also very simple, and the heart simply tubular and not divided into distinct chambers (and hence the name of the class). The mouth is an elongated aperture bounded by a semicartilaginous hoop, which is beset with filamentary processes clothed with ciliated tentacles; this opens into "an expanded pharyngeal chamber, which is split on each side by obliquely transverse clefts, through which the water taken in by the mouth is discharged into an "atrial chamber," and thence through a pore which represents the branchial orifice of the Myxinidæ. Such are the chief distinctive characters of this type. The differences from all others are so great that it is at first difficult to perceive the homologies of the various organs and parts with those of the higher vertebrates. So great, indeed, are the differences that the original describer of the European species, Pallas, failed to perceive any resemblance to fishes or other vertebrates, and referred it to the mollusk genus *Limax.* Quite recently, too (in 1874), Semper, with a full knowledge of its organization, has deliberately excluded it from the vertebrates altogether. By all other authorities, however, it has been referred to the branch of vertebrates, but in various degrees of relationship to the class of fishes. Costa, Yarrell, and most other authors until recently have regarded it as the lowest of fishes. Isidore Geoffrey St. Hilaire, C. Bonaparte, and Moquin-Tandon (all under the name Myelozoa), and Häckel, Gegenbaür, O. Schmidt, Cope (all under the name Leptocardia), and others, have raised the type to class value; and several of them have contrasted it with all the other vertebrates, and thus expressed their views as to the fundamental nature of its distinctive characters.

Although the animal is so peculiar, it can be, however, in general terms, compared with the Marsipobranchiates, and therefore with the other vertebrates; and although the brain is in a rudimentary condition, the principal nerves are developed (though under somewhat doubtful guises), and their relation to the frame-work permits the probable recognition of the homologies of the several regions of the "head." The muscular system is represented by flake-like segments or "myotomes," V-shaped and pointed forwards. According to Huxley, the oral aperture is large and extends backwards to the level of the junction between the sixth and seventh myotomes, and is there divided from the branchial cavity by a "*velum palati.*" Eight ["*a* — *h*"] pairs of nerves are given off from the cerebro-spinal axis as far as this point. The eighth or most posterior of these, which for convenience may be called *h*, passes out between the sixth and seventh myotomes, and runs down parallel with the lateral attachment of the velum. The next five (*g, f, e, d, c*) pass out between the first six myotomes to the integument and to the walls of the buccal cavity. The foremost two nerves (*b* and *a*) pass in front of the first myotome; and the nerve *a* runs parallel with the upper side of the notochord to the end of the snout, giving off branches to that region of the body which lies in front of the mouth; this nerve lies above the eye-spot. In Huxley's opinion, the eighth nerve (*h*) corresponds with the last of the pre-auditory cranial nerves in the Ammocœtes or young of *Petromyzon*, which is the "*portio dura;*" while those between it and the optic nerve represent, apparently, the third (*motores oculorum*), fourth (*pathetici*), fifth (*trigeminal*), and sixth (*abducentes*) pairs of cranial nerves in the higher vertebrates, the optic nerves of course being the second pair, while the first (*a*) in Branchiostoma "has the characteristic course and distribution of the orbito-nasal division of the trigeminal." Thus the head has at least six pre-auditory myotomes, and "on the other hand, from the seventh myotome backwards, a certain number (supposed to be eight) of segments answer to the post-auditory or parachordal region of the higher vertebrata." These are supposed to represent "proto-vertebræ," and thus antagonize the hypothesis, at one time so prevalent, that the head of vertebrates is composed of four "vertebræ;" and Huxley suggests "that the numerous proto-vertebræ which lie in front of the fourteenth of *Amphioxus* (Branchiostoma) are represented only by muscles and nerves in the higher Vertebrata." The other characteristics of this curious type will be found in the works of the numerous authors who have directed attention to it, the most recent of whom are Stieda of Dorpat, and Huxley and Ray Lankester of London. But one genus (Branchiostoma of Costa, 1834, or *Amphioxus* of Yarrell, 1836) is known, and the species are doubtful. Representatives have been found along almost the entire European coast, but most abundantly in the Mediterranean Sea, the Indian seas (Borneo, etc.), North Carolina, the Caribbean Sea, and Brazil. They live in the sand from lower water mark to a depth of at least ten or twelve fathoms. They are transparent, and specimens rarely exceed three inches in length. THEODORE GILL.

Lep′tophis [Gr. λεπτός, "slender," and ὄφις, "snake"], a genus of non-venomous colubroid serpents of very slender proportions and arboreal habits. Some serpents of the U. S. (*e. g.* grass-snake, or *Cyclophis æstivus*, and ribbon-snake, or *Eutænia saurita*) have been erroneously referred to the genus.

Lequesne′ (EUGÈNE LOUIS), b. at Paris Feb. 15, 1815; studied law, and was admitted to the bar in 1839, but entered in 1841 the School of Fine Arts; became a pupil of Pradier at Rome, and began to exhibit in 1845. His most prominent works are the *Dancing Faun* in the garden of the Luxembourg, the *Victory* on the tomb of Napoleon, and

the *Pegasus* on the front of the new opera-house; he has also made a number of excellent busts.

Leray′, tp. of Blue Earth co., Minn. Pop. 448.

Le Ray, tp. of Jefferson co., N. Y. It contains several villages. Pop. 2862.

Le Rays′ville, post-b. of Pike tp., Bradford co., Pa. Pop. 284.

Lerca′ra Frid′di, town of Sicily, in the province of Palermo, pleasantly situated in a very fertile district abounding in sulphur-mines. Pop. in 1874, 9154.

Ler′do de Teja′da (Sebastian), president of Mexico, b. at Jalapa, in the state of Vera Cruz, Apr. 25, 1825, of pure Spanish ancestry; studied at a college in Puebla with a view to the priesthood, but, abandoning that purpose, entered the College of San Ildefonso in Mexico and studied law; was admitted to the bar in 1851; was chosen rector of San Ildefonso in 1852, and became in Dec., 1855, one of the magistrates of the supreme court of justice. About this time his brother, Miguel Lerdo de Tejada, an eminent statesman and economist, was appointed minister of finance in the cabinet of President Comonfort, and by his energetic policy respecting the privileges and property of the Catholic Church became the leader of the liberal party. To him Sebastian lent such efficient co-operation as to be called to the ministry of foreign affairs, which he accepted June 4, 1857. On the overthrow of Comonfort in Jan., 1858, he devoted himself anew to the direction of the college and to practice at the bar, where he soon gained an eminent position. On the restoration of the liberal government Lerdo was elected to Congress (Apr., 1861), re-elected in the following year, and was three times chosen to the presidency of that body, the term of that office in Mexico being only one month. He was president of Congress in May, 1863, when the capture of Puebla forced President Juarez to abandon the capital of the republic, and was one of the few prominent statesmen who accompanied the government in its retreat to San Luis Potosi. In that city he accepted the post of minister of justice, Sept. 15, and that of minister of foreign affairs, Sept. 24, 1863, thereby becoming, next to Juarez, the leading representative of the cause of national independence during the protracted struggle against the French intervention and the so-called empire of the Austrian archduke Ferdinand Maximilian. In the successive retreats of the republican government to Monterey, Saltillo, Durango, Chihuahua, and Paso del Norte, as well as in its advance three years later to Chihuahua, Zacatecas, and San Luis Potosi, Lerdo preserved an imperturbable confidence in the ultimate success of the cause to which his entire energies were devoted, and when the turning of the tide placed the archduke a prisoner in the hands of the republicans, neither Juarez nor Lerdo wavered before the most urgent appeals in his resolution to execute upon that prince the sentence to which he had been condemned after a protracted trial. Upon the restoration of the national government to the city of Mexico in 1867, Lerdo was elected president of the supreme court of justice, to which post was annexed the vice-presidency of the republic, but continued to discharge the duties of minister of foreign affairs, and was generally credited with being the originator of the most important measures taken for the rebuilding of the shattered political edifice. He retired from the cabinet Jan. 17, 1871; was an unsuccessful candidate for the presidency in the election of July of that year, and upon the sudden death of Juarez (July 18, 1872) succeeded him by virtue of his office as vice-president. In the election of Oct., 1872, Lerdo was chosen president for four years, ending Dec. 1, 1876. His administration has been characterized by a strict adherence to the policy established by Juarez, by the enforcement of the "laws of reform" against the alleged machinations of the reactionary or "Church party," and by a rigid suppression of all attempts at revolution. He is distinguished for consummate urbanity and great diplomatic sagacity, combined with inflexible determination. Porter C. Bliss.

Ler′ici, town of Italy, in the province of Genoa. It lies on the Gulf of Spezia in the midst of charming scenery, and has acquired some notoriety from the confinement of Garibaldi within its fortress in 1862. Its maritime activity is great for its population, which in 1874 was 5940.

Ler′ida, province of Spain, bounded N. by the Pyrenees and E. by Barcelona, comprises an area of 4919 square miles, with 330,348 inhabitants. The northern portion is covered with spurs of the Pyrenees, and rich in iron, copper, lead, zinc, marble, jasper, and gypsum. The southern portion is an extensive plain, which produces wheat, fruits, and vegetables.

Lerida [Lat. *Ilerda*], town of Spain, the capital of the province of Lerida, on the Segre, is surrounded by walls and strongly fortified, as it is the key of Aragon and Catalonia, and consequently a point of great military importance. It has two remarkable cathedrals, one of the thirteenth, the other of the eighteenth century; a lyceum, and several other educational institutions; its university, founded in 1300, was suppressed by Philip V. Pop. 19,627.

Lérins, The, several small islands off Antibes, and in the department of Var, France. The largest, Ste. Marguerite, was the place of imprisonment of the "Man in the Iron Mask" from 1686 to 1698. Its fortress, Monterey, is now a prison for military convicts and Algerines, and Bazaine was here confined (1874). It was the *Leron* of the ancients. The next smaller island, St. Honorat (*Planaria Lerina*), is named from St. Honoratus, archbishop of Arles, who founded here in the fourth century the convent of Lérins, which became a famous school of theology, and passed into the Benedictine order. After 1650 the monastery lost its importance, and is now in ruins, and the island supports some agricultural inhabitants. There are some smaller uninhabited islands in the vicinity.

Ler′ma (Francisco de Roxas de Sandoval), Duke of, b. in Spain during the sixteenth century; was made a duke and prime minister of Spain immediately on the accession of Philip III. in 1598, and governed the empire till 1618, during which period the exhausted and distracted state of the country became more and more apparent. His foreign policy was marked by defeats, his internal by cruelty and weakness. In spite of enormous exertions, he was compelled to conclude peace with England in 1604 and with the United Provinces in 1608 on humiliating conditions. In 1609 he issued the decree of proscription by which several thousand Moorish families, forming one of the richest and most industrious elements of the Spanish population, were driven out of Spain, and their property, at least in many cases, confiscated. Under Philip IV. the animosity against the fallen minister became so strong that an examination was made of his adminstration, and he was compelled to return a large sum of money to the treasury. D. shortly after, in 1625.

Lermontoff′ (Michael), b. Oct. 15, 1814; received a military education, and entered the imperial guard, but was removed in 1837 to the army of Caucasus on account of a poem he wrote on the death of Pushkin. In 1840 he published a volume of poems at St. Petersburg, which made a great sensation, and gained for him the title of "the poet of Caucasus." But a novel he wrote shortly after, *The Hero of Our Time*, caused a duel between him and one of his fellow-officers in the army of Caucasus, and he was shot July 27, 1841. Most of his works have been translated into German by Bodenstedt (1852), and some of them—as, for instance, *The Song of Czar Ivan Vasilievitch*—into French by Saint René Taillandier.

Lernæ′ada [from *Lernæa*, one of the genera], a proposed order of crustaceans, not recognized by all systematists. They are assigned to the Entomostraca, and to a section called Pœcilopoda. The mouth is for suction, the thorax not jointed, the organs very small. The males are totally unlike the females. All are parasites of very degraded type. They are often much more completely organized when young than when mature. In the latter stage they lose the power and organs of locomotion and of sight. There are many diverse and strange forms referred to this order, most of which would never be recognized as crustaceans but for their larval forms. They are found attached to fishes and other aquatic animals.

Le′ros [Λέρος], a Turkish island of the Ægean, 35 miles S. of Samos, is 6 miles long from N. to S., and 4 miles wide, is very fertile, and has good harbors. Pop. 3000. Its people were anciently proverbial for ill-nature, and its present inhabitants are despised as niggardly.

Lerot. See Dormouse.

Leroux′ (Pierre), b. at Paris in 1798; studied at the Lyceum Charlemagne; founded the *Globe* newspaper in 1824, as organ of the philosophers; adhered to the Saint Simonians in 1831, converting his paper into the organ of their socialistic policy; withdrew after the promulgation of the new doctrines of Enfantin. He became in 1832 editor of the *Revue Encyclopédique*, and in connection with Jean Reynaud, established in 1838 the *New Encyclopædia*, which was a continuation of the *Encyclopédie* of the eighteenth century. His capital work, *De l'Humanité, de son Principe et de son Avenir*, appeared in 1839, containing his philosophical and theological ideas, consisting in a continued progress of man and nature towards perfection through changing forms. He founded in 1841 the *Revue Indépendante*, with Viardot and George Sand, and in 1848, was elected a representative of the National Assembly as an ultra radical. After the *coup d'état* of 1851 he emigrated to the island of Jersey, and afterwards to Lausanne, Switzerland. Pierre Leroux was a kind of modern and

secular Zwingli, the representative of pure and honest radicalism in philosophy. He wrote also *Christianity and its Democratic Origin, Malthus and the Economists, or Shall there be always Poor? Job*, a drama, *The Samarese Beach*, a philosophic poem, *The Plutocracy, or The Government of the Rich*, etc. He returned to France after the amnesty of Aug. 15, 1869, and d. at Paris Apr. 12, 1871.

FÉLIX AUCAIGNE.

Le Roy, tp. of Boone co., Ill. Pop. 1002.

Le Roy, post-v. of Empire tp., McLean co., Ill., on the Indianapolis Bloomington and Western R. R., has 1 weekly newspaper. Pop. 862.

Leroy', tp. of Benton co., Ia. Pop. 1807.

Leroy, tp. of Bremer co., Ia. Pop. 363.

Leroy, post-v. and tp. of Coffey co., Kan., on Neosho River, which affords good water-power. The town has some manufactures. The station, 2 miles distant, is on the Missouri Kansas and Texas R. R. Pop. of v. 410; of tp. 1094.

Leroy, tp. of Calhoun co., Mich. Pop. 1303.

Leroy, tp. of Ingham co., Mich. Pop. 859.

Leroy, post-v. of Osceola co., Mich. Pop. 148.

Leroy, post-v. and tp. of Mower co., Minn., on the Milwaukee and St. Paul R. R. Pop. 1057.

Le Roy, post-v. and tp. of Genesee co., N. Y., on the Erie, Central, and State Line R. Rs., 25 miles S. W. of Rochester, 50 miles E. of Buffalo, and 10 miles E. of Batavia, has 7 churches, 2 banks, 2 weekly newspapers, 4 lime-kilns, 4 stone-quarries, several flour, planing, gypsum, plaster, and saw mills, with fine water-power supplied by Oatka Creek. It is the seat of Ingham University for ladies, and has an academic institute, an art conservatory, and a public library. Pop. of v. 2634; of tp. 4627.

C. B. THOMSON, ED. "GAZETTE."

Leroy, post-v. of Westfield tp., Medina co., O.

Leroy, tp. of Lake co., O. Pop. 811.

Le Roy, post-tp. of Bradford co., Pa. Pop. 1144.

Le Roy, post-tp. of Dodge co., Wis. Pop. 1576.

Leroy (WILLIAM E.), U. S. N., b. Mar. 24, 1818, in New York; entered the navy as a midshipman Jan. 11, 1832; became passed midshipman in 1838, lieutenant in 1843, commander in 1861, captain in 1866, commodore in 1870, and rear-admiral in 1874; commanded the Keystone State in a severe engagement with Confederate iron-clads off Charleston, S. C., Jan. 31, 1863, and the Oneida at the battle of Mobile Bay, Aug. 5, 1864, and conspicuous on both occasions for "gallantry and determination."

FOXHALL A. PARKER.

Leroy d'Étiolles (JEAN JACQUES JOSEPH), b. at Paris Apr. 5, 1798; studied medicine, and took his degree in 1824. In 1822 he presented to the Academy of Surgery a set of instruments which he had invented for the operation of lithotrity. The invention was disputed by Civiale and Amussat, who also claimed it, but after close examination of the case the prize was awarded to Leroy d'Étiolles. The most prominent of his writings is his *Histoire de la Lithotritie* (1839). D. at Paris Aug. 25, 1860.

Leroy de St.-Arnaud (JACQUES ACHILLE), b. at Paris Aug. 20, 1801; enlisted in 1816 in the body-guard of Louis XVIII., but left in 1820 the military service, and led for several years a rather adventurous life in France and England. In 1831 he again entered the army; served at Blaye, where the duchess of Berry was detained; became in 1837 captain in the foreign legion in Algeria, and distinguished himself very much during the following years at the taking of Constantine, by the capture of Bou-Maza, as commander of the province of Constantine, and by his campaign against the Kabyles. In 1851 he was made a general and commander of one of the military divisions of Paris. In the same year he became minister of war, and in this position he rendered great services to Napoleon Dec. 2, 1852, for which he was rewarded with the title of marshal. In 1854 he commanded the French army in the Crimean war, and won the battle of Alma, but in September he had to give up his command on account of sickness, and d. on board the Berthollet, Sept. 29, 1854.

Lery', de (JEAN), b. at Lery, France, in 1534; was in 1555 a Calvinistic minister at Geneva, when he was engaged by Villegagnon to accompany his expedition to Brazil and introduce the Reformed religion in that country (1556). He preached for some time to the colonists on the small island in the bay of Rio de Janeiro now called Villegagnon, and was thus the first Protestant preacher in the New World. After the unfortunate result of that colony, Lery returned to France; was in 1560 a citizen of Geneva; was afterward preacher at Belleville, Nevers, and Sancerre; lost twenty-two of his congregation by the massacre of St. Bartholomew; retired to Berne, Switzerland, where he seems to have passed the remainder of his life, and d. there in 1611. He wrote an account of his Brazilian adventures, *Histoire d'un Voyage fait en la terre du Brésil* (La Rochelle, 1578; often reprinted), and a *Histoire mémorable de la ville de Sancerre* (1574).

Lesage' (ALAIN RENÉ), b. May 8, 1668, at Sarzeau, in the present department of Morbihan; received his first education by the Jesuits at Vannes; studied philosophy and law in Paris since 1692, and began to practise as an advocate in 1695, but gave up this career in 1698, in order to devote himself exclusively to literary pursuits, in which undertaking he was aided by the Abbé de Lyonne, who gave him a pension of 600 livres a year. His literary career he began by translating dramas and novels from the Spanish, but from mere translations he rose by degrees to the production of independent works of the greatest merit. Of his numerous plays, which mostly consist of farces and comic operas, the most prominent are *Crispin* (1707) and *Turcaret* (1709), which latter comedy is a satire on the financiers of that time, who are said to have offered the author 100,000 francs if he would suppress his work. A still greater success he achieved as a romancer. *Le Diable boiteux* (1707), *Histoire de Guzman d'Alfarache* (1732), and especially *Histoire de Gil Blas de Santillane* (1715), were received with great applause, and the last-mentioned is still a favorite in all civilized countries and with all educated people, on account of its striking psychological observations and refined satire. D. at Boulogne Nov. 17, 1747. His *Œuvres complètes* (12 vols.) were published at Paris in 1828.

Le Sauk, tp. of Stearns co., Minn. Pop. 268.

Lesbo'nax [Λεσβῶναξ], of Mitylene in Lesbos, lived in the time of Augustus; wrote a number of orations in imitation of the Attic orators, of which two have come down to us. They are given in the collections of Reiske and of Dobson, separately by Orelli (Leipsic, 1820).—Another Lesbonax, a grammarian, whose date is unknown, has left a treatise on grammatical figures, published in Valckenaer's edition of Ammonius (Leyden, 1749; reprinted, Leipsic, 1822).

H. DRISLER.

Les'bos, or **Mitylene,** an island of the Grecian Archipelago, 10 miles distant from the coast of Asia Minor, and belonging to Turkey. Area, 600 square miles. Pop. 40,000, of whom 15,000 are Turks. The island is mountainous, but very fertile, producing excellent olive oil, figs, grapes, and pine timber; its wine, famous in olden time, is now inferior. Theophrastus, Alcæus, and Sappho were born here. Chief town, Castro.

Lescarbot' (MARC), seigneur de St. Audebert, b. at Vervins, France, about 1570; became a lawyer; was associated with De Mont in the colonization of Acadia (Nova Scotia) in 1605, and was engaged with Poutrincourt in the settlement of Port Royal (now Annapolis) until its abandonment in 1607, when he returned to France. He published in 1609 a *Histoire de la Nouvelle France*, giving an account of Cartier's voyages to Canada, of Laudonnière's failures in Florida, and of the enterprise with which he was personally connected, the first attempt at settlement having been made on what is now Boon Island on the coast of Maine. He added a collection of poems, written by himself and others in the new colony, under the title *Les Muses de la Nouvelle France*, one of which relates the defeat of the Micmac by the Armouchiquois Indians in Maine in 1607. The description of the country and the accounts of the Indians are spirited, and probably faithful. The volume attracted the attention of Hakluyt, and under his auspices an English translation of the greater part was published the same year, under the title *Nova Francia, or the Description of that part of New France which is one Continent with Virginia* (1609). A second edition, enlarged, of the original work appeared in 1611, and a third in 1618, with the addition of two smaller treatises, *La Conversion des Sauvages* and *Rélation dernière de ce qui c'est passé au voyage du Sieur de Poutrincourt*, the former having been first printed in 1610 and the latter about 1612. An account is given therein of the disputes between Poutrincourt and the Jesuits, in which Lescarbot sided with the former. He also published in 1613 a poetical description of Switzerland, *Le Tableau de la Suisse*, and in 1629 an account of the repulse of the English from the Isle of Rhé. As early as 1599 he had written a *Discours* in favor of the union of the Greek Church with the Catholic. D. about 1630.

Les'ches [Λέσχης], b. near Mitylene, one of the class known as the Cyclic poets, flourished about 700 B. C. His poem, entitled the *Little Iliad* (μικρὰ Ἰλιάς), treated of the events subsequent to Homer's great poem, including the destruction of Troy, from which that part is called also the *Destruction of Troy* (Ἰλίου πέρσις). Pausanias has quotations from Lesches, and an extract is preserved in Proclus.

H. DRISLER.

Les'ghians, a people of the Caucasus, Asiatic Russia, numbering about 300,000, and speaking many languages. Under the influence of Shamyl they united into a single political body, and for many years carried on a brave resistance to Russia. Since 1859 they have been peaceable. Their religion, called Muradism, is a form of Mohammedanism taught by a native prophet, who began his religious career about 1830. They inhabit the mountains of Western Daghestan, where each village is a fortress.

Les'ley (John), b. in Scotland Sept. 29, 1527; graduated at King's College, Aberdeen; studied at several continental universities, and in 1554 was appointed professor of canon law at Aberdeen. He attached himself to the fortunes of Mary queen of Scots, by whom he was made bishop of Ross; became her diplomatic agent; was implicated in the project for her marriage to the duke of Norfolk, and the consequent rebellion in the N. of England (1568); went to France in 1573 in her service and for the promotion of Catholic interests; received ecclesiastical appointments in that country, becoming in 1593 bishop of Coutances in Normandy, and was soon after obliged to take refuge in Brussels, where he d. May 31, 1596. He wrote much in defence of his royal mistress, and published at Rome a history of Scotland, *De Origines Moribus et Rebus Gestis Scotorum* (Rome, 1578), in 10 books, seven in Latin and the last three in the Scottish dialect. This portion was reprinted in 1830 by the Bannatyne Club.

Lesley (J. Peter), b. Sept. 17, 1819, at Philadelphia; graduated at the University of Pennsylvania in 1838, and at Princeton Theological Seminary in 1844; was assistant geologist on the first survey of Pennsylvania in 1839–41, and prepared the maps and illustrations for the final report in 1842; after travelling on foot around France, heard lectures in the University of Halle through the winter of 1844; returned home in 1845, and was authorized by the American Tract Society to establish its colportage system in the northern and middle counties of Pennsylvania; became pastor of the Milton church near Boston in 1847, and left the ministry in 1850 to settle at Philadelphia as a professional geologist; was appointed secretary of the American Iron Association in 1855, secretary and librarian of the American Philosophical Society in 1858, professor of geology and mining engineering in the scientific department of the University of Pennsylvania in 1873, and State geologist of Pennsylvania in 1874; examined the Bessemer iron-works of Europe in 1863; was U. S. Senate commissioner to the Exposition of 1867, and spent the following winter in Egypt; was chosen one of the corporate members of the National Academy in 1864; published a *Manual of Coal and its Topography* (1856), a *Guide to the Iron-works of the U. S.* (1858), and the first series of reports of progress of the geological survey of Pennsylvania in 1875.

Les'lie, post-v. and tp. of Ingham co., Mich., on the Jackson Lansing and Saginaw R. R., 24 miles S. of Lansing. It has 5 churches, a large union high school, a newspaper, 6 magnetic artesian wells of great flow, 3 hotels, 1 private bank, 6 steam-mills, 1 iron-foundry, extensive stave-works, and a number of stores. It is in a rich agricultural district. Pop. 1996. J. W. Allen, Ed. "Leslie Herald."

Leslie (Charles), b. at Raphoe, Donegal co., Ireland, about 1645. His father, Dr. John Leslie, was successively bishop of the Orkneys, of Raphoe, and of Clogher for more than fifty years, and d. in 1671, at the age of 101 years. Charles was educated at Trinity College, Dublin; studied law at the Temple, London, for several years subsequent to 1671; took orders in the Church of England in 1680, and was chancellor of the cathedral of Connor in 1687, but by refusing to take the oath of allegiance to William and Mary cut off all prospect of ecclesiastical preferment. He then devoted himself to religious and political controversy, for both of which he was well fitted by extensive studies in English history and law and in theological literature. For thirty-three years he was the leading literary champion of the Jacobites. His works against Jews, Socinians, Presbyterians, Quakers, and Catholics once enjoyed great fame, but the only work of Leslie which has exercised any influence in the present century is the *Short Method with the Deists* (1694), the argument of which rests principally upon the Christian miracles. Though still esteemed by evangelical theologians, it is regarded as inadequate to the wants of the present day, and is now little read. Leslie was for some years at the court of the Pretender on the Continent, then resided in Italy, returned to England in 1721, and d. Apr. 13, 1722.

Leslie (Charles Robert), b. at Clerkenwell, London, of American parents, in 1794. His father was a watchmaker of Philadelphia. The boy returned with his parents to Philadelphia in 1800, and after leaving school was apprenticed to a bookseller; in 1811 went to England; studied with West and Allston; was elected associate of the Academy in 1821, and member in 1826. His first attempts at painting were on a large scale of historical subjects, but he soon abandoned this style for another, in which he became famous. In 1833 he was appointed professor of drawing at West Point, but held the position for five months only. In 1847 he was chosen professor of painting at the Royal Academy, held the office four years, and delivered lectures which were published by the title of *A Handbook for Young Painters*. In 1845 appeared his *Life of Constable*, the artist. Leslie's productiveness has been very great. His works cover a period of about half a century; they exhibit much variety in subject, but with much sameness of manner. Several of the best of them have been engraved. His *Anne Page and Slender, Sir Roger de Coverley going to Church, May Day in the Reign of Queen Elizabeth*, are familiar. His works found great favor in England, partly from the character of his subjects, which were taken chiefly from English literature, and partly from the artist's sympathy with English scenery and manners. They are full of a sweet humor, elegant in conception, graceful in execution, and finished in style. The best are in the Sheepshanks Collection. Leslie painted a few portraits and some ceremonial pieces, among which are the *Coronation of the Queen* and the *Christening of the Princess Royal*. He d. in London May 5, 1859. O. B. Frothingham.

Leslie (Eliza), b. at Philadelphia, Pa., Nov. 15, 1787, sister of C. R. Leslie; accompanied her parents to England in 1793, returning in 1800; made her first appearance as an authoress in 1827 with her *Seventy-five Receipts for Pastry, Cakes, and Sweetmeats*, the popularity of which led to other successful works of the same class. In 1831 she published the *American Girls' Book*, and having won a prize offered by Mr. Godey of the *Lady's Book* by her story *Mrs. Washington Potts*, she thereafter devoted herself chiefly to writing works for the young, by which she acquired great popularity. Her *Domestic Cookery Book*, published in 1837, went through fifty or sixty editions, while the *House Book* (1840) and *Lady's Receipt Book* (1846) were also widely circulated. Her only novel was entitled *Amelia, or a Young Lady's Vicissitudes* (1848). She contributed to Hart's *Female Prose Writers of America* an interesting autobiographical sketch. D. at Gloucester, N. J., Jan. 2, 1858.

Leslie (George Dunlop), b. in London, England, July 2, 1835, son of C. R. Leslie; was educated at the Mercers' School, received artistic training from his father and at a school of art at Bloomsbury, and was in 1854 admitted as a student of the Royal Academy. He began to exhibit pictures at the Academy in 1857, was elected an associate of that institution in 1868, and has attained considerable popularity as an artist.

Leslie (Henry David), b. in London, England, June 18, 1822; studied music under the direction of Prof. C. Lucas; founded in 1856 a choral society known by his name, and in 1864 was made principal of the College of Music, an institution founded in that year on the system of the continental conservatories. He has published several symphonies, overtures, oratorios, and cantatas, besides various compositions for stringed instruments, and sixty or seventy songs, duets, anthems, and pieces for the piano. In 1864 he composed a romantic opera in three acts.

Leslie (Sir John), b. at Largo, Fifeshire, Scotland, Apr. 16, 1766; was educated at the universities of St. Andrew's and Edinburgh; spent two years (1788–89) in Virginia as tutor in one of the Randolph families; settled in London in 1790, and applied himself to science. He translated Buffon's *Natural History of Birds* (9 vols., 1793), travelled on the Continent as tutor, and was an unsuccessful candidate for professorships at St. Andrew's and Glasgow. In 1805 he was elected by the town-council of Edinburgh professor of mathematics in the university of that city, after a vigorous opposition by the clergy on the score of dangerously liberal opinions both in politics and religion. In 1819 he succeeded Prof. Playfair in the chair of natural philosophy, which he held through life. He was knighted a few months before his death, which occurred Nov. 3, 1832. He early took high rank as a scientific investigator and discoverer. His *Experimental Inquiry into the Nature and Propagation of Heat* (1804) gained the Rumford medal of the Royal Society. From 1809 to 1822 he published a series of textbooks in geometry and the higher mathematics, and from 1822 to his death a similar series on natural philosophy. In 1810 he discovered the process of artificial congelation. He was the author of a large number of scientific articles in the *Encyclopædia Britannica*.

Les'seps, de (Ferdinand), Viscount, b. at Versailles Nov. 19, 1805; entered public life in 1828 as an attaché at Lisbon; held various consular offices; proposed in 1854 to Mehemet Saïd, viceroy of Egypt, the cutting of a canal across the Isthmus of Suez, and published in that year a report, *Percement de l'Isthme de Suez exposé*. A firman

sanctioning the enterprise was granted in 1854, and the work was executed 1859–69. (For a sketch of the history of the Suez Canal and the many difficulties, financial, diplomatic, and natural, which were overcome largely by the energies of M. de Lesseps, see SUEZ CANAL.) M. de Lesseps since the completion of his great work has been the recipient of many honors and rewards, and has directed his attention to other vast projects, such as a central Asian railway and the conversion of the Desert of Sahara into an inland sea.

Les'sing (GOTTHOLD EPHRAIM), b. at Camenz, Saxony, 1729; studied at Leipsic, or rather tried to study, first theology and then medicine, but his innate passion for the theatre, drama, and literature in general was too powerful; moved to Berlin, where, in intimate connection with Moses Mendelssohn and Nicolai, he led for several years an exclusively literary life, the most remarkable fruit of which were his *Letters on Literature*. In 1760 went to Breslau as government secretary to Gen. von Tauenzien, and while residing there, in the midst of the Seven Years' war, wrote *Minna von Barnhelm*, the first national drama of Germany and the inauguration of a great and brilliant literature. It made a great sensation, and the impression was both widened and deepened by his tragedy, *Emilie Galotti*, which soon followed. In 1769 he went to Hamburg as director of the theatre, and there wrote his *Hamburgische Dramaturgie*, a series of theatrical reviews, which, together with his *Laokoon*, a series of general critical analyses, not only exercised a great influence on German literature, but raised a new issue in modern civilization; from Hamburg went to Wolfenbüttel as librarian at the ducal library, and while in this position published the famous *Wolfenbüttelsche Fragmente*, the first and perhaps the strongest attack on the historical basis of Christianity. The *Fragmente* were written by Reimarus; Lessing was only their editor and champion, but he defended them against the orthodox Church with such superiority of intelligence and brilliancy of argument that the ducal government became alarmed and bade him stop. Although a very independent character, he submitted, and later on set forth his religious views in another form, in his great philosophical drama, *Nathan der Weise*, one of his last and most perfect works. His philosophical essay on the development of civilization, *Die Erziehung des Menschengeschlechts*, followed next year. He d. at Wolfenbüttel in 1781. Lessing's mind is very strikingly characterized by the well-known saying of his, that if God held truth in the right hand and doubt in the left, and offered him the choice, he would choose the left hand. Truth in the form of dogma, maxim, or rule he did not acknowledge. He understood truth only in the form of something to be searched after, to be striven for. To him, religion was not obedience, but insight; morality, not duty, but wisdom; poesy, not inspiration, but taste. Although Voltaire's antagonist, he is Voltaire's disciple. But in his searchings after truth and in his exertions towards perfection few have ever surpassed him in acuteness and penetrating power, and none in resoluteness and veracity. What was a needle between Voltaire's fingers became a sword in Lessing's hand. What Voltaire had used only as a brilliant means of repartee, Lessing laid down and carried through as a powerful principle. He was a greater critic than Voltaire, and he is the founder of modern art-criticism, of that kind of authorship which at present attracts the attention of the greatest and most accomplished minds in all nations by its analyses and demonstrations of the relation between art on the one side and nature, history, morality, and religion on the other. All that had been written about art before Lessing—by Aristotle and Horace, by Boileau and Voltaire—became insignificant when *Laokoon* and the *Hamburgische Dramaturgie* were published. It consisted merely of rules, and was founded on the idea that art could be defined by rules. Lessing understood that art is as free in its creations as nature, and, like her, bound by laws, not by rules; and to find out and establish these laws, every one of which opens up new perspectives into the philosophy of matter and mind, is the task of criticism. This idea is truly the discovery of a new world, and every point on which Lessing lighted is explored and described with wonderful completeness and accuracy. A positive system of philosophy and religion Lessing probably did not possess. Yet his criticism on these two fields was not merely destructive. He never took from people their prejudices without giving them a hint or suggestion of how the empty place was to be filled; and his ideas in philosophy of the infinite perfectibility of mankind, and in religion of the true relation between the Bible and the tradition, have not been without influence. CLEMENS PETERSEN.

Lessing (KARL FRIEDRICH), b. at Wartenberg, Silesia, Feb. 15, 1808; received his first artistic instruction at the school of architecture at Berlin; studied then for several years at Düsseldorf under Schadow, and was appointed director of the gallery of paintings at Carlsruhe in 1858. His paintings are partly landscapes, partly historical, and among the latter his *Hussites* (1830), *Huss before the Council* (1842), *The Martyrdom of Huss* (1850), and others, excited great admiration by the strength and richness of their characterization. A pupil himself of the school of Düsseldorf, and laboring in many points under its influence, he has contributed much to elevate and ennoble it.

Les'ter, post-tp. of Black Hawk co., Ia. Pop. 844.

Lester (CHARLES EDWARDS), b. at Griswold, Conn., July 15, 1815, a descendant of Jonathan Edwards; resided for a time in the South and West; came to the bar in Mississippi, and was afterwards ordained to the Presbyterian ministry; was U. S. consul at Genoa, Italy, 1842–47, and has attained distinction as a journalist and political lecturer. Among other works he has published *The Glory and Shame of England* (1841), *Condition and Fate of England* (1842), *Life of Vespucius* (1846), *The Napoleon Dynasty* (1852), *Life of Charles Sumner* (1874), *Our First Hundred Years* (1874–75), and several translations of standard Italian authors.

Lestocq' (JEAN HERMAN), b. at Celle, Hanover, Apr. 29, 1692. His father, a French emigrant, was a surgeon, and the son chose the same profession; in 1713 went to St. Petersburg, and was appointed surgeon in the service of Peter the Great, but was banished to Kazan in 1718 on account of his dissolute habits. In 1725, Catharine I. recalled and appointed him surgeon in the service of the princess Elizabeth. He soon acquired complete control over the mind of the princess, and it was by his instigation and by his aid that she undertook the revolution of Nov. 25, 1741, which made her empress of Russia. The king of Poland now made Lestocq a count, the empress gave him a pension of 7000 rubles annually, and for several years his influence in Russian politics was very great. But in 1748 the vice-chancellor, Bestoozhef, succeeded in rousing the empress's suspicion against him. He was arrested, put to the torture, and banished to Ooglitch. In 1761, Peter III. recalled him to the court, and Catharine II. gave him an estate in Livonia, where he d. June 12, 1767.

Lestosau'rus [Gr. λῃστής, "pirate," and σαῦρος, "lizard"], a genus of extinct reptiles from the Cretaceous of Kansas. (See MOSASAURUS, by PROF. O. C. MARSH.)

L'Estrange' (Sir ROGER), b. at Hunstanton Hall, Norfolkshire, England, in 1616; was probably educated at Cambridge; accompanied King Charles I. in 1639 in his expedition against the Scots, and being a zealous royalist during the civil war was captured in an attack on Lynn (1644), and condemned to death by the Roundheads. He was, however, reprieved, and kept captive several years, until in 1648 he escaped and unsuccessfully tried to stir up a rebellion in Kent; after which he fled to the Continent. He returned to England on the dissolution of the Long Parliament in 1653, and made terms with Cromwell. At the Restoration he was appointed censor or "licenser" of the press; established the *Public Intelligencer* newspaper in 1665 and the *Observator* in 1679, in both of which sheets and in a multitude of pamphlets he showed himself a most energetic supporter of the Crown. He made translations of Josephus, Cicero's *Offices*, Æsop's *Fables*, Erasmus's *Colloquies*, Quevedo's *Visions*, and other works, ancient and modern, some of which possessed considerable merit, though unfaithful and disfigured by flippant phrases. He was knighted on the accession of James II., elected to the Parliament of 1685, and dismissed from his office of censor at the revolution of 1688, soon after which he became insane. D. in London Dec. 11, 1704.

Lestrid'inæ [from *Lestris*, the generic name, literally "robber," and the sub-family affix *-inæ*], a sub-family of the family Laridæ, distinguished by a well-developed beak, the upper mandible of which is strongly hooked, overhanging the lower, and which has at its base a well-developed cere. In this group are embraced the jägers or gull-hunters, and these names, as well as their scientific designations, are derived from an alleged peculiarity in their habits, it being affirmed that they chiefly obtain their food by pursuing the smaller gulls after they have secured food, and compelling them to disgorge; the food thus dejected they pounce upon, and, as the bald-headed eagle does to the fish-hawk, appropriate it to themselves. The species are mostly inhabitants of the polar regions, G. R. Gray recognizing four species from the northern seas and one from the Antarctic; but, according to the same authority, two species (not even represented in the British Museum) are found in intermediate regions, one (*Stercorarius Hordyi*) being attributed to "Malay, Philippines, Sandwich Islands," and another (*S. spinicauda*) to "Atlantic Ocean, St. Helena." Dr. Coues admits four North American species, which he

places in two sub-genera, *Buphagus*, with one species, and *Stercorarius*, with three. THEODORE GILL.

Le Sueur, county of S. Central Minnesota, bounded W. by the Minnesota River. Area, 440 square miles. It is fertile, level, and well wooded. Grain and lumber are leading products. The county contains a great number of small lakes, and is traversed by the St. Paul and Sioux City R. R. Cap. Le Sueur. Pop. 11,607.

Le Sueur, post-v. and tp., cap. of Le Sueur co., Minn., on the Minnesota River and on the St. Paul and Sioux City R. R., 65 miles from St. Paul. It has 6 churches, an elegant public school, several wagon and furniture manufactories, and a number of stores. Pop. 1009.
M. R. PRENDERGAST, LATE ED. "LE SUEUR COURIER."

Lesueur' (EUSTACHE), b. at Paris in 1617; received his first artistic instruction from his father, who was a sculptor; studied under Simon Vouet, together with Lebrun, his future rival, and soon became one of the most esteemed painters of that time in France, but d. at Paris in 1655. His pictures represent subjects of the Bible, *St. Paul at Ephesus;* of the Christian legends, *Scenes in the Life of St. Bruno;* and of the Greek mythology, *Scenes in the Life of Cupid;* and the circumstance that he had never been in Italy, nor made a thorough study of the history of the art of painting, gave his genius a freshness, naïveté, and originality which still charm in his pictures, while it is just these qualities which are missing in Lebrun, who followed Poussin to Italy, and succeeded in throwing Lesueur into the shade.

Lesueur (JEAN FRANÇOIS), b. Jan. 15, 1763, at Drucat-Plessiel, near Abbeville, France; was appointed director of music at the cathedral of Seez in 1779, and in 1786 at the church of Notre Dame in Paris. The innovations which his compositions introduced into the style of sacred music attracted the public, but were not approved of by connoisseurs and the clergy, and in 1788 he gave up his position, and lived for some years in retirement in the country. In 1793 his opera *La Caverne* made a great success, and in 1795 he was appointed professor at the newly formed conservatory of music in Paris. This position he lost in 1802 on account of dissensions with his colleagues, but in 1804, Napoleon made him director of the imperial orchestra. The mass and *Te Deum* which he composed for the coronation of the emperor were received with great applause, and his opera, *Les Bardes*, even excited enthusiasm. *La Mort d'Adam*, on the contrary, was more coolly received in 1809, and his later masses and oratorios failed to make much impression. In 1817 he was appointed professor in composition at the reorganized conservatory of music, and among his pupils were Berlioz, Ambroise Thomas, Gounod, and Dietsch. D. in Paris Oct. 6, 1837.

Letart', tp. of Meigs co., O., on Ohio River. Pop. 1319.

Letch'er, county of Kentucky, bounded S. E. by Virginia. It is a mountain region, having beds of bituminous coal. Corn is the principal crop. Area, 300 square miles. Cap. Whitesburg. Pop. 4608.

Letcher (JOHN), b. at Lexington, Va., Mar. 29, 1813; educated partly at Washington College, but graduated at Randolph-Macon College, Va.; studied law and was admitted to the bar in 1839, and while practising edited a newspaper in his native town; in 1850 was a member of the State constitutional convention, and a member of Congress from 1853 to 1859, when he was elected governor of Virginia. This position he was holding when the State passed her ordinance of secession in 1861. Though he had not favored the policy of secession, yet as an individual and as chief magistrate he sustained the action of the State with zeal, energy, and ability. After the war he took no prominent part in politics, but resumed the practice of law at Lexington. A. H. STEPHENS.

Letcher (ROBERT P.), b. in Gerard co., Ky.; was a lawyer by profession; a member of the State legislature for a number of years, and once Speaker of the house; was a member of Congress from 1823 to 1833; was an intimate personal and political friend of Mr. Clay and Mr. Crittenden; was elected governor of the State in 1840, and was minister to Mexico in 1849. D. at Frankfort, Ky., Jan. 24, 1861. A. H. STEPHENS.

Le'the, in Grecian mythology, was a river in the lower world of which the departed souls drank before entering the Elysian Fields, thereby entirely forgetting all about their life on earth. It was also used as a personification of oblivion.

Leto. See LATONA.

Letohatch'ee, post-tp., Lowndes co., Ala. Pop. 2538.

Letronne' (JEAN ANTOINE), b. at Paris Jan. 25, 1787; studied the art of painting under David, but felt himself more strongly drawn towards science; worked for several years under Mentelle, professor in geography; travelled from 1810 to 1812 through France, Italy, and Switzerland; wrote in 1814 his *Cours élémentaire de Géographie, ancienne et moderne*, which was often republished; became in 1831 professor in history and archæology at the Collége de France, and in 1840 keeper of the archives of the kingdom. D. at Paris Dec. 13, 1848. His principal works are *Recherches pour servir à l'Histoire de l'Egypte* (1823), *Recueil des Inscriptions grecques et latines de l'Egypte* (1842–48), and *Diplomes et Chartres de l'époque Mérovingienne sur papyrus et sur vélin* (1844). Noteworthy among his minor works is his *La Statue vocale de Memnon* (1833).

Letter of Attorney. See POWER OF ATTORNEY.

Letter of Credit, a letter written by one merchant or correspondent to another requesting him to credit the bearer or the person therein named with a sum of money. Letters of credit are either general or special. They are general when addressed to any and every person to whom they may be presented, and therefore give any person to whom they may be shown authority to make advances upon the credit of the drawer. They are special when addressed to a particular individual by name, who alone is authorized to act upon the request. If advances be made upon a letter of credit by the person to whom it is presented, he has a right of action against the drawer for reimbursement. A privity of contract springs up between them upon acceptance of the request by the drawee. (See GUARANTY. Burge on *Suretyship;* Bell's *Commentaries Laws of Scotland;* Story on *Bills*.)
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lette're, town of S. Italy, in the province of Naples, not far from Castellammare. Pop. in 1874, 5640.

Letterken'y, tp. of Franklin co., Pa. Pop. 2178.

Letters. See PALÆOGRAPHY.

Letters, Law Concerning. See LITERARY PROPERTY, by PROF. T. W. DWIGHT, LL.D.

Letters of Administration. See LETTERS TESTAMENTARY, ADMINISTRATION.

Letters of Marque. See PRIVATEER, WAR, MARQUE (LETTERS OF).

Letters Patent. See PATENT.

Let'ters Ro'gatory, a writ or instrument sent in the name and by the authority of a judge or court to another in a different country or State, requesting that the deposition of a witness be taken who is within the jurisdiction of the foreign tribunal, to be used as testimony in a cause pending before the judge or court from which the letters are sent. This instrument informs the court abroad of the pendency of the action, the names of the foreign witnesses, and is frequently accompanied by written interrogatories, prepared by the litigating parties, upon which the witness is to be examined. It also contains an offer on the part of the court issuing the letters to perform a similar service for the foreign tribunal whenever required. The witness is examined either before the judge receiving the letters, or before a commissioner appointed for the purpose, and the answers, signed and sworn to by the deponent, and duly authenticated, are then returned to the court from which the letters issued. (See DEPOSITION, WITNESS.)
GEORGE CHASE. REVISED BY T. W. DWIGHT.

Let'ters Testament'ary, an instrument in writing granted by a surrogate or other judicial officer having jurisdiction of the probate of wills to an executor as evidence of his authority, and empowering him to administer the estate of the deceased. When a person dies intestate, letters of a similar character are granted to the person who is appointed administrator, but they are then termed "letters of administration." By the English common law executors could perform most of the acts pertaining to their office, except engaging in suits in relation to the estate, before obtaining letters testamentary, since an executor's authority and title is deemed in law to be derived from the will, and only to be evidenced by the letters granted. This rule has generally been changed in American practice by statute, and it is usually required that letters testamentary must be obtained before an executor will be authorized to perform any of his usual duties in the settlement of the estate except those of minor importance. An administrator has no authority to act until letters of administration are granted to him, though after the grant is made his title and authority will, by fiction of law, relate back to the death of the intestate. (See FICTION.) Letters granted by the surrogate are only valid within the limits of the State in which they are issued. If there are assets of the deceased within a foreign State or country, letters must be issued there to subordinate or ancillary administrators, and the principal executor or administrator, as such, will have no authority to administer such assets, unless they are re-

mitted to him from the foreign jurisdiction. (See WILL, ADMINISTRATOR, EXECUTOR, PROBATE, SURROGATE.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Let'ter-wood, or **Snake-wood,** a rare and costly ornamental wood used for inlaying and veneering, the product of *Brosimum Aubletii*, an artocarpaceous tree of South America. It is so hard that axes of extraordinary temper are required to fell the tree. Its rich brown wood has somewhat letter-shaped marks, which are nearly black. It is one of the most beautiful kinds of wood.

Let'tic Race, The, forms a subdivision of the Slavic group, belonging to the Indo-European family, and is itself divided into three branches—the Lithuanians, the Letts, and the Old Prussians. The Old Prussians inhabited the region between the Niemen and the Vistula, but were completely Germanized in the seventeenth century. The few remains of their language were collected by Nesselmann, and published at Berlin (1846). The Letts, numbering about 1,000,000, inhabit Courland, Western Livonia, and the adjacent districts of the governments of Vitebsk, Kovno, and Pskov. Their language was not reduced to writing until the sixteenth century, on the introduction of the Reformation; the first book printed in Lettish was the minor catechism by Luther, which appeared in 1586. Since that time the language has been cultivated with steadily increasing care. Religious books, and even books of fiction, were translated; lyrical poetry, and even plays, were produced by native authors; and at present Lettish newspapers and periodicals are issued. The Lithuanians comprise the Lithuanians proper, numbering about 750,000, and inhabiting the eastern part of Courland and the governments of Vilna and Grodno; the Samogitians or Shamaites, numbering about 500,000, and occupying the government of Kovno; and the Lithuanians in Prussia, numbering about 150,000. The Lithuanian language is spoken in several dialects. Like the Lettish, it was not reduced to writing until the time of the introduction of the Reformation, but it is much older than the Lettish, and exists in a much more primitive state, for which reason it is of peculiar interest to the student of the Indo-Germanic languages. It is rich in songs, of which a small collection was published by Rhesa at Königsberg in 1825; and in tales, proverbs, and riddles, of which a collection was published at Weimar in 1857 by Schleicher. A Lithuanian dictionary was published in 1854 by Nesselmann, and a grammar by Schleicher (Prague, 1856); Bielenstein gave a Lettish grammar in 2 vols. (Berlin, 1863–66).

Lettres de Cachet. See CACHET, LETTRES DE.

Lett's, post-v. of Grandview tp., Louisa co., Ia., on the South-western division of the Chicago Rock Island and Pacific R. R. (Onowa Station). Pop. 88.

Let'tuce [Lat. *lactuca*], an important salad-plant, the *Lactuca sativa*, a composite herb, the native country of which is not known. There are many varieties, some of which form heads of leaves and others do not. It is easy of digestion, rather laxative, and gently soporific. From its juice the narcotic LACTUCARIUM (which see) is prepared. There are several Asiatic, European, and American species of wild lettuce (*Lactuca*), most of which have an acrid-narcotic quality.

Leucadia. See SANTA MAURA.

Leucan'iline [Gr. λευκός, "white," and Sans. *nil*, "indigo"], $C_{20}H_{21}N_3$, a base produced by the action of reducing agents on rosaniline, and related to it in the same manner as indigo-white to indigo blue:

$$\underset{\text{Rosaniline.}}{C_{20}H_{19}N_3} + H_2 = \underset{\text{Leucaniline.}}{C_{20}H_{21}N_3}.$$

(See Watts's *Dict.*, iii. 574.)

Leuch'tenberg, in the Middle Ages an independent principality of Germany, received its name from the castle of Leuchtenberg, and was ruled by a landgrave. In 1646 the male line of the dynasty became extinct, and the landgraviate fell to Bavaria. In 1817 the Bavarian king, Maximilian Joseph, ceded it for 5,000,000 francs to his son-in-law, Eugène Beauharnais, who assumed the title of duke of Leuchtenberg. Area, about 80 square miles. Pop. about 6500. Cap. Pfreimt.

Leu'cine [Gr. λευκός, "white"], a curious crystalline substance which is among the products of incipient putrefaction of the albuminoid or proteid bodies. Proust was the discoverer of it in cheese, and Braconnot obtained it by treating animal substances with sulphuric acid. It occurs diffused widely throughout living animal tissues. Its composition is $C_6H_{13}NO_2$. Another name now given to it, conveying a theory of its constitution, is *amidocaproic acid*, represented thus: $C_6H_{11}(NH_2)O_2$; as derived from caproic acid, $C_6H_{12}O_2$, by replacement of H_2 by NH_2, amidogen. It was called by its earlier investigators *oxide of caseine* or *caseous oxide*. Another crystalline substance, called *tyrosine*, which is $C_9H_{11}NO_3$, always accompanies leucine, both in nature and as formed artificially. Leucine is prepared by dissolving washed lean meat in oil of vitriol, removing the latter by chalk, evaporating, dissolving in alcohol, decolorizing with animal charcoal, and crystallizing. There are several other methods, however. Leucine may be sublimed like camphor. It dissolves in warm, not in cold, water.

The study of these immediate products of metamorphoses of the nitrogenous substances that form animal tissues is of the utmost importance in connection with physiology and the learning of the chemical laws of life and death, of health and disease. In this view, leucine and tyrosine, and their associates and congeners, are bodies of high importance, which call for the serious attention and investigation of the chemical student. H. WURTZ.

Leucip'pus, the teacher of Democritus and the founder of the atomic school in the Greek philosophy, lived probably about 500 B. C., but of his personal life nothing is known. His writings have all perished, and from the notices which Aristotle, Plutarch, and Cicero give it is impossible to see now how far he had developed the atomic theory.

Leu'cite [Gr. λευκός, "white"], a natural silicate of alumina and potash, crystallizing in the monometric system, and of a gray or white color (hence it is sometimes called "white garnet"). It occurs abundantly in the volcanic rocks of the Rhine and of Italy.

Leuck'art (KARL GEORG FRIEDRICH RUDOLF), b. at Helmstedt, in Brunswick, Oct. 7, 1823; studied medicine and natural science at Göttingen under Wagner, and was appointed professor of zoology and comparative anatomy at the University of Giessen in 1850. His *Beiträgen zur Kenntniss wirbelloser Thiere* (1848) and *Ueber den Polymorphismus der Individuen* (1851) attracted much attention, but it was more especially his helminthological researches, *Die Blasenbandwürmer* (1856) and *Trichina spiralis* (1861), which made his name celebrated. He also wrote *Die Parasiten des Menschen* (2 vols., 1861–66).

Leucocythæ'mia [Gr. λευκός, "white," κύτος, "cell," and αἷμα, "blood"], or **Leuchæmia,** a disease of the human subject, characterized by a very great excess of the white cells in the blood, and by a corresponding diminution of the proportion of red corpuscles. It is accompanied by enlargement of the spleen or of some of the lymphatic glands, or of both, and cases are reported accompanied by disease of the medullary mass in the bones, which mass takes on, or perhaps normally possesses, the lymphatic function. In some cases the white blood-cells are not to be distinguished from the normal ones; in others they are smaller and accompanied by free nuclei and granules. The liver is frequently enlarged. A hæmorrhagic diathesis is often developed. The patient wastes away and becomes anæmic. Of the causation and cure of this disease nothing is known. It is always fatal; but often chronic.

Leu'coline [Gr. λευκός, "white"], C_9H_7N, a volatile oily base, isomeric with chinoline, obtained from the oil of coal-tar. (See *Chem. Soc. Jour.*, xvi. 377.)

Leucorrhœ'a [Gr. λευκός, "white," and ῥεῖν, to "flow"], the "whites," a catarrhal flow from the vaginal or uterine mucous membranes. This disease is an exaggeration of the normal mucous secretion, and is often consequent upon a somewhat inflammatory condition of the mucous membranes. Rest, the use of iron and other tonics, and astringent washes are often highly beneficial. Sometimes the catamenia assume a leucorrhœal character, especially towards the close. The cervix uteri is often involved in a sub-acute or chronic inflammation, which not unfrequently is best treated by local caustic or other applications.

Leucothea. See INO.

Leuc'tra, village of Bœotia, Greece, became famous as the place where the Thebans under Epaminondas defeated the Spartans under Cleombrotus in 371 B. C., thereby checking for ever the influence which Sparta had exercised over Greece for several centuries.

Leuk, village of Switzerland, in the canton of Valais, on the Rhone. It is situated at an elevation of 5000 feet above the level of the sea, and is famous for its hot springs, saline, sulphurous, and chalybeate, which are used for both bathing and drinking, chiefly in diseases of the skin.

Leuret' (FRANÇOIS), b. at Nancy Dec. 3, 1797; studied medicine, and took his degree in 1826. Having applied himself with special interest to the study of mental diseases, and developed original ideas of the treatment of the insane, he was appointed physician of the insane section of the Bicêtre, then director of a lunatic asylum in Paris, and at last director of the Bicêtre. His most prominent writings are *Fragments psychologiques sur la Folie*

(1834), *Traitement moral de la Folie* (1840), and *Des Indications à suivre dans le Traitement moral de la Folie* (1846). D. at Nancy Jan. 6, 1851.

Leu'then, village of Prussia, in the province of Silesia, 9 miles W. of Breslau. Here Frederick the Great completely defeated the Austrians under Prince Charles of Lorraine on Dec. 8, 1757.

Leut'schau, town of Hungary, in the county of Zips, has 5729 inhabitants, mostly engaged in the cultivation of wine, fruit, saffron, and hops.

Leut'ze (Emmanuel), b. at Emingen, Würtemberg, May 24, 1816, son of a mechanic, who on account of his political opinions left Germany for the U. S., and made his home in Philadelphia. His early passion for art showed itself in rude portraits. A picture representing an *Indian Gazing on the Setting Sun* indicated so much talent that his commissions soon enabled him to travel abroad. In 1841 he arrived in Amsterdam, and from there went to Düsseldorf, and became a pupil of Lessing. His first picture, *Columbus before the Council of Salamanca*, was purchased by the Art Union of Düsseldorf. At Munich, Leutze became an admirer of Kaulbach. Thence he went to Italy, visiting the chief cities and studying the great masters, but he was a German by birth and temperament, and he came back to Germany as to his home, married there, and there lived till 1859; then returned to America, and between Philadelphia and Washington passed the rest of his life. D. in Washington, D. C., July, 1868. Leutze painted numerous portraits, and of eminent persons, of Gen. Grant among the rest. But his chosen field of art was the romance of history, which he illustrated with such vigor and truth as were in him. In Washington and Philadelphia his work meets the eye of the visitor in public and private places. In the Capitol his *Western Emigration* is conspicuous. His *Washington Crossing the Delaware* is familiar through engravings. Other pieces, well known and more or less celebrated, are *The Landing of the Norsemen, Cromwell and his Daughter, The Iconoclast, John Knox admonishing Mary Stuart, Columbus before Ferdinand and Isabella, Venetian Masquers, Godiva*. Leutze was a rapid painter, with immense fire and dash. His works are popular with the lovers of action, but distasteful to the lover of delicacy in drawing and color. He was the American exemplar of the modern German school of Kaulbach and Cornelius, with a tumult of passion all his own.

O. B. Frothingham.

Leuze, town of Belgium, in the province of Hainaut, on the Dender, has breweries, distilleries, salt-refineries, oil-mills, dyeing establishments, bleaching-grounds, and manufactures of hosiery and lace. Pop. 6069.

Levaillant' (François), b. in 1753 at Paramaribo, in Dutch Guiana, of French parents; removed to Europe in 1763; was educated at different places in Germany, and in 1777 studied natural science at Paris; in 1780 proceeded to the Cape of Good Hope, whence he made two journeys to the interior of Africa, which he described on his return to Paris in 1785 in his *Voyage dans l'Interieur de l'Afrique* (1790) and *Second Voyage* (1795). These books were read with great interest and ran through several editions, though they were much criticised by scientific authorities. Of unquestionable value were his collections, sold partly in France, partly in Holland, and his ornithological works, *Histoire naturelle des Oiseaux d'Afrique* (6 vols., 1798–1812), *Histoire naturelle des Perroquets* (2 vols., 1801–05). D. at Sezanne in Champagne Nov. 22, 1824.

Le'van, tp. of Jackson co., Ill. Pop. 1321.

Levan, tp. of Pope co., Minn. Pop. 150.

Levan'na, post-v. of Union tp., Brown co., O., on the Ohio River, opposite Dover, Ky. Pop. 104.

Levant', post-tp. of Penobscot co., Me., 8 miles W. by N. of Bangor. It has manufactures of lumber. Pop. 1159.

Levant, The, a name of Italian origin, *Il levante*. It denotes the countries bordering on the eastern part of the Mediterranean—Asia Minor, Syria, and Egypt. Like Orient, it signifies "rising, east," and was brought into use in the early Middle Ages, when the Italian republics controlled the commerce of Europe.

Lev'ee. The word *levée* is French, and signifies, among other meanings, "raising," "embankment," "embanking," "bank," "causeway," "mole." Levees, embankments, dikes, dams, were used by the ancients during the earliest historical periods. Probably the first to use them were the Egyptians in the Nile valley. The Assyrians and Babylonians also leveed and reclaimed portions of the valley of the Euphrates and Tigris. The Chinese leveed their great rivers, the Yang-tze-Kiang, or Blue River, and the Hoang-Ho, or Yellow River. Egypt being a rainless country, or nearly so, except near the sea-coast, the alluvial valley-lands of the Nile could not be cultivated without irrigation. During the flood season of the Nile—the greatest height being reached about the time of the autumnal equinox—water is drawn off through sluices in the levees, and conveyed through canals to where it is needed; it is there retained within leveed areas or basins as long as required. Variations of a few feet in the annual rise of the Nile are therefore of the utmost importance to the Egyptians, for low inundations cause dearths or famines, and excessive inundations destruction of property, disease, and loss of life. The Nile system is one of leveeing and irrigation, but the irrigation includes the inundation of the valley-lands throughout, leaving dry only the mounds on which the cities, towns, and villages are built, or the leveed areas from which the water is excluded. Near Cairo the river levees are from 12 to 15 feet in height, and but very little higher than the river flood-line. The annual overflow of the Nile lands through sluices—or graduated outlets—for many centuries has caused the gradual elevation of these lands—about four to four and a half inches in a century—and also the elevation of the river flood-line. Below Cairo, at the head of the Delta proper, there has been constructed since 1846 a masonry dam, or "barrage," provided with numerous sluice-gates, across the branches of the Nile, for the purpose of facilitating irrigation during low water in the river. Navigation is provided for by means of a lock at the end of the "barrage." It is said that 200,000 laborers were employed to strengthen and maintain the Nile levees during the excessive flood of 1874.

Queen Semiramis, says Wheeler, "prevented the overflow of the Euphrates valley by the erection of stupendous mounds or dams along the banks of the Euphrates; and henceforth the land was irrigated by hand and by engines." In China, says M. Huc, "the maintenance of the dikes on Yellow River is entrusted to a special board, which forms in the provinces of Chee, Shan-Toong, and Honan a body independent of the provincial government." In Hindostan levees or embankments, or "bunds," are used to construct reservoirs for the purpose of irrigating the sterile hills and plains, which were only barren for want of irrigation during the protracted seasons of drought. In the Madras provinces alone, Capt. Smith informs us, there exist no less than 43,000 reservoir-tanks in repair, and 10,000 out of repair—all of native origin. He estimates the length of the levees or embankments which form these reservoirs at 30,000 miles, sufficient "to put a girdle round the globe."

In Italy the levee system has been in use for many centuries—for reclamation as well as to facilitate irrigation—and the old Italian engineers announced some truths which, though manifest and plain, are not even yet fully recognized among modern engineers, or those of to-day. They learned that the lower or alluvial portions of turbid or sedimentary rivers can be leveed safely, without elevation of their beds or surface as the result of the increased quantity of water confined within the channel by levees; that "derivations," or outlets, will not permanently lower the flood-line in such portions of a sedimentary river; and that a division of the waters of such a river into more than one channel results in the elevation of the beds and high-water lines of the divided channels. Frisi says: "It is a hydrostatical paradox, commonly taught by Italian engineers in the past century, and uniformly confirmed by experience, that you do not diminish the height of the waters in great floods by lessening the quantity of the water." Guglielmini taught that "the greater the quantity of water that a river carries the less will be its fall" or surface slope, and also that "the greater the force of the stream the less will be the slope of its bed." It has been the prevalent belief that levees have caused the rising of the bed and surface of the river Po until the flood-line of that river is above the roofs of the houses in Ferrara. But it is now well known that neither the flood-line nor the bed of the Po has been elevated at all during the past 100 years and more, and that for "the roofs" the "first floor" of the houses should be substituted in speaking of the comparative height of the river at high water. The exaggerations are due to M. Cuvier, and were alleged to be based upon statements made by De Prony, but the engineer Lombardini has proven their falsity.

The levees of Holland, whereby immense areas of land, submerged from five to fifteen feet below mean tide in the North Sea, have been reclaimed, drained, and cultivated, are the most wonderful of any in the world. The levees and hydraulic works of Holland are said to have cost fully $1,500,000,000. The whole country is an intricate network of rivers, water-channels, and canals bordered by levees, and the unconquerable perseverance and industry of the Dutch people have converted a desolate marsh and lakes into the richest farms and gardens in Europe. By means of steam machinery and windmills these lands are kept dry. To prevent their being overwhelmed again, the levees are placed under a careful system of surveillance.

Levees for the protection of river lowlands, as well as to facilitate the reclamation of marshes, morasses, fens, and overflowed land, have been extensively constructed in other portions of the German states, and in France, England, Ireland, and elsewhere. Since 1871 the levee system has been applied on a large scale in California to the reclamation of the tule-lands in the valley of the Sacramento and San Joaquin rivers. The aggregate length of these levees at this time probably exceeds 1000 miles.

Levees as Applied to the Mississippi River.—The leveeing of the Mississippi River was commenced at New Orleans in about the year 1720, the engineer Dumont de la Tour having, after locating the future city in 1717, ordered a front levee of 5400 feet in length by 4 feet in height and 18 feet wide at top, as necessary to protect the city. In 1717, De la Tour's observations showed that the river flood-line was three feet higher than the river-bank in the bend where he located the proposed city, and he allowed for a levee one foot above the then high-water line. We are informed by the historian F. Xavier Martin that in 1718 there was an "extraordinary rise of the Mississippi" which greatly discouraged the new settlers. "Bienville," he says, "had selected a site for a city, but the colony not having means to build dikes or levees, the idea was abandoned." Nevertheless, the New Orleans levee was undertaken afterwards, and completed in 1726. Soon after the founding of New Orleans plantations were established along the river-banks above and below the city, but each proprietor had to construct and maintain his own levee. At that time the river during its floods rose above its banks everywhere—from three to four feet in the bends, and one foot or more around the points—thus affording vent to the water through continuous lateral outlets on both banks, and submerging the valley annually; but the reduction of current velocity in the channel, and of channel section, prevented the banks from caving rapidly, therefore the levees required were insignificant compared with what they are now. The levees were low, because the river deposits had kept the banks always nearly up to the flood-line. They were more permanent, because the banks caved in but little; therefore levee maintenance then cost but a fraction of what is now required. In 1723 small settlements had already been established at several points between the mouth of Red River and New Orleans—at Pointe Coupée, Baton Rouge, Manchac, below the Lafourche, at Cannes Brûlées, and at Tchapitoulas. In 1728 the settlements extended almost continuously "for thirty miles above New Orleans," and in 1735 twelve miles below and thirty miles above on both sides of the river. In 1735 a great flood occurred, which inundated New Orleans and broke through or overtopped the levees in many places, and probably the New Orleans levee. The range from high to low water observed and recorded in that year at New Orleans was 15 feet; which slightly exceeds the range of recent years (14.8 feet, which is to the flood-line of 1862, the highest due to a river-rise only recorded for fifty years past) at New Orleans. This proves, on the assumption that the Gulf level is unaltered, that the river flood-line is no higher at New Orleans now than it was in 1735, if so high. In 1743, says Gayaré, "an ordinance was promulgated requiring the inhabitants to complete their levees by Jan. 1, 1744, under penalty of forfeiture of their lands to the Crown." In 1752, according to Monette, the settlements were nearly continuous for "20 miles below and 30 miles above New Orleans," while "nearly the whole coast was in a high state of cultivation and securely protected from floods." In 1770 a great flood occurred with inundations, and in 1782 another. Great floods occurred also in 1785, 1791, and 1799, and during each of these years New Orleans was inundated. But little progress was made in levee construction from 1763, when France ceded Louisiana to Spain, until 1803, when it passed to the U. S., after having been ceded back to France by Spain in the year 1800. In 1805 the settlements and levees began about 40 miles below and extended nearly 120 miles above New Orleans; and the Pointe Coupée settlement above had a front of 24 miles on the river. Opposite Natchez, near the mouth of the Arkansas River, and at New Madrid, small settlements had been made. Both banks of the Bayou Lafourche in Lower Louisiana were leveed for about 45 miles from the river Mississippi. In 1812, Louisiana was admitted into the Federal Union, and, according to Stoddard, the levees were continuous on "both sides of the river from the lowest settlements" to Baton Rouge, and on the right bank to Pointe Coupée. In 1828 the river-banks were leveed nearly to the mouth of Red River, and above, here and there on the W. bank, levees were in existence as far up as the mouth of the Arkansas. In 1844 they were nearly continuous to Napoleon on the W. bank, with many isolated levees between Vicksburg and Memphis. In 1861 levees extended almost continuously from Cape Girardeau in Missouri, with about 40 miles of openings in the aggregate above the Arkansas River, right bank, according to Prof. Forshey, down to near the forts below New Orleans.

The process of levee construction, as applied to the Mississippi River, began at New Orleans. The lower Mississippi —that portion below the last affluent, Red River—was first leveed; therefore the enlargement of the lower river by the closure of its outlets and the confinement of all the water to the channel, took place before the leveeing of the upper river. It was well that it so happened, for had the upper river been first leveed, before the enlargement of the lower river, the flood-height below would have been much increased and the inundations made more frequent and disastrous. To prevent injury and danger to Lower Louisiana, the sugar region, its levee system should be perfected first and every outlet closed. During 150 years, since about 1720, the levee system was gradually extended, from New Orleans, about 70 miles below and about 1000 miles above. Every bend, before levees were built around it, was a continuous outlet, for the river flood-line was several feet higher than the banks in the bends. Even the banks around the points were overflowed before they were leveed, for they were formed by alluvial deposits while inundated, and were leveed because subject to overflow. The lower river was first accommodated to the leveeing up of outlets. The building of levees is nothing else but the closing up of outlets, and the retention between the river-banks and the levees of the waters which previously passed out laterally over the banks. No evidence exists that the flood-line of the lower Mississippi River is the fraction of an inch higher now than it was before the building of the first levee in front of New Orleans, but the area of the river's channel has been increased undoubtedly. Every outlet except the Bayou Lafourche—the high-water capacity of which is only about 12,000 cubic feet per second, or less than the one-hundredth part of the Mississippi—has been closed below Red River without adding to the height of the river flood-line in the lower river. Had the levee system been commenced above and extended downward, the first effect would have been different.

The last outlet closed below Red River was the Bayou Plaquemine in 1865, the capacity of which was about 35,000 cubic feet per second; but the highest flood-line of recent years below it was that of 1862, which was 0.7 foot above the 1858 mark opposite New Orleans. In 1871 a storm-tide backed up the river at New Orleans to a height about the same as in 1862, but at Donaldsonville, 30 miles below the Plaquemine, the river in 1871 was 1.45 feet lower than in 1862. Again, in 1874 an extraordinary storm-tide raised the river (Apr. 15 and 16) at New Orleans about 8 inches above the 1862 mark, but at a point 45 miles above New Orleans, and about 30 miles below Donaldsonville, and 60 miles below the Plaquemine, the flood-line of 1874 was about 6 inches below that of 1862. Hence the statement (by the U. S. levee engineer commission in their recent report) that the effect of closing the Plaquemine outlet was to add "*about six inches to the normal flood-height at New Orleans*," seems to want the support of facts.

The front-lands at the Belleville foundry, opposite New Orleans, formed by overflow deposits before the river was leveed, were found (see *Ph. and Hyd. of the Miss.*) to be but three-tenths of a foot below the flood-line of the great flood-year 1858, and they were but 1 foot below that of 1862, the highest known for fifty years. Observation shows that in a current deposits do not generally reach within 1 foot of the flood-line. Recent levellings show that the flood-line of 1862 was but 2.1 feet higher than the crown of Old Levee street, opposite Jackson Square (the old Place d'Armes), New Orleans, about 100 yards from the river, and but 4.2 feet above the crown of Chartres street, opposite the square, and about 200 yards distant from the river. The river-bank here is the same as it was in 1717, having neither caved in nor receded by accretion. When De la Tour laid out the city in 1717 the flood-line was 3 feet, at least, above the river-bank here, or certainly as high as now; again showing no rise of the flood-height since then.

It has been claimed (by U. S. engineers Humphreys and Abbot) that the blue clay bed of the Mississippi River "resists the action of the strong current like marble," and that therefore "the bed of the Mississippi cannot yield" and accommodate itself to the increased quantity of water confined to the channel by levees. It is therefore assumed by them that no enlargement of water-way occurs, and no allowance for it is made in calculating the effect of adding to the quantity of water by extending levees. It is well known that the action of running water slowly wears away even the hardest primitive and volcanic rocks—as, for instance, through the immense cañons of the Colorado River, and elsewhere all over the world; and that it dissolves and wears away clay, no matter how firm, cannot be gainsaid

with truth. Whenever a "cut-off" occurs in the Mississippi River, the clay bed of the river is rapidly excavated, and the cut-off soon becomes as large in section as the river elsewhere. Every bend of the river below a cut-off is excavated rapidly and lengthened, and the deepest water is always found nearest to the bank in the bend where the blue clay bed has just been washed out. In 1874, for instance, the maximum horizontal range or extent of caving at Morganzia, below Red River, during that year was 550 feet; at Point Manoir, opposite Port Hudson, it was 1100 feet; at Lobdell's, above Baton Rouge, it was 460 feet; near Bayou Goula it was 350 feet; at Landry's, in Ascension parish, it was 420 feet; in two places in St. Charles parish it was 300 feet; opposite New Orleans it was 200 feet in one place and 220 feet in another, while cavings of 220 feet, 160 feet, and 80 feet occurred between New Orleans and the forts below;* all of which show that the clay bed of the Mississippi does yield and wear away from year to year, and far more rapidly than is necessary for the very slow, and in fact inappreciable, yearly increase due to levee extension. A recent comparison of river cross-sections opposite Jackson and St. Anne streets, New Orleans, by Prof. Forshey, furnishes another proof that the area of the channel-way is enlarging by yielding of the clay bed. Sections were taken opposite the above-named streets in 1850 and in 1872, and the areas of section in 1872 were 54,000 and 56,000 square feet, respectively, greater than in 1850. Opposite Jackson street the depth had increased 13 feet, and opposite St. Anne street it had increased from 150 to 165 feet. Opposite the lower portion of New Orleans a like increase of section and depth was manifest.

There is evidence that in many places the lower Mississippi is slightly widening as well as deepening. Below Baton Rouge, at a point where, on the left bank, levees have existed since 1805, new levees have been built farther back because of the caving in of the river-bank; and directly opposite, on the W. side of the river, the same thing has occurred. In other places opposite banks are caving in, and the river's width is increasing in straight reaches of the river. Opposite Baton Rouge—the bank on the E. or bluff side remaining as it was—the W. bank is caving in yearly, thereby compelling the construction of new levees farther back. The artesian well-borings at New Orleans showed that the river had cut through clay strata before reaching its present depth. Everything indicates that the Mississippi River is not and cannot be an exception to the laws which govern the flow of water in all sedimentary rivers, small or great. As the normal maximum quantity of water is increased, the mean velocity of current is accelerated, the area of channel-way is enlarged, and the slopes of the bed and surface are diminished. The levee system, therefore, as applied to such a river as the Mississippi, is based upon correct principles, and the effect of levees, if persevered in and maintained properly, will be to lessen the liability to inundations, and, if anything, to reduce the flood-line; if cut-offs and outlets, which alone interrupt the establishment of a permanent river regimen, are prevented.

"Cut-offs" precipitate a whole river, by shortening the plane of descent, upon a lower level below the bend cut-off. The effects are, a considerable lowering of the flood-line in the vicinity above; a less corresponding elevation of the flood-line in the region below, and for a time a partial gorge of water below; a greatly increased velocity of current above and below and through the cut-off, due to the increased slopes of bed and surface; and for years afterward, in a great river like the Mississippi, a rapid excavation and prolongation of the river-bends below, and to some extent above, thereby compelling the frequent reconstruction of levees around the bends, and each time on lower ground, and therefore higher and much more expensive embankments than ever before, because the river alluvial lands are highest next the river, and they slope downward away from the river. A fall of 15 feet below the river flood-line, within a distance of one mile back from the river, is not uncommon above New Orleans, and even a fall of 20 feet within one mile may be found in places.

When the river was first leveed below Red River, embankments of from 4 to 5 feet high, with a crown of 4 feet and slopes of 2 to 1, were found sufficient around the bends, where now levees from 15 to 20 feet high, with a crown of 10 feet or more and slopes of 3 to 1, are needed, and are now built and maintained. A levee 15 feet high, of the crown and slopes last named, contains nearly twelve times as much earth, for a given length, as was required for the old levees; hence the largely increased cost of levee construction and maintenance now, with the river flood-line no higher than at first notwithstanding the effects of cut-offs. Every cut-off increases the cost of levee maintenance and the danger of inundations; therefore, so far as possible, they should be prevented. Above Red River many cut-offs have occurred; below, including one opposite the mouth of Red River, but three in all have ever occurred. Fausse River Cut-off dates back to 1722, at the beginning of the levee era. Red River Cut-off was made by Capt. Shreve, an employé of the U. S. government, in 1831. The Raccourci, between the two former, was made by the State of Louisiana in 1848–49, by digging a deep canal three-fourths of a mile long across the neck of the bend. The total distance around these three lower Mississippi cut-offs was about 65 miles, and the total fall across their necks about 12 feet, where the usual high-water slope was less than three inches per mile. Their effect in adding to the caving and lengthening of the river-bends below, and thereby increasing the cost of levee maintenance, was, and is still, very great; for the river has not yet regained its original length and slopes.

Outlets temporarily lower the flood-line of a sedimentary river, but their final effect always must be an increased elevation of the bed and surface of such a river, and the contraction of its channel-way; for the law is that the less the quantity of water flowing, as the normal maximum, the greater must be the slopes of bed and surface. Outlets, therefore, cannot be depended upon for lowering the flood-line of the lower Mississippi permanently, and they are not needed, because the extension and perfection of the levee system never has caused, and will not cause, any elevation of the river flood-line. Levees, and levees alone, if properly constructed and maintained, can be relied upon for the reclamation of all the alluvial lands subject to overflow in the valley of the Mississippi, and the improvement of navigation will also result from a perfection of the system.

It has been said (*Ph. and Hyd. of the Miss.*) that the waters of the Mississippi at flood are "undercharged with sediment;" that is, that more could be sustained than is held up and transported down stream with the current; therefore, that it contains less sediment than is due to its velocity. This conclusion is based upon observations showing that sometimes, in some places, when the river is falling, and is at a stage between high and low water, the river-water is more highly charged with sediment than at a flood stage. It is assumed or erroneously inferred because of this that no deposits can occur at any stage of the river below an outlet or a crevasse, no matter of what dimensions. It is very well known that in all turbid streams flowing between banks of alluvium the caving in of the banks occurs principally when the floods are subsiding, when the banks have lost the support of the water which they had at a high stage. Then the river-water as it passes around a caving bend becomes *overcharged* with sediment, and as it cannot all be sustained and transported to the river-mouth, the surplus is dropped on the next bars below, or wherever the velocity or sustaining power of the current is reduced. To assert that the Mississippi is *at all times* "undercharged with sediment," and therefore different from other sedimentary rivers, because it is in places and at times less muddy at its high stage than when the banks are caving in at a mid stage, is certainly unwarranted. The waters of all sedimentary rivers with caving banks are more turbid when and where the banks are caving in, and the same laws govern the flow of water in the Mississippi as in other turbid rivers. The "clay bed of the Mississippi" obviously *does* yield, because the river excavates its bends by undermining its banks, deepens its channel, and scours out its cut-off channels; deposits *are* made from its waters after they become overcharged with sediment by caving banks wherever and whenever there is a loss of current in the eddies under or below the points and below outlets.

As an example of the effect of an outlet or crevasse to cause a deposit in, and contraction of, the channel of the Mississippi below it, the following is given: In 1874, Apr. 11, a crevasse occurred in a large levee at Bonnet Carré, left bank of the Mississippi, 40 miles above New Orleans. It became 1370 feet wide, with an area of discharge of about 32,000 square feet, or nearly one-sixth that of the river opposite. The range of the river here from high to low water is about 21 feet, and the level of the land one-fourth of a mile back of the line of levee which had given way was 15 feet below the river flood-line. On the 15th of July, when the river had fallen 15 feet, the water ceased to run through the crevasse outlet opening. In the latter part of September, when the river had fallen 20 feet, sections of the river were carefully taken above and below this outlet. The results, briefly summed up, were as follows: Maximum depths above crevasse, 110 and 79 feet on two sections at the then stage of water; maximum depths of sections below

* In Tensas parish, above Red River, at Kempe's, the effect of the Davis Cut-off of 1867 has been to cause an average caving in of the river-bank during the years 1868 to 1873, both inclusive, of 1200 feet per year. In 1874 the caving at Wilson's, same parish, was 2100 feet. In Concordia parish, at Marengo, the maximum caving in 1868 was 3000 feet, and 1400 feet in 1873.

crevasse, 62 and 64 feet. Firm clay bottom above; soft, silty ooze bottom, indicating recent deposit, below crevasse. Low-water widths above, 2886 and 3014 feet; below, 2406 and 2452 feet, showing a reduction in mean width below of 521 feet. Low-water areas of upper sections, 184,653 and 164,167 square feet; of lower sections, 96,640 and 106,150 square feet, a reduction of channel section, means of upper and lower, of 73,015 square feet. The widths on the high-water lines averaged 3165 feet for the upper sections, and 3365 feet below; the width below being 200 feet the greatest at high water. The mean high-water areas of sections were, however, 75,000 square feet less below than above. It was estimated, approximately, that this outlet or crevasse of the full dimensions measured would discharge at high water about one-tenth of the river at flood. Below this crevasse there were, in the next bend as well as opposite, extensive deposits of sand and earth, reaching several feet above the low-water line, *which were known to be new*. All of which measurements and observations demonstrate unmistakably that the Bonnet Carré crevasse outlet of 1874 did cause a partial filling up and contraction of the river-channel below it.

Numerous examples of the effects of outlets to contract the river-channel below them on Red River and elsewhere could be given if space permitted. We shall mention one only. Tone's Bayou, 20 miles below Shreveport, which had its origin as an overflow coulée of insignificant dimensions twenty-five years ago, now discharges nearly two-thirds of the turbid waters of Red River which reach it, and yet the flood-line below is as high as, if not higher than, before, while the channel below has been reduced to correspond with the quantity of water abstracted. All of the water of Red River now passes Shreveport, and the high-water section there is about 23,000 square feet. Below Shreveport and above Tone's Bayou three outlets exist on the right bank, and others on the left bank, whereby the river-section just above Tone's is reduced to 9000 square feet. Tone's Bayou itself has a section of 5600 square feet—or had in 1872—while that of Red River below it has been contracted to but 3500 square feet, and to a width of less than 200 feet. Fully five-sixths of the water of Red River escapes through outlets within about 20 miles below Shreveport, and yet, while the area of the river's section is reduced correspondingly, the river flood-line is as high as, if not higher than, ever. Outlets therefore cannot permanently lower the flood-line in sedimentary rivers, although, as we see in the Mississippi, when they occur suddenly, as crevasses, and enlarge rapidly, their effect is to reduce it temporarily, or until the river has had time to accommodate itself to its new regimen by deposits in and contraction of its channel below. The result is certain; how soon is a mere question of time.

In calculating the effects of adding to the quantity of water in the Mississippi River by closing outlets, or in perfecting the levee system, or of reducing the quantity by outlets, it will not do to assume that the sectional area of channel-way will be neither enlarged nor contracted—that it is fixed and unchangeable. That certain determinate and determinable relations exist between the quantity of water flowing, the mean velocity of current, the sectional area of channel-way, and the slopes of bed and surface, cannot be ignored or disregarded. They must be admitted to ensure a reliable result. It is evident, therefore, that levees alone can be relied upon for the permanent reclamation of the Mississippi Valley lands. The only way to safety and exemption from inundations is to build and maintain adequate levees. Cut-offs should be prevented as long as possible. Outlets are worse than useless, even if it were possible, which it is not, to provide a separate and leveed channel to the sea for the water so drawn off; they overflow land when reclamation is the end in view. Artificial reservoirs are impracticable, and what natural swamp-reservoirs there are above Red River only add to the river-floods, and thereby increase the danger of inundation, by feeding the rise below them. As to the diversion of tributaries, it would be useless even if practicable. By means of levees, and afterwards of interior drainage, every acre of land in the Mississippi Valley, exclusive of drainage channels, may be reclaimed, cultivated, and made the home of millions of prosperous inhabitants. According to U. S. engineer Gen. Abbot, with levee protection and drainage 2,500,000 acres of sugar-land, 7,000,000 acres of cotton-land, and 1,000,000 acres of corn-land of inexhaustible fertility may be opened for cultivation and settlement.

The total lengths of levees required to protect the Mississippi front may be stated as follows: In Louisiana below Red River, 500 miles; above Red River, 280 miles. In Mississippi, 380 miles. In Arkansas, 545 miles. In Missouri, 80 miles. Total, 1785 miles. In Louisiana, the interior rivers, bayous, and old river lakes would require about 925 miles more. The U. S. is engaged in a struggle for the maintenance of her supremacy as the greatest cotton-producer in the world, and the only way to maintain this supremacy is to perfect the Mississippi River levee system, and so bring all of the valley-lands into cultivation. The U. S. alone can do this. It has been demonstrated that the States of Louisiana, Mississippi, and Arkansas have not the means and resources necessary for its accomplishment. Surely, the permanent reclamation of the great Mississippi Valley, with its ten or twelve millions of acres of the richest alluvial lands in the world, is or should be of sufficient national importance to justify its being undertaken by the general government. G. W. R. BAYLEY.

Lev'el [Ang.-Sax. *læfel*, from Lat. *libella*, "level"]. A *level surface* is one that is concentric with the surface of the ocean; that is, with the surface the ocean would have if the globe were entirely covered with water. Any line drawn in a level surface is a *level line*. For small areas, that is, for areas of a few miles in extent, we may regard a level surface as the surface of a sphere osculatory to the ellipsoidal surface of the earth at the middle point of the area in question. The surface just described is a surface of *true level*. A surface of *apparent level* at any point is a plane drawn tangent to the surface of true level at that point. Any line drawn in a surface of apparent level is a line of apparent level. The lines indicated by our levelling instruments are lines of apparent level, but we may deduce from them lines of true level by making suitable *corrections* for curvature. W. G. PECK.

Levelling. See HYPSOMETRY.

Levelling Instruments. The instruments used in levelling are of *two* classes. Those of the *first* class are used to point out or indicate a line or surface of apparent level, and are technically called *levels;* those of the *second* class are used to measure the distances of this line or surface of apparent level above the points whose difference of level is to be determined, and these are called *levelling-rods*. W. G. PECK.

Levelling-rods. These are rods of wood graduated to feet and decimals of a foot, the lines of division being numbered from below upward; the 0 of the scale is at the bottom of the rod. One of the best consists of a staff of hard wood, capped with metal, usually about 12 feet in length. A sliding *vane* can be moved up and down by a cord running on pulleys let into the rod. This rod is graduated to *hundredths* of a foot, and on one edge of the rectangular opening that is made in the vane is a vernier, by means of which the rod may be read to *thousandths* of a foot. The vane is divided into four sections by lines through its centre, one parallel to the rod and the other perpendicular to it, and these sections are painted in contrasted colors for greater facility in determining the middle of the vane. A second form of levelling-rod is similar to that just described, except that the rod is constructed in two sections, one of which slides in a groove of the other. The arrangement of the graduation is modified to conform to the peculiar character of the sliding joint. A third form of rod is now much used. It consists of a simple rod without a vane, the divisions and numbers being so distinct that the readings may be made by the observer. This form of rod is mostly employed in connection with the Gravatt level, a level which differs from the Y level already described in having an inverting telescope. This form of level admits of greater optical power, with the same length of telescope, and is therefore better adapted to making close readings at great distances. When this species of level is used the figures on the levelling-rod are both reversed and inverted.

The *difference of level* between two neighboring points may be determined by means of the levelling instruments just described as follows: Let the level be set up at some convenient place and so arranged as to indicate a surface of apparent level; place a levelling-rod at the first point and note the height at which it is intersected by the level surface; in like manner, place a rod at the second point and note the height at which it is cut by the level surface; subtract the first of these heights from the second, and the remainder will be the difference of level of the two points. If the remainder is +, the second point is higher than the first; if the remainder is —, the second point is lower than the first. In the same manner we may determine the difference of level between the second point and a third point, between the third point and a fourth, and so on, as far as may be desirable. The total difference of level between the first point and the last is then equal to the algebraic sum of all the partial differences of level. W. G. PECK.

Levels. Levels are constructed on one of three principles: 1st, a line of apparent level is perpendicular to a plumb-line freely suspended; 2d, a line of apparent level is tangent to the free surface of a liquid in equilibrium;

and 3d, a ray of light which is perpendicular to a vertical mirror is a line of apparent level.

The level used by bricklayers, carpenters, etc., affords an example of the method of applying the first principle. In its simplest form, this kind of level consists of a T-shaped frame, the line corresponding to the top of the T being perfectly straight and at right angles to a second line drawn through the middle of the stem of the T. A plumb-line is attached at some point of the second line; and when the instrument is held so that the plumb-line corresponds to this second line, the first line is a line of apparent level. The cross line of the T may be turned downwards, as is usually the case when used by mechanics, or it may be turned upwards, in which case, if supported on a suitable stand, it can be used for the rougher kinds of field levelling.

The ordinary Y level is an example of the instruments constructed on the *second* principle. It consists essentially of a telescope mounted on two vertical supports, which from their shape are called Y's. The Y's themselves are attached to a solid bar, called the *limb*, which turns about an axis at right angles to it. The limb and its axis are connected with a supporting tripod by means of a ball-and-socket joint, so arranged that the axis may be made vertical by the aid of levelling-screws. Suspended from the telescope is a delicate spirit-level, which, when in adjustment, is parallel to the line of collimation of the telescope. The line of collimation of the telescope is indicated by two cross hairs mounted on an adjustable diaphragm placed in the common focus of the field lens and eye-piece. The parts of the instrument are so constructed that they may be brought into accurate adjustment; that is, into proper relative positions. When the instrument is adjusted the attached level is parallel to the line of collimation of the telescope, and both are perpendicular to the axis of the limb, that is, the line that remains fixed when the limb is turned in azimuth.

To use the instrument thus adjusted we plant the tripod firmly in the ground, and by means of the levelling-screws bring the level in such a position that the bubble will remain in the middle of the tube during an entire revolution in azimuth. The axis of the limb is then vertical, and consequently the line of collimation of the telescope in all its positions is a line of apparent level.

Levels constructed on the third principle are called *reflecting* levels. One form of this class of levels consists of a plate of glass suspended from a ring and weighted so that the plane of the glass shall always be vertical. One half of the glass is silvered and the other half unsilvered, the line of division between the two portions being vertical. A line is ruled across the middle of the plate perpendicular to the one last mentioned, and is consequently horizontal. To use the instrument, it is held by the ring and raised or lowered until the observer sees the image of his eye reflected from the ruled horizontal line on the silvered portion; the plane through the eye in that position and the line on the unsilvered portion is a plane of apparent level. Instruments of this kind are convenient for making reconnaissances, and also for contouring in topographical surveys, but they are not very accurate. W. G. PECK.

Lévêque (JEAN CHARLES), b. at Bordeaux, France, Aug. 7, 1818; made extensive studies of the Greek and Alexandrian philosophers; resided in 1847–48 at Athens, and became professor in philosophy at the Collége de France in 1856; in 1865 member, and in 1873 vice-president, of the Academy of Moral and Political Sciences. Besides a number of articles in the *Revue des Deux Mondes* remarkable for erudition, he published in 1860 *La Science du Beau* (2 vols.), a work which received prizes from several French academies, but which, as a philosophy of the beautiful, stands far behind what the modern German philosophy contains on the subject.

Lev′en, Loch, a lake of Scotland, in the county of Kinross, about 11 miles in circuit. On an island opposite the town of Kinross are remains of Loch Leven Castle, in which Mary queen of Scots was imprisoned from June, 1567, to May, 1568.

Lever. See MECHANICAL POWERS, by PROF. W. P. TROWBRIDGE, A. M.

Le′ver (CHARLES JAMES), M. D., LL.D., b. at Dublin Aug. 31, 1806; took the degree of M. B. at Dublin University 1831, and of M. D. at Göttingen; was medical superintendent in Londonderry during the cholera season of 1832; physician to the legation at Brussels; editor of the *Dublin University Magazine* 1842–45; vice-consul at Spezia 1858–67, and afterwards consul at Trieste; attained great success as a writer of humorous novels, chiefly descriptive of Irish life and character, among which are *Harry Lorrequer* (1840), *Charles O'Malley* (1841), *Arthur O'Leary* (1844), *The O'Donoghue* (1845), *Horace Templeton* (1849), *Con Cregan* (1857), *The Bramleighs of Bishop's Folly* (1868), *Lord Kilgobbin* (1872), and many others. D. at Trieste June 1, 1872.

Lev′erett, post-tp. of Franklin co., Mass., on the New London Northern R. R., 106 miles W. of Boston, has manufactures of pails, satinets, and lumber, and tobacco is raised. Pop. 877.

Leverett (FREDERICK PERCIVAL), b. at Portsmouth, N. H., Sept. 11, 1803; graduated at Harvard in 1821, and was afterwards principal of the Boston Latin School; published a Latin lexicon (1836) and a number of Latin classics, with notes. D. at Boston, Mass., Oct. 6, 1836.

Leverett (Sir JOHN), BART., b. in England in 1616, and came with his father to America in 1633. He held many important positions, both in Massachusetts and in England, where he was an officer in the army of Cromwell, his intimate friend. In Massachusetts he was Speaker of the house 1665–71, major-general 1663–73, deputy-governor 1671–73, and governor 1673–79. In 1676 he was knighted and made a baronet by Charles II. D. Mar. 16, 1679.

Leverett (JOHN), F. R. S., b. at Boston, Mass., Aug. 25, 1662, a grandson of Sir John Leverett; graduated at Harvard in 1680; was a judge, lawyer, and Speaker in the general court, and was president of Harvard College 1707–24. He had a wide reputation for learning. D. May 3, 1724.

Leverrier′ (URBAIN JEAN JOSEPH), b. at St. Lô Mar. 11, 1811; studied at the École Polytechnique, Paris; made some important discoveries in chemistry, and in 1846 astonished the world by the correct announcement of the place in the heavens where would be discovered the planet now called Neptune. He was director of the observatory of Paris 1854–70, to which he was reappointed in 1872; became a senator, an académician, and a grand officer of the Legion of Honor, and has done much to promote popular education.

Le Vert (HENRY STRACHEY), M. D., b. in King William co., Va., Dec. 26, 1804, a descendant of a naval surgeon from Count Rochambeau's fleet, who after the siege of Yorktown settled in Virginia; graduated M. D. in the University of Pennsylvania 1829, and his thesis on metallic ligatures was afterwards published; went to Mobile, and from his genial disposition, erudition, skill, and noble impulses soon rose to great distinction. He married Octavia Walton (see O. W. LE VERT). D. in Mobile Mar. 15, 1864. PAUL F. EVE.

Le Vert (OCTAVIA WALTON), b. at Bellevue, near Augusta, Ga., about 1810. Her father, Col. George Walton (son of the signer of the Declaration of Independence of the same name), removed to Pensacola, Fla., in her childhood, as territorial secretary, and for a time acted as governor. Here she imbibed such a knowledge of French and Spanish that they were almost equally with English her mother-tongues. She was invited while still a girl to select a name for the future capital of Florida, and chose the musical Seminole word Tallahassee. Upon the expiration of his term of office, Col. Walton removed to Mobile, where his daughter was married in 1836 to Dr. H. S. Le Vert. She had previously spent one or two winters in Washington, where she enjoyed the friendship of Clay, Webster, Calhoun, and Washington Irving, and acquired distinction for the precision of the reports she wrote of the famous congressional debates on the removal of the deposits from the U. S. Bank. In 1853–54, and again in 1855, Mrs. Le Vert travelled in Europe, was received into the best circles of society in England and on the Continent, and recorded her observations in the interesting volumes called *Souvenirs of Travel* (2 vols., 1857). She rendered good service in behalf of the Mount Vernon Association, and was noted for offices of charity during the civil war. She is understood to have prepared two books, *Souvenirs of Distinguished People* and *Souvenirs of the War*, which have not yet been published. She enjoys a great reputation as an accomplished linguist, conversationalist, and leader of society.

Le′vi [Heb., "wreathed"], in biblical history the third son of Jacob and Leah, b. in Padan-aram about B. C. 1917, and the ancestor of one of the twelve tribes of Israel, called by his name. (See LEVITES.) Of his personal history the only trait which has been recorded is the massacre which, with his brother Simeon, he perpetrated upon the inhabitants of Shechem to avenge the wrong done his sister Dinah (Gen. xxxiv.). Levi went into Egypt with his father and brothers after the elevation of Joseph, and d. there. Moses and Aaron were his descendants, apparently in the fourth generation.

Levi (LEONE), PH. D., b. at Ancona, Italy, of Jewish parents, June 6, 1821; removed in 1844 to Liverpool; was naturalized in 1847; was one of the founders of the Liverpool Chamber of Commerce 1849; became in 1852 professor

of commercial law, etc. in University College, London; became a barrister in 1859; received the doctorate from Tübingen 1861; has done much for the reform of commercial law and practice, the utilization of statistics, etc. Author of *Commercial Law* (4 vols., 1850–52), *Mercantile Law* (1854), *On Taxation* (1860), *International Commercial Law* (1864), and other works, besides many valuable papers on statistical and commercial science.

Levi'athan [Heb., "wreathed monster"], in the Old Testament usually designates the crocodile, but in the Talmudical writers the whale, the fabulous dragon, or any other creature of monstrous size, may be called leviathan. The name is also used figuratively for gigantic animals as well as other objects.

Lev'ico, town of Austria, in the province of Tyrol, at the issue of the Brenta into the Lake of Levico, has 5674 inhabitants, mostly employed in the cultivation and manufacture of silk.

Leviga'tion [Lat. *lævigare,* "to plane," "to rub smooth"], a special manipulation of the laboratory, devised for the purpose of converting substances to a smooth, uniform powder. A flat surface, called the "slab," is used to place the substance upon, composed of stone, glass, or metal; and a "muller," having a flat surface below, is propelled round and round with an eccentric motion over the mass. A liquid is always added, usually oil or water, to assist the operation. The process of levigation has passed, probably hundreds of years ago, from the laboratory into the arts, and paints, printing-inks, and often drugs, are comminuted by a process of levigation, on the manufacturing scale, in so-called "eccentric mills." *Porphyrization* is another name formerly applied, from slabs of porphyry being employed. A *spatula* is an essential adjunct in the small laboratory operation to collect together readily and heap up the mass when spread by the muller. H. Wurtz.

Lev'ings (Noah), D. D., b. in Cheshire co., Me., in 1796; early joined the Methodist Episcopal Church, and in 1818 entered its itinerant ministry as a candidate of the New York conference; travelled and preached with much popularity and success in New York, Connecticut, Massachusetts, and Vermont; was presiding elder over large districts of his Church, and a member of its General Conference; in 1844 was appointed one of the secretaries of the American Bible Society. In this office he often travelled over the U. S., preaching with great effect, and successfully promoting the interests of the society. After a laborious tour through the South-western States he was attacked by epidemic cholera, and d. at Cincinnati on his way home, Jan. 9, 1849. Abel Stevens.

Lev'irate Mar'riage [Lat. *levir,* a "husband's brother"], the marriage of a widow by the brother of the deceased husband. This custom (common among the ancient Hebrews, and not unknown at the present day among rude and simple races) was perpetuated by the Mosaic law. It is, however, practically obsolete among the Jews. The canon law expressly forbids such marriage, and in Great Britain it is still unlawful. In the U. S. it is generally permitted to marry the brother of a deceased husband. But the true levirate marriage was compulsory, or at least obligatory (except on certain conditions), but only in case the deceased husband left no male issue. In Abyssinia and parts of Asia the levirate law is still in force. It seems to have prevailed in ancient Italy also.

Lev'is, county of Quebec, Canada, on the S. shore of the St. Lawrence, opposite Quebec. It is traversed by the Grand Trunk Railway. Cap. Levis. Pop., including Levistown, 24,831.

Levis (formerly Point Levi), an important suburb of Quebec, Canada, in Levis co., is opposite that city, on the S. bank of the St. Lawrence (here 1 mile wide), and is on the Grand Trunk Railway. It has a larger trade than any town in Canada except Quebec and Montreal. It is the seat of a convent, and has a board of trade. The river is crossed by a ferry. Pop. in 1871, 13,021.

Le'vite, one of the tribe of Levi, a descendant of Levi, one of the sons of Jacob, but in a more limited sense one of those members of that tribe who did not belong to the priestly families of the ancient Hebrews. The Levites constituted a kind of inferior priesthood. They had no inheritance except certain cities on either side of the river Jordan; in which, however, they were not compelled to reside. There are at the present day some Jewish families who claim a lineage, more or less pure, from the Levitical stock.

Levit'icus [so named in the Vulgate because it is largely occupied with directions for the Levitical service], the third book of the Pentateuch and of the Old Testament. It contains the Mosaic law of sacrifices, the laws regarding ceremonial uncleanness, the laws with regard to intercourse between Israelites and foreigners, together with brief historical accounts, admonitions, and the like. Its direct Mosaic origin has usually been taken for granted, but several recent German, Dutch, and English commentators refer it to the period of Ezra. (See Pentateuch.)

Lev'ulose [Lat. *lævum,* "left"], $C_6H_{12}O_6$, a variety of glucose. It occurs associated with dextro-glucose in honey, in many fruits, and other saccharine substances. Fruit-sugar or invert-sugar is a mixture of equal proportions of these two sugars. Cane-sugar is *inverted*—that is, transformed—into a mixture of dextro-glucose and levulose by warming with dilute acids, or by contact with yeast, pectase, etc.:

$$\underset{\text{Cane-sugar.}}{C_{12}H_{22}O_{11}} + H_2O = \underset{\text{Dextro-glucose.}}{C_6H_{12}O_6} + \underset{\text{Levulose.}}{C_6H_{12}O_6}.$$

Levulose may be extracted from inverted cane-sugar by adding to the inverted sugar obtained from 10 grammes of cane-sugar 6 gms. of slaked lime and 100 of water. A solid compound of levulose and calcium is formed, while the calcium compound of dextro-glucose remains in solution, and may be separated by pressure. On suspending the precipitate in water, and decomposing with carbonic acid, the levulose is set free, and can be obtained as a syrup on evaporating the filtered solution. Levulose is also produced in a pure state by treating inulin with dilute acids. It is a colorless, uncrystallizable syrup, as sweet as cane-sugar, and exhibiting most of the reactions of dextro-glucose. It is more easily altered by heat and acids, less readily by alkalies and ferments. (See Glucose and Sugar.)
C. F. Chandler.

Le'vy, county of Florida, bounded S. W. by the Gulf of Mexico, N. W. by the Suwanee River, and S. by the Withlacoochee. Area, 850 square miles. A large part of its area is occupied by the "Gulf Hammock," an extremely fertile tract, covered with dense hard-wood forests. Corn, cotton, and lumber are staple products. The county is traversed by Florida R. R. Cap. Cedar Keys. Pop. 2018.

Levy (Émile), b. at Paris Aug. 29, 1826; studied at the École des Beaux Arts, and under Pujol and Picot, and began to exhibit in 1854. His most celebrated pictures are *Le Souper libre* (1859), *Vercingétorix* (1863), *La Mort d'Orphée* (1866), and *La Musique* (1869).

Lew'es, town of England, in the county of Sussex, is picturesquely situated on the Ouse, on a declivity of the South Downs, and carries on a considerable trade in grain, cattle, and sheep. Pop. 10,753.

Lewes, post-v. of Sussex co., Del., on Delaware Bay, 2 miles S. W. of Cape Henlopen, and directly in front of the Delaware Breakwater, which affords an excellent and ample harbor for vessels of all classes and sizes. It is the terminus of the Junction and Breakwater R. R., which connects here with the Old Dominion Steamship Co., and lies directly opposite and 12 miles distant from Cape May. It has 3 churches, a weekly newspaper, and a number of stores. Wrecking, fishing, and farming form the principal business. Pop. 1090.
J. H. D. Knowles, Ed. "Breakwater Light."

Lewes (George Henry), b. in London, England, Apr. 18, 1817; was in youth a clerk in a commercial house; commenced the study of medicine, but abandoned it for that of philosophy and psychology, to which he devoted two years in Germany; returned to London in 1840; devoted himself to literature, and speedily became known as a deep thinker and a writer of uncommon attainments, especially by his articles in the magazines and quarterly reviews. His earliest important work was the *Biographical History of Philosophy from Thales to Comte,* published in 1847, which foreshadowed his own opinions as being of the so-called Positivist type—a book of considerable ability, which became popular and has reached a fourth edition. From 1849 to 1854, Lewes was literary editor of the *Leader,* wrote a compendium of *Comte's Philosophy of the Sciences* (1853), *Lives* of Robespierre (1850) and of Goethe (1855), *Seaside Studies* (1858), *Physiology of Common Life* (1860), *Studies in Animal Life* (1861), and *Aristotle, a Chapter from the History of Science* (1864), besides one or two novels and dramas of minor importance. Since 1854 he has been largely engaged in physiological and anatomical researches, some of the results of which were embodied in papers communicated to the British Association for the Advancement of Science—*On the Spinal Cord as a Centre of Sensation and Volition* (1858), and *On the Nervous System* (1859). In 1865 he founded the *Fortnightly Review,* but in Dec., 1866, was compelled by ill-health to retire from its editorship. His most ambitious work, that in which he purposes to embody his whole system of philosophy, bears the title *Problems of Life and Mind.* Vol. i., *The Foundation of a Creed,* was published in 1873; vol. ii. in 1875.

Lewes (Marian Evans), wife of George H. Lewes, and known by the *nom-de-plume* of George Eliot, b. in Warwickshire, England, about 1820, was the daughter of a poor curate, but was adopted by a wealthy clergyman, who gave her a careful education. On leaving the academy she became a pupil of Herbert Spencer, since become famous as a philosopher, and under his training acquired great breadth of mental development, learning German, French, and Italian, studying music and art as well as metaphysics and logic. Her earliest literary effort was a translation of Strauss's *Life of Jesus* (1846), followed in 1854 by Feuerbach's *Essence of Christianity*. As associate editor of the *Westminster Review* she soon became acquainted with the leading representatives of the school of Bentham and J. S. Mill, with which she may be classified. As a novelist her first work was *Scenes of Clerical Life* (1858), originally published in *Blackwood*. In 1859 *Adam Bede* proved a brilliant success, and her reputation was maintained by *The Mill on the Floss* (1860), *Silas Marner* (1861), *Romola* (1863), *Felix Holt* (1866), and *Middlemarch* (1871–72), the last of which is considered one of the greatest novels of the century. As a poet she has published *The Spanish Gypsy* (1868), *Agatha* (1869), and *The Legend of Jubal* (1874), which would have sufficed to establish a poetical reputation of an unknown writer, but have scarcely added to the fame of the great novelist. Her skill as a painter of strongly marked types of character is marvellous.

Lewes and Rehoboth, hundred of Sussex co., Del. Pop. 2128.

Lew'in (Thomas), F. S. A., b. at Ifield, Sussex, England; educated at the Merchant Tailors' School, London, and at Trinity College, Oxford, taking high honors in classics; was admitted to the bar in 1833, and in 1853 became conveyancing counsel to the court of chancery. He has written a treatise on *The Law of Trusts* (1842), *The Life and Epistles of St. Paul* (1851), an *Essay on the Chronology of the New Testament* (1854), *Jerusalem, a Sketch of the City and Temple from the Earliest Times to the Siege by Titus* (1861), *Cæsar's Invasion of Britain* (1862), *Siege of Jerusalem by Titus* (1863), and *Fasti Sacri, or a Key to the Chronology of the New Testament* (1865). In the work on Cæsar's invasion he questioned the correctness of the received theories as to the landing-place of that conqueror, and was involved in a controversy on the subject with Dr. Airy, the astronomer-royal, which led to a new survey by the admiralty of the tides in the British Channel near Dover. For more than twenty years after the publication of his early work on St. Paul, Mr. Lewin was engaged in the study of the apostle's missionary journeys, visiting in person through a series of years nearly every place named in the New Testament in connection with Paul, collecting the geographical data of antiquity, and illustrating his materials by accurate modern plans of the localities in question. As the result, a revised edition of his work on St. Paul appeared in 1874 in two large volumes, splendidly illustrated. Mr. Lewin's views upon the sacred localities in Jerusalem, especially the site of the temple, have given rise to much controversy in connection with the rival theories of Robinson, Williams, and Fergusson.

Lew'is, or **Lew'isson** [said to have been invented by Louis XIV., though known long before his time], a simple and effective clamp by which to raise blocks of stone. Three iron keys, suspended from a cross-bolt, are let into a fish-tail-shaped hole in the stone. The three keys together fill this hole, and the stone can be lifted by means of the cross-bolt, which is attached to a crane. When the stone is in place the bolt is withdrawn, the middle key, which is straight, is slipped out, and the lateral wedge-shaped keys are then readily removed. There is also an apparatus called the lewis used for shearing cloth.

Lewis, county of N. E. Kentucky, bounded N. by the Ohio River. It is a hilly but fertile limestone region. Area, 400 square miles. Corn is the largest agricultural product. Cap. Vanceburg. Pop. 9115.

Lewis, county of N. E. Missouri, bounded E. by the Mississippi River. Area, 500 square miles. It is rolling and fertile, abounding in timber, coal, and limestone. Cattle, grain, and wool are staple products. It is traversed by the Quincy Missouri and Pacific and the Mississippi Valley and Western R. Rs. Cap. Monticello. Pop. 15,114.

Lewis, county of N. New York. Area, 1288 square miles. The county is traversed by Black River, the valley of which is very fertile, but the E. portion and a part of the W. are chiefly wilderness, covered by forests. Cattle, grain, wool, hay, butter, and cheese are extensively produced. Lumber, carriages, leather, cooperage, saddlery, paper, paper-pulp, hemlock extract, and wooden wares are leading articles of manufacture; but dairying is the principal industry of the county, which is traversed by the Utica and Black River R. R. Cap. Lowville. Pop. 28,699.

Lewis, county of W. Middle Tennessee. Area, 420 square miles. It is uneven and generally fertile, but is not extensively settled. Indian corn is the chief product. Cap. Newburg. Pop. 1986.

Lewis, county of Washington Territory, extending W. from the Cascade Range. Area, 1820 square miles. The W. part is level and fertile. The E. abounds in forests and is broken by mountain-ranges. The county is traversed by the Northern Pacific R. R. Grain is the staple product. Cap. Claquato. Pop. 888.

Lewis, county of N. Central West Virginia. Area, 530 square miles. It is hilly and rolling. The soil is uniformly fertile. Tobacco, live-stock, wool, and corn are the chief staples. Grazing is extensively followed. Coal and iron abound. The county is traversed by the W. fork of the Monongahela River. Cap. Weston. Pop. 10,175.

Lewis, tp. of Coosa co., Ala. Pop. 367.

Lewis, tp. of Clay co., Ind. Pop. 1220.

Lewis, post-v. of Cass tp., Cass co., Ia. Pop. 400.

Lewis, tp. of Holt co., Mo. Pop. 4081.

Lewis, post-tp. of Essex co., N. Y., in the Adirondack region, has beds of iron ore and a mineral spring. Pop. 1724.

Lewis, tp. (P. O. West Leyden) in Lewis co., N. Y., is largely covered with forests, and has 5 churches. Pop. 1252.

Lewis, tp. of Brown co., O. Pop. 2817.

Lewis, tp. of Lycoming co., Pa. Pop. 963.

Lewis, tp. of Northumberland co., Pa. Pop. 1228.

Lewis, tp. of Union co., Pa. Pop. 1007.

Lewis, tp. of Mason co., West Va. Pop. 1364.

Lewis (Gen. Andrew), b. in Ulster co., Ireland, about 1730; was brought to Virginia in 1732 by his father, who settled at Bellefonte, Augusta co., and was the first white resident of that county. Andrew was a volunteer in the campaign to the Ohio in 1754; was a major in Braddock's expedition, and present at the great defeat on the Monongahela (July, 1755); commanded the Sandy Creek expedition in 1756; was taken prisoner by the French in 1758 near Fort Duquesne, and taken to Montreal; was the Virginian commissioner in the treaty made with the Iroquois at Fort Stanwix in 1768; was made brigadier-general in 1774, and commanded the Virginia troops in the victory over the Shawnee confederacy at Point Pleasant at the mouth of the Great Kanawha River, Oct. 10, 1774, probably the severest engagement with the Indians recorded in American annals up to that time. He was for several years a member of the house of burgesses, took part in the convention of 1775, was appointed a brigadier-general by Congress at Washington's request in 1776, and was engaged in military operations against Lord Dunmore. He resigned his commission on account of ill-health in 1777, and d. in Bedford co., Va., in 1780. Gen. Lewis was distinguished for athletic powers and an imposing presence, and was highly esteemed by Washington. His statue occupies one of the pedestals around the Washington monument at Richmond. He had four brothers who are mentioned in Virginian annals: Samuel, who commanded a company at Braddock's defeat; Thomas (1718–90), who advocated Patrick Henry's resolutions in the house of burgesses in 1765, was a member of the State conventions of 1775 and 1776, and of that for the ratification of the Federal Constitution; William (1724–1811), who served under his brother in the French and Indian war, and was colonel in the Revolution; and Charles, b. in Virginia, who also became colonel, and was killed at the battle of Point Pleasant, Oct. 10, 1774.

Lewis (Dio), M. D., b. at Auburn, N. Y., Mar. 3, 1823; studied at the Harvard Medical School in Boston, and practised for a time at Port Byron, N. Y., and at Buffalo, where he published a monthly medical magazine, in which he inculcated the importance of gymnastics as a necessary part of a good education, and proposed to replace the use of drugs by diet and exercise. He founded at Boston in 1863 an institution for training teachers, and established in the following year at Lexington, Mass., an academy for young ladies. In Sept., 1868, the institute at Lexington was destroyed by fire, and Dr. Lewis then engaged in medical practice in Boston. Has published *The New Gymnastics* (1862), *Weak Lungs, and How to Make them Strong* (1863), *Talks about People's Stomachs* (1870), *Our Girls* (1871), and *Chats with Young Women* (1874).

Lewis (Dixon Hall), b. in Dinwiddie co., Va., Aug. 10, 1802; removed in youth to Hancock co., Ga.; was educated at Mount Zion Academy and South Carolina College; removed before 1823 to Autauga co., Ala.; entered public life when twenty-three years old, and at once took a leading position as a State Rights man; was in Congress 1829–44; U. S. Senator 1844–48. D. in New York Oct. 25, 1848. Mr. Lewis was excessively corpulent, weighing 450 pounds,

but possessed no small degree of physical activity. He was an able supporter of extreme State Rights views.

Lewis (Ellis), M. D., LL.D., b. at Lewisberry, York co., Pa., May 16, 1798; was a printer in his youth, and in 1822 came to the bar; in 1824 was deputy attorney-general of Pennsylvania, attorney-general in 1833, held various judgeships in the district and supreme courts of Pennsylvania, became in 1854 chief-justice of the latter court, and in 1857 was rechosen. His skill in medical jurisprudence won for him the honorary degree of M. D. In 1858 he was appointed a commissioner to revise the criminal code of the State. He wrote *Abridgment of the Criminal Law of the U. S.* D. in Philadelphia Mar. 19, 1871.

Lewis (Estella Anna Robinson), b. near Baltimore, Md., Apr., 1824; was educated at Mrs. Willard's seminary at Troy; married in 1841, Sidney D. Lewis, Esq., of Brooklyn, since deceased, and has resided chiefly in Europe. She published the volume of poems entitled *The Record of the Heart* in 1844, *The Child of the Sea* in 1848, *The Myths of the Minstrel* in 1852, and *Helemah*, a tragedy, in 1863. A collection of her poems was issued in the U. S. in 1858 and in England in 1866. She has since published the tragedies *Sappho of Lesbos* (1868), *The King's Stratagem* (1869), and a series of letters upon European topics addressed to American journals over the signature *Stella.*

Lewis (Francis), one of the signers of the Declaration of Independence, b. at Llandaff, Wales, in Mar., 1713, and educated at Westminster; became a merchant of New York, and in 1757 was on the staff of Gen. Mercer, and was captured at Oswego and sent to France; received a grant of 5000 acres from the British; was 1775–79 a member of Congress, and was afterwards exceedingly useful to the country, especially as an importer of military stores. His wife and himself were long imprisoned by the enemy, and the greater part of his estates was destroyed. D. in New York Dec. 30, 1803.

Lewis (Sir George Cornewall), Bart., b. in Radnorshire, England, Oct., 1806; graduated with high honors at Oxford, in 1828; came to the bar in 1831 at the Middle Temple; entered Parliament in 1847; was an under-secretary of state 1848; secretary of the treasury 1850–52; chancellor of the exchequer 1855–58; became secretary of state for the home department 1859, for war 1861, and was one of the translators of Müller's *History and Antiquities of the Doric Race* (1830); author of *Origin of Romance Languages* (1835), *Influence of Authority in Matters of Opinion* (1849), *Methods of Observation and Reasoning in Politics* (1852), *Inquiry into the Credibility of Early Roman History* (1855); editor of the *Edinburgh Review* (1854–55), wrote *Astronomy of the Ancients* (1861), *A Dialogue on the Best Form of Government* (1863). He also translated a part of Müller's *History of the Literature of Ancient Greece.* D. in Herefordshire Apr. 13, 1863.

Lewis (John Frederick), R. A., b. in London, England, July 14, 1805; first attracted attention by a series of studies from wild animals which were engraved by himself; was next engaged in making sketches of manners and costumes in Spain, of which lithographic copies were published in 1833–34 in 2 vols.; resided on the Continent, chiefly in Italy, from 1838 to 1851, making long visits to Greece, Turkey, and Egypt; exhibited in 1853 a series of 64 copies in water-colors of the most famous pictures of the Venetian and Spanish schools, which collection was purchased by the Scottish Academy; was president of the Society of Water Colors from 1855 to 1858; elected associate in 1859, and member of the Royal Academy in 1865.

Lewis (John Travers), LL.D., D. D., b. June 20, 1825, at Cork, Ireland; graduated in 1846 at Trinity College, Dublin; was appointed curate of Newtown Butts in 1848; went as missionary to Hawkesbury in Canada in 1850; became rector of Brockville in 1855; was nominated bishop of Ontario in 1862, and is the author of several articles for periodicals.

Lewis (Matthew Gregory), "Monk Lewis," b. in London, England, July 9, 1775; was educated at Oxford and in Germany. His famous romance, *The Monk* (1795), was in its original form so obscene that he was obliged to suppress the first edition, but in its amended form it had an immense popularity. He fell heir to great West Indian estates, and exerted himself to improve the condition of his slaves; was the literary associate of Sir Walter Scott, author of many tales, plays, and poems, mostly full of supernatural horrors, and, except *The Monk,* mostly forgotten. The *Journal of a West Indian Proprietor* (1834) is one of his best books. Lewis was a man of amiable and benevolent character. D. at sea May 14, 1818.

Lewis (Meriwether), b. near Charlottesville, Va., Aug. 18, 1774, the son of W. F. Lewis, a wealthy citizen; volunteered in the "Whisky Insurrection" of 1794; became an ensign in the regular army 1795, and captain in 1800. Soon afterwards he was Jefferson's private secretary, and in 1803–06 he, with Capt. William Clarke, was sent upon a famous expedition to the Pacific Ocean. In 1807, Lewis was made governor of Louisiana Territory. He was habitually subject to depression of spirits, and in one of his hours of melancholy took his own life, near Nashville, Tenn., Oct. 11, 1809. (His memoir was written by Mr. Jefferson, and published with Biddle and Allen's *Narrative of the Lewis and Clarke Expedition,* 1814.)

Lewis (Gen. Morgan), b. in New York City Oct. 16, 1754, son of Francis Lewis; graduated at Princeton in 1773; studied law in the office of John Jay; joined Washington's army at Cambridge in June, 1775; was made captain of a rifle company in Aug., major of 2d New York regiment in Nov., colonel and chief of staff to Gen. Gates in June, 1776; was at the battle of Saratoga, and was distinguished in Gen. Clinton's campaign against Sir John Johnson in the Mohawk Valley, especially at the battle of Stone Arabia. After the war he was admitted to the bar in Dutchess co., became a judge of common pleas, was elected attorney-general in 1791, made judge of the supreme court of the State in 1792, and chief-justice in 1801. He was governor of New York 1805–06; member of the legislature 1808–11; quartermaster-general, with the rank of brigadier-general, in 1812; promoted to major-general in 1813; was engaged in the operations on the Niagara frontier in Apr., 1813, and was in command of the defences of New York City in 1814. He subsequently devoted himself to literature and agriculture, delivered an address before the authorities of New York City on the centenary anniversary of Washington's birth, Feb. 22, 1832; was president of the New York Historical Society in 1835, and d. in New York Apr. 7, 1844.

Lewis (Tayler), LL.D., L. H. D., b. at Northumberland, Saratoga co., N. Y., Mar. 27, 1802; graduated at Union College in 1820; studied law at Albany, and began to practise at Fort Miller, but relinquished this pursuit, and devoted himself exclusively to the study of the classical languages and literatures of Hebrew, Syriac, and Arabic, became professor in Greek at the University of New York in 1838, and at Union College in 1849. Besides several translations and numerous articles in periodicals, he wrote *The Six Days of Creation* (1855), *The Bible and Science* (1856), *The Divine Human in the Scriptures* (1860), and, together with E. W. Blyden and Theodore Dwight, *The People of Africa, their Character, Condition, and Future Prospects* (1871).

Lewis (Winslow), b. in Boston, Mass., July 8, 1799; graduate of Harvard University in 1819; proceeded to Europe, and pursued his medical studies under Dupuytren in Paris, and in London under Dr. Abernethy; returning to Boston, at once took a leading position in the profession, and succeeded Dr. Warren as consulting physician of the Massachusetts General Hospital; was also city physician of Boston 1861; repeatedly chosen to the State legislature; was president of the N. E. Historical and Genealogical Society 1861–66; and a prominent member of the order of Freemasons, of which he was for many years grand master of Massachusetts. D. at Boston Aug. 3, 1875.

Lewis and Clarke, county of W. Central Montana. Area, 2819 square miles. It is bounded E. by the Missouri River and N. by the Medicine River. It has good grazing and farm land, producing butter and grain. Gold quartz-mining is the principal industry. Cap. Helena. Pop. 5040, largely increased since the census.

Lew'isberry, post-b. of Newberry tp., York co., Pa., 12 miles S. of Harrisburg. Pop. 268.

Lew'isborough, post-tp. of Westchester co., N. Y., on the Connecticut line. Pop. 1601.

Lew'isburg, post-v. of Faulkner co., Ark., on the Arkansas River, 50 miles above Little Rock, has 2 churches, 2 schools, 3 hotels, a carriage and wagon factory, etc. Pop. 239. E. B. Henry, Ed. "Western Empire."

Lewisburg, tp. of Montgomery co., Kan. Pop. 827.

Lewisburg, a v. of Mason co., Ky., on the Maysville and Lexington R. R. Pop. 151.

Lewisburg, a v. of St. Tammany parish, La., on the N. shore of Lake Pontchartrain. Pop. 110.

Lewisburg, a v. of Champaign co., O. Pop. 733.

Lewisburg, post-v. of Harrison tp., Preble co., O. Pop. 391.

Lewisburg, post-b., cap. of Union co., Pa., on the W. branch of the Susquehanna River, opposite the Lewisburg junction on the Philadelphia and Erie R. R., 68 miles N. of Harrisburg, has 7 churches, 2 banks, 2 weekly newspapers, 2 extensive manufactories of agricultural im-

plements, a large and well-appointed boat-yard, a woollen factory, and iron-works. It is the seat of a university and an academy. Large quantities of grain are annually shipped from this point. A railroad connects it with Tyrone. Pop. 3121. J. R. CORNELIUS, ED. "CHRONICLE."

Lewisburg, post-v. and cap. of Marshall co., Tenn., 50 miles S. of Nashville and 21 miles W. of Shelbyville, on the Duck River Valley R. R., has 14 business-houses, 4 churches, 1 weekly newspaper, 1 hotel, a male and female institute, a plough and a shoe factory, and other industries. Pop. 322. G. WYTHE EWING, ED. "GAZETTE."

Lewisburg, post-v. and tp., cap. of Greenbrier co., West Va., on the line of the James River and Kanawha turnpike, 4 miles from the Chesapeake and Ohio R. R., and 9 miles from the Greenbrier White Sulphur Springs, has 5 churches, 1 bank, 1 weekly newspaper, 3 public and several private schools, and 10 stores. Is in a fine blue-grass country. Pop. 875. B. F. HARLOW, ED. "INDEPENDENT."

Lewis Creek, tp. of Washington co., Ala. Pop. 1250.

Lewis Fork, tp. of Wilkes co., N. C. Pop. 1062.

Lewis Fork, the southern branch of the Columbia River, in Idaho Territory, called also Shoshone, Snake, and Saptin or Sahaptin River. (See SHOSHONE.)

Lewis'ia, a plant of the *Portulaca* family, named from its discoverer, Capt. Meriwether Lewis, who found it in the mountains about the sources of the Columbia River. It is found as far S. as Arizona. The root is called *racine amère* by the Canadian voyageurs, and is used for food by the Oregon Indians, who call it *spatlum.* It yields abundance of starch.

Lew'isport, post-v. of Hancock co., Ky., on the Ohio River, 8 miles above Rockport, Ind. Pop. 308.

Lew'iston, post-v. of Trinity co., Cal., on Trinity River, in a gold-mining region among lofty mountains, 14 miles N. E. of Weaverville. Pop. 338.

Lewiston, post-v. and cap. of Nez Percé co., Id., at the junction of the Snake and Clearwater rivers and head of steamboat navigation, 90 miles from Walla-Walla, Wash. Ter. It was formerly the capital of Idaho. It has 1 weekly newspaper.

Lewiston, city of Androscoggin co., Me., 30 miles E. of Portland, situated on the Maine Central R. R. and on Androscoggin River at one of the most powerful waterfalls in New England; is largely engaged in the manufacture of cotton and woollen fabrics; has 13 churches, 1 daily and 2 weekly newspapers, 2 national and 3 savings banks, Bates College (Free Baptist) and theological school, fine school system with costly edifices, a public library, and an elegant city building with one of the largest public halls in New England. In the park in the centre of the city is a soldiers' monument surmounted by a bronze statue by Simmons. There are 10 cotton-mills, with 242,548 spindles, and 5 woollen-mills, with $7,750,000 invested, which manufactured by water-power in 1873, 35,000,000 yards of cotton and woollen goods, valued at $11,500,000. The river here falls 50 feet over a ledge of rocks, and the surrounding scenery is highly picturesque. Lewiston is now (1875) the second city of the State in population, having largely increased since 1870, when the number was 13,600. F. L. DINGLEY, ED. "EVENING JOURNAL."

Lewiston, post-v. of Winona co., Minn., on the Winona and St. Peter R. R., 19 miles by rail W. of Winona.

Lewiston, post-v. and tp. of Niagara co., N. Y., on the Niagara River, opposite Queenston, Canada, is the N. terminus of the Buffalo and Niagara Falls R. R., and is at the head of navigation from Lake Ontario. It has 4 churches, and was formerly connected with Queenston by a suspension bridge. It is partly occupied by the Tuscarora Indians. Lewiston is the seat of the seminary of Our Lady of the Angels. Pop. of v. 770; of tp. 2959.

Lewiston, tp. of Lunenburg co., Va. Pop. 1805.

Lewiston, post-tp. of Columbia co., Wis. Pop. 1031.

Lew'istown, post-v. and tp., cap. of Fulton co., Ill., on the Lewistown branch of the Chicago Burlington and Quincy R. R., 60 miles N. W. of Springfield, has 1 national bank, 1 weekly newspaper, 2 hotels, carriage, wagon, woollen, plough, spoke, and hub factories, flouring and saw mills, and a number of stores and shops. Pop. of tp. 2952. W. T. DAVIDSON, ED. "FULTON DEMOCRAT."

Lewistown, post-b., cap. of Mifflin co., Pa., on the Juniata River and Canal, 61 miles W. of Harrisburg, is on the main line of the Pennsylvania R. R., and terminus of two of its branches, has 7 churches, 7 hotels, 3 banks, 3 weekly newspapers, an academy, a fine public school building, 2 flouring-mills, 2 furnaces; Mann's axe-factories, Logan's steel-works, and Logan's trout-ponds are located in the vicinity. Grain, iron, and coal are largely shipped. The surrounding mountain-scenery is surpassingly grand, attracting numerous visitors during the summer months. Pop. 2737. FRYSINGER BROS., PUBS. "GAZETTE."

Lew'isville, post-v., cap. of La Fayette co., Ark., 19 miles S. E. of Fulton.

Lewisville, post-v. of Franklin tp., Henry co., Ind., on the Columbus Chicago and Indiana Central R. R. Pop. 416.

Lewisville, post-tp. of Forsyth co., N. C. Pop. 816.

Lewisville, post-v. of Summit tp., Monroe co., O. Pop. 124.

Lewisville, a b. (ULYSSES P. O.) of Ulysses tp., Potter co., Pa. Pop. 226.

Lewisville, tp. of Chester co., S. C. Pop. 2507.

Lewis-with-Harris, the largest and northernmost of the Outer Hebrides, separated from the mainland by the Minsh Channel, comprises an area of 770 square miles, with 23,666 inhabitants. The coasts, especially of the southern part, Harris, are wild and rugged; in the interior tracts of swamp and peat-moor occur. Barley and potatoes are cultivated, but fishing is the principal occupation. The inhabitants speak the Gaelic language, though in the northern part there is a colony of purely Scandinavian descent. Stornoway, situated on the eastern coast, is the only town of the island. Remains of Druidical structures are very frequent, and remnants of forests which formerly covered the surface are everywhere met with.

Lex Domicilii. See DOMICILE, INTERNATIONAL LAW, PRIVATE.

Lex Fo'ri [Lat., the "law of the forum"], the law of the place or state where a remedy is sought or action instituted. It is a well-established legal doctrine that the forms of remedies, the modes of procedure in the conduct of suits, and the execution of judgments are to be regulated exclusively by the laws of the place where the action is brought. This rule is applied in determining what parties are legally entitled to maintain and defend actions, what form of action should be brought, and what kind of process may be employed in securing the enforcement of a claim. For instance, a written instrument having a scrawl instead of a regular seal would be considered in some States as a sealed and in others as an unsealed instrument, and the appropriate form of action might therefore vary in different States, being governed by the *lex fori.* · Arrest and imprisonment might not be allowable upon a certain claim by the law of the place where the contract was made (*lex loci contractus*), but might be adopted as a mode of legal process if permitted by the law of the State in which the action was instituted. The defence of set-off (see SET-OFF) or of discharge under insolvent laws (see INSOLVENCY) is also governed by the *lex fori.* The same is true of defences under the statute of frauds (see FRAUDS, STATUTE OF) or under the statute of limitations (see LIMITATIONS, STATUTE OF). All suits must be brought within the period prescribed by the law of the country where the suit is brought, or they will be barred. (See LEX LOCI, LEX REI SITÆ.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lex'icon, Dictionary, Thesaurus, Vocabulary, Glossary. The first two of these words are the etymological equivalents of each other, the Greek λέξις, the source of the one, corresponding in signification to the Latin *dictio,* the parent of the other. Λέξις and *dictio,* though sometimes used in the sense of *word,* both mean rather a phrase, a *manière de dire,* or at least a special use of a term, than an ordinary single vocable, and the explanation of such phrases was the original office of lexicons or dictionaries. The titles "lexicon" and "dictionary" are of comparatively modern origin, because, though there were explanatory lists of the λέξεις or *dictiones* of particular Greek and Latin authors, true dictionaries or collective vocabularies of the whole verbal stock of particular languages hardly existed in the classic ages. There is no well-established distinction of use or meaning between the two words, though "lexicon" is perhaps more frequently applied than "dictionary" to the larger word-books of the Hebrew, Greek, Arabic, Sanskrit, and other dead or unfamiliar languages. In present usage a lexicon or dictionary, in its complete normal form, is a general list of the authorized words, phrases, and idiomatic expressions occurring in the literature of a given language, with indications of the pronunciation, the etymology, and the history of each word, with equivalents, definitions, or explanations in the same or in another tongue, and with exemplifications of the actual use of the words in combination with others, and illustrations of peculiarities in their grammatical relations. Many dictionaries, both for greater clearness and for saving space, now introduce engravings of material objects in cases where verbal descriptions would necessarily be unintelligible or prolix. This is a real improvement, and the objections which have

been urged against it have generally their foundation in pure lexicographical pedantry.

A *thesaurus* is also a general explanatory word-list, but professedly more copious than ordinary dictionaries, and provided with more of citation and discussion in illustration and support of the definitions ascribed by it to the words which compose it. In English this term is not often applied to dictionaries of modern languages, however voluminous and complete.

A *vocabulary* is an expository catalogue of words, but in English use it commonly comprises only technical or professional terms occurring in a particular author or in a given art or science, though it is also applied to partial lists of words collected from little-known tongues. We employ "vocabulary," too, as the equivalent of the German *Wortvorrath*, or "word-stock," implying not a list of words, but the entire verbal wealth of a given language as displayed in its literature or speech. This use of this word is hardly authorized in the Romance languages, and they often apply the term "vocabulary" to copious general dictionaries.

A *glossary* is a work of a lexical character, but commonly restricted to obsolete, provincial, obscure, or technical words. It may embrace only such as are employed by a particular author or class of authors, or it may aim to comprise all the antiquated or professional words of a language, or those occurring only in a particular stage or period of it. In continental lexicography, "glossary" is generally confined to explanatory lists of obsolete words, or of words employed in senses different from classical or from modern usage, and is not often applied to collections of words of art.

But, after all, the common usage, even of lexicographers, does not always accurately discriminate between any two of these words, and our definitions must accordingly be taken with some latitude.

The order of the words in lexical lists is usually alphabetical, but in certain languages an etymological arrangement is preferred. Even here, however, the radical forms under which derivative words are grouped commonly follow the alphabet. In some alphabetical dictionaries the alphabet itself does not conform to the ordinary modern A B C sequence, but the letters are arranged according to their phonological affinities. There are also word-books in which a classification according to primary signification, without reference to real or supposed radical forms, has been adopted. Dictionaries of these classes require for convenient use, and are often provided with, an alphabetical index. The Spanish and English dictionary of Fernandez is remarkable as having the words of the two languages under a single alphabet. Besides general lexicons, whether of words or of science, literature, or art (see DICTIONARY), modern philology has given birth to numerous new classes of word-books. Thus, almost all the principal living languages have dictionaries of their dialects, and even America, remarkable as it is for substantial uniformity of speech, whether in its Hispanic or in its Anglo-Saxon districts, has furnished important contributions to English dialectology in Bartlett's *Dictionary of Americanisms* (2d ed., Boston, 1859) and in other kindred glossaries. There are also dictionaries of pronunciation, of prosody, and of rhymes; of etymology; of idiomatic and conventional phrases; of grammatical difficulties; of synonyms and of rhetorical analogues or equivalents; and in the essentially homogeneous languages, as German, of foreign words which have been more or less completely naturalized and adopted.

All dictionaries, even those of science and art, are essentially word-books, for the knowledge of words is the knowledge of things, inasmuch as the full comprehension of the nomenclature of a given science implies the mastery of the science itself. No lexicon or other list of the words of a living language, or of the terminology of a progressive knowledge, can ever be complete, for new words are formed and introduced faster than lexicographers can collect them, and the hourly discoveries of science are hourly demanding the coinage of fresh terms to enunciate them. A certain time must elapse before the claims of a new word to the rights of citizenship, whether in literature or in art, can be established and recognized; and besides, no scholar or body of scholars, no student or association of students of nature, can keep pace with the swift advance of human intellectual culture and attainment, or with the rapid multiplication of the words in which new ideas require to clothe themselves. Dictionaries, whatever their range or purpose, are at best but imperfect digests, and, like the digests of legal adjudications, are never to be cited as *authorities*. The exemplified use of the words by rabbis in literature or in science is the authority. Hence, the real test of a lexicon is the multitude of its judiciously selected citations. In this lay the crowning excellence of Dr. Johnson's *English Dictionary*, and the destruction of the 40,000 exemplifications which he sacrificed to save space is one of the greatest losses that English literature has sustained.

All literature, especially poetry and jurisprudence, inclines to archaic forms of expression, and its diction is in other respects less readily intelligible than that of ordinary conversation. Hence, explanatory lists of peculiar vocables and verbal combinations, first, no doubt, in the form of marginal glosses, must have been almost coeval with the birth of written literature itself. These glosses, gradually collected into separate volumes, were the earliest lexicons. Rudimentary dictionaries have been found stamped even on the bricks of Assyria, and more or less complete lexical collections existed at a very remote period in all the cultivated nations of the East, as well as in Greece. The Greek lexicon of Hesychius, of the fourth century, is said to be the oldest European general dictionary extant. Incomplete as were the ancient dictionaries, they have been of extreme value to scholars, for the very reason that, being designed exclusively for the elucidation of rare words or obscure verbal combinations, the space and labor requisite for cataloguing and explaining familiar expressions of every-day life have been spared, and the compilers have consequently been able to be more full and thorough in the exposition of really difficult words and phrases. Hence, we are indebted to such word-lists for our knowledge of the force of many ἅπαξ λεγομένα, or "once-used words," technical terms, and the like, which without them would have remained quite unintelligible. And this is equally true of the more primitive word-books of modern languages. Palsgrave, Florio, Cotgrave, and still older vocabularies answer many questions in English philology of which we have no other solution.

It does not appear that the Greeks and Latins had bilingual lexicons, or dictionaries explaining their word-list in another tongue. Instruction in foreign languages was oral, as, in fact, it continued to be, substantially, in modern Europe until the seventeenth century. The pupil in general had little or no self-help, and his teacher was his dictionary. Modern dictionaries of the learned languages, indeed, existed at an earlier period, but Stephens and the other great lexicographers of the sixteenth century labored for advanced scholars, not for tyros; and this explains why not only Greek and Latin dictionaries had their explanations in the latter language, but why even the old English and German word-books employed the same universal medium for defining obscure words of the vernaculars. Notwithstanding the immense importance which the rapidly increasing study of foreign languages has given to dictionaries of this class, the principles of bilingual lexicography, at least in regard to modern languages, do not appear to have ever been well considered and discussed, and consequently there are few bilingual dictionaries of living languages which have any pretensions to philological merit. Hilpert's German-English dictionary may be said to have been good for its time, and the same remark may be applied to Fleming and Tibbin's French and English dictionary, but the latest editions of both are far behind the demands and the possibilities of the age. Of other bilingual general dictionaries of living languages, the only three known to the writer which can be pronounced even tolerable are the late edition of Kramer's Dutch and French dictionary, the German and French dictionary of Sachs, and the Icelandic and English dictionary of Cleasby and Sigfusson, which, with great compression and economy of space, are all truly excellent.

The material form and construction, scarcely less than the literary execution, of lexicons is a matter of very great importance, especially in an age whose habits of study oblige every scholar to unshelve and reshelve dictionaries twenty times in a day. The principles of convenience in this respect are almost universally sadly neglected by lexicographers and compilers of encyclopædias and other books of reference. We are acquainted with no satisfactory essay on this subject, and for want of a better we refer to a series of criticisms on the form, composition, and statistics of Webster's and other dictionaries by the writer of the present article in the New York *Nation* for 1865. (For a list of important lexical works see our article DICTIONARY; and we may notice, as of recent publication or now in progress, the following additional general dictionaries: of Sanskrit, that of Böhtlingk and Roth, just finished at St. Petersburg; Sander's German Dictionary, very full, but arranged on bad principles, very badly carried out; Tommaseo's very voluminous Italian Dictionary, now advanced to letter *S;* Lane's great Arabic Lexicon, rather more than half issued; and two new editions of Facciolati and Forcellini's Latin Dictionary, at Prato and at Padua.)

GEORGE P. MARSH.

Lex'ington, county of Central South Carolina. Area, 700 square miles. It is hilly, with a good soil. It is bounded on the N. E. by the Congaree River. Live-stock, rice, corn,

and cotton are leading products. Flour is the chief article of manufacture. It is traversed by the Columbia and Augusta R. R. Cap. Lexington Court-house. Pop. 12,988.

Lexington, tp. of Dallas co., Ala. Pop. 650.

Lexington, tp. of Lauderdale co., Ala. Pop. 1236.

Lexington, post-v., cap. of Oglethorpe co., Ga., near the Athens branch of the Georgia R. R. (CRAWFORD STATION).

Lexington, post-v. and tp. of McLean co., Ill., on the Chicago and Alton R. R., 100 miles S. of Chicago and 15 W. of Bloomington, has 6 churches, 2 banks, 2 weekly newspapers, 1 hotel, a public graded school, lodges of Patrons of Husbandry, and a good trade, dealing largely in stock and farm products. Pop. 2404. ED. "ENTERPRISE."

Lexington, post-v., cap. of Scott co., Ind., on the Lexington branch of the Ohio and Mississippi R. R. Pop. of v. 440; of tp. 2529.

Lexington, tp. of Johnson co., Kan., on the Kansas River and the St. Louis Lawrence and Western R. R., on which is De Soto Station. Pop. 1256.

Lexington, city, cap. of Fayette co., Ky., on a branch of the Elkhorn River, 65 miles S. E. of Louisville and 20 miles S. E. of Frankfort, on the Louisville Cincinnati and Lexington and the Kentucky Central R. Rs., has 18 churches, 1 State and 3 national banks, 1 daily, 4 weekly, and 2 semi-weekly newspapers, 7 free schools, 2 private Catholic schools, 5 denominational female seminaries, a library company owning 16,000 volumes, a State insane asylum, an orphan asylum, carriage, bagging, and rope factories, and a large trade sustained by the resources of the fertile and beautiful surrounding country. The city is regularly laid out at right angles, is well built, well paved and lighted, and the streets are bordered with shade trees. Founded by Col. Robert Patterson in May, 1775, the town received its name in commemoration of the battle of Lexington fought the preceding month. It was incorporated in 1782, was for a time the State capital, and soon became the principal seat of wealth and culture W. of the Alleghanies, and celebrated as the home of several eminent men, chief of whom was Henry Clay, to whose memory a monument has been erected in the beautiful cemetery. Transylvania University, the oldest college in the Western States, was founded here in 1798, and had law and medical departments. The Kentucky State University, chartered in 1858, and opened at Harrodsburg in 1859, was removed to Lexington in 1865, and Transylvania University was combined with it. The new institution had in 1872, 21 professors, 9 other officers, 579 students, and 20,000 volumes in its libraries. Pop. 14,801.

Lexington, post-tp. of Somerset co., Me., 24 miles N. W. of Norridgewock. Pop. 397.

Lexington, post-v. and tp. of Middlesex co., Mass., 11 miles N. W. of Boston, on the Boston Lowell and Nashua R. R. (Lexington branch), has 5 churches, 1 savings bank, 1 weekly newspaper, a fine high school, and a public library with 3500 volumes. There are no manufactures, the principal business being farming, dairying, and market-gardening. It was settled in 1642 under the name of "Cambridge Farms," and probably received its name from Lexington (Laxington or Laxton), Nottinghamshire, England, of which place Francis Whitmore, an early settler, was a native. Memorable as the spot where the first blood was shed in the Revolutionary struggle, this historic town possesses many mementoes of that period. A modest granite monument upon the village green tells its story of life sacrificed for principle, while a beautiful memorial-hall is eloquent with tablets and statues of John Hancock, Samuel Adams, the minute-man of 1775 and the soldier of 1861. The two former were inaugurated at the centennial celebration of the battle of Lexington, Apr. 19, 1775, an occasion which was brilliantly successful in the many thousands of visitors attracted from all parts of the Union, including the national and State executives, and elicited eloquent orations and genuine poetry. Lexington is the native place of Theodore Parker, whose grandfather, Capt. John Parker, commanded the company of minute-men fired upon by the British troops in 1775. Pop. of tp. 2277. (See the excellent *History of Lexington,* published in 1868 by Hon. Charles Hudson.)

On the evening of the 18th of April, Gen. Gage despatched a force of 800 men, under Lieut.-Col. Smith, to Concord for the purpose of destroying the military stores there collected, and in anticipation had picketed the roads leading from Boston to prevent the news of the intended expedition from spreading. The capture of Hancock and Adams, who were at Lexington, was also contemplated. But in these excited times everybody was on the alert, and the first movement of the enemy was at once made known by preconcerted signals, and Paul Revere, rowing across to the Charlestown shore, mounted his horse and rode swiftly away towards Lexington, arousing each household as he went; the bells of the village churches now rang out the alarm; signal-guns were fired and other messengers were arousing the country. By midnight Paul Revere had arrived at Lexington and given the alarm; the militia at once assembled on the village green, but there being no signs of the enemy, they were dismissed to await their coming, after a number of men had been sent out towards Boston to report the approach of the British. It was about $4\frac{1}{2}$ in the morning when Major Pitcairn, with six companies, who had surprised and captured all the outposts, arrived within a mile or two of Lexington. A general alarm was now sounded, and the militia to the number of 60 or 70, under command of Capt. John Parker, were drawn up in line upon the green. Pitcairn, moving rapidly forward with his men, himself rode up and ordered the militia to surrender and disperse. The militia, however, held their ground, and after firing a volley over their heads without effect, a second fire was poured into the American line, which killed eight and wounded ten of the little band. Capt. Parker, seeing that further resistance would result in the certain destruction of all hands, ordered his men to disperse, which they did, some discharging their muskets at the British as they retired, inflicting, however, but little injury upon the enemy (three of the regulars were wounded and Pitcairn's horse struck), who now pressed on to Concord, six miles beyond, whence Revere, continuing his ride with Ebenezer Dow and Dr. Samuel Prescott, had hastened to spread the alarm. Revere and Dow were captured by a British patrol; Prescott, however, barely escaping, succeeded in reaching Concord. The Lexington men rallied after the departure of the regulars, and followed on to Concord, and in the retreat of the British which followed the battle at Concord bridge, joined in the pursuit, which only terminated on the arrival of the regulars at Charlestown Neck, under the guns of their shipping. In this pursuit three more of the Lexington militia were killed. During a visit in 1852 of Kossuth to "the birthplace of American liberty," he said of the fallen heroes of that day: "It is their sacrificed blood with which is written the preface of your nation's history. Their death was, and ever will be, the first bloody revelation of America's destiny, and Lexington the opening scene of a revolution that is destined to change the character of human governments and the condition of the human race." In 1799 a small monument was erected upon the spot where began the contest of the Revolution.

FRANK E. WETHERELL, ED. "MINUTE-MAN."

Lexington, post-v. and tp., cap. of Sanilac co., Mich., is a port of entry on Lake Huron, 20 miles N. of Port Huron, has 5 churches, 4 hotels, 1 weekly newspaper, a flouring-mill, 1 woollen and 2 furniture factories, and a number of stores and shops. Pop. of v. about 1000; of tp. 2433. C. S. NIMS, ED. "JEFFERSONIAN."

Lexington, post-tp. of Le Sueur co., Minn. Pop. 507.

Lexington, post-v., cap. of Holmes co., Miss., situated equidistant between the Yazoo River and the Mississippi Central R. R., has 4 churches, 1 weekly newspaper, 1 hotel, 2 schools, and a number of stores and shops. Pop. 744. HOSKINS & WILLIAMS, PUBS. "ADVERTISER."

Lexington, city, tp., and cap. of La Fayette co., Mo., on the S. bank of the Missouri River and the Missouri Pacific R. R. (Sedalia branch), 250 miles W. of St. Louis (370 by the river) and 40 miles E. of the Kansas line; is situated on a high bluff 300 feet above the river. The terminus of the St. Joseph and Lexington R. R. is at North Lexington, on the opposite bank of the river, where also the St. Louis Kansas City and Northern R. R. passes along the river-bottom. The city has 10 churches, 4 banks, 4 weekly newspapers (1 German), 3 female seminaries, and excellent public schools, and is the centre of the hemp-growing region. Immense strata of coal, reputed the best in the State, underlie the whole county, and furnish the leading article of commerce. Lexington was settled in 1837; it is healthy, and enjoys substantial commercial prosperity. In Sept., 1861, a Union force of about 2800 men, under Col. James Mulligan, occupied the hill on the N. E. of Lexington, which naturally strong position was fortified and held against a Confederate force of some 25,000 men, under Gen. Sterling Price; the siege terminating on the 20th in the surrender of the town and garrison. Major Frank J. White retook the town Oct. 16, capturing 60 or 70 prisoners, and releasing such of Mulligan's force as were found there. Again, in Oct., 1864, the army of Gen. Price here attacked Gen. Blunt, who after a two hours' resistance withdrew. Pop. of city 4373; of tp. 6336.

MARK L. DE MOTTE, ED. "REGISTER."

Lexington, post-tp. of Greene co., N. Y., among the Catskill Mountains, has 3 churches, and contains a natural ice-cave. Pop. 1371.

Lexington, post-v. and tp., cap. of Davidson co., N. C., on the North Carolina R. R. Pop. of v. 475; of tp. 2289.

Lexington, post-v. of Richland co., O., on the Baltimore and Ohio R. R. (Lake Erie div.). Pop. 482.

Lexington, tp. of Stark co., O. It contains the city of ALLIANCE (which see). Pop. 5700.

Lexington, tp. of Lexington co., S. C. It contains the county-seat, LEXINGTON COURT-HOUSE (which see). Pop. 1563.

Lexington, post-v. and cap. of Henderson co., Tenn., an inland town, 30 miles E. of Jackson, has 2 churches, 2 hotels, 1 weekly newspaper, and an academy. It was located in 1821, was seriously damaged during the war, but is now being rapidly rebuilt. Pop. about 300.

L. M. FORD, ED. "REPORTER."

Lexington, post-v. of Burleson co., Tex. Pop. 157.

Lexington, post-v. and tp., cap. of Rockbridge co., Va., situated in the "Valley of Virginia," on the N. branch of James River, 35 miles N. N. W. of Lynchburg, has 7 churches, 3 hotels, 1 weekly and 1 semi-monthly newspaper, 1 bank, a public library, a foundry, flouring-mills, and a number of business-houses. It has unlimited water-power, and is the head of canal navigation on the James River and Kanawha Canal, and on the line of the Valley R. R. The celebrated Natural Bridge and the picturesque Peaks of Otter are in the immediate vicinity. Washington College was founded here in 1798 by George Washington, and the Virginia Military Institute (the West Point of the South) established in 1839. The former was reorganized after the civil war as Washington and Lee University, under the presidency of Gen. Robert E. Lee, who resided here until his death. It now has over 20 instructors, nearly 300 students, and a library of 10,000 volumes, while the Military Institute has 12 professors, 300 students, and a library of 5000 volumes. It receives an annual appropriation from the State, which appoints a certain number of cadets. Stonewall Jackson was a professor at this institute, and, like Gen. Lee, is buried here. Pop. of v. 2873; of tp. 3948.

BARCLAY & CO., PUBS. "GAZETTE."

Lexington Court-house, post-v. of Lexington tp., cap. of Lexington co., S. C., on the Charlotte Columbia and Augusta R. R., 12 miles W. of Columbia, has 3 churches, 1 weekly newspaper, several schools, 2 hotels, an excellent water-power, supplying 4 flouring-mills, and manufactories of cotton-yarn and furniture. It is a noted place for summer resort; famous also for its fruits. Pop. in 1874 about 450. G. M. HARMAN, PUB. "DISPATCH."

Lex Lo'ci [Lat., the "law of the place"], a phrase used in law as a common abbreviation for the more complete expression *lex loci contractus*, the "law of the place of a contract." It is a general principle of private international law that the validity, interpretation, and obligatory force of personal contracts are to be determined by the law of the place where the contract is made, if that is also the place where, by the stipulations of the parties, the agreement is to be performed. But if a different place of performance is agreed upon, this is deemed the place of the contract, the law of which is to be followed in its construction, the determination of the rights acquired under it, and the duties and obligations which it imposes. The rule may be briefly stated, that a contract valid by the law of the place where it is made or is to be performed is valid everywhere, and if void by such law is void everywhere. This rule, however, is not without important exceptions, for a contract may be valid in one country which would not be enforcible in another, on account of its being considered in the latter as injurious to public morals or welfare, or in contravention of public policy or some positive law. There is no binding obligation resting upon any state to give force and effect to contracts made in other states; and though this is generally done, it depends entirely upon international comity, which will not be extended so far as to operate disadvantageously to the interests or public institutions of the state in which the contract is sought to be enforced. The capacity of the parties to contract, as determined by minority, coverture, guardianship, and other causes of personal disability, is also, as a general rule in English and American law, governed by the *lex loci contractus*. The place where the contract is made is that in which the assent of the parties first concurs and becomes complete. For instance, if a proposition be made by a person in one place to a person in another, and an assent to the offer be deposited in the mail addressed to the first party, the contract is generally deemed to be fully made at the time and place of mailing the answer. The *lex loci* also governs as to the formalities and modes of authentication necessary in the execution of contracts. (See INTERNATIONAL LAW, PRIVATE; LEX FORI; LEX REI SITÆ; Story on the *Conflict of Laws;* Westlake's *Private International Law.*) GEORGE CHASE. REVISED BY T. W. DWIGHT.

Lex Re'i Si'tæ [Lat., the "law of the place of the situation of a thing"]. The transfer of real estate, the tenure by which it may be held, and all contracts or acts in regard to its management, enjoyment, or disposition, are governed by the law of the place where such property is situated. It is only in reference to real property that this invariable rule prevails. The ownership, management, and conveyance of personal property are governed in some cases by the law of the place where the owner is domiciled (see DOMICILE), in other cases by the law of the place where contracts in regard to it are made or are to be performed (see LEX LOCI). These laws may be either those of the state or country where the personal estate is situated, or those of some other state. The capacity of persons to take or transfer real estate is also determined by the *lex rei sitæ*. If, for instance, aliens are prohibited by the laws of a country from holding lands, they can obtain no valid title to real property situated therein, whatever may be the law of the place of their domicile. The formalities to be observed and the modes of conveyance to be employed must be those which the local law prescribes. Thus, it is a general rule at common law that a seal is required to an instrument conveying an interest in lands, and therefore a deed executed without a seal in a country where this was not required would be held invalid as a conveyance of land in a state where the common-law rule prevailed. The *lex rei sitæ* further determines the interest in real property which may be transferred. If this law provides that an owner of land shall not alienate more than a certain portion by devise or any other specified method, no larger interest can be transferred, although the instrument of conveyance be executed in a foreign country. The law of the place of situation governs not only real property of a corporeal nature, as land, but also that which is incorporeal, as servitudes, easements, rents, etc. (See INTERNATIONAL LAW, PRIVATE; LEX LOCI; LEX FORI.)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Ley'den [anc. *Lugdunum Batavorum;* Fr. *Leyde*], an important city of the Netherlands, in the province of South Holland, on the Old Rhine, 6 miles from its outlet in the North Sea. It is intersected by canals, kept exceedingly clean, well built, with straight and broad streets; its Breede straat is considered one of the finest streets in Europe. Thus, although the former splendor of the city is almost entirely lost, there is not the least indication of decay. It was once a strong fortress, and the siege which it sustained from the Spaniards in 1573–74 made it famous. For seven weeks there was no bread within the walls, but the burghers still resisted, though the hunger became almost unbearable. At last the prince of Orange came to their rescue. The dikes were opened, and the waters, which drowned a great number of the besiegers, carried a fleet of 200 boats loaded with provisions to the city. Now the bastions are covered with windmills, and the citadel and the towers transformed into storehouses. As a reward for the valor the city evinced during the siege the prince of Orange founded a university here, and it soon became one of the most celebrated institutions of learning in Europe, adorned with such names as those of Scaliger, Gomar, Arminius, Grotius, and Descartes. An immense trade in books developed at the same time, and its Elzevir editions are world-renowned. Now, the university, although an institution of good reputation, has but 500 students, and the city only 5 printing-offices. In the seventeenth and eighteenth centuries Leyden was one of the cloth-manufacturing centres of the world. It had 100,000 inhabitants, and its broadcloths commanded the highest prices at any fair. Now, it has only 39,121 inhabitants, and only half a score of factories, employing about 1000 hands. Yet, although retiring from the bustle of life, Leyden shows no signs of decay; it seems only to rest and prepare itself for any new chance which may come up. The great painters, Metzu, Mieris, Dow, and Rembrandt were born here. The Pilgrim Fathers who left England for Amsterdam in 1608 remained in Leyden from 1609 till their departure for America in 1620.

Leyden, post-tp. of Cook co., Ill., 10 miles N. W. of Chicago. Pop. 1437.

Leyden, post-tp. of Franklin co., Mass., 9 miles N. of Greenfield. Leyden Glen is a place much visited for its romantic scenery. Pop. 518.

Leyden, post-tp. of Lewis co., N. Y., on the Utica and Black River R. R., has stone-quarries and various manufacturing interests, and contains several villages. Pop. 2048.

Leyden (JOHN), b. in Denholm, Roxburghshire, Scotland, Sept. 8, 1775; studied at Edinburgh University; was ordained in 1798, but soon abandoned the clerical for the medical profession, and in 1802 obtained an appointment as assistant surgeon in India. He first resided at Madras; studied the Oriental languages, and removing to Calcutta, became professor of Hindostanee in Fort William College. He afterwards became a judge and assay-master at the

mint. He accompanied the English expedition against Java, and d. at Batavia Aug. 21, 1811. Among other works he wrote a *Historical Account of Discoveries and Travels in Africa* and an *Essay on the Languages and Literature of the Indo-Chinese Nations*, in vol. x. of *Asiatic Researches;* also *Poems and Ballads*, published after his death. The centennial of his birth was in 1875 celebrated in Scotland.

Leyden (LUCAS VAN; real name LUCAS JACOBEZ), b. at Leyden, Netherlands, in 1494; was a contemporary and friend of Albert Dürer. His genius was precocious and original. Under the tuition of Engelbrechtsen he made such progress that at the age of twelve he was already distinguished. He painted in oil, distemper, and on glass, and excelled in history, portrait, and landscape. His pictures are rare, and fine impressions of his prints are scarce and costly. His most important picture is a *Last Judgment* in the town-house at Leyden; the *Card-Players*, the *Virgin and Child* in the Munich Gallery, the *Portrait of the Emperor Maximilian* in the Belvidere at Vienna, and the *Descent from the Cross* in the church formerly of the Jesuits in Paris are remarkable. As an engraver he held rank with Dürer and Marc Antonio. His *Eulenspiegel* is said to be the rarest of all prints. Lucas exerted a powerful influence on the artists who came after him, by deciding them to take fresh subjects and treat them naturally. His industry was great, for in spite of the brevity and dissipation of his life upwards of 100 paintings and 174 prints are ascribed to him. D. in 1533. O. B. FROTHINGHAM.

Leys (JOHN AUGUST HENRY), b. at Antwerp Feb. 18, 1815; was destined for the Church, but at the age of fifteen entered the studio of Brakeleer, his brother-in-law; exhibited in 1833 a picture that excited remark, *Combat of a Grenadier with a Cossack;* travelled and studied in France and Holland, and on his return till his death, Aug. 26, 1869, lived in his native city. The artist took the subjects for his canvases from the history of his own country and the life of the Middle Ages, and painted with the fidelity and feeling of one who describes what he thoroughly knows and is imbued with the spirit of what he depicts. His work has the solid reality of truth and the earnest glow of natural feeling. Few of his pieces have come to the U. S. His chief works, such of them as were not painted for his rich patron, M. Couteau, were executed, it is said, for public places in Belgium. Three pictures which he sent to the Exposition in Paris of 1855 obtained for him one of the grand medals of honor. To the Exposition of 1867 he sent eleven pieces, and was again honored by a medal. In 1846 he was decorated with the order of Leopold; in 1851 raised to the rank of officer; in 1867 made commander of the order, and promoted to the dignity of officer in the Legion of Honor. He had already been created a baron by Leopold I. and elected a member of the Royal Academy of Belgium. O. B. FROTHINGHAM.

L'Hôpital, de (MICHEL), b. at Aigueperse, in the present department of Puy de Dôme, about 1504; studied jurisprudence at Padua; was sent by the French court in 1547 to the Council of Trent, which had just removed to Bologna; became in 1554 president of the court of accounts, and in 1560 chancellor of France. By his ability and integrity he gained the respect of all parties, but the policy of moderation by which he endeavored to pacify the tumultuous state of the popular mind made him many enemies, and several of his measures, by which he prevented the establishment of the Inquisition in France and authorized the free exercise of Protestant worship, as well as the circumstance that his family became Protestant, made him suspected in the eyes of the Catholic party. In 1568 he resigned his office and retired to his estate at Bellebat, in the present department of Seine-et-Oise, where he d. Mar. 13, 1573. His *Œuvres*, containing Latin poems, speeches, and memoirs, were published in 1824 at Paris in 4 vols., and his poems separately in 1827.

Lia'na [Fr. *liane*], a name (usually found in the plural) applied to the climbing and twining woody plants which, in some tropical countries (as Brazil), entwine themselves among forest trees, often rendering great areas of land quite impenetrable. They belong to a great number of different natural orders. Some are of very great size, and by their constriction and weight they often kill the trees which support them.

Li'as, The, a group of strata occurring in Western Europe and belonging to the Jurassic period. The word was originally a local term, a corruption, it is said, of "layers," in allusion to the thin bedded limestones that in its lower portion alternate with marls. It is divisible into two natural groups, the older of which combines the strata that are known as the Lower and Middle Lias. The Lower Lias rests below on the Keuper, and commences by limestones, which we find giving place as we ascend the series to bluish marls. Where the entire series is well developed we find the blue marls succeeded by gray marls (of the Middle Lias); these become micaceous, and finally arenaceous, passing above into the "Middle Lias Sands," which in turn are capped by a highly ferruginous and sometimes arenaceous limestone known as the "Marlstone." Succeeding to the Marlstone we find a similar series of strata recurring—namely, the "Upper Lias Limestone," the "Upper Lias Clay," and the "Upper Lias Sands," which are capped by the inferior Oolite limestone of the next formation. To the palæontologist the Lias is classical ground; in both Germany and England it has yielded hundreds of perfectly preserved skeletons of saurians (*Ichthyosauri, Plesiosauri, Teleosauri, Scelidosaurus*) and of *Pterodactyls;* from 70 to 100 species of fish, often most beautifully preserved; and a host of Mollusca (970 species are recorded from the English Lias alone), amongst which Ammonites, Belemnites, and Brachiopods are especially abundant. Pentacrinites abounded in the Liassic waters, Crustaceans and Echinoderms left their remains more sparingly, and corals were not so abundantly represented as in some other secondary formations. We may on the whole, however, safely affirm that the fossils of the Lias give us the most complete representation that we have yet found of any extinct fauna. The most characteristic forms of the Lower Lias are *Gryphæa incurva, Lima gigantea*, and Ammonites of the group *Arietes;* of the Middle Lias, Ammonites of the group *Amalthei;* and of the Upper Lias, Ammonites of the group *Falciferi;* the vertebrate remains are met with most commonly in the limestones of the Lower Lias and the marls immediately over them, and again in the Upper Lias limestone. The Marlstone of Yorkshire, England, has of late years proved to be one of the most valuable sources of iron ore. This Cleveland Ironstone, as it is termed, is an argillaceous carbonate of iron, yielding on an average about 30 per cent. of iron. According to Ansted, it extends over a district of some hundreds of square miles, in a stratum, generally Oolitic in structure, sixteen feet in thickness, and from which are annually obtained 1,000,000 tons of ore. EDWARD C. H. DAY.

Liba'nius, b. at Antioch in 314 or 316, and d. there shortly after 391, in the reign of Arcadius; studied at Athens, and mentions Cleobulus, Didymus, and Zenobius as his teachers, but acquired his education principally by private study of the old Greek writers, whom he often imitated with success, and for whom he always showed great enthusiasm. He first set up a private school of rhetoric at Constantinople, and his teachings conquered the attention of the students so absolutely that the schools of the official teachers were deserted. These now brought an accusation of magic against him, and by the aid of the prefect, Limenius, a personal enemy of Libanius, they succeeded in getting him expelled from the city, about 346. He went to Nicomedia, where he taught with equal success for five years, but when recalled to Constantinople he was rather coolly received, and, persecuted by the intrigues of his rivals and harassed by domestic troubles and ill-health, he gave up teaching and lived in retirement in his native city. He was vain and meddlesome in character, and the moderation of his views—his toleration, for instance, towards Christianity, though himself a pagan—was due, at least to some extent, to his being a rhetorician and not a philosopher; he cared more for the form than for the substance. But he was, nevertheless, a man of superior talent and of friendly disposition, and stood in intimate connection not only with Julian the Apostate, but also with St. Chrysostom and St. Basil. A considerable number of his writings are still extant. His orations, declamations, etc. have been published by Reiske (4 vols., Leipsic, 1791–97), and his letters, which are very interesting and of great value for the student of the history of that period, by I. C. Wolf (Amsterdam, 1738). There exist, however, still many letters by him, in manuscript and unpublished, at Madrid, Venice, and other places.

Liba'tion [Lat. *libare*, to "pour"], an offering of wine, milk, oil, or other fluid as a ceremony of divine worship. The Mosaic law required libations (drink-offerings) of wine, and similar practices were common among the pagans of antiquity. Libations were poured upon the hearth before meals in honor of the Roman Lares, and before sacrificiæ wine often was poured upon the victim's head, upon the altar, or upon the ground. Libations were often employed in the confirmation of public treaties with foreign states.

Li'bau, town of Russia, in the government of Courland, on the Baltic. It has a considerable shipbuilding interest and large trade in timber and corn. Its harbor freezes later than other harbors of the Baltic, and is earlier free of ice. Pop. 9090.

Li'bel [Lat. *libellus*, "little book," "pamphlet"]. The term "libel" has in legal usage two diverse significations.

As employed in one sense it denotes a particular mode of defamation of character, constituting an offence punishable at law, while in another application it denotes one of the pleadings employed in proceedings in courts of admiralty.

I. Libel as denoting defamation of character, and considered as the basis of a civil action, may be defined as a malicious publication in printing, writing, signs, or pictures imputing to another something which has a tendency to injure his reputation, to disgrace or to degrade him in society, or to hold him up to hatred, contempt, or ridicule. As distinguished from the offence of slander, which is defamatory matter addressed to the ear, libel is defamatory matter addressed to the eye. (See SLANDER.) Libel is moreover distinguished from slander in this respect—that it constitutes both a criminal offence and a civil injury, and is therefore punishable both by indictment and by a civil action for damages. Slander, on the other hand, is only a civil wrong, a violation of private rights, and is never indictable, the only available mode of redress being a private action. But while it is generally true that a libellous charge is both indictable and actionable, this is not invariably the case. There are certain forms of libel which constitute criminal offences, but which will not support an action for damages, inasmuch as they are not deemed in law to be in violation of individual rights. The definition of libel, therefore, which has just been given, and which describes it merely as an offence against the right of reputation, is not sufficiently comprehensive to include its full extent of meaning and application in its criminal aspect. All actionable libels are also indictable, but the converse of the proposition is not true that all indictable libels are also actionable. While the general definition, as above given, embraces modes of defamation or injury which are open to both forms of redress, those varieties of libel which are distinctively of a criminal character may more conveniently be classified and described separately. These are of three principal classes—libels which blacken the memory of the dead, libels upon the government, and obscene libels tending to corrupt the public morals. Of these, the first class is of the most importance. Publications reflecting upon the memory of one who is dead, vilifying him or tending to detract from his posthumous reputation, are regarded in law as likely to excite the animosity of his family, and provoke them to measures of retaliation or punishment, and thus to occasion violations of public peace and order. But only such criticism of the character or conduct of a deceased person is criminal as is made with malevolent purpose, with a design to degrade his memory. Fair and honest consideration of his actions, motives of conduct, and mode of life is allowable. Libels against the government consist of calumnious publications in denunciation or unwarrantable criticism of the established governmental system or in censure of methods of administration, provided the allegations are of such a nature that their natural tendency or evident purpose is to promote disaffection among the citizens or to excite a spirit of revolution. But indictments for libels of this kind are very rare, and would probably not be sustained at the present day except in very extreme cases, though the rules of the common law in most of the States probably remain unchanged. Obscene or immoral libels are such indecent or immodest publications as tend to destroy the love of purity, morality, and virtue, and corrupt the public morals. This form of libel is generally at the present day made the subject of express statutory provisions, whose object is to repress such pernicious publications, and punish those who issue them with severe penalties. It is, moreover, somewhat unusual now to designate such publications as libels, though they are so considered and classified at common law.

But the most common forms of libel are those which constitute both civil and criminal offences, and which affect the reputation of some living person. The theory of law, however, upon which libel is adjudged to be a criminal offence is essentially diverse from that upon which it is declared to be a civil or private injury and open to redress by an action for damages. It is regarded as a tort or private wrong, because it is a violation of the right of reputation which inheres in every individual. (See TORT.) But a crime is a public and not a private wrong—an offence against the community considered in its social aggregate capacity, instead of a violation of personal rights; and libel is adjudged to be a crime, not because it is an infringement upon the right of reputation, but because it tends to public detriment. Thus, libels against the government and obscene libels are indictable because in the one case the tendency is to weaken or destroy the allegiance of citizens to the state and foment intestine disorders, and in the other to occasion a pernicious laxity of morals. But libels which blacken the memory of the dead and those which injure the reputation of the living are indictable on account of their tendency to occasion breaches of the peace, by provoking the person defamed, or his relatives and friends if he be deceased, to punish the libeller. In former times it was viewed as a natural and probable consequence that the libeller would be challenged to fight a duel or would be assaulted; and upon this legal presumption the jurisdiction of criminal courts over this offence was based and still depends as a matter of principle, though the probability that acts of violence will be resorted to in a particular case is a wholly immaterial point.

A more definite and specific statement as to the point what charges against a person's reputation will be considered libellous than is comprised in the general definition already given is hardly practicable. Every form of malicious defamatory publication which is calculated to make a person appear ridiculous or contemptible is to be deemed a libel, and modes of casting derision and degrading imputations are of course infinitely various. It has been held, however, that mere terms of general abuse are not libellous, though the discrimination between charges that are libellous and those that are merely abusive is necessarily difficult. It has also been decided in some cases that charges of violation of etiquette, of good taste, or the rules of polite society are not actionable. As illustrations of charges which have been adjudged libellous the following may be referred to: Imputations of fraudulent or dishonest conduct; of committing any crime or of being guilty of any dishonorable practices; against a professional man of unfitness to practise his profession; of incontinency or unchastity; or assertions that a dealer's wares are adulterated, or that he knowingly sells bad articles, etc. It is not necessary that the charge should be expressed in the form of direct and positive assertion. An ironical mode of conveying an imputation will be sufficient. So a defamatory charge may be made by indirect allusion, by covert innuendo, or in the form of an interrogation. It is, moreover, not requisite that the person defamed should be mentioned by name in the libel, or should be referred to with such definiteness of description that all who saw the publication would know to whom it applied. It is enough if the designation be to such a degree specific that the natural and reasonable understanding of the charge would be, at least among some portion of those to whose knowledge it came, that a particular person was alluded to. Thus it has been held that a person whose name was indicated merely by asterisks, but who was otherwise sufficiently described, might maintain an action for libel. All persons who take part in the dissemination of the libel by republication are responsible to the same extent as the original libeller. It is no defence to one who circulates a charge of this kind that he was not himself the author of the imputation. Hence, publishers of newspapers are responsible for whatever statements of a libellous character appear in their columns, though these may be merely copied from some other paper or publication as matters of interest. This is true even though the name of the author be given in connection with the publication. So it is no excuse that a libellous publication is based upon a widely circulated rumor, even though this be generally credited and have a reasonable semblance of truth.

As regards the nature of the defamatory charges which will sustain an action by the party defamed, there is an important distinction between libel and slander. While every form of imputation calculated to bring a man into contempt will be adjudged libellous if written or printed, there are only certain kinds of defamatory charges which if circulated orally will be adjudged slanderous. These will be considered in the article on slander. (See SLANDER.) The reason for this distinction between the two species of defamation is that the wider circulation which charges are likely to receive, and their more permanent character, if written or printed, than if merely spoken, are calculated to render them more productive of injury to a person's reputation, and to make refutation particularly difficult. It follows as a natural result of this distinction that the author of a defamatory charge may be wholly relieved from legal accountability because he only circulated it by word of mouth, while another to whom he communicated it, and who published it and thus extended its circulation, will be liable to an action or prosecution for libel.

It is an essential element in libel that the defamatory charge be made with *malice*. But the word "malice" is used in this connection not in its popular but legal meaning. A legal distinction is made between malice in law and malice in fact. Malice in fact denotes actual malevolence, positive ill-will, spite, or animosity against some person to whom an injury is done; and this phrase has therefore much the same signification as the simple word "malice" in common acceptation. Malice in law, on the other hand, signifies that intent or disposition of mind from which proceed wrongful acts done intentionally, without just cause or excuse. This use of these phrases is not

confined to the law of libel, but appertains to various criminal and tortious acts. The malice which is a necessary ingredient in libel is not, except in special cases, malice in fact, but malice in law, and its existence is inferred from the defamatory nature of the imputation and the absence of legal justification. If, for example, one man traduces another in a published statement, and there are no attendant circumstances connected with the making of the charge to render it legal and justifiable, or, as it is technically termed, a "privileged communication," it will be malicious, and therefore libellous, whether the traducer knew the other or not, or whether he intended to do him an injury or not. As every man is presumed to intend the natural consequences of his acts, an intent is imputed to him in such a case which would reasonably be expected to accompany and occasion libellous accusations. Malice in such cases is a conclusion of law which the plaintiff is not required to prove, nor the defendant permitted to deny. Malice in fact need not be proved to exist in order to sustain an action for libel, but evidence to this effect may be given for the purpose of enhancing the damages. The presumption of malice will be made in all cases of trial for libel, except in regard to communications made under circumstances of privilege. As respects these the existence of actual malice must be established. The same principles prevail in regard to actions for slander. In criminal prosecutions for libel also the same general distinctions are maintained in relation to the subject of malice as in civil proceedings.

It is furthermore necessary that the defamatory charge be *published*. But the meaning attached to the term "publication" is somewhat diverse in the criminal and the civil law. This distinction depends upon the difference of theory which has been already referred to. As a civil action is maintainable because the plaintiff's reputation has been injured, the libel is said, in reference to this mode of redress, to be published only when it is communicated to some other person than the plaintiff himself. It will be sufficient if it be communicated to the plaintiff's wife, since for this purpose husband and wife are not regarded as one. But in criminal law it is held to be a sufficient publication if the charge be communicated simply to the party defamed, since in such a case it has a tendency to cause a breach of the peace in the same way as if brought to the notice of third persons. It has been held in a civil case sufficient publication to read defamatory charges contained in a letter or any written or printed document to a third person, even though he did not himself see the article.

The principal defences to an action or a prosecution for libel are (1) that the charge is a "privileged communication," and (2) justification. A communication or publication is said to be "privileged" when, though containing statements that would ordinarily be deemed libellous, it is yet held in law to be justifiable because made in the discharge of some public or private duty, legal, moral, or social, or in the protection of important interests, or in the furtherance of public welfare, etc. The peculiar circumstances under which the imputation is made are regarded as rebutting the presumption of malice which the law usually makes in cases of defamation of character, and afford in some cases a full, and in others a qualified, defence to the action or prosecution. When they afford a full defence, the publication is said to be absolutely priviieged; when they furnish only a qualified defence, the communication is conditionally privileged. In cases of the latter kind the action or prosecution will be sustainable if actual malice or malice in fact be proved to have actuated the defendant's conduct in making the charge. The existence of actual malice, being a question of fact, is to be determined by the jury upon the testimony adduced before them, and not by the court. If a publication is known to be false by the party making it, and sufficient evidence to this effect is given, actual malice is plainly and unquestionably inferable, and he loses the benefit of the privilege claimed. But if a publication be absolutely privileged, it cannot under any circumstances become the subject of legal proceedings for redress or punishment, whether civil or criminal. Proof of actual malice will not in such a case deprive the defamer of the privilege. There are two classes of communications which are absolutely privileged: (1) Proceedings in legislative assemblies in the regular transaction of public business, as the reports of members upon any subject, written speeches, etc.; (2) proceedings in judicial tribunals which are pertinent to any cause of which the court has jurisdiction. This rule is established in order that legislators, judges, counsel, jurors, witnesses, etc. may be fearless in the performance of their official duties, and active and diligent in ferreting out corruption, incompetence, and violation of law, undeterred by apprehensions of being harassed by legal proceedings. This privilege is usually secured to legislators by constitutional provisions. (See U. S. Constitution, Art. I. § 6, and State constitutions.) Other classes of privileged communications are conditional or qualified, the privilege being complete only when the charge is made *bona fide*, in full belief of its truth. A few instances of publications of this kind may be mentioned for the sake of illustration: Petitions to the legislature or proper public officer for the purpose of securing reforms in which the petitioners are particularly interested as citizens; communications by public officers acting in the discharge of a public duty; charges made by the officers or members of a religious organization or public or private association against a fellow-member in the course of the regular discipline of the body to which they belong; private confidential communications between relatives or friends to prevent anticipated injury to their special interests; communications between persons engaged in a common business enterprise in strict reference to their business affairs; statements concerning the character of servants made to those who intend to employ them; fair and honest reports of trials without defamatory comments; the publication of speeches and proceedings in legislative bodies. The privilege in these last two cases is sometimes made the subject of express statutory or constitutional provisions. So reviews of books or literary productions of any kind are privileged if the critic do not step aside from a consideration of the work to defame the author's private character. The same rule applies to criticisms upon works of art or of one journalist upon another. The same principles in regard to matters of privilege prevail in the law of slander as in the law of libel.

A "justification" is a plea in defence that the defamatory allegations are true, and therefore justifiable. But here, also, there is a difference between the rules of criminal and those of civil procedure in regard to this offence. It has always been a rule of law that in a civil action for libel a plea that the charge is true is a valid and effectual defence, since a man is entitled to no better reputation than his actual character would warrant. As the theory upon which the civil action is based allows the recovery of damages for the injury which the reputation of the party defamed has sustained, he is entitled to recover nothing if the injury is really attributable to his own misconduct. But in criminal procedure a different rule was adopted, and it even became a maxim at common law that "the greater the truth the greater the libel." This was on account of the principle that the criminality of a libel depended upon its tendency to cause a breach of the peace. The view was taken that a person defamed would be likely to be more incensed, and more inclined to retaliation, if the charge were true than if it were false, by reason of the great difficulty or impossibility of successfully refuting it. This rule has been modified in modern times by statute or constitutional provision, and it is usually the rule that the truth of the alleged libellous matter shall be a defence in a criminal prosecution if the publication be made with good motives and for justifiable ends. It is evident, however, that even with this change there is an important difference between civil and criminal proceedings upon this point. If "good motives and justifiable ends" be not proved in a trial upon indictment, the truth is not, as in a civil action, an effectual defence. It was a rule of common law that a justification must be as broad as the charge, and if the truth of the allegation were not substantially proved the plea was equivalent to a repetition of the libel, and in a civil action would aggravate the damages.

Libel considered as a crime was at common law a misdemeanor only, and not a felony (see CRIME, FELONY), and the statutes which have been generally enacted in this country defining the offence and declaring its punishment have usually left this rule unchanged. As respects civil actions for libel, the question as to the measure of damages which may be awarded becomes of much importance. (See MEASURE OF DAMAGES.) It may be shown by way of mitigation of damages that the plaintiff was a man of blemished or ruined character before the publication of the libel, so that he has sustained comparatively little injury; or that a full and unqualified retraction was subsequently made; or that the defendant was insane or intoxicated when the charge was made; or that he was provoked by previous libels of the plaintiff upon himself, etc. It was a rule of common law that facts tending to establish the truth of the charge were not to be used in mitigation of damages, but only by way of "justification." This rule has, however, been changed in a number of the States by statutes providing, in substance, that facts and circumstances which tend to prove the truth of the charge, but fail to amount to complete justification, may be given in evidence to reduce the damages. A defendant in these States is permitted to set up a plea of justification, together with a plea of mitigating circumstances, although the one plea affirms the truth of the charge and the other impliedly admits its falsity. This

rule, however, though not strictly logical, has been thought to be better adapted than the common-law doctrine to work substantial justice between the parties.

There is an important distinction between civil and criminal proceedings for libel as to the province of the jury in the construction of the alleged libellous charges. In a civil action, when the words of an alleged libel are unambiguous, the question whether the publication is actually a libel is to be determined by the court, and not by the jury. But if the words are of doubtful meaning, the question becomes one of fact for the decision of the jury. In respect to criminal prosecutions, there was at common law much uncertainty as to the proper function of the jury in this respect. It was held in England by a number of decisions of the court of king's bench that the court alone had power to determine whether the subject of the publication was or was not a libel, as in civil cases. But this rule was much controverted, and to reduce the matter to certainty a statute was passed giving power to the jury to render a general verdict of guilty or not guilty upon the whole matter in issue, and thus to determine questions both of law and of fact. Similar statutes or constitutional provisions have been adopted in a number of the States of this country. The construction of the alleged libel is thus made to devolve upon the jury, instead of upon the court. This is an anomalous provision in criminal law, and peculiar to prosecutions for this offence. It is a general rule in the interpretation and construction of libels that the language is to be understood in its natural and ordinary sense. If obscure and ambiguous language is used, or that which is figurative or ironical, its sense is to be gathered from the context and the facts and circumstances under which it was used. (See for general rules INTERPRETATION AND CONSTRUCTION. Consult on this general subject the works of Bishop, Wharton, Russell, and Chitty on *Criminal Law;* Townsend on *Libel and Slander;* Addison on *Torts;* Hilliard on *Torts;* Starkie on *Slander;* Heard on *Libel and Slander.*)

II. LIBEL in admiralty practice denotes the first pleading of the complainant in a suit, and contains a statement of his cause of action. In England the word is also applied to a similar pleading in the ecclesiastical courts. A libel in admiralty is not required to be drawn in any specific form. It should, however, be addressed to the proper judge, should state the names of the parties accurately, and should contain a clear and comprehensive statement (usually in propositions or "articles") of the facts upon which the libellant bases his suit. The libel should also include a prayer for relief. A libel answers to the declaration or complaint in a civil action. The plaintiff in an admiralty suit is termed the libellant, and the defendant the respondent. (See works on *Admiralty Practice.*)

GEORGE CHASE. REVISED BY T. W. DWIGHT.

Li'belt (KAROL), b. at Posen Apr. 8, 1807; studied philosophy and mathematics at Berlin, where he gained a prize for his essay *De Pantheismo,* and acquired the degree of Ph. D. in 1829; served in 1830 as an officer in the artillery, and distinguished himself in the battle of Ostrolenka and at the defence of Warsaw; retired after the failure of the revolution to his estates in Posen; founded in 1840 the successful periodicals *Tygodnik literacki* and *Rok,* to which the best Polish writers contributed; was arrested in 1846 for participation in the conspiracy of Mieroslawski, but liberated on the outbreak of the revolution at Berlin in 1848; took part afterwards in politics as member of the Slavic congress at Prague in 1849, and as leader of the Polish fraction in the second Prussian chamber in 1859; commenced the publication of his philosophical writings, the most prominent of which are *Filozofia i Krytyka* ("Philosophy and Criticism"), (5 vols., Posen, 1845–50), and *Estetyka* ("Æsthetics"), (3 vols., Posen, 1851); he also wrote a number of mathematical, economical, and agricultural essays and pamphlets. His philosophical works have been translated into German, and have attracted considerable attention as an individual development of the ideas of the German philosophy.

Li'ber, post-v. of Jay co., Ind.

Libe'ria, a republic on the western coast of Africa, founded in 1820 by the AMERICAN COLONIZATION SOCIETY (which see), and established as an independent state in 1847, is situated between 4° 20′ and 7° 20′ N. lat., and stretches along the Atlantic from the Sherboro River on the N. W. to the Pedro River on the S. E., a distance of about 600 miles, extending inland from the coast from 10 to 40 miles. Its area, which is steadily increased by purchases from the native tribes, was estimated in 1873 at 9700 square miles. The shore is elevated and rocky in the S. E., but otherwise low, generally sandy or gravelly, seldom marshy. In the interior the country rises, swelling into forest-covered hills and lofty mountain-ranges traversed by fine valleys. Many streams flow to the ocean, but none of them is navigable for more than 20 miles from the mouth; the most important are the St. Paul, navigable for 18 miles, and having 7 feet of water at low tide on the bar at its mouth; the St. John, the Junk, and the Cape Mount River. The climate is thoroughly tropical. Of the two seasons, the dry lasts from October to June, and the wet from June to October. In the dry season the average heat is 84° F., the thermometer seldom rising above 90° in the shade; in the wet season the average heat is 76°, the thermometer never falling below 60°. To the white man the climate is deadly—not from its excessive heat, but probably from miasmata; and even the negro, when born and reared in another climate, suffers on his arrival here from the so-called African fever. The natives, on the contrary, are robust, healthy, and long-lived. The soil is generally very fertile. The principal farming districts lie along the banks of the St. Paul. Here the sugar-cane grows luxuriantly; the produce of 1871 was estimated at 300,000 pounds. Cotton is indigenous, and yields two crops annually. Coffee of excellent quality is cultivated with success in the interior. The cereals, maize, rice, wheat, barley, and oats; the vegetables, cabbages, peas, beans, tomatoes, cucumbers, etc.; and the fruits, lemons, oranges, guavas, tamarinds, pomegranates, pineapples, African peaches, etc., are easily raised. The forests contain teak, mahogany, rosewood, hickory, poplar, several kinds of gum trees, dyewoods, medicinal shrubs, and different varieties of useful palms, among which is the nut-bearing palm, from which palm oil is made. Wild animals, the elephant, hippopotamus, crocodile, leopard, etc., are now nearly exterminated. Of minerals, iron abounds, and copper is said to occur in the interior. The inhabitants of the republic numbered, according to the latest estimates, about 720,000, of whom about 19,000 were Americo-Liberians, and the rest natives. The natives belong to different tribes: the Veys, mostly Mohammedans, among whom the Protestant Episcopal Church of the U. S. has established a mission school at Totocoreh; the Pessehs, entirely pagans; the Bassas, among whom the American Baptist missionaries established a mission in 1835; the Kroos, mostly idolaters; the Mandingos, the most gifted of the tribes under the jurisdiction of the republic; and others. The Americo-Liberians have a regular system of schools, and are progressing in all branches of civilization. Industrial processes and manufactures have been started among them, and a lively trade has sprung up between the republic and the U. S., Great Britain, Belgium, and Hamburg. Palm oil, sugar, cotton, coffee, ivory, camwood, arrowroot, etc. are exported; cotton goods, cutlery, powder, and tobacco are imported. The country is divided into four counties—Mesurado, Grand Bassa, Sinou, and Maryland. The capital, Monrovia, is situated on Cape Mesurado, and has about 13,000 inhabitants. Other settlements are New Georgia, Caldwell, Virginia, Edina, Greenville, Lexington, Buchanan, Millsburg, etc. The annual revenue is about $100,000, almost exclusively derived from custom-house duties. A public debt of $500,000 was contracted in 1871. The constitution of the republic is modelled after that of the U. S. All men are born free and equal. Elections take place by ballot, and every male citizen who possesses real estate has the right of suffrage. But no white man can be admitted to citizenship, and none but citizens can hold real estate in the republic (a temporary provision). The president is elected for two years; the senators for four; the representatives for two. Each county sends two senators to the legislative assembly, and one representative for every 10,000 inhabitants. The first president was Joseph Jenkins Roberts, who served four terms, from 1848 to 1856, and was once more elected in 1871. The official language is the English. (See Stockwell, *The Republic of Liberia, its Geography, Climate, Soil, and Productions, with a History of its early Settlement,* New York, 1868.)

Libe'rius, SAINT, a bishop of Rome, reckoned in the series of popes after Julius I., whom he succeeded May 22, 350. The Semi-Arians, countenanced by the emperor Constantius, were then in the ascendant, and in the councils of Arles (353) and Milan (355) they condemned the doctrine of Athanasius. Liberius, together with some other Western bishops, having refused to sign this condemnation, he was arrested by the emperor's order and taken to Milan, where Constantius endeavored to secure his obedience by personal solicitations. Finding him resolute in maintaining his previous attitude, Constantius declared Liberius deposed from the bishopric of Rome, banished him to Berea in Macedonia, and had Felix, a deacon, consecrated in his place. In 358, Liberius was restored to his post in consequence of a petition from the principal ladies of Rome. The Council of Ariminum (Rimini), convened in 359 for the settlement of doctrinal difficulties, at first followed the suggestions of Liberius by confirming the Nicene Creed and condemning Arius, but gave way to the influence of

Constantius, and finally accepted an Arian confession of faith proposed by him. Liberius has been falsely accused of having signed this confession, as well as of having purchased his recall from Berea by submission to the emperor's will as regarded Arianism. He built the basilica now called Santa Maria Maggiore. D. in 366, and was succeeded by Damasus I. His festival occurs in the Catholic calendar Aug. 27, and in the Greek Sept. 23.

Lib'erty [Lat. *libertas*, "freedom"], in the abstract, denotes the power of acting as you will (*postestas vivendi ut velis—Cicero*); but for a finite being this definition has to be modified into the power of acting as you will within the sphere of existence pertaining to the individual. It is assumed also that the will itself is free, in view of motives, to choose what appears to be the greater good before the less, or the less before the greater. For an infinite being the highest freedom coincides with the highest moral necessity; that is to say, there is one course, and one only, which his perfection of nature requires him to choose, and makes it certain that he will choose. And for a finite being, moral excellence, united with the greatest perfection of intellect pertaining to human nature, will make the best course of action certain within his sphere of existence.

Liberty in the sphere of the citizen cannot be understood without a correct idea of rights. Here we must refer to the articles JUSTICE and RIGHTS, and will only add that personal and civic liberty may pertain to a man, while in particular cases he renounces the exercise of it; in which case a man waives his right—that is, freely renounces what he was free to own, do, or enjoy. Liberty in this sphere consists in the power of freely exercising those rights which may be deduced from a true idea of the nature and destiny of man. The entire, or nearly entire, absence of such rights makes a man a slave. To be authorized to exercise some of them is imperfect liberty; to enjoy all of them is perfect liberty. Sometimes the liberty exists in a degree, although the individual would be injured if he were free to act as he chose. Such is the case with children, who have rights even against their parents, yet cannot, under wise law, exercise the rights of contract and of testament, because they would be in danger, if they did, of injuring themselves.

Political liberty implies a share in political power, and those restraints on a government and on individuals which are necessary for the protection of one and of all in the civil and political spheres. Such liberty consists in the right of voting, the right of holding office, in a great variety of institutions and of guaranties, and in certain free modes of action in concert with others, such as the rights of association, of discussing, petitioning, and remonstrating against public measures, of freedom of the press, and others. What may be called personal liberty and equality of individual rights may exist without equality of political rights. Thus, a man who cannot read, or who does not hold a certain amount of property or pay a certain house-rent, may have no right of suffrage or eligibility to office. So a woman, a male minor, a foreigner, may have no suffrage; a man over seventy may be incapable of holding a judicial office, or a man under thirty-five be ineligible to that of President of the U. S. All these last-mentioned disqualifications exist under our form of government. Have such persons, then, no complete political liberty? In the most exact use of terms we must deny that their status is equal to that of some others, although the disqualifications affect all, in each of the classes affected, alike. We do make a difference between *cives optimo jure* and *civis non optimo jure* (citizens enjoying the best right, and citizens enjoying a right that is not the best). But under free institutions these disqualifications are so few that the persons affected by them are in no danger of having their personal liberties invaded, especially as they are connected by close relations with others who have a somewhat greater share of political power. If, however, a larger part of a community was shut out of suffrage and the power to hold office, in order to keep power in the hands of another distinct part, the guaranties of personal rights would not be felt to be great enough, and the prohibited good would be much coveted, while yet not one of a thousand, perhaps, of such persons would under unlimited suffrage ever hold office. T. D. WOOLSEY.

Liberty, county of Florida, bounded E. by the Ocklockonnee and W. by the navigable Appalachicola River. Area, 650 square miles. It is sparsely settled, and is mostly employed as a cattle-range, but contains much good land. Cap. Bristol. Pop. 1050.

Liberty, county of E. Georgia. Area, 770 square miles. Its E. extremity reaches St. Catharine's Sound; its S. W. border is washed by the navigable Altamaha River. The surface is level, well timbered, and in part marshy. Rice, cotton, and corn are staple products. It is traversed by the Atlantic and Gulf R. R. Cap. Hinesville. Pop. 7688.

Liberty, county of S. E. Texas. Area, 1600 square miles. It is partly prairie and partly fine timber-land. The county is traversed by the Trinity River and the Texas and New Orleans R. R. Petroleum has been found and mineral springs are abundant. Live-stock and cotton are the chief products. Cap. Liberty. Pop. 4414.

Liberty, tp. of Carroll co., Ark. Pop. 253.

Liberty, tp. of Independence co., Ark. Pop. 455.

Liberty, post-tp. of Ouachita co., Ark. Pop. 908.

Liberty, tp. of Pope co., Ark. Pop. 741.

Liberty, tp. of St. Francis co., Ark. Pop. 273.

Liberty, tp. of Van Buren co., Ark. Pop. 295.

Liberty, tp. of White co., Ark. Pop. 368.

Liberty, tp. of Klamath co., Cal. Pop. 348.

Liberty, post-tp. of San Joaquin co., Cal. Pop. 1231.

Liberty, post-tp. of Adams co., Ill. Pop. 1623.

Liberty, tp. of Effingham co., Ill. Pop. 504.

Liberty, tp. of Crawford co., Ind. Pop. 757.

Liberty, tp. of Delaware co., Ind. Pop. 1639.

Liberty, tp. of Fulton co., Ind. Pop. 1429.

Liberty, tp. of Grant co., Ind. Pop. 1989.

Liberty, tp. of Hendricks co., Ind. Pop. 2478.

Liberty, tp. of Henry co., Ind. Pop. 1884.

Liberty, tp. of Howard co., Ind. Pop. 1697.

Liberty, tp. of Parke co., Ind. Pop. 1540.

Liberty, tp. of Porter co., Ind. Pop. 798.

Liberty, tp. of Shelby co., Ind. Pop. 1465.

Liberty, tp. of St. Joseph co., Ind. Pop. 1394.

Liberty, tp. of Tipton co., Ind. Pop. 1746.

Liberty, post-v. of Centre tp., cap. of Union co., Ind., on the Cincinnati Hamilton and Indianapolis R. R., near the E. fork of the Whitewater River, 50 miles N. W. of Cincinnati, O., and 70 miles S. E. of Indianapolis. It has 2 national banks, 2 large flouring mills, an agricultural implement manufactory, planing-mills and shops, 2 hotels, good schools, 4 churches, 1 weekly newspaper, a number of stores, etc. Principal business, farming and stock-raising. Pop. 700. C. W. STIVERS, ED. "HERALD."

Liberty, tp. of Union co., Ind. Pop. 763.

Liberty, tp. of Wabash co., Ind. Pop. 1816.

Liberty, tp. of Warren co., Ind. Pop. 1176.

Liberty, tp. of Wells co., Ind. Pop. 1097.

Liberty, tp. of White co., Ind. Pop. 888.

Liberty, tp. of Buchanan co., Ia. Pop. 1272.

Liberty, post-tp. of Clarke co., Ia. Pop. 778.

Liberty, tp. of Clinton co., Ia. Pop. 931.

Liberty, tp. of Dubuque co., Ia. Pop. 1102.

Liberty, tp. of Jefferson co., Ia. Pop. 1082.

Liberty, tp. of Johnson co., Ia. Pop. 640.

Liberty, tp. of Keokuk co., Ia. Pop. 1135.

Liberty, tp. of Lucas co., Ia. Pop. 600.

Liberty, tp. of Marion co., Ia. Pop. 1532.

Liberty, tp. of Marshall co., Ia. Pop. 709.

Liberty, tp. of Mitchell co., Ia. Pop. 173.

Liberty, tp. of O'Brien co., Ia. Pop. 715.

Liberty, tp. of Ringgold co., Ia. Pop. 243.

Liberty, tp. of Scott co., Ia. Pop. 1193.

Liberty, tp. of Warren co., Ia. Pop. 891.

Liberty, tp. of Wright co., Ia. Pop. 269.

Liberty, tp. of Howard co., Kan. Pop. 394.

Liberty, tp. of Labette co., Kan. Pop. 720.

Liberty, tp. of Linn co., Kan. Pop. 480.

Liberty, tp. of Woodson co., Kan. Pop. 363.

Liberty, post-v., cap. of Casey co., Ky., on the Louisville and Cincinnati R. R.

Liberty, post-tp. of Waldo co., Me., 16 miles W. of Belfast, has manufactures of leather, axes, pegs, handles, boots, shoes, wooden ware, furniture, and woollen and other goods. Pop. 907.

Liberty, post-v. and tp. of Frederick co., Md., 11 miles N. E. of Frederick, has 4 churches, 3 schools, 1 printing-office, 2 hotels, a lodge of Red Men and 1 of Good Templars, and stores, shops, etc. The principal business of the surrounding neighborhood is farming. Pop. 3281.

J. S. L. RODRICK, ED. "THE BANNER OF LIGHT."

Liberty, post-tp. of Jackson co., Mich. Pop. 1070.

Liberty, post-v., cap. of Amite co., Miss., has 5 churches, 2 newspapers, 3 hotels, 2 drug and several other stores. Principal business, cotton-planting. Pop. 560.
MISS P. W. FORSYTHE, ED. "ADVOCATE."

Liberty, tp. of Adair co., Mo. Pop. 854.

Liberty, tp. of Bollinger co., Mo. Pop. 1680.

Liberty, tp. of Callaway co., Mo. Pop. 1646.

Liberty, tp. of Cape Girardeau co., Mo. Pop. 870.

Liberty, post-v. and tp., cap. of Clay co., Mo., on the Hannibal and St. Joseph R. R. (Kansas branch), 16 miles S. of Holt, has 2 weekly newspapers and considerable trade. Pop. of v. 1700; of tp. 4831.

Liberty, tp. of Cole co., Mo. Pop. 901.

Liberty, tp. of Crawford co., Mo. Pop. 1071.

Liberty, tp. of Daviess co., Mo. Pop. 781.

Liberty, tp. of Grundy co., Mo. Pop. 1036.

Liberty, tp. of Iron co., Mo. Pop. 479.

Liberty, tp. of Macon co., Mo. Pop. 1210.

Liberty, tp. of Madison co., Mo. Pop. 480.

Liberty, tp. of Marion co., Mo., contains PALMYRA (which see). Pop. 3871.

Liberty, tp. of Phelps co., Mo. Pop. 470.

Liberty, tp. of Pulaski co., Mo. Pop. 893.

Liberty, tp. of Putnam co., Mo. Pop. 1174.

Liberty, tp. of Schuyler co., Mo. Pop. 1529.

Liberty, tp. of St. François co., Mo. Pop. 1405.

Liberty, tp. of Stoddard co., Mo. Pop. 1307.

Liberty, tp. of Sullivan co., Mo. Pop. 772.

Liberty, tp. of Washington co., Mo. Pop. 879.

Liberty, tp. of Cass co., Neb. Pop. 400.

Liberty, tp. of Gage co., Neb. Pop. 770.

Liberty, tp. of Richardson co., Neb. Pop. 506.

Liberty, post-v. and tp. of Sullivan co., N. Y., on the New York and Oswego Midland R. R. The township has an uneven surface, with two ponds, the chief industry being dairying and stock-raising. The village has 4 churches, 2 weekly newspapers, and a normal institute. There are 5 other post-offices within the township—Liberty Falls, Parksville, Red Brick, Robertsonville, and Stevensville. Pop. of v. about 500; of tp. 3389.

Liberty, tp. of Lincoln co., N. C. Pop. 1170.

Liberty, tp. of Nash co., N. C. Pop. 2860.

Liberty, tp. of Randolph co., N. C. Pop. 1009.

Liberty, tp. of Yadkin co., N. C. Pop. 1588.

Liberty, tp. of Adams co., O. Pop. 1377.

Liberty, tp. of Butler co., O. Pop. 1443.

Liberty, tp. of Clinton co., O. Pop. 1184.

Liberty, tp. of Crawford co., O. Pop. 1597.

Liberty, tp. of Delaware co., O. Pop. 1395.

Liberty, tp. of Fairfield co., O. Pop. 3000.

Liberty, a v. (Kimbolton P. O.) and tp. of Guernsey co., O., 9 miles N. of Cambridge. Pop. of v. 169; of tp. 1163.

Liberty, tp. of Hancock co., O. Pop. 1011.

Liberty, tp. of Hardin co., O. Pop. 2308.

Liberty, tp. of Henry co., O. Pop. 1766.

Liberty, tp. of Highland co., O., contains the village of Hillsborough. Pop. 5189.

Liberty, tp. of Jackson co., O. Pop. 1747.

Liberty, tp. of Knox co., O. Pop. 959.

Liberty, tp. of Licking co., O. Pop. 837.

Liberty, tp. of Logan co., O. Pop. 1624.

Liberty, tp. of Mercer co., O. Pop. 779.

Liberty, tp. of Putnam co., O. Pop. 1120.

Liberty, tp. of Ross co., O. Pop. 1460.

Liberty, tp. of Seneca co., O. Pop. 1668.

Liberty, tp. of Trumbull co., O. Pop. 2420.

Liberty, tp. of Union co., O. Pop. 1414.

Liberty, tp. of Van Wert co., O. Pop. 1174.

Liberty, tp. of Washington co., O. Pop. 1632.

Liberty, tp. of Wood co., O. Pop. 965.

Liberty, tp. of Adams co., Pa. Pop. 860.

Liberty, tp. of Bedford co., Pa. Pop. 806.

Liberty, tp. of Centre co., Pa. Pop. 1062.

Liberty, tp. of McKean co., Pa. Pop. 1093.

Liberty, tp. of Mercer co., Pa. Pop. 634.

Liberty, tp. of Montour co., Pa. Pop. 1229.

Liberty, tp. of Susquehanna co., Pa. Pop. 1030.

Liberty, post-tp. of Tioga co., Pa. Pop. 1379.

Liberty, tp. of Orangeburg co., S. C. Pop. 408.

Liberty, post-v., cap. of Liberty co., Tex. Pop. 458.

Liberty, post-v. and tp., cap. of Bedford co., Va., on the Atlantic Mississippi and Ohio R. R., 25 miles W. of Lynchburg, has 7 tobacco-factories, with 2 large additional ones in course of construction, 2 tobacco-warehouses, 2 banks, a school, 2 weekly newspapers, and 7 churches. The Peaks of Otter, 10 miles distant, rival the White Mountains in grandeur and sublimity. Pop. of v. 1208; of tp. 5840.
JAMES R. GUY, ED. "BEDFORD SENTINEL AND NEWS."

Liberty, tp. of Marshall co., West Va. Pop. 2062.

Liberty, tp. of Ohio co., West Va. Pop. 1362.

Liberty, tp. of Grant co., Wis. Pop. 907.

Liberty, tp. of Manitowoc co., Wis. Pop. 1430.

Liberty, tp. of Outagamie co., Wis. Pop. 461.

Liberty, post-v. and tp. of Vernon co., Wis., 9 miles S. E. of Viroqua, and on Kickapoo River. Pop. 414.

Liberty Grove, tp. of Door co., Wis., on Green Bay and Lake Michigan. Pop. 333.

Liberty Hill, post-v. of Williamson co., Tex. Pop. 47.

Liberty, Religious. The distinction is quite clear and broad between what is civil and what is religious. Civil government is not to support or hinder any form of religion. Privileges are not to be granted nor are injuries to be inflicted because of religious belief. A state is manifestly unable to exercise minute supervision over religious opinions. The state cannot go behind the overt act. Religion looks to the posture of the mind and the heart. Men are bound to submit their judgment on points of faith to no visible body. Religious liberty is absolute freedom of religious opinion and worship, the equality of all churches, religious associations, or persons in the way of protection or restraint by the legally expressed will of the nation. Toleration is the assumption of the right by civil process to control religious affairs. Toleration *ex vi termini* implies that the state prefers one or more forms of belief, but graciously allows others. To permit implies the right to prevent.

The New Testament contains no precept favoring a national or state religion, or interference by government with the right of worship. It recognizes a clear distinction between "the things which are God's" and "the things which are Cæsar's." Disciples of Christ were such not by compulsion, but by free choice. The kingdom set up was not of this world, acknowledged no temporal head, asked no help from, nor alliance with, civil power. Until the third century Christianity had the hostility of governments. A state religion, under pagan governments, subjected the early Christians to severe persecutions. Unfortunately, Constantine in 313 established Christianity by law, and since that time Christians, when they have obtained power, have allied their religion with civil authorities. When papacy was established and became strong, the governments of Europe were not so much in alliance with, as in subjection to, the ecclesiastical power. According to the Roman Catholic theory, states have rights only by permission of superior authority expressed through the Church. When, as the result of the Reformation, several states in Europe renounced the authority of the pope, Protestant kings and governments, as a substitute for papal dominion, assumed to themselves authority over religion. In some instances, when the pope's authority ceased in the realm, much of the authority exercised by him was claimed by sovereigns, who became the heads of the Church in their respective dominions. Civil governments in Europe universally claimed and exercised the right of legislating upon ecclesiastical and spiritual matters. The power of legislation or control extended to the very being and constitution of the state Church—to its creed, ministry, offices, and ordinances. The Church became completely at the disposal of the civil power in temporalities and in spiritual condition.

As the result of this claim on the part of the separate governments, a national Church was established in each. The Church thus established or denomination taken into alliance became the recipient of state favors, was supported by state property, endowed with manifold and exclusive privileges, and became a part of the government. These national establishments rested at first on the principle of making citizenship and church-membership coextensive. To secure conformity and crush dissent, lives were sometimes taken, property confiscated, civil and educational disabilities imposed, and other repressive measures enacted and enforced. Under the humanizing influences of Christian civilization this harshness has been greatly modified. In every government of Europe there has been more or less relaxation of rigid rules. Toleration is becoming general, and the tendency is towards unrestrained liberty of

worship. In France several denominations receive government patronage. In Germany, although the government claims the management of ecclesiastical affairs, there is little interference with the right of worship. In Russia progress has not been so marked, but even there the public opinion of Christendom has made itself felt in opening prison-doors and obtaining exemptions. The revolutions in Spain and Italy have rid those countries of former exclusiveness, and now different forms of faith are entitled to protection. In Great Britain the change has been marvellous. The colonies enjoy perfect liberty of religion. The Anglican Church has been disestablished in Ireland. It still remains the establishment in England, as the Presbyterian is the establishment in Scotland, with many privileges, but there is now no public position, not ecclesiastical, for the tenure of which a particular religious belief is required, except the throne and the office of governor of a few colleges. These reforms in Europe indicate the irresistible advance of public sentiment. Propagation of religion has almost ceased to be regarded as one of the ends of government. It has been found quite as easy to persecute or bribe into one religion as into another. The connection of Church and State is increasingly regarded as corrupting to the Church, destructive of the purity and spirituality of religion, and antagonistic to the rights of men.

The success and popularity of American ideas of government have contributed largely to these gratifying results. A distinctive American principle of government is, that what is religious is necessarily, from its very character, beyond the control of the civil government. In the U. S. religious liberty is an absolute *personal* right. All denominations, churches, and religious faiths are equal and free in the eye of the law. None receive gratuities, none are subjected to inequalities. There is entire divorce of Church and State. So long as private rights are not violated, no one is restrained from publishing or advocating his opinions on religion or morals. Voluntaryism is the universal rule. Worship is sustained, ministers are supported, church-houses are built, missionary operations are carried on, by purely voluntary contributions. The Constitution of the U. S. contains these two articles: "No religious test shall ever be required as a qualification to any office or public trust under the U. S.;" "Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof." The State constitutions are equally emphatic, and generally more specific in the expression of their jealousy of ecclesiastical ambition and sectarian intolerance. Absolute religious liberty is the contribution of the U. S. to the science of politics. Many external causes conspired to give us the vantage-ground in the establishment of soul liberty. To Rhode Island belongs the pre-eminent honor of being the first state in the world to incorporate in its organic law, and to practise, absolute religious liberty. Other colonies set up some forms of Christian worship and established some articles of faith. In New England a kind of theocratic government was established. In South Carolina, New York, and Virginia the Episcopal Church was established. In some of these States harsh attempts were made to enforce conformity. Very early there was positive and prolonged resistance to the attempt to perpetuate the establishment of the English Church in the colonies, and the evidence is conclusive that such an attempt hastened the beginning and aided in the success of the American Revolution. J. L. M. Curry.

Lib'ertyville, post-v. and tp. of Lake co., Ill., 32 miles N. W. of Chicago. Pop. 1236.

Liboce'drus [Gr. λίβος, "tears," or "frankincense," and *cedrus*, "the cedar"], a genus of coniferous trees, of which four species are known—two in New Zealand, one in Chili, and one (*L. decurrens*) in California, where it was discovered by Fremont, and is now known as "white cedar." In France and England it was for some time confounded with the *Thuja gigantea* or arbor vitæ of Oregon, which it somewhat resembles. The California species is found only in the mountains, generally at an elevation of 4000 feet or more. It is a beautiful tree, attaining a height of 120 to 200 feet, with a trunk 6 or 7 feet in diameter, and a peculiar fibrous bark, much like that of *Sequoia*. It has a yellowish wood of great durability, the leaves are glossy and bright, and the elegant form of the young tree has brought it into request as an evergreen.

Libourne', town of France, in the government of Gironde, on the Dordogne, at its confluence with the Isle. It is a handsome and thriving town, with large manufactures of leather, ropes, nails, and yarn, and trade in wine, salt, grain, and timber. Pop. 13,565.

Li'bra [Lat., "The Balance"], the sign of the Zodiac which the sun enters at the autumnal equinox (about Sept. 23). The constellation Libra has no very remarkable stars. It corresponds at present to the sign Scorpio, while the sign Libra corresponds to the constellation Virgo.

Li'brary [from the Lat. *librarium*, a "repository of books"], a collection of volumes, whether manuscript or printed, containing the product of human thought. Libraries are to be ranked among the foremost agencies of civilization. The great development which they have undergone in modern times, and especially during the last twenty years, both in Europe and America, has very nearly doubled the numerical extent of the principal collections, while many more progressive libraries have advanced in a still greater ratio.

The oldest approximation to libraries of which any records exist were brought to light by recent Assyrian discoveries, and consist of the Babylonish books inscribed on clay tablets, supposed to have been prepared for public instruction about 650 B. C. It is said that Pisistratus founded a library at Athens about 537 B. C., though there is no clear evidence of the fact. Strabo says that Aristotle was the first known collector of a library, which he bequeathed (B. C. 322) to Theophrastus; and this library, through successive hands, at length found its way to Rome on the capture of Athens by Sylla. The story of the great Alexandrian library, founded by Ptolemy Soter, and burned by order of the caliph Omar in the seventh century, rests on insufficient evidence. Its alleged number of volumes, stated by different writers at from 100,000 to 700,000, so vastly exceeding the aggregate of any library of the Middle Ages, or indeed for three centuries after the introduction of printing, throws discredit upon the whole story, except the single fact of the existence of a collection of books at Alexandria. Plutarch says that the library of Lucullus at Rome was open to all, and this antedated the library of Pollio, which Pliny asserts was the first public library established at Rome. Suetonius relates that Augustus collected in the temple of Apollo two libraries of Greek and Latin writers, while Tiberius and Domitian assembled manuscripts to add to these libraries, and employed scribes at Alexandria to copy works there preserved. Many Romans, and notably Cicero, collected extensive libraries, notwithstanding the limitations which the great cost of copying and the scarcity of books and material entailed upon the collectors. St. Jerome records that St. Pamphilus of Cæsarea (A. D. 309) made a collection of 30,000 volumes, chiefly religious, with a view of lending them out to read. This, if authentic, is the first record of a circulating library, except some obscure notices in the Latin writers.

The libraries of the Middle Ages were very limited in extent, and were of monkish origin. One of the earliest known was the still existing library of the Swiss abbey of St. Gall, which claims an antiquity of 1000 years. As early as the thirteenth century there are records of a library-tax levied on all the members of an individual monastery. Indeed, many mediæval conventual institutions were universities for the copying or reproduction of books, and rendered inestimable service in preserving before the invention of the printing-press precious manuscripts which might otherwise have been lost. The first approach to a library in England is said to have been nine precious MSS. brought by Augustine on a mission from Pope Gregory the Great (A. D. 596), and preserved at Canterbury. In 668 this deposit at the monastery of Christ Church was enlarged by the library of Theodore of Tarsus, brought from Rome in the same year. The abbey of St. Alban's had gathered quite a collection by the year 1100, and other monasteries of the English Benedictines collected a few hundred volumes. The monastery of Croyland had 300 volumes and 400 tracts, all of which perished by fire in 1091. Richard of Bury (A. D. 1333) was an enthusiastic book-collector, and has eloquently written in praise of libraries in his *Philobiblon*. Among the earliest royal libraries, that of Charles VI. of France numbered 1100 volumes in 1411. As late as the reign of Henry VIII. the royal library of the British crown contained only 329 volumes. In striking contrast to this literary poverty in England and France is the splendid library of Matthias Corvinus, king of Hungary, which at his death in 1490 numbered 50,000 volumes, nearly all MSS. Forty years afterward this precious collection was pillaged and burned by the Turks. Lorenzo de' Medici gathered a great library, which still forms the basis of the Laurentian library of Florence. In 1556 the royal library of France, then containing 2000 volumes (of which only about 200 were printed books), received by royal ordinance the privilege of a copy of every book printed in France. This was the foundation of the copy-tax, which has been the means of enriching so many of the great government libraries of Europe. That of France had grown to 200,000 volumes as early as 1789, and was then, as now, the foremost library in the world. Italy, which has long enjoyed the reputation of being rich in libraries, and which possesses many manuscript treasures and early printed

books, is poor in collections of modern literature. The library of the Vatican, the most precious in Rome, contains about 100,000 volumes of printed books and 25,000 MSS. In Germany, the land of books and universities, are more libraries of great extent and value than in any other European country. Petzholdt, in his *Adressbuch der Bibliotheken Deutschlands* (1875), enumerates 1044 libraries of all grades in Germany, Austria, and Switzerland, twenty of which contained over 200,000 volumes each. The largest collections are the Royal Library of Berlin, 700,000 volumes, including pamphlets; the Imperial Public Library, Vienna, 400,000; the Royal Public of Dresden, 500,000, and 400,000 pamphlets; and the Royal Library at Munich, 400,000 books, to which must be added 400,000 pamphlets. The latter library has long passed in statistical tables as the second in Europe; this claim was based on the fallacious system of enumeration, which counted every thesis and tract as a separate book—a method which would swell many collections in our table to double the figures claimed for them. France has, besides the National Library, half a dozen collections of 100,000 volumes or upward, and the provincial libraries of that country furnish superior opportunities for improvement. Spain has about 30 public libraries, containing altogether some 700,000 volumes, of which the largest, the National Library at Madrid, has 220,000. The Imperial Library of St. Petersburg, now containing over 1,000,000 volumes, is, next to the libraries of Paris and the British Museum, the richest in Europe. Of Northern European libraries, the Royal at Copenhagen contains 500,000 volumes, all others being of small account in comparison.

In England the library of the British Museum dwarfs all other collections. Founded in 1753 by the wise and timely purchase of Sir Hans Sloane's collection for £20,000, it received no other grant of public money for its increase until 1807, or more than half a century. But it has been fortunate in munificent gifts of many valuable private collections, and during the last thirty years there has been a systematic and highly successful effort to collect in London a great monumental library whose fundamental idea should be inclusiveness, not exclusiveness. For many years past the sum expended for books and binding has been £16,000 (or $80,000) annually, and the British Museum Library now counts 1,150,000 volumes. Next to this stands the Bodleian Library at Oxford, the oldest and most valuable collection, next to the British Museum, in England, now numbering over 330,000 volumes. The library of the Faculty of Advocates of Edinburgh stands next, with 300,000 volumes. The University of Cambridge numbers 250,000, and the library of Trinity College, Dublin, has about 150,000. These five libraries enjoy the benefit of the copy-tax, and can each claim one copy of every work printed in the United Kingdom. In Great Britain there are only nine libraries exceeding 100,000 volumes each. Provincial and town libraries are, however, springing up, having been originated as recently as 1850 with the Manchester Free Library. The fact that for nearly a century and a half after Shakspeare's time there was no public library in London speaks volumes as to the very recent development of this means of public enlightenment.

In the U. S. the annals of the foundation and growth of libraries show that while our collections can never hope to rival those of Europe in manuscripts or early printed books, they will one day equal them in the number and extent of the collections. The first foundation of an American library was in 1638, when the library of Harvard College was started at Cambridge, Mass. In 1700 a public library was founded at New York City, which was known for over half a century as the City Library, but, not flourishing in that form, was converted into a subscription library in 1754, becoming the New York Society Library. Yale College Library was founded in 1700. In 1731, Dr. Franklin and his associates founded in Philadelphia a library company still in existence, which has the honor of having been the first subscription or proprietary library of which we have any record. At the date of its formation no town in England possessed a subscription library. The Library of Congress—or, as it was called in its first general catalogue, the Library of the United States—was founded in 1800, on the establishment of the seat of government at Washington. The Capitol and library having been burned in 1814 by the British army, Congress purchased ex-President Jefferson's collection of 7000 volumes as the basis of a new library, which was gradually increased until 1851, when it had reached 55,000 volumes, and was again nearly consumed by fire, only 20,000 volumes being saved. The collection has since grown with rapidly accelerating volume, until it now numbers over 280,000 books, besides 50,000 pamphlets. The valuable scientific library of the Smithsonian Institution was incorporated with the collection in 1866. The Library of Congress is rich in history, jurisprudence, political science, and books relating to America, while no other department of letters has been neglected in its formation. It is the only American library receiving the benefit of the copyright law, through which it will in time come to possess an approximately complete representation of the entire product of the American press. The preservation in a national fireproof repository of all the national literature, with a selection of the best literature of all other countries, is a boon which will be more and more appreciated by scholars with the advancing development of the country. Next to the Library of Congress in numerical extent stands the Public Library of Boston, founded in 1848, and now numbering 225,000 volumes, besides 60,000 more in its eleven branches or subsidiary libraries in the suburbs of that city. This is unquestionably the most widely useful collection of books in America, lending its volumes free of charge to all citizens. Its example has been widely followed in other cities and towns, not only in Massachusetts, but in the West, where Cincinnati and Chicago have each rapidly increasing free-lending libraries, supported, like that of Boston, by funds derived from municipal taxation.

The school-district library system, originated by New York in 1838, has been adopted by ten to twelve States, the books collected being paid for by a proportion of the school taxation fund of the respective States. The State libraries of the country are many of them collections of considerable extent and value. That of New York at Albany is the largest, numbering 95,000 volumes, and furnishing a model of a well-stored and liberally managed public library, free to all. In the other States, and in all of the Territories, libraries have been gathered at the seat of government, primarily for legislative uses, and consisting chiefly of documents, all of which are, however, open to public use and reference.

A class of subscription libraries which have had much success in America are the mercantile libraries, of which those of New York and Boston were founded in 1820, the Philadelphia Mercantile in 1821, the Cincinnati in 1835, and the San Francisco in 1853. Twenty-nine of these libraries were established from 1820 to 1870, inclusive. Of professional libraries, law, medical, theological, and scientific, there are many. The largest medical collection in the country is the library of the surgeon-general's office at Washington, numbering 37,000 volumes; next to which stands the library of the College of Surgeons, Philadelphia, with 18,000. Several of the historical societies, of which more than 160 have been organized in the U. S. since 1789, have valuable libraries, those of New York and Massachusetts being especially rich in early American books and pamphlets, and in manuscripts. Public libraries founded by individual bequest are becoming numerous. Some of the principal are the Astor and the Lenox Library at New York, the Watkinson Reference Library at Hartford, and the Peabody Institute Library at Baltimore.

By the census of 1870 there were reported 107,673 private libraries in the U. S., containing 25,500,000 volumes. The superintendent of the census expresses the opinion that this is far below the truth for the whole country, and adds that it is difficult to see what value attaches to an enumeration of private libraries which includes such ephemeral productions as school-books, public documents, Sunday-school literature, and pamphlets. By the same census the public libraries in the U. S., including in that designation every little collection down to parishes and Sunday schools, as well as the large libraries open to public reference, numbered 55,580 collections, aggregating about 20,000,000 volumes. According to the report of the bureau of education for 1874, the number of libraries in the U. S. which returned their statistics was 790, with an aggregate of 7,760,118 volumes. This enumeration, however, is properly confined to the libraries which can be fairly considered public or associated.

The following table exhibits all the libraries of the world known to contain 100,000 volumes or upwards at the latest dates:

City.	Library.	Volumes.
Athens	University	125,000
Augsburg	City	100,000
Bamberg	Royal	120,000
	and pamphlets	150,000
Bâle	Public	100,000
Berlin	Royal	700,000
"	University	115,000
Bologna	University	200,000
Bonn	University	180,000
Bordeaux	City	123,000
Boston	Public	225,000
	Branches	60,000
"	Athenæum	108,000
Breslau	University	340,000
Brussels	Royal	250,000
Buda-Pesth	Public	200,000
"	University	105,000
Cambridge, Eng.	University	250,000

City.	Library.	Volumes.
Cambridge, Mass.	Harvard College	250,000
Carlsruhe	Grand ducal	110,000
Cassel	National	120,000
Christiania	University	200,000
Copenhagen	Royal	500,000
“	University	200,000
Cracow	University	140,000
Darmstadt	Grand ducal	380,000
Dresden	Royal Public	500,000
	and pamphlets	400,000
Dublin	Trinity College	150,000
Edinburgh	Faculty of Advocates	300,000
“	University	130,000
Erlangen	University	110,000
Florence	National	200,000
Frankfort	City	150,000
Freiburg	University	250,000
Giessen	University	150,000
Glasgow	University	105,000
Gotha	Ducal	240,000
Göttingen	University	400,000
Hague	Royal	100,000
Halle	University	100,000
Hamburg	City	300,000
Hanover	Royal Public	170,000
Heidelberg	University	300,000
Helsingfors	University	140,000
Jena	University	180,000
Kiel	University	150,000
Königsberg	Royal and University	220,000
Leipsic	City	100,000
“	University	350,000
Lisbon	National	100,000
Liverpool	Public	100,000
London	British Museum	1,150,000
Lyons	City	120,000
Madrid	National	220,000
Manchester	Public	120,000
Marburg	University	120,000
Mentz	City	110,000
Mexico	National	100,000
Milan	Ambrosian	100,000
“	Brera	185,000
Modena	Esti	100,000
Moscow	University	160,000
Munich	Royal	400,000
	and pamphlets	400,000
“	University	280,000
Münster	Royal Paul	100,000
Naples	National	200,000
New Haven	Yale College	105,000
New York	Astor	150,000
“	Mercantile	160,000
Oxford	Bodleian	330,000
Padua	University	100,000
Paris	National	2,000,000
“	Arsenal	225,000
“	St. Geneviève	200,000
“	Sorbonne	140,000
“	Mazarin	160,000
“	Institute	100,000
Parma	Public	140,000
Prague	University	152,000
Rome	Vatican	105,000
“	Casanata	160,000
“	Angelica	100,000
Rouen	City	120,000
Rostock	University	140,000
St. Petersburg	Imperial	1,100,000
“	Academy of Sciences	130,000
Stockholm	Royal	125,000
Strasbourg	City	300,000
Stuttgart	Royal Public	180,000
Treves	City	100,000
Tübingen	University	220,000
Turin	University	150,000
Upsal	University	150,000
Venice	St. Mark's	120,000
Vienna	Imperial Public	400,000
“	University	210,000
Washington	Library of Congress	280,000
Weimar	Grand ducal	170,000
Wolfenbüttel	Brunswick Ducal	250,000
Würzburg	University	200,000
Zurich	City	100,000

The subject of library economy and management can here be touched on only in the briefest manner. Three points are of cardinal importance: library buildings, the classification of books, and the catalogue system. While most libraries are bestowed in dark and ill-ventilated buildings, there are some modern constructions which afford worthy repositories for the learning they contain. Every library building should be isolated and fireproof, with adequate room for expansion. The classification of every library by subject-matters is indispensable to economy of time in the supply of books and information, and to the highest utility of the library. Yet many of the collections, including some of the largest in Europe and America, have no principle of arrangement other than the sizes of the volumes or the order of acquisition. The catalogue system most universally employed is the card catalogue in manuscript, by which a strict alphabetical arrangement is secured, and the accessions to the library can be kept constantly catalogued up to date. The printing of catalogues has been abandoned by most of the largest collections, including the principal government libraries of Europe, as too expensive and laborious to be kept up without falling hopelessly into arrears. When it is considered how enormous is the production of printed matter, and that the principal libraries both in Europe and in the U. S. have doubled during the last twenty-five years, this deprivation to the public of the boon of printed catalogues of the largest collections is partially explained. Yet there is no library hitherto gathered, however large, which contains anything like a complete collection of the literature of all nations, or even of its own. Every national library should have for its object the collection and preservation, on the exhaustive system, of all that the country within which it is located produces. The use of a great library is not for one generation only, but its value is developed by passing into the hands of successive generations, and furnishing a complete record of the progress of letters from age to age.

The private libraries of a country, after they have served their purpose to the owners, continually tend to feed the public collections. A great capital like London, Paris, or New York constantly receives a flood of private libraries, which are poured into auctions or otherwise sold, and from them the vigilant collectors for our public libraries are always recruiting and enriching them.

The relation of libraries to popular education has come into prominence only within the last few years. If, as Carlyle remarks, "the true university of these days is a collection of books," and all education is to teach us how to read, the importance of cherishing and extending these aids to civilization can hardly be overrated. A good library is like a dictionary—not a mere mass of pages to be read through, but a vast repository of learning for the continual use and reference of all comers. That is the best library, and he is the most useful librarian, by whose aid every reader is enabled to put his finger on the fact he wants at the moment it is wanted. A. R. SPOFFORD.

Li'bri Carruc'ci del'la Sommai'a (GUILLAUME BRUTUS ICILIUS TIMOLÉON), COUNT, b. at Florence Jan. 2, 1803; studied mathematics, and was appointed professor at the University of Pisa, but being implicated in the political disturbances of 1830, fled to France, where he was naturalized in 1833; first ingratiated himself with Arago, and became professor at the Sorbonne; then with Guizot, and was made inspector-general of public instruction and public libraries; but in 1847 was accused of stealing large numbers of costly books from the libraries, and was condemned to ten years' imprisonment. He had fled to England, however, and returned afterwards to Florence, where he d. Sept. 28, 1869. His *Histoire des Sciences mathématiques en Italie* (Paris, 1838–41) enjoys a great reputation, as do also his numerous annotated catalogues.

Libur'nia, in ancient geography, a mountainous district of Illyricum extending along the coast of the Adriatic in the present Croatia and Dalmatia. Its inhabitants were famous as sailors, or rather as pirates, and from them the Romans adopted those small, fast-sailing vessels with the one large lateen sail which were known under the name of *naves Liburnæ*, or simply *Liburnæ*.

Lib'ya, the name which often was given by the ancients to the whole continent of Africa, but which was generally applied only to that part which is now called the Libyan Desert, extending from Egypt to Fezzan and from the Mediterranean to Darfoor, and consisting of vast stony terraces, sometimes covered with sand and gravel, and sometimes broken by oases, Seewah being the largest.

Lib'yans, The, occupied in ancient times the whole northern coast of Africa with the exception of the delta of the Nile, and according to Lepsius and other Ægyptologists they probably at one time occupied this territory too, but were driven out by the Egyptians. They were a seafaring nation, and harassed the Egyptians with continuous invasions, until their power was checked in the sixteenth century B. C. by Thothmes III. In the fourteenth century B. C., when the Pelasgians on the northern coasts of the Mediterranean had acquired some importance on the sea, the Libyans renewed their attacks on Egypt in connection with the Tyrrhenians and Achæans, and conquered Lower Egypt, but were entirely defeated by Rameses II. At the period when the Phœnicians founded Carthage, and the Greeks Cyrene, the Libyans seem to have become enfeebled. They were pressed back from the coast, and submitted completely to the Romans, and fell partly into barbarism. (With respect to their ethnographical and linguistical relations, see the articles BERBERS, MAN AND HIS MIGRATIONS, and SEMITIC RACES AND LANGUAGES.)

Libyan Sea, The, in ancient geography, was that part of the Mediterranean which is situated between the island of Crete, the delta of the Nile, and the territory of Carthage, or Africa proper. *Syrtis Major* and *Syrtis Minor* were inlets of the Libyan Sea.

Licata. See ALICATA.

Li'cense [Lat. *licentia*] signifies primarily permission, and as used in law denotes a privilege, power, or authority granted by an individual or a public or private body to do a specified act or series of acts, to carry on a particular occupation, and the like. Thus, an oral permission given by a landowner to another person to pass over the land or to erect buildings or other structures upon it is a license. Trades of various kinds are frequently so regulated that the right to follow them depends upon statutory license, as, for instance, to sell liquors, to keep a tavern, to engage in hawking and peddling, etc. This variety of licenses will be considered under the topic LICENSE LAWS (which see). The subject of license has particular importance in law with reference to real property, and will be examined in this article wholly from this point of view. A license appertaining to land must be distinguished from an easement. An easement is a permanent, irrevocable interest in the land, which, in accordance with the requirements of the statute of frauds, can be strictly created only by a sealed instrument called a grant, or its equivalent, prescription. (See EASEMENT; FRAUDS, STATUTE OF; PRESCRIPTION.) An easement amounts in reality to an estate in the land, and is therefore not subject to defeasance by any act of the grantor, except when depending upon a condition. A license, on the other hand, is a mere privilege or authority to do a particular act or series of acts upon another's land, or upon one's own land in such a manner as to deprive an adjacent owner of certain rights which he possesses, as, *e. g.*, an easement of light. It is simply a permission of a temporary nature not capable of assignment, and valid though oral. It is true that licenses are sometimes given by instruments with or without seal, but they would be of the same validity and effect if granted orally. The question whether a particular transaction is a license or an easement depends upon its nature and the intent of the parties, and not merely upon the point whether there is a writing. Licenses are either express or implied. They are express when permission is given in definite and specific terms to do a particular act; implied, when from the fair interpretation of the dealings of the parties permission to enter upon the licenser's land or to do any act thereon may be presumed. Thus, if a purchase be made of goods which are upon the land of the vendor, the purchaser has an implied authority to enter during a reasonable time in order to remove them. The act of opening and keeping a place of business gives an implied license to any one to enter for the purpose of transacting such business as is usually carried on there. Thus, railway stations are kept for public accommodation, and may be freely entered by any one who desires to become a passenger. So an entry into the house of a friend or neighbor for the purpose of paying him a visit is allowable, because the relations of intimacy between the parties afford ground for a natural inference that no objection would be made. On similar grounds, public officers, by a mere rule of law, sometimes called an implied license, are justified in entering upon any person's land to execute, when necessary, legal process. There is no implied license, however, for an officer to enter a man's dwelling-house in the service or execution of civil process, unless he finds it open. There is a maxim of law that "every man's house is his castle," and accordingly it can be only broken open by the peace-officer when the process is criminal, and when entrance has been demanded and refused. (See EXECUTION, FIERI FACIAS.) In this class of cases the officers may enter even against the will of the owner and in disregard of his express prohibition or remonstrance.

Licenses are further distinguished as executory and executed. This distinction is of considerable importance, as affecting the question whether a license is revocable by the grantor. Licenses are said to be executory when the privilege given is yet to be exercised; executed, when it has already been exercised, either in whole or in part. It is a general principle in courts of law, as distinguished from courts of equity, that all licenses, whether executed or executory, are revocable at the pleasure of the grantor, provided they are not coupled with any interest in property. But when the license is coupled with the grant of an interest, or where an interest exists whose value, continuance, and enjoyment depend upon the license, there is, in general, no power of revocation. Hence, the right of a purchaser of personal chattels to enter upon the premises of the vendor within a reasonable time, and remove the articles to which he has acquired a right by the sale, is irrevocable by the vendor. Permission to fell and carry away standing timber upon the land of the licenser will give an irrevocable right to remove the timber after it has been cut, unless there be unreasonable delay in making the removal. But until the trees are felled, the privilege, if it does not amount to an easement, can be withdrawn, for not until that time is any right of ownership in the timber acquired. In like manner, a license to a person to kill game for his own use upon the licenser's land will give him an irrevocable right to carry away the game which has actually been killed. But where there is no proprietary interest connected with the license, it is, if executory, revocable at any time. For instance, a license to hunt in a man's park, or to fish in his waters, or to pass through his land gives the licensee no permanent interest, but merely a privilege whose continuance depends entirely upon the will of the landowner. It is thus seen that no mere license can create or transfer an indefeasible interest in real property. A license is, in reality, in the nature of a power, and is governed by the same general rule as powers, that they are essentially revocable at the will of the person who creates them. (See POWERS.) The same principle, qualified by previous statements, prevails in regard to executed licenses, except in courts of equity. There is, however, a distinction necessary to be taken between such executed licenses as are and such as are not attended with expenditure. Licenses of the latter class are revocable at any time, both at law and in equity. A license to deposit property—*e. g.* coal—upon a man's land is of this nature. But where expense has been incurred in carrying into effect the authority given by the license, courts of equity in some of the States adopt different principles from those prevailing in courts of law. At law, it is held that though the licensee may have sustained expense, and may be subjected to necessary loss and injury, the authority may nevertheless be revoked at pleasure by the licenser. If, for instance, the licensee were to construct a drain across the licenser's land to carry off waste water from the premises of the licensee, the privilege might be withdrawn at any time, even though the drain may have been in use. So if a house be erected upon another's land by license, the right to occupy or use it may be revoked whenever the licenser may desire. The right of revocation is sustained at law in these and similar cases because a contrary rule would be virtually in contravention of the statute of frauds, since an indefeasible interest in land would be created without the use of writing. But in equity there is not such strict adherence to the provisions of the statute of frauds as at law, and they are sometimes disregarded when to observe them would be likely rather to encourage or promote fraud than to prevent it, or would operate as a denial of substantial justice between the parties. Therefore, it is held in some States in courts of equity, or in courts having equitable powers, that where expense has been incurred by the licensee on the faith of the license, so that he would sustain loss if it were revoked, no power of revocation remains, and he acquires an absolute right to the continued enjoyment of the license and a permanent interest in the licenser's land. In some cases the delivery of a deed or writing has been required in order to confirm the licensee's right. This equitable practice proceeds upon the doctrine of equitable estoppel, the view being taken that the licensee should not be deprived of the benefit of the expenditure which he was encouraged to make by the very party who seeks to render it fruitless. (See ESTOPPEL.) Equity treats the license thus executed as a contract giving absolute rights. The courts of Pennsylvania have perhaps gone farthest in maintaining this doctrine. But the same general principle is sustained by decisions in England and a number of the States of this country. An executed license, on this view, becomes equivalent to an executed oral contract for an easement, which is treated as though it were a grant under seal in equity when the parties cannot be restored to their original position. An executed license is irrevocable, both at law and in equity, when by force of it some act is done upon the licensee's own land the effect of which is to impair or destroy an easement appurtenant to the licenser's property. If, for instance, a landowner has an easement of light over the premises of another, and gives permission to the latter to erect a wall or a dwelling in such proximity to his land as to darken his buildings or entirely cut off the light, he cannot countermand the license after it has been carried into effect. The license when executed operates as an abandonment of the licenser's right to the light, and this is sufficient to extinguish an easement. This reasoning would not apply to a license executory in its nature.

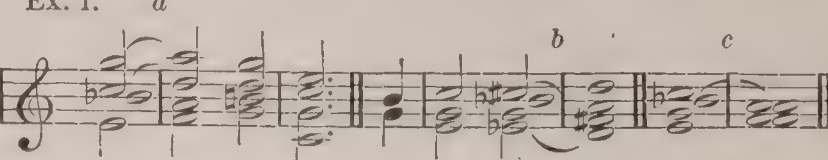
A license is a full justification for acts done carefully and prudently in pursuance of the authority given, and relieves the licensee from all liability for such acts, and for the consequences which may subsequently result from their performance. The rule is sometimes expressed briefly in this way—that a license excuses all trespasses committed under it until it is properly revoked. But for the consequences of negligence or unskilfulness in the performance of the act permitted, the licensee will not be relieved. There is a legal obligation resting upon every man to exercise, in respect to the rights of others, a reasonable degree of care and caution in what he does, and from this duty the license will afford no exemption. A license is in general a privi-

lege of a personal nature. The death of either party operates as a revocation of it. So, if the licenser conveys to another the premises to which the license appertains, it is extinguished without any express act of revocation. These rules, however, apply to mere licenses, and do not extend to licenses coupled with an interest. A license is sometimes granted upon the payment of a consideration. If it be revoked, there will be a failure of consideration, and the licensee can recover back the money paid. For example, the sale of a ticket to witness a theatrical performance or other similar entertainment is in general but a license to the purchaser to enter the building and be one of the spectators. But the license may be revoked before the performance is concluded and the purchaser required to leave the premises. He will in such a case have a claim against the proprietor of the theatre or other place of entertainment for full reimbursement, or for the recovery of a proportional amount of the sum he has paid, as the case may be. (See the leading case of Wood *v.* Leadbitter, 13 Meeson & Welsby's Reports, 838.)

George Chase. Revised by T. W. Dwight.

License [Lat. *licere,* to "be permitted"]. The technical sense of this word in music is a liberty knowingly taken in violation of some recognized rule of harmony. Licenses are not unfrequently found even in the compositions of the best masters, and are therefore not to be considered as results of ignorance or heedlessness. They differ also from the mistakes often made by inexperienced composers, by being knowingly written and carefully considered, with a view either to certain unusual effects or to enrich and strengthen (even by irregular means) some otherwise meagre spot in the harmony. To avoid suspicion of ignorance, it is customary with some writers to mark such progressions with the words "*con licenza,*" but in Bach, Haydn, Mendelssohn, and many others licenses occur without any special notice or apology. The nature of these licenses will be apparent from the following example, where at *a* the treble and alto make consecutive fifths (as pointed out by strokes); at *b* similar fifths are made by the lower part with the alto; and at *c* the treble crosses the alto, and unlawfully duplicates the resolution of the seventh, making also a hidden unison with the alto:

Ex. 1.



There are many *arpeggio* passages which, though pleasing and satisfactory even to a cultivated ear, are nevertheless indefensible except when construed as licenses. When reduced to plain chords, and so played, their irregular and unscientific structure becomes at once apparent, and their effect is intolerable even to the ordinary ear. An instance of this kind, involving a double train of consecutive fifths, may be seen at *a* in Ex. 2, and the same in unbroken chords at *b:*

Ex. 2.

By a judicious *distribution* of the parts or voices the ill effects more or less inherent in licenses may be softened or concealed, but the use of them is always hazardous, except in the hand of a master. William Staunton.

License (in legal pleading). When the defendant to an action relies upon a license given to him by the plaintiff, as justifying or excusing either in whole or in part the act complained of, it is the practice at common law for him to answer the declaration of the plaintiff by a special form of plea or answer, which is technically termed a plea of "license" or of "leave and license." (See Declaration, Pleading.) This form of plea is most commonly employed in actions for trespass upon land, but may be also resorted to in actions for trespass to personal property, or in actions of covenant or of detinue, or in actions upon the case. (See Trespass, Covenant, Detinue, Case, Action.) Every variety of valid license derived from the plaintiff, whether it be general or particular, express or implied, will support a plea of license on the part of the defendant. Thus, the permission or authority obtained from the plaintiff may have related to the entire act committed, or only to some one or more of a series of acts; it may have been given in definite, specific terms, or it may have been rightfully presumed by reason of particular acts of the plaintiff, his general conduct, or his management and disposition of his property. (Illustrations of these various kinds of licenses have already been given under the topic License.) The plea should justify only to the extent of the license claimed, and so far as it is capable of being established by proof. It is a general rule that a license must be specially pleaded, and cannot be given in evidence under the general issue. (See General Issue.) This is invariably true of all forms of action except actions upon the case. In these, however, a license need not be pleaded, but it is the practice to admit it in evidence. A plea of license in an action of covenant is not sustainable if the license claimed is by parol, unless it be provided for by the terms of the deed. A parol discharge is in general inoperative against a deed. In those States where common-law pleading has been abolished a license may still be pleaded in justification, but there is no particular form of plea or answer designated by this specific name. George Chase. Revised by T. W. Dwight.

License Laws. These are statutes passed in the various States regulating the pursuit of a particular calling or business. It is common in this way to govern the sale of ardent spirits by innkeepers or retail dealers, or the sale of goods at auction or by peddlers, etc. The laws of the respective States are so varied upon this subject that few general principles can be extracted. Statutes of this kind rest largely upon rules of public policy prevailing in the State which adopts them, and fluctuate with the changes of feeling continually occurring in society as to the best mode of regulating subjects having in them, when unregulated, an element of danger to social interests. Efforts have frequently been made in the courts to attack these laws on constitutional grounds, as depriving a person who is required to obtain a license of his liberty or property. Such a doctrine is untenable. These laws must be regarded as an exercise of police power inherent in the States, and not withdrawn by the provisions of the U. S. Constitution. They simply direct how a trade shall be conducted in articles intimately connected with the public morals or public safety. The business might be altogether suppressed if the public good required it. It cannot be claimed that such a license is a contract, but it is merely a temporary permission to do what would otherwise be an offence against the general law. Accordingly, if a legislature has granted a license to sell liquors for a particular time, it may before the expiration of that time modify or revoke it if it see fit. This topic is well discussed in the case of the *Metropolitan Board* v. *Barrie,* 34 New York Reports, 657 (1866). Congress in the course of its legislation concerning the internal revenue has purported to grant a license to carry on a business coming within the police power of the States. Though called a license, such a provision is in substance a tax, and the prohibition under penalties against carrying on the business without license is only a mode of enforcing the payment of such a tax. (*License Tax Cases,* 5 Wallace Reports, 462, 475.) Such a Congressional "license" does not prevent the State legislature, in the exercise of its "police power," from suppressing the traffic altogether, even though the "license" under the U. S. law was granted on the payment of a fee. All that such a license means is, that while the business is allowed by the State law to be carried on a fee in the nature of a tax must be paid to the U. S. The legislation of the State and of Congress is thus altogether consistent. (See the case of *McGuire* v. *Commonwealth,* 3 Wallace Reports, 387.) The license laws of the States may, however, come in conflict with the U. S. Constitution, as, for example, where a discrimination is made by a State in favor of the sale of its own products or of one made by its own citizens, adverse to one made by the citizens of another State or of its products. Such a law may conflict with the power of Congress "to regulate commerce among the States," as well as with the constitutional provision that the "citizens of each State shall be entitled to all privileges and immunities of citizens in the several States." A corporation existing in another State cannot be regarded as a "citizen" within this rule, and a State, so long as it does not interfere with the power of Congress to regulate commerce, etc., may discriminate against the acts of a non-resident corporation. (See Privileges and Immunities.) T. W. Dwight.

License to Trade. In international law this license denotes a permission given by a belligerent government through its agent, such as a commander of a squadron, to trade with the enemy. It may be given to a neutral trader or to a fellow-subject; and it generally specifies the kind of articles to be conveyed to the enemy, the port, the time, perhaps the amount. It may allow of importation, and not of exportation. Being a permission to do something otherwise forbidden, it is of strict interpretation, so that to go beyond its specifications would subject the vessel and cargo to heavy penalties, unless the violation could be shown to be unavoidable. Of course, the enemy is not bound to receive such a licensed vessel into his ports. T. D. Woolsey.

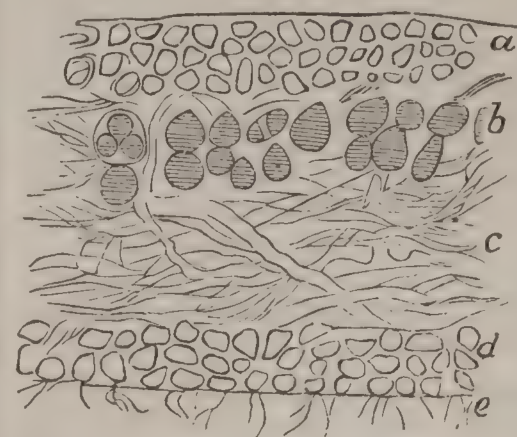
Li'chen [Gr. λειχήν], a skin disease, characterized by an inflammation producing groups of small elevated persistent spots, containing no serum or pus, and terminating by desquamation. It is common among scrofulous persons, and is rarely caused by external irritation. More often its cause is quite unknown. It may be circumscribed or general, chronic or short-lived. Acute cases are sometimes accompanied by fever and intense itching. If general and long continued, the patient may die of the long and unceasing irritation. Arsenic, alkaline, tarry, and sulphurous washes are often useful. Arsenic has a favorable effect upon some cases. But many of the severer examples of lichen will yield to no treatment. Happily, the disease is not very common. The term *lichen* is vaguely used. Some varieties have been described which appear to be allied to purpura, there being bloody exudations beneath the skin. *Lichen circumscriptus* is caused by a parasitic plant-growth which can be readily destroyed.

Lichen'ine [Gr. λειχήν, "lichen"], or **Moss-Starch** [Ger. *Moosstärke*], a substance contained in the cryptogams called lichens, constituting in some cases, as in that of the so-called Iceland moss, reindeer moss, *tripe de roche*, etc., nearly the whole mass. Many other lichens contain similar mucilaginous bodies. Lichenine may be obtained pure from Iceland moss by long soaking first in *cold* water, renewed until it remains tasteless, which removes a bitter principle and saline substances. Addition of a little carbonate of soda to the first water is useful. Some chemists treat also with ether and alcohol. The washed mass may then be dissolved in boiling water, strained and evaporated to a hard, brittle, tasteless mass, which swells in cold water without dissolving, but forms a jelly with boiling water familiar in all households. Like other starch-isomeres, it is converted into a gummy or dextrine-like body by long boiling with water. Glucose is formed by dilute acids, as in the case of common starch, and strong nitric acid forms with it oxalic acid. Iodine does not blue lichenine when pure, as it does common starch, but forms merely a yellow stain, as with cellulose. Lichenine does not occur in the plant in the cellular or granular form, like common starch; and some investigators have advanced the idea that it is properly not to be classed with starch, but is *cellulose* in a soluble modification. It is stated of late years that strong alcoholic liquors are prepared on a large scale in extreme Northern regions from these lichens—an art not difficult to comprehend or to carry out. H. Wurtz.

Lich'ens [Gr. λειχήν] are cellular cryptogamous plants, bearing fruit (*apothecia*) containing free spores in closed sacs (*thekes*), upon a thallus containing green cells (*gonidia*), and often abounding in crystals of oxalate of lime. They rank between Algæ and Fungi, differing from the former in the fruit character, and from the thecasporous groups of the latter (Ascomycetes), in the presence of gonidia, and in a great degree in chemical reactions, the hymenium of Lichens being usually colored blue or vinous-red by iodine, but those of Fungi yellow, though there are some exceptions in both classes. The thallus is, however, sometimes obscure, and in certain parasitic Lichens wanting. A theory, based partly on the alleged absence of connection between the medullary filaments of the thallus and the gonidia, has recently been maintained by Schwendener and others, that Lichens are compound plants, the thallus being an Alga and the apothecia Fungi, whose mycelium draws nourishment from the gonidia. But it has not found favor with lichenists.

Lichens are found in all climates and at all elevations, mostly preferring exposure to light. They grow on rocks, by their decay forming a soil for higher vegetation; on trees, and on the earth, the individuals being more numerous in the colder, and the species in the warmer, regions of the earth. Some are so small as hardly to be perceptible to the eye, and others attain dimensions of several feet. They remain inactive while dry, and vegetate when moist, and sometimes reach a great age. In the northern regions they furnish food for reindeer, are stored as fodder for cattle, and are said to increase the quantity of milk. Bread is also made of some species, and species of Umbilicaria (rock-tripe) have furnished an unpalatable food for Arctic travellers in time of need. They yield bitter extracts, but are not poisonous. Many species, especially the orchil (*Roccella*), furnish coloring-matters, and have been extensively used in dyeing; and recently alcohol has been manufactured from them on an extensive scale in Sweden. Some species have had considerable repute as remedics, but their medicinal virtues are slight. The thallus is fruticulous, foliaceous, squamaceous, or crustaceous, and diversified in color. The gonidia often burst into mealy or powdery excrescences (*soredia*), and by their distribution, as well as by the spores, the plants are propagated. The thallus consists, in the best developed forms, (1) of an external cortical layer, subject often to modifications which render it indistinct; (2) of a gonidial layer; (3) of a medullary layer, composed of more or less compact filaments of a cottony or rarely (*Usnea*) of a woody texture.

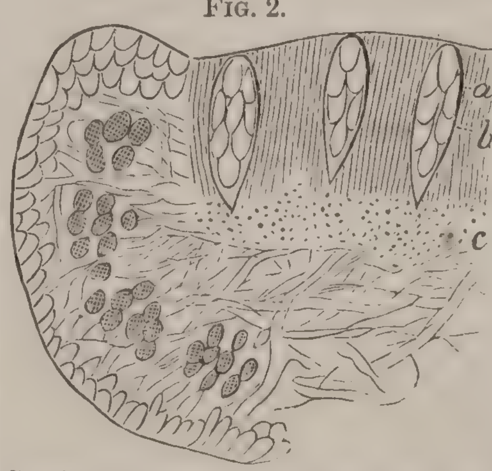
Fig. 1.



Section of thallus: *a*, cortical layer; *b*, gonidia; *c*, medullary layer; *d*, inferior layer; *e*, hypothalline fibres.

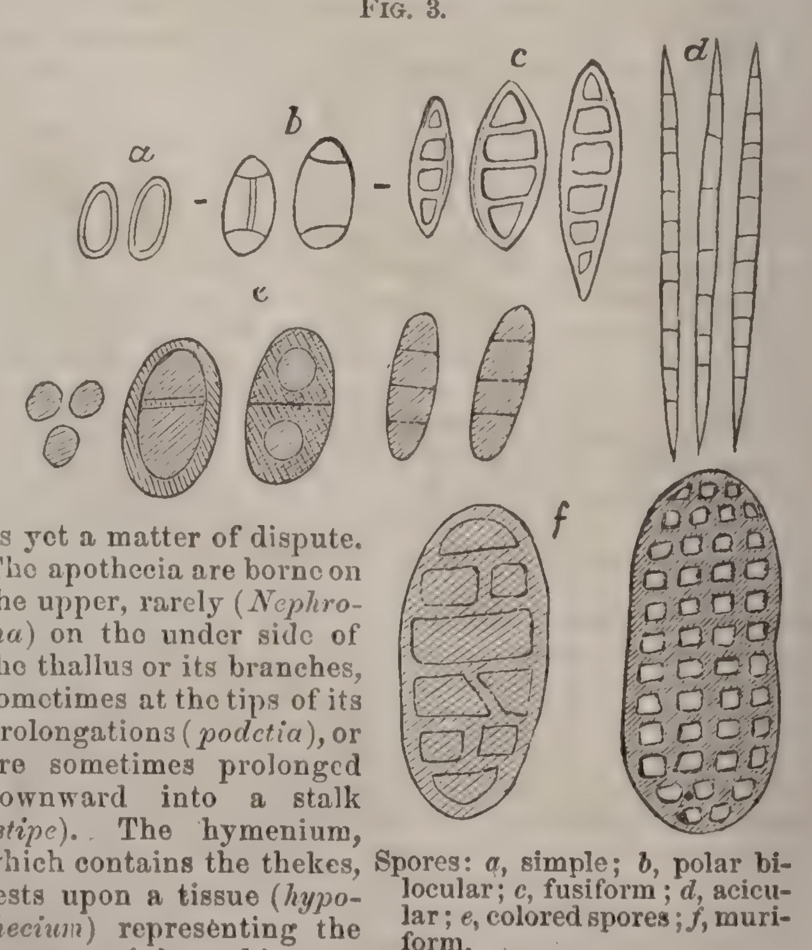
In foliaceous species it is often beset beneath by fibrils, by which it is attached to the substratum, and is there sometimes veined (*Peltigera*) or pitted and cyphellate (*Sticta*); and in crustaceous species it often rests on a filamentary tissue (*hypothallus*). The cortical layer is especially modified, and the medullary filaments become lax or indistinct in *Collema* and allied genera. The gonidia lie near the upper surface or encircle the medulla, or are sometimes scattered throughout the tissue, and are either (1) true gonidia, of a yellowish-green color, or (2) collogonidia (*Tuckerman*, *granula gonima*, *Auctt.*), which are bluish-green, imbedded in a colloid envelope, and often disposed in necklace-like chains. Collogonidia occur chiefly in the *Collemei* and *Pannariei*, but are also found in other genera (*Sticta*, etc.). The application of hydrate of potash and chloride of lime to the thallus produces changes of color which have been made the basis of specific distinctions; but their value is as yet a matter of dispute. The apothecia are borne on the upper, rarely (*Nephroma*) on the under side of the thallus or its branches, sometimes at the tips of its prolongations (*podetia*), or are sometimes prolonged downward into a stalk (*stipe*). The hymenium, which contains the thekes, rests upon a tissue (*hypothecium*) representing the proper exciple, and is composed of filaments (*paraphyses*) imbedded in a colloid substance (*hymeneal gelatine*). The spores are expelled from the thekes by the pressure caused by the swelling of the hymenial tissue when wetted. They vary from one to an

Fig. 2.



Section of angiocarpous apothecium: *a*, thekes; *b*, paraphyses; *c*, hypothecium.

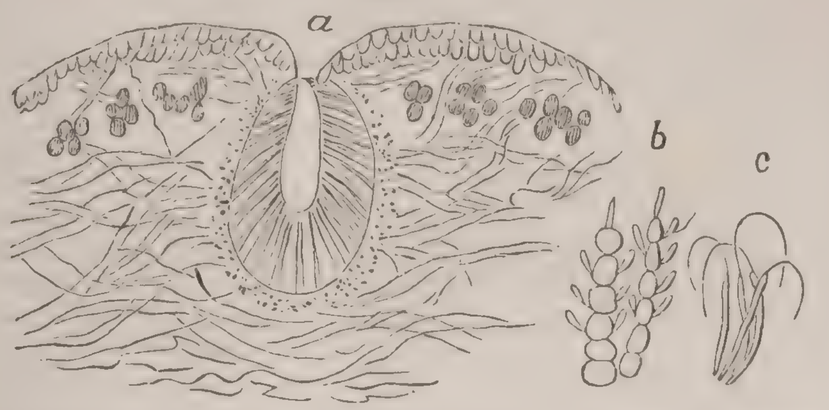
Fig. 3.



Spores: *a*, simple; *b*, polar bilocular; *c*, fusiform; *d*, acicular; *e*, colored spores; *f*, muriform.

indefinite number in the thekes, but the usual number is eight. In form they are globular, ellipsoid, or elongated, and are either simple or divided by dissepiments (2 to plurilocular), or when these are in both the transverse and perpendicular directions, are muriform; and are either colorless or brown, the elongated spore tending to the colorless, and

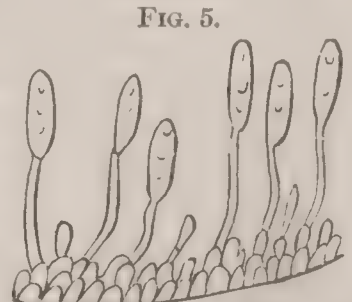
FIG. 4.



a, section of spermogone; *b*, jointed and, *c*, simple sterigmas, with spermatia.

the distended one to the colored type. But the typically colored spore is sometimes decolorate. In size the spores vary from 0.001 to 0.18, or even 0.3 millimètre in length. In germinating they give off extended filaments, forming a confused tissue, but no attempt at producing a perfect lichen from the spores has been successful. Spermogones are small, usually black bodies, scattered over the thallus, containing minute ellipsoid or elongated organs (*spermatia*) on simple or branched filaments (*sterigmas*). They have been supposed to be male reproductive organs, but nothing is certainly known on this point. Pycnides are similar to spermogones, but of less frequent occurrence, containing organs (*stylospores*) on simple filaments; their function is unknown.

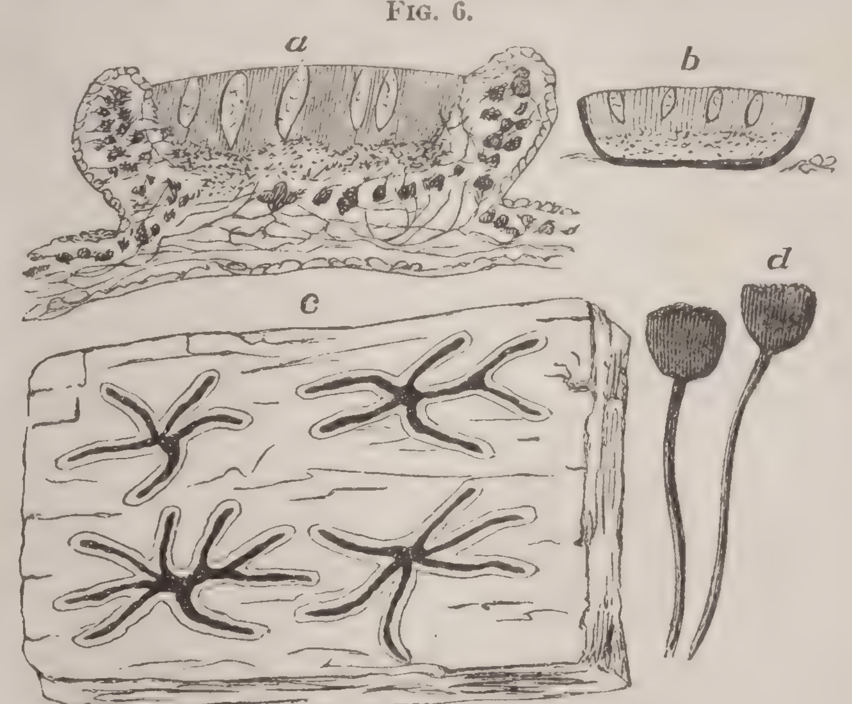
FIG. 5.

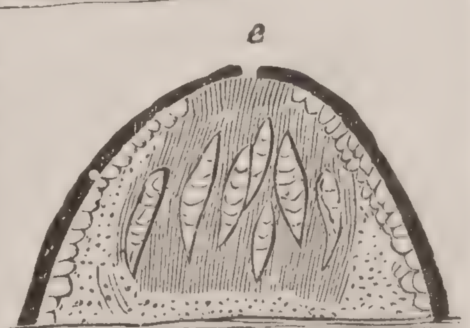


Portion of pycnide, with stylospores.

Lichens are divided according to the characters of the apothecia into two series: (1) open (gymnocarpous), and (2) closed (angiocarpous); and five tribes—viz. 1, PARMELIACEI: apoth. open, margined by a thalline exciple (*scutellæform*); 2, LECIDEACEI: apoth. open, margined by a proper exciple (*patellæform*); 3, GRAPHIDACEI: apoth. with a proper exciple, elongated (*lirellæform*); 4, CALICIACEI: apoth. goblet-shaped (*crateriform*), with a proper exciple margining a disk compacted of naked spores; and 5, VERRUCARIACEI: apoth. closed, opening only by a

FIG. 6.





Families of Lichens: *a*, Parmeliacei; *b*, Lecideacei; *c*, Graphidacei; *d*, Caliciacei; *e*, Verrucariacei.

pore at the summit, with an external proper exciple (*amphithecium*) surrounding an interior envelope (*perithecium*), which encloses the nucleiform hymenium. These tribes are divided in North American Lichens into 18 families and about 75 genera, containing, according to the present state of knowledge, about 800 species; the whole number of known lichens being from 1500 to 1800. The systematic arrangement above given is that of Fries (1831), as developed by Prof. Tuckerman in his *Genera Lichenum* (1873). The system of Koerber (1855) is based upon the characters of the thallus (fruticulose, foliaceous, or crustaceous), and that of Nylander (*Synopsis*, 1858) is eclectic, taking all parts into consideration. Lichens were confounded by the ancients with other cryptogams, and the name was originally applied to certain Hepaticæ. They were first accurately distinguished by Tournefort (1694), further described and figured by Micheli (1729), Dillenius (1741), and Hoffman (1790). At the time of Linnæus about 185 species were known. Acharius, "the father of lichenography," published his *Methodus*, based on thalline characters, in 1803, and described all then known lichens (about 900 species) in the *Lichenographia Universalis* (1810) and *Synopsis* (1814). Other works down to the modern period are Schœrer, *Spicilegium Lich. Helvet.* (1823–46); Eschweiler, *Systema* (1824); E. Fries's excellent *Lichenographia Europæa* (1831); Fée, *Essai* and *Suppl.*, figuring accurately the spores (1824–37); Tuckerman, *Synopsis of New England Lichens* (1848), continued in the *Am. Jour. Sci.* (1858–59). Catalogues of North American Lichens have been published by Muhlenberg (*Catalogus Plantarum*, Lancaster, Pa., 1813), by Halsey (*Synoptical View of the Lichens of New York*, printed in the *Annals of the N. Y. Lyceum of Natural History*, 1823), and by Torrey and others. The spores had been noticed by Micheli, and genera were based upon them by Eschweiler, Fée, and Flotow; but in 1846 a new impulse was given to the study by the publication of the *Frammenti* of De Notaris, who was followed by many able investigators, the expounders and representatives of modern lichenology. The most important works of this period are Massalongo, *Ricerche*; Norman, *Conatus*; and Tulasne, *Mémoire*, all published in 1852; Koerber, *Systema and Parerga* (1854–65). But these microscopical studies tended to an extreme—to the making the most of all differences whatever in spore-history—and led to the construction of very many imperfectly distinguished genera. Anzi, *Catal. Lich. Sondr.* (1860), and other works, indicated in a marked way a reaction from this, influenced largely by the earlier writings of Nylander, and the turn became still more marked in Th. Fries, *Genera Heterolichenum Europæ* (1861), and Stitzenberger, *Beitrage* (1862). But the whole question of the value of these spore-differences was first considered by Prof. Tuckerman (*Introd. to Lichens of Calif., etc.*, 1866); and the reasoning of this paper is perhaps not far from conclusive against the new genera of the Italian and German schools, and tends thus to restore the system to the place as indicated for it by Fries, and maintained to a very great degree in all the writings of Nylander. According to Tuckerman, all the spore-differences are to be regarded as gradal modifications of but two distinct types, complemented in the highest tribe only by what appears an intermediate one (the polar-bilocular); and he disallows any but subordinate value to the distinctions based on the number of spores in the thekes, much insisted on by all other recent writers. Nor should it be omitted that, according to this writer, there is much looking to show that "the ultimate or highest condition of a type of spore being assumed to include potentially all the steps of the preceding process of evolution, such ultimate state may be expected to afford, in its total history, an index to the spore-modification possible within the whole circuit of the natural group or genus to which the species furnishing the ultimate condition belongs." (*Gen.* p. 15.) Montagne, in his descriptions of the lichens of Cuba, Guiana, etc. (1838–55), was the first who conjoined spore-characters with the Friesian system. Th. Fries, *Lichenes Arctoi* (1860), *Lichenographia Scandinavica* (vol. i., 1871); Nylander, *Nouvelle Classification* (1834); *Prodr. Lich. Galliæ* (1857); *Enum. générale* (1858; 1348 species); *Synopsis Lichenum* (1860, vol. i., all published); *Lichenes Scandinaviæ* (1861). The same writer has contributed more largely than any other living botanist to the general knowledge of lichens in publications too numerous to cite here. Lindsay, *Spermogones and Pycnides*, in *Linn. Trans.* (1859–69); Schwendener, *Untersuch. üb. d. Flechtenthallus* (1860–63); *Algentypen der Flechtengonidien* (1869); Bornet, *Recherches sur les Gonidies* (1873); Hepp, *Flechten Europas* (Exs.) and *Abbildungen der Sporen* (1853–67); Rabenhorst, *Lichenes Europæi Exs.* (1855–71); Tuckerman, *Obs. Lichenologicæ* in *Proc. Amer. Acad.* (1860–64); *Lichens of California* (1866); *Genera Lichenum* (1873), which last may be recommended to the student as the most instructive contribution of recent times to a philosophic knowledge of systematic lichenology. (For a fuller account of American lichenography to 1868, see paper in *Proceed. Essex Inst.* (1869), and for the history and literature of the whole subject, Krempelhuber, *Geschichte und Litteratur der Lichenologie*, from the earliest times to 1870 (3 vols., Munich, 1867–72).)

H. WILLEY.

S. A. G.

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